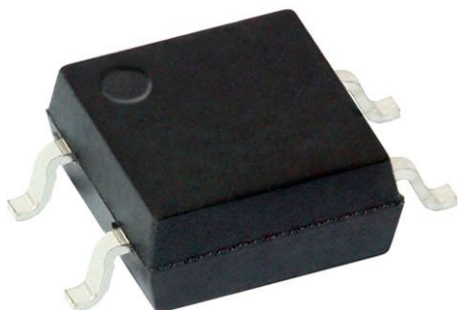


## 1 Form A Solid-State Relay

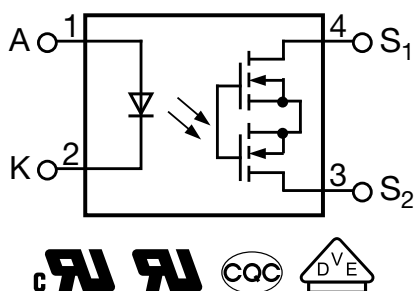


### DESCRIPTION

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<sub>RMS</sub>
- 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](http://www.vishay.com/doc?99912)



### APPLICATIONS

- Hybrid / electric vehicle applications
- Battery management
- Security systems
- Instrumentation
- Industrial controls

### AGENCY APPROVALS

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

### 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

<b>ABSOLUTE MAXIMUM RATINGS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)				
PARAMETER	CONDITIONS	SYMBOL	VALUE	UNIT
<b>INPUT</b>				
LED continuous forward current		$I_F$	50	mA
LED reverse voltage		$V_R$	5	V
Input power dissipation		$P_{diss}$	80	mW
<b>OUTPUT</b>				
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
<b>SSR</b>				
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.

<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	$I_L = 100\text{ mA}$ , $t_{delay} = 10\text{ ms}$	$I_{Fon}$	-	0.2	2	mA
LED forward current, switch turn-off	$V_L = 100\text{ V}$	$I_{Foff}$	50	-	-	$\mu\text{A}$
LED reverse current	$V_R = 5\text{ V}$	$I_R$	-	0.001	10	$\mu\text{A}$
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
<b>OUTPUT</b>						
On-resistance	$I_F = 10\text{ mA}$ , $I_L = 100\text{ mA}$	$R_{ON}$	-	2	6	$\Omega$
Off-state leakage current	$I_F = 0\text{ mA}$ , $V_L = 100\text{ V}$	$I_{LEAK}$	-	0.001	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.

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

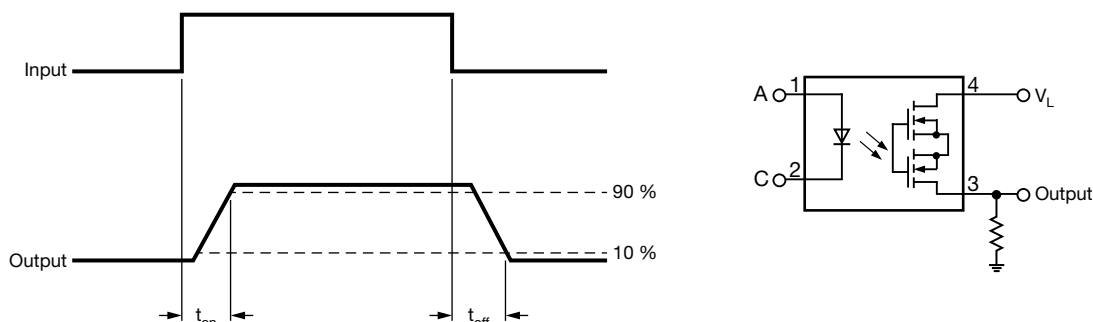


Fig. 1 - Timing Schematic

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	$T_{amb} = 125^{\circ}C, V_{IO} = 500 V$	$R_{IO}$	$\geq 10^{11}$	$\Omega$
	$T_{amb} = T_S, V_{IO} = 500 V$	$R_{IO}$	$\geq 10^9$	$\Omega$
Output safety power		$P_{SO}$	400	mW
Input safety current		$I_{SI}$	150	mA
Input safety temperature		$T_S$	165	$^{\circ}C$
Clearance distance			$\geq 5$	mm
Creepage distance			$\geq 5$	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 $t_M = 1 s$ , 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.

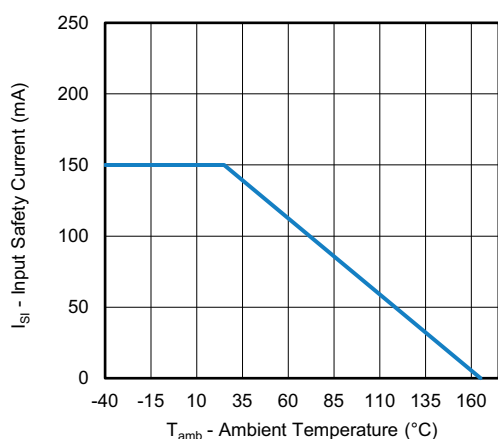


Fig. 2 - Safety Input Current vs. Ambient Temperature

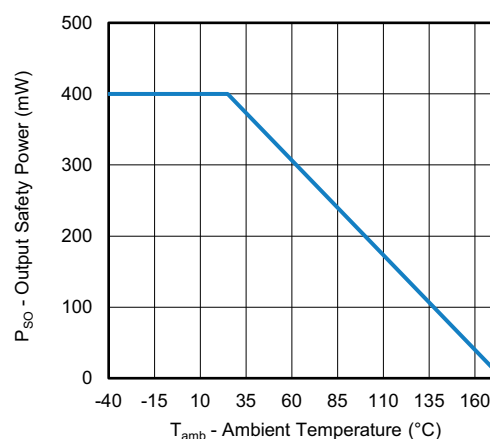


Fig. 3 - Safety Power Dissipation vs. Ambient Temperature

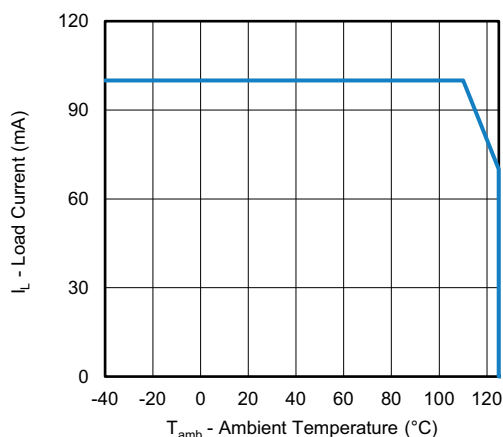
**TYPICAL CHARACTERISTICS** ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)


Fig. 4 - Maximum Load Current vs. Ambient Temperature

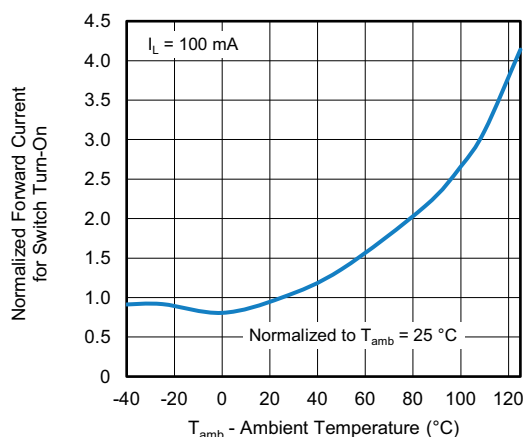


Fig. 7 - Normalized Forward Current for Switch Turn-On vs. Ambient Temperature

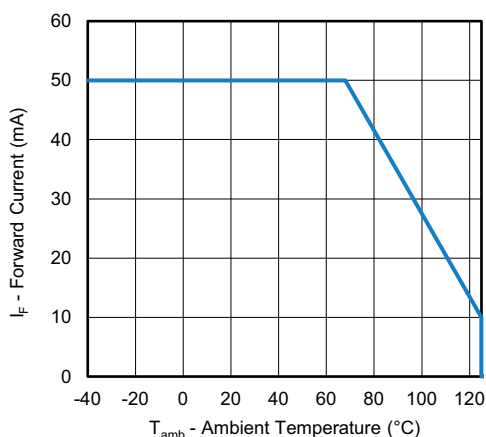


Fig. 5 - Forward Current vs. Ambient Temperature

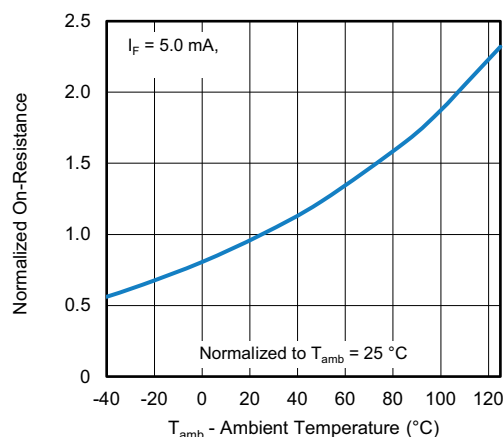


Fig. 8 - Normalized On-Resistance vs. Ambient Temperature

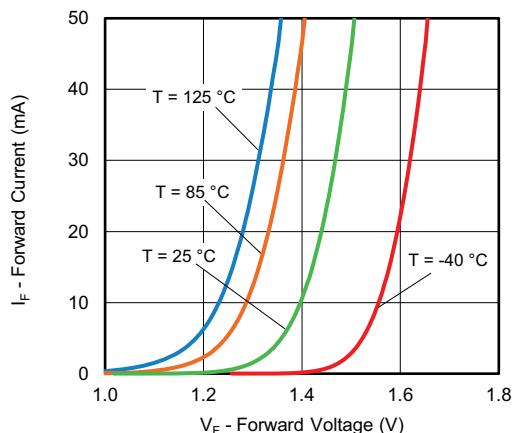


Fig. 6 - Forward Current vs. Forward Voltage

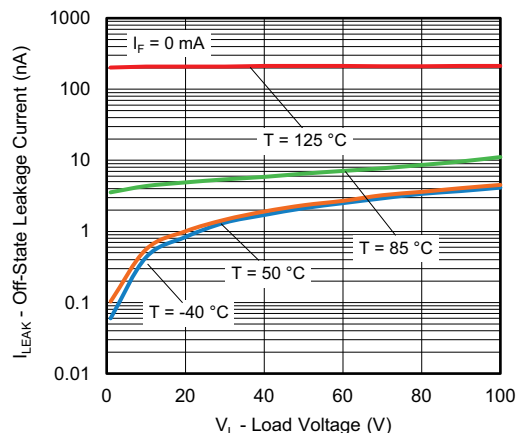


Fig. 9 - Off-State Leakage Current vs. Load Voltage

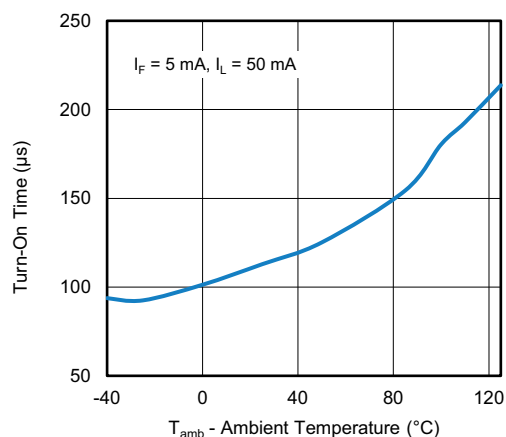


Fig. 10 - Turn-On Time vs. Ambient Temperature

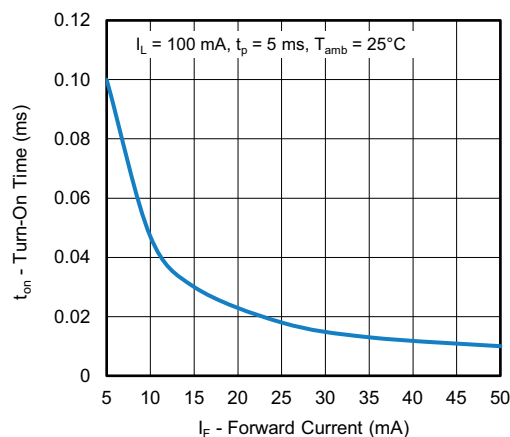


Fig. 11 - Turn-Off Time vs. Ambient Temperature

### PACKAGE DIMENSIONS (in millimeters)

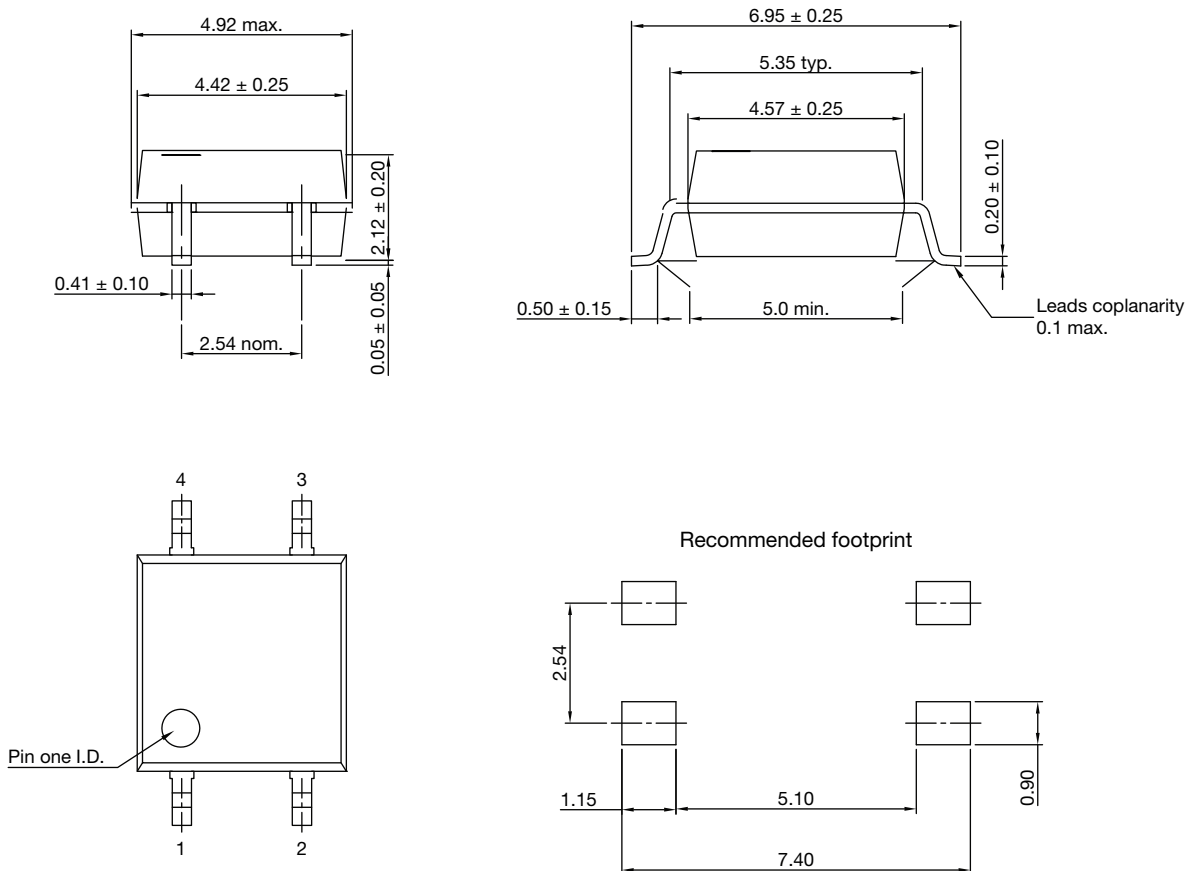


Fig. 12 - Package Drawings

## PACKAGE MARKING

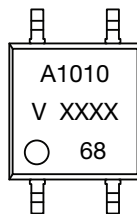
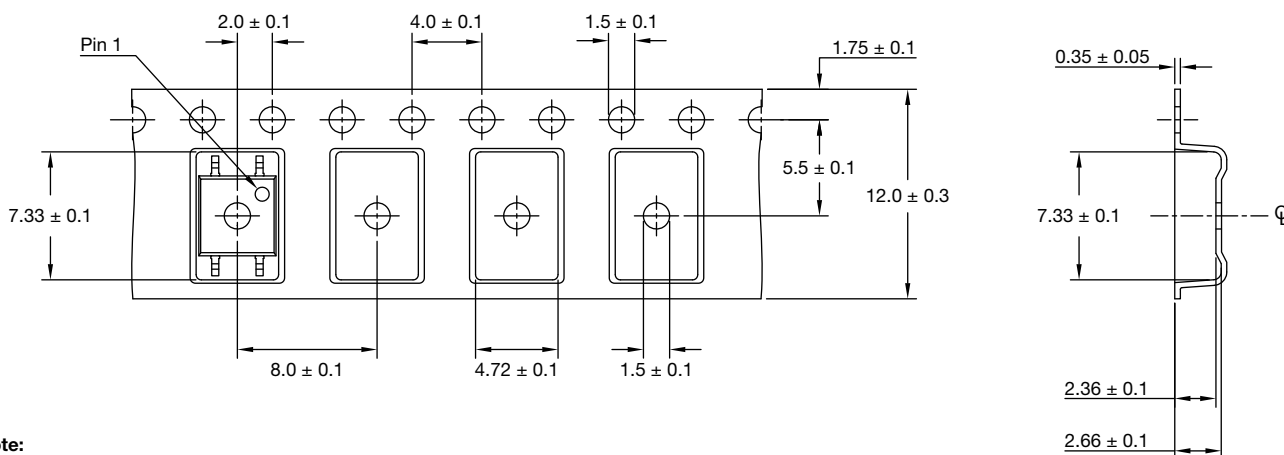


Fig. 13 - VORA1010M4

### 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

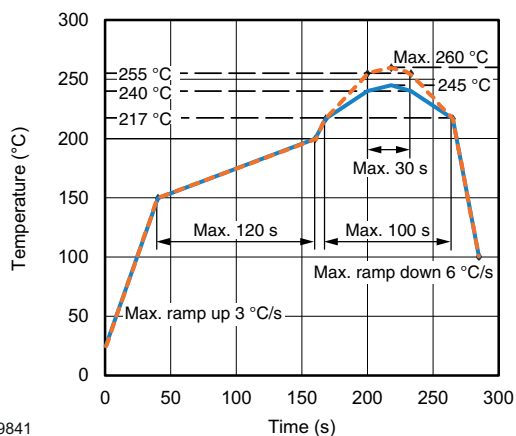


Fig. 15 - Lead (Pb)-free Reflow Solder Profile  
According to J-STD-020 for SMD Devices

## 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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