

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)
- Pb Free
- 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 V_{rms} (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,

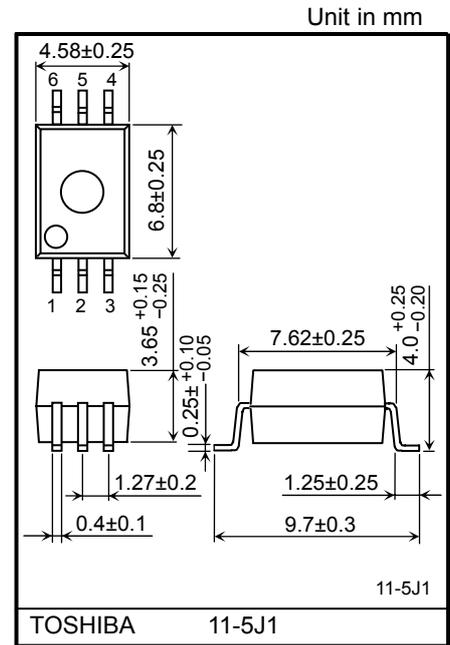
Please designate "Option(D4)"

- Construction Mechanical Rating

	7.62 mm pich standard type	10.16 mm pich TLPXXXF 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)

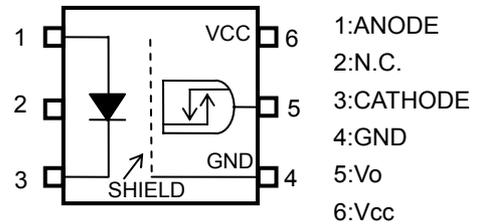
Truth Table

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

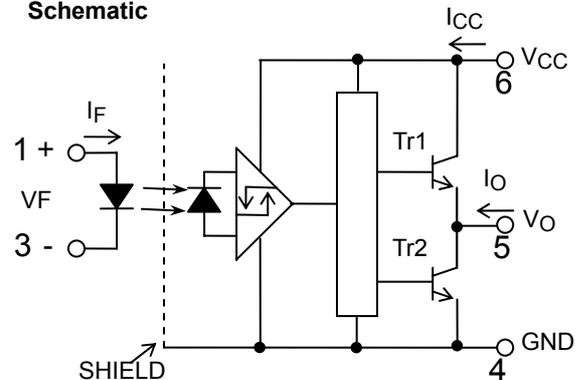


Weight : 0.26 g (typ.)

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)	IF	20	mA
	Forward Current Derating (Ta > 85°C)	ΔIF/ΔTa	-0.5	mA/°C
	Peak Transient Forward Current (Note 1)	IFPT	1	A
	Reverse Voltage	VR	5	V
	Junction Temperature	TJ	125	°C
DETECTOR	Output Current 1 (Ta ≤ 25°C)	IO1	15/-15	mA
	Output Current 2 (Ta ≤ 100°C)	IO2	4.5/-4.5	mA
	Peak Output Current	IOP	20/-20	mA
	Output Voltage	VO	-0.5~20	V
	Supply Voltage	VCC	-0.5~20	V
	Junction Temperature	TJ	125	°C
Operating Temperature Range		Topr	-40~100	°C
Storage Temperature Range		Tstg	-55~125	°C
Lead Solder Temperature (10 s)		Tsol	260	°C
Isolation Voltage (AC, 1 min., R.H. ≤ 60%, Ta = 25°C) (Note 2)		BVs	5000	Vrms

Recommended Operating Conditions

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT
Input Current, ON	IF (ON)	7	-	12	mA
Input Voltage, OFF	VF (OFF)	0	-	0.8	V
Supply Voltage (*) (Note 3, Note 4)	VCC	4.5	-	20	V

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.

Note1 : Pulse width $PW \leq 1 \mu s, 300 \text{ pps}$.

Note2 : Device Considered a two terminal device : pins 1,2 and 3 shorted together and pins 4,5 and 6 shorted together.

Note3 :The detector of this product requires a power supply voltage (VCC) of 4.5 V or higher for stable operation.

If the VCC 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.

Note4 : 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	—	$I_F = 5 \text{ mA}$, $T_a = 25^\circ\text{C}$	—	1.6	1.7	V	
Temperature coefficient of forward voltage	$\Delta V_F / \Delta T_a$	—	$I_F = 5 \text{ mA}$	—	-2.0	—	mV/°C	
Input reverse current	I_R	—	$V_R = 5 \text{ V}$, $T_a = 25^\circ\text{C}$	—	—	10	μA	
Input capacitance	C_T	—	$V = 0 \text{ V}$, $f = 1 \text{ MHz}$, $T_a = 25^\circ\text{C}$	—	30	—	pF	
Logic LOW output voltage	V_{OL}	1	$I_{OL} = 3.5 \text{ mA}$, $V_F = 0.8 \text{ V}$	—	0.1	0.35	V	
Logic HIGH output voltage	V_{OH}	2	$I_{OH} = -3.5 \text{ mA}$, $I_F = 5 \text{ mA}$	$V_{CC} = 5 \text{ V}$	2.4	3.1	—	V
				$V_{CC} = 20 \text{ V}$	17.4	18.1	—	
Logic LOW supply current	I_{CCL}	3	$V_F = 0 \text{ V}$	$V_{CC} = 20 \text{ V}$ $T_a = -40 \sim 100^\circ\text{C}$	—	4.0	6.0	mA
				$V_{CC} = 5 \text{ V}$ $T_a = 25^\circ\text{C}$	—	3.6	4.5	
Logic HIGH supply current	I_{CCH}	4	$I_F = 5 \text{ mA}$	$V_{CC} = 20 \text{ V}$ $T_a = -40 \sim 100^\circ\text{C}$	—	3.1	6.0	mA
				$V_{CC} = 5 \text{ V}$ $T_a = 25^\circ\text{C}$	—	2.8	4.5	
Logic LOW short circuit output current	I_{OSL}	5	$V_F = 0.8 \text{ V}$ $V_{CC} = V_O = 20 \text{ V}$	7	37	—	mA	
Logic HIGH short circuit output current	I_{OSH}	6	$I_F = 5 \text{ mA}$, $V_O = \text{GND}$ $V_{CC} = 20 \text{ V}$	-7	-40	—	mA	
Input current logic HIGH output	I_{FLH}	—	$I_O = -3.5 \text{ mA}$, $V_O > 2.4 \text{ V}$ $V_{CC} = 5 \text{ V}$	—	0.5	5	mA	
Input voltage logic LOW output	V_{FHL}	—	$I_O = 3.5 \text{ mA}$, $V_O < 0.4 \text{ V}$	0.8	—	—	V	
Input current hysteresis	I_{HYS}	—	$V_{CC} = 5 \text{ V}$	—	0.05	—	mA	

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

Isolation Characteristics (Ta = 25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Capacitance input to output	C_S	$V = 0 \text{ V}$, $f = 1 \text{ MHz}$ (Note 2)	—	1.0	—	pF
Isolation resistance	R_S	R.H. $\leq 60\%$, $V_S = 500 \text{ V}$ (Note 2)	1×10^{12}	10^{14}	—	Ω
Isolation voltage	BV_S	AC, 1 minute	5000	—	—	V_{rms}
		AC, 1 second, in oil	—	10000	—	Vdc
		DC, 1 minute, in oil	—	10000	—	

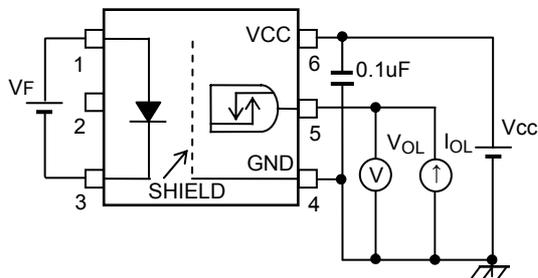
Switching Characteristics

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

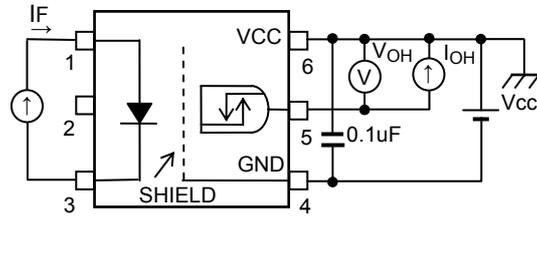
CHARACTERISTIC	SYMBOL	TEST CIRCUIT	CONDITION	MIN.	TYP. *	MAX.	UNIT
Propagation delay time to logic HIGH output	t_{pLH}	7	$I_F = 0 \rightarrow 5 \text{ mA}$, $C_L = 100 \text{ pF}$ $V_{CC} = 20 \text{ V}$	50	250	600	ns
Propagation delay time to logic LOW output	t_{pHL}		$I_F = 5 \rightarrow 0 \text{ mA}$, $C_L = 100 \text{ pF}$ $V_{CC} = 20 \text{ V}$	50	260	600	ns
Switching time dispersion Between ON and OFF	$ t_{pHL} - t_{pLH} $		$I_F = 0 \sim 5 \text{ mA}$, $C_L = 100 \text{ pF}$ $V_{CC} = 20 \text{ V}$	—	—	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 $T_a = 25^\circ\text{C}$.

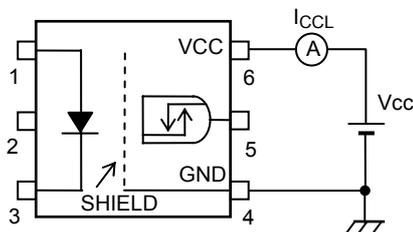
TEST CIRCUIT 1 : V_{OL}



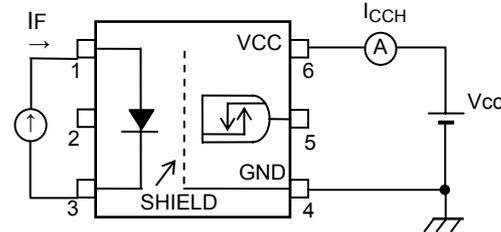
TEST CIRCUIT 2 : V_{OH}



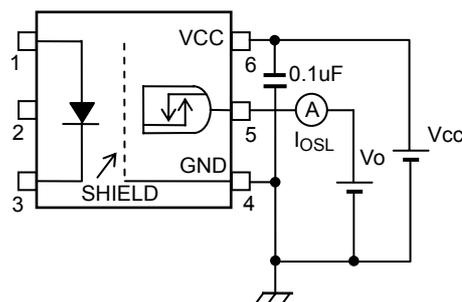
TEST CIRCUIT 3 : I_{CCL}



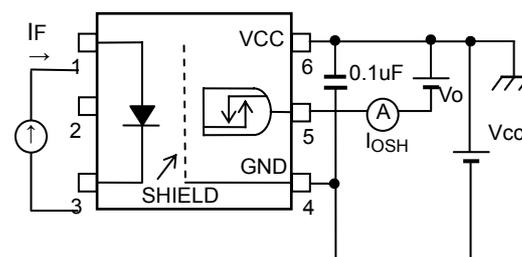
TEST CIRCUIT 4 : I_{CCH}



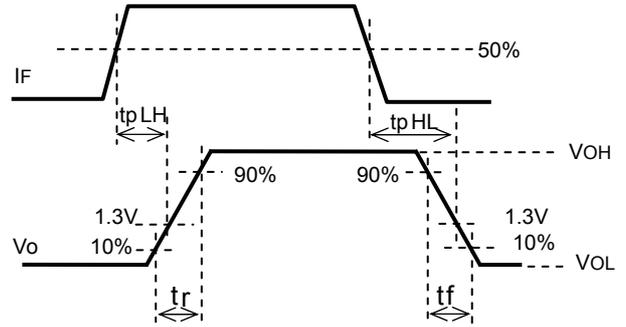
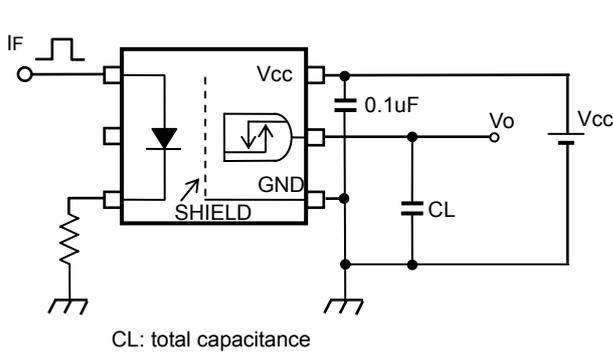
TEST CIRCUIT 5 : I_{OSL}



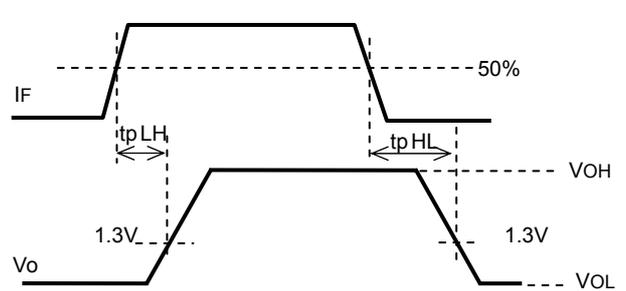
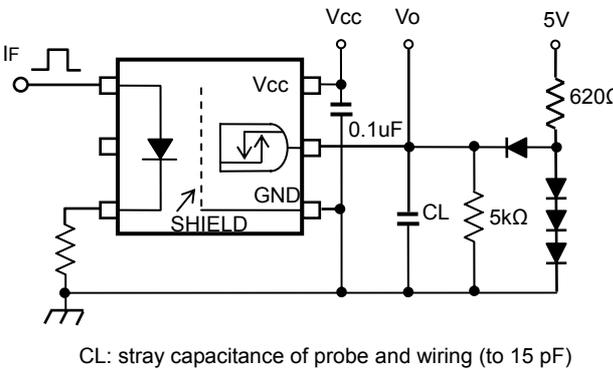
TEST CIRCUIT 6 : I_{OSH}



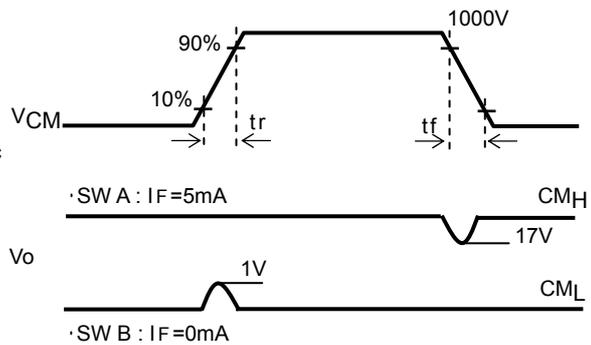
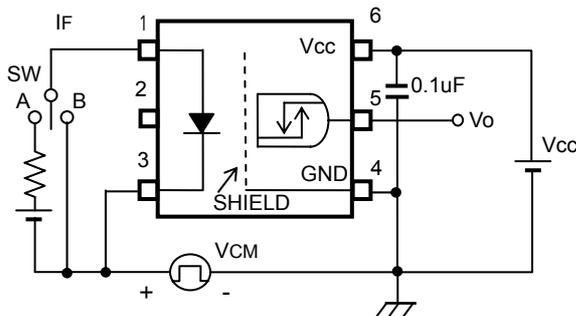
TEST CIRCUIT 7: Switching Time Test Circuit



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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