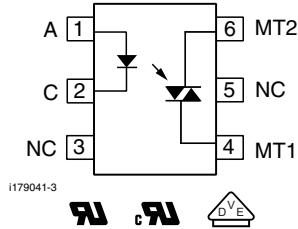


# Optocoupler, Phototriac Output, Non-Zero Crossing, 1.5 kV/ $\mu$ s dV/dt, 600 V



i179041-3



## FEATURES

- 1500 V/ $\mu$ s dV/dt minimum 2000 V/ $\mu$ s 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 / cUL](#) 1577
- [DIN EN 60747-5-5 \(VDE 0884\)](#) available with option 1

## LINKS TO ADDITIONAL RESOURCES



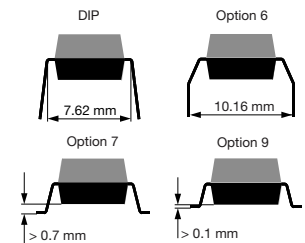
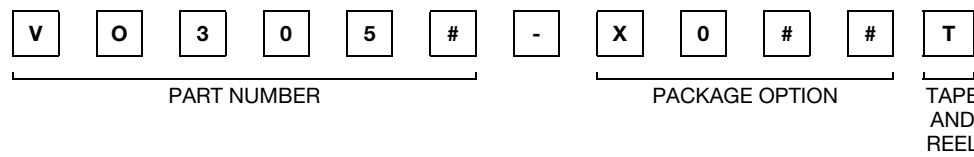
**SPICE**  
Models

## 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.

## ORDERING INFORMATION



| AGENCY CERTIFIED / PACKAGE | TRIGGER, CURRENT I <sub>FT</sub> (mA) |              |
|----------------------------|---------------------------------------|--------------|
|                            | 5                                     | 10           |
| <b>UL, cUL</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>        |                                       |              |
| DIP-6                      | -                                     | VO3052-X001  |
| DIP-6, 400 mil, option 6   | -                                     | VO3052-X016  |
| SMD-6, option 7            | VO3053-X017T                          | -            |
| SMD-6, option 9            | -                                     | VO3052-X019T |

### 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 - 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   | $^{\circ}\text{C}$          |  |
| 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  | $I_{TM} = 100\text{ mA peak}$ ,<br>$I_F = \text{rated } I_{FT}$ |        | $V_{TM}$     | -    | 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)

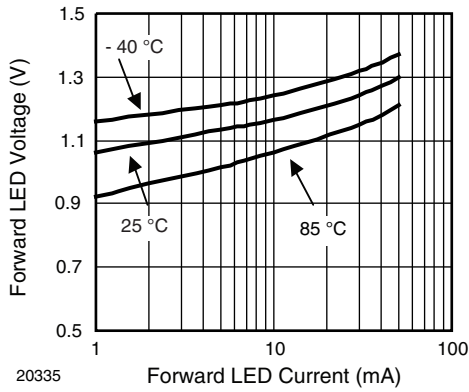


Fig. 1 - Forward Voltage vs. Forward Current

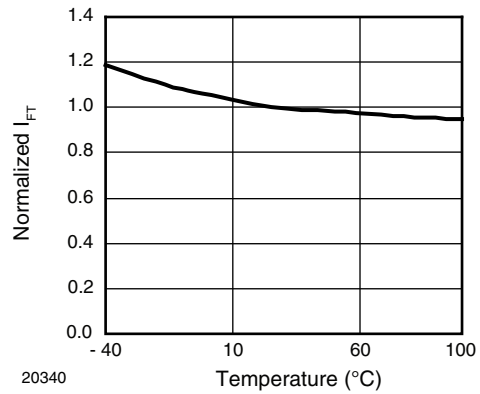


Fig. 4 - Normalized Trigger Current vs. Temperature

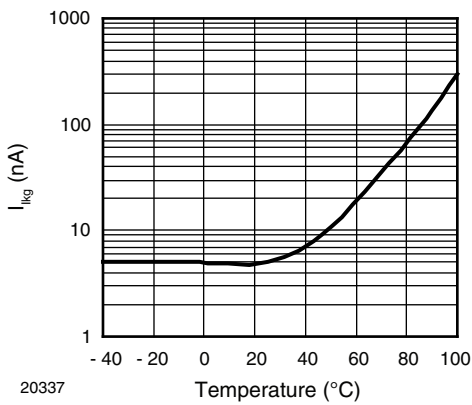


Fig. 2 - Off-State Leakage Current vs. Temperature

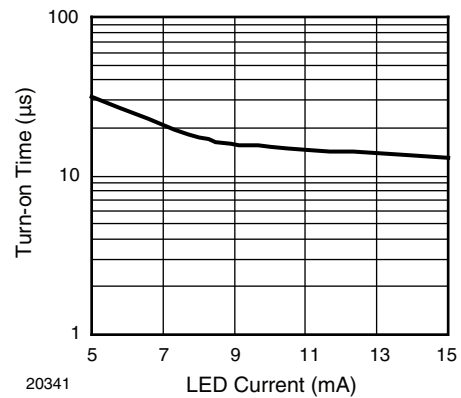


Fig. 5 - Turn-on Time vs. LED Current

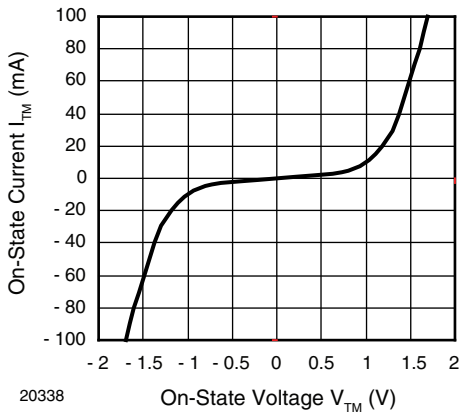


Fig. 3 - On-State Current vs.  $V_{TM}$

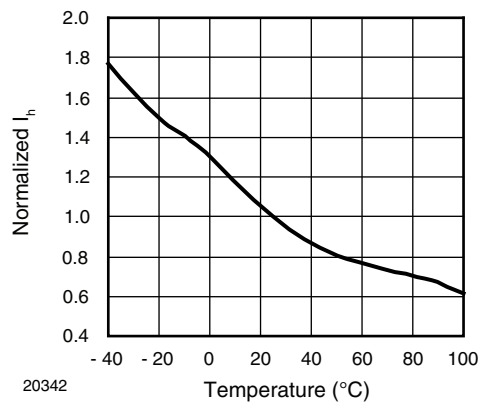


Fig. 6 - Normalized Holding Current vs. Temperature

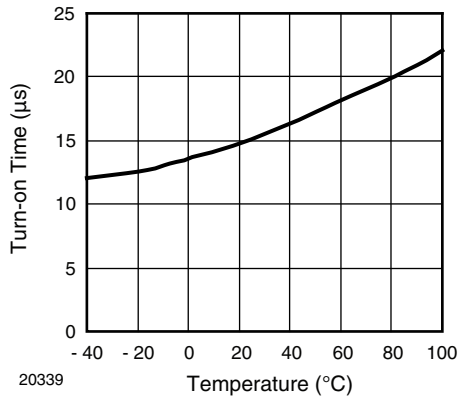


Fig. 7 - Turn-on Time vs. Temperature

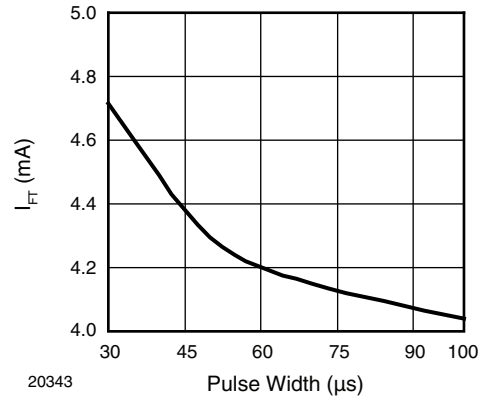
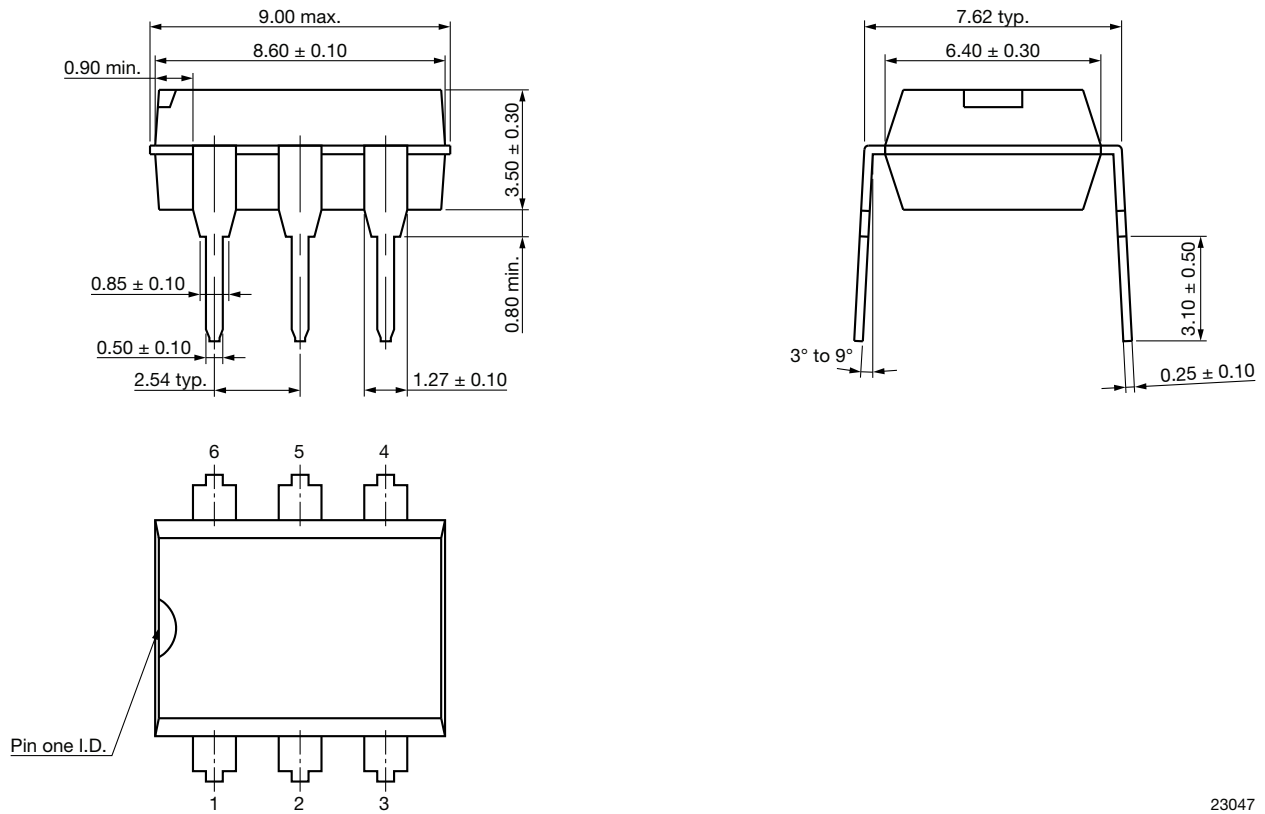


Fig. 8 - Trigger Current vs. Pulse Width

**PACKAGE DIMENSIONS** (in millimeters)

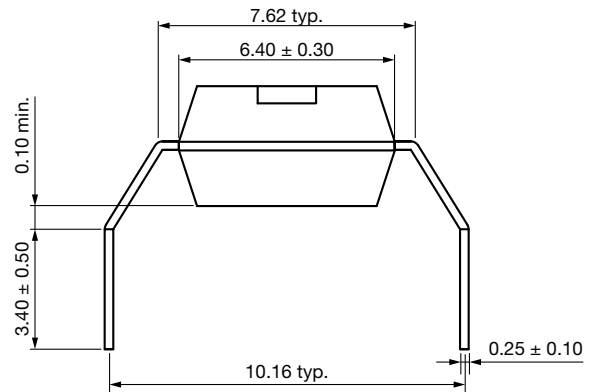
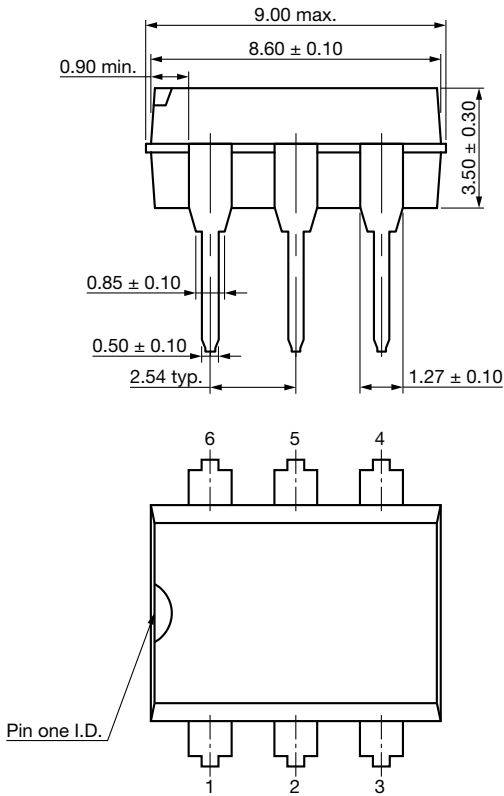
**DIP-6**



23047

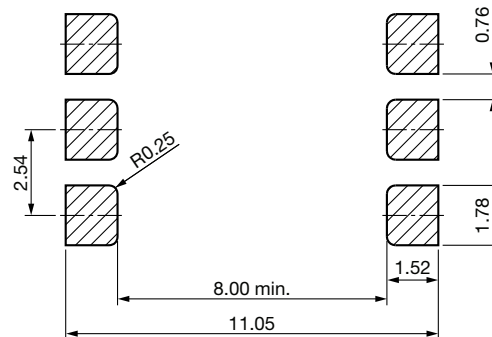
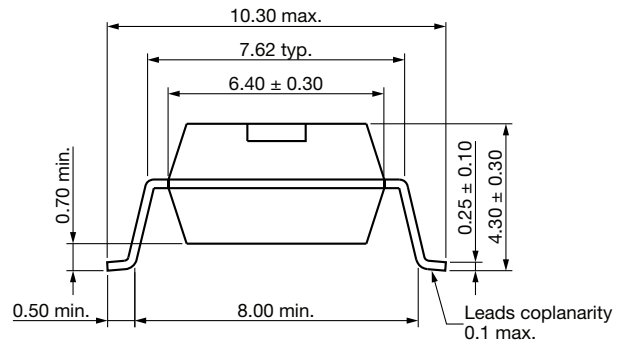
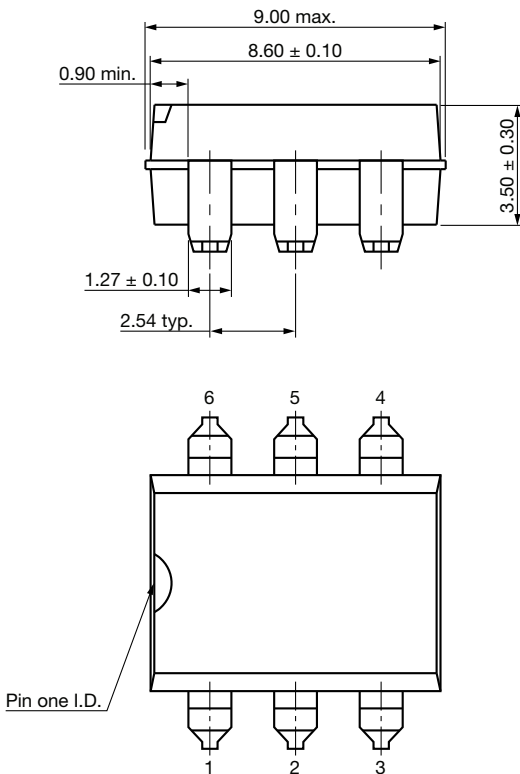


DIP-6, 400 mil, Option 6



23048

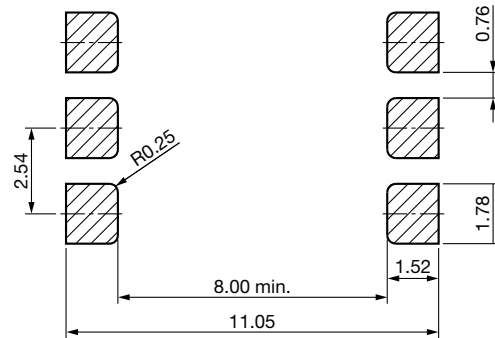
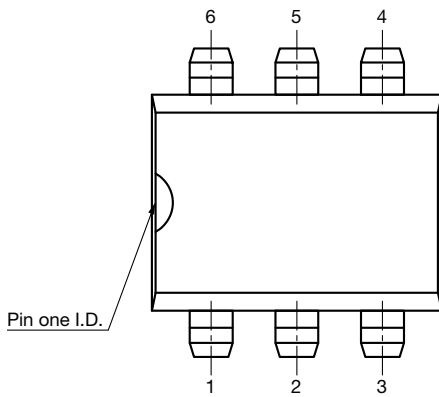
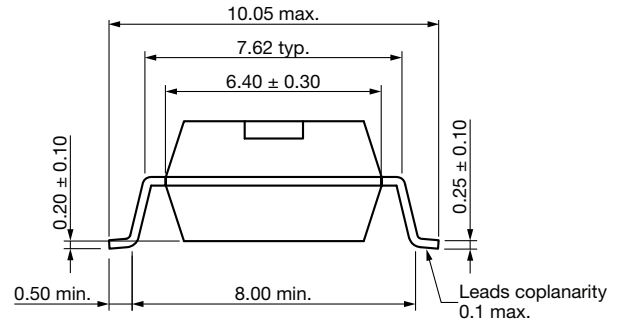
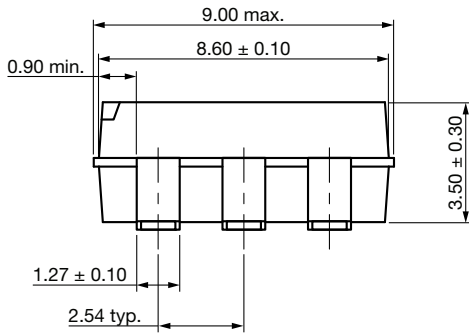
SMD-6, Option 7



23049

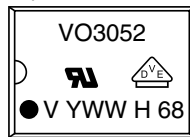


SMD-6, Option 9



23050

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**

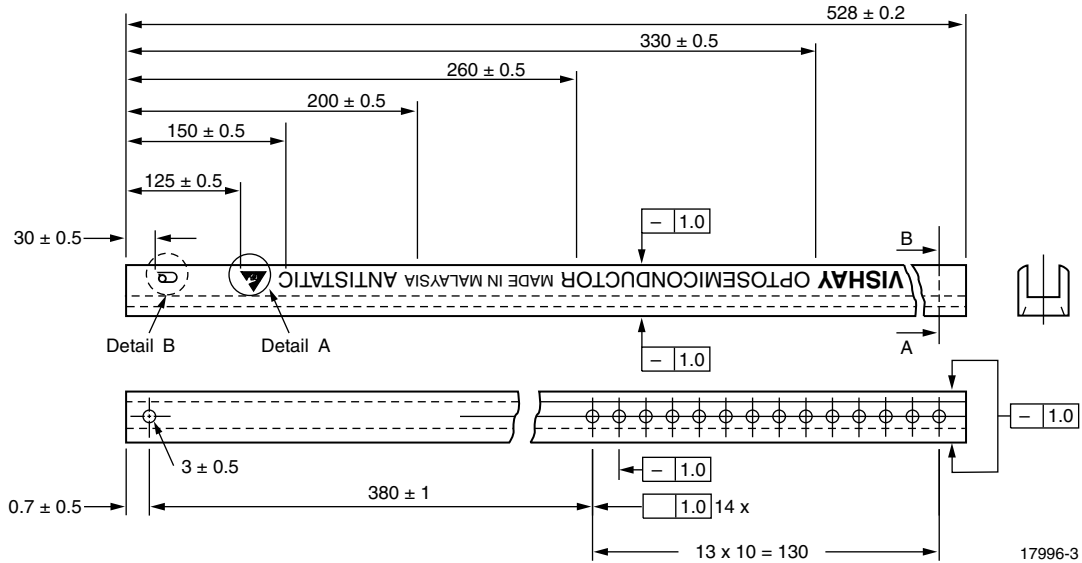


Fig. 9 - Shipping Tube Specifications for DIP-6 Packages

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

**DIP-6**

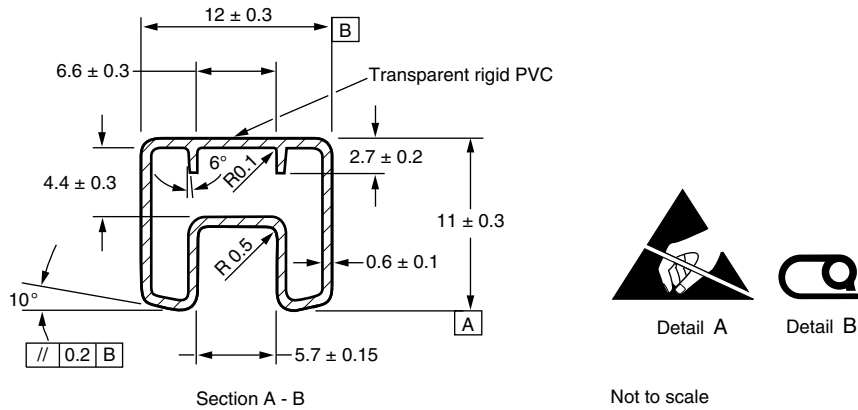


Fig. 10 - Tube Shipping Medium



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

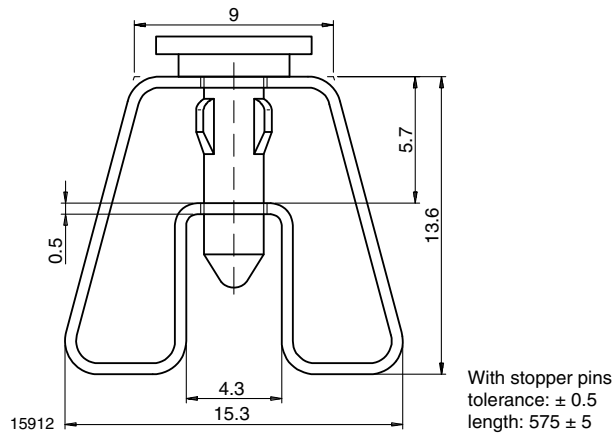


Fig. 11 - Tube Shipping Medium

**Tape and Reel**

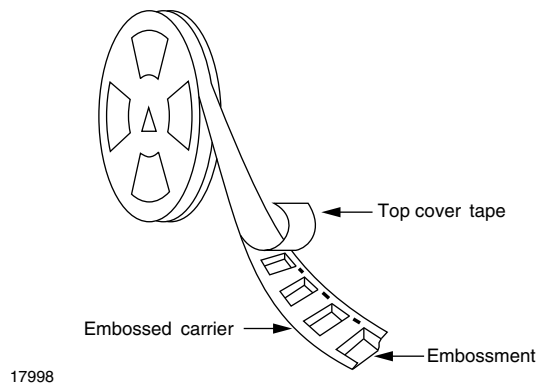


Fig. 12 - Tape and Reel Shipping Medium

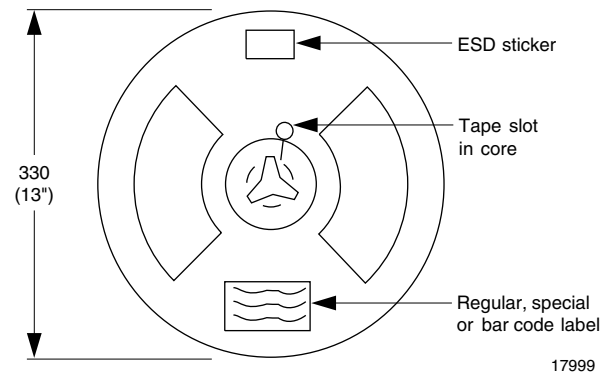


Fig. 13 - Tape and Reel Shipping Medium

**SMD-6, Option 7**

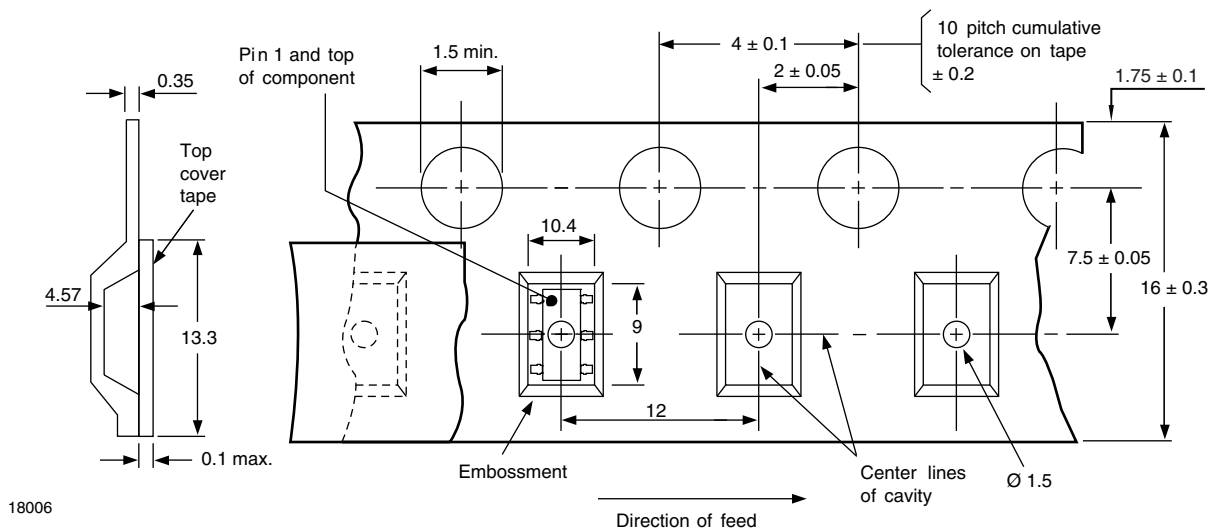


Fig. 14 - Tape and Reel Packing (1000 pieces on Reel)

**SMD-6, Option 9**

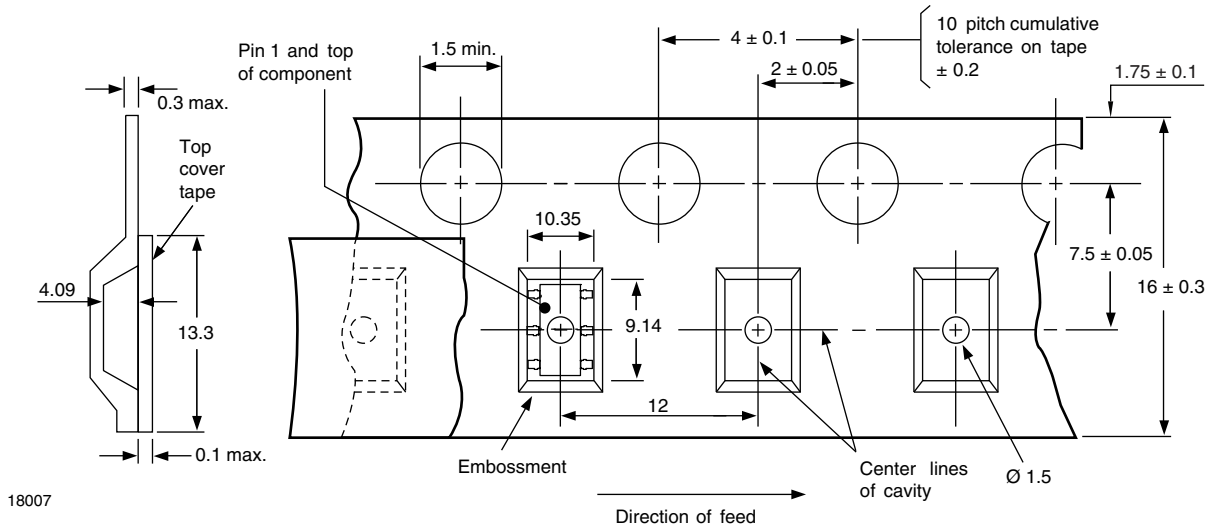


Fig. 15 - Tape and Reel Shipping Medium

**SOLDER PROFILES**

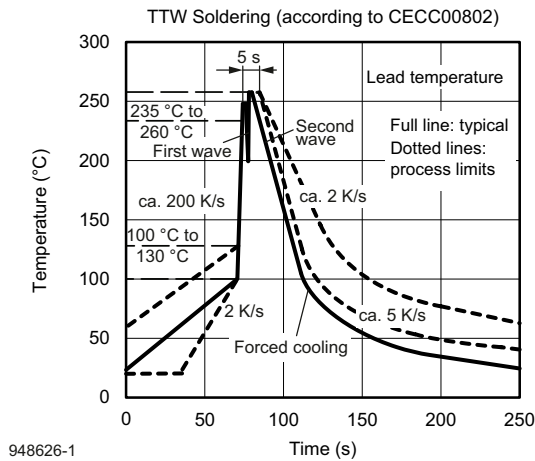


Fig. 16 - Wave Soldering Double Wave Profile According to J-STD-020 for DIP Devices

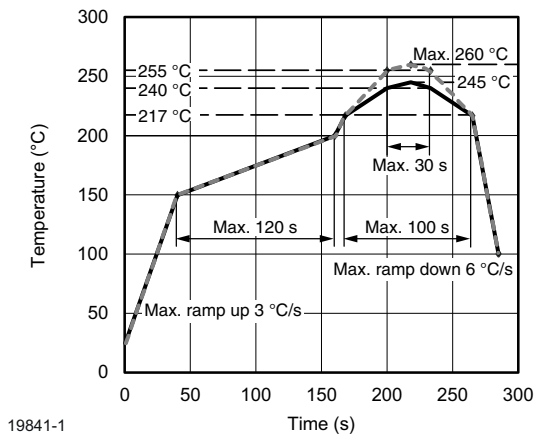


Fig. 17 - Lead (Pb)-free Reflow Solder Profile According to J-STD-020 for SMD Devices

**HANDLING AND STORAGE CONDITIONS**

- ESD level: HBM class 2
- Floor life: unlimited
- Conditions:  $T_{amb} < 30\text{ °C}$ ,  $RH < 85\%$
- Moisture sensitivity level 1, according to J-STD-020



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