

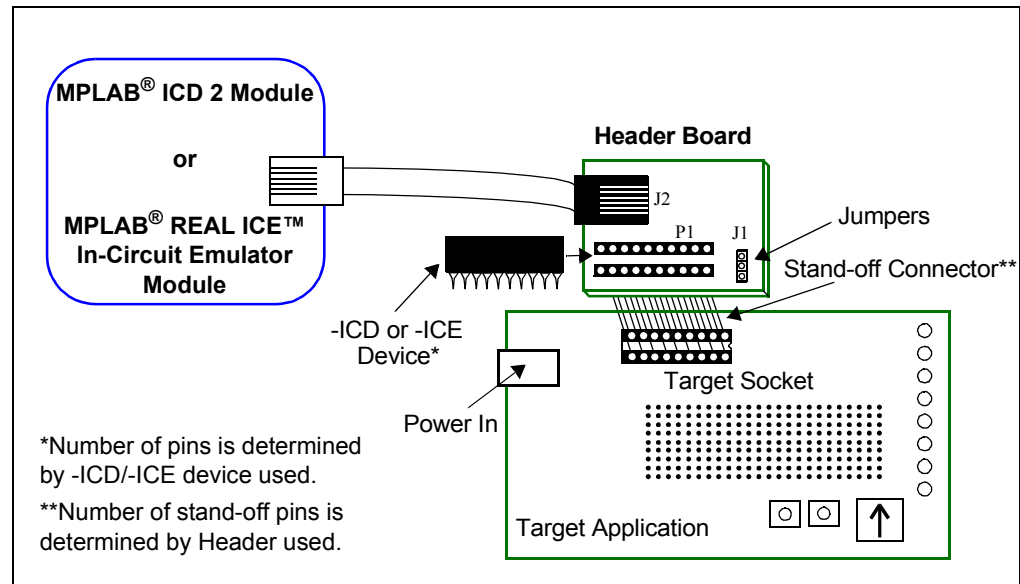
# Header Board Specification

## INTRODUCTION

This document contains information about MPLAB® ICD 2 in-circuit debugger 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 debugger or 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 MCLR functions required, so regular pins do not have to be forfeited
- 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 emulator use. However, ICD devices may be used with the MPLAB REAL ICE emulator and ICE devices may be used with the MPLAB ICD 2 debugger, but will provide only basic ICD functionality.

# Header Board Specification

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## GENERAL HEADER 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 for that header.

## 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](http://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 PIC<sup>®</sup> MCU devices do not support partial program memory erase; therefore, users may experience slower performance than with other devices.

## REFERENCES

Please consult the following resources, as needed:

- MPLAB ICD 2
  - “MPLAB<sup>®</sup> 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<sup>®</sup> REAL ICE<sup>™</sup> In-Circuit Emulator User’s Guide” (DS51616)
  - MPLAB REAL ICE Help
  - Readme for MPLAB REAL ICE
- MPLAB IDE
  - “MPLAB<sup>®</sup> IDE, Editor and Simulator User’s Guide” (DS51519)
  - MPLAB IDE Help
  - Readme for MPLAB IDE

# Header Board Specification

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NOTES:

## Headers for ICD Devices

### INTRODUCTION

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 below.

**TABLE 1: HEADERS – ICD DEVICES**

Device	Header Part Number	ICD Device Used	Pin Count	V <sub>DD</sub> Max
PIC10F200/2/4/6	AC162059	PIC16F505-ICD	14	5.5V
PIC10F220/2	AC162070	PIC16F506-ICD	14	5.5V
PIC12F508/509	AC162059	PIC16F505-ICD	14	5.5V
PIC12F510	AC162070	PIC16F506-ICD	14	5.5V
PIC12F629	AC162050	PIC12F675-ICD <sup>(1)</sup>	8	5.5V
PIC12F635	AC162057	PIC16F636-ICD	14	5.5V
PIC12F675	AC162050	PIC12F675-ICD <sup>(1)</sup>	8	5.5V
PIC12F683	AC162058	PIC12F683-ICD	8	5.5V
PIC16F505	AC162059	PIC16F505-ICD	14	5.5V
PIC16F506	AC162070	PIC16F506-ICD	14	5.5V
PIC16F627A/628A	AC162053	PIC16F648A-ICD <sup>(1)</sup>	18	5.5V
PIC16F630	AC162052	PIC16F676-ICD <sup>(1)</sup>	14	5.5V
PIC16F631	AC162061	PIC16F690-ICD	20	5.5V
PIC16F636	AC162057	PIC16F636-ICD	14	5.5V
PIC16F639 (Dual die)	AC162066	PIC16F636-ICD	20	5.5V
PIC16F648A	AC162053	PIC16F648A-ICD <sup>(1)</sup>	18	5.5V
PIC16F676	AC162052	PIC16F676-ICD <sup>(1)</sup>	14	5.5V
PIC16F677	AC162061	PIC16F690-ICD	20	5.5V
PIC16F684	AC162055	PIC16F684-ICD	14	5.5V
PIC16F685/687	AC162061	PIC16F690-ICD	20	5.5V
PIC16F688	AC162056	PIC16F688-ICD	14	5.5V
PIC16F689/690	AC162061	PIC16F690-ICD	20	5.5V

# Headers for ICD Devices

**TABLE 1: HEADERS – ICD DEVICES (CON'T)**

Device	Header Part Number	ICD Device Used	Pin Count	VDD Max
PIC16F716	AC162054	PIC16F716-ICD	18	5.5V
PIC16F785/HV785	AC162060	PIC16F785-ICD	20	5.5V
PIC18F1230/1330	AC162078	PIC18F1330-ICD	18/20/28	5.5V

(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.

## ICD HEADER SETUP

From the table in the previous section, determine the appropriate header for your device.

### **AC162050, AC162052, AC162055, AC162056, AC162057, AC162058**

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

Header	Jumper J1	Function	Device Selected
AC162050	2-3	A/D Disabled	PIC12F629
	1-2	A/D Enabled	PIC12F675
AC162052	2-3	A/D Disabled	PIC16F630
	1-2	A/D Enabled	PIC16F676
AC162055	Don't care	N/A	PIC16F684
AC162056	Don't care	N/A	PIC16F688
AC162057	2-3	PORTC, Comparator 2 Disabled	PIC12F635
	1-2	PORTC, Comparator 2 Enabled	PIC16F636
AC162058	1-2	A/D Enabled	PIC12F683

### **AC162053**

For this 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.

### **AC162054**

This header supports one device (PIC16F716) so there are no jumpers or switches.

### **AC162059, AC162070**

The ICD devices on these headers are specifically designed to select a device without the use of additional jumpers or switches.

## AC162060

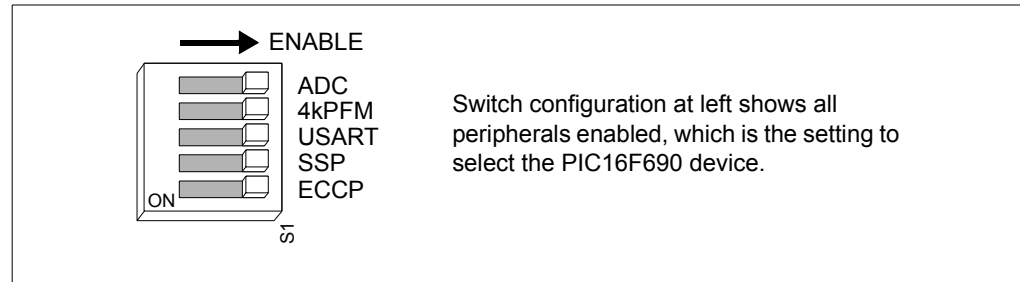
For the PIC16F785 20-pin header, you will need to connect the jumper J2 to enable the shunt regulator.

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

## AC162061

For the PIC16F690 20-pin header, you will need to set the S1 switches (Figure 1) to enable peripherals and choose devices (Table 2).

**FIGURE 1: S1 SWITCH HARDWARE**



**TABLE 2: 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

## AC162066

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

Tool	Jumper Setting	Function
MPLAB <sup>®</sup> 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.

# Headers for ICD Devices

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## AC162078

This header board can be used with the following targets:

1. Customer target board for PIC18F1230/1330 devices. The target board should have an 18-pin DIP socket to connect to the 18-pin DIP socket on the header board.
2. PICDEM MC motor control demo board. Use the 28-pin DIP socket on both boards to mount the header board on to the PICDEM MC board.
3. PICDEM MC LV motor control demo board. Use the 28-pin DIP socket on both boards to mount the header board on to the PICDEM MC LV board.

The following sections detail the configuration of the jumpers on the header board for use with the above-mentioned boards. For more details, refer to the Schematics section of this document.

### CUSTOMER TARGET BOARD

The default configuration is to remove all jumpers.

S1 is not populated and should not be used.

After the header board is set up, do the following:

1. Connect the header to the target board.
2. Power the target board. You should see the red LED on the header board turn on.
3. Connect the MPLAB ICD 2 to the header board.
4. Use MPLAB IDE and MPLAB ICD 2 to develop your application.

### PICDEM MC/MC LV MOTOR CONTROL DEMO BOARDS

To run a BLDC motor on the PICDEM MC board or PICDEM MC LV board using the supplied firmware, use the following jumper setup:

Jumper	Jumper Setting	Jumper	Jumper Setting
J1	2-3	JP1	Open
J2	2-3	JP2	Open
J3	2-3	JP3	Open
J5	2-3		
J6	1-2		
J7	1-2		

S1 is not populated and should not be used.

After the header board is set up, do the following:

1. Connect the header to the PICDEM MC/MC LV target board.
2. Power the target board. You should see the red LED on the header board turn on.
3. Connect the MPLAB ICD 2 to the header board.
4. Program the part with the demo code.
5. Run the program.
6. Press and release switch S2 on the target board to toggle the direction of rotation of the motor.
7. Press and release switch S1 on the target board to toggle between run and stop the motor.
8. If the motor stops while reversing from a high speed, there could be an overcurrent condition detected by the system. Reset the system to run the program again.



## ICD HEADER DIMENSIONS

The table below lists the dimensions for each ICD header board. Dimensions are design values in inches.

**TABLE 3: HEADER DIMENSIONS**

Header Part Number	Length	Width	Height
AC162050	1.275	1.000	0.525
AC162052	1.300	1.275	0.525
AC162053	2.350	0.750	0.525
AC162054	2.350	0.750	0.525
AC162055	1.300	1.275	0.525
AC162056	1.300	1.275	0.525
AC162057	1.300	1.275	0.525
AC162058	1.275	1.000	0.525
AC162059	2.25	0.75	0.525
AC162060	2.25	0.75	0.525
AC162061	1.650	1.450	0.525
AC162066	2.325	0.850	0.525
AC162070	2.25	0.75	0.525
AC162078	2.3	2.05	0.525

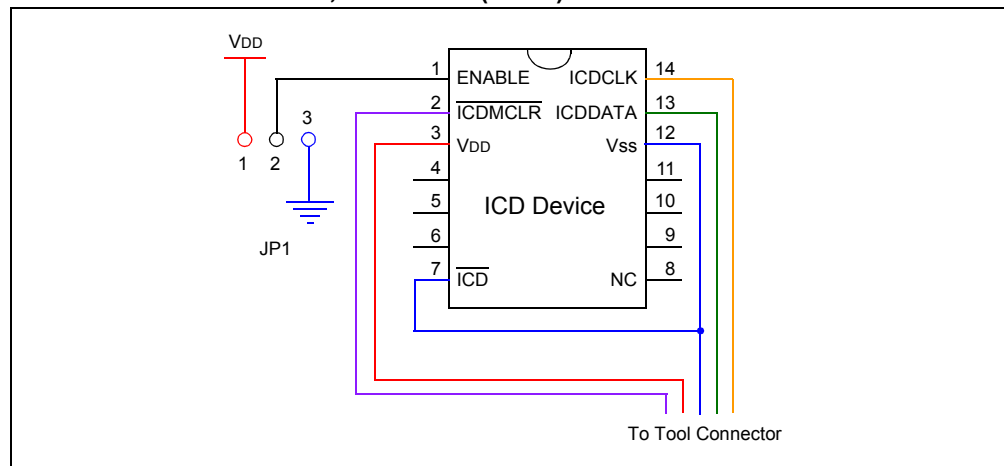
If the length and/or width of the header board is too large a footprint for the target board, consider using stand-offs, transition sockets or other extenders in the header connection socket to raise the header above the target.

# Headers for ICD Devices

## ICD HEADER SCHEMATICS

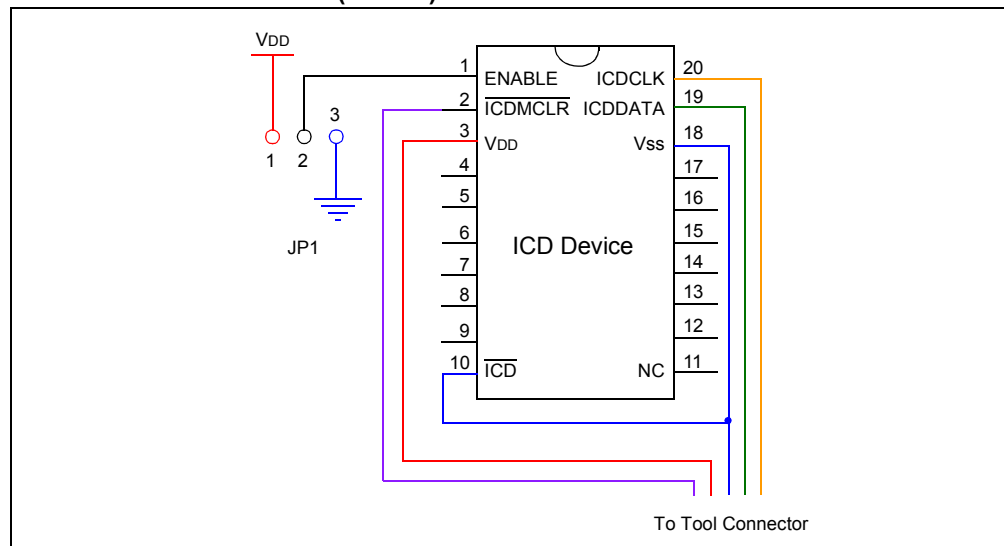
The following schematics show header electrical connections.

**FIGURE 2: AC162050, AC162058 (8-PIN)**



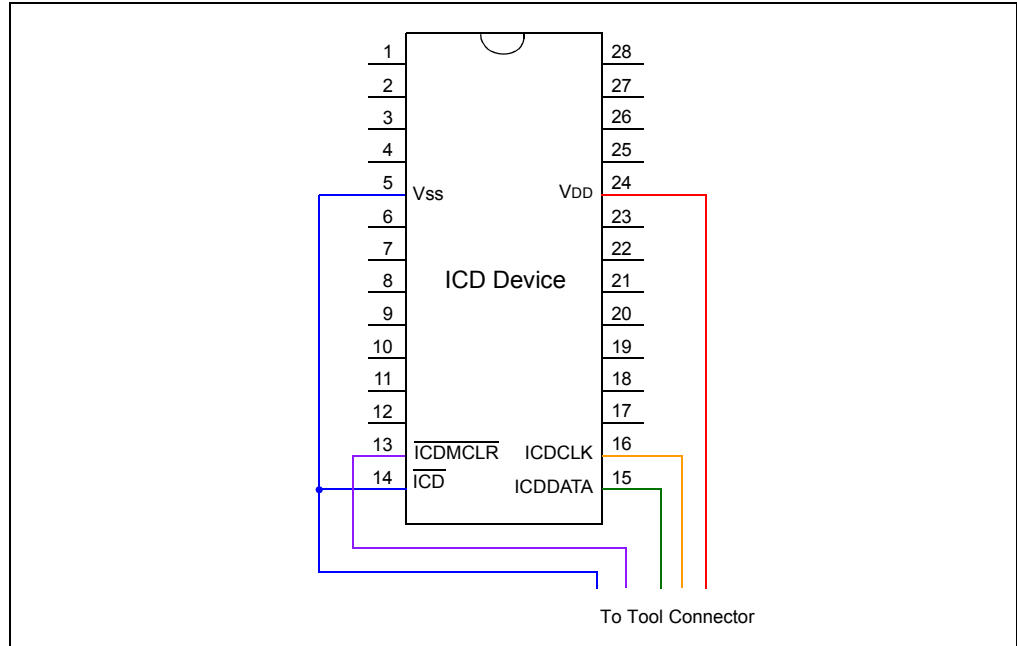
VDD:Red, Vss:Blue, ICDCLK:Yellow, ICDDATA:Green, ICDMCLR:Purple

**FIGURE 3: AC162052, AC162055, AC162056, AC162057, AC162059, AC162070 (14-PIN)**



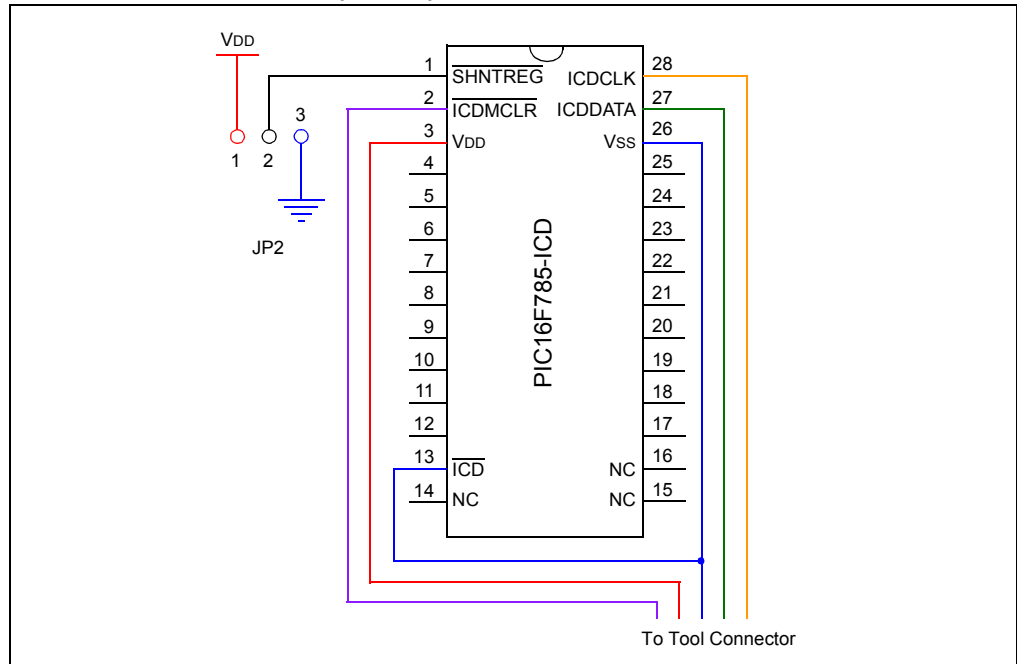
VDD:Red, Vss:Blue, ICDCLK:Yellow, ICDDATA:Green, ICDMCLR:Purple

**FIGURE 4: AC162053, AC162054 (18-PIN)**



VDD:Red, Vss:Blue, ICDCLK:Yellow, ICDDATA:Green, ICDMCLR:Purple

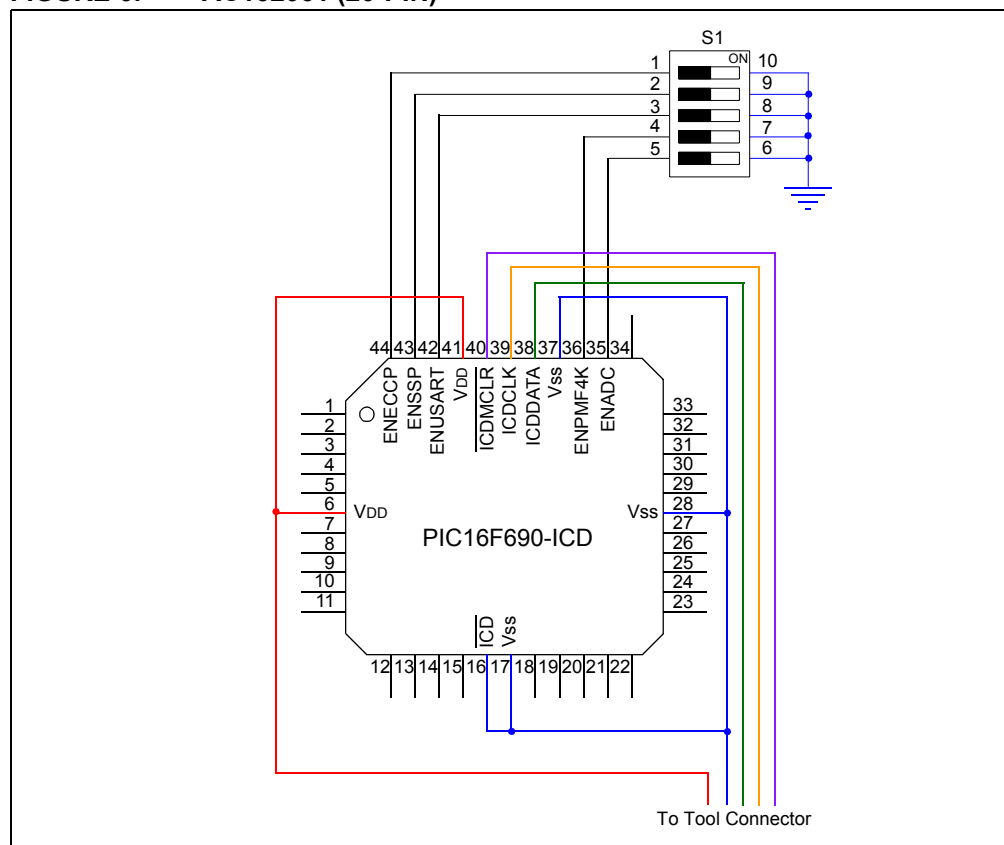
**FIGURE 5: AC162060 (20-PIN)**



VDD:Red, Vss:Blue, ICDCLK:Yellow, ICDDATA:Green, ICDMCLR:Purple

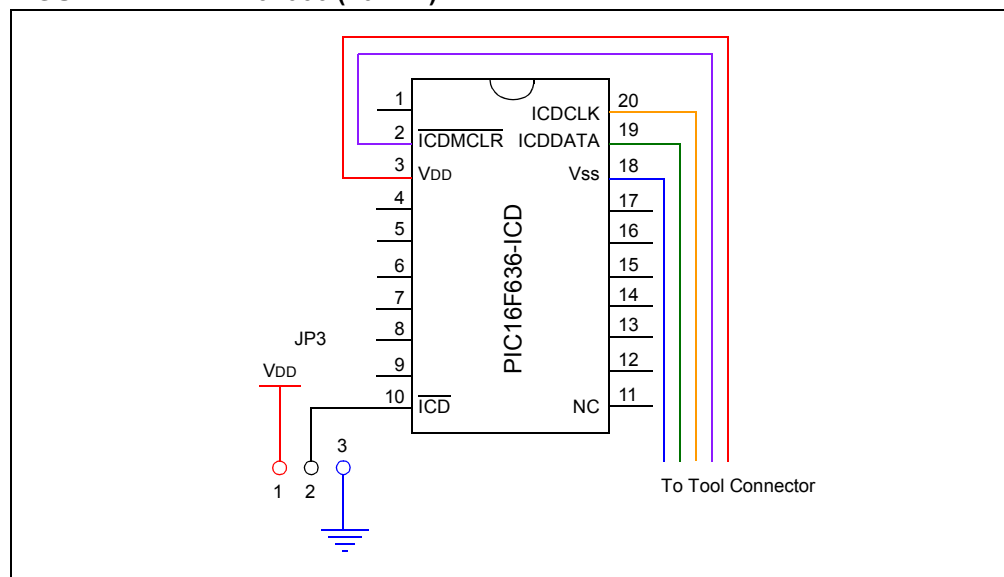
# Headers for ICD Devices

**FIGURE 6: AC162061 (20-PIN)**



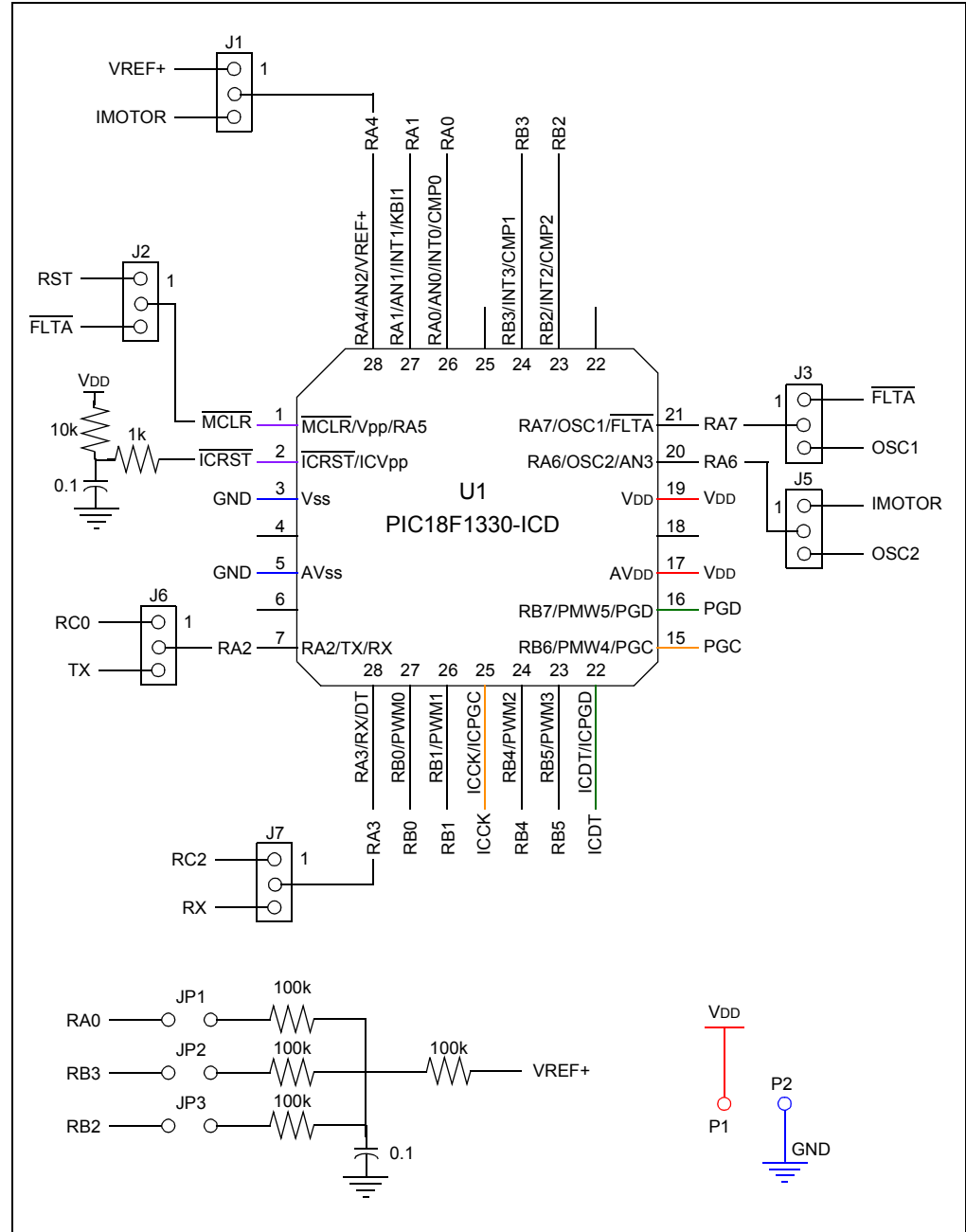
VDD:Red, VSS:Blue, ICDCLK:Yellow, ICDDATA:Green, ICDMCLR:Purple

**FIGURE 7: AC162066 (20-PIN)**



VDD:Red, VSS:Blue, ICDCLK:Yellow, ICDDATA:Green, ICDMCLR:Purple

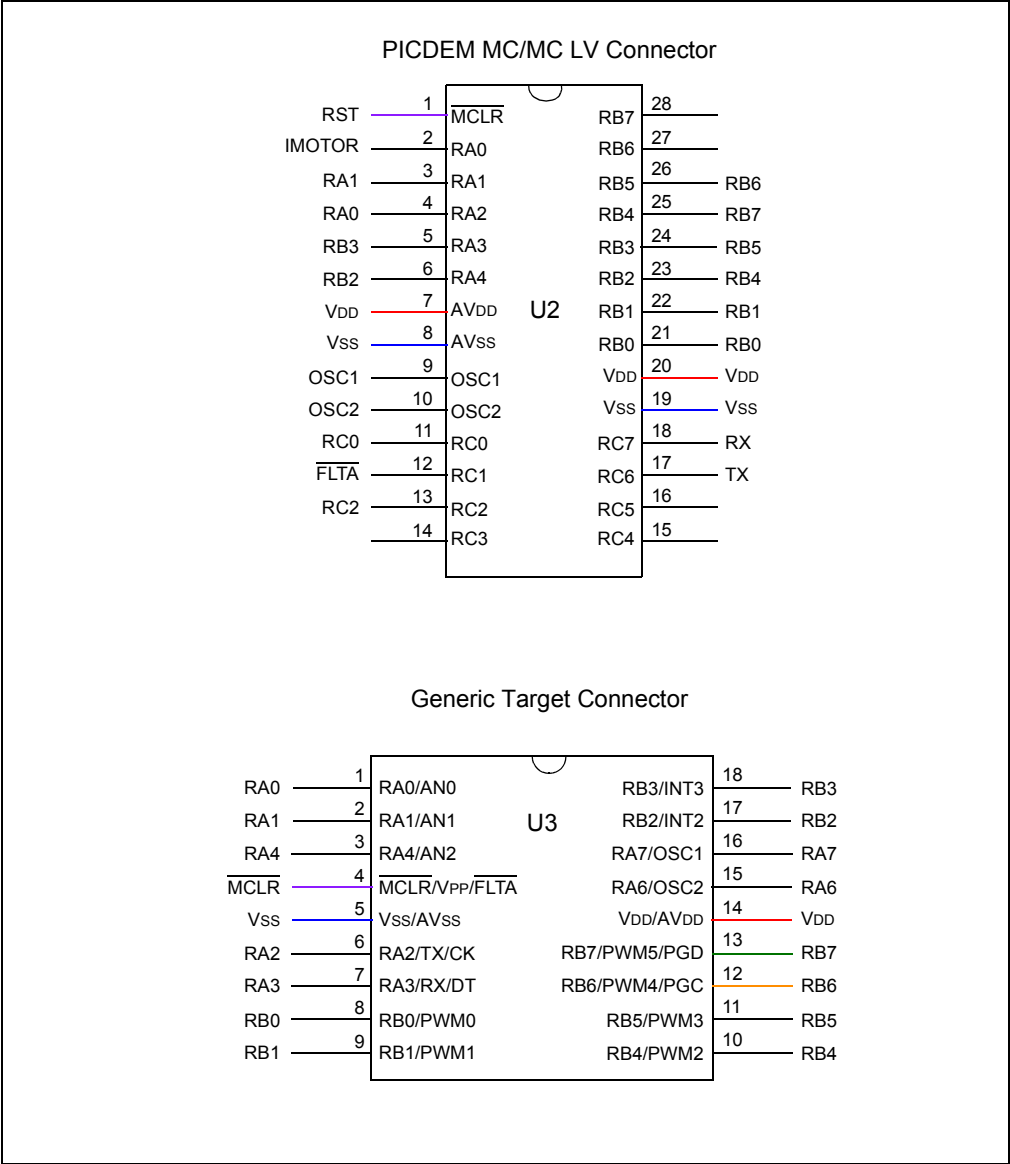
**FIGURE 8: AC162078 – PART 1**



VDD/AVDD:Red, VSS/AVSS:Blue, ICCK:Yellow, ICDT:Green, ICRST:Purple

# Headers for ICD Devices

FIGURE 9: AC162078 – PART 2



VDD/AVDD:Red, VSS/AVSS:Blue, ICCK:Yellow, ICDT:Green, ICNST:Purple

## Headers for ICE Devices

### INTRODUCTION

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 below.

**TABLE 1: HEADER TYPES – ICE DEVICES**

Device	Header Part Number	ICE Device Used	Pin Count	V <sub>DD</sub> Max
PIC18F24J10 PIC18F25J10	AC162067	PIC18F45J10-ICE	28/40	3.6V
PIC18LF24J10 PIC18LF25J10				3.6V <sup>(1)</sup>
PIC18F44J10 PIC18F45J10				3.6V
PIC18LF44J10 PIC18LF45J10				3.6V <sup>(1)</sup>
PIC18F44J10 PIC18F45J10	AC162074	PIC18F45J10-ICE	44	3.6V
PIC18LF44J10 PIC18LF45J10				3.6V <sup>(1)</sup>
PIC18F65J10 PIC18F65J15 PIC18F66J10 PIC18F66J15 PIC18F67J10	AC162062	PIC18F87J10-ICE	64/80	3.6V
PIC18F85J10 PIC18F85J15 PIC18F86J10 PIC18F86J15 PIC18F87J10				
PIC18F66J60 PIC18F66J65 PIC18F67J60	AC162064	PIC18F97J60-ICE	64/80/100	3.6V
PIC18F86J60 PIC18F86J65 PIC18F87J60				
PIC18F96J60 PIC18F96J65 PIC18F97J60				

(1) LF devices require two voltages, where V<sub>DD</sub> Max = 3.6V and V<sub>DD</sub>core Max = 2.75V

# Headers for ICE Devices

## ICE HEADER SETUP

From the table in the previous section, determine the appropriate header for your device.

### AC162067, AC162074

For these 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

\* VDDcore must be supplied externally.

### AC162062

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: VDD, VDDcore and ground.

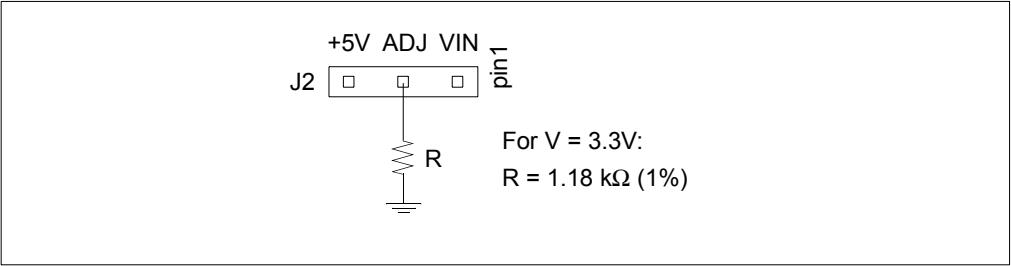
CAUTION

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 in Figure 1 to modify the operating voltage. See demo board documentation for more information.

FIGURE 1: DEMO BOARD J2 CONNECTIONS



### AC162064

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: VDD, VDDcore and ground.



## ICE HEADER DIMENSIONS

The table below lists the dimensions for each ICE header board. Dimensions are design values in inches.

**TABLE 2: HEADER DIMENSIONS**

Header Part Number	Length	Width	Height
AC162062	2.325	1.800	0.540
AC162064	2.250	1.750	0.540
AC162067	2.300	1.800	0.540
AC162074	1.800	1.350	0.540

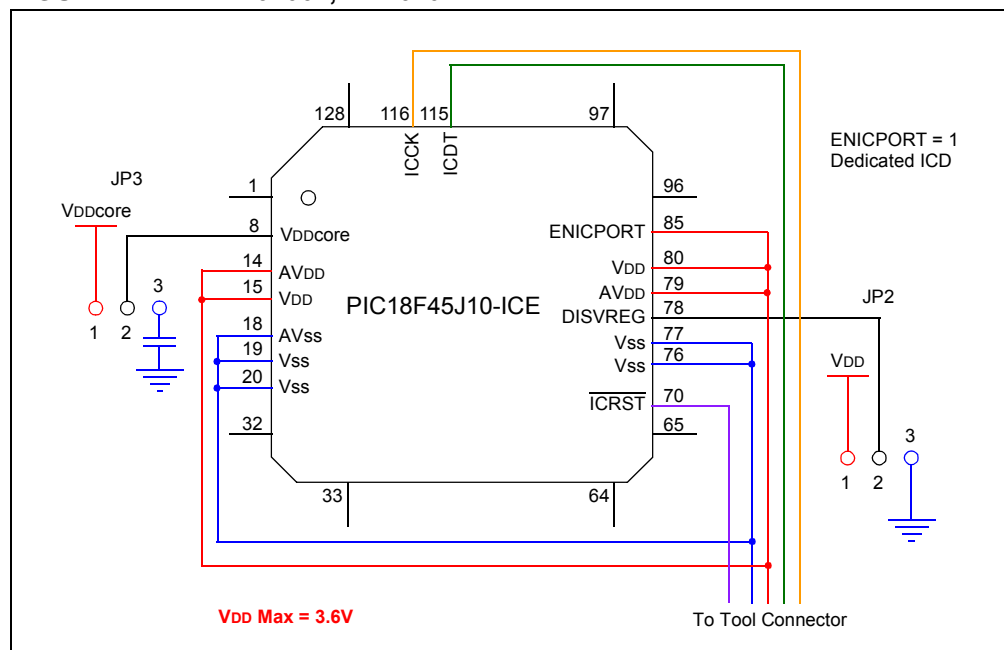
If the length and/or width of the header board is too large a footprint for the target board, consider using stand-offs, transition sockets or other extenders in the header connection socket to raise the header above the target.

# Headers for ICE Devices

## ICE HEADER SCHEMATICS

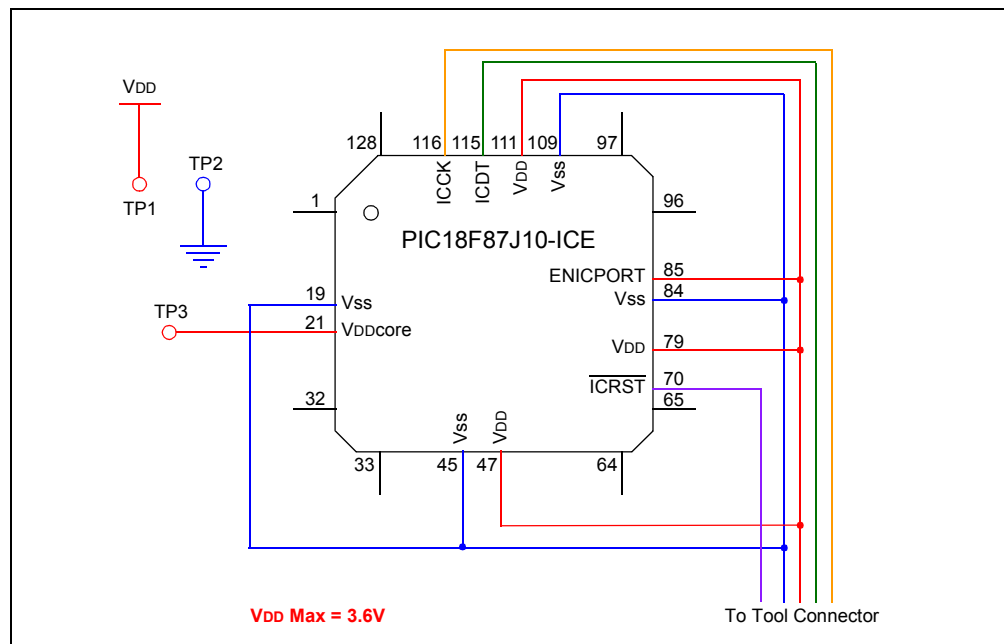
The following schematics show header electrical connections.

**FIGURE 2: AC162067, AC162074**



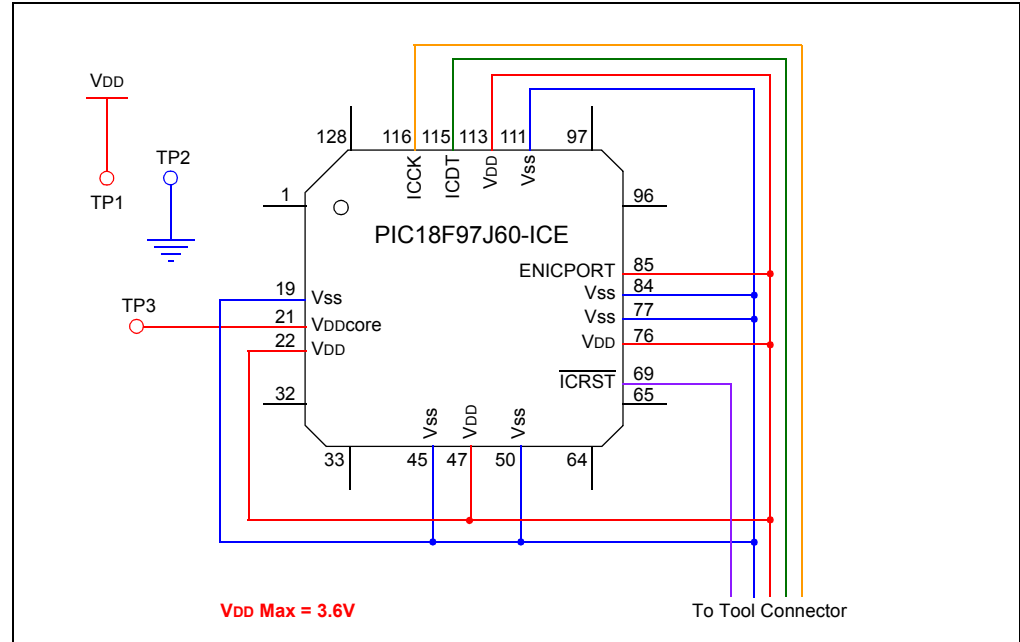
VDD/AVDD:Red, Vss/AVss:Blue, ICCK:Yellow, ICDT:Green, ICRST:Purple

**FIGURE 3: AC162062**



VDD/VDDcore:Red, Vss:Blue, ICCK:Yellow, ICDT:Green, ICRST:Purple

**FIGURE 4: AC162064**



**VDD/VDDcore:Red, VSS:Blue, ICCK:Yellow, ICDT:Green, ICRST:Purple**

# Headers for ICE Devices

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NOTES:

## **APPENDIX A: REVISION HISTORY**

### **A.1 Revision N (March 2007)**

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

# Header Board Specification

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