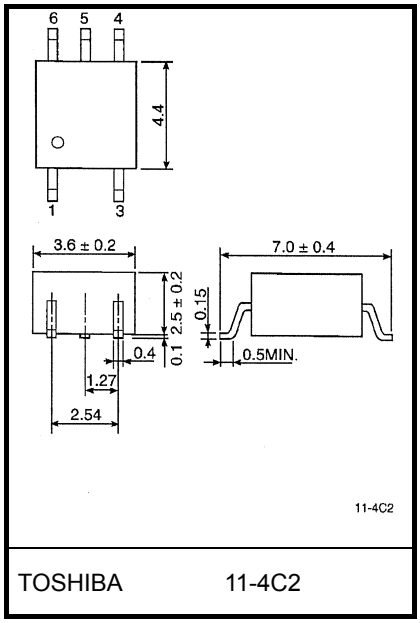
TOSHIBA PHOTOCOUPLER GaAℓAs IRED & PHOTO-IC

TLP102

Intelligent Power Module Signal Isolation
Industrial Inverters
Motor Drive

Unit in mm



TOSHIBA	11-4C2

Weight: 0.09 g(typ.)

The Toshiba TLP102 consists of a GaAℓAs light-emitting diode and an integrated high-gain, high-speed photodetector. The TLP102 is suitable for isolating input control signals 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.

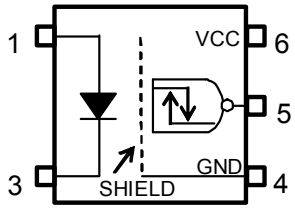
The TLP102 is of an inverter logic type. A buffer logic version, the TLP106, is also available.

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

Truth Table

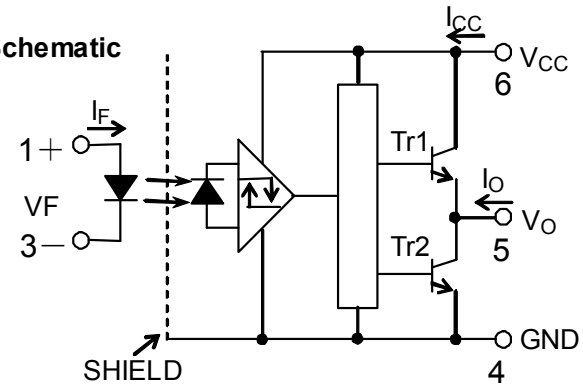
Input	LED	Tr1	Tr2	Output
H	ON	OFF	ON	L
L	OFF	ON	OFF	H

Pin Configuration (Top View)



1:ANODE
3:CATHODE
4:GND
5:VO
6:VCC

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

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) (Note 2)		BVs	3750	Vrms

Note 1: Pulse width PW ≤ 10 μs, 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 = -40~85°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	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 , IF = 5 mA		—	0.1	0.35	V
Logic HIGH Output Voltage	VOH	2	IOH = -3.5 mA, VF = 0.8 V	VCC = 5 V	2.4	3.1	—	V
				VCC = 20 V	17.4	18.1	—	
Logic LOW Supply Current	ICCL	3	IF = 5 mA	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	VF=0V	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	IF = 5 mA VCC = VO = 20 V		7	37	—	mA
Logic HIGH Short Circuit Output Current	IOSH	6	VF = 0 V, VO = GND VCC = 20 V		-7	-40	—	mA
Input Current Logic LOW Output	IFHL	—	IO = 3.5 mA, VO < 0.4 V		—	0.3	3	mA
Input Voltage Logic HIGH Output	VFLH	—	IO = -3.5 mA, VO > 2.4V		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)

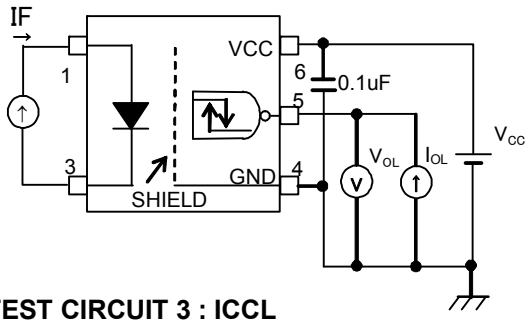
CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Capacitance Input to Output	C_S	V = 0, f = 1 MHz (Note 2)	—	0.8	—	pF
Isolation Resistance	R_S	R.H. ≤ 60%, V_S = 500 V (Note 2)	1×10^{12}	10^{14}	—	Ω
Isolation Voltage	BV_S	AC, 1 minute	3750	—	—	V_{rms}
		AC, 1 second, in oil	—	10000	—	Vdc
		DC,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

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

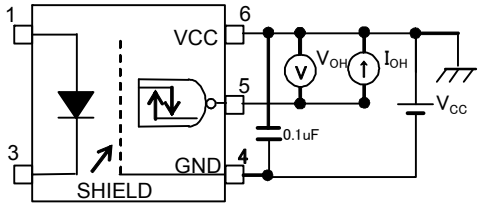
CHARACTERISTIC	SYMBOL	TEST CIRCUIT	CONDITION	MIN.	TYP.	MAX.	UNIT
Propagation Delay Time to Logic HIGH Output	tpLH	7	IF = 5→0 mA, CL = 100 pF VCC = 20 V	50	250	400	ns
Propagation Delay Time to Logic LOW Output	tpHL		IF = 0→5 mA, CL = 100 pF VCC = 20 V	50	270	400	ns
Switching Time Dispersion between ON and OFF	|tpHL-tpLH|		CL = 100 pF	—	—	350	ns
Output Rise Time	tr		IF = 5→0 mA, VCC = 20 V	—	175	—	ns
Output Fall Time	tf		IF = 0→5 mA, VCC = 20 V	—	95	—	ns
Propagation Delay Time to Logic HIGH Output	tpLH	8	IF = 5→0 mA	50	—	400	ns
Propagation Delay Time to Logic LOW Output	tpHL		IF = 0→5 mA	50	—	400	ns
Common-Mode Transient Immunity at HIGH Level Output	CMH	9	VCM = 1000 Vp-p, IF = 0 mA, VCC = 20 V, Ta = 25°C	10000	—	—	V/us
Common-Mode Transient Immunity at LOW Level Output	CML		VCM = 1000 Vp-p, IF = 5 mA, VCC = 20 V, Ta = 25°C	-10000	—	—	V/us

*All typical values are at Ta = 25°C.

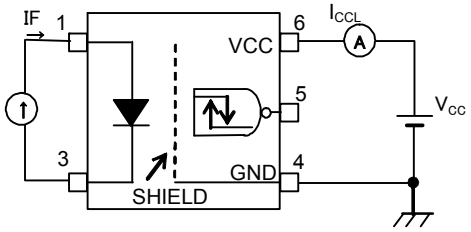
TEST CIRCUIT 1 : VOL



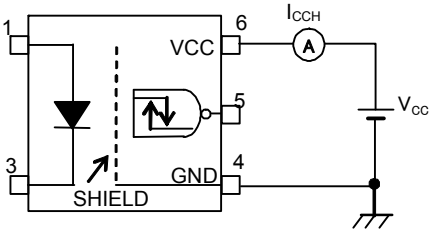
TEST CIRCUIT 2 : VOH



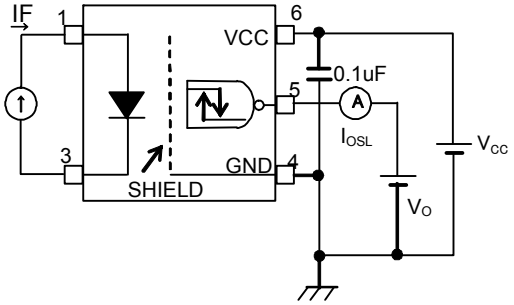
TEST CIRCUIT 3 : ICCL



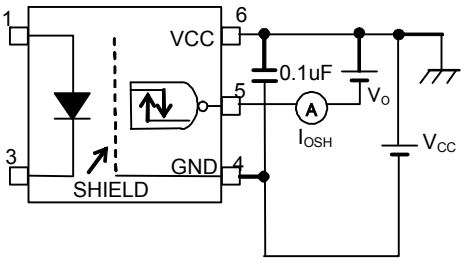
TEST CIRCUIT 4 : ICCH



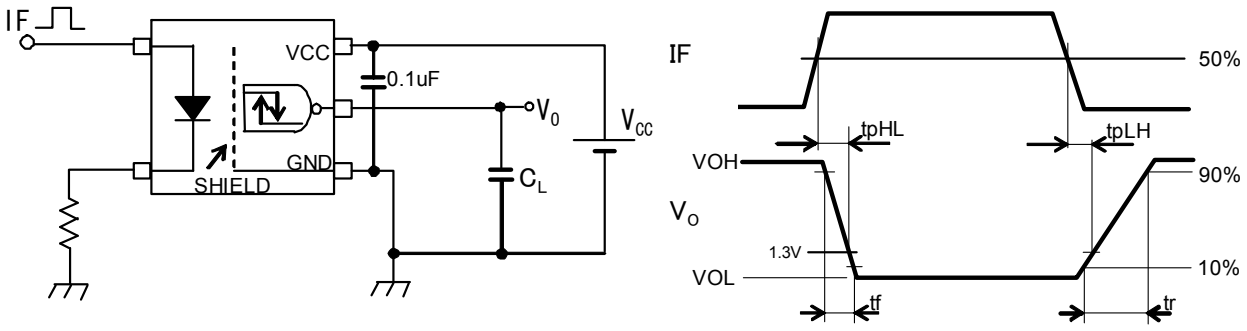
TEST CIRCUIT 5 : IOSL



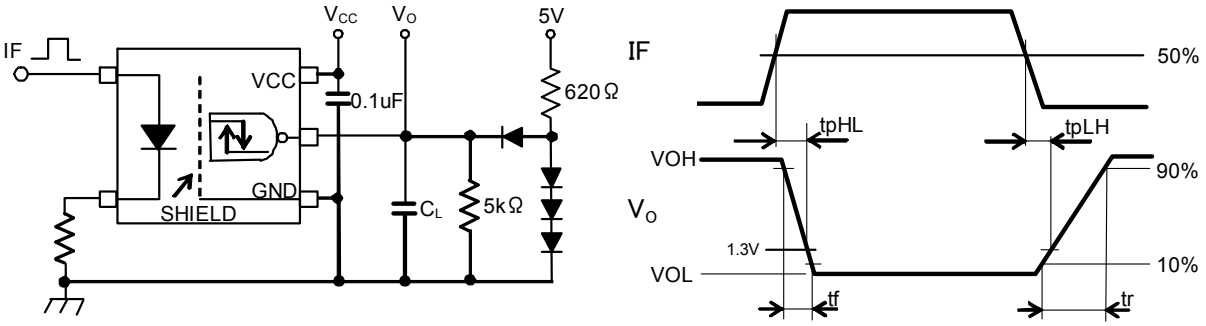
TEST CIRCUIT 6 : IOSH



TEST CIRCUIT 7: Switching Time Test Circuit

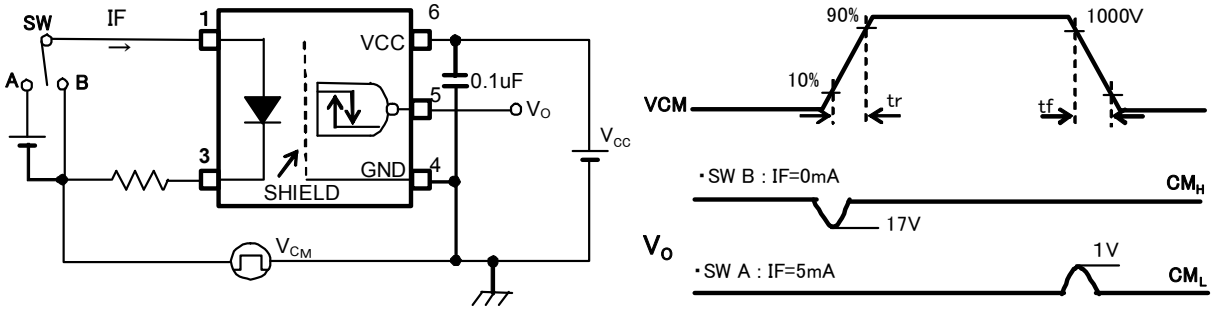


TEST CIRCUIT 8: Switching Time Test Circuit



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

TEST CIRCUIT 9: Common-Mode Transient Immunity Test Circuit



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

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