GS003

In-Circuit Debugging Interface Options with dsPIC DSC

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INTRODUCTION

This document describes useful options that facilitate in-circuit debugging of dsPIC30F embedded application programs.

MULTIPLE DEBUGGING CHANNELS

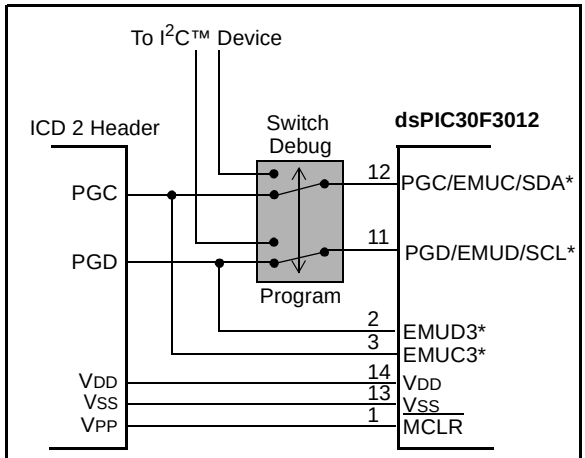
dsPIC30F Digital Signal Controllers use Microchip's low-cost development tool, MPLAB® ICD 2 In-Circuit Debugger for both programming and in-circuit debugging. MPLAB ICD 2 provides a 5-pin interface to the dsPIC30F device. These pins are: VDD, VSS, MCLR, PGC/EMUC and PGD/EMUD. The PGC/EMUC and PGD/EMUD pins are used to communicate clock and data signals, respectively, between the MPLAB ICD 2 unit and the dsPIC30F device during programming and debugging operations.

To give you flexibility in board layout, dsPIC30F DSC devices provide multiple options for connecting the MPLAB ICD 2 to your target board for in-circuit debugging. dsPIC30F devices are available in packages ranging from 18 to 80 pins. Devices in small packages often have several peripheral functions multiplexed on each pin (see Figure 1). In certain cases, the default programming and debugging pin functions, PGC/EMUC and PGD/EMUD, are multiplexed on pins that may be used by other peripherals like the I2C™, SPI™, or UART modules. In such cases, the application is able to use these pins for programming, however they cannot be used for in-circuit debugging. In-circuit debugging should then be performed using alternate debugging channels, as listed in Table 1. You should note that the device programming and connect operations using MPLAB ICD 2 will continue to require the use of the PGC and PGD pins.

TABLE 1: DEBUGGING CHANNELS

Pin Name	Pin Function
EMUD EMUC	Default Debug Data pin Default Debug Clock pin
EMUD1 EMUC1	Alternate Debug Channel #1 Data pin Alternate Debug Channel #1 Clock pin
EMUD2 EMUC2	Alternate Debug Channel #2 Data pin Alternate Debug Channel #2 Clock pin
EMUD3 EMUC3	Alternate Debug Channel #3 Data pin Alternate Debug Channel #3 Clock pin

FIGURE 1: TYPICAL ALTERNATE DEBUGGING CHANNEL



*** Pin Multiplexing on dsPIC30F3012 (PDIP Package):**

Pin	Multiplexed Functions
2	**EMUD3**/AN0/VREF+/CN2/RB0
3	**EMUC3**/AN1/VREF-/CN3/RB1
11	**PGD/EMUD**/AN6/U1TX/SDO1/**SCL**/CN6/RB4
12	**PGC/EMUC**/AN5/U1RX/SDI1/**SDA**/CN7/RB5

DESIGN PROCEDURE

To make use of these alternate debugging channels, a few steps need to be taken:

1. Before you lay out your circuit board, decide whether you will need to use alternate debugging channels.

   For instance, assume that an application running on a dsPIC30F3012 requires the SDA and SCL pin functions to communicate via the I^2C protocol with other components on the board. On the dsPIC30F3012 device, the SCL and SDA pins (11 and 12) are multiplexed with the default in-circuit debugging pins, EMUD and EMUC, respectively. So, this application requires an alternate in-circuit debugging channel.

2. Select the alternate debugging channel to use from EMUC1/EMUD1, EMUC2/EMUD2 or EMUC3/EMUD3.

   For the hypothetical application, assume that pins 2 and 3 on the dsPIC30F3012 are available for use during in-circuit debugging operations. Thus, you would use EMUC3 and EMUD3 as the alternate in-circuit debugging channel for this application.

3. While designing your board, provide a connection between the PGC and PGD pins on the MPLAB ICD 2 unit and the selected alternate debugging channel, EMUC3 and EMUD3, as shown by the switch in Figure 1.

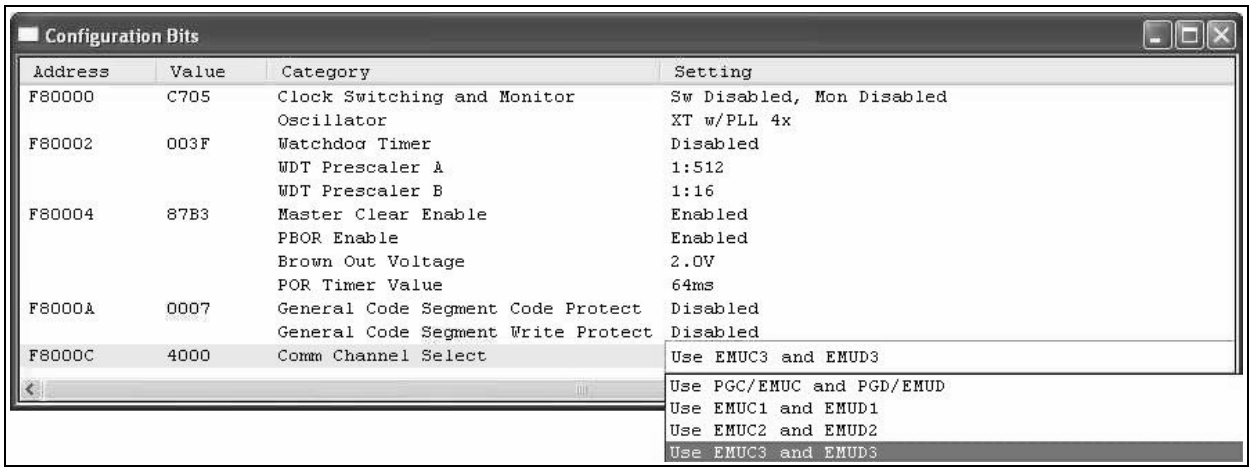
4. Before downloading code (programming) into the target device, you'll need to set the configuration bits dialog in MPLAB IDE to accurately reflect the selected in-circuit debugging channel. MPLAB IDE, by default, uses the PGC/EMUC and PGD/EMUD pins for programming and debugging. For the hypothetical application you'll set the "COMM CHANNEL SELECT" option to "Use EMUC3 and EMUD3", as shown in Figure 2. The configuration bits dialog is invoked by selecting the *Configure>Configuration Bits* menu in MPLAB IDE.

5. During a programming or connect operation (with MPLAB ICD 2 selected as a Debugger), the switch (or jumper) should be positioned so that the MPLAB ICD 2 unit communicates with the target dsPIC30F device via PGC and PGD (pins 12 and 11, respectively).

6. When programming is complete, the switch (or jumper) should be positioned so that the MPLAB ICD 2 unit communicates with the target dsPIC30F device via EMUC3 and EMUD3 (pins 3 and 2, respectively).

7. You are now ready to perform in-circuit debugging operations using such functions as Reset, Run, Single-step, Halt, Set Breakpoint, etc.

FIGURE 2: EXAMPLE MPLAB® IDE CONFIGURATION BITS DIALOG

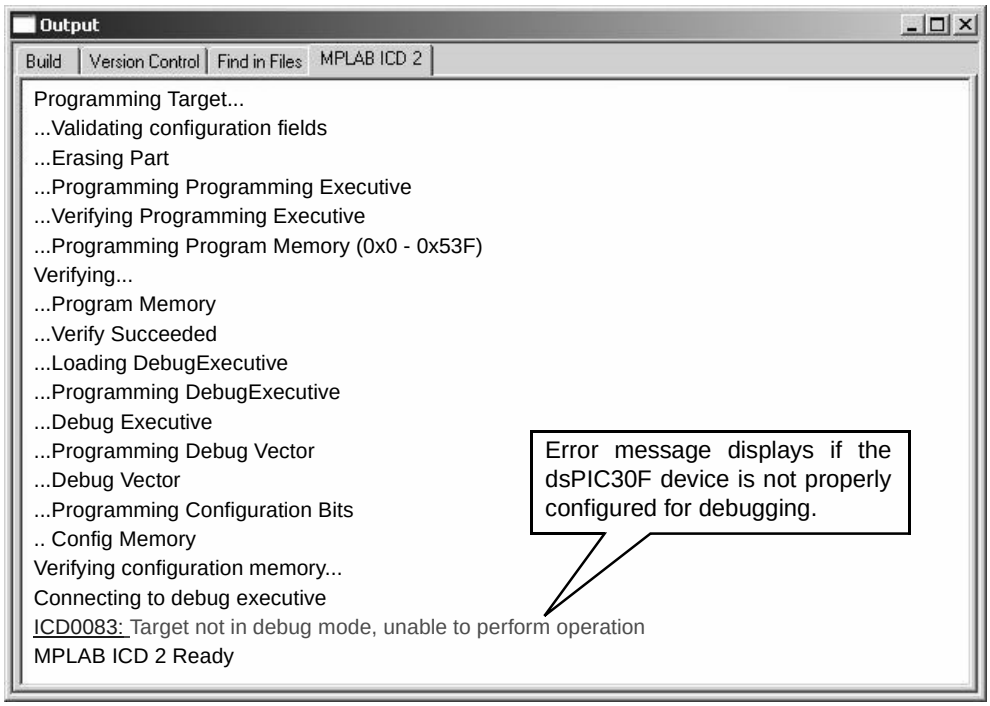


MPLAB ICD 2 ERROR HANDLING

If any of the steps detailed in this document were not performed, MPLAB IDE may display an error message such as shown in Figure 3.

This error message is displayed because MPLAB ICD 2 is not able to communicate with the Debug Executive running on the dsPIC® DSC. This communication failure occurs because the Debug Executive expects to communicate with MPLAB ICD 2 on a channel (for example EMUC3 and EMUD3) different from the board configuration (for example EMUC and EMUD).

FIGURE 3: EXAMPLE DEBUGGING ERROR ON INCORRECT CONFIGURATION



SUMMARY

This document described how alternate debugging channels (EMUCx & EMUDx pins) can be used for in-circuit debugging when the default debugging channel (EMUC & EMUD pins) is in use by the application and, hence, rendered unavailable for use by MPLAB ICD 2. Several dsPIC30F Development Boards, including dsPICDEM™ MC1 and dsPICDEM 2, include jumpers or switches that allow you to select alternate debugging channels.

For circuit details, see the schematics included in the User's Guides for these Development Boards (*dsPICDEM™ 1.1 Development Board User's Guide* (DS70099) and *dsPICDEM™ 2 Development Board User's Guide* (DS51558)).