PD69201

PD-IM-7601/SP Evaluation Board User Guide

Introduction

The PD-IM-7601/SP evaluation board is developed based on Microchip's PD69201 1-Port PSE PoE Manager and demonstrates the operation of one 2-pair port. The part number for this EVB is PD-IM-7601.

Microchip's PD69201 device is an IEEE® 802.3af and IEEE® 802.3at compliant single-port Power over Ethernet (PoE) Manager, used in Ethernet switches and midspans/injectors to allow network devices to share power and data over the same cable. With minimal external components, the PD69201 supports both IEEE 802.3af/at and Legacy Power Devices (PDs). Integrating power, analog, and state-of-the-art logic, the PD69201 is available in a 10-pin, 3 mm x 4 mm DFN package.

PD69201 supports supply voltages between 32 V and 57 V without additional power sources. Ongoing monitoring of system parameters for the host software is available through I^2C communication. For higher reliability, internal thermal protection is implemented in the chip. PD69201 is the most integrated PSE IC including internal MOSFET and sense resistor to achieve a low power dissipation.

The evaluation system has the following features.

- Two RJ45 connectors (one for Data in and one for Power and Data out).
- Switch domain isolated from PoE domain.
- Switch domain USB interface to be connected to a PC with Microchip GUI.
- PoE controller manual reset and serial communication setting.
- LED status indication for system power, Port power, and Port disabled.
- Requires only a single power source.
- 0 °C to 40 °C working temperature.
- RoHS compliant.

Figure 1. PD-IM-7601/SP Evaluation Board

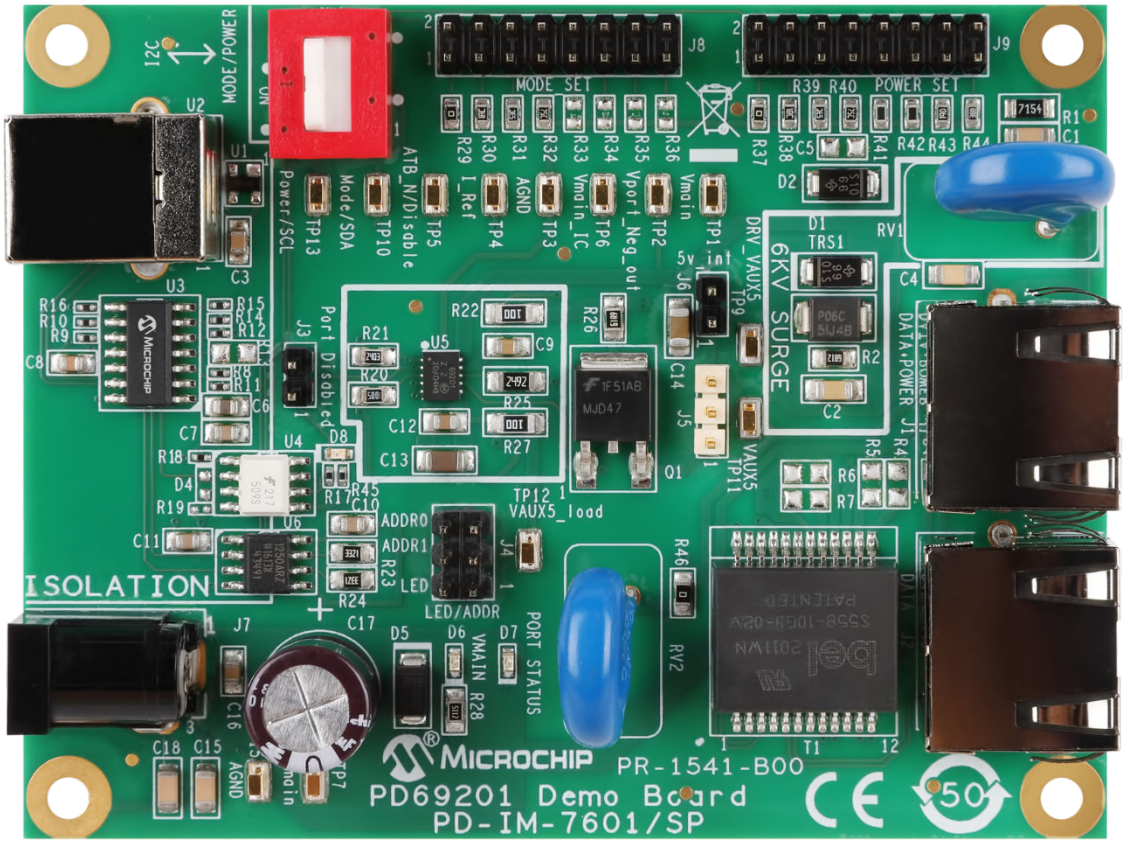


Figure 2. PD-IM-7601/SP System Block Diagram

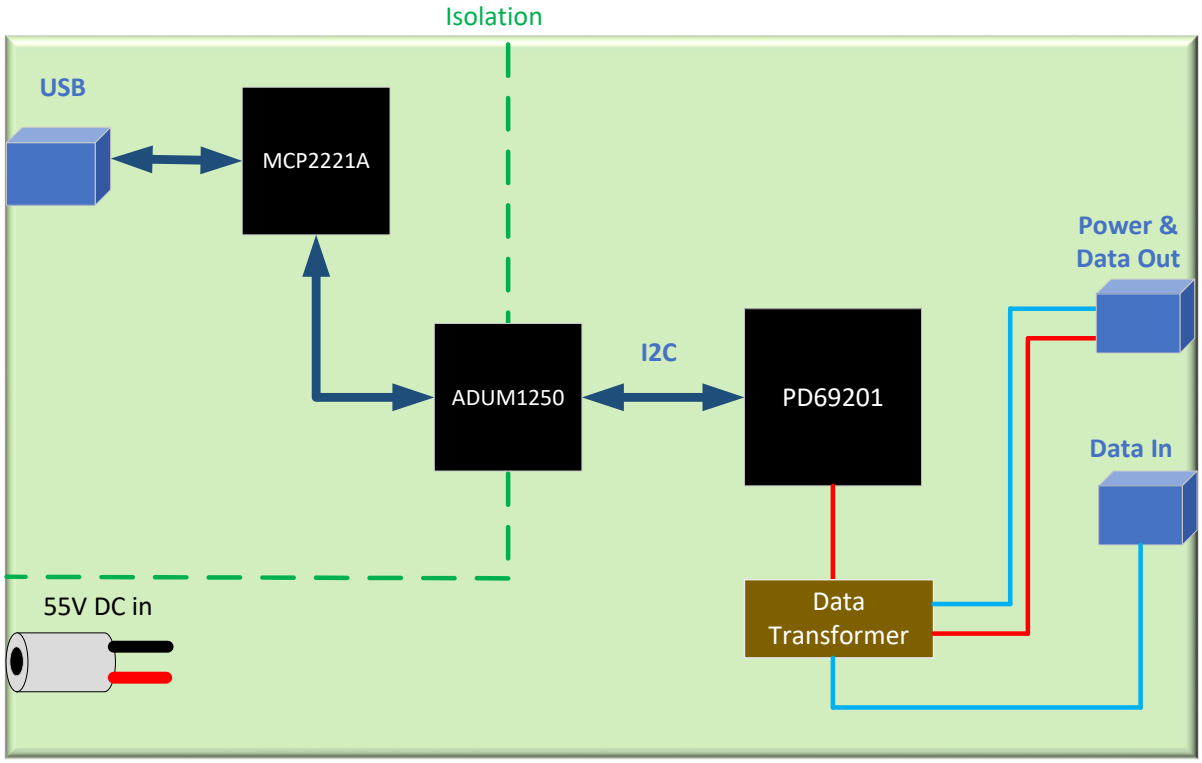


Table of Contents

1. Product Overview

1.1 Power

The EVB is powered by a single source via the DC connector J7. The input voltage level can be selected according to the IEEE 802.3 PoE standards:

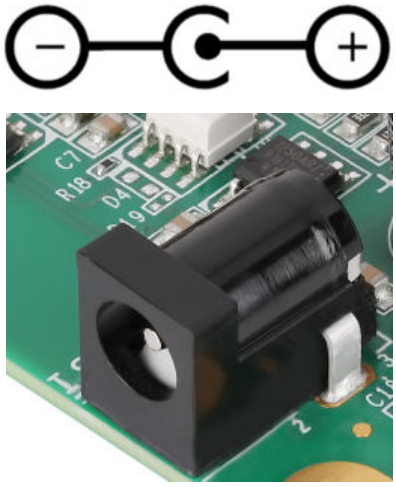
- IEEE 802.3af: 44 VDC to 57 VDC
- IEEE 802.3at: 50 VDC to 57 VDC

The recommended voltage level is 55 VDC, which covers all PoE standards.

The EVB has two power domains:

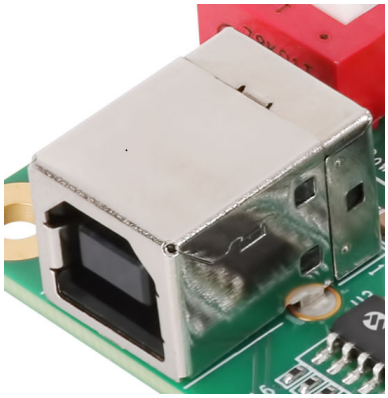
- PoE domain, which is fed directly by the main supply, and it is the power domain provided by the RJ45. The EVB DC input is polarity sensitive.

  Figure 1-1. DC Connector J7 Polarity



- Isolated 5 VDC, which feeds the serial communication peripherals. The isolated 5 VDC is derived from U2 (USB connector).

  Figure 1-2. USB Connector U2



Auxiliary 5 VDC power options:

- The PD69201 has an internal 5 VDC regulator, which eliminates the need for an external DC/DC converter.
- In case it is required to use the 5 VDC for external periphery, the 5 VDC regulator can be boosted by an external NPN transistor.
- 5 VDC can be supplied by an external source. Connect positive to TP12 Vaux5_load and negative to TP3 AGND.

The following table lists the options that are set by jumpers J5 and J6.

Table 1-1. Auxiliary 5 VDC Options

Auxiliary 5 VDC Option	J5 Jumper	J6 Jumper
Internal	Pin 2-3	NC
NPN Transistor (recommended for managed mode)	Pin 1-2	Pin 1-2
External	NC	Pin 1-2

Figure 1-3. Auxiliary 5 VDC Select Jumpers J5 and J6

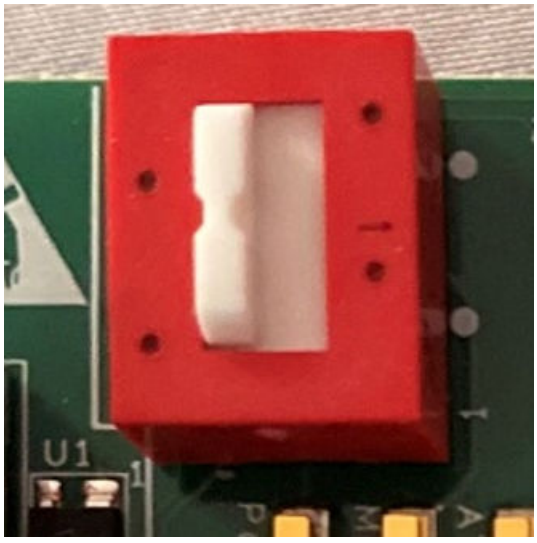
1.2 Interface and Control

The EVB supports Managed and Unmanaged mode of operation. In the Managed application, Host CPU issues commands utilizing I^2C Communication Protocol to the PD69201 PoE manager.

The I^2C communication is converted to USB, to allow the user-friendly experience using Microchip GUI.

The following figure shows switch, SW1, that selects I^2C mode.

Figure 1-4. Managed/Unmanaged Mode Selection Switch SW1

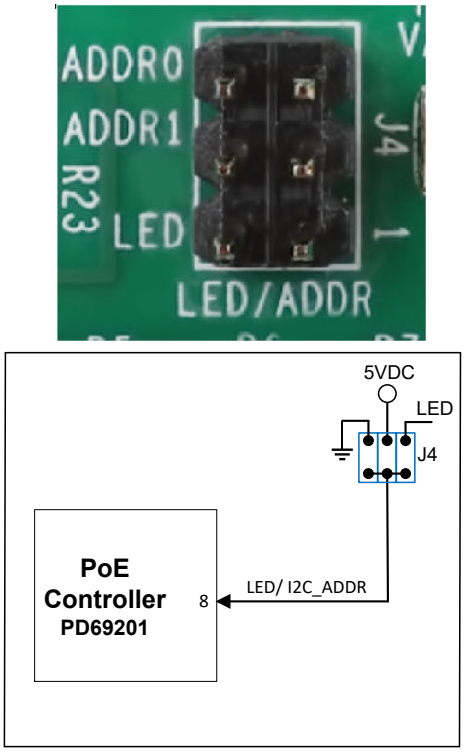


The following table lists the two I²C addresses that are selected by jumper J4.

Table 1-2. I²C Address Setting

I²C Address	J4 Jumper Setting	PCB Marking
0x20	GND	ADDR0
0x21	5VDC	ADDR1
0x21	LED	LED

Figure 1-5. LED/Address Select Jumper J4

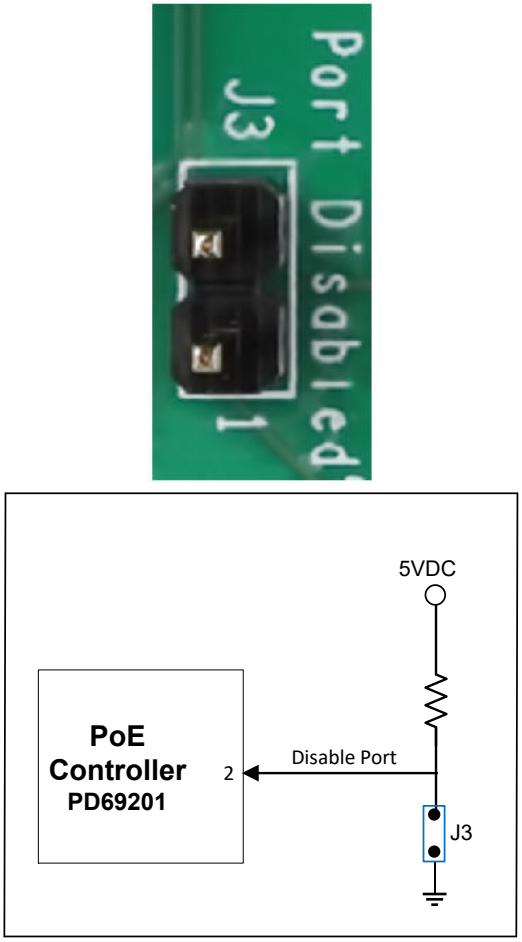


PoE disabled port settings are:

- J3 is connected to the disable pin of the PD69201 (Pin 2).
- When the jumper J3 is installed, the disable pin is connected to GND and PoE functionality is disabled.

The following figure shows the J3 jumper settings.

Figure 1-6. Port Disabled Jumper J3



1.3 RJ45 Connector Polarity

The following table lists the RJ45 connector polarity settings.

Table 1-3. RJ45 Connector 2-pair Port

Pin Number	Polarity
1,2	N.A
3,6	N.A
4,5	Positive Alt B
7,8	Negative Alt B

1.4 Power Select Settings

In the Unmanaged application, the power limit of the port is set by the jumpers on J9, as listed in the following table.

Table 1-4. Power Select Settings

J9 Pins	Resistor Value	Function		
		I_{cut} (OVL)	I_{lim} (Typ)	Class
1,2	0 Ω	375 mA	430 mA	No
3,4	15 kΩ	Disabled	111 mA	No
5,6	34.8 kΩ	Disabled	197 mA	No
7,8	59 kΩ	Disabled	283 mA	No
9,10	86.6 kΩ	Disabled	490 mA	No
11,12	118 kΩ	Disabled	614 mA	No
13,14	154 kΩ	Disabled	981 mA	Yes
15,16	200 kΩ	642 mA	759 mA	Yes

Figure 1-7. Power Set Jumper J9

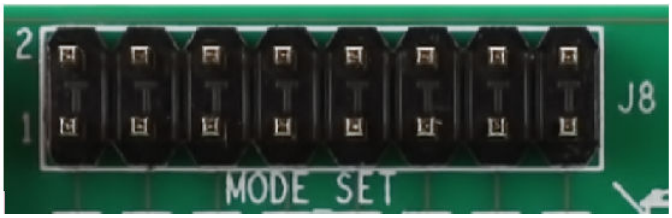
1.5 Mode Settings

In the Unmanaged application, the mode of the port is set by the jumpers on J8, as listed in the following table.

Table 1-5. Mode Select Settings

J8 Pins	Resistor Value	Function	
		ALT A/B	Detection
1,2	0 Ω	Alt B	Res
3,4	15 kΩ	Alt B	Res+Cap
5,6	34.8 kΩ	Alt A	Res
7,8	59 kΩ	Alt A	Res+Cap

Figure 1-8. Mode Set Jumper J8



1.6 LED Indication

The following table lists the evaluation board status indication LEDs.

Table 1-6. LED List

Designation	Function
D6	Vmain ON
D4	Port Disabled
D7 (Port Status)	Led off→ Port is OFF Led on→ Port is ON Led blink 1 Hz→Port OVL/short/dvdt error/res fail/class error LED blink 4 Hz→Vmain is out of range or OVT LED Pulse of 30 ms every 2 s→ Port is Idle

1.7 Test Points

The following table lists the test points in the evaluation board.

Table 1-7. Test Points

Designation	Description
TP1, TP7	Positive input Vmain
TP2	Negative output Vport_Neg_out
TP3, TP15	Ground AGND
TP4	Connected to IREF pin #1
TP5	Connected to Disable Port pin #2
TP6	Connected to Vmain pin #9
TP9	Connected to output of internal regulator DRV_VAUX5 pin #7
TP10	I^2C bus serial data (SDA)/Mode pin #4
TP11	Regulated 5 V input Vaux5 pin #6
TP12	5 V Supply Vaux5_load
TP13	I^2C bus serial clock (SCL)/Power_set pin #5

1.8 Surge Requirements

The following table lists the PoE surge standards that the EVB is designed to meet. Protection is implemented by use of varistors (RV1, RV2) and Sidactor (TRS1). Refer to *AN3580 Designing 1-port PoE System Using PD69201, DS00003580* for additional information.

Table 1-8. Surge Standards

Standard	Test Circuit Waveform	Level [±]	Tested Channel Condition	Coupling Mode
ITU-T K21 2018 Test 2.1.11	1.2/50-8/20 us R1=10 Ω R2=10 Ω	6 kV	Channel OFF	Differential
ITU-T K21 2018 Test 2.1.8	1.2/50-8/20 us R=10 Ω	6 kV	Channel OFF	Common
ITU-T K21 2018 Test 2.1.4a	10/700 us R=25 Ω	6 kV	Channel OFF and ON	Common

2. Installation and Settings

This section describes the steps required for installing and operating the PD-IM-7601/SP.

2.1 Prerequisites

Take the following precautions before starting the installation:

- Ensure that the power supply is turned-off before plugging in the DC connecter.
- Ensure the auxiliary 5 VDC supply is configured correctly.
- After the DC connector is plugged-in, turn the main supply ON.
- Ensure the correct polarity of the power supply cable. The polarity of the power supply cable is as shown in Figure 2-1.

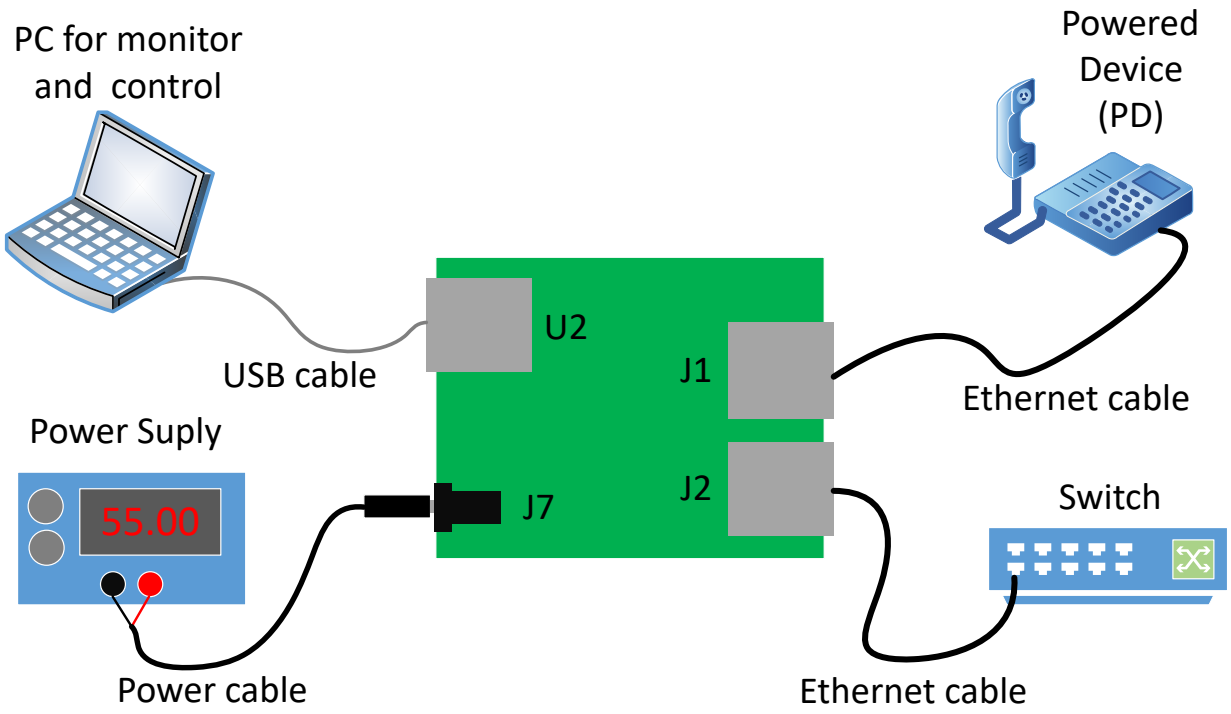
Download and install MCP2221A USB to I2C windows driver from MCP2221A, under Documents tab. Extract all files and run the Driver Installation Tool that is appropriate for your system (x64 or x86).

2.2 Initial Configuration

Note: It is important to verify that the Evaluation Board is setup as shown in Figure 2-1 prior to starting any operation.

- Set the DIP switch SW1 to the correct position (Managed or Unmanaged mode of operation).
- If managed mode is selected, make sure the 5V is boosted by the NPN Transistor.
- If using Unmanaged mode of operation, set the Mode and Power_set jumpers accordingly.
- If using Managed mode of operation, connect the computer with Microchip GUI installed to USB connector U2.
- Connect a power cable from the power supply to the Evaluation Board (J7) and turn the main supply ON.
- Verify Vmain LED is ON.

Figure 2-1. Test Setup



2.3 PD69201 Evaluation Board Schematics

The full schematics of the EVB are available on the Microchip website.

3. Reference Documents

The following is the list of reference documents.

- *IEEE 802.3af-2003 standard, DTE Power via MDI*
- *IEEE802.3at-2009 standard, DTE Power via MDI*
- *PD69201 Data Sheet, DS00003454*
- *AN3580 Designing 1-port PoE System Using PD69201, DS00003580*

4. Revision History

Revision	Date	Description
B	02/2021	Updated Table 1-1. Updated PD-IM-7601/SP System Block Diagram.
A	01/2021	Initial Revision.

The Microchip Website

Microchip provides online support via our website at www.microchip.com/. This website is used to make files and information easily available to customers. Some of the content available includes:

- **Product Support** – Data sheets and errata, application notes and sample programs, design resources, user's guides and hardware support documents, latest software releases and archived software
- **General Technical Support** – Frequently Asked Questions (FAQs), technical support requests, online discussion groups, Microchip design partner program member listing
- **Business of Microchip** – Product selector and ordering guides, latest Microchip press releases, listing of seminars and events, listings of Microchip sales offices, distributors and factory representatives

Product Change Notification Service

Microchip's product change notification service helps keep customers current on Microchip products. Subscribers will receive email notification whenever there are changes, updates, revisions or errata related to a specified product family or development tool of interest.

To register, go to www.microchip.com/pcn and follow the registration instructions.

Customer Support

Users of Microchip products can receive assistance through several channels:

- Distributor or Representative
- Local Sales Office
- Embedded Solutions Engineer (ESE)
- Technical Support

Customers should contact their distributor, representative or ESE for support. Local sales offices are also available to help customers. A listing of sales offices and locations is included in this document.

Technical support is available through the website at: www.microchip.com/support

Microchip Devices Code Protection Feature

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

- Microchip products meet the specifications contained in their particular Microchip Data Sheet.
- Microchip believes that its family of products is secure when used in the intended manner and under normal conditions.
- There are dishonest and possibly illegal methods being used in attempts to breach the code protection features of the Microchip devices. We believe that these methods require using the Microchip products in a manner outside the operating specifications contained in Microchip's Data Sheets. Attempts to breach these code protection features, most likely, cannot be accomplished without violating Microchip's intellectual property rights.
- Microchip is willing to work with any customer who is concerned about the integrity of its code.
- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of its code. Code protection does not mean that we are guaranteeing the product is "unbreakable." Code protection is constantly evolving. We at Microchip are committed to continuously improving the code protection features of our products. Attempts to break Microchip's code protection feature may be a violation of the Digital Millennium Copyright Act. If such acts allow unauthorized access to your software or other copyrighted work, you may have a right to sue for relief under that Act.

Legal Notice

Trademarks

ISBN: 978-1-5224-7724-2

Quality Management System

For information regarding Microchip's Quality Management Systems, please visit www.microchip.com/quality.

Worldwide Sales and Service

AMERICAS	ASIA/PACIFIC	ASIA/PACIFIC	EUROPE
Corporate Office 2355 West Chandler Blvd. Chandler, AZ 85224-6199 Tel: 480-792-7200 Fax: 480-792-7277 Technical Support: www.microchip.com/support Web Address: www.microchip.com **Atlanta** Duluth, GA Tel: 678-957-9614 Fax: 678-957-1455 **Austin, TX** Tel: 512-257-3370 **Boston** Westborough, MA Tel: 774-760-0087 Fax: 774-760-0088 **Chicago** Itasca, IL Tel: 630-285-0071 Fax: 630-285-0075 **Dallas** Addison, TX Tel: 972-818-7423 Fax: 972-818-2924 **Detroit** Novi, MI Tel: 248-848-4000 **Houston, TX** Tel: 281-894-5983 **Indianapolis** Noblesville, IN Tel: 317-773-8323 Fax: 317-773-5453 Tel: 317-536-2380 **Los Angeles** Mission Viejo, CA Tel: 949-462-9523 Fax: 949-462-9608 Tel: 951-273-7800 **Raleigh, NC** Tel: 919-844-7510 **New York, NY** Tel: 631-435-6000 **San Jose, CA** Tel: 408-735-9110 Tel: 408-436-4270 **Canada - Toronto** Tel: 905-695-1980 Fax: 905-695-2078	**Australia - Sydney** Tel: 61-2-9868-6733 **China - Beijing** Tel: 86-10-8569-7000 **China - Chengdu** Tel: 86-28-8665-5511 **China - Chongqing** Tel: 86-23-8980-9588 **China - Dongguan** Tel: 86-769-8702-9880 **China - Guangzhou** Tel: 86-20-8755-8029 **China - Hangzhou** Tel: 86-571-8792-8115 **China - Hong Kong SAR** Tel: 852-2943-5100 **China - Nanjing** Tel: 86-25-8473-2460 **China - Qingdao** Tel: 86-532-8502-7355 **China - Shanghai** Tel: 86-21-3326-8000 **China - Shenyang** Tel: 86-24-2334-2829 **China - Shenzhen** Tel: 86-755-8864-2200 **China - Suzhou** Tel: 86-186-6233-1526 **China - Wuhan** Tel: 86-27-5980-5300 **China - Xian** Tel: 86-29-8833-7252 **China - Xiamen** Tel: 86-592-2388138 **China - Zhuhai** Tel: 86-756-3210040	**India - Bangalore** Tel: 91-80-3090-4444 **India - New Delhi** Tel: 91-11-4160-8631 **India - Pune** Tel: 91-20-4121-0141 **Japan - Osaka** Tel: 81-6-6152-7160 **Japan - Tokyo** Tel: 81-3-6880- 3770 **Korea - Daegu** Tel: 82-53-744-4301 **Korea - Seoul** Tel: 82-2-554-7200 **Malaysia - Kuala Lumpur** Tel: 60-3-7651-7906 **Malaysia - Penang** Tel: 60-4-227-8870 **Philippines - Manila** Tel: 63-2-634-9065 **Singapore** Tel: 65-6334-8870 **Taiwan - Hsin Chu** Tel: 886-3-577-8366 **Taiwan - Kaohsiung** Tel: 886-7-213-7830 **Taiwan - Taipei** Tel: 886-2-2508-8600 **Thailand - Bangkok** Tel: 66-2-694-1351 **Vietnam - Ho Chi Minh** Tel: 84-28-5448-2100	**Austria - Wels** Tel: 43-7242-2244-39 Fax: 43-7242-2244-393 **Denmark - Copenhagen** Tel: 45-4485-5910 Fax: 45-4485-2829 **Finland - Espoo** Tel: 358-9-4520-820 **France - Paris** Tel: 33-1-69-53-63-20 Fax: 33-1-69-30-90-79 **Germany - Garching** Tel: 49-8931-9700 **Germany - Haan** Tel: 49-2129-3766400 **Germany - Heilbronn** Tel: 49-7131-72400 **Germany - Karlsruhe** Tel: 49-721-625370 **Germany - Munich** Tel: 49-89-627-144-0 Fax: 49-89-627-144-44 **Germany - Rosenheim** Tel: 49-8031-354-560 **Israel - Ra'anana** Tel: 972-9-744-7705 **Italy - Milan** Tel: 39-0331-742611 Fax: 39-0331-466781 **Italy - Padova** Tel: 39-049-7625286 **Netherlands - Drunen** Tel: 31-416-690399 Fax: 31-416-690340 **Norway - Trondheim** Tel: 47-72884388 **Poland - Warsaw** Tel: 48-22-3325737 **Romania - Bucharest** Tel: 40-21-407-87-50 **Spain - Madrid** Tel: 34-91-708-08-90 Fax: 34-91-708-08-91 **Sweden - Gothenberg** Tel: 46-31-704-60-40 **Sweden - Stockholm** Tel: 46-8-5090-4654 **UK - Wokingham** Tel: 44-118-921-5800 Fax: 44-118-921-5820