High Speed Optocoupler, 10 MBd SOIC-8 Package

Features

- Choice of CMR performance of 10 kV/µs, 5 kV/µs, and 100 v/µs
- High speed: 10 MBd typical
- + 5 V CMOS compatibility
- Guaranteed AC and DC performance over temperature: - 40 to + 100 °C Temp. Range
- Pure tin leads
- Meets IEC60068-2-42 (SO_2) and IEC60068-2-43 (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

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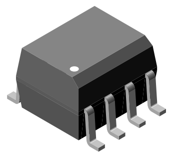

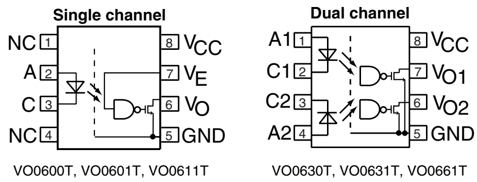

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Agency Approvals

- UL1577, File No. E52744
- CUL-File No. E52744, equivalent to CSA bulletin 5A
- DIN EN 60747-5-2 (VDE0884)
- Reinforced insulation rating per IEC 2.10.5.1
- VDE available with Option 1

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

Description

The VO06xxT family are single and dual channel 10 MBd optocoupler utilizing a high efficient input LED coupled with an integrated optical photodiode IC detector. The detector has an open drain NMOS-transister output, providing less leakage compared to an open collector Schottky clamped transister output. 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 VO0601T and VO0631T and 10 kV/µs for the VO0611T and VO0661T. The use of a 0.1 µF bypass capacitor connected between pin 5 and 8 is recommended.

Order Information

Part	Remarks
VO0600T	100 V/µs, Single channel, SOIC-8
VO0601T	5 kV/µs, Single channel, SOIC-8
VO0611T	10 kV/µs, Single channel, SOIC-8
VO0630T	100 V/µs, Dual channel, SOIC-8
VO0631T	5 kV/µs, Dual channel, SOIC-8
VO0661T	10 kV/µs, Dual channel, SOIC-8

Truth Table (Positive Logic)

LED	OUTPUT
ON	L
OFF	H

Absolute Maximum Ratings

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 Rating for extended periods of the time can adversely affect reliability.

Input

Parameter	Test condition	Symbol	Value	Unit
Average forward current (single channel)		I_F	15	mA
Average forward current (dual channel)		I_F		mA
Reverse input voltage		V_R	5	V
Enable input voltage (single channel)		V_E	V_{CC} + 0.5 V	V
Enable input current (single channel)		I_E	5	mA
Surge current	t = 100 µs	I_{FSM}	200	mA

Output

Parameter	Test condition	Symbol	Value	Unit
Supply voltage	1 minute max.	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 duals)		P_{diss}	60	mW

Coupler

Parameter	Test condition	Symbol	Value	Unit
Storage temperature		T_{stg}	- 55 to + 150	°C
Operating temperature		T_{amb}	- 40 to + 100	°C
Lead solder temperature	for 10 sec.		260	°C
Solder reflow temperature	for 1 minute		260	°C
Isolation test voltage	t = 1.0 sec.	V_{ISO}	3000	V_{RMS}

Recommended Operating Conditions

Parameter	Test condition	Symbol	Min	Typ.	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
Output pull up resistor		R_L	330		4 K	Ω
Logic high enable voltage		V_{EH}	2.0		V_{CC}	V
Logic low enable voltage		V_{EL}	0.0		0.8	V
Fanout	R_L = 1 kΩ	N			5	-

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Electrical Characteristics

T_{amb} = 25 °C and V_{cc} = 5.5 V, 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.

Input

Parameter	Test condition	Symbol	Min	Typ.	Max	Unit
Input forward voltage	I_F = 10 mA	V_F	1.1	1.4	1.7	V
Reverse current	V_R = 5.0 V	I_R		0.01	10	µA
Input capacitance	f = 1 MHz, V_F = 0 V	C_I		55		pF

Output

Parameter	Test condition	Symbol	Min	Typ.	Max	Unit
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 = 2.0 V, V_O = 5.5 V, I_F = 250 µA	I_{OH}		0.002	1	µA
Low level output voltage	V_E = 2.0 V, I_F = 5 mA, I_{OL} (sinking) = 13 mA	V_{OL}		0.2	0.6	V
Input threshold current	V_E = 2.0 V, V_O = 5.5 V, I_{OL} (sinking) = 13 mA	I_{TH}		2.4	5.0	mA
High level enable current		I_{EH}		- 0.6	- 1.6	mA
Low level enable current		I_{EL}		- 0.8	- 1.6	mA
High level enable voltage		V_{EH}	2.0			V
Low level enable voltage		V_{EL}			0.8	V

Switching Characteristics

Over Recommended Temperature (T_a = - 40 to + 100 °C), V_{CC} = 5 V, I_F = 7.5 mA unless otherwise specified.
All Typicals at T_a = 25 °C, V_{CC} = 5 V.

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	100	ns
Propagation delay time to low output level	R_L = 350 Ω, C_L = 15 pF	t_{PHL}	25	50	100	ns
Pulse width distortion	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 - 90 %)	R_L = 350 Ω, C_L = 15 pF	t_r		23		ns
Output fall time (90 - 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

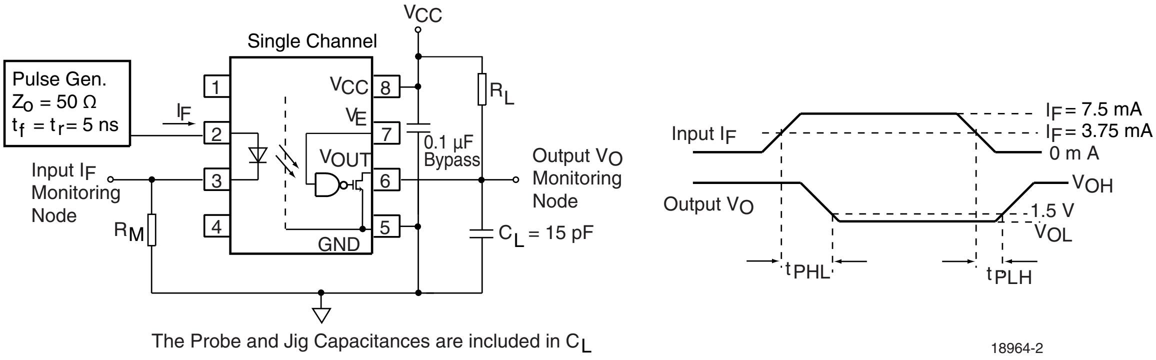


Figure 1. Single Channel Test Circuit for t_{PLH}, t_{PHL}, t_r and t_f

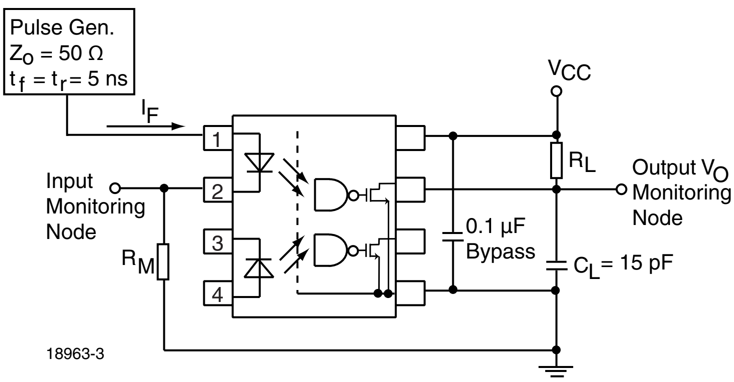


Figure 2. Dual Channel Test Circuit for t_{PLH}, t_{PHL}, t_r and t_f

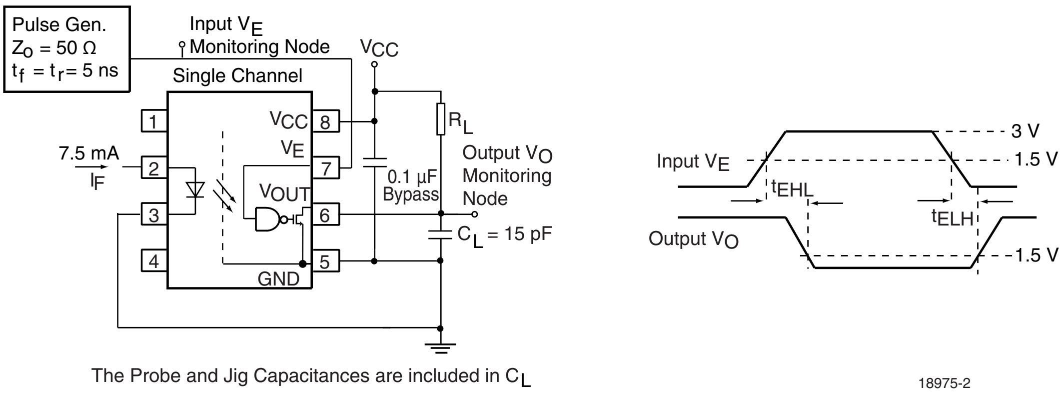


Figure 3. Single Channel Test Circuit for t_{EHL}, t_{ELH}

Common Mode Transient Immunity

Parameter	Test condition	Symbol	Min	Typ.	Max	Unit
Common mode transient immunity (high)	$\|V_{CM}\|$ = 10 V, V_{CC} = 5 V, I_F = 0 mA, $V_{O(min)}$ = 2 V, R_L = 350 Ω, T_{amb} = 25 °C [1]	$\|CM_H\|$	100			V/µs
	$\|V_{CM}\|$ = 50 V, V_{CC} = 5 V, I_F = 0 mA, $V_{O(min)}$ = 2 V, R_L = 350 Ω, T_{amb} = 25 °C [2]	$\|CM_H\|$	5000	10000		V/µs
	$\|V_{CM}\|$ = 1 kV, V_{CC} = 5 V, I_F = 0 mA, $V_{O(min)}$ = 2 V, R_L = 350 Ω, T_{amb} = 25 °C [3]	$\|CM_H\|$	10000	15000		V/µs
Common mode transient immunity (low)	$\|V_{CM}\|$ = 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]	$\|CM_L\|$	100			V/µs
	$\|V_{CM}\|$ = 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]	$\|CM_L\|$	5000	10000		V/µs
	$\|V_{CM}\|$ = 1 kV, V_{CC} = 5 V, I_F = 7 mA, $V_{O(max)}$ = 0.8 V, R_L = 350 Ω, T_{amb} = 25 °C [3]	$\|CM_L\|$	10000	15000		V/µs

[1] For VO0600T and VO0630T
[2] For VO0601T and VO0631T
[3] For VO0611T and VO0661T

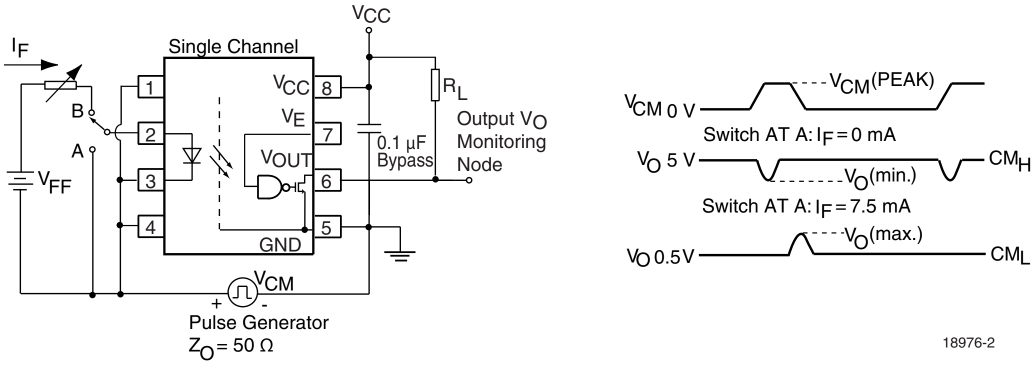


Figure 4. Single Channel Test Circuit for Common Mode Transient Immunity

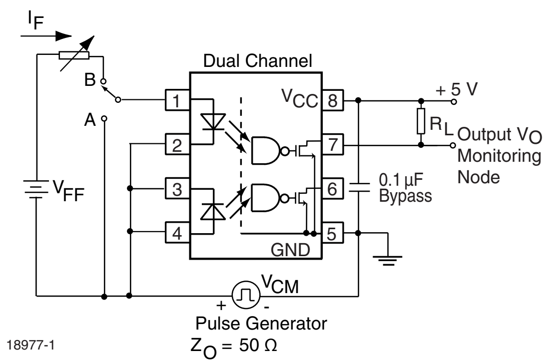


Figure 5. Dual Channel Test Circuit for Common Mode Transient Immunity

Safety and Insulation Ratings

As per IEC60747-5-2, §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 protective circuits.

Parameter	Test condition	Symbol	Min	Typ.	Max	Unit
Climatic Classification (according to IEC 68 part 1)				55/110/21		
Comparative Tracking Index		CTI	175		399	
V_{IOTM}			5000			V
V_{IORM}			560			V
P_{SO}					350	mW
I_{SI}					150	mA
T_{SI}					165	°C
Creepage			4			mm
Clearance			4			mm
Insulation thickness, reinforced rated	per IEC60950 2.10.5.1		0.2			mm

Typical Characteristics

T_{amb} = 25 °C unless otherwise specified

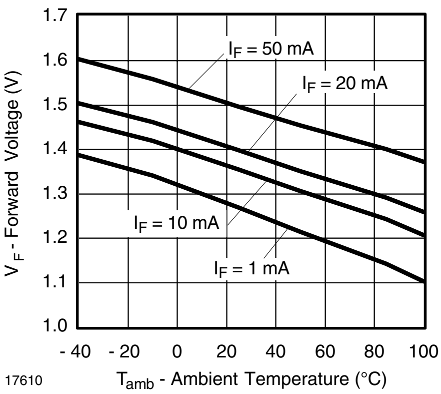


Figure 6. Forward Voltage vs. Ambient Temperature

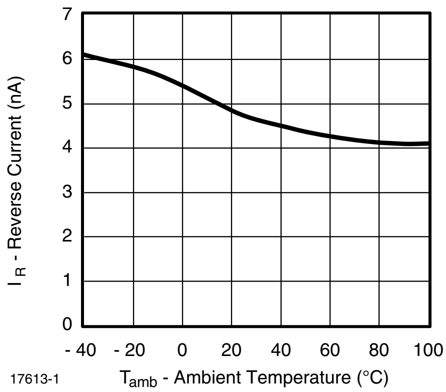


Figure 8. Reverse Current vs. Ambient Temperature

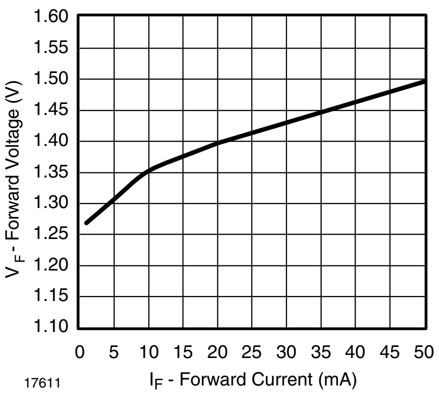


Figure 7. Forward Voltage vs. Forward Current

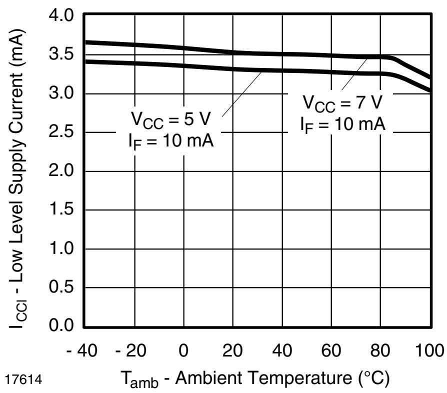


Figure 9. Low Level Supply Current vs. Ambient Temperature

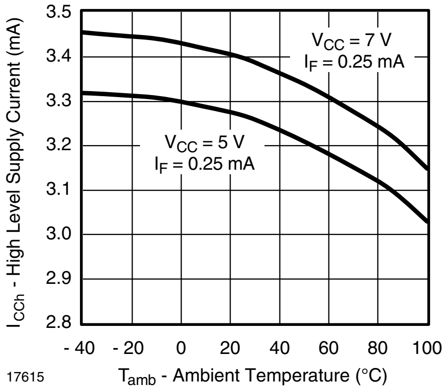


Figure 10. High Level Supply Current vs. Ambient Temperature

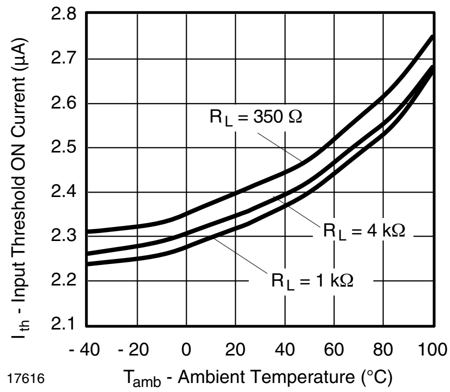


Figure 11. Input Threshold ON Current vs. Ambient Temperature

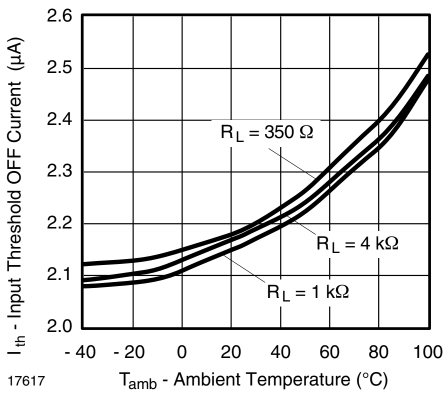


Figure 12. Input Threshold OFF Current vs. Ambient Temperature

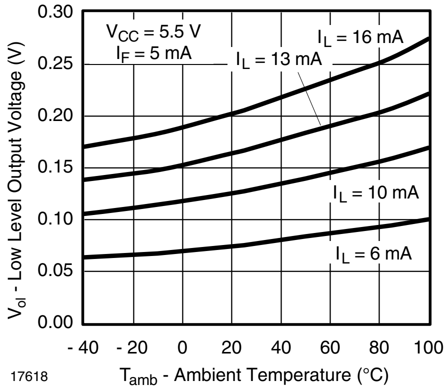


Figure 13. Low Level Output Voltage vs. Ambient Temperature

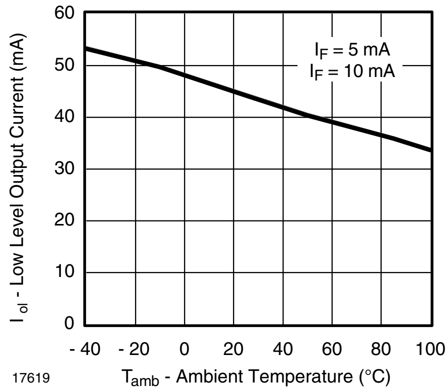


Figure 14. Low Level Output Current vs. Ambient Temperature

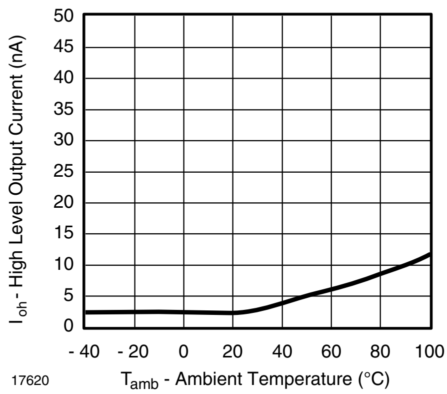


Figure 15. High Level Output Current vs. Ambient Temperature

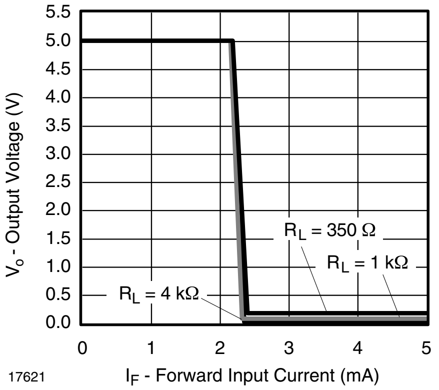


Figure 16. Output Voltage vs. Forward Input Current

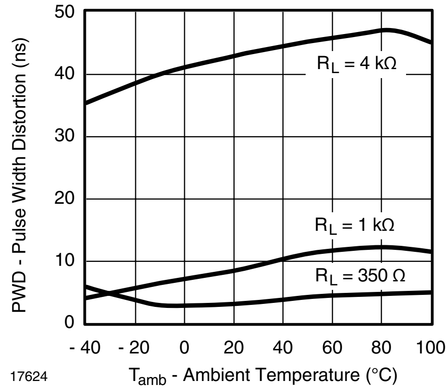


Figure 19. Pulse Width Distortion vs. Ambient Temperature

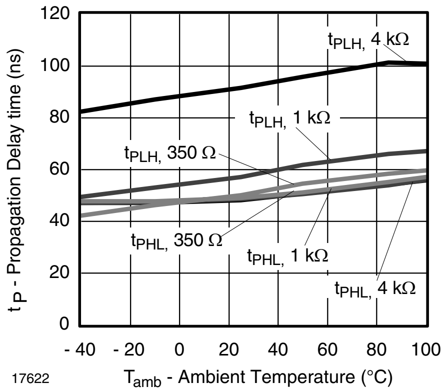


Figure 17. Propagation Delay vs. Ambient Temperature

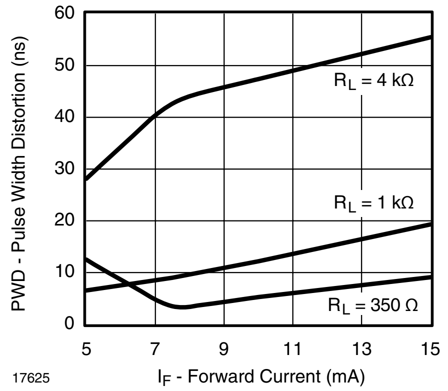


Figure 20. Pulse Width Distortion vs. Forward Current

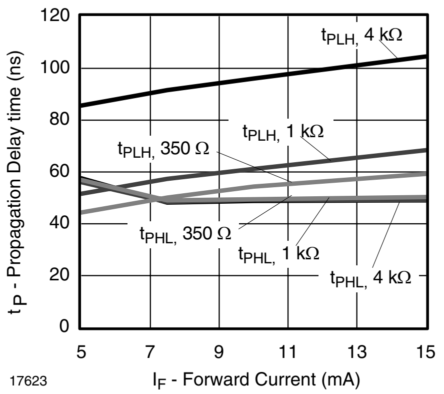


Figure 18. Propagation Delay vs. Forward Current

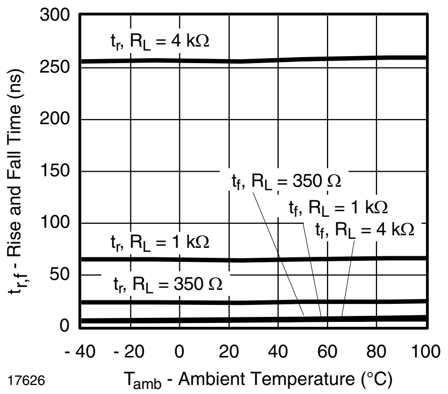


Figure 21. Rise and Fall Time vs. Ambient Temperature

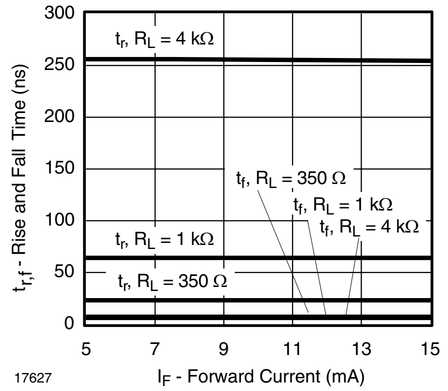


Figure 22. Rise and Fall Time vs. Forward Current

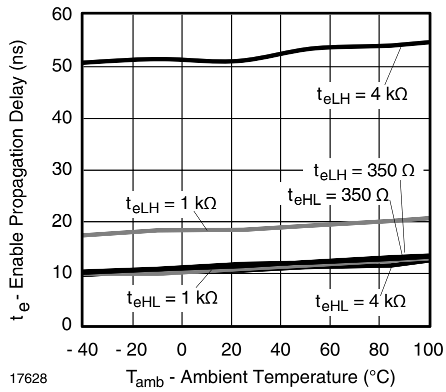
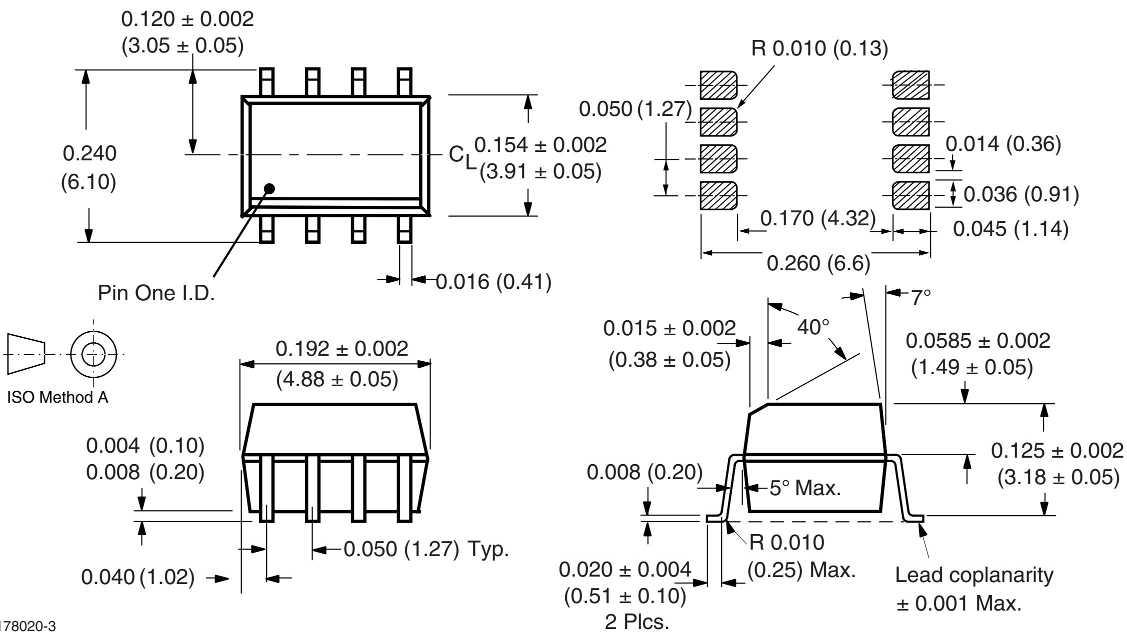


Figure 23. Enable Propagation Delay vs. Ambient Temperature

Package Dimensions in Inches (mm)



ESD Caution

This is an ESD (electro static discharge) sensitive device. Electrostatic charges accumulate on the human body and test equipment and can discharge without detection. Therefore, proper ESD precautions are recommended to avoid performance degradation or loss of functionality. ESD withstand voltage of this device is up to 1500 V acc. to JESD22-A114-B.

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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