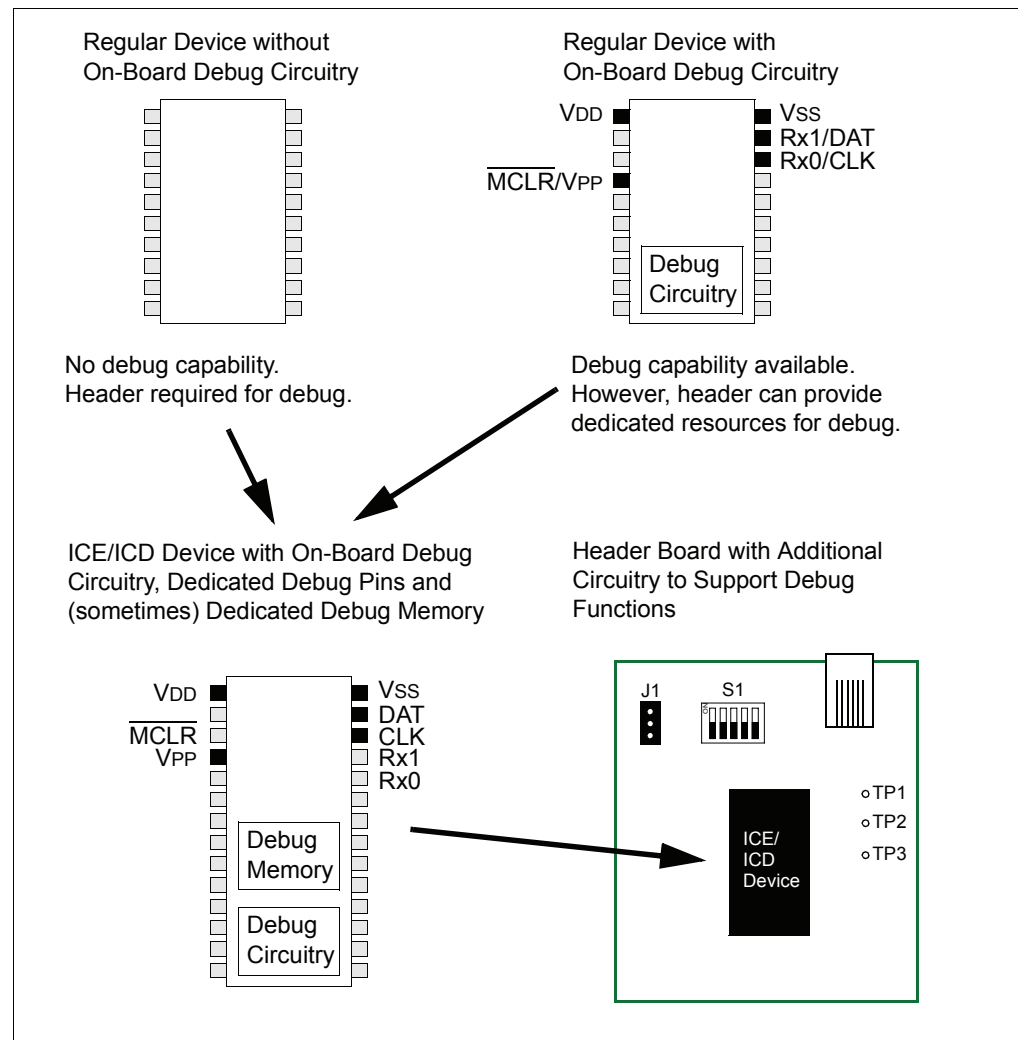


Header Board Specification

INTRODUCTION

This document contains information about the MPLAB[®] REAL ICE[™] in-circuit emulator and MPLAB ICD 2 in-circuit debugger header boards. Header boards, or headers, provide in-circuit debugging and/or emulating capabilities for specific Microchip devices. Depending on your device, a header may be necessary, unnecessary or optional in order to debug your application code (Figure 1).

FIGURE 1: DEBUG OPTIONS



To determine what device resources must still be dedicated to debugging for either a device with on-board debug capability or the special ICE/ICD device, see the "Resources used by the Emulator" section of the MPLAB REAL ICE in-circuit emulator on-line help file or the "Resources used by MPLAB ICD 2" section of the MPLAB ICD 2 in-circuit debugger on-line help file.

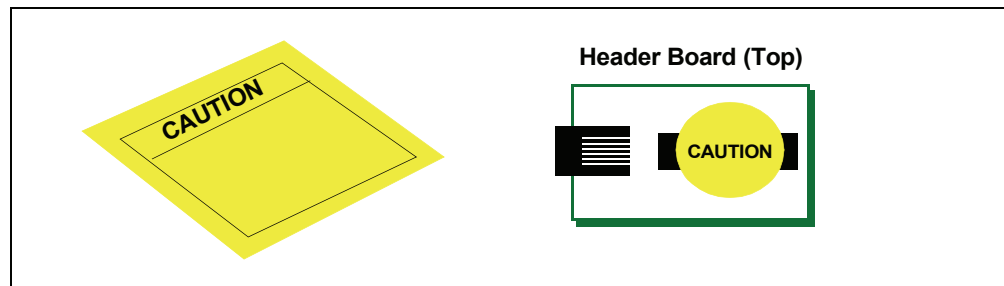
Header Board Specification

HEADER SETUP

To set up your header, do the following:

1. Check the header board for any stickers and the header box for any paper inserts that may specify special operating instructions (Figure 2). Follow these instructions before doing anything else.

FIGURE 2: SPECIAL HEADER INSTRUCTIONS

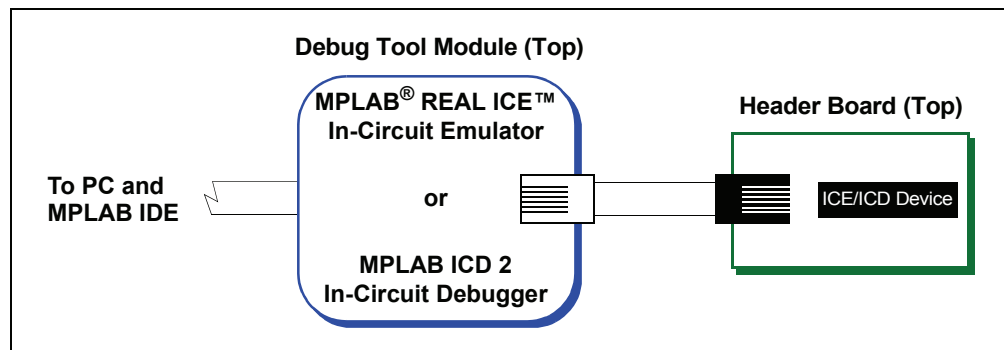


2. Set any jumpers or switches on the header to determine device functionality or selection as specified for that header. See the sections “Headers for ICE Devices” or “Headers for ICD Devices” for information on how to set up individual headers.
3. Connect the header to your desired debug tool. For the MPLAB REAL ICE in-circuit emulator, consult the emulator documentation for connection options. For the MPLAB ICD 2 in-circuit debugger, connect the modular interface cable between the debugger and the header board. An example connection is shown in Figure 3.

The special ICE/ICD device is mounted on the top of a header and its signals are routed to the emulator or debugger connector. These special device versions are labeled with the appropriate suffix (i.e., either *Device-ICE* or *Device-ICD*).

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

FIGURE 3: CONNECT HEADER TO DEBUG TOOL



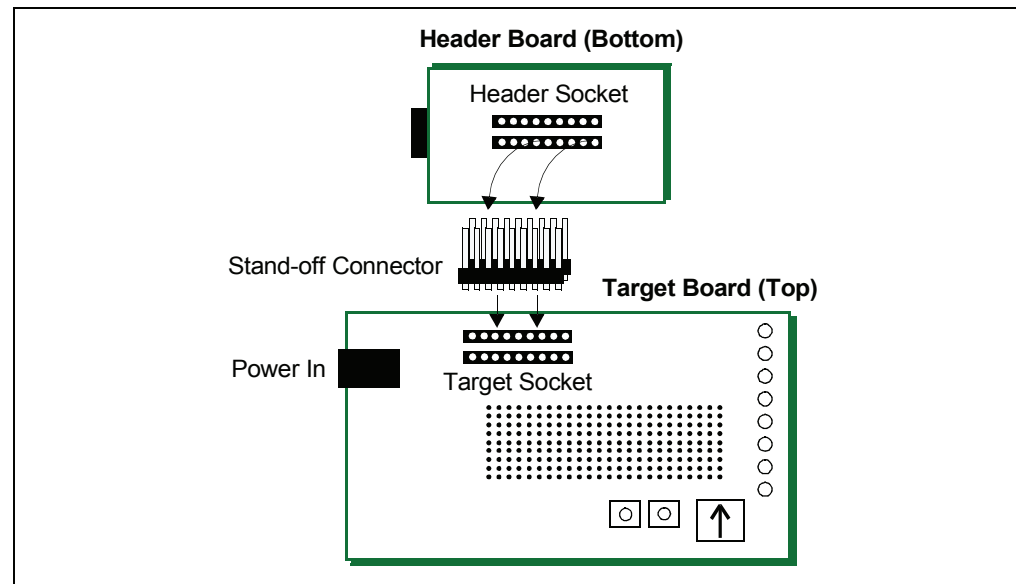
Header Board Specification

4. Connect the header to the target board. On the bottom of the header is a socket that is used to connect to the target board. The header may be connected to the target board as follows:
 - a) PDIP header socket to PDIP target socket with a stand-off (male-to-male) connector
 - b) Header socket to plug on the target board
 - c) Header socket to target socket with a transition socket (see the “*Transition Socket Specification*”, DS51194)

An example connection is shown in Figure 4.

The header socket will have the same pin count as your selected device. The ICE/ICD device on the top of the header usually has a larger pin count because it has additional pins that are dedicated to debug.

FIGURE 4: CONNECT HEADER TO TARGET



5. If using the MPLAB ICD 2 in-circuit debugger to power the target, power the MPLAB ICD 2 now.
6. Power the target, if needed.

PROGRAMMING ICE/ICD AND NON-ICE/ICD DEVICES

The header board is designed to be used with the MPLAB REAL ICE in-circuit emulator or the MPLAB ICD 2 in-circuit debugger selected as a Debugger, not a Programmer, in MPLAB IDE. Any programming of the ICE/ICD device on the header is for debug purposes and includes the debug executive. See your related debug tool documentation for details on using it as a debugger.

To program regular (non-ICE/ICD) devices with your debug tool, 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).

Also, regular devices may be programmed with the following tools:

- MPLAB PM3 device programmer
- PRO MATE[®] II device programmer
- PICSTART[®] Plus development programmer
- PICkit[™] 1 or 2 development programmer

Header Board Specification

CALIBRATION BITS

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

PERFORMANCE ISSUES

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

Also, see either the MPLAB REAL ICE in-circuit emulator or the MPLAB ICD 2 in-circuit debugger Help file for information on specific device limitations that may affect performance.

REFERENCES

Please consult the following resources, as needed:

- 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 ICD 2
 - *MPLAB® ICD 2 In-Circuit Debugger User's Guide* (DS51331)
 - MPLAB ICD 2 Help
 - Readme for MPLAB ICD 2
- MPLAB IDE
 - *MPLAB® IDE, Editor and Simulator User's Guide* (DS51519)
 - MPLAB IDE Help
 - Readme for MPLAB IDE

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 in Table 1.

TABLE 1: HEADER TYPES – ICE DEVICES

Device	Pin Count	Header Part Number	ICE Device Used	Needed/Available ⁽¹⁾
For F device headers: VDD Max = 3.6V For LF device headers: VDD Max = 3.6V, VDDCORE Max = 2.75V				
PIC18F24J10 PIC18F25J10	28/40	AC162067	PIC18F45J10-ICE	A
PIC18LF24J10 PIC18LF25J10				
PIC18F44J10 PIC18F45J10				
PIC18LF44J10 PIC18LF45J10				
PIC18F44J10 PIC18F45J10	44	AC162074	PIC18F45J10-ICE	A
PIC18LF44J10 PIC18LF45J10				
PIC18F63J11 PIC18F63J90 PIC18F64J11 PIC18F64J16 PIC18F64J90 PIC18F64J95 PIC18F65J11 PIC18F65J90	64/80	AC162079	PIC18F85J90-ICE	A
PIC18F83J11 PIC18F83J90 PIC18F84J11 PIC18F84J16 PIC18F84J90 PIC18F84J95 PIC18F85J11 PIC18F85J90				

Note 1: **N:** A header must be used to debug with this device.

A: A header is not needed to debug with this device; however, one is available to provide dedicated debug resources.

Headers for ICE Devices

TABLE 1: HEADER TYPES – ICE DEVICES (CON'T)

Device	Pin Count	Header Part Number	ICE Device Used	Needed/ Available ⁽¹⁾
For F device headers: VDD Max = 3.6V For LF device headers: VDD Max = 3.6V, VDDCORE Max = 2.75V				
PIC18F65J10 PIC18F65J15 PIC18F66J10 PIC18F66J15 PIC18F67J10	64/80	AC162062	PIC18F87J10-ICE	A
PIC18F85J10 PIC18F85J15 PIC18F86J10 PIC18F86J15 PIC18F87J10				
PIC18F65J16 PIC18F66J11 PIC18F66J16 PIC18F67J11	64/80	AC162091	PIC18F87J11-ICE	A
PIC18F85J16 PIC18F86J11 PIC18F86J16 PIC18F87J11				
PIC18F65J50 PIC18F65J55 PIC18F66J50 PIC18F66J55 PIC18F67J50	64/80	AC162087	PIC18F87J50-ICE	A
PIC18F85J50 PIC18F85J55 PIC18F86J50 PIC18F86J55 PIC18F87J50				
PIC18F66J60 PIC18F66J65 PIC18F67J60	64/80/100	AC162064	PIC18F97J60-ICE	A
PIC18F86J60 PIC18F86J65 PIC18F87J60				
PIC18F96J60 PIC18F96J65 PIC18F97J60				
dsPIC33FJGPXXX	64/80/100	AC244020	dsPIC33FJ256-ICE	A
dsPIC33FJMCXXX		AC244022		

Note 1: **N:** A header must be used to debug with this device.

A: A header is not needed to debug with this device; however, one is available to provide dedicated debug resources.

ICE HEADER SETUP

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

AC162067, AC162074

For these headers, 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 the selected device to choose the correct device to emulate.

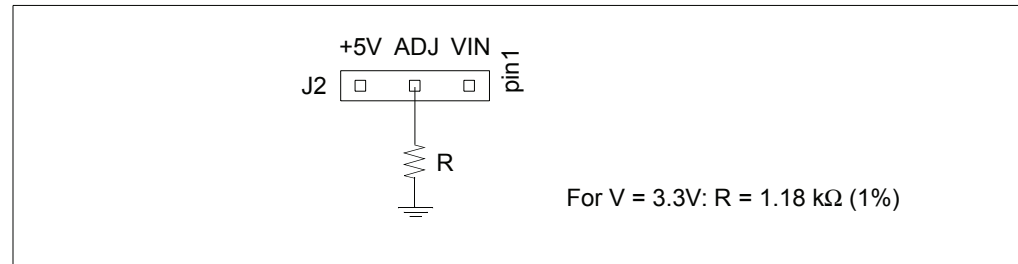
Test points are available on this header to check the following: VDD, VDDCORE and ground.

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 maximum. 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 5 to modify the operating voltage. See demo board documentation for more information.

FIGURE 5: DEMO BOARD J2 CONNECTIONS



AC162064, AC162079, AC162087, AC162091

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

Test points are available on this header to check the following: VDD, VDDCORE and ground.

Headers for ICE Devices

AC244020, AC244022

Both dsPIC33FJGPXXX (General Purpose) and dsPIC33FJMCXXX (Motor Control) device headers have jumpers which need to be set before use.

Jumpers J4 and J5 relate to the enabling or disabling of the on-chip 2.5 volt voltage regulator. Please see the section entitled “On-Chip Voltage Regulator” in the “dsPIC33F Family Reference Manual” (DS70165) for more details.

Jumper J4	Jumper J5	Function
1-2	1-2	Enable voltage regulator
2-3	NC	Disable voltage regulator

ICE HEADER DIMENSIONS

Table 2 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
AC162079	2.325	1.800	0.540
AC162087	2.325	1.800	0.540
AC162091	2.325	1.800	0.540
AC244020	2.250	1.750	0.540
AC244022	2.250	1.750	0.540

If the length and/or width of the header board's footprint is too large 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.

ICE HEADER PIN CONNECTIONS

The following diagrams show header pin connections.

FIGURE 6: AC162067, AC162074

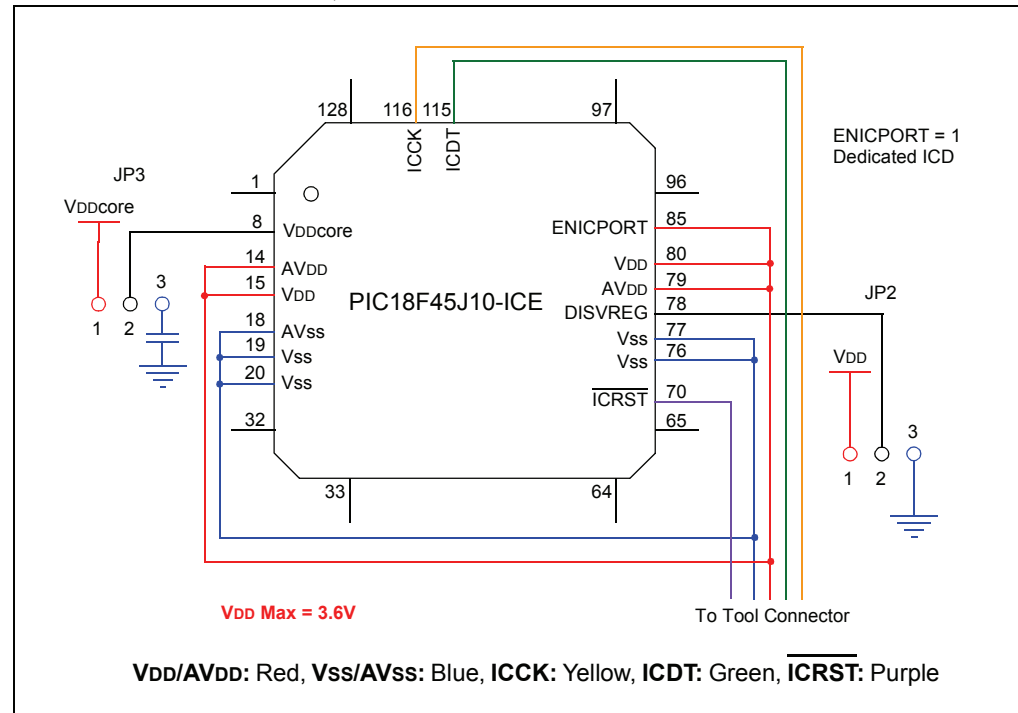
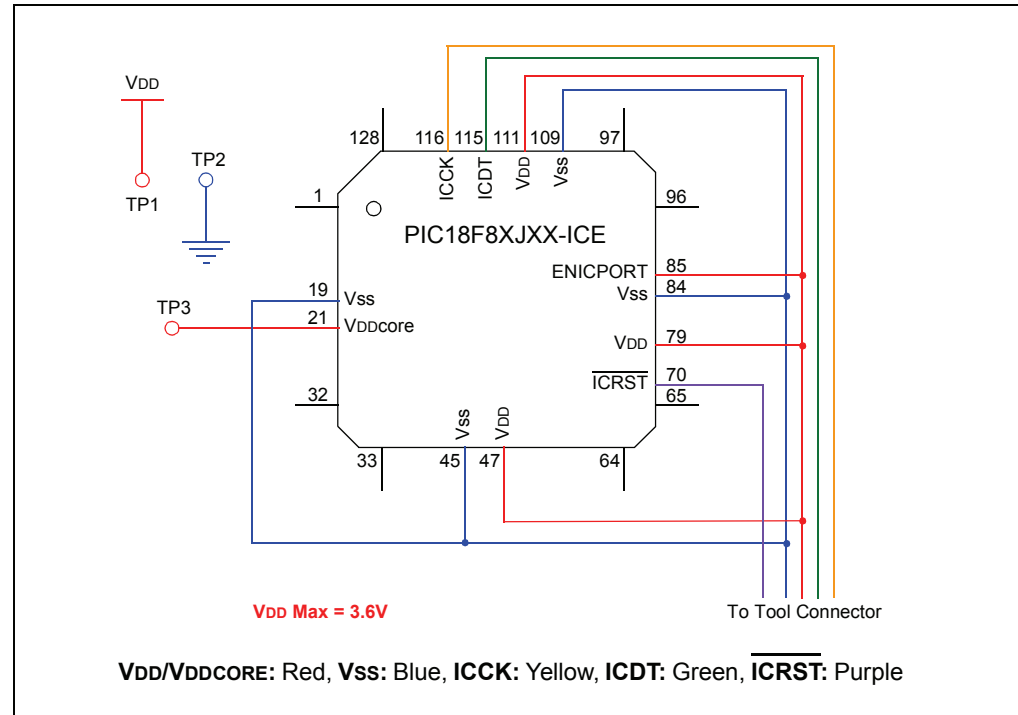


FIGURE 7: AC162062, AC162079, AC162087, AC162091



Headers for ICE Devices

FIGURE 8: AC162064

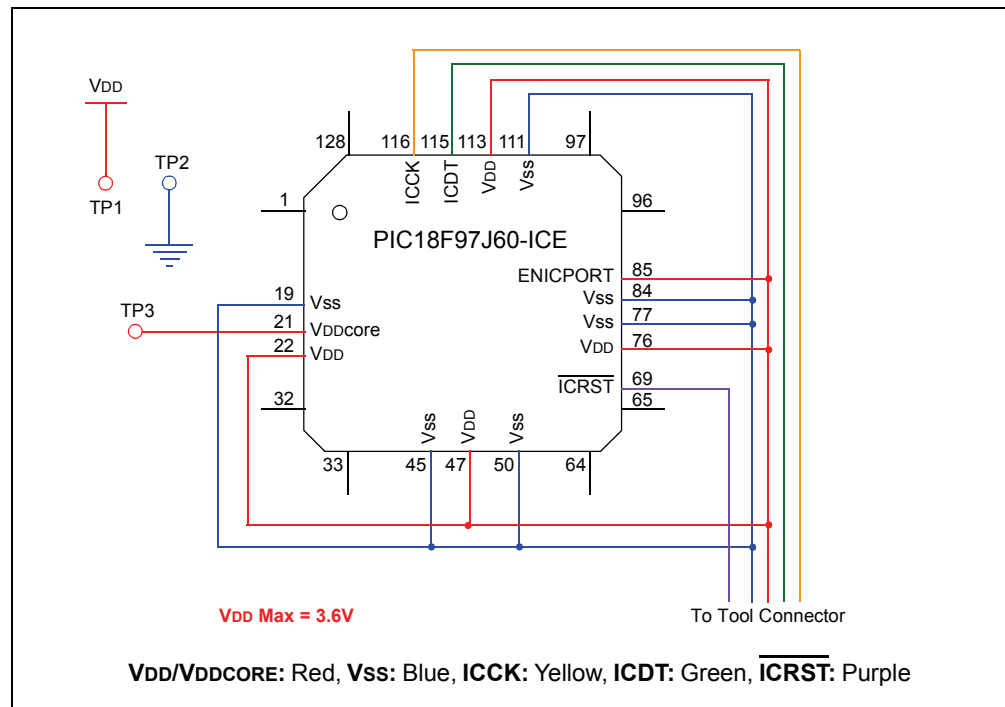
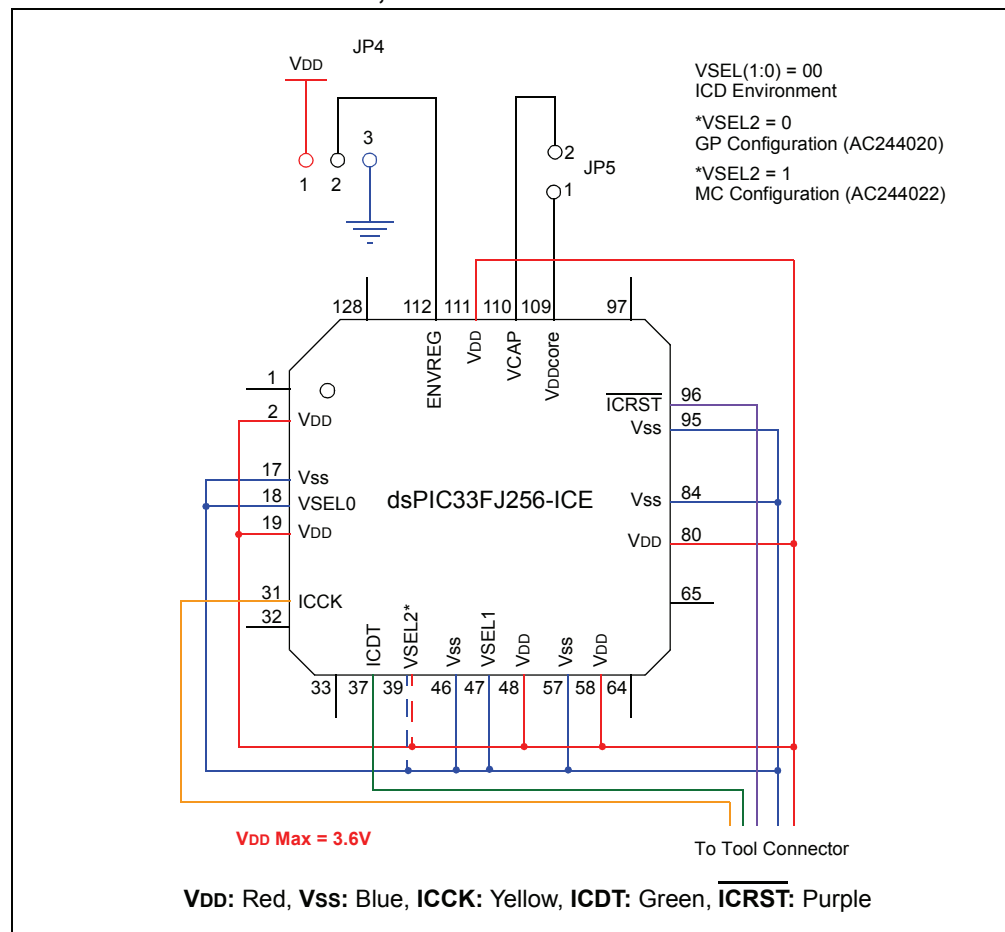


FIGURE 9: AC244020, AC244022



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 in Table 3.

TABLE 3: HEADERS – ICD DEVICES

Device	Pin Count	Header Part Number	ICD Device Used	Needed/Available ⁽¹⁾
For all these headers: VDD Max = 5.5V				
PIC10F200/2/4/6	8/14	AC162059	PIC16F505-ICD	N
PIC10F220/2	8/14	AC162070	PIC16F506-ICD	N
PIC12F508/509	8/14	AC162059	PIC16F505-ICD	N
PIC12F510	8/14	AC162070	PIC16F506-ICD	N
PIC12F519	8/14	AC162096	PIC16F526-ICD	N
PIC12F609/HV609	28	AC162083	PIC16F616-ICD	N
PIC12F615/HV615	28	AC162083	PIC16F616-ICD	N
PIC12F629	8	AC162050	PIC12F675-ICD ⁽²⁾	N
PIC12F635	14	AC162057	PIC16F636-ICD	N
PIC12F675	8	AC162050	PIC12F675-ICD ⁽²⁾	N
PIC12F683	8	AC162058	PIC12F683-ICD	N
PIC16F505	8/14	AC162059	PIC16F505-ICD	N
PIC16F506	8/14	AC162070	PIC16F506-ICD	N
PIC16F526	8/14	AC162096	PIC16F526-ICD	N
PIC16F610/HV610	28	AC162083	PIC16F616-ICD	N
PIC16F616/HV616	28	AC162083	PIC16F616-ICD	N
PIC16F627A/628A	18	AC162053	PIC16F648A-ICD ⁽²⁾	N
PIC16F630	14	AC162052	PIC16F676-ICD ⁽²⁾	N
PIC16F631	20	AC162061	PIC16F690-ICD	N

Note 1: N: A header must be used to debug with this device.

A: A header is not needed to debug with this device; however, one is available to provide dedicated debug resources.

2: 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 ICD Devices

TABLE 3: HEADERS – ICD DEVICES (CON'T)

Device	Pin Count	Header Part Number	ICD Device Used	Needed/ Available ⁽¹⁾
For all these headers: VDD Max = 5.5V				
PIC16F636	14	AC162057	PIC16F636-ICD	N
PIC16F639 (Dual die)	20	AC162066	PIC16F636-ICD	N
PIC16F648A	18	AC162053	PIC16F648A-ICD ⁽²⁾	N
PIC16F676	14	AC162052	PIC16F676-ICD ⁽²⁾	N
PIC16F677	20	AC162061	PIC16F690-ICD	N
PIC16F684	14	AC162055	PIC16F684-ICD	N
PIC16F685/687	20	AC162061	PIC16F690-ICD	N
PIC16F688	14	AC162056	PIC16F688-ICD	N
PIC16F689/690	20	AC162061	PIC16F690-ICD	N
PIC16F716	18	AC162054	PIC16F716-ICD	N
PIC16F785/HV785	20	AC162060	PIC16F785-ICD	N
PIC18F1230/1330	28	AC162078	PIC18F1330-ICD	A

Note 1: **N:** A header must be used to debug with this device.

A: A header is not needed to debug with this device; however, one is available to provide dedicated debug resources.

2: 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 header, 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 error appears because 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

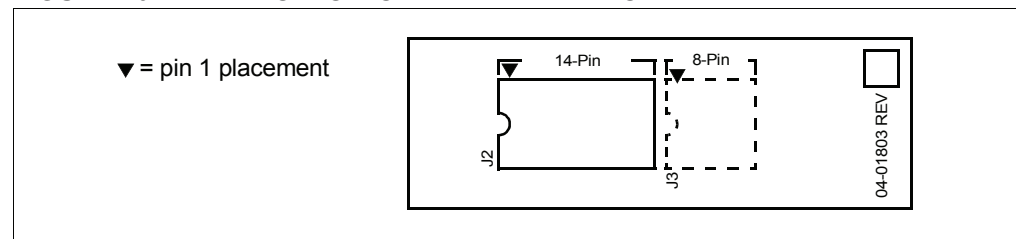
This header only supports the PIC16F716 device so there are no jumpers or switches.

AC162059, AC162070, AC162096

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

These headers support 8 and 14-pin devices. For the AC162059 and AC162070, there is an 8-pin and a 14-pin connector. For the AC162096, there is only a 14-pin connector. (The 8-pin connector is not populated.) Use the 14-pin connector for 8-pin devices, but make sure device pin 1 is placed as shown in Figure 10.

FIGURE 10: BOTTOM OF THE HEADER BOARD



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

Headers for ICD Devices

AC162061

For the PIC16F690 20-pin header, you will need to set the S1 switches (Figure 11) to enable peripherals and choose devices (Table 4).

FIGURE 11: S1 SWITCH HARDWARE

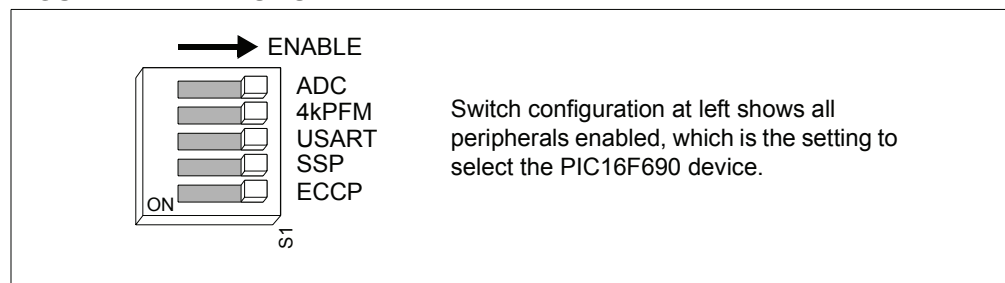


TABLE 4: S1 SWITCH DEVICE SELECTION

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® 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.

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 onto 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 Figure 18 and Figure 19.

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

S1 is not populated and should not be used.

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

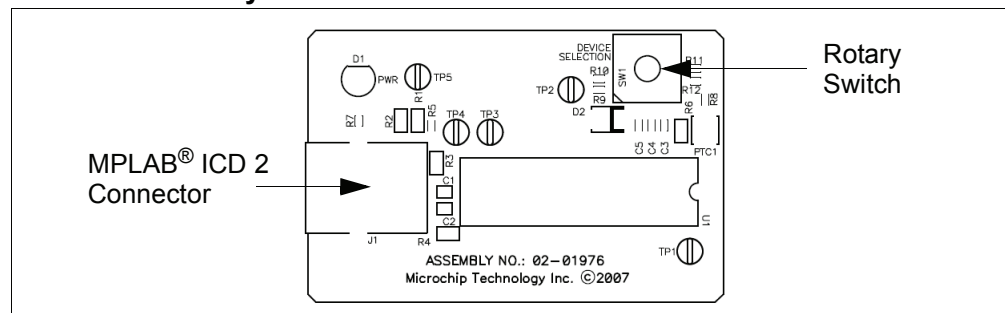
1. Connect the header to the PICDEM MC/MC LV target board.
2. Power the target board. You should see the red LED on the header board turn on.
3. Connect the MPLAB ICD 2 to the header board.
4. Program the part with the demo code.
5. Run the program.
6. Press and release switch S2 on the target board to toggle the direction of the motor's rotation.
7. Press and release switch S1 on the target board to toggle between running and stopping 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.

Headers for ICD Devices

AC162083

CAUTION	
	Incorrect rotary switch settings may irreparably damage the header. Ensure rotary switch settings are correct before powering or connecting the header. Do not change the rotary switch setting while the header is powered or connected to MPLAB ICD 2. Do not power shunt regulator (HV) devices from MPLAB ICD 2.

Header Board Layout



Test points are available on this header to check the following: Ground (TP1), VDD (TP2), ICD Clock (TP3), ICD Data (TP4) and ICD MCLR/VPP (TP5).

Rotary Switch Setting

TABLE 5: SWITCH DEVICE SELECTION

Switch Position	Device
0	PIC12HV609
1	PIC12HV615
2	Reserved HV
3	PIC16HV610
4	PIC16HV616
5	Reserved HV
6	Reserved HV
7	Reserved HV
8	PIC12F609
9	PIC12F615
A	Reserved F
B	PIC16F610
C	PIC16F616
D	Reserved F
E	Reserved F
F	Reserved F

POTENTIAL ISSUES

HV device selected instead of F device

If you inadvertently select a shunt regulator (HV) device and attempt to use it in a target board designed for a non-shunt regulator (F) device, the shunt may draw excessive current due to the lack of current-limiting circuitry on the target board and damage the device mounted on the header.

F device selected instead of HV device

If you inadvertently select a non-shunt regulator (F) device and attempt to use it in a target board designed for a shunt regulator (HV) device, the device may draw excessive current due to the higher voltage used on a target board designed for HV devices and damage the device mounted on the header.

HV devices cannot be powered from MPLAB ICD 2

In MPLAB IDE, do not select to power the target (debug header) from MPLAB ICD 2 when using shunt regulator (HV) devices since this will also cause the shunt to draw excessive current.

DETERMINING DAMAGE

A damaged header will cause MPLAB IDE to report a device ID of 0. However, there are other issues that can cause the device ID to report as 0. Please consult MPLAB ICD 2 documentation on troubleshooting to identify the problem. If you believe you have a damaged header, please contact Microchip technical support at <http://support.microchip.com>.

ICD HEADER DIMENSIONS

Table 6 lists the dimensions for each ICD header board. Dimensions are design values in inches.

TABLE 6: 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
AC162083	2.450	1.600	0.525
AC162096	2.25	0.75	0.525

If the length and/or width of the header board's footprint is too large 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 PIN CONNECTIONS

The following diagrams show header pin connections.

FIGURE 12: AC162050, AC162058 (8-PIN)

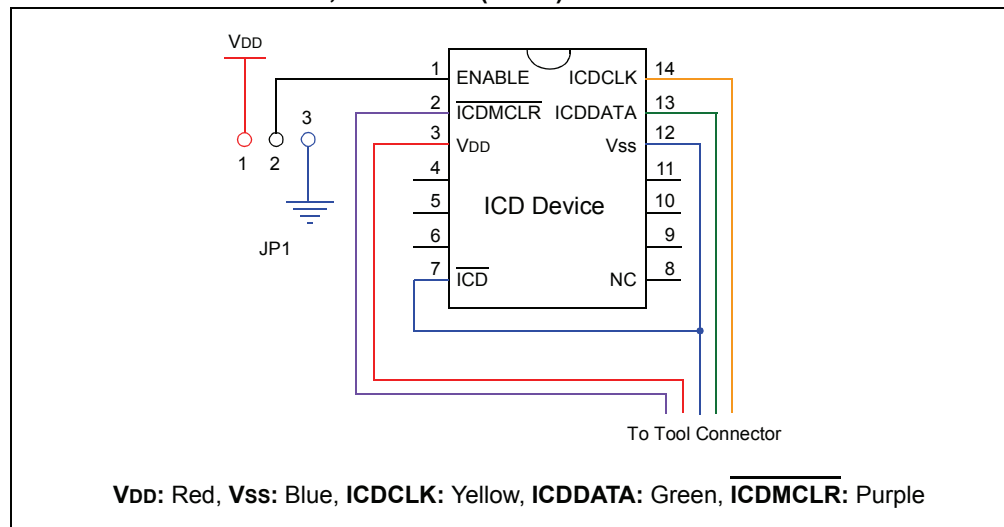


FIGURE 13: AC162052, AC162055, AC162056, AC162057, AC162059, AC162070, AC162096 (14-PIN)

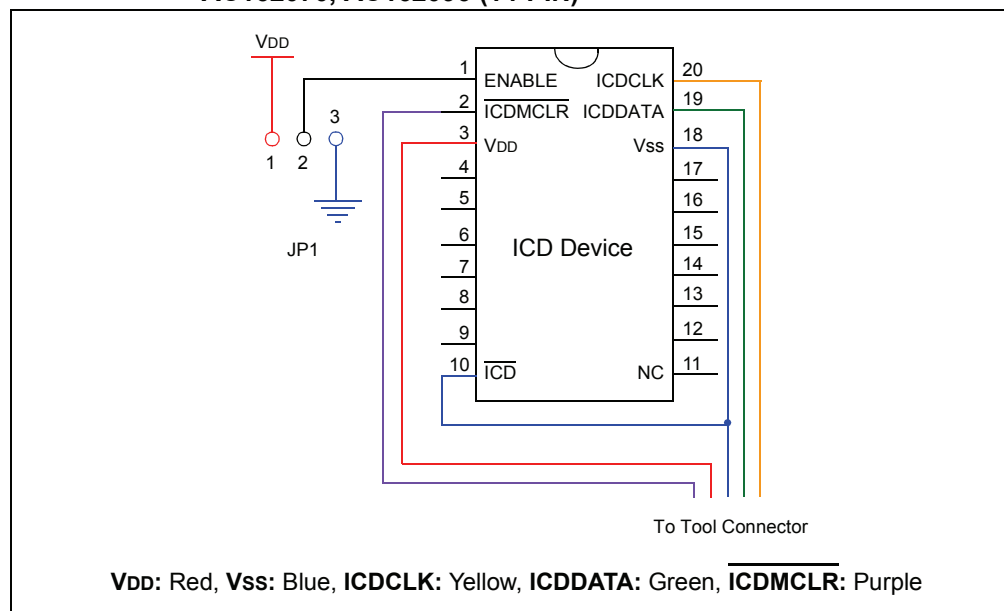


FIGURE 14: AC162053, AC162054 (18-PIN)

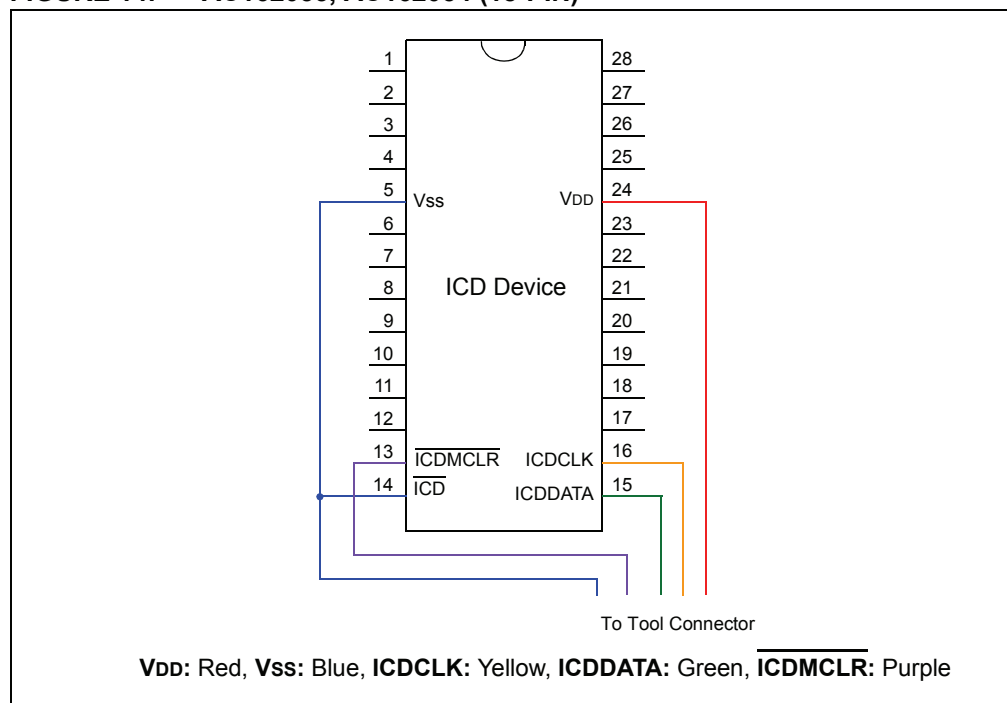
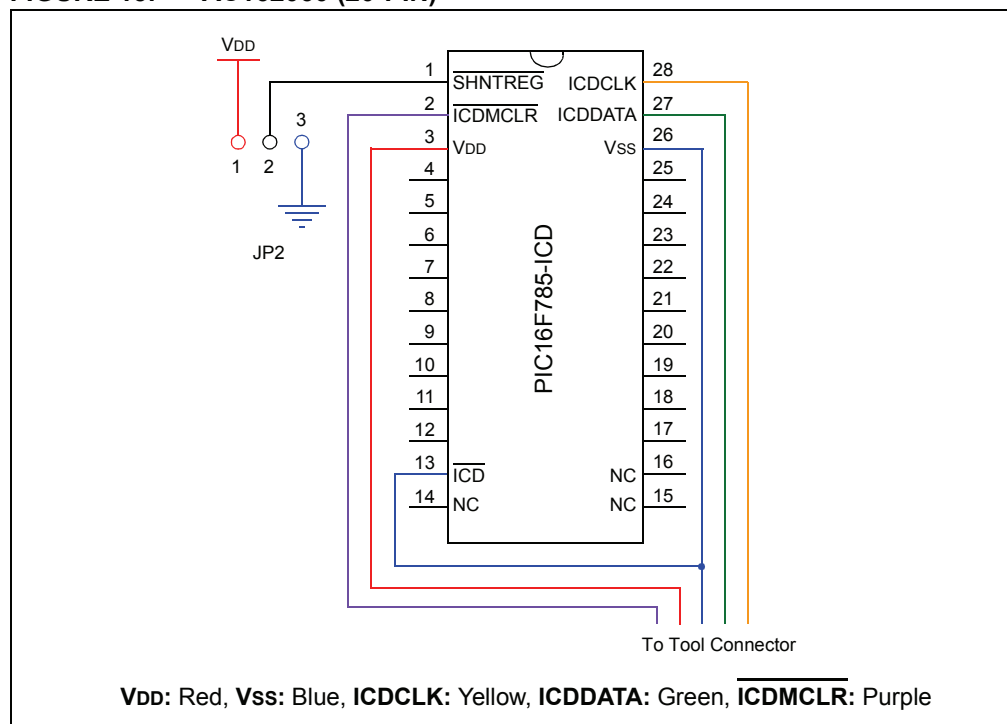


FIGURE 15: AC162060 (20-PIN)



Headers for ICD Devices

FIGURE 16: AC162061 (20-PIN)

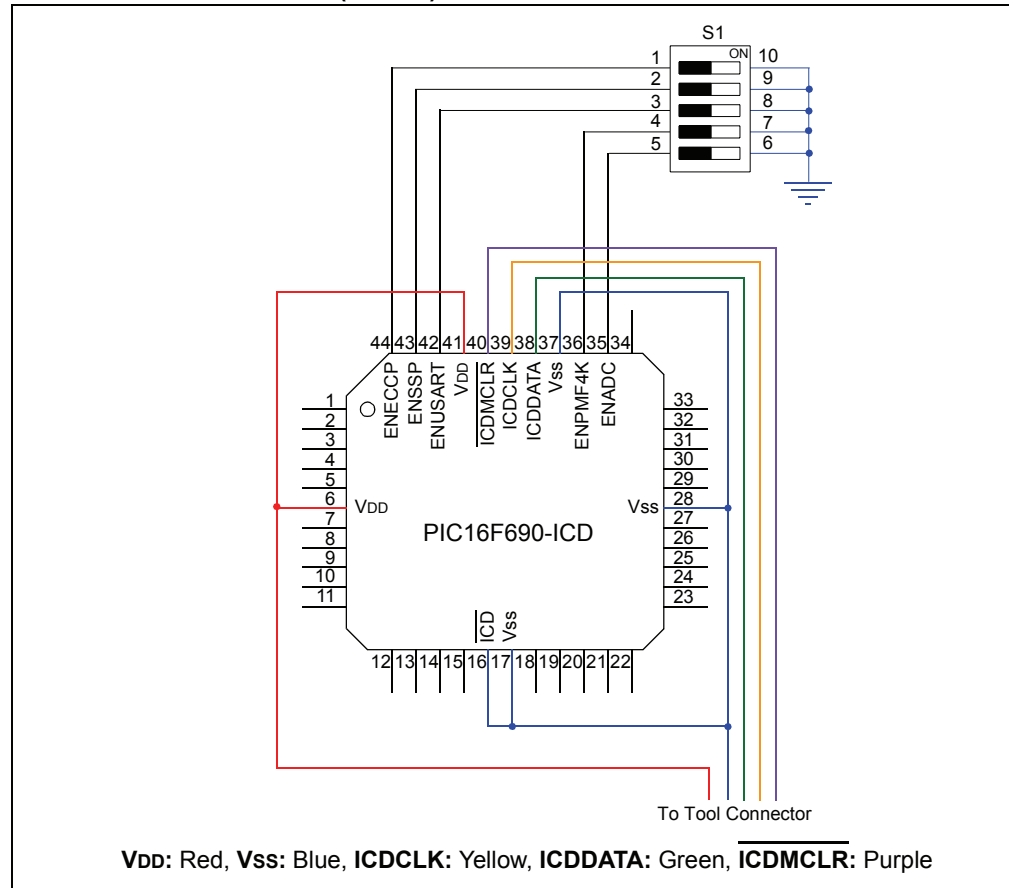
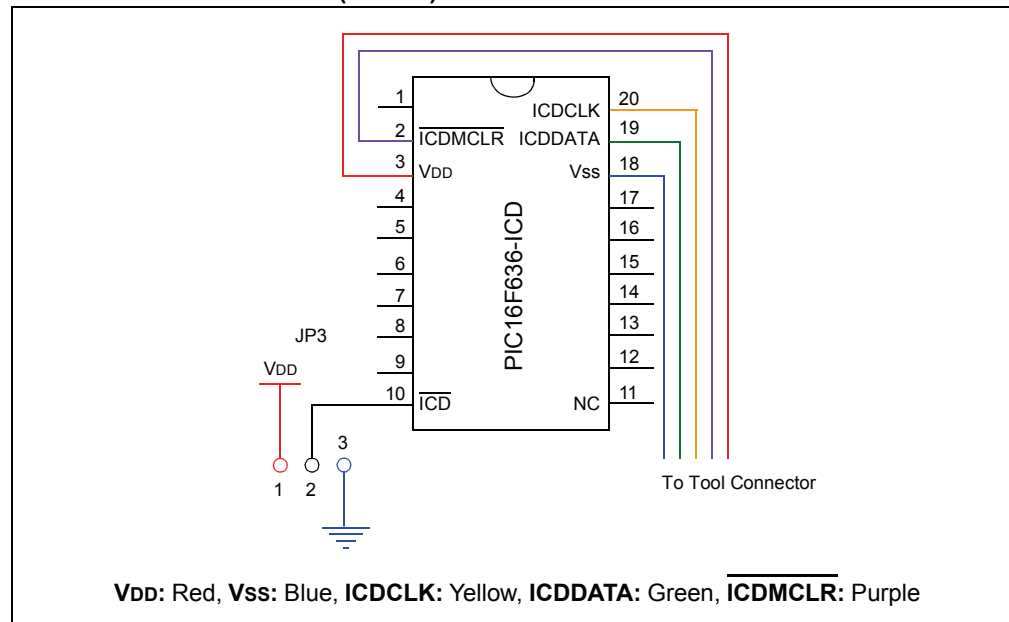


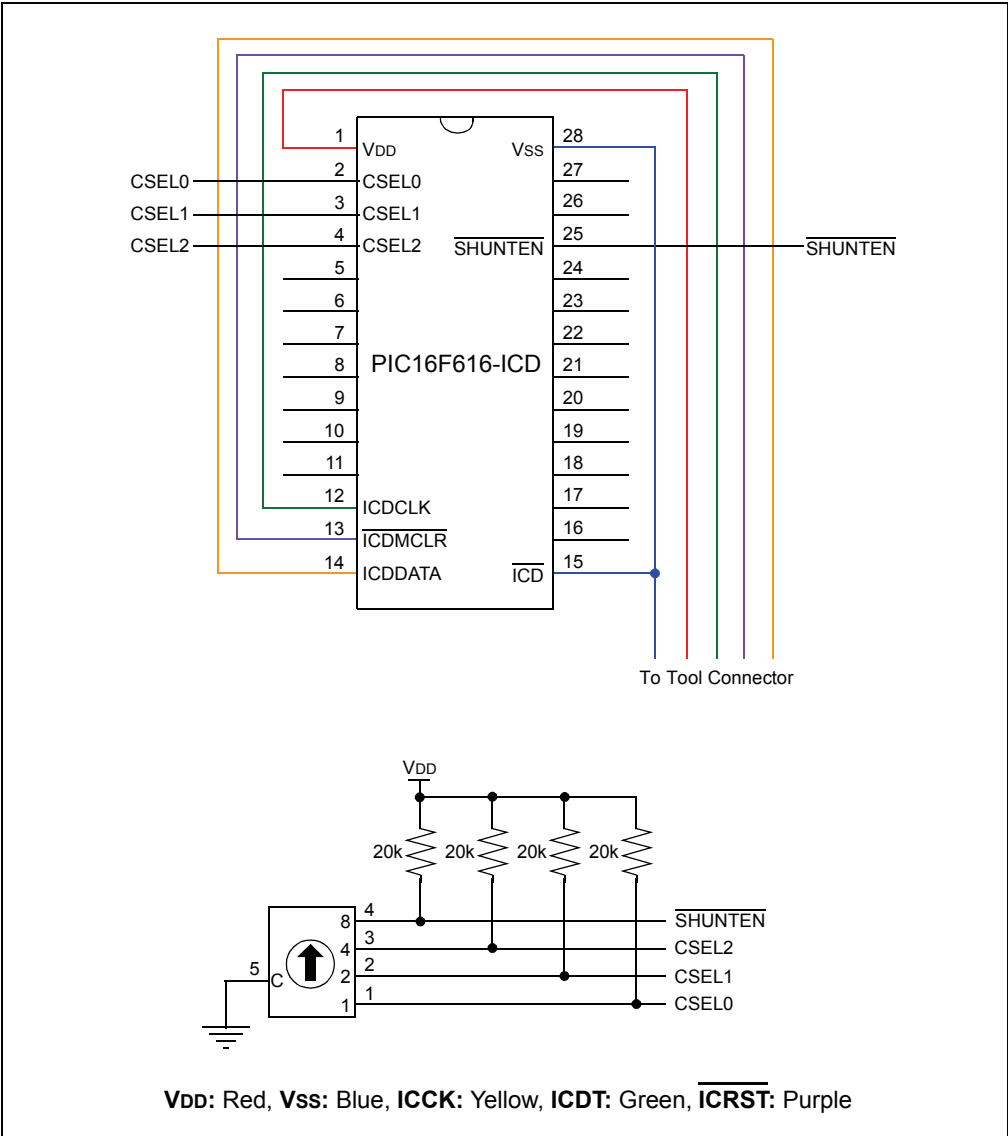
FIGURE 17: AC162066 (20-PIN)



[illegible]

[illegible]

FIGURE 20: AC162083



Headers for ICD Devices

NOTES:

APPENDIX A: REVISION HISTORY

A.1 Revision N (February 2006)

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

A.2 Revision P (February 2008)

- Updated document to reflect support of additional tools
- Additional minor corrections throughout document text

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