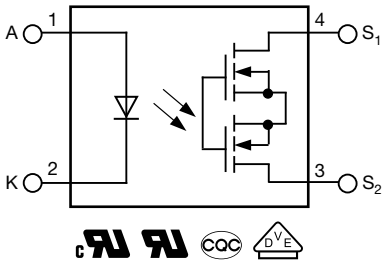
1 Form A Solid-State Relay



DESCRIPTION

The VOR1060M4 is an optically isolated 1 form A solid-state relay in a surface-mount 4 pin SOP package. This 1 form A opto-isolated relay comes in a low profile SOP-4 package making it suitable for space constrained high voltage designs.

Note

- For automotive qualification please get in touch with our local sales

FEATURES

- Load voltage 600 V
- Load current 50 mA
- Isolation voltage 3750 V_{RMS}
- Low on resistance R_{ON} = 40 Ω (typ.)
- Fast switching:
  t_{on} = 0.3 ms (typ.), t_{off} = 0.15 ms (typ.)
- Low leakage current I_{LEAK} = 2 nA (typ.)
- Material categorization:
  for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

e3

RoHS COMPLIANT

HALOGEN FREE GREEN (5-2008)

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	1	0	6	0	M	4	#

PART NUMBER — TAPE AND REEL

PACKAGE	UL, cUL, CQC, VDE, FIMKO
SOP-4, tape and reel	VOR1060M4T

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °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
OUTPUT				
DC or peak AC load voltage		V_L	600	V
Continuous load current		I_L	50	mA
SSR				
Total power dissipation		P_{diss}	550	mW
Ambient temperature range		T_{amb}	-40 to +125	°C
Storage temperature range		T_{stg}	-40 to +150	°C
Soldering temperature	t ≤ 10 s max.	T_{sld}	260	°C

Note

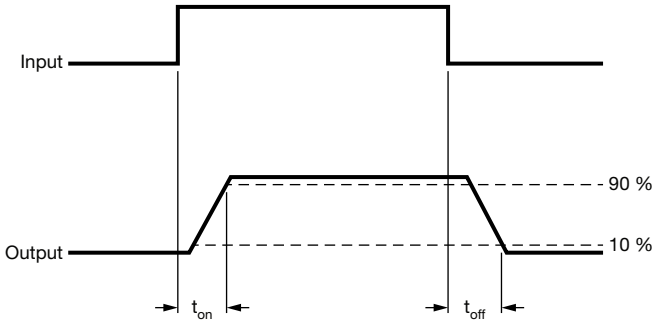
- Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of this document. Exposure to absolute maximum ratings for extended periods of the time can adversely affect reliability.

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
INPUT						
LED forward current, switch turn-on	I_L = 50 mA, t_{delay} = 10 ms	I_{Fon}	-	2	5	mA
LED forward current, switch turn-off	I_L = 1 µA	I_{Foff}	0.1	0.2	-	mA
LED reverse current	V_R = 5 V	I_R	-	0.04	1.3	µA
LED forward voltage	I_F = 10 mA	V_F	-	1.4	1.6	V
LED reverse voltage	I_R = 10 µA	V_R	5	10	-	V
OUTPUT						
On-resistance	I_F = 10 mA, I_L = 50 mA	R_{ON}	-	40	70	Ω
Off-state leakage current	I_F = 0 mA, V_L = 600 V	I_{LEAK}	-	0.002	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						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Turn-on time	I_F = 10 mA, R_L = 200 Ω, I_L = 50 mA	t_{on}	-	0.3	3	ms
Turn-off time	I_F = 10 mA, R_L = 200 Ω, I_L = 50 mA	t_{off}	-	0.15	0.5	ms



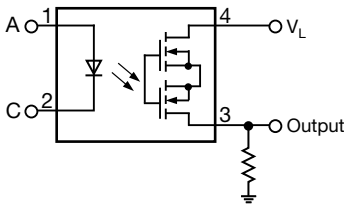


Fig. 1 - Timing Schematic

SAFETY AND INSULATION RATINGS				
PARAMETER	**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
Climatic classification	According to IEC 68 part 1		55 / 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}	4800	V_{peak}
Maximum repetitive peak isolation voltage	According to DIN EN 60747-5-5	V_{IORM}	707	V_{peak}
Insulation resistance	T_{amb} = 25 °C, V_{IO} = 500 V	R_{IO}	≥ 10^{12}	Ω
	T_{amb} = 125 °C, V_{IO} = 500 V	R_{IO}	≥ 10^{10}	Ω
	T_{amb} = 150 °C, V_{IO} = 500 V	R_{IO}	≥ 10^{9}	Ω
Output safety power		P_{SO}	750	mW
Input safety current		I_{SI}	200	mA
Input safety temperature		T_S	150	°C
Clearance distance			≥ 5.2	mm
Creepage distance			≥ 5.2	mm

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.

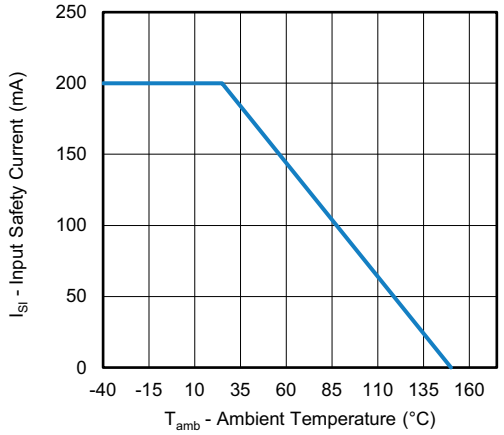


Fig. 2 - Safety Input Current vs. Ambient Temperature

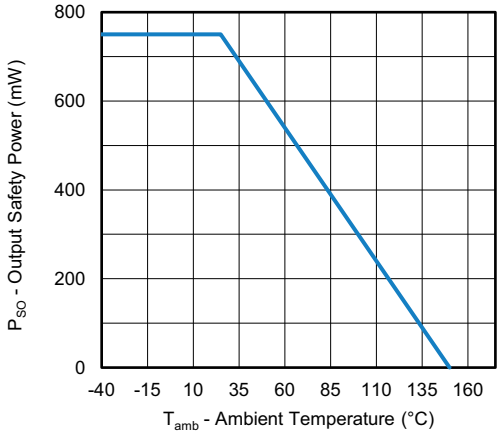


Fig. 3 - Safety Power Dissipation vs. Ambient Temperature

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

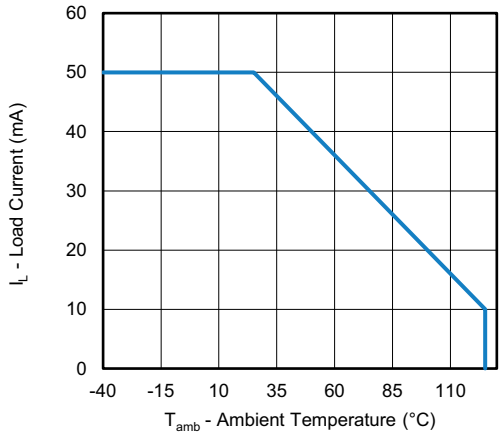


Fig. 4 - Load Current vs. Ambient Temperature

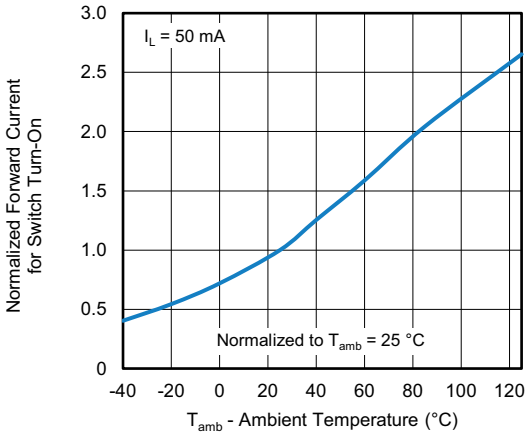


Fig. 7 - Normalized Forward Current for Switch Turn-On vs. Ambient Temperature

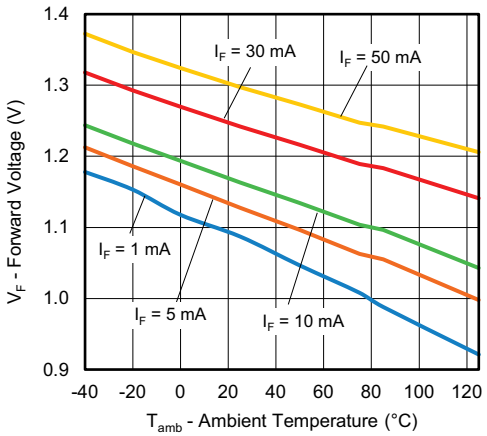


Fig. 5 - Forward Voltage vs. Ambient Temperature

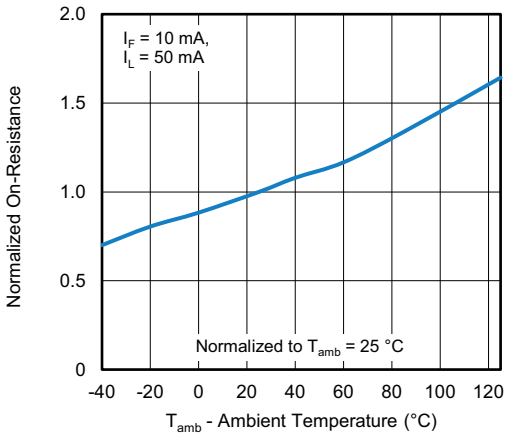


Fig. 8 - Normalized On-Resistance vs. Ambient Temperature

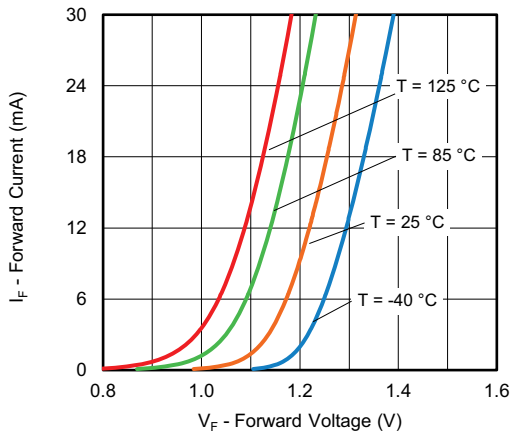


Fig. 6 - Forward Current vs. Forward Voltage

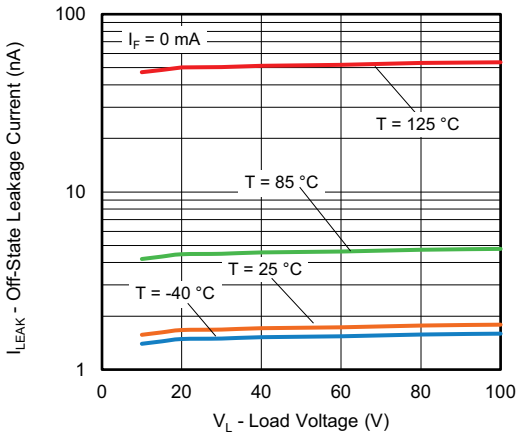


Fig. 9 - Off-State Leakage Current vs. Load Voltage

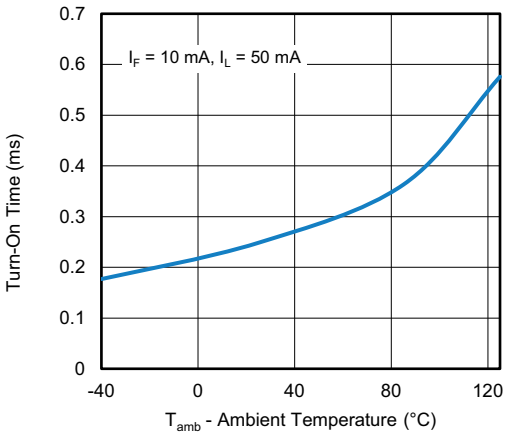


Fig. 10 - Turn-On Time vs. Ambient Voltage

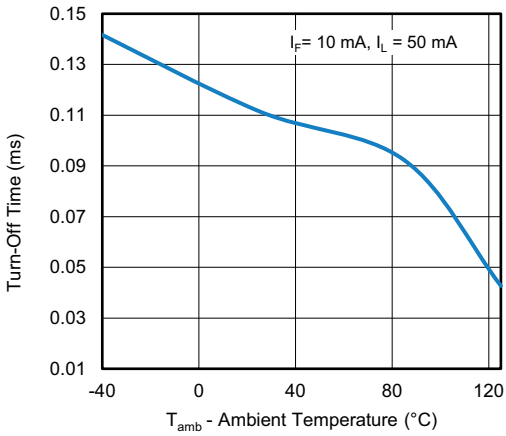


Fig. 12 - Turn-Off Time vs. Ambient Temperature

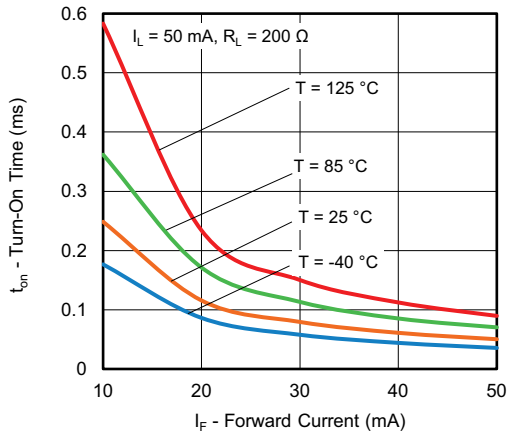


Fig. 11 - Turn-On Time vs. Forward Current

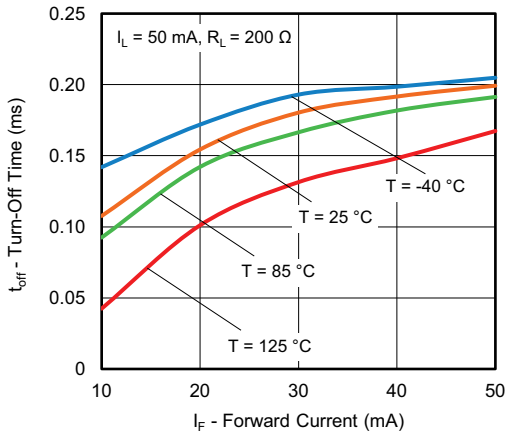
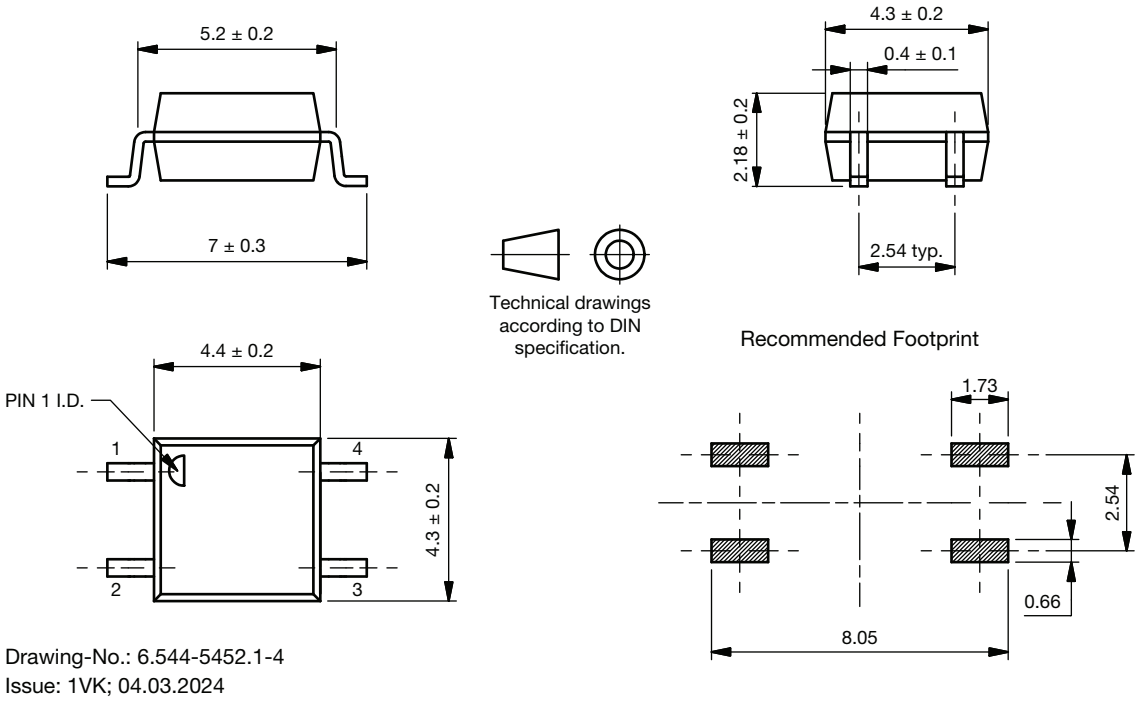


Fig. 13 - Turn-Off Time vs. Forward Current

PACKAGE DIMENSIONS (in millimeters)



Drawing-No.: 6.544-5452.1-4
Issue: 1VK; 04.03.2024

Fig. 14 - Package Drawings

PACKAGE MARKING

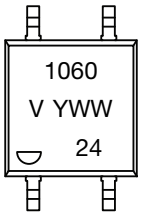
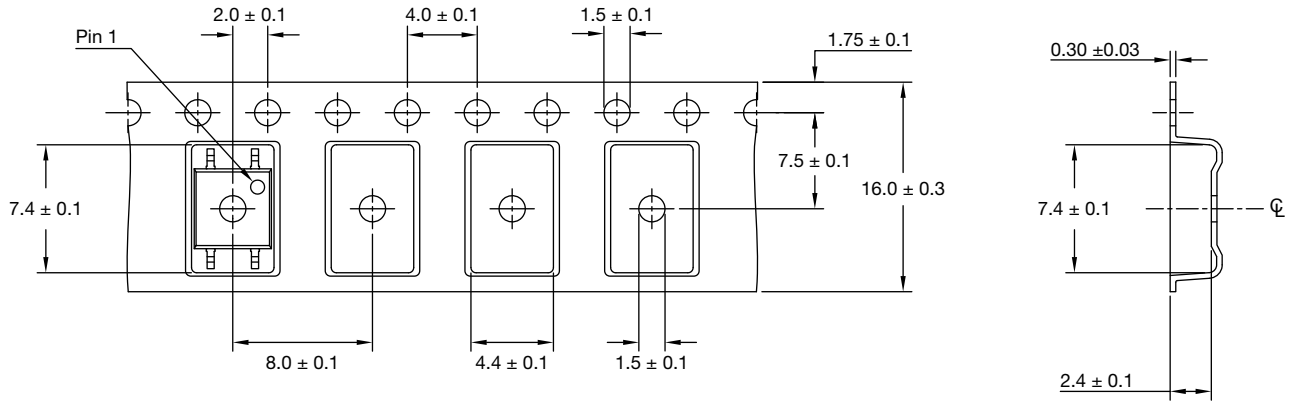


Fig. 15 - VOR1060M4

Notes

- YWW = date code
- Tape and reel suffix (T) is not part of the package marking

TAPE AND REEL INFORMATION (in millimeters)



Note:
• Cummulative tolerance of 10 spocket holes is 0.20

Fig. 16 - VOR1060M4T (3000 pieces on reel)

SOLDER PROFILES

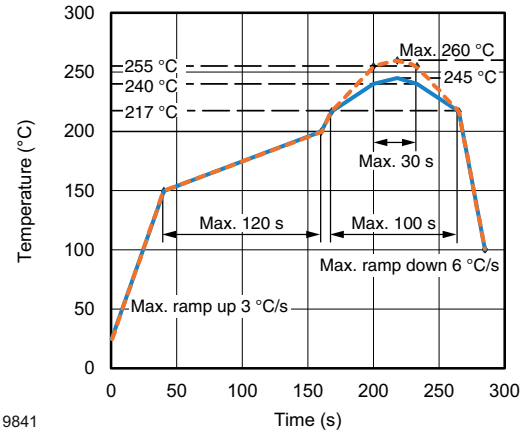


Fig. 17 - Lead (Pb)-free Reflow Solder Profile
According to J-STD-020 for SMD Devices

HANDLING AND STORAGE CONDITIONS

ESD level: HBM class 2

Floor life: 168 h

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

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

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