

# **HPUSB, USB, HPPCI and MSP430 Emulators Users Guide**

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Analog Devices, Inc.  
One Technology Way  
Norwood, Mass. 02062-9106



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The USB and PCI based emulators are designed to be used solely in a laboratory environment. The emulator is not intended to be used in any end products or as a portion of an end product. The emulators may cause interference to other electronic devices operating at close proximity. The emulators should not be used in or near any medical equipment or RF devices.

The USB and PCI based emulators have been certified to comply with the essential requirements of the European EMC directive 89/336/EEC (inclusive 93/68/EEC) and, therefore, carries the “CE” mark.

The USB and PCI based emulators have been appended to Analog Devices Development Tools Technical Construction File referenced “DSPTOOLS1” dated December 21, 1997 and was awarded CE Certification by an appointed European Competent Body and is on file.



The EZ-KIT Lite evaluation system contains ESD (electrostatic discharge) sensitive devices. Electrostatic charges readily accumulate on the human body and equipment and can discharge without detection. Permanent damage may occur on devices subjected to high-energy discharges. Proper ESD precautions are recommended to avoid performance degradation or loss of functionality. Store unused EZ-KIT Lite boards in the protective shipping package.



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# PREFACE

Thank you for purchasing an Analog Devices USB or PCI based JTAG emulator. The USB-based emulator family consists of the High Performance USB JTAG emulator, the USB JTAG emulator, and the MS430 emulator. The USB and PCI based emulators are used in conjunction with the VisualDSP++<sup>®</sup> development environment to create, test, and debug advanced processor application software on all of Analog Devices fixed point and floating point JTAG based DSPs.

The HPUSB-ICE system provides state-of-the-art support for JTAG-compliant Analog Devices processors. Key features of the HPUSB-ICE include:

- Plug-n-Play, USB 2.0 compliant
- High speed USB device
- Windows<sup>®</sup> 2000 or Windows XP operation
- Multiple processor IO voltage support
  - ✓ 1.8V, 2.5V, and 3.3V compliance
  - ✓ 5V tolerant in all ranges
- Multiprocessor support
- JTAG clock operation up to 50 MHz

The HPPCI-ICE system provides state-of-the-art support for JTAG-compliant Analog Devices processors. Key features of the HPPCI-ICE include:

- Plug-n-Play, PCI 2.2 compliant
- Windows 2000 or Windows XP operation
- Multiple processor IO voltage support
  - ✓ 1.8V, 2.5V, and 3.3V compliance
  - ✓ 5V tolerant in all ranges
- Multiprocessor support
- JTAG clock operation up to 50 MHz



The JTAG clock frequency is dependent on the delay characteristics of the JTAG interface and processor on the target board.

The USB-ICE system provides state-of-the-art support for selected processors within the Analog Devices MCP430 processor family. Key features of the USB-ICE include:

- Plug-n-Play, USB 2.0 compliant
- High-speed USB device
- Windows 2000 or Windows XP operation
- Multiple processor I/O voltage support
  - ✓ 1.8V, 2.5V, and 3.3V compliance
  - ✓ 5V tolerant in all ranges
- Multiprocessor support
- JTAG clock operation of 10 MHz



The MSP430-ICE system provides state-of-the-art support for selected processors within the Analog Devices MSP430 processor family. Key features of the MSP430-ICE include:

- Plug-n-Play, USB 2.0 compliant
- Full-speed USB device
- Windows 2000 or Windows XP operation
- Processor I/O voltage support
  - ✓ 3.3V compliance

## Purpose of This Manual

The *HPUSB, USB, HPPCI and MSP430 Emulators User's Guide* provides directions for installing the High Performance USB-ICE, USB ICE, High Performance HPPCI-ICE, and MSP430-ICE hardware and software on your PC. The manual also describes how to configure and use the components of the USB and PCI based emulators.

## Intended Audience

This manual is intended to help the customer understand the features and operation of the HPUSB-ICE, HPPCI-ICE, USB-ICE, and MSP430-ICE so they can begin using VisualDSP++.

# Manual Contents

The manual consists of:

- Chapter 1, “[Getting Started](#)” on page 1-1  
Provides software and hardware installation procedures, PC system requirements, and basic board information.
- Chapter 2, “[Hardware Description](#)” on page 2-1  
Provides information on hardware aspects of the USB-based emulators.
- Chapter 3, “[Support](#)” on page 3-1  
Provides technical support contact information.
- Chapter 4, “[References](#)” on page 4-1  
Provides information on different resources available in developing an ADI processor application.

## Technical or Customer Support

You can reach DSP Tools Support in the following ways.

- Visit the Embedded Processing and DSP products Web site at <http://www.analog.com/processors/technicalSupport>
- E-mail tools questions to [dsptools.support@analog.com](mailto:dsptools.support@analog.com)
- E-mail processor questions to [dsp.support@analog.com](mailto:dsp.support@analog.com)
- Phone questions to **1-800-ANALOGD**

- Contact your Analog Devices, Inc. local sales office or authorized distributor
- Send questions by mail to:

Analog Devices, Inc.  
One Technology Way  
P.O. Box 9106  
Norwood, MA 02062-9106  
USA



# 1 GETTING STARTED

This chapter provides the information needed to begin using the USB and PCI based emulators.

This chapter includes the following sections.

- [“Contents of Emulator Package” on page 1-2](#)  
Provides a list of the components that are shipped with the USB and PCI based emulators.
- [“PC Configuration” on page 1-2](#)  
Describes the minimal PC requirements.
- [“Installation Tasks” on page 1-3](#)  
Describes the step-by-step procedure for setting up the emulator hardware.
- [“Attaching Cable to Emulation Target” on page 1-5](#)  
Describes how to connect a USB, PCI, and MSP43 emulators to your target board.
- [“JTAG Frequency Selection” on page 1-6](#)  
Describes how to change the JTAG frequency.
- [“HPPCI JTAG Voltage Detection” on page 1-8](#)  
Describes the JTAG voltage detection features of the emulators.

# Contents of Emulator Package

### USB Based Emulator:

Your USB based emulator package contains the following items.

- HPUSB-ICE, USB-ICE, or MSP430 assembly
- 5 volt power supply
- 3 meter USB type-A to mini-B cable
- Registration card – please fill out and return

### HPPCI-PCI Emulator:

Your High Performance PCI emulator package contains the following items.

- HPPCI-ICE or JTAG daughter card
- HPPCI-ICE pod assembly
- Registration card – please fill out and return

## PC Configuration

For correct operation of the USB or PCI based emulator, your computer must have the minimal configuration:

1. Windows 2000 or Windows XP
2. VisualDSP++ 3.5 or later
3. USB full or high speed port (for USB based emulators)
4. One available PCI slot (for PCI based emulators)

## Installation Tasks

The following tasks are provided for the safe and effective installation of the USB and PCI based emulator. Follow these instructions in the presented order to ensure correct operation of your software and hardware.

### Installing USB Based Emulators

1. Connect power to the USB assembly.
2. Connect the USB cable to the USB assembly and a USB port of your computer.
3. Install VisualDSP++ 3.5 or later. VisualDSP++ includes the USB driver needed for your USB emulation hardware. VisualDSP++ can be installed on Windows 2000 or Windows XP. Refer to the *Installation Quick Reference Card* for details.
4. Verify driver installation.

### Installing PCI Based Emulators

1. Install the HPPCI -ICE hardware. For specific instructions on installing a PCI card into your computer, consult the documentation provided by the computer manufacturer.
2. Install VisualDSP++ 3.5 or later. VisualDSP++ includes the HPPCI driver needed for your PCI emulation hardware. VisualDSP++ can be installed on Windows 2000 or Windows XP. Refer to the *Installation Quick Reference Card* for details.
3. Verify driver installation



The driver must be installed before you start the HPPCI-ICE for the first time.

# Installation Tasks

## Verifying Driver Installation

Before using your USB or PCI based emulator, verify that the driver software is installed properly.

Open the Windows **Device Manager** and verify that the HPUSB-ICE, HPPCI-ICE, USB-ICE, or MSP430-ICE shows under **ADI Development Tools** as shown in [Figure 1-1](#)

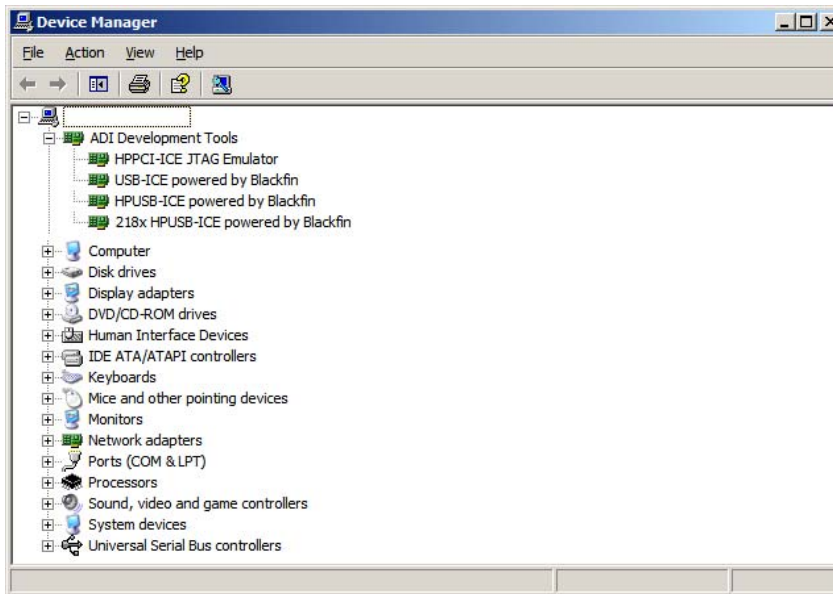


Figure 1-1. Verifying Driver Installation



## Attaching Cable to Emulation Target

### HPUSB, HPPCI, USB JTAG (not MSP430):

The final step is to connect the 14-pin header side of the pod cable to the target board via the debug interface. This connection should only be made while power is applied to the emulator. The 14-pin connector is keyed at pin 3 on the pod cable to ensure the cable correctly sits on the 14-pin target emulation header. The target board should also have pin 3 keyed.

For custom processor boards still in design, refer to engineering note EE-68 found at [http://www.analog.com/Uploaded-Files/Application\\_Notes/4280679728866EE068v09.pdf](http://www.analog.com/Uploaded-Files/Application_Notes/4280679728866EE068v09.pdf) as a technical reference for implementing the JTAG interface on your target.

### MSP430:

The final step is to connect the 14-pin header side of the pod cable to the target board via the JTAG interface. This connection must only be made while power is applied to the emulator. The 14-pin connector is keyed at pin 7 on the pod cable to ensure the cable correctly sits on the 14-pin target emulation header. The target board must also have pin 7 keyed.


For custom processor boards still in design, refer to Engineering Note EE-68, found at [http://www.analog.com/Uploaded-Files/Application\\_Notes/4280679728866EE068v09.pdf](http://www.analog.com/Uploaded-Files/Application_Notes/4280679728866EE068v09.pdf), as a technical reference for implementing the JTAG interface on your target.

The emulator hardware now is ready to be used in conjunction with VisualDSP++ to debug a processor target system.


# JTAG Frequency Selection

High Performance PCI-ICE and High Performance USB-ICE support a JTAG clock operation up to 50 MHz, while USB-ICE supports a JTAG clock operation of 10 MHz.

There is a relationship between the JTAG frequency and the core clock frequency of the processor. Typically, the core clock runs at the frequency that is more than 2x the JTAG clock's frequency. On Analog Devices modern processors, the core clock is a variable, sometimes being set by switches or by software.


 If the core/JTAG clock relation is not followed, scan failures may prevent the emulator from connecting to the processor.

Choosing the **JTAG Frequency Selection** from the **Settings** menu in VisualDSP++ opens the **JTAG Frequency Selection** dialog box shown in [Figure 1-2](#) and [Figure 1-3](#). The dialog box is used to change the rate at which the JTAG Test Clock signal (TCK) runs.

 Not all frequencies shown above appear for all processor families. Displayed frequencies depend on the processor family.

The entries in the **Status** box are the tests that are run when clicking **Test** on the **JTAG Frequency Selection** dialog box. The blue arrow points to the frequency currently being used. The arrow does not change after you run the tests because pressing the **Cancel** button goes back to using the frequency pointed to by the blue arrow. To use a different frequency, select the appropriate frequency from the list and click **Test**. Clicking **OK** uses the frequency that is highlighted and that has already been tested.

[Table 1-1](#) lists and describes each of the available options.

 If a problem is encountered when launching VisualDSP++ at a certain frequency, delete your session in VisualDSP++ and create a new one. This sets TCK back to the default value of 10 MHz.

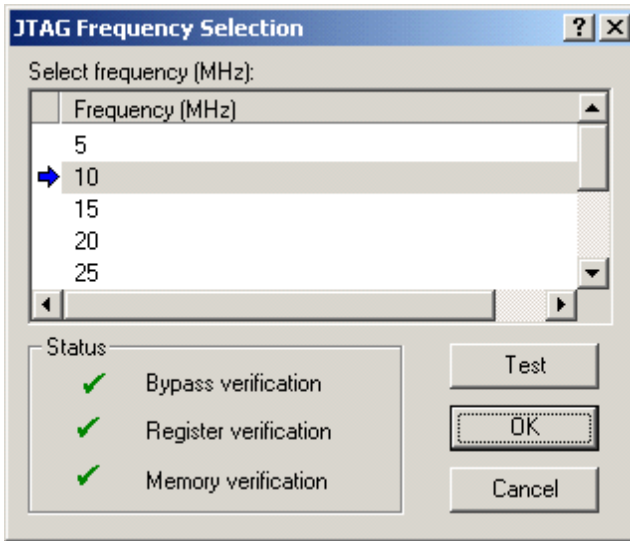


Figure 1-2. HPUSB JTAG Frequency Selection Dialog Box

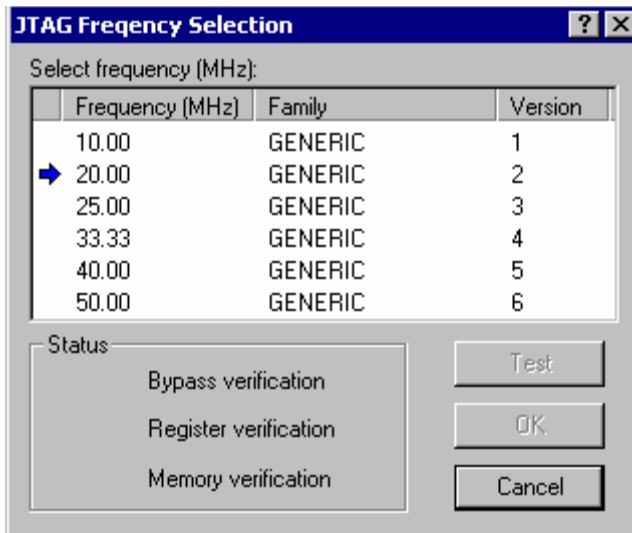


Figure 1-3. HPPCI JTAG Frequency Selection Dialog Box


## HPPCI JTAG Voltage Detection

Table 1-1. JTAG Frequency Selection Field

Dialog Field	Description
Select frequency (MHz)	Selects the frequency to run TCK.
Frequency (MHz)	Displays the frequency at which TCK runs.
Status	Updates status of the tests indicated within the test group. The test status indicator can show the running icon, not running icon, pass icon, or fail icon, depending on the test status.
Test	Tests the selected frequency by running the tests in the <b>Status</b> group. <b>NOTE:</b> If tests fail, you may have to shut down VisualDSP++ and restart your session.
OK	Saves the selected frequency. This should only be highlighted if all the tests have passed.
Cancel	Continues using the frequency pointed to by the blue arrow.

## HPPCI JTAG Voltage Detection

The mode of operation supported by the PCI emulator is dependent on the connection method used for the 14-pin JTAG header on your target. [Figure 1-4](#) and [Figure 1-5](#) show how the target JTAG header connects for Legacy and Auto Detection modes.

 Voltage selection is not available on the MSP430 emulator. The MSP430 emulator is fixed at 3.3 volts and has a different pinout than shown in [Figure 1-4](#) or [Figure 1-5](#).

## HPUSB/USB Legacy Mode

Legacy mode is used for older targets that do not provide a Target VDDIO input for automatic voltage detection by the emulator. In this mode, the voltage at which the JTAG signals run is set manually through VisualDSP++ via the VisualDSP++ Configurator utility. The configurator utility provides a voltage selection setting when configuring the target.

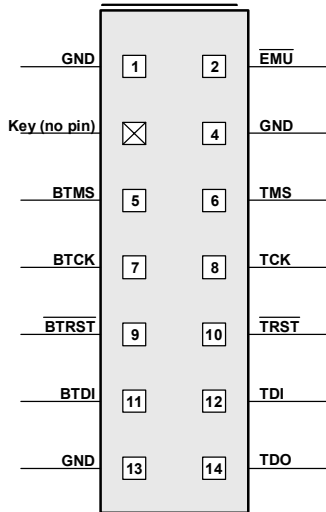


Figure 1-4. Legacy Pinout

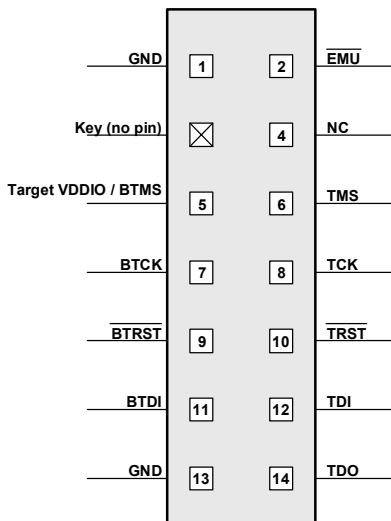



Figure 1-5. Auto Detection Pinout

## HPPCI JTAG Voltage Detection

 The HPUSB and USB emulators do not support the Auto Voltage Detection mode.

## HPPCI Legacy/Auto Detection Mode

The factory default for the pod shown in [Figure 1-6](#) is Legacy mode. For more information about available modes, refer to “[HPPCI Legacy/Auto Detection Mode](#)” on [page 1-10](#) and “[Auto Detection Mode](#)” on [page 1-12](#). In order to modify the factory default setting, remove the four screws on the bottom of the plastic enclosure. When opening the case, first remove the top of the enclosure with the top facing up. This needs to be done to ensure that the four light pipes used for the LEDs are not damaged. The default pod setting is shown in [Figure 1-7](#). To determine whether the default setting of your HPPCI-ICE needs to be modified, refer to “[Legacy Mode \(Factory Default Setting\)](#)” on [page 1-11](#).

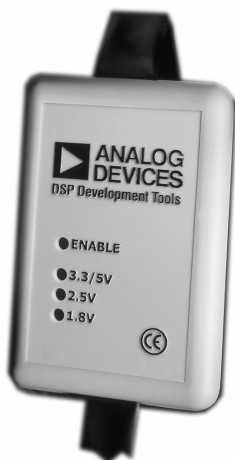


Figure 1-6. HPPCI-ICE Pod

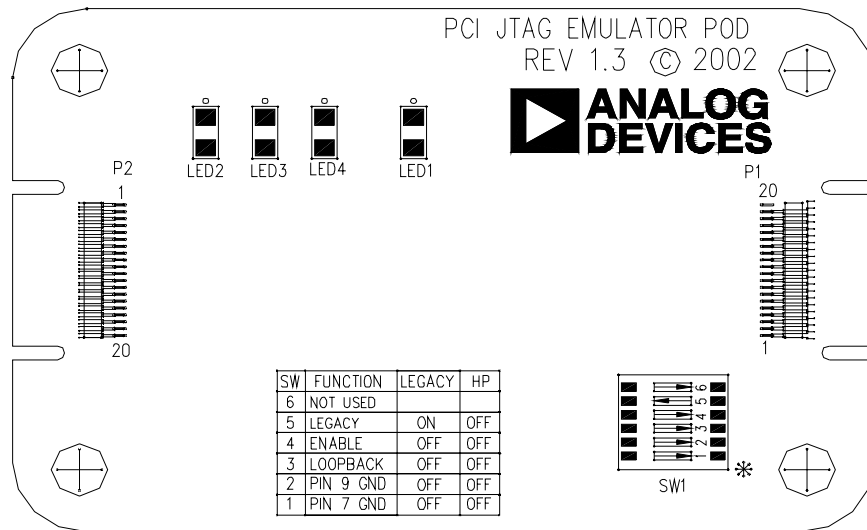


Figure 1-7. Default Switch Setting for HPPCI-ICE Pod

## Legacy Mode (Factory Default Setting)

Legacy mode is used for older targets that do not support voltages less than 3.3V and do not provide an IOVDD input for automatic voltage detection by the pod. Consequently, the emulator in Legacy mode is used for all previously designed 3.3V and 5V target boards. The HPPCI-ICE is 3.3V compliant and 5.0V tolerant in this mode and accepts both 3.3V and 5.0V signals but only drives 3.3V CMOS level signals. In Legacy mode, the LED labeled 3.3/5V is lit.

The emulator is set to Legacy mode before leaving the factory. The switch must be set in the manner shown in [Figure 1-8](#) to verify the emulator is in legacy mode, or to change the emulator to legacy mode.

## HPPCI JTAG Voltage Detection

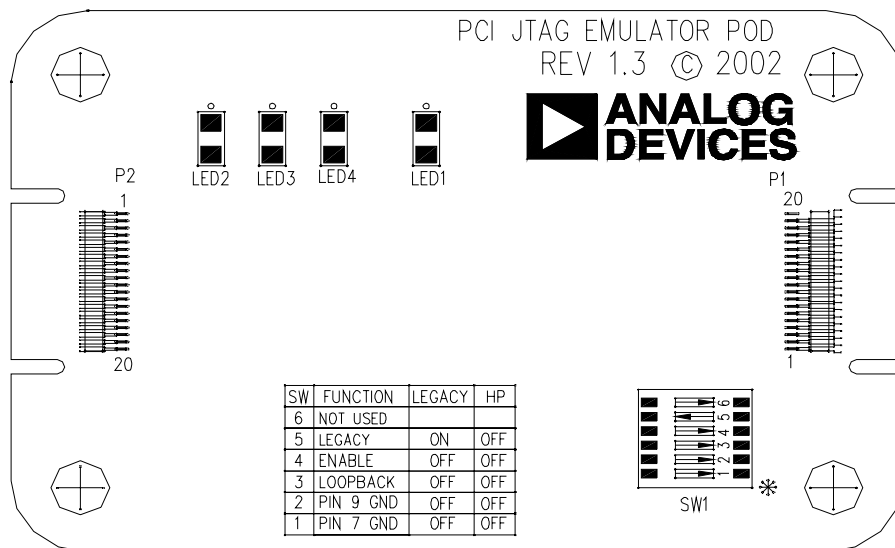


Figure 1-8. Legacy Switch Setting for HPPCI-ICE Pod

## Auto Detection Mode

Auto Voltage Detection mode is recommended for all newly designed target boards. This mode supports 1.8V, 2.5V, 3.3V and 5V target boards. The PCI based emulators are 1.8V, 2.5V, and 3.3V compliant in Auto Voltage Detection mode. This means that the emulator can accept 1.8V, 2.5V, and 3.3V signals and can also drive the respective 1.8V, 2.5V, and 3.3V CMOS level signals back. The emulator is also 5V tolerant. Consequently, the emulator accepts 5V signaling and drives back 3.3V signaling back to the target.



In Auto Voltage Detection mode, the emulator samples the Target VDDIO signal (pin 5 on the JTAG header) and drive the JTAG signals from the emulator at the voltage that has been sampled. The respective 1.8V, 2.5V, or 3.3/5V LED also lights up to show at which voltage the JTAG signals are driven.

The emulator is set to Legacy mode before leaving the factory. The switch must be set in the manner shown in [Figure 1-9](#) to verify the emulator is in Auto Voltage Detect mode, or to change the emulator to Auto Voltage Detect mode.

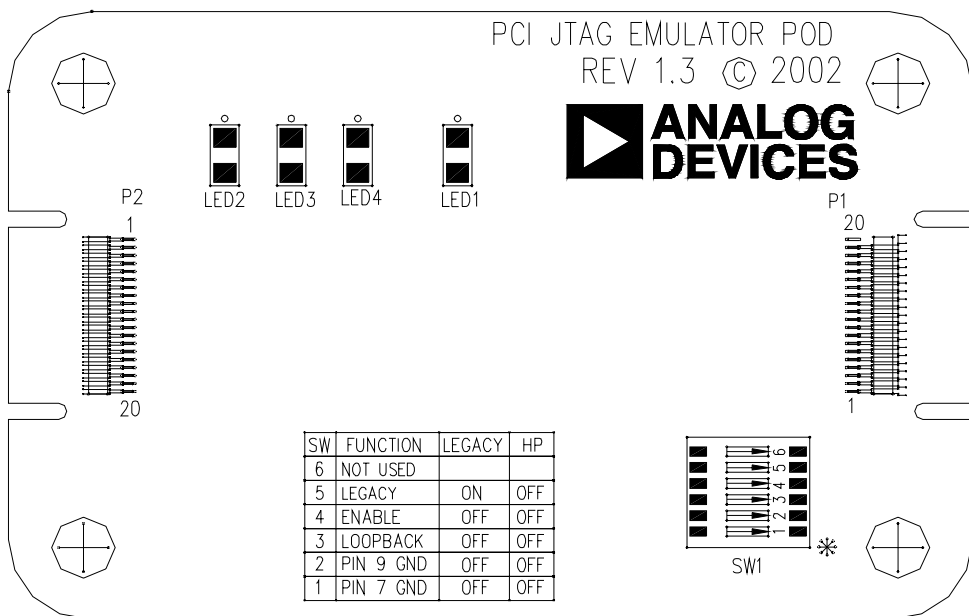


Figure 1-9. Auto Detect Switch Setting for HPPCI-ICE Pod

# HPPCI JTAG Voltage Detection

# 2 HARDWARE DESCRIPTION

This chapter describes the hardware design of the USB and PCI based emulators.

## LEDs

### HPUSB-ICE/USB-ICE LEDs

There are four LEDs located on the enclosure. The following text explains what each LED signifies.

- 1.8V LED – This LED signifies that the ICE drives all signals at 1.8V compliant levels.
- 2.5V LED – This LED signifies that the ICE drives all signals at 2.5V compliant levels.
- 3.3/5V LED – This LED signifies that the ICE drives all signals at 3.3V compliant levels.
- ENABLE – This LED is turned on when a VisualDSP++ session is running. The LED shuts off every time the VisualDSP++ session is closed. When the LED is off, it signifies that all outputs of the pod logic connected to the target have been tri-stated. Tri-stating the outputs of the pod when VisualDSP++ is inactive prevents the target processor from entering an unknown state during the target power up sequencing.

## LEDs

### HPPCI-ICE LEDs

There are four LEDs located on the Pod enclosure (shown in [Figure 2-1](#)), and five LEDs on the daughter board (shown in [Figure 2-2](#)).

### Pod LEDs

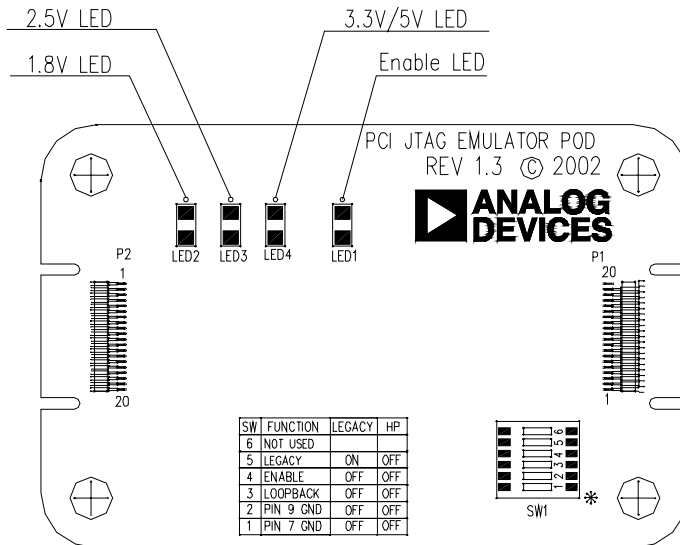


Figure 2-1. Pod LEDs

- 1.8V LED – In Auto Voltage Detect mode, this LED signifies that a target VDDIO of 1.8V has been detected on the JTAG header (pin 5) on the processor target board, and the HPPCI-ICE drives all signals at 1.8V compliant levels.
- 2.5V LED – In Auto Voltage Detect mode, this LED signifies that a target VDDIO of 2.5V has been detected on the JTAG header (pin 5) on the processor target board, and the HPPCI-ICE drives all signals at 2.5V compliant levels.

- 3.3/5V LED – In Auto Voltage Detect mode, this LED signifies that a target VDDIO of 3.3V or 5V has been detected on the JTAG header (pin 5) on the processor target board, and the HPPCI-ICE drives all signals at 3.3V compliant levels. In Legacy mode, this LED is automatically powered, and pin 5 of the JTAG header on the target board is not used to detect the target VDDIO voltage.
- ENABLE – This LED is turned on when a VisualDSP++ session is running. This LED shuts off every time the VisualDSP++ session is closed. When this LED is off, it signifies all outputs of the pod logic connected to the target have been tri-stated. Tri-stating the outputs of the pod when VisualDSP++ is inactive prevents the target processor from entering an unknown state during the target power up sequencing.

### Board LEDs

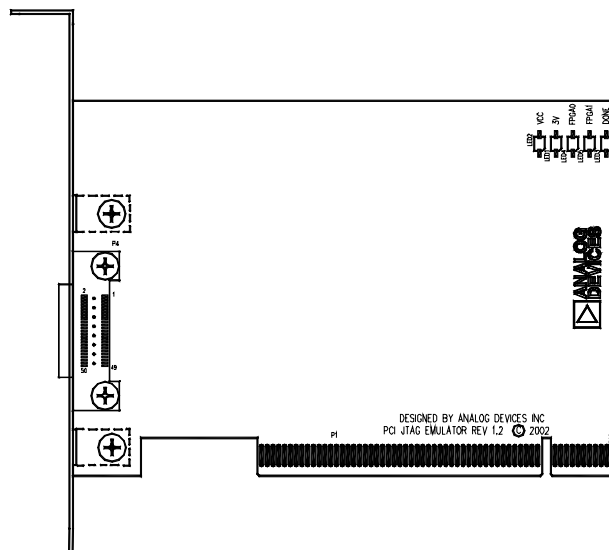


Figure 2-2. Board LEDs

## Designing Custom Processor Boards

- VCC – This LED signifies that the board is receiving 5V power. If this LED is not active, the HPPCI-ICE does not function properly.
- 3V – This LED signifies that the board is receiving 3.3V power. If this LED is not active, the HPPCI-ICE does not function properly.
- FPGA[1:0] – These two LEDs are used for factory purposes only.
- DONE – This LED is activated when a VisualDSP++ session is started. The LED should remain active even after the respective session has been terminated. The LED shuts off and re-activates at the beginning of every new VisualDSP++ session.

### MSP430-ICE LED

There is one LED located on the enclosure.

ENABLE – This LED is turned on when a VisualDSP++ session is running. The LED shuts off every time the VisualDSP++ session is closed. When this LED is off, it signifies all outputs of the pod logic connected to the target have been tri-stated. Tri-stating the outputs of the pod when VisualDSP++ is inactive prevents the target processor from entering an unknown state during the target power up sequencing.

## Designing Custom Processor Boards

When designing a custom processor board using ADI DSPs, special care must be taken to ensure that the JTAG interface is designed and laid out correctly. If the board is not designed correctly, communication via the JTAG port may not work. Another side effect can be that the interface works, but the user is not able to run at the highest possible JTAG clock frequency. The JTAG clock frequency is dependant on the particular Analog Devices processor, as well as the delay characteristics of the custom processor board.

To ensure that the custom board's JTAG interface is designed and laid out correctly, refer to the EE-68 found at

[http://www.analog.com/Uploaded-Files/Application\\_Notes/42866710583EE068.pdf](http://www.analog.com/Uploaded-Files/Application_Notes/42866710583EE068.pdf).

# Mechanical Specifications

## HPPCI-ICE

The HPPCI-ICE consists of a daughter board and a pod cable. The system is compliant with revision 2.2 of the PCI specification and plugs into 5V only motherboards. It uses only the 5V from the PC's PCI slot. The pod cable consists of a small PCB that has a multi-conductor cable soldered at each end. The multi-conductor cable is constructed with individual coaxial cables that are encapsulated by shield ground. The PCB in the pod is fully enclosed in a copper-sprayed plastic enclosure. The multi-conductor cables and copper spray reduce system noise and electromagnetic interference. The mechanical dimensions of the daughter board, pod cable assembly, and pod enclosure are shown in [Figure 2-3](#), [Figure 2-4](#), and [Figure 2-5](#), respectively. Unless specified, all dimensions are in inches.

# Mechanical Specifications

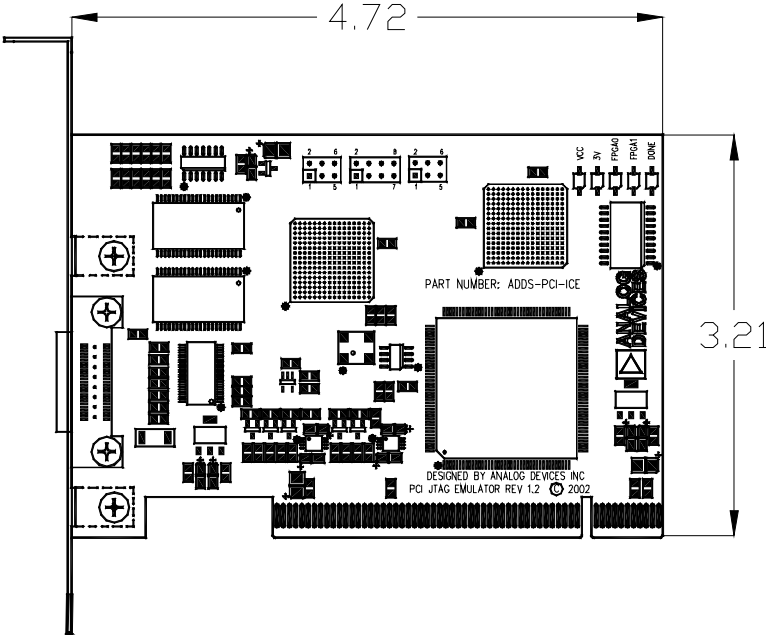


Figure 2-3. Daughter Board Dimensions

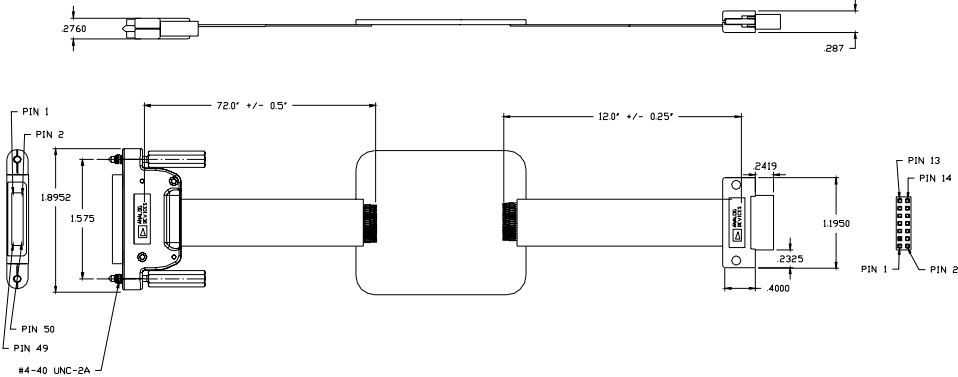


Figure 2-4. Pod Cable Dimensions Pod Cable Dimensions



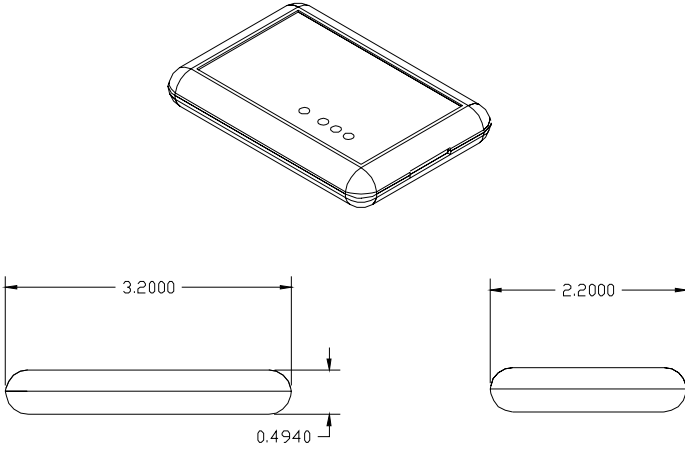


Figure 2-5. Pod Box Dimensions

# Mechanical Specifications

# 3 SUPPORT

Analog Devices provides free technical support.

## Technical Support

For technical support, you may contact the Analog Devices DSP Tools Technical Support group in any of the following ways.

- Fill out the DSP Tools Technical Support Web site form at [http://forms.analog.com/Form\\_Pages/DSP/tools/contactDSP.asp](http://forms.analog.com/Form_Pages/DSP/tools/contactDSP.asp)
- Send a description of the problem by e-mail to [dsptools.support@analog.com](mailto:dsptools.support@analog.com)
- Call the customer support hotline at 1-800-ANALOG-D (1-800-262-5643 U.S.A. only).

For direct support of the Analog Devices processors, call the Analog Devices DSP Applications Engineering group at 1-800-ANALOG-D or email [dsp.support@analog.com](mailto:dsp.support@analog.com).

## Quality Assurance

Analog Devices is committed to providing quality products and services. To continually provide this quality, please contact our Quality Assurance Department directly if you have any concerns at (603) 883-2430, Monday

## Quality Assurance

through Friday during normal business hours, or via e-mail at [dsp-tools@analog.com](mailto:dsp-tools@analog.com). Our Quality Assurance manager will listen to your concerns and provide a timely and effective solution.

# 4 REFERENCES

This section describes documentation resources helpful in your application development.

- For information on designing the interface between an Analog Devices SHARC processor and the emulation header on your custom processor target board, refer to the latest version of Analog Devices EE-68 found at [http://www.analog.com/Uploaded-Files/Application\\_Notes/42866710583EE068.pdf](http://www.analog.com/Uploaded-Files/Application_Notes/42866710583EE068.pdf).
- For information on the architecture and system interface of the ADI processor, refer to the appropriate Analog Devices processor's *Hardware Reference*.
- For ADSP timing specification and other hardware design information, refer to the appropriate processor's *Data Sheet*.
- For complete information on software development tools (assembler, compiler, linker, and so on), refer to the documentation included with VisualDSP++. This information is available in printed format, online help, and online in PDF format.
- For information about your development platform, refer to your operating system manuals and hardware system manuals.

- For information about digital signal processing theory and applications, you may wish to consult:
  - ✓ Higgins. Digital Signal Processing In VLSI. Prentice-Hall, 1990.
  - ✓ Oppenheim and Schaffer. Digital Signal Processing. Prentice-Hall, 1975.

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