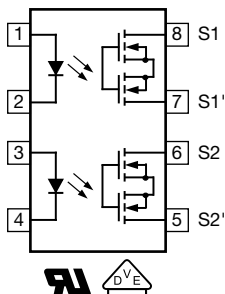
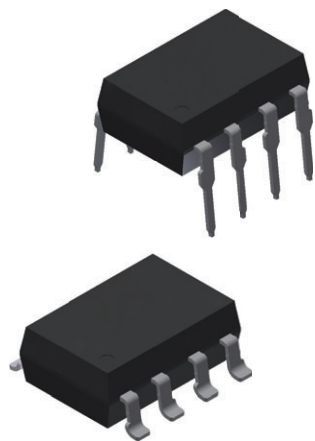




## Dual 1 Form A Solid-State Relay



## FEATURES

- Isolation test voltage 5300 V<sub>RMS</sub>
- Typical R<sub>ON</sub> 22 Ω
- Load voltage 400 V
- Load current 140 mA
- Clean bounce free switching
- Current limit protection
- Low power consumption
- Wide temperature range
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**  
**GREEN**  
(5-2008)

## DESCRIPTION

The VOR2142 is a 400 V dual channel normally open optically isolated solid-state relay (SPST - 1 form A). Based on hybrid architecture which allows fast switching times with a wide operating ambient temperature range. A high efficient GaAlAs IRED enables low forward current on the input side. On the output side high performance MOSFET switches provide a low R<sub>ON</sub> and can switch both DC and AC signals.

## APPLICATIONS

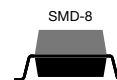
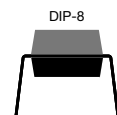
- General telecom switching
- Metering
- Security equipment
- Instrumentation
- Industrial controls
- Battery management systems
- Automatic test equipment

## AGENCY APPROVALS

- UL1577, file no. E52744
- DIN EN 60747-5-5 (VDE 0884-5)

## ORDERING INFORMATION

|             |   |   |   |   |   |   |                       |   |   |
|-------------|---|---|---|---|---|---|-----------------------|---|---|
| V           | O | R | 2 | 1 | 4 | 2 | #                     | 8 | # |
| PART NUMBER |   |   |   |   |   |   | PACKAGE CONFIGURATION |   |   |



| PACKAGE              | UL, VDE    |
|----------------------|------------|
| SMD-8, tape and reel | VOR2142B8T |
| SMD-8, tube          | VOR2142B8  |
| DIP-8, tube          | VOR2142A8  |



| <b>ABSOLUTE MAXIMUM RATINGS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified) |                        |            |             |      |
|--------------------------------------------------------------------------------------------------------|------------------------|------------|-------------|------|
| PARAMETER                                                                                              | CONDITIONS             | SYMBOL     | VALUE       | UNIT |
| <b>INPUT</b>                                                                                           |                        |            |             |      |
| IRED continuous forward current                                                                        |                        | $I_F$      | 50          | mA   |
| IRED reverse voltage                                                                                   |                        | $V_R$      | 5           | V    |
| Input power dissipation                                                                                |                        | $P_{diss}$ | 80          | mW   |
| <b>OUTPUT</b>                                                                                          |                        |            |             |      |
| DC or peak AC load voltage                                                                             |                        | $V_L$      | 400         | V    |
| Continuous DC load current at 25 °C, one channel                                                       |                        | $I_L$      | 140         | mA   |
| Continuous DC load current at 25 °C, two channels                                                      |                        | $I_L$      | 100         | mA   |
| SSR output power dissipation                                                                           |                        | $P_{diss}$ | 550         | mW   |
| <b>SSR</b>                                                                                             |                        |            |             |      |
| Ambient temperature range                                                                              |                        | $T_{amb}$  | -40 to +100 | °C   |
| Storage temperature range                                                                              |                        | $T_{stg}$  | -40 to +150 | °C   |
| Soldering temperature                                                                                  | $t = 10\text{ s max.}$ | $T_{sld}$  | 260         | °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>ELECTRICAL CHARACTERISTICS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified) |                                                                  |             |      |      |      |                  |
|----------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|-------------|------|------|------|------------------|
| PARAMETER                                                                                                | TEST CONDITION                                                   | SYMBOL      | MIN. | TYP. | MAX. | UNIT             |
| <b>INPUT</b>                                                                                             |                                                                  |             |      |      |      |                  |
| IRED forward current, switch turn-on                                                                     | $I_L = 100\text{ mA}$ , $t = 10\text{ ms}$                       | $I_{Fon}$   | -    | 0.25 | 2    | mA               |
| IRED forward current, switch turn-off                                                                    | $V_L = \pm 350\text{ V}$                                         | $I_{Foff}$  | 0.05 | 0.15 | -    | mA               |
| IRED forward voltage                                                                                     | $I_F = 10\text{ mA}$                                             | $V_F$       | -    | 1.36 | 1.5  | V                |
| IRED reverse current                                                                                     | $V_R = 5\text{ V}$                                               | $I_R$       | -    | -    | 10   | $\mu\text{A}$    |
| <b>OUTPUT</b>                                                                                            |                                                                  |             |      |      |      |                  |
| On-resistance                                                                                            | $I_F = 5\text{ mA}$ , $I_L = 50\text{ mA}$                       | $R_{ON}$    | -    | 22   | 27   | $\Omega$         |
| Off-resistance                                                                                           | $I_F = 0\text{ mA}$ , $V_L = \pm 100\text{ V}$                   | $R_{OFF}$   | 1    | 5000 | -    | $\text{G}\Omega$ |
| Off-state leakage current                                                                                | $I_F = 0\text{ mA}$ , $V_L = \pm 100\text{ V}$                   | $I_O$       | -    | < 1  | 100  | nA               |
|                                                                                                          | $I_F = 0\text{ mA}$ , $V_L = \pm 400\text{ V}$                   | $I_O$       | -    | 6    | 500  | nA               |
| Output capacitance                                                                                       | $I_F = 0\text{ mA}$ , $V_L = 1\text{ V}$ , 1 MHz                 | $C_O$       | -    | 39   | -    | pF               |
|                                                                                                          | $I_F = 0\text{ mA}$ , $V_L = 50\text{ V}$ , 1 MHz                | $C_O$       | -    | 6    | -    | pF               |
| Current limit AC/DC                                                                                      | $I_F = 5\text{ mA}$ , $t = 5\text{ ms}$ , $V_L = \pm 6\text{ V}$ | $I_{limit}$ | 170  | 300  | 450  | mA               |
| <b>TRANSFER</b>                                                                                          |                                                                  |             |      |      |      |                  |
| Capacitance (input to output)                                                                            | $V_{IO} = 1\text{ V}$                                            | $C_{IO}$    | -    | 1    | -    | pF               |

**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.

| <b>SWITCHING CHARACTERISTICS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified) |                                            |           |      |      |      |      |
|---------------------------------------------------------------------------------------------------------|--------------------------------------------|-----------|------|------|------|------|
| PARAMETER                                                                                               | TEST CONDITION                             | SYMBOL    | MIN. | TYP. | MAX. | UNIT |
| Turn-on time                                                                                            | $I_F = 5\text{ mA}$ , $I_L = 50\text{ mA}$ | $t_{on}$  | -    | 0.13 | 0.5  | ms   |
| Turn-off time                                                                                           | $I_F = 5\text{ mA}$ , $I_L = 50\text{ mA}$ | $t_{off}$ | -    | 0.05 | 0.2  | ms   |

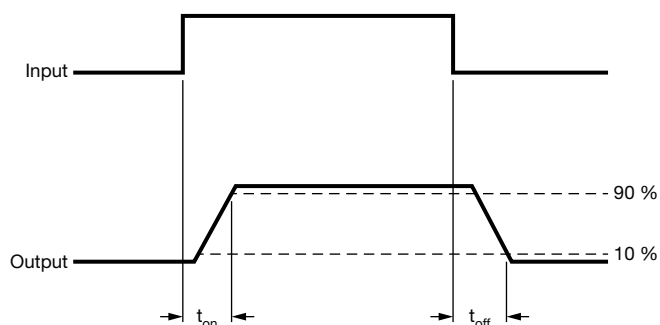
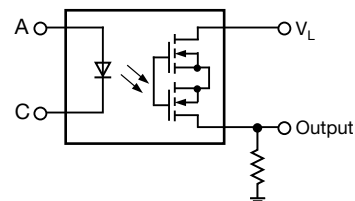


Fig. 1 - Timing Schematic



| SAFETY AND INSULATION RATINGS                |                                                                                                                         |                   |                    |                   |
|----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|-------------------|--------------------|-------------------|
| PARAMETER                                    | TEST CONDITION                                                                                                          | SYMBOL            | VALUE              | UNIT              |
| Climatic classification                      | According to IEC 68 part 1                                                                                              |                   | 40 / 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 min                                                                                          | V <sub>ISO</sub>  | 5300               | V <sub>RMS</sub>  |
| Maximum transient isolation voltage          | According to DIN EN 60747-5-5                                                                                           | V <sub>IOTM</sub> | 8000               | V <sub>peak</sub> |
| Maximum repetitive peak isolation voltage    | According to DIN EN 60747-5-5                                                                                           | V <sub>IORM</sub> | 890                | V <sub>peak</sub> |
| Isolation resistance                         | V <sub>IO</sub> = 500 V, T <sub>amb</sub> = 25 °C                                                                       | R <sub>IO</sub>   | ≥ 10 <sup>12</sup> | Ω                 |
|                                              | V <sub>IO</sub> = 500 V, T <sub>amb</sub> = 100 °C                                                                      | R <sub>IO</sub>   | ≥ 10 <sup>11</sup> | Ω                 |
| Output safety power                          |                                                                                                                         | P <sub>SO</sub>   | 640                | mW                |
| Input safety current                         |                                                                                                                         | I <sub>SI</sub>   | 240                | mA                |
| Safety temperature                           |                                                                                                                         | T <sub>S</sub>    | 175                | °C                |
| Creepage distance                            | DIP-8                                                                                                                   |                   | ≥ 7                | mm                |
| Clearance distance                           | DIP-8                                                                                                                   |                   | ≥ 7                | mm                |
| Creepage distance                            | SMD-8                                                                                                                   |                   | ≥ 8                | mm                |
| Clearance distance                           | SMD-8                                                                                                                   |                   | ≥ 8                | mm                |
| Insulation thickness                         |                                                                                                                         | DTI               | ≥ 0.4              | mm                |
| Input to output test voltage, method B       | V <sub>IORM</sub> × 1.875 = V <sub>PR</sub> , 100 % production test with t <sub>M</sub> = 1 s, partial discharge < 5 pC | V <sub>PR</sub>   | 1669               | V <sub>peak</sub> |
| Input to output test voltage, method A       | V <sub>IORM</sub> × 1.6 = V <sub>PR</sub> , 100 % sample test with t <sub>M</sub> = 10 s, partial discharge < 5 pC      | V <sub>PR</sub>   | 1424               | V <sub>peak</sub> |

**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.

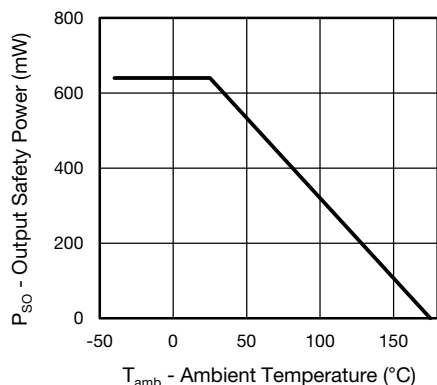


Fig. 2 - Safety Power Dissipation vs. Ambient Temperature

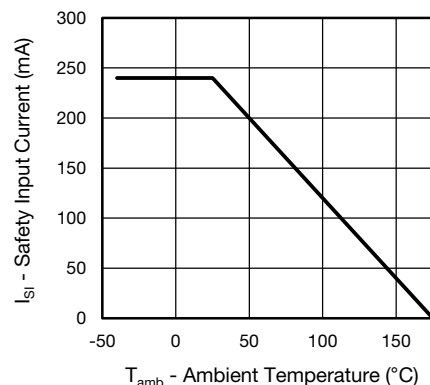


Fig. 3 - Safety Input Current vs. Ambient Temperature

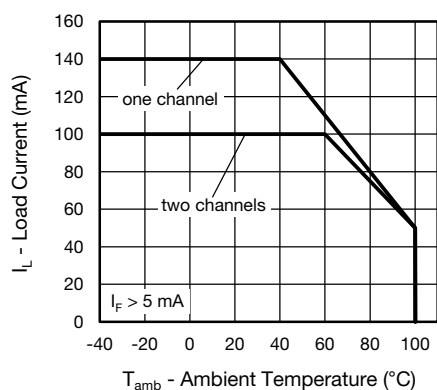
**TYPICAL CHARACTERISTICS** ( $T_{amb} = 25^\circ\text{C}$ , unless otherwise specified)


Fig. 4 - Maximum Load Current vs. Ambient Temperature

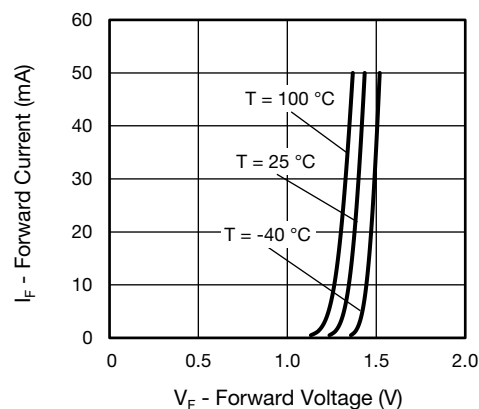


Fig. 6 - Forward Current vs. Forward Voltage

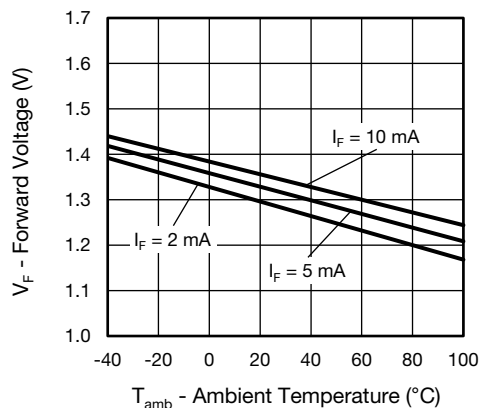


Fig. 5 - Forward Voltage vs. Ambient Temperature

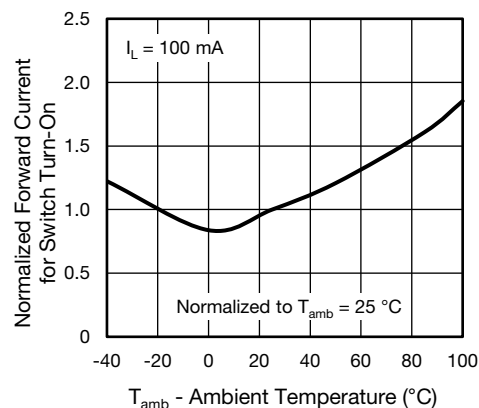


Fig. 7 - Normalized Forward Current for Switch Turn-On vs. Ambient Temperature

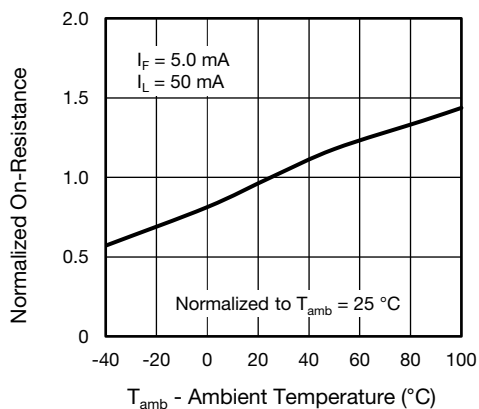


Fig. 8 - Normalized On-Resistance vs. Ambient Temperature

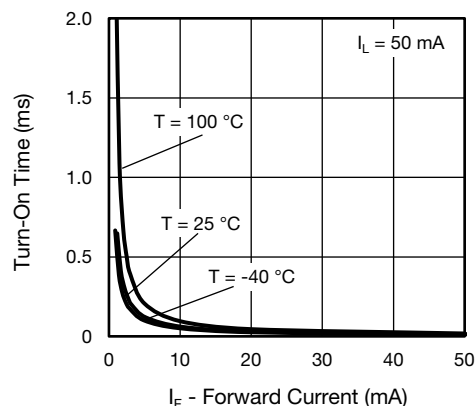


Fig. 11 - Turn-On Time vs. Forward Current

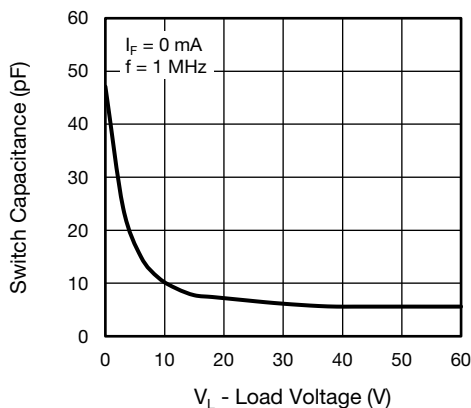


Fig. 9 - Output Capacitance vs. Load Voltage

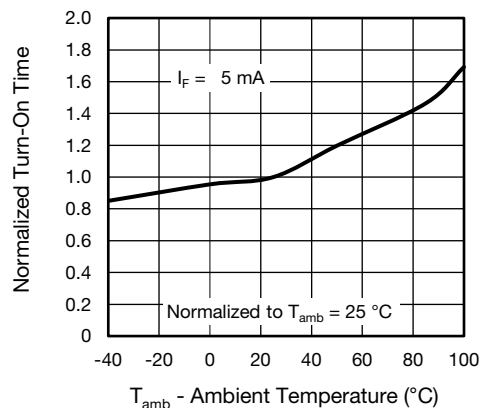


Fig. 12 - Normalized Turn-On Time vs. Ambient Temperature

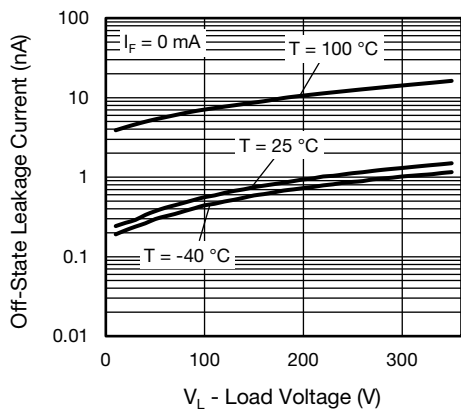


Fig. 10 - Off-State Leakage Current vs. Load Voltage

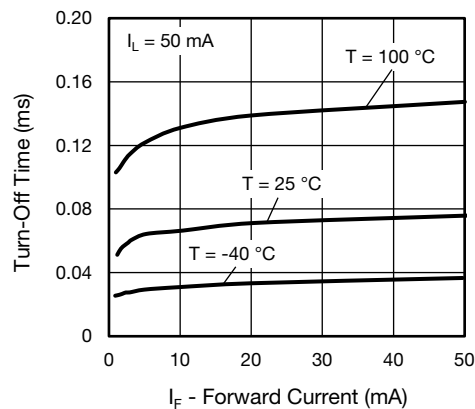


Fig. 13 - Turn-Off Time vs. Forward Current

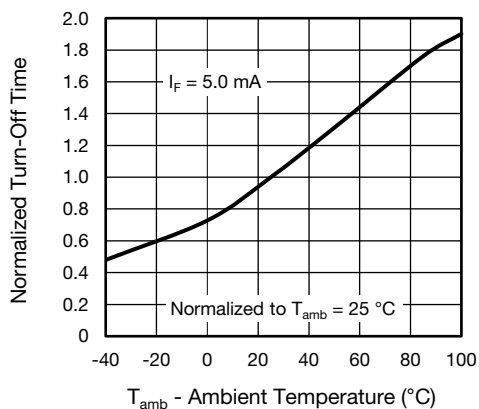
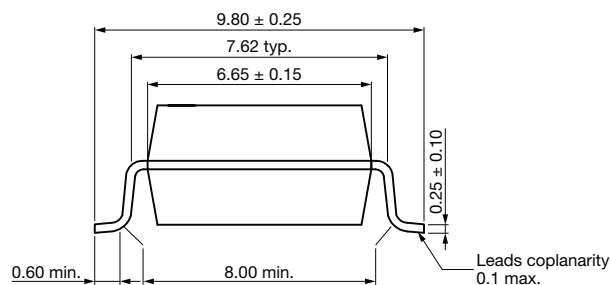
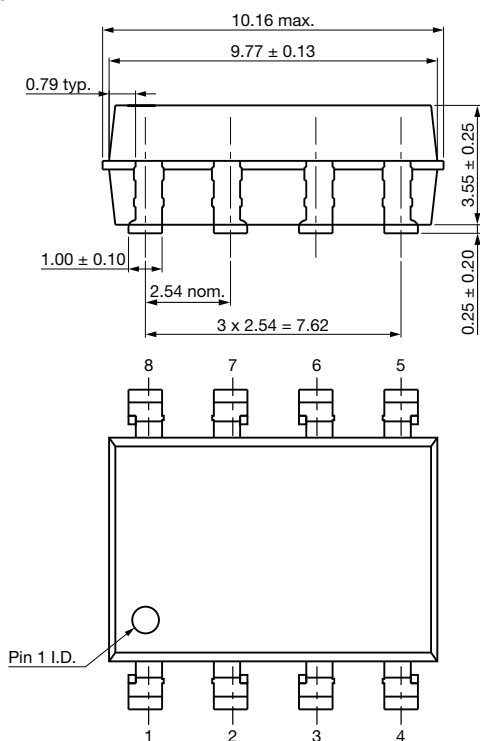


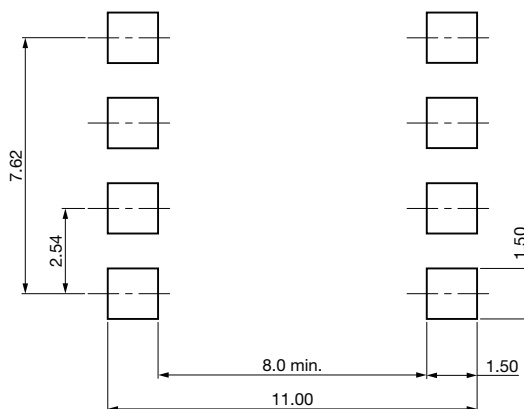
Fig. 14 - Normalized Turn-Off Time vs. Ambient Temperature

## PACKAGE DIMENSIONS (in millimeters)

### SMD-8

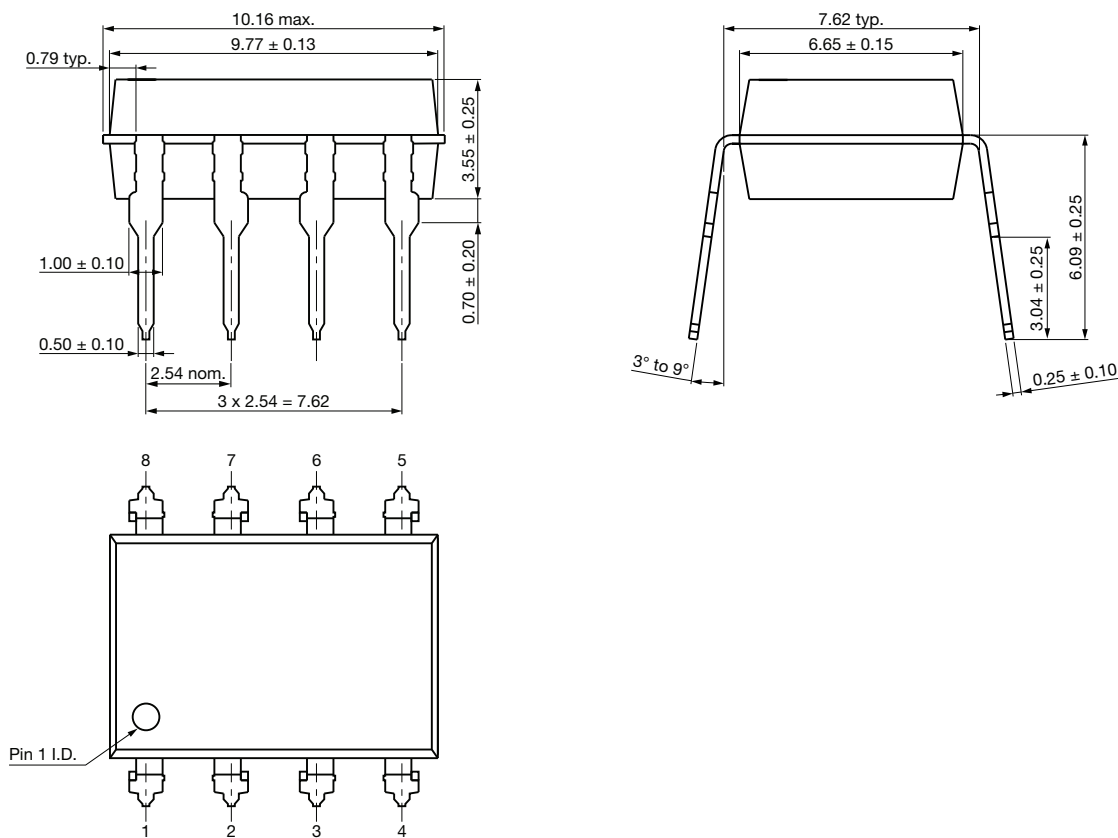


### Recommended footprint





## DIP-8



## PACKAGE MARKING (example)

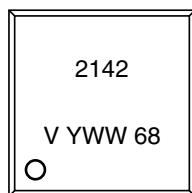


Fig. 15 - VOR2142

## Note

- Package configurations (T, A, B) are not part of the package marking.

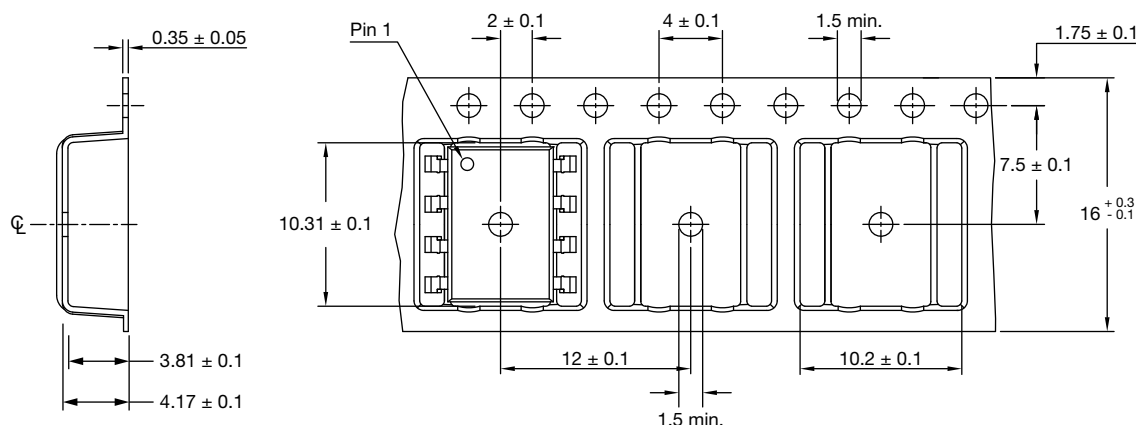
**PACKING INFORMATION** (in millimeters)


Fig. 16 - Tape and Reel Packing

| TAPE AND REEL PACKING |            |
|-----------------------|------------|
| TYPE                  | UNITS/REEL |
| SMD-8                 | 1000       |

| TUBE PACKING |            |           |           |
|--------------|------------|-----------|-----------|
| TYPE         | UNITS/TUBE | TUBES/BOX | UNITS/BOX |
| SMD-8        | 50         | 40        | 2000      |
| DIP-8        | 50         | 40        | 2000      |

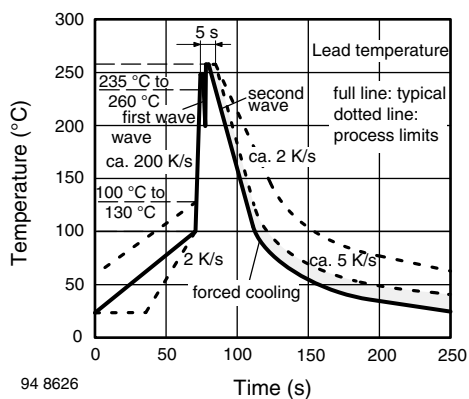
**SOLDER PROFILES**


Fig. 17 - Wave Soldering Double Wave Profile According to J-STD-020 for DIP Devices

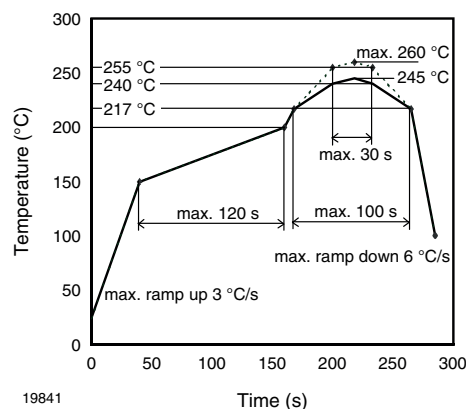


Fig. 18 - Lead (Pb)-free Reflow Solder Profile According to J-STD-020 for SMD Devices

**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



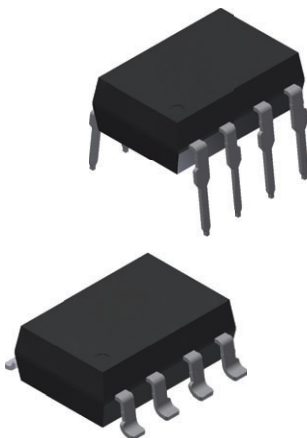
### Footprint and Schematic Information for VOR2142

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                                                                                                    |
|-------------|--------------------------------------------------------------------------------------------------------------------------|
| VOR2142A8   | <a href="http://www.snapeda.com/parts/VOR2142A8/Vishay/view-part">www.snapeda.com/parts/VOR2142A8/Vishay/view-part</a>   |
| VOR2142B8   | <a href="http://www.snapeda.com/parts/VOR2142B8/Vishay/view-part">www.snapeda.com/parts/VOR2142B8/Vishay/view-part</a>   |
| VOR2142B8T  | <a href="http://www.snapeda.com/parts/VOR2142B8T/Vishay/view-part">www.snapeda.com/parts/VOR2142B8T/Vishay/view-part</a> |

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





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