INTRODUCTION

There are many different microcontrollers on the market today that are being used in embedded control applications. Many of these embedded control systems need non-volatile memory. Because of their small footprint, byte level flexibility, low I/O pin requirement, low power consumption, and low cost, Serial EEPROMs are a popular choice for non-volatile storage.

Microchip addresses these needs by offering a full line of Serial EEPROMs covering industry standard serial communication protocols for 2-wire, 3-wire, and SPI communication. Serial EEPROM devices are available in a variety of densities, operational voltage ranges, and packaging options.

Microchip realizes that its customer base is very broad, and because of this, different microcontrollers are used to interface to SPI Serial EEPROMs. One of the microcontrollers used in these applications is the Motorola 68HC11. In order to simplify the design process, Microchip has written an assembly code routine to communicate with our SPI parts that is verified and tested to function properly on a 68HC11.

Figure 1 describes the hardware schematic for the interface between Microchip's SPI devices and the Motorola 68HC11E9. The schematic shows the connections necessary between the microcontroller and the serial EEPROM, and the software was written assuming these connections. Appendix A contains a listing of the SPI source code.

FIGURE 1: CIRCUIT FOR MC68HC11E9

SPI is a trademark of Motorola.
APPENDIX A: SOURCE CODE

an646.asm Assembled with CASM 03/19/1997 16:10 PAGE 1

1 ;*******************************************************************
2 ;* This code demonstrates how the Microchip SPI Devices
3 ;* can be interfaced to the SPI port of the 68HC11 microcontroller.
4 ;* The interface uses the three SPI lines (SCK,MOSI and MISO) on
5 ;* the 68HC11 Microcontroller for the clock (SCK), data out (SO)
6 ;* and data in (SI). A chip select (CS) is generated with a
7 ;* general purpose port line (PD5). The 68HC11 is placed into the
8 ;* master mode which allows use of the slave select input (SS) for
9 ;* other things. The code uses the 0 mode (CPOL = 0, CPHA = 0)
10 ;* of operation to define clock polarity and phase. MODE 3
11 ;* (CPOL = 1, CPHA = 1) could also have been used. The baud rate
12 ;* set at one eighth of the clock frequency (SPR0 = 0, SPR1 = 0)
13 ;*
14 ;* This code shows a read and write operation, as well as data
15 ;* polling, setting the write enable latch, clearing the write
16 ;* enable latch, writing and reading the block protect
17 ;* register
18 ;*******************************************************************
19 ; LOAD VALUES FOR USE LATER
20
21 0000          22 23 MASKCS EQU $20 ;MASK THE CHIP ENABLE BIT
22 0000          24 24 DDRD EQU $09 ;PORTD DATA DIRECTION REGISTER
22 0000          25 25 PORTD EQU $08 ;PORT D ADDRESS
22 0000          26 26 SPCR EQU $28 ;SPI CONTROL REGISTER
22 0000          27 27 SPSR EQU $29 ;SPI STATUS REGISTER
22 0000          28 28 SPD R EQU $2A ;SPI DATA REGISTER
22 0000          29 29 ADDRLO EQU $80 ;LOW ADDRESS LOCATION
22 0000          30 30 ADDRHI EQU $81 ;HIGH ADDRESS LOCATION
22 0000          31 31 RDATA EQU $82 ;READ DATA SCRATCH PAD LOCATION
22 0000          32 32 SDATA EQU $83 ;SEND DATA SCRATCH PAD LOCATION
23
24 ;*******************************************************************
25 ;* SET RESET VECTOR TO THE BEGINNING OF THE PROGRAM
26 ;*******************************************************************
27 ; ORG $FFE ;RESET VECTOR TO PROGRAM ENTRY POINT
28 ; FDB $E000
29
30 ;*******************************************************************
31 ;* BEGINNING OF PROGRAM EXECUTION
32 ;*******************************************************************
33 B600          34 44 ORG SB600 ;BEGINNING ADDRESS OF EXECUTABLE CODE
35
36 B600 8E00FF   37 46 BEGIN LDS #$00FF ;INITIALIZE STACK POINTER
38 B603 CE1000   39 47 LDX #$1000 ;INITIALIZE PAGE OFFSET LOCATION
39 B606 863F     40 48 LDAA #$3F ;LOAD ACCUMULATOR WITH 3F HEX
39 B608 A709     41 49 STAA DDRD,X ;MAKE ALL PORTD PINS OUTPUTS
39 B60A 8650     42 50 LDAA #$50 ;SPI (MODE 0,0), USE #$5C FOR (MODE 1,1)
39 B60C A728     43 51 STAA SPCR,X ;STORE VALUE IN THE SPI CONTROL REG
39 B60E A629     44 52 LDAA SPSR,X ;READ MICRO SPI STATUS REG, CLEAR SPIF
39 B610 8655     45 53 LDAA #$55 ;LOAD ACCUMULATOR A WITH 2E HEX
39 B612 9780     46 54 STAA ADDRLO ;STORE THIS VALUE IN ADDRESS LOW
39 B614 8600     47 55 LDAA #$00 ;LOAD ACCUMULATOR A WITH 00 HEX

Please check the Microchip BBS for the latest version of the source code. Microchip’s Worldwide Web Address: www.microchip.com; Bulletin Board Support: MCHIPBBS using CompuServe® (CompuServe membership not required).
B616 9781  56  STAA  ADDRH1 ;STORE THIS VALUE IN ADDRESS HIGH
57  ;SEND THE WRITE ENABLE SEQUENCE (WREN)
B618 BD6EE  58  JSR  CSLOW ;JUMP TO THE CHIP SELECT LOW ROUTINE
B61B 8606  59  LDAAA  #$06 ;LOAD THE WRITE SELECT COMMAND
B61D 9783  60  STAA  SDATA ;STORE THE VALUE IN THE SDATA LOCATION
B61F BD6E1  61  JSR  OUTBYTE ;JUMP TO THE SEND BYTE ROUTINE
B622 BD6F2  62  JSR  CSHIGH ;JUMP TO THE CHIP SELECT HIGH ROUTINE
63  ;SEND THE WRITE STATUS REGISTER SEQUENCE (WRST)
B625 BD6EE  64  JSR  CSLOW ;JUMP TO THE CHIP SELECT LOW ROUTINE
B629 86D1  65  LDAAA  #$01 ;LOAD THE WRITE STATUS REGISTER COMMAND
B62A 9783  66  STAA  SDATA ;STORE THE VALUE IN THE SDATA LOCATION
B62C BD6E1  67  JSR  OUTBYTE ;JUMP TO THE SEND BYTE ROUTINE
B62F 8600  68  LDAAA  #$00 ;LOAD ZERO'S INTO THE STATUS REGISTER
B631 9783  69  STAA  SDATA ;STORE THE VALUE IN THE SDATA LOCATION
B633 BD6E1  70  JSR  OUTBYTE ;JUMP TO THE SEND BYTE ROUTINE
B636 BD6F2  71  JSR  CSHIGH ;JUMP TO THE CHIP SELECT HIGH ROUTINE
72  ;WAIT THE REQUIRED 5mS FOR THE WRITE CYCLE TIMER Twc
B639 BD6F6  73  JSR  DELAY ;JUMP TO THE DELAY SUBROUTINE
74  ;SEND THE WRITE ENABLE SEQUENCE (WREN)
B63C BD6EE  75  JSR  CSLOW ;JUMP TO THE CHIP SELECT LOW ROUTINE
B63F 86D6  76  LDAAA  #$06 ;LOAD THE WRITE ENABLE COMMAND
B641 9783  77  STAA  SDATA ;STORE THE VALUE IN THE SDATA LOCATION
B643 BD6E1  78  JSR  OUTBYTE ;JUMP TO THE SEND BYTE ROUTINE
B646 BD6F2  79  JSR  CSHIGH ;JUMP TO THE CHIP SELECT HIGH ROUTINE
80  ;SEND THE READ STATUS REGISTER SEQUENCE (RDSR)
B649 BD6EE  81  JSR  CSLLOW ;JUMP TO THE CHIP SELECT LOW SUBROUTINE
B64C 86D5  82  LDAAA  #$05 ;LOAD THE READ STATUS REGISTER COMMAND
B64E 9783  83  STAA  SDATA ;STORE THE VALUE IN THE SDATA LOCATION
B650 BD6E1  84  JSR  OUTBYTE ;JUMP TO THE SEND BYTE ROUTINE
B653 BD6E1  85  JSR  OUTBYTE ;JUMP TO THE SEND BYTE ROUTINE (READ)
B656 BD6F2  86  JSR  CSHIGH ;JUMP TO THE CHIP SELECT HIGH ROUTINE
87  ;SEND THE WRITE SEQUENCE (WRITE)
B659 BD6EE  88  JSR  CSLLOW ;JUMP TO THE CHIP SELECT LOW SUBROUTINE
B65C 86D2  89  LDAAA  #$02 ;LOAD THE WRITE COMMAND
B65E 9783  90  STAA  SDATA ;STORE THE VALUE IN THE SDATA LOCATION
B660 BD6E1  91  JSR  OUTBYTE ;JUMP TO THE SEND BYTE ROUTINE
92  ;***COMMENT OUT FOR USE WITH 25XX010, 25XX020, OR 25XX040*************
B663 9681  93  LDAAA  ADDRH1 ;LOAD ACCA WITH ADDRH1
B665 9783  94  STAA  SDATA ;STORE THE VALUE IN THE SDATA LOCATION
B667 BD6E1  95  JSR  OUTBYTE ;JUMP TO THE SEND BYTE ROUTINE
96  ;*********************************************************************
B66A 9680  97  LDAAA  ADDRL0 ;LOAD ACCA WITH ADDRL0
B66C 9783  98  STAA  SDATA ;STORE THE VALUE IN THE SDATA LOCATION
B66E BD6E1  99  JSR  OUTBYTE ;JUMP TO THE SEND BYTE ROUTINE
B671 86AA 100  LDAAA  #$AA ;LOAD ACCA WITH HEX AA
B673 9783 101  STAA  SDATA ;STORE THE VALUE IN THE SDATA LOCATION
B675 BD6E1 102  JSR  OUTBYTE ;JUMP TO THE SEND BYTE ROUTINE
B678 BD6F2 103  JSR  CSHIGH ;JUMP TO THE CHIP SELECT HIGH ROUTINE
104  ;PERFORM DATA POLLING (RDSR BIT 0)
B67B BD6EE 105  JSR  CSLLOW ;JUMP TO THE CHIP SELECT LOW ROUTINE
B67E 86D5 106  LDAAA  #$05 ;LOAD THE READ STATUS REGISTER COMMAND
B680 9783 107  STAA  SDATA ;STORE THE VALUE IN THE SDATA LOCATION
B682 BD6E1 108  JSR  OUTBYTE ;JUMP TO THE SEND BYTE ROUTINE
109  ;
B685 8630 110  LDAAA  #$30 ;GIVE THE SPI DEVICE TIME TO SET WIP
B687 4A 111  LOOP  DECA ;DECREMENT ACCUMULATOR A
B688 26FD 112  BNE  LOOP ;BRANCH IF NOT EQUAL TO LOOP
113  ;
B68A BD6E1 114  POLLING  JSR  OUTBYTE ;READ THE DATA IN THE STATUS REGISTER
B68D 8601 115  LDAAA  #$01 ;LOAD ACCA WITH 1 HEX
B68F 9482 116  ANDA  ROATA ;AND ACCA WITH THE RECEIVED DATA
B691 26F7 117  BNE  POLLING ;BRANCH IF NOT = TO POLLING
B693 BD6F2 118  JSR  CSHIGH ;JUMP TO THE CHIP SELECT HIGH ROUTINE
119  ;SEND THE READ SEQUENCE, READ ADDRESS 0X55
B696 BD6EE 120  JSR  CSLLOW ;JUMP TO THE CHIP SELECT LOW ROUTINE
B699 8603 121  LDAAA  #$03 ;LOAD THE READ COMMAND
B69B 9783 122  STA  SDATA ;STORE THE VALUE IN THE SDATA LOCATION
B69D BDB6E1 123  JSR  OUTBYTE ;JUMP TO THE SEND BYTE ROUTINE
124  ; ***COMMENT OUT FOR USE WITH 25XX010, 25XX020, OR 25XX040*************
B6A0 9681 125  LDAA  ADDRHI ;LOAD ACCA WITH ADDRHI
B6A2 9783 126  STA  SDATA ;STORE THE VALUE IN THE SDATA LOCATION
B6A4 BDB6E1 127  JSR  OUTBYTE ;JUMP TO THE SEND BYTE ROUTINE
128  ; *****************************************************************************
B6A7 9680 129  LDAA  ADDRL0 ;LOAD ACCA WITH ADDRL0
B6A9 9783 130  STA  SDATA ;STORE THE VALUE IN THE SDATA LOCATION
B6AB BDB6E1 131  JSR  OUTBYTE ;JUMP TO THE SEND BYTE ROUTINE
132  ; SEND THE WRITE ENABLE SEQUENCE (WREN)
B6B0 9783 133  STA  SDATA ;STORE THE VALUE IN THE SDATA LOCATION
B6B2 BDB6E1 134  JSR  OUTBYTE ;JUMP TO THE SEND BYTE ROUTINE
135  ;*********************************************************
B6C1 BDB6EE 136  JSR  CSLOW ;JUMP TO THE CHIP SELECT LOW ROUTINE
B6C4 8604 137  LDAA  #$04 ;LOAD THE WRITE DISABLE COMMAND
B6C6 9783 138  STA  SDATA ;STORE THE VALUE IN THE SDATA LOCATION
B6C8 BDB6E1 139  JSR  OUTBYTE ;JUMP TO THE SEND BYTE ROUTINE
B6CB BDB6F2 140  JSR  CSLOW ;JUMP TO THE CHIP SELECT HIGH ROUTINE
141  ; SEND THE WRITE DISABLE SEQUENCE (WRDI)
B6D1 8605 142  LDAA  #$05 ;LOAD THE READ STATUS REGISTER COMMAND
B6D3 9783 143  STA  SDATA ;STORE THE VALUE IN THE SDATA LOCATION
B6D5 BDB6E1 144  JSR  OUTBYTE ;JUMP TO THE SEND BYTE ROUTINE
B6D8 BDB6E1 145  JSR  CSLOW ;JUMP TO THE CHIP SELECT LOW ROUTINE
146  ; SEND THE READ STATUS REGISTER SEQUENCE
B6D9 9783 147  STA  SDATA ;STORE THE VALUE IN THE SDATA LOCATION
B6DB BDB6F2 148  JSR  CSLOW ;JUMP TO THE CHIP SELECT LOW ROUTINE
B6E1 9683 149  STA  SDATA ;STORE THE VALUE IN THE SDATA LOCATION
B6E3 A72A 150  STAA  SPDR,X ;LOAD A WITH WHAT’S IN SDA
B6E5 1F2980FC 151  LDAA  SPDR,X ;SEND BYTE OUT PART
B6E6 1C0820 152  CSLOW  BSET    PORTD,X,MASKCS ;SET CE HIGH
153  ;********************
154  ;* DELAY SUBROUTINE
155  ;*********************
B6E7 9782 156  STA  SDATA ;STORE THE READ IN LOCATION RDATA
B6E9 A62A 157  LDAA  SPDR,X ;READ BYTE BACK INTO ACCA
B6EA 7EB600 158  JMP BEGIN ;LOOP UNTIL RESET
159  ;;;***********************************************************************
160  ; ;* THIS ROUTINE SENDS A BYTE OUT TO THE SPI PART. THEN IT READS WHAT IS SENT
161  ; ;* BACK ON THE DO PIN. DATA IS SENT OUT FROM THE 68HC11 ON THE MOSI PIN AND
162  ; ;* READ IN ON THE MISO PIN. THE CLOCK IS GENERATED BY THE SCK PIN. THIS
163  ; ;* POLLS THE SPIF BIT IN THE SPSR TO SEE IF THE TRANSFER HAS BEEN COMPLETED
164  ; ;* WHEN COMPLETE THE DATA READ IS AVAILABLE IN THE SPDR SPI DATA REGISTER
165  ; ;***********************************************************************
166  ;***********************************************************************
167  ;***********************************************************************
168  ;***********************************************************************
B6E1 10D0820 169  RTS  ;RETURN FROM SUBROUTINE
B6E2 9783 170  RTS  ;RETURN FROM SUBROUTINE
B6E3 A72A 171  STA  SPDR,X ;SEND BYTE OUT PART
B6E6 1F2980FC 172  STA  SPDR,X ;SEND BYTE OUT PART
B6E7 9782 173  STA  RDATA ;STORE THE READ IN LOCATION RDATA
B6E9 A62A 174  LDAA  SPDR,X ;READ BYTE BACK INTO ACCA
B6EA 7EB600 175  JMP BEGIN ;LOOP UNTIL RESET
176  ; ;***********************************************************************
177  ; ;***********************************************************************
178  ; ;***********************************************************************
179  ; ;***********************************************************************
180  ; ;***********************************************************************
181  ; ;***********************************************************************
B6E2 10D0820 182  RTS  ;RETURN FROM SUBROUTINE
B6E3 A72A 183  RTS  ;RETURN FROM SUBROUTINE
B6E4 9783 184  RTS  ;RETURN FROM SUBROUTINE
B6E6 1F2980FC 185  RTS  ;RETURN FROM SUBROUTINE
B6E7 9782 186  RTS  ;RETURN FROM SUBROUTINE
B6E9 A62A 187  RTS  ;RETURN FROM SUBROUTINE

© 1997 Microchip Technology Inc.
188  ;DELAY 250 (0xFA) * 400Ns X 50 (0x32)
189
B6F6 B632 190  DELAY  LDAA  #$32  ;LOAD ACCA WITH HEX 32
B6F8 C6FA 191  DEC2  LDAB  #$FA  ;LOAD ACCB WITH FA HEX
B6FA 5A   192  DEC1  DECB  ;DECREMENT ACCB
B6FB 26FD 193  BNE  DEC1  ;BRANCH IF NOT EQUAL TO DEC1
B6FD 4A   194  DECA  ;DECREMENT ACCA
B6FE 26F8 195  BNE  DEC2  ;BRANCH IF NOT EQUAL TO DEC2
B700 39   196  RTS  ;RETURN FROM SUBROUTINE
197
Note the following details of the code protection feature on PICmicro® MCUs.

- The PICmicro family meets the specifications contained in the Microchip Data Sheet.
- Microchip believes that its family of PICmicro microcontrollers is one of the most secure products 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 PICmicro microcontroller in a manner outside the operating specifications contained in the data sheet. The person doing so may be 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 product.

If you have any further questions about this matter, please contact the local sales office nearest to you.

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, FilterLab, KEELOQ, microID, MPLAB, PIC, PICmicro, PICMASTER, PICSTART, PRO MATE, SEEVAL and The Embedded Control Solutions Company are registered trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

dsPIC, ECONOMONITOR, FanSense, FlexROM, fuzzyLAB, In-Circuit Serial Programming, ICSP, ICEPIC, microPort, Migratable Memory, MPASM, MPLIB, MPSIM, MXDEV, PICC, PICDEM, PICDEM.net, rIPIC, Select Mode and Total Endurance are trademarks of Microchip Technology Incorporated in the U.S.A.

Serialized Quick Turn Programming (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.

© 2002, Microchip Technology Incorporated, Printed in the U.S.A., All Rights Reserved.

Printed on recycled paper.
## AMERICAS

**Corporate Office**
2335 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
2335 West Chandler Blvd.
Chandler, AZ 85224-6199
Tel: 480-792-7966 Fax: 480-792-7456

### ATLANTA
500 Sugar Mill Road, Suite 200B
Chandler, GA 30350
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: 972-818-7924 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 92812
Tel: 949-263-1888 Fax: 949-263-1338

### NEW YORK
150 Motor Parkway, Suite 202
Hauppauge, NY 11788
Tel: 631-279-5305 Fax: 631-273-5335

### SAN JOSE
Microchip Technology Inc.
2107 North First Street, Suite 590
San Jose, CA 95131
Tel: 408-436-7850 Fax: 408-436-7955

### TORONTO
6285 Northam Drive, Suite 108
Mississauga, Ontario L4V 1XS, Canada
Tel: 905-673-0699 Fax: 905-673-6509

## ASIA/PACIFIC

### AUSTRALIA
Microchip Technology Australia Pty Ltd
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, 24th Floor,
Ming Xing Financial Tower
No. 88 TIDU Street
Chengdu 610016, China
Tel: 86-28-6766200 Fax: 86-28-6766599

### CHINA - FUZHOU
Microchip Technology Consulting (Shanghai)
Co., Ltd., Fuzhou Liaison Office
Unit 701, World Trade Plaza
No. 71 Wulai Road
Fuzhou 350001, China
Tel: 86-591-7503506 Fax: 86-591-7503521

### CHINA - SHANGHAI
Microchip Technology Consulting (Shanghai)
Co., Ltd.
Room 701, Bldg. B
Far East International Plaza
No. 317 Xian Xing Road
Shanghai, 200005
Tel: 86-21-6275-5700 Fax: 86-21-6275-5060

### CHINA - SHENZHEN
Microchip Technology Consulting (Shanghai)
Co., Ltd., Shenzhen Liaison Office
Rm. 1315, 13/F, Shenzhen Kerry Centre,
Renminnan Lu
Shenzhen 518001, China
Tel: 86-755-2350361 Fax: 86-755-2366086

### HONG KONG
Microchip Technology Hong Kong 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

### INDIA
Microchip Technology Inc.
India Liaison Office
Divyagiri Chambers
1 Floor, Wing A (A3/A4)
No. 11, O’Shaugnessy 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, Shinoyokohama
Kohoku-Ku, Yokohama-shi
Kanagawa, 222-0033, Japan
Tel: 81-45-471-6168 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, 189890
Tel: 65-334-8870 Fax: 65-334-8850

### TAIWAN
Microchip Technology Taiwan
11F-3, No. 207
Tung Hua North Road
Taipei, 105, Taiwan
Tel: 886-2-2717-7175 Fax: 886-2-2545-0139

## EUROPE

### DENMARK
Microchip Technology Nordic ApS
Regus Business Centre
Lautrup høj 1-3
Ballupark DK-2750 Denmark
Tel: 45 4420 9895 Fax: 45 4420 9910

### FRANCE
Microchip Technology SARL
Parc d’Activité du Moulin de Massy
43 Rue du Saule Trapu
Batiment A - 1er Etage
91000 Massy, France
Tel: 33-1-69-53-63-20 Fax: 33-1-69-30-90-79

### GERMANY
Microchip Technology GmbH
Gustav-Heinemann Ring 125
D-81739 Munich, Germany
Tel: 49-89-6275-700 Fax: 49-89-6275-5060

### ITALY
Microchip Technology SRL
Centro Direzionale Colleoni
Palazzo Taurus 1 V. Le Colleoni 1
20041 Agrate Brianza
Milan, Italy
Tel: 39-039-65791-1 Fax: 39-039-6899883

### UNITED KINGDOM
Microchip Technology Ltd.
505 Eskdale Road
Winkens Triangle
Wokingham
Berkshire, England RG41 5TU
Tel: 44 118 921 5869 Fax: 44-118 921-5820

© 2002 Microchip Technology Inc.