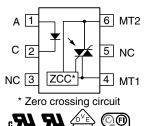


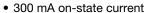
Optocoupler, Phototriac Output, Zero Crossing, High dV/dt, Low Input Current





FEATURES

- High static dV/dt 5 kV/µs
- High input sensitivity I_{FT} = 1.6 mA, 2 mA, and 3 mA



- Zero voltage crossing detector
- 800 V blocking voltage
- Isolation rated voltage 4420 V_{RMS}
- Material categorization: for definitions of compliance please see <u>www.vishay.com/doc?99912</u>

LINKS TO ADDITIONAL RESOURCES













DESCRIPTION

The VO4158 consists of a GaAs IRLED optically coupled to a photosensitive zero crossing TRIAC packaged in a DIP-6 package.

High input sensitivity is achieved by using an emitter follower phototransistor and a cascaded SCR predriver resulting in an LED trigger current of 1.6 mA for bin D, 2 mA for bin H, and 3 mA for bin M.

The new phototriac zero crossing family uses a proprietary dV/dt clamp resulting in a static dV/dt of greater than 5 $kV/\mu s$.

The VO4158 isolates low-voltage logic from 120 V_{AC} , 240 V_{AC} , and 380 V_{AC} lines to control resistive, inductive, or capacitive loads including motors, solenoids, high current thyristors or TRIAC and relays.

APPLICATIONS

- Solid-state relays
- Industrial controls
- Office equipment
- Consumer appliances

AGENCY APPROVALS

- UL
- cUL
- DIN EN 60747-5-5 (VDE 0884-5), available with option 1
- FIMKO

ORDERING INFORMATION 8 0 5 0 DIP-6 Option 7 PACKAGE OPTION TAPE PART NUMBER AND REEL **V**_{DRM} 800 **AGENCY CERTIFIED / PACKAGE** TRIGGER CURRENT, IFT (mA) UL, cUL, FIMKO 1.6 3 DIP-6 VO4158D VO4158H SMD-6, option 7 VO4158H-X007T VO4158M-X007T SMD-6, option 9 VO4158D-X009T UL, cUL, FIMKO, VDE (option 1) 1.6 3 2 SMD-6, option 7 VO4158H-X017T



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ABSOLUTE MAXIMUM RATINGS (T _{amb} = 25 °C, unless otherwise specified)						
PARAMETER	TEST CONDITION	PART	SYMBOL	VALUE	UNIT	
INPUT						
Reverse voltage			V _R	6	V	
Forward current			I _F	60	mA	
Surge current			I _{FSM}	2.5	Α	
Derate from 25 °C				1.33	mW/°C	
OUTPUT	·					
Peak off-state voltage		VO4158D/H/M	V_{DRM}	800	V	
RMS on-state current			I _{TM}	300	mA	
Derate from 25 °C				6.6	mW/°C	
COUPLER						
Storage temperature range			T _{stg}	-55 to +150	°C	
Ambient temperature range			T _{amb}	-55 to +100	°C	
Soldering temperature	Max. ≤ 10 s dip soldering ≥ 0.5 mm from case bottom		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.

This phototriac should not be used to drive a load directly. It is intended to be a trigger device only.

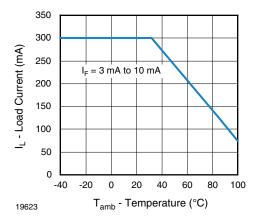


Fig. 1 - Recommended Operating Condition



THERMAL CHARACTERISTICS			
PARAMETER	SYMBOL	VALUE	UNIT
LED power dissipation	P _{diss}	100	mW
Output power dissipation	P _{diss}	500	mW
Total power dissipation	P _{tot}	600	mW
Maximum LED junction temperature	T _{jmax.}	125	°C
Maximum output die junction temperature	T _{jmax.}	125	°C
Thermal resistance, junction emitter to board	θ_{JEB}	150	°C/W
Thermal resistance, junction emitter to case	θ_{JEC}	139	°C/W
Thermal resistance, junction detector to board	θ_{JDB}	78	°C/W
Thermal resistance, junction detector to case	θ_{JDC}	103	°C/W
Thermal resistance, junction emitter to junction detector	θ_{JED}	496	°C/W
Thermal resistance, case to ambient	θ_{CA}	3563	°C/W

Note

The thermal characteristics table above were measured at 25 °C and 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.

ELECTRICAL CHARACTERISTICS (T _{amb} = 25 °C, unless otherwise specified)							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
INPUT							
Forward voltage	I _F = 10 mA		V_{F}	-	1.2	1.4	V
Reverse current	V _R = 6 V		I_R	-	0.1	10	μΑ
Input capacitance	$V_F = 0 V, f = 1 MHz$		Cı	-	25	-	pF
OUTPUT							
Repetitive peak off-state voltage	$I_{DRM} = 100 \mu A$	VO4158D/H/M	V_{DRM}	800	-	-	V
Off-state current	$V_D = V_{DRM}, I_F = 0$		I _{DRM}	-	-	100	μΑ
On-state voltage	$I_T = 300 \text{ mA}$		V_{TM}	-	-	3	V
On-state current	$PF = 1, V_{T(RMS)} = 1.7 V$		I _{TM}	-	ı	300	mA
Off-state current in inhibit state	$I_F = 2 \text{ mA}, V_{DRM}$		I _{DINH}	-	-	200	μΑ
Holding current			I _H	-	i	500	μΑ
Zero cross inhibit voltage	$I_F = \text{rated } I_{FT}$		V_{IH}	-	ı	20	V
Critical rate of rise of off-state voltage	$V_D = 0.67 \ V_{DRM}, \ T_J = 25 \ ^{\circ}C$		dV/dt _{cr}	5000	-	-	V/µs
COUPLER							
LED trigger current, current required to latch output		VO4158D	I _{FT}	-	ı	1.6	mA
	V _D = 3 V	VO4158H	I _{FT}	-	-	2	mA
		VO4158M	I _{FT}	-	ı	3	mA
Common mode coupling capacitance			C _{CM}	-	0.01	-	pF
Capacitance (input to output)	f = 1 MHz, V _{IO} = 0 V		C _{IO}	-	0.8	-	pF

Note

• Minimum and maximum values were tested 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.

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SAFETY AND INSULATION RATINGS						
PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT		
Climatic classification	According to IEC 68 part 1		55 / 100 / 21			
Comparative tracking index		CTI	175			
Maximum rated withstanding isolation voltage	t = 1 min	V _{ISO}	4420	V _{RMS}		
Maximum transient isolation voltage		V _{IOTM}	8000	V _{peak}		
Maximum repetitive peak isolation voltage		V_{IORM}	890	V _{peak}		
Isolation resistance	$V_{IO} = 500 \text{ V}, T_{amb} = 25 ^{\circ}\text{C}$	R _{IO}	≥ 10 ¹²	Ω		
isolation resistance	V _{IO} = 500 V, T _{amb} = 100 °C	R _{IO}	≥ 10 ¹¹	Ω		
Output safety power		P _{SO}	500	mW		
Input safety current		I _{SI}	250	mA		
Safety temperature		T _S	175	°C		
Creepage distance	Standard DIP-4		≥ 7	mm		
Clearance distance	Standard DIP-4		≥ 7	mm		
Insulation thickness		DTI	≥ 0.4	mm		

Note

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

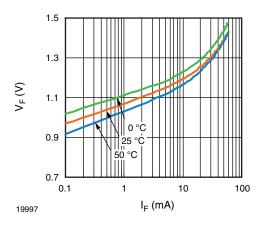


Fig. 2 - Diode Forward Voltage vs. Forward Current

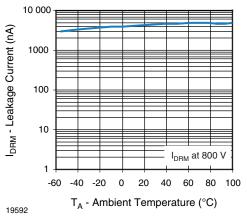


Fig. 4 - Leakage Current vs. Ambient Temperature

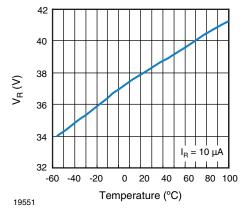


Fig. 3 - Diode Reverse Voltage vs. Temperature

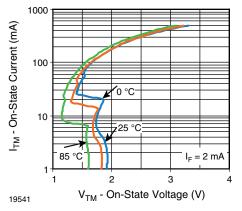


Fig. 5 - On State Current vs. On State Voltage

As per IEC 60747-5-5, § 7.4.3.8.2, this optocoupler is suitable for "safe electrical insulation" only within the safety ratings. Compliance with
the safety ratings shall be ensured by means of protective circuits.





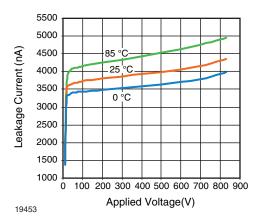


Fig. 6 - Output Off Current (Leakage) vs. Voltage

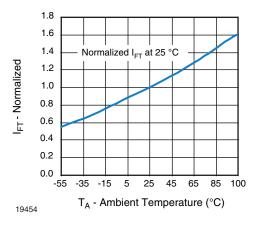


Fig. 7 - Normalized Trigger Input Current vs. Temperature

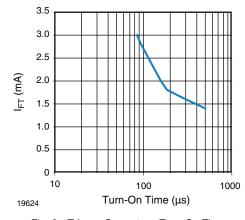


Fig. 8 - Trigger Current vs. Turn-On Time

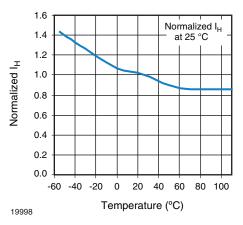


Fig. 9 - Normalized Holding Current vs. Temperature

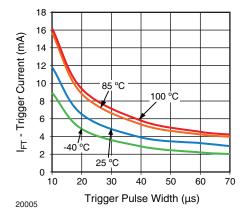


Fig. 10 - I_{FT} vs. LED Pulse Width

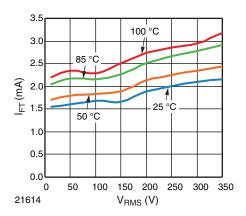


Fig. 11 - I_{FT} vs. V_{RMS} and Temperature



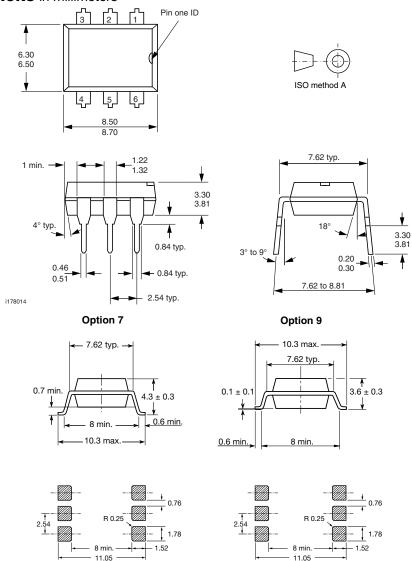
Fig. 12 - Basic Power Triac Driver Circuit

POWER FACTOR CONSIDERATIONS

As a zero voltage crossing optotriac, the commutating dV/dt spikes can inhibit one half of the TRIAC from turning on. If the spike potential exceeds the inhibit voltage of the zero-cross detection circuit, half of the TRIAC will be held-off and not turn-on. This hold-off condition can be eliminated by using a capacitor or RC snubber placed directly across the power triac as shown in fig. 11. Note that the value of the capacitor increases as a function of the load current.

The hold-off condition also can be eliminated by providing a higher level of LED drive current. The higher LED drive provides a larger photocurrent which causes the phototransistor to turn-on before the commutating spike has activated the zero-cross detection circuit. For example, if a device requires 1.5 mA for a resistive load, then 2.7 mA (1.8 times) may be required to control an inductive load whose power factor is less than 0.3.

PACKAGE DIMENSIONS in millimeters





PACKAGE MARKING (example)



Notes

- XXXX = LMC (lot marking code)
- VDE logo is only marked on option 1 parts. Tape and reel suffix (T) is not part of the package marking



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