IR Sensor Module for Reflective Sensor, Light Barrier, and Fast Proximity Applications

FEATURES
- Up to 2 m for presence and proximity sensing
- Uses modulated bursts of infrared light
- 940 nm peak wavelength
- PIN diode and sensor IC in one package
- Low supply current
- Shielding against EMI
- Visible light is suppressed by IR filter
- Insensitive to supply voltage ripple and noise
- Supply voltage: 2.5 V to 5.5 V
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

DESCRIPTION
The TSSP60.. series are compact infrared detector modules for presence and fast proximity sensing applications. They provide an active low output in response to infrared bursts at 940 nm. The frequency of the burst should correspond to the carrier frequency shown in the parts table. This component has not been qualified according to automotive specifications.

MECHANICAL DATA
Pinning
1 = GND, 2 = N.C., 3 = VS, 4 = OUT

APPLICATIONS
- Reflective sensors for hand dryers, towel or soap dispensers, water faucets, toilet flush
- Vending machine fall detection
- Security and pet gates
- Person or object vicinity activation
- Fast proximity sensors for toys, robotics, drones, and other consumer and industrial uses

PARTS TABLE

<table>
<thead>
<tr>
<th>Carrier frequency</th>
<th>TSSP6038</th>
<th>TSSP6056</th>
</tr>
</thead>
<tbody>
<tr>
<td>38 kHz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>56 kHz</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Package</th>
<th>Panhead</th>
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<tbody>
<tr>
<td>Pinning</td>
<td>1 = GND, 2 = N.C., 3 = VS, 4 = OUT</td>
</tr>
<tr>
<td>Dimensions (mm)</td>
<td>7.5 W x 5.3 H x 4.0 D</td>
</tr>
<tr>
<td>Mounting</td>
<td>SMD</td>
</tr>
<tr>
<td>Application</td>
<td>Presence sensors, fast proximity sensors</td>
</tr>
</tbody>
</table>
**BLOCK DIAGRAM**

![Block Diagram]

**PRESENCE SENSING**

![Presence Sensing Diagram]

**ABSOLUTE MAXIMUM RATINGS**

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>TEST CONDITION</th>
<th>SYMBOL</th>
<th>VALUE</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage</td>
<td>VS</td>
<td>-0.3 to +6 V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply current</td>
<td>IS</td>
<td>5 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output voltage</td>
<td>VO</td>
<td>-0.3 to (VS + 0.3) V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output current</td>
<td>IO</td>
<td>5 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Junction temperature</td>
<td>TJ</td>
<td>100 °C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage temperature range</td>
<td>Tstg</td>
<td>-25 to +85 °C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>Tamb</td>
<td>-25 to +85 °C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power consumption</td>
<td>Ptot</td>
<td>10 mW</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**ELECTRICAL AND OPTICAL CHARACTERISTICS (Tamb = 25 °C, unless otherwise specified)**

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>TEST CONDITION</th>
<th>SYMBOL</th>
<th>MIN.</th>
<th>TYP.</th>
<th>MAX.</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply current (pin 3)</td>
<td>Eo = 0, VS = 5 V</td>
<td>ISD</td>
<td>0.55</td>
<td>0.7</td>
<td>0.9</td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td>Eo = 40 klx, sunlight</td>
<td>ISh</td>
<td>-</td>
<td>0.8</td>
<td>-</td>
<td>mA</td>
</tr>
<tr>
<td>Supply voltage</td>
<td>VS</td>
<td>2.5</td>
<td>-</td>
<td>5.5</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Transmission distance</td>
<td>Eo = 0, test signal see Fig. 1, IR diode TSAL6200, IF = 400 mA</td>
<td>d</td>
<td>-</td>
<td>25</td>
<td>m</td>
<td></td>
</tr>
<tr>
<td>Output voltage low (pin 1)</td>
<td>Iosl</td>
<td>0.5 mA</td>
<td>2 mW/m²</td>
<td>100 mV</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum irradiance</td>
<td>Pulse width tolerance: tp1 - 5/fo &lt; tp0 &lt; tp2 + 6/fo, test signal see Fig. 1</td>
<td>Eemin</td>
<td>-</td>
<td>0.7</td>
<td>1.2</td>
<td>mW/m²</td>
</tr>
<tr>
<td>Maximum irradiance</td>
<td>tp1 - 5/fo &lt; tp0 &lt; tp2 + 6/fo, test signal see Fig. 1</td>
<td>Eemax</td>
<td>50</td>
<td>-</td>
<td>-</td>
<td>W/m²</td>
</tr>
<tr>
<td>Directivity</td>
<td>Angle of half transmission distance</td>
<td>φ1/2</td>
<td>-</td>
<td>± 50</td>
<td>-</td>
<td>deg</td>
</tr>
</tbody>
</table>

**Note**

Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect the device reliability.
**TYPICAL CHARACTERISTICS**  
(T_\text{amb} = 25 \, ^\circ\text{C}, unless otherwise specified)

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**Optical Test Signal**  
(IR diode TSAL6200, I_\text{p} = 0.4 A, 30 pulses, f = f_0, t = 10 ms)

- E_\text{e}
- V_\text{O}
- V_{\text{OH}}
- V_{\text{OL}}

---

**Output Signal**

1) 7/f_0 < t_\text{d} < 15/f_0
2) t_\text{pi} - 5/f_0 < t_\text{po} < t_\text{pi} + 6/f_0

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**Fig. 1 - Output Active Low**

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**Fig. 2 - Pulse Length and Sensitivity in Dark Ambient**

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**Fig. 3 - Output Function**

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**Fig. 4 - Output Pulse Diagram**

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**Fig. 5 - Frequency Dependence of Responsivity**

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**Fig. 6 - Sensitivity vs. Ambient Temperature**
The typical application of these devices is a reflective or beam break sensor with active low “detect” or “no detect” information contained in its output. The TSSP6056 is also suitable for fast (~ 5 ms) proximity sensor applications for ranges between 10 cm and 2 m. Please see application note “Vishay’s TSSP4056 Sensor for Fast Proximity Sensing” (www.vishay.com/doc?82741).

Example for a sensor hardware:

There should be no common window in front of the emitter and detector in order to avoid crosstalk via guided light through the window.
PACKAGE DIMENSIONS in millimeters

Reflow Soldering
- Reflow soldering must be done within 72 h while stored under a max. temperature of 30 °C, 60 % RH after opening the dry pack envelope.
- Set the furnace temperatures for pre-heating and heating in accordance with the reflow temperature profile as shown in the diagram. Exercise extreme care to keep the maximum temperature below 260 °C. The temperature shown in the profile means the temperature at the device surface. Since there is a temperature difference between the component and the circuit board, it should be verified that the temperature of the device is accurately being measured.
- Handling after reflow should be done only after the work surface has been cooled off.

Manual Soldering
- Use a soldering iron of 25 W or less. Adjust the temperature of the soldering iron below 300 °C.
- Finish soldering within 3 s.
- Handle products only after the temperature has cooled off.

ASSEMBLY INSTRUCTIONS

Drawing-No.: 6.544-5341.01-4
Issue: B 02.09.09
**VISHAY LEAD (Pb)-FREE REFLOW SOLDER PROFILE**

**TAPING VERSION TSSP60..TT DIMENSIONS** in millimeters

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**Drawing-No.**: 9.700-5259.01-4

**Issue**: 05.09.01

16584
TAPING VERSION TSSP60..TR DIMENSIONS in millimeters

Technical drawings according to DIN specifications

Drawing No.: 9 700-5260.01-4
Issue: 2; 25 09 01

16585
REEL DIMENSIONS in millimeters

LEADER AND TRAILER DIMENSIONS in millimeters

COVER TAPE PEEL STRENGTH
According to DIN EN 60286-3
0.1 N to 1.3 N
300 mm/min. ± 10 mm/min.
165° to 180° peel angle

LABEL
Standard bar code labels for finished goods
The standard bar code labels are product labels and used for identification of goods. The finished goods are packed in final packing area. The standard packing units are labeled with standard bar code labels before transported as finished goods to warehouses. The labels are on each packing unit and contain Vishay Semiconductor GmbH specific data.
DRY PACKING

The reel is packed in an anti-humidity bag to protect the devices from absorbing moisture during transportation and storage.

FINAL PACKING

The sealed reel is packed into a cardboard box.

RECOMMENDED METHOD OF STORAGE

Dry box storage is recommended as soon as the aluminum bag has been opened to prevent moisture absorption. The following conditions should be observed, if dry boxes are not available:

- Storage temperature 10 °C to 30 °C
- Storage humidity ≤ 60 % RH max.

After more than 72 h under these conditions moisture content will be too high for reflow soldering.

In case of moisture absorption, the devices will recover to the former condition by drying under the following condition:

192 h at 40 °C + 5 °C / - 0 °C and < 5 % RH (dry air / nitrogen) or
96 h at 60 °C + 5 °C and < 5 % RH for all device containers or
24 h at 125 °C + 5 °C not suitable for reel or tubes.

An EIA JEDEC® standard J-STD-020 level 4 label is included on all dry bags.
ESD PRECAUTION

Proper storage and handling procedures should be followed to prevent ESD damage to the devices especially when they are removed from the antistatic shielding bag. Electrostatic sensitive devices warning labels are on the packaging.

VISHAY SEMICONDUCTORS STANDARD BAR CODE LABELS

The Vishay Semiconductors standard bar code labels are printed at final packing areas. The labels are on each packing unit and contain Vishay Semiconductors specific data.
Tape and Reel Standards for Surface-Mount IR Receiver Modules

Vishay Semiconductor surface-mount IR receivers are packaged on tape and reel. The following specification is based on IEC publication 286, which takes the industrial requirements for automatic insertion into account.

Absolute maximum ratings, mechanical dimensions, optical and electrical characteristics for taped devices are identical to the basic catalog types and can be found in the specifications for untaped devices.

PACKAGING
The tapes of components are available on reels. Each reel is marked with labels which contain the following information:
- Vishay
- Type
- Group
- Tape code, normally part of type name
- Production code
- Quantity

MISSING COMPONENTS
Up to 3 consecutive components may be missing if the gap is followed by at least 6 components. A maximum of 0.5 % of the components per reel quantity may be missing. At least 5 empty positions are present at the start and the end of the tape to enable tape insertion.

Tensile strength of the tape: > 15 N

NUMBER OF COMPONENTS
A. Panhead: quantity per reel:
   TT, top view package, 1190 pcs
   TR, side view package, 1120 pcs
B. Heimdall: quantity per reel:
   TT, top view package, 2200 pcs
   TR, side view package, 2300 pcs
C. Heimdall without lens: quantity per reel:
   WTT, top view package, 2200 pcs
   WTR, side view package, 2300 pcs
D. Belobog: quantity per reel:
   TT1, top view package, 1800 pcs
E. Belobog with shield: quantity per reel:
   TT1, top view package, 1500 pcs
F. Minimold DF1P: quantity per reel:
   DF1P, 1100 pcs
G. TVCastSMD TR1: quantity per reel:
   TR1, side view package, 2000 pcs

ORDER DESIGNATION
The type designation of the device is extended by TT or TT1 for top view or TR for side view.

Example:
- TSOP6238TR (reel packing)
- TSOP75238TR (reel packing)
- TSOP75338WTT (reel packing)
- TSOP57438TT1 (reel packing)
- TSOP57238HTT1 (reel packing)
- TSOP39438TR1 (reel packing)
REEL DIMENSIONS FOR PANHEAD, HEIMDALL, AND TVCASTSMD TR in millimeters

Form of the leave open of the wheel is supplier specific.

Dimension acc. to IEC EN 60 286-3

Tape width 16

Note
- The body structure of the reel can vary
TAPPING VERSION TSOP..TT (TOP VIEW) DIMENSIONS in millimeters
A. Panhead (TSOP36...TT, TSSP....TT, TSOP6...TT, TSOP16...TT, TSOP96...TT)

Drawing-No.: 9.700-5259.01-4
Issue: 1; 05.09.01
16584
Taping Version TSOP..TT (Top View) Dimensions in millimeters

B. Heimdall (TSOP75...TT, TSOP77...TT, TSSP77...TT, TSOP15...TT, TSOP95...TT)

Drawing-No.: 9.700-5338.01-4
Issue: 4; 12.06.13

Direction of feed

technical drawings according to DIN specifications
TAPING VERSION TSOP..TT (TOP VIEW) DIMENSIONS in millimeters

C. Heimdall without lens (TSOP75...WTT, TSOP77...WTT, TSSP77...WTT, TSOP15...WTT, TSOP95...WTT)

Drawing-No.: 9.700-5341.01-4
Issue: 3; 06.10.15
**Taping Version TSOP..TT1 (Top View) Dimensions** in millimeters

D. Belobog (TSOP37..TT1, TSOP57..TT1, TSOP17..TT1, TSOP97..TT1)

**Tape and Reel Dimensions:**

- **Reel size “Y”**
  - TT1 Ø 180 ± 2 = 1800 pcs.
  - Ø 60 min.
  - Ø Y
- **Unreel direction**
  - Tape position coming out from reel
- **Direction of pulling out**
  - Parts mounted
  - Empty leader 400 mm min.
  - Empty trailer 200 mm min.
  - 100 mm min. with cover tape
- **Leader and trailer tape**
  - Direction of pulling out
- **Tape position**
  - Label posted here
- **Technical drawings**
  - According to DIN specifications

**Drawing-No.:** 9.700-5347.01-4
**Issue:** 2; 07.03.18

**Not indicated tolerances ± 0.1**
TAPING VERSION TSOP..TT1 (TOP VIEW) DIMENSIONS in millimeters

E. Belobog with shield (TSOP37...HTT1, TSOP57...HTT1, TSOP17...HTT1, TSOP97...HTT1)

Tape and reel dimensions:

Reel size “Y”
TT1 Ø 180 ± 2 = 1500 pcs.

X:
Ø Y
Ø 60 mm
(12.4)
18.4 max.

Unreel direction
Tape position coming out from reel

Ø 21 ± 0.8
Ø 13 ± 0.2
Label posted here

Parts mounted
Empty leader 400 mm min.

100 mm min. with cover tape

Leader and trailer tape:
Empty trailer 200 mm min.

Direction of pulling out

Technical drawings according to DIN specifications

Drawing-No.: 9.700-5380.01-4
Issue: 3; 07.03.18

Not indicated tolerances ± 0.1
**Taping Version TSOP..DF1P (Side View) Dimensions** in millimeters

F. Minimold DF1P (TSOP33...DF1P, TSOP53...DF1P, TSOP13...DF1P, TSOP93...DF1P)

Form of the leave open of the wheel is supplier specific.
Dimensions according to IEC EN 60 286-3
Tape width: 24

Technical drawing according to DIN specifications

Drawing-No.: 9.800-5052.V3-4
Issue: 1; 17.12.02

Drawing-No.: 9.700-5399.01-4
Issue: 1; 30.06.16
**Taping Version TSOP..TR (Side View) Dimensions** in millimeters

G. TVCastSMD TR1 (TSOP59...TR1, TSOP39...TR1, TSOP19...TR1, TSOP99...TR1)

Direction of feed:

Technical drawings according to DIN specification.

Drawing-No.: GO-100220.10_Z
Issue B: 08.02.17
TAPING VERSION TSOP..TR (SIDE VIEW) DIMENSIONS in millimeters

A. Panhead (TSOP36..TR, TSSP6..TR, TSOP6..TR, TSOP16..TR, TSOP96..TR)
Taping Version TSOP..TR (Side View) Dimensions in millimeters

B. Heimdall (TSSP7..., TSOP75...TR, TSOP77...TR, TSSP7....TR, TSOP15...TR, TSOP95...TR)

Technical drawings according to DIN specifications
TAPING VERSION TSOP..TR (SIDE VIEW) DIMENSIONS in millimeters

C. Heimdall without lens (TSOP75...WTR, TSOP77...WTR, TSSP...WTR, TSOP15...WTR, TSOP95...WTR)

Drawing-No.: 9.700-5342.01-4
Issue: 2; 12.06.13

Direction of feed

technical drawings according to DIN specifications
LEADER AND TRAILER DIMENSIONS in millimeters

COVER TAPE REEL STRENGTH
According to DIN EN 60286-3
0.1 N to 1.3 N
300 mm/min. ± 10 mm/min.
165° to 180° peel angle

LABEL
Standard bar code labels for finished goods
The standard bar code labels are product labels and used for identification of goods. The finished goods are packed in final packing area. The standard packing units are labeled with standard bar code labels before transported as finished goods to warehouses. The labels are on each packing unit and contain Vishay Semiconductor GmbH specific data.

VISHAY SEMICONDUCTOR GmbH STANDARD BAR CODE PRODUCT LABEL (finished goods)

<table>
<thead>
<tr>
<th>PLAIN WRITING</th>
<th>ABBREVIATION</th>
<th>LENGTH</th>
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<tbody>
<tr>
<td>Item-description</td>
<td>-</td>
<td>18</td>
</tr>
<tr>
<td>Item-number</td>
<td>INO</td>
<td>8</td>
</tr>
<tr>
<td>Selection-code</td>
<td>SEL</td>
<td>3</td>
</tr>
<tr>
<td>LOT-/serial-number</td>
<td>BATCH</td>
<td>10</td>
</tr>
<tr>
<td>Data-code</td>
<td>COD</td>
<td>3 (YWW)</td>
</tr>
<tr>
<td>Plant-code</td>
<td>PTC</td>
<td>2</td>
</tr>
<tr>
<td>Quantity</td>
<td>QTY</td>
<td>8</td>
</tr>
<tr>
<td>Accepted by</td>
<td>ACC</td>
<td>-</td>
</tr>
<tr>
<td>Packed by</td>
<td>PCK</td>
<td>-</td>
</tr>
<tr>
<td>Mixed code indicator</td>
<td>MIXED CODE</td>
<td>-</td>
</tr>
<tr>
<td>Origin</td>
<td>xxxxxxx++</td>
<td>Company logo</td>
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</table>

<table>
<thead>
<tr>
<th>LONG BAR CODE TOP</th>
<th>TYPE</th>
<th>LENGTH</th>
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</thead>
<tbody>
<tr>
<td>Item-number</td>
<td>N</td>
<td>8</td>
</tr>
<tr>
<td>Plant-code</td>
<td>N</td>
<td>2</td>
</tr>
<tr>
<td>Sequence-number</td>
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<td>3</td>
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<tr>
<td>Quantity</td>
<td>N</td>
<td>8</td>
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<tr>
<td>Total length</td>
<td>-</td>
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</table>

<table>
<thead>
<tr>
<th>SHORT BAR CODE TOP</th>
<th>TYPE</th>
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<tr>
<td>Selection-code</td>
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</tr>
<tr>
<td>Data-code</td>
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<td>Filter</td>
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<td>1</td>
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<tr>
<td>Total length</td>
<td>-</td>
<td>17</td>
</tr>
</tbody>
</table>
**DRY PACKAGING**

The reel is packed in an anti-humidity bag to protect the devices from absorbing moisture during transportation and storage.

![Image: Aluminum bag and label]

**RECOMMENDED METHOD OF STORAGE**

Dry box storage is recommended as soon as the aluminum bag has been opened to prevent moisture absorption. The following conditions should be observed, if dry boxes are not available:

- Storage temperature 10 °C to 30 °C
- Storage humidity ≤ 60 % RH max.

After more than 72 h under these conditions moisture content will be too high for reflow soldering. In case of moisture absorption, the devices will recover to the former condition by drying under the following condition:
  - 192 h at 40 °C + 5 °C / - 0 °C and < 5 % RH (dry air / nitrogen)
  - 96 h at 60 °C + 5 °C and < 5 % RH for all device containers
  - 24 h at 125 °C + 5 °C not suitable for reel or tubes.

An EIA JEDEC® standard JSTD-020 level 4 label is included on all dry bags.

**ESD PRECAUTION**

Proper storage and handling procedures should be followed to prevent ESD damage to the devices especially when they are removed from the antistatic shielding bag. Electrostatic sensitive devices warning labels are on the packaging.

**VISHAY SEMICONDUCTORS STANDARD BAR CODE LABELS**

The Vishay Semiconductors standard bar code labels are printed at final packing areas. The labels are on each packing unit and contain Vishay Semiconductors specific data.

![Image: Bar code label]

**OUTER PACKAGING**

The sealed reel is packed into a pizza box.

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**CARTON BOX DIMENSIONS** in millimeters

<table>
<thead>
<tr>
<th>THICKNESS</th>
<th>WIDTH</th>
<th>LENGTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pizza box (SMD and heimdall) (taping in reels)</td>
<td>50</td>
<td>340</td>
</tr>
</tbody>
</table>
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