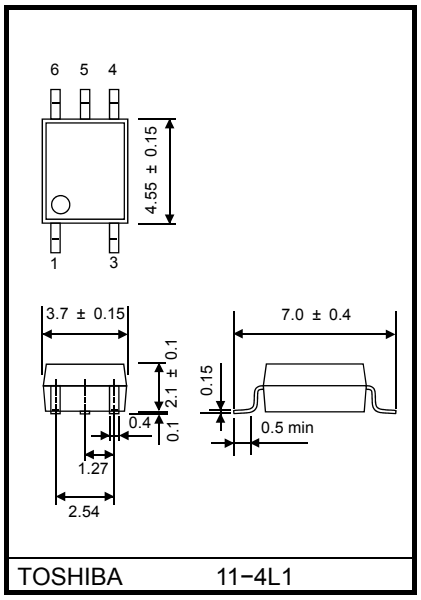
TOSHIBA PHOTOCOUPLER GaAℓAs LED & PHOTO-IC

TLP116A

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

Unit: mm



Weight: 0.08 g (typ.)

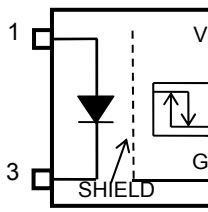
The Toshiba TLP116A mini-flat coupler is a small-outline coupler suitable for surface-mount assembly.
The TLP116A consists of a GaAℓAs light-emitting diode and an integrated high-gain, high-speed photodetector.
This unit is housed in the 6-pin SO package and guarantees a creepage distance of ≥ 5.0mm, 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/us
- Isolation voltage: 3750 Vrms
- UL approval: UL1577, File No.E67349 Under application

Truth Table

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

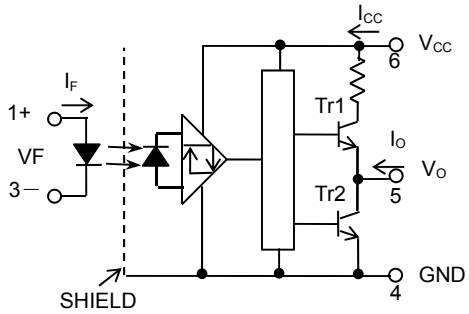
Pin Configuration (Top View)



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

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

Schematic



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

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)	$\Delta I_F / \Delta Ta$	−0.5	mA/°C
	Peak transient forward current (Note 1)	I_{FPT}	1	A
	Reverse voltage	V_R	5	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		Topr	−40 to 100	°C
Storage temperature range		Tstg	−55 to 125	°C
Lead solder temperature(10 s)		Tsol	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 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).

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 (Note 3)	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.

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

Note 1 : Pulse width PW ≤ 1μs, 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.

Note 3 : 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.

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
Input capacitance	C_T	—	V = 0, 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,f = 1 MHz (Note 2)	—	0.8	—	pF
Isolation resistance	R_S	R.H. ≤ 60%, V_S = 500 V (Note 2)	1×10^{12}	10^{14}	—	Ω
Isolation voltage	BV_S	AC, 1 minute	3750	—	—	V_{rms}
		AC, 1 second, in oil	—	10000	—	V_{rms}
		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.

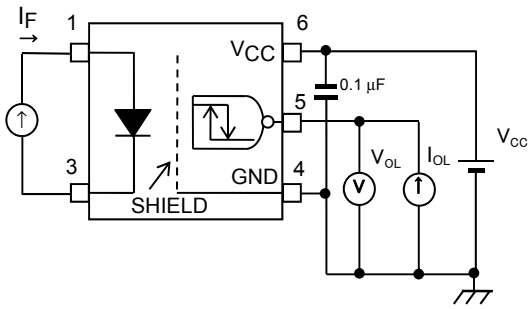
Switching Characteristics
(Unless otherwise specified, Ta=-40 to 100°C, V_{CC}=4.5 to 5.5 V)

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 5)	—	—	60	ns
Propagation delay time to logic low output	tpLH		I_F = 12→0 mA		—	—	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 5)	—	—	60	ns
Propagation delay time to logic low output	tpLH		V_{IN} = 5→0 V (I_F = 8→0 mA)		—	—	60	ns
Switching time dispersion between ON and OFF	|tpHL-tpLH|	5	I_F = 12 mA , R_{IN} = 100 Ω, CL =v15 pF (Note 5)		—	—	30	ns
Output fall time(90-10%)	tf		I_F = 0→12 mA	R_{IN} = 100 Ω, C_L = 15 pF (Note 5)	—	15	—	ns
Output rise time(10-90%)	tr		I_F = 12→0 mA		—	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		V_{CM} = 1000 Vp-p, I_F = 12 mA, Vo(Max) = 0.4 V, Ta = 25°C		-10000	—	—	V/μs

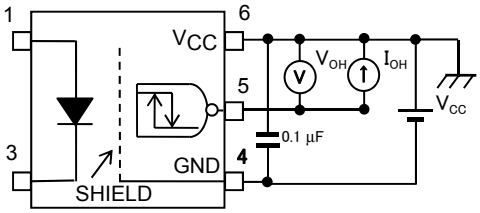
*All typical values are at Ta=25°C

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

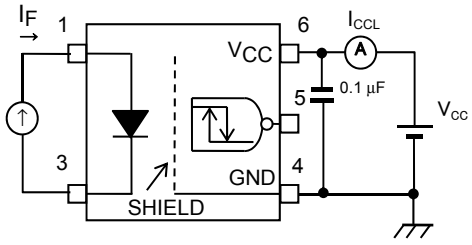
TEST CIRCUIT 1: V_{OL}



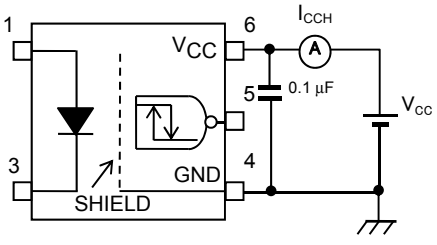
TEST CIRCUIT 2: V_{OH}



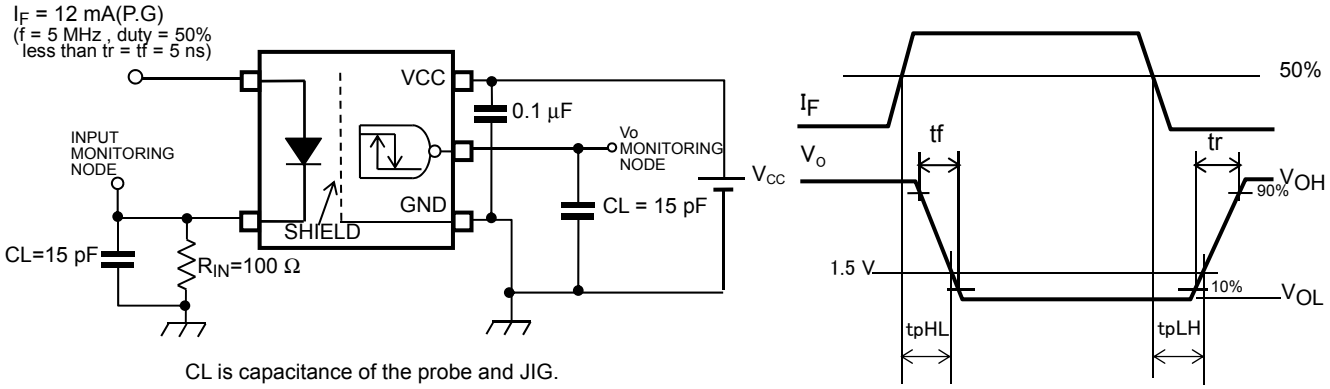
TEST CIRCUIT 3: I_{CCL}



TEST CIRCUIT 4: I_{CCH}

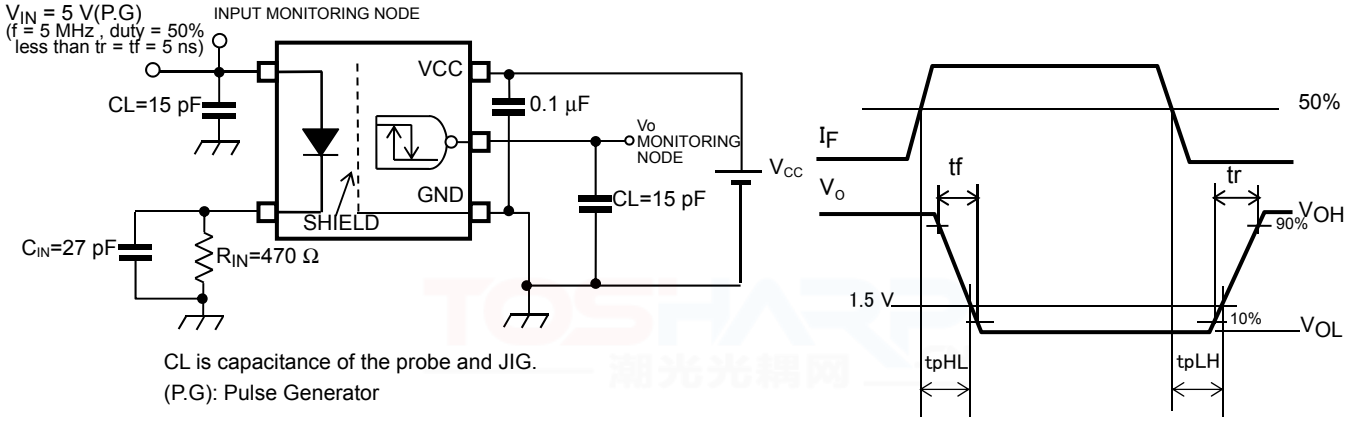


TEST CIRCUIT 5: tpHL, tpLH



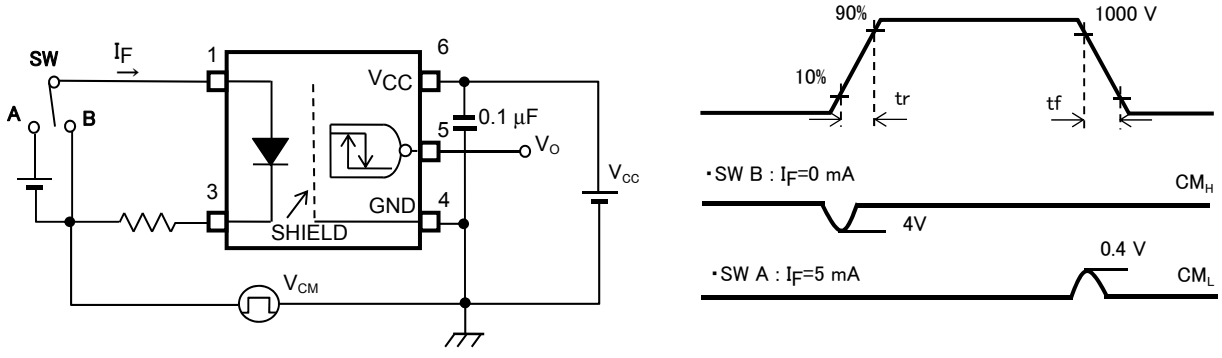
CL is capacitance of the probe and JIG.
(P.G): Pulse Generator

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



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

Specification for Embossed–Tape Packing (TPL)(TPR) for SO6 Coupler

1. Applicable Package

Package	Product Type
SO6	Mini-flat coupler

2. Product Naming System

Type of package used for shipment is denoted by a symbol suffix after a product number. The method of classification is as below.

(Example)

TLP116A(TPL)

Tape type

Device name

3. Tape Dimensions

3.1 Specification Classification Are as Shown in Table 1

Table 1 Tape Type Classification

Tape type	Classification	Quantity (pcs/reel)
TPL	L direction	3000
TPR	R direction	3000

3.2 Orientation of Device in Relation to Direction of Tape Movement

Device orientation in the recesses is as shown in Figure 1.

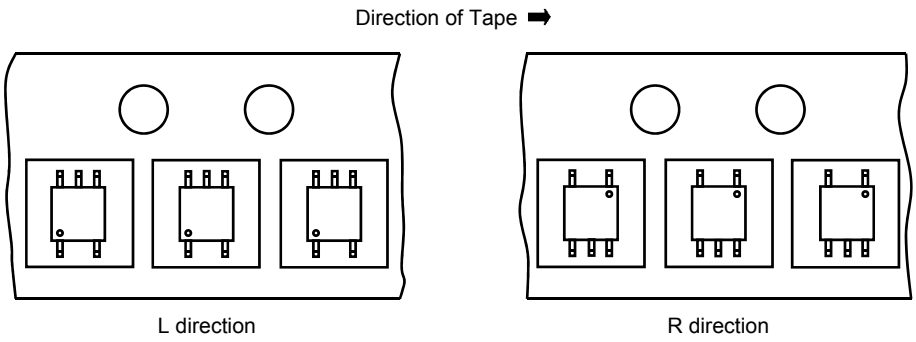


Figure 1 Device Orientation

3.3 Empty Device Recesses Are as Shown in Table 2.

Table 2 Empty Device Recesses

	Standard	Remarks
Occurrences of 2 or more successive empty device recesses	0	Within any given 40-mm section of tape, not including leader and trailer
Single empty device recesses	6 devices (max.) per reel	Not including leader and trailer

3.4 Start and End of Tape

The start of the tape has 50 or more empty holes. The end of tape has 50 or more empty holes and two empty turns only for a cover tape.

3.5 Tape Specification

(1) Tape material: Plastic (protection against electrostatics)
(2) Dimensions: The tape dimensions are as shown in Figure 2 and Table 3.

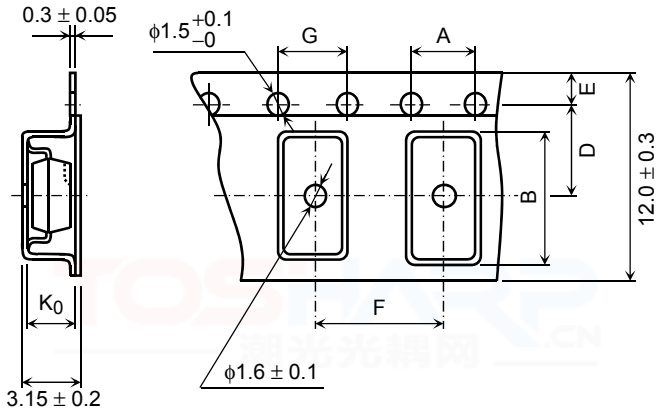


Figure 2 Tape Forms

Table 3 Tape Dimensions

Unit: mm
Unless otherwise specified: ±0.1

Symbol	Dimension	Remark
A	4.2	—
B	7.6	—
D	5.5	Center line of indented square hole and sprocket hole
E	1.75	Distance between tape edge and hole center
F	8.0	Cumulative error $^{+0.1}_{-0.3}$ (max) per 10 feed holes
G	4.0	Cumulative error $^{+0.1}_{-0.3}$ (max) per 10 feed holes
K_0	2.8	Internal space

3.6 Reel

(1) Material: Plastic

(2) Dimensions: The reel dimensions are as shown in Figure 3 and Table 4.

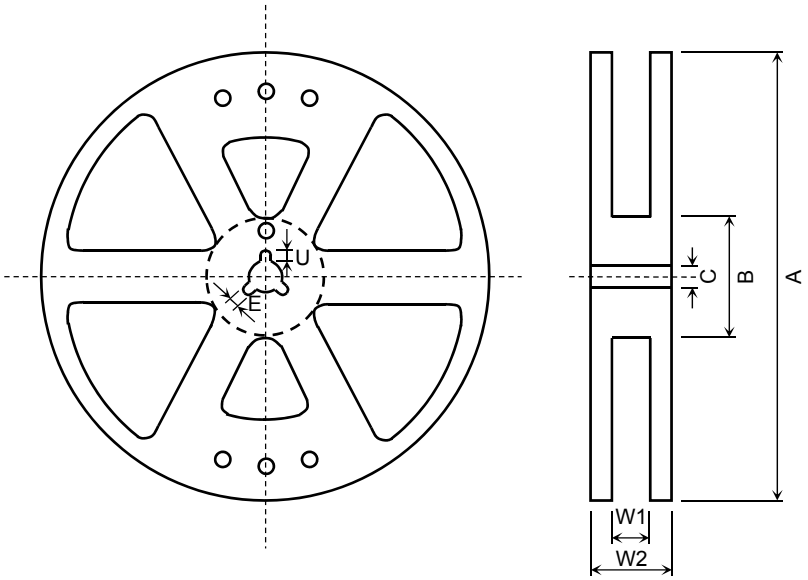


Figure 3 Reel Form

Table 4 Reel Dimensions

Unit: mm

Symbol	Dimension
A	Φ380 ±2
B	Φ80 ±1
C	Φ13 ±0.5
E	2.0 ±0.5
U	4.0 ±0.5
W1	13.5 ±0.5
W2	17.5 ±1.0

4. Packing

Either one reel or five reels of photocoupler are packed in a shipping carton.

5. Label Indication

The carton bears a label indicating the product number, the symbol representing classification of standard, the quantity, the lot number and the Toshiba company name.

6. Ordering Method

When placing an order, please specify the product number, the tape type and the quantity as shown in the following example.

(Example)

TLP116A (TPL) 3000 pcs

- Quantity (must be a multiple of 3000)
- Tape type
- Device name

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