

TOSHIBA Photocoupler GaAlAs Ired & Photo-IC

TLP251

Inverter For Air Conditioner
Induction Heating
Transistor Inverter
Power MOS FET Gate Drive
IGBT Gate Drive

The TOSHIBA TLP251 consists of a GaAlAs light emitting diode and a integrated photodetector.
This unit is 8-lead DIP package.
TLP251 is suitable for gate driving circuit of IGBT or power MOS FET.
Especially TLP251 is capable of "direct" gate drive of lower power IGBTs.
(~15A)

- Input threshold current: $I_F=5\text{mA}(\text{max.})$
- Supply current (I_{CC}): $11\text{mA}(\text{max.})$
- Supply voltage (V_{CC}): $10\sim35\text{V}$
- Output current (I_O): $\pm0.4\text{A}(\text{max.})$
- Switching time (t_{pLH} / t_{pHL}): $1\mu\text{s}(\text{max.})$
- Isolation voltage: $2500\text{Vrms}(\text{min.})$
- UL recognized: UL1577, file no.E67349
- Option(D4)

VDE Approved : DIN EN60747-5-2

Maximum Operating Insulation Voltage : 890V_{PK}

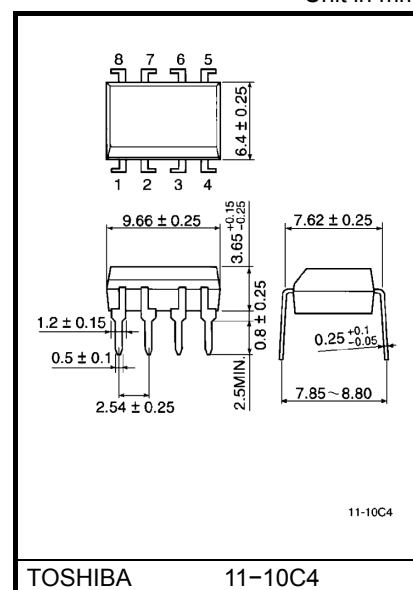
Highest Permissible Over Voltage : 4000V_{PK}

(Note):When a EN60747-5-2 approved type is needed,
Please designate "Option(D4)"

Truth Table

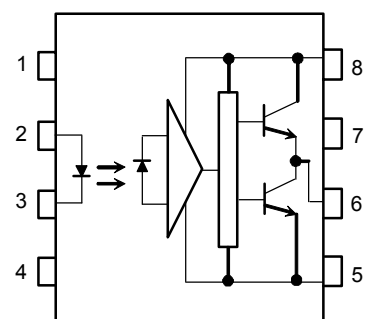
		Tr1	Tr2
Input	On	On	Off
	Off	Off	On

Unit in mm



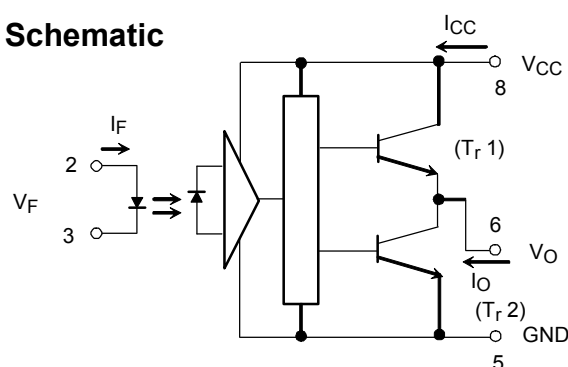
Weight: 0.54g(typ.)

Pin Configuration (top view)



- 1 : N.C.
- 2 : Anode
- 3 : Cathode
- 4 : N.C.
- 5 : GND
- 6 : V_O (Output)
- 7 : N.C.
- 8 : V_{CC}

Schematic



A 0.1 μF bypass capacitor must be connected between pin 8 and 5(see Note 5).

Absolute Maximum Ratings (Ta = 25°C)

Characteristic			Symbol	Rating	Unit
LED	Forward current		I _F	20	mA
	Forward current derating (Ta ≥ 70°C)		ΔI _F / ΔTa	− 0.36	mA / °C
	Peak transient forward current (Note 1)		I _{FPT}	1	A
	Reverse voltage		V _R	5	V
	Junction temperature		T _j	125	°C
Detector	“H” peak output current (P _W ≤ 2.0μs, f ≤ 15kHz) (Note 2)		I _{OPH}	− 0.4	A
	“L ” peak output current (P _W ≤ 2.0μs, f ≤ 15kHz) (Note 2)		I _{OPL}	0.4	A
	Output voltage	(Ta ≤ 70°C)	V _O	35	V
		(Ta = 85°C)		24	
	Supply voltage	(Ta ≤ 70°C)	V _{CC}	35	V
		(Ta = 85°C)		24	
	Output voltage derating (Ta ≥ 70°C)		ΔV _O / ΔTa	− 0.73	V / °C
	Supply voltage derating (Ta ≥ 70°C)		ΔV _{CC} / ΔTa	− 0.73	V / °C
	Junction temperature		T _j	125	°C
	Operating frequency (Note 3)			f	25
Operating temperature range			T _{opr}	−20~85	°C
Storage temperature range			T _{stg}	−55~125	°C
Lead soldering temperature(10s)			T _{sol}	260	°C
Isolation voltage (AC, 1min., R.H.≤ 60%) (Note 4)			BV _S	2500	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 1: Pulse width $P_W \leq 1\mu s$, 300pps

Note 2: Exponential waveform

Note 3: Exponential waveform, $I_{OPH} \leq -0.25A(\leq 2.0\mu s)$, $I_{OPL} \leq +0.25A(\leq 2.0\mu s)$

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

Note 5: A ceramic capacitor(0.1μF)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 1cm.

Recommended Operating Conditions

Characteristic	Symbol	Min.	Typ.	Max.	Unit
Input current, on (Note6)	$I_{F(ON)}$	7	8	10	mA
Input voltage, off	$V_{F(OFF)}$	0	—	0.8	V
Supply voltage	V_{CC}	10	—	30 20	V
Peak output current	I_{OPH} / I_{OPL}	—	—	± 0.1	A
Operating temperature	T_{opr}	-20	25	70 85	°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 6: Input signal rise time(fall time)<0.5 μ s.

Electrical Characteristics ($T_a = -20\sim 70^\circ\text{C}$, unless otherwise specified)

Characteristic		Symbol	Test Cir- cuit	Test Condition		Min.	Typ.*	Max.	Unit
Input forward voltage		V _F	—	I _F = 10 mA , Ta = 25°C		—	1.6	1.8	V
Temperature coefficient of forward voltage		ΔV _F / ΔTa	—	I _F = 10 mA		—	−2.0	—	mV / °C
Input reverse current		I _R	—	V _R = 5V, Ta = 25°C		—	—	10	μA
Input capacitance		C _T	—	V = 0 , f = 1MHz , Ta = 25°C		—	45	250	pF
Output current	“H” level	I _{OPH}	1	V _{CC} =30V (*1)	I _F = 10mA V ₈₋₆ = 4V	−0.1	−0.25	—	A
	“L” level	I _{OPL}	2		I _F = 0 V ₆₋₅ = 2.5V	0.1	0.2	—	
Output voltage	“H” level	V _{OH}	3	V _{CC1} = +15V, V _{EE1} = −15V R _L = 200Ω, I _F = 5mA		11	13.2	—	V
	“L” level	V _{OL}	4	V _{CC1} = +15V, V _{EE1} = −15V R _L = 200Ω, V _F = 0.8V		—	−14.5	−12.5	
Supply current	“H” level	I _{CCH}	—	V _{CC} = 30V, I _F = 10mA Ta = 25°C		—	7.5	—	mA
				V _{CC} = 30V, I _F = 10mA		—	—	11	
	“L” level	I _{CCL}	—	V _{CC} = 30V, I _F = 0mA Ta = 25°C		—	8	—	
				V _{CC} = 30V, I _F = 0mA		—	—	11	
Threshold input current	“Output L → H”	I _{FLH}	—	V _{CC1} = +15V, V _{EE1} = −15V R _L = 200Ω, V _O > 0V		—	1.2	5	mA
Threshold input voltage	“Output H → L”	V _{FHL}	—	V _{CC1} = +15V, V _{EE1} = −15V R _L = 200Ω, V _O < 0V		0.8	—	—	V
Supply voltage		V _{CC}	—			10	—	35	V
Capacitance (input–output)		C _s	—	Vs = 0 , f = 1MHz Ta = 25°C		—	1.0	2.0	pF
Resistance (input–output)		R _s	—	Vs = 500V, Ta = 25°C R.H. ≤ 60%		1×10 ¹²	10 ¹⁴	—	Ω

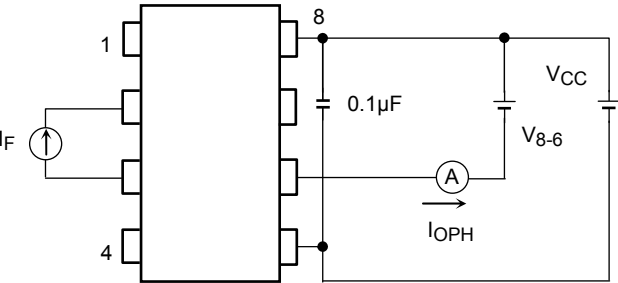
* All typical values are at $T_a=25^\circ\text{C}$ (*1): Duration of I_O time $\leq 50\mu\text{s}$

Switching Characteristics (Ta = -20~70°C, unless otherwise specified)

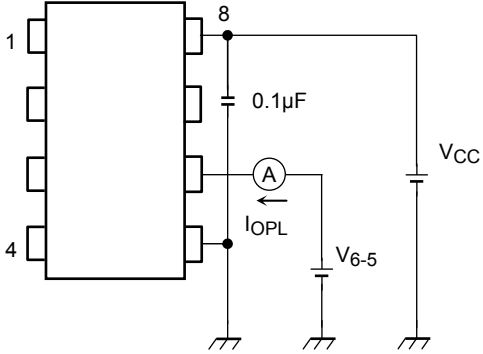
Characteristic		Symbol	Test Cir-cuit	Test Condition	Min.	Typ.*	Max.	Unit
Propagation delay time	L→H	t _{pLH}	5	I _F = 8mA V _{CC1} = +15V, V _{EE1} = -15V R _L = 200 Ω	—	0.25	1.0	μs
	H→L	t _{pHL}			—	0.25	1.0	
Output rise time		t _r			—	—	—	
Output fall time		t _f			—	—	—	
Common mode transient immunity at high level output		C _{MH}	6	V _{CM} = 600V, I _F = 8mA, V _{CC} = 30V, Ta = 25°C	-5000	—	—	V / μs
Common mode transient immunity at low level output		C _{ML}		V _{CM} = 600V, I _F = 0mA, V _{CC} = 30V, Ta = 25°C	5000	—	—	V / μs

*All typical values are at Ta=25°C

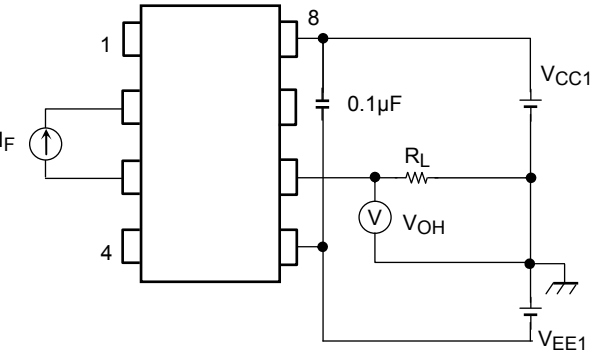
Test Circuit 1 : I_{OPH}



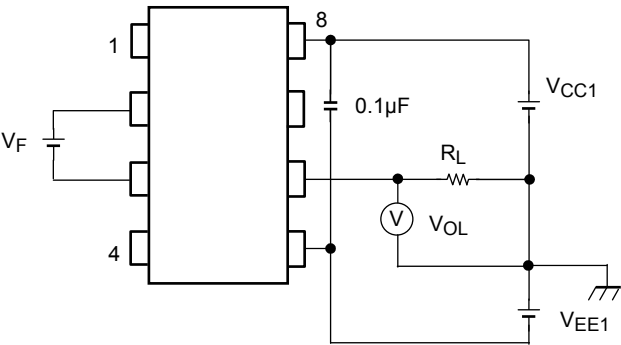
Test Circuit 2 : I_{OPL}



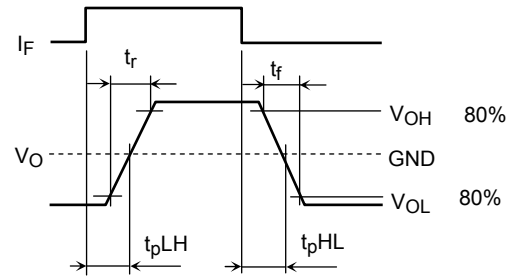
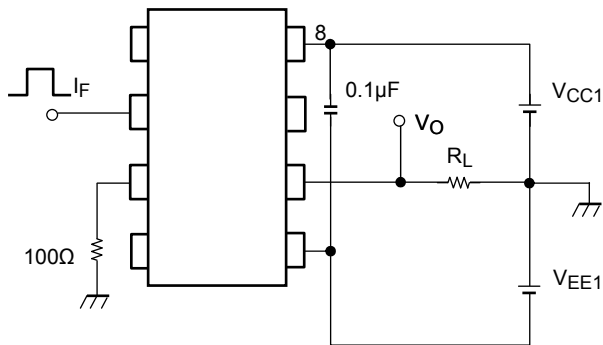
Test Circuit 3 : V_{OH}



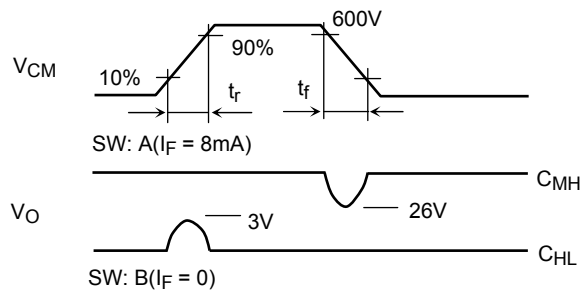
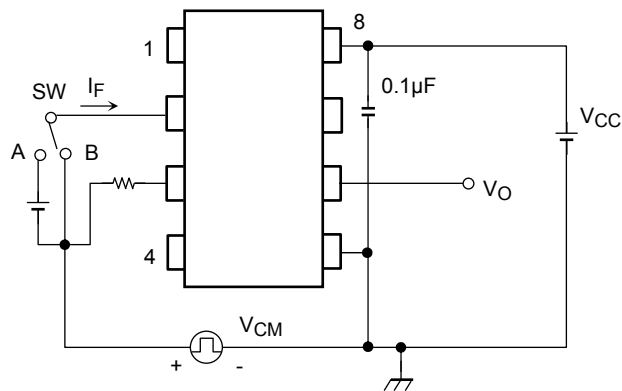
Test Circuit 4 : V_{OL}



Test Circuit 5: t_{pLH} , t_{pHL} , t_r , t_f



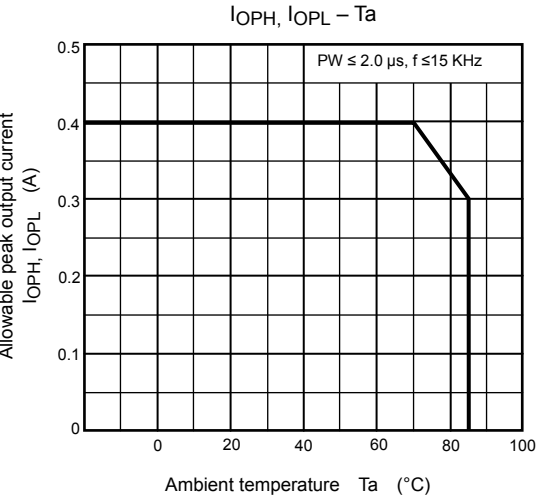
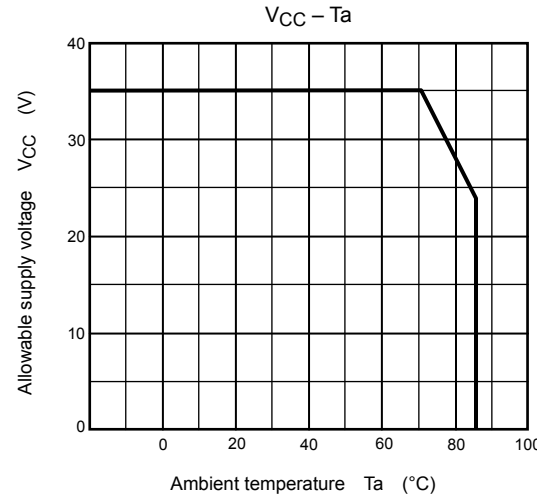
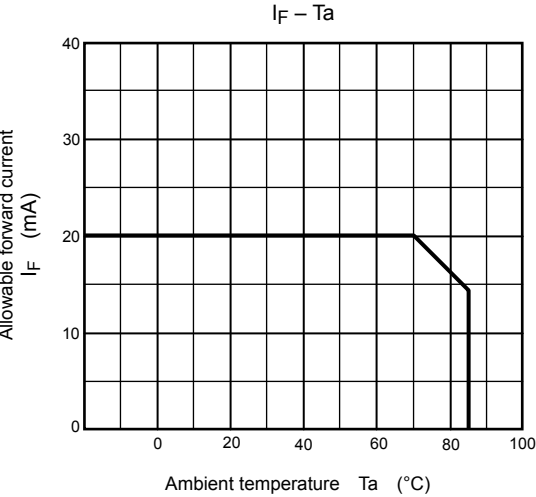
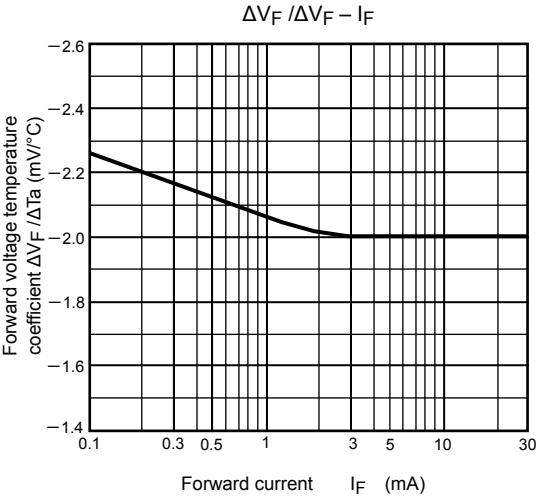
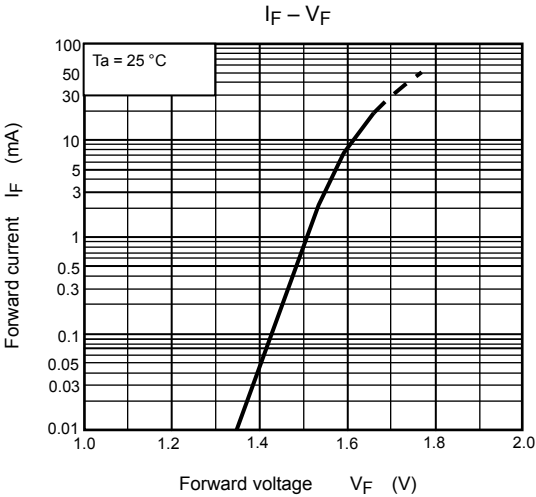
Test Circuit 6: C_{MH} , C_{ML}



$$C_{ML} = \frac{480(V)}{t_r(\mu s)}$$

$$C_{MH} = \frac{480(V)}{t_f(\mu s)}$$

C_{ML} (C_{MH}) 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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20070701-EN

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