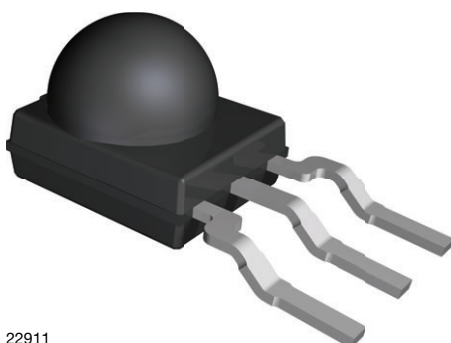
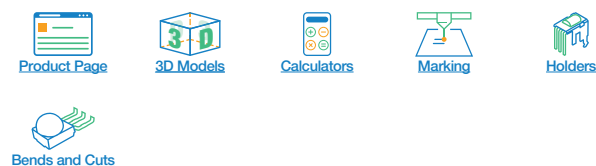


IR Receiver Modules for Remote Control Systems



22911

LINKS TO ADDITIONAL RESOURCES



DESCRIPTION

The TSOP93...DF1P series devices are the latest generation miniaturized IR receiver modules for infrared remote control systems. These series provide improvements in sensitivity to remote control signals in dark ambient as well as in sensitivity in the presence of optical disturbances e.g. from CFLs.

The devices contain a PIN diode and a preamplifier assembled on a lead frame. The epoxy package contains an IR filter. The demodulated output signal can be directly connected to a microprocessor for decoding.

The TSOP931..DF1P, TSOP933..DF1P, and TSOP935..DF1P, series devices are designed to receive short burst codes (6 or more carrier cycles per burst). The third digit designates the AGC level (AGC1, AGC3, or AGC5) and the last two digits designate the band-pass frequency (see table below). The higher the AGC, the better noise is suppressed, but the lower the code compatibility. AGC3 provides enhanced noise suppression and AGC5 provides maximized noise suppression. Generally, we advise to select the highest AGC that satisfactorily receives the desired remote code.

These components have not been qualified to automotive specifications.

FEATURES

- Improved dark sensitivity
- Improved immunity against optical noise
- Very low supply current
- Photo detector and preamplifier in one package
- Internal filter for PCM frequency
- Supply voltage: 2.0 V to 3.6 V
- Insensitive to supply voltage ripple and noise
- Material categorization:
for definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT
HALOGEN
FREE
GREEN
(5-2008)

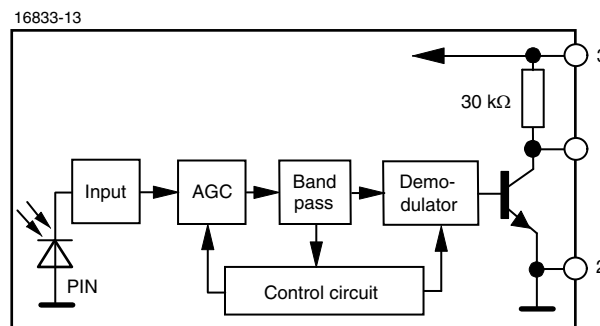
MECHANICAL DATA

1 = OUT, 2 = GND, 3 = V_S

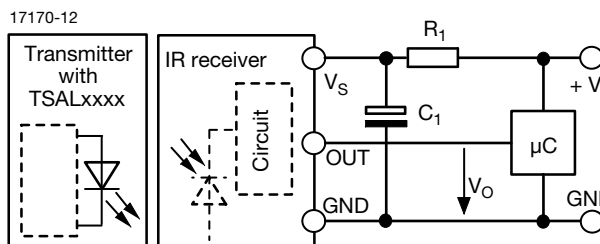
ORDERING CODE

TSOP93...DF1P - 1100 pieces in tape and reel

BLOCK DIAGRAM



APPLICATION CIRCUIT



R_1 and C_1 recommended to reduce supply ripple for $V_S < 2.2$ V



| PARTS TABLE | | | | |
|-------------------|--------|--|-----------------------------------|------------------------------------|
| AGC | | LEGACY, FOR SHORT BURSTS (AGC1) | ENHANCED NOISE SUPPRESSION (AGC3) | MAXIMIZED NOISE SUPPRESSION (AGC5) |
| Carrier frequency | 30 kHz | TSOP93130DF1P | TSOP93330DF1P | TSOP93530DF1P |
| | 33 kHz | TSOP93133DF1P | TSOP93333DF1P | TSOP93533DF1P |
| | 36 kHz | TSOP93136DF1P | TSOP93336DF1P ⁽¹⁾⁽⁵⁾ | TSOP93536DF1P |
| | 38 kHz | TSOP93138DF1P | TSOP93338DF1P ⁽²⁾⁽⁴⁾ | TSOP93538DF1P |
| | 40 kHz | TSOP93140DF1P | TSOP93340DF1P | TSOP93540DF1P |
| | 56 kHz | TSOP93156DF1P | TSOP93356DF1P | TSOP93556DF1P ⁽³⁾ |
| Package | | Minimold | | |
| Pinning | | 1 = OUT, 2 = GND, 3 = V _S | | |
| Dimensions (mm) | | 5.4 W x 6.35 H x 4.9 D | | |
| Mounting | | SMD | | |
| Application | | Remote control | | |
| Best choice for | | ⁽¹⁾ RCMM ⁽²⁾ RECS-80 Code ⁽³⁾ r-map ⁽⁴⁾ XMP-1, XMP-2 ⁽⁵⁾ MCIR | | |
| Special options | | <ul style="list-style-type: none"> Narrow optical filter: www.vishay.com/doc?81590 Wide optical filter: www.vishay.com/doc?82726 | | |

Note

- 30 kHz and 33 kHz only available on written request

| ABSOLUTE MAXIMUM RATINGS | | | | |
|-----------------------------|--------------------------|------------------|--------------------------------|------|
| PARAMETER | TEST CONDITION | SYMBOL | VALUE | UNIT |
| Supply voltage | | V _S | -0.3 to +3.6 | V |
| Supply current | | I _S | 3 | 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} ≤ 85 °C | P _{tot} | 10 | mW |
| Soldering temperature | t ≤ 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 current | E _v = 0, V _S = 3.3 V | I _{SD} | 0.25 | 0.37 | 0.45 | mA |
| | E _v = 40 klx, sunlight | I _{SH} | - | 0.50 | - | mA |
| Supply voltage | | V _S | 2.0 | - | 3.6 | V |
| Transmission distance | E _v = 0, test signal see Fig. 1, IR diode TSAL6200, I _F = 50 mA | d | - | 28 | - | 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 | Test signal: XMP code | E _{e min.} | - | 0.12 | 0.25 | mW/m ² |
| | Test signal: NEC code | | - | 0.09 | 0.20 | |
| Maximum irradiance | t _{pi} - 3.0/f ₀ < t _{po} < t _{pi} + 3.5/f ₀ , test signal see Fig. 1 | E _{e max.} | 30 | - | - | W/m ² |
| Directivity | Angle of half transmission distance | Φ _{1/2} | - | ± 45 | - | ° |



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

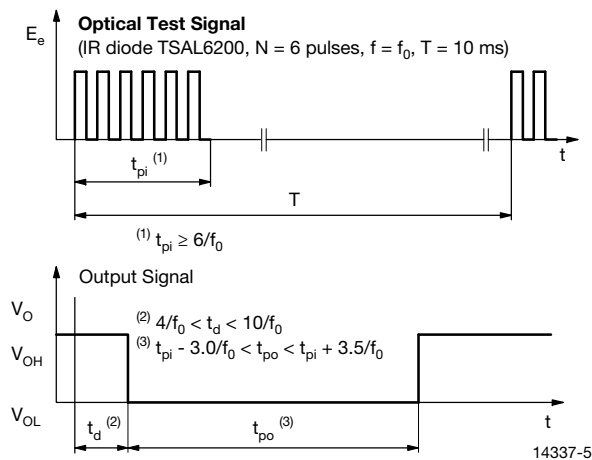


Fig. 1 - Output Delay and Pulse-Width

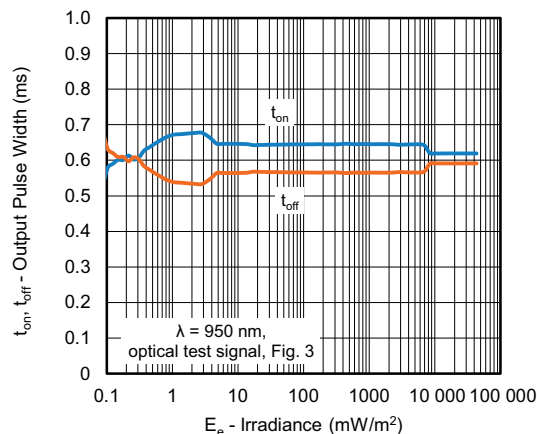


Fig. 4 - Pulse-Width vs. Irradiance in Dark Ambient

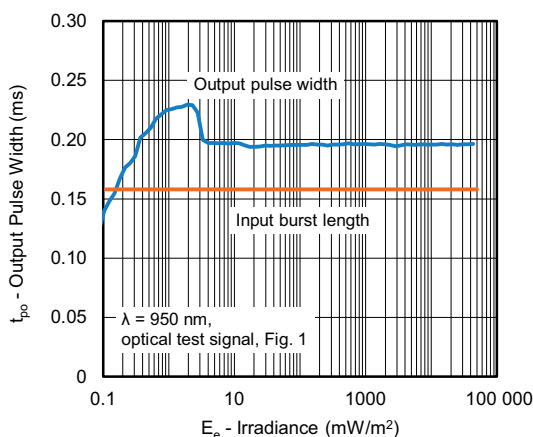


Fig. 2 - Pulse-Width vs. Irradiance in Dark Ambient

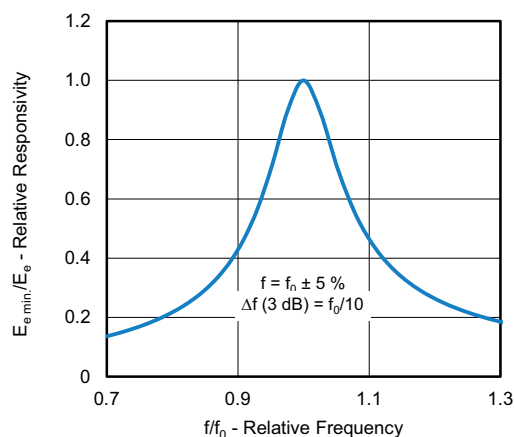


Fig. 5 - Frequency Dependence of Responsivity

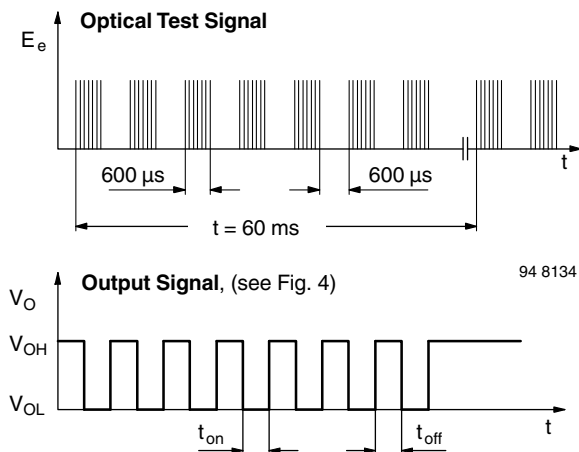


Fig. 3 - Test Signal

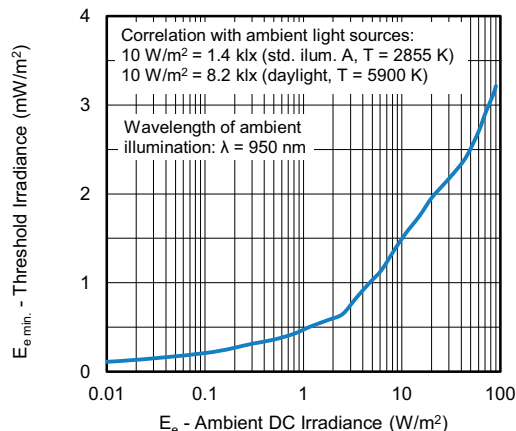


Fig. 6 - Sensitivity in Bright Ambient

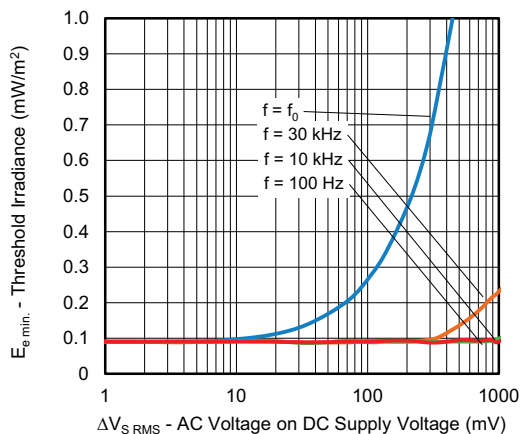


Fig. 7 - Sensitivity vs. Supply Voltage Disturbances

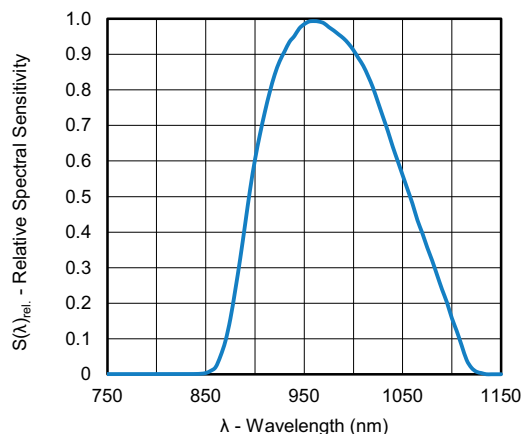


Fig. 10 - Relative Spectral Sensitivity vs. Wavelength

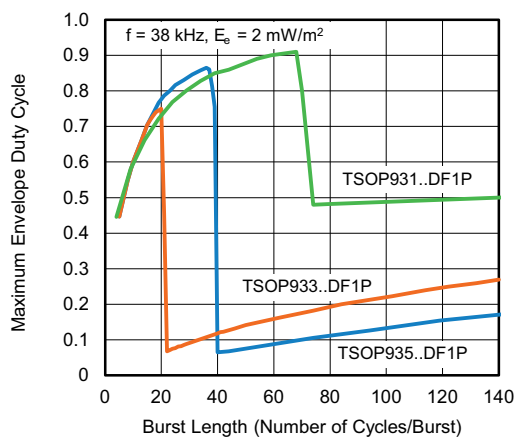


Fig. 8 - Max. Envelope Duty Cycle vs. Burst Length

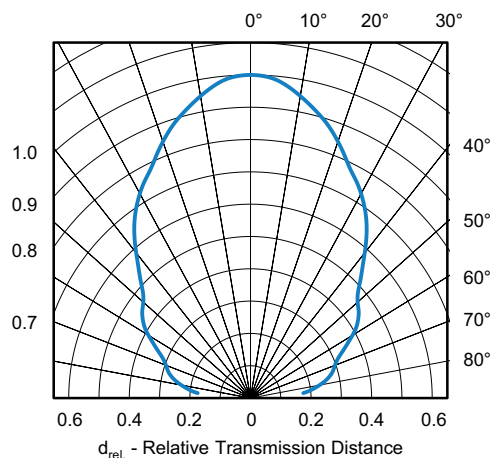


Fig. 11 - Directivity

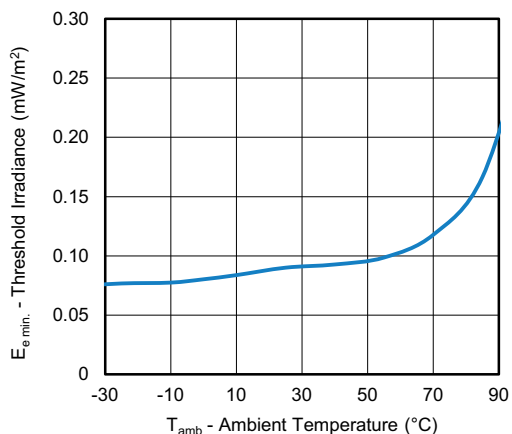


Fig. 9 - Sensitivity vs. Ambient Temperature

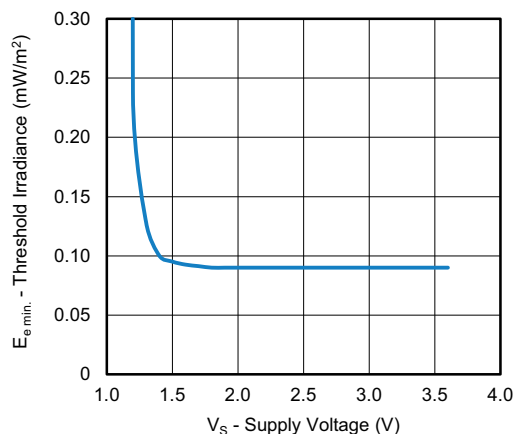


Fig. 12 - Sensitivity vs. Supply Voltage

**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. 13 or Fig. 14)



Fig. 13 - IR Emission from Fluorescent Lamp With Low Modulation



Fig. 14 - IR Emission from Fluorescent Lamp With High Modulation

| | TSOP931..DF1P | TSOP933..DF1P | TSOP935..DF1P |
|---|---------------------------------|---------------------------------|------------------------------|
| Minimum burst length | 6 cycles/burst | 6 cycles/burst | 6 cycles/burst |
| After each burst of length A gap time is required of | 6 to 70 cycles ≥ 6 cycles | 6 to 20 cycles ≥ 8 cycles | 6 to 38 cycles ≥ 8 cycles |
| For bursts greater than a minimum gap time in the data stream is needed of | 70 cycles > 1 x burst length | 20 cycles > 6 x burst length | 38 cycles > 20 ms |
| Maximum number of continuous short bursts/second | 3000 | 2500 | 2500 |
| RCMM code | Yes | Preferred | Yes |
| XMP-1 code | Yes | Preferred | Yes |
| r-map code | Yes | Yes | Preferred |
| RECS-80 code | Yes | Preferred | Yes |
| MCIR | Yes | Preferred | Yes |
| Suppression of interference from fluorescent lamps | Fig. 13 | Fig. 13 and Fig. 14 | Fig. 13 and Fig. 14 |

Note

- For data formats with long bursts (more than 10 carrier cycles) please see the datasheet for TSOP932..DF1P, TSOP934..DF1P, or TSOP936..DF1P

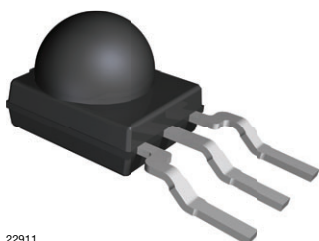


TSOP931..DF1P, TSOP933..DF1P, TSOP935..DF1P

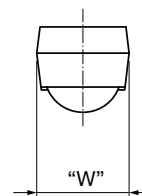
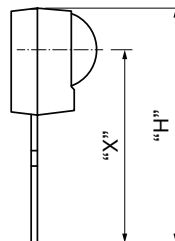
www.vishay.com

Vishay Semiconductors

BENT LEADS: H = 11.4 mm, W = 5.4 mm, X = 8.85 mm



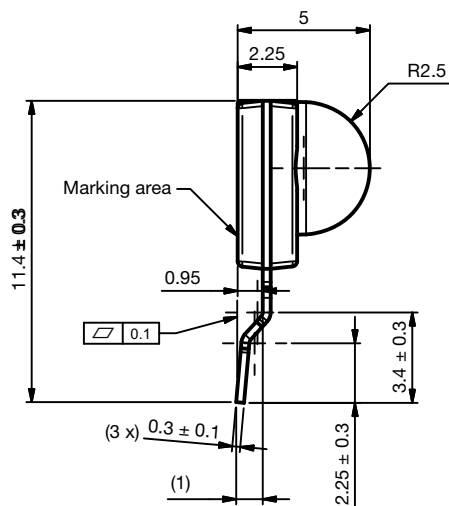
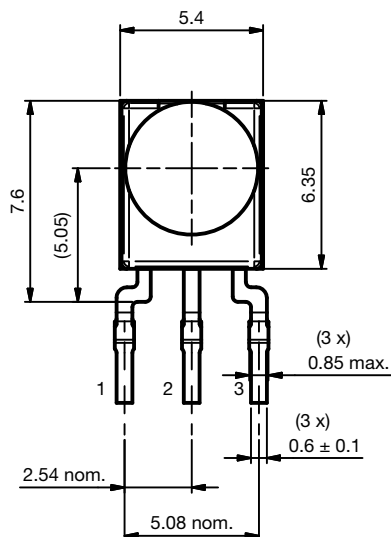
22911



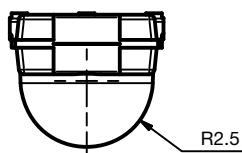
20258

| NAME | LENS AXIS (X) | VIEW | TYPE | HEIGHT (H) | WIDTH (W) | DEPTH (D) |
|------|---------------|------|------|------------|-----------|-----------|
| DF1P | 8.85 | - | Bend | 11.4 | 5.4 | - |

MECHANICAL DIMENSIONS in millimeters

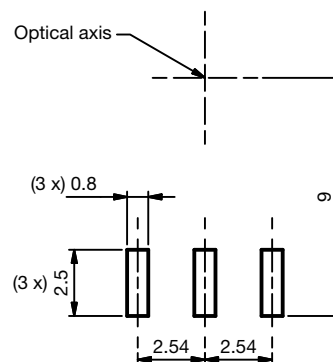


Not indicated tolerances ± 0.2



Technical drawings according to DIN specification

Proposed pad layout from component side (for reference only)



Drawing-No.: 6.550-5343.01-4
Issue: 2; 02.07.19



ASSEMBLY INSTRUCTIONS

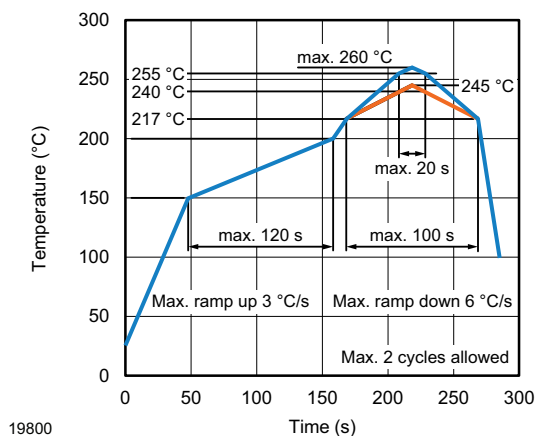
Reflow Soldering

- 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

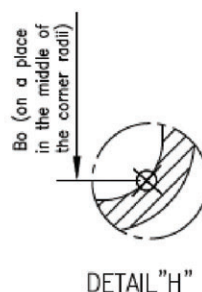
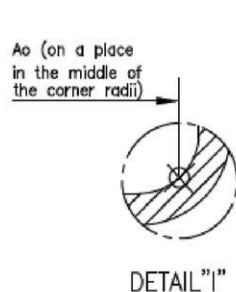
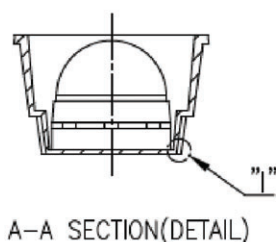
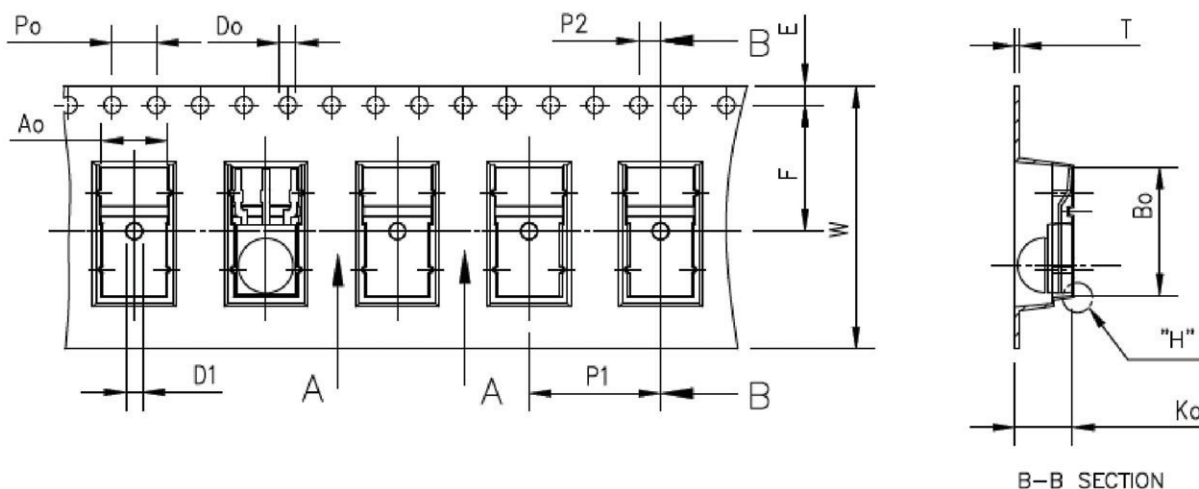
- Use a soldering iron of 25 W or less. Adjust the temperature of the soldering iron below 300 °C
- Finish soldering within 3 s
- Handle products only after the temperature has cooled off

VISHAY LEAD (Pb)-FREE REFLOW SOLDER PROFILE





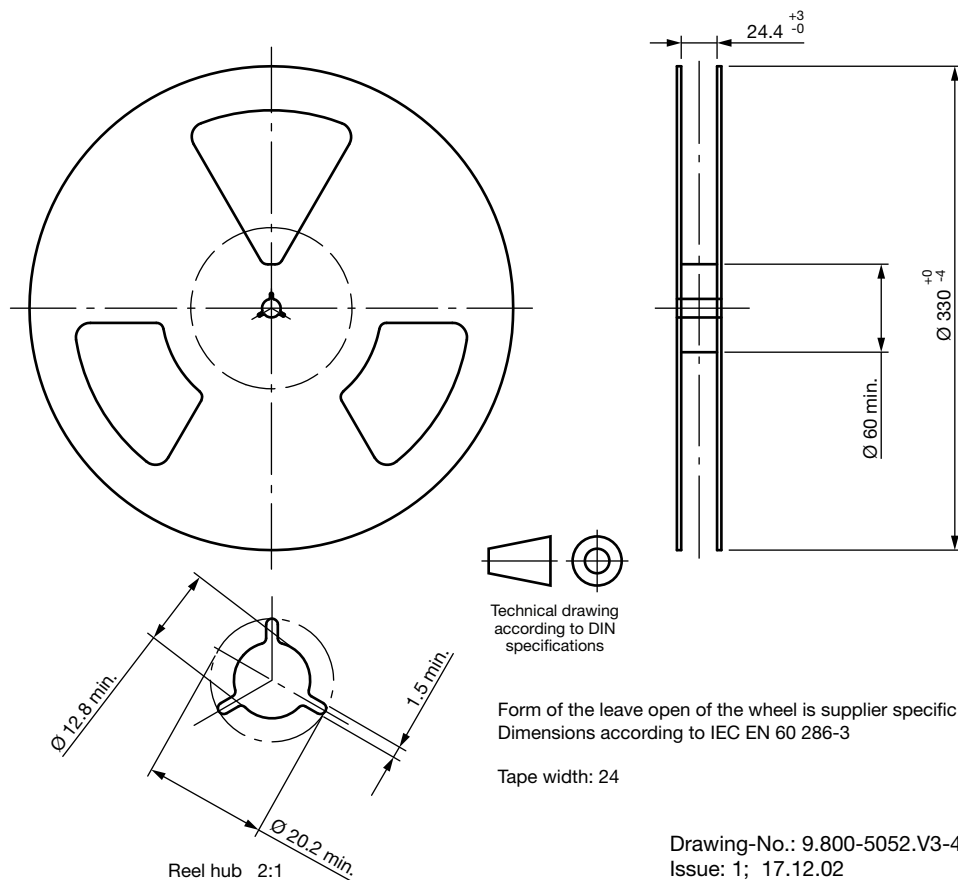
PACKAGING DIMENSIONS in millimeters



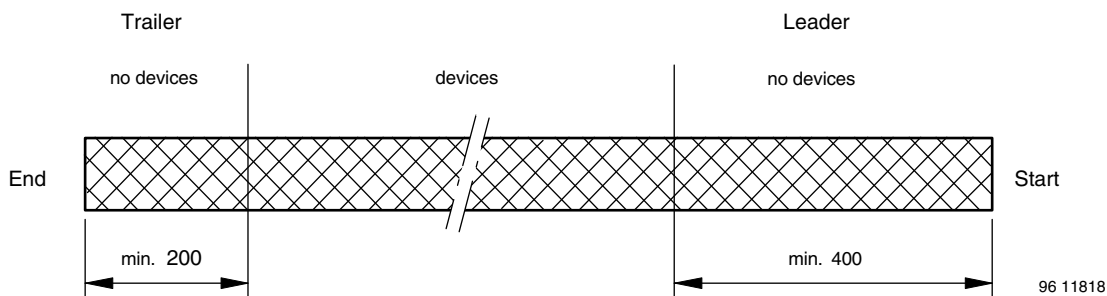
Drawing-No.: 9.700-5399.01-4
Issue: 2; 29.06.18

| Item | A_0 | B_0 | K_0 | P_0 | P_1 | P_2 | T |
|------------|-----------------|------------------|-----------------|----------------|----------------------|-----------------|-----------------|
| Dimensions | 6.08 ± 0.10 | 11.75 ± 0.10 | 5.25 ± 0.10 | 4.0 ± 0.10 | 12.0 ± 0.10 | 2.0 ± 0.10 | 0.40 ± 0.05 |
| Item | E | F | D_0 | D_1 | W | $10P_0$ | |
| Dimensions | 1.75 ± 0.10 | 11.50 ± 0.10 | 1.55 ± 0.05 | 1.5 min. | $24.0 +0.30 / -0.10$ | 40.0 ± 0.20 | |

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

**ORDERING INFORMATION****Note**

- d = "digit", please consult the list of available series on the previous page to create a valid part number

Example: TSOP93538DF1P**PACKAGING QUANTITY**

- 1100 pieces per reel
- 1 reel per box

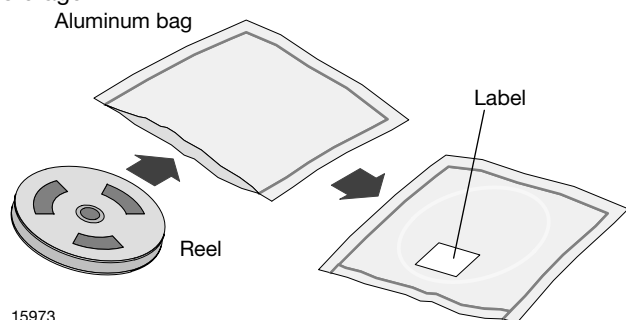
LABEL**Standard bar code labels for finished goods**

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. 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.

ESD PRECAUTION

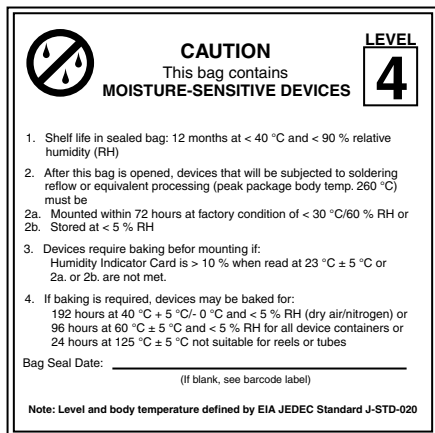
Proper storage and handling procedures should be followed to prevent ESD damage to the devices especially when they are removed from the antistatic shielding bag. Electrostatic sensitive devices warning labels are on the packaging.

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.



22645



22522

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



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