

## Tiny Serial Digital Thermal Sensor

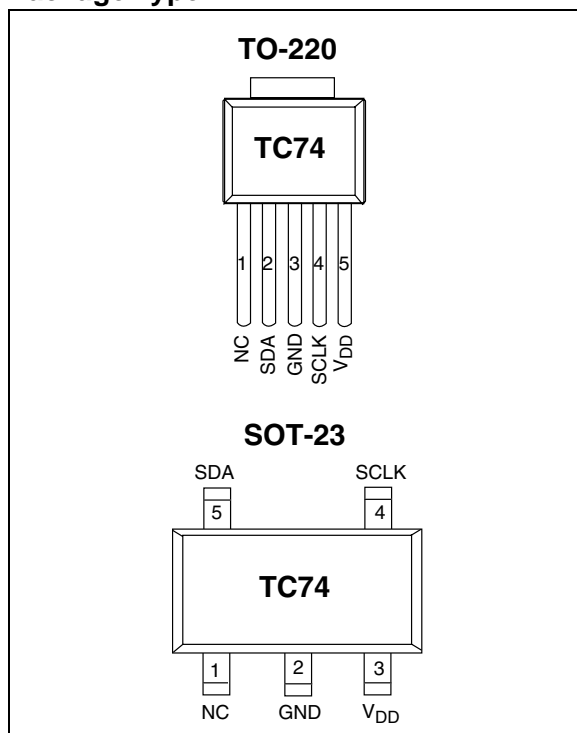
### Features

- 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  $0^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$
- 3.0 and 5.5V Operating Range
- Low Power:
  - $200\mu\text{A}$  Operating
  - $5\mu\text{A}$  Standby Mode

### 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

### Package Type



### General Description

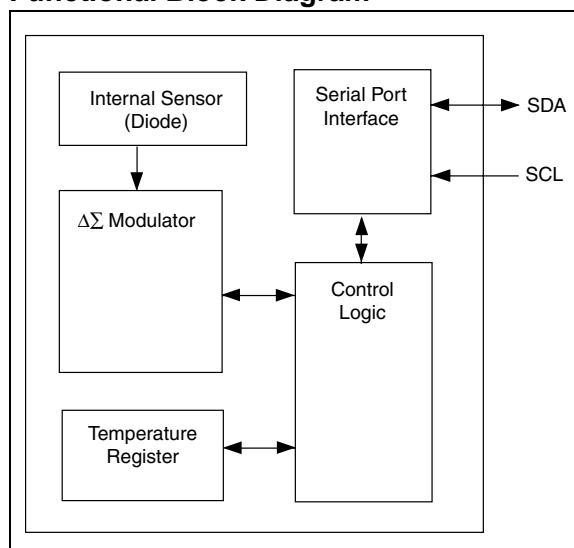
The TC74 is a serially accessible digital temperature sensor particularly suited for low cost and small form-factor applications. Temperature data is converted from the onboard thermal sensing element and made available as an 8-bit digital word.

Communication with the TC74 is accomplished via a 2-wire SMBus/I<sup>2</sup>C™ 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  $1^{\circ}\text{C}$ . Conversion rate is a nominal 8 samples/sec. Power consumption is only  $200\mu\text{A}$  typ, ( $5\mu\text{A}$  Standby, typ).

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

### Functional Block Diagram



# TC74

## Device Selection Table

Part Number	Package	Address	Temperature Range
TC74A0-3.3VCT	SOT-23A-5	1001 000	-40°C to +125°C
TC74A1-3.3VCT	SOT-23A-5	1001 001	-40°C to +125°C
TC74A2-3.3VCT	SOT-23A-5	1001 010	-40°C to +125°C
TC74A3-3.3VCT	SOT-23A-5	1001 011	-40°C to +125°C
TC74A4-3.3VCT	SOT-23A-5	1001 100	-40°C to +125°C
TC74A5-3.3VCT*	SOT-23A-5	1001 101*	-40°C to +125°C
TC74A6-3.3VCT	SOT-23A-5	1001 110	-40°C to +125°C
TC74A7-3.3VCT	SOT-23A-5	1001 111	-40°C to +125°C
TC74A0-5.0VCT	SOT-23A-5	1001 000	-40°C to +125°C
TC74A1-5.0VCT	SOT-23A-5	1001 001	-40°C to +125°C
TC74A2-5.0VCT	SOT-23A-5	1001 010	-40°C to +125°C
TC74A3-5.0VCT	SOT-23A-5	1001 011	-40°C to +125°C
TC74A4-5.0VCT	SOT-23A-5	1001 100	-40°C to +125°C
TC74A5-5.0VCT*	SOT-23A-5	1001 101	-40°C to +125°C
TC74A6-5.0VCT	SOT-23A-5	1001 110	-40°C to +125°C
TC74A7-5.0VCT	SOT-23A-5	1001 111	-40°C to +125°C
TC74A0-3.3VAT	TO-220-5	1001 000	-40°C to +125°C
TC74A1-3.3VAT	TO-220-5	1001 001	-40°C to +125°C
TC74A2-3.3VAT	TO-220-5	1001 010	-40°C to +125°C
TC74A3-3.3VAT	TO-220-5	1001 011	-40°C to +125°C
TC74A4-3.3VAT	TO-220-5	1001 100	-40°C to +125°C
TC74A5-3.3VAT	TO-220-5	1001 101	-40°C to +125°C
TC74A6-3.3VAT	TO-220-5	1001 110	-40°C to +125°C
TC74A7-3.3VAT	TO-220-5	1001 111	-40°C to +125°C
TC74A0-5.0VAT	TO-220-5	1001 000	-40°C to +125°C
TC74A1-5.0VAT	TO-220-5	1001 001	-40°C to +125°C
TC74A2-5.0VAT	TO-220-5	1001 010	-40°C to +125°C
TC74A3-5.0VAT	TO-220-5	1001 011	-40°C to +125°C
TC74A4-5.0VAT	TO-220-5	1001 100	-40°C to +125°C
TC74A5-5.0VAT	TO-220-5	1001 101	-40°C to +125°C
TC74A6-5.0VAT	TO-220-5	1001 110	-40°C to +125°C
TC74A7-5.0VAT	TO-220-5	1001 111	-40°C to +125°C

**NOTE:** \*Default Address.

## 1.0 ELECTRICAL CHARACTERISTICS

### Absolute Maximum Ratings\*

Supply Voltage ( $V_{DD}$ ) .....	+6V
Voltage On Any Pin .....	(GND – 0.3V) to ( $V_{DD}$ + 0.3V)
Current On Any Pin .....	±50 mA
Operating Temperature ( $T_A$ ) .....	See Below
Storage Temperature ( $T_{STG}$ ) .....	-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.

### TC74 ELECTRICAL SPECIFICATIONS

Electrical Characteristics: $V_{DD} = 3.3V$ or $5.0V$ (Note 5), $-40^\circ C \leq T_A \leq 125^\circ C$ , unless otherwise noted.						
Symbol	Parameter	Min	Typ.	Max	Unit	Test Conditions
<b>Power Supply</b>						
$V_{POR}$	Power-on Reset Threshold	1.2	—	2.2	V	$V_{DD}$ Falling Edge or Rising Edge
$I_{DD}$	Operating Current	—	200	350	μA	$V_{DD} = 5.5V$ Serial Port Inactive (Note 1)
$I_{DD-STANDBY}$	Standby Supply Current	—	5	10	μA	$V_{DD} = 3.3V$ Serial Port Inactive (Note 1)
<b>Temperature to Bits Converter</b>						
$T_{ERR}$	Temperature Accuracy TC74A	-2 -3 —	—	+2 — +2	°C	+25°C < $T_A$ < +85°C 0°C < $T_A$ < +125°C -40°C < $T_A$ < 0°C
CR	Conversion Rate	4	8	—	Sps	(Note 2)
<b>Serial Port Interface</b>						
$V_{IH}$	Logic Input High	$0.8 \times V_{DD}$	—	—	V	
$V_{IL}$	Logic Input Low	—	—	$0.2 \times V_{DD}$	V	
$V_{OL}$	SDA Output Low	— —	— —	0.4 0.6	V V	$I_{OL} = 3$ mA $I_{OL} = 6$ mA (Note 3)
$C_{IN}$	Input Capacitance SDA, SCL	—	5	—	pF	
$I_{LEAK}$	I/O Leakage	-1	0.1	1	μA	

- Note**
- 1: Operating current is an average value integrated over multiple conversion cycles. Transient current may exceed this specification.
  - 2: Maximum ensured conversion time after Power-on Reset (POR to DATA\_RDY) is 250 msec.
  - 3: Output current should be minimized for best temperature accuracy. Power dissipation within the TC74 will cause self-heating and temperature drift error.
  - 4: SDA and SCLK must be connected to  $V_{DD}$  or GND.
  - 5:  $V_{DD} = 3.3V$  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.

# TC74

## TC74 ELECTRICAL SPECIFICATIONS (CONTINUED)

Electrical Characteristics: $V_{DD} = 3.3V$ or $5.0V$ (Note 5), $-40^{\circ}C \leq T_A \leq 125^{\circ}C$ , $C_L = 80pF$ unless otherwise noted.						
Serial Port AC Timing						
Symbol	Parameter	Min	Typ.	Max	Unit	Test Conditions
$f_{SMB}$	SMBus Clock Frequency	10	—	100	kHz	
$t_{LOW}$	Low Clock Period	4.7	—	—	$\mu sec$	10% to 10%
$t_{HIGH}$	High Clock Period	4	—	—	$\mu sec$	90% to 90%
$t_R$	SMBus Rise Time	—	—	1000	nsec	10% to 90%
$t_F$	SMBus Fall Time	—	—	300	nsec	90% to 10%
$t_{SU(START)}$	START Condition Setup Time (for repeated START Condition)	4	—	—	$\mu sec$	90% SCLK to 10% SDA
$t_{H(START)}$	START Condition Hold Time	4	—	—	$\mu sec$	
$t_{SU-DATA}$	Data In Setup Time	1000	—	—	nsec	
$t_{H-DATA}$	Data In Hold Time	1250	—	—	nsec	
$t_{SU(STOP)}$	STOP Condition Setup Time	4	—	—	$\mu sec$	
$t_{IDLE}$	Bus Free Time Prior to New Transition	4.7	—	—	$\mu sec$	
$t_{POR}$	Power-on Reset Delay	—	500	—	$\mu sec$	$V_{DD} \geq V_{POR}$ (Rising Edge)

- Note**
- 1: Operating current is an average value integrated over multiple conversion cycles. Transient current may exceed this specification.
  - 2: Maximum ensured conversion time after Power-on Reset (POR to DATA\_RDY) is 250 msec.
  - 3: Output current should be minimized for best temperature accuracy. Power dissipation within the TC74 will cause self-heating and temperature drift error.
  - 4: SDA and SCLK must be connected to  $V_{DD}$  or GND.
  - 5:  $V_{DD} = 3.3V$  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  $1^{\circ}C/V$  of  $V_{DD}$  change.

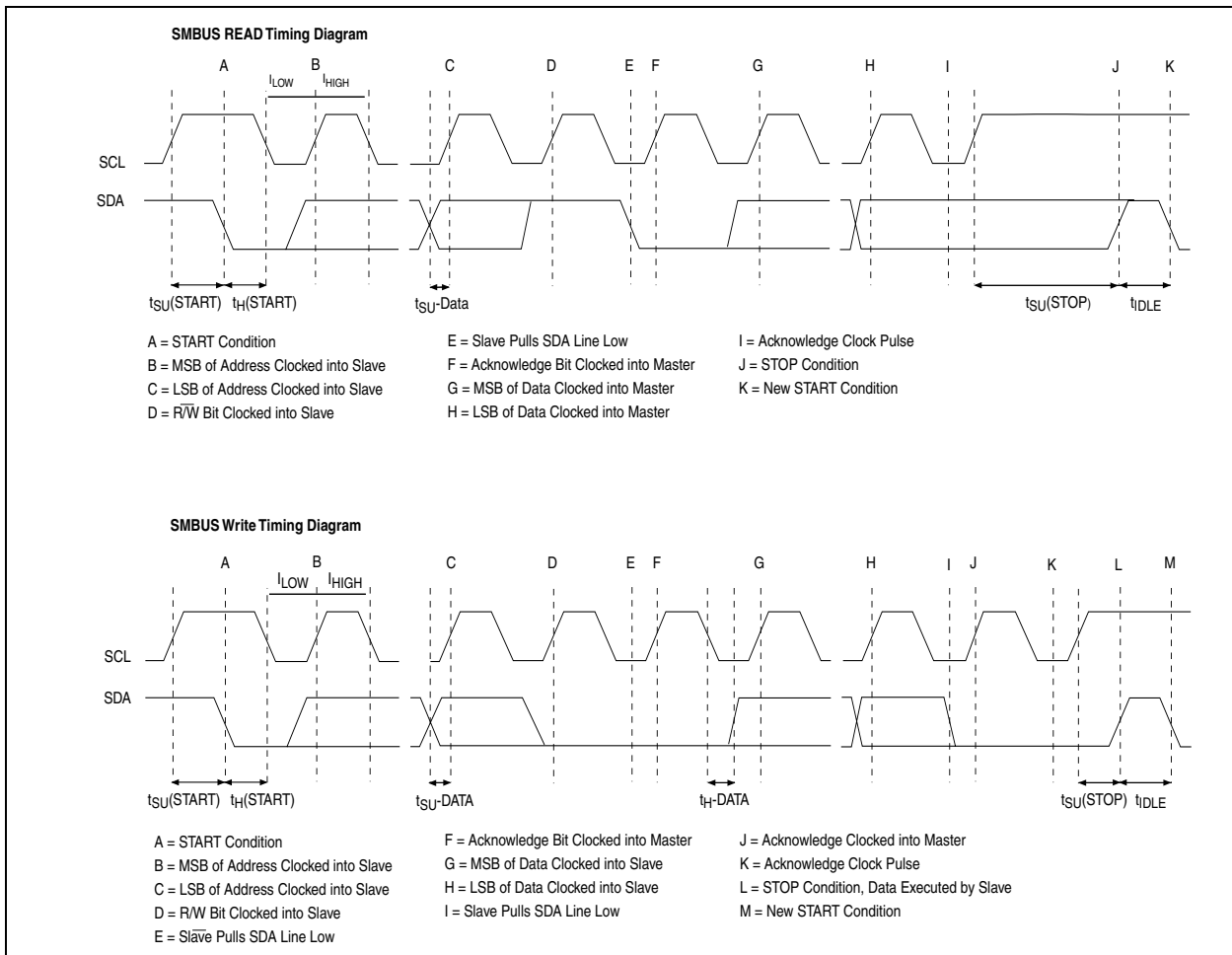
## 2.0 PIN DESCRIPTIONS

The descriptions of the pins are listed in Table 2-1.

**TABLE 2-1: PIN FUNCTION TABLE**

Pin Number (5-Pin SOT-23)	Pin Number (5-Pin TO-220)	Symbol	Type	Description
1	1	NC	None	No Internal Connection.
2	3	GND	Power	System Ground
3	5	V <sub>DD</sub>	Power	Power Supply Input
4	4	SCLK	Input	SMBus Serial Clock
5	2	SDA	Bi-directional	SMBus Serial Data

## Timing Diagrams



## 3.0 DETAILED DESCRIPTION

### 3.1 Functional Description

The TC74 acquires and converts temperature information from its onboard solid-state sensor with a resolution 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 when temperature acquisition is suspended.

#### 3.1.1 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. Table 3-1 summarizes this operation.

**TABLE 3-1: STANDBY MODE OPERATION**

SHDN Bit	Operating Mode
0	Normal
1	Standby

#### 3.1.2 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).

### 3.2 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:

**TABLE 3-2: 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 3-1 All data transfers have two phases; all bytes are transferred MSB first. Accesses are initiated by a START condition, 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. 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).

**FIGURE 3-1: SMBUS PROTOCOLS**

**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		

S = START Condition

P = STOP Condition

Shaded = Slave Transmission

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

### 3.3 START Condition (S)

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.

### 3.4 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 8-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.

### 3.5 Acknowledge (ACK)

Acknowledge (ACK) provides a positive handshake between the host and the TC74. The host releases SDA after transmitting 8 bits. The host then generates a ninth clock cycle to allow the TC74 to pull the SDA line LOW. This action acknowledges that the TC74 successfully received the previous eight bits of data or address.

### 3.6 Data Byte

After a successful ACK of the address byte, the host must transmit the data byte to be written or clock in 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.

### 3.7 STOP Condition (P)

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.



## 4.0 REGISTER SET AND PROGRAMMER'S MODEL

**TABLE 4-1: COMMAND BYTE DESCRIPTION (SMBUS READ\_BYTE AND WRITE\_BYTE)**

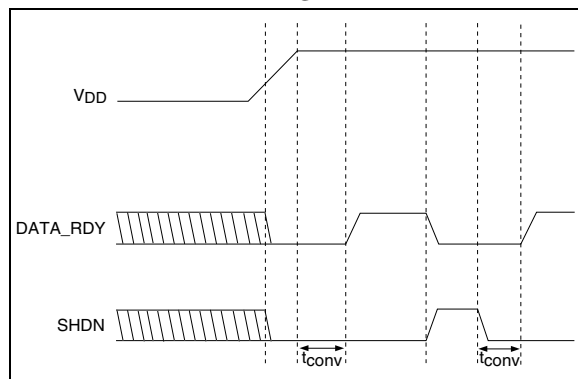
COMMAND	CODE	FUNCTION
RTR	00h	Read Temperature (TEMP)
RWCR	01h	Read/Write Configuration (CONFIG)

**TABLE 4-2: CONFIGURATION REGISTER (CONFIG); 8 BITS, READ/WRITE**

BIT	POR	FUNCTION	TYPE	OPERATION
D[7]	0	STANDBY Switch	Read/Write	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

\*Note: DATA\_RDY bit RESET at power-up and SHDN enable.

**FIGURE 4-1: DATA\_RDY, SHDN OPERATION LOGIC DIAGRAM**



### 4.1 Temperature Register (TEMP), 8 Bits, READ ONLY

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

**TABLE 4-3: 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 Table 4-4.

**TABLE 4-4: TEMPERATURE TO DIGITAL VALUE CONVERSION (TEMP)**

ACTUAL TEMP.	REGISTERED TEMP.	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

### 4.2 Register Set Summary

The TC74 register set is summarized in Table 4-5. All registers are 8 bits wide.

**TABLE 4-5: TC74 REGISTER SET SUMMARY**

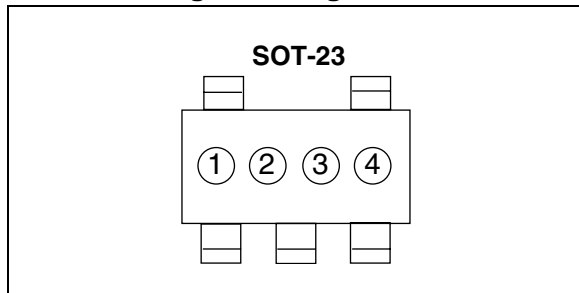
NAME	DESCRIPTION	POR State	READ	WRITE
TEMP	Internal Sensor Temp. (2's Complement)	0000 0000b*	✓	
CONFIG	CONFIG Register	0000 0000b	✓	✓

\*Note: The TEMP register will be immediately updated by the A/D converter after the DATA\_RDY Bit goes High.

# TC74

## 5.0 PACKAGING INFORMATION

### 5.1 Package Marking Information



1 & 2 = part number code + temperature range and voltage

3 = year and quarter code

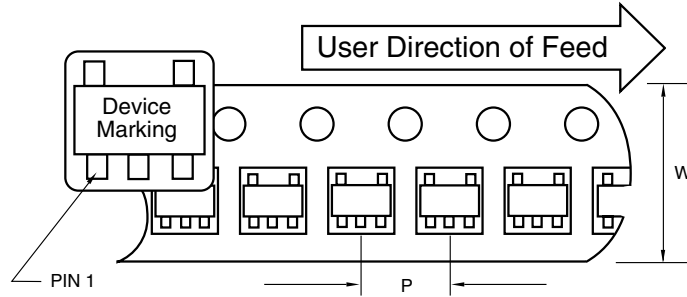
4 = lot ID number

TABLE 5-1: PACKAGE MARKING CODES

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

## 5.2 Taping Forms

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



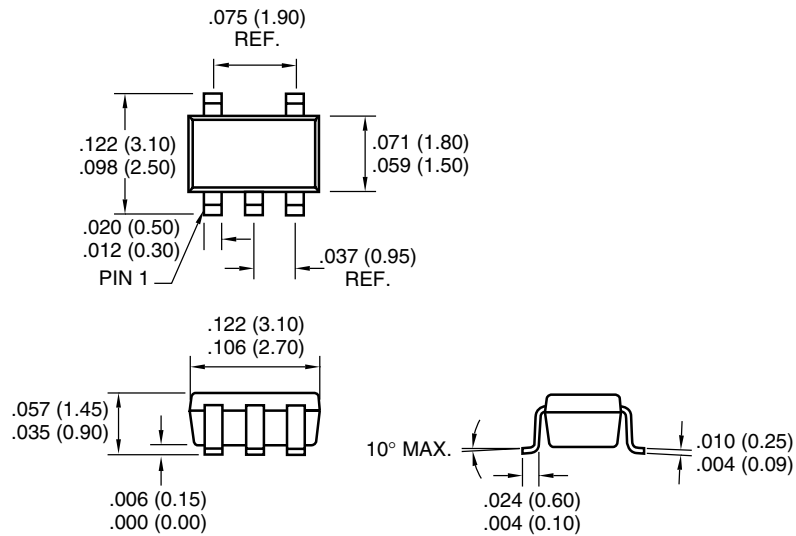
Standard Reel Component Orientation  
TR Suffix Device  
(Mark Right Side Up)

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

## 5.3 Package Dimensions

### SOT-23A-5



Dimensions: inches (mm)

# TC74

---

---

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](http://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](http://www.microchip.com/cn)) to receive the most current information on our products.

# TC74

---

---

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

