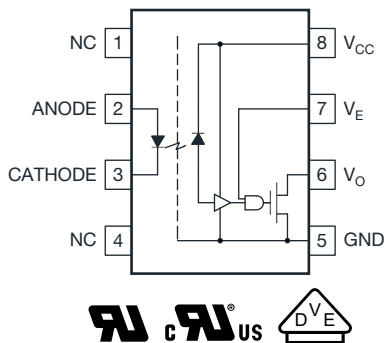
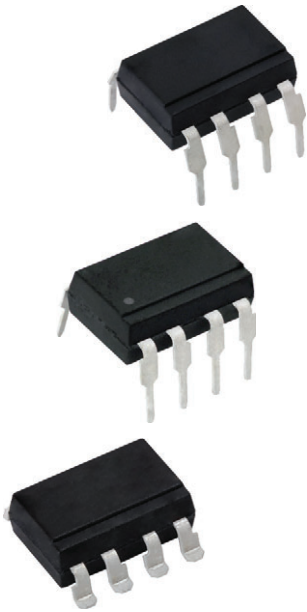


## High Speed Optocoupler, 10 MBd



### DESCRIPTION

The 6N137, VO2601, VO2611 are single channel 10 MBd optocoupler utilizing a high efficient input LED coupled to a high speed integrated photo-detector logic gate with a strobable output. This detector features an open drain output.

### FEATURES

- Common mode rejection (CMR) of 15 kV/ $\mu$ s
- LVTTL/LVCMOS compatibility
- Low power consumption
- 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
- Ground loop elimination
- Digital bus systems isolation
- High speed A/D and D/A conversion
- Digital control power supply
- Level shifting

### AGENCY APPROVALS

- [UL1577](#)
- [cUL](#)
- [DIN EN 60747-5-5 \(VDE 0884-5\), available with option 1](#)

### LINKS TO ADDITIONAL RESOURCES





ORDERING INFORMATION			
<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 2px 5px;">V</div> <div style="border: 1px solid black; padding: 2px 5px;">O</div> <div style="border: 1px solid black; padding: 2px 5px;">2</div> <div style="border: 1px solid black; padding: 2px 5px;">6</div> <div style="border: 1px solid black; padding: 2px 5px;">0</div> <div style="border: 1px solid black; padding: 2px 5px;">1</div> <div style="border: 1px solid black; padding: 2px 5px;">-</div> <div style="border: 1px solid black; padding: 2px 5px;">X</div> <div style="border: 1px solid black; padding: 2px 5px;">0</div> <div style="border: 1px solid black; padding: 2px 5px;">#</div> <div style="border: 1px solid black; padding: 2px 5px;">#</div> <div style="border: 1px solid black; padding: 2px 5px;">T</div> </div>	PART NUMBER	PACKAGE OPTION	TAPE AND REEL
AGENCY CERTIFIED / PACKAGE	CMR (V/μs)		
UL, cUL	1000	5000	15 000
DIP-8	6N137	VO2601	VO2611
DIP-8, 400 mil (option 6)	6N137-X006	VO2601-X006	VO2611-X006
SMD-8 (option 7)	6N137-X007T	VO2601-X007T	VO2611-X007T
UL, cUL, VDE (option 1)	1000	5000	15 000
DIP-8, 400 mil (option 6)	-	-	VO2611-X016
SMD-8 (option 7)	-	VO2601-X017T	VO2611-X017T

**Note**

- Additional options may be possible, please contact sales office

ABSOLUTE MAXIMUM RATINGS (T <sub>amb</sub> = 25 °C, unless otherwise specified)				
PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
<b>INPUT</b>				
Input forward current		I <sub>F</sub>	20	mA
Reverse input voltage		V <sub>R</sub>	5	V
Enable input voltage		V <sub>E</sub>	V <sub>CC</sub> + 0.5 V	V
Enable input current		I <sub>E</sub>	5	mA
Input power dissipation		P <sub>diss</sub>	40	mW
<b>OUTPUT</b>				
Supply voltage		V <sub>CC</sub>	7	V
Output current		I <sub>O</sub>	50	mA
Output voltage		V <sub>O</sub>	7	V
Output power dissipation		P <sub>diss</sub>	85	mW
<b>COUPLER</b>				
Storage temperature		T <sub>stg</sub>	-55 to +125	°C
Operating temperature		T <sub>amb</sub>	-40 to +100	°C
Solder reflow temperature <sup>(1)</sup>	5 s		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.
- <sup>(1)</sup> Refer to reflow profile for soldering conditions for surface mounted devices (SMD). Refer to wave profile for soldering conditions for through hole devices (DIP).

**RECOMMENDED OPERATING CONDITIONS**

PARAMETER	SYMBOL	MIN.	MAX.	UNIT
Operating temperature	$T_{amb}$	-40	+100	°C
Supply voltage	$V_{CC}$	4.5	5.5	V
Input current low level	$I_{FL}$	0	250	$\mu$ A
Input current high level	$I_{FH}$	5	15	mA
Logic low enable voltage	$V_{EL}$	0	0.8	V
Logic high enable voltage	$V_{EH}$	2	$V_{CC}$	V
Output pull up resistor	$R_L$	330	4000	$\Omega$
Fanout ( $R_L = 1\text{ k}\Omega$ )	N	-	5	TTL loads

**TRUTH TABLE** (positive logic)

LED	ENABLE	OUTPUT
On	H	L
Off	H	H
On	L	H
Off	L	H
On	Not connected / open	L
Off	Not connected / open	H

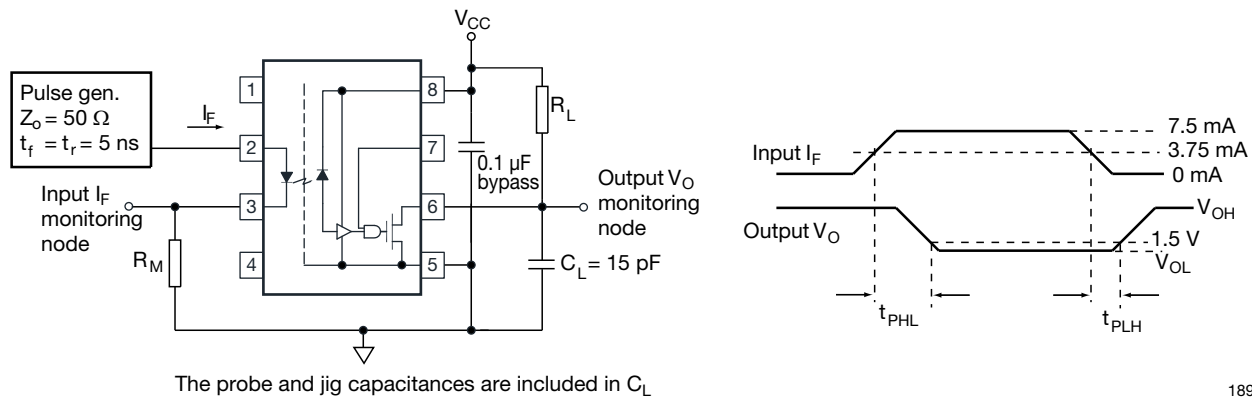
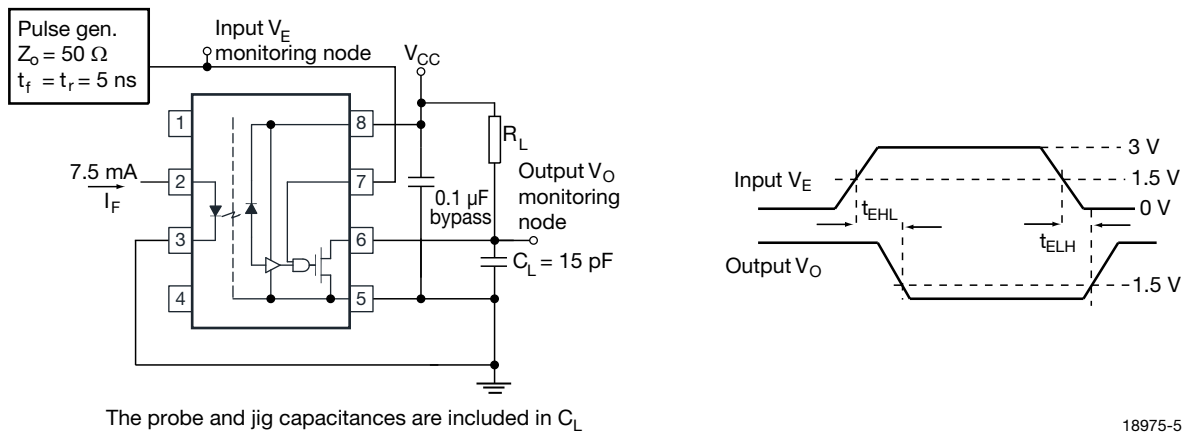
**ELECTRICAL CHARACTERISTICS** ( $T_{amb} = -40\text{ °C}$  to  $+100\text{ °C}$ ,  $4.5\text{ V} \leq V_{CC} \leq 5.5\text{ V}$ ,  $I_F = 7.5\text{ mA}$ , unless otherwise specified; typical values are at  $V_{CC} = 5.0\text{ V}$ ,  $T_{amb} = 25\text{ °C}$ )

PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
<b>INPUT</b>						
Input forward voltage	$I_F = 10\text{ mA}$	$V_F$	-	1.38	1.70	V
Input forward voltage temperature coefficient	$I_F = 10\text{ mA}$	$\Delta V_F / \Delta T$	-	-1.5	-	mV/K
Input reverse voltage	$I_R = 10\text{ }\mu\text{A}$	$BV_R$	5	-	-	V
Input threshold current	$V_E = 2\text{ V}$ , $V_O = 0.6\text{ V}$ , $V_{CC} = 5.5\text{ V}$ , $I_{OL}(\text{sinking}) = 13\text{ mA}$	$I_{TH}$	-	2	5	mA
Input capacitance	$f = 1\text{ MHz}$ , $V_F = 0\text{ V}$	$C_I$	-	34	-	pF
<b>OUTPUT</b>						
Low level supply current	$I_F = 10\text{ mA}$ , $V_{CC} = 5.5\text{ V}$ , $V_E = 0.5\text{ V}$	$I_{CCL}$	-	3.5	5	mA
High level supply current	$I_F = 0\text{ mA}$ , $V_{CC} = 5.5\text{ V}$ , $V_E = 0.5\text{ V}$	$I_{CCH}$	-	3.7	5	mA
Low level enable current	$V_{CC} = 5.5\text{ V}$ , $V_E = 0.5\text{ V}$	$I_{EL}$	-	-0.9	-1.6	mA
High level enable current	$V_{CC} = 5.5\text{ V}$ , $V_E = 2\text{ V}$	$I_{EH}$	-	-0.19	-1.6	mA
Low level enable voltage		$V_{EL}$	-	-	0.8	V
High level enable voltage		$V_{EH}$	2	-	-	V
Low level output voltage	$V_{CC} = 5.5\text{ V}$ , $V_E = 2\text{ V}$ , $I_F = 5\text{ mA}$ , $I_{OL}(\text{sinking}) = 13\text{ mA}$	$V_{OL}$	-	0.20	0.60	V
High level output current	$V_{CC} = 5.5\text{ V}$ , $V_E = 2\text{ V}$ , $V_O = 5.5\text{ V}$ , $I_F = 250\text{ }\mu\text{A}$	$I_{OH}$	-	1	10	$\mu$ A
<b>COUPLER</b>						
Input to output capacitance	$f = 1\text{ MHz}$ , $T_{amb} = 25\text{ °C}$	$C_{IO}$	-	4	-	pF

**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> ( $T_{amb} = -40\text{ }^{\circ}\text{C}$ to $+100\text{ }^{\circ}\text{C}$ , $4.5\text{ V} \leq V_{CC} \leq 5.5\text{ V}$ , $I_F = 7.5\text{ mA}$ , unless otherwise specified; typical values are at $V_{CC} = 5.0\text{ V}$ , $T_{amb} = 25\text{ }^{\circ}\text{C}$ )						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Propagation delay time to high output level	$R_L = 350\ \Omega$ , $C_L = 15\text{ pF}$ , $T_{amb} = 25\text{ }^{\circ}\text{C}$	$t_{PLH}$	25	50	90	ns
	$R_L = 350\ \Omega$ , $C_L = 15\text{ pF}$	$t_{PLH}$	-	-	100	ns
Propagation delay time to low output level	$R_L = 350\ \Omega$ , $C_L = 15\text{ pF}$ , $T_{amb} = 25\text{ }^{\circ}\text{C}$	$t_{PHL}$	25	40	90	ns
	$R_L = 350\ \Omega$ , $C_L = 15\text{ pF}$	$t_{PHL}$	-	-	100	ns
Pulse width distortion	$R_L = 350\ \Omega$ , $C_L = 15\text{ pF}$	$ t_{PLH} - t_{PHL} $	-	10	-	ns
Propagation delay skew	$R_L = 350\ \Omega$ , $C_L = 15\text{ pF}$	$t_{PSK}$	-	-	40	ns
Output rise time (10 % to 90 %)	$R_L = 350\ \Omega$ , $C_L = 15\text{ pF}$	$t_r$	-	23	-	ns
Output fall time (90 % to 10 %)	$R_L = 350\ \Omega$ , $C_L = 15\text{ pF}$	$t_f$	-	10	-	ns
Propagation delay time of enable from $V_{EH}$ to $V_{EL}$	$R_L = 350\ \Omega$ , $C_L = 15\text{ pF}$ , $V_{EL} = 0\text{ V}$ , $V_{EH} = 3\text{ V}$	$t_{ELH}$	-	15	-	ns
Propagation delay time of enable from $V_{EL}$ to $V_{EH}$	$R_L = 350\ \Omega$ , $C_L = 15\text{ pF}$ , $V_{EL} = 0\text{ V}$ , $V_{EH} = 3\text{ V}$	$t_{EHL}$	-	15	-	ns


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

 Fig. 2 - Test Circuit for  $t_{EHL}$ , and  $t_{ELH}$

COMMON MODE TRANSIENT IMMUNITY ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)							
PARAMETER	TEST CONDITION	PART NAME	SYMBOL	MIN.	TYP.	MAX.	UNIT
Logic high common mode transient immunity	$V_{CC} = 5\text{ V}$ , $ V_{CM}  = 1000\text{ V}$ , $I_F = 0\text{ mA}$ , $V_O > 2.0\text{ V}$ , $R_L = 350\text{ }\Omega$	6N137	$ CM_H $	1000	-	-	V/ $\mu$ s
		VO2601		5000	-	-	
		VO2611		15 000	-	-	
Logic low common mode transient immunity	$V_{CC} = 5\text{ V}$ , $ V_{CM}  = 1000\text{ V}$ , $I_F = 10\text{ mA}$ , $V_O < 0.8\text{ V}$ , $R_L = 350\text{ }\Omega$	6N137	$ CM_L $	1000	-	-	V/ $\mu$ s
		VO2601		5000	-	-	
		VO2611		15 000	-	-	

**Notes**

- No external pull up is required for a high logic state on the enable input. If the enable pin is not used, connect it to  $V_{CC}$ .

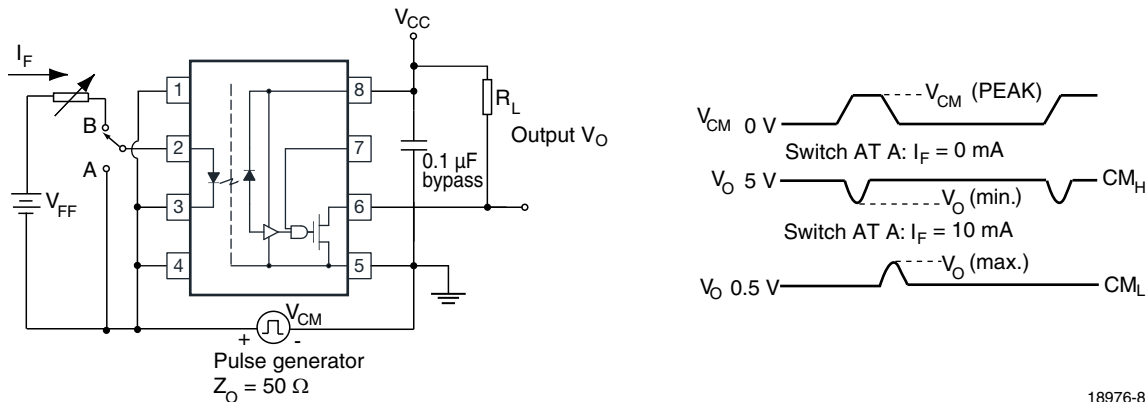


Fig. 3 - Test Circuit for Common Mode Transient Immunity

18976-8

SAFETY AND INSULATION RATINGS				
PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Climatic classification	According to IEC 68 part 1		55 / 110 / 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, $t = 1\text{ min}$	$V_{ISO}$	5000	$V_{RMS}$
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	$V_{IORM}$	630	$V_{peak}$
Isolation resistance	$T_{amb} = 25\text{ }^{\circ}\text{C}$ , $V_{IO} = 500\text{ V}$	$R_{IO}$	$\geq 10^{12}$	$\Omega$
Maximum output power dissipation		$P_{SO}$	600	mW
Maximum input current		$I_{SI}$	230	mA
Maximum ambient temperature (derated)		$T_S$	175	$^{\circ}\text{C}$
Creepage distance	DIP-8, SMD-8		$\geq 7$	mm
	DIP-8, 400 mil		$\geq 8$	mm
Clearance distance	DIP-8, SMD-8		$\geq 7$	mm
	DIP-8, 400 mil		$\geq 8$	mm
Insulation thickness		DTI	$\geq 0.4$	mm

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

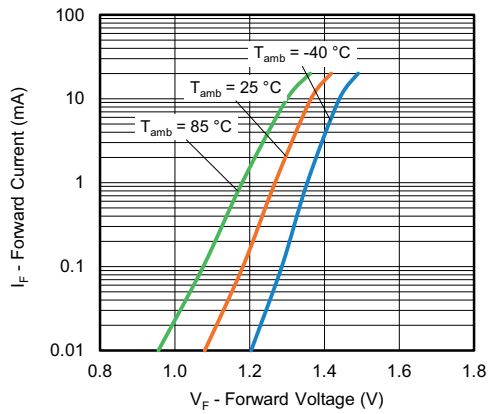


Fig. 4 - Diode Forward Current vs. Forward Voltage

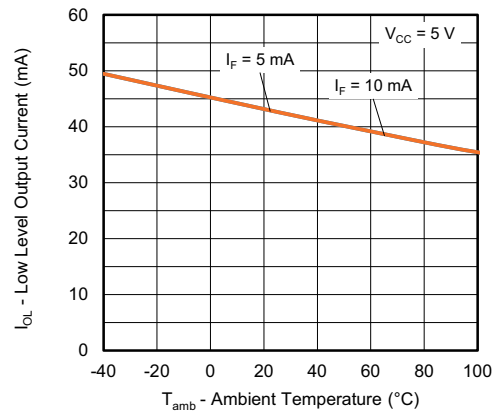


Fig. 7 - Low Level Output Current vs. Ambient Temperature

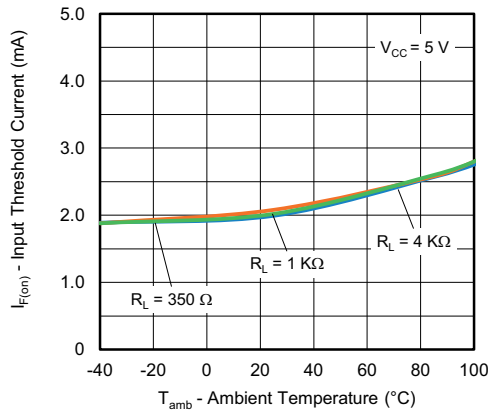


Fig. 5 - Input Threshold Current vs. Ambient Temperature

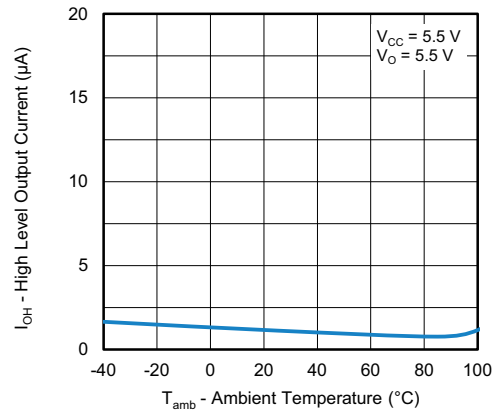


Fig. 8 - High Level Output Current vs. Ambient Temperature

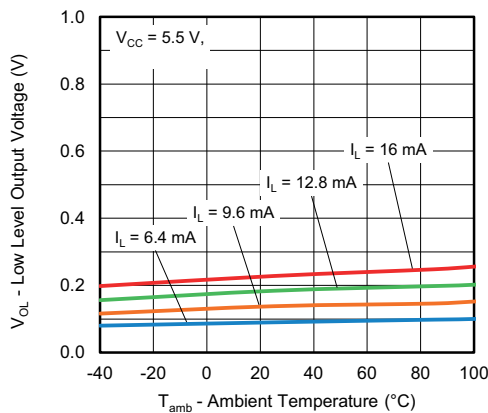


Fig. 6 - Low Level Output Voltage vs. Ambient Temperature

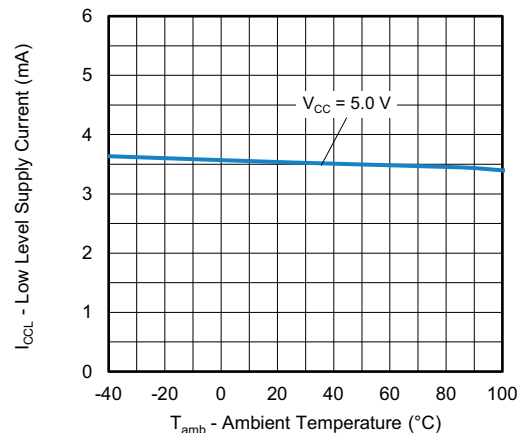


Fig. 9 - Low Level Supply Current vs. Ambient Temperature

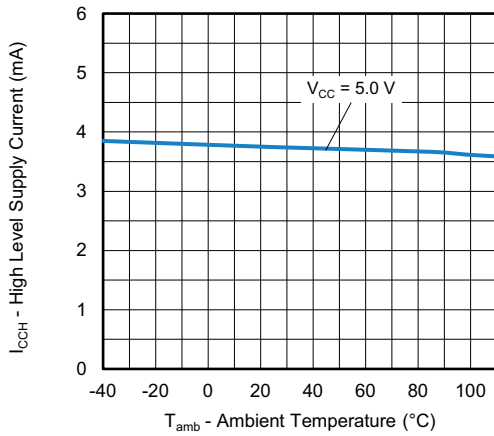


Fig. 10 - High Level Supply Current vs. Ambient Temperature

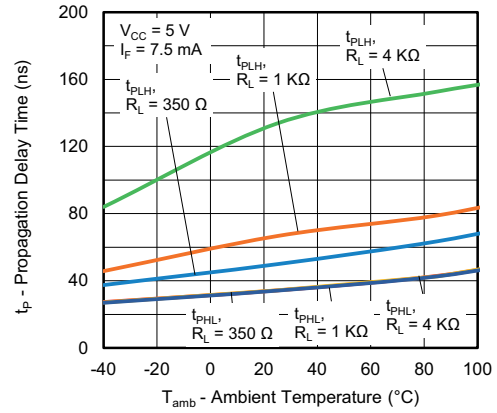


Fig. 12 - Propagation Delay Time vs. Ambient Temperature

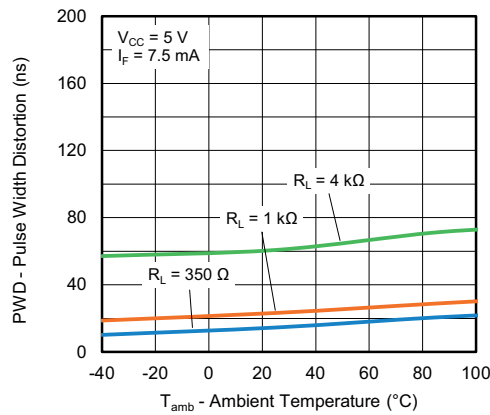


Fig. 11 - Pulse Width Distortion vs. Ambient Temperature

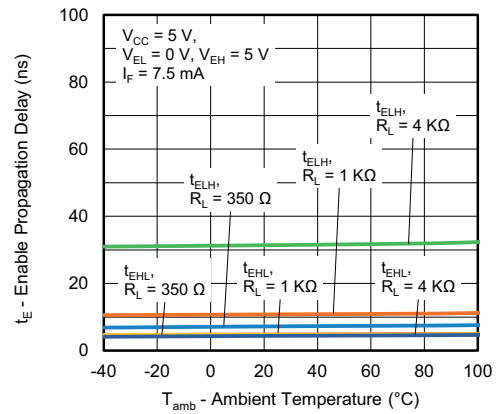


Fig. 13 - Enable Propagation Delay vs. Ambient Temperature



PACKAGE DIMENSIONS (in millimeters)

DIP-8

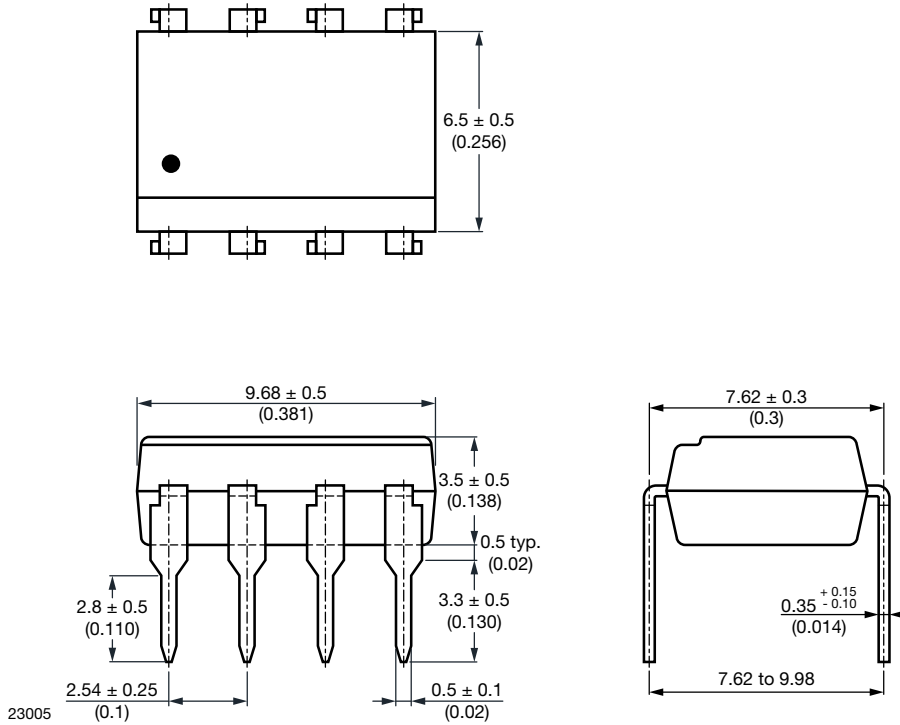


Fig. 14

DIP-8, 400 mil

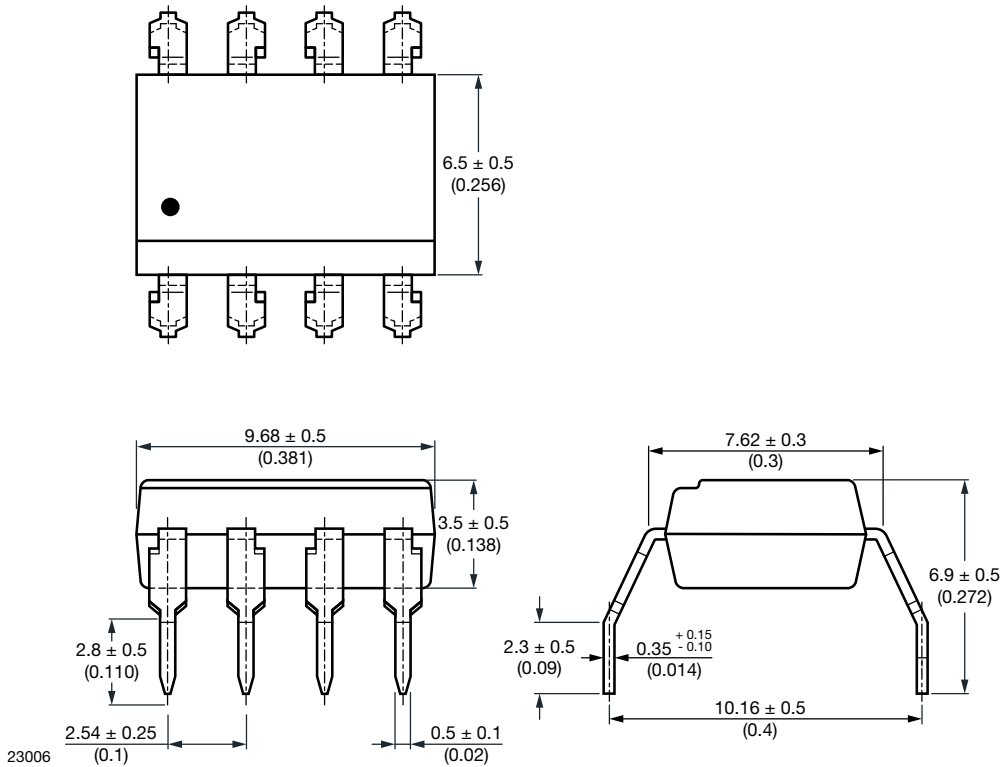


Fig. 15



SMD-8

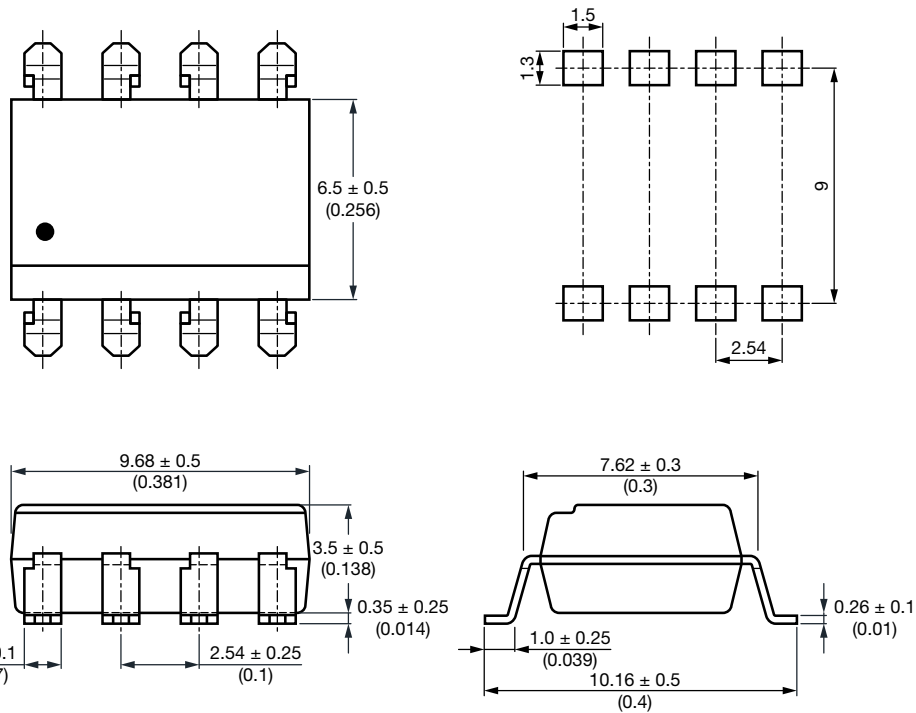


Fig. 16

**PACKAGE MARKING**

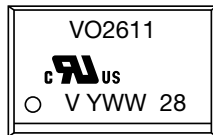


Fig. 17 - Example of VO2611

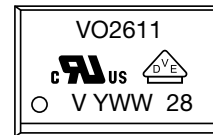


Fig. 18 - Example of VO2611-X017T

**Notes**

- “YWW” is the date code marking (Y = year code, WW = week code)
- VDE logo is only marked on VDE option parts
- Tape and reel suffix (T) is not part of the package marking



PACKAGING INFORMATION (in millimeters)

DEVICES PER TUBES			
TYPE	UNITS/TUBE	TUBES/BOX	UNITS/BOX
DIP-8	50	40	2000
DIP-8, 400 mil	50	40	2000

SMD-8 Tape

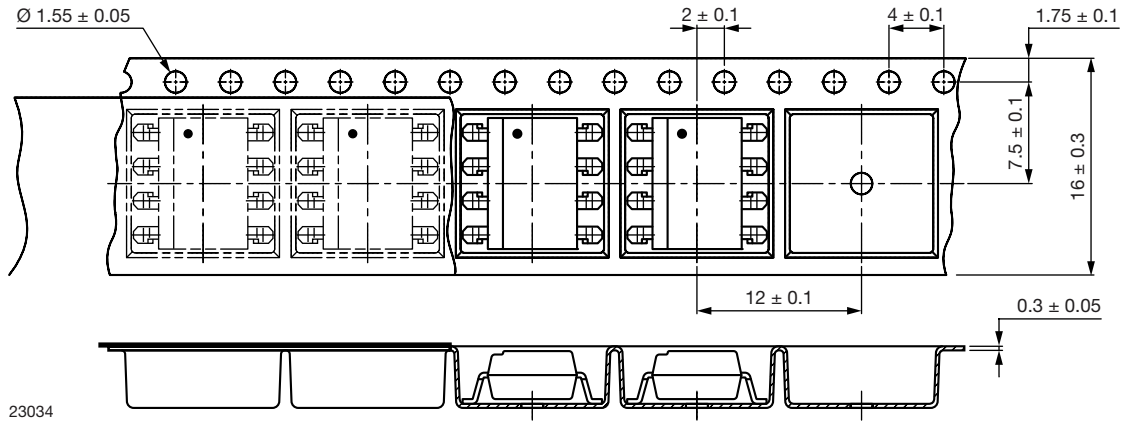


Fig. 19 - Tape and Reel Packaging (1000 pieces on reel)

Reel

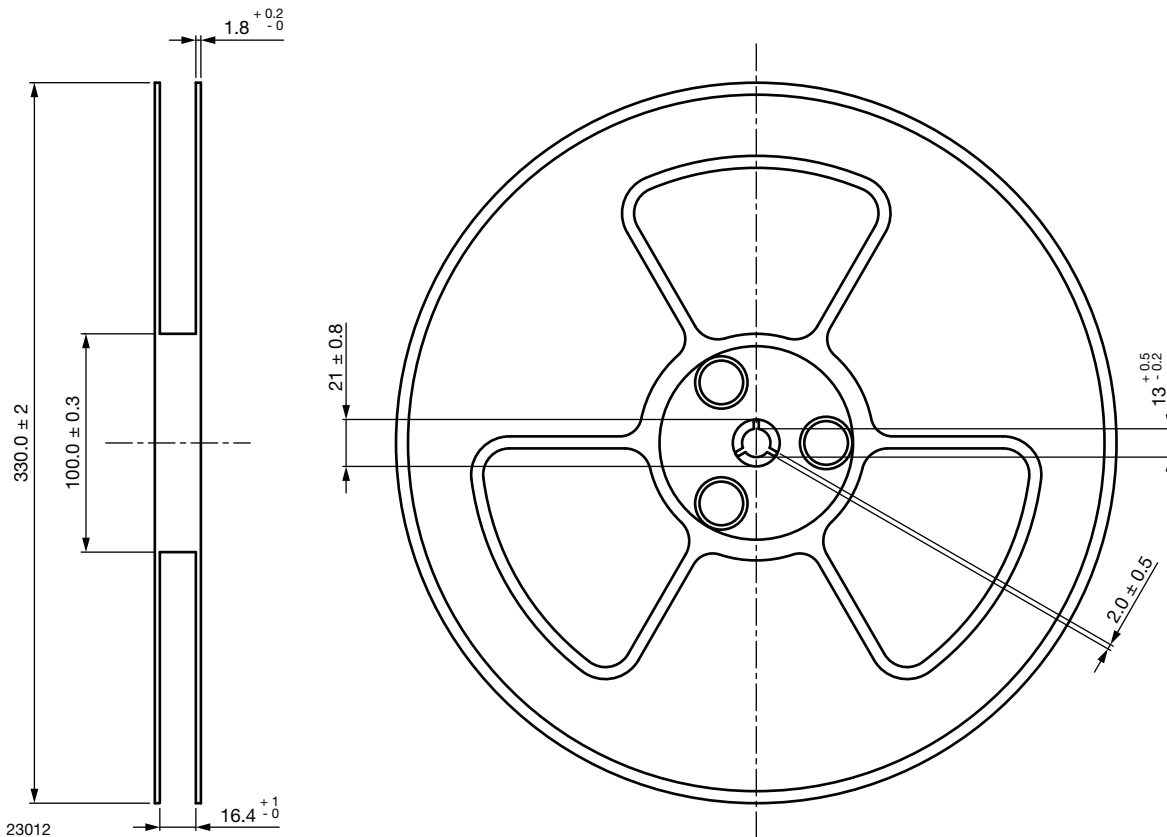


Fig. 20 - Tape and Reel Shipping Medium

**SOLDER PROFILES**
**IR Reflow Soldering (JEDEC® J-STD-020C compliant)**

One time soldering reflow is recommended within the condition of temperature and time profile shown below. Do not solder more than three times.

PROFILE ITEM	CONDITIONS
Preheat	
- Temperature minimum ( $T_{S \text{ min.}}$ )	150 °C
- Temperature maximum ( $T_{S \text{ max.}}$ )	200 °C
- Time (min. to max.) ( $t_s$ )	90 s ± 30 s
Soldering zone	
- Temperature ( $T_L$ )	217 °C
- Time ( $t_L$ )	60 s
Peak temperature ( $T_p$ )	260 °C
Ramp-up rate	3 °C/s max.
Ramp-down rate	3 °C/s to 6 °C/s

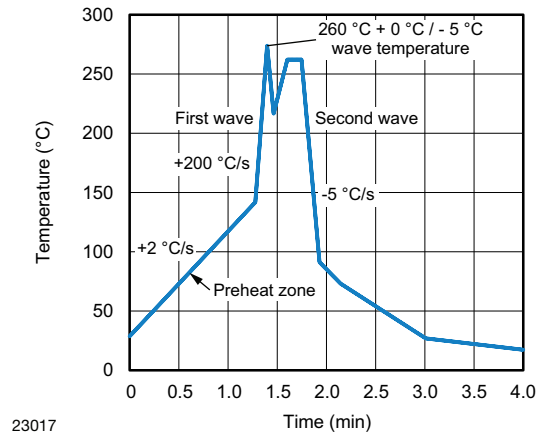


Fig. 22

**Hand Soldering by Soldering Iron**

Allow single lead soldering in every single process. One time soldering is recommended.

Temperature: 380 °C + 0 °C / - 5 °C

Time: 3 s max.

**HANDLING AND STORAGE CONDITIONS**

ESD level: HBM class 2

Floor life: unlimited

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

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

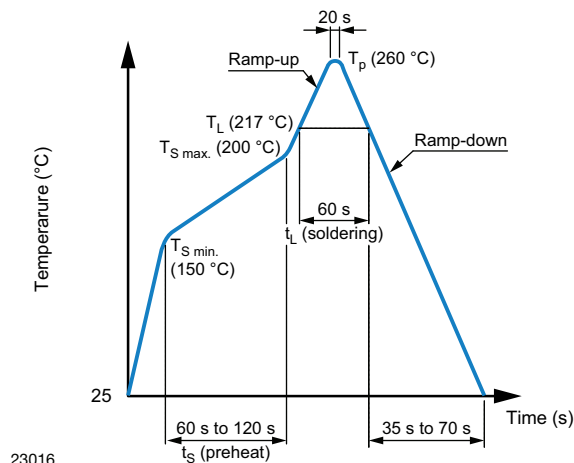


Fig. 21

**Wave Soldering (JEDEC JESD22-A111 compliant)**

One time soldering is recommended within the condition of temperature.

Temperature: 260 °C + 0 °C / - 5 °C

Time: 10 s

Preheat temperature: 25 °C to 140 °C

Preheat time: 30 s to 80 s



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