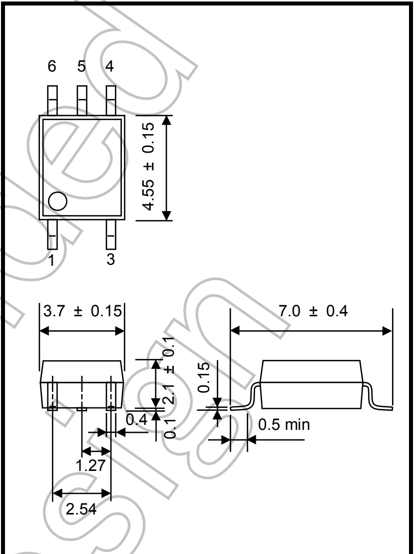
TOSHIBA PHOTOCOUPLER IRED & PHOTO-IC

TLP116A

Plasma Display Panels (PDPs)
High-Speed Interface
Factory Automation (FA)

Unit: mm



TOSHIBA 11−4L1

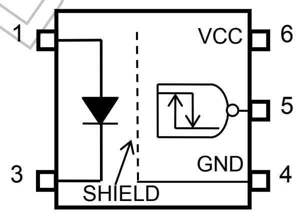
Weight: 0.08 g (typ.)

The Toshiba TLP116A mini-flat coupler is a small-outline coupler suitable for surface-mount assembly. The TLP116A consists of an infrared LED and an integrated high-gain, high-speed photodetector. This unit is housed in the 6-pin SO package and guarantees a creepage distance of ≥ 5.0mm, a clearance of ≥ 5.0mm and an insulation thickness of ≥ 0.4mm. Therefore, the TLP116A meets the reinforced insulation class requirements of international safety standards.

- Inverter logic (totem-pole output)
- SO6 package
- Guaranteed performance over: −40 to 100°C
- Power supply voltage: 4.5 to 5.5V
- Input thresholds current: I_{FHL} = 5 mA (max)
- Propagation delay time (tpHL / tpLH): 60 ns (max)
- Switching speed: 20 MBd (typ.)
- Common-mode transient immunity: 10 kV/μs
- Isolation voltage: 3750 Vrms
- UL-recognized: UL 1577, File No.E67349
- cUL-recognized: CSA Component Acceptance Service No.5A File No.E67349
- CQC-approved: GB4943.1,GB8898 Japan and Thailand Factory
  仅适用于海拔 2000m 以下地区安全使用
- VDE-approved: EN 60747-5-5 , EN 62368-1 (Note 1)

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

Pin Configuration (Top View)

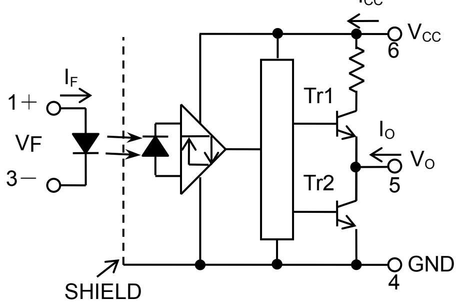


1: ANODE
3: CATHODE
4: GND
5: V_O (Output)
6: V_{CC}

Truth Table

Input	LED	Tr1	Tr2	Output
H	ON	OFF	ON	L
L	OFF	ON	OFF	H

Schematic



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

Construction Mechanical Rating
Creepage Distance: 5.0mm (min)
Clearance: 5.0mm (min)
Insulation Thickness: 0.4mm (min)

Start of commercial production
2008-07

Absolute Maximum Ratings (Ta=25°C)

	Characteristic	Symbol	Rating	Unit
LED	Forward current	I_F	20	mA
	Forward current derating (Ta ≥ 85°C)	ΔI_F / °C	−0.5	mA/°C
	Peak transient forward current (Note 1)	I_{FPT}	1	A
	Reverse voltage	V_R	5	V
	Input power dissipation	P_D	40	mW
	Input power dissipation derating (Ta ≥ 85°C)	ΔP_D/°C	-1.0	mW/°C
DETECTOR	Output current	I_O	10	mA
	Output current derating (Ta ≥ 85°C)	ΔI_O/°C	-0.25	mA/°C
	Output voltage	V_O	6	V
	Supply voltage	V_{CC}	6	V
	Output power dissipation	P_O	40	mW
Operating temperature range		Topr	−40 to 100	°C
Storage temperature range		Tstg	−55 to 125	°C
Lead solder temperature(10 s)		Tsol	260	°C
Isolation voltage (AC,60 s, R.H. ≤ 60 %) (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 and the operating ranges. 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, as are pins 4,5 and 6.

Recommended Operating Conditions

Characteristic	Symbol	Min	Typ.	Max	Unit
Input current ON	$I_{F(ON)}$	8	—	18	mA
Input voltage , OFF	$V_{F(OFF)}$	0	—	0.8	V
Supply voltage	V_{CC}	4.5	5.0	5.5	V
Operating temperature	Topr	-40	—	100	°C

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

Correlation between Input current, switching speed and drive circuit (reference information).

Input current (IF)	Test Circuit	Typical switching speed
12mA	1 (Page 4)	21 to 23 MBd
8mA	1 (Page 4)	18 to 20 MBd
8mA	2 (Page 4, With Speed up capacitor)	23 to 27 MBd

Electrical Characteristics
(Unless otherwise specified, Ta=-40 to 100°C, V_{CC}=4.5 to 5.5 V)

Characteristic	Symbol	Test Circuit	Conditions	Min	Typ.	Max	Unit
Input forward voltage	V_F	—	I_F = 10 mA ,Ta = 25 °C	1.45	1.58	1.85	V
Temperature coefficient of forward voltage	$\Delta V_F / \Delta Ta$	—	I_F = 10 mA	—	-2.0	—	mV/°C
Input reverse current	I_R	—	V_R=5 V, Ta = 25 °C	—	—	10	μA
Capacitance between Input terminals	C_T	—	V_F = 0 V, f= 1 MHz, Ta = 25 °C	—	60	—	pF
Logic low output voltage	V_{OL}	1	I_{OL} = 1.6 mA, I_F = 12 mA, V_{CC} = 5 V	—	—	0.4	V
Logic high output voltage	V_{OH}	2	I_{OH} = −0.02 mA, V_F = 1.05 V, V_{CC} = 5 V	4.0	—	—	V
Logic low supply current	I_{CCL}	3	I_F = 12 mA	—	—	5.0	mA
Logic high supply current	I_{CCH}	4	V_F = 0 V	—	—	5.0	mA
Input current logic low output	I_{FHL}	—	I_O = 1.6 mA, V_O < 0.4 V	—	—	5	mA
Input voltage logic high output	V_{FLH}	—	I_O = -0.02 mA, V_O > 4.0 V	0.8	—	—	V

*All typical values are at Ta=25°C, V_{CC}=5 V, I_F(ON)=12 mA unless otherwise specified

Isolation Characteristics (Ta = 25°C)

Characteristic	Symbol	Test Conditions	Min	Typ.	Max	Unit
Capacitance input to output	C_S	Vs = 0 V,f = 1 MHz	—	0.8	—	pF
Isolation resistance	R_S	R.H. ≤ 60 %, V_S = 500 V	10^{12}	10^{14}	—	Ω
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, as are pins 4,5 and 6.

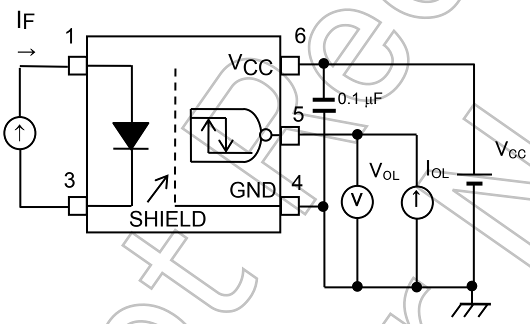
Switching Characteristics
(Unless otherwise specified, Ta=-40 to 100°C, V_{CC}=4.5 to 5.5 V)

Characteristic	Symbol	Test Circuit	Conditions		Min	Typ.	Max	Unit
Propagation delay time to logic high output	tpHL	5	I_F = 0→12 mA	R_{IN} = 100 Ω, C_L = 15 pF (Note 1)	—	—	60	ns
Propagation delay time to logic low output	tpLH	5	I_F = 12→0 mA	R_{IN} = 100 Ω, C_L = 15 pF (Note 1)	—	—	60	ns
Propagation delay time to logic high output	tpHL	6	V_{IN} = 0→5 V (I_F = 0→8 mA)	R_{IN} = 470 Ω, C_{IN} = 27 pF, C_L = 15 pF (Note 1)	—	—	60	ns
Propagation delay time to logic low output	tpLH	6	V_{IN} = 5→0 V (I_F = 8→0 mA)	R_{IN} = 470 Ω, C_{IN} = 27 pF, C_L = 15 pF (Note 1)	—	—	60	ns
Switching time dispersion between ON and OFF	|tpHL-tpLH|	5	I_F = 12 mA , R_{IN} = 100 Ω, CL =15 pF (Note 1)		—	—	30	ns
Output fall time(90-10%)	tf	5	I_F = 0→12 mA	R_{IN} = 100 Ω, C_L = 15 pF (Note 1)	—	15	—	ns
Output rise time(10-90%)	tr	5	I_F = 12→0 mA	R_{IN} = 100 Ω, C_L = 15 pF (Note 1)	—	15	—	ns
Common mode transient immunity at high Level output	CM_H	7	V_{CM} = 1000 Vp-p, I_F = 0 mA, Vo(Min) = 4 V, Ta = 25°C		10000	—	—	V/μs
Common mode transient immunity at low level output	CM_L	7	V_{CM} = 1000 Vp-p, I_F = 12 mA, Vo(Max) = 0.4 V, Ta = 25°C		-10000	—	—	V/μs

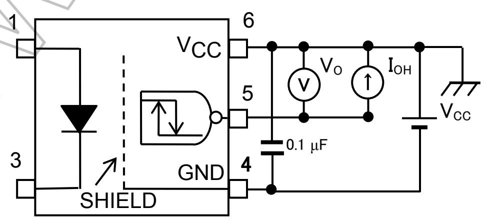
*All typical values are at Ta=25°C

Note 1: C_L is less than 15 pF which includes probe and Jig/stray wiring capacitance.

TEST CIRCUIT 1: V_{OL}

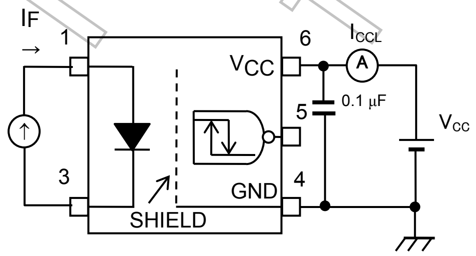


TEST CIRCUIT 2: V_{OH}

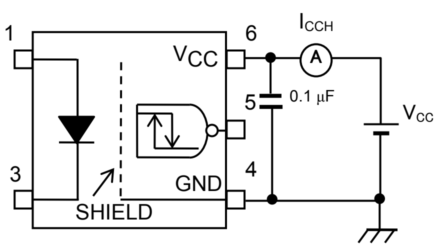


$V_{OH} = V_{CC} - V_O$

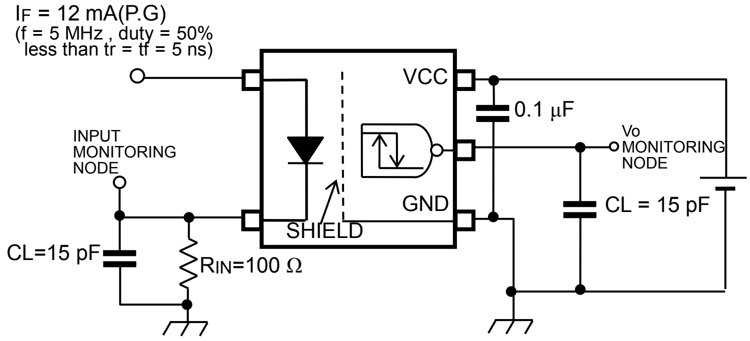
TEST CIRCUIT 3: I_{CCL}

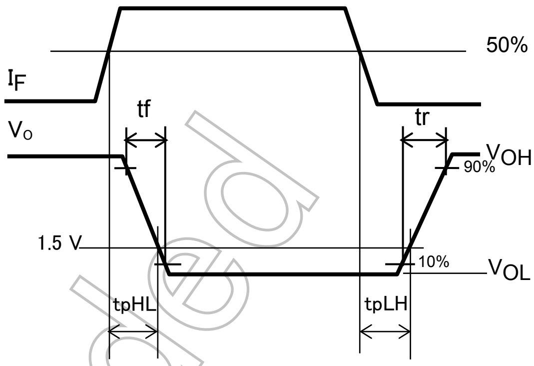


TEST CIRCUIT 4: I_{CCH}



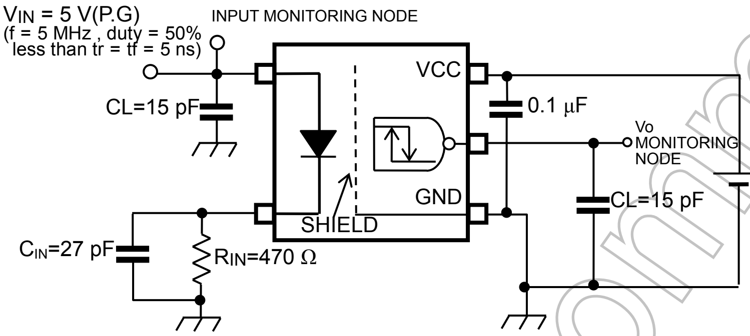
TEST CIRCUIT 5: tpHL, tpLH

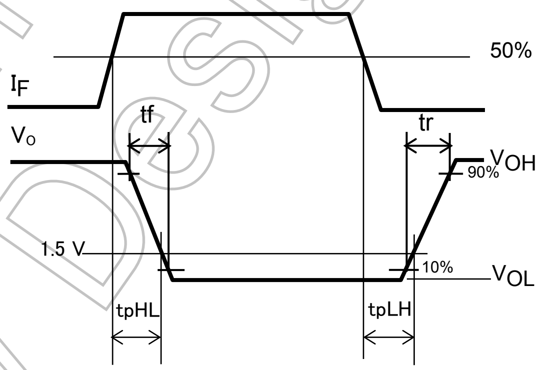




CL is capacitance of the probe and JIG.
(P.G): Pulse Generator

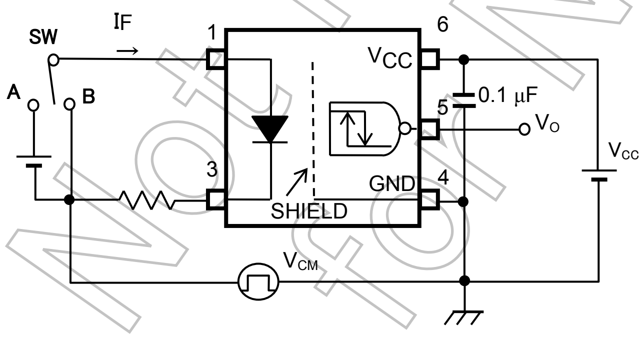
TEST CIRCUIT 6: tpHL, tpLH

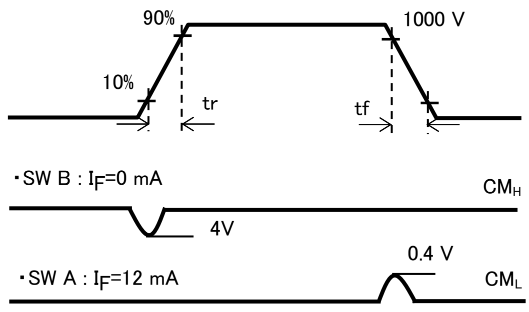




CL is capacitance of the probe and JIG.
(P.G): Pulse Generator

TEST CIRCUIT 7: Common-Mode Transient Immunity Test Circuit





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

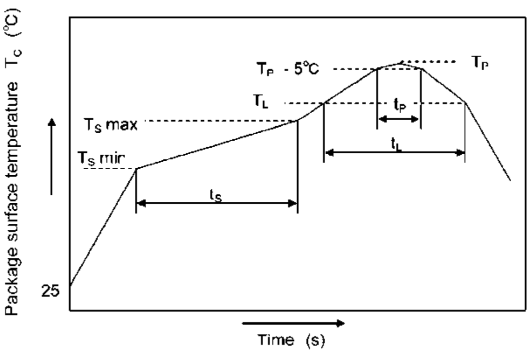
Soldering and Storage

1. Precautions for Soldering

The soldering temperature should be controlled as closely as possible to the conditions shown below, irrespectiveof whether a soldering iron or a reflow soldering method is used.

1) When Using Soldering Reflow

An example of a temperature profile when lead(Pb)-free solder is used.



	Symbol	Min	Max	Unit
Preheat temperature	T_S	150	200	°C
Preheat time	t_S	60	120	s
Ramp-up rate (T_L to T_P)			3	°C/s
Liquidus temperature	T_L	217		°C
Time above T_L	t_L	60	150	s
Peak temperature	T_P		260	°C
Time during which T_c is between (T_P – 5) and T_P	t_P		30	s
Ramp-down rate (T_P to T_L)			6	°C/s

- The soldering temperature profile is based on the package surface temperature (See the figure shown above.)
- Reflow soldering must be performed once or twice.
- The mounting should be completed with the interval from the first to the last mountings being 2 weeks.

2) When using soldering Flow

- Preheat the device at a temperature of 150 °C (package surface temperature) for 60 to 120 seconds.
- Mounting condition of 260 °C within 10 seconds is recommended
- Flow soldering must be performed once.

3) When using soldering Iron

- Complete soldering within 10 seconds for lead temperature not exceeding 260 °C or within 3 seconds not exceeding 350 °C.
- Heating by soldering iron must be done only once per lead.

2. Precautions for General Storage

1) Avoid storage locations where devices may be exposed to moisture or direct sunlight.

2) Follow the precautions printed on the packing label of the device for transportation and storage.

3) Keep the storage location temperature and humidity within a range of 5°C to 35°C and 45% to 75%, respectively.

4) Do not store the products in locations with poisonous gases (especially corrosive gases) or in dusty conditions.

5) Store the products in locations with minimal temperature fluctuations. Rapid temperature changes during storage can cause condensation, resulting in lead oxidation or corrosion, which will deteriorate the solderability of the leads.

6) When restoring devices after removal from their packing, use anti-static containers.

7) Do not allow loads to be applied directly to devices while they are in storage.

8) If devices have been stored for more than two years under normal storage conditions, it is recommended that you check the leads for ease of soldering prior to use.

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