

**Preliminary**

TOSHIBA Photocoupler GaAlAs IRED + Photo IC

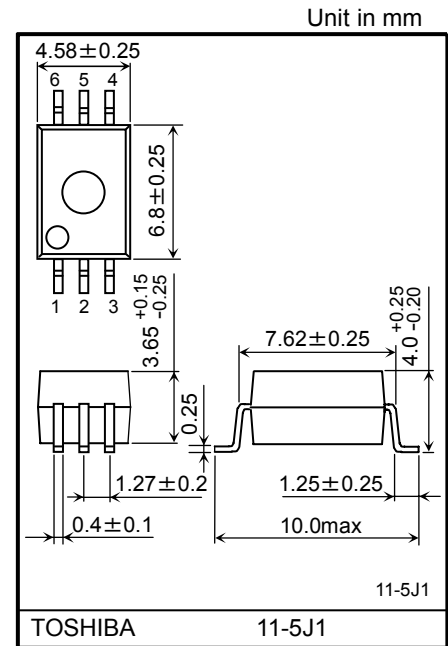
# TLP705

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

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 :  $\pm 0.45$  A (max)
- Operating frequency : 250kHz (max)
- Guaranteed performance over temperature :  $-40$  to  $100^{\circ}\text{C}$
- 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/ $\mu\text{s}$
- 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)

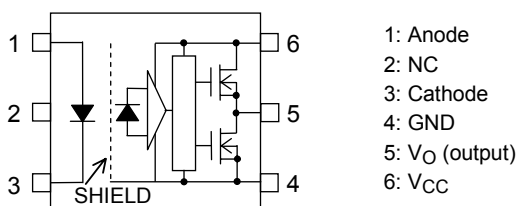


Weight : 0.26 g (typ.)

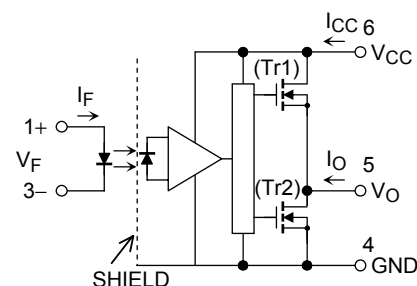
## Truth Table

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

## Pin Configuration (top view)



## Schematic



A 0.1  $\mu\text{F}$  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)	$\Delta I_F / \Delta T_a$	-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  $P_W \leq 1\mu s$ , 300 pps

Note 2: Exponential waveform pulse width  $P_W \leq 10\mu s$ ,  $f \leq 15\text{ kHz}$

Note 3: Exponential waveform  $I_{OPH} \leq -0.25\text{ A}$  ( $\leq 80\text{ ns}$ ),  $I_{OPL} \leq +0.25\text{ A}$  ( $\leq 80\text{ ns}$ ),  $T_a = 100\text{ °C}$

Note 4: It is effective soldering area of Lead .

Note 5: Device considered 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  $\mu F$ ) 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	$I_{OPH} / I_{OPL}$	—	—	$\pm 0.15$	A
Operating temperature	$T_{opr}$	-40	—	100	°C

Note 7: Input signal rise time (fall time) < 0.5  $\mu s$ .

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

Characteristics		Symbol	Test Circuit	Test Condition	Min	Typ.*	Max	Unit	
Forward voltage		V <sub>F</sub>	—	I <sub>F</sub> = 10 mA, Ta = 25°C	—	1.6	1.8	V	
Temperature coefficient of forward voltage		ΔV <sub>F</sub> /ΔTa	—	I <sub>F</sub> = 10 mA	—	-2.0	—	mV/°C	
Input reverse current		I <sub>R</sub>	—	V <sub>R</sub> = 5 V, Ta = 25°C	—	—	10	μA	
Input capacitance		C <sub>T</sub>	—	V = 0 V, f = 1 MHz, Ta = 25°C	—	45	—	pF	
Output current (Note 8)	"H" Level	I <sub>OPH1</sub>	1	V <sub>CC</sub> = 15 V I <sub>F</sub> = 10 mA	V <sub>6-5</sub> = 4 V	-0.15	-0.35	—	A
		I <sub>OPH2</sub>			V <sub>6-5</sub> = 10 V	-0.3	-0.6		
	"L" Level	I <sub>OPL1</sub>	2	V <sub>CC</sub> = 15 V I <sub>F</sub> = 0 mA	V <sub>5-4</sub> = 2 V	0.15	0.36	—	
		I <sub>OPL2</sub>			V <sub>5-4</sub> = 10 V	0.3	0.62	—	
Output voltage	"H" Level	V <sub>OH</sub>	3	V <sub>CC</sub> = 10 V	I <sub>O</sub> = -100 mA, I <sub>F</sub> = 10 mA	6.0	8.5	—	V
	"L" Level	V <sub>OL</sub>			4	I <sub>O</sub> = 100 mA, V <sub>F</sub> = 0.8 V	—	0.4	
Supply current	"H" Level	I <sub>CCH</sub>	5	V <sub>CC</sub> = 10 to 20 V V <sub>O</sub> open	I <sub>F</sub> = 10 mA	—	2.0	3.0	mA
	"L" Level	I <sub>CCCL</sub>	6		I <sub>F</sub> = 0 mA	—	2.0	3.0	
Threshold input current	L → H	I <sub>FLH</sub>	—	V <sub>CC</sub> = 15 V, V <sub>O</sub> > 1 V	—	2.5	8	mA	
Threshold input voltage	H → L	V <sub>FHL</sub>	—	V <sub>CC</sub> = 15 V, V <sub>O</sub> < 1 V	0.8	—	—	V	
Supply voltage		V <sub>CC</sub>	—	—	10	—	20	V	

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

Note 8: Duration of I<sub>O</sub> 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)

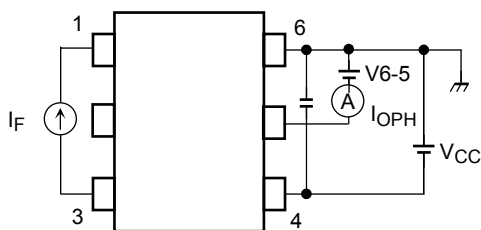
Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Capacitance input to output	C <sub>S</sub>	V = 0 V, f = 1MHz (Note 5)	—	1.0	—	pF
Isolation resistance	R <sub>S</sub>	R.H. ≤ 60%, V <sub>S</sub> = 500V (Note 5)	1×10 <sup>12</sup>	10 <sup>14</sup>	—	Ω
Isolation voltage	BV <sub>S</sub>	AC, 1 minute	5000	—	—	V <sub>rms</sub>
		AC, 1 second, in oil	—	10000	—	
		DC, 1 minute, in oil	—	10000	—	V <sub>dc</sub>

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

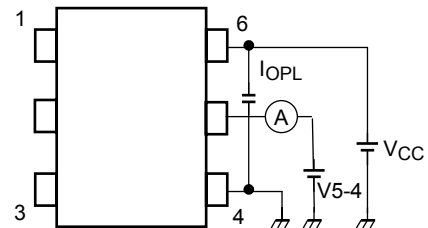
Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.*	Max	Unit	
Propagation delay time	L → H	7	$V_{CC} = 20\text{ V}$ $R_g = 30\ \Omega$ $C_g = 1\text{ nF}$ $f = 250\text{ kHz}$ Duty Cycle = 50%	Ta = 25 $I_F = 0\ 10\text{ mA}$	70	95	170	ns
	H → L			Ta = 25 $I_F = 10 \rightarrow 0\text{ mA}$	70	105	170	
Propagation delay time	L → H			Ta = -40 to 100 $I_F = 0\ 10\text{ mA}$	50	—	200	
	H → L			Ta = -40 to 100 $I_F = 10\ 0\text{ mA}$	50	—	200	
Propagation delay difference between any two parts or channels	tpsk			Ta = -40 to 100 $I_F = 10\text{ mA}$	-90	—	90	
Pulse Width Distortion	PWD ( $t_{pHL} - t_{pLH}$ )			Ta = -40 to 100 $I_F = 10\text{ mA}$	-65	—	65	
Output rise time (10-90%)	$t_r$			$I_F = 0 \rightarrow 10\text{ mA}$	—	—	—	
Output fall time (90-10%)	$t_f$			$I_F = 10 \rightarrow 0\text{ mA}$	—	—	—	
Common mode transient immunity at high level output	CMH	8	$V_{CM} = 1000\text{ Vp-p}$ $V_{CC} = 20\text{ V}$ Ta = 25°C	$I_F = 10\text{ mA}$ $V_O(\text{min}) = 16\text{ V}$	-10000	—	—	V/μs
Common mode transient immunity at low level output	CM <sub>L</sub>			$I_F = 0\text{ mA}$ $V_O(\text{max}) = 1\text{ V}$	10000	—	—	

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

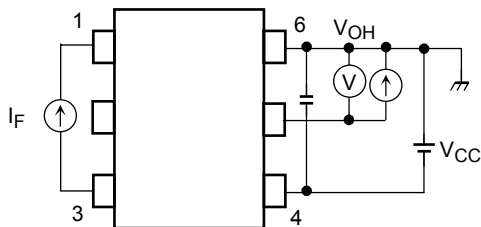
**Test Circuit 1: I<sub>OPH</sub>**



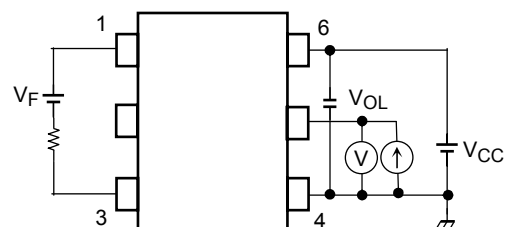
**Test Circuit 2: I<sub>OPL</sub>**

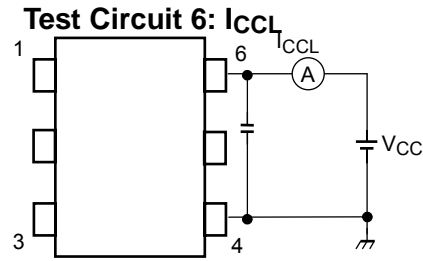
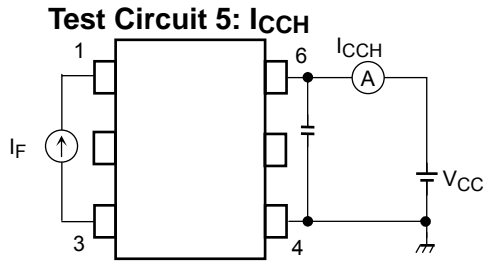


**Test Circuit 3: V<sub>OH</sub>**

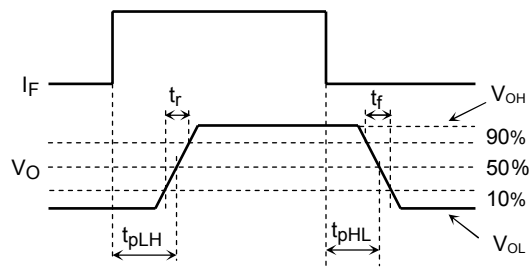
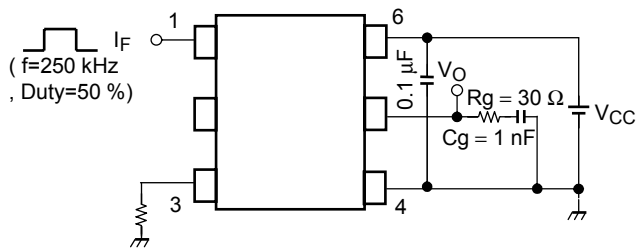


**Test Circuit 4: V<sub>OL</sub>**

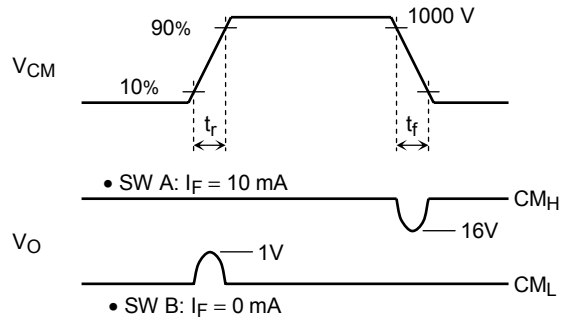
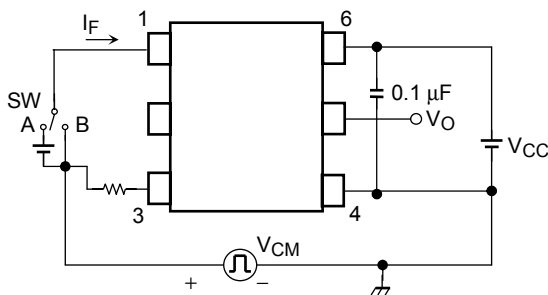




**Test Circuit 7 : t<sub>pLH</sub>, t<sub>pHL</sub>, t<sub>r</sub>, t<sub>f</sub>, PWD**



**Test Circuit 8: CM<sub>H</sub>, CM<sub>L</sub>**



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

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

CM<sub>L</sub> (CM<sub>H</sub>) 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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