Debug Header Specification

NOTICE TO CUSTOMERS

All documentation becomes dated, and this manual is no exception. Microchip tools and documentation are constantly evolving to meet customer needs, so some actual dialogs and/or tool descriptions may differ from those in this document. Please refer to our web site (www.microchip.com) to obtain the latest documentation available.

Documents are identified with a "DS" number. This number is located on the bottom of each page, in front of the page number. The numbering convention for the DS number is "DSXXXXXA", where "XXXXX" is the document number and "A" is the revision level of the document.

For the most up-to-date information on development tools, see the MPLAB® IDE online Help. Select the Help menu, and then Topics to open a list of available online Help files.

This chapter contains the following:

- Why Do I Need A Header To Debug?
- Debug Details
- Programming Details
- General Header Setup
- Calibration Bits
- Performance Issues
- Related Debug Tools
- Customer Support

Debug Header Specification

WHY DO I NEED A HEADER TO DEBUG?

Some PIC® microcontrollers, particularly low pin count devices (with 20 pins or less), generally must use a header for debugging. This is done to free up I/O lines for your application and to make production parts more affordable. Optional headers are also available for high pin count devices (with 64 pins or higher).

Debugging requires a two-line connection (plus V_{DD}, V_{SS} and V_{PP}) to communicate with the device. In a high pin count device, losing a few I/O lines is generally not a problem for most designs. But in a low pin count device, it can be a critical problem. Imagine having to do an 8-pin design where there are only 5 I/Os, having used up 2 I/Os just for debugging!

Headers are also used to save you money. In high pin count devices, adding debugging to the silicon can generally be done at little or no cost since the silicon is already fairly large. However, low pin count devices are low cost specifically because they use very little silicon. So, adding debugging circuitry on-board these parts would add significant cost since it would raise the amount of silicon used by a considerable percentage. The header places the cost for debugging up front and frees your production parts from the extra cost of an unused debug module.

Microchip also makes optional debug modules, usually for high pin count devices. The module is optional because you can still do basic debugging without a header, but if you use one, you get back I/O lines, and may also gain additional debugging features. Only certain devices can use an optional header, see the device page on our website for details.

Microchip lists what header must be ordered to work with your device, if one is required. Simply consult the device page on our website, or our other ordering guides.

Note that in all cases, devices can be programmed "in circuit" (called ICSP™) with very few exceptions. Even devices without an internal debug feature can still be programmed by connecting the programming/debugging tool to the in-circuit programming lines. These devices simply cannot perform debugging without a header.

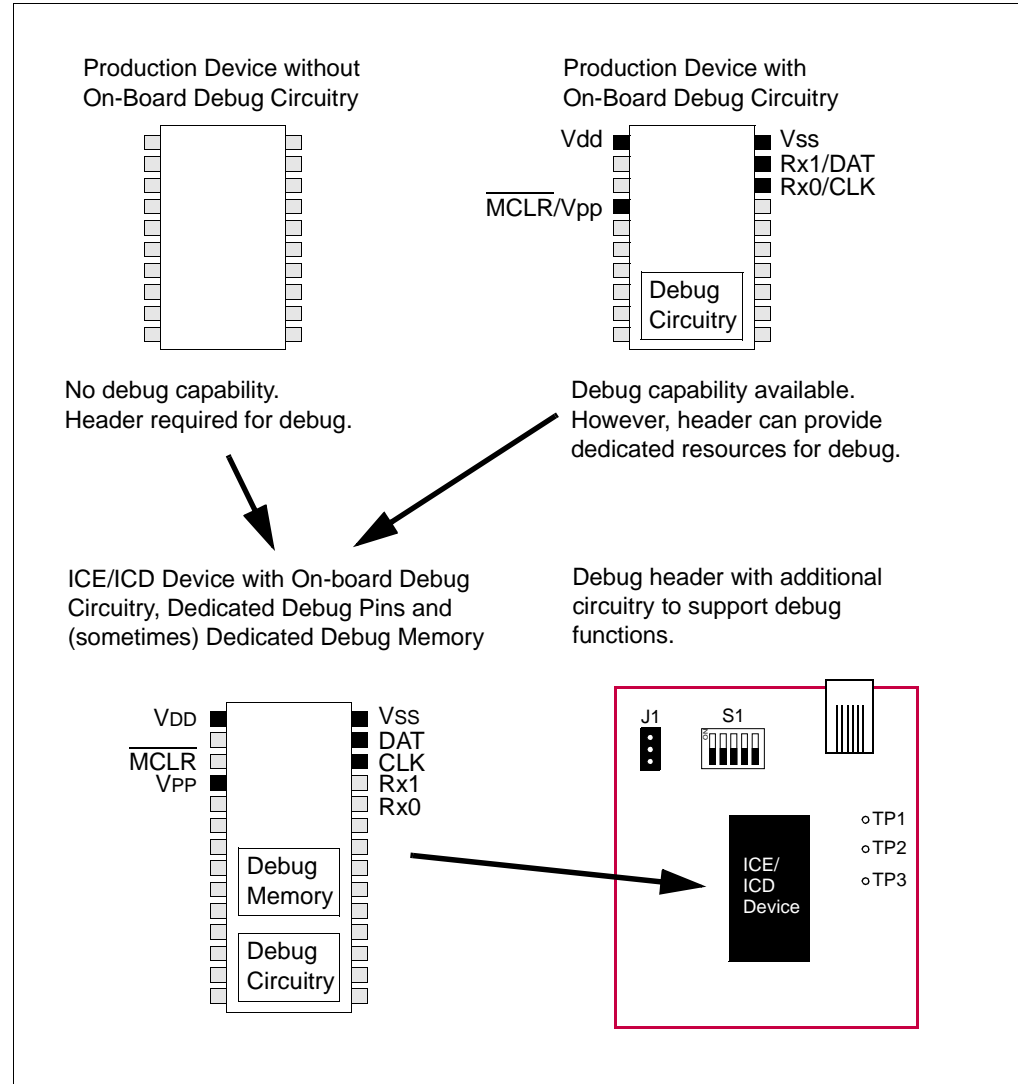**FIGURE 1:** **PRODUCTION DEVICE VS. HEADER DEVICE (-ICE/-ICD)**

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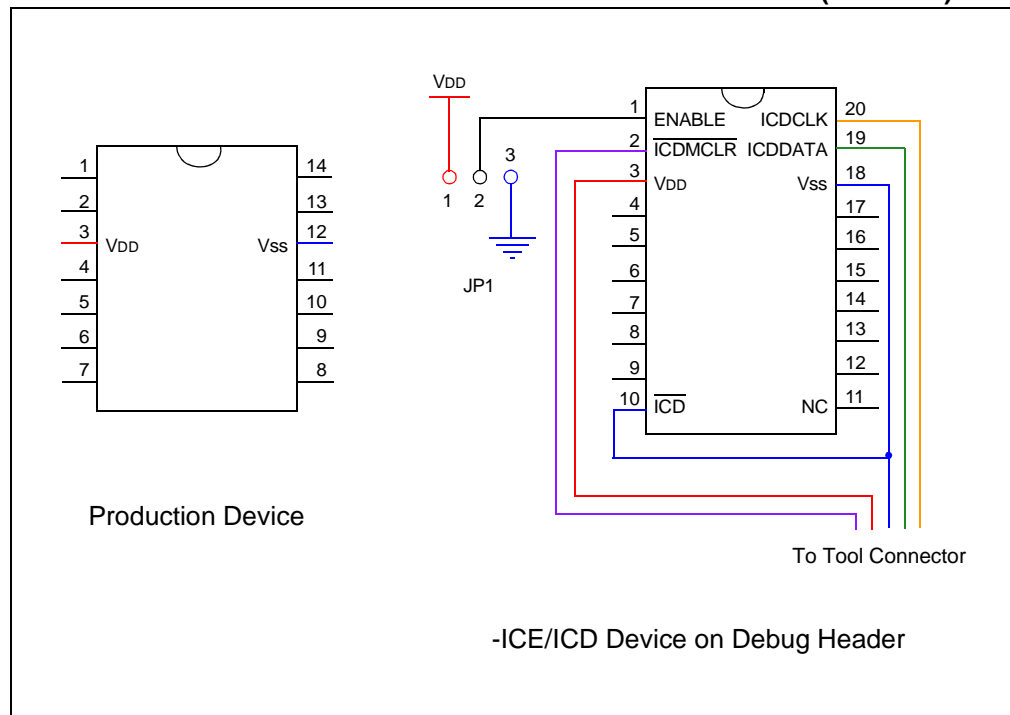
DEBUG DETAILS

Next generation in-circuit emulators (such as the MPLAB® REAL ICE™ in-circuit emulator) and in-circuit debuggers work with devices that have on-chip debug circuitry. Sometimes the actual production device will have this circuitry and sometimes a special version of this device is required or available for code debugging. This special version of the chip, with the suffix -ICD or -ICE, is mounted on a debug header (Figure 2).

> **Note:** ICE/ICD devices are only used on the header; they are not sold separately.

FIGURE 2: **DEBUG OPTIONS**

Production Device without On-Board Debug Circuitry

Production Device with On-Board Debug Circuitry

Vdd — Vss / Rx1/DAT / Rx0/CLK

MCLR/Vpp

Debug Circuitry

No debug capability. Header required for debug.

Debug capability available. However, header can provide dedicated resources for debug.

ICE/ICD Device with On-board Debug Circuitry, Dedicated Debug Pins and (sometimes) Dedicated Debug Memory

Debug header with additional circuitry to support debug functions.

VDD — VSS / DAT / CLK / Rx1 / Rx0
MCLR VPP

Debug Memory

Debug Circuitry

J1   S1

ICE/ICD Device

○TP1
○TP2
○TP3

In general, ICE devices are designed for next-generation in-circuit emulator use and ICD devices are designed for in-circuit debugger use. However, ICE devices may be used with an in-circuit debugger and ICD devices may be used with a next-generation in-circuit emulator, but will provide only basic ICD functionality.

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

Debug Header Specification

PROGRAMMING DETAILS

The debug header is designed to be used with the in-circuit emulator or the 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 production (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, production devices may be programmed with the following tools:

- MPLAB PM3 device programmer
- PICSTART® Plus development programmer
- PICkit™ 1, 2 or 3 development programmer
- MPLAB ICD 3 in-circuit debugger (select as a programmer)
- MPLAB REAL ICE in-circuit emulator (select as a programmer)

GENERAL HEADER SETUP

To set up your header, do the following:

1. Check the debug header for any stickers and the header box for any paper inserts that may specify special operating instructions (Figure 3). Follow these instructions before doing anything else.

**FIGURE 3:   SPECIAL HEADER INSTRUCTIONS**
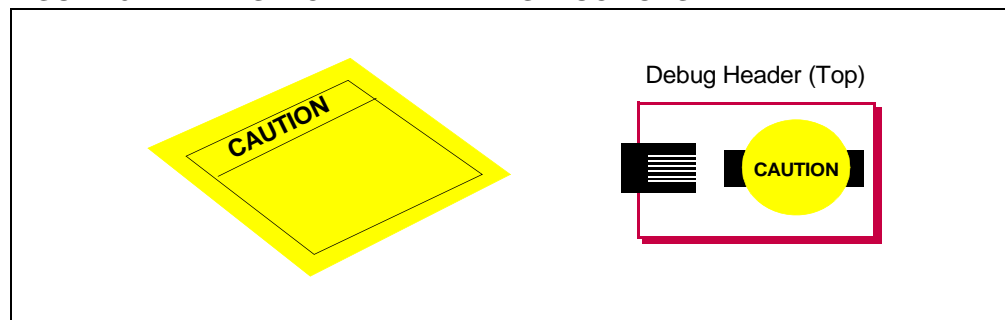
2. Set any jumpers or switches on the header to determine device functionality or selection as specified for that header. See the sections "Optional Debug Headers" or "Required Debug Headers" for information on how to set up individual headers.

3. Connect the header to your desired debug tool by consulting the tool documentation for connection options. An example connection is shown in Figure 4.

   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).

**FIGURE 4:**   **CONNECT HEADER TO DEBUG TOOL**
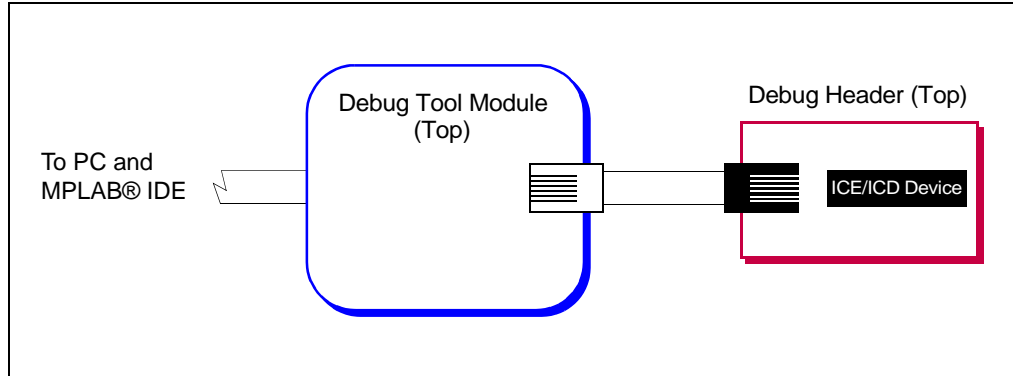
4. Connect the header to the target board. On the bottom of the header is a socket that is used to connect to the target board. The header may be connected to the target board as follows:
   a) PDIP header socket to PDIP target socket with a stand-off (male-to-male) connector
   b) Header socket to plug 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 5.

   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 5:   **CONNECT HEADER TO TARGET**
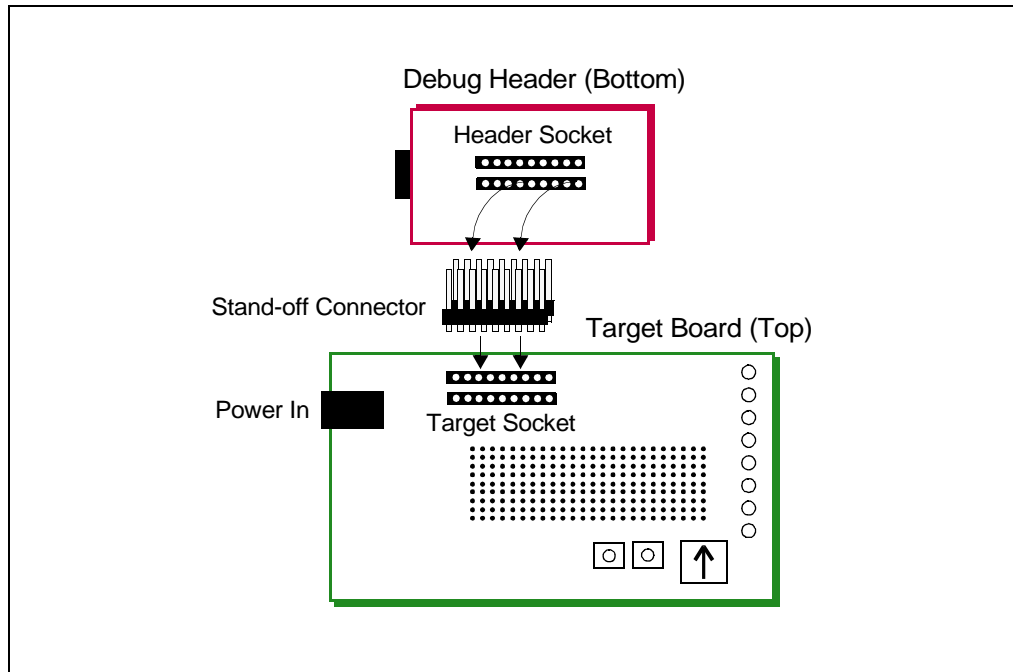
5. If using a debug tool that can power the target, power that tool now.
6. Power the target, if needed.

Debug Header 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 in-circuit emulator or the in-circuit debugger Help file for information on specific device limitations that may affect performance.

RELATED DEBUG TOOLS

The following tools support the use of headers:

- MPLAB REAL ICE In-Circuit Emulator
- MPLAB ICD 2 or 3 In-Circuit Debugger
- PICkit 2 or 3 Debug Express

See the Microchip website (http://www.microchip.com) for the latest documentation.

CUSTOMER SUPPORT

Users of Microchip products can receive assistance through several channels:

- Distributor or Representative
- Local Sales Office
- Field Application Engineer (FAE)
- Technical Support

Customers should contact their distributor, representative or field application engineer (FAE) for support. Local sales offices are also available to help customers.

Technical support is available through the web site at: http://support.microchip.com.

Documentation errors or comments may be sent to docerrors@microchip.com.

Required Debug Headers

INTRODUCTION

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

Currently available debug headers and their associated ICE/ICD devices are shown below, sorted by supported device.

TABLE 1:   REQUIRED DEBUG HEADERS BY DEVICE

Device	Pin Count	Header Part Number	ICE/ICD Device Used	VDD Max
PIC10F200/2/4/6	8/14	AC162059	PIC16F505-ICD	5.5V
PIC10F220/2	8/14	AC162070	PIC16F506-ICD	5.5V
PIC10F320/322	6/8	AC244045	PIC10F320-ICE	5.5V
PIC10LF320/322	6/8	AC244045	PIC10F320-ICE	3.6V
PIC12F508/509	8/14	AC162059	PIC16F505-ICD	5.5V
PIC12F510	8/14	AC162070	PIC16F506-ICD	5.5V
PIC12F519	8/14	AC162096	PIC16F526-ICD	5.5V
PIC12F609/HV609	28	AC162083	PIC16F616-ICD	5.5V
PIC12F615/HV615	28	AC162083	PIC16F616-ICD	5.5V
PIC12F617	28	AC162083	PIC16F616-ICD	5.5V
PIC12F629	8	AC162050	PIC12F675-ICD	5.5V
PIC12F635	14	AC162057	PIC16F636-ICD	5.5V
PIC12F675	8	AC162050	PIC12F675-ICD	5.5V
PIC12F683	8	AC162058	PIC12F683-ICD	5.5V
PIC16F505	8/14	AC162059	PIC16F505-ICD	5.5V
PIC16F506	8/14	AC162070	PIC16F506-ICD	5.5V
PIC16F526	8/14	AC162096	PIC16F526-ICD	5.5V
PIC16F610/HV610	14/16	AC162083	PIC16F616-ICD	5.5V
PIC16F616/HV616	14/16	AC162083	PIC16F616-ICD	5.5V
PIC16F627A/628A	18	AC162053	PIC16F648A-ICD	5.5V
PIC16F630	14	AC162052	PIC16F676-ICD	5.5V
PIC16F631	20	AC162061	PIC16F690-ICD	5.5V
PIC16F636	14	AC162057	PIC16F636-ICD	5.5V
PIC16F639[1]	20	AC162066	PIC16F636-ICD	5.5V
PIC16F648A	18	AC162053	PIC16F648A-ICD	5.5V
PIC16F676	14	AC162052	PIC16F676-ICD	5.5V
PIC16F677	20	AC162061	PIC16F690-ICD	5.5V
PIC16F684	14	AC162055	PIC16F684-ICD	5.5V

Required Debug Headers

TABLE 1: REQUIRED DEBUG HEADERS BY DEVICE (CON'T)

Device	Pin Count	Header Part Number	ICE/ICD Device Used	VDD Max
PIC16F685/687	20	AC162061	PIC16F690-ICD	5.5V
PIC16F688	14	AC162056	PIC16F688-ICD	5.5V
PIC16F689/690	20	AC162061	PIC16F690-ICD	5.5V
PIC16F716	18	AC162054	PIC16F716-ICD	5.5V
PIC16F785/HV785	20	AC162060	PIC16F785-ICD	5.5V
PIC18F13K50 PIC18F14K50	20	AC244023	PIC18F14K50-ICE	5.5V
PIC18LF13K50 PIC18LF14K50	20	AC244024	PIC18LF14K50-ICE	3.6V 2.75V[2]
PIC24F04KA200 PIC24F04KA201	14 20	AC244028	PIC24F16KA102-ICE[3]	3.6V

Note 1: Dual die

Note 2: VDDCORE Max

Note 3: Header optional for other devices

AC162050, AC162058

Header Identification

The header AC number is used for ordering the header. However, this number is not on the debug header, as the board is often used for multiple headers by inserting different ICE/ICD devices. To identify these debug headers, use the following information.

Header	ICE/ICD Device	Board Assembly Number
AC162050	PIC12F675-ICD	02-01662
AC162058	PIC12F683-ICD	

Header Setup and Operation

For these headers, device peripherals need to be selected by setting jumper J1 to the appropriate position. For AC162050, 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
AC162058	1-2	A/D Enabled	PIC12F683

Header Limitations

See the "Limitations" section in your debug tool online Help file for details.

Header Dimensions

The figure below lists the dimensions for the debug header. Dimensions are design values in inches.

If the length and/or width of the debug header 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.

FIGURE 1: **DIMENSIONS – AC162050, AC162058**
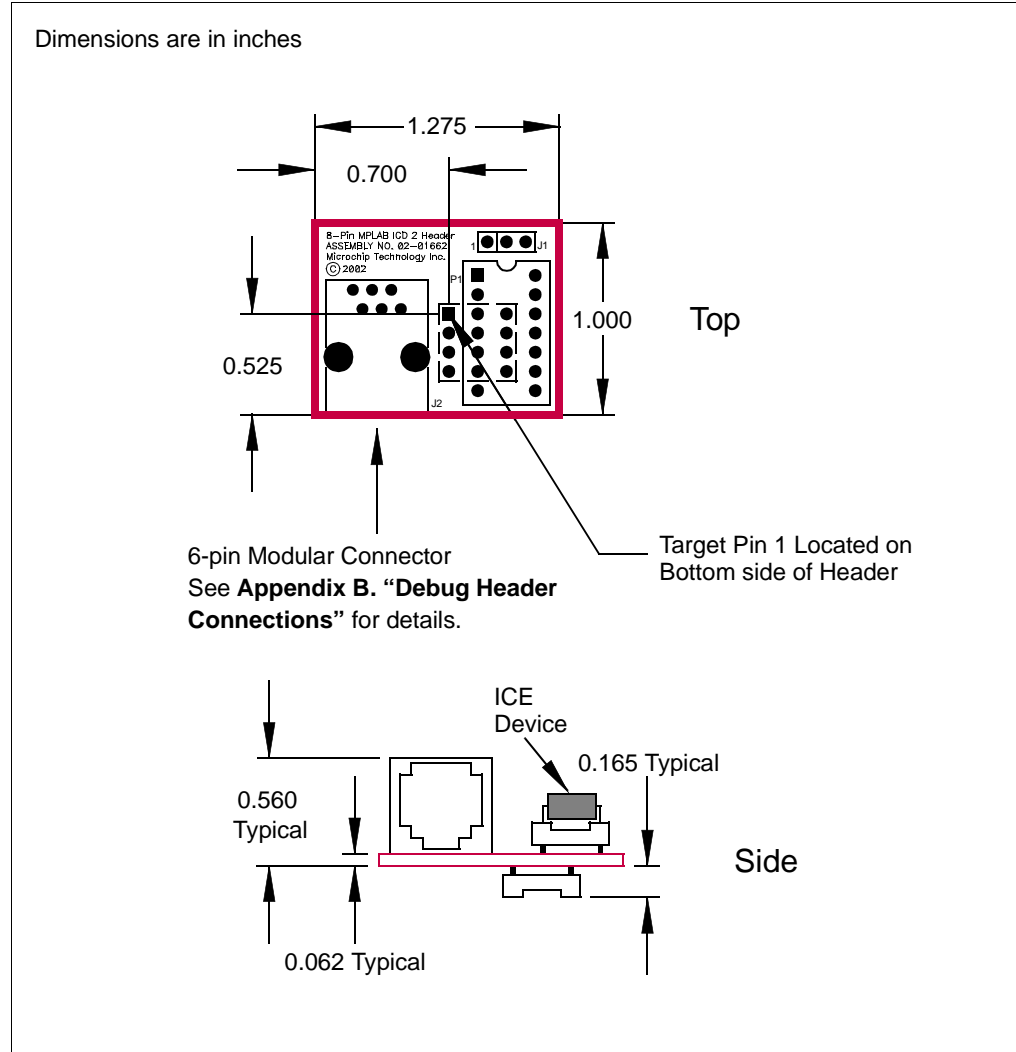
Required Debug Headers

AC162052, AC162055, AC162056, AC162057

Header Identification

The header AC number is used for ordering the header. However, this number is not on the debug header, as the board is often used for multiple headers by inserting different ICE/ICD devices. To identify these debug headers, use the following information.

Header	ICE/ICD Device	Board Assembly Number
AC162052	PIC16F676-ICD	02-01686
AC162055	PIC16F684-ICD	
AC162056	PIC16F688-ICD	
AC162057	PIC16F636-ICD	

Header Setup and Operation

For these headers, device peripherals need to be selected by setting jumper J1 to the appropriate position. For AC162052 and AC162057, this will have the effect of selecting the device.

Header	Jumper J1	Function	Device Selected
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

Header Limitations

See the "Limitations" section in your debug tool online Help file for details.

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Header Dimensions

The figure below lists the dimensions for the debug header. Dimensions are design values in inches.

If the length and/or width of the debug header 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.

FIGURE 2:   DIMENSIONS – AC162052, AC162055, AC162056, AC162057
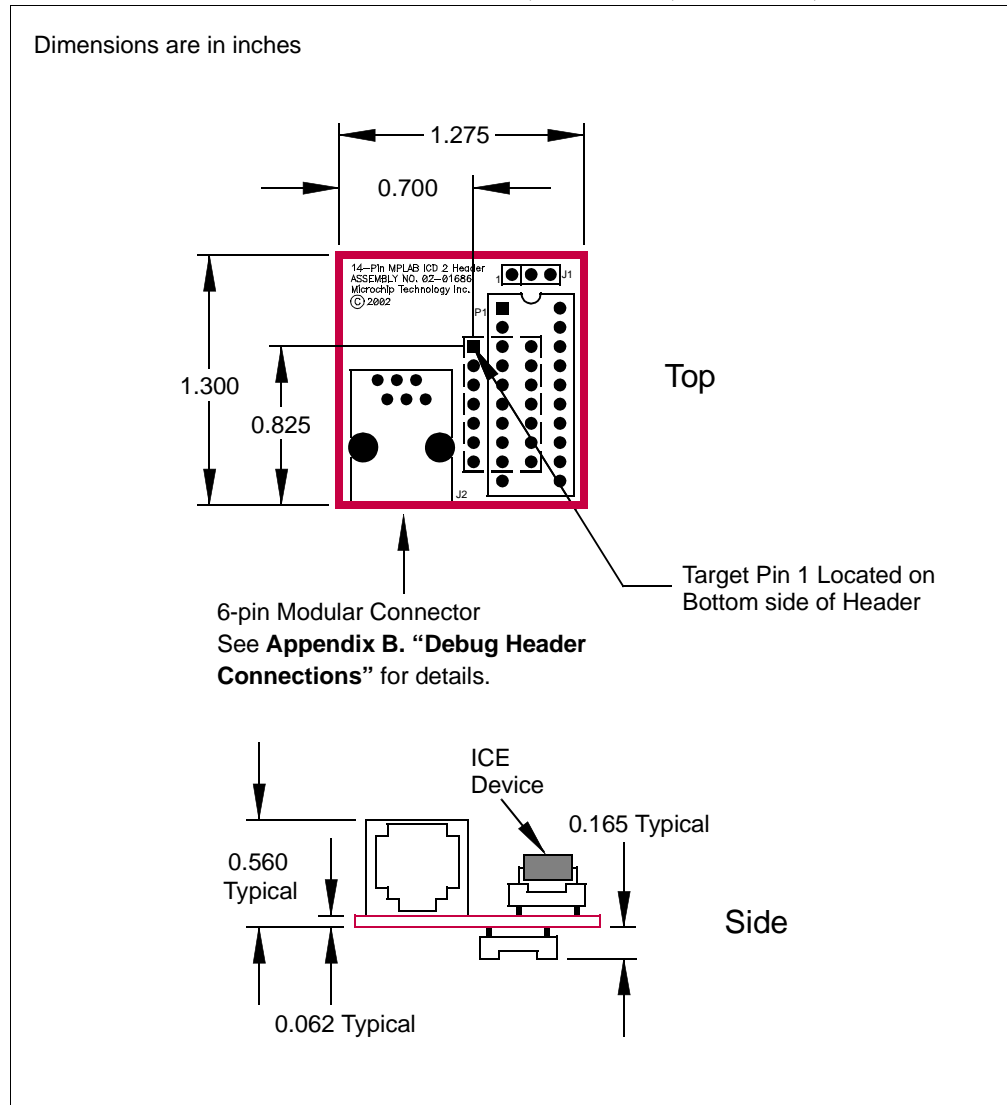
Required Debug Headers

AC162053, AC162054

Header Identification

The header AC number is used for ordering the header. However, this number is not on the debug header, as the board is often used for multiple headers by inserting different ICE/ICD devices. To identify these debug headers, use the following information.

Header	ICE/ICD Device	Board Assembly Number
AC162053	PIC16F648A-ICD	02-01695
AC162054	PIC16F716-ICD	

Header Setup and Operation – 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 development in MPLAB IDE, the warning "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.

Header Setup and Operation – AC162054

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

Header Limitations

See the "Limitations" section in your debug tool online Help file for details.

Header Dimensions

The figure below lists the dimensions for the debug header. Dimensions are design values in inches.

If the length and/or width of the debug header 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.

FIGURE 3:   DIMENSIONS – AC162053, AC162054
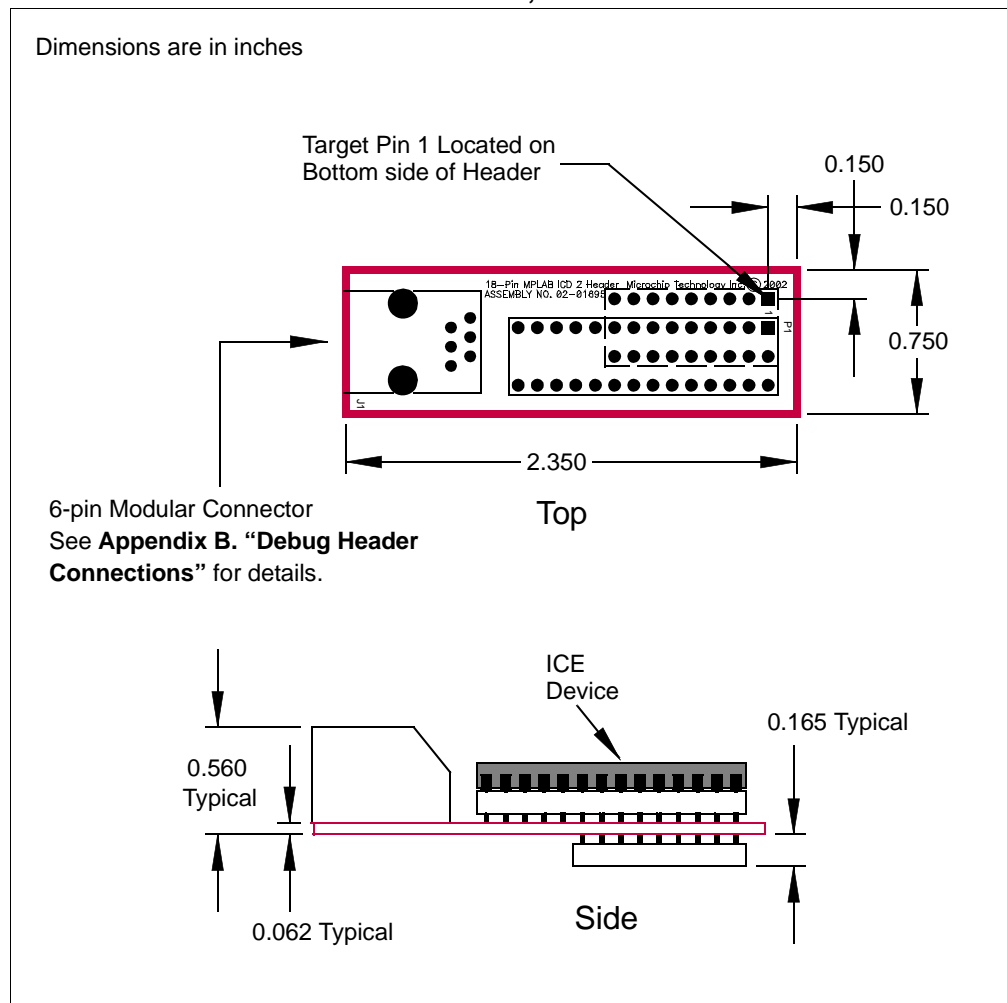
Required Debug Headers

AC162059, AC162070, AC162096

Header Identification

The header AC number is used for ordering the header. However, this number is not on the debug header, as the board is often used for multiple headers by inserting different ICE/ICD devices. To identify these debug headers, use the following information.

Header	ICE/ICD Device	Board Assembly Number
AC162059	PIC16F505-ICD	02-01803
AC162070	PIC16F506-ICD	
AC162096	PIC16F526-ICD	

Header Setup and Operation

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 (see Figure 4.) 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 at the 14-pin connector pin 1.

Header Limitations

See the "Limitations" section in your debug tool online Help file for details.

Header Dimensions

The figure below lists the dimensions for the debug header. Dimensions are design values in inches.

If the length and/or width of the debug header 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.

FIGURE 4:   DIMENSIONS – AC162059, AC162070, AC162096
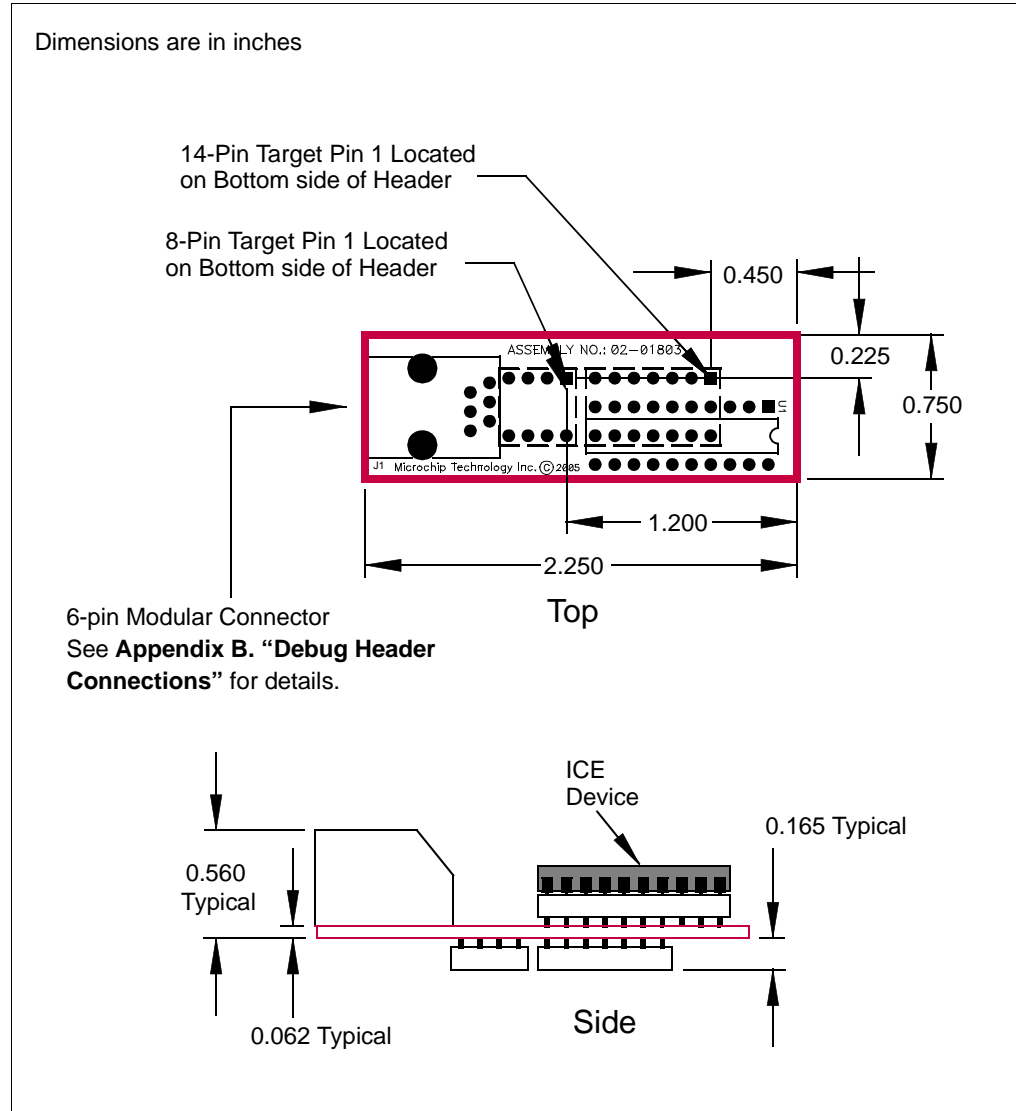
Required Debug Headers

AC162060

Header Identification

The header AC number is used for ordering the header. However, this number is not on the debug header, as the board is often used for multiple headers by inserting different ICE/ICD devices. To identify this debug header, use the following information.

Header	ICE/ICD Device	Board Assembly Number
AC162060	PIC16F785-ICD	02-01820

Header Setup and Operation

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

Device	Device Type	Jumper J2	Function
PIC16F785	F	1-2	Disable shunt regulator
PIC16HV785	HV	2-3	Enable shunt regulator

Header Limitations

See the "Limitations" section in your debug tool online Help file for details.

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Header Dimensions

The figure below lists the dimensions for the debug header. Dimensions are design values in inches.

If the length and/or width of the debug header 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.

FIGURE 5:   DIMENSIONS – AC162060
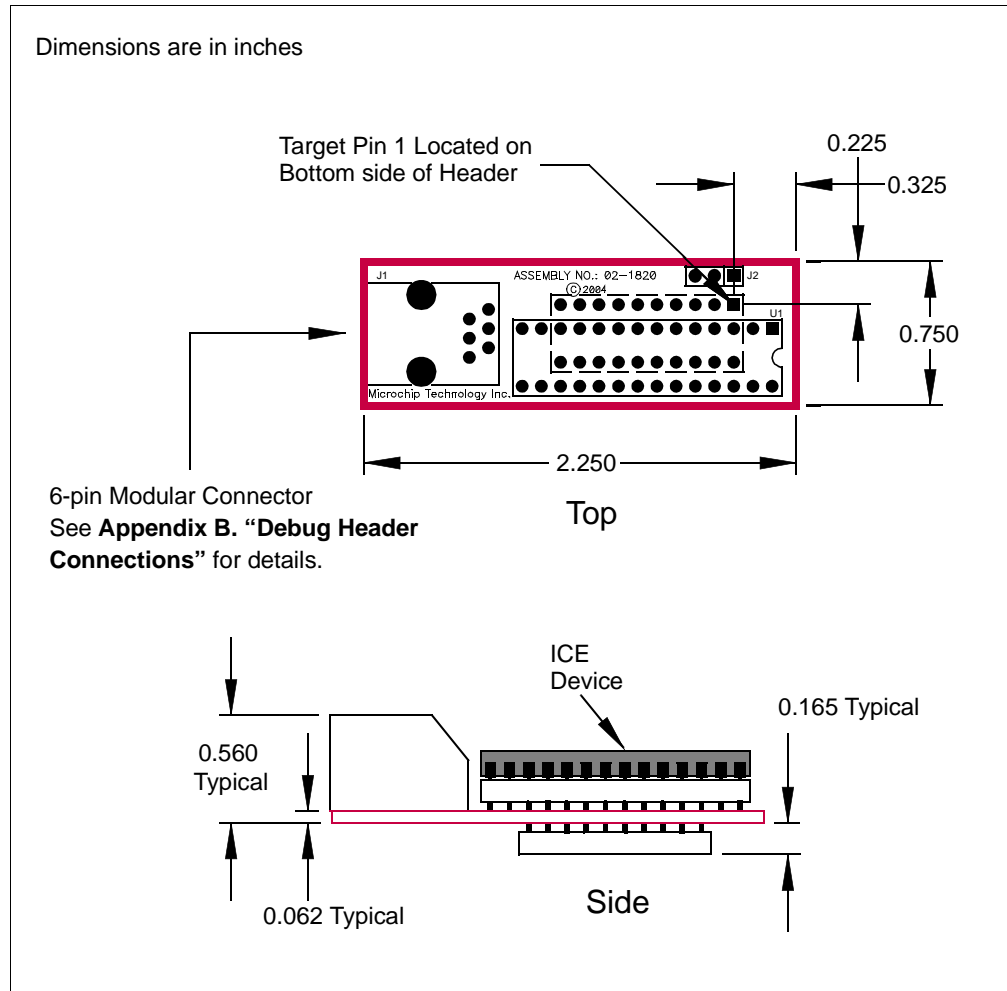
Required Debug Headers

AC162061

Header Identification

The header AC number is used for ordering the header. However, this number is not on the debug header, as the board is often used for multiple headers by inserting different ICE/ICD devices. To identify this debug header, use the following information.

Header	ICE/ICD Device	Board Assembly Number
AC162061	PIC16F690-ICD	02-01835

Header Setup and Operation

For the PIC16F690 20-pin header, you will need to set the S1 switches (Figure 6) to enable peripherals and choose devices (Table 2).
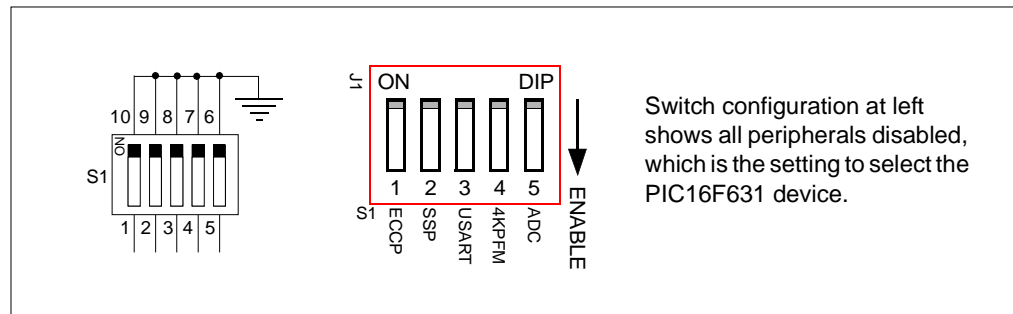
FIGURE 6:   S1 SWITCH HARDWARE

Switch configuration at left shows all peripherals disabled, which is the setting to select the PIC16F631 device.

TABLE 2:   S1 SWITCH DEVICE SELECTION

Device	Switches				
	1 ECCP	2 SSP	3 USART	4 4k PFM	5 ADC
PIC16F631	0	0	0	0*	0
PIC16F677	0	1	0	0**	1
PIC16F685	1	0	0	1	1
PIC16F687	0	1	1	0**	1
PIC16F689	0	1	1	1	1
PIC16F690	1	1	1	1	1

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

Header Limitations

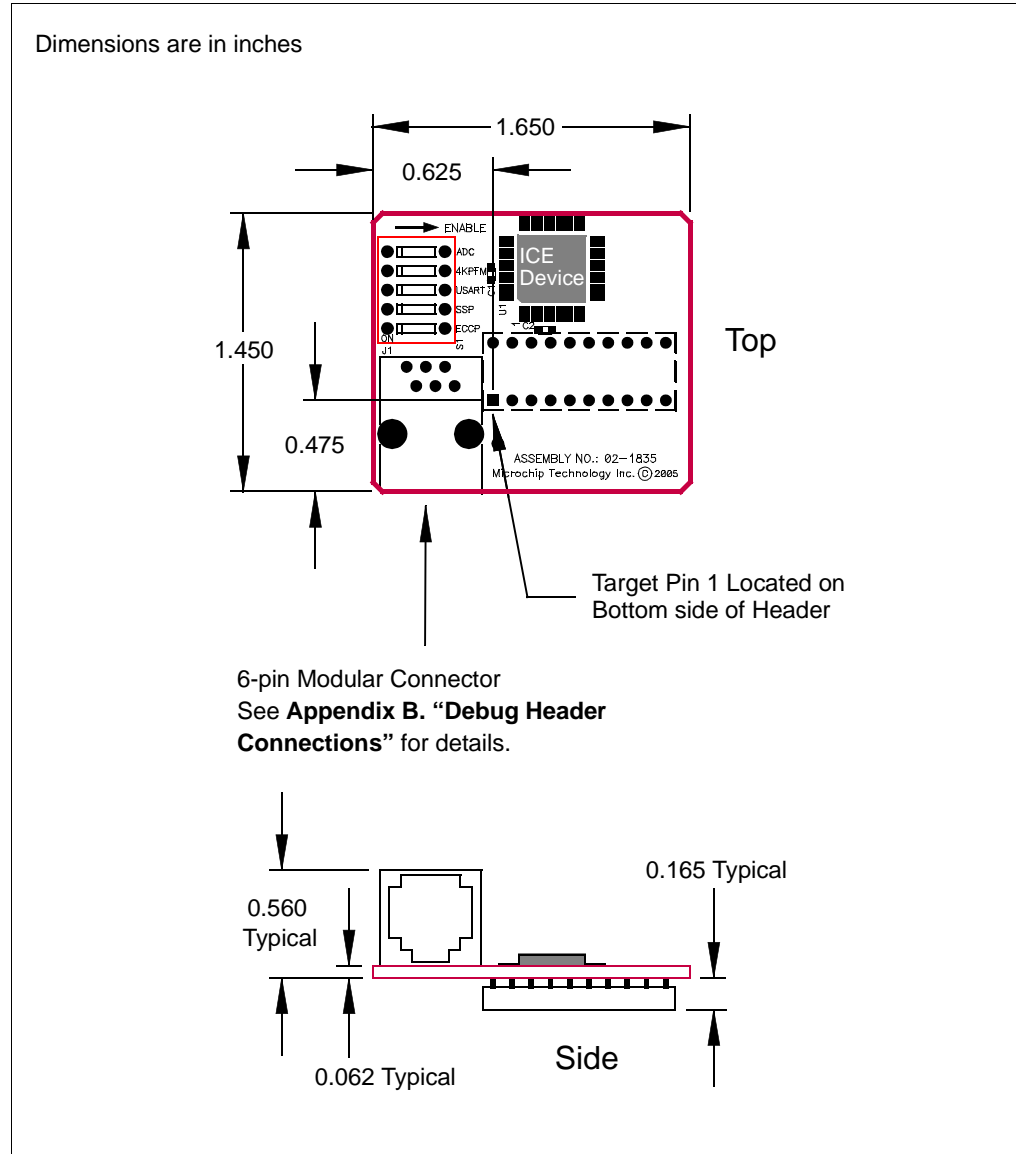See the "Limitations" section in your debug tool online Help file for details.

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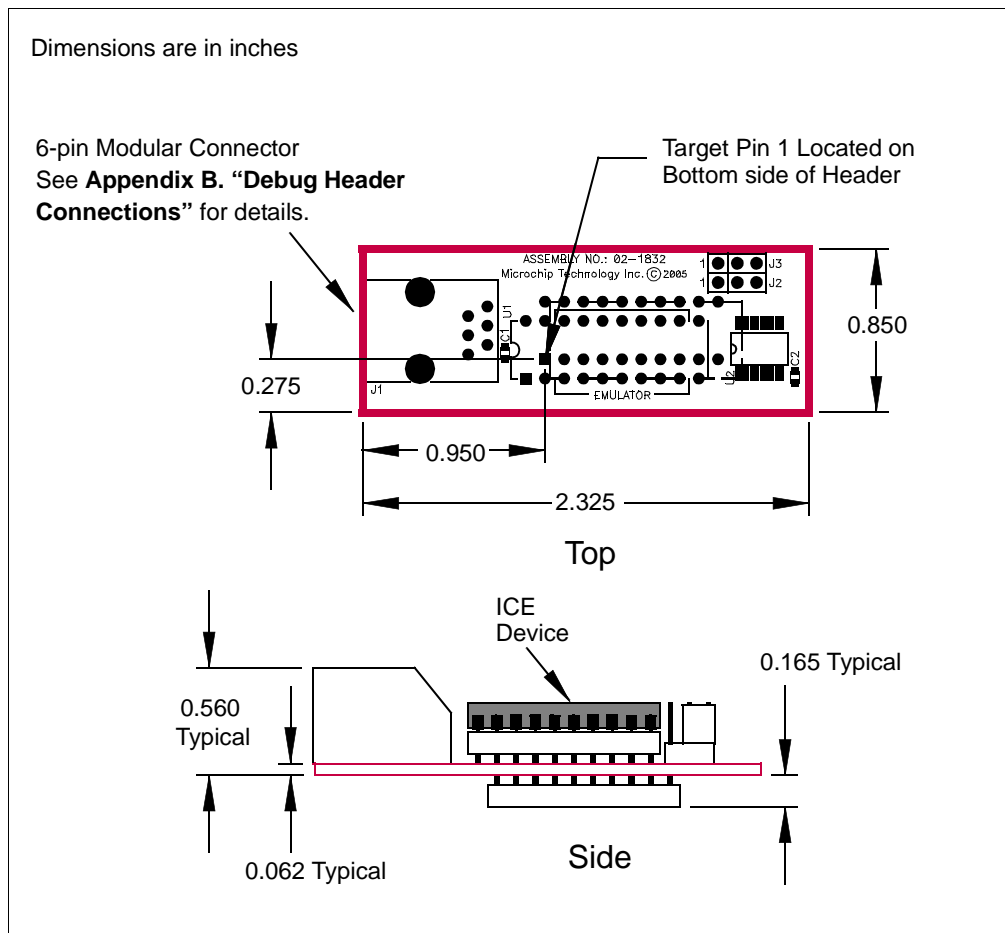## Header Dimensions

The figure below lists the dimensions for the debug header. Dimensions are design values in inches.

If the length and/or width of the debug header 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.

FIGURE 7:   **DIMENSIONS – AC162061**

Dimensions are in inches

1.650

0.625

1.450

0.475

ENABLE
ADC
4KPFM
USART
SSP
ECCP
ON
J1

ICE Device

Top

Target Pin 1 Located on
Bottom side of Header

ASSEMBLY NO.: 02–1835
Microchip Technology Inc. © 2005

6-pin Modular Connector
See **Appendix B. "Debug Header Connections"** for details.

0.560 Typical

0.165 Typical

0.062 Typical

Side

Required Debug Headers

AC162066

Header Identification

The header AC number is used for ordering the header. However, this number is not on the debug header, as the board is often used for multiple headers by inserting different ICE/ICD devices. To identify this debug header, use the following information.

Header	ICE/ICD Device	Board Assembly Number
AC162066	PIC16F636-ICD	02-01832

Header Setup and Operation

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

Tool	Jumper J3	Function
®	1-2	Run/program as production device
In-circuit debuggers, next generation in-circuit emulators	2-3	Run/program as ICD device

Header Limitations

See the "Limitations" section in your debug tool online Help file for details.

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Header Dimensions

The figure below lists the dimensions for the debug header. Dimensions are design values in inches.

If the length and/or width of the debug header 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.

FIGURE 8:   DIMENSIONS – AC162066

Dimensions are in inches

6-pin Modular Connector
See **Appendix B. "Debug Header Connections"** for details.

Target Pin 1 Located on Bottom side of Header

ASSEMBLY NO.: 02–1832
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0.850

0.275

0.950

2.325

Top

ICE Device

0.165 Typical

0.560 Typical

0.062 Typical

Side

Required Debug Headers

AC162083

Header Identification

The header AC number is used for ordering the header. However, this number is not on the debug header, as the board is often used for multiple headers by inserting different ICE/ICD devices. To identify this debug header, use the following information.

Header	ICE/ICD Device	Board Assembly Number
AC162083	PIC16F616-ICD	02-01976

Header Setup and Operation

CAUTION
Incorrect rotary switch (Figure 9) settings may irreparably damage the header. Ensure rotary switch settings are correct (Table 3) before powering or connecting the header. Do not change the rotary switch setting while the header is powered or connected to a debug tool. Do not power shunt regulator (HV) devices from the debug tool.

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

TABLE 3:   ROTARY SWITCH SETTINGS

Switch Position	Device	Switch Position	Device
0	**PIC12HV609**	8	**PIC12F609**
1	**PIC12HV615**	9	**PIC12F615**
2	Reserved HV	A	**PIC12F617**
3	**PIC16HV610**	B	**PIC16F610**
4	**PIC16HV616**	C	**PIC16F616**
5	Reserved HV	D	Reserved F
6	Reserved HV	E	Reserved F
7	Reserved HV	F	Reserved F

Also see the AC162083 Insert (DS51693).

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 debug tool

Do not select in MPLAB IDE to power the target (debug header) from the debug tool (if it supports powering the target) when using shunt regulator (HV) devices since this will also cause the shunt to draw excessive current.

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<u>DETERMINING DAMAGE</u>

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 your debug tool 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.
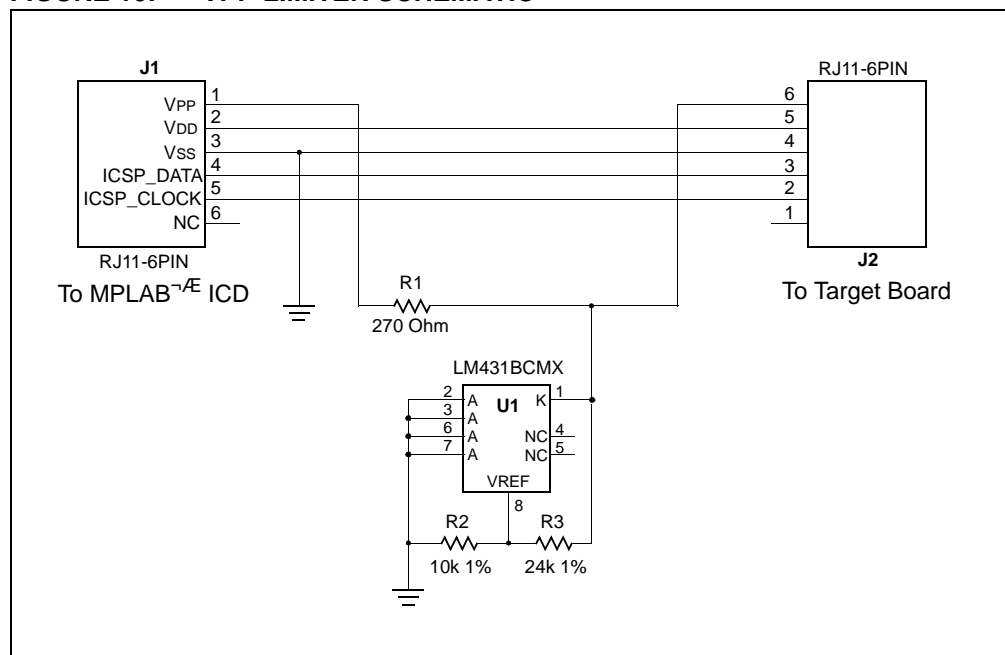
Header Limitations

See the "Limitations" section in your debug tool online Help file for details.
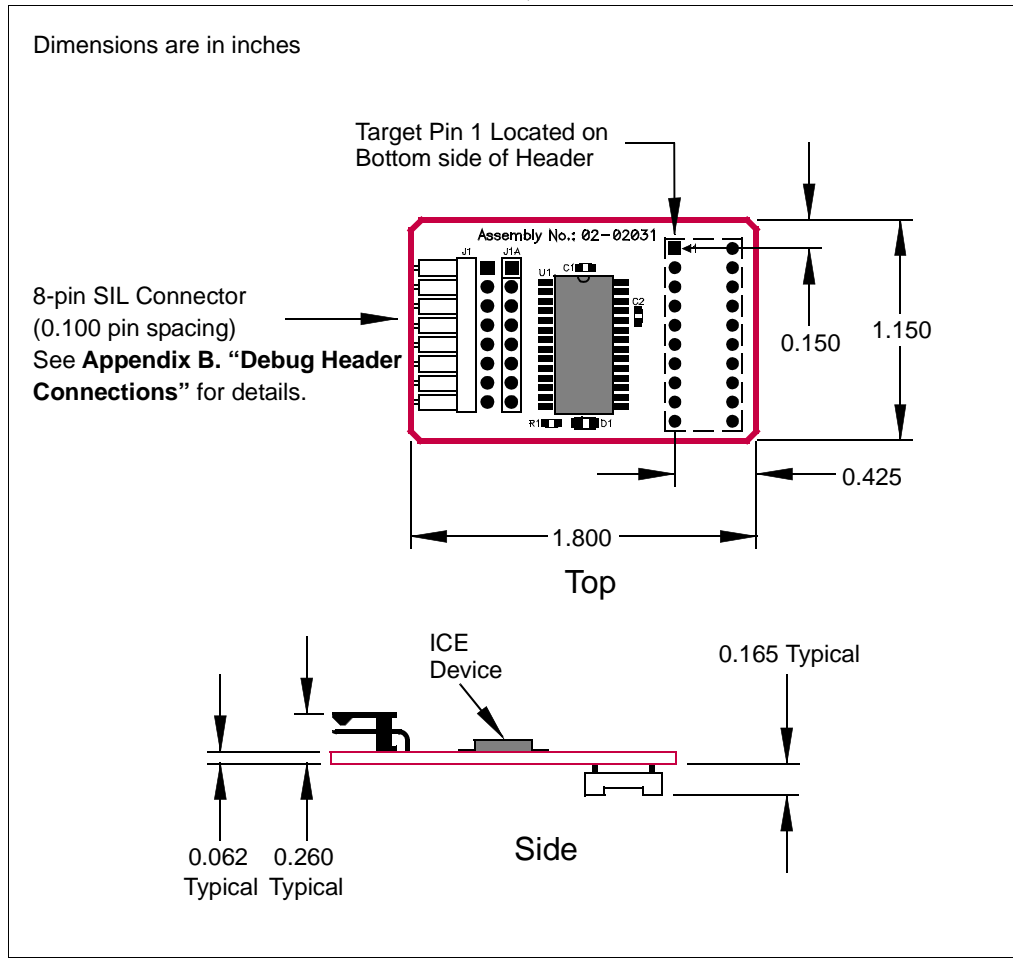
Header Dimensions

The figure below lists the dimensions for the debug header. Dimensions are design values in inches.

If the length and/or width of the debug header 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.

FIGURE 9:   DIMENSIONS – AC162083
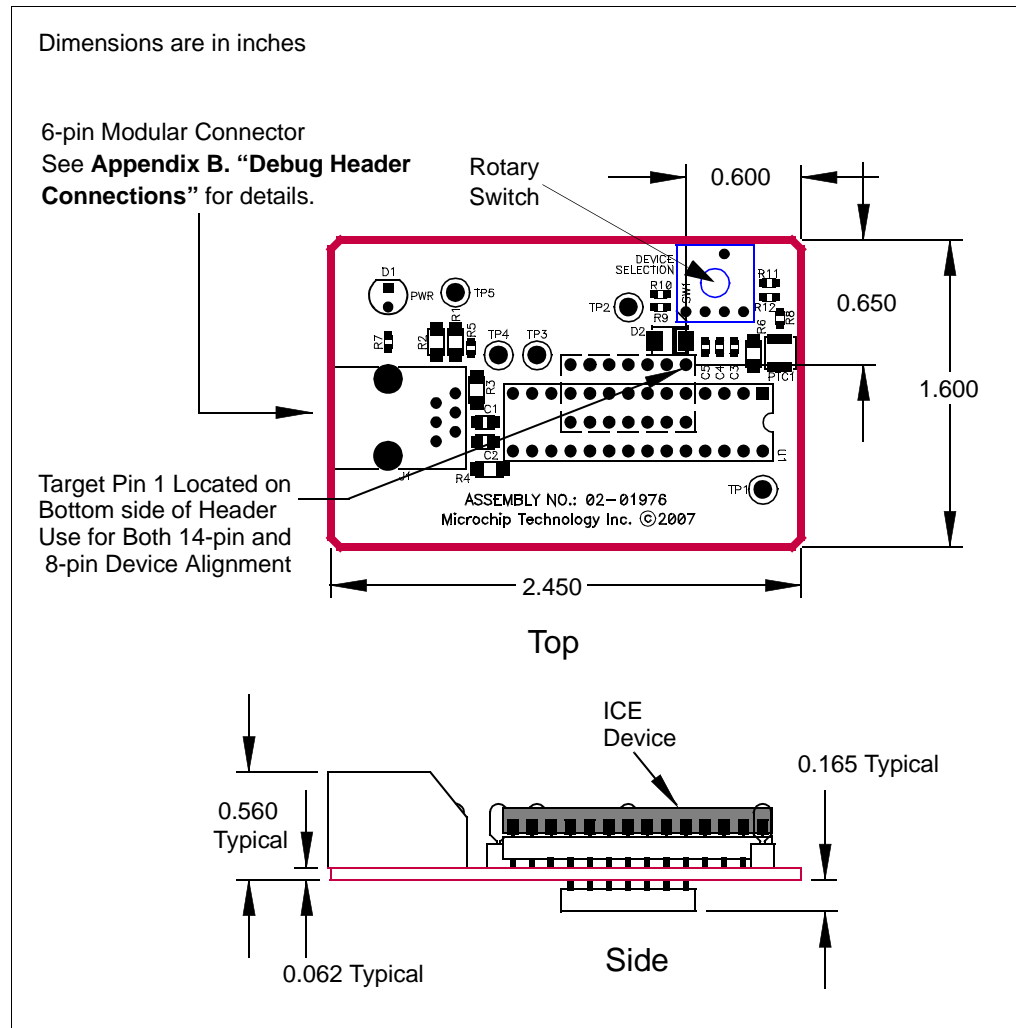
Required Debug Headers

AC244023, AC244024

Header Identification

The header AC number is used for ordering the header. However, this number is not on the debug header, as the board is often used for multiple headers by inserting different ICE/ICD devices. To identify these debug headers, use the following information.

Header	ICE/ICD Device	Board Assembly Number
AC244023	PIC18F14K50-ICE	02-02031
AC244024	PIC18LF14K50-ICE	

Header Setup and Operation

When the MPLAB ICD 2 is used with this header, you must use the Vpp Limiter (AC164112).

FIGURE 10:   VPP LIMITER SCHEMATIC

Header Limitations

See the "Limitations" section in your debug tool online Help file for details.

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## Header Dimensions

The figure below lists the dimensions for the debug header. Dimensions are design values in inches.

If the length and/or width of the debug header 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.

FIGURE 11:   DIMENSIONS – AC244023, AC224024

Dimensions are in inches

Target Pin 1 Located on Bottom side of Header

Assembly No.: 02-02031

8-pin SIL Connector (0.100 pin spacing) See **Appendix B. "Debug Header Connections"** for details.

0.150   1.150

0.425

1.800

Top

ICE Device

0.165 Typical

0.062 Typical   0.260 Typical

Side

Required Debug Headers

AC244028

Header Identification

The header AC number is used for ordering the header. However, this number is not on the debug header, as the board is often used for multiple headers by inserting different ICE/ICD devices. To identify this debug header, use the following information.

Header	ICE/ICD Device	Board Assembly Number
AC244028	PIC24F16KA102-ICE	02-02107

Header Setup and Operation

For this header, you will need to set up jumper J2 and J3.

Jumper	Setting	Function
J2	Open	Disable weak ICE/$\overline{\text{MCLR}}$ pull-up resistor
	Short	Enable weak ICE/$\overline{\text{MCLR}}$ pull-up resistor
J3	Open	Disable power LED indicator
	Short	Enable power LED indicator

Header Limitations

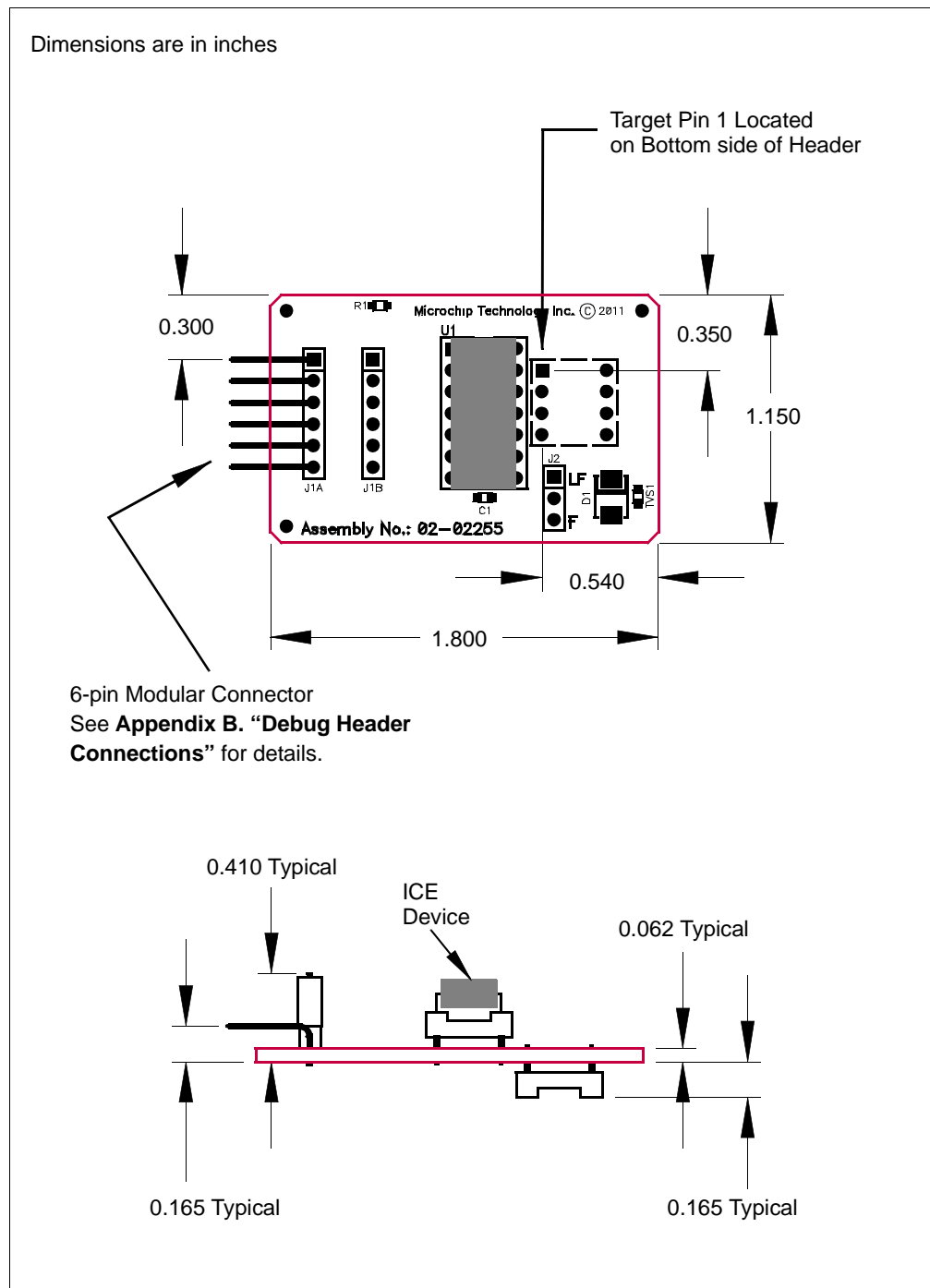See the "Limitations" section in your debug tool online Help file for details.

Header Dimensions

The figure below lists the dimensions for the debug header. Dimensions are design values in inches.

If the length and/or width of the debug header 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.

FIGURE 12:   DIMENSIONS - AC244028
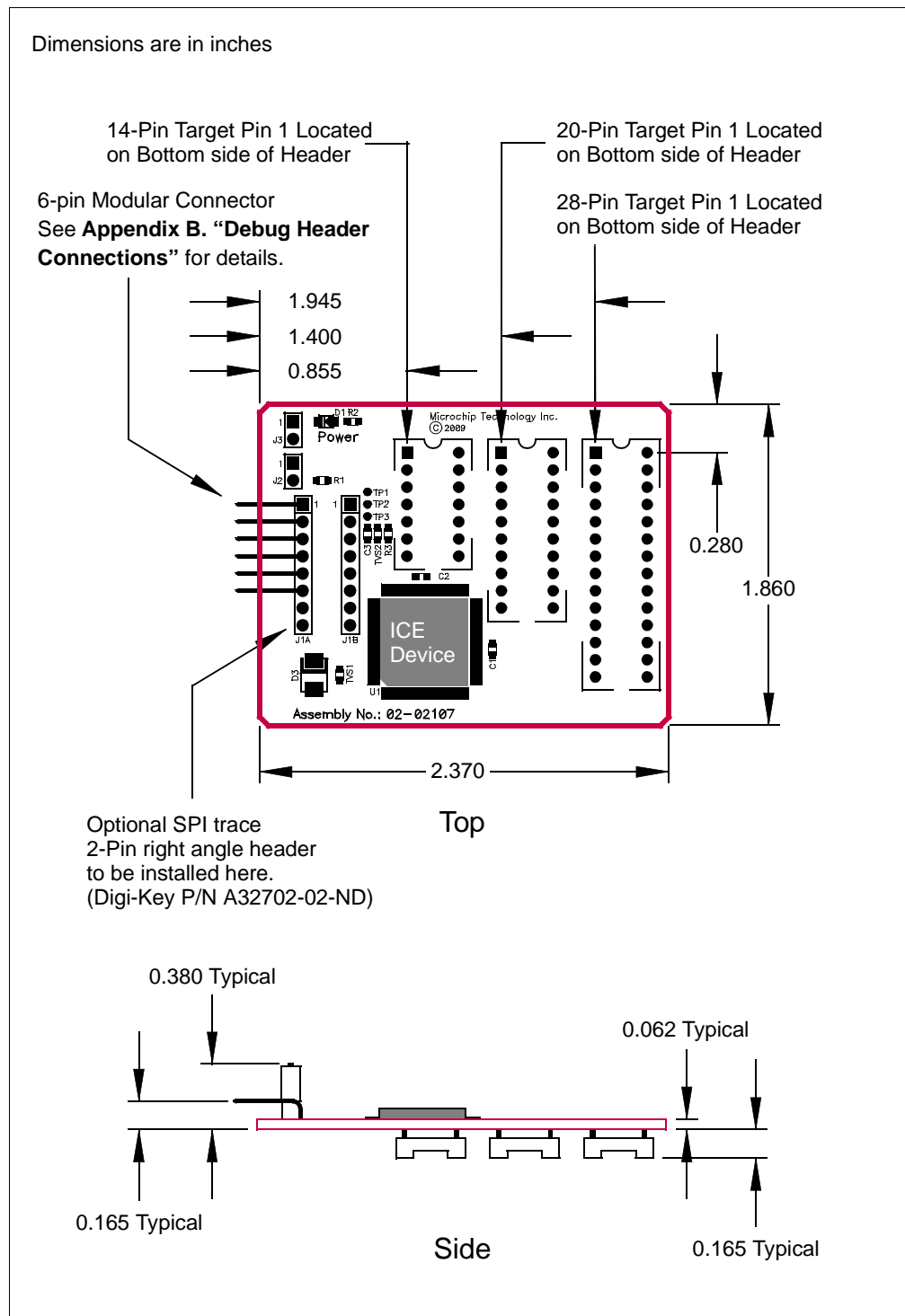
Required Debug Headers

AC244045

Header Identification

The header AC number is used for ordering the header. However, this number is not on the debug header, as the board is often used for multiple headers by inserting different ICE/ICD devices. To identify this debug header, use the following information.

Header	ICE/ICD Device	Board Assembly Number
AC244045	PIC10F320-ICE	02-02255

Because the ICE chip is based on the PIC10F320 device, the ICE device memory will be greater that the actual chip for the PIC10F322 device.

Header Limitations

See the "Limitations" section in your debug tool online Help file for details.

Header Dimensions

The figure below lists the dimensions for the debug header. Dimensions are design values in inches.

If the length and/or width of the debug header 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.

FIGURE 13:   DIMENSIONS - AC244045

Dimensions are in inches

Target Pin 1 Located on Bottom side of Header

0.300

0.350

1.150

0.540

1.800

6-pin Modular Connector See **Appendix B. "Debug Header Connections"** for details.

0.410 Typical

ICE Device

0.062 Typical

0.165 Typical

0.165 Typical

Required Debug Headers

NOTES:

Optional Debug Headers

INTRODUCTION

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

Currently available debug headers and their associated ICE/ICD devices are shown below by supported device.

TABLE 1: OPTIONAL DEBUG HEADERS BY DEVICE

Device	Pin Count	Header Part Number	ICE/ICD Device Used	V$_{DD}$ Max
PIC16F722 PIC16F723 PIC16F724 PIC16F726 PIC16F727	28 28 40/44 28 40/44	AC244026	PIC16F727-ICE	5.5V
PIC16LF722 PIC16LF723 PIC16LF724 PIC16LF726 PIC16LF727	28 28 40/44 28 40/44	AC244027	PIC16LF727-ICE	3.6V
PIC16F1826 PIC16F1827 PIC16F1847	18/20/28	AC244046	PIC16F1847-ICE	3.6V
PIC12F1822 PIC12F1840 PIC16F1823 PIC16F1824 PIC16F1825 PIC16F1829	8/14/20	AC244043	PIC16F1829-ICE	5.5V
PIC16LF1826 PIC16LF1827 PIC16LF1847	18/20/28	AC244047	PIC16LF1847-ICE	3.6V
PIC12F1822 PIC12F1840 PIC16F1823 PIC16F1824 PIC16F1825 PIC16F1829	8/14/20	AC244044	PIC16LF1829-ICE	3.6V
PIC16F1933 PIC16F1934 PIC16F1936 PIC16F1937 PIC16F1938 PIC16F1939	28 40/44 28 40/44 28 40/44	AC244035	PIC16F1939-ICE	5.5V

Optional Debug Headers

TABLE 1:   OPTIONAL DEBUG HEADERS BY DEVICE (CON'T)

Device	Pin Count	Header Part Number	ICE/ICD Device Used	V$_{DD}$ Max
PIC16LF1933 PIC16LF1934 PIC16LF1936 PIC16LF1937 PIC16LF1938 PIC16LF1939	28 40/44 28 40/44 28 40/44	AC244036	PIC16LF1939-ICE	3.6V 2.75V[2]
PIC18F1230/1330	28	AC162078	PIC18F1330-ICD	5.5V
PIC18F13K22 PIC18F14K22	20	AC244033	PIC18F14K22-ICE	5.5V
PIC18LF13K22 PIC18LF14K22	20	AC244034	PIC18LF14K22-ICE	3.6V 2.75V[1]
PIC18F24J10 PIC18F25J10	28	AC162067	PIC18F45J10-ICE	3.6V
PIC18LF24J10 PIC18LF25J10				3.6V 2.75V[1]
PIC18F44J10 PIC18F45J10	40			3.6V
PIC18LF44J10 PIC18LF45J10				3.6V 2.75V[1]
PIC18F44J10 PIC18F45J10	44	AC162074	PIC18F45J10-ICE	3.6V
PIC18LF44J10 PIC18LF45J10				3.6V 2.75V[1]
PIC18F63J11 PIC18F63J90 PIC18F64J11 PIC18F64J16 PIC18F64J90 PIC18F64J95 PIC18F65J11 PIC18F65J90	64	AC162079	PIC18F85J90-ICE	3.6V
PIC18F83J11 PIC18F83J90 PIC18F84J11 PIC18F84J16 PIC18F84J90 PIC18F84J95 PIC18F85J11 PIC18F85J90	80			
PIC18F65J10 PIC18F65J15 PIC18F66J10 PIC18F66J15 PIC18F67J10	64	AC162062	PIC18F87J10-ICE	3.6V
PIC18F85J10 PIC18F85J15 PIC18F86J10 PIC18F86J15 PIC18F87J10	80			

TABLE 1: OPTIONAL DEBUG HEADERS BY DEVICE (CON'T)

Device	Pin Count	Header Part Number	ICE/ICD Device Used	VDD Max
PIC18F65J16 PIC18F66J11 PIC18F66J16 PIC18F67J11	64	AC162091	PIC18F87J11-ICE	3.6V
PIC18F85J16 PIC18F86J11 PIC18F86J16 PIC18F87J11	80			
PIC18F65J50 PIC18F65J55 PIC18F66J50 PIC18F66J55 PIC18F67J50	64	AC162087	PIC18F87J50-ICE	3.6V
PIC18F85J50 PIC18F85J55 PIC18F86J50 PIC18F86J55 PIC18F87J50	80			
PIC18F66J60 PIC18F66J65 PIC18F67J60	64	AC162064	PIC18F97J60-ICE	3.6V
PIC18F86J60 PIC18F86J65 PIC18F87J60	80			
PIC18F96J60 PIC18F96J65 PIC18F97J60	100			
PIC24F08KA101 PIC24F08KA102 PIC24F16KA101 PIC24F16KA102	20 20/28 20 20/28	AC244028	PIC24F16KA102-ICE[2]	3.6V
PIC24FJ16GA002 PIC24FJ32GA002 PIC24FJ48GA002 PIC24FJ64GA002	28	AC162088	PIC24FJ64GA004-ICE	3.6V
PIC24FJ16GA004 PIC24FJ32GA004 PIC24FJ48GA004 PIC24FJ64GA004	44	AC162094		
PIC24FJ64GA006 PIC24FJ64GA008 PIC24FJ64GA010	64 80 100	AC162065 or AC244022	PIC24FJ128GA010-ICE	3.6V
PIC24FJ96GA006 PIC24FJ96GA008 PIC24FJ96GA010	64 80 100			
PIC24FJ128GA006 PIC24FJ128GA008 PIC24FJ128GA010	64 80 100			

Note 1: VDDCORE Max

Note 2: Header required for other devices.

Optional Debug Headers

AC162062, AC162079, AC162087, AC162091

Header Identification

The header AC number is used for ordering the header. However, this number is not on the debug header, as the board is often used for multiple headers by inserting different ICE/ICD devices. To identify these debug headers, use the following information.

Header	ICE/ICD Device	Board Assembly Number
AC162062	PIC18F87J10-ICE	02-01830
AC162079	PIC18F85J90-ICE	
AC162087	PIC18F87J50-ICE	
AC162091	PIC18F87J11-ICE	

Header Setup and Operation – 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: V_{DD}, V_{DDCORE} and ground.

CAUTION
This header cannot be plugged directly into the PICDEM™ HPC Explorer Board! 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
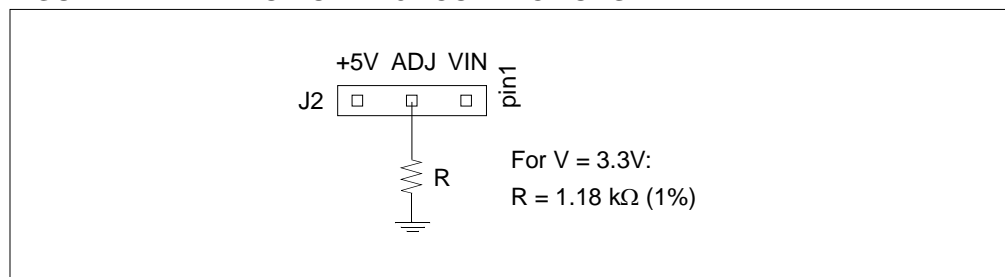
Header Setup and Operation – AC162079, AC162087, AC162091

For these headers, 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_{DDCORE} and ground.

Header Limitations

See the "Limitations" section in your debug tool online Help file for details.
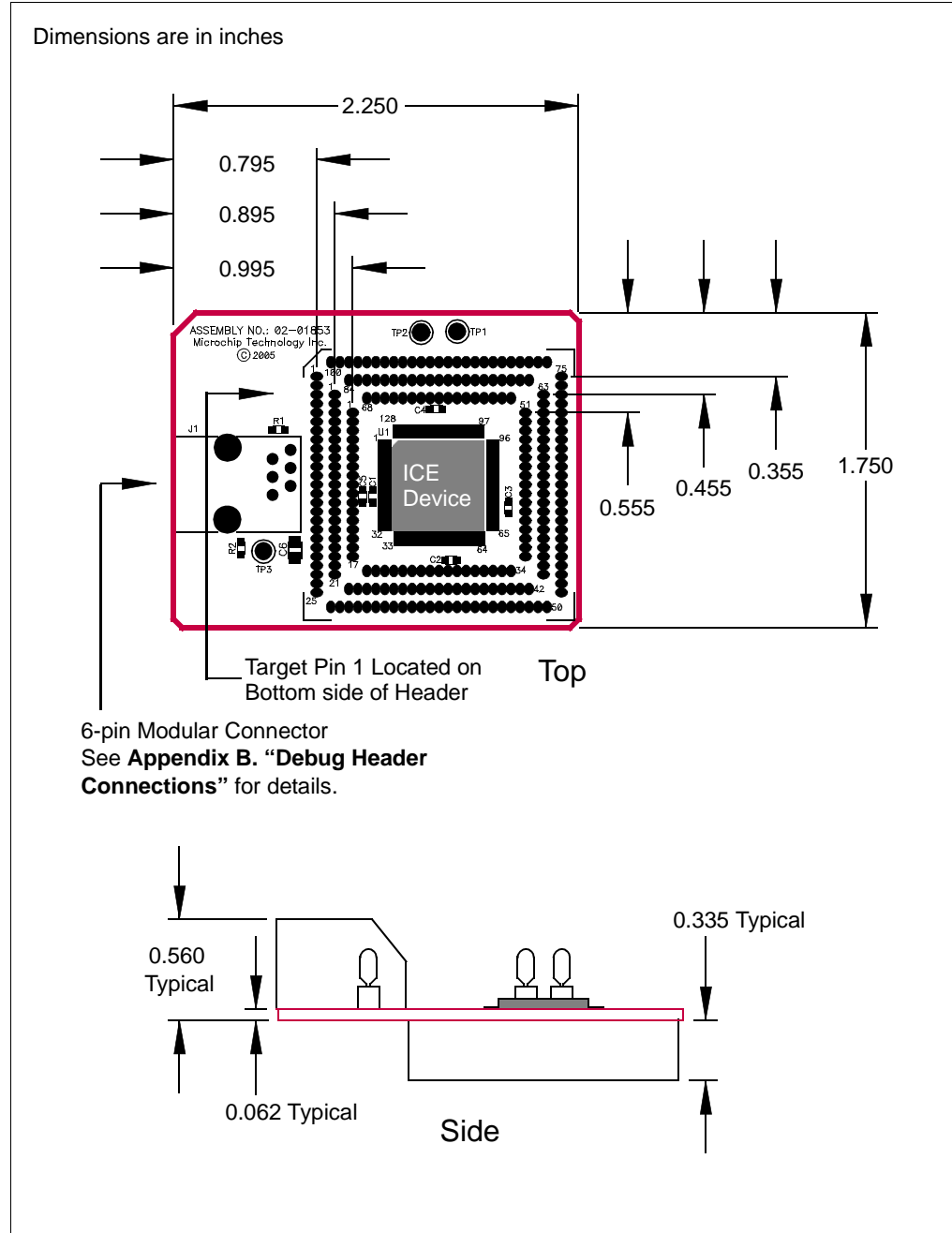
Header Dimensions

The figure below lists the dimensions for the debug header. Dimensions are design values in inches.

If the length and/or width of the debug header 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.

FIGURE 2: **DIMENSIONS – AC162062, AC162079, AC162087, AC162091**
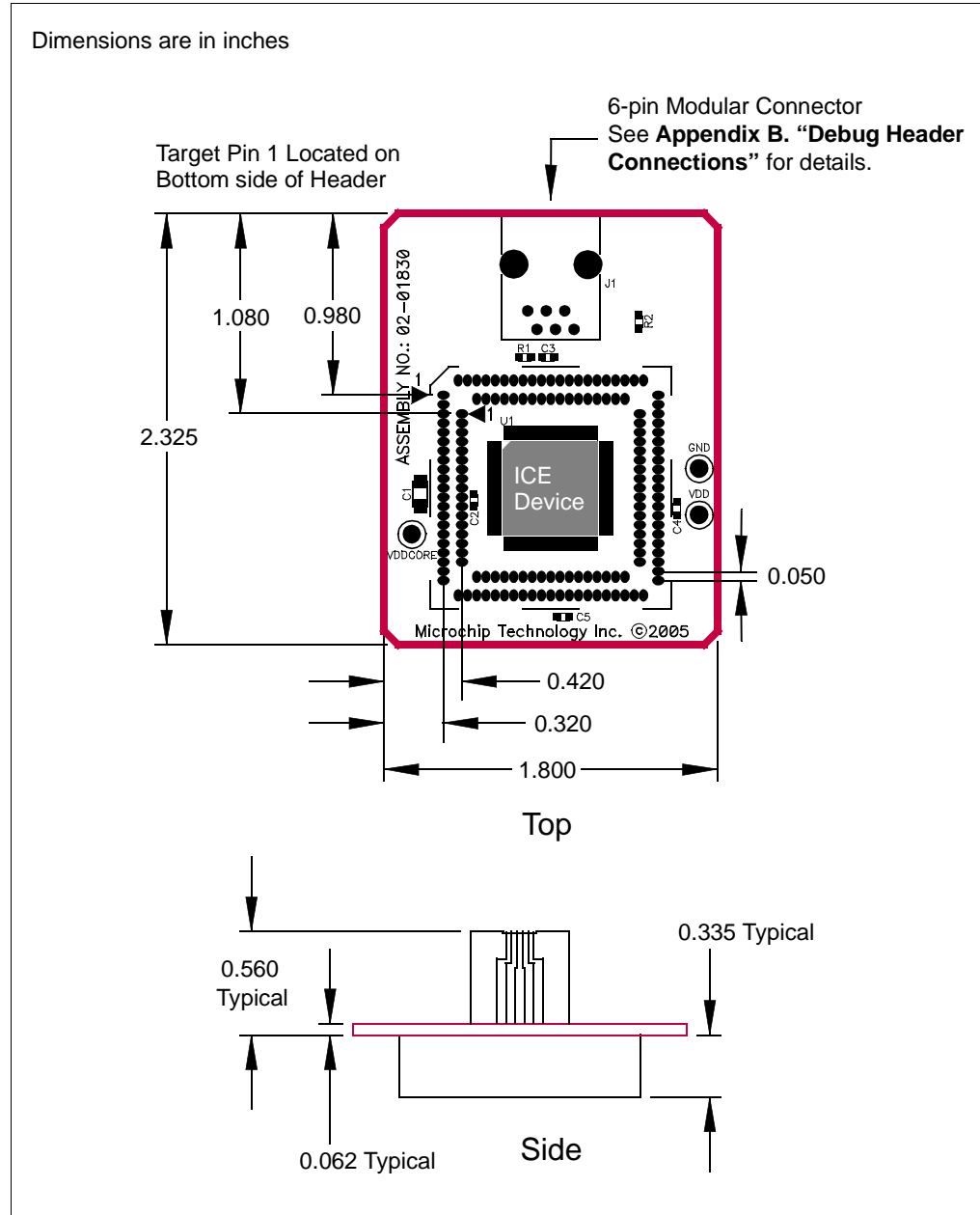
Optional Debug Headers

AC162064

Header Identification

The header AC number is used for ordering the header. However, this number is not on the debug header, as the board is often used for multiple headers by inserting different ICE/ICD devices. To identify this debug header, use the following information.

Header	ICE/ICD Device	Board Assembly Number
AC162064	PIC18F97J60-ICE	02-01853

Header Setup and Operation

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_{DDCORE} and ground.

Header Limitations

See the "Limitations" section in your debug tool online Help file for details.
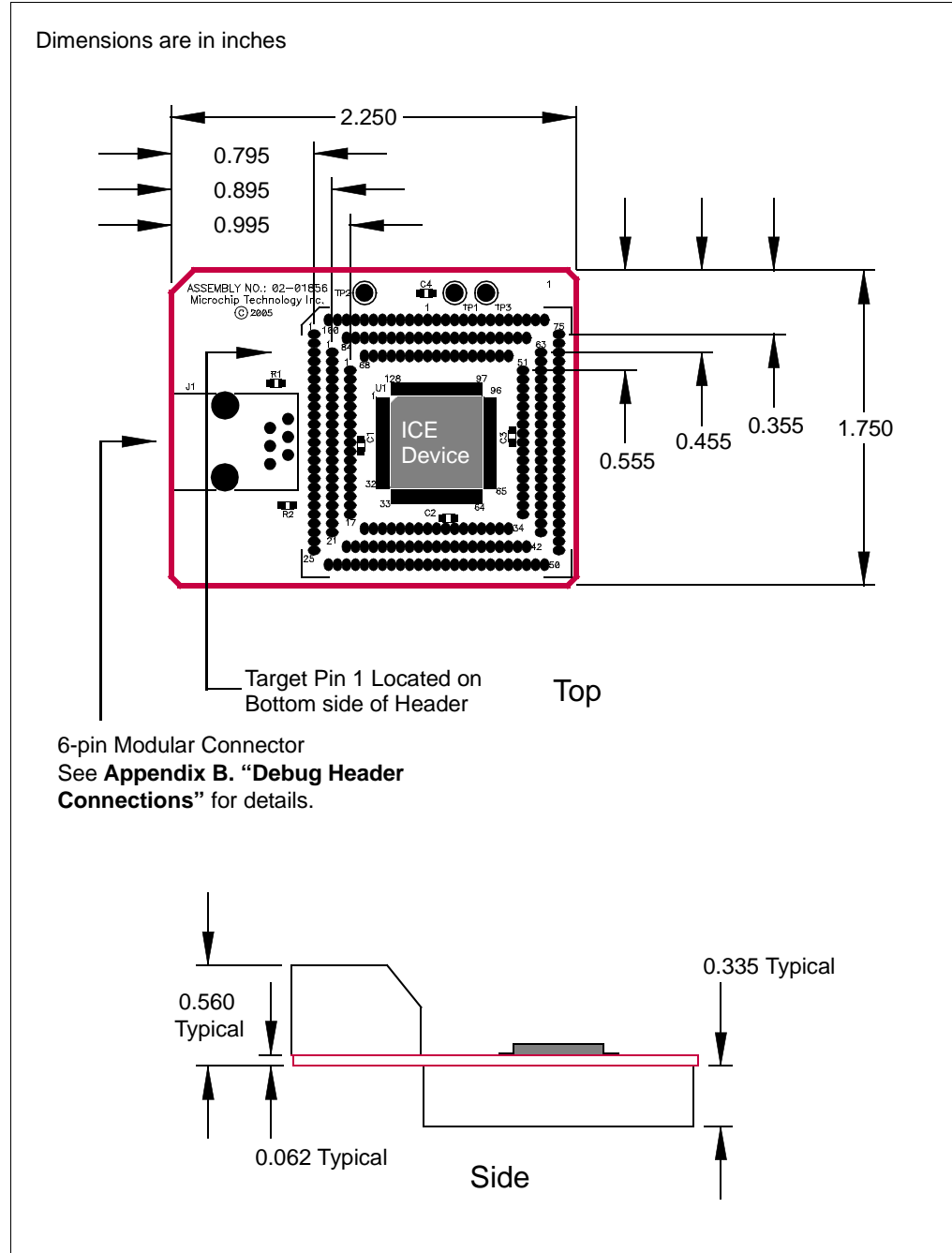
Header Dimensions

The figure below lists the dimensions for the debug header. Dimensions are design values in inches.

If the length and/or width of the debug header 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.
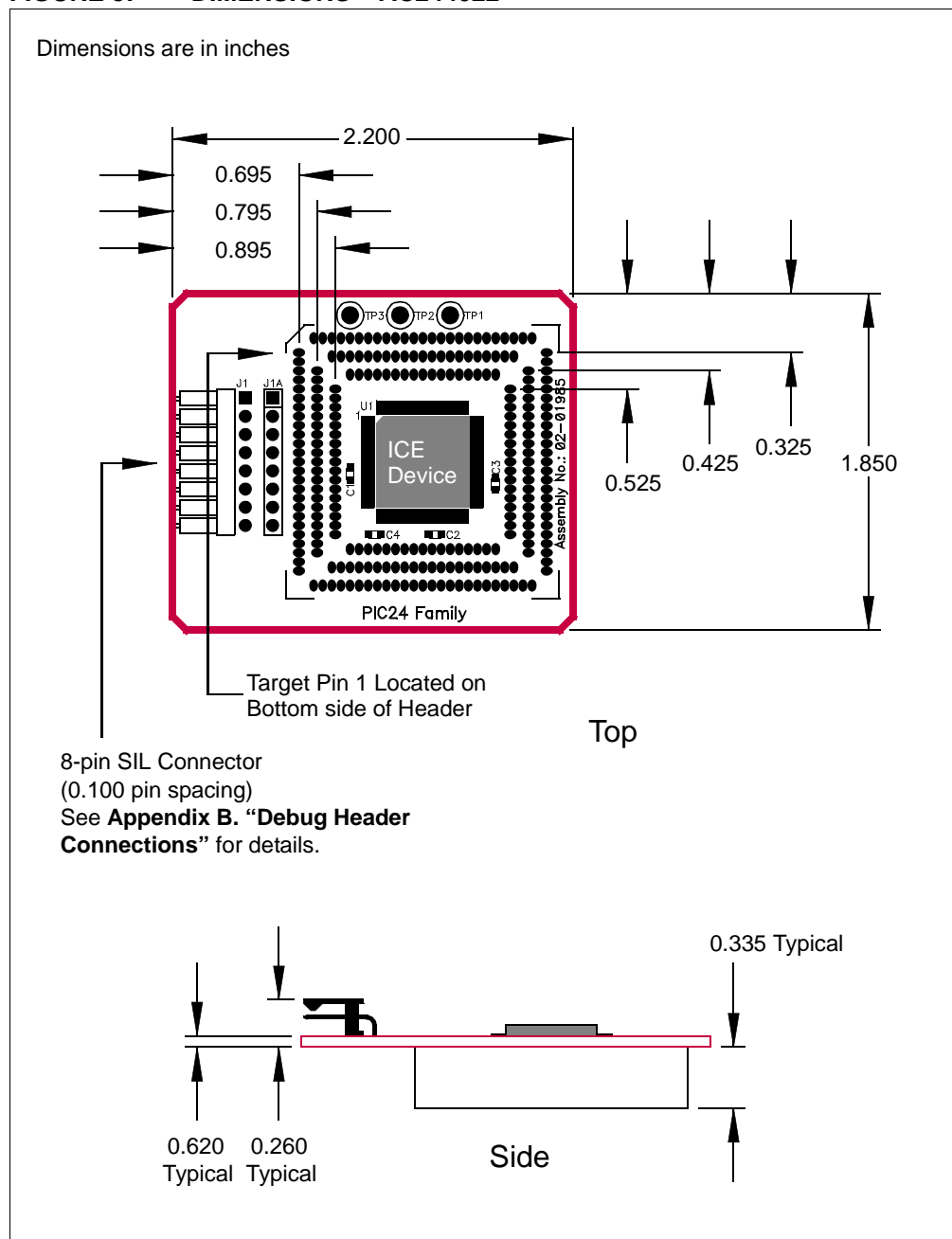
FIGURE 3: **DIMENSIONS – AC162064**

Dimensions are in inches

2.250

0.795

0.895

0.995

ASSEMBLY NO.: 02–01653
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TP2   TP1

100
84   83
68   C4   97
128
U1   96
ICE
Device
32   65
33   64
17   C2   34
21   42
25   50

J1
R1
R2   C6
TP3

1.750

0.555   0.455   0.355

Target Pin 1 Located on
Bottom side of Header

Top

6-pin Modular Connector
See **Appendix B. "Debug Header
Connections"** for details.

0.560
Typical

0.335 Typical

0.062 Typical

Side

Optional Debug Headers

AC162065, AC244022

Header Identification

The header AC number is used for ordering the header. However, this number is not on the debug header, as the board is often used for multiple headers by inserting different ICE/ICD devices. To identify these debug headers, use the following information.

Header	ICE/ICD Device	Board Assembly Number
AC162065	PIC24FJ128GA010-ICE	02-01856
AC244022		02-01985

Header Setup and Operation

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_{DDCORE} and ground.

Header Limitations

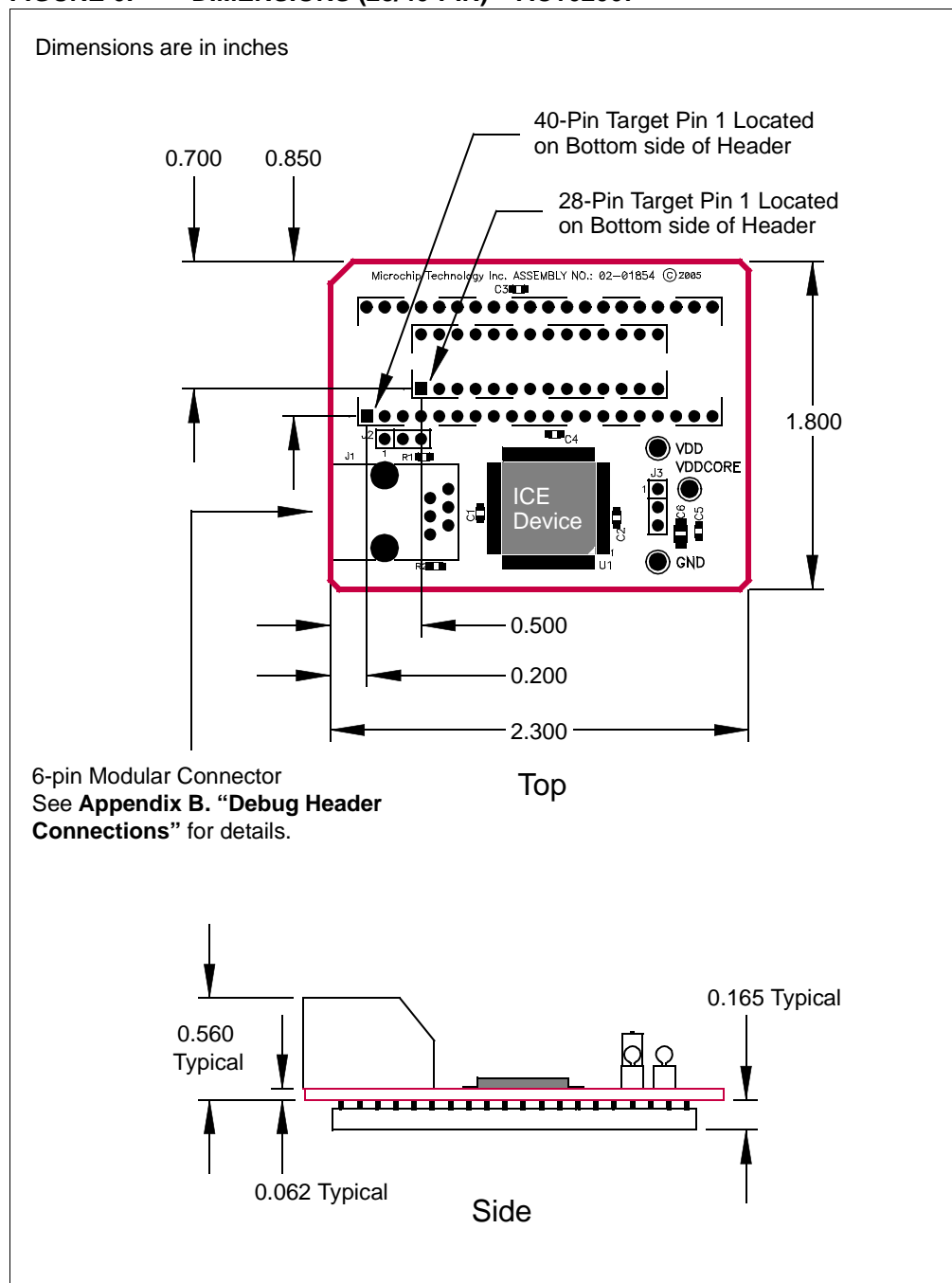See the "Limitations" section in your debug tool online Help file for details.

Header Dimensions

The figures below lists the dimensions for the debug headers. Dimensions are design values in inches.

For this device family, header AC162065 will be sold until depleted. Then only header AC244022 will remain as a Performance Pak.

If the length and/or width of the debug header 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.
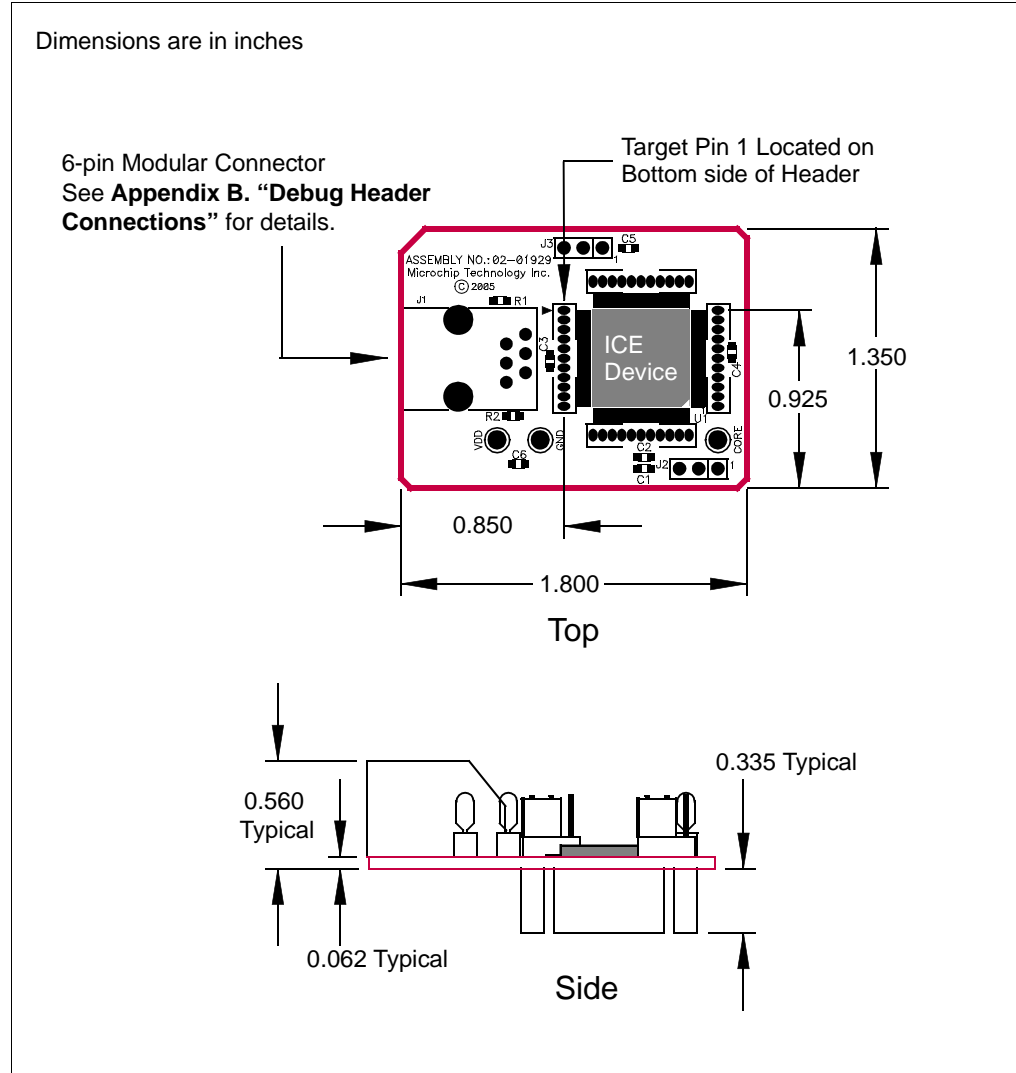
© 2006-2012 Microchip Technology Inc.

FIGURE 4: **DIMENSIONS – AC162065**

Dimensions are in inches

Target Pin 1 Located on
Bottom side of Header

Top

6-pin Modular Connector
See **Appendix B. "Debug Header
Connections"** for details.

Side

Optional Debug Headers

FIGURE 5:   DIMENSIONS – AC244022

Dimensions are in inches

2.200

0.695
0.795
0.895

TP3 TP2 TP1

J1 J1A

U1

ICE
Device

PIC24 Family

Assembly No.: 02-01985

0.525   0.425   0.325   1.850

Target Pin 1 Located on
Bottom side of Header

Top

8-pin SIL Connector
(0.100 pin spacing)
See **Appendix B. "Debug Header
Connections"** for details.

0.335 Typical

0.620   0.260
Typical   Typical   Side

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AC162067, AC162074

Header Identification

The header AC number is used for ordering the header. However, this number is not on the debug header, as the board is often used for multiple headers by inserting different ICE/ICD devices. To identify these debug headers, use the following information.

Header	ICE/ICD Device	Board Assembly Number
AC162067	PIC18F45J10-ICE	02-01854
AC162074		02-01929

Header Setup and Operation

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

 * V_{DDCORE} must be supplied externally.

Header Limitations

See the "Limitations" section in your debug tool online Help file for details.

### Header Dimensions

The figures below lists the dimensions for the debug headers. Dimensions are design values in inches.

If the length and/or width of the debug header 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.

Optional Debug Headers

FIGURE 6:   DIMENSIONS (28/40-PIN) – AC162067

Dimensions are in inches

40-Pin Target Pin 1 Located
on Bottom side of Header

28-Pin Target Pin 1 Located
on Bottom side of Header

0.700   0.850

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1.800

VDD
VDDCORE

ICE
Device

GND

0.500

0.200

2.300

6-pin Modular Connector
See **Appendix B. "Debug Header
Connections"** for details.

Top

0.560
Typical

0.165 Typical

0.062 Typical

Side

FIGURE 7: **DIMENSIONS (44-PIN) – AC162074**

Dimensions are in inches

6-pin Modular Connector
See **Appendix B. "Debug Header Connections"** for details.

Target Pin 1 Located on
Bottom side of Header

ICE
Device

1.350

0.925

0.850

1.800

Top

0.560
Typical

0.335 Typical

0.062 Typical

Side

Optional Debug Headers

AC162078

Header Identification

The header AC number is used for ordering the header. However, this number is not on the debug header, as the board is often used for multiple headers by inserting different ICE/ICD devices. To identify this debug header, use the following information.

Header	ICE/ICD Device	Board Assembly Number
AC162078	PIC18F1330-ICD	02-01896

Header Setup and Operation

This debug header 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 debug header.
2. PICDEM MC motor control demo board. Use the 28-pin DIP socket on both boards to mount the debug header 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 debug header on to the PICDEM MC LV board.

The following sections detail the configuration of the jumpers on the debug header for use with the above mentioned boards.

CUSTOMER TARGET BOARD

The default configuration is to remove all jumpers.

S1 is not populated and should not be used.

After the debug header 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 debug header turn on.
3. Connect the debug tool to the debug header.
4. Use MPLAB IDE and the debug tool 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		
J3	2-3	JP2	Open
J5	2-3		
J6	1-2	JP3	Open
J7	1-2		

S1 is not populated and should not be used.

After the debug header 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 debug header turn on.
3. Connect the debug tool to the debug header.
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.

Header Limitations

See the "Limitations" section in your debug tool online Help file for details.

Optional Debug Headers

Header Dimensions

The figure below lists the dimensions for the debug header. Dimensions are design values in inches.

If the length and/or width of the debug header 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.

FIGURE 8:   DIMENSIONS – AC162078

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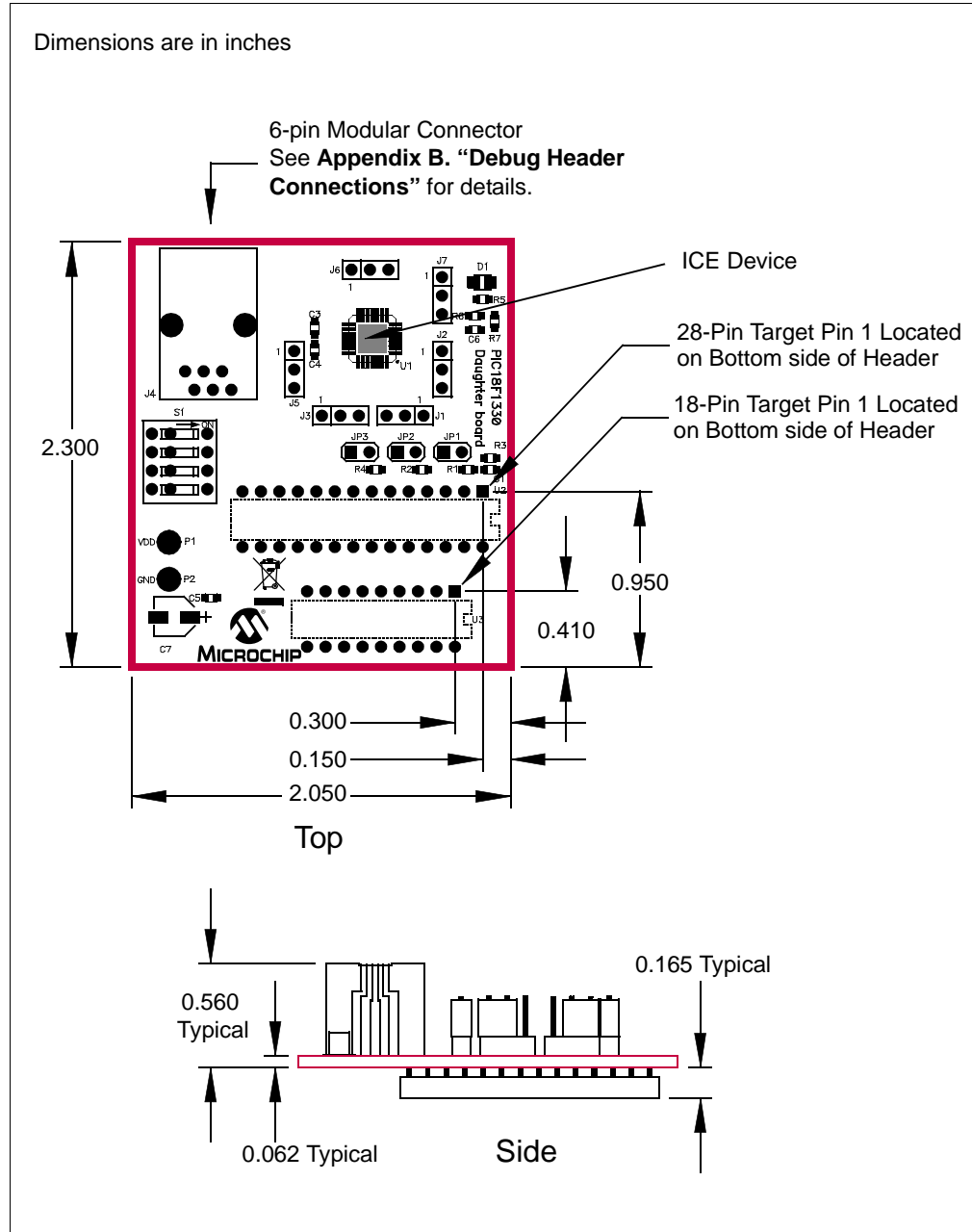
AC162088, AC162094

Header Identification

The header AC number is used for ordering the header. However, this number is not on the debug header, as the board is often used for multiple headers by inserting different ICE/ICD devices. To identify this debug header, use the following information.

Header	ICE/ICD Device	Board Assembly Number
AC162088	PIC24FJ64GA004-ICE	02-01979
AC162094		02-01982

Header Setup and Operation

Both 28-pin and 44-pin device headers have jumpers related 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 J2	Function
1-2	Disable voltage regulator
2-3	Enable voltage regulator
No connection	DISVREG controlled by target

Test points are available on this header to check the following:

Test Point	Color	Signal	Test Point	Color	Signal
TP1	Black	Ground	TP5	White	DISVREG
TP2	Red	V_{DD}	TP6	White	PGC
TP3	Black	AV_{SS}	TP7	White	PGD
TP4	Red	AV_{DD}	TP8	Yellow	$\overline{ICRST}$

Header Limitations

See the "Limitations" section in your debug tool online Help file for details.

Header Dimensions

The figures below list the dimensions for the debug headers. Dimensions are design values in inches.

If the length and/or width of the debug header 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.

Optional Debug Headers

FIGURE 9: **DIMENSIONS (28 PIN) – AC162088**

Dimensions are in inches

6-pin Modular Connector
See **Appendix B. "Debug Header Connections"** for details.

Target Pin 1 Located on Bottom side of Header

Top

Side

0.560 Typical

0.062 Typical

0.165 Typical

1.600

0.700

0.175

2.450
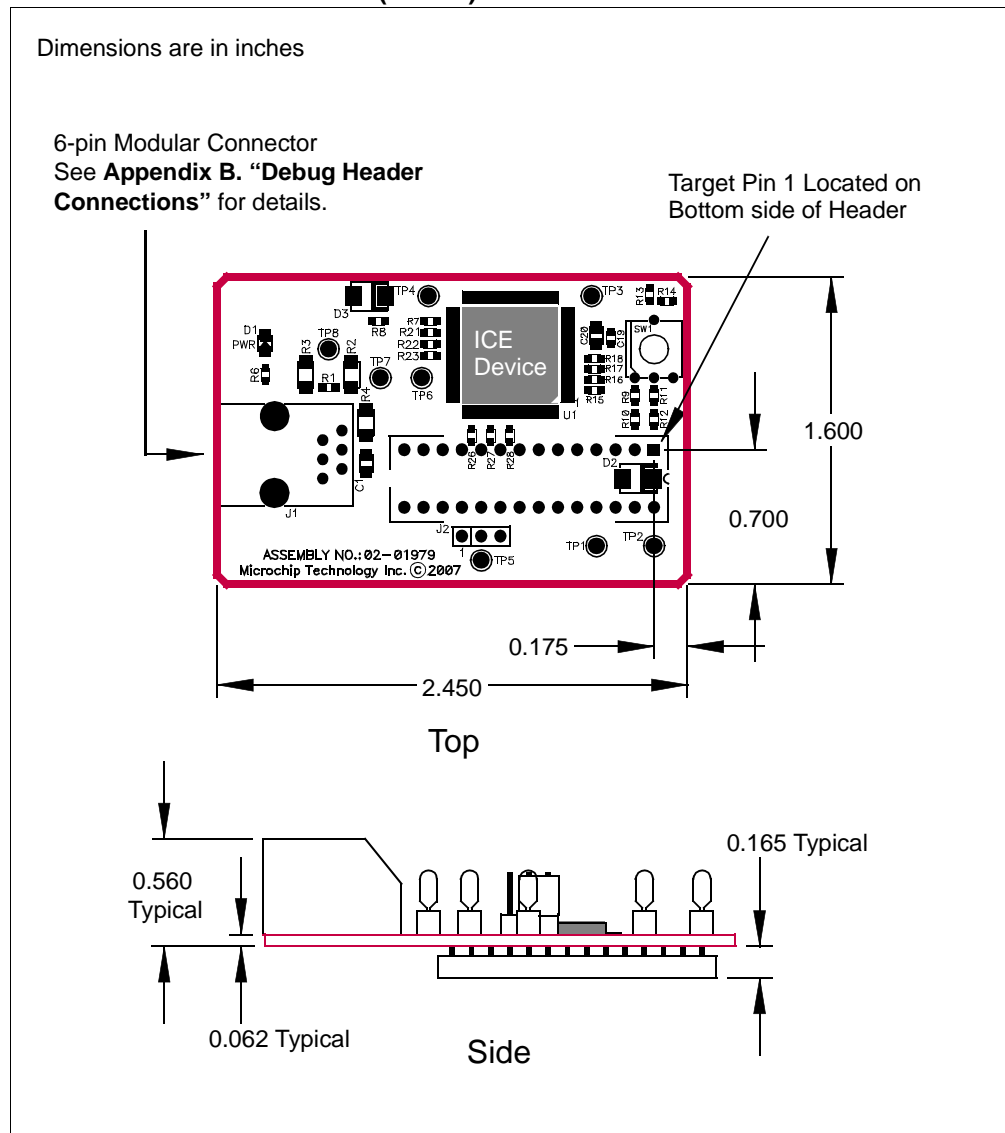
FIGURE 10:   DIMENSIONS (44 PIN) – AC162094

Dimensions are in inches

6-pin Modular Connector
See **Appendix B. "Debug Header Connections"** for details.

Target Pin 1 Located on Bottom side of Header

ICE Device

ASSEMBLY NO.:02−01982
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1.600

0.550

0.400

2.400

Top

0.335 Typical

0.560 Typical

0.062 Typical

Side
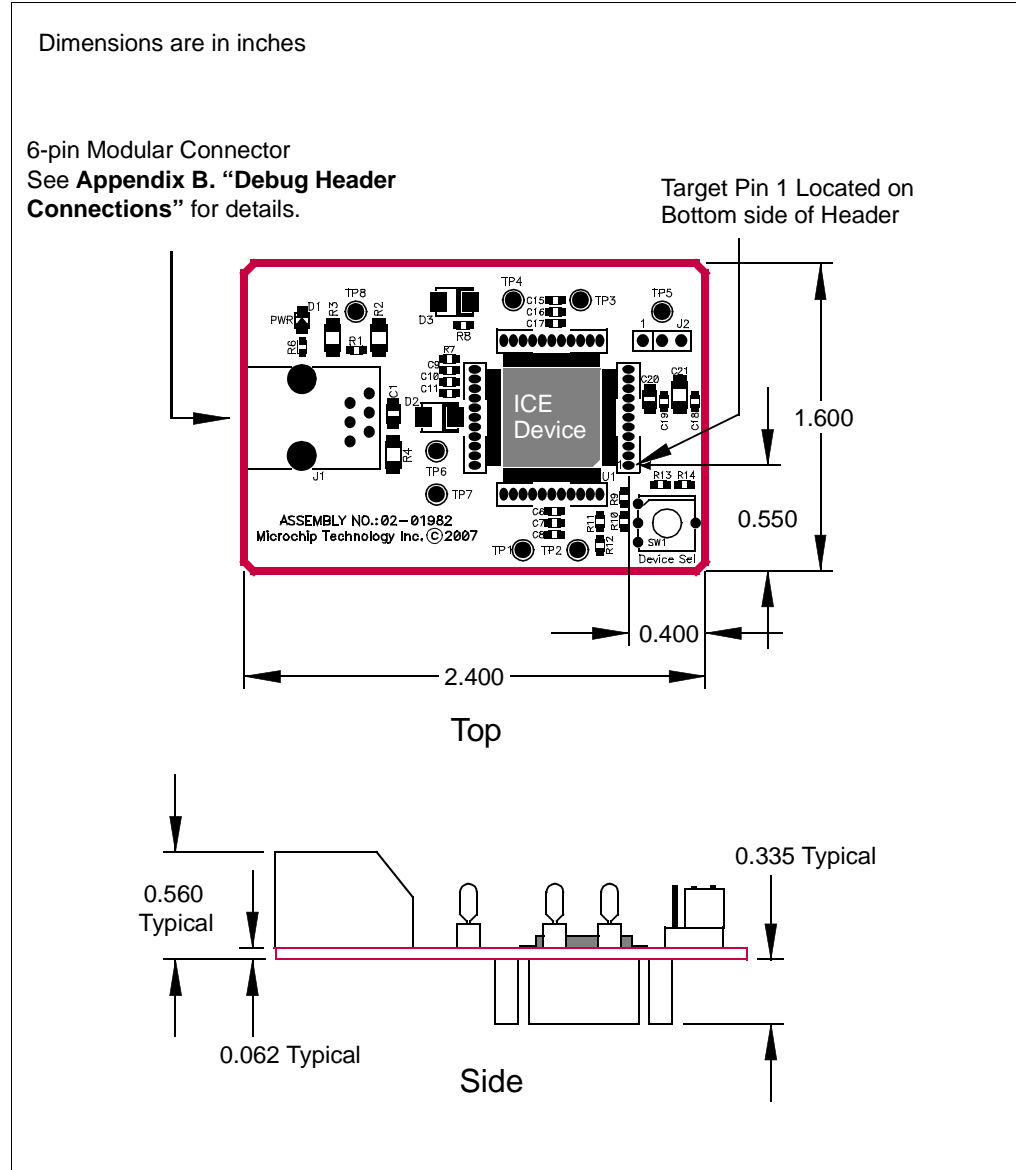
Optional Debug Headers

AC244026, AC244027

Header Identification

The header AC number is used for ordering the header. However, this number is not on the debug header, as the board is often used for multiple headers by inserting different ICE/ICD devices. To identify this debug header, use the following information.

Header	ICE/ICD Device	Board Assembly Number
AC244026	PIC16F727-ICE	02-02105
AC244027	PIC16LF727-ICE	

Header Setup and Operation - AC244026

This Processor Extension Pak provides extra debugging capability not available on PIC16F727 production devices:

- 3 Address / Data breakpoints (1 Address only breakpoint on production devices)
- Data capture (Real Time Data Streaming)
- No user Flash resources needed for debugging
- No user RAM resources needed for debugging
- No user pins required

This header has jumpers available for MCLR pull-up and power LED control.

Jumper	Setting	Function
J2	Open	Disable weak ICE $\overline{MCLR}$ pull-up resistor.
	Short	Enable weak ICE $\overline{MCLR}$ pull-up resistor. This option keeps the target program running even after the tool has been disconnected from the header, i.e., the pin will not float high.
J3	Open	Disable power LED indicator. This option saves power.
	Short	Enable power LED indicator.

Additionally, this header has jumpers related to the LDO voltage regulator. Depending on the device pin used for this function, you would use either J4 (RA0), J5 (RA5) or J6 (RA6) for Vcap selection. For details on the voltage regulator, see the *PIC16F72X/PIC16LF72X Data Sheet* (DS41341).

Jumper	Setting	Function
J4, J5, or J6	Open	Use only target capacitance for Vcap. This is the standard configuration.
	Short	Use both on-board and target capacitance for Vcap. This option is to provide extra margin for the voltage regulator stability/regulation in cases where there is a long lead length between the emulation header Vcap pin and the target Vcap pin. (As examples, when using long-pin DIP transition sockets or certain QFN transition sockets.)

Test points are available on this header to check the following:

Test Point	Signal	Test Point	Signal	Pin	Jumper
TP1	Vss	**TP6**	Vcap	RA0	J4
TP2	V$_{DD}$	**TP7**	Vcap	RA5	J5
TP3	$\overline{\text{ICD}}$ Enable	**TP8**	Vcap	RA6	J6
TP4	V$_{DD}$				
TP5	Vss				

Header Setup and Operation - AC244027

This Processor Extension Pak provides extra debugging capability not available on PIC16LF727 production devices:

- 3 Address / Data breakpoints (1 Address only breakpoint on production devices)
- Data capture (Real Time Data Streaming)
- No user Flash resources needed for debugging
- No user RAM resources needed for debugging
- No user pins required

This header has jumpers available for MCLR pull-up and power LED control.

Jumper	Setting	Function
J2	Open	Disable weak ICE $\overline{\text{MCLR}}$ pull-up resistor.
	Short	Enable weak ICE $\overline{\text{MCLR}}$ pull-up resistor. This option keeps the target program running even after the tool has been disconnected from the header, i.e., the pin will not float high.
J3	Open	Disable power LED indicator. This option saves power.
	Short	Enable power LED indicator.

Test points are available on this header to check the following:

Test Point	Signal	Test Point	Signal
TP1	Vss	**TP4**	V$_{DD}$
TP2	V$_{DD}$	**TP5**	Vss
TP3	$\overline{\text{ICD}}$ Enable		

Header Limitations

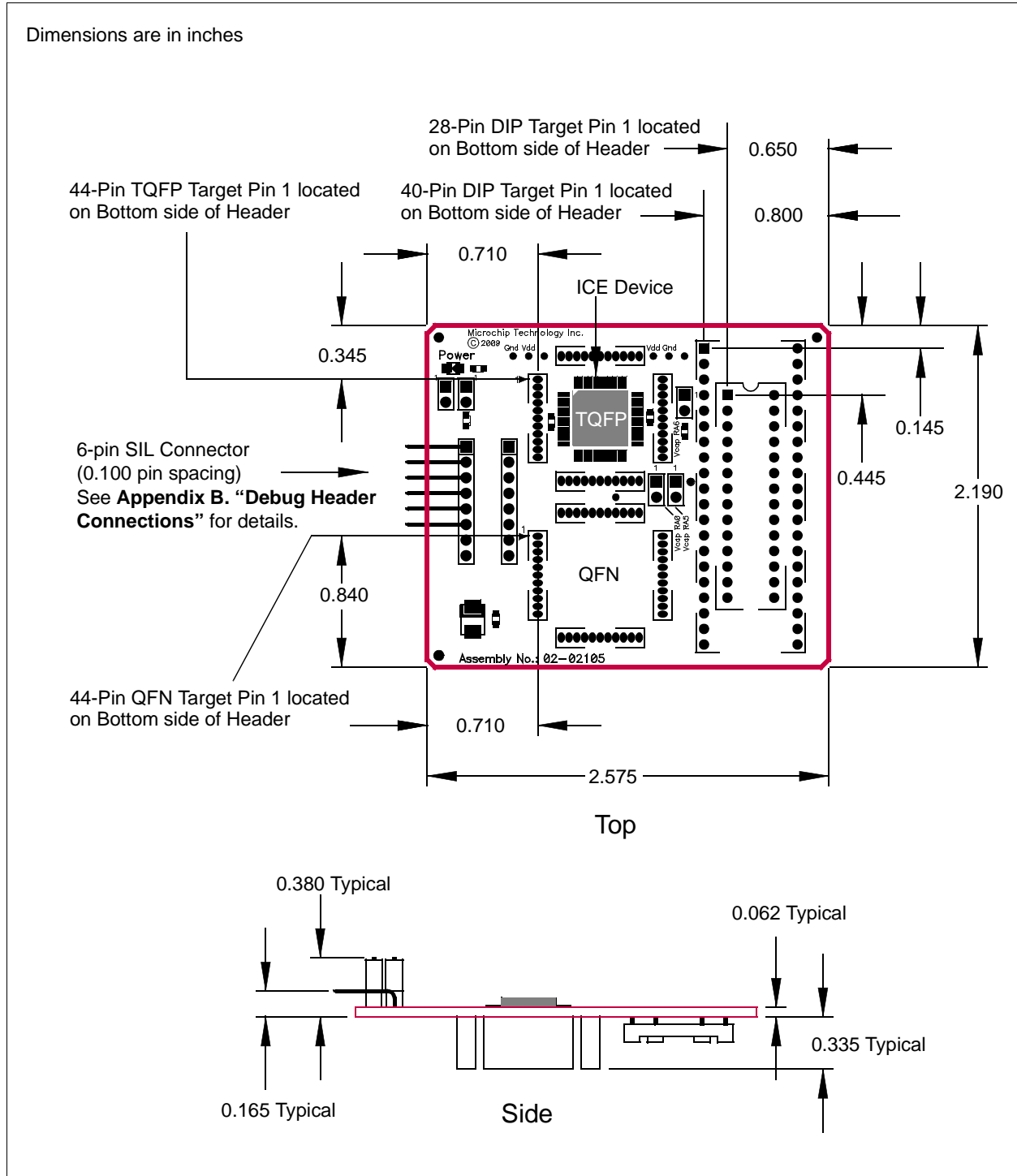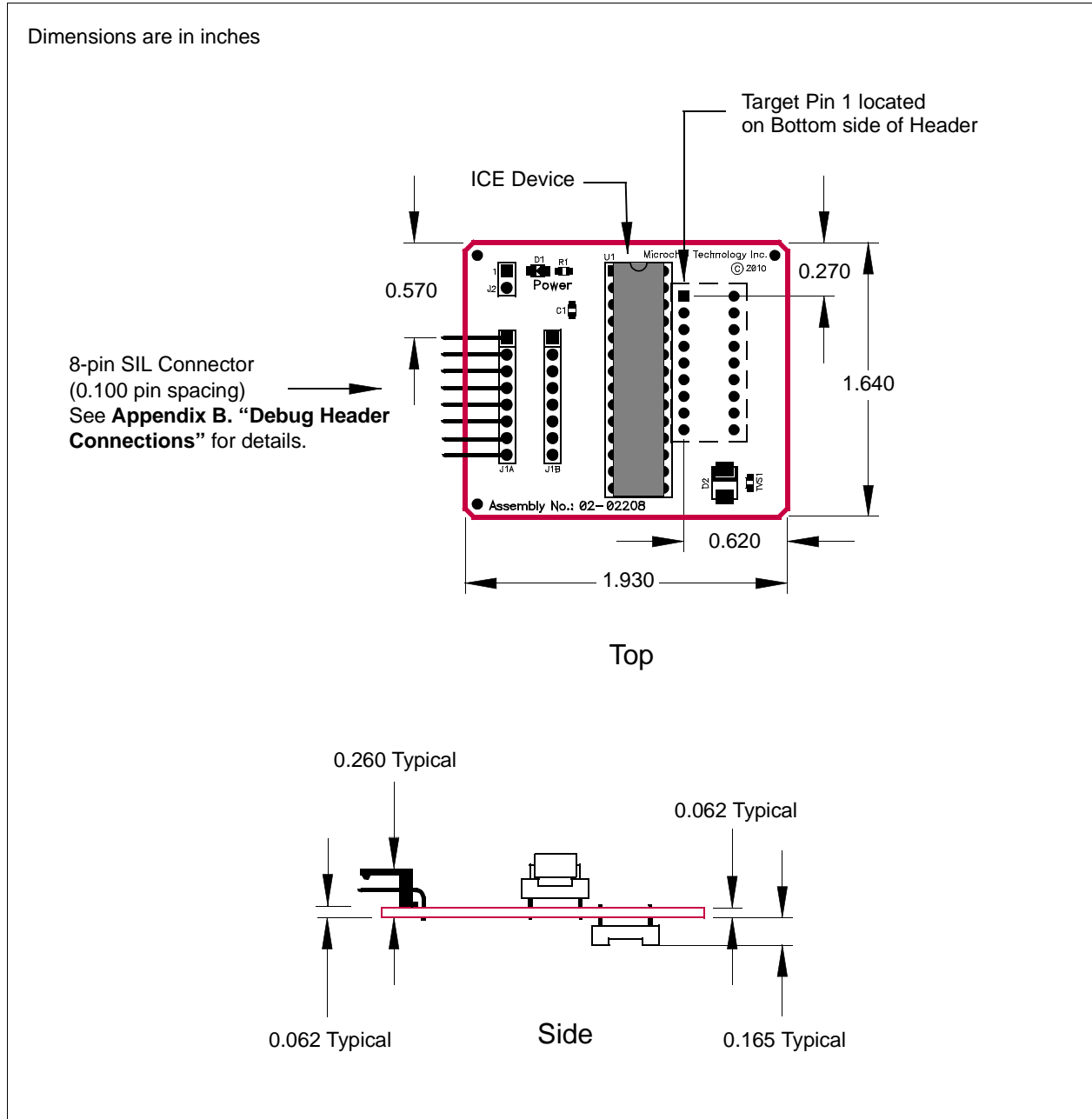See the "Limitations" section in your debug tool online Help file for details.

Header Dimensions

The figures below list the dimensions for the debug headers. Dimensions are design values in inches.

If the length and/or width of the debug header 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.

Optional Debug Headers

FIGURE 11:   DIMENSIONS – AC244026, AC244027

Dimensions are in inches

Top

Side
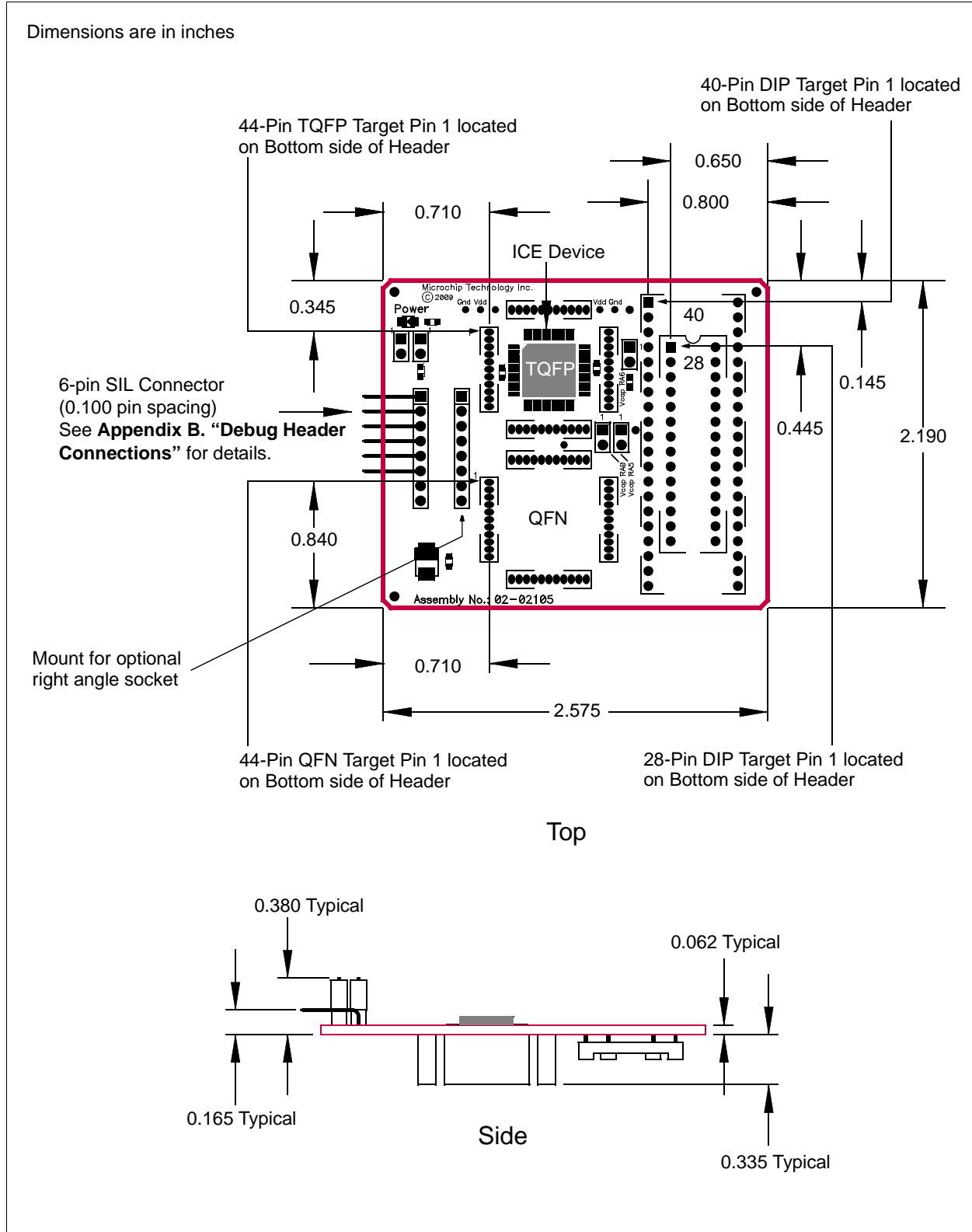
AC244033, AC244034

Header Identification

The header AC number is used for ordering the header. However, this number is not on the debug header, as the board is often used for multiple headers by inserting different ICE/ICD devices. To identify this debug header, use the following information.

Header	ICE/ICD Device	Board Assembly Number
AC244033	PIC18F14K22-ICE	02-02031
AC244034	PIC18LF14K22-ICE	

Header Setup and Operation

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

Header Limitations

See the "Limitations" section in your debug tool online Help file for details.

Header Dimensions

The figures below list the dimensions for the debug headers. Dimensions are design values in inches.

If the length and/or width of the debug header 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.

Optional Debug Headers

FIGURE 12: DIMENSIONS (20 PIN) – AC244033, AC244034

Dimensions are in inches

6-pin SIL Connector
(0.100 pin spacing)
See **Appendix B. "Debug Header Connections"** for details.

Target Pin 1 Located on
Bottom side of Header

ICE Device

Assembly No.: 02-02031

J1A J1B

U1 C1

C2

R1 D1

1.150

0.150

0.425

1.800

Top

0.165 Typical

0.062 Typical 0.182 Typical

Side
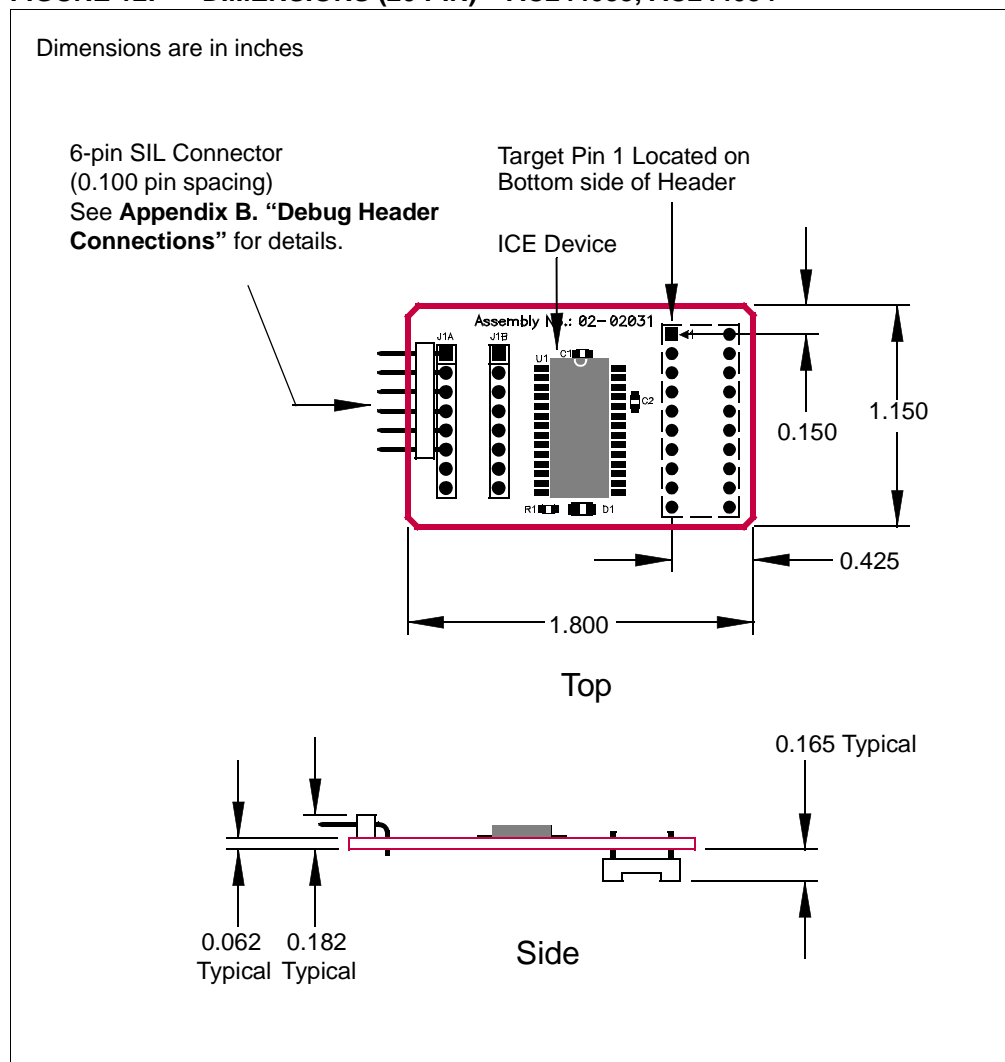
AC244035, AC244036

Header Identification

The header AC number is used for ordering the header. However, this number is not on the debug header, as the board is often used for multiple headers by inserting different ICE/ICD devices. To identify this debug header, use the following information.

Header	ICE/ICD Device	Board Assembly Number
AC244035	PIC16F1939-ICE	02-02105
AC244036	PIC16LF1939-ICE	

Header Setup and Operation

For this header, you will need to set up the jumpers below.

Jumper	Setting	Function
J2	Open	Disable weak ICE/$\overline{MCLR}$ pull-up resistor
	Short	Enable weak ICE/$\overline{MCLR}$ pull-up resistor
J3	Open	Disable power LED indicator
	Short	Enable power LED indicator
J4	Open	Use only target capacitance for VCAP (on RA0 pin)
	Short	Use both on-board and target capacitance for VCAP (on RA0 pin)
J5	Open	Use only target capacitance for VCAP (on RA5 pin)
	Short	Use both on-board and target capacitance for VCAP (on RA5 pin)
J6	Open	Use only target capacitance for VCAP (on RA6 pin)
	Short	Use both on-board and target capacitance for VCAP (on RA6 pin)

Header Limitations

See the "Limitations" section in your debug tool online Help file for details.

Optional Debug Headers

Header Dimensions

The figure below lists the dimensions for the debug header. Dimensions are design values in inches.

If the length and/or width of the debug header 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.

FIGURE 13:   DIMENSIONS - AC244035, AC244036

Dimensions are in inches

28-Pin DIP Target Pin 1 located on Bottom side of Header ⟶ 0.650

44-Pin TQFP Target Pin 1 located on Bottom side of Header

40-Pin DIP Target Pin 1 located on Bottom side of Header ⟶ 0.800

0.710

ICE Device

0.345

Power

6-pin SIL Connector
(0.100 pin spacing)
See **Appendix B. "Debug Header Connections"** for details.

TQFP

QFN

0.145

0.445

2.190

0.840

44-Pin QFN Target Pin 1 located on Bottom side of Header

0.710

2.575

Top

0.380 Typical

0.062 Typical

0.335 Typical

0.165 Typical

Side

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AC244043, AC244044

Header Identification

The header AC number is used for ordering the header. However, this number is not on the debug header, as the board is often used for multiple headers by inserting different ICE/ICD devices. To identify this debug header, use the following information.

Header	ICE/ICD Device	Board Assembly Number
AC244043	PIC16F1829-ICE	02-02208
AC244044	PIC16LF1829-ICE	

Header Setup and Operation

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

Header Limitations

See the "Limitations" section in your debug tool online Help file for details.

Optional Debug Headers

Header Dimensions

The figure below lists the dimensions for the debug header. Dimensions are design values in inches.

If the length and/or width of the debug header 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.

FIGURE 14: **DIMENSIONS - AC244043, AC244044**

Dimensions are in inches

Target Pin 1 located on Bottom side of Header

ICE Device

0.570

0.270

8-pin SIL Connector (0.100 pin spacing) See **Appendix B. "Debug Header Connections"** for details.

1.640

0.620

1.930

Top

0.260 Typical

0.062 Typical

0.062 Typical

Side

0.165 Typical

AC244046, AC244047

Header Identification

The header AC number is used for ordering the header. However, this number is not on the debug header, as the board is often used for multiple headers by inserting different ICE/ICD devices. To identify this debug header, use the following information.

Header	ICE/ICD Device	Board Assembly Number
AC244046	PIC16F1847-ICE	02-02258
AC244047	PIC16LF1847-ICE	

Header Setup and Operation

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

Header Limitations

See the "Limitations" section in your debug tool online Help file for details.

Optional Debug Headers

Header Dimensions

The figure below lists the dimensions for the debug header. Dimensions are design values in inches.

If the length and/or width of the debug header 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.

FIGURE 15:   DIMENSIONS - AC244046, AC244047

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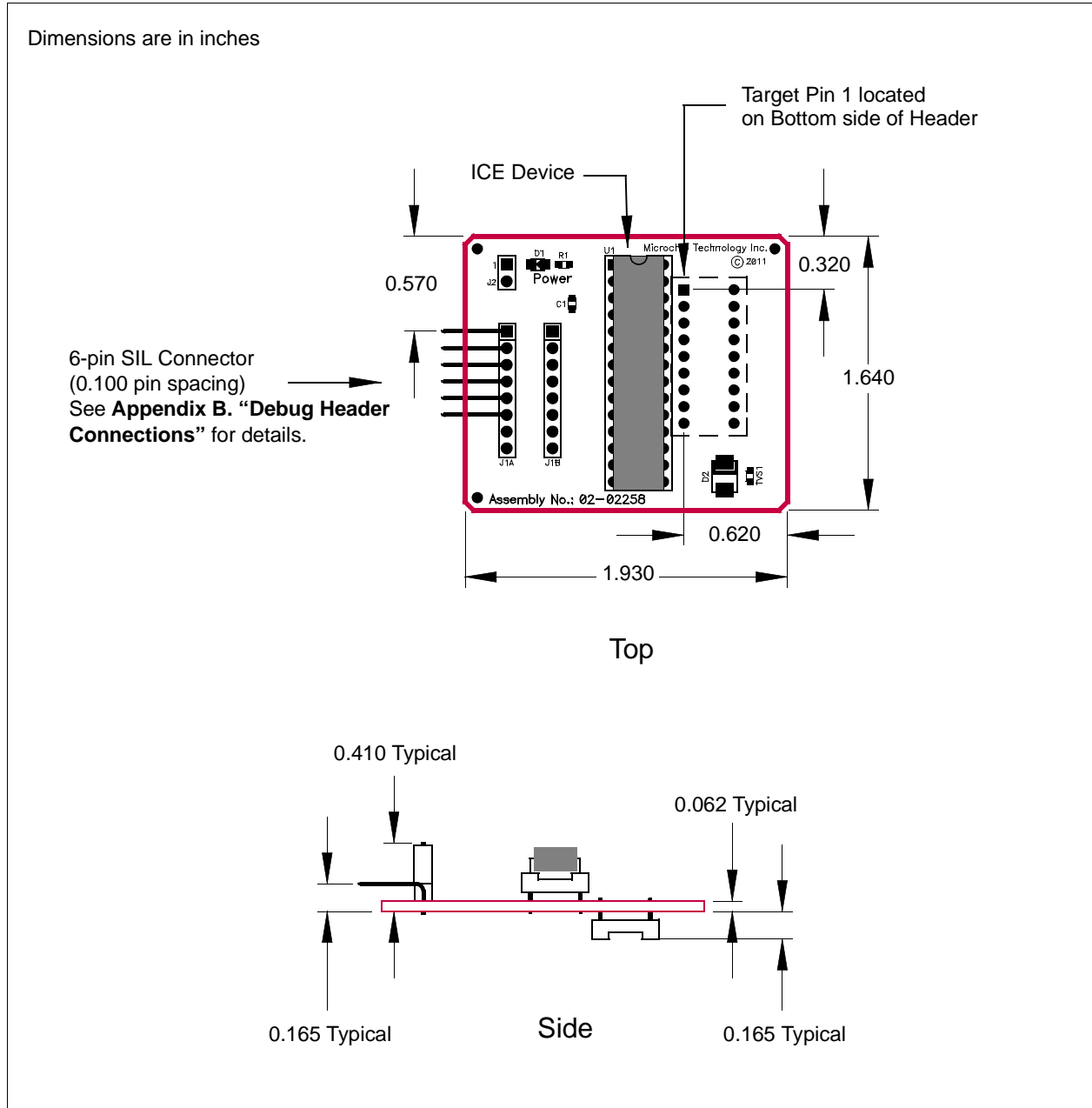
Appendix A. Debug Header Target Footprints

INTRODUCTION

To connect a debug header directly to a target board (without the use of a transition socket) the following information will be helpful.

- DIP Device Footprints
- TQFP/PLCC Device Footprints

DIP DEVICE FOOTPRINTS

DIP device adapter footprints shown will accept adapter plugs like Samtec series APA plugs. These plugs can be soldered in place during development/emulation and eliminate the need for any other sockets.

FIGURE 16:   DIP FOOTPRINT

0.028 DIA PLATED-THRU HOLES

0.100

C

UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES.

Drawing of DIP is 40-pin.

DIP	C
8-Pin	0.300
14-Pin	0.300
18-Pin	0.300
20-Pin	0.300
28-Pin	0.300
40-Pin	0.600
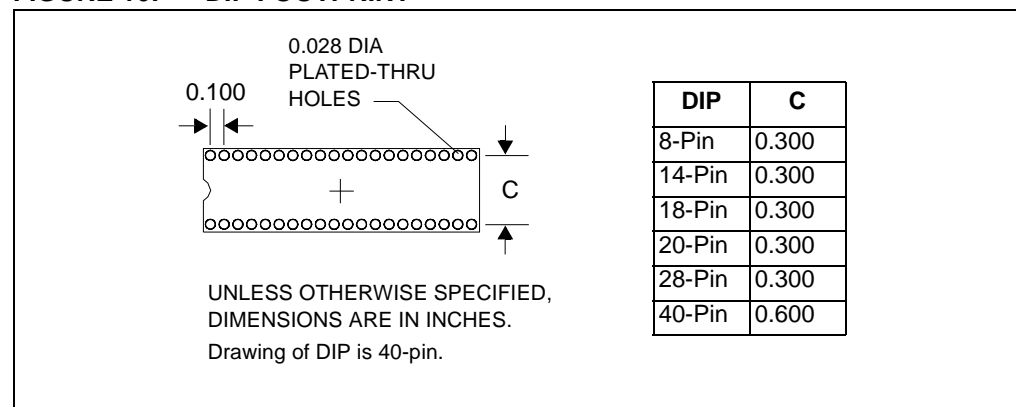
TQFP/PLCC DEVICE FOOTPRINTS

TQFP/PLCC device adapter footprints shown will accept board stackers like Samtec series DWM 0.050 Pitch Stackers. These stackers can be soldered in place during development/emulation and eliminate the need for any other sockets.

FIGURE 17:   SINGLE-ROW TQFP/PLCC FOOTPRINT

0.028 DIA PLATED-THRU HOLES

0.050

0.800

0.800

UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES.

Drawing of device is 44-pin TQFP/PLCC.
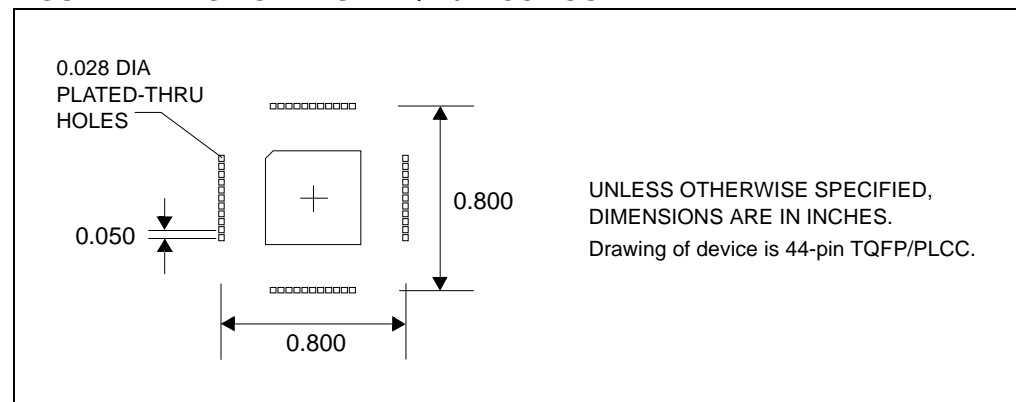
FIGURE 18:   DOUBLE AND TRIPLE-ROW TQFP/PLCC FOOTPRINT

0.028 DIA
PLATED-THRU
HOLES

0.960 1.160 1.360

0.050

0.960

1.160

1.360

UNLESS OTHERWISE SPECIFIED,
DIMENSIONS ARE IN INCHES.

Drawing of device is 64/68-pin,
80/84-pin and 100-pin
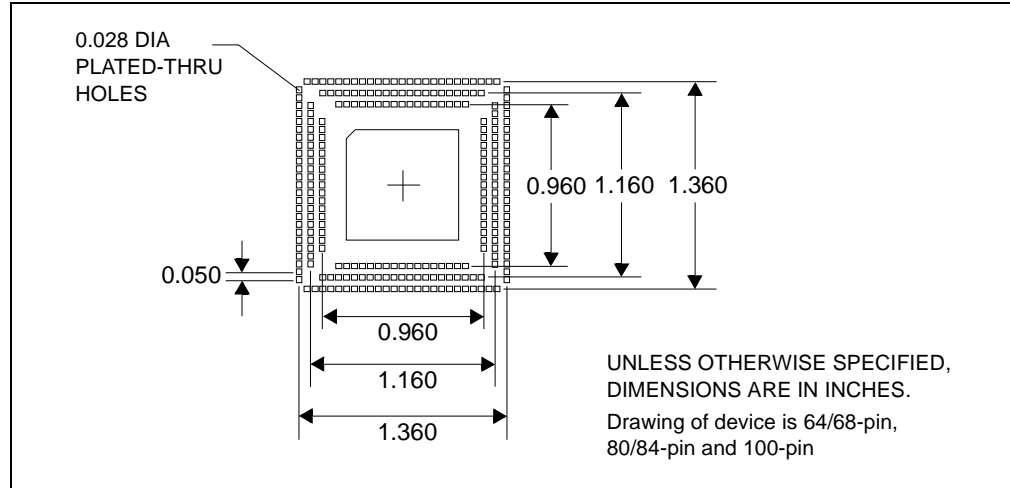
Header pin-out matches the PLCC package. PLCC will map to TQFP as follows:

- Header to 44-pin TQFP – one-to-one mapping.
- Header to 64-pin TQFP – see Figure 19 for mapping.
- Header to 80-pin TQFP – see Figure 20 for mapping.
- Header to 100-pin TQFP – one-to-one mapping.

FIGURE 19:   HEADER TO 64-PIN TQFP

NC = No Connection

64   49

68   60   52

1   1   NC   51   48

9   NC   NC   43

16   17   NC   35   33

18   26   34

17   32
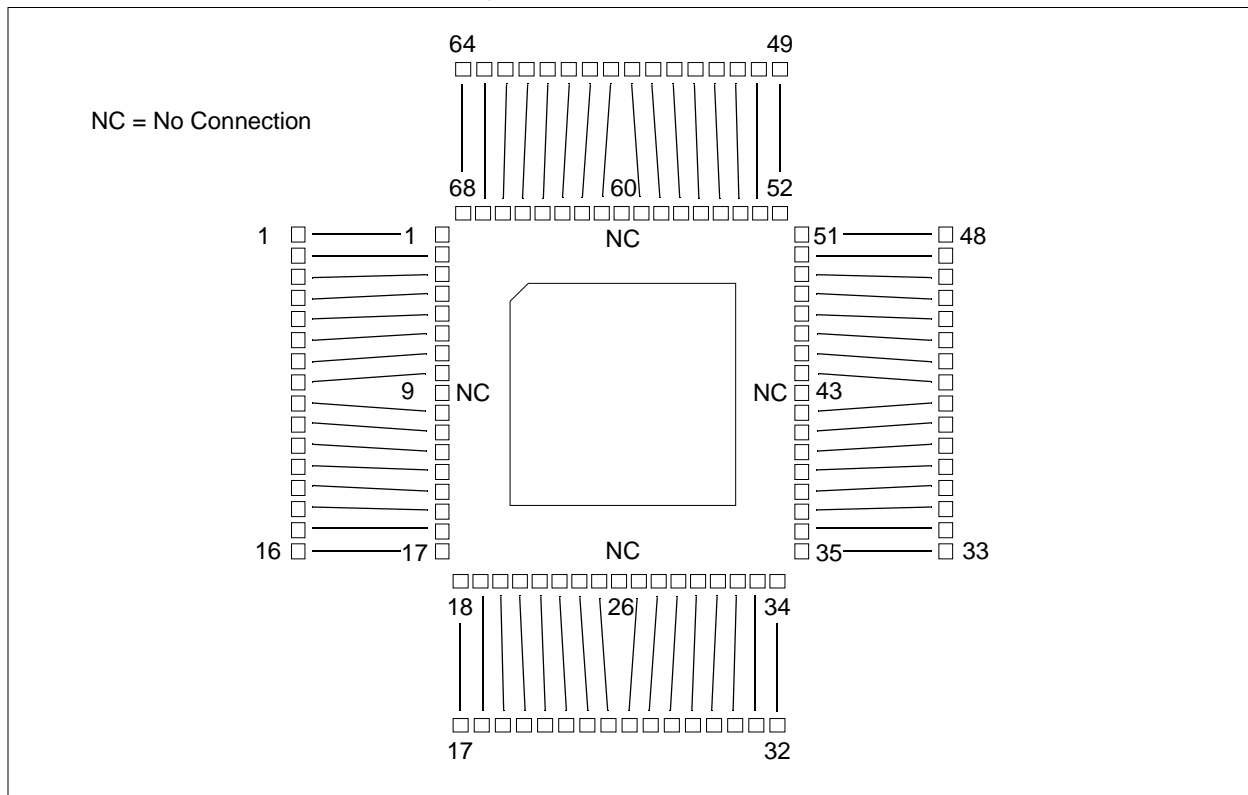
FIGURE 20: HEADER TO 80-PIN TQFP
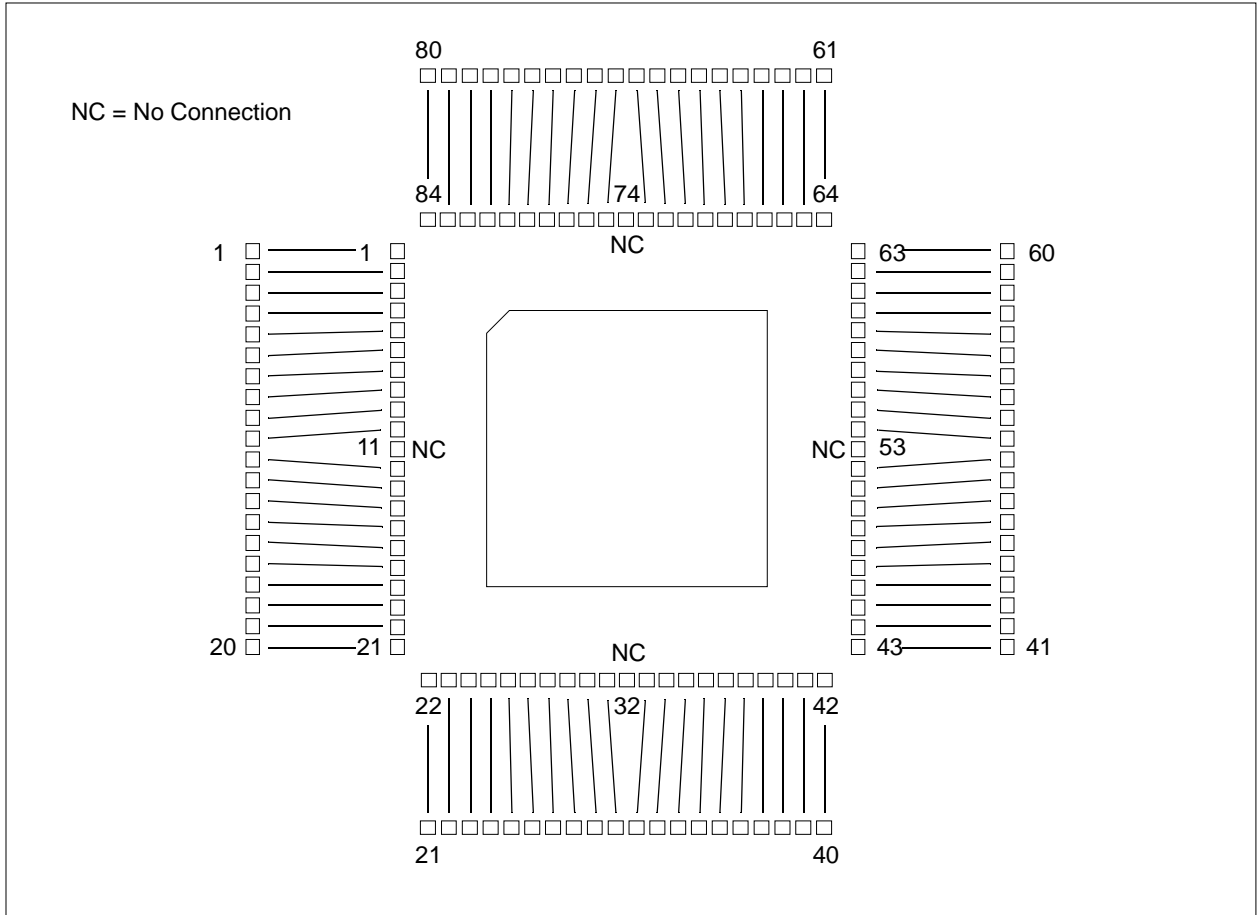
NOTES:

Appendix B. Debug Header Connections

INTRODUCTION

The different types of debug header connectors are shown here, as well as information on connecting development tools to the header.

- 6-Pin Modular Connector
- 8-Pin SIL Connector
- 6-Pin SIL Connector
- SIL Optional Connection
- Modular-to-SIL Adapter
- Ordering Information

6-PIN MODULAR CONNECTOR

Debug headers with 6-pin modular (RJ-11/ICSP) connectors can connect directly with the following tools:

- MPLAB REAL ICE in-circuit emulator (Standard Driver Board)
- MPLAB ICD 2 or 3

FIGURE 1:   MODULAR CONNECTION
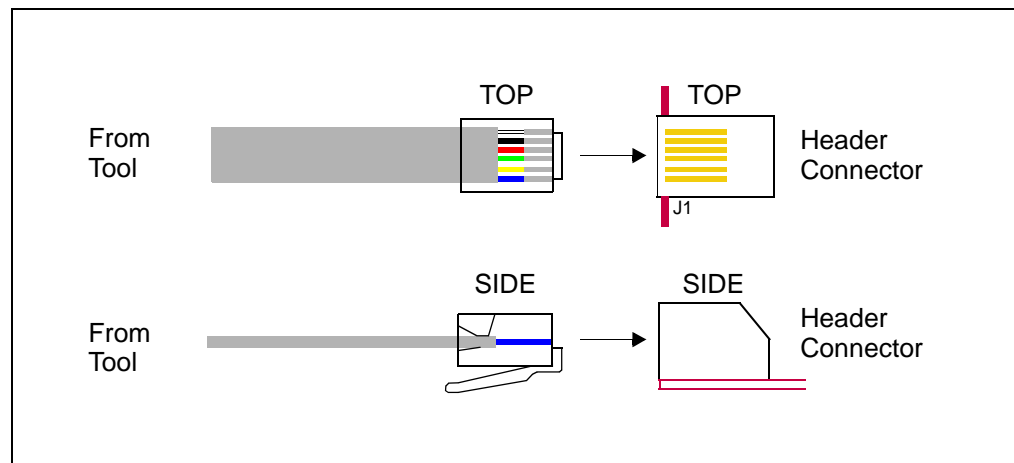
8-PIN SIL CONNECTOR

Debug headers with 8-pin SIL (Single In-Line) connectors are compatible with the tools listed below.

PICkit 2 or 3 Programmer/Debug Express

The 6-pin socket of the PICkit 2 or PICkit 3 may be connected to the 8 header pins by removing the two DAT and CLK pins. However, this may compromise future use of these pins/functions with other tools.

FIGURE 2:   8-PIN SIL CONNECTION TO A PICKIT
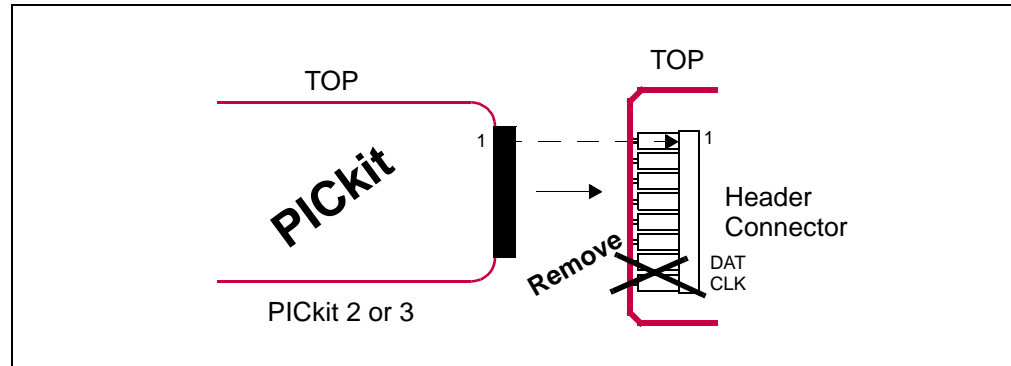
MPLAB ICD 2 or 3 In-Circuit Debugger

The 6-pin modular cable attached to the MPLAB ICD 2 or MPLAB ICD 3 may be connected to the 8 header pins through the Modular-to-SIL Adapter.

MPLAB REAL ICE In-Circuit Emulator

The 6-pin modular cable attached to the Standard Driver Board may be connected to the 8 header pins through the Modular-to-SIL Adapter. No SPI trace is available with this connection because of the loss of the DAT and CLK pins.

The 8-pin socket of the High Speed Driver Board or optional Isolation Unit may be directly connected to the 8 header pins. Be sure to line up pin 1 on the board with pin 1 on the header.

FIGURE 3:   8-PIN SIL CONNECTION TO AN EMULATOR
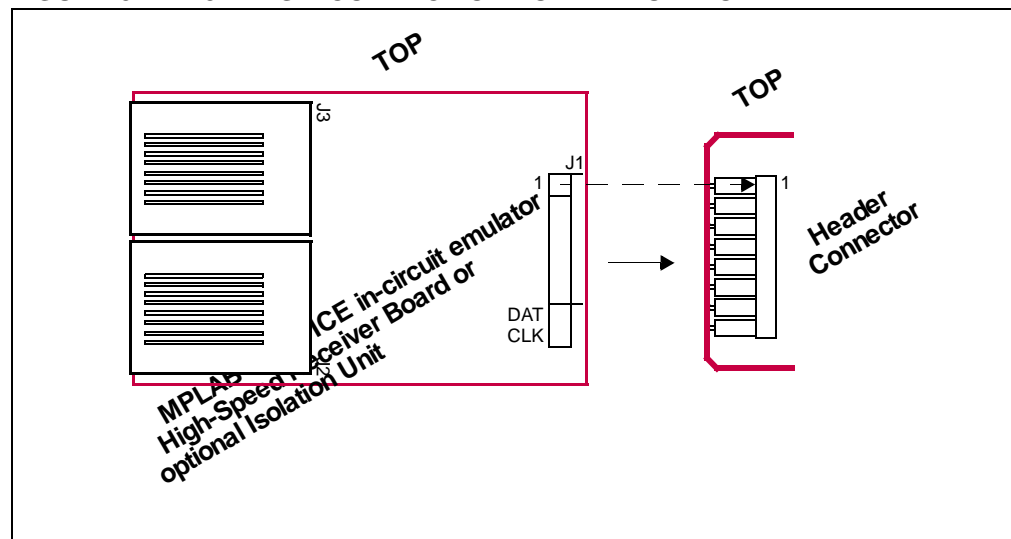
6-PIN SIL CONNECTOR

Debug headers with 6-pin SIL (Single In-Line) connectors are compatible with the tools listed below.

PICkit 2 or 3 Programmer/Debug Express

The 6-pin socket of the PICkit 2 or PICkit 3 may be directly connected to the 6 header pins. Be sure to line up pin 1 on PICkit with pin 1 on header.

FIGURE 4:   6-PIN SIL CONNECTION TO A PICKIT
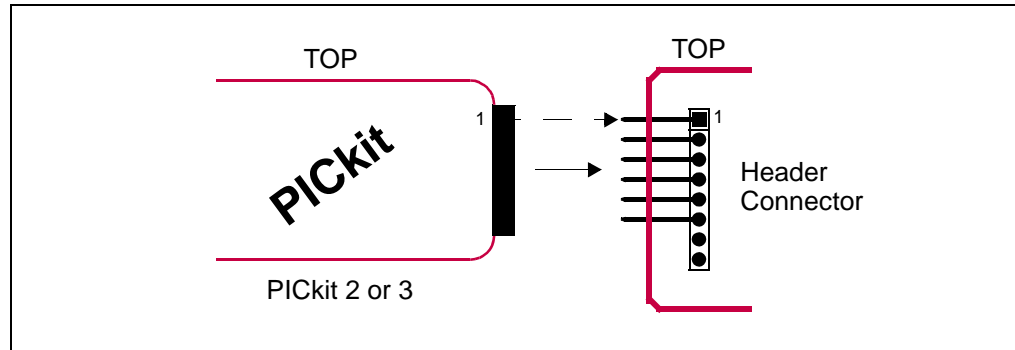
MPLAB ICD 2 or 3 In-Circuit Debugger

The 6-pin modular cable attached to the MPLAB ICD 2 or MPLAB ICD 3 may be connected to the 6 header pins through the Modular-to-SIL Adapter.

MPLAB REAL ICE In-Circuit Emulator

The 6-pin modular cable attached to the Standard Driver Board may be connected to the 6 header pins through the Modular-to-SIL Adapter. No SPI trace is available with this connection because of the loss of the DAT and CLK pins.

The 8-pin socket of the High Speed Driver Board or optional Isolation Unit may be directly connected to the 6 header pins. Be sure to line up pin 1 on the board with pin 1 on the header.

> **Note:** No SPI trace is possible in this case because of the loss of DAT and CLK pins. However, if the device supports SPI, two additional header pins can be attached to add this functionality.

FIGURE 5:   6-PIN SIL CONNECTION TO AN EMULATOR
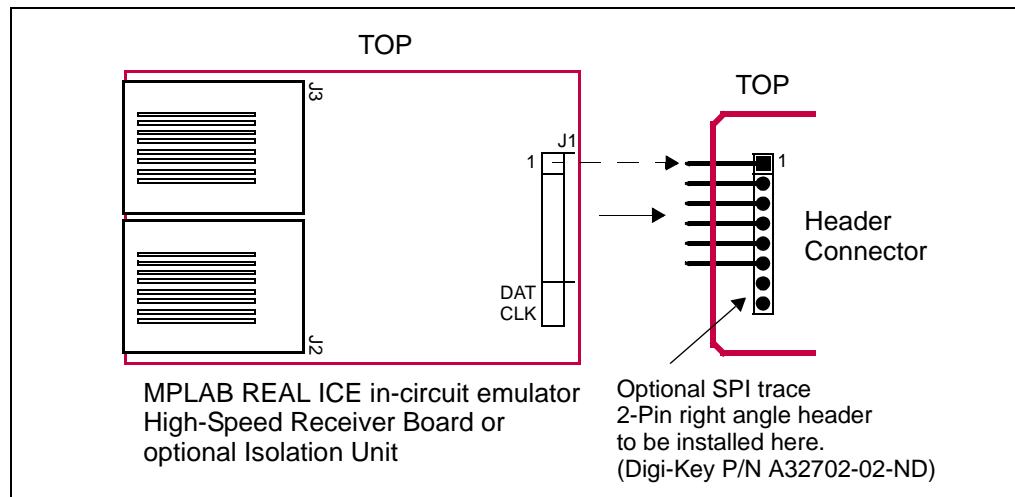
SIL OPTIONAL CONNECTION

Debug headers with 6- and 8-pin SIL connectors have an additional unpopulated connector available for customer use. This connector has the same pinout as the SIL connector. Solder wires to access individual pins or attach an entire vertical connector.

FIGURE 6:   SIL OPTIONAL CONNECTION

SIL Connector   Optional Connector

J1   J1A
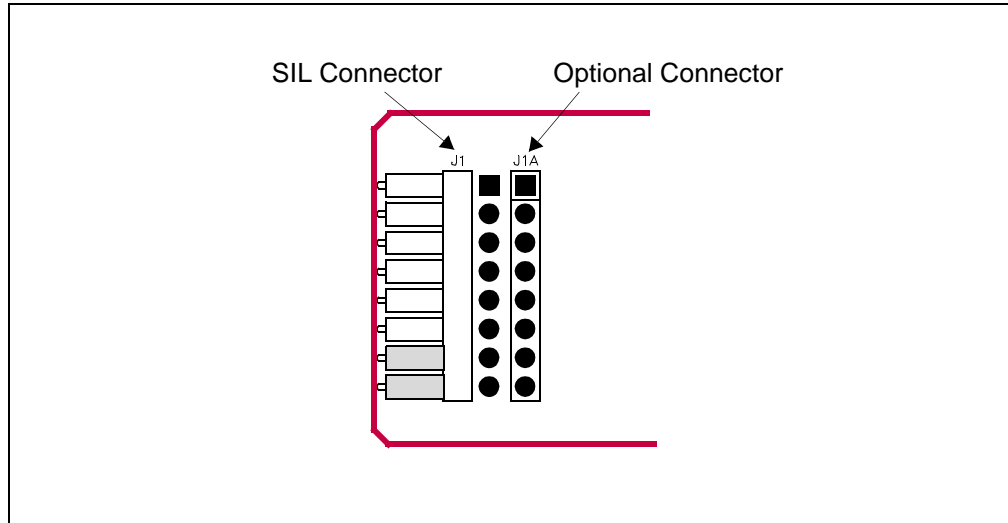
MODULAR-TO-SIL ADAPTER

To adapt a 6-pin modular connector to an 8-pin SIL (Single In-Line) connector, you can use this adapter. You can also use this adapter for a 6-pin modular connector to an 6-pin SIL connector. In either case, **line up pin 1 of J1 with pin 1** of the 6- or 8-pin header connector.

FIGURE 7:   MODULAR-TO-SIL ADAPTER CONNECTION
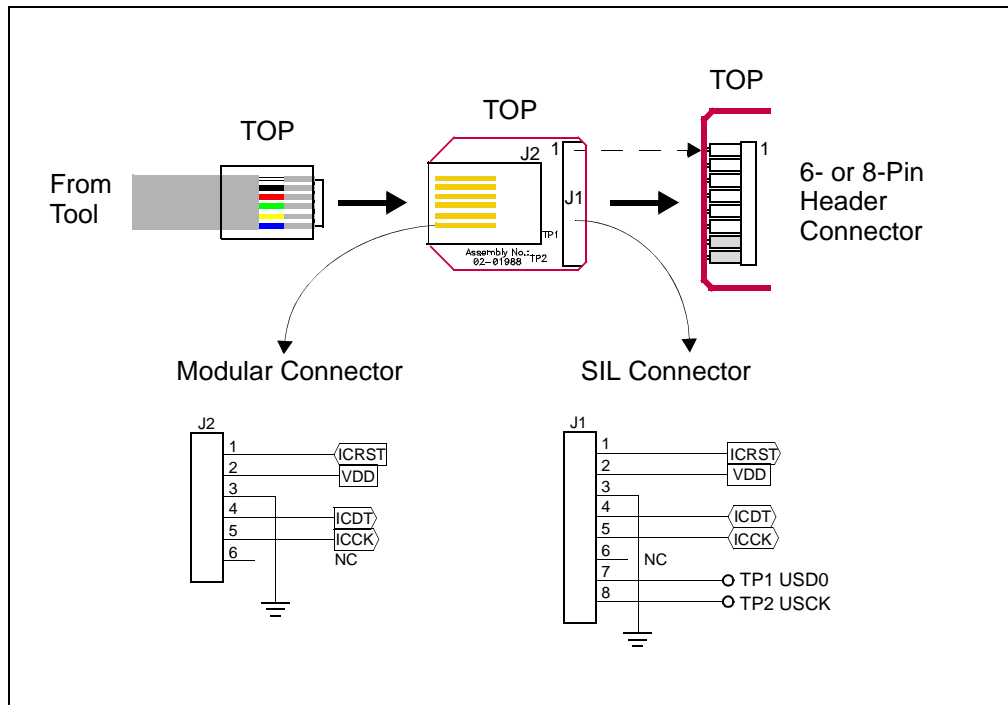
ORDERING INFORMATION

To order the development tools and other hardware shown here, please refer to the table below.

TABLE B-1: MICROCHIP HARDWARE ORDERING NUMBERS

Hardware	Order #
MPLAB REAL ICE in-circuit emulator (Standard Communication)	DV244005
MPLAB REAL ICE in-circuit emulator (High-Speed Communication) - Performance Pak	AC244002
MPLAB REAL ICE Isolation Unit (works with High-Speed Communication)	AC244005
MPLAB ICD 2	DV164005
MPLAB ICD 3	DV164035
PICkit 2 Debug Express	DV164121
PICkit 3 Debug Express	DV164131
Modular-to-SIL Adapter	AC164110

NOTES:

APPENDIX C: REVISION HISTORY

C.1 Revision N (February 2006)

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

C.2 Revision P (September 2007)

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

C.3 Revision Q (December 2008)

- Added limitations to header setup sections as needed.
- Changed "ICD Headers" and "ICE Headers" to "Required Headers" and "Optional Headers" and move sections as necessary.
- Rearranged sections to organize by header (AC) number.

C.4 Revision R (April 2009)

- Added board dimensions
- Removed header pinouts
- Added board identification info
- Added "why use a header" section
- Added footprint appendix
- Changed MPLAB ICD 2 and MPLAB ICD 3 references to generic debug tool
- Added MPLAB REAL ICE in-circuit emulator and MPLAB ICD 3 as programmers

C.5 Revision S (July 2010)

- Added AC244028
- Added Header Connections chapter
- Added AC244033, AC244034
- Moved limitations to common Limitations file and added small section referencing Help files
- Added PIC12F617 to AC162083

C.6 Revision T (February 2012)

- Added AC244043 and AC244044 and associated devices
- Removed Header Setup and Operation for AC244045

Header Board Specification

NOTES:

Index

Header Board Specification

Header Board Specification

NOTES:

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