

## TLP250

Industrial Inverter  
Inverter For Air Conditioner  
IGBT Gate Drive  
Power MOS FET Gate Drive

The TOSHIBA TLP250 consists of a GaAlAs light emitting diode and a integrated photodetector.

This unit is 8-lead DIP package.

TLP250 is suitable for gate driving circuit of IGBT or power MOS FET.

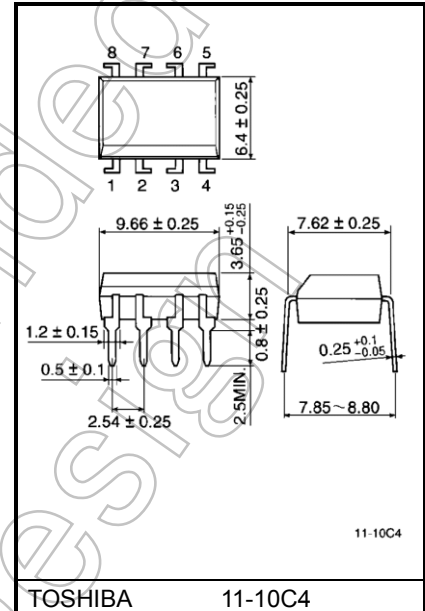
- Input threshold current: 5mA(max)
- Supply current : 11mA(max)
- Supply voltage : 10-35V
- Output current :  $\pm 1.5A$  (max)
- Switching time  $t_{pLH}/t_{pHL}$ : 0.5 $\mu$ s(max)
- Isolation voltage: 2500Vrms(min)
- UL recognized: UL1577, file No.E67349
- c-UL approved : CSA Component Acceptance Service  
No. 5A, File No.E67349

### Option(D4)

VDE Approved : EN60747-5- 5

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

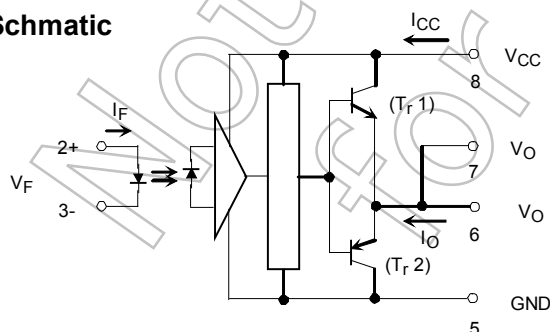
Unit: mm



### Truth Table

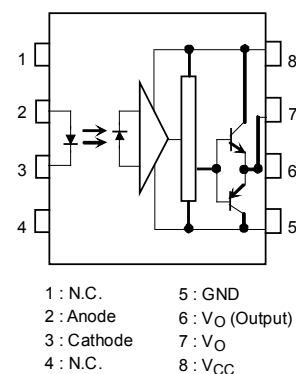
		Tr1	Tr2
Input LED	On	On	Off
	Off	Off	On

### Schematic



A 0.1 $\mu$ F bypass capacitor must be connected between pin 8 and 5

### Pin Configuration (top view)



Start of commercial production  
1990-11

## Absolute Maximum Ratings (Ta = 25°C)

Characteristic		Symbol	Rating	Unit
LED	Forward current	I <sub>F</sub>	20	mA
	Forward current derating (Ta ≥ 70°C)	ΔI <sub>F</sub> / ΔTa	-0.36	mA / °C
	Peak transient forward current (Note 1)	I <sub>FPT</sub>	1	A
	Reverse voltage	V <sub>R</sub>	5	V
	Diode power dissipation	P <sub>D</sub>	40	mW
	Diode power dissipation derating (Ta ≥ 70°C)	ΔP <sub>D</sub> / °C	-0.72	mW / °C
	Junction temperature	T <sub>J</sub>	125	°C
Detector	"H" peak output current (P <sub>W</sub> ≤ 2.5μs, f ≤ 15kHz) (Note 2)	I <sub>OPH</sub>	-1.5	A
	"L" peak output current (P <sub>W</sub> ≤ 2.5μs, f ≤ 15kHz) (Note 2)	I <sub>OPL</sub>	+1.5	A
	Output voltage	V <sub>O</sub>	35	V
			24	
	Supply voltage	V <sub>CC</sub>	35	V
			24	
	Output voltage derating (Ta ≥ 70°C)	ΔV <sub>O</sub> / ΔTa	-0.73	V / °C
	Supply voltage derating (Ta ≥ 70°C)	ΔV <sub>CC</sub> / ΔTa	-0.73	V / °C
	Power dissipation	P <sub>C</sub>	800	mW
	Power dissipation derating (Ta ≥ 70°C)	ΔP <sub>C</sub> / °C	-14.5	mW / °C
	Junction temperature	T <sub>J</sub>	125	°C
Operating frequency (Note 3)		f	25	kHz
Operating temperature range		T <sub>opr</sub>	-20 to 85	°C
Storage temperature range		T <sub>stg</sub>	-55 to 125	°C
Lead soldering temperature (10 s)		T <sub>sol</sub>	260	°C
Isolation voltage (AC, 60 s., R.H. ≤ 60%) (Note 4)		BV <sub>S</sub>	2500	V <sub>rms</sub>

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  $PW \leq 1\mu s$ , 300pps

Note 2: Exponential waveform

Note 3: Exponential waveform,  $I_{OPH} \leq -1.0A (\leq 2.5\mu s)$ ,  $I_{OPL} \leq +1.0A (\leq 2.5\mu s)$

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.

## Recommended Operating Conditions

Characteristic	Symbol	Min	Typ.	Max	Unit
Input current, on	I <sub>F(ON)</sub>	7	8	10	mA
Input voltage, off	V <sub>F(OFF)</sub>	0	—	0.8	V
Supply voltage	V <sub>CC</sub>	15	—	30	V
Peak output current	I <sub>OPH</sub> /I <sub>OPL</sub>	—	—	±0.5	A
Operating temperature	T <sub>opr</sub>	-20	25	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 : 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.

Note : Input signal rise time(fall time)<0.5μs.

## Electrical Characteristics (Ta = -20 to 70°C, unless otherwise specified)

Characteristic		Symbol	Test Cir-cuit	Test Condition		Min	Typ.*	Max	Unit
Input 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> = 5V, Ta = 25°C		—	—	10	μA
Input capacitance		C <sub>T</sub>	—	V = 0 V, f = 1MHz, Ta = 25°C		—	45	250	pF
Output current	"H" level	I <sub>OPH</sub>	1	V <sub>CC</sub> = 30V (Note 1)	I <sub>F</sub> = 10 mA V <sub>8-6</sub> = 4V	-0.5	-1.5	—	A
	"L" level	I <sub>OPL</sub>	2		I <sub>F</sub> = 0 mA V <sub>6-5</sub> = 2.5V	0.5	2	—	
Output voltage	"H" level	V <sub>OH</sub>	3	V <sub>CC1</sub> = +15V, V <sub>EE1</sub> = -15V R <sub>L</sub> = 200Ω, I <sub>F</sub> = 5mA		11	12.8	—	V
	"L" level	V <sub>OL</sub>	4	V <sub>CC1</sub> = +15V, V <sub>EE1</sub> = -15V R <sub>L</sub> = 200Ω, V <sub>F</sub> = 0.8V		—	-14.2	-12.5	
Supply current	"H" level	I <sub>CCH</sub>	—	V <sub>CC</sub> = 30V, I <sub>F</sub> = 10mA Ta = 25°C		—	7	—	mA
				V <sub>CC</sub> = 30V, I <sub>F</sub> = 10mA		—	—	11	
	"L" level	I <sub>CCL</sub>	—	V <sub>CC</sub> = 30V, I <sub>F</sub> = 0mA Ta = 25°C		—	7.5	—	
				V <sub>CC</sub> = 30V, I <sub>F</sub> = 0mA		—	—	11	
Threshold input current	"Output L→H"	I <sub>FLH</sub>	—	V <sub>CC1</sub> = +15V, V <sub>EE1</sub> = -15V R <sub>L</sub> = 200Ω, V <sub>O</sub> > 0V		—	1.2	5	mA
Threshold input voltage	"Output H→L"	V <sub>FHL</sub>	—	V <sub>CC1</sub> = +15V, V <sub>EE1</sub> = -15V R <sub>L</sub> = 200Ω, V <sub>O</sub> < 0V		0.8	—	—	V
Supply voltage		V <sub>CC</sub>	—	—		10	—	35	V
Capacitance (input-output)		C <sub>S</sub>	—	V <sub>S</sub> = 0 V, f = 1MHz Ta = 25°C		—	1.0	2.0	pF
Resistance(input-output)		R <sub>S</sub>	—	V <sub>S</sub> = 500V, Ta = 25°C R.H. ≤ 60%		1×10 <sup>12</sup>	10 <sup>14</sup>	—	Ω

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

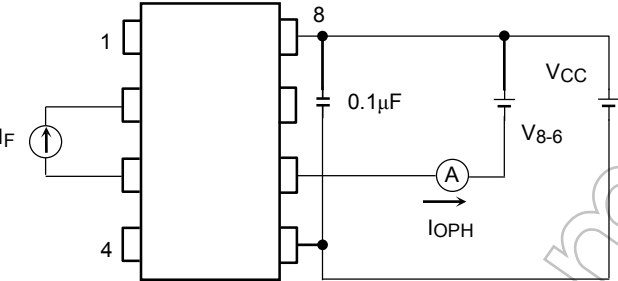
Note 1: Duration of I<sub>O</sub> time ≤ 50μs

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

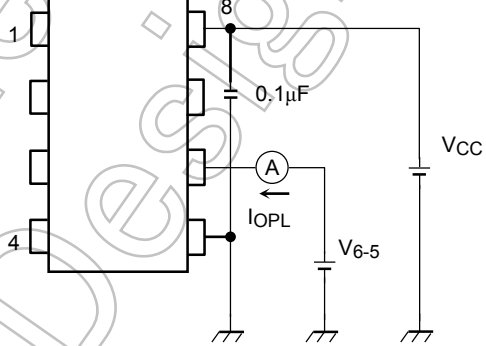
Characteristic		Symbol	Test Cir-cuit	Test Condition	Min	Typ.	Max	Unit
Propagation delay time	L→H	tpLH	5	IF = 8mA VCC1 = +15V, VEE1 = -15V RL = 200Ω	—	0.15	0.5	μs
	H→L	tpHL			—	0.15	0.5	
Common mode transient immunity at high level output		CMH	6	VCM = 600V, IF = 8mA VCC = 30V, Ta = 25°C	-5000	—	—	V / μs
Common mode transient immunity at low level output		CML		VCM = 600V, IF = 0mA VCC = 30V, Ta = 25°C	5000	—	—	V / μs

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

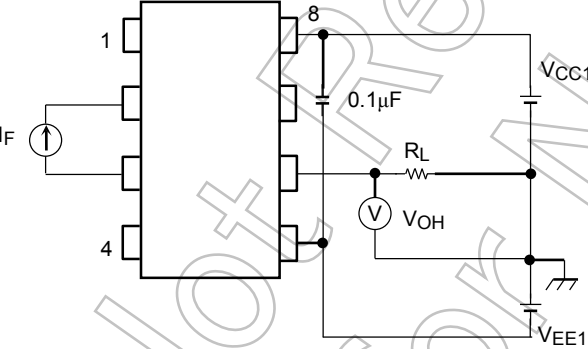
Test Circuit 1 : IOPH



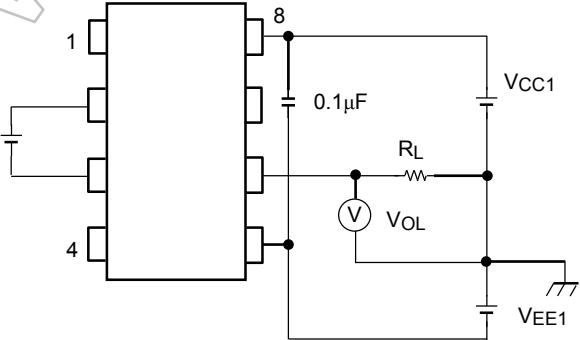
Test Circuit 2 : IOPL



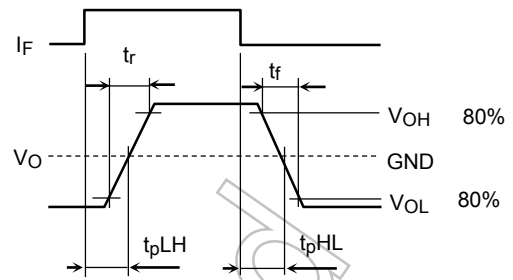
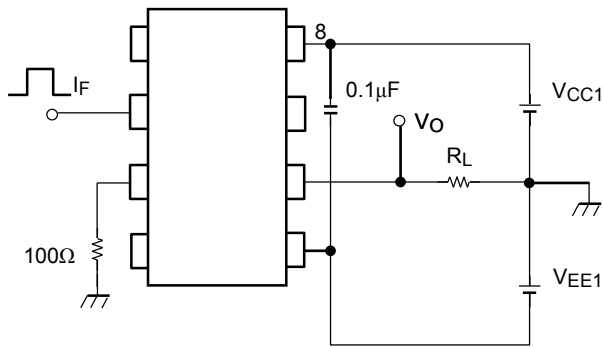
Test Circuit 3 : VOH



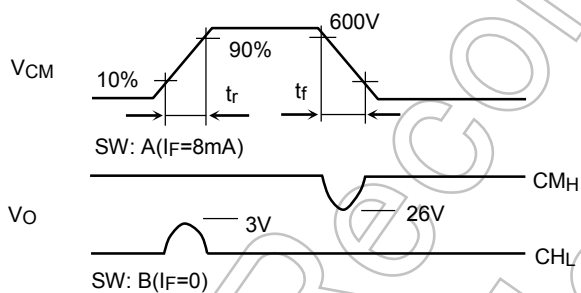
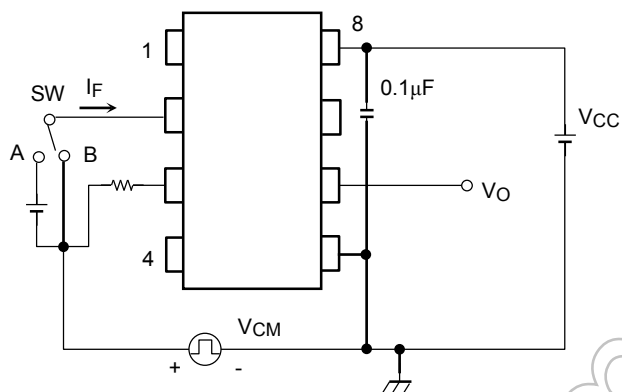
Test Circuit 4 : VOL



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



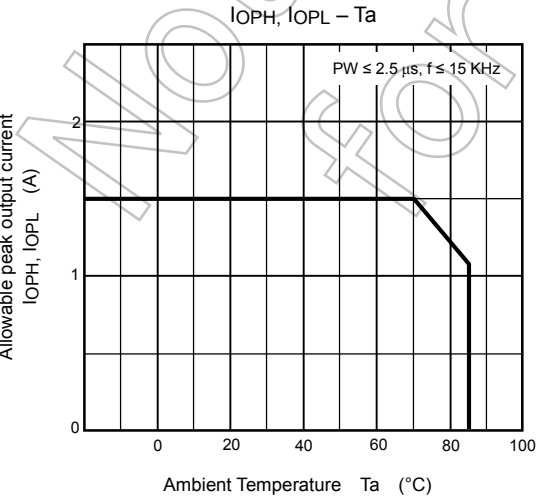
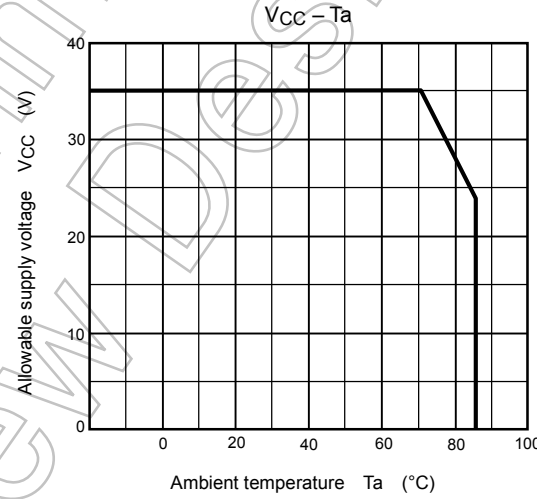
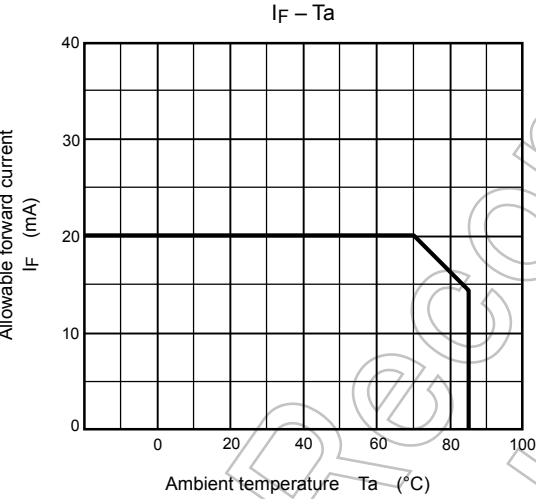
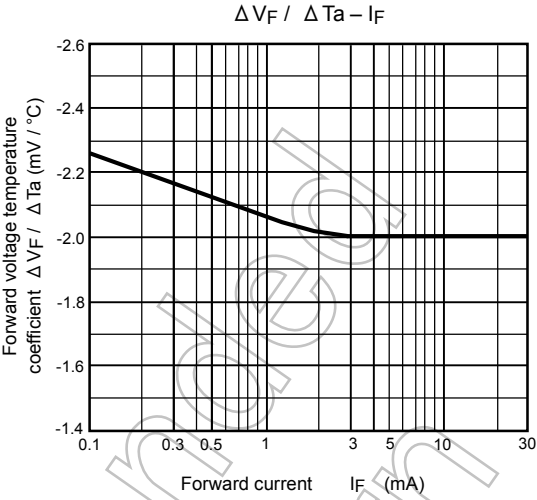
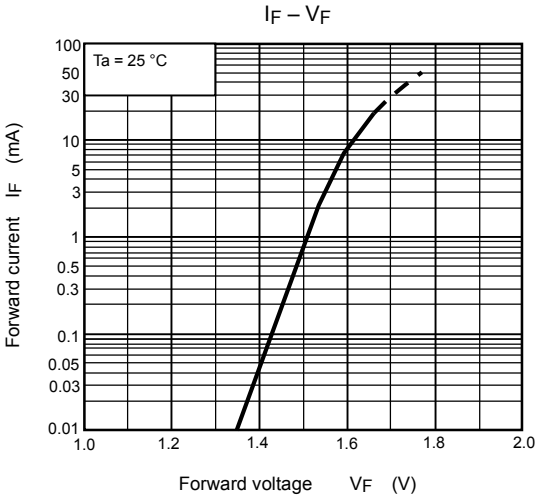
Test Circuit 6:  $CM_H$ ,  $CM_L$



$$CM_L = \frac{480 \text{ (V)}}{t_r \text{ (}\mu\text{s)}}$$

$$CM_H = \frac{480 \text{ (V)}}{t_f \text{ (}\mu\text{s)}}$$

$CM_L$  ( $CM_H$ ) 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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