

# TLP106

Intelligent Power Module Signal Isolation  
 Industrial Inverters  
 Motor Drive

The Toshiba TLP106 consists of a GaAlAs light-emitting diode and an integrated high-gain, high-speed photo-detector. The TLP106 is suitable for isolating input control signals isolation to intelligent power modules. This unit is a 6-pin MFSOP.

The detector has a totem pole output stage to provide source drive and sink drive and features a built-in Schmitt trigger.

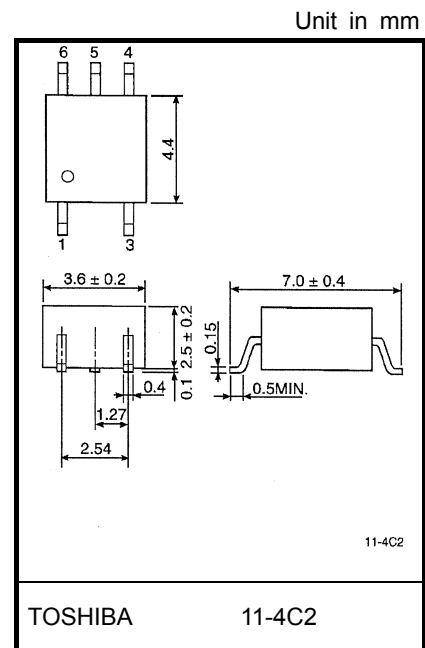
The detector IC has an internal shield that provides a guaranteed common-mode transient immunity of 10 kV/ $\mu$ s.

The TLP106 is of a buffer logic type. An inverter logic version, the TLP102, is also available.

- Buffer logic type (totem pole output)
- Guaranteed performance over temperature : -40~85°C
- Power supply voltage: -0.5~20 V
- Input current: IFLH = 3 mA (Max.)
- Switching Time (tpLH/tpHL): 400 ns (Max.)
- Common-mode transient immunity : 10 kV/ $\mu$ s
- Isolation voltage: 3750 Vrms

**Truth Table**

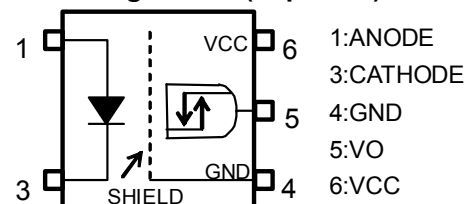
Input	LED	Tr1	Tr2	Output
H	ON	ON	OFF	H
L	OFF	OFF	ON	L



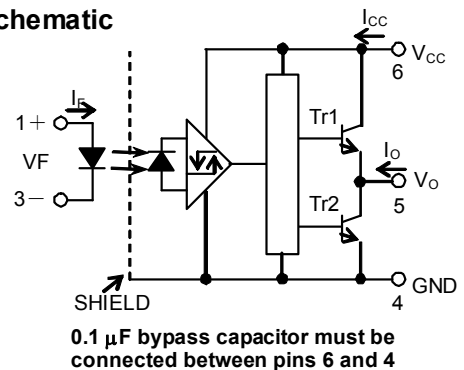
TOSHIBA 11-4C2

Weight: 0.09 g(typ.)

**Pin Configuration (Top View)**



**Schematic**



## Recommended Operating Conditions

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT
Input Current, ON	IF (ON)	5	—	10	mA
Input Voltage, OFF	VF (OFF)	0	—	0.8	V
Supply Voltage	VCC	4.5	—	20	V
Operating Temperature	Topr	-40	—	85	°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.

## Absolute Maximum Ratings (Ta = 25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
LED	Forward Current	IF	20	mA
	Peak Transient Forward Current (Note 1)	IFPT	1	A
	Reverse Voltage	VR	5	V
DETECTOR	Output Current 1 (Ta ≤ 25°C)	IO1	15/15	mA
	Output Current 2 (Ta = 85°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
	Operating Temperature Range	Topr	-40~85	°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) (Note2)	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.

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  $PW \leq 10 \mu s$ , 500 pps.

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

## Electrical Characteristics

(Unless otherwise specified, Ta = -40 to 85°C, VCC = 4.5~20 V.)

CHARACTERISTIC	SYMBOL	TEST CIRCUIT	CONDITION	MIN.	TYP.	MAX.	UNIT	
Input Forward Voltage	VF	—	IF = 5 mA, Ta = 25°C	—	1.5	1.7	V	
Temperature Coefficient of Forward Voltage	$\Delta VF/\Delta Ta$	—	IF = 5 mA	—	-2.0	—	mV/°C	
Input Reverse Current	IR	—	VR = 5 V, Ta = 25°C	—	—	10	μA	
Input Capacitance	CT	—	V = 0, f = 1 MHz, Ta = 25°C	—	30	—	pF	
Logic LOW Output Voltage	VOL	1	IOL = 3.5 mA, VF = 0.8 V	—	0.1	0.35	V	
Logic HIGH Output Voltage	VOH	2	IOH = -3.5 mA, VCC = 5 V	2.4	3.1	—	V	
			IF = 5 mA, VCC = 20 V	17.4	18.1	—		
Logic LOW Supply Current	ICCL	3	VF = 0 V	VCC = 20 V, Ta = -40~85°C	—	4.0	6.0	mA
				VCC = 5 V, Ta = 25°C	—	3.6	4.5	
Logic HIGH Supply Current	ICCH	4	IF = 5 mA	VCC = 20 V, Ta = -40~85°C	—	3.1	6.0	mA
				VCC = 5 V, Ta = 25°C	—	2.8	4.5	
Logic LOW Short Circuit Output Current	IOSL	5	VF = 0 V VCC = VO = 20 V	7	37	—	mA	
Logic HIGH Short Circuit Output Current	IOSH	6	IF = 5 mA, VO = GND VCC = 20 V	-7	-40	—	mA	
Input Current Logic HIGH Output	IFLH	—	IO = -3.5 mA, VO > 2.4 V	—	0.3	3	mA	
Input Voltage Logic LOW Output	VFHL	—	IO = 3.5 mA, VO < 0.4 V	0.8	—	—	V	
Input Current Hysteresis	IHYS	—	VCC = 5 V	—	0.05	—	mA	

\*All typical values are at Ta = 25°C.

## Isolation Characteristics (Ta = 25°C)

CHARACTERISTIC	SYMBOL	TEST CIRCUIT	MIN.	TYP.	MAX.	UNIT
Capacitance Input to Output	CS	V = 0, f = 1 MHz (Note 2)	—	0.8	—	pF
Isolation Resistance	RS	R.H. ≤ 60%, VS = 500 V (Note 2)	$1 \times 10^{12}$	$10^{14}$	—	Ω
Isolation Voltage	BVS	AC, 1 minute	3750	—	—	Vrms
		AC, 1 second, in oil	—	10000	—	Vdc
		DC, 1 minute, in oil	—	10000	—	

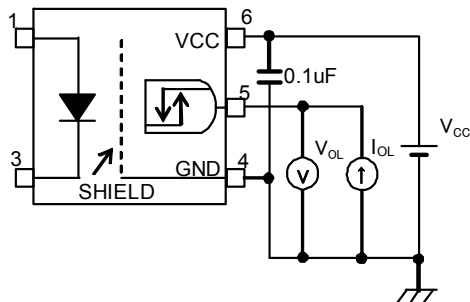
## Switching Characteristics

(Unless otherwise specified,  $T_a = -40$  to  $85^\circ\text{C}$ ,  $V_{CC} = 4.5\sim 20\text{ V}$ .)

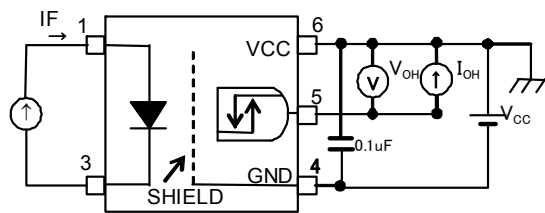
CHARACTERISTIC	SYMBOL	TEST CIRCUIT	CONDITION	MIN.	TYP.	MAX.	UNIT
Propagation Delay Time to Logic HIGH Output	$t_{pLH}$	7	$I_F = 0 \rightarrow 5\text{ mA}$ , $C_L = 100\text{ pF}$ $V_{CC} = 20\text{ V}$	50	250	400	ns
Propagation Delay Time to Logic LOW Output	$t_{pHL}$		$I_F = 5 \rightarrow 0\text{ mA}$ , $C_L = 100\text{ pF}$ $V_{CC} = 20\text{ V}$	50	260	400	ns
Switching Time Dispersion between ON and OFF	$ \text{tpHL} - \text{tpLH} $		$C_L = 100\text{ pF}$	—	—	350	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	—	400	ns
Propagation Delay Time to Logic LOW Output	$t_{pHL}$		$I_F = 5 \rightarrow 0\text{ mA}$	50	—	400	ns
Common-Mode Transient Immunity at HIGH Level Output	CMH	9	$V_{CM} = 1000\text{ Vp-p}$ , $I_F = 5\text{ mA}$ , $V_{CC} = 20\text{ V}$ , $T_a = 25^\circ\text{C}$	-10000	—	—	V/us
Common-Mode Transient Immunity at LOW Level Output	CML		$V_{CM} = 1000\text{ Vp-p}$ , $I_F = 0\text{ mA}$ , $V_{CC} = 20\text{ V}$ , $T_a = 25^\circ\text{C}$	10000	—	—	V/us

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

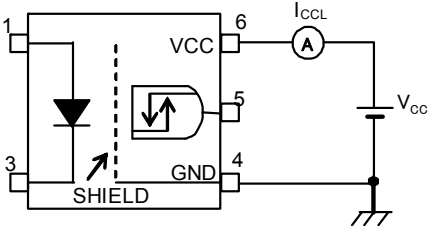
TEST CIRCUIT 1 : VOL



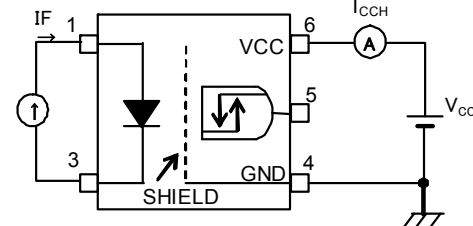
TEST CIRCUIT 2 : VOH



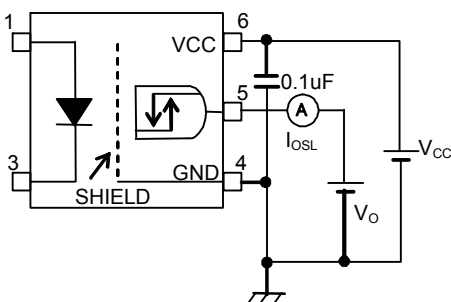
TEST CIRCUIT 3 : ICCL



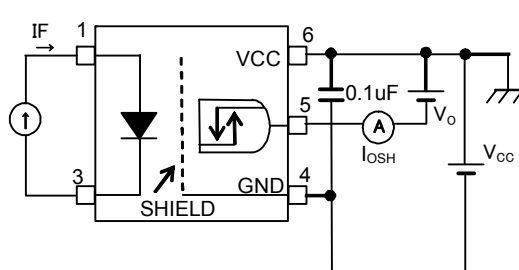
TEST CIRCUIT 4 : ICCH



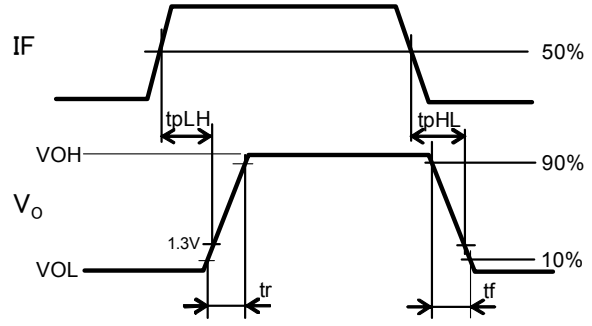
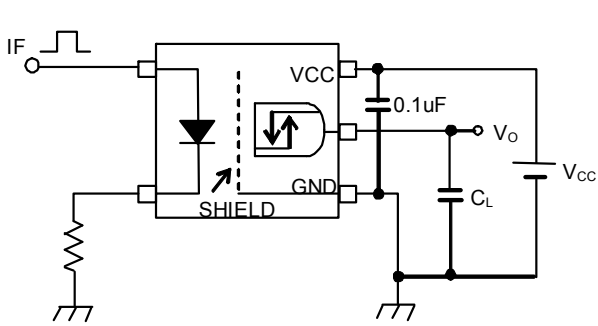
TEST CIRCUIT 5 : IOSL



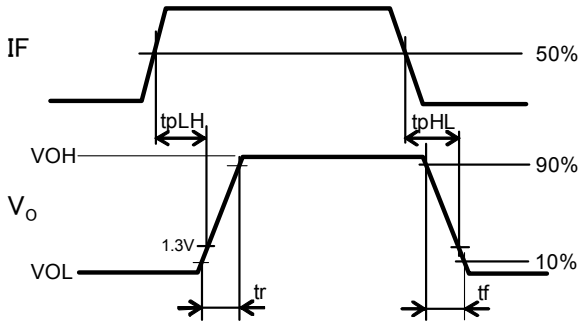
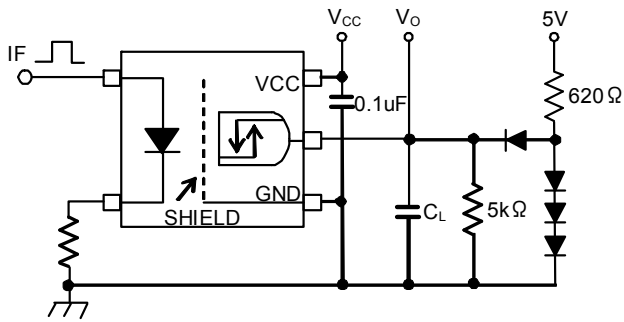
TEST CIRCUIT 6 : IOSH



**TEST CIRCUIT 7: Switching Time Test Circuit**

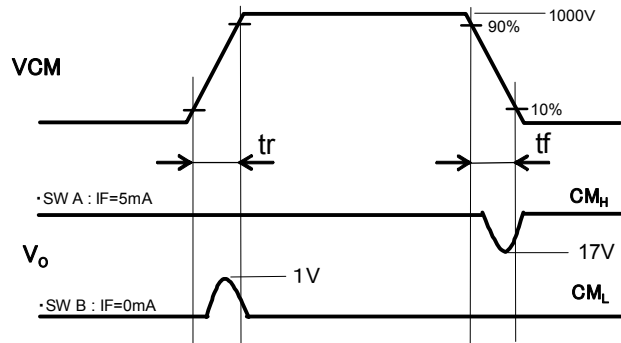
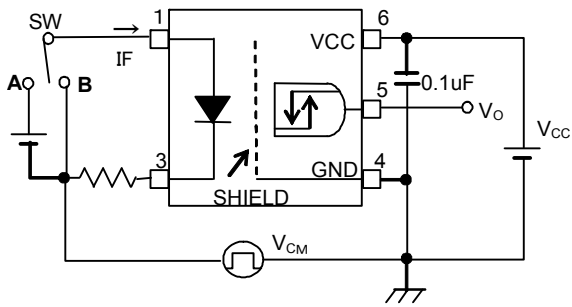


**TEST CIRCUIT 8: Switching Time Test Circuit**



CL: stray capacitance of probe and wiring (to 15 pF)

**TEST CIRCUIT 9: Common-Mode Transient Immunity Test Circuit**



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

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

**RESTRICTIONS ON PRODUCT USE**

20070701-EN

- The information contained herein is subject to change without notice.
- TOSHIBA is continually working to improve the quality and reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to comply with the standards of safety in making a safe design for the entire system, and to avoid situations in which a malfunction or failure of such TOSHIBA products could cause loss of human life, bodily injury or damage to property.  
In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent TOSHIBA products specifications. Also, please keep in mind the precautions and conditions set forth in the "Handling Guide for Semiconductor Devices," or "TOSHIBA Semiconductor Reliability Handbook" etc.
- The TOSHIBA products listed in this document are intended for usage in general electronics applications (computer, personal equipment, office equipment, measuring equipment, industrial robotics, domestic appliances, etc.). These TOSHIBA products are neither intended nor warranted for usage in equipment that requires extraordinarily high quality and/or reliability or a malfunction or failure of which may cause loss of human life or bodily injury ("Unintended Usage"). Unintended Usage include atomic energy control instruments, airplane or spaceship instruments, transportation instruments, traffic signal instruments, combustion control instruments, medical instruments, all types of safety devices, etc.. Unintended Usage of TOSHIBA products listed in this document shall be made at the customer's own risk.
- The products described in this document shall not be used or embedded to any downstream products of which manufacture, use and/or sale are prohibited under any applicable laws and regulations.
- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA for any infringements of patents or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any patents or other rights of TOSHIBA or the third parties.
- GaAs(Gallium Arsenide) is used in this product. The dust or vapor is harmful to the human body. Do not break, cut, crush or dissolve chemically.
- Please contact your sales representative for product-by-product details in this document regarding RoHS compatibility. Please use these products in this document in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances. Toshiba assumes no liability for damage or losses occurring as a result of noncompliance with applicable laws and regulations.