Chipsmall

Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of "Quality Parts,Customers Priority,Honest Operation,and Considerate Service",our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!
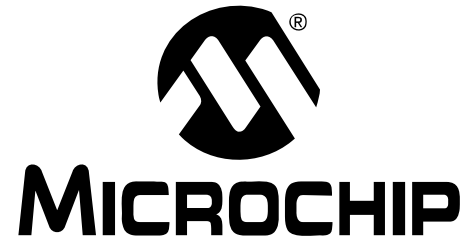

Contact us

TC115
PFM/PWM
Evaluation Board
User's Guide

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

- Microchip products meet the specification contained in their particular Microchip Data Sheet.

- Microchip believes that its family of products is one of the most secure families of its kind on the market today, when used in the intended manner and under normal conditions.

- There are dishonest and possibly illegal methods used to breach the code protection feature. All of these methods, to our knowledge, require using the Microchip products in a manner outside the operating specifications contained in Microchip's Data Sheets. Most likely, the person doing so is engaged in theft of intellectual property.

- Microchip is willing to work with the customer who is concerned about the integrity of their code.

- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of their code. Code protection does not mean that we are guaranteeing the product as "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.

Trademarks

The Microchip name and logo, the Microchip logo, Accuron, dsPIC, KEELOQ, KEELOQ logo, MPLAB, PIC, PICmicro, PICSTART, rfPIC, SmartShunt and UNI/O are registered trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

FilterLab, Linear Active Thermistor, MXDEV, MXLAB, SEEVAL, SmartSensor and The Embedded Control Solutions Company are registered trademarks of Microchip Technology Incorporated in the U.S.A.

Analog-for-the-Digital Age, Application Maestro, CodeGuard, dsPICDEM, dsPICDEM.net, dsPICworks, dsSPEAK, ECAN, ECONOMONITOR, FanSense, In-Circuit Serial Programming, ICSP, ICEPIC, Mindi, MiWi, MPASM, MPLAB Certified logo, MPLIB, MPLINK, mTouch, PICkit, PICDEM, PICDEM.net, PICtail, PIC^{32} logo, PowerCal, PowerInfo, PowerMate, PowerTool, REAL ICE, rfLAB, Select Mode, Total Endurance, WiperLock and ZENA are trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

SQTP is a service mark of Microchip Technology Incorporated in the U.S.A.

All other trademarks mentioned herein are property of their respective companies.

© 2009, Microchip Technology Incorporated, Printed in the U.S.A., All Rights Reserved.

♻ Printed on recycled paper.

Microchip received ISO/TS-16949:2002 certification for its worldwide headquarters, design and wafer fabrication facilities in Chandler and Tempe, Arizona; Gresham, Oregon and design centers in California and India. The Company's quality system processes and procedures are for its PIC® MCUs and dsPIC® DSCs, KEELOQ® code hopping devices, Serial EEPROMs, microperipherals, nonvolatile memory and analog products. In addition, Microchip's quality system for the design and manufacture of development systems is ISO 9001:2000 certified.

QUALITY MANAGEMENT SYSTEM
CERTIFIED BY DNV
═ ISO/TS 16949:2002 ═

TC115 EVALUATION BOARD USER'S GUIDE

Table of Contents

TC115 Evaluation Board User's Guide

NOTES:

TC115 EVALUATION BOARD USER'S GUIDE

Preface

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 on-line help. Select the Help menu, and then Topics to open a list of available on-line help files.

INTRODUCTION

This chapter contains general information that will be useful to know before using the TC115 Evaluation Board. Items discussed in this chapter include:

- Document Layout
- Conventions Used in this Guide
- Recommended Reading
- The Microchip Web Site
- Customer Support
- Document Revision History

DOCUMENT LAYOUT

This document describes how to use the TC115 Evaluation Board as a development tool to emulate and debug firmware on a target board. The manual layout is as follows:

- **Chapter 1. "Product Overview"** – Important information about the TC115 Evaluation Board.
- **Chapter 2. "Installation and Operation"** – Includes a description of the evaluation board, as well as instructions on how to get started.
- **Appendix A. "Schematic and Layouts"** – Shows the schematic and layout diagrams for the TC115 Evaluation Board.
- **Appendix B. "Bill of Materials (BOM)"** – Lists the parts used to build the TC115 Evaluation Board.

TC115 Evaluation Board User's Guide

CONVENTIONS USED IN THIS GUIDE

This manual uses the following documentation conventions:

DOCUMENTATION CONVENTIONS

Description	Represents	Examples
Arial font:		
Italic characters	Referenced books	*MPLAB® IDE User's Guide*
	Emphasized text	...is the *only* compiler...
Initial caps	A window	the Output window
	A dialog	the Settings dialog
	A menu selection	select Enable Programmer
Quotes	A field name in a window or dialog	"Save project before build"
Underlined, italic text with right angle bracket	A menu path	*File>Save*
Bold characters	A dialog button	Click **OK**
	A tab	Click the **Power** tab
N'Rnnnn	A number in verilog format, where N is the total number of digits, R is the radix and n is a digit.	4'b0010, 2'hF1
Text in angle brackets < >	A key on the keyboard	Press <Enter>, <F1>
Courier New font:		
Plain Courier New	Sample source code	`#define START`
	Filenames	`autoexec.bat`
	File paths	`c:\mcc18\h`
	Keywords	`_asm, _endasm, static`
	Command-line options	`-Opa+, -Opa-`
	Bit values	`0, 1`
	Constants	`0xFF, 'A'`
Italic Courier New	A variable argument	`file`.o, where `file` can be any valid filename
Square brackets [ ]	Optional arguments	`mcc18 [options] file [options]`
Curly brackets and pipe character: { | }	Choice of mutually exclusive arguments; an OR selection	`errorlevel {0|1}`
Ellipses...	Replaces repeated text	`var_name [, var_name...]`

	Represents code supplied by user	`void main (void)`
		`{ ...`
		`}`

RECOMMENDED READING

This user's guide describes how to use TC115 Evaluation Board. Other useful documents are listed below. The following Microchip documents are available and recommended as supplemental reference resources.

• **TC115 Data Sheet -** *"PFM/PWM Step-Up DC/DC Converter"* **(DS21361)**

This data sheet provides detailed information regarding the TC115 step-up converter.

THE MICROCHIP WEB SITE

Microchip provides online support via our web site at www.microchip.com. This web site is used as a means to make files and information easily available to customers. Accessible by using your favorite Internet browser, the web site contains the following information:

• **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 consultant 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

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. A listing of sales offices and locations is included in the back of this document.

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

DOCUMENT REVISION HISTORY

Revision B (January 2009)

• Updated Board Schematic (see **Appendix A. "Schematic and Layouts"**).
• Updated **Appendix B. "Bill of Materials (BOM)"**.

Revision A (September 2005)

• Initial Release of this Document.

TC115 Evaluation Board User's Guide

NOTES:

Chapter 1. Product Overview

1.1 INTRODUCTION

The TC115 Evaluation Board is used to evaluate Microchip's TC115 in a single-cell boost converter application. As provided, the TC115 Evaluation Board generates a 3.0V output from a single-cell battery.

This chapter covers the following topics:

- What is the TC115 Evaluation Board?
- What the TC115 Evaluation Board Kit Includes?

1.2 WHAT IS THE TC115 EVALUATION BOARD?

The TC115 Evaluation Board is a complete, step-up, switch-mode, dc-dc power converter. The TC115 Evaluation Board generates a regulated 3.0V output at load currents up to 110 mA. Different output voltages are obtainable by replacing the fixed 3.0V output TC115 with a fixed 3.3V or 5.0V device. Since the TC115 operates from a minimum input voltage of 0.9V, the input voltage can be provided by a single-cell battery.

The TC115 Evaluation Board is provided with an aluminum electrolytic output capacitor. However, there are ceramic and tantalum capacitor pads so other capacitor technologies can be evaluated.

Test points are provided for input power, output load and shutdown control.

1.3 WHAT THE TC115 EVALUATION BOARD KIT INCLUDES?

This TC115 Evaluation Board Kit includes:

- The TC115 Evaluation Board (102-00074)
- Analog and Interface Products Demonstration Boards CD-ROM (DS21912) includes:
  - TC115 Evaluation Board User's Guide (DS51578)

TC115 Evaluation Board User's Guide

NOTES:

Chapter 2. Installation and Operation

2.1 INTRODUCTION

The TC115 Evaluation Board demonstrates Microchip's TC115 PFM/PWM step-up dc-dc converter in a single cell battery powered application. The TC115 is a high-efficiency step-up, dc-dc converter for small, low input voltage or battery-powered systems. The device has a start-up voltage of 0.9V. Due to its integrated MOSFET feature, the TC115 may be used in conjunction with only an external diode, an inductor and a capacitor to design a complete boost converter.

The TC115 Evaluation Board is shipped with an aluminum electrolytic output capacitor. However, there are additional surface-mount pads on the board to evaluate tantalum or ceramic capacitors.

2.2 FEATURES

The TC115 Evaluation Board has the following features:

• Regulated 3.0V output voltage
• Maximum output current: 110 mA
• Automatic PFM/PWM modes of operation
• Test point to apply external Enable signal

TC115 Evaluation Board User's Guide

2.3 GETTING STARTED

The TC115 Evaluation Board is fully assembled and tested for generating a regulated 3.0V output voltage. The TC115 Evaluation Board requires the use of an external input voltage source (0.9V - 3.0V).

2.3.1 Power Input and Output Connections

2.3.1.1 POWERING THE TC115 EVALUATION BOARD

1. Apply the input voltage to the V_{IN} test point (TP1) and GND test point (TP4). The input voltage should be limited to the 0V to +3.0V range. For normal operation, the input voltage should be between +0.9V and +3.0V.

> **Note 1:** Since the TC115 Evaluation Board is a boost converter, applying an input voltage greater than 3.0V will result in an output voltage equal to the input voltage. The TC115 Evaluation Board cannot regulate to an output voltage that is lower than the input voltage.
>
> **2:** With the boost topology, there always exist a path from the input source to the output load.

2.3.1.2 APPLY THE LOAD TO THE REGULATED OUTPUT VOLTAGE TEST POINTS

1. To apply a load to the TC115 Evaluation Board, the positive side (+) of the load should be connected to the V_{OUT} test point (TP3). The negative side (–) of the load should be connected to the GND test point (TP2).

> **Note:** Since the TC115 device receives bias from the output, it may be necessary to remove the load before starting the TC115 Evaluation Board.

2. The TC115 Evaluation Board is supplied with a fixed 3.0V output voltage version of the TC115. However, by changing the TC115 device, other output voltages can be achieved. Besides the fixed 3.0V version, the TC115 is also offered in a fixed 3.3V or 5.0V version.

2.3.1.3 ENABLING/DISABLING THE TC115 EVALUATION BOARD

The $\overline{\text{SHDN}}$ pin of the TC115 is pulled-up to V_{IN} to always enable the device. Test point TP5 can be used to apply an external Enable signal to the device.

Appendix A. Schematic and Layouts

A.1   INTRODUCTION

This appendix contains the following schematic and layout diagrams for the TC115 Evaluation Board:

- Board Schematic
- Board – Top Overlay
- Board – Top Layer
- Board – Bottom Layer

TC115 Evaluation Board User's Guide

A.2   BOARD SCHEMATIC

A.3   BOARD – TOP OVERLAY

TC115 Evaluation Board User's Guide

A.4   BOARD – TOP LAYER

Schematic and Layouts
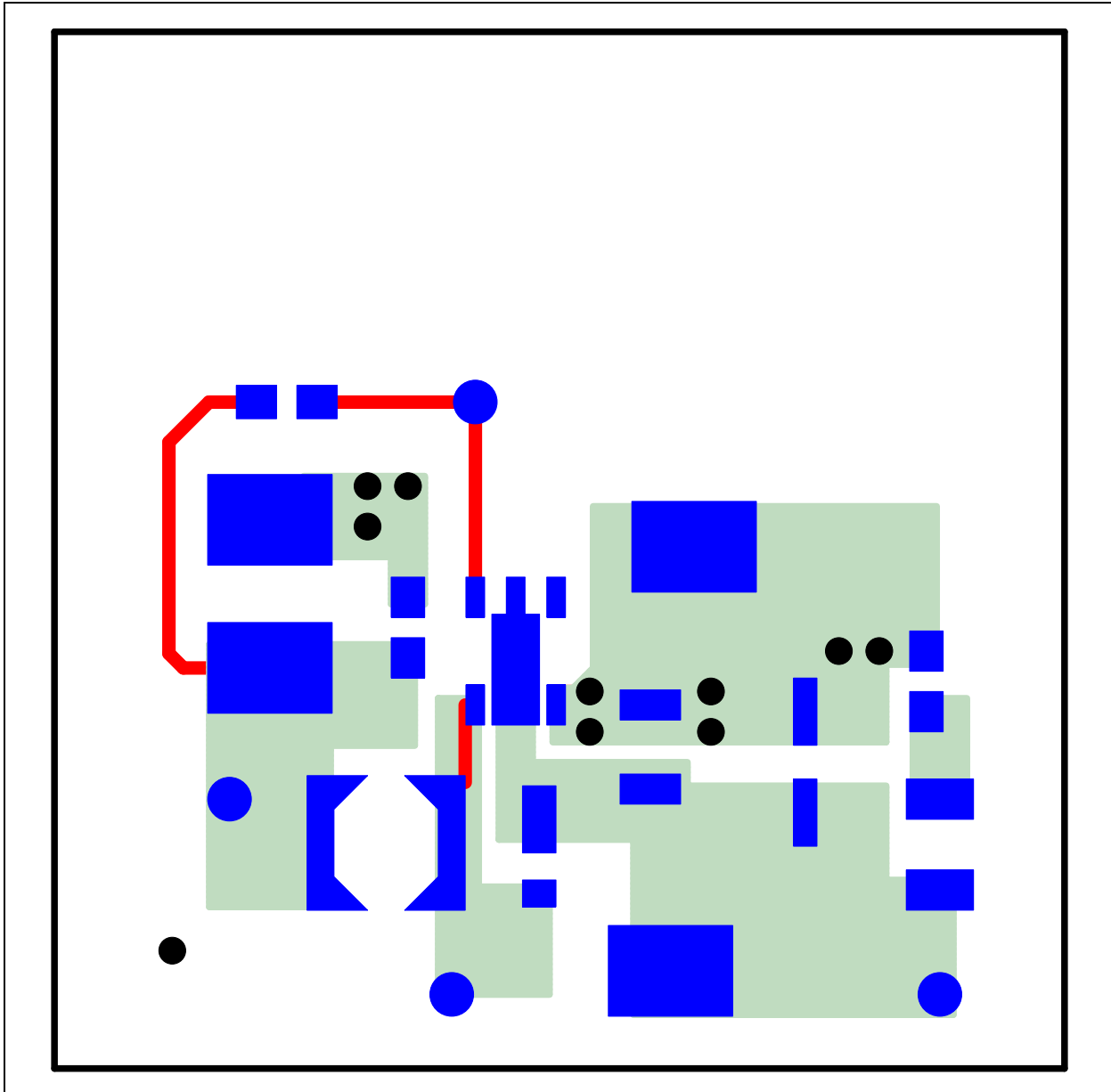
A.5   BOARD – BOTTOM LAYER

TC115 Evaluation Board User's Guide

NOTES:

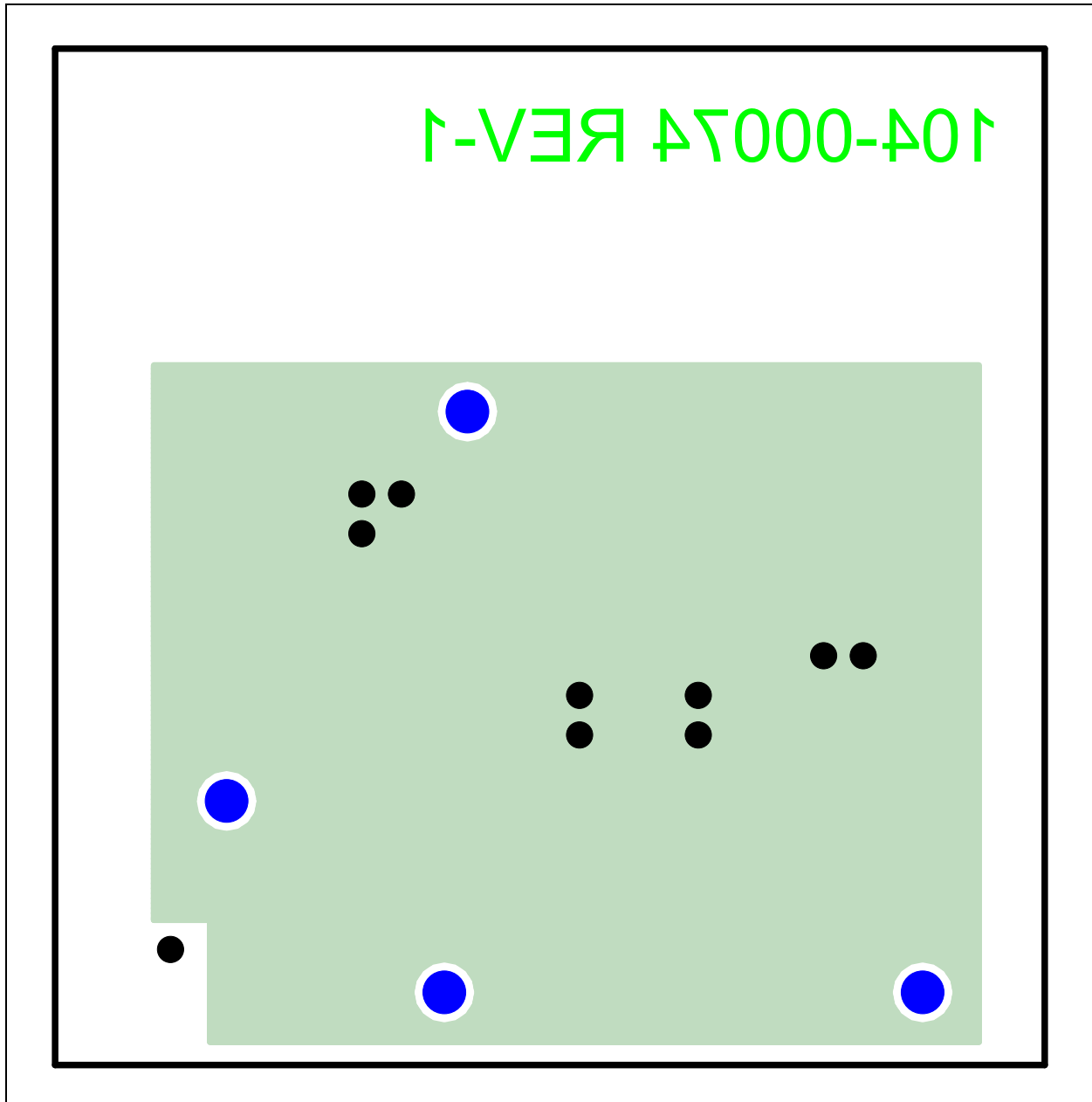# Appendix B. Bill of Materials (BOM)

TABLE B-1: BILL OF MATERIALS (BOM)

Qty.	Reference	Description	Mfgr.	Part Number
1	C1	10 µF, X5R Ceramic, 6.3V 0805	Panasonic®	ECJ-CV50J106M
-	C2	Do Not Populate	—	—
1	C3	47 µF, Electrolytic Capacitator, 6.3V	Nichicon	UWT0J470MCL1GB
-	C4	Do Not Populate	—	—
1	D1	1A, 20V Shottky Diode	Diodes Inc.	DFLS120L
1	L1	100 µH, Inductor, SD25	Coiltronics®	SD25-101-R
1	PCB	RoHS Compliant Bare PCB, TC115 PFM/PWM Boost Evaluation Board	—	104-00074
-	R1	Do Not Populate	—	—
1	R2	475K, 1/8W,1%, Chip Resistor, 0805	Rohm	MCR10EZHF4753
4	TP1,TP2, TP3, TP4	Test Point	Keystone Electronics®	5016
1	U1	TC115 Step-up dc-dc Converter	Microchip Technology Inc.	TC115301EMTTR

WORLDWIDE SALES AND SERVICE

AMERICAS

Corporate Office
2355 West Chandler Blvd.
Chandler, AZ 85224-6199
Tel: 480-792-7200
Fax: 480-792-7277
Technical Support:
http://support.microchip.com
Web Address:
www.microchip.com

Atlanta
Duluth, GA
Tel: 678-957-9614
Fax: 678-957-1455

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
Farmington Hills, MI
Tel: 248-538-2250
Fax: 248-538-2260

Kokomo
Kokomo, IN
Tel: 765-864-8360
Fax: 765-864-8387

Los Angeles
Mission Viejo, CA
Tel: 949-462-9523
Fax: 949-462-9608

Santa Clara
Santa Clara, CA
Tel: 408-961-6444
Fax: 408-961-6445

Toronto
Mississauga, Ontario,
Canada
Tel: 905-673-0699
Fax: 905-673-6509

ASIA/PACIFIC

Asia Pacific Office
Suites 3707-14, 37th Floor
Tower 6, The Gateway
Harbour City, Kowloon
Hong Kong
Tel: 852-2401-1200
Fax: 852-2401-3431

Australia - Sydney
Tel: 61-2-9868-6733
Fax: 61-2-9868-6755

China - Beijing
Tel: 86-10-8528-2100
Fax: 86-10-8528-2104

China - Chengdu
Tel: 86-28-8665-5511
Fax: 86-28-8665-7889

China - Hong Kong SAR
Tel: 852-2401-1200
Fax: 852-2401-3431

China - Nanjing
Tel: 86-25-8473-2460
Fax: 86-25-8473-2470

China - Qingdao
Tel: 86-532-8502-7355
Fax: 86-532-8502-7205

China - Shanghai
Tel: 86-21-5407-5533
Fax: 86-21-5407-5066

China - Shenyang
Tel: 86-24-2334-2829
Fax: 86-24-2334-2393

China - Shenzhen
Tel: 86-755-8203-2660
Fax: 86-755-8203-1760

China - Wuhan
Tel: 86-27-5980-5300
Fax: 86-27-5980-5118

China - Xiamen
Tel: 86-592-2388138
Fax: 86-592-2388130

China - Xian
Tel: 86-29-8833-7252
Fax: 86-29-8833-7256

China - Zhuhai
Tel: 86-756-3210040
Fax: 86-756-3210049

ASIA/PACIFIC

India - Bangalore
Tel: 91-80-4182-8400
Fax: 91-80-4182-8422

India - New Delhi
Tel: 91-11-4160-8631
Fax: 91-11-4160-8632

India - Pune
Tel: 91-20-2566-1512
Fax: 91-20-2566-1513

Japan - Yokohama
Tel: 81-45-471- 6166
Fax: 81-45-471-6122

Korea - Daegu
Tel: 82-53-744-4301
Fax: 82-53-744-4302

Korea - Seoul
Tel: 82-2-554-7200
Fax: 82-2-558-5932 or
82-2-558-5934

Malaysia - Kuala Lumpur
Tel: 60-3-6201-9857
Fax: 60-3-6201-9859

Malaysia - Penang
Tel: 60-4-227-8870
Fax: 60-4-227-4068

Philippines - Manila
Tel: 63-2-634-9065
Fax: 63-2-634-9069

Singapore
Tel: 65-6334-8870
Fax: 65-6334-8850

Taiwan - Hsin Chu
Tel: 886-3-572-9526
Fax: 886-3-572-6459

Taiwan - Kaohsiung
Tel: 886-7-536-4818
Fax: 886-7-536-4803

Taiwan - Taipei
Tel: 886-2-2500-6610
Fax: 886-2-2508-0102

Thailand - Bangkok
Tel: 66-2-694-1351
Fax: 66-2-694-1350

EUROPE

Austria - Wels
Tel: 43-7242-2244-39
Fax: 43-7242-2244-393

Denmark - Copenhagen
Tel: 45-4450-2828
Fax: 45-4485-2829

France - Paris
Tel: 33-1-69-53-63-20
Fax: 33-1-69-30-90-79

Germany - Munich
Tel: 49-89-627-144-0
Fax: 49-89-627-144-44

Italy - Milan
Tel: 39-0331-742611
Fax: 39-0331-466781

Netherlands - Drunen
Tel: 31-416-690399
Fax: 31-416-690340

Spain - Madrid
Tel: 34-91-708-08-90
Fax: 34-91-708-08-91

UK - Wokingham
Tel: 44-118-921-5869
Fax: 44-118-921-5820

01/02/08