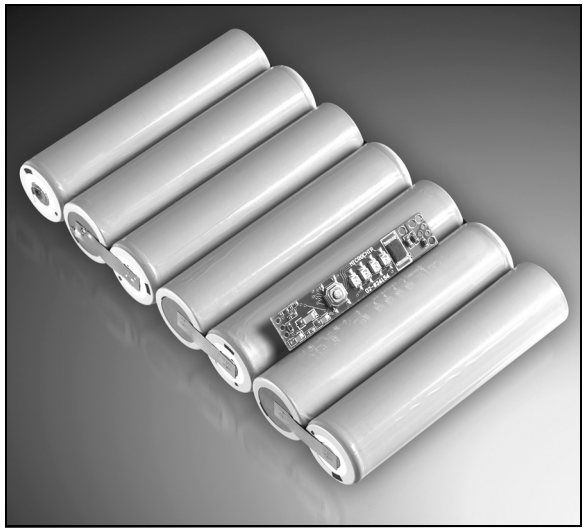
PS4200

PS402 Battery Manager Module with LED SOC Display

Features

- PS402 tested, fully populated modules for evaluation and production
- Designed to work with 6 to 10 series cell NiMH configurations
- Performs all major NiMH battery management functions including
  - Accurate capacity monitoring
  - Optional external thermistor configuration for accurate temperature monitoring
  - Supports three full charge detection methods - dT/dt, -dV, programmable overcharge
- SOC display with four LEDs and a switch
- Fully compliant with industry standard Smart Battery Data Specification v1.1a
- SMBus v1.1 with PEC/CRC-8 communication with system host
- High accuracy measurement of charge/discharge current, voltage, and temperature with on-chip 15-bit integrating A/D
- Precise capacity reporting using Microchip patented algorithms and 3D battery cell models
- 3D models and “learned” parameters stored in integrated EPROM and EEPROM
- Extremely low power operation:
  - Sleep Mode: < 13 µA typical
  - Run Mode: < 500 µA typical
  - Sample Mode: < 250 µA typical
- Complete hardware and software development tools available
- Overall mechanical dimensions:
  - 0.339 W x 1.772 L (inches)
  - 8.6 W x 45.0 L (millimeters)

Board Photo



Ordering Information

Part Number	Description
PS4200	NiMH - 6 to 10 series cells

© 2003 Microchip Technology Inc.

1.0 GENERAL DESCRIPTION

The PS4200 module is a complete smart battery controller subsystem based on the Microchip PS402 battery manager with patented Accuron™ technology. The module is designed to operate in a battery pack consisting of six (6) to ten (10) series connected Ni-based cells. The module consists of the Microchip PS402 battery manager IC with a four LED SOC display and an optional connection for an external thermistor.

1.1 Quick Start - Pack Assembly

Follow these directions to assemble a pack with the PS4200 module.

- Use standard precautions when handling static sensitive devices.
- Modules should be connected to battery cells in the order indicated below to insure proper start-up and operation. Wires should be attached to the modules first and then connected to the battery cells as instructed.
- The connection sequence is critical to successful use of the PS402 family of CMOS ASICs. The pack positive should be securely connected to the module first, followed by pack negative.

Step 1: Configure the module for optional external thermistor use. PS4200 modules are shipped configured to use the internal temperature sensor only. To add an external thermistor to the board, remove resistor R16 and connect the thermistor across vias TN and TR.

Step 2: Connect wires to module. Use large diameter wire (18 AWG-20 AWG) for current carrying lines from VR and V1. All others are signal only lines (24 to 22 AWG).

Step 3: Connect V1 to the most positive point on the battery cell stack.

Step 4: Connect VR to the most negative point on the battery cell stack.

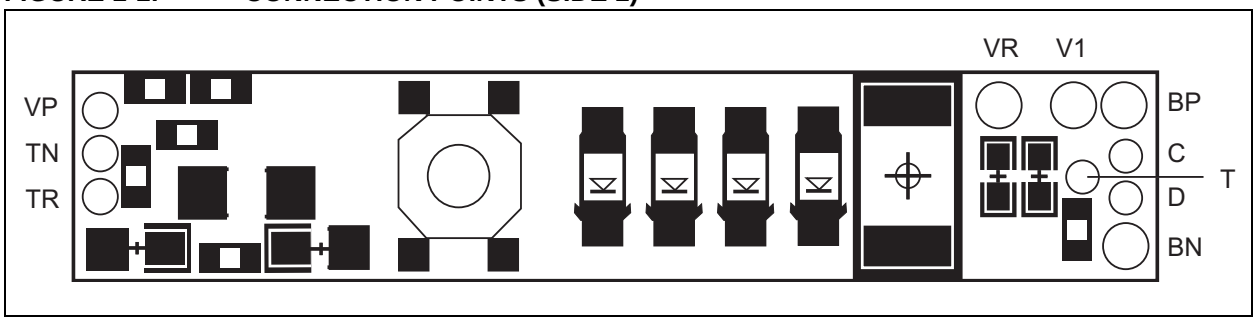
Step 5: Connect external connector to BN, T, C, D and BP.

Step 6: Program the assembled pack using Microchip's PowerTool™ software and PowerCal™ board or PowerInfo™ board hardware.

The EEPROM parameters can be changed at will using the utilities on the P4 EE page in the PowerTool software. The OTP EPROM parameters can be changed a limited number of times using utilities on the P4 OTP page. To write to the OTP EPROM, an additional voltage (V_{PP}) must be applied to the PS402. This programming voltage can be obtained from the PowerInfo board and applied to the PS4200 at connection VP (small thru-hole) located on the small edge of the board opposite the connector edge.

Step 7: Calibrate the pack using the PowerTool software and PowerCal board hardware. The pack is now ready for use.

FIGURE 1-1: CONNECTION POINTS (SIDE 1)



 © 2003 Microchip Technology Inc.

FIGURE 1-2: BOARD ASSEMBLY (SIDE 1)

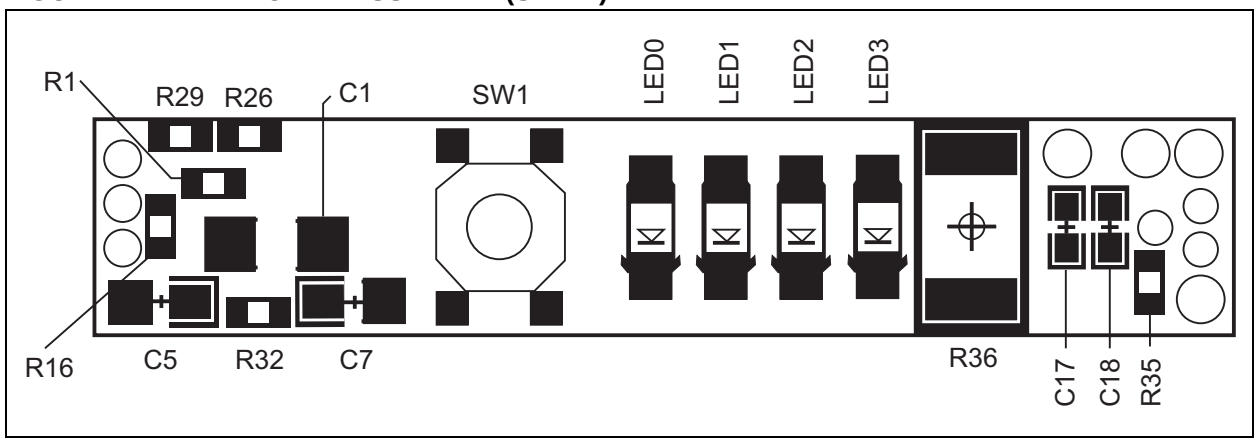
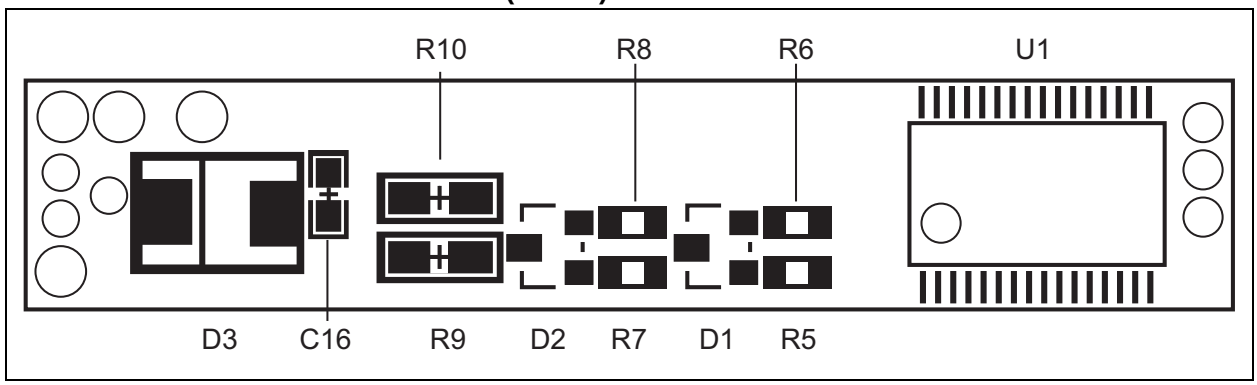


FIGURE 1-3: BOARD ASSEMBLY (SIDE 2)



2.0 FUNCTIONAL DESCRIPTION

2.1 PS402 Fuel Gauge

The module fuel gauge provides State-of-Charge (SOC) and battery status data in accordance with the SMBus standards version 1.1. The PS402 monitors the pack voltage, battery temperature and current to determine SOC and battery status. The State-of-Charge calculations are compensated for cell self discharge and charge acceptance. The remaining time calculation is compensated for temperature and discharge rate. The parameters for determining battery status flags and alarm thresholds are all programmable as is the battery design capacity and the battery performance model data. Please refer to the data sheet "PS402 Single Chip Battery Manager - Nickel Chemistries" for details on configuring the PS402.

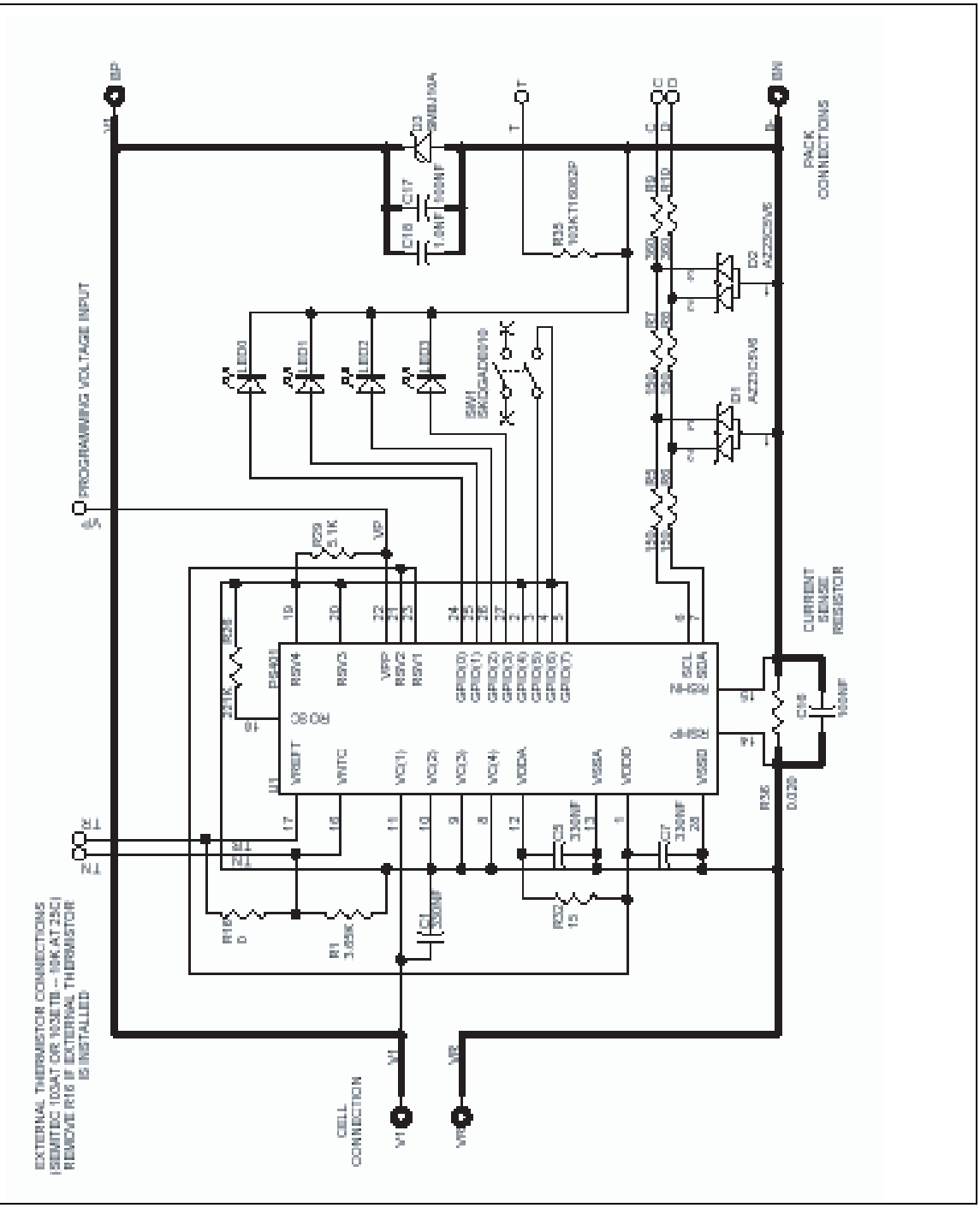
2.2 OTP EPROM Programming

To write to the OTP EPROM, an additional voltage (V_{PP}) must be applied to the PS402. This programming voltage can be obtained from the PowerInfo board and applied to the PS4200 at connection VP (small thru-hole) located on the small edge of the board opposite the connector edge. Then use the utilities located on the P4 OTP page of the PowerTool software to write new values to the PS402 OTP EPROM.

3.0 BOARD DESCRIPTION

PCB schematics and bill of materials are included here for completeness. To download full size schematic and BOM, please visit the Microchip web site.

FIGURE 3-1: BOARD SCHEMATIC



 © 2003 Microchip Technology Inc.

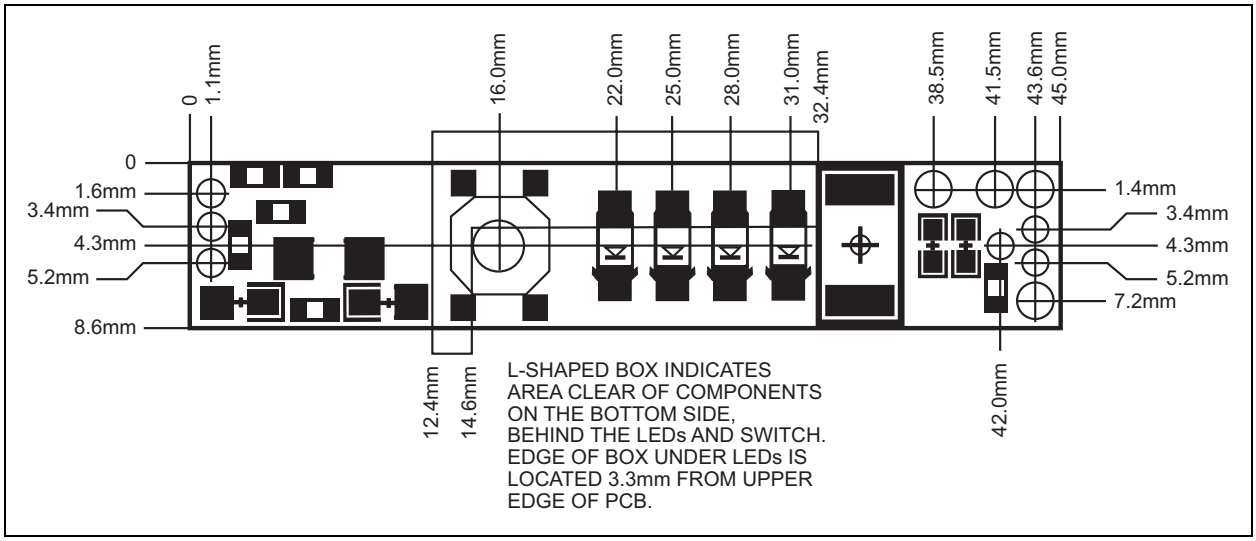
TABLE 3-1: BILL OF MATERIALS

ID	PartSmart Part Number	Symbols	Description	Manufacturer	Manufacturer PN	Supplier	Supplier PN	Qty:
1	04-826156 Rev. 1.1		Raw PCB, PS4200	Microchip	04-826156 Rev. 1.1	Microchip	04-826156 Rev. 1.1	1
2	CC-0603-10X7R50-1.0NF-01	C18	Capacitor, Ceramic, 1.0nF, 50V, +/-10%, X7R dielectric, 0603	Panasonic	ECJ-1VB1H102K	Digikey	PCC1772CT-ND	1
3	CC-0603-8020Y5V25-100NF-01	C16-C17	Capacitor, Ceramic, 100nF, 25V, +80%/-20%, Y5V dielectric, 0603	Panasonic	ECJ-1VF1E104Z	Digikey	PCC1794CT-ND	2
4	CC-0805-8020Y5V25-330NF-01	C5, C7	Capacitor, Ceramic, 330nF, 25V, +80%/-20%, Y5V dielectric, 0805	Panasonic	ECJ-2YF1E334Z	Digikey	PCC1856CT-ND	2
5	CC-1206-10X7R25-330NF-01	C1	Capacitor, Ceramic, 330nF, 25V, +/-10%, X7R dielectric, 1206	Panasonic	ECJ-3VB1E334K	Digikey	PCC1889CT-ND	1
6	DL-1206LED-GC-SMLLX1206GC-01	LED0-LED3	LED, clear green, 1206 package	Lumex	SML-LX1206GC-TR	Digikey	67-1357-1-ND	4
7	DT-SMB-X-SMBJ20A-01	D3	TVS, 20V, 600W, unipolar, SMB package	Diodes, Inc. Crydom Central Semi.	SMBJ20A-13 SMBJ20A 1SMB20A-PST	Digikey Digikey Central Semi.	SMBJ20ADICT-ND SMBJ20ACCCT-ND 1SMB20A-PST	1
8	DZ-SOT23-5D-AZ23C5V6-01	D1, D2	Dual Zener Diode, 5.6V +/-5%, 300mW, common-anode, SOT-23	Diodes Inc. General Semi.	AZ23C5V6-7 AZ23-C5V6	Digikey General Semi.	AZ23C5V6DICT-ND AZ23-C5V6	2
9	RF-0603-1-221K-01	R26	Resistor, film, 0603, 1%, 221K ohms	Panasonic	ERJ-3EKF2213V	Digikey	P221KHCT-ND	1
10	RF-0603-1-3.65K-01	R1	Resistor, film, 0603, 1%, 3.65K ohms	Panasonic	ERJ-3EKF3651V	Digikey	P3.65KHCT-ND	1
11	RF-0603-5-0-01	R16	Resistor, zero-ohm, 0603	Panasonic	ERJ-3GEY0R00V	Digikey	P0.0GCT-ND	1
12	RF-0603-5-150-01	R5-R8	Resistor, film, 0603, 5%, 150 ohms	Panasonic	ERJ-3GEYJ151V	Digikey	P150GCT-ND	4
13	RF-0603-5-15-01	R32	Resistor, film, 0603, 5%, 15 ohms	Panasonic	ERJ-3GEYJ150V	Digikey	P15GCT-ND	1
14	RF-0603-5-5.1K-01	R29	Resistor, film, 0603, 5%, 5.1K ohms	Panasonic	ERJ-3GEYJ512V	Digikey	P5.1KGCT-ND	1
15	RF-0805-5-360-01	R9-R10	Resistor, film, 0805, 5%, 360 ohms	Panasonic	ERJ-6GEYJ361V	Digikey	P360ACT-ND	2
16	RF-2512-1-0.020-01	R36	Resistor, metal strip, 2512, 1%, 0.020 ohms	Vishay	WSL2512-0.020-1%-R86	Vishay	WSL2512-0.020-1%-R86	1
17	RT-0603-2-103KT16082P-01	R35	Thermistor, 10K ohms at 25C, B value 3435, -40C to 125C operating temperature range, 0603 SMT package	Semitec	103KT1608-2P	Semitec	103KT1608-2P	1
18	SW-SWSMD65X52-SPSTM-SKQGADE010-01	SW1	Switch, SPST-momentary, pushbutton, surface-mount	ALPS	SKQGADE010	ALPS	SKQGADE010	1
19	UM-SSOP28-2585-PS402-01	U1	IC, Single-chip NiMH Battery Manager, programmable, -25C to 85C, SSOP-28	Microchip	PS402	Microchip	PS402	1

3.1 Mechanical Dimensions

Overall Dimensions: 1772 mils x 339 mils

FIGURE 3-2: PS4200 DIMENSION DETAILS



4.0 DEVELOPMENT TOOL SUMMARY

Microchip provides all the necessary hardware and software to enable easy tailoring of battery control algorithm parameters and cell performance models to meet specific application requirements and attain the highest accuracy available anywhere. Table 4-1 summarizes the development tool offering from Microchip to support the PS4200. Please refer to the Microchip web site for ordering information and design documentation (including schematics) at www.microchip.com.

4.1 Reference Documents

This data sheet provides an overview of the PS4200 Battery Manager Module. For further information on the PS402 and development tool operations, please refer to the documents listed in Table 4-2 available for download at www.microchip.com.

TABLE 4-1: MICROCHIP DEVELOPMENT TOOL SUMMARY

Development Tool	Use
PowerInfo™ hardware with PowerTool™ software (PS041)	Read and write Smart Battery data values, EEPROM programming, OTP EPROM programming
PowerCal™ hardware with PowerTool software (PS042)	Read and write Smart Battery data values, EEPROM programming, OTP EPROM programming, pack calibration, pack test

TABLE 4-2: MICROCHIP REFERENCE DOCUMENTS

Document Number	Documents Available
DS21766A	PS402 Single Chip Battery Manager - Nickel Chemistries Data Sheet (IC Products)
DS40234A	PS041 PowerInfo Configuration Interface Product Brief
DS40237A	PS042 PowerCal Calibration Platform Data Sheet (Development Tool Documentation)

 © 2003 Microchip Technology Inc.

Information contained in this publication regarding device applications and the like is intended through suggestion only and may be superseded by updates. It is your responsibility to ensure that your application meets with your specifications. No representation or warranty is given and no liability is assumed by Microchip Technology Incorporated with respect to the accuracy or use of such information, or infringement of patents or other intellectual property rights arising from such use or otherwise. Use of Microchip's products as critical components in life support systems is not authorized except with express written approval by Microchip. No licenses are conveyed, implicitly or otherwise, under any intellectual property rights.

Trademarks

The Microchip name and logo, the Microchip logo and PowerSmart are registered trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

Accuron, PowerTool, SmartSensor, SmartShunt, SmartTel, PowerCal and PowerInfo are trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

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

© 2003, Microchip Technology Incorporated. Printed in the U.S.A., All Rights Reserved.

Printed on recycled paper.

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: 480-792-7627
Web Address: http://www.microchip.com

Rocky Mountain
2355 West Chandler Blvd.
Chandler, AZ 85224-6199
Tel: 480-792-7966 Fax: 480-792-4338

Atlanta
3780 Mansell Road, Suite 130
Alpharetta, GA 30022
Tel: 770-640-0034 Fax: 770-640-0307

Boston
2 Lan Drive, Suite 120
Westford, MA 01886
Tel: 978-692-3848 Fax: 978-692-3821

Chicago
333 Pierce Road, Suite 180
Itasca, IL 60143
Tel: 630-285-0071 Fax: 630-285-0075

Dallas
4570 Westgrove Drive, Suite 160
Addison, TX 75001
Tel: 972-818-7423 Fax: 972-818-2924

Detroit
Tri-Atria Office Building
32255 Northwestern Highway, Suite 190
Farmington Hills, MI 48334
Tel: 248-538-2250 Fax: 248-538-2260

Kokomo
2767 S. Albright Road
Kokomo, Indiana 46902
Tel: 765-864-8360 Fax: 765-864-8387

Los Angeles
18201 Von Karman, Suite 1090
Irvine, CA 92612
Tel: 949-263-1888 Fax: 949-263-1338

San Jose
Microchip Technology Inc.
2107 North First Street, Suite 590
San Jose, CA 95131
Tel: 408-436-7950 Fax: 408-436-7955

Toronto
6285 Northam Drive, Suite 108
Mississauga, Ontario L4V 1X5, Canada
Tel: 905-673-0699 Fax: 905-673-6509

ASIA/PACIFIC

Australia
Microchip Technology Australia Pty Ltd
Marketing Support Division
Suite 22, 41 Rawson Street
Epping 2121, NSW
Australia
Tel: 61-2-9868-6733 Fax: 61-2-9868-6755

China - Beijing
Microchip Technology Consulting (Shanghai) Co., Ltd., Beijing Liaison Office
Unit 915
Bei Hai Wan Tai Bldg.
No. 6 Chaoyangmen Beidajie
Beijing, 100027, No. China
Tel: 86-10-85282100 Fax: 86-10-85282104

China - Chengdu
Microchip Technology Consulting (Shanghai) Co., Ltd., Chengdu Liaison Office
Rm. 2401-2402, 24th Floor,
Ming Xing Financial Tower
No. 88 TIDU Street
Chengdu 610016, China
Tel: 86-28-86766200 Fax: 86-28-86766599

China - Fuzhou
Microchip Technology Consulting (Shanghai) Co., Ltd., Fuzhou Liaison Office
Unit 28F, World Trade Plaza
No. 71 Wusi Road
Fuzhou 350001, China
Tel: 86-591-7503506 Fax: 86-591-7503521

China - Hong Kong SAR
Microchip Technology Hongkong Ltd.
Unit 901-6, Tower 2, Metroplaza
223 Hing Fong Road
Kwai Fong, N.T., Hong Kong
Tel: 852-2401-1200 Fax: 852-2401-3431

China - Shanghai
Microchip Technology Consulting (Shanghai) Co., Ltd.
Room 701, Bldg. B
Far East International Plaza
No. 317 Xian Xia Road
Shanghai, 200051
Tel: 86-21-6275-5700 Fax: 86-21-6275-5060

China - Shenzhen
Microchip Technology Consulting (Shanghai) Co., Ltd., Shenzhen Liaison Office
Rm. 1812, 18/F, Building A, United Plaza
No. 5022 Binhe Road, Futian District
Shenzhen 518033, China
Tel: 86-755-82901380 Fax: 86-755-82966626

China - Qingdao
Rm. B505A, Fullhope Plaza,
No. 12 Hong Kong Central Rd.
Qingdao 266071, China
Tel: 86-532-5027355 Fax: 86-532-5027205

India
Microchip Technology Inc.
India Liaison Office
Marketing Support Division
Divyasree Chambers
1 Floor, Wing A (A3/A4)
No. 11, O'Shaugnessey Road
Bangalore, 560 025, India
Tel: 91-80-2290061 Fax: 91-80-2290062

Japan
Microchip Technology Japan K.K.
Benex S-1 6F
3-18-20, Shinyokohama
Kohoku-Ku, Yokohama-shi
Kanagawa, 222-0033, Japan
Tel: 81-45-471- 6166 Fax: 81-45-471-6122

Korea
Microchip Technology Korea
168-1, Youngbo Bldg. 3 Floor
Samsung-Dong, Kangnam-Ku
Seoul, Korea 135-882
Tel: 82-2-554-7200 Fax: 82-2-558-5934

Singapore
Microchip Technology Singapore Pte Ltd.
200 Middle Road
#07-02 Prime Centre
Singapore, 188980
Tel: 65-6334-8870 Fax: 65-6334-8850

Taiwan
Microchip Technology (Barbados) Inc., Taiwan Branch
11F-3, No. 207
Tung Hua North Road
Taipei, 105, Taiwan
Tel: 886-2-2717-7175 Fax: 886-2-2545-0139

EUROPE

Austria
Microchip Technology Austria GmbH
Durisolstrasse 2
A-4600 Wels
Austria
Tel: 43-7242-2244-399
Fax: 43-7242-2244-393

Denmark
Microchip Technology Nordic ApS
Regus Business Centre
Lautrup hoj 1-3
Ballerup DK-2750 Denmark
Tel: 45 4420 9895 Fax: 45 4420 9910

France
Microchip Technology SARL
Parc d'Activite du Moulin de Massy
43 Rue du Saule Trapu
Batiment A - ler Etage
91300 Massy, France
Tel: 33-1-69-53-63-20 Fax: 33-1-69-30-90-79

Germany
Microchip Technology GmbH
Steinheilstrasse 10
D-85737 Ismaning, Germany
Tel: 49-089-627-144-100
Fax: 49-089-627-144-44

Italy
Microchip Technology SRL
Via Quasimodo, 12
20025 Legnano (MI)
Milan, Italy
Tel: 39-0331-742611 Fax: 39-0331-466781

United Kingdom
Microchip Ltd.
505 Eskdale Road
Winnersh Triangle
Wokingham
Berkshire, England RG41 5TU
Tel: 44 118 921 5869 Fax: 44-118 921-5820

02/12/03

© 2003 Microchip Technology Inc.