Atmel Digital Temperature Sensors

World's Most Versatile Temperature Sensing Solutions

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Ideal For:

- **Industrial**—Industrial controls, smart meters, HVAC, lighting ballast, fire alarms, test equipment, medical devices, and LED lighting
- **Consumer**—Li-ion batteries, set-top boxes, audio/video equipment, game consoles, white goods, thermostats, and LED lighting
- **Communications**—Telecom equipment, smartphones, gateways, routers, headsets, call servers, and power supplies
- **Computers**—Desktops, laptops, netbooks, tablets, servers, SSDs and HDDs

Atmel® Digital Temperature Sensor products are complete and easy-to-use solutions that address the ever-growing need for temperature sensing. Atmel offers these solutions as a drop-in replacement for industry-standard LM75 type devices as well as JEDEC standard compliant solutions for DDR3 DIMM modules. Atmel Digital Temperature Sensors also provide enhanced features such as EEPROM and nonvolatile registers to reduce BOM cost, improve system flexibility, ensure product reliability, and enhance safety.

| Atmel AT30TS750 Family | Drop-in compatible and enhanced version of industry-standard LM75 type devices. |

| Atmel AT30TSE002B Family | JEDEC-defined industry-standard device supporting three temperature alarms (low, high, critical) and hysteresis function. |

Atmel AT30TS750 Family Enhancements:

Enhancement	Benefits
Non-volatile Registers	Enforce preset condition to improve safety
Integrated 2-, 4-, 8-Kbit EEPROM	Reduce BOM cost
Lockable Settings	Minimize liability exposure from user misconfiguration
SMBus Time-out	Enhance fault tolerance
One-shot Mode	Turn on device only when needed to save power
9 to 12-bit Selectable Resolution	Choice of resolution vs. conversion speed to custom fit application requirement
I²C High Speed Mode (AT30TS75 only)	The system does not need to throttle down to communicate with the temperature sensor and thus maintains the high-speed operation

Application Example:

Atmel Digital Temperature Sensors provide highly accurate measurement to better control temperature and prolong the life of LEDs.
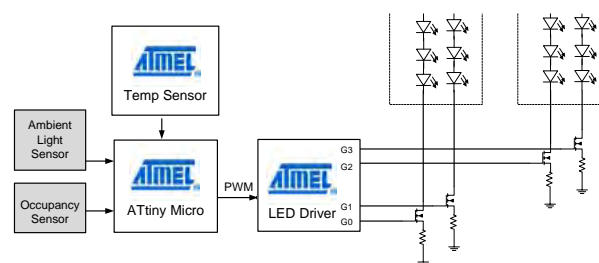
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Why Do Applications Need a Temperature Sensor?

As electronic systems run faster they generate more heat, making temperature sensors more important than ever. A temperature sensor allows the processor clock to be throttled back when the system exceeds a preset limit to ensure product safety without utilizing a larger fan or heat sink, which may not be practical in today's increasingly compact designs. Furthermore, even if a fan can sufficiently maintain the system temperature at the proper level, using a temperature sensor to slow down the fan speed whenever it does not have to run at the top speed greatly prolongs the life of the fan.

Atmel Digital Temperature Sensors
Accurate, Complete and Easy to Use

Currently, the industry uses four major temperature-sensing technologies: Digital Temperature Sensor, Thermistor, Resistance Temperature Device (RTD), and Thermocouple. While RTD and thermocouple are suitable for extreme temperature conditions, most electronic systems can benefit from either a digital temperature sensor or a thermistor. A digital temperature sensor is a complete, self-contained solution, while a thermistor requires the support of external circuitry such as an analog-to-digital converter.

In terms of performance, digital temperature sensors offer superior accuracy, and they are calibration-free. In comparison, thermistors require time-consuming calibration to achieve accurate measurement and thus add significant manufacturing cost. Therefore, while at first glance a thermistor may have lower unit cost, a designer should consider the overall system and manufacturing cost to properly evaluate the true costs of the two devices.

Typical Characteristics	Digital Temperature Sensors	General Purpose Thermistors	Resistance Temperature Device	Thermocouples (TCs)
Temperature Range	-40°C to +125°C	-55°C to +125°C	-200°C to +850°C	-270°C to +2000°C
Accuracy	Best	*	2 Point Calibration	2 Point Calibration
Sensitivity	Highest	High	Low	Medium
Calibration Required	No	Yes	Yes	Yes
ADC Required	No	Yes	Yes	Yes
Unit Cost	Low To Moderate	Low	Low To High	Moderate To High
System Cost	Low	Low to Moderate	Moderate To High	Moderate To High

* Depends on an accurate external current source

AT30TS750 Family

The Atmel AT30TS750 Digital Temperature Sensor family comprises five high-precision devices based on the industry-standard xx75 functionality. These devices offer designers a choice of nonvolatile registers and serial EEPROM for optimal system reliability and increased integration.
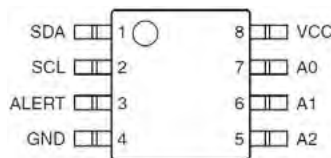
The AT30TS750 digital temperature sensor family is a complete, fully factory calibrated, real-time temperature monitoring solution with ±0.5°C typical accuracy over an operating temperature range of 0°C to +85°C. The devices output digitized temperature data via a standard I^{2}C/SMBus-compatible serial interface, eliminating the need for any external components such as A/D converters and data post processing.

| Part Number	LM75/I^{2}C Protocal Compatible	SMBus Timeout	I^{2}C High Speed Mode	9 to 12-bit Selectable Resolution	One Shot Mode	NVM Registers	Integrated EEPROM
AT30TS75	Yes	Yes	Yes	Yes	Yes	No	No
AT30TS750	Yes	Yes	No	Yes	Yes	Yes	No
AT30TSE752 AT30TSE754 AT30TSE758	Yes	Yes	No	Yes	Yes	Yes	Yes

Key Features and Benefits

- Pin and software compatible with industry-standard LM75-type devices
- Up to 12-bit resolution A/D converter, user-configurable (temperature-to-digital converter)
- Highly accurate temperature sensing
  - ±1°C (max.) over the 0°C to +85°C temperature range
  - ±2°C (max.) over the –20°C to +105°C temperature range
  - ±3°C (max.) over the –40°C to +125°C temperature range

- Integrated nonvolatile registers
- Integrated serial EEPROM data memory (2-, 4-, or 8-Kbits)
- I^{2}C/SMBus™-compatible serial interface
- I^{2}C high speed mode compatible (3.4MHz maximum clock frequency)
- SMBus time-out supported
- Programmable high and low temperature limits
- Power-saving shutdown and one-shot modes
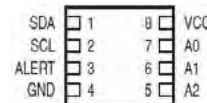- Alert output pin to indicate temperature alarms

Packages
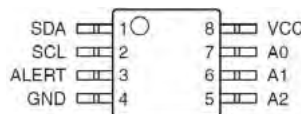
SOIC (3.9 x 4.9 mm)   MSOP (3 x 3 mm)   Ultra Thin DFN (UDFN – 2 x 3 x 0.6mm)

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AT30TSE002B Family

In addition to the DDR3 DIMM application, the Atmel AT30TSE002B Family is an ideal solution for any application that sets high safety and reliability as a top concern to reduce overheating liability with the added benefit of containing a robust 2-Kbit nonvolatile memory to store customer preference data. In many cases, the AT30TSE002B Family can drop in and replace an existing low-density I^2C serial EEPROM and have the value added security of providing real-time temperature monitoring to enhance safety and reliability of the product.

Part Number	JEDEC Compliant for DDR3	SMBus Timeout	Resolution (bit)	Programmable Triple Alarms	Programmable Hysteresis Threshold	Standby Mode	Integrated EEPROM
AT30TS00	B-Grade (best)	Yes	11	Yes	Yes	Yes	No
AT30TSE002B	B-Grade (best)	Yes	11	Yes	Yes	Yes	Yes

Key Features and Benefits

- 11-bit A/D converter (temperature-to-digital converter) with 0.125°C resolution
- Highly accurate temperature sensing
  - ±1°C (max.) over the +75°C to +95°C temperature range
  - ±2°C (max.) over the +40°C to +125°C temperature range
  - ±3°C (max.) over the -20°C to +125°C temperature range
- Integrated 2-Kbits (256 bytes) of serial EEPROM data memory
- I^2C/SMBus™-compatible serial interface
- SMBus timeout supported

- Programmable critical, upper, and lower temperature alarms
- Programmable hysteresis threshold (off, 0°C, 1.5°C, 3°C, or 6°C)
- EEPROM permanent and reversible software write-protect features
- Very low current consumption
  - 1.6µA (typ.) standby current
  - 0.2mA (typ.) EEPROM read current
  - 1.5mA (typ.) EEPROM write current

Packages

8-WDFN

```
        V_CC □8    1□ A0
      EVENT □7    2□ A1
        SCL □6    3□ A2
        SDA □5    4□ GND
```
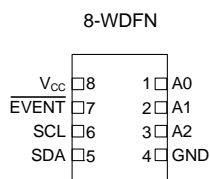
Bottom View

Very Thin DFN (2 x 3 x 0.8 mm)

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Product Availability and Ordering Information

| Atmel Ordering Code	Voltage Range	Interface	Nonvolatile Registers	Integrated EEPROM	Package	Availability
AT30TS75–XM8–T	2.7–5.5V	I²C/SMBus	No	No	MSOP 8	Now
AT30TS75–SS8–T	2.7–5.5V	I²C/SMBus	No	No	SOIC 8	Now
AT30TS75–MA8–T	2.7–5.5V	I²C/SMBus	No	No	UDFN 8	Now
AT30TS750–XM8–T	2.7–5.5V	I²C/SMBus	Yes	No	MSOP 8	Now
AT30TS750–SS8–T	2.7–5.5V	I²C/SMBus	Yes	No	SOIC 8	Now
AT30TS750–MA8–T	2.7–5.5V	I²C/SMBus	Yes	No	UDFN 8	Now
AT30TSE752–XM8–T	2.7–5.5V	I²C/SMBus	Yes	2-Kbits	MSOP 8	Now
AT30TSE752–SS8–T	2.7–5.5V	I²C/SMBus	Yes	2-Kbits	SOIC 8	Now
AT30TSE752–MA8–T	2.7–5.5V	I²C/SMBus	Yes	2-Kbits	UDFN 8	Now
AT30TSE754–XM8–T	2.7–5.5V	I²C/SMBus	Yes	4-Kbits	MSOP 8	Now
AT30TSE754–SS8–T	2.7–5.5V	I²C/SMBus	Yes	4-Kbits	SOIC 8	Now
AT30TSE754–MA8–T	2.7–5.5V	I²C/SMBus	Yes	4-Kbits	UDFN 8	Now
AT30TSE758–XM8–T	2.7–5.5V	I²C/SMBus	Yes	8-Kbits	MSOP 8	Now
AT30TSE758–SS8–T	2.7–5.5V	I²C/SMBus	Yes	8-Kbits	SOIC 8	Now
AT30TSE758–MA8–T	2.7–5.5V	I²C/SMBus	Yes	8-Kbits	UDFN 8	Now
AT30TS00–MAH–T	2.7–3.6V	I²C/SMBus	No	No	WDFN 8	Now
AT30TSE002B–MAH–T	2.7–3.6V	I²C/SMBus	No	2-Kbits	WDFN 8	Now

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Atmel Digital Temperature Sensor Tools

AVR-based Kits with Easy-to-Use Software

The Atmel digital temperature sensor development tools enable rapid development and system integration for applications that require accurate, real-time temperature monitoring to improve product safety and reliability, improve system performance, and reduce the risk of system overheating.

Temperature Sensor Xplained

- Temperature Sensor Xplained add-on board
- Software development using Atmel AVR® Xplained Kit series
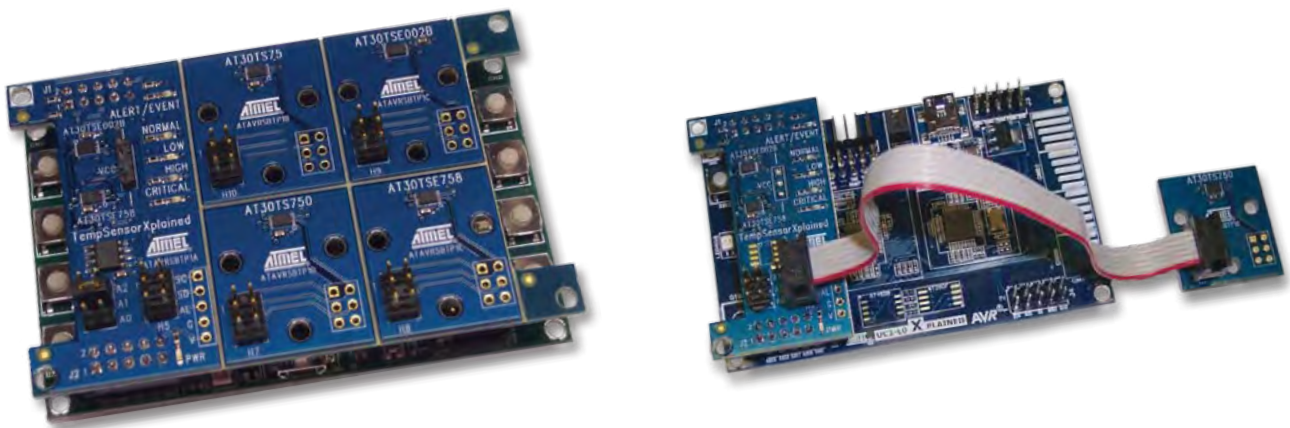
The Atmel ATAVRTEMPSENSORX is an add-on board for the Atmel AVR® Xplained series development platform that adds temperature monitoring functionality in embedded design applications. The ATAVRTEMPSENSORX add-on board has been developed to allow fast system prototyping with a wide range of AVR microcontrollers. The software drivers eliminate low-level development to ease and accelerate development. The boards and software are part of the development environment and tool chain for AVR microcontrollers. Additionally, the ATAVRTEMPSENSORX add-on board was designed with breakaway capability to support remote temperature sensing evaluation and development.

Software tools, libraries, and documentation available at www.atmel.com/ATAVRTEMPSENSORX

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Temperature Sensor Development Kit

- Easy-to-use demonstration platform
- Flexible modular hardware design
- Compatible with any development platform supporting I²C Interface

The Atmel AT30TK175STK development kit allows users to experiment and develop with the Atmel family of digital temperature sensors. The kit includes an AT88Microbase board, an AT30TK175 daughterboard, a ribbon cable to support remote sensing, and a USB cable extension. The daughterboard interfaces to the AT88Microbase board to provide communication to a PC via a USB interface allowing designers to learn and experiment with the temperature sensor demonstration utility. The temperature sensor demonstration utility showcases the unique features of the AT30TSE002B and AT30TS750 family of devices. In addition, the AT30TK175STK daughterboard can be connected to any MCU development platform to easily add temperature monitoring to applications.

Software tools, libraries, and documentation available at www.atmel.com/AT30TK175STK

Enabling Unlimited Possibilities™

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