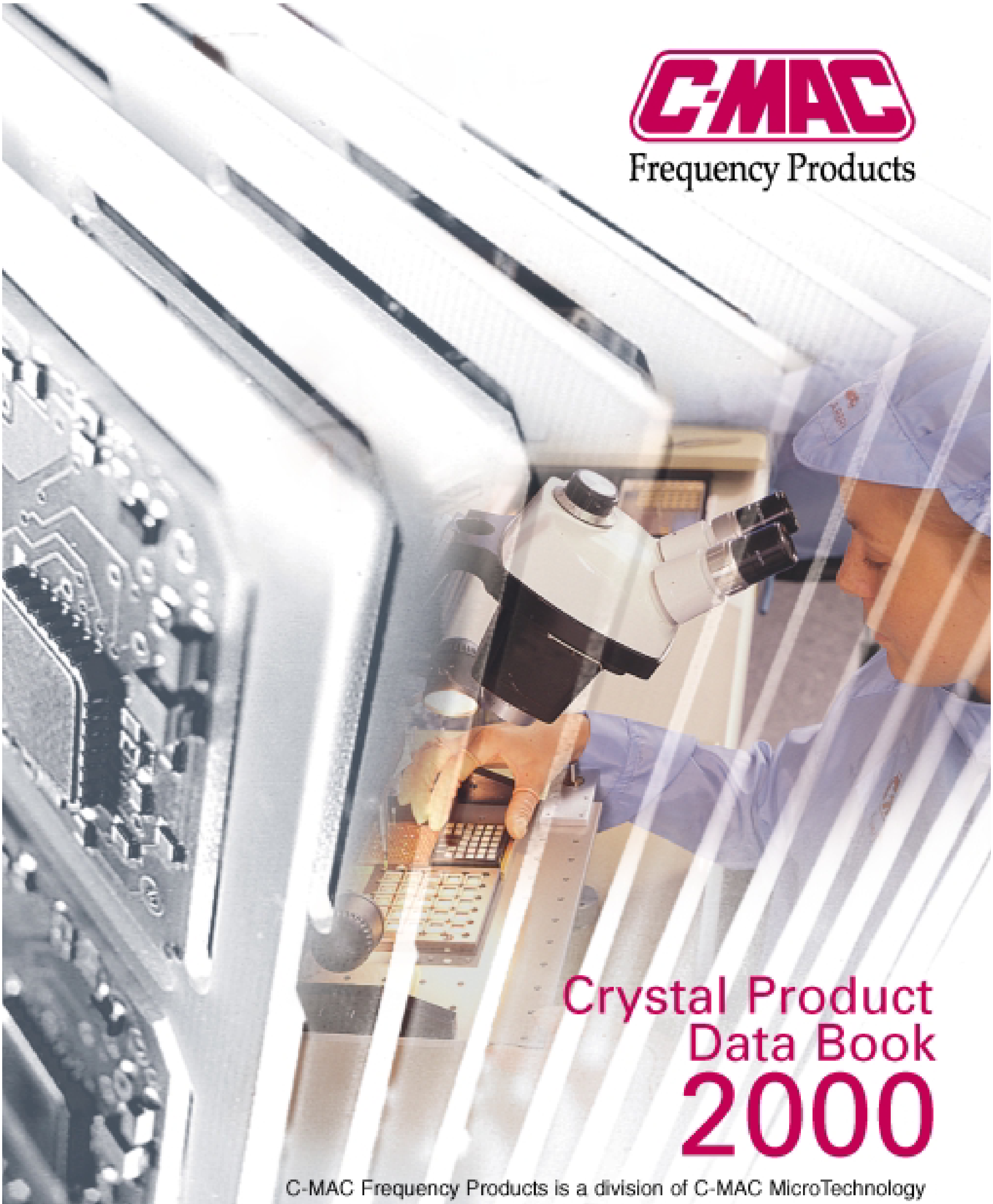
C-MAC

Frequency Products



Crystal Product Data Book 2000

C-MAC Frequency Products is a division of C-MAC MicroTechnology

CONTENTS

PROFILE OF C-MAC FREQUENCY PRODUCTS

A Division of C-MAC MicroTechnology

MicroTechnology

C-MAC MicroTechnology was formed during 1999 to unite the resources of C-MAC Frequency Products and C-MAC Microcircuits, bringing together the broad capabilities and products of C-MAC Frequency Products and the advanced manufacturing, engineering and packaging technologies of C-MAC Microcircuits. The new division employs the best in class customer service, manufacturing and engineering techniques through leveraging the strengths and capabilities of both divisions. With manufacturing in the UK, France, Germany, Belgium, USA, Canada, China and India, a global technical sales network providing customers both leading-edge technology and unprecedented levels of engineering support wherever and whenever they are needed.

C-MAC MicroTechnology can offer world class product solutions in response to customer and market requirements, addressing the complex analogue, digital and frequency control requirements of modern systems. Our customers are many of the world's leading telecommunications, automotive, military, aerospace and medical manufacturers, with whom we have developed strategic partnerships over a number of years.

Microcircuits

C-MAC Microcircuits is a world leader in the supply of microelectronic solutions, with mutliple manufacturing facilities throughout North America, Europe and Asia. Extensive design and manufacturing experience in thick film substrates, surface mount hybrids, chip and wire hybrids and multi-chip modules enables us to offer integrated microelectronic solutions to a range of complex system challenges.

Engineering expertise includes extensive circuit design and hybrid layout skills, backed by state-of-the-art CAD and CAE systems enabling us to offer simulated electronic and thermal performance at the early project stages. In addition, our considerable experience in silicon design enables cost effective ASIC solutions to a wide variety of electronic packaging products.

C-MAC Microcircuits brings a wide variety of technology and low cost manufacturing capability to the newly formed MicroTechnology division. The latest in advanced materials and assembly techniques are currently in volume production.

Advanced material and processing capabilities include:

- LTCC (Low Temperature Co-Fired Ceramic) substrates with a unique 'no shrink' process, with the capability of buried/embedded components and complex cavities.
- Fine line photo image ceramic thick film for high density and high performance interconnects.
- Chip on board, chip on ceramic and direct attach flip chip
- Highly automated thick film printing
- Highly automated SMT manufacturing capability

As an indication of commitment to quality, our manufacturing processes are assesed and operated under Statistical Process Control (SPC). This is complemented by techniques such as design and process Failure Mode and Effect Analysis (FMEA) and product simulation. The dedication to building quality product is fundamental and is reflected in our wide range of international approvals, which include QS9000, ISO 9001, MIL PRF38534, UKAS, CECC and BS9450 plus many individual customer certifications.

We have an established reputation in providing high reliability microelectronic components for **Space** integration. The products we offer range from simple resistor networks to semiconductor die packs with Class K screening to full custom hybrids. An integrated design to engineering package is provided, featuring analogue, digital and thermal simulation prior to thick film design realisation, and there is a separate suite for full custom or FPGA ASIC design requirements.

C-MAC Microcircuits is a major manufacturer of custom hybrids for the **Military** market. We have a long history in the design and manufacture of avionics databus products for MIL STD 1553 and MIL STD 1760 applications. To achieve the functionality and cost effectiveness required by the military sector we have invested considerably in the development of full and semi-custom ASICs that are at the heart of these products.

We supply many millions of pieces per annum of thick film hybrid circuits into the **Telecommunications** market. Typical applications include, main switches (line cards), private switches and transmission products.

Through close working partnerships with some of the world's leading **Wireless Communications** OEMs, we have co-developed a range of leading edge RF power modules. Today, we are internationally recognised for our state-of-the-art solutions in cellular telephones, cellular base stations and two-way radios.

In order to support our continued expansion into the **Automotive** sector, we have gained QS 9000 approval for our key sites. This development of our ISO 9000 registration is part of our commitment to continuous improvement, a policy that extends throughout C-MAC.

Frequency Products

C-MAC Frequency Products was formed during 1998 to combine the strengths of four industry leaders, C-MAC Quartz Crystals, CEPE, Greenray and IQD Limited.

Our range of frequency control products is probably the widest available from a single source, ranging from low-cost commercial crystals to high-specification oscillators used in the most demanding military and space applications. Besides the standard products described in this Data Book, C-MAC Frequency Products offers a well developed custom design service to cater for requirements that go beyond those commonly specified. A variety of products with European Space Agency and British Standard releases are also available.

Because the C-MAC Frequency Products Division includes several well established manufacturing operations, its in-house expertise covers the full spectrum of quartz frequency control technologies. Alternate sourcing for individual devices is available, so continuity of supply is assured. Manufacturing throughout the division is controlled by networked MRPII manufacturing resource planning systems, giving total visibility across all stages of the process. Constant inspection and evaluation ensure reliability in the finished product. ISO9001 quality procedures are in force across all sites being either ISO9001 certified or working towards certification.

C-MAC Frequency Products preferred approach to customer service is one of partnership. Each customer is assigned a specialist account manager who, drawing upon the engineering expertise of C-MAC's Application Support Department, guides customers through the product development cycle from design concept to full-scale manufacture.

Customers can order from C-MAC Frequency Products through this comprehensive Data Book, its CD-ROM counterpart, or via the world wide web at http://cfpwww.com. C-MAC stocks a wide range of commonly specified components for immediate delivery and can deliver many others within a few days through its express manufacturing service.

One of the few truly international frequency control specialists, C-MAC Frequency Products has a substantial direct sales organisation supported by over 200 distributors and representatives in 37 countries (see page 279).

C-MAC FREQUENCY PRODUCTS SITES

C-MAC Quartz Crystals - Harlow and Lincoln, UK.

C-MAC Quartz Crystals traces its roots back to 1937 and the Radio Division of Standard Telephones and Cable (STC). Following a move from Woolwich to Harlow, UK, in 1952 and the addition of quartz growing facilities in 1962, STC's crystal and hybrid circuit operations were purchased from Nortel by C-MAC Industries in 1992. In 1995 the business was strengthened by the acquisition of GEC Plessey Semiconductors' quartz crystal facility in Lincoln, UK.

Today C-MAC Quartz Crystals offers an extensive product range, including temperature compensated and voltage controlled crystal oscillators (TCXOs and VCXOs), to SAW (surface acoustic wave) filters, simple crystal oscillators (XOs) and resonators.

Dedication to supplying quality product is reflected in C-MAC's ISO9001 certification and its range of customer and product approvals, which include CECC 68000, CECC 68100 and ESA/SCC 3501. Total quality management (TQM), practised throughout the company, is supported by 'continuous improvement teams' whose self imposed targets are zero defects and 100% on-time delivery.

C-MAC CEPE - Argenteuil, France

CEPE (Compagnie d'Électronique et de Piézo-Électricité) is a world leader in the design and manufacture of ultrastable quartz OCXOs, with a dedicated 7800-square-metre facility in Argenteuil, Paris, France. Set up within Thomson-CSF nearly 50 years ago to provide BAW (bulk acoustic wave) crystal products for the defence and avionics markets, the company has since diversified into commercial markets such as mobile communications. CEPE was purchased by C-MAC Industries in January 1998.

CEPE has considerable expertise in the manufacture, cutting, metallisation and mounting of high-stability SC cut quartz crystals, as well as in the thermal optimisation of oscillator circuitry, component locations, and oven and PCB materials.

C-MAC Quartz Crystals Inc. - Mechanicsburg, USA.

Formerly known as Greenray, this site is a long established provider of oscillator products for a diverse range of applications and industries, who were acquired by C-MAC Industries in 1995. Its 20,000-square-foot facility in Mechanicsburg, Pennsylvania, is well located to serve the requirements of all North American customers. Besides conventional printed wiring board construction, C-MAC are qualified to manufacture product using bare semiconductor chips and wire bonded connections.

C-MAC Frequency Products (formerly IQD Ltd.) - Crewkerne, UK.

IQD was established in 1973 to manufacture and market a wide range of frequency control products, from commercial grade to that used in the most stringent military & professional applications. Quality has been a cornerstone of the company's success. IQD was the first crystal manufacturer to be approved to BS5750 and is now ISO9001 certified. Its comprehensive TQM programme encompasses all aspects of customer support from initial sales contact to on-time delivery. The company has changed its name following acquistion by C-MAC in 1998 and is now the centre of excellence for factored product sales.

NEW PRODUCTS

The formation of C-MAC Frequency Products has resulted in perhaps the widest range of frequency control products available from a single source. Featured below is a list of new products that have recently been launched.

VCXOs

- CFPV-2365 - see p75

OCXOs & Rubidium Oscillators

C-MAC design and manufacture a wide range of high specification OCXO's. Many variants are available with stabilities down to $\pm 1 \times 10^{-10}$, with frequencies available up to 60.0MHz.. A range of package styles is offered (with options being produced) which cater for fine frequency tuning adjustment. In addition, C-MAC are willing to discuss individual customer requirements. For further information, please see p109.

- CFPO-US1 - see p100
- CFPO-DO3 - see p108
- CFPR-01, -02 - see p118

SM Quartz Crystals

- CFPX-5 - see p154

The CFPX-5 series of surface mountable crystals are housed within a sub-miniature 3.2 x 2.5 x 0.8mm ceramic package with a seam welded metal lid. Operating in the fundamental mode over the frequency range of 20MHz to 40MHz.

- CFPX-93 - see p172

Housed in a ceramic package measuring 8.0 x 4.5 x 1.6mm the CFPX-93 series of quartz crystal is available in a large number of standard frequencies including 16.384MHz and 40.32MHz. All the devices operate in the fundamental mode and are designed to match an 18pF load.

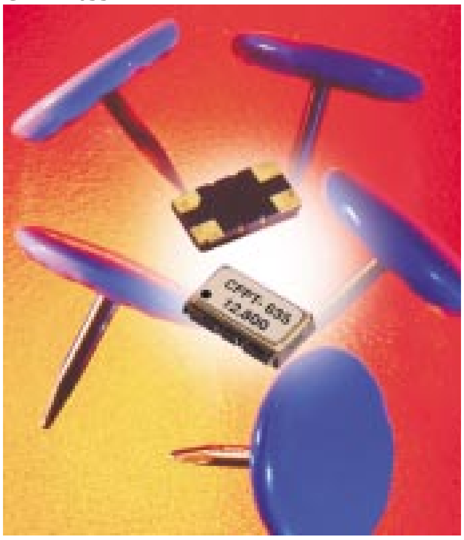
CFPT-9100

SM SPXOs

- CFPS-8 - see p182

The CFPS-8, a family of surface mountable simple packaged crystal oscillators (SPXOs) in ultraminiature 5.0 x 3.2 x 0.95 mm packages. Operating from a 3.0 V power supply, these tiny oscillators are well suited to provide the clock signal in a wide range of portable telecommunications, computing, multimedia and digital TV equipment.

CFPT-635



- CFPS-72, -73 - see p190
- CFPS-95, -96, -97 - see p196

Designed in the industry standard 7.0 x 5.0mm surface mountable package, this series of SPXO (simple packaged crystal oscillator) has the advantage of very short lead times. This is by virtue of it's ability to be programmed by the factory to a specific customer specified frequency in the range 1.0 to 125.0MHz.Versions are available at 3.3V and 5.0V supply with all devices being tri-stateable as standard.

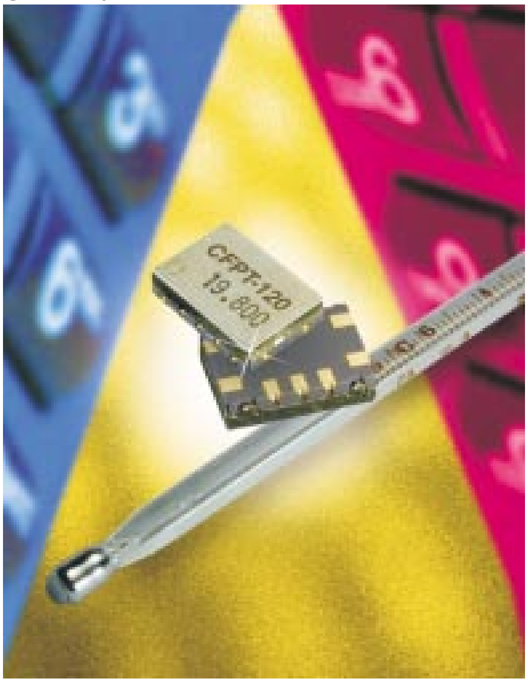
- CFPS-130, -131 - see p198

Designed to compliment the existing IQXO-53 and IQXO-57 series, these J Leaded surface mountable crystal oscillators are housed in a plastic package. Operating from a standard 3.3V supply, the devices can be specified with output frequencies of upto 70MHz and provide for HCMOS drive. If the CFPS-131 is requested then this automatically comes with tri-state capability.

SM VCXOs

- CFPV-41, -42, -43, -44 - see p210

CFPT-120



CFPV-41, -42, -43, -44 voltage controlled quartz crystal oscillators offer a high degree of "frequency pulling" — i.e. control of the output frequency via an applied voltage — allowing degraded incoming signals to be corrected to nominal frequency through a phase locked loop (PLL). Frequency pulling up to at least ±50 ppm is specified for CFPV-41 and -42 devices, while the CFPV-43 and -44 offer control to at least ±100 ppm. The CFPV-41 and -43 operate from a 5 V power supply and require a 2.5 V ± 2.0V frequency control voltage at pin 1, while the CFPV-42 and -44 use a 3.3 V supply and work from a 1.65 V ± 1.5 V control voltage.

- CFPV-386, -387 - see p214

Specified in an industry standard 6 pad surface mountable package, this series of voltage controlled crystal oscillators can be ordered for either 5.0V (CFPV-386) or 3.3V (CFPV-387) operation. Standard frequencies are available including 13.0MHz and 32.0MHz with frequency pulling being a minimum of +/-100ppm. Coming with tri-state capability as standard.

- CFPV-2340 - see p217

Operating at the standard SONET frequency of 155.52MHz, the CFPV-2340 is housed in a 20 x 14 x 5.5mm surface mountable package. Providing a complimentary current mode logic output into 50 Ohms, the device allows frequency pulling of between +/-65 and +/-110ppm over a control voltage range of 0.5 to 4.5V.

SM TCXOs

- CFPT-101, -102, -103 - see p230
- CFPT-105 - see p232

Where board area is limited but the need is for high performance then the CFPT-105 may be the ideal solution. This TCXO (temperature compensated crystal oscillator) is offered in a surface mountable package measuring only 9.0 x 7.0 x 2.0mm. Offered in a number of standard frequencies including 12.8MHz and 19.2MHz, the oscillator provides a performance of better than +/-2.5ppm over an operating temperature range of –20 to +75^{0}C. Driven by a 3V supply, a clipped sine wave output is provided together with external frequency adjustment.

- CFPT-120 - see p234

The CFPT-120 is available in a range of frequencies between 12.6 and 19.8 MHz, including the standard mobile telecomms frequencies at 13.0 and 19.44 MHz. For error correction in the incoming signal, a voltage control facility allows the end user to trim the frequency by a minimum of 8.0 ppm by application of an external voltage in the range 0.5 to 2.5 V. Besides the specification mentioned above, the CFPT-120 offers ±2.5 ppm frequency stability over –20° to +75°C as standard, and an extended temperature option of –30° to +75°C at ±5 ppm stability.

- CFPT-141 - see p236
- CFPT-635 - see p238
- CFPT-9100 Series - see p246

Iincorporating a base which is thermally matched to FR4 substrates, the CFPT-9100 series of temperature compensated crystal oscillators can be customised for individual requirements. Offering stabilities down to +/-0.3ppm, the device offers either a HCMOS or a Sine wave output with 3.3V or 5.0V supply options. Various frequency pulling ranges, tri-state options and drive capabilities can also be offered.

SM OCXOs

- CFPO-12 - see p252

CFPS-97

ORDERING INFORMATION

ORDERING INFORMATION & QUARTZ OVERVIEW

Minimum Order Charge

Account Orders £50.00; Prepaid £50.00; or other currency equivalent (+ postage & packaging).

Quotations

Quotations made by C-MAC Frequency Products are valid for 30 days unless otherwise stated.

Certificate of Conformance (C of C)

C of C's are available upon request for a fixed charge of £11.00 (or other currency equivalent) if the order is confirmed in writing by fax or letter.

Order Acknowledgment

Order acknowledgments are sent out for all orders within 3 days of order.

Order Cancellation

Purchase orders for made-to-order products are non-cancellable.

Despatch

Orders received by 4pm for ex-stock items can normally be despatched the same day if specifically requested at time of order. Please see Standard Conditions of Sale regarding postponement of delivery dates.

Terms

30 days from date of invoice for approved credit accounts.

Special Services

- Electronic Data Interchange (EDI)

We offer EDI communication to the internationally agreed standards. Please contact our I.T. department.

- Bar Coding

Product Packaging can be bar-coded if required. Please contact our I.T. department.

Payment in Currencies other than Sterling

Our preferred international currency is US dollars, but we can operate an account for you in any one of a number of different currencies; please agree this with your sales contact when placing your first order. Please ensure that remittance in the agreed currency reaches us in full without deduction of charges.

Returns

Customers wishing to return goods for whatever reason should contact our sales department first, otherwise considerable delays can result in processing the return.

Specifications

As part of its continuing efforts to provide customers with the very latest technology in crystal components, C-MAC Frequency Products reserves the right to change specifications, designs and models without notice.

INTRODUCTION TO QUARTZ

NATURAL & CULTURED QUARTZ

Quartz is a crystalline form of silicon dioxide (SiO2) which is abundant in nature, forming about 12% of the Earth's crust. A combination of the limited supply of natural quartz along with its high cost has resulted in the development of cultured quartz.

Crystals of quartz are grown by dissolving SiO2 in an alkaline solution at high temperature and pressure. This process takes place in autoclaves which are built to withstand the extreme conditions required.

Seed crystals are mounted in frames in the cooler part of the autoclave whilst a solution of sodium carbonate or hydroxide and fragments of SiO2 are placed in the warmer portion. The solution moves from the hotter to the cooler region and in doing so, dissolves the nutrient and deposits on the seed crystal. Temperatures are controlled throughout this process.

Large bars of crystal can be grown in about ten weeks. The quality of the quartz depends on the conditions of growth. Crystals are grown in shapes and sizes that minimise wastage of time and material.

The bars of crystal are cut into wafers. The angle at which these wafers are cut is crucial in determining the frequency and temperature stability of the final crystal. The most common cut is the AT-cut where the blank is cut from the bar of crystal at approximately 35°, allowing a frequency range of 1MHz to 300MHz.

PIEZOELECTRIC PROPERTIES OF QUARTZ

Since the discovery of the piezoelectric properties of quartz in 1880 by Pierre Curie, quartz has become a significant factor in the growth of the electronics industry.

By stretching or compressing a piezoelectric material a voltage is generated. The reverse is also true: a voltage applied to the material causes it to become mechanically stressed.

In the case of crystals, the pressure resulting from a voltage being applied is displayed in the form of oscillations at a particular resonant frequency. This frequency is a function of the thickness of the crystal. By carefully preparing a crystal, it can be made to oscillate at any frequency.

AN OVERVIEW OF CRYSTAL PRODUCTION

The manufacturing process begins by reducing the thickness of the blank. Frequency is determined by thickness; blanks are cut thicker than required so that they can be reduced according to the frequency desired. This reduction is achieved by lapping with an abrasive such as aluminium oxide, to produce a fine surface finish. The crystal is lapped until it is slightly above the required final frequency.

This process is followed by cleaning and etching the blanks which further improves the surface finish and also reduces the frequency spread within the batch of crystals.

Electrical connections are formed by depositing a metal (usually silver) on the blank by evaporation under vacuum.

The crystal is then mounted on its base which has spring mounts. Once the crystal is positioned, a conductive adhesive bonds the tails of the electrode to the mount.

Next the crystal requires adjustment to final frequency. This can be achieved by plating more silver on the crystal until the exact frequency is reached.

Once the frequency is correct, the crystals are baked in ovens before being encapsulated into their package. When this is complete, the crystal unit can be fully tested.

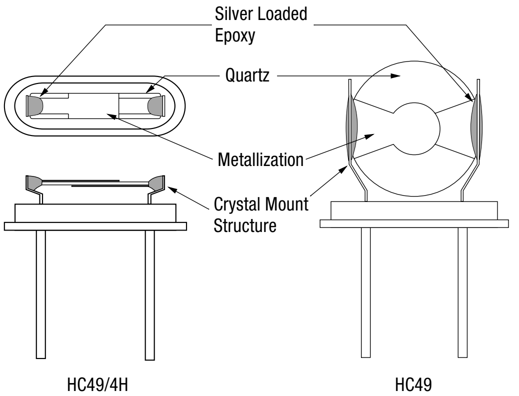
The intricacy of the production process, with considerations for frequency and stability throughout, highlights the need for detailed specifications from customers as to what they require from their crystals. The minimum specifications that are typically required when placing an order for crystal products are outlined at the beginning of each section.

NOTES

CRYSTAL PRODUCT HANDLING PRECAUTIONS

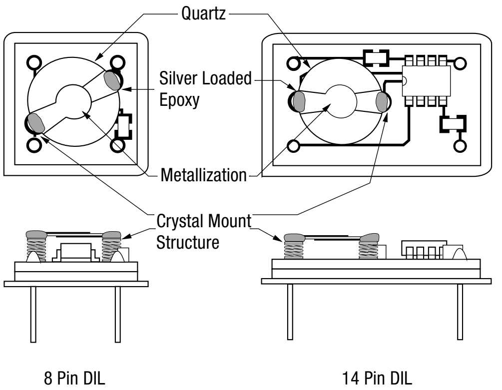
As described previously, the quartz crystal unit includes a small disc or strip of quartz that is processed to an exact size and thickness dependent on the customer-specified resonating frequency. The quartz is plated with conducting electrodes and mounted in an hermetically sealed protective enclosure (See Fig. 1).

Figure 1



The electrodes connect to leads which pass through the base assembly via glass to metal seals.

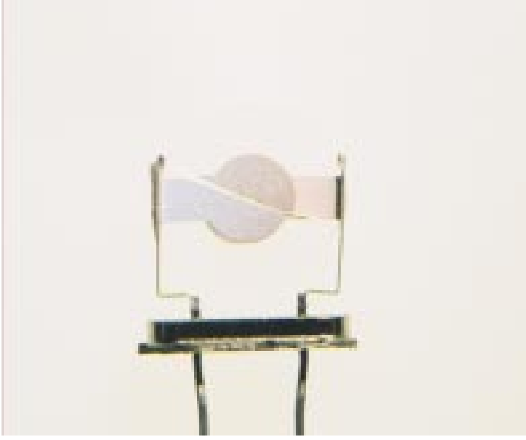
Figure 2



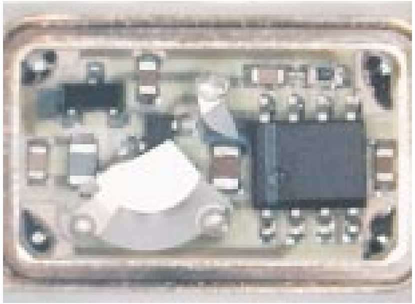
Crystal units are often encapsulated together with other circuitry in order to realise a fully functional module, e.g. an oscillator or a complex filter. Fig. 2 illustrates a simple crystal oscillator.

Because of the nature of the crystal unit, correct handling is very important.

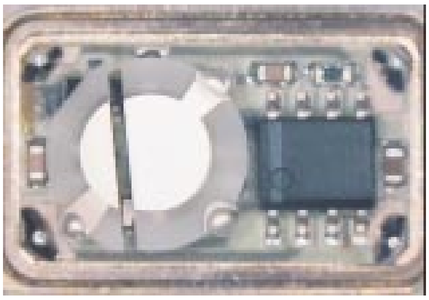
Mechanical Shock



Crystal components are manufactured to withstand a certain level of mechanical shock. These levels are outlined within the environmental specifications for each individual component type throughout the Data Book.



Excessive levels of shock can cause a change to the electrical characteristics, which will most likely manifest itself as a change of frequency. Severe mistreatment, such as dropping onto a hard surface, may well result in actual breakage.



Handling Leads

Excessive bending of leads can cause damage to the glass to metal seal which can result in the loss of the hermeticity of the enclosure. Enclosures are filled with a dry inert gas and loss of hermeticity will result in a rapid deterioration of the product due to atmospheric contamination. Care should therefore be taken when handling a crystal not to pull or bend the leads. If the component needs to be moved in a way that involves bending, the lead should be bent slightly away from the glass seal to avoid cracking it. The recommended minimum radius of curvature is product dependent, for example: 2mm for HC49's and 1mm for UM1's.

Tape & Reel Product

Before using crystal components on automated placement machines, tests should be undertaken to test the level of shock that the crystal devices will be subjected to during the placement process. If necessary the shock level should be reduced.

Temperature

If crystals are subjected to extreme temperatures outside storage temperature limits, the electrical performance can be affected, resulting in eventual failure.

Electrostatic Discharge (ESD)

Only at extreme voltages can static electricity be seen, heard or even felt, but even the lowest voltages can damage electronic circuits. The damage caused to oscillators as a result of electrostatic discharge may not immediately be evident but can be delayed, causing the oscillator circuitry to degrade, which in turn can cause failure of the oscillator in the field.

Although quartz is not necessarily susceptible to ESD damage, the associated electronic circuitry contained within an oscillator *is* and should be considered as an Electrostatic Discharge Sensitive device (ESDS).

ESDS devices should only be handled in an ESD Protected Area or EPA, where typically wrist straps are used. Any transportation should be undertaken using the appropriate protective Packaging. All Packaging should be marked with a warning notice and protective measures and Packaging should conform to BS EN 100015. For a more detailed breakdown of the precautions that should be taken please contact the Application Support Department.

General Information

The approximate thickness of the quartz disc or strip is given by the following equation:

$$\text{Thickness(mm)} = \frac{1.67}{\text{f (MHz)}}$$

Note: Multiply thickness (mm) × O/T mode if using overtone crystal (e.g. 16MHz crystal = 0.1mm thick)

EINFÜHRUNG UND VERKAUFSINFORMATIONEN

Eine Abteilung von C-MAC MicroTechnology

C-MAC MicroTechnology wurde 1999 gegründet, um die Ressourcen von C-MAC Frequency Products und von C-MAC Microcircuits zu vereinen und die breitgefächterte Palette der Fähigkeiten und Produkte von C-MAC Frequency Products mit den hochmodernen technischen Planungs-, Herstellungs- und Kapselungstechnologien von C-MAC Microcircuits zu kombinieren. Die neue Abteilung bietet unübertroffenen Kundendienst sowie überlegene Planungs- und Herstellungstechniken, indem sie die Stärken und Kapazitäten beider Abteilungen nutzt. Das Unternehmen hat Produktionseinrichtungen in Großbritannien, in den USA, in Frankreich, Kanada, China und Indien, sowie ein sechs Kontinente umspannendes technisches Verkaufsnetz, so daß es seinen Kunden modernste Technologie und unübertroffene technische Unterstützung bieten kann, wann und wo immer dies nötig ist.

C-MAC MicroTechnology entwickelt Produktlösungen von Weltklasse als Reaktion auf Kunden- und Marktanforderungen und erfüllt die komplexen Analog-, Digital- und Frequenzregelungserfordernise moderner Systeme. Zu unserem Kundenkreis gehören viele der weltweit führenden Hersteller aus den Branchen Telekommunikation, Kfz, Militär, Luft-/Raumfahrt und Medizin, mit denen wir über viele Jahre strategische Partnerschaften aufgebaut haben.

C-MAC Microcircuits ist weltweit führend in der Entwicklung mikroelektronischer Lösungen und verfügt über mehrere Produktionsstätten in Nordamerika, Europa und Asien. Aufgrund unserer umfangreichen Erfahrungen im Entwurf und der Herstellung von Dickschichtsubstraten, Oberflächenmontagehybriden, Chip- und Drahthybriden sowie Multichip-Modulen sind wir in der Lage, integrierte mikroelektronische Lösungen zu einer Reihe komplexer Systemherausforderungen anzubieten.

Unsere technische Expertise umfaßt u.a. extensive Fähigkeiten im Bereich Schaltungsdesign und Hybridlayout, unterstützt durch modernste CAD- und CAE-Systeme, so daß wir bereits in den frühen Phasen eines Projekts die elektronische und thermische Leistung simuliert darstellen können. Darüber hinaus können wir aufgrund unserer beträchtlichen Erfahrung in der Planung von Siliziumbauelementen preiswerte ASIC-Lösungen für die verschiedensten elektronischen Kapselungsprodukte entwickeln.

C-MAC Microcircuits bringt eine Reihe verschiedener Technologien und kostengünstiger Herstellungskapazitäten in die neu gegründete MicroTechnology-Abteilung ein. Die neuesten fortschrittlichen Werkstoffe und Montagetechniken befinden sich derzeit in der Massenproduktion.

Zu unseren fortschrittlichen Material- und Verarbeitungskapazitäten gehören:

- LTCC- (Low Temperature Co-Fired Ceramic) Substrate mit einem einzigartigen ´schrumpffreien´ Verfahren und der Kapazität für vergrabene/eingebettete Komponenten und komplexe Hohlräume.
- Mikrostrukturierte Fotoimage-Keramikdickschicht für Verbindungen von hoher Dichtigkeit und Leistung.
- Leiterplattenchips,Keramikchips und Direktanschluß -Flip-Chips
- Hochautomatisiertes Dickschichtdrucken
- Hochautomatisierte SMT-Herstellungskapazität

Als Zeichen unserer Verpflichtung zu Qualität beurteilen und betreiben wir unsere Herstellungsprozesse mit Statistischer Prozeßlenkung (SPC). Dies wird ergänzt durch Techniken wie Entwurfs- und Prozeß-FMEA sowie Produktsimulation. Unser Engagement in die Konstruktion von Produkten hoher Qualität ist fundamental und spiegelt sich wider in unserer breiten Palette internationaler Normenzulassungen, wie z.B. QS9000, ISO 9001, MIL STD 1 772A, MIL PRF38534, UKAS, CECC und BS9450, plus zahlreiche individuelle Bescheinigungen unserer Kunden.

Wir haben uns einen Namen in der Herstellung hochzuverlässiger mikroelektronischer Komponenten für die Raumintegration gemacht. Die Produkte, die wir anbieten, reichen von einfachen Widerstandsnetzen bis hin zu Halbleiterchip-Paketen mit Screening der Klasse K und vollkommen anwendungsspezifischen Hybriden. Wir bieten ein integriertes Paket von Entwurf bis Engineering an, einschließlich Analog-, Digital- und Thermosimulation vor der Dickschichtherstellung, und wir haben ein separates Portefeuille für vollkommen anwendungsspezifische oder FPGA ASIC Konstruktionsanforderungen.

C-MAC Microcircuits ist ein bedeutender Hersteller von anwendungsspezifischen Hybriden für den Militärmarkt. Wir blicken auf eine lange Geschichte in Entwurf und Herstellung von Datenbusprodukten in der Luftfahrt zurück, mit Anwendungen gemäß MIL STD 1553 und MIL STD 1760. Um die Funktionalität und Rentabilität zu erzielen, die der Militärsektor verlangt, haben wir erheblich in die Entwicklung von ganz und teilweise anwendungsspezifischen ASICs investiert, die das Kernstück dieser Produkte sind.

Wir liefern jährlich viele Millionen Dickschichthybridschaltungen für den Telekommunikationsmarkt. Typische Anwendungen sind u.a. Knotenvermittlungsstellen, (Leitungsanschlußkarten), private Vermittlungsstellen und Übertragungsprodukte.

Durch unsere engen Partnerschaften mit einigen der weltweit führenden OEMs im Bereich der Drahtloskommunikation konnten wir an der Entwicklung branchenführender RF-Leistungsmodule mitwirken. Wir genießen heute internationale Anerkennung für unsere hochmodernen Lösungen für Zellulartelefone, Zellularbasisstationen und Halbduplex-Funkgeräte.

Um unsere fortgesetzte Expansion in den Kfz-Sektor zu unterstützen, erlangten wir für unsere Hauptproduktionsstätten die Zulassung gemäß QS 9000. Diese Entwicklung unserer ISO 9000 Registrierung ist Teil unserer Verpflichtung zu ständiger Verbesserung, eine Strategie, die sich über das gesamte Unternehmen C-MAC erstreckt.

C-MAC Frequency Products wurde 1998 gegründet, um die Stärken von vier Branchenführern zu kombinieren: C-MAC Quartz Crystals, CEPE, Greenray und IQD Limited.

Die Palette unserer Frequenzregelungsprodukte ist möglicherweise die größte, die von einer einzigen Quelle erhältlich ist, und reicht von kostenarmen kommerziellen Kristallen bis hin zu hochentwickelten Oszillatoren, die in den anspruchsvollsten Anwendungen in Militär und Raumfahrt zum Einsatz kommen. Neben den im vorliegenden Data Book beschriebenen Standardprodukten bietet C-MAC Frequency Products einen etablierten Spezialentwurfsdienst an, der Anforderungen abdeckt, die über die üblichen hinausgehen. Es steht auch eine Reihe verschiedener Produkte zur Verfügung, die gemäß den Anforderungen der European Space Agency Normen und British Standard geprüft wurden.

Da die C-MAC Frequency Products Division über mehrere wohletablierte Herstellungsbetriebe verfügt, umfaßt ihre hauseigene Expertise das gesamte Spektrum der Quarz-Frequenzregelungstechnologien. Einzelne Bauelemente können auch fremdbeschafft werden, um die Kontinuität der Versorgung sicherzustellen. Die Herstellung in der gesamten Abteilung wird durch im Netzbetrieb arbeitende MRP II Herstellungsressourcen-Planungssysteme gelenkt, so daß alle Phasen des Prozesses vollkommen transparent sind. Konstante Inspektion und Beurteilung gewährleisten die Zuverlässigkeit des fertigen Produkts. In allen Produktionsanlagen wird mit den Qualitätssicherungsverfahren gemäß ISO9001 gearbeitet, sei es, daß das jeweilige Werk bereits die Zulassung besitzt oder darauf hinarbeitet.

Der bevorzugte Ansatz von C-MAC Frequency Products zum Kundendienst ist eine Partnerschaft. Jedem Kunden wird sein eigener Manager zugeordnet, der sich auf die technische Expertise der Anwendungssupportabteilung von C-MAC stützt und den Kunden vom Entwurfskonzept bis zur Vollserienherstellung durch den Produktentwicklungszyklus begleitet.

Der Kunde kann bei C-MAC Frequency Products über das umfangreiche Data Book, sein CD-ROM Pendant, oder über die Website http://cfpwww.com bestellen. C-MAC hält eine Vielzahl der häufig verlangten Komponenten für die sofortige Lieferung vorrätig und kann viele weitere über seinen Expreßproduktionsdienst innerhalb weniger Tage liefern.

C-MAC Frequency Products ist einer der wenigen wahrhaft internationalen Frequenzregelungsspezialisten und verfügt über eine umfangreiche Direktverkaufsorganisation, die von mehr als 200 Distributoren und Vertretungen in 37 Ländern unterstützt wird (seite 275).

DIE MITGLIEDER DER C-MAC FREQUENCY PRODUCTS FIRMENGRUPPE

C-MAC Quartz Crystals

Die Anfänge von C-MAC Quartz Crystals gehen zurück auf das Jahr 1937 und die Radioabteilung von Standard Telephones and Cable (STC). Nach einem Umzug von Woolwich nach Harlow, UK, 1952 und dem Anbau der Quarzzüchtungseinrichtungen 1962 erwarb C-MAC Industries 1992 die Kristall- und Hybridschaltungsbetriebe von Nortel. 1995 wurde das Unternehmen durch den Erwerb der Quarzkristalleinrichtung von GEC Plessey Semiconductors in Lincoln, UK, verstärkt.

Heute bietet C-MAC Quartz Crystals eine umfassende Produktreihe an, einschließlich der temperaturkompensierten und spannungsgeregelten Kristalloszillatoren (TCXOs und VCXOs), bis hin zu SAW- (akustische Oberflächenwellen) Filtern, einfachen Kristalloszillatoren (XOs) und Resonatoren.

Die Verpflichtung zur Lieferung von Qualitätsprodukten spiegelt sich in der 1S09001-Zulassung von C-MAC sowie den zahlreichen Kunden- und Produktprüfbescheinigungen wider, wie u.a. CECC 68000, CECC 68100 und ESA/SCC 3501. Das vollkommene Qualitätsmanagement, das im gesamten Unternehmen praktiziert wird, wird durch ´kontinuierliche Verbesserungsteams´ unterstützt, deren selbstauferlegte Ziele absolute Fehlerfreiheit und 100% ige Lieferpünktlichkeit sind.

CEPE

CEPE (Compagnie d´Electronique et de Piézo-Electricité) ist weltweit führend in Entwurf und Herstellung ultrastabiler Quarz-OCXOs und besitzt eine spezielle, 7800 Quadratmeter große Produktionsanlage in Argenteuil in Paris. Das Unternehmen wurde vor nahezu 50 Jahren mit dem Ziel gegründet, BAW- (Bulk Acoustic Wave) Kristallprodukte für die Märkte Militär sowie Luft- und Raumfahrt herzustellen, und hat seinen Tätigkeitsbereich inzwischen auf kommerzielle Märkte wie die Mobilkommunikation ausgeweitet. CEPE wurde im Januar 1998 von C-MAC lndustries erworben.

CEPE verfügt über beträchtliche Expertise in der Herstellung, im Schneiden, in der Metallisierung und der Montage hochstabiler geschnittener Halbleiterquarzkristalle sowie in der thermischen Optimierung von Oszillatorschaltungsanordnungen, Komponentenplazierung, sowie in Ofen- und Leiterplattenmaterialien.

Greenray

Greenray ist ein seit langem etablierter Hersteller von Oszillatorprodukten für eine große Palette an Anwendungen und Industriezweigen und wurde 1995 von C-MAC Industries aufgekauft. Der Standort seiner Produktionsanlage von 1860 Quadratmetern in Mechanicsburg, Pennsylvania, ist günstig, um die Anforderungen aller nordamerikanischen Kunden zu erfüllen. Greenray produziert nicht nur konventionelle Leiterplatten, sondern ist auch in der Lage, Produkte mit unbestückten Halbleiterchips und drahtgebondeten Anschlüssen herzustellen.

IQD Limited

IQD, das seinen Sitz im englischen Crewkerne hat, wurde 1973 mit dem Ziel gegründet, eine Reihe verschiedener Frequenzregelungsprodukte zu vermarkten, angefangen bei kommerziellen Güteklassen bis hin zu den anspruchsvollsten Militär- und Fachanwendungen. Qualität war schon immer Kern des Erfolgs des Unternehmens. 1QD wurde zum ersten Kristallhersteller, der die Zulassung gemäß BS5750 erhielt, und hat heute die IS09001-Bescheinigung. Sein umfangreiches TQM-Programm umfaßt alle Aspekte der Kundenbetreuung, angefangen beim ersten Verkaufskontakt bis hin zur pünktlichen Lieferung. TQM wird durch ein Personalentwicklungs- und -ausbildungsprogramm ergänzt, dessen Erfolg durch die prestigeträchtige Auszeichnung “Investors in People Award” anerkannt wurde, die dem Unternehmen im Dezember 1997 überreicht wurde.

AUFTRAGSINFORMATIONEN

Mindestbestellwert

Für Kundenkonten: DM 125,00 (£50); Vorauszahlung: DM 125,00 oder entsprechender Betrag in anderen Landeswährungen (+ Post und Verpackung).

Angebote

Wenn nicht anders angegeben, sind die von CFP genannten Preise 30 Tage gültig.

Güteprüfscheine (Certificate of Conformance = C of C)

Qualitätsnachweise sind auf Anfrage gegen eine geringe Gebühr erhältlich (£11.00 oder entsprechender Betrag in anderen Landeswährungen), wenn die Bestellung schriftlich durch Fax oder Brief bestätigt worden ist.

Auftragsbestätigung

Auftragsbestätigungen werden fü alle Aufträge innerhalb von 3 Tagen nach Auftragseingang versandt.

Auftragsstornierung

Aufträge für Sonderanfertigungen können nicht storniert werden.

Zustellung

Bestellungen von ab Lager lieferbaren Waren, die vor 17:00 h (deutscher Zeit) eingehen, können auf Wunsch am gleichen Tag verschickt werden.

Zahlungsbedingungen

Bei zugelassenen Kundenkonten hat die Bezahlung 30 Tage nach Monatsende der Rechnungsstellung zu erfolgen.

Sonderdienstleistungen

Elektronischer Datenaustausch (EDA)

Wir bieten elektronischen Datenaustausch gemäß international abgestimmten Normen. Bitte wenden Sie sich an unsere EDV-Abteilung.

Strichcodes

Gegebenenfalls kann die Verpackung mit Strichcodes versehen werden. Bitte wenden Sie sich an unsere EDV-Abteilung.

Bezahlung in ausländischer Landeswährung

Unsere bevorzugte ausländische Währung sind US-Dollar, Ihr Kunden-Konto kann jedoch auf Wunsch in einer Reihe von Währungen geführt werden. Besprechen Sie Ihre Anforderungen bei Ihrem ersten Auftrag mit unserer Verkaufsabteilung, und bitte stellen Sie sicher, daß uns die vollen Beträge in der entsprechenden Währung ohne Abzüge erreichen.

Warenrückgabe

Kunden, die Waren - aus welchen Gründen auch immer - zurücksenden wollen, sollten vorher unsere Verkaufsabteilung verständigen, da es sonst bei der Bearbeitung der Rücksendung zu beträchtlichen Verzögerungen kommen kann.

Technische Daten

Im Rahmen unserer ständigen Bemühungen, unseren Kunden stets Quarz-Komponenten auf dem neuesten Stand der Technik zu liefern, behält CFP sich das Recht vor, technische Daten, Design und Modell ohne vorherige Ankündigung zu ändern.

NATÜRLICHE UND TECHNISCH ERZEUGTE QUARZKRISTALLE

Quarz ist eine kristalline Form von Silicium Dioxid (SIO2), die in der Natur sehr häufig vorkommt, bestehen doch rund 12 Prozent der Erdkruste aus diesem Material. Die begrenzte Förderung von Naturquarz und die damit verbundenen hohen Kosten haben gleichermaßen die Entwicklung von technisch erzeugtem Quarz forciert.

Der Aufwachsprozeß von Quarzkristallen wird durch das Lösen von Siliciumdioxid in einer alkalischen Flüssigkeit bei hoher Temperatur und hohem Druck angestoßen. Dieser Prozeß läuft in speziellen Tiegeln (Autoklaven) ab, die für die dabei benötigten extremen Bedingungen ausgelegt sind.

Im kühleren Teil des Autoklaven werden auf speziellen Trägern Kristallkeime aufgebracht, während in den wärmeren Teil eine Lösung aus Natriumcarbonat und einigen Anteilen Siliciumdioxid eingebracht wird. Die Lösung wandert vom heißeren in den kühleren Bereich, löst auf diesem Weg den Nährstoff und lagert ihn auf dem Kristallkeimen ab. Während des ganzen Prozesses wird die Temperatur laufend überwacht.

In ungefähr zehn Wochen wachsen dann große Kristallstäbe auf. Die Qualität des Quarzkristalls hängt ganz entscheidend von den Bedingungen des Aufwachsprozesses ab. Form und Größe der Kristallstäbe sind auf eine optimale Nutzung von Zeit und Material ausgerichtet.

Die Stäbe werden in Scheiben (Wafer) geschnitten. Der Schnittwinkel ist dabei ausschlaggebend für die Frequenz und Temperaturstabilität des Endprodukts. Am gängigsten ist der sogenannte AT Schnitt, bei dem der Rohling in einem Winkel von ungefähr 35 Grad abgeschnitten wird, womit ein Frequenzbereich von 1MHz bis 300 MHz abgedeckt werden kann.

PIEZOELEKTRISCHE EIGENSCHAFTEN VON QUARZ

Seit der Entdeckung der piezoelektrischen Eigenschaften von Quarz durch die Pierre und Marie Curie im Jahr 1880 ist Quarz zu einem bedeutsamen Faktor für das Wachstum der Elektronikindustrie geworden.

Wenn piezoelektrisches Material auseinandergezogen oder zusammengedrückt wird, entsteht eine elektrische Spannung. Ebenso gilt der umgekehrte Effekt: Durch das Anlegen einer elektrischen Spannung an dem betreffenden Material entsteht eine mechanische Verformung.

Im Fall von Schwingquarzen wird der Druck, der sich aus der angelegten Spannung ergibt, in der Form einer Schwingung bei einer bestimmten Resonanzfrequenz dargestellt. Diese Frequenz ist eine Funktion der Kristalldicke. Durch eine sorgfältige Verarbeitung des Kristalls können Schwingungen bei jeder beliebigen Frequenz erzeugt werden.

EIN ÜBERBLICK ÜBER DIE HERSTELLUNG VON SCHWINGQUARZ KOMPONENTEN

Der Herstellungsprozeß beginnt mit der Reduzierung der Dicke des Rohlings. Denn die Frequenz wird durch die Dicke bestimmt. Die Rohlinge werden dicker als erforderlich geschnitten und dann sukzessive dünner gemacht, bis die gewünschte Resonanzfrequenz erreicht ist. Abgetragen werden die überschüssigen Schichten durch Läppen mit einer ätzenden Substanz wie beispielsweise Aluminiumoxid, sodaß eine sehr glatte Oberflächenpolitur entsteht. Der Schwingquarz wird so lange geläppt, bis die Schichtdicke knapp über der für die gewünschte Frequenz benötigten Dicke liegt.

Danach folgt ein Säuberungs- und Ätzprozeß, bei dem die Oberfläche der Rohlinge weiter verbessert und die Frequenzabweichungen innerhalb der einzelnen Lose reduziert werden.

Elektrische Verbindungen werden durch Abscheiden eines Metalls (in der Regel Silber) auf dem Rohling mittels Verdampfung unter Vakuum gebildet.

Danach wird der Schwingquarz auf seiner Grundseite, die mit Federhalterungen ausgestattet ist, befestigt. Nach der Positionierung des Bauelements verbindet ein leitfähiger Kleber die Elektrodenenden mit der Halterung.

Jetzt muß der Schwingquarz auf die gewünschte Frequenz feinabgestimmt werden. Dies wird durch Zugeben von Silber erreicht.

Nach der Einstellung auf die gewünschte Frequenz werden die Schwingquarze in speziellen Öfen gebrannt und dann in die jeweils vorgesehenen Gehäuse eingebracht.

Die Kompliziertheit des Herstellungsprozesses, bei dem ständig auf die Frequenz und die Stabilität geachtet werden muß, unterstreicht die Notwendigkeit, von den Anwendern genaue Angaben über die tatsächlichen Anforderungen zu bekommen, die sie an den jeweiligen Schwingquarz stellen. Am Beginn jedes Abschnitts werden in diesem Datenbuch die Mindestspezifikationen aufgelistet, die bei der Bestellung eines Schwingquarzes erforderlich sind.

VORSICHTSMAßNAHMEN BEI DER HANDHABUNG

Wie zuvor beschrieben, beinhaltet die Quarzkristalleinheit eine kleine Scheibe oder einen Streifen aus Quarz, die/der je nach der vom Kunden vorgegebenen Resonanzfrequenz auf eine genaue Größe und Dicke zugeschnitten wird. Der Quarz wird mit Leitungselektroden versehen und in ein hermetisch abgedichtetes Schutzgehäuse (S. Abb 1) gesteckt. An die Elektroden werden Kabel angeschlossen, die durch die Grundbaugruppe über Glas-Metall-Dichtungen führen.

Kristallvorrichtungen werden häufig mit anderen Schaltungen zusammen verkapselt, um ein vollfunktionelles Modul wie z.B. einen Oszillator oder ein komplexes Filter herzustellen. Abb. 2 veranschaulicht einen einfachen Kristalloszillator. Aufgrund der Natur der Kristalleinheit ist eine korrekte Handhabung sehr wichtig.

Mechanische Stöße

Kristallkomponenten werden so hergestelit, daß sie mechanische Stöße bis zu einer bestimmten Stärke aushalten. Diese Werte sind in den Umgebungsdaten für jeden einzelnen Komponententyp im Datenbuch ausgewiesen.

Zu starke Stöße können eine Veränderung der elektrischen Eigenschaften zur Folge haben, die sich mit hoher Wahrscheinlichkeit als Frequenzänderung äußern. Bei schwerwiegender Mißhandlung, wie z.B. Fallenlassen auf eine harte Oberfläche, kann die Vorrichtung zerbrechen.

Handhabung von Kabeln

Ein zu starkes Verbiegen von Kabeln kann Schäden an der Glas-Metall-Dichtung verursachen, die den Vertlust der hermetischen Abdichtung des Gehäuses zur Folge haben können. Die Gehäuse sind mit einem trockenen Edelgas gefüllt, und bei einem Verlust der hermetischen Abdichtung kommt es zu einer raschen Verschlechterung des Produkts aufgrund atmosphärischer Kontamination. Es ist daher bei der Handhabung eines Kristalls sorgfältig darauf zu achten, daß die Kabel nicht gedehnt oder verbogen werden. Wenn das Teil auf eine solche Weise bewegt werden muß, daß ein Biegen unvermeidlich ist, dann sollte das Kabel leicht von der Glasdichtung weggebogen werden, um Reißen zu verhüten. Der empfohlene Mindestkrümmungsradius ist vom jeweiligen Produkt abhängig, z.B: 2 mm für HC49-Modelle, 1 mm für UM1-Modelle.

Band & Rollenprodukt

Vor dem Benutzen von Kristallkomponenten auf automatischen Verpackungsmaschinen sollten die Stoßwerte geprüft werden, denen die Kristallgeräte während des Plazierungsvorgangs ausgesetzt sind. Falls notwendig, sollten diese Stoßwerte reduziert werden.

Temperatur

Wenn Kristalle extremen Temperaturen außerhalb der Lagertemperatur-Grenzwerte ausgesetzt werden, dann kann dies die elektrische Leistung beeinträchtigen, was schließlich den Ausfall des Gerätes zur Folge hat.

Elektrostatische Entladung (ESD)

Statische Elektrizität ist nur bei extremen Spannungswerten sicht-, hör- oder sogar fühlbar, aber selbst niedrigste Spannungswerten können elektronische Schaltungen beschädigen. Schäden, die aufgrund statischer Entladungen an Oszillatoren entstehen, sind zwar nicht unbedingt sofort sichbar, können aber verzögert zutage treten, was dazu führt, daß die Qualität der Oszillatorschaltung abnimmt, was wiederum einen Ausfall des Oszillators in der Praxis nach sich zieht.

Quarz ist zwar nicht unbedingt empfindlich gegenüber Schäden durch ESD, aber die in jedem Oszillator vorhandene elektronische Schaltung ist ein gegenüber elektrostatische Entladungen empfindliches Gerät (ESDS) und sollte auch als solches behandelt werden.

ESDS-Geräte sollten nur in einem ESD-Schutzbereich (EPA) gehandhabt werden, wo gewöhnlich Armbänder getragen werden. Die Geräte sollten nur in geeigneter Schutzverpackung transportiert werden. Sämtliches Verpackungsmaterial sollte mit einem Warnhinweis versehen werden, und Schutzmaßnahmen wie Verpackung sollten der BS EN 100015 entsprechen. Ausführlichere Informationen über die zu treffenden Vorsichtsmaßnahmen sind bei der Anwendungsunterstützungsabteilung erhältlich.

Allgemeine Informationen

Die ungefähre Dicke des Quarzstreifens ergibt sich durch die folgende Gleichung:

Dicke (in mm) = 1,67/f(MHz)

PRESENTATION ET CONDITIONS DE VENTES

C-MAC MicroTechnology fût créée en 1999 dans le but de réunir les ressources de C-MAC Frequency Products et de C-MAC Microcircuits, réunissant ainsi le large éventail de savoir faire et de produits de C-MAC Frequency Products à la production, aux services de développement et aux technologies de pointe de C-MAC Microcircuits. La nouvelle division utilise ce qu'il existe de mieux pour le développement, pour la fabrication ainsi que pour son service à la clientèle, augmentant ainsi les forces et compétences des deux divisions. Avec des sites de production au Royaume-Uni, Etats-Unis, France, Canada, Belgique, Allemagne, Chine et Inde, le réseau technique des ventes s'étend sur 6 continents et offre des technologies de pointe à un niveau de support jamais atteint jusqu'ici, là, où et quand cela s'avère nécessaire.

C-MAC MicroTechnology peut répondre par des solutions de première classe à la demande des clients et du marché; faisant front aux exigences les plus complexes du contrôle analogue, digital et de fréquence des systèmes modernes. Au fil des années des partenariats stratégiques se sont développés avec nos clients dont beaucoup sont des leaders dans le secteur de télécommunications, de l'automobile, du miliaire, de l'aérospatiale et de l'instrumentation médicale.

C-MAC Microcircuits, un leader mondial de l'approvisionnement de solutions micro-électronique, dispose de multiples sites de production en Amérique du Nord, Europe et Asie. Notre grande expérience des applications et de la production de substrats couche épaisse, d'hybrides à composants CMs, d'hybrides avec report et câblage de puces et de modules multi-puces nous permet d'offrir des solutions micro-électroniques intégrées nécessaires aux systèmes de plus en plus complexes.

La compétence de notre ingénierie assure une conception et un développement réalisés par des experts sur des systèmes CAD et CAE les plus récents et nous permet de simuler les performances électroniques et thermiques dès le premier stade d'un projet. En plus, notre expérience considérable dans le domaine du silicium nous permet d'offrir des solutions ASIC à des prix compétitifs pour une large gamme de produits électroniques enrobés.

C-MAC Microcircuits apporte à la nouvelle division une considérable diversification en technologie et capacité de production à des prix compétitifs. Les matériaux les plus récents et techniques d'assemblage de pointe assurent actuellement des productions de grand volume.

Les capabilités des matériaux et de production de pointe comprennent:

- LTCC (Substrat co-cuit basse température) fabriqués avec un procédé "sans rétrécissement" et permettant d'y incorporer des composants ainsi que des cavités de toutes formes.
- Photo gravure pistes fines en couche épaisse pour des interconnections de haute densité et performance.
- Chip on board, report de puces sur céramique et montage direct de flip chip
- Sérigraphie couche épaisse hautement automatisée
- Capacité de production CMS hautement automatisée.

Une preuve de notre engagement dans le domaine de la qualité est que nos procédés de fabrication travaillent sous Contrôle Statistique du Procédé (CSP). Ceci complété par des techniques telles que AMDEC (Analyse des modes de défaillance, de leurs effets et de leur criticité) et simulations des produits. L'engagement de fabriquer des produits de qualité est fondamental et se reflète dans la large gamme des certifications internationales obtenues parmi lesquelles QS9000, ISO 9001, MIL STD 1772A, MIL PRF38534, UKAS, CECC, BS9450 ainsi que de nombreux certificats individuels de clients.

Nous avons une réputation établie de fournir de composants micro-électroniques hautement fiables pour l'intégration **spatiale.** Les produits offerts s'étendent du simple réseau résistif et die pack semiconductors déverminés selon classe K à l'hybride entièrement développé sur mesure. Un développement intégré de la solution modulaire est réalisée, comprenant une simulation analogue, digitale et thermique avant la réalisation du circuit en couche épaisse et il y a un groupe séparé pour le développement des ASICS's FPGA ou entièrement sur mesure.

C-MAC Microcircuits est un des principaux fabricants d'hybrides sur mesure du marché **militaire**. Nous avons une longue histoire dans le développement et la fabrication de produits databus avioniques pour les applications MIL STD 1553 et MIL STD 1760. Afin d'arriver à la fonctionnalité et à un coût compétitif exigés par le secteur militaire, nous avons considérablement investi dans le développement des ASIC's partiellement ou entièrement sur mesure étant au coeur de ces produits.

Annuellement, nous fournissons des millions de pièces de circuits hybrides au marché **télécommunication**. Des applications typiques comprennent les centrales publiques (cartes ligne) centrales privés et des produits de transmission.

Par partenariat très étroit avec les principaux fabricants mondiaux en **communications sans fil** nous avons développés une gamme très avancée de modules de puissance RF. Actuellement, nous sommes internationalement reconnus pour nos solutions de pointe pour la téléphonie cellulaire, les centrales cellulaires et les radios bidirectionnelles.

Afin de supporter notre expansion continue dans le secteur de **l'automobile**, deux sites clé ont obtenu la certification QS9000. Ce développement de notre qualification ISO 9000 fait partie de notre engagement à l'amélioration continue, une politique qui s'étend à C-MAC tout entière.

C-MAC Frequency Products a été établi en 1998 afin de combiner les forces de quatre leaders industriels, C-MAC Quartz Crystals, CEPE, Greenray et IQD Limited.

Notre gamme de produits de contrôle de fréquence est probablement la plus importante disponible d'une seule source; elle varie de cristaux commerciaux bon marchés à des oscillateurs hautement spécifiques employés dans la majorité des applications militaires et spaciales.

Complémentairement aux produits standards décrits dans le Data Book, C-MAC Frequency Products offre un service sur mesure bien développé qui satisfait à des exigences bien au-delà de celles généralement requises. Une variété de produits qualifiés par l'Agence Européenne de l'Espace ainsi que le British Standard sont disponibles.

Comme la division C-MAC Frequency Products dispose de plusieurs sites de fabrication, ses compétences propres couvrent le spectre entier de la technologie de contrôle de fréquence par quartz. Plusieurs sources alternatives sont disponibles, assurant ainsi la continuité de l'approvisionnement. La production de toute la division est contrôlée par un système MRPII (système de planification des resources de production) permettant une vue claire à toutes les étapes du procédé de fabrication. Des inspections et évaluations permanentes assurent la fiabilité du produit fini. Des procédures de qualité ISO9001 sont appliquées dans tous les sites lesquels sont soit certifiés ISO9001 ou en cours de qualification.

L'approche choisie par le service clientèle de C-MAC Frequency Products est celle du partenariat. Un responsable client spécialisé est désignée; celui-ci, avec le soutien de l'ingénierie du département Application et Support de C-MAC, guide le client depuis la conception du produit jusqu'à la fabrication à grande échelle.

Le client peut commander soit via le très compréhensif Data Book, soit via son pendant CD-ROM, ou via le world wide web à l'adresse http://cfpwww.com. C-MAC dispose de stocks considérables en composants courants permettant une livraison immédiate et est en mesure de livrer bon nombre de composants spécifiques en quelques jours grâce à son service de fabrication rapide.

Etant l'un des rares spécialistes internationaux en produits de contrôle de fréquence, C-MAC Frequency Products dispose d'une organisation de ventes soutenue par plus de 200 distributeurs et représentants dans 37 pays (voir page 275).

MEMBRES DU GROUP C-MAC FREQUENCY PRODUCTS

C-MAC Quartz Crystals

Les racines de C-MAC Quartz Crystals remontent en 1937 avec la Radio Division of Standard Telephones and Cable (STC). Après le déménagement de Woolwich à Harlow UK en 1952 et l'ajoute d'installations de développement de quartz en 1962, les opérations cristaux et circuits hybrides STC ont été racheté à Nortel par C-MAC Industries en 1992. En 1995 la compagnie a été renforcée suite à l'achat de l'unité de production quartz cristal de GEC Plessey Semiconductors à Lincoln, UK.

Actuellement, C-MAC Quartz Crystals offre une gamme très étendue de produits, allant des oscillateurs compensés en température (TCXO), des oscillateurs contrôlés par tension (VCXO) aux filtres SAW (surface acoustic wave), aux simples oscillateurs et résonateurs à quartz (XO).

L'engagement de C-MAC de livrer des produits de qualité se reflète dans sa certification ISO 9001 ainsi que dans la gamme de qualifications des clients et des produits, parmi lesquelles CECC 68000, CECC 68100 et ESA/SCC 3501. Une gestion de qualité totale (TQM), appliquée à travers toute la compagnie, est soutenue par des "groupes d'amélioration continue" dont les buts imposés volontairement sont le zéro défaut et la livraison à temps à 100%.

CEPE

(Compagnie d'Electronique et de Piézo-Electricité) est un leader mondial dans le développement et la fabrication de quartz ultrastables OCXO's, et dispose d'un site production de 7800 m² à Argenteuil, Paris, France. Etabli au sein de Thomson-CSF il y a environ 50 ans afin de produire des produits BAW (bulk acoustic wave crystal) pour les marchés de la défense et de l'avionique, la compagnie s'est diversifiée dans des produits du secteur commercial tel que communications mobiles. CEPE a été était achetée en 1998 par les Industries C-MAC.

CEPE dispose d'une considérable compétence dans la fabrication, le taillage, la métallisation et le montage de cristaux de quartz SC de haute stabilité, ainsi que dans le domaine de l'optimalisation thermique de l'électronique des oscillateurs, de l'emplacement des composants, du choix des matériaux de four et de circuit imprimé.

Greenray

Greenray, un fournisseur bien établi de produits de fréquence pour une gamme diverse d'applications et d'industries a été acheté par C-MAC Industries en 1995. Son usine de 20000 sq/ft sise à Mechanicsburg, Pennsylvania, est bien située pour servir les besoins de toute la clientèle de l'Amérique du Nord. A côté de la fabrication de circuits imprimés, Greenray est qualifiée pour fabriquer des produits utilisant des puces cablées.

IQD Limited

IQD, basé à Crewkerne, UK, a été fondée en 1973 afin de produire et vendre une large gamme de produits de contrôle de fréquence, allant du niveau commercial à celui requis par les applications militaires et professionnelles les plus astreignantes. La qualité a été à la base du succès de la compagnie. IQD était le premier fabricant ayant été approuvé BS5750 et dispose actuellement de la certification ISO 9001. Son programme TQM englobe tous les aspects du support à la clientèle, du premier contact de vente jusqu'à la livraison dans les délais.

CONDITIONS DE VENTE

Commandes minimum

Commandes de clients établis: £50.00; paiement à l'avance: £50.00; ou l'équivalent en devises (+ port & emballage).

Devis

Les devis établis par IQD sont valides pendant 30 jours, sauf indication contraire.

Certificat de conformité (C de C)

Des certificats de conformité sont disponibles sur demande (pour un coût minimum - £11.00 ou l'équivalent en devises) si la commande est confirmée par fax ou par courrier.

Accusé de réception de commande

Un accusé de réception est envoyé dans le trois jours suivant la reception des commandes.

Annulation de commande

L'achat de produits fabriqués sur mesure ne peu pas être annulé.

Envois

Les commandes reçues au plus tard à 17h00 et portant sur des articles pris en stock peuvent normalement être envoyés le jour même à condition que vous l'ayez spécifié sur la commande.

Termes et conditions

Trente jours à compter de la fin du mois de facturation pour tous les comptes créditeurs agréés.

Services spéciaux

es Echangde données électroniques

Nous offrons ce type de communication sur la base de normes internationales. Veuillez contacter pour cela notre Service Informatique.

Codes à barres

L'emballage des produits peut recevoir un code barres, à condition de le demander. Veuillez contacter pour cela notre Service Informatique.

Paiement en devises autres que la livre sterling

La devise internationale que nous préférons est le dollar US mais nous pouvons exploiter pour vous un compte dans un grand nombre de devises différentes; veuillez vous mettre d'accord sur ce point avec notre représentant du service ventes lorsque vous passez votre première commande. Veuillez également vous assurer que les versements dans la devise agréée nous parviennent en totalité, sans aucune déduction de frais.

Renvois

Nous prions les clients de contactet notre service ventes avant de nous renvoyer des produits, pour quelque raison que ce soit, ce afin d'éviter des délais importants dans le traitement du renvoi des produits.

Spécifications

IQD fait des efforts continuels ayant pour but d'offrir à sa clientèle la technologie la plus récente dans le secteur des composants à cristaux et se réserve le droit de changer ses spécifications, modèles et conceptions, sans aucun préavis.

LE QUARTZ - NATUREL ET SYNTHÉTIQUE

Le quartz est une forme cristalline de la silice, ou dioxyde de silicium ($SiO2$), qui est abondant dans la nature, formant environ 12 % de l'écorce terrestre. La combinaison d'une disponibilité limitée du quartz naturel et de son prix élevé a conduit au développement de quartz synthétique. On fait croître les cristaux de quartz en dissolvant la silice dans une solution alcaline à température et pression élevées. Ce processus a lieu dans des autoclaves qui sont construits de manière à supporter les conditions extrêmes nécessaires.

Les cristaux d'amorçage sont placés dans des cadres dans la partie la plus froide de l'autoclave, tandis qu'une solution de carbonate de sodium et de fragments de silice sont placés dans la partie la plus chaude. Cette solution se déplace de la région la plus chaude vers la plus froide et ce faisant, dissout la silice et la dépose sur le cristal d'amorçage. Les températures sont contrôlées pendant tout le processus.

Il faut environ dix semaines pour obtenir de grandes barres de cristal. La qualité du quartz dépend des conditions de la croissance. On fait croître les cristaux selon des formes et des tailles qui réduisent la perte de temps et de matériau.

Ces barres de cristal sont coupées en tranches. L'angle de découpe de ces tranches est critique dans la détermination de la fréquence et de la stabilité en température du quartz final. La coupe la plus courante est la coupe AT où la tranche est coupée selon un angle d'environ 35°, permettant une gamme de fréquences de 1MHz à 300 MHz.

PROPRIÉTÉS PIÉZOÉLECTRIQUES DU QUARTZ

Depuis la découverte des propriétés piézoélectriques du quartz en 1880 par Pierre et Marie Curie, le quartz est devenu un facteur important dans la croissance de l'industrie électronique.

La traction ou la compression d'un matériau piézoélectrique produit une tension. L'inverse est également vrai, une tension appliquée au matériau provoque des déformations mécaniques.

Dans le cas des quartz, la pression résultant d'une tension qui est appliquée est produite sous la forme d'oscillations à une fréquence de résonance particulière. Cette fréquence est fonction de l'épaisseur du quartz. En préparant soigneusement ce dernier, on peut le fabriquer pour qu'il oscille à une fréquence déterminée.

VUE GÉNÉRALE DE LA PRODUCTION DES COMPOSANTS Á QUARTZ

Ce processus de fabrication commence par réduire l'épaisseur du wafer. La fréquence est déterminée par l'épaisseur, les wafer sont coupés plus épais que ce qui est nécessaire pour qu'ils puissent être amincis en fonction de la fréquence désirée. Cette réduction est obtenue en l'usant avec un abrasif comme l'alumine pour produire un état de surface lisse. Le quartz est usé jusqu'à l'obtention d'une fréquence légèrement supérieure à la fréquence finale désirée.

Ce processus est suivi d'un nettoyage et d'une attaque du wafer pour améliorer encore la finition de la surface et réduire la dispersion de fréquence dans un même lot de quartz.

Les connexions électriques sont formées en déposant un métal (habituellement de l'argent) sur le wafer par vaporisation sous vide.

Le quartz est ensuite monté sur une embase à ressort. Une fois le quartz positionné, un adhésif conducteur relie les électrodes au montage.

Le quartz nécessite ensuite un ajustage à la fréquence finale. Ceci peut être obtenu en plaquant un peu plus d'argent sur le quartz jusqu'à ce que la fréquence exacte soit atteinte.

Une fois que la fréquence correcte, les cristaux sont cuits dans des fours avant d'être encapsulés dans leur boîtier. Une fois l'opération terminée, le quartz peut être totalement testé.

La complexité de ce processus de fabrication, avec les considérations de fréquence et de stabilité, souligne le besoin de spécifications détaillées que les clients doivent attendre de leurs quartz. Les spécifications minimum qui sont habituellement nécessaires lors d'une commande de quartz sont mises en valeur au début de chaque section.

PRÉCAUTIONS DE MANIPULATION

Ainsi que nous l'avons décrit auparavant, l'unite de quartz comprend un petit disque ou une petite barre de quartz aux dimensions et épaisseur exactes correspondant aux fréquences de résonace spécifiées par les clients. Le quartz est plaqué avec électrodes de conduction et monté dans un compartiment de protection scellé (Voir illustration 1). Les électrodes sont reliées á des fils qui passent dans l'assemblée de base par des sceaux verre-métal.

Les unités de quartz sont souvert incorporées á d'autres circuits afin de produire un module fontionnel, c'est á dire un oscillateur ou un filtre complexe. L'illustration 2 montre un oscillateur á quartz simple.

Etant donné sa nature, il est important de manipuler correctement l'unité de quartz.

Chocs mécaniques

Les éléments de cristal sont fabriqués de manière à subir certains niveaux de choc mécaniques. Ce niveaux sont donnés dans le Data Book en suivant les spécification environnementales de chaque élément individuel.

Des niveaux de choc excessifs peuvent provoquer des changements dans les caractéristiques électriques, et cela produira un changement de fréquence. L'élément peut se briser à la suite d'une manipulation brutale, par exemple si on le lasisse tomber sur une surface dure.

Manipulation des fils

Il est dangereux de trop les fils car cela peut endommager le sceau verre-métal et faire que le compartiment ne sera plus hermétique. Les compartiments sont remplis de gaz inerte et, si le sceau est brisé, la pollution atmosphérique détériorera rapidement le produit. Il faut donc faire attention á ne pas todre ni tendre les fils lorsque l'on manipule le cristal.

S'il est nécessaire de déplacer l'élément en tordant le fil, il fuadra tordre le fil doucement en l'éloignant du sceau de verre pour éviter de le briser. Le rayon minimum de courbe dépend du produit, par exemple il sera de 2mm pour le HC49 et de 1mm pour l'UM1.

Produit bande et bobine

Avant d'utiliser des éléments de quartz sur des machines à mise en place automatiques, il est nécessaire de tester le niveau de choc auquel l'élément sera pendant le processus de mise en place. Si nécessaire, il faudra réduire le niveau de choc.

Température

Si les cristaux sont soumis à des températures extrêmes en dehors des limites de température de stockage, leur performance électrique en sera affectée et pourra provoquer une panne.

Décarge électrostatique (ESD)

L' électricité statique ne peut être vue, entendue ou même sentie qu'à des voltages extrêmes,mais même les voltages les plus bas peuvent endommager les circuits électroniques.

L' endommagement de oscillateur peut ne pas être évident dans l'immédiat et subir un délai résultant en une détérioration des circuits et, par la suite, une panne de l'oscillateur.

Bien que le quartz ne soit pas nécessairement sensible aux détériorations ESD, les circuits électroniques assoviés contenus dans un oscillateur le sont et ils doivent être considérés comme étant des produits sensibles aux électrostatiques (ESDS - Electrostatic Discharge Sensitive Device).

Les ESDS devraient être manipulés dans une zone protégée contre les décharges électrostatiques (EPA - ESD Protective Area), où on utilisera des bandes de poignets. Tout transport devra s'effectuer en utilisant un conditionnement protecteur approprié. Tout conditionnement devra porter un avertissement et les mesures de protection ainsi que le conditionnement devront être au standard BS EN 100015. Pour plus de détails sur les précautions à prendre, veuillez contacter le service Application Support Department.

Généralités

L'épaisseur approximative du disque ou de la barre de quartz est donnée selon l'equation suivante:

Epaisseur (mm) = 1,67 / F (MHz)

INTRODUCCION E INFORMACION SOBRE PEDIDOS

Una división de C-MAC MicroTechnology

Durante 1999 se formó **C-MAC MicroTechnology** para reunir los recursos de C-MAC Frequency Products y C-MAC Microcircuits, y así aglomerar la pericia y productos de C-MAC Frequency Products con las avanzadas tecnologías de fabricación, ingeniería y embalaje de C-MAC Microcircuits. La nueva división emplea lo mejor en el servicio a clientes, y en las técnicas de fabricación e ingeniería usando como palanca los puntos fuertes y habilidades de las dos divisiones. Contamos con plantas de fabricación en el Reino Unido, EE.UU., Francia, Canadá, China e India, y una red técnica de ventas que se extiende en seis continentes, para ofrecerle a nuestros clientes la tecnología más moderna y niveles inigualables de apoyo técnico cuando y en donde se necesite.

C-MAC MicroTechnology ofrece soluciones de productos de clase mundial como respuesta a las necesidades mercantiles y del cliente, encarándose a las complejas necesidades analógicas, digitales y de frecuencia de los sistemas modernos. Nuestros clientes están entre los principales fabricantes a nivel mundial en las áreas de telecomunicaciones, automotriz, militar, aeroespacial y médica y, con el paso del tiempo, hemos desarrollado con ellos asociaciones estratégicas.

C-MAC Microcircuits es el líder mundial en la entrega de soluciones microelectrónicas, con varias plantas de fabricación en Norteamérica, Europa y Asia. Gracias a nuestra amplia experiencia en el diseño y fabricación de substratos gruesos en película, montaje superficial híbrida, chips de tecnología híbrida y módulos de chips múltiples, podemos ofrecerle soluciones microelectrónicas integradas para diversos sistemas complejos.

Nuestra amplia experiencia técnica incluye el diseño de circuitos e híbridos, respaldada con los sistemas más modernos CAD y CAE, lo que nos permite ofrecerle la actuación simulada electrónica y térmica durante las etapas tempranas del proyecto. Además, nuestra considerable experiencia en el diseño con silicio nos permite ofrecerle soluciones económicas CIAE para una amplia variedad de productos de embalaje electrónico.

La participación de C-MAC Microcircuits en la recién formada división MicroTechnology trae consigo diversas habilidades y pericias tecnológicas y de fabricación económica. En la actualidad, se usan los materiales más avanzados y las técnicas de montaje más moderna en la producción de volumen.

Entre las posibilidades de materiales y procesamiento avanzado cuenta con:

- LTCC - Substratos de cerámica co-cocida a baja temperatura mediante un proceso exclusivo “sin contracción”, con la posibilidad de tener componentes incrustados/intercalados y cavidades complejas.
- Película gruesa para cerámica para imágenes fotográficas de línea fina para interconexiones de alta densidad y alta actuación.
- Chips en placa, en cerámica, y pastillas dispersoras de interconexión directa.
- Impresión muy automatizada de película gruesa.
- Posibilidad de fabricación muy automatizada de tecnología de montaje superficial.

Como indicación de nuestro compromiso con la calidad, nuestros procesos de fabricación se evalúan y operan bajo el Control Estadístico de Procesos, complementado con técnicas tales como análisis de Modo de Fallos y Efectos del diseño y proceso (FMEA) y simulación de productos. Nuestra dedicación a la construcción de productos de alta calidad es fundamental y se refleja en nuestra amplia gama de aprobaciones bajo normas internacionales como QS9000, ISO 9001, MIL STD 1772A, MIL PRF38534, UKAS, CECC y BS9450, además de certificados de clientes individuales.

Se nos reconoce por la distribución de componentes microelectrónicos de gran fiabilidad para la integración espacial. Nuestros productos van desde redes de resistencias simples hasta empaques de troqueles semiconductores con blindaje Clase K, pasando por híbridos “a la medida”. Ofrecemos un paquete integrado desde el diseño hasta la ingeniería, incluyendo la simulación analógica, digital y térmica antes de llevar a cabo el diseño de la película gruesa, y contamos con un área separada para los requisitos de diseño individuales o bajo FPGA ASIC.

C-MAC Microcircuits es uno de los fabricantes principales de híbridos a la medida para el mercado militar. Desde hace mucho tiempo hemos participado en el diseño y fabricación de productos aviónicos de canal de datos para aplicaciones MIL STD 1553 y MIL STD 1760. Para alcanzar la funcionalidad y economía requeridas por el sector militar, hemos invertido considerablemente en el desarrollo de CIAE a la medida o casi a la medida, que son el meollo de estos productos.

Proveemos al mercado de telecomunicaciones muchos millones de piezas al año de circuitos híbridos de película gruesa. Entre las aplicaciones normales están los conmutadores principales (tarjetas de línea), conmutadores privados y productos de transmisión.

Gracias a la estrecha colaboración de trabajo que tenemos con algunos de los fabricantes originales de equipo más importantes del mundo en las comunicaciones inalámbricas, hemos desarrollado conjuntamente una gama de avanzada de módulos de alimentación de radiofrecuencia. En la actualidad, se nos reconoce mundialmente por nuestras soluciones vanguardistas en teléfonos celulares, estaciones base celulares y radios bidireccionales.

Con el fin de apoyar nuestra expansión continua en el sector automotriz, hemos obtenido la aprobación bajo la norma QS 9000 para nuestras fábricas clave. Este desarrollo de nuestro registro bajo ISO 9000 es parte de nuestro compromiso con las mejorías continuas, una política que se extiende a lo largo de C-MAC.

Durante 1998 se formó **C-MAC Frequency Products** para combinar los puntos fuertes de cuatro líderes industriales: C-MAC Quartz Crystals, CEPC, Greenray y IQD Limited.

Probablemente nuestra gama de productos de control de frecuencias sea la más amplia disponible en una sola fuente, y va desde cristales comerciales de bajo costo hasta osciladores de alta especificación usados en las aplicaciones militares y espaciales más difíciles. Además de los productos estándar descritos en este Libro de Datos, C-MAC Frequency Products ofrece un servicio bien desarrollado de diseño a la medida para cubrir las necesidades que van más allá de las especificadas normalmente. También contamos con diversos productos con emisiones de la Agencia Espacial Europea y las Normas Británicas.

Ya que la división de C-MAC Frequency Products incluye varias operaciones de fabricación bien establecidas, su experiencia interna cubre el espectro completo de las tecnologías de control de frecuencia de cuarzo. Contamos con fuentes alternativas para equipos individuales, de manera que podemos asegurar la continuidad de entregas. La fabricación en toda la división se controla mediante sistemas interconectados de planeación de los recursos de fabricación MRPII, logrando una visibilidad total a lo largo de todas las etapas del proceso. La inspección y evaluación constantes aseguran la fiabilidad del producto terminado. Todas nuestras plantas funcionan bajo los procedimientos de calidad ISO9001, ya sea que hayan sido certificados bajo esta norma o estén buscando la certificación.

La política preferida de C-MAC Frequency productos en cuanto al servicio al cliente es la de la asociación. Se le asigna a cada cliente un director especializado de cuentas que, apoyándose en la experiencia técnica del Departamento de Apoyo a la Aplicación de C-MAC, guía a los clientes a través del ciclo de desarrollo de productos desde el concepto de diseño hasta la fabricación a escala completa.

Los clientes podrán enviar pedidos a C-MAC Frequency Products usando este Libro de Datos, su presentación en CD-ROM, o a través del Internet en la dirección http://cfpwww.com. C-MAC tiene en existencia una amplia gama de componentes especificados comúnmente para la entrega inmediata, y puede entregar muchos otros en unos cuantos días gracias a su servicio exprés de fabricación.

C-MAC Frequency Products, uno de los pocos especialistas verdaderamente internacionales en el control de frecuencias, cuenta con una gran organización de ventas directas apoyada por más de 200 distribuidores y representantes en 37 países (ver página 275).

MIEMBROS DEL GRUPO C-MAC FREQUENCY PRODUCTS

C-MAC Quartz Crystals

Las raíces de C-MAC Quartz Crystals se remontan a 1937 y la División de Radio de Standard Telephones and Cable (STC). Después de que en 1952 se mudaron a Woolwich desde Harlow, en el Reino Unido, y con la adición de la planta de cristalización de cuarzo en 1962, C-MAC Industries adquirió las operaciones de circuitos de cristal e híbridos de STC de Nortel en 1992. En 1995, la empresa se fortaleció mediante la adquisición de la planta de cristal de cuarzo de GEC Plessey Semiconductors, en Lincoln, RU.

En la actualidad, C-MAC Quartz Crystals ofrece una extensa línea de productos, incluyendo osciladores cristalinos compensados por temperatura (TCXO) y controlados por voltaje (VCXO), filtros de ondas acústicas de superficie (OAS), osciladores cristalinos simples (XO) y resonadores.

Nuestra dedicación a suplir productos de calidad se refleja en la certificación bajo la norma ISO9001 de C-MAC y su gama de aprobaciones de clientes y productos, incluyendo CECC 68000, CECC 68100 y ESA/SCC 3501. La gestión total de calidad que se practica en toda la compañía, está apoyada por los “equipos de mejoras continuas” cuyos objetivos autodeterminados son “cero defectos” y “entrega a tiempo en 100% de los casos”.

CEPE

CEPE (Compagnie d’Électronique et de Piézo-Électricité) es un líder mundial en el diseño y fabricación de osciladores cristalinos controlados por estufa (OCXO) de cuarzo ultraestable, con una planta especializada de 7800 m^2 de superficie, ubicada en Argenteuil, París, Francia. Establecida hace casi 50 años dentro de Thomson-CSF para suplir productos de cristal de onda acústica volumétrica para los mercados militar y aviónico, la compañía se ha diversificado a mercados comerciales como el de comunicaciones móviles. En enero de 1998, C-MAC Industries adquirió CEPE.

CEPE cuenta con una experiencia considerable en la fabricación, corte, metalización y montaje de cristales de cuarzo de gran estabilidad cortados con carburo de silicio, así como en la optimización térmica de los circuitos osciladores, ubicación de componentes y materiales de horno y PCI.

Greenray

Greenray, un proveedor de productos osciladores de reconocido prestigio para una amplia gama de aplicaciones e industrias, fue adquirido en 1995 por C-MAC Industries. Su planta de 1860 m^2 en Mechaniesburg, Pennsylvania, está bien ubicada para atender las necesidades de todos los clientes norteamericanos. Además de la construcción de placas de circuito impreso tradicionales, Greenray está calificada para construir productos usando conexiones con chips semiconductores sin aislamiento y unidas con alambre.

IQD Limited

En 1973, se estableció IQD, con sede en Crewkerne, RU, para fabricar y vender una amplia gama de productos de control de frecuencias, desde grado comercial hasta los usados en las aplicaciones militares y profesionales más estrictas. La calidad ha sido la piedra de toque del éxito de la compañía. IQD fue el primer fabricante de cristales que recibió la aprobación bajo la norma BS5750 y, en la actualidad, posee también la certificación bajo ISO9001. Su programa completo de gestión total de calidad abarca todos los aspectos de apoyo al cliente, desde el contacto inicial de ventas hasta la entrega a tiempo. Este programa de gestión va acompañado de un programa de desarrollo y capacitación del personal cuyo éxito ha sido reconocido con el prestigioso premio Investors in People Award, recibido por la compañía en 1997.

INFORMACION SOBRE PEDIDOS

Cargo minimo por pedido

Pedidos de clientes con cuenta: 50 libras esterlinas; pago por anticipado: 50 libras esterlinas u otra moneda equivalente a dicha suma (+ gastos de embalaje y envio).

Cotizaciones

Las cotizaciones hechas por IQD son válidas durante 30 días a me nos que se estipule de otra manera.

Certificado de conformidad

Previa solicitud se facilitarán certificados de conformidad (por un coste mínimo - £11.00 - u otra moneda equivalente a dicha suma) si se confirma el pedido por escrito mediante fax o carta.

suma) si se confirma el pedido por escrito mediante fax o carta.

Otros acuses de recibo

Se envian acuses de recibo para todos los pedidos dentro de 3 dias 3 dfas después del pedido.

Cancelación de pedido

Los pedidos de compra de pedidos personalizados no se pueden cancelar.

Envío

Normalmente, los pedidos de artículos en existencia recibidos antes de las 4 de la tarde se pueden enviar el mismo día si así se solicita al hacer el pedido.

Condiciones

30 días a partir del final del mes de la factura para clientes con crédito aprobado.

Servicios especiales

Intercambio de datos electrónico (Electronic Data Interchange) (EDI)

Ofrecemos comunicaciones EDI bajo normas internacionales. Sírvase ponerse en contacto con nuestro Departamento IT.

Codificación de barras

El embalaje de productos puede codificarse con barras si se requiere. Sírvase ponerse en contacto con nuestro Departamento IT.

Pago en monedas distintas de la libra esterlina

Nuestra moneda internacional preferida es el dólar de EEUU, pero podemos abrir una cuenta para usted en cualquiera de varias monedas distintas; al hacer su primer pedido clarifique esto con su contacto de ventas. Asegúrese de que recibamos íntegramente la transferencia de fondos en la moneda acordada, es decir sin deducciones de gastos.

Devoluciones

Los clientes que por cualquier razón dessen devolver mercancias deberán primero contactar con nuestro departamento de ventas. De otro modo, podria resultar en demoras considerables del procesamiento de las devoluciones.

Especificaciones

Como parte de su continua dedicación a ofrecer a sus clientes la tecnología más avanzada en componentes de cristal, IQD se reserva el derecho de cambiar las especificaciones, los diseños y los modelos sin notificación previa.

CRISTAL DE CUARZO - NATURAL Y CULTIVADO

El cuarzo es una forma cristalina de dióxido de silicio (SiO_2), material que abunda en la naturaleza y que constituye el 12% de la corteza terrestre. Como resultado de la escasez de cuarzo natural y de su alto coste, se ha desarrollado el cuarzo cultivado.

Se generan cristales de cuarzo disolviendo SiO_2 en una solución alcalina a alta temperatura y presión. Este proceso se realiza en autoclaves construidos para tolerar las extremas condiciones requeridas.

Los cristales así generados se montan en marcos en la parte más fría del autoclave, mientras que en la parte más caliente se coloca una solución de carbonato de sodio y de fragmentos de SiO_2. La solución pasa desde la parte más caliente a la más fría y, al hacerlo, disuelve los pequeños trozos y depósitos de cuarzo natural en el cristal cultivado. Durante la totalidad de este proceso, la temperatura se mantiene bajo control.

En unas diez semanas es posible cultivar grandes barras de cristal. La calidad del cuarzo dependerá de las condiciones del cultivo. Los cristales se generan en formas y tamaños que permitan reducir al mínimo las pérdidas de tiempo y de material.

Las barras de cristal se cortan en láminas u obleas. El ángulo de corte de estas láminas es crucial para determinar la frecuencia y la estabilidad térmica del cristal final. El corte más común es el llamado AT, en el que la pieza se corta con una oblicuidad de unos 35º con respecto a la barra de cristal, lo que permite obtener una gama de frecuencias de entre 1 y 300 MHz.

LAS PROPIEDADES PIEZOELÉCTRICAS DEL CUARZO

Desde que la familia Curie descubrieran en 1880 las propiedades piezoeléctricas del cuarzo, este material se ha convertido en un elemento importante para el desarrollo del sector de la electrónica.

Al estirar o comprimir un material piezoeléctrico se genera una tensión. También ocurre lo contrario: al aplicar una tensión al material, éste queda sometido a una tensión mecánica.

En el caso de los cristales, la tensión resultante de la aplicación de una tensión se traduce en oscilaciones a una determinada frecuencia resonante. Esta frecuencia es una función del espesor del cristal. Preparándolo cuidadosamente, es posible hacerlo oscilar a cualquier frecuencia.

INFORMACIÓN GENERAL SOBRE LA PRODUCCIÓN DE COMPONENTES DE CRISTAL DE CUARZO

El proceso de fabricación comienza reduciendo el espesor de la pieza. La frecuencia queda determinada por el espesor. Por lo general, las piezas se cortan a un espesor mayor del necesario, a fin de poder ser reducidas de acuerdo con la frecuencia deseada. Esta reducción se consigue mediante un lapidado con un abrasivo, como el óxido de aluminio, para producir un acabado homogéneo. El cristal es lapidado hasta alcanzar un espesor ligeramente superior al necesario para la frecuencia final.

A continuación, el material es sometido a un proceso de limpieza y pulido, que suaviza aún más el acabado y reduce asimismo la dispersión de frecuencia en el lote de cristales.

Utilizando un metal (por lo general plata), se forman sobre la pieza conexiones eléctricas mediante evaporación al vacío.

A continuación, el cristal se monta sobre su base, que tiene soportes de muelle. Una vez colocado en su lugar, un adhesivo conductor une los extremos del electrodo al soporte.

Seguidamente, el cristal se somete a un ajuste para la obtención de la frecuencia final. Esto puede realizarse mediante la aplicación de más plata de metal, hasta alcanzar la frecuencia exacta.

Una vez que la frecuencia es correcta, los cristales se secan en hornos antes de introducirse en sus contenedores. Finalmente, la unidad podrá ser sometida a diversas pruebas.

La complejidad del proceso de producción, que debe tomar en cuenta consideraciones tales como la frecuencia y la estabilidad, hace hincapié en la necesidad de obtener del cliente especificaciones detalladas acerca del uso que va a darle a los cristales. Por lo general, al recibir un pedido de cristales, al comienzo de cada sección se estipulan las especificaciones mínimas.

PRECAUCIONES DE MANIPULACIÓN

Como ya se ha descrito anteriomente, la unidad de cristal de cuarzo incluye un pequeño disco o tira de cuarzo que se procesa a un tamaño y espesor exactos, dependiendo de la frecuencia especificada por le cliente. Se recubre el cuaezo con electrodos conductores y se le instala en una unidad hermética (vease la Figura 1). Los electrodos están conectado a conductores que pasan por el conjunto de la base mediante sellos de metal a visrio.

A menudo se encapsulan las unidades de cristal con otros circuitos para formar un módulo totalmente fincional, por ejemplo, un oscilador o un filtro complejo. La Figura 2 muestra un oscilador de cristal sencillo.

Debido a las caracteristicas de la unidad de cristal, es muy importante manejarla correctamente.

Impactos mecánicos

Se fabrican los componentes de cristal para que resistan cierto nivel de impacto mecánico. Se resumen estos niveles en las especificaciones ambientales de cada tipo de componente en el Libro de Datos.

Los impactos excesivos pueden causar cambios de las caracteristicas electricas que probablemente se manifestaran en la forma de un cambio de frecuencia. Un maltrato excesivo, por ejemplo, si caen sobre una superficie dura, puede resultar en una fractura de la unidad.

Manejo de los conductores

Si se doblan excesivamente los conductores puede resultar en daar el sello entre vidrio y metal y una pérdida de la hermeticidad de la unidad. Las unidades contienen un gas inerte seco y si se pierde hermeticidad podria resultar en un deteriorio rápido del producto debido a contaminacion atmosférica. Por lo tanto, hay que teber cuidad cuando se maneja la unidad para no doblar ni tirar de los conductores. Si se necesario desplazar el componente de una manera que neceaite doblar el conductor, se debe doblar este a cirte distancia del sello de vidrio para evitar rajarlo. El radio de curvatura minino recomendado depende del producto; por ejemplo, 2mm para los HC49s y 1mm para los UM1s.

Producto en cinta y bobina

Antes de usar productos de cristal en las máquinas de colocación automatizada, se deben realizar pruebas para medir el impacto al que se someten los dispositivos de cristal durante el proceso de colocación. Si se necesario, reducir la intensidad de impacto.

Temperatura

Si se someten los cristales a temperatura fuera de los limites recomendados de almacenamiento, podria afectar las prestaciones electricas y causar un fallo enentual.

Descarga electrostática (DES)

Solamente se pueden ver, oir o hasta sentir las descargas electrostáticas cuando hay una tensión excesiva, pero los voltajes más minimos pueden dañar los circuitos electrónicos. Quizás no sea inmediatamente evidente el daño causado por una descarga electrostática, pero puede retardarse y a su vez podria causar un fallo del oscilador durante su uso.

Aunque el cuarzo no es necesariamente vulnerable a las DES, los circuitos electróniocos asociados del oscilador lo pueden ser y se le debe considerar como un dispositivo sensible a las descargas electrstáticas (SDES).

Los dispositivos SDES se deben manejar en una zona protegida contra DES, en donde normalmente se usan pulseras conductoras. Cualquier transporte se debe realizar usando los empaques protectores correspondientes. Todos los empaques deben estar marcados con una advertencia, y las medidas protectoras y los empaques deberán conformar con la especificación BS FN 100015. Para un analisis mas detallado de las precauciones que se deben tomar, sirvase contactar con nuestro Departamento de Soporte de Aplicaciones.

Información general

El espesor aproximado de un disco o tira de cuarzo se puede obtener de la siguiente ecuación:

Espesor (mm) =1,67 / f (MHz)

INTRODUZIONE ED INFORMAZIONI SUGLI ORDINI

Una divisione della C-MAC MicroTechnology

La **C-MAC MicroTechnology** è stata fondata durante il 1999 per unificare le risorse della C-MAC Frequency Products e della C-MAC Microcircuits, amalgamando le vaste capacità ed i prodotti della C-MAC Frequency Products e le avanzate tecnologie della tecnica e di produzione della C-MAC Microcircuits.

La nuova divisione utilizza le migliori tecnologie per l'assistenza al cliente, per la produzione e per la tecnica, avvalendosi delle forze e delle capacità di entrambe le divisioni. Con stabilimenti nel Regno Unito, USA, Francia, Canada, Cina ed India, una rete di vendite che copre sei continenti che fornisce ai clienti sia la tecnologia d'avanguardia che i livelli di assistenza tecnica senza precedenti dovunque ed in qualsiasi momento sono richiesti.

La C-MAC MicroTechnology può offrire soluzioni di classe mondiale in risposta alle esigenze dei clienti e del mercato, indirizzando le esigenze dei complessi controlli analogici, digitali e di frequenza dei moderni sistemi. I nostri clienti sono la maggior parte dei produttori leader mondiali nei settori delle telecomunicazioni, dell'industria automobilistica, militare, aerospaziale e medicale, con cui abbiamo sviluppato delle associazioni strategiche durante un numero di anni.

La **C-MAC Microcircuits** è leader nella fornitura di soluzioni di microelettronica, con multipli impianti di produzione in tutto il Nord America, Europa ed Asia.

La Vasta esperienza nella progettazione e nella produzione di spessi substrati di pellicola, ibridi di supporti di superficie, ibridi di chip e cavi e moduli multi chip ci consentono di offrire soluzioni di microelettronica integrate per una gamma di sfide ai sistemi complessi.

La competenza tecnica include la vasta progettazione di circuiti e l'abilità di lay-out ibridi, con il supporto di sistemi CAD e CAE allo stato dell'arte ci consentono di offrire prestazioni simulate elettroniche e termiche all'inizio degli stadi di progettazione. Inoltre la nostra considerevole esperienza nella progettazione del silicone consente soluzioni ASIC costo efficienti per una vasta varietà di prodotti d'imballaggio elettronici.

La C-MAC Microcircuits porta una vasta varietà tecnologica e capacità produttiva economica alla nuova divisione della MicroTechnology. I materiali più avanzati e più recenti e le tecniche di assemblaggio sono attualmente in produzione a volume.

Il materiale avanzato e le capacità produttive includono:

- Substrati di LTCC (Low Temperature Co-Fired Ceramic) con un singolare processo 'no shrink' (senza ristringimento) di componenti incassati/nascosti, e complesse cavità.
- Pellicola spessa in ceramica foto immagine fine per alta densità ed elevati collegamenti ad alte prestazioni.
- Chip su scheda, chip su ceramica e chip flip a diretto attacco
- Stampa di pellicola spessa altamente automatizzato
- Capacità produttive STM altamente automatizzate

Come indicazione dell'impegno alla qualità, i nostri processi di produzione vengono valutati ed azionati sotto il Controllo Processo Statistico (SPC).Questo è complimentato dalle tecniche come Failure Mode ed Effect Analysis (FMEA) e simulazione di prodotto. La dedicazione a produrre prodotti di qualità è fondamentale e viene riflessa nella nostra vasta gamma di approvazioni internazionali, che includono QS9000, ISO 9001, MIL STD 1772A, MIL PRF38534, UKAS, CECC e BS9450 oltre a molte certificazioni di clienti individuali.

Noi vantiamo una reputazione stabilita nella fornitura di componenti di microelettronica per integrazione dello Spazio. I prodotti che noi offriamo vanno da semplici reti di resistenze a pacchetti di mescolatura di semiconduttori con schermatura di classe K ad ibridi completamente customizzati. Viene fornito un design integrato a pacchetto tecnico, caratterizzato da simulazione analogica, digitale e termica prima della realizzazione della pellicola spessa, e vi è una versione separata di completa customizzazione o requisiti di design FPGA ASIC.

La C-MAC Microcircuits è un grande produttore di ibridi customizzati per il settore di mercato militare. Noi vantiamo una storia di progettazione e produzione di prodotti databus avionica per applicazioni MIL STD 1553 e MIL STD 1760. Al fine di ottenere la funzionalità ed il costo effettivo richiesto dal settore militare, abbiamo investito considerevoli somme nello sviluppo di customizzazioni ASIC che suono al centro di questi prodotti.

Forniamo milioni di pezzi l'anno di circuiti ibridi di pellicola spessa al mercato delle telecomunicazioni. Tipiche applicazioni includono interruttori principali (schede di linea), interruttori privati e prodotti di trasmissione.

Tramite la stretta collaborazione di lavoro con alcuni dei leader OEM della Comunicazione Radio, abbiamo sviluppato una gamma di moduli di potenza RF all'avanguardia. Oggi siamo riconosciuti in campo internazionale per le nostre soluzioni allo stato dell'arte dei telefoni cellulari, stazioni base cellulari e radio ricetrasmittenti.

Al fine di sostenere il nostro impegno d'espansione nel settore dell'industria automobilistica, abbiamo ottenuto l'approvazione QS 9000 per i nostri stabilimenti chiave. Questo sviluppo della nostra registrazione ISO 9000 fa parte del nostro impegno al continuo miglioramento, una politica che i estende per tutta la C-MAC.

La **C-MAC Frequency Products** è stata fondata durante il 1998 per combinare le forze di quattro industrie leader, C-MAC Quartz Crystals, CEPE, Greenray e IQD Limited.

La nostra gamma di prodotti di controllo di frequenza è probabilmente la più vasta disponibile da un singolo fornitore, che va da cristalli commerciali economici ad oscillatori ad alte specifiche usati nelle più esigenti applicazioni militari e spaziali.

Oltre ai prodotti standard descritti nel presente Manuale Dati, la C-MAC Frequency Products offre un servizio di progettazione customizzata ben sviluppato per soddisfare quelle esigenze che vanno oltre quelle comunemente specificate. Una varietà di prodotti per le normative della

European Space Agency e della British Standard sono anche disponibili.

Poiché la C-MAC Frequency Products Division include diversi impianti di produzione stabiliti, la competenza in sede copre l'intero spettro delle tecnologie di controllo di frequenze al quartz. Fonti alternative per dispositivi individuali sono disponibili, quindi la continuità di fornitura è assicurata. La produzione in tutta la divisione è controllata dai sistemi di pianificazione in rete MRPII, che offre completa visibilità per tutte le fasi del processo. La costante ispezione e valutazione assicura l'affidabilità del prodotto finito. Le procedure della qualità ISO9001 sono in vigore in tutti gli stabilimenti sia certificata che in corso di certificazione ISO001.

L'approccio preferito della C-MAC Frequency Products al servizio del cliente è uno di partner. Ad ogni cliente viene assegnato un manager specialista il quale, attingendo dalla competenza tecnica del Reparto di Assistenza Applicazione della C-MAC, guida i clienti attraverso il ciclo di sviluppo dei dal concetto della progettazione dei prodotti alla produzione in piena scala.

I clienti possono ordinare dal C-MAC Frequency Products tramite questo esauriente libro dati (Data Book), dal relativo CD-ROM, o tramite il sito internet ad http://cfpwww.com. La C-MAC tiene in magazzino una vasta gamma di componenti specificati per consegna immediata e può consegnare molti altri entro pochi giorni grazie al suo servizio di produzione espressa.

Uno fra i pochi veri specialisti internazionali nel controllo della frequenza, la C-MAC Frequency Products ha una solida organizzazione di vendita diretta assistita da oltre 200 distributori e rappresentanti in 37 paesi (vedi pagina 275).

MEMBRI DEL GRUPPO C-MAC FREQUENCY PRODUCTS

C-MAC Quartz Crystals

La C-MAC Quartz Crystals trova le sue radici al 1937 ed alla divisione Radio Division of Standard Telephones and Cable (STC). A seguito di un trasloco da Woolwich a Harlow, RU, nel 1952 l'aggiunta della crescita dei servizi quartz nel 1962, gli stabilimenti dei circuiti ibridi e di cristallo della STC vennero acquistati dalla Nortel dalla C-MAC Industries nel 1992. Nel 1995 l'azienda venne rinforzata con l'acquisizione degli impianti di cristallo quartz della GEC Plessey Semiconductors a Lincoln, RU.

Oggi la C-MAC Quartz Crystals offre una gamma intensiva di prodotti, incluso oscillatori (TCXO E VCXO) di cristallo a compenso di temperatura ed a controllo di tensione per filtri SAW (onde acustiche superficie), semplici oscillatori a cristallo (XO) e risonanti.

La dedicazione a fornire si riflette nella certificazione ISO9001 della C-MAC e la gamma di approvazioni di clienti e del prodotto, che includono CECC 68000, CECC 68100 and ESA/SCC 3501. La totale gestione della qualità (TQM), adottata in tutta l'azienda, è coadiuvata dalle 'squadre di continuo supporto' i cui bersagli auto imposti sono di zero difetti e 100% tempi di consegna.

CEPE

La CEPE (Compagnie d'Électronique et de Piézo-Électricité) è leader mondiale nella progettazione e nella produzione di OCXO quartz, con uno stabilimento dedicato di 7800 metri quadri ad Argenteuil, Parigi, Francia. Fondato all'interno della Thomson-CSF circa 50 anni fa allo scopo di offrire prodotti di cristallo BAW (onda acustica in massa) (bulk acoustic wave) per i mercati della difesa e dell'avionica, l'azienda ora ha diversificato in mercati commerciali quali le comunicazioni mobili. La CEPE è stata acquisita dalla C-MAC Industries a gennaio 1998.

La CEPE ha considerevole competenza nella produzione, nel taglio, nella metallizzazione e montaggio di cristalli quartz Sc tagliati, ad alta stabilità, nonché nell'ottimizzazione termica dei circuiti di oscillatori, locazione di componenti e materiali per PCB.

Greenray

La Greenray, rinomata ditta da lungo tempo per la fornitura di prodotti oscillatori per una varia gamma di applicazioni ed industrie, è stata acquisita dalla C-MAC Industries nel 1995. Il suo stabilimento di 20,000 piedi quadri a Mechanicsburg, Pennsylvania, è ben piazzato per servire le esigenze dei clienti del Nord America. Oltre alla produzione di schede stampate convenzionali, la Greenray è qualificata per la manifattura di prodotti utilizzando chip di semiconduttori nudi e collegamenti leganti a cavi.

IQD Limited

La IQD, con sede a Crewkerne, RU, è stata fondata nel 1973 per produrre e commercializzare un vasta gamma di prodotti di controllo di frequenza, da grado commerciale a quello usato nelle più rigide applicazioni militari e professionali. La qualità è stato la pietra angolare del successo dell'azienda. La IQD è stato il primo produttore da ricevere l'approvazione BS5750 ed ora possiede la certificazione ISO9001.Il suo esauriente programma TQM comprende tutti gli aspetti di assistenza al cliente dal contatto della vendita iniziale alla consegna a tempo. La TQM è complimentata da un programma di sviluppo ed addestramento del personale il cui successo è stato riconosciuto dall'ambito premio Investors in People Award, presentato all'azienda a dicembre 1997.

INFORMAZIONI SUGLI ORDINI

Ammontare minimo per ordine

Ordini da clienti abituali £50.00; Prepagata £50.00 o altre valute (+ invio e confezionamento).

Preventivi

I preventivi fatti dalla IQD sono validi per un periodo di 30 giorni, se non altrimenti dichiarato.

Certificati di Conformità (C di C)

Certificati di Conformità sono disponibili su richiesta (con un importo minimo - £11.00 - o altre valute) se l'ordine è confermato per iscritto via fax o lettera.

Conferma dell'ordine

Le accuse di ricezione ordini inviate per tutti gli ordini entro 3 giorni dalla ricezione.

Cancellazione dell'ordine

Ordini d'acquisto per merce prodotta su ordinazione non sono annullabili.

Spedizione

Ordini per merce ex-stock, ricevuti prima delle 17:00 pomeridiane, sono normalmente spediti lo stesso giorno se specificatamente richiesto al momento dell'ordine.

Termini di pagamento

30 giorni dalla fine del mese della fattura da approvazione del credito al cliente.

Speciali servizi

Scambio elettronico di dati (EDI)

Offriamo collegamenti EDI per accesso agli standard internazionali. Co ntattare il nostro Dipartimento I.T.

Codice a barre

Su richiesta, il codice a barre può essere applicato alla confezione del prodotto. Vi prechiamo di contattare il nostro Dipartimento I.T.

Pagamenti in valuta, esclusa la sterlina.

La nostra valuta internazionale preferita è il dollaro americano, ma possiamo operare in qualsiasi valuta desiderasse; la preghiamo di discutere la cosa con il reparto vendite prima di fare il suo primo ordine. La preghiamo inoltre di assicurarsi che la rimessa nella valuta stabilita ci arrivi completa, senza deduzione degli oneri.

Restituzione della merce

I clienti che desiderano restituire della merce per qualsiasi ragione devono contattare in primo luogo il nostro reparto vendite, altrimenti siverificherebbero considerevoli ritardi nel trattare le restituzioni.

Specifiche

Nel mettere a disposizione dei clienti, tecnologie per componenti al quarzo sempre più avanzate, la IQD si riserva il diritto di modificare senza preavviso le specifiche, il disegno e i modelli in vendita.

CRISTALLI DI QUARZO: NATURALI E COLTIVATI

Il quarzo è una forma cristallina del biossido di silicio (SiO_2), una sostanza estremamente comune in natura, tanto da costituire circa il 12% della crosta terrestre. La combinazione tra il limitato numero di fornitori di quarzo naturale e l'elevato costo di questo materiale ha favorito la produzione di quarzo "coltivato".

La crescita dei cristalli di quarzo avviene dissolvendo, in un ambiente ad alta temperatura e ad alta pressione, del biossido di silicio in una soluzione alcalina. Questo processo si svolge in autoclavi appositamente costruite per sopportare le severe condizioni ambientali richieste.

I cristalli "seme" vengono montati su cornici posizionate nella parte più fredda dell'autoclave: una soluzione di carbonato di sodio e alcuni frammenti di SiO_2 vengono invece posizionati nella parte più calda dell'impianto.

La soluzione si muove dalla sezione calda a quella fredda: durante questo spostamento vengono dissolti i frammenti che vanno così a depositarsi sul cristallo seme. Nel corso di tutto il processo le temperature vengono accuratamente controllate.

Nell'arco di circa dieci settimane possono essere ottenute barre di cristallo di dimensioni rilevanti. La qualità del prodotto dipende in larga parte dalle condizioni della crescita. I cristalli vengono comunque prodotti secondo profili e dimensioni che consentono di minimizzare gli sprechi di tempo e di materiale.

Una volta prodotte, le barre vengono tagliate a fette. L'angolo di taglio dei wafer è essenziale ai fini della determinazione della frequenza e della stabilità in temperatura del cristallo finale. Il tipo di taglio più diffuso è l'AT, dove il pezzo grezzo viene ottenuto incidendo la barra di cristallo con un'angolazione di circa 35o: tale inclinazione consente di ottenere un range di frequenze compreso tra 1 MHz e 300 MHz.

PROPRIETA' PIEZOELETTRICHE DEL QUARZO

Sin dalla scoperta delle proprietà piezoelettriche del quarzo, avvenuta nel 1880 ad opera dei Pierre e Marie Curie, questo materiale ha assunto, ai fini della crescita dell'industria elettronica, un ruolo estremamente significativo.

Comprimendo o allungando un materiale piezoelettrico è possibile ottenere una tensione. Questa proprietà è bivalente: una tensione applicata al materiale causa infatti una deformazione di tipo meccanico.

Nel caso dei cristalli la pressione risultante da una tensione adesso applicata viene restituita sotto forma di una oscillazione ad una particolare frequenza di risonanza. Tale frequenza è funzione dello spessore del cristallo. Se accuratamente preparato il cristallo può essere predisposto per oscillare a una qualsiasi frequenza.

UNA PANORAMICA DELLA PRODUZIONE DI COMPONENTI BASATI SU CRISTALLI

Il processo produttivo ha inizio con la riduzione dello spessore del pezzo grezzo. Come detto, la frequenza viene determinata dallo spessore: i pezzi vengono tagliati con uno spessore superiore a quello richiesto in modo tale da potere operare una riduzione dell'altezza fino ad ottenere la frequenza desiderata. Tale riduzione viene realizzata tramite lappatura con abrasivi (come ad esempio quelli a base di ossido d'alluminio), operazione che consente di ottenere superfici estremamente rifinite. Il cristallo viene lappato fino a quando il suo spessore raggiunge una dimensione leggermente superiore a quello corrispondente alla frequenza finale. Il processo di lappatura viene seguito dalla pulitura e dal taglio del pezzo: tali fasi permettono di migliorare la finitura della superficie riducendo inoltre le variazioni di frequenza nell'ambito di uno stesso lotto di cristalli.

Le connessioni elettriche vengono realizzate depositando sul pezzo un metallo (normalmente argento): il metodo seguito si basa sull'evaporazione a vuoto.

A questo punto il cristallo viene montato tramite una serie di apposite molle sulla relativa base. Una volta posizionato il cristallo, un opportuno adesivo conduttivo si incarica di collegare le code degli elettrodi.

Il passo successivo prevede l'accordatura alla frequenza finale. La regolazione viene ottenuta deponendo uno strato maggiore di argento. Una volta accertata la frequenza corretta, i cristalli vengono cotti nei forni prima di essere incapsulati nella confezione. Completato l'assemblaggio le unità sono finalmente pronte per il test finale.

La complicazione del processo produttivo - specialmente per quanto riguarda la frequenza e i livelli di stabilità - sottolinea l'esigenza del fornitore di potere contare su dettagliate specifiche d'utente. Le specifiche minime normalmente richieste quando si ordinano dei prodotti al quarzo sono elencate all'inizio di ciascuna sezione.

PRECAUZIONI

Come descritto in precedenza, l'unita del cristallo quartz comprende un piccolo disco o striscia di quartz che è stato elaborato all'esatta dimensione e spessore a seconda della frequenza risonante specificata dal cliente. Il quartz èplaccato con elettrodi conduttivi e montato in un astuccio ermeticamente sigillato (Vedi Fig.1) Gli elettrodi si collegano ai conduttori che passano attraverso il gruppo base mediante delle tenute vetro a metallo.

Le inità di cristallo sono spesso incapsulate assieme Ada altri circuiti al fine di realizzare un modulo completamente completamente funzionale, es, un oscillatore o un filtro complesso, la Fig. 2) illustra un semplice oscillatore di cristallo.

Data la natura dell'unità di cristallo, la corretta manipolazione è molto importante.

Urto meccanico

I componenti di cristallo sono prodotti per resistere un certo livello di urto meccanico. Tali livelli sono descritti all'interno delle specifiche ambientali per ciascun tipo di componente individuale per tutto il Manuale Dati.

Eccessivi d'urto possono causare dei cambiamenti nelle caratteristiche elettriche, che molto probabilmente si manifesterà come un cambio di frequenza. Severo maltrattamento, come lasciarlo cadere su di una superficie dura, potrebbe risultare in effettiva rottura.

Manipolazione dei conduttori

Eccessiva piegature dei conduttori potrebbe causare danni alla tenuta vetro a metallo che causerebbe perdita d'ermeticità dell'astuccio. Gli astucci sono riempiti di gas inerte e la perdita d'ermeticità causerà una rapida deteriorazione del prodotto a causa di contaminazione atmosferica. Pertanto bisogna aver cura nella manipolazione di un cristallo di non tirare o piegare i conduttori. Se il componente ha bisogno di essere spostato in un modo in cui necessita piegare i conduttori, questi ultimi devono essere piegati lievemente distanti dalla tenuta del vetro onde evitare lesione. Il raggio minimo consigliato di curvatura dipende dal pdodotto, ad esempio: 2 mm per HC49 e 1 mm per UM1.

Prodotti Tape & Reel

Prima di utilizzare i cristalli con un macchinario di piazzamento automatico è necessario svolgere dei test che verifichino il livello di shock meccanico cui il dispositivo sarà sottoposto durante il processo di montaggio: se necessario tale livello dovrà essere ridotto.

Temperatura

Se i cristalli vengono sottoposti ad estreme temperature, fuori dei limiti di temperature d'immagazzinaggio, le prestazioni elettriche potrebbe subire degli effetti, che causerebbero eventuale guasto.

Scarica elettrostatica (ESD)

Solo ad estreme tensioni si può vedere, udire o sentire l'elettricità statica, ma anche le più basse tensioni possono danneggiare i circuiti elettronici. Il danneggiamento causato agli oscillatori a risultori di scariche elettrostatiche potrebbe non essere evidente immediatamente ma può essere ritardato, causando il degrado dei circuiti, che a sua volta può causare guasto dell'oscillatore nel campo.

Sebbene il quartz non è suscettibile a danneggiamenti ESD,i circuiti elettronici associati contenuti all'interno dell'oscillatore è e deve essere considerato come un dispositivo Sensibile alle Scariche Elettrostatiche (ESDS).

I dispositivi ESDS devono essere manipolati soltanto in un Area a protezione da ESDS o EPA, dove tipicamente vengono usate fascette polsini. Qualsiasi forma di trasporto deve essere intrapresa utilizzando i'opportuno imballaggio protettivo. Tutti gli imballaggi devono essere contrassegnati con un avviso di avvertenza e le misure di protezione e l'imballaggio devono essere conformi alla BS EN 100015. Per un più dettagliato elenco delle precauzioni che bisogna prendere si prega contattare il reparto Application Support Department.

Informazioni Generali

L' approssimato spessore del disco o della fascetta si ottiene seguendo l'equazione riportata qui di seguito:

Spessore (mm) = 1,67 / f (MHz)

NOTES

QUARTZ CRYSTALS - Section Contents

SPECIFYING QUARTZ CRYSTALS

A typical quartz crystal specification reads like this:

35.0MHz HC49 15 30 20 SR 3RD BU T

- Frequency (35.0MHz)
- Holder Style (HC49)
- Frequency Tolerance at 25°C (15)
- Frequency Stability (30)
- Lower end of Operating Temp Range (20)
- Circuit Condition (SR)
- Overtone order (3RD)
- Packaging (BU)
- Additional Text Code (for non-standard product) (T)

The following notes define each element of the specification.

Frequency

Frequency is normally specified in kilohertz (kHz) up to 999.999kHz and in megahertz (MHz) from 1.0MHz. All our computer-generated transaction documents follow this standard convention automatically.

The frequency should be given to seven significant figures. If seven significant figures are not used, any figure that might follow those given will be taken as zero. Thus a frequency given as 16.6MHz will be taken as 16.60, not 16.66667.

Some specifiers extend the use of kHz to all crystals operating in fundamental mode, reserving MHz for overtones. To minimise the possibility of misunderstanding it is best to use the standard method and specify the mode.

Holder Style

Before manufacture of the crystal can start, the holder style must be defined. If the holder size is not known or it is unimportant, we will supply the holder normally adopted for the frequency specified, such as HC49 for the majority of microprocessor applications. The holder information should also cover any mechanical variant required such as a top wire or cropped leads. The following variants for example are available for most crystals, either singly or in some cases, in combination:

- 3 lead base
- Top wire
- Insulating sleeve
- Taped and reeled
- Fitted insulator
- Cropped leads
- Formed leads

Frequency Tolerance

The cost of manufacture depends partly on the accuracy required at the reference temperature (which in the case of the AT-cut crystal, is usually 25°C).

Where high initial accuracy is important the additional manufacturing cost should be weighed against the cost of including a frequency trimming facility within the oscillator.

Frequency Stability

Frequency stability is normally specified as a frequency tolerance over a defined operating temperature range with respect to the frequency at reference temperature. The temperature ranges are defined for each crystal in the relevant data sheet. However the majority of crystals will continue to operate quite satisfactorily outside the temperature range for which they are specified, but with a possible degradation of their frequency stability.

Generalised frequency vs temperature curves for the AT-cut crystal types are illustrated in the following pages. These indicate that, without compensation, a crystal specified for operation over a wide frequency range will probably have an inferior performance over a narrower range than one whose design was optimised for the narrower range. The angle of cut of the quartz blank from its quartz stone determines which curve will be followed; the chosen angle being subject to its own tolerance. Thus, since manufacturing cost is tolerance-dependent it is wise not to specify a wider operating temperature range than is actually needed unless some sacrifice of stability, or an increase in cost, can be accepted.

Standard Frequency Tolerances and Stabilities

- ±5ppm, ±10ppm, ±15ppm, ±20ppm, ±30ppm, ±50ppm, ±100ppm

Operating Temperature Ranges

0 to 50°C	–40 to 90°C
–10 to 60°C	–55 to 105°C
–20 to 70°C	–55 to 125°C
–30 to 80°C	

When the required temperature range is symmetrical about 25°C, it is indicated in the specification by the lower figure, ie: –20 to 70°C would read ‘20’ as shown in the example. If the required temperature range is not symmetrical about 25°C, both figures are used, ie: –55 to 85°C and appear in the additional text code section (T).

Circuit condition

The characters ‘SR’ are used to denote calibration of the crystal at series resonance. If it is to be calibrated at load resonance the characters represent the circuit load capacitance in pF.

Packaging Codes

Tape & Reel packaging is available as an option on many of the products outlined in the Quartz Crystal chapter.

Unless individual datasheets state Tape and Reel packaging, items will be Bulk packed. Please note: only complete Reels are sold.

- BU = Bulk packed
- TR = Tape & Reel packed

Additional Text Code

If the product is non-standard, the letter ‘T’ will appear at the end of the product specification. This refers to additional text on the quotation/sales order to identify the special requirements.

Outline Drawings

Dimensions on the crystal outline drawings are shown only as a guide. Precise dimensions of crystal holders are available from our Engineering Department upon request. All dimensions are shown in mm (& inches) and are nominal unless otherwise stated. All outlines are at a scale of 1:1 unless otherwise specified.

Marking

Product will be indelibly marked as detailed in the individual data sheets. Where space is limited some or all of the information will be omitted or truncated at C-MAC Frequency Products discretion. Full product details will be found on the individual batch packaging.

Delivery Options

The following Express delivery options are available for certain crystals; timescales refer to despatch from our factories.

- 3 working days (Express service)
- 5 working days (Express service)
- 7 working days (Express service)
- 10 working days (Express service)

Prices for larger quantities and longer delivery times are generally lower due to substantially reduced manufacturing costs. Please refer to individual datasheets for further information.

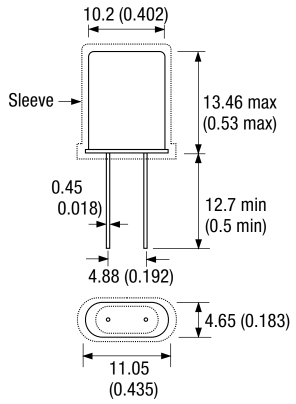
Ordering Information

- See individual datasheet

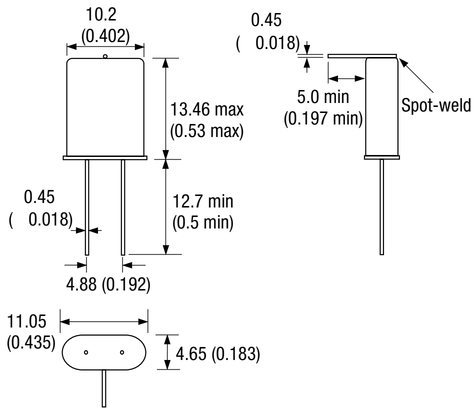
Stability Conversion Chart

10^x	PPM	%
10^{-3}	1000	0.1
10^{-4}	100	0.01
10^{-5}	10	0.001
10^{-6}	1	0.0001
10^{-7}	0.1	0.00001
10^{-8}	0.01	0.000001
10^{-9}	0.001	0.0000001
10^{-10}	0.0001	0.00000001

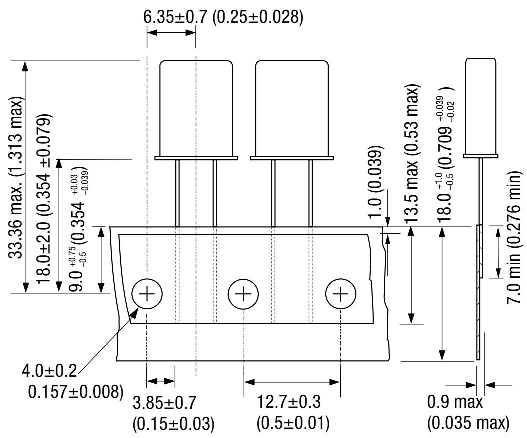
Outline in mm (inches)- Insulated Sleeve HC49



Outline in mm (inches)- HC49 with Top Wire



Outline in mm (inches)- Tape for HC49



QUARTZ CRYSTALS

STOCK QUARTZ CRYSTALS

QUARTZ CRYSTALS

Minimum Order Information Required

- Stock Number or Alpha Code

WATCH CRYSTALS

Frequency	Holder	Specification	Stock No.	Alpha Code
32.7680kHz	3x8mm	20/-/-/12.5	XTAL002995	A103A
32.7680kHz	3x8mm	15/-/-/12.5	XTAL002996	A103B
32.7680kHz	2x6mm	20/-/-/12.5	XTAL002997	A103C
32.7680kHz	2x6mm	-/-/-/6	XTAL014219	A103V
40.0kHz	3x8mm	100/-/-/12.5	XTAL003018	A109C
60.0kHz	2x6mm	50/-/10/10	XTAL011315	A103U

HC49/4H CRYSTALS

Frequency	Holder	Specification	Stock No.	Alpha Code
3.27680MHz	HC49/4H	30/50/10/12	XTAL003052	A118C
3.579545MHz	HC49/4H	30/50/20/20	XTAL003063	A119K
3.68640MHz	HC49/4H	30/50/20/30	XTAL003263	A169K
4.0MHz	HC49/4H	20/50/10/30	XTAL003074	A120K
4.0320MHz	HC49/4H	30/50/20/30	XTAL003081	A121K
4.0960MHz	HC49/4H	30/50/10/30	XTAL003084	A122K
4.194304MHz	HC49/4H	30/50/10/30	XTAL003092	A123J
4.194304MHz	HC49/4H	30/50/10/12	XTAL003093	A123K
4.433619MHz	HC49/4H	30/50/10/20	XTAL003102	A124K
4.91520MHz	HC49/4H	30/50/20/30	XTAL003115	A127K
5.0MHz	HC49/4H	30/50/10/30	XTAL003119	A128K
5.760MHz	HC49/4H	30/50/10/30	XTAL003510	L102K
6.0MHz	HC49/4H	30/50/10/30	XTAL003132	A132K
6.1440MHz	HC49/4H	30/50/10/30	XTAL003137	A133K
7.37280MHz	HC49/4H	30/50/10/30	XTAL003335	A194K
7.37280MHz	HC49/4H	15/30/10/18	XTAL003336	A194L
7.864320MHz	HC49/4H	30/50/10/30	XTAL003145	A139A
8.0MHz	HC49/4H	30/50/20/30	XTAL003156	A140K
8.1920MHz	HC49/4H	30/50/10/30	XTAL003271	A170K
9.83040MHz	HC49/4H	30/50/10/30	XTAL003279	A173K
10.0MHz	HC49/4H	30/50/20/30	XTAL003169	A143K
10.7520MHz	HC49/4H	30/50/10/30	XTAL003365	A212K
11.05920MHz	HC49/4H	30/50/20/30	XTAL003523	L108K
12.0MHz	HC49/4H	30/50/20/30	XTAL003215	A158K
12.2880MHz	HC49/4H	30/50/10/30	XTAL003286	A175K
14.318180MHz	HC49/4H	30/50/20/30	XTAL003200	A153L
14.74560MHz	HC49/4H	30/50/10/30	XTAL003224	A159K

Frequency	Holder	Specification	Stock No.	Alpha Code
15.0MHz	HC49/4H	30/50/10/30	XTAL003236	A160K
15.360MHz	HC49/4H	20/30/10/30	XTAL003554	M451K
16.0MHz	HC49/4H	30/50/20/30	XTAL003240	A161K
16.93440MHz	HC49/4H	30/50/10/30	XTAL003366	A213K
18.4320MHz	HC49/4H	30/50/20/30	XTAL003176	A146K
19.66080MHz	HC49/4H	30/50/10/30	XTAL003309	A182K
20.0MHz	HC49/4H	30/50/20/12	XTAL003185	A147K
20.0MHz	HC49/4H	30/50/10/20	XTAL003186	A147L
24.0MHz	HC49/4H	30/50/10/30 Fund	XTAL003325	A189K
24.5760MHz	HC49/4H	30/50/10/20 Fund	XTAL003046	A116K
32.0MHz	HC49/4H	30/50/20/SR 3rd	XTAL003254	A166K
35.25120MHz	HC49/4H	15/30/20/18 3rd	XTAL003371	A216K
40.320MHz	HC49/4H	30/50/10/18 3rd	XTAL003379	A220H

HC49 CRYSTALS

Please note: Specifications followed by ** denote USA specification.

Frequency	Holder	Specification	Stock No.	Alpha Code
1.84320MHz	HC49	20/50/10/30	XTAL003033	A113B
2.0MHz	HC49	50/100/0/20	XTAL003037	A114E
2.45760MHz	HC49	20/50/10/30	XTAL003044	A116C
2.45760MHz	HC49	30/50/20/32 **	XTAL012873	A116U
3.27680MHz	HC49	20/30/10/12	XTAL003081	A118B
3.579545MHz	HC49	20/50/10/20	XTAL003056	A119C
3.579545MHz	HC49	30/50/10/20	XTAL003064	A119M
3.579545MHz	HC49	30/50/20/18 **	XTAL010035	A119U
3.68640MHz	HC49	20/50/10/30	XTAL003257	A169A
3.68640MHz	HC49	30/50/10/30	XTAL003264	A169M
3.68640MHz	HC49	30/50/20/20 **	XTAL012878	A169U
4.0MHz	HC49	20/10/20/30	XTAL003067	A120A
4.0MHz	HC49	20/50/10/30	XTAL003068	A120B
4.0MHz	HC49	30/50/10/30	XTAL003077	A120N
4.0MHz	HC49	30/50/20/20 **	XTAL011512	A120U
4.0320MHz	HC49	20/10/20/30	XTAL003079	A121A
4.0960MHz	HC49	20/10/20/30	XTAL003082	A122A
4.0960MHz	HC49	20/50/10/30	XTAL003083	A122B
4.194304MHz	HC49	20/30/10/12	XTAL003086	A123A
4.433619MHz	HC49	20/30/10/20	XTAL003099	A124D
4.433619MHz	HC49	30/50/10/20	XTAL003628	A124M

Frequency	Holder	Specification	Stock No.	Alpha Code
4.6080MHz	HC49	20/50/10/30	XTAL003107	A125C
4.91520MHz	HC49	20/50/10/30	XTAL003110	A127A
4.91520MHz	HC49	30/50/10/30	XTAL003111	A127B
5.0MHz	HC49	20/50/10/30	XTAL003118	A128B
5.0MHz	HC49	30/50/20/20 **	XTAL012882	A128U
5.242880MHz	HC49	20/30/10/12	XTAL003316	A186A
6.0MHz	HC49	20/50/10/30	XTAL003127	A132A
6.0MHz	HC49	30/50/10/30	XTAL003128	A132B
6.1440MHz	HC49	20/50/10/30	XTAL003134	A133A
6.1440MHz	HC49	20/50/0/12	XTAL003135	A133B
6.1440MHz	HC49	30/50/20/20 **	XTAL012886	A133U
6.55360MHz	HC49	20/30/10/12	XTAL003141	A135A
7.37280MHz	HC49	20/50/10/30	XTAL003329	A194A
7.37280MHz	HC49	30/50/20/20 **	XTAL012889	A194U
7.6800MHz	HC49	20/50/10/30	XTAL003144	A138A
8.0MHz	HC49	20/50/10/30	XTAL003147	A140A
8.0MHz	HC49	30/50/10/30	XTAL003148	A140B
8.0MHz	HC49	30/50/20/20 **	XTAL010875	A140U
8.1920MHz	HC49	20/50/10/30	XTAL003268	A170A
8.388608MHz	HC49	20/50/10/30	XTAL003157	A141A
8.867237MHz	HC49	30/30/10/20	XTAL003201	A154A
9.83040MHz	HC49	20/50/10/30	XTAL003277	A173A
10.0MHz	HC49	20/10/20/30	XTAL003162	A143A
10.0MHz	HC49	20/50/10/30	XTAL003164	A143E
11.0MHz	HC49	20/30/10/30	XTAL003327	A193A
11.05920MHz	HC49	20/30/10/20	XTAL003515	L108A
11.05920MHz	HC49	20/30/10/30	XTAL003517	L108C
11.05920MHz	HC49	30/50/10/20	XTAL003518	L108D
11.05920MHz	HC49	30/50/10/30	XTAL003995	L108S
11.05920MHz	HC49	30/50/20/20**	XTAL012876	L108U
11.28960MHz	HC49	20/30/10/30	XTAL003367	A214A
12.0MHz	HC49	20/30/10/30	XTAL003206	A158A
12.0MHz	HC49	30/50/10/30	XTAL003207	A158B
12.0MHz	HC49	30/50/20/20 **	XTAL012884	A158U
12.2880MHz	HC49	20/30/10/30	XTAL003280	A175A
12.2880MHz	HC49	30/50/20/20 **	XTAL012892	A175U
14.0MHz	HC49	20/50/10/30	XTAL003338	A195A
14.318180MHz	HC49	20/50/10/30	XTAL003194	A153A
14.74560MHz	HC49	20/30/10/30	XTAL003218	A159A
15.0MHz	HC49	20/50/10/30	XTAL003228	A160C
15.360MHz	HC49	20/30/10/30	XTAL003552	M451A

Frequency	Holder	Specification	Stock No.	Alpha Code
16.0MHz	HC49	20/30/10/30	XTAL003231	A161A
16.0MHz	HC49	30/50/10/30	XTAL003242	A161N
16.0MHz	HC49	30/50/20/20 **	XTAL012898	A161U
18.4320MHz	HC49	30/50/20/20 **	XTAL011515	A146U
19.66080MHz	HC49	30/50/10/18	XTAL003306	A182C
20.0MHz	HC49	20/50/10/30	XTAL003177	A147A
20.0MHz	HC49	30/50/10/30	XTAL003180	A147D
20.480MHz	HC49	30/50/10/30	XTAL010276	A208B
22.57920MHz	HC49	10/20/10/15 Fund	XTAL003407	A315A
24.0MHz	HC49	20/50/10/30 Fund	XTAL003320	A189A
24.000140MHz	HC49	15/30/10/18 Fund	XTAL003360	A210A
24.5760MHz	HC49	20/50/10/30 Fund	XTAL003386	A223A
32.0MHz	HC49	20/30/10/SR 3rd	XTAL003248	A166A
32.0MHz	HC49	30/50/10/SR Fund	XTAL003667	A166M
35.25120MHz	HC49	15/30/10/18/ 3rd	XTAL003370	A216A
40.320MHz	HC49	15/30/10/18/ 3rd	XTAL003377	A220A

CRYSTAL ACCESSORIES

Description	For Holder	Stock No.	Alpha Code
Insulators (Mylar, 3 holes)	UM1 (HC45)	INSL000003	M153C
Insulators (Mylar, 3 holes)	HC49	INSL000002	M153B
Insulator (PTFE, 2 holes)	HC49	INSL000004	M153D
Clips	HC49	CLPS000001	M156A

NOTES

QUARTZ CRYSTALS

WATCH CRYSTALS 32.7680kHz

ISSUE 9; 12 JUNE 1998

Delivery Options

- Product available from stock. Please see p4 for details

Holder Style

- Watch crystals are press sealed. Two sizes are available: 3.0 × 8.2mm & 2.0 × 6.2mm

General Specifications

- Load Capacitance (C_L): 6pF to 15pF
- Drive Level: 1.0 W max.
- Static Capacitance (C_0): 1.6pF typical

Standard Frequency Tolerances and Stabilities

- ±20ppm, ±30ppm, ±50ppm, ±100ppm

Operating Temperature Ranges

- 0 to 50°C –20 to 70°C
  –10 to 60°C –30 to 80°C

Storage Temperature Range

- –55 to 125°C

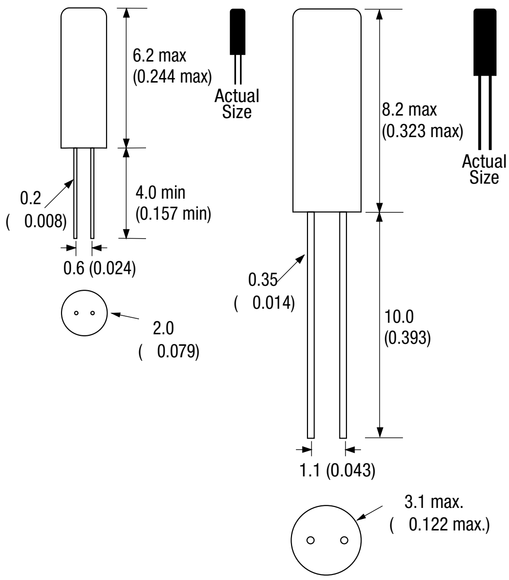
Marking

- Frequency (3.0 × 8.2mm only; 2.0 × 6.2mm product is unmarked)

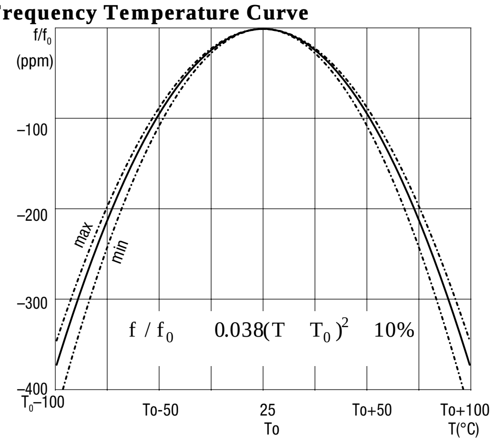
Minimum Order Information Required

- Frequency + Holder + Frequency Tolerance @ 25°C + Operating Temperature Range + Circuit Condition

Outline in mm (inches) - (scale 3:1)



Frequency Temperature Curve



Electrical Specification – maximum limiting values

Frequency Range	Frequency Tolerance @ 25°C ±2°C	Operating Temperature Range	Frequency Stability Available Over Operating Temperature		ESR Max	Vibration Mode
			Minimum	Maximum		
32.7680kHz	±10ppm to ±100ppm	0 to 50°C	–25ppm	–100ppm	50k	Fundamental
		–10 to 60°C	–50ppm	–100ppm		
		–20 to 70°C	–85ppm	–100ppm		
		–30 to 80°C	–150ppm	–300ppm		

CYLINDER CRYSTALS (3.0 x 9.0mm)

ISSUE 11; 23 JUNE 1999

Delivery Options

- Please contact our sales office for current leadtimes

Holder Style

- 3.0 × 9.0mm cylinder crystals are press sealed

General Specifications

- Load Capacitance (C_L):
  6pF to 15pF (15.0kHz to 1.5360MHz)
  10pF to 50pF or Series (3.570MHz to 60.0MHz)
- Drive Level:
  1.0 W max. (15.0kHz to 1.5360MHz)
  500.0 W max. (3.570MHz to 60.0MHz)

Standard Frequency Tolerances and Stabilities

- ±10ppm, ±20ppm, ±30ppm, ±50ppm, ±100ppm, ±150ppm, ±200ppm, ±300ppm

Operating Temperature Ranges

- 0 to 50°C –30 to 80°C
  –10 to 60°C –40 to 90°C
  –20 to 70°C

Storage Temperature Range

- –55 to 125°C

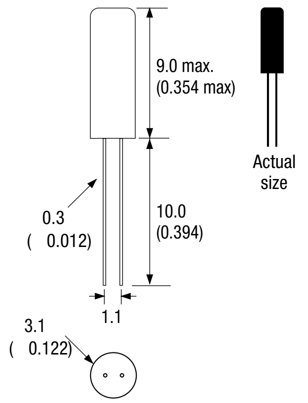
Marking

- Frequency

Minimum Order Information Required

- Frequency + Holder + Frequency Tolerance @ 25°C + Operating Temperature Range + Circuit Condition

Outline in mm (inches) - (scale 2:1)



Electrical Specification – maximum limiting values

Frequency Range	Frequency Tolerance @ 25°C ±2°C	Operating Temperature Range	Frequency Stability Available Over Operating Temperature		ESR max.	Vibration Mode
			Minimum	Maximum		
15.0 to 150.0kHz	±20ppm to ±100ppm	0 to 50°C	–25ppm	–300ppm	35k	Fundamental
		–10 to 60°C	–50ppm	–300ppm		
		–20 to 70°C	–80ppm	–300ppm		
		–30 to 80°C	–120ppm	–300ppm		
		–40 to 90°C	–170ppm	–500ppm		
350.0kHz to 1.5360MHz	±50ppm to ±100ppm	0 to 50°C	±50ppm	±300ppm	1.5k	Fundamental
		–10 to 60°C	±100ppm	±300ppm		
		–20 to 70°C	±150ppm	±300ppm		
		–30 to 80°C	±200ppm	±300ppm		
		–40 to 90°C	±300ppm	±500ppm		

Frequency Range	Frequency Tolerance @ 25°C ±2°C	Operating Temperature Range	Frequency Stability Available Over Operating Temperature		ESR max.	Vibration Mode
			Minimum	Maximum		
3.570 to < 3.70MHz	±30ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	200	Fundamental
		–10 to 60°C	±20ppm	±100ppm		
		–20 to 70°C	±30ppm	±100ppm		
		–30 to 80°C	±40ppm	±100ppm		
		–40 to 90°C	±50ppm	±100ppm		
3.70 to < 4.0MHz	±30ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	180	Fundamental
		–10 to 60°C	±20ppm	±100ppm		
		–20 to 70°C	±30ppm	±100ppm		
		–30 to 80°C	±40ppm	±100ppm		
		–40 to 90°C	±50ppm	±100ppm		
4.0 to < 5.0MHz	±30ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	200	Fundamental
		–10 to 60°C	±20ppm	±100ppm		
		–20 to 70°C	±30ppm	±100ppm		
		–30 to 80°C	±40ppm	±100ppm		
		–40 to 90°C	±50ppm	±100ppm		
5.0 to < 10.0MHz	±30ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	120	Fundamental
		–10 to 60°C	±20ppm	±100ppm		
		–20 to 70°C	±30ppm	±100ppm		
		–30 to 80°C	±40ppm	±100ppm		
		–40 to 90°C	±50ppm	±100ppm		
10.0 to < 16.0MHz	±30ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	50	Fundamental
		–10 to 60°C	±20ppm	±100ppm		
		–20 to 70°C	±30ppm	±100ppm		
		–30 to 80°C	±40ppm	±100ppm		
		–40 to 90°C	±50ppm	±100ppm		
16.0 to < 26.0MHz	±30ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	40	Fundamental
		–10 to 60°C	±20ppm	±100ppm		
		–20 to 70°C	±30ppm	±100ppm		
		–30 to 80°C	±40ppm	±100ppm		
		–40 to 90°C	±50ppm	±100ppm		
26.0 to < 30.0MHz	±30ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	40	Fundamental
		–10 to 60°C	±20ppm	±100ppm		
		–20 to 70°C	±30ppm	±100ppm		
		–30 to 80°C	±40ppm	±100ppm		
		–40 to 90°C	±50ppm	±100ppm		
30.0 to 60.0MHz	±30ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	100	3rd Overtone AT Cut
		–10 to 60°C	±20ppm	±100ppm		
		–20 to 70°C	±30ppm	±100ppm		
		–30 to 80°C	±40ppm	±100ppm		
		–40 to 90°C	±50ppm	±100ppm		

CX-1-03 CRYSTALS 10.0kHz to 2.10MHz

ISSUE 6; 26 MARCH 1998

Delivery Options

- Please contact our sales office for current leadtimes

Description

- Statek's CX-1,-1V, -1H crystals are high quality chemically etched resonators manufactured with a photolithographic process.
- The CX-1H version is a tuning fork resonator intended for use in simple series oscillators over the frequency range 10.0 to < 614.40kHz.
- The CX-1V versions are intended for use in simple Pierce oscillators. They are tuning fork resonators over the frequency range 10.0 to < 614.40kHz.
- The CX-1 are length extensional resonators covering the frequency range 530.0kHz to 2.10MHz.

Holder Style

- CX-1-03 crystals are housed in a ceramic package, hermetically sealed, with a soft soldered glass lid & leads.

General Specifications

- Load Capacitance (C_L) CX-1V type:
  11pF (10.0 to < 16.0kHz)
  10pF (16.0 to < 25.0kHz)
  9pF (25.0 to < 55.0kHz)
  8pF (55.0 to < 100.0kHz)
  5pF (100.0 to < 180.0kHz)
  4pF (180.0 to < 614.40kHz)
- Load Capacitance (C_L) CX-1 type:
  7pF (530.0kHz to 2.10MHz)
  Other values available upon request
  CX-1H type is calibrated at Series Resonance
- Static Capacitance (C_0): 1.0pF to 2.0pF
- Drive Level CX-1V type:
  0.5 W max. (10.0 to < 25.0kHz)
  1.0 W max. (25.0 to < 614.40kHz)
- Drive Level CX-1 type:
  3.0 W max. (530.0kHz to 2.10MHz)
- Drive Level CX-1H type:
  1.5 W max. (10.0 to < 25.0kHz)
  3.0 W max. (25.0 to < 614.40kHz)
- Ageing: ±5ppm maximum first year

Operating Temperature Ranges

- –10 to 70°C = C
- –40 to 85°C = I
- –55 to 125°C = M

Storage Temperature Range

- –55 to 125°C

Environmental Specification

- Shock: 1000g, 1.0ms ½ sine (< 614.40kHz)
- Shock: 750g, 0.3ms ½ sine (530.0kHz to 2.10MHz)
- Vibration: 20g, 10 to 2000Hz

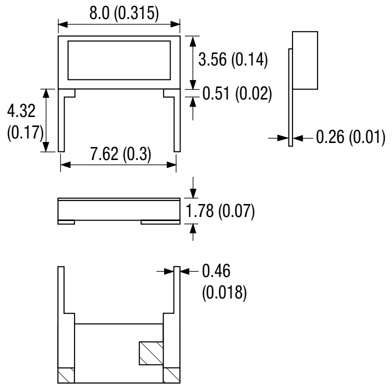
Marking

- Includes Frequency

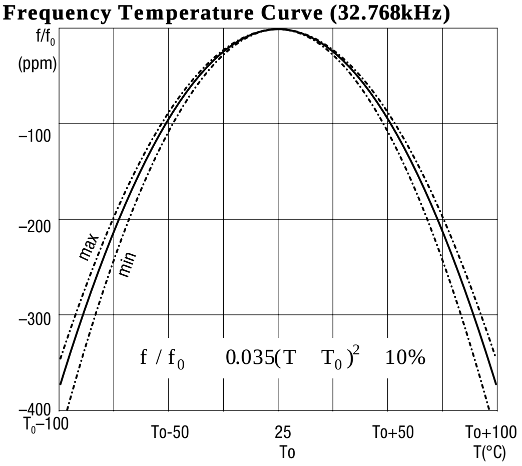
Minimum Order Information Required

- Frequency + Model + Terminations + Frequency Tolerance @ 25°C + Operating Temperature Range + Circuit Condition

Outline in mm (inches) - (scale 2:1)



Frequency Temperature Curve (32.768kHz)



Electrical Specification – maximum limiting values

Frequency Range	*Frequency Tolerance @ 25°C ±2°C	Operating Temperature Range	**ESR max.	Vibration Mode
10.0 to < 25.0kHz	A = ±30ppm B = ±100ppm C = ±1000ppm	–10 to 70°C –40 to 85°C –55 to 125°C	2.1M	Tuning Fork
25.0 to < 50.0kHz	A = ±30ppm B = ±100ppm C = ±1000ppm	–10 to 70°C –40 to 85°C –55 to 125°C	360k	Tuning Fork
50.0 to < 75.0kHz	A = ±30ppm B = ±100ppm C = ±1000ppm	–10 to 70°C –40 to 85°C –55 to 125°C	160k	Tuning Fork
75.0 to < 170.0kHz	A = ±50ppm B = ±100ppm C = ±1000ppm	–10 to 70°C –40 to 85°C –55 to 125°C	100k	Tuning Fork
170.0 to < 250.0kHz	A = ±100ppm B = ±200ppm C = ±2000ppm	–10 to 70°C –40 to 85°C –55 to 125°C	50k	Tuning Fork
250.0 to < 614.40kHz	A = ±200ppm B = ±500ppm C = ±5000ppm	–10 to 70°C –40 to 85°C –55 to 125°C	25k	Tuning Fork
530.0kHz to 2.10MHz ***	A = ±500ppm B = ±1000ppm C = ±10000ppm	–10 to 70°C –40 to 85°C –55 to 125°C	3k	Extensional

Ordering Example: 50.0kHz CX-1V 03 C C 9pF

- Frequency — 50.0kHz
- Model No — CX-1V
- Terminations — 03
- Frequency Tolerance @ 25°C — C
- Operating Temperature Range: C = –10 to 70°C; I = –40 to 85°C; M = –55 to 125°C — C
- Load Capacitance (Circuit Condition) - if non-standard — 9pF

*Please note: other frequency tolerances are available on request.
** Above ESR values are for CX-1H only, CX-1V divide above values by 3.
*** Only CX-1 available

CX-1-03 CRYSTALS 8.0 to 160.0MHz

ISSUE 6; 26 MARCH 1998

Delivery Options

- Please contact our sales office for current leadtimes

Description

- Statek's CX-1-03 crystals are high quality chemically etched resonators manufactured with a photolitho-graphic process.

Holder Style

- CX-1-03 crystals are housed in a ceramic package, hermetically sealed, with a soft soldered glass lid & leads.

General Specifications

- Load Capacitance (C_L): 20pF
  Other values available upon request
- Static Capacitance (C_0): 2.0 to 3.5pF
- Drive Level: 500 W max
- Ageing: 5ppm max first year

Standard Frequency Tolerances*

- 100ppm, 1000ppm, 10000ppm
  * Tighter tolerances available

Operating Temperature Ranges

- –10 to 70°C = C
- –40 to 85°C = I
- –55 to 125°C = M

Storage Temperature Range

- –55 to 125°C

Environmental Specification
(higher specification available on request)

- Shock: 3000g, 0.3ms ½ sine
- Vibration: 20g rms, 10 to 2000Hz random

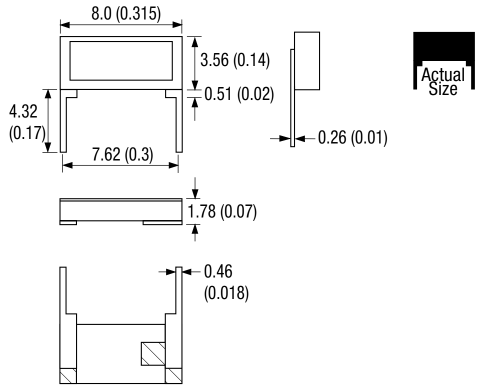
Marking

- Includes Frequency

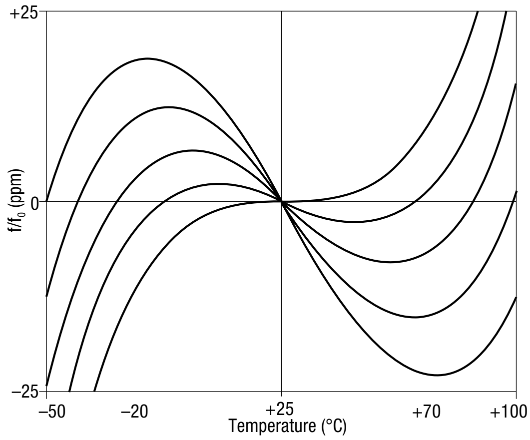
Minimum Order Information Required

- Frequency + Model + Terminations + Frequency Tolerance @ 25°C + Frequency Stability + Operating Temperature Range + Circuit Condition

Outline in mm (inches) - (scale 2:1)



Typical Frequency vs Temperature Curves
for various angles of AT-cut crystals



Electrical Specification – maximum limiting values

Frequency Range	*Frequency Tolerance @ 25°C ±2°C	Operating Temperature Range	Frequency Stability Available Over Operating Temperature		ESR Max	Vibration Mode
			Minimum	Maximum		
8.0 to < 9.0MHz	A = ±100ppm B = ±1000ppm C = ±10000ppm	–10 to 70°C	±10ppm	±100ppm	300	Fundamental AT cut
		–40 to 85°C	±20ppm	±100ppm		
		–55 to 125°C	±30ppm	±300ppm		
9.0 to < 11.0MHz	A = ±100ppm B = ±1000ppm C = ±10000ppm	–10 to 70°C	±10ppm	±100ppm	200	Fundamental AT cut
		–40 to 85°C	±20ppm	±100ppm		
		–55 to 125°C	±30ppm	±300ppm		
11.0 to < 14.0MHz	A = ±100ppm B = ±1000ppm C = ±10000ppm	–10 to 70°C	±10ppm	±100ppm	100	Fundamental AT cut
		–40 to 85°C	±20ppm	±100ppm		
		–55 to 125°C	±30ppm	±300ppm		
14.0 to < 20.0MHz	A = ±100ppm B = ±1000ppm C = ±10000ppm	–10 to 70°C	±10ppm	±100ppm	70	Fundamental AT cut
		–40 to 85°C	±20ppm	±100ppm		
		–55 to 125°C	±30ppm	±300ppm		
20.0 to 70.0MHz	A = ±100ppm B = ±1000ppm C = ±10000ppm	–10 to 70°C	±10ppm	±100ppm	50	Fundamental AT cut
		–40 to 85°C	±20ppm	±100ppm		
		–55 to 125°C	±30ppm	±300ppm		
48.0 to 160.0MHz	A = ±100ppm B = ±1000ppm C = ±10000ppm	–10 to 70°C	±10ppm	±100ppm	80	3rd Overtone
		–40 to 85°C	±20ppm	±100ppm		
		–55 to 125°C	±30ppm	±300ppm		

Ordering Example 10.0MHz CX-1 03 A 100ppm C 18pF

Frequency
Model No
Terminations
Frequency Tolerance @ 25°C
Frequency Stability
Operating Temperature Range: C = –10 to 70°C; I = –40 to 85°C; M = –55 to 125°C
Load Capacitance (Circuit Condition) -if non-standard

*Please note: other frequency tolerances are available on request.

QUARTZ CRYSTALS

HC35 (TO5) CRYSTALS

ISSUE 9; 19 JUNE 1998

Delivery Options

- 3 day Express Manufacturing Service, subject to piece part stock availability

Holder Style

- HC35 (TO5) crystals are resistance welded, hermetically sealed in an inert atmosphere with glass to metal seals securing the lead wires

General Specifications

- Load Capacitance (C_L): 10pF to 75pF or Series
- Drive Level: 1.0mW max.
- Static Capacitance (C_0): 7pF max.
- Ageing: ±3ppm typical per year

Standard Frequency Tolerances and Stabilities

- ±5ppm, ±10ppm, ±15ppm, ±20ppm, ±30ppm, ±50ppm, ±100ppm

Operating Temperature Ranges

0 to 50°C	–40 to 90°C
–10 to 60°C	–55 to 105°C
–20 to 70°C	–55 to 125°C
–30 to 80°C	

Storage Temperature Range

- –55 to 125°C

Environmental Specification

- Shock: 981m/s^2 for 6ms, three shocks in each direction along three mutually perpendicular planes
- Vibration: 10 to 60Hz 0.75mm displacement, 60 to 2000Hz 98.1m/s^2 acceleration, 30 minutes in each of three mutually perpendicular planes

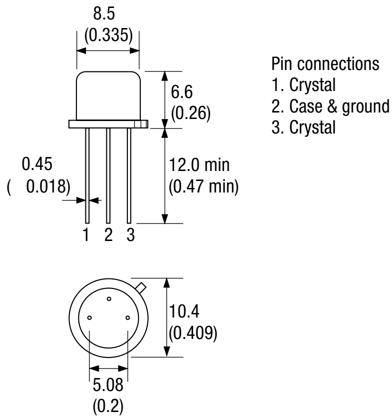
Marking

- Includes Frequency

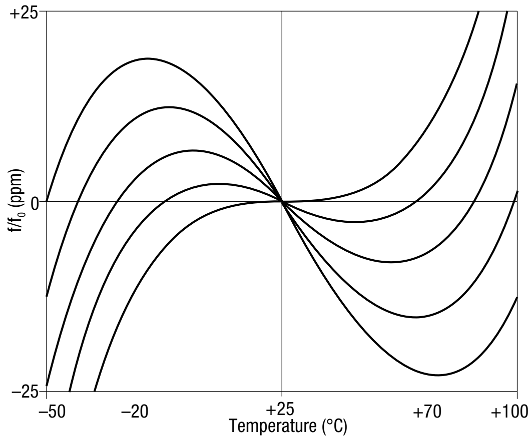
Minimum Order Information Required

- Frequency + Holder + Frequency Tolerance @ 25°C + Frequency Stability + Operating Temperature Range + Circuit Condition + Overtone Order

Outline in mm (inches)



Typical Frequency vs Temperature Curves for various angles of AT-cut crystals



Electrical Specification – maximum limiting values

Frequency Range	Frequency Tolerance @ 25°C ±2°C	Operating Temperature Range	Frequency Stability Available Over Operating Temperature		ESR max.	Vibration Mode
			Minimum	Maximum		
6.0 to < 8.0MHz	±5ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	60	Fundamental AT cut
		–10 to 60°C	±15ppm	±100ppm		
		–20 to 70°C	±15ppm	±100ppm		
		–30 to 80°C	±20ppm	±100ppm		
		–40 to 90°C	±25ppm	±100ppm		
		–55 to 105°C	±50ppm	±100ppm		
		–55 to 125°C	±50ppm	±100ppm		
8.0 to < 15.0MHz	±5ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	30	Fundamental AT cut
		–10 to 60°C	±15ppm	±100ppm		
		–20 to 70°C	±15ppm	±100ppm		
		–30 to 80°C	±20ppm	±100ppm		
		–40 to 90°C	±25ppm	±100ppm		
		–55 to 105°C	±50ppm	±100ppm		
		–55 to 125°C	±50ppm	±100ppm		
15.0 to 30.0MHz	±5ppm to ±100ppm	0 to 50°C	±5ppm	±100ppm	20	Fundamental AT cut
		–10 to 60°C	±5ppm	±100ppm		
		–20 to 70°C	±10ppm	±100ppm		
		–30 to 80°C	±20ppm	±100ppm		
		–40 to 90°C	±25ppm	±100ppm		
		–55 to 105°C	±50ppm	±100ppm		
		–55 to 125°C	±50ppm	±100ppm		
25.0 to 90.0MHz	±5ppm to ±100ppm	0 to 50°C	±5ppm	±100ppm	40	3rd Overtone AT cut
		–10 to 60°C	±5ppm	±100ppm		
		–20 to 70°C	±10ppm	±100ppm		
		–30 to 80°C	±20ppm	±100ppm		
		–40 to 90°C	±25ppm	±100ppm		
		–55 to 105°C	±50ppm	±100ppm		
		–55 to 125°C	±50ppm	±100ppm		
60.0 to 150.0MHz	±5ppm to ±100ppm	0 to 50°C	±5ppm	±100ppm	60	5th Overtone AT cut
		–10 to 60°C	±5ppm	±100ppm		
		–20 to 70°C	±10ppm	±100ppm		
		–30 to 80°C	±20ppm	±100ppm		
		–40 to 90°C	±25ppm	±100ppm		
		–55 to 105°C	±50ppm	±100ppm		
		–55 to 125°C	±50ppm	±100ppm		
125.0 to 175.0MHz	±5ppm to ±100ppm	0 to 50°C	±5ppm	±100ppm	100	7th Overtone AT cut
		–10 to 60°C	±5ppm	±100ppm		
		–20 to 70°C	±10ppm	±100ppm		
		–30 to 80°C	±20ppm	±100ppm		
		–40 to 90°C	±25ppm	±100ppm		
		–55 to 105°C	±50ppm	±100ppm		
		–55 to 125°C	±50ppm	±100ppm		
170.0 to 210.0MHz	±5ppm to ±100ppm	0 to 50°C	±5ppm	±100ppm	200	9th Overtone AT cut
		–10 to 60°C	±5ppm	±100ppm		
		–20 to 70°C	±10ppm	±100ppm		
		–30 to 80°C	±20ppm	±100ppm		
		–40 to 90°C	±25ppm	±100ppm		
		–55 to 105°C	±50ppm	±100ppm		
		–55 to 125°C	±50ppm	±100ppm		

UM1 CRYSTALS

ISSUE 8; 15 JUNE 1998

QUARTZ CRYSTALS

Delivery Options

- 3 day Express Manufacturing Service, subject to piece part stock availability

Holder Style

- UM1 crystals are resistance welded, hermetically sealed in an inert atmosphere with glass to metal seals securing the lead wires
- Holders suffixed '–3L have a centre third wire which grounds the case
- HC45 is not dimensionally identical to the UM1 but for most purposes the two are interchangeable
- Gull wing available upon request

General Specifications

- Load Capacitance (C_L): 10pF to 75pF or Series
- Drive Level: 1mW max.
- Static Capacitance (C_0): 7pF max.
- Ageing: ±3ppm typical per year

Standard Frequency Tolerances and Stabilities

- ±5ppm, ±10ppm, ±15ppm, ±20ppm, ±30ppm, ±50ppm, ±100ppm

Operating Temperature Ranges

- 0 to 50°C
  –10 to 60°C
  –20 to 70°C
  –30 to 80°C
  –40 to 90°C
  –55 to 105°C
  –55 to 125°C

Storage Temperature Range

- –55 to 125°C

Environmental Specification

- Shock: 981m/s^2 for 6ms, three shocks in each direction along three mutually perpendicular planes
- Vibration: 10 to 60Hz 0.75mm displacement, 60 to 2000Hz 98.1m/s^2 acceleration, 30 minutes in each of three mutually perpendicular planes

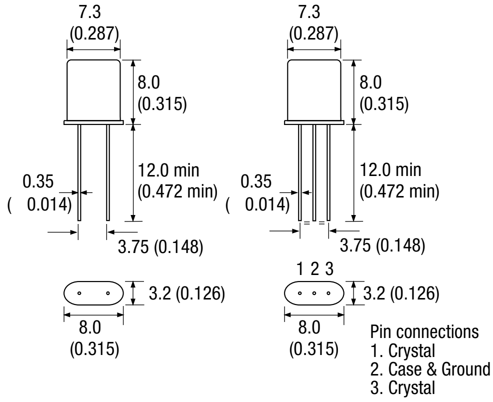
Marking

- Includes Frequency

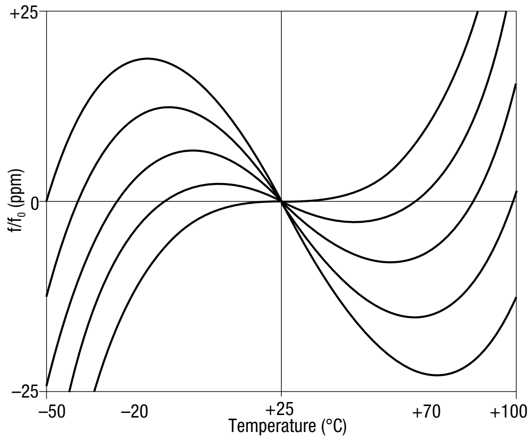
Minimum Order Information Required

- Frequency + Holder + Frequency Tolerance @ 25°C + Frequency Stability + Operating Temperature Range + Circuit Condition + Overtone Order

Outline in mm (inches) - UM1 & UM1-3L



Typical Frequency vs Temperature Curves for various angles of AT-cut crystals



Electrical Specification – maximum limiting values

Frequency Range	Frequency Tolerance @ 25°C ±2°C	Operating Temperature Range	Frequency Stability Available Over Operating Temperature		ESR max.	Vibration Mode
			Minimum	Maximum		
6.0 to < 10.0MHz	±5ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	80	Fundamental AT cut
		–10 to 60°C	±15ppm	±100ppm		
		–20 to 70°C	±15ppm	±100ppm		
		–30 to 80°C	±20ppm	±100ppm		
		–40 to 90°C	±25ppm	±100ppm		
		–55 to 105°C	±50ppm	±100ppm		
		–55 to 125°C	±50ppm	±100ppm		
10.0 to < 15.0MHz	±5ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	60	Fundamental AT cut
		–10 to 60°C	±15ppm	±100ppm		
		–20 to 70°C	±15ppm	±100ppm		
		–30 to 80°C	±20ppm	±100ppm		
		–40 to 90°C	±25ppm	±100ppm		
		–55 to 105°C	±50ppm	±100ppm		
		–55 to 125°C	±50ppm	±100ppm		
15.0 to 30.0MHz	±5ppm to ±100ppm	0 to 50°C	±5ppm	±100ppm	30	Fundamental AT cut
		–10 to 60°C	±5ppm	±100ppm		
		–20 to 70°C	±10ppm	±100ppm		
		–30 to 80°C	±20ppm	±100ppm		
		–40 to 90°C	±25ppm	±100ppm		
		–55 to 105°C	±50ppm	±100ppm		
		–55 to 125°C	±50ppm	±100ppm		
25.0 to 90.0MHz	±5ppm to ±100ppm	0 to 50°C	±5ppm	±100ppm	45	3rd Overtone AT cut
		–10 to 60°C	±5ppm	±100ppm		
		–20 to 70°C	±10ppm	±100ppm		
		–30 to 80°C	±20ppm	±100ppm		
		–40 to 90°C	±25ppm	±100ppm		
		–55 to 105°C	±50ppm	±100ppm		
		–55 to 125°C	±50ppm	±100ppm		
60.0 to 150.0MHz	±5ppm to ±100ppm	0 to 50°C	±5ppm	±100ppm	100	5th Overtone AT cut
		–10 to 60°C	±5ppm	±100ppm		
		–20 to 70°C	±10ppm	±100ppm		
		–30 to 80°C	±20ppm	±100ppm		
		–40 to 90°C	±25ppm	±100ppm		
		–55 to 105°C	±50ppm	±100ppm		
		–55 to 125°C	±50ppm	±100ppm		
125.0 to 175.0MHz	±5ppm to ±100ppm	0 to 50°C	±5ppm	±100ppm	150	7th Overtone AT cut
		–10 to 60°C	±5ppm	±100ppm		
		–20 to 70°C	±10ppm	±100ppm		
		–30 to 80°C	±20ppm	±100ppm		
		–40 to 90°C	±25ppm	±100ppm		
		–55 to 105°C	±50ppm	±100ppm		
		–55 to 125°C	±50ppm	±100ppm		
175.0 to 250.0MHz	±5ppm to ±100ppm	0 to 50°C	±5ppm	±100ppm	200	9th Overtone AT cut
		–10 to 60°C	±5ppm	±100ppm		
		–20 to 70°C	±10ppm	±100ppm		
		–30 to 80°C	±20ppm	±100ppm		
		–40 to 90°C	±25ppm	±100ppm		
		–55 to 105°C	±50ppm	±100ppm		
		–55 to 125°C	±50ppm	±100ppm		

UM5 & UM4 CRYSTALS

ISSUE 6; 12 JANUARY 1996

Delivery Options

- Please contact our sales office for current leadtimes

Holder Style

- UM5 & UM4 crystals are resistance welded, hermetically sealed in an inert atmosphere with glass to metal seals securing the lead wires
- Holders suffixed '–3L have a centre third wire which grounds the case

General Specifications

- Load Capacitance (C_L): 10pF to 75pF or Series
- Drive Level: 1mW max.
- Static Capacitance (C_0): 6pF max
- Ageing: ±3ppm typical per year

Standard Frequency Tolerances and Stabilities

- ±5ppm, ±10ppm, ±15ppm, ±20ppm, ±30ppm, ±50ppm, ±100ppm

Operating Temperature Ranges

- 0 to 50°C
  –10 to 60°C
  –20 to 70°C
  –30 to 80°C
  –40 to 90°C
  –55 to 105°C

Storage Temperature Range

- –55 to 125°C

Environmental Specification

- Shock: 981m/s^2 for 6ms, three shocks in each direction along three mutually perpendicular planes
- Vibration: 10 to 60Hz 0.75mm displacement, 60 to 500Hz 98.1m/s^2 acceleration, 30 minutes in each of three mutually perpendicular planes

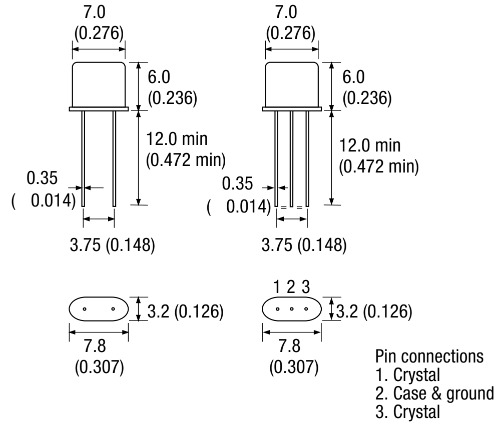
Marking

- Includes Frequency

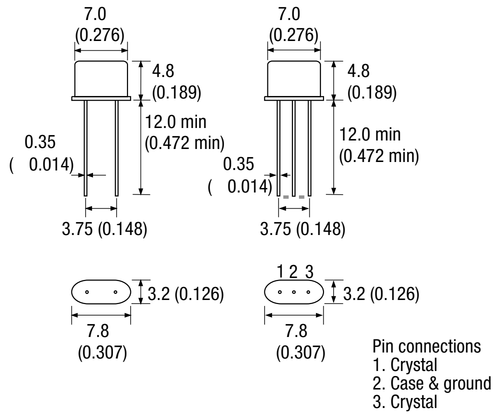
Minimum Order Information Required

- Frequency + Holder + Frequency Tolerance @ 25°C + Frequency Stability + Operating Temperature Range + Circuit Condition + Overtone Order

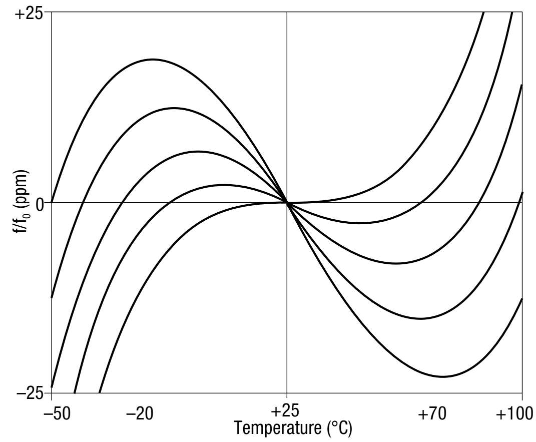
Outline in mm (inches) - UM5 & UM5-3L



Outline in mm (inches) - UM4 & UM4-3L



Typical Frequency vs Temperature Curves for various angles of AT-cut crystals



Electrical Specification – maximum limiting values

Frequency Range	Frequency Tolerance @ 25°C ±2°C	Operating Temperature Range	Frequency Stability Available Over Operating Temperature		ESR max.	Vibration Mode
			Minimum	Maximum		
10.0 to < 16.0MHz	±10ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	60	Fundamental AT cut
		–10 to 60°C	±15ppm	±100ppm		
		–20 to 70°C	±15ppm	±100ppm		
		–30 to 80°C	±20ppm	±100ppm		
		–40 to 90°C	±25ppm	±100ppm		
		–55 to 105°C	±50ppm	±100ppm		
16.0 to < 20.0MHz	±5ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	50	Fundamental AT cut
		–10 to 60°C	±15ppm	±100ppm		
		–20 to 70°C	±15ppm	±100ppm		
		–30 to 80°C	±20ppm	±100ppm		
		–40 to 90°C	±25ppm	±100ppm		
		–55 to 105°C	±50ppm	±100ppm		
20.0 to < 30.0MHz	±5ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	40	Fundamental AT cut
		–10 to 60°C	±15ppm	±100ppm		
		–20 to 70°C	±15ppm	±100ppm		
		–30 to 80°C	±20ppm	±100ppm		
		–40 to 90°C	±25ppm	±100ppm		
		–55 to 105°C	±50ppm	±100ppm		
30.0 to 40.0MHz	±10ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	40	Fundamental AT cut
		–10 to 60°C	±15ppm	±100ppm		
		–20 to 70°C	±15ppm	±100ppm		
		–30 to 80°C	±20ppm	±100ppm		
		–40 to 90°C	±25ppm	±100ppm		
		–55 to 105°C	±50ppm	±100ppm		
40.0 to 90.0MHz	±5ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	120	3rd Overtone AT cut
		–10 to 60°C	±15ppm	100ppm		
		–20 to 70°C	±15ppm	±100ppm		
		–30 to 80°C	±20ppm	±100ppm		
		–40 to 90°C	±25ppm	±100ppm		
		–55 to 105°C	±50ppm	±100ppm		
70.0 to 150.0MHz	±5ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	150	5th Overtone AT cut
		–10 to 60°C	±15ppm	±100ppm		
		–20 to 70°C	±15ppm	±100ppm		
		–30 to 80°C	±20ppm	±100ppm		
		–40 to 90°C	±25ppm	±100ppm		
		–55 to 105°C	±50ppm	±100ppm		
125.0 to 175.0MHz	±5ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	150	7th Overtone AT cut
		–10 to 60°C	±15ppm	±100ppm		
		–20 to 70°C	±15ppm	±100ppm		
		–30 to 80°C	±20ppm	±100ppm		
		–40 to 90°C	±25ppm	±100ppm		
		–55 to 105°C	±50ppm	±100ppm		

HC49/4H & HC49/3H CRYSTALS

QUARTZ CRYSTALS

ISSUE 9; 18 OCTOBER 1999

Delivery Options

- Common frequencies are available from stock. Please see p4 for details

Holder Style

- HC49/4H & HC49/3H crystals are resistance welded, hermetically sealed in an inert atmosphere with glass to metal seals securing the lead wires.
- Holders suffixed '–3L have a centre third wire which grounds the case

General Specifications

- Load Capacitance (C_L): 10pF to 75pF or Series
- Drive Level: 500 W max.
- Static Capacitance (C_0): 7pF max.
- Ageing: ±3ppm typical per year

Standard Frequency Tolerances and Stabilities

- ±10ppm, ±20ppm, ±30ppm, ±50ppm, ±100ppm

Operating Temperature Ranges

- 0 to 50°C –30 to 80°C
  –10 to 60°C –40 to 90°C
  –20 to 70°C –55 to 105°C

Storage Temperature Range

- –55 to 125°C

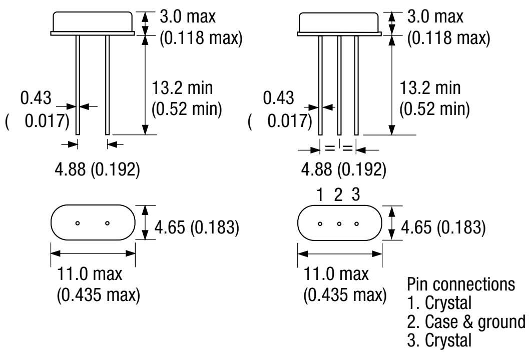
Environmental Specification

- Shock: 981m/s^2 for 6ms, three shocks in each direction along three mutually perpendicular planes
- Vibration: 10 to 60Hz 0.75mm displacement, 60 to 500Hz 98.1m/s^2 acceleration, 30 minutes in each of three mutually perpendicular planes

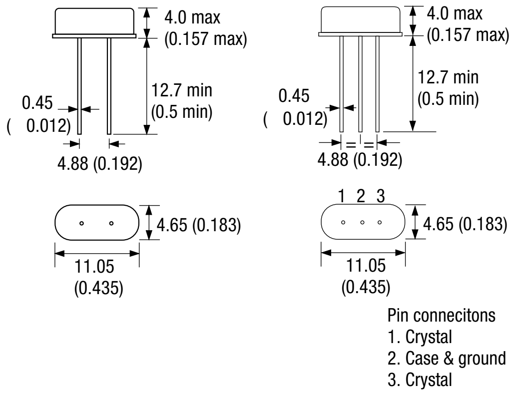
Marking

- Frequency only

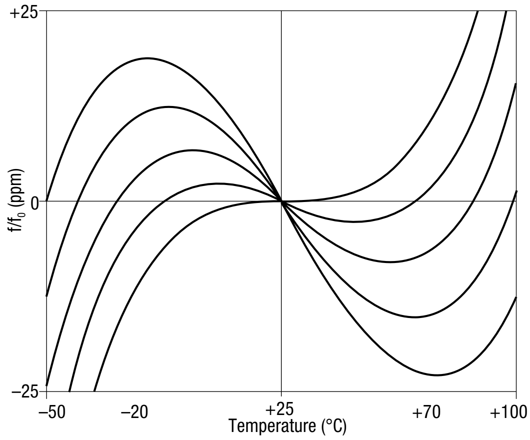
Outline in mm (inches) - HC49/3H & HC49/3H-3L



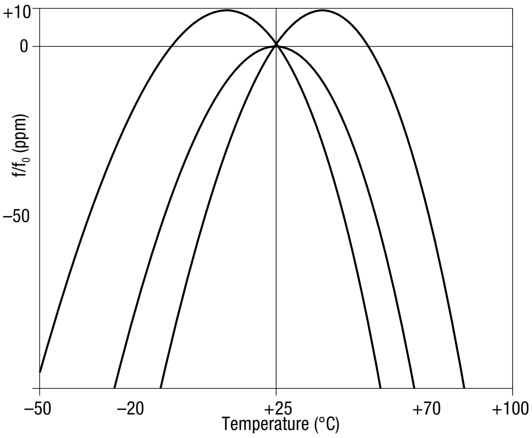
Outline in mm (inches) - HC49/4H & HC49/4H-3L



Typical Frequency vs Temperature Curves for various angles of AT-cut crystals



Typical Frequency vs Temperature Curves for various angles of BT-cut crystals



Minimum Order Information Required

- Frequency + Holder + Frequency Tolerance @ 25°C + Frequency Stability + Operating Temperature Range + Circuit Condition + Overtone Order

Electrical Specification – maximum limiting values

Frequency Range	Frequency Tolerance @ 25°C ±2°C	Operating Temperature Range	Frequency Stability Available Over Operating Temperature		ESR max.	Vibration Mode
			Minimum	Maximum		
3.50 to < 5.0MHz	±15ppm to ±100ppm	0 to 50°C	±15ppm	±100ppm	200	Fundamental AT cut
		–10 to 60°C	±20ppm	±100ppm		
		–20 to 70°C	±20ppm	±100ppm		
		–30 to 80°C	±25ppm	±100ppm		
		–40 to 90°C	±30ppm	±100ppm		
		–55 to 105°C	±100ppm	±500ppm		
5.0 to < 8.0MHz	±15ppm to ±100ppm	0 to 50°C	±15ppm	±100ppm	120	Fundamental AT cut
		–10 to 60°C	±20ppm	±100ppm		
		–20 to 70°C	±20ppm	±100ppm		
		–30 to 80°C	±25ppm	±100ppm		
		–40 to 90°C	±30ppm	±100ppm		
		–55 to 105°C	±100ppm	±500ppm		
8.0 to < 12.0MHz	±15ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	70	Fundamental AT cut
		–10 to 60°C	±15ppm	±100ppm		
		–20 to 70°C	±15ppm	±100ppm		
		–30 to 80°C	±20ppm	±100ppm		
		–40 to 90°C	±50ppm	±100ppm		
		–55 to 105°C	±50ppm	±100ppm		
12.0 to < 25.0MHz	±15ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	50	Fundamental AT cut
		–10 to 60°C	±15ppm	±100ppm		
		–20 to 70°C	±15ppm	±100ppm		
		–30 to 80°C	±20ppm	±100ppm		
		–40 to 90°C	±50ppm	±100ppm		
		–55 to 105°C	±50ppm	±100ppm		
25.0 to 32.0MHz	±15ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	30	Fundamental AT cut
		–10 to 60°C	±15ppm	±100ppm		
		–20 to 70°C	±15ppm	±100ppm		
		–30 to 80°C	±20ppm	±100ppm		
		–40 to 90°C	±50ppm	±100ppm		
		–55 to 105°C	±50ppm	±100ppm		
20.0 to 40.0MHz	Inclusive with Frequency Stability	0 to 50°C	±50ppm	±100ppm	50	Fundamental BT cut
		–10 to 60°C	±50ppm	±100ppm		
		–20 to 70°C	±100ppm	±100ppm		
		–30 to 80°C	±100ppm	±100ppm		
25.0 to 70.0MHz	±15ppm to ±100ppm	0 to 50°C	±15ppm	±100ppm	100	3rd Overtone AT cut
		–10 to 60°C	±20ppm	±100ppm		
		–20 to 70°C	±20ppm	±100ppm		
		–30 to 80°C	±25ppm	±100ppm		
		–40 to 90°C	±50ppm	±100ppm		
		–55 to 105°C	±50ppm	±100ppm		
Please Note: Frequencies 3.0 to 3.5MHz are available; please contact the sales office for more information.						

HC49 CRYSTALS

ISSUE 9; 7 SEPTEMBER 1999

Delivery Options

- Common frequencies are available from stock. Please see p4 for details
- 3 day Express Manufacturing Service, subject to piece part stock availability

Holder Style

- HC49 crystals are resistance welded, hermetically sealed in an inert atmosphere with glass to metal seals securing the lead wires; HC49/T is truncated version; HC50 is plug–in version
- HC43 crystals are cold welded; HC43/T is truncated version; HC42 is plug-in version
- Holders suffixed '–3L have a centre third wire which grounds the case; this is not applicable to the HC50 and HC42
- Truncated versions are only available in the frequency range 4.0 to 300.0MHz

General Specifications

- Load Capacitance (C_L): 10pF to 75pF or Series
- Drive Level: 1mW max.
- Static Capacitance (C_0): 7pF max.
- Ageing: ±3ppm typical per year

Standard Frequency Tolerances and Stabilities

- ±5ppm, ±10ppm, ±15ppm, ±20ppm, ±30ppm, ±50ppm, ±100ppm

Operating Temperature Ranges

0 to 50°C	–40 to 90°C
–10 to 60°C	–55 to 105°C
–20 to 70°C	–55 to 125°C
–30 to 80°C	

Storage Temperature Range

- –55 to 125°C

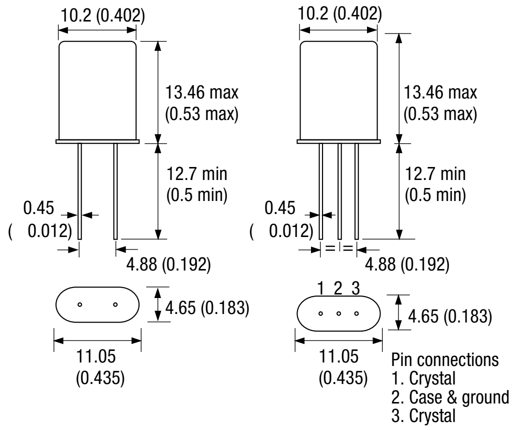
Environmental Specification

- Shock: 981m/s^2 for 6ms, three shocks in each direction along three mutually perpendicular planes
- Vibration: 10 to 60Hz 0.75mm displacement, 60 to 500Hz 98.1m/s^2 acceleration, 30 minutes in each of three mutually perpendicular planes

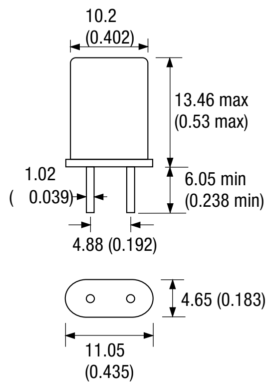
Marking

- Includes Frequency

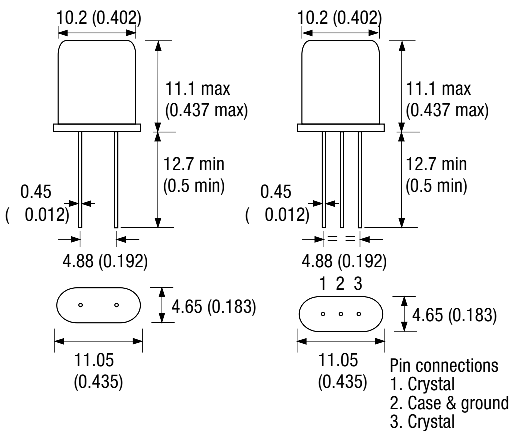
Outline in mm (inches) - HC49 & HC49-3L



Outline in mm (inches) - HC50 & HC42



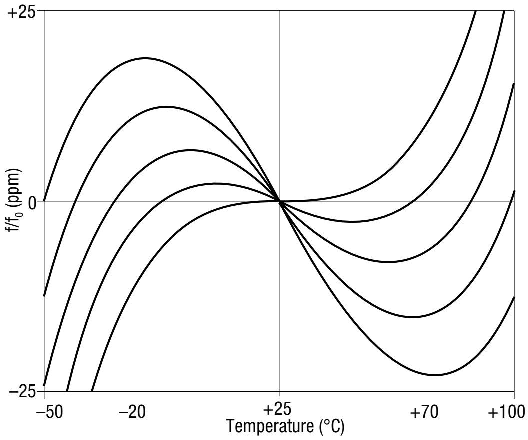
Outline in mm (inches) - HC49/T & HC49/T-3L



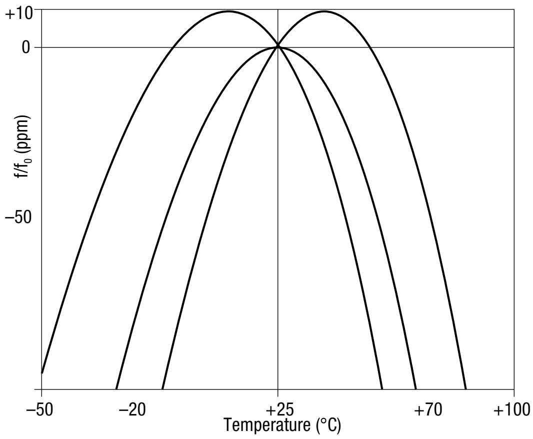
Minimum Order Information Required

- Frequency + Holder + Frequency Tolerance @ 25°C + Frequency Stability + Operating Temperature Range + Circuit Condition + Overtone Order

Typical Frequency vs Temperature Curves for various angles of AT-cut crystals



Typical Frequency vs Temperature Curves for various angles of BT-cut crystals



QUARTZ CRYSTALS

Electrical Specification – maximum limiting values

Frequency Range	Frequency Tolerance @ 25°C ±2°C	Operating Temperature Range	Frequency Stability Available Over Operating Temperature		ESR max.	Vibration Mode
			Minimum	Maximum		
1.84320 to < 2.0MHz	±5ppm to ±100ppm	0 to 50°C	±15ppm	±200ppm	800	Fundamental AT cut
		–10 to 60°C	±20ppm	±200ppm		
		–20 to 70°C	±20ppm	±200ppm		
		–30 to 80°C	±25ppm	±200ppm		
		–40 to 90°C	±30ppm	±200ppm		
		–55 to 105°C	±50ppm	±200ppm		
		–55 to 125°C	±100ppm	±200ppm		
2.0 to < 3.0MHz	±5ppm to ±100ppm	0 to 50°C	±15ppm	±200ppm	600	Fundamental AT cut
		–10 to 60°C	±20ppm	±200ppm		
		–20 to 70°C	±20ppm	±200ppm		
		–30 to 80°C	±25ppm	±200ppm		
		–40 to 90°C	±30ppm	±200ppm		
		–55 to 105°C	±50ppm	±200ppm		
		–55 to 125°C	±100ppm	±200ppm		
3.0 to < 4.0MHz	±5ppm to ±100ppm	0 to 50°C	±15ppm	±200ppm	150	Fundamental AT cut
		–10 to 60°C	±20ppm	±200ppm		
		–20 to 70°C	±20ppm	±200ppm		
		–30 to 80°C	±25ppm	±200ppm		
		–40 to 90°C	±30ppm	±200ppm		
		–55 to 105°C	±50ppm	±200ppm		
		–55 to 125°C	±55ppm	±200ppm		

QUARTZ CRYSTALS

Frequency Range	Frequency Tolerance @ 25°C ±2°C	Operating Temperature Range	Frequency Stability Available Over Operating Temperature		ESR max.	Vibration Mode
			Minimum	Maximum		
4.0 to < 7.0MHz	±5ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	100	Fundamental AT cut
		–10 to 60°C	±15ppm	±100ppm		
		–20 to 70°C	±15ppm	±100ppm		
		–30 to 80°C	±20ppm	±100ppm		
		–40 to 90°C	±25ppm	±100ppm		
		–55 to 105°C	±50ppm	±100ppm		
		–55 to 125°C	±50ppm	±100ppm		
7.0 to < 10.0MHz	±5ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	50	Fundamental AT cut
		–10 to 60°C	±10ppm	±100ppm		
		–20 to 70°C	±10ppm	±100ppm		
		–30 to 80°C	±20ppm	±100ppm		
		–40 to 90°C	±25ppm	±100ppm		
		–55 to 105°C	±50ppm	±100ppm		
		–55 to 125°C	±50ppm	±100ppm		
10.0 to 36.0MHz	±5ppm to ±100ppm	0 to 50°C	±5ppm	±100ppm	35	Fundamental AT cut
		–10 to 60°C	±5ppm	±100ppm		
		–20 to 70°C	±10ppm	±100ppm		
		–30 to 80°C	±20ppm	±100ppm		
		–40 to 90°C	±25ppm	±100ppm		
		–55 to 105°C	±50ppm	±100ppm		
		–55 to 125°C	±50ppm	±100ppm		
20.0 to 45.0MHz	Inclusive with Frequency Stability	0 to 50°C	±50ppm	±100ppm	35	Fundamental BT cut
		–10 to 60°C	±50ppm	±100ppm		
		–20 to 70°C	±100ppm	±100ppm		
		–30 to 80°C	±100ppm	±100ppm		
21.0 to 90.0MHz	±5ppm to ±100ppm	0 to 50°C	±5ppm	±100ppm	40	3rd Overtone AT cut
		–10 to 60°C	±5ppm	±100ppm		
		–20 to 70°C	±10ppm	±100ppm		
		–30 to 80°C	±20ppm	±100ppm		
		–40 to 90°C	±25ppm	±100ppm		
		–55 to 105°C	±50ppm	±100ppm		
		–55 to 125°C	±50ppm	±100ppm		
45.0 to 135.0MHz	Inclusive with Frequency Stability	0 to 50°C	±50ppm	±100ppm	35	3rd Overtone BT cut
		–10 to 60°C	±50ppm	±100ppm		
		–20 to 70°C	±100ppm	±100ppm		
		–30 to 80°C	±100ppm	±100ppm		
60.0 to 150.0MHz	±5ppm to ±100ppm	0 to 50°C	±5ppm	±100ppm	70	5th Overtone AT cut
		–10 to 60°C	±5ppm	±100ppm		
		–20 to 70°C	±10ppm	±100ppm		
		–30 to 80°C	±20ppm	±100ppm		
		–40 to 90°C	±25ppm	±100ppm		
		–55 to 105°C	±50ppm	±100ppm		
		–55 to 125°C	±50ppm	±100ppm		

Frequency Range	Frequency Tolerance @ 25°C ±2°C	Operating Temperature Range	Frequency Stability Available Over Operating Temperature		ESR max.	Vibration Mode
			Minimum	Maximum		
90.0 to 225.0MHz	Inclusive with Frequency Stability	0 to 50°C	±50ppm	±100ppm	70	5th Overtone BT cut
		–10 to 60°C	±50ppm	±100ppm		
		–20 to 70°C	±100ppm	±100ppm		
		–30 to 80°C	±100ppm	±100ppm		
85.0 to 210.0MHz	±5ppm to ±100ppm	0 to 50°C	±5ppm	±100ppm	100	7th Overtone AT cut
		–10 to 60°C	±5ppm	±100ppm		
		–20 to 70°C	±10ppm	±100ppm		
		–30 to 80°C	±20ppm	±100ppm		
		–40 to 90°C	±25ppm	±100ppm		
		–55 to 105°C	±50ppm	±100ppm		
		–55 to 125°C	±50ppm	±100ppm		
125.0 to 300.0MHz	Inclusive with Frequency Stability	0 to 50°C	±50ppm	±100ppm	100	7th Overtone BT cut
		–10 to 60°C	±50ppm	±100ppm		
		–20 to 70°C	±100ppm	±100ppm		
		–30 to 80°C	±100ppm	±100ppm		
110.0 to 270.0MHz	±5ppm to ±100ppm	0 to 50°C	±5ppm	±100ppm	150	9th Overtone AT cut
		–10 to 60°C	±5ppm	±100ppm		
		–20 to 70°C	±10ppm	±100ppm		
		–30 to 80°C	±20ppm	±100ppm		
		–40 to 90°C	±25ppm	±100ppm		
		–55 to 105°C	±50ppm	±100ppm		
		–55 to 125°C	±50ppm	±100ppm		

SC CUT CRYSTALS: CFPX-2000 SERIES

ISSUE 2; 12 OCTOBER 1999

- The CFPX-2000 series of SC cut quartz resonators are double rotated crystals that offer considerable advantages over single rotated AT or BT cuts for certain applications. The term SC stands for “Stress Compensated” and it was the property of compensation for thermal transient and planar stress effects that was sought in its orginal development. The frequency/temperature characteristics of the SC cut are most suitable for oven controlled oscillator applications for precision frequency control.

QUARTZ CRYSTALS

Key Features:

- Thermal transient compensation - fast warm up
- Low frequency/temperature response slope suitable for ovened applications
- Smooth frequency/temperature characteristics reduce coupled mode problems
- Low thermal hysteresis
- Ageing as low as 1×10^{-10}/day at 85°C (3rd overtone) can be achieved
- Low acceleration sensitivity
- Q factor > 1.0 million for 10.0MHz 3rd overtone crystal

Environmental Specification:

- Bump: IEC 68-2-29 Test Eb, 4000 ±10 bumps at 400m/ s^2 (40_{gn}) in each of three mutually perpendicular planes
- Vibration: IEC 68-2-6 Test Fc Procedure B4 (MIL-STD-202 Method 204), Duration 12 hours, 10 to 55Hz 0.75mm D.A., 55 to 2000Hz 98m/s^2 (10_{gn})
- Shock: IEC 68-2-27 Test Ea, (MIL-STD-202 Method 213) ½ sine wave, 981m/s^2 (100_{gn}) 11ms, 6 shocks in each plane
- Damp Heat: IEC 68-2-3 Test Ca (Steady State), Duration 56 days, recovery time 12 hours
- Change of temperature: IEC 68-2-14 Test Na (Rapid Change) (MIL-STD-202 Method 107), 10 cycles of 30 mintues duration each for -55/+125°C cycle
- Solderability: IEC 68-2-20 Test Ta Method1 (Solder Bath) (MIL-STD-202 Method 208), Temperature 235°C
- Robustness of Termination: IEC 68-2-21 Test Ua (Tensile or Thrust)(MIL-STD-202 Method 211), 10 Newtons (Tensile) or 20 Newtons (Thrust)
- Hermetic Seal: IEC 68-2-17 Test Qk (Fine Leak), (MIL-STD-202 Method 112 Test condition C) and IEC 68-2-17 Test Qc (Gross Leak) (MIL-STD-202 Method 112 Test condition D)
- Marking: Engraving

Frequency\Holder Range

Frequency Range	Mode	Holder	IEC Code
12.0 to 50.0MHz	Fundamental	HC35/U (TO5)	DK
30.0 to 150.0MHz	3rd Overtone		
5.0 to 20.0MHz	Fundamental	HC37/U (TO8)	DL
8.0 to 20.0MHz	3rd Overtone		
2.50 to 10.0MHz	Fundamental	HC40/U	DU, DM, DR
4.0 to 20.0MHz	3rd Overtone		
15.0 to 50.0MHz	3rd Overtone	HC43/U	

General Characteristics

- Turnover temperature: 50 to 90°C
- Ageing: < 5×10^{-9}/day at 85°C (fundamental)
  < 1×10^{-9}/day at 85°C (3rd overtone)

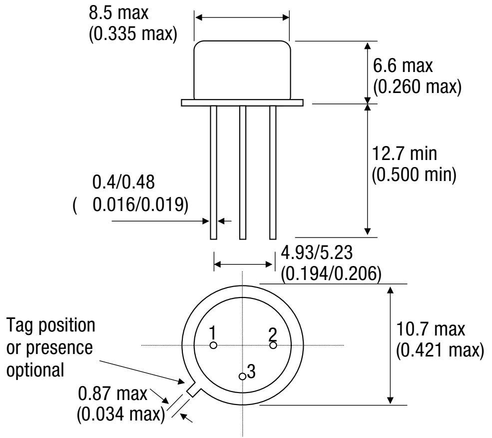
Note: Tighter specifications available

- Q - factor: > 1.0 million for 10.0MHz 3rd overtone
- g - sensitivity: < 5×10^{-9}/g typical for HC35, HC37, HC40 or HC43

Note: g - sensitivity: < 1×10^{-9}/g achievable using 4-point mounting upon request for holders HC35, HC37 or HC40

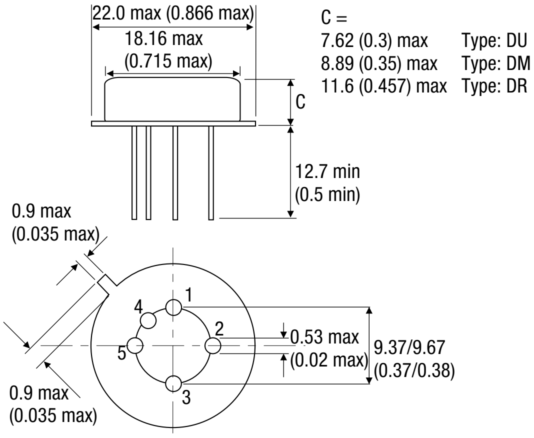
- Material: Premium Q, low inclusion density or swept
- HC37: The crystal may be connected to Pin 1 and Pin3 or Pin 2 and Pin 4
- To determine your exact requirements please contact our Applications Support Department

Outline in mm (inches) - HC35/U (TO5) DK - (scale 1.5:1)

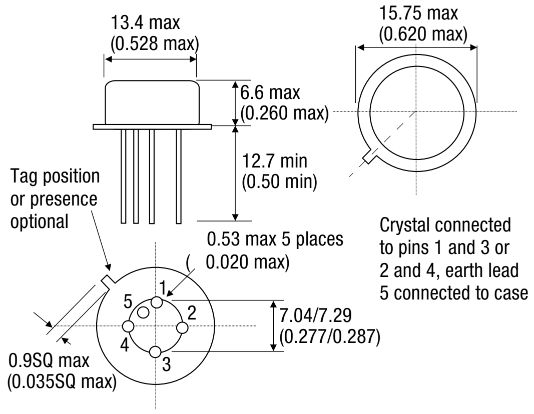


CFPX-2000 Series Outline Drawings

Outline in mm (inches) - HC40/U, DU, DM, DR

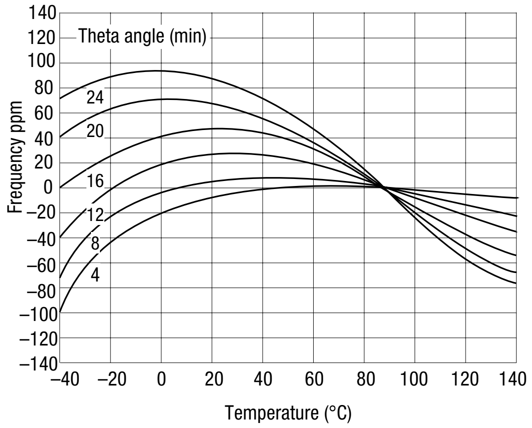


Outline in mm (inches) - HC37/U (TO8) DL

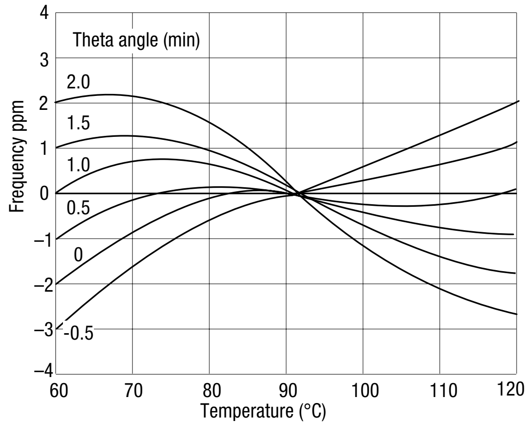


QUARTZ CRYSTALS

Frequency/Temperature Curves SC Cut -40+140°C



Frequency/Temperature Curves SC Cut -60+120°C



CFPX-3000 ESA/SCC Approved Quartz Crystals

ISSUE 2; 11 JUNE 1999

C-MAC has had a range of quartz crystal units approved to the requirements of ESA/SCC, as defined in the ESA/SCC generic specification, since 1985. The scope of this approval, including the frequency range and holder styles applicable, is detailed below. C-MAC can therefore provide customers with a source of released quartz crystal units, suitable for use in any ESA project. New type variants can be raised to cover specific customer applications providing the requirement is within the scope of the ESA/SCC detail specifications. The applicable Generic specification is ESA/SCC 3501, and the applicable Detail specifications are ESA/SCC 3501/001, 3501/002, 3501/008, 3501/009, 3501/011 & 3501/012.

Key Features:

- Fully approved to the requirements of ESA/SCC
- All processing & testing is performed in accordance with an ESA approved Process Identification Document (PID)
- Lot Acceptance Testing (LAT) is performed, to the level specified by the customer
- Type variants can be raised to cover specific customer requirements

Range of Qualification

ESA/SCC 3501/001, 3501/008, 3501/011 and 3501/012 specification:

- Frequency: 4.0 - 140.0MHz in Fundamental , 3rd Overtone and 5th Overtone Mode
- Holder Style: Metal welded type T807
- CFPX Series: CFPX-3750

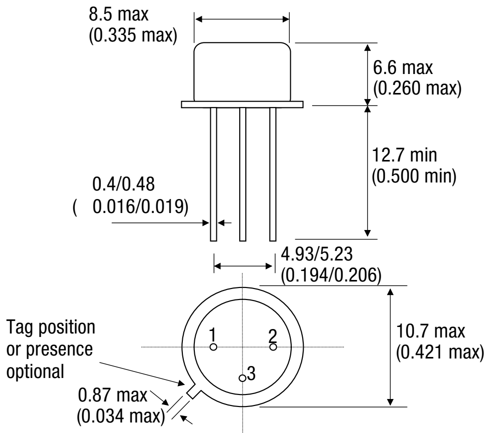
ESA/SCC 3501/002 and 3501/009 specification:

- Frequency: 2.5 - 20.0MHz Fundamental Mode
- Holder Style: Metal welded type T1507
- CFPX Series: CFPX-3758

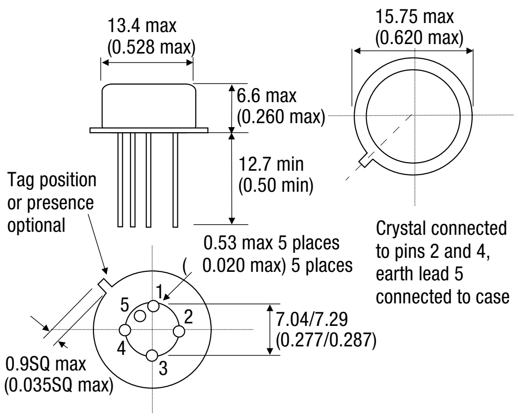
Ordering Procedure

- Please refer to ESA/SCC Table 1 and enter parameters as required

Outline in mm (inches): ESA/SCC 3501/001, 3501/008, 3501/011 & 3501/012 CFPX-3750 Series - (scale 1.5:1)



Outline in mm (inches): ESA/SCC 3501/002 & 3501/009 CFPX-3758 Series



ESA/SCC Table 1

Customer Fax Form - Please copy form, fill out and fax to CFP on +44 (0)1460 72578						
No	Characteristic	Symbol	Limits		Unit	Remarks
			Min.	Max.		
1	Holder Style					
2	Resonance Frequency	F_r or f_L			MHz	
3	Reference Temperature	T_o			°C	
4	Overtone Order					
5	Load Capacitance	C_L			pF	
6	Rated Drive Level	P_o			mW	
7	Frequency Adjustment Tolerance	$\frac{f}{f}$			10^{-6}	At T_o°C
8	Resonance Resistance	R_r or R_L				At T_o°C
9	Frequency Variation with Temperature over T_{op}	$\frac{f}{f}$			10^{-6}	From frequency measured at T_o°C
10	Resistance Variation with Temperature over T_{op}	$\frac{R}{R}$			%	From resistance measured at T_o°C
11	Operating Temperature Range	T_{op}			°C	
12	Frequency variation with Drive Level	$\frac{f}{f}$			10^{-6}	From P_{S1} = mW to P_{S2} = mW
13	Resistance variation with Drive Level	$\frac{R}{R}$			%	
14	Motional Inductance	L_1			mH	
15	Motional Capacitance	C_1			fF	
16	Static Capacitance	C_o			pF	
17	Q Factor	Q			-	
18	Ratio of unwanted: Response Resistance to Resonance Resistance or Response Impedance to Resonance Resistance	R_p/R or $\lvert Z_p\rvert/R$				In the frequency range: f - kHz to f + kHz
19	Ageing	$\frac{f}{f}$			10^{-6}	
20	Terminal Length	L			mm	
21	Storage Temperature Range	T_{stg}			°C	
22	Intended Application					

NOTES

QUARTZ
CRYSTALS

SPXOs - Section Contents

SPECIFYING SIMPLE PACKAGED CRYSTAL OSCILLATORS (SPXOs)

A typical SPXO specification reads like this:

19.66080MHz IQXO-350 B D BU T

- Frequency — 19.66080MHz
- Model Number — IQXO-350
- Frequency Stability — B
- Frequency Tolerance — D
- Packaging — BU
- Additional Text Code (for non-standard product) — T

The following notes define each element of the specification.

Frequency

Frequency is normally specified in kilohertz (kHz) up to 999.999 kHz and in megahertz (MHz) from 1.0MHz. All our computer-generated transaction documents follow this standard convention automatically.

The SPXO frequency should be described to seven significant figures. If seven significant figures are not used, we assume that any figure that might follow those given may be taken as zero. Thus a frequency given as 16.6MHz will be taken as 16.60, not 16.66667.

Model Number

The model number incorporates information which describes output compatibility and holder style.

Frequency Stability

The frequency stability of an SPXO includes the initial adjustment tolerance at room temperature, the tolerance over operating temperature range and the effect of supply voltage variation. This value is specified as 'parts per million' (ppm) and is available in four ranges; ±15ppm, ±25ppm, ±50ppm & ±100ppm.

- A = ±25ppm
- B = ±50ppm
- C = ±100ppm
- N = ±15ppm

Non-Standard Frequency Tolerances

During manufacture, it is possible to adjust some SPXO's to a specific tolerance at room temperature. The frequency tolerance forms part of the frequency stability. These oscillators have a second letter code to indicate the frequency tolerance.

- D = ±5ppm
- E = ±10ppm
- F= ±25ppm

Standard Operating Temperature Ranges

- 0 to 50°C –40 to 85°C
  0 to 70°C –55 to 125°C

Operating Temperature Range

An oscillator is designed to work over any one of three temperature ranges:

- Commercial: 0 to 70°C
- Military: –55 to 125°C
- Industrial: –40 to 85°C

Although in general oscillators will continue to operate outside their normal temperature range with a degradation in frequency stability, damage can result if the temperatures reached are excessive.

Packaging Code

All items are bulked packed only.

- BU = Bulk packed

Additional Text Code

If the product is non-standard, the letter 'T' will appear at the end of the product specification. This refers to additional text on the purchase order to identify the special requirements.

Outline Drawings

Dimensions on the oscillator outline drawings are shown only as a guide. Precise dimensions of oscillator holders are available from our Engineering Department upon request. All dimensions are shown in mm (& inches) and are nominal unless otherwise stated. All outlines are at a scale of 1:1 unless otherwise specified.

Delivery Options

The following Express delivery options are available for certain oscillators; timescales refer to despatch from our factories.

- 3 working days (Express service)
- 5 working days (Express service)
- 7 working days (Express service)
- 10 working days (Express service)

Prices for larger quantities and longer delivery times are generally lower due to substantially reduced manufacturing costs. Please refer to individual datasheets for further information.

Marking

Product will be indelibly marked as detailed in the individual data sheets. Where space is limited some or all of the information will be omitted/truncated at CFP's discretion. Full product description will be found on the individual batch packaging.

Ordering Information

- See individual data sheets

NEW MILITARY OSCILLATOR RANGES

C-MAC Frequency Products introduced several new military oscillator substrates utilising the latest in design techniques and technology. Consequently, certain model numbers are now obsolete and new (replacement) model numbers have been issued.

The table below, provides a comparison between the old and the new model numbers. It must be emphasised that all existing devices have a direct alternative within the new range and some ranges have been extended in order to encompass new customer requirements.

Please refer to the appropriate component data sheet for more detailed information. If you require further help, please contact our Applications Support Department.

Military Oscillators Cross Reference Table

Type	Frequency Range (MHz)	Obsolete CFP Model Number *(except IQXO-525/526)*		New CFP Model Number Only 250.0kHz to 72.0MHz	
		Non-Screened	Screened	Non-Screened	Screened
HCMOS/LS TTL	0.5 to 75.0	IQXO-41	IQXO-42	IQXO-85	IQXO-86
TTL	0.5 to 75.0	IQXO-43	IQXO-44	IQXO-85	IQXO-86
Tri-state HCMOS/LS TTL	0.5 to 75.0	IQXO-45	IQX0-46	IQXO-87	IQXO-88
HCMOS/TTL	0.03 to 32.0	*IQXO-525*	*IQXO-526*	IQXO-625	IQXO-626
HCMOS/LS TTL	> 32.0 to 100.0	IQXO-527	IQXO-528	IQXO-625	IQXO-626
TTL	> 32.0 to 100.0	IQXO-529	IQXO-530	IQXO-625	IQXO-626
Tri-state HCMOS/LS TTL	0.5 to 100.0	IQXO-531	IQXO-532	IQXO-627	IQXO-628

STOCK OSCILLATORS

Minimum Order Information Required

- Stock Number or Alpha Code

8-pin DIL Clock Oscillators- HCMOS/TTL

Frequency	Frequency Stability	Model No.	Stock No.	Alpha Code
3.68640MHz	±100ppm	IQXO-22C	SPXO003223	X363H
4.0MHz	±100ppm	IQXO-22C	SPXO003155	X351H
8.0MHz	±100ppm	IQXO-22C	SPXO003162	X352H
10.0MHz	±100ppm	IQXO-22C	SPXO003168	X353H
12.0MHz	±100ppm	IQXO-22C	SPXO003176	X354H
12.2880MHz	±100ppm	IQXO-22C	SPXO003257	X379H
14.318180MHz	±100ppm	IQXO-22C	SPXO003247	X373H
14.74560MHz	±100ppm	IQXO-22C	SPXO003277	X388H
16.0MHz	±100ppm	IQXO-22C	SPXO003182	X355H
20.0MHz	±100ppm	IQXO-22C	SPXO003189	X356H
24.0MHz	±100ppm	IQXO-22C	SPXO003239	X371H
24.5760MHz	±100ppm	IQXO-22C	SPXO003039	X386H
25.0MHz	±100ppm	IQXO-22C	SPXO003280	X390H
28.636360MHz	±100ppm	IQXO-22C	SPXO003254	X376H
32.0MHz	±100ppm	IQXO-22C	SPXO003213	X360H
32.7680MHz	±100ppm	IQXO-22C	SPXO003258	X380H
40.0MHz	±100ppm	IQXO-22C	SPXO003197	X357H
50.0MHz	±100ppm	IQXO-22C	SPXO003204	X358H
60.0MHz	±100ppm	IQXO-22C	SPXO003260	X381H
60.0MHz	±100ppm	IQXO-23C	SPXO003261	X381T
64.0MHz	±100ppm	IQXO-22C	SPXO003266	X384H
80.0MHz	±100ppm	IQXO-22C	SPXO003279	X389H

14-pin DIL Clock Oscillators - HCMOS/TTL

Frequency	Frequency Stability	Model No.	Stock No.	Alpha Code
1.0MHz	±100ppm	IQXO-350C	SPXO010197	X331B
1.84320MHz	±100ppm	IQXO-350C	SPXO011520	X337B
2.0MHz	±100ppm	IQXO-350C	SPXO000118	E618A
3.68640MHz	±100ppm	IQXO-350C	SPXO010296	X325B
4.0MHz	±100ppm	IQXO-350C	SPXO003154	X351A
4.0960MHz	±100ppm	IQXO-350C	SPXO003246	X373A
4.91520MHz	±100ppm	IQXO-350C	SPXO003222	X363A
5.0MHz	±100ppm	IQXO-350C	SPXO011220	X333B
6.0MHz	±100ppm	IQXO-350C	SPXO011505	X335B

Frequency	Frequency Stability	Model No.	Stock No.	Alpha Code
8.0MHz	±100ppm	IQXO-350C	SPXO003161	X352A
9.83040MHz	±100ppm	IQXO-350C	SPXO003210	X359A
10.0MHz	±100ppm	IQXO-350C	SPXO003167	X353A
11.28960MHz	±100ppm	IQXO-350C	SPXO003263	X382A
12.0MHz	±100ppm	IQXO-350C	SPXO003174	X354A
12.2880MHz	±100ppm	IQXO-350C	SPXO010198	X342B
14.74560MHz	±100ppm	IQXO-350C	SPXO010980	X388A
16.0MHz	±100ppm	IQXO-350C	SPXO003181	X355A
16.3840MHz	±50ppm	IQXO-350B	SPXO003236	X370A
18.4320MHz	±100ppm	IQXO-350C	SPXO003228	X367A
19.66080MHz	±100ppm	IQXO-350C	SPXO003225	X364A
20.0MHz	±100ppm	IQXO-350C	SPXO003188	X356A
24.0MHz	±100ppm	IQXO-350C	SPXO003238	X371A
25.0MHz	±100ppm	IQXO-350C	SPXO010147	X350B
30.0MHz	±100ppm	IQXO-350C	SPXO011178	X359B
32.0MHz	±100ppm	IQXO-350C	SPXO003211	X360A
32.7680MHz	±100ppm	IQXO-350C	SPXO010117	X380A
33.3330MHz	±100ppm	IQX0-350C	SPXO003227	X366A
33.330MHz	±100ppm	IQXO-350C	SPXO010220	X361B
40.0MHz	±50ppm	IQXO-350B	SPXO003196	X357B
40.0MHz	±100ppm	IQXO-350C	SPXO003195	X357A
40.960MHz	±50ppm	IQXO-350B	SPXO003220	X362A
48.0MHz	±100ppm	IQXO-350C	SPXO003246	X373A
50.0MHz	±100ppm	IQXO-350C	SPXO003203	X358A
64.0MHz	±100ppm	IQXO-350C	SPXO011525	X393B
66.0MHz	±100ppm	IQXO-350C	SPXO003232	X368A

NOTES

SPXOs

IQXO-22, -23 Commercial Oscillator

ISSUE 15; 19 OCTOBER 1999

Delivery Options

- Common frequencies are available from stock. Please see p34 for details
- 3 day Express Manufacturing Service, subject to piece part stock availability.

Output Compatibility

- HCMOS/TTL
- Drive Capability: 50pF or 10 TTL
- Non tri-state (IQXO-22, -22I)
- Tri-state (IQXO-23, -23I)

Package Outline

- 8-pin DIL compatible resistance welded enclosure, hermetically sealed with glass to metal seals. Available over 0 to 70°C (IQXO-22, -23) or –40 to 85°C (IQXO-22I, -23I)

Standard Frequency Stabilities

- 25ppm, 50ppm, 100ppm (over operating temperature range)

Frequency Tolerance at 25°C (Optional)

- 5ppm, ±10ppm, 25ppm

Operating Temperature Range

- 0 to 70°C (IQXO-22, -23)
- –40 to 85°C (IQXO-22I, -23I)

Storage Temperature Range

- –55 to 125°C

Environmental Specification

- Terminal Strength: 0.91kg max. Force perpendicular to top & bottom.
- Hermetic Seal: not to exceed 1×10^{-8} mBar litres of Helium leakage
- Solderability: MIL-STD-202E, Method 208C
- Vibration: 10 to 55Hz 0.76mm displacement, sweep 60 seconds, duration 2 hours.
- Rapid Change of Temperature over Operating Temperature Range: 10 cycles
- Shock: 981m/s^2 for 6ms, three shocks in each direction along the three mutually perpendicular planes

Tri-state Operation (IQXO-23, -23I)

- Logic '0' to pin 1 disables oscillator output; when disabled the oscillator output goes to the high impedance state
- No connection or Logic '1' to pin 1 enables oscillator output
- Maximum 'pull-down' resistance required to disable output = 20k
- Disable current 50 A typical

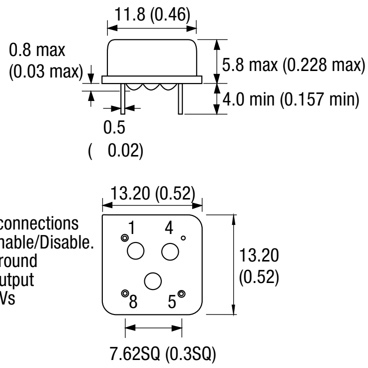
Marking

- Model number (+ Operating Temperature Code; if applicable)
- Frequency Stability Code
- Frequency Tolerance Code (Optional)
- Frequency
- Date code (Year/Week)

Minimum Order Information Required

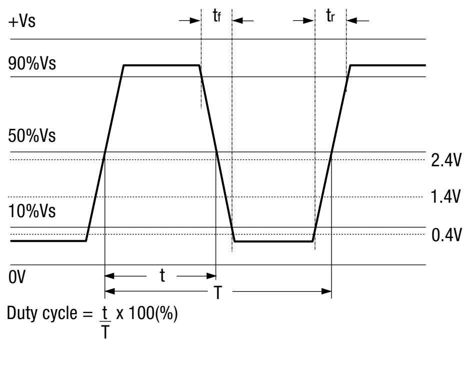
- Frequency + Model Number + Operating Temperature Code (if applicable) + Frequency Stability

Outline in mm (inches)



Note: Pin 1= No connnection on non tri-state models

Output Waveform - HCMOS/TTL



Electrical Specification – maximum limiting values when measured in HCMOS test circuit

Frequency Range	Frequency Stability	Supply Voltage	Supply Current	Rise Time (t_r)	Fall Time (t_f)	Duty Cycle	Model Number
500.0kHz to < 5.0MHz	±25ppm, ±50ppm, ±100ppm	5V±0.25V	20mA	15ns	15ns	45/55%	IQXO-22, -22I, -23, -23I
5.0 to < 16.0MHz	±25ppm, ±50ppm, ±100ppm	5V±0.25V	20mA	10ns	10ns	45/55%	IQXO-22, -22I, -23, -23I
16.0 to < 30.0MHz	±25ppm, ±50ppm, ±100ppm	5V±0.25V	30mA	10ns	10ns	45/55%	IQXO-22, -22I, -23, -23I
30.0 to < 50.0MHz	±25ppm, ±50ppm, ±100ppm	5V±0.25V	40mA	8ns	8ns	45/55%	IQXO-22, -22I, -23, -23I
50.0 to 80.0MHz	±25ppm, ±50ppm, ±100ppm	5V±0.25V	50mA	6ns	6ns	40/60%	IQXO-22, -22I, -23, -23I

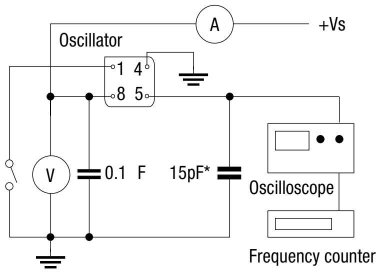
Ordering Example 22.0MHz IQXO-22I B F

Frequency
Model No: -22, -22I = Non tri-state & -23, -23I = Tri-state
Operating Temperature Code: I = –40 to 85°C Not applicable for 0 to 70°C
Frequency Stability: A = ±25ppm; B = ±50ppm; C = ±100ppm
Frequency Tolerance @ 25°C: D = ±5ppm; E = ±10ppm; F = ±25ppm

Please note: Code combination A F is not available

SPXOs

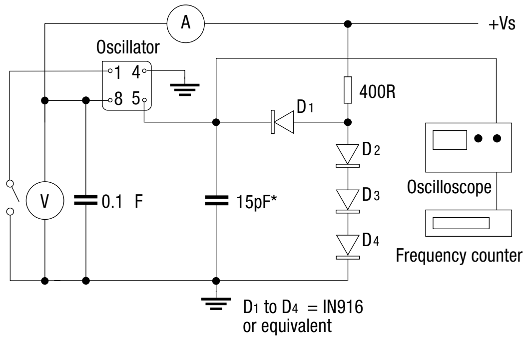
Test Circuit - HCMOS



*Inclusive of jigging & equipment capacitance

Note: Pin 1 = No connection on non tri-state models

Test Circuit - TTL



*Inclusive of jigging & equipment capacitance

Note: Pin 1 = No connection on non tri-state models

IQXO-149 Commercial Oscillator

ISSUE 12; 19 OCTOBER 1999

Delivery Options

- 3 day Express Manufacturing Service, subject to piece part stock availability.

Output Compatibility

- Tri-state HCMOS/TTL
- Drive Capability: 50pF or 10 TTL

Package Outline

- 14-pin DIL compatible resistance welded enclosure, hermetically sealed with glass to metal seals. Available over 0 to 70°C (IQXO-149) or –40 to 85°C (IQXO-149I)

Standard Frequency Stabilities

- 25ppm, 50ppm, 100ppm
  (over operating temperature range)

Frequency Tolerance at 25°C (Optional)

- 5ppm, 10ppm, 25ppm

Operating Temperature Range

- 0 to 70°C (IQXO-149)
- –40 to 85°C (IQXO-149I)

Storage Temperature Range

- –55 to 125°C

Environmental Specification

- Terminal Strength: 0.91kg max. Force perpendicular to top & bottom.
- Hermetic Seal: not to exceed 1×10^{-8} mBar litres of Helium leakage
- Solderability: MIL-STD-202E, Method 208C
- Vibration: 10 to 55Hz 0.76mm displacement, sweep 60 seconds, duration 2 hours.
- Rapid Change of Temperature over Operating Temperature Range: 10 cycles
- Shock: 981m/s^2 for 6ms, three shocks in each direction along the three mutually perpendicular planes

Tri-state Operation

- Logic ‘0’ to pin 1 disables oscillator output; when disabled the oscillator output goes to the high impedance state
- No connection or Logic ‘1’ to pin 1 enables oscillator output
- Maximum ‘pull-down’ resistance required to disable output = 20k
- Disable current 50 A typical

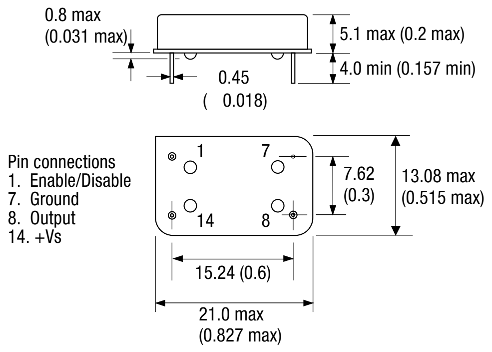
Marking

- Model number (+ Operating Temperature Code; if applicable)
- Frequency Stability Code
- Frequency Tolerance Code (Optional)
- Frequency
- Date code (Year/Week)

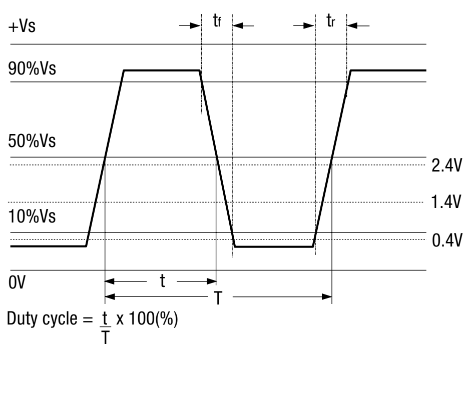
Minimum Order Information Required

- Frequency + Model Number + Operating Temperature Code (if applicable) + Frequency Stability

Outline in mm (inches)



Output Waveform - HCMOS/TTL



SPXOs

Electrical Specification – maximum limiting values when measured in HCMOS test circuit

Frequency Range	Frequency Stability	Supply Voltage	Supply Current	Rise Time (t_r)	Fall Time (t_f)	Duty Cycle	Model Number
500.0kHz to < 5.0MHz	±25ppm, ±50ppm, ±100ppm	5V±0.25V	20mA	15ns	15ns	45/55%	IQXO-149, -149I
5.0 to < 30.0MHz	±25ppm, ±50ppm, ±100ppm	5V±0.25V	30mA	10ns	10ns	45/55%	IQXO-149, -149I
30.0 to < 50.0MHz	±25ppm, ±50ppm, ±100ppm	5V±0.25V	40mA	8ns	8ns	45/55%	IQXO-149, -149I
50.0 to 80.0MHz	±25ppm, ±50ppm, ±100ppm	5V±0.25V	50mA	6ns	6ns	40/60%	IQXO-149, -149I

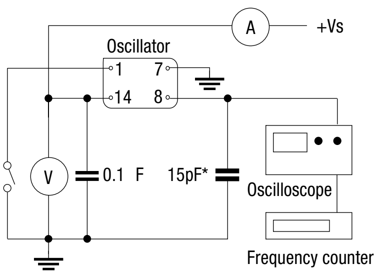
Ordering Example: 22.0MHz IQXO-149I B F

- Frequency
- Model No
- Operating Temperature Code: I = –40 to 85°C Not applicable for 0 to 70°C
- Frequency Stability: A = ±25ppm; B = ±50ppm; C = ±100ppm
- Frequency Tolerance @ 25°C: D = ±5ppm; E = ±10ppm; F = ±25ppm

Please note: Code combination A F is not available

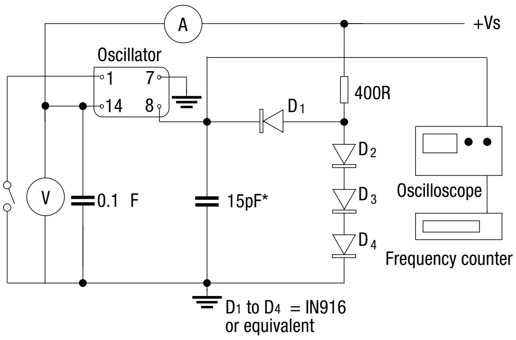
SPXOs

Test Circuit - HCMOS



*Inclusive of jigging & equipment capacitance

Test Circuit - TTL



*Inclusive of jigging & equipment capacitance

CFPS-300, -301, -302, -303 Commercial Oscillator

ISSUE 1; 28 MAY 1999

Delivery Options

- Please contact our sales office for current leadtimes

Output Compatibility

- HCMOS/TTL
- Drive Capability: 15pF or 10 TTL
- Non tri-state (CFPS-300, -302)
- Tri-state (CFPS-301, -303)

Package Outline

- 8-pin DIL compatible resistance welded enclosure, hermetically sealed with glass to metal seals. Available over 0 to 70°C (CFPS-300, -301, -302, -303) or –40 to 85°C (CFPS-300I, -301I, -302I, -303I)

Standard Frequency Stabilities

- 25ppm, 50ppm, 100ppm (over operating temperature range)

Frequency Tolerance at 25°C (Optional)

- 10ppm, 25ppm

Operating Temperature Range

- 0 to 70°C (CFPS-300, -301, -302, -303)
- –40 to 85°C (CFPS-300I, -301I, -302I, -303I)

Storage Temperature Range

- –65 to 150°C

Environmental Specification

- Terminal Strength: 0.91kg max. Force perpendicular to top & bottom.
- Hermetic Seal: not to exceed 1×10^{-8} mBar litres of Helium leakage
- Solderability: MIL-STD-202E, Method 208C
- Vibration: 10 to 55Hz 0.76mm displacement, sweep 60 seconds, duration 2 hours.
- Rapid Change of Temperature over Operating Temperature Range: 10 cycles
- Shock: 981m/s^2 for 6ms, three shocks in each direction along the three mutually perpendicular planes

Tri-state Operation (CFPS-301, -303)

- Logic ‘0’ to pin 1 disables oscillator output; when disabled the oscillator output goes to the high impedance state
- No connection or Logic ‘1’ to pin 1 enables oscillator output
- Maximum ‘pull-down’ resistance required to disable output = 20k
- Disable current 50 A typical

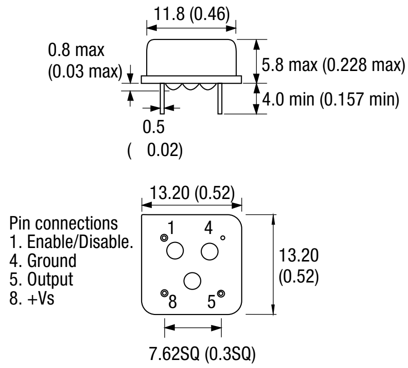
Marking

- Model number (+ Operating Temperature Code; if applicable)
- Frequency Stability Code
- Frequency Tolerance Code (Optional)
- Frequency
- Date code (Year/Week)

Minimum Order Information Required

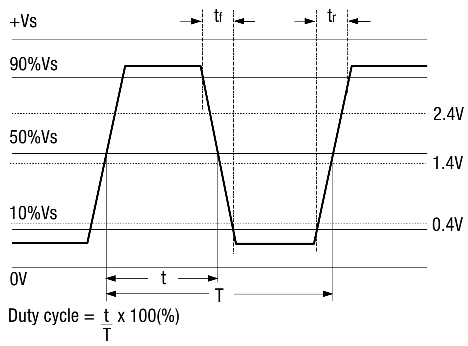
- Frequency + Model Number + Operating Temperature Code (if applicable) + Frequency Stability

Outline in mm (inches)



Note: Pin 1= No connnection on non tri-state models

Output Waveform - HCMOS/TTL



Electrical Specification – maximum limiting values when measured in HCMOS test circuit

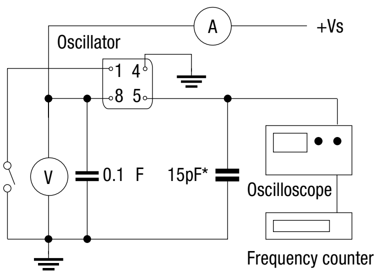
Frequency Range	Frequency Stability	Supply Voltage	Supply Current	Rise Time (t_r)	Fall Time (t_f)	Duty Cycle	Model Number
500.0kHz to 20.0MHz	±25ppm, ±50ppm, ±100ppm	3.0V±0.3V	10mA	10ns	10ns	40/60%	CFPS-300, -301
		3.3V±0.33V					CFPS-302, -303
> 20.0 to 25.0MHz	±25ppm, ±50ppm, ±100ppm	3.0V±0.3V	20mA	10ns	10ns	40/60%	CFPS-300, -301
		3.3V±0.33V					CFPS-302, -303
> 25.0 to 70.0MHz	±25ppm, ±50ppm, ±100ppm	3.0V±0.3V	20mA	6ns	6ns	40/60%	CFPS-300, -301
		3.3V±0.33V					CFPS-302, -303

Ordering Example 22.0MHz CFPS-302I B F

Frequency
Model No: -300, -302 = Non tri-state & -301, 303 = Tri-state
Operating Temperature Code: I = –40 to 85°C Not applicable for 0 to 70°C
Frequency Stability: A = ±25ppm; B = ±50ppm; C = ±100ppm
Frequency Tolerance @ 25°C: E = ±10ppm; F = ±25ppm

Please note: Code combination A F is not available

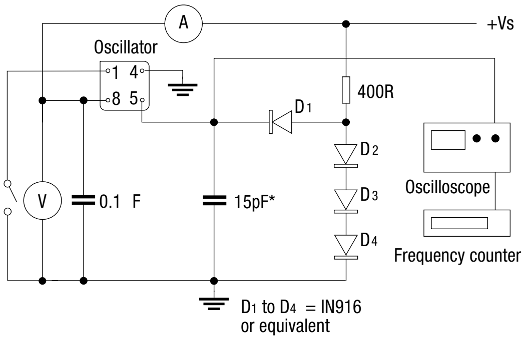
Test Circuit - HCMOS



*Inclusive of jigging & equipment capacitance

Note: Pin 1 = No connection on non tri-state models

Test Circuit - TTL



*Inclusive of jigging & equipment capacitance

Note: Pin 1 = No connection on non tri-state models

CFPS-304, -305, -306, -307 Commercial Oscillator

ISSUE 1; 28 MAY 1999

Delivery Options

- Please contact our sales office for current leadtimes

Output Compatibility

- HCMOS/TTL
- Drive Capability: 15pF or 10 TTL
- Non tri-state (CFPS-304, -306)
- Tri-state (CFPS-305, -307)

Package Outline

- 14-pin DIL compatible resistance welded enclosure, hermetically sealed with glass to metal seals. Available over 0 to 70°C (CFPS-304, -305, -306, -307) or –40 to 85°C (CFPS-304I, -305I, -306I, -307I)

Standard Frequency Stabilities

- 25ppm, 50ppm, 100ppm
  (over operating temperature range)

Frequency Tolerance at 25°C (Optional)

- 10ppm, 25ppm

Operating Temperature Range

- 0 to 70°C (CFPS-304, -305, -306, -307)
- –40 to 85°C (CFPS-304I, -305I, -306I, -307I)

Storage Temperature Range

- –65 to 150°C

Environmental Specification

- Terminal Strength: 0.91kg max. Force perpendicular to top & bottom.
- Hermetic Seal: not to exceed 1 × 10^{-8} mBar litres of Helium leakage
- Solderability: MIL-STD-202E, Method 208C
- Vibration: 10 to 55Hz 0.76mm displacement, sweep 60 seconds, duration 2 hours.
- Rapid Change of Temperature over Operating Temperature Range: 10 cycles
- Shock: 981m/s^2 for 6ms, three shocks in each direction along the three mutually perpendicular planes

Tri-state Operation (CFPS-305, -307)

- Logic ‘0’ to pin 1 disables oscillator output; when disabled the oscillator output goes to the high impedance state
- No connection or Logic ‘1’ to pin 1 enables oscillator output
- Maximum ‘pull-down’ resistance required to disable output = 20k
- Disable current 50 A typical

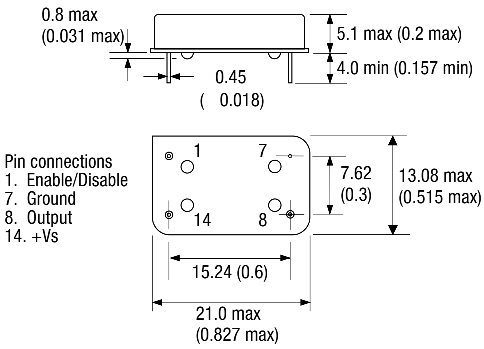
Marking

- Model number (+ Operating Temperature Code; if applicable)
- Frequency Stability Code
- Frequency Tolerance Code (Optional)
- Frequency
- Date code (Year/Week)

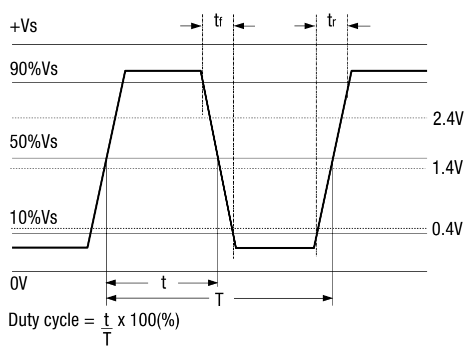
Minimum Order Information Required

- Frequency + Model Number + Operating Temperature Code (if applicable) + Frequency Stability

Outline in mm (inches)



Output Waveform - HCMOS/TTL



Electrical Specification – maximum limiting values when measured in HCMOS test circuit

Frequency Range	Frequency Stability	Supply Voltage	Supply Current	Rise Time (t_r)	Fall Time (t_f)	Duty Cycle	Model Number
500.0kHz to 20.0MHz	±25ppm, ±50ppm, ±100ppm	3.0V±0.3V	10mA	10ns	10ns	40/60%	CFPS-304, -305
		3.3V±0.33V					CFPS-306, -307
> 20.0 to 25.0MHz	±25ppm, ±50ppm, ±100ppm	3.0V±0.3V	20mA	10ns	10ns	40/60%	CFPS-304, -305
		3.3V±0.33V					CFPS-306, -307
> 25.0 to 70.0MHz	±25ppm, ±50ppm, ±100ppm	3.0V±0.3V	20mA	6ns	6ns	40/60%	CFPS-304, -305
		3.3V±0.33V					CFPS-306, -307

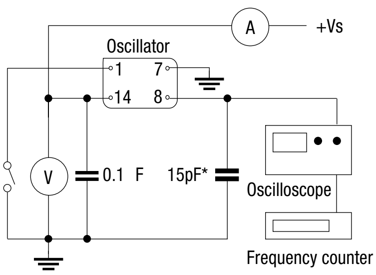
Ordering Example: 22.0MHz CFPS-306I B F

Frequency
Model No: -304, -306 = Non tri-state & -305, 307 = Tri-state
Operating Temperature Code: I = –40 to 85°C Not applicable for 0 to 70°C
Frequency Stability: A = ±25ppm; B = ±50ppm; C = ±100ppm
Frequency Tolerance @ 25°C: E = ±10ppm; F = ±25ppm

Please note: Code combination A F is not available

SPXOs

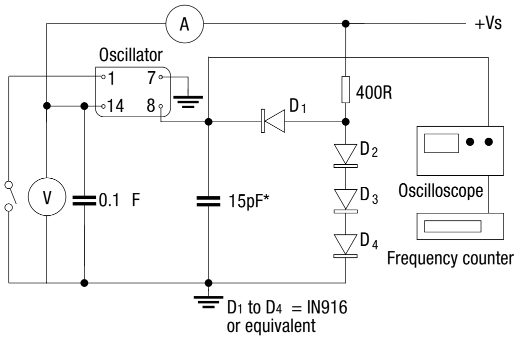
Test Circuit - HCMOS



*Inclusive of jigging & equipment capacitance

Note: Pin 1= No connnection on non tri-state models

Test Circuit - TTL



*Inclusive of jigging & equipment capacitance

Note: Pin 1= No connnection on non tri-state models

IQXO-331, -336 Commercial Oscillator

ISSUE 4; 24 JUNE 1998

Recommended For New Designs

Delivery Options

- Please contact our sales office for current leadtimes

Output Compatibility

- ACMOS/TTL
- Drive Capability: 50pF (70.0 to 110.0MHz)
  15pF (>110.0 to 150.0MHz)
  10 TTL
- Tri-state (IQXO-331, -331I)
- Non tri-state (IQXO-336, -336I)

Package Outline

- 14-pin DIL compatible resistance welded enclosure, hermetically sealed with glass to metal seals. Available over 0 to 70°C (IQXO-331, -336) or –40 to 85°C (IQXO-331I, -336I)

SPXOs

Standard Frequency Stabilities

- 25ppm, 50ppm, 100ppm
  (over operating temperature range)

Frequency Tolerance at 25°C (Optional)

- 5ppm, 10ppm, 25ppm

Operating Temperature Range

- 0 to 70°C (IQXO-331, -336)
- –40 to 85°C (IQXO-331I, -336I)

Storage Temperature Range

- –55 to 125°C

Environmental Specification

- Terminal Strength: 0.91kg max. Force perpendicular to top & bottom.
- Hermetic Seal: not to exceed 1×10^{-8} mBar litres of Helium leakage
- Solderability: MIL-STD-202E, Method 208C
- Vibration: 10 to 55Hz 0.76mm displacement, sweep 60 seconds, duration 2 hours.
- Rapid Change of Temperature over Operating Temperature Range: 10 cycles
- Shock: 981m/s^2 for 6ms, three shocks in each direction along the three mutually perpendicular planes

Tri-state Operation (IQXO-331, -331I)

- Logic ‘0’ to pin 1 disables oscillator output; when disabled the oscillator output goes to the high impedance state
- No connection or Logic ‘1’ to pin 1 enables oscillator output
- Maximum ‘pull-down’ resistance required to disable output = 20k

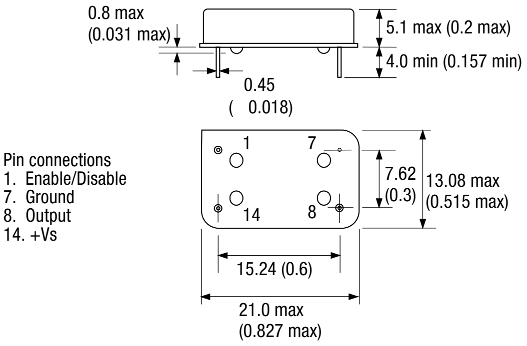
Marking

- Model number (+ Operating Temperature Code; if applicable)
- Frequency Stability Code
- Frequency Tolerance Code (Optional)
- Frequency
- Date code (Year/Week)

Minimum Order Information Required

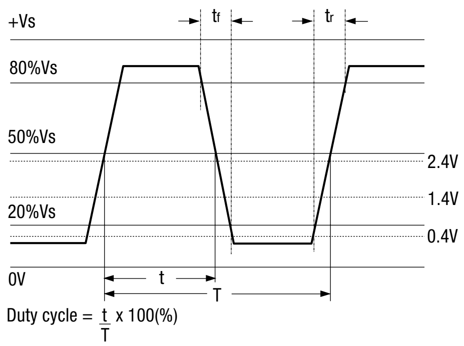
- Frequency + Model Number + Operating Temperature Code (if applicable) + Frequency Stability

Outline in mm (inches)



Note: Pin 1 = No connection on non tri-state models

Output Waveform - ACMOS/TTL



Electrical Specification – maximum limiting values when measured in ACMOS test circuit

Frequency Range	Frequency Stability	Supply Voltage	Supply Current	Rise Time (t_r)	Fall Time (t_f)	Duty Cycle	Model Number
70.0 to < 90.0MHz	±25ppm, ±50ppm, ±100ppm	5V±0.25V	45mA	3ns	3ns	40/60%	IQXO-331, -331I, -336, -336I
90.0 to < 115.0MHz	±25ppm, ±50ppm, ±100ppm	5V±0.25V	60mA	3ns	3ns	40/60%	IQXO-331, -331I, -336, -336I
115.0 to 150.0MHz	±25ppm, ±50ppm, ±100ppm	5V±0.25V	65mA	3ns	3ns	40/60%	IQXO-331, -331I, -336, -336I

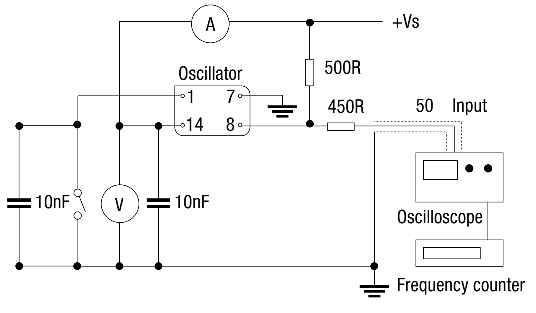
Ordering Example 75.0MHz IQXO-331I B F

Frequency
Model No: -331, -331I = Tri-state -336, -336I = Non tri-state
Operating Temperature Code: I = –40 to 85°C Not applicable for 0 to 70°C
Frequency Stability: A = ±25ppm; B = ±50ppm; C = ±100ppm
Frequency Tolerance @ 25°C: D = ±5ppm; E = ±10ppm; F = ±25ppm

Please note: Code combination A F is not available

SPXOs

Test Circuit - ACMOS



Note: Pin 1 = No connection on non tri-state models

IQXO-350 Commercial Oscillator

ISSUE 16; 19 OCTOBER 1999

Delivery Options

- Common frequencies are available from stock. Please see p34 for details
- 3 day Express Manufacturing Service, subject to piece part stock availability.

Output Compatibility

- HCMOS/TTL
- Drive Capability: 50pF or 10 TTL (1.0 to < 100.0kHz 15pF or 10 LS TTL only)

Package Outline

- 14-pin DIL compatible resistance welded enclosure, hermetically sealed with glass to metal seals. Available over 0 to 70°C (IQXO-350) or –40 to 85°C (IQXO-350I)

Standard Frequency Stabilities

- 25ppm, 50ppm, 100ppm (over operating temperature range)

Frequency Tolerance at 25°C (Optional)

- 5ppm, 10ppm, 25ppm

Operating Temperature Range

- 0 to 70°C (IQXO-350)
- –40 to 85°C (IQXO-350I)

Storage Temperature Range

- –55 to 125°C

Environmental Specification

- Terminal Strength: 0.91kg max. Force perpendicular to top & bottom.
- Hermetic Seal: not to exceed 1×10^{-8} mBar litres of Helium leakage
- Solderability: MIL-STD-202E, Method 208C
- Vibration: 10 to 55Hz 0.76mm displacement, sweep 60 seconds, duration 2 hours.
- Rapid Change of Temperature over Operating Temperature Range: 10 cycles
- Shock: 981m/s^2 for 6ms, three shocks in each direction along the three mutually perpendicular planes

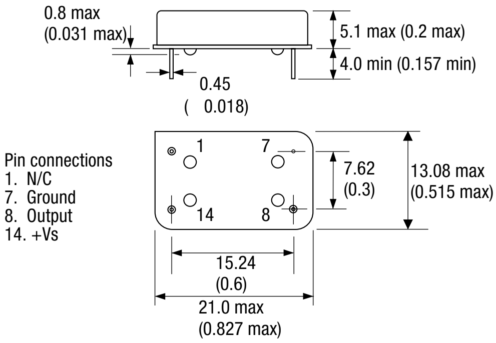
Marking

- Model number (+ Operating Temperature Code; if applicable)
- Frequency Stability Code
- Frequency Tolerance Code (Optional)
- Frequency
- Date code (Year/Week)

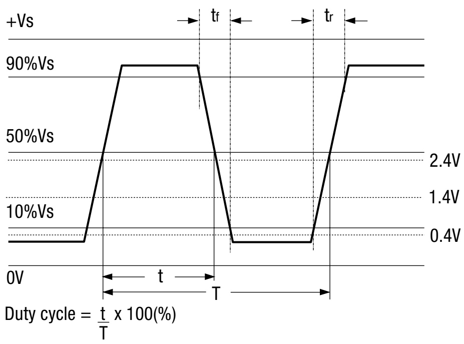
Minimum Order Information Required

- Frequency + Model Number + Operating Temperature Code (if applicable) + Frequency Stability

Outline in mm (inches)



Output Waveform - HCMOS/TTL/LS TTL



SPXOs

Electrical Specification – maximum limiting values when measured in HCMOS test circuit

Frequency Range	Frequency Stability	Supply Voltage	Supply Current	*Rise Time (t_r)	*Fall Time (t_f)	**Duty Cycle	Model Number
1.0 to < 100.0kHz	±25ppm, ±50ppm, ±100ppm	5V±0.25V	10mA	10ns	10ns	45/55%	IQXO-350, -350I
100.0 to < 250.0kHz	±25ppm, ±50ppm, ±100ppm	5V±0.25V	10mA	15ns	15ns	45/55%	IQXO-350, -350I
250.0kHz to < 5.0MHz	±25ppm, ±50ppm, ±100ppm	5V±0.25V	30mA	15ns	15ns	45/55%	IQXO-350, -350I
5.0 to < 16.0MHz	±25ppm, ±50ppm, ±100ppm	5V±0.25V	15mA	10ns	10ns	45/55%	IQXO-350, -350I
16.0 to < 30.0MHz	±25ppm, ±50ppm, ±100ppm	5V±0.25V	30mA	10ns	10ns	45/55%	IQXO-350, -350I
30.0 to < 50.0MHz	±25ppm, ±50ppm, ±100ppm	5V±0.25V	40mA	8ns	8ns	45/55%	IQXO-350, -350I
50.0 to 80.0MHz	±25ppm, ±50ppm, ±100ppm	5V±0.25V	50mA	6ns	6ns	40/60%	IQXO-350, -350I

Ordering Example: 22.0MHz IQXO-350I B F

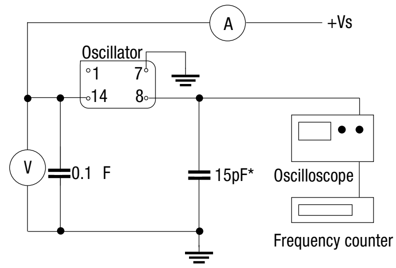
- Frequency
- Model No
- Operating Temperature Code: I = –40 to 85°C Not applicable for 0 to 70°C
- Frequency Stability: A = ±25ppm; B = ±50ppm; C = ±100ppm
- Frequency Tolerance @ 25°C: D = ±5ppm; E = ±10ppm; F = ±25ppm

Please note: Code combination A F is not available

* Rise & Fall times will be 6ns max in TTL cct.
** Duty Cycle will be 40/60% in TTL cct for 5.0MHz

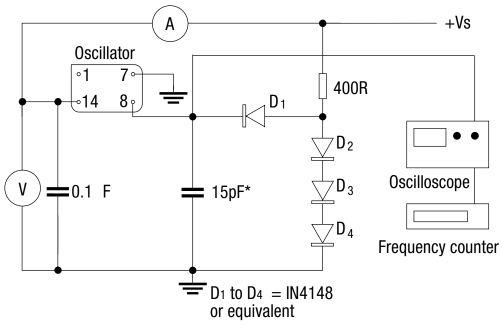
SPXOs

Test Circuit - HCMOS



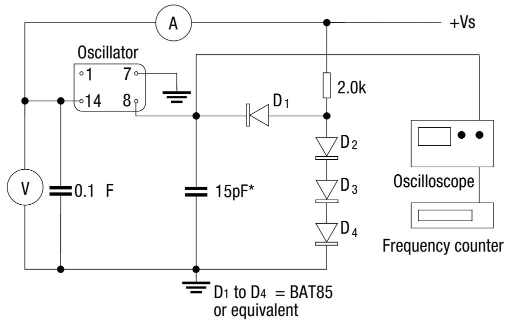
*Inclusive of jigging & equipment capacitance

Test Circuit - TTL



*Inclusive of jigging & equipment capacitance

Test Circuit - LS TTL



*Inclusive of jigging & equipment capacitance

IQXO-415 Professional Oscillator

ISSUE 4; 30 JUNE 1998

Delivery Options

- Please contact our sales office for current leadtimes

Output Compatibility

- Tri-state HCMOS/TTL
- Drive Capability: 50pF or 10 TTL

Package Outline

- 14-pin DIL compatible resistance welded enclosure, hermetically sealed with glass to metal seals. Available over 0 to 70°C (IQXO-415) or –40 to 85°C (IQXO-415I)

Frequency Tolerance @ 25°C

- ±5ppm or ±10ppm

Frequency Stability Inclusive Of :-

- Frequency Tolerance (as above)
- Voltage Variation: ±0.5ppm
- Load Variation: ±0.5ppm (< 60.0MHz)
- Load Variation: ±1.0ppm (60.0MHz)
- Ageing for 5 years: ±5ppm

Operating Temperature Range

- 0 to 70°C (IQXO-415)
- –40 to 85°C (IQXO-415I)

Storage Temperature Range

- –55 to 125°C

Environmental Specification

- Acceleration: 490m/s^2 for 1 minute in the ‘Y_1’ plane
- Bump: 4000 bumps at 390m/s^2 in each of the three mutually perpendicular planes
- Hermetic Seal: not to exceed 1×10^{-8} mBar litres of Helium leakage
- Humidity: steady state: in accordance with test Ca of IEC 68-2-3, for 56 days at 40°C at a relative humidity of 93%, cyclic: in accordance with test Db variant 1 of IEC 68-2-30, at severity b), 55 deg.C for six cycles
- Shock: 981m/s^2 for 6ms, three shocks in each direction along the three mutually perpendicular planes
- Solderability: BS2011 test TA
- Thermal Shock: 10 cycles from –55 to 125°C
- Vibration: 10 to 60Hz 0.75mm displacement, 60 to 2000Hz 98.1m/s^2 acceleration, 30 minutes in each of three mutually perpendicular planes

Tri-state Operation

- Logic ‘0’ to pin 1 disables oscillator output; when disabled the oscillator output goes to the high impedance state
- No connection or Logic ‘1’ to pin 1 enables oscillator output
- Disable current 50 A typical

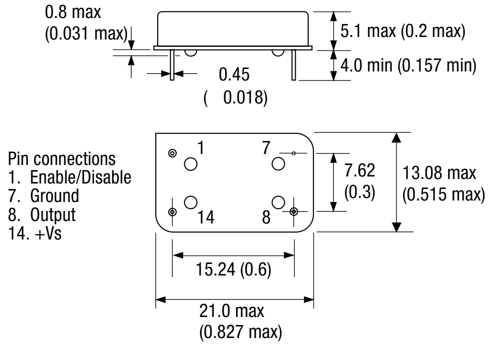
Marking

- Model number
- Frequency Stability Code
- Frequency Tolerance Code (Optional)
- Frequency
- Date code (Year/Week)

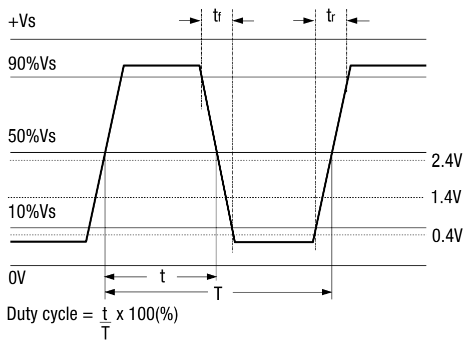
Minimum Order Information Required

- Frequency + Model Number + Operating Temperature Code (if applicable) + Frequency Stability

Outline in mm (inches)



Output Waveform - HCMOS/TTL



SPXOs

SPXOs

Electrical Specification – maximum limiting values when measured in HCMOS test circuit

Frequency Range	Overall Frequency Stability	Supply Voltage	Supply Current	Rise Time (t_r)	Fall Time (t_f)	Duty Cycle	Model Number
250.0kHz to < 8.0MHz	±15ppm, ±25ppm, ±50ppm	5V±0.5V	5mA	10ns	10ns	45/55%	IQXO-415, -415I
8.0 to < 23.0MHz	±15ppm, ±25ppm, ±50ppm	5V±0.5V	10mA	5ns	5ns	45/55%	IQXO-415, -415I
23.0 to 80.0MHz	±15ppm, ±25ppm, ±50ppm	5V±0.5V	65mA	3ns	3ns	45/55%	IQXO-415, -415I

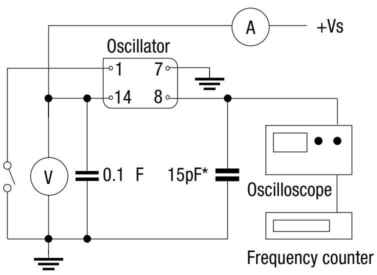
Please note that variations to the above specification are considered upon request; please contact our sales office.

Ordering Example 22.0MHz IQXO-415I B E

Frequency
Model No
Operating Temperature Code: I = –40 to 85°C Not applicable for 0 to 70°C
Frequency Stability: A = ±25ppm; B = ±50ppm; N = ±15ppm (Only available for 0 to 70°C)
Frequency Tolerance @ 25°C: D = ±5ppm; E = ±10ppm

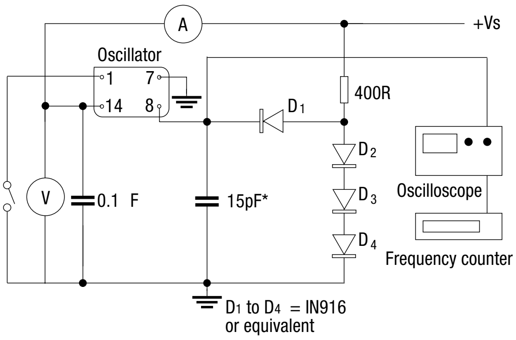
Please note: Code combination N E is not available

Test Circuit - HCMOS



*Inclusive of jigging & equipment capacitance

Test Circuit - TTL



*Inclusive of jigging & equipment capacitance

IQXO-35, -36 Industrial Oscillator

ISSUE 5; 19 OCTOBER 1999

Delivery Options

- 3 day Express Manufacturing Service, subject to piece part stock availability.

Output Compatibility

- HCMOS/TTL
- Drive Capability: 50pF or 10 TTL
- Non tri-state (IQXO-35)
- Tri-state (IQXO-36)

Package Outline

- 8-pin DIL compatible resistance welded enclosure, hermetically sealed with glass to metal seals and high environmental performance.

SPXOs

Standard Frequency Stabilities

- 25ppm, 50ppm, 100ppm
  (over the operating temperature range)

Frequency Tolerance at 25°C (Optional)

- 5ppm, 10ppm, 25ppm

Operating Temperature Range

- –40 to 85°C

Storage Temperature Range

- –55 to 125°C

Environmental Specification

- Acceleration: 490m/s^2 for 1 minute in the ‘Y_1’ plane
- Bump: 4000 bumps at 390m/s^2 in each of the three mutually perpendicular planes
- Hermetic Seal: not to exceed 1×10^{-8} mBar litres of Helium leakage
- Humidity: steady state: in accordance with test Ca of IEC 68-2-3, for 56 days at 40°C at a relative humidity of 93%, cyclic: in accordance with test Db variant 1 of IEC 68-2-30, at severity b), 55 deg.C for six cycles
- Shock: 981m/s^2 for 6ms, three shocks in each direction along the three mutually perpendicular planes
- Solderability: BS2011 test TA
- Rapid Change of Temperature over Operating Temperature Range: 10 cycles
- Vibration: 10 to 60Hz 0.75mm displacement, 60 to 2000Hz 98.1m/s^2 acceleration, 30 minutes in each of three mutually perpendicular planes

Tri-state Operation (IQXO-36)

- Logic ‘0’ to pin 1 disables oscillator output; when disabled the oscillator output goes to the high impedance state
- No connection or Logic ‘1’ to pin 1 enables oscillator output
- Maximum ‘pull-down’ resistance required to disable output = 20k
- Disable current 50 A typical

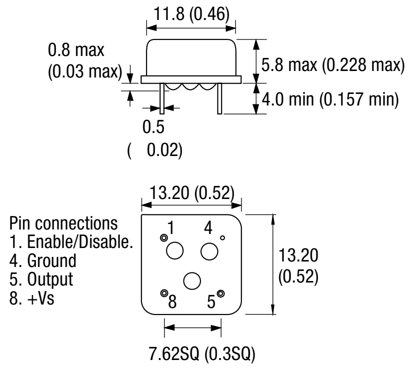
Marking

- Model number
- Frequency Stability Code
- Frequency Tolerance Code (Optional)
- Frequency
- Date code (Year/Week)

Minimum Order Information Required

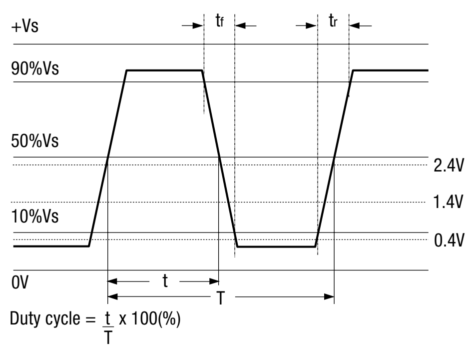
- Frequency + Model Number + Frequency Stability

Outline in mm (inches)



Note: Pin 1= No connnection on non tri-state models

Output Waveform - HCMOS/TTL



Electrical Specification – maximum limiting values when measured in HCMOS test circuit

Frequency Range	Frequency Stability	Supply Voltage	Supply Current	Rise Time (t_r)	Fall Time (t_f)	Duty Cycle	Model Number
500.0kHz to < 5.0MHz	±25ppm, ±50ppm, ±100ppm	5V±0.25V	20mA	15ns	15ns	45/55%	IQXO-35, -36
5.0 to < 16.0MHz	±25ppm, ±50ppm, ±100ppm	5V±0.25V	20mA	10ns	10ns	45/55%	IQXO-35, -36
16.0 to < 30.0MHz	±25ppm, ±50ppm, ±100ppm	5V±0.25V	30mA	10ns	10ns	45/55%	IQXO-35, -36
30.0 to < 50.0MHz	±25ppm, ±50ppm, ±100ppm	5V±0.25V	40mA	8ns	8ns	45/55%	IQXO-35, -36
50.0 to 70.0MHz	±25ppm, ±50ppm, ±100ppm	5V±0.25V	50mA	6ns	6ns	40/60%	IQXO-35, -36

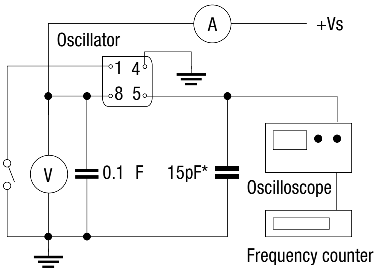
Ordering Example 22.0MHz IQXO-35 B F

Frequency
Model No: -35 = Non tri-state, -36 = Tri-state
Frequency Stability: A = ±25ppm; B = ±50ppm; C = ±100ppm
Frequency Tolerance @ 25°C: D = ±5ppm; E = ±10ppm; F = ±25ppm

Please note: Code combination A F is not available

SPXOs

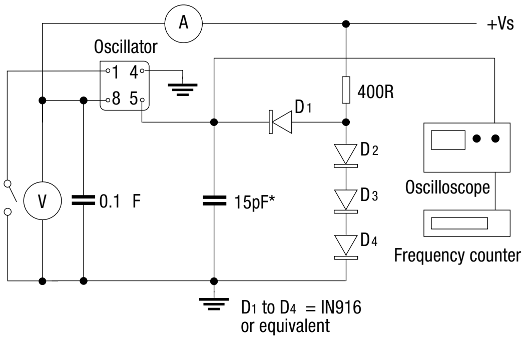
Test Circuit - HCMOS



*Inclusive of jigging & equipment capacitance

Note: Pin 1 = No connection on non tri-state models

Test Circuit - TTL



*Inclusive of jigging & equipment capacitance

Note: Pin 1 = No connection on non tri-state models

IQXO-365, -366 Industrial Oscillator

ISSUE 6; 19 OCTOBER 1999

SPXOs

Delivery Options

- 3 day Express Manufacturing Service, subject to piece part stock availability.

Output Compatibility

- HCMOS/TTL
- Drive Capability: 50pF or 10 TTL
- Non tri-state (IQXO-365)
- Tri-state (IQXO-366)

Package Outline

- 14-pin DIL compatible resistance welded enclosure, hermetically sealed with glass to metal seals and high environmental performance.

Standard Frequency Stabilities

- 25ppm, 50ppm, 100ppm
  (over the operating temperature range)

Frequency Tolerance at 25°C (Optional)

- 5ppm, 10ppm, 25ppm

Operating Temperature Range

- –40 to 85°C

Storage Temperature Range

- –55 to 125°C

Environmental Specification

- Acceleration: 490m/s^2 for 1 minute in the ‘Y_1’ plane
- Bump: 4000 bumps at 390m/s^2 in each of the three mutually perpendicular planes
- Hermetic Seal: not to exceed 1×10^{-8} mBar litres of Helium leakage
- Humidity: steady state: in accordance with test Ca of IEC 68-2-3, for 56 days at 40°C at a relative humidity of 93%, cyclic: in accordance with test Db variant 1 of IEC 68-2-30, at severity b), 55 deg.C for six cycles
- Shock: 981m/s^2 for 6ms, three shocks in each direction along the three mutually perpendicular planes
- Solderability: BS2011 test TA
- Rapid Change of Temperature over Operating Temperature Range: 10 cycles
- Vibration: 10 to 60Hz 0.75mm displacement, 60 to 2000Hz 98.1m/s^2 acceleration, 30 minutes in each of three mutually perpendicular planes

Tri-state Operation (IQXO-366)

- Logic ‘0’ to pin 1 disables oscillator output; when disabled the oscillator output goes to the high impedance state
- No connection or Logic ‘1’ to pin 1 enables oscillator output
- Maximum ‘pull-down’ resistance required to disable output = 20k
- Disable current 50 A typical

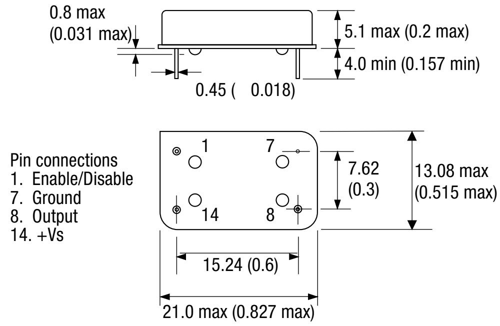
Marking

- Model number
- Frequency Stability Code
- Frequency Tolerance Code (Optional)
- Frequency
- Date code (Year/Week)

Minimum Order Information Required

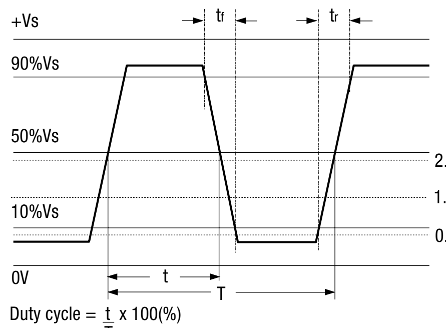
- Frequency + Model Number + Frequency Stability

Outline in mm (inches)



Note: Pin 1 = No connection on non tri-state models

Output Waveform - HCMOS/TTL



Duty cycle = $\frac{t}{T}$ x 100(%)

Electrical Specification – maximum limiting values when measured in HCMOS test circuit

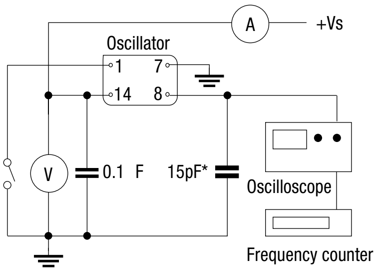
Frequency Range	Frequency Stability	Supply Voltage	Supply Current	Rise Time (t_r)	Fall Time (t_f)	Duty Cycle	Model Number
500.0kHz to < 5.0MHz	±25ppm, ±50ppm, ±100ppm	5V±0.25V	20mA	15ns	15ns	45/55%	IQXO-365, -366
5.0 to < 16.0MHz	±25ppm, ±50ppm, ±100ppm	5V±0.25V	20mA	10ns	10ns	45/55%	IQXO-365, -366
16.0 to < 30.0MHz	±25ppm, ±50ppm, ±100ppm	5V±0.25V	30mA	10ns	10ns	45/55%	IQXO-365, -366
30.0 to < 50.0MHz	±25ppm, ±50ppm, ±100ppm	5V±0.25V	40mA	8ns	8ns	45/55%	IQXO-365, -366
50.0 to 70.0MHz	±25ppm, ±50ppm, ±100ppm	5V±0.25V	50mA	6ns	6ns	40/60%	IQXO-365, -366

Ordering Example 22.0MHz IQXO-365 B F

Frequency
Model No: -365 = Non tri-state, -366 = Tri-state
Frequency Stability: A = ±25ppm; B = ±50ppm; C = ±100ppm
Frequency Tolerance @ 25°C: D = ±5ppm; E = ±10ppm; F = ±25ppm

Please note: Code combination A F is not available

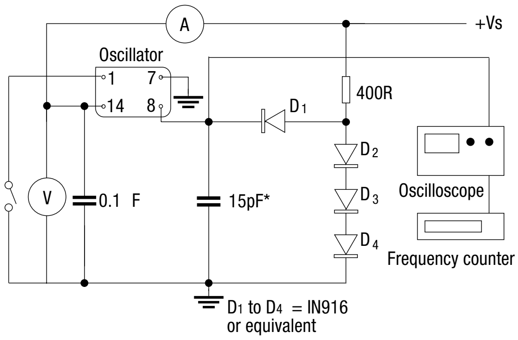
Test Circuit - HCMOS



*Inclusive of jigging & equipment capacitance

Note: Pin 1= No connection on non tri-state models

Test Circuit - TTL



*Inclusive of jigging & equipment capacitance
Note: Pin 1= No connection on non tri-state models

MILITARY OSCILLATOR CAPABILITY

ISSUE 2; 23 JUNE 1999

For customers preferring full BS release, C-MAC Frequency Products are able to offer the following:

QC6107 series of DIL oscillator (released to BS9625 F0014)

- Frequency Range: 1.50kHz to 32.0MHz (HCMOS)
- Package Styles: Full DIL (4 pins), Full DIL (14 pins)
- Stabilities: down to 25ppm
- Operating Temperature Ranges: –40 to 85°C or –55 to 125°C

QC6108 series of DIL oscillator (released to BS9625 F0014)

- Frequency Range: 375.0kHz to 32.0MHz (TTL)
- Package Styles: Full DIL (4 pins), Full DIL (14 pins)
- Stabilities: down to 25ppm
- Operating Temperature Ranges: –40 to 85°C or –55 to 125°C

QC6115 series of tri-stateable high drive DIL oscillator (released to BS 9265 F0018)

- Frequency Range: 5.0 to 25.0MHz
- Package Style: Full DIL (4 pins)
- Stabilities: down to ±25ppm
- Operating Temperature Ranges: –40 to 85°C or –55 to 125°C
- Output enable at Pin 1: Logic 1 or Logic 0
- Drive Capability: 150pF

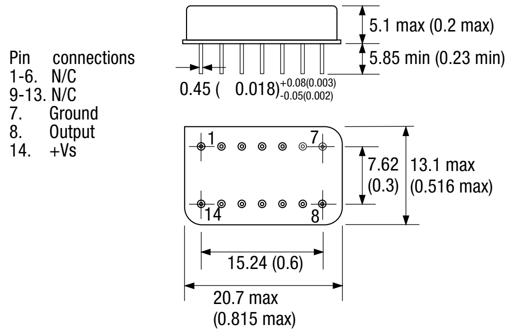
QC6111 series of 40 pin leadless chip carrier (LCC) oscillator (released to BS9625 F0016)

- Frequency Range: 375.0kHz to 30.0MHz (HCMOS)
- Package Style: 40 pin leadless chip carrier oscillator (LCC)
- Stabilities: down to 35ppm
- Operating Temperature Ranges: of –40 to 85°C or –55 to 125°C

QC6112 series of 40 pin leadless chip carrier (LCC) oscillator (released to BS9625 F0016)

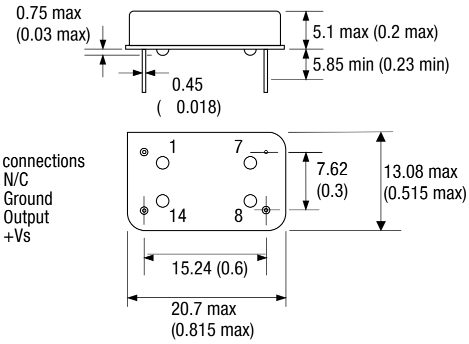
- Frequency Range: 375.0kHz to 30.0MHz (TTL)
- Package Style: 40 pin leadless chip carrier oscillator (LCC)
- Stabilities: down to 35ppm
- Operating Temperature Ranges: of –40 to 85°C or –55 to 125°C

Outline in mm (inches) - QC6107/2 & QC6108/2



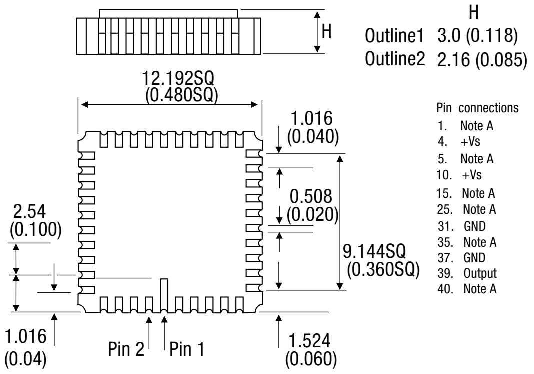
Note: 14 Pin package has no insulating stand-off.

Outline in mm (inches) - QC6107/1, QC6108/1 & QC6115



*Pin 1 is the enable/disable pin for the QC6115 series

Outline in mm (inches) - QC6111 & QC6112



A - Internally connected. No external electrical connections permissable
B - All other pins may have external electrical connections

Customer Military SPXO Requirements Fax Form - Please copy form, fill out using BLOCK CAPITALS and fax to C-MAC on +44 (0)1460 72578				
x = Minimum Specification Information Required for Military SPXO pricing				
Frequency		x		MHz
QC Reference				
Part 70 release?				Yes/No
Please note - if QC Reference or Part 70 release is given - all other information below will not be required				
Output Waveform				TTL/CMOS/Sine
Output Level/Load		x		TTL/CMOS/Sine
Rise/Fall Time				ns
Duty Cycle				%
Supply Voltage		x		Vdc
Output Current				mA
Frequency Tolerance @ 25°C				ppm
Operating Temperature Range		x		°C
Frequency Stability	vs. Input Voltage Change			ppm
	vs. load Change			ppm
	vs. Operating Temperature	x		ppm
Screening required?				Yes/No
Ageing				per year
Tri-state Option				Yes/No
Package	Outline	x		
	Connections	x		
	Marking			
Additional Notes				
Name				
Job Title				
Company Name				
Address				
Postcode				
Telephone			E-mail	
Fax			http://	

SPXOs

IQXO-85, -86, -87, -88 Military Oscillator

ISSUE 5; 8 JULY 1999

SPXOs

Delivery Options

- Please contact our sales office for current leadtimes

Output Compatibility

- HCMOS/TTL
- Drive Capability: 50pF or 10 TTL
- Non tri-state (IQXO-85, -86)
- Tri-state (IQXO-87, -88)

Package Outline

- 8-pin DIL compatible resistance welded enclosure, hermetically sealed with glass to metal seals and gold plated pins and bases. Available non-screened (IQXO-85, -87) and fully screened (IQXO-86, -88).

Standard Frequency Stabilities

- ±50ppm, ±100ppm
  (inclusive of supply voltage variations over the operating temperature range)

Frequency Tolerance at 25°C (Optional)

- 10ppm, 25ppm

Operating Temperature Range

- –55 to 125°C

Storage Temperature Range

- –55 to 125°C

Screening On Each Device (IQXO-86, -88)

- Acceleration: 49000m/s^2 for 1 minute in the ‘Y_1’ plane
- High Temperature Storage: 24hrs at 150°C
- Rapid Change of Temperature: –55 to 125°C, 10 cycles
- Dynamic burn-in for 168hrs at 125°C
- Check all parameters & assess

Environmental Specification

- Bump: 4000 bumps at 391m/s^2 in each of the three mutually perpendicular planes
- Hermetic Seal: not to exceed 1×10^{-8} mBar litres of helium
- Humidity: steady state: in accordance with test Ca of IEC 68-2-3, for 56 days at 40°C at a relative humidity of 93%, cyclic: in accordance with test Db variant 1 of IEC 68-2-30, at severity b), 55 deg.C for six cycles
- Shock: 981m/s^2 for 6ms, three shocks in each direction along the three mutually perpendicular planes
- Solderability: BS2011 test TA
- Vibration: 10 to 60Hz 0.75mm displacement, 60 to 2000Hz 98.1m/s^2 acceleration, 30 minutes in each of three mutually perpendicular planes.

Tri-state Operation (IQXO-87, -88)

- Logic ‘0’ to pin 1 disables oscillator output; when disabled the oscillator output goes to the high impedance state
- No connection or Logic ‘1’ to pin 1 enables oscillator output
- Disable current 50 A typical

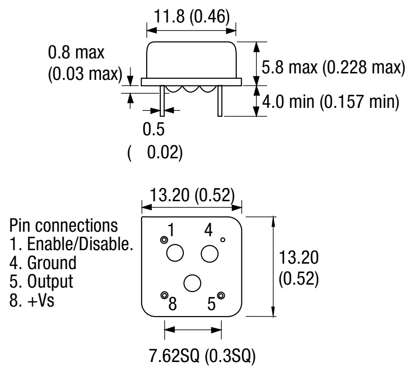
Marking

- Model number
- Frequency Stability Code
- Frequency Tolerance Code (Optional)
- Frequency
- Date code (Year/Week)

Minimum Order Information Required

- Frequency + Model Number + Frequency Stability

Outline in mm (inches)



Note: Pin 1= No connnection on non tri-state models

Electrical Specification – maximum limiting values measured in HCMOS test circuit

Frequency Range	Frequency Stability	Supply Voltage	Supply Current	Rise Time (t_r)	Fall Time (t_f)	Duty Cycle	Model Number
250.0kHz to < 8.0MHz	±50ppm ±100ppm	5V±0.5V	5mA	10ns	10ns	45/55%	IQXO-85, -86, -87, -88
8.0 to < 23.0MHz	±50ppm ±100ppm	5V±0.5V	10mA	5ns	5ns	40/60%	IQXO-85, -86, -87, -88
23.0 to < 48.0MHz	±50ppm ±100ppm	5V±0.5V	50mA	5ns	5ns	40/60%	IQXO-85, -86, -87, -88
48.0 to 72.0MHz	±50ppm ±100ppm	5V±0.5V	65mA	3ns	3ns	40/60%	IQXO-85, -86, -87, -88

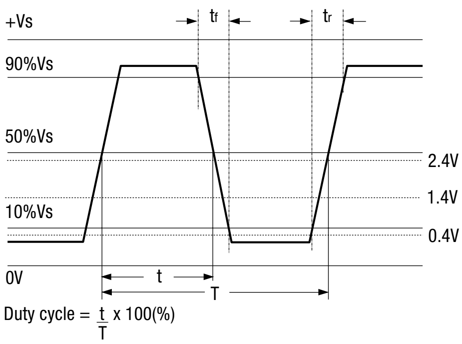
Ordering Example: 50.0MHz IQXO-85 B E

- Frequency — 50.0MHz
- Model No: -85, -86, = Non tri-state, -87, -88 = Tri-state — IQXO-85
- Frequency Stability: B = ±50ppm; C = ±100ppm — B
- Frequency Tolerance @ 25°C: E = ±10ppm; F = ±25ppm — E

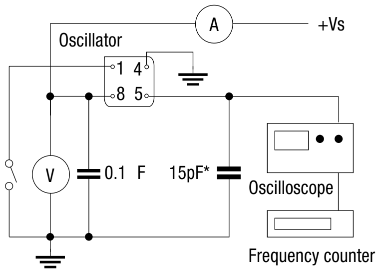
Please note: Code combination B F is not available

SPXOs

Output Waveform - HCMOS/TTL



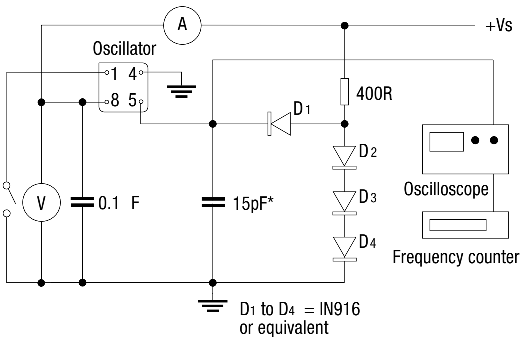
Test Circuit - HCMOS



*Inclusive of jigging & equipment capacitance

Note: Pin 1=No connection on non tri-state models

Test Circuit - TTL



*Inclusive of jigging & equipment capacitance

Note: Pin 1= No connection on non tri-state models

IQXO-625, -626, -627, -628 Military Oscillator

ISSUE 4; 8 JULY 1999

Delivery Options

- Please contact our sales office for current leadtimes

Output Compatibility

- HCMOS/TTL
- Drive Capability: 50pF or 10 TTL
- Non tri-state (IQXO-625, -626)
- Tri-state (IQXO-627, -628)

Package Outline

- 14-pin DIL compatible resistance welded enclosure, hermetically sealed with glass to metal seals and gold plated pins and bases. Available non-screened (IQXO-625, -627) and fully screened (IQXO-626, -628).

SPXOs

Standard Frequency Stabilities

- ±50ppm, ±100ppm
  (inclusive of supply voltage variations over the operating temperature range)

Frequency Tolerance at 25°C (Optional)

- 10ppm, 25ppm

Operating Temperature Range

- –55 to 125°C

Storage Temperature Range

- –55 to 125°C

Screening On Each Device (IQXO-626,- 628)

- Acceleration: 49000m/s^2 for 1 minute in the ‘Y_1’ plane
- High Temperature Storage: 24hrs at 150°C
- Rapid Change of Temperature: –55 to 125°C, 10 cycles
- Dynamic burn-in for 168hrs at 125°C
- Check all parameters & assess

Environmental Specification

- Bump: 4000 bumps at 391m/s^2 in each of the three mutually perpendicular planes
- Hermetic Seal: not to exceed 1 × 10^{-8} mBar litres of helium
- Humidity: steady state: in accordance with test Ca of IEC 68-2-3, for 56 days at 40°C at a relative humidity of 93%, cyclic: in accordance with test Db variant 1 of IEC 68-2-30, at severity b), 55 deg.C for six cycles
- Shock: 981m/s^2 for 6ms, three shocks in each direction along the three mutually perpendicular planes
- Solderability: BS2011 test TA
- Vibration: 10 to 60Hz 0.75mm displacement, 60 to 2000Hz 98.1m/s^2 acceleration, 30 minutes in each of three mutually perpendicular planes.

Tri-state Operation (IQXO-627, -628)

- Logic ‘0’ to pin 1 disables oscillator output; when disabled the oscillator output goes to the high impedance state
- No connection or Logic ‘1’ to pin 1 enables oscillator output
- Disable current 50 A typical

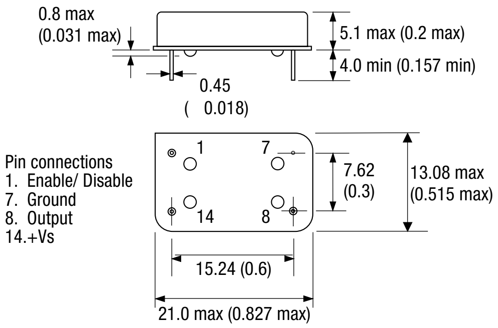
Marking

- Model number
- Frequency Stability Code
- Frequency Tolerance Code (Optional)
- Frequency
- Date code (Year/Week)

Minimum Order Information Required

- Frequency + Model Number + Frequency Stability

Outline in mm (inches)



Note: Pin 1 = No connection on non tri-state models

Electrical Specification – maximum limiting values measured in HCMOS test circuit

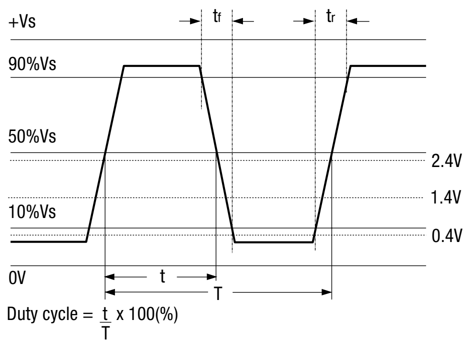
Frequency Range	Frequency Stability	Supply Voltage	Supply Current	Rise Time (t_r)	Fall Time (t_f)	Duty Cycle	Model Number
250.0kHz to < 8.0MHz	±50ppm ±100ppm	5V±0.5V	5mA	10ns	10ns	45/55%	IQXO-625, -626 -627, -628
8.0 to < 23.0MHz	±50ppm ±100ppm	5V±0.5V	10mA	5ns	5ns	40/60%	IQXO-625, -626 -627, -628
23.0 to < 48.0MHz	±50ppm ±100ppm	5V±0.5V	50mA	5ns	5ns	40/60%	IQXO-625, -626 -627, -628
48.0 to 72.0MHz	±50ppm ±100ppm	5V±0.5V	65mA	3ns	3ns	40/60%	IQXO-625, -626 -627, -628

Ordering Example: 50.0MHz IQXO-625 B E

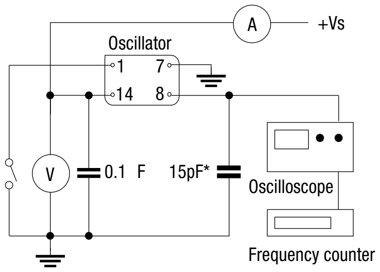
- Frequency
- Model No: -625, -626 = Non tri-state, -627, -628 = Tri-state
- Frequency Stability: B = ±50ppm; C = ±100ppm
- Frequency Tolerance @ 25°C: E = ±10ppm; F = ±25ppm

Please note: Code combination B F is not available

Output Waveform- HCMOS/TTL



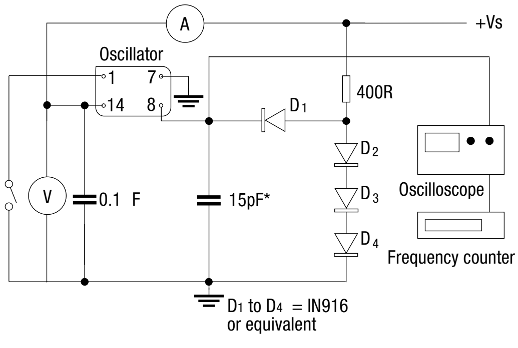
Test Circuit - HCMOS



*Inclusive of jigging & equipment capacitance

Note: Pin 1= No connection on non tri-state models

Test Circuit - TTL



*Inclusive of jigging & equipment capacitance

Note: Pin 1= No connection on non tri-state models

IQXO-899, -909

ISSUE 8; 30 JUNE 1998

SPXOs

Delivery Options

- Please contact our sales office for current leadtimes

Output Compatibility

- ECL 10kH (IQXO-899)
- Dual Complimentary ECL 10kH (IQXO-909)

Package Outline

- 14-pin DIL compatible resistance welded enclosure, hermetically sealed with glass to metal seals.

Standard Frequency Stabilities

- 50ppm, 100ppm
  (inclusive of supply voltage variations over the operating temperature range)

Operating Temperature Range

- 0 to 70°C

Storage Temperature Range

- –55 to 125°C

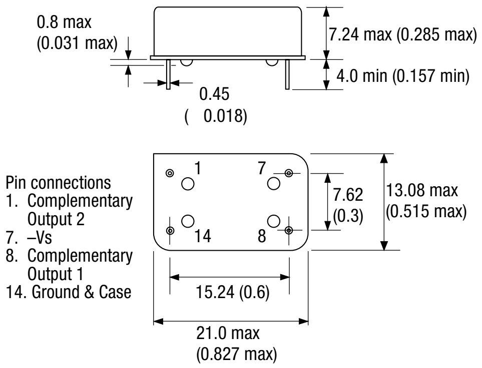
Marking

- Model number
- Frequency Stability Code
- Frequency
- Date code (Year/Week)

Minimum Order Information Required

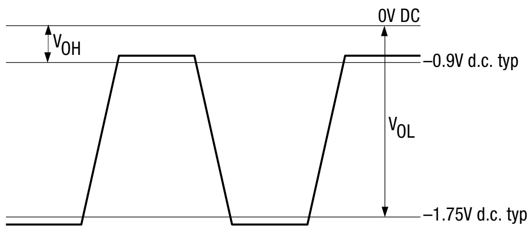
- Frequency + Model Number + Frequency Stability

Outline in mm (inches)



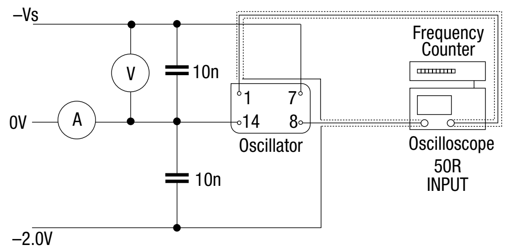
Note: Pin 1 = No connection on IQXO-899, Pin 8 = Ouput

Logic Levels



Logic 0 (V_{OL}) minimum –1.87V; maximum –1.625V
Logic 1 (V_{OH}) minimum –1.06V; maximum –0.72V

Test Circuit



Note: Pin 1 = No connection on IQXO-899

Electrical Specification – maximum limiting values when measured in test circuit

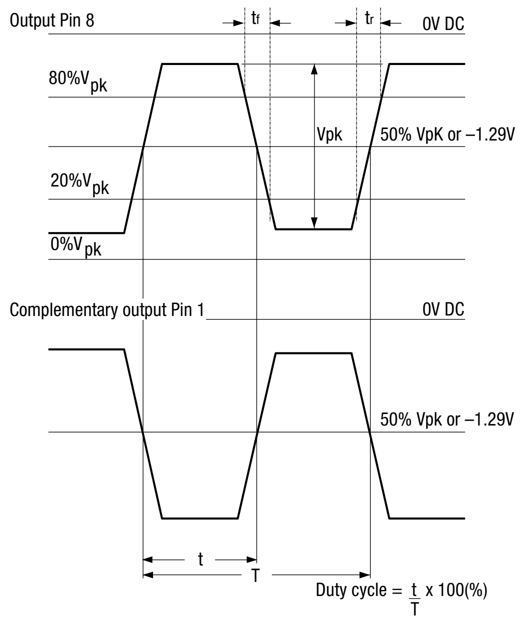
Frequency Range	Frequency Stability	Supply Voltage	Supply Current	Rise Time (t_r)	Fall Time (t_f)	Duty Cycle	Model Number
30.0 to < 70.0MHz	±50ppm ±100ppm	–5.2V±0.25V	60mA	2ns	2ns	40/60%	IQXO-899, -909
70.0 to < 125.0MHz	±50ppm ±100ppm	–5.2V±0.25V	60mA	2ns	2ns	40/60%	IQXO-899, -909
125.0 to < 200.0MHz	±50ppm ±100ppm	–5.2V±0.25V	60mA	2ns	2ns	40/60%	IQXO-899, -909

Note: ECL output require a pull-down resistor in the range 270 to 2k to the most negative rail.

Ordering Example 125.0MHz IQXO-899 B

Frequency
Model No
Frequency Stability: B = ±50ppm; C = ±100ppm

Output Waveform



IQXO-904, -919

ISSUE 8; 19 JUNE 1997

Delivery Options

- Please contact our sales office for current leadtimes

Output Compatibility

- PECL 10kH (IQXO-904)
- Dual Complimentary PECL 10kH (IQXO-919)

Package Outline

- 14-pin DIL compatible resistance welded enclosure, hermetically sealed with glass to metal seals.

Standard Frequency Stabilities

- 50ppm, 100ppm
(inclusive of supply voltage variations over the operating temperature range)

Operating Temperature Range

- 0 to 70°C

Storage Temperature Range

- –55 to 125°C

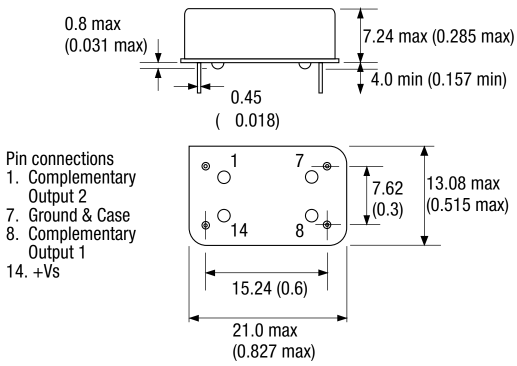
Marking

- Model number
- Frequency Stability Code
- Frequency
- Date code (Year/Week)

Minimum Order Information Required

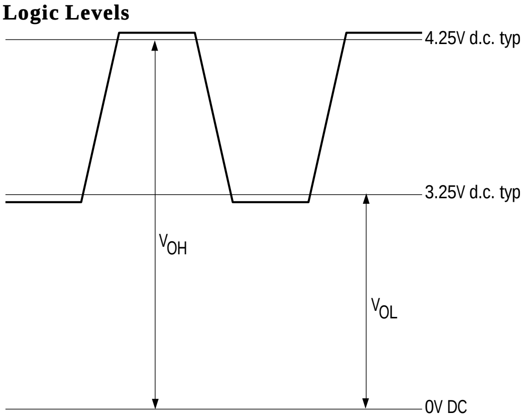
- Frequency + Model Number + Frequency Stability

Outline in mm (inches)



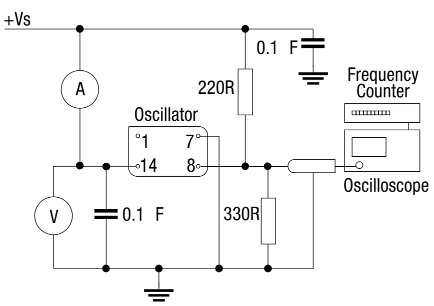
Note: Pin 1 = No connection on IQXO-904, Pin 8 = Ouput

Logic Levels

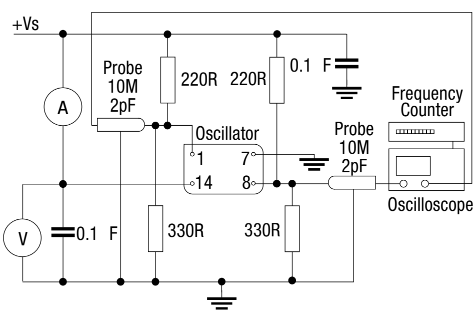


Logic 0 (V_{OL}) minimum 3.05V; maximum 3.42V
Logic 1 (V_{OH}) minimum 4.0V; maximum 4.45V

Test Circuit - IQXO-904



Test Circuit - IQXO-919



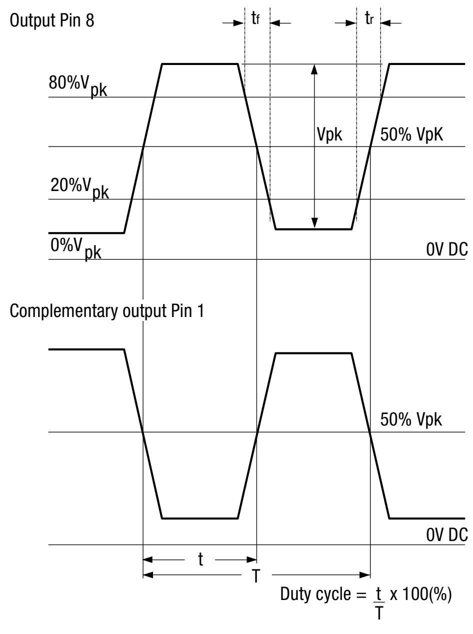
Electrical Specification – maximum limiting values when measured in test circuit

Frequency Range	Frequency Stability	Supply Voltage	Supply Current	Rise Time (t_r)	Fall Time (t_f)	Duty Cycle	Model Number
30.0 to < 70.0MHz	±50ppm ±100ppm	5.0V±0.25V	60mA	2ns	2ns	40/60%	IQXO-904, -919
70.0 to < 125.0MHz	±50ppm ±100ppm	5.0V±0.25V	60mA	2ns	2ns	40/60%	IQXO-904, -919
125.0 to < 200.0MHz	±50ppm ±100ppm	5.0V±0.25V	60mA	2ns	2ns	40/60%	IQXO-904, -919

Ordering Example 125.0MHz IQXO-919 B

Frequency — 125.0MHz
Model No — IQXO-919
Frequency Stability: B = ±50ppm; C = ±100ppm — B

Output Waveform



SPXOs

NOTES

SPXOs

VCXOs - Section Contents

SPECIFYING VOLTAGE CONTROLLED CRYSTAL OSCILLATORS (VCXOs)

A typical VCXO specification reads like this:

16.3840MHz IQVCXO-161 B BU T

- Frequency — 16.3840MHz
- Model Number — IQVCXO-161
- Frequency Stability — B
- Packaging — BU
- Additional Text Code (for non-standard product) — T

The following notes define each element of the specification.

Frequency

Frequency is normally specified in kilohertz (kHz) up to 999.999 kHz and in megahertz (MHz) from 1.0MHz. All our computer-generated transaction documents follow this standard convention automatically.

The VCXO frequency should be described to seven significant figures. If seven significant figures are not used, we assume that any figure that might follow those given may be taken as zero. Thus a frequency given as 16.6MHz will be taken as 16.60, not 16.66667.

Model Number

The model number incorporates information which describes output compatibility and holder style.

Frequency Stability

The frequency stability of a VCXO includes the initial adjustment tolerance at room temperature (with the control pin set to centre trim voltage: e.g. 2.5V), the tolerance over operating temperature range and the effect of supply voltage variation unless otherwise stated on the individual data sheet. This value is specified as 'parts per million' (ppm) and is available in three ranges, 25ppm, 50ppm and 100ppm.

For standard oscillators the following codes apply:

- A = ±25ppm
- B = ±50ppm
- C = ±100ppm

Frequency Pullability

As standard the centre trim voltage is 2.5V. The pullability is specified as the change in frequency when the trim voltage is varied by ±2V. This value is specified as 'parts per million' (ppm) and is available in three ranges; ±50ppm, ±100ppm & ±200ppm.

Operating Temperature Range

Standard operating temperature ranges for VCXO's are

- 0 to 70°C
- –20 to 70°C
- –40 to 85°C

Although in general oscillators will continue to operate outside their normal temperature range with a degradation in frequency stability, damage can result if the temperatures reached are excessive.

For other temperature ranges please contact the CFP sales office.

Packaging Code

All items are bulk packed only.

- BU = Bulk packed

Additional Text Code

If the product is non-standard, the letter 'T' will appear at the end of the product specification. This refers to additional text on the quotation/sales order to identify the non-standard requirements.

Outline Drawings

Dimensions on the oscillator outline drawings are shown only as a guide. Precise dimensions of oscillator holders are available from our Engineering Department upon request. All dimensions are shown in mm (& inches) and are nominal unless otherwise stated. All outlines are at a scale of 1:1 unless otherwise specified.

Delivery Options

The following Express delivery options are available for certain VCXOs; timescales refer to despatch from our factories.

- 3 working days (Express service)
- 5 working days (Express service)
- 7 working days (Express service)
- 10 working days (Express service)

Prices for larger quantities and longer delivery times are generally lower due to substantially reduced manufacturing costs. Please refer to individual datasheets for further information.

Marking

Product will be indelibly marked as detailed in the individual data sheets. Where space is limited some or all of the information will be omitted/truncated at CFP's discretion. Full product details will be found on the individual batch packaging.

Ordering Information

- See individual datasheets

STOCK VCXOs

STOCK VCXOs

Minimum Order Information Required

- Stock Number or Alpha Code

14-pin DIL VCXOs- HCMOS/ TTL

Frequency	Frequency Pulling	Model No.	Stock No.	Alpha Code
8.1920MHz	±100ppm	IQVCXO-161B	VCXO011124	X124K
10.0MHz	±100ppm	IQVCXO-161B	VCXO011125	X108K
12.2880MHz	±100ppm	IQVCXO-161B	VCXO010450	X122K
15.360MHz	±100ppm	IQVCXO-161B	VCXO011126	X131K
16.3840MHz	±100ppm	IQVCXO-161B	VCXO011127	X130K

VCXO Selection Chart

Model	Frequency Range (MHz)								Operating Temperature Range							Stability within Temperature Range (ppm)				Output Frequency Change (ppm)			Page
	1.0	20	25	30	45	52	90	622.08	–40	–25	–20	0	+70	+75	+85	30	25	50	100	±50ppm min.	±100ppm min.	±200ppm min.	
IQVCXO-161																							70
IQVCXO-172																							72
IQVCXO-173																							72
IQVCXO-174																							72
CFPV-2337																							74
CFPV-2365																							75

Please note: Shading indicates a wider Operating Temperature Range for limited frequencies. Shading indicates a capability.

Customer VCXO Requirements Fax Form - Please copy form, fill out using BLOCK CAPITALS and fax to C-MAC on +44 (0)1460 72578				
x = Minimum Specification Information Required for VCXO pricing				
Frequency		x		MHz
Output Waveform				TTL/CMOS/Sine
Output Level/Load		x		TTL/CMOS/Sine
Rise/Fall Time (Square Wave)				ns
Duty Cycle (Square Wave)				%
Supply Voltage		x		Vdc
Output Current				mA
Frequency Tolerance @ 25°C				ppm
Operating Temperature Range		x		°C
Frequency Stability	vs. Input Voltage Change			ppm
	vs. load Change			ppm
	vs. Operating Temperature	x		ppm
Ageing				per year
Voltage Control	Centre Control Voltage	x		Vdc
	Control Voltage Range	x		Vdc
	Linearity			%
	Slope	x		+/–
Frequency Pullability		x		ppm
Tri-state Option				Yes/No
Package	Outline	x		
	Connections	x		
	Marking			
Additional Notes				
Name				
Job Title				
Company Name				
Address				
Postcode				
Telephone			E-mail	
Fax			http://	

VCXOs

IQVCXO-161

ISSUE 6; 23 AUGUST 1998

Delivery Options

- Common frequencies are available from stock. Please see p67 for details

Output Compatibility

- HCMOS/TTL
- Drive Capability: 15pF/10 TTL

Package Outline

- 14-pin DIL compatible resistance welded enclosure, hermetically sealed with glass to metal seals.

Standard Frequency Stabilities

- 25ppm, 50ppm @ V_C=2.5V
  (inclusive of supply voltage & output load variations over the operating temperature range)

Operating Temperature Ranges

- 0 to 70°C
- 20 to 70°C
- 40 to 85°C (available 30.0 to 90.0MHz only)

Storage Temperature Range

- –40 to 85°C

Environmental Specification

- Terminal Strength: 0.91kg max. Force perpendicular to top & bottom.
- Hermetic Seal: not to exceed 1×10^{-8} mBar litres of Helium leakage
- Solderability: MIL-STD-202E, Method 208C
- Vibration: 10 to 55Hz 0.76mm displacement, sweep 60 seconds, duration 2 hours.
- Rapid Change of Temperature over Operating Temperature Range: 10 cycles
- Shock: $981m/s^2$ for 6ms, three shocks in each direction along the three mutually perpendicular planes

Output Frequency Change

- 100ppm min

Voltage Control Pin 1

- 2.5V 2.0V

Modulation Bandwidth

- >15kHz

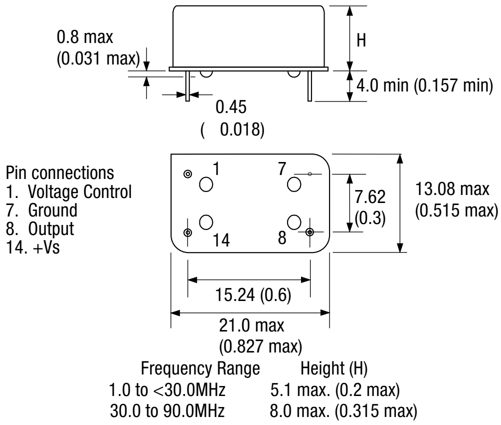
Marking

- Model number
- Frequency Stability Code
- Frequency Tolerance Code (Optional)
- Frequency
- Date code (Year/Week)

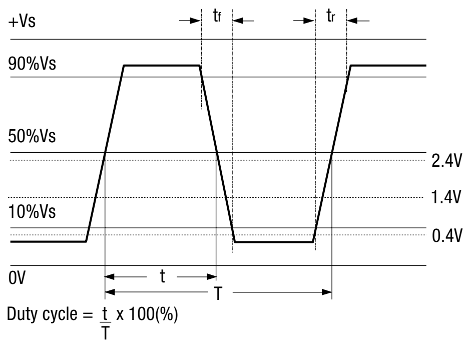
Minimum Order Information Required

- Frequency + Model Number + Operaturing Temperature + Frequency Stability

Outline in mm (inches)



Output Waveform - HCMOS/TTL



Electrical Specification – maximum limiting values when measured in HCMOS test circuit

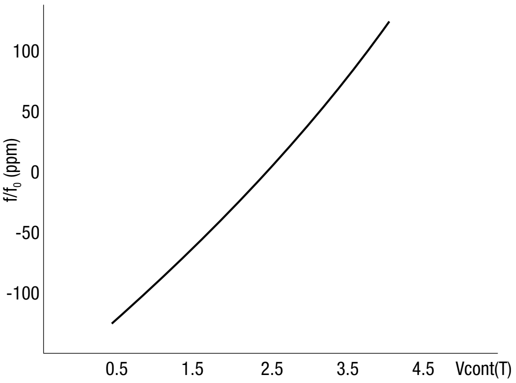
Frequency Range	Frequency Stability	Supply Voltage	Output Frequency Change	Supply Current	Rise Time (t_r)	Fall Time (t_f)	Duty Cycle	Model Number
1.0 to < 24.0MHz	±25ppm ±50ppm	5V±0.25V	±100ppm	15mA	10ns	10ns	40/60%	IQVCXO-161
24.0 to < 30.0MHz	±25ppm ±50ppm	5V±0.25V	±100ppm	40mA	10ns	10ns	40/60%	IQVCXO-161
30.0 to 90.0MHz	±25ppm ±50ppm	5V±0.25V	±100ppm	30mA	5ns	5ns	40/60%	IQVCXO-161

Ordering Example 22.0MHz IQVCXO-161 S B

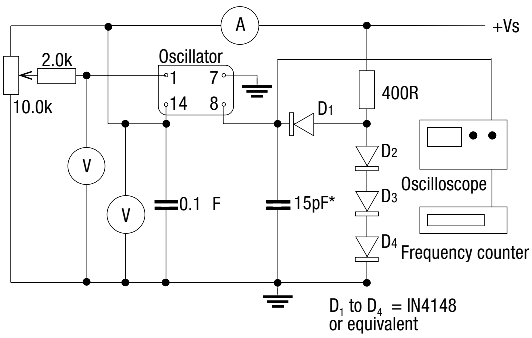
Frequency
Model No
Operating Temperature Code: *X = 40 to 85°C, S = -20 to 70°C, Not applicable for 0 to 70°C
Frequency Stability: A = ±25ppm; B = ±50ppm

*Please note: Available 30.0 to 90.0MHz only

Typical Voltage Control Curve @ 25°C & 20.0MHz

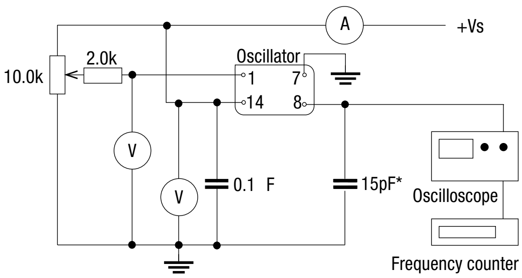


Test Circuit - TTL



*Inclusive of jigging & equipment capacitance

Test Circuit - HCMOS



*Inclusive of jigging & equipment capacitance

IQVCXO-172, -173, -174

ISSUE 8; 18 MAY 1998

Delivery Options

- Please contact our sales office for current leadtimes

Output Compatibility

- HCMOS/LS TTL

Package Outlines

- 14-pin DIL compatible resistance welded enclosure, hermetically sealed with glass to metal seals.

Standard Frequency Stabilities

- ±25ppm, ±50ppm , ±100ppm @ V_C=2.5V (inclusive of supply voltage & output load variations over the operating temperature range)

Operating Temperature Range

- 0 to 70°C

Storage Temperature Range

- –30 to 85°C

Output Frequency Change

- ±50ppm min (IQVCXO-172)
- ±100ppm min (IQVCXO-173)
- ±200ppm min (IQVCXO-174)

Voltage Control Pin 1

- 2.5V ±2.0V

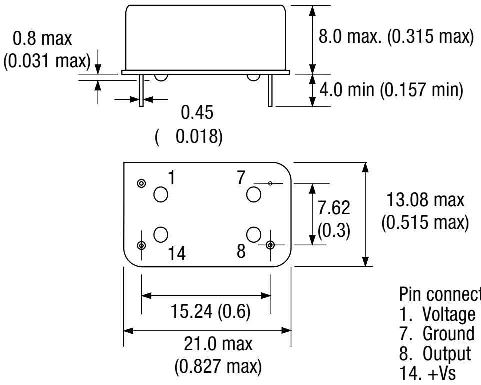
Marking

- Model number
- Frequency Stability Code
- Frequency
- Date code (Year/Week)

Minimum Order Information Required

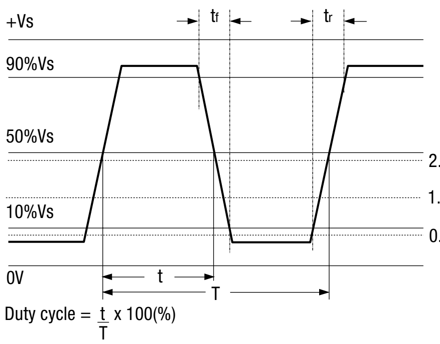
- Frequency + Model Number + Frequency Stability

Outline in mm (inches)

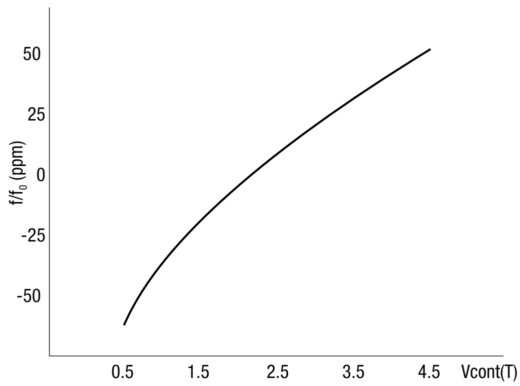


Pin connections
1. Voltage Control
7. Ground
8. Output
14. +Vs

Output Waveform - HCMOS/LS TTL



Typical Voltage Control Curve @ 25°C & 20.0MHz (IQVCXO-172)



Electrical Specification – maximum limiting values when measured in HCMOS test circuit

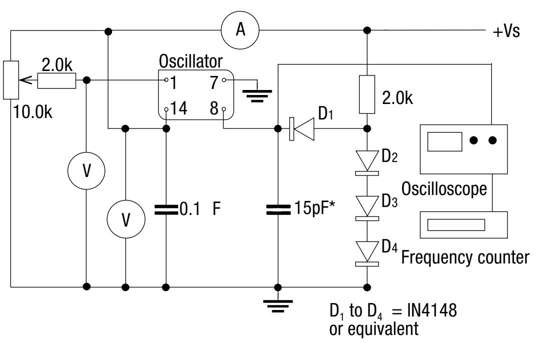
Frequency Range	Frequency Stability	Supply Voltage	Supply Current	Output Frequency Change	Rise Time (t_r)	Fall T ime (t_f)	Duty Cycle	Model Number
1.0 to < 24.0MHz	±25ppm	5V±0.25V	20mA	±50ppm min	10ns	10ns	40/60%	IQVCXO-172
1.0 to < 24.0MHz	±25ppm ±50ppm	5V±0.25V	20mA	±100ppm min	10ns	10ns	40/60%	IQVCXO-173
1.0 to < 24.0MHz	±25ppm ±50ppm ±100ppm	5V±0.25V	20mA	±200ppm min	10ns	10ns	40/60%	IQVCXO-174
24.0 to 45.0MHz	±25ppm	5V±0.25V	40mA	±50ppm min	10ns	10ns	40/60%	IQVCXO-172
24.0 to 45.0MHz	±25ppm ±50ppm	5V±0.25V	40mA	±100ppm min	10ns	10ns	40/60%	IQVCXO-173
24.0 to 45.0MHz	±25ppm ±50ppm ±100ppm	5V±0.25V	40mA	±200ppm min	10ns	10ns	40/60%	IQVCXO-174

Ordering Example 22.0MHz IQVCXO-172 A

Frequency
Model No
Frequency Stability: A = ±25ppm, B = ±50ppm, C = ±100ppm

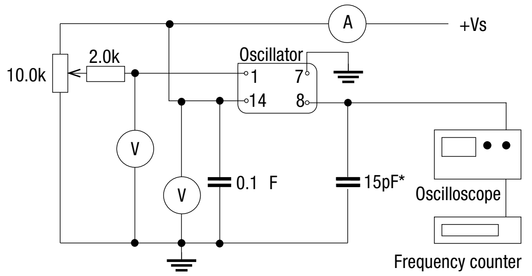
VCXOs

Test Circuit - LS TTL



*Inclusive of jigging & equipment capacitance

Test Circuit - HCMOS



*Inclusive of jigging & equipment capacitance

CFPV-2337

ISSUE 2; 8 JULY 1999

Delivery Options

- In order to determine your exact performance parameter needs, please either call our Application Support Department or fill in the Customer Requirements Fax Form on p69 and fax to C-MAC Frequency Products.

Frequency Range

- 150.0kHz to 160.0MHz

Output Options

- HCMOS/ACMOS
- ECL
- Sinewave
- TTL

Description

- C-MAC Frequency Products has a wide ranging capability in the area of DIL VCXOS, most specifications can be catered for. Other packaging options include 14-pin DIL 5mm height, 16-pin double DIL and 24-pin double DIL all fully qualified against the appropriate IEC specification.

VCXOs

Supply Voltage Options

- 3.3V ±0.165V
- 5.0V ±0.25V
- -5.2V ±0.25V for ECL option

Operating Temperature Range

- Operating Temperature Ranges can be as wide as –40 to 85°C with frequency stabilities down to ±10ppm depending upon specification, with an initial frequency tolerance as low as ±2ppm.

Output Frequency Change

- ±100ppm min.(standard)
- Frequency pulling is available, whatever the application requires, frequency pulling can be specified from 50ppm min. to 300ppm min. at a standard control voltage 0.5V to 4.5V.

Voltage Control Pin 1

- 2.5V ±2.0V (standard)
- Other control voltages can be specified.

Ageing

- 3ppm max. in first year
- 10ppm max. in 20 years
- Tighter ageing performance available on request

Environmental Specification

- Terminal Strength: 0.91kg max. Force perpendicular to top & bottom.
- Hermetic Seal: not to exceed 1×10^{-8}mBar litres of Helium leakage
- Solderability: MIL-STD-202E, Method 208C
- Vibration: 10 to 55Hz 0.76mm displacement, sweep 60 seconds, duration 2 hours.
- Rapid Change of Temperature over Operating Temperature Range: 10 cycles
- Shock: 981m/s^2 for 6ms, three shocks in each direction along the three mutually perpendicular planes

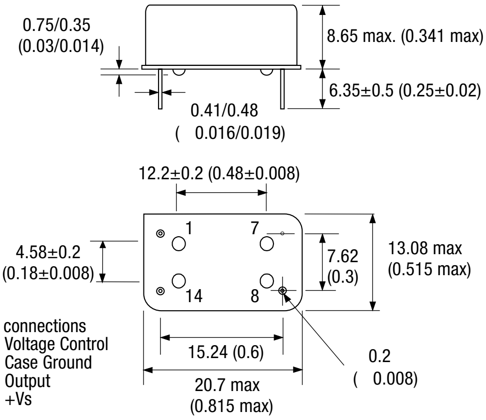
Marking

- Part Number/Model number
- Frequency
- Date Code
- Static Sensitivity Symbol (denotes pin 1)

Minimum Order Information Required

- Discrete Part Number

Outline in mm (inches)



Pin connections
1. Voltage Control
7. Case Ground
8. Output
14. +Vs

CFPV-2365

ISSUE 1; 8 SEPTEMBER 1999

Preliminary Specification

Delivery Options
- Please contact our sales office for current leadtimes

Nominal Frequency
- 622.080MHz

Output Compatibility
- Sinewave
- Load: 50
- Level: 1.0Vpp, 2.0Vpp

Description
- The CFPV-2365 is a voltage controlled crystal oscillator based on a high frequency fundamental mode crystal. The oscillator runs at 155.520MHz and this frequency is multiplied 4 times to obtain the output frequency. This method provides for excellent jitter characteristics.

Package Outline
- 20.7 × 20.7 × 9.9mm

Frequency Tolerance
- ±10ppm @ 25°C

Standard Frequency Stabilities
- Temperature: –25 to 85°C; ±30ppm
- Temperature: 0 to 70°C; ±20ppm
- Supply Voltage Variation: ±3ppm

Supply Voltage
- 3.3V ±5%

Supply Current
- 80mA

Operating Temperature Range
- 0 to 70°C
- –25 to 85°C

Storage Temperature Range
- –40 to 85°C

Output Frequency Change
- ±80ppm min / 120ppm max positive slope

Voltage Control Pin 1
- 1.5V ±1.5V

Modulation Bandwidth
- >3.0kHz

Ageing
- < ±5ppm first year
- < ±2ppm in following years

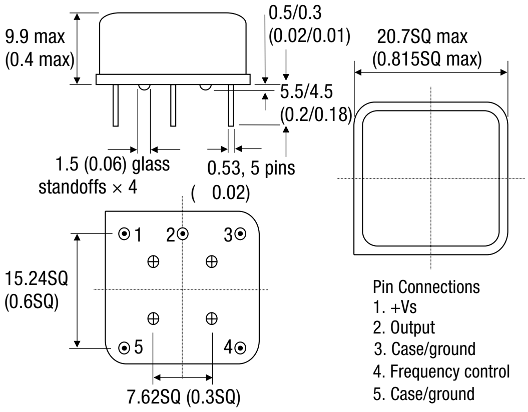
Jitter (peak to peak)
- 80 ps

Environmental Specification
- Vibration: IEC 68-2-6 Test Fc Procedure B4, 10-60Hz 0.75mm displacement, 60-500Hz at 98.1m/s^2, 30 minutes in each of three mutually perpendicular planes at 1 octave per minute.
- Shock: IEC 68-2-27 Test Ea, 981m/s^2 acceleration for 6ms duration, 3 shocks in each direction along three mutually perpendicular axes.
- SMD: Infra-red (class C, test category 1 as defined in classification BS CECC 00802; 1994). Testing to be performed in accordance with BS CECC 00802, IEC 68-2-20 and IEC 68-2-58.
- Sealing: Non hermetic package
- Marking: Label, resistant to all common solvents.

Marking
- Model number
- Frequency
- Date code (Year/Week)
- Static Sensitivity Symbol (denotes pin 1)

Minimum Order Information Required
- Frequency + Model Number

Outline in mm (inches)



VCXOs

NOTES

VCXOs

TCXOs - Section Contents

SPECIFYING TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS (TCXOs)

A typical TCXO specification reads like this:

10.0MHz IQTCXO-250 H R BU T

- Frequency — 10.0MHz
- Model Number — IQTCXO-250
- Frequency Stability — H
- Operating Temperature Range — R
- Packaging — BU
- Additional Text Code (for non-standard product) — T

The following notes define each element of the specification.

Frequency

Frequency is normally specified in kilohertz (kHz) up to 999.9kHz and in megahertz (MHz) from 1.0MHz. All our computer generated transaction documents follow this standard automatically.

The TCXO frequency should be specified to as many significant figures as demanded by its tolerance. If all figures are not used, we assume that any figure that might follow those given may be taken as zero. Thus a frequency given as 16.6MHz will be taken as 16.60 not 16.6666.

Please contact the sales office for details of developed frequencies.

Model Number

The model number incorporates information which describes output compatibility and holder style.

Frequency Stability

The frequency stability of a TCXO is the frequency change over the Operating Temperature Range.

In tight tolerance applications it may be necessary to apply a frequency offset at 25°C in order to centralise the frequency/temperature characteristic to the nominal frequency. Please refer to the Offset Frequency section.

The following codes apply for the frequency stability:

A = ±0.3ppm	H = ±2.5ppm
B = ±0.8ppm	J = ±3.0ppm
C = ±1.5ppm	K = ±5.0ppm
D = ±0.25ppm	L = ±10.0ppm
E = ±0.5ppm	M = ±0.2ppm
F = ±1.0ppm	N = ±15.0ppm
G = ±2.0ppm	

Frequency Trimming

In order to meet their specification over the full operating temperature range, close tolerance TCXOs are often adjusted to have a frequency offset at room temperature. Adjustment of the mechanical trimmers of such TCXOs should not be attempted, therefore, unless facilities exist to measure their frequency over their full operating temperature range.

Operating Temperature Range

Although TCXOs may continue to operate outside their specified temperature range, their frequency-temperature characteristic may become uncompensated and begin to resemble that of a SPXO.

The following codes apply for Operating Temperature Ranges:

A = –55 to 95°C	U = –30 to 75°C
C = 0 to 70°C	V = –30 to 80°C
P = 0 to 50°C	W = –30 to 85°C
R = –10 to 60°C	X = –40 to 85°C
S = –20 to 70°C	Y = –55 to 105°C
T = –25 to 75°C	Z = –55 to 125°C

Packaging Code

All items are bulk packed only.

- BU = Bulk packed

Additional Text Code

If the product is non-standard, the letter ‘T’ will appear at the end of the product specification. This refers to additional text on the quotation/sales order to identify the non-standard requirements.

Outline Drawings

Dimensions on the TCXO drawings are shown only as a guide. Precise dimensions of the TCXO holders are available upon request. All dimensions are shown in mm (& inches) and are nominal unless otherwise stated. All outlines are at a scale of 1:1 unless otherwise specified.

Standard Frequency Tolerances and Stabilities

Please refer to the individual datasheets for each TCXO.

Offset Frequency

The frequency difference, positive or negative, (expressed in Hz) which should be added to the nominal frequency when setting the oscillator at the specified temperature (usually 25 C). The purpose is to minimise the frequency deviation over the entire operating temperature range. Each oscillator will have it’s own offset frequency marked on the case.

In the following example Fig 1., the dotted line shows that if the oscillator is set to nominal frequency at 25°C, the frequency deviates from –1.7 ppm to +0.3 ppm over the temperature range. By setting the frequency at 25°C to the specified offset frequency, the overall frequency deviation is reduced to ±1.0 ppm.

- Offset frequency @ 25°C is used in some specifications. If it is used it will be indicated in the individual specification.

Delivery Options

Please refer to the individual datasheets for each TCXO.

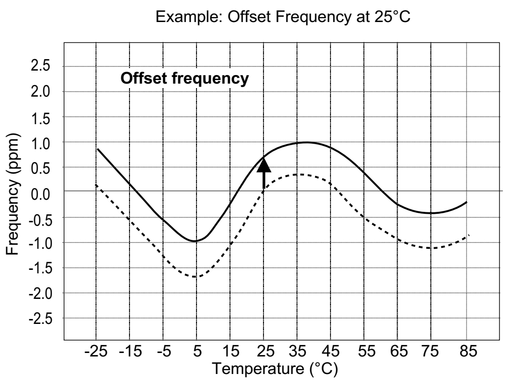
Marking

Product will be indelibly marked as detailed in the individual data sheets. Where space is limited some or all of the information will be omitted/truncated at C-MAC Frequency Products discretion. Full product description will be found on the individual batch packaging.

Ordering Information

- See individual data sheets

Fig. 1



STOCK TCXOs

Minimum Order Information Required

- Stock Number or Alpha Code

IQTCXO-250HU

Frequency	Type	Frequency Stability	Stock No.	Alpha Code
10.0MHz	Clipped Sine	±2.5ppm	TCXO013079	T600A
12.60MHz	Clipped Sine	±2.5ppm	TCXO016637	T601A
12.80MHz	Clipped Sine	±2.5ppm	TCXO012610	T602A
13.0MHz	Clipped Sine	±2.5ppm	TCXO016640	T603A
14.40MHz	Clipped Sine	±2.5ppm	TCXO016570	T604A
16.80MHz	Clipped Sine	±2.5ppm	TCXO016643	T605A
19.20MHz	Clipped Sine	±2.5ppm	TCXO016645	T606A
19.440MHz	Clipped Sine	±2.5ppm	TCXO016648	T607A
19.680MHz	Clipped Sine	±2.5ppm	TCXO016650	T608A

IQTCXO-251HU

Frequency	Type	Frequency Stability	Stock No.	Alpha Code
10.0MHz	HCMOS	±2.5ppm	TCXO013158	T610A
12.60MHz	HCMOS	±2.5ppm	TCXO016638	T611A
12.80MHz	HCMOS	±2.5ppm	TCXO016639	T612A
13.0MHz	HCMOS	±2.5ppm	TCXO016641	T613A
14.40MHz	HCMOS	±2.5ppm	TCXO016642	T614A
16.80MHz	HCMOS	±2.5ppm	TCXO016644	T615A
19.20MHz	HCMOS	±2.5ppm	TCXO016646	T616A
19.440MHz	HCMOS	±2.5ppm	TCXO016649	T617A
19.680MHz	HCMOS	±2.5ppm	TCXO016651	T618A

TCXO Selection Chart

Model	Frequency Range (MHz)													Operating Temperature Range												Stability within Temperature Range (ppm)								Output	Ext Trim	Outline (mm)	Page
	0.001	0.005	1.0	1.5	3.2	9	10	20	25	30	40	52	155.52	–55	–40	–30	–20	–10	0	+50	+60	+70	+75	+85	+95	0.2	0.3	0.5	1.0	1.5	2.0	3.0	5.0				
IQTCXO-195									24																									C/Sine	-	14-pin DIL	82
IQTCXO-250																																		C/Sine	-	14-pin compatible	84
IQTCXO-251																																		C-MOS	-	14-pin compatible	84
IQTCXO-252																																		C/Sine	-	14-pin compatible	84
IQTCXO-253									24																									C-MOS	-	14-pin compatible	84
IQTCVCXO-258																																		C/Sine	✓	14-pin compatible	86
IQTCVCXO-259																																		C-MOS	✓	14-pin compatible	86
IQTCVCXO-260																																		C/Sine	✓	14-pin compatible	86
IQTCVCXO-261																																		C/Sine	✓	14-pin compatible	86
IQTCVCXO-262																																		C-MOS	✓	14-pin compatible	86
CFPT-5100 Series																																		C-MOS	✓	14-pin DIL	88
CFPT-5200 Series																																		C-MOS	✓	14-pin DIL	90
CFPT-6100 Series																																		C-MOS	✓	20.7 × 20.7 × 9.9	92

Please note: Shading indicates a wider Operating Temperature Range

Customer TCXO Requirements Fax Form - Please copy form, fill out using BLOCK CAPITALS and fax to C-MAC on +44 (0)1460 72578					
x = Minimum Specification Information Required for TCXO pricing					
Frequency			x		MHz
Output Waveform					CMOS/TTL/Sine
Output Level/Load			x		CMOS/TTL/Sine
Rise/Fall Time (Square Wave)					ns
Duty Cycle (Square Wave)					%
Supply Voltage			x		Vdc
Frequency Tolerance @ 25°C					ppm
Output Current					mA
Operating Temperature Range			x		°C
Phase Noise	10Hz				dBc
	100Hz				dBc
	1000Hz				dBc
	10kHz				dBc
Frequency Stability	vs. Input Voltage Change				ppm
	vs. load Change				ppm
	vs. Operating Temperature		x		ppm
Ageing					per year
Frequency Adjust	Mechanical (Internal)	Range			ppm
	Electrical (External)	Range			ppm
	Control Voltage Range				Vdc
Tri-state Option					Yes/No
Package	Outline		x		
	Connections		x		
	Marking				
Additional Notes					
Name					
Job Title					
Company Name					
Address					
Postcode					
Telephone				E-mail	
Fax				http://	

TCXOs

IQTCXO-195

ISSUE 2; 28 AUGUST 1996

Delivery Options

- Please contact our sales office for current leadtimes

Description

- IQTCXO-195 are temperature compensated crystal oscillators providing a high degree of frequency stability over a wide temperature range.

Waveform

- Clipped Sine 1V peak to peak

Package Outline

- 14-pin DIL compatible resistance welded enclosure with internal trimmer

Ageing

- 2ppm typical per year

Frequency Adjustment

- 3ppm minimum internal trimmer adjustment

Storage Temperature Range

- –40 to 125°C

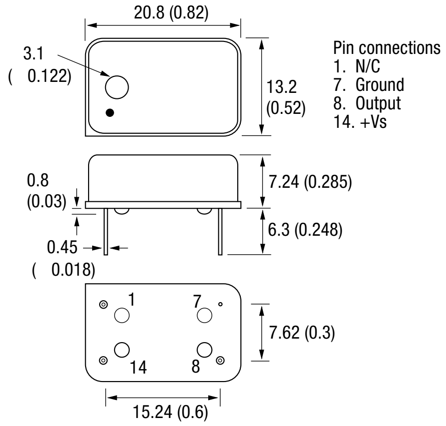
Marking

- Model number
- Frequency Stability Code /Temperature Range Code
- Frequency
- Date code (Year/Week)

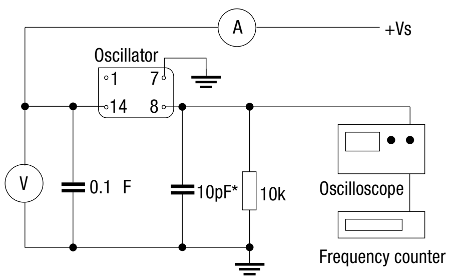
Minimum Order Information Required

- Frequency + Model Number + Frequency Stability + Operating Temperature Range

Outline in mm (inches)



Test Circuit



*Inclusive of jigging & equipment capacitance

TCXOs

Electrical Specification – maximum limiting values when measured in test circuit

Frequency Range	Supply Voltage	Supply Current	Output Waveform	Output	Duty cycle	Model Number
9.0 to 24.0MHz	5V±0.25V	5mA	Clipped Sine	1Vp-p min	40/60%	IQTCXO-195

Frequency Stabilities Available Over Operating Temperature Ranges

Operating Temperature Ranges	Frequency Stabilities Vs Operating Temperature Range	
	±5.0ppm	±10.0ppm
0 to 50°C	Code KP	Code LP
–10 to 60°C	Code KR	Code LR

Ordering Example 15.0MHz IQTCXO-195 KP

Frequency — 15.0MHz
Model No — IQTCXO-195
Frequency Stability Vs Operating Temperature Code — KP

TCXOs

IQTCXO-250, -251, -252, -253

ISSUE 5; 8 JULY 1999

Delivery Options

- Common frequencies are available from stock. Please see p79 for details

Description

- IQTCXO-250, -251, -252, -253 are temperature compensated crystal oscillators providing a high degree of frequency stability over a wide temperature range. They are particularly suited to applications where space is at a premium

Waveform

- Clipped Sine 1V peak to peak
- Clipped Sine 0.7V peak to peak
- Square HCMOS

Package Outline

- 14-pin DIL compatible enclosure with internal trimmer

Ageing

- 1ppm typical first year

Frequency Adjustment

- 3ppm minimum internal trimmer adjustment

Storage Temperature Range

- –40 to 85°C

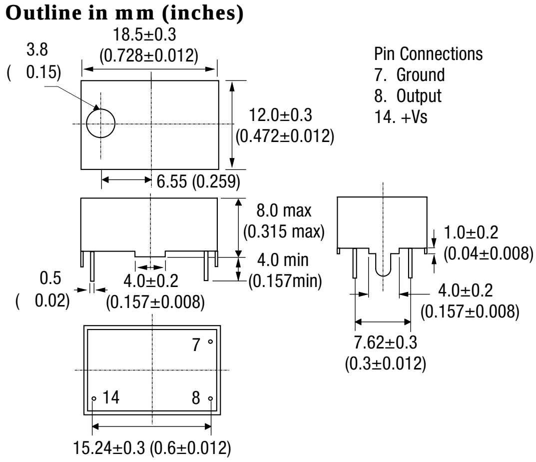
Marking

- Model number
- Frequency Stability Code /Temperature Range Code
- Frequency
- Date code (Year/Week)

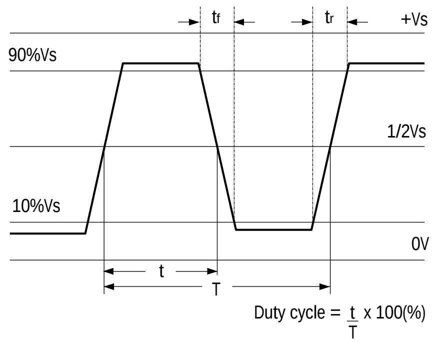
Minimum Order Information Required

- Frequency + Model Number + Frequency Stability + Operating Temperature Range

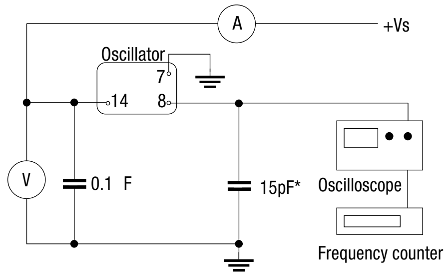
Outline in mm (inches)



Output Waveform - HCMOS



Test Circuit - HCMOS



*Inclusive of jigging & equipment capacitance

Electrical Specification – maximum limiting values when measured in test circuit

Frequency Range	Supply Voltage	Supply Current	Output Waveforms	Output	Duty cycle	Model Number
3.20 to 40.0MHz	5V±0.25V	5mA	Clipped Sine	1Vp-p min	—	IQTCXO-250
3.20 to 40.0MHz	5V±0.25V	20mA	Square	HCMOS	40/60%	IQTCXO-251
3.20 to 40.0MHz	3V±0.15V	3mA	Clipped Sine	0.7Vp-p min	—	IQTCXO-252
1.50 to 24.0MHz	5V±0.25V	20mA	Square	HCMOS	40/60%	IQTCXO-253

Frequency Stabilities Available Over Operating Temperature Ranges

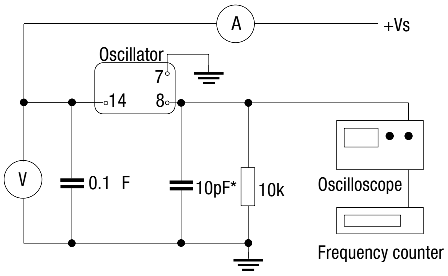
Operating Temperature Ranges	Frequency Stabilities Vs Operating Temperature Range					
	±1.0ppm	±2.0ppm	±2.5ppm	±3.0ppm	±5.0ppm	±10.0ppm
0 to 50°C	Code FP	Code GP	Code HP	Code JP	Code KP	Code LP
–10 to 60°C	—	Code GR	Code HR	Code JR	Code KR	Code LR
–20 to 70°C	—	Code GS	Code HS	Code JS	Code KS	Code LS
–30 to 75°C	—	—	Code HU	Code JU	Code KU	Code LU
–30 to 85°C	—	—	—	Code JW	Code KW	Code LW
–40 to 85°C	—	—	—	Code JX	Code KX	Code LX

Ordering Example: 24.0MHz IQTCXO-250 GS

- Frequency — 24.0MHz
- Model No — IQTCXO-250
- Frequency Stability Vs Operating Temperature Code — GS

TCXOs

Test Circuit - Clipped Sine



*Inclusive of jigging & equipment capacitance

IQTCVCXO-258, -259, -260, -261, -262

ISSUE 4; 8 JULY 1999

Delivery Options

- Please contact our sales office for current leadtimes

Description

- IQTCVCXO-258, -259, -260, -261, -262 are temperature compensated voltage controlled crystal oscillators providing a high degree of frequency stability over a wide temperature range. They are particularly suited to applications where space is at a premium

Waveform

- Clipped Sine 1V peak to peak
- Square HCMOS

Package Outline

- 14-pin DIL compatible enclosure with internal trimmer

Ageing

- 1ppm typical first year

Frequency Adjustment

- 3ppm minimum internal trimmer adjustment

Voltage Control Change

- Please see Electrical Specification table overleaf

Storage Temperature Range

- –40 to 85°C

Marking

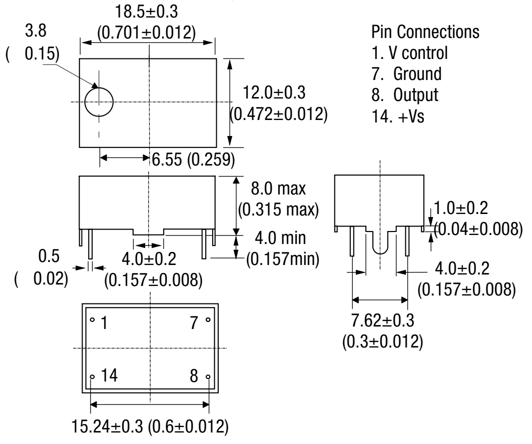
- Model number
- Frequency Stability Code /Temperature Range Code
- Frequency
- Date code (Year/Week)

Minimum Order Information Required

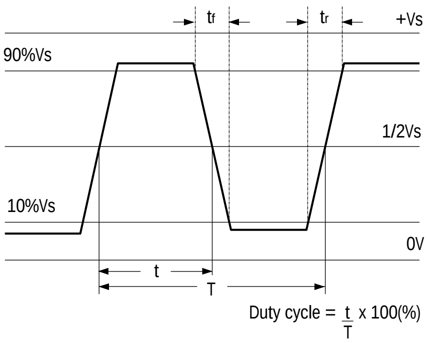
- Frequency + Model Number + Frequency Stability + Operating Temperature Range

TCXOs

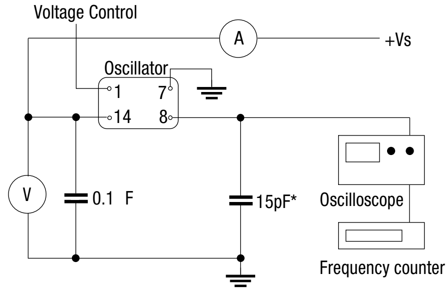
Outline in mm (inches)



Output Waveform - HCMOS



Test Circuit - HCMOS



*Inclusive of jigging & equipment capacitance

Electrical Specification – maximum limiting values when measured in test circuit

Frequency Range	Supply Voltage	Supply Current	Voltage Control Change	Output Waveforms	Output	Duty cycle	Model Number
3.20 to 40.0MHz	5V±0.25V	3mA	±5ppm/2.5V±2V	Clipped Sine	1Vp-p min	—	IQTCVCXO-258
3.20 to 40.0MHz	5V±0.25V	30mA	±15ppm/2.5V±2V	Square	HCMOS	40/60%	IQTCVCXO-259
3.20 to 40.0MHz	5V±0.25V	3mA	±5ppm/2.0V±1.5V	Clipped Sine	1Vp-p min	—	IQTCVCXO-260
3.20 to 40.0MHz	5V±0.25V	3mA	±8ppm/2.5V±2V	Clipped Sine	1Vp-p min	—	IQTCVCXO-261
3.20 to 40.0MHz	5V±0.25V	30mA	±50ppm/2.5V±2V	Square	HCMOS	40/60%	IQTCVCXO-262

Frequency Stabilities Available Over Operating Temperature Ranges

Operating Temperature Ranges	Frequency Stabilities Vs Operating Temperature Range					
	±1.0ppm	±2.0ppm	±2.5ppm	±3.0ppm	±5.0ppm	±10.0ppm
0 to 50°C	Code FP	Code GP	Code HP	Code JP	Code KP	Code LP
–10 to 60°C	—	Code GR	Code HR	Code JR	Code KR	Code LR
–20 to 70°C	—	Code GS	Code HS	CodeJS	Code KS	Code LS
–30 to 75°C	—	—	Code HU	Code JU	Code KU	Code LU
–30 to 85°C	—	—	—	Code JW	Code KW	Code LW
–40 to 85°C	—	—	—	Code JX	Code KX	Code LX

Ordering Example 24.0MHz IQTCVCXO-260 GS

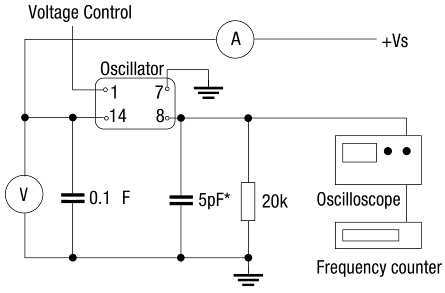
Frequency

Model No

Frequency Stability Vs Operating Temperature Code

TCXOs

Test Circuit - Clipped Sine



*Inclusive of jigging & equipment capacitance

CFPT-5103, -5104, -5105, -5106, -5133, -5144

ISSUE 2; 8 SEPTEMBER 1999

Recommended For New Designs

Delivery Options

- Please contact our sales office for current leadtimes

Description

- The CFPT-5100 series of temperature compensated crystal oscillators provide for ultra high stabilities down to   1.5ppm over an operating temperature range of -55 to +95 C. Housed in an industry standard 14 pin DIL package. Output frequencies are available between 1.0kHz and 40.0MHz.

Waveform

- Square HCMOS

Package Outline

- 14-pin compatible resistance welded enclosure, hermetically sealed with glass to metal seals

Standard Frequencies

- 1.0MHz, 1.0240MHz, 2.097152MHz, 3.840MHz, 4.0960MHz, 5.0MHz, 6.1440MHz, 8.1840MHz, 8.1920MHz, 9.60MHz, 10.0MHz, 10.520MHz, 10.949297MHz, 12.0MHz, 16.0MHz, 16.3840MHz, 20.0MHz, 20.460MHz, 21.0MHz, 24.0MHz, 30.0MHz, 38.880MHz,

Ageing

- ±1ppm max. in first year
- ±5ppm max. for 10 years

Frequency Stability

- Temperature: see table
- Supply Voltage Variation ±5%   25MHz ±0.2ppm
>25MHz ±0.3ppm
- Load Coefficient 15pF ±5pF   ±0.1ppm

Frequency Adjustment

- ±5ppm External Control Voltage 0.25V to 2.5V applied to pin 1 (CFPT- 5103, -5133, -5105)
- ±5ppm External 100k Potentiometer connected as a variable resistor from pin 1 to ground (CFPT-5104, -5144, -5106)

Storage Temperature Range

- –55 to +95°C

Environmental Specification

- Bump: 1000 ±10 bumps at 400m/s^2 in each of the three mutually perpendicular planes
- Shock: 981m/s^2 for 6ms duration, three shocks in each direction along the three mutually perpendicular planes
- Solderability: IEC 68-2-20 Test Ta Method1 (Solder Bath) (MIL-STD-202 Method 208), Temperature 235°C
- Vibration: 10 to 60Hz 0.75mm displacement, 60 to 500Hz 98.1m/s^2 acceleration, 30 minutes in each of three mutually perpendicular planes at 1 octave per minute
- Damp Heat: IEC 68-2-3 Test Ca (Steady State), Duration 56 days, recovery time 12 hours.
- Robustness of Termination: IEC 68-2-21 Test Ua (Tensile)
- Sealing: IEC 68-2-17 Test Qc Method 2 (Gross Leak)
IEC 68-2-17 Test Qk (Fine Leak)
- Marking: Heat cured epoxy or engraving, resistant to all common solvents

Marking

- Manufacturer
- Date Code (Year/Week)
- Part number
- Frequency (MHz)
- Offset frequency at 25°C (Hz)
- Static Sensitivity Symbol   (denotes pin 1)

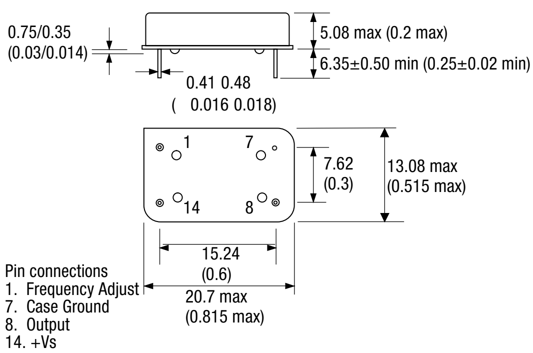
Minimum Order Information Required

- Discrete Part Number

OR

- Frequency + Model Number + Frequency Stability + Operating Temperature Range

Outline in mm (inches)



Available Standard Specifications

Frequency Range	Supply Voltage	Supply Current	Output	Frequency Adjustment	Rise Time (t_r)	Fall Time (t_f)	Duty Cycle	Model Number
1.0kHz to 25.0MHz	3V 0.15	10mA	HCMOS 15pF	Ext. Control Voltage	4ns	4ns	40/60%	CFPT-5103
1.0kHz to 25.0MHz	3V 0.15	10mA	HCMOS 15pF	Ext. 100k Potentiometer	4ns	4ns	40/60%	CFPT-5104
1.0kHz to 25.0MHz	3.3V 0.17	10mA	HCMOS 15pF	Ext. Control Voltage	4ns	4ns	40/60%	CFPT-5133
1.0kHz to 25.0MHz	3.3V 0.17	10mA	HCMOS 15pF	Ext. 100k Potentiometer	4ns	4ns	40/60%	CFPT-5144
1.0kHz to 40.0MHz	5V 0.25	15mA	HCMOS 15pF	Ext. Control Voltage	4ns	4ns	40/60%	CFPT-5105
1.0kHz to 40.0MHz	5V 0.25	15mA	HCMOS 15pF	Ext. 100k Potentiometer	4ns	4ns	40/60%	CFPT-5106

Frequency Stability Available Over Operating Temperature Ranges

Operating Temperature Ranges	Frequency Stabilities Vs Operating Temperature Range			
	±0.5ppm	±0.8ppm	±1.0ppm	±1.5ppm
–20 to 70°C	Code ES	Code BS	Code FS	Code CS
–30 to 75°C	—	Code BU	Code FU	Code CU
–30 to 85°C	—	—	Code FW	Code CW
–40 to 85°C	—	—	Code FX	Code CX
–55 to 95°C	—	—	—	Code CA

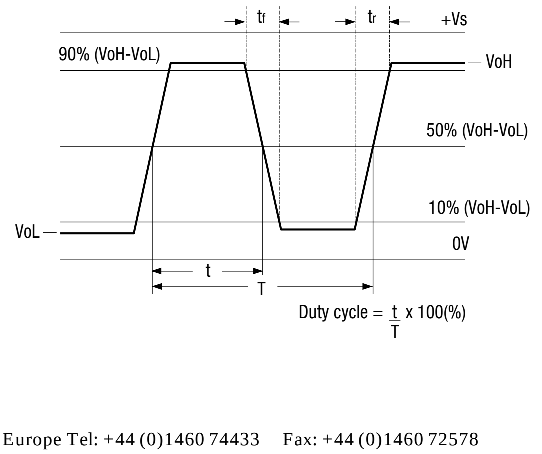
Ordering Example 23.0MHz CFPT-5105 ES

Frequency

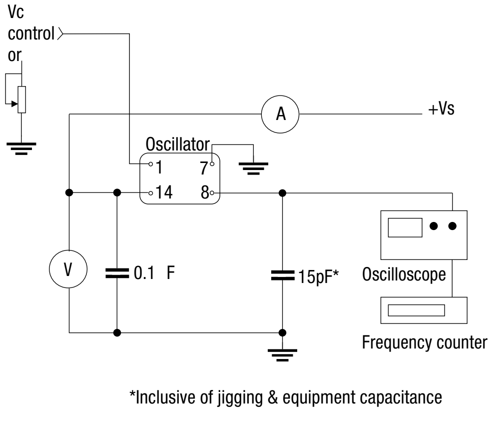
Model No

Frequency Stability Vs Operating Temperature Code

Output Waveform - HCMOS



Test Circuit - HCMOS



*Inclusive of jigging & equipment capacitance

CFPT-5203, -5204, -5205, -5206, -5233, -5244

ISSUE 2; 14 SEPTEMBER 1999

Recommended For New Designs

Delivery Options

- Please contact our sales office for current leadtimes

Description

- The CFPT-5200 series of temperature compensated crystal oscillators provide for ultra high stabilities down to 1.0ppm over an operating temperature range of -55 to +95 C. Housed in an industry standard 14 pin DIL package. Output frequencies are available between 1.0kHz and 52.0MHz.

Waveform

- Square HCMOS

Package Outline

- 14-pin compatible resistance welded enclosure, hermetically sealed with glass to metal seals

Standard Frequencies

- 32.0kHz, 10.0MHz, 12.2880MHz, 13.0MHz, 16.0MHz, 16.93440MHz, 20.0MHz, 38.785316MHz, 38.880MHz, 48.0MHz

Ageing

- ±1ppm max. in first year
- ±5ppm max. for 10 years

Frequency Stability

- Temperature: see table
- Supply Voltage Variation ±5% 25MHz ±0.1ppm
  >25MHz ±0.2ppm
- Load Coefficient 15pF ±5pF ±0.1ppm

Frequency Adjustment

- ±5ppm External Control Voltage 0.25V to 2.5V applied to pin 1 (CFPT-5203, -5233, -5205)
- ±5ppm External 100k Potentiometer connected as a variable resistor from pin 1 to ground (CFPT-5204, -5244, -5206)

Storage Temperature Range

- –55 to +95°C

Environmental Specification

- Bump: 1000 ±10 bumps at 400m/s^2 in each of the three mutually perpendicular planes
- Shock: 981m/s^2 for 6ms duration, three shocks in each direction along the three mutually perpendicular planes
- Solderability: IEC 68-2-20 Test Ta Method1 (Solder Bath) (MIL-STD-202 Method 208), Temperature 235°C
- Vibration: 10 to 60Hz 0.75mm displacement, 60 to 500Hz 98.1m/s^2 acceleration, 30 minutes in each of three mutually perpendicular planes at 1 octave per minute
- Damp Heat: IEC 68-2-3 Test Ca (Steady State), Duration 56 days, recovery time 12 hours.
- Robustness of Termination: IEC 68-2-21 Test Ua (Tensile)
- Sealing: IEC 68-2-17 Test Qc Method 2 (Gross Leak)
  IEC 68-2-17 Test Qk (Fine Leak)
- Marking: Heat cured epoxy, engraving or label, resistant to all common solvents

Marking Includes

- Model number
- Frequency Stability Code /Temperature Range Code
- Frequency
- Date code (Year/Week)

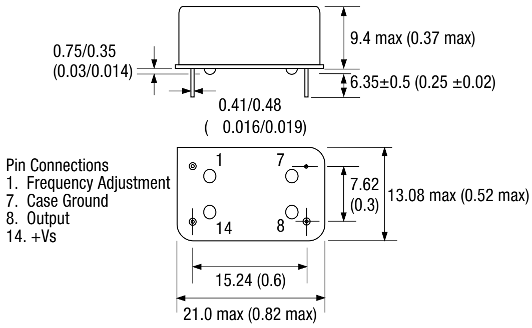
Minimum Order Information Required

- Discrete Part Number

OR

- Frequency + Model Number + Frequency Stability + Operating Temperature Range

Outline in mm (inches)



Electrical Specification - limiting values when measured in test circuit

Frequency Range	Supply Voltage	Supply Current	Output	Frequency Adjustment	Rise Time (t_r)	Fall Time (t_f)	Duty Cycle	Model Number
1.0kHz to 25.0MHz	3V 0.15	10mA	HCMOS 15pF	Ext. Control Voltage	4ns	4ns	40/60%	CFPT-5203
1.0kHz to 25.0MHz	3V 0.15	10mA	HCMOS 15pF	Ext. 100k Potentiometer	4ns	4ns	40/60%	CFPT-5204
1.0kHz to 25.0MHz	3.3V 0.17	10mA	HCMOS 15pF	Ext. Control Voltage	4ns	4ns	40/60%	CFPT-5233
1.0kHz to 25.0MHz	3.3V 0.17	10mA	HCMOS 15pF	Ext. 100k Potentiometer	4ns	4ns	40/60%	CFPT-5244
1.0kHz to 52.0MHz	5V 0.25	20mA	HCMOS 15pF	Ext. Control Voltage	4ns	4ns	40/60%	CFPT-5205
1.0kHz to 52.0MHz	5V 0.25	20mA	HCMOS 15pF	Ext. 100k Potentiometer	4ns	4ns	40/60%	CFPT-5206

Frequency Stability Available Over Operating Temperature Range

Operating Temperature Ranges	Frequency Stabilities Vs Operating Temperature Range				
	±0.3ppm	±0.5ppm	±0.8ppm	±1.0ppm	±1.5ppm
–20 to 70°C	Code AS	Code ES	Code BS	Code FS	Code CS
–30 to 75°C	—	Code EU	Code BU	Code FU	Code CU
–30 to 85°C	—	Code EW	Code BW	Code FW	Code CW
–40 to 85°C	—	Code EX	Code BX	Code FX	Code CX
–55 to 95°C	—	—	—	Code FA	Code CA

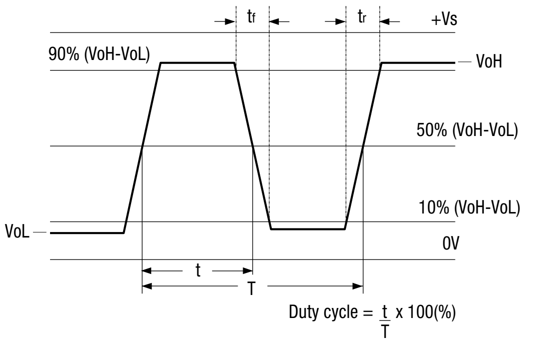
Ordering Example: 23.0MHz CFPT-5205 ES

- Frequency — 23.0MHz
- Model No — CFPT-5205
- Frequency Stability Vs Operating Temperature Code — ES

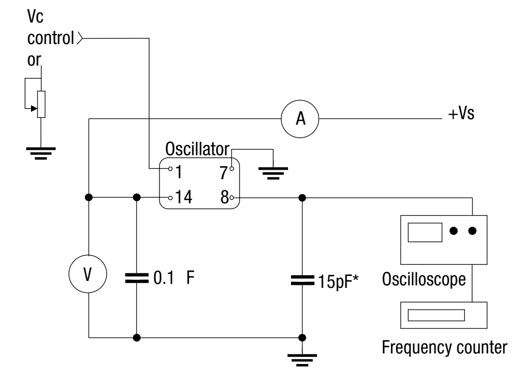
Please note: Minimum Order Quantity = 100 pieces

TCXOs

Output Waveform - HCMOS



Test Circuit - HCMOS



*Inclusive of jigging & equipment capacitance

CFPT-6103, -6104, -6105, -6106, -6133, -6144

ISSUE 1; 19 JUNE 1998

Delivery Options

- Please contact our sales office for current leadtimes

Description

- The CFPT-6100 series of very high stability temperature compensated crystal oscillators are housed in a 20.7mm square leaded package. Operating from standard 5V or 3V supplies and available in the frequency range 1.0kHz to 52.0MHz, the CFPT 6100 series can also be specified with low ageing performance if required.

Waveform

- Square HCMOS

Package Outline

- Resistance welded enclosure

Standard Frequencies

- 4.0MHz, 4.0960MHz, 4.194303MHz, 5.0MHz, 8.1920MHz, 9.899980MHz, 10.0MHz, 12.0MHz, 12.2880MHz, 16.0MHz, 16.3840MHz, 19.440MHz, 24.5760MHz, 32.0MHz, 40.960MHz, 51.840MHz

Ageing

- ±1ppm max. in first year
- ±3ppm max. in 10 years
- Tighter ageing performance available on request

Frequency Stability

- Temperature: see table
- Supply Voltage Variation ±5% 25MHz ±0.1ppm
>25MHz ±0.2ppm
- Load Coefficient 15pF ±5pF ±0.1ppm

Frequency Adjustment

- ±4ppm External Control Voltage 0.25V to 2.5V applied to pin 4 (CFPT-6103, -6133, -6105)
- ±4ppm External 100k Potentiometer connected as a variable resistor from pin 4 to ground (CFPT-6104, -6144, -6106)
- Wider frequency adjustment is available on request

Tri-state

- Pin 5 open circuit or > 0.7Vs enable
- < 0.2Vs tri-state
- Tri-state not available >25MHz (Pin 5 = No Connection)

Storage Temperature Range

- –55 to +95°C

Environmental Specification

- Bump: 1000 ±10 bumps at 400m/s^2 in each of the three mutually perpendicular planes
- Shock: 981m/s^2 for 6ms duration, three shocks in each direction along the three mutually perpendicular planes
- Solderability: IEC 68-2-20 Test Ta Method1 (Solder Bath) (MIL-STD-202 Method 208), Temperature 235°C
- Vibration: 10 to 60Hz 0.75mm displacement, 60 to 500Hz 98.1m/s^2 acceleration, 30 minutes in each of three mutually perpendicular planes at 1 octave per minute
- Damp Heat: IEC 68-2-3 Test Ca (Steady State), Duration 56 days, recovery time 12 hours.
- Robustness of Termination: IEC 68-2-21 Test Ua (Tensile)
- Sealing: IEC 68-2-17 Test Qc Method 2 (Gross Leak)
- Marking: Heat cured epoxy or engraving, resistant to all common solvents

Marking Includes

- Model number
- Frequency Stability Code /Temperature Range Code
- Frequency
- Date code (Year/Week)
- Offset frequency at 25°C (Hz)
- Static Sensitivity Symbol (denotes pin 1)

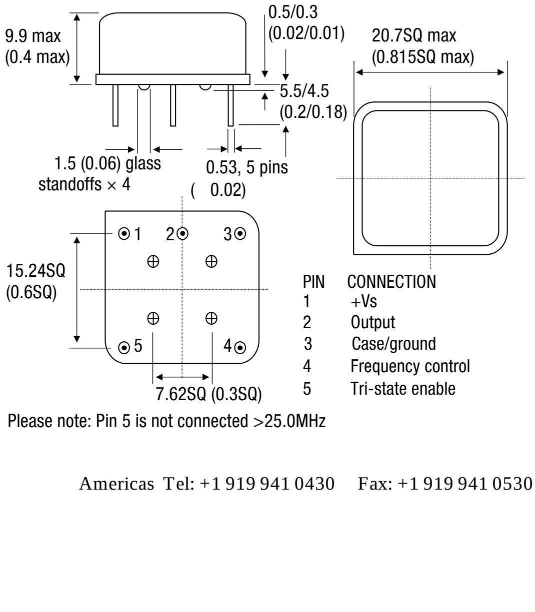
Minimum Order Information Required

- Discrete Part Number

OR

- Frequency + Model Number + Frequency Stability + Operating Temperature Range

Outline in mm (inches)



Please note: Pin 5 is not connected >25.0MHz

Electrical Specification - maximum limiting values when measured in test circuit

Frequency Range	Supply Voltage	Supply Current	Output	Frequency Adjustment	Rise Time (t_r)	Fall Time (t_f)	Duty Cycle	Model Number
1.0kHz to 52.0MHz	3V±0.15	10mA	HCMOS 15pF	Ext. Control Voltage	4ns	4ns	40/60%	CFPT-6103
1.0kHz to 52.0MHz	3V±0.15	10mA	HCMOS 15pF	Ext. 100k Potentiometer	4ns	4ns	40/60%	CFPT-6104
1.0kHz to 52.0MHz	3.3V±0.17	10mA	HCMOS 15pF	Ext. Control Voltage	4ns	4ns	40/60%	CFPT-6133
1.0kHz to 52.0MHz	3.3V±0.17	10mA	HCMOS 15pF	Ext. 100k Potentiometer	4ns	4ns	40/60%	CFPT-6144
1.0kHz to 52.0MHz	5V±0.25	15mA	HCMOS 15pF	Ext. Control Voltage	4ns	4ns	40/60%	CFPT-6105
1.0kHz to 52.0MHz	5V±0.25	15mA	HCMOS 15pF	Ext. 100k Potentiometer	4ns	4ns	40/60%	CFPT-6106

Frequency Stabilities over Operating Temperature Ranges

Operating Temperature Ranges	Frequency Stabilities Vs Operating Temmperature Range			
	±0.3ppm	±0.5ppm	±1.0ppm	±1.5ppm
–20 to 70°C	Code AS	Code ES	Code FS	Code CS
–40 to 85°C	—	Code EX	Code FX	Code CX
–55 to 95°C	—	—	—	Code CA

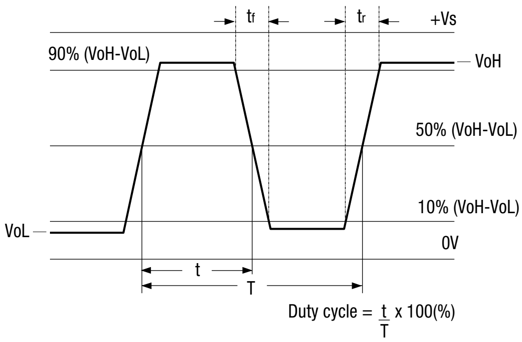
Please note that variations to the above specifications are considered upon request; please contact our sales office.

Ordering Example 23.0MHz CFPT-6105 ES

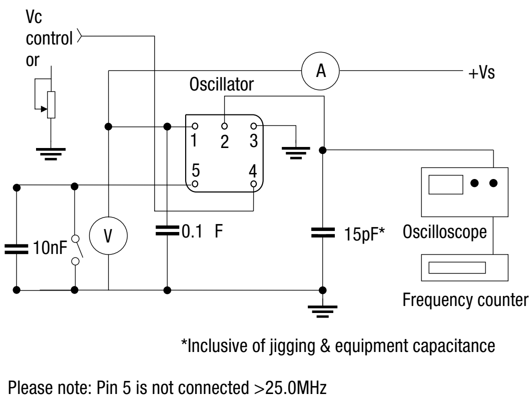
Frequency — 23.0MHz
Model Number — CFPT-6105
Frequency Stability Vs Operating Temperature Code — ES

Please note: Minimum Order Quantity = 100 pieces

Output Waveform - HCMOS



Test Circuit - HCMOS



Please note: Pin 5 is not connected >25.0MHz

NOTES

TCXOs

OCXOs & Rubidium Oscillators - Section Contents

SPECIFYING OVEN CONTROLLED CRYSTAL OSCILLATORS (OCXOs)

The following notes define each element of an OCXO specification. An OCXO is generally used when a very stable frequency is required.

Input Supply Voltage

Various dc input supply options are available to suit a wide range of applications, eg: +5V,+9V, +12V, +15V, +24V.

New generation OCXO's will also include the input supply option of +3.3V.

Output Compatibility

Various output options are available, e.g. Sinewave, HCMOS, TTL.

Long Term Stability (Ageing)

Defined as Long Term Stability in OCXOs, the initial Ageing is monitored by the manufacturer at final test until the 'Ageing' rate achieves the agreed rate of change. Ageing rate will normally be specified per day, per month or per year. Very stable OCXOs can have an annual frequency change of a few parts per billion (parts in 10^{-9}). More typical products will achieve annual drift of a few parts in 10^{8}.

Operating Temperature Stability

In the past, only AT-cut crystals were employed in ovened oscillators and were selected such that their upper turnover temperature, where their temperature coefficient is zero, was at or close to the nominal oven temperature.

However, for very high stability, so-called 'doubly-rotated' crystal cuts are now used. The SC- (stress compensated) cut in particular is used because it is much less sensitive to mounting stress and thermal gradients than an AT-cut. This type of crystal has a family of static f-t curves like the AT, except shifted upwards in temperature by about 70 degrees. The optimum oven temperature is therefore normally at the crystal's lower turnover where the slope of its characteristic is low over a relatively wide temperature range. For the most stable OCXOs the crystal is operated on an overtone mode of oscillation to achieve the highest Q factor and stability.

Despite the temperature control applied to the crystal there will still be some variation in frequency with ambient temperature change, usually over one year this is outweighed by the ageing. Typical operating temperature ranges are between –20 to 60°C and –20 to 75°C with resulting variations in frequency in the range of 10^{-11} to 10^{-8}. Because crystals age more rapidly at high temperatures, it is desirable that the oven temperature be as low as possible. It must however, be a few degrees higher than the maximum ambient temperature or temperature control would become impossible. Take care therefore not to specify too high an operating temperature for the unit unless it is really needed.

Phase Noise

Phase noise is expressed in units of dBc/Hz at a specified offset from the carrier or centre frequency. Other things being equal, the dominating factor which governs the phase noise characteristic of an oscillator is the Q of the crystal and this is one of the reasons why operation on a high overtone is often chosen in preference to the fundamental mode. A very high performance oscillator may exhibit a phase noise in one sideband of –160 dBc/Hz at 1kHz offset from its carrier with –150 dBc/Hz being a typical performance.

Package Size

There are several standard package size options available for OCXO products and normally one of those should be selected. A fully customised device can be designed if essential but please remember that utilising existing packages will reduce lead time and cost. Even so, if an application requires a non-standard package CFP will discuss and advise the most efficient approach.

Warm Up Time

An OCXO will typically take 10 minutes to warm up and stabilise from the initial power up. During warm up there will be a significant frequency change of several parts per million followed by a very small drift over an hour or so. Consideration should be given to decide whether warm up time is a critical factor to the application. Faster warm up time involves more power consumption but fast warm up products can be provided to meet special needs.

Warm Up Power

At first switch on, the oven will take maximum current and therefore consume most power as the oven commences to warm up. Again this initial surge of power can be critical in some applications and must be taken into consideration. Once the oven has achieved temperature, the current consumption will dramatically reduce e.g. from 6W to less than half that amount.

Note: The external ambient temperature determines the amount of power the oven takes. The colder the outer ambient temperature the higher the current consumption will be to maintain the constant internal temperature.

Package Mounting

There are various methods available for mounting the device. Large devices have mounting screws for security in addition to connection pins. With smaller devices PCB pins are sufficient.

Frequency Adjust

Some means of frequency adjustment is provided to enable re-calibration of frequency after ageing has occurred. If an external control voltage is used to adjust the frequency care should be taken that it is sufficiently stable for the performance required from the oscillator.

Express Manufacture OCXOs

From November 1998, C-MAC will be able to offer an Express Manufacturing service for a selection of OCXO products.

- Goods will be despatched within 3 weeks after receipt of order

Minimum Order Information Required

- Model Option + Frequency Option + Type Option + Supply Voltage Option + Package Outline Option

Express Manufacture OCXO Option Table (shaded cells indicate Options for each Model)

Model	Frequency Options (MHz)										Type Option		Supply Voltage Option					Package Outline Option							
	4.096	5.0	8.192	10.0	13.0	16.384	19.44	20.0	26.0	38.88	HCMOS	Sine	5	9	12	15	24	25	36	40	50	50B	51	67	67A
CFPO-1		■		■							■	■			■	■	■					■			■
CFPO-2 H		■		■							■	■			■	■	■					■			■
CFPO-2 S		■		■							■	■			■	■					■			■	
CFPO-3	■	■	■	■	■						■	■			■	■					■		■	■	
CFPO-4 A1,-A2	■	■	■	■	■						■			■	■	■				■	■		■		
CFPO-4 A3,-A4	■	■	■	■	■				■		■			■	■	■				■	■		■		
CFPO-5	■	■	■	■	■	■	■	■	■	■	■		■		■				■						
CFPO-6				■	■	■	■	■	■	■	■		■					■							

Please contact the Applications Support Department for further details.

OCXO Selection Chart

Model	Frequency Range (MHz)											Operating Temperature Range							All Inclusive Stability (over 1 year) Scale = × 10^{-8}									Page
CFPO-	2	4.096	5	8.192	10	13	16.384	26	38..88	40	60	–40	–20	0	+60	+65	+70	+75	<0.1	<1	<2.5	< 5	< 10	< 20	< 40	< 80	< 110	
-US1																												100
-1 H					10.24															-H1, -S1	-H3	-H4						102
-1 S																				-H1, -H2	-S3	-S4						102
-2 H																				-S1, -S2	-H2	-H3						104
-2 S																				-H1	-S1, S2	-S3	-S4					106
-DO3 H1																					-H1							108
-DO3 H2, -S1																					-H2, -S1							108
-DO3 H3, S2, -S3																						-H3, -S2	-S3					108
-3 H1, -H2, -S1, -S2																					H1, -H2, -S1, -S2							110
-3 H3, -H4, -S3, -S4																						-H3, -S3	-H4, -S4					110
- 4 A1, -A2																					-A1, -A2							110
-4 A3, -A4																						-A3	-A4					112
-5 A1, -A3																							-A1, -A3					114
-5 A2, -A4, -A5, -B1, -B2, -B3, -C1																								-A2, -A4, -A5, -B1, -B2	-B3	-C1		114
-6 A1, -A3																							-A1, -A3					116
-6 A2, -A4, -B1, -B2				8..0																				-A2, -A4, -B1	-B2			116
-6 HF1																											-HF1	116
Rubidium															+55													118
-11 A1, -A2, -B1 (SMD)																							-A1	-A2	-B1			250
-12 (SMD)				9.0					33.0																			252

Customer OCXO Requirements Fax Form - Please copy form, fill out using BLOCK CAPITALS and fax to C-MAC on +44 (0)1460 72578					
x = Minimum Specification Information Required for OCXO pricing					
Frequency			x		MHz
Output Waveform			x		
Output Level/Load			x		
Rise/Fall Time (Square Wave)					ns
Duty Cycle (Square Wave)					%
Supply Voltage			x		Vdc
Supply Power	During Warm-Up				watts
	Stabilized at 25ºC				watts
Warm-Up @ 25ºC to within ±1×10–7					minutes
Operating Temperature Range			x		°C
Harmonics/Sub-Harmonics					dBc
Phase Noise	10Hz				dBc
	100Hz				dBc
	1000Hz				dBc
	10kHz				dBc
Short Term Stability					
Frequency Stability	vs. Input Voltage Change				ppm
	vs. load Change				ppm
	vs. Operating Temperature		x		ppm
Ageing	After 7 days on Power		x		per day
	After 30 days on Power		x		per month
	Per Year				per year
Frequency Adjust	Mechanical	Coarse			
		Fine			
	Electrical	Range			
		Linearity			%
		Slope			
	Control Voltage Range				Vdc
Package Size			x		
Mounting Style			x		
Connections			x		
Marking					
Additional Notes					
Name					
Job Title					
Company Name					
Address					
Postcode					
Telephone			E-mail		
Fax			http://		

CFPO-US1: Ultra Stable OCXO

ISSUE 1; 10 SEPTEMBER 1999

Package Outline
- 67.0 × 60.0 × 40.0mm (67A)
- 89.0 × 80.0 × 55.0mm (89)
- 138.0 × 73.0 × 88.0mm (138)

Supply Option
- 12V (12), 15V (15), 24V (24)

Standard Frequencies
- 5.0MHz, 10.0MHz

Input Current @ 12V
- Warm up: 850mA (10W
- @ 25°C: 200mA (2.4W

Storage Temperature Range
- –30 to 85°C

Warm Up Time
- 1×10^{-8} after 15 minutes

Retrace after 24 hours off
- 2×10^{-9} after 60 minutes

Output Compatibility
- HCMOS (C) (67A)
- Sine (S): 4dBm (67A) 7dBm (89, 138)

Frequency Stability Vs Supply Voltage change (±5%) and Load Change (50Ω±10%)
- Load: $\pm 2 \times 10^{-11}$; Supply: $\pm 2 \times 10^{-11}$

Harmonic Distortion
- 40dBc

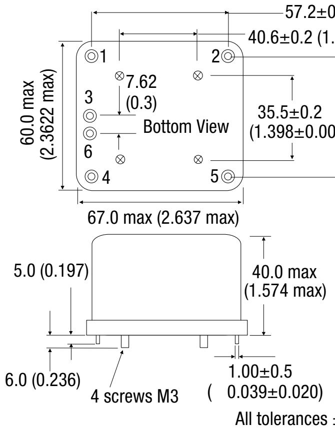
Spurious
- <70dBc

Environmental Specification (non-operating)
- Shock: 50g for 11ms, 3 shocks in each direction of main axis
- Vibration: 10 to 500Hz 10g acceleration (67A)
- Vibration: 10 to 150Hz 10g acceleration (89, 138)

Weight
- 350g (67A), 600g (89), 900g (138)

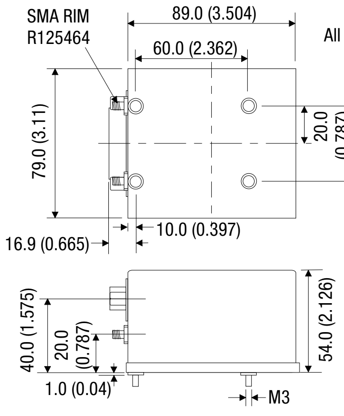
Marking Includes
- Model number (including options)
- Frequency
- Date Code (Year/Week)

Outline in mm (inches) - (scale 1:3) - Package 67A



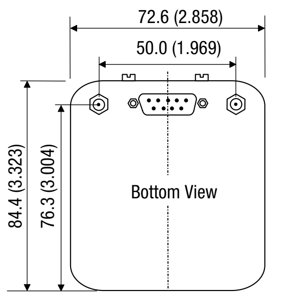
Pin	Function
1	Output Signal
2	Output reference voltage
3	Mechanical ground and (-) supply
4	Input frequency control
5	Input supply (+)
6	Oven Alarm

Outline in mm (inches) - (scale 1:3) - Package 89



Pin	Function
1	N/C
2	0V (Gnd)
3	Gnd
4	Potentiometer CCW (to ground)
5	Input Frequency Control
6	N/C
7	+Vs
8	N/C
9	Potentiometer CW (output reference voltage)
SMA	Output Signal

Outline in mm (inches) - (scale 1:3) - Package 138



Pin	Function
1	N/C
2	0V (Gnd)
3	Gnd
4	Potentiometer CCW (to ground)
5	Input Frequency Control
6	N/C
7	+Vs
8	N/C
9	Potentiometer CW (output reference voltage)
SMA	Output Signal

Electrical Specification

Operating Temperature Range*	Stability within Temperature Range	Short Term Stability @ 5.0MHz (typical figures) Allan Std deviation			Long Term Stability at 25°C after 30 days operation			Frequency Adjustment	Model Number
		1 second	10 seconds	100 seconds	Per day	Per Month	Per Year		
20 to 60°C	$\pm2.5\times10^{-11}$	$\pm2\times10^{-13}$	$\pm1.5\times10^{-13}$	$\pm5\times10^{-13}$	$\pm2\times10^{-11}$	$\pm6\times10^{-10}$	$\pm5\times10^{-9}$	5×10^{-7}	CFPO-US1 H1
20 to 60°C	$\pm2.5\times10^{-11}$	$\pm5\times10^{-13}$	$\pm3\times10^{-13}$	$\pm8\times10^{-13}$	$\pm2\times10^{-11}$	$\pm6\times10^{-10}$	$\pm5\times10^{-9}$	5×10^{-7}	CFPO-US1 S1

Ordering Example CFPO-US1 H1 89-S 12 10MHz

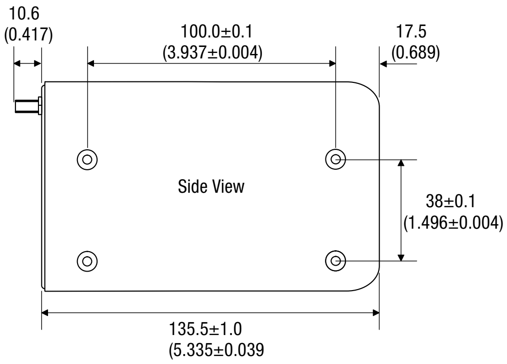
Model
Package Outline (67A) (89) (138)
Output Signal (C) (S)
Supply Voltage (12) (15) (24)
Frequency (MHz)

*Please note: Extended Operating Temperature Ranges may be available on request. Please contact Application Support for further details.

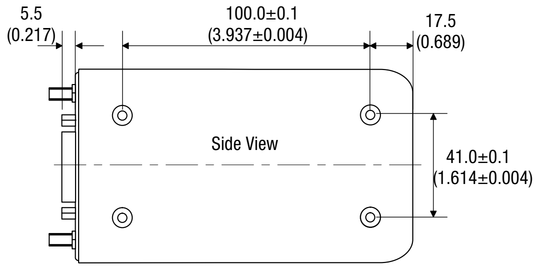
Phase Noise (typical figures)

Frequency	Frequency offset from carrier: 1Hz	Frequency offset from carrier: 10Hz	Frequency offset from carrier: 100Hz	Frequency offset from carrier: 1kHz	Model Number
5.0MHz	120dBc/Hz	140dBc/Hz	150dBc/Hz	150dBc/Hz	CFPO-US1 H1
5.0MHz	115dBc/Hz	135dBc/Hz	145dBc/Hz	155dBc/Hz	CFPO-US1 S1

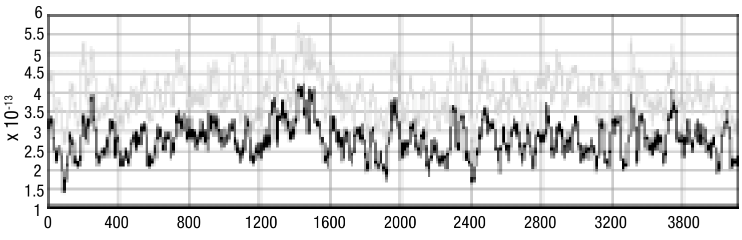
Outline in mm (inches) - (scale 1:3) - Package 138



Outline in mm (inches) - (scale 1:3) - Package 138



Performance - short term stability Allan Std deviation @ 10.0MHz - 10 seconds



CFPO-1: Very High Stability OCXO

ISSUE 2; 5 JULY 1999

Description

- The CFPO-1 is a very high stability oven controlled crystal oscillator providing excellent frequency stability and insensitivity to temperature variations in a hermetically sealed metal package

Package Outlines

- 50.8 × 50.8 × 38.0mm (50B)
- 67.0 × 60.0 × 40.0mm (67A)

Supply Options

- 12V (12)
- 15V (15)
- 24V (24)

Standard Frequencies

- 4.0960MHz, 5.0MHz, 8.1920MHz, 10.0MHz

Frequency Ranges

- 2.0 to 10.240MHz (CFPO-1 H1, -H2, -H3, -H4)
- 2.0 to 13.0MHz (CFPO-1 S1, -S2, -S3, -S4)

Input Current @ 12V

- Warm Up: 700mA (8.5W)
- @ 25°C: 200mA (2.4W) (calm air)

Storage Temperature Range

- –55 to 90°C

Warm Up Time @ 25°C

- 1×10^{-8} after 15 mins

Retrace after 24 hours off @ 25°C

- 2×10^{-9} after 60 minutes

Output Compatibility

- Sinewave 4 dBm typical (50ohms) (S)
- HCMOS (C)

Harmonic Distortion

- 40dB

Phase Noise @ 10.0MHz (sine output)

10Hz –135 dBc/Hz

100Hz –145 dBc/Hz

1kHz –155 dBc/Hz

10kHz –155 dBc/Hz

Oven Alarm

- Included

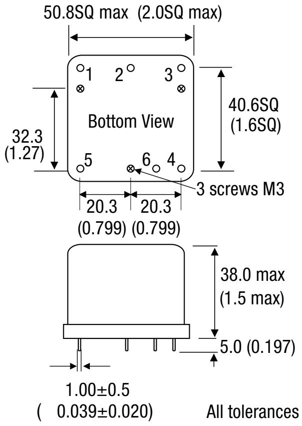
Environmental Specification (non-operating)

- Shock: 50g for 11ms
- Vibration: 10g for 10 to 500Hz

Marking Includes

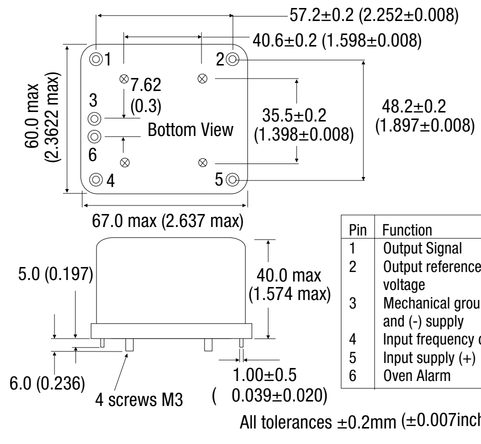
- Model number (including options)
- Frequency
- Date Code (Year/Week)

Outline in mm (inches) - (scale 1:3) - Package 50B



Pin	Function
1	Input frequency control
2	Output reference voltage
3	Output signal
4	Mechanical ground and (-) supply
5	Input supply (+)
6	Oven Alarm

Outline in mm (inches) - (scale 1:3) - Package 67A



Pin	Function
1	Output Signal
2	Output reference voltage
3	Mechanical ground and (-) supply
4	Input frequency control
5	Input supply (+)
6	Oven Alarm

Electrical Specification

Operating Temperature Range*	Stability within Temperature Range	Long Term Stability @ 25°C after 30 days operation			Frequency Adjustment	Frequency Stability Vs Supply Voltage change (±5%) and Load Change (50Ω ±10%)	Model Number
		Per day	Per Month	Per Year			
–20 to 60°C	$\pm5\times10^{-11}$	$\pm2\times10^{-11}$	$\pm6\times10^{-10}$	$\pm5\times10^{-9}$	2×10^{-7}	$\pm5\times10^{-11}$	CFPO-1 H1
–20 to 60°C	$\pm5\times10^{-11}$	$\pm3\times10^{-11}$	$\pm1\times10^{-9}$	$\pm8\times10^{-9}$	4×10^{-7}	$\pm5\times10^{-11}$	CFPO-1 H2
–20 to 60°C	$\pm5\times10^{-11}$	$\pm7\times10^{-11}$	$\pm2\times10^{-9}$	$\pm1.5\times10^{-8}$	6×10^{-7}	$\pm1\times10^{-10}$	CFPO-1 H3
–20 to 60°C	$\pm5\times10^{-11}$	$\pm1.5\times10^{-10}$	$\pm4\times10^{-9}$	$\pm2.5\times10^{-8}$	8×10^{-7}	$\pm1\times10^{-10}$	CFPO-1 H4
–20 to 60°C	$\pm1\times10^{-10}$	$\pm2\times10^{-11}$	$\pm6\times10^{-10}$	$\pm5\times10^{-9}$	2×10^{-7}	$\pm1\times10^{-10}$	CFPO-1 S1
–20 to 60°C	$\pm1\times10^{-10}$	$\pm3\times10^{-11}$	$\pm1\times10^{-9}$	$\pm8\times10^{-9}$	4×10^{-7}	$\pm1\times10^{-10}$	CFPO-1 S2
–20 to 60°C	$\pm1\times10^{-10}$	$\pm7\times10^{-11}$	$\pm2\times10^{-9}$	$\pm1.5\times10^{-8}$	6×10^{-7}	$\pm1\times10^{-10}$	CFPO-1 S3
–20 to 60°C	$\pm1\times10^{-10}$	$\pm1.5\times10^{-10}$	$\pm4\times10^{-9}$	$\pm2.5\times10^{-8}$	8×10^{-7}	$\pm1\times10^{-10}$	CFPO-1 S4

Ordering Example CFPO-1 S2 50B-C24 10.0MHz

- Model
- Package Outline (50B) (67A)
- Output Signal (S) (C)
- Supply Voltage (12) (15) (24)
- Frequency (MHz)

*Please note: Extended Operating Temperature Ranges may be available on request. Please contact Application Support for further details.

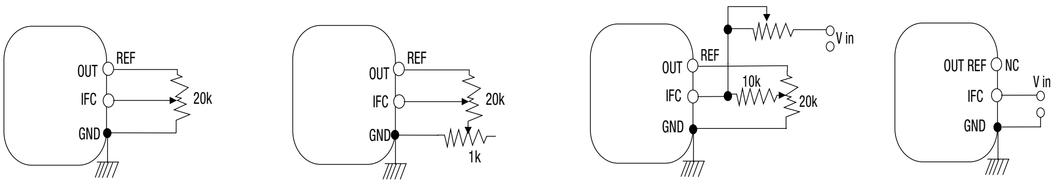
External Frequency Adjustment

Manual freq. adjust.
Settability ≤ 1 x 10 $^{-8}$

Fine manual freq. adjust.
Settability ≤1 x 10 $^{-10}$

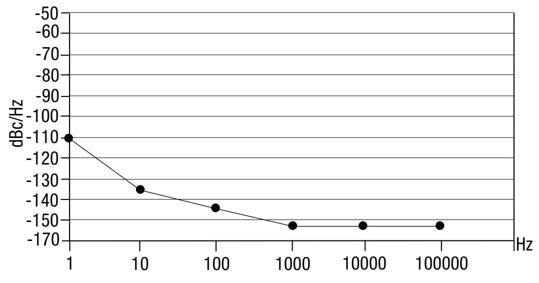
Freq. control voltage and manual adjust

Ext. freq. control voltage



All potentiometers must be 10 turns type with temperature coefficient 50ppm/°C

Typical Phase Noise @ 10.0MHz



CFPO-2 H: Ultra Low Phase Noise & High Stability OCXO

ISSUE 3; 10 SEPTEMBER 1999

Description
- Ultra low phase noise and high stability OCXO

Package Outlines
- 50.8 × 50.8 × 38.0mm (50B)
- 67.0 × 60.0 × 40.0mm (67A)

Supply Options
- 12V (12), 15V (15), 24V (24)

Standard Frequencies
- 5.0MHz, 10.0MHz

Input Current @ 12V
- Warm Up: 700mA (8.5W)
- @ 25°C: 200mA (2.4W) (calm air)

Storage Temperature Range
- –55 to 90°C

Warm Up Time @ 25°C
- 1 × 10^{-8} after 15 mins (calm air)

Retrace after 24 hours off @ 25°C
- 2 × $^{-9}$ after 60 mins

Output Compatibility
- Sine 4 dBm typical 50)

Harmonic Distortion
- 30dB

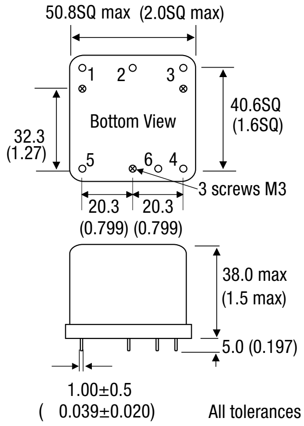
Phase Noise @ 10.0MHz (sine output)
10Hz –130 dBc/Hz
100Hz –152 dBc/Hz
1kHz –160 dBc/Hz
10kHz –165 dBc/Hz

Oven Alarm
- Included

Environmental Specification (non-operating)
- Shock: 50g for 11ms
- Vibration: 10g for 10 to 500Hz

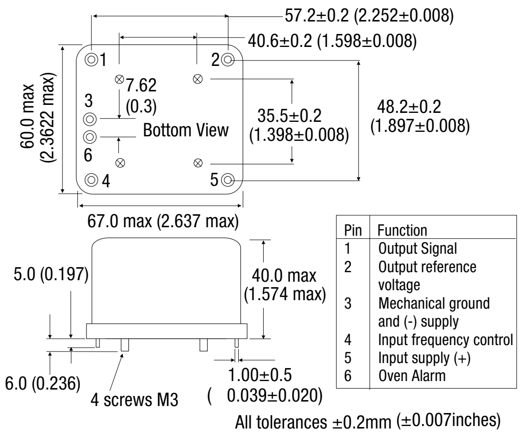
Marking Includes
- Model number (including options)
- Frequency
- Date Code (Year/Week)

Outline in mm (inches) - (scale 1:3) - Package 50B



Pin	Function
1	Input frequency control
2	Output reference voltage
3	Output signal
4	Mechanical ground and (-) supply
5	Input supply (+)
6	Oven Alarm

Outline in mm (inches) - (scale 1:3) - Package 67A



Pin	Function
1	Output Signal
2	Output reference voltage
3	Mechanical ground and (-) supply
4	Input frequency control
5	Input supply (+)
6	Oven Alarm

OCXOs & RUBIDIUM OSCILLATORS

Electrical Specification

Operating Temperature Range*	Stability within Temperature Range	Long Term Stability @ 25°C after 30 days operation			Frequency Adjustment	Frequency Stability Vs Supply Voltage change (±5%) and Load Change (50Ω ±10%)	Model Number
		Per day	Per Month	Per Year			
–20 to 60°C	$\pm1\times10^{-10}$	$\pm3\times10^{-11}$	$\pm1\times10^{-9}$	$\pm8\times10^{-9}$	4×10^{-7}	$\pm1\times10^{-10}$	CFPO-2 H1
–20 to 60°C	$\pm1\times10^{-10}$	$\pm7\times10^{-11}$	$\pm2\times10^{-9}$	$\pm1.5\times10^{-8}$	6×10^{-7}	$\pm1\times10^{-10}$	CFPO-2 H2
–20 to 60°C	$\pm1\times10^{-10}$	$\pm1.5\times10^{-10}$	$\pm4\times10^{-9}$	$\pm2.5\times10^{-8}$	8×10^{-7}	$\pm1\times10^{-10}$	CFPO-2 H3

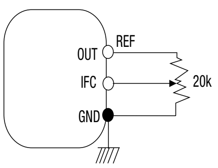
Ordering Example CFPO-2 H3 50B-15V 8.1920MHz

Model
Package Outline (50B) (67A)
Supply Voltage (12) (15) (24)
Oven Alarm (V)
Frequency (MHz)

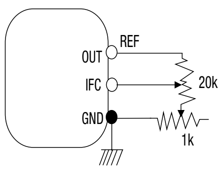
*Please note: Extended Operating Temperature Ranges may be available on request. Please contact Application Support for further details.

External Frequency Adjustment

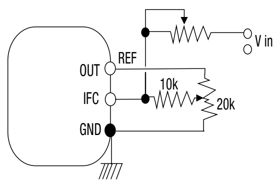
Manual freq. adjust.
Settability $\le 1 \times 10^{-8}$



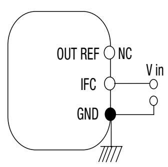
Fine manual freq. adjust.
Settability $\le 1 \times 10^{-10}$



Freq. control voltage and manual adjust

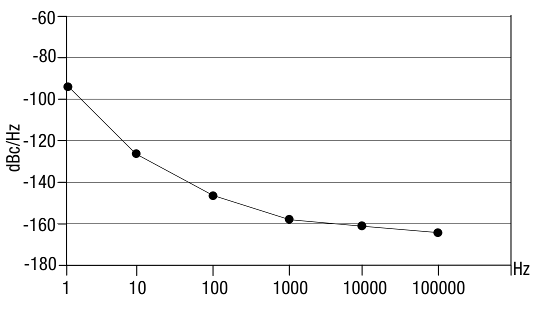


Ext. freq. control voltage



All potentiometers must be 10 turns type with temperature coefficient 50ppm/°C

Typical Phase Noise @ 10.0MHz



CFPO-2 S: Ultra Low Phase Noise & High Stability OCXO

ISSUE 3; 10 SEPTEMBER 1999

Description
- Ultra low phase noise and high stability OCXO

Package Outlines
- 50.8 × 50.8 × 25.4mm (50)
- 51.0 × 41.0 × 25.0mm (51)
- 67.0 × 60.0 × 40.0mm (67)

Supply Options
- 12V (12)
- 15V (15)
- 24V (24)

Standard Frequencies
- 5.0MHz, 10.0MHz

Frequency Range
- 5.0 to 13.0MHz

Input Current @ 12V
- Warm Up: 500mA (6.0W)
- @ 25°C: 180mA (2.2W) (calm air)

Storage Temperature Range
- –55 to 90°C

Warm Up Time @ 25°C
- $\pm 3 \times 10^{-8}$ after 15 mins

Retrace after 24 hours off @ 25°C
- $\pm 2 \times 10^{-9}$ after 60 mins

Output Compatibility
- Sine 4 dBm typical (50ohms) (S)

Harmonic Distortion
- 30dB

Phase Noise @ 10.0MHz (sine output)
10Hz –130 dBc/Hz

100Hz –152 dBc/Hz

1kHz –160 dBc/Hz

10kHz –165 dBc/Hz

Oven Alarm
- Optional (V)

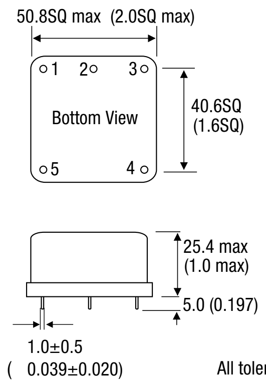
Mechanical Adjustment
- Optional (T)

OCXOs & RUBIDIUM OSCILLATORS

Environmental Specification (non-operating)
- Shock: 50g for 11ms
- Vibration: 10g for 10 to 500Hz

Marking Includes
- Model number (including options)
- Frequency
- Date Code (Year/Week)

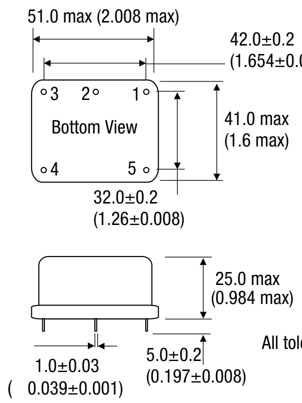
Outline in mm (inches) - (scale 1:3) - Package 50



Pin	Function
1	Input frequency control
2	Output ref. voltage
3	Output signal
4	Mechanical ground and (–) supply
5	Input supply (+)

All tolerances ±0.2mm (±0.007inches)

Outline in mm (inches) - (scale 1:3) - Package 51



Pin	Function
1	Mechanical GND and supply
2	Frequency control input
3	Ref. voltage output
4	Supply Input
5	Signal output

All tolerances ±0.2mm (±0.007inches)

Electrical Specification

Operating Temperature Range*	Stability within Temperature Range	Long Term Stability @ 25°C after 30 days operation			Frequency Adjustment	Frequency Stability Vs Supply Voltage change (±5%) and Load Change (50Ω ±10%)	Model Number
		Per day	Per Month	Per Year			
0 to 70°C	$\pm 2.5\times10^{-9}$	$\pm 5\times10^{-11}$	$\pm 1.5\times10^{-9}$	$\pm 1.2\times10^{-8}$	5×10^{-7}	$\pm 2\times10^{-10}$	CFPO-2 S1
0 to 70°C	$\pm 5\times10^{-9}$	$\pm 1\times10^{-10}$	$\pm 3\times10^{-9}$	$\pm 1.5\times10^{-8}$	7×10^{-7}	$\pm 2\times10^{-10}$	CFPO-2 S2
0 to 70°C	$\pm 5\times10^{-9}$	$\pm 2\times10^{-10}$	$\pm 6\times10^{-9}$	$\pm 3\times10^{-8}$	7×10^{-7}	$\pm 3\times10^{-10}$	CFPO-2 S3
0 to 70°C	$\pm 5\times10^{-9}$	$\pm 3\times10^{-10}$	$\pm 1\times10^{-8}$	$\pm 5\times10^{-8}$	7×10^{-7}	$\pm 5\times10^{-10}$	CFPO-2 S4

Ordering Example** CFPO-2 S1 50-C15VT 10.0MHz

Model
Package Outline (50) (51) (67)
Output Signal (C) (S)
Supply Voltage (12) (15) (24)
Oven Alarm (V)
Mechanical Adjustment (T)
Frequency (MHz)

*Please note: Extended Operating Temperature Ranges may be available on request. Please contact Application Support for further details.
**Please note options Mechanical Adjustment and 24V Supply Voltage are not available with package 51

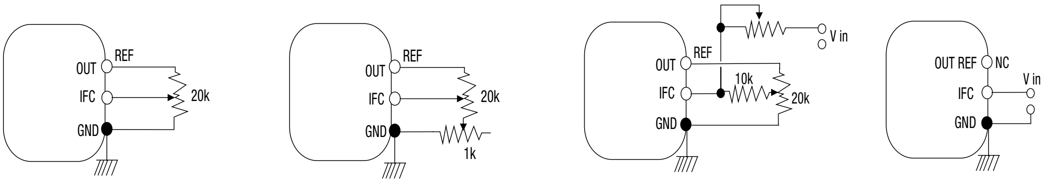
External Frequency Adjustment

Manual freq. adjust.
Settability ≤ 1 x 10 $^{-8}$

Fine manual freq. adjust.
Settability ≤1 x 10 $^{-10}$

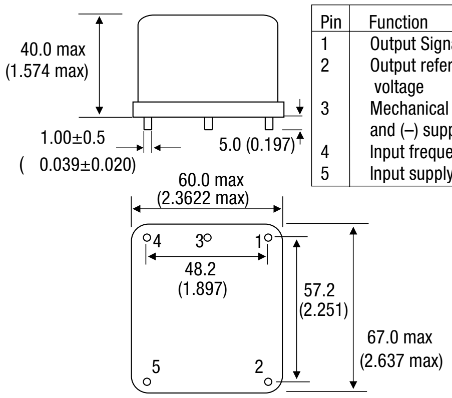
Freq. control voltage and manual adjust

Ext. freq. control voltage



All potentiometers must be 10 turns type with temperature coefficient 50ppm/°C

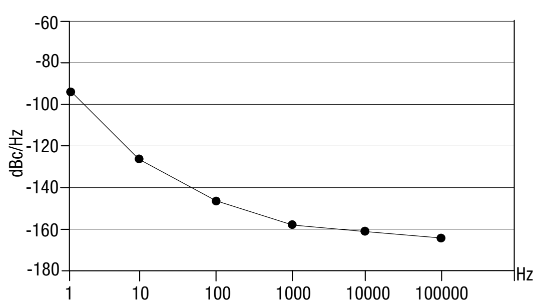
Outline in mm (inches) - (scale 1:3) - Package 67



Pin	Function
1	Output Signal
2	Output reference voltage
3	Mechanical ground and (–) supply
4	Input frequency control
5	Input supply (+)

All tolerances ±0.2mm (±0.007inches)

Typical Phase Noise @ 10.0MHz



CFPO-DO3: High Stability OCXO

ISSUE 1; 1 OCTOBER 1999

Description

- Double Oven high stability OCXO

Package Outlines

- 50.8 × 50.8 × 38.0mm (50C)
- 67.0 × 60.0 × 40.0mm (67)

Supply Options

- 12V (12)
- 15V (15)

Standard Frequencies

- 4.0960MHz, 5.0MHz, 8.1920MHz, 10.0MHz, 13.0MHz, 16.3840MHz

Frequency Ranges

- 2.0 to 16.3840MHz (CFPO-3 DO H1)
- 2.0 to 26.0MHz (CFPO-3 DO H2, -S1)
- 2.0 to 40.0MHz (CFPO-3 DO H3, -S2, -S3)

Input Current @ 12V

- Warm up: 850m (10W)
- @ 25°C 250mA (3W)(calm air)

Storage Temperature Range

- –55 to 90°C

Warm Up Time @ 25°C

- $\pm 5 \times 10^{-8}$ after 10 mins (calm air)

Retrace after 24 hours off @ 25°C

- $\pm 2 \times 10^{-9}$ after 60 mins

Ouput Compatibility

- Sine 3dBm (S)
- HCMOS (C)

Harmonic Distortion

- 30dB

Phase Noise @ 10MHz (sine output)

10Hz –130 dBc/Hz

z –140 dBc/Hz

1kHz –150 dBc/Hz

10kHz –155 dBc/Hz

Oven Alarm

- Optional (V)

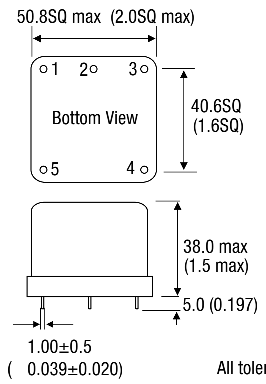
Environmental Specification (non-operating)

- Shock: 50g for 11ms
- Vibration: 10g for 10 to 500Hz

Marking Includes

- Model number (including options)
- Frequency
- Date Code (Year/Week)

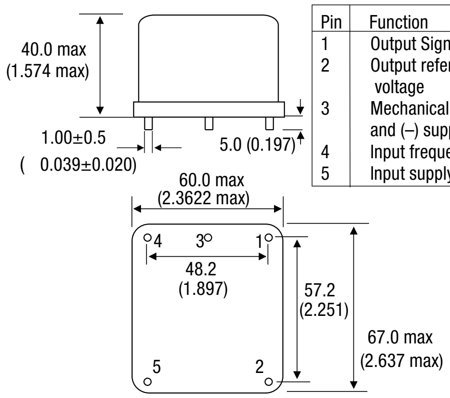
Outline in mm (inches) - (scale 1:3) - Package 50C



Pin	Function
1	Input frequency control
2	Output ref. voltage
3	Output signal
4	Mechanical ground and (–) supply
5	Input supply (+)

All tolerances ±0.2mm (±0.007inches)

Outline in mm (inches) - (scale 1:3) - Package 67



Pin	Function
1	Output Signal
2	Output reference voltage
3	Mechanical ground and (–) supply
4	Input frequency control
5	Input supply (+)

All tolerances ±0.2mm (±0.007inches)

OCXOs & RUBIDIUM OSCILLATORS

Electrical Specification

Operating Temperature Range*	Stability within Temperature Range	Long Term Stability @ 25°C after 30 days operation			Frequency Adjustment	Frequency Stability Vs Supply Voltage change (±5%) and Load Change (50Ω ±10%)	Model Number
		Per day	Per Month	Per Year			
–20 to 60°C	$\pm 2.5\times10^{-10}$	$\pm 5\times10^{-11}$	$\pm 1.5\times10^{-9}$	$\pm 1.2\times10^{-8}$	6×10^{-7}	$\pm 2\times10^{-10}$	CFPO-DO3 H1
–20 to 60°C	$\pm 2.5\times10^{-10}$	$\pm 1\times10^{-10}$	$\pm 3\times10^{-9}$	$\pm 1.5\times10^{-8}$	6×10^{-7}	$\pm 2\times10^{-10}$	CFPO-DO3 H2
–20 to 60°C	$\pm 2.5\times10^{-10}$	$\pm 2\times10^{-10}$	$\pm 6\times10^{-9}$	$\pm 3\times10^{-8}$	7×10^{-7}	$\pm 2\times10^{-10}$	CFPO-DO3 H3
–20 to 60°C	$\pm 5\times10^{-10}$	$\pm 1\times10^{-10}$	$\pm 3\times10^{-9}$	$\pm 1.5\times10^{-8}$	6×10^{-7}	$\pm 5\times10^{-10}$	CFPO-DO3 S1
–20 to 60°C	$\pm 5\times10^{-10}$	$\pm 2\times10^{-10}$	$\pm 6\times10^{-9}$	$\pm 3\times10^{-8}$	7×10^{-7}	$\pm 5\times10^{-10}$	CFPO-DO3 S2
–20 to 60°C	$\pm 1\times10^{-9}$	$\pm 3\times10^{-10}$	$\pm 1\times10^{-8}$	$\pm 5\times10^{-8}$	7×10^{-7}	$\pm 5\times10^{-10}$	CFPO-DO3 S3

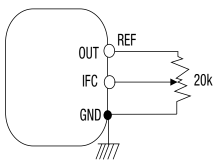
Ordering Example: CFPO-DO3 S2 50C-C12V 10.0MHz

- Model
- Package Outline (50C) (67)
- Output Signal (C) (S)
- Supply Voltage (12) (15) (24)
- Oven Alarm (V)
- Frequency (MHz)

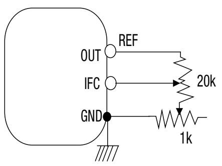
*Please note: Extended Operating Temperature Ranges may be available on request. Please contact Application Support for further details.

External Frequency Adjustment

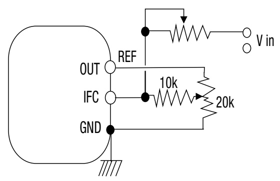
Manual freq. adjust.
Settability $\leq 1 \times 10^{-8}$



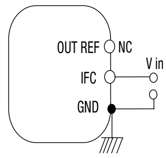
Fine manual freq. adjust.
Settability $\leq 1 \times 10^{-10}$



Freq. control voltage and manual adjust



Ext. freq. control voltage



All potentiometers must be 10 turns type with temperature coefficient 50ppm/°C

CFPO-3: High Stability OCXO

ISSUE 2; 5 JULY 1999

Description

- High stability OCXO

Package Outlines

- 50.8 × 50.8 × 25.4mm (50)
- 51.0 × 41.0 × 25.0mm (51)
- 67.0 × 60.0 × 40.0mm (67)

Supply Options

- 12V (12), 15V (15), 24V (24)

Standard Frequencies

- 4.096MHz, 5.0MHz, 8.192MHz, 10.0MHz, 13.0MHz, 16.384MHz

Frequency Ranges

- 2.0 to 16.384MHz (CFPO-3 H1, -H2, -S1, -S2)
- 2.0 to 40.0MHz (CFPO-3 H3, -H4, -S3, -S4)

Input Current @ 12V

- Warm up: 500m (6W)
- @ 25°C 180mA (2.2W)(calm air)

Storage Temperature Range

- –55 to 90°C

Warm Up Time @ 25°C

- 3×10^{-8} after 10 mins (calm air)

Retrace after 24 hours off @ 25°C

- 2×10^{-9} after 60 mins

Ouput Compatibility

- Sine 3dBm (S)
- HCMOS (C)

Harmonic Distortion

- 30dB

Frequency Control Linearity

- 10%

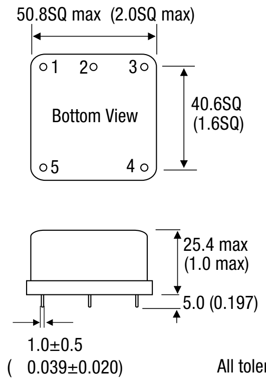
Environmental Specification (non-operating)

- Shock: 50g for 11ms
- Vibration: 10g for 10 to 500Hz

Marking Includes

- Model number (including options)
- Frequency
- Date Code (Year/Week)

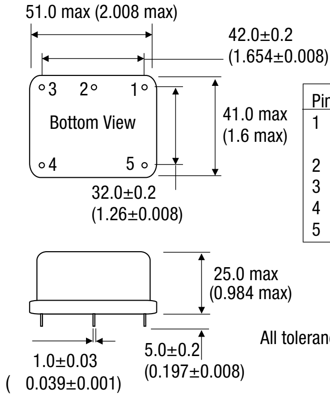
Outline in mm (inches) - (scale 1:3) - Package 50



Pin	Function
1	Input frequency control
2	Output ref. voltage
3	Output signal
4	Mechanical ground and (–) supply
5	Input supply (+)

All tolerances ±0.2mm (±0.007inches)

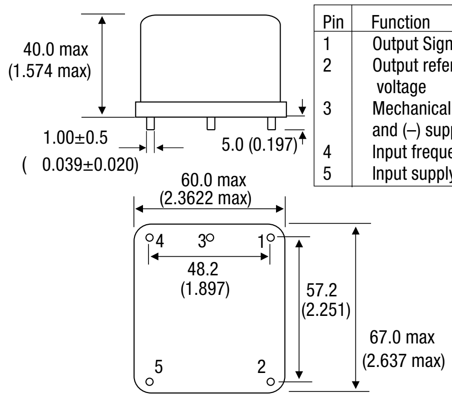
Outline in mm (inches) - (scale 1:3) - Package 51



Pin	Function
1	Mechanical GND and supply
2	Frequency control input
3	Ref. voltage output
4	Supply Input
5	Signal output

All tolerances ±0.2mm (±0.007inches)

Outline in mm (inches) - (scale 1:3) - Package 67



Pin	Function
1	Output Signal
2	Output reference voltage
3	Mechanical ground and (–) supply
4	Input frequency control
5	Input supply (+)

All tolerances ±0.2mm (±0.007inches)

Electrical Specification

Operating Temperature Range*	Stability within Temperature Range	Long Term Stability @ 25°C after 30 days operation			Frequency Adjustment	Frequency Stability Vs Supply Voltage change (±5%) and Load Change (50Ω ±10%)	Model Number
		Per day	Per Month	Per Year			
–20 to 70°C	$\pm2.5\times10^{-9}$	$\pm5\times10^{-11}$	$\pm1.5\times10^{-9}$	$\pm1.2\times10^{-8}$	7×10^{-7}	$\pm 2\times10^{-10}$	CFPO-3 H1
–20 to 70°C	$\pm2.5\times10^{-9}$	$\pm1\times10^{-10}$	$\pm3\times10^{-9}$	$\pm2\times10^{-8}$	7×10^{-7}	$\pm 2\times10^{-10}$	CFPO-3 H2
–20 to 70°C	$\pm2.5\times10^{-9}$	$\pm2\times10^{-10}$	$\pm6\times10^{-9}$	$\pm3\times10^{-8}$	7×10^{-7}	$\pm 2\times10^{-10}$	CFPO-3 H3
–20 to 70°C	$\pm2.5\times10^{-9}$	$\pm3\times10^{-10}$	$\pm1\times10^{-8}$	$\pm5\times10^{-8}$	7×10^{-7}	$\pm 2\times10^{-10}$	CFPO-3 H4
–20 to 70°C	$\pm.5\times10^{-9}$	$\pm5\times10^{-11}$	$\pm1.5\times10^{-9}$	$\pm1.2\times10^{-8}$	7×10^{-7}	$\pm 2\times10^{-10}$	CFPO-3 S1
–20 to 70°C	$\pm.5\times10^{-9}$	$\pm1\times10^{-10}$	$\pm3\times10^{-9}$	$\pm2\times10^{-8}$	7×10^{-7}	$\pm 2\times10^{-10}$	CFPO-3 S2
–20 to 70°C	$\pm.5\times10^{-9}$	$\pm2\times10^{-10}$	$\pm6\times10^{-9}$	$\pm3\times10^{-8}$	7×10^{-7}	$\pm 2\times10^{-10}$	CFPO-3 S3
–20 to 70°C	$\pm.5\times10^{-9}$	$\pm3\times10^{-10}$	$\pm1\times10^{-8}$	$\pm5\times10^{-8}$	7×10^{-7}	$\pm 2\times10^{-10}$	CFPO-3 S4

Ordering Example** CFPO-3 S1 50-C12V 10.0MHz

- Model
- Package Outline (50) (51) (67)
- Output Signal (C) (S)
- Supply Voltage (12) (15) (24)
- Optional Oven Alarm (V)
- Frequency (MHz)

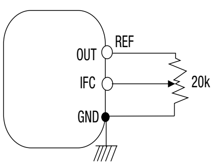
*Please note: Extended Operating Temperature Ranges may be available on request. Please contact Application Support for further details.
**Please note: Supply Voltage options are not available with package 51

Phase Noise - Sine Output (typical figures)

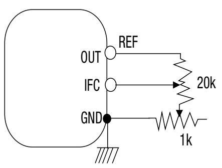
Frequency	Frequency offset from carrier: 10Hz	Frequency offset from carrier: 100Hz	Frequency offset from carrier: 1kHz	Frequency offset from carrier: 10kHz	Model Number
10.0MHz	130dBc/Hz	140dBc/Hz	155dBc/Hz	158dBc/Hz	CFPO-3

External Frequency Adjustment

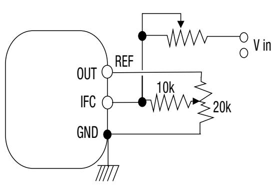
Manual freq. adjust.
Settability $\leq 1 \times 10^{-8}$



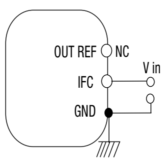
Fine manual freq. adjust.
Settability $\leq 1 \times 10^{-10}$



Freq. control voltage and manual adjust



Ext. freq. control voltage



All potentiometers must be 10 turns type with temperature coefficient 50ppm/°C

CFPO-4: High Stability OCXO

ISSUE 3; 10 SEPTEMBER 1999

Description
- High stability OCXO

Package Outline
- 40.0 × 30.0 × 20.0mm (40)
- 50.8 × 50.8 × 25.4mm (50)
- 51.0 × 41.0 × 25.0mm (51)

Supply Options
- 9V (9)
- 12V (12)
- 15V (15)

Standard Frequencies
- 4.0960MHz, 5.0MHz, 8.1920MHz, 10.0MHz, 13.0MHz, 16.3840MHz, 26.0MHz

Frequency Ranges
- 2.0 to 16.3840MHz (CFPO-4, -A1, -A2)
- 2.0 to 40.0MHz (CFPO-4, -A3, -A4)

Input Current @ 12V
- Warm up: 500m (6W)
- @ 25°C: 150mA (1.8W calm air)

Storage Temperature Range
- –55 to 90°C

Warm Up Time @ 25°C
- 1 × $^{-8}$ after 10 minutes (calm air)

Retrace after 24 hours off
- 2 × 10^{-9} after 60 minutes

Ouput Compatibility
- Sine 3dBm (50ohms) (S)
- HCMOS (C)

Phase Noise @ 10MHz (sine output)
10Hz –120 dBc/Hz

100Hz –140 dBc/Hz

1kHz –150 dBc/Hz

10kHz –155 dBc/Hz

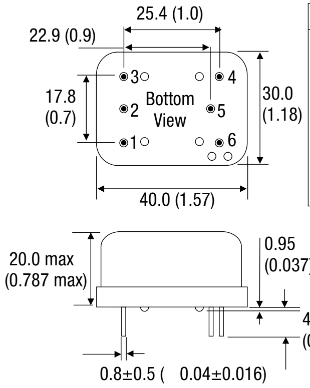
Frequency Control Linearity
- 10%

Oven Alarm
- Included in package 40
- Optional in package 50 (V)
- Optional in package 51 (V)

Environmental Specification (non-operating)
- Shock: 50g for 11ms
- Vibration: 10g for 10 to 500Hz

Marking Includes
- Model number (including options)
- Frequency
- Date Code (Year/Week)

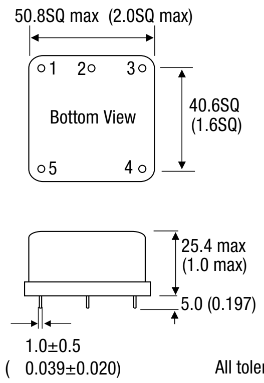
Outline in mm (inches) - (scale 1:2) - Package 40



Pin	Function
1	Input frequency control
2	Output reference voltage
3	Input supply (+)
4	Output signal
5	Oven alarm
6	Mechanical ground and (–) supply

All tolerances ±0.2mm (±0.007inches)

Outline in mm (inches) - (scale 1:3) - Package 50



Pin	Function
1	Input frequency control
2	Output ref. voltage
3	Output signal
4	Mechanical ground and (–) supply
5	Input supply (+)

All tolerances ±0.2mm (±0.007inches)

OCXOs & RUBIDIUM OSCILLATORS

Electrical Specification

Operating Temperature Range*	Stability within Temperature Range	Long Term Stability @ 25°C after 30 days operation			Frequency Adjustment	Frequency Stability Vs Supply Voltage change (±5%) and Load Change (1 to 2 HCMOS)	Model Number
		Per day	Per Month	Per Year			
–20 to 75°C	$\pm2\times10^{-9}$	$\pm7\times10^{-11}$	$\pm2\times10^{-9}$	$\pm1.3\times10^{-8}$	7×10^{-7}	$\pm2\times10^{-10}$	CFPO-4 A1
–20 to 75°C	$\pm3\times10^{-9}$	$\pm1\times10^{-10}$	$\pm3\times10^{-9}$	$\pm1.5\times10^{-8}$	7×10^{-7}	$\pm2\times10^{-10}$	CFPO-4 A2
–20 to 75°C	$\pm5\times10^{-9}$	$\pm2\times10^{-10}$	$\pm6\times10^{-9}$	$\pm3\times10^{-8}$	7×10^{-7}	$\pm5\times10^{-10}$	CFPO-4 A3
–20 to 75°C	$\pm5\times10^{-9}$	$\pm3\times10^{-10}$	$\pm1\times10^{-8}$	$\pm5\times10^{-8}$	7×10^{-7}	$\pm5\times10^{-10}$	CFPO-4 A4

Ordering Example CFPO-4 A1 50-C12V 10.0MHz

Model
Package Outline (40) (50) (51)
Output Signal (C) (S**)
Supply Voltage (9) (12) (15)
Oven Alarm (V)
Frequency (MHz)

*Please note: Extended Operating Temperature Ranges may be available on request. Please contact Application Support for further details.
** Sine available in package 40 from 8.19MHz to 16.384MHz

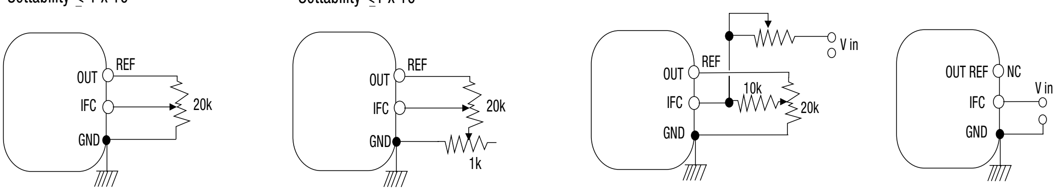
External Frequency Adjustment

Manual freq. adjust.
Settability $\leq 1 \times 10^{-8}$

Fine manual freq. adjust.
Settability $\leq 1 \times 10^{-10}$

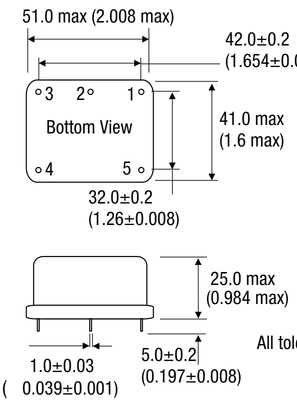
Freq. control voltage and manual adjust

Ext. freq. control voltage



All potentiometers must be 10 turns type with temperature coefficient 50ppm/°C

Outline in mm (inches) - (scale 1:3) - Package 51



Pin	Function
1	Mechanical GND and supply
2	Frequency control input
3	Ref. voltage output
4	Supply Input
5	Signal output

All tolerances ±0.2mm (±0.007inches)

OCXOs & RUBIDIUM OSCILLATORS

CFPO-5: Standard OCXO

ISSUE 2; 10 SEPTEMBER 1999

Description

- SC Cut Standard OCXO (CFPO-5A)
- AT Cut Standard OCXO (CFPO-5B)
- AT Cut, Large Pulling OCXO (CFPO-5C)

Package Outlines

- 36.0 × 27.0 × 19.0mm (36)
- 36.0 × 27.0 × 19.0mm (36A)
- 50.8 × 50.8 × 25.4mm (50)
- 51.0 × 41.0 × 25.0mm (51)

Supply Options

- 5V (5)
- 9V (9)
- 12V (12)

Standard Frequencies

- 8.1920MHz, 10.0MHz, 13.0MHz, 16.3840MHz, 19.440MHz, 20.0MHz, 26.0MHz, 38.880MHz

Frequency Range

- 4.0960 to 26.0MHz (CFPO-5A1, -A3)
- 4.0960 to 38.880MHz (CFPO-5A2, -A4, -A5, -B1, -B2, -B3, -C1)

Input Current @ 12V

- Warm up: 330mA (W
- @ 25°C: 100mA (1.2W

Storage Temperature Range

- –55 to 90°C

Warm Up Time

- 1×10^{-7} after 5 minutes

Output Compatibility

- HCMOS
- Sine (packages 50, 51)

Frequency Stability Vs Supply Voltage change (±5%) and Load Change (1 to 2 HCMOS)

- 5×10^{-9}

Phase Noise @ 10.0MHz

- 10Hz –120 dBc/Hz
- 100Hz –140 dBc/Hz
- 1kHz –145 dBc/Hz
- 10kHz –150 dBc/Hz

Frequency Control Linearity

- 10%

Oven Alarm

- Optional in package 36 (V)
- Included in package 36A

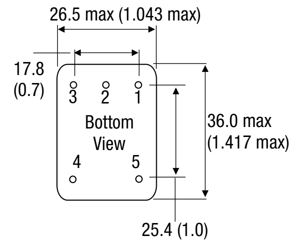
Environmental Specification (non-operating)

- Shock: 50g for 11ms
- Vibration: 10g for 10 to 500Hz

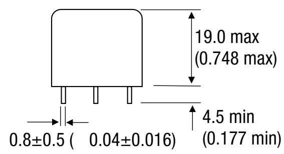
Marking Includes

- Model number (including options)
- Frequency
- Date Code (Year/Week)

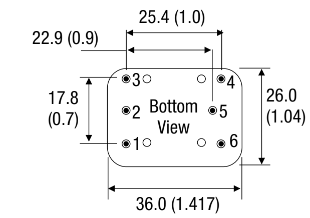
Outline in mm (inches) - (scale 1:2) - Package 36



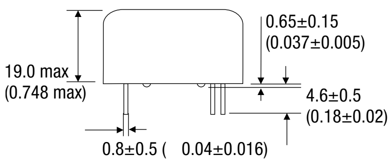
Pin	Function
1	Input supply (+)
2	Output reference voltage
3	Input frequency control
4	Mechanical ground and (–) supply
5	Output signal



Outline in mm (inches) - (scale 1:2) - Package 36A



Pin	Function
1	Input frequency control
2	Output reference voltage
3	Input supply (+)
4	Output signal
5	Oven alarm
6	Mechanical ground and (–) supply



All tolerances ±0.2mm (±0.007inches)

Electrical Specification

Operating Temperature Range*	Stability within Temperature Range	Long Term Stability @ 25°C after 30 days operation			Frequency Adjustment	Model Number
		Per day	Per Month	Per Year		
–20 to 70°C	$\pm 5\times10^{-9}$	$\pm 3\times10^{-10}$	$\pm 1\times10^{-8}$	$\pm 5\times10^{-8}$	$\pm 8\times10^{-7}$	CFPO-5 A1
–20 to 70°C	$\pm 5\times10^{-9}$	$\pm 1\times10^{-9}$	$\pm 3\times10^{-8}$	$\pm 1.5\times10^{-7}$	$\pm 1\times10^{-6}$	CFPO-5 A2
–20 to 70°C	$\pm 1\times10^{-8}$	$\pm 3\times10^{-10}$	$\pm 1\times10^{-8}$	$\pm 5\times10^{-8}$	$\pm 8\times10^{-7}$	CFPO-5 A3
–20 to 70°C	$\pm 1\times10^{-8}$	$\pm 1\times10^{-9}$	$\pm 3\times10^{-8}$	$\pm 1.5\times10^{-7}$	$\pm 1\times10^{-6}$	CFPO-5 A4
–20 to 70°C	$\pm 3\times10^{-8}$	$\pm 1\times10^{-9}$	$\pm 3\times10^{-8}$	$\pm 1.5\times10^{-7}$	$\pm 1\times10^{-6}$	CFPO-5 A5
–20 to 70°C	$\pm 5\times10^{-8}$	$\pm 1\times10^{-9}$	$\pm 3\times10^{-8}$	$\pm 1.5\times10^{-7}$	$\pm 1\times10^{-6}$	CFPO-5 B1
–20 to 70°C	$\pm 1\times10^{-7}$	$\pm 1\times10^{-9}$	$\pm 3\times10^{-8}$	$\pm 1.5\times10^{-7}$	$\pm 4\times10^{-6}$	CFPO-5 B2
–20 to 70°C	$\pm 1\times10^{-7}$	$\pm 2.5\times10^{-9}$	$\pm 8\times10^{-8}$	$\pm 4\times10^{-7}$	$\pm 4\times10^{-6}$	CFPO-5 B3
–20 to 70°C	$\pm 2.5\times10^{-7}$	$\pm 3\times10^{-9}$	$\pm 1\times10^{-7}$	$\pm 5\times10^{-7}$	$\pm 10\times10^{-6}$	CFPO-5 C1

Ordering Example: CFPO-5 B2 36-5V 10.0MHz

- Model
- Package Outline (36) (36A) (50) (51)
- Supply Voltage (5) (9) (12)
- Oven Alarm (V)
- Frequency (MHz)

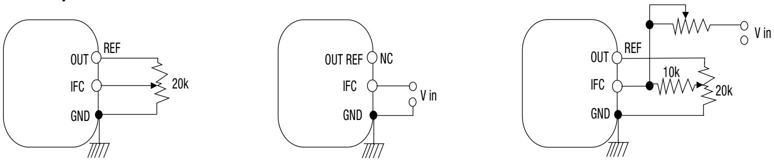
*Please note: Extended Operating Temperature Ranges may be available on request. Please contact Application Support for further details.

External Frequency Adjustment

Manual freq. adjust.
Settability $\leq 1 \times 10^{-7}$

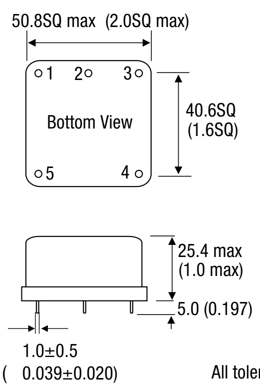
Ext. freq. control voltage

Freq. control voltage and manual adjust



All potentiometers must be 10 turns type with temperature coefficient 50ppm/°C

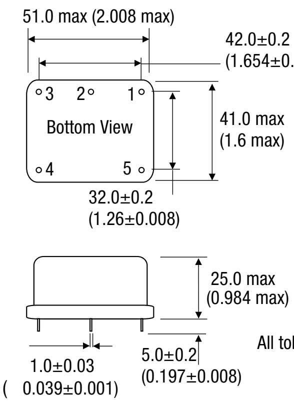
Outline in mm (inches) - (scale 1:3) - Package 50



Pin	Function
1	Input frequency control
2	Output ref. voltage
3	Output signal
4	Mechanical ground and (–) supply
5	Input supply (+)

All tolerances ±0.2mm (±0.007inches)

Outline in mm (inches) - (scale 1:3) - Package 51



Pin	Function
1	Mechanical GND and supply
2	Frequency control input
3	Ref. voltage output
4	Supply Input
5	Signal output

All tolerances ±0.2mm (±0.007inches)

CFPO-6: Miniature OCXO

ISSUE 2; 10 SEPTEMBER 1999

Description

- Miniature SC Cut OCXO (CFPO-6 A)
- Miniature AT Cut OCXO (CFPO-6 B)
- Miniature High Frequency OCXO (CFPO-6 HF)

Package Outline

- 25.4 × 25.4 × 12.7mm (25)
- SMD package available; please contact our Application Support Department for more details

Supply Option

- Standard: 5V (5)
- Optional: 3.3V (3.3)

Standard Frequencies

- 10.0MHz, 13.0MHz, 16.3840MHz, 19.440MHz, 26.0MHz, 38.880MHz

Frequency Range

- 4.0960 to 26.0MHz (CFPO-6 A1, -A3)
- 8.0 to 38.880MHz (CFPO-6 A2, -A4, -B1, -B2)
- 40.0 to 60.0MHz (CFPO-HF1)

Input Current @ 5V

- Warm up: 500mA (2.5W
- @ 25°C: 200mA (1.0W

Storage Temperature Range

- –55 to 90°C

Warm Up Time

- 1×10^{-7} after 5 minutes

Output Compatibility

- Standard: HCMOS (C)
- Optional: Sine (S)

Frequency Stability Vs Supply Voltage change (±5%) and Load Change (1 to 2 HCMOS)

- $\pm 5 \times 10^{-9}$(CFPO-6A, CFPO-6B)
- $\pm 5 \times 10^{-8}$ (CFPO-6HF)

Phase Noise @ 10.0MHz (CFPO-6A)

10Hz –120 dBc/Hz

100Hz –140 dBc/Hz

1kHz –145 dBc/Hz

10kHz –150 dBc/Hz

Frequency Control Linearity

- 10%

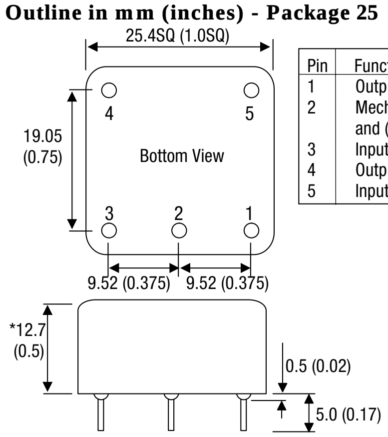
Environmental Specification (non-operating)

- Shock: 50g for 11ms
- Vibration: 10g for 10 to 500Hz

Marking Includes

- Model number (including options)
- Frequency
- Date Code (Year/Week)

Outline in mm (inches) - Package 25



Pin	Function
1	Output signal
2	Mechanical ground and (–) supply
3	Input frequency control
4	Output ref. voltage
5	Input supply (+)

*Please note: 11.5mm height option available

Electrical Specification

Operating Temperature Range*	Stability within Temperature Range	Long Term Stability at 25°C after 30 days operation			Frequency Adjustment	Model Number
		Per day	Per Month	Per Year		
–20 to 70°C	$\pm1\times10^{-8}$	$\pm3\times10^{-10}$	$\pm1\times10^{-8}$	$\pm5\times10^{-8}$	$\pm8\times10^{-7}$	CFPO-6 A1
–20 to 70°C	$\pm1\times10^{-8}$	$\pm1\times10^{-9}$	$\pm3\times10^{-8}$	$\pm1.5\times10^{-7}$	$\pm1\times10^{-6}$	CFPO-6 A2
–20 to 70°C	$\pm3\times10^{-8}$	$\pm3\times10^{-10}$	$\pm1\times10^{-8}$	$\pm5\times10^{-8}$	$\pm8\times10^{-7}$	CFPO-6 A3
–20 to 70°C	$\pm3\times10^{-8}$	$\pm1\times10^{-9}$	$\pm3\times10^{-8}$	$\pm1.5\times10^{-7}$	$\pm1\times10^{-6}$	CFPO-6 A4
–20 to 70°C	$\pm1\times10^{-7}$	$\pm1\times10^{-9}$	$\pm3\times10^{-8}$	$\pm1.5\times10^{-7}$	$\pm4\times10^{-6}$	CFPO-6 B1
–20 to 70°C	$\pm1\times10^{-7}$	$\pm2.5\times10^{-9}$	$\pm8\times10^{-8}$	$\pm4\times10^{-7}$	$\pm4\times10^{-6}$	CFPO-6 B2
–20 to 70°C	$\pm2.5\times10^{-7}$	$\pm5\times10^{-9}$	$\pm1.5\times10^{-7}$	$\pm8\times10^{-7}$	$\pm4\times10^{-6}$	CFPO-6 HF1

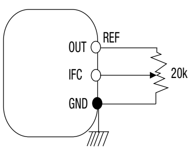
Ordering Example CFPO-6 A2 25-S 3.3 10.0MHz

Model
Package Outline (25)
Output Signal (C) (S)
Supply Voltage (5) (3.3)
Frequency (MHz)

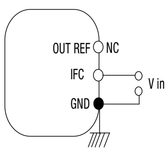
*Please note: Extended Operating Temperature Ranges may be available on request. Please contact Application Support for further details.

External Frequency Adjustment

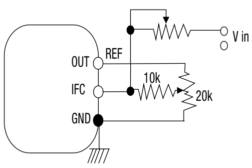
Manual freq. adjust.
Settability $\leq 1 \times 10^{-7}$



Ext. freq. control voltage



Freq. control voltage and manual adjust



All potentiometers must be 10 turns type with temperature coefficient 50ppm/°C

CFPR-01, -02: Rubidium Oscillator

ISSUE 1: 1 OCTOBER 1999

Delivery Options

- Please contact our sales office for current leadtimes

Package Outline

- 51.0 × 76.0 × 102.0mm (CFPR-01)
- 38.0 × 93.0 × 126.0mm (CFPR-02)

Standard Frequency

- 10.0MHz

Standard Supply Voltage

- 22 - 30Vdc

Input current @ 24V

- Warm up: 1.875A (45W)
- @ 25°C: 420mA (10W)

Factory Setting of Fractional Frequency Offset

- $\pm 5 \times 10^{-11}$

Storage Temperature Range

- –40 to 85°C (unpowered)

Warm Up Time

- $\pm 2 \times 10^{-9}$ after 2 minutes
- $\pm 5 \times 10^{-10}$ after 5 minutes

Retrace after 24 hours off

- $\pm 2 \times 10^{-11}$after 4 hours

MTBF @ 25°C

- 350,000 hours approx.

Harmonics

- < –40dBc

Output Compatibility

- Sinewave (50ohms)

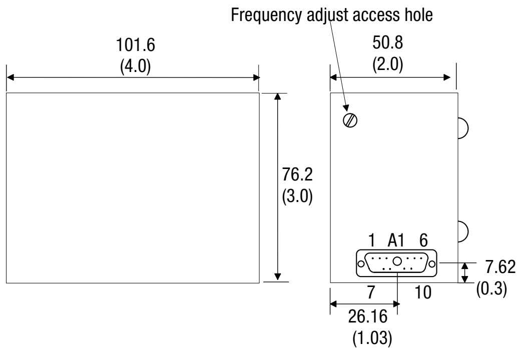
Frequency Adjustment (min per volt)

- 2×10^{-9} (mechnical); 2×10^{-9} (electrical)

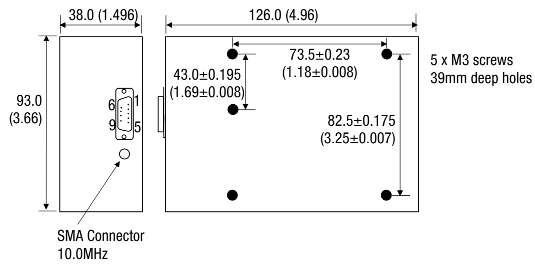
Marking Includes

- Model number (including options)
- Frequency.
- Date Code (Year/Week)

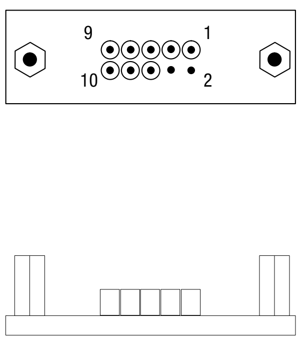
Outline in mm (inches) - (scale 1:3) - CFPR-01(FRS)



Outline in mm (inches) - (scale 1:3) - CFPR-02 (LPRO)



Optional Connector



Electrical Specification

Operating Temperature Range*	Frequency offset with Temperature Range	Operational Stability @ 25°C over time				Drift per month	Phase Noise (from carrier)				Model Number
		Per 1 sec	Per 10 sec	Per 100 sec	Per 1 day		10Hz	100Hz	1kHz	10kHz	
–10 to 55°C	$\pm 3\times10^{-10}$	3×10^{-11}	1×10^{-11}	3×10^{-12}	5×10^{-12}	$\pm 1\times10^{-11}$	–100 dBc/Hz	–130 dBc/Hz	–140 dBc/Hz	–145 dBc/Hz	CFPR-01A CFPR-02A
–10 to 55°C	$\pm 3\times10^{-10}$	3×10^{-11}	1×10^{-11}	3×10^{-12}	1×10^{-11}	$\pm 4\times10^{-11}$	–100 dBc/Hz	–130 dBc/Hz	–140 dBc/Hz	–145 dBc/Hz	CFPR-01B CFPR-02B
–10 to 55°C	$\pm 3\times10^{-10}$	Please note stability can vary due to model C being a low phase noise option					–100 dBc/Hz	–130 dBc/Hz	–140 dBc/Hz	–155 dBc/Hz	CFPR-01C CFPR-02C
–10 to 55°C	$\pm 3\times10^{-10}$	1×10^{-10}	3×10^{-11}	1×10^{-11}	5×10^{-11}	$\pm 1\times10^{-10}$	–100 dBc/Hz	–130 dBc/Hz	–140 dBc/Hz	–145 dBc/Hz	CFPR-01D CFPR-02D

Ordering Example: CFPR-02B 10.0MHz

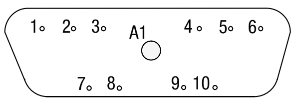
Model Number — CFPR-02B

Frequency (MHz) — 10.0MHz

* Please note: Operating Temperature Range is available up to –65 to 65°C, please contact our Application Support Department.

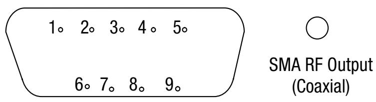
CFPR-01 Connections

Pin Connections
A1: RF Output (coaxial)
Pin 1: Lock monitor
Pin 2: External frequency control
Pin 3: External frequency control return
Pin 4: Rubidium lamp monitor
Pin 5: N/C
Pin 6: +24V dc (heater) common to pin 9
Pin 7: VCXO monitor
Pin 8: Regulator monitor for external frequency adjustment
Pin 9: +24V dc common to pin 6
Pin 10: Power return earth

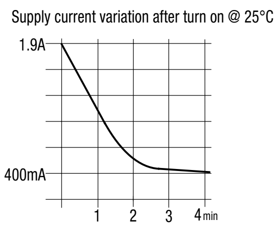


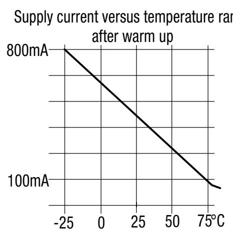
CFPR-02 Connections

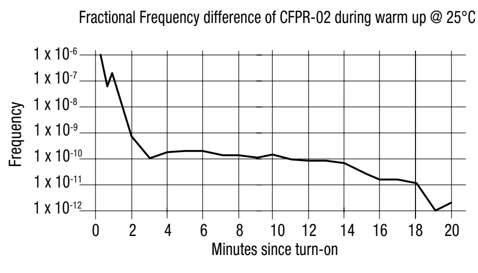
Pin Connections
Pin 1: Lock monitor
Pin 2: External frequency adjust
Pin 3: N/C
Pin 4: Rubidium lamp monitor
Pin 5: N/C
Pin 6: +22 to +30V dc input common to pin 9
Pin 7: VCXO monitor
Pin 8: Common negative
Pin 9: +22 to +30V dc input common to pin 6



Current Consumption Characteristics







NOTES

PROGRAMMABLE OSCILLATORS - Section Contents

STOCK PROGRAMMABLE OSCILLATORS

Minimum Order Information Required

- Stock Number or Alpha Code

IQEXO Series

Frequency	Type	Frequency Stability	Model No.	Stock No.	Alpha Code
12.0MHz	PXO	±100ppm	IQEXO-3C	PPXO000013	X701A
12.2880MHz	PXO	±100ppm	IQEXO-3C	PPXO000014	X702A
12.80MHz	PXO	±100ppm	IQEXO-3C	PPXO000023	X711A
14.31818MHz	PXO	±100ppm	IQEXO-3C	PPXO000022	X710A
14.74560MHz	PXO	±100ppm	IQEXO-3C	PPXO000015	X703A
16.0MHz	PXO	±100ppm	IQEXO-3C	PPXO000016	X704A
16.3840MHz	PXO	±100ppm	IQEXO-3C	PPXO000017	X705A
17.73447MHz	PXO	±100ppm	IQEXO-3C	PPXO000018	X706A
18.4320MHz	PXO	±100ppm	IQEXO-3C	PPXO000019	X707A
19.66080MHz	PXO	±100ppm	IQEXO-3C	PPXO000020	X708A
20.0MHz	PXO	±100ppm	IQEXO-3C	PPXO000021	X709A

NOTES

PROGRAMMABLE OSCILLATORS

IQEXO-3

ISSUE 3; 12 JANUARY 1996

Delivery Options

- Common frequencies are available from stock. Please see p122 for details

Output Compatibility

- HCMOS

Package Outline

- 8-pin DIL compatible plastic encapsulated

Frequency Stability

- ±100ppm

Operating Temperature Range

- –10 to 70°C

Storage Temperature Range

- –55 to 125°C

Mechanical Specification

- Mechanical Shock: 1000g, ½ sine wave impulse for 0.35ms in three directions
- Resistance to Soldering Heat: Leads dipped in soldering bath @ 260°C for 10 secs
- Resistance to Solvent: Dipping in fluoric solvent for 90 secs
- Solderability: 90% of soldered surface masked with new solder after dipping in solder bath @ 230°C for 3 secs
- Vibration: 10 to 55Hz 1.5mm displacement, 50 to 2000Hz 20g acceleration, 1 hour in each of three mutually perpendicular planes

Handling & Operational Precautions

- Observe anti-static handling precautions
- A decoupling capacitor of <0.01 F should be connected between Pin 8 and Ground

Terminal Connections

- 1: Crystal frequency output (fo)
- 2: Divided frequency output (fo/2^n)
- 3: Standby terminal; Logic '1' to pin 3 enables oscillator output; logic '0' to pin 3 disables oscillator output; when disabled the oscillator output goes to the high impedance state
- 4: Ground
- 5: Programs division ratio
- 6: Programs division ratio
- 7: Programs division ratio
- 8: Power supply voltage

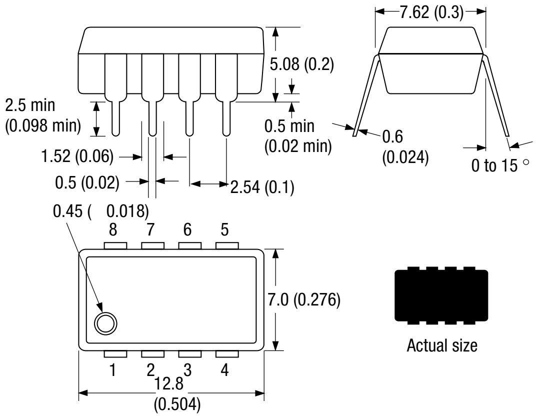
Marking

- Model number
- Frequency

Minimum Order Information Required

- Frequency + Model Number

Outline in mm (inches) (scale 2:1)



Frequency Programming

Input				Output	
Select			Pin 3	Pin 1 Fundamental Oscillation	Pin 2 Divided Frequency
Pin 7 C	Pin 6 B	Pin 5 A	ST		
L	L	L	H	fo	fo 2
L	L	H	H	fo	fo 4
L	H	L	H	fo	fo 8
L	H	H	H	fo	fo 16
H	L	L	H	fo	fo 32
H	L	H	H	fo	fo 64
H	H	L	H	fo	fo 128
H	H	H	H	fo	fo 256

PROGRAMMABLE OSCILLATORS

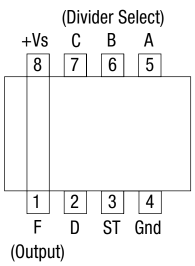
Electrical Specification – maximum limiting values

Supply Voltage	Input Voltage		Output Voltage		Rise Time (t_r)	Fall Time (t_f)	Current		Start-up Time		Duty Cycle	Ageing
	High	Low	High	Low			Supply	Standby	Supply	Standby		
5.0V±1V	3.6V min	0.8V max	4.5V min	0.5V max	15ns max	15ns max	20mA	10.0 A	1.5ms	1.5ms	40/60%	±5ppm

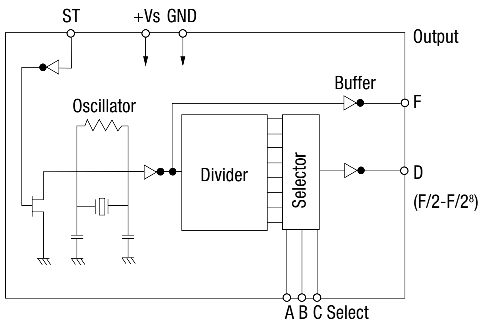
Crystal Frequency (MHz)

Fundamental Frequency (fo)	Divided Frequency (fo/2^n)							
fo (MHz)	fo 2 (MHz)	fo 4 (MHz)	fo 8 (MHz)	fo 16 (kHz)	fo 32 (kHz)	fo 64 (kHz)	fo 128 (kHz)	fo 256 (kHz)
12.0	6.0	3.0	1.50	750.0	375.0	187.50	93.750	46.8750
12.2880	6.1440	3.0720	1.5360	768.0	384.0	192.0	96.0	48.0
12.80	6.40	3.20	1.60	800.0	400.0	200.0	100.0	50.0
14.318180	7.159090	3.579545	1.789772	894.880	447.440	223.720	111.860	55.930
14.50	7.250	3.6250	1.81250	906.250	453.1250	226.5620	113.2810	56.640
14.74560	7.37280	3.68640	1.84320	921.60	460.80	230.40	115.20	57.60
14.91050	7.45520	3.72760	1.86380	931.9060	465.9530	232.9760	116.4880	58.2440
15.0	7.50	3.750	1.8750	937.50	468.750	234.3750	117.1870	58.5930
15.360	7.680	3.840	1.920	960.0	480.0	240.0	120.0	60.0
15.97440	7.98720	3.99360	1.99680	998.40	499.20	249.60	124.80	62.40
16.0	8.0	4.0	2.0	1000.0	500.0	250.0	125.0	62.50
16.1280	8.0640	4.0320	2.0160	1008.0	504.0	252.0	126.0	63.0
16.2570	8.125850	4.06425	2.032125	1016.0620	508.030	254.0150	127.0070	63.5030
16.3840	8.1920	4.0960	2.0480	1024.0	512.0	256.0	128.0	64.0
17.734476	8.867238	4.433619	2.216809	1108.4	554.20	277.10	138.550	69.2750
18.4320	9.2160	4.6080	2.3040	1152.0	576.0	288.0	144.0	72.0
19.09090	9.545450	4.772725	2.386362	1193.1810	596.590	298.2950	149.1470	74.5730
19.20	9.60	4.80	2.40	1200.0	600.0	300.0	150.0	75.0
19.66080	9.83040	4.91520	2.45760	1228.80	614.40	307.20	153.60	76.80
20.0	10.0	5.0	2.5	1250.0	625.0	312.50	156.250	78.1250
20.480	10.240	5.120	2.560	1280.0	640.0	320.0	160.0	80.0
21.477270	10.738635	5.369317	2.684650	1342.3290	671.1640	355.5820	167.7910	83.89550
22.0	11.0	5.50	2.750	1375.0	687.50	343.750	171.8750	85.93750
22.11840	11.05920	5.52960	2.76480	1382.40	691.20	345.60	172.80	86.40
24.0	12.0	6.0	3.0	1500.0	750.0	375.0	187.50	93.750
24.5760	12.2880	6.1440	3.0720	1536.0	768.0	384.0	192.0	96.0

Terminal Connections



Circuit Diagram



NOTES

PROGRAMMABLE OSCILLATORS

CRYSTAL FILTERS - Section Contents

SPECIFYING CRYSTAL FILTERS

A typical Crystal Filter specification reads like this:

45.0MHz ±7.5kHz ±15kHz 3 2 90 3k 20 UM1

- Centre Frequency, f_0 — 45.0MHz
- Passband — ±7.5kHz
- Stopband (dB) — ±15kHz
- Insertion Loss (dB) — 3
- Ripple — 2
- Guaranteed Attenuation — 90
- Terminating Impedances — 3k
- Operating Temperature Range — 20
- Holder — UM1

Definitions

The following terms and definitions will aid you in specifying a filter for your application. **Please refer to p134 for a guide to ordering your filter.**

Centre Frequency (f_0)

- The arithmetic mean of the passband limits or the defined nominal frequency

Passband (BW1)

- The range of frequencies attenuated less than a specified value, typically 3dB or 6dB.

Stopband (BW2)

- The range of frequencies attenuated greater than a specified minimum level of attenuation, typically 40dB or 60dB.

Insertion Loss

- The loss at centre frequency or at the maximum transmission level normally expressed in dB as a result of inserting the filter into the circuit

Ripple

- The amplitude difference in dB between the maximum passband peak and the minimum passband valley. Both peak and valley are defined by a surrounding change in slope, i.e. The sign of the amplitude response.

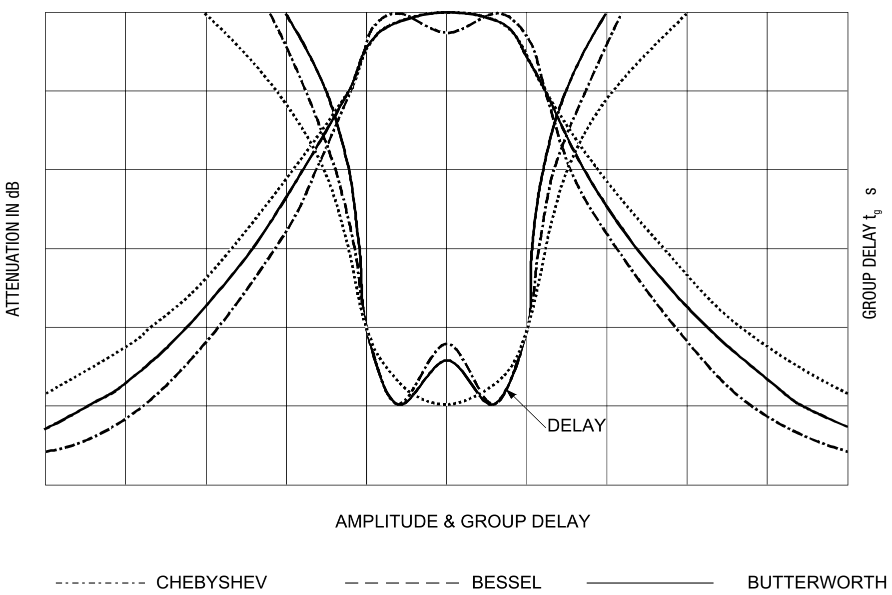
Guaranteed Attenuation

- A minimum attenuation in dB by which a specified frequency band either side of F_0 must be guaranteed.

Source & Load Impedance

- Source Impedance: The impedance driving the filter.

Attenuation and Group Delay Graph



- Load Impedance: The impedance of the circuit terminating the filter.

Shape Factor

- Ratio of bandwidths, normally stopband and passband of filter.

Spurious Attenuation

- The specified minimum level of attenuation received by all non-harmonic related resonances of each crystal resonator within the filter network.

Maximum Drive Level

- For continuous operation normally specified in dBm.

Linear Phase Characteristics

- The term phase shift is defined as ‘phase shift of output voltage with respect to input voltage as a function of frequency’. There are two ways to specify this:-
  By directly defining the slope per segment of bandwidth
  $N_2 \quad N$degrees/kHz $\quad N_1$
  or by the phase shift derivative with respect to frequency, i.e. Group Delay

  $$Tg \quad \frac{_2 - _1}{360 \quad f_2 - f_1}$$

  where Tg = Group delay in seconds
  and $_1$ & $_2$ are phase shift at frequency f_1 & f_2 (measured in degrees and Hertz)

- The phase slope is proportional to the number of poles and inversly proportional to bandwidth. The 2nd order characteristic is dependant upon filter design i.e. Butterworth, Chebychev, Bessel, however for a given number of poles phase distortion will increase with selectivity.
- Phase linearity is a different parameter and is sensitive to ambiant conditions such as temperature, vibration & termination impedances.

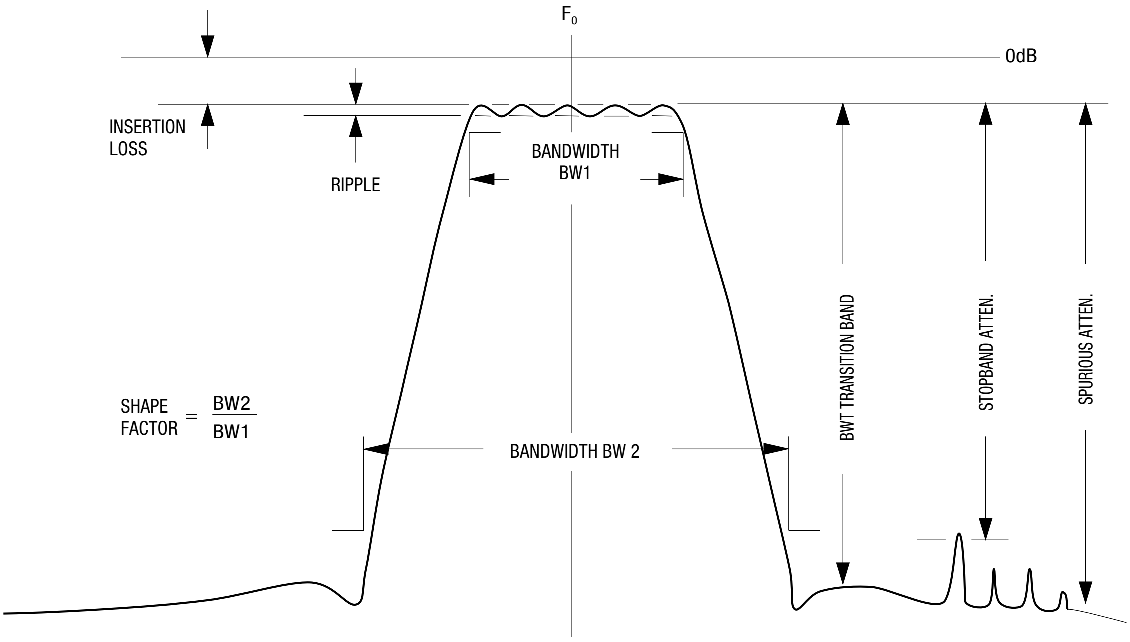
Inband Intermodulation Distortion

- The attenuation, in dB, of 3rd and higher order signal products, inband, relative to the power level of two signals placed within the passband.

Out of Band Intermodulation Distortion

- The attenuation, in dB, of 3rd and higher order signal products, inband, relative to the power level of two signals placed in the stopband, or one tone in the transition region and the other in the stopband.

Filter Characteristics

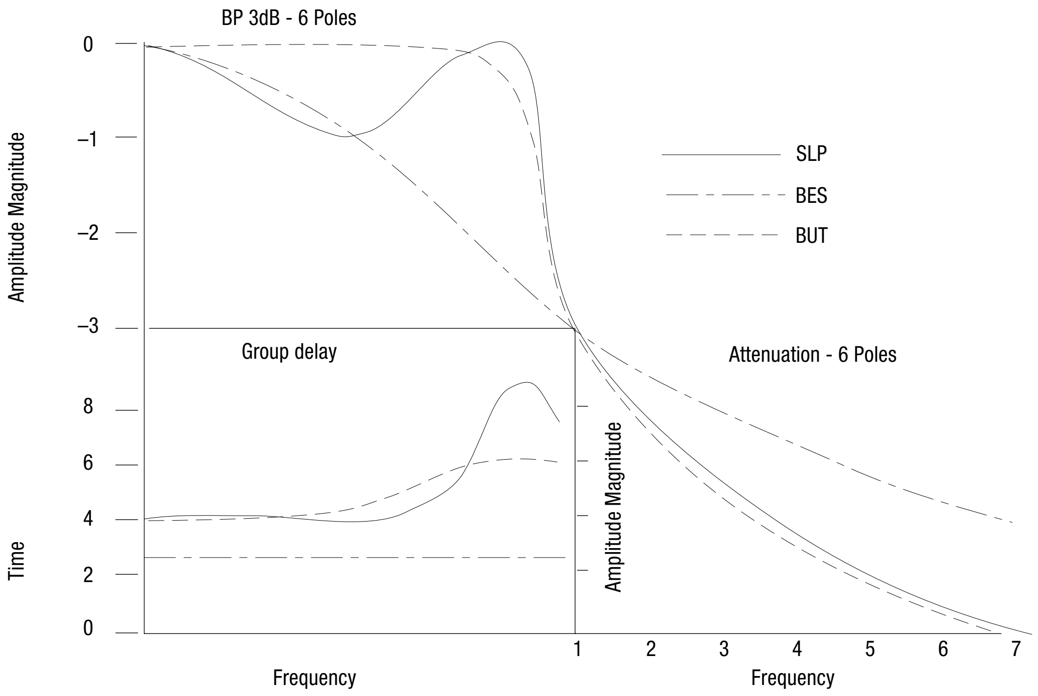


CRYSTAL FILTERS

Theoretical Characteristics

No. of poles	Type of filter	Magnitude shape factors for 10% phase linearity (theoretical values)				
		BA/BP	BU/BP	ONDUL. BU dB	BA/BU*	Notes
4	CHEB. 5	4	0.20	0.5	20	BP: pass band 3 dB
	CHEB. 1	4.5	0.40	0.1	11.2	
	S.L.P.	4.15	0.68	1.5	6.1	BU: 10% phase
	BUTTER	5.6	0.45	0	12.5	linearity band
	GAUSS6	7.1	1.75	14	7.1	
	BESSEL	8.5	1.18	5	8.5	BA: stop band 60 dB
6	CHEB. 5	2.1	0.15	0.5	13.8	*BA/BU (if BU <BP)
	CHEB. 1	2.3	0.50	0.1	4.6	
	S.L.P.	2.75	0.70	1.5	3.9	BA/BP (if BU >BP)
	BUTTER	3.15	0.50	0	6.3	
	GAUSS6	3.4	0.90	2.5	3.7	
	BESSEL	5.45	1.70	9.5	5.4	

No. of poles	Type of filter	Bandwidth relative group delay variation (%) (theoretical values)				
		0.3 × BP	0.6 × BP	0.9 × BP	1 × BP	Value of T at Fo T in seconds/BP in Hz
4	CHEB. 5	19.4	22.6	142	150	0.95/BP
	CHEB. 1	6.5	22.6	97	97	0.95/BP
	S.L.P.	5.3	6.4	112	125	1.03/BP
	BUTTER	4.7	23.2	51	51	0.83/BP
	GAUSS6	3	3	4.5	4.5	0.71/BP
	BESSEL	0	0	0	0	0.66/BP
6	CHEB. 5	18	30	120	232	1.53/BP
	CHEB. 1	6	24	116	160	1.54BP
	S.L.P.	2.2	2.2	116	210	1.44/BP
	BUTTER	3.1	18.8	66	67	1.24/BP
	GAUSS6	4	4	9.5	12	4.14/BP
	BESSEL	0	0	0	0	0.85/BP



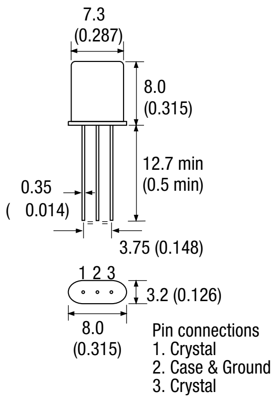
STANDARD CRYSTAL FILTERS

MONOLITHIC CRYSTAL FILTERS

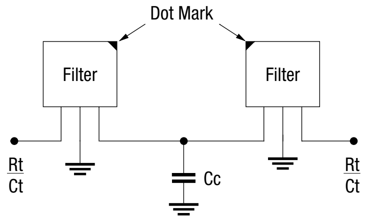
Model	Centre Frequency	Passband Width @ –3dB	Vibration Mode	Attenuation Bandwidth		Poles	Ripple (max.)	Ins. Loss (ax)	Terminating Impedance (//pF)	Holder
IQXF-10M08A	10.7MHz	±3.75kHz	Fundamental	±12.5kHz	–18dB	2	1.0dB	2.0dB	1.5k//5	HC49/T
IQXF-10M15A	10.7MHz	±7.5kHz	Fundamental	±25.0kHz	–18dB	2	1.0dB	2.0dB	3k//2	HC49/T
IQXF-10M30A	10.7MHz	±15.0kHz	Fundamental	±50.0kHz	–18dB	2	0.5dB	2.0dB	5k//0	HC49/T
IQXF-21M07AU	21.4MHz	±3.75kHz	Fundamental	±18.0kHz	–20dB	2	0.5dB	1.5dB	850//6	UM1
IQXF-21M07BU	21.4MHz	±3.75kHz	Fundamental	±14.0kHz	–40dB	4	1.0dB	2.5dB	850//5	UM1 x 2
IQXF-21M15AU	21.4MHz	±7.5kHz	Fundamental	±25.0kHz	–18dB	2	0.5dB	1.5dB	1.5k//2	UM1
IQXF-21M15BU	21.4MHz	±7.5kHz	Fundamental	±25.0kHz	–40dB	4	1.0dB	2.5dB	1.5k//2	UM1 x 2
IQXF-21M30AU	21.4MHz	±15.0kHz	Fundamental	±45.0kHz	–15dB	2	0.5dB	1.5dB	3.0k/0.5	UM1
IQXF-21M30BU	21.4MHz	±15.0kHz	Fundamental	±50.0kHz	–40dB	4	1.0dB	2.5dB	3.0k//–0.5	UM1 x 2
IQXF-21M30C	21.4MHz	±15.0kHz	Fundamental	±50.0kHz	–65dB	6	2.0dB	2.5dB	2.2k//0.5	MF-61
IQXF-21M30D	21.4MHz	±15.0kHz	Fundamental	±50.0kHz	–80dB	8	2.0dB	2.0dB	2.2k//0.5	MF-61
IQXF-45K07AU	45.0MHz	±3.75kHz	Fundamental	±12.5kHz	–10dB	2	1.0dB	2.5dB	300//10	UM1
IQXF-45K07BU	45.0MHz	±3.75kHz	Fundamental	±12.5kHz	–30dB	4	1.0dB	4.0dB	300//8	UM1 x 2
IQXF-45K15AU	45.0MHz	±7.5kHz	Fundamental	±25.0kHz	–15dB	2	1.0dB	2.0dB	650//4.5	UM1
IQXF-45K15BU	45.0MHz	±7.5kHz	Fundamental	±25.0kHz	–30dB	4	1.0dB	3.0dB	600//1.5	UM1 x 2
IQXF-45K30AU	45.0MHz	±15.0kHz	Fundamental	±50.0kHz	–15dB	2	1.0dB	2.0dB	800//1.5	UM1
IQXF-45K30BU	45.0MHz	±15.0kHz	Fundamental	±60.0kHz	–40dB	4	1.0dB	3.0dB	800//1.0	UM1 x 2
IQXF-45M07AU	45.0MHz	±3.75kHz	3rd Overtone	±12.5kHz	–10dB	2	1.0dB	2.5dB	2.5k//–0.5	UM1
IQXF-45M07BU	45.0MHz	±3.75kHz	3rd Overtone	±12.5kHz	–30dB	4	1.0dB	4.0dB	2.5k//–0.5	UM1 x 2
IQXF-45M15AU	45.0MHz	±7.5kHz	3rd Overtone	±25.0kHz	–18dB	2	1.0dB	3.0dB	3k//0	UM1
IQXF-45M15BU	45.0MHz	±7.5kHz	3rd Overtone	±30.0kHz	–40dB	4	1.0dB	3.0dB	4k//–1.0	UM1 x 2
IQXF-45M20AU	45.0MHz	±10.0kHz	3rd Overtone	±30.0kHz	–15dB	2	1.0dB	2.0dB	5k//–1.0	UM1
IQXF-45M20BU	45.0MHz	±10.0kHz	3rd Overtone	±40.0kHz	–35dB	4	1.0dB	3.0dB	5k//–1.0	UM1 x 2
IQXF-45M30AU	45.0MHz	±15.0kHz	3rd Overtone	±50.0kHz	–15dB	2	1.0dB	2.0dB	8k//–1.0	UM1
IQXF-45M30BU	45.0MHz	±15.0kHz	3rd Overtone	±50.0kHz	–30dB	4	1.0dB	3.0dB	8k//–1.0	UM1 x 2
IQXF-91M15AU	90.0MHz	±7.5kHz	3rd Overtone	±30.0kHz	–15dB	2	1.0dB	2.0dB	1.4k//0	UM1
IQXF-91M15BU	90.0MHz	±7.5kHz	3rd Overtone	±25.0kHz	–25dB	4	1.0dB	3.5dB	1.4k//0	UM1 x 2
IQXF-91M20AU	90.0MHz	±10.0kHz	3rd Overtone	±40.0kHz	–15dB	2	1.0dB	2.0dB	1.5k//–1.0	UM1
IQXF-91M20BU	90.0MHz	±10.0kHz	3rd Overtone	±40.0kHz	–35dB	4	1.0dB	3.0dB	1.5k//–1.0	UM1 x 2
IQXF-91M30AU	90.0MHz	±15.0kHz	3rd Overtone	±50.0kHz	–15dB	2	1.0dB	2.0dB	4k//–1.0	UM1
IQXF-91M30BU	90.0MHz	±15.0kHz	3rd Overtone	±50.0kHz	–25dB	4	1.0dB	3.0dB	4k//–1.0	UM1 x 2

Please Note: Operating Temperature Range (for all filters shown above) is –20 to 70ºC
Please contact the Application Support Department for the value of the coupling capacitor

Outline in mm (inches) - UM1

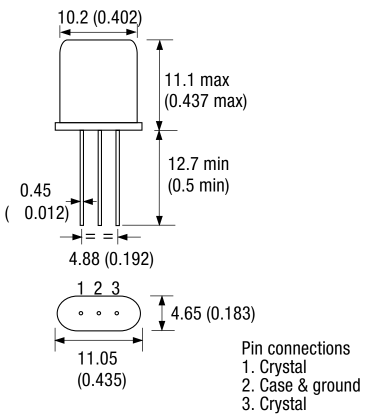


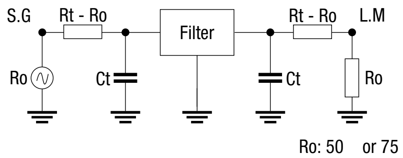
Test Circuits



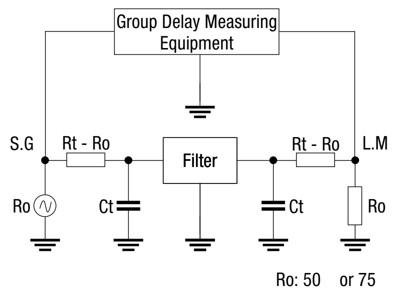
Coupling Capacitance

Outline in mm (inches) - HC49/T



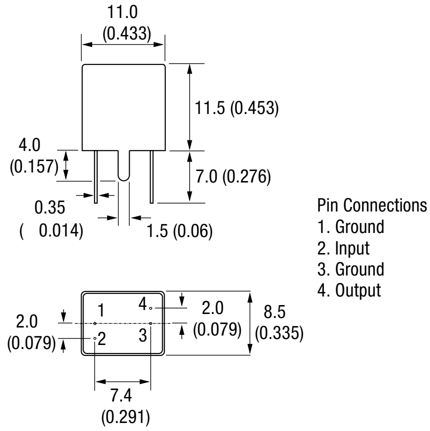


Attenuation Measurement



Group Delay Measurement

Outline in mm (inches) - MF61

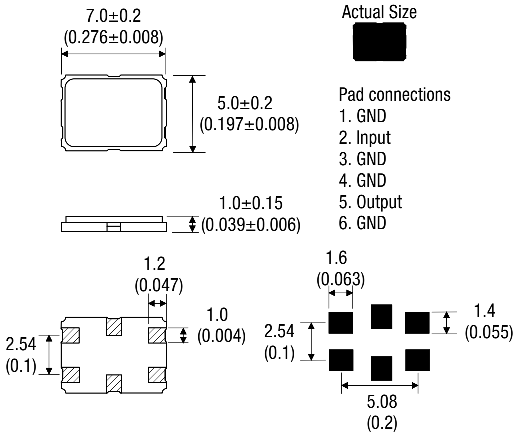


Surface Mount Monolithic Crystal Filters in a Ceramic Package

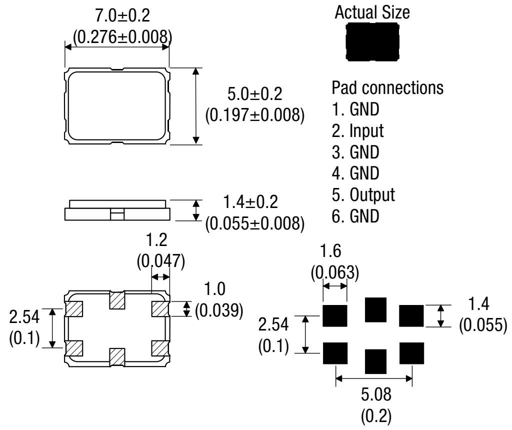
Model	Nominal Frequency	Passband Width @ –3dB	Attenuation Bandwidth		Ripple	Loss	Spurious	Guaranteed Attenuation	Terminating Impedance			Pole
									R	C1	C2	
CFPF-12	21.400MHz	±7.5kHz	18dB	±25.0kHz	1.0dB	2.0dB	10.0dB	70.0dB	1.5k	2.5pF	—	2
CFPF-12	21.700MHz	±3.75kHz	18dB	±12.5kHz	1.0dB	2.0dB	18.0dB	70.0dB	850	8.0pF	—	2
CFPF-12	21.700MHz	±7.5kHz	18	±25.0kHz	1.0dB	2.0dB	10.0dB	70.0dB	1.5k	2.5pF	—	2
CFPF-13	45.000MHz	±7.5kHz	13	±25.0kHz	1.0dB	2.0dB	10.0dB	70.0dB	560	6.0pF	—	2
CFPF-13	45.000MHz	±15.0kHz	15	±60.0kHz	1.0dB	3.0dB	3.0dB	70.0dB	1.2k	0.0pF	—	2
CFPF-14	45.000MHz	±7.5kHz	25	±22.0kHz	1.0dB	3.0dB	40.0dB	80.0dB	800	1.7pF	8.0pF	4
CFPF-14	45.000MHz	±10.0kHz	25	±25.0kHz	1.0dB	3.0dB	40.0dB	80.0dB	800	1.7pF	7.0pF	4
CFPF-14	45.000MHz	±15.0kHz	35	±50.0kHz	1.0dB	3.0dB	40.0dB	80.0dB	800	1.7pF	6.0pF	4
CFPF-13	73.350MHz	±10.0kHz*	15	±50.0kHz	1.5dB	5.0dB	15.0dB	70.0dB	600	2.5pF	—	2
CFPF-13	90.000MHz	±4.0kHz	8	±12.5kHz	0.5dB	5.0dB	20.0dB	70.0dB	200	8.0pF	—	2

*Please note: Passband Width is @ –1dB

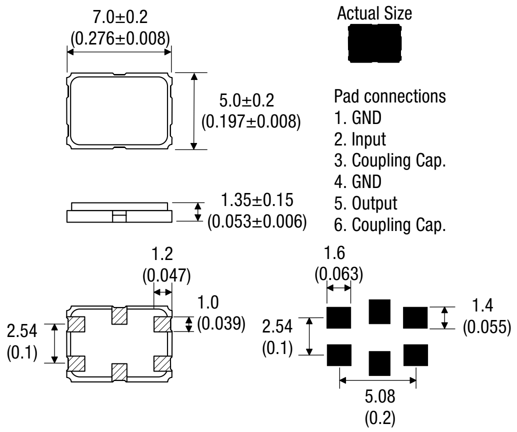
Outline in mm (inches) - CFPF-12 (scale 2:1)



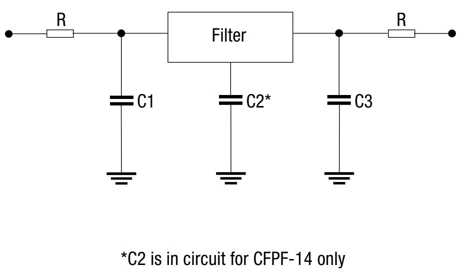
Outline in mm (inches) - CFPF-13 (scale 2:1)



Outline in mm (inches) - CFPF-14 (scale 2:1)



Test Circuit



*C2 is in circuit for CFPF-14 only

CRYSTAL FILTERS

Custom filter order form

Customer Filter Requirements Fax Form - Please copy form, fill out using BLOCK CAPITALS and fax to C-MAC on +44 (0)1460 72578					
x = Minimum Specification Information Required for Filter pricing					
Nominal Frequency (F_0)		x			MHz
Passband (Min)		x	dB	F_0 ±	kHz
Stopband (Max)		x	dB	F_0 ±	kHz
Insertion Loss		x			dB
Ripple (Peak to valley)		x	dB	F_0 ±	kHz
Guaranteed attenuation	dB		From F_0–	to F_0 –	kHz
	dB		From F_0+	to F_0 +	kHz
Terminating impedances	Source	x	Ω	pF	±pF
	Load	x		pF	±pF
Operating Temperature Range		x			°C
Holder style		x			
Spurious attenuation	dB		From F_0–	to F_0 –	kHz
	dB		From F_0+	to F_0 +	kHz
Input levels	Test level				dBm
	Max continous level				dBm
	Max level before damage				dBm
Group delay requirements			F_0± (kHz)	µS	max
Intermodulation requirements	Test tone frequencies		f_1	f_2	MHz
	Test tone power level				dBm
	Third order IM product				dBm min
V.S.W.R. requirements			F_0± (kHz)	dBm min	
Environmental Specification specification	Vibration (operational)				
	Vibration (non-operational)				
	Shock (non-operational)				
Additional Notes					
Name					
Job Title					
Company Name					
Address					
Postcode					
Telephone			E-mail		
Fax			http://		

SAWs - Section Contents

CFPSV-1074, -1468, -1489

ISSUE 1; 19 JUNE 1998

- The CFPSV-1000 series of surface acoustic wave (SAW) voltage controlled oscillators are designed for use in todays high bit rate telecoms systems. The frequency is stabilised by a SAW delay line that uses advanced packaging technology to ensure minimum drift of frequency with both temperature and time. The oscillators are supplied in a range of hermetically sealed metal enclosures

Key Features:

- Frequencies from 130.0MHz to 2600.0MHz
- Standard frequencies available for SDH/SONET at STM1/OC3, STM4/OC12 and STM16/OC48 - 155.520MHz, 311.040MHz, 622.080MHz, 2488.320MHz
- High stability & wide operating temperature range
- Supply voltage available from -5.2V to 12V (type dependant)
- Frequency control range can exceed ±1000ppm
- Custom specifications available
- Sine or Complimentary ECL Output Options

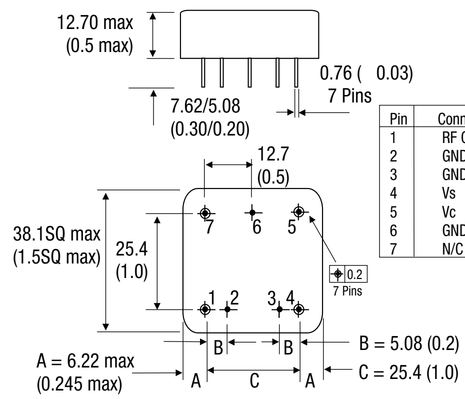
Environmental Specification:

- Vibration: IEC 68-2-6 Test Fc Procedure B4, (MIL-STD-202 Method 204), 10 - 60 Hz 0.75mm displacement, 60 - 500 Hz 98m/ s^2 (10_{gn}) acceleration 30 minutes in each of three mutually perpendicular planes at 1 octave per minute
- Shock: IEC 68-2-27 Test Ea, (MIL-STD-202 Method 213) ½ sine wave, 981 m/s^2 (100_{gn}) acceleration for 6ms duration, three shocks in each direction along three mutually perpendicular axes
- Damp Heat: IEC 68-2-3 Test Ca (Steady State), Duration 56 days, recovery time 12 hours
- Solderability: IEC 68-2-20 Test Ta Method 1 (solder bath) (MIL-STD 202 Method 208), Temperature 235°C
- Robustness of Termination: IEC 68-2-21 Test Ua (Tensile)(MIL-STD-202 Method 211)
- Hermetic Seal: IEC 68-2-17 Test Qc (Gross Leak), (MIL-STD-202 Method 112 Test condition D)

Minimum Order Information Required

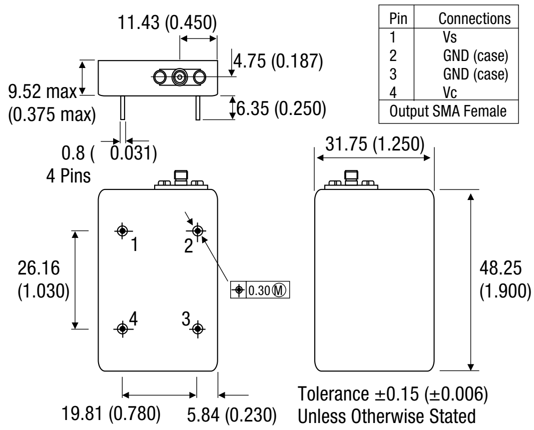
- Due to a wide range of possible alternatives and combinations it is essential that you contact C-MAC Frequency Products to discuss your requirements. Minimum information to include: Frequency + Temperature range + Frequency control range + Control voltage range + Modulation bandwidth + Phase noise/Jitter + Output type/Level

Outline in mm (inches) - (scale 1:2) - CFPSV-1074



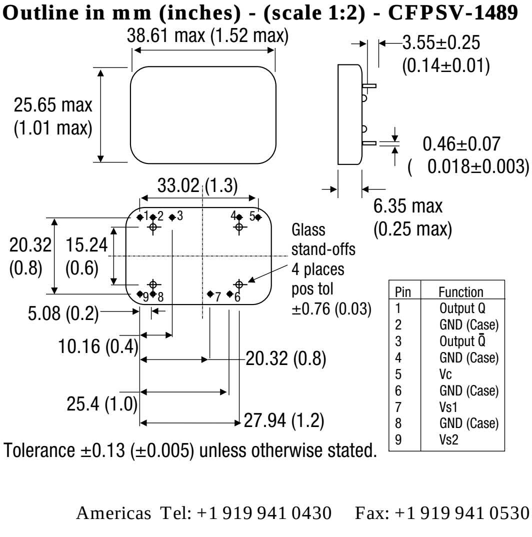
Pin	Connections
1	RF Output
2	GND (case)
3	GND (case)
4	Vs
5	Vc
6	GND (case)
7	N/C

Outline in mm (inches) - (scale 1:2) - CFPSV-1468



Pin	Connections
1	Vs
2	GND (case)
3	GND (case)
4	Vc
Output SMA Female	

Outline in mm (inches) - (scale 1:2) - CFPSV-1489



Pin	Function
1	Output Q
2	GND (Case)
3	Output $\bar{Q}$
4	GND (Case)
5	Vc
6	GND (Case)
7	Vs1
8	GND (Case)
9	Vs2

CFPSF-1000 SERIES

ISSUE 1; 19 JUNE 1998

Description

- The CFPSF-1000 series of UHF SAW filters is aimed at the professional telecoms market. Device characteristics may be optimised for such typical applications as Pulse Code Modulation (PCM) re-timing systems or voltage controlled oscillators. Standard devices are available at the synchronous digital hierarchy (SDH) frequencies of 622.080MHz and 2488.320MHz. The filters surface-mount packages are filled with dry nitrogen and hermetically sealed to ensure maximum long term reliability.

Key Features:

- Frequencies from 500.0MHz to 2600.0MHz
- Standard frequencies available
- Ageing characteristics < 10ppm in first year
- Surface-mount ceramic base package, gold plated kovar walls, kovar lid, hermetically seam welded
- Low profile; < 1.9mm
- Custom design capability

Package Outline

- Leadless Chip Carrier (LCC) SAW filters are encapsulated in a ceramic package with a seam welded metal lid.

Frequency Range (Fc) (mean of 3dB points)

- 500.0MHz to 2600.0MHz

Operating Temperature Range

- –40°C to 85°C

Storage Temperature Range

- –55°C to 125°C

Q (Fc/bandwidth)

- 200 to 800 Typical (depending on design)

Insertion loss (IL)

- 15 to 25dB into 50 (depending on design)

Ageing

- ±10ppm first year max
- ±5ppm per year thereafter

Environmental Specification

- Hermetic Seal: IEC 68-2-17 test Qk (Fine Leak), (MIL-STD-202 Method 112 Test condition C) and IEC 68-2-17 test Qc (Gross Leak), (MIL-STD-202 Method 112 Test condition D)
- Shock: IEC 68-2-27 test Ea (MIL-STD-202 Method 213), ½ Sinewave 981m/s^2 for 11ms, three shocks in each plane
- Damp Heat: IEC 68-2-3 test Ca (steady state), duration 56 days, recovery time 12 hours
- Solderability: IEC 68-2-20 test Ta Method 1 (solder bath) (MIL-STD-202 Method 208), Temperature 235°C
- Change of Temperature: IEC 68-2-14 test Na (rapid change) (MIL-STD-202 Method 107), 5 cycles of 1½ hour duration each for –40/+25/+85/+25°C cycle
- Vibration: IEC 68-2-6 test Fc Procedure B4, (MIL-STD-202 Method 204), Duration 12 hours, 10 to 55Hz 1.5mm D.A., 55 to 2000Hz 98m/s² (10_{gn})
- Bump: IEC 68-2-29 test Eb, 4000 ±10 bumps at 400m/s^2 (40_{gn}) in each of three mutually perpendicular planes

Options

- For other packages/specifications please contact our sales office

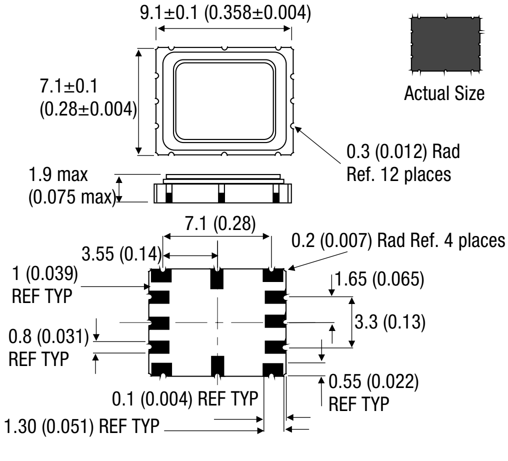
Marking

- Manufacturer
- Model Number
- Frequency
- Date code (Year/Week)

Minimum Order Information Required

- Due to a wide range of possible alternatives and combinations it is essential that you contact C-MAC Frequency Products.

Outline in mm (inches) - (scale 1:2)



NOTES

SM Quartz Crystals - Section Contents

SPECIFYING SURFACE MOUNT QUARTZ CRYSTALS

A typical surface mount quartz crystal specification reads like this:

24.0140MHz 14SMX 15 30 20 18 FUND TR T

Frequency
Holder Style
Frequency Tolerance at 25°C
Frequency Stability
Lower end of Operating Temp Range
Circuit Condition
Overtone order
Packaging
Additional Text Code (for non-standard product)

The following notes define each element of the specification.

Frequency

Frequency is normally specified in kilohertz (kHz) up to 999.999kHz and in megahertz (MHz) from 1.0MHz. All our computer-generated transaction documents follow this standard convention automatically.

The frequency should be described to seven significant figures. If seven significant figures are not used, we assume that any figure that might follow those given may be taken as zero. Thus a frequency given as 16.6MHz will be taken as 16.60, not 16.66667.

Some specifiers extend the use of kHz to all crystals operating in fundamental mode, reserving MHz for overtones. To minimise the possibility of misunderstanding it is best to use the standard method and specify fundamental or overtone mode separately.

Please contact the sales office for details of developed frequencies.

Holder Style

Before manufacture of the crystal can start, the holder style must be defined. Each holder style covers a frequency range which is defined in the relevant specification.

Frequency Tolerance

The cost of manufacture depends partly on the accuracy required at reference temperature (which in the case of the AT-cut crystal, is usually 25 C).

Where high initial accuracy is important the additional manufacturing cost should be weighed against the cost of including a frequency trimming facility within the oscillator.

Frequency Stability

Frequency stability is normally specified as a frequency tolerance over a defined operating temperature range with respect to the frequency reference temperature. The temperature ranges are defined for each crystal in the relevant data sheet. However the majority of crystals will continue to operate quite satisfactorily outside the temperature range for which they are specified, but with a degradation in the value of frequency stability. Under normal conditions this will not damage the crystal.

A crystal designed for operation over a restricted operating temperature range, (such as from 0 to 50°C) has a better frequency stability over that range than one designed for operation over a wide operating temperature range. Therefore it is important not to over specify the temperature range, as doing so will result in inferior performance for the same or greater cost; or greater cost for the same or inferior performance.

Operating Temperature Range

The standard operating temperature ranges for a crystal are:

- 0 to 50°C
  –10 to 60°C
  –20 to 70°C
  –30 to 80°C
  –40 to 90°C
  –55 to 105°C
  –55 to 125°C

When the required temperature range is symmetrical about 25°C, it is indicated in the specification by the lower figure, ie: –20 to 70°C would read ‘20’ as shown in the example. If the required temperature range is not symmetrical about 25°C, both figures are used, ie: –55 to 85°C and appear in the addtional text code section (T).

Circuit condition

The characters ‘SR’ are used to denote calibration of the crystal at series resonance. If it is to be calibrated at load resonance the characters represent the circuit load capacitance in pF.

Packaging Codes

Tray Packaging is available as an option on many of the products outlined in the SM Quartz Crystal chapter.

Unless individual datasheets state Bulk Packaging, items will be Tape & Reel packed. Please note: only complete Reels are sold.

- BU = Bulk packed
- TR = Tape & Reel packed
- TY = Tray packed

Additional Text Code

If the product is non-standard, the letter ‘T’ will appear at the end of the product specification. This refers to additional text on the purchase order to identify the special requirements.

Outline Drawings

Dimensions on the crystal outline drawings are shown only as a guide. Precise dimensions of crystal holders are available from our factory upon request. All dimensions are shown in mm (& inches) and are nominal unless otherwise stated. All outlines are at a scale of 1:1 unless otherwise specified.

Standard Frequency Tolerances and Stabilities

- 10ppm, 15ppm, 20ppm, 30ppm, 50ppm, 100ppm

Soldering Conditions

Recommended solder pad layouts and soldering temperature profile are shown on each data sheet.

Delivery Options

The following delivery options are available for crystals; timescales refer to despatch from our factories. Prices for larger quantities and longer delivery times are generally lower due to substantially reduced manufacturing costs.

- 6 weeks
- 10 to 12 weeks

Marking

Where possible the frequency of operation will be marked in full on the crystal. On the smaller types the full frequency may not fit in the available space and will therefore be truncated. Please refer to the despatch packaging for the relevant crystal to see the frequency in full.

Some stock surface mount crystals are marked only with the C-MAC Frequency Products stock code. Referencing this to the stock table will give you the full frequency and specification.

Ordering Information

- See individual datasheets

Stability Conversion Chart

10^x	PPM	%
10^{-3}	1000	0.1
10^{-4}	100	0.01
10^{-5}	10	0.001
10^{-6}	1	0.0001
10^{-7}	0.1	0.00001
10^{-8}	0.01	0.000001
10^{-9}	0.001	0.0000001
10^{-10}	0.0001	0.00000001

STOCK SURFACE MOUNT QUARTZ CRYSTALS

Minimum Order Information Required

- Stock Number or Alpha Code

90SMX CRYSTALS

Frequency	Specification	Stock No.	Alpha Code	Packaging
32.7680kHz	20/-/-/6	XTAL015822	A103L	BU
32.7680kHz	20/-/-/6	XTAL013015	A103M	T & R
32.7680kHz	20/-/-/12.5	XTAL002998	A103D	T & R

91SMX CRYSTALS

Frequency	Specification	Stock No.	Alpha Code	Packaging
32.7680kHz	20/-/-/12.5	XTAL002999	A103E	T & R
32.7680kHz	20/-/-/12.5	XTAL003003	A103N	BU
32.7680kHz	20/-/-/6	XTAL010193	A103R	BU
32.7680kHz	20/-/-/6	XTAL003001	A103G	T & R
32.7680kHz	20/-/-/12.5	XTAL003004	A103S	BU

85SMX CRYSTALS

Frequency	Specification	Stock No.	Alpha Code	Packaging
32.7680kHz	20/-/-/12.5	XTAL003000	A103F	BU
32.7680kHz	20/-/-/12.5	XTAL016207	A103J	T & R
32.7680kHz	20/-/-/6	XTAL017503	A103K	T & R
32.7680kHz	20/-/-/6	XTAL016178	A103W	BU

86SMX CRYSTALS

Frequency	Specification	Stock No.	Alpha Code	Packaging
3.579545MHz	50/100/20/20	XTAL003057	A119D	BU
3.68640MHz	50/100/20/16	XTAL003258	A169B	BU
4.0MHz	50/100/20/30	XTAL003069	A120C	BU
4.91520MHz	50/100/20/16	XTAL003112	A127C	BU
6.0MHz	50/100/20/30	XTAL003129	A132C	BU
7.37280MHz	50/100/20/16	XTAL003331	A194C	BU
8.0MHz	50/100/20/16	XTAL003149	A140C	BU
10.0MHz	50/100/20/20	XTAL003163	A143C	BU
12.0MHz	50/100/20/16	XTAL003209	A158D	BU
14.318180MHz	50/100/20/16	XTAL003196	A153C	BU
16.0MHz	50/100/20/16	XTAL003232	A161B	BU
16.0MHz	50/100/20/20	XTAL003234	A161D	BU
16.0MHz	50/100/20/SR	XTAL003235	A161E	BU
18.4320MHz	50/100/20/20	XTAL003175	A146C	BU
20.0MHz	50/100/20/16	XTAL003178	A147B	BU
24.0MHz	50/100/20/16	XTAL003321	A189C	BU
* Please note: The 86SMX is being replaced by CFPX-86				

CFPX-86 CRYSTALS

Frequency	Specification	Stock No.	Alpha Code	Packaging
3.579545MHz	50/100/20/20	XTAL022427	A452B	BU
3.579545MHz	50/100/20/20	XTAL022429	A452A	T & R
3.68640MHz	50/100/20/16	XTAL022430	A453B	BU
3.68640MHz	50/100/20/16	XTAL022431	A453A	T & R
4.0MHz	50/100/20/30	XTAL022432	A454B	BU
4.0MHz	50/100/20/30	XTAL022433	A454A	T & R
4.91520MHz	50/100/20/16	XTAL022434	A455B	BU
4.91520MHz	50/100/20/16	XTAL022435	A455A	T & R
6.0MHz	50/100/20/30	XTAL022437	A456B	BU
7.37280MHz	50/100/20/16	XTAL022438	A457B	BU
8.0MHz	50/100/20/16	XTAL022439	A458B	BU
8.0MHz	50/100/20/16	XTAL022440	A458A	T & R
10.0MHz	50/100/20/20	XTAL022441	A459B	BU
12.0MHz	50/100/20/16	XTAL022442	A460B	BU
12.0MHz	50/100/20/16	XTAL022443	A460A	T & R
14.318180MHz	50/100/20/16	XTAL022444	A461B	BU
14.318180MHz	50/100/20/16	XTAL022445	A461A	T & R
16.0MHz	50/100/20/16	XTAL022446	A462B	BU
16.0MHz	50/100/20/16	XTAL022423	A462A	T & R
16.0MHz	50/100/20/SR	XTAL022447	A462C	BU
18.4320MHz	50/100/20/20	XTAL022448	A463B	BU
18.4320MHz	50/100/20/20	XTAL022449	A463A	T & R
20.0MHz	50/100/20/16	XTAL022450	A464B	BU
20.0MHz	50/100/20/16	XTAL022451	A464A	T & R
24.0MHz	50/100/20/16	XTAL022452	A465B	BU
24.0MHz	50/100/20/16	XTAL022453	A465A	T & R

12SMX (B) CRYSTALS

Frequency	Specification	Stock No.	Alpha Code	Packaging
28.2240MHz	30/50/10/18	XTAL018105	A224S	BU
28.2240MHz	30/50/10/18	XTAL017178	A224R	T & R
56.4480MHz	30/50/10/18	XTAL018104	A225S	BU
56.4480MHz	30/50/10/18	XTAL017179	A225R	T & R

14SMX CRYSTALS

Frequency	Specification	Stock No.	Alpha Code	Packaging
14.74560MHz	15/30/10/18	XTAL003226	A159N	BU
14.74560MHz	15/30/10/18	XTAL003225	A159R	T & R
16.3840MHz	20/50/10/20	XTAL003295	A178R	T & R

19.66080MHz	15/30/20/18	XTAL003310	A182R	BU
24.000140MHz	15/30/20/18	XTAL003362	A210R	BU
35.25120MHz	15/30/20/18 3rd	XTAL003371	A216R	T & R
38.000530MHz	15/30/20/18 3rd	XTAL003376	A219R	BU
40.320MHz	15/30/20/18 Fund	XTAL003380	A220R	T & R
40.320MHz	30/50/10/18 3rd	XTAL010131	A220S	BU

32SMX CRYSTALS

Frequency	Specification	Stock No.	Alpha Code	Packaging
3.579545MHz	50/50/10/20	XTAL021722	A316B	BU
3.579545MHz	50/50/10/20	XTAL022058	A316C	T & R
3.68640MHz	50/50/10/20	XTAL021510	A317B	BU
3.68640MHz	50/50/10/20	XTAL019918	A169R	T & R
4.0MHz	50/50/10/30	XTAL021723	A318B	BU
4.0MHz	50/50/10/30	XTAL022059	A318C	T & R
8.0MHz	30/50/10/16	XTAL021724	A319B	BU
8.0MHz	30/50/10/16	XTAL022060	A319C	T & R
11.05920MHz	30/50/10/20	XTAL021725	A320B	BU
11.05902MHz	30/50/10/20	XTAL022061	A320C	T & R
14.74560MHz	30/50/10/18	XTAL021701	A321B	BU
14.74560MHz	30/50/10/18	XTAL022062	A321C	T & R
16.0MHz	30/50/10/16	XTAL020437	A322B	BU
16.0MHz	30/50/10/16	XTAL018388	A322C	T & R

HC49/4H SMX CRYSTALS

Frequency	Specification	Stock No.	Alpha Code	Packaging
3.579545MHz	30/50/10/16	XTAL003058	A119E	BU
3.579545MHz	30/50/10/16	XTAL010218	A119W	T & R
3.579545MHz	30/50/10/30	XTAL017141	A119S	BU
3.579545MHz	30/50/10/30	XTAL015517	A119L	T & R
3.68640MHz	30/50/10/16	XTAL003260	A169E	BU
3.68640MHz	30/50/10/16	XTAL003265	A169N	T & R
3.68640MHz	30/50/10/30	XTAL017142	A169S	BU
3.68640MHz	30/50/10/30	XTAL015030	A169L	T & R
4.0MHz	30/50/10/16	XTAL003071	A120E	BU
4.0MHz	30/50/10/16	XTAL003078	A120R	T & R
4.0MHz	30/50/10/30	XTAL011300	A120S	BU
4.0MHz	30/50/10/30	XTAL013676	A120H	T & R
4.91520MHz	30/50/10/16	XTAL003113	A127E	BU
4.91520MHz	30/50/10/16	XTAL018153	A127J	T & R
4.91520MHz	30/50/10/30	XTAL017143	A127S	BU
4.91520MHz	30/50/10/30	XTAL017158	A127L	T & R
5.0MHz	30/50/10/30	XTAL012312	A128S	BU

Frequency	Specification	Stock No.	Alpha Code	Packaging
5.0MHz	30/50/10/30	XTAL012246	A128L	T & R
6.0MHz	30/50/10/30	XTAL016788	A132S	BU
6.0MHz	30/50/10/30	XTAL017159	A132L	T & R
7.37280MHz	30/50/10/30	XTAL010689	A194S	BU
7.37280MHz	30/50/10/30	XTAL010386	A194G	T & R
8.0MHz	30/50/10/16	XTAL003151	A140E	BU
8.0MHz	30/50/10/16	XTAL010702	A140I	T & R
8.0MHz	30/50/10/30	XTAL011301	A140S	BU
8.0MHz	30/50/10/30	XTAL013919	A140L	T & R
8.1920MHz	30/50/10/30	XTAL017144	A170R	BU
8.1920MHz	30/50/10/30	XTAL017160	A170L	T & R
9.83040MHz	30/50/10/30	XTAL017048	A173S	BU
9.83040MHz	30/50/10/30	XTAL010387	A173L	T & R
10.0MHz	30/50/10/16	XTAL003166	A143G	BU
10.0MHz	30/50/10/16	XTAL011400	A143I	T & R
10.0MHz	30/50/10/30	XTAL017145	A143S	BU
10.0MHz	30/50/10/30	XTAL013493	A143L	T & R
11.05920MHz	30/50/10/16	XTAL003519	L108E	BU
11.05920MHz	30/50/10/16	XTAL010880	L108I	T & R
12.0MHz	30/50/10/16	XTAL003210	A158E	BU
12.0MHz	30/50/10/16	XTAL010430	A158R	T & R
12.0MHz	30/50/10/30	XTAL010043	A158S	BU
12.0MHz	30/50/10/30	XTAL005214	A158M	T & R
14.318180MHz	30/50/10/30	XTAL011650	A153S	BU
14.318180MHz	30/50/10/30	XTAL016724	A153N	T & R
14.74560MHz	30/50/10/30	XTAL012313	A159L	BU
14.74560MHz	30/50/10/30	XTAL010878	A159G	T & R
15.360MHz	30/50/10/30	XTAL013819	M451S	BU
15.360MHz	30/50/10/30	XTAL017161	M451L	T & R
16.0MHz	30/50/10/16	XTAL003237	A161G	BU
16.0MHz	30/50/10/16	XTAL013322	A161V	T & R
18.4320MHz	30/50/10/30	XTAL013406	A146S	BU
18.4320MHz	30/50/10/30	XTAL014134	A146L	T & R
19.66080MHz	30/50/10/30	XTAL010690	A182S	BU
19.66080MHz	30/50/10/30	XTAL014441	A182L	T & R
20.0MHz	30/50/10/16	XTAL003181	A147E	BU
20.0MHz	30/50/10/16	XTAL003187	A147R	T & R
20.0MHz	30/50/10/30	XTAL017146	A147S	BU
20.0MHz	30/50/10/30	XTAL017162	A147G	T & R

CX-1-SM CRYSTALS 10.0kHz to 2.10MHz

ISSUE 5; 26 MARCH 1998

Delivery Options

- Please contact our sales office for current leadtimes

Description

- Statek's CX-1, -1V, -1H range of SM quartz crystals are designed for surface mounting on printed circuit boards or hybrid substrates. CX-1V-SM models are for use in Pierce oscillators. CX-1H-SM models are for use in series oscillators and CX-1-SM are length extensional mode resonators.

Holder Style

- CX-1-SM: hermetically sealed ceramic package.

Terminations

- SM1 - gold plated
- SM2 - nickel solder plated
- SM3 - nickel solder plated, solder dipped

Methods of Attachment

- Vapour phase, wave solder, infrared or silver epoxy.

General Specifications

- Load Capacitance (C_L) CX-1V-SM type:
  11pF (10.0 to < 16.0kHz)
  10pF (16.0 to < 25.0kHz)
  9pF (25.0 to < 55.0kHz)
  8pF (55.0 to < 100.0kHz)
  5pF (100.0 to < 180.0kHz)
  4pF (180.0 to < 614.40kHz)
- Load Capacitance (C_L) CX-1-SM type:
  7pF (530.0 to 2.10MHz)
  Other values available upon request
  CX-1H-SM type is calibrated at Series Resonance
- Static Capacitance (C_0): 1.0 to 2.0pF
- Drive Level CX-1V-SM type
  0.5 W max. (10.0 to < 25.0kHz)
  1.0 W max. (25.0 to 614.40kHz)
- Drive Level CX-1-SM type
  3.0 W max. (530.0kHz to 2.10MHz)
- Drive Level CX-1H-SM type
  1.5 W max. (10.0 to < 25.0kHz)
  3.0 W max. (25.0 to 614.40kHz)
- Ageing: 5ppm max first year

Operating Temperature Ranges

- –10 to 70°C = C   –40 to 85°C = I
- –55 to 125°C = M

Storage Temperature Range

- –55 to 125°C

Environmental Specification

- Shock: 1000g, 1.0ms ½ sine (< 614.40kHz)
- Shock: 750g, 0.3ms ½ sine (530.0kHz to 2.10MHz)
- Vibration: 20g, 10 to 2000Hz

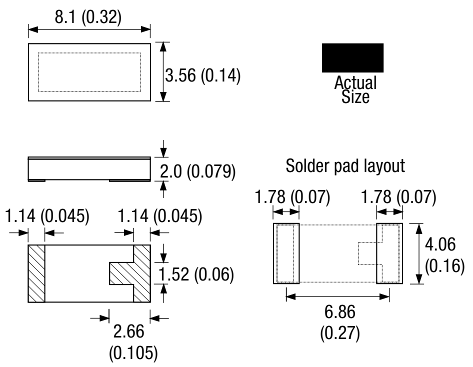
Marking

- Includes Frequency

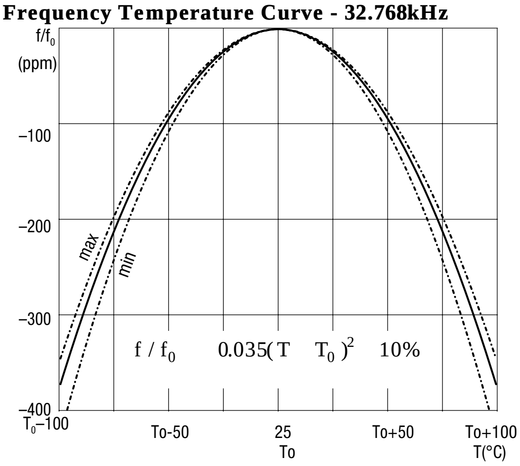
Minimum Order Information Required

- Frequency + Model + Termination + Frequency Tolerance @ 25°C + Operating Temperature Range + Circuit Condition

Outline in mm (inches) - (scale 2:1)



Frequency Temperature Curve - 32.768kHz



SURFACE MOUNT QUARTZ CRYSTALS

Electrical Specification – maximum limiting values

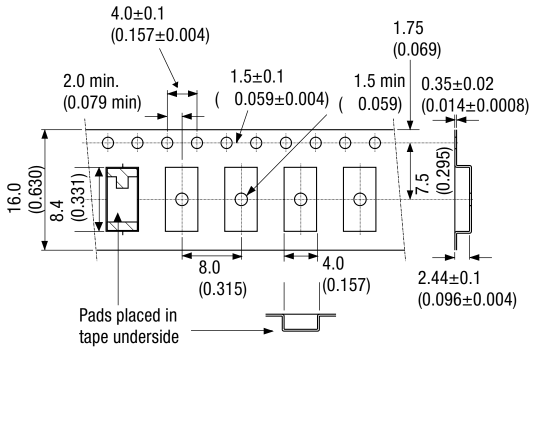
Frequency Range	Frequency Tolerance @ 25°C ±2°C	Operating Temperature Range	*ESR max.	Vibration Mode
10.0 to < 25.0kHz	A = ±30ppm B = ±100ppm C = ±1000ppm	–10 to 70°C –40 to 85°C –55 to 125°C	2.1M	Tuning Fork
25.0 to < 50.0kHz	A = ±30ppm B = ±100ppm C = ±1000ppm	–10 to 70°C –40 to 85°C –55 to 125°C	360k	Tuning Fork
50.0 to < 75.0kHz	A = ±30ppm B = ±100ppm C = ±1000ppm	–10 to 70°C –40 to 85°C –55 to 125°C	160k	Tuning Fork
75.0 to < 170.0kHz	A = ±50ppm B = ±100ppm C = ±1000ppm	–10 to 70°C –40 to 85°C –55 to 125°C	100k	Tuning Fork
170.0 to < 250.0kHz	A = ±100ppm B = ±200ppm C = ±2000ppm	–10 to 70°C –40 to 85°C –55 to 125°C	50k	Tuning Fork
250.0 to < 614.40kHz	A = ±200ppm B = ±500ppm C = ±5000ppm	–10 to 70°C –40 to 85°C –55 to 125°C	25k	Tuning Fork
530.0kHz to 2.10MHz**	A = ±500ppm B = ±1000ppm C = ±10000ppm	–10 to 70°C –40 to 85°C –55 to 125°C	3k	Extensional

Ordering Example: 600.0kHz CX-1V SMI C C 9pF

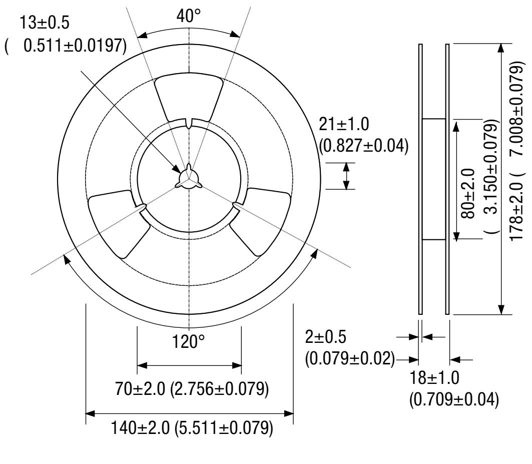
- Frequency — 600.0kHz
- Model — CX-1V
- Termination — SMI
- Frequency Tolerance @ 25°C — C
- Operating Temperature Range: C = –10 to 70°C; I = –40 to 85°C; M = –55 to 125°C — C
- Load Capacitance (Circuit Condition) (if non standard) — 9pF

* Above ESR values are for CX-1H only, CX-1V divide above values by 3.
**Only CX-1 available, ESR for this range is as shown in table
Please note: other frequency tolerances are available on request.

Outline in mm (inches) - Tape



Outline in mm (inches) - Reel (scale 1:5)



CX-1-SM CRYSTALS 8.0 to 160.0MHz

ISSUE 5; 26 MARCH 1998

Delivery Options

- Please contact our sales office for current leadtimes

Description

- Statek's CX-1-SM quartz crystals are designed for surface mounting on printed circuit boards or hybrid substrates.

Holder Style

- CX-1-SM: hermetically sealed ceramic package.

Terminations

- SM1 - gold plated
- SM2 - nickel solder plated
- SM3 - nickel solder plated, solder dipped

Methods of Attachment

- Vapour phase, wave solder, infrared or silver epoxy.

General Specifications

- Load Capacitance (C_L): 20pF
  Other values available upon request
- Static Capacitance (C_0): 2.0 to 3.5pF
- Drive Level: 500 W max
- Ageing: 5ppm max first year

Standard Frequency Tolerance*

- ±100ppm, ±1000ppm, ±10000ppm
  * Tighter tolerances available

Operating Temperature Ranges

- –10 to 70°C = C
- –40 to 85°C = I
- –55 to 125°C = M

Storage Temperature Range

- –55 to 125°C

Environmental Specification
(higher specification available on request)

- Shock: 3000g, 0.3ms ½ sine
- Vibration: 20g rms, 10 to 2000Hz random

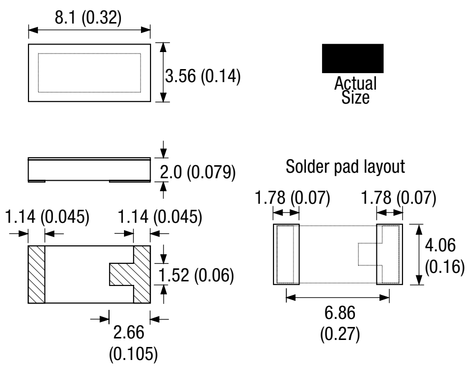
Marking

- Includes Frequency

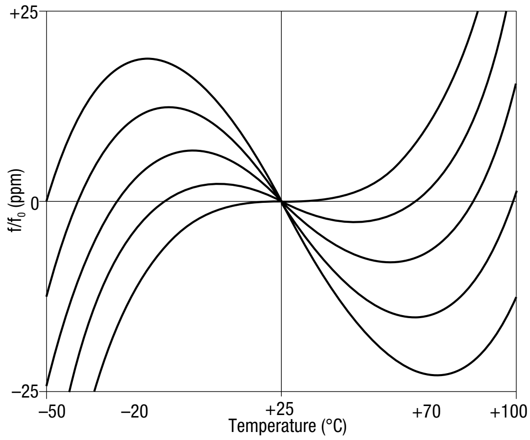
Minimum Order Information Required

- Frequency + Model + Termination + Frequency Tolerance @ 25°C + Frequency Stability + Operating Temperature Range + Circuit Condition

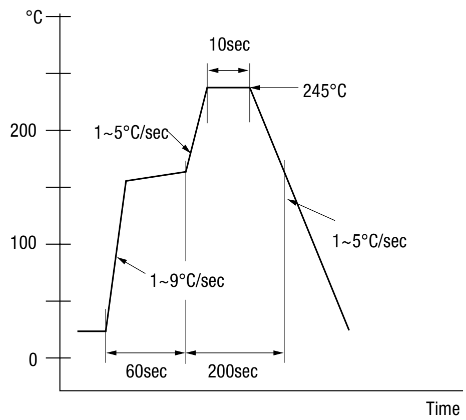
Outline in mm (inches) - (scale 2:1)



Frequency Temperature Curve



Typical Solder Condition - Infrared Reflow



Electrical Specification – maximum limiting values

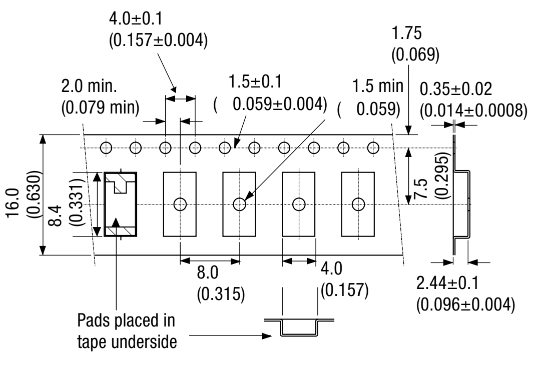
Frequency Range	*Frequency Tolerance @ 25°C ±2°C	Operating Temperature Range	Frequency Stability Available Over Operating Temperature		ESR Max	Vibration Mode
			Minimum	Maximum		
8.0 to < 9.0MHz	A = ±100ppm B = ±1000ppm C = ±10000ppm	–10 to 70°C	±10ppm	±100ppm	300	Fundamental AT cut
		–40 to 85°C	±20ppm	±100ppm		
		–55 to 125°C	±30ppm	±300ppm		
9.0 to < 11.0MHz	A = ±100ppm B = ±1000ppm C = ±10000ppm	–10 to 70°C	±10ppm	±100ppm	200	Fundamental AT cut
		–40 to 85°C	±20ppm	±100ppm		
		–55 to 125°C	±30ppm	±300ppm		
11.0 to < 14.0MHz	A = ±100ppm B = ±1000ppm C = ±10000ppm	–10 to 70°C	±10ppm	±100ppm	100	Fundamental AT cut
		–40 to 85°C	±20ppm	±100ppm		
		–55 to 125°C	±30ppm	±300ppm		
14.0 to < 20.0MHz	A = ±100ppm B = ±1000ppm C = ±10000ppm	–10 to 70°C	±10ppm	±100ppm	70	Fundamental AT cut
		–40 to 85°C	±20ppm	±100ppm		
		–55 to 125°C	±30ppm	±300ppm		
20.0 to 70.0MHz	A = ±100ppm B = ±1000ppm C = ±10000ppm	–10 to 70°C	±10ppm	±100ppm	50	Fundamental AT cut
		–40 to 85°CI	±20ppm	±100ppm		
		–55 to 125°C	±30ppm	±300ppm		
48.0 to 160.0MHz	A = ±100ppm B = ±1000ppm C = ±10000ppm	–10 to 70°C	±10ppm	±100ppm	80	3rd Overtone
		–40 to 85°C	±20ppm	±100ppm		
		–55 to 125°C	±30ppm	±300ppm		

Ordering Example 10.0MHz CX-1 SMI A 100ppm C 18pF

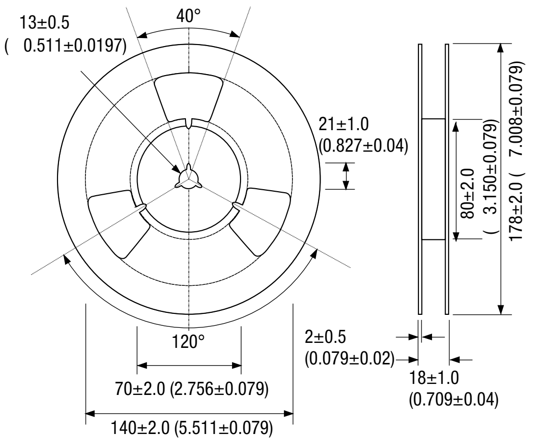
Frequency
Model
Termination
Frequency Tolerance @ 25°C
Frequency Stability
Operating Temperature Range: C = –10 to 70°C; I = –40 to 85°C; M = –55 to 125°C
Load Capacitance (Circuit Condition) (if non standard)

*Please note: other frequency tolerances are available on request.

Outline in mm (inches) - Tape



Outline in mm (inches) - Reel (scale 1:5)



2SMX CRYSTALS

ISSUE 3; 9 SEPTEMBER 1999

Delivery Options

- Please contact our sales office for current leadtimes

Holder Style

- 2SMX surface mount crystals are encapsulated in a ceramic package with a seam welded metal lid

General Specifications

- Load Capacitance (C_L): 10pF to 75pF or Series
- Drive Level: 0.1mW max.
- Static Capacitance (C_0): 7pF max.

Packaging

- 2SMX surface mount crystals are available packaged individually or on tape and reel

Standard Frequencies

- 12.0MHz, 14.318180MHz, 14.74560MHz, 15.0MHz, 16.0MHz, 16.000312MHz, 16.58880MHz, 18.4320MHz, 19.66080MHz, 20.0MHz, 20.27520MHz, 24.0MHz, 24.000140MHz, 24.5760MHz, 29.49120MHz, 30.0MHz, 32.0MHz, 36.0MHz, 40.0MHz, 40.320MHz, 50.0MHz

Standard Frequency Tolerances and Stabilities

- ppm, ppm

Operating Temperature Ranges

- –10 to 60°C

Storage Temperature Range

- –40 to 85°C

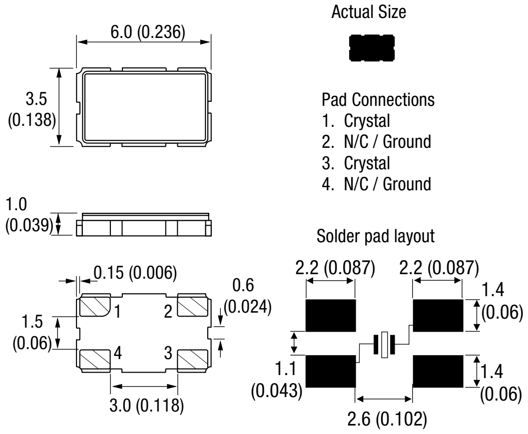
Marking

- Frequency only

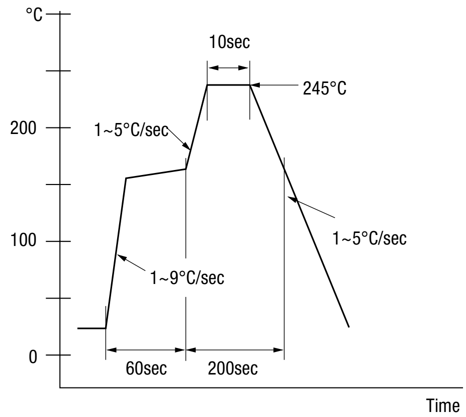
Minimum Order Information Required

- Frequency + Holder + Frequency Tolerance @ 25°C + Frequency Stability + Operating Temperature Range + Circuit Condition + Overtone Order

Outline in mm (inches) - (scale 3:1)



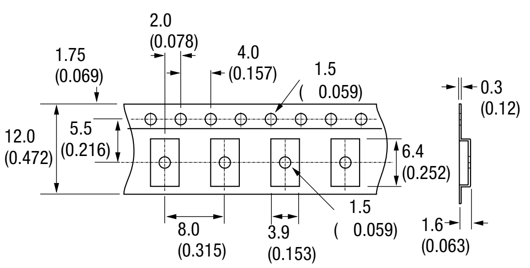
Typical Solder Condition - Infrared Reflow



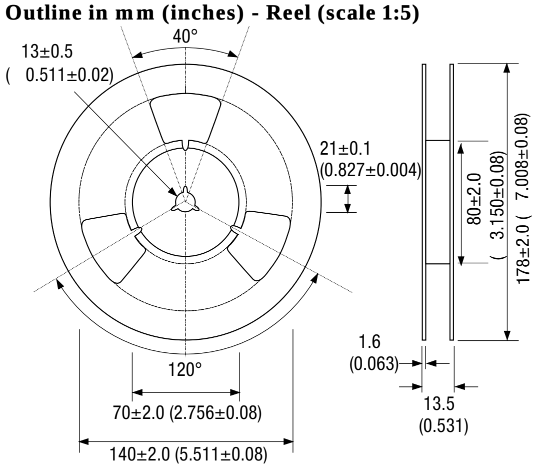
Electrical Specification - maximum limiting values

Frequency Range	Frequency Tolerance @ 25°C ±2°C	Operating Temperature Range	Frequency Stability Available Over Operating Temperature		ESR Max	Vibration Mode
			Minimum	Maximum		
12.0 to <16.0MHz	±10ppm to ±50ppm	0 to 50°C	±5ppm	±50ppm	60	Fundamental AT cut
		–10 to 60°C	±5ppm	±50ppm		
		–20 to 70°C	±10ppm	±50ppm		
		–30 to 80°C	±10ppm	±50ppm		
		–40 to 85°C	±15ppm	±50ppm		
16.0 to 40.0MHz	±10ppm to ±50ppm	0 to 50°C	±5ppm	±50ppm	40	Fundamental AT cut
		–10 to 60°C	±5ppm	±50ppm		
		–20 to 70°C	±10ppm	±50ppm		
		–30 to 80°C	±10ppm	±50ppm		
		–40 to 85°C	±15ppm	±50ppm		
> 40.0 to 67.0MHz	±10ppm to ±50ppm	0 to 50°C	±5ppm	±50ppm	70	3rd Overtone AT cut
		–10 to 60°C	±5ppm	±50ppm		
		–20 to 70°C	±10ppm	±50ppm		
		–30 to 80°C	±10ppm	±50ppm		
		–40 to 85°C	±15ppm	±50ppm		

Outline in mm (inches) - Tape



Outline in mm (inches) - Reel (scale 1:5)



3SMX CRYSTALS

ISSUE 1; 6 APRIL 1998

Delivery Options

- Please contact our sales office for current leadtimes

Holder Style

- 3SMX surface mount crystals are housed in a hermetically glass sealed ceramic package.

General Specifications

- Load Capacitance (C_L): 10pF to 75pF or Series
- Drive Level: 0.1mW max.
- Static Capacitance (C_0): 7pF max.

Packaging

- 3SMX surface mount crystals are available packaged individually or on tape and reel

Standard Frequencies

- 12.0MHz, 14.318180MHz, 14.74560MHz, 15.0MHz, 16.0MHz, 16.000312MHz, 16.58880MHz, 18.4320MHz, 19.66080MHz, 20.0MHz, 20.27520MHz, 24.0MHz, 24.000140MHz, 24.5760MHz, 28.2240MHz, 29.49120MHz, 30.0MHz, 32.0MHz, 36.0MHz, 40.0MHz, 40.320MHz, 50.0MHz, 56.4480MHz

Standard Frequency Tolerances and Stabilities

- 50ppm, 100ppm

Operating Temperature Range

- –10 to 60°C

Storage Temperature Range

- –30 to 85°C

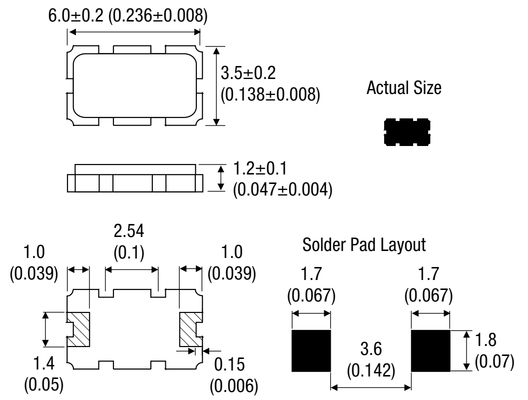
Marking

- Frequency only

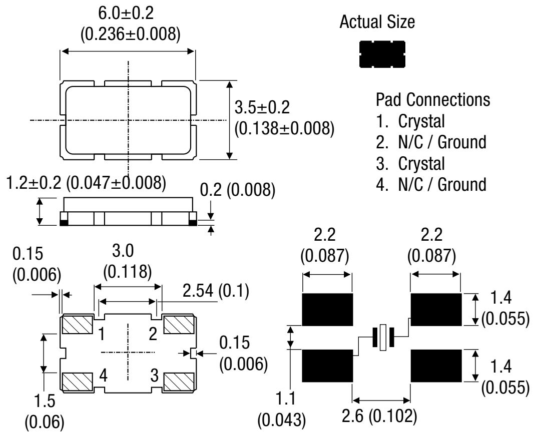
Minimum Order Information Required

- Frequency + Holder + Frequency Tolerance @ 25°C + Frequency Stability + Operating Temperature Range + Circuit Condition + Overtone Order

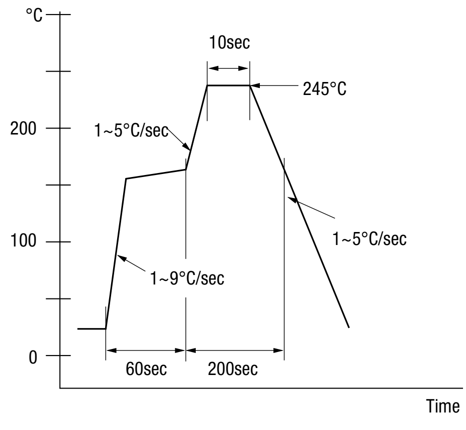
Outline in mm (inches) - 3SMX (A) (scale 3:1)



Outline in mm (inches) - 3SMX (B) (scale 3:1)



Typical Solder Condition - Infrared Reflow

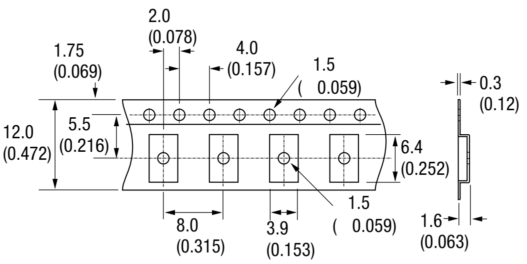


SURFACE MOUNT QUARTZ CRYSTALS

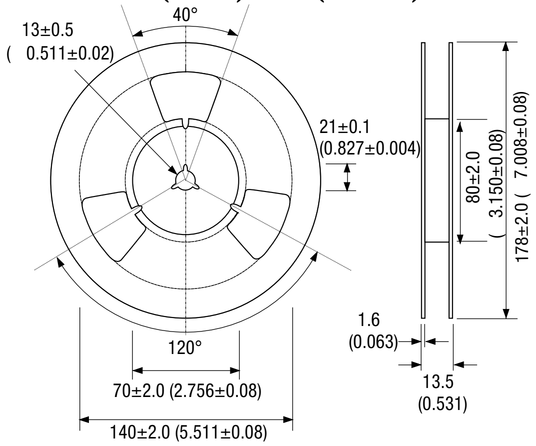
Electrical Specification - maximum limiting values

Frequency Range	Frequency Tolerance @ 25°C ±2°C	Operating Temperature Range	Frequency Stability Available Over Operating Temperature		ESR Max	Vibration Mode
			Minimum	Maximum		
12.0 to <16.0MHz	±50ppm	–10 to 60°C	±50ppm	±100ppm	60	Fundamental AT cut
16.0 to 40.0MHz	±50ppm	–10 to 60°C	±50ppm	±100ppm	40	Fundamental AT cut
> 40.0 to 67.0MHz	±50ppm	–10 to 60°C	±50ppm	±100ppm	70	3rd Overtone AT cut

Outline in mm (inches) - Tape



Outline in mm (inches) - Reel (scale 1:5)



4SMX CRYSTALS

ISSUE 2; 9 SEPTEMBER 1999

Delivery Options

- Please contact our sales office for current leadtimes

Holder Style

- 4SMX surface mount crystals are encapsulated in a hermetically glass sealed ceramic package.

General Specifications

- Load Capacitance (C_L): 10pF to 75pF or Series
- Drive Level: 0.1mW max.
- Static Capacitance (C_0): 7pF max.

Packaging

- 4SMX surface mount crystals are available packaged individually or on tape and reel

Standard Frequencies

- 12.0MHz, 14.318180MHz, 14.74560MHz, 16.0MHz, 18.4320MHz, 19.20MHz, 19.66080MHz, 20.0MHz, 24.0MHz, 25.0MHz, 27.0MHz, 28.2240MHz, 30.0MHz, 32.0MHz, 33.3330MHz, 40.0MHz, 48.0MHz, 56.4480MHz

Standard Frequency Tolerances and Stabilities

- 50ppm, ppm

Operating Temperature Range

- –10 to 60°C

Storage Temperature Range

- –30 to 85°C

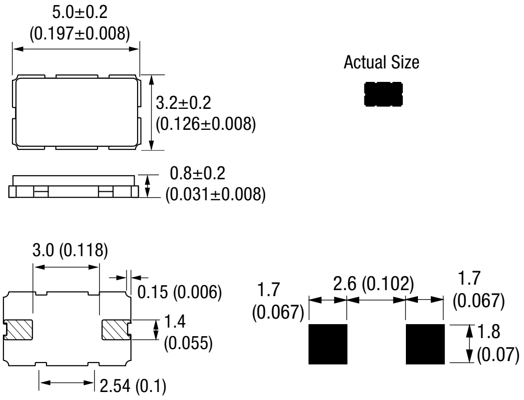
Marking

- Frequency only

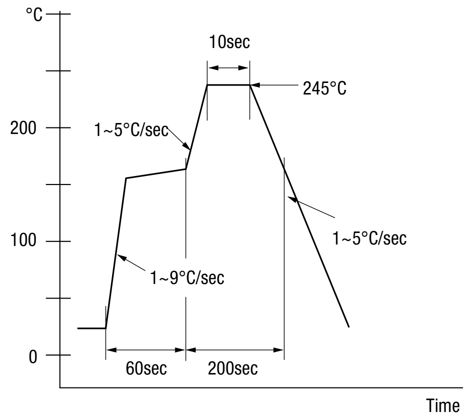
Minimum Order Information Required

- Frequency + Holder + Frequency Tolerance @ 25°C + Frequency Stability + Operating Temperature Range + Circuit Condition + Overtone Order

Outline in mm (inches) - (scale 3:1)



Typical Solder Condition - Infrared Reflow

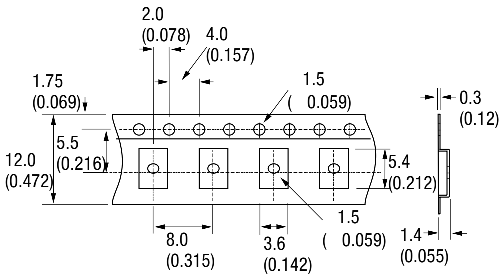


Electrical Specification - maximum limiting values

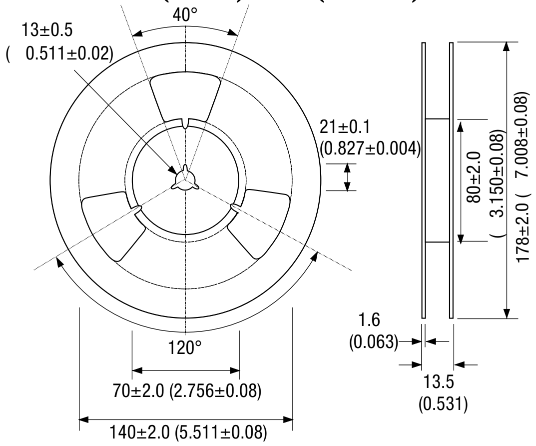
Frequency Range	Frequency Tolerance @ 25°C ±2°C	Operating Temperature Range	Frequency Stability Available Over Operating Temperature	ESR Max	Vibration Mode
12.0 to <14.0MHz	±50ppm	–10 to 60°C	±100ppm	140	Fundamental AT cut
14.0 to <16.0MHz	±50ppm	–10 to 60°C	±100ppm	90	Fundamental AT cut
16.0 to 67.0MHz	±50ppm	–10 to 60°C	±100ppm	60	Fundamental BT cut

SURFACE MOUNT QUARTZ CRYSTALS

Outline in mm (inches) - Tape



Outline in mm (inches) - Reel (scale 1:5)



CFPX-5 CRYSTALS

ISSUE 1; 9 SEPTEMBER 1999

Delivery Options

- Please contact our sales office for current leadtimes

Holder Style

- CFPX-5 surface mount crystals are encapsulated in a ceramic package with a seam welded metal lid

General Specifications

- Load Capacitance (C_L): 16pF standard
- Drive Level: 100 W max

Packaging

- CFPX-5 surface mount crystals are available packaged individually or on tape and reel

Operating Temperature Ranges

- –10 to 60°C

Storage Temperature Range

- –40 to 85°C

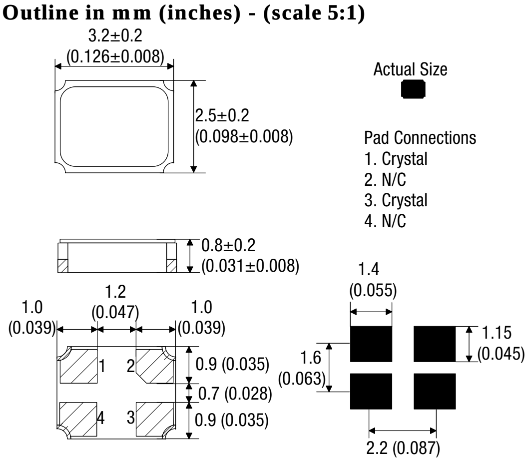
Marking

- Frequency only

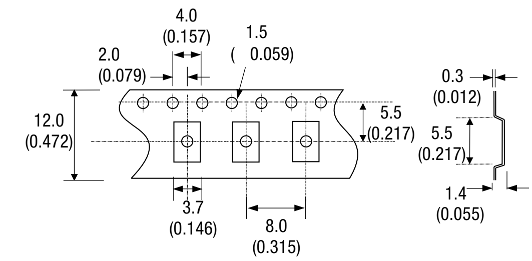
Minimum Order Information Required

- Frequency + Holder and Pad Configuration + Frequency Tolerance @ 25°C + Frequency Stability + Operating Temperature Range + Circuit Condition + Overtone Order

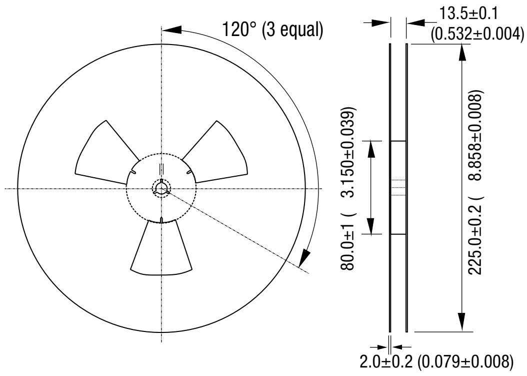
Outline in mm (inches) - (scale 5:1)



Outline in mm (inches) - Tape



Outline in mm (inches) - Reel (scale 1:6)



Electrical Specification - maximum limiting values

Frequency Range	Frequency Tolerance @ 25°C ±3°C	Operating Temperature Range	Frequency Stability Available Over Operating Temperature Range	ESR Max	Vibration Mode
20.0 to < 25.0MHz	±50ppm	–10 to 60°C	±50ppm	150	Fundamental AT cut
25.0 to < 40.0MHz	±50ppm	–10 to 60°C	±50ppm	100	Fundamental AT cut

12SMX CRYSTALS

ISSUE 8; 14 JULY 1998

Delivery Options

- Please contact our sales office for current leadtimes

Holder Style

- 12SMX surface mount crystals are encapsulated in a ceramic package with a resin sealed lid

General Specifications

- Load Capacitance (C_L): 10pF to 75pF or Series
- Drive Level: 0.1mW max
- Static Capacitance (C_0): 7pF max

Packaging

- 12SMX surface mount crystals are available packaged individually or on tape and reel

Standard Frequencies

- 9.83040MHz, 10.0MHz, 11.05920MHz, 12.0MHz, 14.318180MHz, 14.74560MHz, 15.0MHz, 16.0MHz, 16.000312MHz, 16.58880MHz, 18.4320MHz, 19.66080MHz, 20.0MHz, 20.27520MHz, 24.0MHz, 24.000140MHz, 24.5760MHz, 28.2240MHz, 29.49120MHz, 30.0MHz, 32.0MHz, 36.0MHz, 40.0MHz, 40.320MHz, 50.0MHz, 56.4480MHz

Standard Frequency Tolerances and Stabilities

- 30ppm, ±50ppm, 100ppm

Operating Temperature Ranges

- 0 to 50°C
  –10 to 60°C

Storage Temperature Range

- –40 to 85°C

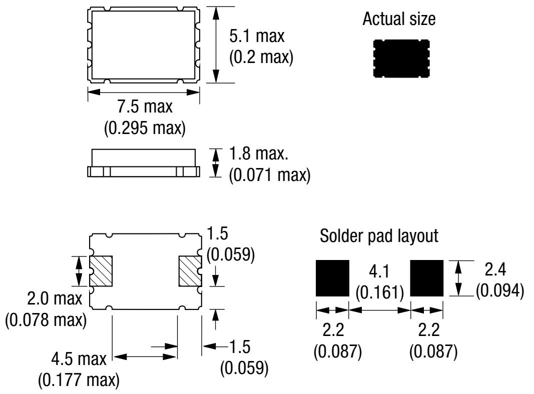
Marking

- Frequency only

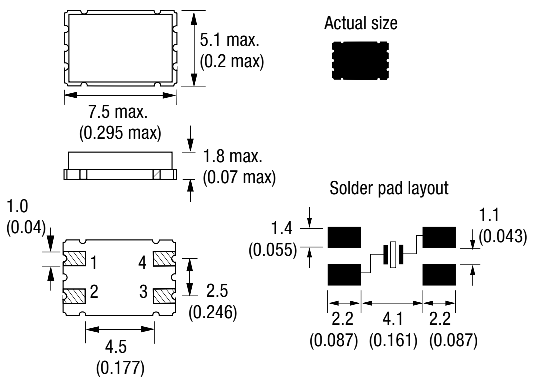
Minimum Order Information Required

- Frequency + Holder and Pad Configuration + Frequency Tolerance @ 25°C + Frequency Stability + Operating Temperature Range + Circuit Condition + Overtone Order

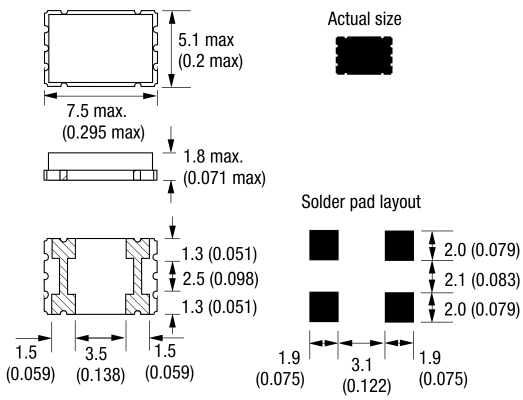
Outline in mm (inches) - 12SMX (A) (scale 2:1)



Outline in mm (inches) - 12SMX (B) (scale 2:1)



Outline in mm (inches) - 12SMX (C) (scale 2:1)

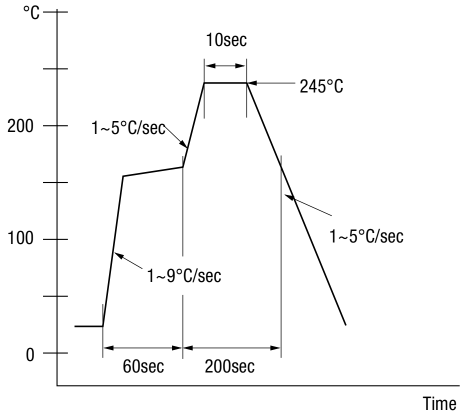


SURFACE MOUNT QUARTZ CRYSTALS

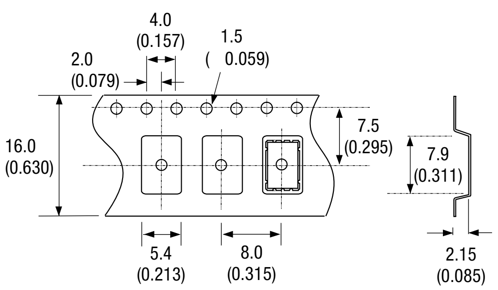
Electrical Specification - maximum limiting values

Frequency Range	Frequency Tolerance @ 25°C ±2°C	Operating Temperature Range	Frequency Stability Available Over Operating Temperature		ESR Max	Vibration Mode
			Minimum	Maximum		
8.0 to < 10.0MHz	±30ppm to ±100ppm	0 to 50°C	±30ppm	±100ppm	80	Fundamental
		–10 to 60°C	±30ppm	±100ppm		
10.0 to < 16.0MHz	±30ppm to ±100ppm	0 to 50°C	±30ppm	±100ppm	60	Fundamental
		–10 to 60°C	±30ppm	±100ppm		
16.0 to 32.0MHz	±30ppm to ±100ppm	0 to 50°C	±30ppm	±100ppm	40	Fundamental
		–10 to 60°C	±30ppm	±100ppm		
28.0 to < 67.0MHz	±30ppm to ±100ppm	0 to 50°C	±30ppm	±100ppm	60	3rd Overtone
		–10 to 60°C	±30ppm	±100ppm		

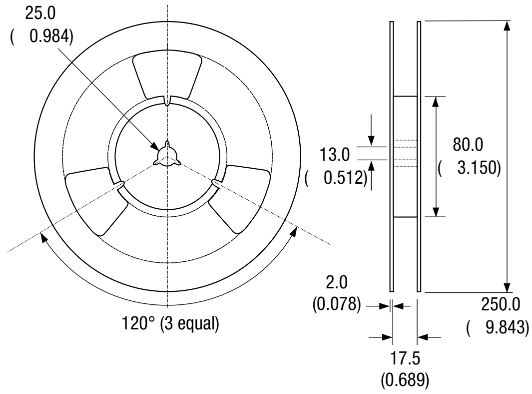
Typical Solder Condition - Infrared Reflow



Outline in mm (inches) - Tape



Outline in mm (inches) - Reel (scale 1:7)



14SMX CRYSTALS

ISSUE 7; 9 SEPTEMBER 1999

Delivery Options

- Common frequencies are available from stock. Please see p142 for details

Holder Style

- 14SMX surface mount crystals are encapsulated in a ceramic package with a seam welded metal lid

General Specifications

- Load Capacitance (C_L): 10pF to 75pF or Series
- Drive Level: 0.1mW max
- Static Capacitance (C_0): 7pF max

Packaging

- 14SMX surface mount crystals are available packaged individually or on tape and reel

Standard Frequencies

- 9.83040MHz, 10.0MHz, 11.05920MHz, 12.0MHz, 12.2880MHz, 14.318180MHz, 14.74560MHz, 15.0MHz, 16.0MHz, 16.000310MHz, 16.58880MHz, 16.3840MHz, 18.4320MHz, 19.66080MHz, 20.0MHz, 20.27520MHz, 24.0MHz, 24.000140MHz, 35.25120MHz, 36.0MHz, 38.000530MHz, 40.0MHz, 40.320MHz, 50.0MHz, 56.4480MHz, 64.0MHz, 66.6660MHz

Standard Frequency Tolerances and Stabilities

- 15ppm, ±20ppm, ±30ppm, ±50ppm, ±100ppm

Operating Temperature Ranges

- 0 to 50°C
  –10 to 60°C
  –20 to 70°C

Storage Temperature Range

- –55 to 125°C

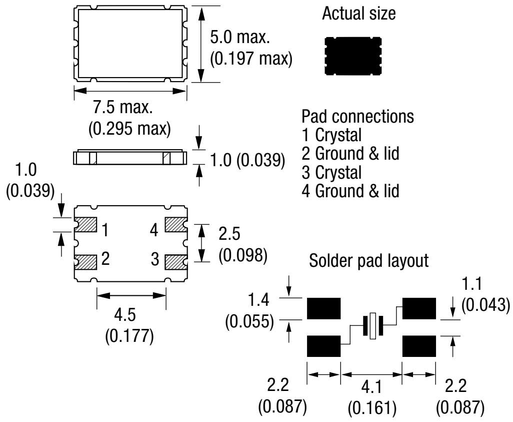
Marking

- Frequency only

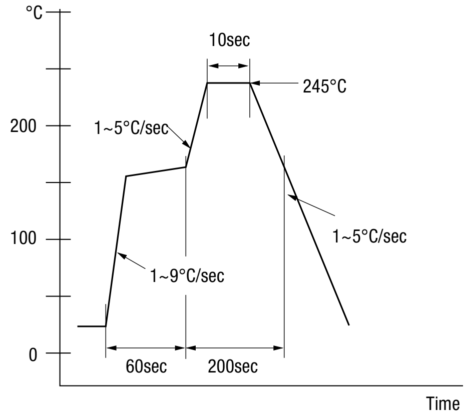
Minimum Order Information Required

- Frequency + Holder + Frequency Tolerance @ 25°C + Frequency Stability + Operating Temperature Range + Circuit Condition + Overtone Order

Outline in mm (inches) - (scale 2:1)



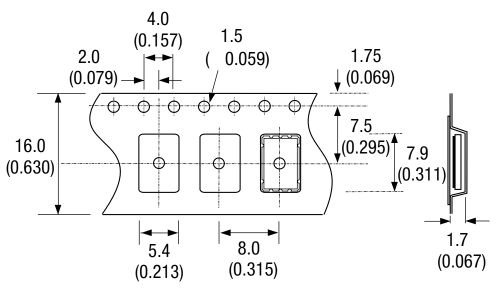
Typical Solder Condition - Infrared Reflow



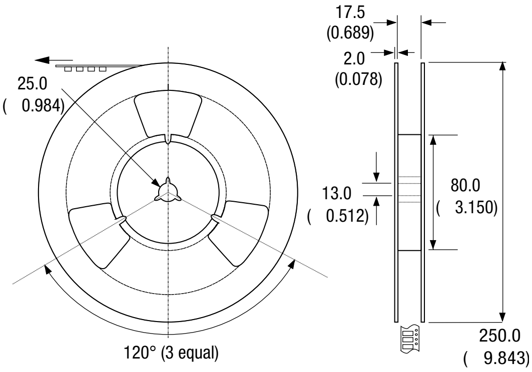
Electrical Specification - maximum limiting values

Frequency Range	Frequency Tolerance @ 25°C ±2°C	Operating Temperature Range	Frequency Stability Available Over Operating Temperature		ESR Max	Vibration Mode
			Minimum	Maximum		
9.83040 to < 10.0MHz	±10ppm to ±100ppm	0 to 50°C	±5ppm	±100ppm	80	Fundamental AT cut
		–10 to 60°C	±5ppm	±100ppm		
		–20 to 70°C	±5ppm	±100ppm		
		–30 to 80°C	±15ppm	±100ppm		
		–40 to 85°C	±20ppm	±100ppm		
10.0 to < 16.0MHz	±10ppm to ±100ppm	0 to 50°C	±5ppm	±100ppm	60	Fundamental AT cut
		–10 to 60°C	±5ppm	±100ppm		
		–20 to 70°C	±5ppm	±100ppm		
		–30 to 80°C	±15ppm	±100ppm		
		–40 to 85°C	±20ppm	±100ppm		
16.0 to 41.0MHz	±10ppm to ±100ppm	0 to 50°C	±5ppm	±100ppm	40	Fundamental AT cut
		–10 to 60°C	±5ppm	±100ppm		
		–20 to 70°C	±5ppm	±100ppm		
		–30 to 80°C	±15ppm	±100ppm		
		–40 to 85°C	±20ppm	±100ppm		
32.0 to 84.0MHz	±10ppm to ±100ppm	0 to 50°C	±3ppm	±100ppm	60	3rd Overtone AT cut
		–10 to 60°C	±5ppm	±100ppm		
		–20 to 70°C	±5ppm	±100ppm		
		–30 to 80°C	±15ppm	±100ppm		
		–40 to 85°C	±20ppm	±100ppm		
84.0 to 100.0MHz	±10ppm to ±100ppm	0 to 50°C	±3ppm	±100ppm	80	5th Overtone AT cut
		–10 to 60°C	±5ppm	±100ppm		
		–20 to 70°C	±5ppm	±100ppm		
		–30 to 80°C	±15ppm	±100ppm		
		–40 to 85°C	±20ppm	±100ppm		
Note: Frequencies are available up to 150.0MHz, please contact Application Support						

Outline in mm (inches) - Tape



Outline in mm (inches) - Reel (scale 1:7)



32SMX CRYSTALS

ISSUE 3; 30 JULY 1999

Delivery Options

- Common frequencies are available from stock. Please see p143 for details

Holder Style

- 32SMX surface mount crystals are housed in a hermetically glass sealed ceramic package.

General Specifications

- Load Capacitance (C_L): 16pF to 32pF or Series
- Drive Level: 0.1mW max.
- Static Capacitance (C_0): 5pF max.

Packaging

- 32SMX surface mount crystals are available packaged individually or on tape and reel

Standard Frequencies

- 3.579545MHz, 3.68640MHz, 4.0MHz, 8.0MHz, 11.05920MHz, 14.74560MHz, 16.0MHz

Standard Frequency Tolerances and Stabilities

- ±50ppm, ±100ppm

Operating Temperature Ranges

- –10 to 60°C
  –20 to 70°C

Storage Temperature Range

- –55 to 125°C

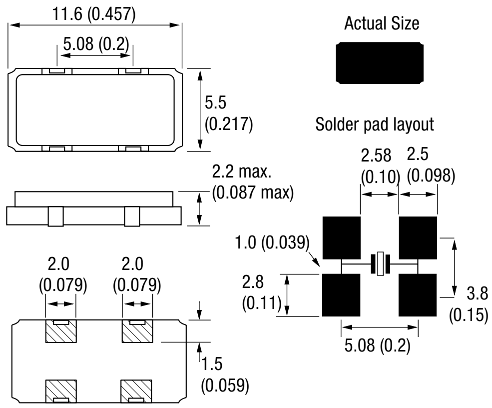
Marking

- Frequency

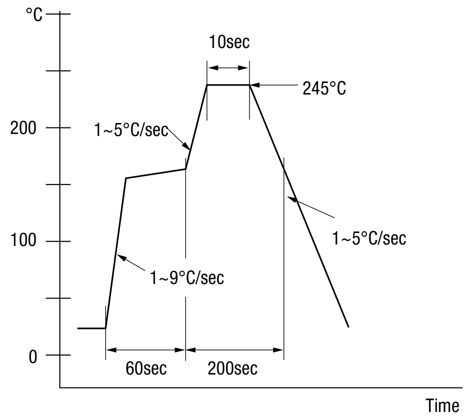
Minimum Order Information Required

- Frequency + Holder + Frequency Tolerance @ 25°C + Frequency Stability + Operating Temperature Range + Circuit Condition + Overtone Order

Outline in mm (inches) - (scale 2:1)



Typical Solder Condition - Infrared Reflow



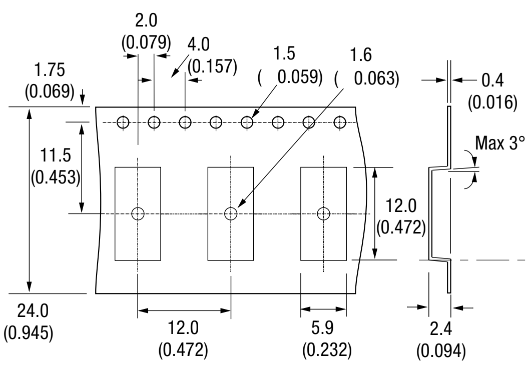
SURFACE MOUNT QUARTZ CRYSTALS

Electrical Specification – maximum limiting values

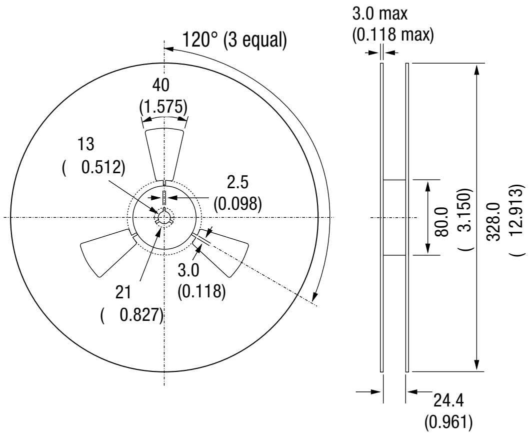
Frequency Range	Frequency Tolerance @ 25°C ±2°C	Operating Temperature Range	Frequency Stability Available Over Operating Temperature		ESR Max	Vibration Mode
			Minimum	Maximum		
3.5790 to < 4.0MHz	±30ppm to ±100ppm	–10 to 60°C	±30ppm	±100ppm	300	Fundamental AT or BT cut*
		–20 to 70°C	±30ppm	±100ppm		
4.0 to < 8.0MHz	±30ppm to ±100ppm	–10 to 60°C	±30ppm	±100ppm	200	Fundamental AT or BT cut*
		–20 to 70°C	±30ppm	±100ppm		
8.0 to < 10.0MHz	±30ppm to ±100ppm	–10 to 60°C	±30ppm	±100ppm	120	Fundamental AT or BT cut*
		–20 to 70°C	±30ppm	±100ppm		
10.0 to < 20.0MHz	±30ppm to ±100ppm	–10 to 60°C	±30ppm	±100ppm	100	Fundamental AT or BT cut*
		–20 to 70°C	±30ppm	±100ppm		
20.0 to 25.0MHz	±30ppm to ±100ppm	–10 to 60°C	±30ppm	±100ppm	80	Fundamental AT or BT cut*
		–20 to 70°C	±30ppm	±100ppm		

*Please note: Frequency stabilities ±50ppm are AT cut and ±100ppm are BT cut.

Outline in mm (inches) - Tape



Outline in mm (inches) - Reel (scale 1:8)



HC49/4H SMX CRYSTALS

ISSUE 9; 18 OCTOBER 1999

Delivery Options

- Common frequencies are available from stock. Please see p143 for details

Holder Style

- HC49/4H SMX crystals are resistance welded, hermetically sealed in an inert atmosphere with glass to metal seals securing the lead wires. The lead wires are formed into a gull wing and mounted on a plastic former
- Lower profiles available, please contact our sales office

General Specifications

- Load Capacitance (C_L): 10pF to 75pF or Series
- Drive Level: 0.5mW max
- Static Capacitance (C_0): 9pF max
- Ageing: ±3ppm typical per year

Standard Frequencies

- 3.579545MHz, 3.68640MHz, 4.0MHz, 4.91520MHz, 5.0MHz, 6.0MHz, 7.37280MHz, 8.0MHz, 8.1920MHz, 9.83040MHz, 10.0MHz, 11.05920MHz, 12.0MHz, 14.318180MHz, 14.74560MHz, 15.360MHz, 16.0MHz, 18.4320MHz, 19.66080MHz, 20.0MHz

Standard Frequency Tolerances and Stabilities

- ±50ppm, ±100ppm

Operating Temperature Ranges

- 0 to 50°C
  –10 to 60°C
  –20 to 70°C
  –30 to 80°C

Storage Temperature Range

- –40 to 85°C

Environmental Specification

- Shock: 981m/s^2 for 6ms, three shocks in each direction along three mutually perpendicular planes
- Vibration: 10 to 60Hz 0.75mm displacement, 60 to 500Hz 98.1m/s^2 acceleration, 30 minutes in each of three mutually perpendicular planes

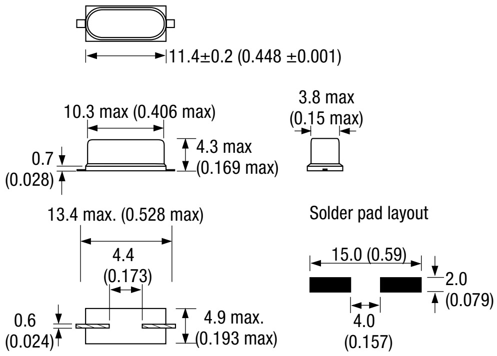
Marking

- Frequency only

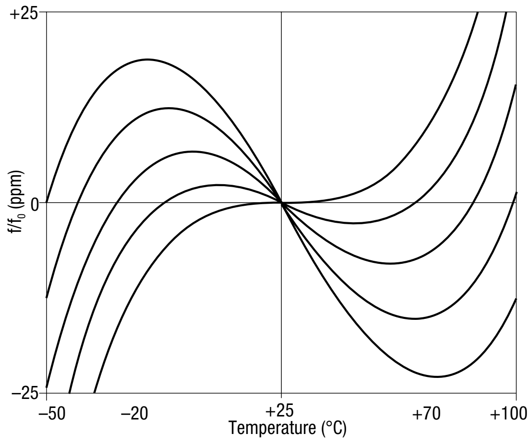
Minimum Order Information Required

- Frequency + Holder + Frequency Tolerance @ 25°C + Frequency Stability + Operating Temperature Range + Circuit Condition + Overtone Order

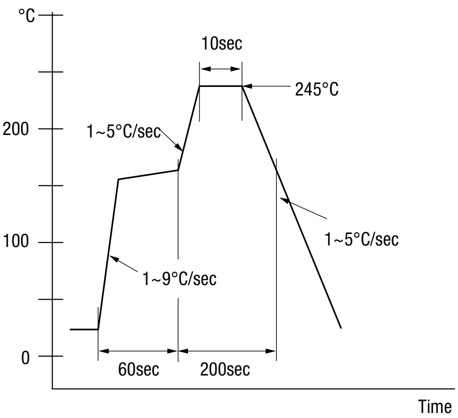
Outline in mm (inches)



Typical Frequency vs Temperature Curves for various angles of AT-cut crystals



Typical Solder Condition - Infrared Reflow

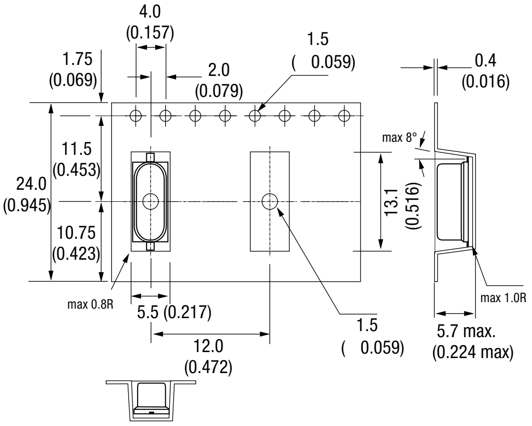


Electrical Specification - maximum limiting values

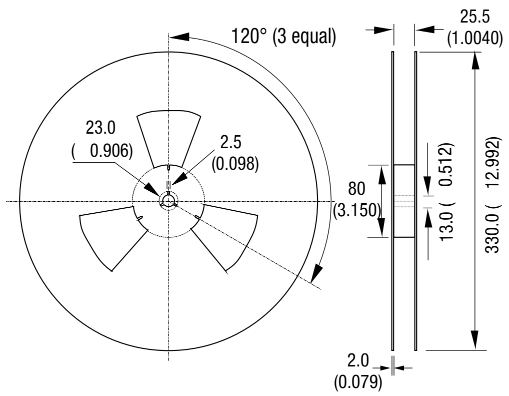
Frequency Range	Frequency Tolerance @ 25°C ±2°C	Operating Temperature Range	Frequency Stability Available Over Operating Temperature		ESR Max	Vibration Mode
			Minimum	Maximum		
3.50 to < 5.0MHz	±15ppm to ±100ppm	0 to 50°C	±15ppm	±100ppm	200	Fundamental AT cut
		–10 to 60°C	±20ppm	±100ppm		
		–20 to 70°C	±20ppm	±100ppm		
		–30 to 80°C	±25ppm	±100ppm		
5.0 to < 8.0MHz	±15ppm to ±100ppm	0 to 50°C	±15ppm	±100ppm	120	Fundamental AT cut
		–10 to 60°C	±20ppm	±100ppm		
		–20 to 70°C	±20ppm	±100ppm		
		–30 to 80°C	±25ppm	±100ppm		
8.0 to < 12.0MHz	±15ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	70	Fundamental AT cut
		–10 to 60°C	±15ppm	±100ppm		
		–20 to 70°C	±15ppm	±100ppm		
		–30 to 80°C	±20ppm	±100ppm		
12.0 to <25.0MHz	±15ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	50	Fundamental AT cut
		–10 to 60°C	±15ppm	±100ppm		
		–20 to 70°C	±15ppm	±100ppm		
		–30 to 80°C	±20ppm	±100ppm		
25.0 to 32.0MHz	±15ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	30	Fundamental AT cut
		–10 to 60°C	±15ppm	±100ppm		
		–20 to 70°C	±15ppm	±100ppm		
		–30 to 80°C	±20ppm	±100ppm		
25.0 to 40.0MHz	Inclusive with Frequency Stabiity	0 to 50°C	±50ppm	±100ppm	50	Fundamental BT cut
		–10 to 60°C	±50ppm	±100ppm		
		–20 to 70°C	±100ppm	±100ppm		
		–30 to 80°C	±100ppm	±100ppm		
25.0 to 70.0MHz	±15ppm to ±100ppm	0 to 50°C	±15ppm	±100ppm	100	3rd Overtone AT cut
		–10 to 60°C	±20ppm	±100ppm		
		–20 to 70°C	±20ppm	±100ppm		
		–30 to 80°C	±25ppm	±100ppm		

SURFACE MOUNT QUARTZ CRYSTALS

Outline in mm (inches) - Tape



Outline in mm (inches) - Reel (scale 1:8)



85SMX CRYSTALS

ISSUE 2; 7 SEPTEMBER 1999

Delivery Options

- Stock is available. Please see p142 for details

Holder Style

- 85SMX surface mount crystals are plastic encapsulated

General Specifications

- Load Capacitance (C_L): 12.5pF standard
- Drive Level: 1.0 W max

Packaging

- 85SMX surface mount crystals are available packaged individually or on tape and reel

Standard Frequencies

- 32.0kHz, 32.7680kHz, 38.0kHz, 40.0kHz, 44.10kHz, 60.0kHz, 75.0kHz, 76.80kHz, 77.50kHz, 77.5030kHz, 77.5050kHz, 96.0kHz, 100.0kHz, 150.0kHz, 153.60kHz, 200.0kHz, 307.20kHz, 614.40kHz

Standard Frequency Tolerances and Stabilities

- ±30ppm, ±50ppm, ±100ppm

Operating Temperature Ranges

- –20 to 70°C
  –40 to 85°C

Storage Temperature Range

- –55 to 125°C

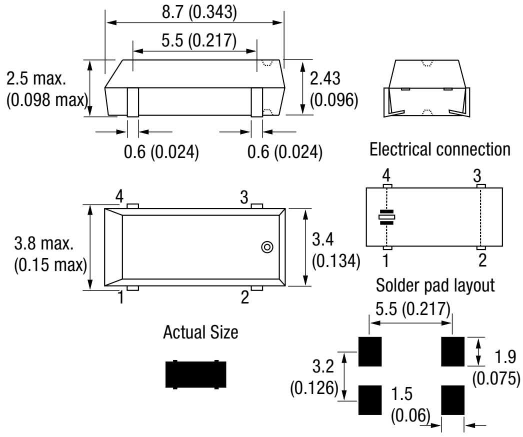
Marking

- Includes Frequency

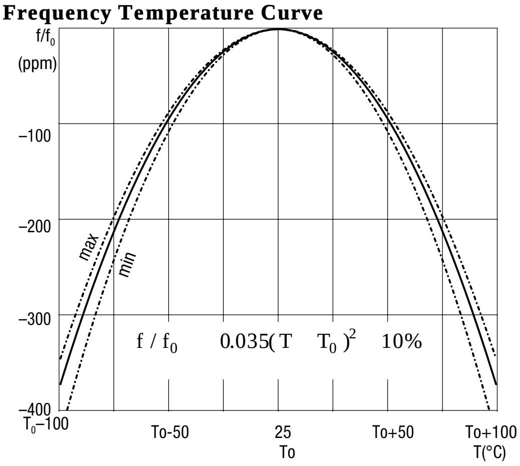
Minimum Order Information Required

Frequency + Holder + Frequency Tolerance @ 25°C + Operating Temperature Range + Circuit Condition

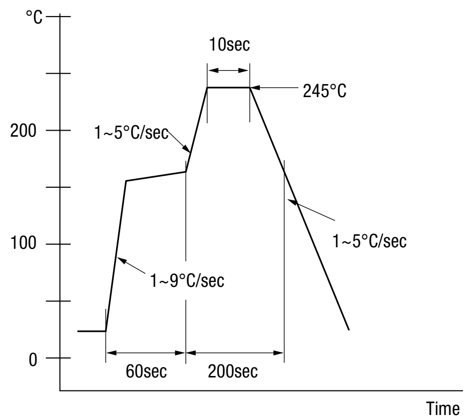
Outline in mm (inches) - 85SMX (scale 3:1)



Frequency Temperature Curve



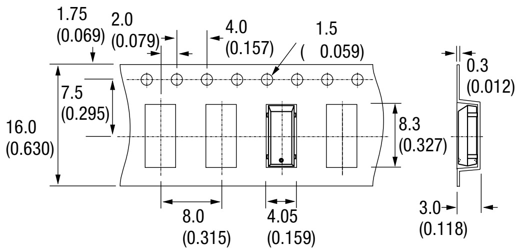
Typical Solder Condition - Infrared Reflow



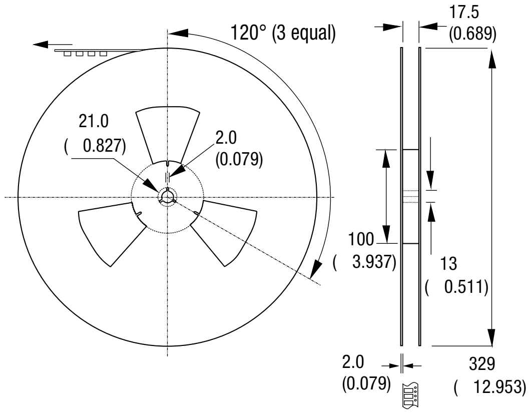
Electrical Specification – maximum limiting values

Frequency	Frequency Tolerance @ 25°C ±2°C	Operating Temperature Range	Frequency Stability	ESR Max	Vibration Mode
30.0 to 150.0kHz	±30ppm to ±100ppm	–20 to 70°C	–80ppm	55k	Fundamental X cut
		–40 to 85°C	–160ppm		
150.0 to 615.0kHz	±100ppm to ±1000ppm	–20 to 70°C	–80ppm	50k	Fundamental X cut
		–40 to 85°C	–160ppm		

Outline in mm (inches) - Tape



Outline in mm (inches) - Reel (scale 1:8)



86SMX CRYSTALS

ISSUE 5; 18 OCTOBER 1999

Not Recommended For New Designs

Delivery Options

- Common frequencies are available from stock. Please see p142 for details

Holder Style

- 86SMX surface mount crystals are plastic encapsulated

General Specifications

- Load Capacitance (C_L): 10pF to 50pF or Series
- Drive Level:100 W max

Packaging

- 86SMX surface mount crystals are available bulk packed or on tape and reel

Standard Frequency Tolerances and Stabilities

- ±10ppm, ±20ppm, ±30ppm, ±50ppm, ±100ppm, ±150ppm

Operating Temperature Ranges

- 0 to 50°C –20 to 70°C
  –10 to 60°C –40 to 90°C

Storage Temperature Range

- –55 to 125°C

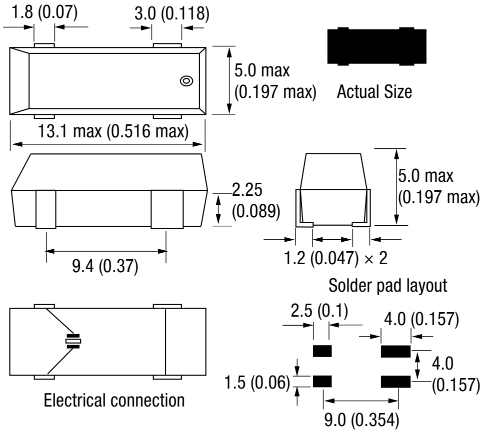
Marking

- Frequency only

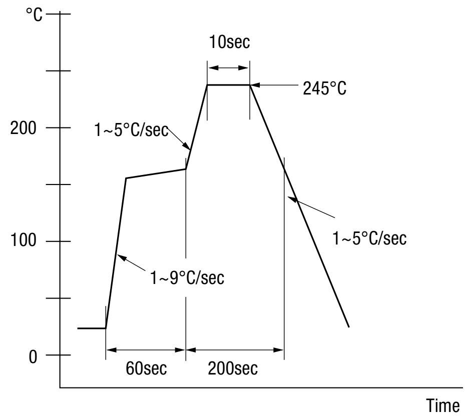
Minimum Order Information Required

- Frequency + Holder + Frequency Tolerance @ 25°C + Frequency Stability + Operating Temperature Range + Circuit Condition

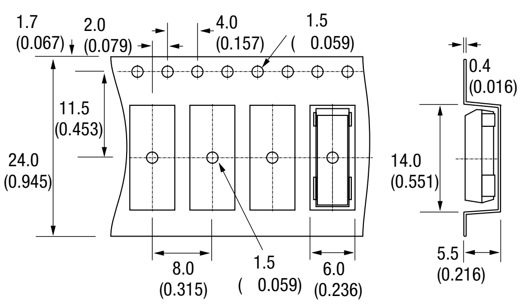
Outline in mm (inches) - 86SMX (scale 2:1)



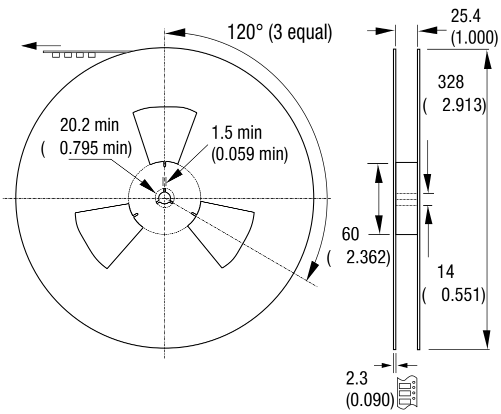
Typical Solder Condition - Infrared Reflow



Outline in mm (inches) - Tape



Outline in mm (inches) - Reel (scale 1:8)



Electrical Specification - maximum limiting values

Frequency Range	Frequency Tolerance @ 25°C 2°C	Operating Temperature Range	Frequency Stability Available Over Operating Temperature		ESR Max	Vibration Mode
			Minimum	Maximum		
3.57 to < 3.70MHz	±10ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	200	Fundamental
		–10 to 60°C	±20ppm			
		–20 to 70°C	±30ppm			
		–40 to 90°C	±50ppm	±150ppm		
3.70 to < 4.0MHz	±10ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	180	Fundamental
		–10 to 60°C	±20ppm			
		–20 to 70°C	±30ppm			
		–40 to 90°C	±50ppm	±150ppm		
4.0 to < 5.0MHz	±10ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	150	Fundamental
		–10 to 60°C	±20ppm			
		–20 to 70°C	±30ppm			
		–40 to 90°C	±50ppm	±150ppm		
5.0 to < 10.0MHz	±10ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	120	Fundamental
		–10 to 60°C	±20ppm			
		–20 to 70°C	±30ppm			
		–40 to 90°C	±50ppm	±150ppm		
10.0 to < 16.0MHz	±10ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	50	Fundamental
		–10 to 60°C	±20ppm			
		–20 to 70°C	±30ppm			
		–40 to 90°C	±50ppm	±150ppm		
16.0 to < 26.0MHz	±10ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	40	Fundamental
		–10 to 60°C	±20ppm			
		–20 to 70°C	±30ppm			
		–40 to 90°C	±50ppm	±150ppm		
26.0 to 33.0MHz	±10ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	25	Fundamental
		–10 to 60°C	±20ppm			
		–20 to 70°C	±30ppm			
		–40 to 90°C	±50ppm	±150ppm		
26.0 to < 36.0MHz	±10ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	100	3rd Overtone
		–10 to 60°C	±20ppm			
		–20 to 70°C	±30ppm			
		–40 to 90°C	±50ppm	±150ppm		
36.0 to 90.0MHz	±10ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	80	3rd Overtone
		–10 to 60°C	±20ppm			
		–20 to 70°C	±30ppm			
		–40 to 90°C	±50ppm	±150ppm		

CFPX-86 CRYSTALS

ISSUE 1; 7 OCTOBER 1999

Recommended For New Designs

Delivery Options

- Please contact our sales office for current leadtimes

Holder Style

- CFPX-86 surface mount crystals are plastic encapsulated

General Specifications

- Load Capacitance (C_L): 10pF to 50pF or Series
- Drive Level:100 W max

Standard Frequencies

- 3.579545MHz, 3.68640MHz, 4.0MHz, 4.91520MHz, 6.0MHz, 7.37280MHz, 8.0MHz, 10.0MHz, 12.0MHz, 14.318180MHz, 16.0MHz, 18.4320MHz, 20.0MHz

Standard Frequency Tolerances and Stabilities

- ±50ppm, ±100ppm

Standard Operating Temperature Ranges

- –10 to 60°C
  –20 to 70°C

Storage Temperature Range

- –55 to 125°C

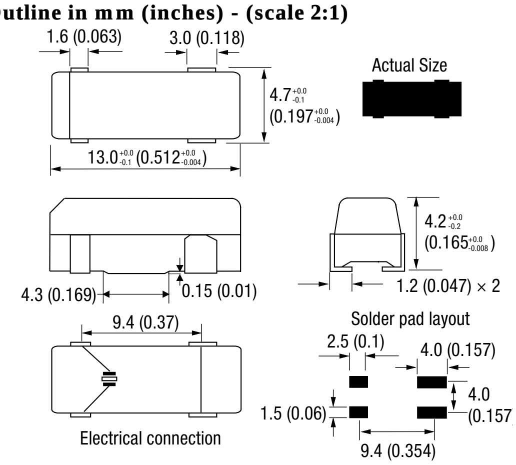
Marking

- Frequency only

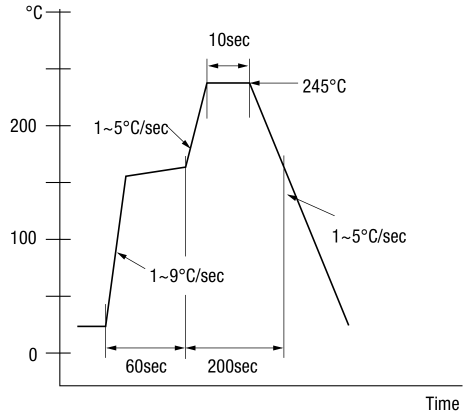
Minimum Order Information Required

- Frequency + Holder + Frequency Tolerance @ 25°C + Frequency Stability + Operating Temperature Range + Circuit Condition

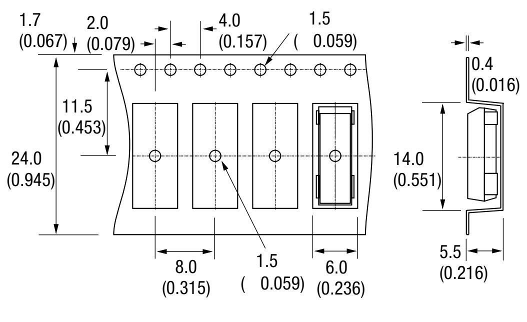
Outline in mm (inches) - (scale 2:1)



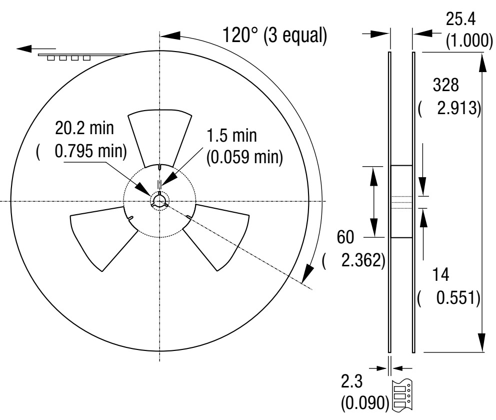
Typical Solder Condition - Infrared Reflow



Outline in mm (inches) - Tape



Outline in mm (inches) - Reel (scale 1:8)



Electrical Specification - maximum limiting values

Frequency Range	Frequency Tolerance @ 25°C 2°C	Operating Temperature Range	Frequency Stability Available Over Operating Temperature		ESR Max	Vibration Mode
			Minimum	Maximum		
3.570 to < 4.0MHz	±10ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	200	Fundamental
		–10 to 60°C	±20ppm			
		–20 to 70°C	±30ppm			
		–40 to 90°C	±50ppm	±150ppm		
4.0 to < 5.0MHz	±10ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	150	Fundamental
		–10 to 60°C	±20ppm			
		–20 to 70°C	±30ppm			
		–40 to 90°C	±50ppm	±150ppm		
5.0 to < 10.0MHz	±10ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	120	Fundamental
		–10 to 60°C	±20ppm			
		–20 to 70°C	±30ppm			
		–40 to 90°C	±50ppm	±150ppm		
10.0 to < 16.0MHz	±10ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	60	Fundamental
		–10 to 60°C	±20ppm			
		–20 to 70°C	±30ppm			
		–40 to 90°C	±50ppm	±150ppm		
16.0 to < 26.0MHz	±10ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	50	Fundamental
		–10 to 60°C	±20ppm			
		–20 to 70°C	±30ppm			
		–40 to 90°C	±50ppm	±150ppm		
26.0 to 33.0MHz	±10ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	40	Fundamental
		–10 to 60°C	±20ppm			
		–20 to 70°C	±30ppm			
		–40 to 90°C	±50ppm	±150ppm		
30.0 to < 45.0MHz	±10ppm to ±100ppm	–10 to 60°C	±100ppm	–	100	Fundamental BT Cut
		–20 to 70°C	±100ppm			
32.0 to 60.0MHz	±10ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	100	3rd Overtone
		–10 to 60°C	±20ppm			
		–20 to 70°C	±30ppm			
		–40 to 90°C	±50ppm	±150ppm		

90SMX & 91SMX CRYSTALS

ISSUE 6; 28 AUGUST 1996

Delivery Options

- Stock is available. Please see p142 for details

Holder Style

- 90SMX & 91SMX surface mount crystals are plastic encapsulated

General Specifications

- Load Capacitance (C_L): 12.5pF standard
- Drive Level: 1.0 W max

Packaging

- 90SMX & 91SMX surface mount crystals are available packaged individually or on tape and reel

Standard Frequency Tolerances

- ±10ppm, ±15ppm, ±20ppm, ±30ppm, ±50ppm, ±100ppm

Operating Temperature Ranges

- 0 to 50°C
  –10 to 60°C
  –20 to 70°C
  –30 to 80°C
  –40 to 90°C

Storage Temperature Range

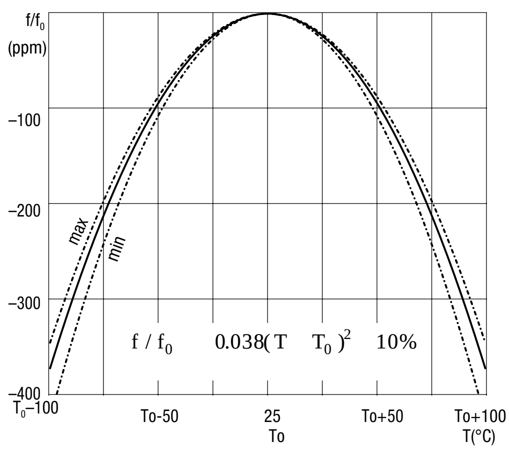
- –55 to 125°C

Marking

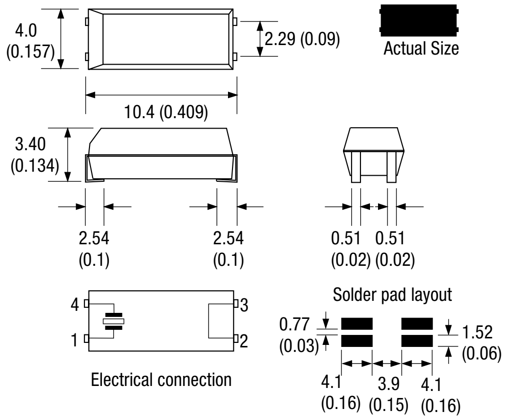
- Includes Frequency

Minimum Order Information Required

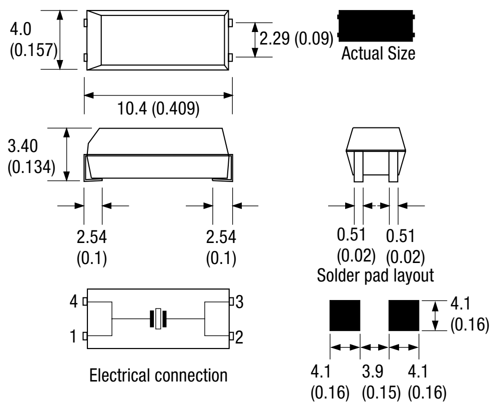
- Frequency + Holder + Frequency Tolerance @ 25°C + Operating Temperature Range + Circuit Condition



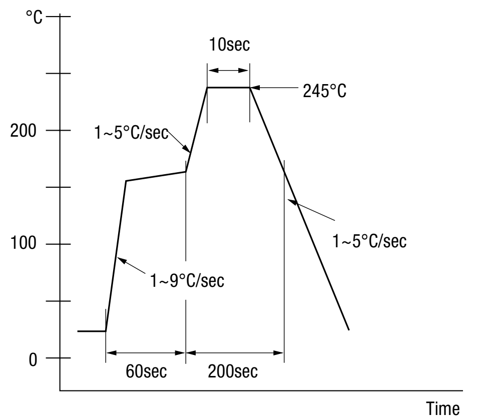
Outline in mm (inches) - 90SMX (scale 2:1)



Outline in mm (inches) - 91SMX (scale 2:1)



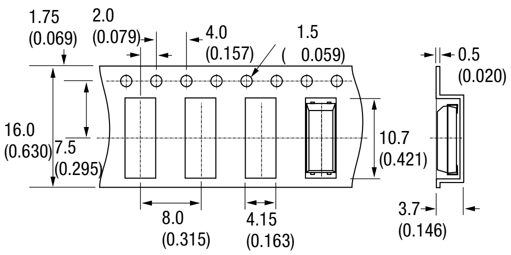
Typical Solder Condition - Infrared Reflow



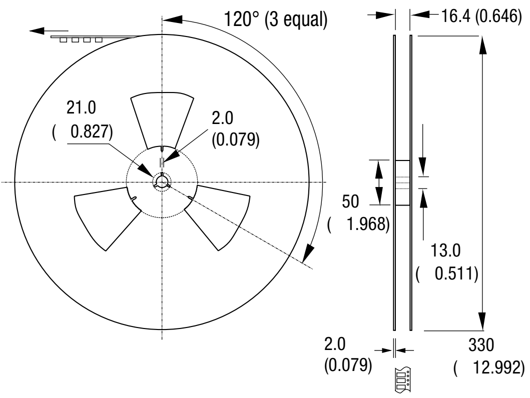
Electrical Specification - maximum limiting values

Frequency Range	Frequency Tolerance @ 25°C ±2°C	Operating Temperature Range	Frequency Stability Available Over Operating Temperature		ESR Max	Vibration Mode
			Minimum	Maximum		
32.7680kHz	±10ppm to ±100ppm	0 to 50°C	–25ppm	–100ppm	60k	Fundamental
		–10 to 60°C	–50ppm	–100ppm		
		–20 to 70°C	–85ppm	–100ppm		
		–30 to 80°C	–150ppm	–300ppm		
		–40 to 90°C	–180ppm	–500ppm		

Outline in mm (inches) - Tape



Outline in mm (inches) - Reel (scale 1:8)



CFPX-93 CRYSTALS

ISSUE 1; 9 SEPTEMBER 1999

Delivery Options

- Please contact our sales office for current leadtimes

Holder Style

- CFPX-93 surface mount crystals are encapsulated in a ceramic package with a glass-frit sealed lid

General Specifications

- Load Capacitance (C_L): 18pF standard
- Drive Level: 0.1mW max
- Static Capacitance (C_0): 5pF max

Packaging

- CFPX-93 surface mount crystals are available packaged individually or on tape and reel

Standard Frequencies

- 12.0MHz, 12.0960MHz, 12.2880MHz, 12.2960MHz, 13.50MHz, 14.318180MHz, 16.3840MHz, 16,8960MHz, 17.4080MHz, 17.734475MHz,18.4320MHz, 19.440MHz, 20.0MHz, 20.480MHz, 24.0MHz, 24.5760MHz, 25.0MHz, 25.1750MHz, 27.0MHz, 28.0MHz, 30.0MHz, 35.25120MHz, 35.468950MHz, 36.0MHz, 40.0MHz 0.320MHz, 40.23680MHz

Operating Temperature Ranges

- –10 to 60°C
  –20 to 70°C

Storage Temperature Range

- –55 to 125°C

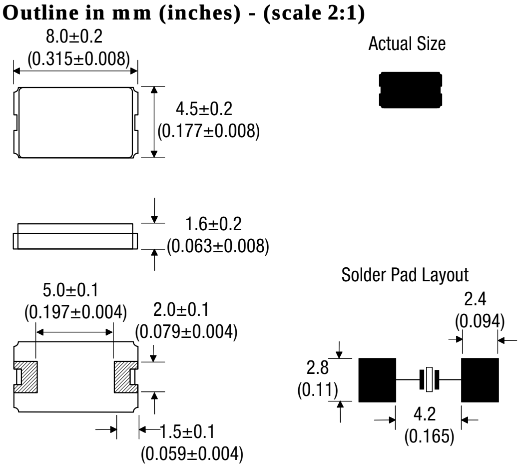
Marking

- Frequency only

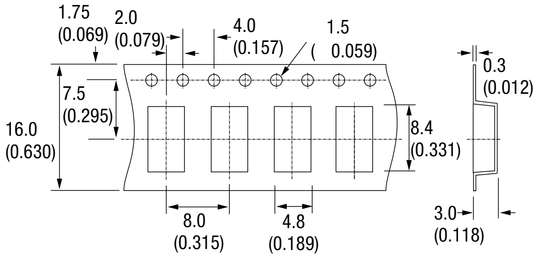
Minimum Order Information Required

- Frequency + Holder and Pad Configuration + Frequency Tolerance @ 25°C + Frequency Stability + Operating Temperature Range + Circuit Condition + Overtone Order

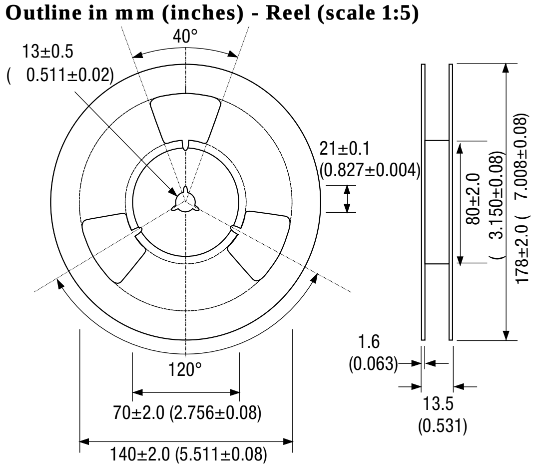
Outline in mm (inches) - (scale 2:1)



Outline in mm (inches) - Tape



Outline in mm (inches) - Reel (scale 1:5)



Electrical Specification - maximum limiting values

Frequency Range	Frequency Tolerance @ 25°C ±2°C	Operating Temperature Range	Frequency Stability Available Over Operating Temperature		ESR Max	Vibration Mode
			Minimum	Maximum		
12.0 to < 20.0MHz	±50ppm	–10 to 60°C	±100ppm	–	50	Fundamental BT cut
		–20 to 70°C	±50ppm	±100ppm		Fundamental AT cut
20.0 to < 45.0MHz	±50ppm	–10 to 60°C	±100ppm	–	40	Fundamental BT cut
		–20 to 70°C	±50ppm	±100ppm		Fundamental AT cut

CFPX-5000 CRYSTALS

ISSUE 2: 11 JUNE 1999

Delivery Options

- Please contact our sales office for current leadtimes

Holder Style

- CFPX-5000 series crystals are encapsulated in a ceramic resistance welded hermetic package

General Specifications

- Load Capacitance (C_L): 10pF to 50pF or Series
- Drive Level: 0.1mW max.
- Static Capacitance (C_0): 7pF max

Standard Frequency Tolerances and Stabilities

- ±5ppm, ±7.5ppm, ±10ppm, ±15ppm, ±20ppm, ±30ppm

Operating Temperature Ranges

- 0 to 50°C –30 to 80°C
- –10 to 60°C –40 to 90°C
- –20 to 70°C –55 to 105°C

Storage Temperature Range

- –55 to 125°C

Ageing

- ±2ppm max. during first year
- ±5ppm max. during 10 years

Environmental Specification

- Bump: IEC 68-2-29 Test Eb, 1000±10 bumps at 400m/s^2(40gn) in each of 3 mutually perpendicular planes.
- Vibration: IEC 68-2-6 Test Fc Procedure B4, 1-60Hz 1.5mm displacement, 60-500Hz at 98.1m/s^2, 30 minutes in each of thrre mutually perpendicular planes at 1 octave per minute.
- Shock: IEC 68-2-27 Test Ea, 98.1m/s^2 acceleration for 6ms duration, 3 shocks in each direction along 3 mutually perpendicular axes.
- Damp Heat; IEC 68-2-3 Test Ca (Steady State), Duration 56 days, recovery time 12 hours.
- Change of Tempertaure: IEC 68-2-14 Test Na (Rapid Change), (MIL-STD-202 Method 107), 10 cycles of 30 minutes duration each for –55/125°C cycle
- SMD: Infra-red (class C, test category 1 as defined in classification BS CECC 00802; 1994). Profile in accordance with figure 3. Testing to be performed in acordance with BS CECC 00802, IEC 68-2-20 and IEC 68-2-58.
- Solderability: IEC 68-2-20 Test Ta Method 1(solder bath), (MIL-STD-202 Method 208), Temperature 235°C.
- Sealing: IEC 68-2-17 Test Qk (Fine Leak), (MIL-STD-202 Method 112 Test Condition C) IEC 68-2-17 Test Qc (Gross Leak), (MIL-STD-202 Method 112 Test condition D)

Internal Construction

- Options are available for a ruggedised crystal mount assembly for the most stringent applications

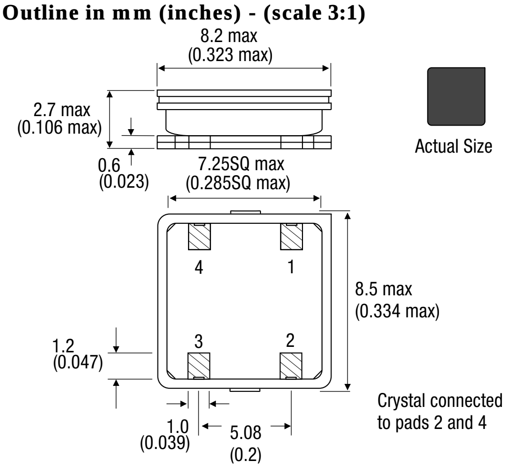
Marking

- Includes Frequency

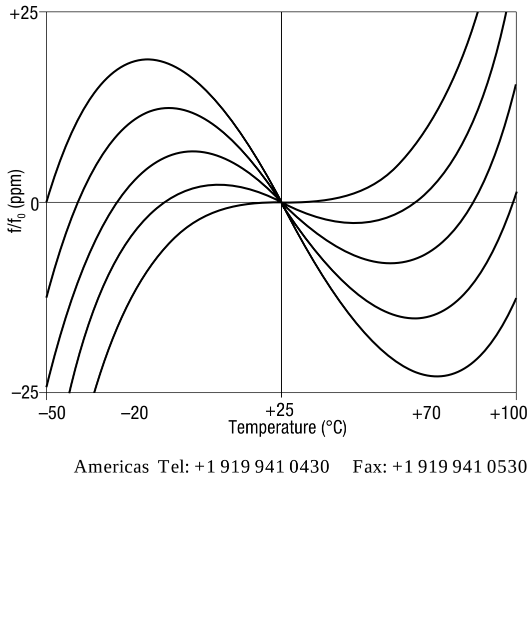
Minimum Order Information

- Frequency + Holder + Frequency Tolerance @ 25°C + Frequency Stability + Operating Temperature Range + Circuit Condition + Overtone Order

Outline in mm (inches) - (scale 3:1)



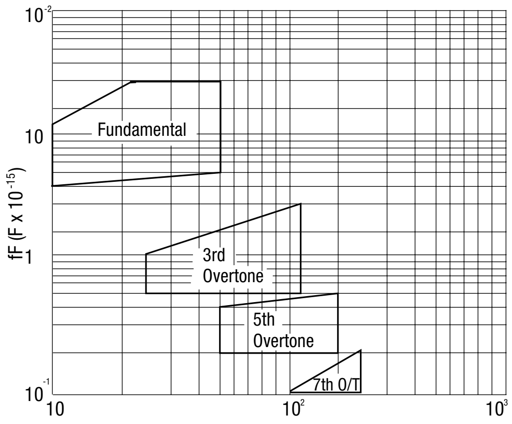
Typical Frequency vs Temperature Curves for various angles of AT-cut crystals



Electrical Specification - maximum limiting values

Frequency Range	Frequency tolerance @25°C (from)	Operating Temperature Range	Frequency Stability Available Over Operating Temperature Range		ESR max.	Vibration Mode
			Minimum	Maximum		
10.0 to <15.0MHz	±10ppm	0 to 50°C	±5ppm	±100ppm	30	Fundamental AT cut
		–10 to 60°C	±7.5ppm	±100ppm		
		–20 to 70°C	±10ppm	±100ppm		
		–30 to 80°C	±15ppm	±100ppm		
		–40 to 90°C	±20ppm	±100ppm		
		–55 to 105°C	±30ppm	±100ppm		
15.0 to 52.0MHz	±10ppm	0 to 50°C	±5ppm	±100ppm	20	Fundamental AT cut
		–10 to 60°C	±7.5ppm	±100ppm		
		–20 to 70°C	±10ppm	±100ppm		
		–30 to 80°C	±15ppm	±100ppm		
		–40 to 90°C	±20ppm	±100ppm		
		–55 to 105°C	±30ppm	±100ppm		
25.0 to 150.0MHz	±10ppm	0 to 50°C	±5ppm	±100ppm	40	3rd Overtone AT cut
		–10 to 60°C	±7.5ppm	±100ppm		
		–20 to 70°C	±10ppm	±100ppm		
		–30 to 80°C	±15ppm	±100ppm		
		–40 to 90°C	±20ppm	±100ppm		
		–55 to 105°C	±30ppm	±100ppm		
60.0 to <200.0MHz	±10ppm	0 to 50°C	±5ppm	±100ppm	60	5th Overtone AT cut
		–10 to 60°C	±7.5ppm	±100ppm		
		–20 to 70°C	±10ppm	±100ppm		
		–30 to 80°C	±15ppm	±100ppm		
		–40 to 90°C	±20ppm	±100ppm		
		–55 to 105°C	±30ppm	±100ppm		
120.0 to 250.0MHz	±10ppm	0 to 50°C	±5ppm	±100ppm	100	7th Overtone AT cut
		–10 to 60°C	±7.5ppm	±100ppm		
		–20 to 70°C	±10ppm	±100ppm		
		–30 to 80°C	±15ppm	±100ppm		
		–40 to 90°C	±20ppm	±100ppm		
		–55 to 105°C	±30ppm	±100ppm		

Motional Capacitance



NOTES

SURFACE MOUNT QUARTZ CRYSTALS

SM SPXOs - Section Contents

SPECIFYING SURFACE MOUNT SIMPLE PACKAGED CRYSTAL OSCILLATORS (SM SPXOs)

A typical surface mount SPXO specification reads like this:

19.66080MHz IQXO-57 B E TR T

- Frequency — 19.66080MHz
- Model Number — IQXO-57
- Frequency Stability — B
- Frequency Tolerance — E
- Packaging — TR
- Additional Text code (for non-standard product) — T

The following notes define each element of the specification.

Frequency

Frequency is normally specified in kilohertz (kHz) up to 999.999 kHz and in megahertz (MHz) from 1.0MHz. All our computer-generated transaction documents follow this standard convention automatically.

The frequency should be described to seven significant figures. If seven significant figures are not used, we assume that any figure that might follow those given may be taken as zero. Thus a frequency given as 16.6MHz will be taken as 16.60, not 16.6667.

Please contact the sales office for details of developed frequencies.

Model Number

The model number incorporates information which describes output compatibility and holder style.

Frequency Stability

The frequency stability of a surface mount oscillator includes the initial adjustment tolerance at room temperature, the tolerance over operating temperature range and the effect of supply voltage variation. This value is specified as ‘parts per million’ (ppm) and is available in four ranges; ±15ppm, ±25ppm, ±50ppm & ±100ppm.

The following codes apply:

- A = ±25ppm
- B = ±50ppm
- C = ±100ppm
- N = ±15ppm

Non-Standard Frequency Tolerances

During manufacture, it is possible to adjust some surface mount SPXO’s to a specific tolerance at room temperature. The frequency tolerance forms part of the frequency stability. These oscillators have a second letter code to indicate the frequency tolerance.

- E = ±10ppm
- F= ±25ppm

Operating Temperature Range

- 0 to 70°C
  –10 to 70°C
  –40 to 85°C
  –55 to 125°C

Although in general oscillators will continue to operate outside their normal temperature range with a degradation in frequency stability, damage can result if the temperatures reached are excessive.

Packaging

Tape and Reel packaging is available as an option on many of the products outlined in the SM SPXO chapter.

Unless individual datasheets state Tape and Reel packaging, items will be bulk packed. Please note: only complete Reels are sold.

- BU = Bulk packed
- TR = Tape & Reel packed

Addtional Text Code

If the product is non-standard, the letter ‘T’ will appear at the end of the product specification. This refers to additional text on the sales order/quotation to identify the non-standard requirements.

Outline Drawings

Dimensions on the oscillator outline drawings are shown only as a guide. Precise dimensions of oscillator holders are available from our factory upon request. All dimensions are shown in mm (& inches) and are nominal unless otherwise stated. All outlines are at a scale of 1:1 unless otherwise specified.

Delivery Options

The following Express delivery options are available for certain oscillators; timescales refer to despatch from our factories.

- 5 working days (Express service)
- 7 working days (Express service)
- 10 working days (Express service)

Prices for larger quantities and longer delivery times are generally lower due to substantially reduced manufacturing costs.

Marking

Product will be indelibly marked as detailed in the individual data sheets. Where space is limited some or all of the information will be omitted/truncated at C-MAC Frequency Products discretion. Full product description will be found on the individual batch packaging.

Ordering Information

- See individual data sheets

NOTES

SURFACE MOUNT SPXOs

STOCK SURFACE MOUNT SPXOs

SURFACE MOUNT SPXOs

Minimum Order Information Required

- Stock Number or Alpha Code

IQXO-57 Tri-state - HCMOS/LS TTL

Frequency	Frequency Stability	Stock No.	Alpha Code	Packaging
2.45760MHz	±100ppm	SPXO003289	X393M	BU
3.68640MHz	±100ppm	SPXO003224	X363M	BU
4.0MHz	±100ppm	SPXO003157	X351M	BU
4.91520MHz	±100ppm	SPXO003269	X385M	BU
6.1440MHz	±100ppm	SPXO003265	X383M	BU
7.680MHz	±100ppm	SPXO003290	X394M	BU
8.0MHz	±100ppm	SPXO003164	X352M	BU
10.0MHz	±100ppm	SPXO003170	X353M	BU
12.0MHz	±100ppm	SPXO003178	X354M	BU
14.318180MHz	±100ppm	SPXO003249	X373M	BU
16.0MHz	±100ppm	SPXO003184	X355M	BU
16.3840MHz	±100ppm	SPXO003237	X370M	BU
18.4320MHz	±100ppm	SPXO003230	X367M	BU
20.0MHz	±100ppm	SPXO003191	X356M	BU
24.0MHz	±100ppm	SPXO003241	X371M	BU
24.5760MHz	±100ppm	SPXO003272	X386M	BU
25.0MHz	±100ppm	SPXO003282	X390M	BU
32.0MHz	±100ppm	SPXO003215	X360M	BU
33.3330MHz	±100ppm	SPXO003275	X387M	BU
40.0MHz	±100ppm	SPXO003199	X357M	BU
50.0MHz	±100ppm	SPXO003206	X358M	BU
53.1250MHz	±100ppm	SPXO016759	X440M	BU
100.0MHz	±100ppm	SPXO016760	X450M	BU
106.250MHz	±100ppm	SPXO016411	X453M	BU
125.0MHz	±100ppm	SPXO016761	X455M	BU

IQXO-70 Tri-state - HCMOS/TTL

Frequency	Frequency Stability	Stock No.	Alpha Code	Packaging
1.84320MHz	±100ppm	SPXO010848	X404T	BU
1.84320MHz	±100ppm	SPXO010849	X404S	T & R
2.0480MHz	±100ppm	SPXO011680	X406T	BU
2.0480MHz	±100ppm	SPXO014571	X406S	T & R
3.68640MHz	±100ppm	SPXO010069	X363T	BU
3.68640MHz	±100ppm	SPXO013807	X362S	T & R

Frequency	Frequency Stability	Stock No.	Alpha Code	Packaging
4.0MHz	±100ppm	SPXO003159	X351T	BU
4.0MHz	±100ppm	SPXO011267	X408S	T & R
8.0MHz	±100ppm	SPXO003166	X352T	BU
8.0MHz	±100ppm	SPXO012346	X410S	T & R
10.0MHz	±100ppm	SPXO003172	X353T	BU
10.0MHz	±100ppm	SPXO014941	X412S	T & R
12.0MHz	±100ppm	SPXO003180	X354T	BU
12.0MHz	±100ppm	SPXO012091	X414S	T & R
12.2880MHz	±50ppm	SPXO014934	X416T	BU
14.318180MHz	±100ppm	SPXO003251	X373T	BU
14.318180MHz	±100ppm	SPXO010860	X418S	T & R
16.0MHz	±100ppm	SPXO003186	X355T	BU
16.0MHz	±100ppm	SPXO011496	X420S	T & R
16.3840MHz	±100ppm	SPXO013061	X370T	BU
16.3840MHz	±100ppm	SPXO013806	X370S	T & R
20.0MHz	±100ppm	SPXO003194	X356T	BU
20.0MHz	±100ppm	SPXO011032	X424S	T & R
24.0MHz	±100ppm	SPXO003243	X371T	BU
24.0MHz	±100ppm	SPXO013928	X426S	T & R
25.0MHz	±100ppm	SPXO003283	X390T	BU
25.0MHz	±50ppm	SPXO010801	X428S	T & R
32.0MHz	±100ppm	SPXO003217	X360T	BU
32.0MHz	±100ppm	SPXO010061	X430S	T & R
32.7680MHz	±100ppm	SPXO011194	X432T	BU
32.7680MHz	±100ppm	SPXO011403	X432S	T & R
40.0MHz	±100ppm	SPXO003201	X357T	BU
40.0MHz	±100ppm	SPXO011590	X434S	T & R
48.0MHz	±100ppm	SPXO010111	X436T	BU
48.0MHz	±100ppm	SPXO010163	X436S	T & R
50.0MHz	±100ppm	SPXO003208	X358T	BU
50.0MHz	±100ppm	SPXO012038	X438S	T & R
53.1250MHz	±100ppm	SPXO010954	X440T	BU
53.1250MHz	±100ppm	SPXO015965	X440S	T & R
54.0MHz	±100ppm	SPXO015968	X442T	BU
54.0MHz	±100ppm	SPXO015668	X442S	T & R
60.0MHz	±100ppm	SPXO010112	X444T	BU
60.0MHz	±100ppm	SPXO010063	X444S	T & R

Frequency	Frequency Stability	Stock No.	Alpha Code	Packaging
64.0MHz	±100ppm	SPXO003286	X391T	BU
64.0MHz	±100ppm	SPXO010672	X446S	T & R
80.0MHz	±100ppm	SPXO003287	X392T	BU
80.0MHz	±100ppm	SPXO013992	X448T	T & R

IQXO-71 Tri-state - HCMOS/TTL

Frequency	Frequency Stability	Stock No.	Alpha Code	Packaging
1.84320MHz	±50ppm	SPXO015954	X405T	BU
1.84320MHz	±50ppm	SPXO015643	X405S	T & R
2.0480MHz	±50ppm	SPXO015680	X407T	BU
2.0480MHz	±50ppm	SPXO015644	X407S	T & R
4.0MHz	±50ppm	SPXO015642	X409S	T & R
4.0MHz	±100ppm	SPXO003160	X351V	BU
8.0MHz	±50ppm	SPXO015650	X411S	T & R
8.0MHz	±100ppm	SPXO012513	X411T	BU
10.0MHz	±50ppm	SPXO014281	X413S	T & R
12.0MHz	±50ppm	SPXO015651	X415S	T & R
12.0MHz	±100ppm	SPXO014587	X415T	BU
12.2880MHz	±50ppm	SPXO016242	X417T	BU
12.2880MHz	±50ppm	SPXO015964	X417S	T & R
14.318180MHz	±50ppm	SPXO012848	X419T	BU
14.318180MHz	±50ppm	SPXO015655	X419S	T & R
16.0MHz	±50ppm	SPXO014265	X421T	BU
16.0MHz	±50ppm	SPXO015653	X421S	T & R
16.3840MHz	±50ppm	SPXO015573	X423T	BU
16.3840MHz	±50ppm	SPXO015654	X423S	T & R
20.0MHz	±50ppm	SPXO015482	X425S	T & R
20.0MHz	±100ppm	SPXO012682	X425T	BU
24.0MHz	±50ppm	SPXO015043	X427S	T & R
24.0MHz	±100ppm	SPXO015142	X427T	BU
25.0MHz	±50ppm	SPXO010053	X429T	BU
25.0MHz	±50ppm	SPXO014450	X429S	T & R
25.0MHz	±100ppm	SPXO003284	X390V	BU
32.0MHz	±100ppm	SPXO003218	X360V	BU
32.0MHz	±100ppm	SPXO014898	X431S	T & R
32.7680MHz	±50ppm	SPXO015545	X433T	BU
32.7680MHz	±50ppm	SPXO015542	X433S	T & R
40.0MHz	±50ppm	SPXO012068	X435S	T & R
40.0MHz	±100ppm	SPXO003202	X357V	BU

Frequency	Frequency Stability	Stock No.	Alpha Code	Packaging
48.0MHz	±50ppm	SPXO010164	X437S	T & R
48.0MHz	±100ppm	SPXO013682	X437T	BU
50.0MHz	±50ppm	SPXO014545	X439S	T & R
50.0MHz	±100ppm	SPXO003209	X358V	BU
53.1250MHz	±50ppm	SPXO012895	X441T	BU
53.1250MHz	±50ppm	SPXO015967	X441S	T & R
54.0MHz	±100ppm	SPXO015343	X443T	BU
54.0MHz	±100ppm	SPXO015214	X443S	T & R
60.0MHz	±50ppm	SPXO014768	X445T	BU
60.0MHz	±100ppm	SPXO015693	X445S	BU
64.0MHz	±50ppm	SPXO014814	X447T	BU
64.0MHz	±50ppm	SPXO015007	X447S	T & R
80.0MHz	±50ppm	SPXO016236	X449S	T & R
80.0MHz	±100ppm	SPXO016206	X449T	BU
100.0MHz	±100ppm	SPXO016238	X450T	BU
100.0MHz	±100ppm	SPXO016239	X450S	T & R
106.250MHz	±100ppm	SPXO016240	X453T	BU
106.250MHz	±100ppm	SPXO016241	X453S	T & R
125.0MHz	±100ppm	SPXO008073	X455T	BU
125.0MHz	±100ppm	SPXO008074	X455S	T & R

SURFACE MOUNT
SPXOs

CFPS-8

ISSUE 1; 30 JULY 1999

Delivery Options

- Please contact our sales office for current leadtimes

Output Compatibility

- Tri-state HCMOS (3.0V)

Package Outline

- 5.0 × 3.2 × 0.95mm SMD (surface mount device) ceramic package.

Operating Temperature Range

- 0 to 70°C

Storage Temperature Range

- –55 to 125°C

Solder Reflow

- Pre-heat: 150 to 180°C/55 to 70 seconds max.
- Reflow: 180°C/40 to 60 seconds max., 200°C/40 seconds max., 220°C ±5°C/5 to 15 seconds max.

Ageing

- ±5ppm per year

Tri-state Operation

- Logic ‘1’ to pad 1 enables oscillator output, 2.2V min
- Logic ‘0’ to pad 1 disables oscillator output; when disabled the oscillator output goes to the high impedance state, 0.8V max
- No connection to pad 1 enables oscillator output

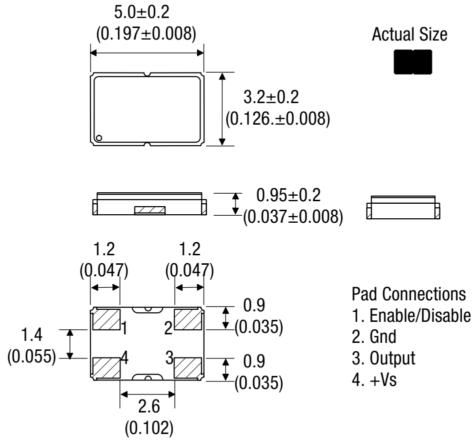
Marking

- Model number (+ Operating Temperature Code; if applicable)
- Frequency Stability Code
- Frequency

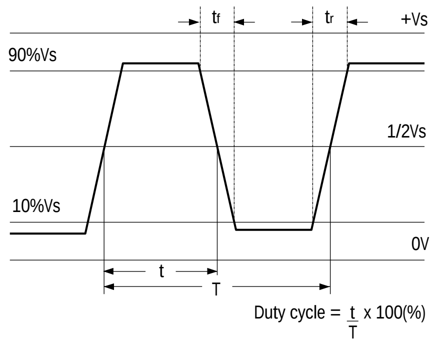
Minimum Order Information Required

- Frequency + Model Number + Operating Temperature Code (if applicable)+ Frequency Stability

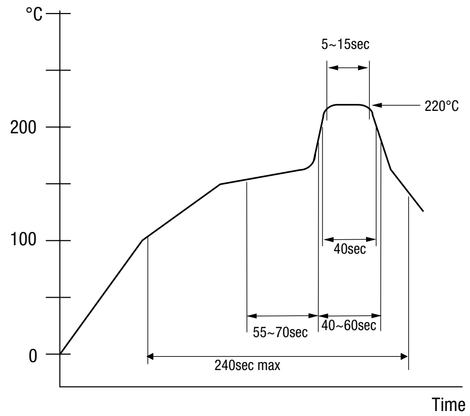
Outline in mm (inches) - (scale 2:1)



Output Waveform



Typical Solder Condition - Infrared Reflow



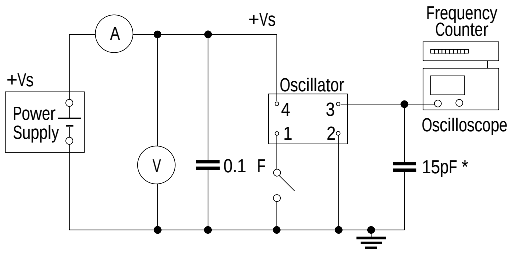
Electrical Specification – maximum limiting values when measured in test circuit

Frequency Range	Frequency Stability	Supply Voltage	Supply Current	Rise Time (t_r)	Fall Time (t_f)	Duty Cycle	Model Number
2.5 to < 55.0MHz	±100ppm	3.0V±0.3V	50mA	6ns	6ns	40/60%	CFPS-8

Ordering Example 24.0MHz CFPS-8 C

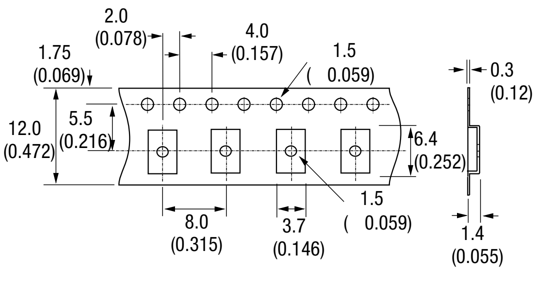
Frequency — 24.0MHz
Model No — CFPS-8
Frequency Stability: C = ±100ppm — C

Test Circuit

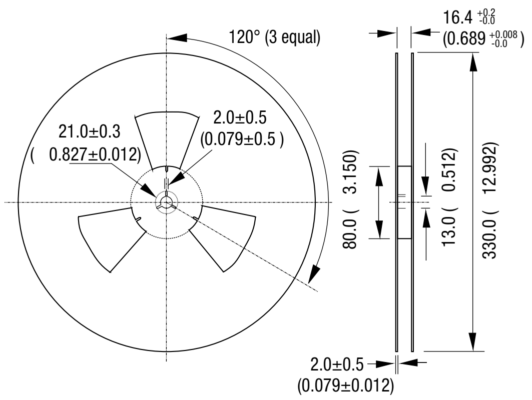


* Inclusive of jigging & equipment capacitance

Outline in mm (inches) - Tape



Outline in mm (inches) - Reel (scale 1:8)



IQXO-53, -57

ISSUE 10; 17 JULY 1998

Delivery Options

- Common frequencies are available from stock. Please see p180 for details

Output Compatibility

- HCMOS/LS TTL
- Tri-state (IQXO-57, -57I)
- Non tri-state (IQXO-53, -53I)

Package Outline

- SMD (surface mount device) plastic encapsulated. Available over 0 to 70°C (IQXO-53, -57) or –40 to 85°C (IQXO-53I, -57I)

Standard Frequency Stabilities

- ±50ppm, ±100ppm (inclusive of supply voltage variations over the operating temperature range)

Operating Temperature Range

- 0 to 70°C (IQXO-53,-57)
- –40 to 85°C (IQXO-53I, -57I)

Storage Temperature Range

- –50 to 125°C

Non-Standard Duty Cycle

- Tighter duty cycles are available on request

Tri-state Operation (IQXO-57, -57I)

- Logic ‘1’ to pin 1 enables oscillator output, 2.0V min
- Logic ‘0’ to pin 1 disables oscillator output; when disabled the oscillator output goes to the high impedance state, 0.8V max
- No connection to pin 1 enables oscillator output
- When oscillator is enabled, maximum transition time = 100ns

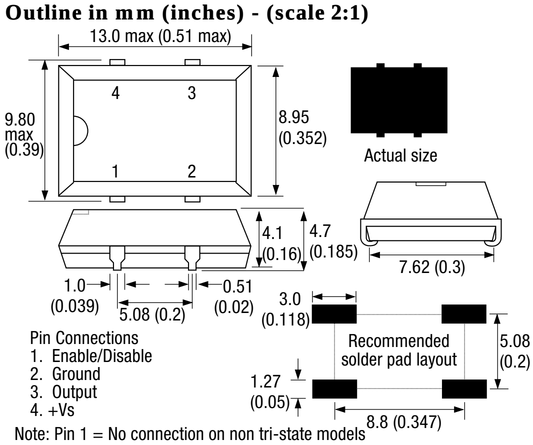
Marking

- Model number (+ Operating Temperature Code; if applicable)
- Frequency Stability Code
- Frequency
- Date Code

Minimum Order Information Required

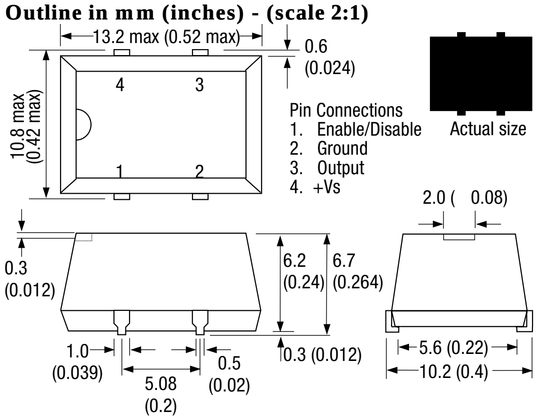
- Frequency + Model Number + Operating Temperature Code (if applicable) + Frequency Stability

Outline in mm (inches) - (scale 2:1)



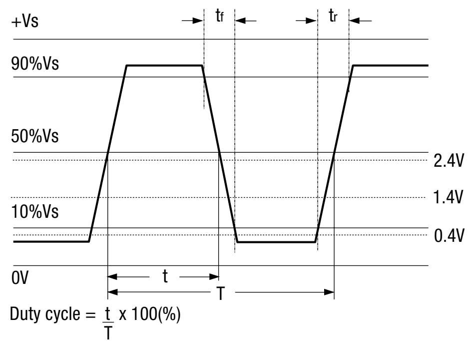
Note: Pin 1 = No connection on non tri-state models
Frequency Range = 1.0 to 70.0MHz

Outline in mm (inches) - (scale 2:1)



Note: Pin 1 = No connection on non tri-state models
Frequency Range = > 70.0 to 130.0MHz

Output Waveform - HCMOS/LS TTL



Electrical Specification – maximum limiting values when measured in HCMOS test circuit

Frequency Range	Frequency Stability	Supply Voltage	Supply Current	Rise Time (t_r)	Fall Time (t_f)	Duty Cycle	Model Number
1.0 to < 26.0MHz	±50ppm, ±100ppm	5V±0.5V	15mA	8ns	8ns	40/60%	IQXO-53, 53I, 57, 57I
26.0 to < 40.0MHz	±50ppm, ±100ppm	5V±0.5V	30mA	8ns	8ns	40/60%	IQXO-53, 53I, 57, 57I
40.0 to < 50.0MHz	±50ppm, ±100ppm	5V±0.5V	30mA	6ns	6ns	40/60%	IQXO-53, 53I, 57, 57I
50.0 to 70.0MHz	±50ppm, ±100ppm	5V±0.5V	38mA	6ns	6ns	40/60%	IQXO-53, 53I, 57, 57I
> 70.0 to 130.0MHz	±50ppm, ±100ppm	5V±0.5V	65mA	3ns	3ns	40/60%	IQXO-53, 53I, 57, 57I

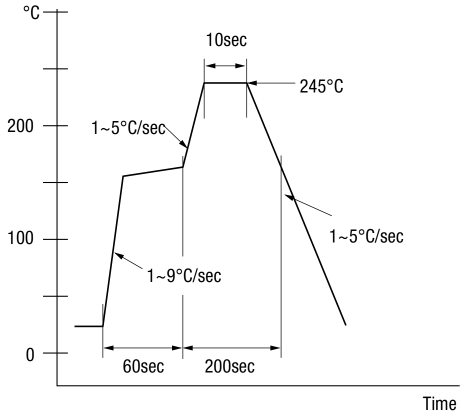
Please note: TTL models (IQXO-52, -52I, -56, -56I) are available; contact our sales office for further details

Ordering Example 24.0MHz IQXO-57I C

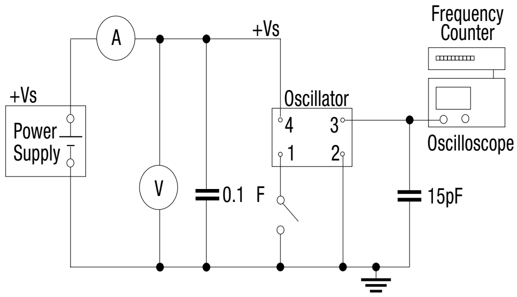
Frequency
Model No: 57, 57I = Tri-state 53, 53I = Non Tri-state
Operating Temperature Code: I = –40 to 85°C Not applicable for 0 to 70°C
Frequency Stability: B = ±50ppm; C = ±100ppm

SURFACE MOUNT SPXOs

Typical Solder Condition - Infrared Reflow



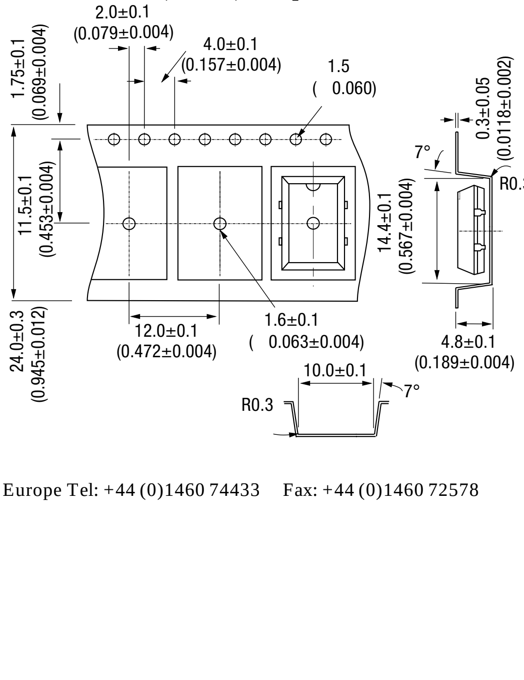
Test Circuit - HCMOS



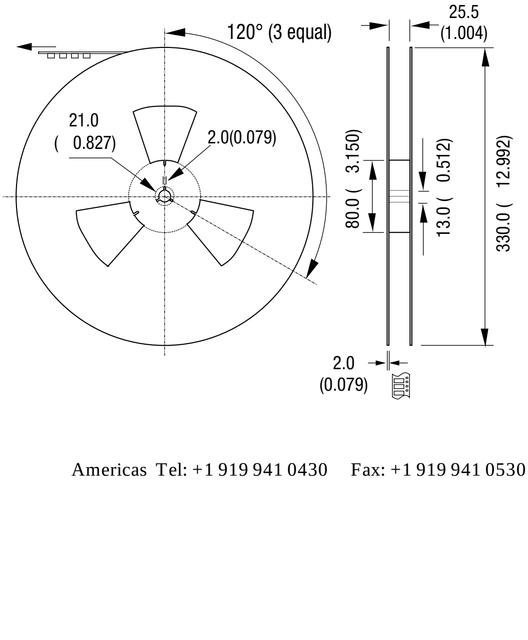
Load Capacitance (C_L) - Inclusive of jigging & equipment
C_L = 15pF (1.0 to 70.0MHz)

Note: Pin 1 = No connection on non tri-state models

Outline in mm (inches) - Tape



Outline in mm (inches) - Reel (scale 1:8)



IQXO-62, -63

ISSUE 2; 19 OCTOBER 1999

Delivery Options

- Please contact our sales office for current leadtimes

Output Compatibility

- Tri-state HCMOS/TTL (5.0V) (IQXO- 62)
- Tri-state HCMOS (3.3V) (IQXO- 63)

Package Outline

- SMD (surface mount device) ceramic package with high drive capability

Standard Frequencies

- 1.84320MHz, 2.0MHz, 3.68640MHz, 4.0MHz, 5.0MHz, 8.0MHz, 10.0MHz, 12.0MHz, 14.318180MHz, 16.0MHz, 20.0MHz, 24.0MHz, 25.0MHz, 29.49120MHz, 30.0MHz, 32.0MHz, 33.86880MHz, 36.8640MHz, 40.0MHz, 44.23680MHz, 48.0MHz, 50.0MHz

Standard Frequency Stabilities

- 50ppm, 100ppm (inclusive of supply voltage & output load variations over the operating temperature range)

Operating Temperature Range

- –10 to 70°C

Storage Temperature Range

- –30 to 85°C

Tri-state Operation

- Logic ‘1’ to pad 1 enables oscillator output, 2.2V min
- Logic ‘0’ to pad 1 disables oscillator output; when disabled the oscillator output goes to the high impedance state, 0.8V max
- No connection to pad 1 enables oscillator ouput

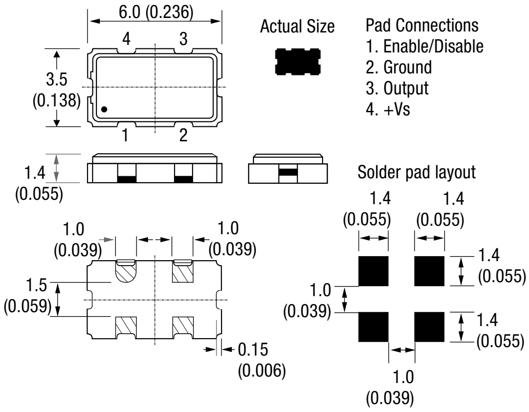
Marking

- Model number
- Frequency Stability Code
- Frequency

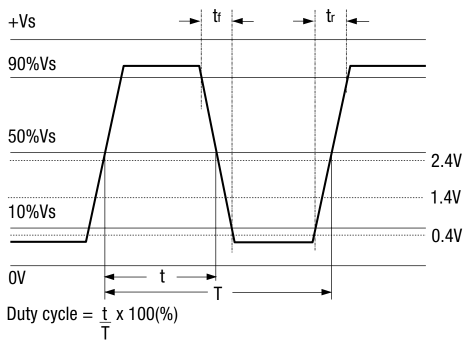
Minimum Order Information Required

- Frequency + Model Number + Frequency Stability

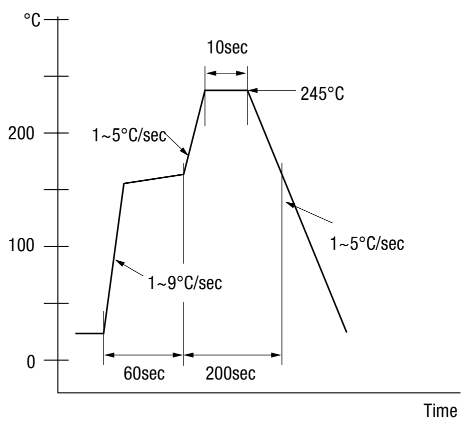
Outline in mm (inches) - (scale 3:1)



Output Waveform - HCMOS/TTL



Typical Solder Condition - Infrared Reflow



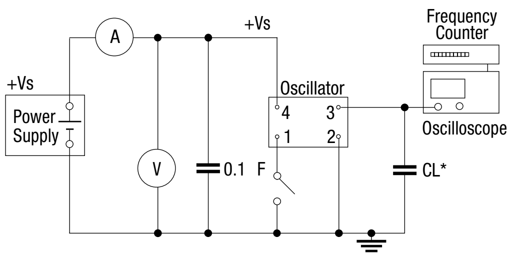
Electrical Specification - maxmum limiting values when measured in HCMOS test circuit

Frequency Range	Frequency Stability	Supply Voltage	Supply Current	Rise Time (t_r)	Fall Time (t_f)	Duty Cycle	Model Number
1.80 to 25.0MHz	±50ppm, ±100ppm	3.3V±0.3V	15mA	6ns	6ns	40/60%	IQXO-63
		5.0V±0.5V	27mA	5ns	5ns		IQXO-62
> 25.0 to 50.0MHz	±50ppm, ±100ppm	3.3V±0.3V	15mA	6ns	6ns	40/60%	IQXO-63
		5.0V±0.5V	40mA	5ns	5ns		IQXO-62

Ordering Example 24.0MHz IQXO-62 B

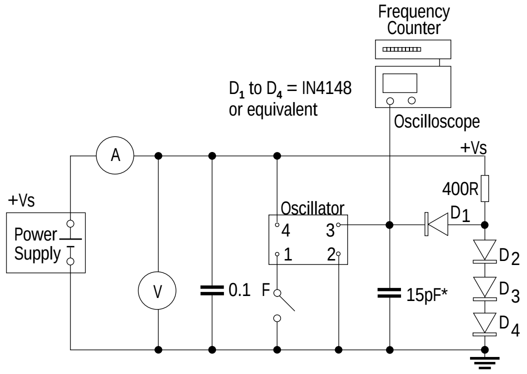
Frequency — 24.0MHz
Model No — IQXO-62
Frequency Stability: B = ±50ppm; C= ±100ppm — B

Test Circuit - HCMOS



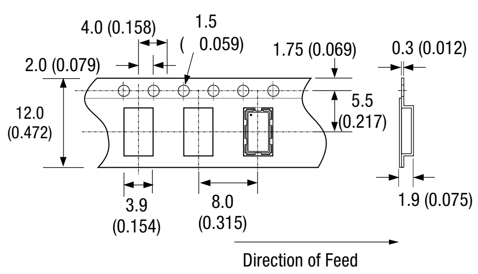
* Inclusive of jigging & equipment capacitance
Note: CL = 50pF for model IQXO-62 and 15pF for model IQXO-63

Test Circuit - TTL (IQXO-62)

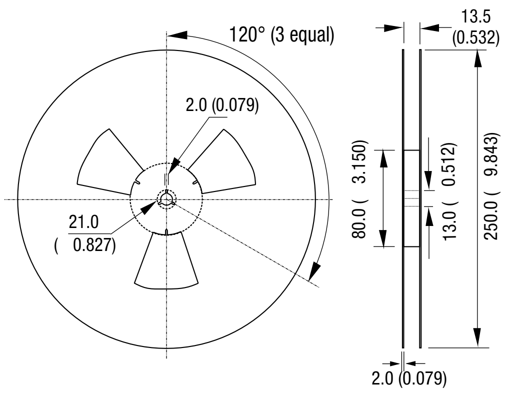


*Inclusive of jigging & equipment capacitance

Outline in mm (inches) - Tape



Outline in mm (inches) - Reel (scale 1:8)



IQXO-70, -71

ISSUE 7; 13 SEPTEMBER 1999

Delivery Options

- Common frequencies are available from stock please see p181 for details

Output Compatibility

- Tri-state HCMOS/TTL (5.0V)(IQXO-70)
- Tri-state HCMOS (3.3V) (IQXO-71)

Package Outline

- SMD (surface mount device) ceramic package. Available over –10 to 70°C (IQXO-70, -71) or –40 to 85°C (IQXO-70I, -71I)

Standard Frequencies

- 1.84320MHz, 2.0MHz, 2.0480MHz, 3.68640MHz, 4.0MHz, 5.0MHz, 8.0MHz, 10.0MHz, 12.0MHz, 12.2880MHz, 14.318180MHz, 16.0MHz, 16.3840MHz, 20.0MHz, 24.0MHz, 25.0MHz, 29.49120MHz, 30.0MHz, 32.0MHz, 32.7680MHz, 33.86880MHz, 36.8640MHz, 40.0MHz, 44.23680MHz, 48.0MHz, 50.0MHz, 53.1250MHz, 64.0MHz, 66.6660MHz, 70.0MHz, 80.0MHz, 100.0MHz, 106.250MHz, 125.0MHz

Standard Frequency Stabilities

- ±25ppm, not available over –40 to 85°C ±50ppm, ±100ppm (inclusive of supply voltage & output load variations over the operating temperature range)

Operating Temperature Range

- –10 to 70°C (IQXO-70, -71)
- –40 to 85°C (IQXO-70I, -71I)

Storage Temperature Range

- –55 to 125°C

Tri-state Operation

- Logic ‘1’ to pad 1 enables oscillator output, 2.2V min
- Logic ‘0’ to pad 1 disables oscillator output; when disabled the oscillator output goes to the high impedance state, 0.8V max
- No connection to pad 1 enables oscillator output

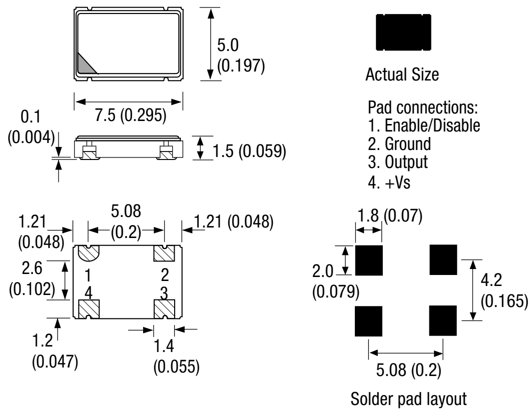
Marking

- Model number (+ Operating Temperature Code; if applicable)
- Frequency Stability Code
- Frequency

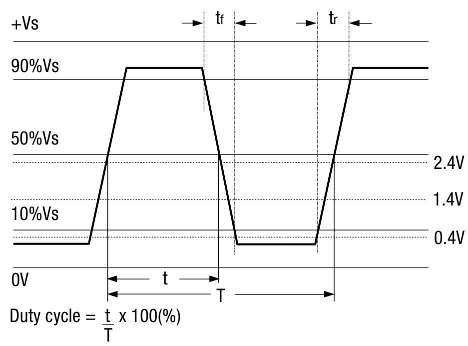
Minimum Order Information Required

- Frequency + Model Number + Operating Temperature Code (if applicable) + Frequency Stability

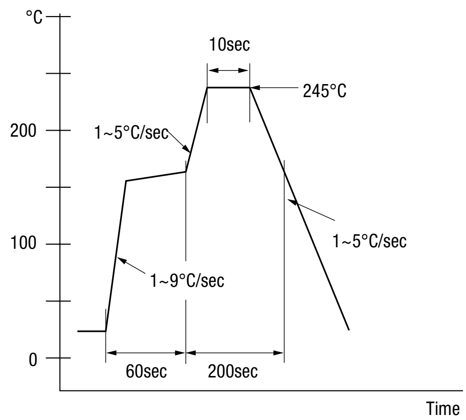
Outline in mm (inches) - (scale 2:1)



Output Waveform



Typical Solder Condition - Infrared Reflow



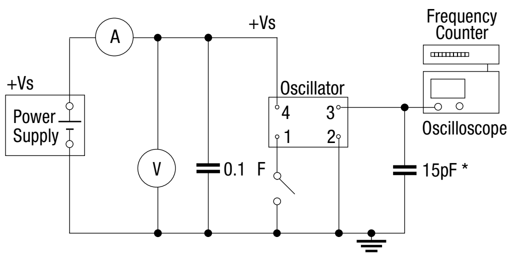
Electrical Specification – maximum limiting values when measured in test circuit

Frequency Range	Frequency Stability	Supply Voltage	Supply Current	Rise Time (t_r)	Fall Time (t_f)	Duty Cycle	Model Number
1.544 to 25.0MHz	±25ppm, ±50ppm, ±100ppm	5.0V±0.5V	25mA	5ns	5ns	45/55%	IQXO-70, -70I
		3.3V±0.3V	10mA	6ns	6ns	45/55%	IQXO-71, -71I
> 25.0 to 32.0MHz	±25ppm, ±50ppm, ±100ppm	5.0V±0.5V	40mA	5ns	5ns	45/55%	IQXO-70, -70I
		3.3V±0.3V	10mA	6ns	6ns	45/55%	IQXO-71, -71I
> 32.0 to 50.0MHz	±25ppm, ±50ppm, ±100ppm	5.0V±0.5V	40mA	5ns	5ns	45/55%	IQXO-70, -70I
		3.3V±0.3V	15mA	6ns	6ns	45/55%	IQXO-71, -71I
> 50.0 to 67.0MHz	±50ppm, ±100ppm	5.0V±0.5V	60mA	5ns	5ns	45/55%	IQXO-70, -70I
		3.3V±0.3V	18mA	6ns	6ns	40/60%	IQXO-71, -71I
> 67.0 to 80.0MHz	±50ppm, ±100ppm	5.0V±0.5V	73mA	5ns	5ns	45/55%	IQXO-70, -70I
		3.3V±0.3V	30mA	6ns	6ns	40/60%	IQXO-71, -71I
> 80.0 to 125.0MHz	±100ppm	5.0V±0.5V	–	–	–	–	IQXO-70, -70I
		3.3V±0.3V	30mA	6ns	6ns	40/60%	IQXO-71, -71I

Ordering Example 24.0MHz IQXO-71I C

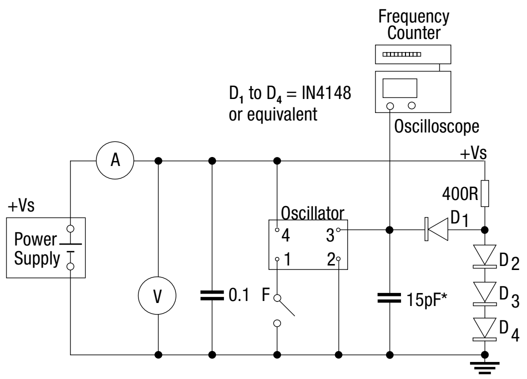
Frequency
Model No
Operating Temperature Code: I= –40 to 85°C Not applicable for –10 to 70°C
Frequency Stability: A = ±25ppm (not available over –40 to 85°C); B = ±50ppm; C = ±100ppm

Test Circuit - HCMOS



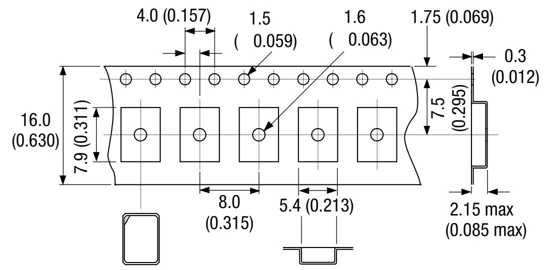
* Inclusive of jigging & equipment capacitance

Test Circuit - TTL

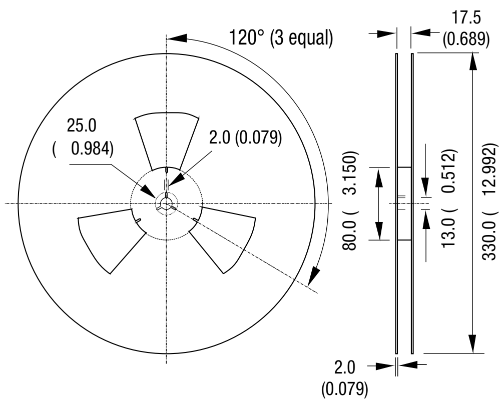


*Inclusive of jigging & equipment capacitance
Note: IQXO-70, 70I only

Outline in mm (inches) - Tape



Outline in mm (inches) - Reel (scale 1:8)



CFPS-72, -73

SURFACE MOUNT SPXOs

ISSUE 1; 7 OCTOBER 1999

Delivery Options

- Please contact our sales office for current leadtimes

Output Compatibility

- Tri-state HCMOS/TTL (5.0V) (CFPS-72)
- Tri-state HCMOS (3.3V) (CFPS-73)

Package Outline

- SMD (surface mount device) ceramic package. Available over 0 to 70°C (CFPS-72, -73) or –40 to 85°C (CFPS-72I, -73I)

Standard Frequency Stabilities

- ±25ppm not available over –40 to 85°C ±50ppm, ±100ppm (inclusive of supply voltage & output load variations over the operating temperature range)

Operating Temperature Range

- 0 to 70°C (CFPS-72, -73)
- –40 to 85°C (CFPS-72I, -73I)

Storage Temperature Range

- –55 to 125°C

Tri-state Operation

- Logic ‘1’ to pad 1 enables oscillator output, 2.2V min
- Logic ‘0’ to pad 1 disables oscillator output; when disabled the oscillator output goes to the high impedance state, 0.8V max
- No connection to pad 1 enables oscillator output

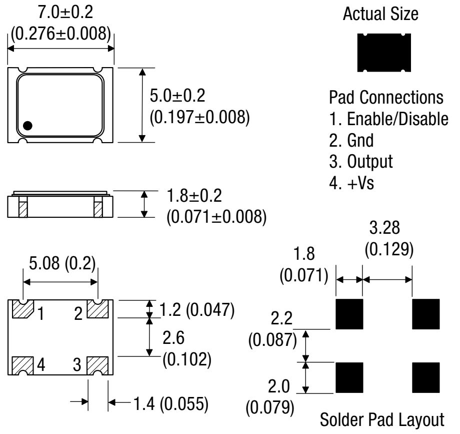
Marking

- Model number (+ Operating Temperature Code; if applicable)
- Frequency Stability Code
- Frequency

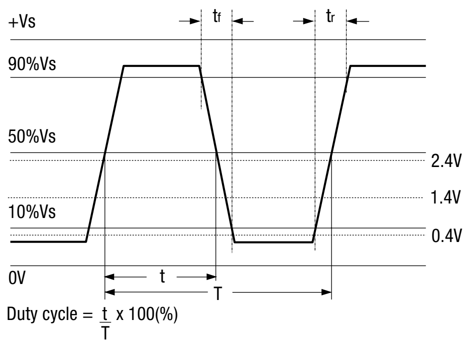
Minimum Order Information Required

- Frequency + Model Number + Operating Temperature Code (if applicable) + Frequency Stability

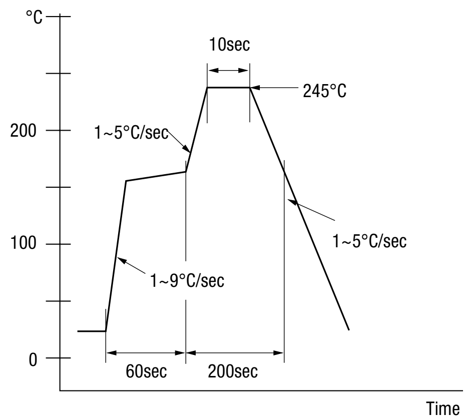
Outline in mm (inches) - (scale 2:1)



Output Waveform



Typical Solder Condition - Infrared Reflow



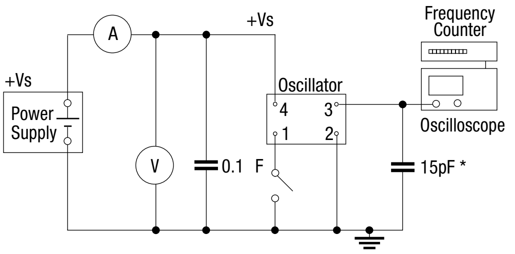
Electrical Specification – maximum limiting values when measured in HCMOS test circuit

Frequency Range	Frequency Stability	Supply Voltage	Supply Current	Rise Time (t_r)	Fall Time (t_f)	Duty Cycle	Model Number
1.544 to 20.0MHz	±25ppm, ±50ppm, ±100ppm	5.0V±0.5V	20mA	10ns	10ns	40/60%	CFPS-72, -72I
		3.3V±0.3V	10mA	10ns	10ns	40/60%	CFPS-73, -73I
> 20.0 to 70.0MHz	±25ppm, ±50ppm, ±100ppm	5.0V±0.5V	40mA	6ns	6ns	40/60%	CFPS-72, -72I
		3.3V±0.3V	20mA	6ns	6ns	40/60%	CFPS-73, -73I

Ordering Example 24.0MHz CFPS-73I C

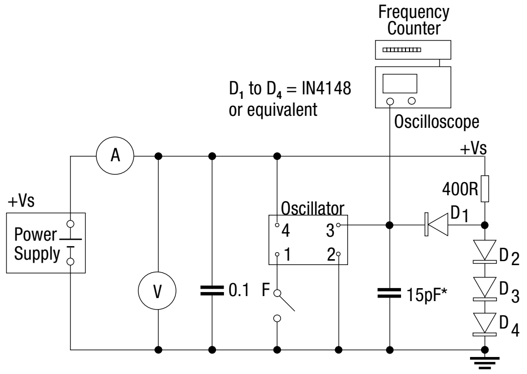
Frequency
Model No
Operating Temperature Code: I= –40 to 85°C Not applicable for –10 to 70°C
Frequency Stability: A = ±25ppm (not available over –40 to 85°C); B = ±50ppm; C = ±100ppm

Test Circuit - HCMOS



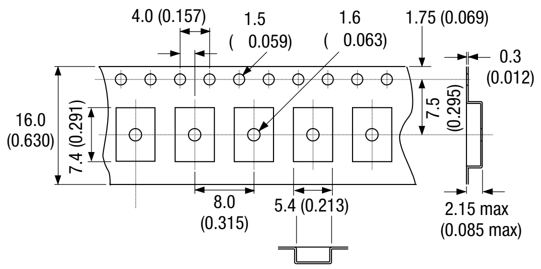
* Inclusive of jigging & equipment capacitance

Test Circuit - TTL

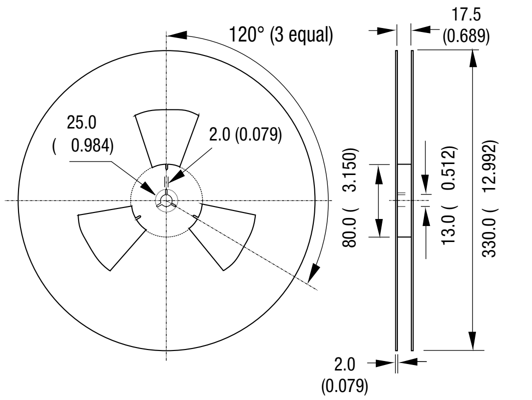


*Inclusive of jigging & equipment capacitance
Note: CFPS-72, 72I only

Outline in mm (inches) - Tape



Outline in mm (inches) - Reel (scale 1:8)



IQXO-80, -81

ISSUE 1; 19 JUNE 1997

Delivery Options

- Please contact our sales office for current leadtimes

Output Compatibility

- PECL 10kH (IQXO-80)
- Dual Complimentary PECL 10kH (IQXO-81)

Package Outline

- 14.0 × 9.8 × 3.35mm SMD (surface mount device)

Standard Frequency Stabilities

- ±100ppm (inclusive of supply voltage variations over the operating temperature range)

Operating Temperature Range

- –10 to 70°C

Storage Temperature Range

- –55 to 125°C

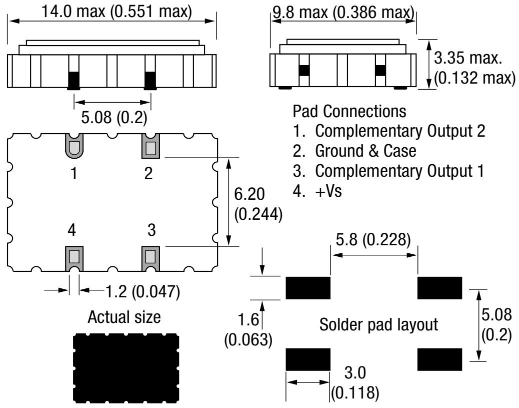
Marking

- Model number
- Frequency Stability Code
- Frequency
- Date code (Year/Week)

Minimum Order Information Required

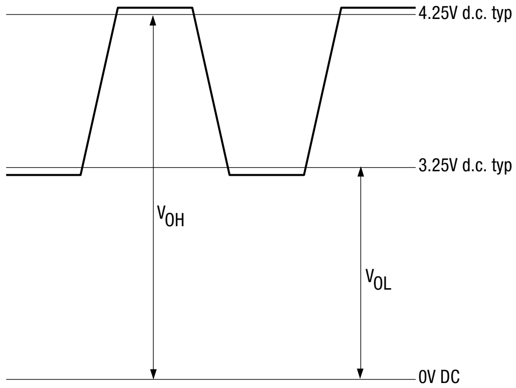
- Frequency + Model Number + Frequency Stability

Outline in mm (inches) - (scale 2:1)



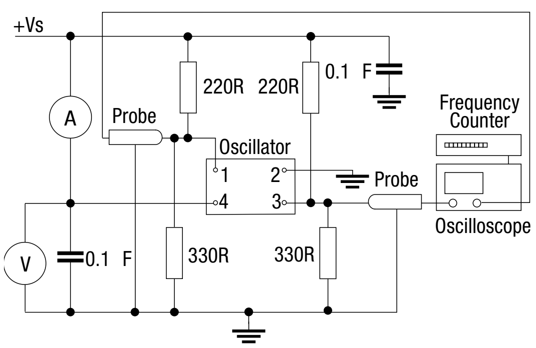
Note: Pin 1 = No connection on IQXO-80, Pin 3 = Output

Logic Levels



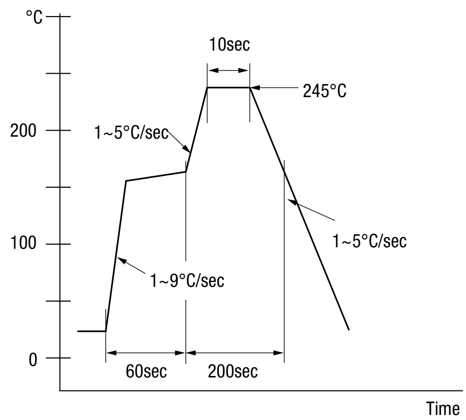
Logic 0 (V_{OL}) minimum 3.05V; maximum 3.42V
Logic 1 (V_{OH}) minimum 4.0V; maximum 4.45V

Test Circuit



Note: Pin 1 = No connection on IQXO-80

Typical Solder Condition - Infrared Reflow



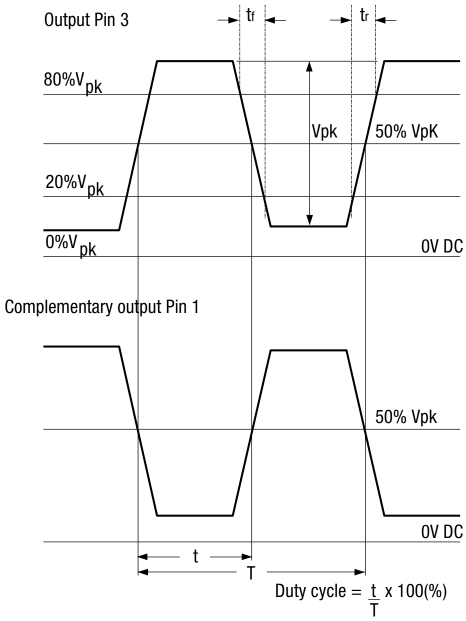
Electrical Specification – maximum limiting values when measured in test circuit

Frequency Range	Frequency Stability	Supply Voltage	Supply Current	Rise Time (t_r)	Fall Time (t_f)	Duty Cycle	Model Number
30.0 to 170.0MHz	±100ppm	5.0V±0.25V	60mA	2ns	2ns	40/60%	IQXO-80, -81

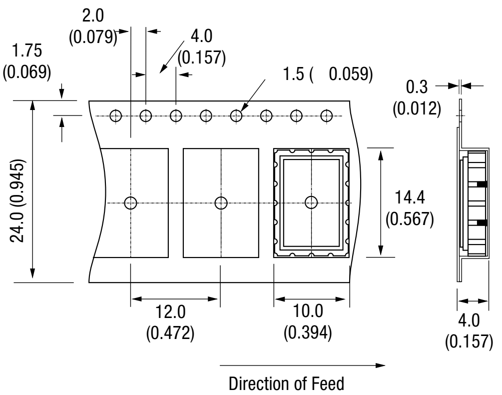
Ordering Example: 125.0MHz IQXO-80 C

- Frequency — 125.0MHz
- Model No — IQXO-80
- Frequency Stability: C= ±100ppm — C

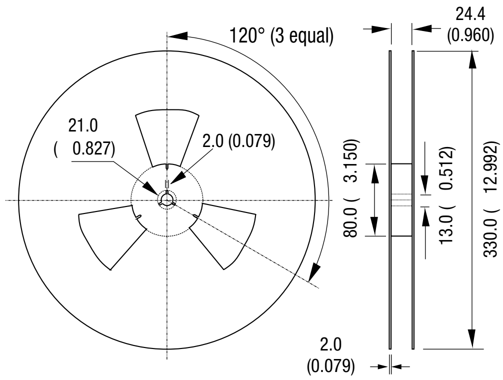
Output Waveform



Outline in mm (inches) - Tape



Outline in mm (inches) - Reel (scale 1:8)



IQXO-82, -83

ISSUE 1; 19 JUNE 1997

Delivery Options

- Please contact our sales office for current leadtimes

Output Compatibility

- ECL 10kH (IQXO-82)
- Dual Complimentary ECL 10kH (IQXO-83)

Package Outline

- 14.0 × 9.8 × 3.35mm SMD (surface mount device)

Standard Frequency Stabilities

- ±100ppm (inclusive of supply voltage variations over the operating temperature range)

Operating Temperature Range

- –10 to 70°C

Storage Temperature Range

- –55 to 125°C

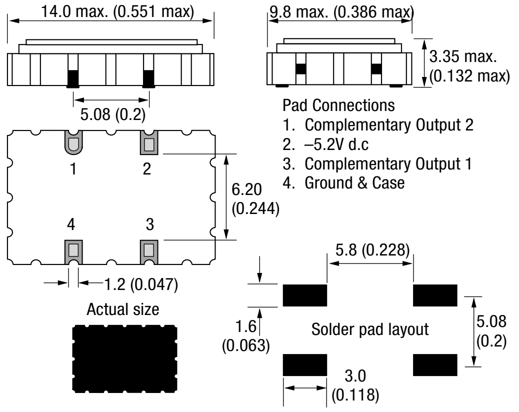
Marking

- Model number
- Frequency Stability Code
- Frequency
- Date code (Year/Week)

Minimum Order Information Required

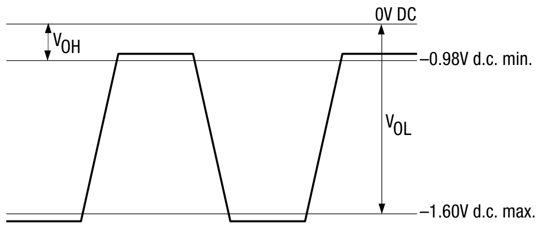
- Frequency + Model Number + Frequency Stability

Outline in mm (inches) - (scale 2:1)

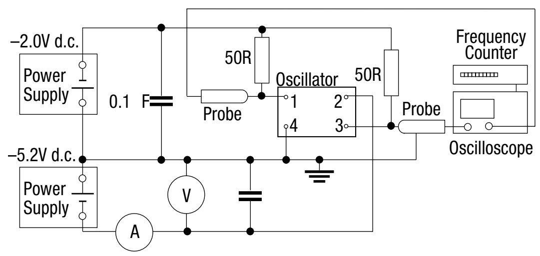


Note: Pin 1 = No connection on IQXO-82, Pin 3 = Output

Logic Levels

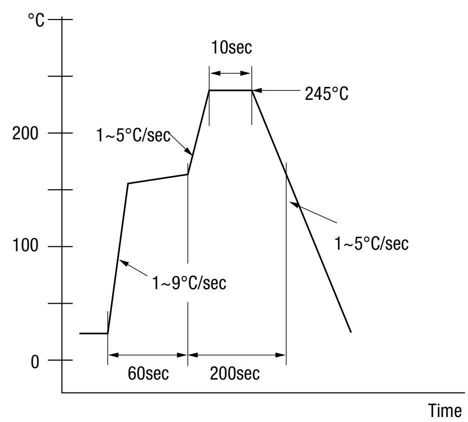


Test Circuit



Note: Pin 1 = No connection on IQXO-82

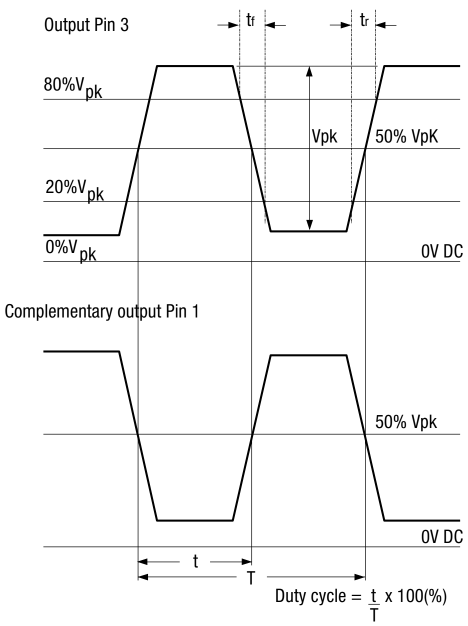
Typical Solder Condition - Infrared Reflow



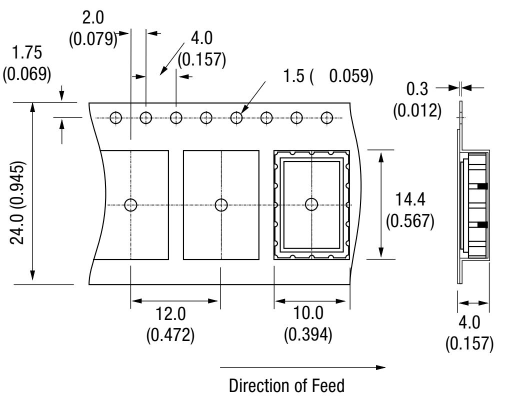
Electrical Specification – maximum limiting values when measured in test circuit

Frequency Range	Frequency Stability	Supply Voltage	Supply Current	Rise Time (t_r)	Fall Time (t_f)	Duty Cycle	Model Number
30.0 to 170.0MHz	±100ppm	–5.2V±0.25V	50mA	2ns	2ns	40/60%	IQXO-82, -83
Note: Both Complimentary outputs require terminating to either 270 to ground or 50 to –2.0V d.c							
Ordering Example					125.0MHz	IQXO-83	C
Frequency					125.0MHz		
Model No						IQXO-83	
Frequency Stability: C= ±100ppm							C

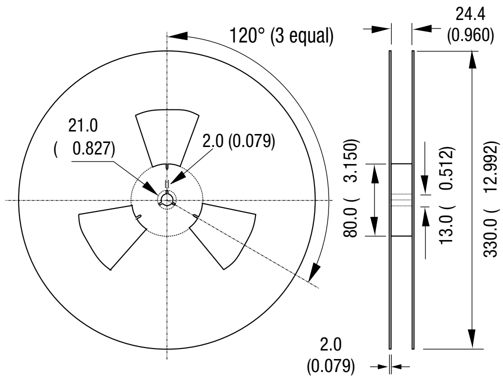
Output Waveform



Outline in mm (inches) - Tape



Outline in mm (inches) - Reel (scale 1:8)



CFPS-95, -96, -97

ISSUE 1; 30 JULY 1999

SURFACE MOUNT
SPXOs

Delivery Options

- Please contact our sales office for current leadtimes

Output Compatibility

- Tri-state TTL (5.0V) (CFPS-96)
- Tri-state HCMOS (5.0V) (CFPS-95)
- Tri-state HCMOS (3.3V) (CFPS-97)

Package Outline

- One Time Factory Programmable crystal oscillator in a SMD (surface mount device) ceramic package. Available over –10 to 70°C (CFPS-95, -96, -97) or –40 to 85°C (CFPS-95I, -96I, -97I)

Standard Frequency Stabilities

- ±50ppm, 100ppm (inclusive of supply voltage & output load variations over the operating temperature range)

Operating Temperature Range

- –10 to 70°C (CFPS-95,- 96, -97)
- –40 to 85°C (CFPS-95I, -96I, -97I)

Storage Temperature Range

- –55 to 125°C

Tri-state Operation

- Logic ‘1’ to pad 1 enables oscillator output, 2.2V min
- Logic ‘0’ to pad 1 disables oscillator output; when disabled the oscillator output goes to the high impedance state, 0.8V max
- No connection to pad 1 enables oscillator output

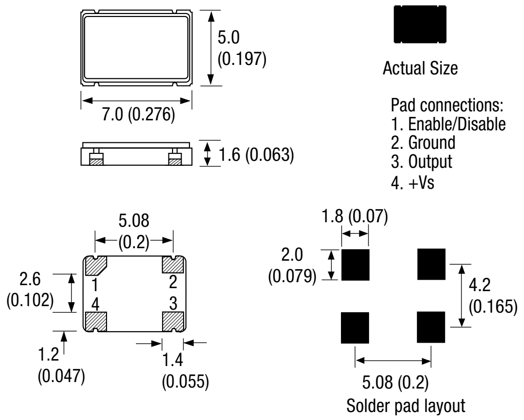
Marking

- Model number (+ Operating Temperature Code; if applicable)
- Frequency Stability Code
- Frequency

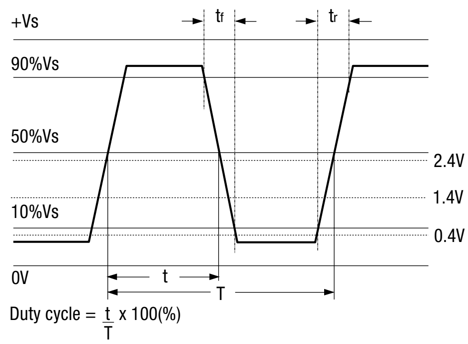
Minimum Order Information Required

- Frequency + Model Number + Operating Temperature Code (if applicable)+ Frequency Stability

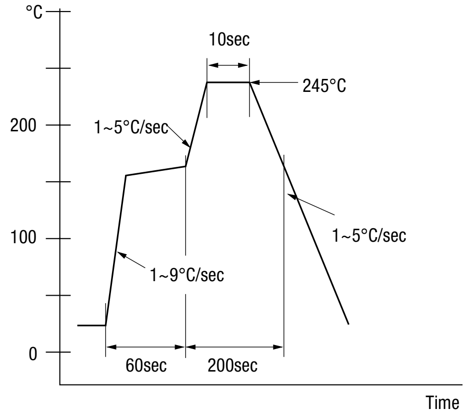
Outline in mm (inches) - (scale 2:1)



Output Waveform



Typical Solder Condition - Infrared Reflow



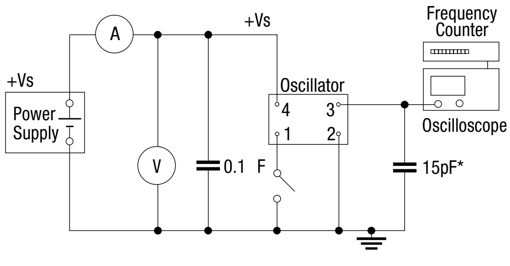
Electrical Specification – maximum limiting values when measured in test circuit

Frequency Range	Frequency Stability	Supply Voltage	Supply Current	Rise Time (t_r)	Fall Time (t_f)	Duty Cycle	Model Number
1.0 to 100.0MHz	±50ppm, ±100ppm	5.0V±0.5V	45mA	4ns	4ns	45/55%	CFPS-95, -96, -95I, -96I
		3.3V±0.3V	25mA	4ns	4ns	45/55%	CFPS-97, -97I
>100.0 to 125.0MHz	±50ppm, ±100ppm	5.0V±0.5V	45mA	4ns	4ns	45/55%	CFPS-95, -96, -95I, -96I

Ordering Example: 24.0MHz CFPS-96I C

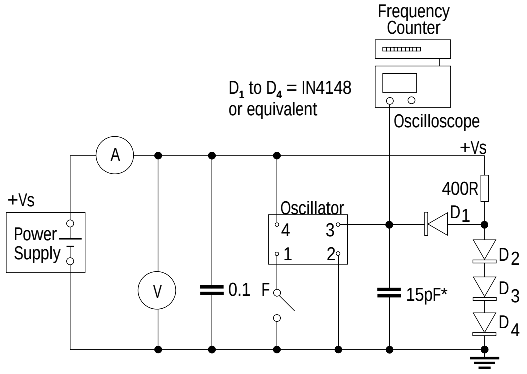
- Frequency — 24.0MHz
- Model No — CFPS-96
- Operating Temperature Code: I= –40 to 85°C Not applicable for –10 to 70°C — I
- Frequency Stability: B = ±50ppm (not available over –40 to 85°C); C = ±100ppm — C

Test Circuit - HCMOS



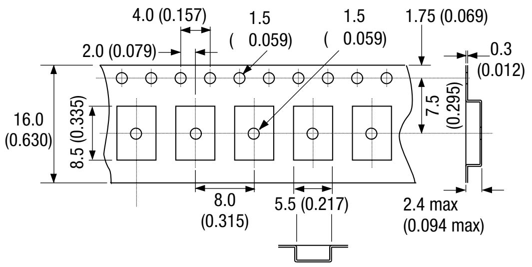
* Inclusive of jigging & equipment capacitance

Test Circuit - TTL

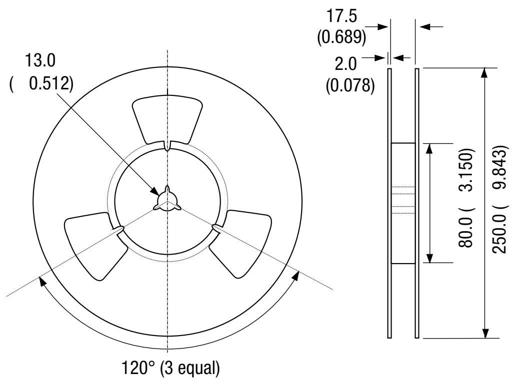


*Inclusive of jigging & equipment capacitance

Outline in mm (inches) - Tape



Outline in mm (inches) - Reel (scale 1:8)



CFPS-130, -131

ISSUE 1; 3 MARCH 1999

Delivery Options

- Please contact our sales office for current leadtimes

Output Compatibility

- HCMOS
- Tri-state (CFPS-131)
- Non tri-state (CFPS-130)

Package Outline

- SMD (surface mount device) plastic encapsulated. Available over 0 to 70°C

Standard Frequencies

- 1.84320MHz, 2.0MHz, 3.68640MHz, 4.0MHz, 5.0MHz, 8.0MHz, 10.0MHz, 12.0MHz, 14.318180MHz, 16.0MHz, 20.0MHz, 24.0MHz, 25.0MHz, 29.49120MHz, 30.0MHz, 32.0MHz, 33.86880MHz, 36.8640MHz, 40.0MHz, 44.23680MHz, 48.0MHz, 50.0MHz, 66.6660MHz

Standard Frequency Stabilities

- ±50ppm, ±100ppm(inclusive of supply voltage variations over the operating temperature range)

Operating Temperature Range

- 0 to 70°C

Storage Temperature Range

- –50 to 125°C

Non-Standard Duty Cycle

- Tighter duty cycles are available on request

Tri-state Operation (CFPS-131)

- Logic ‘1’ to pin 1 enables oscillator output
- Logic ‘0’ to pin 1 disables oscillator output; when disabled the oscillator output goes to the high impedance state, 0.2V max
- No connection to pin 1 enables oscillator output
- When oscillator is enabled, maximum transition time = 100ns

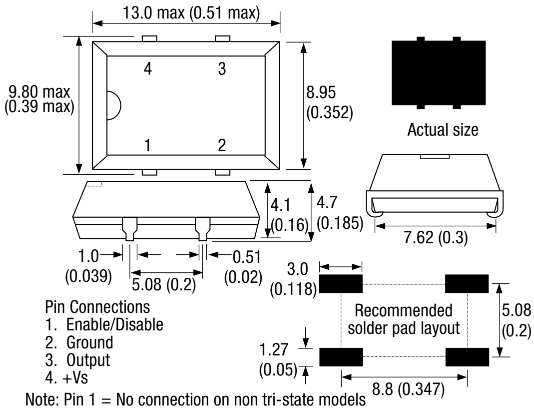
Marking

- Model number (+ Operating Temperature Code; if applicable)
- Frequency Stability Code
- Frequency
- Date code (Year/Week)

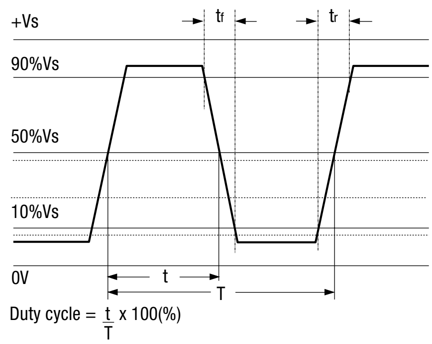
Minimum Order Information Required

- Frequency + Model Number + Operating Temperature Code (if applicable)+ Frequency Stability

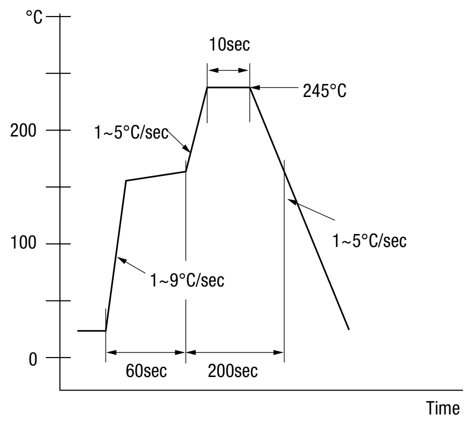
Outline in mm (inches) - (scale 2:1)



Output Waveform - HCMOS



Typical Solder Condition - Infrared Reflow



Electrical Specification – maximum limiting values when measured in HCMOS test circuit

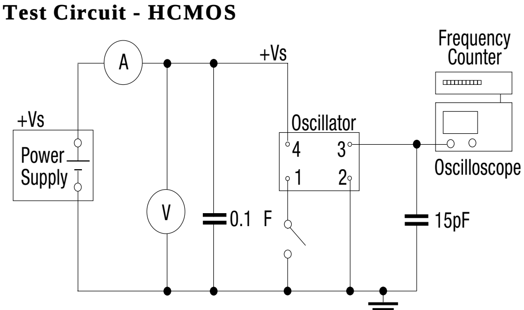
Frequency Range	Frequency Stability	Supply Voltage	Supply Current	Rise Time (t_r)	Fall Time (t_f)	Duty Cycle	Model Number
1.0MHz to <27.0MHz	±50ppm, ±100ppm	3.3V±0.3V	10mA	5ns	5ns	40/60%	CFPS-130, -131
27.0MHz to <50.0MHz	±50ppm, ±100ppm	3.3V±0.3V	20mA	5ns	5ns	40/60%	CFPS-130, -131
50.0MHz to 70.0MHz	±50ppm, ±100ppm	3.3V±0.3V	25mA	5ns	5ns	40/60%	CFPS-130, -131

Ordering Example: 24.0MHz CFPS-130 C

- Frequency: 24.0MHz
- Model No: CFPS-130
- Frequency Stability: B = ±50ppm; C = ±100ppm: C

SURFACE MOUNT SPXOs

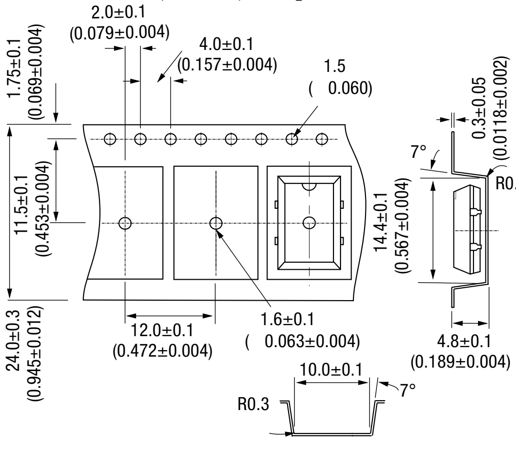
Test Circuit - HCMOS



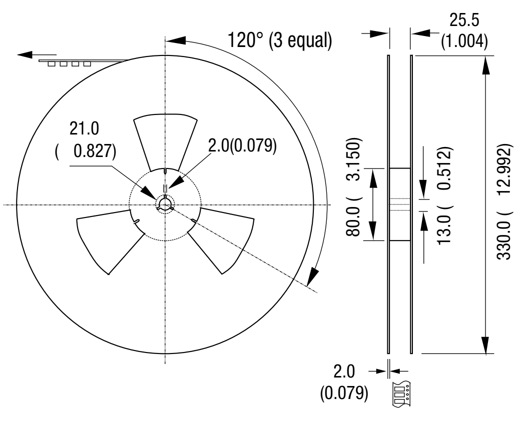
Load Capacitance (C_L) - Inclusive of jigging & equipment
C_L = 15pF (1.0 to 70.0MHz)

Note: Pin 1 = No connection on non tri-state models

Outline in mm (imches) - Tape



Outline in mm (inches) - Reel



CFPS-611, -612

ISSUE 2; 30 JULY 1999

Delivery Options

- Please contact our sales office for current leadtimes

Output Compatibility

- Tri-state HCMOS
- Tri-state TTL
- Drive Capability: 50pF or 10 TTL (CFPS-611)
- Drive Capability: 30pF/10 LS TTL (CFPS-612)

Package Outline

- 7.0 × 5.0 × 1.6mm SMD (surface mount device) housed in a hermetically glass sealed ceramic package

Standard Frequencies

- 1.84320MHz, 2.0480MHz, 3.68840MHz, 4.0MHz, 4.0960MHz, 4.35450MHz, 4.433619MHz, 5.0MHz, 5.0688MHz, 6.0MHz, 6.1440MHz, 7.20MHz, 8.0MHz, 10.0MHz, 11.05920MHz,12.0MHz, 12.50MHz, 13.330MHz, 14.318180MHz, 16.0MHz, 18.4320MHz, 20.0MHz, 22.11840MHz, 24.0MHz, 25.0MHz, 26.660MHz, 27.0MHz, 29.49120MHz, 30.0MHz, 32.0MHz, 33.3330MHz, 33.86880MHz, 36.0MHz, 36.8640MHz, 40.0MHz, 44.23680MHz, 48.0MHz, 49.1520MHz, 50.0MHz, 60.0MHz, 65.5360MHz, 67.73760MHz, 71.50MHz, 80.0MHz

Standard Frequency Stabilities

- ±50ppm, 100ppm (inclusive of supply voltage & output load variations over the operating temperature range)

Operating Temperature Range

- 0 to 70°C

Storage Temperature Range

- –55 to 125°C

Tri-state Operation

- Logic ‘1’ to pad 1 enables oscillator output, 2.2V min
- Logic ‘0’ to pad 1 disables oscillator output; when disabled the oscillator output goes to the high impedance state, 0.8V max

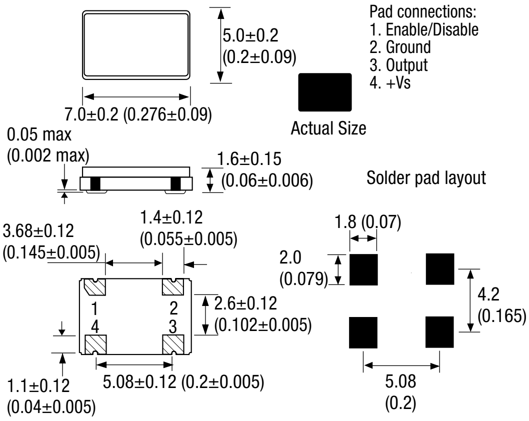
Marking

- Model number (+ Operating Temperature Code; if applicable)
- Frequency Stability Code
- Frequency

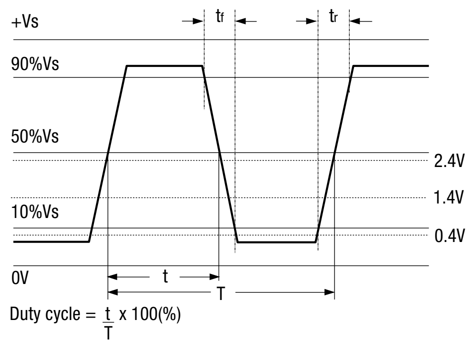
Minimum Order Information Required

- Frequency + Model Number + Operating Temperature Code (if applicable) + Frequency Stability

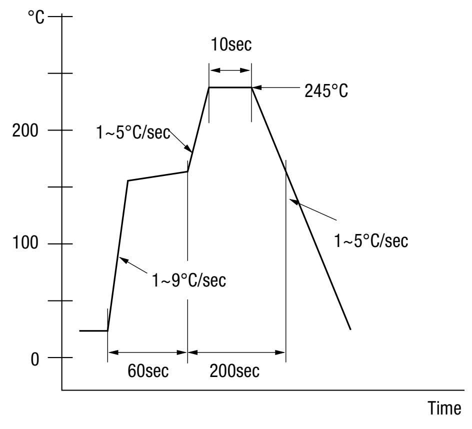
Outline in mm (inches) - (scale 2:1)



Output Waveform - HCMOS/TTL



Typical Solder Condition - Infrared Reflow



Electrical Specification – maximum limiting values when measured in HCMOS test circuit

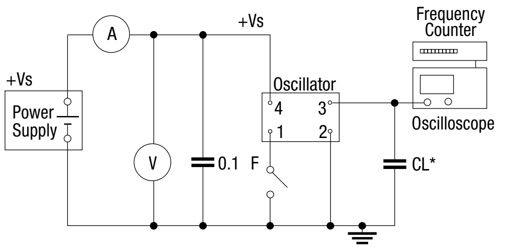
Frequency Range	Frequency Stability	Supply Voltage	Supply Current	Rise Time (t_r)	Fall Time (t_f)	Duty Cycle	Model Number
1.5 to < 20.0MHz	±50ppm ±100ppm	3.3V±0.3V	10mA	10ns	10ns	40/60%	CFPS-612
		5.0V±0.5V	20mA				CFPS-611
20.0 to < 50.0MHz	±50ppm ±100ppm	3.3V±0.3V	20mA	10ns	10ns	40/60%	CFPS-612
		5.0V±0.5V	35mA				CFPS-611
50.0 to 66.666MHz	±50ppm ±100ppm	3.3V±0.3V	25mA	10ns	10ns	40/60%	CFPS-612
		5.0V±0.5V	60mA				CFPS-611

Ordering Example: 24.0MHz CFPS-611 B

Frequency — 24.0MHz
Model No — CFPS-611
Frequency Stability: B = ±50ppm; C= ±100ppm — B

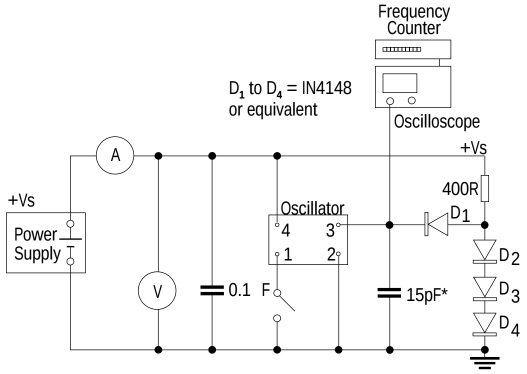
SURFACE MOUNT SPXOs

Test Circuit - HCMOS



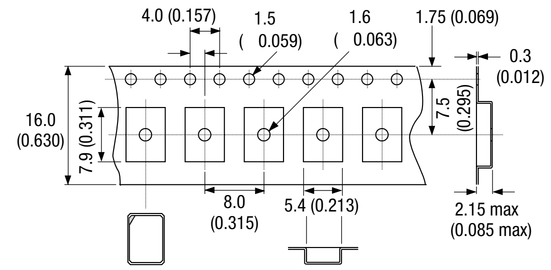
* Inclusive of jigging & equipment capacitance
Note: CL = 50pF for model CFPS-611 and 15pF for model CFPS-612

Test Circuit - TTL (CFPS-611)

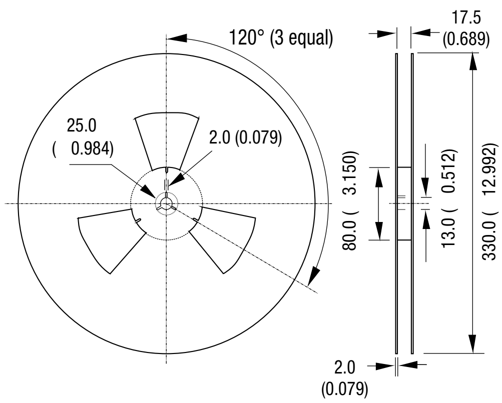


*Inclusive of jigging & equipment capacitance

Outline in mm (inches) - Tape



Outline in mm (inches) - Reel (scale 1:8)



CXO-M Military Oscillator 1.250 to 70.0MHz

ISSUE 1; 19 JUNE 1997

Delivery Options

- Please contact our sales office for current leadtimes

Output Compatibility

- HCMOS/TTL
- Tri-state HCMOS/TTL
- Drive Compability: 50pF or 10 TTL

Package Outline

- Statek's 6.5 × 5.0 × 1.6mm SMD (surface mount device). Available in 5V and 3.0V Non Tri-state or Tri-state versions.

Terminations

- SM1 - Gold over Nickel
- SM3 - Solder dipped

Standard Frequency Stabilities

- Please see Electrical Specification table overleaf

Operating Temperature Ranges

- C = –10 to 70°C
  I = –40 to 85°C
  M = –55 to 125°C

Storage Temperature Range

- –55 to 125°C

Environmental Specification

- Shock: 3000g peak, 0.3ms, ½ sine
- Vibration: 20g rms 10-2000Hz random

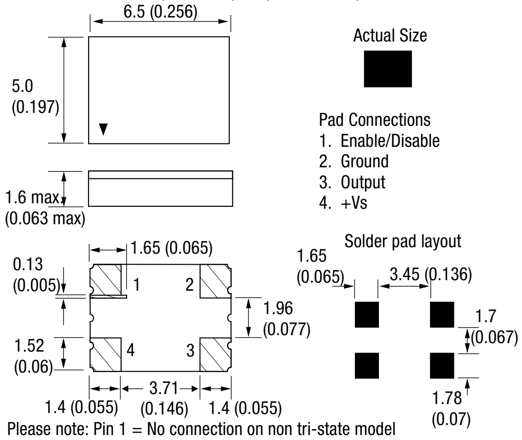
Tri-state Operation

- Pin1 normally high (internal pull-up resistor)
- Tri-state Type
  Pin 1 logic '0' or not connected, Pin 3 high impedance
  Pin 1 logic '1', Pin 3 Output
- Non Tri-state Type
  Pin 1 logic '1' or not connected, Pin3 Output

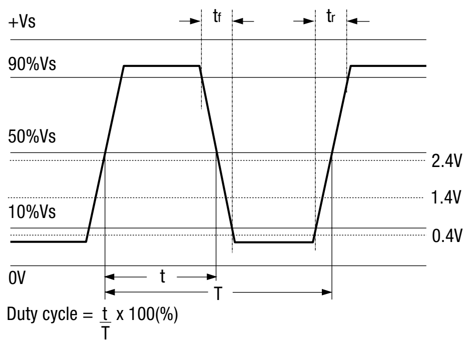
Marking

- Model number
- Frequency Stability Code
- Frequency
- Date code (Year/Week)

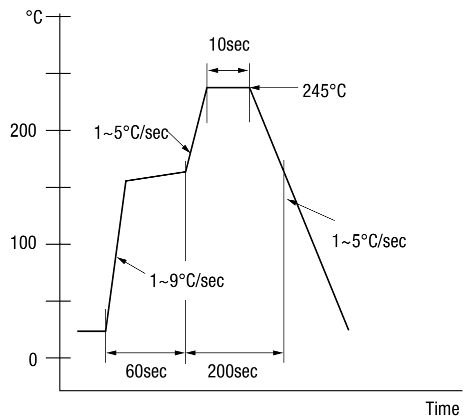
Outline in mm (inches) - (scale 3:1)



Output Waveform - HCMOS/TTL



Typical Solder Condition - Infrared Reflow



Minimum Order Information Required

- Frequency + Model Number + Load + Enable +Termination + Frequency Tolerance @ 25°C + Frequency Stability over Operating Temperture Range + Operating Range

Electrical Specification – maximum limiting values

Frequency Range	*Frequency Tolerance @ 25°C ±2°C	Supply Current (Typical)	Supply Voltage	Operating Temperature Range	Frequency Stability Available Over Operating Temperature		Rise Time (t_r)	Fall Time (t_f)	Duty Cycle	Model Number
					Minimum	Maximum				
1.25 to 24.0MHz	A = ±100ppm B = ±1000ppm C = ±10000ppm	12mA	5.0V±0.5V	–10 to 70°C	±10ppm	±50ppm	6ns	6ns	40/60%	CXO-M
				–40 to 85°C	±20ppm	±100ppm				
				–55 to 125°C	±30ppm	±100ppm				
> 24.0 to 30.0MHz	A = ±100ppm B = ±1000ppm C = ±10000ppm	16mA	5.0V±0.5V	–10 to 70°C	±10ppm	±50ppm	6ns	6ns	40/60%	CXO-M
				–40 to 85°C	±20ppm	±100ppm				
				–55 to 125°C	±30ppm	±100ppm				
> 30.0 to 40.0MHz	A = ±100ppm B = ±1000ppm C = ±10000ppm	20mA	5.0V±0.5V	–10 to 70°C	±10ppm	±50ppm	6ns	6ns	40/60%	CXO-M
				–40 to 85°C	±20ppm	±100ppm				
				–55 to 125°C	±30ppm	±100ppm				
> 40.0 to 70.0MHz	A = ±100ppm B = ±1000ppm C = ±10000ppm	25mA	5.0V±0.5V	–10 to 70°C	±10ppm	±50ppm	6ns	6ns	40/60%	CXO-M
				–40 to 85°C	±20ppm	±100ppm				
				–55 to 125°C	±30ppm	±300ppm				

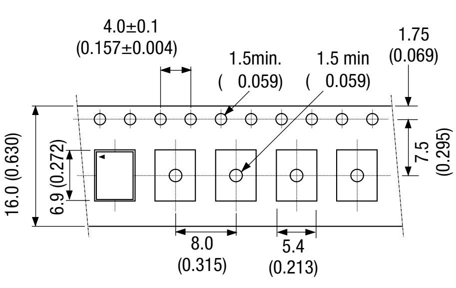
Ordering Example 50.0MHz CXO-M 10 T SM1 A 50 C

- Frequency — 50.0MHz
- Model — CXO-M
- Load: 10= 10 TTL — 10
- Enable: T= Tri-State; N= Non tri-state — T
- Termination — SM1
- Frequency Tolerance @ 25°C — A
- Frequency Stability over Operating Temperature Range — 50
- Operating Temperature Range: C = –10 to 70°C; I = –40 to 85°C; M = –55 to 125°C — C

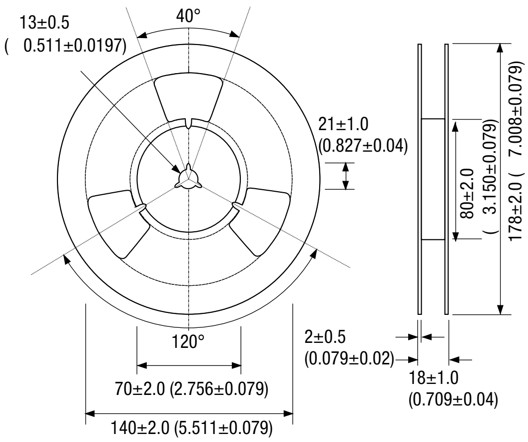
Please note: Above parameters are measured at @ 25°C with a 10M and 10pF load at @ 5.0V
3.0V HCMOS version and other frequency tolerances are available on request. Please contact our Application Support Department.

SURFACE MOUNT SPXOs

Outline in mm (inches) - Tape



Outline in mm (inches) - Reel (scale 1:5)



NOTES

SM VCXOs - Section Contents

SPECIFYING SURFACE MOUNT VOLTAGE CONTROLLED CRYSTAL OSCILLATORS (SM VCXOs)

A typical surface mount VCXO specification reads like this:

15.0MHz CFPV-1000 C A TR T

Frequency

Model Number

Operating Temperature Code

Frequency Stability

Packaging

Additional Text Code (for non-standard product)

The following notes define each element of the specification.

Frequency

Frequency is normally specified in kilohertz (kHz) up to 999.999 kHz and in megahertz (MHz) from 1.0MHz. All our computer-generated transaction documents follow this standard convention automatically.

The VCXO frequency should be described to seven significant figures. If seven significant figures are not used, we assume that any figure that might follow those given may be taken as zero. Thus a frequency given as 16.6MHz will be taken as 16.60, not 16.66667.

Model Number

The model number incorporates information which describes output compatibility and holder style.

Frequency Stability

The frequency stability of a VCXO includes the initial adjustment tolerance at room temperature (with the control pin set to centre trim voltage: e.g. 2.5V), the tolerance over operating temperature range and the effect of supply voltage variation unless otherwise stated on the individual data sheet. This value is specified as ‘parts per million’ (ppm) and is available in four ranges, ±10ppm, ±25ppm, ±50ppm and ±100ppm.

For standard oscillators the following codes apply:

- A = ±25ppm
- B = ±50ppm
- C = ±100ppm

Frequency Pullability

As standard the centre trim voltage is 2.5V. The pullability is specified as the change in frequency when the trim voltage is varied by ±2V. This value is specified as ‘parts per million’ (ppm). Please see individual data sheets for further details.

Operating Temperature Range

Although in general oscillators will continue to operate outside their normal temperature range with a degradation in frequency stability, damage can result if the temperatures reached are excessive.

For other temperature ranges please contact the sales office.

Packaging Codes

Tape and Reel packaging is available as an option on many of the products outlined in the SM VCXO chapter.

Unless individual datasheets state Tape and Reel packaging, items will be bulk packed. Please note: only complete Reels are sold.

- BU = Bulk packed
- TR = Tape & Reel packed

Additional Text Code

If the product is non-standard, the letter ‘T’ will appear at the end of the product specification. This refers to additional text on the quotation/sales order to identify the non-standard requirements.

Outline Drawings

Dimensions on the oscillator outline drawings are shown only as a guide . Precise dimensions of oscillator holders are available from our factory upon request. All dimensions are shown in mm (& inches) and are nominal unless otherwise stated. All outlines are at a scale of 1:1 unless otherwise specified.

Soldering Recommendations

Recommended solder pad layouts are shown on each datasheet.

Delivery Options

The following Express delivery options are available for certain oscillators; timescales refer to despatch from our factories.

- 5 working days (Express service)
- 7 working days (Express service)
- 10 working days (Express service)

Prices for larger quantities and longer delivery times are generally lower due to substantially reduced manufacturing costs. Please refer to individual datasheets for further information.

Marking

Product will be indelibly marked as detailed in the individual data sheets. Where space is limited some or all of the information will be omitted/truncated at C-MAC Frequency Products discretion. Full product details will be found on the individual batch packaging.

Ordering Information

- See individual datasheets

STOCK SURFACE MOUNT VCXOs

Minimum Order Information Required

- Stock Number or Alpha Code

CFPV-43 - HCMOS/LS TTL

Frequency	Frequency Pulling	Stock No.	Alpha Code	Packaging
8.192MHz	±50ppm	VCXO016906	V200T	BU
8.192MHz	±50ppm	VCXO016911	V201T	T & R
13.5MHz	±50ppm	VCXO016927	V208T	BU
16.384MHz	±50ppm	VCXO016907	V104T	BU
16.384MHz	±50ppm	VCXO016912	V105T	T & R
19.44MHz	±50ppm	VCXO016908	V202T	BU
19.44MHz	±50ppm	VCXO016913	V203T	T & R
27.0MHz	±50ppm	VCXO016928	V209T	BU
32.768MHz	±50ppm	VCXO016909	V204T	BU
32.768MHz	±50ppm	VCXO016914	V205T	T & R
38.88MHz	±50ppm	VCXO016910	V206T	BU
38.88MHz	±50ppm	VCXO016915	V207T	T & R

CFPV-44 - HCMOS/LS TTL

Frequency	Frequency Pulling	Stock No.	Alpha Code	Packaging
8.192MHz	±50ppm	VCXO016733	V100T	BU
8.192MHz	±50ppm	VCXO016826	V103T	T & R
13.5MHz	±50ppm	VCXO016929	V210T	BU
16.384MHz	±50ppm	VCXO016734	V101T	BU
16.384MHz	±50ppm	VCXO016829	V106T	T & R
19.44MHz	±50ppm	VCXO016735	V102T	BU
19.44MHz	±50ppm	VCXO016832	V111T	T & R
27.0MHz	±50ppm	VCXO016930	V211T	BU
32.768MHz	±50ppm	VCXO016835	V107T	BU
32.768MHz	±50ppm	VCXO016834	V108T	T & R
38.88MHz	±50ppm	VCXO016840	V109T	BU
38.88MHz	±50ppm	VCXO016841	V110T	T & R

Surface Mount VCXO Selection Chart

Model	Frequency Range (MHz)											Operating Temperature Range									Stability within Temperature Range (ppm)			Supply Voltage		Output Frequency Change			Outline	Page
	0.5	1.0	2.0	10	25	30	40	45	50	90	160	–40	–20	–10	–5	0	+60	+70	+75	+85	10	25	50	5V	3.3V	±50ppm min.	±80ppm min.	±100ppm min.	(mm)	
CFPV-41									52																				7.5 × 5.0 × 1.9	210
CFPV-42																													7.5 × 5.0 × 1.9	210
CFPV-43									52																				7.5 × 5.0 × 1.9	210
CFPV-44																													7.5 × 5.0 × 1.9	210
CFPV-200				8.0																									13.4 × 10.8 × 6.9	212
CFPV-203				8.0																									13.4 × 10.8 × 6.9	212
CFPV-386																													14.0 × 9.8 × 3.2	214
CFPV-387																													14.0 × 9.8 × 3.2	214
IQVCXO-490		1.25																											14.2 × 9.2 × 6.5	216
CFPV-1000																													14.2 × 9.35 × 4.96	218
CFPV-1100																													14.2 × 9.35 × 4.96	218
CFPV-2340											155.52																65		20.3 × 13.7 × 5.7	217

Customer SM VCXO Requirements Fax Form - Please copy form, fill out using BLOCK CAPITALS and fax to C-MAC on +44 (0)1460 72578

x = Minimum Specification Information Required for SM VCXO pricing

Frequency		x		MHz
Output Waveform				TTL/CMOS/Sine
Output Level/Load		x		TTL/CMOS/Sine
Rise/Fall Time (Square Wave)				ns
Duty Cycle (Square Wave)				%
Supply Voltage		x		Vdc
Output Current				mA
Frequency Tolerance @ 25°C				ppm
Operating Temperature Range		x		°C
Frequency Stability	vs. Input Voltage Change			ppm
	vs. load Change			ppm
	vs. Operating Temperature	x		ppm
Ageing				per year
Voltage Control	Centre Control Voltage	x		Vdc
	Control Voltage Range	x		Vdc
	Linearity			%
	Slope	x		+/–
Frequency Pullability		x		ppm
Tri-state Option				Yes/No
Package	Outline	x		
	Connections	x		
	Marking			
Additional Notes				
Name				
Job Title				
Company Name				
Address				
Postcode				
Telephone			E-mail	
Fax			http://	

CFPV-41, -42, -43, -44

SURFACE MOUNT VCXOs

ISSUE 1; 14 OCTOBER 1999

Delivery Options

- Please contact our sales office for current leadtimes

Output Compatibility

- Tri-state HCMOS

Description

- CFPV-41, -42, -43, -44 are surface mount voltage controlled crystal oscillators providing a high degree of frequency stability over a wide temperature range. It is particularly suited to applications where space is at a premium

Package Outline

- 7.5 × 5.0 × 1.9mm SMD (surface mount device)

Standard Frequencies

- 2.048MHz, 4.096MHz, 8.192MHz, 10.0MHz, 12.288MHz, 16.384MHz, 19.44MHz, 20.48MHz, 24.576MHz, 26.0MHz, 28.6363MHz, 32.768MHz, 34.368MHz, 34.816MHz, 38.880MHz, 40.960MHz, 44.7360MHz, 49.152MHz, 50.0MHz, 51.84MHz

Standard Frequency Stabilities

- ±25ppm, ±50ppm, ±100ppm (inclusive of supply voltage & output load variations over the operating temperature range)

Operating Temperature Range

- –10 to 70°C

Storage Temperature Range

- –40 to 85°C

Voltage Control Pin 1

- 2.5V±2.0V (CFPV-41, -43)
- 1.65V±1.5V (CFPV-42, -44)

Linearity

- <±10%

Modulation Bandwidth

- >20kHz

Start up Time

- 10mS max.

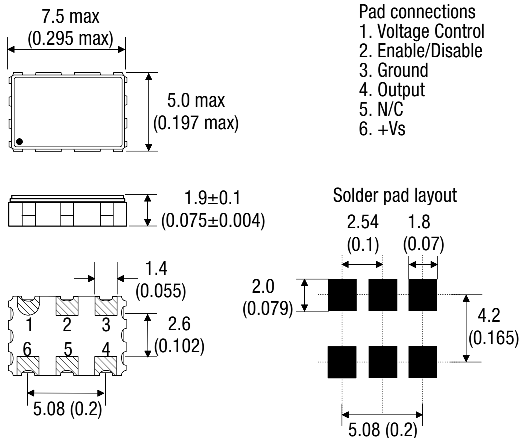
Marking

- Model number
- Frequency Stability Code
- Frequency

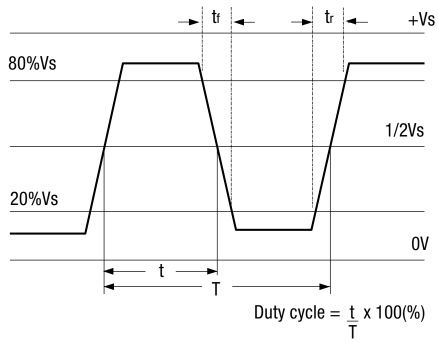
Minimum Order Information Required

- Frequency + Model Number + Frequency Stability

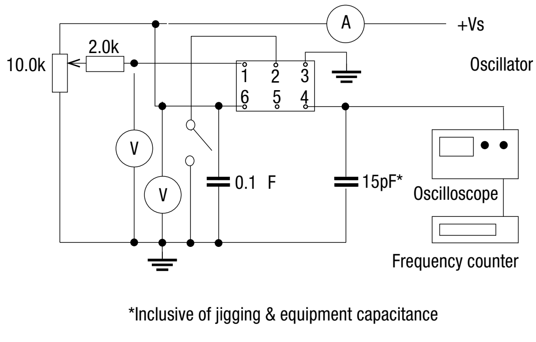
Outline in mm (inches) - (scale 2:1)



Output Waveform - HCMOS



Test Circuit



*Inclusive of jigging & equipment capacitance

Electrical Specification - maximum limiting values when measured in test circuit

Frequency Range	Frequency Stability	Supply Voltage	Supply Current	Output Frequency Change	Rise Time (t_r)	Fall Time (t_f)	Duty Cycle	Model Number
1.0 to 18.0MHz	±25ppm, ±50ppm, ±100ppm	5V±0.25V	20mA	±50ppm min	5ns	5ns	40/60%	CFPV-41
				±100ppm min				CFPV-43
		3.3V±0.16V	15mA	±50ppm min				CFPV-42
				±100ppm min				CFPV-44
>18.0 to 30.0MHz	±25ppm, ±50ppm, ±100ppm	5V±0.25V	30mA	±50ppm min	5ns	5ns	40/60%	CFPV-41
				±100ppm min				CFPV-43
		3.3V±0.16V	15mA	±50ppm min				CFPV-42
				±100ppm min				CFPV-44
>30.0 to 36.0MHz	±25ppm, ±50ppm, ±100ppm	5V±0.25V	30mA	±50ppm min	5ns	5ns	40/60%	CFPV-41
				±100ppm min				CFPV-43
		3.3V±0.16V	25mA	±50ppm min				CFPV-42
				±100ppm min				CFPV-44
>36.0 to 45.0MHz	±25ppm, ±50ppm, ±100ppm	5V±0.25V	40mA	±50ppm min	5ns	5ns	40/60%	CFPV-41
				±100ppm min				CFPV-43
		3.3V±0.16V	25mA	±50ppm min				CFPV-42
				±100ppm min				CFPV-44
>45.0 to 52.0MHz	±25ppm, ±50ppm, ±100ppm	5V±0.25V	40mA	±50ppm min	5ns	5ns	40/60%	CFPV-41
				±100ppm min				CFPV-43

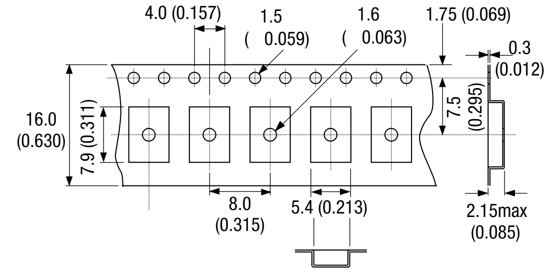
Ordering Example 13.0MHz CFPV-43 B

Frequency

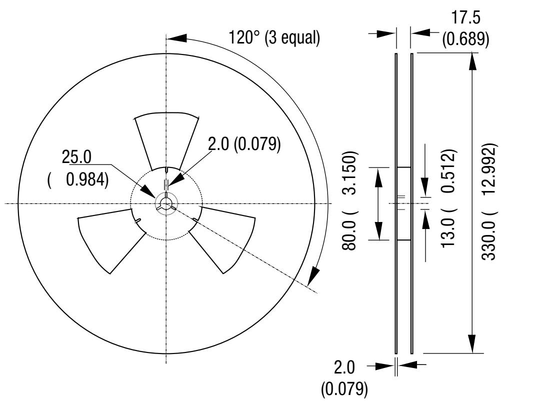
Model No

Frequency Stability: A = ±25ppm; B = ±50ppm; C = ±100ppm

Outline in mm (inches) - Tape



Outline in mm (inches) - Reel (scale 1:8)



CFPV-200, -203

ISSUE 1; 7 OCTOBER 1999

Delivery Options

- Please contact our sales office for current leadtimes

Output Compatibility

- Tri-state HCMOS
- CFPV-203 (5V)
- CFPV-200 (3.3V)

Description

- CFPV-200, -203 are surface mount plastic encapsulated voltage controlled crystal oscillators providing a high degree of frequency stability over a wide temperature range. It is particularly suited to applications where space is at a premium

Package Outline

- 13.4 × 10.8 × 6.9mm SMD (surface mount device)

Standard Frequency Stability

- 50ppm (inclusive of supply voltage & output load variations over the operating temperature range)

Operating Temperature Range

- 0 to 70°C

Storage Temperature Range

- –50 to 125°C

Output Frequency Change

- ±100ppm min. (CFPV-203)
- ±80ppm min. (CFPV-200)

Voltage Control Pin 1

- 2.5V±2.0V (CFPV-203)
- 1.65V±1.5V (CFPV-200)

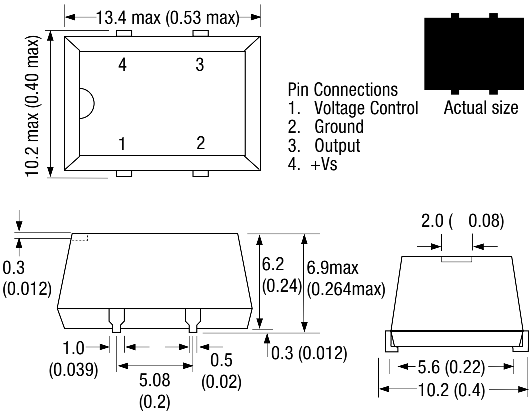
Marking

- Model number
- Frequency Stability Code
- Frequency
- Date code (Year/Week)

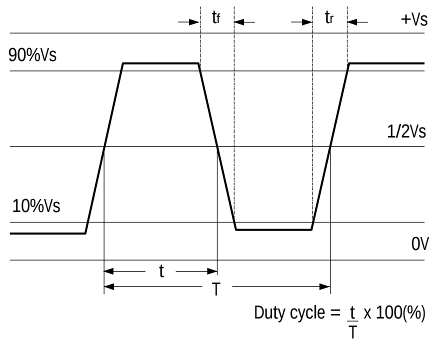
Minimum Order Information Required

- Frequency + Model Number + Frequency Stability

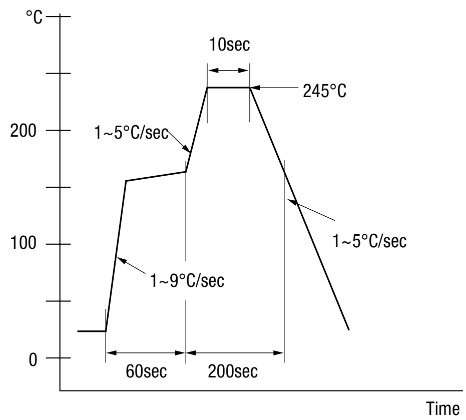
Outline in mm (inches) (scale 2:1)



Output Waveform - HCMOS



Typical Solder Condition - Infrared Reflow



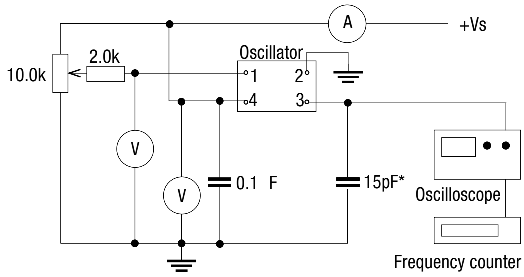
Electrical Specification - maximum limiting values when measured in test circuit

Frequency Range	Frequency Stability	Supply Voltage	Supply Current	Rise Time (t_r)	Fall Time (t_f)	Duty Cycle	Model Number
8.0 to 30.0MHz	±50ppm	5V±0.25V	30mA	5ns	5ns	40/60%	CFPV-203
8.0 to 30.0MHz	±50ppm	3.3V±0.165V	20mA	5ns	5ns	40/60%	CFPV-200

Ordering Example 27.0MHz CFPV-203 B

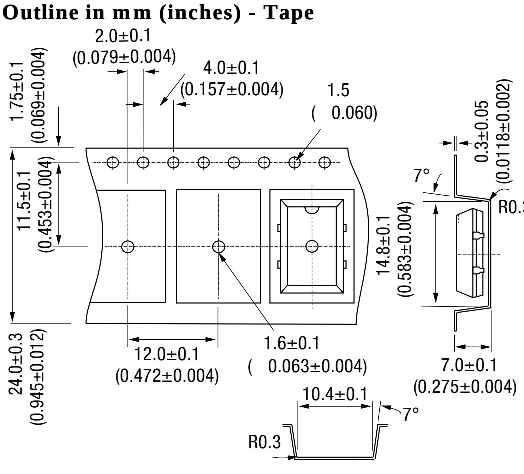
Frequency — 27.0MHz
Model No — CFPV-203
Frequency Stability: B = ±50ppm — B

Test Circuit

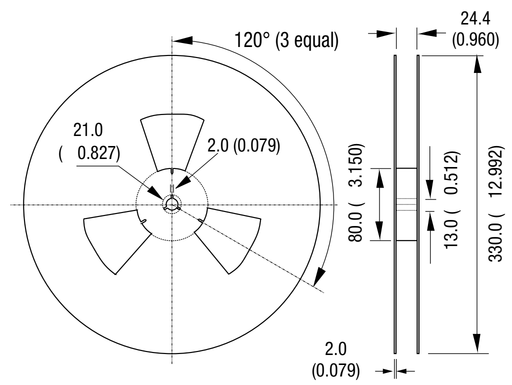


*Inclusive of jigging & equipment capacitance

Outline in mm (inches) - Tape



Outline in mm (inches) - Reel (scale 1:8)



CFPV-386, -387

ISSUE 1; 7 OCTOBER 1999

Delivery Options

- Please contact our sales office for current leadtimes

Output Compatibility

- Tri-state HCMOS
- CFPV-386 (5V)
- CFPV-387 (3.3V)

Description

- CFPV-386, -387 are surface mount voltage controlled crystal oscillators providing a high degree of frequency stability over a wide temperature range. It is particularly suited to applications where space is at a premium

Package Outline

- 14.0 × 9.8 × 3.2mm SMD (surface mount device)

Standard Frequencies

- 2.048MHz, 11.520MHz, 13.0MHz, 16.384MHz, 32.768MHz

Standard Frequency Stability

- 50ppm (inclusive of supply voltage & output load variations over the operating temperature range)

Operating Temperature Range

- –10 to 70°C

Storage Temperature Range

- –30 to 85°C

Output Frequency Change

- ±100ppm min. (CFPV-386)
- ±80ppm min. (CFPV-387)

Voltage Control Pin 1

- 2.5V±2.0V (CFPV-386)
- 1.65V±1.5V (CFPV-387)

Linearity

- <±10%.

Modulation Bandwidth

- >20kHz

Start-up time

- 10mS max.

Tri-state Operation

- Logic '1' to pin 1 enables oscillator output, 2.2V min (CFPV-386), 2.7V min (CFPV-387)
- Logic '0' to pin 1 disables oscillator output; when disabled the oscillator output goes to the high impedance state, 0.8V max (CFPV-386), 0.3V max (CFPV-387)

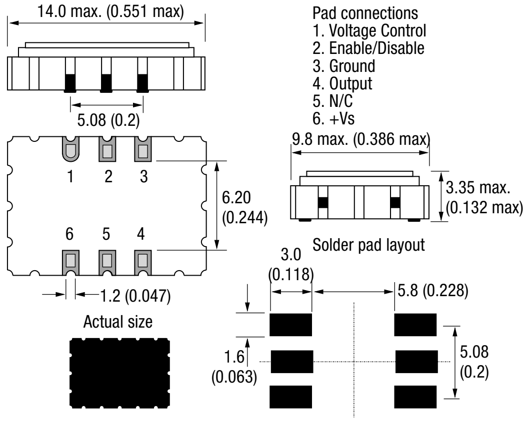
Marking

- Model number
- Frequency Stability Code
- Frequency
- Date code (Year/Week)

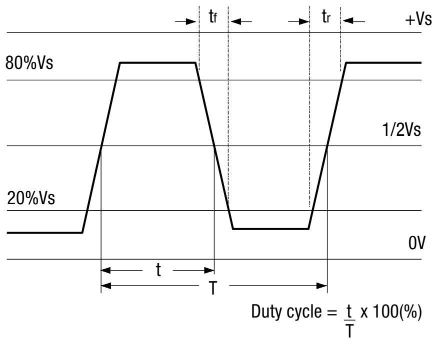
Minimum Order Information Required

- Frequency + Model Number + Frequency Stability

Outline in mm (inches) - (scale 2:1)



Output Waveform - HCMOS



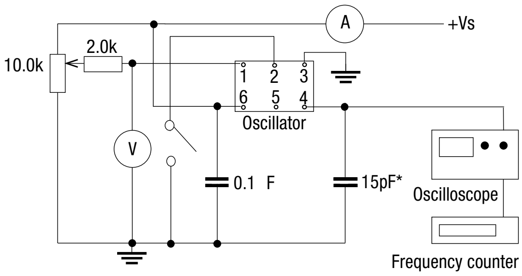
Electrical Specification - maximum limiting values when measured in test circuit

Frequency Range	Frequency Stability	Supply Voltage	Supply Current	Rise Time (t_r)	Fall Time (t_f)	Duty Cycle	Model Number
2.0 to 30.0MHz	±50ppm	5V±0.25V	25mA	10ns	10ns	40/60%	CFPV-386
2.0 to 30.0MHz	±50ppm	3.3V±0.165V	20mA	10ns	10ns	40/60%	CFPV-387

Ordering Example 13.0MHz CFPV-386 B

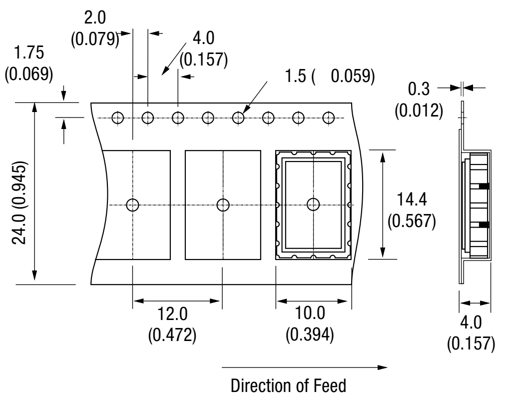
Frequency — 13.0MHz
Model No — CFPV-386
Frequency Stability: B = ±50ppm — B

Test Circuit

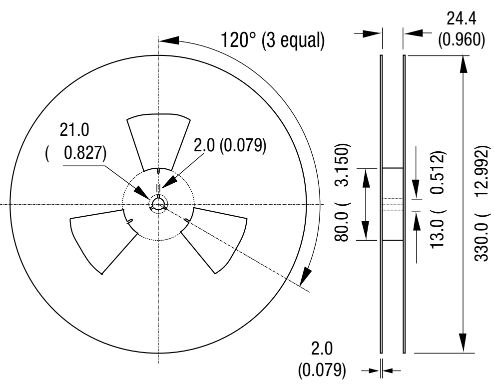


*Inclusive of jigging & equipment capacitance

Outline in mm (inches) - Tape



Outline in mm (inches) - Reel (scale 1:8)



IQVCXO-490

ISSUE 4; 14 SEPTEMBER 1999

Delivery Options

- In order to determine your exact performance parameter needs, please either call our Application Support Department or fill in the Customer Requirements Fax Form on p209 and fax to C-MAC.

Frequency Range

- 1.0MHz to 160.0MHz

Output Compatibility

- Tri-state HCMOS
- Drive Capability: 15pF

Description

- IQVCXO-490 is a surface mount voltage controlled crystal oscillator providing a high degree of frequency stability over a wide temperature range. It is particularly suited to applications where space is at a premium

Package Outline

- 14.1 × 9.1 × 5.9mm SMD (surface mount device)

Standard Frequency Stabilities

- 25ppm @ V_C= Nominal (inclusive of supply voltage & output load variations over the operating temperature range)

Supply Voltage Options

- 3.3V ±0.165V (1.0 to 80.0MHz)
- 5.0V ±0.25V (1.0 to 160.0MHz)

Supply Current (frequency dependent)

- <30mA (3.3V)
- <60mA (5.0V)

Operating Temperature Range

- Operating Temperature Ranges can be as wide as –40 to 85°C with frequency stabilities down to ±10ppm depending upon specification, with an initial frequency tolerance as low as ±2ppm.

Storage Temperature Range

- –40 to 85°C

Output Frequency Change

- ±100ppm min.(standard)
- Frequency pulling is available, whatever the application requires, frequency pulling can be specified from ±50ppm min. to ±150ppm min. at a standard control voltage 0.5V to 4.5V.

Voltage Control Pin 1

- 2.5V ±2.0V (+Vs = 5.0V)
- 1.65V±1.35V (+Vs = 3.3V)
- Other control voltages can be specified.

Ageing

- 3ppm max. in first year
- 10ppm max. in 20 years
- Tighter ageing performance available on request

Modulation Bandwidth

- >10.0kHz

Tri-state Control (6 pad version only)

- Pin 2: <30%Vs: tri-state
- Pin 2: >70%Vs or open connection: oscillation
- Inverted Control available upon request

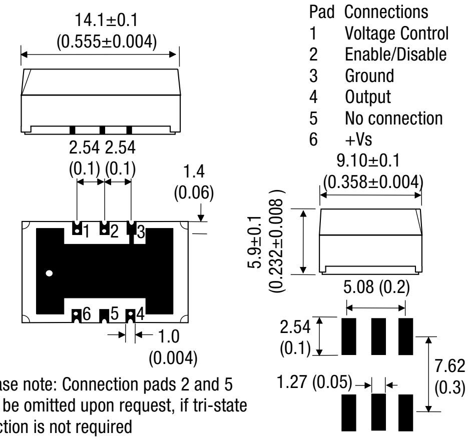
Marking

- Part Number/Model number
- Frequency
- Date Code
- Static Sensitivity Symbol (denotes pin 1)

Minimum Order Information Required

- Discrete Part Number

Outline in mm (inches)



Please note: Connection pads 2 and 5 can be omitted upon request, if tri-state function is not required

CFPV-2340

ISSUE 1; 14 OCTOBER 1999

Preliminary Specification

Delivery Options

- Please contact our sales office for current leadtimes

Nominal Frequency

- 155.520MHz

Output Compatibility

- Complementary Current Mode Logic
- Load: 50 , AC Coupled
- Voh - Vol 0.2Vpp
- Rise and Fall time: 1.5ns
- Duty Cycle: 45/55%
- Skew between outputs: 100 ps

Description

- The CFPV-2340 is a surface mount voltage controlled crystal oscillator based on a high frequency fundamental mode crystal providing for excellent jitter characteristics.

Package Outline

- 20.3 × 13.7 × 5.7mm SMD (surface mount device)

Frequency Tolerance

- ±10ppm @ 25°C

Standard Frequency Stabilities

- ±25ppm over temperature and supply voltage range

Supply Voltage

- 5V ±5%

Supply Current

- 15mA

Operating Temperature Range

- –20 to 70°C

Storage Temperature Range

- –55 to 125°C

Frequency Control

- ±65ppm min / ±110ppm max positive slope

Voltage Control Pin 1

- 2.5V ±2.5V

Modulation Bandwidth

- >50.0kHz

Ageing

- < ±3ppm first year
- < ±10ppm 15 years

Jitter (peak to peak)

- 20 ps

Environmental Specification

- Vibration: IEC 68-2-6 Test Fc Procedure B4, 10-60Hz 0.75mm displacement, 60-500Hz at 98.1m/s^2, 30 minutes in each of three mutually perpendicular planes at 1 octave per minute.
- Shock: IEC 68-2-27 Test Ea, 981m/s^2 acceleration for 6ms duration, 3 shocks in each direction along three mutually perpendicular axes.
- SMD: Infra-red (class C, test category 1 as defined in classification BS CECC 00802; 1994). Testing to be performed in accordance with BS CECC 00802, IEC 68-2-20 and IEC 68-2-58.
- Sealing: Non hermetic package
- Marking: Label, resistant to all common solvents.

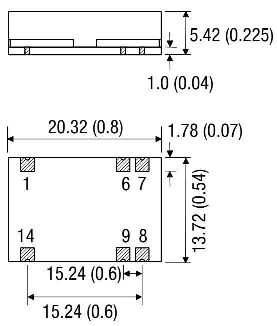
Marking

- Model number
- Frequency
- Date code (Year/Week)
- Static Sensitivity Symbol (denotes pin 1)

Minimum Order Information Required

- Frequency + Model Number

Outline in mm (inches)



Pad Connections
1. Voltage Control
6. Disable
7. Gnd
8. Output
9. Output
14. +Vs

CFPV-1000, -1100

ISSUE 2; 14 OCTOBER 1999

Recommended For New Designs

Delivery Options
- Please contact our sales office for current leadtimes

Output Compatibility
- Tri-state HCMOS/TTL
- Drive Capability: 50pF/10 TTL <40.0MHz
- Drive Capability: 15pF/10 TTL >40.0MHz

Description
- CFPV-1000, -1100 are surface mount voltage controlled crystal oscillators providing a high degree of frequency stability over a wide temperature range. They are particularly suited to applications where space is at a premium

Package Outline
- 14.2 × 9.35 × 4.96mm SMD (surface mount device)

Standard Frequencies
- 4.0960MHz, 12.960MHz, 13.0MHz, 16.3840MHz, 19.44MHz, 21.805054MHz, 20.57560MHz, 26.21440MHz, 27.0MHz, 33.554431MHz, 33.7920MHz, 35.3280MHz, 38.78530MHz, 38.880MHz, 40.960MHz, 44.7360MHz, 50.0MHz, 51.84MHz, 77.76MHz, 155.52MHz

Standard Frequency Stabilities
- ±25ppm, ±50ppm inclusive of supply voltage & output load variations over the operating temperature range

Frequency Tolerance
- < ±20ppm at 25°C

Storage Temperature Range
- –40 to 85°C

Frequency Control (ref: @ 25°C, nominal control voltage)
- ±85ppm min / ±200ppm max

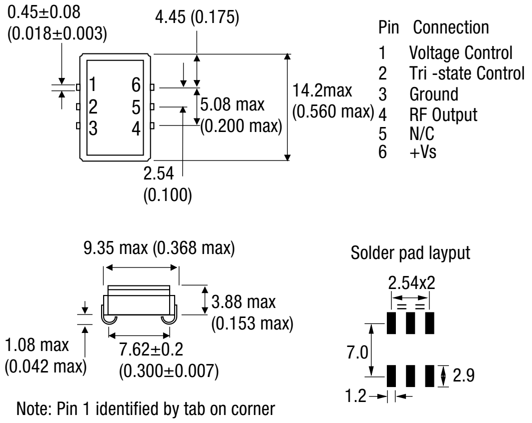
Linearity (to MIL-0-55310)
- < ±10%

Modulation Bandwidth
- >10.0kHz

Tri-state Control
- Pin 2: < 0.8V tri-state Pin 2: > Vs/2 oscillation
- Pin 2: Open circuit oscillation

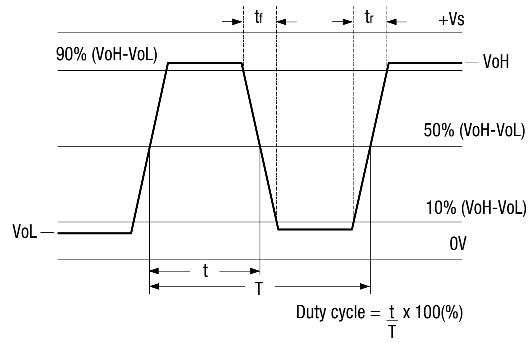
Ageing
- < ±5ppm first year
- < ±15ppm 10 years

Outline in mm (inches)

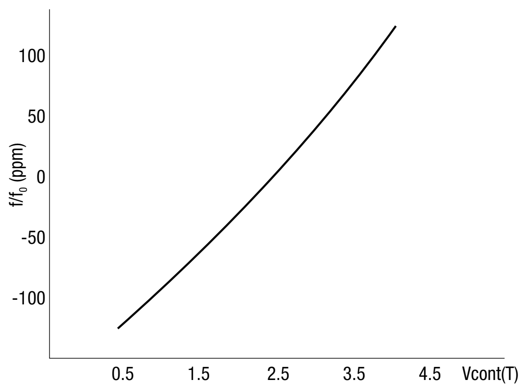


Note: Pin 1 identified by tab on corner

Output Waveform - HCMOS/TTL



Typical Voltage Control Curve @ 25°C



SURFACE MOUNT VCXOs

Marking Includes

- Model number
- Operating Temperature Code/Frequency Stability Code
- Frequency
- Date code (Year/Week)

Minimum Order Information Required

- Frequency + Model Number + Frequency Stability

Electrical Specification – maximum limiting values when measured in HCMOS test circuit

Frequency Range	Frequency Stability	Supply Voltage	Supply Current	Voltage Control Pin 1	Rise Time (t_r)	Fall Time (t_f)	Duty Cycle	Model Number
0.5 to < 24.0MHz	±25ppm, ±50ppm	5V±0.25V	15mA	2.5V±2.0V	6ns	6ns	40/60%	CFPV-1000
24.0 to < 30.0MHz	±25ppm, ±50ppm	5V±0.25V	25mA	2.5V±2.0V	6ns	6ns	40/60%	CFPV-1000
30.0 to 156.0MHz	±25ppm, ±50ppm	5V±0.25V	65mA	2.5V±2.0V	6ns	6ns	40/60%	CFPV-1000
0.5 to < 24.0MHz	±25ppm, ±50ppm	3.3V±0.15V	15mA	1.65V ±1.35V	6ns	6ns	40/60%	CFPV-1100
24.0 to < 30.0MHz	±25ppm, ±50ppm	3.3V±0.15V	25mA	1.65V ±1.35V	6ns	6ns	40/60%	CFPV-1100
30.0 to 100.0MHz	±25ppm, ±50ppm	3.3V±0.15V	50mA	1.65V ±1.35V	6ns	6ns	40/60%	CFPV-1100

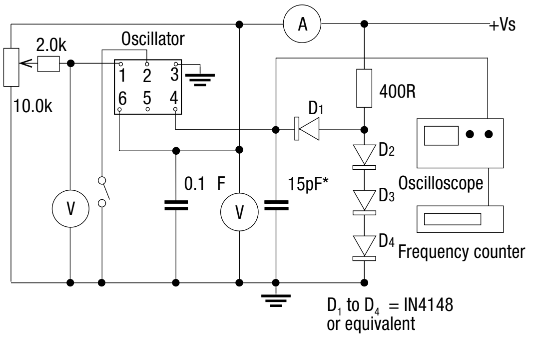
Operating Temperature Ranges Vs Frequency Stability

Operating Temperature Ranges	Operating Temperature Range Vs Frequency Stabilities	
	±25ppm	±50ppm
0 to 70°C	Code CA	Code CB
–20 to 70°C	Code SA	Code SB
–40 to 85°C	—	Code XB

Ordering Example: 24.0MHz CFPV-1000 S A

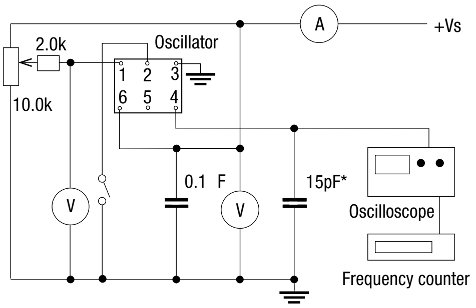
- Frequency: 24.0MHz
- Model No: CFPV-1000
- Operating Temperature Code: S
- Frequency Stability: A

Test Circuit - TTL



*Inclusive of jigging & equipment capacitance

Test Circuit - HCMOS



*Inclusive of jigging & equipment capacitance

NOTES

SURFACE MOUNT VCXOs

SM TCXOs - Section Contents

SPECIFYING SURFACE MOUNT TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS (SM TCXOs)

A typical surface mount TCXO specification reads like this:

13.0MHz CFPT-635 H V TR T

- Frequency — 13.0MHz
- Model Number — CFPT-635
- Frequency Stability — H
- Operating Temperature Range — V
- Packaging — TR
- Additional Text Code (for non-standard product) — T

The following notes define each element of the specification.

Frequency

Frequency is normally specified in kilohertz (kHz) up to 999.9kHz and in megahertz (MHz) from 1.0MHz. All our computer-generated transaction documents follow this standard convention automatically.

The TCXO frequency should be described to seven significant figures. If seven significant figures are not used, we assume that any figure that might follow those given may be taken as zero. Thus a frequency given as 16.6MHz will be taken as 16.60 not 16.6666.

Please contact the sales office for details of developed frequencies.

Model Number

The model number incorporates information which describes output compatibility and holder style.

Frequency Stability

The frequency stability of a TCXO is the frequency change over the Operating Temperature Range.

In tight tolerance applications it may be necessary to apply a frequency offset at 25°C in order to centralise the frequency/temperature characteristic to the nominal frequency. If applicable this will be stated in the individual datasheet.

The following codes apply for the frequency stability:

- A = ±0.3ppm
- B = ±0.8ppm
- C = ±1.5ppm
- D = ±0.25ppm
- E = ±0.5ppm
- F = ±1.0ppm
- G = ±2.0ppm
- H = ±2.5ppm
- J = ±3.0ppm
- K = ±5.0ppm
- L = ±10.0ppm
- M = ±0.2ppm
- N = ±15.0ppm

Frequency Trimming

In order to meet their specification over their full operating temperature range, close tolerance TCXOs are often adjusted to have a frequency offset at room temperature. Adjustment of the mechanical trimmers of such TCXOs should not be attempted, therefore, unless facilities exist to measure their frequency over their full operating temperature range

Operating Temperature Range

Although in general TCXO's will continue to operate ouside their normal temperature range with a degradation in frequency stability, damage can result if the temperatures reached are excessive.

The following codes apply for Operating Temperature Ranges:

- C = 0 to 70°C
- G = –20 to 75°C
- H = –55 to 95°C
- P = 0 to 50°C
- R = –10 to 60°C
- S = –20 to 70°C
- T = –25 to 75°C
- U = –30 to 75°C
- V = –30 to 80°C
- W = –30 to 85°C
- X = –40 to 85°C
- Y = –55 to 105°C
- Z = –55 to 125°C

Packaging Code

Tape and Reel packaging is available as an option on many of the products outlined in the SM TCXO Chapter.

Unless individual datasheets state Tape and Reel packaging, items will be bulk packed. Please note: only complete Reels are sold.

- BU = Bulked packed
- TR = Tape & Reel packed

Additional Text Code

If the product is non-standard, the letter 'T' will appear at the end of the product specification.This refers to additional text on the sales order/quotation to identify the non-standard requirements.

Outline Drawings

Dimensions on the TCXO drawings are shown only as a guide. Precise dimensions of the TCXO holders are available upon request. All dimensions are shown in mm (& inches) and are nominal unless otherwise stated. All outlines are at a scale of 1:1 unless otherwise specified.

Soldering Conditions

Recommended solder pad layouts and soldering temperature profiles are shown on each datasheet.

Standard Frequency Tolerances and Stabilities

Please refer to the individual datasheets for each TCXO.

Offset Frequency

The frequency difference, positive or negative, (expressed in Hz) which should be added to the nominal frequency when setting the oscillator at the specified temperature (usually 25 C). The purpose is to minimise the frequency deviation over the entire operating temperature range. Each oscillator will have it's own offset frequency marked on the case.

In the following example Fig 1., the dotted line shows that if the oscillator is set to nominal frequency at 25°C, the frequency deviates from –1.7 ppm to +0.3 ppm over the temperature range. By setting the frequency at 25°C to the specified offset frequency, the overall frequency deviation is reduced to ±1.0 ppm

Delivery Options

Please refer to the individual datasheets for each TCXO.

Marking

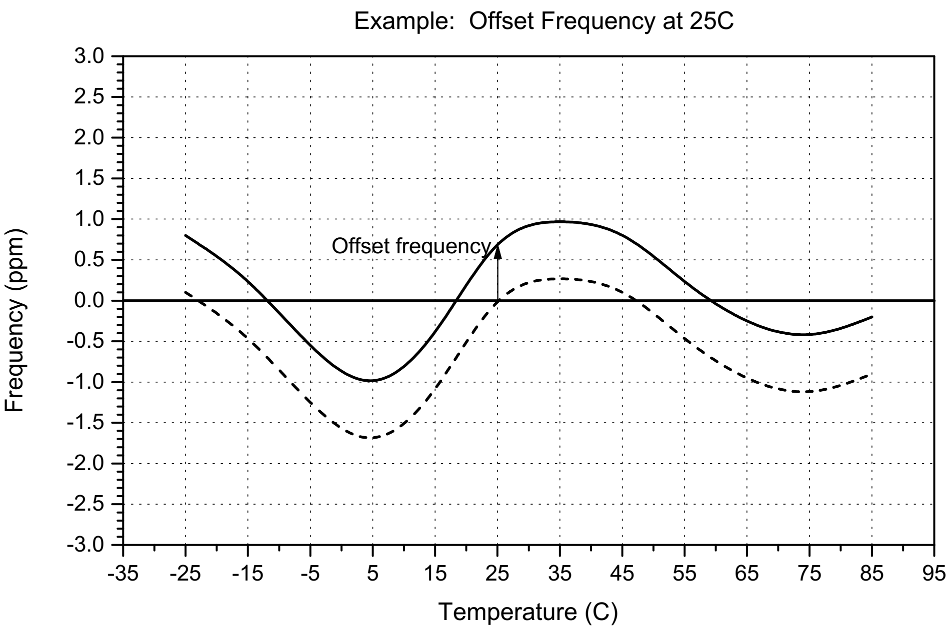
Product will be indelibly marked as detailed in the individual data sheets. Where space is limited some or all of the information will be omitted/truncated at C-MAC Frequency Products discretion. Full product description will be found on the individual batch packaging.

Ordering Information

See individual datasheet

SURFACE MOUNT TCXOs

Fig. 1



STOCK SURFACE MOUNT TCXOs

Minimum Order Information Required

- Stock Number or Alpha Code

IQDTCVCXO-91 - Clipped Sine

Frequency	Frequency Stability	Stock No.	Alpha Code	Packaging
12.8MHz	±2.5ppm	TCXO006888	T101A	BU
13.0MHz	±2.5ppm	TCXO006889	T102A	BU
14.4MHz	±2.5ppm	TCXO006890	T103A	BU
16.8MHz	±2.5ppm	TCXO006891	T104A	BU

CFPT-102 - Clipped Sine

Frequency	Frequency Stability	Stock No.	Alpha Code	Packaging
12.6MHz	±2.5ppm	TVXO016698	T710A	BU
12.8MHz	±2.5ppm	TVXO016699	T711A	BU
13.0MHz	±2.5ppm	TVXO016700	T712A	BU
14.4MHz	±2.5ppm	TVXO016701	T713A	BU
14.85MHz	±2.5ppm	TVXO016702	T714A	BU
16.8MHz	±2.5ppm	TVXO016703	T715A	BU
19.2MHz	±2.5ppm	TVXO016704	T716A	BU
19.44MHz	±2.5ppm	TVXO016705	T717A	BU
19.68MHz	±2.5ppm	TVXO016706	T718A	BU
19.8MHz	±2.5ppm	TVXO016707	T719A	BU

CFPT-103 - Clipped Sine

Frequency	Frequency Stability	Stock No	Alpha Code	Packaging
12.6MHz	±2.5ppm	TVXO016708	T720A	BU
12.8MHz	±2.5ppm	TVXO016709	T721A	BU
13.0MHz	±2.5ppm	TVXO016710	T722A	BU
14.4MHz	±2.5ppm	TVXO016711	T723A	BU
14.85MHz	±2.5ppm	TVXO016712	T724A	BU
16.8MHz	±2.5ppm	TVXO016713	T725A	BU
19.2MHz	±2.5ppm	TVXO016714	T726A	BU
19.44MHz	±2.5ppm	TVXO016715	T727A	BU
19.68MHz	±2.5ppm	TVXO016716	T728A	BU
19.8MHz	±2.5ppm	TVXO016717	T729A	BU

CFPT-105 - Clipped Sine

Frequency	Frequency Stability	Stock No.	Alpha Code	Packaging
12.6MHz	±2.5ppm	TVXO016718	T730A	BU
12.8MHz	±2.5ppm	TVXO016719	T731A	BU
13.0MHz	±2.5ppm	TVXO016720	T732A	BU
14.4MHz	±2.5ppm	TVXO016721	T733A	BU
14.85MHz	±2.5ppm	TVXO016722	T734A	BU
16.8MHz	±2.5ppm	TVXO016723	T735A	BU
19.2MHz	±2.5ppm	TVXO016724	T736A	BU
19.44MHz	±2.5ppm	TVXO016725	T737A	BU
19.68MHz	±2.5ppm	TVXO016726	T738A	BU
19.8MHz	±2.5ppm	TVXO016727	T739A	BU

CFPT-120 - Clipped Sine

Frequency	Frequency Stability	Stock No.	Alpha Code	Packaging
12.6MHz	±2.5ppm	TVXO016730	T701A	BU
12.8MHz	±2.5ppm	TVXO016731	T702A	BU
13.0MHz	±2.5ppm	TVXO016748	T703A	BU
14.4MHz	±2.5ppm	TVXO016749	T704A	BU
14.85MHz	±2.5ppm	TVXO016750	T705A	BU
16.8MHz	±2.5ppm	TVXO016751	T706A	BU
19.2MHz	±2.5ppm	TVXO016732	T707A	BU
19.44MHz	±2.5ppm	TVXO016752	T708A	BU
19.8MHz	±2.5ppm	TVXO016753	T709A	BU

CFPT-635 - Clipped Sine

Frequency	Frequency Stability	Stock No.	Alpha Code	Packaging
12.8MHz	±2.5ppm	TCXO006908	T101B	BU
13.0MHz	±2.5ppm	TCXO006909	T102B	BU
14.4MHz	±2.5ppm	TCXO006910	T103B	BU
16.8MHz	±2.5ppm	TCXO006911	T104B	BU

NOTES

Surface Mount TCXO Selection Chart

Model	Frequency Range (MHz)							Operating Temperature Range										Stability within Temperature Range (ppm)							Output	Ext Trim	Outline (mm)	Page
	0.001	3.2	9.6	12	19.2	26	120	–55	–30	–20	0	+50	+70	+75	+80	+85	+95	0.3	1.0	1.5	2.0	2.5	3.0	5.0				
IQDTCVCXO-91				12.6	19.68																				C/Sine	✓	9.0 × 7.0 × 2.0	228
CFPT-101				12.6	19.8																				C/Sine		11.4 × 9.6 × 2.5	230
CFPT-102				12.6	19.8																				C/Sine	✓	11.4 × 9.6 × 2.5	230
CFPT-103				12.6	19.8																				C/Sine	✓	11.4 × 9.6 × 2.5	230
CFPT-105				12.6	19.8					-10			+60												C/Sine	✓	9.0 × 7.0 × 2.0	232
CFPT-120				12.6	19.8					-10			+60												C/Sine	✓	7.0 × 5.0 × 2.0	234
CFPT-141				12.6	19.8					-10			+60												C/Sine	✓	5..0 × 3.2 × 1.5	236
CFPT-635				12.6	19.68																				C/Sine	✓	6.0 × 3.5 × 1.7	238
CFPT-4000					20													0.8							C-MOS	✓	12.19 × 12.19 × 3.0	240
CFPT-7000						33																			C-MOS	✓	19.2 × 11.9 × 5.35	242
CFPT-8000				13																					C-MOS	✓	19.1 × 11.8 × 7.6	244
CFPT-9100			9.0			33			–40																C-MOS	✓	14.3 × 9.1 × 6.2	246

Please note: Shading indicates best stabilities — Shading indicates a capability

Customer SM TCXO Requirements Fax Form - Please copy form, fill out using BLOCK CAPITALS and fax to C-MAC on +44 (0)1460 72578					
x = Minimum Specification Information Required for SM TCXO pricing					
Frequency			x		MHz
Output Waveform					CMOS/TTL/Sine
Output Level/Load			x		CMOS/TTL/Sine
Rise/Fall Time (Square Wave)					ns
Duty Cycle (Square Wave)					%
Supply Voltage			x		Vdc
Frequency Tolerance @ 25°C					ppm
Supply Current					mA
Operating Temperature Range			x		°C
Harmonics/Sub-Harmonics					dBc
Phase Noise	10Hz				dBc
	100Hz				dBc
	1000Hz				dBc
	10kHz				dBc
Frequency Stability	vs. Input Voltage Change				ppm
	vs. load Change				ppm
	vs. Operating Temperature		x		ppm
Ageing			x		per year
Frequency Adjust	Mechanical (Internal)	Range			ppm
	Electrical (External)	Range			ppm
	Control Voltage Range				Vdc
Tri-state Option					Yes/No
Package	Outline		x		
	Connections		x		
	Marking				
Additional Notes					
Name					
Job Title					
Company Name					
Address					
Postcode					
Telephone				E-mail	
Fax				http://	

SURFACE MOUNT TCXOs

IQDTCVCXO-91

ISSUE 2; 14 OCTOBER 1999

Delivery Options

- Please contact our sales office for current leadtimes

Description

- IQDTCVCXO-91 is a surface mount temperature compensated crystal oscillator which comes in a ultra-compact, low profile package. Achieving high precision of frequency stability over a wide temperature range by digital control. An AFC (Automatic Frequency Control) function is also provided.

Standard Frequencies

- 12.60MHz, 12.80MHz, 13.0MHz, 14.4MHz, 16.80MHz, 19.20MHz, 19.680MHz, 19.80MHz

Output Waveform

- Clipped Sine 1V peak to peak

Package Outline

- 9.0 × 7.0 × 2.0 mm SMD (ceramic surface mount device)

Ageing

- ±1ppm maximum first year @ 25°C

Voltage Control

- 1.5±1.0V applied to pin 1

Storage Temperature Range

- –40 to 85°C

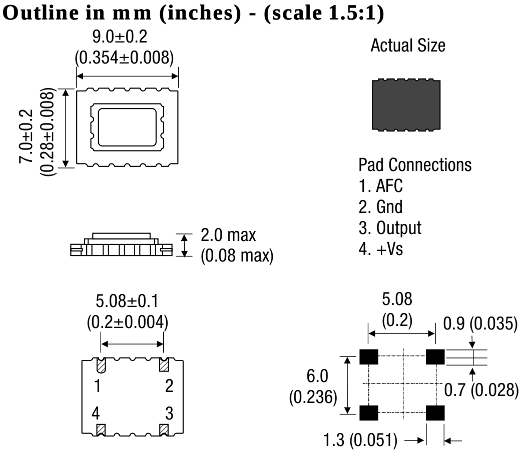
Marking

- Model number
- Frequency Stability Code /Temperature Range Code
- Frequency
- Date code (Year/Week)

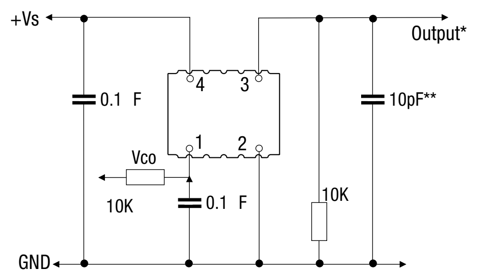
Minimum Order Information Required

- Frequency + Model Number + Frequency Stability + Operating Temperature Range

Outline in mm (inches) - (scale 1.5:1)

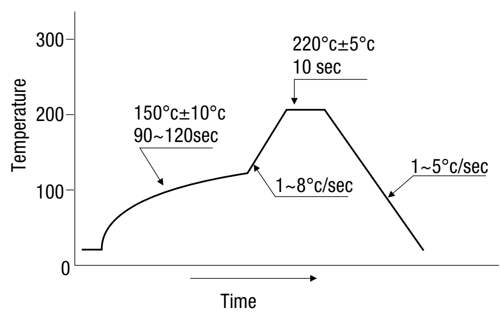


Test Circuit



* Output Voltage is DC biased
** inclusive of probe and jig capacitance

Typical Solder Condition - Infrared Reflow



Electrical Specification - maximum limiting values when measured in test circuit

Frequency Range	Supply Voltage	Supply Current	Voltage Control Change	Output Waveform	Output	Model Number
12.60 to 13.0MHz	3V±0.15V	1.5mA	±5ppm min. / 1.5±1.0V	Clipped Sine	1Vp-p min	IQDTCVCXO-91
14.40 to 19.80MHz	3V±0.15V	2.0mA	±5ppm min. / 1.5±1.0V	Clipped Sine	1Vp-p min	IQDTCVCXO-91

Frequency Stabilities Available Over Operating Temperature Ranges

Operating Temperature Ranges	±2.5ppm	±5.0ppm
–20 to 75°C	Code HG	Code KG
–30 to 80°C	Code HV*	Code KV

* Please note Code HV is the standard frequency stability vs operating temperature range

Ordering Example 14.40MHz IQDTCVCXO-91 HV

Frequency

Model number

Frequency Stability Vs Operating Temperature Code

SURFACE MOUNT TCXOs

CFPT-101, -102, -103

ISSUE 1; 7 SEPTEMBER 1999

Delivery Options

- Please contact our sales office for current leadtimes

Description

- CFPT-101, -102, -103 are surface mount temperature compensated voltag e controlled crystal oscillators providing a high degree of frequency stability over a wide temperature range. They are particularly suited to applications where space is at a premium.

Package Outline

- 11.4 × 9.6 × 2.5mm SMD (surface mount device)

Standard Frequencies

- 12.6MHz, 12.8MHz, 13.0MHz, 14.4MHz, 14.85MHz, 16.8MHz, 19.2MHz, 19.44MHz, 19.68MHz, 19.8MHz

Output Waveform

- Clipped Sine 0.8V peak to peak minium (10k \\10pF)

Ageing

- 1ppm typical first year @ 25°C

Frequency Adjustment

- 2ppm minimum internal trimmer adjustment (CFPT-101, -103)

Frequency Stability

- Temperature: see table
- Supply Voltage Variation: ±5% ±0.3ppm max.
- Load variation: (10k \\ pF ppm max.
- After reflow: ±1ppm max

Voltage Control

- 1.5V ±1.0V applied to pin 1 (CFPT-102, -103)

Storage Temperature Range

- –40 to 85°C

Marking

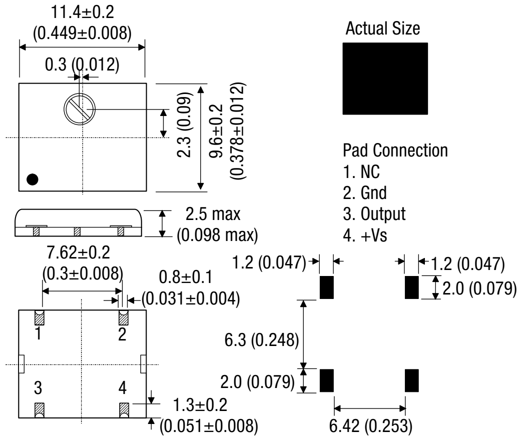
- Model number
- Frequency Stability Code /Temperature Range Code
- Frequency
- Date code (Year/Week)

Minimum Order Information Required

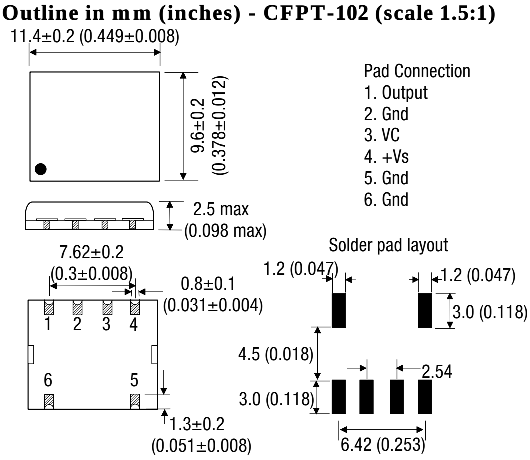
- Frequency + Model Number + Frequency Stability + Operating Temperature Range

SURFACE MOUNT TCXOs

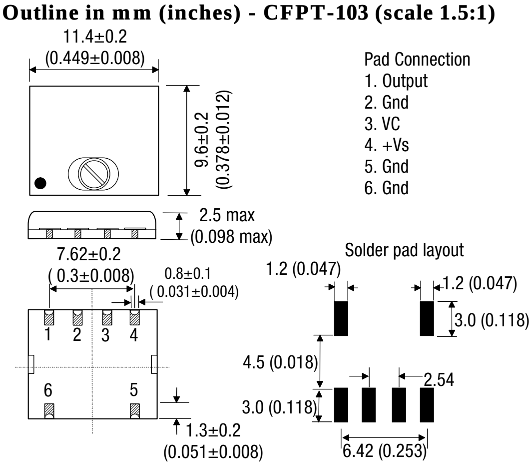
Outline in mm (inches) - CFPT-101 (scale 1.5:1)



Outline in mm (inches) - CFPT-102 (scale 1.5:1)



Outline in mm (inches) - CFPT-103 (scale 1.5:1)



Electrical Specification - maximum limiting values when measured in test circuit

Frequency Range	Frequency Tolerance @ 25°C	Supply Voltage	Supply Current	Voltage Control Change	Output Waveform	Output	Model Number
12.6 to 19.8MHz	±0.5ppm	3V±0.15V	2.0mA	—	Clipped Sine	0.8Vp-p min	CFPT-101
12.6 to 19.8MHz	±2.5ppm	3V±0.15V	2.0mA	±10.0ppm to ±15.0ppm max. / 1.5V±1.0V	Clipped Sine	0.8Vp-p min	CFPT-102
12.6 to 19.8MHz	±0.5ppm	3V±0.15V	2.0mA	±8.0ppm to ±12.0ppm max. / 1.5V±1.0V	Clipped Sine	0.8Vp-p min	CFPT-103

Frequency Stabilities Available Over Operating Temperature Ranges

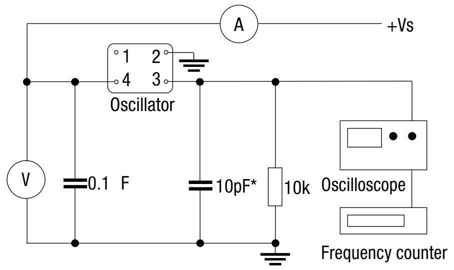
Operating Temperature Ranges	Frequency Stabilities Vs Operating Temperature Range	
	±2.5ppm	±5.0ppm
–20 to 70°C	Code HS	Code KS
–25 to 75°C	CodeHT	Code KT
–30 to 75°C	Code HU*	Code KU

* Please note Code HU is the standard frequency stability vs operating temperature range

Ordering Example: 12.60MHz CFPT-102 HU

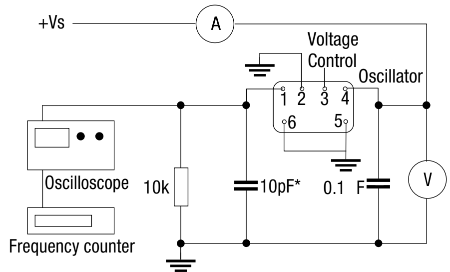
- Frequency (12.60MHz)
- Model number (CFPT-102)
- Frequency Stability Vs Operating Temperature Code (HU)

Test Circuit - CFPT-101



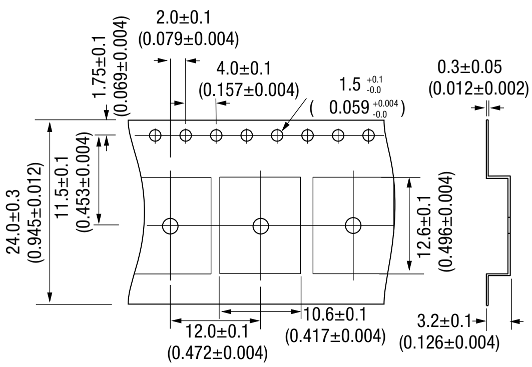
*Inclusive of jigging & equipment capacitance

Test Circuit - CFPT-102, -103

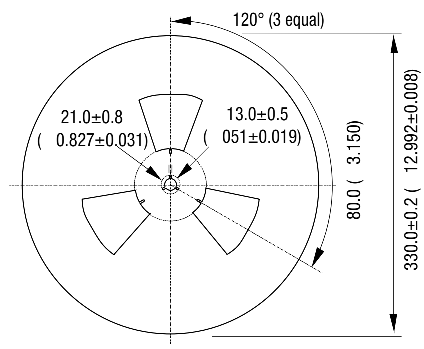


*Inclusive of jigging & equipment capacitance

Outline in mm (inches) - Tape



Outline in mm (inches) - Reel (scale 1:8)



SURFACE MOUNT TCXOs

CFPT-105

ISSUE 1; 7 SEPTEMBER 1999

Delivery Options

- Please contact our sales office for current leadtimes

Description

- CFPT-105 is a surface mount temperature compensated voltage controlled crystal oscillator providing a high degree of frequency stability over a wide temperature range. They are particularly suited to applications where space is at a premium.

Package Outline

- 9.0 × 7.0 × 2.0mm SMD (surface mount device)

Standard Frequencies

- 12.6MHz, 12.8MHz, 13.0MHz, 14.4MHz, 14.85MHz, 16.8MHz, 19.2MHz, 19.44MHz, 19.68MHz, 19.8MHz

Output Waveform

- Clipped Sine 0.8V peak to peak minimum

Ageing

- 1ppm max first year @ 25°C

Frequency Adjustment

- ±9ppm to ±15ppm external control voltage at 1.5V ±1.0V applied to pin 1

Frequency Stability

- Temperature: see table
- Supply Voltage Variation: ±5% ±0.3ppm max.
- Load variation: (10k \\10pF) ±10% ±0.2ppm max.
- After reflow: ±1ppm max

Voltage Control

- 1.5V ±1.0V applied to pin 1

Storage Temperature Range

- –40 to 85°C

Phase Noise @ 1kHz

- –140dBc/Hz min.

Harmonic Distortion

- –5.0dBc max.

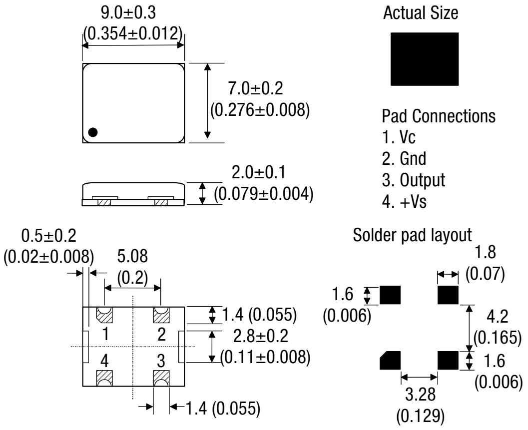
Marking

- Model number
- Frequency Stability Code /Temperature Range Code
- Frequency
- Date code (Year/Week)

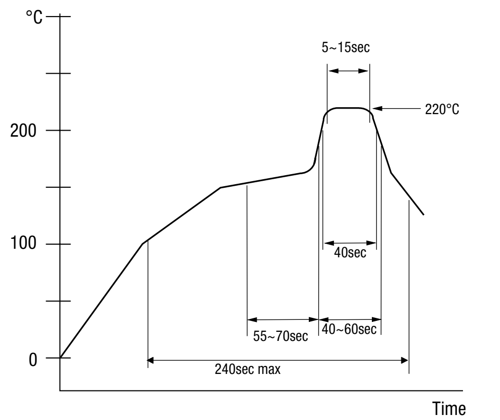
Minimum Order Information Required

- Frequency + Model Number + Frequency Stability + Operating Temperature Range

Outline in mm (inches) - (scale 1.5:1)



Typical Solder Condition - Infrared Reflow



Electrical Specification - maximum limiting values when measured in test circuit

Frequency Range	Frequency Tolerance @ 25°C	Supply Voltage	Supply Current	Voltage Control change	Output Waveforms	Output	Model Number
12.6 to 19.8MHz	±2.5ppm	3V±0.15V	2.0mA	±9.0ppm to ±15.0ppm / 1.5V±1.0V	Clipped Sine	0.8Vp-p min	CFPT-105

Frequency Stabilities Available Over Operating Temperature Ranges

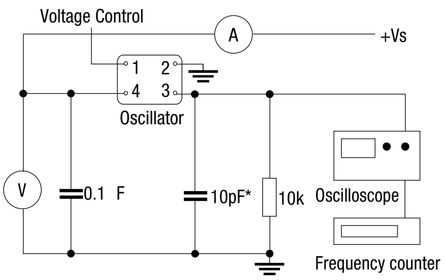
Operating Temperature Ranges	Frequency Stabilities Vs Operating Temperature Range		
	±2.0ppm	±2.5ppm	±5.0ppm
0 to 50°C	Code GP	Code HP	Code KP
–10 to 60°C	Code GR	Code HR	Code KR
–20 to 75°C	—	Code HG*	Code KG
–30 to 75°C	—	—	Code KU

* Please note Code HG is the standard frequency stability vs operating temperature range

Ordering Example: 15.0MHz CFPT-105 HG

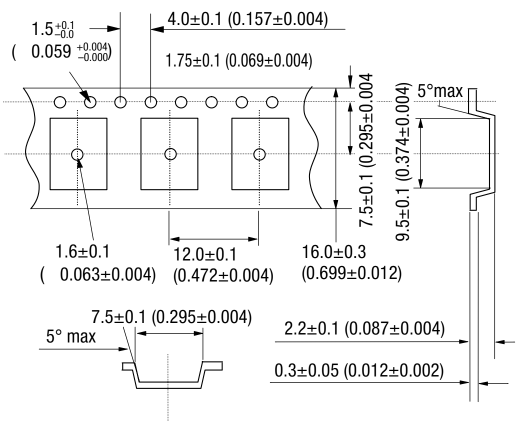
- Frequency — 15.0MHz
- Model No — CFPT-105
- Frequency Stability Vs Operating Temperature Code — HG

Test Circuit

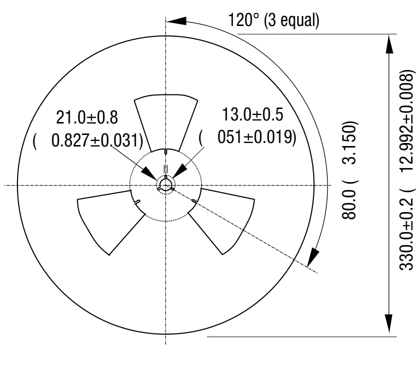


*Inclusive of jigging & equipment capacitance

Outline in mm (inches) - Tape



Outline in mm (inches) - Reel (scale 1:8)



CFPT-120

SURFACE MOUNT TCXOs

ISSUE 1; 7 SEPTEMBER 1999

Delivery Options

- Please contact our sales office for current leadtimes

Description

- CFPT-120 is a surface mount temperature compensated voltage controlled crystal oscillator providing a high degree of frequency stability over a wide temperature range.

Package Outline

- 7.0 × 5.0 × 2.0mm SMD (surface mount device)

Standard Frequencies

- 12.6MHz, 12.8MHz, 13.0MHz, 14.4MHz, 14.85MHz, 19.2MHz, 19.44MHz, 19.68MHz, 19.8MHz

Output Waveform

- Clipped Sine 0.8V peak to peak minimum

Ageing

- ±1ppm typical first year @ 25°C

Frequency Adjustment

- 5ppm to ±15ppm external control voltage at 1.5V ±1.0V applied to pin 1

Frequency Stability

- Temperature: see table
- Supply Voltage Variation: ±5% ±0.2ppm max.
- Load Variation: ±10% ±0.3ppm max.
- After reflow: ±1ppm max

Voltage Control

- 1.5V ±1.0V applied to pin 1

Storage Temperature Range

- –40 to 85°C

Solder Reflow

- Pre-heat: 150 to 180°C/55 to 70 seconds max.
- Reflow: 180°C/40 to 60 seconds max., 200°C/40 seconds max., 220°C ±5°C/5 to 15 seconds max.

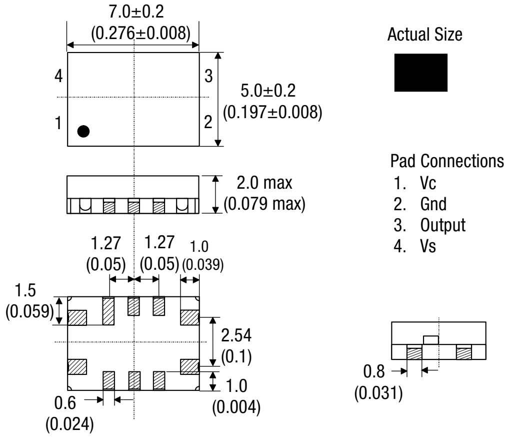
Marking

- Model number
- Frequency Stability Code /Temperature Range Code
- Frequency
- Date code (Year/Week)

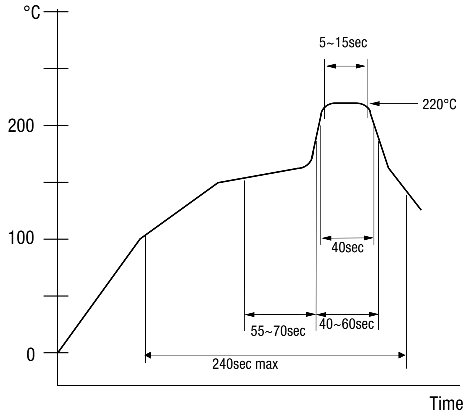
Minimum Order Information Required

- Frequency + Model Number + Frequency Stability + Operating Temperature Range

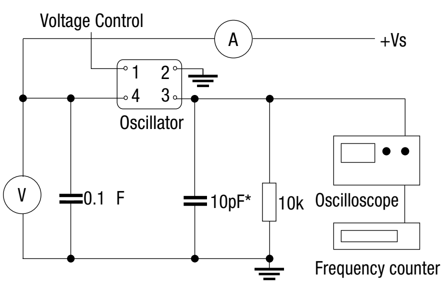
Outline in mm (inches) - (scale 2:1)



Typical Solder Condition - Infrared Reflow



Test Circuit



*Inclusive of jigging & equipment capacitance

Electrical Specification - maximum limiting values when measured in test circuit

Frequency Range	Frequency Tolerance @ 25°C	Supply Voltage	Supply Current	Voltage Control Change	Output Waveform	Output	Model Number
12.60 to 19.80MHz	±.1.0ppm	3V±0.15V	2.0mA	±8.0ppm min. / 1.5V±1.0V	Clipped Sine	0.8Vp-p min	CFPT-120

Frequency Stabilities Available Over Operating Temperature Ranges

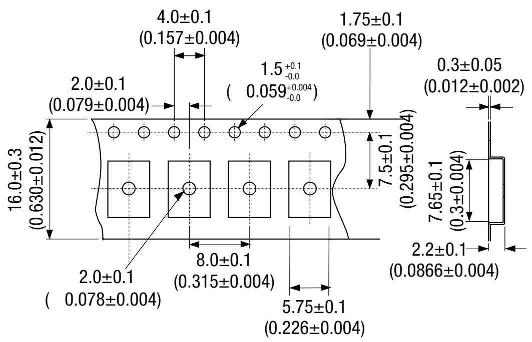
Operating Temperature Ranges	Frequency Stabilities Vs Operating Temperature Range		
	±2.0ppm	±2.5ppm	±5.0ppm
0 to 50°C	Code GP	Code HP	Code KP
–10 to 60°C	Code GR	Code HR	Code KR
–20 to 75°C	—	Code HG*	Code KG
–30 to 75°C	—	—	Code KU

* Please note Code HG is the standard frequency stability vs operating temperature range

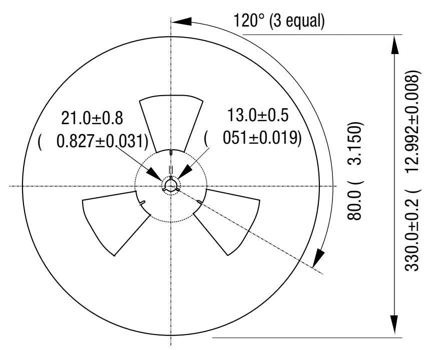
Ordering Example: 12.60MHz CFPT-120 HG

- Frequency — 12.60MHz
- Model No — CFPT-120
- Frequency Stability Vs Operating Temperature Code — HG

Outline in mm (inches) - Tape



Outline in mm (inches) - Reel (scale 1:8)



SURFACE MOUNT TCXOs

CFPT-141

ISSUE 1; 7 OCTOBER 1999

Delivery Options

- Please contact our sales office for current leadtimes

Description

- CFPT-141 is a surface mount temperature compensated voltage controlled crystal oscillator providing a high degree of frequency stability over a wide temperature range. They are particularly suited to applications where space is at a premium.

Package Outline

- 5.0 × 3.2 × 1.50mm SMD (surface mount device)

Standard Frequencies

- 13.0MHz, 16.80MHz

Output Waveform

- Clipped Sine 0.8V peak to peak minimum

Ageing

- ±1ppm typical first year @ 25°C

Frequency Adjustment

- ±5ppm to ±15ppm external control voltage at 1.5V ±1.0V applied to pin 1

Frequency Stability

- Temperature: see table
- Supply Voltage Variation: ±5% ±0.2ppm max.
- Load Variation: ±10% ±0.3ppm max.
- After reflow: ±1ppm max

Voltage Control

- 1.5V ±1.0V applied to pin 1

Storage Temperature Range

- –40 to 85°C

Solder Reflow

- Pre-heat: 150 to 180°C/55 to 70 seconds max.
- Reflow: 180°C/40 to 60 seconds max., 200°C/40 seconds max., 220°C ±5°C/5 to 15 seconds max.

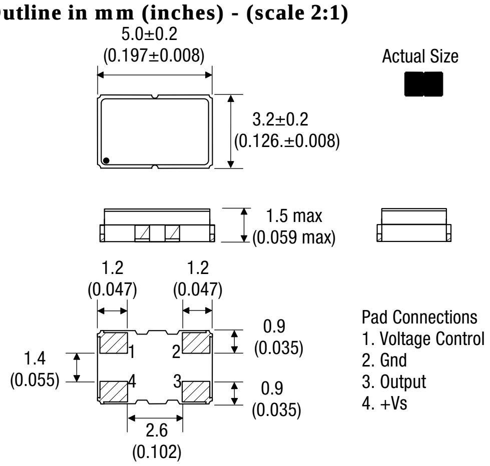
Marking

- Model number
- Frequency Stability Code /Temperature Range Code
- Frequency
- Date code (Year/Week)

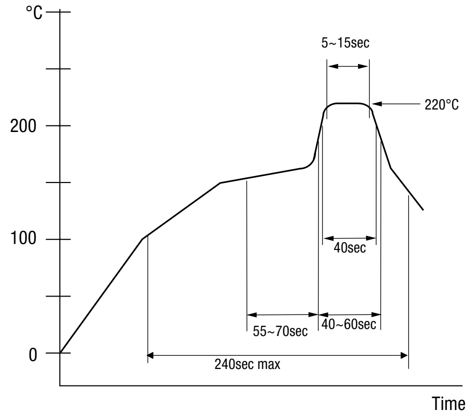
Minimum Order Information Required

- Frequency + Model Number + Frequency Stability + Operating Temperature Range

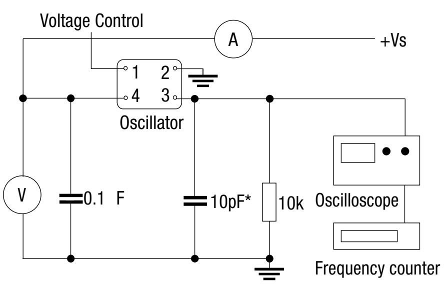
Outline in mm (inches) - (scale 2:1)



Typical Solder Condition - Infrared Reflow



Test Circuit



*Inclusive of jigging & equipment capacitance

Electrical Specification - maximum limiting values when measured in test circuit

Frequency Range	Frequency Tolerance @ 25°C	Supply Voltage	Supply Current	Voltage Control Change	Output Waveform	Output	Model Number
12.60 to 19.80MHz	±0.5ppm	3V±0.15V	2.0mA	±8.0ppm min. / 1.5V±1.0V	Clipped Sine	0.8Vp-p min	CFPT-141

Frequency Stabilities Available Over Operating Temperature Ranges

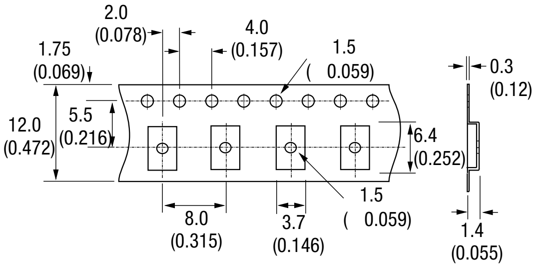
Operating Temperature Ranges	Frequency Stabilities Vs Operating Temperature Range		
	±2.0ppm	±2.5ppm	±5.0ppm
0 to 50°C	Code GP	Code HP	Code KP
–10 to 60°C	Code GR	Code HR	Code KR
–20 to 75°C	—	Code HG	Code KG
–30 to 75°C	—	Code HU	Code KU
–30 to 85°C	—	Code HW*	Code KW

* Please note Code HG is the standard frequency stability vs operating temperature range

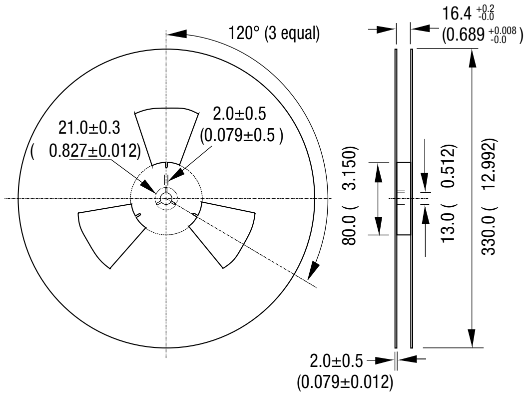
Ordering Example 13.0MHz CFPT-141 HW

Frequency
Model No
Frequency Stability Vs Operating Temperature Code

Outline in mm (inches) - Tape



Outline in mm (inches) - Reel



CFPT-635

ISSUE 1; 7 SEPTEMBER 1999

Delivery Options

- Please contact our sales office for current leadtimes

Description

- CFPT-635 is a surface mount temperature compensated voltage controlled crystal oscillator providing a high degree of frequency stability over a wide temperature range. They are particularly suited to applications where space is at a premium.

Package Outline

- 6.0 × 3.5 × 1.7mm SMD (surface mount device)

Standard Frequencies

- 12.6MHz, 12.8MHz, 13.0MHz, 14.4MHz, 16.8MHz, 19.2MHz, 19.68MHz, 19.8MHz

Output Waveform

- Clipped Sine 0.9V peak to peak minium (10k \\10pF)

Ageing

- ±1ppm typical first year @ 25°C

Frequency Adjustment

- 5ppm to ±12ppm external control voltage at 1.5V ±1.0V applied to pin 1

Frequency Stability

- Temperature: see table
- Supply Voltage Variation: ±10% ±0.3ppm max.
- Load Variation: (10k \\10pF) ±10% ±0.3ppm max.

Voltage Control

- 1.5V ±1.0V applied to pin 1

Storage Temperature

- –40 to 85°C

Marking

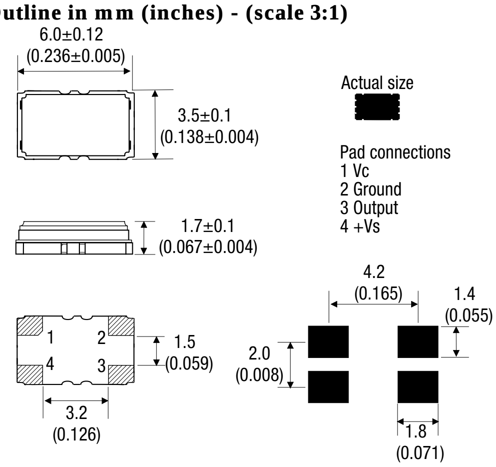
- Model number
- Frequency

Minimum Order Information Required

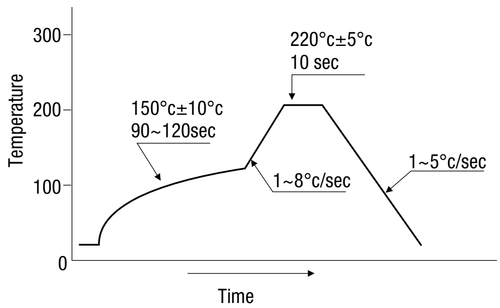
- Frequency + Model Number + Frequency Stability + Operating Temperature Range

SURFACE MOUNT TCXOs

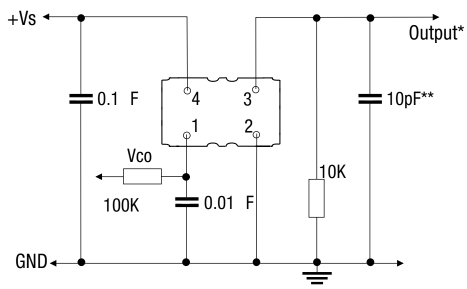
Outline in mm (inches) - (scale 3:1)



Typical Solder Condition - Infrared Reflow



Test Circuit



* Output Voltage is DC biased
** inclusive of probe and jig capacitance

Electrical Specification - maximum limiting values when measured in test circuit

Frequency Range	Supply Voltage	Supply Current	Voltage Control Change	Output Waveform	Output	Model Number
12.6 to 13.0MHz	3V±0.3V	1.5mA	±5.0ppm min. / 1.5V±1.0V	Clipped Sine	0.9Vp-p min	CFPT-635
14.4 to 19.68MHz	3V±0.3V	2.0mA	±5.0ppm min. / 1.5V±1.0V	Clipped Sine	0.9Vp-p min	CFPT-635

Frequency Stabilities Available Over Operating Temperature Ranges

Operating Temperature Ranges	Frequency Stabilities Vs Operating Temperature Range		
	±2.0ppm	±2.5ppm	±5.0ppm
–30 to 80°C	—	Code HV	—

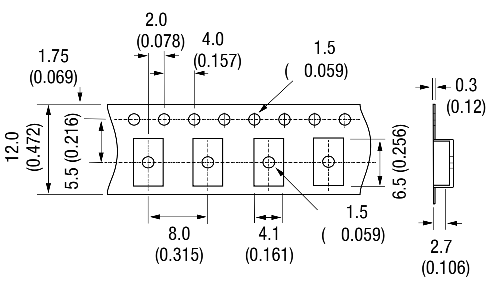
Ordering Example 12.6MHz CFPT-635 HV

Frequency — 12.6MHz
Model No — CFPT-635
Frequency Stability Vs Operating Temperature Code — HV

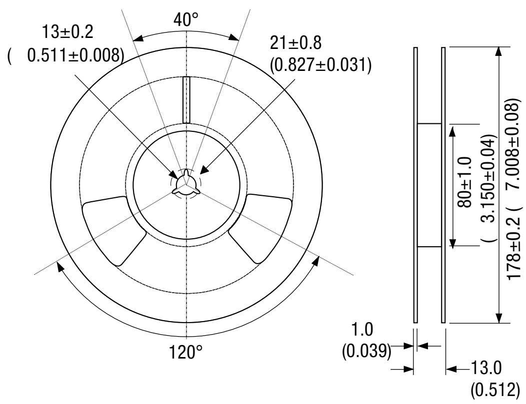
Phase Noise (typical figures)

Frequency	Frequency offset from carrier: 10Hz	Frequency offset from carrier: 1kHz	Frequency offset from carrier: 10kHz
12.8MHz	110dBc/Hz	130dBc/Hz	135dBc/Hz

Outline in mm (inches) - Tape



Outline in mm (inches) - Reel



SURFACE MOUNT TCXOs

CFPT-4003, -4033, -4005

ISSUE 2; 11 JUNE 1999

Delivery Options

- Please contact our sales office for current leadtimes

Description

- The CFPT-4000 series of temperature compensated crystal oscillators are housed in a 40 pin LCC. With high stability and tri-state capability, the CFPT-4000 series is ideal where board space and height is at a premium. Operation can be specified in the supply range 3V to 5V, with HCMOS drive frequencies being available from 1.0kHz to 20.0MHz.

Waveform

- Square HCMOS

Package Outline

- LCC ceramic seam welded package

Ageing

- ±1ppm max. in first year
- ±3ppm max. for 10 years
- ±1ppm max. after reflow

Frequency Stability

- Temperature: see table
- Supply Voltage Variation ±5% ±0.3ppm
- Load Coefficient 15pF ±5pF ±0.1ppm

Frequency Adjustment

- ±4ppm External Control Voltage 0.25V to 2.5V applied to pin 31 (or 21)
- ±4ppm External 100k Potentiometer connected between Vref (pin 28) and ground, wiper to pin 31 (or 21)

Tri-state Control

- Pin 7 open circuit or >0.7Vs enable
- < 0.2Vs tri-state

Storage Temperature Range

- –55 to +125°C

Environmental Specification

- Bump: IEC 68-2-29 Test Eb, 1000±10 bumps at 400m/s^2 in each of 3 mutually perpendicular planes.
- Vibration: IEC 68-2-6 Test Fc Procedure B4, Duration 12 hours, 10-55Hz 1.5mm D.A., 55-2000Hz at 98m/s^2 acceleration
- Shock: IEC 68-2-27 Test Ea, half sine wave, 981m/s^2 acceleration, 11ms duration, 3 shocks in each plane
- Sealing: IEC 68-2-17 Test Qk (Fine Leak) and IEC 68-2-17 Test Qc (Gross Leak)

Marking Includes

- Model number
- Frequency Stability Code /Temperature Range Code
- Frequency
- Date code (Year/Week)
- Static Sensitivity Symbol (denotes pin 1)

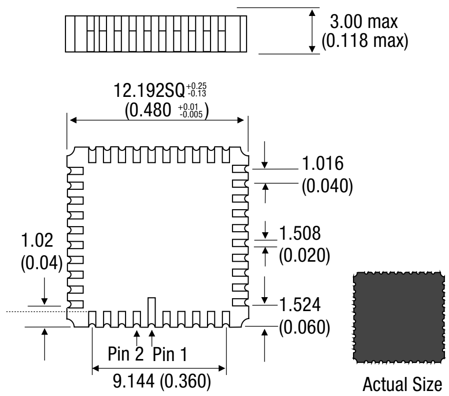
Minimum Order Information Required

- Discrete Part Number

OR

- Frequency + Model Number + Frequency Stability + Operating Temperature Range

Outline in mm (inches) - (scale 2:1)



Please note: dot indicates Pin 1

Electrical Specification - limiting values when measured in test circuit

Frequency Range	Supply Voltage (7.5V max.)	Supply Current (max.)	Output Waveform	Output	Rise Time (t_r) (max.)	Fall Time (t_f) (max.)	Duty Cycle	Model Number
1.0kHz to 20.0MHz	3.0V 0.15	8mA	Square	HCMOS 15pF	4ns	4ns	40/60%	CFPT-4003
1.0kHz to 20.0MHz	3.3V 0.17	8mA	Square	HCMOS 15pF	4ns	4ns	40/60%	CFPT-4033
1.0kHz to 20.0MHz	5.0V 0.25	8mA	Square	HCMOS 15pF	4ns	4ns	40/60%	CFPT-4005

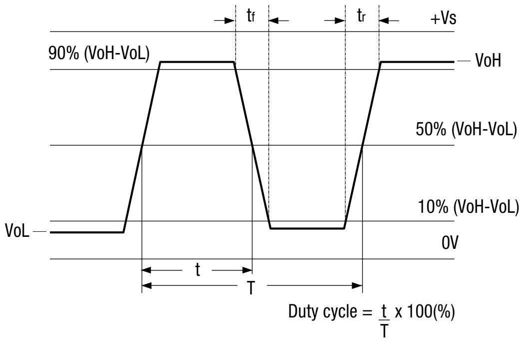
Frequency Stability Available Over Operating Temperature Ranges

Operating Temperature Ranges	Frequency Stabilities Vs Operating Temperature Range		
	±0.8ppm	±1.0ppm	±1.5ppm
–20 to 70°C	Code BS	Code FS	Code CS

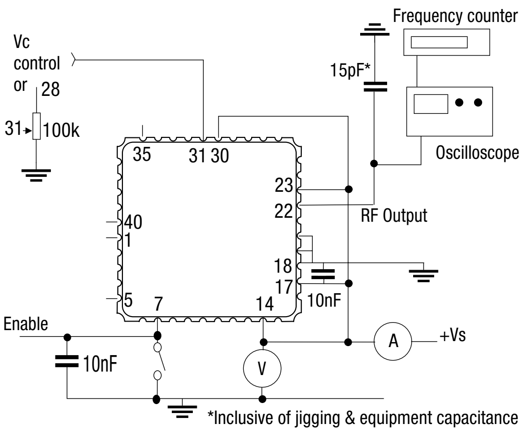
Ordering Example 10.0MHz CFPT-4005 BS

Frequency — 10.0MHz
Model No — CFPT-4005
Frequency Stability Vs Operating Temperature Code — BS

Output Waveform - HCMOS



Test Circuit



CFPT-4000 Pin Connections

1-6, 8-13,15-16, 25, 27, 29, 32, 35-40	No connection
7	Tri-state control
14	Supply Voltage Vs (Connected internally to 17)
17	Supply Voltage Vs (Connected internally to 14)
18-20	Ground (Connected internally to 34)
21	Control Voltage Vc (Connected internally to 31)
22	RF Output
23	Supply Voltage Vs (Connected internally to 30)
24	DO NOT CONNECT
26	DO NOT CONNECT
28	V ref
30	Supply Voltage Vs (Connected internally to 23)
31	Control Voltage Vc (Connected internally to 21)
33	DO NOT CONNECT
34	

CFPT-7003, -7033, -7005

ISSUE 2; 8 SEPTEMBER 1999

Recommended for New Designs

Delivery Options

- Please contact our sales office for current leadtimes

Description

- The CFPT-7000 series of surface mountable temperature compensated crystal oscillators are intended for the next generation of equipment where small size and high performance are pre-requisites. Available in the frequency range of 1.0kHz to 33.0MHz, the CFPT-7000 series can be specified for either 3.0V, 3.3V or 5.0V operation, suitable for infra-red reflow assembly the device comes as standard with external frequency adjustment to allow for long term ageing.

Output Waveform

- HCMOS

  Load: 15pF

  VoL: 10% Vs; VoH: 90 Vs

  Rise and Fall time: 4ns

  Duty Cycle: 40/60%

Package Outline

- Low profile surface-mount filled package which is thermally matched to FR4

Supply Options

- 3.0V ±0.15V (CFPT-7003)
- 3.3V ±0.17V (CFPT-7033)
- 5.0V ±0.25V (CFPT-7005)

Supply Current

- 8.0mA max

Ageing

- ±1ppm max. in first year
- ±3ppm max. for 10 years (includes first year)
- ±1ppm max. after reflow (allow 48 hours recovery)

Frequency Stability

- Over Operating Temperature Range: down to ±0.3ppm
- Supply Voltage Variation ±5% 25.0MHz ±0.1ppm
  >25.0MHz ±0.2ppm
- Load Coefficient 15pF±5pF ±0.1ppm

Operating Temperature Range

- Available up to –55 to 95°C

Frequency Adjustment

- ±4ppm External Control Voltage 0.25V to 2.5V applied to pin 1

Available Options

- Tri-state (Pin 6)
- Improved Ageing
- High Drive (50pF load)
- Extended Frequency Adjust (±10ppm)
- No Frequency Adjust
- Reference Voltage (2.5V±0.1V, Nominal Load 10k Pin 3

Storage Temperature Range

- –55 to +95°C

Environmental Specification

- Bump: IEC 68-2-29 Test Eb, 1000±10 bumps at 400m/s^2 in each of 3 mutually perpendicular planes.
- Vibration: IEC 68-2-6 Test Fc Procedure B4, 10-58Hz 1.5mm peak to peak displacement, 58-500Hz at 100m/s^2, 30 minutes in each of three mutually perpendicular planes at 1 octave per minute.
- Shock: IEC 68-2-27 Test Ea, 1000m/s^2 acceleration for 6ms duration half sine, 3 shocks in each direction along three mutually perpendicular axes.
- SMD: Infra-red (class C, test category 1 as defined in classification BS CECC 00802; 1994). Testing to be performed in accordance with BS CECC 00802, IEC 68-2-20 and IEC 68-2-58.
- Solderability: 215°C/ 3 second immersion, steam age pre-conditioning applicable.
- Resistance to Soldering Heat: 260°C/10 sec exposure
- Marking: Heat cured epoxy or label, resistant to all common solvents.

Marking Includes

- Model number
- Frequency
- Date code (Year/Week)
- Offset frequency at 25°C (Hz)
- Static Sensitivity Symbol (denotes pin 1)

Minimum Order Information Required

- Discrete Part Number

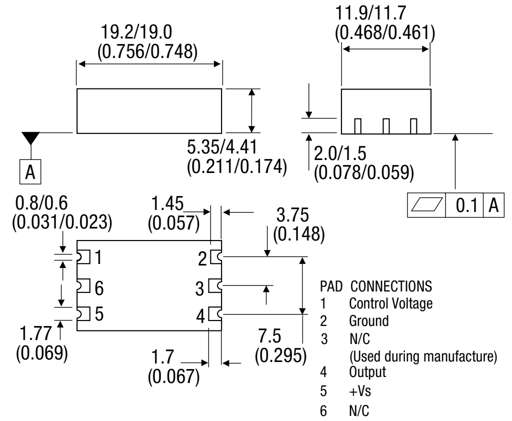
Available Standard Specifications

Frequency	Supply Voltage	Supply Current	Output Waveform	Operating Temperature Range	Frequency Adjust	Frequency Stability	Part Number
10.0MHz	3.3V	8.0mA	HCMOS	–40 to 85°C	±3.5ppm/0.25V to 2.5V	±0.5ppm	R2384
10.0MHz	5.0V	8.0mA	ACMOS	–10 to 70°C		±0.3ppm	R2216, R2351
10.0MHz	5.0V	8.0mA	HCMOS	–40 to 85°C	±3.5ppm/0.25V to 2.5V	±0.5ppm	R2347
16.384MHz	3.3V	8.0mA	ACMOS	0 to 70°C		±0.5ppm	R2392
24.576MHz	3.3V	8.0mA	HCMOS	–30 to 85°C	±4.0ppm/0.25V to 2.5V	±0.7ppm	R2302
Please note contact our sales office to discuss your exact requirements.							

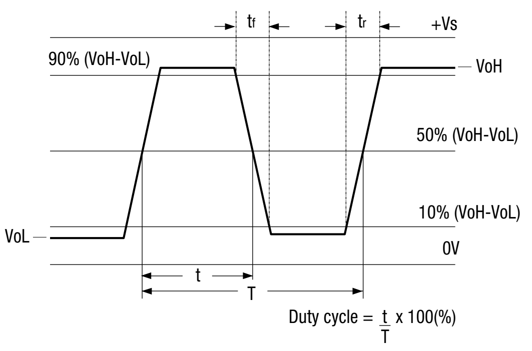
Phase Noise (typical figures)

Frequency	Frequency offset from carrier: 10Hz	Frequency offset from carrier: 1kHz	Frequency offset from carrier: 10kHz
8.192MHz	90dBc/Hz	135dBc/Hz	145dBc/Hz
19.44MHz	85dBc/Hz	130dBc/Hz	140dBc/Hz

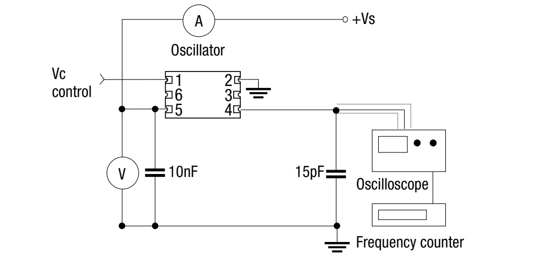
Outline in mm (inches)



Output Waveform - HCMOS



Test Circuit



Please note: Available options are Pin 6 = Tri-state function and Pin 3 = Reference voltage

CFPT-8000, -8010, -8100, -8110, -8200, -8210

ISSUE 2; 18 MAY 1999

Recommended For New Designs

Delivery Options

- Please contact our sales office for current leadtimes

Output Compatibility

- HCMOS

Description

- CFPT-8000 series are surface mount temperature compensated voltage controlled crystal oscillators providing a high degree of frequency stability over a wide temperature range. They are particularly suited to Stratum and SONET clock applications.

Package Outline

- 19.9 × 12.9 × 7.7mm SMD (surface mount device)

Standard Frequency

- 19.440MHz

Frequency Stability

- ±2.0ppm (ref. 25°C)
- Supply Voltage (+Vs) ±5%   ±0.2ppm

Frequency Tolerance

- ±1.0ppm @ 25°C
- Vc = 2.5V @ 5V supply voltage
- Vc = 1.5V @ 3.3V supply voltage

Storage Temperature Range

- –25 to 80°C

Environmental Specification

- Vibration: IEC 68-2-6 Test Fc Procedure B4, 10-60Hz 0.75mm displacement, 60-500Hz at 98.1m/s^2, 30 minutes in each of three mutually perpendicular planes at 1 octave per minute.
- Shock: IEC 68-2-27 Test Ea, 981m/s^2 acceleration for 6ms duration, 3 shocks in each direction along three mutually perpendicular axes.
- SMD: Infra-red (class C, test category 1 as defined in classification BS CECC 00802; 1994). Testing to be performed in accordance with BS CECC 00802, IEC 68-2-20 and IEC 68-2-58.
- Sealing: Non hermetic package
- Marking: Label, resistant to all common solvents.

Frequency Control (positive slope)

- 40ppm min /   62ppm max (CFPT-8000, 8010)
- 10ppm min (CFPT-8100, 8110)
- No adjust (CFPT-8200, -8210)

Voltage Control Pin 1

- 2.5V (+0.5V to +4.5V) @ 5V supply voltage (CFPT-8000, -8100, -8200))
- 1.5V (+0.3V to +3.0V) @ 3.3V supply voltage (CFPT-8010, -8110, -8210)

Modulation Bandwidth

- 2.0kHz

Ageing

- <±3ppm first year
- <±10ppm 15 years

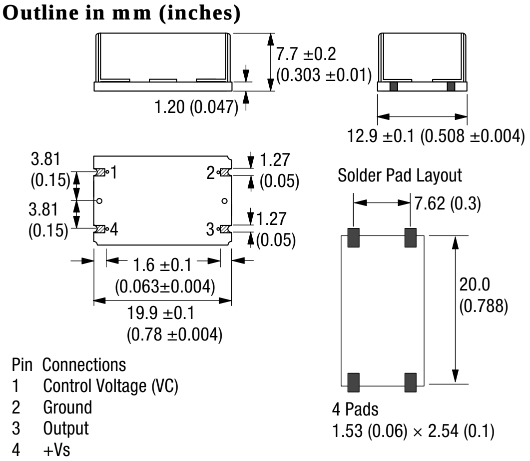
Marking

- Model number
- Frequency
- Date code (Year/Week)
- Static Sensitivity Symbol   (denotes pin 1)

Minimum Order Information Required

- Frequency + Model Number

Outline in mm (inches)



Electrical Specification – maximum limiting values when measured in HCMOS test circuit

Frequency Range	Supply Voltage	Supply Current	Rise Time (t_{rD})	Fall Time (t_f)	Duty Cycle	Model Number
13.0 to 26.0MHz	5V±0.25V	15mA	10ns	10ns	40/60%	CFPT-8000
>26.0 to 160.0MHz		40mA	3ns	2ns		
13.0 to 26.0MHz	3.3V±0.10V	10mA	10ns	10ns	40/60%	CFPT-8010
>26.0 to 120.0MHz		30mA	3ns	2ns		
13.0 to 26.0MHz	5V±0.25V	15mA	10ns	10ns	40/60%	CFPT-8100
>20.0 to 160.0MHz		40mA	3ns	2ns		
13.0 to 26.0MHz	3.3V±0.10V	10mA	10ns	10ns	40/60%	CFPT-8110
>26.0 to 120.0MHz		30mA	3ns	2ns		
13.0 to 26.0MHz	5V±0.25V	15mA	10ns	10ns	40/60%	CFPT-8200
>26.0 to 160.0MHz		40mA	3ns	2ns		
13.0 to 26.0MHz	3.3V±0.10V	10mA	10ns	10ns	40/60%	CFPT-8210
>26.0 to 120.0MHz		30mA	3ns	2ns		

Frequency Stability Available Over Operating Temperature Ranges

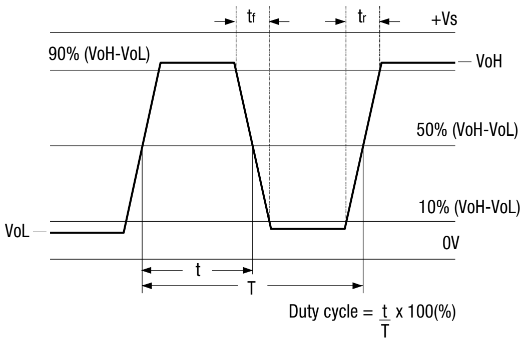
Operating Temperature Ranges	Frequency Stabilities Vs Operating Temperature Range					
	±1.0ppm	±1.5ppm	±2.0ppm	±2.5ppm	±3.0ppm	±5.0ppm
0 to 50°C	Code FP	Code CP*	Code GP*	Code HP*	Code JP*	Code KP*
–10 to 60°C	—	Code CR	Code GR	Code HR*	Code JR*	Code KR*
0 to 70°C	—	Code CC	Code GC	Code HC*	Code JC*	Code KC*
–20 to 70°C	—	—	Code GS	Code HS	Code JS	Code KS
–25 to 75°C	—	—	—	—	Code JT	Code KT
–30 to 75°C	—	—	—	—	Code JU	Code KU
–30 to 85°C	—	—	—	—	—	Code KW

* Denotes the only frequency stabilities available for model numbers CFPT-8000 & -8010

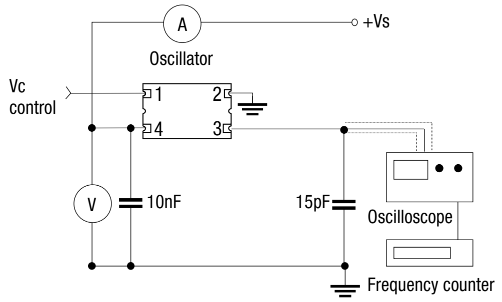
Ordering Example 19.440MHz CFPT-8000 HP

Frequency
Model No
Frequency Stability Vs Operating Temperature Code

Output Waveform - HCMOS



Test Circuit



CFPT-9101, -9102, -9103, -9104, -9105, -9106, -9107, -9108

ISSUE 1; 8 SEPTEMBER 1999

Preliminary Specification
Recommended for New Designs

Delivery Options
- Please contact our sales office for current leadtimes

Description
- The CFPT-9100 series of surface mountable temperature compensated crystal oscillators are intended for the next generation of equipment where small size and high performance are pre-requisites.

Output Waveform
- HCMOS

  Load: 15pF

  VoL: 10% Vs; VoH: Vs

  Rise and Fall time: 3ns

  Duty Cycle: 40/60% (3.3V); 45/55% (5.0V)
- Sinewave

  Load: 10k // 10pF

  Level: 0.8V pk-pk (3.3V); 1.0V pk-pk (5.0V)

  Harmonics: –20dBc

Package Outline
- 14.3 × 9.1 × 6.2mm low profile surface-mount package with FR4 base.

Supply Options
- 3.3V ±0.17V (CFPT-9101, -9102, -9103, -9104)
- 5.0V ±0.25V (CFPT-9105, -9106, -9107, -9108)

Supply Current
- 20mA max (HCMOS output)
- 3.0mA max (Clipped Sine output)

Ageing
- ±2ppm max. in first year
- ±5ppm max. for 10 years (includes first year)
- ±1ppm max. after reflow (allow 48 hours recovery)
- Improved Ageing is available

Frequency Stability
- Over Operating Temperature Range: down to ±0.3ppm
- Supply Voltage Variation ±5% 0.2ppm
- Load Coefficient 15pF±5pF ±0.1ppm
- Load Coefficient 10k // 10pF ±10% ± 0.2ppm

Operating Temperature Range
- Available up to –40 to 85°C

Voltage Control Pin 1
- 1.65V±1.5V (CFPT-9101, -9102, -9103, -9104)
- 2.5V±2.0V (CFPT-9105, -9106, -9107, -9108)

Frequency Adjustment
- Range (reference to the frequency at nominal control voltage):

  ±13.0 to ±17.0ppm (CFPT-9101, -9103)

  ±17.0 to ±23.0ppm (CFPT -9105, -9107)

  ±26.0 to ±34.0ppm (CFPT-9102, -9104)

  ±34.0 to ±46.0ppm (CFPT-9106, -9108)
- Slope: Positive
- Linearity: 5%
- Input Impedance: 100k
- Modulation Bandwidth: 5kHz

Storage Temperature Range
- –40 to +85°C

Environmental Specification
- Bump: IEC 68-2-29 Test Eb, 1000±10 bumps at 400m/s^2 in each of 3 mutually perpendicular planes.
- Vibration: IEC 68-2-6 Test Fc Procedure B4, 10-58Hz 1.5mm peak to peak displacement, 58-500Hz at 100m/s^2, 30 minutes in each of three mutually perpendicular planes at 1 octave per minute.
- Shock: IEC 68-2-27 Test Ea, 1000m/s^2 acceleration for 6ms duration half sine, 3 shocks in each direction along three mutually perpendicular axes.
- SMD: Infra-red (class C, test category 1 as defined in classification BS CECC 00802; 1994). Profile in accordance with Fig.3, except reflow temperature to be 200°C for a minimum of 1.5 minutes. Testing to be performed in accordance with BS CECC 00802, IEC 68-2-20 and IEC 68-2-58.

Tri-state Operation
- Pin 2 <30%Vs: disabled; >70%Vs or open: enabled
- HCMOS: Tri-state; Sinewave: Non tri-state

Marking Includes
- Model number
- Frequency Stability Code /Temperature Range Code
- Frequency
- Date code (Year/Week)
- Static Sensitivity Symbol (denotes pin 1)

Minimum Order Information Required

- Discrete Part Number

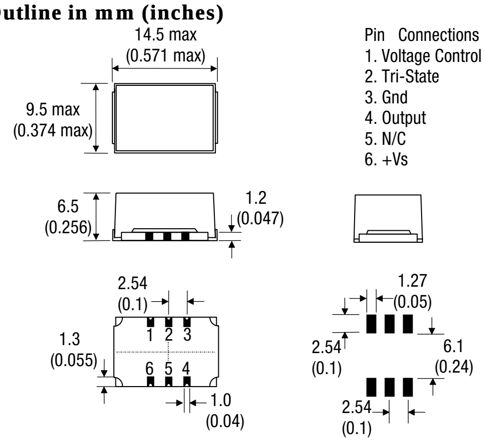
Available standard specifications

Frequency	Supply Voltage	Supply Current	Output	Operating Temperature Range	Frequency Adjustment	Frequency Stability	Part Number
16.384MHz	5.0V	12mA	HCMOS	0 to 70°C	±5ppm 0 to 2.5V	±0.5ppm	N2501
19.44MHz	5.0V	14mA	HCMOS	–5 to 65°C	±40ppm 0.5 to 4.5V	±2ppm	N2445
20.0MHz	5.0V	14mA	HCMOS	–5 to 85°C	—	±0.9ppm	N2444
Please note contact our sales office to discuss your exact requirements.							

Phase Noise (typical figures)

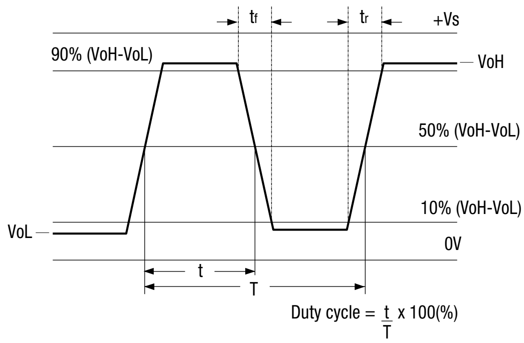
Frequency	Frequency offset from carrier: 1.0Hz	Frequency offset from carrier: 10Hz	Frequency offset from carrier: 100Hz	Frequency offset from carrier: 1kHz	Frequency offset from carrier: 10kHz
10.0MHz	55dBc/Hz	80dBc/Hz	110dBc/Hz	130dBc/Hz	140dBc/Hz

Outline in mm (inches)

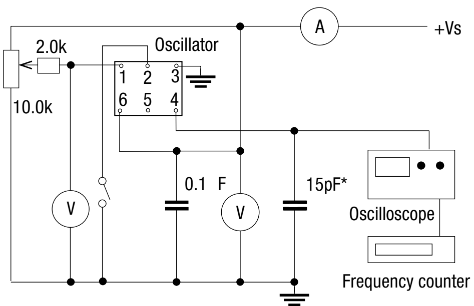


Note: Pin 2 = No connnection on sinewave output models

Output Waveform - HCMOS

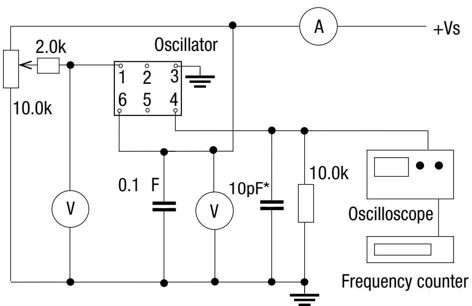


Test Circuit - HCMOS



*Inclusive of jigging & equipment capacitance

Test Circuit - Sinewave



*Inclusive of jigging & equipment capacitance

NOTES

SURFACE MOUNT TCXOs

SM OCXOs - Section Contents

CFPO-11: SMD Micro High Stability OCXO

ISSUE 2: 10 SEPTEMBER 1999

Description

- Micro high stability surface mount OCXO

Package Outline

- 25.0 × 22.0 × 14.0mm (25AS) (CFPO-11 A1)
- 25.0 × 22.0 × 11.5mm (25LP) (CFPO-11 A2, -B1)

Supply Options

- 5V (5)
- 9V (9)
- 12V (12)

Standard Frequencies

- 10.0MHz, 13.0MHz, 16.3840MHz, 26.0MHz

Frequency Range

- 4.0960 to 40.0MHz

Input Current @ 12V

- Warm Up: 210mA (2.5W)
- @ 25°C: 100mA (1.2W)

Storage Temperature Range

- –55 to 90°C

Warm Up Time

- $\pm 1 \times 10^{-8}$ after 5 minutes

Retrace after 24 hours off

- 3×10^{-9} after 60 minutes

Output Compatibility

- HCMOS

Frequency Stability Vs Supply Voltage change (±5%) and Load Change (1 to 2 HCMOS)

- $\pm 5 \times 10^{-9}$

Frequency Control Linearity

- 10%

Oven Alarm

- Included

Environmental Specification (non-operating)

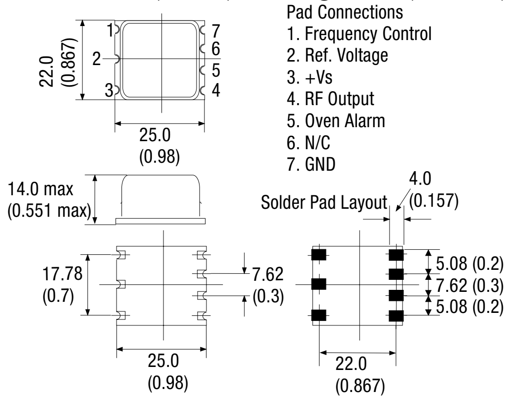
- Shock: 50g for 11ms
- Vibration: 10g for 10 to 500Hz

Marking Includes

- Model number (including options)
- Frequency
- Date Code (Year/Week)

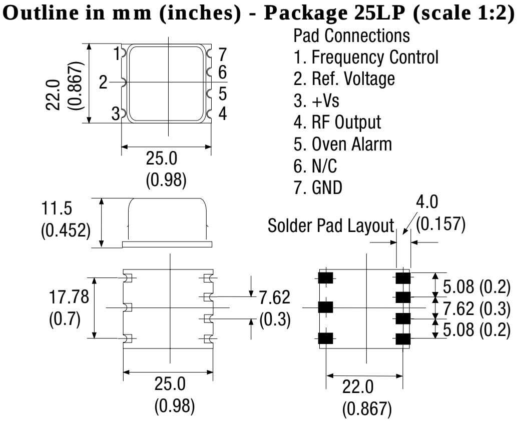
SURFACE MOUNT OCXOs

Outline in mm (inches) - Package 25AS (scale 1:2)



Tolerance ±0.2mm (±0.008)

Outline in mm (inches) - Package 25LP (scale 1:2)



Tolerance ±0.2mm (±0.008)

Electrical Specification

Operating Temperature Range*	Stability within Temperature Range	Long Term Stability @ 25°C after 30 days operation			Frequency Adjustment	Phase noise			Model Number
		Per day	Per Month	Per Year		Output frequency	@ 10Hz	@ 1kHz	
0 to 70°C	$\pm5\times10^{-9}$	$\pm3\times10^{-10}$	$\pm1\times10^{-8}$	$\pm5\times10^{-8}$	$\pm6\times10^{-7}$	@ 10MHz	–115 dBc/Hz	–145 dBc/Hz	CFPO-11 A1
0 to 70°C	$\pm1\times10^{-8}$	$\pm1\times10^{-9}$	$\pm3\times10^{-8}$	$\pm1.5\times10^{-7}$	$\pm6\times10^{-7}$	@ 10MHz	–115 dBc/Hz	–145 dBc/Hz	CFPO-11 A2
0 to 70°C	$\pm1\times10^{-7}$	$\pm2.5\times10^{-9}$	$\pm8\times10^{-8}$	$\pm4\times10^{-7}$	$\pm2\times10^{-6}$	@ 26MHz	–105 dBc/Hz	–140 dBc/Hz	CFPO-11 B1

Ordering Example: CFPO-11 A2 20AS-12 10.0MHz

Model (CFPO-11 A1) (CFPO-11 A2) (CFPO-11 B1)
Package Style (25AS)
Supply Voltage (5) (9) (12)
Frequency (MHz)

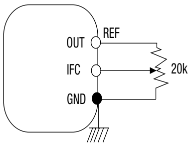
*Please note: Extended Operating Temperature Ranges may be available on request. Please contact Application Support for further details.

Phase Noise (typical figures)

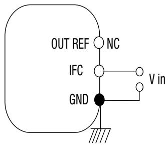
Frequency	Frequency offset from carrier: 10Hz	Frequency offset from carrier: 100Hz	Frequency offset from carrier: 1kHz	Model Number
10.0MHz	115dBc/Hz	140dBc/Hz	145dBc/Hz	CFPO-11 A1, -A2
28.0MHz	105dBc/Hz	130dBc/Hz	140dBc/Hz	CFPO-11 B1

External Frequency Adjustment

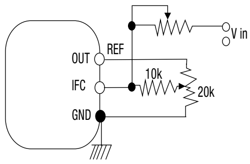
Manual freq. adjust.
Settability < 1 x 10^{-7}



Ext. freq. control voltage



Freq. control voltage and manual adjust



All potentiometers must be 10 turns type with temperature coefficient 50ppm/°C

CFPO-12: TCOCXO

ISSUE 1; 14 SEPTEMBER 1999

Preliminary Specification

Description
- Temperature Compensated surface mount OCXO

Package Outline
- 19.9 × 12.9 × 8.5mm

Supply Options
- Optional: 3.3V (3.3)
- Standard: 5.0V (5)
- Optional: 9.0V (9)
- Optional: 12.0V (12)

Output Waveform
- HCMOS

  Load: 15pF

  VoL: 10% Vs; VoH: Vs

  Rise and Fall time: 3ns

  Duty Cycle: 40/60% (3.3V); 45/55% (5.0V)

Frequency Tolerance @ 25°C
- ±0.5ppm

Input Current @ 5.0V
- Warm Up: 400mA (2W)
- Stabilised @ 25°C: 120mA (0.6W)
- Stabilised @ 40°C: 240mA (1.2W)

Ageing
- ±0.5ppm max. in first year
- ±1.5ppm max. predicted for 10 years (includes first year)

Frequency Stability
- Over Operating Temperature Range: down to ±0.1ppm
- Supply Voltage Variation ±5% 0.02ppm
- Load Coefficient 15pF±5pF ±0.01ppm
- ±0.5ppm max. after reflow (allow 48 hours recovery)

Operating Temperature Range Vs Stability
- 0 to 60°C: ±0.1ppm
- –10 to 70°C: ±0.2ppm
- –40 to 70°C: ±0.3ppm

Voltage Control Pin 1
- Optional: 1.65V±1.5V
- Standard: 2.5V±2.0V

Frequency Adjustment
- Range (reference to frequency at nominal control voltage):

  Standard: ±4.0ppm; Optional: ±15.0ppm
- Slope: Positive

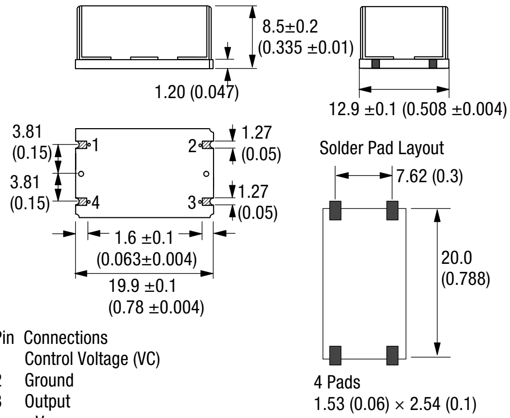
Storage Temperature Range
- –55 to +90°C

Environmental Specification
- Vibration: IEC 68-2-6 Test Fc Procedure B4, 10-58Hz 1.5mm peak to peak displacement, 58-500Hz at 100m/s^2, 30 minutes in each of three mutually perpendicular planes at 1 octave per minute.
- Shock: IEC 68-2-27 Test Ea, 1000m/s^2 acceleration for 6ms duration half sine, 3 shocks in each direction along three mutually perpendicular axes.
- SMD: Infra-red (class C, test category 1 as defined in classification BS CECC 00802; 1994). Profile in accordance with Fig.3, except reflow temperature to be 200°C for a minimum of 1.5 minutes. Testing to be performed in accordance with BS CECC 00802, IEC 68-2-20 and IEC 68-2-58.
- Marking: Label, resistant to all common solvents

Marking Includes
- Manufacturer
- Part Number
- Frequency
- Date code (Year/Week)
- Static Sensitivity Symbol (denotes pin 1)

Minimum Order Information Required
- Discrete Part Number

Outline in mm (inches) - (scale 1:2)



Pin	Connections
1	Control Voltage (VC)
2	Ground
3	Output
4	+Vs

NOTES

SURFACE MOUNT OCXOs

NOTES

SURFACE MOUNT
OCXOs

APPLICATION NOTES - Section Contents

QUARTZ CRYSTALS

The importance of quartz crystal resonators in electronics results from their extremely high Q, relatively small size and excellent temperature stability.

A quartz crystal resonator utilizes the piezoelectric properties of quartz. If a stress is applied to a crystal in a certain direction, electric charges appear in the perpendicular direction.

Conversely, if an electric field is applied, it will cause mechanical deflection of the crystal. In a quartz crystal resonator, a thin slice of quartz is placed between two electrodes. An alternating voltage applied to these electrodes causes the quartz to vibrate.

If the frequency of this voltage is very near the mechanical resonance of the quartz slice, the amplitude of the vibrations will become very large. The strain of these vibrations causes the quartz to produce a sinusoidal electric field which controls the effective impedance between the two electrodes.

This impedance is strongly dependent on the excitation frequency and possesses an extremely high Q.

Electrically, a quartz crystal can be represented by the equivalent circuit of Fig.1 where the series combination R_1, L_1 and C_1 represent the quartz and C_o represents the shunt capacitance of the electrodes in parallel with the can capacitance. The inductor L_1 is a function of the mass of the quartz while C_1 is associated with its stiffness. The R_1 results from the loss in the quartz and in the mounting arrangement. The parameters of the equivalent circuit can be measured quite accurately using a crystal impedance (CI) meter.

A reactance-frequency plot of the equivalent circuit is given in Fig.2. There are many related formulae for crystal performance; the first of these is f_s. This is the frequency at which the crystal is series resonant and is given by:

$$f_S \quad \frac{1}{2\sqrt{L_1C_1}}$$

Where
f_s =series resonant frequency (Hz - hertz)
L_1=motional arm inductance (H - henries)
C_1=motional arm capacitance (F - farads)

Fig.1 Equivalent Circuit of a Crystal

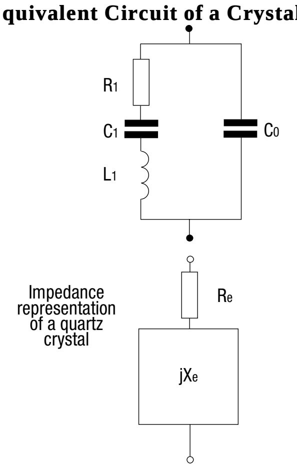
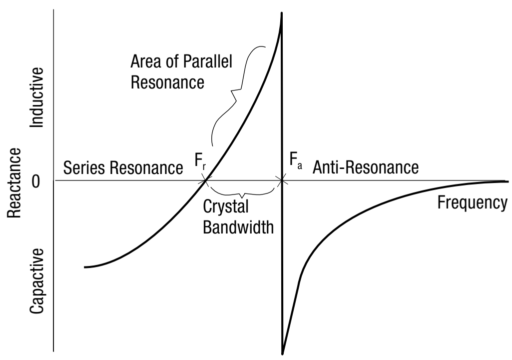


Fig. 2 Reactance vs Frequency



Plot of reactance vs frequency of a quartz crystal

Typical Crystal Parameter Values

Parameter	200kHz	2MHz	30MHz	90MHz
	Fundamental		Third o/t	Fifth o/t
R_1	2k	100	20	40
L_1	27H	520mH	11mH	6mH
C_1	0.024pF	0.012pF	0.0026pF	0.0005pF
C_0	9pF	4pF	6pF	4pF
Q	$18x10^3$	$18x10^3$	$18x10^3$	$18x10^3$

Calibration Tolerance

Calibration tolerance is the maximum allowable deviation in frequency of a crystal at a specific temperature, the reference temperature (usually 25 C).

Frequency Stability

Crystals suffer instability from several causes: temperature variation and a physical change of mass which results in the long-term drift we call Ageing are probably those which concern us most.

The effects of temperature variation are minimized by an appropriate choice of crystal cut and (in close tolerance requirements) by including temperature-dependent reactance in the crystal's circuit, or by holding it at a constant temperature in a small oven. AT-cut crystals are the most widely used today because their family of frequency-temperature curves readily provides good performance at low cost for all but the most demanding applications.

Specifications for AT-cut crystals are 50ppm or 25ppm from –10 C to 60 C. Improved temperature performance can be obtained if the temperature range is limited and can be seen in Fig.3, which illustrates a typical family of their frequency-temperature curves. These curves may be represented by cubic equations and are strongly dependent on the angle of cut of the quartz blank. The points of zero temperature coefficient are called the turning points lower and upper frequency inversion point temperatures. One turning point can be placed where desired by selecting the angle of cut; the other is then fixed, since both are symmetrical about a point in the 20–30°C range. The slope between the turning points becomes smaller as the they move together. Crystals designed for use in an oven are cut so that the upper turning point occurs at the oven temperature.

Fig.4 shows the frequency temperature curves for several low frequency cuts. The J-cut is used below 10kHz, while an XY-cut may be used from 3kHz to 85kHz. An NT-cut may be used in the 10kHz range. A DT-cut is applicable from 100kHz to about 800kHz and a CT-cut from 300kHz to 900kHz.

Load Capacitance

Crystals can be calibrated by their manufacturer at either f_r, where they appear resistive (or f_s which is very close to f_r), or for resonance with a capacitive load, where of course they must appear inductive. The latter condition is called load-resonant and is represented in general terms by the symbol f_L or, more specifically, the symbol f_{30} would, for example, represent the frequency at which the crystal is at resonance with a 30pF capacitor.

At which point on the crystal's reactance curve calibration is needed is determined by the circuit configuration. As a general rule, a non-inverting maintaining amplifier in an oscillator requires calibration at f_r and an inverting amplifier needs calibration at some value of 'load capacitance', c_l. The latter arrangement relies upon the inductive crystal, together with two capacitors with which it is at resonance, to provide a further 180° of phase shift.

Fig. 3 AT Cut Frequency vs Temperature Curve

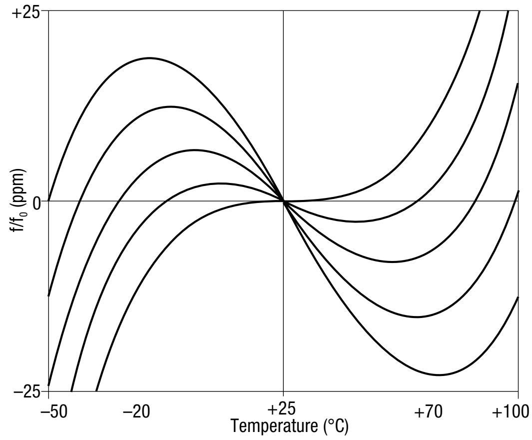
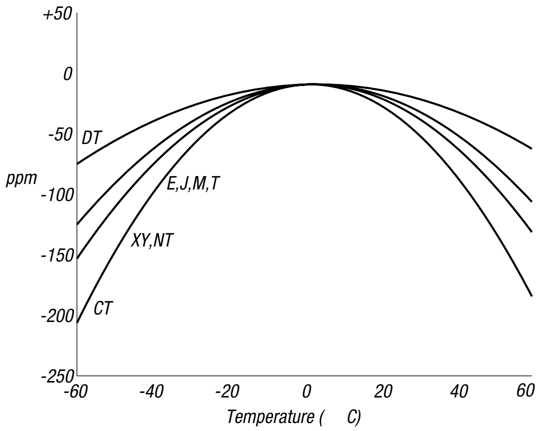


Fig. 4 Low Frequency Crystal



The most common exception to the rule is when a small capacitor, a varicap diode for example, is placed in series with the crystal in the non-inverting amplifier circuit in order to provide a degree of frequency adjustment. In such a case the crystal must be calibrated for resonance with the mean value of that capacitance.

Pullability

The pullability of a crystal is its frequency change for a given change of load capacitance. This is often expressed in kHz as the difference between its series-resonance frequency and that when resonant with a given load capacitance. This offset can be calculated in parts per million using:

- Fractional load resonance frequency offset (D_L). The actual frequency change from F_r to F_L for a given value of C_L,

$$D_L \quad \frac{C_1 . 10^6}{2(C_0 \quad C_L)} \; ppm$$

Fig. 5 shows a typical curve for the effect of frequency change with respect to change in load capacitance.

Alternatively, it is common to express a crystal's pullability as a trim sensitivity in ppm per pF change of load capacitance. This is represented approximately by:

$$\frac{D_L}{C_L} \quad \frac{C_1 . 10^6}{2(C_0 \quad C_L)^2} \; ppm / pF$$

and is shown graphically in Fig. 6 for various values of (C_0 + C_L).

Typical Values

Frequency	Vibration Mode	C_1 (fF)	C_0 (pF)
1.0 to 1.999MHz	Fundamental	5 to 8	3
2.0 to 3.999MHz		6 to 12	
4.0 to 6.4999MHz		8 to 20	5
6.5 to 30.0MHz		16 to 25	6
21.0 to 90.0MHz	3rd Overtone	1.0 to 2.5	
60.0 to 150.0MHz	5th Overtone	<0.70	
85.0 to 210.0MHz	7th Overtone	<0.40	

Fig. 5 Frequency/Load Capacitance

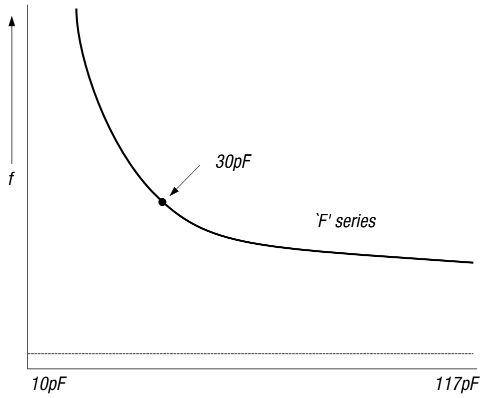
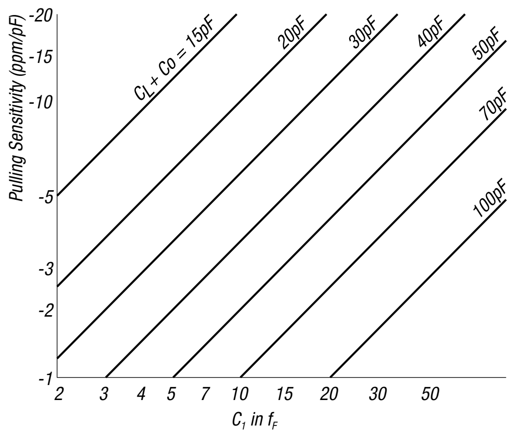


Fig. 6 Typical Crystal Pulling Sensitivity



BT CUT CRYSTALS

In the frequency range 1.0 to 200MHz, AT-cut crystals are normally chosen as they represent the best compromise between temperature related frequency stability, frequency accuracy and pulling capability (adjustment of frequency by external capacitance).

However, above approximately 27MHz AT cut crystals are normally only available operating in an overtone mode. Operation in an overtone mode restricts the design engineer by requiring circuit designs of greater stability than normal.

There is always a risk if the oscillator design is insufficiently rigorous for the frequency to revert to the fundamental mode of operation when the oscillator has been apparently designed to run in the third overtone mode. Additionally, crystals operated in the overtone mode often exhibit spurious responses within 200kHz of the main response and unless the ratio of the main response to the spurious is of the order of 4:1 the oscillator will run on the spurious response and so give an incorrect frequency.

Fundamental BT Cut Crystals

To overcome the above problems, CFP has designed a range of BT cut crystals which operate within the fundamental mode over the frequency range 18 to 46MHz, thereby almost doubling the frequency range over which crystals operating in the fundamental mode are available. These crystals are 1½ times thicker than AT-cut crystals, which allows them to be economically produced at higher fundamental frequencies. When introduced into an oscillator circuit, BT-cut crystals will run without any of the problems described above.

Specifications

- Holder style HC49
- Maximum frequency calibration at 25°C = 2.5ppm
- Frequency stability –10 to +60°C = 50ppm

Fig.8 shows typical frequency variations against temperature.

Overtone BT Cut Crystals

BT cut crystals are also available operating in overtone modes 3rd, 5th, 7th etc. In each overtone mode they are able to operate at a higher frequency than the equivalent AT-cut would be able to do. This will allow oscillators to be designed having higher frequencies than are normally obtained for any given overtone mode.

Fig. 7 Overtone Response of a Quartz Crystal

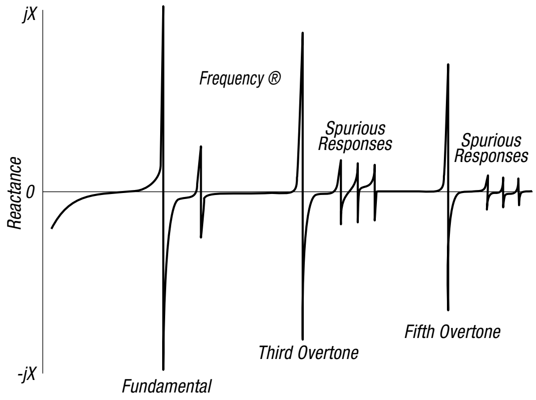
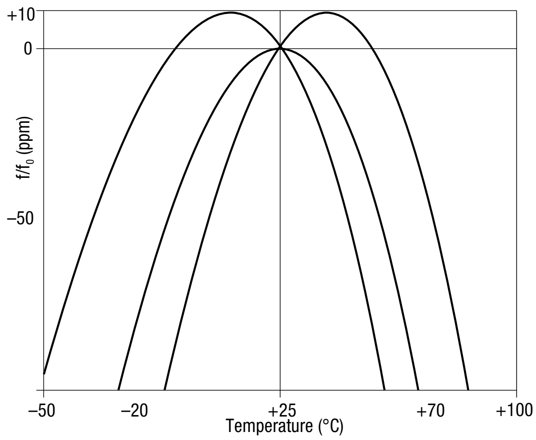


Fig. 8 Typical Frequency vs Temperature Curve



APPLICATION NOTES

CRYSTAL OSCILLATOR CIRCUITS

An oscillator circuit requires that two conditions be satisfied: that it contains an amplifier having sufficient gain to overcome the loss due to its feedback network, and that the phase shift around the whole loop is zero at the wanted frequency. It must be ensured also that the loop gain at other frequencies where the phase shift might be zero, is less than that at the wanted frequency. For example a crystal oscillator which is intended to operate at the crystal's third overtone frequency could do so otherwise at its fundamental.

When power is first applied to an oscillator the signal amplitude builds up until it is limited by the non-linearity of its maintaining amplifier or, by an external level-control circuit. In the former case, the limiting method employed by all but high-precision oscillators, the output waveform is therefore dependent upon the type of amplifier and its method of limiting, and the point of signal extraction. Any point in the circuit can be chosen to extract the signal as long as impedance levels are borne in mind. It is important that any loading be as light as possible in order to maintain a high circuit Q and, thereby, good short-term stability and low phase noise.

The Circuit Condition

Some of the circuits to be illustrated require crystal calibration at series resonance, while others require load-resonance calibration with a stated load capacitance value. The appropriate circuit condition must be stated when ordering crystals or, while they will oscillate, they will not do so at precisely the desired and marked frequency.

Below 150.0kHz

The relatively high equivalent series resistance of crystals in this frequency range demands a high amplifier gain. This can be provided as shown in Fig.9 by employing two cascaded common emitter bipolar stages. Component values are indicated for frequencies down to 50kHz.

The diodes D1 and D2 in the collector circuit of TR1 limit the crystal drive level to avoid damage and the tuned circuit in the collector of TR2 adds some selectivity. The crystal should be calibrated at load resonance with the mid value of the trimmer capacitor C2. Series-resonance calibration is recommended only if precise frequency trimming is not required as only a limited pulling range is afforded by adjustment of L1.

150.0 to 550.0kHz

DT and CT are the usual cuts for conventional crystals in this frequency range, for which a suitable circuit for those calibrated at series resonance is shown in Fig. 10. These cuts have a strong mode at about twice the wanted frequency which should not cause a problem.

L1, which must be initially adjusted for oscillation near the crystal frequency with the crystal shorted, may be used as a fine frequency trimmer. Series resonance crystal calibration should be specified but parallel resonant crystals may be used if C1 is replaced by a capacitor whose value is equal to the crystal load capacitance.

Fig. 9

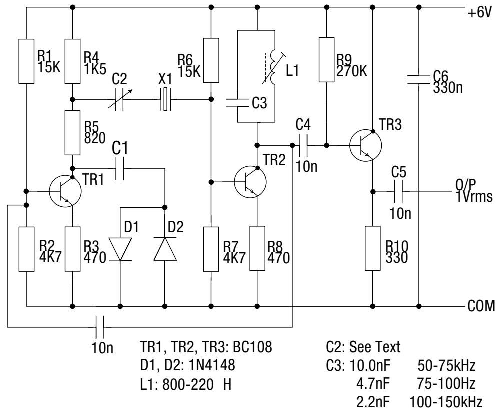
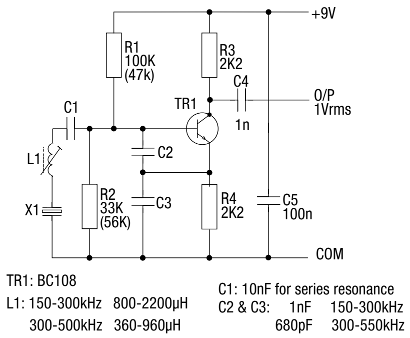


Fig. 10



0.95 to 21.0MHz

The circuit shown in Fig.11 is designed for use with high stability AT-cut fundamental mode crystals calibrated at load resonance. Specify 30pF load capacitance 950kHz to 10MHz and 20pF for 10 to 21MHz.

15.0 to 105.0MHz

Figs.12 and 13 give circuits suitable for operation with 15 to 63MHz third and 50 to 105MHz fifth overtone series resonant crystals respectively. A small positive frequency offset, +20ppm, will allow a wide trimming range.

When ordering an overtone crystal, reference must not be made to its fundamental frequency since it is not an exact sub-multiple of the overtone frequency. Overtone crystals are produced and calibrated specifically for operation at their marked frequencies.

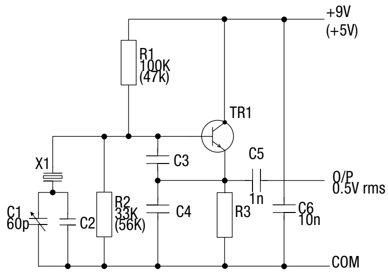
By including a tuned circuit at twice or three times the crystal frequency in the collector TR1 of these circuits, it is possible to extract, from the collector, harmonics of the crystal frequency. Such an approach offers an easy and economical solution to VHF crystal oscillator design.

Above 105.0MHz

The low reactance of stray circuit capacitances at these high frequencies can make a reliable oscillator design difficult to achieve. To help prevent oscillation not controlled by the crystal, the static capacitance Co of the crystal is often tuned out with a small parallel inductance – L2 in Fig.14. L1 in the circuit is tuned for maximum output but it can also serve a fine frequency trimmer. Alternatively, the frequency can be trimmed by inserting variable reactance in series with the crystal.

At these frequencies, it may be necessary to obtain correlation of the oscillator frequency with crystal frequency as measured by the crystal manufacturer. If high accuracy is required therefore, it is important to experiment with a sample crystal on which the manufacturer's precise frequency reading is known. Any discrepancy between the crystal and oscillator frequencies can then be remedied by calling for an offset calibration tolerance for further crystal supplies.

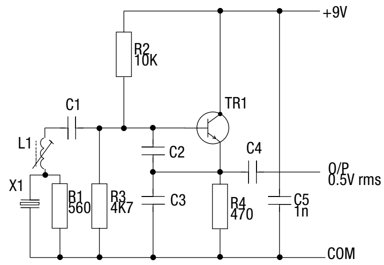
Fig. 11



TR1: BC 108

f(MHz)	R3	C2(pF)	C3(pF)	C4(pF)
0.95-3	3K3	not used	220	220
3-6	3K3	33	150	150
6-10	2K2	33	150	150
10-18	1K2	not used	100	100
18-21	680	not used	68	33

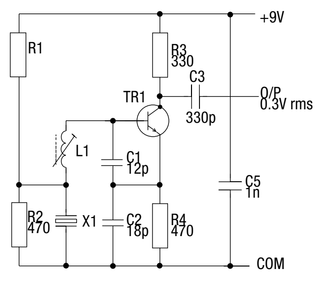
Fig. 12



TR1: BC 108
L1: 0.5 H - 3.0 H

f(MHz)	C1(pF)	C2(pF)	C3(pF)	C4(pF)
15-10	100	100	68	33
20-26	100	100	68	33
26-48	100	68	47	33
48-63	68	33	15	15

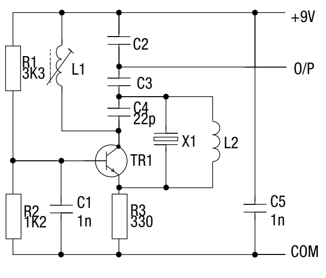
Fig. 13



TR1: BF 180
L1: 0.3 H-1.5 H

R1: 2K7 50-80MHz
1K2 80-105MHz

Fig. 14



TR1: BF 180

$\frac{C2.C3}{C2+C3} = 10pF$ Adjust the ratio to suit following circuit $L1 = \frac{1}{^2.7pF}$ $L2 = \frac{1}{^2.C_o}$

APPLICATION NOTES

TTL Clock Oscillators

Many circuits have appeared over the years that use TTL inverters and gates as the active elements. Often, such designs are prone to oscillate at unwanted frequencies or, for a variety of reasons, do not operate properly. Even certain integrated circuits which have been designed specifically for the purpose can be troublesome. As a general rule, extensive testing should be done on these circuits to make sure that the design is not marginal and will not result in belated problems.

Figs.16 to 18 illustrate some possible arrangements for use with the 7400, 7402, 7404 etc. Unused inputs of NAND gates should be connected to the positive supply and those of NOR types, to earth. The approximate frequency ranges shown apply only to standard TTL ICs; although with higher value bias resistors in Figs.16 and 17, the low power families can be used to advantage. In these two circuits, the value of C1 and C2 if found to be necessary, should be determined experimentally. For the frequency range 4 to 14MHz, the circuit of Fig.18 will give good results.

TTL gate circuits cannot be fully recommended if the highest stability is required. Random phase shift within the IC will cause jitter and the relatively high crystal drive level does not make for good long-term stability.

A conventional discrete component oscillator such as one already described, followed by a buffer amplifier provides a better way of obtaining a stable design. A suitable buffer is shown in Fig.15 in which the resistor R2 decouples the supply to the oscillator. The insert shows a Complimentary version of the buffer amplifier which can be used for a faster rise time when feeding capacitive loads. For operation of the circuits of Figs. 10 and 11 from a 5V supply, the values for R1 and R2 shown in brackets should be used. In order to reduce the output to a level suitable for the logic buffer, reduce R3 in Fig.9; and increase C3 and C4 in Fig.11. For the latter circuit, crystals calibrated for 30pF load capacitance can now be specified for use up to about 15MHz.

Fig. 15

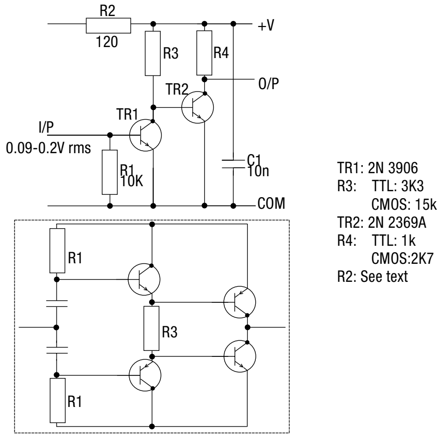


Fig. 16

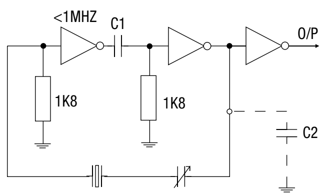
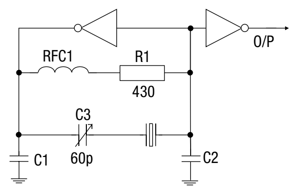
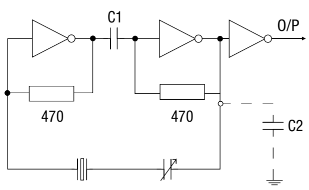


Fig. 18



f1(MHz)	C1 (pF)	C2 (pF)	RFC1 (H)
4.0 - 6.0	330	220	100
6.0 - 9.0	330	180	68
9.0 - 11.5	220	150	39
11.5 - 14.0	330	120	22

Fig. 17



CMOS Clock Oscillators

Fig.19 shows the circuit of a typical CMOS inverter oscillator in which the crystal is connected in a pi-network and operates at load resonance. Again, only one gate input is connected to the crystal; unused inputs are tied to the appropriate supply rail. Simple formulae for calculating the values of Ca, Cb and R are given which will result in a reliable 4000UB-series design for use up to about 3MHz. However, the actual values used may differ slightly owing to variations in the stray capacitances of individual layouts. If frequency trimming is required, a trimmer capacitor can be fitted in parallel with Cb and the fixed capacitor reduced accordingly.

If connections to the sources of each FET in the inverter are available, as in a 4007, the resistor value calculated for R may be inserted at these points, the single series resistor being no longer used. This arrangement, which is illustrated in Fig.20 gives better stability than the standard configuration due to negative feedback.

For operation above 3MHz, the resistor R is omitted and the crystal connected directly between the inverter input and output. The two pi-network capacitors will now have the same value and their series combination plus inverter capacitances and strays will be equal to CL. Low values of CL, for example 12pF, and/or a high supply voltage may be necessary for reliable operation.

If preferred, a discrete component oscillator together with the logic buffer of Fig.16 can be used. The power consumption however will be considerably greater than that of a CMOS inverter oscillator.

Frequencies 20.0 to 200.0MHz

The schematic of this VHF overtone oscillator is shown in Figs.21 & 22. The crystal operates at its overtone and is tapped into the capacitive side of the LC tank circuit. The circuit has no parasitic effects of any kind.

There are no 2.6V zener diodes available, so four signal diodes are cascaded in series for base biasing. The emitter's output resistance that drives the crystal is 25ohms. The crystal load impedance is mostly capacitive and is one or two times the impedance of C_2 (35ohms), depending on

Fig. 22

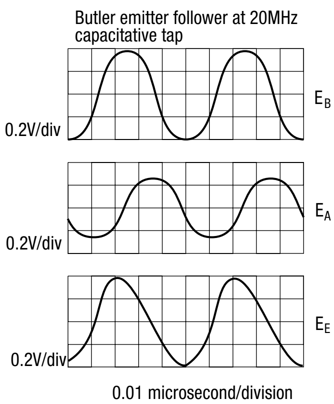


Fig. 19

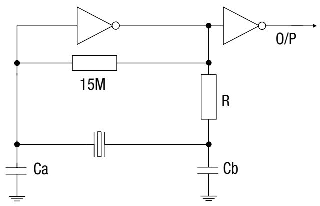


Fig. 20

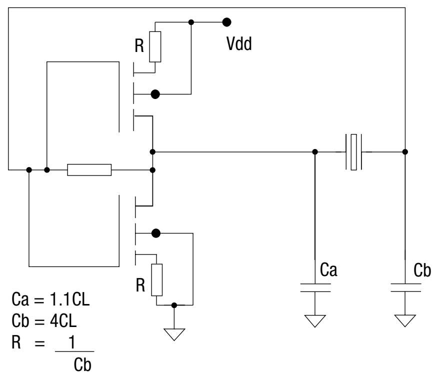
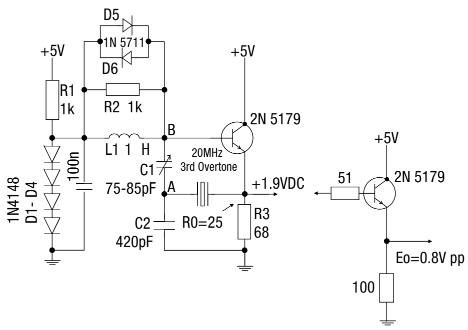


Fig. 21



the value of C. The crystals internal series resistance R_1 is between 30 and 40ohms.

The circuit works very well and the absence of parasitics is a big help. By tuning C, the oscillation frequency can be set either at or slightly above (2ppm) the series resonance.

Figs.23 & 24 show typical values for 50MHz and 100MHz operation.

Integrated Circuits as Oscillators

A large number of integrated circuits are available for use as an oscillator or include a crystal oscillator. Many existing IC's require only the attachment of an external crystal while some require other components as well. There are three main types of oscillator, the first provides a single bipolar or field effect transistor to which the external crystal and feedback network can be attached. For this class of circuit the designs shown for transistor oscillators are directly applicable and the frequency stability is generally good.

The second class of circuit, often using MOS technology, provides a gate which can be used as a crystal oscillator. The frequency stability is generally equivalent to that of oscillators using discrete gates of the same type.

The third class of circuit is designed with a multi-stage amplifier on the chip and the external crystal either closes the feedback path from the amplifier output to its input or it serves as a frequency-selective by-pass at some point in the amplifier. Many of these circuits are used as clock drivers for microprocessors, as frequency synthesizers, modems, TV circuits, phase-locked loops and the like. As might be expected, the frequency stability varies greatly with the design and while some are good, others are very poor indeed.

While it is desirable in the design of integrated circuit oscillators to use a set of analytical tools, the detailed equations for oscillation are generally too complex to be useful. Two approaches are presented here based on the terminal parameters of the integrated circuit. In those circuits where the crystal acts as a frequency-selective by-pass in the amplifier which is internally cross-coupled, it may be convenient to think of the circuit as a negative-resistive element in series with an inductance and a series compensating capacitor C in series with the crystal. For on-frequency operation with a series resonant crystal, C should be resonant with Lo at the nominal frequency of the crystal. The resistance Rn is a negative value and must be larger in magnitude than the equivalent resistance of the crystal for oscillation to take place.

It is possible to determine the magnitude of Rn in several ways. Perhaps the most obvious is to place a crystal between the appropriate terminals of the IC and add series resistance until oscillation will no longer occur. The magnitude of the negative resistance is then given by the sum of the crystal resistance and the additional series resistance. The magnitude of the oscillator inductance can be found by noting the difference between the frequency of oscillation and the series resonant frequency of the crystal (without C or the series resistance) and calculating.

Fig. 23

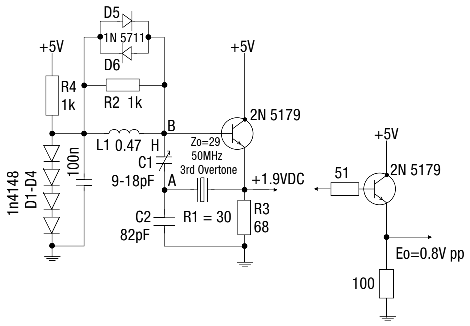
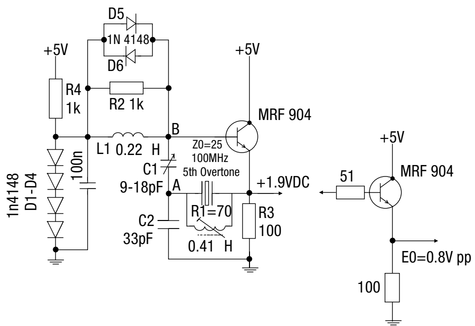


Fig. 24



It can also be found experimentally by selecting C to obtain the series resonant frequency of the crystal. Then:

$$L_O \quad \frac{1}{(2 \;\; _{fs})^2 C}$$

Since the equivalent inductance will in general vary as a function of frequency it should be computed near the nominal frequency of the crystal used.

It is desirable to minimize the equivalent inductance of an oscillator for several reasons. First the equivalent inductance of an oscillator will change with temperature and supply voltage, causing the oscillator frequency to drift. Secondly, it may result in free-running oscillations through Co of the crystal.

The equivalent inductance is a result of phase shift in the amplifier and can be minimized in the design by using as few stages as possible and by increasing bandwidth of the amplifier. The negative resistance will of course be a function of the gain of the amplifier and the impedance level where the crystal is placed.

Test data on several IC's of the cross-coupled type shows a wide variation in the equivalent inductance, from approximately 1- 2 H to greater than 250 H over the frequency range from 1 to 20MHz. Therefore, while some IC's operate with the crystal near series resonance, others operate as much as 1% low in frequency.

Frequencies 1 to 20MHz

The schematic circuit for this series resonant oscillator at 1MHz is shown in Fig. 25. The circuit waveforms are shown in Fig.26. This circuit has outstanding performance and works very nicely off a 5V supply. Waveforms at the crystal are very good. The frequency changes very little when power supply voltage or temperature are changed. The low ECL drive voltage keeps crystal dissipation low and the low ECL drive resistance R_L, which gives very good frequency stability. The ECL receiver format is well adapted to high frequency oscillator circuits. At high frequencies crystals are low impedance devices and ECL circuits can drive low impedance loads down to 50   easily. Input resistances of ECL circuits are high and they are also linear over the ECL voltage range. As shown in Fig.26 the crystals square wave drive waveform at Pin 3 has a definite slope during transition between binary states, indicating the ECL unit is operating as a linear amplifier during the transition interval.

Fig.27 shows the circuit at 20MHz. The crystals internal series resistance R_1 is 7   ; the crystals load resistance R_L is 10   . At 20MHz the ECL receiver has to be able to drive a 17   load (R_1+R_L=12   ), a very low value. The receivers output resistance is controlled by the ECL emitters output current, which is in turn controlled by the emitters pull-down resistor R_3. R_3=510   works well at 1MHz but has to be decreased to 100   at 20MHz to get the ECL output resistance down low enough to provide a reasonable drive waveform to the crystal.

There are three ECL receivers in one DIP. One of the two unused ones could be used as a no-cost buffer between the

Fig. 25

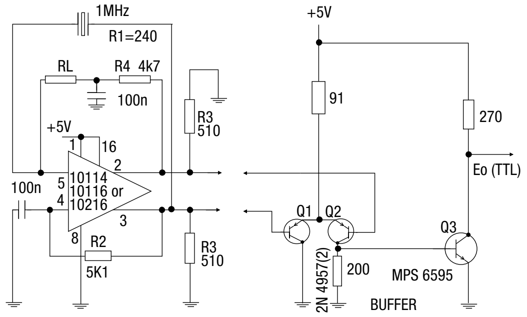


Fig. 26

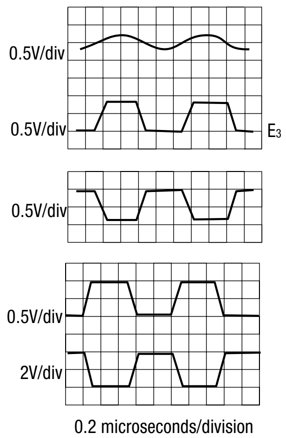
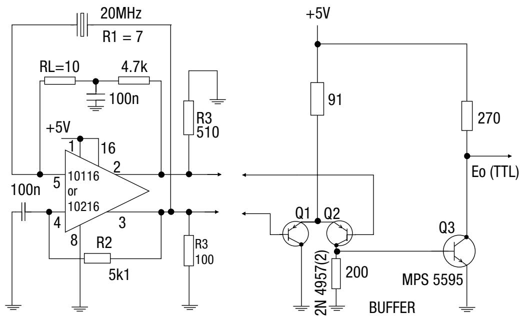


Fig. 27



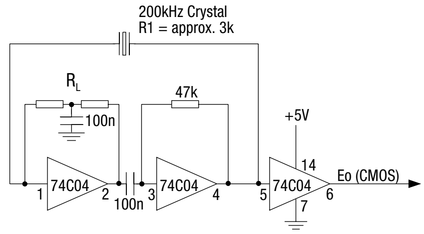
oscillator and the two transistor buffer, but the circuit will oscillate spuriously when the crystal is removed. Because of this the ECL receiver should not be used as a buffer.

Frequencies up to 500kHz (CMOS)

Each inverter in Fig.28 has negative feedback round it to ensure that it is biased in the middle of its linear region, so that oscillation will always start when power is applied. The feedback resistor round the first inverter is divided into two series resistors and the centre point is bypassed to ground. R_L is used as the crystals load resistor and is set equal to or somewhat less than the crystals internal series resistance R_1. Figs.29 & 30 shows good waveform at the crystal. The spikes on the crystal sine wave output appear to be due to sharp edges of the crystals square wave drive feeding through on the crystals shunt terminal capacitance CO.

The overall performance of this oscillator is average with on/off times of 2.45 sec to 2.55 secs. This is due to its frequency sensitivity to power supply voltage changes being higher than it should be. This high sensitivity to power supply voltage changes seems to be characteristic of most CMOS IC's.

Fig. 28



Note: Not suitable for miniature crystals

Fig. 29

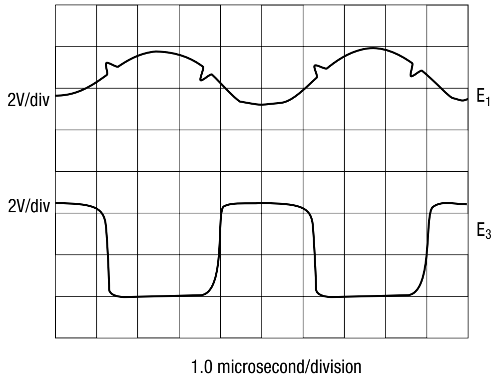
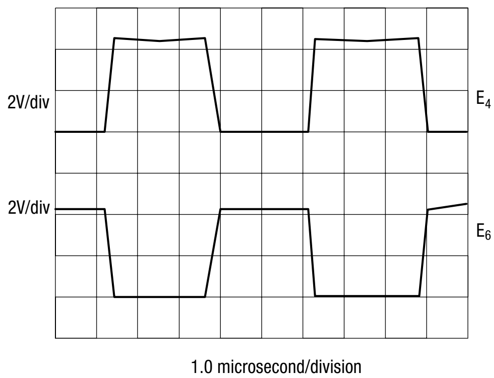


Fig. 30



TIME KEEPING WITH QUARTZ CRYSTALS

Since its introduction the 32.768kHz miniature watch crystal has become the most popular time keeping reference ever. This application note is intended to give some guidance as to the use of quartz crystals in time keeping applications.

In almost all circumstances designers will want to use simple logic gate oscillators for this application for the sake of convenience and cost. The criteria normally applied to this type of design are that it should be accurate, low in cost and low in power consumption. Using a watch crystal and CMOS logic all these criteria can be met.

In a CMOS oscillator circuit, power consumption rises with frequency and so it makes sense to reduce the operation frequency to a minimum, this is the reason for choosing 32.768kHz. The second way of reducing power consumption in a CMOS circuit is to reduce the size of any loads being driven. It is partly for this reason that watch crystals are designed to operate with typically a 12.5pF load, instead of the more usual 20 or 30pF. It also has to do with: a) the type of CMOS employed runs out of steam at the low voltages used in watches unless a low crystal load capacitance is used; b) in order to keep the crystal drive level low while maintaining adequate inverter input voltage, and c) to allow the use of a very tiny trimmer capacitor while still providing the necessary trimming range.

The basic requirements of a CMOS inverter oscillator can be met with a single gate and a handful of other components to provide bias and feedback. Fig 31 shows a typical circuit of this type. The load capacitance seen by the quartz crystal is the series combination of C_{out} and C_{in} together with any circuit strays including the logic gate input and output pin capacitances. The component values used in Fig 31 work well and give good correlation with measured test results obtained from a Saunders 140 crystal impedance meter.

The apparent load capacitance presented to the crystal is:

$$\frac{C_{out} \quad C_{in}}{C_{out} \quad C_{in}}$$

C_{out} = Gate output capacitor C_{in} = Gate input capacitor

This gives a figure of 6.9pF load. This is well below the required figure of 12.5pF, however both the input and output pins of the logic gate present an appreciable load. These additional values need to be added to the 6.9pF. These loads will typically be in the order of 3pF to 4pF per pin but can be up to 10pF and will also depend on the logic family used. These extra loads together with any stray capacitances in circuit should add up to approximately 12.5pF.

If a trimmable oscillator is needed, the 22pF output capacitor can be replaced by a fixed 10pF capacitor in parallel with a 2pF to 22pF trimmer. For best results NPO, COG or similar low temperature coefficient dielectric capacitors should be used for best stability.

Fig. 31 Watch Crystal Test Circuit

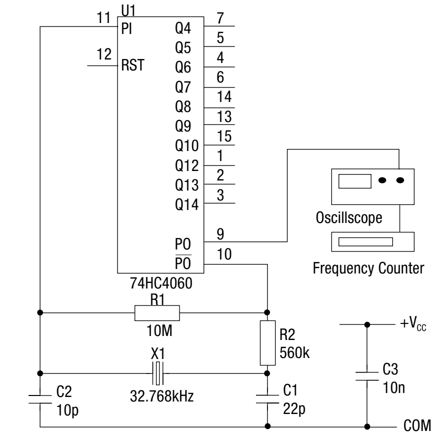
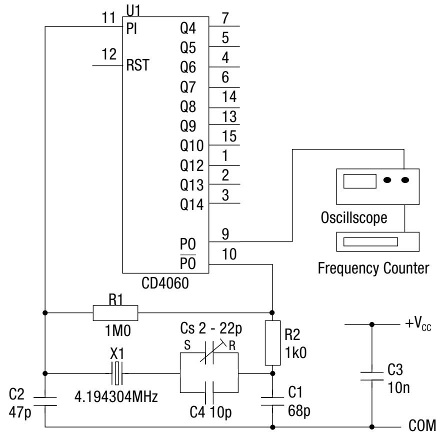


Fig. 32 AT Crystal Test Circuit



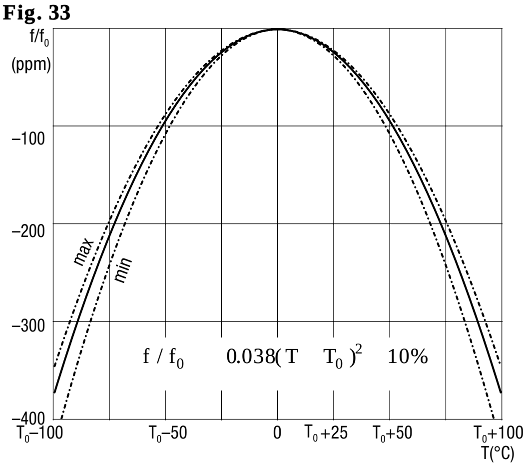
A frequently expressed requirement for oscillators such as this is close tolerance, often indeed in layouts in which no provision will be made for a trimmer. Apart from the effect of capacitor tolerances, it must be appreciated that because their values are low, the somewhat variable impedances attributable to the IC will result in a somewhat uncertain phase shift, hence oscillation frequency. A trimmer is recommended strongly, therefore, if precision better than say, ±50ppm, is needed, regardless of the actual crystal tolerance.

The other important effect is that due to temperature variation. Watch crystals and other similar types below 1MHz have a parabolic frequency-temperature characteristic with a design turnover temperature of 25°C, see Fig. 33. The tolerance of the turnover temperature and the parabolic curvature constant, typically ±3°C and 0.038 ppm/°C² respectively, mean that close tolerances can be maintained over only a limited temperature range. This is of little consequence in a watch, of course, since in use it is kept close to the crystal's turnover temperature, but it could render the choice of this type of crystal less cost-effective than an AT-cut unit if an operating temperature range wider than 0 to 50°C is desired.

A similar circuit for 4.194304MHz (32.768kHz

cut crystals is illustrated in Fig. 32. C3 and C4 are intended to facilitate precise frequency trimming of crystals calibrated at the standard clock crystal load of 12pF. If trimming is not required, either replace those capacitors with a 18pF or 22pF fixed unit (choose the value which results in oscillation closest to nominal frequency), or omit them altogether and specify the crystals for calibration at 30pF load.

Fig. 33



APPENDIX - Section Contents

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Stock & Model Index

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Puerto Rico	Future - Mayaguez	Distributor	+1 809 833 6267	+1 809 833 6267
Rhode Island	Advanced Components Group	Representative	+1 508 845 2023	+1 508 845 2051
Texas	Corwin Techologies	Representative	+1 512 515 5762	+1 512 515 5763
	Corwin Techologies	Representative	+1 972 780 0322	+1 972 780 1727
	Corwin Techologies	Representative	+1 972 682 4878	+1 972 682 4979
	FAI - Austin	Distributor	+1 512 346 6426	+1 512 346 6781
	FAI - Houston	Distributor	+1 713 952 7088	+1 713 952 7098
	FAI - Dallas	Distributor	+1 972 231 7195	+1 972 231 2508
	Future - Dallas	Distributor	+1 972 437 2437	+1 972 669 2347
	Future - El Paso	Distributor	+1 915 592 3865	+1 915 592 3818
	Future - Houston	Distributor	+1 713 785 1155	+1 713 785 4558
	Future - Austin	Distributor	+1 512 502 0991	+1 512 502 0740
Utah	FAI - Salt Lake City	Distributor	+1 801 467 9696	+1 801 467 9755
	Future - Salt Lake City	Distributor	+1 801 467 4448	+1 801 467 3604
Virginia	FAI - Charlottesville	Distributor	+1 804 984 5022	+1 804 984 5422
	Future - Charlottsville	Distributor	+1 804 984 4579	+1 804 984 4879
	Nexus Technology Sales, Inc.	Representative	+1 301 663 4159	+1 301 663 4671
Virginia (West)	Nexus Technology Sales, Inc.	Representative	+1 301 663 4159	+1 301 663 4671
Vermont	Advanced Components Group	Representative	+1 508 845 2023	+1 508 845 2051
Washington	Eclipse Marketing Group	Representative	+1 425 885 6991	+1 425 883 9481
	FAI - Seattle	Distributor	+1 206 485 6616	+1 206 483 6109
	Future - Seattle	Distributor	+1 206 489 3400	+1 206 489 3411
Wisconsin	ESCO Assoc. Inc	Representative	+1 847 298 5310	+1 847 298 3833
	FAI - Milwaukee	Distributor	+1 414 792 9778	+1 414 792 9779
	Future - Brookfield	Distributor	+1 414 879 0244	+1 414 879 0250

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