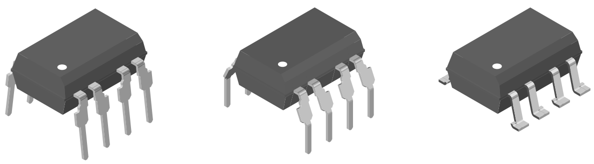
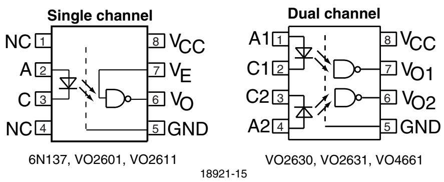
High Speed Optocoupler, 10 MBd





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/µs for the VO2601 and VO2631 and 15 kV/µs for the VO2611 and VO4661. The use of a 0.1 µF bypass capacitor connected between pin 5 and 8 is recommended.

AGENCY APPROVALS

- UL1577, file no. E52744 system code H or J, double protection
- CUL - file no. E52744, equivalent to CSA bulletin 5A
- DIN EN 60747-5-2 (VDE 0884) available with option 1
- BSI, IEC60950

FEATURES

- Choice of CMR performance of 15 kV/µs, 5 kV/µs, and 100 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_2) and IEC 60068-2-43 (H_2S) requirements
- Low input current capability: 5 mA
- Lead (Pb)-free component
- Component in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC

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

ORDER INFORMATION

PART	REMARKS
6N137	100 V/µs, single channel, DIP-8
6N137-X006	100 V/µs, single channel, DIP-8 400 mil
6N137-X007	100 V/µs, single channel, SMD-8
VO2601	5 kV/µs, single channel, DIP-8
VO2601-X006	5 kV/µs, single channel, DIP-8 400 mil
VO2601-X007	5 kV/µs, single channel, SMD-8
VO2611	15 kV/µs, single channel, DIP-8
VO2611-X006	15 kV/µs, single channel, DIP-8 400 mil
VO2611-X007	15 kV/µs, single channel, SMD-8
VO2630	100 V/µs, dual channel, DIP-8
VO2630-X006	100 V/µs, dual channel, DIP-8 400 mil
VO2630-X007	100 V/µs, dual channel, SMD-8
VO2631	5 kV/µs, dual channel, DIP-8
VO2631-X006	5 kV/µs, dual channel, DIP-8 400 mil

ORDER INFORMATION

PART	REMARKS
VO2631-X007	5 kV/µs, dual channel, SMD-8
VO4661	15 kV/µs, dual channel, DIP-8
VO4661-X006	15 kV/µs, dual channel, DIP-8 400 mil
VO4661-X007	15 kV/µs, dual channel, SMD-8

Note
For additional information on the available options refer to option information.

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 (1)

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 V	V
Enable input current		I_E	5	mA
Surge current	t = 100 µs	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 = 1.0 s	V_{ISO}	5300	V_{RMS}
Storage temperature		T_{stg}	- 55 to + 150	°C
Operating temperature		T_{amb}	- 40 to + 100	°C
Lead solder temperature	for 10 s		260	°C
Solder reflow temperature (2)			260	°C

Notes
(1) T_{amb} = 25 °C, unless otherwise specified.
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.
(2) 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	°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 kΩ	N		5	-

ELECTRICAL CHARACTERISTICS						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
INPUT						
Input forward voltage	I_F = 10 mA	V_F	1.1	1.4	1.7	V
Reverse current	V_R = 5 V	I_R		0.01	10	µA
Input capacitance	f = 1 MHz, V_F = 0 V	C_I		55		pF
OUTPUT						
High level supply current (single channel)	V_E = 0.5 V, I_F = 0 mA	I_{CCH}		4.1	7.0	mA
	V_E = V_{CC}, I_F = 0 mA	I_{CCH}		3.3	6.0	mA
High level supply current (dual channel)	I_F = 0 mA	I_{CCH}		6.5	12.0	mA
Low level supply current (single channel)	V_E = 0.5 V, I_F = 10 mA	I_{CCL}		4.0	7.0	mA
	V_E = V_{CC}, I_F = 10 mA	I_{CCL}		3.3	6.0	mA
Low level supply current (dual channel)	I_F = 10 mA	I_{CCL}		6.5	12.0	mA
High level output current	V_E = 2 V, V_O = 5.5 V, I_F = 250 µA	I_{OH}		0.002	1	µA
Low level output voltage	V_E = 2 V, I_F = 5 mA, I_{OL} (sinking) = 13 mA	V_{OL}		0.2	0.6	V
Input threshold current	V_E = 2 V, V_O = 5.5 V, I_{OL} (sinking) = 13 mA	I_{TH}		2.4	5.0	mA
High level enable current	V_E = 2 V	I_{EH}		- 0.6	- 1.6	mA
Low level enable current	V_E = 0.5 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

T_{amb} = 25 °C, unless otherwise specified.
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 (1)						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Propagation delay time to high output level	R_L = 350 Ω, C_L = 15 pF	t_{PLH}	20	48	75 (2)	ns
		t_{PLH}			100	ns
Propagation delay time to low output level	R_L = 350 Ω, C_L = 15 pF	t_{PHL}	25	50	75 (2)	ns
		t_{PHL}			100	ns
Pulse width disortion	R_L = 350 Ω, C_L = 15 pF	$\lvert t_{PHL} - t_{PLH} \rvert$		2.9	35	ns
Propagation delay skew	R_L = 350 Ω, C_L = 15 pF	t_{PSK}		8	40	ns
Output rise time (10 to 90 %)	R_L = 350 Ω, C_L = 15 pF	t_r		23		ns
Output fall time (90 to 10 %)	R_L = 350 Ω, C_L = 15 pF	t_f		7		ns
Propagation delay time of enable from V_{EH} to V_{EL}	R_L = 350 Ω, C_L = 15 pF, V_{EL} = 0 V, V_{EH} = 3 V	t_{ELH}		12		ns
Propagation delay time of enable from V_{EL} to V_{EH}	R_L = 350 Ω, C_L = 15 pF, V_{EL} = 0 V, V_{EH} = 3 V	t_{EHL}		11		ns

Notes

(1) Over recommended temperature (T_{amb} = - 40 °C to + 100 °C), V_{CC} = 5 V, I_F = 7.5 mA unless otherwise specified. All Typicals at T_{amb} = 25 °C, V_{CC} = 5 V.

(2) 75 ns applies to the 6N137 only, a JEDEC registered specification

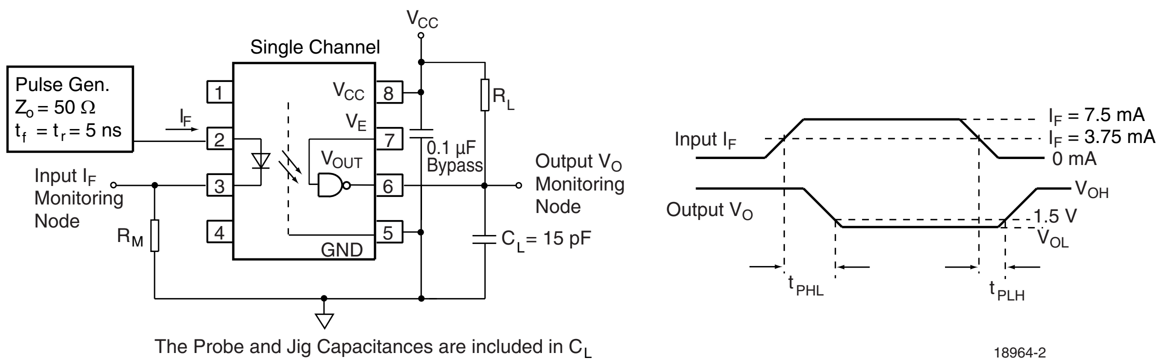


Fig. 1 - Single Channel Test Circuit for t_{PLH}, t_{PHL}, t_r and t_f

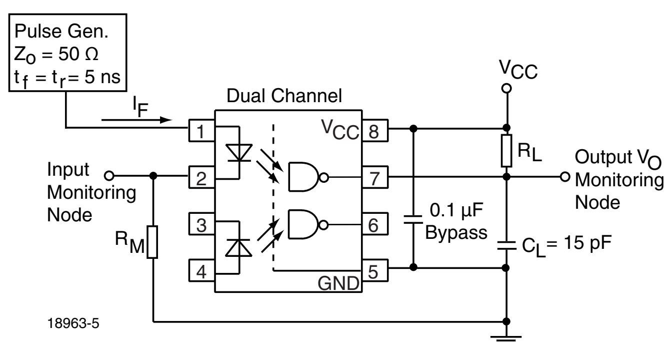


Fig. 2 - Dual Channel Test Circuit for t_{PLH}, t_{PHL}, t_r and t_f

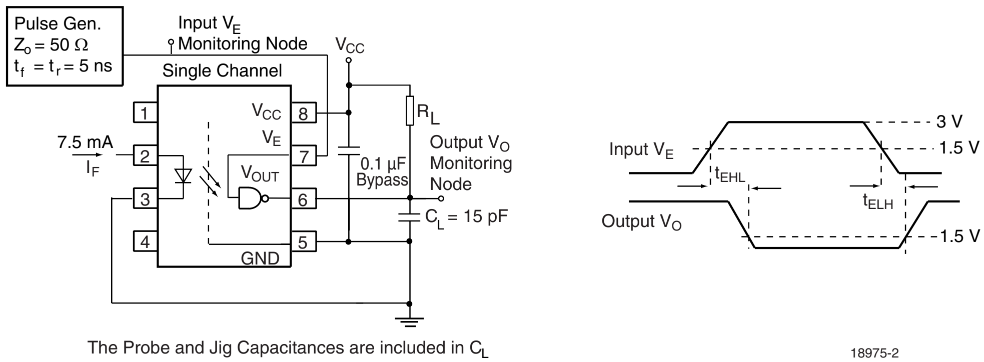


Fig. 3 - Single Channel Test Circuit for t_{EHL}, and t_{ELH}

COMMON MODE TRANSIENT IMMUNITY						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Common mode transient immunity (high)	$\lvert V_{CM}\rvert$ = 10 V, V_{CC} = 5 V, I_F = 0 mA, $V_{O(min)}$ = 2 V, R_L = 350 Ω, T_{amb} = 25 °C (1)	$\lvert CM_H\rvert$	100			V/µs
	$\lvert V_{CM}\rvert$ = 50 V, V_{CC} = 5 V, I_F = 0 mA, $V_{O(min)}$ = 2 V, R_L = 350 Ω, T_{amb} = 25 °C (2)	$\lvert CM_H\rvert$	5000	10000		V/µs
	$\lvert V_{CM}\rvert$ = 1 kV, V_{CC} = 5 V, I_F = 0 mA, $V_{O(min)}$ = 2 V, R_L = 350 Ω, T_{amb} = 25 °C (3)	$\lvert CM_H\rvert$	15000	25000		V/µs
	$\lvert V_{CM}\rvert$ = 10 V, V_{CC} = 5 V, I_F = 7.5 mA, $V_{O(max)}$ = 0.8 V, R_L = 350 Ω, T_{amb} = 25 °C (1)	$\lvert CM_L\rvert$	100			V/µs
	$\lvert V_{CM}\rvert$ = 50 V, V_{CC} = 5 V, I_F = 7.5 mA, $V_{O(max)}$ = 0.8 V, R_L = 350 Ω, T_{amb} = 25 °C (2)	$\lvert CM_L\rvert$	5000	10000		V/µs
	$\lvert V_{CM}\rvert$ = 1 kV, V_{CC} = 5 V, I_F = 7.5 mA, $V_{O(max)}$ = 0.8 V, R_L = 350 Ω, T_{amb} = 25 °C (3)	$\lvert CM_L\rvert$	15000	25000		V/µs

Notes

(1) For 6N137 and VO2630

(2) For VO2601 and VO2631

(3) For VO2611 and VO4661

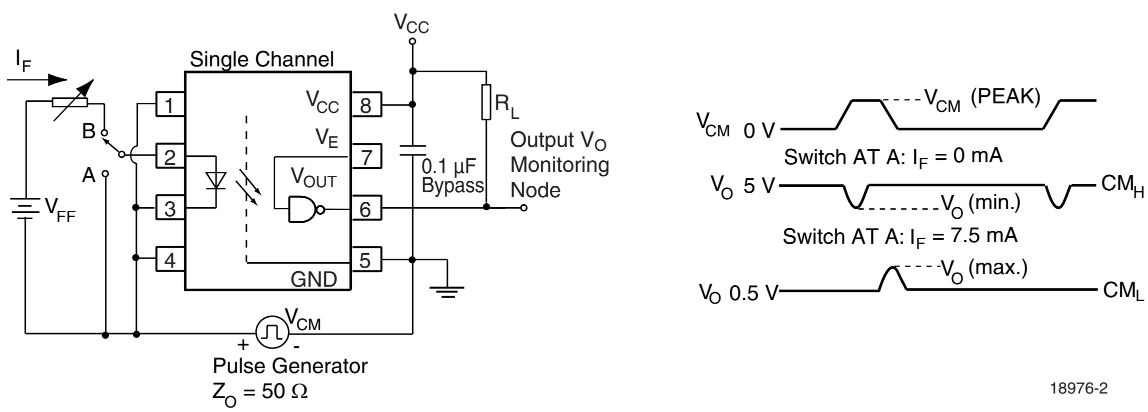


Fig. 4 - Single Channel Test Circuit for Common Mode Transient Immunity

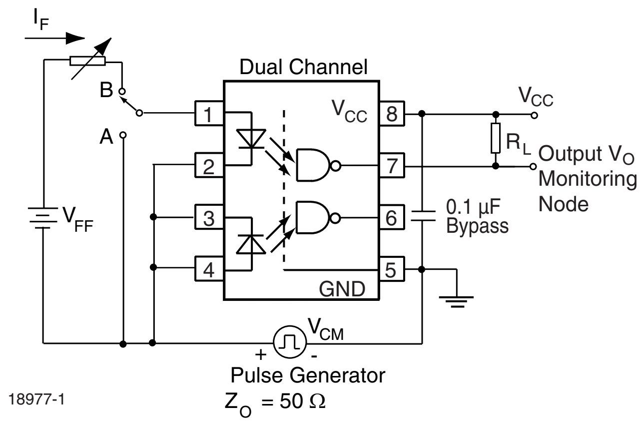


Fig. 5 - Dual Channel Test Circuit for Common Mode Transient Immunity

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 IEC 60950 2.10.5.1		0.2			mm

Note

As per IEC 60747-5-2, §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 prodective circuits.

TYPICAL CHARACTERISTICS

T_{amb} = 25 °C, unless otherwise specified

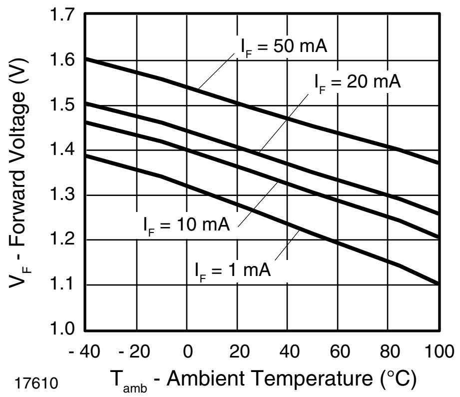


Fig. 6 - Forward Voltage vs. Ambient Temperature

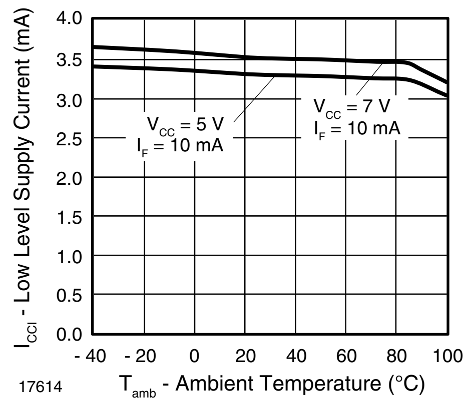


Fig. 9 - Low Level Supply Current vs. Ambient Temperature

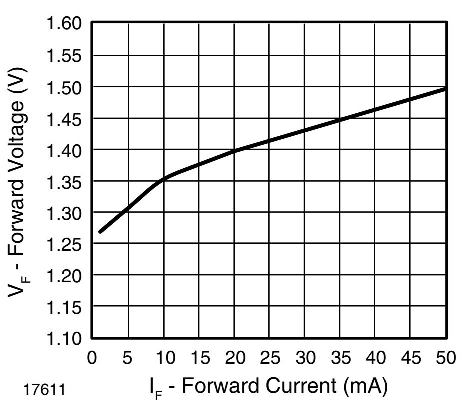


Fig. 7 - Forward Voltage vs. Forward Current

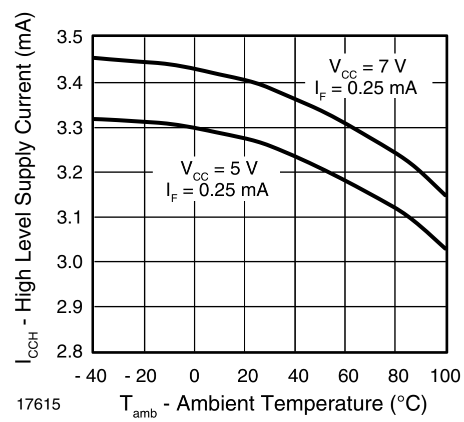


Fig. 10 - High Level Supply Current vs. Ambient Temperature

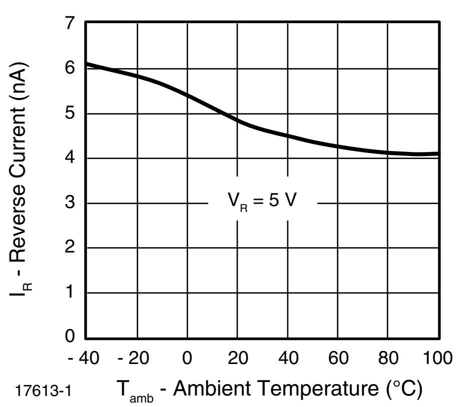


Fig. 8 - Reverse Current vs. Ambient Temperature

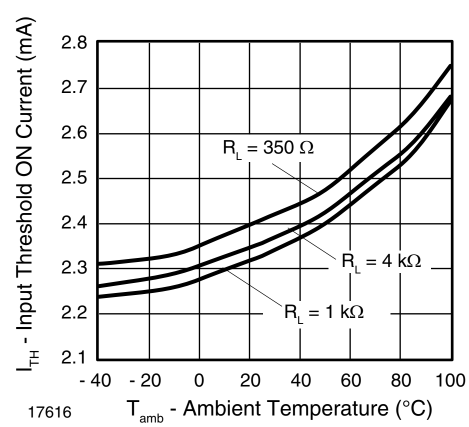


Fig. 11 - Input Threshold ON Current vs. Ambient Temperature

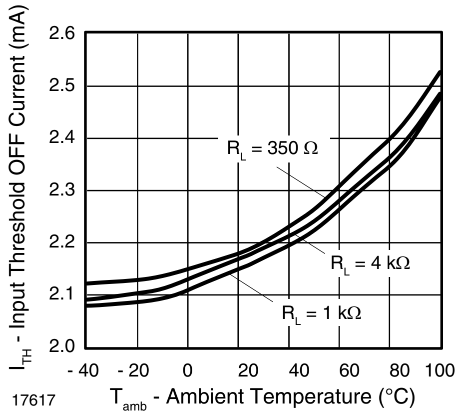


Fig. 12 - Input Threshold OFF Current vs. Ambient Temperature

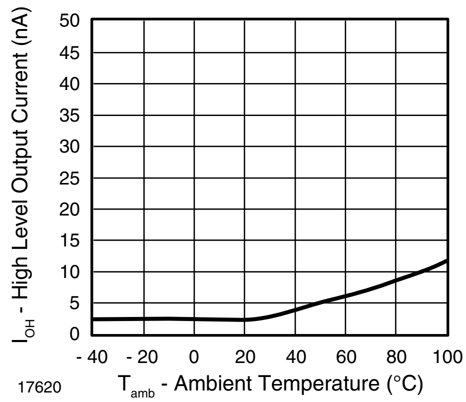


Fig. 15 - High Level Output Current vs. Ambient Temperature

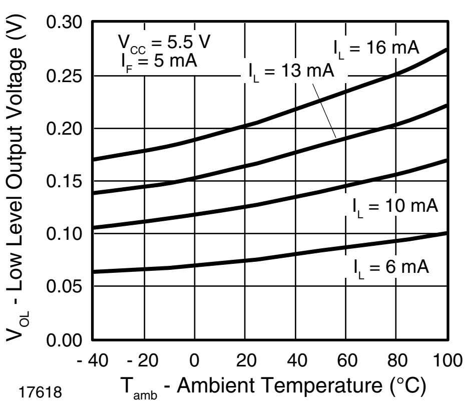


Fig. 13 - Low Level Output Voltage vs. Ambient Temperature

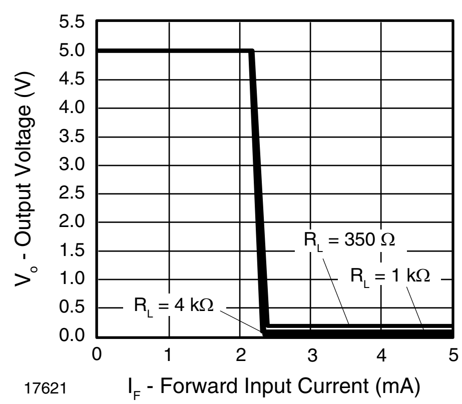


Fig. 16 - Output Voltage vs. Forward Input Current

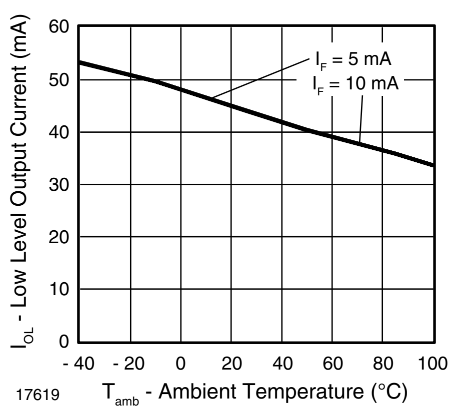


Fig. 14 - Low Level Output Current vs. Ambient Temperature

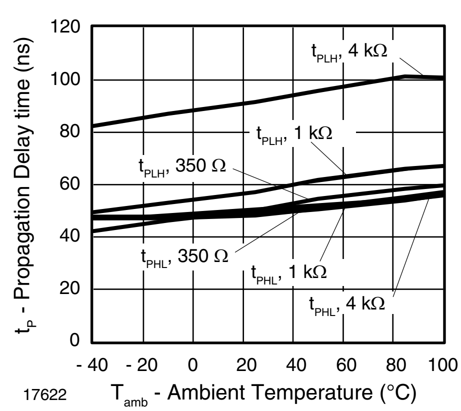


Fig. 17 - Propagation Delay vs. Ambient Temperature

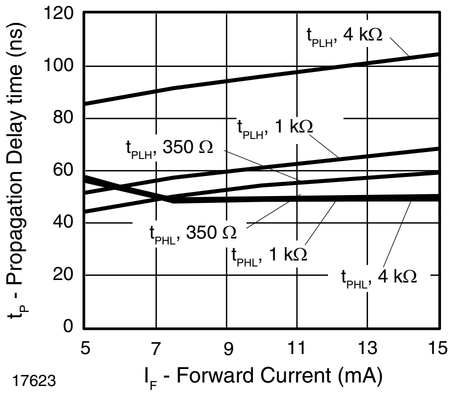


Fig. 18 - Propagation Delay vs. Forward Current

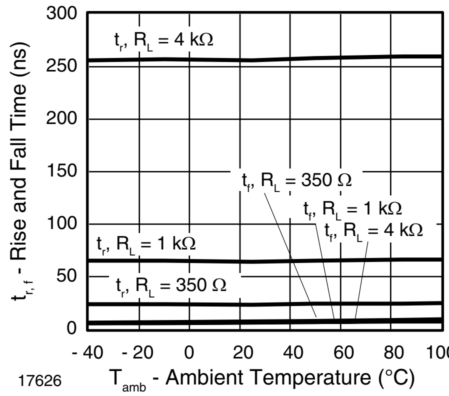


Fig. 21 - Rise and Fall Time vs. Ambient Temperature

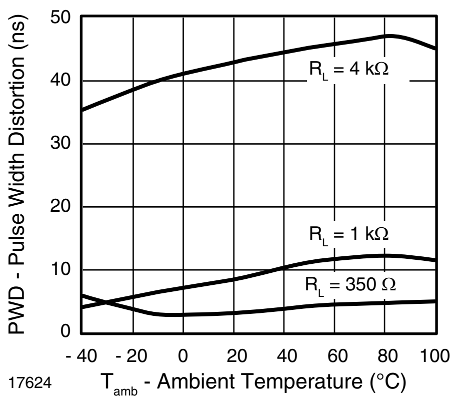


Fig. 19 - Pulse Width Distortion vs. Ambient Temperature

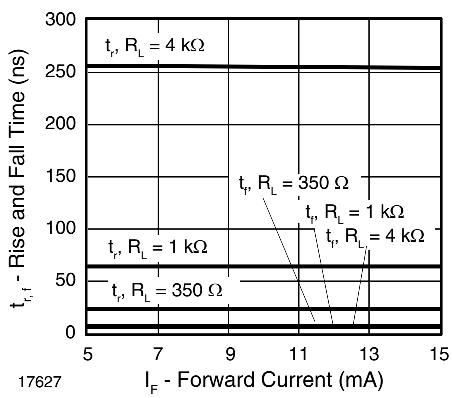


Fig. 22 - Rise and Fall Time vs. Forward Current

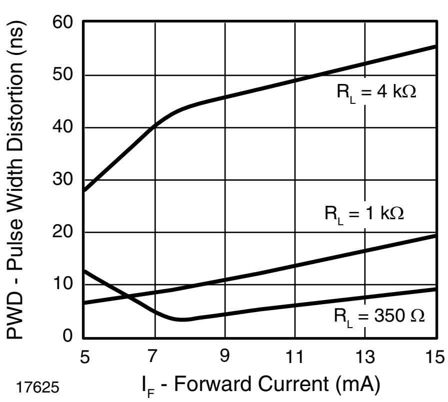


Fig. 20 - Pulse Width Distortion vs. Forward Current

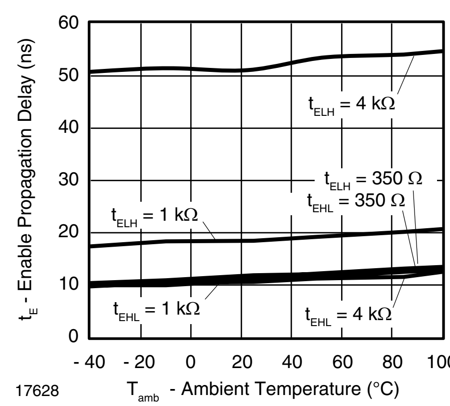
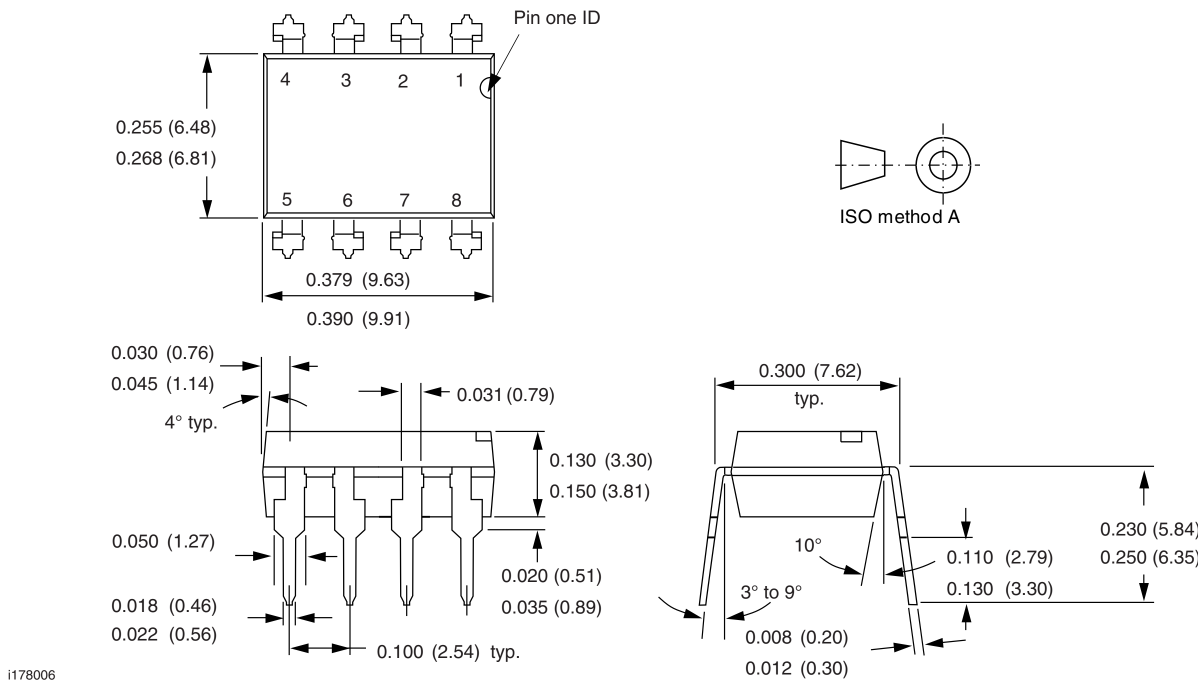
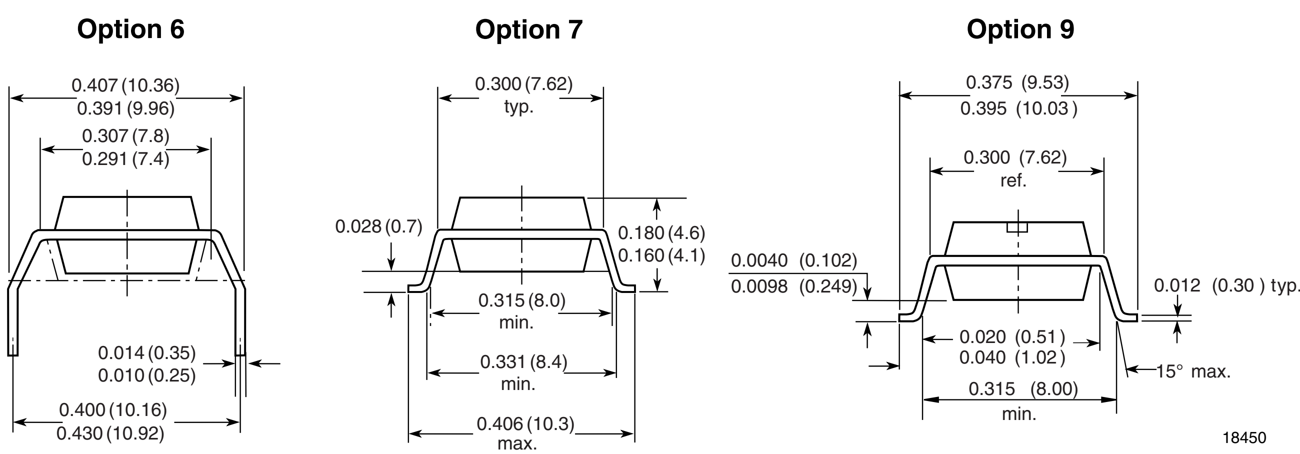


Fig. 23 - Enable Propagation Delay vs. Ambient Temperature

PACKAGE DIMENSIONS in inches (millimeters)





OZONE DEPLETING SUBSTANCES POLICY STATEMENT

It is the policy of Vishay Semiconductor GmbH to

1. Meet all present and future national and international statutory requirements.
2. Regularly and continuously improve the performance of our products, processes, distribution and operating systems with respect to their impact on the health and safety of our employees and the public, as well as their impact on the environment.

It is particular concern to control or eliminate releases of those substances into the atmosphere which are known as ozone depleting substances (ODSs).

The Montreal Protocol (1987) and its London Amendments (1990) intend to severely restrict the use of ODSs and forbid their use within the next ten years. Various national and international initiatives are pressing for an earlier ban on these substances.

Vishay Semiconductor GmbH has been able to use its policy of continuous improvements to eliminate the use of ODSs listed in the following documents.

1. Annex A, B and list of transitional substances of the Montreal Protocol and the London Amendments respectively.
2. Class I and II ozone depleting substances in the Clean Air Act Amendments of 1990 by the Environmental Protection Agency (EPA) in the USA.
3. Council Decision 88/540/EEC and 91/690/EEC Annex A, B and C (transitional substances) respectively.

Vishay Semiconductor GmbH can certify that our semiconductors are not manufactured with ozone depleting substances and do not contain such substances.

Vishay Semiconductor GmbH, P.O.B. 3535, D-74025 Heilbronn, Germany

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