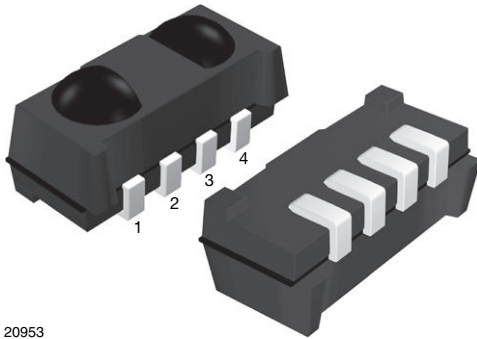


## IR Detector for Mid Range Proximity Sensor



20953

### MECHANICAL DATA

#### Pinning:

 1, 4 = GND, 2 =  $V_S$ , 3 = OUT

### ORDERING CODE

#### Taping:

TSSP77P38TT - top view taped

TSSP77P38TR - side view taped

### DESCRIPTION

The TSSP77P38 is a compact infrared detector module for proximity sensing application. It receives 38 kHz modulated signals and has a peak sensitivity of 940 nm.

The length of the detector's output pulse varies in proportion to the amount of light reflected from the object being detected.

### FEATURES

- Up to 2 m for proximity sensing
- Very low supply current
- Photo detector and preamplifier in one package
- Shielding against EMI
- Supply voltage: 2.5 V to 5.5 V
- Visible light is suppressed by IR filter
- Capable of side or top view
- Insensitive to supply voltage ripple and noise
- Two lenses for high sensitivity and wide receiving angle
- 940 nm peak wavelength
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)

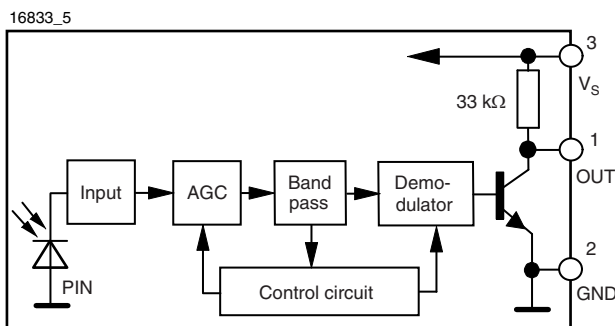


### APPLICATIONS

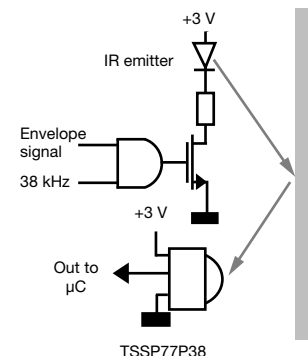
- Object approach detection for activation of displays and user consoles, signaling of alarms, etc.
- Simple gesture controls
- Differentiation of car arrival, static, car departure in parking lots
- Reflective sensors for toilet flush
- Navigational sensor for robotics

| PARTS TABLE       |        |                                 |
|-------------------|--------|---------------------------------|
| Carrier frequency | 38 kHz | TSSP77P38                       |
| Package           |        | Heimdall                        |
| Pinning           |        | 1, 4 = GND, 2 = $V_S$ , 3 = OUT |
| Dimensions (mm)   |        | 6.8 W x 3.0 H x 3.2 D           |
| Mounting          |        | SMD                             |
| Application       |        | Proximity sensors               |

### BLOCK DIAGRAM



### PROXIMITY SENSING



| ABSOLUTE MAXIMUM RATINGS    |                             |           |                       |      |
|-----------------------------|-----------------------------|-----------|-----------------------|------|
| PARAMETER                   | TEST CONDITION              | SYMBOL    | VALUE                 | UNIT |
| Supply voltage              |                             | $V_S$     | -0.3 to +6            | V    |
| Supply current              |                             | $I_S$     | 5                     | mA   |
| Output voltage              |                             | $V_O$     | -0.3 to $(V_S + 0.3)$ | V    |
| Output current              |                             | $I_O$     | 5                     | mA   |
| Junction temperature        |                             | $T_j$     | 100                   | °C   |
| Storage temperature range   |                             | $T_{stg}$ | -25 to +85            | °C   |
| Operating temperature range |                             | $T_{amb}$ | -25 to +85            | °C   |
| Power consumption           | $T_{amb} \leq 85\text{ °C}$ | $P_{tot}$ | 10                    | mW   |

**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.

| ELECTRICAL AND OPTICAL CHARACTERISTICS ( $T_{amb} = 25\text{ °C}$ , unless otherwise specified) |  |                   |      |          |      |                 |
|---|--|-------------------|------|----------|------|-----------------|
| PARAMETER   | TEST CONDITION   | SYMBOL            | MIN. | TYP.     | MAX. | UNIT            |
| Supply voltage  |  | $V_S$             | 2.5  | -        | 5.5  | V               |
| Supply current  | $V_S = 5\text{ V}, E_e = 0$  | $I_{SD}$          | 0.55 | 0.7      | 0.9  | mA              |
|   | $E_v = 40\text{ klx}$ , sunlight   | $I_{SH}$          | -    | 0.8      | -    | mA              |
| Receiving distance  | Direct line of sight,<br>IR diode TSAL6200,<br>$I_F = 250\text{ mA}$ , test signal see fig. 1    | $d$               | -    | 40       | -    | m               |
| Output voltage low  | $I_{OSL} = 0.5\text{ mA}, E_e = 0.7\text{ mW/m}^2$ ,<br>test signal see fig. 1                   | $V_{OSL}$         | -    | -        | 100  | mV              |
| Minimum irradiance  | Pulse width tolerance:<br>$t_{pi} - 5/f_0 < t_{po} < t_{pi} + 6/f_0$ ,<br>test signal see fig. 1 | $E_e\text{ min.}$ | -    | 0.2      | 0.4  | $\text{mW/m}^2$ |
| Maximum irradiance  | $t_{pi} - 5/f_0 < t_{po} < t_{pi} + 6/f_0$ ,<br>test signal see fig. 1                           | $E_e\text{ max.}$ | 50   | -        | -    | $\text{W/m}^2$  |
| Directivity   | Angle of half receiving distance   | $\phi_{1/2}$      | -    | $\pm 50$ | -    | deg             |

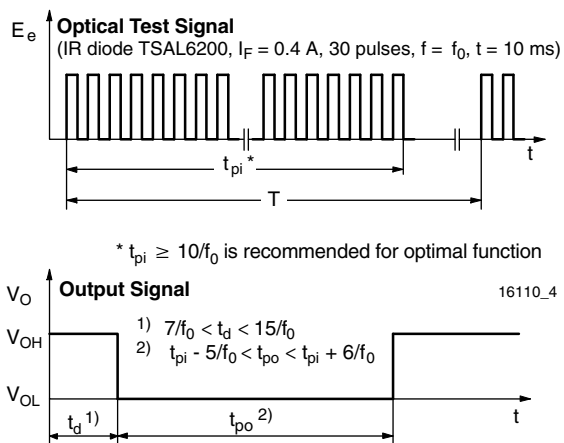
**TYPICAL CHARACTERISTICS** ( $T_{amb} = 25\text{ °C}$ , unless otherwise specified)


Fig. 1 - Output Active Low

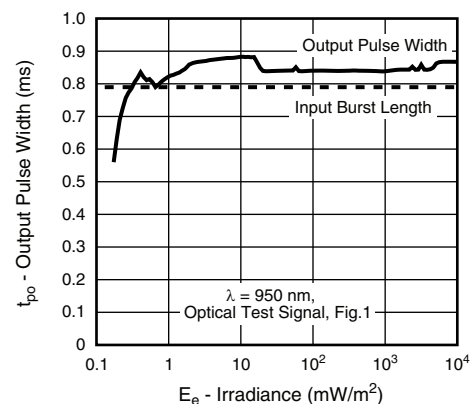


Fig. 2 - Pulse Length and Sensitivity in Dark Ambient

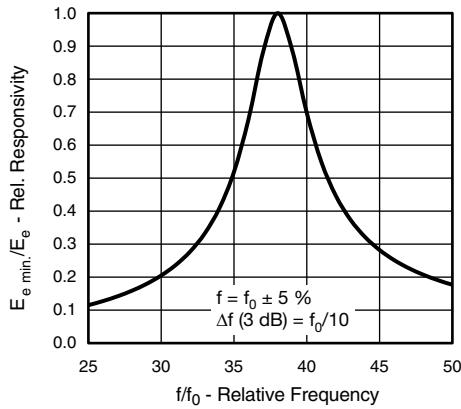


Fig. 3 - Frequency Dependence of Responsivity

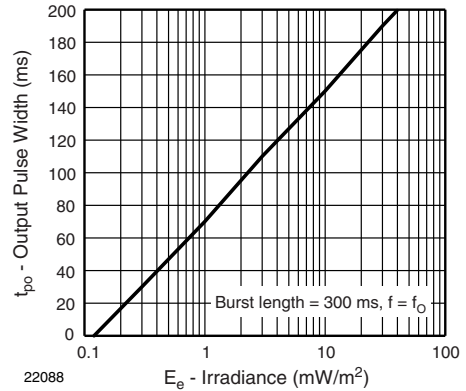


Fig. 6 - Output Pulse Width vs. Irradiance

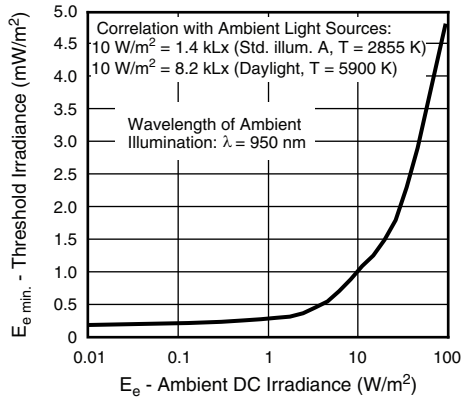


Fig. 4 - Sensitivity in Bright Ambient

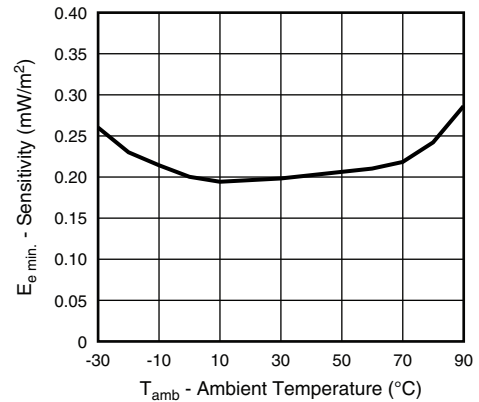


Fig. 7 - Sensitivity vs. Ambient Temperature

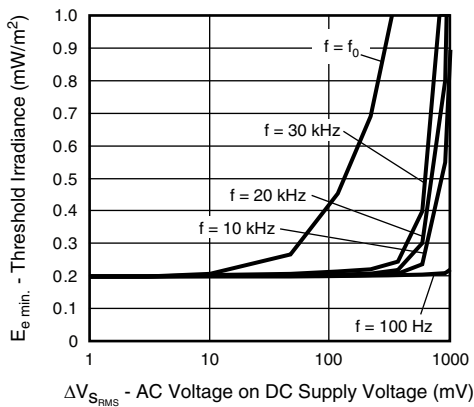


Fig. 5 - Sensitivity vs. Supply Voltage Disturbances

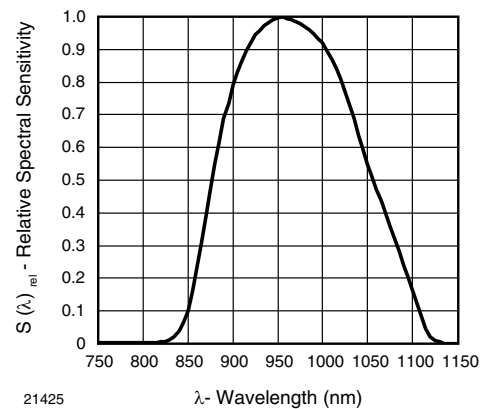


Fig. 8 - Relative Spectral Sensitivity vs. Wavelength

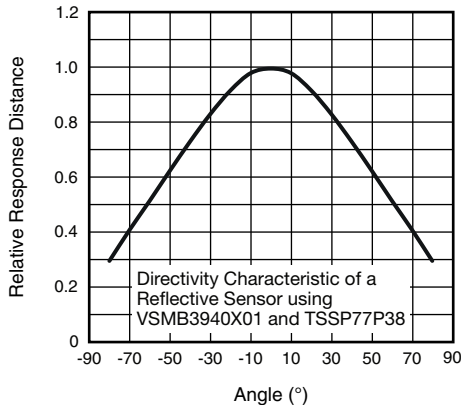


Fig. 9 - Angle Characteristic

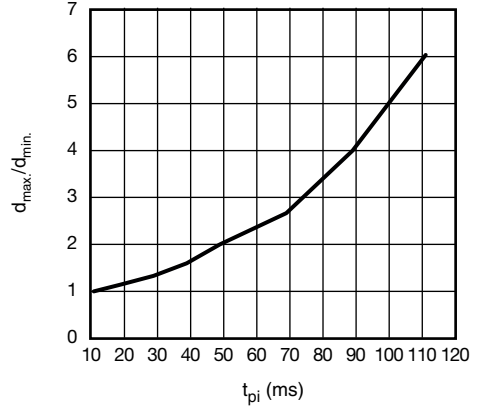


Fig. 11 - Dynamic Range of Sensor vs.  $t_{pi}$

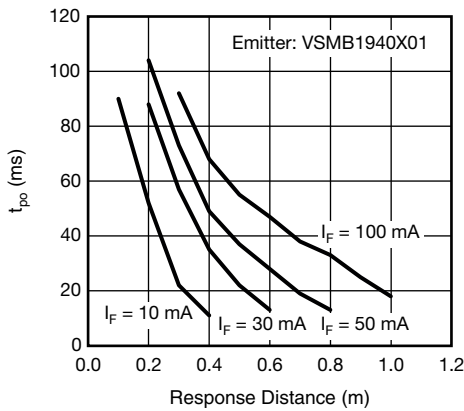


Fig. 10 -  $t_{po}$  vs. Distance Kodak Gray Card Plus 15 %

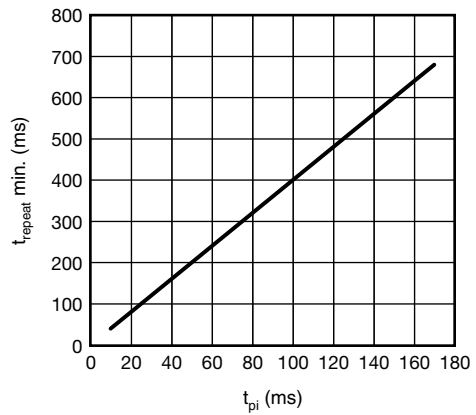
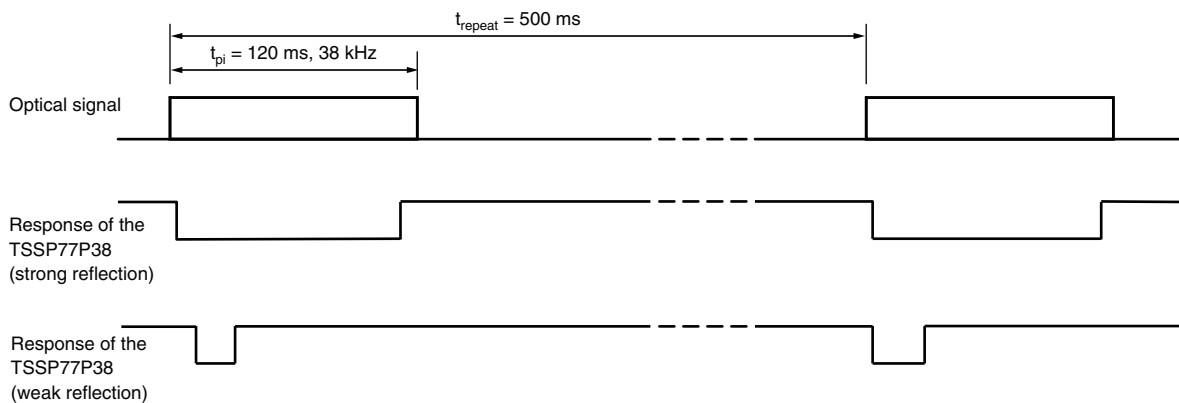


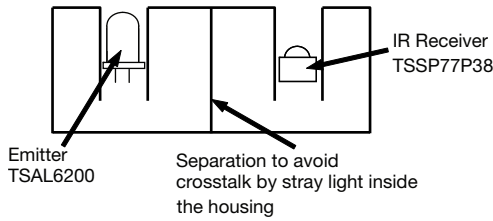
Fig. 12 - Max. Rate of Bursts

The typical application of the TSSP77P38 is a reflective sensor with analog information contained in its output. Such a sensor is evaluating the time required by the AGC to suppress a quasi continuous signal. The time required to suppress such a signal is longer when the signal is strong than when the signal is weak, resulting in a pulse length corresponding to the distance of an object from the sensor. This kind of analog information can be evaluated by a microcontroller. The absolute amount of reflected light depends much on the environment and is not evaluated. Only sudden changes of the amount of reflected light, and therefore changes in the pulse width, are evaluated using this application.

Example of a signal pattern:



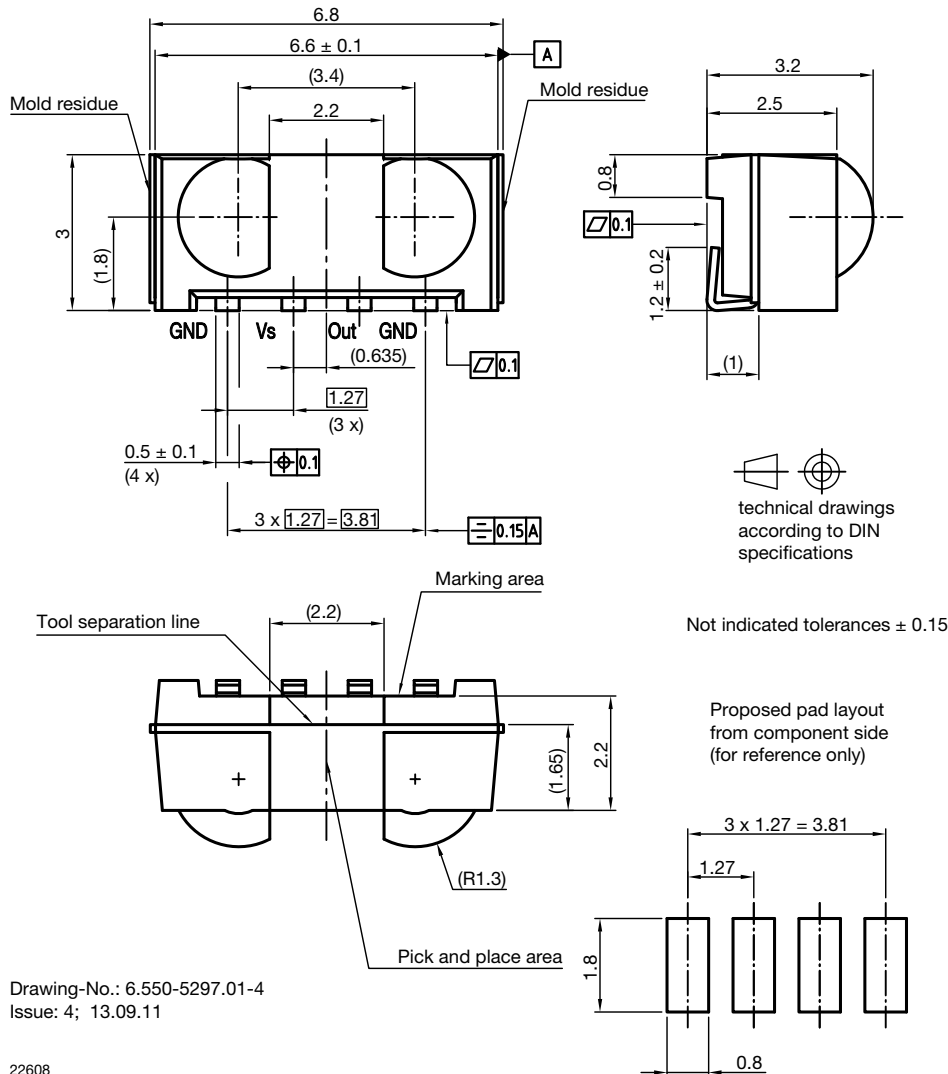
Example for a sensor hardware:



There should be no common window in front of the emitter and receiver in order to avoid crosstalk by guided light through the window.

The logarithmic characteristic of the AGC in the TSSP77P38 results in an almost linear relationship between distance and pulse width. Ambient light has also some impact to the pulse width of this kind of sensor, making the pulse shorter.

## PACKAGE DIMENSIONS in millimeters





### ASSEMBLY INSTRUCTIONS

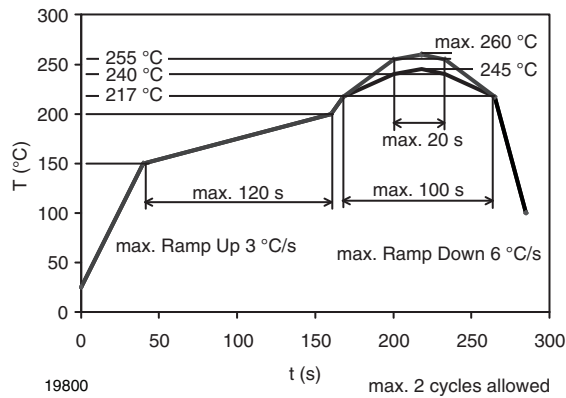
#### Reflow Soldering

- 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

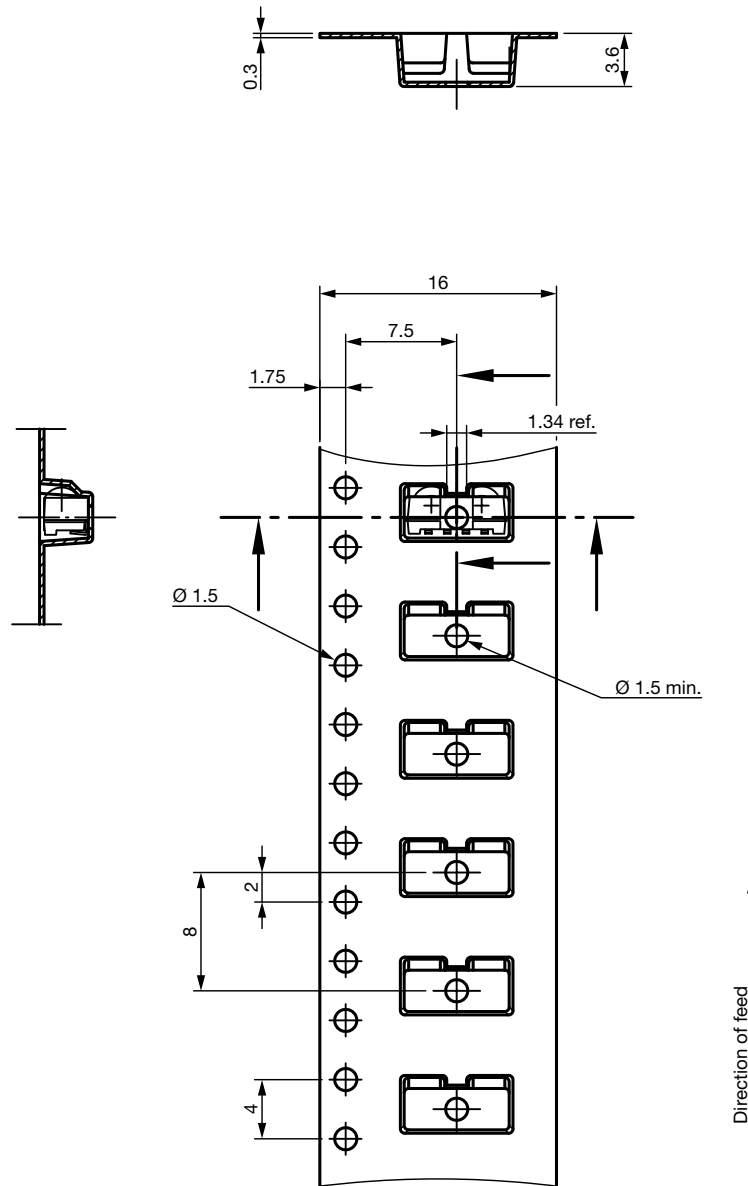
- Use a soldering iron of 25 W or less. Adjust the temperature of the soldering iron below 300 °C
- Finish soldering within 3 s
- Handle products only after the temperature has cooled off

### VISHAY LEAD (Pb)-FREE REFLOW SOLDER PROFILE

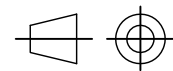




## TAPING VERSION TSSP77P38TR DIMENSIONS in millimeters



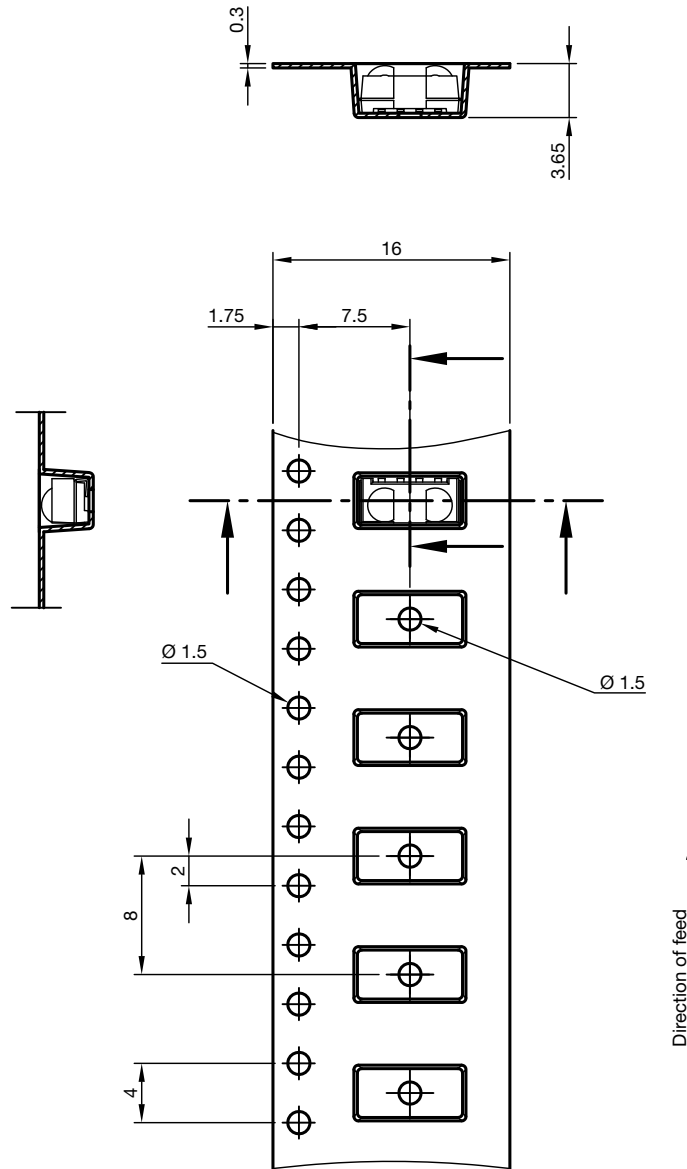
Drawing-No.: 9.700-5337.01-4  
Issue: 2; 06.10.15



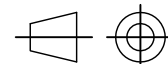
technical drawings  
according to DIN  
specifications



## TAPING VERSION TSSP77P38TT DIMENSIONS in millimeters



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



technical drawings  
according to DIN  
specifications



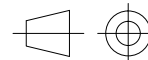
**REEL DIMENSIONS** in millimeters



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

Dimension acc. to IEC EN 60 286-3

Tape width 16



technical drawings according to DIN specifications

Drawing-No.: 9.800-5052.V2-4

Issue: 1; 07.05.02

16734

**LEADER AND TRAILER DIMENSIONS** in millimeters



**COVER TAPE PEEL STRENGTH**

According to DIN EN 60286-3

0.1 N to 1.3 N

300 ± 10 mm/min.

165° to 180° peel angle

**LABEL**

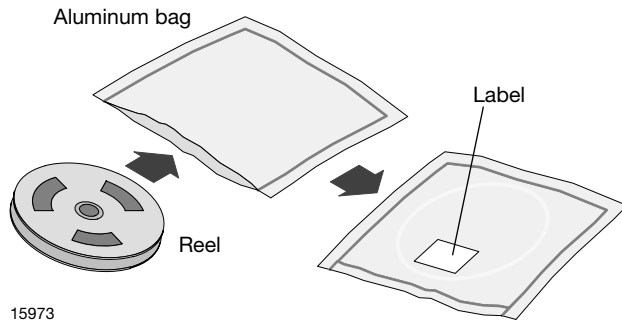
**Standard bar code labels for finished goods**

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.

| <b>VISHAY SEMICONDUCTOR GmbH STANDARD BAR CODE PRODUCT LABEL (finished goods)</b> |                     |               |
|---|---------------------|---------------|
| <b>PLAIN WRITING</b>  | <b>ABBREVIATION</b> | <b>LENGTH</b> |
| Item-description  | -                   | 18            |
| Item-number   | INO                 | 8             |
| Selection-code  | SEL                 | 3             |
| LOT-/serial-number  | BATCH               | 10            |
| Data-code   | COD                 | 3 (YWW)       |
| Plant-code  | PTC                 | 2             |
| Quantity  | QTY                 | 8             |
| Accepted by   | ACC                 | -             |
| Packed by   | PCK                 | -             |
| Mixed code indicator  | MIXED CODE          | -             |
| Origin  | xxxxxxx+            | Company logo  |
| <b>Long bar code top</b>  | <b>Type</b>         | <b>Length</b> |
| Item-number   | N                   | 8             |
| Plant-code  | N                   | 2             |
| Sequence-number   | X                   | 3             |
| Quantity  | N                   | 8             |
| Total length  | -                   | 21            |
| <b>Short bar code bottom</b>  | <b>Type</b>         | <b>Length</b> |
| Selection-code  | X                   | 3             |
| Data-code   | N                   | 3             |
| Batch-number  | X                   | 10            |
| Filter  | -                   | 1             |
| Total length  | -                   | 17            |

### 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. A secondary cardboard box is used for shipping purposes.

### RECOMMENDED METHOD OF STORAGE

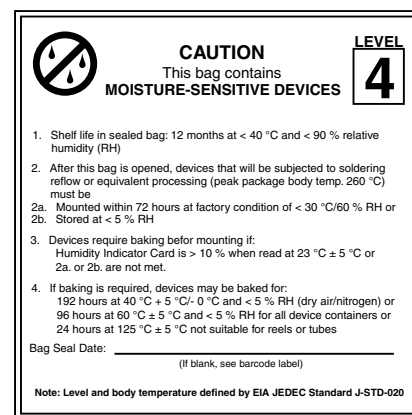
Dry box storage is recommended as soon as the aluminum bag has been opened to prevent moisture absorption. The following conditions should be observed, if dry boxes are not available:

- 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.



EIA JEDEC standard J-STD-020 level 4 label is included on all dry bags

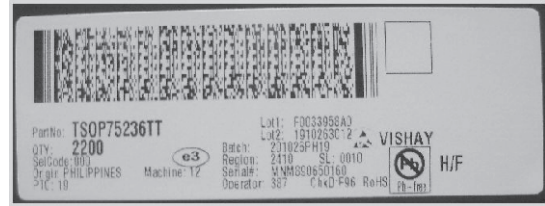


**ESD PRECAUTION**

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** (example)

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.



22178



## 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
  - TT2, top view package, 7000 pcs
- E. Belobog with shield: quantity per reel:
  - TT1, top view package, 1500 pcs
  - TT2, top view package, 5000 pcs
- F. Minimold DF1P: quantity per reel:
  - DF1P, 1100 pcs
- G. TVCastSMD TR1: quantity per reel:
  - TR1, side view package, 2200 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



technical drawings according to DIN specifications

Drawing-No.: 9.800-5052.V2-4

Issue: 1; 07.05.02

16734

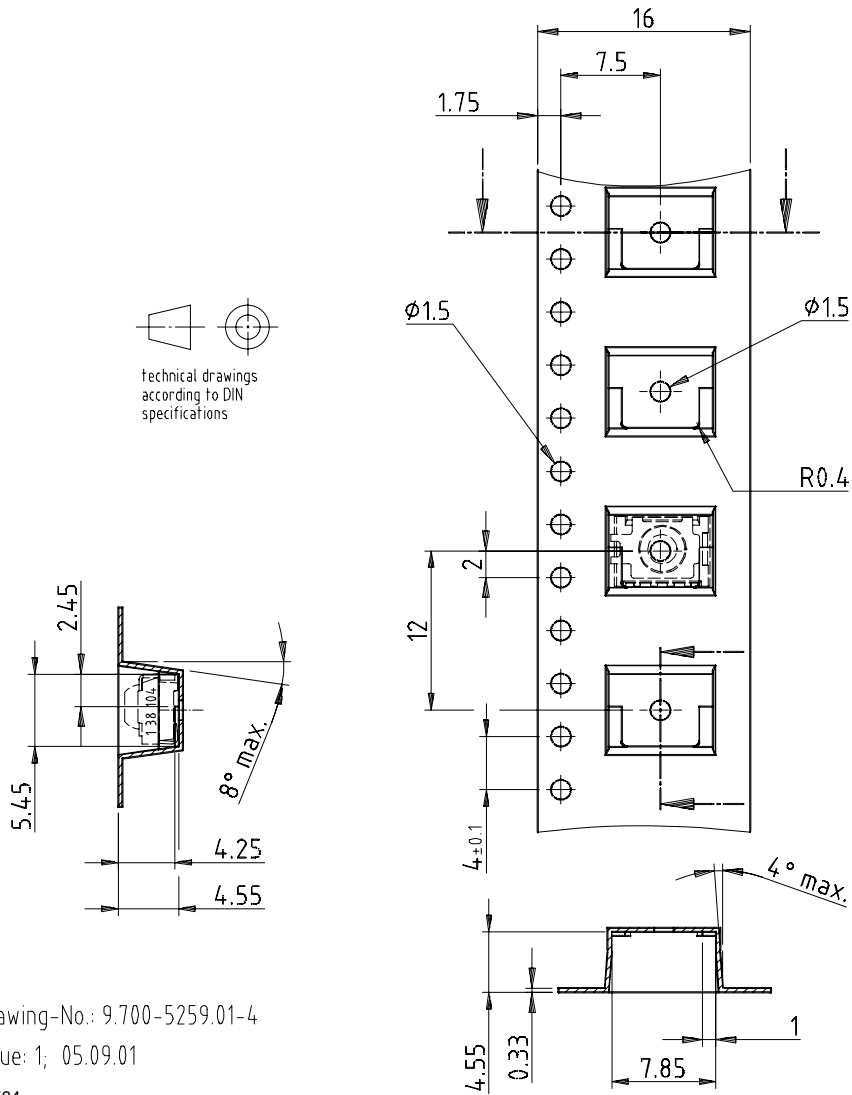
### Note

- The body structure of the reel can vary



## TAPING 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

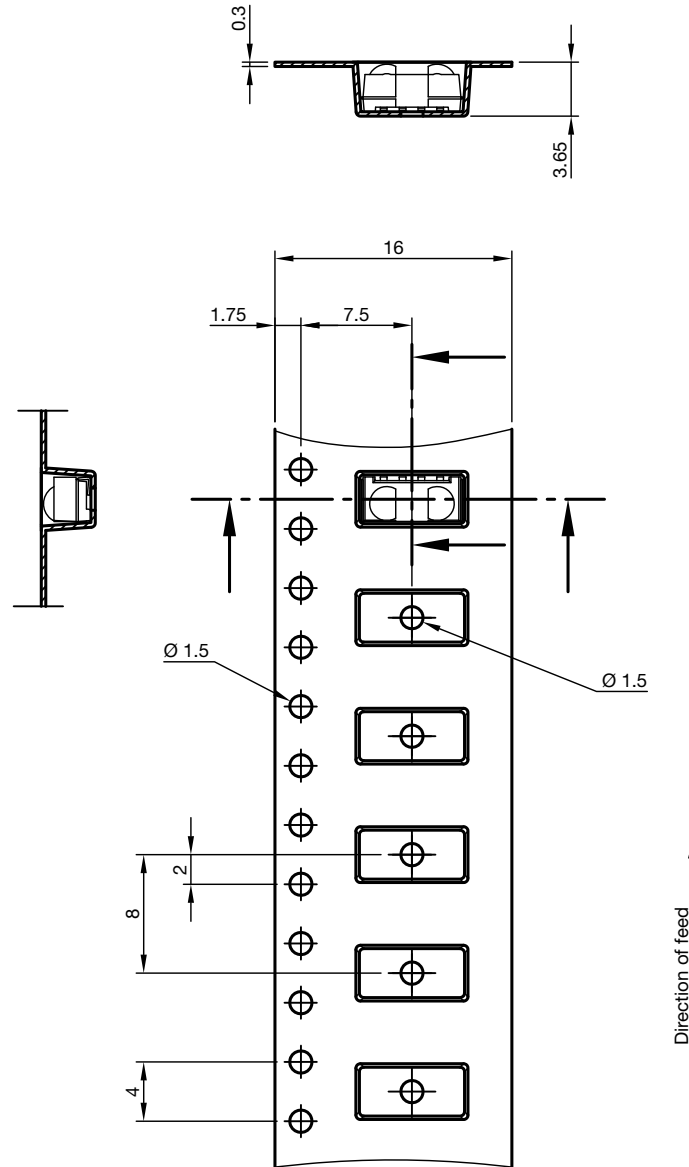
Issue: 1; 05.09.01

16584

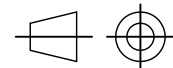


## TAPING VERSION TSOP..TT (TOP VIEW) DIMENSIONS in millimeters

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



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

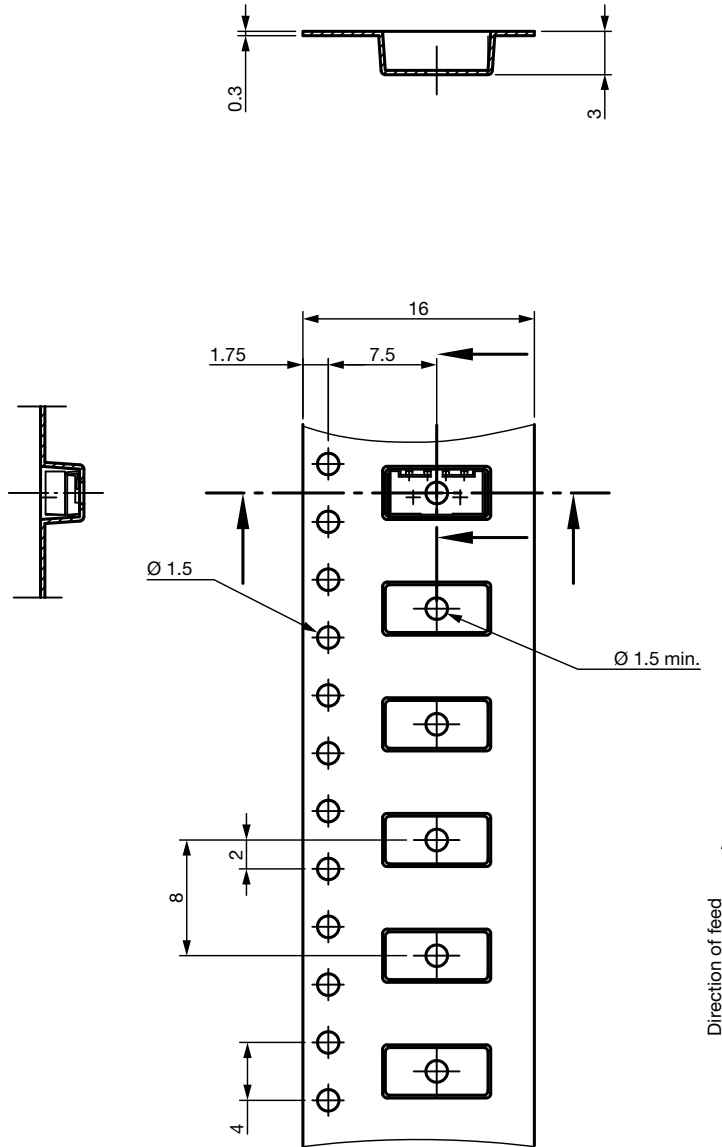


technical drawings  
according to DIN  
specifications

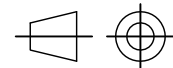


## TAPING VERSION TSOP..TT (TOP VIEW) DIMENSIONS in millimeters

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



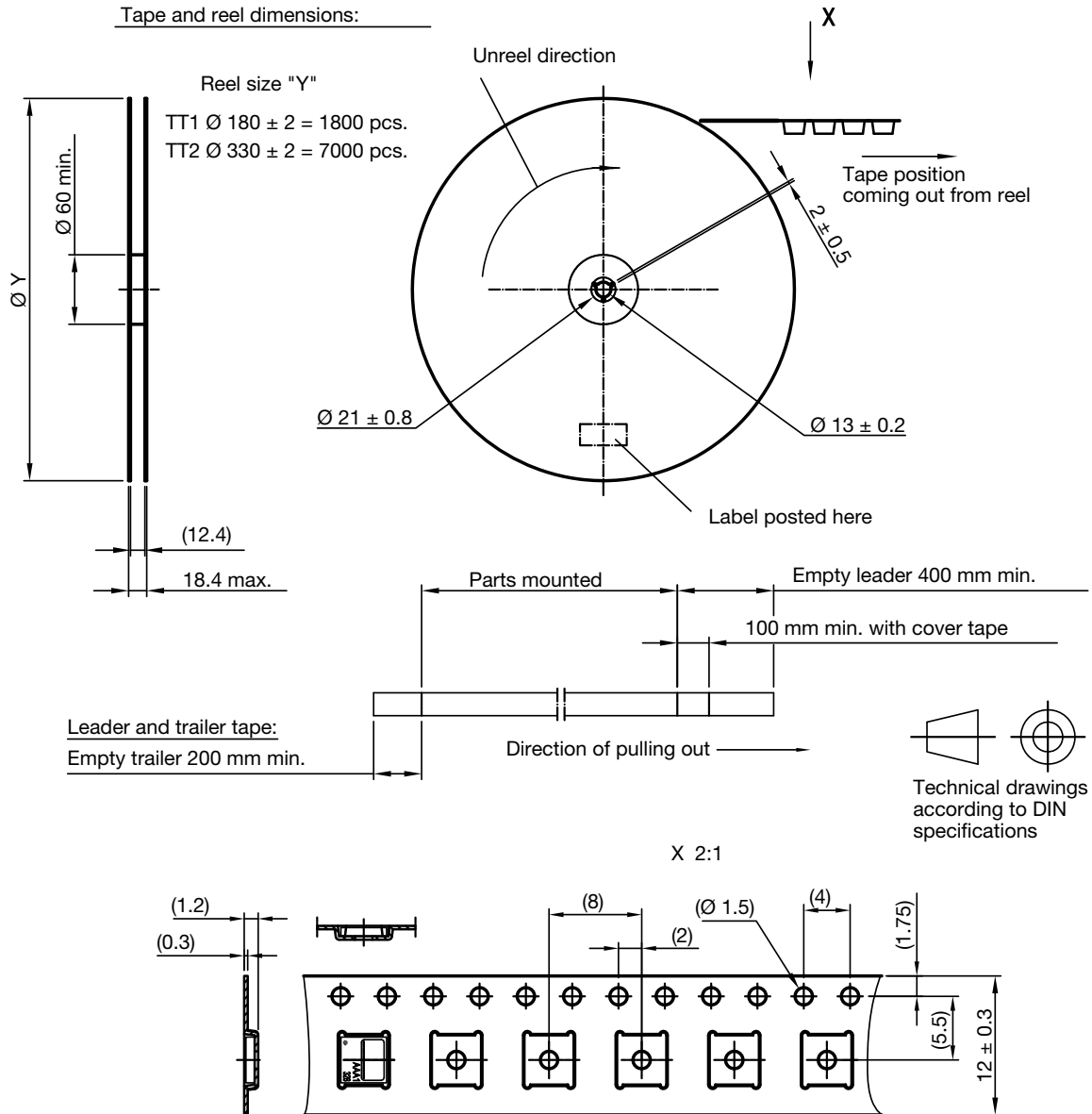
technical drawings  
according to DIN  
specifications





### TAPING VERSION TSOP..TT1, TSOP..TT2 (TOP VIEW) DIMENSIONS in millimeters

D. Belobog (TSOP37...TT1, TSOP37...TT2, TSOP57...TT1, TSOP57...TT2, TSOP17...TT1, TSOP17...TT2, TSOP97...TT1, TSOP97...TT2)



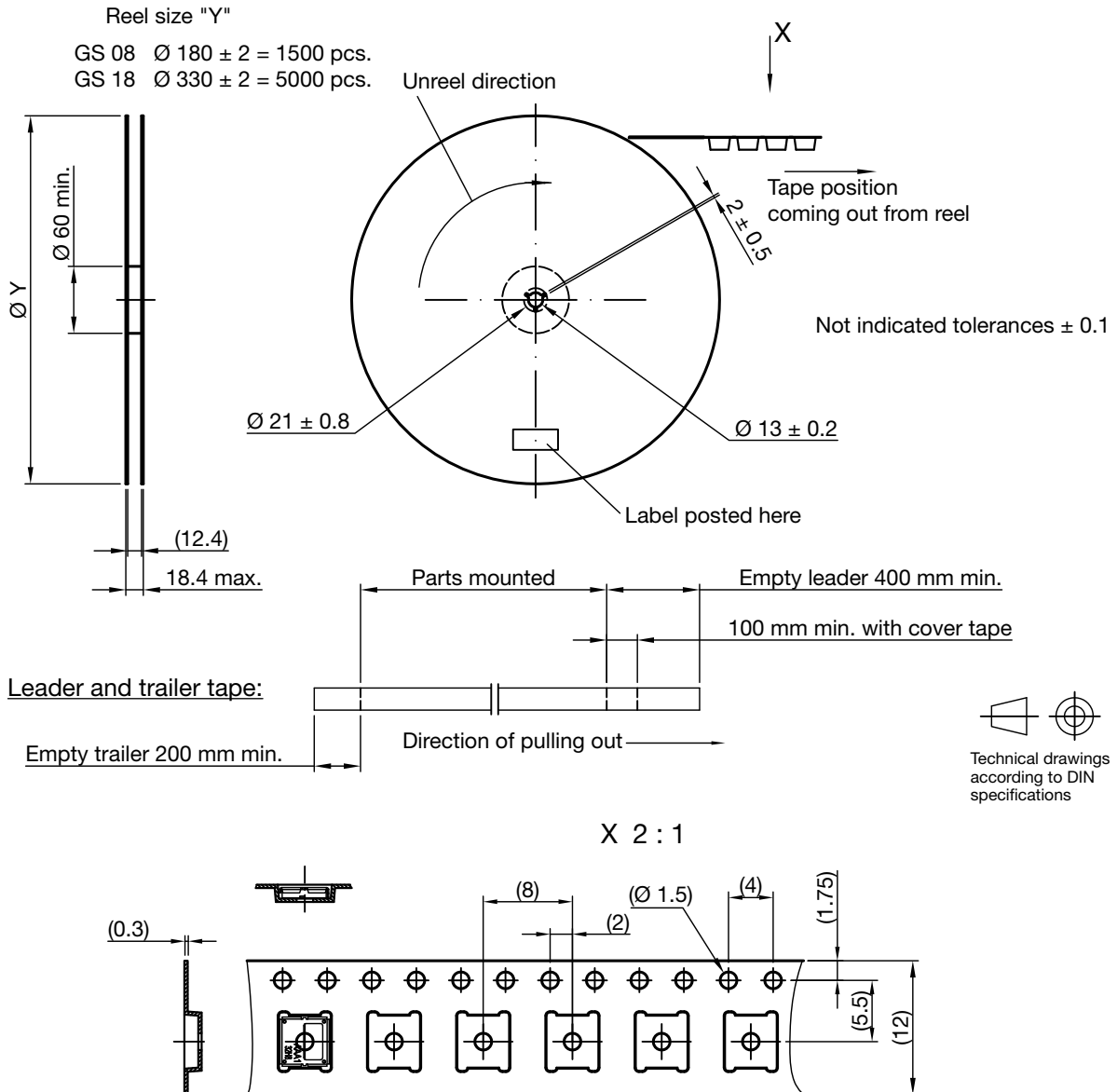
Drawing-No.: 9.700-5347.01-4  
Issue: 1; 14.11.11

Not indicated tolerances  $\pm 0.1$

## TAPING VERSION TSOP..TT1, TSOP..TT2 (TOP VIEW) DIMENSIONS in millimeters

E. Belobog with shield (TSOP37...HTT1, TSOP37...HTT2, TSOP57...HTT1, TSOP57...HTT2, TSOP17...HTT1, TSOP17...HTT2, TSOP97...HTT1, TSOP97...HTT2)

Tape and Reel dimensions:



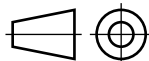
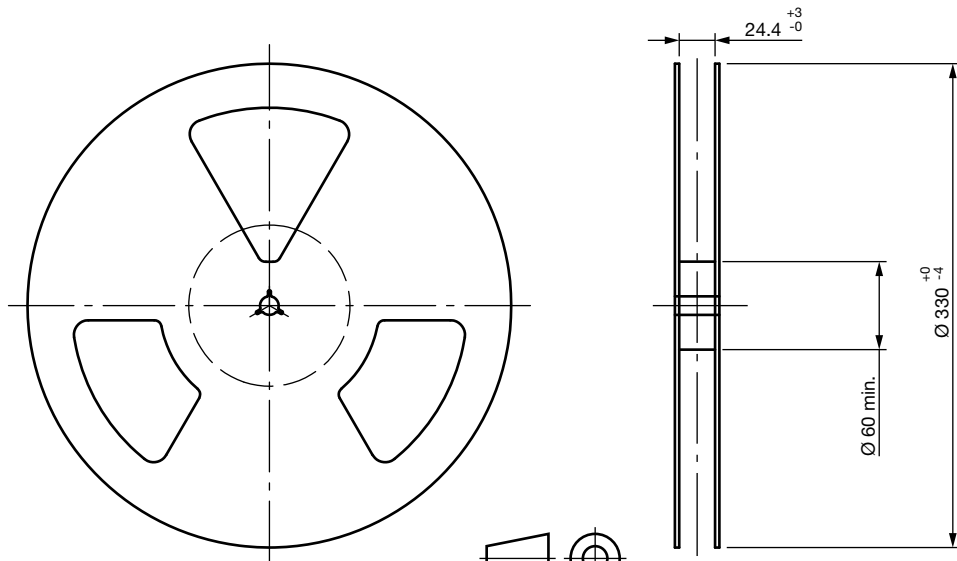
Reel dimensions and tape

Drawing-No.: 9.700-5380.01-4  
Issue: 1; 28.10.13



### TAPING VERSION TSOP..DF1P (SIDE VIEW) DIMENSIONS in millimeters

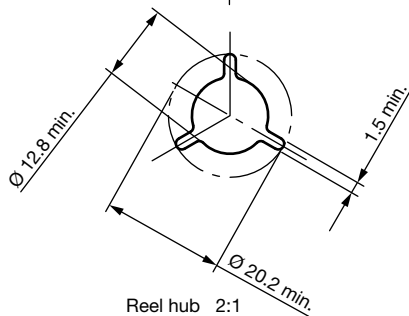
F. Minimold DF1P (TSOP33...DF1P, TSOP53...DF1P, TSOP13...DF1P, TSOP93...DF1P)



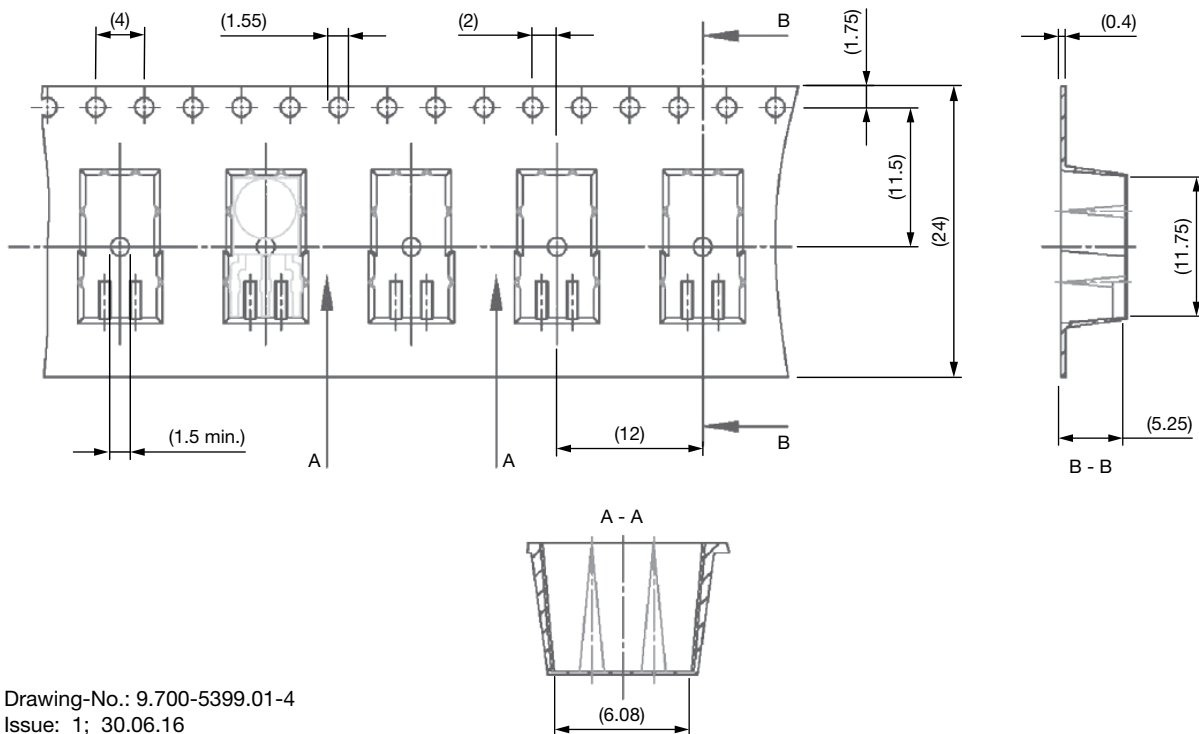
Technical drawing according to DIN specifications

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

Tape width: 24



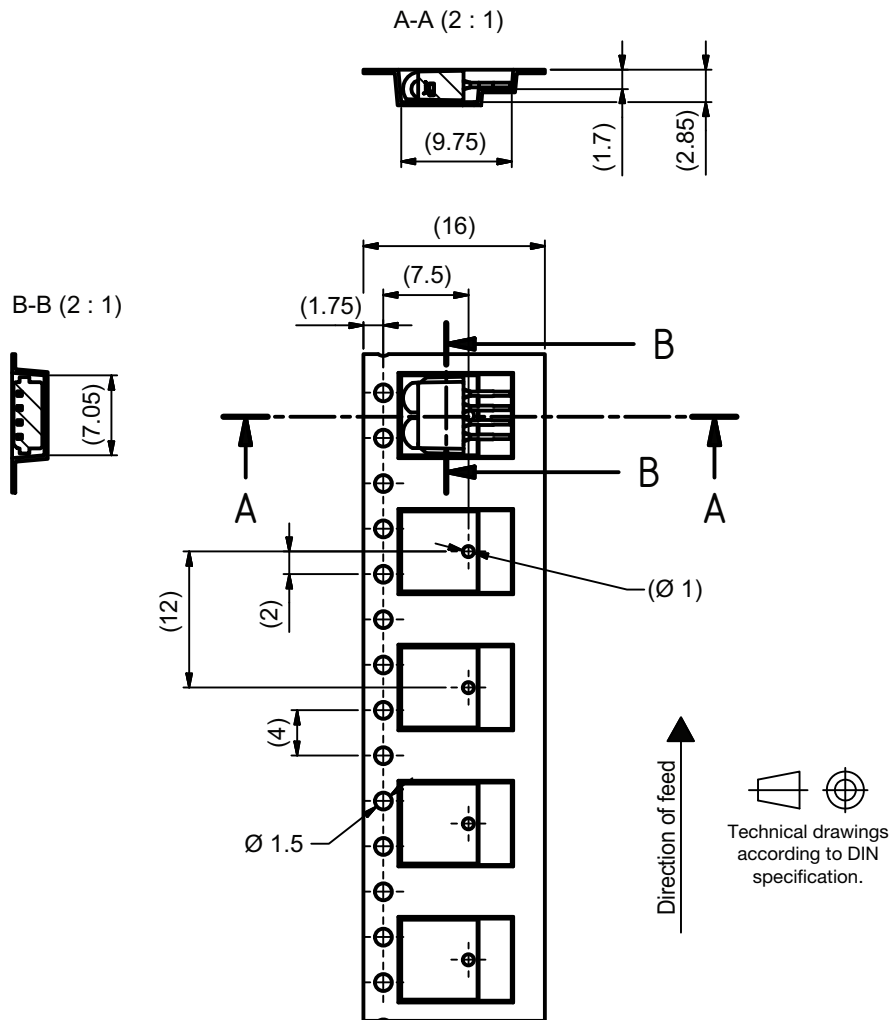
Drawing-No.: 9.800-5052.V3-4  
Issue: 1; 17.12.02



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)



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)



Drawing-No.: 9.700-5260.01-4

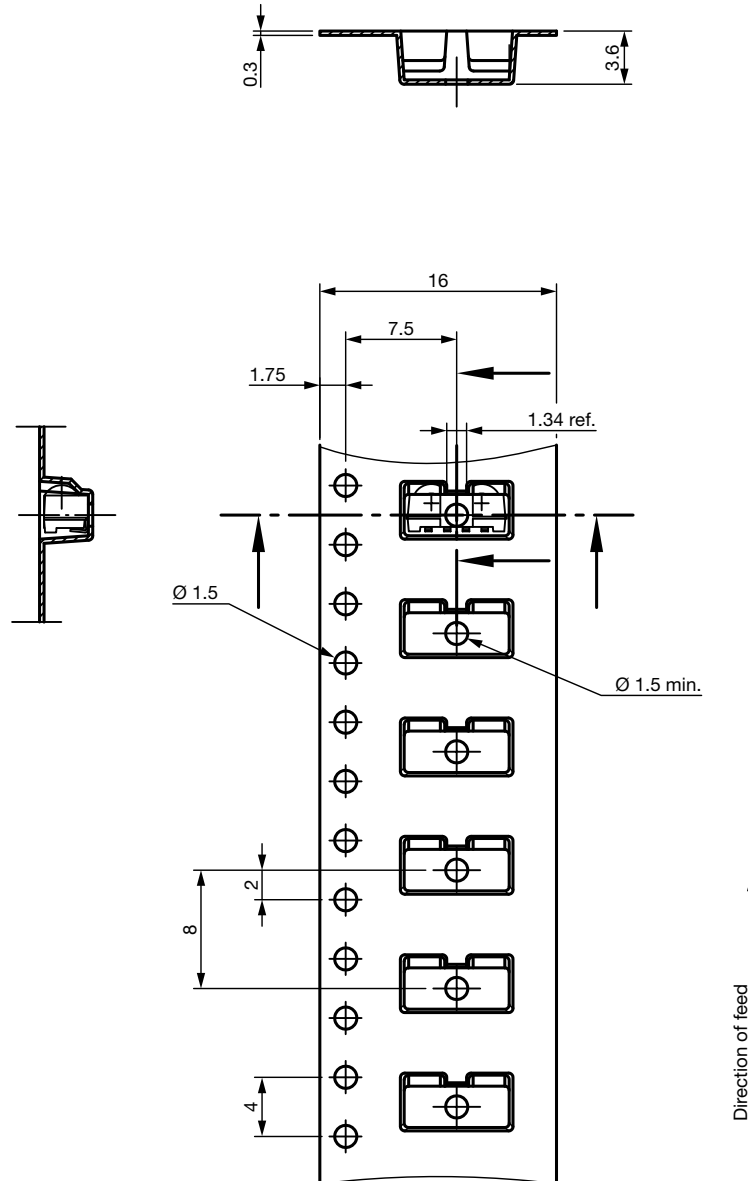
Issue: 2; 25.09..01

16585

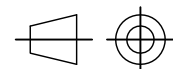


## TAPING VERSION TSOP..TR (SIDE VIEW) DIMENSIONS in millimeters

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



Drawing-No.: 9.700-5337.01-4  
Issue: 2; 06.10.15

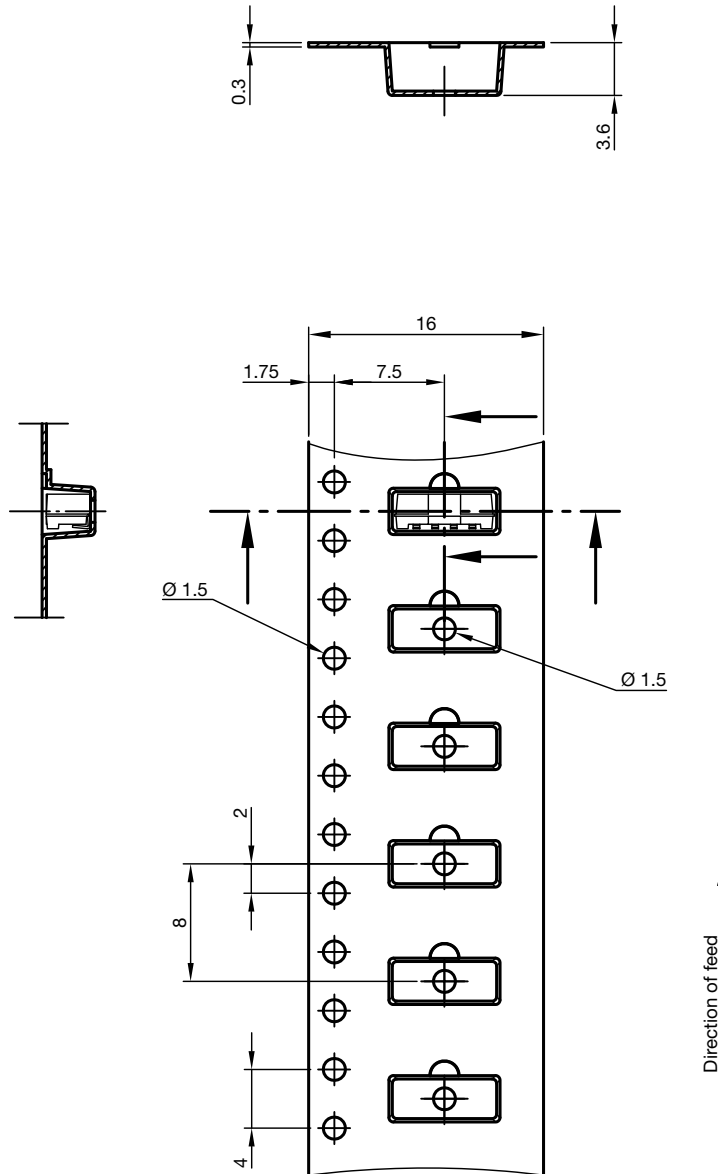


technical drawings  
according to DIN  
specifications

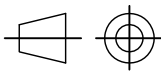


TAPING VERSION TSOP..TR (SIDE VIEW) DIMENSIONS in millimeters

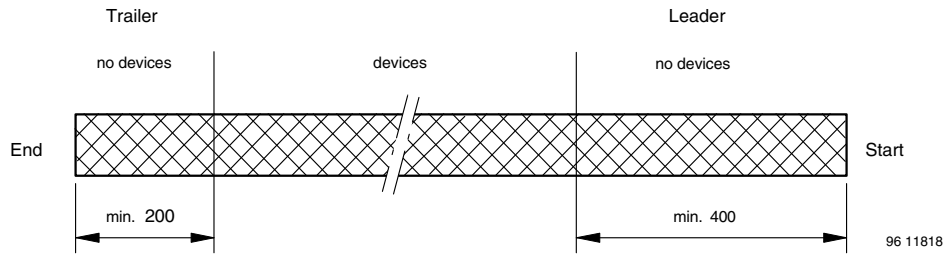
C. Heimdall without lens (TSOP75...WTR, TSOP77...WTR, TSSP...WTR, TSOP15...WTR, TSOP95...WTR)



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

  
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.  $\pm$  10 mm/min.

165° to 180° peel angle

### LABEL

#### Standard bar code labels for finished goods

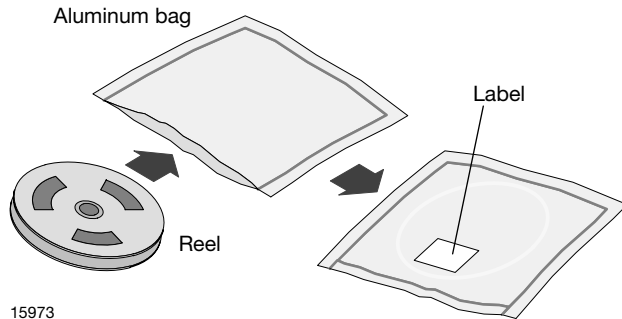
The standard bar code labels are product labels and used for identification of goods. The finished goods are packed in final packing area. The standard packing units are labeled with standard bar code labels before transported as finished goods to warehouses. The labels are on each packing unit and contain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

| VISHAY SEMICONDUCTOR GmbH STANDARD BAR CODE PRODUCT LABEL (finished goods) |              |              |
|--|--------------|--------------|
| PLAIN WRITING  | ABBREVIATION | LENGTH       |
| Item-description   | -            | 18           |
| Item-number  | INO          | 8            |
| Selection-code   | SEL          | 3            |
| LOT-/serial-number   | BATCH        | 10           |
| Data-code  | COD          | 3 (YWW)      |
| Plant-code   | PTC          | 2            |
| Quantity   | QTY          | 8            |
| Accepted by  | ACC          | -            |
| Packed by  | PCK          | -            |
| Mixed code indicator   | MIXED CODE   | -            |
| Origin   | xxxxxxx+     | Company logo |
| LONG BAR CODE TOP  | TYPE         | LENGTH       |
| Item-number  | N            | 8            |
| Plant-code   | N            | 2            |
| Sequence-number  | X            | 3            |
| Quantity   | N            | 8            |
| Total length   | -            | 21           |
| SHORT BAR CODE TOP   | TYPE         | LENGTH       |
| Selection-code   | X            | 3            |
| Data-code  | N            | 3            |
| Batch-number   | X            | 10           |
| Filter   | -            | 1            |
| Total length   | -            | 17           |



## DRY PACKAGING

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



15973

## 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:

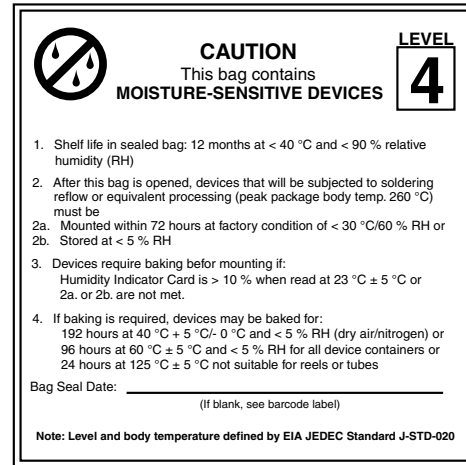
- Storage temperature 10 °C to 30 °C
- Storage humidity ≤ 60 % RH max.

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 JSTD-020 level 4 label is included on all dry bags.



22522

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.



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## OUTER PACKAGING

The sealed reel is packed into a pizza box.

| CARTON BOX DIMENSIONS in millimeters           |           |       |        |
|--|-----------|-------|--------|
|  |           |       |        |
|  | THICKNESS | WIDTH | LENGTH |
| Pizza box (SMD and heimdall) (taping in reels) | 50        | 340   | 340    |

22127



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