TOSHIBA PHOTOCOUPLER GaAℓAs IRED & PHOTO-IC

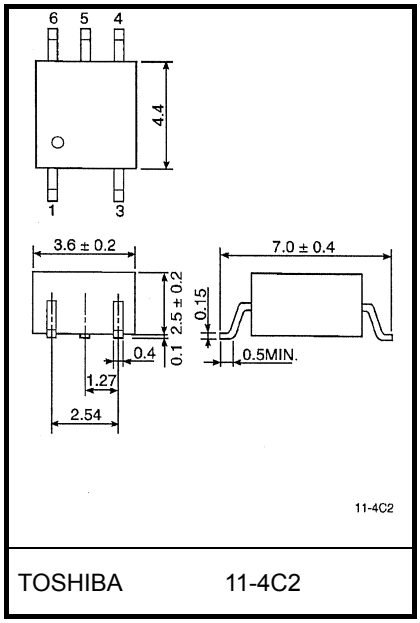
TLP106

Intelligent Power Module Signal Isolation

Industrial Inverters

Motor Drive

Unit in mm



TOSHIBA	11-4C2

Weight: 0.09 g (typ.)

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/μs.

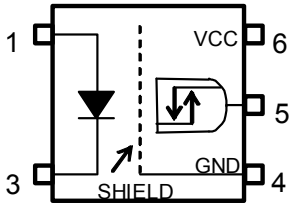
The TLP106 is of a buffer logic type. An inverter logic version, the TLP102, is also available.

- 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/μs
- Isolation voltage: 3750 Vrms

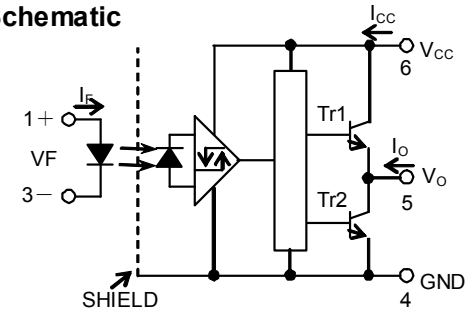
Truth Table

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

Pin Configuration (Top View)



Schematic



0.1 μF bypass capacitor must be connected between pins 6 and 4

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 ≤ 10 us, 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 ,T a = 25°C		—	1.5	1.7	V
Temperature Coefficient of Forward Voltage	ΔVF/ΔTa	—	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, IF = 5 mA	VCC = 5 V	2.4	3.1	—	V
				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)

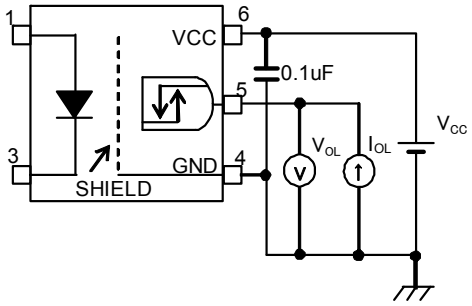
CHARACTERISTIC	SYMBOL	TEST CIRCUIT	MIN.	TYP.	MAX.	UNIT
Capacitance Input to Output	C_S	V = 0, f = 1 MHz (Note 2)	—	0.8	—	pF
Isolation Resistance	R_S	R.H. ≤ 60%, V_S = 500 V (Note 2)	1×10^{12}	10^{14}	—	Ω
Isolation Voltage	BV_S	AC, 1 minute	3750	—	—	V_{rms}
		AC, 1 second, in oil	—	10000	—	Vdc
		DC, 1 minute, in oil	—	10000	—	

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

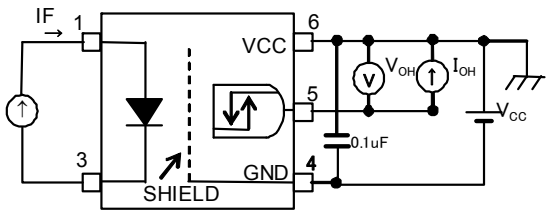
CHARACTERISTIC	SYMBOL	TEST CIRCUIT	CONDITION	MIN.	TYP.	MAX.	UNIT
Propagation Delay Time to Logic HIGH Output	tpLH	7	IF = 0→5mA、CL = 100 pF VCC = 20 V	50	250	400	ns
Propagation Delay Time to Logic LOW Output	tpHL		IF = 5→0 mA、CL = 100 pF VCC = 20 V	50	260	400	ns
Switching Time Dispersion between ON and OFF	|tpHL-tpLH|		CL = 100 PF	—	—	350	ns
Output Rise Time	tr		IF = 0→5 mA, VCC = 20 V	—	175	—	ns
Output Fall Time	tf		IF = 5→0 mA, VCC = 20 V	—	95	—	ns
Propagation Delay Time to Logic HIGH Output	tpLH	8	IF = 0→5 mA	50	—	400	ns
Propagation Delay Time to Logic LOW Output	tpHL		IF = 5→0 mA	50	—	400	ns
Common-Mode Transient Immunity at HIGH Level Output	CMH	9	VCM = 1000 Vp-p, IF = 5 mA, VCC = 20 V,Ta = 25°C	-10000	—	—	V/us
Common-Mode Transient Immunity at LOW Level Output	CML		VCM = 1000 Vp-p, IF = 0 mA, VCC = 20 V,Ta = 25°C	10000	—	—	V/us

*All typical values are at Ta = 25°C.

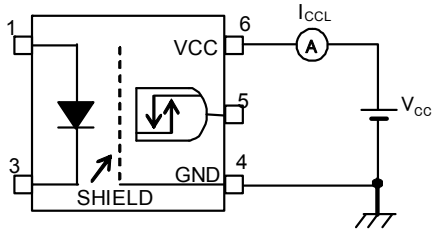
TEST CIRCUIT 1 : VOL



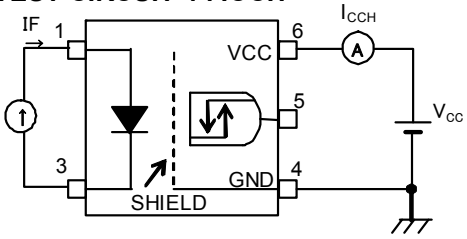
TEST CIRCUIT 2 : VOH



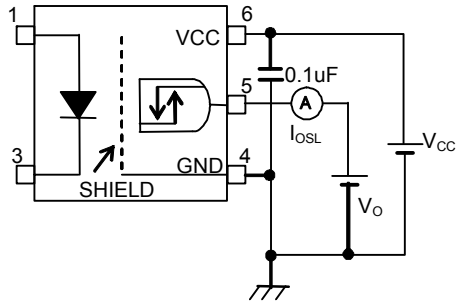
TEST CIRCUIT 3 : ICCL



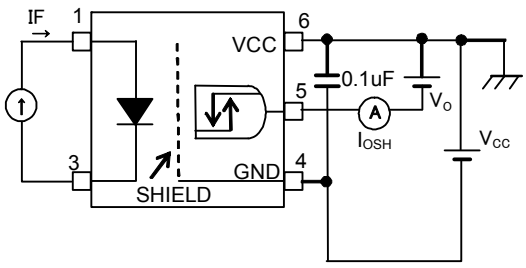
TEST CIRCUIT 4 : ICCH



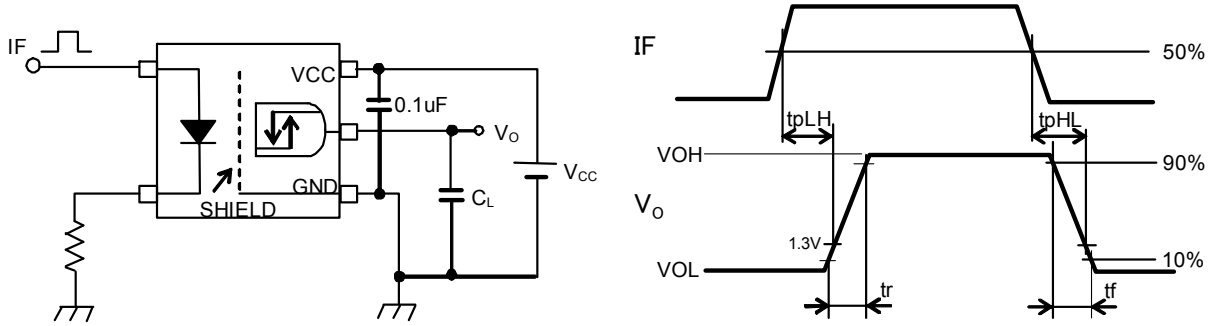
TEST CIRCUIT 5 : IOSL



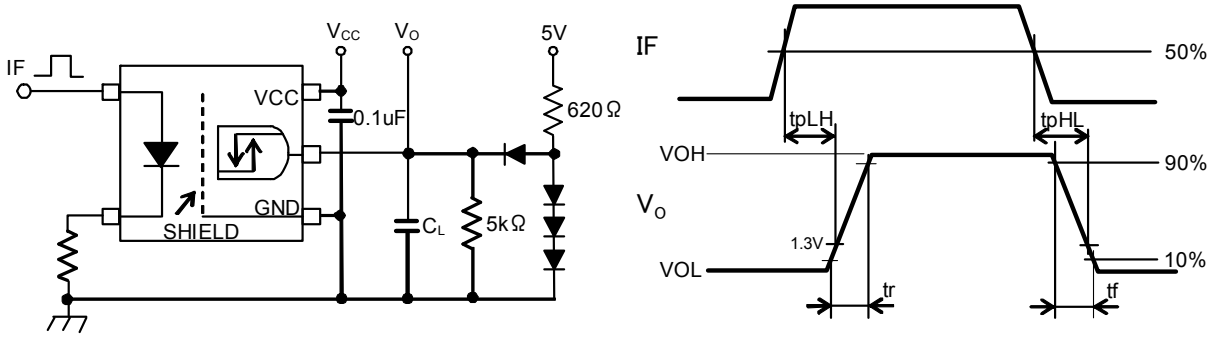
TEST CIRCUIT 6 : IOSH



TEST CIRCUIT 7: Switching Time Test Circuit

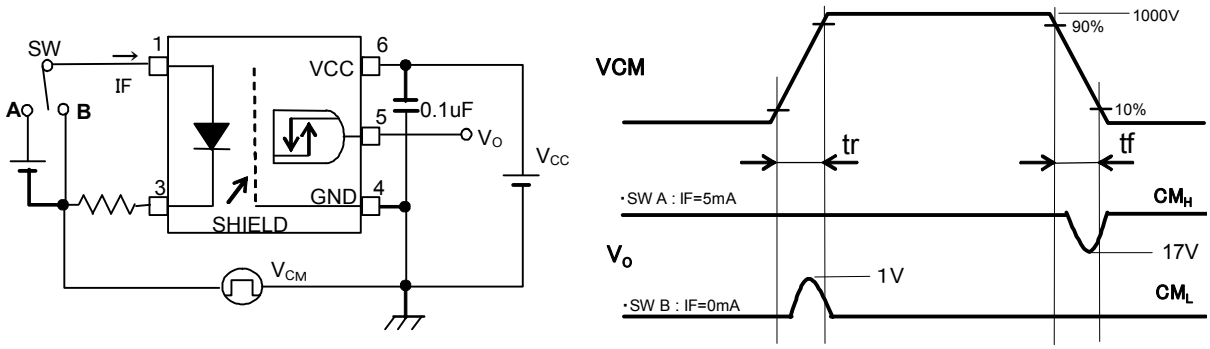


TEST CIRCUIT 8: Switching Time Test Circuit



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

TEST CIRCUIT 9: Common-Mode Transient Immunity Test Circuit



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

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