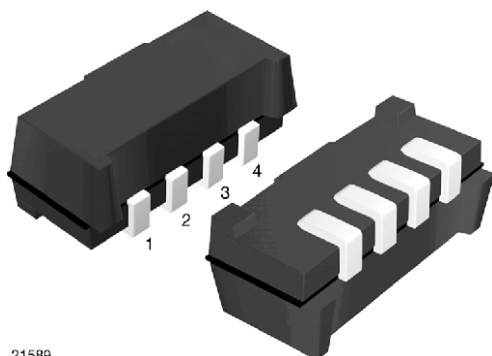


IR Receiver Modules for Remote Control Systems



21589

DESIGN SUPPORT TOOLS

[click logo to get started](#)


MECHANICAL DATA

Pinning:

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

ORDERING CODE

Taping:

TSOP77...WTT - top view taped

TSOP77...WTR - side view taped

FEATURES

- Continuous data transmission possible
- Very low supply current
- Photo detector and preamplifier in one package
- Internal filter for PCM frequency
- Supply voltage: 2.5 V to 5.5 V
- Improved immunity against ambient light
- Capable of side or top view
- Insensitive to supply voltage ripple and noise
- Low profile 2.35 mm
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT
HALOGEN
FREE
GREEN
(5-2008)

DESCRIPTION

The TSOP77...W series are miniaturized SMD IR receiver modules for infrared remote control systems. Two PIN diodes and a preamplifier are assembled on a leadframe, the epoxy package contains an IR filter.

The demodulated output signal can be directly connected to a microprocessor for decoding. The TSOP774..W series devices are optimized to suppress almost all spurious pulses from Wi-Fi and CFL sources. They may suppress some data signals if continuously transmitted.

The TSOP772..W series devices are provided primarily for compatibility with old AGC2 designs. New designs should prefer the TSOP534.. series containing the newer AGC4.

These components have not been qualified according to automotive specifications.

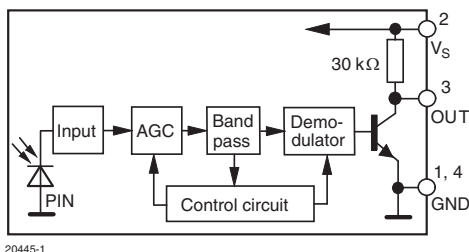
| PARTS TABLE | | | |
|----------------------|--------|--|---|
| AGC | | LEGACY, FOR LONG BURST REMOTE CONTROLS (AGC2) | RECOMMENDED FOR LONG BURST CODES (AGC4) ⁽¹⁾ |
| Carrier frequency | 30 kHz | TSOP77230W | TSOP77430W |
| | 33 kHz | TSOP77233W | TSOP77433W |
| | 36 kHz | TSOP77236W | TSOP77436W ⁽²⁾⁽³⁾⁽⁴⁾ |
| | 38 kHz | TSOP77238W | TSOP77438W ⁽⁵⁾⁽⁶⁾⁽⁹⁾ |
| | 40 kHz | TSOP77240W | TSOP77440W |
| | 56 kHz | TSOP77256W | TSOP77456W ⁽⁷⁾⁽⁸⁾ |
| Package | | Heimdall no lens | |
| Pinning | | 1, 4 = GND, 2 = V_S , 3 = OUT | |
| Dimensions (mm) | | 6.8 W x 3.0 H x 2.35 D | |
| Mounting | | SMD | |
| Application | | Remote control | |
| Best choice for | | ⁽²⁾ RC-5 ⁽³⁾ RC-6 ⁽⁴⁾ Panasonic ⁽⁵⁾ NEC ⁽⁶⁾ Sharp ⁽⁷⁾ r-step ⁽⁸⁾ Thomson RCA ⁽⁹⁾ r-map | |

Note

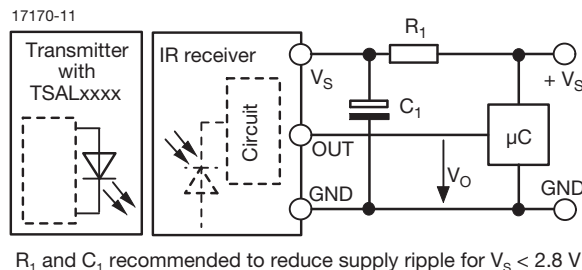
⁽¹⁾ We advise try AGC4 first if the burst length is unknown



BLOCK DIAGRAM



APPLICATION CIRCUIT



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 5.5 | V |
| Voltage at output to supply | | $V_S - V_O$ | -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 | $T_{amb} \leq 85$ °C | P_{tot} | 10 | mW |
| Soldering temperature | $t \leq 10$ s, 1 mm from case | T_{sd} | 260 | °C |

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 ($T_{amb} = 25$ °C, unless otherwise specified)

| PARAMETER | TEST CONDITION | SYMBOL | MIN. | TYP. | MAX. | UNIT |
|-----------------------|---|--------------------|------|----------|------|-------------------|
| Supply voltage | | V_S | 2.5 | - | 5.5 | V |
| Supply current | $V_S = 5$ V, $E_v = 0$ | I_{SD} | 0.55 | 0.7 | 0.9 | mA |
| | $E_v = 40$ klx, sunlight | I_{SH} | - | 0.8 | - | mA |
| Transmission distance | $E_v = 0$, IR diode TSAL6200, $I_F = 400$ mA, test signal see Fig. 1 | d | - | 35 | - | m |
| Output voltage low | $I_{OSL} = 0.5$ mA, $E_e = 0.7$ mW/m ² , test signal see Fig. 1 | V_{OSL} | - | - | 100 | mV |
| Minimum irradiance | Pulse width tolerance: $t_{pi} - 5/f_0 < t_{po} < t_{pi} + 6/f_0$, test signal see Fig. 1 | $E_e \text{ min.}$ | - | 0.4 | 0.8 | mW/m ² |
| Maximum irradiance | $t_{pi} - 5/f_0 < t_{po} < t_{pi} + 6/f_0$, test signal see Fig. 1 | $E_e \text{ max.}$ | 50 | - | - | W/m ² |
| Directivity | Angle of half transmission distance | $\phi_{1/2}$ | - | ± 75 | - | deg |

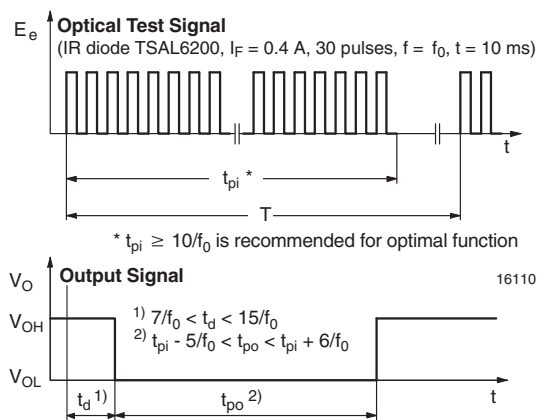
TYPICAL CHARACTERISTICS ($T_{amb} = 25$ °C, unless otherwise specified)

Fig. 1 - Output Active Low

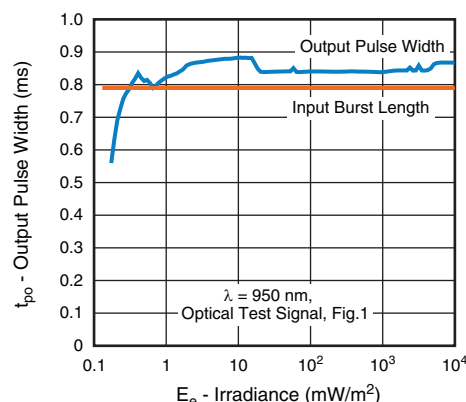


Fig. 2 - Pulse Length and Sensitivity in Dark Ambient

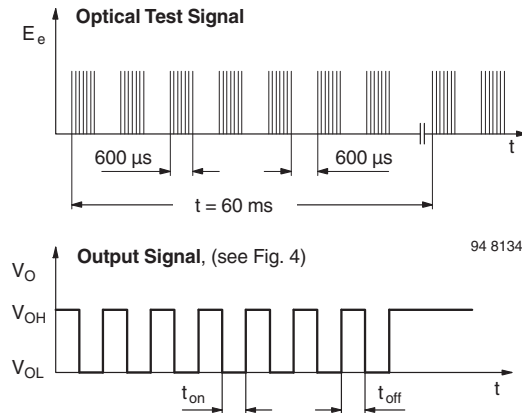


Fig. 3 - Output Function

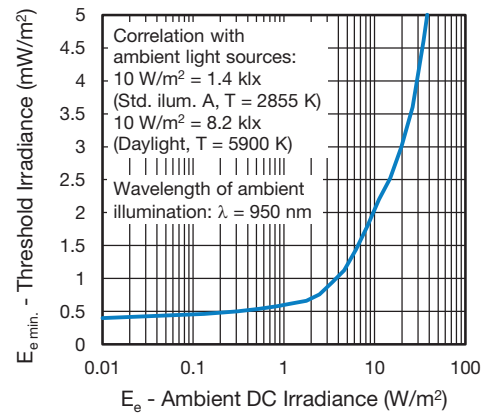


Fig. 6 - Sensitivity in Bright Ambient

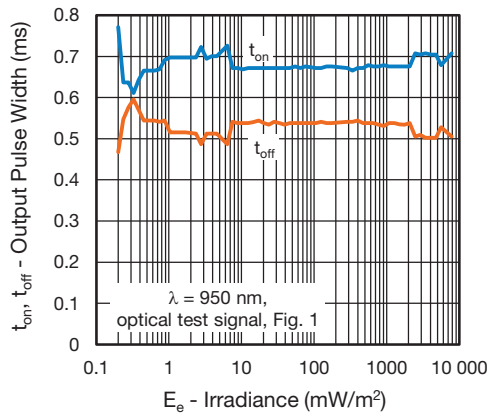


Fig. 4 - Output Pulse Diagram

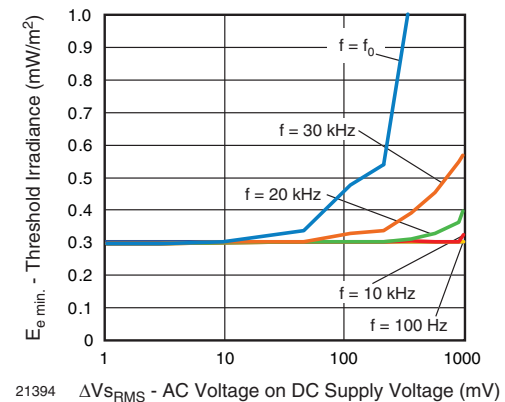


Fig. 7 - Sensitivity vs. Supply Voltage Disturbances

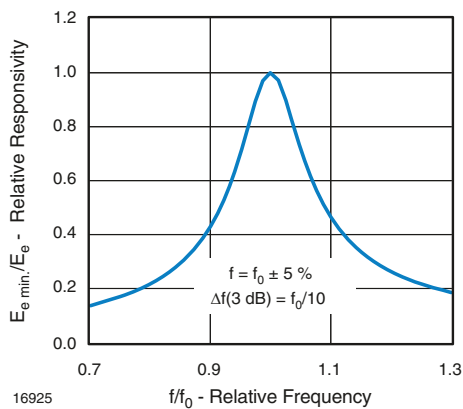


Fig. 5 - Frequency Dependence of Responsivity

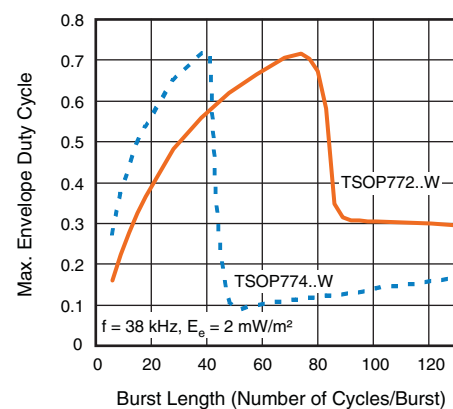


Fig. 8 - Max. Envelope Duty Cycle vs. Burst Length

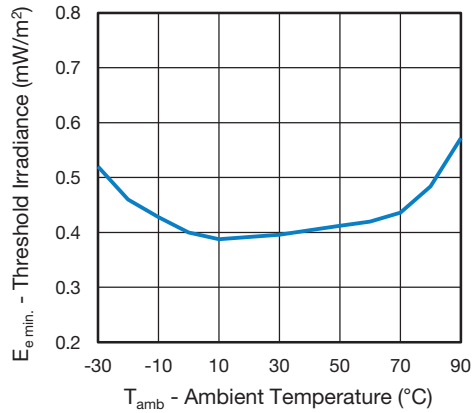


Fig. 9 - Sensitivity vs. Ambient Temperature

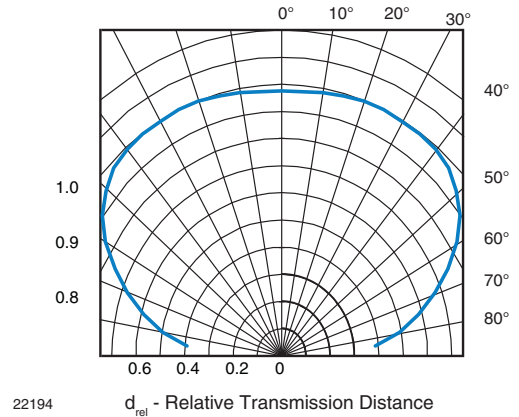


Fig. 12 - Vertical Directivity

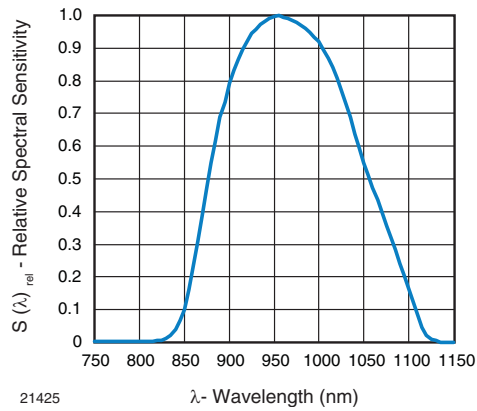


Fig. 10 - Relative Spectral Sensitivity vs. Wavelength

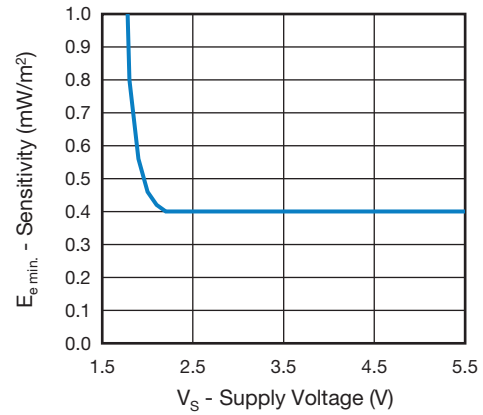


Fig. 13 - Sensitivity vs. Supply Voltage

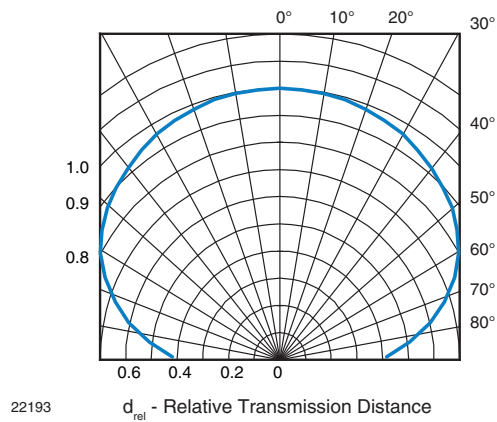


Fig. 11 - Horizontal Directivity

**SUITABLE DATA FORMAT**

This series is designed to suppress spurious output pulses due to noise or disturbance signals. The devices can distinguish data signals from noise due to differences in frequency, burst length, and envelope duty cycle. The data signal should be close to the device's band-pass center frequency (e.g. 38 kHz) and fulfill the conditions in the table below.

When a data signal is applied to the product in the presence of a disturbance, the sensitivity of the receiver is automatically reduced by the AGC to insure that no spurious pulses are present at the receiver's output.

Some examples which are suppressed are:

- DC light (e.g. from tungsten bulbs sunlight)
- Continuous signals at any frequency
- Strongly or weakly modulated patterns from fluorescent lamps with electronic ballasts (see Fig. 14 or Fig. 15)
- 2.4 GHz and 5 GHz Wi-Fi

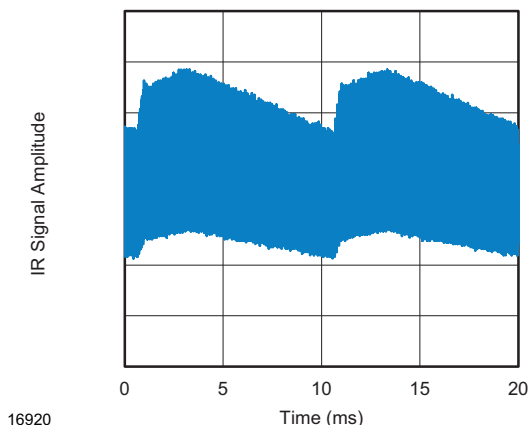


Fig. 14 - IR Disturbance from Fluorescent Lamp With Low Modulation

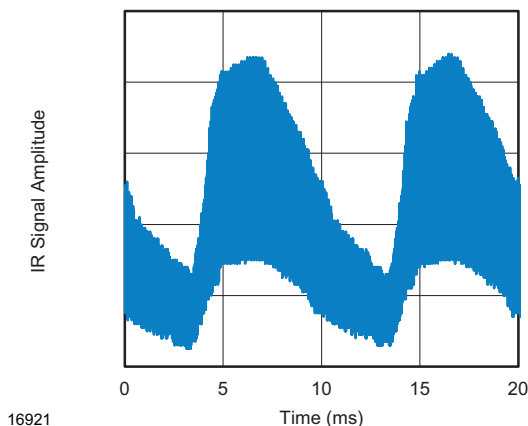
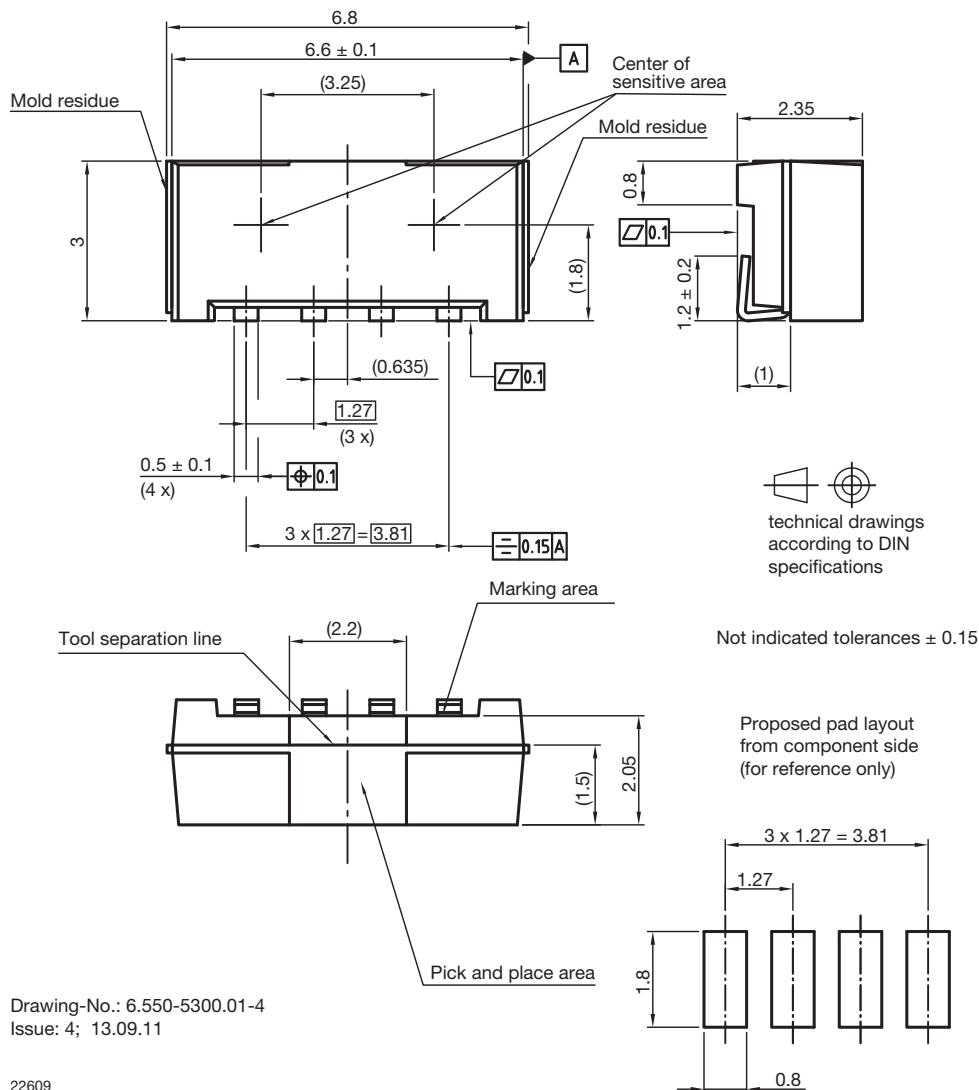


Fig. 15 - IR Disturbance from Fluorescent Lamp With High Modulation

| | TSOP772..W | TSOP774..W |
|---|---|--|
| Minimum burst length | 10 cycles/burst | 10 cycles/burst |
| After each burst of length a minimum gap time is required of | 10 to 70 cycles ≥ 12 cycles | 10 to 35 cycles ≥ 12 cycles |
| For bursts greater than a minimum gap time in the data stream is needed of | 70 cycles > 4 x burst length | 35 cycles > 10 x burst length |
| Maximum number of continuous short bursts/second | 800 | 1300 |
| NEC code | Yes | Preferred |
| RC5 / RC6 code | Yes | Preferred |
| Thomson 56 kHz code | Yes | Preferred |
| Sharp code | Yes | Preferred |
| Suppression of interference from fluorescent lamps | Mild disturbance patterns are suppressed (example: signal pattern of Fig. 14) | Complex and critical disturbance patterns are suppressed (example: signal pattern of Fig. 15 or highly dimmed LCDs) |

Notes

- For data formats with short bursts please see the datasheet of TSOP773..W and TSOP775..W

PACKAGE DIMENSIONS in millimeters

ASSEMBLY INSTRUCTIONS
Reflow Soldering

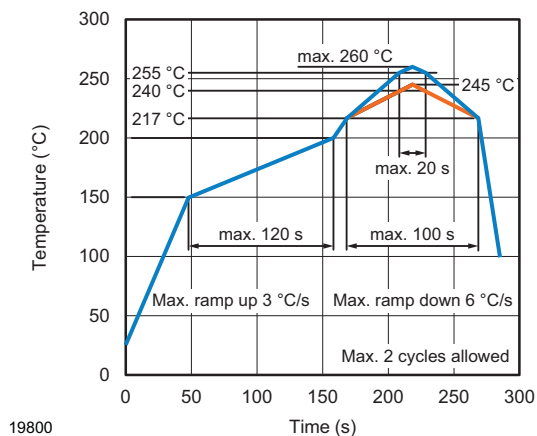
- Reflow soldering must be done within 72 h while stored under a max. temperature of 30 °C, 60 % RH after opening the dry pack envelope
- Set the furnace temperatures for pre-heating and heating in accordance with the reflow temperature profile as shown in the diagram. Exercise extreme care to keep the 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

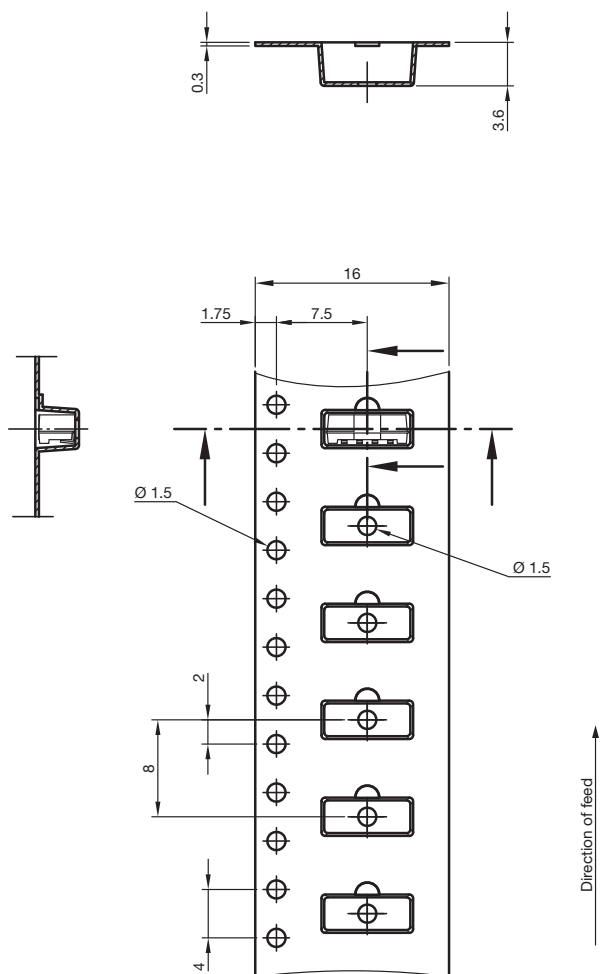
- Use a soldering iron of 25 W or less. Adjust the temperature of the soldering iron below 300 °C
- Finish soldering within 3 s
- Handle products only after the temperature has cooled off



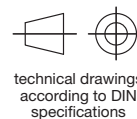
VISHAY LEAD (Pb)-FREE REFLOW SOLDER PROFILE



TAPING VERSION TSOP..TR DIMENSIONS in millimeters

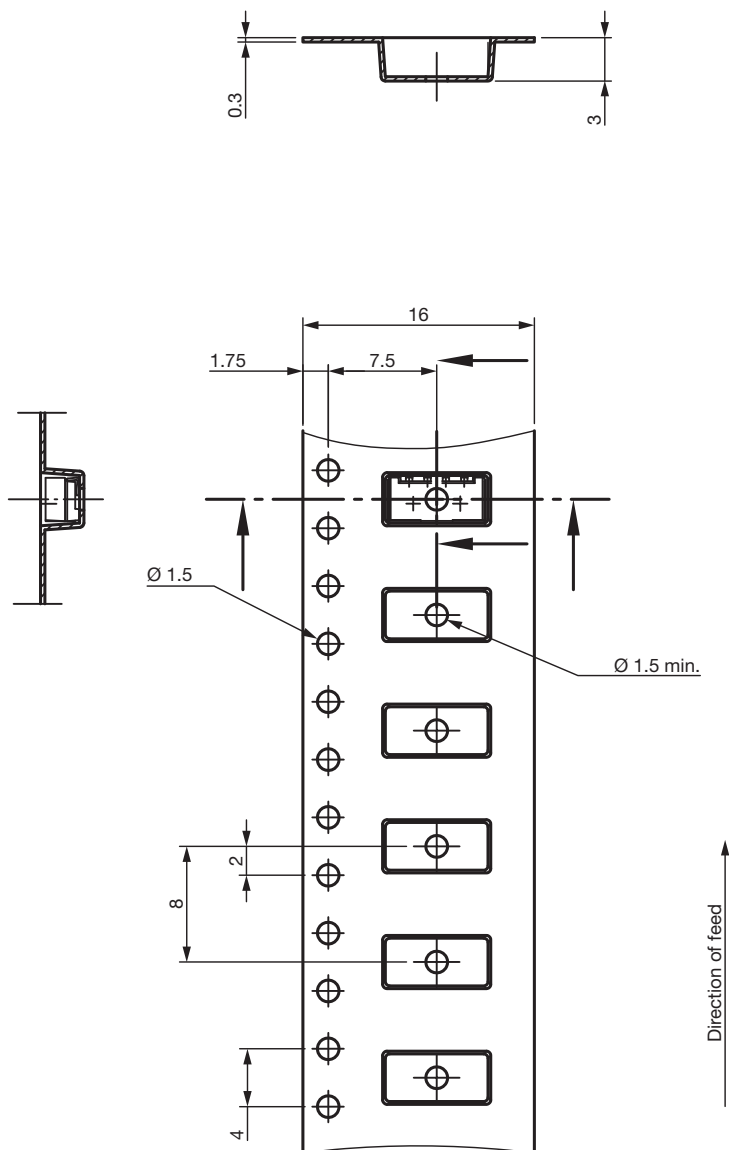


Drawing-No.: 9.700-5342.01-4
Issue: 2; 12.06.13

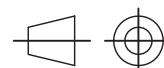




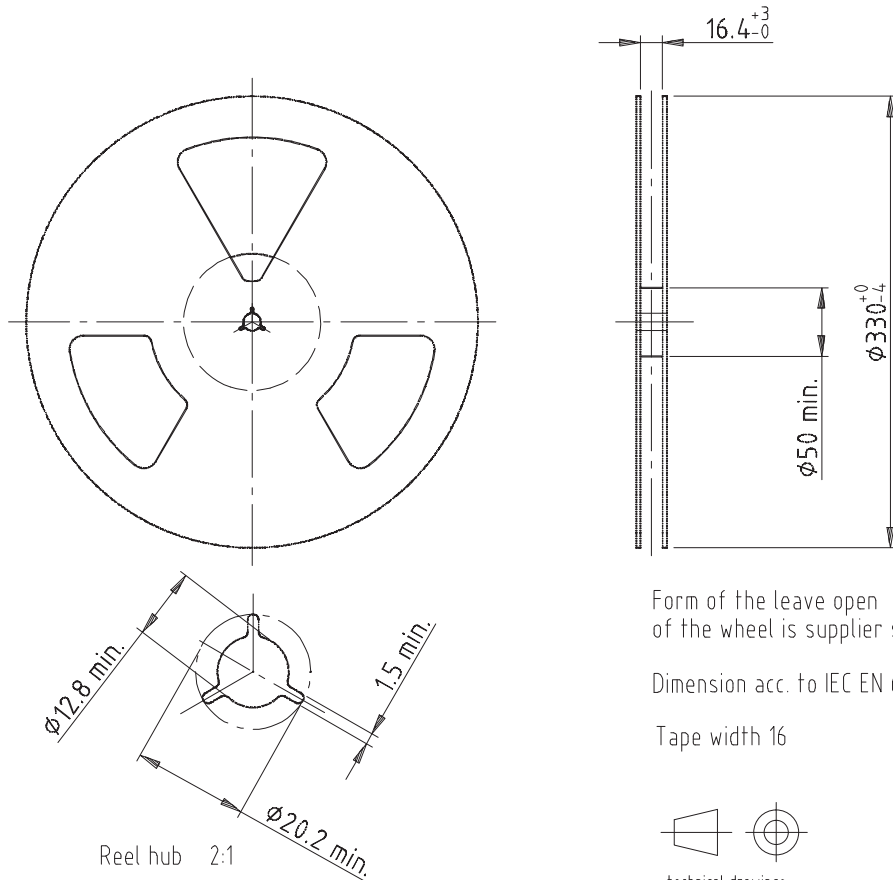
TAPING VERSION TSOP..TT DIMENSIONS in millimeters



Drawing-No.: 9.700-5341.01-4
Issue: 3; 06.10.15



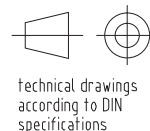
technical drawings
according to DIN
specifications

REEL DIMENSIONS in millimeters


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

Dimension acc. to IEC EN 60 286-3

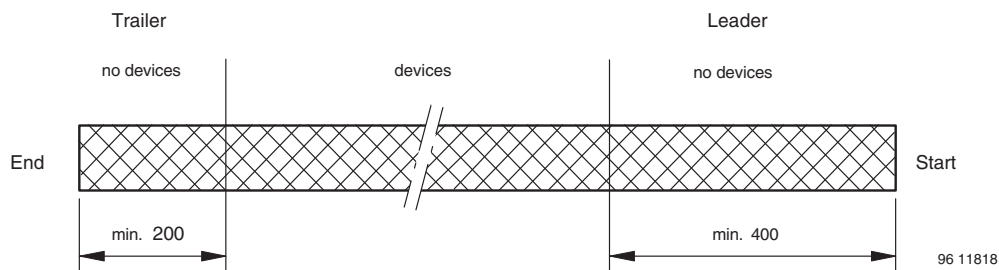
Tape width 16



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 \pm 10 mm/min.

165° to 180° peel angle

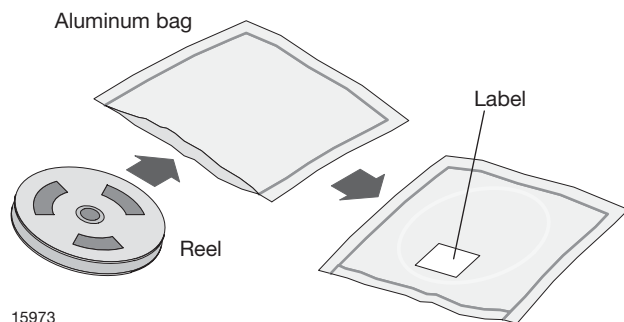
LABEL
Standard bar code labels for finished goods

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 bottom | Type | Length |
| 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.

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.

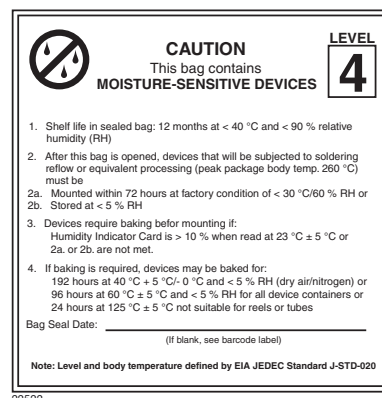
In case of moisture absorption, the devices will recover to the former condition by drying under the following condition:

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



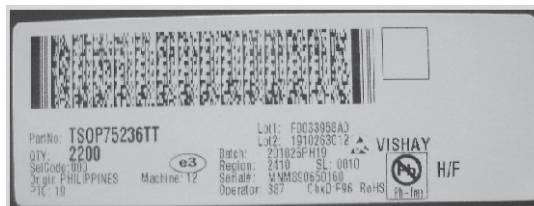
ESD PRECAUTION

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

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.

BAR CODE PRODUCT LABEL (example)



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
- 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

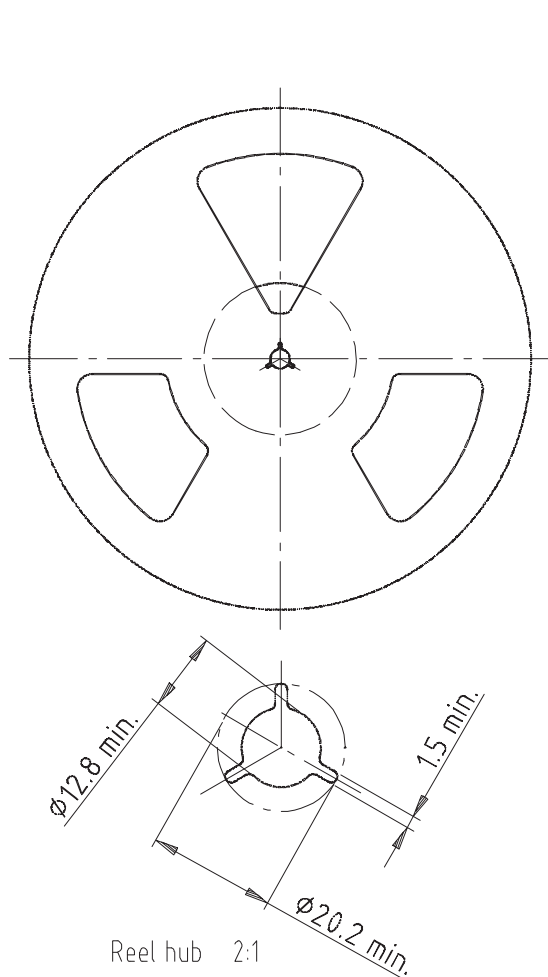
The type designation of the device is extended by TT or TT1 for top view or TR for side view.

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



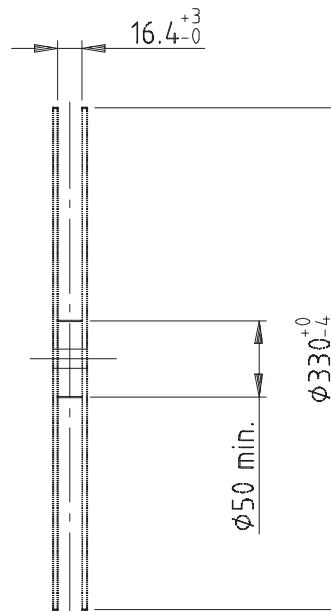
Drawing-No.: 9.800-5052.V2-4

Issue: 1; 07.05.02

16734

Note

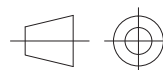
- The body structure of the reel can vary



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

Dimension acc. to IEC EN 60 286-3

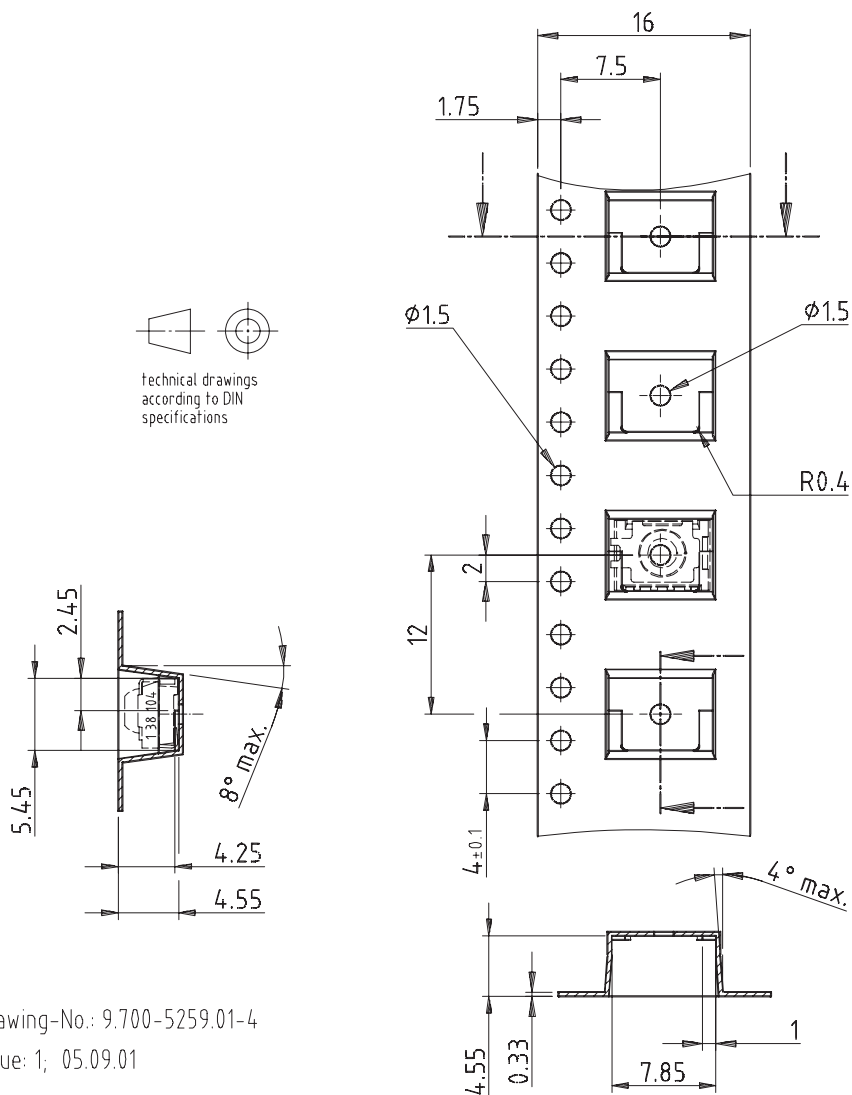
Tape width 16



technical drawings
according to DIN
specifications

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

A. Panhead (TSOP36...TT, TSSP...TT, TSOP6...TT, TSOP16...TT, TSOP96...TT)



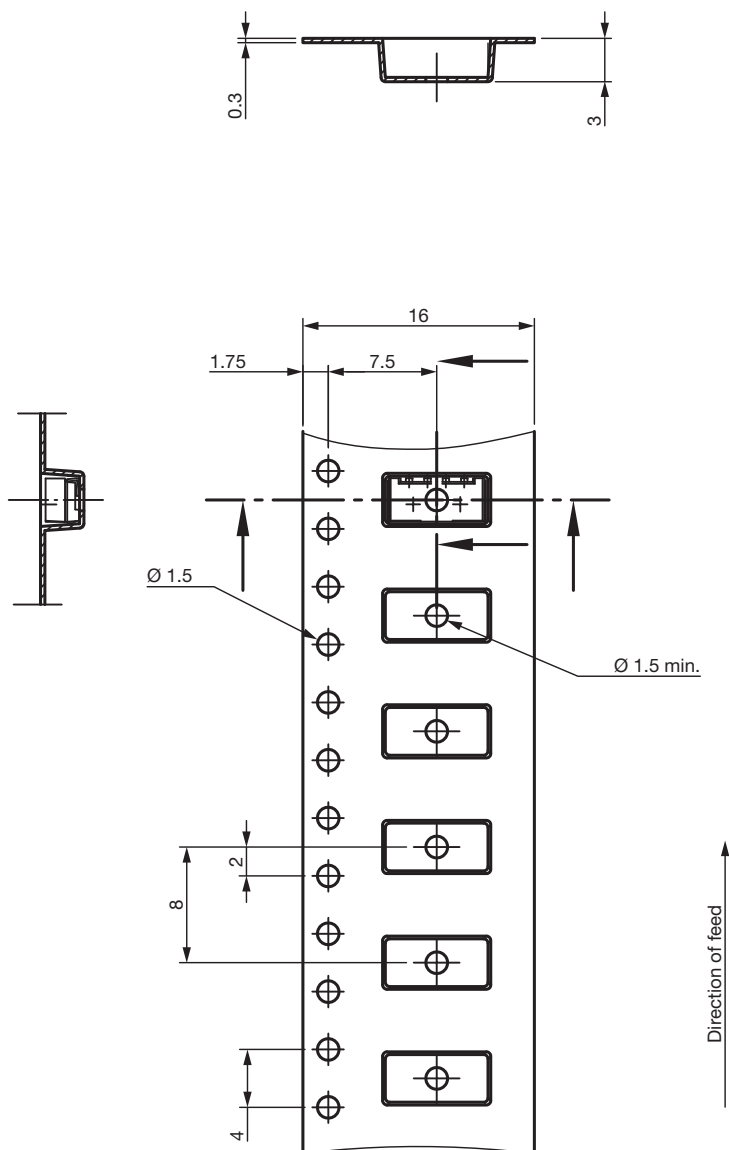
Drawing-No.: 9.700-5259.01-4

Issue: 1; 05.09.01

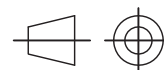
16584

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

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

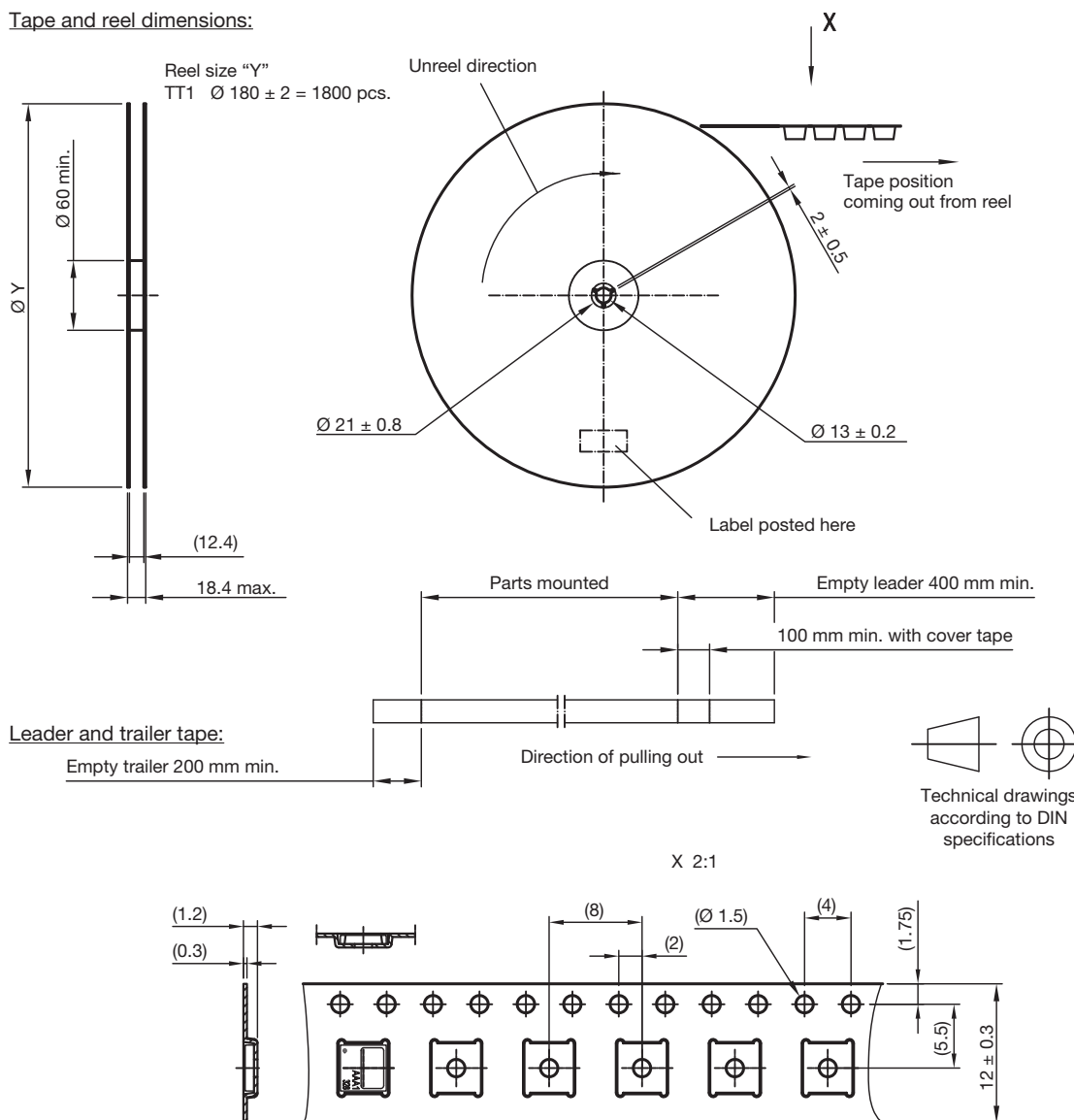


technical drawings
according to DIN
specifications

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

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

Tape and reel dimensions:



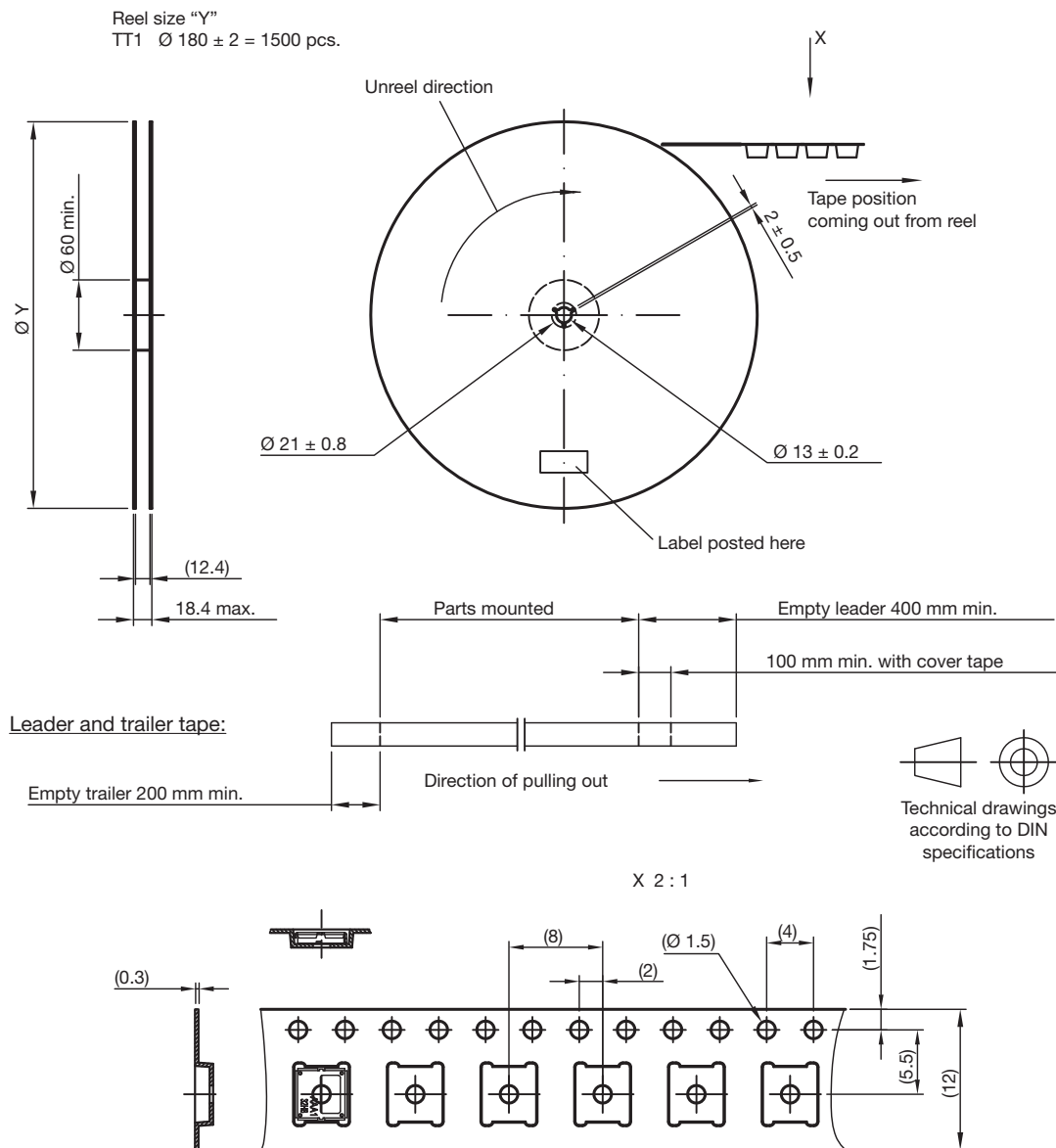
Drawing-No.: 9.700-5347.01-4
Issue: 2; 07.03.18

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:

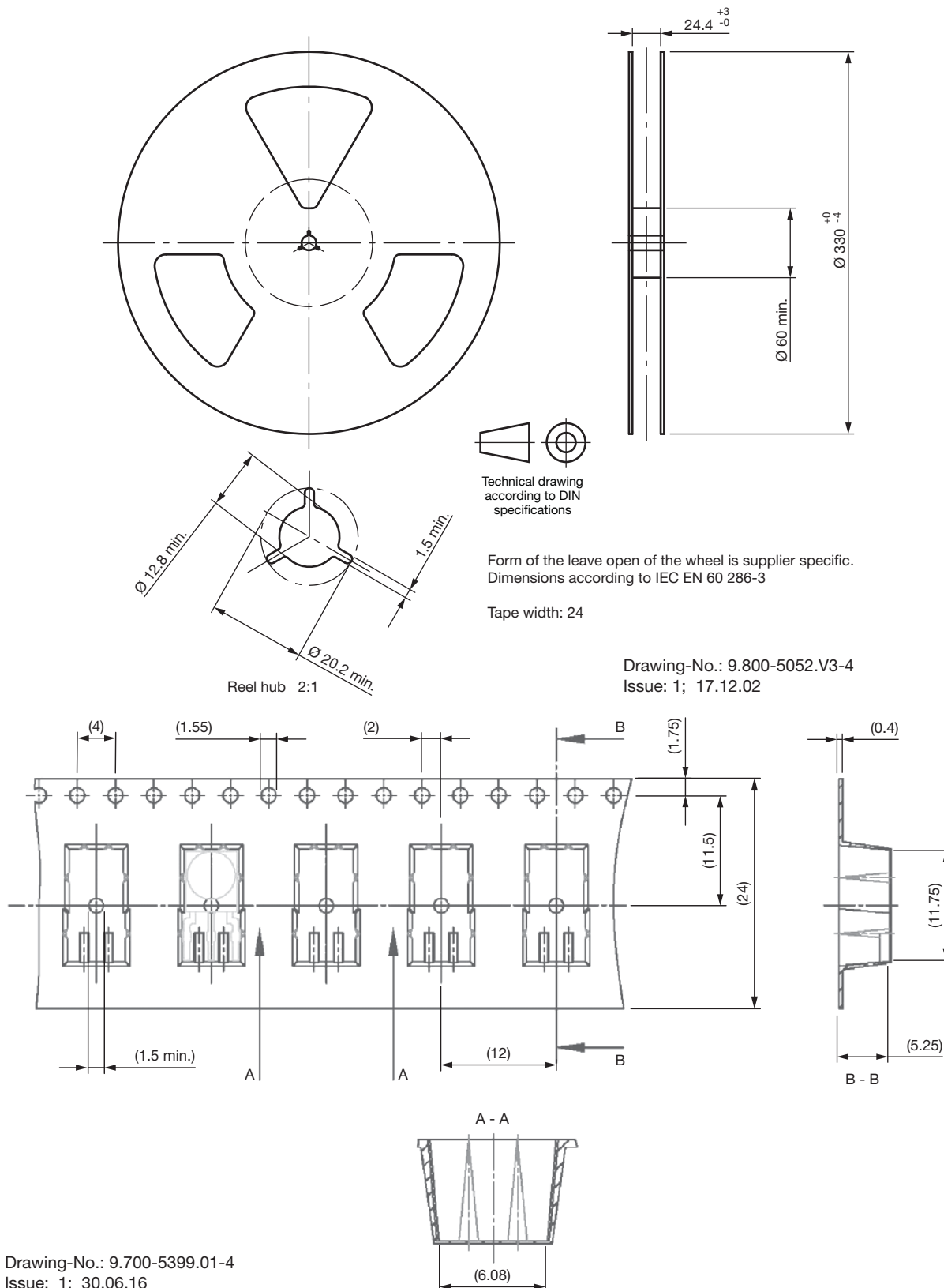


Drawing-No.: 9.700-5380.01-4
Issue: 3; 07.03.18

Not indicated tolerances ± 0.1

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

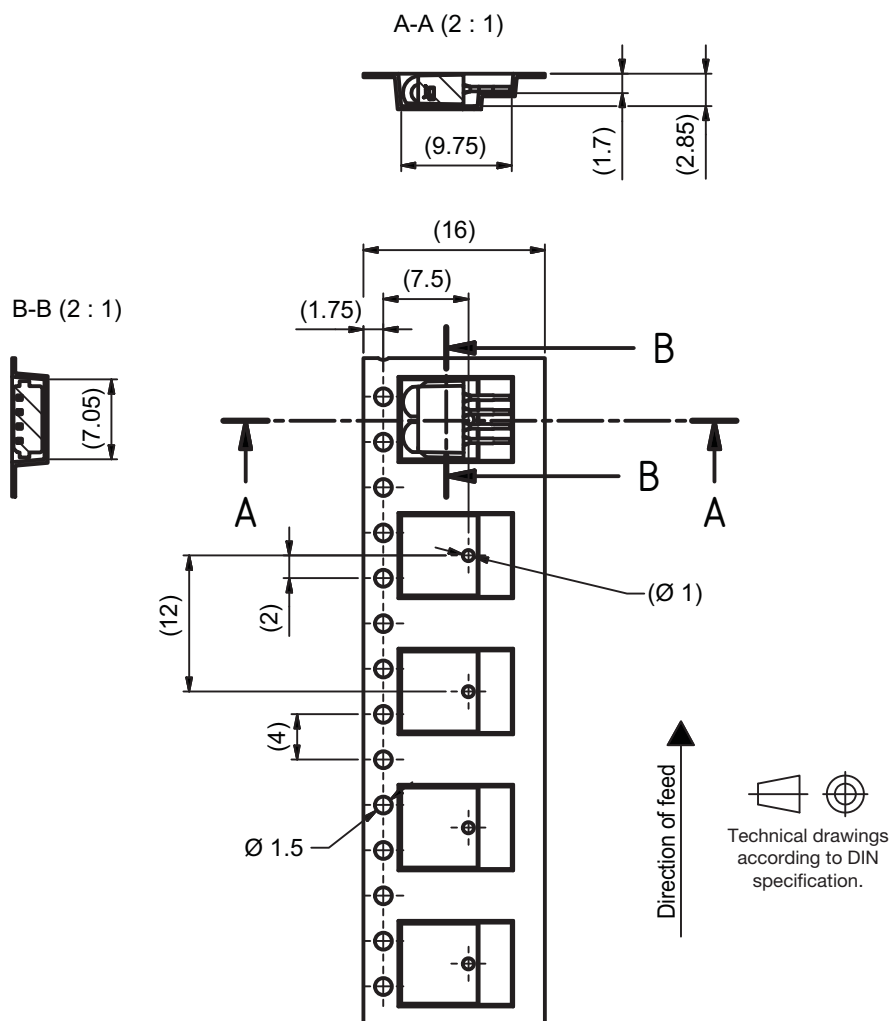
F. Minimold DF1P (TSOP33...DF1P, TSOP53...DF1P, TSOP13...DF1P, TSOP93...DF1P)



Drawing-No.: 9.700-5399.01-4
Issue: 1; 30.06.16

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

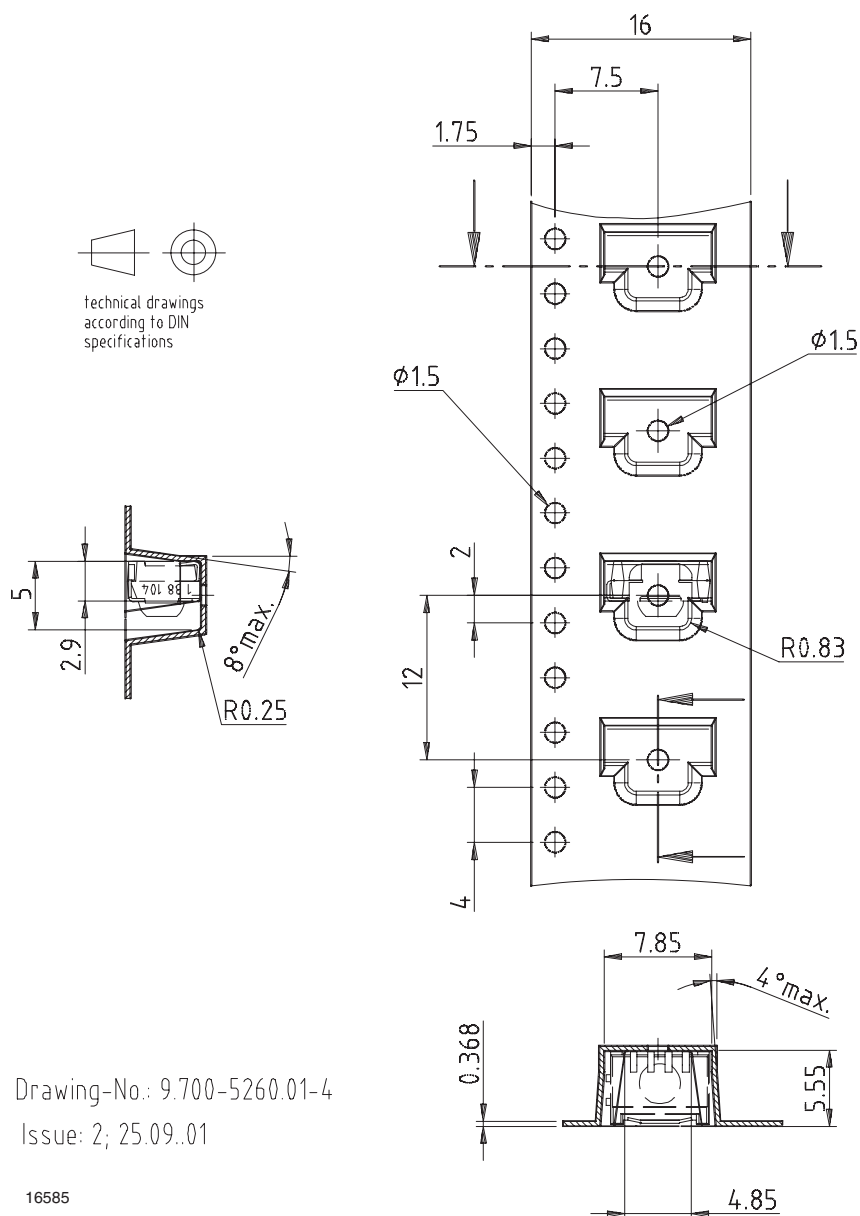
G. TVCastSMD TR1 (TSOP59...TR1, TSOP39...TR1, TSOP19...TR1, TSOP99...TR1)



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)



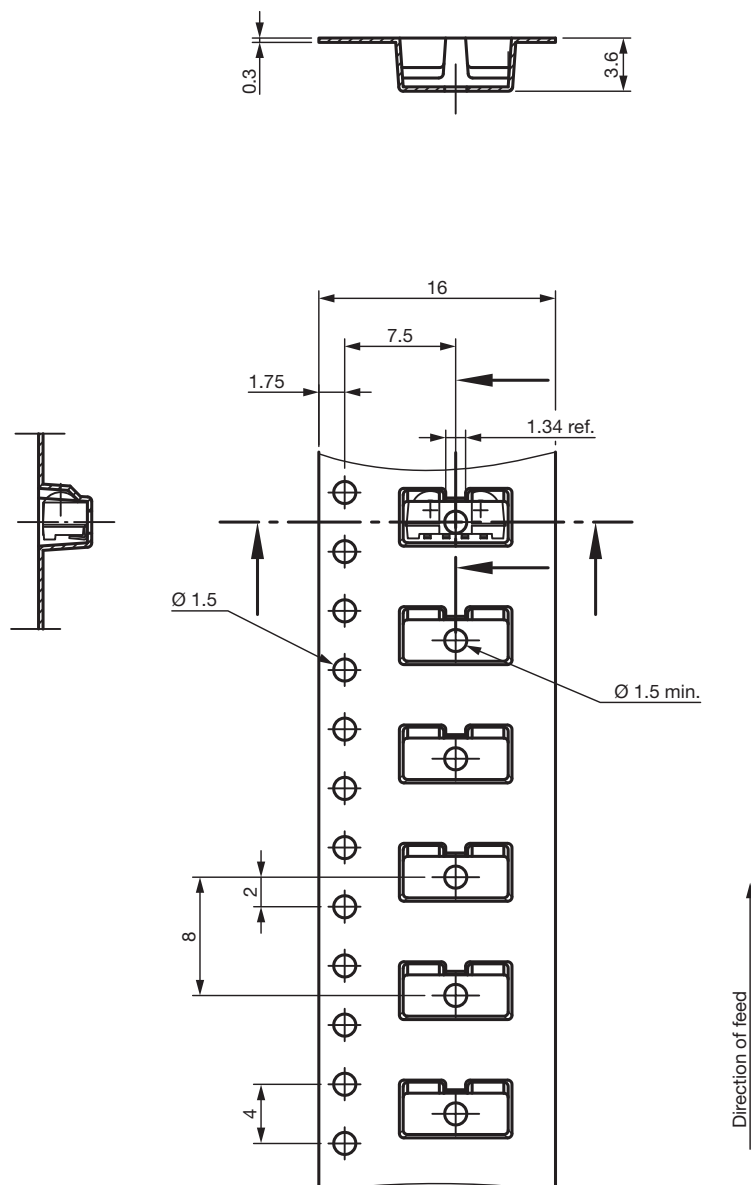
Drawing-No.: 9.700-5260.01-4

Issue: 2; 25.09..01

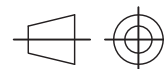
16585

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

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



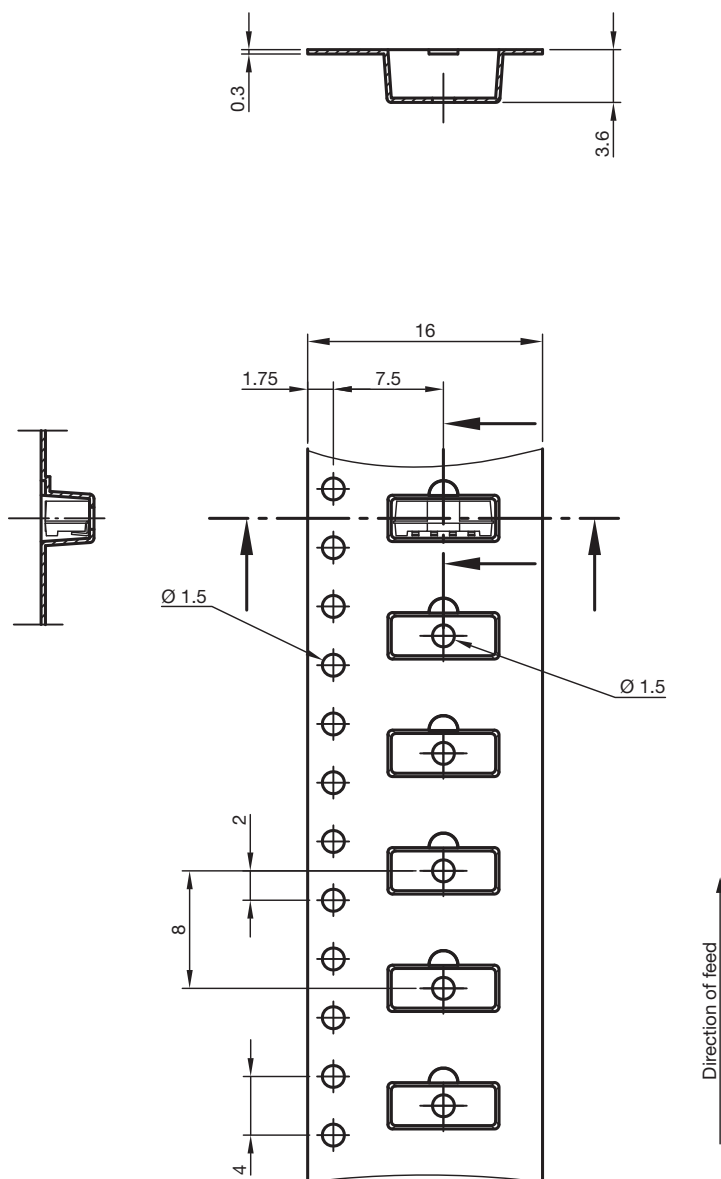
Drawing-No.: 9.700-5337.01-4
Issue: 2; 06.10.15



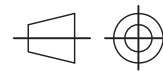
technical drawings
according to DIN
specifications

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

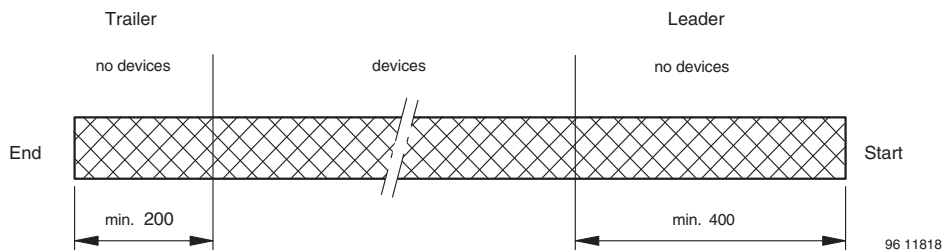
C. Heimdall without lens (TSOP75...WTR, TSOP77...WTR, TSSP...WTR, TSOP15...WTR, TSOP95...WTR)



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

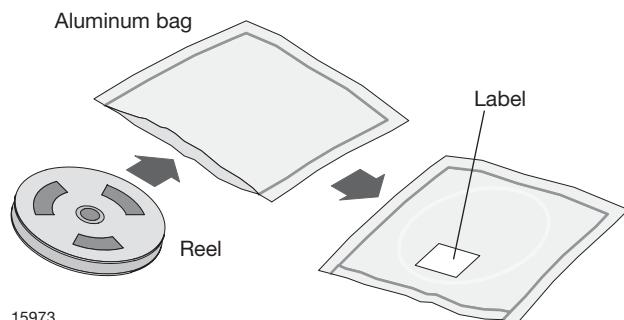
Standard bar code labels for finished goods

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.

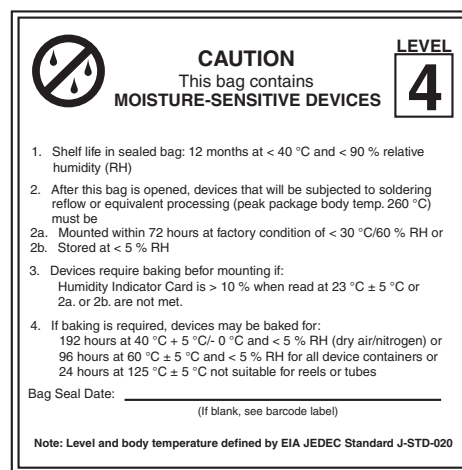
In case of moisture absorption, the devices will recover to the former condition by drying under the following condition:

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

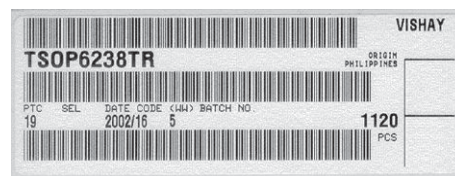
EIA JEDEC standard JSTD-020 level 4 label is included on all dry bags

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

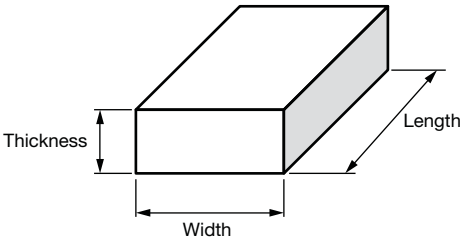
The Vishay Semiconductors standard bar code labels are printed at final packing areas. The labels are on each packing unit and contain Vishay Semiconductors specific data.



16962

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 |



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Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



Как с нами связаться

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