

# TLP102

Intelligent Power Module Signal Isolation  
 Industrial Inverters  
 Motor Drive

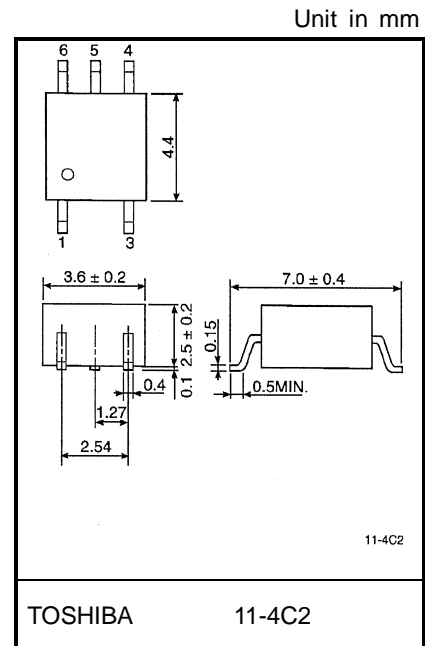
The Toshiba TLP102 consists of a GaAlAs light-emitting diode and an integrated high-gain, high-speed photodetector. The TLP102 is suitable for isolating input control signals to intelligent power modules. This unit is a 6-pin MFSOP.

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/ $\mu$ s.

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/ $\mu$ s
- Isolation voltage: 3750 Vrms

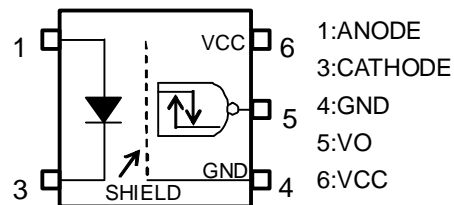


Weight: 0.09 g(typ.)

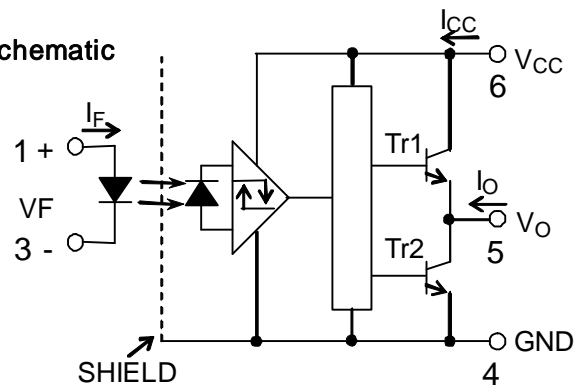
### Truth Table

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

### Pin Configuration (Top View)



### Schematic



0.1  $\mu$ F 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	$\Delta VF/\Delta Ta$	—	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, IF = 5 mA	—	0.1	0.35	V	
Logic HIGH Output Voltage	VOH	2	IOH = -3.5 mA,	VCC = 5 V	2.4	3.1	—	V
			VF = 0.8 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	CS	V = 0, f = 1 MHz (Note 2)	—	0.8	—	pF
Isolation Resistance	RS	R.H. ≤ 60%, VS = 500 V (Note 2)	1×10 <sup>12</sup>	10 <sup>14</sup>	—	Ω
Isolation Voltage	BVS	AC, 1 minute	3750	—	—	Vrms
		AC, 1 second, in oil	—	10000	—	Vdc
		DC, 1 minute, in oil	—	10000	—	

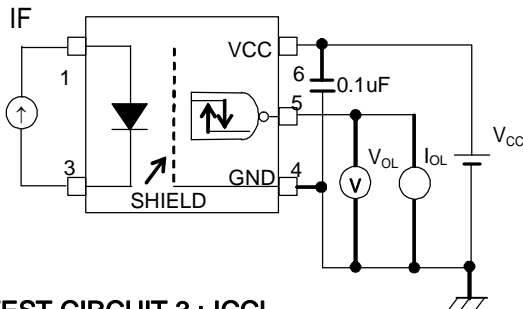
## Switching Characteristics

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

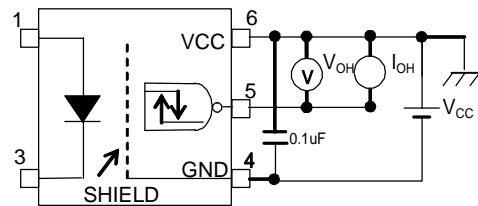
CHARACTERISTIC	SYMBOL	TEST CIRCUIT	CONDITION	MIN.	TYP.	MAX.	UNIT
Propagation Delay Time to Logic HIGH Output	tpLH	7	IF = 5→0 mA, CL = 100 pF VCC = 20 V	50	250	400	ns
Propagation Delay Time to Logic LOW Output	tpHL		IF = 0→5 mA, CL = 100 pF VCC = 20 V	50	270	400	ns
Switching Time Dispersion between ON 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  $T_a = 25^\circ\text{C}$ .

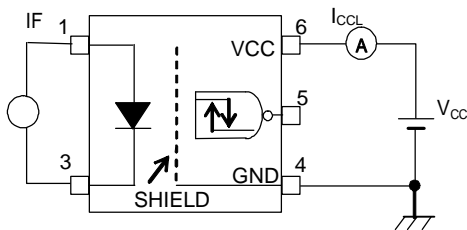
TEST CIRCUIT 1 : VOL



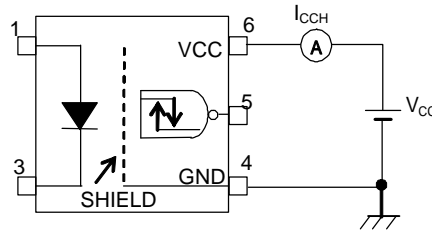
TEST CIRCUIT 2 : VOH



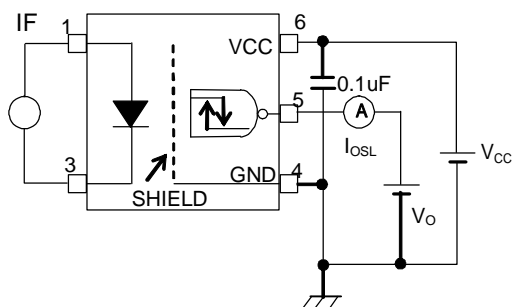
TEST CIRCUIT 3 : ICCL



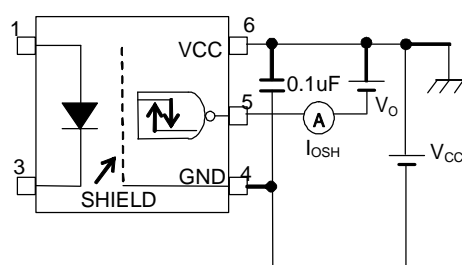
TEST CIRCUIT 4 : ICCH



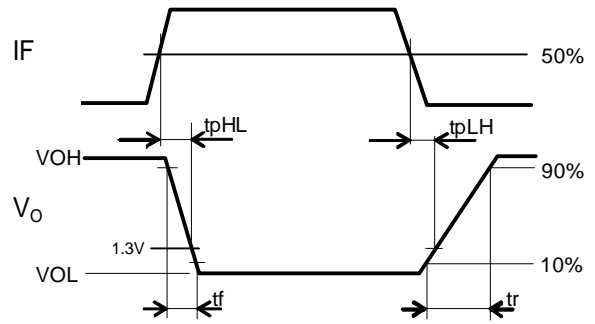
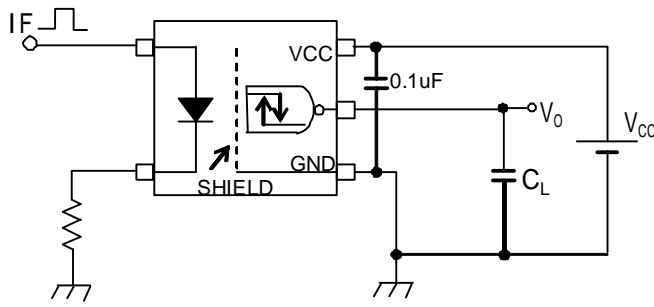
TEST CIRCUIT 5 : IOSL



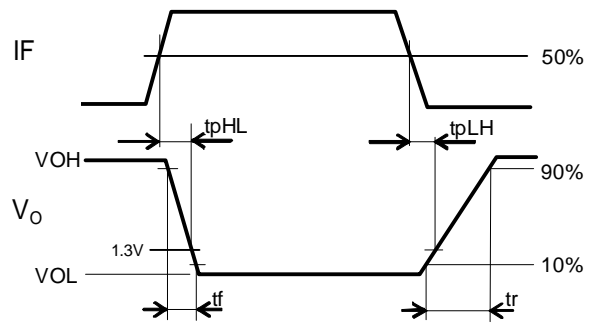
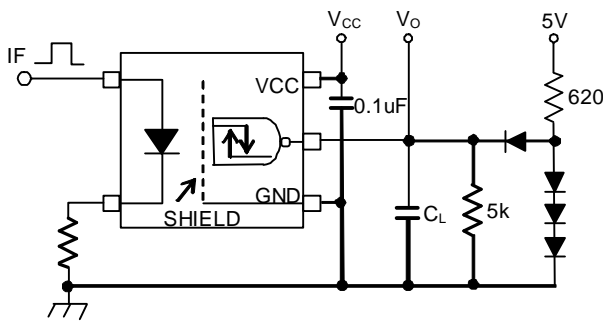
TEST CIRCUIT 6 : IOSH



TEST CIRCUIT 7: Switching Time Test Circuit

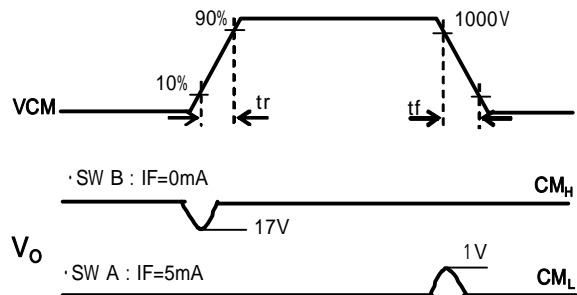
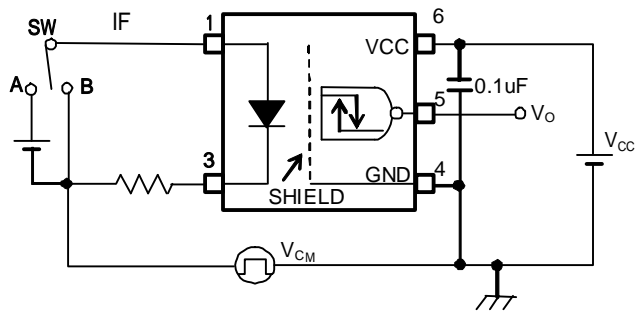


TEST CIRCUIT 8: Switching Time Test Circuit



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

TEST CIRCUIT 9: Common-Mode Transient Immunity Test Circuit



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

**RESTRICTIONS ON PRODUCT USE**

030619EBC

- The information contained herein is subject to change without notice.
- 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 patent or patent rights of TOSHIBA or others.
- 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 are subject to the foreign exchange and foreign trade laws.
- TOSHIBA products should not be embedded to the downstream products which are prohibited to be produced and sold, under any law and regulations.
- 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.