

Product Specification

Infrared Thermopile Module TSEV01-C

Version 0.3

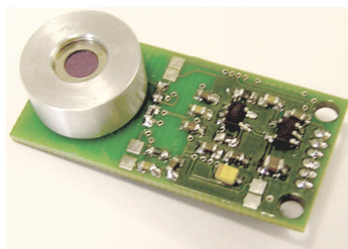


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1 History

| Ver. | Document name | Date | Purpose | Author |
|------|---------------------------------|------------|-------------------------------------|----------|
| 0.1 | TSEV01_C_LQFP_Specification.doc | 08.12.2006 | Creation | M. Basel |
| 0.2 | TSEV01C_Specification_0_2.doc | 15.01.2007 | General Update, Update Chapter 9 | M. Basel |
| 0.3 | TSEV01C_Specification_0_3.doc | 08.02.2007 | Update Chapter 5 | M. Basel |

2 General Information

TSEV01C is a contact-less temperature measuring system for OEM use based on the detection of infrared radiation.

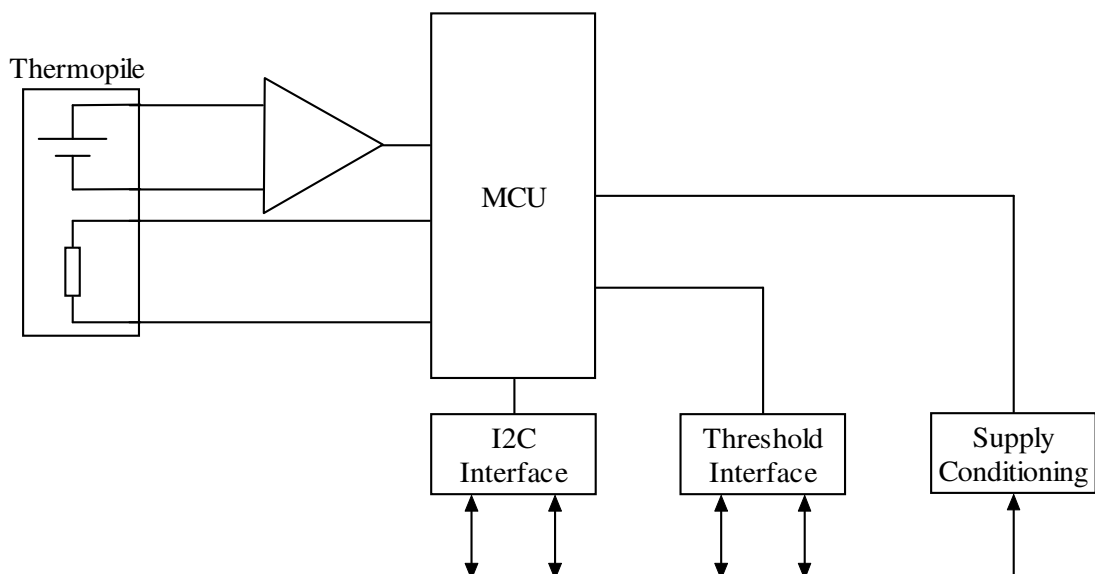
TSEV01C is equipped with an infrared sensor (Thermopile) in front. The Thermopile Sensor has to be pointed at the target object of interest.

The basic working principle is:

- Detection of infrared radiation with a Thermopile sensor, which turns incoming radiation to an analogue voltage
- Determination of sensor temperature using a thermistor
- Further analogue signal processing and conditioning
- Calculation of ambient and object temperature using a processing unit
- Providing the ambient and objects temperature at digital output bus (I²C)

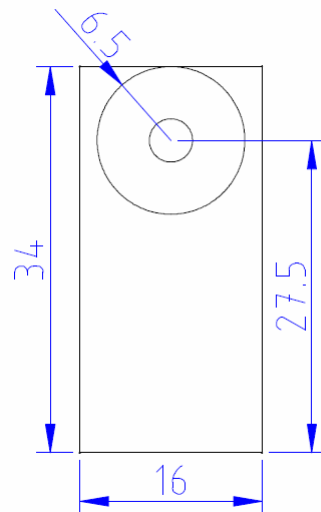
The TSEV01 is suitable for a wide range of application where non-contact temperature measurement and high accuracy are required.

3 Block Diagram

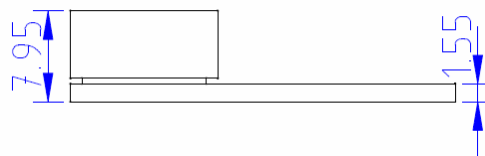


4 Dimensions

4.1 Top View

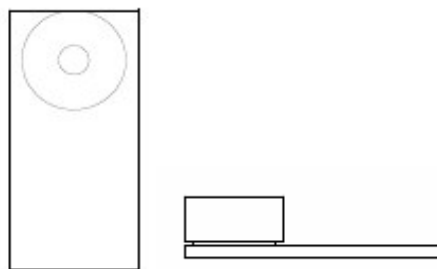


4.2 Side View



All units: mm

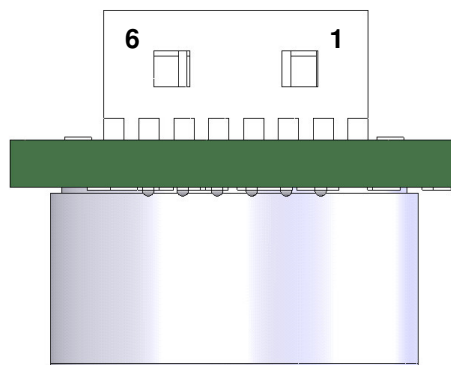
4.3 Original Size



5 Terminals

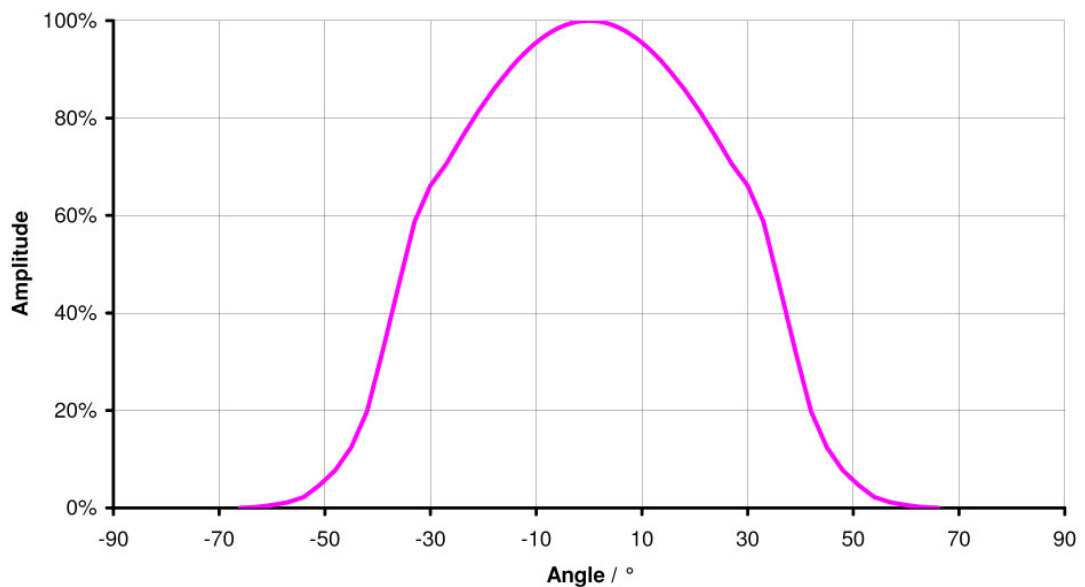
Connector: Molex 51021-0600 (Farnell-In-One: 1012261, Digikey: WM1724-ND)

| Pin | Name | Description | Type |
|-----|-------|-------------------------------|-----------|
| 1 | TRES1 | Temperature Threshold | Output |
| 2 | TRES2 | Temperature Threshold | Output |
| 3 | SDA | I ² C Data (3.6V) | Interface |
| 4 | SCL | I ² C Clock (3.6V) | Interface |
| 5 | GND | Ground | Supply |
| 6 | VCC | Supply Voltage (5V) | Supply |



6 Sensor Characteristic

6.1 Field of View



7 Requirements

- High accuracy
- Small size
- Standard bus interface (I²C)

7.1 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 | V _{cc} | Measured versus GND | -0.3 | | 16 | V |
| Operating Temperature | T _{op} | | -10 | | 85 | °C |
| Storage temperature | T _{stor} | | -40 | | 85 | °C |

7.2 Operating Conditions

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|----------------------|-----------------|---------------------|------|-----|-----|------|
| Supply voltage | V _{cc} | Measured versus GND | 4 | 5 | 16 | V |
| Emission Coefficient | ε | | 0.95 | | | |

7.3 Electrical Requirements

If not otherwise noted, 25°C ambient temperature, 5V supply voltage and object with ε = 0.98 were applied.

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit | |
|--|------------------|--|-----|--------------|-----|------|-----|
| Field of View | FOV | | | 70 | | ° | |
| Spectral Sensitivity | S | | | 5.5 (cut on) | | μm | |
| Supply Current | I | Full ambient temp. range, no output load | | 1 | 2 | 4 | mA |
| Digital Output Clock Rate (I ² C) | F _{I2C} | | | 20 | | 50 | kHz |
| Data Output Rate | F _{out} | | | | 1 | | Hz |

7.4 Operational Characteristics

If not otherwise noted, 25°C ambient temperature, 5V supply voltage and object with ε = 0.98 were applied.

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|--------------------|-----------------------------------|-----|------|-----|------|
| Object Temperature Range | T _{obj} | | 0 | | 50 | °C |
| Ambient Temperature Range | T _{amb} | | 0 | | 85 | °C |
| Standard Start-Up Time | t _{Start} | | | 5 | | s |
| Stabilization Time | t _{Stab} | | | 3 | | min |
| Accuracy offset – prior to thermal stability time | ΔT _{stab} | | | 2 | | °C |
| Accuracy tolerance when 10°C < T _{ambient} < 40°C and after 3 minutes stabilization time | ΔT | 16°C < T _{object} < 36°C | | 0.55 | | °C |
| | | Outside above range | | 2 | | °C |

8 I²C Interface

This module is always operating in pure slave modus of a two wire interface similar to I²C. The typical baud rate of this device is 20kBit/s. The supported address length is seven bits. The I²C slave address is 54h.

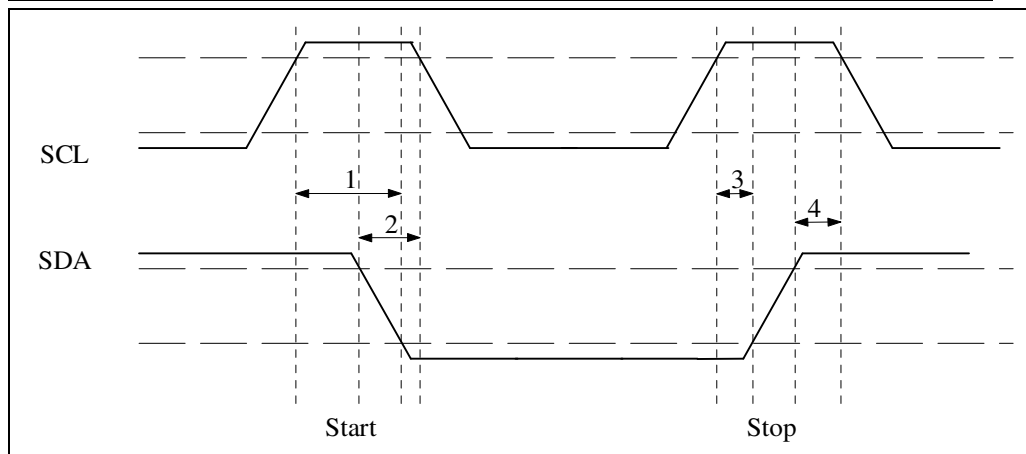
8.1 Physical Interface Parameters

| Parameter | Min | Typical | Max | Unit |
|--------------------|-----|---------|-----|--------|
| Baudrate | 10 | --- | 50 | kBit/s |
| Address length | --- | 7 | --- | Bit |
| Address (standard) | --- | 54h | --- | --- |
| Input High Level | 2 | --- | 3.6 | V |
| Input Low Level | --- | --- | 1 | V |
| Output High Level | 2.5 | --- | --- | V |
| Output Low Level | --- | --- | 1 | V |

8.2 Timing Parameters

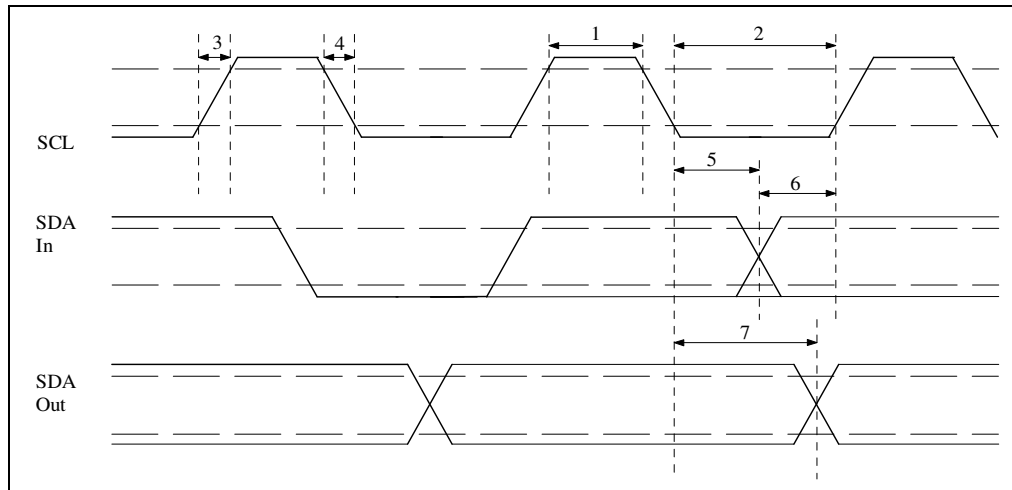
Start/Stop

| No. | Parameter | Description | Min | Typ | Max | Unit |
|-----|-----------|------------------|-----|-----|-----|------|
| 1 | TSU:STA | Start Setup Time | 4.7 | --- | --- | μs |
| 2 | THD:STA | Start Hold Time | 4.0 | --- | --- | μs |
| 3 | TSU:STO | Stop Setup Time | 4.0 | --- | --- | μs |



Data

| No | Parameter | Description | Min | Max | Unit |
|----|-----------|-----------------------|------|-----|------|
| 1 | THIGH | Clock High Time | 4.0 | 50 | µs |
| 2 | TLOW | Clock Low Time | 4.7 | --- | µs |
| 3 | TR | SDA & SCL Rise Time | --- | 1 | µs |
| 4 | TF | SDA & SCL Fall Time | --- | 0.3 | µs |
| 5 | THD:DAT | Data Input Hold Time | 0.3 | --- | µs |
| 6 | TSU:DAT | Data Input Setup Time | 0.25 | --- | µs |
| | TBUF | Bus Free Time | 4.7 | --- | µs |



9 I²C Command Reference

9.1 Ambient and Object Measurement

Please refer following table for I²C commands to read object temperature and ambient temperature. Both values are transmitted in hundredth of degrees.

| Command | Description | Reply | Bytes |
|---------|--------------------------|--|-------|
| 0xB6 | Read object temperature | Object temperature in hundredth of degree | 2 |
| 0xB5 | Read ambient temperature | Ambient temperature in hundredth of degree | 2 |

9.2 Example of Temperature Calculation

For reading object temperature send: 0xB6

Return values i.e.: Byte(0) = 0x0E, Byte(1) = 0xAA

Temperature $T_{obj} = (256 * \text{Byte}(0) + \text{Byte}(1)) / 100 = (256 * 14 + 170) / 100 = \underline{37.54^\circ\text{C}}$

9.3 Out of Range Indication

In case of ambient or object temperature over exceeding specified temperature ranges temperature outputs showing following data:

| Command | Description | Reply | Bytes |
|---------|-----------------------------|--------|-------|
| 0xB6 | Object temperature > 50 °C | 0xFFF0 | 2 |
| 0xB6 | Object temperature < 0 °C | 0xFFF1 | 2 |
| 0xB5 | Ambient temperature > 85 °C | 0xFFFF | 2 |
| 0xB5 | Ambient temperature < 0 °C | 0xF000 | 2 |