TSic™ 506F/503F/501F

High precision, longterm stability Temperature Sensor IC

TEMPERATURE
HUMIDITY
FLOW

Product

The TSic™ series of temperature sensor ICs were specifically designed as a low-power solution for temperature sensing in building automation, measurement devices, industrial, medical/pharmacy technology and mobile applications.

The TSic™ employs a high precision band gap reference with proportional-to-absolute-temperature (PTAT), low-power, precision ADC, and on-chip DSP core with electrically erasable (EE) memory to precisely calibrate the output temperature signal.

The temperature sensor family TSic™ from IST are fully tested and calibrated sensors to allow absolute measurement accuracy at delivery and eliminates further calibration efforts. The temperature measurement with the TSic™ is very simple; it can achieve outstanding accuracy combined with a long term stability.

With an accuracy of ± 0.1°C in a range of 40°C, the sensor is more accurate than a 1/3 DIN B platinum sensor.

The TSic™ is available with a digital (ZacWire, TSic™ 506), analogue (0-1V, TSic™ 501), or ratiometric (10% - 90% V^+, TSic™ 503) output signal. The low power consumption of the TSic™ makes it ideal for mobile applications.

Features

- **Accuracy:** ±0.1°C[1)] in the range of 5°C to 45°C (other ranges on request)
- **Resolution**: 0.034°C
- **Measurement range:** -10°C to 60°C
- Signal-Output every 0.1s (digital)
- **Supply Voltage:** V^+ = 3.0V to 5.5V, high precision operation in range V^+ = 4.5V to 5.5V
- **Package:** 8-pin SOP-8, 3-pin TO92 (further packages and assemblies on request)
- **Low supply current** of type 30µA @ 25°C and V^+=3.3V Supply Current for minimal self heating.

1) *Accuracy on delivery; the kind of assembly can influence the accuracy!*

Customized calibrations

The accuracy range of 40°C (standard: 5°C – 45°C) can be shifted to another range.

Please contact us for your custom-calibrated TSic™ Sensor.

Key benefits

- **No calibration necessary!**
- **Low power consumption – appropriate for mobile applications**
- **More accurate than a 1/3 DIN B platinum sensor in the range of 5°C to 45°C**
- **Easy to integrate – low development costs**
- **Digital and analogue output signal in the same package available**
- **Robust and elementary signal transmission requires only one signal line**
- **Optimum solution for temperature control, thanks to fast data measurement**
- **Packages for standard SMD, THT or application-specific assembly**
- **Outstanding long term stability!**

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Packages

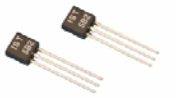
SOP-8 Package (150mil, Standard SMT Technology, SOIC-8) based on IEC 191-2Q: Type 076E35 B

The SOP-8 package is qualified for automatic assembly on PCB.

Principally all TSic™ types are available in this package. However, it should be noted that the reflow soldering process influences the calibrated accuracy and can generate a spreading loss of accuracy through thermal and mechanical stress in the package.

In order to achieve the high accuracy with this package, we also provide calibration after assembly. Please contact us for further discussions.

TO92 (small THT package)

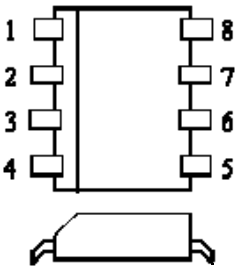


The TO92 package is intended for temperature probes, e.g. stainless steel tubes and other assemblies. This package has a better thermal decoupling through the pins than the SOP-8 package.

For exact dimensions of the packages, refer to the package datasheet.

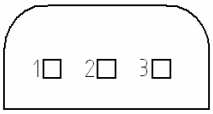
Pin assignment

SOP-8:



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

TO92:



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

Note: The e-line package (discontinued) has swapped pins 1 and 3!

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Accuracy

The tolerances of the TSic™ and DIN A and DIN Y (1/3 DIN B) platinum sensors are illustrated in Figure 1.

In the standard calibration, the TSic™ 50x is more accurate than the DIN Y platinum sensor in the range between 5°C and 45°C.

An outstanding long-term stability ensures that the accuracy will remain in the described tolerances.

The accuracy range of the TSic™ can be shifted. Please contact us for custom calibrations.

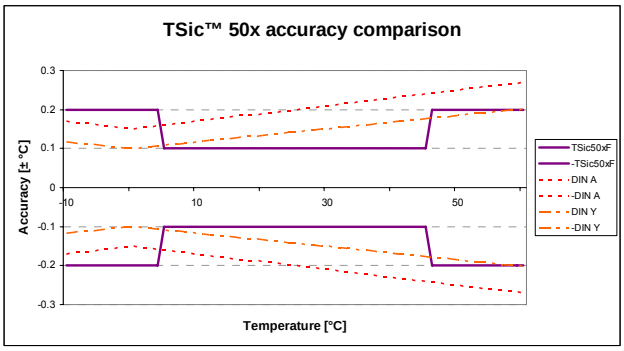

Figure 1: Comparison of TSic™ <--> platinum sensor accuracy

Signal output

Formulas for the output signal:

Digital Output: ***T= (Digital_signal/2047*(HT-LT)+LT) [°C]***

Programming -Example: refer TSic ZACwire Documentation.

Analogue output signal (0-1V): ***T = (Sig[Volt]*(HT-LT)+LT) [°C]***

Ratiometric output signal (10%-90%): ***T= ((Sig[V]/VDD[V]-0.1)/0.8*(HT-LT)+LT) [°C]***

Output examples:

		Measurement range: -10°C to 60°C 14°F to 140°F)		
Temp (°C)	**Temp (°F)**	**digital value (TSic 506)**	**analogue 0-1V [V] (TSic 501)**	**analogue ratiometric 10%~90% (V^+ = 5.0V) (TSic 503)**
-10[1]	14	0x000	0.000	10.0% of V+ (e.g. 0.5V)
0	32	0x124	0.143	21.4% of V+ (e.g. 1.07V)
25	77	0x3FF	0.500	50.0% of V+ (e.g. 2.5V)
60[2]	140	0x7FF	1.000	90.0% of V+ (e.g. 4.5V)

[1] LT = -10, [2] HT = 60 as standard value for the temperature-calculation.

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Absolute Maximum Ratings

PARAMETER	MIN	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[1] 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[2] Range (T_{amb})	-10		60	°C
Output Load Capacitance (C_L)			15	nF
External Capacitance between V+ and Gnd[3] (C_{V+})	80	100	470	nF
Output Load Resistance between signal and Gnd (or V+)	47			KΩ

Temperature Accuracies[4)]

PARAMETER	MIN	TYP	MAX	UNITS
Very High Accuracy Range Device for 5° to 45°C				
5°C to 45°C	-0.1	+/-0.07	+0.1	°C[4]
-10°C to 5°C	-0.2	+0.1	+0.2	°C
+45°C to +60°C	-0.2	+0.1	+0.2	°C
Measurement range: -10°C to +60°C (±3°C)				

Accuracy on delivery; the kind of mounting can influence the accuracy!

[1]Best accuracy with supply voltage 4.5V – 5.5V. With supply voltage 2.97V – 4.5V, accuracy reduced. Other supply voltages on request.

[2]Output signal is limited to this ambient temperature.

[3]Recomended as close to TSic V+ and Gnd-Pins as possible.

. [4] Accuracy = specification plus quantization error of 1 bit (0.034°C). This device gets calibrated at 5V. For applications where best accuracy at 3V is requested: ask for a customer specific 3V calibrated device. Accuracy for supply voltage within V+ = 4.5V to 5.5V, 2K (95%) value,

Other TSic™ products with customer specific calibration available on request: i.e. with special calibration where the 40°C span with the high precision temperature range of ±0.1°C is shifted to another (lower or higher) temperature range.

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