

MURATA

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In this issue:

Improved sensitivity
GHz noise suppression
Tiny 100 μ F MLCCs
Lowest profile IFs
Gyroscopes go automatic !
Detect micro-shocks
Versatile 2mm pots
Major Move to Pb-Free
Technical Notes:
EMI suppression
for DVI interfaces
Sensing the potential
of piezoelectric
ceramic materials
Slimmest choke coils
0.4mm Capacitors ?
Another world first
Yes, another world first
Late News ! Cadmium Free
trimmer potentiometers
DC noise suppression



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muRata
Innovator in Electronics

Improved sensitivity

Bluetooth® with its low power consumption, and WLAN/Home RF systems will benefit from Murata's GaAs MMIC for the 2.4GHz band.



Designed to aid the development of these applications, Murata's latest MMIC is in a SOT23-6 package (2.8 by 2.9 by 1.1mm nominal). Comprising low noise and driver amplifiers with internal input and output matching circuits, it has the following key features: one positive 3V supply, 4.5mA power consumption, small signal gain 15.5dB and a noise figure of 1.9dB. Input and output VSWRs are both 1.8 and output impedance is 50ohms.

Future developments will see this LM2400 family of products expand to include the 5GHz HiperLAN range. For more information on these and other products, please contact us at info@murata-europe.com.

Ref.1201

GHz noise suppression

An addition to our 0603 range of high frequency noise suppression filters increases designers' options when filtering at up to 6GHz.

The new filter provides a typical impedance of 1800ohms at 1GHz and about 600ohms at as high as 4GHz. It gives an effective filtering range of 100MHz to 6GHz. An added advantage is very low impedance change with current loading, so that impedance fluctuation under operating conditions is small.

Applications for these chip ferrite beads are with high-speed CPUs and buses, and interface lines in peripheral equipment. They will suppress harmonic noise in products with higher clock frequencies and minimise operation errors caused by local oscillators in mobile products.

The BLM18GG471 is specified as having 1800ohms $\pm 30\%$ impedance

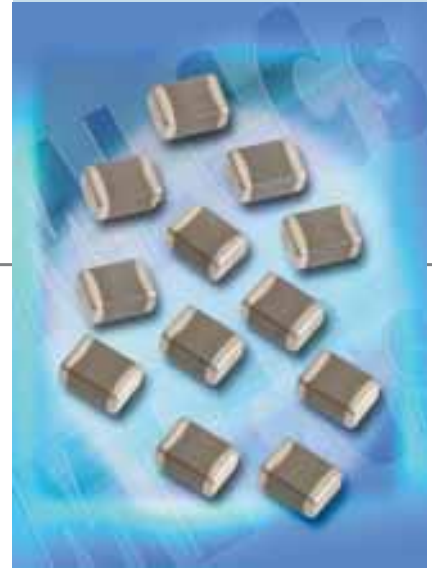


at 1.0GHz, is rated at 100mA and -55°C to 125°C . Maximum DC resistance is $1.0 \pm 0.3\text{ohms}$.

We recommend reflow soldering for all small components to ensure positional accuracy. At these frequencies, pad design has a significant effect on filter performance and our catalogue (C31E-10) contains advice on how to optimise performance.

For more information on these and other products, please contact us at info@murata-europe.com.

Ref.1202



Tiny 100µF MLCCs

Murata offers small, high value capacitors in high stability ceramic, by the application of advance processing technology and innovative material research. High C/V per unit volume provides 0.1µF to 100µF in a range of small sizes.

Not so very long ago the world struggled to get 1.0µF in any ceramic dielectric into a useably small space. Now, 1.0µF is in a minuscule EIA 0402 format (1.0 by 0.5mm) in X5R dielectric ($\pm 15\%$, -55°C to 85°C). More importantly, 100µF in the same stable hi-k materials as in the EIA 1210 format (3.2 x 2.5mm).

To make this possible, Murata has developed dielectric layers down to below $2\mu\text{m}$ and, with ultra-fine grain materials plus high variance technologies, using them to extend the possibilities for MLCC production and performance.

These new devices also feature high reliability and low ESR. They are suitable for decoupling applications in place of the larger and less efficient aluminium or Tantalum electrolytics. They are non-polarised and can withstand application of 150% rated voltage at 85°C for 1,000 hours. Try that with electrolytics!

For more information on these products, please contact us at info@murata-europe.com.

Ref. 1203

Lowest profile IFs

Murata 10.7MHz IF filters are the thinnest in the world at the time of going to print! With maximum thickness of only 1.0mm in SMD format, they solve space problems in mobile receivers.



The series is nominally 3.45 by 3.2mm and only two thirds of the thickness of our previous offering for these applications. This has been achieved by an improved ceramic material that provides enhanced strength, allowing a reduction in the thickness of an internal element. Combined with structural improvements this extends capability into the more robust requirements of automotive applications like tyre pressure monitoring and remote keyless entry systems. Of course, they are also suitable for more benign applications like card PHS modules and card FM radios.

These SFECD10M7 filters can be reflow soldered using lead-free solder at up to 260°C. They can be mounted by modern pick-and-place machinery and are packed in 180mm diameter reels.

For more information on these and other products, please contact us at info@murata-europe.com.

Ref.1204

Gyroscopes go automatic!

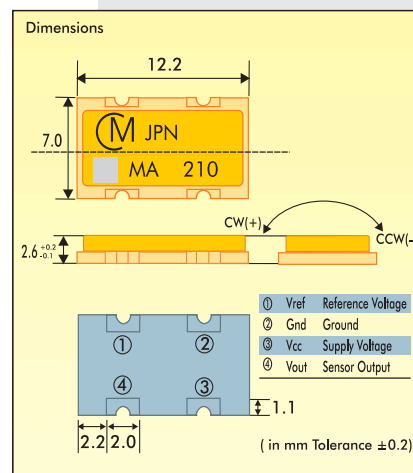


Murata's Gyrostar® piezoelectric gyroscopes have taken the world by storm, creating an entirely new gyroscope technology. Now they can be processed automatically.

Our miniature ceramic gyroscopes introduced the concept of the ceramic bimorph vibrator, comprising ceramic elements detecting the Coriolis force generated by angular velocity. Since then it has been refined and developed, getting more sensitive, smaller and more accurate.

The structure has changed to facilitate processing and size reduction. Now, a new rectangular structure reduced the size by something over 75% compared with earlier designs. However, until recently, the size was still not quite small enough for automatic handling. Today, with a footprint of only 12.2 by 7.0mm the new ENC-03M is small enough to be automatically processed, cutting processing costs and increasing component density. For convenience, 1,500 pieces are contained in plastic tape on 330mm diameter reels.

There is no performance loss in this change, but volume is down by 60% compared with the previous model. It still offers quick response, wide



dynamic range, low drive voltage and low current consumption (5.0mA max.). Linearity is $\pm 5\%$ of full scale.

It is already used for the detection of camera-shake; future uses will include robotics, head-mounted displays and pointing devices to name but a few. For more information on these and other products, please contact us at info@murata-europe.com.

Ref.1205

Detect micro-shocks

Our latest shock sensor is so sensitive that it can detect what you are thinking! Well almost, but it is ideal for protection of display cases, safes, equipment vibration, vending machine drop detection and a whole range of similar functions.



The PKS1-4B1 is compact, lightweight and very sensitive. At the same time it is very rugged and will serve as the shock and vibration detector in most types of equipment. This is a piezoelectric device with an element that produces an electrical signal proportional to the impact or vibration to which it is subjected. The element is a "unimorph" diaphragm comprising a piezoelectric ceramic disk laminated to a metal disk and supported around its periphery in a housing.

Typical output voltage is 40mV/G into a 20Mohm load at 1.0 to 10kHz and 25°C. Minimum insulation resistance is 30Mohms at 100Vdc. The circular case is 24mm in diameter and 5.5mm high.

For more information on these and other products, please contact us at info@murata-europe.com.

Ref.1206

Versatile 2mm pots

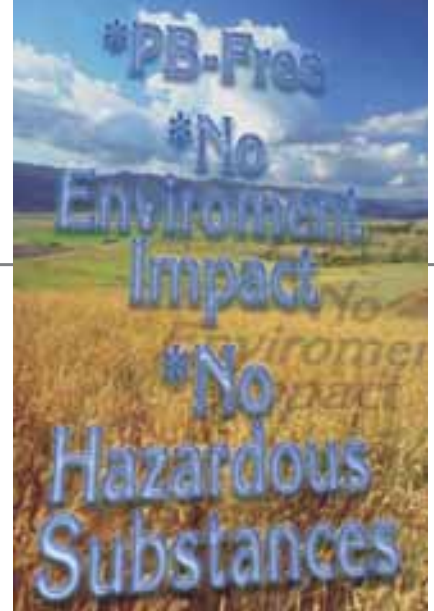
Murata's 2mm open potentiometers have special features and are useful in pick-up modules, cellular 'phones, digital cameras and other tight spaces.



With a 2.1 by 2.7mm footprint 1.0mm or less in height the PVZ2A series has a chip style construction and the PVZ2K has formed terminals for mounting in an aperture. Both have a two-part design that saves money and a cross-shaped driver slot for in-process adjustment.

Special plating techniques provide excellent solderability and a unique resin substrate allows high peak temperature reflow soldering. Maximum resistance values are from 500ohms to 1Mohm $\pm 30\%$, power rating is 0.1W at 50°C and the TCR is $\pm 500\text{ppm}/^\circ\text{C}$. The effective rotational angle is $240^\circ \pm 10^\circ$. For more information on these and other products, please contact us at info@murata-europe.com.

Ref.1207



Major Move to Pb-Free

In a big contribution to the reduction of Environmentally Hazardous Substances, helping customers to move to Pb-free soldering, Murata is eliminating Lead (Pb) from a significant part of our EMI filter range. Some 900 million parts sold around the world are becoming Pb free.

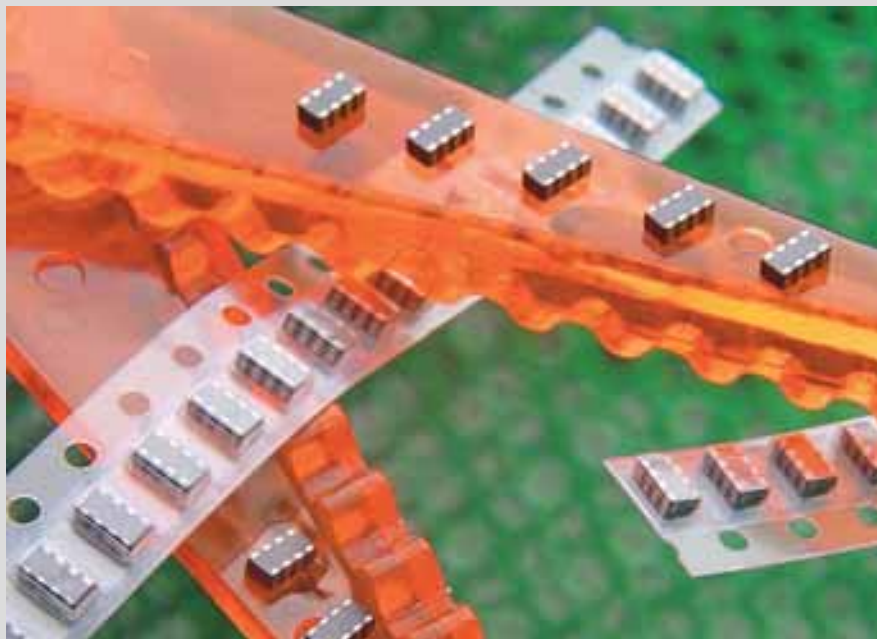
We have been actively reducing Pb in components and their terminations for some years. However, with the company's vast range of sophisticated components, it has to be a rolling process and this is another step in that direction. Many products have already become Pb free and others are making the transition as you read this information.

Most regular customers will be contacted directly by the local Murata office or their regular distributor. Generally, Tin-Lead on terminations and wires is replaced by Tin-Copper, inside components it will be changed to either Tin-Copper or Tin-Silver. Each product family has been assessed and there is no change in performance, solderability, wettability or bond strength. Test evidence is available to customers if required.

Parts affected include EMI filters with a varistor function, disk EMI filters and leaded ferrite bead inductors. For more information on these and other products, please contact us at info@murata-europe.com.

Ref.1208

Technical Notes



high speed transfer of high volumes of digital image data. DVI can transfer high quality images with considerably less degradation than the VGA approach, which is based on the analogue transmission of waveforms. In an analogue system, such as VGA, as signal transmission speeds increase, picture quality deteriorates as waveforms deform in transit and unwanted ghost effects are introduced.

DVI, meanwhile, deals with purely digital data and uses a technique called Transmission Minimised Differential Signalling (TMDS) which allows for faster communication with less likelihood of image degradation. As a result, DVI has started making significant inroads in such devices as personal computers, digital displays and projectors.

The TMDS image transmission format, developed by Silicon Image Inc, is also used in the High Definition Multimedia Interface (HDMI) standard, published last year. HDMI is already widely used in consumer audio-video equipment and is increasingly being adopted for use in set-top boxes, DVD players and digital TV's.

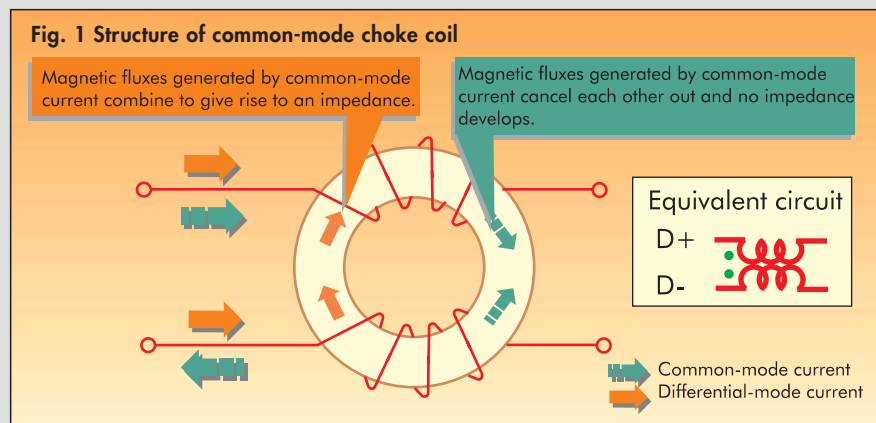
However, as with most equipment based on high speed digital circuitry, DVI based systems are prone to electromagnetic interference (EMI) problems. Designers are finding that even with the incorporation of conventional EMI suppression tech-

EMI suppression for DVI interfaces

Digital video imaging involves the transmission of high speed digital signals, and introduces attendant EMI challenges for circuit designers.

The growth in home entertainment systems is expected to be a major electronics industry driver over the next decade. It is fuelled by the increasing availability of high speed broadband internet access enabling efficient downloading of video data, home networking and the convergence of computer, communications and consumer devices. Whatever the ultimate nature of electronics systems in the home, whether it be a home server, a personal computer with TV incorporated or TV with PC incorporated, the need for larger format display screens is assured. In addition, the increased handling of higher resolution data, is driving the need for faster refresh rates and higher speed data transmission. But today's customers will no longer

tolerate the loss of image quality. For this reason, digital video imaging (DVI) is fast replacing the traditional VGA standard, and is becoming the de facto standard interface for the



niques, which have been effective in conventional differential transmission circuitry, noise is still a problem. A major issue is that the addition of an EMI filter, for example, can cause waveforms to lose their shape, making faithful data transmission impossible.

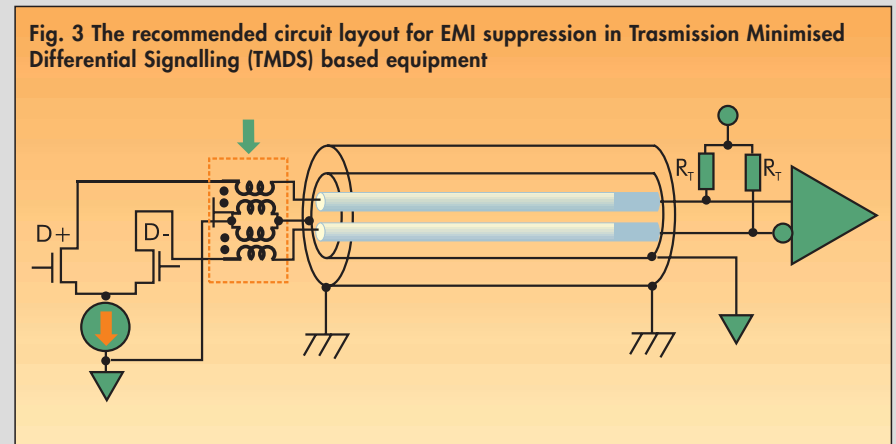
Choking out interference

Certainly, ferrite beads are no longer a viable solution. For relatively slow speed differential transmissions, such as full speed USB (at 12Mbps) and low speed USB (at 1.5Mbps), it is possible to suppress noise by using low pass filters such as ferrite beads. Such an approach continues to be effective for high frequency noise components travelling along signal lines.

However, DVI transmission rates are in excess of 1.6Gbps, and if ferrite beads are added to signal lines, not only is the extraneous noise component eliminated, but also the frequency components that make up the signals to be transmitted!

For high speed differential signals, such as those passing through DVI based systems, Murata has found that common mode choke coils are an effective method of eliminating noise because they focus on signal transmission mode differences rather than frequency differences.

The construction of a common mode choke coil is illustrated in Figure 1. Note the pair of signal lines wound on its ferrite core. Typically, on one side, common mode noise (common mode current) is generated via the



surrounding circuitry. This then combines with magnetic fluxes which are also generated, and impedance is developed as a result. Conversely, on the other side, magnetic fluxes generated by a differential transmission signal cancel each other out and no impedance develops. Based on this principle, it is possible to attenuate common mode noise without weakening differential signals while in differential mode.

For typical high speed differential transmission interfaces, the most effective approach is to employ a common mode choke coil between paired differential transmission lines.

This has certainly proved to be a satisfactory technique for LVDS (low voltage differential signalling) interface circuitry. However, there may still be cases in DVI and HDMI based circuits where this approach will not work sufficiently well, primarily because of the differences in the method of transmission.

It has been found that when pulse current alternately flows through two coils of the common mode choke coil, multiple reflections tend to develop on a PCB, between the transmitter and the common mode choke coil, due to impedance mismatches. The end result, once again, is that wave-

Fig. 2 Equivalent circuit of Murata DLP31D series

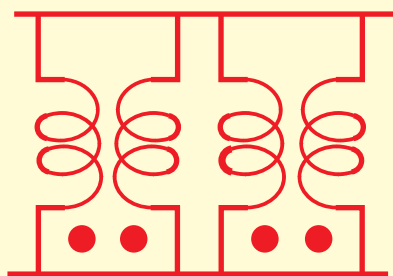
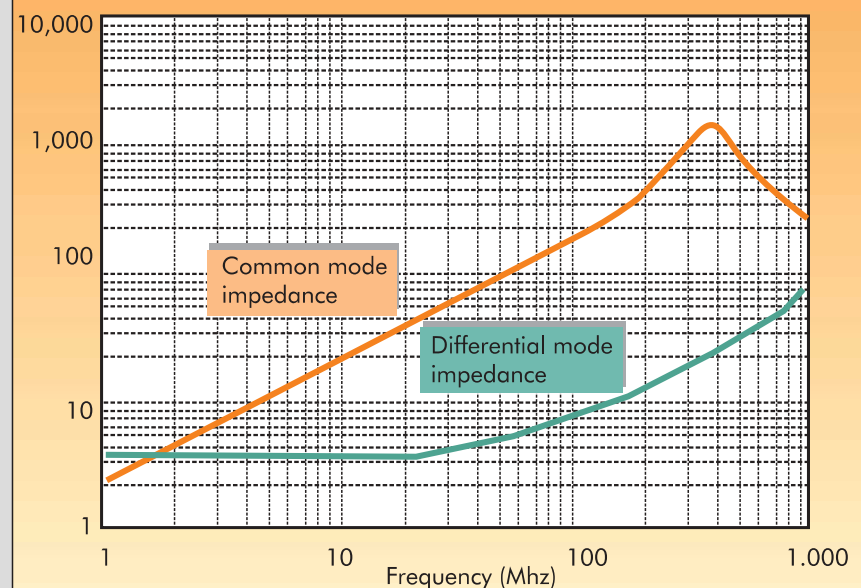


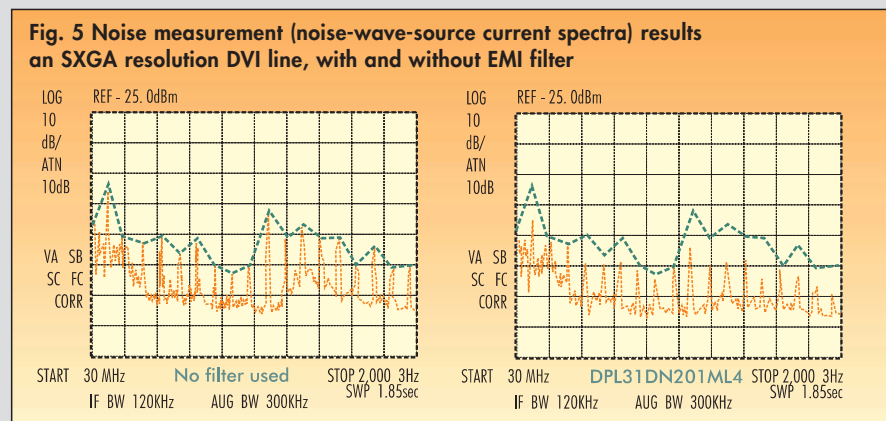
Fig. 4 Impedance vs. Frequency Characteristics of Murata DLP31D series



form quality is degraded. In such cases, the solution is to apply common mode choke coils where ground lines are combined with D+ and D- wires. Using this method, impedance can be generated only with respect to common mode current, resulting in radiated noise which is comparatively straightforward to reduce. Figure 3 shows the recommended EMI suppression method for TMDS circuitry, such as that adopted for DVI and HDMI based equipment. Note the use of the two circuit filters.

Arrayed solution

The EMI filter recommended for this approach is Murata's DLP31DN201ML4 common mode choke coil array. Each DLP31D series array is a two circuit filter block incorporating two common mode choke coils. This is a far more cost effective and space saving approach than using two discrete single circuit filters. The common mode impedance of the choke coil array at 100MHz is specified at 200ohms. Rated voltage is 10Vdc and rated current 100mA. DC resistance is less than 2.2ohms



while insulation resistance is greater than 100Mohms.

Consider a typical DVI line (SXGA resolution), at a clock frequency of 108MHz. The results of using and not using a DLP31D series common mode choke coil array can be clearly seen in Figure 5.

The combination of the common mode choke coil array and the ground lines effectively reduces noise without disturbing the waveform. Murata has considerable applications expertise in the use of EMI suppression measures for DVI and HDMI

circuitry. The company supplies a variety of components designed to eliminate the problems of EMI in high speed digital and differential transmission environments. Such techniques are already becoming widely adopted in a various systems requiring the fast transmission of high resolution images. Murata is continuing to develop and improve its component range, and current efforts are concentrated on enhancing performance while miniaturising the components still further.

Ref. Tech12a

Sensing the potential of piezoelectric ceramic materials

Piezoelectric ceramics are a type of multi-crystal dielectric with a high dielectric constant.

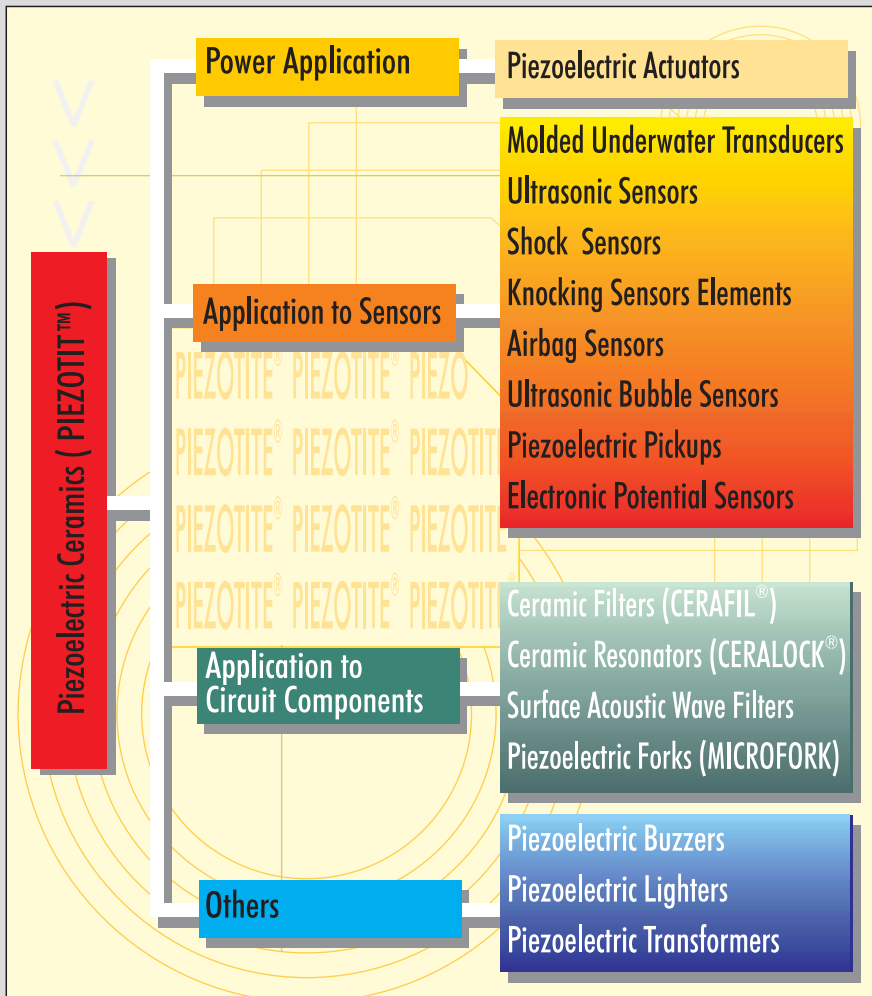
In operation, the piezoelectric effect causes a crystal to produce an electrical potential when subjected to mechanical vibration. Conversely, the reverse piezoelectric effect causes the crystal to produce vibration when it is placed in an electric field.

Applications for piezoelectric ceramic technology are broad and diverse.



The electrical to mechanical transducer can be applied to piezoelectric actuators, piezoelectric fans and ultrasonic cleaners whereas the mechanical to electrical transducer is at the heart of ultrasonic sensors, knock sensors, shock sensors and acceleration sensors. The range of generic electronic component appli-

cations for piezoelectric transducers includes ceramic filters, ceramic resonators, surface acoustic wave filters along with many other niche areas. The advantages of piezoelectric ceramic components include: high electromechanical transformation efficiency; high machinability; high stability; and low costs in volume pro-



duction. In addition, a broad range of characteristics can be generated through different material compositions, thereby continuing to expand the application of the technology into a wide range of industries. Murata has long been a major player in the piezoelectric ceramic industry and continues to direct extensive research and development efforts into this branch of materials technology. Meanwhile the company offers a wide range of products based on piezoelectric materials.

Murata's Piezotite™ material is used for a variety of component applications including actuators, transducers, filters, resonators and buzzers. The piezoelectric actuator ranges (P-5E, P-7 and P-7B) for example, provide precise displacement from 0.01µm to several hundred µm, simply by controlling the applied voltage.

Applications for these devices include tracking adjustment of VCR heads, focus adjustment of VCR cameras, shutter drives of cameras and ink jet printers. Applications can also be found in the industrial and instrumentation markets.

Murata's Piezotite™ ceramic sensor range includes moulded underwater transducers, typically used in fish finders and depth sounders. The device emits an ultrasonic wave into the water and the appropriate receiving device can detect the reflected wave.

Ultrasonic sensors (MA40 series) are built using either an open or closed structure, which is compact and light weight, offering high sensitivity and sound pressure. Waterproof and high frequency versions are also available.

Applications for these sensors include burglar alarms, range finders, auto-

matic doors, automatic rear sonar, parking meters and remote control devices.

The PKGS series of shock sensors consist of an acceleration sensor with two terminals. The device is used to detect acceleration and/or shock applied from the outside, and converts this energy to an electrical signal. The surface mount devices feature high sensitivity and excellent

Fig.1 Structure of the shock sensors PKGS series

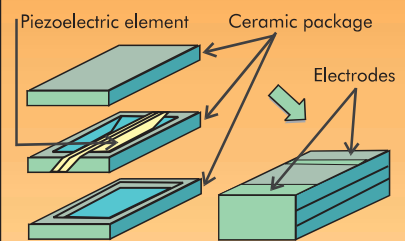
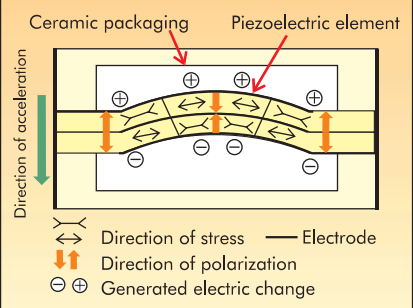


Fig.2 Acceleration detection principle of the shock sensor



durability. For all applications the axis of detection can be changed (either X, Y or Z) so that the appropriate shock sensor can be selected. For other applications, such as car burglar alarms, intruder sensors and vibration sensors for car audio equipment, Murata offers the PKS1 range of shock sensors. The piezoelectric element produces a voltage that is proportional to the impact or vibration to which it is exposed. The impact energy again being converted to an electrical signal.

Other application specific piezoelectric ceramic sensors have been developed by Murata, including knock sensors for car engines and ultrasonic bubble sensors for vending machines.

Ref. Tech12b

Slimmest choke coils

The smallest in the industry from Murata again! This time it is 1.025mm³ common mode choke coils (CMCCs) for noise suppression in high-speed signal lines.

As digital cameras, PDAs and the like get smaller and their operating systems get faster, space for noise suppression gets tighter. Among Murata designs for such situations is this family of Murata CMCCs. Never thicker than 0.92mm, with a nominal footprint of 1.0 by 1.25mm and tight dimensional tolerances, external electrode pitch approaches that of IC pinch-pins at 0.55mm. DLPSNs are the product of a combination of advance ferrite material and film micro-fabrication technologies.

Electrically, good common mode filtering is combined with low differ-



rential mode impedance, ensuring minimal impact on signal waveform. For example, the CM impedance of the 200Ω version offers a differential mode impedance of just 10Ω.

Typical nominal values of 90, 120, 160 and 200Ω are available, rated voltage is 5V with rated currents between 130 and 160mA. DC resistance is between 1.4 and 2.5Ω, insulation resistance 100MW mini-

mum and the operating temperature range is -40°C to 85°C.

As the terminal pitch allows PCB tracks be laid out in straight lines matching the IC pitch more space is saved and filtering is further enhanced. For details of this and other Murata products please contact us at info@murata-europe.com.

Ref.1209



0.4mm Capacitors ?

Yes, for those who still think in inches, we are now talking about capacitors with a maximum dimension of ~16 thousandths of an inch.

These are Multilayer Ceramic Chip Capacitors (MLCCs) with all the usual advantages of COG and stable high K X5R dielectrics. Full dimensions are 0.4 x 0.2 x 0.2mm (01005). By comparison with the previously smallest available size (0201) this reduces the PCB footprint by about 50% and volume by roughly 70%.

As usual, Murata leads the world and we have patents pending on this technology.

Electrically, the 33% reduction in length results in lower inductance, further improving the performance at high frequencies. The initial capacitance range is between 2pF in COG dielectric and 10,000pF in X5R.

Making multilayer devices with these dimensions calls for far higher precision fabrication technologies. To maintain our high standards we have enhanced our printing, laminating and cutting processes. Used with our thin-layer dielectric materials this is what makes values as high as 10,000pF possible in this 01005 package. Furthermore, terminals have an electroplated structure offering excellent soldering heat resistance.

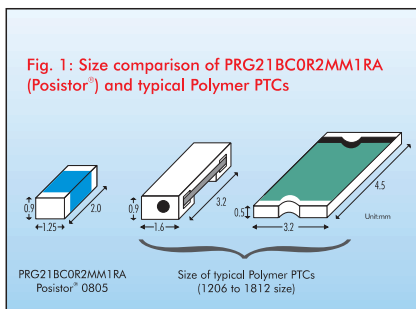
For more information on these and other products, please contact us at info@murata-europe.com.

Ref.1210

Another world first

Murata invented the POSISTOR[®], an improved ceramic chip PTC thermistor. Now we introduce the first ever multilayer ceramic POSISTOR[®]. Superior to any Polymer, it has the lowest minimum resistance in the smallest body yet.

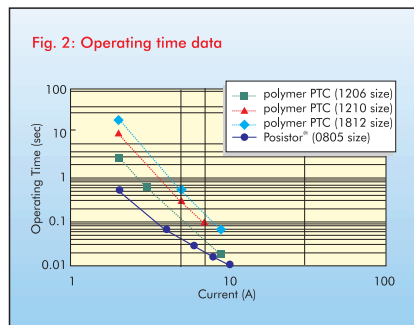
The qualities of components depend on their materials. Murata develops and makes the materials and the components, giving us total control over everything that can influence performance!



The new Thermistor is Pb-free (PRG21BCOR2MM1RA), and 0805 sized (world's smallest) (Fig.1). The nearest alternatives are 1206 or 1812 in the less effective Polymer. Minimum resistance at 25°C is 0.2ohms, again the best available. Non-operating current at 60°C is 500mA, operating current at -10°C is 2000mA and maximum voltage is 6Vdc.

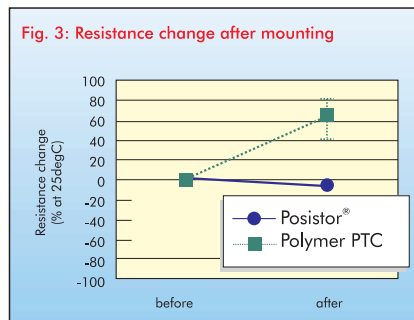
This is ideal for over-current prevention in USB and microcomputer circuits. It reduces the number of components needed while the combination of ceramic material with low volume (2.25mm³) gives faster response than Polymer types (Fig.2).

That speed, with our better stability, provides greater operating accuracy. Furthermore, the PRG21 is superior to Polymer in other ways. Comparing



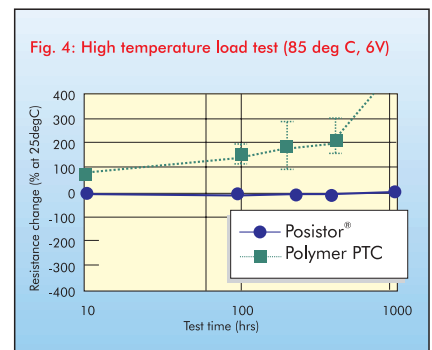
resistance change in Ceramic and Polymer devices, ceramic wins every time.

With initial resistance of 0.2ohms at 25°C, Polymer responded to soldering heat with a 60% increase when subsequently measured at 25°C. Ceramic by comparison, showed only a minor negative change (Fig. 3). 1000-Hour no-load tests at 85°C produced a dramatic resistance change in the Polymer and negligible change in the Ceramic.



Most important and dramatic, were the tests for long term performance.

1000-Hour load tests at 85°C and 6.0Vdc showed little change in the Ceramic but >400% resistance increase in the Polymer before the end of the 1000 hours (Fig. 4). In intermittent load tests at -20°C/6Vdc the Polymer resistance initially stabilised at about +100%, but rose rapidly at a little over 100 cycles to a final 200% plus. Again, the Ceramic was stable, showing only a minor increase at the very end of the test period.



As in so many comparisons with other materials, ceramics combined with Murata's world class materials capabilities, produce components that are easier to use, provide economies beyond the sell price and out-perform the alternatives. For more information on these and other products, please contact us at info@murata-europe.com.

Ref.1211

Late News! Cadmium Free trimmer potentiometers

Murata is now mass producing Cadmium-free cermet resistive materials, becoming the worlds first Pot's supplier to realise Cadmium-free production of complete ranges.



Previously, all trimmer potentiometers utilising cermet resistive materials for industrial use have contained a small

amount of Cadmium. We, Murata, have already succeeded in making Cadmium-free chip potentiometers

(PVA3, PVS3) and some through-hole potentiometers (PV32, PVM6 and PV12). Now, we introduce 10 new Cadmium-free series of potentiometers, the PVG3, PVM4, PVG5, PV01, PVC6, PV34, PV37, PV23, PV22 and PV36. Detailed specifications are available on the Murata website at www.murata.com.

These Cadmium-free families meet the "Restriction of hazardous substances in electronic equipment, (2002/95/EC) Directive." This requires that, from 1st July 2006, new electrical and electronic equipment on the market does not contain mercury, cadmium, hexavalent chromium etc.

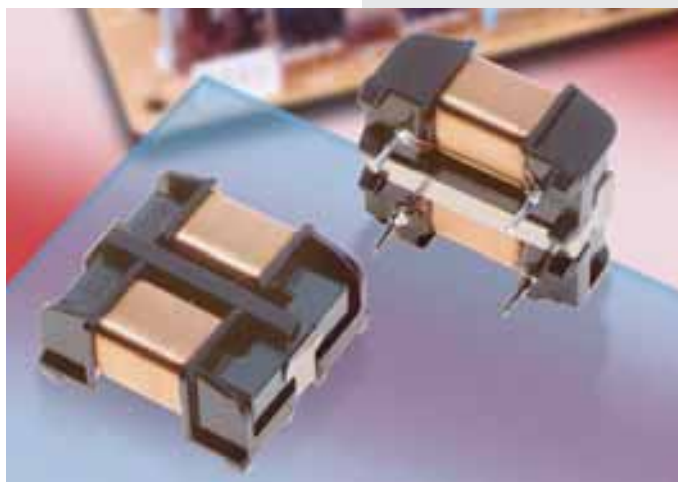
This is another example of Murata innovation and material technology helping our customers to meet future legislation.

Ref.1212

Yes, another world first

Suppress Conducted and Radiated Disturbance with one component in place of three! Murata's new Hybrid Choke Coil (HCC) is both a common mode and a differential mode choke..

This provides better noise suppression at frequencies above 30MHz than discrete filters for each mode. Today, these noise forms are a significant problem in lighting devices and household digital appliances. Until now, suppressing these noise sources required three components, a common mode and a differential mode choke coil for line conducted noise, plus a high frequency common mode choke for radiated noise. Switched mode power supplies, lighting ballast, medical equipment and audio products are among the



obvious applications for this new invention.

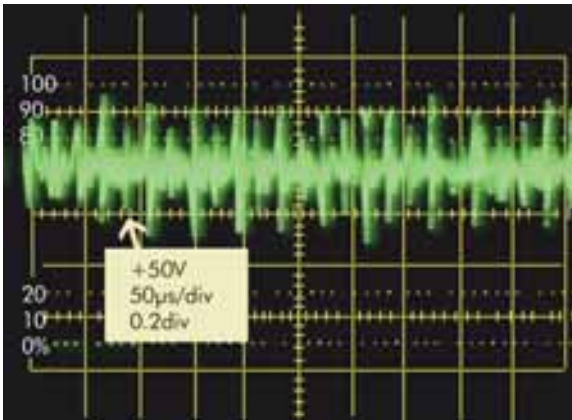
Clearly, three components represent both cost and space problems. Both are solved by our new PLY17 range of HCCs, all in a 24.5x22.5mm package 12.5mm high. There are ten common mode inductance values between 1.0 and 9.3mH. Each value has a standard and a high perfor-

mance version, the latter having a higher differential mode inductance, allowing optimum matching of component to the noise generated, and giving the designer 20 options. For more information on these and other products, please contact us at info@murata-europe.com.

Ref 1213

DC noise suppression

Noise suppression in high current DC lines gets easier with our latest 15Amp low DC resistance block filter.



This filter is designed specifically for the suppression of noise in large screen displays. It employs Murata's advanced discrete components to achieve high levels of filtering in a relatively small component (12 x 11mm, 8mm high).

Insertion loss between 1MHz and 1GHz is a minimum of 40dB at 20 to 25°C with a line impedance of 50ohms. DC resistance is typically 0.8mohms, rated voltage is 50Vdc, withstanding voltage is 125Vdc and minimum insulation resistance is 500Mohms.

The operating temperature range is -40°C to 125°C with current derating necessary at 85°C and above. For more information on these and other products, please contact us at info@murata-europe.com. Ref. 1214

Contacting us:

One-stop information. E-mail your requirements to info@murata-europe.com and our nearest office will contact you with the information you need.

Alternatively, you can enquire your local Murata office, your preferred distributor (see right) or go to <http://www.murata.com>, for access to our product search engine.

Specifications:

Data published in Murata Mail is continuously being updated. Before finalising your design, please tell us about your requirements to ensure that you have the latest information on the products that you intend to use.

Murata Europe Management GmbH
Holbeinstrasse 23
90441 Nuernberg - GERMANY
E-mail: mail@murata.de

Murata Elektronik GmbH
Holbeinstrasse 23
90441 Nuernberg - GERMANY
E-mail: info@murata.de

Budapest office:
Buda Plaza Irodaház, Budafoki út 111
1117 Budapest - HUNGARY
E-mail: info@murata.de

Murata Electronique SA
18-22, Avenue Edouard
Herriot, COPERNIC 6
92356 Le Plessis Robinson Cedex - FRANCE
E-mail: info@murata.fr

Murata Elettronica S.p.A.
Via San Carlo,1
20040 Caponago (Milano) - ITALY
E-mail: info@murata.it
Rome office: Via Castelrosso, 6
00144 Rome - ITALY

Murata Electronics (UK) Ltd
Oak House, Ancells Road,
Ancells Business Park
Fleet, Hampshire - GU51 2QW (UK)
E-mail: enquiry@murata.co.uk

Murata Electronics (Netherlands) B.V.
Daalmeerstraat 4
2131 HC Hoofddorp - THE NETHERLANDS
E-mail: info@murata.nl

Spanish office:
Centro de Empresas
Parque Tecnológico del Vallés
08290 Cerdanyola - Barcelona SPAIN

Nordic office Sweden:
Strandbergsgatan 61
112 89 Stockholm - SWEDEN

Nordic office Finland:
Pakkalankuja 7 - FIN-01510 Vantaa
FINLAND

Murata Electronics Switzerland A.G.
Isenrietstrasse 19
8617 Mönchaltorf - SWITZERLAND
E-mail: info@murata.ch

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