



# TSic™ 301

## Rapid Response, Low-Cost Temperature Sensor IC with Analog Voltage Output

### Data Sheet

#### TSic™ 301 Features

- Low cost, precision temperature sensor
- Analog 0 to 1 Volt signal output
- Resolution: 0.1°C
- Accuracy:  $\pm 0.3^\circ\text{C}$  over span of  $80^\circ\text{C}$
- Wide measurement range:  $-50$  to  $+150^\circ\text{C}$
- Signal read-out every 0.1s (other rates available on request)
- Supply Voltage 3.0V to 5.5V; high accuracy operation in range 4.5V to 5.5V
- Package: 8-pin SOIC, 3-pin e-line, Chip on Flex
- Low quiescent current to minimize self-heating and power consumption
- System-on-chip based on advanced mixed-signal CMOS technology integrating precision temperature sensing bandgap reference with proportional-to-absolute-temperature (PTAT) output, digital signal processor (DSP) core, and electrically erasable memory (EEPROM)

#### TSic™ Family

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 (Supply voltage (V+) = 3.0V to 5.5V) or ratiometric (10~90% of supply voltage); or the digital serial output signal for interfacing with microcontrollers.

#### 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**
- **Miniaturized solutions with Bare-Chip (COB, COF, CSP\*) or e-line packages – very fast response time for COF**
- **Very low power consumption – ideal for mobile and standard applications**
- **Field reconfiguration/recalibration option available (high volume customers only)**
- **Outstanding long term stability**

\* COB: Chip-On-Board; COF: Chip-On-Flex; CSP: Chip Scale Packaging

#### Application Support

For TSic™ evaluation ZMD provides a special Evaluation Tool. (Ordering Code: TSic Lab Kit )

Further application support is available through the hotline: email: [tsic@zmd.de](mailto:tsic@zmd.de)

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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 <sub>INA</sub> , V <sub>OUTA</sub> )	-0.3	V <sub>DDA</sub> +0.3	V
Storage Temperature Range (T <sub>stor</sub> )	-50	150	°C

#### Operating Conditions

PARAMETER	MIN	TYP	MAX	UNITS
Supply <sup>1</sup> Voltage to Gnd (V+)	3.0	5.0	5.5	V
Supply Current (I <sub>V+</sub> ) <sup>2</sup> @ V+ = 3.3V, RT			200	µA
Ambient Temperature <sup>3</sup> Range (T <sub>amb</sub> )	-50		150	°C
External Capacitance between V+ and Gnd <sup>4</sup> (C <sub>V+</sub> )	80	100	470	NF
Output Load Resistance between signal and Gnd (or V+)	47	100		kΩ

<sup>1</sup> Best accuracy with supply voltage 4.5V – 5.5V. With supply voltage 3.5V – 4.5V accuracy reduced.

<sup>2</sup> Without load

<sup>3</sup> Output signal is limited to this ambient temperature ±3°C (with regard to calibration, offset and gain)

<sup>4</sup> Recommended as close to TSic V+ and Gnd-Pins as possible

#### Temperature Accuracy<sup>5</sup>

PARAMETER	MIN	TYP	MAX	UNITS
<i>Wide Range Device for -50° to 150°C</i>				
T1 +10°C to +90°C	-0.3	±0.3	0.3	°C
T2 -20°C to +110°C	-0.3	+0.3	0.95	°C
T3 -50°C to +150°C	-0.3	+0.9	2.0	°C

<sup>5</sup> Accuracy = specification plus quantization error of 1 bit (0.1°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, 2σ value.

Other TSic products with customer specific calibration available on request: i.e. with special calibration where the 80°C span (bandgap) with the high precision temperature range of ±0.3 °C is shifted to another (lower or higher) temperature range.

Temperature range limits T1, T2: ±0.1°C; T3: ±3°C



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### Output Examples for TSic™ Devices

		Temperature Measurement Range -50°C to 150°C or -58°F to 302°F (Wide Range Device)
		TSic-301
Temp (°C)	Temp (°F)	Analog 0~1V
-50	-58	0.000
-10	14	0.200
0	32	0.250
25	77	0.375
60	140	0.550
125	257	0.875
150	302	1.000

### Lifetime for TSic™ Devices

TSic™ device lifetime is dependent upon its operating temperature.

Operating Temperature	expected Lifetime
140°C...150°C	min. 1500h
125°C...140°C	min. 3000h

### Package Information

TSic™ 301 SOP8: 150mil, Standard SMT Package, SOIC, Based on IEC 191-2Q, Type 076E35 B. Other packages available on demand: TSic™ 301 e-line; 3 pin THT package; Chip on Flex.

For further information see also Technical Note:

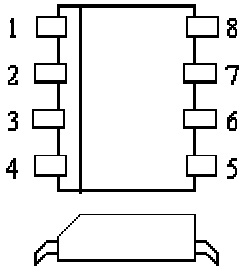
*“TSic™ Die and Package Specifications for TSic™ Temperature Sensor IC”*

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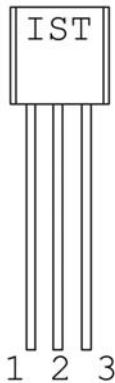
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### SOP8 Package



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

### E-Line Package



Pin	Name	Description
1	GND	Ground
2	Signal	Temperature output signal
4	V+	Supply Voltage (3.0-5.5V)

### Related products and ordering information

For related products and ordering information see [www.zmd.biz](http://www.zmd.biz) and ZMD "TSic™ Ordering Guide".



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### ZMD Sales Contacts

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### ZMD Distribution Partners

ZMD partners with WBC for device distribution in Europe and Future Electronics / All American for North- and South America.

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For the current revision of this document and for additional product information please look at [www.zmd.biz](http://www.zmd.biz).

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***Notes :***