

3V Logic Output Temperature Sensor with Programmable Hysteresis

Features

- User Programmable Hysteresis and Temperature Set Point
- Easily Programs with Two External Resistors
- Wide Temperature Detection Range
  - TC07CXA: -0°C to +70°C
  - TC07EXA: -40°C to +85°C
  - TC07VXA: -40°C to +125°C
- 8-Pin MSOP and 8-Pin SOIC Packages
- Cost Effective

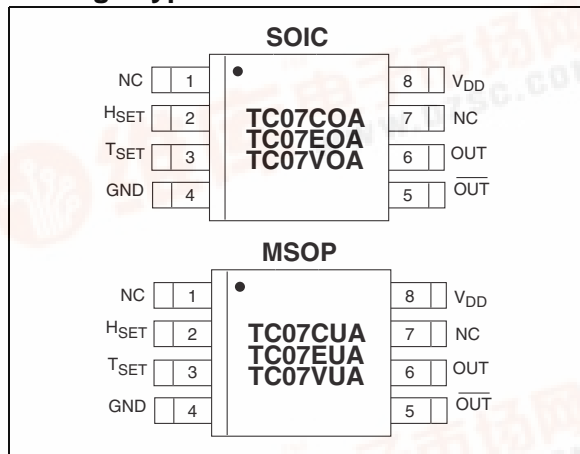
Applications

- Power Supply Over-Temperature Detection
- Consumer Equipment
- Temperature Regulators

Device Selection Table

Part Number	Package	Temperature Range
TC07COA	8-Pin SOIC	0°C to +70°C
TC07CUA	8-Pin MSOP	0°C to +70°C
TC07EOA	8-Pin SOIC	-40°C to +85°C
TC07EUA	8-Pin MSOP	-40°C to +85°C
TC07VOA	8-Pin SOIC	-40°C to +125°C
TC07VUA	8-Pin MSOP	-40°C to +125°C

Package Type



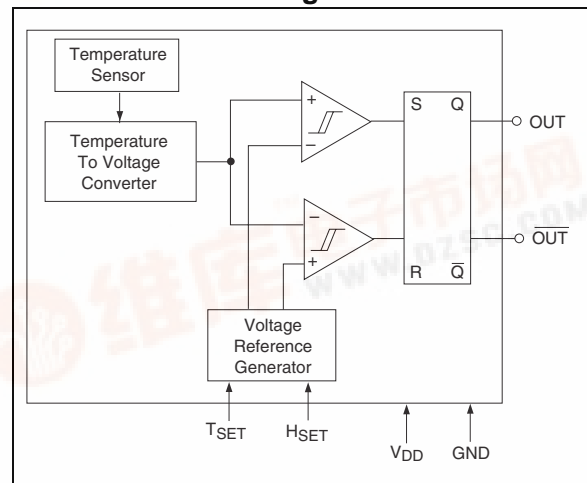
General Description

The TC07 is a programmable, logic output temperature detector that operates from power supply levels as low as 2.7V. Programming is accomplished with external resistors connected from the temperature set point input ( $T_{SET}$ ) and the hysteresis control input ( $H_{SET}$ ) to  $V_{DD}$ .

Complementary outputs ( $OUT$  and  $\overline{OUT}$ ) are driven active when temperature exceeds the temperature threshold programmed by the resistor on  $T_{SET}$ . The states of these outputs are maintained (latched) until temperature falls below threshold programmed by the resistor on  $H_{SET}$ .

The TC07 has an operating temperature range of -40°C to +125°C (TC07VXA). It features low (<130µA) supply current and with 8-pin MSOP and 8-pin SOIC packages, making it suitable for a wide variety of applications.

Functional Block Diagram



# TC07

[查询TC07CUA供应商](#)

## 1.0 ELECTRICAL CHARACTERISTICS

### Absolute Maximum Ratings\*

Supply Voltage ..... 7V  
Input Voltage Any Input (GND – 0.3V) to (V<sub>DD</sub> + 0.3V)  
Operating Temperature ..... -40°C to +125°C  
Storage Temperature, T<sub>J</sub> ..... -65°C to +150°C

\*Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions above those indicated in the operation sections of the specifications is not implied. Exposure to Absolute Maximum Rating conditions for extended periods may affect device reliability.

### TC07 ELECTRICAL SPECIFICATIONS

Electrical Characteristics: T <sub>A</sub> = Over operational temperature range, unless otherwise specified.						
Symbol	Parameter	Min	Typ	Max	Unit	Test Conditions
V <sub>DD</sub>	Supply Voltage Range	2.7	–	5.5	V	
I <sub>DD</sub>	Supply Current	–	130	300	μA	2.7V < V <sub>CC</sub> < 5.5V
V <sub>OH</sub>	Output Voltage (High)	0.8 x V <sub>DD</sub>	–	–	V	I <sub>OUT</sub> = 500μA
V <sub>OL</sub>	Output Voltage (Low)	–	–	0.25 x V <sub>DD</sub>	V	I <sub>OUT</sub> = 1mA
H	Minimum Hysteresis	-5	–	–	°C	H <sub>SET</sub> < T <sub>SET</sub>
T <sub>SET</sub>	Absolute Accuracy	T - 3	T ± 1	T + 3	°C	T = Programmed Temperature
H <sub>SET</sub>	Absolute Accuracy	T - 5	T ± 1	T + 5	°C	T = Programmed Temperature

## 2.0 PIN DESCRIPTIONS

The descriptions of the pins are listed in Table 2-1.

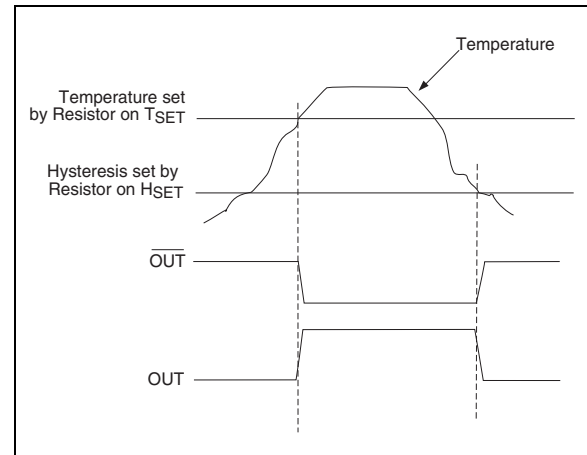
**TABLE 2-1: PIN FUNCTION TABLE**

Pin No. (8-Pin SOIC) (8-Pin MSOP)	Symbol	Description
1	NC	No Internal Connection
2	H <sub>SET</sub>	Absolute Accuracy
3	T <sub>SET</sub>	Absolute Accuracy
4	GND	Ground
5	$\overline{\text{OUT}}$	Minimum Hysteresis
6	OUT	Absolute Accuracy
7	NC	No Internal Connection
8	V <sub>DD</sub>	Supply Voltage Range

## 3.0 DETAILED DESCRIPTION

The TC07 programs with resistors connected from the T<sub>SET</sub> and H<sub>SET</sub> inputs to V<sub>DD</sub>. Output pins OUT and  $\overline{\text{OUT}}$  are driven active when the temperature exceeds the setting determined by the programming resistor on T<sub>SET</sub>. The outputs are maintained (latched) in their active states until temperature drops below the setting determined by the programming resistor on H<sub>SET</sub> (Figure 3-1).

**FIGURE 3-1: TC07 OUTPUT WAVEFORMS**



# TC07

[查询TC07CUA供应商](#)

## 4.0 TYPICAL APPLICATIONS

### 4.1 Trip Point Programming

The resistor values required to achieve the desired trip point temperatures on T<sub>SET</sub> and H<sub>SET</sub> are calculated using the formula below:

$$R_{TRIP} = 0.6 \times T^{2.13}$$

Where:

R<sub>TRIP</sub> = Programming resistor value in Ohms  
T = Desired trip point temperature in degrees Kelvin.

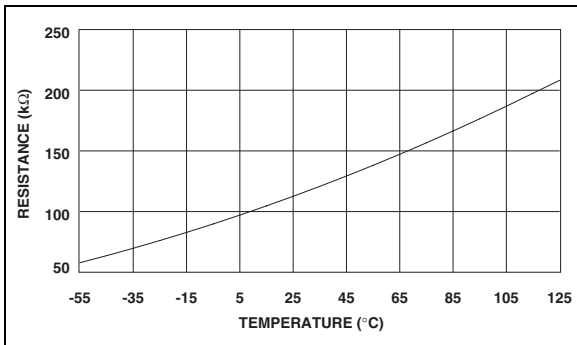
For example, to program the TC07 outputs to go active at 50°C and inactive at 30°C, the R<sub>T</sub> and R<sub>H</sub> programming resistors are calculated as follows:

$$R_T = 0.6 \times ((50 + 273.15)^{2.13}) = 132.8k\Omega$$

$$R_H = 0.6 \times ((30 + 273.15)^{2.13}) = 115.9k\Omega$$

Resistance values for T<sub>SET</sub> and H<sub>SET</sub> can be approximated using Figure 4-1. Care must be taken to ensure the H<sub>SET</sub> programming resistor is a smaller value than the T<sub>SET</sub> programming resistor. The temperature programmed on H<sub>SET</sub> must be at least 5°C lower than the temperature value programmed by T<sub>SET</sub>.

**FIGURE 4-1: PROGRAMMING RESISTOR VALUES VS. TEMPERATURE**

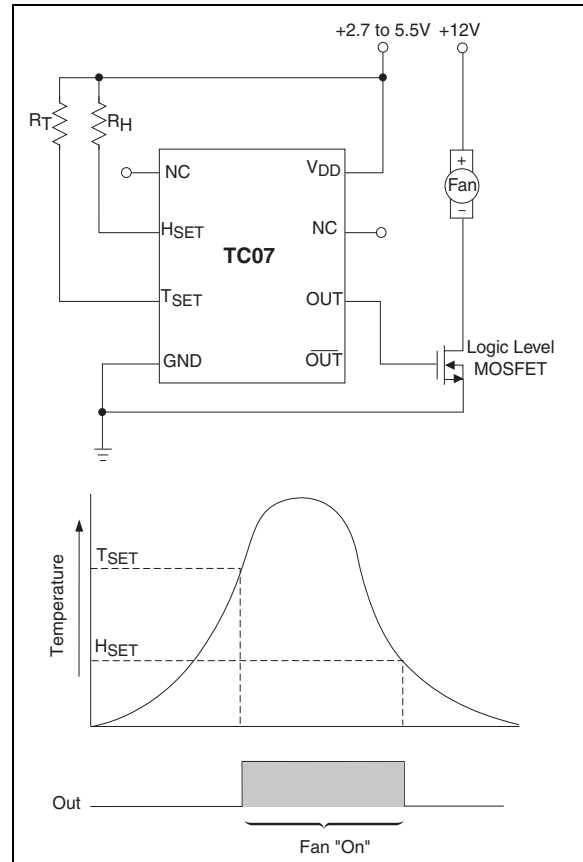


### 4.2 Cooling and Heating Applications

The TC07 can be used to control a DC fan as shown in Figure 4-2. The fan turns on when the sensed temperature rises above the temperature set at T<sub>SET</sub> and remains on until the temperature falls below the temperature set at H<sub>SET</sub>. The amount of “cooling” performed by the fan is dependent on the programmed hysteresis.

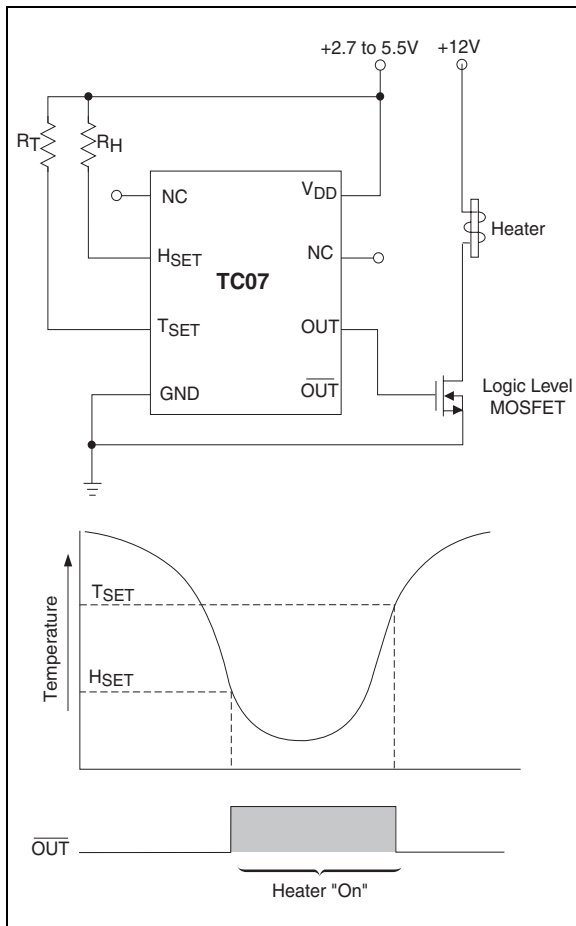
Figure 4-3 shows the TC07 acting as a heater thermostat. Circuit operation is identical to that of the cooling fan application in Figure 4-2.

**FIGURE 4-2: TC07 AS A FAN CONTROLLER**



[查询TC07CUA供应商](#)

**FIGURE 4-3: TC07 AS A HEATER THERMOSTAT**



# TC07

[查询TC07CUA供应商](#)

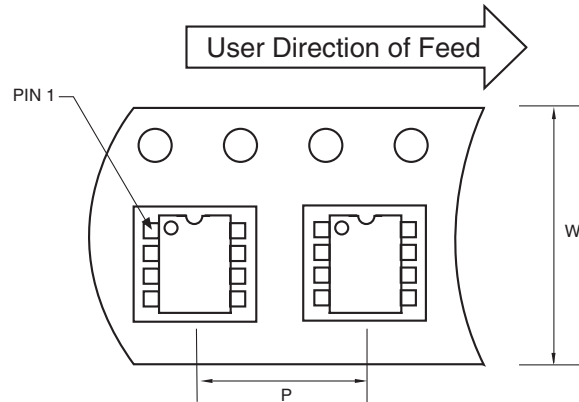
## 5.0 PACKAGING INFORMATION

### 5.1 Package Marking Information

Package marking data not available at this time.

### 5.2 Taping Form

#### Component Taping Orientation for 8-Pin MSOP Devices

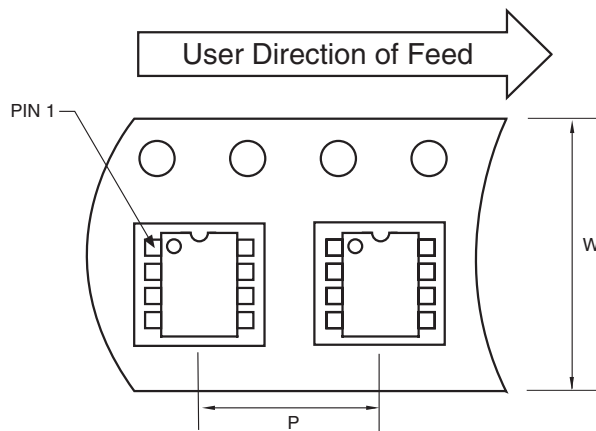


Standard Reel Component Orientation  
for TR Suffix Device

Carrier Tape, Number of Components Per Reel and Reel Size

Package	Carrier Width (W)	Pitch (P)	Part Per Full Reel	Reel Size
8-Pin MSOP	12 mm	8 mm	2500	13 in

#### Component Taping Orientation for 8-Pin SOIC (Narrow) Devices

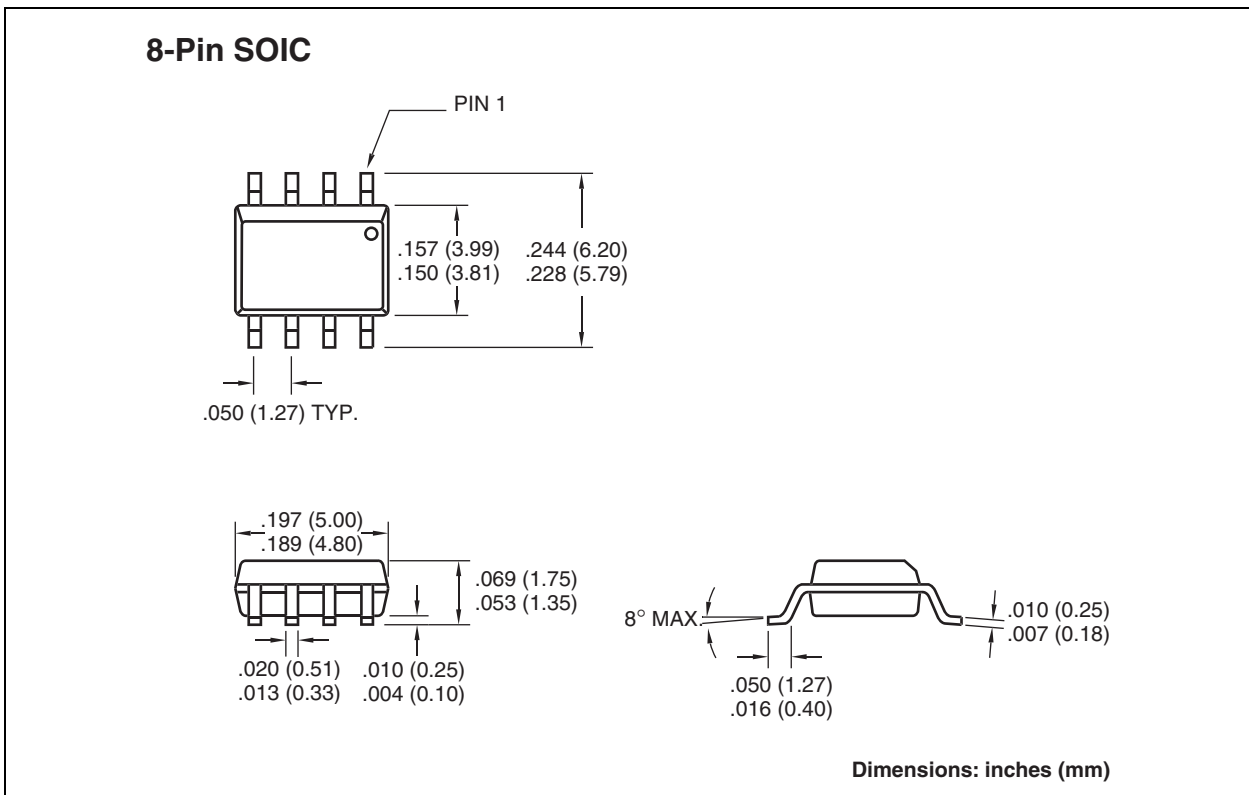
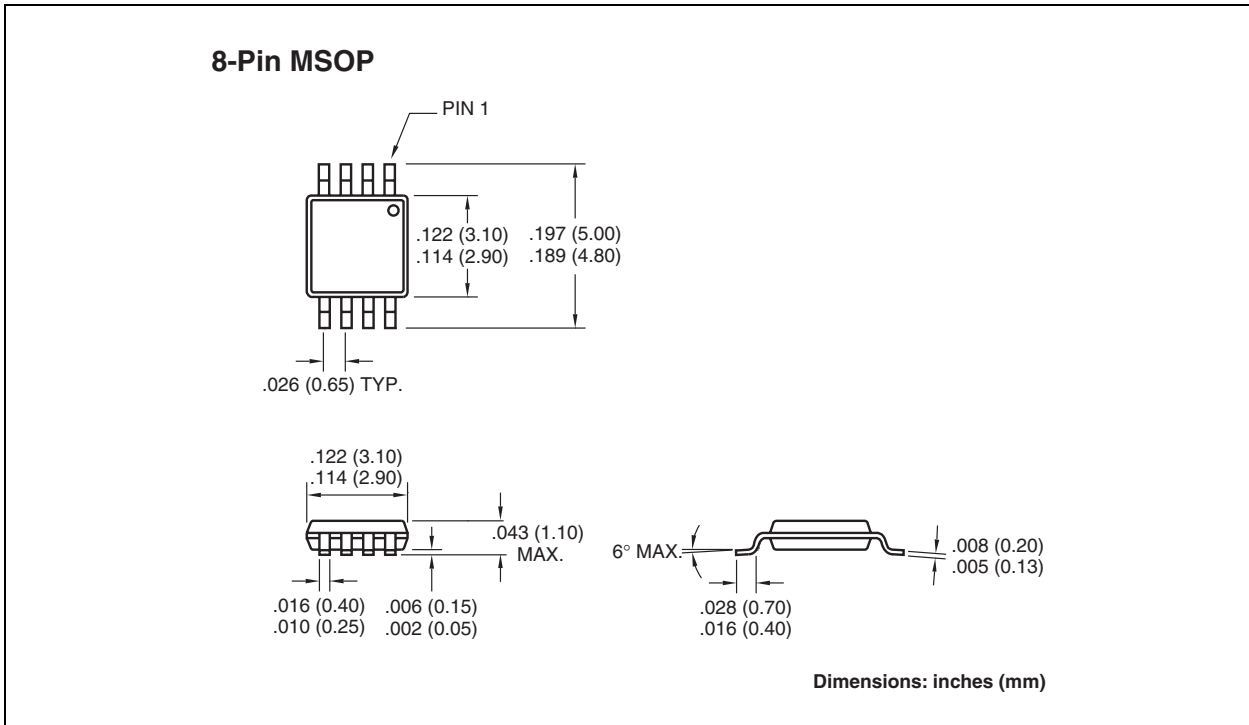


Standard Reel Component Orientation  
for TR Suffix Device

Carrier Tape, Number of Components Per Reel and Reel Size

Package	Carrier Width (W)	Pitch (P)	Part Per Full Reel	Reel Size
8-Pin SOIC (N)	12 mm	8 mm	2500	13 in

## 5.3 Package Dimensions



# TC07

---

---

[查询TC07CUA供应商](#)

**NOTES:**

## SALES AND SUPPORT

### Data Sheets

Products supported by a preliminary Data Sheet may have an errata sheet describing minor operational differences and recommended workarounds. To determine if an errata sheet exists for a particular device, please contact one of the following:

1. Your local Microchip sales office
2. The Microchip Corporate Literature Center U.S. FAX: (480) 792-7277
3. The Microchip Worldwide Site ([www.microchip.com](http://www.microchip.com))

Please specify which device, revision of silicon and Data Sheet (include Literature #) you are using.

### New Customer Notification System

Register on our web site ([www.microchip.com/cn](http://www.microchip.com/cn)) to receive the most current information on our products.

# TC07

---

---

[查询TC07CUA供应商](#)

**NOTES:**

**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 provided only for your convenience and may be superseded by updates. It is your responsibility to ensure that your application meets with your specifications. MICROCHIP MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND WHETHER EXPRESS OR IMPLIED, WRITTEN OR ORAL, STATUTORY OR OTHERWISE, RELATED TO THE INFORMATION, INCLUDING BUT NOT LIMITED TO ITS CONDITION, QUALITY, PERFORMANCE, MERCHANTABILITY OR FITNESS FOR PURPOSE. Microchip disclaims all liability arising from this information and its use. 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 Microchip intellectual property rights.

**Trademarks**

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


AmpLab, FilterLab, Migratable Memory, MXDEV, MXLAB, PICMASTER, 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, dsPICDEM, dsPICDEM.net, dsPICworks, ECAN, ECONOMONITOR, FanSense, FlexROM, fuzzyLAB, In-Circuit Serial Programming, ICSP, ICEPIC, Linear Active Thermistor, MPASM, MPLIB, MPLINK, MPSIM, PICkit, PICDEM, PICDEM.net, PICLAB, PICtail, PowerCal, PowerInfo, PowerMate, PowerTool, rLAB, rPICDEM, Select Mode, Smart Serial, SmartTel, Total Endurance and WiperLock 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.

© 2005, 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, nonvolatile 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:  
<http://support.microchip.com>  
Web Address:  
[www.microchip.com](http://www.microchip.com)

**Atlanta**  
Alpharetta, GA  
Tel: 770-640-0034  
Fax: 770-640-0307

**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

**San Jose**  
Mountain View, CA  
Tel: 650-215-1444  
Fax: 650-961-0286

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

**ASIA/PACIFIC**

**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: 86-28-8676-6200  
Fax: 86-28-8676-6599

**China - Fuzhou**  
Tel: 86-591-8750-3506  
Fax: 86-591-8750-3521

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

**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 - Shunde**  
Tel: 86-757-2839-5507  
Fax: 86-757-2839-5571

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

**China - Xian**  
Tel: 86-29-8833-7250  
Fax: 86-29-8833-7256

**ASIA/PACIFIC**

**India - Bangalore**  
Tel: 91-80-2229-0061  
Fax: 91-80-2229-0062

**India - New Delhi**  
Tel: 91-11-5160-8631  
Fax: 91-11-5160-8632

**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 - Gumi**  
Tel: 82-54-473-4301  
Fax: 82-54-473-4302

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

**Malaysia - Penang**  
Tel: 604-646-8870  
Fax: 604-646-5086

**Philippines - Manila**  
Tel: 632-634-9065  
Fax: 632-634-9069

**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: 43-7242-2244-399  
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