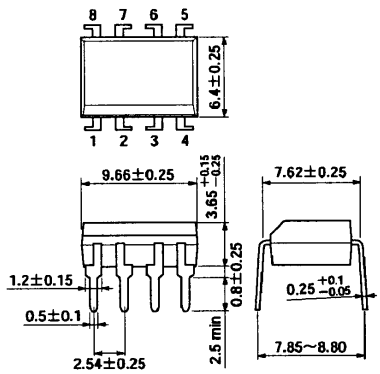
Preliminary

TOSHIBA Photocoupler GaAℓAs IRED + Photo IC

TLP351

Inverter for Air Conditioner
IGBT/Power MOS FET Gate Drive
Industrial Inverter

Unit: mm



JEDEC	—
JEITA	—
TOSHIBA	11-10C4

Weight: 0.54 g (typ.)

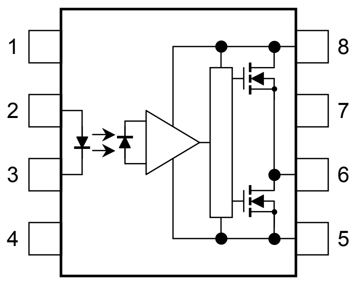
The TOSHIBA TLP351 consists of a GaAℓAs light emitting diode and a integrated photodetector.
This unit is 8-lead DIP package.
TLP351 is suitable for gate driving circuit of IGBT or power MOS FET.
Especially TLP351 is capable of "direct" gate drive of lower Power IGBTs.

- 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_F = 5 mA (max)
- Switching time (t_{pLH}/t_{pHL}) : 700 ns (max)
- Common mode transient immunity: 10 kV/μs
- Isolation voltage: 3750 Vrms

Truth Table

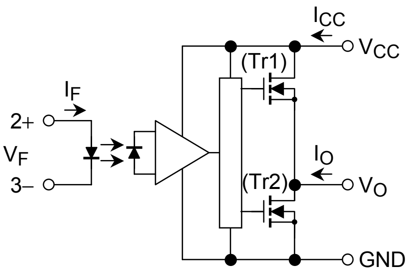
Input	LED	Tr1	Tr2	Output
H	ON	ON	OFF	H
L	OFF	OFF	ON	L

Pin Configuration (top view)



1: NC
2: Anode
3: Cathode
4: NC
5: GND
6: V_O (output)
7: NC
8: V_{CC}

Schematic



A 0.1 μF bypass capacitor must be connected between pin 8 and 5. (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
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	3750	Vrms

Note 1: Pulse width $P_W \leq 1$ µs, 300 pps

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

Note 3: Exponential waveform $I_{OPH} \leq -0.4$ A (≤ 2.0 µs), $I_{OPL} \leq +0.4$ A (≤ 2.0 µs),Ta = 100°C

Note 4: It is 2 mm or more from a lead root.

Note 5: Device considerd a two terminal device: pins 1, 2, 3 and 4 shorted together, and pins 5, 6, 7 and 8 shorted together.

Note 6: A ceramic capacitor(0.1 µF) should be connected from pin 8 to pin 5 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 , 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	$V_{8\text{-}6}$ = 4 V	–0.2	–0.4	—	A
		I_{OPH2}			$V_{8\text{-}6}$ = 10 V	–0.4	–0.67	—	
	"L" Level	I_{OPL1}	2	V_{CC} = 15 V, I_F = 0 mA	$V_{6\text{-}5}$ = 2 V	0.2	0.35	—	
		I_{OPL2}			$V_{6\text{-}5}$ = 10 V	0.4	0.63	—	
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
Capacitance (Input-Output)		C_S	—	V = 0, f = 1 MHz, Ta = 25°C		—	1.0	—	pF
Resistance (Input-Output)		R_S	—	V_S = 500 V, Ta = 25°C, R.H. ≤ 60%		1×10^{12}	10^{14}	—	Ω

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

Note 8: Duration of I_O time ≤ 50 μs

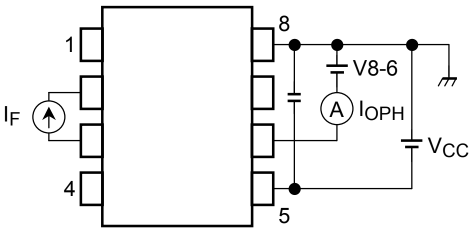
Note 9: This product is more sensitive than the conventional product to static electricity (ESD) because of a lowest power consumption design.
General precaution to static electricity (ESD) is necessary for handling this component.

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

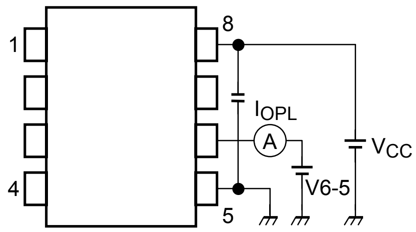
Characteristics		Symbol	Test Circuit	Test Condition		Min	Typ.*	Max	Unit
Propagation delay time	L → H	t_{pLH}	7	V_{CC} = 30 V, R_g = 47 Ω, C_g = 3 nF	I_F = 0 → 5 mA	100	—	700	ns
	H → L	t_{pHL}	7		I_F = 5 → 0 mA	100	—	700	ns
Propagation delay difference between any two parts or channels		PDD $\|t_{pHL}-t_{pLH}\|$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

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

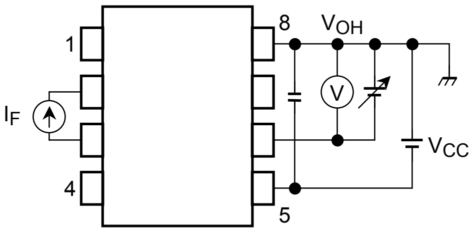
Test Circuit 1: I_{OPH}



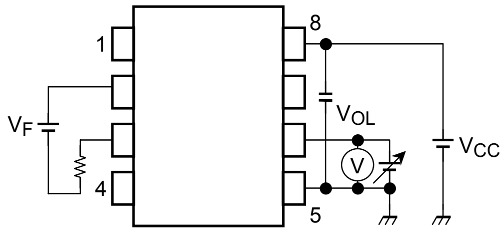
Test Circuit 2: I_{OPL}



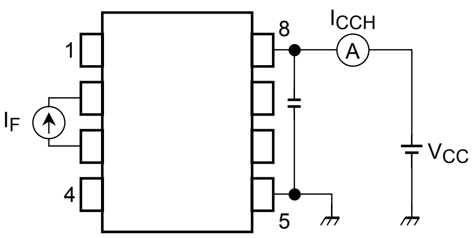
Test Circuit 3: V_{OH}



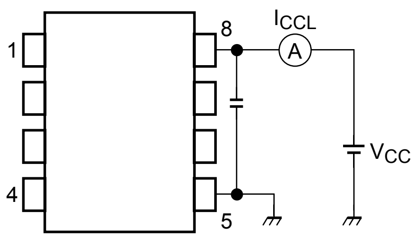
Test Circuit 4: V_{OL}



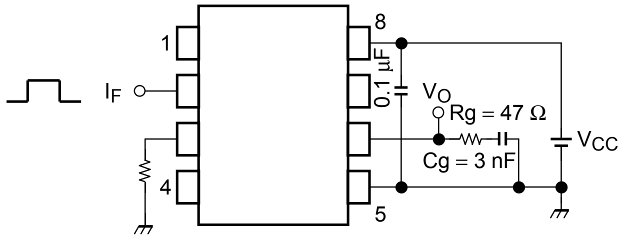
Test Circuit 5: I_{CCH}

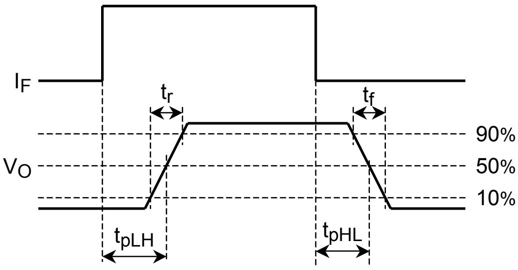


Test Circuit 6: I_{CCL}

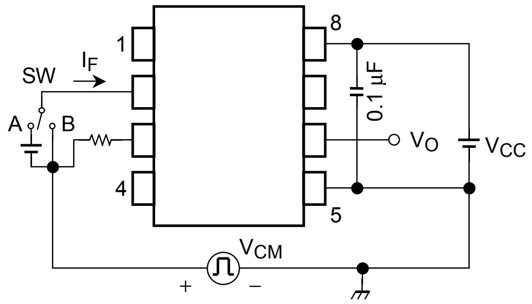


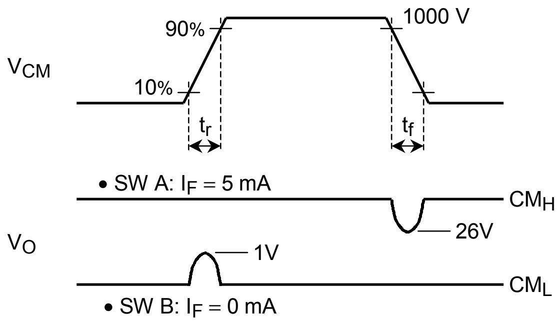
Test Circuit 7: t_{pLH}, t_{pHL}, t_r, t_f, PDD





Test Circuit 8: CM_H, CM_L

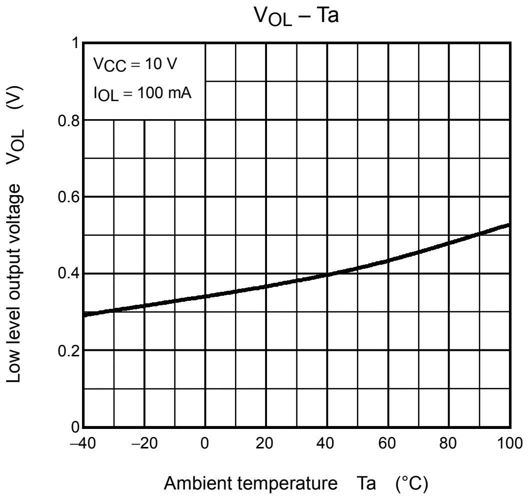


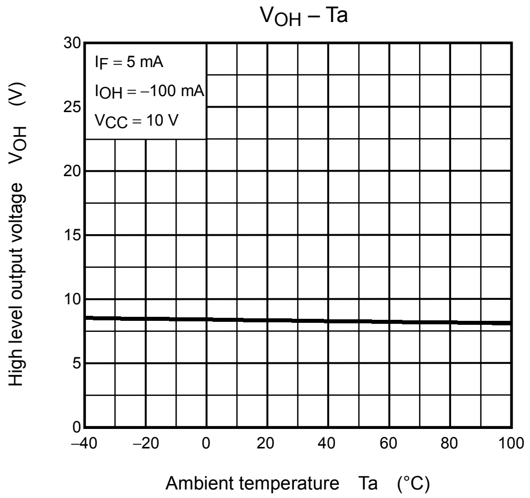


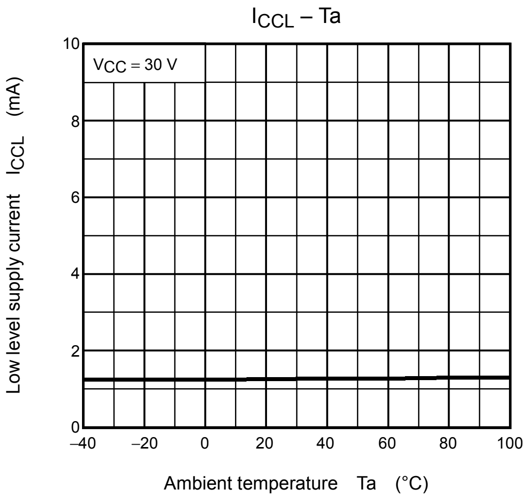
$$CM_L = \frac{800\ \text{V}}{t_f\ (\mu s)}$$

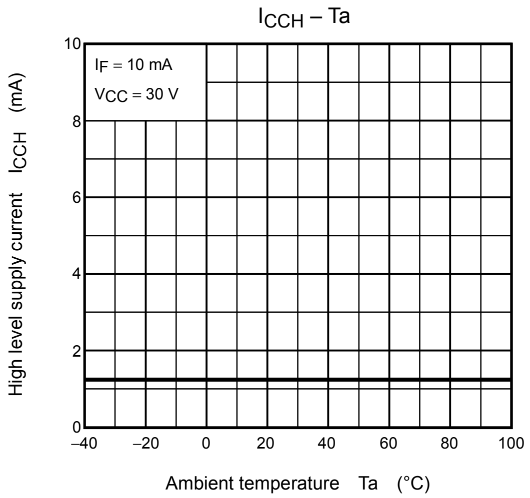
$$CM_H = \frac{800\ \text{V}}{t_r\ (\mu s)}$$

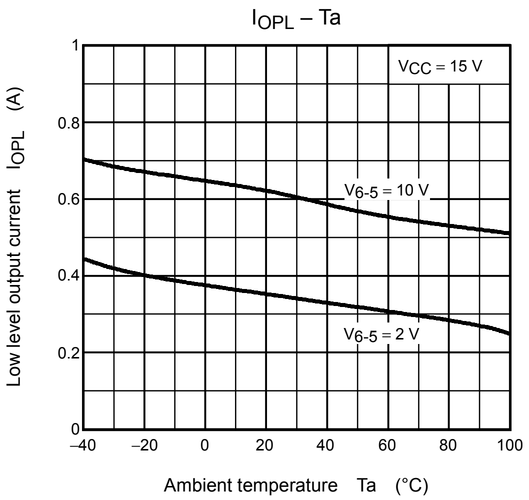
CM_L (CM_H) is the maximum rate of rise (fall) of the common mode voltage that can be sustained with the output voltage in the low (high) state.

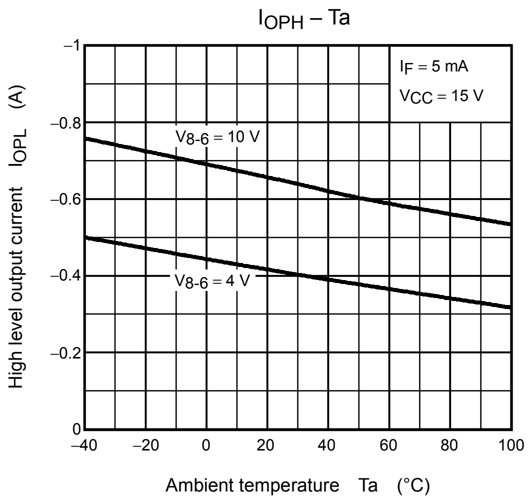




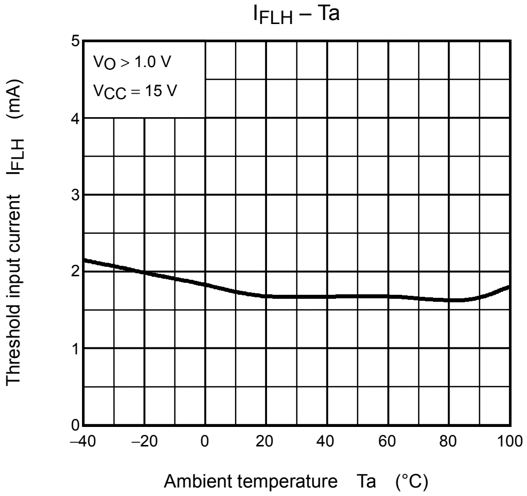


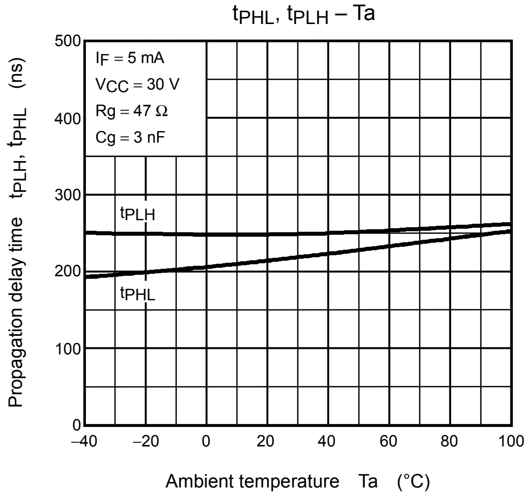






*: The above graphs show typical characteristics.





*: The above graphs show typical characteristics.

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