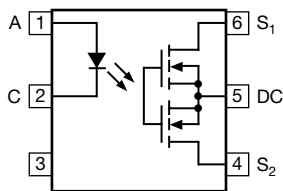
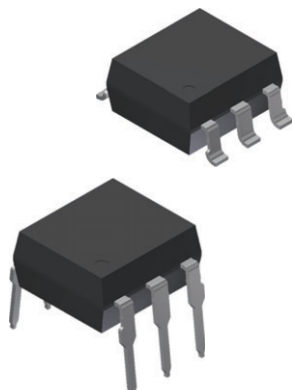


## 1 Form A Solid-State Relay (Normally Open)



### FEATURES

- Isolation test voltage 5300 V<sub>RMS</sub>
- Typical R<sub>ON</sub> 12 Ω
- Load voltage 250 V
- Load current 200 mA / 370 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 VOR1121 is a 250 V single 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

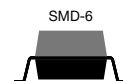
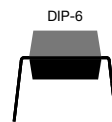
- General telecom switching
- Metering
- Security equipment
- Instrumentation
- Industrial controls
- Battery management systems
- Automatic test equipment

### AGENCY APPROVALS

- UL1577, file no. E52744
- DIN EN 60747-5-5 (VDE0884-5)

### ORDERING INFORMATION

|             |   |   |   |   |   |   |                       |   |   |
|-------------|---|---|---|---|---|---|-----------------------|---|---|
| V           | O | R | 1 | 1 | 2 | 1 | B                     | 6 | # |
| PART NUMBER |   |   |   |   |   |   | PACKAGE CONFIGURATION |   |   |



| PACKAGE              | UL, VDE    |
|----------------------|------------|
| SMD-6, tape and reel | VOR1121B6T |
| SMD-6, tube          | VOR1121B6  |
| DIP-6, tube          | VOR1121A6  |



| <b>ABSOLUTE MAXIMUM RATINGS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified) |                        |            |             |                    |
|--------------------------------------------------------------------------------------------------------|------------------------|------------|-------------|--------------------|
| PARAMETER                                                                                              | CONDITION              | 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                                                                             |                        | $V_L$      | 250         | V                  |
| Continuous load current (AC/DC configuration)                                                          |                        | $I_L$      | 200         | mA                 |
| Continuous load current (DC only configuration)                                                        |                        | $I_L$      | 370         | mA                 |
| SSR output power dissipation (continuous)                                                              |                        | $P_{diss}$ | 550         | mW                 |
| <b>SSR</b>                                                                                             |                        |            |             |                    |
| Ambient temperature range                                                                              |                        | $T_{amb}$  | -40 to +100 | $^{\circ}\text{C}$ |
| Storage temperature range                                                                              |                        | $T_{stg}$  | -40 to +150 | $^{\circ}\text{C}$ |
| Soldering temperature                                                                                  | $t = 10\text{ s max.}$ | $T_{sld}$  | 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>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                                                                     | $I_L = 100\text{ mA}$ , $t = 10\text{ ms}$                       | $I_{Fon}$   | -    | 0.4  | 2    | mA               |
| IRED forward current, switch turn-off                                                                    | $V_L = \pm 200\text{ V}$                                         | $I_{Foff}$  | 0.05 | 0.35 | -    | 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 (AC/DC configuration)                                                                      | $I_F = 5\text{ mA}$ , $I_L = 50\text{ mA}$                       | $R_{ON}$    | -    | 12   | 15   | $\Omega$         |
| On-resistance (DC only configuration)                                                                    | $I_F = 5\text{ mA}$ , $I_L = 100\text{ mA}$                      | $R_{ON}$    | -    | 3.2  | 3.6  | $\Omega$         |
| 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               |
|                                                                                                          | $I_F = 0\text{ mA}$ , $V_L = \pm 200\text{ V}$                   | $I_O$       | -    | < 1  | 500  | nA               |
| Output capacitance (AC/DC configuration)                                                                 | $I_F = 0\text{ mA}$ , $V_L = 1\text{ V}$ , 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 configuration)                                                                      | $I_F = 5\text{ mA}$ , $t = 5\text{ ms}$ , $V_L = \pm 6\text{ V}$ | $I_{limit}$ | 300  | 440  | 550  | mA               |
| Current limit (DC only configuration)                                                                    | $I_F = 5\text{ mA}$ , $t = 5\text{ ms}$ , $V_L = \pm 6\text{ V}$ | $I_{limit}$ | 600  | 870  | 1100 | mA               |
| <b>TRANSFER</b>                                                                                          |                                                                  |             |      |      |      |                  |
| Capacitance (input to output)                                                                            | $V_{IO} = 1\text{ V}$                                            | $C_{IO}$    | -    | 0.4  | -    | 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.

## PIN CONFIGURATION

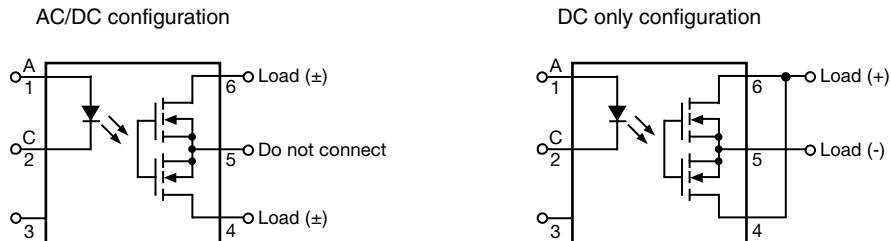


Fig. 1 - Pin Configuration

| SWITCHING CHARACTERISTICS ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified) |                                            |           |      |      |      |      |
|--------------------------------------------------------------------------------------------------|--------------------------------------------|-----------|------|------|------|------|
| PARAMETER                                                                                        | TEST CONDITION                             | SYMBOL    | MIN. | TYP. | MAX. | UNIT |
| Turn-on time                                                                                     | $I_F = 5\text{ mA}$ , $I_L = 50\text{ mA}$ | $t_{on}$  | -    | 0.20 | 0.5  | ms   |
| Turn-off time                                                                                    | $I_F = 5\text{ mA}$ , $I_L = 50\text{ mA}$ | $t_{off}$ | -    | 0.03 | 0.2  | ms   |

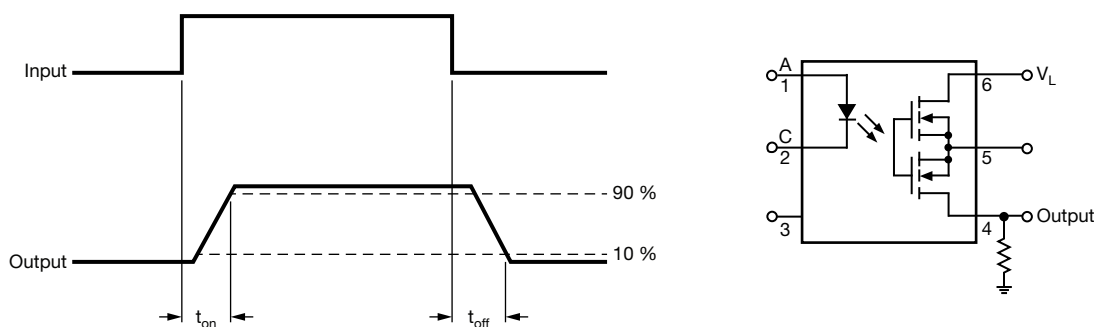


Fig. 2 - Timing Schematic

| SAFETY AND INSULATION RATINGS                |                                                                                                                      |            |                |                    |
|----------------------------------------------|----------------------------------------------------------------------------------------------------------------------|------------|----------------|--------------------|
| PARAMETER                                    | 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, $t = 1\text{ min}$                                                                              | $V_{ISO}$  | 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            | $V_{peak}$         |
| Insulation resistance                        | $V_{IO} = 500\text{ V}$ , $T_{amb} = 25\text{ }^{\circ}\text{C}$                                                     | $R_{IO}$   | $\geq 10^{12}$ | $\Omega$           |
|                                              | $V_{IO} = 500\text{ V}$ , $T_{amb} = 100\text{ }^{\circ}\text{C}$                                                    | $R_{IO}$   | $\geq 10^{11}$ | $\Omega$           |
| Output safety power                          |                                                                                                                      | $P_{SO}$   | 720            | mW                 |
| Input safety current                         |                                                                                                                      | $I_{SI}$   | 240            | mA                 |
| Safety temperature                           |                                                                                                                      | $T_S$      | 175            | $^{\circ}\text{C}$ |
| Creepage distance                            | DIP-6                                                                                                                |            | $\geq 7$       | mm                 |
| Clearance distance                           |                                                                                                                      |            | $\geq 7$       | mm                 |
| Creepage distance                            | SMD-6                                                                                                                |            | $\geq 8$       | mm                 |
| Clearance distance                           |                                                                                                                      |            | $\geq 8$       | mm                 |
| Insulation thickness                         |                                                                                                                      | DTI        | $\geq 0.4$     | mm                 |
| Input to output test voltage, method B       | $V_{IORM} \times 1.875 = V_{PR}$ , 100 % production test with $t_M = 1\text{ s}$ , partial discharge $< 5\text{ pC}$ | $V_{PR}$   | 1669           | $V_{peak}$         |
| 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 $< 5\text{ pC}$      | $V_{PR}$   | 1424           | $V_{peak}$         |

### 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.

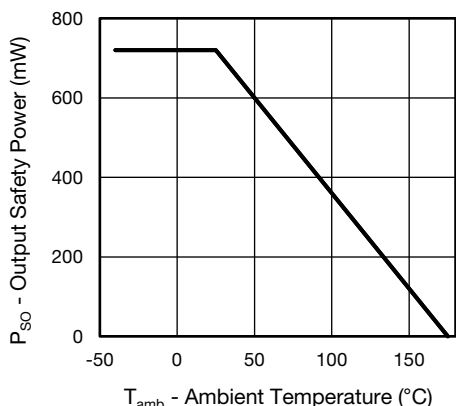


Fig. 3 - Output Safety Power vs. Ambient Temperature

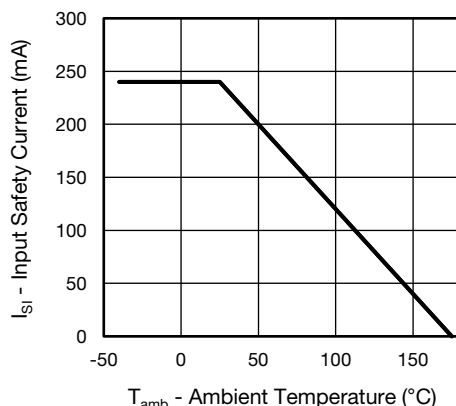


Fig. 4 - Input Safety Current vs. Ambient Temperature

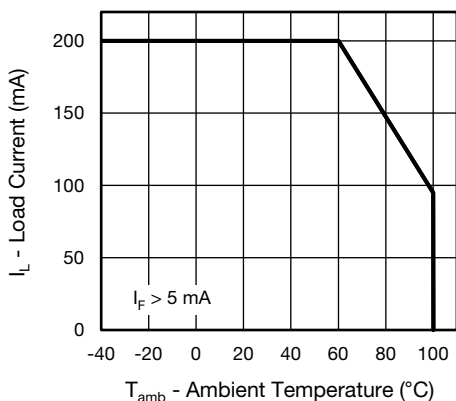
**TYPICAL CHARACTERISTICS** ( $T_{amb} = 25^\circ\text{C}$ , unless otherwise specified)


Fig. 5 - Load Current vs. Ambient Temperature

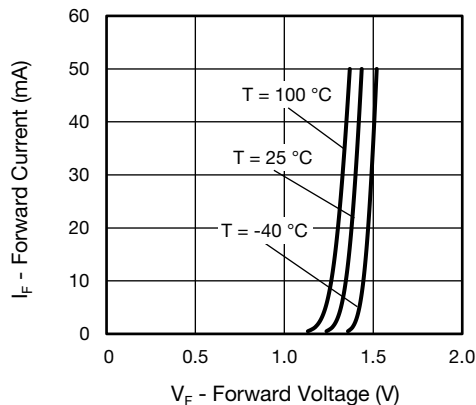


Fig. 7 - Forward Current vs. Forward Voltage

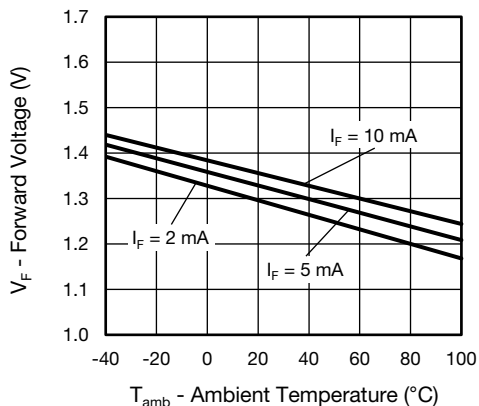


Fig. 6 - Forward Voltage vs. Ambient Temperature

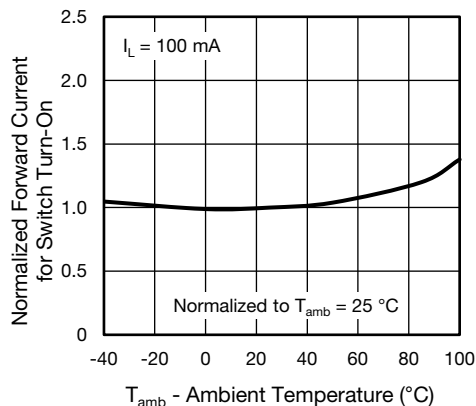


Fig. 8 - Normalized Forward Current for Switch Turn-On vs. Ambient Temperature

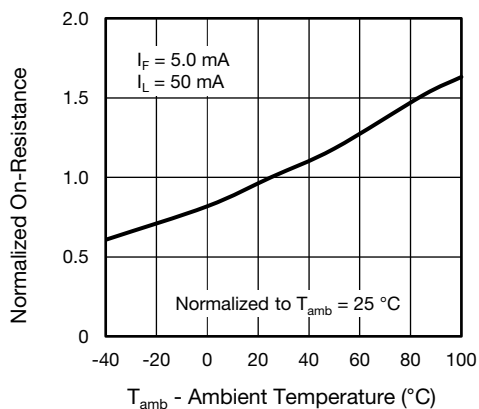


Fig. 9 - Normalized On-Resistance vs. Ambient Temperature

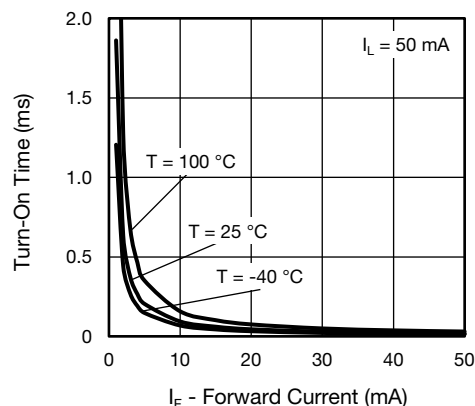


Fig. 12 - Turn-On Time vs. Forward Current

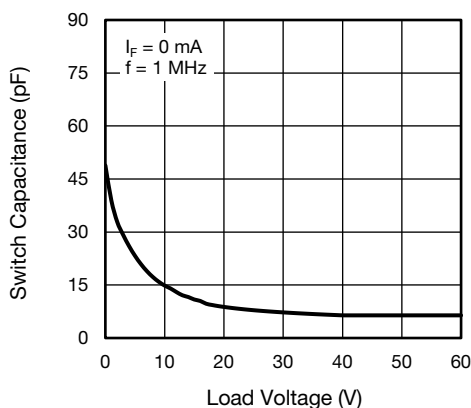


Fig. 10 - Switch Capacitance vs. Load Voltage

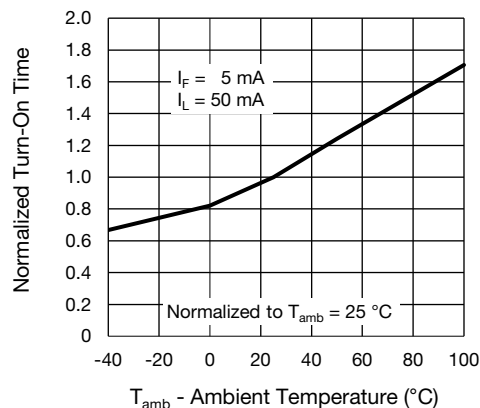


Fig. 13 - Normalized Turn-On Time vs. Ambient Temperature

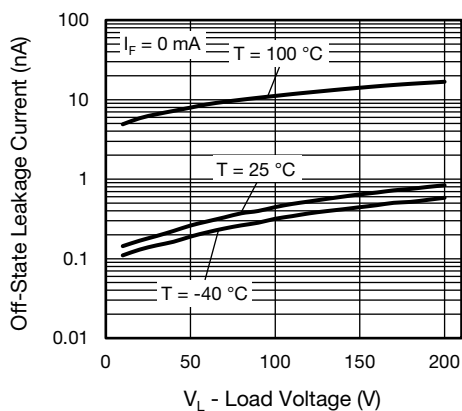


Fig. 11 - Off-State Leakage Current vs. Load Voltage

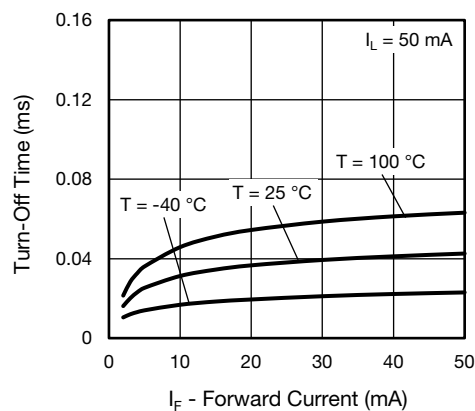


Fig. 14 - Turn-Off Time vs. Forward Current

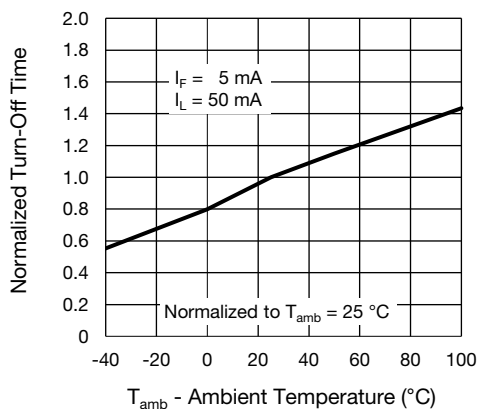


Fig. 15 - Normalized Turn-Off Time vs. Ambient Temperature

## PACKAGE DIMENSIONS (in millimeters)

### SMD-6

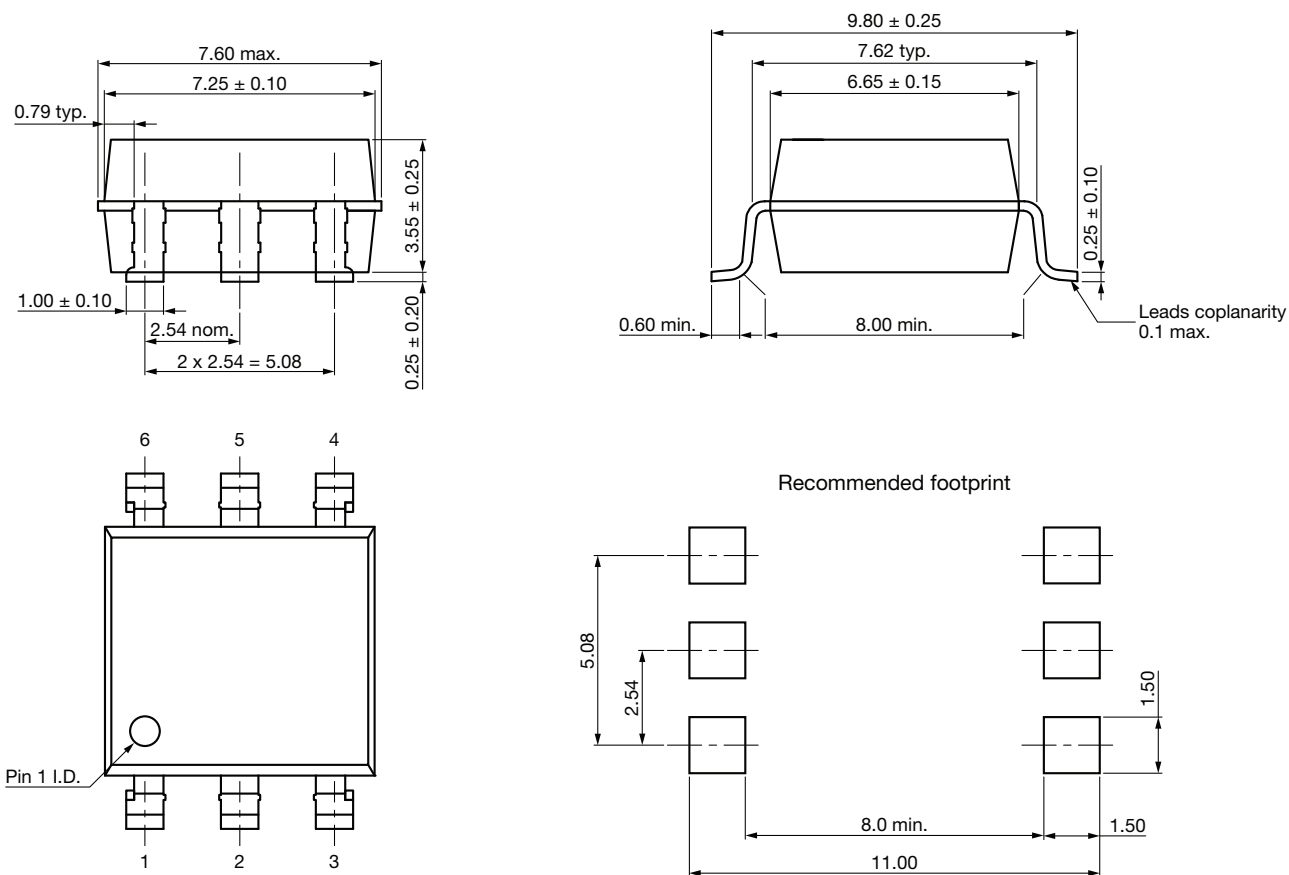


Fig. 16 - Package Drawings



## DIP-6

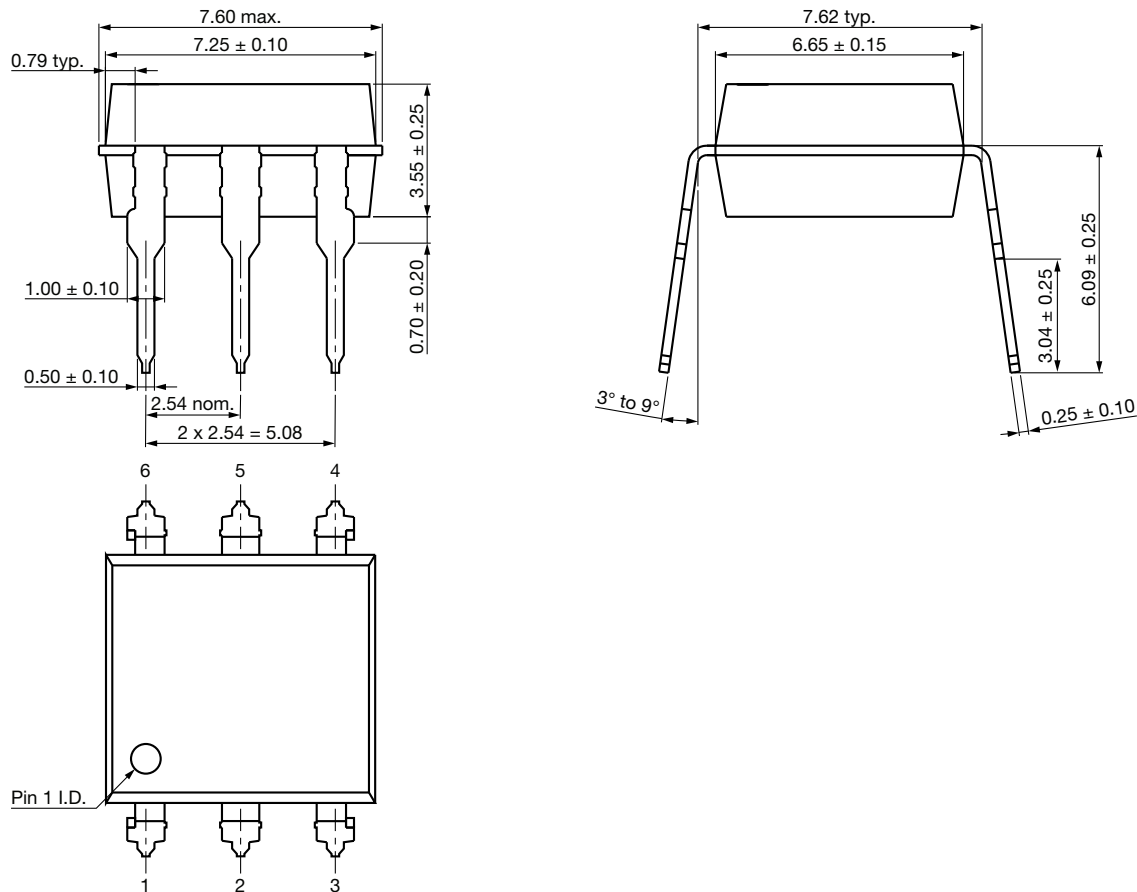


Fig. 17 - Package Drawings

## PACKAGE MARKING

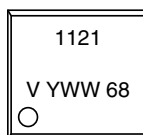


Fig. 18 - VOR1121

### Note

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

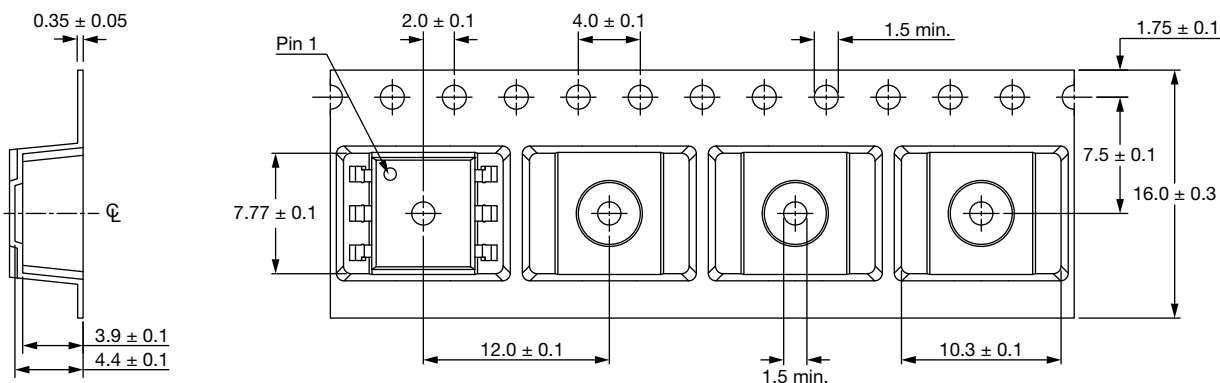
**PACKING INFORMATION** (in millimeters)


Fig. 19 - Tape and Reel Packing

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

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

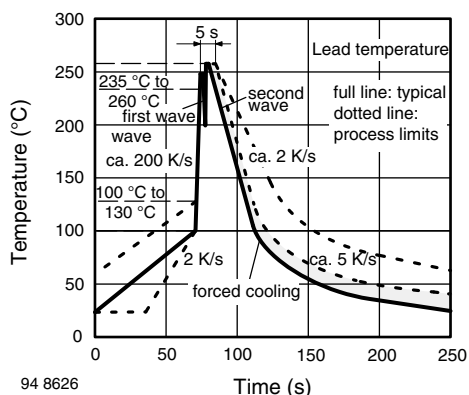
**SOLDER PROFILES**


Fig. 20 - Wave Soldering Double Wave Profile According to J-STD-020 for DIP Devices

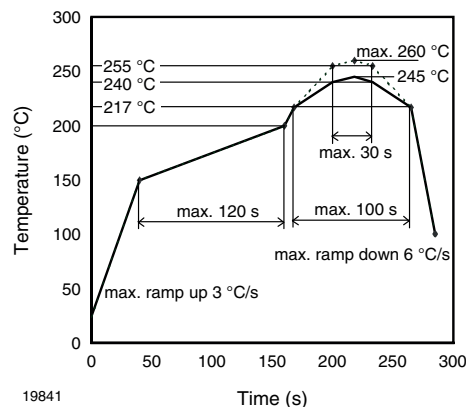


Fig. 21 - Lead (Pb)-free Reflow Solder Profile According to J-STD-020 for SMD Devices

**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





## Disclaimer

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