ACNT-H50L

1MBd Optocoupler
in 14.2mm Creepage/Clearance Stretched SO8 Package

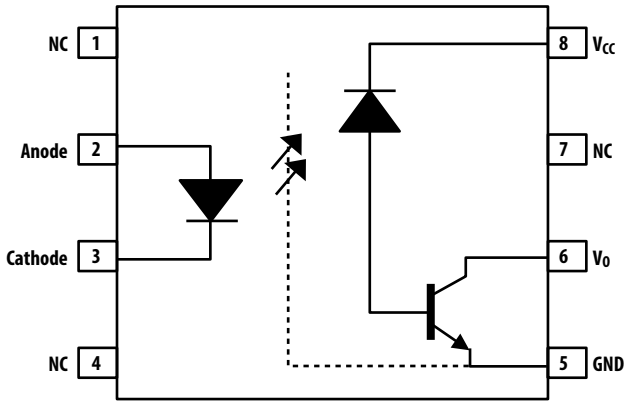
Data Sheet

Description

The ACNT-H50L is a single-channel 1MBd optocoupler in Stretched SO8 footprint. It 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.

14.2mm creepage/clearance and high voltage insulation capability is suitable for isolated communication logic interface and control in high-voltage power systems such as $690V_{AC}$ drives, renewable inverters and medical equipments.

Functional Diagram



TRUTH TABLE

LED	OUTPUT
ON	L
OFF	H

A 0.1µF bypass capacitor must be connected between pins V_{CC} and GND.

Features

- High Speed : 1Mb/s
- TTL compatible
- 14.2mm Stretched SO8 package
- Open-Collector Output
- 15 kV/µs minimum Common-Mode Rejection at V_{CM} = 1500 V
- Guaranteed performance within temperature range: -40°C to +105°C
- Worldwide Safety Approval:
  - UL1577 recognized - $7500V_{rms}$ for 1minute
  - CSA Approval
  - IEC 60747-5-5 Approval for Reinforced Insulation

Applications

- High Voltage power systems, eg 690VAC drives
- Renewable energy inverters
- Feedback Elements in Switching Power Supplies
- Digital isolation for A/D, D/A conversion Digital field
- Communications Interface
- MCU Interface

CAUTION It is advised that normal static precautions be taken in handling and assembly of this component to prevent damage and/or degradation which may be induced by ESD. The components featured in this datasheet are not to be used in military or aerospace applications or environments

Ordering Information

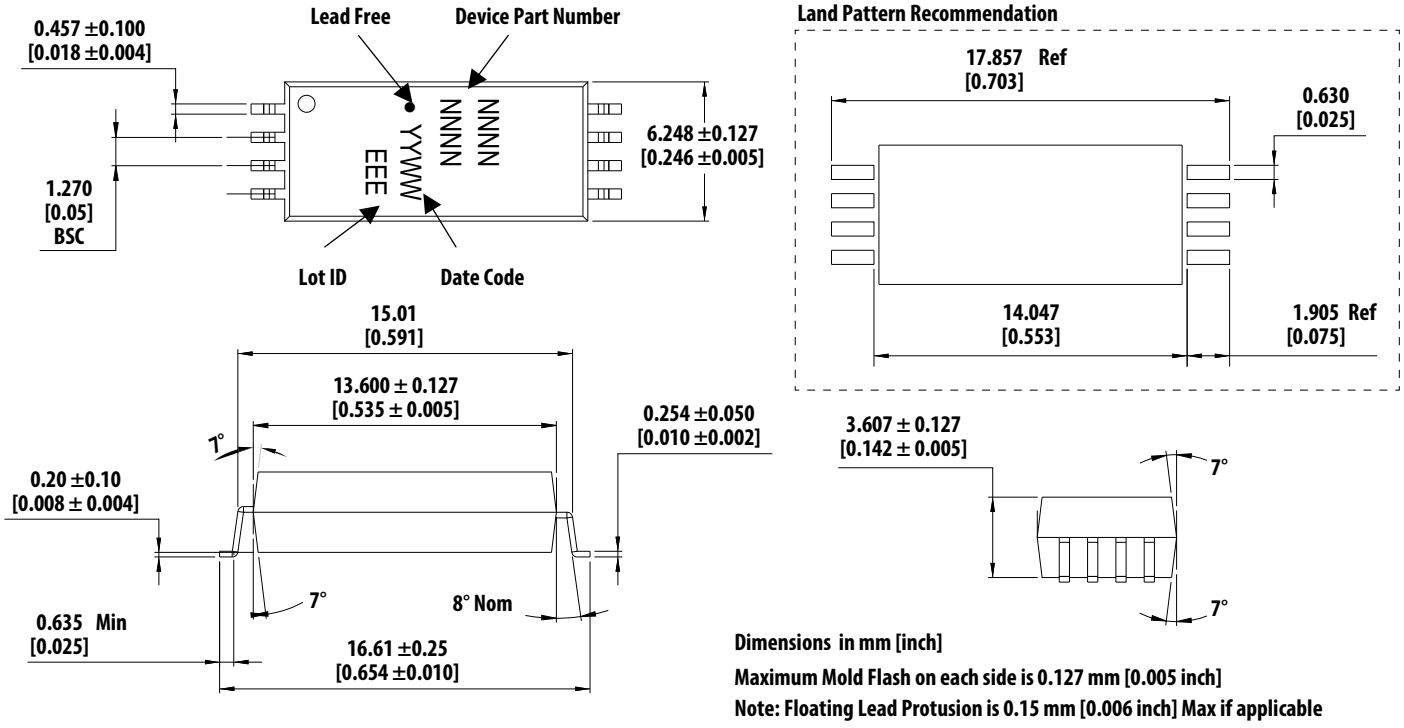
ACNT-H50L is UL Recognized with 7500 V_{rms} for 1 minute per UL1577.

Part number	Option RoHS Compliant	Package	Surface Mount	Tape & Reel	UL 1577	IEC 60747-5-5	Quantity
ACNT-H50L	-000E	14.2mm 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.

Package Outline Drawing

ACNT-H50L Stretched SO8 Package



Dimensions in mm [inch]

Maximum Mold Flash on each side is 0.127 mm [0.005 inch]

Note: Floating Lead Protusion is 0.15 mm [0.006 inch] Max if applicable

Solder Reflow Profile

Recommended reflow conditions are as per JEDEC Standard, J-STD-020 (latest revision). Non-Halide Flux should be used.

Regulatory Information

The ACNT-H50L is approved by the following organizations:

UL Approval under UL 1577, component recognition program up to V_{ISO} = 7500 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} = 2262 V_{PEAK}

Insulation and Safety Related Specifications

Parameter	Symbol	ACNT-H50L	Units	Conditions
Minimum External Air Gap (External Clearance)	L(101)	14.2	mm	Measured from input terminals to output terminals, shortest distance through air.
Minimum External Tracking (External Creepage)	L(102)	14.2	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 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	Unit
Installation classification per DIN VDE 0110/39, Table 1 for rated mains voltage ≤ 600 V_{rms} for rated mains voltage ≤ 1000 V_{rms}		 I – IV I – IV	
Climatic Classification		40/105/21	
Pollution Degree (DIN VDE 0110/39)		2	
Maximum Working Insulation Voltage	V_{IORM}	2262	V_{peak}
Input to Output Test Voltage, Method b* V_{IORM} x 1.875=V_{PR}, 100% Production Test with t_m=1 sec, Partial discharge < 5 pC	V_{PR}	4241	V_{peak}
Input to Output Test Voltage, Method a* V_{IORM} x 1.6=V_{PR}, Type and Sample Test, t_m=10 sec, Partial discharge < 5 pC	V_{PR}	3619	V_{peak}
Highest Allowable Overvoltage (Transient Overvoltage t_{ini} = 60 sec)	V_{IOTM}	12000	V_{peak}
Safety-limiting values – maximum values allowed in the event of a failure. Case Temperature Input Current Output Power	 T_S $I_{S, INPUT}$ $P_{S, OUTPUT}$	 150 230 1000	 °C mA mW
Insulation Resistance at T_S, V_{IO} = 500 V	R_S	$>10^9$	Ω

* 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.

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 (<1μs Pulse Width, <10% Duty Cycle)	$I_{F(peak)}$		80	mA
Peak Transient Input Current (≤1μs pulse width, <300ps)	$I_{F(trans)}$		1	A
Reversed Input Voltage	V_R		5	V
Input Power Dissipation	P_{IN}		35	mW
Output Power Dissipation	P_O		100	mW
Average Output Current	$I_{O(AVG)}$		8	mA
Peak Output Current	$I_{O(PEAK)}$		16	mA
Supply Voltage	V_{CC}	-0.5	30	V
Output Voltage	V_O	-0.5	24	V
Lead Solder Temperature	T_{LS}	260°C for 10 sec, 1.6 mm below seating plane		
Solder Reflow Temperature Profile		Refer to 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

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 values are at T_A = 25°C

Parameter	Sym.	Min.	Typ.	Max.	Units	Conditions			Fig.
Current Transfer Ratio	CTR[1]	31	50	80	%	T_A = 25°C	V_O=0.4V	V_{CC}= 3.3V or 5V I_F= 12mA	2,3
		21			%		V_O=0.5V		
Logic Low Output Voltage	V_{OL}		0.2	0.4	V	T_A = 25°C	I_O=3mA	V_{CC}= 3.3V or 5V I_F= 12mA	
			0.2	0.5	V		I_O=1.6mA		
Logic High Output Current	I_{OH}		0.014	0.5	µA	T_A = 25°C	V_O=V_{CC}=5.5V	I_F=0mA	4,5
			0.06	1			V_O=V_{CC}=24V		
				80			V_O=V_{CC}=24V		
Logic Low Supply Current	I_{CCL}		200	400	µA		I_F = 12mA, V_O = open, V_{CC} = 24V		
Logic High Supply Current	I_{CCH}			2	µA		I_F = 0mA, V_O = open, V_{CC} = 24V		
Input Forward Voltage	V_F	1.10	1.45	1.70	V		I_F= 12mA		1
Input Reversed Breakdown Voltage	BV_R	7			V		I_R=10µA		
Temperature Coefficient of Forward Voltage	$\Delta V_F/\Delta T_A$		-1.5		mV/°C		I_F=12mA		
Input Capacitance	C_{IN}		20		pF		f = 1MHz, V_F = 0		

Notes:
1. 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%.

Switching Specifications

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

Parameter	Symbol	Min.	Typ.	Max.	Units	Test Conditions		Fig.
Propagation Delay Time to Logic Low at Output	T_{PHL}		0.1	0.8	µs	T_A=25°C	Pulse: f = 10kHz, Duty cycle = 50%, VCC = 3.3 V, RL= 1.0kΩ, CL = 15pF, V_{THHL} = 1.5V	15
				1.0	µs			6, 15
			0.1	0.8	µs	T_A=25°C	Pulse: f = 10kHz, Duty cycle = 50%, V_{CC} = 5.0 V, R_L= 1.6kΩ, C_L = 15pF, V_{THHL} = 1.5V	15
				1.0	µs			7, 15
			0.15	0.8	µs	T_A=25°C	Pulse: f = 10kHz, Duty cycle = 50%, V_{CC} = 24V, R_L= 8.2kΩ, C_L = 15pF, V_{THHL} = 1.5V	15
				1.0	µs			8, 15
Propagation Delay Time to Logic High at Output	T_{PLH}		0.4	1.0	µs	T_A=25°C	Pulse: f = 10kHz, Duty cycle = 50%, V_{CC} = 3.3 V, R_L = 1.0kΩ, C_L = 15pF V_{THLH} = 2.0V	15
				1.3	µs			6,15
			0.4	1.0	µs	T_A=25°C	Pulse: f = 10kHz, Duty cycle = 50%, V_{CC} = 5.0 V, R_L = 1.6kΩ, C_L = 15pF, V_{THLH} = 2.0V	15
				1.3	µs			7, 15
			0.4	1.0	µs	T_A=25°C	Pulse: f = 10kHz, Duty cycle = 50%, V_{CC} = 24V, R_L = 8.2kΩ, C_L = 15pF, V_{THLH} = 2.0V	15
				1.3	µs			8, 15
Propagation Delay Difference Between Any two Parts[2]			0.4	0.8	µs	T_A=25°C	Pulse: f = 10kHz, Duty cycle = 50%, V_{CC} = 3.3 V , R_L = 1.0kΩ, C_L = 15pF, V_{THHL} = 1.5V, V_{THLH} = 2.0V	
			0.3	0.6	µs	T_A=25°C	Pulse: f = 10kHz, Duty cycle = 50%, V_{CC} = 5.0V, R_L = 1.6kΩ, C_L = 15pF, V_{THHL} = 1.5V, V_{THLH} = 2.0V	
			0.3	0.6	µs	T_A=25°C	Pulse: f = 10kHz, Duty cycle = 50%, V_{CC} = 24V, R_L = 8.2kΩ, C_L = 15pF, V_{THHL} = 1.5V, V_{THLH} = 2.0V	
Common Mode Transient Immunity at Logic High Output[3]	$\|CM_H\|$	15	40		kV/µs	T_A=25°C	V_{CM} = 1500V, I_F = 0mA, R_L = 1.0kΩ or 1.6kΩ, V_{CC} = 3.3 V / 5V	16
Common Mode Transient Immunity at Logic Low Output[4]	$\|CM_L\|$	15	40		kV/µs	T_A=25°C	V_{CM} = 1500V, I_F = 12mA, R_L = 1.6kΩ, V_{CC} = 5V	16
		15	40		kV/µs	T_A=25°C	V_{CM} = 1500V, I_F = 12mA, R_L = 1.0kΩ, V_{CC} = 3.3V	16

Notes:

2. The difference between t_{PLH} and t_{PHL} between any two parts under the same test condition
3. 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.
4. 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[5]	V_{ISO}	7500			V_{rms}	RH ≤ 50%, t = 1 min., $T_A = 25°C$
Input-Output Resistance[5]	R_{I-O}		10^{14}		Ω	V_{I-O} = 500 Vdc
Input-Output Capacitance[5]	C_{I-O}		0.6		pF	f = 1 MHz, $T_A = 25°C$

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

Figure 1 Input Current vs. Forward Voltage

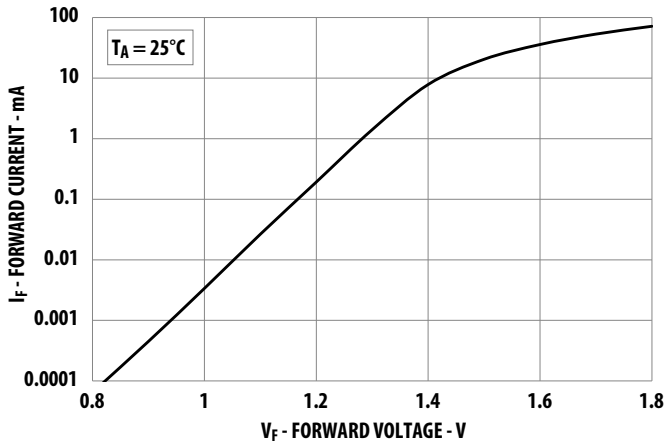


Figure 2 Typical Current Transfer Ratio vs. Temperature

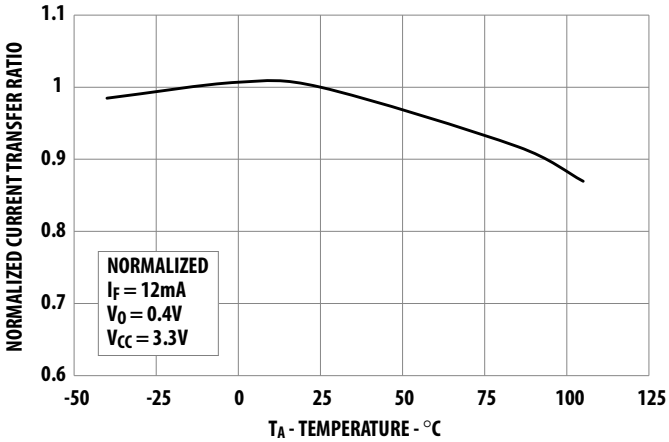


Figure 3 Typical Current Transfer Ratio vs. Temperature

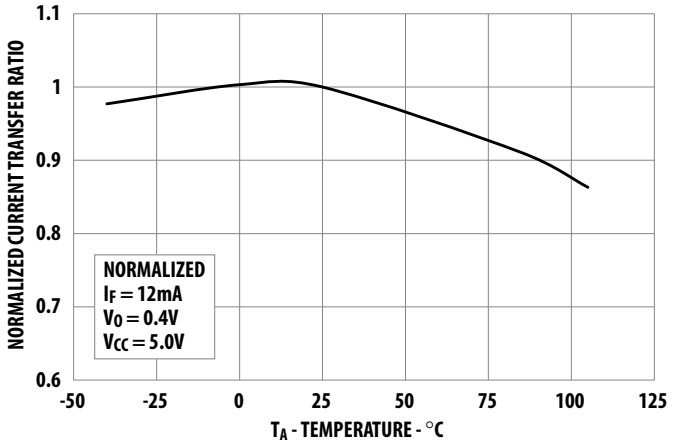


Figure 4 Typical Logic High Output Current vs. Temperature

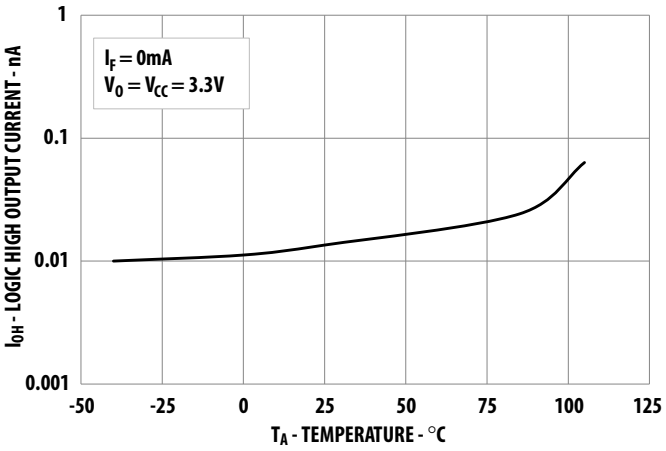


Figure 5 Typical Logic High Output Current vs. Temperature

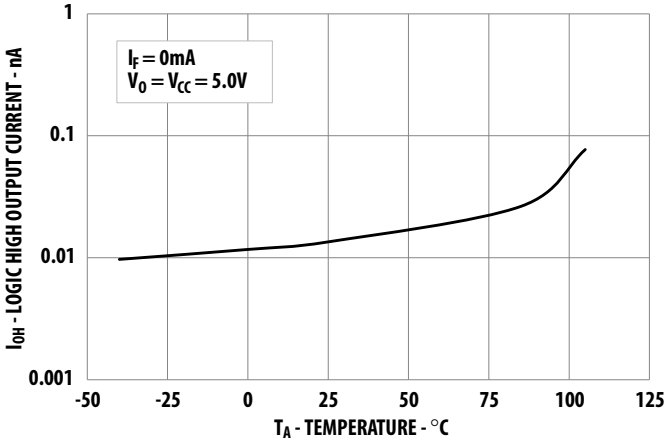


Figure 6 Typical Propagation Delay vs. Temperature

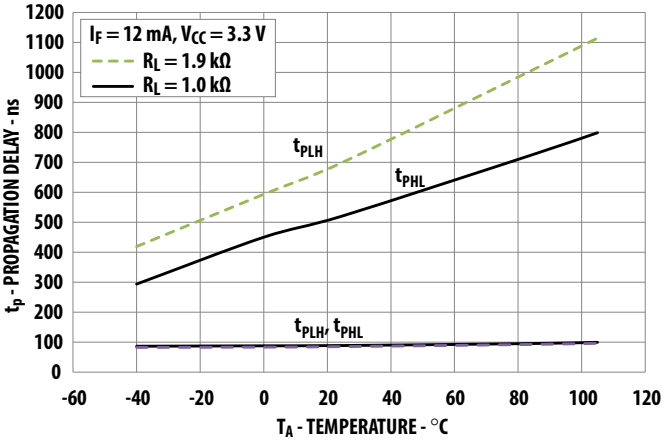


Figure 7 Typical Propagation Delay vs. Temperature

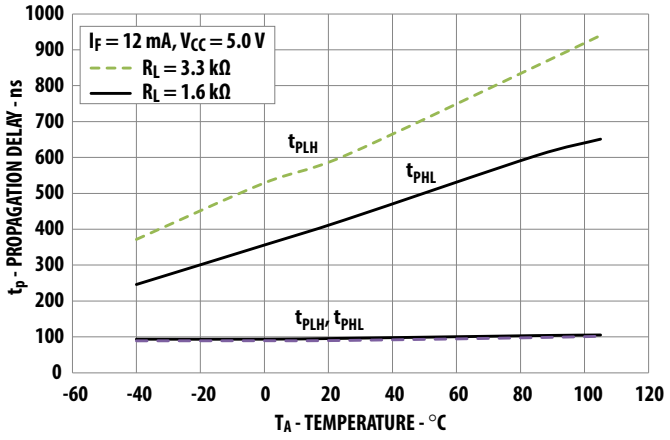


Figure 8 Typical Propagation Delay vs. Temperature

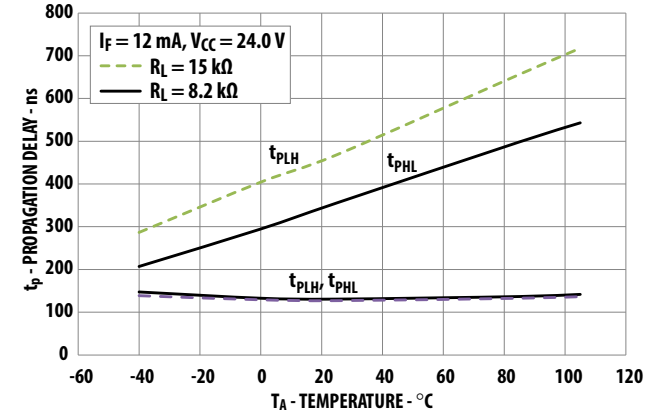


Figure 9 Typical Propagation Delay vs. Load Resistance

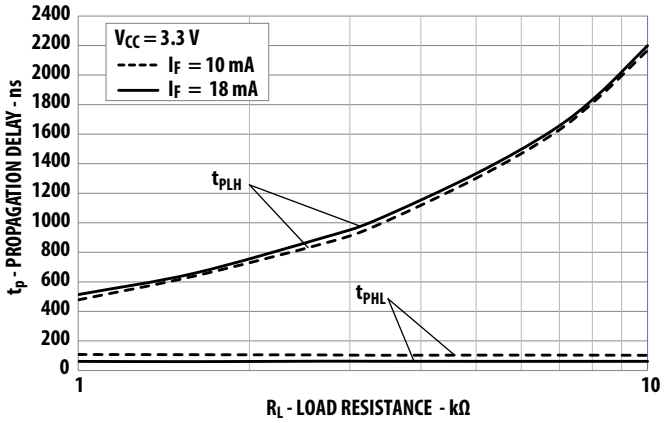


Figure 10 Typical Propagation Delay vs. Load Resistance

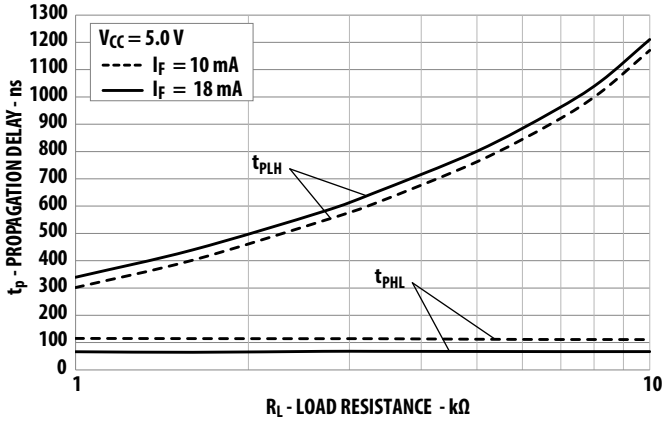


Figure 11 Typical Propagation Delay vs. Supply Voltage

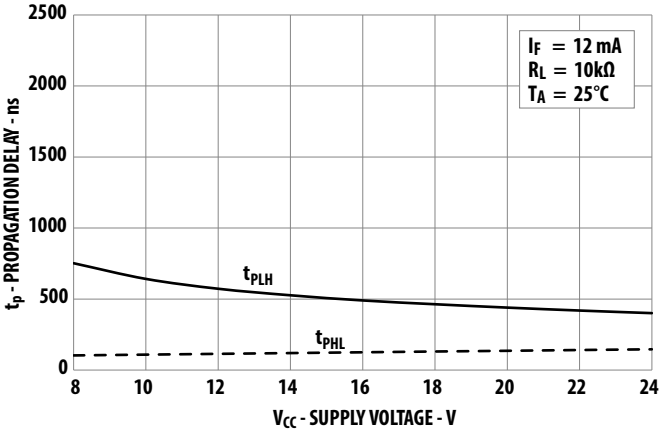


Figure 12 Typical Propagation Delay vs. Input Current

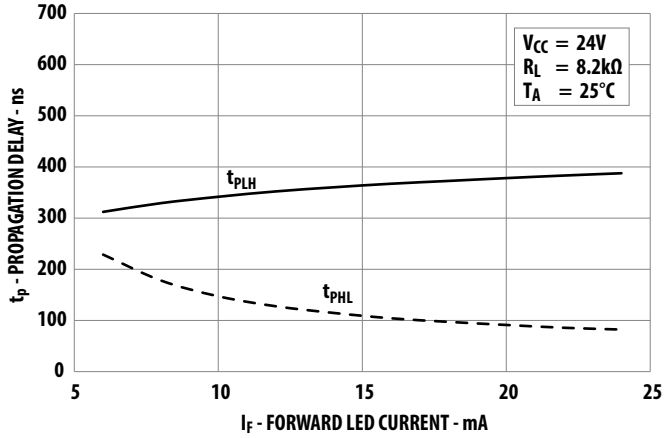


Figure 13 Current Transfer Ratio vs Input Current

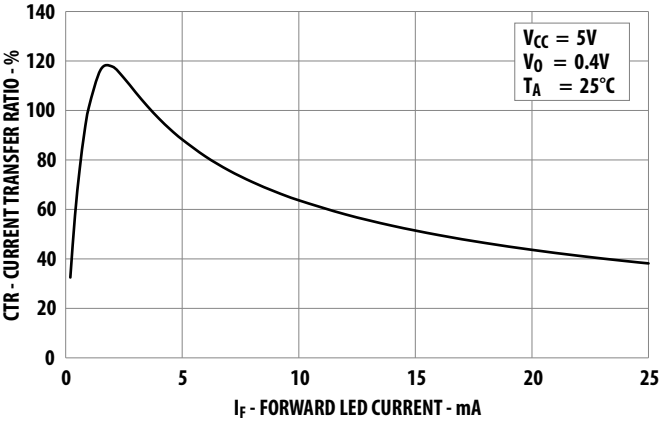
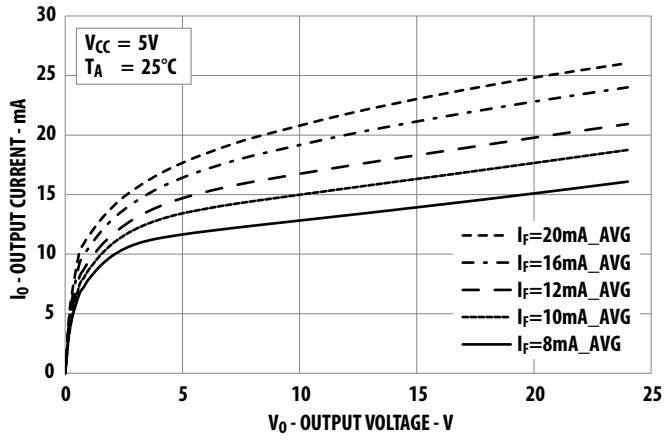


Figure 14 DC Pulse Transfer Characteristic



Test Circuits

Figure 15 Switching Test Circuits

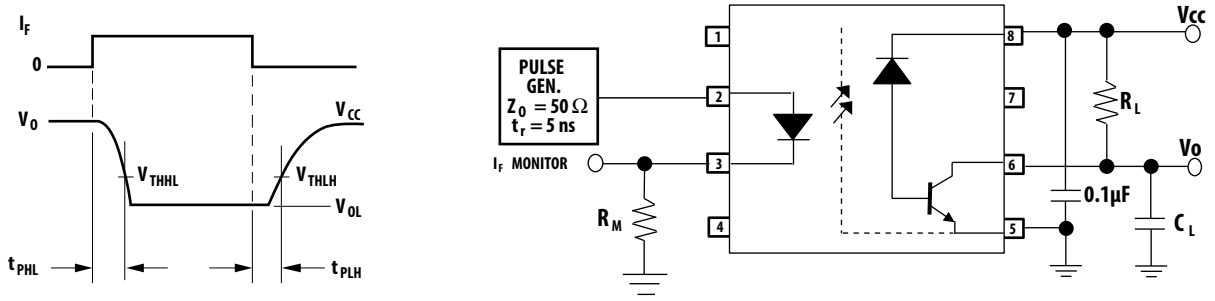
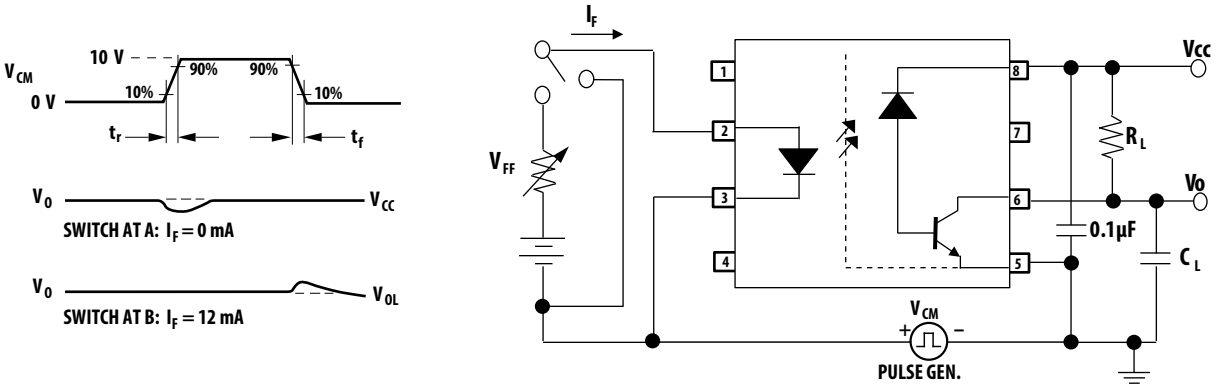


Figure 16 Test Circuit for Transient Immunity and typical waveforms



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Lead (Pb) Free
RoHS 6 fully compliant
RoHS 6 fully compliant options available;
-xxxE denotes a lead-free product