

# TLP117

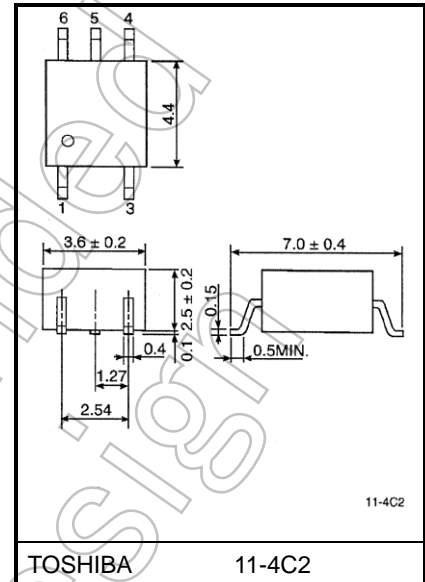
PDP (Plasma Display Panel)  
FA (Factory Automation)  
High-Speed Interface

The Toshiba TLP117 consists of an infrared 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  $V_L=0$  V  
: 20 ns (max) at  $V_L=1.1$  V
- Switching speed : 50 MBd (typ.)
- Common mode transient immunity : 10 kV/ $\mu$ s (min)
- Isolation voltage : 3750 Vrms
- UL-recognized : UL 1577, File No.E67349
- cUL-recognized : CSA Component Acceptance Service No.5A File No.E67349
- VDE-approved : EN 60747-5-5 (Note 1)

Note 1 : When a VDE approved type is needed, please designate the **Option(V4)**.

Unit: mm

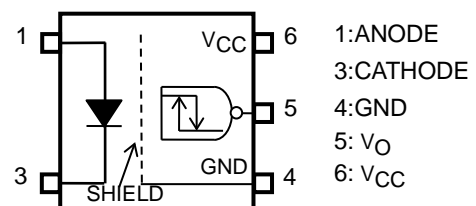


Weight: 0.09 g (typ.)

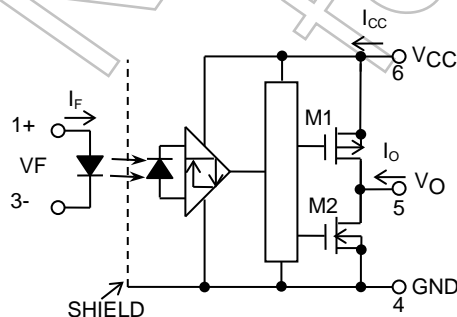
### Truth Table

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

### Pin Configuration (Top View)



### Schematic



Start of commercial production  
2007-05

## Absolute Maximum Ratings (Ta=25°C)

Characteristic		Symbol	Rating	Unit
LED	Forward current	I <sub>F</sub>	25	mA
	Forward current derating (Ta≥85°C)	ΔI <sub>F</sub> /ΔTa	-0.7	mA/°C
	Peak transient forward current (Note 1)	I <sub>FPT</sub>	1	A
	Reverse voltage	V <sub>R</sub>	6	V
	Diode power dissipation	P <sub>D</sub>	40	mW
	Diode power dissipation derating (Ta≥85°C)	ΔP <sub>D</sub> /ΔTa	-1.0	mW/°C
DETECTOR	Output current	I <sub>O</sub>	10	mA
	Output voltage	V <sub>O</sub>	6	V
	Supply voltage	V <sub>CC</sub>	6	V
	Output power dissipation	P <sub>O</sub>	40	mW
Operating temperature range		T <sub>opr</sub>	-40 to 105	°C
Storage temperature range		T <sub>stg</sub>	-55 to 125	°C
Lead solder temperature(10 s)		T <sub>sol</sub>	260	°C
Isolation voltage (AC, 60 s, R.H. ≤ 60 %, ) (Note 2)		BVs	3750	V <sub>rms</sub>

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≤1 μs, 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 <sub>F(ON)</sub>	10	—	16	mA
Input voltage, OFF	V <sub>F(OFF)</sub>	0	—	1.0	V
Supply voltage(*) (Note 1)	V <sub>CC</sub>	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 1: The detector of this product requires a power supply voltage (V<sub>CC</sub>) of 4.5 V or higher for stable operation. If V<sub>CC</sub> is lower than this value, I<sub>CC</sub> 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,  $T_a = -40$  to  $105^\circ\text{C}$ ,  $V_{CC} = 4.5$  to  $5.5\text{V}$ )

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

\*All typical values are at  $T_a = 25^\circ\text{C}$  unless otherwise specified.Isolation Characteristics ( $T_a = 25^\circ\text{C}$ )

Characteristic	Symbol	Test Conditions	Min	Typ.	Max	Unit
Capacitance input to output	$C_S$	$V_S = 0\text{ V}$ , $f = 1\text{ MHz}$	—	0.8	—	pF
Isolation resistance	$R_S$	R.H. $\leq 60\%$ , $V_S = 500\text{ V}$	$1 \times 10^{12}$	$10^{14}$	—	$\Omega$
Isolation voltage	$BV_S$	AC, 60 s	3750	—	—	$V_{rms}$

Note : 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.

## Switching Characteristics

(Unless otherwise specified,  $T_a = -40$  to  $105^\circ\text{C}$ ,  $V_{CC} = 4.5$  to  $5.5\text{V}$ )

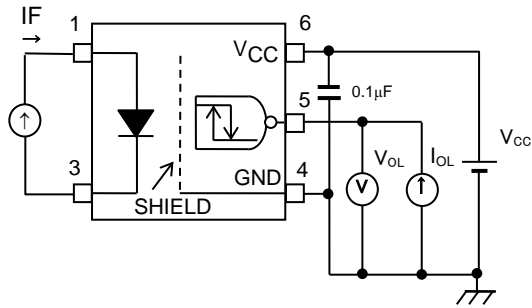
Characteristic	Symbol	Test Circuit	Conditions	Min	Typ.	Max	Unit
Propagation delay time to logic high $\rightarrow$ Low output	$t_{pHL}$	5	$V_{IN} = 0 \rightarrow 5\text{V}$	—	—	30	ns
Propagation delay time to logic low $\rightarrow$ High output	$t_{pLH}$		$V_{IN} = 5 \rightarrow 0\text{V}$	—	—	30	ns
Switching time dispersion between ON and OFF	$ t_{pHL} - t_{pLH} $		$V_{IN} = 5\text{V}$	—	—	10	ns
Output fall time (90-10%)	$t_f$		$V_{IN} = 0 \rightarrow 5\text{V}$	—	3	—	ns
Output rise time (10-90%)	$t_r$		$V_{IN} = 5 \rightarrow 0\text{V}$	—	2	—	ns
			$R_{IN} = 360\ \Omega$ $C_{IN} = 22\text{pF}$ $V_L = 0\text{V}$ (Note 1)				
Propagation delay time to logic high $\rightarrow$ Low output	$t_{pHL}$	6	$V_{IN} = 1.1 \rightarrow 5\text{V}$	—	—	20	ns
Propagation delay time to logic low $\rightarrow$ High output	$t_{pLH}$		$V_{IN} = 5 \rightarrow 1.1\text{V}$	—	—	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%)	$t_f$		$V_{IN} = 1.1 \rightarrow 5\text{V}$	—	3	—	ns
Output rise time (10-90%)	$t_r$		$V_{IN} = 5 \rightarrow 1.1\text{V}$	—	3	—	ns
Data rate	$T$		—	—	50	—	MBd
			$R_{IN} = 360\ \Omega$ $C_{IN} = 22\text{pF}$ $V_L = 1.1\text{V}$ (Note 1)				
Common mode transient immunity at high Level output	$CM_H$	7	$V_{CM} = 1000\text{V}_{p-p}$ , $T_a = 25^\circ\text{C}$ $I_F = 0\text{mA}$ , $V_{CC} = 5\text{V}$ , $V_O(\text{Min}) = 4\text{V}$ ,	10000	—	—	$\text{V}/\mu\text{s}$
Common mode transient immunity at low level output	$CM_L$		$V_{CM} = 1000\text{V}_{p-p}$ , $T_a = 25^\circ\text{C}$ $I_F = 10\text{mA}$ , $V_{CC} = 5\text{V}$ , $V_O(\text{Max}) = 0.4\text{V}$	-10000	—	—	$\text{V}/\mu\text{s}$

\*All typical values are at  $T_a = 25^\circ\text{C}$ ,  $V_{CC} = 5\text{V}$ .

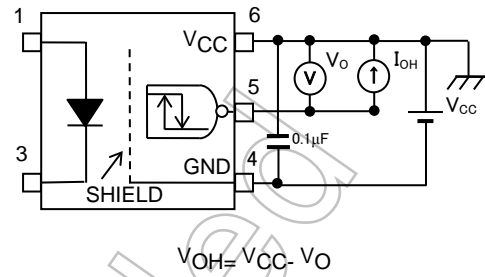
Note : This product has an automatic threshold control (ATC) circuit in order to reduce input current dependence of its switching time. The ATC circuit may not be able to respond accordingly when an input signal is driven after a prolonged absence of signals to the product. As a result, switching operation, 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.

Note 1: CL is approximately 15 pF which includes probe and Jig/stray wiring capacitance.

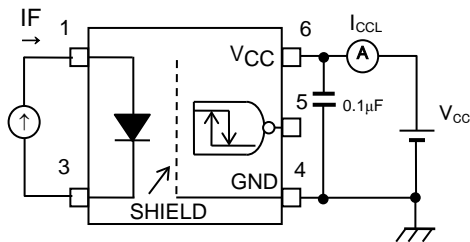
TEST CIRCUIT 1:  $V_{OL}$



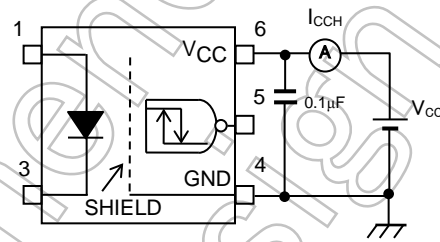
TEST CIRCUIT 2:  $V_{OH}$



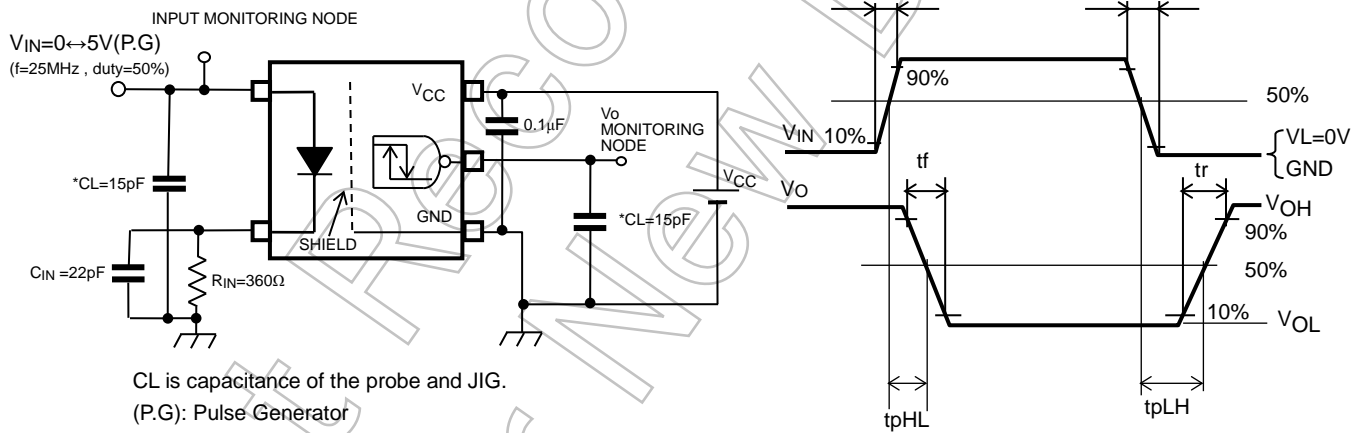
TEST CIRCUIT 3:  $I_{CCL}$



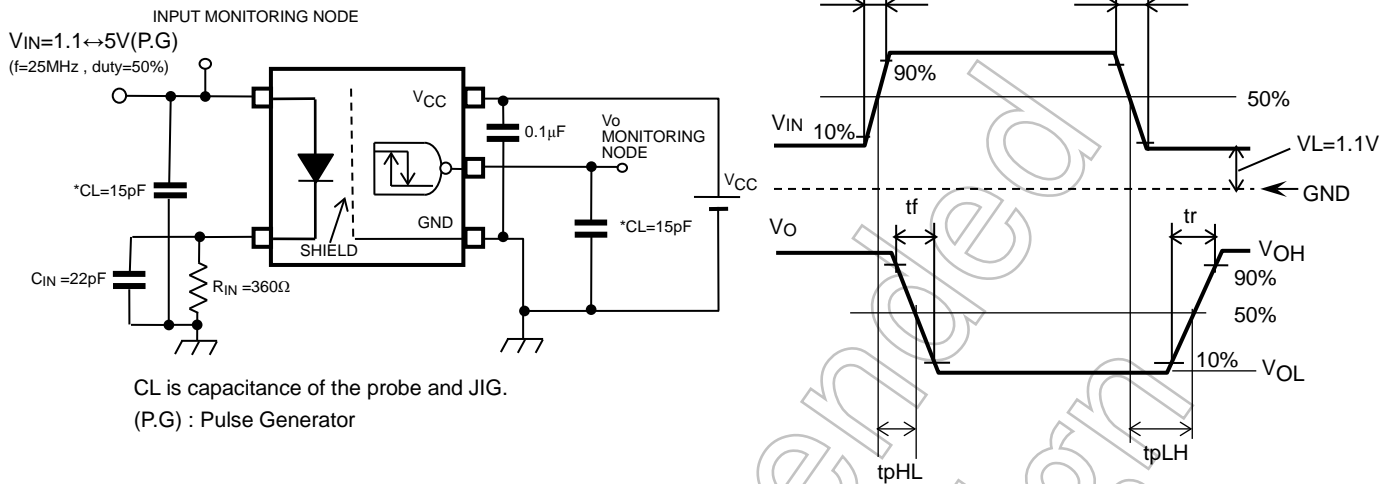
TEST CIRCUIT 4:  $I_{CCH}$



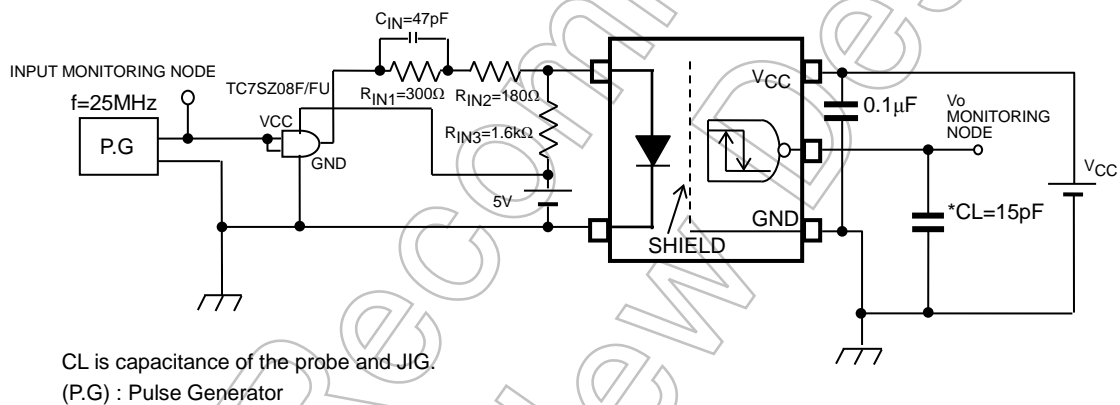
TEST CIRCUIT 5:  $t_{pHL}$ ,  $t_{pLH}$



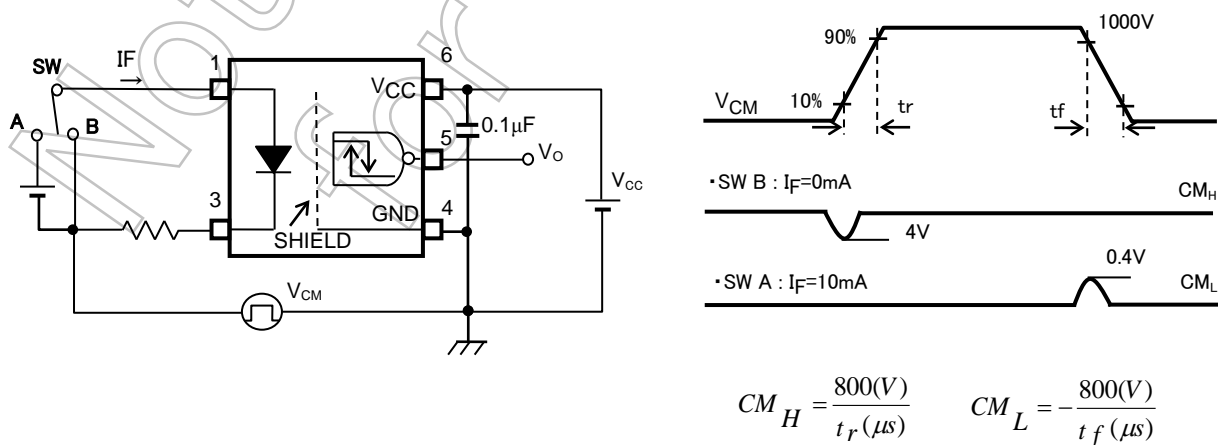
## TEST CIRCUIT 6: tpHL , tpLH



(example for LED drive circuit)



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



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