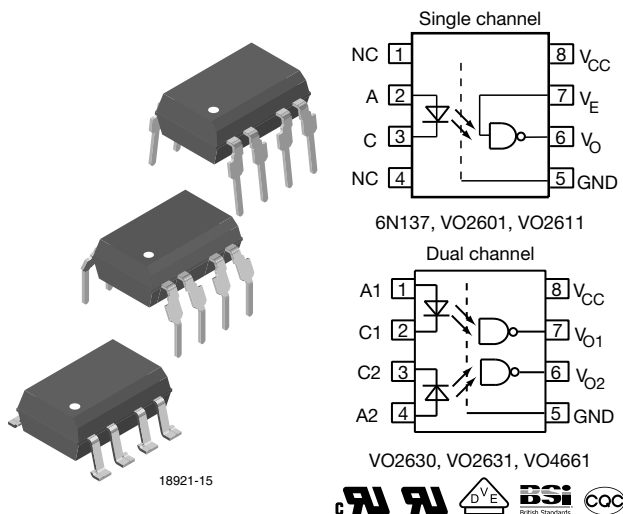




High Speed Optocoupler, Single and Dual, 10 MBd



DESCRIPTION

The 6N137, VO2601, and VO2611 are single channel 10 MBd optocouplers utilizing a high efficient input LED coupled with an integrated optical photodiode IC detector. The detector has an open drain NMOS-transistor output, providing less leakage compared to an open collector Schottky clamped transistor output. The VO2630, VO2631, and VO4661 are dual channel 10 MBd optocouplers. For the single channel type, an enable function on pin 7 allows the detector to be strobed. The internal shield provides a guaranteed common mode transient immunity of 5 kV/ μ s for the VO2601 and VO2631 and 15 kV/ μ s for the VO2611 and VO4661. The use of a 0.1 μ F bypass capacitor connected between pin 5 and 8 is recommended.

FEATURES

- Choice of CMR performance of 15 kV/ μ s, 5 kV/ μ s, and 100 V/ μ s
- 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 (SO₂) and IEC 60068-2-43 (H₂S) requirements
- Low input current capability: 5 mA
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912


RoHS
COMPLIANT

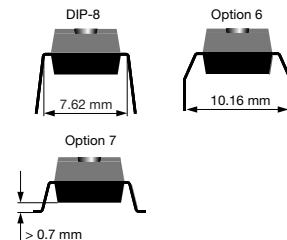
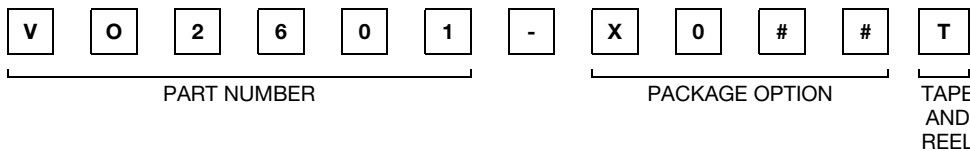
APPLICATIONS

- 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

AGENCY APPROVALS

- UL1577, file no. E52744 system code H, double protection
- cUL - file no. E52744, equivalent to CSA bulletin 5A
- DIN EN 60747-5-5 (VDE 0884-5) available with option 1
- BSI IEC 60950
- CQC GB8898-2001

ORDERING INFORMATION



AGENCY CERTIFIED/PACKAGE	CHANNELS 1			CHANNELS 2		
	CMR (V/ μ s)			CMR (V/ μ s)		
BSI, UL, cUL	1000	5000	15 000	1000	5000	15 000
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
VDE, BSI, UL, cUL	1000	5000	15 000	1000	5000	15 000
DIP-8, 400 mil, option 6	-	VO2601-X016	VO2611-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				
Isolation test voltage	$t = 1\text{ s}$	V_{ISO}	5300	V_{RMS}
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 ⁽¹⁾			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.

⁽¹⁾ 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	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	μA
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	Ω
Fanout	$R_L = 1\text{ k}\Omega$	N		5	-



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

PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
INPUT						
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	μA
Input capacitance	$f = 1\text{ MHz}$, $V_F = 0\text{ V}$	C_I		55		pF
OUTPUT						
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	$V_E = 2\text{ V}$, $V_O = 5.5\text{ V}$, $I_F = 250\text{ }\mu\text{A}$	I_{OH}		0.002	1	μA
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	$V_E = 2\text{ V}$, $V_O = 5.5\text{ V}$, $I_{OL}(\text{sinking}) = 13\text{ mA}$	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

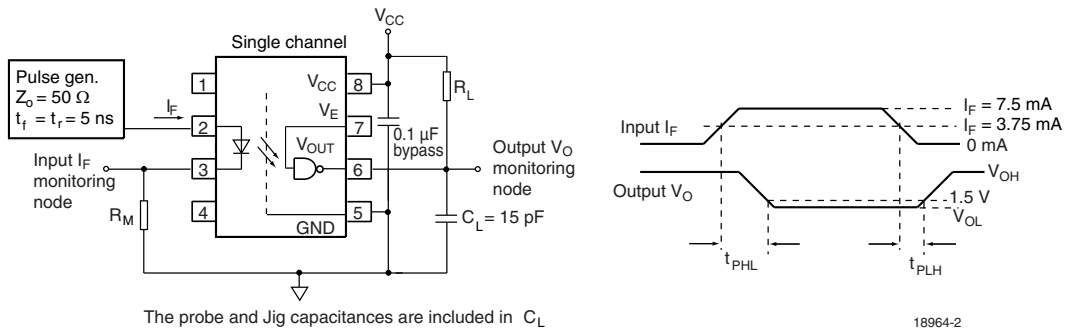
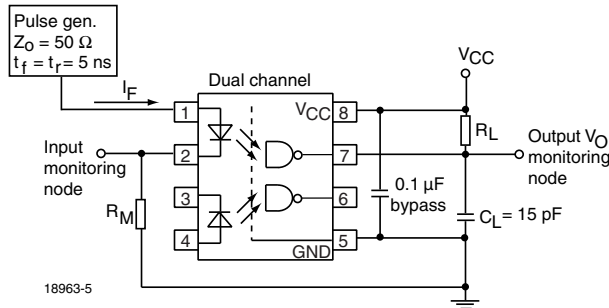
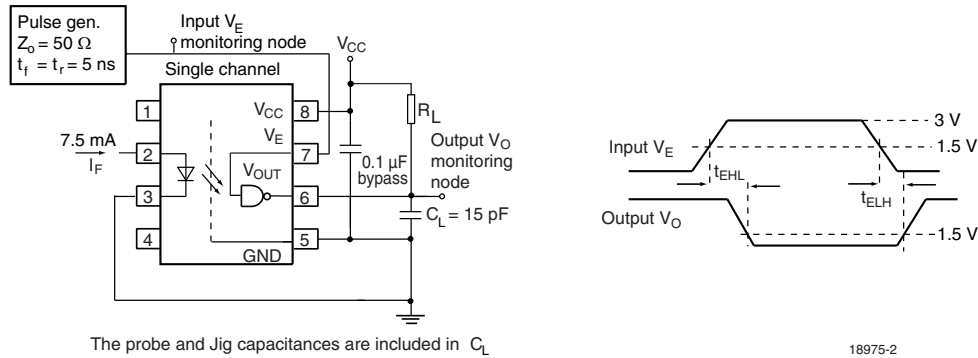
- Minimum and maximum values are testing requirements. Typical values are characteristics of the device and are the result of engineering evaluation. Typical values are for information only and are not part of the testing requirements.

SWITCHING CHARACTERISTICS

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 ⁽¹⁾	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 ⁽¹⁾	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 $T_{amb} = 25\text{ }^{\circ}\text{C}$, $V_{CC} = 5\text{ V}$.
- ⁽¹⁾ 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/μs
	$ 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/μs
	$ 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/μs
	$ 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/μs
	$ 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/μs
	$ 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/μs

Notes

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

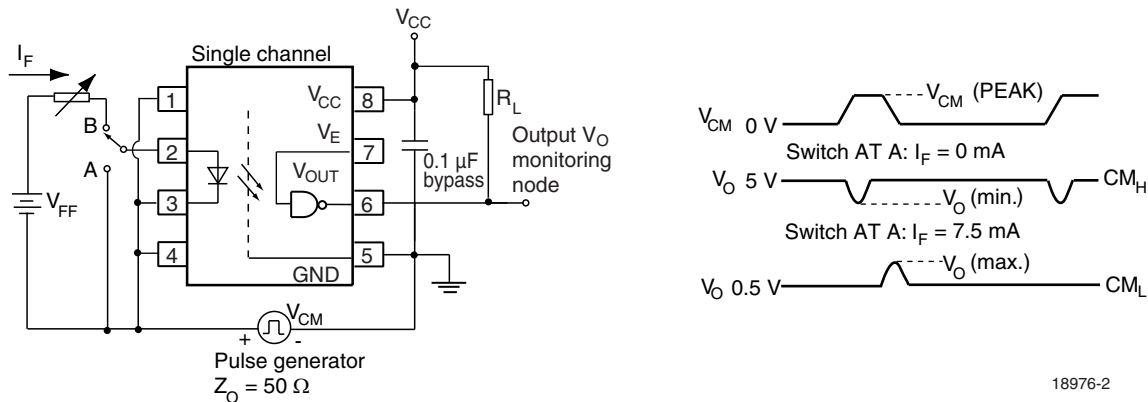


Fig. 4 - Single Channel Test Circuit for Common Mode Transient Immunity

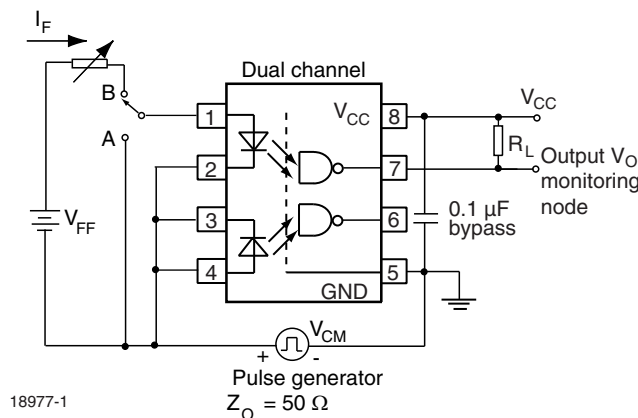


Fig. 5 - Dual Channel Test Circuit for Common Mode Transient Immunity

SAFETY AND INSULATION RATINGS

PARAMETER	TEST CONDITION	SYMBOL	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}	8000			V
Peak insulation voltage		V_{IORM}	890			V
Safety rating - power output		P_{SO}			500	mW
Safety rating - input current		I_{SI}			300	mA
Safety rating - temperature		T_{SI}			175	°C
Creepage distance	Standard DIP-8		7			mm
Clearance distance	Standard DIP-8		7			mm
Creepage distance	400 mil DIP-8		8			mm
Clearance distance	400 mil DIP-8		8			mm
Insulation thickness, reinforced rated	per BSI 60950		0.2			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 ($T_{amb} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified)

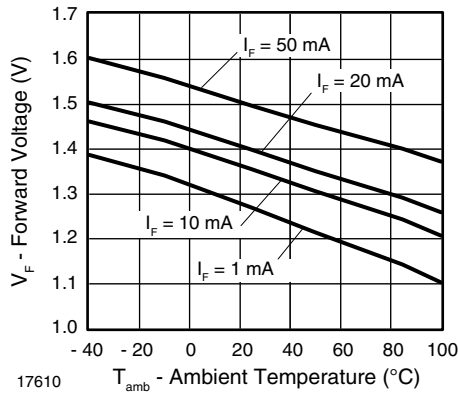


Fig. 6 - Forward Voltage vs. Ambient Temperature

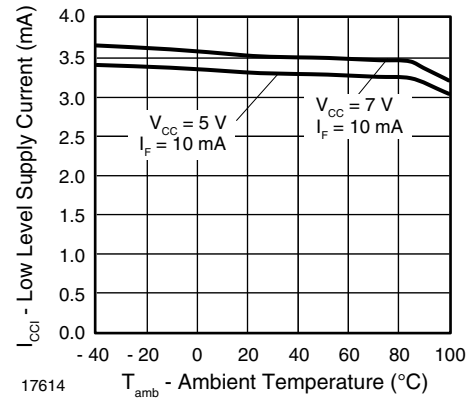


Fig. 9 - Low Level Supply Current vs. Ambient Temperature

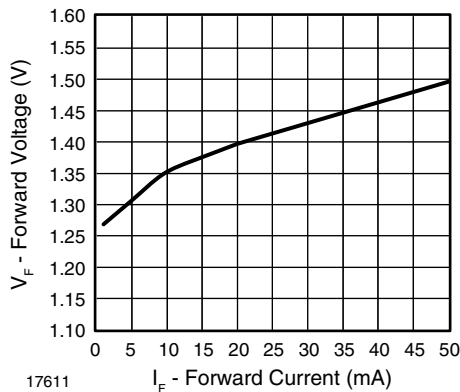


Fig. 7 - Forward Voltage vs. Forward Current

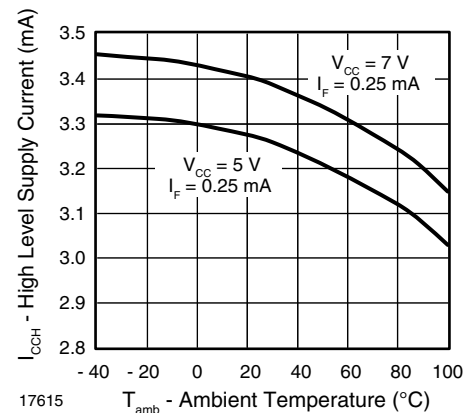


Fig. 10 - High Level Supply Current vs. Ambient Temperature

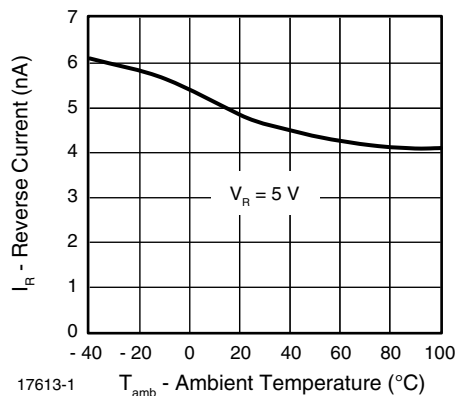


Fig. 8 - Reverse Current vs. Ambient Temperature

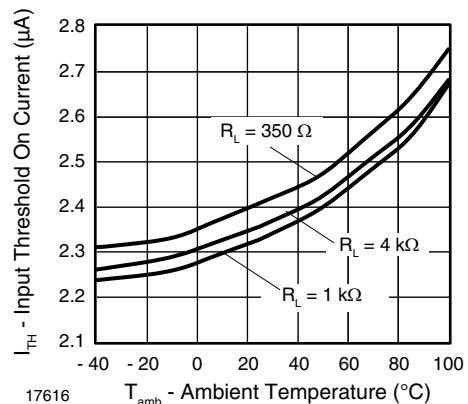


Fig. 11 - Input Threshold On Current vs. Ambient Temperature

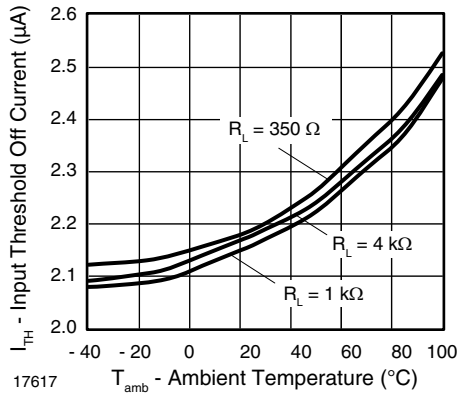


Fig. 12 - Input Threshold Off Current vs. Ambient Temperature

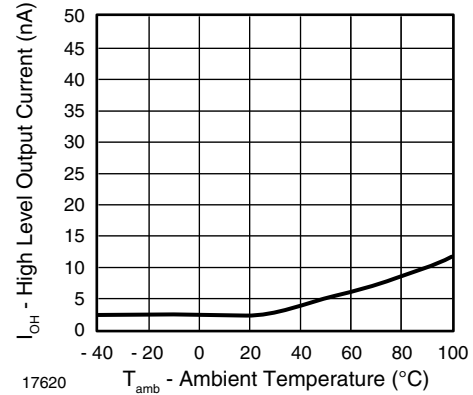


Fig. 15 - High Level Output Current vs. Ambient Temperature

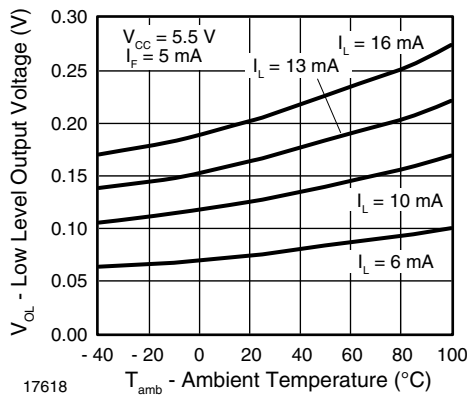


Fig. 13 - Low Level Output Voltage vs. Ambient Temperature

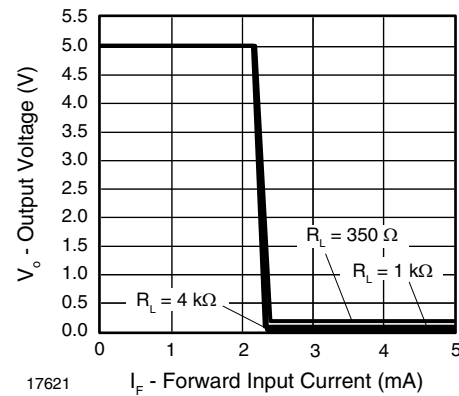


Fig. 16 - Output Voltage vs. Forward Input Current

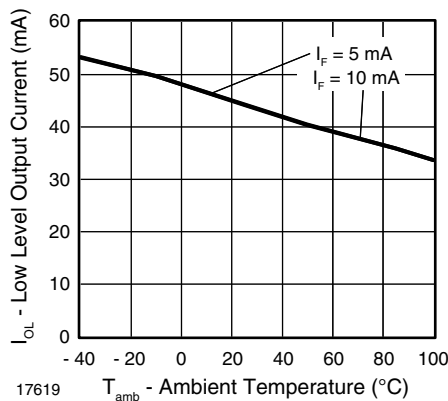


Fig. 14 - Low Level Output Current vs. Ambient Temperature

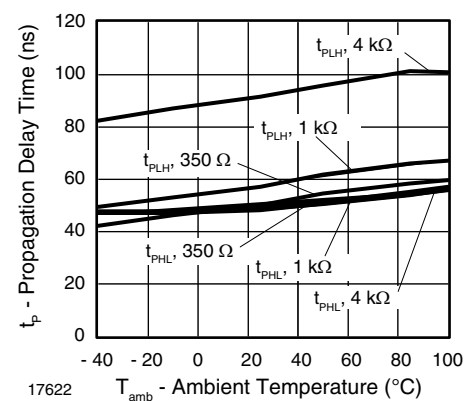


Fig. 17 - Propagation Delay vs. Ambient Temperature

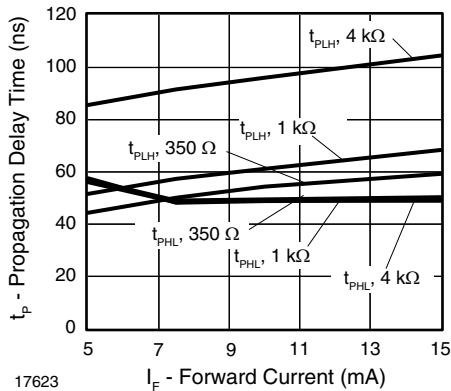


Fig. 18 - Propagation Delay vs. Forward Current

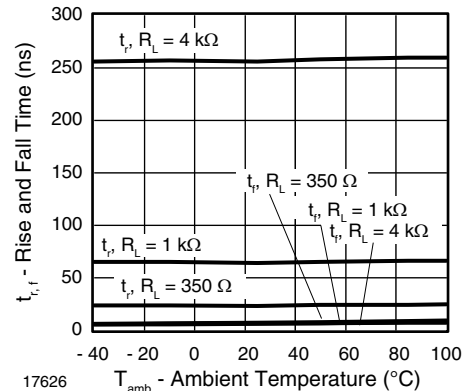


Fig. 21 - Rise and Fall Time vs. Ambient Temperature

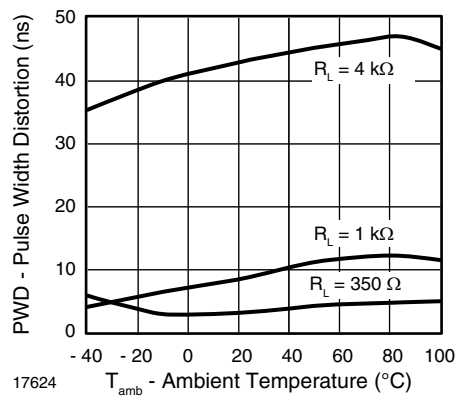


Fig. 19 - Pulse Width Distortion vs. Ambient Temperature

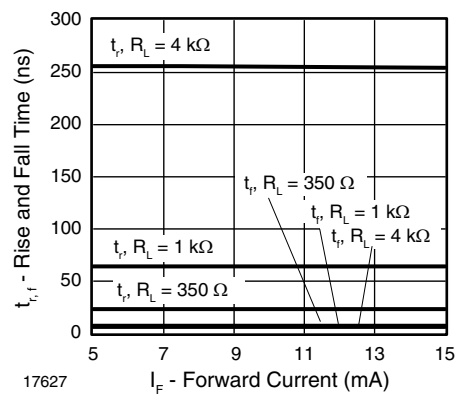


Fig. 22 - Rise and Fall Time vs. Forward Current

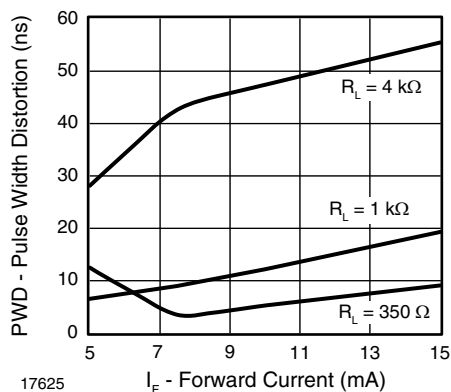


Fig. 20 - Pulse Width Distortion vs. Forward Current

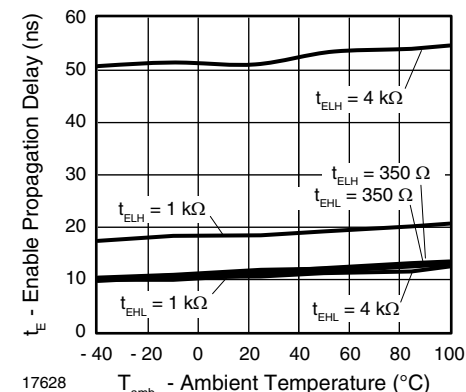
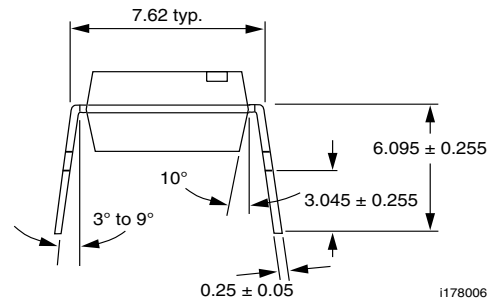
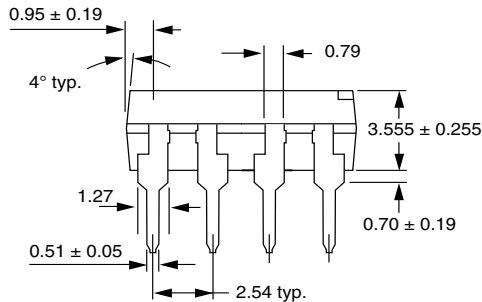
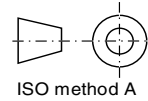
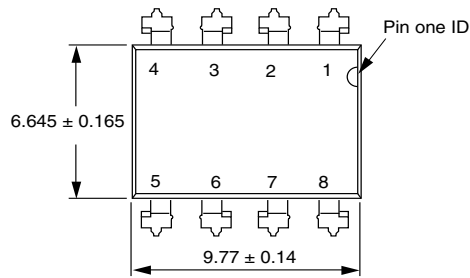


Fig. 23 - Enable Propagation Delay vs. Ambient Temperature

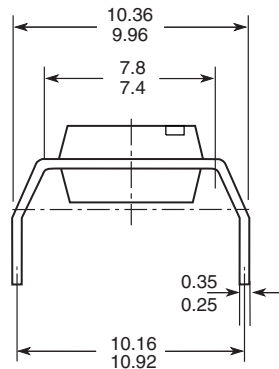


PACKAGE DIMENSIONS in millimeters

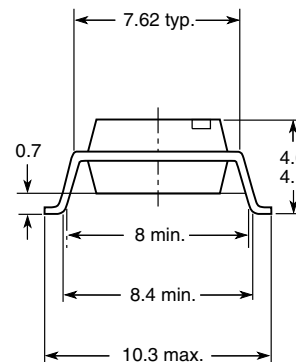


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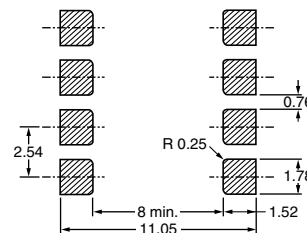
Option 6



Option 7



18450-13



PACKAGE MARKING (example of VO2601-X017T)



Notes

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



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