

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.

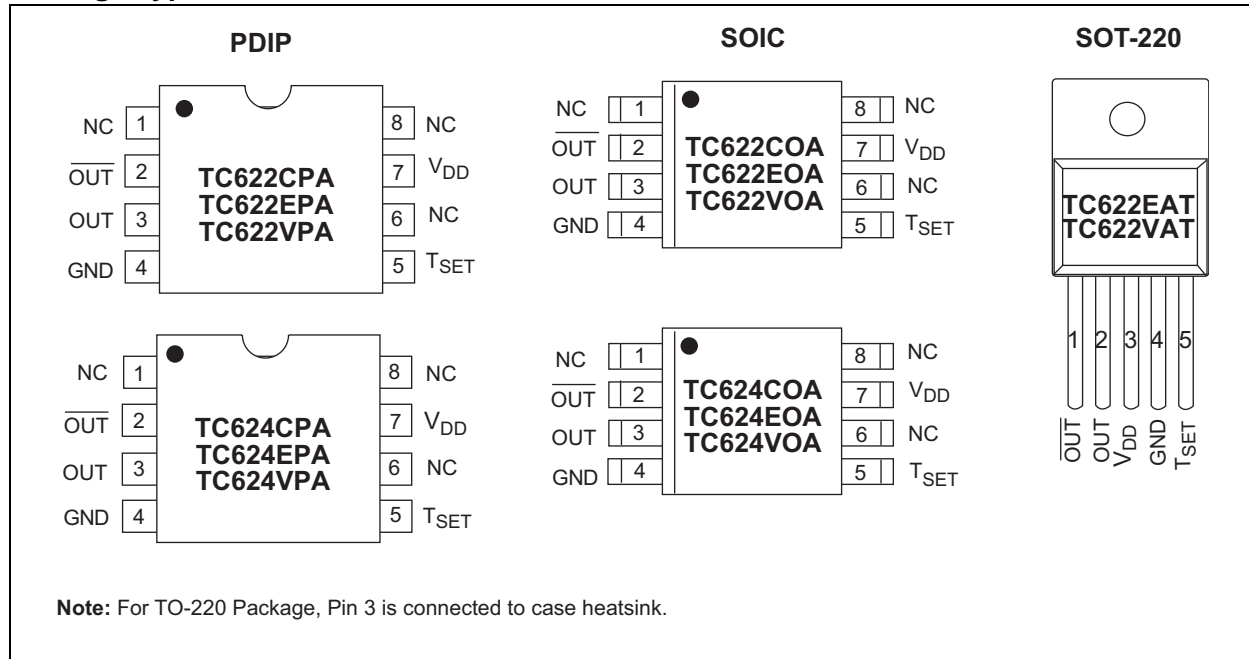
The TC622 and TC624 are single point temperature detectors ideal for use in a wide variety of applications.

Device Selection Table

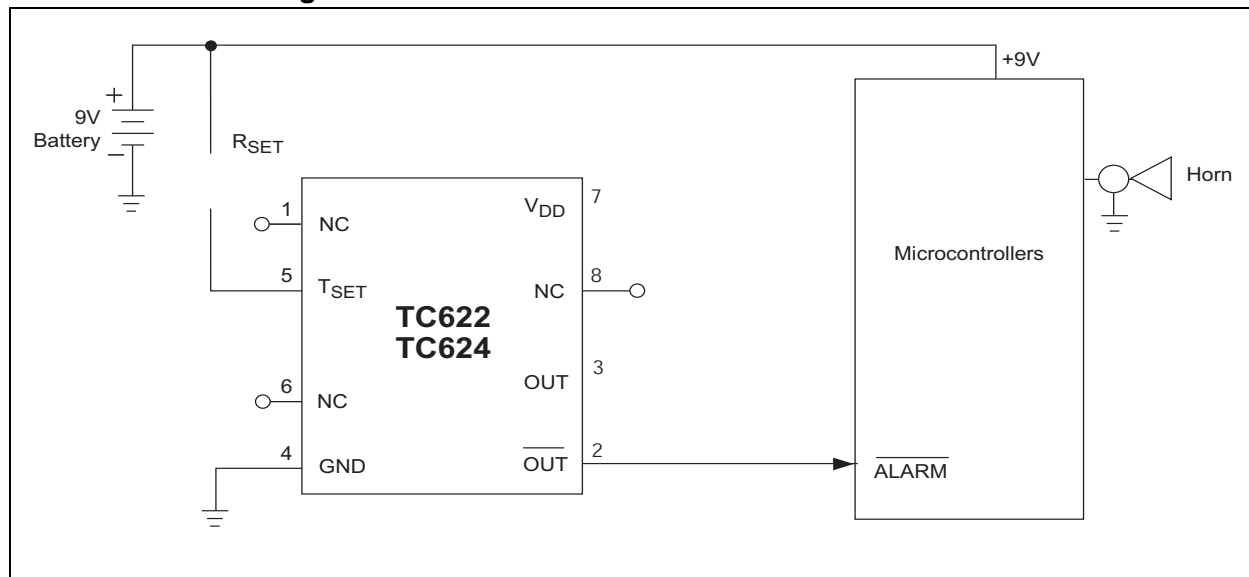
| Part Number | Voltage Operation | Package | Ambient Temperature |
|-------------|-------------------|--------------|---------------------|
| TC622COA | 4.5V to 18V | 8-Pin SOIC | 0°C to +70°C |
| TC622CPA | 4.5V to 18V | 8-Pin PDIP | 0°C to +70°C |
| TC622EAT | 4.5V to 18V | 5-Pin TO-220 | -40°C to +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. | | | | | | | |
|---|-----------------------|----------------|---|----------------|--|------|---|
| Sym | 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} = 250 μA I _{OH} = 500 μA |
| 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} = 500 μA I _{OL} = 1 mA -40°C ≤ T _A ≤ +125°C, I _{OL} = 1 mA |
| 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} = 250 μA I _{OH} = 500 μA |
| 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} = 500 μA I _{OL} = 1 mA -40°C ≤ T _A ≤ +125°C, I _{OL} = 1 mA |
| 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 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:

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

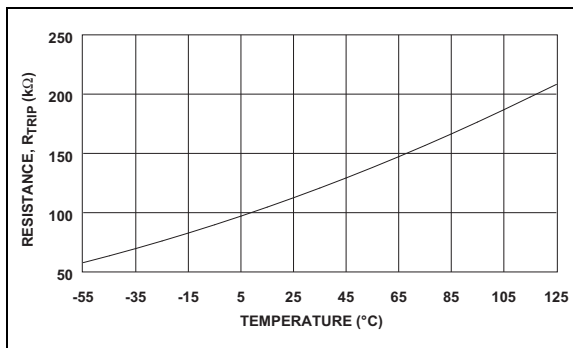


FIGURE 3-1: Programming Resistor Values vs. Temperature

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.

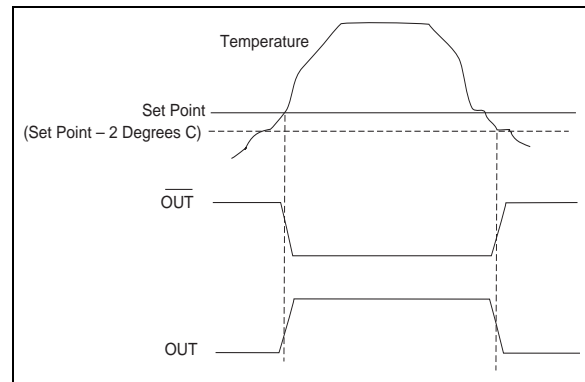


FIGURE 3-2: TC622/TC624 Hysteresis

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°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.

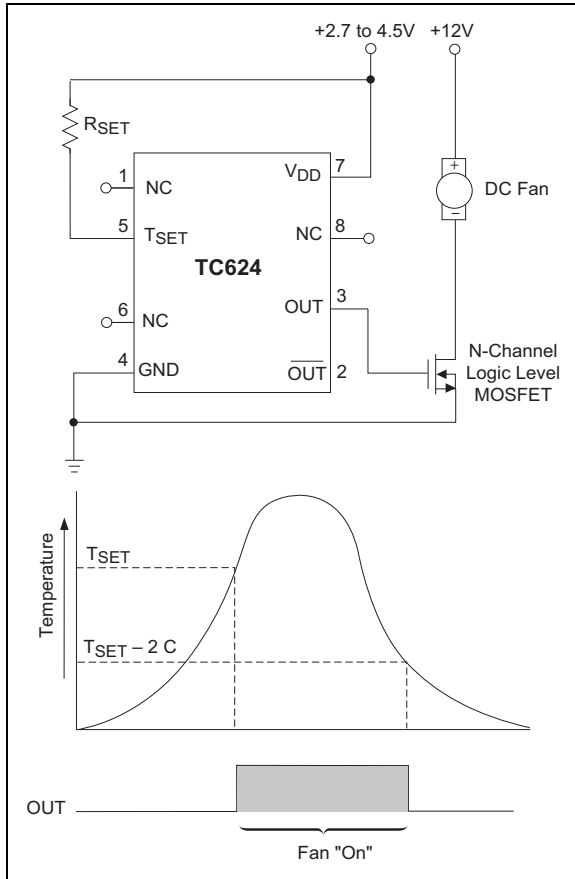


FIGURE 4-2: TC624 As A Fan Controller for Notebook PC



FIGURE 4-3: TC622 As A Heater Thermostat

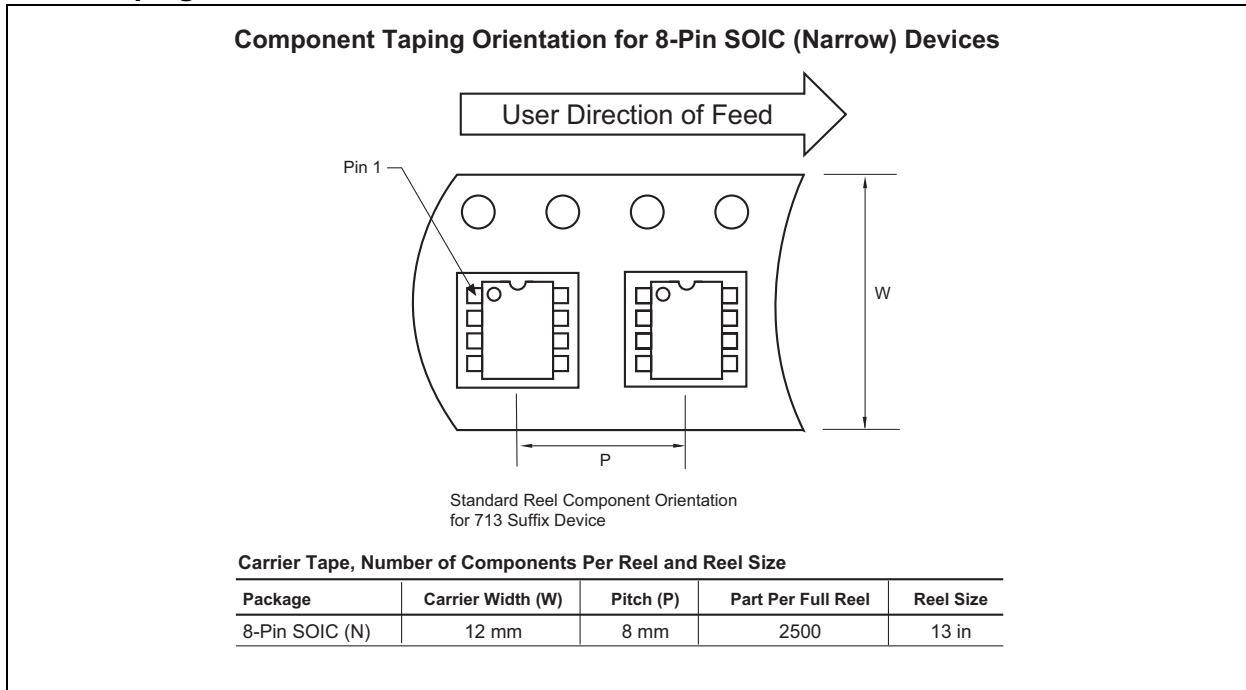
TC622/TC624

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

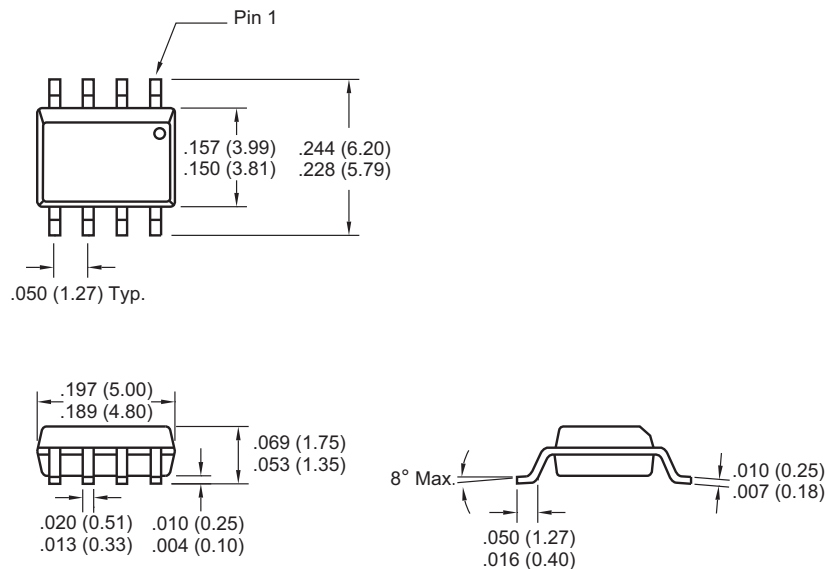


Dimensions: inches (mm)

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

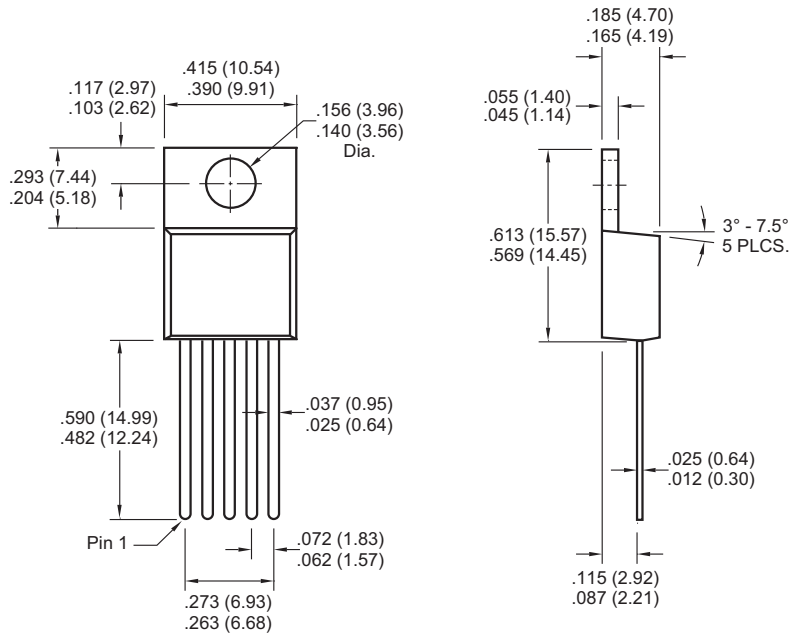


Dimensions: inches (mm)

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)

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:

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, PIC³² 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

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[®] MCUs and dsPIC[®] DSCs, 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.

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



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

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