TC622/TC624

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 $\overline{OUT}$ 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.

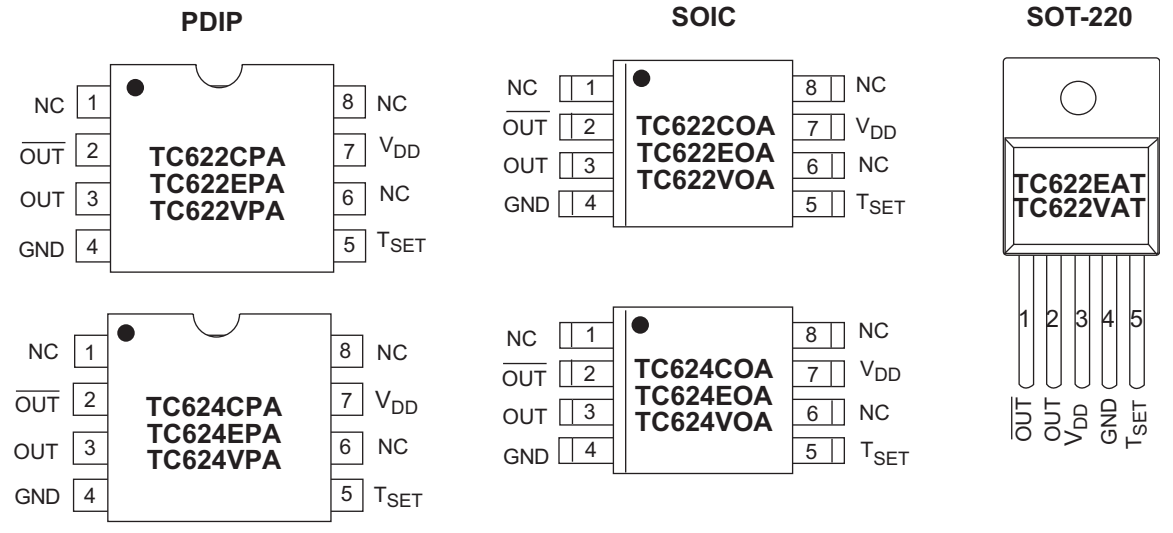
Eight-pin through-hole and surface mount packages are available. The TC622 is also offered in a 5-pin TO-220 package.

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

Device Selection Table

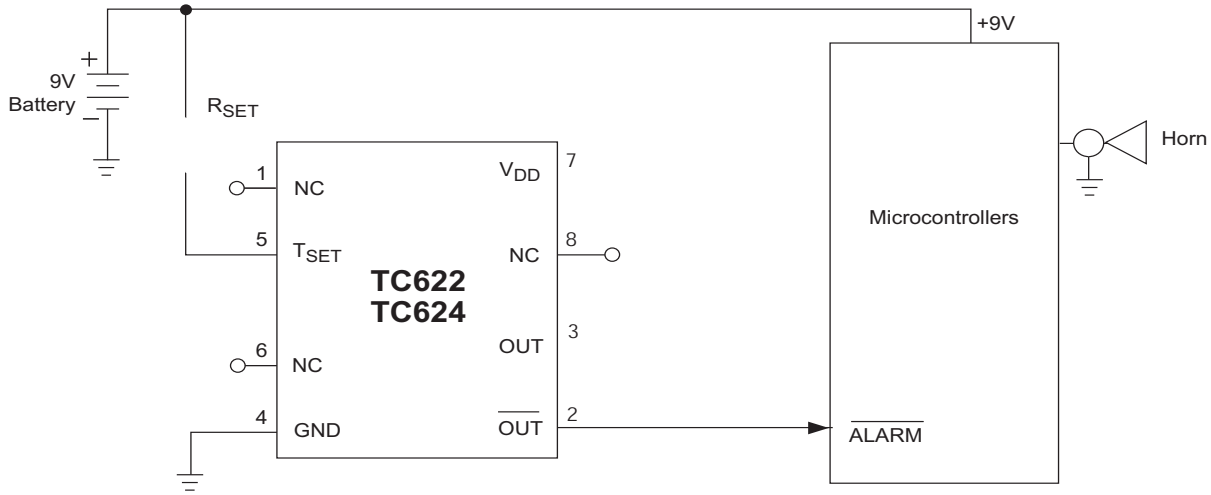
Part Number	Voltage Operation	Package	Ambient Temperature
TC622COA	4.5V to 18V	8-Pin SOIC	0°C to +70°C
TC622CPA	4.5V to 18V	8-Pin PDIP	0°C to +70°C
TC622EAT	4.5V to 18V	5-Pin TO-220	-40°C to +85°C
TC622EOA	4.5V to 18V	8-Pin SOIC	-40°C to +85°C
TC622EPA	4.5V to 18V	8-Pin PDIP	-40°C to +85°C
TC622VAT	4.5V 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°

Package Type



Note: For TO-220 Package, Pin 3 is connected to case heatsink.

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.

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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	

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	$\overline{OUT}$	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	$\overline{OUT}$	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:

$$R_{TRIP} = 0.5997 \text{ x } T^{2.1312}$$

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:

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

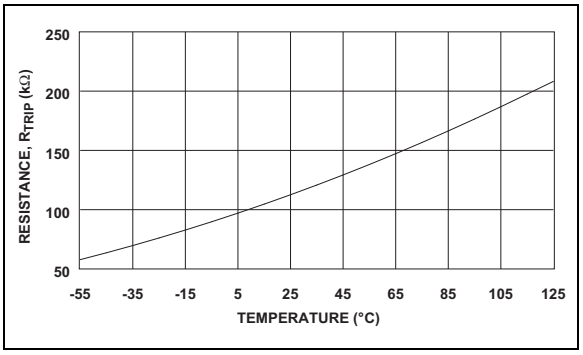


FIGURE 3-1: *Programming Resistor Values vs. Temperature*

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.

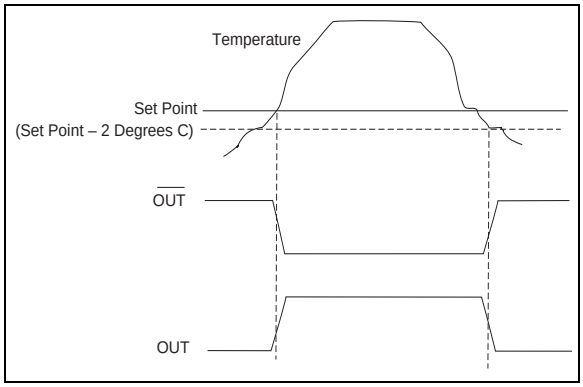


FIGURE 3-2: *TC622/TC624 Hysteresis*

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°C.

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

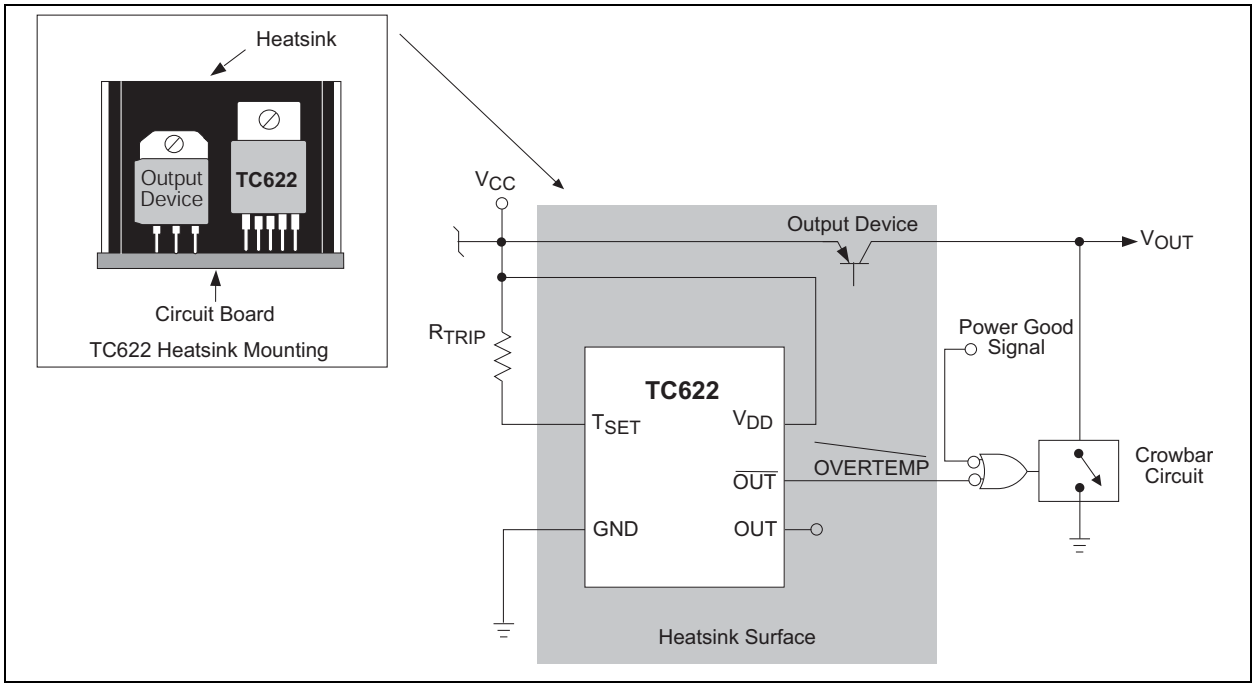


FIGURE 4-1: *TC622 Power Supply Over-Temperature Shutdown*

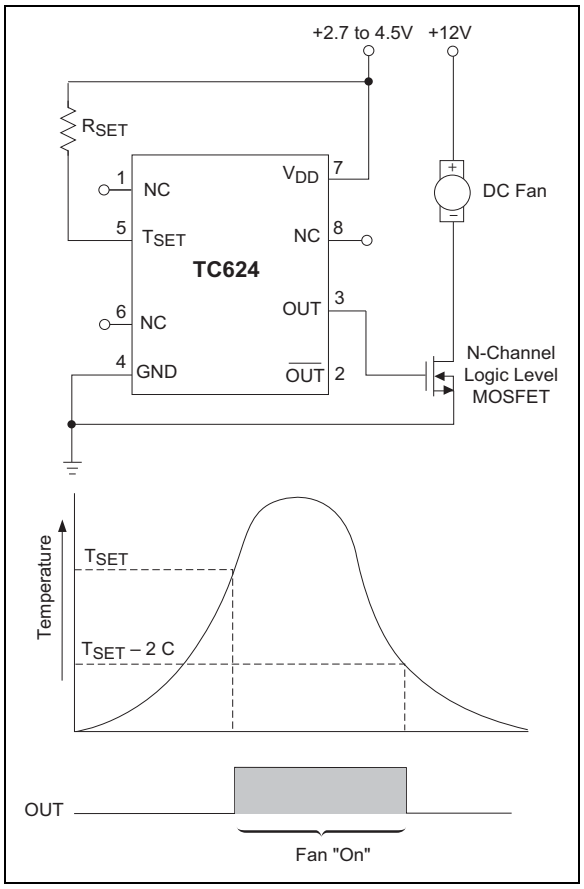


FIGURE 4-2: *TC624 As A Fan Controller for Notebook PC*

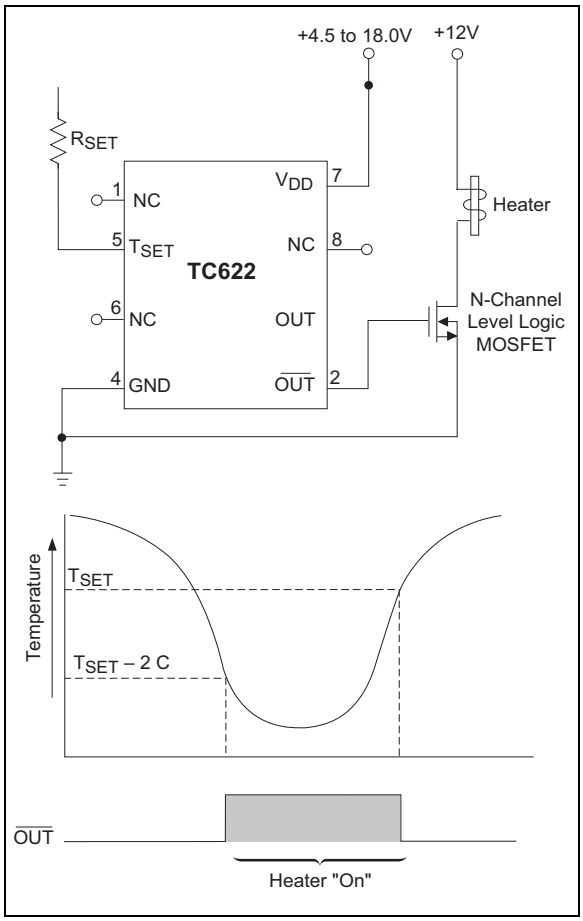


FIGURE 4-3: *TC622 As A Heater Thermostat*

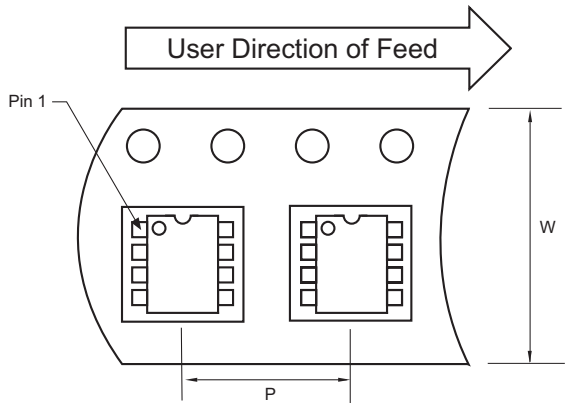
5.0 PACKAGING INFORMATION

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 713 Suffix Device

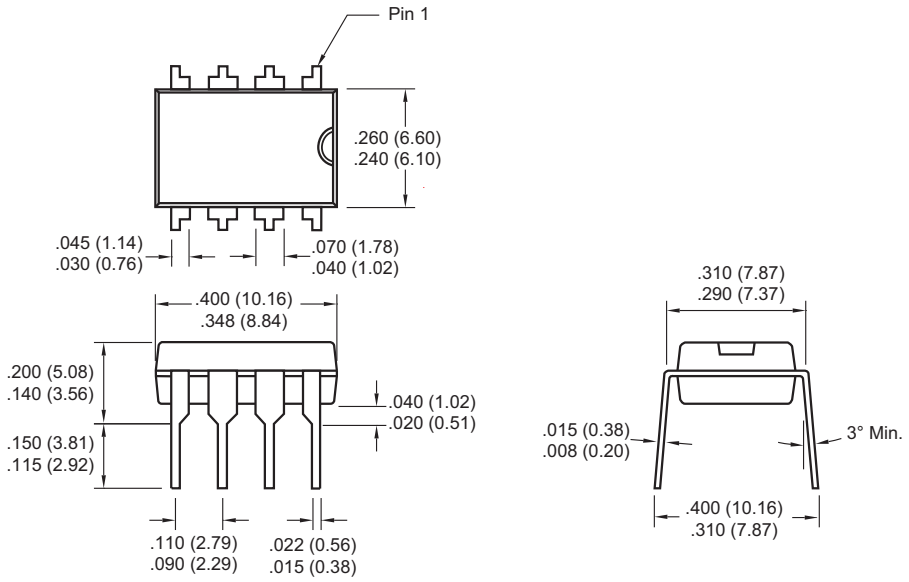
Carrier Tape, Number of Components Per Reel and Reel Size

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

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

8-Pin Plastic DIP

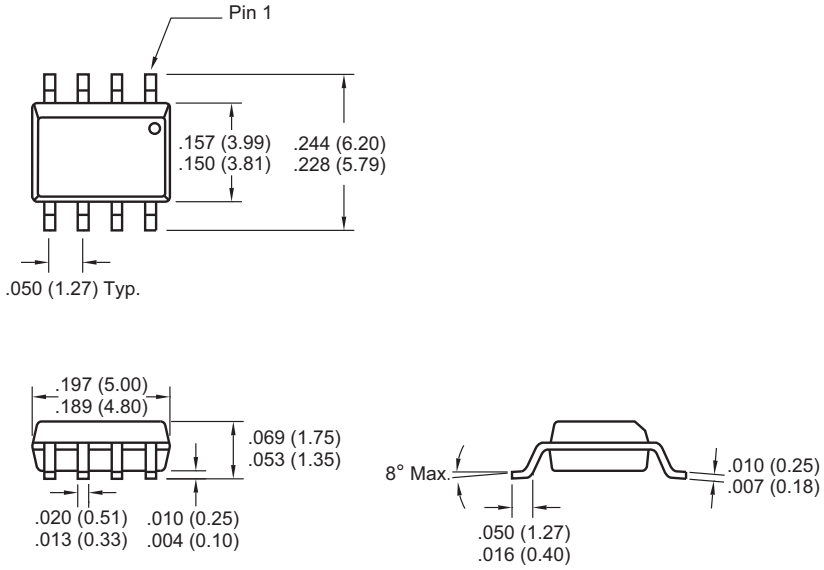


Dimensions: inches (mm)

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

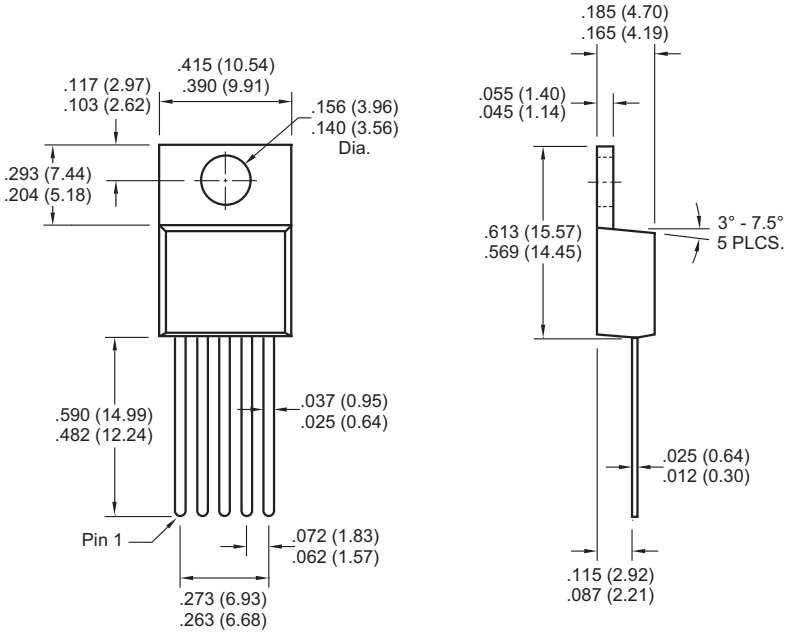
8-Pin SOIC



Dimensions: inches (mm)

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.

NOTES:

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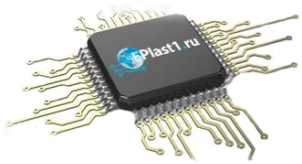

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