IR Receiver Modules for Remote Control Systems

22940

LINKS TO ADDITIONAL RESOURCES

Product Page · 3D Models · Calculators · Marking · Holders

Bends and Cuts

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

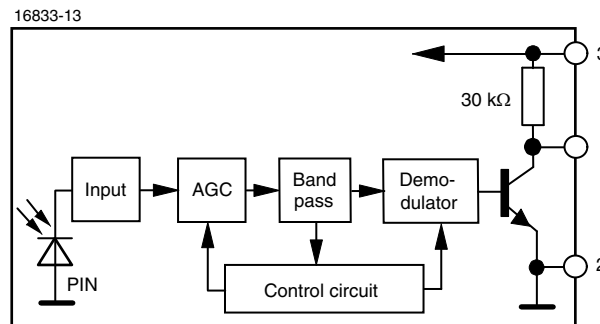Pb-free

e3

RoHS COMPLIANT

HALOGEN FREE

GREEN (5-2008)

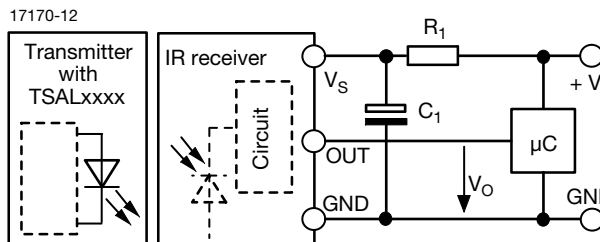## MECHANICAL DATA

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

ORDERING CODE

TSOP93...P16TR - 500 pieces in tape and reel

DESCRIPTION

The TSOP93...P16TR 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..P16TR, TSOP933..P16TR, and TSOP935..P16TR 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.

BLOCK DIAGRAM

16833-13

APPLICATION CIRCUIT

17170-12

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	TSOP93130P16TR	TSOP93330P16TR	TSOP93530P16TR
	33 kHz	TSOP93133P16TR	TSOP93333P16TR	TSOP93533P16TR
	36 kHz	TSOP93136P16TR	TSOP93336P16TR [1][5]	TSOP93536P16TR
	38 kHz	TSOP93138P16TR	TSOP93338P16TR [2][4]	TSOP93538P16TR
	40 kHz	TSOP93140P16TR	TSOP93340P16TR	TSOP93540P16TR
	56 kHz	TSOP93156P16TR	TSOP93356P16TR	TSOP93556P16TR [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		Leaded		
Application		Remote control		
Best choice for		[1] RCMM [2] RECS-80 Code [3] r-map [4] XMP-1, XMP-2 [5] MCIR		
Special options		• Narrow optical filter: www.vishay.com/doc?81590 • Wide optical flter: 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	$T_{amb} \leq 85$ °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 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/m², test signal see Fig. 1	V_{OSL}	-	-	100	mV
Minimum irradiance	Test signal: XMP code	$E_{e\ min.}$	-	0.12	0.25	mW/m²
	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/m²
Directivity	Angle of half transmission distance	$\varphi_{1/2}$	-	± 45	-	°

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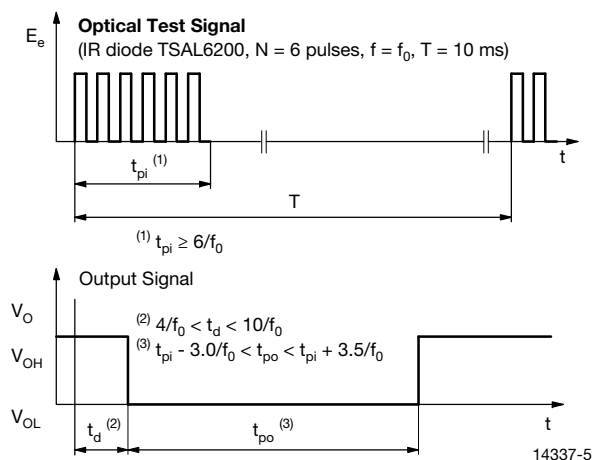

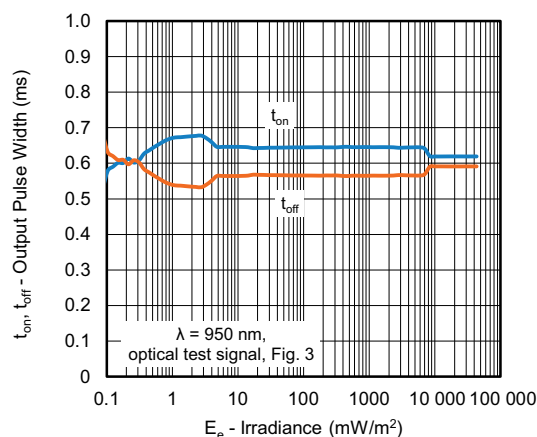Fig. 1 - Output Delay and Pulse-Width

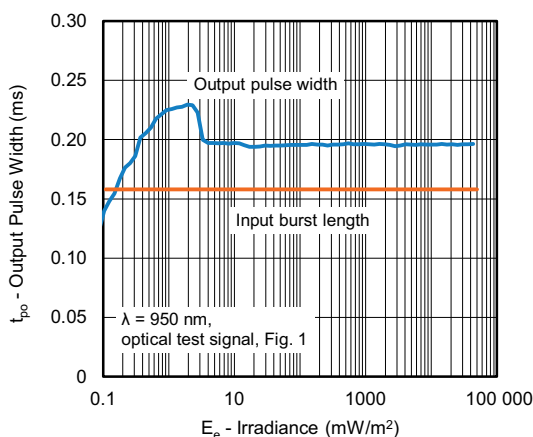Fig. 4 - Pulse-Width vs. Irradiance in Dark Ambient

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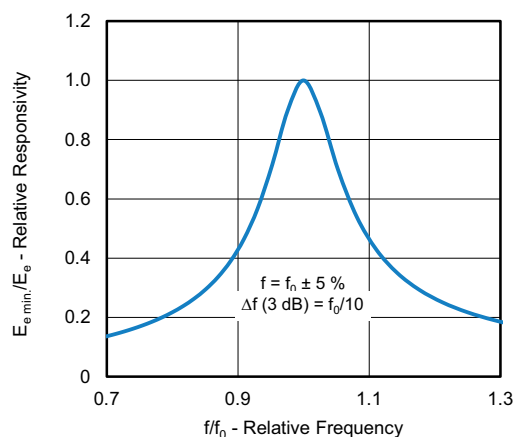

Fig. 5 - Frequency Dependence of Responsivity
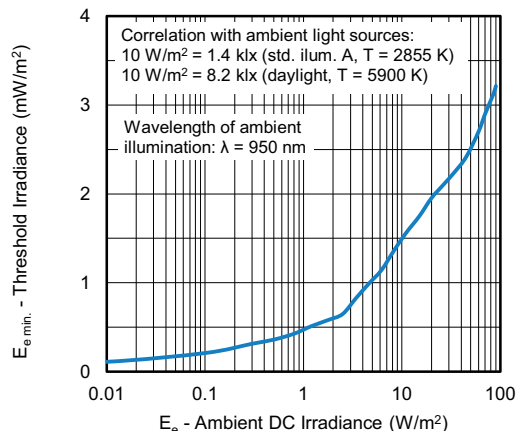

Fig. 3 - Test Signal

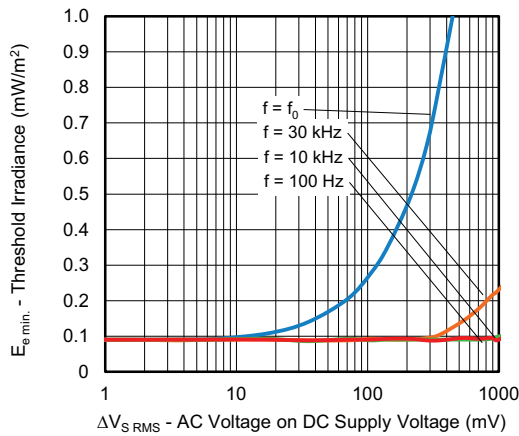Fig. 6 - Sensitivity in Bright Ambient

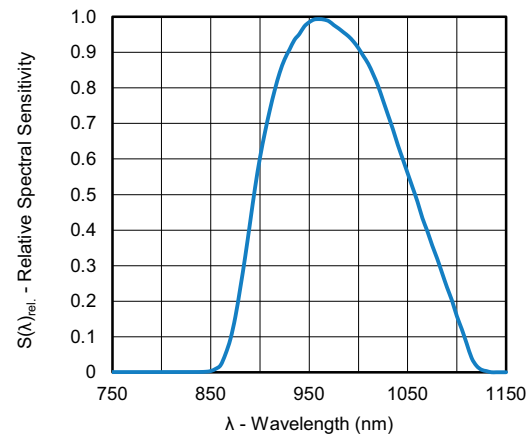Fig. 7 - Sensitivity vs. Supply Voltage Disturbances

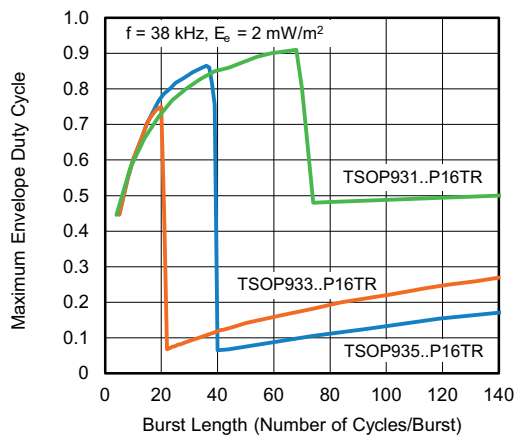Fig. 10 - Relative Spectral Sensitivity vs. Wavelength

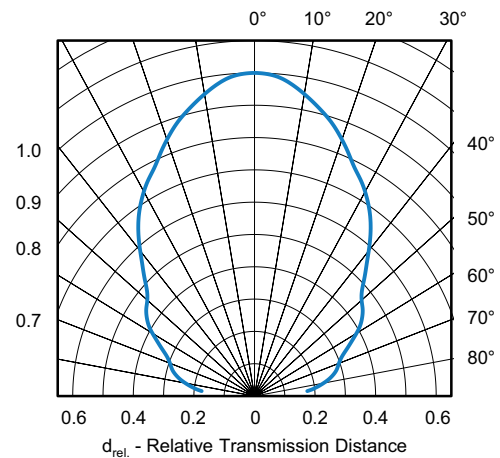Fig. 8 - Max. Envelope Duty Cycle vs. Burst Length
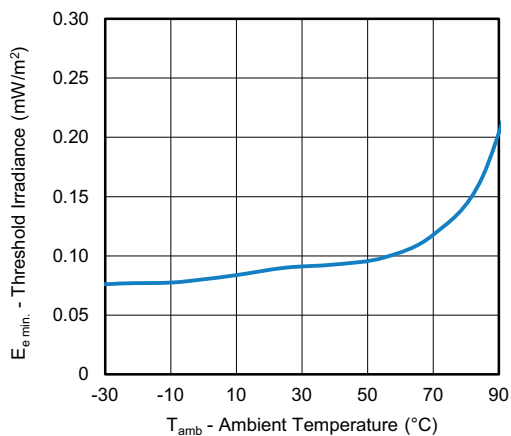

Fig. 11 - Directivity
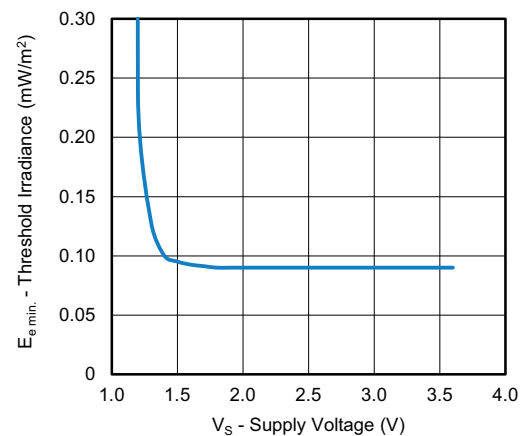

Fig. 9 - Sensitivity vs. Ambient Temperature

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..P16TR	TSOP933..P16TR	TSOP935..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 70 cycles $\geq$ 6 cycles	6 to 20 cycles $\geq$ 8 cycles	6 to 38 cycles $\geq$ 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..P16TR, TSOP934..P16TR, or TSOP936..P16TR

SIDE VIEW PIN-IN-PASTE HOLDER: D = 9.0 mm, H = 8.05 mm, W = 6.2 mm, X = 5.15 mm
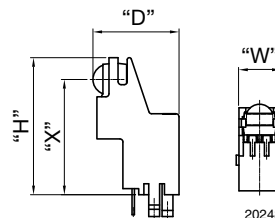
NAME	LENS AXIS (X)	VIEW	TYPE	HEIGHT (H)	WIDTH (W)	DEPTH (D)
P16TR	5.15	Side	Holder	8.05	6.2	9.0

MECHANICAL DIMENSIONS in millimeters

Technical drawings according to DIN specification

Not indicated tolerances ± 0.2

Proposed pad layout from component side (for reference only)
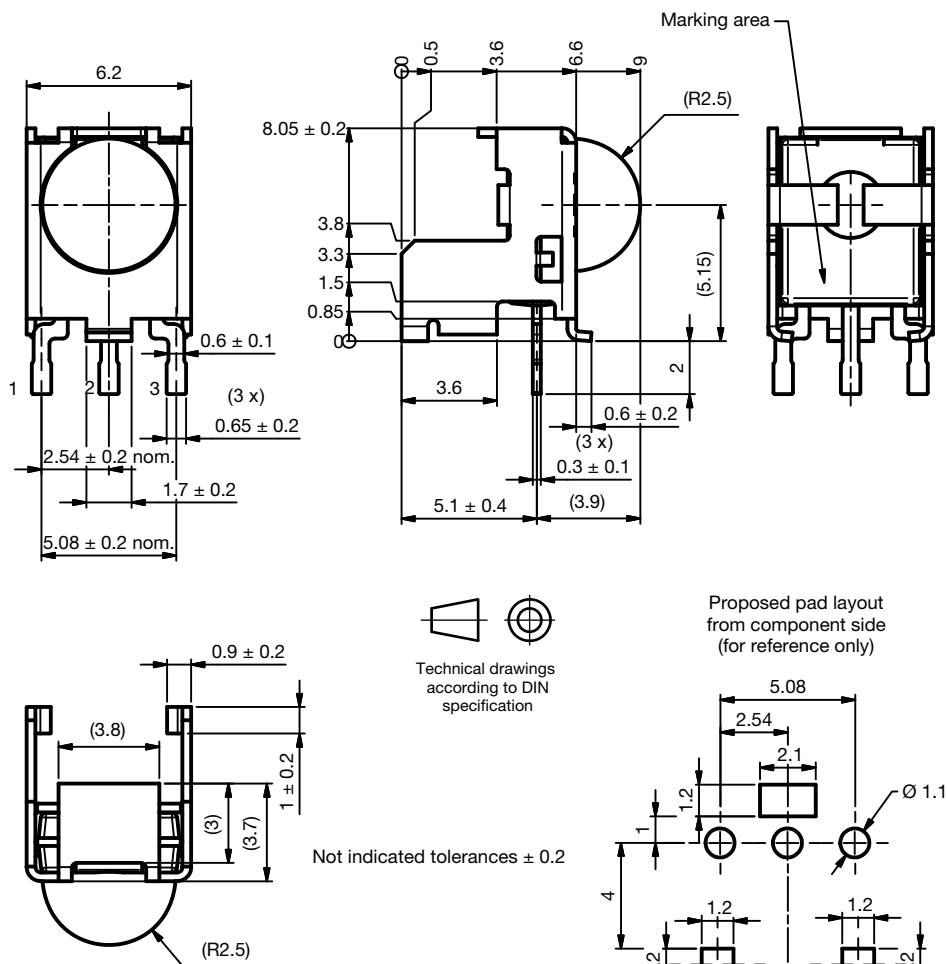
Drawing-No.: 6.550-5351.02-4
Issue: 4; 09.12.2020

TAPING VERSION TSOP..TR DIMENSIONS in millimeters

A-A (2:1)

(8.4)

(10.8)

(3.53)

(7.55)

1.9 ref.

(24)

(11.5)

(1.75)

B

B-B (2:1)

(6.65)

(0.5)

6.23 ref.

B

A

A

(12)

(2)

(Ø 1.5)

(4)

(Ø 1.55)

Direction of feed

Technical drawings
according to DIN
specification.
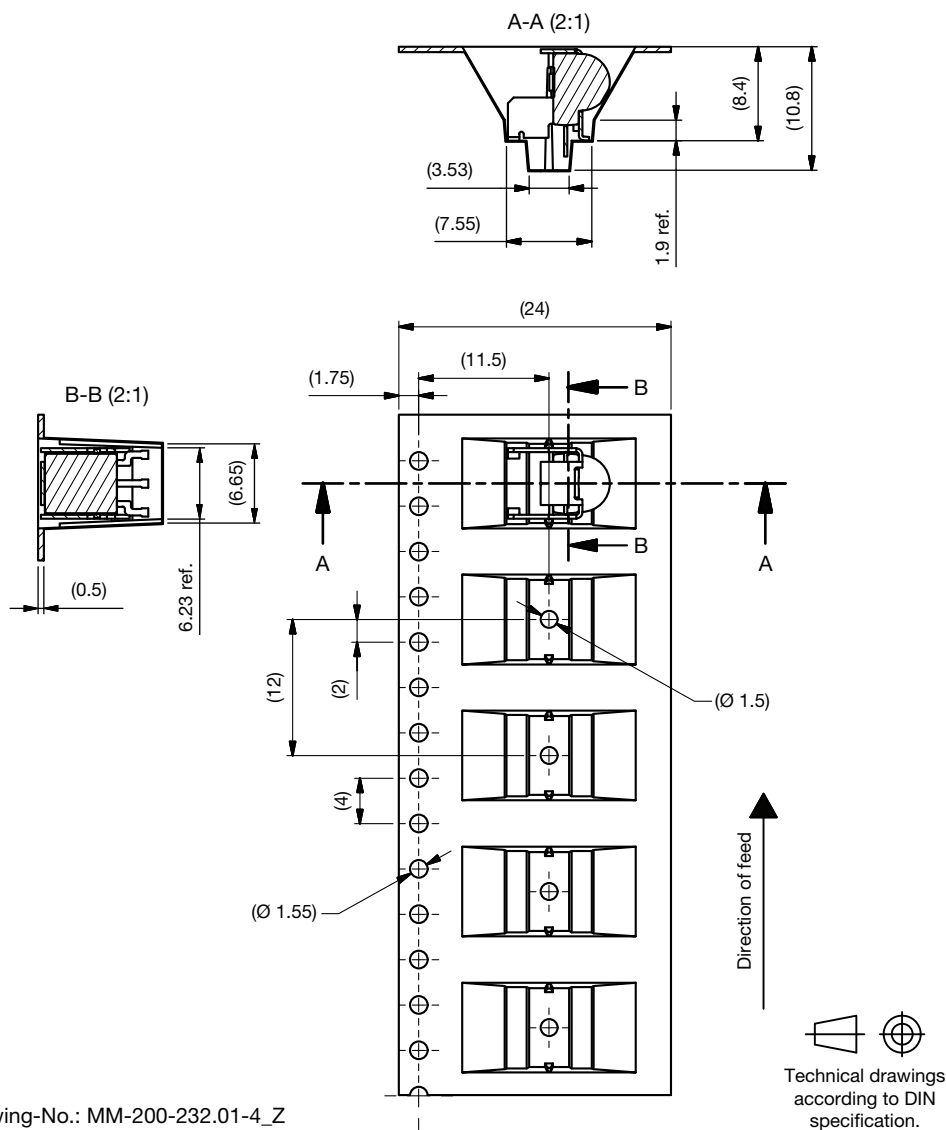
Drawing-No.: MM-200-232.01-4_Z
Issue A: 25.04.17

ORDERING INFORMATION

| T | S | O | P | d | d | d | d | d | P | 1 | 6 | T | R |

Product series
(2 or 3 digits)

Frequency

Holder type

Taping

Note

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

Example: TSOP93338P16TR

PACKAGING QUANTITY

- 500 pieces per reel

REEL DIMENSIONS in millimeters

$24.4 \, {}^{+3}_{-0}$

$\varnothing \, 330 \, {}^{+0}_{-4}$

$\varnothing \, 60$ min.

$\varnothing \, 12.8$ min.

1.5 min.

$\varnothing \, 20.2$ min.

Reel hub 2:1

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
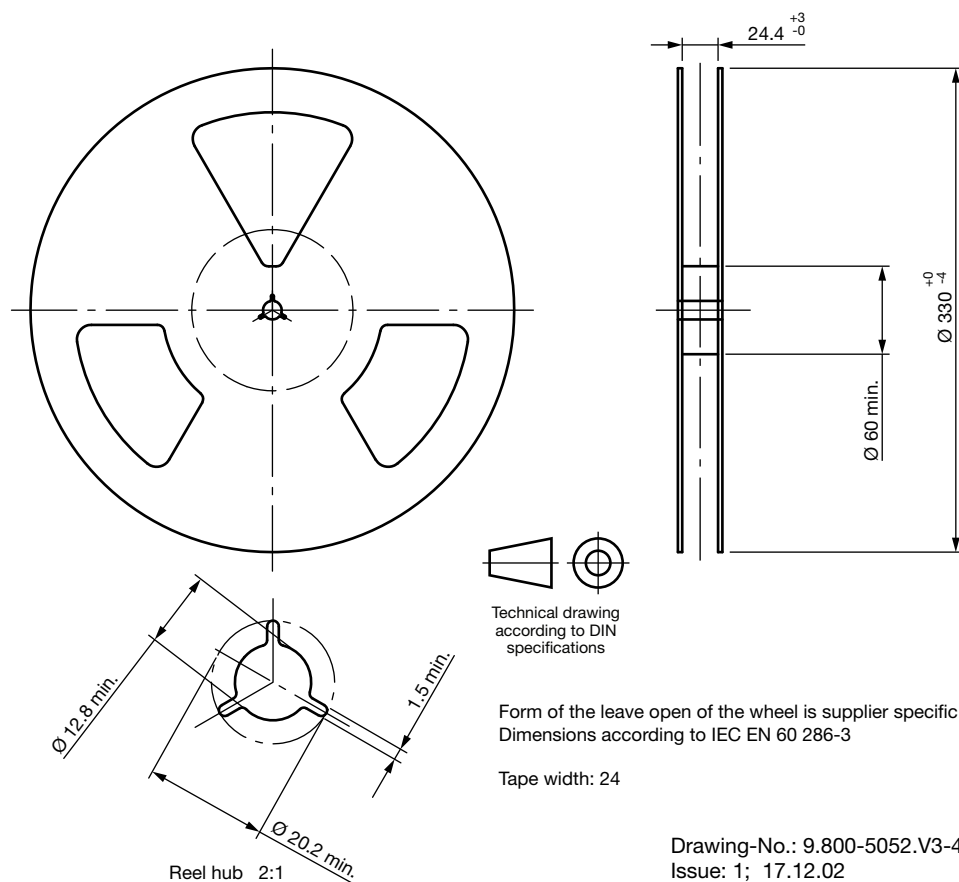
LEADER AND TRAILER DIMENSIONS in millimeters

Trailer

Leader

no devices

devices

no devices

End

Start

min. 200

min. 400

96 11818
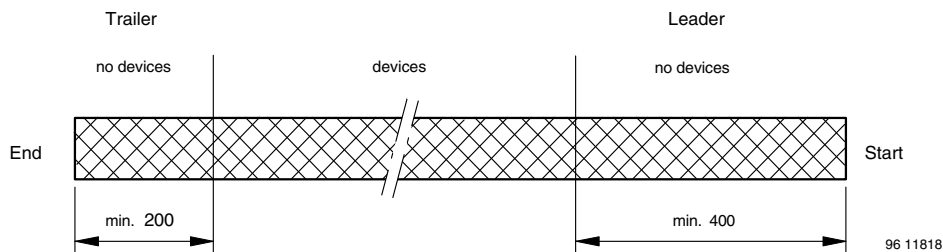
COVER TAPE PEEL STRENGTH

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
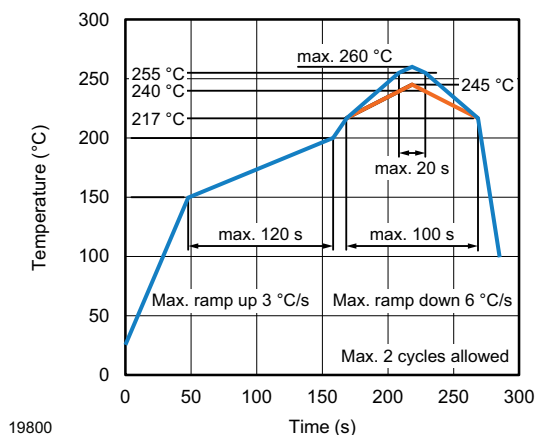
LABEL

**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.
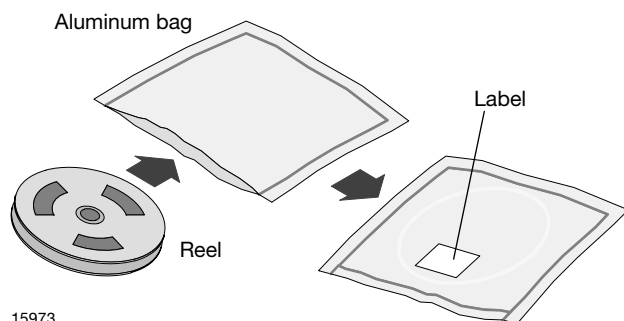
FINAL PACKING

The sealed reel is packed into a cardboard box. A secondary cardboard box is used for shipping purposes.

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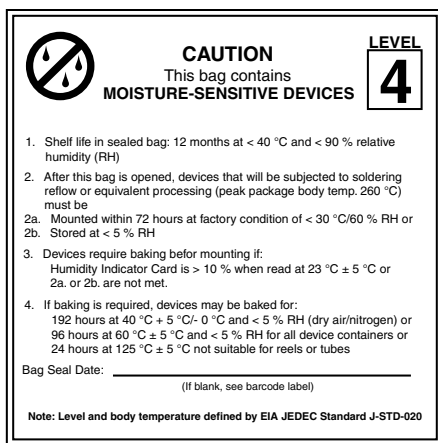
In case of moisture absorption, the devices will recover to the former condition by drying under the following condition:

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 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.

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

Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and / or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Hyperlinks included in this datasheet may direct users to third-party websites. These links are provided as a convenience and for informational purposes only. Inclusion of these hyperlinks does not constitute an endorsement or an approval by Vishay of any of the products, services or opinions of the corporation, organization or individual associated with the third-party website. Vishay disclaims any and all liability and bears no responsibility for the accuracy, legality or content of the third-party website or for that of subsequent links.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.

Revision: 01-Jan-2024 **1** Document Number: 91000

For technical questions, contact:

THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000