

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.

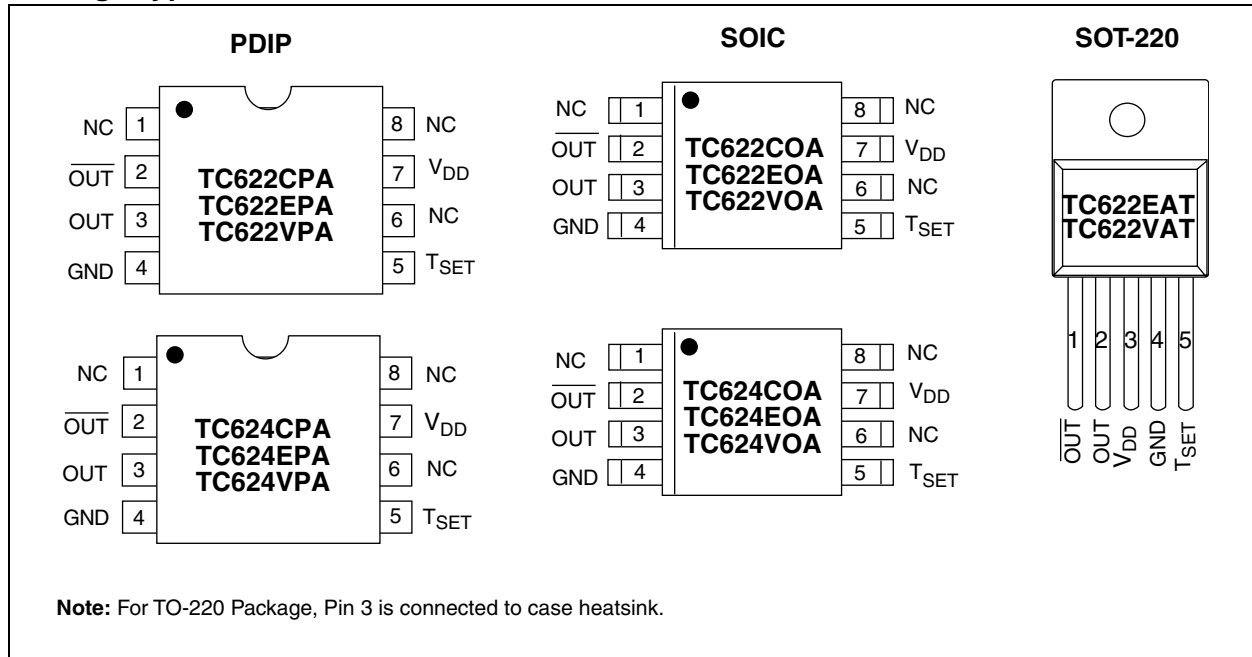
The TC622 and TC624 are single point temperature detectors ideal for use in a wide variety of applications.

Device Selection Table

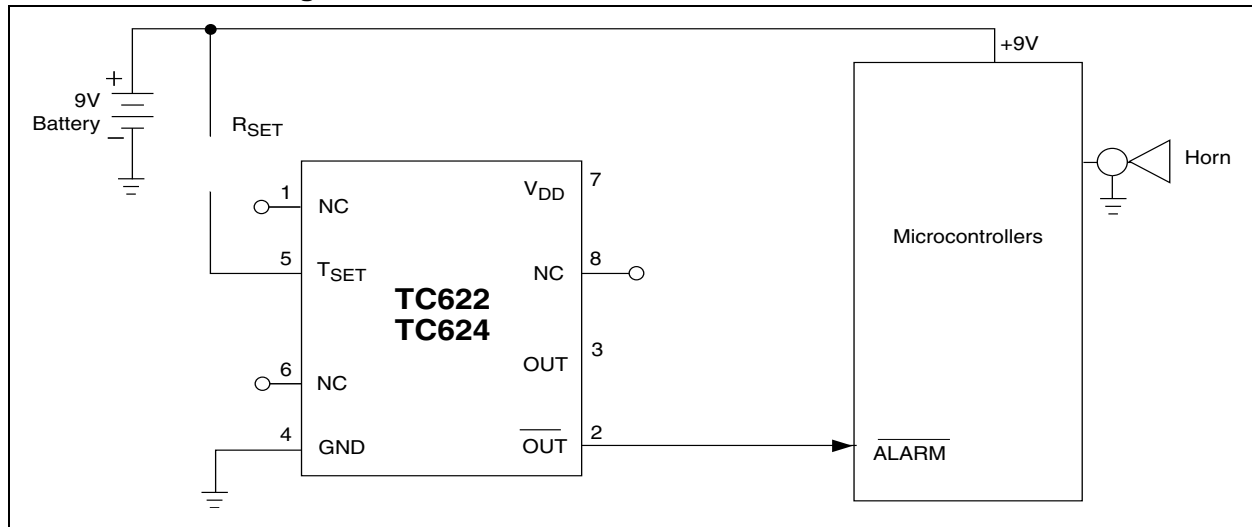
Part Number	Voltage Operation	Package	Ambient Temperature
TC622COA	4.5V to 18V	8-Pin SOIC	0°C to +70°C
TC622CPA	4.5V to 18V	8-Pin PDIP	0°C to +70°C
TC622EAT	4.5V to 18V	5-Pin TO-220	-40°C to +85°C
TC622EOA	4.5V to 18V	8-Pin SOIC	-40°C to +85°C
TC622EPA	4.5V to 18V	8-Pin PDIP	-40°C to +85°C
TC622VAT	4.5V 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 _{DD} +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.							
Symbol	Parameter	Device	Min	Typ	Max	Unit	Test Conditions
V _{DD}	Supply Voltage Range	TC622 TC624	4.5 2.7	— —	18 4.5	V	
I _{DD}	Supply Current	TC622 TC624	— —	200 170	600 300	μA	5.0V ≤ V _{DD} ≤ 18V 2.7V ≤ V _{DD} ≤ 4.5V
V _{OH}	Output Voltage (High)	TC622	0.90 x V _{DD} 0.80 x V _{DD}	— —	— —	V	5.0V ≤ V _{DD} ≤ 18V, -40°C ≤ T _A ≤ +125°C, I _{OH} = 250μA I _{OH} = 500μA
V _{OL}	Output Voltage (Low)	TC622	— — —	— — —	0.15 x V _{DD} 0.30 x V _{DD} 0.35 x V _{DD}	V	-40°C ≤ T _A ≤ +85°C, I _{OL} = 500μA I _{OL} = 1mA -40°C ≤ T _A ≤ +125°C, I _{OL} = 1mA
V _{OH}	Output Voltage (High)	TC624	— 0.90 x V _{DD} 0.80 x V _{DD}	— — —	— — —	V	2.7V ≤ V _{DD} ≤ 4.5V -40°C ≤ T _A ≤ +125°C, I _{OH} = 250μA I _{OH} = 500μA
V _{OL}	Output Voltage (Low)	TC624	— — —	— — —	0.1 x V _{DD} 0.2 x V _{DD} 0.25 x V _{DD}	V	-40°C ≤ T _A ≤ +85°C, I _{OL} = 500μA I _{OL} = 1mA -40°C ≤ T _A ≤ +125°C, I _{OL} = 1mA
T _{SET}	Absolute Accuracy	TC622 TC624	T - 5 T - 5	T ± 1 T ± 1	T + 5 T + 5	°C	T _{SET} = Programmed Temperature T _{SET} = 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 _{SET}	Temperature set point. Connect an external 1% resistor from T _{SET} to V _{CC} to set trip point.
6	NC	No Internal Connection.
7	V _{DD}	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 _{DD}	Power supply input.
4	GND	Ground Terminal.
5	T _{SET}	Temperature set point. Connect an external 1% resistor from T _{SET} to V _{CC} 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 \overline{OUT} and 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:

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

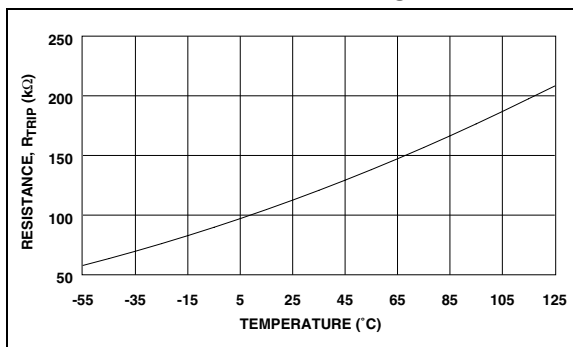
Where:

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:

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

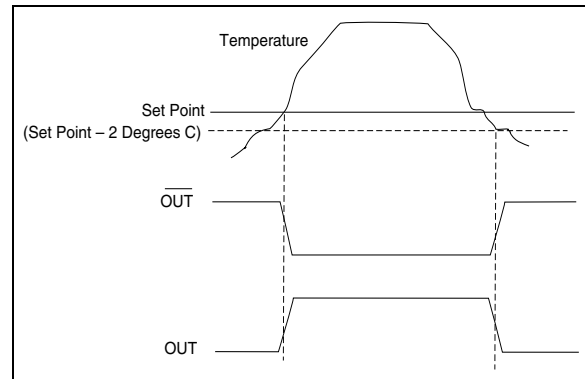
FIGURE 3-1: PROGRAMMING RESISTOR VALUES VS. TEMPERATURE



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°C (built-in hysteresis) below the trip point temperature, at which time the device again allows normal supply operation.

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 4-1: TC622 POWER SUPPLY OVER-TEMPERATURE SHUTDOWN

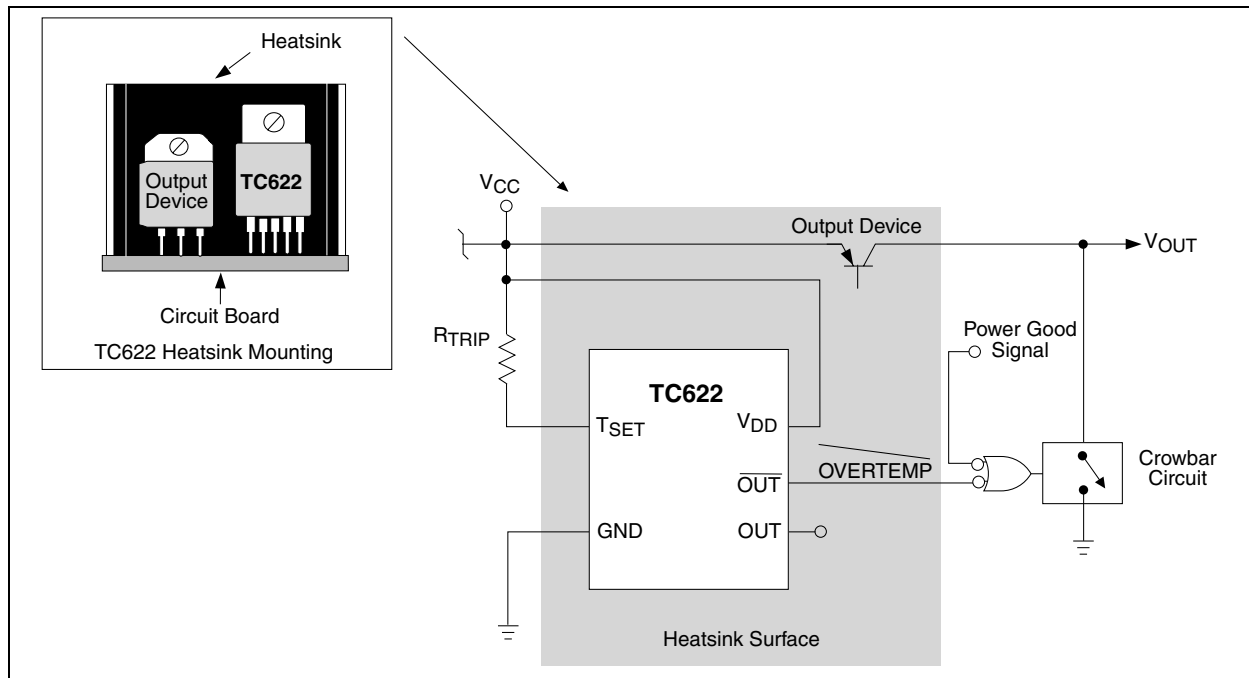


FIGURE 4-2: TC624 AS A FAN CONTROLLER FOR NOTEBOOK PC

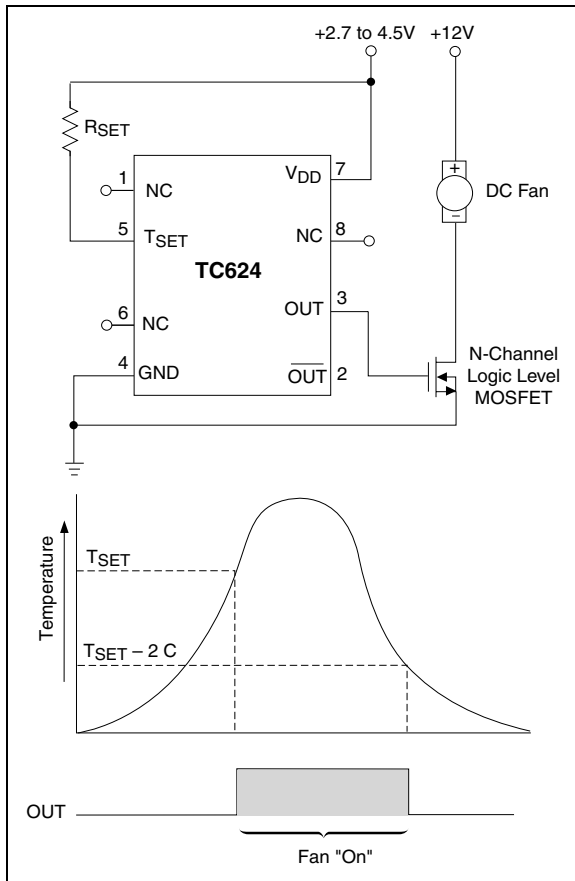
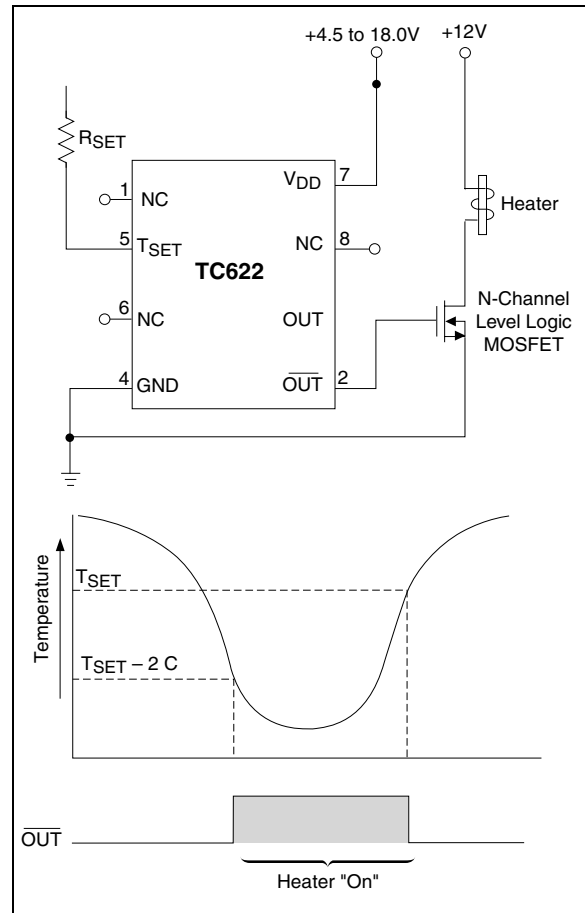


FIGURE 4-3: TC622 AS A HEATER THERMOSTAT



TC622/TC624

5.0 PACKAGING INFORMATION

5.1 Package Marking Information

Package marking data not available at this time.

5.2 Taping Form

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

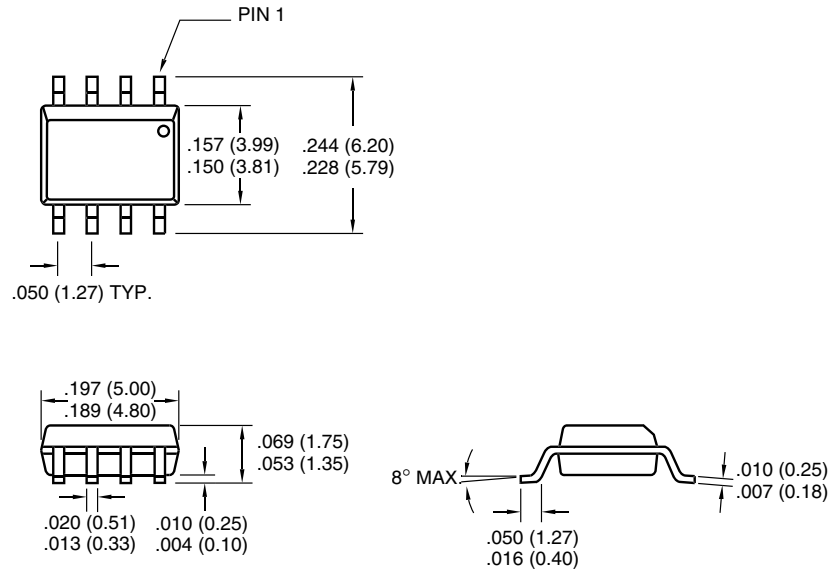
5.3 Package Dimensions

8-Pin Plastic DIP

Dimensions: inches (mm)

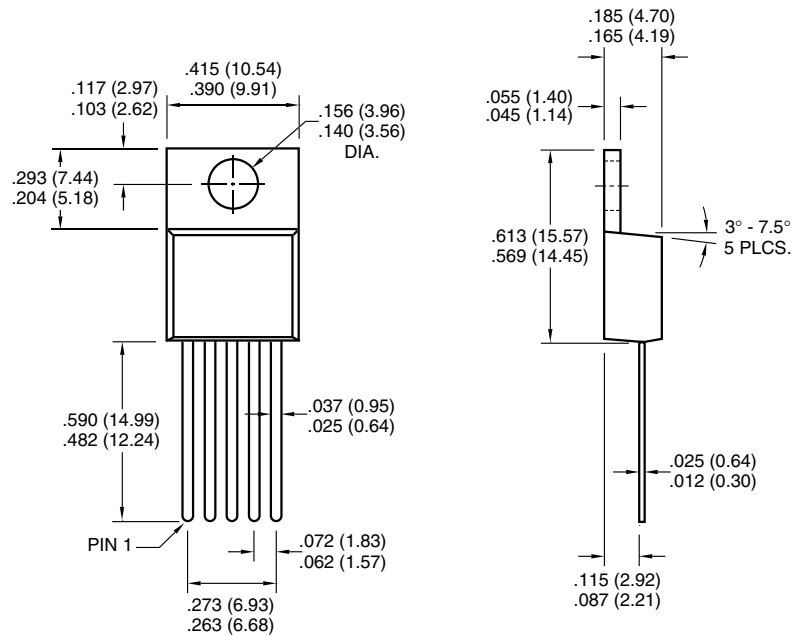
5.4 Package Dimensions (Continued)

8-Pin SOIC



Dimensions: inches (mm)

5-Pin TO-220



Dimensions: inches (mm)

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 Corporate Literature Center U.S. FAX: (480) 792-7277
3. The Microchip Worldwide Site (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) to receive the most current information on our products.

TC622/TC624

NOTES:

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, MPLINK, MPSIM, MXDEV, PICC, PICDEM, PICDEM.net, rfPIC, 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.



Microchip received QS-9000 quality system certification for its worldwide headquarters, design and wafer fabrication facilities in Chandler and Tempe, Arizona in July 1999 and Mountain View, California in March 2002. The Company's quality system processes and procedures are QS-9000 compliant 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 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: 480-792-7627
Web Address: <http://www.microchip.com>

Rocky Mountain

2355 West Chandler Blvd.
Chandler, AZ 85224-6199
Tel: 480-792-7966 Fax: 480-792-7456

Atlanta

500 Sugar Mill Road, Suite 200B
Atlanta, 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: 972-818-7423 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

New York

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

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
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 28F, World Trade Plaza
No. 71 Wusi 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 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. 1315, 13/F, Shenzhen Kerry Centre,
Renminnan Lu
Shenzhen 518001, China
Tel: 86-755-2350361 Fax: 86-755-2366086

Hong Kong

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

India

Microchip Technology Inc.
India Liaison Office
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 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
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 - 1er Etage
91300 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: 49-89-627-144 0 Fax: 49-89-627-144-44

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

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

03/01/02

