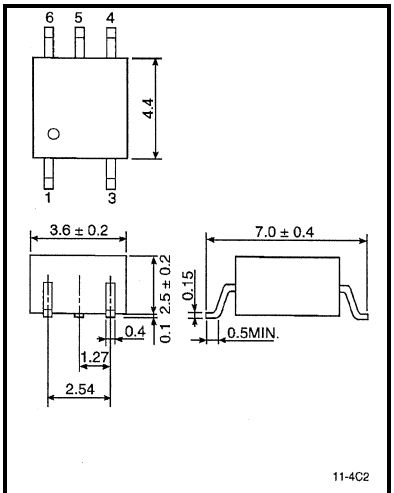
TOSHIBA PHOTOCOUPLER GaAℓAs LED & PHOTO-IC

TLP117

PDP (Plasma Display Panel)
FA (Factory Automation)
High-Speed Interface

The Toshiba TLP117 consists of a GaAℓAs light-emitting diode and an integrated high-gain, high-speed photodetector.

- Inverter logic (totempole output)
- Package type : MFSOP6
- Guaranteed performance over temperature : -40 to 105°C
- Power supply voltage : 4.5 to 5.5V
- Input thresholds current : I_{FHL}=5mA(Max.)
- Propagation delay time (tpHL/tpLH) : 30ns(Max.) at VL=0V
- 20ns(Max.) at VL=1.1V
- Switching speed : 50MBd(TYP.)
- Common mode transient immunity : 10kV/μs (Min.)
- Isolation voltage : 3750Vrms
- UL Recognized : UL1577,File No.E67349



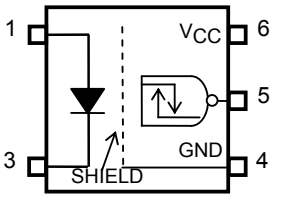
TOSHIBA 11-4C2

Weight: 0.09 g(Typ.)

Truth Table

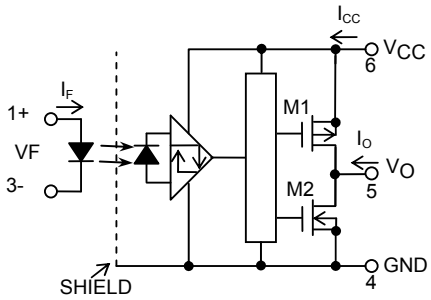
Input	LED	M1	M2	Output
H	ON	OFF	ON	L
L	OFF	ON	OFF	H

Pin Configuration (Top View)



1:ANODE
3:CATHODE
4:GND
5: V_O
6: V_{CC}

Schematic



0.1μF bypass capacitor must be connected between pins 6 and 4

Absolute Maximum Ratings (Ta=25°C)

Characteristic		Symbol	Rating	Unit
LED	Forward current	I_F	25	mA
	Forward current derating (Ta≥85°C)	ΔIF/ΔTa	-0.7	mA/°C
	Peak transient forward current (Note1)	I_{FPT}	1	A
	Reverse voltage	V_R	6	V
DETECTOR	Output current	I_O	10	mA
	Output voltage	V_O	6	V
	Supply voltage	V_{CC}	6	V
	Output power dissipation	P_O	40	mW
Operating temperature range		T_{opr}	-40 to 105	°C
Storage temperature range		T_{stg}	-55 to 125	°C
Lead solder temperature(10s)		T_{sol}	260	°C
Isolation voltage (AC,1min.,R.H.≤60%,Ta=25°C) (Note2)		BVs	3750	Vrms

Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings.
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook (“Handling Precautions”/“Derating Concept and Methods”) and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Note1: Pulse width PW≤1μs,300pps.

Note2: This device is regarded as a two-terminal device: pins 1 and 3 are shorted together, and pins 4,5 and 6 are shorted together.

Recommended Operating Conditions

Characteristic	Symbol	Min	Typ.	Max	Unit
Input current , ON	$I_{F(ON)}$	10	—	16	mA
Input voltage , OFF	$V_{F(OFF)}$	0	—	1.0	V
Supply voltage(*) (Note3)	V_{CC}	4.5	5.0	5.5	V

* This item denotes operating ranges, not meaning of recommended operating conditions.

Note : Recommended operating conditions are given as a design guideline to obtain expected performance of the device. Additionally, each item is an independent guideline respectively. In developing designs using this product, please confirm specified characteristics shown in this document.

Note3 : The detector of this product requires a power supply voltage (V_{CC}) of 4.5 V or higher for stable operation. If V_{CC} is lower than this value, I_{CC} may increase or the output may be unstable.
Be sure to use the product after checking the supply current, and the operation of a power-on/-off.

Electrical Characteristics

(Unless otherwise specified, Ta=-40 to 105°C, V_{CC} =4.5 to 5.5V)

Characteristic		Symbol	Test Circuit	Conditions		Min.	Typ.	Max.	Unit
Input forward voltage		V_F	—	I_F=10mA , Ta=25°C		1.45	1.6	1.85	V
Temperature coefficient of forward voltage		$\Delta V_F/\Delta Ta$	—	I_F=10mA		—	-2.0	—	mV/°C
Input reverse current		I_R	—	V_R=5V,Ta=25°C		—	—	10	μA
Input capacitance		C_T	—	V=0,f=1MHz,Ta=25°C		—	60	—	pF
Output voltage	"L" Level	V_{OL}	1	I_{OL}=4mA, I_F=10mA		—	—	0.6	V
	"H" Level	V_{OH}	2	I_{OH}=-4mA, V_F=1.05V,	V_{CC}=4.5V	3.9	—	—	V
					V_{CC}=5.5V	4.9	—	—	
Supply current	"L" Level	I_{CCL}	3	I_F=10mA		—	—	5.0	mA
	"H" Level	I_{CCH}	4	V_F=0V		—	—	5.0	mA
Input current	H → L	I_{FHL}	—	I_O=20μA,V_O<0.3V		—	—	5	mA
Input voltage	L → H	V_{FLH}	—	I_O=-20μA,V_O>4.0V		0.8	—	—	V

*All typical values are at Ta=25°C unless otherwise specified.

Isolation Characteristics (Ta = 25°C)

Characteristic	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Capacitance input to output	C_S	V = 0,f = 1MHz (Note 2)	—	0.8	—	pF
Isolation resistance	R_S	R.H. ≤ 60%,V_S = 500V (Note 2)	1×10^{12}	10^{14}	—	Ω
Isolation voltage	BV_S	AC,1 minute	3750	—	—	V_{rms}
		AC,1 second,in oil	—	10000	—	
		DC,1 minute,in oil	—	10000	—	Vdc

Note 4: A ceramic capacitor (0.1 μF) should be connected from pin 6 to pin 4 to stabilize the operation of the high gain linear amplifier. Failure to provide the bypass may impair the switching property.
The total lead length between capacitor and coupler should not exceed 1 cm.

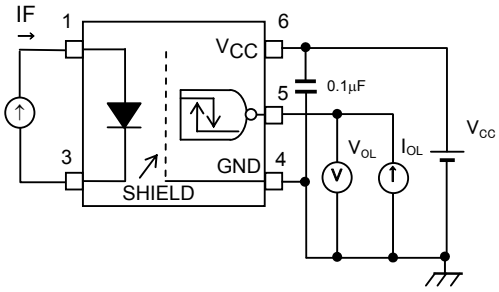
Switching Characteristics
(Unless otherwise specified, Ta=-40 to 105°C, V_{CC}=4.5 to 5.5V)

Characteristic	Symbol	Test Circuit	Conditions		Min.	Typ.	Max.	Unit
Propagation delay time to logic high output	tpHL	5	V_{IN}=0 to 5V	R_{IN}=360Ω, C_{IN} =22pF, VL=0V (Note 5)	—	—	30	ns
Propagation delay time to logic low output	tpLH		V_{IN}=5 to 0V		—	—	30	ns
Switching time dispersion between ON and OFF	|tpHL-tpLH|		—		—	—	10	ns
Output fall time(90-10%)	tf		V_{IN}=0 to 5V		—	3	—	ns
Output rise time(10-90%)	tr		V_{IN}=5 to 0V		—	2	—	ns
Propagation delay time to logic high output	tpHL	6	V_{IN}=1.1 to 5V	R_{IN}=360Ω, C_{IN}=22pF, VL=1.1V (Note 5)	—	—	20	ns
Propagation delay time to logic low output	tpLH		V_{IN}=5 to 1.1V		—	—	20	ns
Propagation delay skew	tpsk		—		—	—	16	ns
Switching time dispersion between ON and OFF	|tpHL-tpLH|		—		—	2	8	ns
Output fall time(90-10%)	tf		V_{IN}=1.1 to 5V		—	3	—	ns
Output rise time(10-90%)	tr		V_{IN}=5 to 1.1V		—	3	—	ns
Data rate	T		—		—	50	—	MBd
Common mode transient immunity at high Level output	CM_H	7	V_{CM}=1000Vp-p, Ta=25°C, I_F=0mA, V_{CC} =5V, V_O(Min)=4V,		10000	—	—	V/μs
Common mode transient immunity at low level output	CM_L		V_{CM}=1000Vp-p, ,Ta=25°C, I_F=10mA, V_{CC}=5V, V_O(Max)=0.4V		-10000	—	—	V/μs

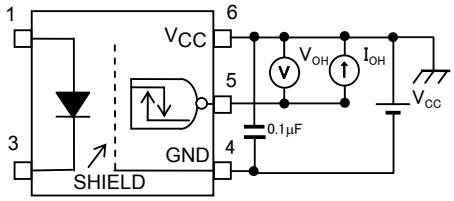
*All typical values are at Ta=25°C, V_{CC} =5V.

Note 5 : C_L is approximately 15pF which includes probe and Jig/stray wiring capacitance.

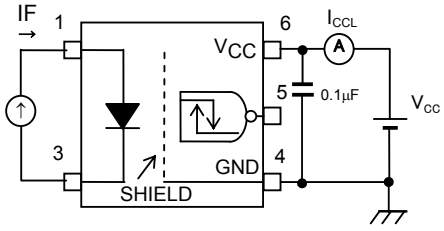
TEST CIRCUIT 1 : V_{OL}



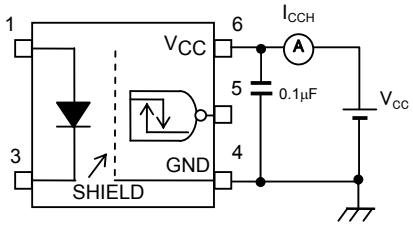
TEST CIRCUIT 2 : V_{OH}



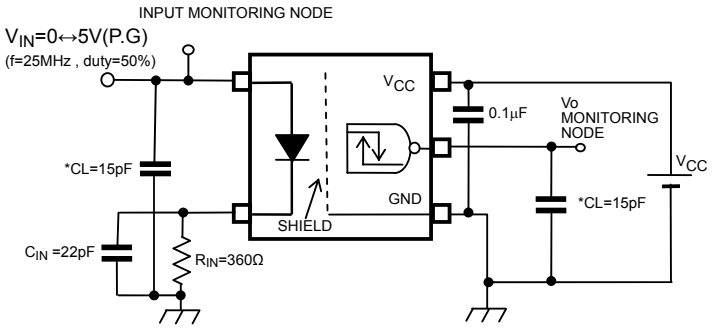
TEST CIRCUIT 3 : I_{CCL}

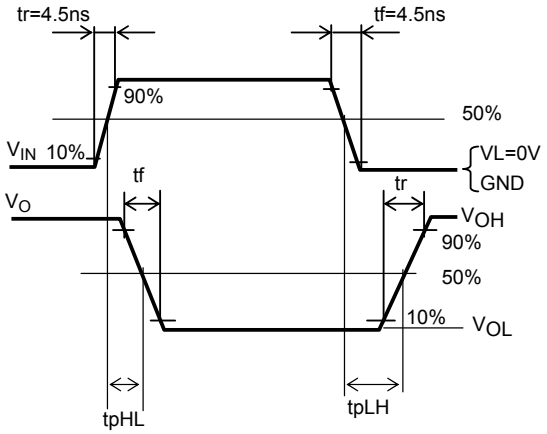


TEST CIRCUIT 4: I_{CCH}



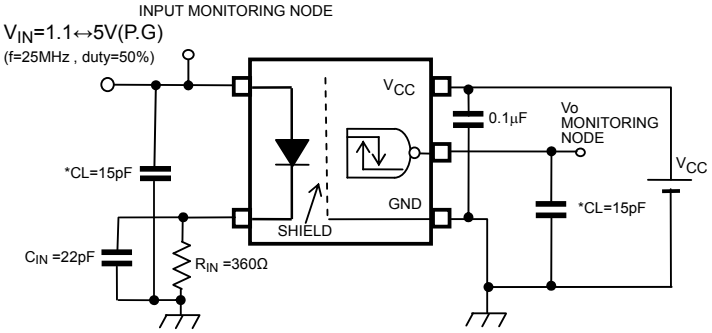
TEST CIRCUIT 5 : tpHL , tpLH

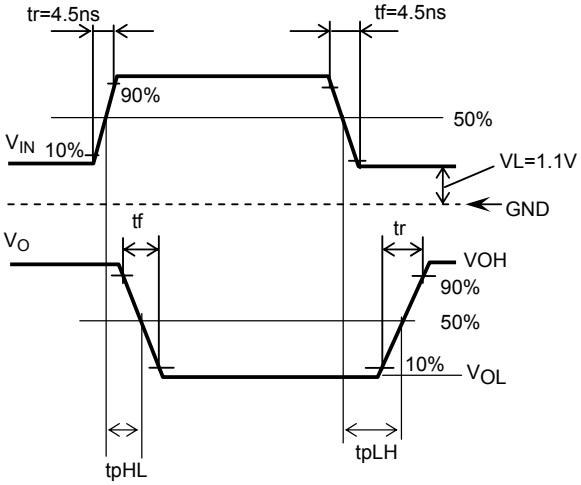




CL is capacitance of the probe and JIG.
(P.G) : Pulse Generator

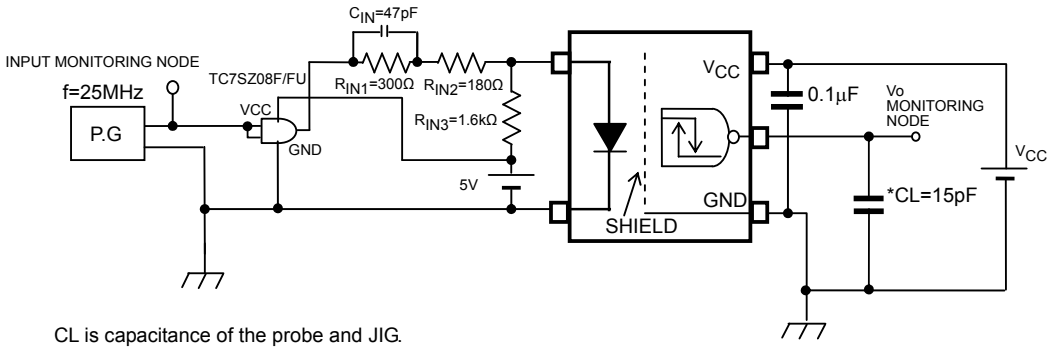
TEST CIRCUIT 6 : tpHL , tpLH





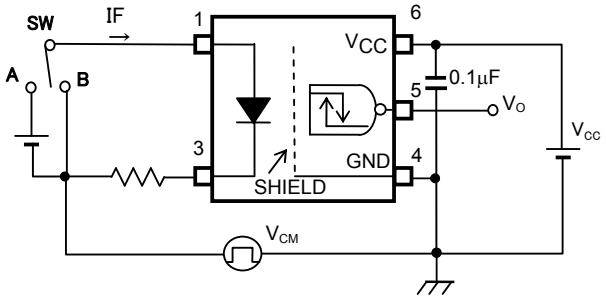
CL is capacitance of the probe and JIG.
(P.G) : Pulse Generator

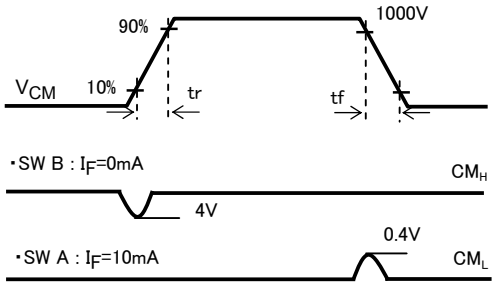
(example for LED drive circuit)



CL is capacitance of the probe and JIG.
(P.G) : Pulse Generator

TEST CIRCUIT 7 : Common-Mode Transient Immunity Test Circuit





$$CM_H = \frac{800(V)}{t_r(\mu s)} \qquad CM_L = \frac{800(V)}{t_f(\mu s)}$$

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