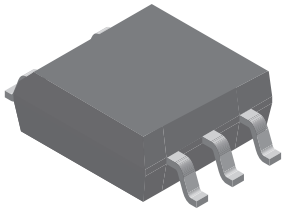
Analog High Speed Coupler, High Noise Immunity, 1 MBd, SOP-5 Package



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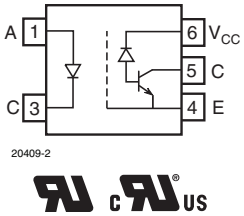


20409-2

FEATURES

- Surface mountable
- Industry standard SOP-5 footprint
- Compatible with infrared vapor phase reflow and wave soldering processes
- Isolation test voltage, 3750 V_{RMS}
- Very high common mode transient immunity: 15 000 V/µs at V_{CM} = 1500 V guaranteed (VOM453T)
- High speed: 1 MBd
- TTL compatible
- Open collector output
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912

Pb-free

e3

RoHS COMPLIANT

DESCRIPTION

The VOM452T and VOM453T, high speed optocouplers, each consists of a GaAlAs infrared emitting diode, optically coupled with an integrated photo detector and a high speed transistor. The photo detector is junction isolated from the transistor to reduce miller capacitance effects. The open collector output function allows circuit designers to adjust the load conditions when interfacing with different logic systems such as TTL, CMOS, etc.

Because the VOM452T and VOM453T have a Faraday shield on the detector chip, it can also reject and minimize high input to output common mode transient voltages. There is no base connection, further reducing the potential electrical noise entering the package.

The VOM452T and VOM453T are packaged in industry standard SOP-5 packages and are suitable for surface mounting.

This an ideal solution for Industrial communication bus isolation, as well as isolated drive circuit applications such as IPM (intelligent power module) drivers.

APPLICATIONS

- Fieldbus communication and control
- Logic ground isolation
- Analog signal ground isolation
- Replace pulse transformers
- IPM (intelligent power module) drivers

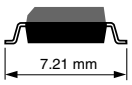
AGENCY APPROVALS

- UL1577, file no. E52744
- cUL - file no. E52744, equivalent to CSA bulletin 5A

ORDERING INFORMATION

V	O	M	4	5	#	T

PART NUMBER



AGENCY CERTIFIED/PACKAGE	CMTI (kV/µs)	
UL, cUL	**≥ 1**	**≥ 15**
SOP-5	VOM452T	VOM453T

Notes

- For additional information on the available options refer to option information.
- The product is available only on tape and reel.

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)				
PARAMETER	**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
INPUT				
Reverse voltage		V_R	3	V
DC forward current		I_F	25	mA
Surge forward current	$t_p \leq 1$ µs, 300 pulses/s	I_{FSM}	1	A
Power dissipation	$T_{amb} \leq 70$ °C	P_{diss}	45	mW
OUTPUT				
Supply voltage		V_S	- 0.5 to 30	V
Output voltage		V_O	- 0.5 to 25	V
Output current		I_O	8	mA
Power dissipation	$T_{amb} \leq 70$ °C	P_{diss}	100	mW
COUPLER				
Isolation test voltage between emitter and detector (refer to climate DIN 40046, part 2, Nov. 74)	t = 1 s	V_{ISO}	3750	V_{RMS}
Pollution degree (DIN VDE 0110)			2	
Creepage distance			≥ 5	mm
Clearance distance			≥ 5	mm
Comparative tracking index per DIN IEC 112/VDE 0303, part 1			175	
Isolation resistance	V_{IO} = 500 V, T_{amb} = 25 °C, R_{ISOL} (1)	R_{IO}	≥ 10^{12}	Ω
	V_{IO} = 500 V, T_{amb} = 100 °C, R_{ISOL} (1)	R_{IO}	≥ 10^{11}	Ω
Storage temperature range		T_{stg}	- 55 to + 125	°C
Ambient temperature range		T_{amb}	- 55 to + 100	°C
Junction temperature		T_j	100	°C
Soldering temperature (2)	t < 10 s max.		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.

(1) Device considered a two-terminal device: pins 1, and 3 shorted together and pins 4, 5, and 6 shorted together.

(2) Refer to reflow profile for soldering conditions for surface mounted devices.

ELECTRICAL CHARACTERISTICS (T_{amb} = - 40 °C to 100 °C, unless otherwise specified)							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
INPUT							
Input forward voltage	I_F = 16 mA		V_F		1.4	1.8	V
Input reverse current	V_R = 3 V		I_R		0.5	10	µA
Input capacitance	f = 1 MHz, V_F = 0 V, T_{amb} = 25 °C		C_{IN}		75		pF
Temperature coefficient of forward voltage	I_F = 16 mA		$\Delta V_F/\Delta T_{amb}$		- 1.7		mV/°C
OUTPUT							
Logic low supply current	I_F = 16 mA, V_O = open, V_{CC} = 15 V		I_{CCL}		200		µA
Logic high supply current	I_F = 0 mA, V_O = open, V_{CC} = 15 V, T_{amb} = 25 °C		I_{CCH}		0.001	1	µA
	I_F = 0 mA, V_O = open, V_{CC} = 15 V		I_{CCH}			2	µA
Logic low output voltage	I_F = 16 mA, V_{CC} = 4.5 V, I_O = 3 mA, T_{amb} = 25 °C		V_{OL}		0.15	0.4	V
	I_F = 16 mA, V_{CC} = 15 V, I_O = 2.4 mA		V_{OL}			0.5	V
Logic high output current	I_F = 0 mA, V_O = V_{CC} = 5.5 V, T_{amb} = 25 °C		I_{OH}		0.003	0.5	µA
	I_F = 0 mA, V_O = V_{CC} = 15 V, T_{amb} = 25 °C		I_{OH}		0.01	1	µA
	I_F = 0 mA, V_O = V_{CC} = 15 V		I_{OH}			50	µA
COUPLER							
Capacitance (input-output) (1)	f = 1 MHz, T_{amb} = 25 °C		C_{IO}		0.4		pF

Notes

- Minimum and maximum values are testing requirements. Typical values are characteristics of the device and are the result of engineering evaluation. Typical values are for information only and are not part of the testing requirements. All typical values are measured at T_{amb} = 25 °C.

(1) A 0.1 µF bypass capacitor connected between pins 4 and 6 is recommended.

CURRENT TRANSFER RATIO (T_{amb} = - 40 °C to 100 °C, unless otherwise specified)						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Current transfer ratio (1)(2)	V_O = 0.5 V, I_F = 16 mA, V_{CC} = 4.5 V	CTR	15	30		%
	V_O = 0.4 V, I_F = 16 mA, T_{amb} = 25 °C		20		50	

Notes

(1) Current transfer ratio in percent equals the ratio of output collector current (I_O) to the forward LED input current (I_F) times 100.

(2) A 0.1 µF bypass capacitor connected between pins 4 and 6 is recommended. All typical values are measured at T_{amb} = 25 °C.

SWITCHING CHARACTERISTICS (T_{amb} = - 40 °C to 100 °C, unless otherwise specified)						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Propagation delay time to logic low at output (see fig. 1 and note 1)	V_{CC} = 5 V, I_F = 16 mA, R_L = 1.9 kΩ	t_{PHL}		0.2	1	µs
Propagation delay time to logic high at output (see fig. 1 and note 1)	V_{CC} = 5 V, I_F = 16 mA, R_L = 1.9 kΩ	t_{PLH}		0.5	1	µs

Note

(1) The 1.9 kΩ load represents 1 TTL unit load of 1.6 mA and the 5.6 kΩ pull-up resistor. All typical values are measured at T_{amb} = 25 °C.

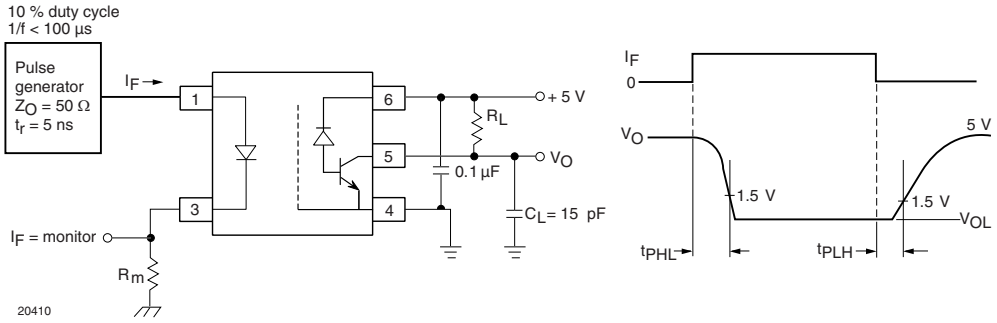


Fig. 1 - Test Circuit for Switching Times

COMMON MODE TRANSIENT IMMUNITY (T_{amb} = 25 °C, unless otherwise specified)							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Common mode transient immunity at logic high level output (see fig. 2 and notes 1, and 2)	R_L = 1.9 kΩ, I_F = 0 mA, V_{CM} = 10 V_{P-P}	VOM452T	$\|CM_H\|$	1			kV/µs
	R_L = 1.9 kΩ, I_F = 0 mA, V_{CM} = 1500 V_{P-P}	VOM453T	$\|CM_H\|$	15			kV/µs
Common mode transient immunity at logic low level output (see fig. 2 and notes 1, and 2)	R_L = 1.9 kΩ, I_F = 16 mA, V_{CM} = 10 V_{P-P}	VOM452T	$\|CM_L\|$	1			kV/µs
	R_L = 1.9 kΩ, I_F = 16 mA, V_{CM} = 1500 V_{P-P}	VOM453T	$\|CM_L\|$	15			kV/µs

Notes

(1) Common mode transient immunity in a logic high level is the maximum tolerable (positive) dV_{CM}/dt on the leading edge of the common mode pulse (V_{CM}) to assure that the output will remain in a logic high state (i.e., V_O > 2 V). Common mode transient immunity in a logic low level the maximum tolerable (negative) dV_{CM}/dt on the trailing edge of the common mode pulse signal (V_{CM} to assure that the output will remain in logic low state, i.e., V_O > 0.8 V).

(2) The 1.9 kΩ load represents 1 TTL unit load of 1.6 mA and the 5.6 kΩ pull-up resistor.

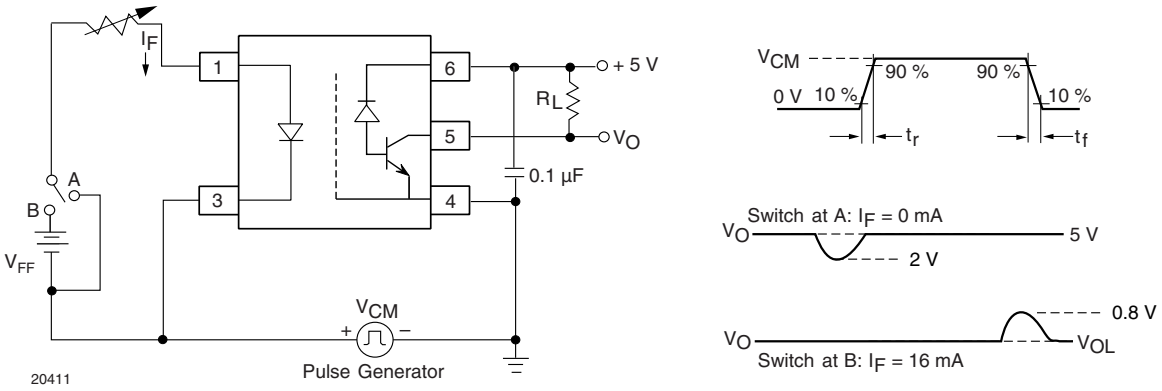


Fig. 2 - Test Circuit for Transient Immunity and Typical Waveforms

SAFETY AND INSULATION RATINGS						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Climatic classification (according to IEC 68 part 1)				55/100/21		
Comparative tracking index		CTI	175		399	
Peak transient overvoltage		V_{IOTM}	6000			V
Peak insulation voltage		V_{IORM}	707			V
Safety rating - power output		P_{SO}			350	mW
Safety rating - input current		I_{SI}			150	mA
Safety rating - temperature		T_{SI}			175	°C
Creepage distance			5			mm
Clearance distance			5			mm

Note

- As per IEC 60747-5-5, § 7.4.3.8.1, this optocoupler is suitable for “safe electrical insulation” only within the safety ratings. Compliance with the safety ratings shall be ensured by means of prodective circuits.

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

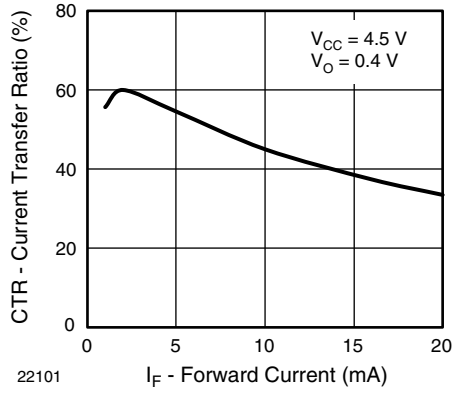


Fig. 3 - Current Transfer Ratio vs. Forward Current

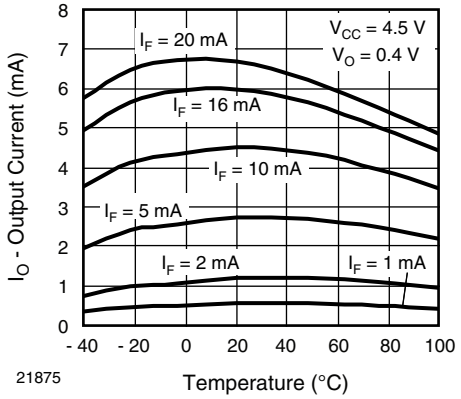


Fig. 5 - Output Current vs. Temperature

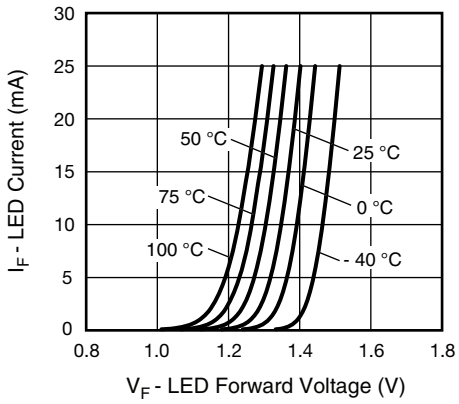


Fig. 4 - LED Current vs. LED Forward Voltage

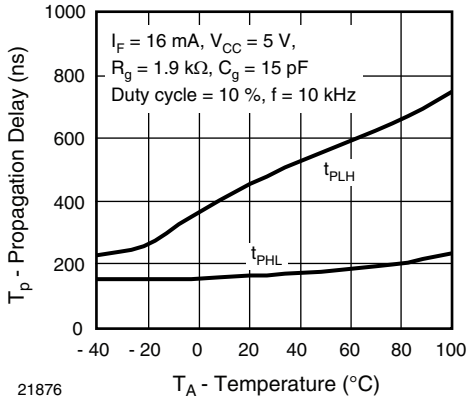


Fig. 6 - Propagation Delay vs. Temperature

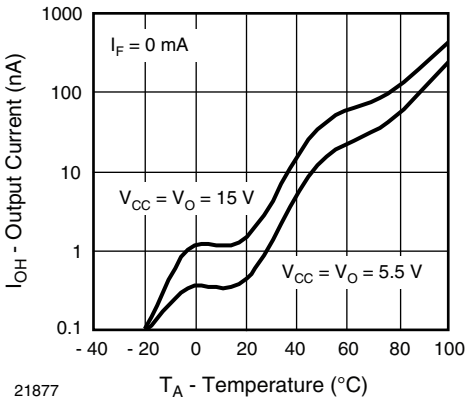


Fig. 7 - Logic High Output Current vs. Temperature

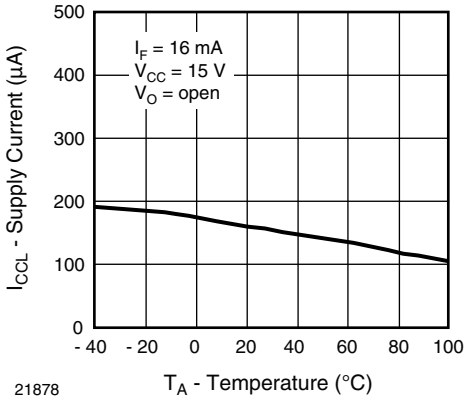


Fig. 8 - Supply Current vs. Temperature

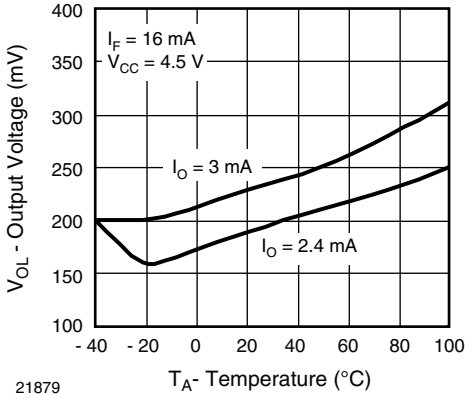
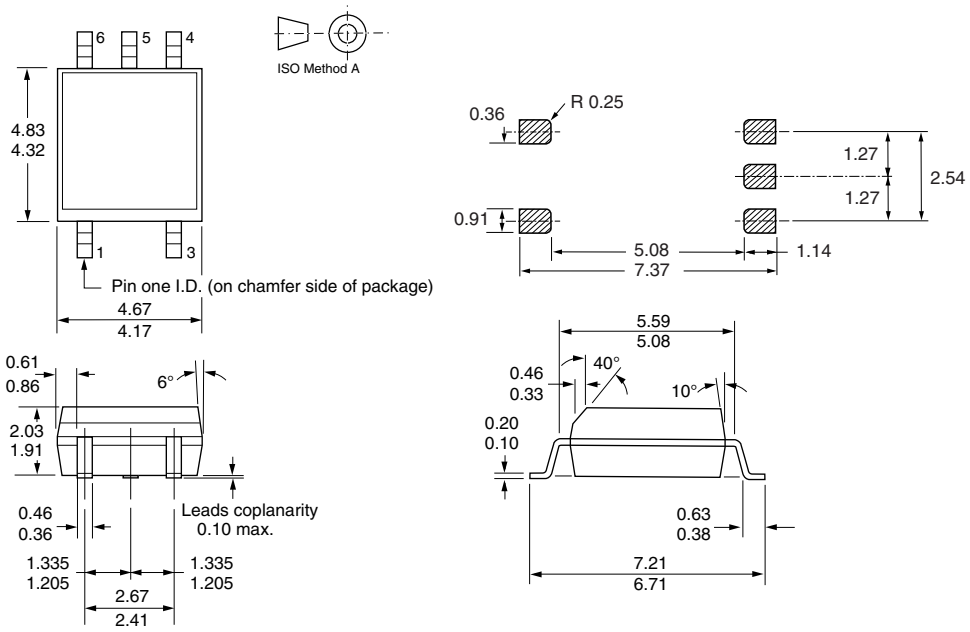


Fig. 9 - Logic Low Output Voltage vs. Temperature

PACKAGE DIMENSIONS in millimeters



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PACKAGE MARKING (example)

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