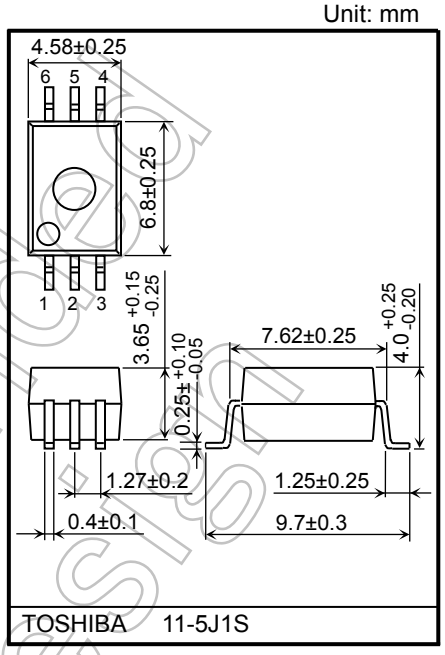
TOSHIBA Photocoupler IRED + Photo IC

TLP705

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

TLP705 consists of an infrared LED and an 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 lower Power IGBTs.

Unit: mm



Weight: 0.26 g (typ.)

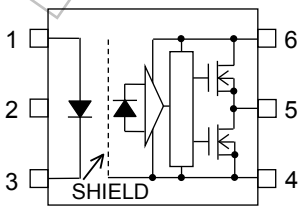
- Peak output current : ±0.45 A (max)
- Operating frequency : 250kHz (max)
- Guaranteed performance over temperature : -40 to 100°C
- Supply current : 3.0mA (max)
- Power supply voltage : 10 to 20 V
- Threshold input current : I_{FLH} = 8 mA (max)
- Switching time (t_{pLH} / t_{pHL}) : 200 ns (max)
- Common mode transient immunity : 10 kV/μs (min)
- Isolation voltage : 5000 Vrms (min)
- Construction Mechanical Rating

Creepage Distance	7.0 mm (min)
Clearance	7.0 mm (min)
Insulation Thickness	0.4 mm (min)

- UL-recognized : UL 1577, File No.E67349
- cUL-recognized : CSA Component Acceptance Service No.5A
  File No.E67349
- VDE-approved : EN 60747-5-5 , EN 62368-1 (Note 1)

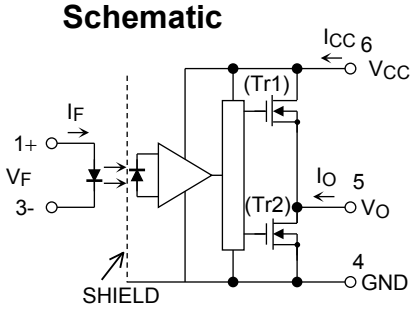
Note 1: When a VDE approved type is needed,
please designate the **Option(D4)**.

Pin Configuration (Top View)



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

Schematic



Note: A 0.1 μF bypass capacitor must be connected between pins 6 and 4.

Truth Table

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

Start of commercial production
2004-04

Absolute 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
	Diode power dissipation		P_D	40	mW
	Diode power dissipation derating (Ta ≥ 85°C)		ΔP_D/°C	-1.0	mW/°C
	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
	Power dissipation		P_C	400	mW
	Power dissipation derating (Ta ≥25°C)		ΔP_C / °C	-4.0	mW / °C
	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, 60 s, R.H. ≤ 60 %)		(Note 5)	BVS	5000	Vrms

Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings.
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc.).

Note : 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.

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} ≤-0.25 A (P_W ≤80 ns), I_{OPL} ≤+0.25 A (P_W ≤80 ns), Ta = 100 °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.

Recommended Operating Conditions

Characteristics	Symbol	Min	Typ.	Max	Unit
Input current, ON (Note 1)	$I_{F\ (ON)}$	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: Recommended operating conditions are given as a design guideline to obtain expected performance of the device. Additionally, each item is an independent guideline respectively. In developing designs using this product, please confirm specified characteristics shown in this document.

Note: If the rising slope of the supply voltage (V_{CC}) for the detector is steep, stable operation of the internal circuits cannot be guaranteed.
Be sure to set 3.0 V/μs or less for a rising slope of the V_{CC}.

Note 1: 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 1)	"H" Level	I_{OPH}	1	V_{CC} = 15 V, I_F = 10 mA	$V_{6\text{-}5}$ = 4 V	-0.15	-0.35	—	A
					$V_{6\text{-}5}$ = 10 V	-0.3	-0.6	—	
	"L" Level	I_{OPL}	2	V_{CC} = 15 V, I_F = 0 mA	$V_{5\text{-}4}$ = 2 V	0.15	0.36	—	
					$V_{5\text{-}4}$ = 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

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

Note: 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.

Note 1: Duration of I_O time ≤ 50 μs

Isolation Characteristics (Ta = 25°C)

Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Capacitance input to output	C_S	V = 0 V, f = 1 MHz	—	1.0	—	pF
Isolation resistance	R_S	R.H. ≤ 60 %, V_S = 500 V	10^{12}	10^{14}	—	Ω
Isolation voltage	BV_S	AC, 60 s	5000	—	—	Vrms

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

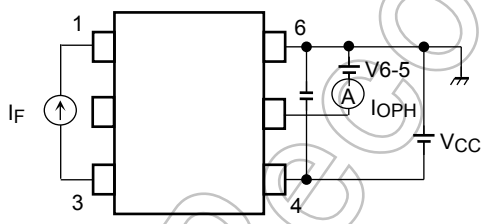
Switching Characteristics (Ta = -40 to 100°C, unless otherwise specified)

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 = 250 kHz 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 skew (Note 1)		tpsk			Ta= -40 to100 °C I_F = 10 mA	-90	—	90	
Switching time dispersion between ON and OFF		$\|t_{pHL}-t_{pLH}\|$			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 high level output		CM_H	8	V_{CM} = 1000 Vp-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	—	—	

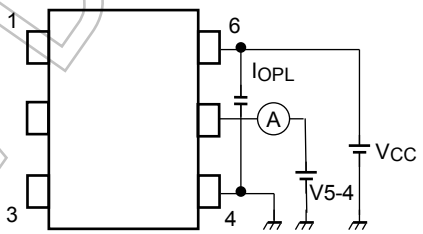
Note: All typical values are at Ta = 25 °C

Note 1: Propagation delay difference between any two parts.

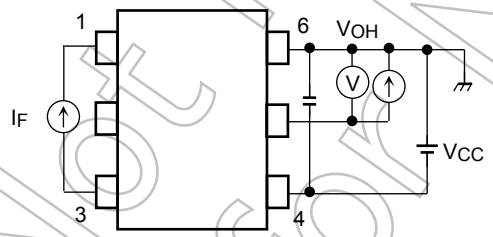
Test Circuit 1: I_{OPH}



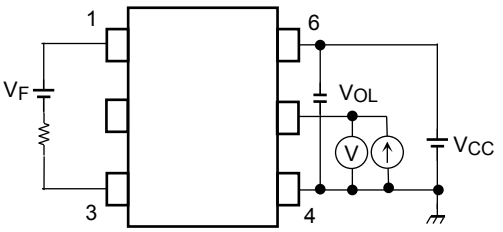
Test Circuit 2: I_{OPL}



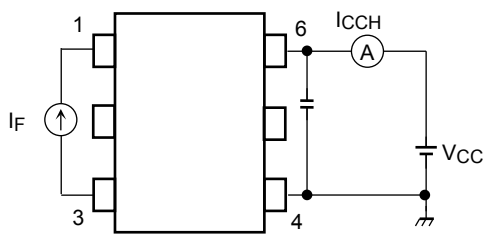
Test Circuit 3: V_{OH}



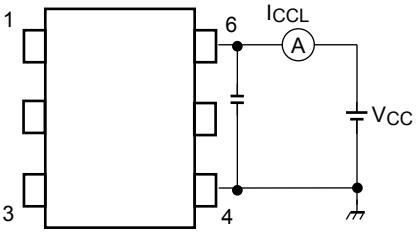
Test Circuit 4: V_{OL}



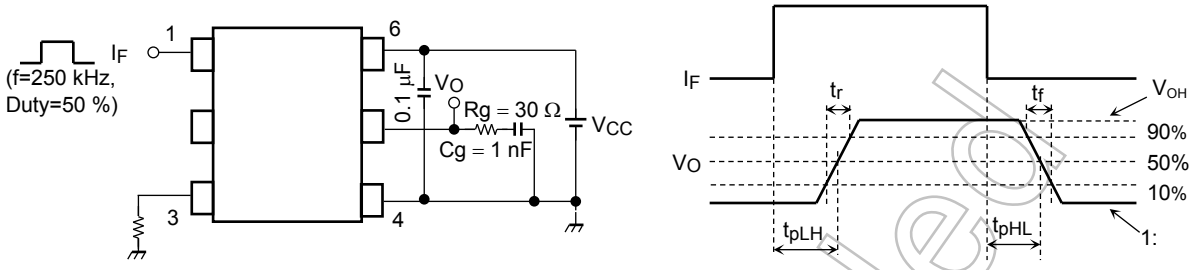
Test Circuit 5: I_{CCH}



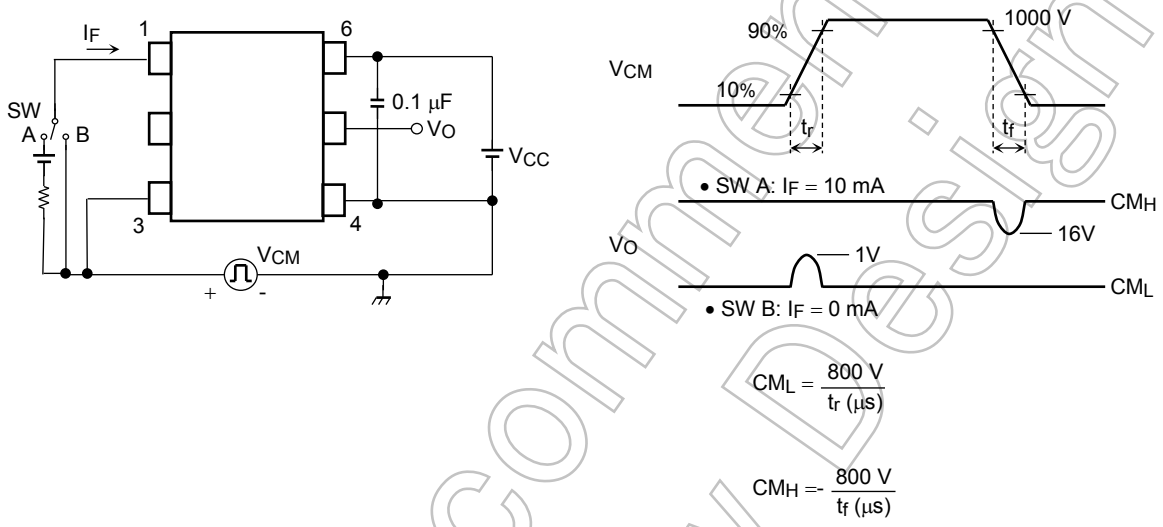
Test Circuit 6: I_{CCL}



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



Test Circuit 8: CM_H, CM_L



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

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

Note: 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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