

TLP2368

1. Applications

- Factory Automation (FA)
- Plasma Display Panels (PDPs)
- Measuring Instruments

2. General

The Toshiba TLP2368 consists of a high-output GaAs light-emitting diode coupled with integrated high gain, high-speed photodetectors. The TLP2368 guarantees operation at up to 125 °C and on supplies from 2.7 V to 5.5 V. It is housed in the SO6 package. The TLP2368 has an internal Faraday shield that provides a guaranteed common-mode transient immunity of ± 20 kV/ μ s.

3. Features

- (1) Inverter logic type (open collector output)
- (2) Package: SO6
- (3) Operating temperature: -40 to 125 °C
- (4) Supply voltage: 2.7 to 5.5 V
- (5) Data transfer rate: 20 MBd (typ.) (NRZ)
- (6) Threshold input current: 5.0 mA (max)
- (7) Supply current: 4 mA (max)
- (8) Common-mode transient immunity: ± 20 kV/ μ s (min)
- (9) Isolation voltage: 3750 Vrms (min)
- (10) Safety standards

UL-approved: UL1577, File No.E67349

cUL-approved: CSA Component Acceptance Service No.5A File No.E67349

VDE-approved: EN60747-5-5, EN60065 or EN60950-1 (**Note 1**)

CQC-approved: GB4943.1, GB8898 Thailand Factory

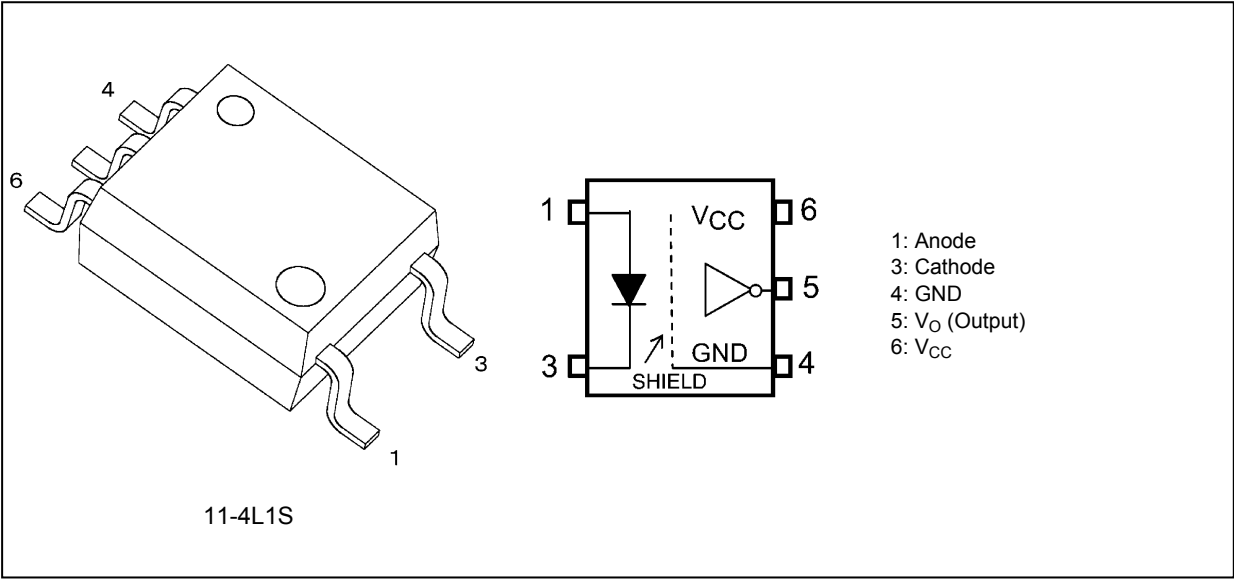


仅适用于海拔 2000m 以下地区安全使用

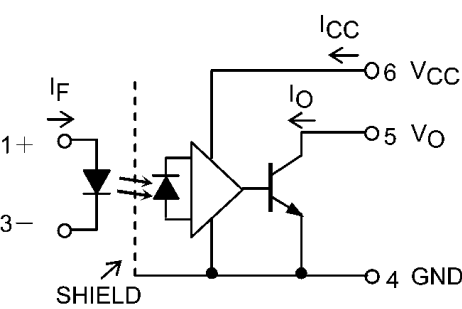
Note 1: When a VDE approved type is needed, please designate the **Option (V4)**.

Start of commercial production
2011-05

4. Packaging and Pin Configuration



5. Internal Circuit



6. Principle of Operation

6.1. Truth Table

Input	LED	Output
H	ON	L
L	OFF	H

6.2. Mechanical Parameters

Characteristics	Min	Unit
Creepage distances	5.0	mm
Clearance distances	5.0	
Internal isolation thickness	0.4	

7. Absolute Maximum Ratings (Note) (Unless otherwise specified, $T_a = 25\text{ }^{\circ}\text{C}$)

	Characteristics	Symbol	Note	Rating	Unit
LED	Input forward current	I_F		25	mA
	Input forward current derating ($T_a \geq 110\text{ }^{\circ}\text{C}$)	$\Delta I_F / \Delta T_a$		-0.67	mA/ $^{\circ}\text{C}$
	Input forward current (pulsed)	I_{FP}	(Note 1)	40	mA
	Input forward current derating (pulsed) ($T_a \geq 110\text{ }^{\circ}\text{C}$)	$\Delta I_{FP} / \Delta T_a$		-1.0	mA/ $^{\circ}\text{C}$
	Peak transient input forward current	I_{FPT}	(Note 2)	1	A
	Peak transient input forward current derating ($T_a \geq 110\text{ }^{\circ}\text{C}$)	$\Delta I_{FPT} / \Delta T_a$		-25	mA/ $^{\circ}\text{C}$
	Input power dissipation	P_D		40	mW
	Input power dissipation derating ($T_a \geq 110\text{ }^{\circ}\text{C}$)	$\Delta P_D / \Delta T_a$		-1.0	mW/ $^{\circ}\text{C}$
	Input reverse voltage	V_R		5	V
Detector	Output current	I_O		25	mA
	Output voltage	V_O		6	V
	Supply voltage	V_{CC}		6	
	Output power dissipation	P_O		60	mW
	Output power dissipation derating ($T_a \geq 110\text{ }^{\circ}\text{C}$)	$\Delta P_O / \Delta T_a$		-1.5	mW/ $^{\circ}\text{C}$
Common	Operating temperature	T_{opr}		-40 to 125	$^{\circ}\text{C}$
	Storage temperature	T_{stg}		-55 to 125	
	Lead soldering temperature (10 s)	T_{sol}		260	
	Isolation voltage AC, 60 s, R.H. $\leq 60\%$	BV_S	(Note 3)	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) $\leq 1\text{ ms}$, duty = 50 %

Note 2: Pulse width (PW) $\leq 1\text{ }\mu\text{s}$, 300 pps

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

8. Recommended Operating Conditions (Note)

Characteristics	Symbol	Note	Min	Typ.	Max	Unit
Input on-state current	$I_{F(ON)}$	(Note 1)	6.3	—	14	mA
Input off-state voltage	$V_{F(OFF)}$		0	—	0.8	V
Supply voltage	V_{CC}	(Note 2)	2.7	3.3/5.0	5.5	
Operating temperature	T_{opr}	(Note 2)	-40	—	125	$^{\circ}\text{C}$

Note: The recommended operating conditions are given as a design guide necessary to obtain the intended performance of the device. Each parameter is an independent value. When creating a system design using this device, the electrical characteristics specified in this datasheet should also be considered.

Note: A ceramic capacitor (0.1 μF) should be connected between pin 6 and pin 4 to stabilize the operation of a high-gain linear amplifier. Otherwise, this photocoupler may not switch properly. The bypass capacitor should be placed within 1 cm of each pin.

Note 1: The rise and fall times of the input on-current should be less than 0.5 μs .

Note 2: Denotes the operating range, not the recommended operating condition.

9. Electrical Characteristics (Note)

(Unless otherwise specified, $T_a = -40$ to $125\text{ }^{\circ}\text{C}$, $V_{CC} = 2.7$ to 5.5 V)

Characteristics	Symbol	Note	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Input forward voltage	V_F		—	$I_F = 10\text{ mA}$, $T_a = 25\text{ }^{\circ}\text{C}$	1.45	1.55	1.7	V
Input forward voltage temperature coefficient	$\Delta V_F / \Delta T_a$		—	$I_F = 10\text{ mA}$	—	-2.0	—	mV/ $^{\circ}\text{C}$
Input reverse current	I_R		—	$V_R = 5\text{ V}$, $T_a = 25\text{ }^{\circ}\text{C}$	—	—	10	μA
Input capacitance	C_t		—	$V = 0\text{ V}$, $f = 1\text{ MHz}$, $T_a = 25\text{ }^{\circ}\text{C}$	—	60	—	pF
High-level output current	I_{OH}		Fig. 12.1.1	$V_F = 0.8\text{ V}$, $V_O = 5.5\text{ V}$, $V_{CC} = 5.5\text{ V}$	—	—	50	μA
				$V_F = 0.8\text{ V}$, $V_O = 5.5\text{ V}$, $V_{CC} = 5.5\text{ V}$, $T_a = 25\text{ }^{\circ}\text{C}$	—	—	10	
Low-level output voltage	V_{OL}		Fig. 12.1.2	$I_F = 10\text{ mA}$ $I_O = 13\text{ mA}$ (Sinking)	—	0.2	0.6	V
High-level supply current	I_{CCH}		Fig. 12.1.3	$I_F = 0\text{ mA}$	—	1.6	4.0	mA
Low-level supply current	I_{CCL}		Fig. 12.1.4	$I_F = 10\text{ mA}$	—	2.0	4.0	
Threshold input current (H/L)	I_{FHL}		—	$I_O = 13\text{ mA}$ (Sinking), $V_O < 0.6\text{ V}$	—	1.0	5.0	

Note: All typical values are at $T_a = 25\text{ }^{\circ}\text{C}$.

10. Isolation Characteristics (Unless otherwise specified, $T_a = 25\text{ }^{\circ}\text{C}$)

Characteristics	Symbol	Note	Test Conditions	Min	Typ.	Max	Unit
Total capacitance (input to output)	C_S	(Note 1)	$V_S = 0\text{ V}$, $f = 1\text{ MHz}$	—	0.8	—	pF
Isolation resistance	R_S	(Note 1)	$V_S = 500\text{ V}$, R.H. $\leq 60\%$	1×10^{12}	10^{14}	—	Ω
Isolation voltage	BV_S	(Note 1)	AC, 60 s	3750	—	—	Vrms
			AC, 1 s in oil	—	10000	—	
			DC, 60 s in oil	—	10000	—	Vdc

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

11. Switching Characteristics (Note)

(Unless otherwise specified, $T_a = -40$ to $125\text{ }^{\circ}\text{C}$, $V_{CC} = 2.7$ to 5.5 V)

Characteristics	Symbol	Note	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Propagation delay time (H/L)	t_{pHL}	(Note 1)	Fig. 12.1.5	$I_F = 0 \rightarrow 7.5\text{ mA}$, $R_L = 350\text{ }\Omega$, $C_L = 15\text{ pF}$	—	—	60	ns
Propagation delay time (L/H)	t_{pLH}	(Note 1)		$I_F = 7.5 \rightarrow 0\text{ mA}$, $R_L = 350\text{ }\Omega$, $C_L = 15\text{ pF}$	—	—	60	
Pulse width distortion	$ t_{pHL} - t_{pLH} $	(Note 1)		$I_F = 7.5\text{ mA}$, $R_L = 350\text{ }\Omega$, $C_L = 15\text{ pF}$	—	—	35	
Propagation delay skew (device to device)	t_{psk}	(Note 1), (Note 2)		$I_F = 7.5\text{ mA}$, $R_L = 350\text{ }\Omega$, $C_L = 15\text{ pF}$	-40	—	40	
Fall time	t_f	(Note 1)		$I_F = 0 \rightarrow 7.5\text{ mA}$, $R_L = 350\text{ }\Omega$, $C_L = 15\text{ pF}$	—	30	—	
Rise time	t_r	(Note 1)		$I_F = 7.5 \rightarrow 0\text{ mA}$, $R_L = 350\text{ }\Omega$, $C_L = 15\text{ pF}$	—	30	—	
Common-mode transient immunity at output high	CM_H		Fig. 12.1.6	$V_{CM} = 1000\text{ V}_{p-p}$, $I_F = 0\text{ mA}$, $V_{CC} = 3.3\text{ V} / 5\text{ V}$, $T_a = 25\text{ }^{\circ}\text{C}$	± 20	± 25	—	kV/ μs
Common-mode transient immunity at output low	CM_L			$V_{CM} = 1000\text{ V}_{p-p}$, $I_F = 10\text{ mA}$, $V_{CC} = 3.3\text{ V} / 5\text{ V}$, $T_a = 25\text{ }^{\circ}\text{C}$	± 20	± 25	—	

Note: All typical values are at $T_a = 25\text{ }^{\circ}\text{C}$.Note 1: $f = 5\text{ MHz}$, duty = 50 %, input current $t_r = t_f = 5\text{ ns}$, C_L is approximately 15 pF which includes probe and stray wiring capacitance.Note 2: The propagation delay skew, t_{psk} , is equal to the magnitude of the worst-case difference in t_{pHL} and/or t_{pLH} that will be seen between units at the same given conditions (supply voltage, input current, temperature, etc).

12.1. Test Circuits

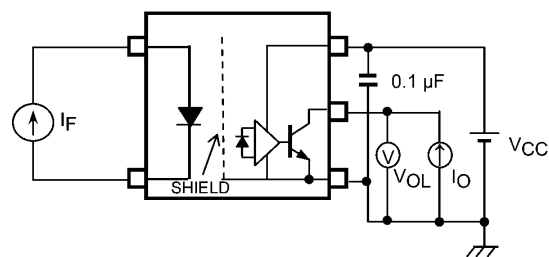


Fig. 12.1.2 V_{OL} Test Circuit

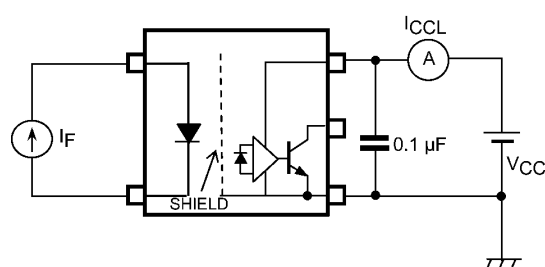


Fig. 12.1.4 I_{CC}L Test Circuit

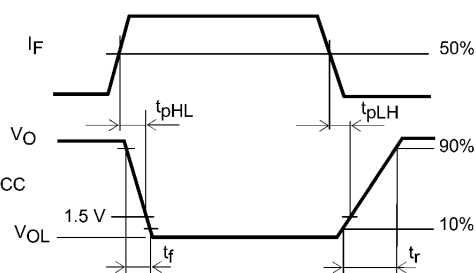


Fig. 12.1.5 Switching Time Test Circuit and Waveform

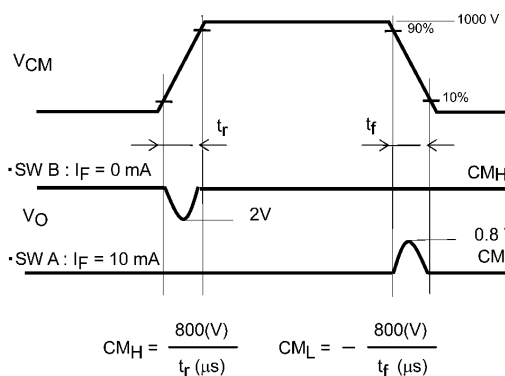


Fig. 12.1.6 Common-Mode Transient Immunity Test Circuit and Waveform

12.2. Characteristics Curves (Note)

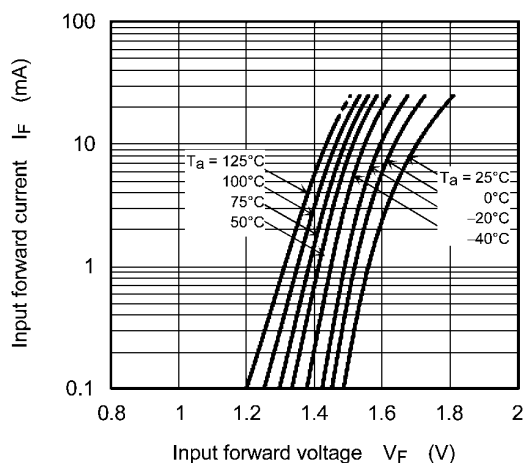


Fig. 12.2.1 $I_F - V_F$

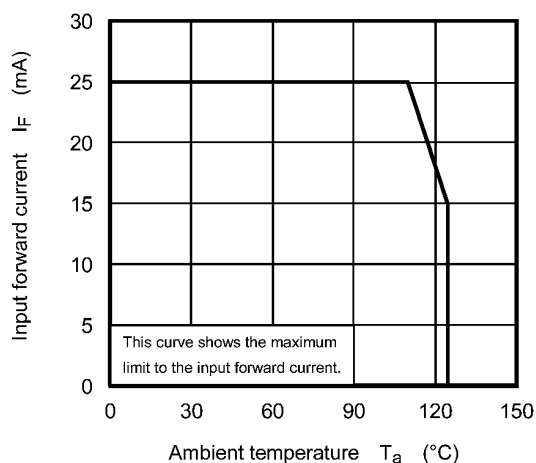


Fig. 12.2.2 $I_F - T_a$

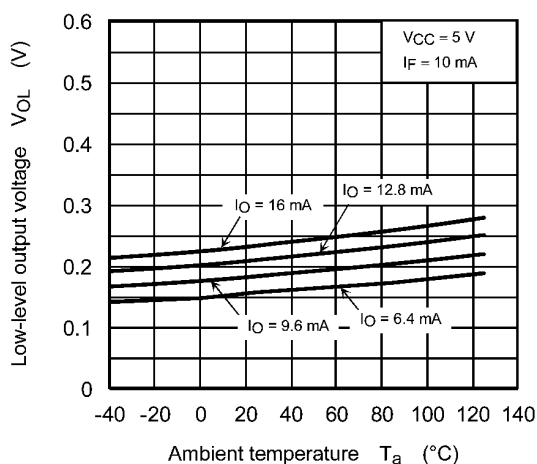


Fig. 12.2.3 $V_{OL} - T_a$

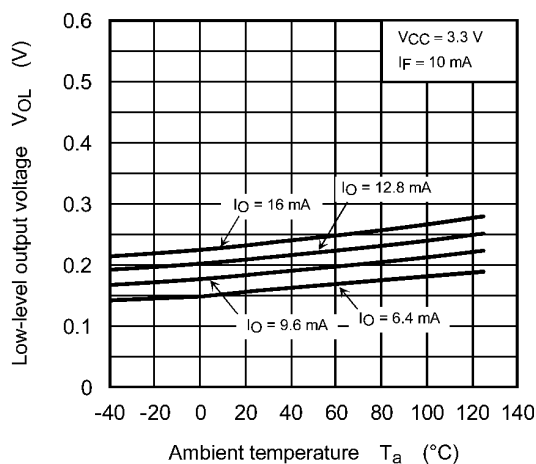


Fig. 12.2.4 $V_{OL} - T_a$

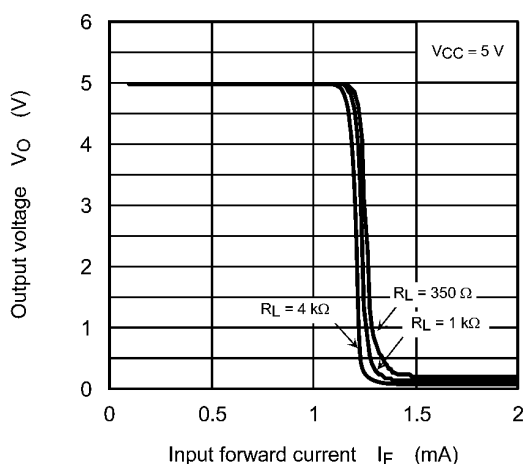


Fig. 12.2.5 $V_O - I_F$

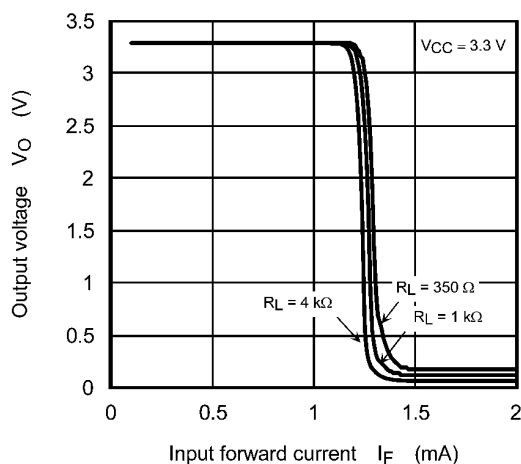
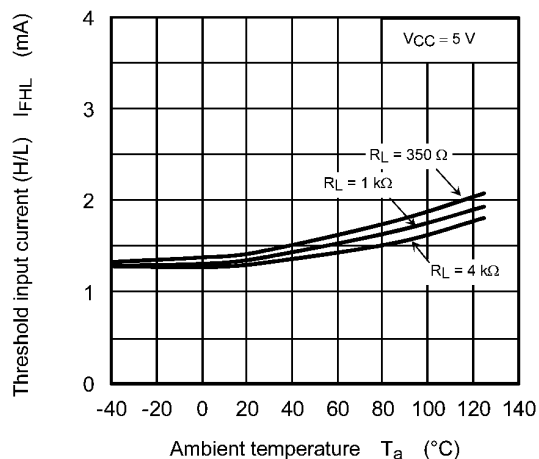
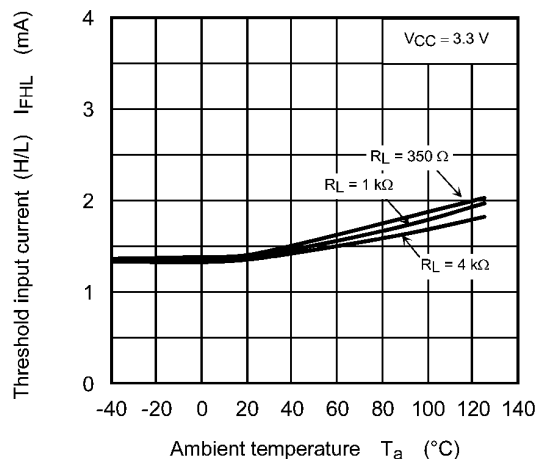
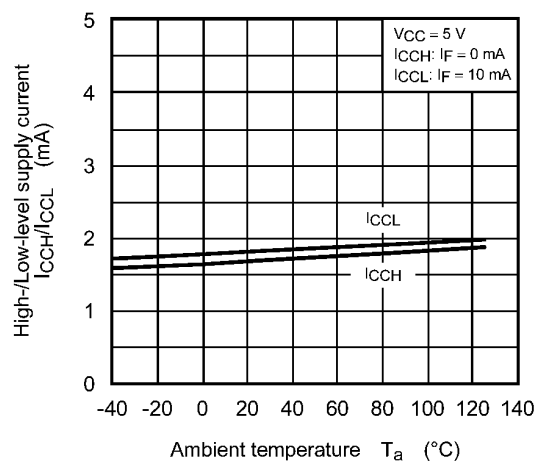
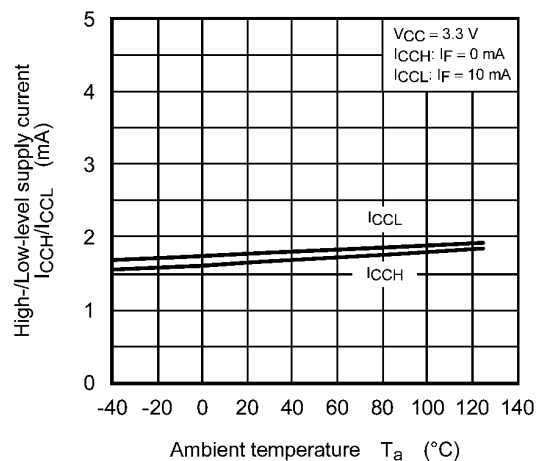
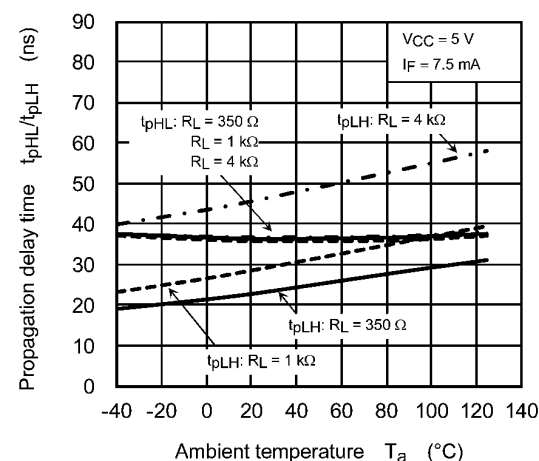
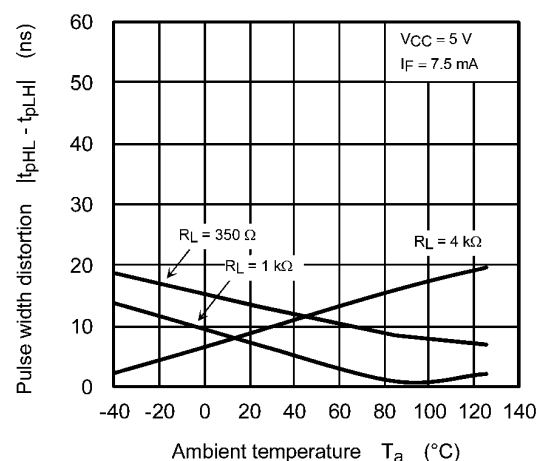
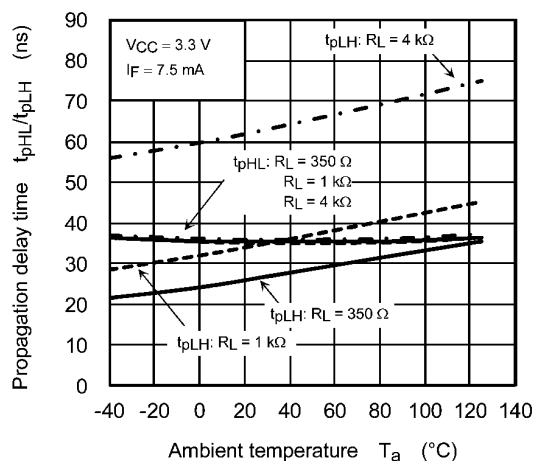
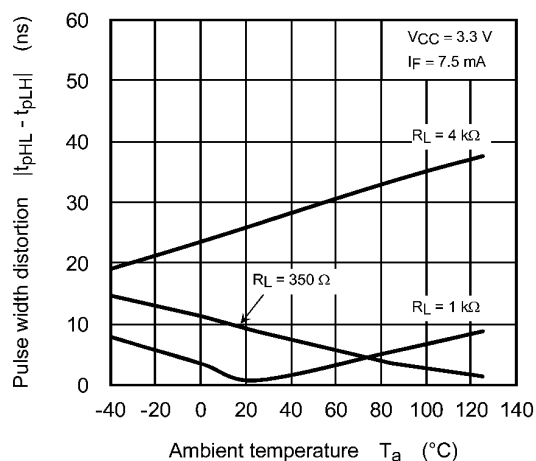
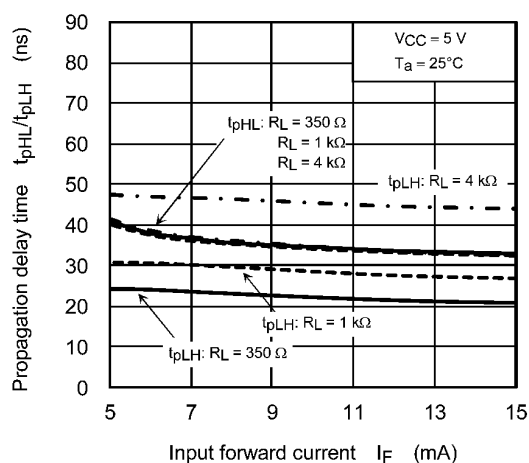
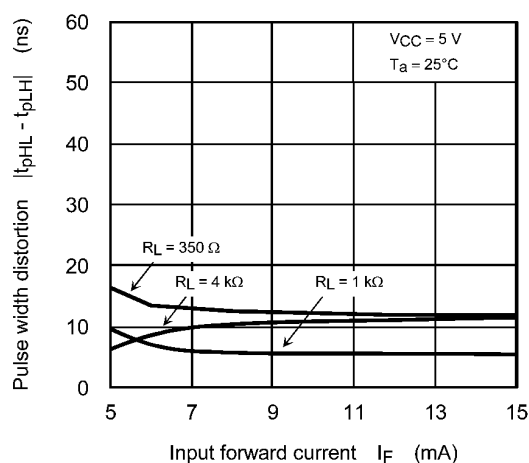
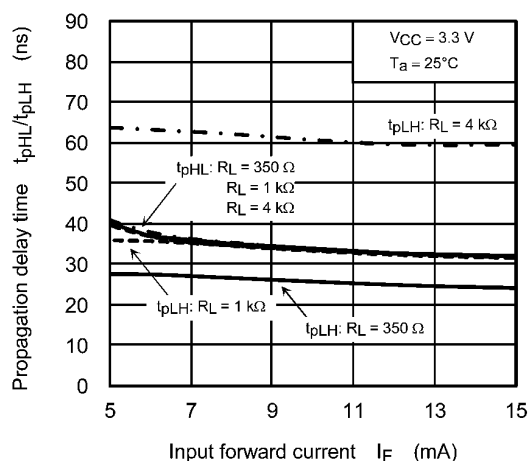
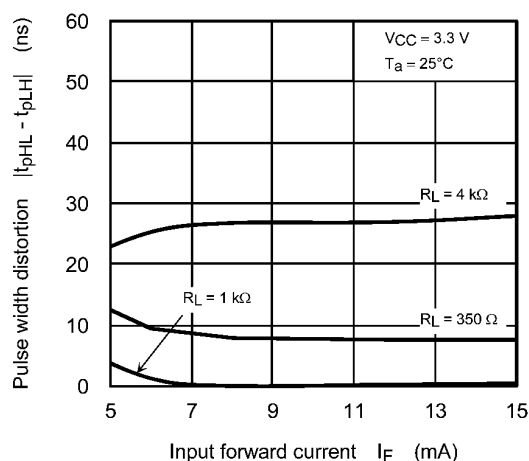


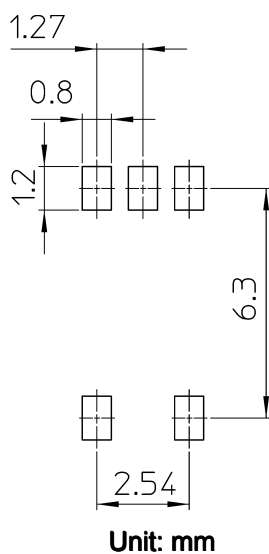
Fig. 12.2.6 $V_O - I_F$

Fig. 12.2.7 $I_{FHL} - T_a$ Fig. 12.2.8 $I_{FHL} - T_a$ Fig. 12.2.9 $I_{CCH}, I_{CCL} - T_a$ Fig. 12.2.10 $I_{CCH}, I_{CCL} - T_a$ Fig. 12.2.11 $t_{pHL}, t_{pLH} - T_a$ Fig. 12.2.12 $|t_{pHL} - t_{pLH}| - T_a$

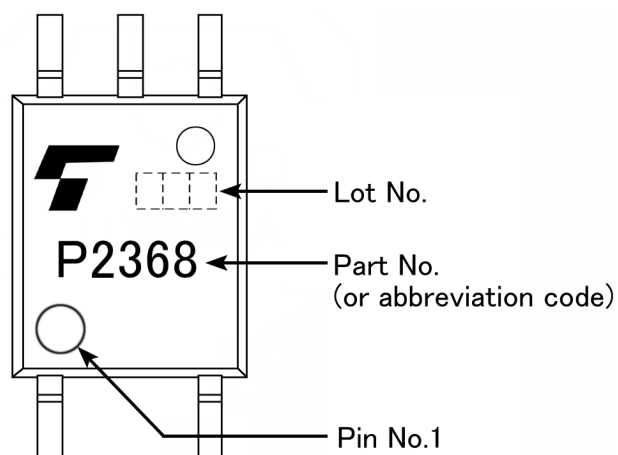
Fig. 12.2.13 $t_{pHL}, t_{pLH} - T_a$ Fig. 12.2.14 $|t_{pHL} - t_{pLH}| - T_a$ Fig. 12.2.15 $t_{pHL}, t_{pLH} - I_F$ Fig. 12.2.16 $|t_{pHL} - t_{pLH}| - I_F$ Fig. 12.2.17 $t_{pHL}, t_{pLH} - I_F$ Fig. 12.2.18 $|t_{pHL} - t_{pLH}| - I_F$

Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

14. Land Pattern Dimensions for Reference Only



15. Marking



16. EN60747-5-5 Option (V4) Specification

- Part number: TLP2368 (**Note 1**)
- The following part naming conventions are used for the devices that have been qualified according to option (V4) of EN60747.

Example: TLP2368(V4-TPL,E(O)

V4: EN60747 option

TPL: Tape type

E: [[G]]/RoHS COMPATIBLE (**Note 2**)

(O: Domestic ID (Country / Region of origin: Japan)

Note 1: Use TOSHIBA standard type number for safety standard application.

e.g., TLP2368(V4-TPL,E(O → TLP2368

Note 2: Please contact your Toshiba sales representative for details on environmental information such as the product's RoHS compatibility.

RoHS is the Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronics equipment.

Description	Symbol	Rating	Unit
Application classification			
for rated mains voltage ≤ 150 Vrms		I-IV	—
for rated mains voltage ≤ 300 Vrms		I-III	
Climatic classification		40 / 125 / 21	—
Pollution degree		2	—
Maximum operating insulation voltage	V_{IORM}	707	Vpeak
Input to output test voltage, Method A $V_{pr} = 1.6 \times V_{IORM}$, type and sample test $t_p = 10$ s, partial discharge < 5 pC	V_{pr}	1131	Vpeak
Input to output test voltage, Method B $V_{pr} = 1.875 \times V_{IORM}$, 100 % production test $t_p = 1$ s, partial discharge < 5 pC	V_{pr}	1325	Vpeak
Highest permissible overvoltage (transient overvoltage, $t_{pr} = 60$ s)	V_{TR}	6000	Vpeak
Safety limiting values (max. permissible ratings in case of fault, also refer to thermal derating curve)			
current (input current I_F , $P_{SO} = 0$)	I_{Si}	250	mA
power (output or total power dissipation)	P_{SO}	400	mW
temperature	T_S	150	°C
Insulation resistance $V_{IO} = 500$ V, $T_a = 25$ °C $V_{IO} = 500$ V, $T_a = 100$ °C $V_{IO} = 500$ V, $T_a = T_S$	R_{Si}	$\geq 10^{12}$ $\geq 10^{11}$ $\geq 10^9$	Ω

Fig. 16.1 EN60747 Isolation Characteristics

Minimum creepage distance	Cr	5.0 mm
Minimum clearance	Cl	5.0 mm
Minimum insulation thickness	ti	0.4 mm
Comparative tracking index	CTI	175

Fig. 16.2 Insulation Related Specifications (Note)

Note: This photocoupler is suitable for **safe electrical isolation** only within the safety limit data.
Maintenance of the safety data shall be ensured by means of protective circuits.



Fig. 16.3 Marking on Packing for EN60747

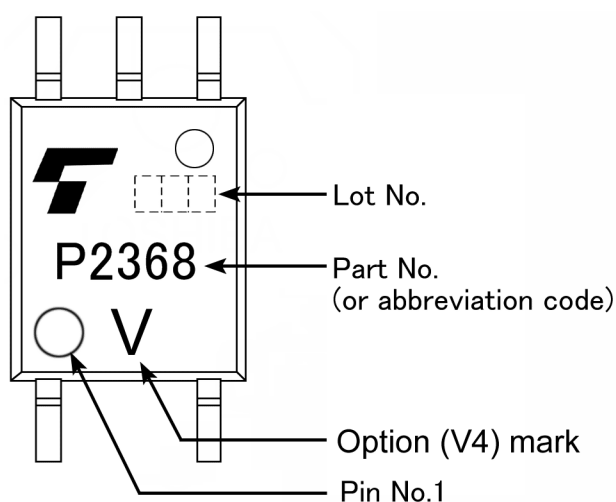


Fig. 16.4 Marking Example (Note)

Note: The above marking is applied to the photocouplers that have been qualified according to option (V4) of EN60747.

Figure 1 Partial discharge measurement procedure according to EN60747
Destructive test for qualification and sampling tests.

Method A

(for type and sampling tests,
destructive tests)

t_1, t_2	= 1 to 10 s
t_3, t_4	= 1 s
t_p (Measuring time for partial discharge)	= 10 s
t_b	= 12 s
t_{ini}	= 60 s

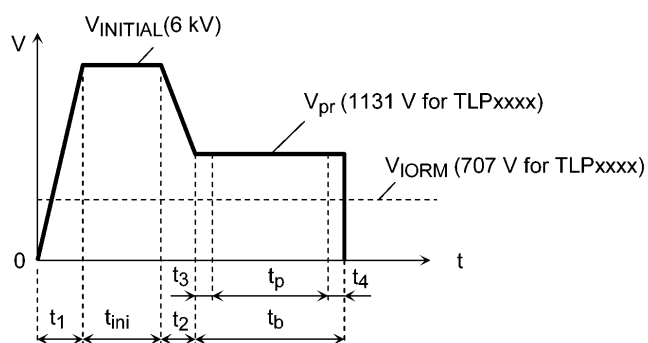


Figure 2 Partial discharge measurement procedure according to EN60747
Non-destructive test for 100 % inspection.

Method B

(for sample test, non-
destructive test)

t_3, t_4	= 0.1 s
t_p (Measuring time for partial discharge)	= 1 s
t_b	= 1.2 s

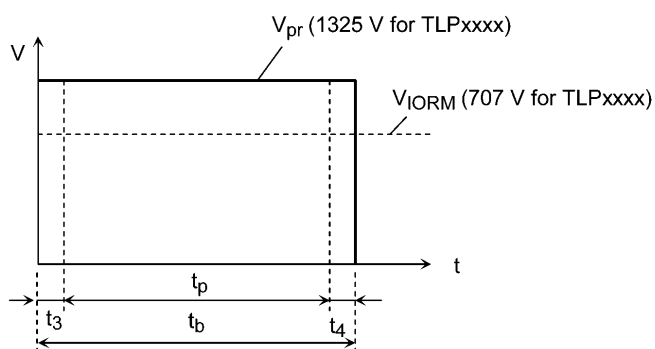


Figure 3 Dependency of maximum safety ratings on ambient temperature

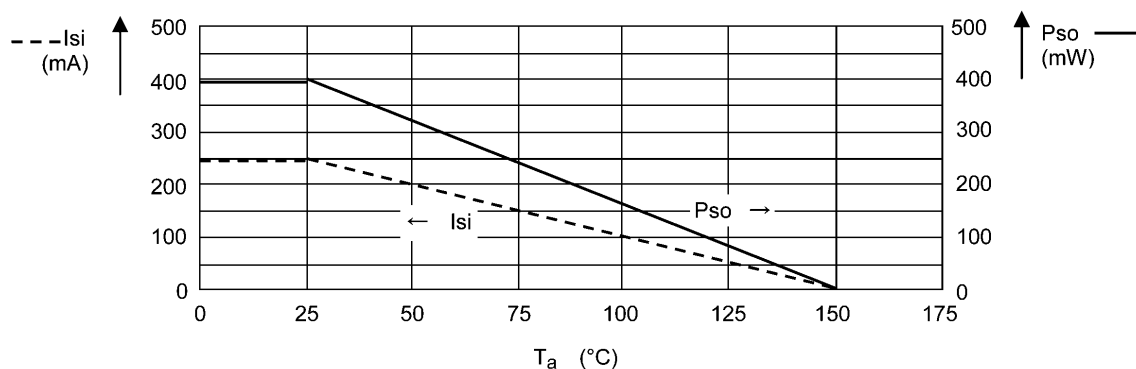
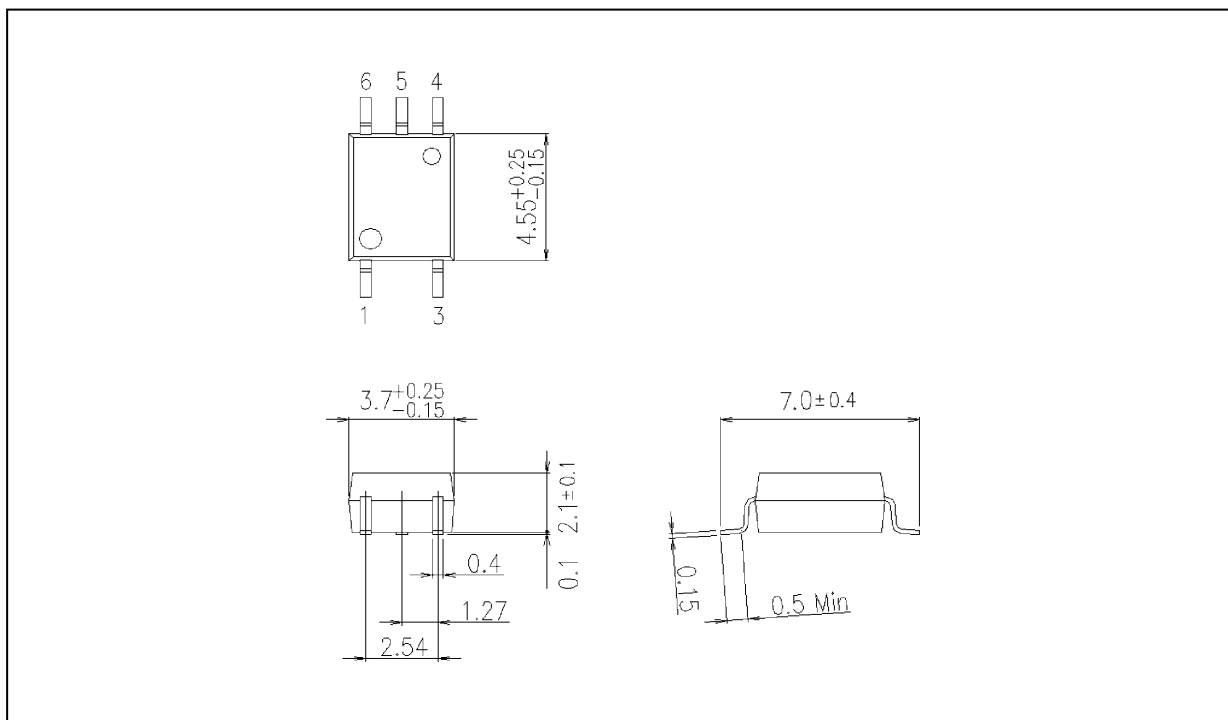


Fig. 16.5 Measurement Procedure

Package Dimensions

Unit: mm



Weight: 0.08 g (typ.)

Package Name(s)
TOSHIBA: 11-4L1S

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