

TOSHIBA Photocoupler GaAlAs IRED + Photo IC

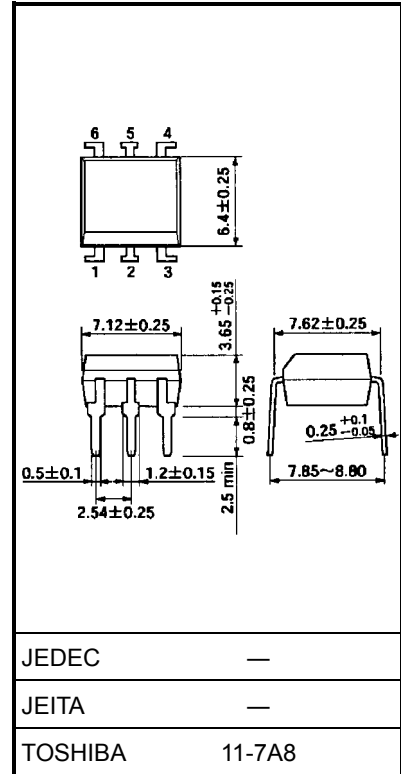
# TLP512

- Digital Logic Ground Isolation
- Line Receiver
- Microprocessor System Interfaces
- Switching Power Supply Feedback Control
- Transistor Inverter

The TLP512 consists of a GaAlAs high-output light emitting diode and a high-speed detector that contains a PN photodiode and an amplifier transistor into a single chip.

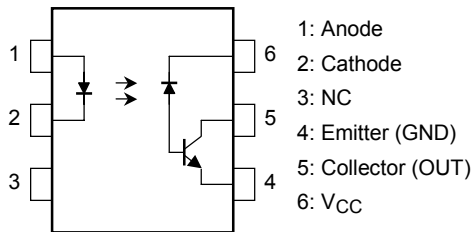
- Isolation voltage: 2500 Vrms (min)
- Switching speed:  $t_{pHL} = 0.8 \mu s$ ,  $t_{pLH} = 0.8 \mu s$  (max)  
@ $R_L = 1.9 k\Omega$
- TTL compatible
- UL recognized: UL1577, file No. E67349

Unit: mm

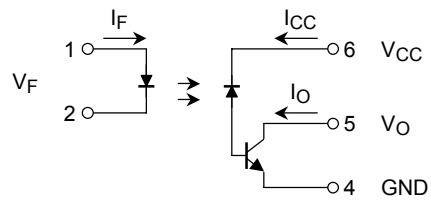


Weight: 0.4 g (typ.)

## Pin Configuration (top view)



## Schematic



## Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating	Unit
LED	DC forward current (Note 1)	I <sub>F</sub>	25	mA
	Pulse forward current (Note 2)	I <sub>FP</sub>	50	mA
	Peak transient forward current (Note 3)	I <sub>FPT</sub>	1	A
	DC reverse voltage	V <sub>R</sub>	5	V
	Diode power dissipation (Note 4)	P <sub>D</sub>	45	mW
Detector	Output current	I <sub>O</sub>	8	mA
	Peak output current	I <sub>OP</sub>	16	mA
	Output voltage	V <sub>O</sub>	-0.5 to 15	V
	Supply voltage	V <sub>CC</sub>	-0.5 to 15	V
	Output power dissipation (Note 5)	P <sub>O</sub>	100	mW
Operating temperature range		T <sub>opr</sub>	-55 to 100	°C
Storage temperature range		T <sub>stg</sub>	-55 to 125	°C
Soldering temperature (10 s) (Note 6)		T <sub>sol</sub>	260	°C
Isolation voltage (R.H. ≤ 60%, AC 1 min) (Note 7)		BV <sub>S</sub>	2500	V <sub>rms</sub>

Note 1: Decreases at the rate of 0.8 mA/°C with the ambient temperature of 70°C or higher.

Note 2: Duty cycle of 50%, pulse width of 1 ms.

Decreases at the rate of 1.6 mA/°C with the ambient temperature of 70°C or higher.

Note 3: Pulse width ≤ 1 μs, 300 pps

Note 4: Decreases at the rate of 0.9 mW/°C with the ambient temperature of 70°C or higher.

Note 5: Decreases at the rate of 2 mW/°C with the ambient temperature of 70°C or higher.

Note 6: Soldering is performed 2 mm from the bottom of the package.

Note 7: Device considered a two-terminal device: pins 1, 2, and 3 shorted together and pins 4, 5 and 6 shorted together.

## Electrical Characteristics (Ta = 25°C)

Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
LED	Forward voltage	$V_F$	$I_F = 16 \text{ mA}$	—	1.65	1.85	V
	Forward voltage temperature coefficient	$\Delta V_F / \Delta T_a$	$I_F = 16 \text{ mA}$	—	-2	—	mV/°C
	Reverse current	$I_R$	$V_R = 5 \text{ V}$	—	—	10	$\mu\text{A}$
	Pin-to-pin capacitance	$C_T$	$V_F = 0, f = 1 \text{ MHz}$	—	4.5	—	pF
Detector	High-level output current	$I_{OH(1)}$	$I_F = 0 \text{ mA}, V_{CC} = V_O = 5.5 \text{ V}$	—	3	500	nA
		$I_{OH(2)}$	$I_F = 0 \text{ mA}, V_{CC} = V_O = 15 \text{ V}$	—	—	5	$\mu\text{A}$
		$I_{OH}$	$I_F = 0 \text{ mA}, V_{CC} = V_O = 15 \text{ V}$ $T_a = 70^\circ\text{C}$	—	—	50	
	High-level supply current	$I_{CCH}$	$I_F = 0 \text{ mA}, V_{CC} = 15 \text{ V}$	—	0.01	1	$\mu\text{A}$

## Coupled Electrical Characteristics (Ta = 25°C)

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Current transfer ratio	$I_O / I_F$	$I_F = 16 \text{ mA}, V_{CC} = 4.5 \text{ V}$ $V_O = 0.4 \text{ V}$	20	40	—	%
		$I_F = 16 \text{ mA}, V_{CC} = 4.5 \text{ V}$ $V_O = 0.4 \text{ V}, T_a = 0 \text{ to } 70^\circ\text{C}$	15	—	—	
Low-level output voltage	$V_{OL}$	$I_F = 16 \text{ mA}, V_{CC} = 4.5 \text{ V}$ $I_O = 2.4 \text{ mA}$	—	—	0.4	V

## Isolation Characteristics (Ta = 25°C)

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Capacitance input to output	$C_S$	$V_S = 0, f = 1 \text{ MHz}$ (Note 7)	—	0.8	—	pF
Isolation resistance	$R_S$	R.H. $\leq 60\%$ , $V_S = 500 \text{ V}$ (Note 7)	$5 \times 10^{10}$	$10^{14}$	—	$\Omega$
Isolation voltage	$BV_S$	AC 1 min	2500	—	—	Vrms
		AC 1 s, in oil	—	5000	—	
		DC 1 min, in oil	—	5000	—	Vdc

**Switching Characteristics (Ta = 25°C)**

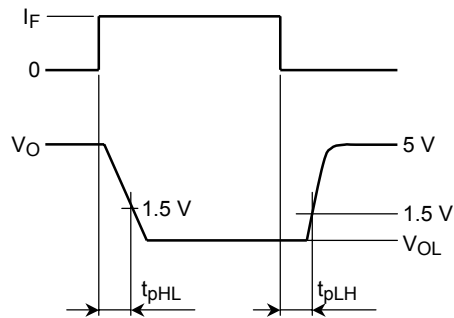
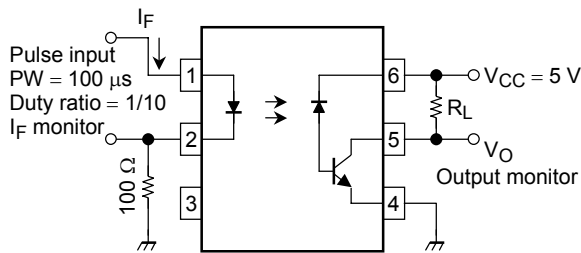
Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Propagation delay time (H → L)	$t_{pHL}$	1	$I_F = 0 \rightarrow 16 \text{ mA}$ , $R_L = 1.9 \text{ k}\Omega$	—	—	0.8	$\mu\text{s}$
Propagation delay time (L → H)	$t_{pLH}$		$I_F = 16 \rightarrow 0 \text{ mA}$ , $R_L = 1.9 \text{ k}\Omega$	—	—	0.8	$\mu\text{s}$
Common mode transient immunity at logic high output (Note 8)	$CM_H$	2	$I_F = 0 \text{ mA}$ , $V_{CM} = 200 \text{ V}_{P-P}$ $R_L = 1.9 \text{ k}\Omega$	—	1500	—	$\text{V}/\mu\text{s}$
Common mode transient immunity at logic low output (Note 8)	$CM_L$		$I_F = 16 \text{ mA}$ , $V_{CM} = 200 \text{ V}_{P-P}$ $R_L = 1.9 \text{ k}\Omega$	—	-1500	—	$\text{V}/\mu\text{s}$

Note 8: Common mode transient immunity in logic high level is the maximum tolerable (positive)  $dV_{CM}/dt$  on the leading edge of the common mode pulse,  $V_{CM}$ , to assure that the output will remain in a logic high state ( $V_{OUT} > 2.0 \text{ V}$ ).

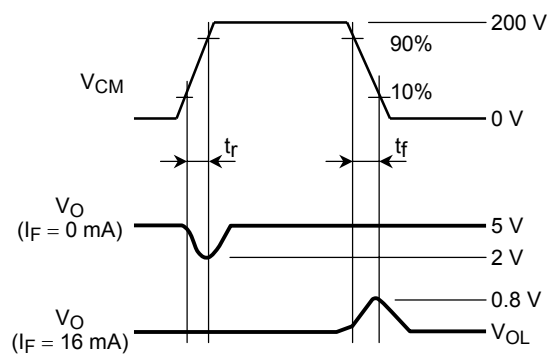
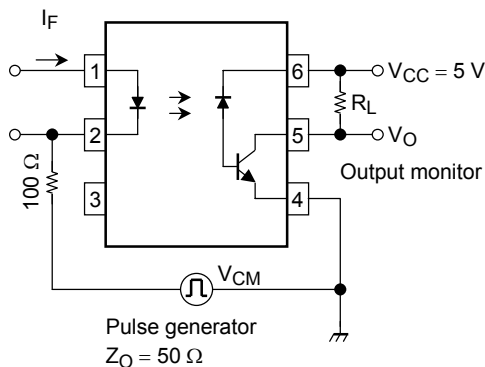
Common mode transient immunity in logic low level is the maximum tolerable (negative)  $dV_{CM}/dt$  on the trailing edge of the common mode pulse,  $V_{CM}$ , to assure that the output will remain in a logic low state ( $V_{OUT} < 0.8 \text{ V}$ ).

Note 9: Electrostatic discharge immunity (pin to pin): 100 V (max)  
( $C \leq 200 \text{ pF}$ ,  $R = 0$ )

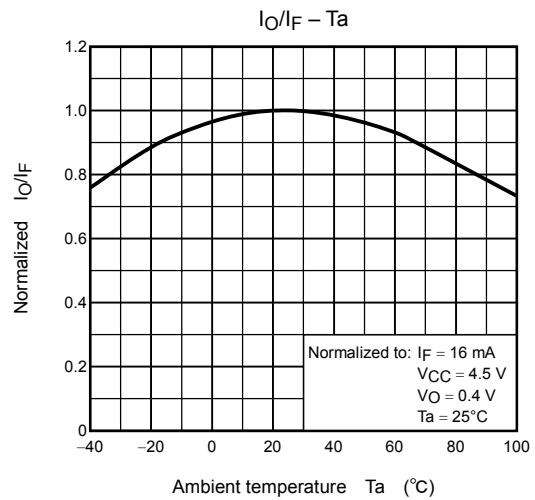
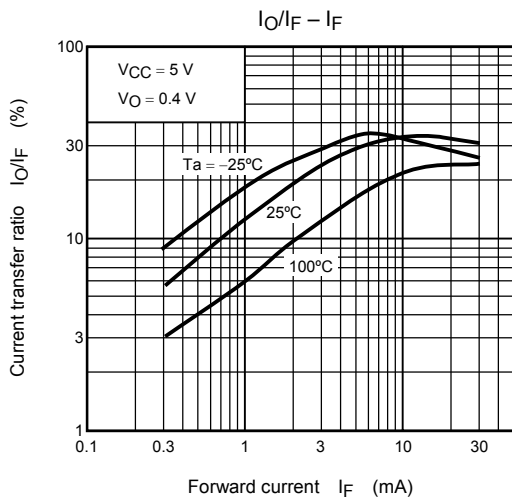
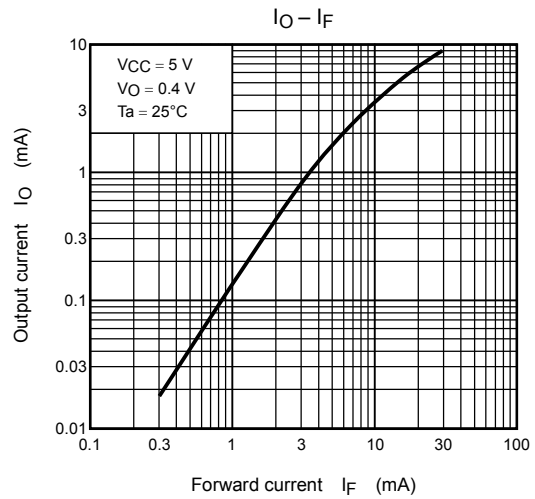
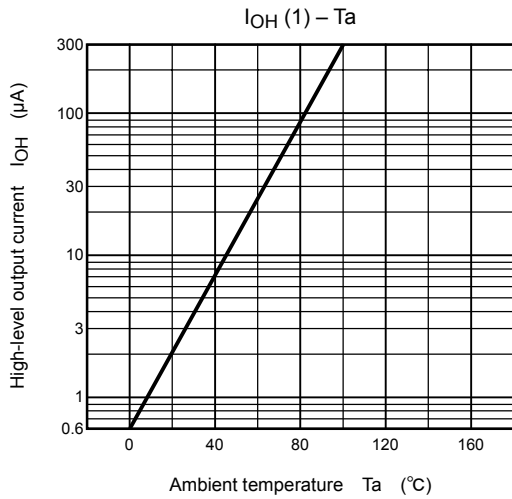
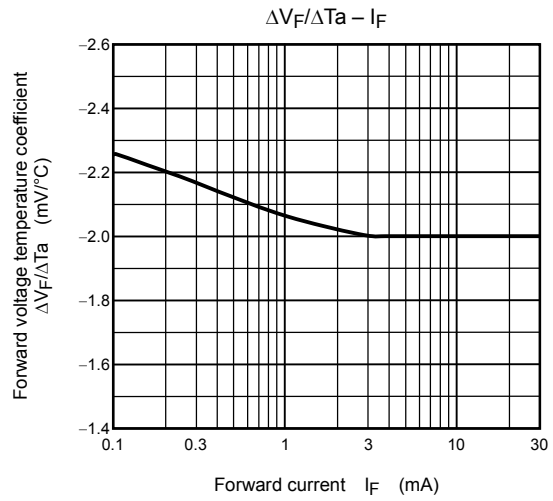
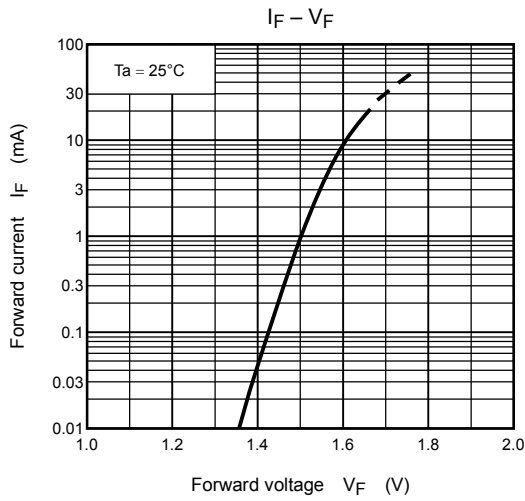
**Test Circuit 1: Switching Time Test Circuit**



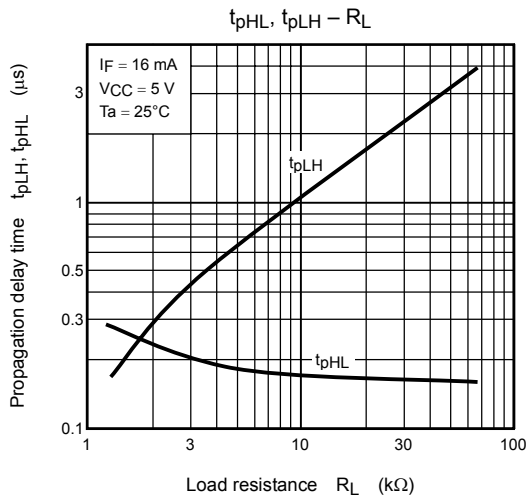
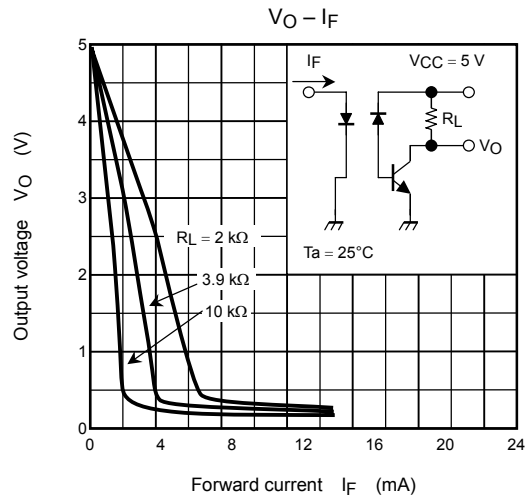
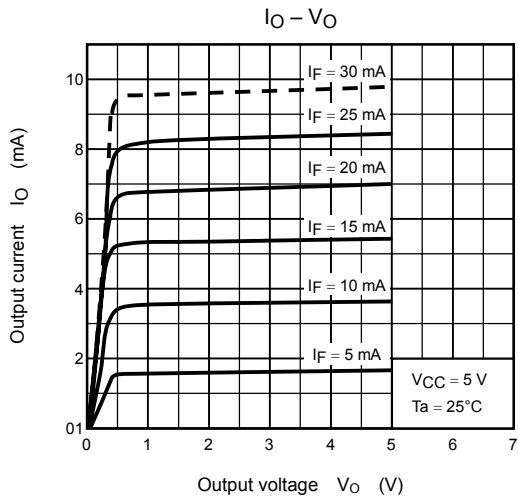
**Test Circuit 2: Common Mode Noise Immunity Test Circuit**



$$CM_H = \frac{160 \text{ (V)}}{t_r \text{ (\mu s)}}, CM_L = \frac{160 \text{ (V)}}{t_f \text{ (\mu s)}}$$



\*: The above graphs show typical characteristics.



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