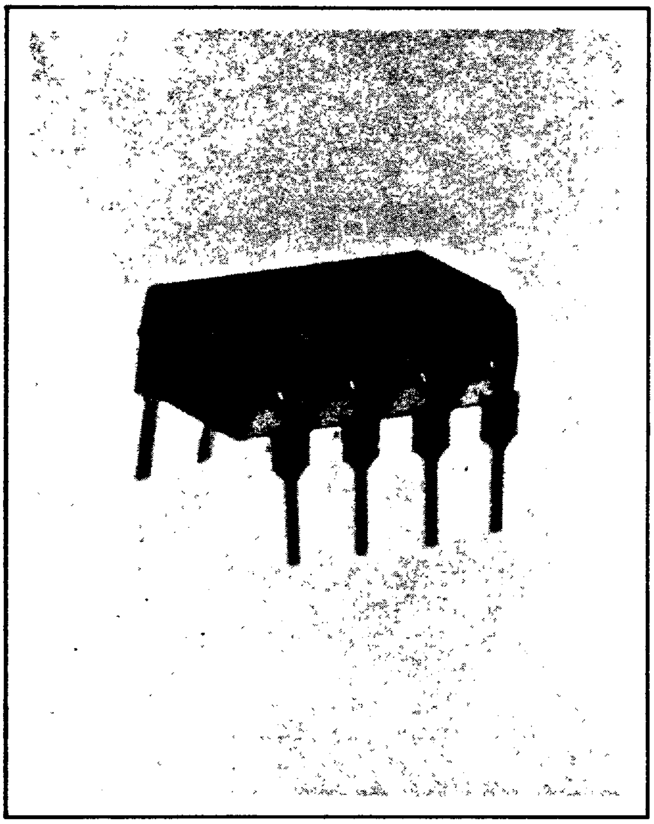
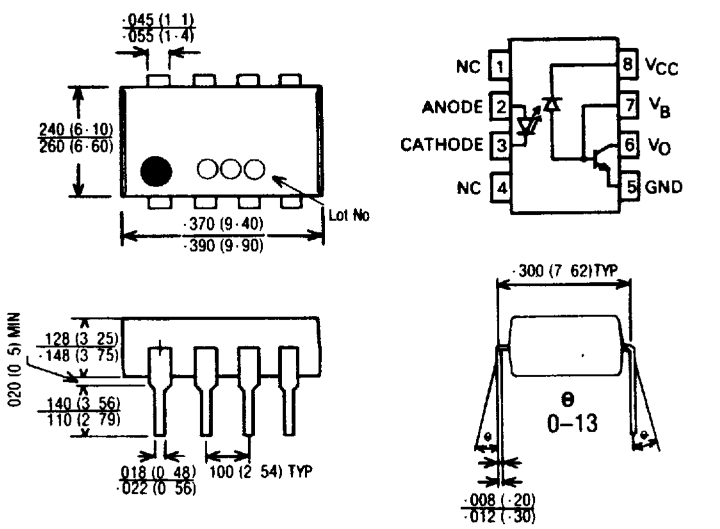
T-41-83

ICPL2502, ICPL2503

TTL COMPATIBLE OPTO ISOLATORS



PACKAGE DIMENSIONS IN INCHES (MM)



FEATURES

- High Speed: 1 Mbit/s
- TTL Compatible
- High Common Mode Transient Immunity: 1000V/μs
- 3000 V dc Withstand Test Voltage
- 2 MHz Bandwidth
- Open Collector Output

DESCRIPTION

These diode-transistor optocouplers use a light emitting diode and an integrated photon detector to provide 3000V dc electrical insulation between input and output. Separate connection for the photodiode bias and output transistor collector improve the speed up to a hundred times that of a conventional photo-transistor coupler by reducing the base-collector capacitance.

All electrical parameters are 100% tested. Specifications are guaranteed to a cumulative 0·65% AQL.

ABSOLUTE MAXIMUM RATINGS (25°C unless otherwise noted)

Storage Temperature .... −55° C to +125° C
Operating Temperature .... −55° C to +100° C
Lead Soldering Temperature
(1/16 inch (1·6mm) from case for 10 seconds)..260° C

Input Diode
Average Current-I_F 25mA (1)
Peak Current-I_F 50mA (2)
(50% duty cycle, 1 ms pulse width)
Peak Transient Current-I_F .... 1·0A
(≤ 1 μs pulse width, 300 pps)
Reverse Voltage-V_R (Pin 3-2) 5V
Power Dissipation 45mW (3)

Output Transister
Average Current-I_O (Pin 6) 8mA
Peak Current 16mA
Emitter-Base Reverse Voltage (Pin 5-7) 5V
Supply and Voltage-V_{CC}(Pin 8-5), V_O(Pin6-5) −0·5 to 15V
Base Current-I_B (Pin 7) 5mA
Power Dissipation 100mW (4)

See notes, following page

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ELECTRICAL CHARACTERISTICS (Over recommended temperature 0° C to 70° C unless specified)

Parameter		Min	Typ*	Max	Units	Test Conditions	Fig.	Note
Current Transfer Ratio CTR	ICPL2502	15		22	%	$I_F = 16mA, V_O = 0 \cdot 4V,$		
	ICPL2503	12	20		%	$V_{CC} = 4 \cdot 5V, T_A = 25°C$		
		9	15		%	$I_F = 16mA, V_O = 0 \cdot 5V, V_{CC} = 4 \cdot 5V$	1, 2	5
		11			%	$I_F = 8mA, V_O = 0 \cdot 5V, V_{CC} = 4 \cdot 5V$		
		15			%	$I_F = 8mA, V_O = 0 \cdot 5V, V_{CC} = 4 \cdot 5V, T_A = 25°C$		
Logic Low Output Voltage V_{OL}	ICPL2503		0·2	0·5	V	$I_F = 16mA, I_O = 1 \cdot 1mA, V_{CC} = 4 \cdot 5V$		
			0·2	0·5	V	$I_F = 8mA, I_O = 0 \cdot 7mA, V_{CC} = 4 \cdot 5V$		
	ICPL2502		0·1	0·4	V	$I_F = 16mA, I_O = 2 \cdot 4mA, V_{CC} = 4 \cdot 5V$		
Logic High Output Current I_{OH}			3	500	nA	$I_F = 0mA, V_O = V_{CC} = 5 \cdot 5V, T_A = 25°C$	6	
			0·01	1	μA	$I_F = 0mA, V_O = V_{CC} = 15V \quad T_A = 25°C$		
				50	μA	$I_F = 0mA, V_O = V_{CC} = 15V$		
Logic Low Supply Current I_{CCL}	ICPL2502		40		uA	$I_F = 16mA, V_O = \text{open}, V_{CC} = 15V$		
	ICPL2503		20		uA	$I_F = 8mA, V_O = \text{open}, V_{CC} = 5 \cdot 5V$		
Logic High Supply Current I_{CCH}	ICPL2502		0·02	1	uA	$I_F = 0mA, V_O = \text{open}, V_{CC} = 15V, T_A = 25°C$		
				2	μA	$I_F = 0mA, V_O = \text{open}, V_{CC} = 15V$		
	ICPL2503			4	uA	$I_F = 0, V_O = \text{open}, V_{CC} = 5 \cdot 5V$		
Input Forward Voltage	V_F		1·5	1·7	V	$I_F = 16mA \quad T_A = 25°C$	3	
Temperature Coefficient of Forward Voltage	$\frac{\Delta V_F}{\Delta T_A}$		-1·6		mV/°C	$I_F = 16mA$		
Input Reverse Breakdown Voltage	BV_R	5			V	$I_R = 10\mu A, T_A = 25°C$		
Input Capacitance	C_{IN}		60		pF	$f = 1$ MHz, $V_F = 0$		
Input-Output Insulation Leakage Current	I_{IO}			1·0	uA	45% Relative Humidity, t = 5 sec. $V_{IO} = 3KVdc, T_A = 25°C$		6
Resistance (Input to Output)	R_{IO}		10^{12}		Ω	$V_{IO} = 500V$ dc		6
Capacitance (Input to Output)	C_{IO}		0·6		pF	$f = 1$ MHz		6
Transistor DC Current Gain	H_{FE}		175			$V_O = 5V, I_O = 3mA$		

* All typicals at $T_A = 25°C$

SWITCHING SPECIFICATIONS AT $T_A = 25°C$ ($V_{CC} = 5V, I_F = 16mA$ unless otherwise specified)

Parameter		Typ.	Max	Units	Test Conditions	Fig	Note
Propagation Delay Time t_{PHL}	ICPL2502	0·3	0·8	us	$R_L = 1 \cdot 9K\Omega$	5,8	8
	ICPL2503	0·4	1·5	us	$R_L = 4 \cdot 7K\Omega$	9	10,11
Propagation Delay Time t_{PLH}	ICPL2502	0·4	0·8	us	$R_L = 1 \cdot 9K\Omega$	5,8	8
	ICPL2503	1·7	2·5	us	$R_L = 4 \cdot 7K\Omega$	9	10,11
Common Mode Transient Immunity at Logic High Level Output CM_H	ICPL2502	1000		V/us	$I_F = 0mA, V_{CM} = 10V_{pp}, R_L = 1 \cdot 9K\Omega$	11	8,9
	ICPL2503	1000		V/us	$I_F = 0mA, V_{CM} = 10V_{pp}, R_L = 4 \cdot 7K\Omega$		9,11
Common Mode Transient Immunity at Logic Low Level Output CM_L	ICPL2502	−1000		V/us	$V_{CM} = 10V_{pp}, R_L = 1 \cdot 9K\Omega$	11	8,9
	ICPL2503	−1000		V/us	$V_{CM} = 10V_{pp}, R_L = 4 \cdot 7K\Omega$		9,11
Bandwidth	BW	2		MHz	$R_L = 100\Omega$	7	11

NOTES:

1. Derate linearly above 70°C free-air temperature at a rate of 0·8mA/°C.
2. Derate linearly above 70°C free-air temperature at a rate of 1·6mA/°C.
3. Derate linearly above 70°C free-air temperature at a rate of 0·9mW/°C.
4. Derate linearly above 70°C free-air temperature at a rate of 2·0mW/°C.
5. CURRENT TRANSFER RATIO is defined as the ratio of output collector current, I_O, to the forward LED input current, I_F, times 100%.
6. Device considered a two-terminal device: Pins 1,2,3 and 4 shorted together and Pins 5,6,7 and 8 shorted together.
7. Common mode transient immunity in Logic High level is the maximum tolerable (positive) dv_{cm}/dt on the leading edge of the common mode pulse V_{CM} to assure that the output will remain in a Logic High state (i.e. $V_O > 2 \cdot 0V$). Common mode transient immunity in Logic Low level is the maximum tolerable (negative) dv_{cm}/dt on the trailing edge of the common mode pulse signal, V_{CM}, to assure that the output will remain in Logic Low State (i.e. $V_O < 0 \cdot 8V$).
8. The 1·9KΩ load represents 1 TTL unit load of 1·6mA and a 5·6KΩ pull-up resistor.
9. The frequency at which the A.C. output voltage is 3db below the low frequency asymptote.
10. The 7·5KΩ load represents 1 LSTTL unit load of 0·36 mA and a 20KΩ pull-up resistor.
11. The 4·7KΩ load represents 1 LSTTL unit load of 0·36 mA and an 8·2KΩ pull-up resister.

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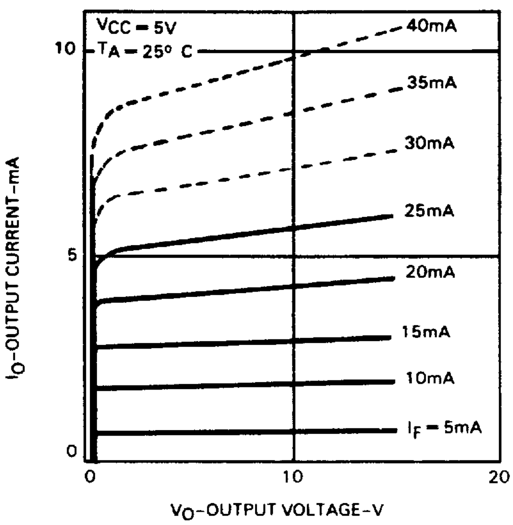
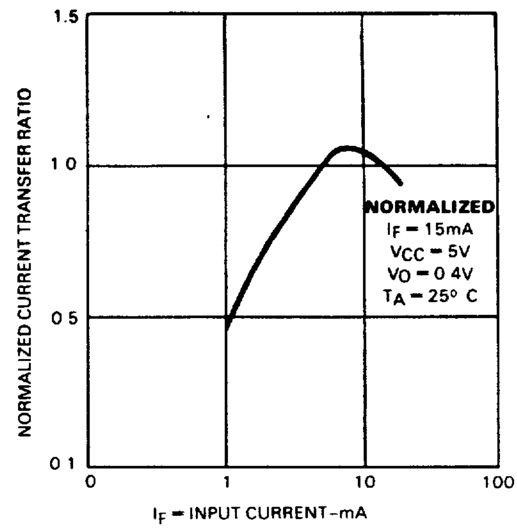
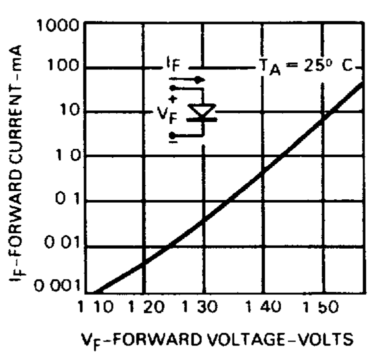
1. DC AND PULSED TRANSFER CHARACTERISTICS



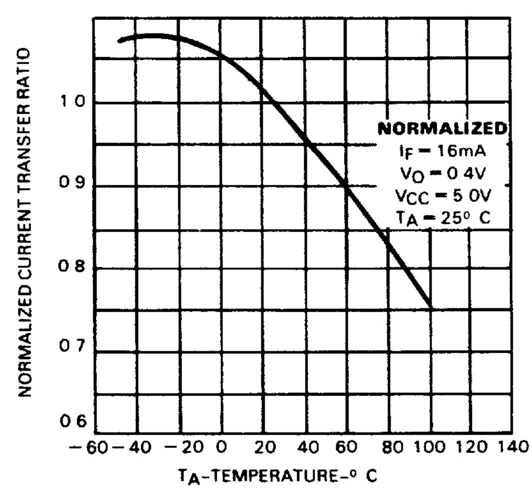
2. CURRENT TRANSFER RATIO vs INPUT CURRENT



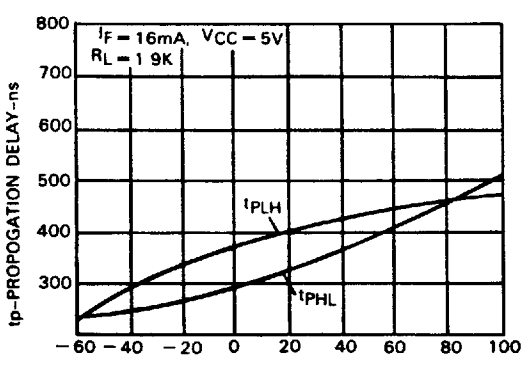
3. INPUT DIODE FORWARD CURRENT vs FORWARD VOLTAGE



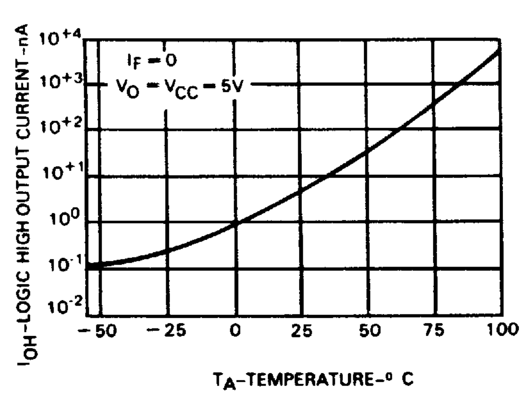
4. CURRENT TRANSFER RATIO vs TEMPERATURE



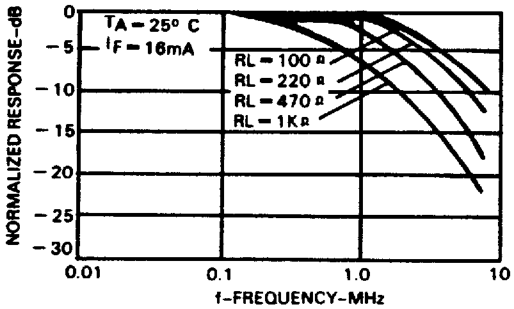
5. PROPAGATION DELAY vs TEMPERATURE

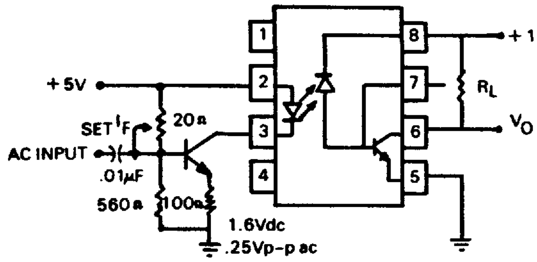


6. LOGIC HIGH OUTPUT CURRENT vs TEMPERATURE

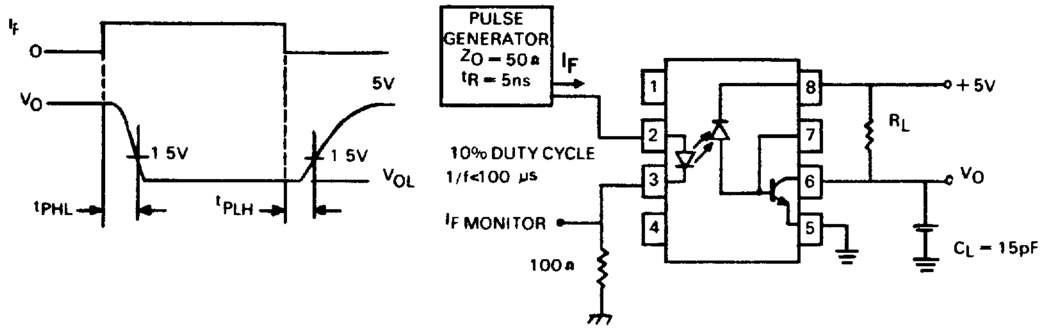


7. FREQUENCY RESPONSE

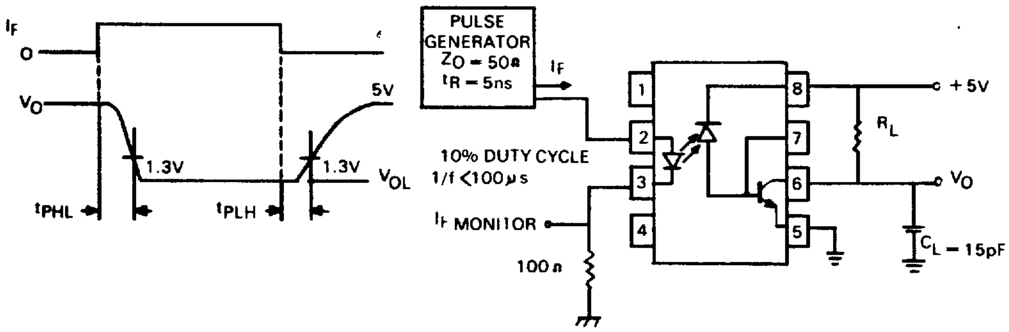




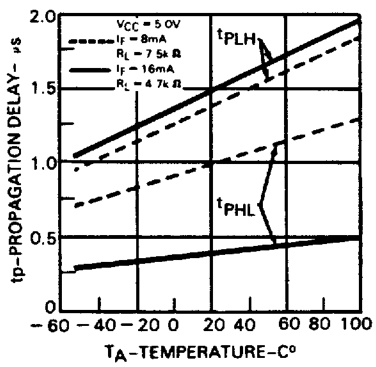
8. SWITCHING TEST CIRCUIT (ICPL 2502)



9. SWITCHING TEST CIRCUIT (ICPL 2503)



10. PROPAGATION DELAY vs TEMPERATURE



11. TEST CIRCUIT FOR TRANSIENT IMMUNITY AND TYPICAL WAVEFORMS