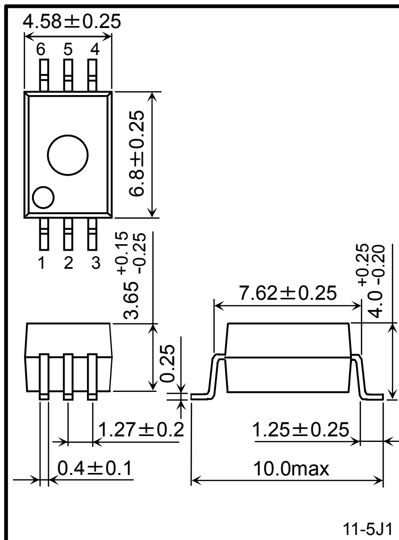
Preliminary TOSHIBA Photocoupler GaAℓAs IRED + Photo IC

TLP705

Plasma Display Panel.
Industrial Inverter
IGBT/Power MOS FET Gate Drive

Unit in mm



TOSHIBA 11-5J1

Weight : 0.26 g (typ.)

The TOSHIBA TLP705 consists of a GaAℓAs light emitting diode and a integrated photodetector.
This unit is 6-lead SDIP package. TLP705 is 50% smaller than 8PIN DIP and has suited the safety standard reinforced insulation class.
So mounting area in safety standard required equipment can be reduced.
TLP705 is suitable for gate driving circuit of IGBT or power MOS FET.
Especially TLP705 is capable of “direct” gate drive of lowr Power IGBTs.

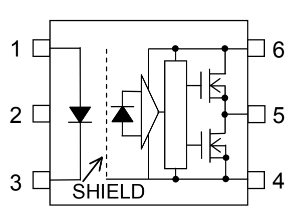
- Peak output current : ±0.45 A (max)
- Operating frequency : 250kHz (max)
- Guaranteed performance over temperature : −40 to 100°C
- Supply current : 3mA (max)
- Power supply voltage : 10 to 20 V
- Threshold input current : I_{FLH} = 8 mA (max)
- Switching time (t_{pLH} / t_{pHL}) : 200 ns (max)
- Common mode transient immunity : 10 kV/μs
- Isolation voltage : 5000 Vrms
- UL Recognized :UL1577, File No.E67349
- Construction Mechanical Rating

	7.62 mm pich standard type	10.16 mm pich 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)

Truth Table

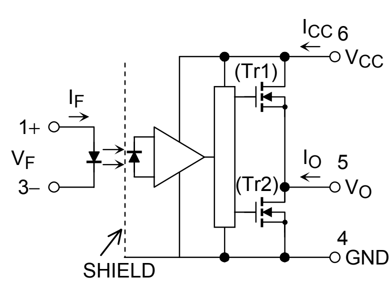
Input	LED	Tr1	Tr2	Output
H	ON	ON	OFF	H
L	OFF	OFF	ON	L

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 pin 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}	–0.45	A
	"L" peak output current	(Note 2)	I_{OPL}	0.45	A
	Output voltage		V_O	25	V
	Supply voltage		V_{CC}	25	V
	Junction temperature		T_j	125	°C
Operating frequency		(Note 3)	f	250	kHz
Storage temperature range			T_{stg}	–55 to 125	°C
Operating temperature range			T_{opr}	–40 to 100	°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 ≤ 1μs, 300 pps

Note 2: Exponential waveform pulse width P_W ≤ 10 μs , f ≤15 kHz

Note 3: Exponential waveform I_{OPH} ≤-0.25 A (≤80 ns) , I_{OPL} ≤+0.25 A (≤80 ns) ,Ta =100 °C

Note 4: It is effective soldering area of Lead .

Note 5: Device considerd a two terminal device: pins 1, 2 and 3 shorted together, and pins 4, 5 and 6 shorted together.

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)	$I_{F (ON)}$	10	—	15	mA
Input voltage, OFF		$V_{F (OFF)}$	0	—	0.8	V
Supply voltage		V_{CC}	10	—	20	V
Peak output current		I_{OPH} / I_{OPL}	—	—	± 0.15	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 = 10 mA, Ta = 25°C		—	1.6	1.8	V
Temperature coefficient of forward voltage		$\Delta V_F/\Delta Ta$	—	I_F = 10 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 = 10 mA	$V_{6\text{-}5}$ = 4 V	–0.15	–0.35	—	A
		I_{OPH2}			$V_{6\text{-}5}$ = 10 V	–0.3	–0.6	—	
	"L" Level	I_{OPL1}	2	V_{CC} = 15 V, I_F = 0 mA	$V_{5\text{-}4}$ = 2 V	0.15	0.36	—	
		I_{OPL2}			$V_{5\text{-}4}$ = 10 V	0.3	0.62	—	
Output voltage	"H" Level	V_{OH}	3	V_{CC} = 10 V	I_O = –100 mA, I_F = 10 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 20 V, V_O open	I_F = 10 mA	—	2.0	3.0	mA
	"L" Level	I_{CCL}	6		I_F = 0 mA	—	2.0	3.0	
Threshold input current	L → H	I_{FLH}	—	V_{CC} = 15 V, V_O > 1 V		—	2.5	8	mA
Threshold input voltage	H → L	V_{FHL}	—	V_{CC} = 15 V, V_O < 1 V		0.8	—	—	V
Supply voltage		V_{CC}	—	—		10	—	20	V

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

Note 8: Duration of I_O time ≤ 50 μs

Note 9: This product is more sensitive than the conventional product to static electricity (ESD) because of a lowest power consumption design.
General precaution to static electricity (ESD) is necessary for handling this component.

Isolation Characteristics (Ta = 25°C)

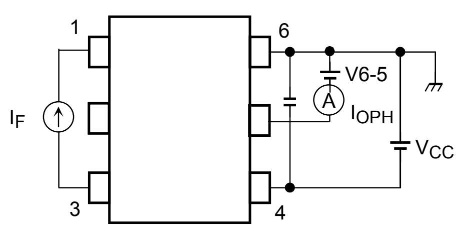
Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Capacitance input to output	C_S	V = 0 V, f = 1MHz (Note 5)	—	1.0	—	pF
Isolation resistance	R_S	R.H. ≤ 60%,V_S = 500V (Note 5)	1×10^{12}	10^{14}	—	Ω
Isolation voltage	BV_S	AC, 1 minute	5000	—	—	Vrms
		AC, 1 second, in oil	—	10000	—	
		DC,1 minute,in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

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

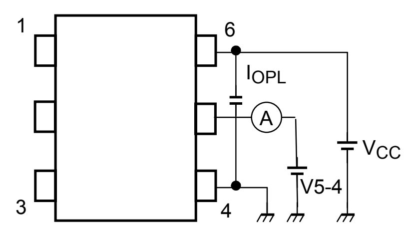
Characteristics		Symbol	Test Circuit	Test Condition		Min	Typ.*	Max	Unit
Propagation delay time	L → H	t_{pLH}	7	V_{CC} = 20 V, R_g = 30 Ω, C_g = 1 nF, f=250kHz, Duty Cycle =50%	Ta= 25°C, I_F = 0→10 mA	70	95	170	ns
	H → L	t_{pHL}			Ta= 25 °C, I_F = 10→ 0 mA	70	105	170	
Propagation delay time	L → H	t_{pLH}			Ta= -40 to100°C, I_F = 0→10 mA	50	—	200	
	H → L	t_{pHL}			Ta= -40 to100°C, I_F = 10→0 mA	50	—	200	
Propagation delay difference between any two parts or channels		tpsk			Ta= -40 to100°C, I_F = 10 mA	-90	—	90	
Pulse Width Distortion		PWD (t_{pHL}-t_{pLH})			Ta= -40 to100°C, I_F = 10 mA	-65	—	65	
Output rise time (10-90%)		t_r			I_F = 0 → 10 mA	—	—	—	
Output fall time (90-10%)		t_f			I_F = 10 → 0 mA	—	—	—	
Common mode transient immunity at hight level output		CM_H	8	V_{CM} = 1000Vp-p, V_{CC} = 20 V, Ta = 25°C	I_F = 10 mA, $V_{O\,(min)}$ = 16 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

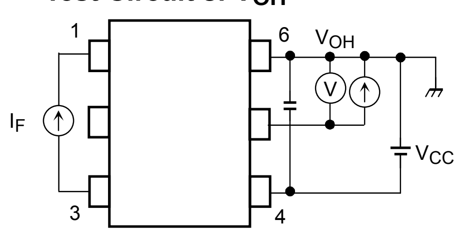
Test Circuit 1: I_{OPH}



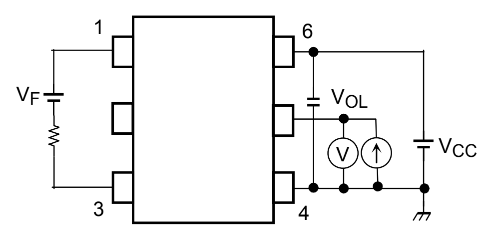
Test Circuit 2: I_{OPL}



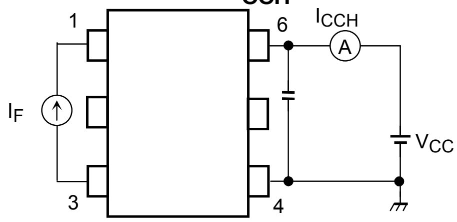
Test Circuit 3: V_{OH}



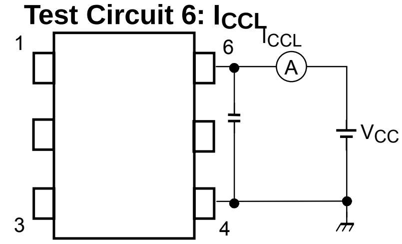
Test Circuit 4: V_{OL}



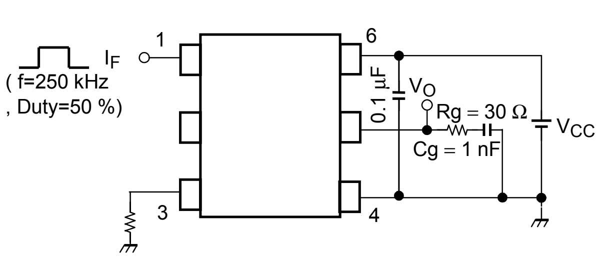
Test Circuit 5: I_{CCH}

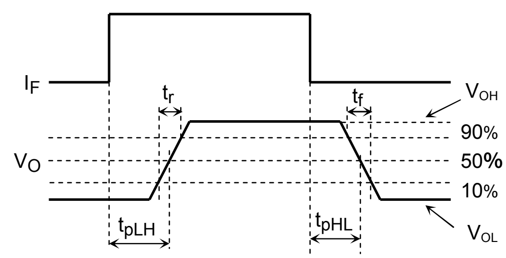


Test Circuit 6: I_{CCL}

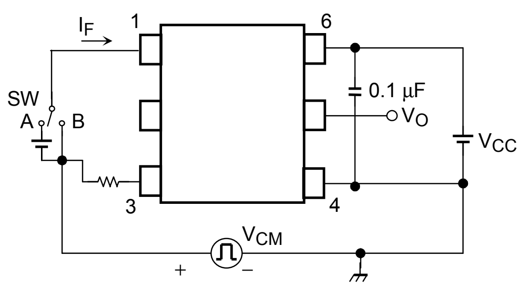


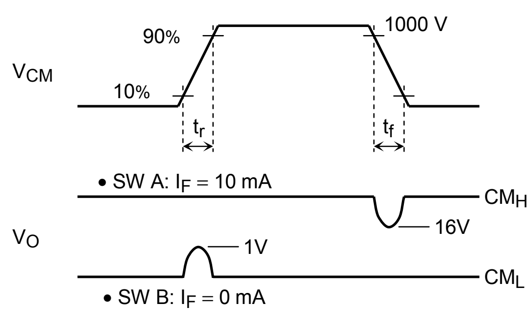
Test Circuit 7 : t_{pLH}, t_{pHL}, tr, tf, PWD





Test Circuit 8: CM_H, CM_L





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

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

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.

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