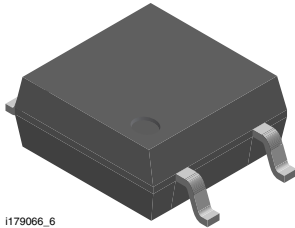
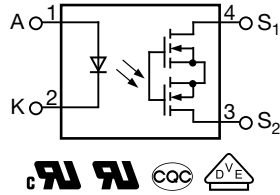


# 1 Form A Solid-State Relay



I179066\_6



## FEATURES

- Maximum  $R_{ON}$  5  $\Omega$
- Load voltage 60 V
- Load current 100 mA
- Isolation test voltage 3750  $V_{RMS}$
- Small 4 pin SOP package
- Clean bounce free switching
- TTL / CMOS compatible input
- High reliability hybrid receptor
- Available on tape and reel
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
COMPLIANT

## DESCRIPTION

The VO1400AEF is an optically isolated 1 form A solid-state relay in a surface mount 4 pin SOP package.

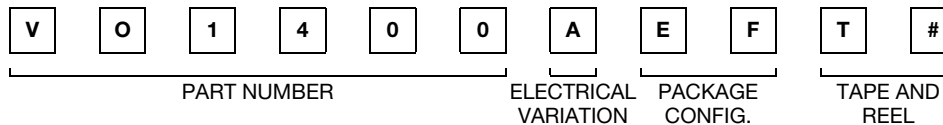
## APPLICATIONS

- Security systems
- Instrumentation
- Industrial controls

## AGENCY APPROVALS

- UL, file no. E52744
- cUL, file no. E52744
- DIN EN 60747-5-5 (VDE 0884-5)
- FIMKO EN 60950-1
- CQC GB8898-2011

## ORDERING INFORMATION



<b>PACKAGE</b>	<b>UL, cUL, CQC, VDE, FIMKO</b>
SOP-4, tape and reel	VO1400AEFTR
SOP-4, tape and reel (product rotated in tape)	VO1400AEFT1

## ABSOLUTE MAXIMUM RATINGS ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , 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
<b>OUTPUT</b>				
DC or peak AC load voltage		$V_L$	60	V
Load current AC peak		$I_L$	100	mA
Peak load current	$t = 10\text{ ms}$	$I_{LPK}$	350	mA
<b>SSR</b>				
Total power dissipation		$P_{diss}$	120	mW
Ambient temperature range		$T_{amb}$	-40 to +85	$^{\circ}\text{C}$
Storage temperature range		$T_{stg}$	-40 to +125	$^{\circ}\text{C}$
Soldering temperature	$t \leq 10\text{ s max.}$	$T_{slid}$	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.

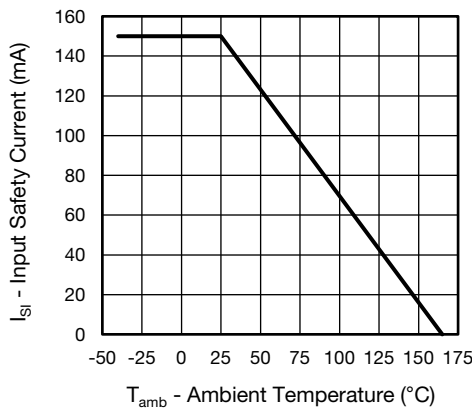
**ABSOLUTE MAXIMUM RATING CURVE**


Fig. 1 - Input Safety Current vs. Ambient Temperature

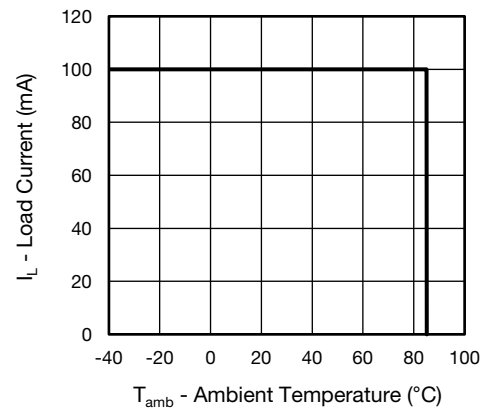


Fig. 3 - Load Current vs. Ambient Temperature

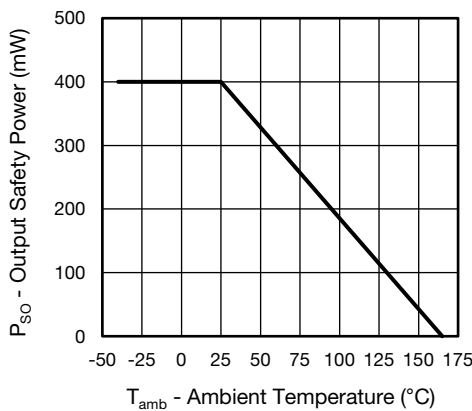


Fig. 2 - Output Safety Power vs. Ambient Temperature

<b>ELECTRICAL CHARACTERISTICS</b> (T <sub>amb</sub> = 25 °C, unless otherwise specified)						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
<b>INPUT</b>						
LED forward current, switch turn-on	I <sub>L</sub> = 100 mA, V <sub>L</sub> ≤ 0.5 V, t = 10 ms	I <sub>Fon</sub>	0.3	0.8	3.2	mA
LED forward current, switch turn-off	V <sub>L</sub> = 60 V	I <sub>Foff</sub>	100	400	-	μA
LED reverse current	V <sub>R</sub> = 5 V	I <sub>R</sub>	-	0.001	10	μA
LED forward voltage	I <sub>F</sub> = 5 mA	V <sub>F</sub>	0.8	1.1	1.4	V
LED reverse voltage	I <sub>R</sub> = 10 μA	V <sub>R</sub>	5	40		V
<b>OUTPUT</b>						
On-resistance	I <sub>F</sub> = 10 mA, I <sub>L</sub> = 100 mA	R <sub>ON</sub>	-	2.3	5	Ω
Off-state leakage current	I <sub>F</sub> = 0 mA, V <sub>L</sub> = 60 V	I <sub>LEAK</sub>	-	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.

<b>SWITCHING CHARACTERISTICS</b>						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Turn-on time	$I_F = 10 \text{ mA}, V_L = 20 \text{ V}, I_L = 100 \text{ mA}$	$t_{on}$	-	52	500	$\mu\text{s}$
Turn-off time	$I_F = 10 \text{ mA}, V_L = 20 \text{ V}, I_L = 100 \text{ mA}$	$t_{off}$	-	36	500	$\mu\text{s}$

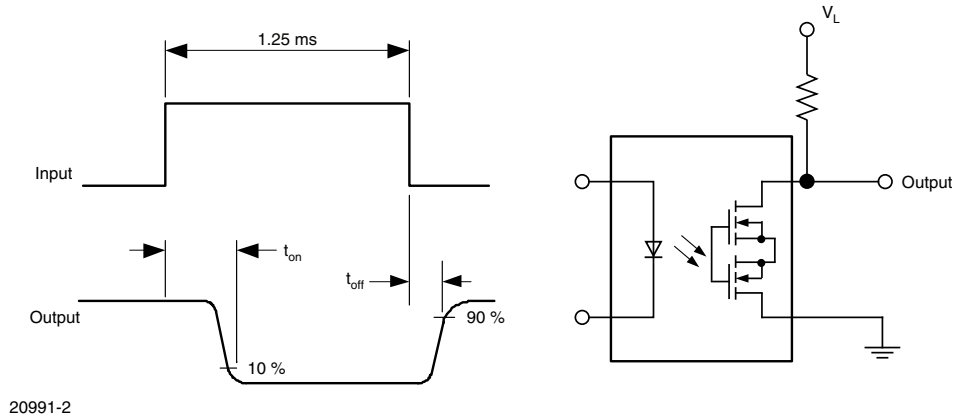


Fig. 4 - Timing Test Circuit and Waveforms

<b>SAFETY AND INSULATION RATINGS</b>				
PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Climatic classification	According to IEC 68 part 1		40/85/21	
Pollution degree	According to DIN VDE 0109		2	
Comparative tracking index	Insulation group IIIa	CTI	175	
Maximum rated withstanding isolation voltage	According to UL1577, $t = 1 \text{ min}$	$V_{ISO}$	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	$T_{amb} = 25 \text{ }^\circ\text{C}, V_{IO} = 500 \text{ V}$	$R_{IO}$	$\geq 10^{12}$	$\Omega$
	$T_{amb} = 100 \text{ }^\circ\text{C}, V_{IO} = 500 \text{ V}$	$R_{IO}$	$\geq 10^{11}$	$\Omega$
	$T_{amb} = T_S, V_{IO} = 500 \text{ V}$	$R_{IO}$	$\geq 10^9$	$\Omega$
Output safety power		$P_{SO}$	400	mW
Input safety current		$I_{SI}$	150	mA
Input safety temperature		$T_S$	165	$^\circ\text{C}$
Clearance distance	Measured from input terminals to output terminals, shortest distance through air		$\geq 5$	mm
Creepage distance	Measured from input terminals to output terminals, shortest distance path along body		$\geq 5$	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	$V_{IORM} \times 1.6 = V_{PR}$ , 100 % sample test with $t_M = 10 \text{ s}$ , partial discharge $< 5 \text{ pC}$	$V_{PR}$	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.

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

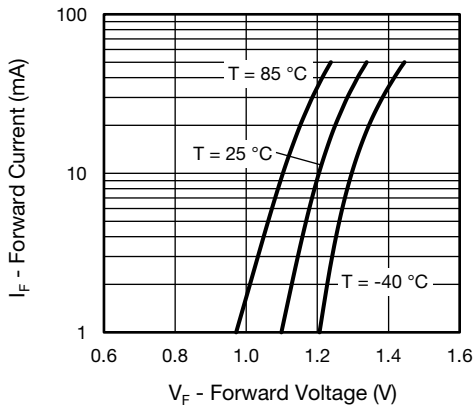


Fig. 5 - Forward Current vs. Forward Voltage

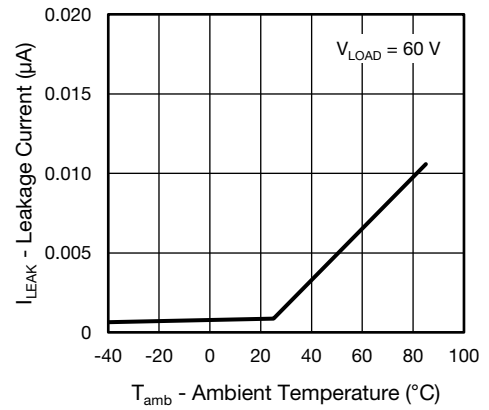


Fig. 8 - Leakage Current vs. Ambient Temperature

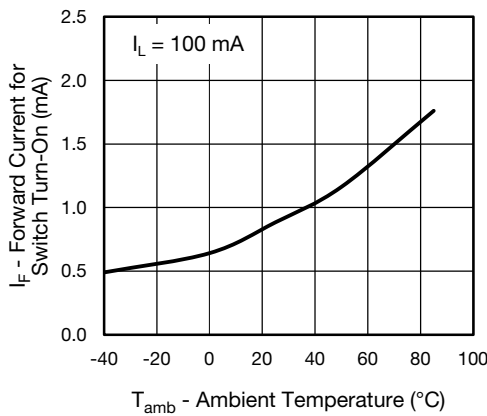


Fig. 6 - Forward Current for Switch Turn-On vs. Ambient Temperature

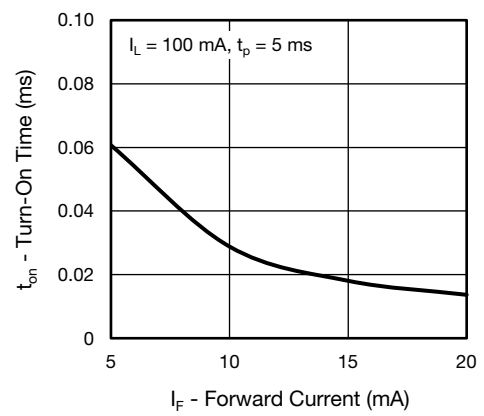


Fig. 9 - Turn-On Time vs. Forward Current

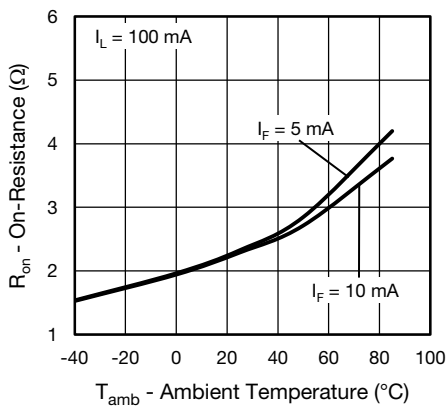


Fig. 7 - On-Resistance vs. Ambient Temperature

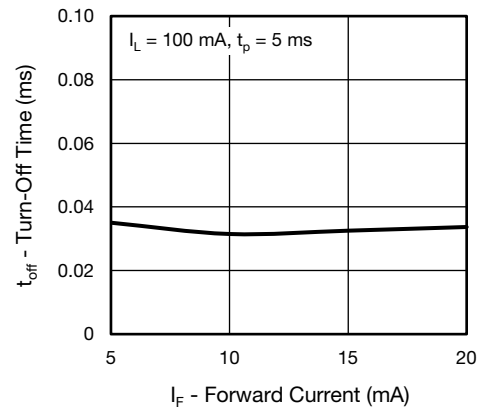


Fig. 10 - Turn-Off Time vs. Forward Current



**PACKAGE DIMENSIONS** (in millimeters)

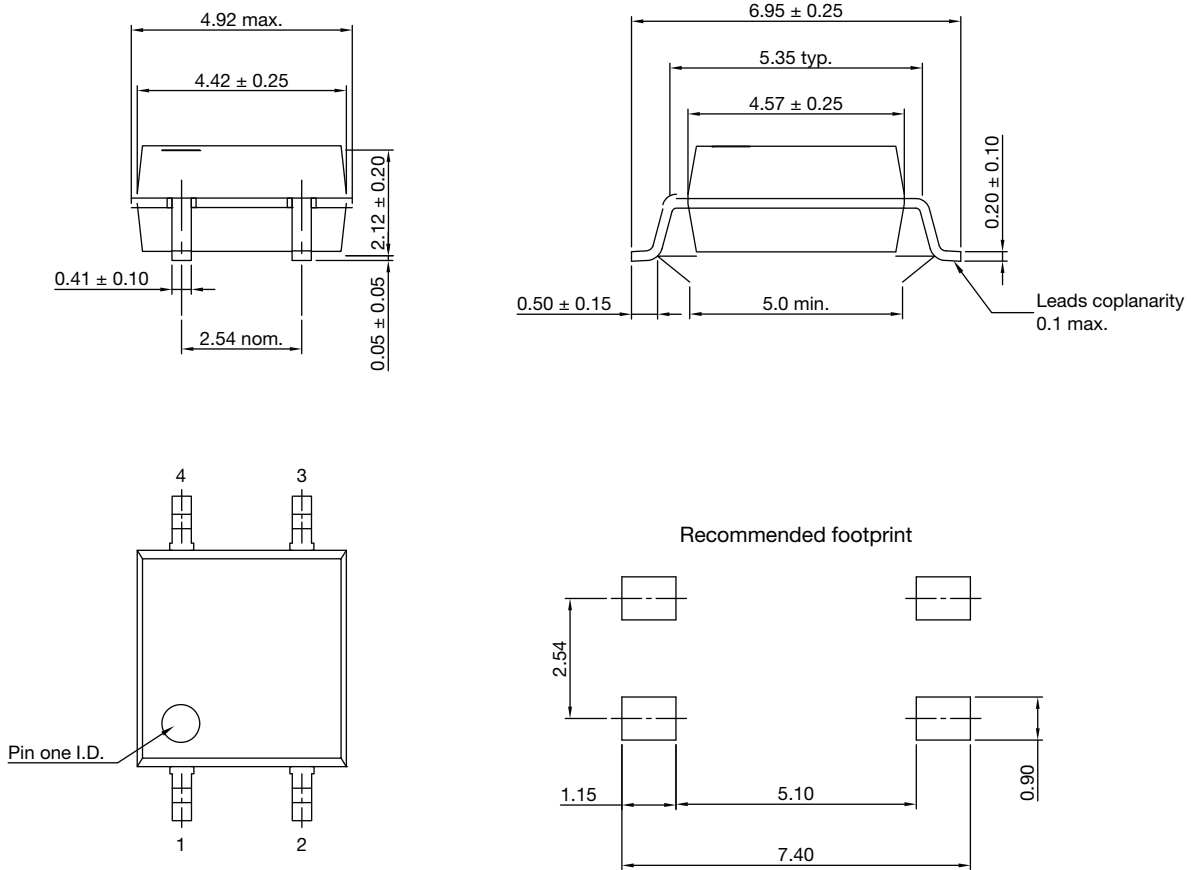


Fig. 11 - Package Drawings

**PACKAGE MARKING**

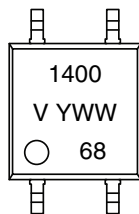
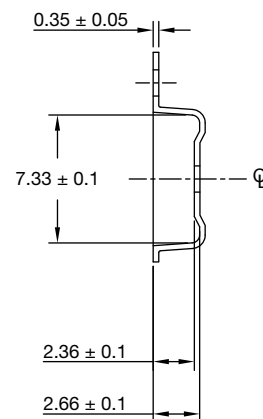
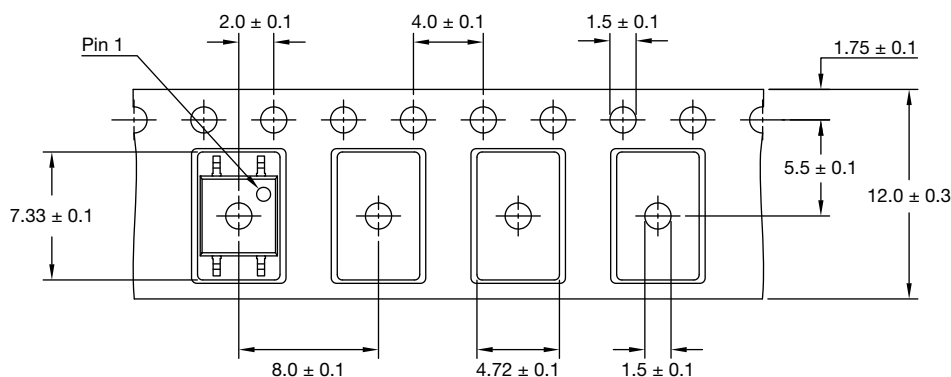


Fig. 12 - VO1400AEF

**Note**

- Tape and reel suffix (TR) is not part of the package marking.

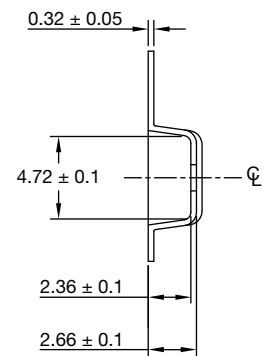
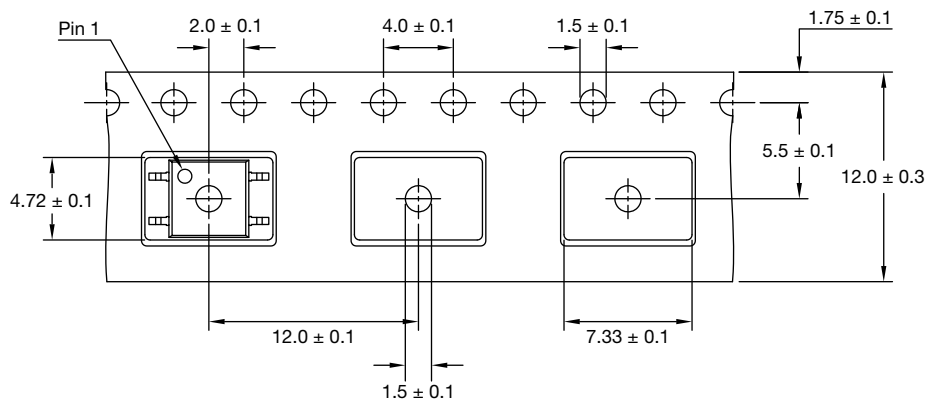
**TAPE AND REEL INFORMATION** (in millimeters)



**Note:**

- Cumulative tolerance of 10 sprocket holes is 0.20

Fig. 13 - VO1400AEFT (2000 pieces on reel)



**Note:**

- Cumulative tolerance of 10 sprocket holes is 0.20

Fig. 14 - VO1400AEFT1 (1000 pieces on reel)

**SOLDER PROFILES**

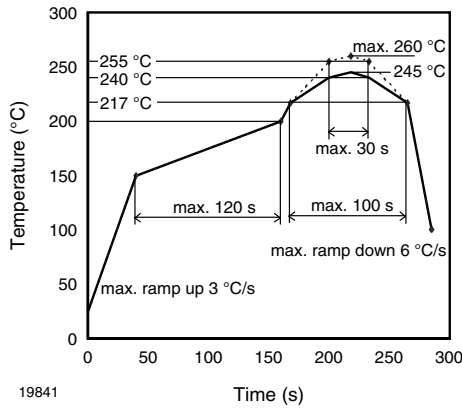


Fig. 15 - Lead (Pb)-free Reflow Solder Profile According to J-STD-020 for SMD Devices

**HANDLING AND STORAGE CONDITIONS**

ESD level: HBM class 2

Floor life: unlimited

Conditions:  $T_{amb} < 30\text{ °C}$ , RH < 85 %

Moisture sensitivity level 1, according to J-STD-020



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