

## Low Cost Single Trip Point Temperature Sensor

### Features:

- Temperature Set Point Easily Programs with a Single External Resistor
- Operates with 2.7V Power Supply (TC624)
- TO-220 Package for Direct Mounting to Heatsink (TC622XAT) or Standard 8-Pin PDIP and SOIC

### Applications:

- Power Supply Over-Temperature Detection
- Consumer Electronics
- Fire/Heat Detection
- UPSs, Amplifiers, Motors
- CPU Thermal Management in PCs

### General Description:

The TC622 and TC624 are programmable solid-state temperature sensors designed to replace mechanical switches in sensing and control applications. Both devices integrate the temperature sensor with a voltage reference and all required detector circuitry. The desired temperature set point is set by the user with a single external resistor.

Ambient temperature is sensed and compared to the programmed set point. The OUT and  $\overline{\text{OUT}}$  outputs are driven to their active state when the measured temperature exceeds the programmed set point.

The TC622 has a power supply voltage range of 4.5V to 18.0V while the TC624 operates over a power supply range of 2.7V to 4.5V. Both devices are usable over a temperature range of -40°C to +125°C (TC622VXX, TC624VXX). Both devices feature low supply current making them suitable for portable applications.

Eight-pin through-hole and surface mount packages are available. The TC622 is also offered in a 5-pin TO-220 package.

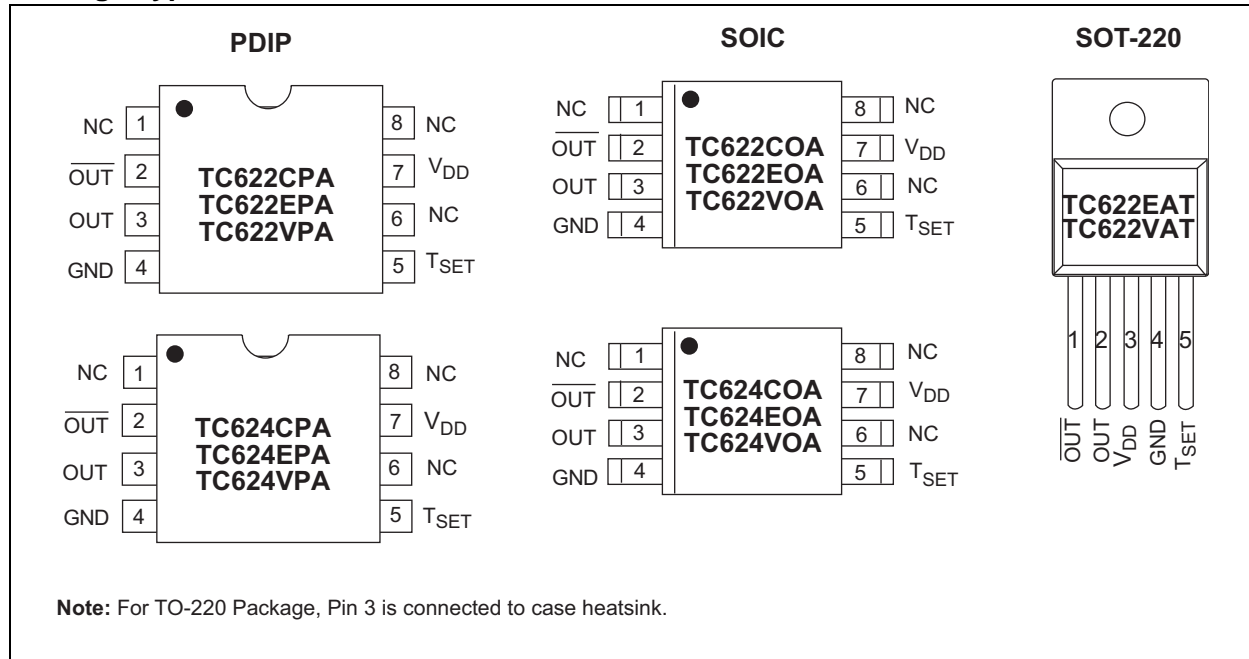
The TC622 and TC624 are single point temperature detectors ideal for use in a wide variety of applications.

### Device Selection Table

Part Number	Voltage Operation	Package	Ambient Temperature
TC622COA	4.5V to 18V	8-Pin SOIC	0°C to +70°C
TC622CPA	4.5V to 18V	8-Pin PDIP	0°C to +70°C
TC622EAT	4.5V to 18V	5-Pin TO-220	-40°C to +85°C
TC622EOA	4.5V to 18V	8-Pin SOIC	-40°C to +85°C
TC622EPA	4.5V to 18V	8-Pin PDIP	-40°C to +85°C
TC622VAT	4.5V to 18V	5-Pin TO-220	-40°C to +125°C
TC622VOA	4.5V to 18V	8-Pin SOIC	-40°C to +125°C
TC622VPA	4.5V to 18V	8-Pin PDIP	-40°C to +125°C
TC624COA	2.7V to 4.5V	8-Pin SOIC	0°C to +70°C
TC624CPA	2.7V to 4.5V	8-Pin PDIP	0°C to +70°C
TC624EOA	2.7V to 4.5V	8-Pin SOIC	-40°C to +85°C
TC624EPA	2.7V to 4.5V	8-Pin PDIP	-40°C to +85°C
TC624VOA	2.7V to 4.5V	8-Pin SOIC	-40°C to +125°C
TC624VPA	2.7V to 4.5V	8-Pin PDIP	-40°C to +125°

# TC622/TC624

## Package Type



## Functional Block Diagram



## 1.0 ELECTRICAL CHARACTERISTICS

### Absolute Maximum Ratings\*

Supply Voltage (TC622) .....	20V
(TC624) .....	5.5V
Input Voltage Any Input.. (GND – 0.3V) to (V <sub>DD</sub> +0.3V)	
Operating Temperature .....	-40°C to +125°C
C Version .....	0°C to +70°C
E Version .....	-40°C to +85°C
V Version .....	-40°C to +125°C
Storage Temperature .....	-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.

### TC622/TC624 ELECTRICAL SPECIFICATIONS

Electrical Characteristics: Over operating temperature range, unless otherwise specified.							
Sym	Parameter	Device	Min	Typ	Max	Unit	Test Conditions
V <sub>DD</sub>	Supply Voltage Range	TC622 TC624	4.5 2.7	— —	18 4.5	V	
I <sub>DD</sub>	Supply Current	TC622 TC624	— —	200 170	600 300	μA	5.0V ≤ V <sub>DD</sub> ≤ 18V 2.7V ≤ V <sub>DD</sub> ≤ 4.5V
V <sub>OH</sub>	Output Voltage (High)	TC622	0.90 x V <sub>DD</sub> 0.80 x V <sub>DD</sub>	— —	— —	V	5.0V ≤ V <sub>DD</sub> ≤ 18V, -40°C ≤ T <sub>A</sub> ≤ +125°C, I <sub>OH</sub> = 250 μA I <sub>OH</sub> = 500 μA
V <sub>OL</sub>	Output Voltage (Low)	TC622	— — —	— — —	0.15 x V <sub>DD</sub> 0.30 x V <sub>DD</sub> 0.35 x V <sub>DD</sub>	V	-40°C ≤ T <sub>A</sub> ≤ +85°C, I <sub>OL</sub> = 500 μA I <sub>OL</sub> = 1 mA -40°C ≤ T <sub>A</sub> ≤ +125°C, I <sub>OL</sub> = 1 mA
V <sub>OH</sub>	Output Voltage (High)	TC624	— 0.90 x V <sub>DD</sub> 0.80 x V <sub>DD</sub>	— — —	— — —	V	2.7V ≤ V <sub>DD</sub> ≤ 4.5V -40°C ≤ T <sub>A</sub> ≤ +125°C, I <sub>OH</sub> = 250 μA I <sub>OH</sub> = 500 μA
V <sub>OL</sub>	Output Voltage (Low)	TC624	— — —	— — —	0.1 x V <sub>DD</sub> 0.2 x V <sub>DD</sub> 0.25 x V <sub>DD</sub>	V	-40°C ≤ T <sub>A</sub> ≤ +85°C, I <sub>OL</sub> = 500 μA I <sub>OL</sub> = 1 mA -40°C ≤ T <sub>A</sub> ≤ +125°C, I <sub>OL</sub> = 1 mA
T <sub>SET</sub>	Absolute Accuracy	TC622 TC624	T - 5 T - 5	T ± 1 T ± 1	T + 5 T + 5	°C	T <sub>SET</sub> = Programmed Temperature T <sub>SET</sub> = Programmed Temperature
OUT	Trip Point Hysteresis	TC622 TC624	— —	2 2	— —	°C	

# TC622/TC624

---

## 2.0 PIN DESCRIPTION

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

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

Pin No. (8-Pin SOIC) (8-Pin PDIP)	Symbol	Description
1	NC	No Internal Connection.
2	$\overline{\text{OUT}}$	Active low output.
3	OUT	Active high output.
4	GND	Ground Terminal.
5	T <sub>SET</sub>	Temperature set point. Connect an external 1% resistor from T <sub>SET</sub> to V <sub>CC</sub> to set trip point.
6	NC	No Internal Connection.
7	V <sub>DD</sub>	Power supply input.
8	NC	No Internal Connection.

Pin No. (5-Pin SOT-220)	Symbol	Description
1	$\overline{\text{OUT}}$	Active low output.
2	OUT	Active high output.
3	V <sub>DD</sub>	Power supply input.
4	GND	Ground Terminal.
5	T <sub>SET</sub>	Temperature set point. Connect an external 1% resistor from T <sub>SET</sub> to V <sub>CC</sub> to set trip point.

## 3.0 DETAILED DESCRIPTION

### 3.1 Trip Point Programming

When the temperature of the device exceeds the programmed temperature trip point,  $T_{SET}$ , the OUT and  $\overline{OUT}$  outputs are driven into their active states. The desired trip point temperature is programmed with a single external resistor connected between the  $T_{SET}$  input and  $V_{CC}$ . The relationship between the resistor value and the trip point temperature is given by Equation 3-1.

#### EQUATION 3-1:

$$R_{TRIP} = 0.5997 \times T^{2.1312}$$

Where:

$R_{TRIP}$  = Programming resistor value in Ohms  
 $T$  = Desired trip temperature in degrees Kelvin.

For example, as shown in Figure 3-1, to program the device to trip at 50°C, the programming resistor is:

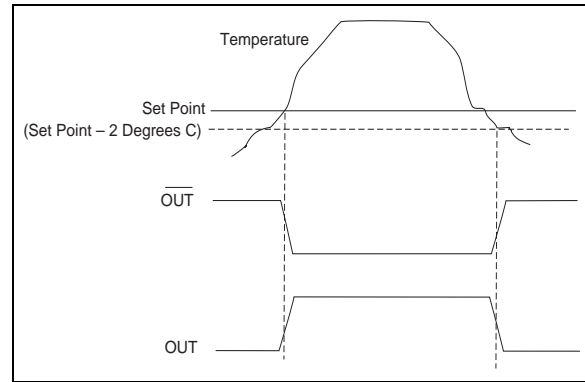
$$R_{TRIP} = 0.5997 \times ((50 + 273.15)^{2.1312}) = 133.65 \text{ k}\Omega$$



**FIGURE 3-1:** Programming Resistor Values vs. Temperature

### 3.2 Hysteresis

To prevent output “chattering” at the trip point temperature, the temperature detector in the TC622/TC624 has 2°C hysteresis (see Figure 3-2). The outputs are driven active when the temperature crosses the set point determined by the external resistor. As temperature declines below the set point, the hysteresis action will hold the outputs true until the temperature drops 2°C below the threshold.



**FIGURE 3-2:** TC622/TC624 Hysteresis

# TC622/TC624

## 4.0 TYPICAL APPLICATIONS

### 4.1 Over-Temperature Shutdown

The TC622 can be used to create a simple over-temperature shutdown circuit. In this circuit, temperature is sensed within the system enclosure (internal system ambient) or at the heatsink itself. When measured temperature exceeds a preset limit, a fault is indicated and the system shuts down.

Figure 4-1 illustrates an over-temperature shutdown circuit using the TC622 sensor in a single TO-220 package, allowing direct attachment to the heatsink surface. As shown, the TC622 outputs are driven active when the heatsink temperature equals the trip point temperature set by  $R_{TRIP}$ . When this happens, the crowbar circuit is activated, causing the supply output to fold back to zero. The TC622 outputs remain active until the heatsink temperature falls a minimum of  $2^{\circ}\text{C}$  (built-in hysteresis) below the trip point temperature, at which time the device again allows normal supply operation.

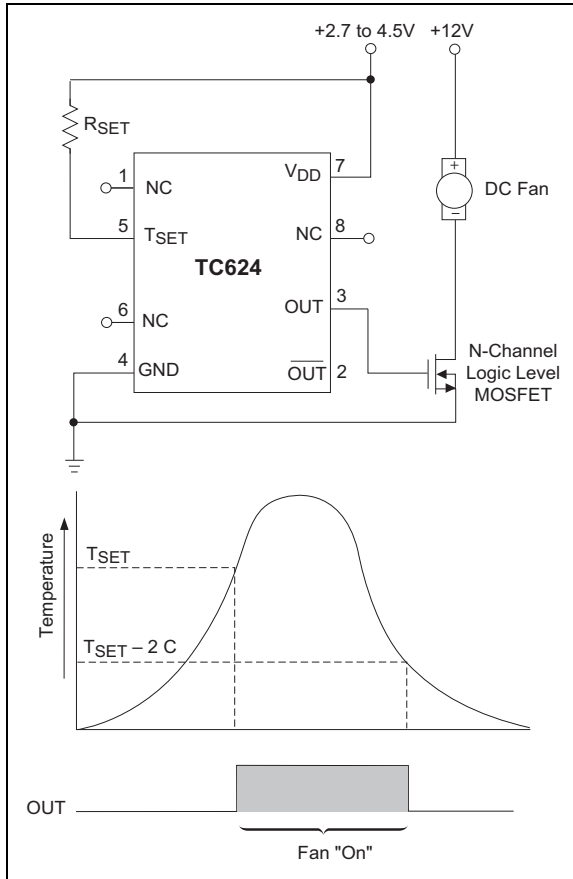


FIGURE 4-1: TC622 Power Supply Over-Temperature Shutdown

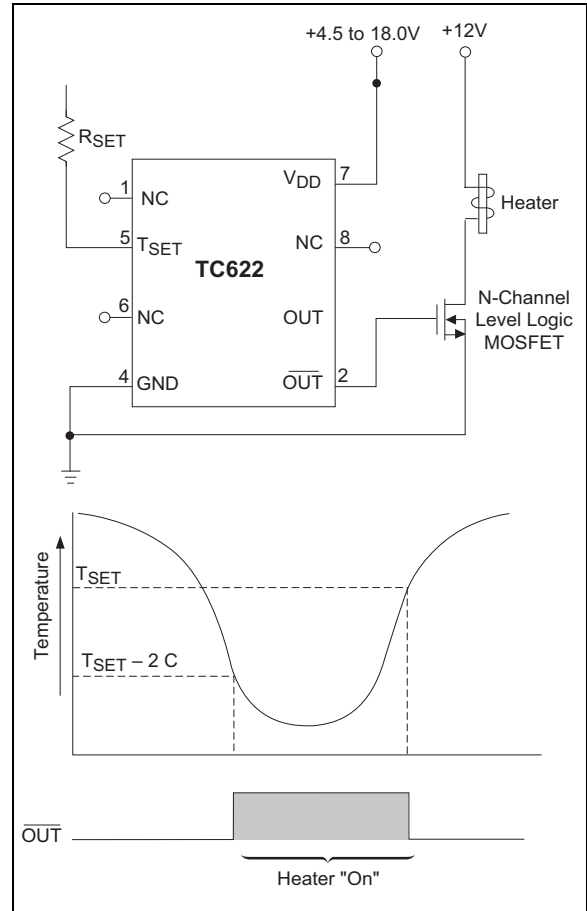
### 4.2 Cooling and Heating Applications

The TC622/TC624 can be used to control a DC fan as shown in Figure 4-2. The fan turns on when the sensed temperature rises above  $T_{SET}$  and remains on until the temperature falls below  $T_{SET} - 2^{\circ}\text{C}$ .

Figure 4-3 shows the TC622 acting as a heater thermostat. Circuit operation is identical to that of the cooling fan application.



**FIGURE 4-2:** TC624 As A Fan Controller for Notebook PC



**FIGURE 4-3:** TC622 As A Heater Thermostat

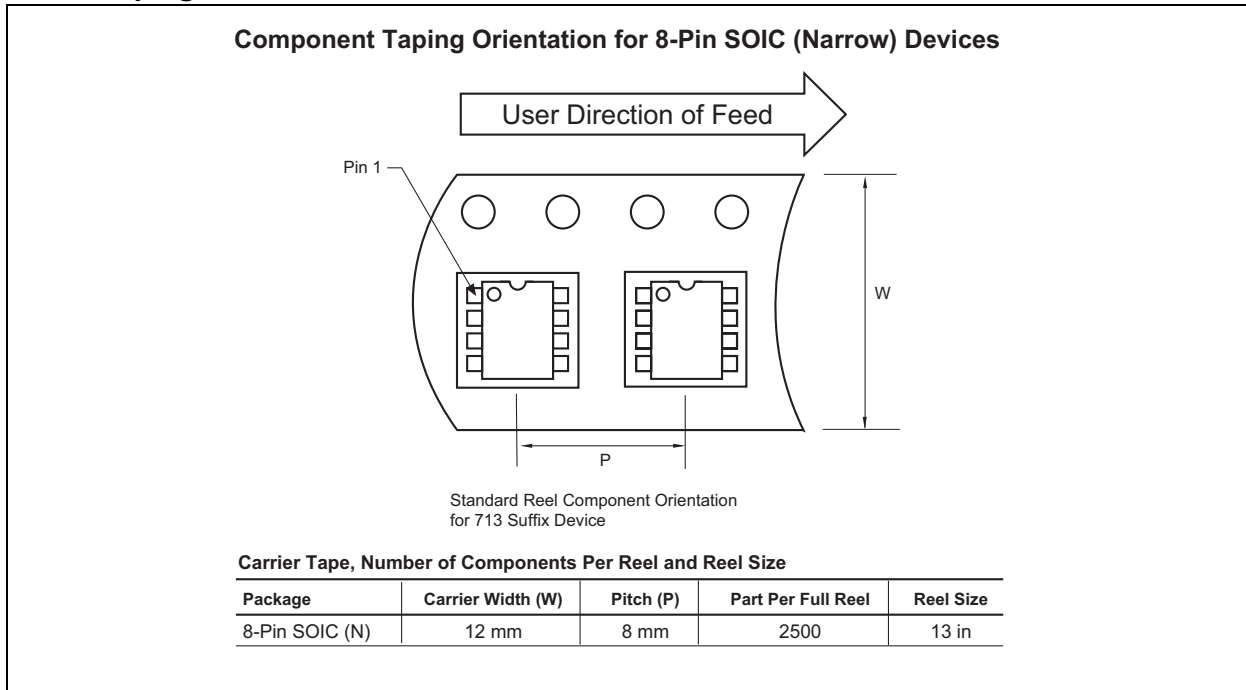
# TC622/TC624

## 5.0 PACKAGING INFORMATION

### 5.1 Package Marking Information

Package marking data not available at this time.

### 5.2 Taping Form





## 5.3 Package Dimensions

**Note:** For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>

### 8-Pin Plastic DIP

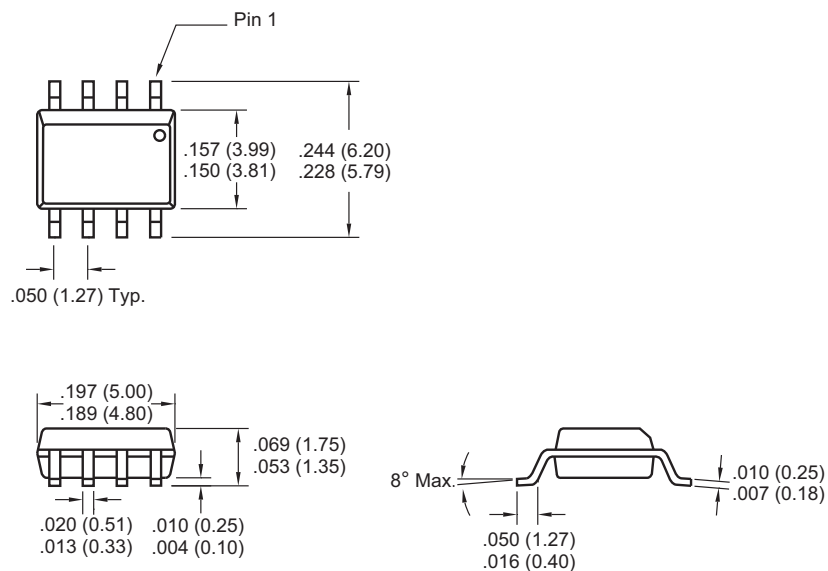


Dimensions: inches (mm)

## 5.4 Package Dimensions (Continued)

**Note:** For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>

### 8-Pin SOIC

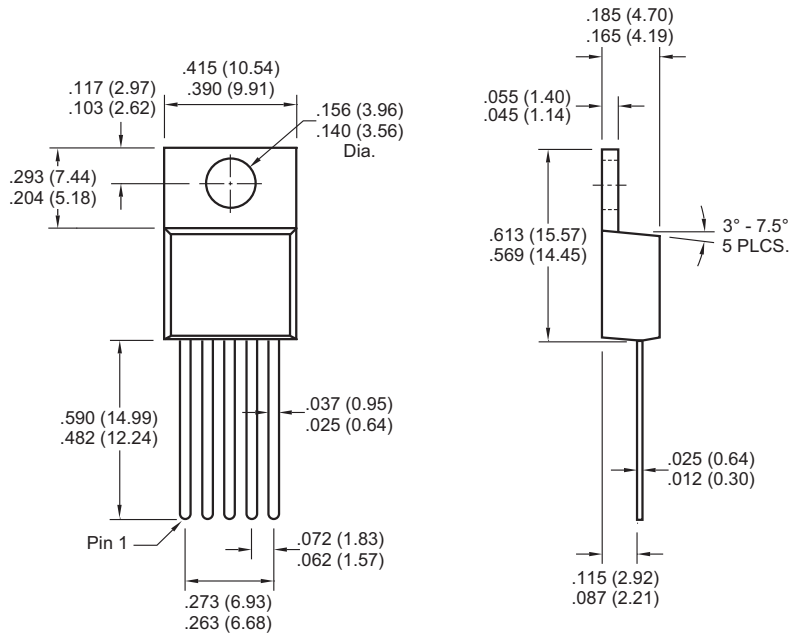


Dimensions: inches (mm)

# TC622/TC624

**Note:** For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>

## 5-Pin TO-220



Dimensions: inches (mm)

## 6.0 REVISION HISTORY

### Revision D (December 2012)

Added a note to each package outline drawing.

# TC622/TC624

---

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 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.

# TC622/TC624

---

---

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 devices in life support and/or safety applications is entirely at the buyer's risk, and the buyer agrees to defend, indemnify and hold harmless Microchip from any and all damages, claims, suits, or expenses resulting from such use. No licenses are conveyed, implicitly or otherwise, under any Microchip intellectual property rights.

**Trademarks**

The Microchip name and logo, the Microchip logo, dsPIC, FlashFlex, KEELOQ, KEELOQ logo, MPLAB, PIC, PICmicro, PICSTART, PIC<sup>32</sup> logo, rPIC, SST, SST Logo, SuperFlash and UNI/O are registered trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

FilterLab, Hampshire, HI-TECH C, Linear Active Thermistor, MTP, SEEVAL and The Embedded Control Solutions Company are registered trademarks of Microchip Technology Incorporated in the U.S.A.

Silicon Storage Technology is a registered trademark of Microchip Technology Inc. in other countries.

Analog-for-the-Digital Age, Application Maestro, BodyCom, chipKIT, chipKIT logo, CodeGuard, dsPICDEM, dsPICDEM.net, dsPICworks, dsSPEAK, ECAN, ECONOMONITOR, FanSense, HI-TIDE, In-Circuit Serial Programming, ICSP, Mindi, MiWi, MPASM, MPF, MPLAB Certified logo, MPLIB, MPLINK, mTouch, Omniclient Code Generation, PICC, PICC-18, PICDEM, PICDEM.net, PICkit, PICtail, REAL ICE, rLAB, Select Mode, SQI, Serial Quad I/O, Total Endurance, TSHARC, UniWinDriver, WiperLock, ZENA and Z-Scale 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.

GestIC and ULPP are registered trademarks of Microchip Technology Germany II GmbH & Co. & KG, a subsidiary of Microchip Technology Inc., in other countries.

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

© 2001-2012, Microchip Technology Incorporated, Printed in the U.S.A., All Rights Reserved.

 Printed on recycled paper.

ISBN: 9781620768242

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

*Microchip received ISO/TS-16949:2009 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<sup>®</sup> MCUs and dsPIC<sup>®</sup> DSCs, KEELOQ<sup>®</sup> 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.*



# MICROCHIP

## 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://www.microchip.com/support>  
Web Address:  
[www.microchip.com](http://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

**Cleveland**  
Independence, OH  
Tel: 216-447-0464  
Fax: 216-447-0643

**Dallas**  
Addison, TX  
Tel: 972-818-7423  
Fax: 972-818-2924

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

**Indianapolis**  
Noblesville, IN  
Tel: 317-773-8323  
Fax: 317-773-5453

**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: 86-10-8569-7000  
Fax: 86-10-8528-2104

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

**China - Chongqing**  
Tel: 86-23-8980-9588  
Fax: 86-23-8980-9500

**China - Hangzhou**  
Tel: 86-571-2819-3187  
Fax: 86-571-2819-3189

**China - Hong Kong SAR**  
Tel: 852-2943-5100  
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: 86-755-8864-2200  
Fax: 86-755-8203-1760

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

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

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

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

### ASIA/PACIFIC

**India - Bangalore**  
Tel: 91-80-3090-4444  
Fax: 91-80-3090-4123

**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 - Osaka**  
Tel: 81-6-6152-7160  
Fax: 81-6-6152-9310

**Japan - Tokyo**  
Tel: 81-3-6880-3770  
Fax: 81-3-6880-3771

**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: 886-3-5778-366  
Fax: 886-3-5770-955

**Taiwan - Kaohsiung**  
Tel: 886-7-213-7828  
Fax: 886-7-330-9305

**Taiwan - Taipei**  
Tel: 886-2-2508-8600  
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

11/29/12





Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



#### Как с нами связаться

**Телефон:** 8 (812) 309 58 32 (многоканальный)

**Факс:** 8 (812) 320-02-42

**Электронная почта:** [org@eplast1.ru](mailto:org@eplast1.ru)

**Адрес:** 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.