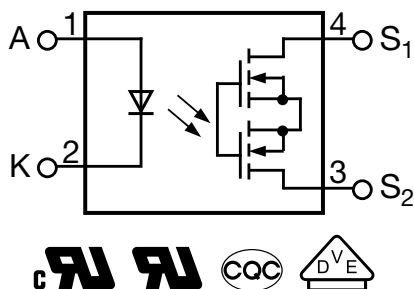


1 Form A Solid-State Relay



DESCRIPTION

The VORA1010M4 is an optically isolated 1 form A solid-state relay in a surface mount 4 pin SOP package.

FEATURES

- AEC-Q102 qualified
- Load voltage 100 V
- Load current 100 mA
- Isolation voltage 3750 V_{RMS}
- SOP-4 low profile package
- Clean bounce free switching
- Available on tape and reel
- Material categorization:
for definitions of compliance please see www.vishay.com/doc?99912



RoHS
 COMPLIANT
 HALOGEN
FREE
GREEN
 (5-2008)

APPLICATIONS

- Hybrid / electric vehicle applications
- [Battery management](#)
- [48 V board net](#)
- Security systems
- Instrumentation
- Industrial controls

AGENCY APPROVALS

- UL (pending)
- cUL (pending)
- DIN EN 60747-5-5 (VDE 0884-5) (pending)
- CQC (pending)

LINKS TO ADDITIONAL RESOURCES


[Infographics](#)

ORDERING INFORMATION

| | | | | | | | | | | |
|-------------|---|---|---|---|---|---|---|---|---|---------------|
| V | O | R | A | 1 | 0 | 1 | 0 | M | 4 | # |
| PART NUMBER | | | | | | | | | | TAPE AND REEL |



| PACKAGE | UL, cUL, CQC, VDE, FIMKO |
|----------------------|--------------------------|
| SOP-4, tape and reel | VORA1010M4T |

| ABSOLUTE MAXIMUM RATINGS ($T_{amb} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified) | | | | |
|--|---------------------------|------------|-------------|--------------------|
| PARAMETER | CONDITIONS | SYMBOL | VALUE | UNIT |
| INPUT | | | | |
| LED continuous forward current | | I_F | 50 | mA |
| LED reverse voltage | | V_R | 5 | V |
| Input power dissipation | | P_{diss} | 80 | mW |
| OUTPUT | | | | |
| DC or peak AC load voltage | | V_L | 100 | V |
| Load current AC peak | | I_L | 100 | mA |
| Output power dissipation | | P_{diss} | 150 | mW |
| SSR | | | | |
| Total power dissipation | | P_{diss} | 200 | mW |
| Ambient temperature range | | T_{amb} | -40 to +125 | $^{\circ}\text{C}$ |
| Storage temperature range | | T_{stg} | -40 to +150 | $^{\circ}\text{C}$ |
| Soldering temperature | $t \leq 10\text{ s max.}$ | 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.

| ELECTRICAL CHARACTERISTICS ($T_{amb} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified) | | | | | | |
|--|--|------------|------|-------|------|---------------|
| PARAMETER | TEST CONDITION | SYMBOL | MIN. | TYP. | MAX. | UNIT |
| INPUT | | | | | | |
| LED forward current, switch turn-on | $I_L = 100\text{ mA}$, $t_{delay} = 10\text{ ms}$ | I_{Fon} | - | 0.2 | 2 | mA |
| LED forward current, switch turn-off | $V_L = 100\text{ V}$ | I_{Foff} | 50 | - | - | μA |
| LED reverse current | $V_R = 5\text{ V}$ | I_R | - | 0.001 | 10 | μA |
| LED forward voltage | $I_F = 5\text{ mA}$ | V_F | - | 1.37 | 1.6 | V |
| LED reverse voltage | $I_R = 10\text{ }\mu\text{A}$ | V_R | 5 | 23 | - | V |
| OUTPUT | | | | | | |
| On-resistance | $I_F = 10\text{ mA}$, $I_L = 100\text{ mA}$ | R_{ON} | - | 2 | 6 | Ω |
| Off-state leakage current | $I_F = 0\text{ mA}$, $V_L = 100\text{ V}$ | I_{LEAK} | - | 0.001 | 1 | μA |

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 | $I_F = 5\text{ mA}$, $V_L = 6\text{ V}$, $I_L = 50\text{ mA}$ | t_{on} | - | 100 | 250 | μs |
| Turn-off time | $I_F = 5\text{ mA}$, $V_L = 6\text{ V}$, $I_L = 50\text{ mA}$ | t_{off} | - | 100 | 150 | μs |

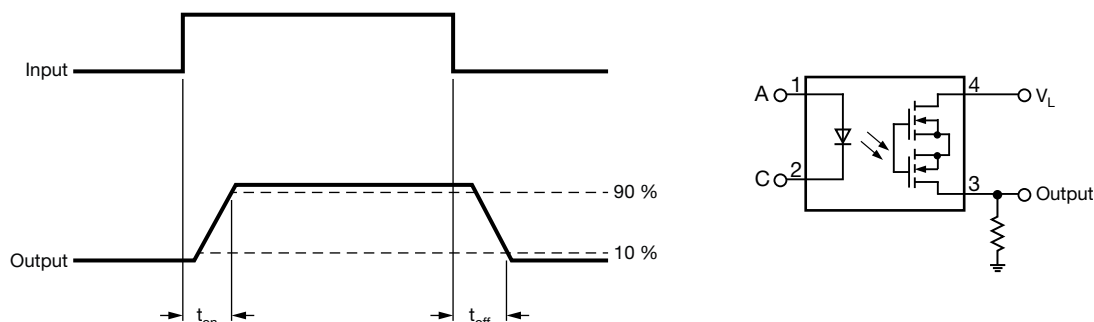


Fig. 1 - Timing Schematic

| SAFETY AND INSULATION RATINGS | | | | |
|--|--|------------|----------------|-------------|
| PARAMETER | TEST CONDITION | SYMBOL | VALUE | UNIT |
| Climatic classification | According to IEC 68 part 1 | | 40 / 125 / 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} | 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} |
| Insulation resistance | $T_{amb} = 125^{\circ}C, V_{IO} = 500 V$ | R_{IO} | $\geq 10^{11}$ | Ω |
| | $T_{amb} = T_S, V_{IO} = 500 V$ | R_{IO} | $\geq 10^9$ | Ω |
| Output safety power | | P_{SO} | 400 | mW |
| Input safety current | | I_{SI} | 150 | mA |
| Input safety temperature | | T_S | 165 | $^{\circ}C$ |
| Clearance distance | | | ≥ 5 | mm |
| Creepage distance | | | ≥ 5 | mm |
| Insulation thickness | | DTI | ≥ 0.3 | mm |
| Input to output test voltage, method B | $V_{IORM} \times 1.875 = V_{PR}$, 100 % production test with $t_M = 1 s$, partial discharge < 5 pC | V_{PR} | 1326 | V_{peak} |
| Input to output test voltage, method A | $V_{IORM} \times 1.6 = V_{PR}$, sample test with $t_M = 10 s$, partial discharge < 5 pC | V_{PR} | 1131 | V_{peak} |

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.

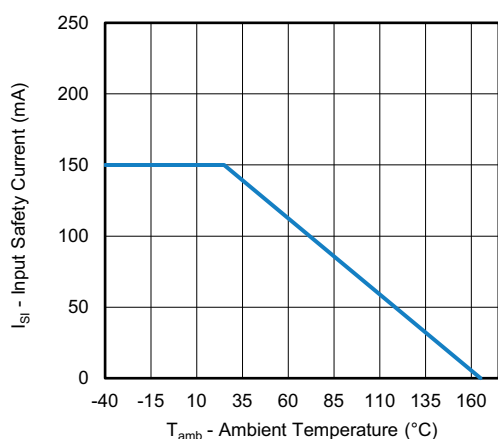


Fig. 2 - Safety Input Current vs. Ambient Temperature

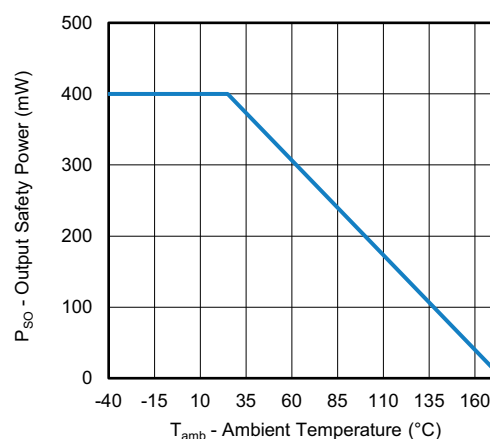


Fig. 3 - Safety Power Dissipation vs. Ambient Temperature

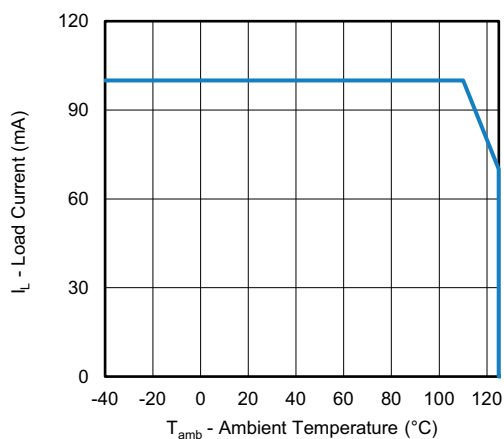
TYPICAL CHARACTERISTICS ($T_{amb} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified)


Fig. 4 - Maximum Load Current vs. Ambient Temperature

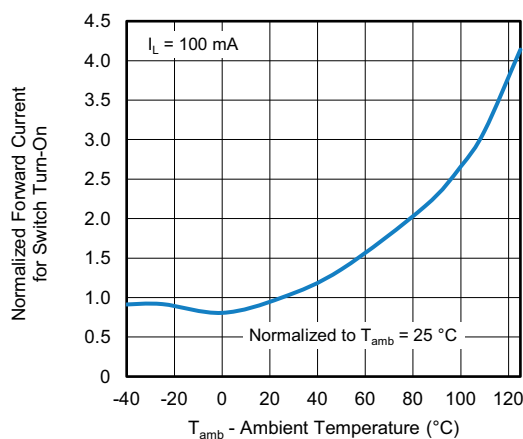


Fig. 7 - Normalized Forward Current for Switch Turn-On vs. Ambient Temperature

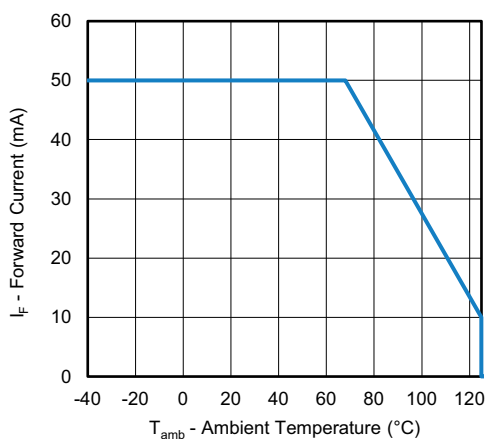


Fig. 5 - Forward Current vs. Ambient Temperature

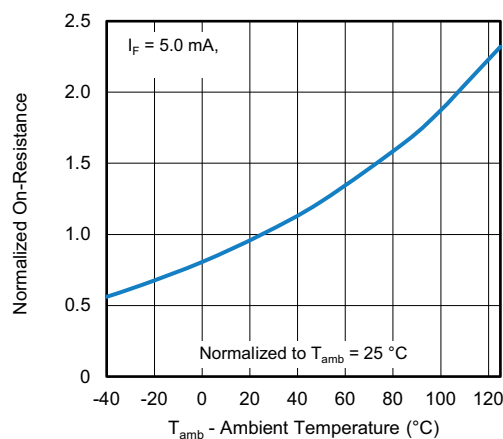


Fig. 8 - Normalized On-Resistance vs. Ambient Temperature

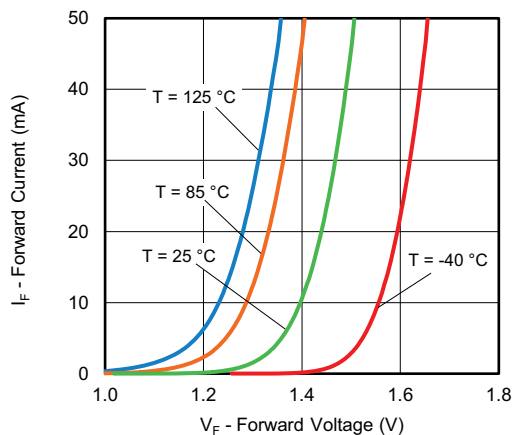


Fig. 6 - Forward Current vs. Forward Voltage

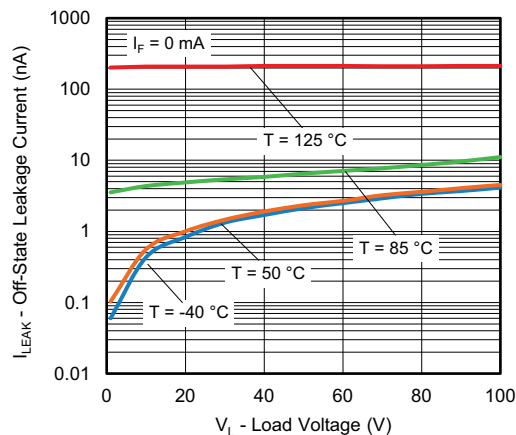


Fig. 9 - Off-State Leakage Current vs. Load Voltage

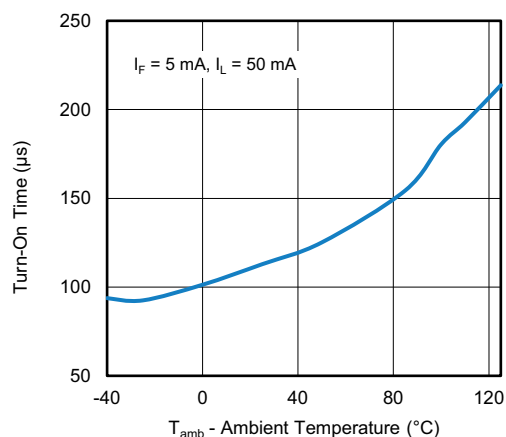


Fig. 10 - Turn-On Time vs. Ambient Temperature

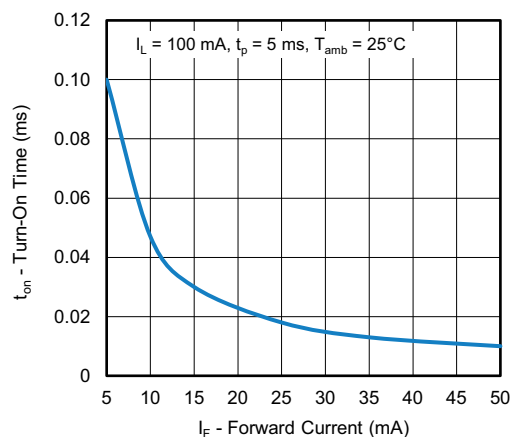


Fig. 11 - Turn-Off Time vs. Ambient Temperature

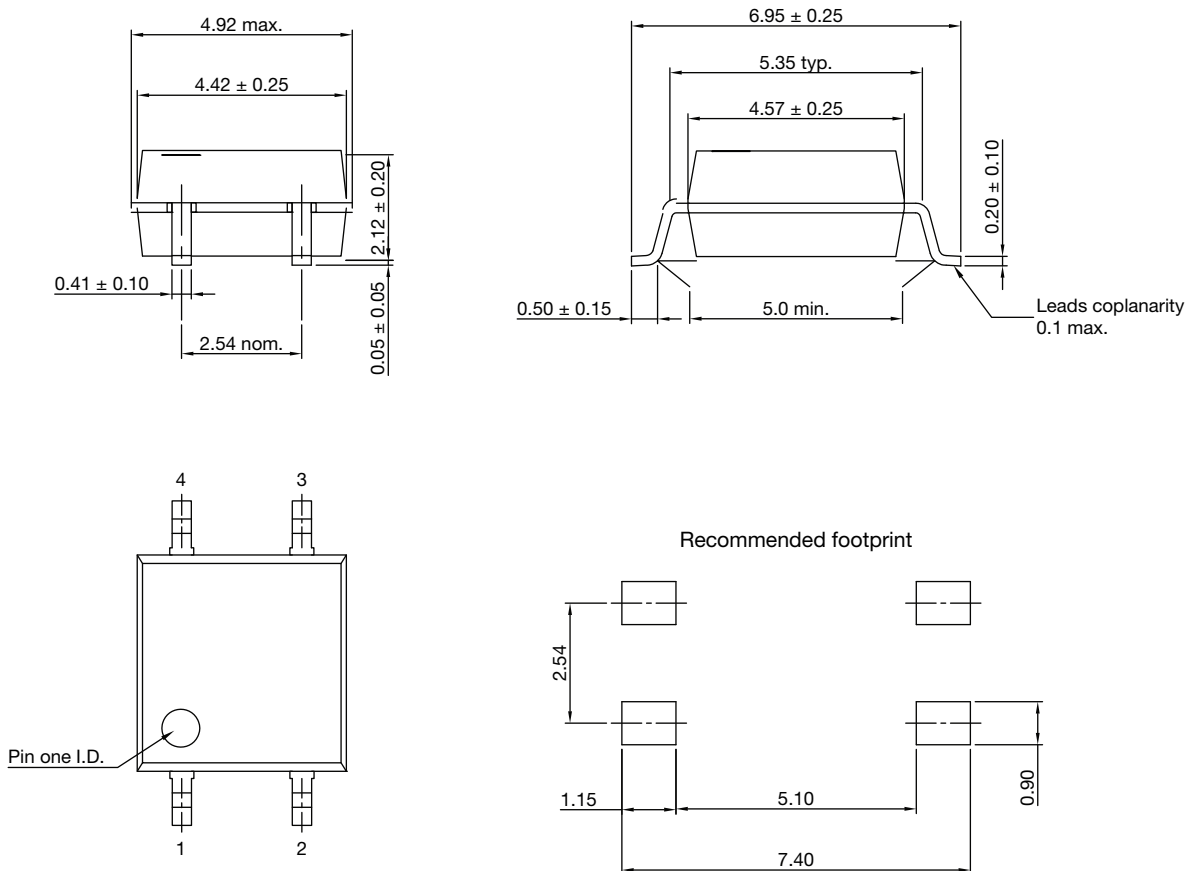
PACKAGE DIMENSIONS (in millimeters)


Fig. 12 - Package Drawings

PACKAGE MARKING

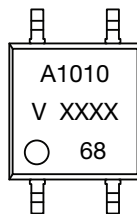
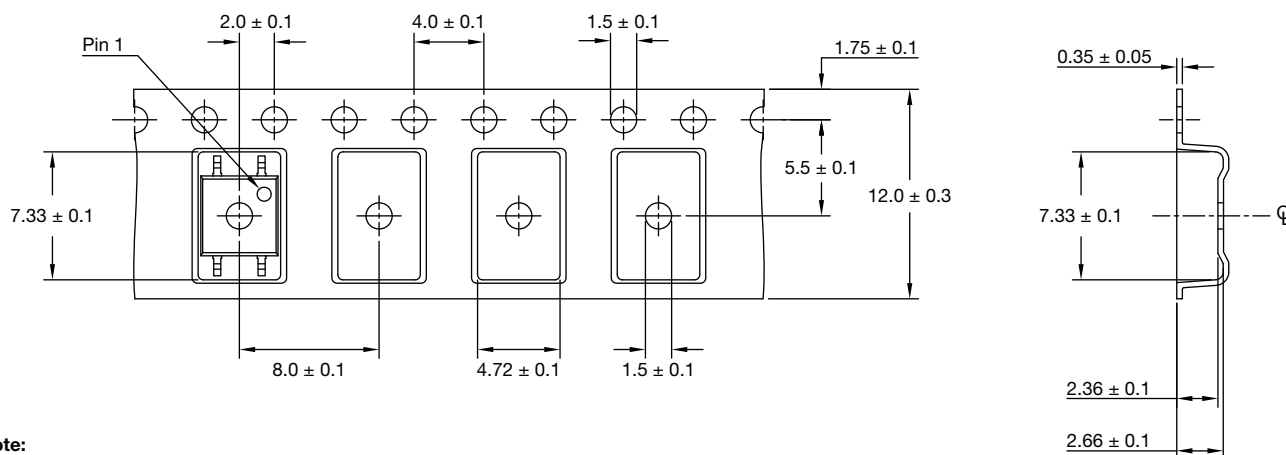


Fig. 13 - VORA1010M4

Notes

- XXXX = LMC (lot marking code)
- Tape and reel suffix (T) is not part of the package marking

TAPE AND REEL INFORMATION (in millimeters)



Note:

- Cumulative tolerance of 10 spocket holes is 0.20

Fig. 14 - VORA1010M4T (2000 pieces on reel)

SOLDER PROFILES

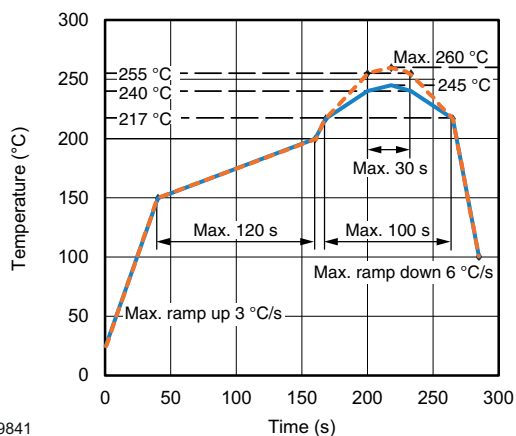


Fig. 15 - Lead (Pb)-free Reflow Solder Profile
According to J-STD-020 for SMD Devices

HANDLING AND STORAGE CONDITIONS

ESD level: HBM class 2

Floor life: 168 h

Conditions: $T_{amb} < 30\text{ °C}$, RH < 60 %

Moisture sensitivity level 3, according to J-STD-020



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