TC623

3V, Dual Trip Point Temperature Sensor

Features

- Integrated Temp Sensor and Detector Operate from a Supply Voltage as Low as 2.7V
- Replaces Mechanical Thermostats and Switches
- On-Chip Temperature Sense
- 8-Pin DIP or SOIC for Direct PCB Mounting
- 2 User Programmable Temperature Set Points
- 2 Independent Temperature Limit Outputs
- Heat/Cool Regulate Output

Applications

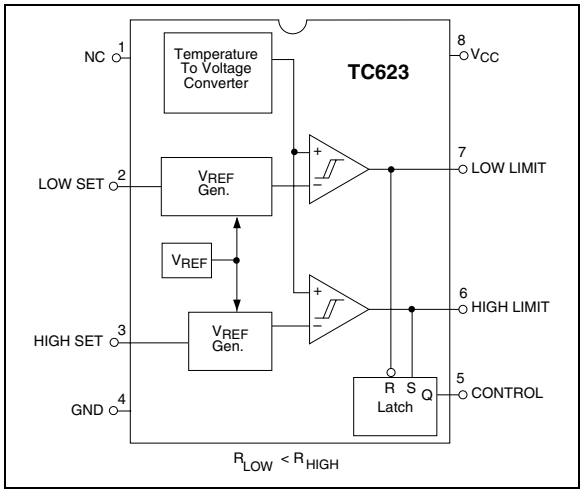
- CPU Thermal Management
- System Over or Under Temperature Shutdown
- Advanced Thermal Warning
- Fan Speed Control Circuits
- Accurate Appliance Temperature Sensing
- Environmental Control

Device Selection Table

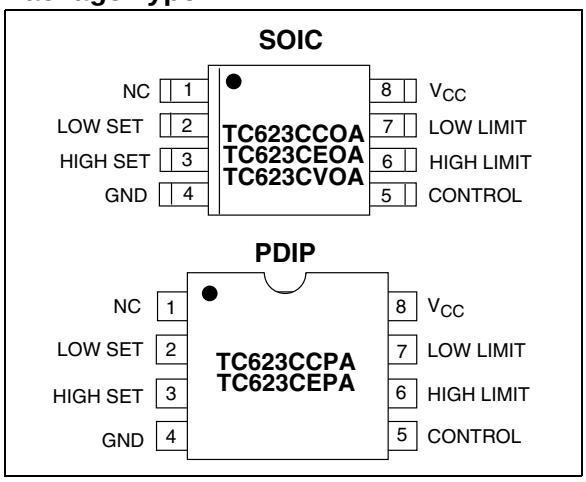
Part Number	Package	Temp. Range
TC623CCOA	8-Pin SOIC	0°C to +70°C
TC623CCPA	8-Pin PDIP	0°C to +70°C
TC623CEOA	8-Pin SOIC	-40°C to +85°C
TC623CEPA	8-Pin PDIP	-40°C to +85°C
TC623CVOA	8-Pin SOIC	-40°C to +125°C

NOTE: Latch Output (C option), is a Standard Device. Contact Factory for Latch Q Output (H option).

Functional Block Diagram



Package Type



General Description

The TC623 is a 3V solid-state, programmable temperature sensor designed for use in thermal management applications. It features dual thermal interrupt outputs (LOW LIMIT and HIGH LIMIT) each of which are set with an external resistor. The HIGH LIMIT and LOW LIMIT outputs are driven active (high) when measured temperature equals the user programmed limits. The CONTROL output is driven active (high) when temperature equals the HIGH LIMIT set point and turned off when temperature falls below the LOW LIMIT set point. The CONTROL output can be used to provide simple ON/OFF control to a cooling fan if so desired.

Low voltage operation, easy set point programming, small size and low cost make the TC623 an ideal choice for many thermal management applications.

1.0 ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings*

Supply Voltage 5.5V
Input Voltage Any Input .. (GND – 0.3V) to (V_{DD} +0.3V)
Package Power Dissipation ($T_A \leq 70°C$)
Plastic DIP.....730mW
SOIC.....470mW
Derating Factors
Plastic DIP .....8mW/°C
SOIC.....6mW/°C
Operating Temperature
V Version .....-40°C to +125°C
E Version .....-40°C to +85°C
C Version ..... 0°C to +70°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.

TC623 ELECTRICAL SPECIFICATIONS

Electrical Characteristics: Over Operating Temperature Range, V_{DD} = 2.7V to 4.5V, unless otherwise specified.						
Symbol	**Parameter**	**Min**	**Typ.**	**Max**	**Unit**	**Test Conditions**
V_{DD}	Supply Voltage Range	2.7	—	4.5	V	
I_{DD}	Supply Current	—	150	250	µA	$2.7V \leq V_{DD} \leq 4.5V$
T_{SET}	Absolute Accuracy	T - 3	T ±1	T + 3	°C	T = Programmed Temperature
V_{OH}	Output Voltage High	0.9 x V_{DD} 0.8 x V_{DD}	— —	— —	V V	I_{OH} = 250µA I_{OH} = 500µA
V_{OL}	Output Voltage Low	— —	— —	0.1 x V_{DD} 0.2 x V_{DD}	V V	I_{OL} = 500 µA I_{OL} = 1mA
HYS	Hysteresis	—	—	-2	°C	Falling Temperature

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	LOW SET	Low temperature set point. Connect an external 1% resistor from LOW SET to V_{DD} to set trip point.
3	HIGH SET	High temperature set point. Connect an external 1% resistor from HIGH SET to V_{DD} to set trip point.
4	GND	Ground Terminal.
5	CONTROL	Control output.
6	HIGH LIMIT	High temperature push/pull output.
7	LOW LIMIT	Low temperature push/pull output.
8	V_{CC}	Power supply input.

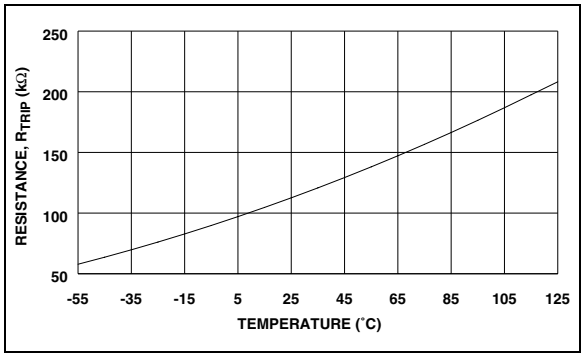
3.0 DETAILED DESCRIPTION

3.1 TC623 Operation

The TC623 has a positive temperature coefficient (Silicon) temperature sensor and dual threshold detector. Temperature set point programming is accomplished with external resistors from the HIGH SET and LOW SET inputs to V_{CC}. The HIGH LIMIT and LOW LIMIT outputs remain inactive (low) as long as the measured temperature is below set point values. As temperature increases, the LOW LIMIT is driven high when temperature equals the LOW LIMIT set point (±3°C). If temperature continues to climb, the HIGH LIMIT output is driven high when temperature equals the HIGH LIMIT set point (±3°C).

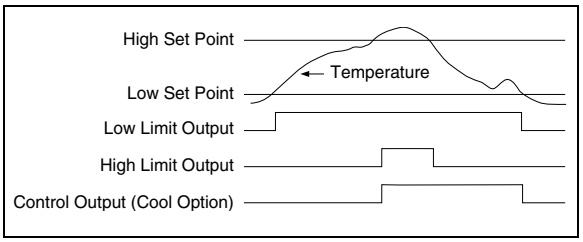
Figure 3-1 shows the relationship between the sense resistance values and trip point temperature.

FIGURE 3-1: TC623 SENSE RESISTORS VS. TRIP TEMPERATURE



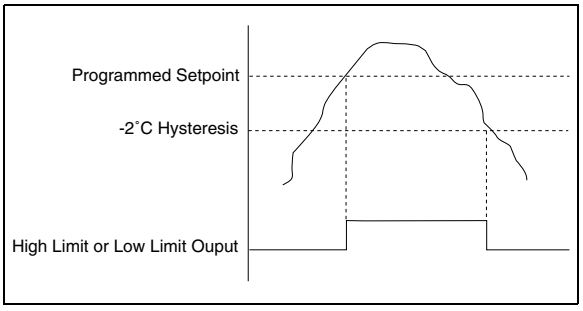
The CONTROL output is driven high when the HIGH LIMIT output goes high and is RESET low when the LOW LIMIT output goes low. This output provides the logic for simple ON/OFF fan control. Figure 3-2 shows overall TC623 operation.

FIGURE 3-2: TC623 TEMPERATURE VS. OUTPUT



To prevent output "chattering" when measured temperature is at (or near) the trip point values, the LOW SET and HIGH SET inputs each have a built-in hysteresis of -2°C max. As a result, the HIGH LIMIT and LOW LIMIT outputs remain active until the measured temperature falls a maximum of 2°C below the programmed HIGH SET and LOW SET thresholds as shown in Figure 3-3. The programmed setting threshold of Figure 3-3 is user programmed temperature trip points of either the LOW SET or HIGH SET inputs. The LOW LIMIT or HIGH LIMIT output is driven active when temperature equals the set point value (to within 3°C). The output remains active until the temperature falls an additional 2°C below the set point due to hysteresis.

FIGURE 3-3: HIGH SET AND LOW SET THRESHOLDS



4.0 TYPICAL APPLICATIONS

4.1 Mounting

If the TC623 is used to measure the temperature of another device, it is important that the top surface of the TC623 package be in intimate contact with the measured device. Good thermal conductivity and no air space is critical to accurate temperature measurement in applications of this type.

4.2 Trip Point Programming

The resistance values required for the HIGH SET and LOW SET inputs are calculated using the formula below:

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

Where;

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

For example, to program a trip point of 50°C, the programming resistor is:

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

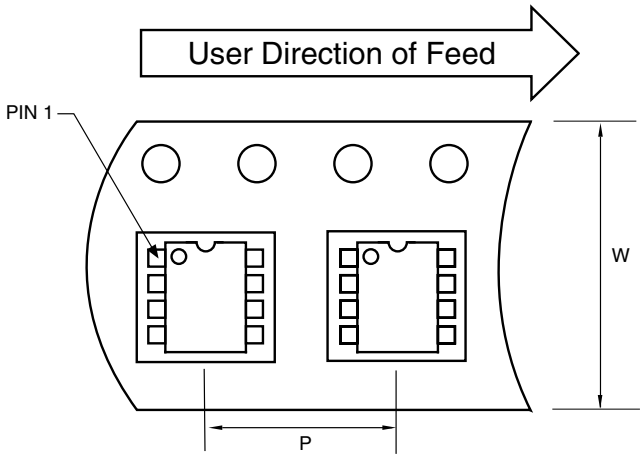
5.0 PACKAGING INFORMATION

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



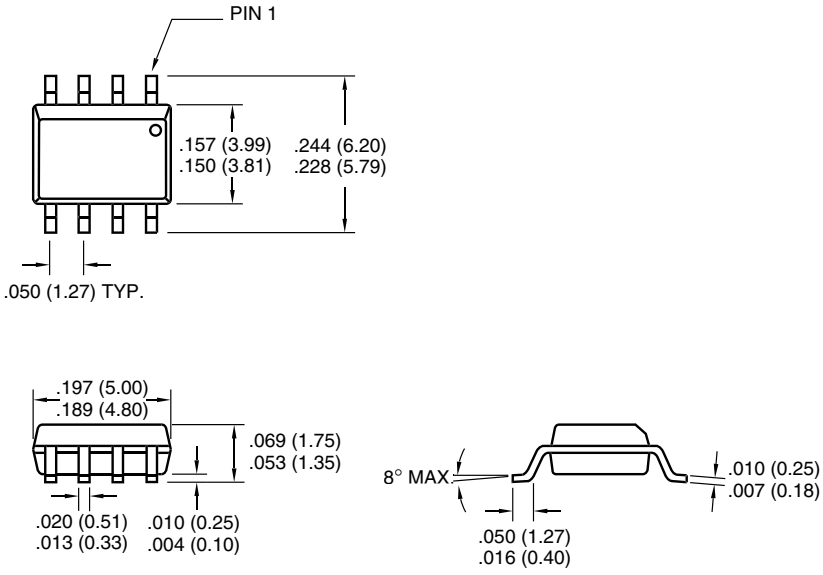
Standard Reel Component Orientation
for TR Suffix Device

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

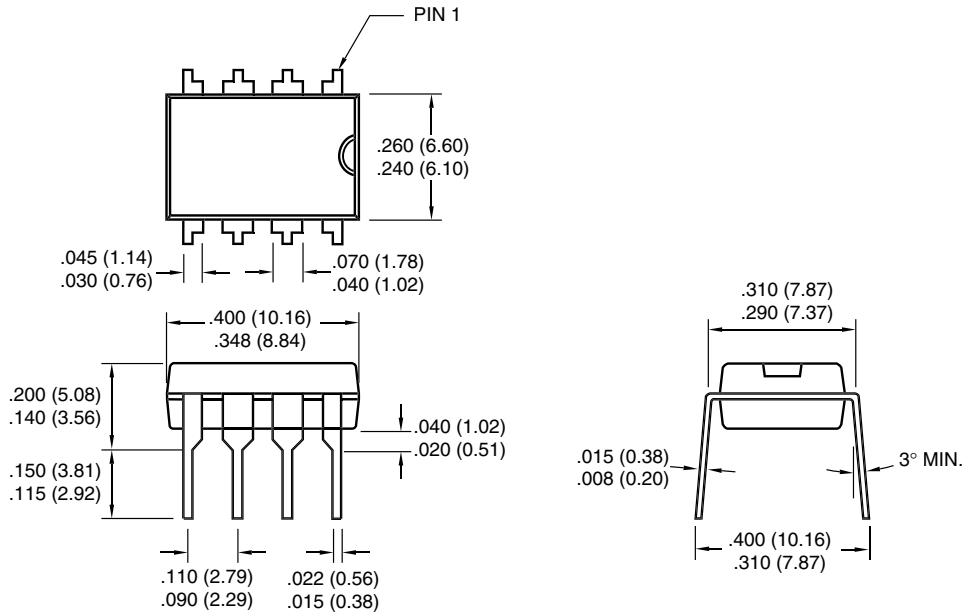
8-Pin SOIC



Dimensions: inches (mm)

Package Dimensions (Continued)

8-Pin Plastic DIP



Dimensions: inches (mm)

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

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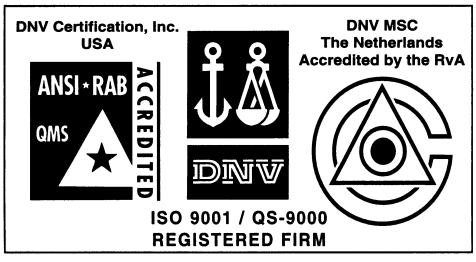

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