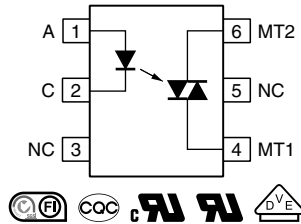


## Optocoupler, Phototriac Output, 400 V<sub>DRM</sub>



23043



### DESCRIPTION

The VO302x series consists of a phototriac optically coupled to a gallium arsenide infrared-emitting diode in a 6-lead plastic dual inline package

### FEATURES

- 400 V blocking voltage
- Isolation test voltage, 5000 V<sub>RMS</sub>, t = 1 min
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



### APPLICATIONS

- High current triac driver
- Solid-state relay
- Switch small AC loads

### AGENCY APPROVALS

- [UL](#)
- [cUL](#)
- [DIN EN 60747-5-5 \(VDE 0884-5\)](#), available with option "1"
- [CQC GB8898-2011](#)
- [CQC GB4943.1-2011](#)
- [FIMKO](#)

### LINKS TO ADDITIONAL RESOURCES



3D Models



Design Tools



Related Documents



Models

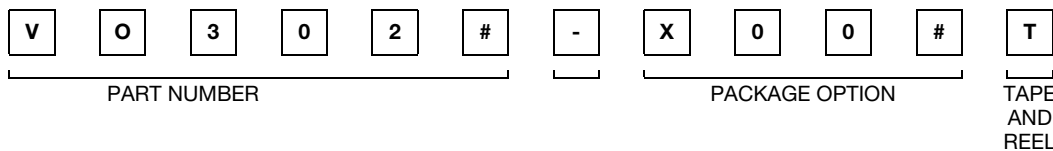


Footprints



Schematics

### ORDERING INFORMATION



AGENCY CERTIFIED / PACKAGE	TRIGGER CURRENT, I <sub>FT</sub>		
	5 mA	10 mA	15 mA
<b>UL, cUL, CQC</b>			
DIP-6	VO3023	VO3022	VO3021
DIP-6, 400 mil, option 6	VO3023-X006	VO3022-X006	VO3021-X006
SMD-6, option 7	VO3023-X007T	VO3022-X007T	VO3021-X007T
<b>UL, cUL, FIMKO, CQC, VDE (Option 1)</b>			
DIP-6	VO3023-X001	VO3022-X001	VO3021-X001
SMD-6, option 7	VO3023-X017T	VO3022-X017T	VO3021-X017T

#### Note

- Additional options may be possible, please contact sales office

<b>ABSOLUTE MAXIMUM RATINGS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)				
PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
<b>INPUT</b>				
Reverse voltage		$V_R$	6	V
Forward current		$I_F$	50	mA
Peak surge current	100 $\mu\text{s}$ , 200 pps	$I_{FSM}$	0.5	A
Power dissipation		$P_{diss}$	70	mW
<b>OUTPUT</b>				
Peak off-state voltage		$V_{DRM}$	400	V
RMS on-state current		$I_{T(RMS)}$	0.1	A
Peak non-repetitive surge current	PW = 100 ms, 120 pps	$I_{TSM}$	1	A
Power dissipation		$P_{diss}$	300	mW
<b>COUPLER</b>				
Total power dissipation		$P_{diss}$	330	mW
Storage temperature range		$T_{stg}$	-55 to +150	$^{\circ}\text{C}$
Ambient temperature		$T_{amb}$	-40 to +100	$^{\circ}\text{C}$
Lead soldering temperature	2 mm from case, $t < 10\text{ s}$	$T_{slid}$	260	$^{\circ}\text{C}$
Junction temperature		$T_J$	125	$^{\circ}\text{C}$

**Note**

- Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of this document. Exposure to absolute maximum ratings for extended periods of the time can adversely affect reliability.

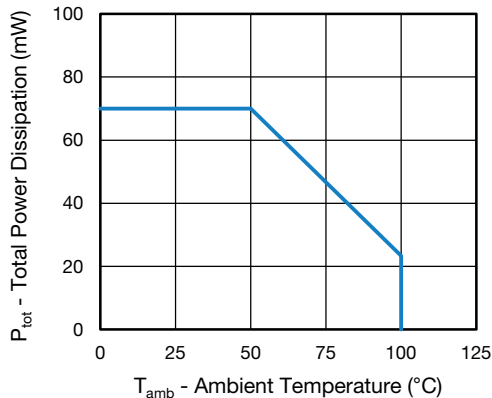


Fig. 1 - Total Power Dissipation vs. Ambient Temperature (IR diode)

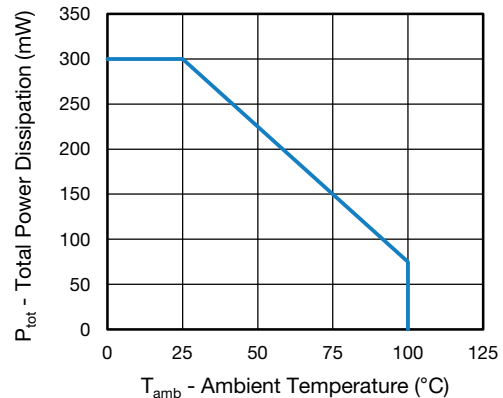


Fig. 2 - Total Power Dissipation vs. Ambient Temperature (Phototriac)



<b>ELECTRICAL CHARACTERISTICS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
<b>INPUT</b>							
Forward voltage	$I_F = 20\text{ mA}$		$V_F$	-	1.3	1.5	V
Reverse voltage	$I_R = 10\text{ }\mu\text{A}$		$V_R$	6	-	-	V
Reverse current	$V_R = 6\text{ V}$		$I_R$	-	-	10	$\mu\text{A}$
Junction capacitance	$V_R = 0\text{ V}$ , $f = 1\text{ MHz}$		$C_j$	-	50	-	pF
<b>OUTPUT</b>							
Peak off-state current, either direction	$V_{DRM} = 400\text{ V}^{(1)}$		$I_{DRM}$	-	10	100	nA
Peak off-state voltage, either direction	$I_{TM} = 100\text{ mA}$		$V_{TM}$	-	1.7	3	V
Critical rate of rise of off-state voltage	$I_F = 0\text{ A}$ , $V_D = 0.67\text{ }V_{DRM}$		$dV/dt_{cr}$	1000	-	-	V/ $\mu\text{s}$
<b>COUPLER</b> <sup>(2)</sup>							
Emitting diode trigger current	$V_T = 3\text{ V}$ , $R_L = 150\text{ }\Omega$	VO3021	$I_{FT}$	-	8	15	mA
		VO3022	$I_{FT}$	-	5	10	mA
		VO3023	$I_{FT}$	-	3	5	mA
Holding current	$I_F = 10\text{ mA}$ , $V_T \geq 3\text{ V}$		$I_H$	-	200	-	$\mu\text{A}$

**Notes**

- Minimum and maximum values are testing requirements. Typical values are characteristics of the device and are the result of engineering evaluation. Typical values are for information only and are not part of the testing requirements.

(1) Test voltage must be applied within dV/dt ratings

(2)  $I_{FT}$  is defined as a minimum trigger current

<b>SAFETY AND INSULATION RATINGS</b>				
PARAMETER		SYMBOL	VALUE	UNIT
<b>MAXIMUM SAFETY RATINGS</b>				
Output safety power		$P_{SO}$	700	mW
Input safety current		$I_{si}$	400	mA
Safety temperature		$T_S$	175	$^{\circ}\text{C}$
Comparative tracking index		CTI	175	
<b>INSULATION RATED PARAMETERS</b>				
Maximum withstanding isolation voltage		$V_{ISO}$	5000	$V_{RMS}$
Maximum transient isolation voltage		$V_{IOTM}$	8000	$V_{peak}$
Maximum repetitive peak isolation voltage		$V_{IORM}$	890	$V_{peak}$
		$V_{IORM}$	1140 <sup>(1)</sup>	$V_{peak}$
Insulation resistance	$T_{amb} = 25\text{ }^{\circ}\text{C}$ , $V_{DC} = 500\text{ V}$	$R_{IO}$	$10^{12}$	$\Omega$
Isolation resistance	$T_{amb} = 100\text{ }^{\circ}\text{C}$ , $V_{DC} = 500\text{ V}$	$R_{IO}$	$10^{11}$	$\Omega$
Climatic classification (according to IEC 68 part 1)			55 / 115 / 21	
Environment (pollution degree in accordance to DIN VDE 0109)			2	
Creepage distance (standard DIP-6)			$\geq 7$	mm
Creepage distance (400 mil DIP-6)			$\geq 8$	mm
Clearance distance (standard DIP-6)			$\geq 7$	mm
Clearance distance (400 mil DIP-6)			$\geq 8$	mm
Insulation thickness		DTI	$\geq 0.4$	mm

**Notes**

- As per DIN EN 60747-5-5, § 7.4.3.8.2, this optocoupler is suitable for "safe electrical insulation" only within the safety ratings. Compliance with the safety ratings shall be ensured by means of protective circuits.

(1) 400 mil, option 6 only

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

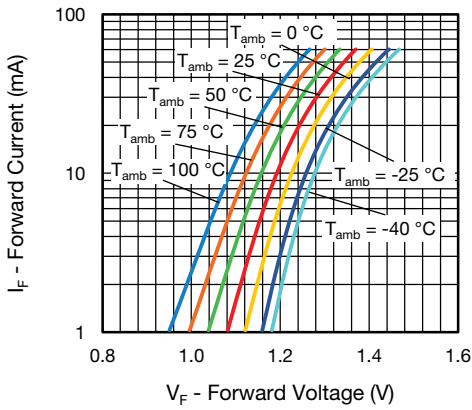


Fig. 3 - Forward Current vs. Forward Voltage

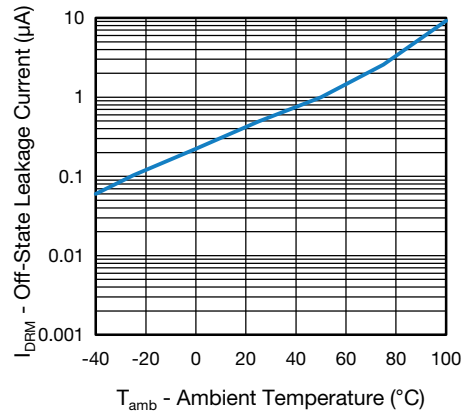


Fig. 6 - Off-State Leakage Current vs. Ambient Temperature

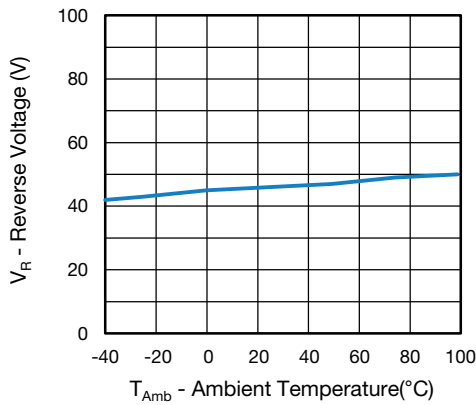


Fig. 4 - Reverse Voltage vs. Ambient Temperature

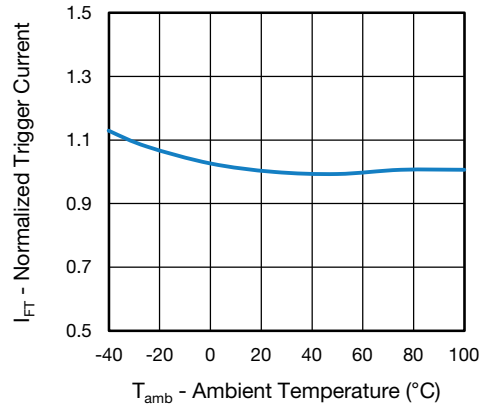


Fig. 7 - Normalized Trigger Current vs. Ambient Temperature

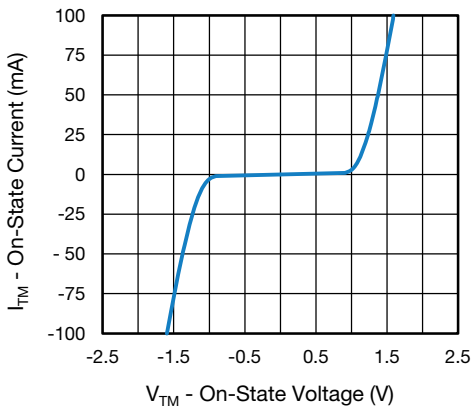


Fig. 5 - On-State Current vs. On-State Voltage

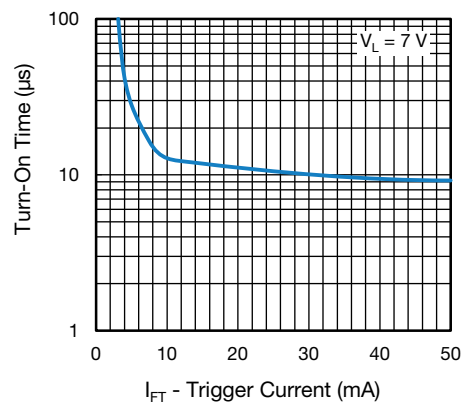


Fig. 8 - Turn-On Time vs. Trigger Current

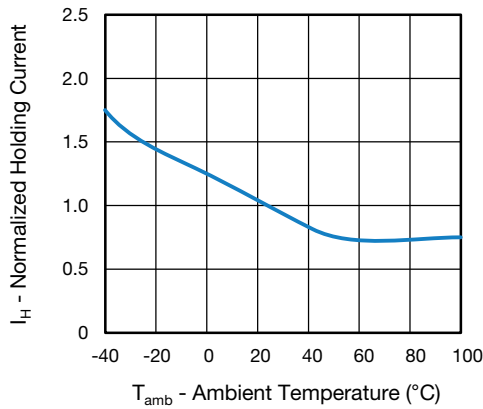


Fig. 9 - Normalized Holding Current vs. Ambient Temperature

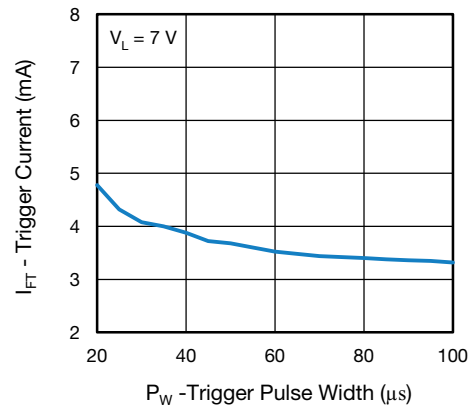


Fig. 11 - Trigger Current vs. Trigger Pulse Width

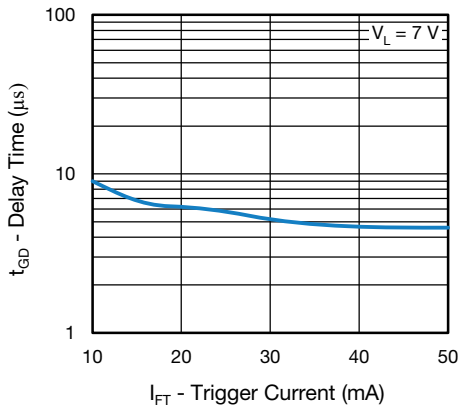


Fig. 10 - Delay Time vs. Trigger Current

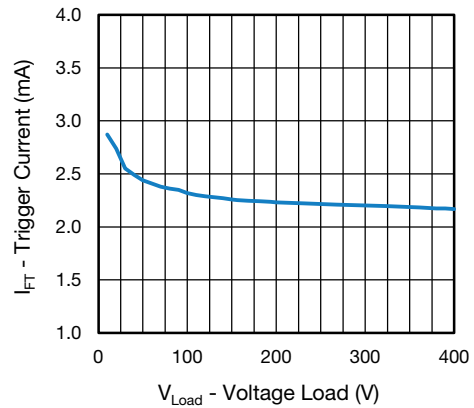
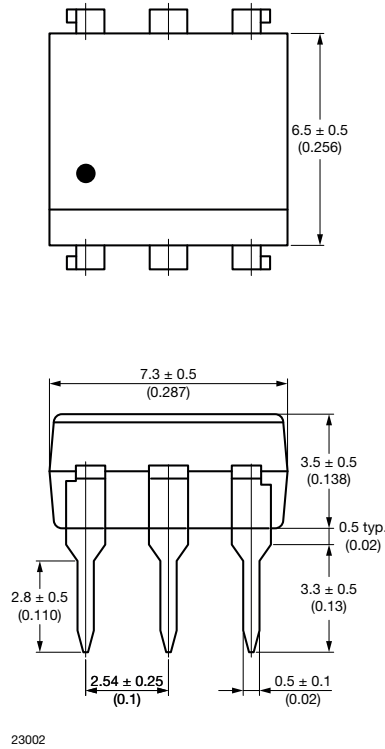


Fig. 12 - Trigger Current vs. Voltage Load



PACKAGE DIMENSIONS (in millimeters)

DIP-6



23002

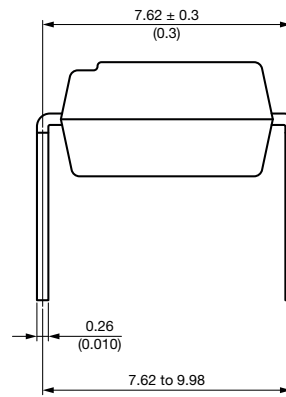
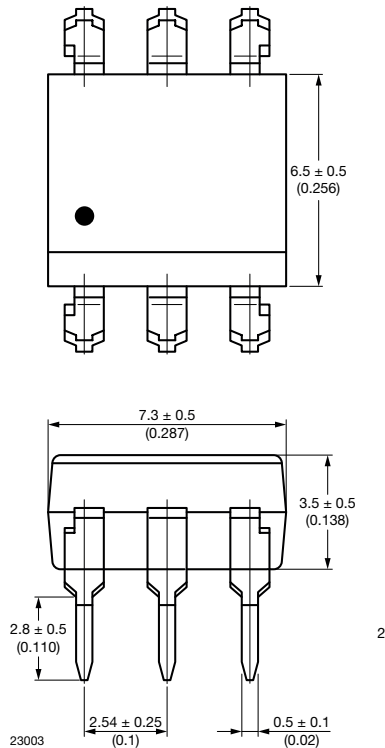


Fig. 13

DIP-6, 400 mil



23003

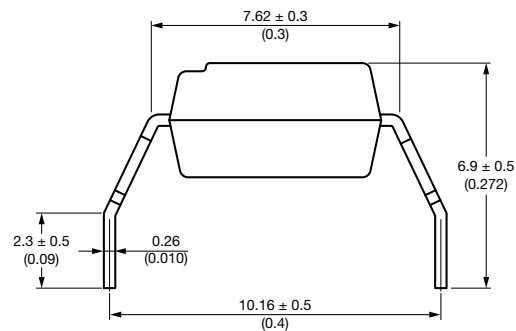


Fig. 14

**SMD-6**

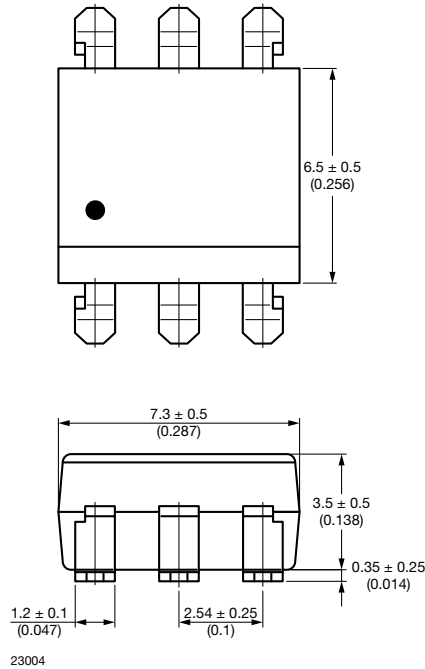


Fig. 15

**PACKAGE MARKING**

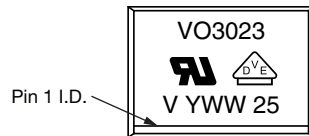


Fig. 16 - Example of VO3023-X017T

**Notes**

- “YWW” is the date code marking (Y = year code, WW = week code)
- VDE logo is only marked on VDE option parts
- Tape and reel suffix (T) is not part of the package marking

**PACKING INFORMATION**

DEVICES PER TUBE			
TYPE	UNITS/TUBE	TUBES/BOX	UNITS/BOX
DIP-6	50	40	2000
DIP-6, 400 mil	50	40	2000

SMD-6 Tape

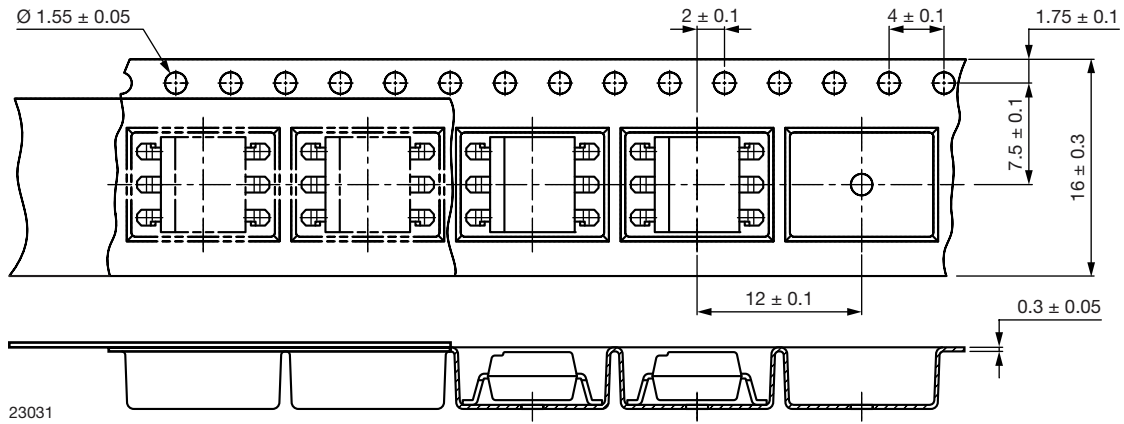


Fig. 17 - Tape and Reel Packaging (1000 pieces on reel)

Reel

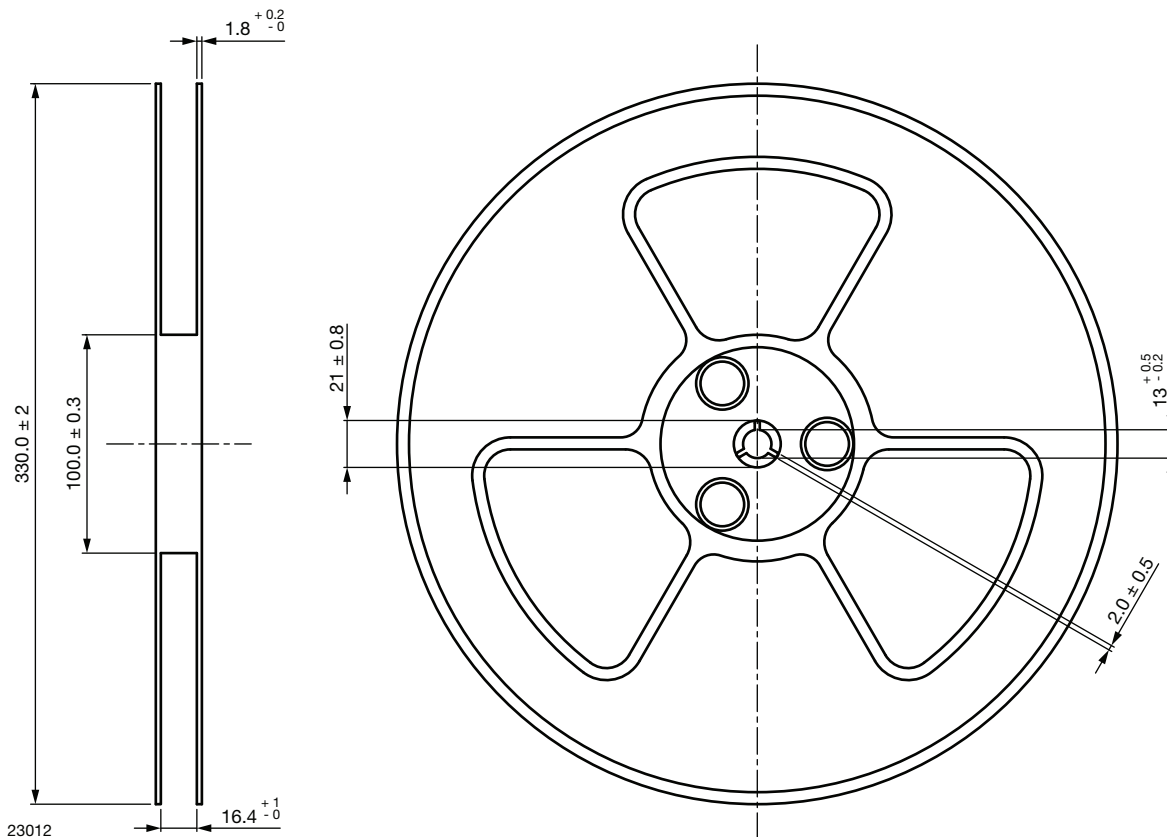


Fig. 18 - Tape and Reel Shipping Medium



**REEL DIMENSIONS** in millimeters

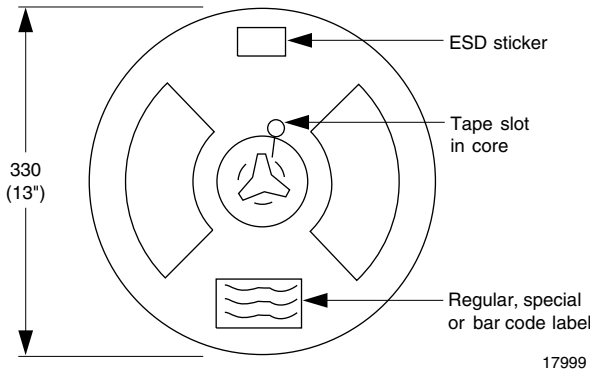


Fig. 19 - Reel Dimensions

**SOLDER PROFILES**

**IR Reflow Soldering (JEDEC® J-STD-020C compliant)**

One time soldering reflow is recommended within the condition of temperature and time profile shown below. Do not solder more than three times.

PROFILE ITEM	CONDITIONS
Preheat	
- Temperature minimum ( $T_{S \text{ min.}}$ )	150 °C
- Temperature maximum ( $T_{S \text{ max.}}$ )	200 °C
- Time (min. to max.) ( $t_s$ )	90 s ± 30 s
Soldering zone	
- Temperature ( $T_L$ )	217 °C
- Time ( $t_L$ )	60 s
Peak temperature ( $T_p$ )	260 °C
Ramp-up rate	3 °C/s max.
Ramp-down rate	3 °C/s to 6 °C/s

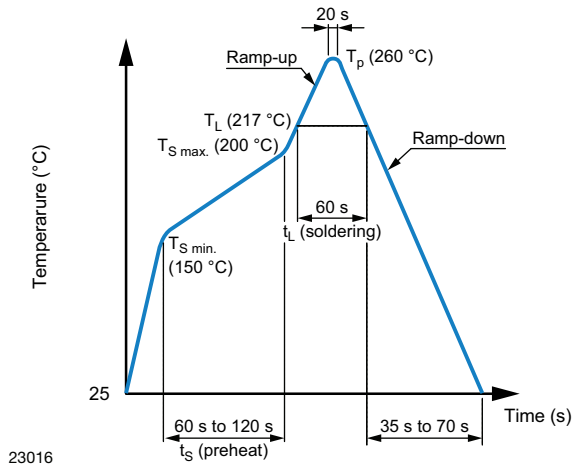


Fig. 20

**Wave Soldering (JEDEC JESD22-A111 compliant)**

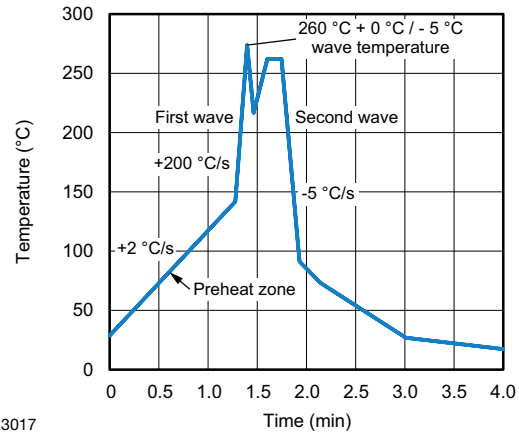
One time soldering is recommended within the condition of temperature.

Temperature: 260 °C + 0 °C / - 5 °C

Time: 10 s

Preheat temperature: 25 °C to 140 °C

Preheat time: 30 s to 80 s



23017

Fig. 21

**Hand Soldering by Soldering Iron**

Allow single lead soldering in every single process. One time soldering is recommended.

Temperature: 380 °C + 0 °C / - 5 °C

Time: 3 s max.

**HANDLING AND STORAGE CONDITIONS**

ESD level: HBM class 2

Floor life: unlimited

Conditions:  $T_{\text{amb}} < 30 \text{ °C}$ , RH < 85 %

Moisture sensitivity level 1, according to J-STD-020



## 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.