

## 2-Wire Serial Temperature Sensor and Thermal Monitor

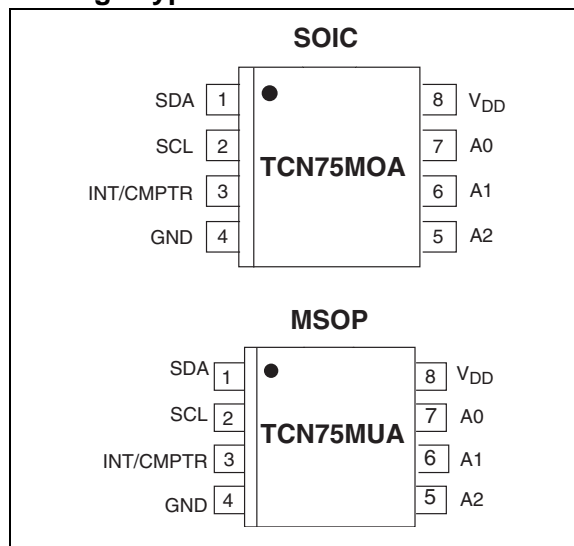
### Features:

- Solid-State Temperature Sensing:  
0.5°C Accuracy (Typ.)
- Operates from -55°C to +125°C
- Operating Supply Range: 2.7V to 5.5V
- Programmable Trip Point and Hysteresis with Power-up Defaults
- Standard 2-Wire Serial Interface
- Thermal Event Alarm Output Functions as Interrupt or Comparator/Thermostat Output
- Up to 8 TCN75s may Share the Same Bus
- Shutdown Mode for Low Standby Power Consumption
- 5V Tolerant I/O at  $V_{DD} = 3V$
- Low Power:
  - 250  $\mu A$  (Typ.) Operating
  - 1  $\mu A$  (Typ.) Shutdown Mode
- 8-Pin SOIC and MSOP Packaging

### Applications:

- Thermal Protection for High-Performance CPUs
- Solid-State Thermometer
- Fire/Heat Alarms
- Thermal Management in Electronic Systems:
  - Computers
  - Telecom Racks
  - Power Supplies/UPS/Amplifiers
- Copiers/Office Electronics
- Consumer Electronics
- Process Control

### Package Type



### General Description:

The TCN75 is a serially programmable temperature sensor that notifies the host controller when ambient temperature exceeds a user programmed set point. Hysteresis is also programmable. The INT/CMPTR output is programmable as either a simple comparator for thermostat operation or as a temperature event interrupt. Communication with the TCN75 is accomplished via a two-wire bus that is compatible with industry standard protocols. This permits reading the current temperature, programming the set point and hysteresis, and configuring the device.

The TCN75 powers up in Comparator mode with a default set point of 80°C with 5°C hysteresis. Defaults allow independent operation as a stand-alone thermostat. A shutdown command may be sent via the 2-wire bus to activate the low-power Standby mode. Address selection inputs allow up to eight TCN75s to share the same 2-wire bus for multizone monitoring.

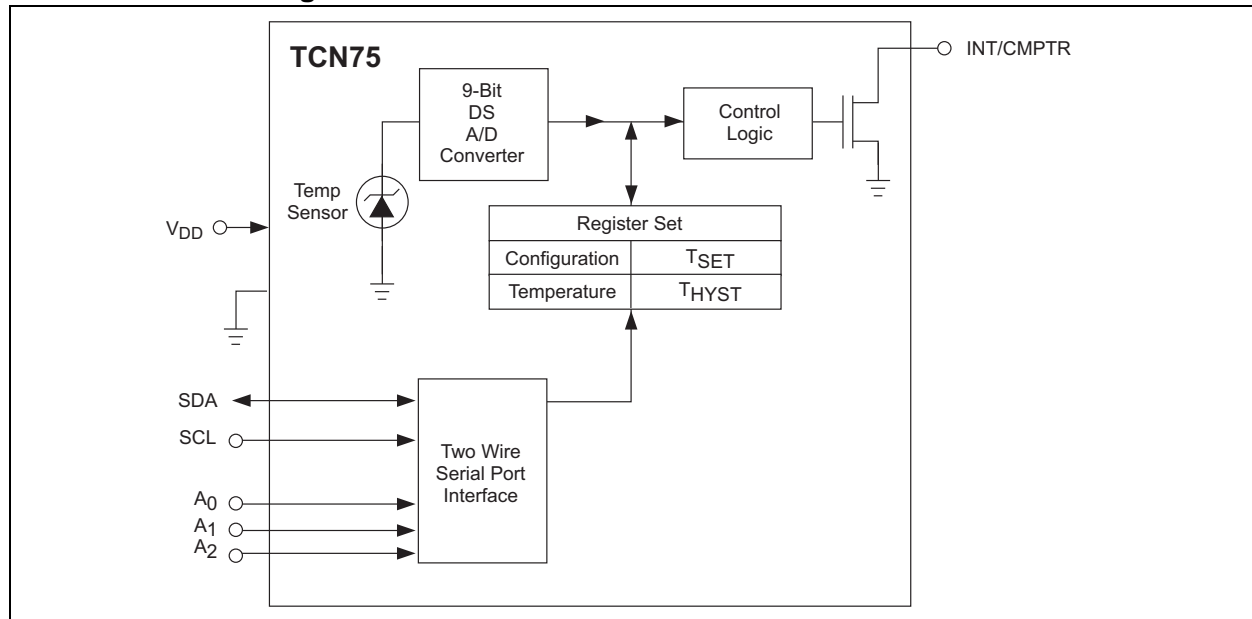
All registers can be read by the host and the INT/CMPTR output's polarity is user programmable. Both polled and interrupt driven systems are easily accommodated. Small physical size, low installed cost, and ease-of-use make the TCN75 an ideal choice for implementing sophisticated system management schemes.

# TCN75

## Device Selection Table

Part Number	Supply Voltage	Package	Junction Temperature Range
TCN75-3.3MOA	3.3	8-Pin SOIC	-55°C to +125°C
TCN75-5.0MOA	5.0	8-Pin SOIC	-55°C to +125°C
TCN75-3.3MUA	3.3	8-Pin MSOP	-55°C to +125°C
TCN75-5.0MUA	5.0	8-Pin MSOP	-55°C to +125°C

## Functional Block Diagram



## 1.0 ELECTRICAL CHARACTERISTICS

### Absolute Maximum Ratings\*

Supply Voltage ( $V_{DD}$ ) .....	6.0V
ESD Susceptibility ( <b>Note 3</b> ) .....	1000V
Voltage on Pins:	
A0, A1, A2 .....	(GND – 0.3V) to ( $V_{DD}$ + 0.3V)
Voltage on Pins:	
SDA, SCL, INT/CMPTR ..	(GND – 0.3V) to 5.5V
Thermal Resistance (Junction to Ambient)	
8-Pin SOIC .....	170°C/W
8-Pin MSOP .....	250°C/W
Operating Temperature Range ( $T_J$ ):	-55°C to +125°C
Storage Temperature Range ( $T_{STG}$ ):	-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.

### TCN75 ELECTRICAL SPECIFICATIONS

Electrical Characteristics: $V_{DD} = 2.7V - 5.5V$ , $-55^{\circ}C \leq (T_A = T_J) \leq 125^{\circ}C$ , unless otherwise noted.						
Symbol	Parameter	Min	Typ	Max	Units	Test Conditions
<b>Power Supply</b>						
$V_{DD}$	Power Supply Voltage	2.7	—	5.5	—	
$I_{DD}$	Operating Current	—	0.250	—	mA	Serial Port Inactive ( $T_A = T_J = 25^{\circ}C$ ) Serial Port Active
$I_{DD1}$	Standby Supply Current	—	1	—	$\mu A$	Shutdown Mode, Serial Port Inactive ( $T_A = T_J = 25^{\circ}C$ )
<b>INT/CMPTR Output</b>						
$I_{OL}$	Sink Current: INT/CMPTR, SDA Outputs	—	1	4	mA	<b>Note 1</b>
$t_{TRIP}$	INT/CMPTR Response Time	1	—	6	$t_{CONV}$	User Programmable
$V_{OL}$	Output Low Voltage	—	—	0.8	V	$I_{OL} = 4.0$ mA
<b>Temp-to-Bits Converter</b>						
$\Delta T$	Temperature Accuracy ( <b>Note 2</b> )	—	$\pm 3$	—	$^{\circ}C$	$-55^{\circ}C \leq T_A \leq +125^{\circ}C$ $V_{DD} = 3.3V$ : TCN75-3.3 MOA, TCN75-3.3 MUA $V_{DD} = 5.0V$ : TCN75-5.0 MOA, TCN75-5.0 MUA
		—	$\pm 0.5$	$\pm 3$	$^{\circ}C$	$25^{\circ}C \leq T_A \leq 100^{\circ}C$
$t_{CONV}$	Conversion Time	—	55	—	msec	
$T_{SET(PU)}$	TEMP Default Value	—	80	—	$^{\circ}C$	Power-up
$T_{HYST(PU)}$	$T_{HYST}$ Default Value	—	75	—	$^{\circ}C$	Power-up
<b>2-Wire Serial Bus Interface</b>						
$V_{IH}$	Logic Input High	$V_{DD} \times 0.7$	—	—	V	
$V_{IL}$	Logic Input Low	—	—	$V_{DD} \times 0.3$	V	
$V_{OL}$	Logic Output Low	—	—	0.4	V	$I_{OL} = 3$ mA
$C_{IN}$	Input Capacitance SDA, SCL	—	15	—	pF	
$I_{LEAK}$	I/O Leakage	—	$\pm 100$	—	$\mu A$	( $T_A = T_J = 25^{\circ}C$ )
$I_{OL(SDA)}$	SDA Output Low Current	—	—	6	mA	

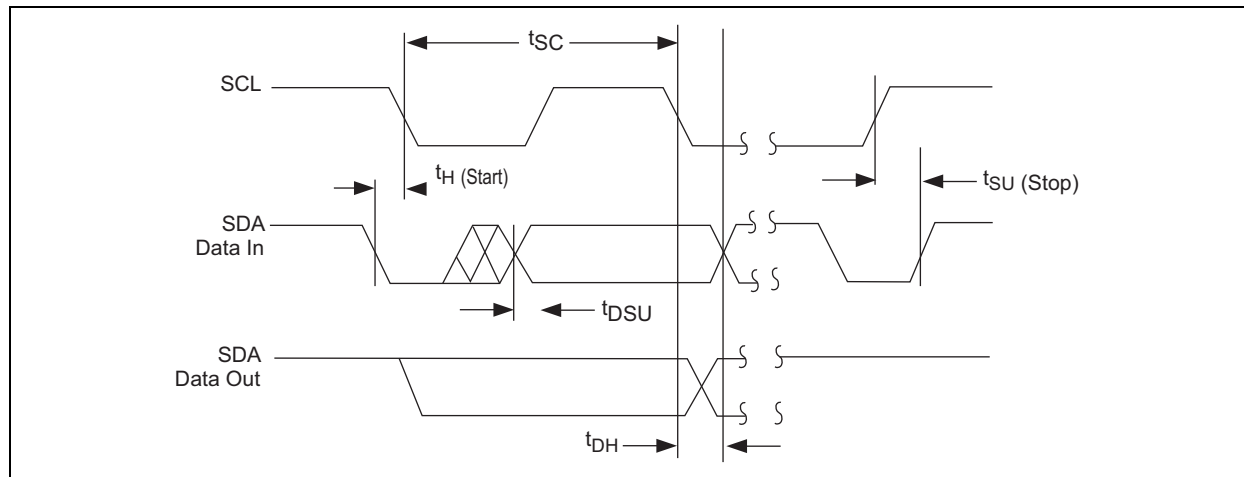
# TCN75

## TCN75 ELECTRICAL SPECIFICATIONS (CONTINUED)

Electrical Characteristics: $2.7V \leq V_{DD} \leq 5.5V$ ; $-55^{\circ}C \leq (T_A = T_J) \leq 125^{\circ}C$ , $C_L = 80$ pF, unless otherwise noted.						
Symbol	Parameter	Min	Typ	Max	Unit	Test Conditions
<b>Serial Port Timing</b>						
$f_{SC}$	Serial Port Frequency	0	100	400	kHz	
$t_{LOW}$	Low Clock Period	1250	—	—	nsec	
$t_{HIGH}$	High Clock Period	1250	—	—	nsec	
$t_R$	SCL and SDA Rise Time	—	—	250	nsec	
$t_F$	SCL and SDA Fall Time	—	—	250	nsec	
$t_{SU(START)}$	Start Condition Setup Time (for repeated Start Condition)	1250	—	—	nsec	
$t_{SC}$	SCL Clock Period	2.5	—	—	$\mu$ sec	
$t_{H(START)}$	Start Condition Hold Time	100	—	—	nsec	
$t_{DSU}$	Data in Setup Time to SCL High	100	—	—	nsec	
$t_{DH}$	Data in Hold Time after SCL Low	0	—	—	nsec	
$t_{SU(STOP)}$	Stop Condition Setup Time	100	—	—	nsec	
$t_{IDLE}$	Bus Free Time Prior to New Transition	1250	—	—	nsec	

- Note 1:** Output current should be minimized for best temperature accuracy. Power dissipation within the TCN75 will cause self-heating and temperature drift. At maximum rated output current and saturation voltage, 4 mA and 0.8V, respectively, the error amounts to 0.544°C for the SOIC.
- Note 2:** All part types of the TCN75 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.
- Note 3:** Human body model, 100 pF discharged through a 1.5k resistor.

## TIMING DIAGRAM



## 2.0 PIN DESCRIPTIONS

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

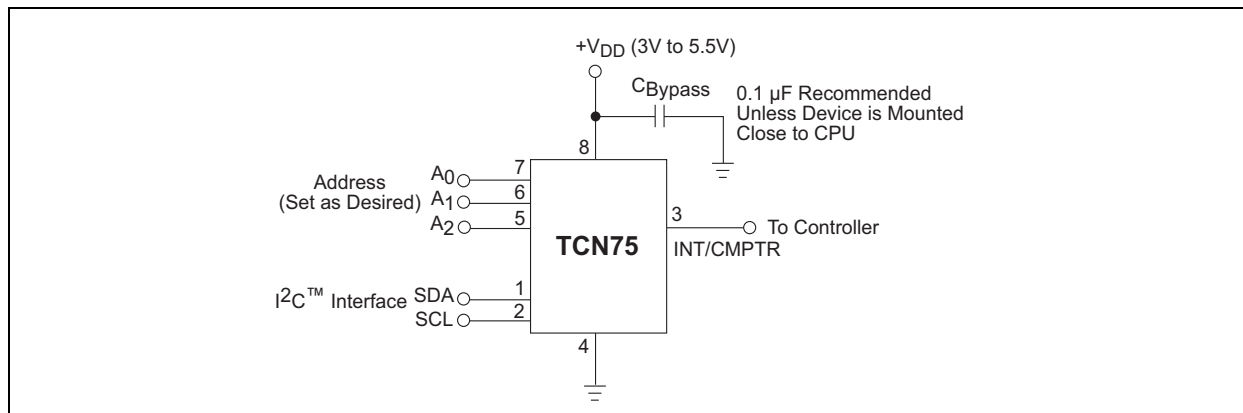
**TABLE 2-1: PIN FUNCTION TABLE**

Pin Number (8-Pin SOIC) 8-Pin MSOP)	Symbol	Description
1	SDA	Bidirectional Serial Data.
2	SCL	Serial Data Clock Input.
3	INT/CMPTR	Interrupt or Comparator Output.
4	GND	System Ground.
5	A <sub>2</sub>	Address Select Pin (MSB).
6	A <sub>1</sub>	Address Select Pin.
7	A <sub>0</sub>	Address Select Pin (LSB).
8	V <sub>DD</sub>	Power Supply Input.

# TCN75

## 3.0 DETAILED DESCRIPTION

A typical TCN75 hardware connection is shown in Figure 3-1.



**FIGURE 3-1:** Typical Application

### 3.1 Serial Data (SDA)

Bidirectional. Serial data is transferred in both directions using this pin.

### 3.2 Serial Clock (SCL)

Input. Clocks data into and out of the TCN75.

### 3.3 INT/CMPTR

Open Collector, Programmable Polarity. In Comparator mode, unconditionally driven active any time temperature exceeds the value programmed into the  $T_{SET}$  register. INT/CMPTR will become inactive when temperature subsequently falls below the  $T_{HYST}$  setting. (See **Section 5.0 “Register Set and Programmer’s Model”**, Register Set and Programmer’s Model). In Interrupt mode, INT/CMPTR is also made active by TEMP exceeding  $T_{SET}$ ; it is unconditionally reset to its inactive state by reading any register via the 2-wire bus. If and when temperature falls below  $T_{HYST}$ , INT/CMPTR is again driven active. Reading any register will clear the  $T_{HYST}$  interrupt. In Interrupt mode, the INT/CMPTR output is unconditionally reset upon entering Shutdown mode. If programmed as an active-low output, it can be wire-ORed with any number of other open collector devices. Most systems will require a pull-up resistor for this configuration.

Note that current sourced from the pull-up resistor causes power dissipation and may cause internal heating of the TCN75. To avoid affecting the accuracy of ambient temperature readings, the pull-up resistor should be made as large as possible. INT/CMPTR’s output polarity may be programmed by writing to the INT/CMPTR POLARITY bit in the CONFIG register. The default is active low.

### 3.4 Address (A2, A1, A0)

Inputs. Sets the three Least Significant bits of the TCN75 8-bit address. A match between the TCN75’s address and the address specified in the serial bit stream must be made to initiate communication with the TCN75. Many protocol-compatible devices with other addresses may share the same 2-wire bus.

### 3.5 Slave Address

The four Most Significant bits of the Address Byte (A6, A5, A4, A3) are fixed to 1001[B]. The states of A2, A1 and A0 in the serial bit stream must match the states of the A2, A1 and A0 address inputs for the TCN75 to respond with an Acknowledge (indicating the TCN75 is on the bus and ready to accept data). The Slave Address is represented in Table 3-1.

**TABLE 3-1: TCN75 SLAVE ADDRESS**

1	0	0	1	A2	A1	A0
MSB						LSBS

## 3.6 Comparator/Interrupt Modes

INT/CMPTR behaves differently depending on whether the TCN75 is in Comparator mode or Interrupt mode. Comparator mode is designed for simple thermostatic operation. INT/CMPTR will go active anytime TEMP exceeds  $T_{SET}$ . When in Comparator mode, INT/CMPTR will remain active until TEMP falls below  $T_{HYST}$ , whereupon it will reset to its inactive state. The state of INT/CMPTR is maintained in Shutdown mode when the TCN75 is in Comparator mode. In Interrupt mode, INT/CMPTR will remain active indefinitely, even if TEMP falls below  $T_{HYST}$ , until any register is read via the 2-wire bus. Interrupt mode is better suited to interrupt driven microprocessor-based systems. The INT/CMPTR output may be wire-OR'ed with other interrupt sources in such systems. Note that a pull-up resistor is necessary on this pin since it is an open-drain output. Entering Shutdown mode will unconditionally reset INT/CMPTR when in Interrupt mode.

## 4.0 SHUTDOWN MODE

When the appropriate bit is set in the configuration register (CONFIG) the TCN75 enters its low-power Shutdown mode ( $I_{DD} = 1 \mu A$ , typical) and the temperature-to-digital conversion process is halted. The TCN75's bus interface remains active and TEMP,  $T_{SET}$ , and  $T_{HYST}$  may be read from and written to. Transitions on SDA or SCL due to external bus activity may increase the standby power consumption. If the TCN75 is in Interrupt mode, the state of INT/CMPTR will be reset upon entering Shutdown mode.

### 4.1 Fault Queue

To lessen the probability of spurious activation of INT/CMPTR the TCN75 may be programmed to filter out transient events. This is done by programming the desired value into the Fault Queue. Logic inside the TCN75 will prevent the device from triggering INT/CMPTR unless the programmed number of sequential temperature-to-digital conversions yield the same qualitative result. In other words, the value reported in TEMP must remain above  $T_{SET}$  or below  $T_{HYST}$  for the consecutive number of cycles programmed in the Fault Queue. Up to a six-cycle "filter" may be selected. See **Section 5.0 "Register Set and Programmer's Model"**, Register Set and Programmer's Model.

### 4.2 Serial Port Operation

The Serial Clock input (SCL) and bidirectional data port (SDA) form a 2-wire bidirectional serial port for programming and interrogating the TCN75. The following table indicates TCN75 conventions that are used in this bus scheme.

**TABLE 4-1: 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.
NOT Busy	When the bus is idle, both SDA & 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 TCN75 *always* operates as a Slave. This serial protocol is illustrated in Figure 5-1. All data transfers have two phases; and 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).

### 4.3 Start Condition (Start)

The TCN75 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.



## 4.3.1 ADDRESS BYTE

Immediately following the Start condition, the host must next transmit the address byte to the TCN75. The four Most Significant bits of the Address Byte (A6, A5, A4, A3) are fixed to 1001(B). The states of A2, A1 and A0 in the serial bit stream must match the states of the A2, A1 and A0 address inputs for the TCN75 to respond with an Acknowledge (indicating the TCN75 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.

## 4.3.2 ACKNOWLEDGE (ACK)

Acknowledge (ACK) provides a positive handshake between the host and the TCN75. The host releases SDA after transmitting eight bits then generates a ninth clock cycle to allow the TCN75 to pull the SDA line LOW to acknowledge that it successfully received the previous eight bits of data or address.

## 4.3.3 DATA BYTE

After a successful ACK of the address byte, the host must next 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 TCN75.

## 4.3.4 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 TCN75.

## 4.3.5 POWER SUPPLY

To minimize temperature measurement error, the TCN75-3.3 MOA and TCN75-3.3 MUA are factory calibrated at a supply voltage of 3.3V  $\pm$ 5% and the TCN75-5.0 MOA and TCN75-5.0 MUA are factory calibrated at a supply voltage of 5V  $\pm$ 5%. Either device is fully operational over the power supply voltage range of 2.7V to 5.5V, but with a lower measurement accuracy. The typical value of this power supply-related error is  $\pm$ 2°C.

## 5.0 REGISTER SET AND PROGRAMMER'S MODEL

**TABLE 5-1: REGISTER (POINT), 8 BITS, WRITE ONLY**

D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]
Must Be Set To Zero						Pointer	

Register Selection Via the Pointer Register		
D1	D0	Register Selection
0	0	TEMP
0	1	CONFIG
1	0	T <sub>HYST</sub>
1	1	T <sub>SET</sub>

**TABLE 5-2: CONFIGURATION REGISTER (CONFIG), 8 BITS, READ/WRITE**

D [7]	D [6]	D [5]	D [4]	D [3]	D [2]	D [1]	D [0]
Must Be Set To Zero			Fault Queue	INT/ CMPTR, Polarity	COM P/INT	Shut-down	

D0: Shutdown:

- 0 = Normal Operation
- 1 = Shutdown Mode

D1: CMPTR/INT:

- 0 = Comparator Mode
- 1 = Interrupt Mode

D2: INT/CMPTR POLARITY:

- 0 = Active Low
- 1 = Active High

D3 – D4: Fault Queue: Number of sequential temperature-to-digital conversions with the same result before the INT/CMPTR output is updated:

D4	D3	Number of Conversions
0	0	1 (Power-up default)
0	1	2
1	0	4
1	1	6

**TABLE 5-3: TEMPERATURE (TEMP) REGISTER, 16 BITS, READ ONLY**

The binary value in this register represents ambient temperature following a conversion cycle.

D[15]	D[14]	D[13]	D[12]	D[11]	D[10]	D[9]	D[8]	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]
MSB	D7	D6	D5	D4	D3	D2	D1	LSB	x	x	x	x	x	x	x

**TABLE 5-4: TEMPERATURE SET POINT (T<sub>SET</sub>) REGISTER, 16 BITS, READ/WRITE**

D[15]	D[14]	D[13]	D[12]	D[11]	D[10]	D[9]	D[8]	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]
MSB	D7	D6	D5	D4	D3	D2	D1	LSB	x	x	x	x	x	x	x

**TABLE 5-5: HYSTERESIS (T<sub>HYST</sub>) REGISTER, 16 BITS, READ/WRITE**

D[15]	D[14]	D[13]	D[12]	D[11]	D[10]	D[9]	D[8]	D[7]	D[6]	D[5]	D[4]	D[3]	D[2]	D[1]	D[0]
MSB	D7	D6	D5	D4	D3	D2	D1	LSB	x	x	x	x	x	x	x

In the TEMP, T<sub>SET</sub>, and T<sub>HYST</sub> registers, each unit value represents one-half degree (Celsius). The value is in 2's – complement binary format such that a reading of 00000000b corresponds to 0°C. Examples of this temperature to binary value relationship are shown in Table 5-6.

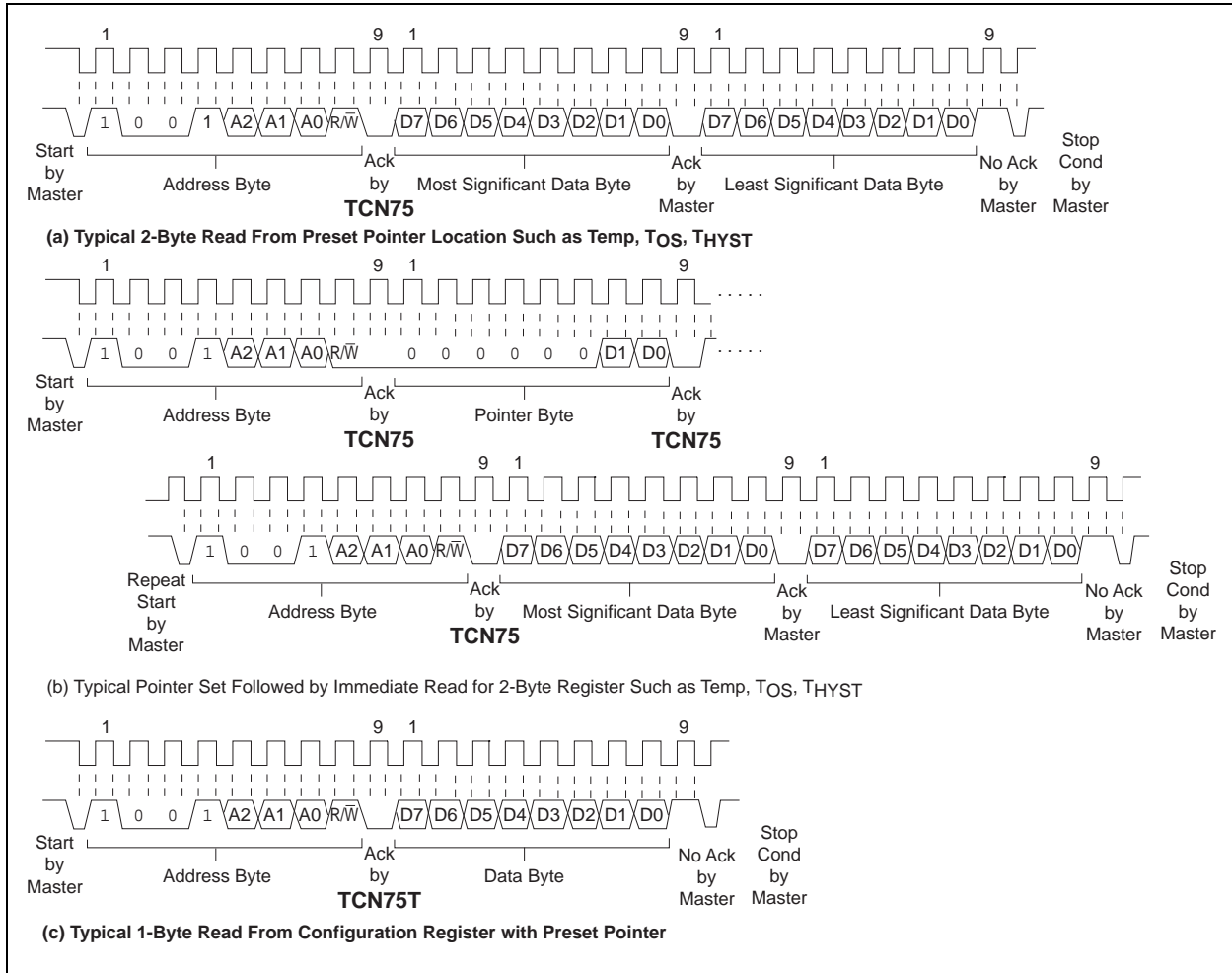
**TABLE 5-6: TEMPERATURE TO DIGITAL VALUE CONVERSION**

Temperature	Binary Value	HEX Value
+125°C	0 11111010	0FA
+25°C	0 00110010	032
+0.5°C	0 00000001	001
0°C	0 00000000	00
0.5°C	1 11111111	1FF
-25°C	1 11001110	1CE
-40°C	1 10110000	1B0
-55°C	1 10010010	192

**TABLE 5-7: TCN75'S REGISTER SET SUMMARY**

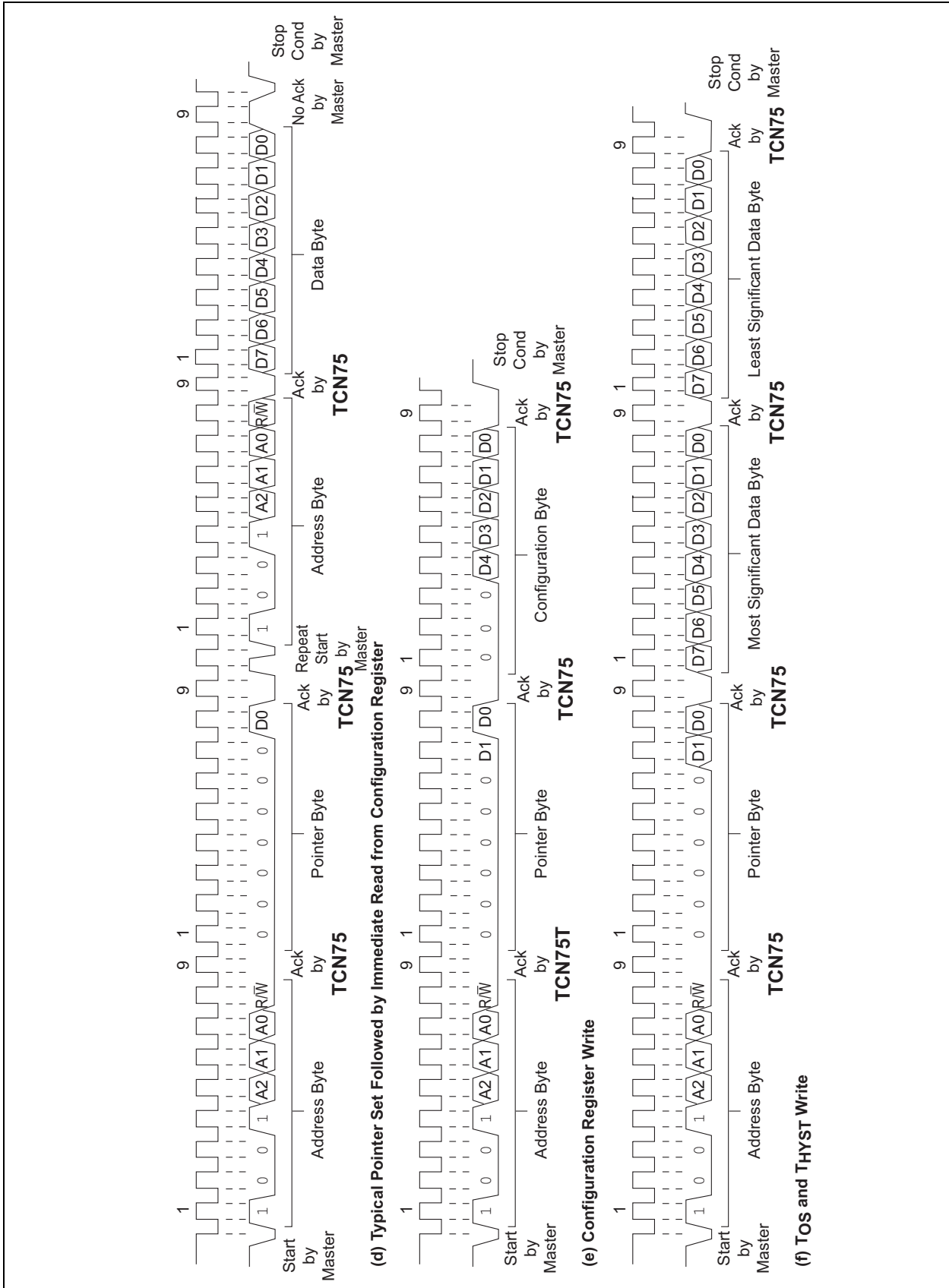
Name	Description	Width	Read	Write	Notes
TEMP	Ambient Temperature	16	x		2's Complement Format
TSET	Temperature Setpoint	16	x	x	2's Complement Format
T <sub>HYST</sub>	Temperature Hysteresis	16	x	x	2's Complement Format
POINT	Register Pointer	8	x	x	
CONFIG	Configuration Register	8	x	x	

# TCN75



**FIGURE 5-1:** Timing Diagrams

## Timing Diagrams (Continued)



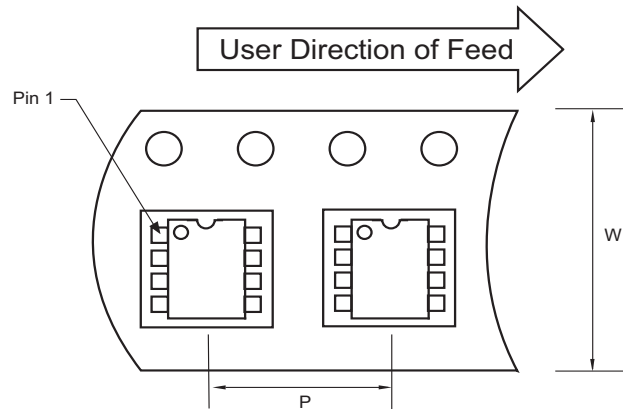
## 6.0 PACKAGING INFORMATION

### 6.1 Package Marking Information

Package marking data not available at this time.

### 6.2 Taping Form

#### Component Taping Orientation for 8-Pin MSOP Devices

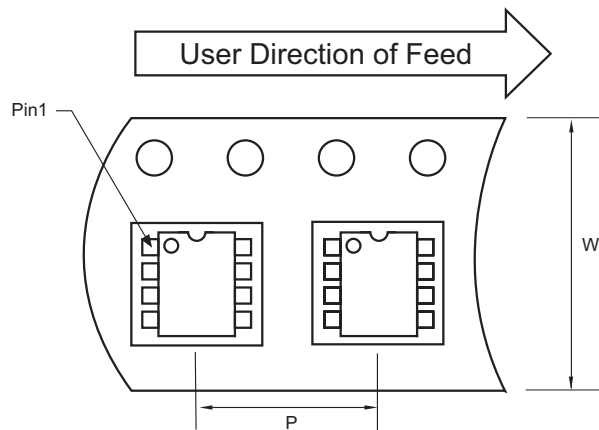


Standard Reel Component Orientation  
for 713 Suffix Device

**Carrier Tape, Number of Components Per Reel and Reel Size**

Package	Carrier Width (W)	Pitch (P)	Part Per Full Reel	Reel Size
8-Pin MSOP	12 mm	8 mm	2500	13 in

#### Component Taping Orientation for 8-Pin SOIC (Narrow) Devices



Standard Reel Component Orientation  
for 713 Suffix Device

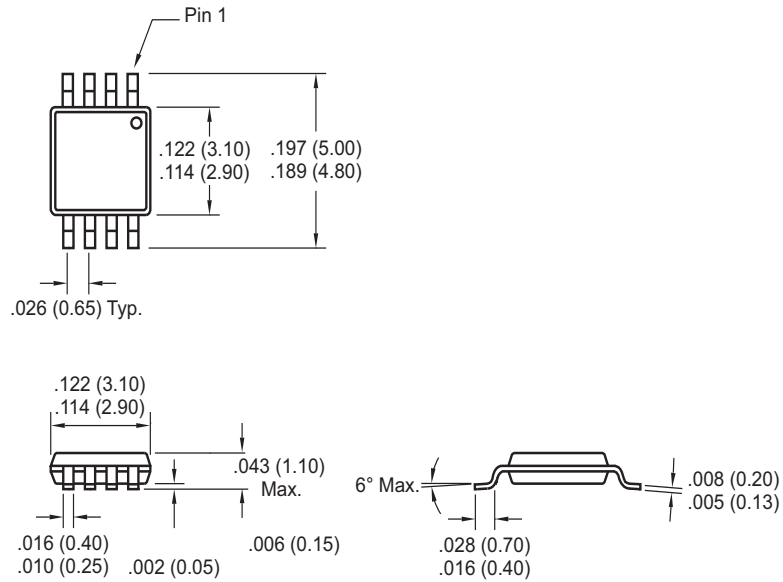
**Carrier Tape, Number of Components Per Reel and Reel Size**

Package	Carrier Width (W)	Pitch (P)	Part Per Full Reel	Reel Size
8-Pin SOIC (N)	12 mm	8 mm	2500	13 in

## 6.3 Package Dimensions

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

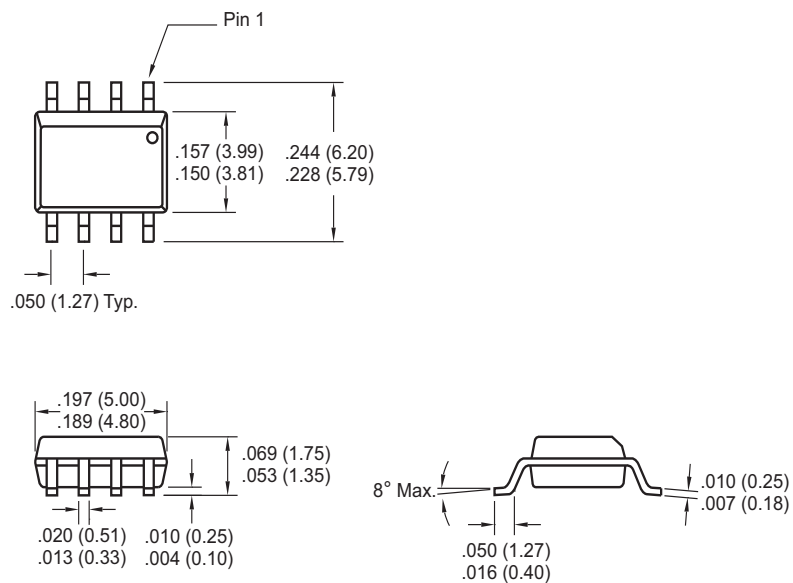
### 8-Pin MSOP



Dimensions: inches (mm)

**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)

## 7.0 REVISION HISTORY

### Revision D (December 2012)

Added a note to each package outline drawing.



## THE MICROCHIP WEB SITE

Microchip provides online support via our WWW site at [www.microchip.com](http://www.microchip.com). This web site is used as a means to make files and information easily available to customers. Accessible by using your favorite Internet browser, the web site contains the following information:

- **Product Support** – Data sheets and errata, application notes and sample programs, design resources, user's guides and hardware support documents, latest software releases and archived software
- **General Technical Support** – Frequently Asked Questions (FAQ), technical support requests, online discussion groups, Microchip consultant program member listing
- **Business of Microchip** – Product selector and ordering guides, latest Microchip press releases, listing of seminars and events, listings of Microchip sales offices, distributors and factory representatives

## CUSTOMER CHANGE NOTIFICATION SERVICE

Microchip's customer notification service helps keep customers current on Microchip products. Subscribers will receive e-mail notification whenever there are changes, updates, revisions or errata related to a specified product family or development tool of interest.

To register, access the Microchip web site at [www.microchip.com](http://www.microchip.com). Under "Support", click on "Customer Change Notification" and follow the registration instructions.

## CUSTOMER SUPPORT

Users of Microchip products can receive assistance through several channels:

- Distributor or Representative
- Local Sales Office
- Field Application Engineer (FAE)
- Technical Support

Customers should contact their distributor, representative or field application engineer (FAE) for support. Local sales offices are also available to help customers. A listing of sales offices and locations is included in the back of this document.

**Technical support is available through the web site at: <http://microchip.com/support>**

## READER RESPONSE

It is our intention to provide you with the best documentation possible to ensure successful use of your Microchip product. If you wish to provide your comments on organization, clarity, subject matter, and ways in which our documentation can better serve you, please FAX your comments to the Technical Publications Manager at (480) 792-4150.

Please list the following information, and use this outline to provide us with your comments about this document.

TO: Technical Publications Manager Total Pages Sent \_\_\_\_\_

RE: Reader Response

From: Name \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

City / State / ZIP / Country \_\_\_\_\_

Telephone: (\_\_\_\_\_) \_\_\_\_\_ - \_\_\_\_\_ FAX: (\_\_\_\_\_) \_\_\_\_\_ - \_\_\_\_\_

Application (optional):

Would you like a reply?  Y  N

Device: TCN75

Literature Number: DS21490D

Questions:

1. What are the best features of this document?

---

---

2. How does this document meet your hardware and software development needs?

---

---

3. Do you find the organization of this document easy to follow? If not, why?

---

---

4. What additions to the document do you think would enhance the structure and subject?

---

---

5. What deletions from the document could be made without affecting the overall usefulness?

---

---

6. Is there any incorrect or misleading information (what and where)?

---

---

7. How would you improve this document?

---

---

---

**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, PIC<sup>32</sup> 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: 9781620768815

*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<sup>®</sup> MCUs and dsPIC<sup>®</sup> DSCs, KEELOQ<sup>®</sup> 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](http://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