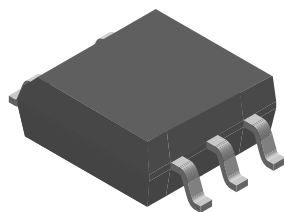
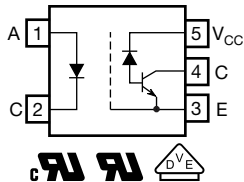


# Analog High Speed Coupler, High Noise Immunity, 1 MBd, SOP-5 Package



20409-1



## 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 (VOM453)
- High speed: 1 MBd
- TTL compatible
- Open collector output
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
COMPLIANT

## LINKS TO ADDITIONAL RESOURCES



## DESCRIPTION

The VOM452 and VOM453, 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 VOM452 and VOM453 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 VOM452 and VOM453 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.

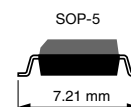
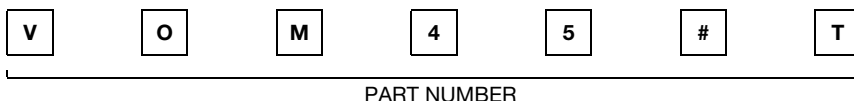
## APPLICATIONS

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

## AGENCY APPROVALS

- [UL](#)
- [cUL](#)
- [DIN EN 60747-5-5 \(VDE 0884-5\)](#), available with option 1

## ORDERING INFORMATION



AGENCY CERTIFIED/PACKAGE	CMTI (kV/μs)	
<b>UL, cUL</b>	<b>≥ 1</b>	<b>≥ 15</b>
SOP-5	VOM452T	VOM453T
<b>UL, cUL, VDE (option 1)</b>	<b>≥ 1</b>	<b>≥ 15</b>
SOP-5	VOM452-X001T	VOM453-X001T

### Notes

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



ABSOLUTE MAXIMUM RATINGS ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , 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>				
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	$t < 10\text{ s max.}$		260	$^{\circ}\text{C}$

**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.

ELECTRICAL CHARACTERISTICS ( $T_{amb} = -40\text{ }^{\circ}\text{C}$ to $+100\text{ }^{\circ}\text{C}$ , unless otherwise specified)						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
<b>INPUT</b>						
Input forward voltage	$I_F = 16\text{ mA}$	$V_F$	-	1.4	1.8	V
Input reverse current	$V_R = 3\text{ V}$	$I_R$	-	0.5	10	$\mu\text{A}$
Input capacitance	$f = 1\text{ MHz}$ , $V_F = 0\text{ V}$ , $T_{amb} = 25\text{ }^{\circ}\text{C}$	$C_{IN}$	-	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	$I_F = 0\text{ mA}$ , $V_O = \text{open}$ , $V_{CC} = 15\text{ V}$ , $T_{amb} = 25\text{ }^{\circ}\text{C}$	$I_{CCH}$	-	0.001	1	$\mu\text{A}$
	$I_F = 0\text{ mA}$ , $V_O = \text{open}$ , $V_{CC} = 15\text{ V}$	$I_{CCH}$	-	-	2	$\mu\text{A}$
Logic low output voltage	$I_F = 16\text{ mA}$ , $V_{CC} = 4.5\text{ V}$ , $I_O = 3\text{ mA}$ , $T_{amb} = 25\text{ }^{\circ}\text{C}$	$V_{OL}$	-	0.15	0.4	V
	$I_F = 16\text{ mA}$ , $V_{CC} = 15\text{ V}$ , $I_O = 2.4\text{ mA}$	$V_{OL}$	-	-	0.5	V
Logic high output current	$I_F = 0\text{ mA}$ , $V_O = V_{CC} = 5.5\text{ V}$ , $T_{amb} = 25\text{ }^{\circ}\text{C}$	$I_{OH}$	-	0.003	0.5	$\mu\text{A}$
	$I_F = 0\text{ mA}$ , $V_O = V_{CC} = 15\text{ V}$ , $T_{amb} = 25\text{ }^{\circ}\text{C}$	$I_{OH}$	-	0.01	1	$\mu\text{A}$
	$I_F = 0\text{ mA}$ , $V_O = V_{CC} = 15\text{ V}$	$I_{OH}$	-	-	50	$\mu\text{A}$
<b>COUPLER</b>						
Capacitance (input-output) <sup>(1)</sup>	$f = 1\text{ MHz}$ , $T_{amb} = 25\text{ }^{\circ}\text{C}$	$C_{IO}$	-	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  $T_{amb} = 25\text{ }^{\circ}\text{C}$ .
- A 0.1  $\mu\text{F}$  bypass capacitor connected between pins 4 and 6 is recommended.

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

**Notes**

- Current transfer ratio in percent equals the ratio of output collector current ( $I_O$ ) to the forward LED input current ( $I_F$ ) times 100.
- A 0.1  $\mu\text{F}$  bypass capacitor connected between pins 4 and 6 is recommended. All typical values are measured at  $T_{amb} = 25\text{ }^{\circ}\text{C}$ .

<b>SWITCHING CHARACTERISTICS</b> ( $T_{amb} = -40\text{ }^{\circ}\text{C}$ to $+100\text{ }^{\circ}\text{C}$ , 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)	$V_{CC} = 5\text{ V}$ , $I_F = 16\text{ mA}$ , $R_L = 1.9\text{ k}\Omega$	$t_{PHL}$	-	0.2	1	$\mu\text{s}$
Propagation delay time to logic high at output (see fig. 1 and note 1)	$V_{CC} = 5\text{ V}$ , $I_F = 16\text{ mA}$ , $R_L = 1.9\text{ k}\Omega$	$t_{PLH}$	-	0.5	1	$\mu\text{s}$

**Note**

(1) The 1.9 k $\Omega$  load represents 1 TTL unit load of 1.6 mA and the 5.6 k $\Omega$  pull-up resistor. All typical values are measured at  $T_{amb} = 25\text{ }^{\circ}\text{C}$ .

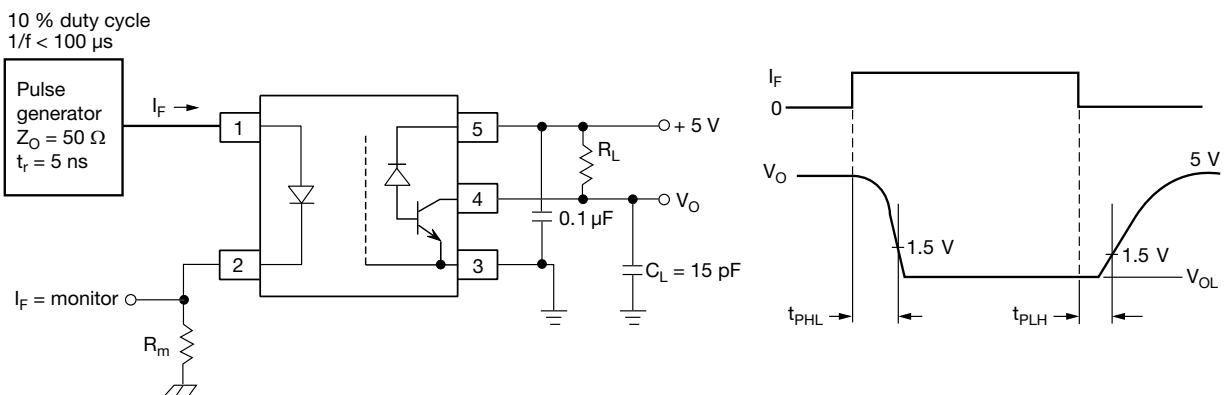


Fig. 1 - Test Circuit for Switching Times

<b>COMMON MODE TRANSIENT IMMUNITY</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , 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)	$R_L = 1.9\text{ k}\Omega$ , $I_F = 0\text{ mA}$ , $V_{CM} = 10\text{ V}_{P-P}$	VOM452T	$ CM_H $	1000	-	-	$\text{V}/\mu\text{s}$
	$R_L = 1.9\text{ k}\Omega$ , $I_F = 0\text{ mA}$ , $V_{CM} = 1500\text{ V}_{P-P}$	VOM453T	$ CM_H $	15 000	-	-	$\text{V}/\mu\text{s}$
Common mode transient immunity at logic low level output (see fig. 2 and notes 1, and 2)	$R_L = 1.9\text{ k}\Omega$ , $I_F = 16\text{ mA}$ , $V_{CM} = 10\text{ V}_{P-P}$	VOM452T	$ CM_L $	1000	-	-	$\text{V}/\mu\text{s}$
	$R_L = 1.9\text{ k}\Omega$ , $I_F = 16\text{ mA}$ , $V_{CM} = 1500\text{ V}_{P-P}$	VOM453T	$ CM_L $	15 000	-	-	$\text{V}/\mu\text{s}$

**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 k $\Omega$  load represents 1 TTL unit load of 1.6 mA and the 5.6 k $\Omega$  pull-up resistor.

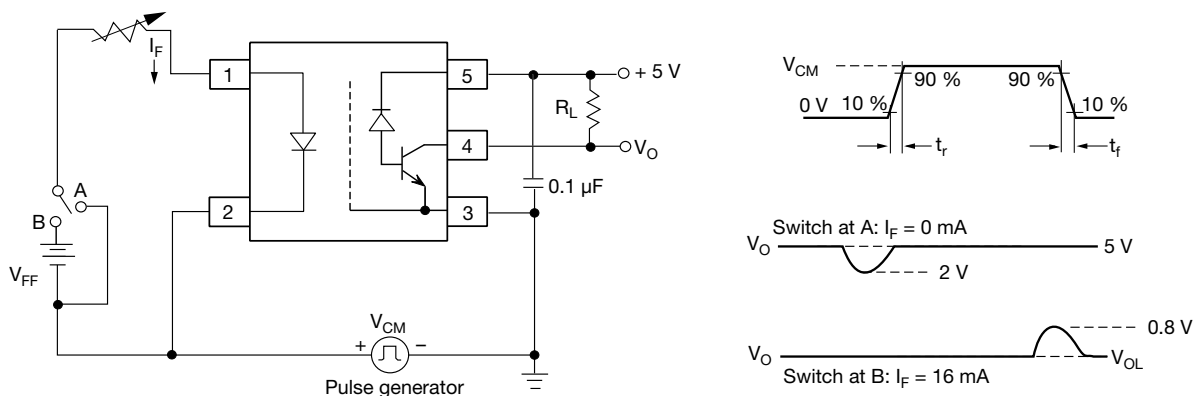


Fig. 2 - Test Circuit for Transient Immunity and Typical Waveforms

<b>SAFETY AND INSULATION RATINGS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)				
PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Climatic classification	According to IEC 68 part 1		55 / 100 / 21	
Pollution degree	According to DIN VDE 0109		2	
Comparative tracking index	Insulation group IIIa	CTI	175	
Maximum rated withstanding isolation voltage	According to UL1577, $t = 1\text{ min}$	$V_{ISO}$	3750	$V_{RMS}$
Maximum transient isolation voltage	According to DIN EN 60747-5-5	$V_{IOTM}$	6000	$V_{peak}$
Maximum repetitive peak isolation voltage	According to DIN EN 60747-5-5	$V_{IORM}$	707	$V_{peak}$
Isolation resistance	$T_{amb} = 25\text{ }^{\circ}\text{C}$ , $V_{IO} = 500\text{ V}$	$R_{IO}$	$\geq 10^{12}$	$\Omega$
	$T_{amb} = 100\text{ }^{\circ}\text{C}$ , $V_{IO} = 500\text{ V}$	$R_{IO}$	$\geq 10^{11}$	$\Omega$
Output safety power		$P_{SO}$	350	mW
Input safety current		$I_{SI}$	150	mA
Input safety temperature		$T_S$	175	$^{\circ}\text{C}$
Creepage distance			$\geq 5$	mm
Clearance distance			$\geq 5$	mm
Insulation thickness		DTI	$\geq 0.1$	mm
Input to output test voltage, method B	$V_{IORM} \times 1.875 = V_{PR}$ , 100 % production test with $t_M = 1\text{ s}$ , partial discharge $< 5\text{ pC}$	$V_{PR}$	1669	$V_{peak}$

**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.

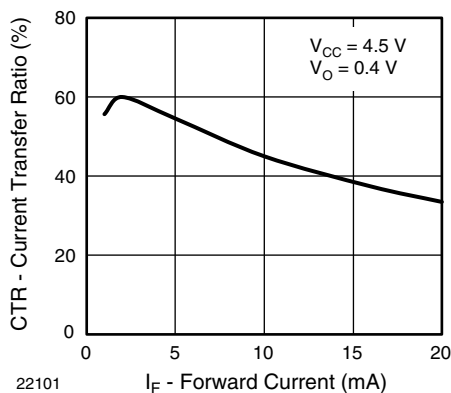
**TYPICAL CHARACTERISTICS** ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)


Fig. 3 - Current Transfer Ratio vs. Forward Current

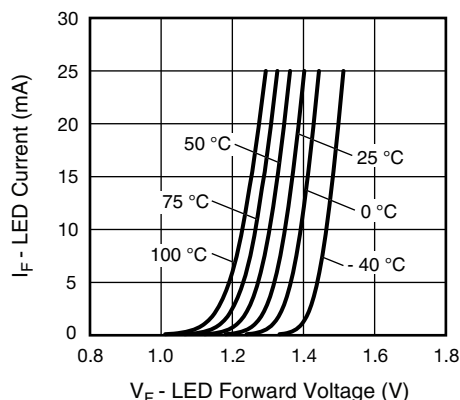


Fig. 4 - LED Current vs. LED Forward Voltage

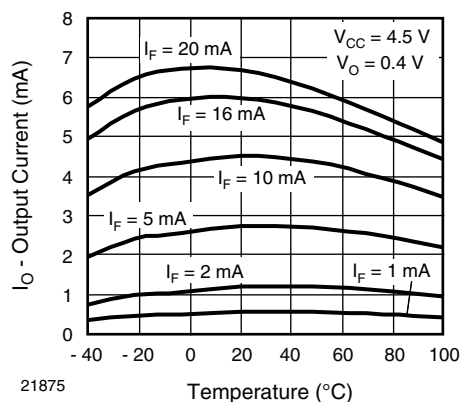


Fig. 5 - Output Current vs. Temperature

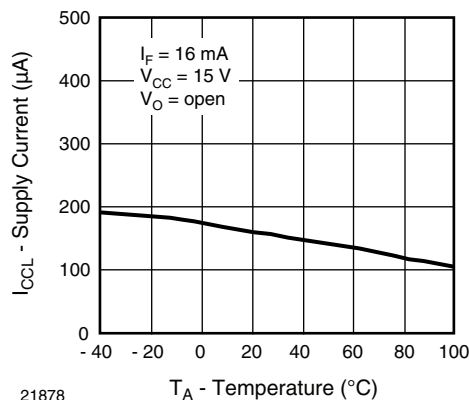


Fig. 8 - Supply Current vs. Temperature

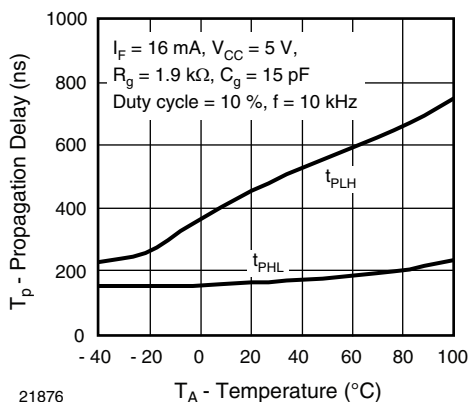


Fig. 6 - Propagation Delay vs. Temperature

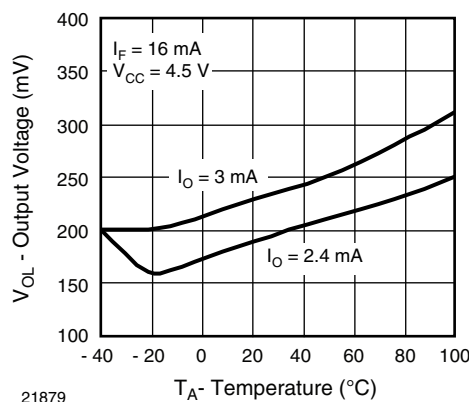


Fig. 9 - Logic Low Output Voltage vs. Temperature

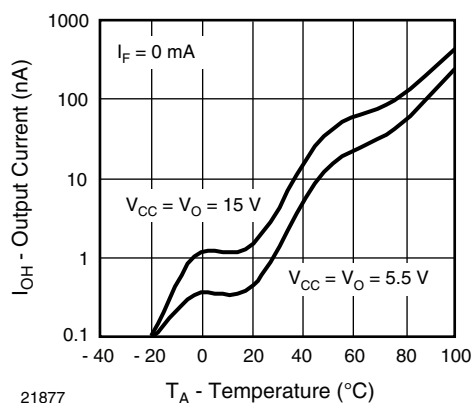
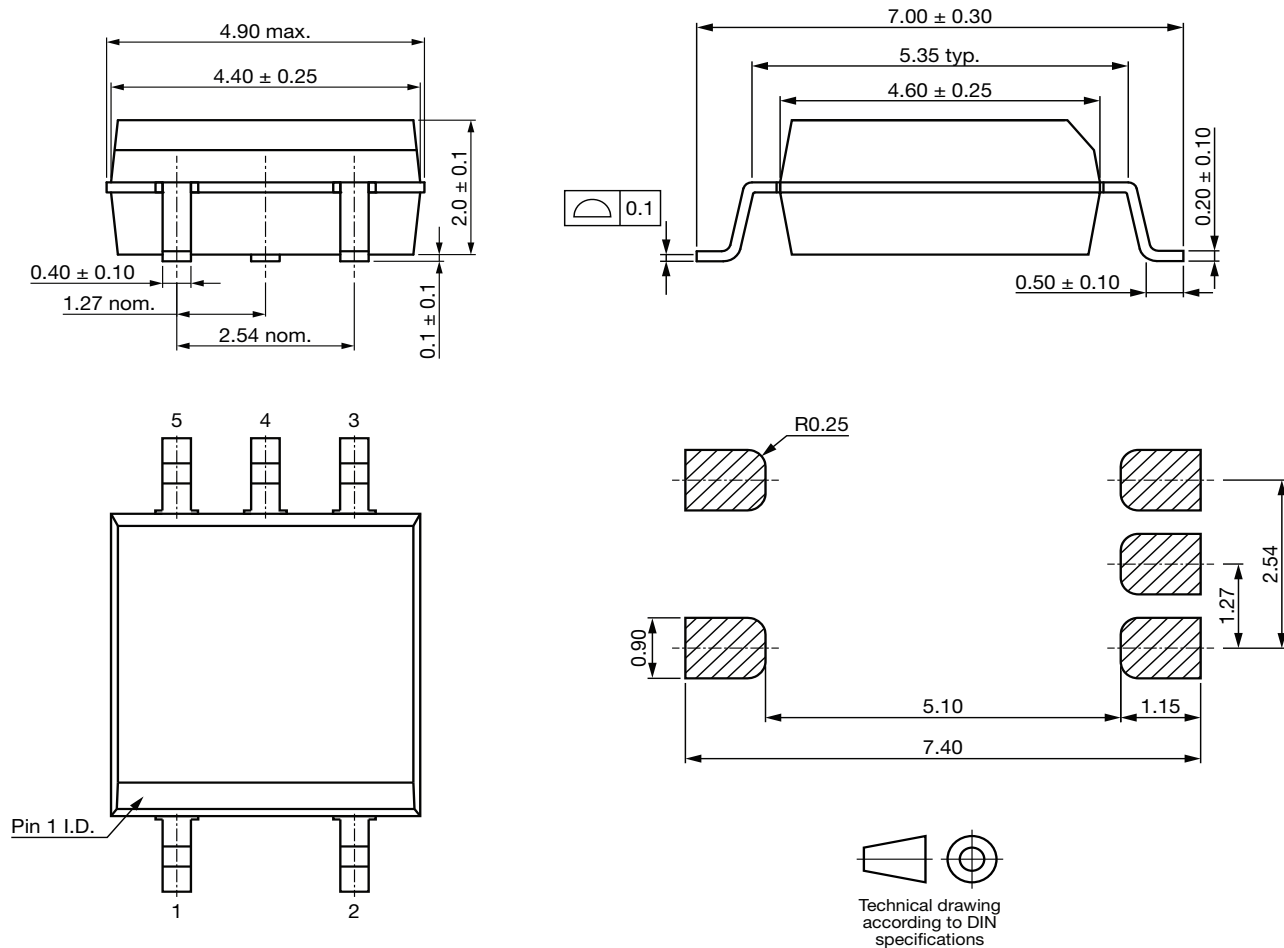


Fig. 7 - Logic High Output Current vs. Temperature

## PACKAGE DIMENSIONS (in millimeters)



## PACKAGE MARKING

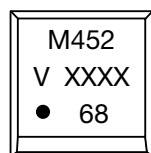


Fig. 10 - Example of VOM452T

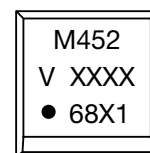


Fig. 11 - Example of VOM452-X001T

### Notes

- XXXX = LMC (lot marking code)
- VDE logo is not part of the package marking
- Tape and reel suffix (T) is not part of the package marking

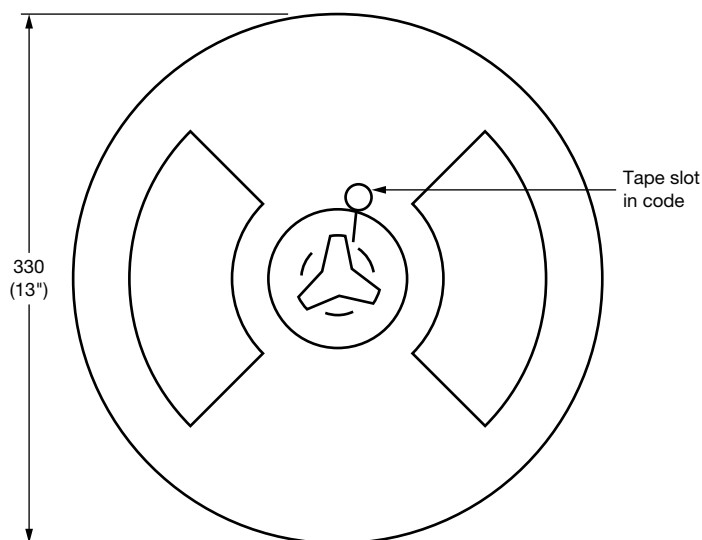
**PACKING INFORMATION** (tape and reel)


Fig. 12 - Tape and Reel Shipping Medium

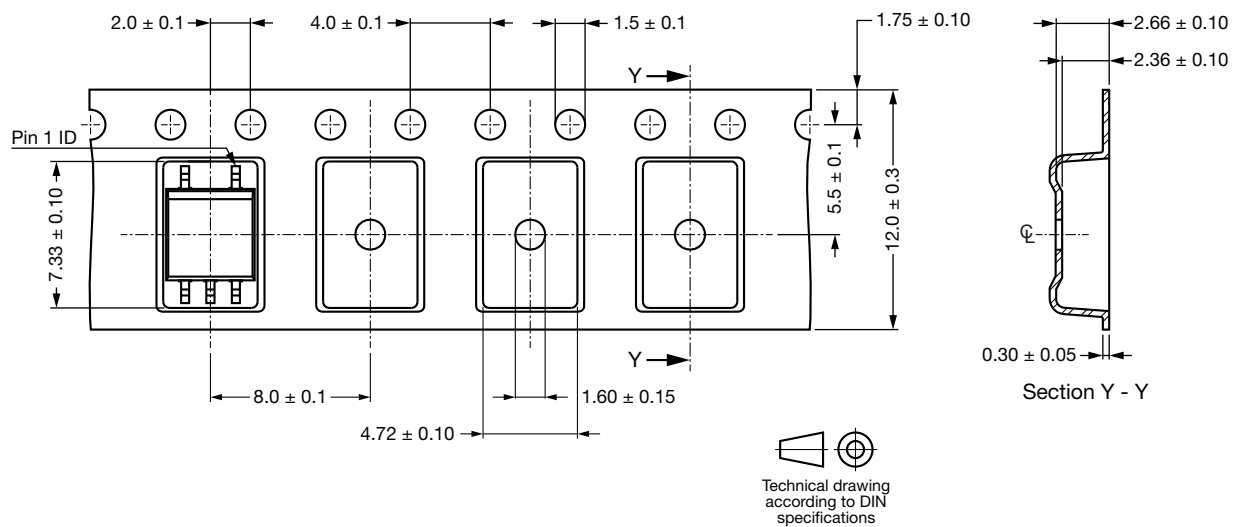
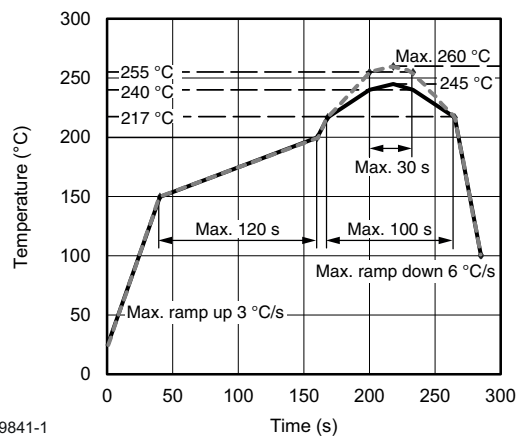


Fig. 13 - Tape and Reel Packing (2000 pieces on reel)



## SOLDER PROFILE



19841-1

Fig. 14 - Lead (Pb)-free Reflow Solder Profile  
According to J-STD-020

## HANDLING AND STORAGE CONDITIONS

ESD level: HBM class 2

Floor life: unlimited

Conditions:  $T_{amb} < 30\text{ °C}$ , RH < 85 %

Moisture sensitivity level 1, according to J-STD-020





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