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Data Sheet

ACNU-250L

1MBd Optocoupler in 11-mm SSO8 Package

Description

The Broadcom® ACNU-250L is a single-channel 1MBd optocoupler in an SSO8 footprint.

This optocoupler uses an insulating layer between the light-emitting diode and an integrated photon detector to provide electrical insulation between input and output. Separate connections for the photodiode bias and output transistor collector increase the speed up to a hundred times over that of a conventional photo-transistor coupler by reducing the base-collector capacitance.

The ACNU-250L is suitable for isolated communication logic interface and control in high-voltage power systems, space-constrained industrial applications, renewable inverters and medical equipments. This package platform features wide 11-mm creepage and 10.5-mm clearance, high insulation voltage of V_{iorm} = 1414 V_{peak} and compact footprint which is 40% smaller than the 400-mil DIP8 package.

Features

- Wide supply voltage: 3.0V to 24V
- 11-mm creepage, 10.5-mm clearance in a compact SSO8 package
- TTL compatible
- Open-collector output
- 40 kV/µs minimum common-mode rejection at V_{CM} = 1500V
- Guaranteed performance within temperature range: –40°C to +105°C
- Worldwide safety approval:
  - UL1577 recognized, 5000 Vrms/1 minute
  - CSA Approval
  - IEC 60747-5-5 Approval for Reinforced Insulation

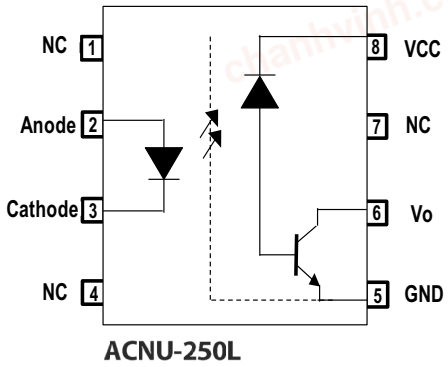
Applications

- Communications interface
- Feedback elements in switching power supplies
- Digital signal isolation for A/D, D/A conversion
- MCU interface
- Renewable energy inverters

CAUTION! Take normal static precautions in handling and assembly of this component to prevent damage, degradation, or both that may be induced by ESD. The components featured in this data sheet are not to be used in military or aerospace applications or environments.

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Functional Diagram



A 0.1-µF bypass capacitor must be connected between pins VCC and GND.

Truth Table

LED	OUTPUT
ON	L
OFF	H

Ordering Information

ACNU-250L is UL Recognized with 5000 V_{rms} for 1 minute per UL1577.

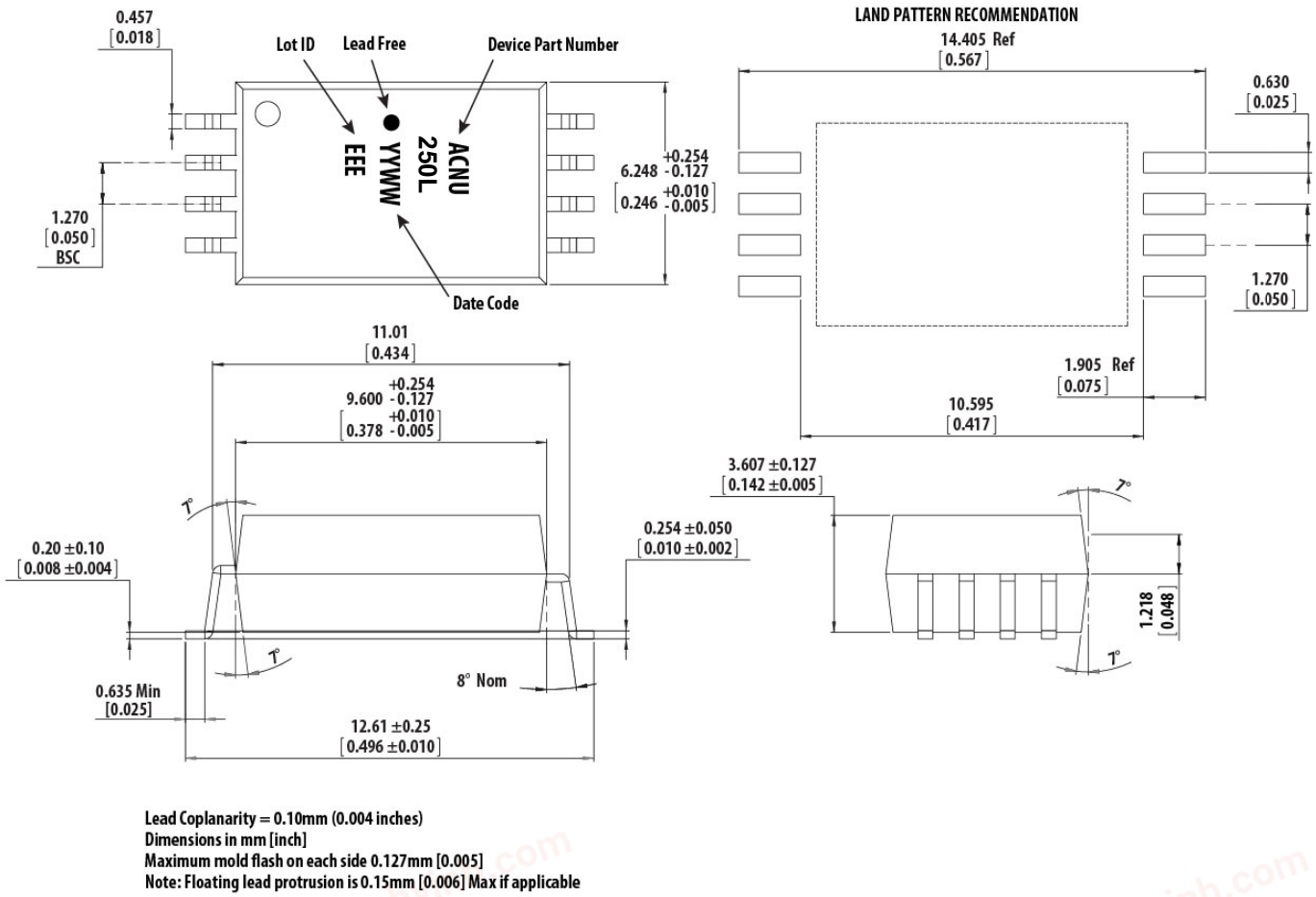
Part Number	Option RoHS Compliant	Package	Surface Mount	Tape and Reel	UL 1577	IEC 60747-5-5	Quantity
ACNU-250L	-000E	11mm Stretched SO8	X		X	X	80 per tube
	-500E		X	X	X	X	1000 per reel

To order, choose a part number from the part number column and combine with the desired option from the option column to form an order entry.

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Package Outline Drawing

ACNU-250L SSO8 Package



Lead Coplanarity = 0.10mm (0.004 inches)
Dimensions in mm [inch]
Maximum mold flash on each side 0.127mm [0.005]
Note: Floating lead protrusion is 0.15mm [0.006] Max if applicable

Solder Reflow Profile

Recommended reflow condition as per JEDEC Standard, J-STD-020 (latest revision). Non-halide flux should be used.

Regulatory Information

The ACNU-250L is approved by the following organizations.

UL	Approval under UL 1577, component recognition program up to V_{ISO} = 5000 V_{RMS} File E55361.
CSA	Approval under CSA Component Acceptance Notice #5, File CA 88324.
IEC 60747-5-5	Maximum Working Insulation Voltage V_{iorm} = 1414 V_{peak}.

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Insulation and Safety Related Specifications

Parameter	Symbol	ACNU-250L	Units	Conditions
Minimum External Air Gap (External Clearance)	L(101)	10.5	mm	Measured from input terminals to output terminals, shortest distance through air.
Minimum External Tracking (External Creepage)	L(102)	11.0	mm	Measured from input terminals to output terminals, shortest distance path along body.
Minimum Internal Plastic Gap (Internal Clearance)		0.5	mm	Through insulation distance conductor to conductor, usually the straight line distance thickness between the emitter and the detector.
Tracking Resistance (Comparative Tracking Index)	CTI	>300	V	DIN IEC 112/VDE 0303 Part 1
Isolation Group		IIIa		Material Group (DIN VDE 0110, 1/89, Table 1)

IEC 60747-5-5 Insulation Characteristics

Description	Symbol	Characteristic	Units
Installation Classification per DIN VDE 0110/39, Table 1			
For rated mains voltage ≤ 600 V_{rms}		I-IV	
For rated mains voltage ≤ 1000 V_{rms}		I-III	
Climatic Classification		40/105/21	
Pollution Degree (DIN VDE 0110/39)		2	
Maximum Working Insulation Voltage	V_{IORM}	1414	V_{peak}
Input to Output Test Voltage, Method b[a] V_{IORM} × 1.875 = V_{PR}, 100% Production Test with t_m = 1s, Partial discharge < 5 pC	V_{PR}	2652	V_{peak}
Input to Output Test Voltage, Method a[a] V_{IORM} × 1.6=V_{PR}, Type and Sample Test, t_m = 10s, Partial discharge < 5 pC	V_{PR}	2262	V_{peak}
Highest Allowable Overvoltage (Transient Overvoltage t_{ini} = 60s)	V_{IOTM}	8000	V_{peak}
Safety-Limiting Values – Maximum values allowed in the event of a failure.			
Case Temperature	T_S	175	°C
Input Current	$I_{S, INPUT}$	230	mA
Output Power	$P_{S, OUTPUT}$	600	mW
Insulation Resistance at T_S, V_{IO} = 500 V	R_S	>109	Ω

a. Refer to the optocoupler section of the Isolation and Control Components Designer's Catalog, under Product Safety Regulations section, (IEC 60747-5-5) for a detailed description of Method a and Method b partial discharge test profiles.

NOTE: These optocouplers are suitable for "safe electrical isolation" only within the safety limit data. Maintenance of the safety limit data is ensured by means of protective circuits.

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Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Units
Storage Temperature	T_S	–55	125	°C
Operating Temperature	T_A	–40	105	°C
Average Forward Input Current	$I_{F(avg)}$	—	20	mA
Peak Forward Input Current (1-ms Pulse Width, 50% Duty Cycle)	$I_{F(peak)}$	—	80	mA
Peak Transient Input Current (≤ 1-µs pulse width, <300 ps)	$I_{F(trans)}$	—	1	A
Reversed Input Voltage	V_R	—	5	V
Input Power Dissipation	P_{IN}	—	37	mW
Output Power Dissipation	P_O	—	100	mW
Output Current	I_O	—	12	mA
Supply Voltage	V_{CC}	–0.5	30	V
Output Voltage	V_O	–0.5	24	V
Lead Solder Temperature	TLS	260°C for 10 seconds, 1.6 mm below seating plane		
Solder Reflow Temperature Profile	Refer to the Solder Reflow Profile section			

Recommended Operating Conditions

Parameter	Symbol	Min.	Max.	Units
Supply Voltage	V_{CC}	3.0	24	V
Input Current, High Level	I_{FH}	10	18	mA
Operating Temperature	T_A	–40	105	°C
Forward Input Voltage(OFF)	$V_{F(OFF)}$	—	0.8	V

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Electrical Specifications (DC)

Over recommended operating T_A = –40°C to 105°C, supply voltage (3.0V ≤ V_{CC} ≤ 24V) and unless otherwise specified. All typical are at T_A = 25°C.

Parameter	Symbol	Min.	Typ.	Max.	Units	Conditions			Figure
Current Transfer Ratio	CTR[a]	23	33	53	%	T_A = 25°C	V_O = 0.4V	V_{CC} = 3.3V or 5V	2, 3
		19	—	—	%		V_O=0.5V	I_F = 12 mA	
Logic Low Output Voltage	V_{OL}	—	0.2	0.4	V	T_A = 25°C	I_O = 3 mA	V_{CC} = 3.3V or 5V	
		—	0.2	0.5	V		I_O = 1.6 mA	I_F = 12 mA	
Logic High Output Current	I_{OH}	—	0.014	0.5	µ A	T_A = 25°C	V_O = V_{CC} = 5.5V	I_F = 0 mA	4, 5
		—	0.06	1			V_O = V_{CC} = 24V		
		—	—	80			V_O = V_{CC} = 24V		
Logic Low Supply Current	I_{CCL}	—	50	200	µ A		I_F = 12 mA, V_O = open, V_{CC} = 24V		
Logic High Supply Current	I_{CCH}	—	0.02	2	µ A		I_F = 0 mA, V_O = open, V_{CC} = 24V		
Input Forward Voltage	V_F	—	1.50	1.80	V		I_F = 12 mA		1
Input Reversed Breakdown Voltage	BV_R	5	—	—	V		I_R = 10 µA		
Temperature Coefficient of Forward Voltage	$\Delta V_F/\Delta T_A$	—	–1.6	—	mV/°C		I_F = 12 mA		
Input Capacitance	C_{IN}	—	77	—	pF		f = 1 MHz, V_F = 0		

a. Current transfer ratio in percent is defined as the ratio of output collector current, I_O, to the forward LED input current, I_F, times 100%.

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Switching Specifications

Over recommended operating (T_A = –40°C to 105°C), I_F = 12 mA, (3.0V ≤ V_{CC} ≤ 24V), unless otherwise specified.

Parameter	Symbol	Min.	Typ.	Max.	Units	Test Conditions		Figure
Propagation Delay Time to Logic Low at Output	t_{PHL}	—	0.3	0.9	µs	T_A = 25°C	V_{CC} = 3.3V, R_L = 1.0 kΩ	15
		—	—	1.0	µs			6
		—	0.3	0.8	µs	T_A = 25°C	V_{CC} = 5.0V, R_L= 1.6 kΩ	15
		—	—	1.0	µs			7
		—	0.7	1.2	µs	T_A = 25°C	V_{CC} = 24V, R_L= 8.2 kΩ	15
		—	—	1.5	µs			8
Propagation Delay Time to Logic High at Output	t_{PLH}	—	0.7	1.0	µs	T_A = 25°C	V_{CC} = 3.3 V, R_L = 1.0 kΩ	15
		—	—	1.4	µs			6
		—	0.5	1.0	µs	T_A = 25°C	V_{CC} = 5.0 V, R_L = 1.6 kΩ	15
		—	—	1.3	µs			7
		—	0.4	0.8	µs	T_A = 25°C	V_{CC} = 24V, R_L = 8.2 kΩ	15
		—	—	1.0	µs			8
Propagation Delay Difference Between Any two Parts[a]		—	0.5	0.9	µs	T_A = 25°C	V_{CC} = 3.3V, R_L = 1.0 kΩ	
		—	0.2	0.6	µs	T_A = 25°C	V_{CC} = 5.0V, R_L = 1.6 kΩ	
		—	0.3	1.0	µs	T_A = 25°C	V_{CC} = 24V, R_L = 8.2 kΩ	
Common Mode Transient Immunity at Logic High Output[b]	$\|CM_H\|$	40	—	—	kV/µs	T_A = 25°C	V_{CM} = 1500V, I_F = 0 mA, R_L = 1.0 kΩ, V_{CC} = 3.3V or R_L = 1.6 kΩ, V_{CC} = 5V	16
Common Mode Transient Immunity at Logic Low Output[c]	$\|CM_L\|$	40	—	—	kV/µs	T_A = 25°C	V_{CM} = 1500V, I_F = 12 mA, R_L = 1.0 kΩ, V_{CC} = 3.3V or R_L = 1.6 kΩ, V_{CC} = 5V	16

a. The difference between t_{PLH} and t_{PHL} between any two parts under the same test condition.

b. Common transient immunity in a Logic High level is the maximum tolerable (positive) dV_{CM}/dt on the rising edge of the common mode pulse, V_{CM}, to assure that the output will remain in a Logic High state.

c. Common mode transient immunity in a Logic Low level is the maximum tolerable (negative) dV_{CM}/dt on the falling edge of the common mode pulse signal, V_{CM}, to assure that the output will remain in a Logic Low state.

Package Characteristics

All Typical at T_A = 25 C.

Parameter	Symbol	Min.	Typ.	Max.	Units	Test Conditions
Input-Output Momentary Withstand Voltage[a]	V_{ISO}	5000	—	—	V_{rms}	RH ≤ 50%, t = 1 minute, T_A = 25°C
Input-Output Resistance[a]	R_{I-O}	—	10^{-14}	—	Ω	V_{I-O} = 500 Vdc
Input-Output Capacitance[a]	C_{I-O}	—	0.6	—	pF	f = 1 MHz, T_A = 25°C

a. The device considered a two terminal device: pins 2 and 3 are shorted together and pins 5, 6, and 8 are shorted together.

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Figure 1: Input Current vs. Forward Voltage

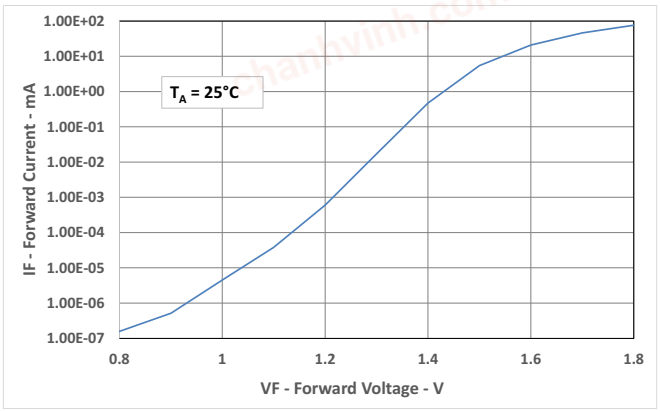


Figure 2: Typical Current Transfer Ratio vs. Temperature, 3.3V

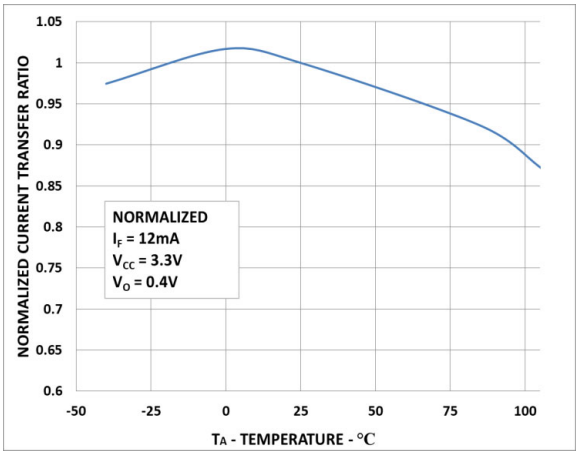


Figure 3: Typical Current Transfer Ratio vs. Temperature, 5.0V

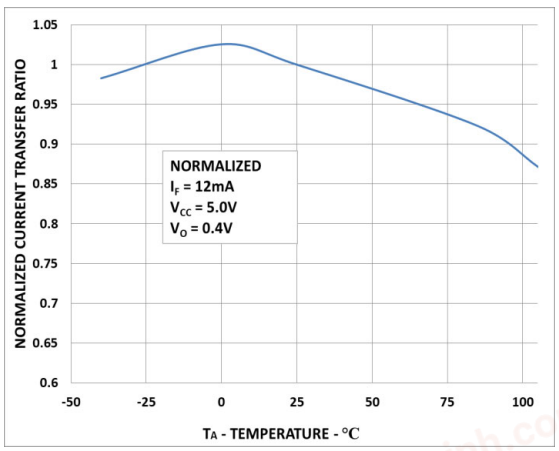


Figure 4: Typical Logic High Output Current vs. Temperature, 3.3V

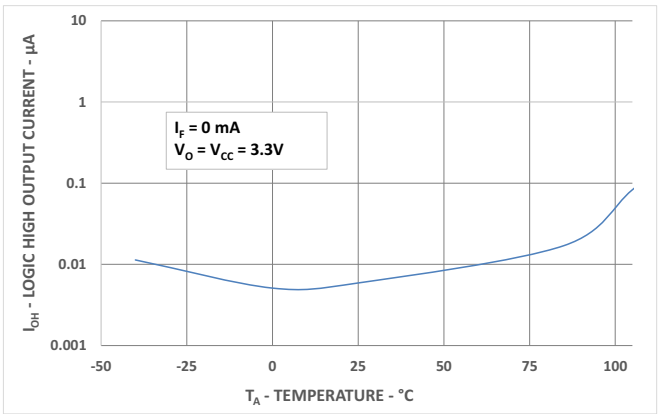


Figure 5: Typical Logic High Output Current vs. Temperature, 5.0V

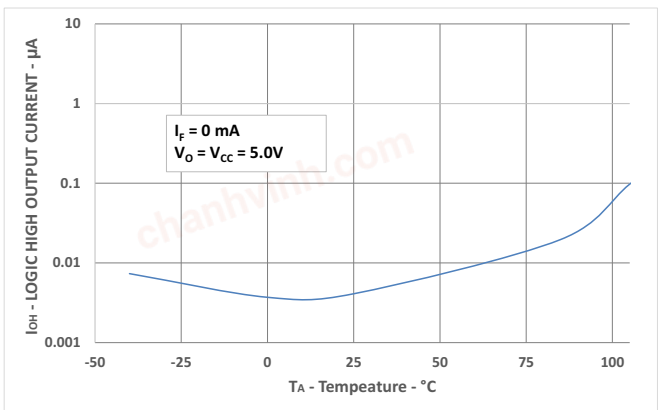
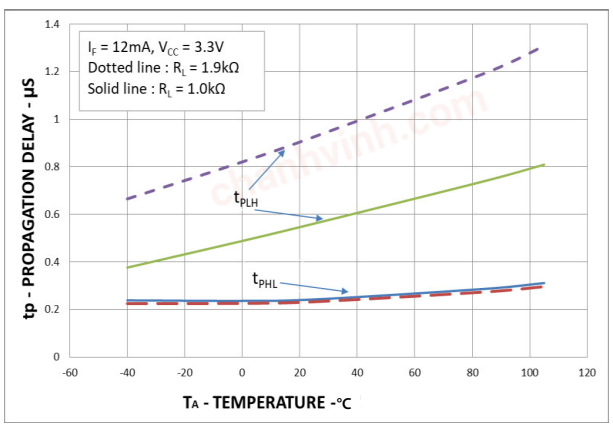


Figure 6: Typical Propagation Delay vs. Temperature, 3.3V



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Figure 7: Typical Propagation Delay vs. Temperature, 5.0V

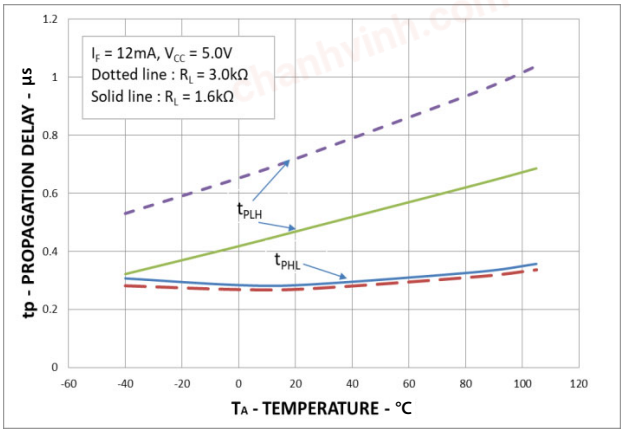


Figure 8: Typical Propagation Delay vs. Temperature, 24V

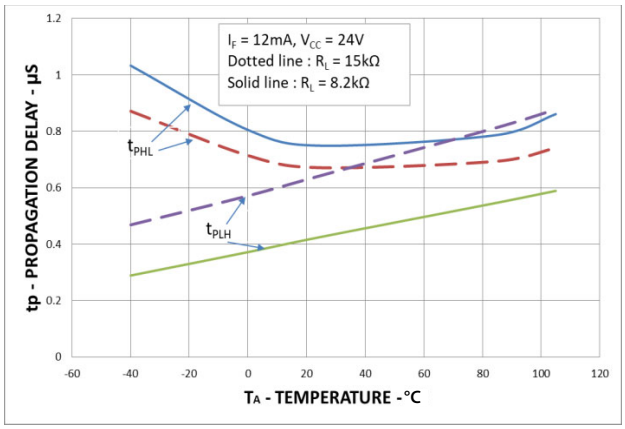


Figure 9: Typical Propagation Delay vs. Load Resistance, 3.3V

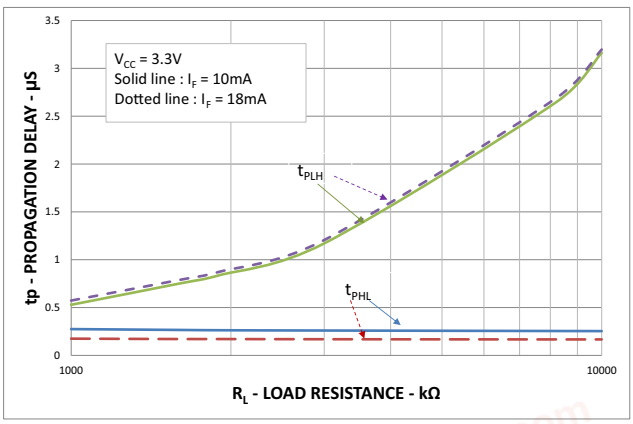


Figure 10: Typical Propagation Delay vs. Load Resistance, 5.0V

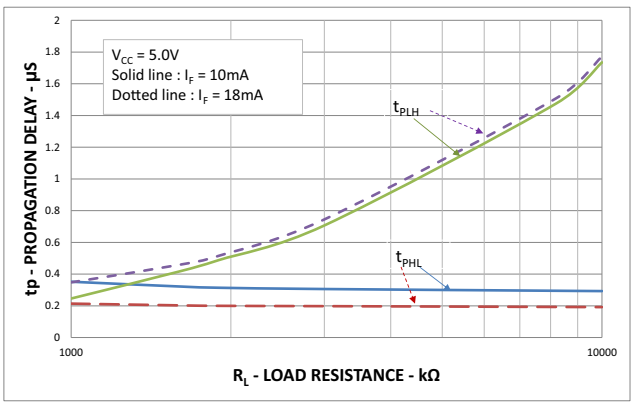


Figure 11: Typical Propagation Delay vs. Supply Voltage

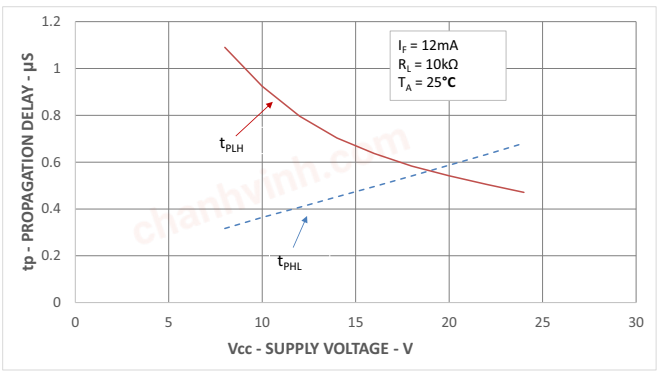
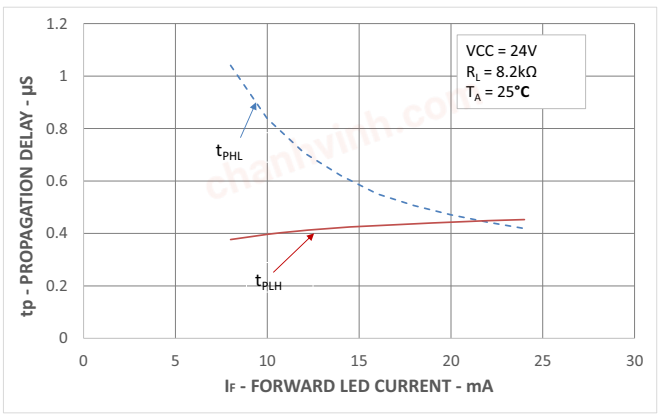


Figure 12: Typical Propagation Delay vs. Input Current



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Figure 13: Current Transfer Ratio vs. Input Current

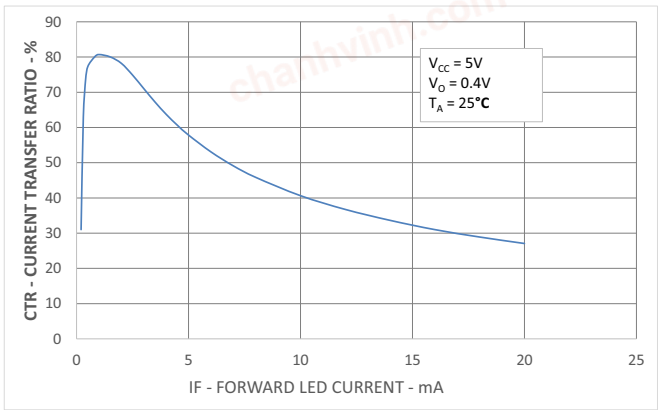


Figure 14: DC Pulse Transfer Characteristic

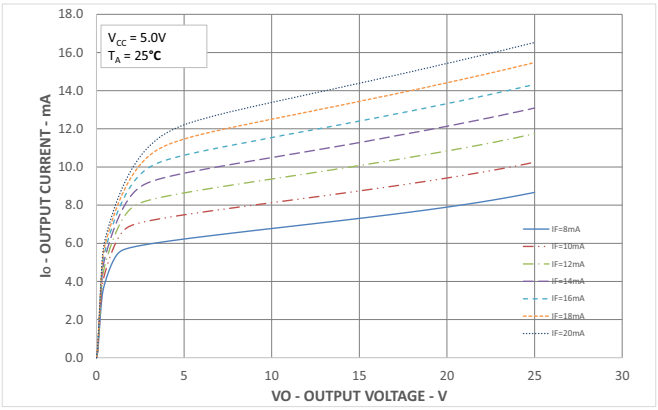


Figure 15: Switching Test Circuits

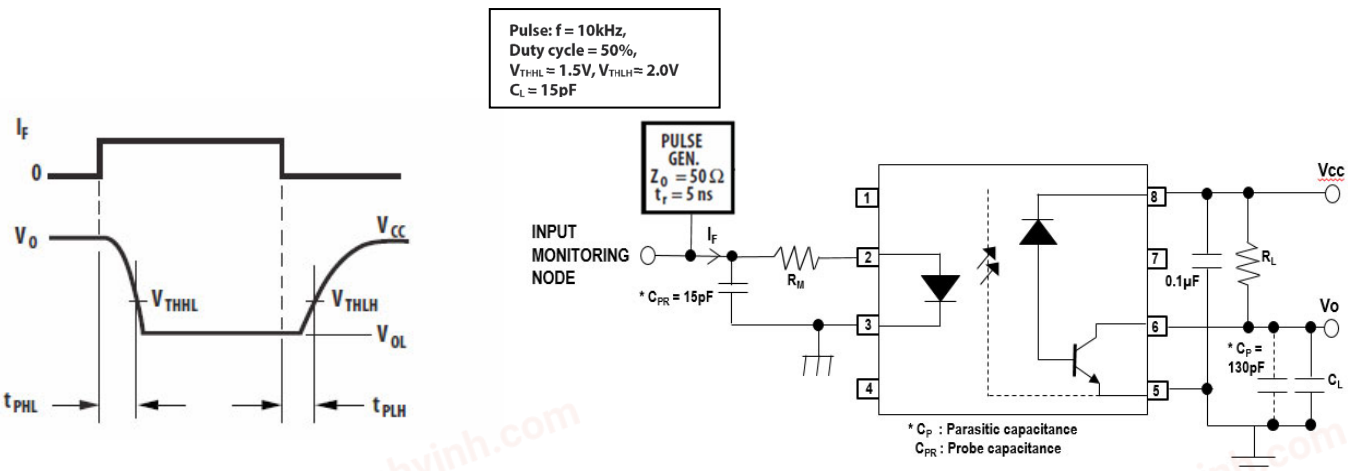
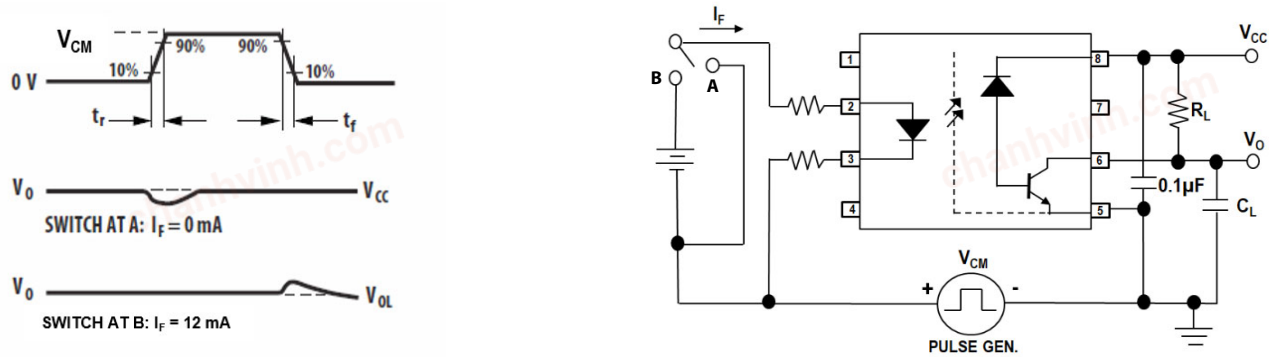


Figure 16: Test Circuit for Transient Immunity and Typical Waveforms



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