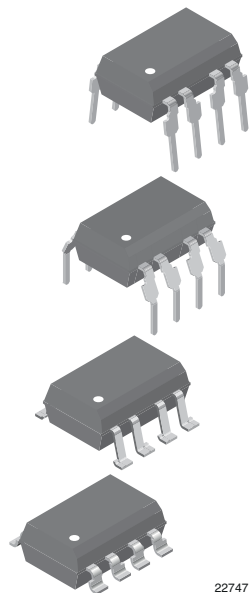
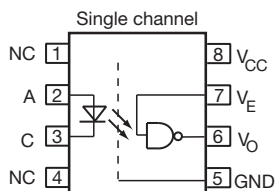


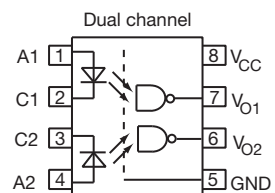
## High Speed Optocoupler, Single and Dual, 10 MBd



22747



6N137, VO2601, VO2611



VO2630, VO2631, VO4661



### FEATURES

- Choice of CMR performance of 15 kV/μs, 5 kV/μs, and 1000 V/μs
- High speed: 10 MBd typical
- +5 V CMOS compatibility
- Pure tin leads
- Guaranteed AC and DC performance over temperature: -40 °C to +100 °C temperature range
- Meets IEC 60068-2-42 (SO<sub>2</sub>) and IEC 60068-2-43 (H<sub>2</sub>S) requirements
- Low input current capability of 5 mA
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


RoHS  
COMPLIANT

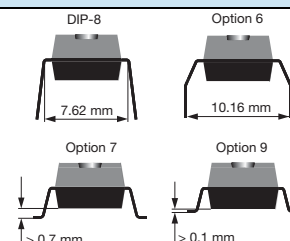
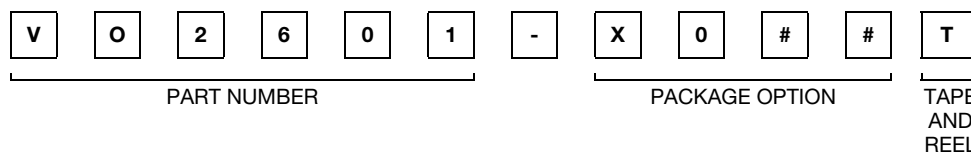
### APPLICATIONS

- Microprocessor system interface
- PLC, ATE input/output isolation
- Computer peripheral interface
- Digital fieldbus isolation: CC-link, DeviceNet, profibus, SDS
- High speed A/D and D/A conversion
- AC plasma display panel level shifting
- Multiplexed data transmission
- Digital control power supply
- Ground loop elimination, noise isolation

### AGENCY APPROVALS

- UL1577
- cUL
- DIN EN 60747-5-5 (VDE 0884-5) available with option 1
- BS EN 60950-1
- CQC GB8898-2011, GB4943.1-2011

### ORDERING INFORMATION



AGENCY CERTIFIED/PACKAGE	CHANNELS 1			CHANNELS 2		
	CMR (V/μs)			CMR (V/μs)		
<b>BSI, UL, cUL</b>	<b>1000</b>	<b>5000</b>	<b>15 000</b>	<b>1000</b>	<b>5000</b>	<b>15 000</b>
DIP-8	6N137	VO2601	VO2611	VO2630	VO2631	VO4661
DIP-8, 400 mil, option 6	6N137-X006	VO2601-X006	VO2611-X006	VO2630-X006	VO2631-X006	VO4661-X006
SMD-8, option 7	6N137-X007T	VO2601-X007T	VO2611-X007T	VO2630-X007T	VO2631-X007T	VO4661-X007T
SMD-8, option 9	6N137-X009T	-	-	VO2630-X009T	-	-
<b>VDE, BSI, UL, cUL</b>	<b>1000</b>	<b>5000</b>	<b>15 000</b>	<b>1000</b>	<b>5000</b>	<b>15 000</b>
DIP-8, 400 mil, option 6	-	VO2601-X016	VO2611-X016	-	VO2631-X016	-
SMD-8, option 7	-	VO2601-X017T	VO2611-X017T	-	VO2631-X017T	-



TRUTH TABLE (positive logic)		
LED	ENABLE	OUTPUT
On	H	L
Off	H	H
On	L	H
Off	L	H
On	NC	L
Off	NC	H

ABSOLUTE MAXIMUM RATINGS ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)				
PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
INPUT				
Average forward current (single channel)		$I_F$	20	mA
Average forward current (per channel for dual channel)		$I_F$	15	mA
Reverse input voltage		$V_R$	5	V
Enable input voltage		$V_E$	$V_{CC} + 0.5\text{ V}$	V
Enable input current		$I_E$	5	mA
Surge current	$t = 100\text{ }\mu\text{s}$	$I_{FSM}$	200	mA
Output power dissipation (single channel)		$P_{diss}$	35	mW
Output power dissipation (per channel for dual channel)		$P_{diss}$	25	mW
OUTPUT				
Supply voltage	1 min maximum	$V_{CC}$	7	V
Output current		$I_O$	50	mA
Output voltage		$V_O$	7	V
Output power dissipation (single channel)		$P_{diss}$	85	mW
Output power dissipation (per channel for dual channel)		$P_{diss}$	60	mW
COUPLER				
Storage temperature		$T_{stg}$	-55 to +150	$^{\circ}\text{C}$
Operating temperature		$T_{amb}$	-40 to +100	$^{\circ}\text{C}$
Lead solder temperature	for 10 s		260	$^{\circ}\text{C}$
Solder reflow temperature			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.

RECOMMENDED OPERATING CONDITIONS					
PARAMETER	TEST CONDITION	SYMBOL	MIN.	MAX.	UNIT
Operating temperature		$T_{amb}$	-40	100	$^{\circ}\text{C}$
Supply voltage		$V_{CC}$	4.5	5.5	V
Input current low level		$I_{FL}$	0	250	$\mu\text{A}$
Input current high level		$I_{FH}$	5	15	mA
Logic high enable voltage		$V_{EH}$	2	$V_{CC}$	V
Logic low enable voltage		$V_{EL}$	0	0.8	V
Output pull up resistor		$R_L$	330	4K	$\Omega$
Fanout	$R_L = 1\text{ k}\Omega$	N		5	-



<b>ELECTRICAL CHARACTERISTICS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
<b>INPUT</b>						
Input forward voltage	$I_F = 10\text{ mA}$	$V_F$	1.1	1.4	1.7	V
Reverse current	$V_R = 5\text{ V}$	$I_R$		0.01	10	$\mu\text{A}$
Input capacitance	$f = 1\text{ MHz}$ , $V_F = 0\text{ V}$	$C_I$		55		pF
<b>OUTPUT</b>						
High level supply current (single channel)	$V_E = 0.5\text{ V}$ , $I_F = 0\text{ mA}$	$I_{CCH}$		4.1	7	mA
	$V_E = V_{CC}$ , $I_F = 0\text{ mA}$	$I_{CCH}$		3.3	6	mA
High level supply current (dual channel)	$I_F = 0\text{ mA}$	$I_{CCH}$		6.5	12	mA
Low level supply current (single channel)	$V_E = 0.5\text{ V}$ , $I_F = 10\text{ mA}$	$I_{CCL}$		4	7	mA
	$V_E = V_{CC}$ , $I_F = 10\text{ mA}$	$I_{CCL}$		3.3	6	mA
Low level supply current (dual channel)	$I_F = 10\text{ mA}$	$I_{CCL}$		6.5	12	mA
High level output current	$V_E = 2\text{ V}$ , $V_{CC} = 5.5\text{ V}$ , $I_F = 250\text{ }\mu\text{A}$	$I_{OH}$		0.002	1	$\mu\text{A}$
Low level output voltage	$V_E = 2\text{ V}$ , $I_F = 5\text{ mA}$ , $I_{OL}(\text{sinking}) = 13\text{ mA}$	$V_{OL}$		0.2	0.6	V
Input threshold current	$V_E = 2\text{ V}$ , $V_{CC} = 5.5\text{ V}$ , $I_{OL}(\text{sinking}) = 13\text{ mA}$	$I_{TH}$		2.4	5	mA
High level enable current	$V_E = 2\text{ V}$	$I_{EH}$		-0.6	-1.6	mA
Low level enable current	$V_E = 0.5\text{ V}$	$I_{EL}$		-0.8	-1.6	mA
High level enable voltage		$V_{EH}$	2			V
Low level enable voltage		$V_{EL}$			0.8	V

**Note**

- 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.

<b>SWITCHING CHARACTERISTICS</b>						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Propagation delay time to high output level	$R_L = 350\text{ }\Omega$ , $C_L = 15\text{ pF}$	$t_{PLH}$	20	48	75 <sup>(1)</sup>	ns
		$t_{PLH}$			100	ns
Propagation delay time to low output level	$R_L = 350\text{ }\Omega$ , $C_L = 15\text{ pF}$	$t_{PHL}$	25	50	75 <sup>(1)</sup>	ns
		$t_{PHL}$			100	ns
Pulse width distortion	$R_L = 350\text{ }\Omega$ , $C_L = 15\text{ pF}$	$ t_{PHL} - t_{PLH} $		2.9	35	ns
Propagation delay skew	$R_L = 350\text{ }\Omega$ , $C_L = 15\text{ pF}$	$t_{PSK}$		8	40	ns
Output rise time (10 % to 90 %)	$R_L = 350\text{ }\Omega$ , $C_L = 15\text{ pF}$	$t_r$		23		ns
Output fall time (90 % to 10 %)	$R_L = 350\text{ }\Omega$ , $C_L = 15\text{ pF}$	$t_f$		7		ns
Propagation delay time of enable from $V_{EH}$ to $V_{EL}$	$R_L = 350\text{ }\Omega$ , $C_L = 15\text{ pF}$ , $V_{EL} = 0\text{ V}$ , $V_{EH} = 3\text{ V}$	$t_{ELH}$		12		ns
Propagation delay time of enable from $V_{EL}$ to $V_{EH}$	$R_L = 350\text{ }\Omega$ , $C_L = 15\text{ pF}$ , $V_{EL} = 0\text{ V}$ , $V_{EH} = 3\text{ V}$	$t_{EHL}$		11		ns

**Notes**

- Over recommended temperature ( $T_{amb} = -40\text{ }^{\circ}\text{C}$  to  $+100\text{ }^{\circ}\text{C}$ ),  $V_{CC} = 5\text{ V}$ ,  $I_F = 7.5\text{ mA}$  unless otherwise specified. All typicals at  $T_{amb} = 25\text{ }^{\circ}\text{C}$ ,  $V_{CC} = 5\text{ V}$ .
- <sup>(1)</sup> 75 ns applies to the 6N137 only, a JEDEC® registered specification

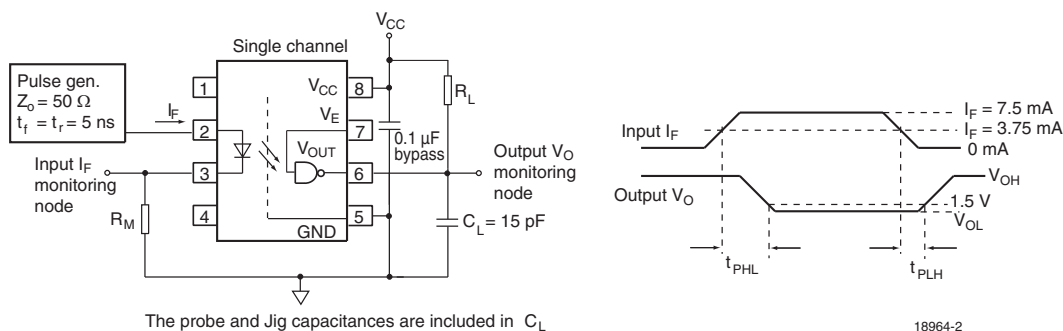


Fig. 1 - Single Channel Test Circuit for  $t_{PLH}$ ,  $t_{PHL}$ ,  $t_r$  and  $t_f$

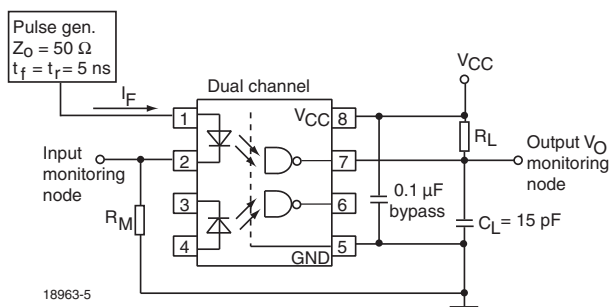


Fig. 2 - Dual Channel Test Circuit for  $t_{PLH}$ ,  $t_{PHL}$ ,  $t_r$  and  $t_f$

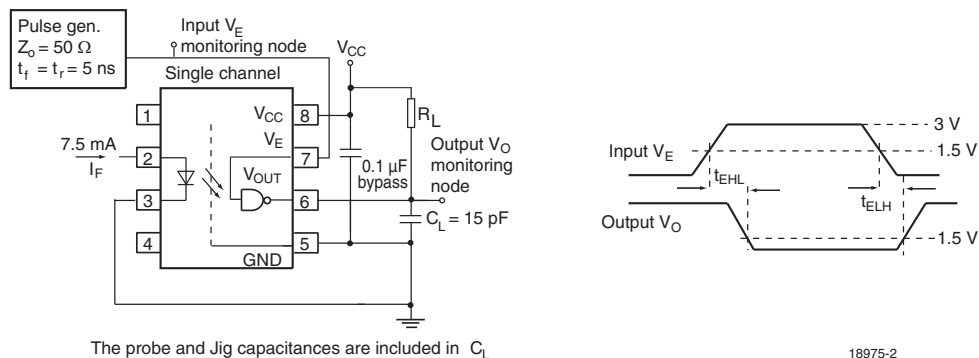


Fig. 3 - Single Channel Test Circuit for  $t_{EHL}$  and  $t_{ELH}$

COMMON MODE TRANSIENT IMMUNITY						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Common mode transient immunity (high)	$ V_{CM}  = 10 \text{ V}$ , $V_{CC} = 5 \text{ V}$ , $I_F = 0 \text{ mA}$ , $V_{O(min.)} = 2 \text{ V}$ , $R_L = 350 \Omega$ , $T_{amb} = 25^\circ \text{C}$ (1)	$ CM_H $	1000			V/ $\mu\text{s}$
	$ V_{CM}  = 50 \text{ V}$ , $V_{CC} = 5 \text{ V}$ , $I_F = 0 \text{ mA}$ , $V_{O(min.)} = 2 \text{ V}$ , $R_L = 350 \Omega$ , $T_{amb} = 25^\circ \text{C}$ (2)	$ CM_H $	5000	10 000		V/ $\mu\text{s}$
	$ V_{CM}  = 1 \text{ kV}$ , $V_{CC} = 5 \text{ V}$ , $I_F = 0 \text{ mA}$ , $V_{O(min.)} = 2 \text{ V}$ , $R_L = 350 \Omega$ , $T_{amb} = 25^\circ \text{C}$ (3)	$ CM_H $	15 000	25 000		V/ $\mu\text{s}$
	$ V_{CM}  = 10 \text{ V}$ , $V_{CC} = 5 \text{ V}$ , $I_F = 7.5 \text{ mA}$ , $V_{O(max.)} = 0.8 \text{ V}$ , $R_L = 350 \Omega$ , $T_{amb} = 25^\circ \text{C}$ (1)	$ CM_L $	1000			V/ $\mu\text{s}$
	$ V_{CM}  = 50 \text{ V}$ , $V_{CC} = 5 \text{ V}$ , $I_F = 7.5 \text{ mA}$ , $V_{O(max.)} = 0.8 \text{ V}$ , $R_L = 350 \Omega$ , $T_{amb} = 25^\circ \text{C}$ (2)	$ CM_L $	5000	10 000		V/ $\mu\text{s}$
	$ V_{CM}  = 1 \text{ kV}$ , $V_{CC} = 5 \text{ V}$ , $I_F = 7.5 \text{ mA}$ , $V_{O(max.)} = 0.8 \text{ V}$ , $R_L = 350 \Omega$ , $T_{amb} = 25^\circ \text{C}$ (3)	$ CM_L $	15 000	25 000		V/ $\mu\text{s}$

## Notes

- (1) For 6N137 and VO2630
- (2) For VO2601 and VO2631
- (3) For VO2611 and VO4661

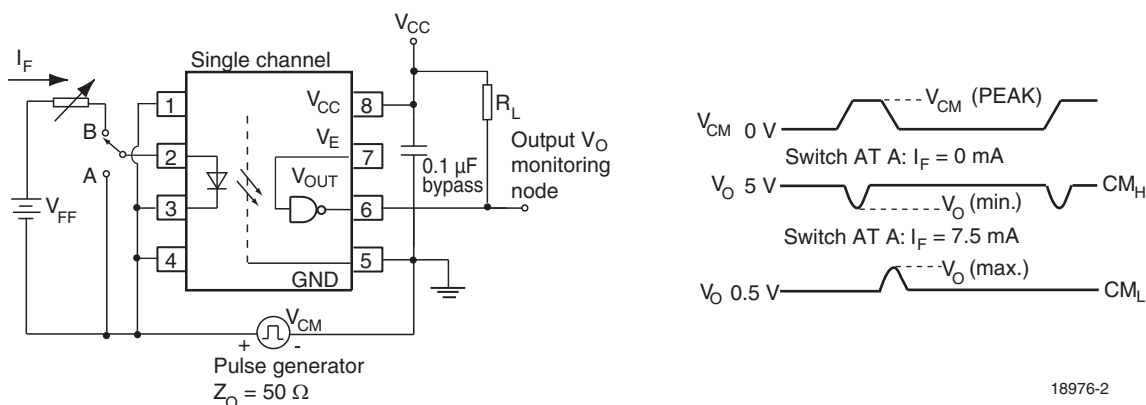


Fig. 4 - Single Channel Test Circuit for Common Mode Transient Immunity

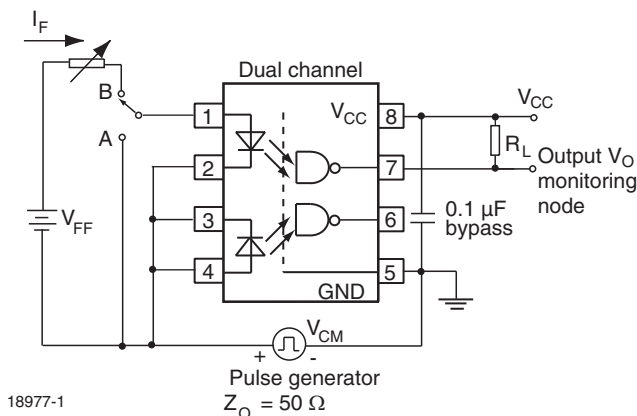


Fig. 5 - Dual Channel Test Circuit for Common Mode Transient Immunity

SAFETY AND INSULATION RATINGS				
PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Climatic classification (according to IEC 68 part 1)			40/100/21	
Comparative tracking index		CTI	175	
Rated isolation voltage	$t = 1 \text{ min}$	$V_{ISO}$	5300	$V_{RMS}$
Maximum transient isolation voltage		$V_{IOTM}$	8000	V
Maximum repetitive peak isolation voltage		$V_{IORM}$	890	V
Isolation resistance	$V_{IO} = 500 \text{ V}, T_{amb} = 25^\circ \text{C}$	$R_{IO}$	$\geq 10^{12}$	$\Omega$
	$V_{IO} = 500 \text{ V}, T_{amb} = 100^\circ \text{C}$	$R_{IO}$	$\geq 10^{11}$	$\Omega$
Output safety power		$P_{SO}$	500	mW
Input safety current		$I_{SI}$	300	mA
Input safety temperature		$T_{SI}$	175	$^\circ \text{C}$
Creepage distance	Standard DIP-4		$\geq 8$	mm
Clearance distance	Standard DIP-4		$\geq 8$	mm
Creepage distance	400 mil DIP-4		$\geq 8$	mm
Clearance distance	400 mil DIP-4		$\geq 8$	mm
Insulation thickness, reinforced rated	per BSI 60950	DTI	$\geq 0.4$	mm

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

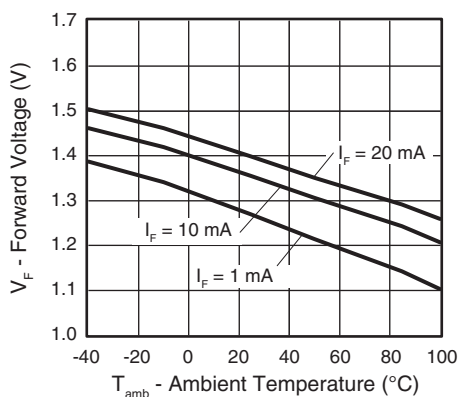


Fig. 6 - Forward Voltage vs. Ambient Temperature

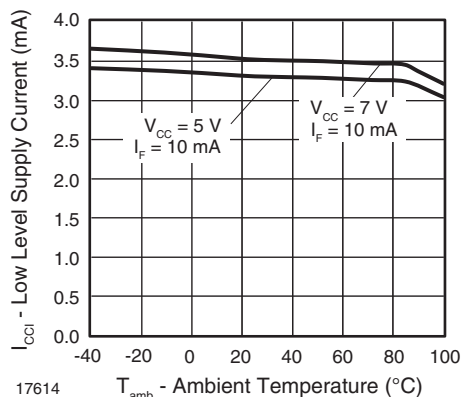


Fig. 9 - Low Level Supply Current vs. Ambient Temperature

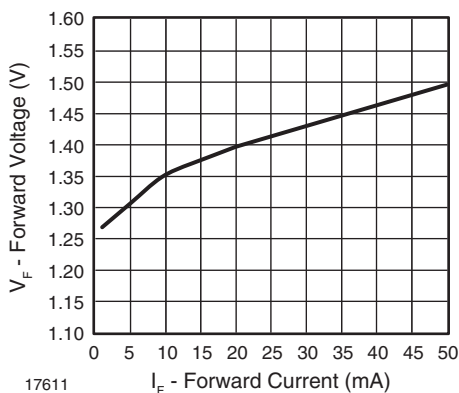


Fig. 7 - Forward Voltage vs. Forward Current

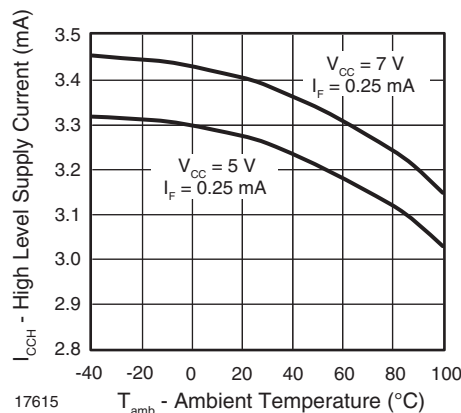


Fig. 10 - High Level Supply Current vs. Ambient Temperature

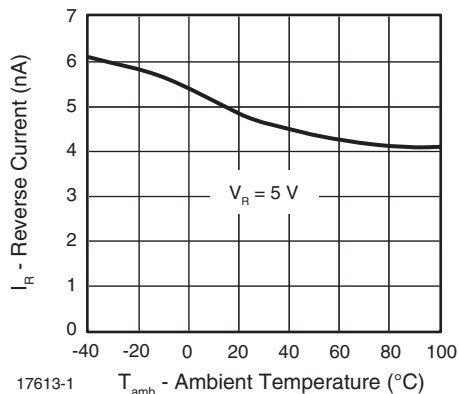


Fig. 8 - Reverse Current vs. Ambient Temperature

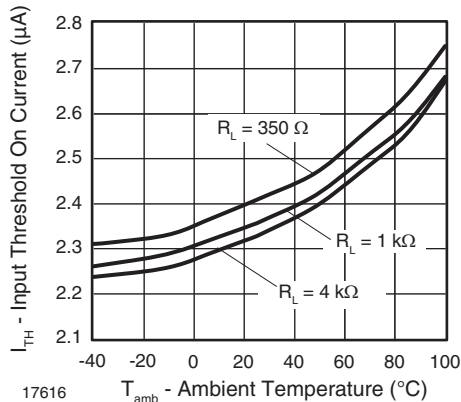


Fig. 11 - Input Threshold On Current vs. Ambient Temperature

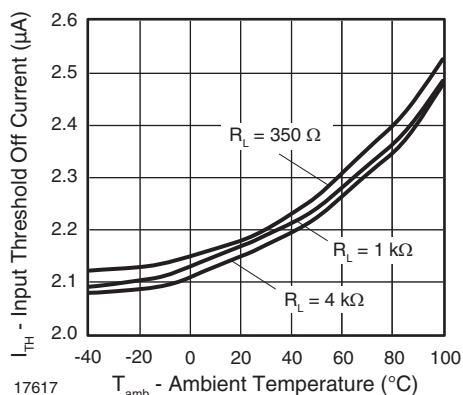


Fig. 12 - Input Threshold Off Current vs. Ambient Temperature

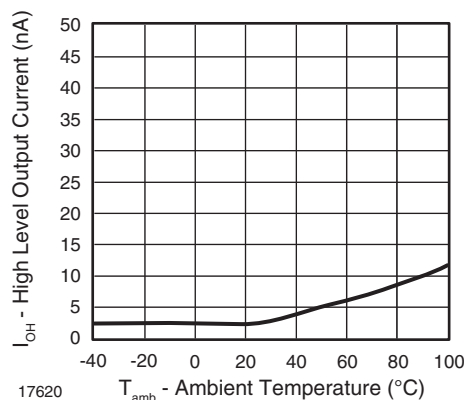


Fig. 15 - High Level Output Current vs. Ambient Temperature

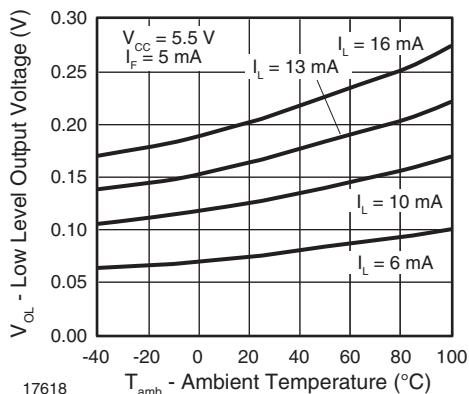


Fig. 13 - Low Level Output Voltage vs. Ambient Temperature

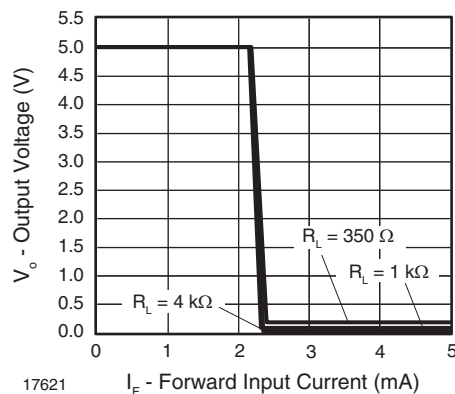


Fig. 16 - Output Voltage vs. Forward Input Current

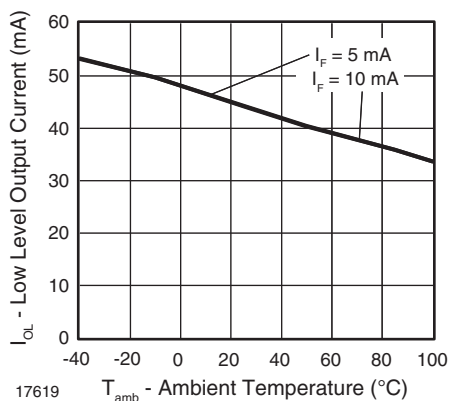


Fig. 14 - Low Level Output Current vs. Ambient Temperature

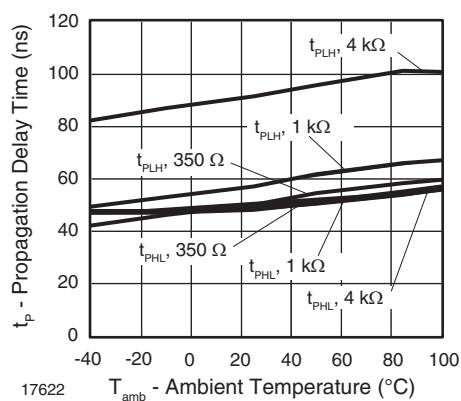


Fig. 17 - Propagation Delay vs. Ambient Temperature

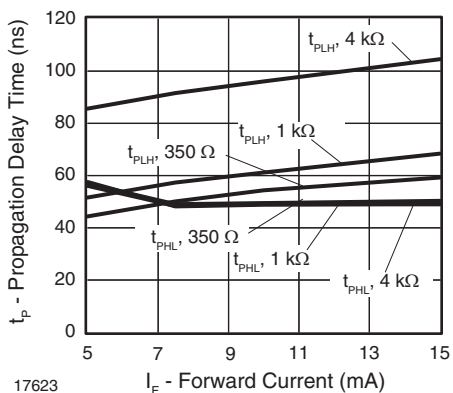


Fig. 18 - Propagation Delay vs. Forward Current

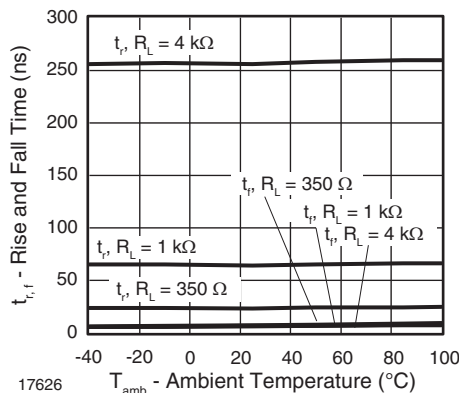


Fig. 21 - Rise and Fall Time vs. Ambient Temperature

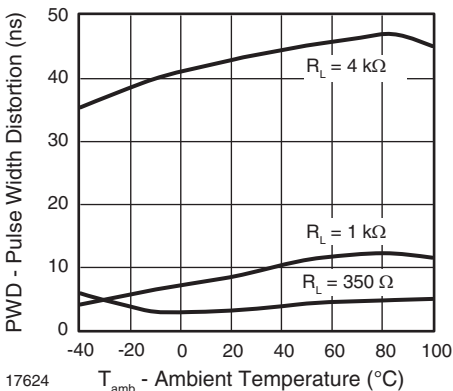


Fig. 19 - Pulse Width Distortion vs. Ambient Temperature

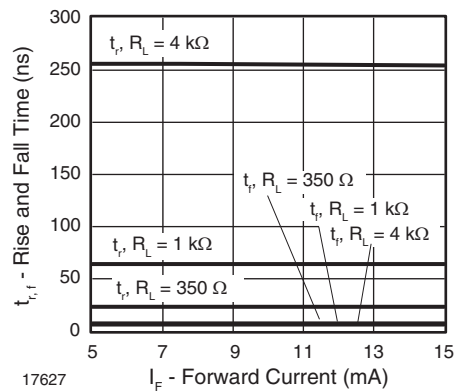


Fig. 22 - Rise and Fall Time vs. Forward Current

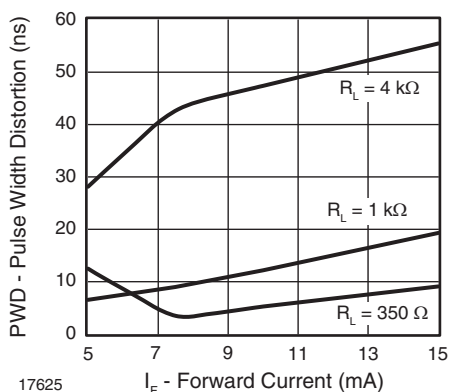


Fig. 20 - Pulse Width Distortion vs. Forward Current

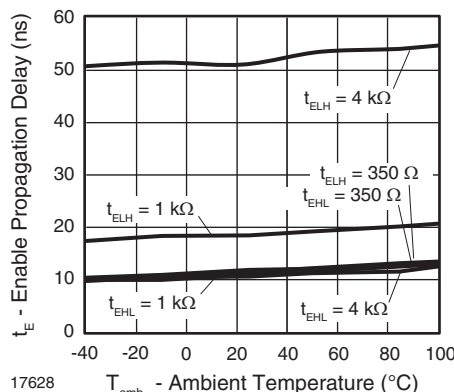


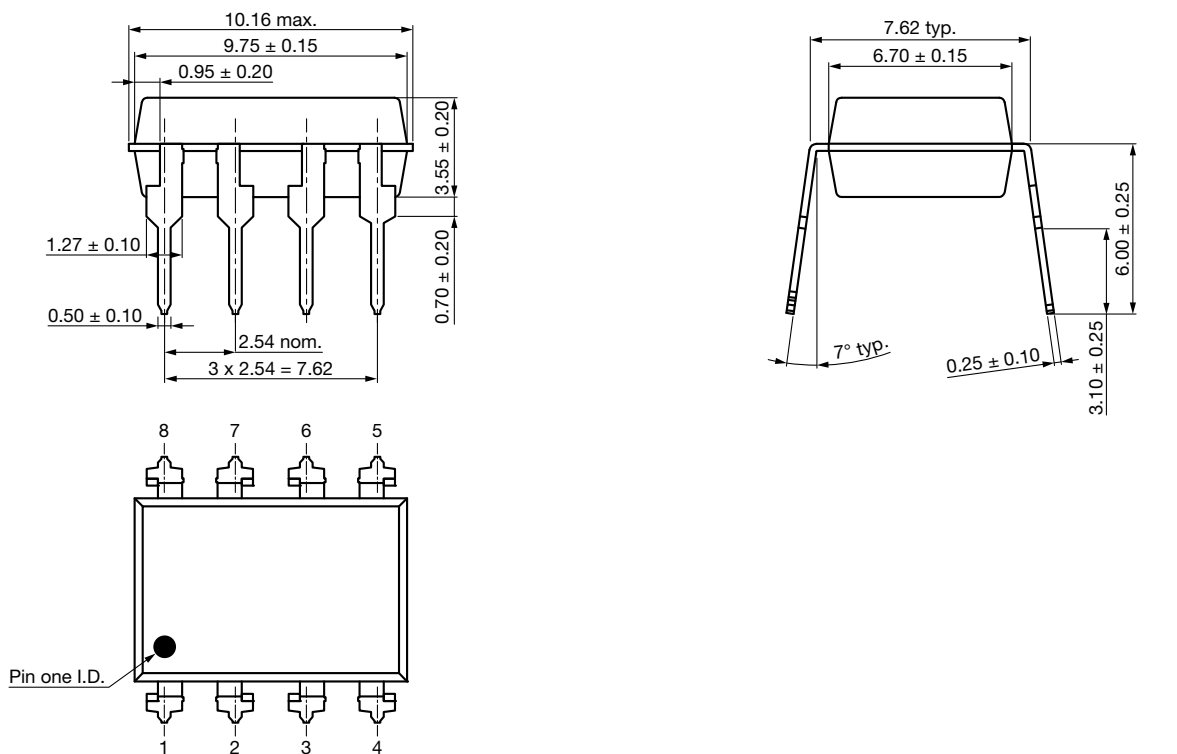
Fig. 23 - Enable Propagation Delay vs. Ambient Temperature



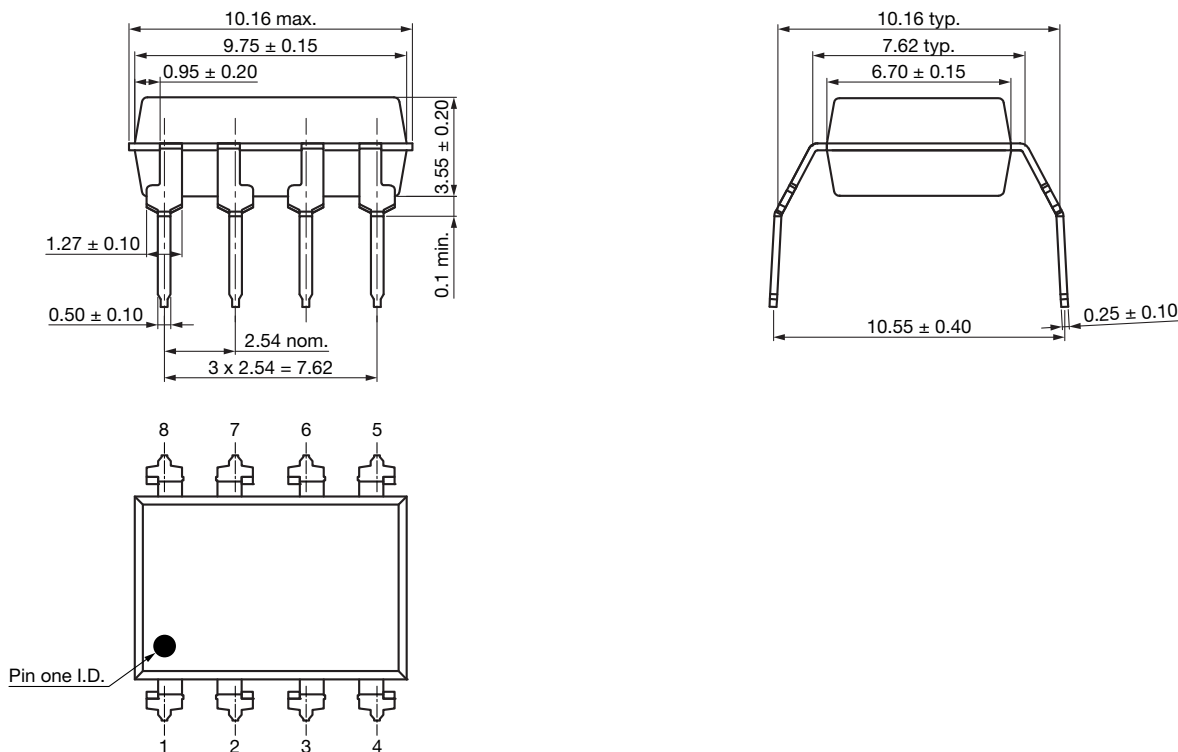


## PACKAGE DIMENSIONS in millimeters

### DIP-8, Standard

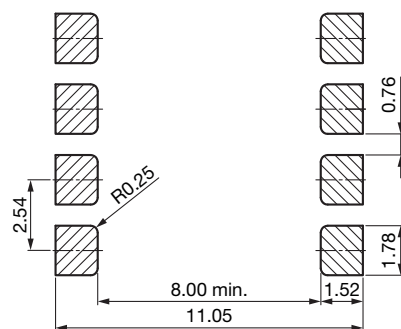
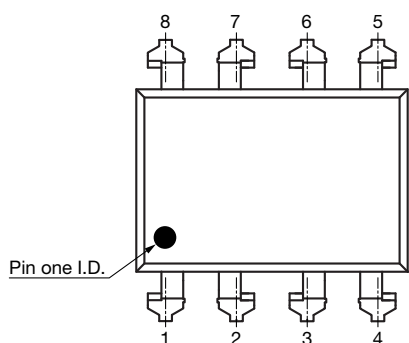
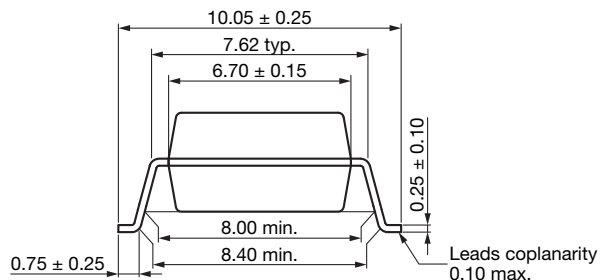
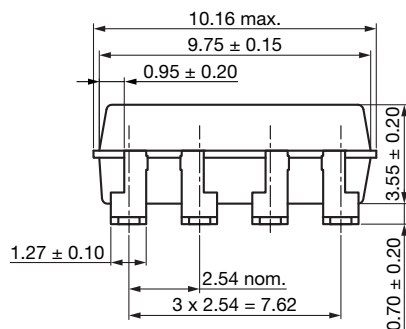


### DIP-8, Option 6

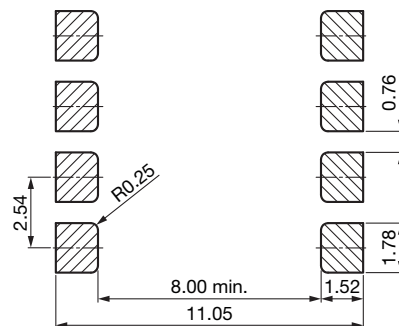
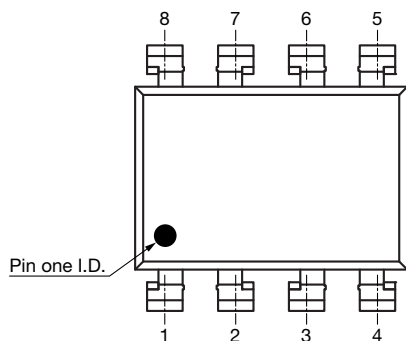
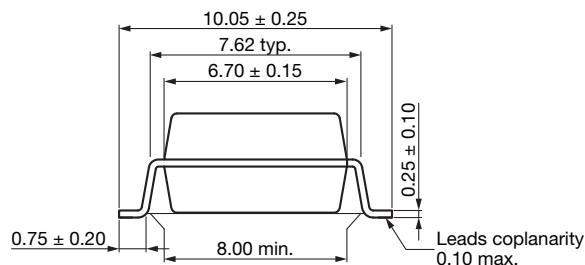
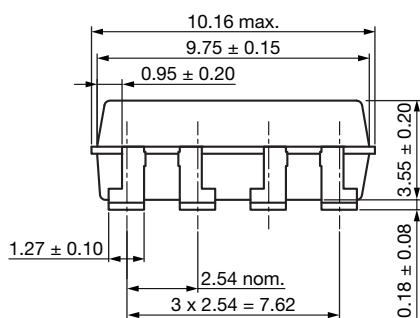




## SMD-8, Option 7

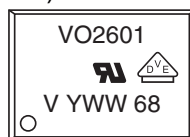


## SMD-8, Option 9





## PACKAGE MARKING (example of VO2601-X017T)



### Notes

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

## SOLDER PROFILES

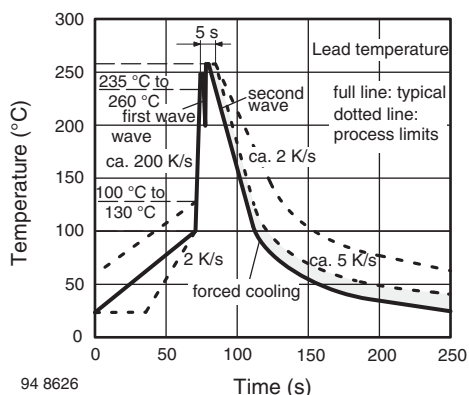


Fig. 24 - Wave Soldering Double Wave Profile According to J-STD-020 for DIP-8 Devices

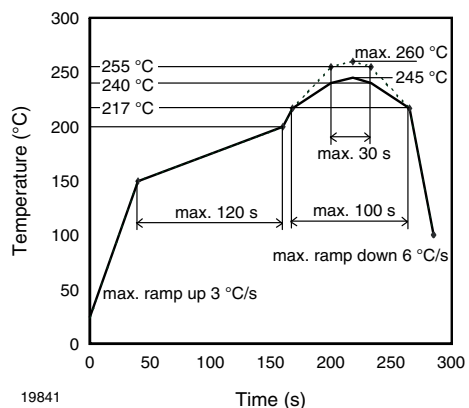


Fig. 25 - Lead (Pb)-free Reflow Solder Profile According to J-STD-020 for SMD-8 Devices

## HANDLING AND STORAGE CONDITIONS

ESD level: HBM class 2

Floor life: unlimited

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

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



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