

TLP706

Intelligent power module signal isolation

Industrial inverters

Motor drive

The Toshiba TLP706 consists of a GaAlAs light-emitting diode and an integrated high-gain, high-speed photodetector. The TLP706 is suitable for isolating input control signals to intelligent power modules. This unit is a 6-pin SDIP. The TLP706 is 50% smaller than the 8-PIN DIP and meets the reinforced insulation class requirements of international safety standards. Therefore the mounting area can be reduced in equipment requiring safety standard certification.

The detector has a totem pole output stage to provide both source and sink driving. The detector IC has an internal shield that provides a guaranteed common-mode transient immunity of 10 kV/μs.

The TLP706 is buffer logic type. For inverter logic type, the TLP702 is in line-up.

- Buffer logic type (totem pole output)
- Guaranteed performance over temperature : -40~100°C
- Power supply voltage : 4.5~20 V
- Input current: I_{FHL} = 5 mA (Max.)
- Switching time (t_{pLH} / t_{pHL}) : 600 ns (Max.)
- Common-mode transient immunity : ±10 kV/μs (Min)
- Isolation voltage : 5000 Vrms (Min)
- UL Recognized :UL1577, File No.E67349
- Option (D4)
TÜV Approved : DIN EN60747-5-2
No.R50033433

Maximum Operating Insulation Voltage : 890V_{PK}

Highest Permissible Over Voltage : 8000V_{PK}

(Note) : When a EN60747-5-2 approved type is needed,
Please designate "Option(D4)"

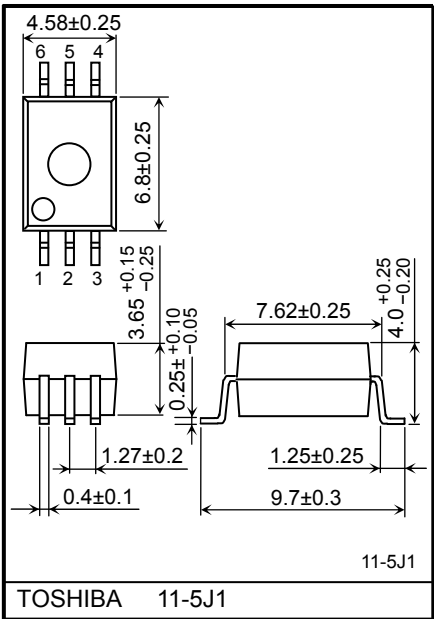
- Construction Mechanical Rating

	7.62 mm pich standard type	10.16 mm pich TLPXXXX type
Creepage Distance	7.0 mm (Min)	8.0 mm (Min)
Clearance	7.0 mm (Min)	8.0 mm (Min)
Insulation Thickness	0.4 mm (Min)	0.4 mm (Min)

Truth Table

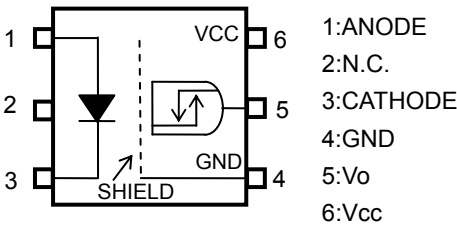
Input	LED	Tr1	Tr2	Output
H	ON	ON	OFF	H
L	OFF	OFF	ON	L

Unit in mm

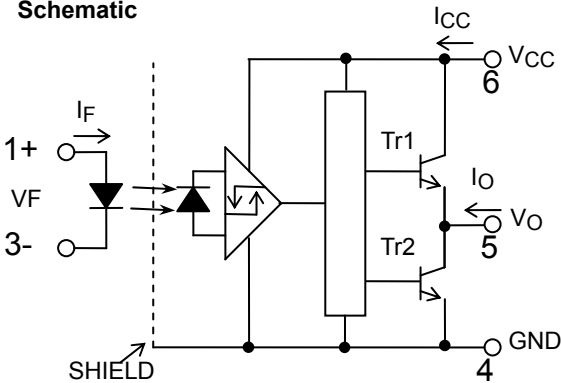


Weight:0.26 g (typ.)

Pin Configuration (Top View)



Schematic



0.1 μF bypass capacitor must be connected between pins 6 and 4. (Note 4)

Absolute Maximum Ratings (Ta = 25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
LED	Forward Current (Ta ≤ 85°C)	I _F	20	mA
	Forward Current Derating (Ta > 85°C)	ΔI _F /ΔTa	-0.5	mA/°C
	Peak Transient Forward Current (Note 1)	I _{FPT}	1	A
	Reverse Voltage	V _R	5	V
	Junction Temperature	T _j	125	°C
DETECTOR	Output Current 1 (Ta ≤ 25°C)	I _{O1}	15/-15	mA
	Output Current 2 (Ta ≤ 100°C)	I _{O2}	4.5/-4.5	mA
	Peak Output Current	I _{OP}	20/-20	mA
	Output Voltage	V _O	-0.5~20	V
	Supply Voltage	V _{CC}	-0.5~20	V
	Junction Temperature	T _j	125	°C
Operating Temperature Range		T _{opr}	-40~100	°C
Storage Temperature Range		T _{stg}	-55~125	°C
Lead Solder Temperature (10 s)		T _{sol}	260	°C
Isolation Voltage (AC, 1 min., R.H. ≤ 60%, Ta = 25°C) (Note 2)		BVs	5000	V _{rms}

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).

Recommended Operating Conditions

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT
Input Current, ON	I _F (ON)	7	-	12	mA
Input Voltage, OFF	V _F (OFF)	0	-	0.8	V
Supply Voltage (*) (Note 3, Note 4)	V _{CC}	4.5	-	20	V

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.

(*) This item denotes operating ranges, not meaning of recommended operating conditions.

Note 1: Pulse width PW ≤ 1 μs, 300 pps.

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

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 output may be unstable. Be sure to use the product after checking the supply current, and the operation of a power-on/-off.

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 bypassing may impair the switching property. The total lead length between capacitor and coupler should not exceed 1 cm.

Electrical Characteristics

(Unless otherwise specified, Ta = -40~100°C, Vcc = 4.5~20 V.)

CHARACTERISTIC	SYMBOL	TEST CIRCUIT	CONDITION	MIN.	TYP. *	MAX.	UNIT
Input forward voltage	V _F	—	I _F = 5 mA, Ta = 25°C	—	1.6	1.7	V
Temperature coefficient of forward voltage	ΔV _F /ΔTa	—	I _F = 5 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 V, f = 1 MHz, Ta = 25°C	—	30	—	pF
Logic LOW output voltage	V _{OL}	1	I _{OL} = 3.5 mA, V _F = 0.8 V	—	0.1	0.35	V
Logic HIGH output voltage	V _{OH}	2	I _{OH} = -3.5 mA, V _{CC} = 5 V	2.4	3.1	—	V
			I _F = 5 mA, V _{CC} = 20 V	17.4	18.1	—	
Logic LOW supply current	I _{CCL}	3	V _F = 0 V, V _{CC} = 20 V, Ta = -40~100°C	—	4.0	6.0	mA
			V _{CC} = 5 V, Ta = 25°C	—	3.6	4.5	
Logic HIGH supply current	I _{CCH}	4	I _F = 5 mA, V _{CC} = 20 V, Ta = -40~100°C	—	3.1	6.0	mA
			V _{CC} = 5 V, Ta = 25°C	—	2.8	4.5	
Logic LOW short circuit output current	I _{OSL}	5	V _F = 0.8 V, V _{CC} = V _O = 20 V	7	37	—	mA
Logic HIGH short circuit output current	I _{OSH}	6	I _F = 5 mA, V _O = GND, V _{CC} = 20 V	-7	-40	—	mA
Input current logic HIGH output	I _{FLH}	—	I _O = -3.5 mA, V _O > 2.4 V, V _{CC} = 5 V	—	0.5	5	mA
Input voltage logic LOW output	V _{FHL}	—	I _O = 3.5 mA, V _O < 0.4 V	0.8	—	—	V
Input current hysteresis	I _{HYS}	—	V _{CC} = 5 V	—	0.05	—	mA

*All typical values are at Ta = 25°C.

Isolation Characteristics (Ta = 25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Capacitance input to output	C _S	V = 0V, f = 1 MHz (Note 2)	—	1.0	—	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	5000	—	—	V _{rms}
		AC, 1 second, in oil	—	10000	—	V _{dc}
		DC, 1 minute, in oil	—	10000	—	

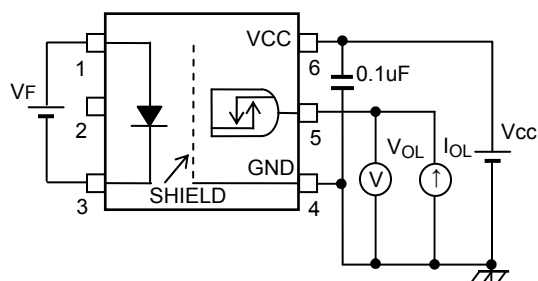
Switching Characteristics

(Unless otherwise specified, $T_a = -40 \sim 100^\circ\text{C}$, $V_{CC} = 4.5 \sim 20\text{ V}$.)

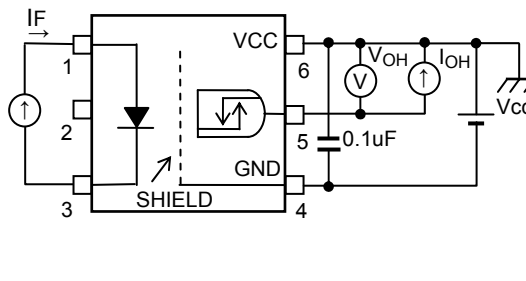
CHARACTERISTIC	SYMBOL	TEST CIRCUIT	CONDITION	MIN.	TYP. *	MAX.	UNIT
Propagation delay time to logic HIGH output	t_{pLH}	7	$I_F = 0 \rightarrow 5\text{ mA}$, $C_L = 100\text{ pF}$ $V_{CC} = 20\text{ V}$	50	250	600	ns
Propagation delay time to logic LOW output	t_{pHL}		$I_F = 5 \rightarrow 0\text{ mA}$, $C_L = 100\text{ pF}$ $V_{CC} = 20\text{ V}$	50	260	600	ns
Switching time dispersion Between ON and OFF	$ t_{pHL} - t_{pLH} $		$I_F = 0 \leftrightarrow 5\text{ mA}$, $C_L = 100\text{ pF}$ $V_{CC} = 20\text{ V}$	—	—	550	ns
Output rise time	t_r		$I_F = 0 \rightarrow 5\text{ mA}$, $V_{CC} = 20\text{ V}$	—	175	—	ns
Output fall time	t_f		$I_F = 5 \rightarrow 0\text{ mA}$, $V_{CC} = 20\text{ V}$	—	95	—	ns
Propagation delay time to logic HIGH output	t_{pLH}	8	$I_F = 0 \rightarrow 5\text{ mA}$	50	—	600	ns
Propagation delay time to logic LOW output	t_{pHL}		$I_F = 5 \rightarrow 0\text{ mA}$	50	—	600	ns
Common-mode transient Immunity at LOW level output	CM_L	9	$V_{CM} = 1000\text{ Vp-p}$, $I_F = 0\text{ mA}$, $V_{CC} = 20\text{ V}$, $T_a = 25^\circ\text{C}$	10000	—	—	V/us
Common-mode transient Immunity at HIGH level output	CM_H		$V_{CM} = 1000\text{ Vp-p}$, $I_F = 5\text{ mA}$, $V_{CC} = 20\text{ V}$, $T_a = 25^\circ\text{C}$	-10000	—	—	V/us

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

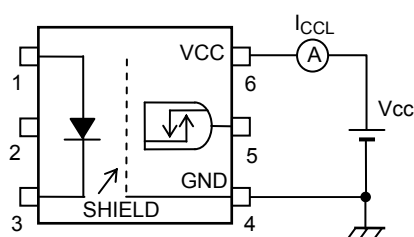
TEST CIRCUIT 1 : V_{OL}



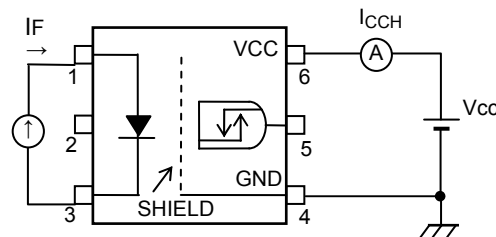
TEST CIRCUIT 2 : V_{OH}



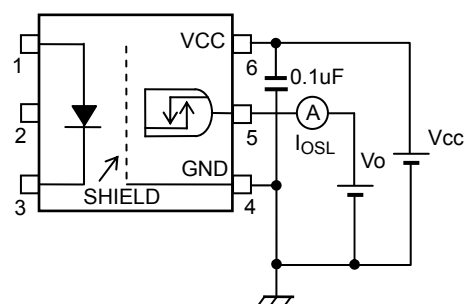
TEST CIRCUIT 3 : I_{CCL}



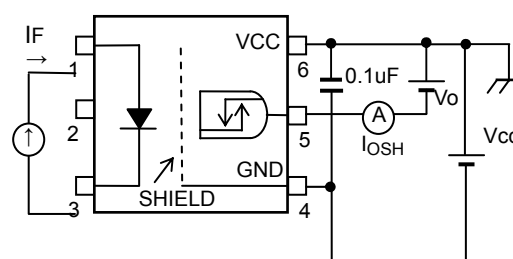
TEST CIRCUIT 4 : I_{CCH}



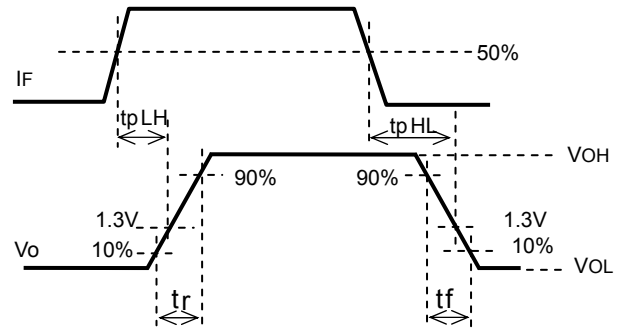
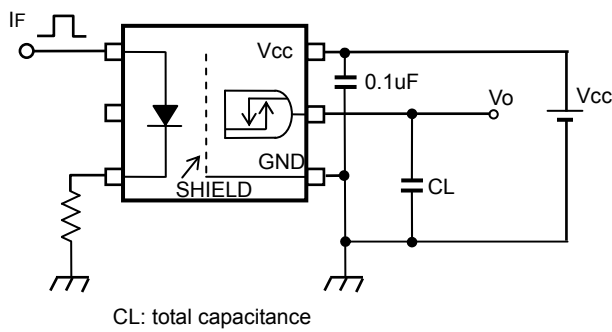
TEST CIRCUIT 5 : I_{OSL}



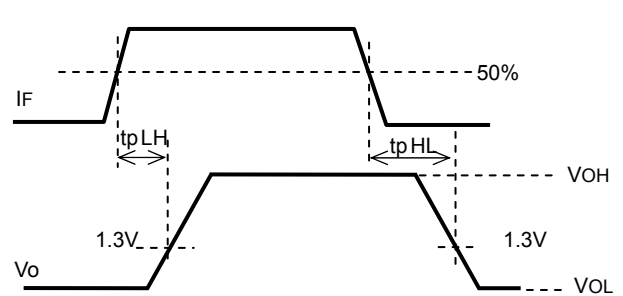
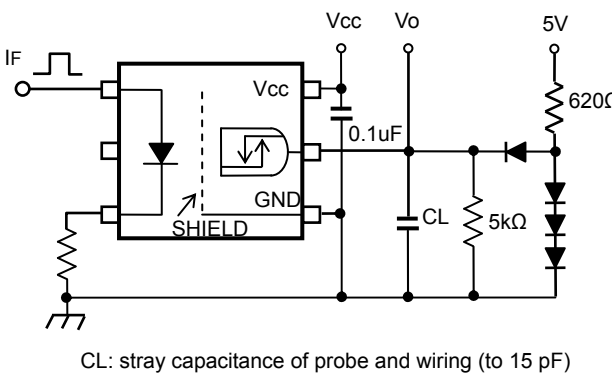
TEST CIRCUIT 6 : I_{OSH}



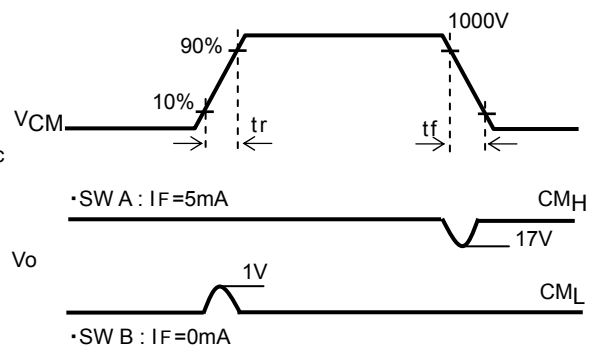
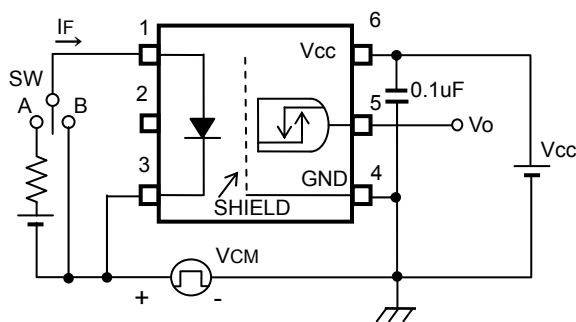
TEST CIRCUIT 7: Switching Time Test Circuit



TEST CIRCUIT 8: Switching Time Test Circuit



TEST CIRCUIT 9: Common-Mode Transient Immunity Test Circuit



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

CM_L (CM_H) is the maximum rate of rise (fall) of the common mode voltage that can be sustained with the output voltage in the low (high) state.

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