

**PIC16F627A/628A/648A Rev. A Silicon/Data Sheet Errata**

The PIC16F627A/628A/648A parts you have received conform functionally to the Device Data Sheet (DS40044A), except for the anomalies described below.

All problems listed here will be addressed in future revisions of the **PIC16F627A/628A/648A silicon**. Where noted, problems apply to listed revision only.

**1. Module: Programming Operations**

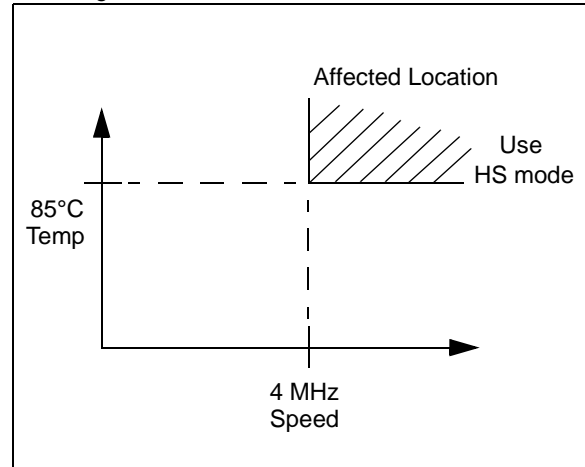
1. PIC16F627A/628A silicon Rev. A3. Accessing of the data EEPROM memory in Low Voltage Programming (LVP) mode.
  - The data EEPROM memory cannot be accessed when programming in LVP mode.
  - The Flash program memory and the configuration bits can be accessed properly in LVP mode.
2. PIC16F627A/628A silicon Rev. A3 and A4. Flash program memory can only be programmed with a VDD of 4.5V-5.5V.
  - Revision A5 and later of the PIC16F627A/628A silicon, the Flash program memory is able to be programmed with a VDD of 2.0V-5.5V.
  - In all current and future revisions of the PIC16F627A/628A silicon, the Flash program memory can only be erased using the Bulk Erase command. The Bulk Erase function requires a VDD of 4.5V-5.5V.

**2. Module: EC Clock**

1. PIC16F648A Silicon Rev. A1.

When using the EC OSC mode at frequencies >4 MHz and temperatures >85°C, the part may execute incorrectly from the program memory causing malfunction.

This problem only affects E-temp parts. Industrial grade parts are unaffected. HS mode should be used for frequencies >4 MHz at extended temps. All other clock modes work to their specified ranges.



2. PIC16F627A/628A Silicon revision A3, A4 and A5. PIC16F648A Silicon revision A1.

Unexpected program execution may occur when waking from Sleep.

**Work around**

Use HS Clock mode.

# PIC16F627A/628A/648A

## 3. Module: Data EEPROM Memory

1. PIC16F648A Silicon revision A1 and PIC16F627A/628A silicon revision A3, A4 and A5.

**Note:** This problem is corrected in PIC16F648A Rev. A3 and PIC16F627A/628A Rev. A6.

Unexpected program execution may occur during data EEPROM write cycles.

### Work around

Execute a SLEEP instruction immediately after setting the EECON1 WR bit and allow the EEIF to wake the processor from Sleep. This requires the PEIE bit of the INTCON register and the EEIE bit of the PIE1 register to be set. All other interrupt enables must be cleared so that only the EE write completion will wake the processor.

**Note:** Most peripherals suspend operation during Sleep. Other precautions may be necessary to ensure all peripheral operations are complete or in a safe halted mode before beginning an EEPROM write.

The following example assumes that the desired address is present in the EEADR register and the desired data to be written is in the EEDATA register:

### EXAMPLE 1: DATA EEPROM WRITE CODE EXAMPLE

```
BANKSEL 0X00      ;select Bank0
BCF      PIR1, EEIF ;ensure write complete
                        ;flag is clear
BANKSEL 0x80      ;change to Bank1
MOVLW   1 << PEIE ;enable only
                        ;peripheral interrupt
MOVWF   INTCON    ;
MOVLW   1 << EEIE ;enable only EE write
                        ;complete interrupt
MOVWF   PIE1      ;
BSF     EECON1, WREN ;enable EE write
MOVLW  0x55        ;required write
                        ;protect squence
MOVWF  EECON2     ;
MOVLW  0xAA        ;second part of
                        ;sequence
MOVWF  EECON2     ;
BSF    EECON1, WR  ;initiate write
SLEEP  ;suspend operation
                        ;during write
BCF    EECON1,WREN ;disable EE write
                        ;program execution
                        ;resumes with this
                        ;instruction upon EE
                        ;write completion
```

# PIC16F627A/628A/648A

## Clarifications/Corrections to the Data Sheet:

In the Device Data Sheet (DS40044A), the following clarifications and corrections should be noted.

### 1. Module: Instruction Set (SUBWF)

Example 1: (SUBWF) changes;

From: Z = DC = 1

To: DC = 1

Z = 0

### 2. Module: Timing Diagrams and Specifications

- In Section 17.6, Electrical Specifications, Table 17-4, External Clock Timing Requirements, External CLKIN Frequency and External CLKIN Period conditions should reflect "**HS, EC Osc mode**". Minimum Instruction Cycle Time (T<sub>CY</sub>) is 200 nsec.

**TABLE 17-4: EXTERNAL CLOCK TIMING REQUIREMENTS**

Parameter No.	Sym	Characteristic	Min	Typ†	Max	Units	Conditions
	FOSC	External CLKIN Frequency <sup>(1)</sup>	DC	—	4	MHz	XT and RC Osc mode, V <sub>DD</sub> = 5.0V
			DC	—	20	MHz	<b>HS, EC Osc mode</b>
			DC	—	200	kHz	LP Osc mode
		Oscillator Frequency <sup>(1)</sup>	—	—	4	MHz	RC Osc mode, V <sub>DD</sub> = 5.0V
			0.1	—	4	MHz	XT Osc mode
			1	—	20	MHz	HS Osc mode
			—	—	200	kHz	LP Osc mode
			—	4	—	MHz	INTOSC mode (fast)
			—	37	—	kHz	INTOSC mode (slow)
1	TOSC	External CLKIN Period <sup>(1)</sup>	250	—	—	ns	XT and RC Osc mode
			50	—	—	ns	<b>HS, EC Osc mode</b>
			5	—	—	μs	LP Osc mode
		Oscillator Period <sup>(1)</sup>	250	—	—	ns	RC Osc mode
		250	—	10,000	ns	XT Osc mode	
		50	—	1,000	ns	HS Osc mode	
		5	—	—	μs	LP Osc mode	
—	250	—	ns	INTOSC mode (fast)			
—	27	—	μs	INTOSC mode (slow)			
2	T <sub>CY</sub>	Instruction Cycle Time	<b>200</b>	T <sub>CY</sub>	DC	ns	T <sub>CY</sub> = 4/FOSC
3	T <sub>OSL</sub> , T <sub>OSH</sub>	External CLKIN (OSC1) High External CLKIN Low	100*	—	—	ns	XT oscillator, TOSC L/H duty cycle
4	RC	External Biased RC Frequency	10 kHz*	—	4 MHz	—	V <sub>DD</sub> = 5.0V

\* These parameters are characterized but not tested.

† Data in "Typ" column is at 5.0V, 25°C unless otherwise stated. These parameters are for design guidance only and are not tested.

**Note 1:** Instruction cycle period (T<sub>CY</sub>) equals four times the input oscillator time-based period. All specified values are based on characterization data for that particular oscillator type under standard operating conditions with the device executing code. Exceeding these specified limits may result in an unstable oscillator operation and/or higher than expected current consumption. All devices are tested to operate at "Min" values with an external clock applied to the OSC1 pin. When an external clock input is used, the "Max" cycle time limit is "DC" (no clock) for all devices.

# PIC16F627A/628A/648A

2. Table 17.2, parameter D020. Maximum Power-down Base Current (IPD) should be **2.7**  $\mu\text{A}$  at 5.0V. WDT current should be **17**  $\mu\text{A}$  at 5.0V, as shown in bold in Table 17.2.

3. Table 17.2 and 17.3 for XT oscillator supply currents (IDD) are changed, as shown in bold in Table 17.2 and 17.3.

## 17.2 DC Characteristics: PIC16F627A/628A/648A (Industrial) PIC16LF627A/628A/648A (Industrial)

		Standard Operating Conditions (unless otherwise stated) Operating temperature $-40^{\circ}\text{C} \leq T_A \leq +85^{\circ}\text{C}$ for industrial					
Param No.	LF and F Device Characteristics	Min†	Typ	Max	Units	Conditions	
						VDD	Note
<b>Supply Voltage (VDD)</b>							
D001	LF	2.0	—	5.5	V	—	
	LF/F	3.0	—	5.5	V	—	
<b>Power-down Base Current (IPD)</b>							
D020	LF	—	0.1	0.80	$\mu\text{A}$	2.0	WDT, BOR, Comparators, VREF and T1OSC: disabled
	LF/F	—	0.1	0.85	$\mu\text{A}$	3.0	
		—	0.2	<b>2.7</b>	$\mu\text{A}$	5.0	
<b>Peripheral Module Current (<math>\Delta\text{I}_{\text{MOD}}</math>)<sup>(1)</sup></b>							
D021	LF	—	1	2.0	$\mu\text{A}$	2.0	WDT Current
	LF/F	—	2	3.4	$\mu\text{A}$	3.0	
		—	9	<b>17.0</b>	$\mu\text{A}$	5.0	
D022	LF/F	—	32	TBD	$\mu\text{A}$	4.5	BOR Current
		—	33	TBD	$\mu\text{A}$	5.0	
D023	LF	—	15	TBD	$\mu\text{A}$	2.0	Comparator Current
	LF/F	—	27	TBD	$\mu\text{A}$	3.0	
		—	49	TBD	$\mu\text{A}$	5.0	
D024	LF	—	34	TBD	$\mu\text{A}$	2.0	VREF Current
	LF/F	—	50	TBD	$\mu\text{A}$	3.0	
		—	80	TBD	$\mu\text{A}$	5.0	
D025	LF	—	1.2	2.0	$\mu\text{A}$	2.0	T1OSC Current
	LF/F	—	1.3	2.2	$\mu\text{A}$	3.0	
		—	1.8	2.9	$\mu\text{A}$	5.0	
<b>Supply Current (IDD)</b>							
D010	LF	—	12	15	$\mu\text{A}$	2.0	Fosc = 32 kHz LP Oscillator Mode
	LF/F	—	21	25	$\mu\text{A}$	3.0	
		—	38	48	$\mu\text{A}$	5.0	
D011	LF	—	<b>130</b>	<b>190</b>	$\mu\text{A}$	2.0	Fosc = 1 MHz XT Oscillator Mode
	LF/F	—	<b>220</b>	<b>340</b>	$\mu\text{A}$	3.0	
		—	<b>370</b>	<b>520</b>	$\mu\text{A}$	5.0	
D012	LF	—	<b>270</b>	<b>350</b>	$\mu\text{A}$	2.0	Fosc = 4 MHz XT Oscillator Mode
	LF/F	—	<b>430</b>	<b>600</b>	$\mu\text{A}$	3.0	
		—	<b>780</b>	<b>995</b>	$\mu\text{A}$	5.0	
D013	LF/F	—	2.6	2.9	mA	4.5	Fosc = 20 MHz HS Oscillator Mode
		—	3	3.3	mA	5.0	

**Note 1:** The “ $\Delta$ ” current is the additional current consumed when this peripheral is enabled. This current should be added to the base IDD or IPD measurement. Max values should be used when calculating total current consumption.

# PIC16F627A/628A/648A

## 17.3 DC Characteristics: DC Characteristics: PIC16F627A/628A/648A (Extended)

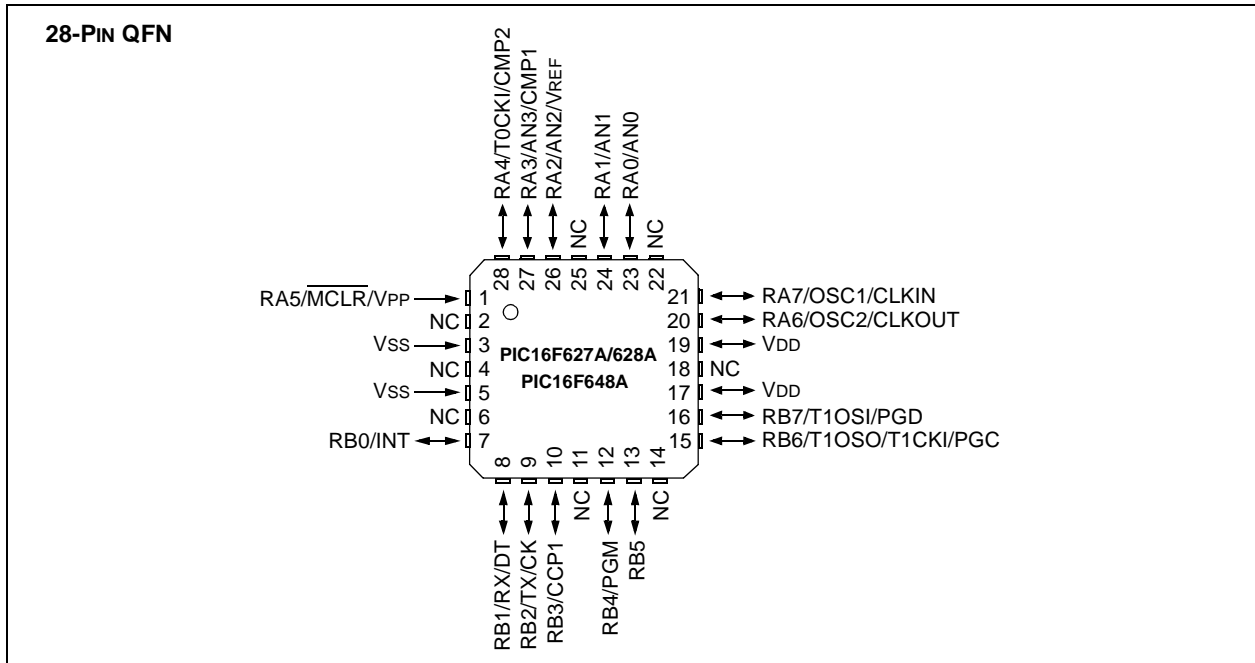
		Standard Operating Conditions (unless otherwise stated) Operating temperature $-40^{\circ}\text{C} \leq T_A \leq +85^{\circ}\text{C}$ for industrial					
Param No.	LF and F Device Characteristics	Min	Typ	Max	Units	Conditions	
						VDD	Note
<b>Supply Voltage (VDD)</b>							
D001	—	3.0	—	5.5	V	—	
<b>Power-down Base Current (IPD)</b>							
D020E	—	—	0.1	TBD	$\mu\text{A}$	3.0	WDT, BOR, Comparators, VREF, and T1OSC: disabled
		—	0.2	TBD	$\mu\text{A}$	5.0	
<b>Peripheral Module Current (<math>\Delta\text{IMOD}</math>)<sup>(1)</sup></b>							
D021E	—	—	2	TBD	$\mu\text{A}$	3.0	WDT Current
		—	9	TBD	$\mu\text{A}$	5.0	
D022E	—	—	32	TBD	$\mu\text{A}$	4.5	BOR Current
		—	33	TBD	$\mu\text{A}$	5.0	
D023E	—	—	27	TBD	$\mu\text{A}$	3.0	Comparator Current
		—	49	TBD	$\mu\text{A}$	5.0	
D024E	—	—	50	TBD	$\mu\text{A}$	3.0	VREF Current
		—	83	TBD	$\mu\text{A}$	5.0	
D025E	—	—	1.3	TBD	$\mu\text{A}$	3.0	T1OSC Current
		—	1.8	TBD	$\mu\text{A}$	5.0	
<b>Supply Current (IDD)</b>							
D010E	—	—	21	TBD	$\mu\text{A}$	3.0	Fosc = 32 kHz LP Oscillator mode
		—	38	TBD	$\mu\text{A}$	5.0	
D011E	—	—	<b>220</b>	TBD	$\mu\text{A}$	3.0	Fosc = 1 MHz XT Oscillator mode
		—	<b>370</b>	TBD	$\mu\text{A}$	5.0	
D012E	—	—	<b>430</b>	TBD	$\mu\text{A}$	3.0	Fosc = 4 MHz XT Oscillator mode
		—	<b>780</b>	TBD	$\mu\text{A}$	5.0	
D013E	—	—	2.6	TBD	$\mu\text{A}$	4.5	Fosc = 20 MHz HS Oscillator mode
		—	3	TBD	$\mu\text{A}$	5.0	

**Note 1:** The “ $\Delta$ ” current is the additional current consumed when this peripheral is enabled. This current should be added to the base IDD or IPD measurement. Max values should be used when calculating total current consumption.

# PIC16F627A/628A/648A

## 3. Module: Pin Diagrams

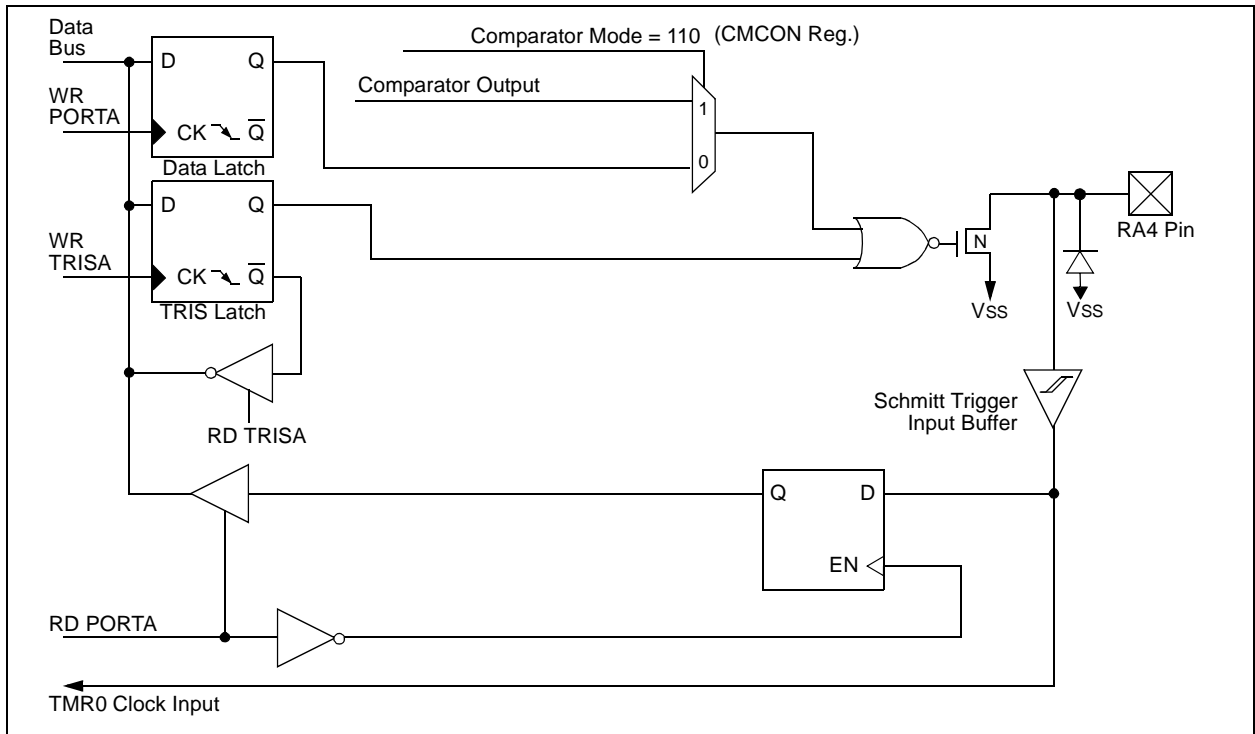
On page 2, Pin Diagrams, Pin 1 of 28-pin QFN package should be labeled: RA5/MCLR/VPP.



## 4. Module: I/O Ports

In Figure 5-4, the diode between VDD and the RA4 pin should be deleted.

**FIGURE 5-4: BLOCK DIAGRAM OF THE RA4/TOCKI PIN**



## 5. Module: Timer1

In Register 7-1, the TMR1ON bit description should be changed as follows:

**Bit 0 TMR1ON: Timer1 on bit**

**1 = Enables Timer1**

**0 = Stops Timer1**

## 6. Module: Data EEPROM Memory

Example 13-4 should be replaced with the following example:

### EXAMPLE 13-4: DATA EEPROM REFRESH ROUTINE

```
BANKSEL    0X80                ;select Bank1
CLRF      EEADR                ;start at address 0
BCF       INTCON, GIE          ;disable interrupts
BSF       EECON1, WREN         ;enable EE writes
Loop
BSF       EECON1, RD           ;retrieve data into EEDATA
MOVLW    0x55                  ;first step of ...
MOVWF    EECON2                ;... required sequence
MOVLW    0xAA                  ;second step of ...
MOVWF    EECON2                ;... required sequence
BSF       EECON1, WR           ;start write sequence
BTFSC    EECON1, WR           ;wait for write complete
GOTO     $ - 1

#IFDEF   __16F648A              ;256 bytes in 16F648A
    INCFSZ    EEADR, f          ;test for end of memory
#ELSE
    INCF      EEADR, f          ;next address
    BTFSS    EEADR, 7          ;test for end of memory
#ENDIF
    GOTO     Loop              ;repeat for all locations

BCF       EECON1, WREN         ;disable EE writes
BSF       INTCON, GIE          ;enable interrupts (optional)
```

# PIC16F627A/628A/648A

---

## APPENDIX A: REVISION HISTORY

### Rev. A Document (2/12/03)

First revision of this document.

### Rev. B Document (3/26/03)

Added 4.5V-5.5V VDD programming requirement on Rev. A2, A3 & A4 silicon.

### Rev. C Document (5/13/03)

Added Item 1 to Clarifications/Corrections Section; Instruction Set, Example 1: (SUBWF).

### Rev. D Document (7/10/03)

Revised document title.

Item 1: Added Module 2: EC Clock for PIC16F648A silicon. Clarifications/Corrections to the Data Sheet, Added Module 2: Timing Diagrams and Specifications, Table 17-4.

Item 2: Added correction to 28-Pin QFN package, Pin 1.

### Rev. E Document (8/15/03)

Module 2: EC Clock: Added Item 2: "PIC16F627A/628A Silicon revision A1, A2, A3 and A4. PIC16F648A Silicon revision A1".

Added Module 3: Data EEPROM Memory, Item 1.

Clarifications/Corrections to the Data Sheet: Added Module 4: I/O Ports, Module 5: Timer1 and Module 6: Data EEPROM Memory.

### Rev. F Document (9/03/03)

Module 1: Corrections to Item 2. Module 2: Corrections to Item 2. Module 3: Corrections to Item 1.

Clarifications/Corrections to the Data Sheet: Module 2: Timing Diagrams and Specifications, added Item 2, corrections to Section 17.2, parameter D020.

### Rev. G Document (12/12/03)

Revise second paragraph, first page. Module 3, Item 1: Add note. Clarifications/Corrections to the Data Sheet: Module 2: Corrections to Item 2 and Table 17.2. Module 2: Added item 3 and corrections to Table 17.2 and 17.3. Module 4: Add Figure 5-4 from Data Sheet. Module 6: Corrections to Example 13-4.



---

---

**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.

---

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, Accuron, dsPIC, KEELOQ, MPLAB, PIC, PICmicro, PICSTART, PRO MATE and PowerSmart are registered trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

AmpLab, FilterLab, microID, MXDEV, MXLAB, PICMASTER, SEEVAL, SmartShunt and The Embedded Control Solutions Company are registered trademarks of Microchip Technology Incorporated in the U.S.A.

Application Maestro, dsPICDEM, dsPICDEM.net, dsPICworks, ECAN, ECONOMONITOR, FanSense, FlexROM, fuzzyLAB, In-Circuit Serial Programming, ICSP, ICEPIC, microPort, Migratable Memory, MPASM, MPLIB, MPLINK, MPSIM, PICKit, PICDEM, PICDEM.net, PowerCal, PowerInfo, PowerMate, PowerTool, rLAB, rPIC, Select Mode, SmartSensor, SmartTel and Total Endurance are trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

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.

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

 Printed on recycled paper.

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

*Microchip received ISO/TS-16949:2002 quality system certification for its worldwide headquarters, design and wafer fabrication facilities in Chandler and Tempe, Arizona and Mountain View, California in October 2003. The Company's quality system processes and procedures are for its PICmicro® 8-bit MCUs, KEELOQ® code hopping devices, Serial EEPROMs, microperipherals, non-volatile memory and analog products. In addition, Microchip's quality system for the design and manufacture of development systems is ISO 9001:2000 certified.*



## 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>

#### 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, IN 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

#### Phoenix

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

#### San Jose

1300 Terra Bella Avenue  
Mountain View, CA 94043  
Tel: 650-215-1444

#### Toronto

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

### ASIA/PACIFIC

#### Australia

Suite 22, 41 Rawson Street  
Epping 2121, NSW  
Australia  
Tel: 61-2-9868-6733  
Fax: 61-2-9868-6755

#### China - Beijing

Unit 706B  
Wan Tai Bei Hai Bldg.  
No. 6 Chaoyangmen Bei Str.  
Beijing, 100027, China  
Tel: 86-10-85282100  
Fax: 86-10-85282104

#### China - Chengdu

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

Unit 28F, World Trade Plaza  
No. 71 Wusi Road  
Fuzhou 350001, China  
Tel: 86-591-7503506  
Fax: 86-591-7503521

#### China - Hong Kong SAR

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

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

Rm. 1812, 18/F, Building A, United Plaza  
No. 5022 Binhe Road, Futian District  
Shenzhen 518033, China  
Tel: 86-755-82901380  
Fax: 86-755-8295-1393

#### China - Shunde

Room 401, Hongjian Building  
No. 2 Fengxiangnan Road, Ronggui Town  
Shunde City, Guangdong 528303, China  
Tel: 86-765-8395507 Fax: 86-765-8395571

#### China - Qingdao

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

#### India

Divyasree Chambers  
1 Floor, Wing A (A3/A4)  
No. 11, O'Shaughnessey Road  
Bangalore, 560 025, India  
Tel: 91-80-2290061 Fax: 91-80-2290062

#### Japan

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

168-1, Youngbo Bldg. 3 Floor  
Samsung-Dong, Kangnam-Ku  
Seoul, Korea 135-882  
Tel: 82-2-554-7200 Fax: 82-2-558-5932 or  
82-2-558-5934

### Singapore

200 Middle Road  
#07-02 Prime Centre  
Singapore, 188980  
Tel: 65-6334-8870 Fax: 65-6334-8850

### Taiwan

Kaohsiung Branch  
30F - 1 No. 8  
Min Chuan 2nd Road  
Kaohsiung 806, Taiwan  
Tel: 886-7-536-4818  
Fax: 886-7-536-4803

### Taiwan

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

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

#### Denmark

Regus Business Centre  
Lautrup høj 1-3  
Ballerup DK-2750 Denmark  
Tel: 45-4420-9895 Fax: 45-4420-9910

#### France

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

#### Germany

Steinheilstrasse 10  
D-85737 Ismaning, Germany  
Tel: 49-89-627-144-0  
Fax: 49-89-627-144-44

#### Italy

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

#### Netherlands

P. A. De Biesbosch 14  
NL-5152 SC Drunen, Netherlands  
Tel: 31-416-690399  
Fax: 31-416-690340

#### United Kingdom

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

11/24/03