

TSic™- 306

High Precision, Rapid Response, Low Cost Temperature Sensor IC

Feature Sheet

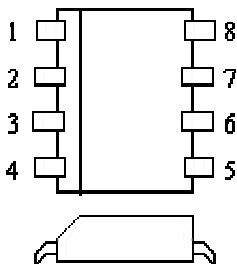
Features

- Low cost, precision temperature sensor
- Single-wire 11-bit digital serial signal output compatible with state-of-the-art μ P controllers
- Communication range > 10 meters
- Resolution: 0.1°C
- Accuracy: $\pm 0.3^\circ\text{C}$ over a span of 80°C
- Wide measurement range: -50 to $+150^\circ\text{C}$
- Signal read-out every 0.1s (other rates available on request)
- V+ supply voltage: 2.97 to 5.5V (industry standard); 3.3V or 5V ($\pm 10\%$) power supplies
- Package: 8-pin SOIC
- Low quiescent current: $< 80\mu\text{A}$ at 25°C with 3.3V – minimizes self-heating errors for applications such as wall-mounted thermostats
- System-on-a-chip based on advanced mixed-signal technology integrating precision temperature sensing bandgap reference with proportional-to-absolute-temperature (PTAT) output, digital signal processor (DSP) core, and electrically erasable memory (EEPROM)

Package Information

TSic™ 306 SOP8: 150mil, Standard SMT Package, SOIC, Based on IEC 191-2Q, Type 076E35 B.

Other packages available on demand: TSic™ 306 e-line; 3 pin THT package.



| Pin | Name | Description |
|--------|--------|---------------------------------|
| 1 | V+ | Supply voltage (3.0-5.5V) |
| 2 | Signal | Temperature output signal |
| 4 | Gnd | Ground |
| 3, 5-8 | TP/NC | Test pin / NC Do not connect |

Brief Description

The TSic™ temperature sensor IC family are fully tested and calibrated sensors with absolute measurement accuracy on delivery – no further calibration needed. The TSic™ combines outstanding accuracy with long term stability, yet it is very simple to use.

The TSic™ series is specifically designed for high performance, cost-effective solutions for sensing temperature in building automation, automotive, industrial, office automation, white goods and low-power/mobile applications.

TSic™ employs a high precision bandgap reference with PTAT output; a low-power, precision ADC; and an on-chip DSP core with EEPROM to precisely calibrate the output temperature signal. The TSic™ series includes ICs with two linear analog signal output options, such as standard 0~1Vout ($V+ = 2.97\text{V}$ to 5.5V) or ratiometric (10~90% of $V+$; i.e., $0.5\sim 4.5\text{Vout}$ @ $V+ = 5\text{V}$) or the digital serial output signal for interfacing with μ P controllers.

Benefits

- **Several accuracy classes available with 100% upward compatibility**
- **No calibration by customer needed; absolute calibration specified**
- **Simple to integrate, reducing cost and time for application-development**
- **Fast data measurement – optimal for temperature control**
- **Packages for standard SMD, THT or application specific assembly**
- **Very low power consumption – ideal for mobile and standard applications**
- **Field reconfiguration/recalibration option available (high volume customers only)**
- **Outstanding long term stability**



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Absolute Maximum Ratings

| PARAMETER | MIN | TYP | MAX | UNITS |
|---|------|-----|-----------------------|-------|
| Supply Voltage (V ₊) | -0.3 | | 6.0 | V |
| Voltages at Analog I/O Pins (V _{INA} , V _{OUTA}) | -0.3 | | V _{DDA} +0.3 | V |
| Storage Temperature Range (T _{stor}) | -50 | | 150 | °C |

Operating Conditions

| PARAMETER | MIN | TYP | MAX | UNITS |
|--|------|-----|-----|-------|
| Supply Voltage to Gnd (V ₊) ¹ | 2.97 | 5.0 | 5.5 | V |
| Supply Current (I _{v+}) @ V ₊ = 3.3V, RT | 30 | 45 | 80 | μA |
| Ambient Temperature Range (T _{amb}) ² | -50 | | 150 | °C |
| Output Load Capacitance (C _L) ³ | | 10 | 15 | nF |
| External Capacitance Between V ₊ and Gnd (C _{V+}) ⁴ | 80 | 100 | 470 | nF |
| Output Load Resistance (R _L) Signal to Gnd (or V ₊) ⁵ | 2.5 | 10 | | KΩ |

- 1 With supply voltage 2.7V - 2.97V, accuracy is slightly reduced; below 2.7V, functionality is unknown.
- 2 Output signal is limited to this ambient temperature (applies to calibration, offset and gain).
- 3 When using the output as a digital output, the load capacitor C_L is limited by maximum rise time for ZACwire™.
- 4 Locate as close as possible to TSic's V₊ and Gnd pins.
- 5 When using the output as a digital output, no pull-down resistor is allowed.

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Temperature Accuracy

| PARAMETER | MIN | TYP | MAX | UNITS |
|--|------|------|------|-----------------|
| <i>Wide Range Device for -50° to 150°C</i> | | | | |
| +10 to 90 °C | -0.3 | ±0.3 | 0.3 | °C ¹ |
| -20 to +10, 90-110 | -0.2 | +0.3 | 0.95 | °C ¹ |
| -50 to -20, 110-150 | 0 | +0.9 | 2.0 | °C ¹ |

¹ 2s value, plus 1 bit quantization error (0.1°C).

Available on request: TSic™ products with customer-specific special calibration which shifts the 80°C span (bandgap) with the high precision temperature range of ±0.3 °C to a lower or higher temperature range.

Output Examples for TSic™ Devices

| | | Temperature Measurement Range -50°C to 150°C or -58°F to 302°F (Wide Range Device) | | |
|-----------|-----------|--|---------------------------------|-----------------------|
| | | TSic-301 | TSic-303 | TSic-306 ¹ |
| Temp (°C) | Temp (°F) | Analog 0~1V | Analog ratiometric 10~90% | Digital ¹ |
| -50 | -58 | 0.000 | 10 | 0x000 |
| -10 | 14 | 0.200 | 26 | 0x199 |
| 0 | 32 | 0.250 | 30 | 0x200 |
| 25 | 77 | 0.375 | 40 | 0x2FF |
| 60 | 140 | 0.550 | 54 | 0x465 |
| 125 | 257 | 0.875 | 80 | 0x6FE |
| 150 | 302 | 1.000 | 90 | 0x7FF |

¹ Temperature = (Digital signal / 2047 * 200 - 50) °C