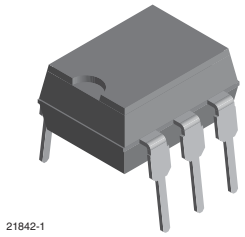
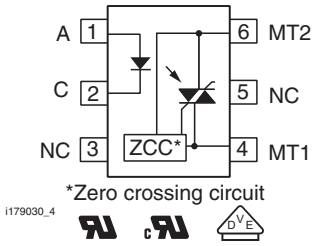
Optocoupler, Phototriac Output, Zero Crossing, High dV/dt, Low Input Current





FEATURES

- High static dV/dt 5 kV/µs
- High input sensitivity I_{FT} = 1.6 mA, 2 mA, and 3 mA
- 300 mA on-state current
- Zero voltage crossing detector
- 400 V and 600 V blocking voltage
- Isolation rated voltage 4420 V_{RMS}
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

e3

RoHS COMPLIANT

DESCRIPTION

The VO4154 and VO4156 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/µs.

The VO4154 and VO4156 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

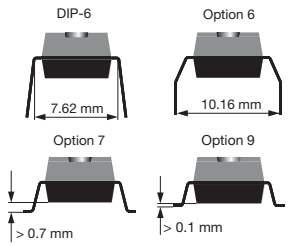
- Solid-state relays
- Industrial controls
- Office equipment
- Consumer appliances

AGENCY APPROVALS

- UL1577, file no. E52744, double protection
- cUL - file no. E52744, equivalent to CSA bulletin 5A
- DIN EN 60747-5-5 (VDE 0884-5), available with option 1

ORDERING INFORMATION

V	O	4	1	5	#	X	-	X	0	0	#	T
PART NUMBER								PACKAGE OPTION				TAPE AND REEL



AGENCY CERTIFIED/PACKAGE	V_{DRM} 400			V_{DRM} 600		
	TRIGGER CURRENT, I_{FT} (mA)					
UL, cUL	**1.6**	**2**	**3**	**1.6**	**2**	**3**
DIP-6	VO4154D	VO4154H	VO4154M	VO4156D	VO4156H	VO4156M
DIP-6, 400 mil, option 6	VO4154D-X006	VO4154H-X006	VO4154M-X006	VO4156D-X006	VO4156H-X006	VO4156M-X006
SMD-6, option 7	VO4154D-X007T	VO4154H-X007T	VO4154M-X007T	VO4156D-X007T	VO4156H-X007T (1)	VO4156M-X007T
UL, cUL, VDE	**1.6**	**2**	**3**	**1.6**	**2**	**3**
DIP-6, 400 mil, option 6	-	-	-	-	VO4156H-X016	-
SMD-6, option 7	-	-	-	VO4156D-X017T	-	-

Note

- Also available in tubes, do not put “T” to the end

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	A
Power dissipation			P_{diss}	100	mW
Derate from 25 °C				1.33	mW/°C
OUTPUT					
Peak off-state voltage		VO4154D/H/M	V_{DRM}	400	V
		VO4156D/H/M	V_{DRM}	600	V
RMS on-state current			I_{TM}	300	mA
Total power dissipation			P_{diss}	500	mW
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

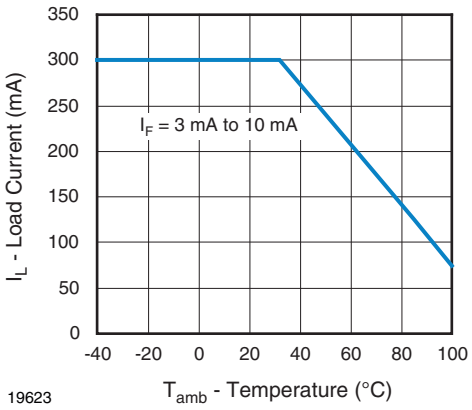
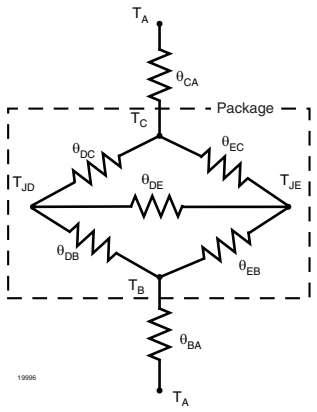


Fig. 1 - Recommended Operating Condition

THERMAL CHARACTERISTICS

PARAMETER	SYMBOL	VALUE	UNIT
LED power dissipation	P_{diss}	100	mW
Output power dissipation	P_{diss}	500	mW
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	µA
Input capacitance	V_F = 0 V, f = 1 MHz		C_I	-	25	-	pF
OUTPUT							
Repetitive peak off-state voltage	I_{DRM} = 100 µA	VO4154D/H/M	V_{DRM}	400	-	-	V
		VO4156D/H/M	V_{DRM}	600	-	-	V
Off-state current	$V_D = V_{DRM}$, I_F = 0 A		I_{DRM}	-	-	100	µA
On-state voltage	I_T = 300 mA		V_{TM}	-	-	3	V
On-state current	PF = 1, $V_{T(RMS)}$ = 1.7 V		I_{TM}	-	-	300	mA
Off-state current in inhibit state	I_F = 2 mA, V_{DRM}		I_{DINH}	-	-	200	µA
Holding current			I_H	-	-	500	µA
Zero cross inhibit voltage	I_F = rated I_{FT}		V_{IH}	-	-	20	V
Critical rate of rise of off-state voltage	V_D = 0.67 V_{DRM}, T_J = 25 °C		dV/dt_{cr}	5000	-	-	V/µs
Critical rate of rise of on-state			dV/dt_{cr}	8	-	-	A/µs
COUPLER							
LED trigger current, current required to latch output	V_D = 3 V	VO4154D	I_{FT}	-	-	1.6	mA
		VO4154H	I_{FT}	-	-	2	mA
		VO4154M	I_{FT}	-	-	3	mA
		VO4156D	I_{FT}	-	-	1.6	mA
		VO4156H	I_{FT}	-	-	2	mA
		VO4156M	I_{FT}	-	-	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

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 V, T_{amb} = 25 °C	R_{IO}	$\geq 10^{12}$	Ω
	V_{IO} = 500 V, T_{amb} = 100 °C	R_{IO}	$\geq 10^{11}$	Ω
Output safety power		P_{SO}	500	mW
Input safety current		I_{SI}	250	mA
Safety temperature		T_S	175	°C
Creepage distance			≥ 7	mm
Clearance distance			≥ 7	mm
Insulation thickness		DTI	≥ 0.4	mm
Pollution degree (DIN VDE 0109)			2	

Note

- 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.

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

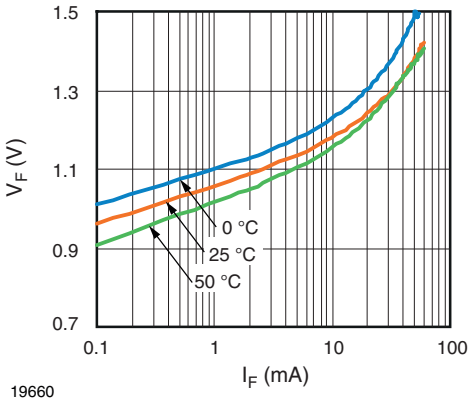


Fig. 2 - Diode Forward Voltage vs. Forward Current

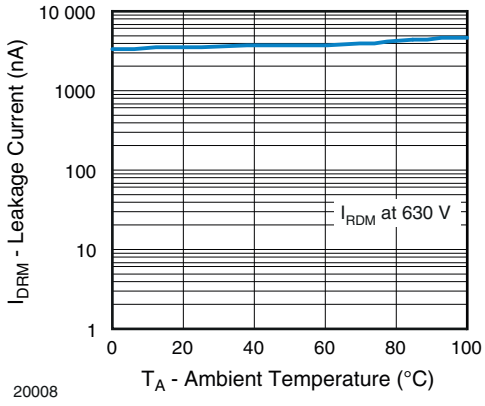


Fig. 4 - Leakage Current vs. Ambient Temperature

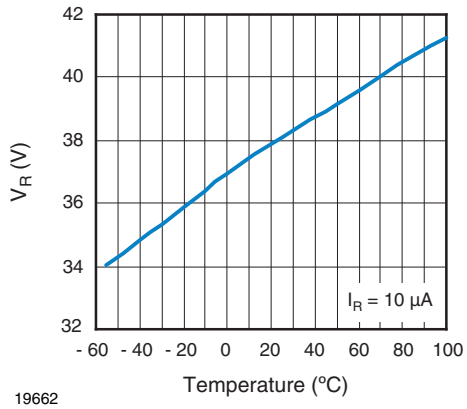


Fig. 3 - Diode Reverse Voltage vs. Temperature

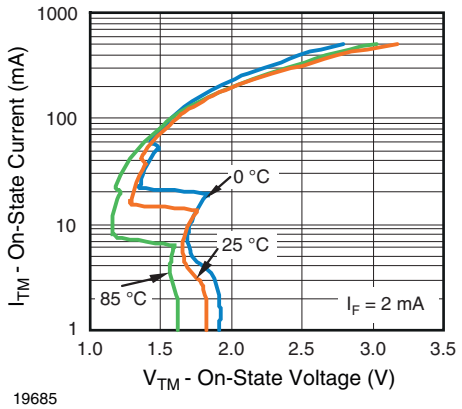


Fig. 5 - On-State Current vs. On-State Voltage

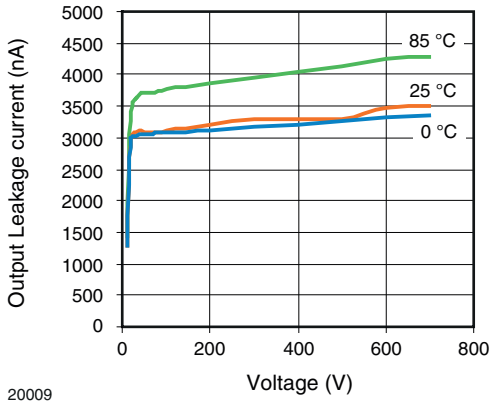


Fig. 6 - Output Off Current (Leakage) vs. Voltage

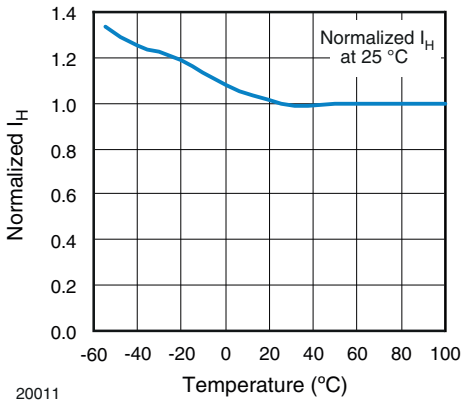


Fig. 9 - Normalized Holding Current vs. Temperature

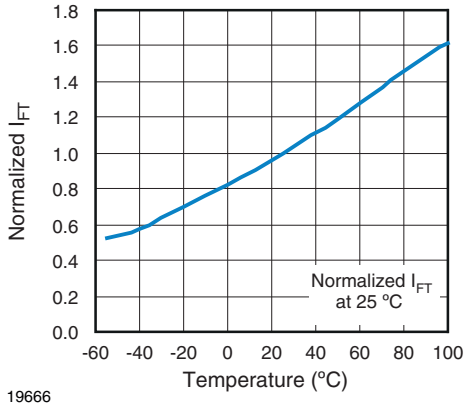


Fig. 7 - Normalized Trigger Input Current vs. Temperature

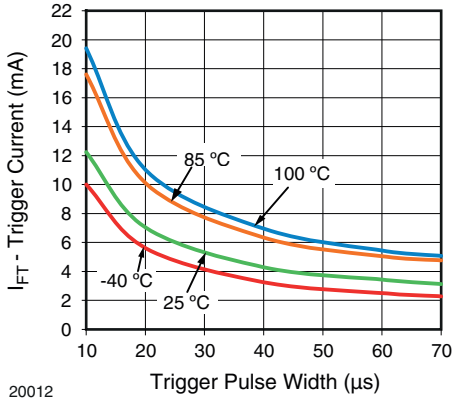


Fig. 10 - I_{FT} vs. LED Pulse Width

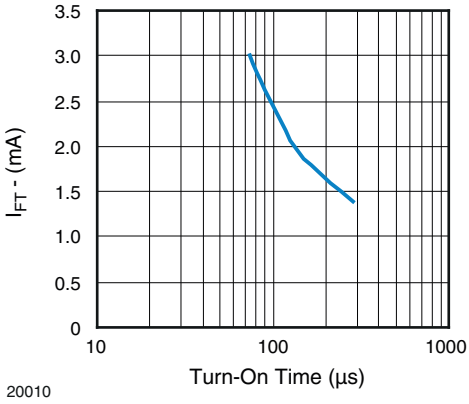
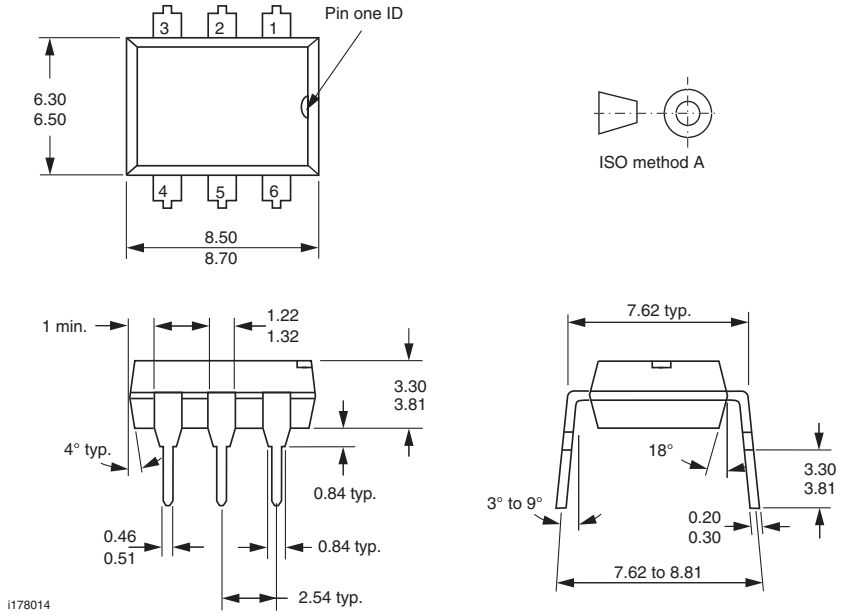
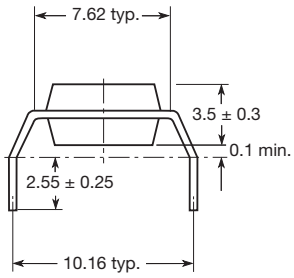


Fig. 8 - I_{FT} (mA) vs. Turn-On Time (µs)

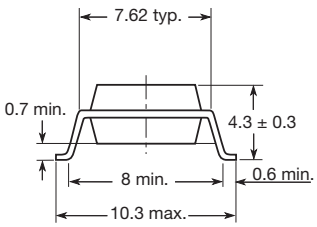
PACKAGE DIMENSIONS in millimeters



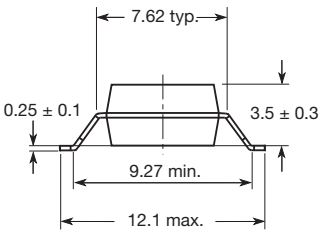
Option 6



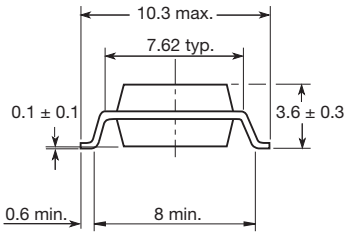
Option 7

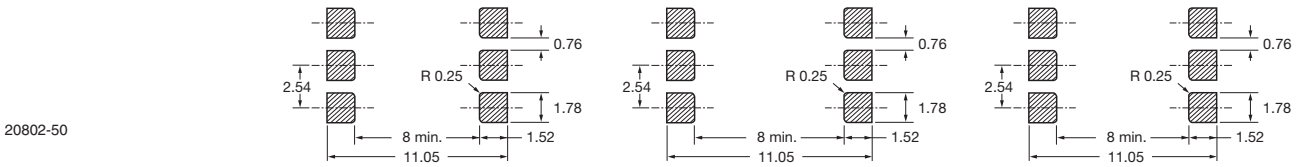


Option 8

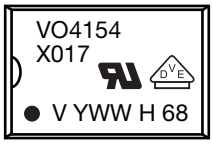


Option 9





PACKAGE MARKING (example)



Notes

- Only options 1, 7, and 8 are reflected in the package marking
- The 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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