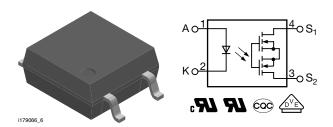


## 1 Form A Solid-State Relay



#### **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

#### **FEATURES**

- Maximum R<sub>ON</sub> 5 Ω
- Load voltage 60 V
- Load current 100 mA
- Isolation test voltage 3750 V<sub>RMS</sub>
- 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 <a href="https://www.vishav.com/doc?99912"><u>www.vishav.com/doc?99912</u></a>

### **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		
V O 1 4 0 0 A  PART NUMBER ELECTRICAL VARIATION	PACKAGE TAPE AND REEL	
PACKAGE	UL, cUL, CQC, VDE, FIMKO	
SOP-4, tape and reel	VO1400AEFTR	
SOP-4, tape and reel (product rotated in tape)	VO1400AEFT1	

<b>ABSOLUTE MAXIMUM RATINGS</b> (T <sub>amb</sub> = 25 °C, unless otherwise specified)						
PARAMETER	CONDITIONS	SYMBOL	VALUE	UNIT		
INPUT	INPUT					
LED continuous forward current		I <sub>F</sub>	50	mA		
LED reverse voltage		$V_R$	5	V		
OUTPUT						
DC or peak AC load voltage		$V_L$	60	V		
Load current AC peak		IL	100	mA		
Peak load current	t = 10 ms	I <sub>LPK</sub>	350	mA		
SSR						
Total power dissipation		P <sub>diss</sub>	120	mW		
Ambient temperature range		T <sub>amb</sub>	-40 to +85	°C		
Storage temperature range		T <sub>stg</sub>	-40 to +125	°C		
Soldering temperature	t ≤ 10 s max.	T <sub>sld</sub>	260	°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**

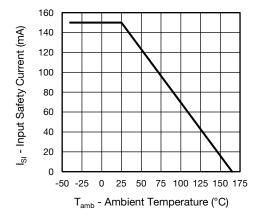


Fig. 1 - Input Safety Current vs. Ambient Temperature

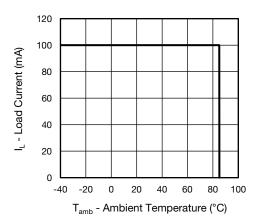


Fig. 3 - Load Current vs. Ambient Temperature

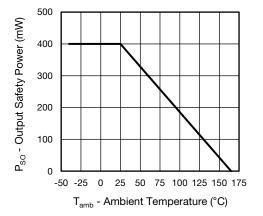


Fig. 2 - Output Safety Power vs. Ambient Temperature

<b>ELECTRICAL CHARACTERISTICS</b> (T <sub>amb</sub> = 25 °C, unless otherwise specified)						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
INPUT	INPUT					
LED forward current, switch turn-on	$I_L = 100 \text{ mA}, V_L \le 0.5 \text{ V}, t = 10 \text{ ms}$	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	-	μΑ
LED reverse current	V <sub>R</sub> = 5 V	I <sub>R</sub>	-	0.001	10	μΑ
LED forward voltage	$I_F = 5 \text{ mA}$	$V_{F}$	0.8	1.1	1.4	V
LED reverse voltage	$I_R = 10 \mu A$	$V_R$	5	40		V
OUTPUT						
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	$I_F = 0 \text{ mA}, V_L = 60 \text{ V}$	I <sub>LEAK</sub>	-	0.002	1	μΑ

#### 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	$I_F = 10 \text{ mA}, V_L = 20 \text{ V}, I_L = 100 \text{ mA}$	t <sub>on</sub>	-	52	500	μs
Turn-off time	$I_F = 10 \text{ mA}, V_L = 20 \text{ V}, I_L = 100 \text{ mA}$	t <sub>off</sub>	-	36	500	μs

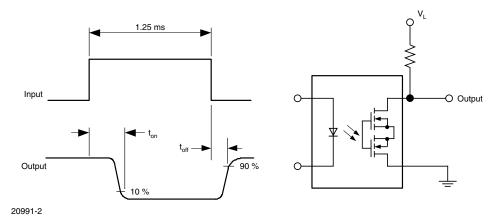


Fig. 4 - Timing Test Circuit and Waveforms

SAFETY AND INSULATION RATINGS				
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 min	V <sub>ISO</sub>	3750	V <sub>RMS</sub>
Maximum transient isolation voltage	According to DIN EN 60747-5-5	V <sub>IOTM</sub>	6000	V <sub>peak</sub>
Maximum repetitive peak isolation voltage	According to DIN EN 60747-5-5	V <sub>IORM</sub>	707	V <sub>peak</sub>
	$T_{amb} = 25  ^{\circ}\text{C},  V_{IO} = 500  \text{V}$	R <sub>IO</sub>	≥ 10 <sup>12</sup>	Ω
Insulation resistance	$T_{amb} = 100  ^{\circ}C,  V_{IO} = 500  V$	R <sub>IO</sub>	≥ 10 <sup>11</sup>	Ω
	$T_{amb} = T_S$ , $V_{IO} = 500 \text{ V}$	R <sub>IO</sub>	≥ 10 <sup>9</sup>	Ω
Output safety power		P <sub>SO</sub>	400	mW
Input safety current		I <sub>SI</sub>	150	mA
Input safety temperature		T <sub>S</sub>	165	°C
Clearance distance	Measured from input terminals to output terminals, shortest distance through air		≥ 5	mm
Creepage distance	Measured from input terminals to output terminals, shortest distance path along body		≥ 5	mm
Input to output test voltage, method B	$V_{IORM}$ x 1.875 = $V_{PR}$ , 100 % production test with $t_M$ = 1 s, partial discharge < 5 pC	$V_{PR}$	1326	V <sub>peak</sub>
Input to output test voltage, method A	$V_{IORM}$ x 1.6 = $V_{PR}$ , 100 % sample test with $t_M$ = 10 s, partial discharge < 5 pC	$V_{PR}$	1131	V <sub>peak</sub>

### 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<sub>amb</sub> = 25 °C, unless otherwise specified)

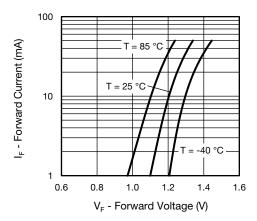


Fig. 5 - Forward Current vs. Forward Voltage

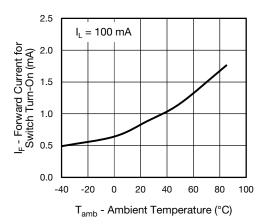


Fig. 6 - Forward Current for Switch Turn-On vs.
Ambient Temperature

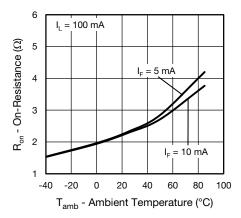


Fig. 7 - On-Resistance vs. Ambient Temperature

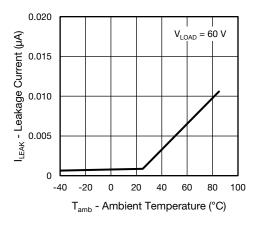


Fig. 8 - Leakage Current vs. Ambient Temperature

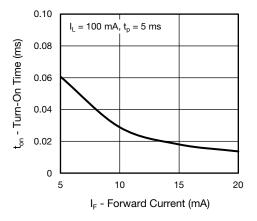


Fig. 9 - Turn-On Time vs. Forward Current

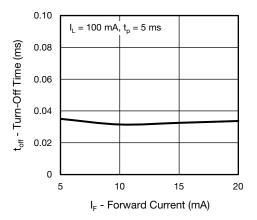
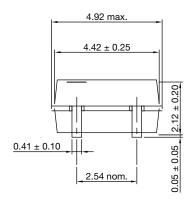
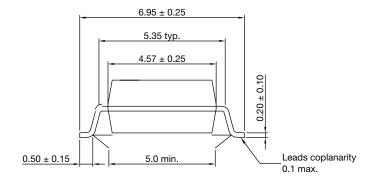
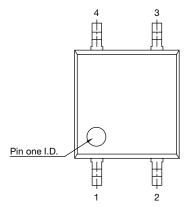


Fig. 10 - Turn-Off Time vs. Forward Current

## **PACKAGE DIMENSIONS** (in millimeters)







### Recommended footprint

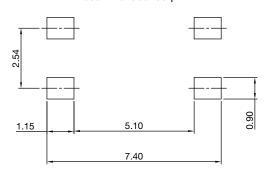


Fig. 11 - Package Drawings

### **PACKAGE MARKING**

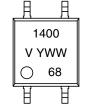
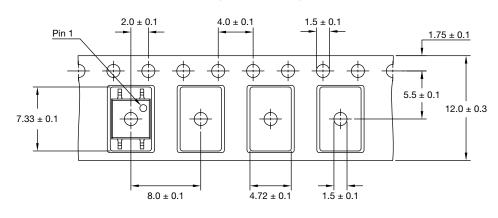


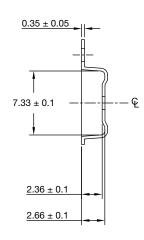
Fig. 12 - VO1400AEF

#### Note

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

### TAPE AND REEL INFORMATION (in millimeters)

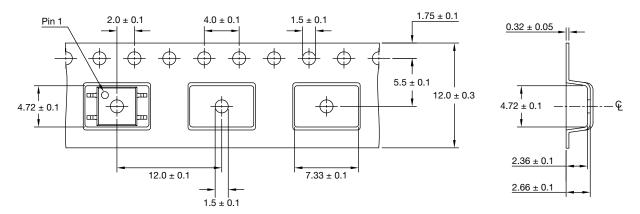




#### Note:

• Cummulative tolerance of 10 spocket holes is 0.20

Fig. 13 - VO1400AEFT (2000 pieces on reel)



#### Note:

• Cummulative tolerance of 10 spocket holes is 0.20

Fig. 14 - VO1400AEFT1 (1000 pieces on reel)



### **SOLDER PROFILES**

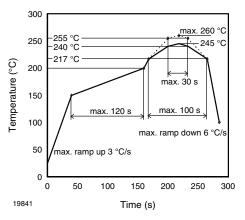


Fig. 15 - Lead (Pb)-free Reflow Solder Profile According to J-STD-020 for SMD Devices

### HANDLING AND STORAGE CONDITIONS

ESD level: HBM class 2 Floor life: unlimited

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

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



# **Footprint and Schematic Information**

Vishay Semiconductors

# Footprint and Schematic Information for VO1400AEF

The footprint and schematic symbols for the following parts can be accessed using the associated links. They are available in Eagle, Altium, KiCad, OrCAD / Allegro, Pulsonix, and PADS.

Note that the 3D models for these parts can be found on the Vishay product page.

PART NUMBER	FOOTPRINT / SCHEMATIC
VO1400AEFT1	www.snapeda.com/parts/VO1400AEFT1/Vishay/view-part
VO1400AEFT2	www.snapeda.com/parts/VO1400AEFT2/Vishay/view-part
VO1400AEFTR	www.snapeda.com/parts/VO1400AEFTR/Vishay/view-part

For technical issues and product support, please contact optocoupleranswers@vishav.com.





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Vishay

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