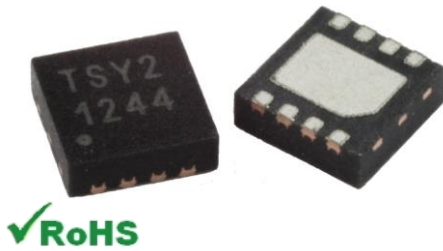


TSYS02P Digital Temperature Sensor



- High Accuracy Temperature Sensor
- 16 bit Resolution
- High Speed, low Response Time
- Low Power Consumption
- PWM Output
- Small TDFN8 Package

DESCRIPTION

The TSYS02P is a single chip, temperature sensor.

It provides factory calibrated data corresponding to the measured temperature.

The data is provided via **PWM output**.

The temperature range is -40°C ... +125°C while the resolution is 0.01°C.

The TDFN8 package provides smallest size and very fast time response.

FEATURES

High Accuracy $\pm 0.2^{\circ}\text{C}$ @ Temp.: -5°C ... $+50^{\circ}\text{C}$
 Adjustment of high accuracy temperature range on request
 Low Supply Current < 420 μA (standby < 0.14 μA)
 PWM Output
 Small IC-Package TDFN8 2.5mm x 2.5mm
 Operating Temperature Range: -40°C ... $+125^{\circ}\text{C}$

APPLICATIONS

Industrial Control
 Replacement of Precision RTDs,
 Thermistors and NTCs
 Heating / Cooling Systems
 HVAC

TSYS02P Digital Temperature Sensor

ABSOLUTE MAXIMUM RATINGS

Absolute maximum ratings are limiting values of permitted operation and should never be exceeded under the worst possible conditions either initially or consequently. If exceeded by even the smallest amount, instantaneous catastrophic failure can occur. And even if the device continues to operate satisfactorily, its life may be considerably shortened.

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|-----------------------|--------|--|----------------|-----|------|------|
| Supply Voltage | VDD | | -0.3 | | +3.6 | V |
| Operating Temperature | Top | | -40 | | +125 | °C |
| Storage temperature | Tstor | | -55 | | +150 | °C |
| ESD rating | ESD | Human Body Model (HBM) pin to pin incl. VDD & GND | -2 | | +2 | kV |
| Humidity | Hum | | Non condensing | | | |

OPERATING CONDITIONS

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|--------------------------|---------|-------------------------|-------|-----|-----|------|
| Operating Supply Voltage | VDD | stabilized | 1.5 | | 3.6 | V |
| Supply Current | IDD | 2 sample per second | | 36 | | µA |
| Peak Supply Current | IDD | During conversion | | 420 | | µA |
| Conversion Time | TCONV | | | 43 | | ms |
| Measurement Frequency | FMEAS | | | 2 | | Hz |
| PWM Period | TPERIOD | | 7.5 | 8.3 | 9.1 | ms |
| VDD Capacitor | | Place close to the chip | 100nF | | | |

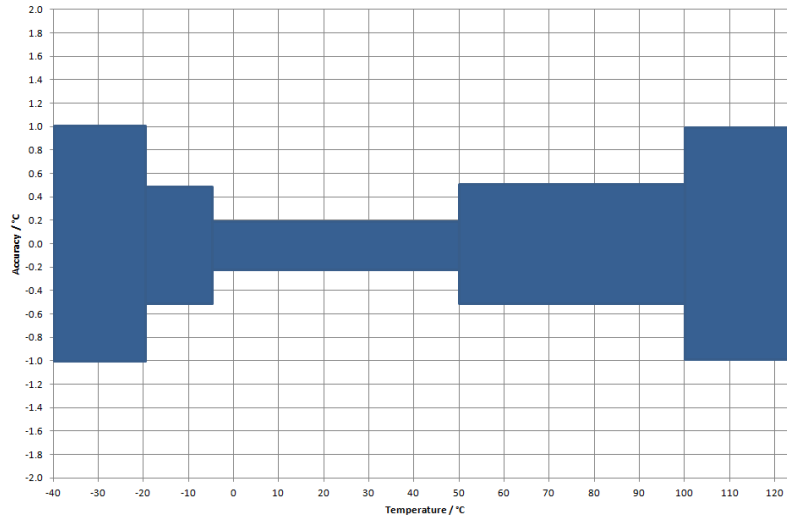
OPERATIONAL CHARACTERISTICS

If not otherwise noted, 3.3V supply voltage is applied.

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|-----------------------------------|--------|---|------|-----|------|------|
| Temp. Measurement Range | TRANG | | -40 | | 125 | °C |
| Accuracy 1 | TACC1 | -5°C < T < +50°C VDD = 3.2V – 3.4V | -0.2 | | +0.2 | °C |
| Accuracy 2 | TACC2 | -20°C < T < +100°C VDD = 3.2V – 3.4V | -0.5 | | +0.5 | °C |
| Accuracy 3 | TACC2 | -40°C < T < +125°C VDD = 3.2V – 3.4V | -1.0 | | +1.0 | °C |
| PSRR Power Supply Reject Ratio | | VDD = 2.7 – 3.6 T = 25°C, C = 100nF | | | 0.1 | °C |
| Temperature Resolution | TRES | | | | 0.01 | °C |
| Self Heating | SH1 | 10 samples/s, 60s, still air | | | 0.1 | °C |

TSYS02P Digital Temperature Sensor

ACCURACY



ANALOGUE TO DIGITAL CONVERTER

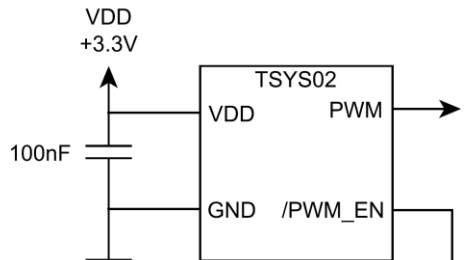
| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|-----------------|--------|------------|-----|-----|-----|------|
| Resolution | | | | 16 | | bit |
| Conversion Time | t_c | | | 43 | | ms |

DIGITAL OUTPUTS (PWM)

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---------------------|--------|------------|-----|-----|-----|------|
| Output High Voltage | VOH | | | VDD | | V |
| Output Low Voltage | VOL | | | 0 | | V |
| Output Sink Current | IOL | | | | 40 | μA |

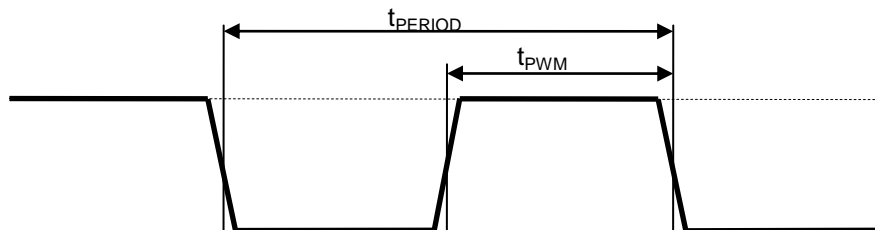
TSYS02P Digital Temperature Sensor

CONNECTION DIAGRAM



PIN FUNCTION TABLE

| Pin | Name | Type | Function |
|-------|---------|----------------|--------------------------------|
| 1 | VDD | Power | Supply Voltage |
| 2 | /PWM_EN | Digital Input | Enable PWM Output (0 = ON) |
| 3 | PWM | Digital Output | PWM Output |
| 4 | VSS | Power | Ground |
| 5 – 8 | NC | --- | Not connected / Do not connect |



PWM OUTPUT

START UP

After power-up (VDD between 1.8V and 3.6V) TSYS02P needs at most 150ms for reaching idle state. During that time PWM output is in undefined state. Afterwards, TSYS02P starts measuring and provides data on PWM output.

TEMPERATURE CALCULATION

TEMPERATURE POLYNOMIAL

$$T / ^\circ\text{C} = t_{\text{PWM}} / t_{\text{PERIOD}} \times 175.72 - 46.85$$

EXAMPLE

$$\begin{aligned} t_{\text{PWM}} &: 4.15\text{ms} \\ t_{\text{PERIOD}} &: 8.30\text{ms} \end{aligned}$$

TSYS02P Digital Temperature Sensor

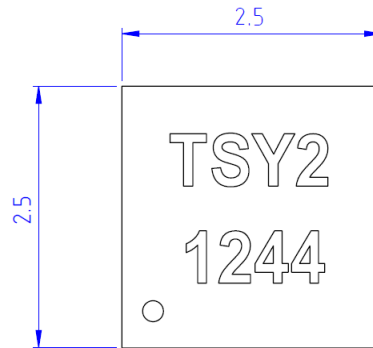
T / °C = 4.15ms / 8.30ms x 175.72 - 46.85

T / °C = 41.01°C

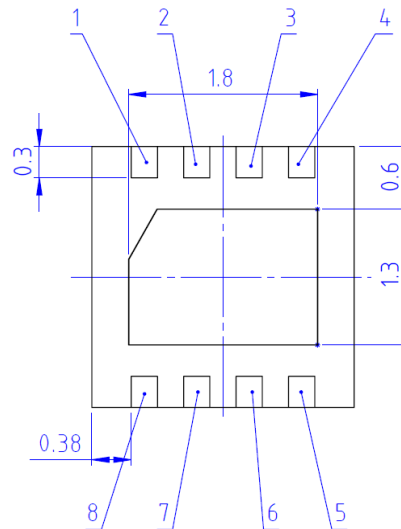
TSYS02P Digital Temperature Sensor

DIMENSIONS

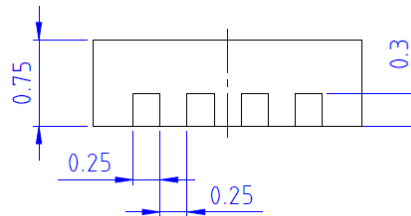
TOP VIEW



BOTTOM VIEW



SIDE VIEW



MARKING

| Line | Description | Example |
|------|---------------------------|---------|
| 1 | Product Name | TSY2 |
| 2 | Pin 1 Dot, Date Code YYWW | 1244 |

TSYS02P Digital Temperature Sensor

ORDER INFORMATION

The TSYS02 temperature sensor family comprises currently three different solutions. Further customer specific adaptations are available on request. Please refer to the table below for part name, description and order information.

| Part Name | Description | Order Number |
|----------------|---|-------------------|
| TSYS02D | Digital Temperature Sensor, TDFN8, I2C Interface | G-NIMO-003 |
| TSYS02P | Digital Temperature Sensor, TDFN8, PWM Interface | G-NIMO-004 |
| TSYS02S | Digital Temperature Sensor, TDFN8, SDM Interface | G-NIMO-005 |

EMC

Due to the use of these modules for OEM application no CE declaration is done. Especially line coupled disturbances like surge, burst, HF etc. cannot be removed by the module due to the small board area and low price feature. There is no protection circuit against reverse polarity or over voltage implemented. The module will be designed using capacitors for blocking and ground plane areas in order to prevent wireless coupled disturbances as good as possible.

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