



TSic™-506F

High-resolution,-precision & fast response Temperature Sensor IC

Product

Accuracy $\pm 0.1\text{ }^\circ\text{C}$

Digital signal output

Measurement range $-10\text{ }^\circ\text{C}.. +60\text{ }^\circ\text{C}$

Resolution $0.034\text{ }^\circ\text{C}$

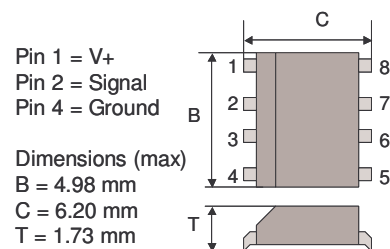
The temperature sensor family TSic™ from IST are fully tested and calibrated sensors to allow absolute measurement accuracy at delivery and eliminates further calibration efforts. The temperature measurement with the TSic™ is very simple, can achieve outstanding accuracy combined with a long term stability.

Advantages

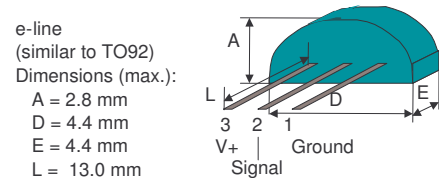
- Different accuracy classes with 100% upward compatibility
- No calibration by customer necessary any more, absolute calibration specified
- Simple to integrate, reducing cost and time for application-development
- Robust and elementary signal transmission requires only one signal line
- Optimum solution for temperature control, thanks to fast data measurement
- Packages for standard SMD, THT or application specific assembly
- Miniaturised solutions with Bare-chip (COB, COF, CSP) or e-line package
- Very fast response time with Bare-chip (COF – Chip on Flex)
- Very small power consumption – ideal for mobile and standard applications
- Field (re-)configuration or (re-)calibration available (option for high volume customers only)
- Outstanding long term stability

Packages

- SOP8 Package (150mil, Standard SMT Technology, SOIC-8) based on IEC 191-2Q: Type 076E35 B



- e-line (small THT package, TO-92 like)



Specification

See next pages “TSic™506 Temperature Sensor Device, Specification”



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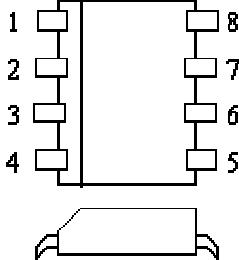
Temperature Sensor IC Specification

Features

- **Digital serial signal output** (11-bit) compatible with state of the art μ P controllers using only one single wire, capable of communication over a distance of > 10 meter.
- **Accuracy: $\pm 0.1^\circ\text{C}$ over span of 40°C**
- **Resolution: 0.034°C**
- **Focused range measurement: -10° to $+60^\circ\text{C}$**
- Signal read out every 0.1 second (other read out frequencies on request)
- Supply Voltage $V_+ = 2.97\text{V}$ to 5.5V , high accuracy operation in range $V_+ = 4.5\text{V}$ to 5.5V
- Precision temperature sensor at low cost
- Package: 8-pin SOIC or 3-pin e-line
- Low quiescent current of less than $80\mu\text{A}$ at 25°C and 5.0V to minimize self-heating and power consumption
- System-on-a-chip based on advanced mixed signal technology incorporating:
 - precision temperature sensing bandgap reference with PTAT output
 - digital signal processor (DSP) core
 - electrically erasable (EE) memory
 - digital serial interface using single wire for signal output

Package Information

- TSic™ 506 SOP8:150mil, Standard SMT Package, SOIC, Based on IEC 191-2Q: Type 076E35 B



Pin No.	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

- Other packages on customer's demand: TSic™ 506 e-line: 3 Pin THT package or 'TSic™ 506 bare die' or '- wafer level'

Description TSic™ Series

The TSic™ series of temperature sensor ICs were specifically designed as a high-performance, cost-effective solution for temperature sensing in building automation, automotive, industrial, office automation, white goods and low power / mobile applications.

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

TSic™ series of temperature sensor ICs offers devices with two linear analog signal output options such as standard $0\sim 1\text{V}_{\text{out}}$ signal ($V_+ = 2.97\text{V}$ to 5.5V) or ratiometric ($10\sim 90\% V_+$ i.e. $0.5\sim 4.5\text{V}_{\text{out}}$ @ $V_+=5\text{V}$) or the digital serial output signal to interface with μ P controllers.

Signal Output / TSic™ Output Examples

		Temperature Measurement Range -10°C to 60°C or 14°F to 140°F (F = focused range device)		
		TSic-501F	TSic-503F	TSic-506F
Temp ($^\circ\text{C}$)	Temp ($^\circ\text{F}$)	Analog $0\sim 1\text{V}$	Analog ratiometric $10\sim 90\%$ (e.g. $V_+=5\text{V}$)	Digital
< -10 -10^1	< 14 14	0.000	10.0% of V_+	0x000
0	32	0.143	21.4% of V_+	0x124
25	77	0.500	50.0% of V_+	0x3FF
$+60^2$ $> +60$	140 > 140	1.000	90.0% of V_+	0x7FF

¹LT = -10 , ²HT = $+60$ as default values for the temperature calculation set points.

Formula for Temperature Signal [$^\circ\text{C}$]:

- Analog output $0\sim 1\text{V}$:
 $T = (\text{Sig}[\text{Volt}] * (\text{HT} - \text{LT}) + \text{LT}) [^\circ\text{C}]$
- Ratiometric $10\%\sim 90\%$ output:
 $T = ((\text{Sig}[\text{V}]/\text{VDD}[\text{V}]) - 0.1) / 0.8 * (\text{HT} - \text{LT}) + \text{LT}$
- **Digital output** (Spec see TSic ZACwire):
 $T = (\text{Digital_signal} / 2047 * (\text{HT} - \text{LT}) + \text{LT}) [^\circ\text{C}]$
Programm example: see TSic ZACwire doc.



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TSic™-506F

Temperature Sensor IC

Specification

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 ₊ = 5.0V, RT	30	45	80	μA
Ambient 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 ⁴ Resistance between signal and Gnd (or V ₊)	1			MΩ

Temperature Accuracies⁵

PARAMETER	MIN	TYP	MAX	UNITS
<i>Focused Range Device for -10 ° to 60 °C</i>				
T1: +5 to +45 °C	-0.1	±0.05	+0.1	°C
T2: -5 to +5 °C	-0.1	+0.1	+0.2	°C
T3: +45 to +55 °C	-0.1	+0.1	+0.2	°C

¹Best accuracy with supply voltage 4.5V – 5.5V. With supply voltage 2.97V – 4.5V accuracy reduced.

²Output signal is limited to this ambient temperature (with regard to calibration, offset and gain)

³Recommended as close to TSic V₊ and Gnd-Pins as possible.

⁴Output load down to 47kOhm possible, but with increased power consumption / self heating.

⁵ Accuracy = specification plus quantization error of 1 bit (0.034 °C). This device gets calibrated at 5V. For applications where best accuracy at 3.3V is requested: ask for a customer specific 3.3V calibrated device. Accuracy for supply voltage within V₊ = 4.5V to 5.5V, 2σ value. Accuracy in liquid or with high gas flow.

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

Temperature range limits T1, T2, T3: ±0.1 °C;
Measurement range limits -10 °C to +60 °C:
±3 °C



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