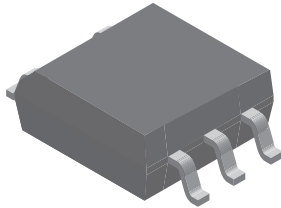
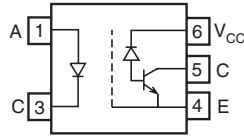


## Analog High Speed Optocoupler, 1 MBd, Transistor Output, SOP-5 Package



20409-1



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<sub>RMS</sub>
- Very high common mode transient immunity: 15 000 V/μs at V<sub>CM</sub> = 1500 V guaranteed (VOM453T)
- High speed: 1 MBd
- TTL compatible
- Open collector output
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC



**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.

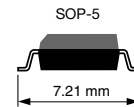
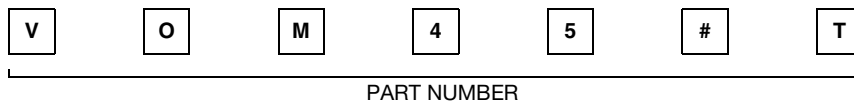
### APPLICATIONS

- Fieldbus communication and control
- Logic ground isolation
- Analog signal ground isolation
- Replace pulse transformers

### AGENCY APPROVALS

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

### ORDERING INFORMATION



AGENCY CERTIFIED/PACKAGE	CTR (%)		CMTI (kV/μs)	
<b>UL, cUL</b>	≥ 15	≥ 15	≥ 1	≥ 15
SOP-5	VOM452T	VOM453T	VOM452T	VOM453T

#### Note

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

# VOM452T, VOM453T



Vishay Semiconductors Analog High Speed Optocoupler, 1 MBd,  
Transistor Output, SOP-5 Package

<b>ABSOLUTE MAXIMUM RATINGS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)				
PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
<b>INPUT</b>				
Reverse voltage		$V_R$	3	V
DC forward current		$I_F$	25	mA
Surge forward current	$t_p \leq 1\text{ }\mu\text{s}$ , 300 pulses/s	$I_{FSM}$	1	A
Power dissipation	$T_{amb} \leq 70\text{ }^{\circ}\text{C}$	$P_{diss}$	45	mW
<b>OUTPUT</b>				
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	$T_{amb} \leq 70\text{ }^{\circ}\text{C}$	$P_{diss}$	100	mW
<b>COUPLER</b>				
Isolation test voltage between emitter and detector (refer to climate DIN 40046, part 2, Nov. 74)	$t = 1\text{ s}$	$V_{ISO}$	3750	$V_{RMS}$
Pollution degree (DIN VDE 0110)			2	
Creepage distance			$\geq 5$	mm
Clearance distance			$\geq 5$	mm
Comparative tracking index per DIN IEC 112/VDE 0303, part 1			175	
Isolation resistance	$V_{IO} = 500\text{ V}$ , $T_{amb} = 25\text{ }^{\circ}\text{C}$ , $R_{ISOL}^{(1)}$	$R_{IO}$	$\geq 10^{12}$	$\Omega$
	$V_{IO} = 500\text{ V}$ , $T_{amb} = 100\text{ }^{\circ}\text{C}$ , $R_{ISOL}^{(1)}$	$R_{IO}$	$\geq 10^{11}$	$\Omega$
Storage temperature range		$T_{stg}$	- 55 to + 125	$^{\circ}\text{C}$
Ambient temperature range		$T_{amb}$	- 55 to + 100	$^{\circ}\text{C}$
Junction temperature		$T_j$	100	$^{\circ}\text{C}$
Soldering temperature <sup>(2)</sup>	$t < 10\text{ s max.}$		260	$^{\circ}\text{C}$

## 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.

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

<sup>(2)</sup> Refer to reflow profile for soldering conditions for surface mounted devices.

<b>ELECTRICAL CHARACTERISTICS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
<b>INPUT</b>							
Input forward voltage	$I_F = 16\text{ mA}$		$V_F$		1.6	1.8	V
Input reverse current	$V_R = 3\text{ V}$		$I_R$		0.5	10	$\mu\text{A}$
Input capacitance	$f = 1\text{ MHz}, V_F = 0\text{ V}$		$C_{IN}$		75		pF
Temperature coefficient of forward voltage	$I_F = 16\text{ mA}$		$\Delta V_F / \Delta T_{amb}$		-1.7		mV/ $^{\circ}\text{C}$
<b>OUTPUT</b>							
Logic low supply current	$I_F = 16\text{ mA}, V_O = \text{open}, V_{CC} = 15\text{ V}$		$I_{CCL}$		200		$\mu\text{A}$
Logic high supply current	$I_F = 0\text{ mA}, V_O = \text{open}, V_{CC} = 15\text{ V}$		$I_{CCH}$		0.001	1	$\mu\text{A}$
	$I_F = 0\text{ mA}, V_O = \text{open}, V_{CC} = 15\text{ V}, T_{amb} = 0\text{ }^{\circ}\text{C to } 70\text{ }^{\circ}\text{C}$		$I_{CCH}$			2	$\mu\text{A}$
Logic low output voltage	$I_F = 16\text{ mA}, V_{CC} = 4.5\text{ V}, I_O = 3\text{ mA}$		$V_{OL}$		0.15	0.4	V
	$I_F = 16\text{ mA}, V_{CC} = 15\text{ V}, I_O = 2.4\text{ mA}, T_{amb} = -40\text{ }^{\circ}\text{C to } 100\text{ }^{\circ}\text{C}$		$V_{OL}$			0.5	V
Logic high output current	$I_F = 0\text{ mA}, V_O = V_{CC} = 5.5\text{ V}$		$I_{OH}$		0.003	0.5	$\mu\text{A}$
	$I_F = 0\text{ mA}, V_O = V_{CC} = 15\text{ V}$		$I_{OH}$		0.01	1	$\mu\text{A}$
	$I_F = 0\text{ mA}, V_O = V_{CC} = 15\text{ V}, T_{amb} = 0\text{ }^{\circ}\text{C to } 70\text{ }^{\circ}\text{C}$		$I_{OH}$			50	$\mu\text{A}$
<b>COUPLER</b>							
Capacitance (input-output) <sup>(1)</sup>	$f = 1\text{ MHz}$		$C_{IO}$		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.

<sup>(1)</sup> A 0.1  $\mu\text{F}$  bypass capacitor connected between pins 4 and 6 is recommended.

<b>CURRENT TRANSFER RATIO</b>						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Current transfer ratio <sup>(1)(2)</sup>	$V_O = 0.4\text{ V}, I_F = 16\text{ mA}, V_{CC} = 4.5\text{ V}$	CTR	15	30		%

### Notes

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

<sup>(2)</sup> A 0.1  $\mu\text{F}$  bypass capacitor connected between pins 4 and 6 is recommended.

<b>SWITCHING CHARACTERISTICS</b> (all typical values, $T_{amb} = 25\text{ }^{\circ}\text{C}$ )							
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT	
Propagation delay time to logic low at output (see fig. 1 and note 1)	$R_L = 1.9\text{ k}\Omega$	$t_{PHL}$		0.25	1	$\mu\text{s}$	
Propagation delay time to logic high at output (see fig. 1 and note 1)	$R_L = 1.9\text{ k}\Omega$	$t_{PLH}$		0.5	1	$\mu\text{s}$	

### Notes

- $V_{CC} = 5\text{ V}, I_F = 16\text{ mA}$  unless otherwise specified.

<sup>(1)</sup> The 1.9 k $\Omega$  load represents 1 TTL unit load of 1.6 mA and the 5.6 k $\Omega$  pull-up resistor.

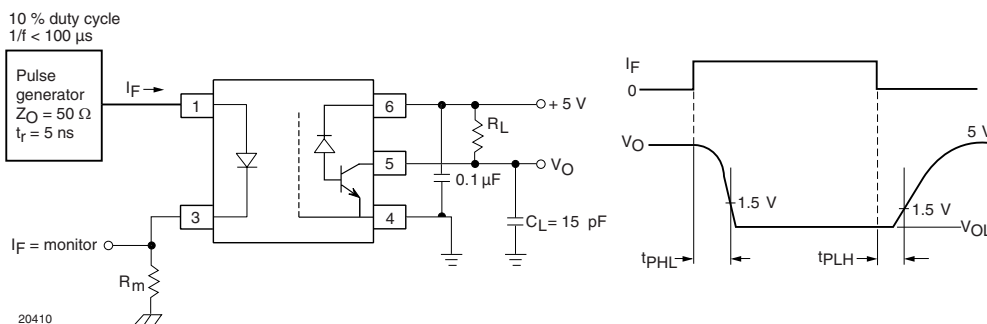


Fig. 1 - Test Circuit for Switching Times

COMMON MODE TRANSIENT IMMUNITY							
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)	$R_L = 1.9\text{ k}\Omega$ , $I_F = 0\text{ mA}$ , $V_{CM} = 10\text{ V}_{P-P}$ , $T_{amb} = 25\text{ }^\circ\text{C}$	VOM452T	$ CM_H $	1			kV/ $\mu\text{s}$
	$R_L = 1.9\text{ k}\Omega$ , $I_F = 0\text{ mA}$ , $V_{CM} = 1500\text{ V}_{P-P}$ , $T_{amb} = 25\text{ }^\circ\text{C}$	VOM453T	$ CM_H $	15			kV/ $\mu\text{s}$
Common mode transient immunity at logic low level output (see fig. 2 and notes 1, and 2)	$R_L = 1.9\text{ k}\Omega$ , $I_F = 16\text{ mA}$ , $V_{CM} = 10\text{ V}_{P-P}$ , $T_{amb} = 25\text{ }^\circ\text{C}$	VOM452T	$ CM_L $	1			kV/ $\mu\text{s}$
	$R_L = 1.9\text{ k}\Omega$ , $I_F = 16\text{ mA}$ , $V_{CM} = 1500\text{ V}_{P-P}$ , $T_{amb} = 25\text{ }^\circ\text{C}$	VOM453T	$ CM_L $	15			kV/ $\mu\text{s}$

### 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.,  $V_O > 2\text{ V}$ ). Common mode transient immunity in a logic low level is 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 a logic low state, i.e.,  $V_O > 0.8\text{ V}$ .
- (2) The  $1.9\text{ k}\Omega$  load represents 1 TTL unit load of  $1.6\text{ mA}$  and the  $5.6\text{ k}\Omega$  pull-up resistor.

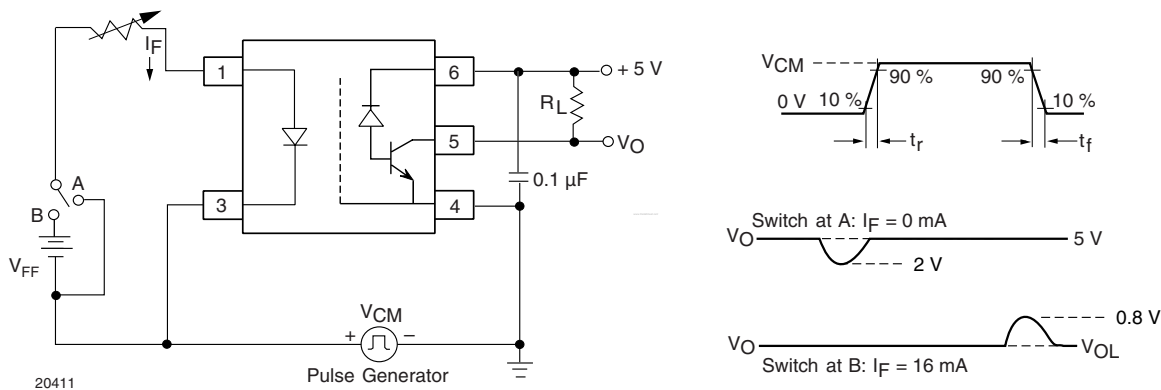


Fig. 2 - Test Circuit for Transient Immunity and Typical Waveforms

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	$^\circ\text{C}$	
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 protective circuits.



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

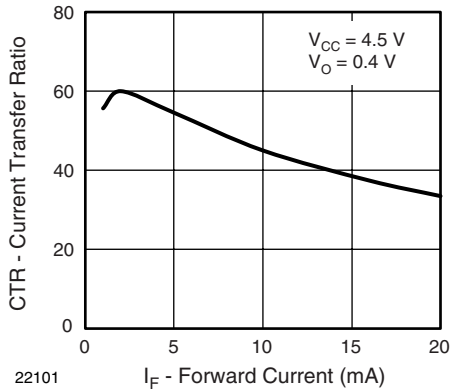


Fig. 3 - Current Transfer Ratio vs. Forward Current

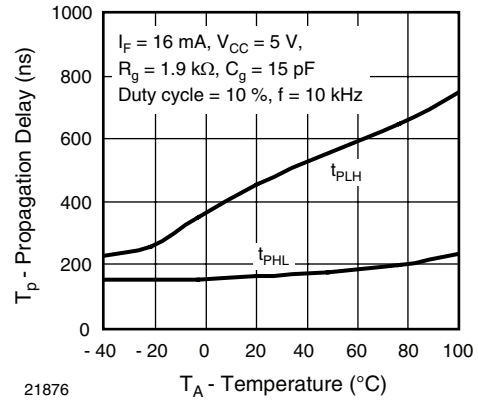


Fig. 6 - Propagation Delay vs. Temperature

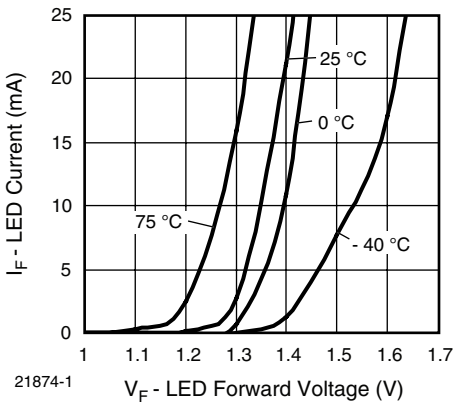


Fig. 4 - LED Current vs. LED Forward Voltage

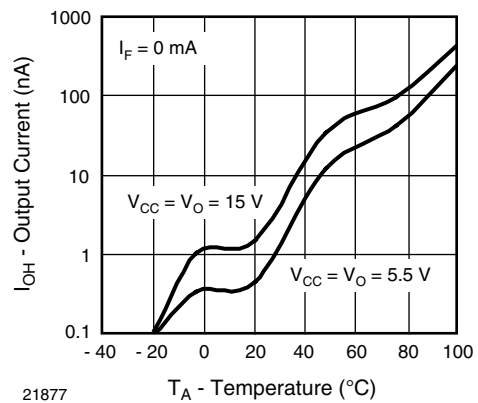


Fig. 7 - Logic High Output Current vs. Temperature

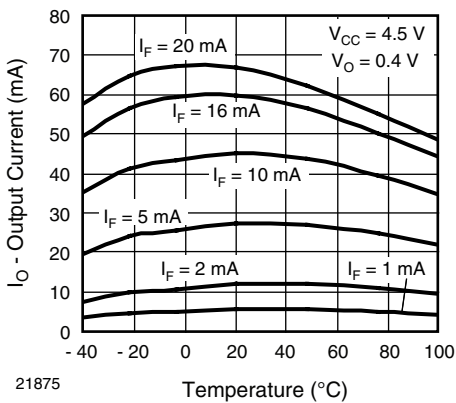


Fig. 5 - Output Current vs. Temperature

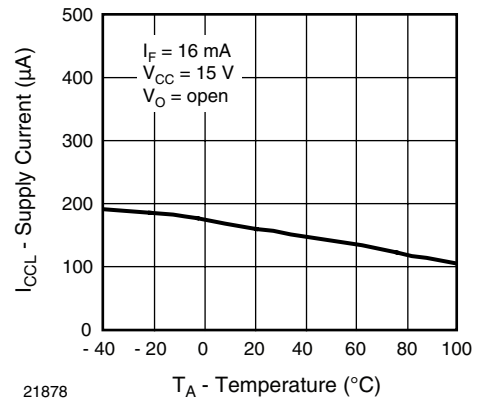


Fig. 8 - Supply Current vs. Temperature

# VOM452T, VOM453T



Vishay Semiconductors Analog High Speed Optocoupler, 1 MBd,  
Transistor Output, SOP-5 Package

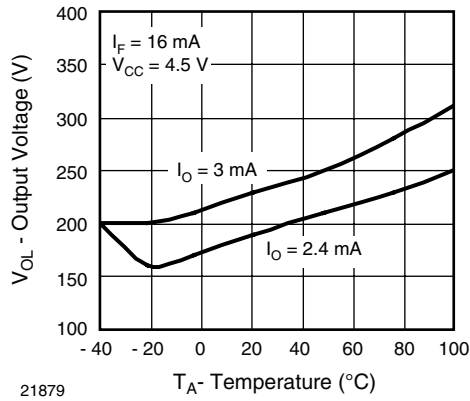
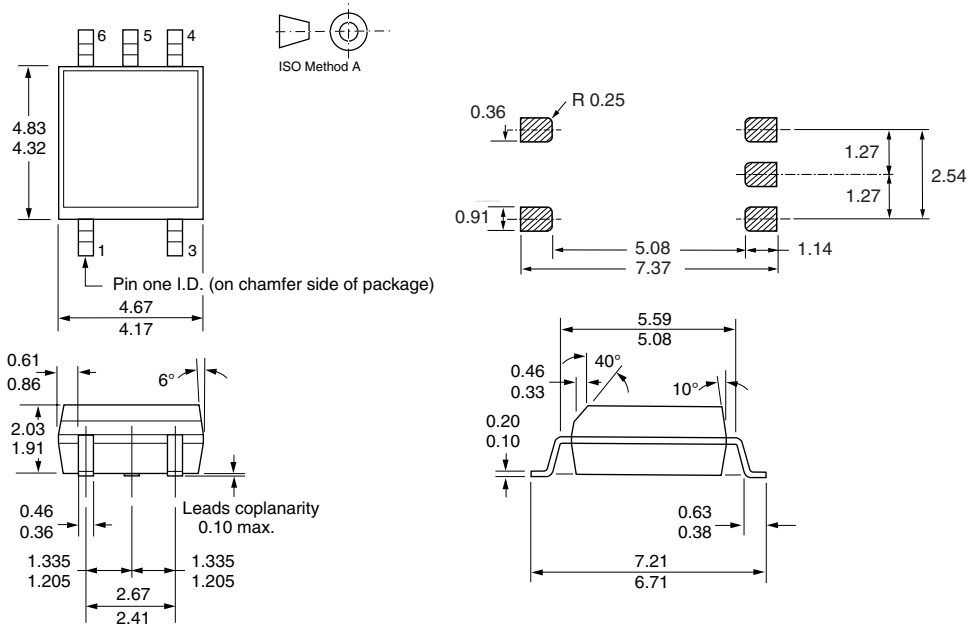


Fig. 9 - Logic Low Output Voltage vs. Temperature

## PACKAGE DIMENSIONS in millimeters



20643

## PACKAGE MARKING



21764-54



## Disclaimer

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