TEMPERATURE
FLOW
HUMIDITY
CONDUCTIVITY

TSic™ 301/306
Easy to integrate, low power temperature sensor IC

RoHS

The Product

The TSic™ series of temperature sensor ICs are specifically designed as a low-power solution for temperature measurement in building automation, medical/pharma technologies, industrial and mobile applications. The TSic™ provides a simple temperature measurement and achieves outstanding accuracy combined with long term stability.

The TSic™ has a high precision bandgap reference with a PTAT (proportional-to-absolute-temperature) output, a low-power and high-precision ADC and an on-chip DSP core with an EEPROM for the precisely calibrated output signal. The TSic™ temperature sensor is fully calibrated, meaning no further calibration effort is required by the customer. With an accuracy of ±0.3K in a range of 80K (e.g. 10°C to 90°C), the sensor is more accurate than a class F0.3 (DIN EN 60751) platinum sensor. Extended long wires (> 10m) will not influence the accuracy.

The TSic™ is available as digital (ZacWire, TSic™ x06) or analog (0-1V, TSic™ x01). The low power consumption of about 35µA makes it suitable for many applications.

Features

- Accuracy: ±0.3K (TSic™ 30x) in the range of 10°C to 90°C
- Resolution: 0.1K
- Measurement Range: -50°C to 150°C
- Sampling Rate: 10Hz
- Supply Voltage: V^+ = 3.0V to 5.5V, high precision operating range V^+ = 4.5V to 5.5V
- Package: SOP-8, TO92
- Supply Current: typ. 30µA at 25°C and V^+ = 3.3V for minimal self-heating

Custom Specific Calibrations

The accuracy range of 80K (default: 10 C – 90 C) can be shifted, e.g. an accuracy of ±0.3K in a range from -30°C to +50°C can be ensured (TSic 30x).

Key Benefits

- No calibration necessary
- Very low power consumption
- Custom calibration and assembly possible
- Digital or analog output signal
- Excellent long term stability

IST
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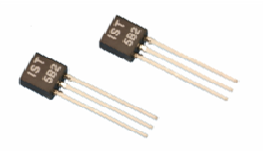
Packages

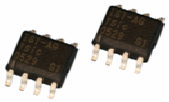
TO92

The TO92 package is suitable for assemblies, e.g. in stainless steel tubes or various sensing probes. The TO92 package is recommended for high precision applications, due to lower thermal and mechanical stress during a reflow assembly process.



SOP-8

The SOP-8 package is highly suitable for automatic assembly on a PCB.
Generally all TSics™ are available in a SOP-8 package. However for high-precision devices, such as the TSic30x, the ensured accuracy cannot be guaranteed after the reflow soldering process (the process brings thermal stress to the chip).



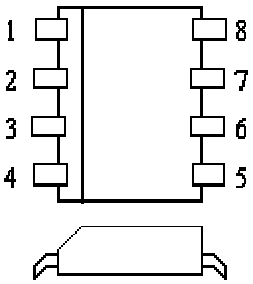
To ensure a high accuracy with SOP-8 package, IST provides calibration of the TSic™ after a PCB assembly. Please contact us for further information.

⇒ see package datasheet for exact dimensions

Pin Assignment

SOP-8:

1 V+, Supply voltage (3.0 - 5.5V)
2 Signal
4 GND
3 5-8 not used



TO92:

1 GND
2 Signal
3 V^+, Supply voltage (3.0 - 5.5V)

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Accuracy

With an accuracy of ±0.3K in a temperature range of 80K (e.g. 10°C to 90°C), the TSic™ sensors are more accurate than a class F0.3 (DIN EN 60751) platinum sensor.
The tolerances of the TSic™ and DIN B and DIN A platinum sensors are compared in Figure 1.
With a standard calibration, the TSic™ 30x is more accurate than a DIN B platinum sensor in the range of 10°C to 110°C. The range can be shifted up or downwards to reach a high accuracy between e.g. -30°C to 50°C.

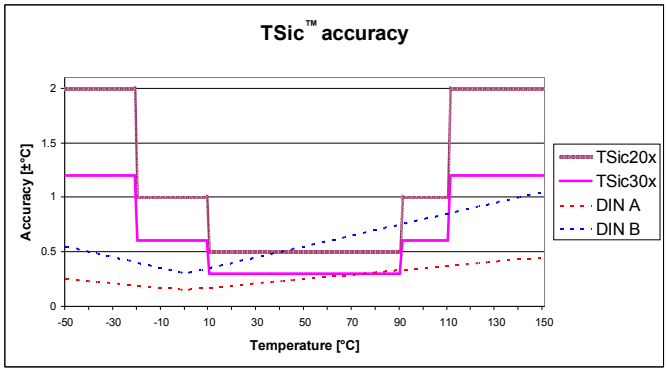

Figure 1: Comparison of TSic™ <--> platinum sensor accuracy

Signal Output

Formulas for the output signal [°C]:

Analog output (0-1V):

$$T = Sig[V] * (HT - LT) + LT\ [°C]$$

Digital output:

$$T = \frac{DigitalSignal}{2047} * (HT - LT) + LT\ [°C]$$

For a programming example see TSic™ ZACwire Documentation

Output examples:

	Temperature Range: -50°C to 150°C	
Temp (°C)	**Digital Values (TSic x06)**	**Analog 0-1V (TSic x01)**
-50 [1]	**0x000**	0.000
-10	**0x199**	0.200
0	**0x200**	0.250
25	**0x2FF**	0.375
60	**0x465**	0.550
125	**0x6FE**	0.875
150 [2]	**0x7FF**	1.000

[1] LT = -50, [2] HT = 150 as standard value for the temperature calculation.

LT: Lower temperature limit [°C]
HT: Higher temperature limit [°C]
V+: Supply voltage [V]
Sig[V]: Analog output signal [V]

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Absolute Maximum Ratings

PARAMETER	MIN	MAX	Units
Supply Voltage (V^+)	-0.3	6.0	V
Voltages for analog I/O – Pins (V_{INA}, V_{OUTA})	-0.3	V_{DDA}+0.3	V
Storage Temperature Range (T_{stor})	-20	80	°C

Operating Conditions

PARAMETER	MIN	TYP	MAX	Units
Supply Voltage to GND (V^+)	2.97	5.0	5.5	V
Supply Current (I_{V+}) @ V^+ = 3.3V, RT	25	30	60	µA
Operating Temperature Range (T_{amb})	-50		150	°C
Output Load Capacitance (C_L)			15	nF
External Capacitance between V^+ and GND[1] (C_{V+})	80	100	470	nF
Output Load Resistance between signal and GND (or V^+)	47			kΩ

[1]Recommended as close to TSic V+ and GND-Pins as possible.

Temperature Accuracies[2]

TSic 30x	Tol.	Units
T1: +10°C to 90°C	±0.3	K
T2: -20°C to +110°C	±0.3	K
T3: -50°C to +150°C	±0.5	K
TSic 20x	**Tol.**	**Units**
T1: +10°C to 90°C	±0.3	K
T2: -20°C to 110°C	±0.4	K
T3: -50°C to 150°C	±0.9	K

[2]The provided accuracy is applicable for a supply voltage between 4.5V and 5.5V. The accuracy is smaller with a supply voltage between 2.97V and 4.5V. For applications where the best accuracy at 3V is requested, ask for a custom specific 3V calibrated device.

Other TSic™ products with custom specific calibrations are available on request e.g. other temperature range for high accuracy.

Accuracy at delivery; the assembly method can influence the accuracy!

Tolerance out of the measurement range:

Below -50°C / above +150°C: ±3K

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