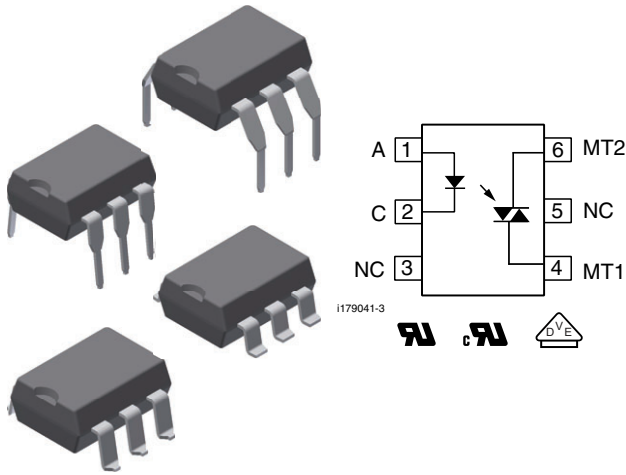


## Optocoupler, Phototriac Output, Non-Zero Crossing, 1.5 kV/μs dV/dt, 600 V



### DESCRIPTION

The VO3052 and VO3053 triac driver family consists of a GaAs infrared LED optically coupled to a monolithic photosensitive non-zero crossing triac detector chip.

The 600 V blocking voltage permits control of off-line voltages up to 240 V<sub>AC</sub>, with a safety factor or more than two, and is sufficient for as much as 380 V.

### FEATURES

- 1500 V/μs dV/dt minimum 2000 V/μs typical
- 600 V blocking voltage
- 100 mA on-state current
- Low input trigger current
- 6 pin DIP package
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
COMPLIANT

### APPLICATIONS

- Household appliances
- Triac drive / AC motor drives
- Solenoid / valve controls
- Office automation equipment / machine
- Temperature (HVAC) / lighting controls
- Switching power supply

### AGENCY APPROVALS

- UL-file E52744
- cUL - file no. E52744, equivalent to CSA bulletin 5A
- DIN EN 60747-5-5 (VDE 0884) available with option 1

ORDERING INFORMATION			
<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 2px;">V</div> <div style="border: 1px solid black; padding: 2px;">O</div> <div style="border: 1px solid black; padding: 2px;">3</div> <div style="border: 1px solid black; padding: 2px;">0</div> <div style="border: 1px solid black; padding: 2px;">5</div> <div style="border: 1px solid black; padding: 2px;">#</div> <div style="border: 1px solid black; padding: 2px;">-</div> <div style="border: 1px solid black; padding: 2px;">X</div> <div style="border: 1px solid black; padding: 2px;">0</div> <div style="border: 1px solid black; padding: 2px;">#</div> <div style="border: 1px solid black; padding: 2px;">#</div> <div style="border: 1px solid black; padding: 2px;">T</div> </div> <div style="display: flex; justify-content: space-around; margin-top: 5px;"> <div style="text-align: center;">PART NUMBER</div> <div style="text-align: center;">PACKAGE OPTION</div> <div style="text-align: center;">TAPE AND REEL</div> </div>			
AGENCY CERTIFIED/PACKAGE	TRIGGER, CURRENT I <sub>FT</sub> (mA)		
<b>UL, cUL</b>	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: center;"><b>5</b></td> <td style="width: 50%; text-align: center;"><b>10</b></td> </tr> </table>	<b>5</b>	<b>10</b>
<b>5</b>	<b>10</b>		
DIP-6	VO3053      VO3052		
DIP-6, 400 mil, option 6	VO3053-X006      VO3052-X006		
SMD-6, option 7	VO3053-X007T      VO3052-X007T		
SMD-6, option 9	VO3053-X009T      VO3052-X009T		
<b>VDE, UL, cUL</b>	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: center;"><b>5</b></td> <td style="width: 50%; text-align: center;"><b>10</b></td> </tr> </table>	<b>5</b>	<b>10</b>
<b>5</b>	<b>10</b>		
DIP-6, 400 mil, option 6	-      VO3052-X016		
DIP-6, option 9	-      VO3052-X019T		

<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 - continuous		$I_F$	60	mA
Power dissipation		$P_{diss}$	100	mW
<b>OUTPUT</b>				
Off state output terminal voltage		$V_{DRM}$	600	V
Peak non-repetitive surge current	PW = 100 ms, 120 pps	$I_{TSM}$	1	A
Power dissipation		$P_{diss}$	200	mW
On-state RMS current		$I_{T(RMS)}$	100	mA
<b>COUPLER</b>				
Total power dissipation		$P_{tot}$	300	mW
Operating temperature		$T_{amb}$	-55 to +100	$^{\circ}\text{C}$
Storage temperature		$T_{stg}$	-55 to +150	$^{\circ}\text{C}$
Soldering temperature	10 s	$T_{slid}$	260	$^{\circ}\text{C}$

**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

<b>THERMAL CHARACTERISTICS</b>				
PARAMETER	SYMBOL	VALUE	UNIT	
Maximum LED junction temperature	$T_{jmax.}$	125	$^{\circ}\text{C}$	<p>The diagram shows a thermal network for an optocoupler. It features a bridge circuit with four resistors representing thermal resistances: <math>\theta_{DC}</math>, <math>\theta_{DE}</math>, <math>\theta_{DB}</math>, and <math>\theta_{EB}</math>. The nodes of the bridge are labeled with temperatures: <math>T_{JD}</math> (junction detector), <math>T_{JE}</math> (junction emitter), <math>T_{JC}</math> (junction case), and <math>T_{JB}</math> (junction board). External thermal resistances connect these nodes to ambient temperatures: <math>\theta_{CA}</math> (case to ambient) from <math>T_{JC}</math> to <math>T_A</math>; <math>\theta_{BA}</math> (board to ambient) from <math>T_{JB}</math> to <math>T_A</math>; <math>\theta_{JDB}</math> (junction detector to board) from <math>T_{JD}</math> to <math>T_B</math>; and <math>\theta_{JEC}</math> (junction emitter to case) from <math>T_{JE}</math> to <math>T_C</math>. The entire bridge is enclosed in a dashed box labeled 'Package'.</p>
Maximum output die junction temperature	$T_{jmax.}$	125	$^{\circ}\text{C}$	
Thermal resistance, junction emitter to board	$\theta_{JEB}$	150	$^{\circ}\text{C}/\text{W}$	
Thermal resistance, junction emitter to case	$\theta_{JEC}$	139	$^{\circ}\text{C}/\text{W}$	
Thermal resistance, junction detector to board	$\theta_{JDB}$	78	$^{\circ}\text{C}/\text{W}$	
Thermal resistance, junction detector to case	$\theta_{JDC}$	103	$^{\circ}\text{C}/\text{W}$	
Thermal resistance, junction emitter to junction detector	$\theta_{JED}$	496	$^{\circ}\text{C}/\text{W}$	
Thermal resistance, case to ambient	$\theta_{CA}$	3563	$^{\circ}\text{C}/\text{W}$	

**Note**

- The thermal model is represented in the thermal network below. Each resistance value given in this model can be used to calculate the temperatures at each node for a given operating condition. The thermal resistance from board to ambient will be dependent on the type of PCB, layout and thickness of copper traces. For a detailed explanation of the thermal model, please reference Vishay's Thermal Characteristics of Optocouplers application note



<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>							
Reverse current	$V_R = 6\text{ V}$		$I_R$	-	-	10	$\mu\text{A}$
Forward voltage	$I_F = 30\text{ mA}$		$V_F$	-	1.2	1.5	V
<b>OUTPUT</b>							
Leakage with LED off, either direction	$V_{DRM} = 600\text{ V}$		$I_{DRM}$	-	10	500	nA
Critical rate of rise off-state voltage	$V_D = 400\text{ V}$		$dV/dt_{cr}$	1500	2000	-	V/ $\mu\text{s}$
<b>COUPLER</b>							
LED trigger current, current required to latch output		VO3053	$I_{FT}$	-	-	5	mA
		VO3052	$I_{FT}$	-	-	10	mA
Peak on-state voltage, either direction	$I_{TM} = 100\text{ mA peak}$ , $I_F = \text{rated } I_{FT}$		$V_{TM}$	-	1.7	3	V
Holding current, either direction			$I_H$	-	200	-	$\mu\text{A}$
Coupling capacitance	10 kHz		$C_{IO}$	-	0.4	-	pF

**Note**

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

<b>SAFETY AND INSULATION RATINGS</b>				
PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Climatic classification	According to IEC 68 part 1		55 / 100 / 21	
Pollution degree	According to DIN VDE 0109		2	
Comparative tracking index	Insulation group IIIa	CTI	175	
Maximum rated withstanding isolation voltage	According to UL1577, $t = 1\text{ min}$	$V_{ISO}$	4420	$V_{RMS}$
Tested withstanding isolation voltage	According to UL1577, $t = 1\text{ s}$	$V_{ISO}$	5300	$V_{RMS}$
Maximum transient isolation voltage	According to DIN EN 60747-5-5	$V_{IOTM}$	8000	$V_{peak}$
Maximum repetitive peak isolation voltage	According to DIN EN 60747-5-5	$V_{IORM}$	890	$V_{peak}$
Isolation resistance	$T_{amb} = 25\text{ }^{\circ}\text{C}$ , $V_{IO} = 500\text{ V}$	$R_{IO}$	$\geq 10^{12}$	$\Omega$
	$T_{amb} = 100\text{ }^{\circ}\text{C}$ , $V_{IO} = 500\text{ V}$	$R_{IO}$	$\geq 10^{11}$	$\Omega$
Output safety power		$P_{SO}$	500	mW
Input safety current		$I_{SI}$	250	mA
Input safety temperature		$T_S$	175	$^{\circ}\text{C}$
Creepage distance	DIP-6, SMD-6 with option 7 and 9		$\geq 7$	mm
Clearance distance			$\geq 7$	mm
Creepage distance	DIP-6, 400 mil, option 6		$\geq 8$	mm
Clearance distance			$\geq 8$	mm
Insulation thickness		DTI	$\geq 0.4$	mm
Input to output test voltage, method A	$V_{IORM} \times 1.6 = V_{PR}$ , 100 % sample test with $t_M = 10\text{ s}$ , partial discharge $< 5\text{ pC}$	$V_{PR}$	1669	$V_{peak}$

**Note**

- As per IEC 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

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

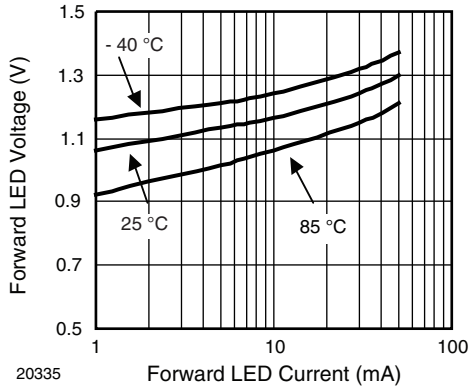


Fig. 1 - Forward Voltage vs. Forward Current

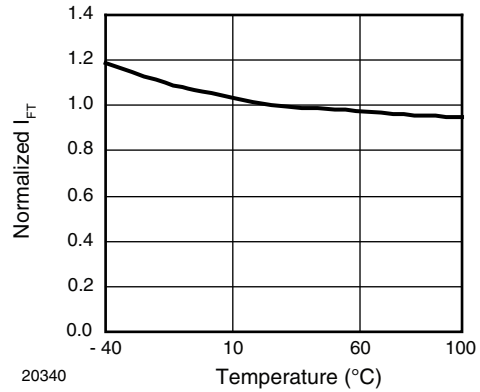


Fig. 4 - Normalized Trigger Current vs. Temperature

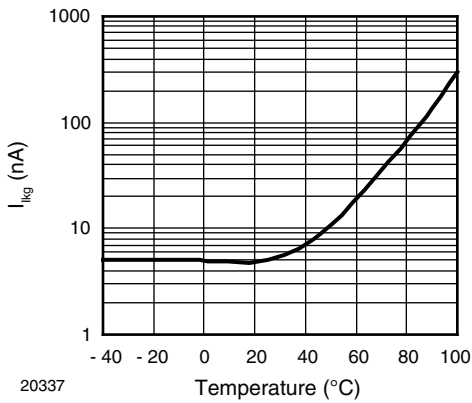


Fig. 2 - Off-State Leakage Current vs. Temperature

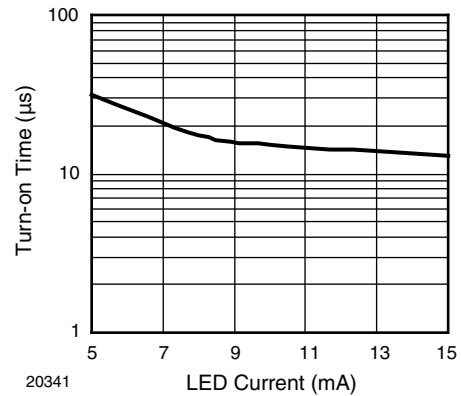


Fig. 5 - Turn-on Time vs. LED Current

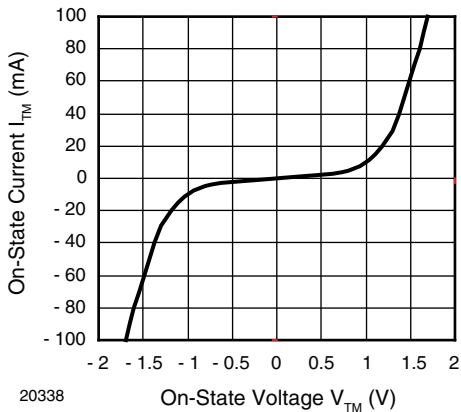


Fig. 3 - On-State Current vs.  $V_{TM}$

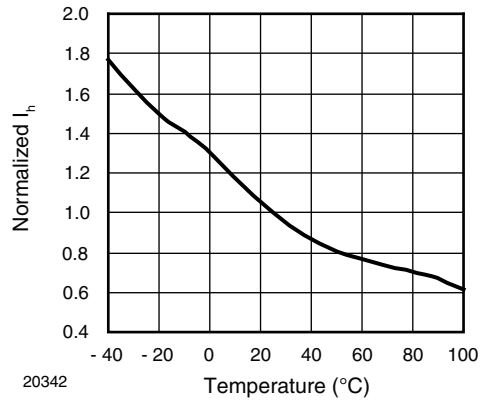


Fig. 6 - Normalized Holding Current vs. Temperature

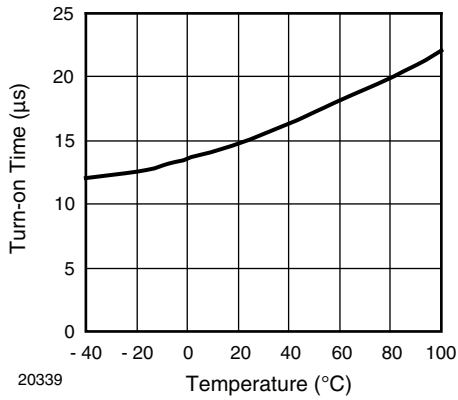


Fig. 7 - Turn-on Time vs. Temperature

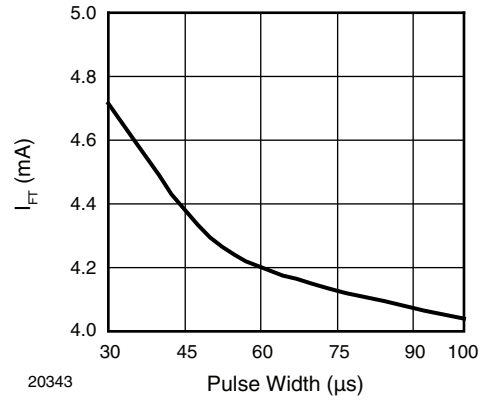
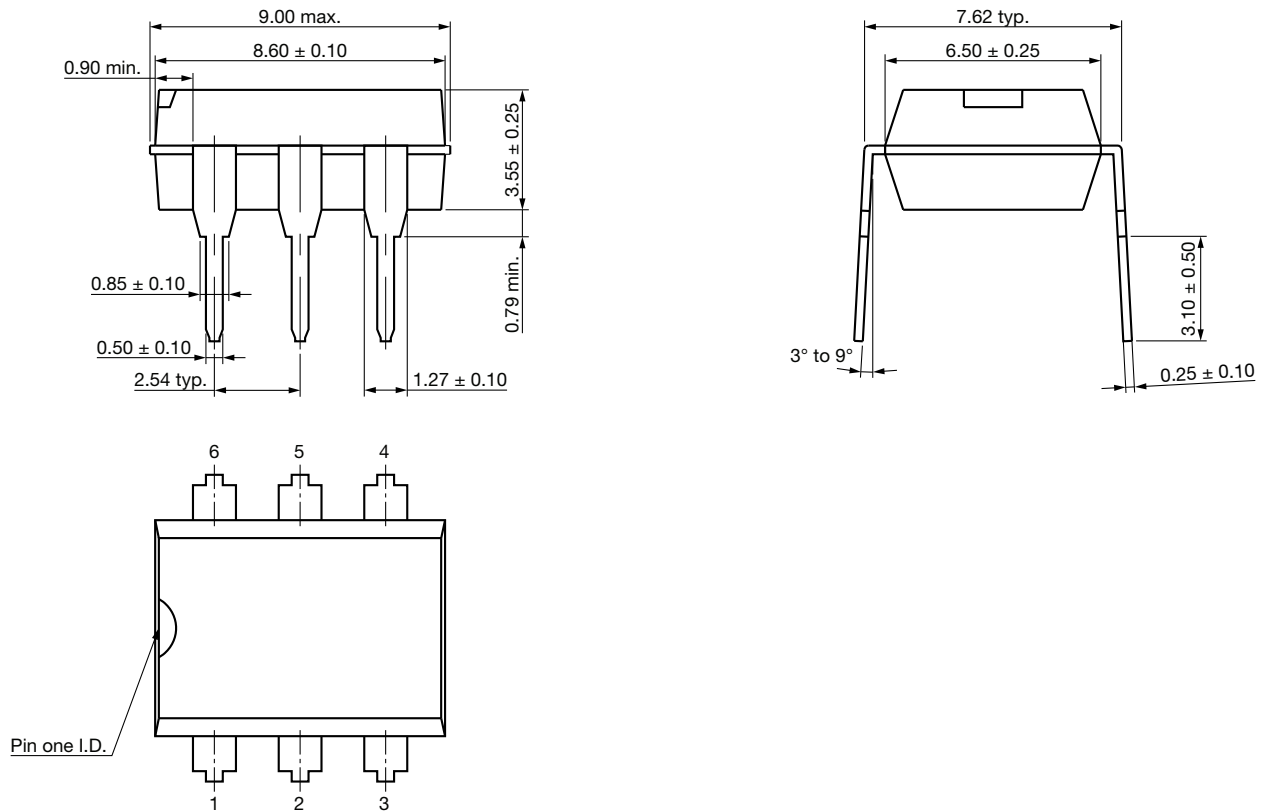


Fig. 8 - Trigger Current vs. Pulse Width

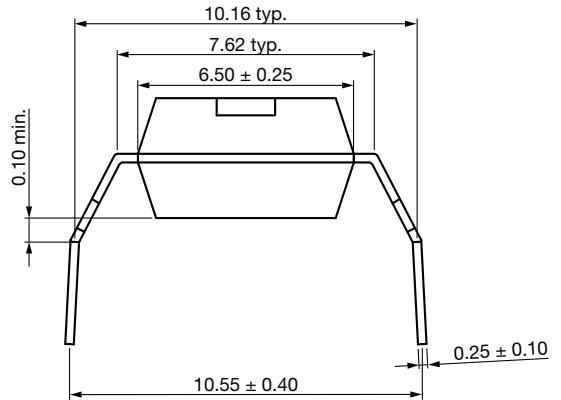
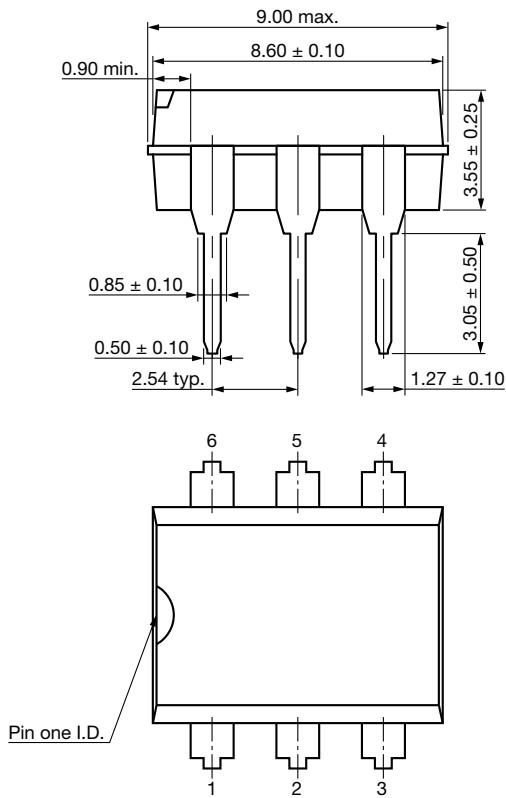
**PACKAGE DIMENSIONS** (in millimeters)

**DIP-6**

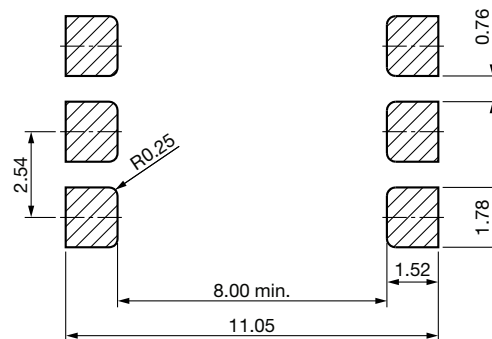
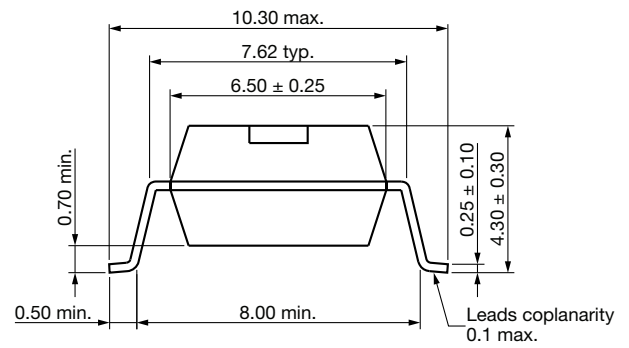
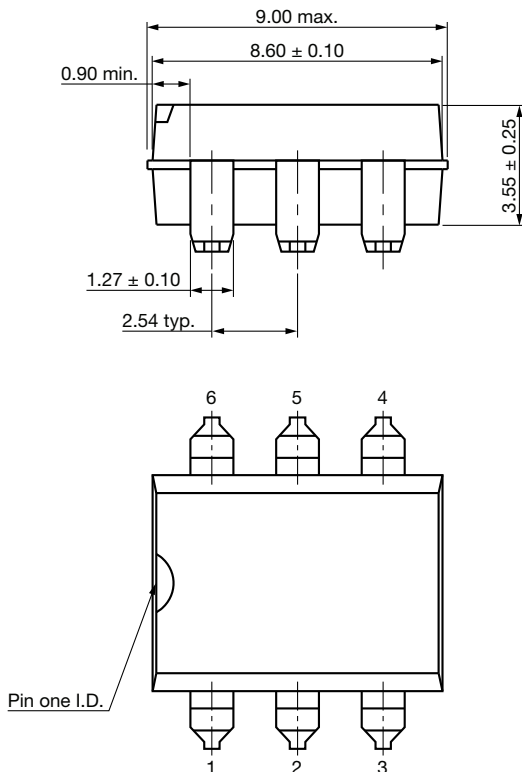




DIP-6, 400 mil, Option 6

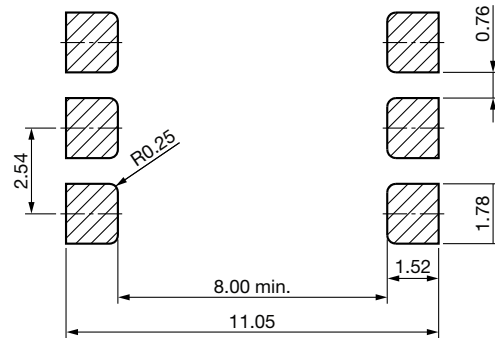
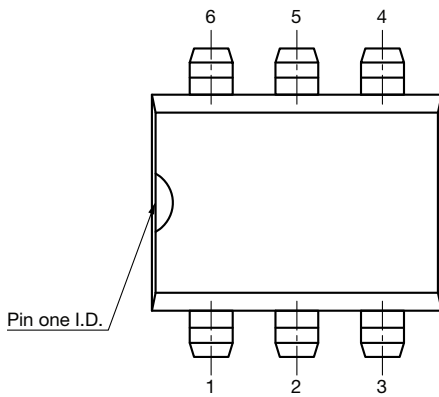
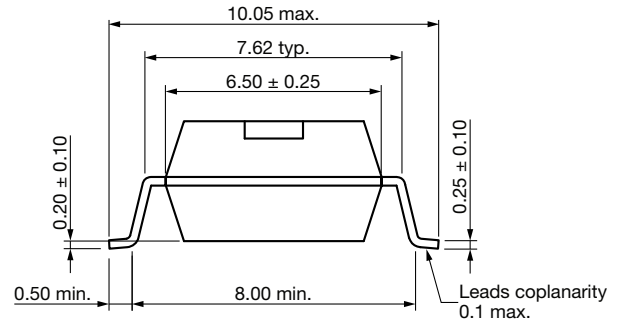
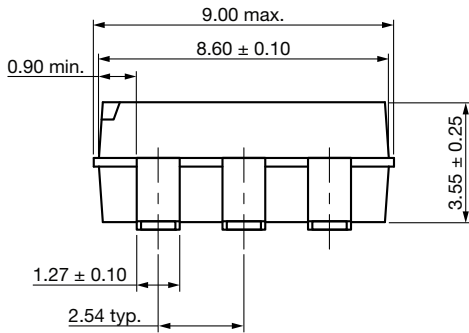


SMD-6, Option 7

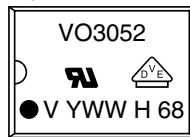




SMD-6, Option 9



PACKAGE MARKING (example of VO3052-X016)



Notes

- The VDE logo is only marked on option1 parts
- Tape and reel suffix (T) is not part of the package marking

**PACKING INFORMATION** (in millimeters)

**Tube**

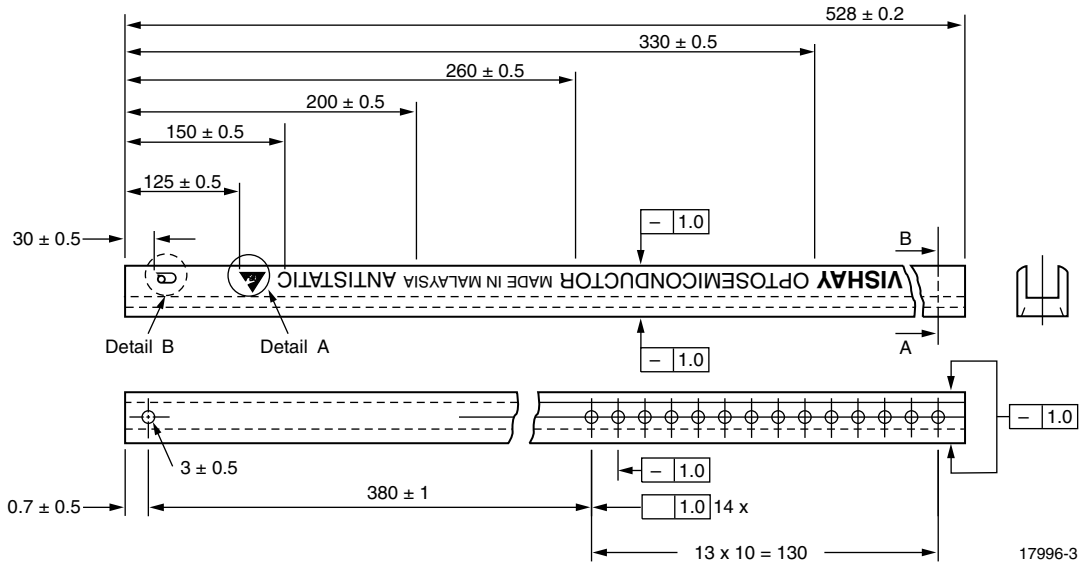


Fig. 9 - Shipping Tube Specifications for DIP-6 Packages

DEVICES PER TUBS			
TYPE	UNITS/TUBE	TUBES/BOX	UNITS/BOX
DIP-6	50	40	2000

**DIP-6**

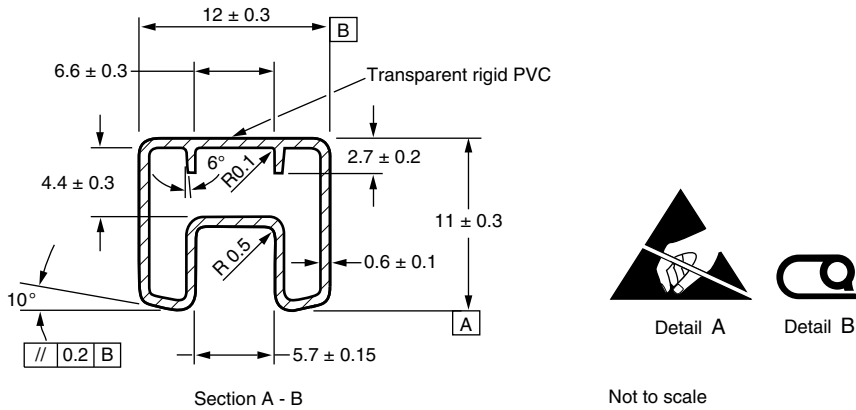


Fig. 10 - Tube Shipping Medium



**DIP-6, 400 mil, Option 6**

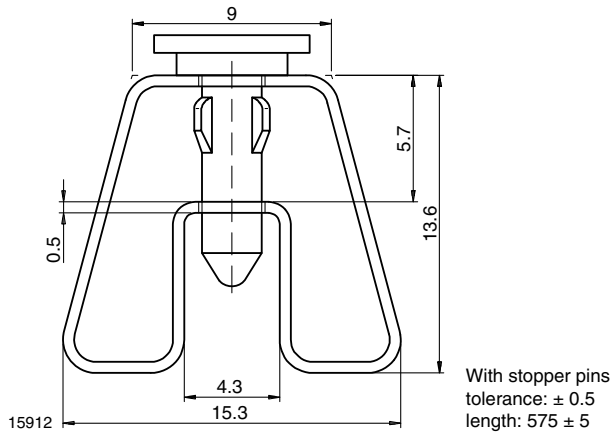


Fig. 11 - Tube Shipping Medium

**Tape and Reel**

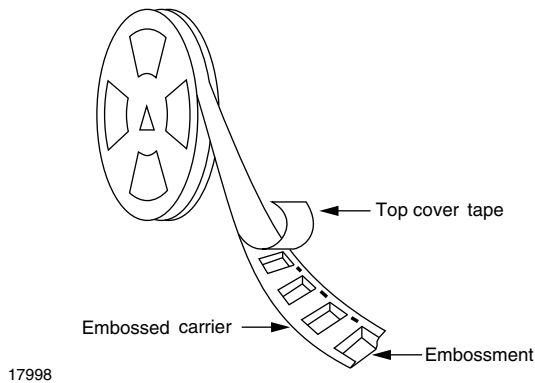


Fig. 12 - Tape and Reel Shipping Medium

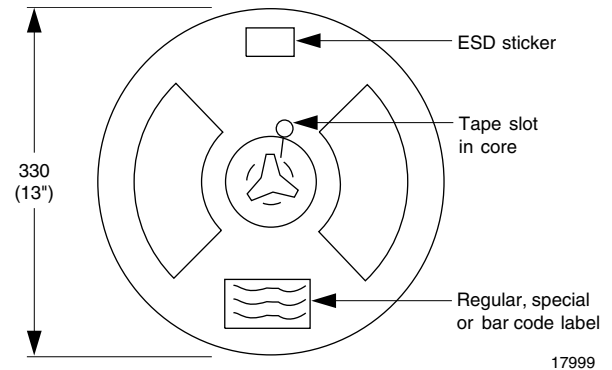


Fig. 13 - Tape and Reel Shipping Medium

**SMD-6, Option 7**

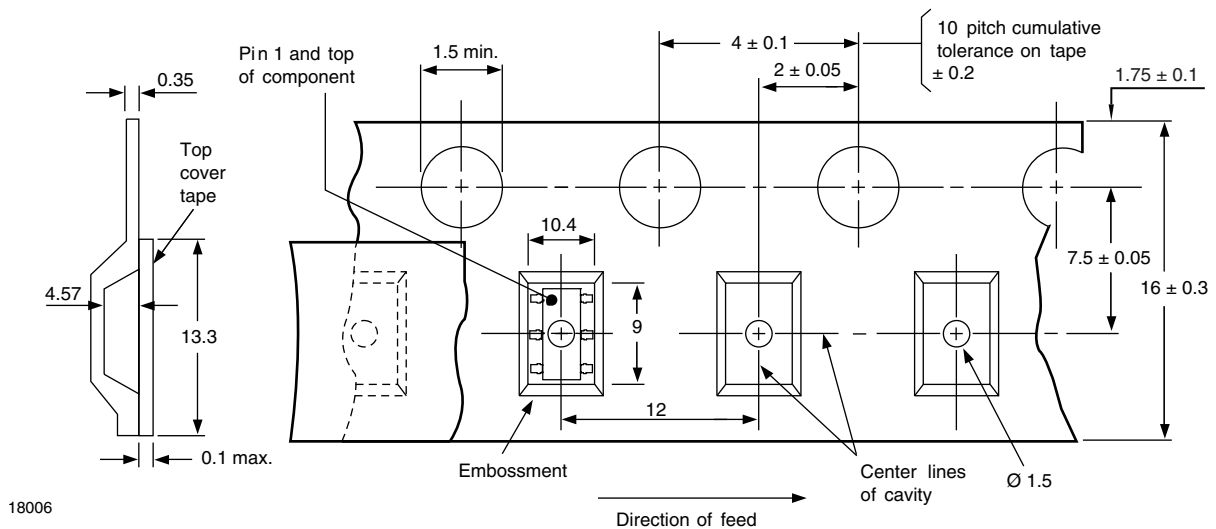


Fig. 14 - Tape and Reel Packing (1000 pieces on Reel)

**SMD-6, Option 9**

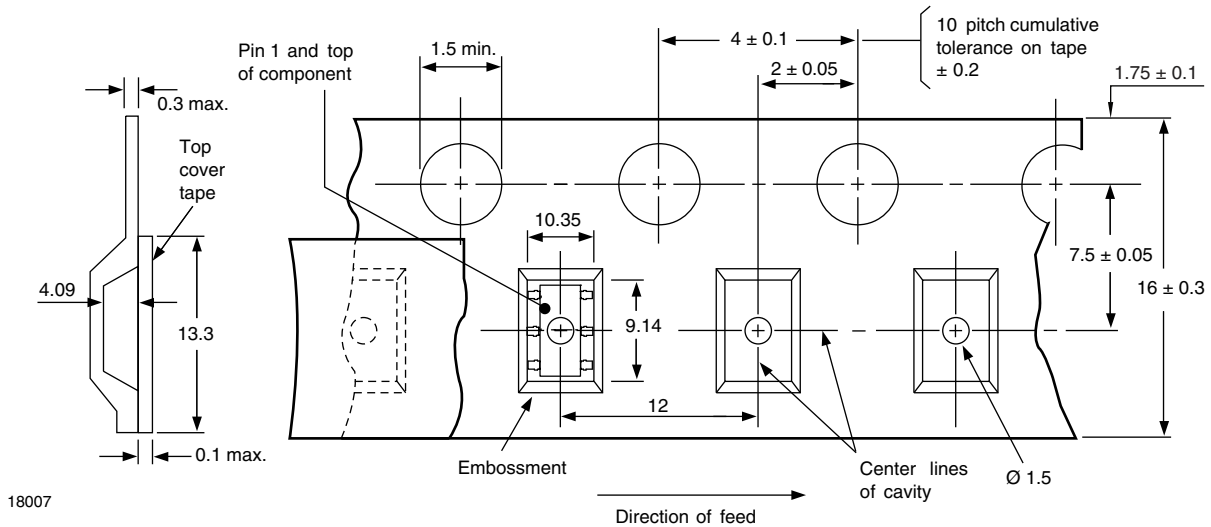


Fig. 15 - Tape and Reel Shipping Medium

**SOLDER PROFILES**

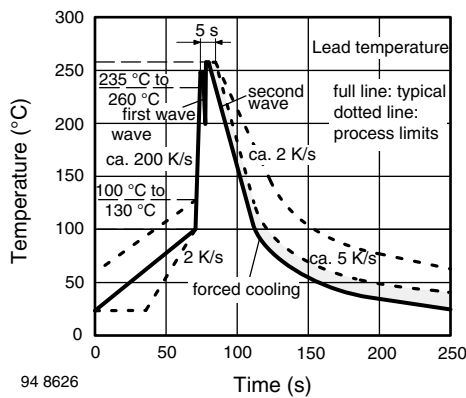


Fig. 16 - Wave Soldering Double Wave Profile According to J-STD-020 for DIP Devices

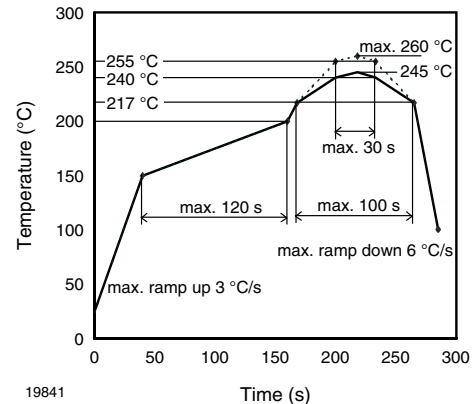


Fig. 17 - Lead (Pb)-free Reflow Solder Profile According to J-STD-020 for SMD Devices

**HANDLING AND STORAGE CONDITIONS**

ESD level: HBM class 2

Floor life: unlimited

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

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



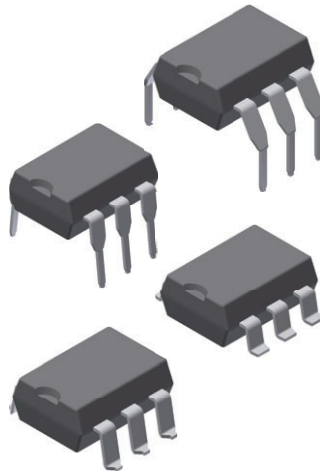
## Footprint and Schematic Information for VO3052, VO3053

The footprint and schematic symbols for the following parts can be accessed using the associated links. They are available in Eagle, Altium, KiCad, OrCAD / Allegro, Pulsonix, and PADS.

Note that the 3D models for these parts can be found on the Vishay product page.

PART NUMBER	FOOTPRINT / SCHEMATIC
VO3052	<a href="http://www.snapeda.com/parts/VO3052/Vishay/view-part">www.snapeda.com/parts/VO3052/Vishay/view-part</a>
VO3052-X007T	<a href="http://www.snapeda.com/parts/VO3052-X007T/Vishay/view-part">www.snapeda.com/parts/VO3052-X007T/Vishay/view-part</a>
VO3053	<a href="http://www.snapeda.com/parts/VO3053/Vishay/view-part">www.snapeda.com/parts/VO3053/Vishay/view-part</a>
VO3053-X007T	<a href="http://www.snapeda.com/parts/VO3053-X007T/Vishay/view-part">www.snapeda.com/parts/VO3053-X007T/Vishay/view-part</a>
VO3053-X009T	<a href="http://www.snapeda.com/parts/VO3053-X009T/Vishay/view-part">www.snapeda.com/parts/VO3053-X009T/Vishay/view-part</a>

For technical issues and product support, please contact [optocoupleranswers@vishay.com](mailto:optocoupleranswers@vishay.com).





## **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.

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.