

TSic™ 106

Rapid Response, Low-Cost Temperature Sensor IC with Digital Output

Data Sheet

TSic™ 106 Features

- Low cost, precision temperature sensor
- Single-wire 11-bit digital serial signal output
- Communication range > 10 meters
- Resolution: 0.1°C
- Accuracy: $\pm 0.5^{\circ}\text{C}$ at room temperature;
 $\pm 1.0^{\circ}\text{C}$ over span of 40°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
- Package: 8-pin SOIC, 3-pin e-line, Chip on Flex, Die on Wafer
- Low quiescent current to minimize self-heating and power consumption ($45\mu\text{A}$ typ.)
- 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

Phone: +49 351 8822-916

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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+) | 3.0 | 5.0 | 5.5 | V |
| Supply Current (I _{V+}) ² @ V+ = 3.3V, RT | 30 | 45 | 80 | µA |
| Ambient Temperature ³ Range (T _{amb}) | -50 | | 150 | °C |
| External Capacitance between V+ and Gnd ⁴ (C _{V+}) | 80 | 100 | 470 | nF |
| Output Load Capacitance (C _L) | | | 15 | nF |
| Output Load Resistance between signal and Gnd (or V+) | 1 | | | MΩ |

¹ With supply voltage 2.7V – 3.0V accuracy reduced.

² Without load

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

⁴ Recommended as close to TSic V+ and Gnd-Pins as possible

Temperature Accuracy⁵

| PARAMETER | MIN | TYP | MAX | UNITS |
|-------------------------------------|------|------|------|-------|
| Wide Range Device for -50° to 150°C | | | | |
| T1 At room temperature | -0.5 | ±0.3 | 0.5 | °C |
| T2 +0°C to +40°C T2 | -1.0 | | +1.0 | °C |
| T3 -50 to 0, +40 to 150°C | | +1.5 | | °C |

⁵ Accuracy = specification plus quantization error of 1 bit (0.1°C), 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 ±0.5 °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-106 |
| Temp (°C) | Temp (°F) | Digital |
| -50 | -58 | 0x000 |
| -10 | 14 | 0x199 |
| 0 | 32 | 0x200 |
| 25 | 77 | 0x2FF |
| 60 | 140 | 0x465 |
| 125 | 257 | 0x6FE |
| 150 | 302 | 0x7FF |

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

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™ 106 SOP8: 150mil, Standard SMT Package, SOIC, Based on IEC 191-2Q, Type 076E35 B. Other packages available on demand: TSic™ 106 e-line; 3 pin THT package; Chip on Flex; TSic™ 106 wafer level.

For further information see also Technical Note:

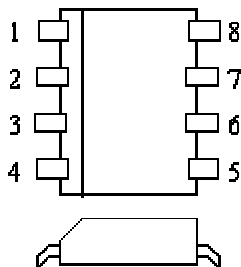
“TSic™ Die and Package Specifications for TSic™ Temperature Sensor IC”

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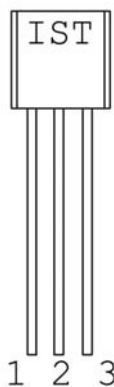
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SOP8 Package



| 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 and ZMD “TSic™ Ordering Guide”.



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ZMD Sales Contacts

ZMD AG

Grenzstrasse 28
01109 Dresden, Germany
Phone: +49 (0)351.8822.366
Fax: +49 (0)351.8822.337
E-mail: sales@zmd.de

ZMD Stuttgart Office

Nord-West-Ring 34
70974 Filderstadt -
Bernhausen
Phone: +49 (0)711.674.517-0
Fax: +49 (0)711.674.517-99
E-mail: sales@zmd.de

ZMD America Inc.

201 Old Country Road,
Suite 204
Melville, NY 11747
Phone: +1 (631) 549-2666
Fax: +1 (631) 549-2882
E-mail: mailto:sales@zmda.com

ZMD Far East

Room 7A-03, No.5 Sec.5 Sinyi Rd.
Taipei 11011, Taiwan
Phone: +886-(0)2-8786-1593
Fax: +886-(0)2-2723-3109
E-mail: agraubner@zmdfareast.com

ZMD Distribution Partners

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

Germany/EMEA

AVNET Memec
Im Technologiepark 2-8
D-85586 Poing

Phone: +49 8121 775 155
Fax: +49 8121 775 592
E-mail: juergen.dudda@wbc-europe.com
Internet: www.wbc-europe.com

Other local AVNET Memec representatives on www.wbc-europe.com.

Other ZMD representatives on www.zmd.biz.

Germany

Henskes Electronic Components GmbH
Bremer Straße 7
D-30880 Laatzen (Rethen)

Phone: +49 5102 938117
Fax: +49 5102 938198
E-mail: hq.senf@henskes.com
Internet: www.henskes.de

Canada, North/South America

Future Electronics
Worldwide Corporate Headquarters
237 Hymus Blvd.
Pointe-Claire, Quebec, H9R 5C7

Phone: +1 (514) 694-7710
Fax: +1 (514) 695-3707
Internet: www.futureelectronics.com

North America

All American Semiconductor Inc.
230 Devcon Drive
San Jose CA 95112

Phone: +1 (800) 573-ASAP
Fax: +48 (0) 71 788 80 13
Internet: www.allamerican.com

Japan

Internix Inc.
59-10 Takakura-cho Hachioji
Tokyo 192-0033

Phone: +81 426 44 8786
Fax: +81 426 48 5204
E-mail: hisoaki@internix.co.jp
Internet: www.internix.co.jp/

South Africa

Tempe technologies
62 Oude Kaap Estate
Dowerglen, South Africa

Phone: +27 11 4520530
Fax: +27 11 4520543
Internet: www.tempetech.co.za

India

M/s Excel Eltech India PVT Ltd.
77 J S Tower, 11 FLOOR
Opp St Patricks Church
Brigade Road
Bangalore - 560 025

Phone: +91 80 2 557 3582
Fax: +91 80 2 557 3609
E-mail: sales@exceleltechindia.com

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