



# TSOP131..P16TR, TSOP133..P16TR, TSOP135..P16TR

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Vishay Semiconductors

## IR Receiver Modules for Remote Control Systems



23203

### DESCRIPTION

This IR receiver series is optimized for short burst remote control systems in different environments. The customer can choose between different IC settings (AGC variants), to find the optimum solution for his application. The higher the AGC, the better noise is suppressed, but the lower the code compatibility.

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. These components have not been qualified to automotive specifications.

### FEATURES

- Individual IC settings to reach maximum performance
- Immunity against noise (lamps, LCD TV, Wi-Fi)
- Low supply current
- Photo detector and preamplifier in one package
- Supply voltage: 2.0 V to 5.5 V
- Material categorization:  
for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**  
**GREEN**  
(5-2008)

### LINKS TO ADDITIONAL RESOURCES



Product Page

Marking

Holders

Bends and Cuts

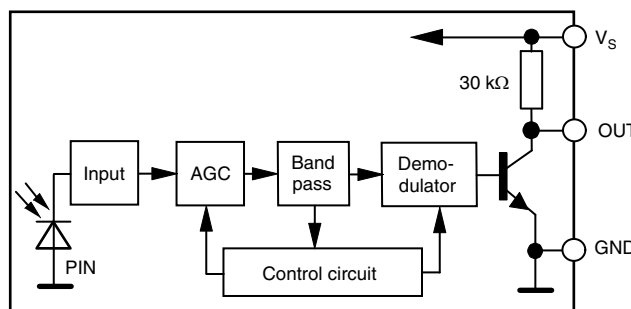
### DESIGN SUPPORT TOOLS

- [3D models](#)
- [Window size calculator](#)

### APPLICATIONS

- Infrared remote control systems

### BLOCK DIAGRAM



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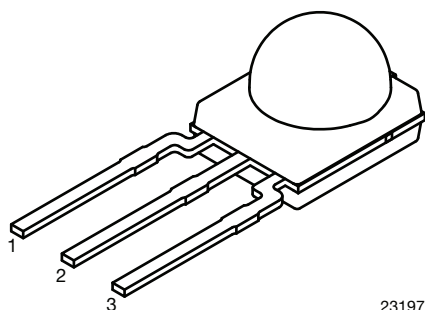
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## MECHANICAL DATA

Pinning for TSOP13...P16TR:

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

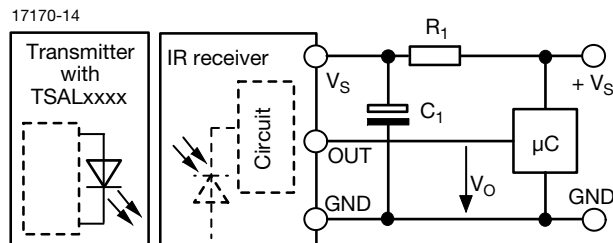


23197

## ORDERING CODE

TSOP13...P16TR - 500 pieces in tape and reel

## APPLICATION CIRCUIT



$R_1$  and  $C_1$  recommended in case there are strong ripple or spikes on the supply line.

## PARTS TABLE

AGC		BASIC NOISE SUPPRESSION (AGC1)	ENHANCED NOISE SUPPRESSION (AGC3)	MAXIMIZED NOISE SUPPRESSION (AGC5)
Carrier frequency	30 kHz	TSOP13130P16TR	TSOP13330P16TR	TSOP13530P16TR
	33 kHz	TSOP13133P16TR	TSOP13333P16TR	TSOP13533P16TR
	36 kHz	TSOP13136P16TR	TSOP13336P16TR <sup>(1)(5)</sup>	TSOP13536P16TR
	38 kHz	TSOP13138P16TR	TSOP13338P16TR <sup>(2)(4)</sup>	TSOP13538P16TR
	40 kHz	TSOP13140P16TR	TSOP13340P16TR	TSOP13540P16TR
	56 kHz	TSOP13156P16TR	TSOP13356P16TR <sup>(3)</sup>	TSOP13556P16TR
Package		Minimold		
Pinning		1 = OUT, 2 = GND, 3 = $V_S$		
Dimensions (mm)		5.4 W x 6.35 H x 4.9 D		
Mounting		Leaded		
Application		Remote control		
Best choice for		<sup>(1)</sup> RCMM <sup>(2)</sup> RECS-80 Code <sup>(3)</sup> r-map <sup>(4)</sup> XMP <sup>(5)</sup> MCIR		
Special options		<ul style="list-style-type: none"> <li>Narrow optical filter: <a href="http://www.vishay.com/doc?81590">www.vishay.com/doc?81590</a></li> <li>Wide optical filter: <a href="http://www.vishay.com/doc?82726">www.vishay.com/doc?82726</a></li> </ul>		

## ABSOLUTE MAXIMUM RATINGS

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Supply voltage		$V_S$	-0.3 to +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	$T_{amb} \leq 85^\circ\text{C}$	$P_{tot}$	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 ( $T_{amb} = 25^{\circ}\text{C}$ , unless otherwise specified)						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Supply current	$E_v = 0, V_S = 3.3\text{ V}$	$I_{SD}$	0.25	0.35	0.45	mA
	$E_v = 40\text{ klx, sunlight}$	$I_{SH}$	-	0.45	-	mA
Supply voltage		$V_S$	2.0	-	5.5	V
Transmission distance	$E_v = 0$ , test signal see Fig. 1, IR diode TSAL6200, $I_F = 50\text{ mA}$	$d$	-	39	-	m
Output voltage low	$I_{OSL} = 0.5\text{ mA}$ , $E_e = 0.7\text{ mW/m}^2$ , test signal see Fig. 1	$V_{OSL}$	-	-	100	mV
Minimum irradiance	Test signal: RC5 code	$E_e\text{ min.}$	-	0.05	0.1	$\text{mW/m}^2$
	Test signal: XMP code	$E_e\text{ min.}$	-	0.1	0.2	$\text{mW/m}^2$
Maximum irradiance	$t_{pi} - 3.0/f_0 < t_{po} < t_{pi} + 3.5/f_0$ , test signal see Fig. 1	$E_e\text{ max.}$	30	-	-	$\text{W/m}^2$
Directivity	Angle of half transmission distance	$\Phi_{1/2}$	-	$\pm 45$	-	$^{\circ}$

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

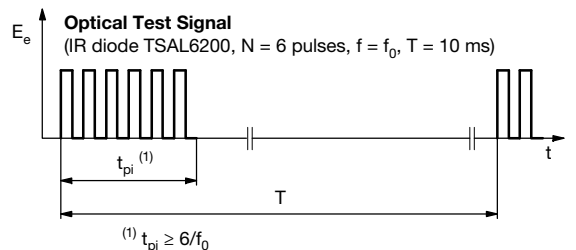


Fig. 1 - Output Delay and Pulse-Width

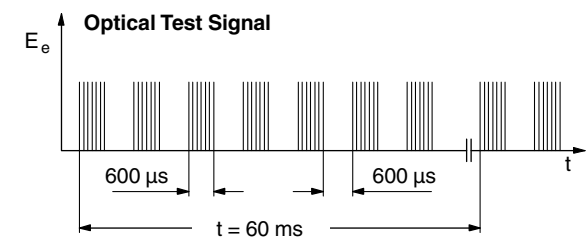


Fig. 3 - Test Signal

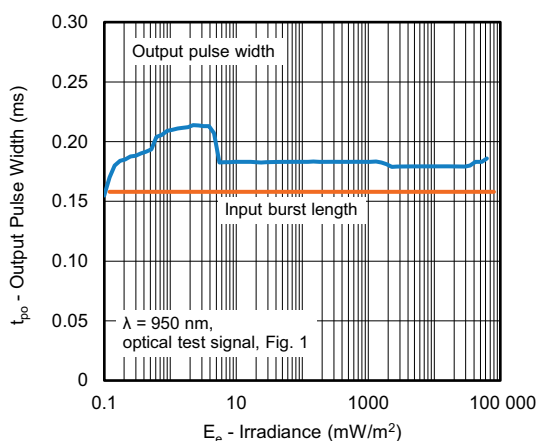


Fig. 2 - Pulse-Width vs. Irradiance in Dark Ambient

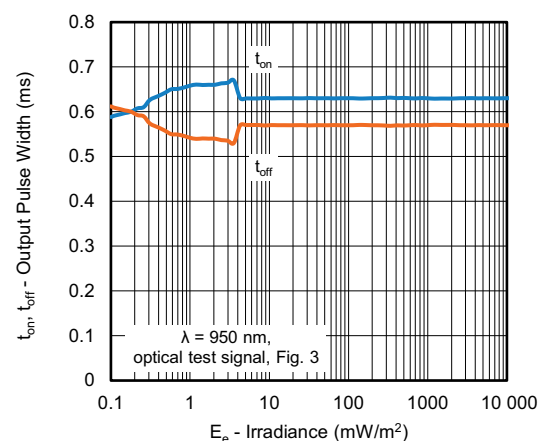


Fig. 4 - Pulse-Width vs. Irradiance in Dark Ambient



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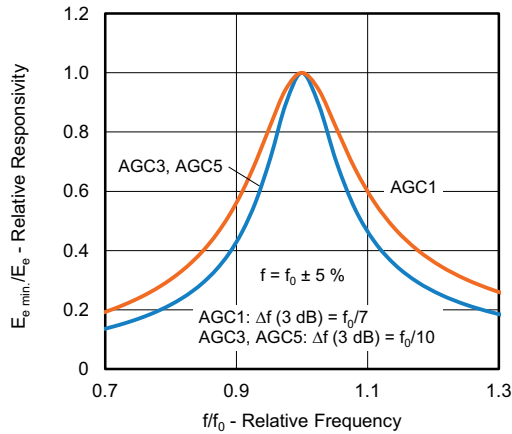


Fig. 5 - Frequency Dependence of Responsivity

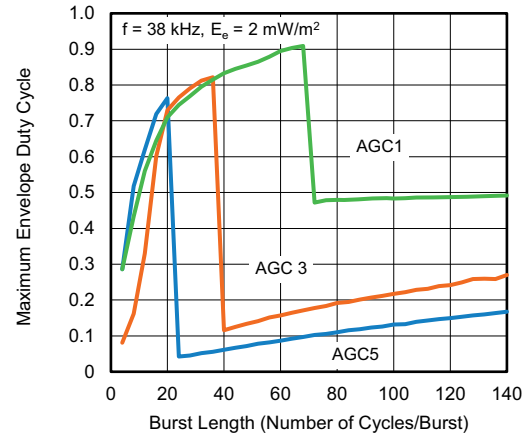


Fig. 8 - Maximum Envelope Duty Cycle vs. Burst Length

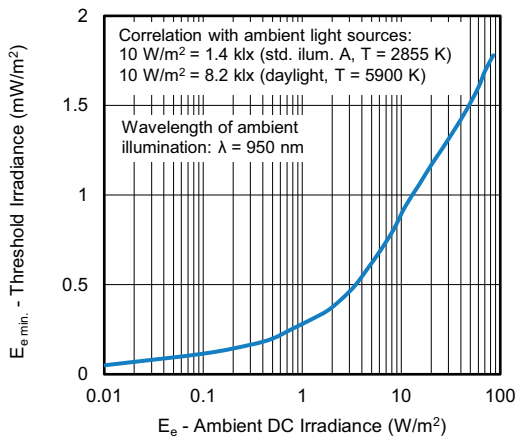


Fig. 6 - Sensitivity in Bright Ambient

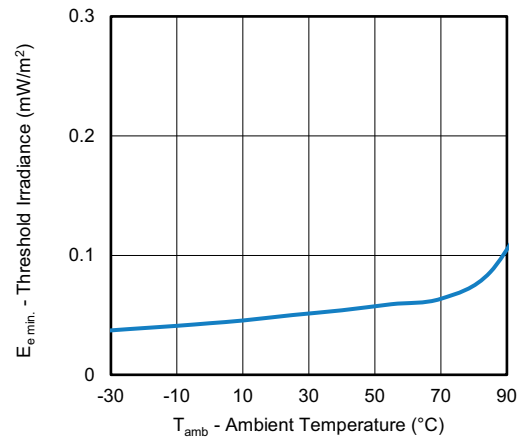


Fig. 9 - Sensitivity vs. Ambient Temperature

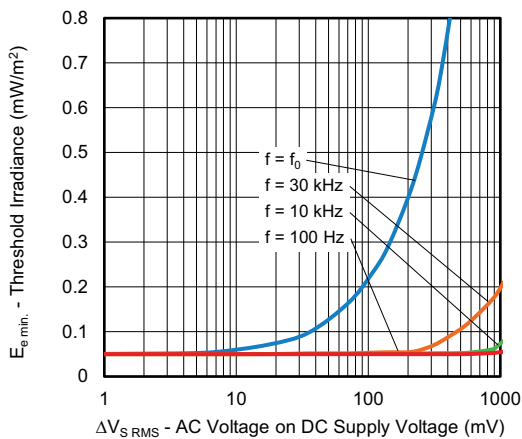


Fig. 7 - Sensitivity vs. Supply Voltage Disturbances

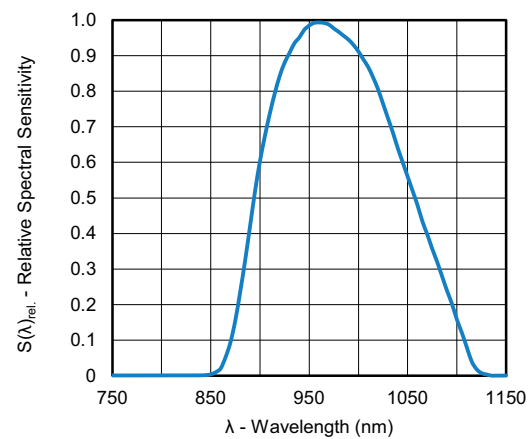


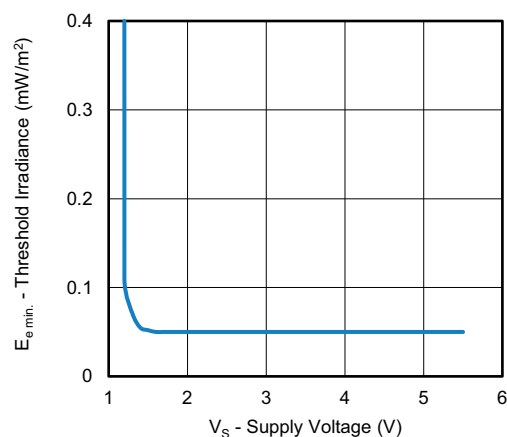
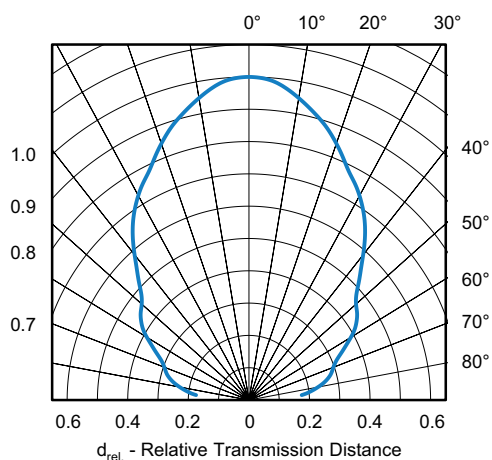
Fig. 10 - Relative Spectral Sensitivity vs. Wavelength



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## 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).
- 2.4 GHz and 5 GHz Wi-Fi



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



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

	TSOP131..P16TR	TSOP133..P16TR	TSOP135..P16TR
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 68 cycles ≥ 7 cycles	6 to 36 cycles ≥ 8 cycles	6 to 19 cycles ≥ 8 cycles
For bursts greater than a minimum gap time in the data stream is needed of	68 cycles > 1 x burst length	36 cycles > 10 x burst length	19 cycles > 10 x burst length
Maximum number of continuous short bursts/second	2100	2100	2100
RCMM code	Yes	Preferred	Yes
XMP code	Yes	Preferred	Yes
r-map code	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 TSOP132..P16TR, TSOP134..P16TR, TSOP136..P16TR



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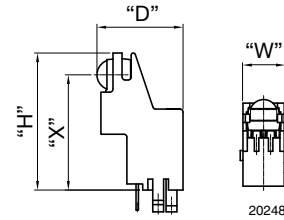
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**SIDE VIEW PIN-IN-PASTE HOLDER: D = 9.0 mm, H = 8.05 mm, W = 6.2 mm, X = 5.15 mm**



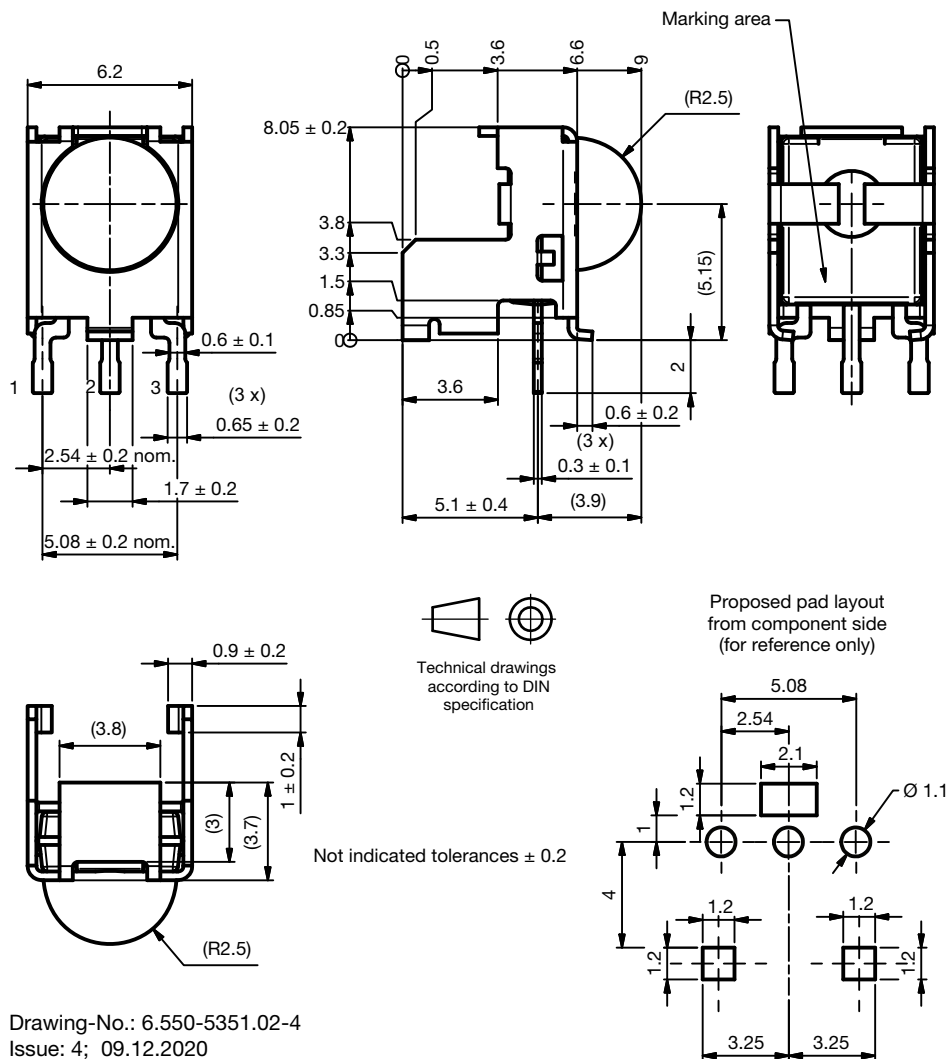
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20248

NAME	LENS AXIS (X)	VIEW	TYPE	HEIGHT (H)	WIDTH (W)	DEPTH (D)
P16TR	5.15	Side	Holder	8.05	6.2	9.0

## MECHANICAL DIMENSIONS in millimeters



Technical drawing of a mechanical part, showing cross-sections A-A and B-B, and a side view with dimensions.

**Section A-A (2:1):** Shows a cross-section of the part. Dimensions include a total width of (7.55), a central width of (3.53), and a height of (8.4) for the main body and (10.8) for the total height. A reference dimension of 1.9 ref. is indicated.

**Section B-B (2:1):** Shows a cross-section of the part. Dimensions include a total width of (0.5) and a height of (6.65). A reference dimension of 6.23 ref. is indicated.

**Side View:** Shows the front view of the part. Dimensions include a total width of (24), a central width of (11.5), and a height of (1.75) for the top section. The part features a series of vertical slots and a central circular feature with a diameter of  $\varnothing 1.55$ . The distance between the centerlines of the slots is (12), and the distance between the centerlines of the slots and the central feature is (2). The distance between the centerlines of the slots and the bottom feature is (4). The part is labeled with "Direction of feed" and "A" and "B" indicating the sections.

Technical drawings  
according to DIN  
specification.

Diagram illustrating the structure of the 16-digit barcode:

- T** (Type)
- S** (Size)
- O** (Orientation)
- P** (Product)
- d d d** (Product series (2 or 3 digits))
- d d** (Frequency)
- P 1 6** (Holder type)
- T R** (Taping)

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

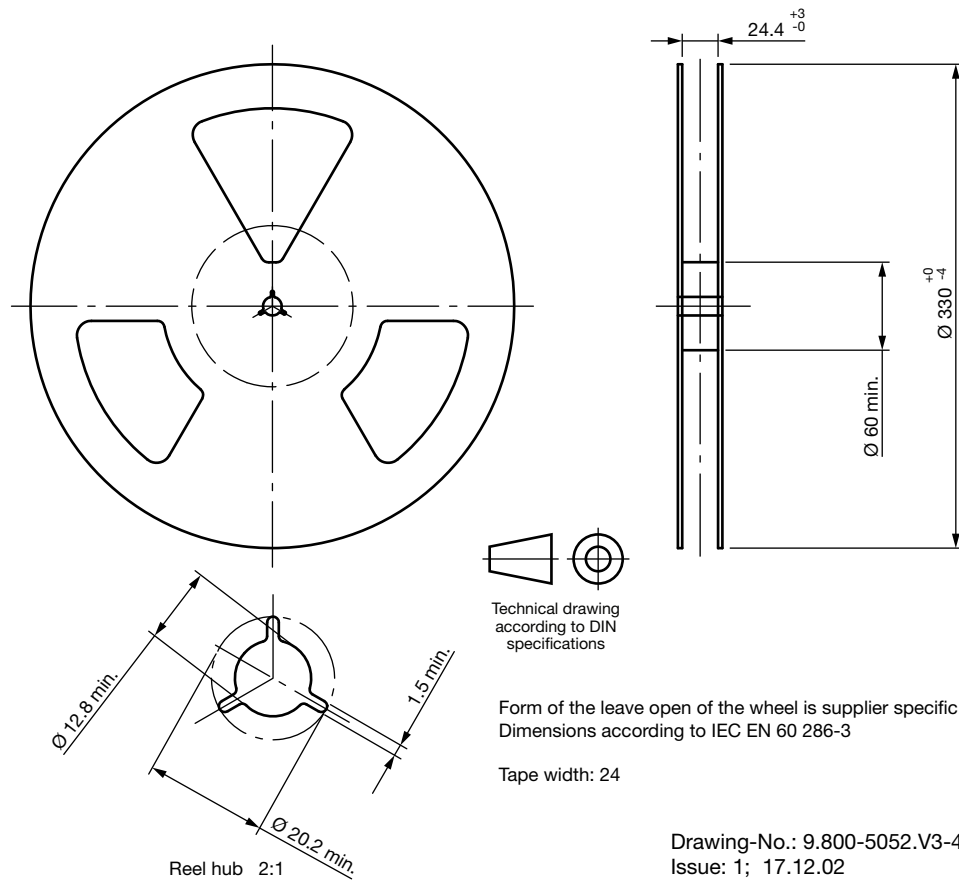
### Example: TSOP13338P16TR

- 500 pieces per reel

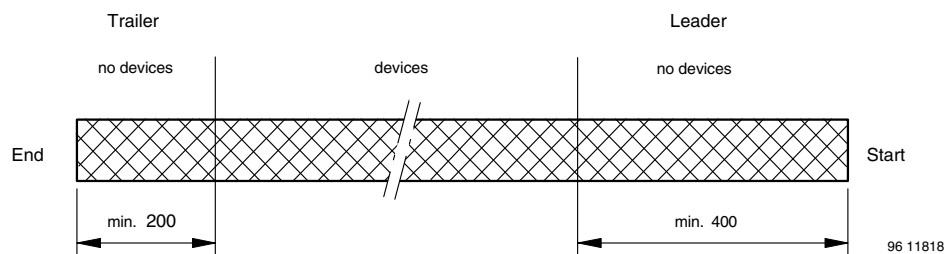




**REEL DIMENSIONS** in millimeters



**LEADER AND TRAILER DIMENSIONS** in millimeters



**COVER TAPE PEEL STRENGTH**

According to DIN EN 60286-3

0.1 N to 1.3 N

300 ± 10 mm/min.

165° to 180° peel angle



## ASSEMBLY INSTRUCTIONS

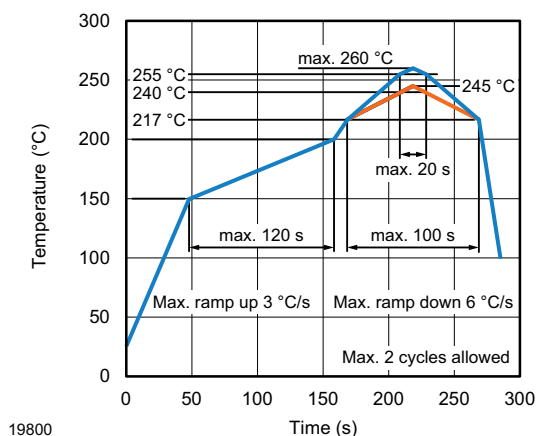
### Reflow Soldering

- 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



## LABEL

### Standard bar code labels for finished goods

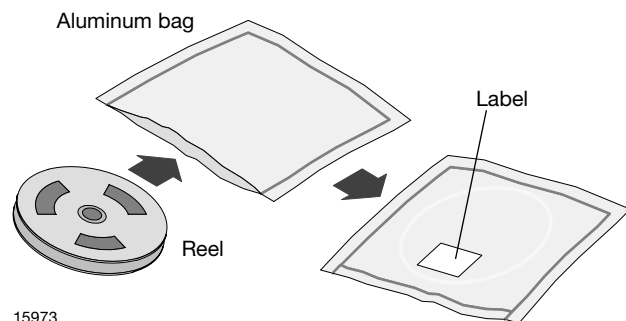
The standard bar code labels are product labels and used for identification of goods. The finished goods are packed in final packing area. The standard packing units are labeled with standard bar code labels before transported as finished goods to warehouses. The labels are on each packing unit and contain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



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## 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.

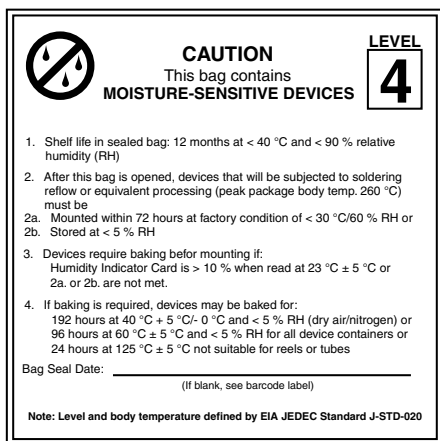
After more than 72 h under these conditions moisture content will be too high for reflow soldering.

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.



22522

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.



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