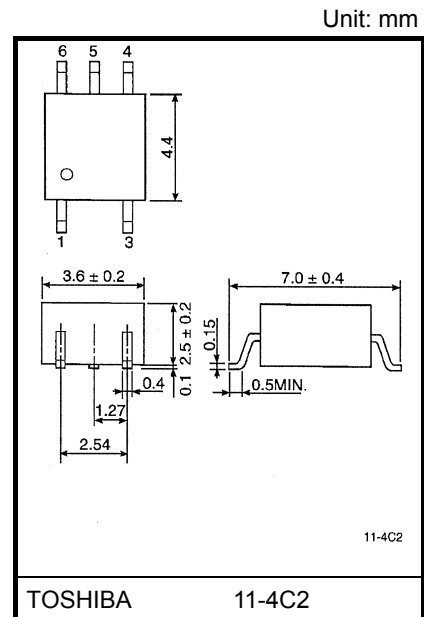


# TLP117

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 5.5 V
- Input thresholds current :  $I_{FHL}=5$  mA (max)
- Propagation delay time (tpHL/tpLH) : 30 ns (max) at VL=0 V
- 20 ns (Max) at VL=1.1 V
- Switching speed : 50 MBd (typ.)
- Common mode transient immunity : 10 kV/μs (min)
- Isolation voltage : 3750 Vrms
- UL Recognized : UL1577, File No.E67349
- c-UL Recognized: CSA Component Acceptance Service No. 5A, File No.E67349

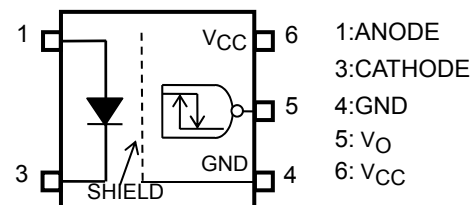


Weight: 0.09 g (typ.)

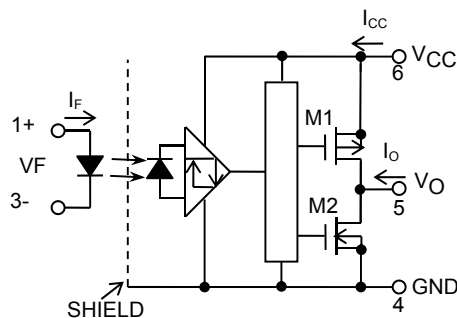
**Truth Table**

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

**Pin Configuration (Top View)**



**Schematic**



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

Start of commercial production  
 2007/05

**Absolute Maximum Ratings (Ta=25°C)**

Characteristic		Symbol	Rating	Unit
LED	Forward current	$I_F$	25	mA
	Forward current derating (Ta≥85°C)	$\Delta I_F/\Delta T_a$	-0.7	mA/°C
	Peak transient forward current (Note 1)	$I_{FPT}$	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, 1 minute, R.H. ≤ 60%, Ta=25°C) (Note 2)		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).

Note 1: Pulse width  $PW \leq 1\mu s$ , 300 pps.

Note 2: 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(*) (Note 3)	$V_{CC}$	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.

Note 3: 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, VCC =4.5 to 5.5V)

Characteristic		Symbol	Test Circuit	Conditions	Min	Typ.	Max	Unit
Input forward voltage		V <sub>F</sub>	—	I <sub>F</sub> =10 mA, Ta=25°C	1.45	1.6	1.85	V
Temperature coefficient of forward voltage		ΔV <sub>F</sub> /ΔTa	—	I <sub>F</sub> =10 mA	—	-2.0	—	mV/°C
Input reverse current		I <sub>R</sub>	—	V <sub>R</sub> =5 V, Ta=25°C	—	—	10	μA
Input capacitance		C <sub>T</sub>	—	V=0, f=1 MHz, Ta=25°C	—	60	—	pF
Output voltage	“L” Level	V <sub>OL</sub>	1	I <sub>OL</sub> =4 mA, I <sub>F</sub> =10 mA	—	—	0.6	V
	“H” Level	V <sub>OH</sub>	2	I <sub>OH</sub> =-4mA, V <sub>F</sub> =1.05V	3.9	—	—	V
				V <sub>CC</sub> =4.5V	4.9	—	—	
Supply current	“L” Level	I <sub>CCL</sub>	3	I <sub>F</sub> =10 mA	—	—	5.0	mA
	“H” Level	I <sub>CCH</sub>	4	V <sub>F</sub> =0 V	—	—	5.0	mA
Input current	H → L	I <sub>FHL</sub>	—	I <sub>O</sub> =20 μA, V <sub>O</sub> <0.3 V	—	—	5	mA
Input voltage	L → H	V <sub>FLH</sub>	—	I <sub>O</sub> =-20 μA, V <sub>O</sub> >4.0 V	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 <sub>S</sub>	V = 0, f = 1 MHz (Note 2)	—	0.8	—	pF
Isolation resistance	R <sub>S</sub>	R.H. ≤ 60%, V <sub>S</sub> = 500 V (Note 2)	1×10 <sup>12</sup>	10 <sup>14</sup>	—	Ω
Isolation voltage	BV <sub>S</sub>	AC, 1 minute	3750	—	—	V <sub>rms</sub>
		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, VCC=4.5 to 5.5V)

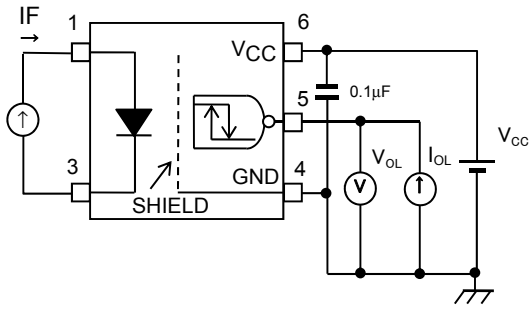
Characteristic	Symbol	Test Circuit	Conditions	Min	Typ.	Max	Unit
Propagation delay time to logic high output	$t_{pHL}$	5	$V_{IN} = 0 \rightarrow 5V$	—	—	30	ns
Propagation delay time to logic low output	$t_{pLH}$		$V_{IN} = 5 \rightarrow 0V$	—	—	30	ns
Switching time dispersion between ON and OFF	$ t_{pHL} - t_{pLH} $		$V_{IN} = 5V$	—	—	10	ns
Output fall time (90-10%)	$t_f$		$V_{IN} = 0 \rightarrow 5V$	—	3	—	ns
Output rise time (10-90%)	$t_r$		$V_{IN} = 5 \rightarrow 0V$	—	2	—	ns
Propagation delay time to logic high output	$t_{pHL}$	6	$V_{IN} = 1.1 \rightarrow 5V$	—	—	20	ns
Propagation delay time to logic low output	$t_{pLH}$		$V_{IN} = 5 \rightarrow 1.1V$	—	—	20	ns
Propagation delay skew	$T_{psk}$		—	—	—	16	ns
Switching time dispersion between ON and OFF	$ t_{pHL} - t_{pLH} $		—	—	2	8	ns
Output fall time (90-10%)	$T_f$		$V_{IN} = 1.1 \rightarrow 5V$	—	3	—	ns
Output rise time (10-90%)	$t_r$		$V_{IN} = 5 \rightarrow 1.1V$	—	3	—	ns
Data rate	T		—	—	50	—	MBd
Common mode transient immunity at high Level output	$CM_H$	7	$V_{CM}=1000V_{p-p}$ , Ta=25°C $I_F=0mA$ , $V_{CC}=5V$ , $V_O(Min)=4V$ ,	10000	—	—	V/μs
Common mode transient immunity at low level output	$CM_L$		$V_{CM}=1000V_{p-p}$ , 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, VCC =5V.

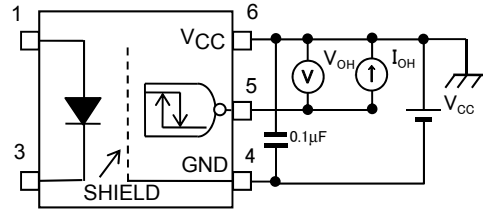
Note 5: CL is approximately 15pF which includes probe and Jig/stray wiring capacitance.

Note 6: This product has an automatic threshold control (ATC) circuit in order to reduce input current dependence of its switching time. The ATC circuit may not be able to respond accordingly when an input signal is driven after a prolonged absence of signals to the product. As a result, switching operation, pertaining to the first pulse of an input signal, could be unstable. Theoretically however, stable switching operation should be achievable from the second pulse onwards. As such, please check the switching operation and take the appropriate measures when designing applications in which this product shall be used.

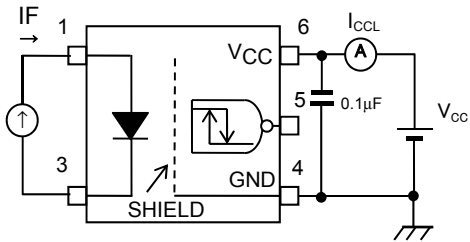
TEST CIRCUIT 1:  $V_{OL}$



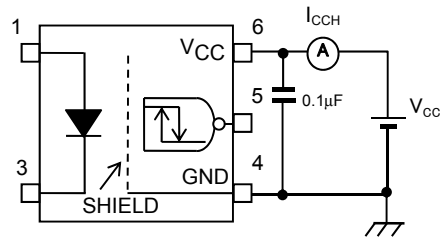
TEST CIRCUIT 2:  $V_{OH}$



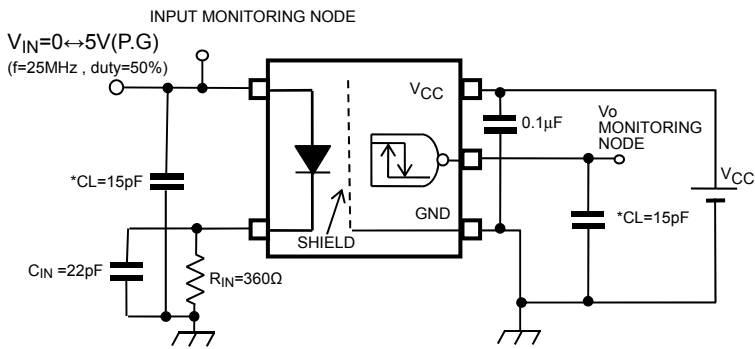
TEST CIRCUIT 3:  $I_{CCL}$



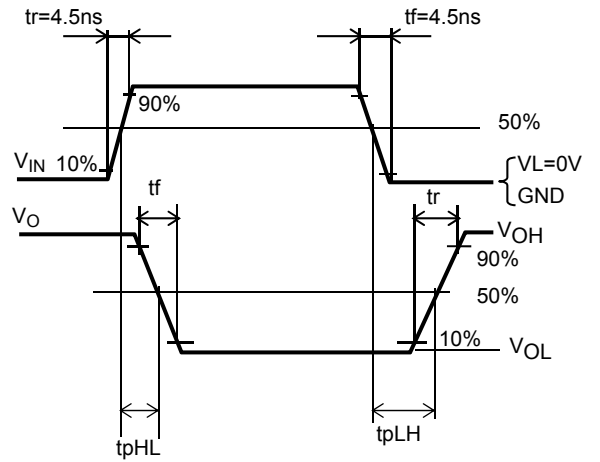
TEST CIRCUIT 4:  $I_{CCH}$



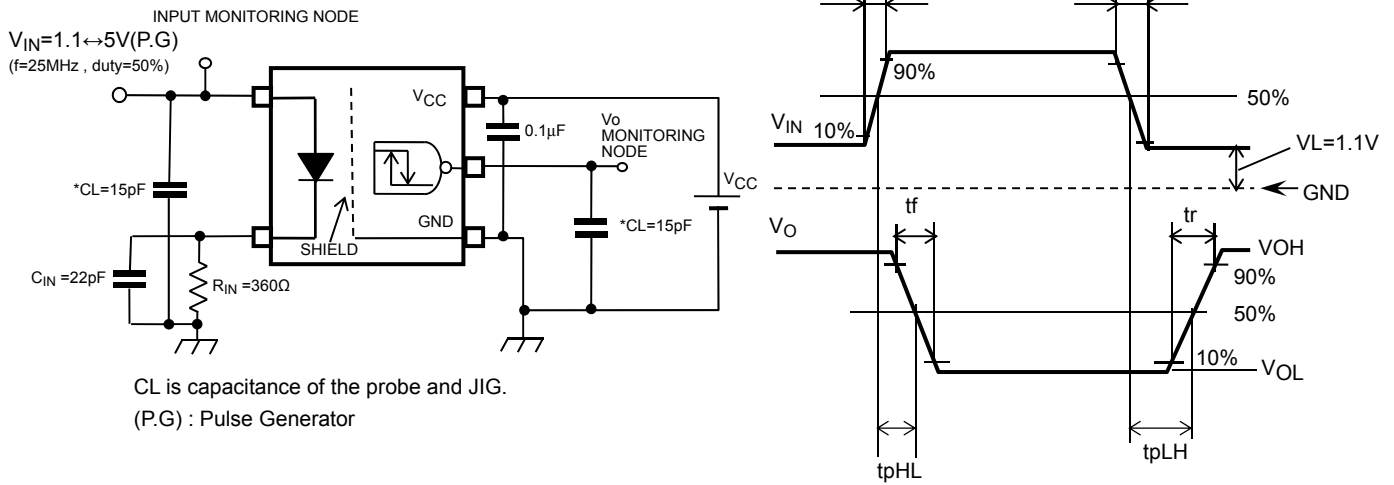
TEST CIRCUIT 5:  $t_{pHL}$ ,  $t_{pLH}$



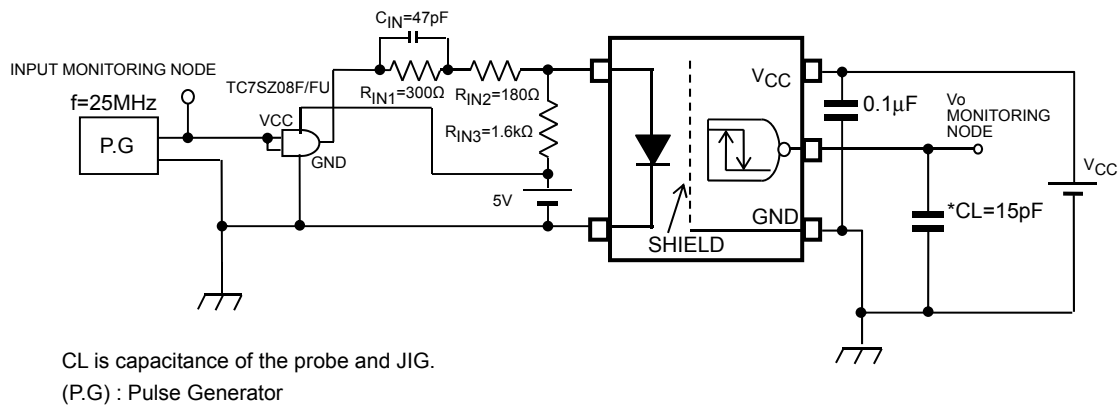
CL is capacitance of the probe and JIG.  
(P.G): Pulse Generator



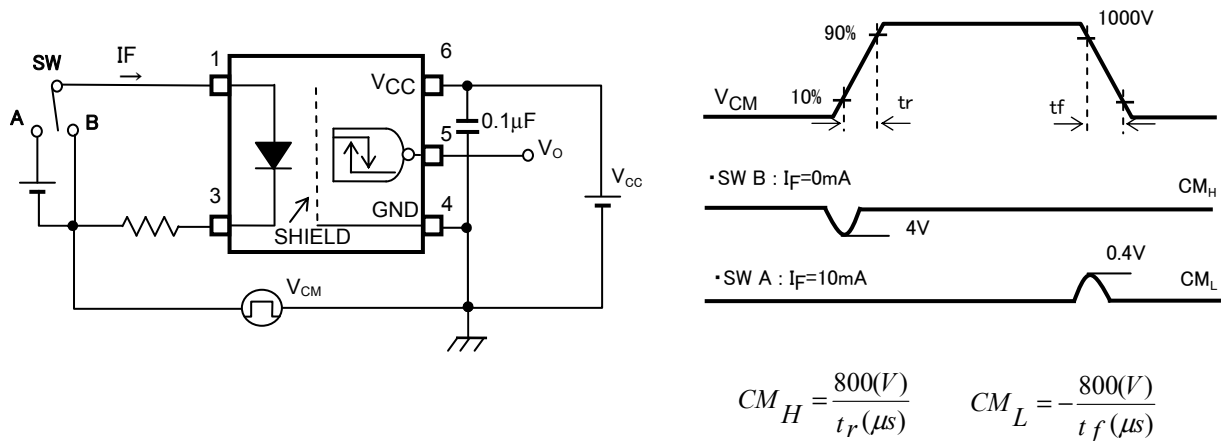
## TEST CIRCUIT 6: tpHL , tpLH



(example for LED drive circuit)



## TEST CIRCUIT 7: Common-Mode Transient Immunity Test Circuit



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