

Tiny Serial Digital Thermal Sensor

FEATURES

- Digital Temperature Sensing in SOT-23-5 Package
- Outputs Temperature as an 8-Bit Digital Word
- Simple Serial Port Interface
- Solid State Temperature Sensing $\pm 2^{\circ}\text{C}$ Accuracy from $+25^{\circ}\text{C}$ to $+85^{\circ}\text{C}$
..... $\pm 3^{\circ}\text{C}$ Accuracy from 0°C to $+125^{\circ}\text{C}$
- 3.0, and 5.5V Operating Range
- Low Power 200 μA Operating
5 μA Standby Mode

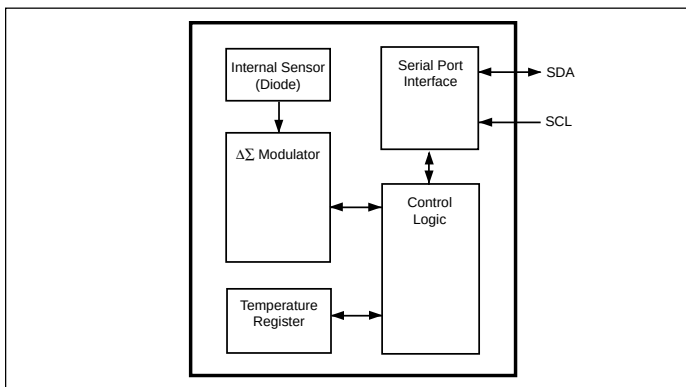
TYPICAL APPLICATIONS

- Thermal Protection for Hard Disk Drives and Other PC Peripherals
- PC-Card Devices for Notebook Computers
- Low-Cost Thermostat Controls
- Power Supplies
- Thermistor Replacement

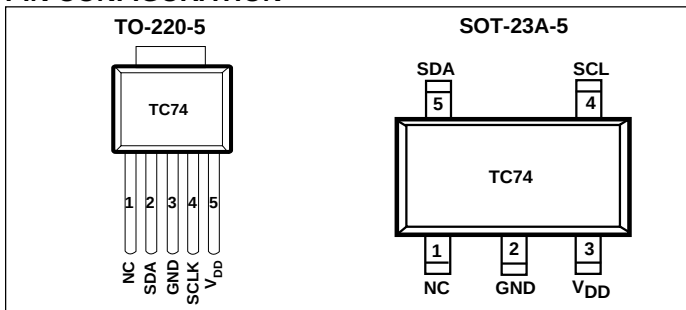
GENERAL DESCRIPTION

The TC74 is a serially accessible digital temperature sensor particularly suited for low cost and small form-factor applications. Temperature data is converted from the on-board thermal sensing element and made available as an 8-bit digital word.

FUNCTIONAL BLOCK DIAGRAM



PIN CONFIGURATION



Communication with the TC74 is accomplished via a simple 2-wire SMBus/I²C-compatible serial port. This bus also can be used to implement multi-drop/multi-zone monitoring. The SHDN bit in the CONFIG register can be used to activate the low-power Standby mode.

Temperature resolution is 1°C . Conversion rate is a nominal 8 samples/sec. Power consumption is only 200 μA (5 μA Standby).

Small size, low installed cost, and ease of use make the TC74 an ideal choice for implementing thermal management in a variety of systems.

ORDERING INFORMATION

Part No.	Package	Address	Temp. Range
TC74A0-3.3VCT	SOT-23A-5	1001 000	-40°C to $+125^{\circ}\text{C}$
TC74A1-3.3VCT	SOT-23A-5	1001 001	-40°C to $+125^{\circ}\text{C}$
TC74A2-3.3VCT	SOT-23A-5	1001 010	-40°C to $+125^{\circ}\text{C}$
TC74A3-3.3VCT	SOT-23A-5	1001 011	-40°C to $+125^{\circ}\text{C}$
TC74A4-3.3VCT	SOT-23A-5	1001 100	-40°C to $+125^{\circ}\text{C}$
TC74A5-3.3VCT*	SOT-23A-5	1001 101	-40°C to $+125^{\circ}\text{C}$
TC74A6-3.3VCT	SOT-23A-5	1001 110	-40°C to $+125^{\circ}\text{C}$
TC74A7-3.3VCT	SOT-23A-5	1001 111	-40°C to $+125^{\circ}\text{C}$
TC74A0-5.0VCT	SOT-23A-5	1001 000	-40°C to $+125^{\circ}\text{C}$
TC74A1-5.0VCT	SOT-23A-5	1001 001	-40°C to $+125^{\circ}\text{C}$
TC74A2-5.0VCT	SOT-23A-5	1001 010	-40°C to $+125^{\circ}\text{C}$
TC74A3-5.0VCT	SOT-23A-5	1001 011	-40°C to $+125^{\circ}\text{C}$
TC74A4-5.0VCT	SOT-23A-5	1001 100	-40°C to $+125^{\circ}\text{C}$
TC74A5-5.0VCT*	SOT-23A-5	1001 101	-40°C to $+125^{\circ}\text{C}$
TC74A6-5.0VCT	SOT-23A-5	1001 110	-40°C to $+125^{\circ}\text{C}$
TC74A7-5.0VCT	SOT-23A-5	1001 111	-40°C to $+125^{\circ}\text{C}$
TC74A0-3.3VAT	TO-220-5	1001 000	-40°C to $+125^{\circ}\text{C}$
TC74A1-3.3VAT	TO-220-5	1001 001	-40°C to $+125^{\circ}\text{C}$
TC74A2-3.3VAT	TO-220-5	1001 010	-40°C to $+125^{\circ}\text{C}$
TC74A3-3.3VAT	TO-220-5	1001 011	-40°C to $+125^{\circ}\text{C}$
TC74A4-3.3VAT	TO-220-5	1001 100	-40°C to $+125^{\circ}\text{C}$
TC74A5-3.3VAT	TO-220-5	1001 101	-40°C to $+125^{\circ}\text{C}$
TC74A6-3.3VAT	TO-220-5	1001 110	-40°C to $+125^{\circ}\text{C}$
TC74A7-3.3VAT	TO-220-5	1001 111	-40°C to $+125^{\circ}\text{C}$
TC74A0-5.0VAT	TO-220-5	1001 000	-40°C to $+125^{\circ}\text{C}$
TC74A1-5.0VAT	TO-220-5	1001 001	-40°C to $+125^{\circ}\text{C}$
TC74A2-5.0VAT	TO-220-5	1001 010	-40°C to $+125^{\circ}\text{C}$
TC74A3-5.0VAT	TO-220-5	1001 011	-40°C to $+125^{\circ}\text{C}$
TC74A4-5.0VAT	TO-220-5	1001 100	-40°C to $+125^{\circ}\text{C}$
TC74A5-5.0VAT	TO-220-5	1001 101	-40°C to $+125^{\circ}\text{C}$
TC74A6-5.0VAT	TO-220-5	1001 110	-40°C to $+125^{\circ}\text{C}$
TC74A7-5.0VAT	TO-220-5	1001 111	-40°C to $+125^{\circ}\text{C}$

*Default address.

TC74

ABSOLUTE MAXIMUM RATINGS*

Supply Voltage (V_{DD})	+6V
Voltage On Any Pin	(GND – 0.3V) to (V_{DD} + 0.3V)
Operating Temperature (T_A)	See Below
Storage Temperature (T_{STG})	– 65°C to +150°C
Current On Any Pin	±50 mA
Package Thermal Resistance (θ_{JA})	330°C/W

*Static-sensitive device. Unused devices must be stored in conductive material. Protect devices from static discharge and static fields. 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 operational sections of the specifications is not implied. Exposure to Absolute Maximum Rating Conditions for extended periods may affect device reliability.

ELECTRICAL CHARACTERISTICS: V_{DD} = 3.3V or 5.0V (Note 5), $-40^{\circ}\text{C} \leq T_A \leq 125^{\circ}\text{C}$, unless otherwise noted.

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
Power Supply						
V_{POR}	Power-On Reset Threshold	V_{DD} Falling Edge or Rising Edge	1.2	—	2.2	V
I_{DD}	Operating Current	V_{DD} = 5.5V Serial Port Inactive (Note 1)	—	200	350	μA
$I_{DD-STANDBY}$	Standby Supply Current	V_{DD} = 3.3V Serial Port Inactive (Note 4)	—	5	10	μA
Temperature-to-Bits Converter						
T_{ERR}	Temperature Accuracy TC74A	+25°C < T_A < +85°C 0°C < T_A < +125°C –40°C < T_A < 0°C	–2 –3 —	— — ±2	+2 +3 —	°C °C °C
CR	Conversion Rate	(Note 2)	4	8	—	Sa/Sec
Serial Port Interface						
V_{IH}	Logic Input High		0.8 x V_{DD}	—	—	V
V_{IL}	Logic Input Low		—	—	0.2 x V_{DD}	V
V_{OL}	SDA Output Low	I_{OL} = 3 mA I_{OL} = 6 mA (Note 3)	— —	— —	0.4 0.6	V V
C_{IN}	Input Capacitance SDA, SCL		—	5	—	pF
I_{LEAK}	I/O Leakage		–1	0.1	1	μA

- NOTES:**
- Operating current is an average value integrated over multiple conversion cycles. Transient current may exceed this specification.
 - Maximum guaranteed conversion time after Power-On RESET (POR to DATA_RDY) is 250 msec.
 - Output current should be minimized for best temperature accuracy. Power dissipation within the TC74 will cause self-heating and temperature drift error.
 - SDA and SCL must be connected to V_{DD} or GND.
 - V_{DD} = 3.3V for TC74x -3.3VCT. V_{DD} = 5.0V for TC74x -5.0VCT. All part types of the TC74 will operate properly over the wider power supply range of 2.7V to 5.5V. Each part type is tested and specified for rated accuracy at its nominal supply voltage. As V_{DD} varies from the nominal value, accuracy will degrade 1°C/V of V_{DD} change.

SERIAL PORT AC TIMING: V_{DD} = 3.3V or 5.0V (Note 5), $-40^{\circ}\text{C} \leq (T_A = T_J) \leq 125^{\circ}\text{C}$; C_L = 80 pF, unless otherwise noted.)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
f_{SMB}	SMBus Clock Frequency		10	—	100	KHz
t_{LOW}	Low Clock Period	10% to 10%	4.7	—	—	μsec
t_{HIGH}	High Clock Period	90% to 90%	4	—	—	μsec
t_R	SMBus Rise Time	10% to 90%	—	—	1000	nsec
t_F	SMBus Fall Time	90% to 10%	—	—	300	nsec
$t_{SU(START)}$	Start Condition Setup Time (for repeated Start Condition)	90% SCL to 10% SDA	4	—	—	μsec
$t_{H(START)}$	Start Condition Hold Time		4	—	—	μsec
$t_{SU-DATA}$	Data In Setup Time		1000	—	—	nsec

SERIAL PORT AC TIMING: ($V_{DD} = 3.3V$ or $5.0V$ (Note 5). $-40^{\circ}C \leq (T_A = T_J) \leq 125^{\circ}C$; $C_L = 80$ pF, unless otherwise noted.)

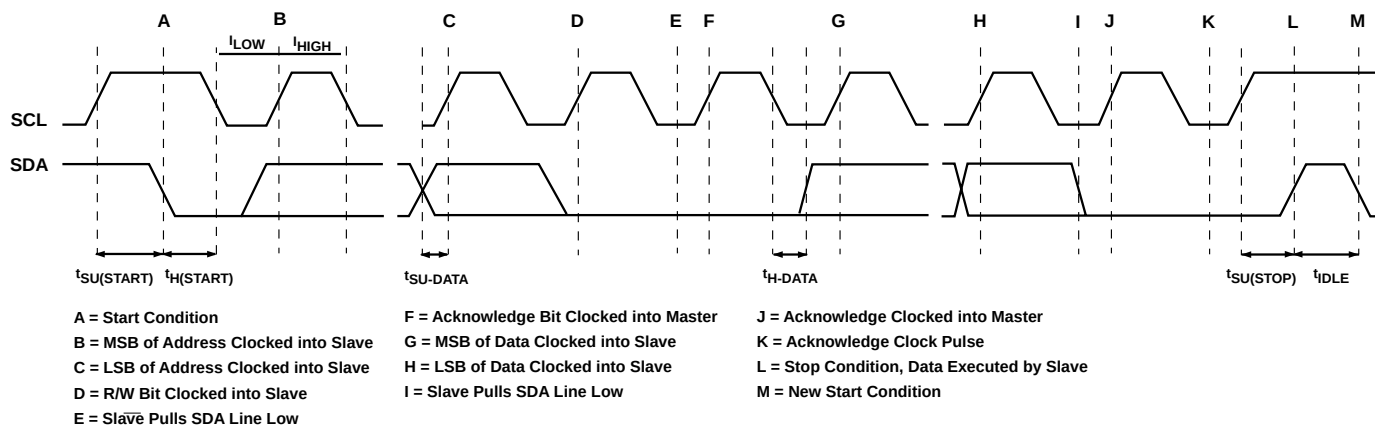
Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
t_{H-DATA}	Data In Hold Time		1250	—	—	nsec
$t_{SU(STOP)}$	Stop Condition Setup Time		4	—	—	μ sec
t_{IDLE}	Bus Free Time Prior to New Transition		4.7	—	—	μ sec
t_{POR}	Power-On Reset Delay	$V_{DD} \geq V_{POR}$ (Rising Edge)	—	500	—	μ sec

PIN DESCRIPTION

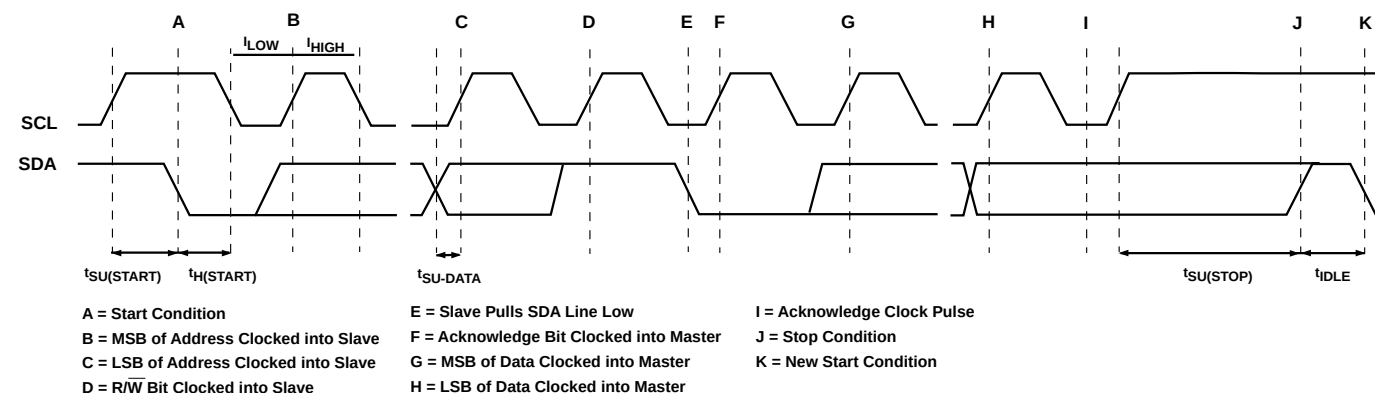
Pin No.	Symbol	Type	Description
1	NC	None	Not Connected
2	GND	Power	System Ground
3	V_{DD}	Power	Power Supply Input
4	SCL	Input	SMBus Serial Clock
5	SDA	Bi-Directional	SMBus Serial Data

TIMING DIAGRAMS

SMBUS Write Timing Diagram



SMBUS READ Timing Diagram



TC74

DETAILED DESCRIPTION

SCL

Input. SMBus serial clock. Clocks data into and out of the TC74. See System Management Bus Specification rev. 1.0 for timing diagrams.

SDA

Bi-directional. Serial data is transferred on the SMBus in both directions using this pin. See System Management Bus Specification rev. 1.0 for timing diagrams.

V_{DD}

Input. Power supply input. See electrical specifications.

GND

Input. Ground return for all TC74 functions.

FUNCTIONAL DESCRIPTION

The TC74 acquires and converts temperature information from its on-board solid state sensor with a basic accuracy of $\pm 1^{\circ}\text{C}$. It stores the data in an internal register which is read through the serial port. The system interface is a slave SMBus. The temperature data can be read at any time through the SMBus port. Eight SMBus addresses are programmable for the TC74, which allows for a multi-sensor configuration. Also, there is low-power Standby mode where temperature acquisition is suspended.

Standby Mode

The TC74 allows the host to put it into a low power ($I_{DD} = 5\mu\text{A}$, typical) Standby mode. In this mode, the A/D converter is halted and the temperature data registers are frozen. The SMBus port operates normally. Standby mode is enabled by setting the SHDN bit in the CONFIG register. The table below summarizes this operation.

Standby Mode Operation

SHDN Bit	Operating Mode
0	Normal
1	Standby

SMBus Slave Address

The TC74 is internally programmed to have a default SMBus address value of 1001 101b. Seven other addresses are available by custom order (contact factory).

SERIAL PORT OPERATION

The Serial Clock input (SCL) and bi-directional data port (SDA) form a 2-wire bi-directional serial port for programming and interrogating the TC74. The following conventions are used in this bus architecture:

TC74 Serial Bus Conventions

TERM	EXPLANATION
Transmitter	The device sending data to the bus.
Receiver	The device receiving data from the bus.
Master	The device which controls the bus: initiating transfers (START), generating the clock, and terminating transfers. (STOP)
Slave	The device addressed by the master.
Start	A unique condition signaling the beginning of a transfer indicated by SDA falling (High –Low) while SCL is high.
Stop	A unique condition signaling the end of a transfer indicated by SDA rising (Low –High) while SCL is high.
ACK	A Receiver acknowledges the receipt of each byte with this unique condition. The Receiver drives SDA low during SCL high of the ACK clock-pulse. The Master provides the clock pulse for the ACK cycle.
Busy	Communication is not possible because the bus is in use.
NOT Busy	When the bus is idle, both SDA and SCL will remain high.
Data Valid	The state of SDA must remain stable during the High period of SCL in order for a data bit to be considered valid. SDA only changes state while SCL is low during normal data transfers. (See Start and Stop conditions.)

All transfers take place under control of a host, usually a CPU or microcontroller, acting as the Master, which provides the clock signal for all transfers. The TC74 *always* operates as a Slave. The serial protocol is illustrated in Figure 1. All data transfers have two phases; all bytes are transferred MSB first. Accesses are initiated by a start condition (START), followed by a device address byte and one or more data bytes. The device address byte includes a Read/Write selection bit. Each access must be terminated by a Stop Condition (STOP). A convention called *Acknowledge* (ACK) confirms receipt of each byte. Note that SDA can change only during periods when SCL is LOW (SDA changes while SCL is HIGH are reserved for Start and Stop Conditions).

Write Byte Format

S	ADDRESS	WR	ACK	COMMAND	ACK	DATA	ACK	P
	7 Bits			8 Bits		8 Bits		

Slave Address

Command Byte: selects which register you are writing to.

Data Byte: data goes into the register set by the command byte.

Read Byte Format

S	ADDRESS	WR	ACK	COMMAND	ACK	S	ADDRESS	RD	ACK	DATA	NACK	P
	7 Bits			8 Bits			7 Bits			8 Bits		

Slave Address

Command Byte: selects which register you are reading from.

Slave Address: repeated due to change in data-flow direction.

Data Byte: reads from the register set by the command byte.

Receive Byte Format

S	ADDRESS	RD	ACK	DATA	NACK	P
	7 Bits			8 Bits		

Data Byte: reads data from the register commanded by the last Read Byte or Write Byte transmission.

S = Start Condition

P = Stop Condition

Shaded = Slave Transmission

Figure 1. SMBus Protocols

TC74

Start Condition (START)

The TC74 continuously monitors the SDA and SCL lines for a start condition (a HIGH to LOW transition of SDA while SCL is HIGH), and will not respond until this condition is met.

Address Byte

Immediately following the Start Condition, the host must transmit the address byte to the TC74. The states of A1 and A0 determine the 7-bit SMBus address for the TC74. The 7-bit address transmitted in the serial bit stream must match for the TC74 to respond with an Acknowledge (indicating the TC74 is on the bus and ready to accept data). The eighth bit in the Address Byte is a Read-Write Bit. This bit is a 1 for a read operation or 0 for a write operation. During the first phase of any transfer this bit will be set = 0 to indicate that the command byte is being written.

Acknowledge (ACK)

Acknowledge (ACK) provides a positive handshake between the host and the TC74. The host releases SDA after transmitting eight bits, then generates a ninth clock cycle to allow the TC74 to pull the SDA line LOW to acknowledge that it successfully received the previous eight bits of data or address.

Data Byte

After a successful ACK of the address byte, the host must transmit the data byte to be written or clock out the data to be read. (See the appropriate timing diagrams.) ACK will be generated after a successful write of a data byte into the TC74.

Stop Condition (STOP)

Communications must be terminated by a stop condition (a LOW to HIGH transition of SDA while SCL is HIGH). The Stop Condition must be communicated by the transmitter to the TC74. NOTE: Refer to Timing Diagrams for serial bus timing.

REGISTER SET AND PROGRAMMER'S MODEL

TC74 Command Set (SMBus READ_BYTE and WRITE_BYTE)

COMMAND BYTE DESCRIPTION		
COMMAND	CODE	FUNCTION
RTR	00h	Read Temperature (TEMP)
RWCR	01h	Read/Write Configuration (CONFIG)

Configuration Register (CONFIG), 8-BITS, READ/WRITE

CONFIGURATION REGISTER (CONFIG)							
D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]
SHDN	DATA_RDY	RESERVED					

BIT	POR	FUNCTION	TYPE	OPERATION
D[7]	0	STANDBY switch	ReadWrite	1 = standby, 0 = normal
D[6]	0	Data Ready*	Read Only	1 = ready, 0 = not ready
D[5]-D[0]	0	Reserved - Always returns zero when read.	N/A	N/A

*DATA_RDY bit reset at power-up and SHDN enable (see below).

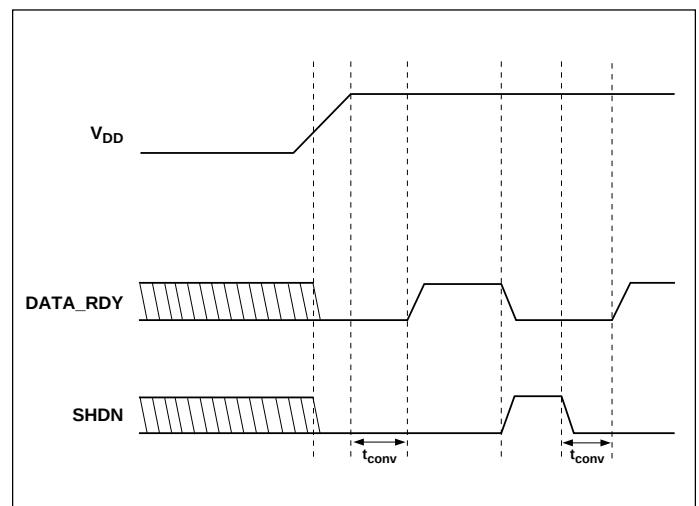


Figure 2. DATA_RDY, SHDN Operation Logic Diagram

Temperature Register (TEMP), 8-Bits, READ-ONLY

The binary value (2's complement format) in this register represents temperature of the on-board sensor following a conversion cycle. The registers are automatically updated in an alternating manner.

Temperature Register (TEMP)

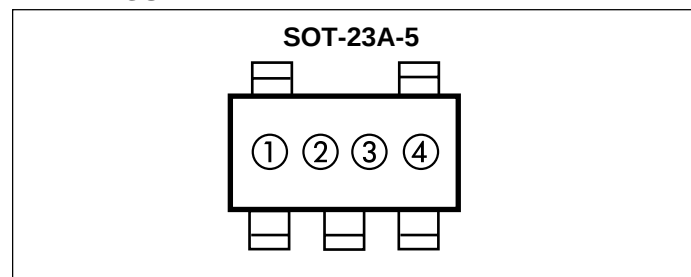
D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]
MSB	X	X	X	X	X	X	LSB

In the temperature data registers, each unit value represents one degree (Celsius). The value is in 2's-complement binary format such that a reading of 0000 0000b corresponds to 0°C. Examples of this temperature to binary value relationship are shown in the following table.

Temperature to Digital Value Conversion (TEMP)

ACTUAL TEMPERATURE	REGISTERED TEMPERATURE	BINARY HEX
+130.00°C	+127°C	0111 1111
+127.00°C	+127°C	0111 1111
+126.50°C	+127°C	0111 1111
+25.25°C	+25°C	0001 1001
+0.50°C	+1°C	0000 0001
+0.25°C	0°C	0000 0000
0.00°C	0°C	0000 0000
-0.25°C	0°C	0000 0000
-0.50°C	0°C	0000 0000
-0.75°C	-1°C	1111 1111
-1.00°C	-1°C	1111 1111
-25.00°C	-25°C	1110 0111
-25.25°C	-25°C	1110 0110
-54.75°C	-55°C	1100 1001
-55.00°C	-55°C	1100 1001
-65.00°C	-65°C	1011 1111

MARKINGS



- ① & ② = part number code + temperature range and voltage
- ③ represents year and quarter code
- ④ represents lot ID number

Register Set Summary

The TC74's register set is summarized below. All registers are 8-bits wide.

NAME	DESCRIPTION	POR State	READ	WRITE
TEMP	Internal Sensor Temperature (2's Complement)	0000 0000b*	✓	
CONFIG	CONFIG Register	0000 0000b	✓	✓

*NOTE: The TEMP register will be immediately updated by the A/D converter after the DATA_RDY bit goes high.

TC74 (V)

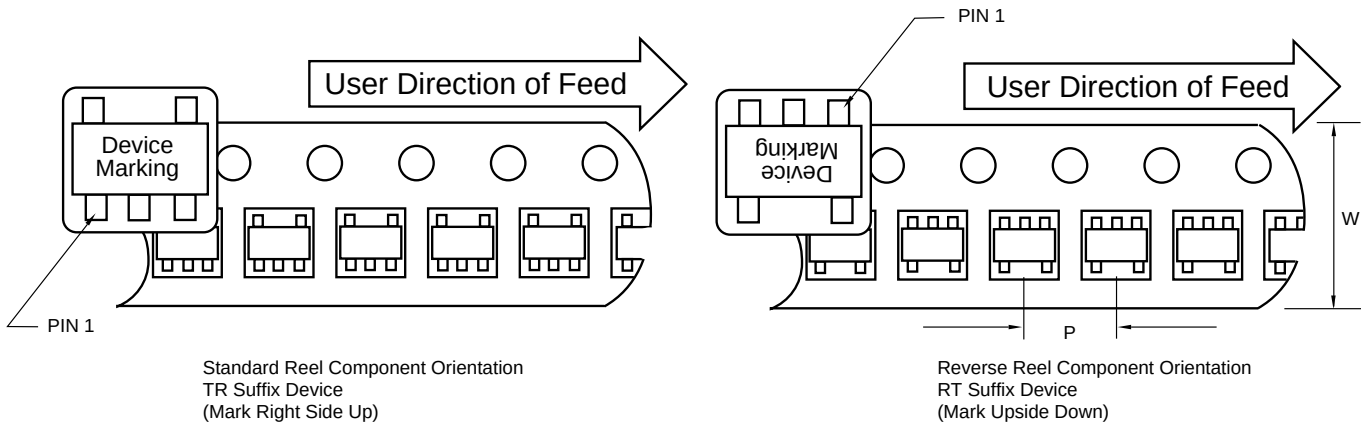
Code

TC74A0-3.3VCT	V0
TC74A1-3.3VCT	V1
TC74A2-3.3VCT	V2
TC74A3-3.3VCT	V3
TC74A4-3.3VCT	V4
TC74A5-3.3VCT	V5
TC74A6-3.3VCT	V6
TC74A7-3.3VCT	V7
TC74A0-5.0VCT	U0
TC74A1-5.0VCT	U1
TC74A2-5.0VCT	U2
TC74A3-5.0VCT	U3
TC74A4-5.0VCT	U4
TC74A5-5.0VCT	U5
TC74A6-5.0VCT	U6
TC74A7-5.0VCT	U7

TC74

TAPING FORM

Component Taping Orientation for 5-Pin SOT-23A (EIAJ SC-74A) Devices

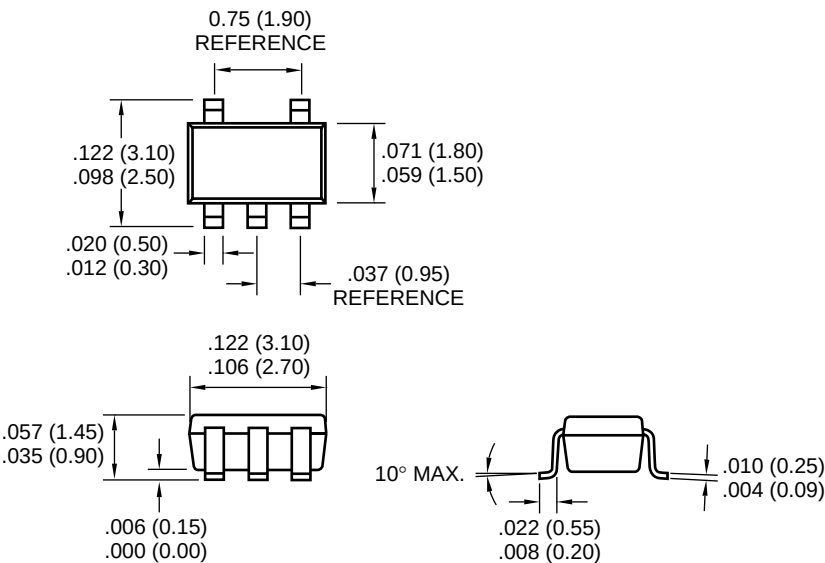


Carrier Tape, Number of Components Per Reel and Reel Size

Package	Carrier Width (W)	Pitch (P)	Part Per Full Reel	Reel Size
5-Pin SOT-23A	8 mm	4 mm	3000	7 in

PACKAGE DIMENSIONS

SOT-23A-5 EIAJ (SC-74A)



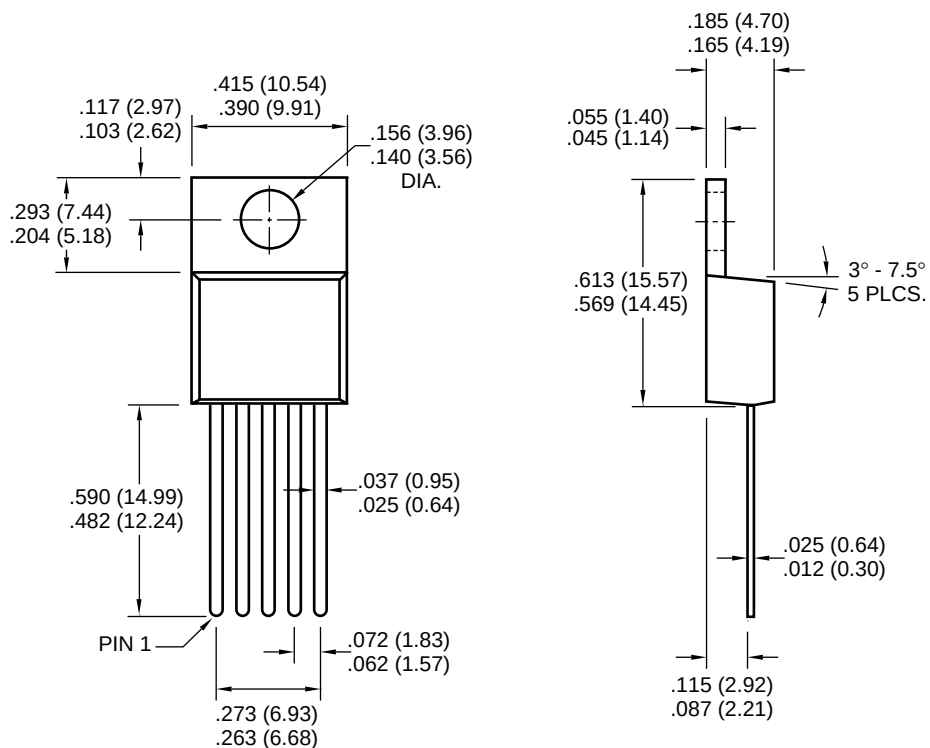
Dimensions: inches (mm)

Tiny Serial Digital Thermal Sensor

TC74

PACKAGE DIMENSIONS

5-Pin TO-220



Dimensions: inches (mm)



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

Austin

Analog Product Sales
8303 MoPac Expressway North
Suite A-201
Austin, TX 78759
Tel: 512-345-2030 Fax: 512-345-6085

Boston

2 Lan Drive, Suite 120
Westford, MA 01886
Tel: 978-692-3848 Fax: 978-692-3821

Boston

Analog Product Sales
Unit A-8-1 Millbrook Tarry Condominium
97 Lowell Road
Concord, MA 01742
Tel: 978-371-6400 Fax: 978-371-0050

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

Dayton

Two Prestige Place, Suite 130
Miamisburg, OH 45342
Tel: 937-291-1654 Fax: 937-291-9175

Detroit

Tri-Atria Office Building
32255 Northwestern Highway, Suite 190
Farmington Hills, MI 48334
Tel: 248-538-2250 Fax: 248-538-2260

Los Angeles

18201 Von Karman, Suite 1090
Irvine, CA 92612
Tel: 949-263-1888 Fax: 949-263-1338

Mountain View

Analog Product Sales
1300 Terra Bella Avenue
Mountain View, CA 94043-1836
Tel: 650-968-9241 Fax: 650-967-1590

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

China - Beijing

Microchip Technology Beijing Office
Unit 915
New China Hong Kong Manhattan Bldg.
No. 6 Chaoyangmen Beidajie
Beijing, 100027, No. China
Tel: 86-10-85282100 Fax: 86-10-85282104

China - Shanghai

Microchip Technology Shanghai Office
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

Hong Kong

Microchip Asia Pacific
RM 2101, 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'Shaughnessy Road
Bangalore, 560 025, India
Tel: 91-80-2290061 Fax: 91-80-2290062

Japan

Microchip Technology Intl. Inc.
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
Tel: 82-2-554-7200 Fax: 82-2-558-5934

ASIA/PACIFIC (continued)

Singapore

Microchip Technology Singapore Pte Ltd.
200 Middle Road
#07-02 Prime Centre
Singapore, 188980
Tel: 65-334-8870 Fax: 65-334-8850

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

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

Denmark

Microchip Technology Denmark ApS
Regus Business Centre
Lautrup høj 1-3
Ballerup DK-2750 Denmark
Tel: 45 4420 9895 Fax: 45 4420 9910

France

Arizona 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

Arizona Microchip Technology GmbH
Gustav-Heinemann Ring 125
D-81739 Munich, Germany
Tel: 49-89-627-144 0 Fax: 49-89-627-144-44

Germany

Analog Product Sales
Lochhamer Strasse 13
D-82152 Martinsried, Germany
Tel: 49-89-895650-0 Fax: 49-89-895650-22

Italy

Arizona 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

All rights reserved. © 2001 Microchip Technology Incorporated. Printed in the USA. 1/01



Printed on recycled paper.

01/09/01

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, except as maybe explicitly expressed herein, under any intellectual property rights. The Microchip logo and name are registered trademarks of Microchip Technology Inc. in the U.S.A. and other countries. All rights reserved. All other trademarks mentioned herein are the property of their respective companies.