

# TLP251

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

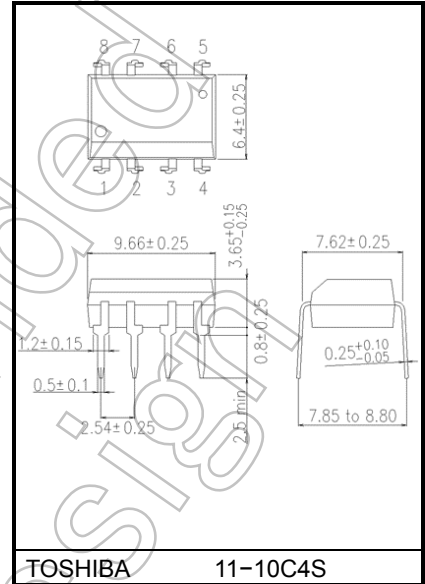
Unit: mm

The TOSHIBA TLP251 consists of an infrared emitting diode and a integrated photodetector.

This unit is 8-lead DIP package.

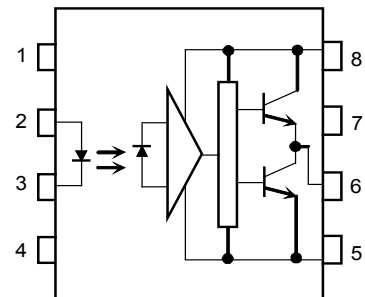
TLP251 is suitable for gate driving circuit of IGBT or power MOS FET. Especially TLP251 is capable of "direct" gate drive of lower power IGBTs. (to 15A)

- Input threshold current:  $I_F=5\text{mA}(\text{max.})$
- Supply current ( $I_{CC}$ ):  $11\text{mA}(\text{max.})$
- Supply voltage ( $V_{CC}$ ): 10–35V
- Output current ( $I_O$ ):  $\pm 0.4\text{A}(\text{max.})$
- Switching time ( $t_{pLH} / t_{pHL}$ ):  $1\mu\text{s}(\text{max.})$
- Isolation voltage:  $2500\text{Vrms}(\text{min.})$
- UL-recognized: UL 1577, File No.E67349
- cUL-recognized: CSA Component Acceptance Service No.5A  
 File No.E67349
- VDE-Approved: EN 60747-5-5 (Note 1)



Weight: 0.54 g (typ.)

### Pin Configuration (top view)



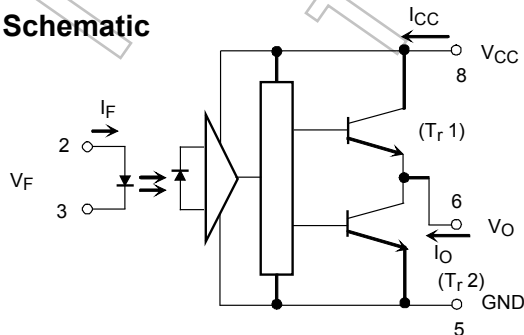
- 1 : N.C.
- 2 : Anode
- 3 : Cathode
- 4 : N.C.
- 5 : GND
- 6 :  $V_O$  (Output)
- 7 : N.C.
- 8 :  $V_{CC}$

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

### Truth Table

		Tr1	Tr2
		Input LED	On
	On	On	Off
	Off	Off	On

### Schematic



A 0.1 $\mu\text{F}$  bypass capacitor must be connected between pin 8 and 5(see Note 5).

Start of commercial production  
 1992-01

## 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> ≤ 2.0μs, f ≤ 15kHz) (Note 2)		I <sub>OPH</sub>	-0.4	A
	“L” peak output current (P <sub>W</sub> ≤ 2.0μs, f ≤ 15kHz) (Note 2)		I <sub>OPL</sub>	0.4	A
	Output voltage	(Ta ≤ 70°C)	V <sub>O</sub>	35	V
		(Ta = 85°C)		24	
	Supply voltage	(Ta ≤ 70°C)	V <sub>CC</sub>	35	V
		(Ta = 85°C)		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
	Output Power dissipation		P <sub>O</sub>	800	mW
	Output Power dissipation derating (Ta ≥ 70°C)		ΔP <sub>O</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 P<sub>W</sub> ≤ 1 μs, 300 pps

Note 2: Exponential waveform

Note 3: Exponential waveform, I<sub>OPH</sub> ≤ -0.25 A(≤ 2.0 μs), I<sub>OPL</sub> ≤ +0.25 A(≤ 2.0 μs)

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 (Note 1)	$I_{F(ON)}$	7	8	10	mA
Input voltage, off	$V_{F(OFF)}$	0	—	0.8	V
Supply voltage	$V_{CC}$	10	—	30	V
Peak output current	$I_{OPH} / I_{OPL}$	—	—	±0.1	A
Operating temperature	$T_{opr}$	-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 1: Input signal rise time(fall time)<0.5 μs.

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

Characteristic		Symbol	Test Circuit	Test Condition	Min.	Typ.*	Max.	Unit	
Input forward voltage		$V_F$	—	$I_F = 10 \text{ mA}$ , $T_a = 25 \text{ °C}$	—	1.6	1.8	V	
Temperature coefficient of forward voltage		$\Delta V_F / \Delta T_a$	—	$I_F = 10 \text{ mA}$	—	-2.0	—	mV / °C	
Input reverse current		$I_R$	—	$V_R = 5 \text{ V}$ , $T_a = 25 \text{ °C}$	—	—	10	μA	
Input capacitance		$C_T$	—	$V = 0 \text{ V}$ , $f = 1 \text{ MHz}$ , $T_a = 25 \text{ °C}$	—	45	250	pF	
Output current	“H” level	$I_{OPH}$	1	$V_{CC} = 30 \text{ V}$ (Note 1)	$I_F = 10 \text{ mA}$ $V_{8-6} = 4 \text{ V}$	-0.1	-0.25	—	A
	“L” level	$I_{OPL}$	2		$I_F = 0 \text{ mA}$ $V_{6-5} = 2.5 \text{ V}$	0.1	0.2	—	
Output voltage	“H” level	$V_{OH}$	3	$V_{CC1} = +15 \text{ V}$ , $V_{EE1} = -15 \text{ V}$ $R_L = 200 \text{ } \Omega$ , $I_F = 5 \text{ mA}$	11	13.2	—	V	
	“L” level	$V_{OL}$	4	$V_{CC1} = +15 \text{ V}$ , $V_{EE1} = -15 \text{ V}$ $R_L = 200 \text{ } \Omega$ , $V_F = 0.8 \text{ V}$	—	-14.5	-12.5		
Supply current	“H” level	$I_{CCH}$	—	$V_{CC} = 30 \text{ V}$ , $I_F = 10 \text{ mA}$ $T_a = 25 \text{ °C}$	—	7.5	—	mA	
				$V_{CC} = 30 \text{ V}$ , $I_F = 10 \text{ mA}$	—	—	11		
	“L” level	$I_{CCL}$	—	$V_{CC} = 30 \text{ V}$ , $I_F = 0 \text{ mA}$ $T_a = 25 \text{ °C}$	—	8	—		
				$V_{CC} = 30 \text{ V}$ , $I_F = 0 \text{ mA}$	—	—	11		
Threshold input current	“Output L → H”	$I_{FLH}$	—	$V_{CC1} = +15 \text{ V}$ , $V_{EE1} = -15 \text{ V}$ $R_L = 200 \text{ } \Omega$ , $V_O > 0 \text{ V}$	—	1.2	5	mA	
Threshold input voltage	“Output H → L”	$V_{FHL}$	—	$V_{CC1} = +15 \text{ V}$ , $V_{EE1} = -15 \text{ V}$ $R_L = 200 \text{ } \Omega$ , $V_O < 0 \text{ V}$	0.8	—	—	V	
Supply voltage		$V_{CC}$	—		10	—	35	V	
Capacitance (input-output)		$C_s$	—	$V_s = 0 \text{ V}$ , $f = 1 \text{ MHz}$ $T_a = 25 \text{ °C}$	—	1.0	2.0	pF	
Resistance (input-output)		$R_s$	—	$V_s = 500 \text{ V}$ , $T_a = 25 \text{ °C}$ R.H. ≤ 60 %	$1 \times 10^{12}$	$10^{14}$	—	Ω	

Note : All typical values are at  $T_a = 25 \text{ °C}$

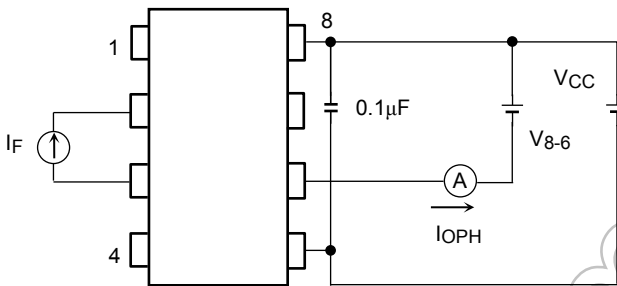
Note 1: Duration of IO time ≤ 50 μs

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

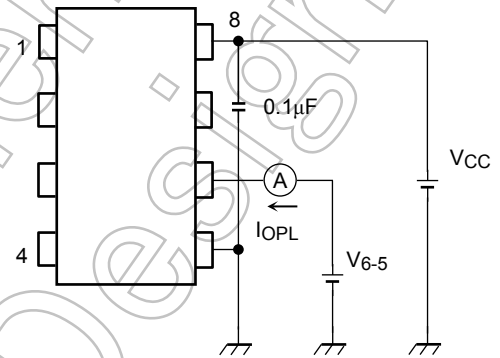
Characteristic		Symbol	Test Circuit	Test Condition	Min.	Typ.*	Max.	Unit
Propagation delay time	L→H	$t_{pLH}$	5	$I_F = 8 \text{ mA}$ $V_{CC1} = +15 \text{ V}, V_{EE1} = -15 \text{ V}$ $R_L = 200 \Omega$	—	0.25	1.0	$\mu\text{s}$
	H→L	$t_{pHL}$			—	0.25	1.0	
Common mode transient immunity at high level output		$CMH$	6	$V_{CM} = 600 \text{ V}, I_F = 8 \text{ mA},$ $V_{CC} = 30 \text{ V}, T_a = 25 \text{ }^\circ\text{C}$	-5000	—	—	$\text{V} / \mu\text{s}$
Common mode transient immunity at low level output		$CML$		$V_{CM} = 600 \text{ V}, I_F = 0 \text{ mA},$ $V_{CC} = 30 \text{ V}, T_a = 25 \text{ }^\circ\text{C}$	5000	—	—	$\text{V} / \mu\text{s}$

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

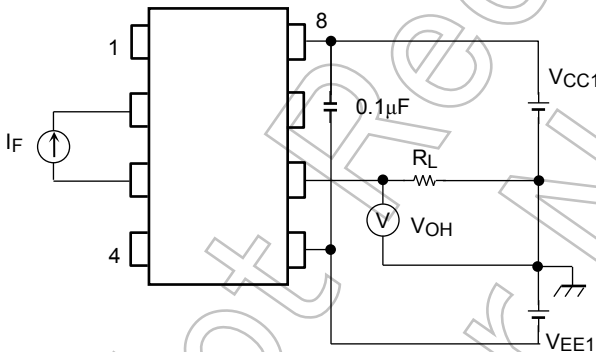
Test Circuit 1 : I<sub>OPH</sub>



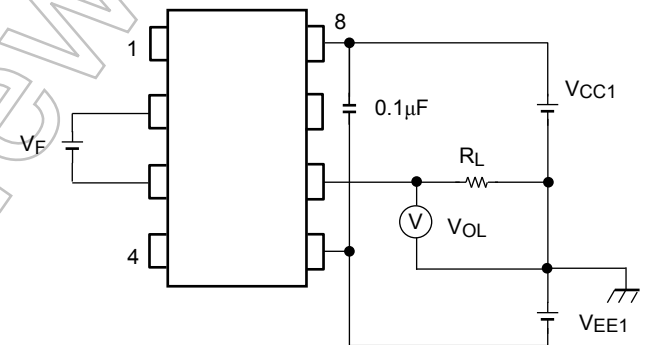
Test Circuit 2 : I<sub>OPL</sub>



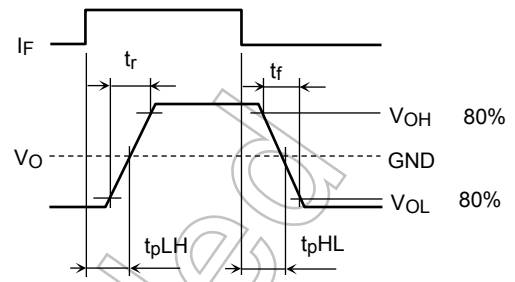
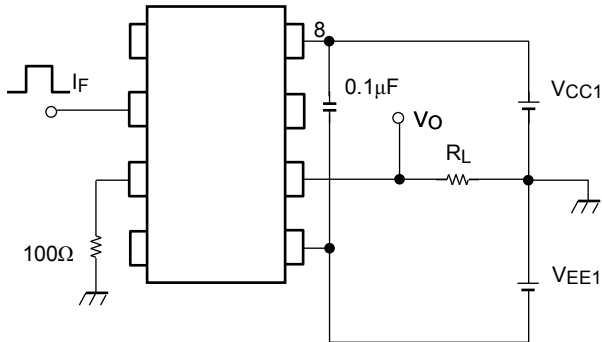
Test Circuit 3 : V<sub>OH</sub>



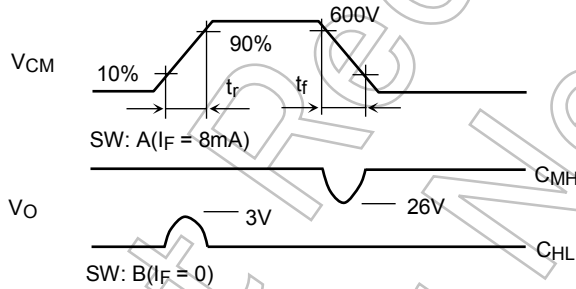
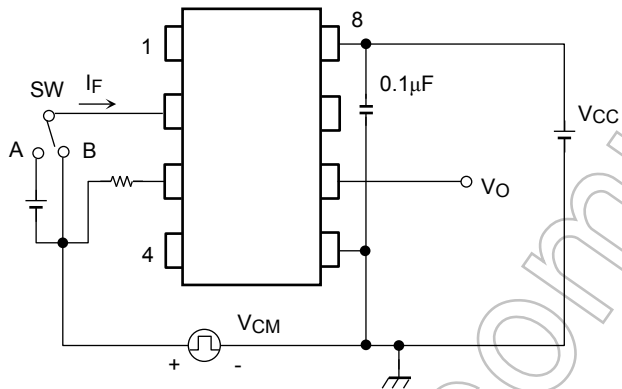
Test Circuit 4 : V<sub>OL</sub>



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



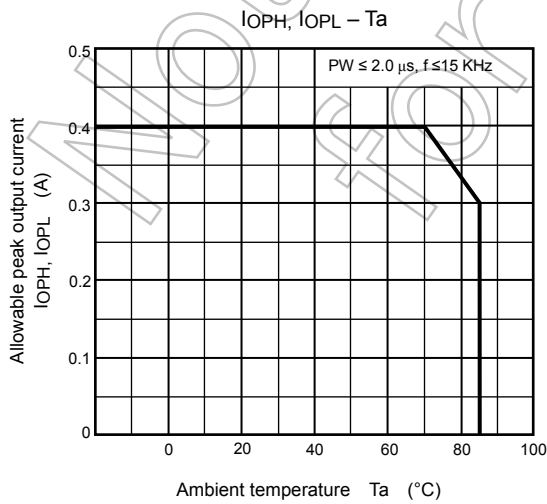
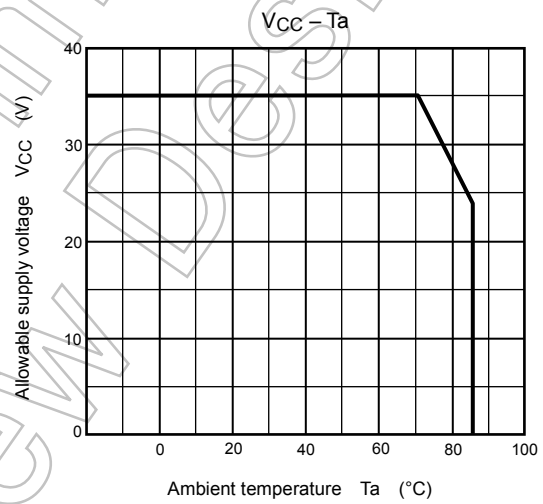
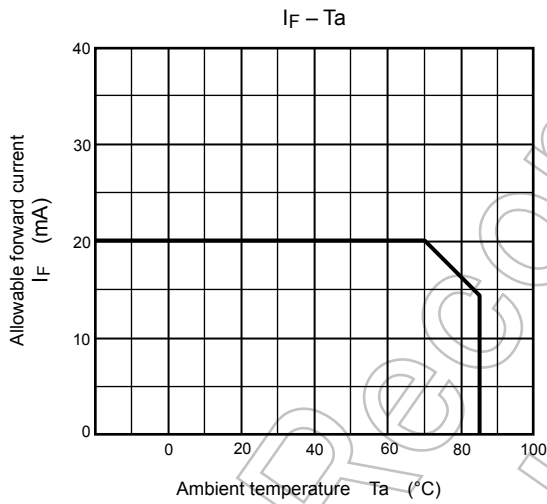
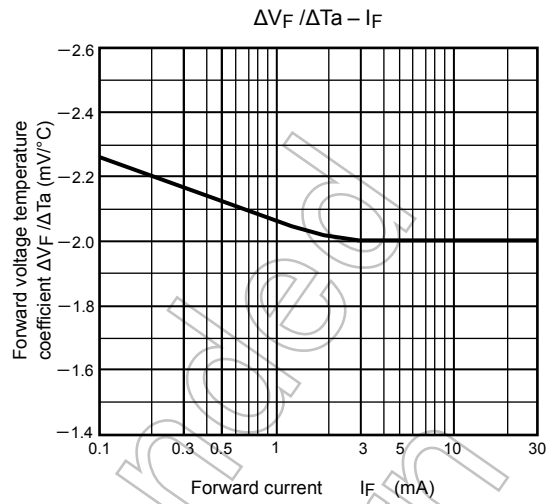
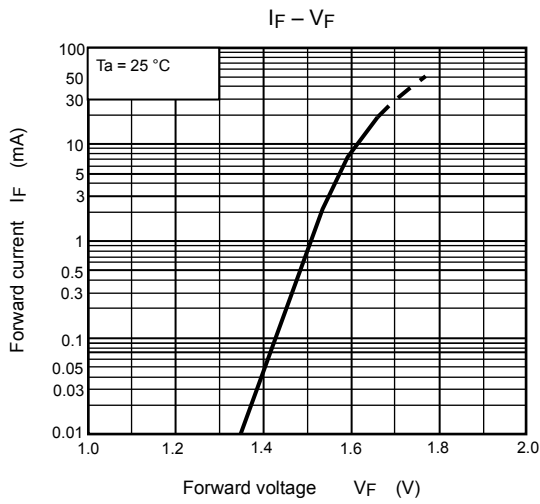
### Test Circuit 6: $C_{MH}$ , $C_{ML}$



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

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

$C_{ML}$  ( $C_{MH}$ ) 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.



NOTE: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

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