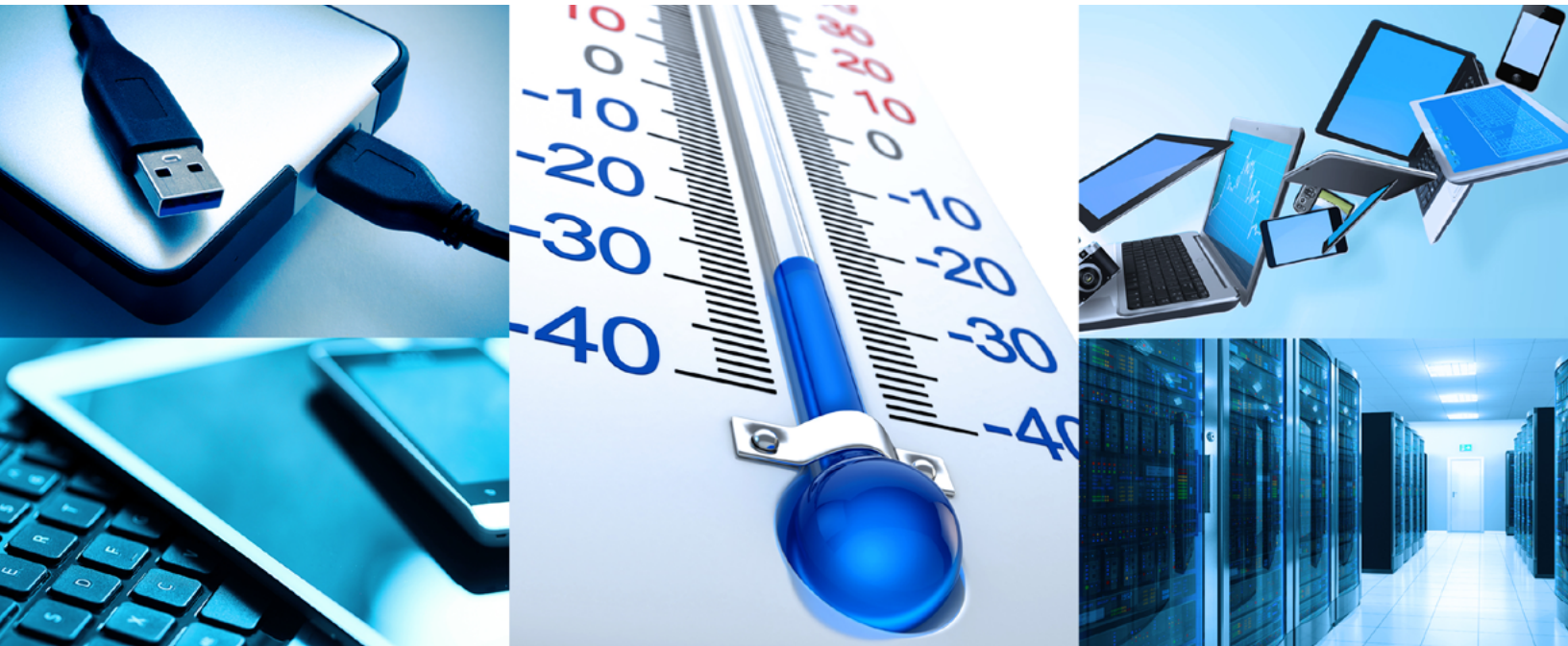# Atmel

Atmel Digital Temperature Sensors

World's Most Versatile Temperature Sensing Solutions

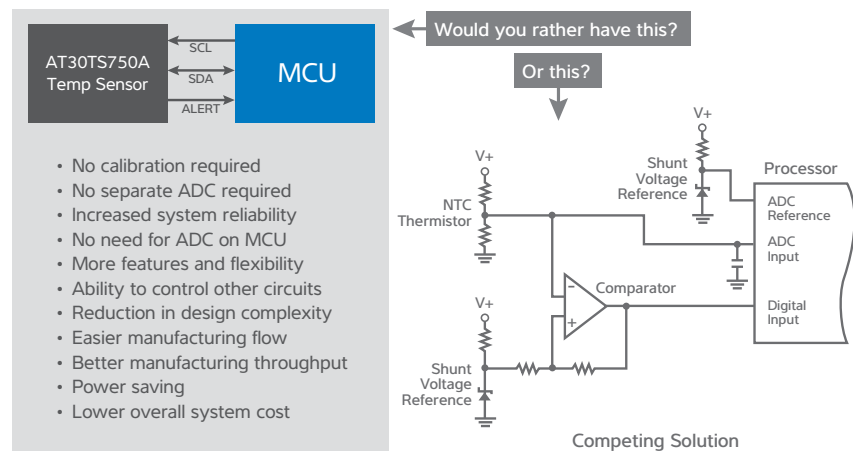# World's Most Versatile Temperature Sensing Solutions

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

Why Do Applications Need a Temperature Sensor?

As today's electronic systems run faster and as silicon content increases, these applications are generating more heat than ever, making the need to monitor temperature increasingly important. A temperature sensor can effectively measure the system and processor temperatures and allows the processor and system bus frequencies to be throttled back when the temperature exceeds a preset limit. This ensures product safety and reliability while minimizing the need for cooling fans and heat sinks which may not be practical in today's increasingly compact designs. For systems that do include a fan to maintain proper conditions, temperature sensors can be used to vary the fan speed as needed to reduce noise, reduce power consumption, and prolong the life of the fan.

In portable applications that utilize Li-ion or Li-polymer batteries, temperatures in excess of 60°C can cause the batteries to overheat and swell, catch on fire, or even explode. A temperature sensor can actively monitor the battery temperature, allowing the system to warn the user, to shut itself down, or to even shut down the battery charging in the event of an over-temperature situation, thereby increasing the safety and reliability of the application.

Digital Temperature Sensor Advantages and Benefits

AT30TS750A Temp Sensor — SCL, SDA, ALERT — MCU

Would you rather have this?

Or this?

- No calibration required
- No separate ADC required
- Increased system reliability
- No need for ADC on MCU
- More features and flexibility
- Ability to control other circuits
- Reduction in design complexity
- Easier manufacturing flow
- Better manufacturing throughput
- Power saving
- Lower overall system cost

Competing Solution

Application Example:

Atmel Digital Temperature Sensors provide highly accurate measurement to better control temperature and prolong the life of the LEDs.
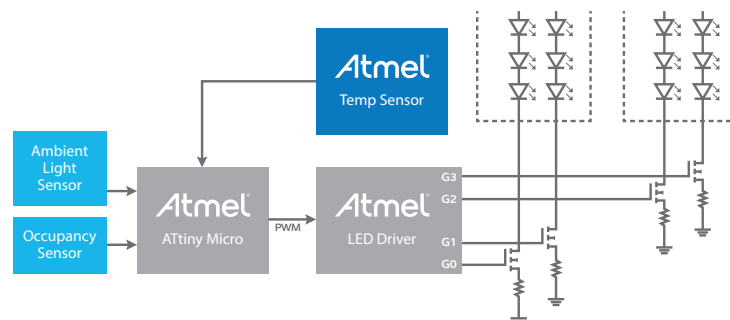
Atmel Digital Temperature Sensors

Accurate, Complete, and Easy to Use

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 drop-in replacements for industry-standard LM75-type devices as well as JEDEC-standard compliant solutions for DDR3 and DDR4 DIMM modules. Atmel Digital Temperature Sensors also provide enhanced features, such as integrated EEPROM and nonvolatile registers, to reduce BOM cost, improve system flexibility and product reliability, and enhance application safety.

In terms of performance, Digital Temperature Sensors offer excellent accuracy and a precise, fully calibrated digital temp- erature reading in degrees celsius. Digital Temperature Sensors eliminate the need for additional components, such as an A/D converter, within the application, and there is no need to calibrate components or the system at specific reference temperatures as required when using thermistors. Atmel Digital Temperature Sensors take care of it all, enabling the critical system temperature monitoring function to be simplified.

AT30TS74/AT30TS75A	• Enhanced version of industry-standard LM75 • Selectable 9-bit to 12-bit resolution (0.5°C to 0.0625°C) • Supports two programmable temperature limits • Power-saving Shutdown/One-shot Mode
AT30TS750A	
AT30TSE752A/4A/8A	• AT30TS75A also supports I^{2}C High-speed Mode (3.4MHz) • AT30TS750A also incorporates nonvolatile registers • AT30TSE752A/4A/8A also integrate 2/4/8Kb of SEEPROM

AT30TS00	• JEDEC-defined industry-standard solutions for DDR3 and DDR4 • Fixed 11-bit resolution (0.125°C) • Supports three programmable temperature limits • User-selectable hysteresis control
AT30TSE002B	
AT30TSE004A	• AT30TSE002B integrates 2Kb of SEEPROM • AT30TSE004A integrates 4Kb of SEEPROM for DDR4 applications

All devices are available in 8-lead packages and support SMBus Time-out

AT30TS74 and AT30TS/TSE75xA Devices

The Atmel AT30TS74 and AT30TS/TSE75xA Digital Temperature Sensor Family comprises six high-precision devices based on the industry-standard LM75 functionality. These devices offer designers a choice of nonvolatile registers and serial EEPROM for optimal system reliability and increased integration.

The Atmel AT30TS74 and AT30TS/TSE75xA Digital Temperature Sensor Family is a complete, fully factory-calibrated, real-time temperature monitoring solution that operates over the -55°C to +125°C temperature range. The devices output digitized temperature data via a standard I2C/SMBus-compatible serial interface, eliminating the need for any external components such as A/D converters and data post-processing.

Feature	Benefit	Devices
Non-volatile registers	Pre-configured power-up settings minimize MCU power-up involvement and enforce preset conditions to improve safety	AT30TS750A, AT30TSE752A/4A/8A
Integrated 2Kb, 4Kb, or 8Kb EEPROM	Reduces component count and BOM costs and minimizes board space	AT30TSE752A/4A/8A
Widest Vcc range of 1.7V to 5.5V	Best-in-class operating voltage range and low voltage capability to save power	AT30TS74, AT30TS75A, AT30TS750A, AT30TSE752A/4A/8A
Lockable settings	Minimize liability exposure from user misconfiguration and tampering	AT30TS750A, AT30TSE752A/4A/8A
SMBus Time-out	Enhances fault tolerance	All
I2C High-speed Mode (3.4MHz)	System does not need to throttle down to communicate with the temperature sensor and thus maintains high-speed operation	AT30TS74, AT30TS75A
I2C Fast Mode Plus (1MHz) frequency	Allows faster data throughputs	AT30TS74, AT30TS75A, AT30TS750A, AT30TSE752A/4A/8A
One-shot Mode	Turn on device only when needed to save power	All
9-bit to 12-bit selectable resolution	Choice of resolution versus conversion speed to custom fit application requirements	All

AT30TS74 Device Typical Accuracy
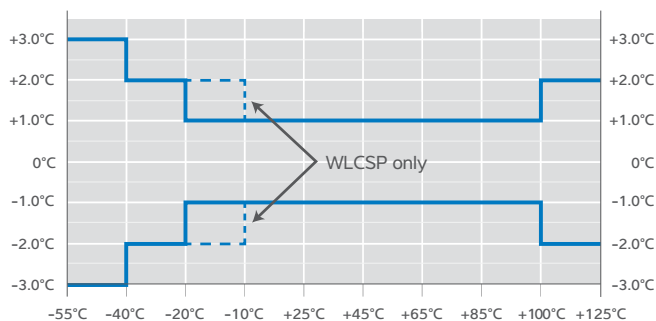
AT30TS75xA/TSE752A/4A/8A Device Typical Accuracy
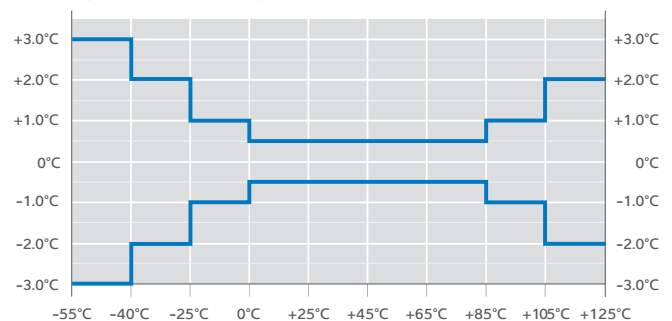
AT30TS/TSE00x Devices

In addition to DDR3 and DDR4 DIMM applications, the Atmel AT30TS/TSE00x devices are ideal solutions for any application that requires high levels of safety and reliability and a reduced risk of overheating—with the added benefit of an integrated, robust 2Kb or 4Kb serial EEPROM to store customer preference data. In many cases, the AT30TS/TSE00x devices can drop in and replace an existing low-density I²C serial EEPROM while offering the value-added security of real-time temperature monitoring to enhance safety and reliability of the product.

Feature	Benefit
Three user-programmable temperature limits	Third temperature limit to improve the temperature monitoring robustness of a system
Integrated 2Kb or 4Kb EEPROM (AT30TSE002B and AT30TSE004A)	Reduces component count and BOM costs and minimizes board space
Wide Vcc range of 1.7V to 3.6V (AT30TSE004A)	Low voltage operation to reduce power consumption
User-selectable hysteresis levels	Ensures temperature limit violations are valid and not glitch-related
SMBus Time-out	Enhances fault tolerance
I²C Fast Mode Plus (1MHz) frequency	Allows faster data throughputs

AT30TS/TSE00x Comparison

| Feature	AT30TSE002B	AT30TSE004A	AT30TS00
EEPROM memory size	2Kb	4Kb	N/A
Operating voltage range	2.7V to 3.6V	1.7V to 3.6V	2.7V to 3.6V
Maximum clock frequency	I²C Fast Mode (400kHz)	I²C Fast Mode Plus (1MHz)	I²C Fast Mode Plus (1MHz)
Permanent write protection	Yes	No	N/A
Reversible software write protection	Yes (protect one section of 128 bytes)	Yes (protect one of four quadrants of 128 bytes each)	N/A
Package options	WDFN-8	WDFN-8 UDFN-8	WDFN-8

AT30TS/TSE00x Device Typical Accuracy
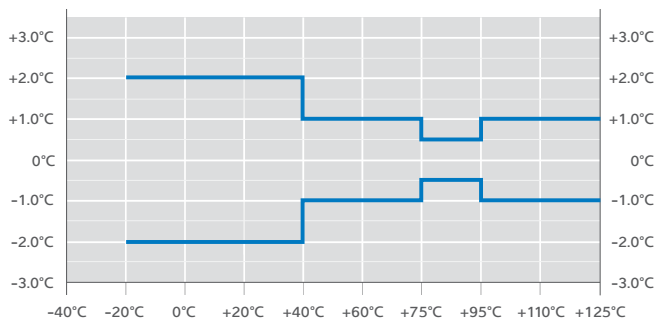
Product Availability and Ordering Information

Atmel Ordering Code	Voltage Range	Interface	Nonvolatile Registers	Integrated EEPROM	Package	Availability
AT30TS75A-XM8M-T	1.7–5.5V	I²C/SMBus	No	No	MSOP-8	Now
AT30TS75A-SS8M-T	1.7–5.5V	I²C/SMBus	No	No	SOIC-8	Now
AT30TS75A-MA8M-T	1.7–5.5V	I²C/SMBus	No	No	UDFN-8	Now
AT30TS74-UFM10-T	1.7–5.5V	I²C/SMBus	No	No	4-ball WLCSP	Now
AT30TS74-UFM11-T	1.7–5.5V	I²C/SMBus	No	No	4-ball WLCSP	Now
AT30TS74-UFM12-T	1.7–5.5V	I²C/SMBus	No	No	4-ball WLCSP	Now
AT30TS750A-XM8M-T	1.7–5.5V	I²C/SMBus	Yes	No	MSOP-8	Now
AT30TS750A-SS8M-T	1.7–5.5V	I²C/SMBus	Yes	No	SOIC-8	Now
AT30TS750A-MA8M-T	1.7–5.5V	I²C/SMBus	Yes	No	UDFN-8	Now
AT30TSE752A-XM8M-T	1.7–5.5V	I²C/SMBus	Yes	2Kb	MSOP-8	Now
AT30TSE752A-SS8M-T	1.7–5.5V	I²C/SMBus	Yes	2Kb	SOIC-8	Now
AT30TSE752A-MA8M-T	1.7–5.5V	I²C/SMBus	Yes	2Kb	UDFN-8	Now
AT30TSE754A-XM8M-T	1.7–5.5V	I²C/SMBus	Yes	4Kb	MSOP-8	Now
AT30TSE754A-SS8M-T	1.7–5.5V	I²C/SMBus	Yes	4Kb	SOIC-8	Now
AT30TSE754A-MA8M-T	1.7–5.5V	I²C/SMBus	Yes	4Kb	UDFN-8	Now
AT30TSE758A-XM8M-T	1.7–5.5V	I²C/SMBus	Yes	8Kb	MSOP-8	Now
AT30TSE758A-SS8M-T	1.7–5.5V	I²C/SMBus	Yes	8Kb	SOIC-8	Now
AT30TSE758A-MA8M-T	1.7–5.5V	I²C/SMBus	Yes	8Kb	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	2Kb	WDFN-8	Now
AT30TSE004A-MAA5M-T	1.7–3.6V	I²C/SMBus	No	4Kb	WDFN-8	Now
AT30TSE004A-MA5M-T	1.7–3.6V	I²C/SMBus	No	4Kb	UDFN-8	Now

Note: Please see the AT30TS74 Datasheet for details on the additional AT30TS74 WLCSP part numbers available.

AT30TS75xA/TSE752A/4A/8A and AT30TS74 Devices
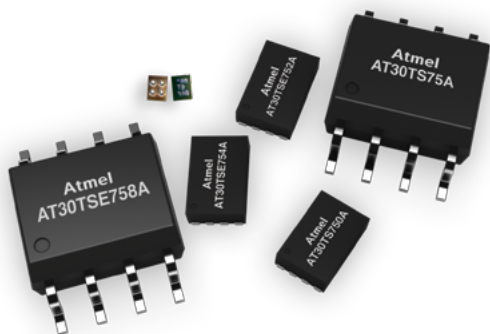

AT30TS/TSE00x Devices

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
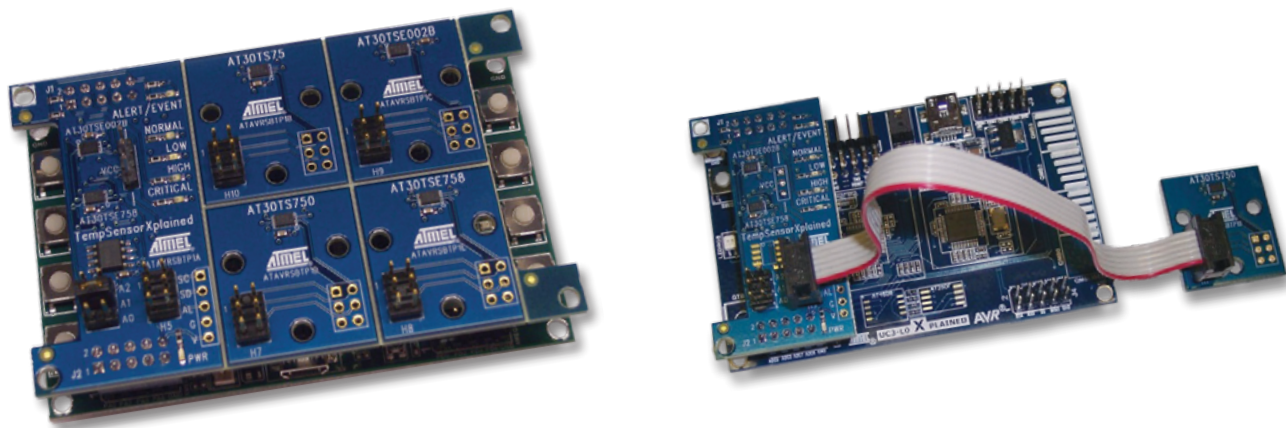
The Atmel ATAVRTEMPSENSORX is an add-on board for the Atmel AVR® Xplained series development platform that adds temperature monitoring functionality in embedded design applications. The ATAVRTEMPSENSORX add-on board has been developed to allow fast system prototyping with a wide range of AVR microcontrollers. 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
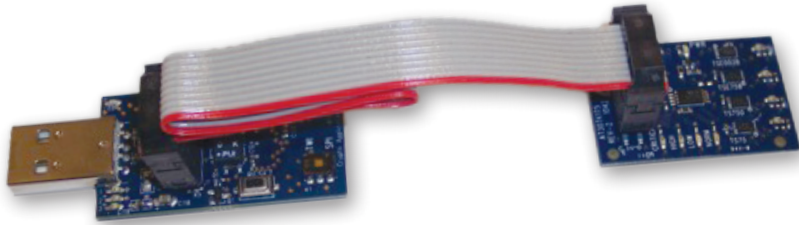
The Atmel AT30TK175STK development kit allows users to experiment and develop with the Atmel family of Digital Temperature Sensors. The kit includes an AT88Microbase board, an AT30TK175 daughterboard, a ribbon cable to support remote sensing, and a USB cable extension. The daughterboard interfaces to 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 AT30TSE004A and AT30TSE002B and the AT30TS74 and AT30TS/TSE75xA 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

Atmel Digital Temperature Sensor Products Home Page
http://www.atmel.com/products/other/digital_temperature_sensors/default.aspx

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