

TLP251

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

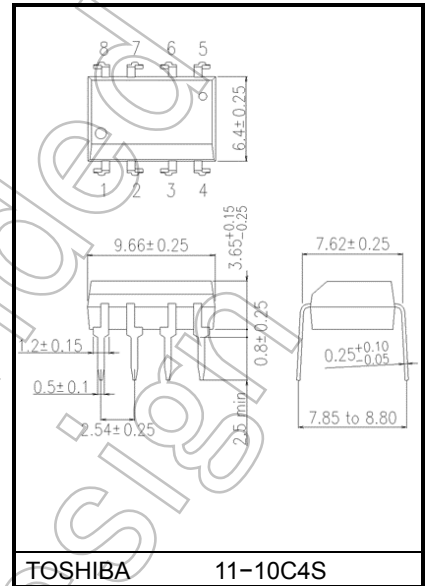
Unit: mm

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

This unit is 8-lead DIP package.

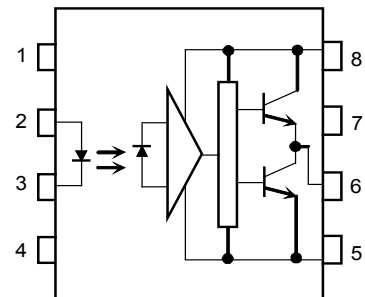
TLP251 is suitable for gate driving circuit of IGBT or power MOS FET. Especially TLP251 is capable of "direct" gate drive of lower power IGBTs. (to 15A)

- Input threshold current: $I_F=5\text{mA}(\text{max.})$
- Supply current (I_{CC}): $11\text{mA}(\text{max.})$
- Supply voltage (V_{CC}): $10\text{--}35\text{V}$
- 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)



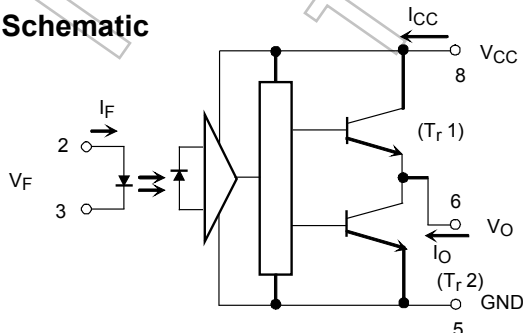
- 1 : N.C.
- 2 : Anode
- 3 : Cathode
- 4 : N.C.
- 5 : GND
- 6 : V_O (Output)
- 7 : N.C.
- 8 : V_{CC}

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

Truth Table

		Tr1	Tr2
Input LED	On	On	Off
	Off	Off	On

Schematic



A 0.1 μF 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_F	20	mA	
	Forward current derating (Ta ≥ 70°C)	$\Delta I_F / \Delta T_a$	-0.36	mA / °C	
	Peak transient forward current (Note 1)	I_{FPT}	1	A	
	Reverse voltage	V_R	5	V	
	Diode power dissipation	P_D	40	mW	
	Diode power dissipation derating (Ta ≥ 70°C)	$\Delta P_D / ^\circ C$	-0.72	mW / °C	
	Junction temperature	T_j	125	°C	
Detector	"H" peak output current (PW ≤ 2.0μs, f ≤ 15kHz) (Note 2)	I_{OPH}	-0.4	A	
	"L" peak output current (PW ≤ 2.0μs, f ≤ 15kHz) (Note 2)	I_{OPL}	0.4	A	
	Output voltage	V_O	(Ta ≤ 70°C)	35	V
			(Ta = 85°C)	24	
	Supply voltage	V_{CC}	(Ta ≤ 70°C)	35	V
			(Ta = 85°C)	24	
	Output voltage derating (Ta ≥ 70°C)	$\Delta V_O / \Delta T_a$	-0.73	V / °C	
	Supply voltage derating (Ta ≥ 70°C)	$\Delta V_{CC} / \Delta T_a$	-0.73	V / °C	
	Output Power dissipation	P_O	800	mW	
	Output Power dissipation derating (Ta ≥ 70°C)	$\Delta P_O / ^\circ C$	-14.5	mW / °C	
	Junction temperature	T_j	125	°C	
	Operating frequency (Note 3)	f	25	kHz	
Operating temperature range	T_{opr}	-20 to 85	°C		
Storage temperature range	T_{stg}	-55 to 125	°C		
Lead soldering temperature(10 s)	T_{sol}	260	°C		
Isolation voltage (AC, 60 s., 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 $P_W \leq 1 \mu s$, 300 pps

Note 2: Exponential waveform

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

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.

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 μ s.

Electrical Characteristics ($T_a = -20$ to 70°C , unless otherwise specified)

Characteristic		Symbol	Test Circuit	Test Condition	Min.	Typ.*	Max.	Unit	
Input forward voltage		V_F	—	$I_F = 10 \text{ mA}$, $T_a = 25^\circ\text{C}$	—	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	—	$V_R = 5 \text{ V}$, $T_a = 25^\circ\text{C}$	—	—	10	μ A	
Input capacitance		C_T	—	$V = 0 \text{ V}$, $f = 1 \text{ MHz}$, $T_a = 25^\circ\text{C}$	—	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	$V_{CC1} = +15 \text{ V}$, $V_{EE1} = -15 \text{ V}$ $R_L = 200 \Omega$, $I_F = 5 \text{ mA}$	11	13.2	—	V	
	"L" level	V_{OL}	4	$V_{CC1} = +15 \text{ V}$, $V_{EE1} = -15 \text{ V}$ $R_L = 200 \Omega$, $V_F = 0.8 \text{ V}$	—	-14.5	-12.5		
Supply current	"H" level	I_{CCH}	—	$V_{CC} = 30 \text{ V}$, $I_F = 10 \text{ mA}$ $T_a = 25^\circ\text{C}$	—	7.5	—	mA	
				$V_{CC} = 30 \text{ V}$, $I_F = 10 \text{ mA}$	—	—	11		
	"L" level	I_{CCL}	—	$V_{CC} = 30 \text{ V}$, $I_F = 0 \text{ mA}$ $T_a = 25^\circ\text{C}$	—	8	—		
				$V_{CC} = 30 \text{ V}$, $I_F = 0 \text{ mA}$	—	—	11		
Threshold input current	"Output L \rightarrow H"	I_{FLH}	—	$V_{CC1} = +15 \text{ V}$, $V_{EE1} = -15 \text{ V}$ $R_L = 200 \Omega$, $V_O > 0 \text{ V}$	—	1.2	5	mA	
Threshold input voltage	"Output H \rightarrow L"	V_{FHL}	—	$V_{CC1} = +15 \text{ V}$, $V_{EE1} = -15 \text{ V}$ $R_L = 200 \Omega$, $V_O < 0 \text{ V}$	0.8	—	—	V	
Supply voltage		V_{CC}	—		10	—	35	V	
Capacitance (input-output)		C_s	—	$V_s = 0 \text{ V}$, $f = 1 \text{ MHz}$ $T_a = 25^\circ\text{C}$	—	1.0	2.0	pF	
Resistance (input-output)		R_s	—	$V_s = 500 \text{ V}$, $T_a = 25^\circ\text{C}$ R.H. $\leq 60 \%$	1×10^{12}	10^{14}	—	Ω	

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

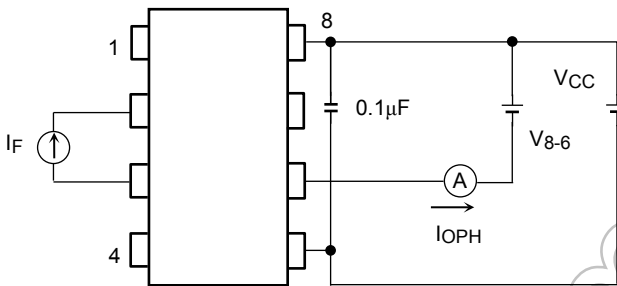
Note 1: Duration of IO time $\leq 50 \mu$ s

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

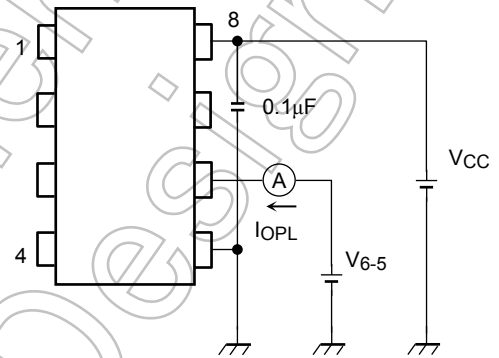
Characteristic		Symbol	Test Circuit	Test Condition	Min.	Typ.*	Max.	Unit
Propagation delay time	L→H	t_{pLH}	5	$I_F = 8 \text{ mA}$ $V_{CC1} = +15 \text{ V}, V_{EE1} = -15 \text{ V}$ $R_L = 200 \Omega$	—	0.25	1.0	μs
	H→L	t_{pHL}			—	0.25	1.0	
Common mode transient immunity at high level output		CMH	6	$V_{CM}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

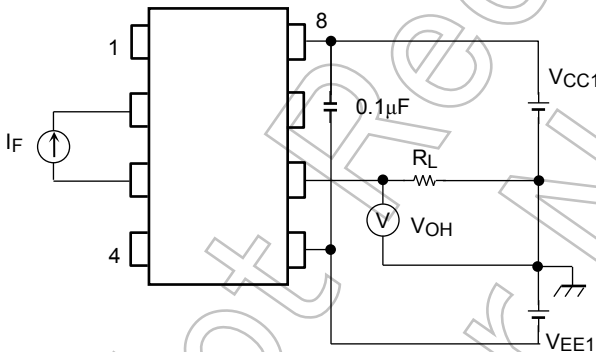
Test Circuit 1 : I_{OPH}



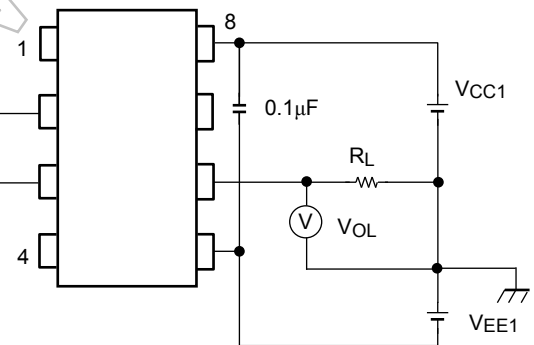
Test Circuit 2 : I_{OPL}



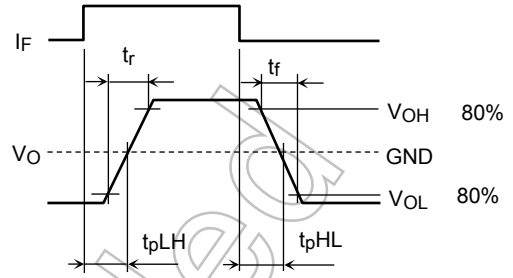
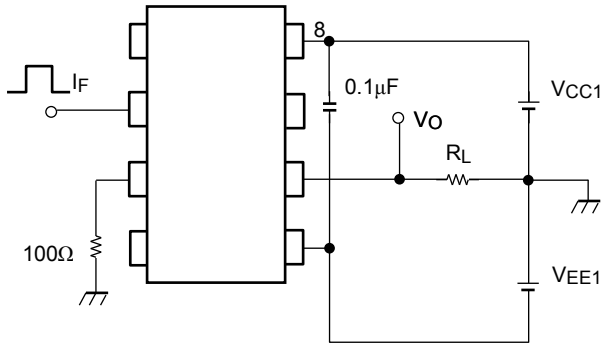
Test Circuit 3 : V_{OH}



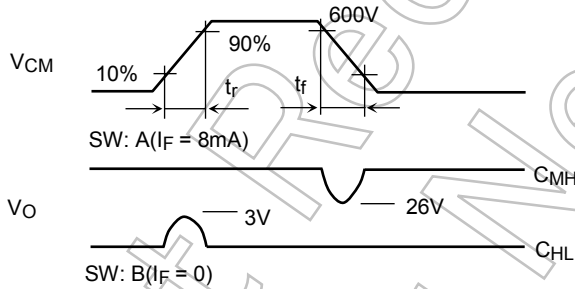
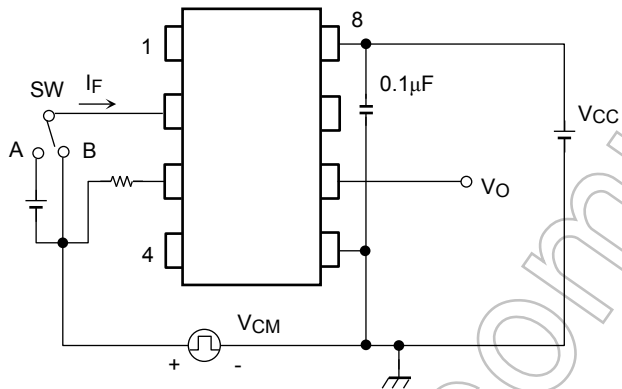
Test Circuit 4 : V_{OL}



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



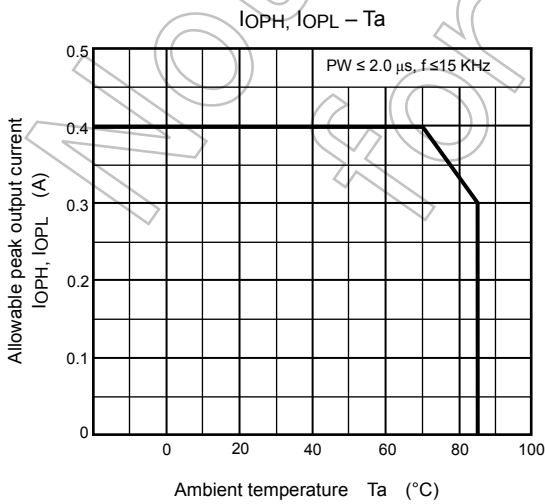
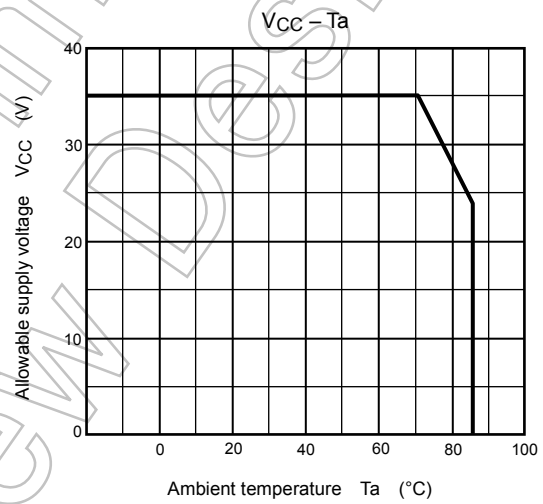
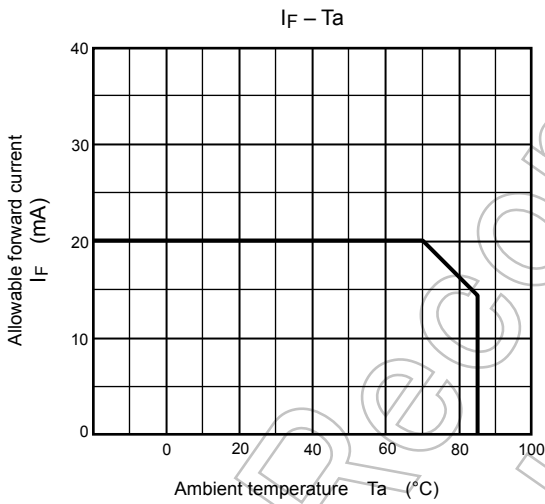
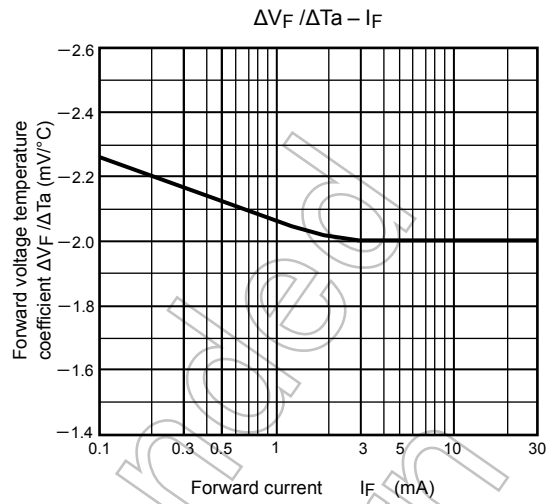
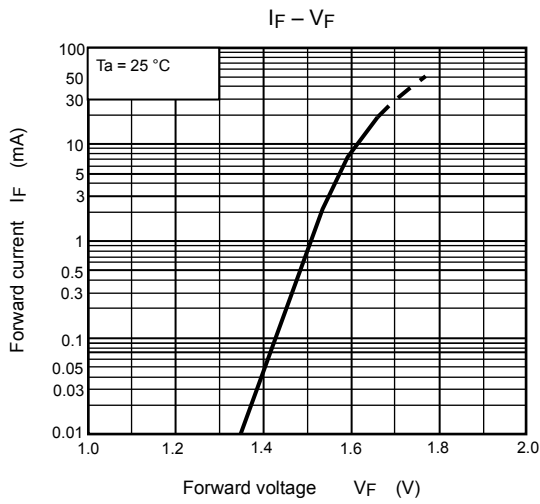
Test Circuit 6: C_{MH} , C_{ML}



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

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

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.



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

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