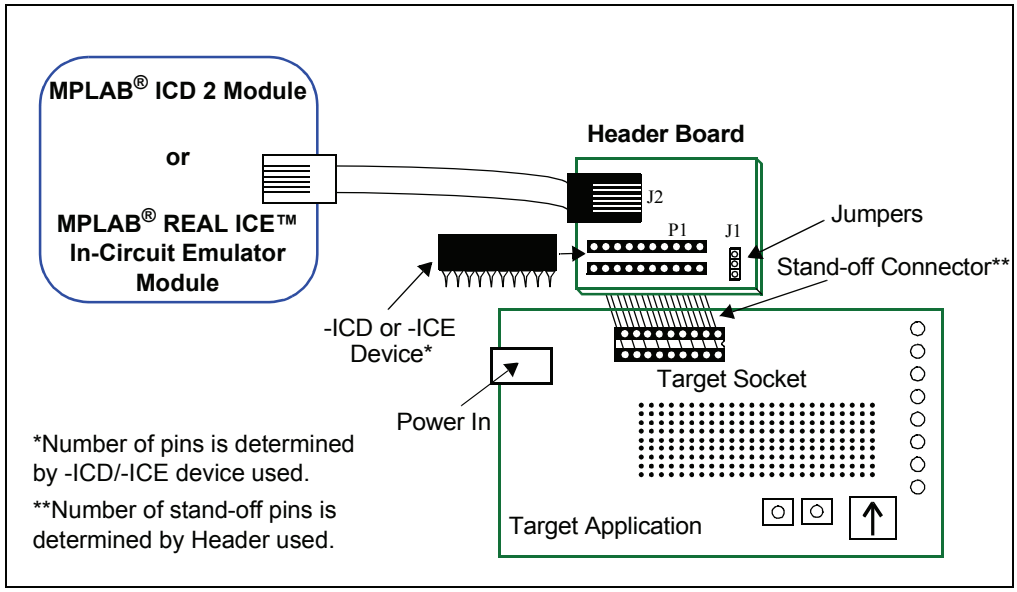
Header Board Specification

INTRODUCTION

This document contains information about MPLAB® ICD 2 and MPLAB® REAL ICE™ in-circuit emulator header boards, which provide in-circuit debugging and/or emulating capabilities for specific Microchip devices.

A special ICD or ICE device is connected to a header board to be used with the MPLAB ICD 2 in-circuit debugger or MPLAB REAL ICE in-circuit emulator. This device is mounted on the top of a header and its signals are routed to the debugger or emulator connector. On the bottom of the header is a socket that is used to connect to the target board. For an example connection, see Figure 1.

FIGURE 1: MODULE CONNECTION WITH HEADER



Special ICD/ICE versions of selected devices are needed to provide one or more of the following:

- the built-in debug circuitry that a device may lack
- additional pins for the clock, data and $\overline{\text{MCLR}}$ functions required
- dedicated program/data memory for in-circuit debug or emulation

These special device versions are labeled with the appropriate suffix (i.e., either *Device*-ICD or *Device*-ICE).

In general, ICD devices are designed for MPLAB ICD 2 debugger use and ICE devices are designed for MPLAB REAL ICE in-circuit emulator use. However, ICD devices may be used with the MPLAB REAL ICE in-circuit emulator and ICE devices may be used with the MPLAB ICD 2 debugger, but will provide only basic ICD functionality.

HEADERS FOR ICD DEVICES

Some devices have no built-in debug circuitry. Therefore, special ICD versions of these devices are required for MPLAB ICD 2 operation.

Other devices have built-in debug circuitry and do not require a header to use MPLAB ICD 2. However, some pins and memory must be used to support the ICD function. Therefore, for some of these devices, special ICD versions offering additional pins (and sometimes memory) are available to provide more transparent debugging capabilities.

Currently available headers and their associated ICD devices/supported devices are shown in Table 1.

TABLE 1: HEADER TYPES – ICD DEVICES

Header	Part Number	ICD Device Used	Devices Supported	V_{DD} Max
8 Pin	AC162050	PIC12F675-ICD(1)	PIC12F629/675	5.5V
	AC162058	PIC12F683-ICD	PIC12F683	5.5V
14 Pin	AC162059	PIC16F505-ICD	PIC10F200/2/4/6 PIC12F508/509 PIC16F505	5.5V
	AC162070	PIC16F506-ICD	PIC10F220/2 PIC12F510 PIC16F506	5.5V
	AC162057	PIC16F636-ICD	PIC12F635 PIC16F636	5.5V
	AC162052	PIC16F676-ICD(1)	PIC16F630/676	5.5V
	AC162055	PIC16F684-ICD	PIC16F684	5.5V
	AC162056	PIC16F688-ICD	PIC16F688	5.5V
18 Pin	AC162053	PIC16F648A-ICD(1)	PIC16F627A/628A/648A	5.5V
	AC162054	PIC16F716-ICD	PIC16F716	5.5V
20 Pin	AC162066	PIC16F636-ICD	PIC16F639 (dual die)	5.5V
	AC162061	PIC16F690-ICD	PIC16F631/677 PIC16F685/687/689/690	5.5V
	AC162060	PIC16F785-ICD	PIC16F785/HV785	5.5V

Note 1: These devices cannot be programmed or read using MPLAB® ICD 2 while GP1/RA1 is high (V_{IH}). Move circuitry that makes GP1/RA1 high to another I/O pin during development. See device programming specifications for more information.

HEADERS FOR ICE DEVICES

Devices that have built-in emulator circuitry do not require a header to use the MPLAB REAL ICE in-circuit emulator. However, some pins and memory must be used to support the ICE function. Special ICE versions offering additional pins, memory and emulator functions can be used to provide superior debugging/emulating capabilities.

Currently available headers and their associated ICE devices/supported devices are shown in Table 2.

TABLE 2: HEADER TYPES – ICE DEVICES

Header	Part Number	ICE Device Used	Devices Supported	V_{DD} Max
28/40-Pin	AC162067	PIC18F45J10-ICE	PIC18LF24J10/44J10 PIC18LF25J10/45J10	3.6V*
			PIC18F24J10/44J10 PIC18F25J10/45J10	3.6V
44-Pin	AC162074	PIC18F45J10-ICE	PIC18LF44J10 PIC18LF45J10	3.6V*
			PIC18F44J10 PIC18F45J10	3.6V
64/80-Pin	AC162062	PIC18F87J10-ICE	PIC18F65J10/85J10 PIC18F65J15/85J15 PIC18F66J10/86J10 PIC18F66J15/86J15 PIC18F67J10/87J10	3.6V

* LF devices require two voltages, where V_{DD} Max = 3.6V and V_{DD}core Max = 2.75V.

HEADER BOARD SETUP

To set up a header board:

1. If the ICD/ICE device is not soldered onto the header, plug the device into the socket on the top of the header.
2. Set any jumpers or switches to determine device functionality/selection as specified in the following sections.

8/14-Pin Headers

For some headers, device peripherals need to be selected by setting jumper J1 to the appropriate position. This will have the effect of selecting the device.

Device	Jumper Setting	Peripheral Function
PIC12F629	2-3	A/D Disabled
PIC12F675	1-2	A/D Enabled
PIC12F683	1-2	A/D Enabled
PIC16F630	2-3	A/D Disabled
PIC16F676	1-2	A/D Enabled
PIC12F635	2-3	PORTC, Comparator 2 Disabled
PIC16F636	1-2	PORTC, Comparator 2 Enabled

18-Pin Headers

For these headers, there are no jumpers/switches. The device with the most program memory is always selected.

If PIC16F627A or PIC16F628A devices are selected for MPLAB ICD 2 development in MPLAB IDE, the warning “ICDWarn0020: Invalid target device id” may be received in the build window and as a dialog. The reason is the PIC16F648A-ICD device supports PIC16F648A, PIC16F627A and PIC16F628A, but only reports the device ID for the PIC16F648A.

Ignore this warning or disable it under the **Warnings** tab on the ICD Programming dialog.

20-Pin Header – PIC16F639

For the PIC16F639 20-pin header, you will need to connect the jumper J3 as specified below.

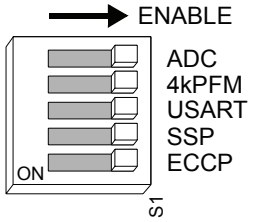
Tool	Jumper Setting	Function
MPLAB® ICE 2000	1-2	Run/program as regular device
MPLAB ICD 2	2-3	Run/program as ICD device

In addition to being used with MPLAB ICD 2, this header is used with the PCM16YM0 processor module to emulate a PIC16F639 on the MPLAB ICE 2000 in-circuit emulator. Plug the end of the processor module into the header, and then plug the header into the transition socket or directly onto the target board.

20-Pin Header – PIC16F690

For the PIC16F690 20-pin header, you will need to set the S1 switches (Figure 2) to enable peripherals and choose devices (Table 3).

FIGURE 2: S1 SWITCH HARDWARE



Switch configuration at left shows all peripherals enabled, which is the setting to select the PIC16F690 device.

TABLE 3: S1 SWITCH DEVICE SELECTION

Device	Switches				
	ADC	4k PFM	USART	SSP	ECCP
PIC16F631	0	0*	0	0	0
PIC16F677	1	0**	0	1	0
PIC16F685	1	1	0	0	1
PIC16F687	1	0**	1	1	0
PIC16F689	1	1	1	1	0
PIC16F690	1	1	1	1	1

Legend: 1 = Enabled 0 = Disabled * = 1k PFM ** = 2k PFM

20-Pin Header – PIC16F785

For the PIC16F785 20-pin header, you will need to connect the jumper J2 to enable the shunt regulator.

Device	Device Type	Jumper Setting	Function
PIC16F785	F	1-2	Disable shunt regulator
PIC16HV785	HV	2-3	Enable shunt regulator

28/40/44-Pin Header – PIC18F45J10

For the PIC18F45J10 header, you will need to connect jumpers J2 and J3 to select between the LF and F versions of devices.

Device	Device Type	Jumper J2	Jumper J3	Function
PIC18LFXXJ10	LF	1-2	1-2	Disable voltage regulator*
PIC18FXXJ10	F	2-3	2-3	Enable voltage regulator

* V_{DD}core must be supplied externally.

64/80-Pin Header – PIC18F87J10

For this header, there are no jumpers/switches. MPLAB IDE will use its selected device to choose the correct device to emulate.

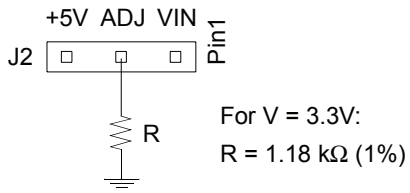
Test points are available on this header to check the following: V_{DD}, V_{DD}core and ground.

CAUTION

This header cannot be plugged directly into the PICDEM™ HPC Explorer Board or device damage will result.

The PICDEM™ HPC Explorer Board is 5V, whereas the ICD device on the header is 3.6V max. Therefore, modification to the demo board is necessary before the header can be used.

1. Switch S3 should be set to ICE.
2. Jumper J2 must be connected as shown to modify the operating voltage. See demo board documentation for more information.



HEADER CONNECTION TO THE DEBUGGER/EMULATOR AND TARGET

Connect the modular interface cable between the MPLAB ICD 2 debugger and the header board. For MPLAB REAL ICE in-circuit emulator connections, consult the emulator documentation.

The header may be connected to the target board as follows:

- PDIP header socket to PDIP target socket with a stand-off (male-to-male connector)
- Header socket to plug on the target board
- Header socket to target socket with a transition socket (see the "*Transition Socket Specification"*, DS51194)

PROGRAMMING NON-ICD/ICE DEVICES

The header board can only program the ICD/ICE device, not the regular device. To program non-ICD/ICE devices, use the Universal Programming Module (AC162049) or design a modular interface connector on the target. See the appropriate specification for connections. For the most up-to-date device programming specifications, see the Microchip website (www.microchip.com).

CALIBRATION BITS

The calibration bits for the band gap and internal oscillator are always preserved to their factory settings.

PERFORMANCE ISSUES

The PICmicro® MCU devices do not support partial program memory erase; therefore, users may experience slower performance than with other devices.

ADDITIONAL INFORMATION

Please consult the following resources, as needed:

MPLAB ICD 2

- *"MPLAB® ICD 2 In-Circuit Debugger User's Guide"* (DS51331)
- MPLAB ICD 2 Help
- Readme for MPLAB ICD 2

MPLAB REAL ICE In-Circuit Emulator

- "*MPLAB REAL ICE In-Circuit Emulator User's Guide"* (DS51616)
- MPLAB REAL ICE Help
- Readme for MPLAB REAL ICE

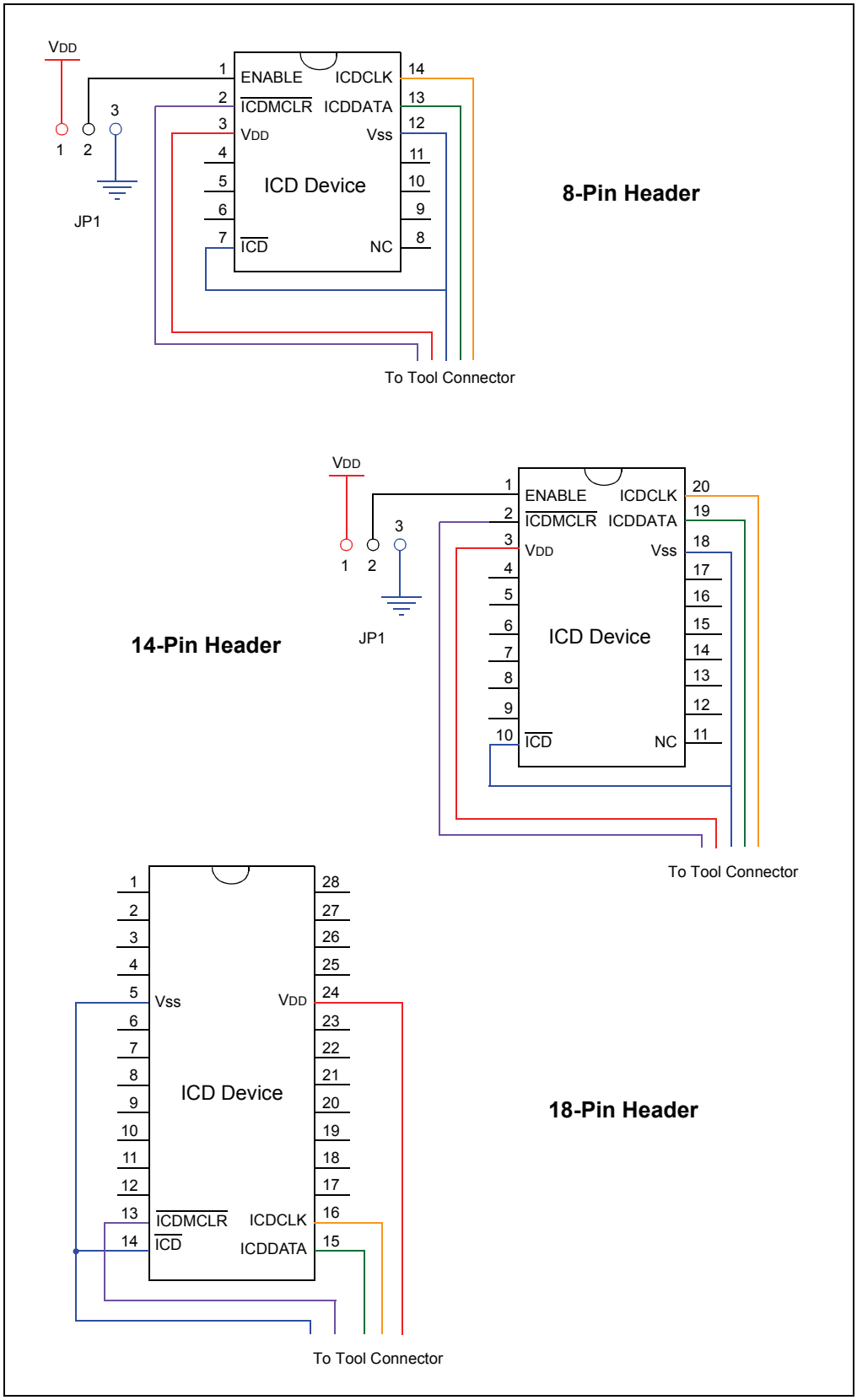
MPLAB IDE

- *"MPLAB® IDE User's Guide*" (DS51519)
- MPLAB IDE Help
- Readme for MPLAB IDE

SCHEMATICS

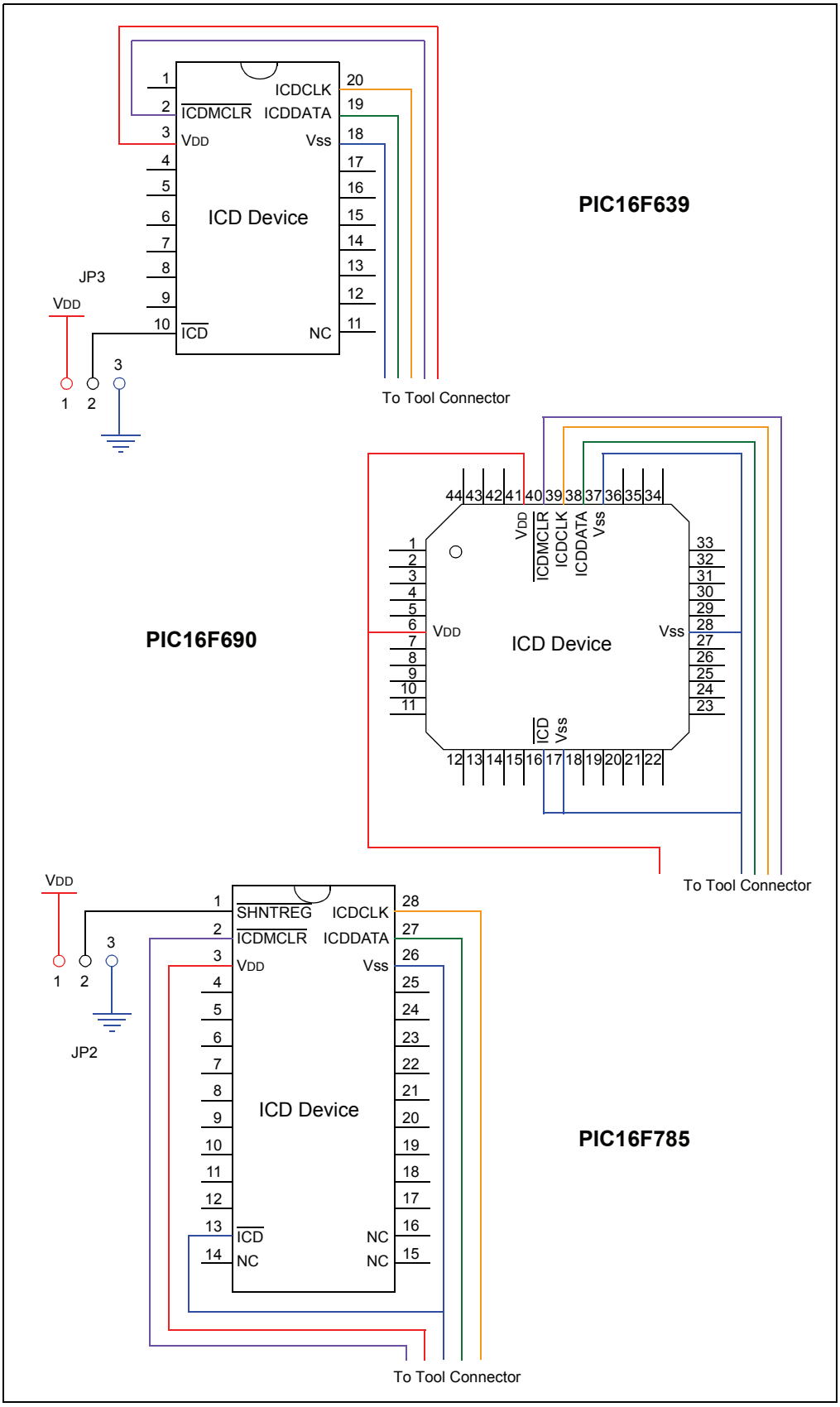
The following schematics show header electrical connections.

FIGURE 3: 8/14/18-PIN HEADERS



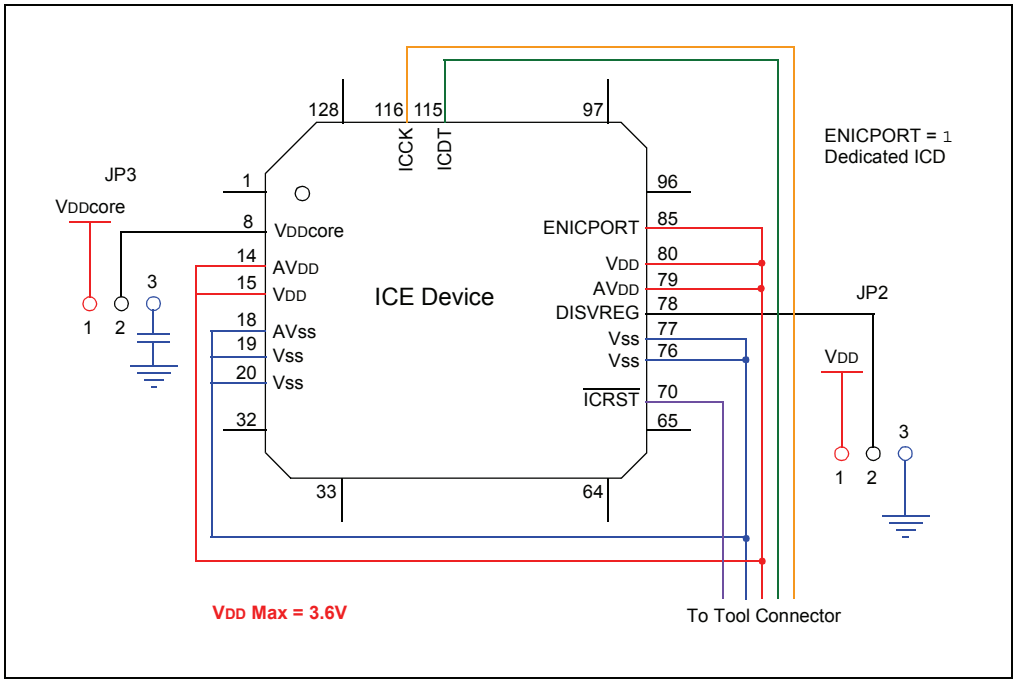
VDD: Red, **Vss:** Blue, **ICDCLK:** Yellow, **ICDDATA:** Green, **$\overline{\text{ICDMCLR}}$:** Purple

FIGURE 4: 20-PIN HEADERS



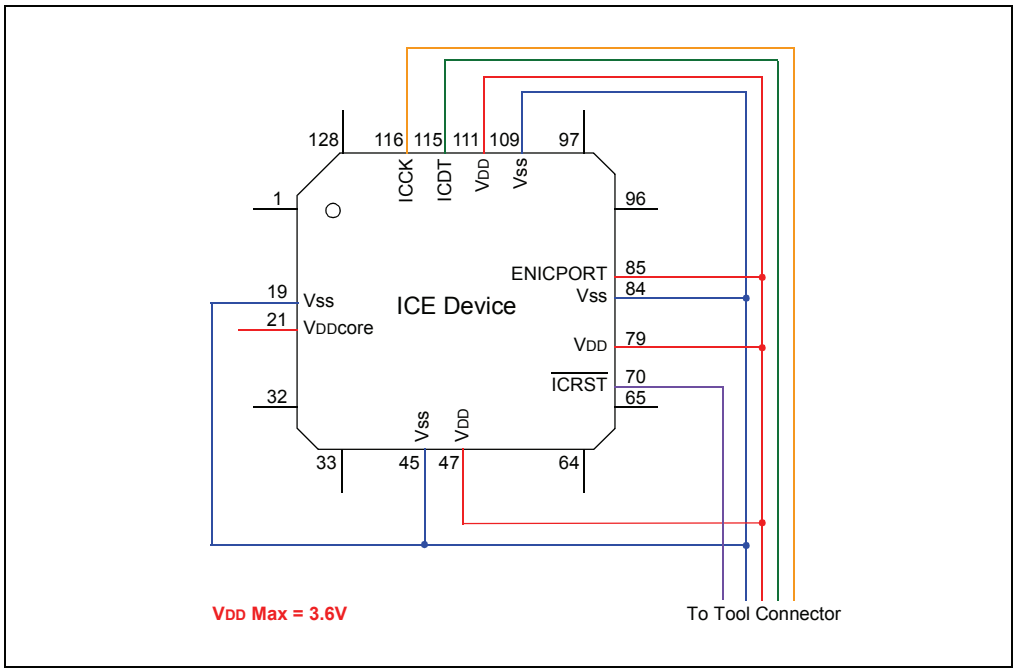
VDD: Red, **Vss:** Blue, **ICDCLK:** Yellow, **ICDDATA:** Green, **$\overline{\text{ICDMCLR}}$:** Purple

FIGURE 5: 28/40/44-PIN HEADER – PIC18F45J10



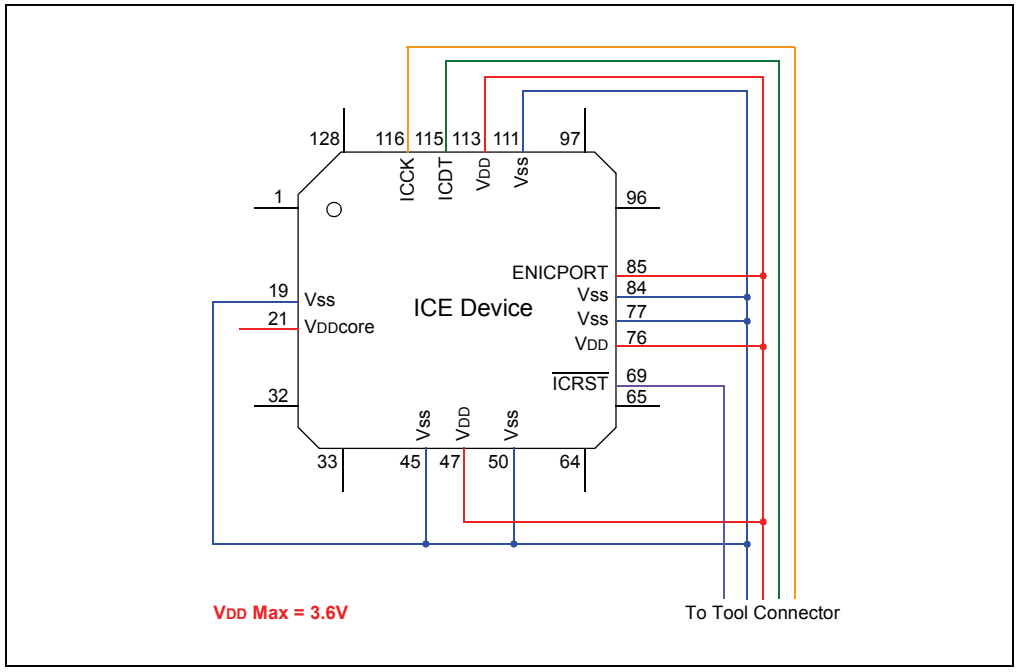
VDD/AVDD: Red, **VSS/AVSS:** Blue, **ICCK:** Yellow, **ICDT:** Green, **$\overline{\text{ICRST}}$:** Purple

FIGURE 6: 64/80-PIN HEADER – PIC18F87J10



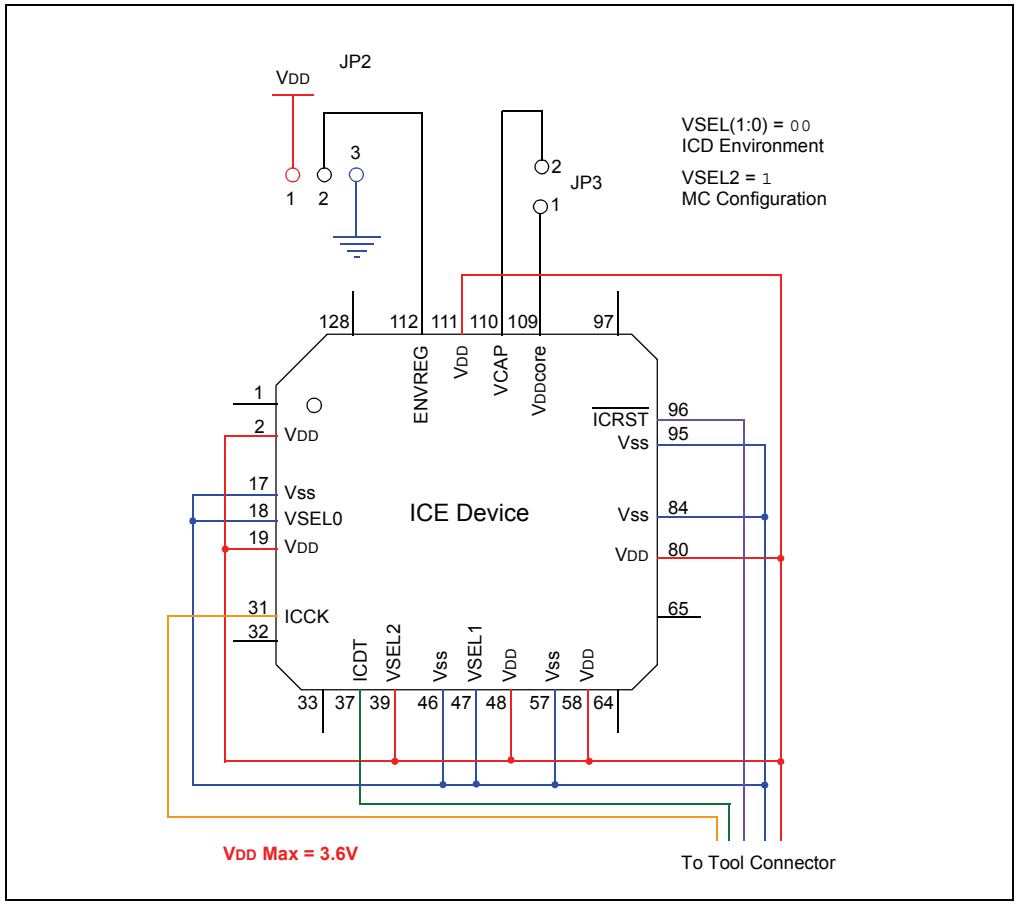
VDD/VDDcore: Red, **VSS:** Blue, **ICCK:** Yellow, **ICDT:** Green, **$\overline{\text{ICRST}}$:** Purple

FIGURE 7: 64/80-PIN HEADER – PIC18F97J60



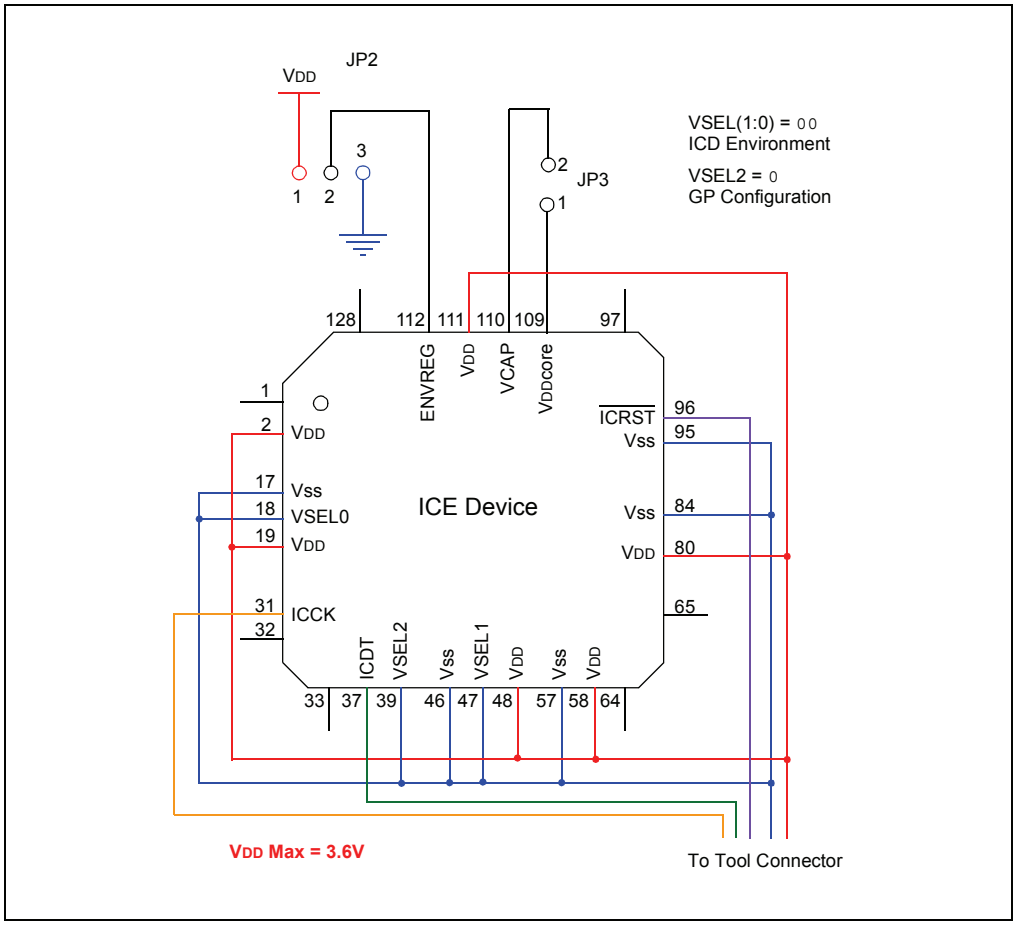
VDD/VDDcore: Red, **Vss:** Blue, **ICCK:** Yellow, **ICDT:** Green, **$\overline{\text{ICRST}}$:** Purple

FIGURE 8: 64/80/100-PIN HEADER – dsPIC33F MC



VDD: Red, **Vss:** Blue, **ICCK:** Yellow, **ICDT:** Green, **$\overline{\text{ICRST}}$:** Purple

FIGURE 9: 64/80/100-PIN HEADER – dsPIC33F GP



VDD: Red, **Vss:** Blue, **ICCK:** Yellow, **ICDT:** Green, **$\overline{\text{ICRST}}$:** Purple

APPENDIX A: REVISION HISTORY

A.1 Revision M (September 2006)

- Added Appendix A: Revision History
- Updated document to reflect support of additional tools
- Additional minor corrections throughout document text

NOTES:

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Note the following details of the code protection feature on Microchip devices:

- Microchip products meet the specification contained in their particular Microchip Data Sheet.
- Microchip believes that its family of products is one of the most secure families of its kind on the market today, when used in the intended manner and under normal conditions.
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