SECURE CONNECTIONS FOR A SMARTER WORLD

**SELECTOR GUIDE**
I3C/I²C-BusTemperature Sensors

# I3C/I²C-BUS TEMPERATURE SENSORS

## Small and accurate sensors for advanced temperature regulation

### ACCURATE PERFORMANCE IN A PROVEN FORMAT

NXP temperature sensors use the familiar I3C/I²C-bus/SMBus format to deliver highly accurate temperature monitoring with low power consumption in a wide variety of applications. Select devices are pin-for-pin compatible with industry-standard sensors and combines a high level of precision with programmable features that help increase design flexibility.

### LOCAL-ONLY TEMPERATURE SENSORS

Our local-only temperature sensors produce highly accurate digital readings of the ambient temperature and can be used to trigger interrupt, shut-down, or overtemperature alarms. They are suited for use in industrial process control, notebook computers, servers, telecomm equipment and office electronics.

- The P3T1085 is an I3C/I²C local temperature sensor with an accuracy of ±0.5 °C in WLCSP
- The P3T1755 is an I3C/I²C local temperature sensor with an accuracy of ±0.5 °C in TSSOP package for Industrial and Automotive applications
- The LM75B is a local temperature sensor and thermal watchdog with an accuracy of ±2 °C
- The PCT2075, a more accurate version of the LM75B, delivers superior performance in temperature-sensitive applications
- The SE98A, designed for applications that use DDR3 RDIMM memory, complies with JEDEC JC42.4, supports SMBus Timeout and Alert, and has security lock bits
- The SE97B brings the SE98A and a 2 Kbit EEPROM serial presence detect (SPD) together in a single device

### REMOTE AND LOCAL TEMPERATURE SENSORS

Our combination remote/local sensors can monitor the temperature of the thermal diode inside the CPU or the diode connected to PNP or NPN transistors, and can trigger an interrupt or alert output.

- The SA56004 sensor, designed for handheld and portable applications, includes an offset register for system calibration, dual outputs for fan control and an interrupt, built-in diode fault detection, and one-shot conversion with power optimization in shutdown mode. It is available in a small, 8-pin package with three possible pre-configured slave device addresses.

### APPLICATIONS

| | |
|---|---|
| Industrial | IoT, PLC, Building Automation |
| Computing | Server, PC, Notebook |
| Telecom | Router, Switches |
| Consumer | Smart home, appliances |
| Medical | CPAP, medical devices |

## NXP I²C-BUS/SMBUS TEMPERATURE SENSORS

| FEATURE | BENEFIT |
|---|---|
| Wide supply range (1.4 to 5.5 V) | Suitable for 1.5 V, 1.8 V, 3.3 V or 5 V systems |
| Wide temperature operating range (-55 to 125 °C) | Suitable for all system thermal management |
| I3C/I²C-bus/SMBus interfaces supported | Enabling future proven interface solutions |
| Low operating and standby power | Suitable for all applications, including battery management |
| Programmable temperature set points | Temperature thresholds are easy to change |
| Standby mode and one-shot conversion | Suitable for power-sensitive applications like laptops and handhelds |
| Programmable fault queue | Prevents noise-triggered temperature trips |

## FAMILY OVERVIEW

| | LOCAL CHANNELS | REMOTE CHANNELS | THERMAL-ALARM OUTPUT* | FAN-CONTROL OUTPUT* | TEMP RANGE | FREQUENCY | ACCURACY (LOCAL SENSING - TYP) | ACCURACY (REMOTE SENSING - TYP) | A/D RESOLUTION (°C/# BITS) | SUPPLY RANGE (V) | SUPPLY CURRENT OPERATING (µA – TYP) | SUPPLY CURRENT SSHUTDOWN (µA – TYP) | PACKAGE(S) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LM75B | 1 | | 1 | | -55 to +125 °C | 400 kHz | ±1 °C | | 0.125/11 | 2.8-5.5 | 100 | 0.2 | SO8, MSOP8, XSON8(U) and HWSON8 |
| PCT2075 | 1 | | 1 | | -55 to +125 °C | 1000 kHz | ±1 °C | | 0.125/11 | 2.7-5.5 | 125 | <0.1 | SO8, TSSOP8, HWSON8 and TSOP6 |
| SA56004 | 1 | 1 | 1 | 1 | -40 to +125 °C | 400 kHz | ±1 °C | ±1 °C | 0.125/11 | 3.0-3.6 | 500 | 10 | SO8, MSOP8 and HVSON8 |
| SE97B | 1 with 2 kbit SPD | | | | -40 to +125 °C | 400 kHz | ±0.5 °C | | 0.125/11 | 3.0-3.6 | 210 | 0.1 | HWSON8 |
| SE98A | 1 | | | | -40 to +125 °C | 400 kHz | ±0.5 °C | | 0.125/11 | 1.7-3.6 | 250 | 0.1 | HWSON8 |
| P3T1084 | 1 | | 1 | | -40 to +125 °C | 12.5 MHz | ±0.4 °C | | 0.0625/12 | 1.4-3.6 | 2.1 | 0.2 | WLCSP6 |
| P3T1085 | 1 | | 1 | | -40 to +125 °C | 12.5 MHz | ±0.5 °C | | 0.0625/12 | 1.4-3.6 | 2.1 | 0.2 | WLCSP6 |
| P3T1035 | 1 | | | | -40 to +125 °C | 12.5 MHz | ±0.5 °C | | 0.0625/12 | 1.4-1.98 | 1.8 | 0.2 | WLCSP4 |
| P3T1750 | 1 | | 1 | | -40 to +125 °C | 12.5 MHz | ±1 °C | | 0.0625/12 | 1.4-3.6 | 4.1 | 0.2 | TSSOP8 |
| P3T1755 | 1 | | 1 | | -40 to +125 °C | 12.5 MHz | ±0.5 °C | | 0.0625/12 | 1.4-3.6 | 4.1 | 0.2 | TSSOP8 |
| P3T2030 | 1 | | | | -40 to +125 °C | 12.5 MHz | ±2 °C | | 0.0625/12 | 1.4-1.98 | 1.8 | 0.2 | WLCSP4 |

* Open-drain output

## LOCAL-ONLY TEMPERATURE SENSORS WITH I3C

### LOCAL TEMPERATURE SENSOR P3T1084/P3T1085 WITH I3C/I²C INTERFACE AND ±0.4/ ±0.5 °C ACCURACY IN WLCSP6

Features:

- On-chip thermal diode
- Bus: I3C up to 12.5 MHz / Two-wire I2C-bus 1 MHz Fast Mode Plus
- Accuracy (max): P3T1084 => ±0.4 °C (from -25 °C to 85 °C) / P3T1084 => ±0.5 °C (from -25 °C to 85 °C)
- Resolution: 12-bit (0.0625 °C)
- One-shot and conversion options
- Programmable temperature conversion rate (0.125 to 30 Hz)
- Shutdown/operating current (max): <1.0/3.5 µA
- Power-supply range: 1.4 to 3.6 V
- Temperature range: -40 °C to 125 °C
- Package: WLCSP6
- Drop-in replacement for: TMP108

### LOCAL TEMPERATURE SENSOR P3T1755/P3T1750 WITH I3C/I²C INTERFACE AND ±0.5/±1 °C ACCURACY IN TSSOP

- AEC-Q100 available as P3T1755DP/Q900 or P3T1750DP/Q900
- 8-pin package with 3 ADDR pin in order to select up to 32 device on the communication bus.

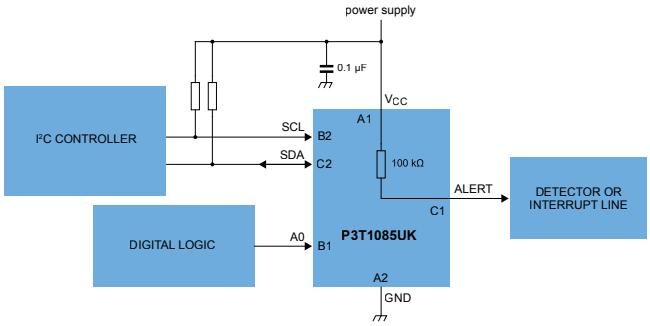
### LOCAL TEMPERATURE SENSOR P3T1035/P3T2030 WITH I3C/I²C INTERFACE AND ±0.5/±2 °C ACCURACY IN WLCSP4

- Power-supply range: 1.4 to 1.98 V
- Right solution to be used with I3C
- No address and interrupt pins. Information can be reported over I3C as IBI

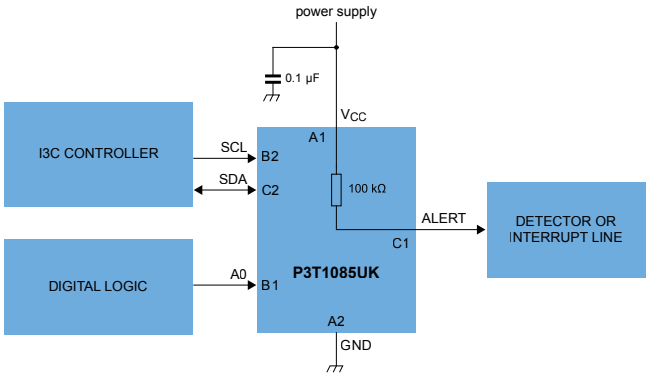
FEATURES ADVANTAGES

- Higher accuracy starting from ±0.4 °C
- Introduction of I3C, reducing the signal routing complexity and power consumption
- One-shot conversion helps improve performance in power-sensitive application
- Ultra-small packages (WLCSP6, WLCSP4) for small size applications

### P3T1085UK I²C-BUS TYPICAL APPLICATION




### P3T1085UK I3C-BUS TYPICAL APPLICATION



## LOCAL-ONLY TEMPERATURE SENSORS

### LOCAL TEMPERATURE SENSOR AND THERMAL WATCHDOG PCT2075 WITH ACCURACY OF ±1 °C

Features:

- On-chip thermal diode
- Bus: two-wire I²C-bus (1MHz Fast Mode Plus)
- Accuracy (max): ±1 °C (from -25 to 100 °C)
- Resolution: 11-bit (0.125 °C)
- Open-drain interrupt or comparator/thermostat output
- Shutdown mode and one-shot conversion capability
- Programmable temperature conversion rate (0.125 to 30 Hz)
- Shutdown/operating current (max): <0.1/400 µA
- Power-supply range: 2.7 to 5.5 V
- Temperature range: -55 to 125 °C
- Package: TSSOP(MSOP)8, SO8, XSON8U and HWSON8
- Drop-in replacement for: National LM75, Microchip TCN75, Maxim DS75, TI TMP75, Analog Devices AD7416

### LOCAL TEMPERATURE SENSOR AND THERMAL WATCHDOG LM75B WITH ACCURACY OF ±2 °C

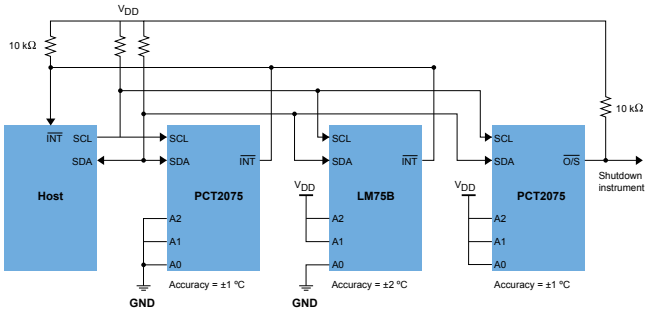
CSame as PCT2075, with the following differences:

- Accuracy (max): ±2 °C (from -25 to 100 °C)
- Shutdown/operating current (max): 1.0/300 µA
- Bus: two-wire I²C-bus (400 kHz Fast Mode)

### FEATURES ADVANTAGES

- Higher accuracy improves thermal guard-banding
- One-shot conversion helps improve performance in power-sensitive applications
- Programmable conversion helps enable more flexible system applications
- Programmable fault queue prevents false temperature trips

## PCT2075/LM75B APPLICATION DIAGRAMLOCAL



## LOCAL-ONLY TEMPERATURE SENSORS (cont.)

### LOCAL TEMPERATURE SENSOR SE98A FOR DDR3 RDIMM WITH ACCURACY OF ±1 °C

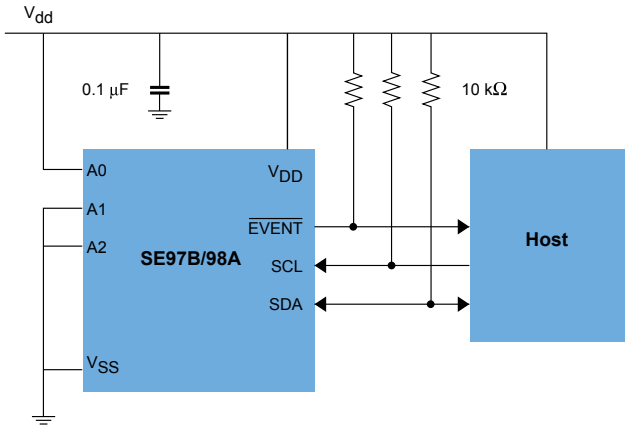
Features:

- Complies with JEDEC JC42.4
- Bus: two-wire SMBus or I²C-bus (standard/fast-mode compatible)
- Accuracy (max): ±1 °C (from 75 to 90 °C)
- Resolution: 11-bit (0.125 °C)
- Minimum conversion rate: 8 Hz
- Programmable hysteresis threshold: 0, 1.5, 3, or 6 °C
- EVENT output associated with three alarms: upper, lower, and critical
- Programmable SMBus alert response and timeout
- Security lock bit for data protection
- Maximum operating current: 100 µA
- I²C address: 0011A2A1A0 (up to 8 devices on same bus)
- Operating-voltage range: 1.7 to 3.6 V
- Operating temperature: -40 to +125 °C
- Packages: HWSON8 package

Benefits:

- SMBus timeout prevents system bus hang-ups
- SMBus alert response enables system polling
- Over-, under-, and critical-temperature status and alarm output
- Security lock bit for data protection

## SE97B/98A APPLICATION DIAGRAM

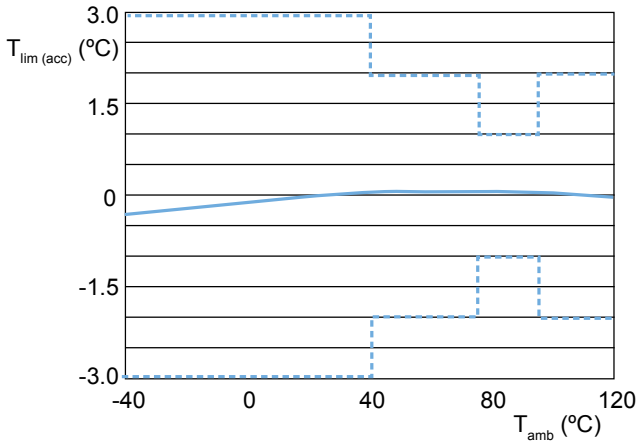



### OCAL TEMPERATURE SENSOR SE97B FOR DDR3 RDIMM WITH INTEGRATED SPD

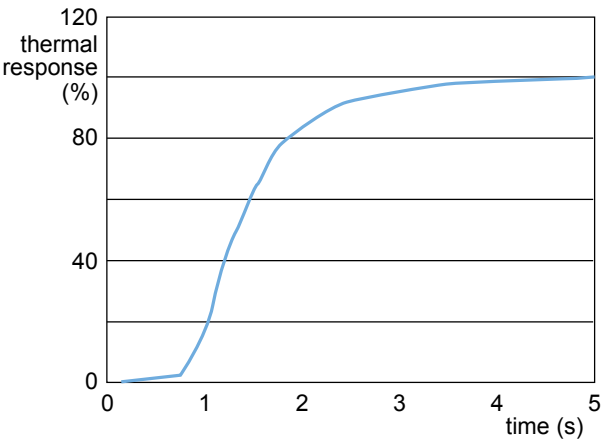
Same as SE98, with the following differences:

- Adds integrated 2-Kbit EEPROM for Serial Presence Detect
- EEPROM I²C-bus address 1010A2A1A0
- Operating-voltage range: 3.0 to 3.6V

## SE98A AND SE97B THERMAL RESPONSE




**Temperature Accuracy (Max)**




From 25 °C to 120 °C (oil bath) at 3.3 V.

**Package Thermal Response**

## REMOTE AND LOCAL TEMPERATURE SENSOR

REMOTE AND LOCAL TEMPERATURE SENSOR SA56004 WITH FAN CONTROL AND ACCURACY OF ±1 °C

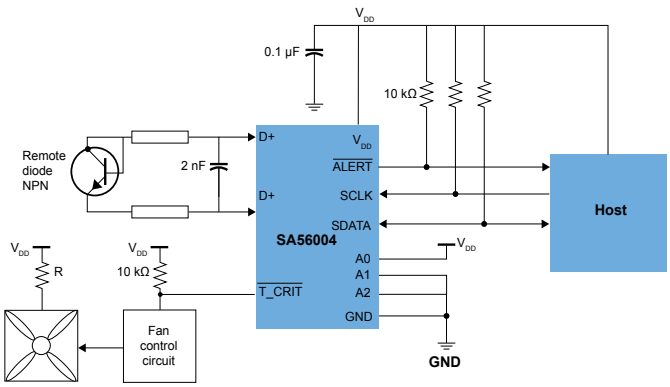
Features:

- Bus: two-wire SMBus or I²C-bus (standard/fast-mode compatible)
- Accuracy (remote sensing) (Max): ±1 °C (from 60 to 100 °C)
- Accuracy: (local sensing) (Max): ±2 °C (from 60 to 100 °C)
- Resolution: 11-bit (0.125 °C)
- Shutdown/operating current (typ): 10/500 µA
- Shutdown mode and one-shot conversion for power savings
- Offset registers for system calibration
- ALERT/T_CRIT output for interrupt/fan control (on/off)
- Supports SMBus alert response and timeout
- Fault queue prevents noise-triggered temperature trips
- Supports diode-fault detection
- Three device addresses for server applications ("E" most commonly used — also A and C)
- Temperature range: -55 to 125 °C
- Power-supply range: 3.0 to 3.6 V
- Packages: TSSOP(MSOP)8, SO8 and HVSON8
- Drop-in replacement for National LM86, Maxim MAX6657/8, Analog Devices ADM1032

Benefits:

- SMBus timeout prevents system bus hang-ups
- SMBus alert response enables system polling
- Fault queue prevents false temperature trips
- Programmable conversion rate for system flexibility

## SA56004 APPLICATION DIAGRAM



## SELECTION GUIDE AND CROSS REFERENCE

### SELECTION GUIDE

| | PART NUMBER | PACKAGE | ORDER INFORMATION | I²C/SMBUS SPEED (KHZ) | TEMPERATURE RANGE (°C) | POWER SUPPLY RANGE (V) | MAX ACCURACY (±°C) | | A/D RESOLUTION (°C / # BITS) | MAX SUPPLY CURRENT (µA) | | CHANNELS | | THERMAL-ALARM OUTPUT (OPEN DRAIN) | FAN-CONTROL OUTPUT (OPEN DRAIN) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | LOCAL | REMOTE | | OPERATING | SHUTDOWN | LOCAL | REMOTE | | |
| LOCAL | LM75B | XSON8U, HWSON8, HVSON8 | LM75BGD, LM75BTP, SA56004XTK* | 400 | -25 to 100 °C<br>-55 to 125 °C | 2.8 to 5.5 | 2<br>3 | N/A | 0.125/11 | 300 | 1.0 | 1 | N/A | 1 | – |
| | PCT2075 | SO8, MSOP8, HWSON8, TSOP6 | PCT2075D, PCT2075DP, PCT2075TP, PCT2075GV | 1000 | -25 to 100 °C<br>-55 to 125 °C | 2.7 - 5.5 | 1<br>2 | N/A | 0.125/11 | 400 | 20 (@125 °C) | 1 | N/A | 1 | – |
| | SE97B | WSON8 | SE97BTP | 400 | 75 to 95 °C<br>40 to 125 °C<br>-40 to 125 °C | 3.0 to 3.6 | 1<br>2<br>3 | N/A | 0.125/11 | 400 | 10 | 1 with EEPROM | N/A | 1 | – |
| | SE98A | WSON8 | SE98ATP | 400 | 75 to 95 °C<br>40 to 125 °C<br>-40 to 125 °C | 1.7 to 3.6 | 1<br>2<br>3 | N/A | 0.125/11 | 400 | 5 | 1 | N/A | 1 | – |
| | P3T1084 | WLCSP6 | P3T1084UK | 12500 | -20 to +85 °C<br>-40 to 125 °C | 1.4-3.6 | 0.4<br>1 | – | 0.0625/12 | 80 (typ) | 1.0 | 1 | – | 1 | – |
| | P3T1085 | WLCSP6 | P3T1085UK | 12500 | -20 to +85 °C<br>-40 to 125 °C | 1.4-3.6 | 0.5<br>1 | – | 0.0625/12 | 3.5 | 1.0 | 1 | – | 1 | – |
| | P3T1035 | WLCSP4 | P3T1035yUK | 12500 | 0 to +70 °C<br>-40 to 125 °C | 1.62-1.98 | 0.5<br>1 | – | 0.0625/12 | 80 (typ) | 1.0 | 1 | – | – | – |
| | P3T1750 | TSSOP8 | P3T1750DP<br>P3T1750DP/Q900 | 12500 | -40 to 125 °C | 1.4-3.6 | 1 | – | 0.0625/12 | 80 (typ) | 1.0 | 1 | – | 1 | – |
| | P3T1755 | TSSOP8 | P3T1755DP<br>P3T1755DP/Q900 | 12500 | -20 to +85 °C<br>-40 to 125 °C | 1.4-3.6 | 0.5<br>1 | – | 0.0625/12 | 80 (typ) | 1.0 | 1 | – | 1 | – |
| | P3T2030 | WLCSP4 | P3T2030yDP | 12500 | -40 to 125 °C | 1.4-1.98 | 2 | – | 0.0625/12 | 80 (typ) | 1.0 | 1 | – | – | – |
| REMOTE AND LOCAL | SA56004 | SO8, MSOP8 | SA56004XD*, SA56004XDP* | 400 | 60 to 100<br>-40 to 125 | 3.0 to 3.6 | 2<br>3 | 1<br>3 | 0.125/11 | 500 (typ) | 10 (typ) | 1 | 1 | 1 | 1 |

* "X" is the version, with "A", "C" and "E" available and "E" the most commonly used.

### CROSS-REFERENCE CHART

| PACKAGE | NXP | NATIONAL | ANALOG DEVICES | MAXIM | TEXAS INSTRUMENTS | MICROCHIP |
|---|---|---|---|---|---|---|
| SO8 | LM75BD | LM75BIM<br>LM75CIM | AD7416AR | DS75S | TMP75AID | TCN75-3.3MOA<br>TCN75-5.0MOA |
| WLCSP6 | P3T1085<br>P3T1084 | | | | TMP108<br>TMP105<br>TMP106 | |
| TSSOP8 | P3T1750DP<br>P3T1755DP | LM75BIMM<br>LM75CIMM | AD7416ARM | | TMP1075<br>TMP75B/C/Q1<br>TMP175<br>TMP275 | TCN75-3.3MUA<br>TCN75-5.0MUA |
| SO8 | SA56004ED | LM86CIM | ADM1032AR | MAX6657MSA<br>MAX6658MSA | | |
| TSSOP8 | SA56004EDP | LM86CIMM | ADM1032ARM | | | |

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