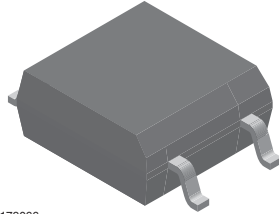
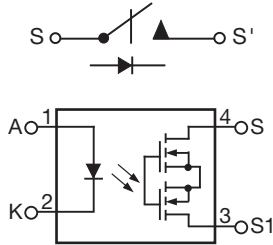


# 1 Form A Solid State Relay



i179066



20050

**ATTENTION**  
Observe Precaution  
For Handling  
Electrostatic Sensitive  
Devices (ESD)

## FEATURES

- Maximum  $R_{ON}$  5  $\Omega$
- Load voltage 60 V
- Load current 100 mA
- Isolation test voltage 1500  $V_{RMS}$
- Small 4 pin SOP package
- Clean bounce free switching
- TTL/CMOS compatible input
- High reliability hybrid receptor
- Available on tape and reel
- Compliant to RoHS Directive 2002/95/EC and in accordance to WEEE 2002/96/EC


**RoHS**  
COMPLIANT

## APPLICATIONS

- Security systems
- Instrumentation
- Industrial controls

## AGENCY APPROVALS

UL: file no. E300068 system code K

cUL: file no. E300068

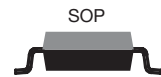
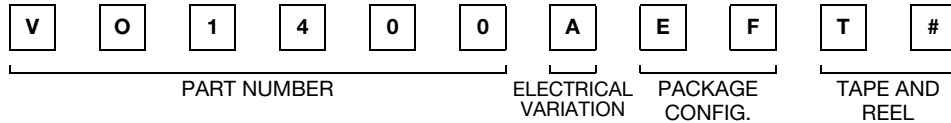
### Note

- IEC 60747-5-2 (VDE 0884) capable, consult sales representative for details

## DESCRIPTION

The VO1400AEFTR is an optically isolated 1 form A solid-state relay in a surface mount 4 pin SOP package.

## ORDERING INFORMATION



PACKAGE	UL, cUL
SOP-4, Tape and reel	VO1400AEFTR
SOP-4, Tape and reel (product rotated in tape)	VO1400AEFT2

## ABSOLUTE MAXIMUM RATINGS ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)

PARAMETER	TEST CONDITION	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		$P_{diss}$	400	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 <sup>(1)</sup>	$t \leq 10\text{ s max.}$	$T_{sld}$	260	$^{\circ}\text{C}$
Isolation test voltage	$t = 1\text{ s}$	$V_{ISO}$	1500	$V_{RMS}$

### 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.

<sup>(1)</sup> Refer to reflow profile for soldering conditions for surface mounted devices.

## ABSOLUTE MAXIMUM RATING CURVE

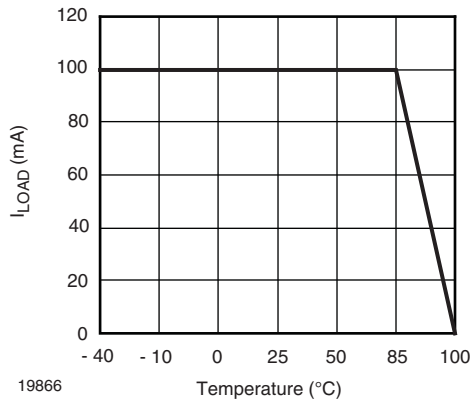
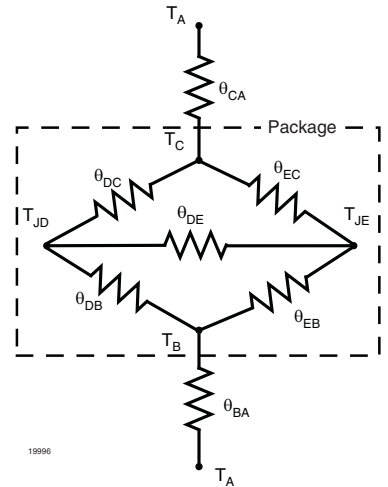


Fig. 1 - I<sub>LOAD</sub> vs. Temperature

THERMAL CHARACTERISTICS			
PARAMETER	SYMBOL	VALUE	UNIT
LED power dissipation	P <sub>diss</sub>	60	mW
Output power dissipation	P <sub>diss</sub>	50	mW
Total power dissipation	P <sub>tot</sub>	110	mW
Maximum LED junction temperature	T <sub>jmax.</sub>	125	°C
Maximum output die junction temperature	T <sub>jmax.</sub>	125	°C
Thermal resistance, junction emitter to board	θ <sub>JEB</sub>	114	°C/W
Thermal resistance, junction emitter to case	θ <sub>JEC</sub>	99	°C/W
Thermal resistance, junction detector to board	θ <sub>JDB</sub>	60	°C/W
Thermal resistance, junction detector to case	θ <sub>JDC</sub>	80	°C/W
Thermal resistance, junction emitter to junction detector	θ <sub>JED</sub>	115	°C/W
Thermal resistance, case to ambient	θ <sub>CA</sub>	2396	°C/W



**Note**

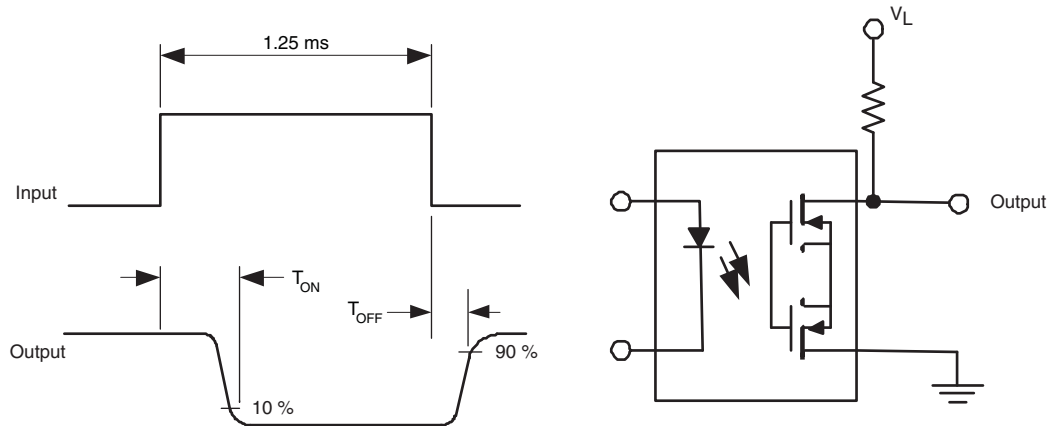
- The thermal model is represented in the thermal network below. Each resistance value given in this model can be used to calculate the temperatures at each node for a given operating condition. The thermal resistance from board to ambient will be dependent on the type of PCB, layout and thickness of copper traces. For a detailed explanation of the thermal model, please reference Vishay's Thermal Characteristics of Optocouplers application note.

<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	$I_L = 100\text{ mA}$ , $V_L \leq 0.5\text{ V}$ , $t = 10\text{ ms}$	$I_{Fon}$	0.3	1	3.2	mA
LED forward current, switch turn-off	$V_L = 60\text{ V}$	$I_{Foff}$	100	150		$\mu\text{A}$
LED reverse current	$V_R = 5\text{ V}$	$I_R$		0.001	10	$\mu\text{A}$
LED forward voltage	$I_F = 5\text{ mA}$	$V_F$	0.8	1.1	1.4	V
LED reverse voltage	$I_R = 10\text{ }\mu\text{A}$	$V_R$	5	40		V
<b>OUTPUT</b>						
On-resistance	$I_F = 10\text{ mA}$ , $I_L = 100\text{ mA}$	$R_{ON}$		2.3	5	$\Omega$
Off-state leakage current	$I_F = 0\text{ mA}$ , $V_L = 60\text{ V}$	$I_{LEAK}$		0.002	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>						
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	$\mu\text{s}$



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SAFETY AND INSULATION RATINGS				
PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Climatic classification	IEC 68 part 1		40/85/21	
Pollution degree	DIN VDE 0109		2	
Tracking resistance (comparative tracking index)	Insulation group IIIa	CTI	175	
Highest allowable overvoltage	Transient overvoltage	$V_{IOTM}$	6000	$V_{peak}$
Maximum working insulation voltage	Recurring peak voltage	$V_{IORM}$	707	$V_{peak}$
Insulation resistance at 25 °C	$V_{IO} = 500 V$	$R_{IS}$	$\geq 10^{12}$	$\Omega$
Insulation resistance at $T_S$	$V_{IO} = 500 V$	$R_{IS}$	$\geq 10^9$	$\Omega$
Insulation resistance at 100 °C	$V_{IO} = 500 V$	$R_{IS}$	$\geq 10^{11}$	$\Omega$
Partial discharge test voltage	Method a, $V_{pd} = V_{IORM} \times 1.875$	$V_{pd}$	1325	$V_{peak}$
Isolation test voltage, 1 s		$V_{RMS}$	1800	$V_{RMS}$
Safety limiting values - maximum values allowed in the event of a failure	Output power	$P_{SO}$	400	mW
	Input current	$I_{SI}$	150	mA
	Case temperature	$T_{SI}$	165	°C
Minimum external air gap (clearance distance)	Measured from input terminals to output terminals, shortest distance through air		$\geq 5$	mm
Minimum external tracking (creepage distance)	Measured from input terminals to output terminals, shortest distance path along body		$\geq 5$	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.

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

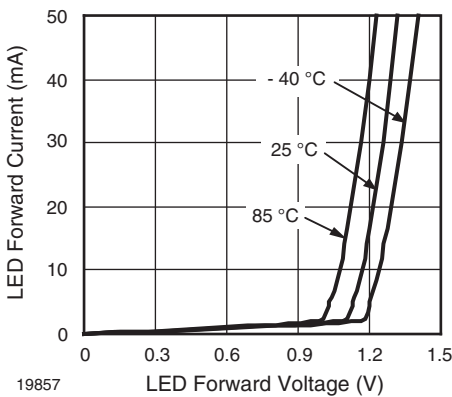


Fig. 2 - Typical LED Forward Voltage vs. Current

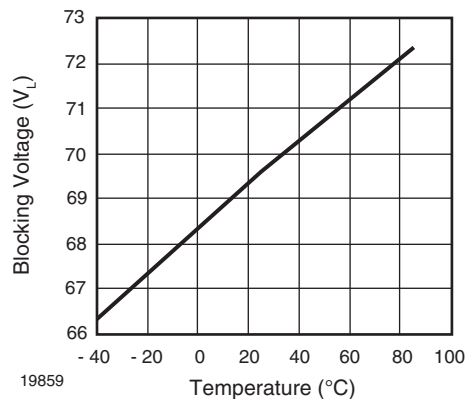


Fig. 3 - Typical Blocking Voltage vs. Temperature

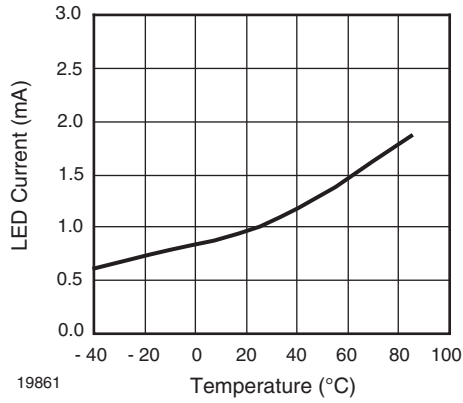


Fig. 4 - Typical  $I_F$  for Switch Operation vs. Temperature (Load Current = 100 mA)

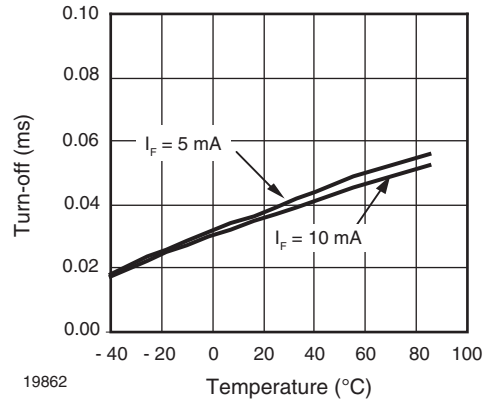


Fig. 7 - Typical Turn-off vs. Temperature (Load Current = 100 mA)

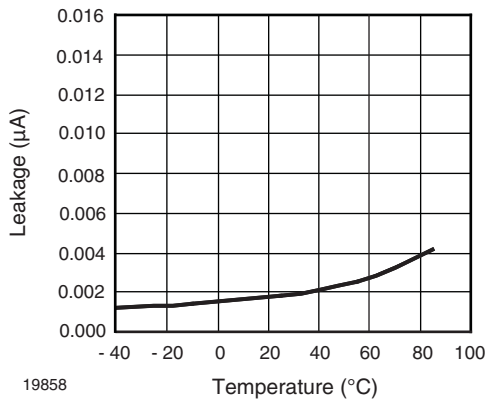


Fig. 5 - Typical Leakage vs. Temperature ( $V_L = 60 V$ )

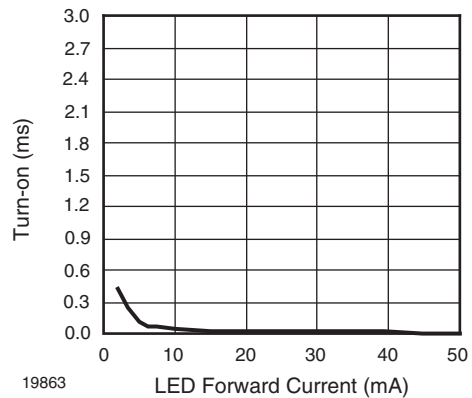


Fig. 8 - Typical Turn-on vs. LED Forward Current (Load Current = 100 mA)

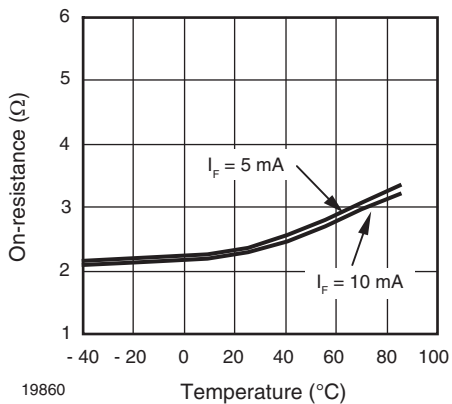


Fig. 6 - Typical On-resistance vs. Temperature (Load Current = 100 mA)

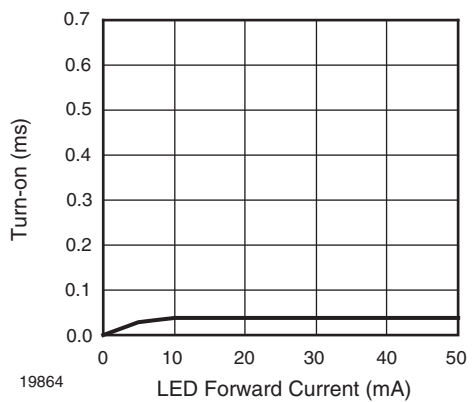
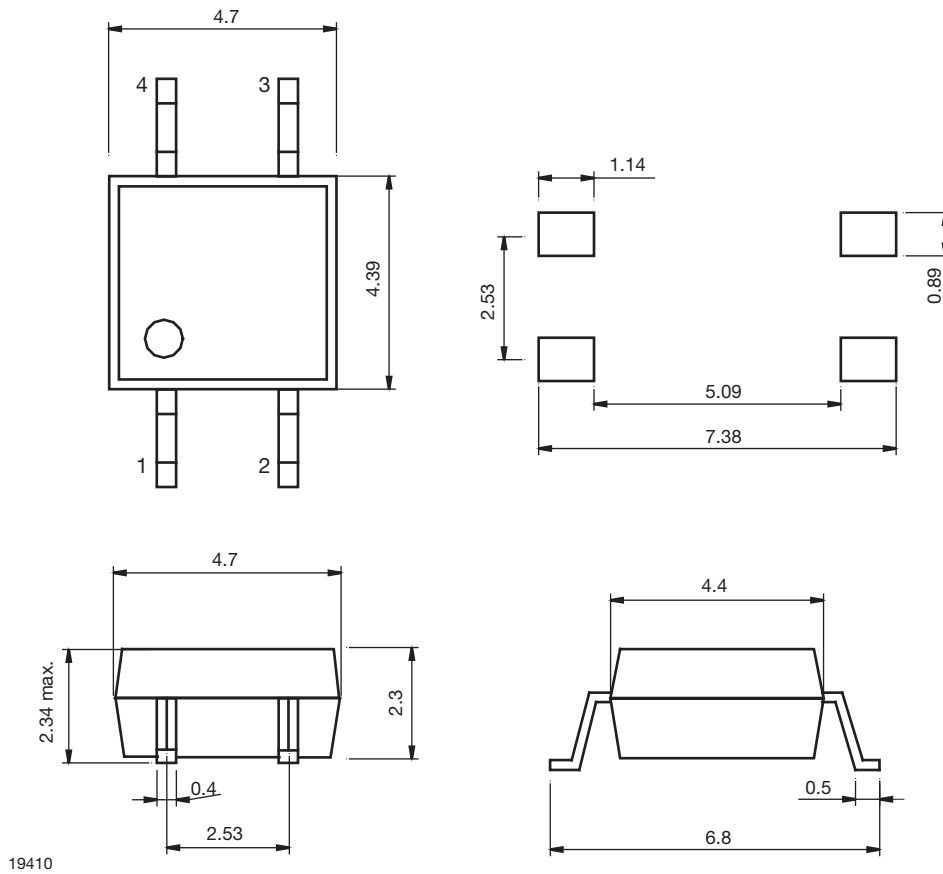


Fig. 9 - Typical Turn-off vs. LED Forward Current (Load Current = 100 mA)

## PACKAGE DIMENSIONS in millimeters



## PACKAGE MARKING



### Note

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

## ESD CAUTION

This is an ESD (electro static discharge) sensitive device. Electrostatic charges accumulate on the human body and test equipment and can discharge without detection. Therefore, proper ESD precautions are recommended to avoid performance degradation or loss of functionality. ESD withstand voltage of this device is up to 1500 V acc. to JESD22-A114-B.



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