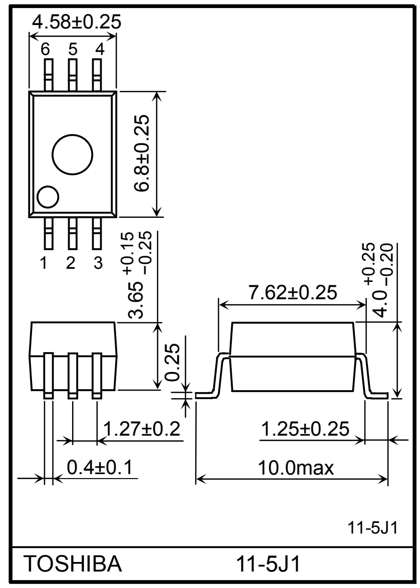
Preliminary

TOSHIBA Photocoupler GaAℓAs IRED + Photo IC

TLP701

INDUSTRIAL INVERTERS
INVERTER FOR AIR CONDITIONERS
IGBT/POWER MOS FET GATE DRIVE

Unit in mm



Weight : 0.26 g (typ.)

The TOSHIBA TLP701 consists of a GaAℓAs light-emitting diode and an integrated photodetector.

This unit is 6-lead SDIP package. The TLP701 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 TLP701 is suitable for gate driving circuits for IGBTs or power MOSFETs. In particular, the TLP701 is capable of “direct” gate driving of low-power IGBTs.

- Peak output current : ±0.6 A (max)
- Guaranteed performance over temperature : −40 to 100°C
- Supply current : 2 mA (max)
- Power supply voltage : 10 to 30 V
- Threshold input current : I_{FLH} = 5 mA (max)
- Switching time (t_{pLH} / t_{pHL}) : 700 ns (max)
- Common mode transient immunity : ±10 kV/μs (min)
- Isolation voltage : 5000 Vrms (min)
- Construction mechanical rating

	7.62-mm pitch standard type	10.16-mm pitch 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)

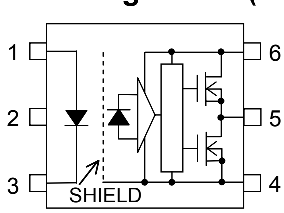
- UL Recognized : UL1577, File No. E67349
- Option (D4)
  TÜV approved : EN60747-5-2
  Certificate No. R50033433
  Maximum operating insulation voltage : 890 V_{pk}
  Highest permissible over voltage : 8000 V_{pk}

(Note) When a EN60747-5-2 approved type is needed, please designate the “Option(D4)”

Truth Table

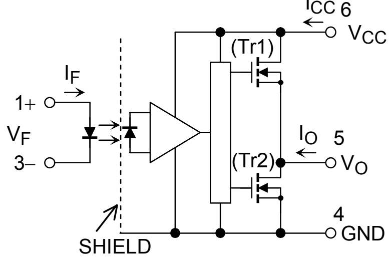
Input	LED	Tr1	Tr2	Output
H	ON	ON	OFF	H
L	OFF	OFF	ON	L

Pin Configuration (Top View)



1: ANODE
2: NC
3: CATHODE
4: GND
5: V_O (OUTPUT)
6: V_{CC}

Schematic



A 0.1-μF bypass capacitor must be connected between pins 6 and 4. (See Note 6.)

Maximum Ratings (Ta = 25 °C)

	Characteristics	Symbol	Rating	Unit
LED	Forward current	I_F	20	mA
	Forward current derating (Ta ≥ 85°C)	$\Delta I_F/\Delta Ta$	−0.54	mA/°C
	Peak transient forward current (Note 1)	I_{FP}	1	A
	Reverse voltage	V_R	5	V
	Junction temperature	T_j	125	°C
Detector	"H" peak output current (Note 2)	I_{OPH}	−0.6	A
	"L" peak output current (Note 2)	I_{OPL}	0.6	A
	Output voltage	V_O	35	V
	Supply voltage	V_{CC}	35	V
	Junction temperature	T_j	125	°C
Operating frequency (Note 3)		f	25	kHz
Operating temperature range		T_{opr}	−40 to 100	°C
Storage temperature range		T_{stg}	−55 to 125	°C
Lead soldering temperature (10 s) (Note 4)		T_{sol}	260	°C
Isolation voltage (AC, 1 minute, R.H. ≤ 60%) (Note 5)		BV_S	5000	Vrms

Note 1: Pulse width P_W ≤ 1 μs, 300 pps

Note 2: Exponential waveform pulse width P_W ≤ 2 μs, f ≤15 kHz

Note 3: Exponential waveform I_{OPH} ≤−0.3 A (≤ 2 μs), I_{OPL} ≤+0.3 A (≤ 2 μs),Ta =100 °C

Note 4: For the effective lead soldering area

Note 5: Device considered a two-terminal device: pins 1, 2 and 3 paired with pins 4, 5 and 6 respectively.

Note 6: 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.

Recommended Operating Conditions

Characteristics	Symbol	Min	Typ.	Max	Unit
Input current, ON (Note 7)	$I_{F (ON)}$	7.5	—	10	mA
Input voltage, OFF	$V_{F (OFF)}$	0	—	0.8	V
Supply voltage	V_{CC}	10	—	30	V
Peak output current	I_{OPH} / I_{OPL}	—	—	± 0.2	A
Operating temperature	T_{opr}	−40	—	100	°C

Note 7: Input signal rise time (fall time) < 0.5 μs.

Electrical Characteristics (Ta = −40 to 100 °C, unless otherwise specified)

Characteristics		Symbol	Test Circuit	Test Condition		Min	Typ.*	Max	Unit
Forward voltage		V_F	—	I_F = 5 mA, Ta = 25 °C		—	1.55	1.70	V
Temperature coefficient of forward voltage		$\Delta V_F/\Delta Ta$	—	I_F = 5 mA		—	−2.0	—	mV/°C
Input reverse current		I_R	—	V_R = 5 V, Ta = 25 °C		—	—	10	μA
Input capacitance		C_T	—	V =0 V, f = 1 MHz, Ta = 25 °C		—	45	—	pF
Output current (Note 8)	“H” Level	I_{OPH1}	1	V_{CC} = 15 V, I_F = 5 mA	$V_{6\text{-}5}$ = 4 V	−0.2	−0.38	—	A
		I_{OPH2}			$V_{6\text{-}5}$ = 10 V	−0.4	−0.60	—	
	“L” Level	I_{OPL1}	2	V_{CC} = 15 V, I_F = 0 mA	$V_{5\text{-}4}$ = 2 V	0.2	0.36	—	
		I_{OPL2}			$V_{5\text{-}4}$ = 10 V	0.4	0.62	—	
Output voltage	“H” Level	V_{OH}	3	V_{CC} = 10 V	I_O = −100 mA, I_F = 5 mA	6.0	8.5	—	V
	“L” Level	V_{OL}	4		I_O = 100 mA, V_F = 0.8 V	—	0.4	1.0	
Supply current	“H” Level	I_{CCH}	5	V_{CC} = 10 to 30 V, V_O=Open	I_F = 10 mA	—	1.4	2.0	mA
	“L” Level	I_{CCL}	6		I_F = 0 mA	—	1.3	2.0	
Threshold input current	L → H	I_{FLH}	—	V_{CC} = 15 V, V_O > 1 V		—	2.5	5	mA
Threshold input voltage	H → L	V_{FHL}	—	V_{CC} = 15 V, V_O < 1 V		0.8	—	—	V
Supply voltage		V_{CC}	—	—		10	—	30	V

(*): All typical values are at Ta = 25°C

Note 8: Duration of Io time ≤ 50 μs, 1 pulse

Note 9: This product is more sensitive than conventional products to electrostatic discharge (ESD) owing to its low power consumption design.
It is therefore all the more necessary to observe general precautions regarding ESD when handling this component.

Isolation Characteristics (Ta = 25 °C)

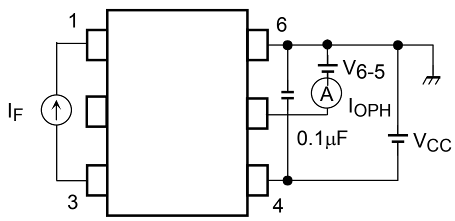
Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Capacitance input to output	C_S	V = 0 V , f = 1MHz (Note 5)	—	1.0	—	pF
Isolation resistance	R_S	R.H. ≤ 60 %, V_S = 500 V (Note 5)	1×10^{12}	10^{14}	—	Ω
Isolation voltage	BV_S	AC, 1 minute	5000	—	—	Vrms
		AC, 1 second, in oil	—	10000	—	Vrms
		DC, 1 minute, in oil	—	10000	—	Vdc

Switching Characteristics (Ta = −40 to 100 °C, unless otherwise specified)

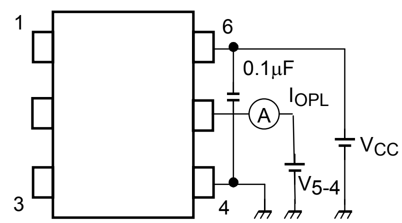
Characteristics		Symbol	Test Circuit	Test Condition		Min	Typ.*	Max	Unit
Propagation delay time	L → H	t_{pLH}	7	V_{CC} = 30 V, R_g = 47 Ω, C_g = 3 nF	I_F = 0 → 5 mA	100	—	700	ns
	H → L	t_{pHL}			I_F = 5 → 0 mA	100	—	700	
Output rise time (10–90 %)		t_r			I_F = 0 → 5 mA	—	50	—	
Output fall time (90–10 %)		t_f			I_F = 5 → 0 mA	—	50	—	
Propagation delay difference between any two parts or channels		PDD $\lvert t_{pHL}$-$t_{pLH} \rvert$			I_F = 0 , 5 mA	−500	—	500	
Common mode transient immunity at HIGH level output		CM_H	8	V_{CM} =1000 Vp-p, V_{CC} = 30 V, Ta = 25 °C	I_F = 5 mA, $V_{O\ (min)}$ = 26 V	−10000	—	—	V/μs
Common mode transient immunity at LOW level output		CM_L			I_F = 0 mA, $V_{O\ (max)}$ = 1 V	10000	—	—	

(*): All typical values are at Ta = 25 °C.

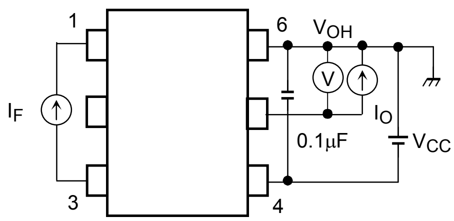
Test Circuit 1: I_{OPH}



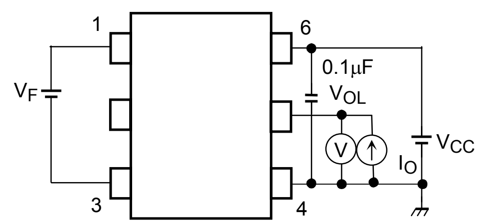
Test Circuit 2: I_{OPL}



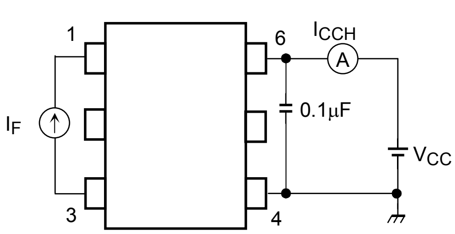
Test Circuit 3: V_{OH}



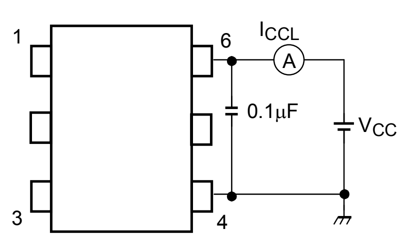
Test Circuit 4: V_{OL}



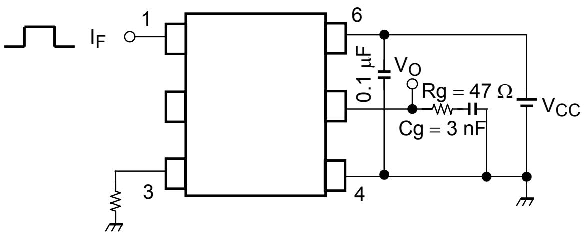
Test Circuit 5: I_{CCH}

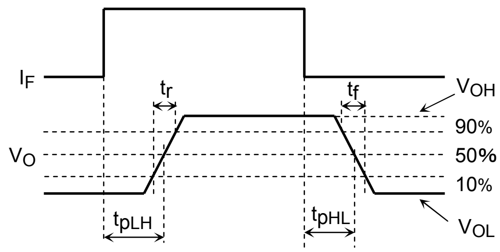


Test Circuit 6: I_{CCL}

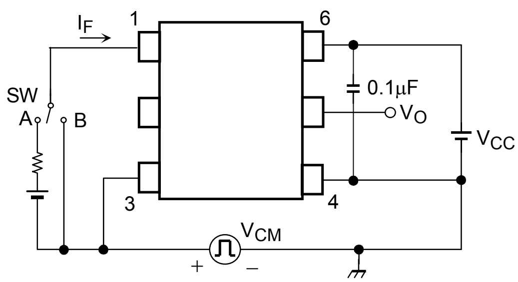


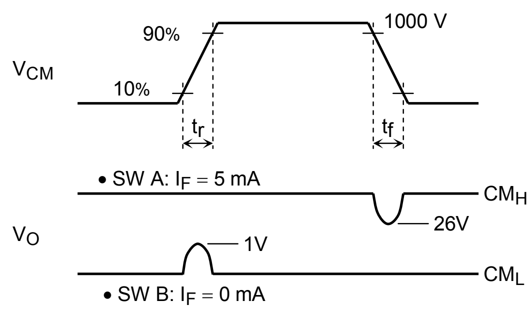
Test Circuit 7: t_{pLH}, t_{pHL}, t_r, t_f, PDD





Test Circuit 8: CM_H, CM_L





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

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

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.

RESTRICTIONS ON PRODUCT USE