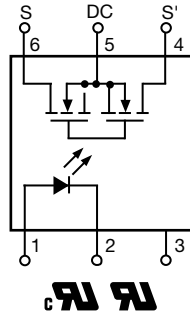
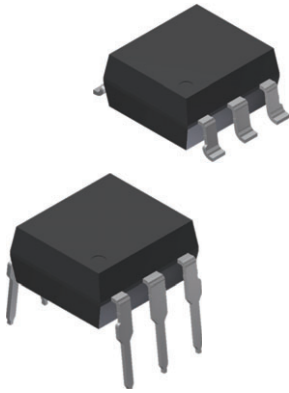


# 1 Form A Solid-State Relay



## FEATURES

- High speed SSR -  $t_{on}/t_{off} < 800 \mu s$
- Maximum  $R_{ON}$  0.25  $\Omega$
- Isolation test voltage 5300  $V_{RMS}$
- Load voltage 60 V
- Load current 2  $A_{DC}$  configuration
- DIP-6 package
- Clean bounce free switching
- TTL / CMOS compatible input
- Available on tape and reel
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
COMPLIANT

## DESCRIPTION

The VO14642 is a high speed single channel normally open solid-state relay (SPST - 1 form A) in a DIP-6 package. The relay is constructed as a multi-chip hybrid device. A high efficient infrared LED enables low forward current on the input side. On the output side high performance MOSFET switches provide a low  $R_{ON}$  and can be configured for AC/DC or DC only operation.

## APPLICATIONS

- Instrumentation
- Industrial controls
- Security
- Automatic measurement equipment

## AGENCY APPROVALS

- UL1577
- cUL - UL1577
- DIN EN 60747-5-5 (VDE 0884-5) capable, consult sales representative for details

### Note

- Agency approvals are valid only for ambient temperature range -40 °C to 85 °C

| ORDERING INFORMATION |   |   |   |   |   |   |                      |                    |   |                  |   |  |  |
|----------------------|---|---|---|---|---|---|----------------------|--------------------|---|------------------|---|--|--|
| V                    | O | 1 | 4 | 6 | 4 | 2 | A                    | x                  | x | T                | R |  |  |
| PART NUMBER          |   |   |   |   |   |   | ELECTR.<br>VARIATION | PACKAGE<br>CONFIG. |   | TAPE AND<br>REEL |   |  |  |
| <b>PACKAGE</b>       |   |   |   |   |   |   |                      |                    |   |                  |   |  |  |
| SMD-6, tape and reel |   |   |   |   |   |   |                      |                    |   | VO14642AABTR     |   |  |  |
| DIP-6, Tubes         |   |   |   |   |   |   |                      |                    |   | VO14642AT        |   |  |  |



| ABSOLUTE MAXIMUM RATINGS (T <sub>amb</sub> = 25 °C, unless otherwise specified) |                |                   |             |      |
|---|----------------|-------------------|-------------|------|
| PARAMETER   | TEST CONDITION | SYMBOL            | VALUE       | UNIT |
| <b>INPUT</b>  |                |                   |             |      |
| LED continuous forward current  |                | I <sub>F</sub>    | 50          | mA   |
| LED reverse voltage   |                | V <sub>R</sub>    | 5           | V    |
| LED power dissipation   | At 25 °C       | P <sub>diss</sub> | 80          | mW   |
| <b>OUTPUT</b>   |                |                   |             |      |
| DC or peak AC load voltage  |                | V <sub>L</sub>    | 60          | V    |
| Load current (DC only)  |                | I <sub>L</sub>    | 2           | A    |
| Peak load current (AC/DC)   | t = 10 ms      | I <sub>LPK</sub>  | 3.6         | A    |
| Output power dissipation  | At 25 °C       | P <sub>diss</sub> | 250         | mW   |
| <b>SSR</b>  |                |                   |             |      |
| Total power dissipation   |                | P <sub>diss</sub> | 330         | mW   |
| Ambient temperature range   |                | T <sub>amb</sub>  | -55 to +85  | °C   |
| Storage temperature range   |                | T <sub>stg</sub>  | -55 to +125 | °C   |
| Soldering temperature <sup>(1)</sup>  | t ≤ 10 s max.  | T <sub>slid</sub> | 260         | °C   |

**Notes**

- 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
- <sup>(1)</sup> Refer to reflow profile for soldering conditions for surface mounted devices (SMD). Refer to wave profile for soldering conditions for through hole devices (DIP)

**ABSOLUTE MAXIMUM RATING CURVE**

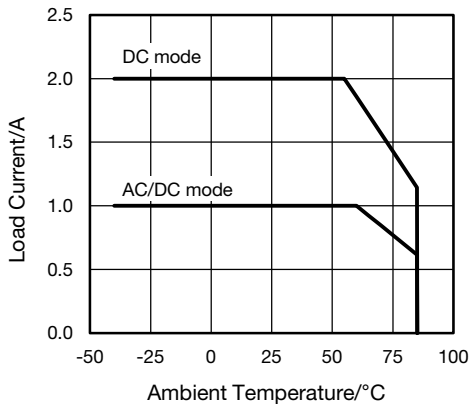
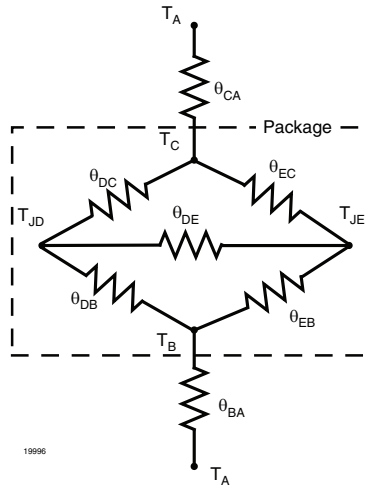


Fig. 1 - Load Current (AC/DC) vs. Temperature

| THERMAL CHARACTERISTICS                                   |                |                    |       |      |
|---|----------------|--------------------|-------|------|
| PARAMETER   | TEST CONDITION | SYMBOL             | VALUE | UNIT |
| Maximum LED junction temperature                          | At 25 °C       | T <sub>jmax.</sub> | 125   | °C   |
| Maximum output die junction temperature                   | At 25 °C       | T <sub>jmax.</sub> | 125   | °C   |
| Thermal resistance, junction emitter to board             | At 25 °C       | θ <sub>EB</sub>    | 176   | °C/W |
| Thermal resistance, junction emitter to case              | At 25 °C       | θ <sub>EC</sub>    | 208   | °C/W |
| Thermal resistance, junction detector to board            | At 25 °C       | θ <sub>DB</sub>    | 67    | °C/W |
| Thermal resistance, junction detector to case             | At 25 °C       | θ <sub>DC</sub>    | 134   | °C/W |
| Thermal resistance, junction emitter to junction detector | At 25 °C       | θ <sub>ED</sub>    | 310   | °C/W |
| Thermal resistance, case to ambient                       | At 25 °C       | θ <sub>CA</sub>    | 2180  | °C/W |

**Note**

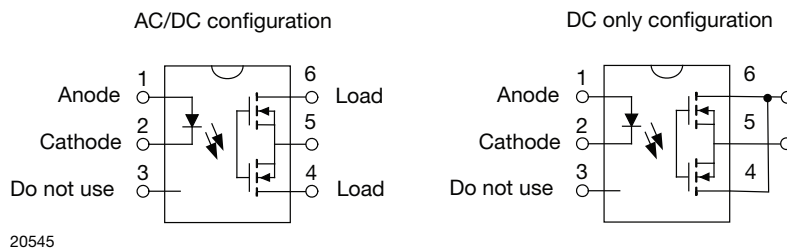
- The thermal model is represented in the thermal network below. Each resistance value given in this model can be used to calculate the temperatures at each node for a given operating condition. The thermal resistance from board to ambient will be dependent on the type of PCB, layout and thickness of 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  | SYMBOL     | MIN. | TYP. | MAX. | UNIT          |
| <b>INPUT</b>   |   |            |      |      |      |               |
| LED forward current, switch turn-on  | $I_L = 1\text{ A}$ , $V_L \leq 0.5\text{ V}$ , $t = 10\text{ ms}$ | $I_{Fon}$  | -    | 0.5  | 2    | mA            |
| LED forward current, switch turn-off   | $V_L = 60\text{ V}$ , $I_L < 1\text{ }\mu\text{A}$                | $I_{Foff}$ | 50   | -    | -    | $\mu\text{A}$ |
| LED reverse current  | $V_R = 5\text{ V}$  | $I_R$      | -    | -    | 10   | $\mu\text{A}$ |
| LED forward voltage  | $I_F = 10\text{ mA}$  | $V_F$      | 1    | 1.3  | 1.5  | V             |
| <b>OUTPUT</b>  |   |            |      |      |      |               |
| On-resistance (AC/DC)  | $I_F = 10\text{ mA}$ , $I_L = 1\text{ A}$                         | $R_{ON}$   | -    | 0.18 | 0.25 | $\Omega$      |
| On-resistance (DC only)  | $I_F = 10\text{ mA}$ , $I_L = 2\text{ A}$                         | $R_{ON}$   | -    | 0.05 | 0.07 | $\Omega$      |
| Off-state leakage current  | $I_F = 0\text{ mA}$ , $V_L = 60\text{ V}$                         | $I_{LEAK}$ | -    | -    | 1    | $\mu\text{A}$ |

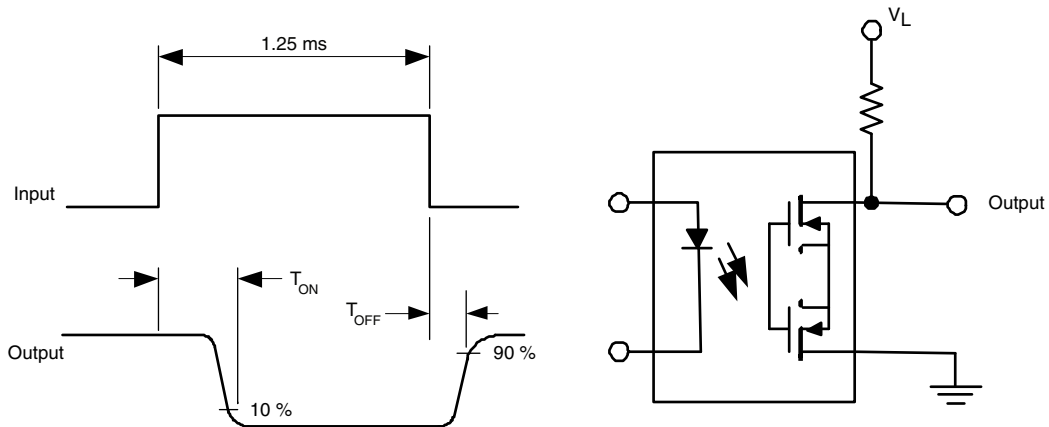
**Note**

- Minimum and maximum values are testing requirements. 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

**PIN CONFIGURATION**


20545

| <b>SWITCHING CHARACTERISTICS (AC/DC CONNECTION)</b> |  |           |      |      |      |               |
|---|--|-----------|------|------|------|---------------|
| PARAMETER   | TEST CONDITION   | SYMBOL    | MIN. | TYP. | MAX. | UNIT          |
| Turn-on time  | $I_F = 10\text{ mA}$ , $V_L = 30\text{ V}$ , $I_L = 200\text{ mA}$ | $t_{on}$  | -    | 370  | 800  | $\mu\text{s}$ |
| Turn-off time                                       | $I_F = 10\text{ mA}$ , $V_L = 30\text{ V}$ , $I_L = 200\text{ mA}$ | $t_{off}$ | -    | 50   | 800  | $\mu\text{s}$ |
| Turn-on time  | $I_F = 10\text{ mA}$ , $V_L = 5\text{ V}$ , $I_L = 1\text{ A}$     | $t_{on}$  | -    | 550  | -    | $\mu\text{s}$ |
| Turn-off time                                       | $I_F = 10\text{ mA}$ , $V_L = 5\text{ V}$ , $I_L = 1\text{ A}$     | $t_{off}$ | -    | 18   | -    | $\mu\text{s}$ |



20991-1

| SAFETY AND INSULATION RATINGS                |  |            |                |                    |
|--|--|------------|----------------|--------------------|
| PARAMETER                                    | TEST CONDITION   | SYMBOL     | VALUE          | UNIT               |
| Climatic classification                      | According to IEC 68 part 1                                     |            | 40 / 085 / 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 min                                 | $V_{ISO}$  | 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                         | $T_{amb} = 25\text{ }^{\circ}\text{C}, V_{IO} = 500\text{ V}$  | $R_{IO}$   | $\geq 10^{12}$ | $\Omega$           |
|  | $T_{amb} = 100\text{ }^{\circ}\text{C}, V_{IO} = 500\text{ V}$ | $R_{IO}$   | $\geq 10^{11}$ | $\Omega$           |
|  | $T_{amb} = T_S, V_{IO} = 500\text{ V}$                         | $R_{IO}$   | $\geq 10^9$    | $\Omega$           |
| Output safety power                          |  | $P_{SO}$   | 400            | mW                 |
| Input safety current                         |  | $I_{SI}$   | 150            | mA                 |
| Input safety temperature                     |  | $T_S$      | 165            | $^{\circ}\text{C}$ |
| Creepage distance                            |  |            | $\geq 7$       | mm                 |
| Clearance distance                           |  |            | $\geq 7$       | mm                 |
| Insulation thickness                         |  | DTI        | $\geq 0.4$     | mm                 |

**Note**

- This SSR is suitable for "safe electrical insulation" only within the safety ratings. Compliance with the safety ratings shall be ensured by means of protective circuits

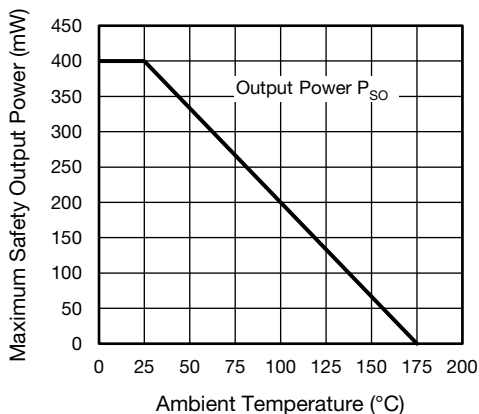


Fig. 2 - Safety Derating (input)

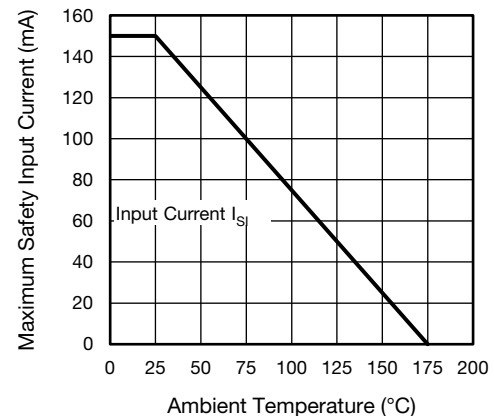


Fig. 3 - Safety Derating (output)



TYPICAL CHARACTERISTICS (T<sub>amb</sub> = 25 °C, unless otherwise specified)

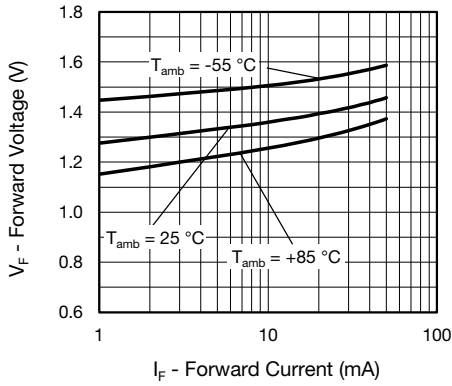


Fig. 4 - Forward Voltage vs. Forward Current

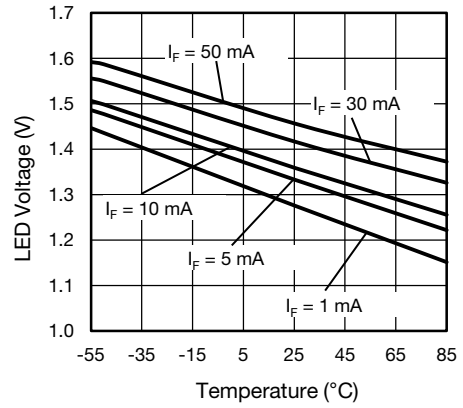


Fig. 7 - LED Voltage vs. Temperature

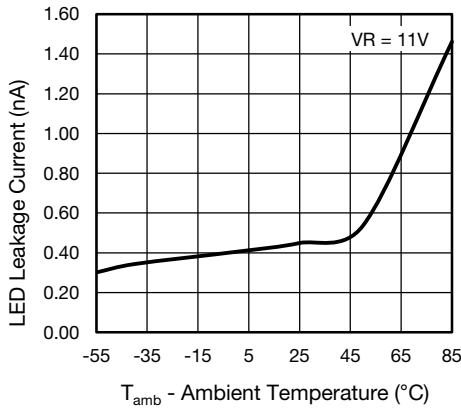


Fig. 5 - LED Leakage Current vs. Ambient Temperature

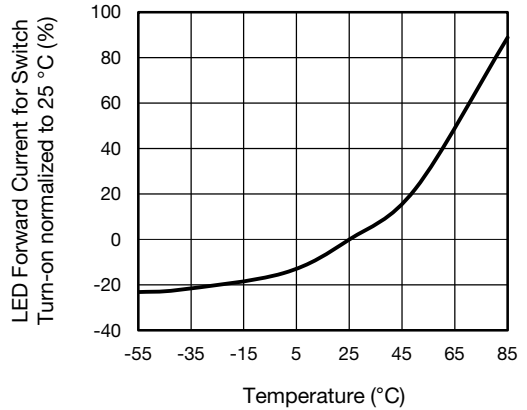


Fig. 8 - LED Forward Current for Switch Turn-On vs. Temperature

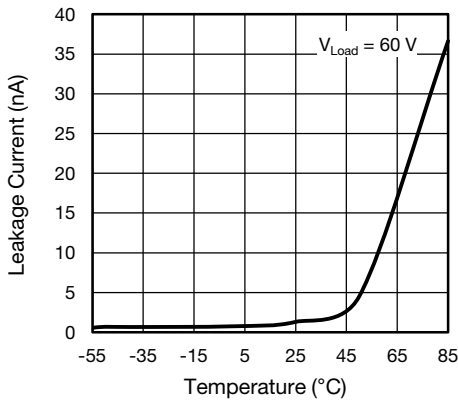


Fig. 6 - Leakage Current vs. Temperature

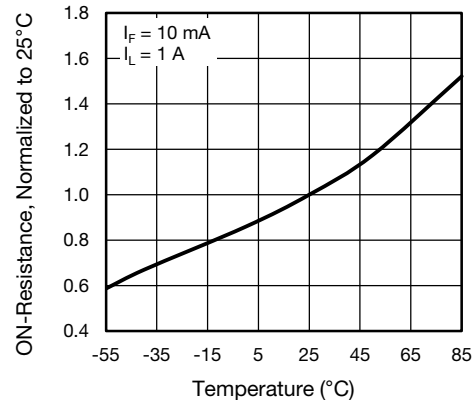


Fig. 9 - On-Resistance vs. Temperature

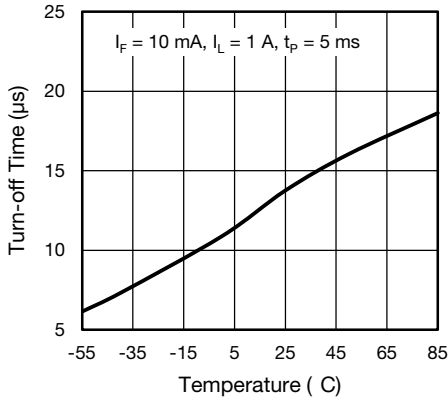


Fig. 10 - Turn-Off Time vs. Temperature

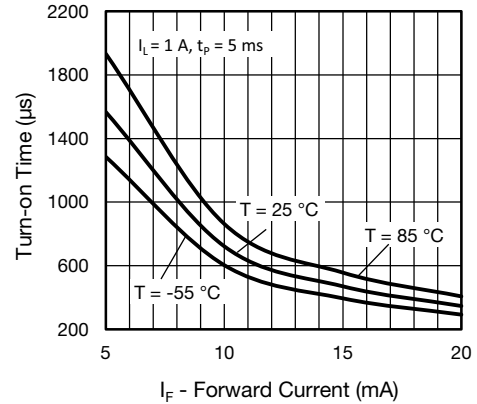


Fig. 13 - Turn-On Time vs. Forward Current

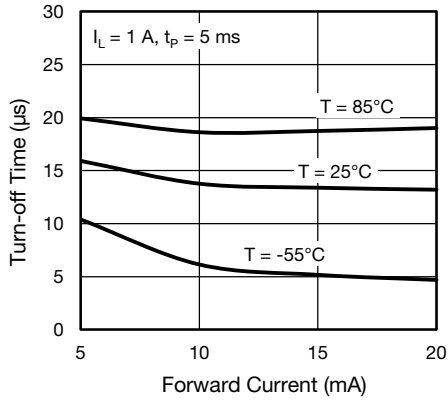


Fig. 11 - Turn-Off Time vs. Forward Current

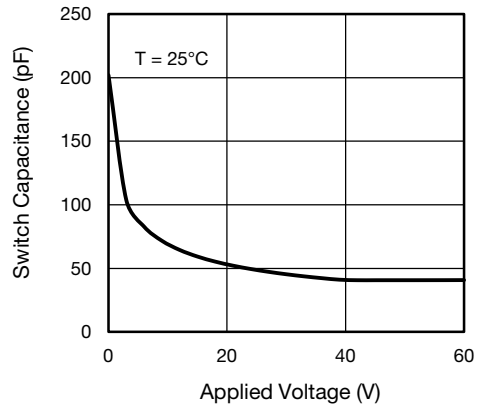


Fig. 14 - Switch Capacitance vs. Applied Voltage

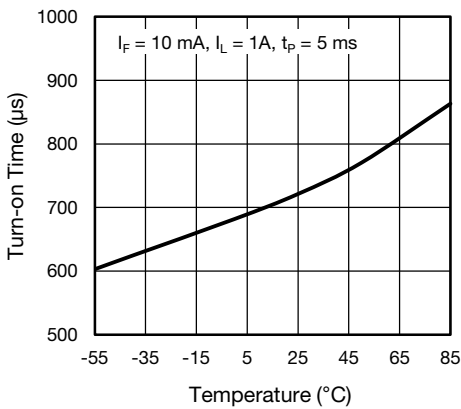
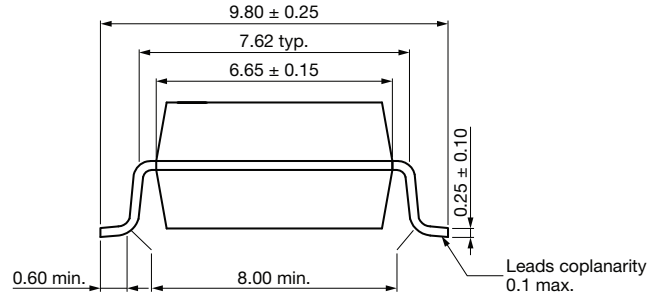
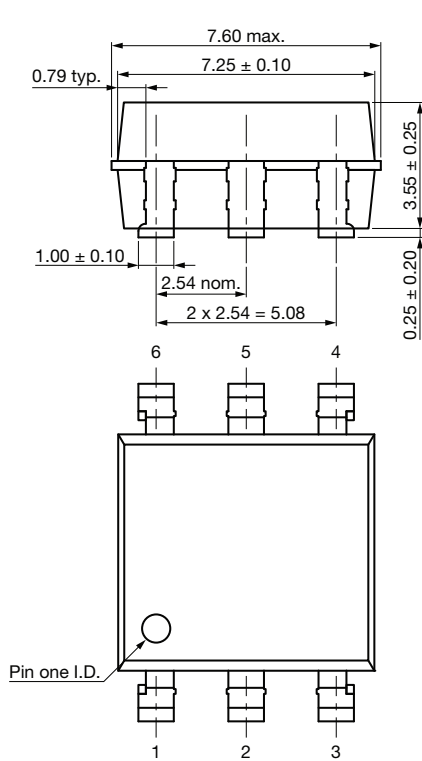


Fig. 12 - Turn-On Time vs. Temperature

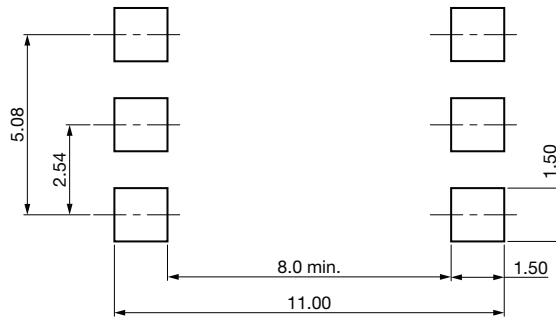


PACKAGE DIMENSIONS (in millimeters)

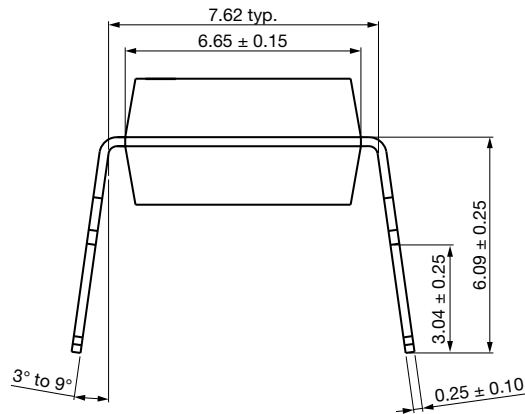
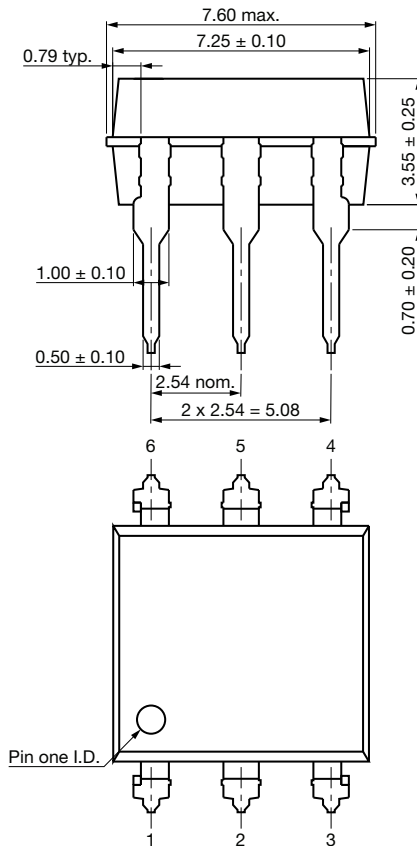
SMD-6



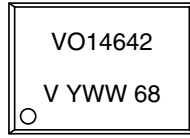
Recommended footprint



DIP-6



**PACKAGE MARKING**



**Note**

- Tape and reel suffix "TR" is not part of the package marking

**PACKING INFORMATION** (in millimeters)

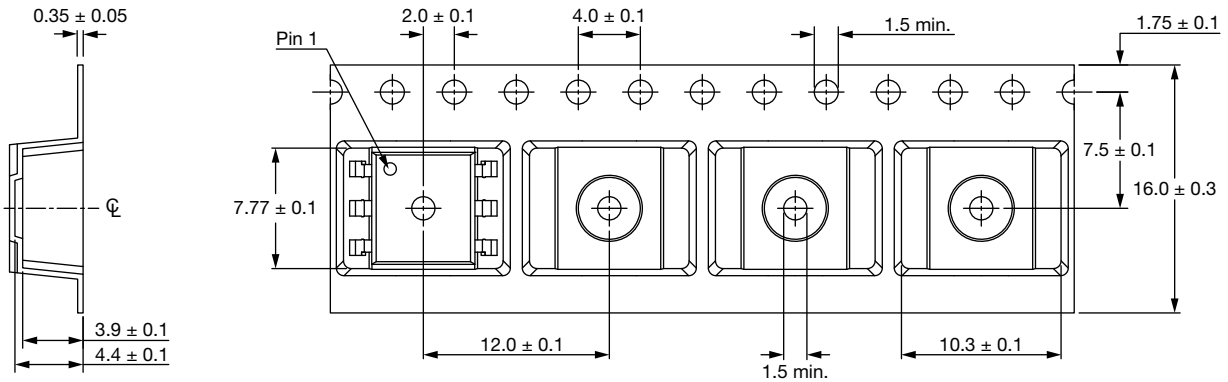


Fig. 15 - Tape and Reel Packing

| TAPE AND REEL PACKING |            |
|-----------------------|------------|
| TYPE                  | UNITS/REEL |
| SMD-6                 | 1000       |

| TUBE PACKING |            |           |           |
|--------------|------------|-----------|-----------|
| TYPE         | UNITS/TUBE | TUBES/BOX | UNITS/BOX |
| DIP-6        | 50         | 40        | 2000      |

**SOLDER PROFILES**

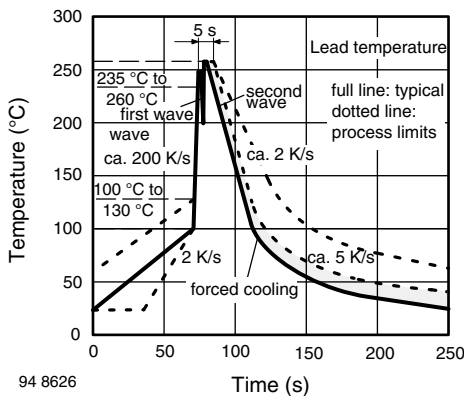


Fig. 16 - Wave Soldering Double Wave Profile According to J-STD-020 for DIP Devices

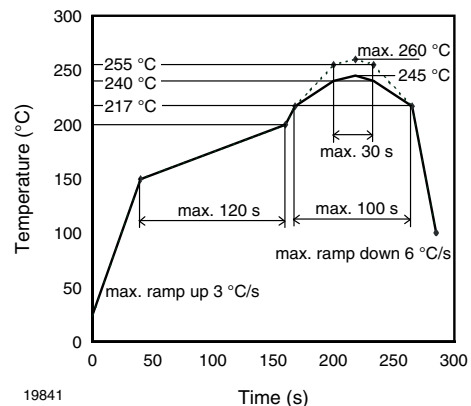


Fig. 17 - Lead (Pb)-free Reflow Solder Profile According to J-STD-020 for SMD Devices

**HANDLING AND STORAGE CONDITIONS**

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





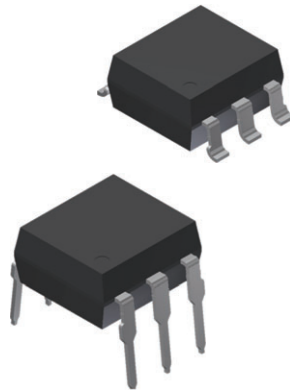
## Footprint and Schematic Information for VO14642AAB, VO14642AT

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  |
|-------------|--|
| VO14642AAB  | <a href="http://www.snapeda.com/parts/VO14642AAB/Vishay/view-part">www.snapeda.com/parts/VO14642AAB/Vishay/view-part</a> |
| VO14642AT   | <a href="http://www.snapeda.com/parts/VO14642AT/Vishay/view-part">www.snapeda.com/parts/VO14642AT/Vishay/view-part</a>   |

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





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