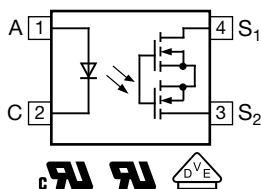
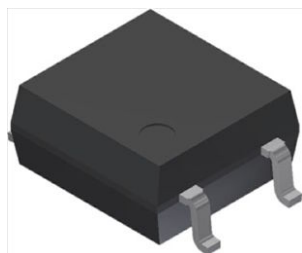


# 1 Form A Solid-State Relay



## FEATURES

- Isolation test voltage 3750 V<sub>RMS</sub>
- Typical R<sub>ON</sub> 19 Ω
- Load voltage 400 V
- Load current 140 mA
- High surge capability
- Clean bounce free switching
- Low power consumption
- High temperature range
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



## LINKS TO ADDITIONAL RESOURCES



## DESCRIPTION

The VOR1142 is an SPST normally open switch (1 form A) that can replace electromechanical relays in many applications. It is constructed using a GaAlAs IRED actuation control and MOSFETs for the switch output.

## APPLICATIONS

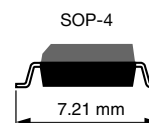
- General telecom switching
- Metering
- Security equipment
- Instrumentation
- Industrial controls
- Battery management systems
- Automatic measurement equipment

## AGENCY APPROVALS

- [UL](#)
- [cUL](#)
- [DIN EN 60747-5-5 \(VDE 0884-5\)](#), available with option 1

## ORDERING INFORMATION

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



| PACKAGE              | UL, cUL, VDE |
|----------------------|--------------|
| SOP-4, tape and reel | VOR1142M4T   |
| SOP-4, tube          | VOR1142M4    |



| <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                 |
| Junction temperature                                                                                   |                        | $T_j$      | 125         | $^{\circ}\text{C}$ |
| <b>OUTPUT</b>                                                                                          |                        |            |             |                    |
| DC or peak AC load voltage                                                                             |                        | $V_L$      | 400         | V                  |
| Continuous DC load current                                                                             |                        | $I_L$      | 140         | mA                 |
| SSR output power dissipation                                                                           |                        | $P_{diss}$ | 550         | mW                 |
| Junction temperature                                                                                   |                        | $T_j$      | 125         | $^{\circ}\text{C}$ |
| <b>SSR</b>                                                                                             |                        |            |             |                    |
| Ambient temperature range <sup>(1)</sup>                                                               |                        | $T_{amb}$  | -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         | $^{\circ}\text{C}$ |

**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> For continuous negative potential from output side to input side only 85  $^{\circ}\text{C}$  is allowed

| <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                                                                    | $V_L = \pm 350\text{ V}$ , $I_L < 1\text{ }\mu\text{A}$ | $I_{Foff}$ | 0.05 | 0.15 | -    | mA               |
| IRED forward voltage                                                                                     | $I_F = 10\text{ mA}$                                    | $V_F$      | -    | 1.4  | 1.6  | V                |
| IRED reverse current                                                                                     | $V_R = 5\text{ V}$                                      | $I_R$      | -    | -    | 10   | $\mu\text{A}$    |
| <b>OUTPUT</b>                                                                                            |                                                         |            |      |      |      |                  |
| On-resistance                                                                                            | $I_F = 5\text{ mA}$ , $I_L = 50\text{ mA}$              | $R_{ON}$   | -    | 19   | 27   | $\Omega$         |
| Off-resistance                                                                                           | $I_F = 0\text{ mA}$ , $V_L = \pm 100\text{ V}$          | $R_{OFF}$  | 0.5  | 850  | -    | $\text{G}\Omega$ |
| Off-state leakage current                                                                                | $I_F = 0\text{ mA}$ , $V_L = \pm 100\text{ V}$          | $I_{leak}$ | -    | < 1  | 100  | nA               |
|                                                                                                          | $I_F = 0\text{ mA}$ , $V_L = \pm 400\text{ V}$          | $I_{leak}$ | -    | 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               |
| <b>COUPLER</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.

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

| PARAMETER     | TEST CONDITION                             | SYMBOL    | MIN. | TYP. | MAX. | UNIT |
|---------------|--------------------------------------------|-----------|------|------|------|------|
| Turn-on time  | $I_F = 5\text{ mA}$ , $I_L = 50\text{ mA}$ | $t_{on}$  | -    | 0.1  | 0.5  | ms   |
| Turn-off time | $I_F = 5\text{ mA}$ , $I_L = 50\text{ mA}$ | $t_{off}$ | -    | 0.05 | 0.2  | ms   |

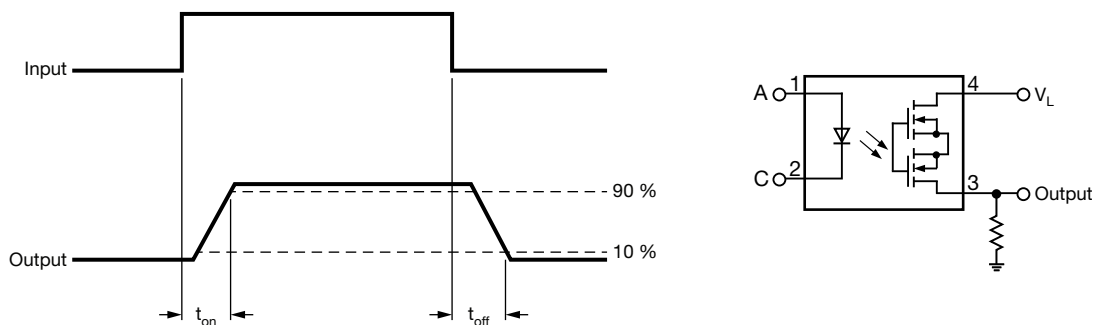


Fig. 1 - Timing Schematic

**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                   |                                                                                                                      | CTI        | 175            |                    |
| Maximum rated withstanding isolation voltage | According to UL1577, $t = 1\text{ min}$                                                                              | $V_{ISO}$  | 3750           | $V_{RMS}$          |
| Maximum transient isolation voltage          | According to DIN EN 60747-5-5                                                                                        | $V_{IOTM}$ | 6000           | $V_{peak}$         |
| Maximum repetitive peak isolation voltage    | According to DIN EN 60747-5-5                                                                                        | $V_{IORM}$ | 707            | $V_{peak}$         |
| 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                          |                                                                                                                      | $P_{SO}$   | 550            | mW                 |
| Input safety current                         |                                                                                                                      | $I_{SI}$   | 180            | mA                 |
| Input safety temperature                     |                                                                                                                      | $T_S$      | 175            | $^{\circ}\text{C}$ |
| Clearance distance                           | SOP-4                                                                                                                |            | $\geq 5$       | mm                 |
| Creepage distance                            | SOP-4                                                                                                                |            | $\geq 5$       | mm                 |
| Insulation thickness                         |                                                                                                                      | DTI        | $\geq 0.3$     | 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 $< 5\text{ pC}$ | $V_{PR}$   | 1326           | $V_{peak}$         |
| Input to output test voltage, method A       | $V_{IORM} \times 1.6 = V_{PR}$ , sample test with $t_M = 10\text{ s}$ , partial discharge $< 5\text{ pC}$            | $V_{PR}$   | 1131           | $V_{peak}$         |

**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.

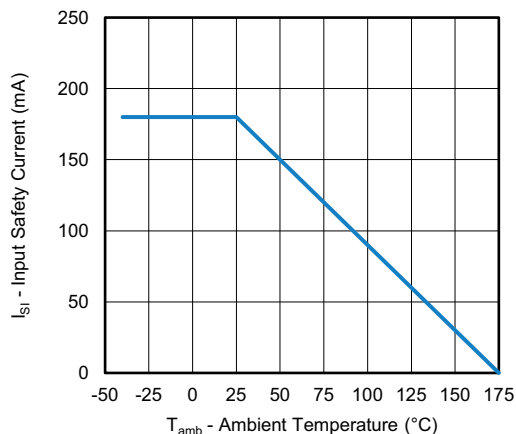


Fig. 2 - Safety Input Current vs. Ambient Temperature

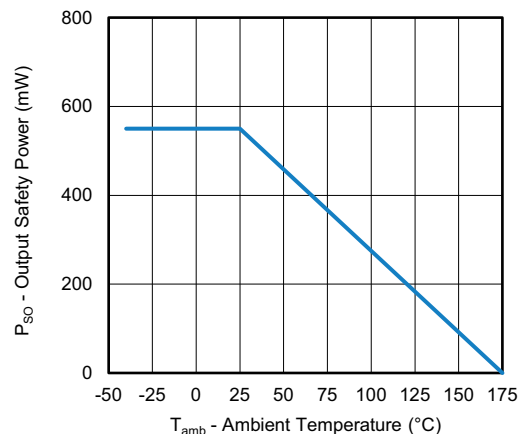


Fig. 3 - Safety Power Dissipation vs. Ambient Temperature

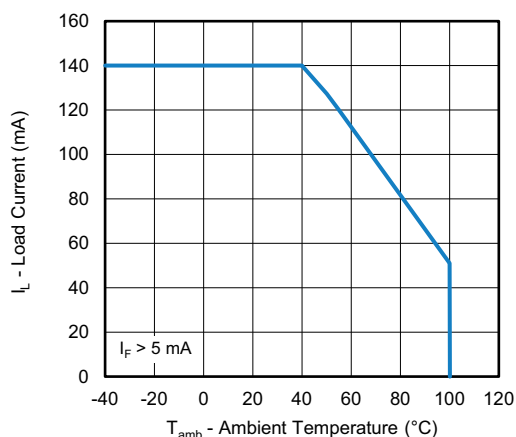
**TYPICAL CHARACTERISTICS** ( $T_{amb} = 25\text{ °C}$ , unless otherwise specified)


Fig. 4 - Maximum Load Current vs. Ambient Temperature

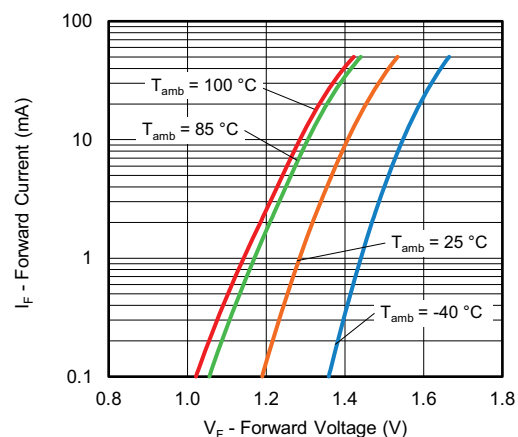


Fig. 6 - Forward Current vs. Forward Voltage

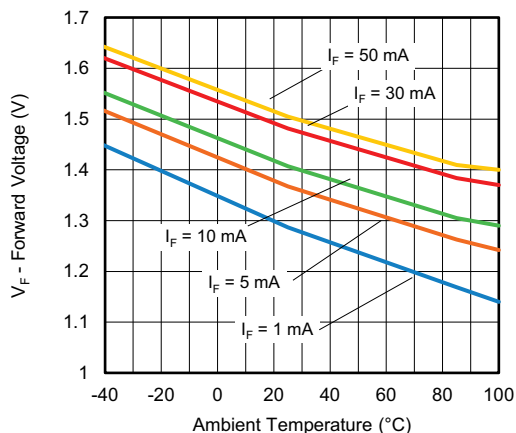


Fig. 5 - Forward Voltage vs. Ambient Temperature

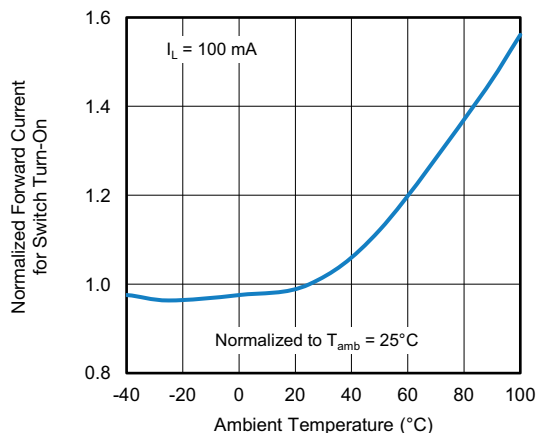


Fig. 7 - Normalized Forward Current for Switch Turn-On vs. Ambient Temperature

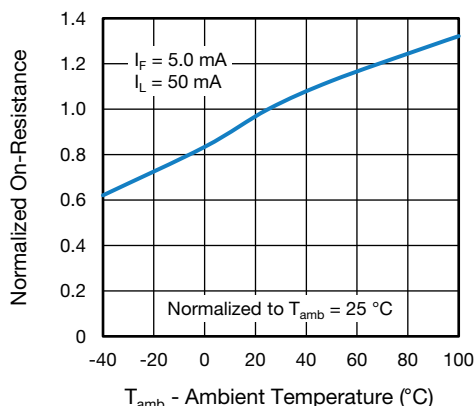


Fig. 8 - Normalized On-Resistance vs. Ambient Temperature

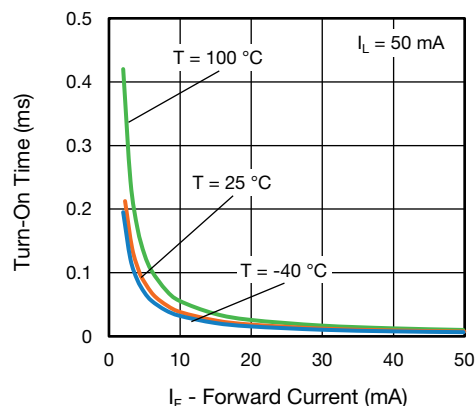


Fig. 11 - Turn-On Time vs. Forward Current

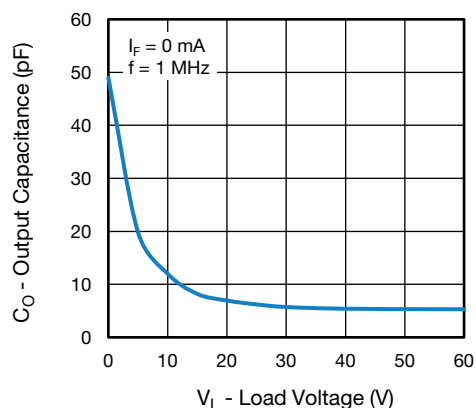


Fig. 9 - Output Capacitance vs. Load Voltage

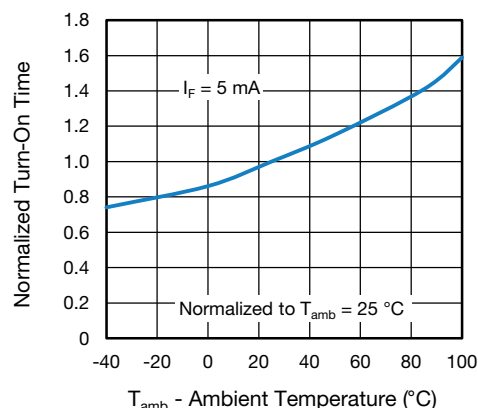


Fig. 12 - Normalized Turn-On Time vs. Ambient Temperature

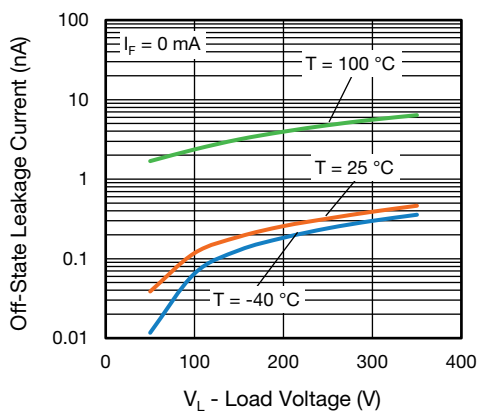


Fig. 10 - Off-State Leakage Current vs. Load Voltage

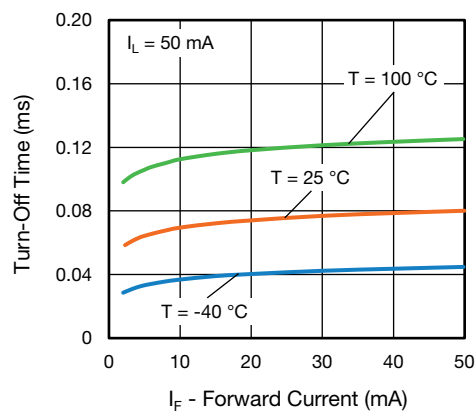


Fig. 13 - Turn-Off Time vs. Forward Current

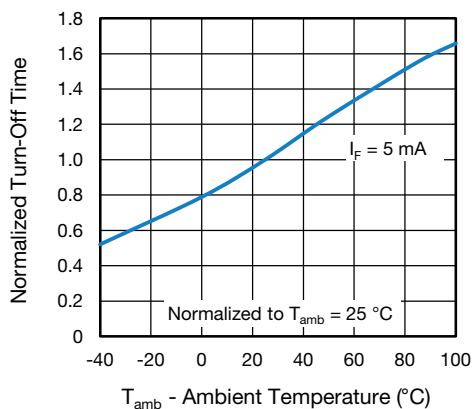
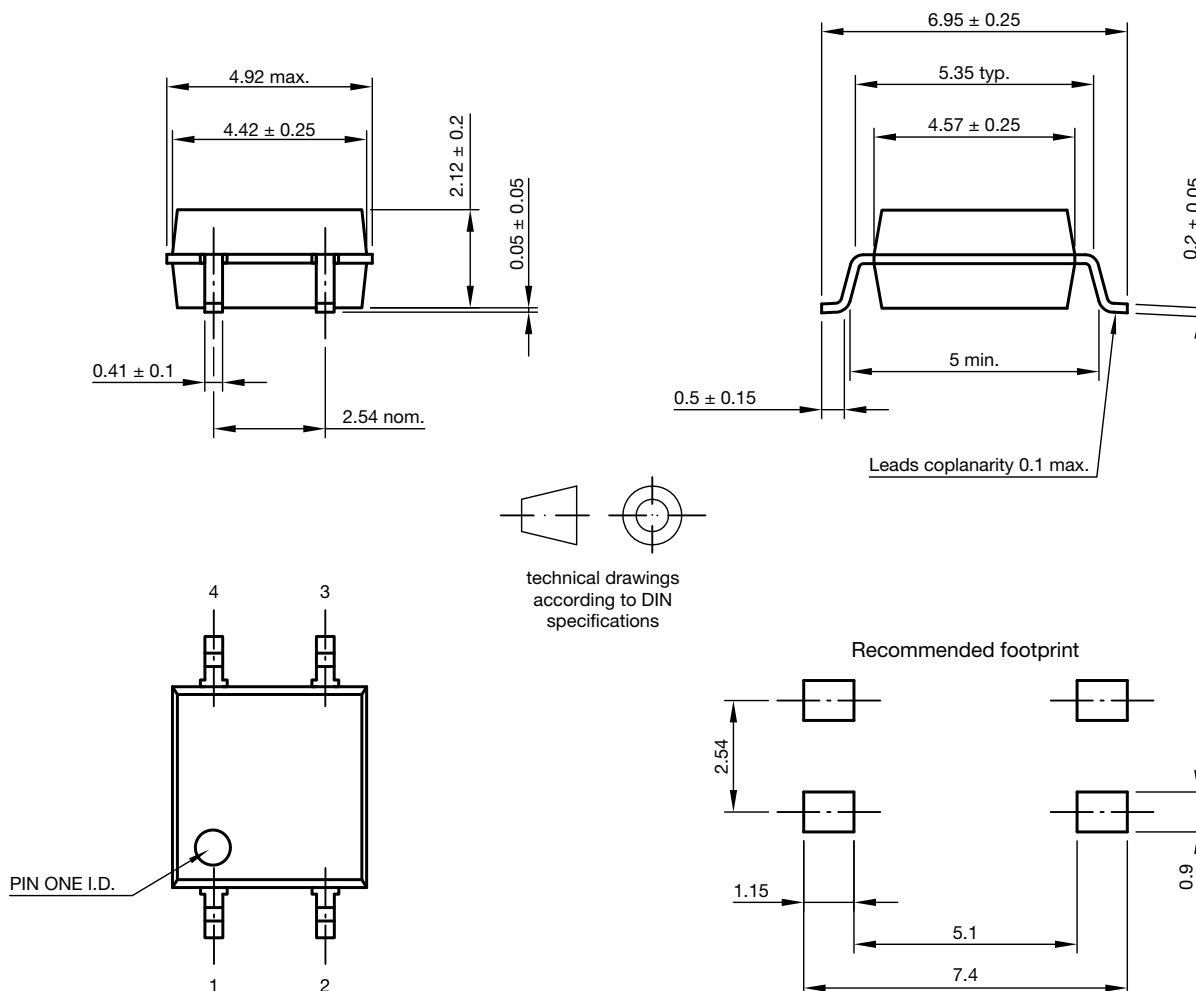


Fig. 14 - Normalized Turn-Off Time vs. Ambient Temperature

### PACKAGE DIMENSIONS (in millimeters)



Drawing-No.: 6.544-5415.01-4  
Issue: 2; 23.07.12

Fig. 15 - Package Drawing

## PACKAGE MARKING

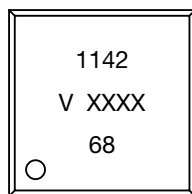
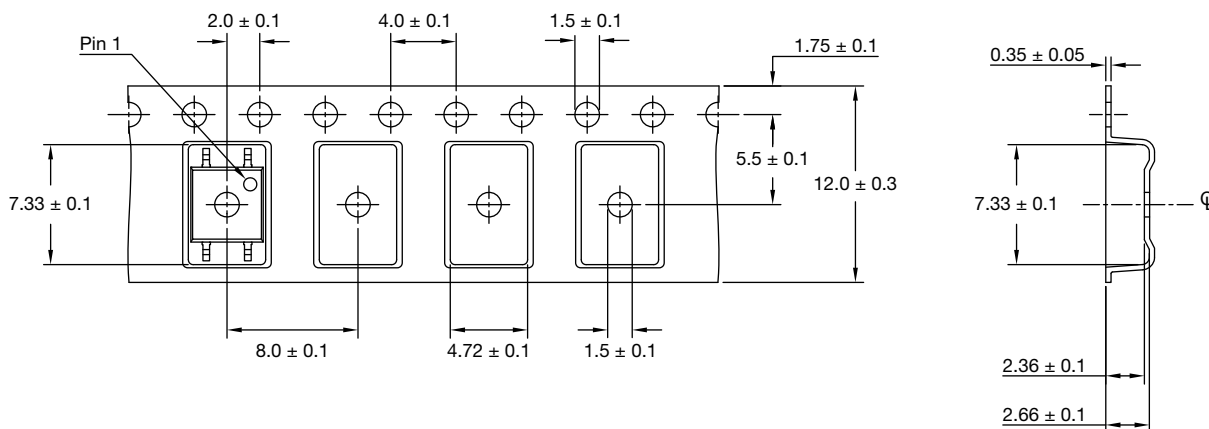


Fig. 16 - VOR1142M4

### Notes

- XXXX = LMC (lot marking code)
- Package configuration (T, M) are not part of the package marking

## PACKAGING INFORMATION (in millimeters)



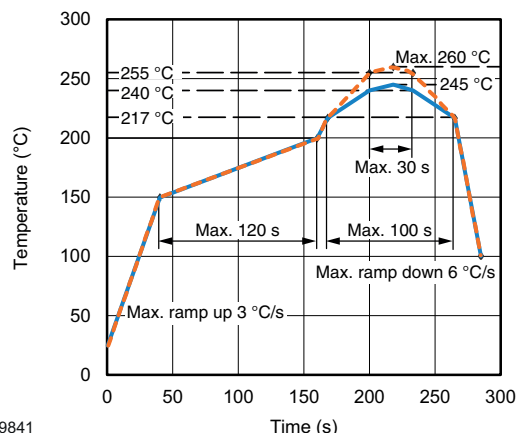
### Note:

- Cummulative tolerance of 10 spocket holes is 0.20 mm

Fig. 17 - Tape and Reel Packing (2000 pieces on reel)

| DEVICE PER TUBE |            |           |           |
|-----------------|------------|-----------|-----------|
| TYPE            | UNITS/TUBE | TUBES/BOX | UNITS/BOX |
| SOP-4           | 100        | 40        | 4000      |

## SOLDER PROFILES



19841

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



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