

## TLP251F

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

The TOSHIBA TLP251F consists of an infrared emitting diode and an integrated photodetector.

This unit is 8-lead DIP package.

TLP251F 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)  
Note 1:When a VDE approved type is needed,  
please designate the **Option(D4)**.

Structural parameter

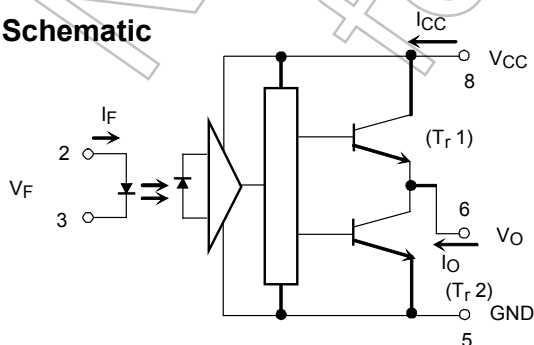
Creepage distance:  $8.0\text{mm}(\text{min.})$

Clearance:  $8.0\text{mm}(\text{min.})$

### Truth Table

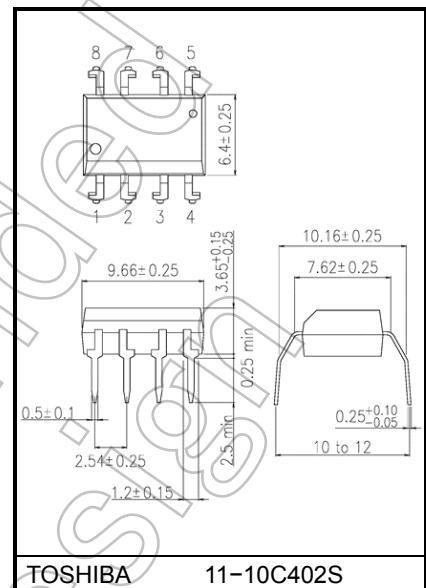
		Tr1		Tr2	
		On	Off	On	Off
Input LED	On	On	Off	Off	On
	Off	Off	On	On	Off

### Schematic



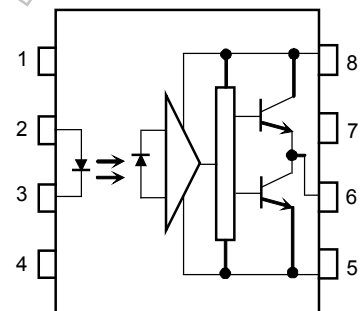
A  $0.1\mu\text{F}$  bypass capacitor must be connected between pin 8 and 5(see Note 5).

Unit: mm



Weight:  $0.54\text{ g}(\text{typ.})$

### Pin Configuration (top view)



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

Start of commercial production  
 1992/01

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

Characteristic		Symbol	Rating	Unit	
LED	Forward current	IF	20	mA	
	Forward current derating (Ta ≥ 70°C)	ΔIF / ΔTa	-0.36	mA / °C	
	Peak transient forward current (Note 1)	IFPT	1	A	
	Reverse voltage	VR	5	V	
	Diode power dissipation	PD	40	mW	
	Diode power dissipation derating (Ta ≥ 70°C)	ΔPD / °C	-0.72	mW / °C	
	Junction temperature	Tj	125	°C	
Detector	“H” peak output current (PW ≤ 2.0μs, f ≤ 15kHz) (Note 2)		IOPH	-0.4	A
	“L” peak output current (PW ≤ 2.0μs, f ≤ 15kHz) (Note 2)		IOPL	0.4	A
	Output voltage	(Ta ≤ 70°C)	VO	35	V
		(Ta = 85°C)		24	
	Supply voltage	(Ta ≤ 70°C)	VCC	35	V
		(Ta = 85°C)		24	
	Output voltage derating (Ta ≥ 70°C)		ΔVO / ΔTa	-0.73	V / °C
	Supply voltage derating (Ta ≥ 70°C)		ΔVCC / ΔTa	-0.73	V / °C
	Output Power dissipation		PO	800	mW
	Output Power dissipation derating (Ta ≥ 70°C)		ΔPO / °C	-14.5	mW / °C
	Junction temperature		Tj	125	°C
Operating frequency (Note 3)		f	25	kHz	
Operating temperature range		Topr	-20 to 85	°C	
Storage temperature range		Tstg	-55 to 125	°C	
Lead soldering temperature(10 s)		Tsol	260	°C	
Isolation voltage (AC, 60 s., R.H. ≤ 60 %) (Note 4)		BVs	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  $P_W \leq 1 \mu\text{s}$ , 300 pps

Note 2: Exponential waveform

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

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 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	
					—	—	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  $T_a = 25 \text{ °C}$

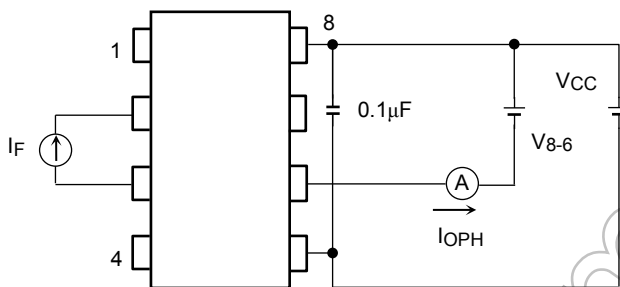
Note 1: Duration of IO time ≤ 50 μs

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

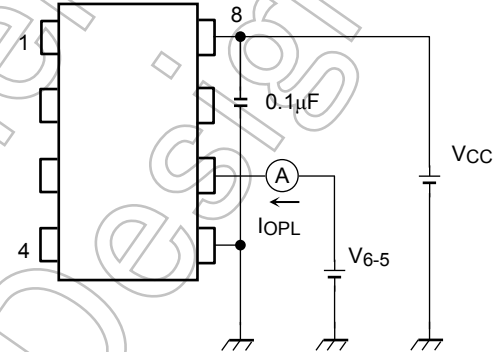
Characteristic		Symbol	Test Circuit	Test Condition	Min.	Typ.*	Max.	Unit
Propagation delay time	L→H	$t_{pLH}$	5	$I_F = 8\text{ mA}$ $V_{CC1} = +15\text{ V}$ , $V_{EE1} = -15\text{ V}$ $R_L = 200\ \Omega$	—	0.25	1.0	$\mu\text{s}$
	H→L	$t_{pHL}$			—	0.25	1.0	
Common mode transient immunity at high level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

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

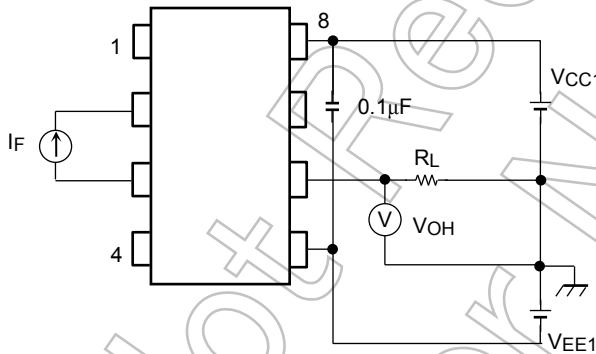
Test Circuit 1 :  $I_{OPH}$



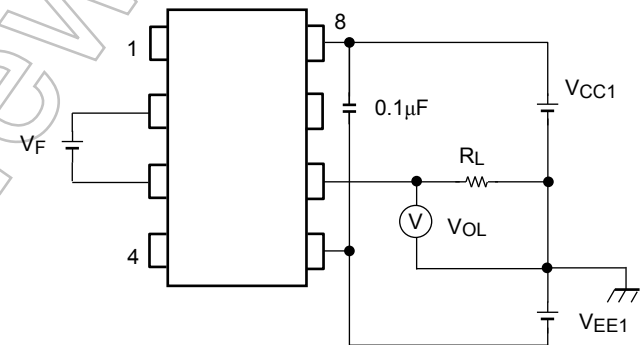
Test Circuit 2 :  $I_{OPL}$



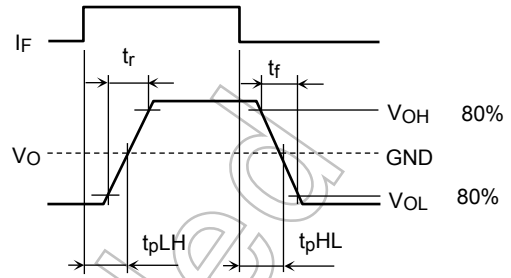
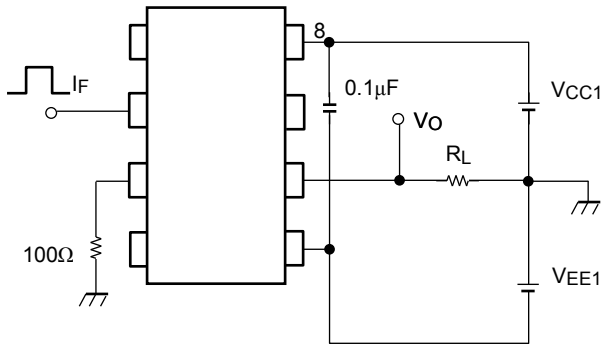
Test Circuit 3 :  $V_{OH}$



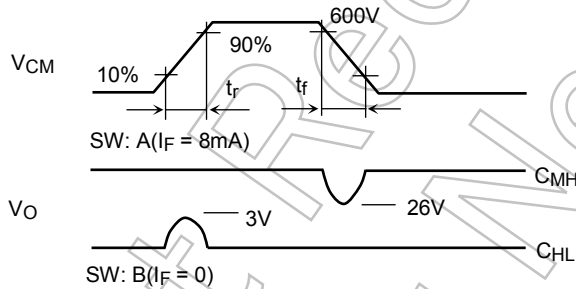
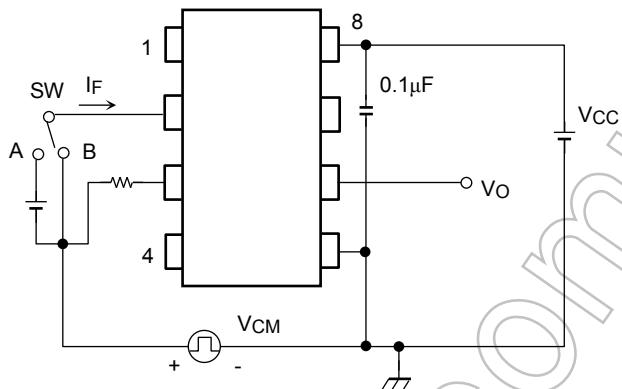
Test Circuit 4 :  $V_{OL}$



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



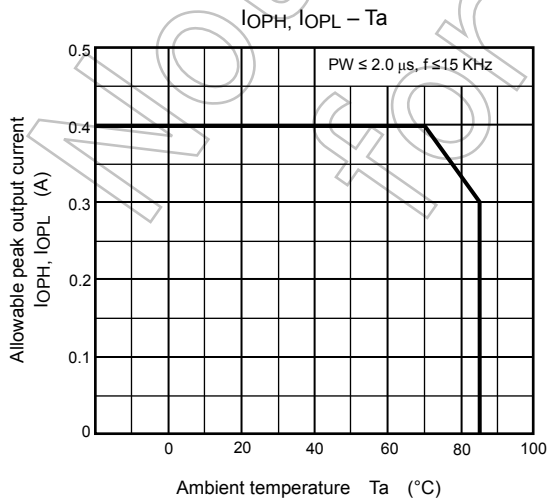
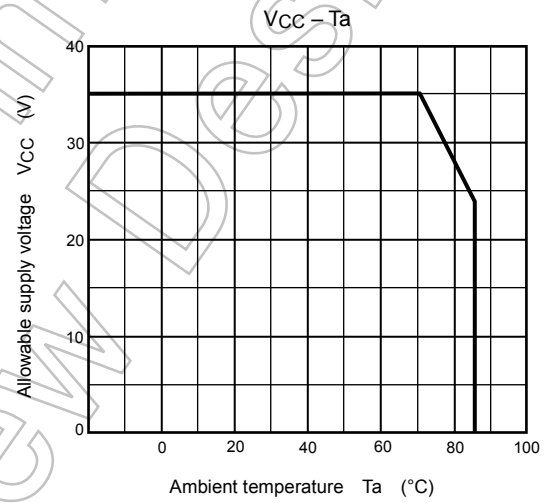
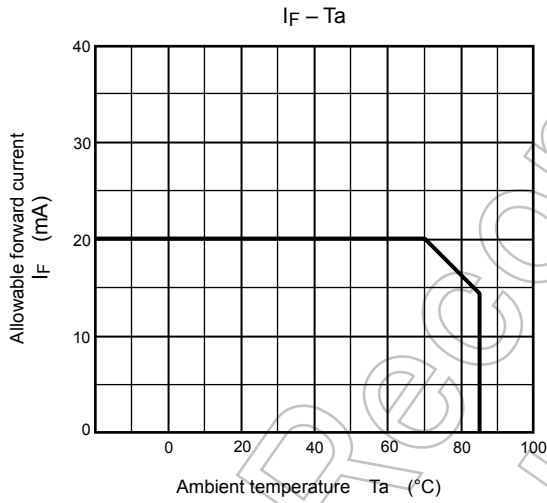
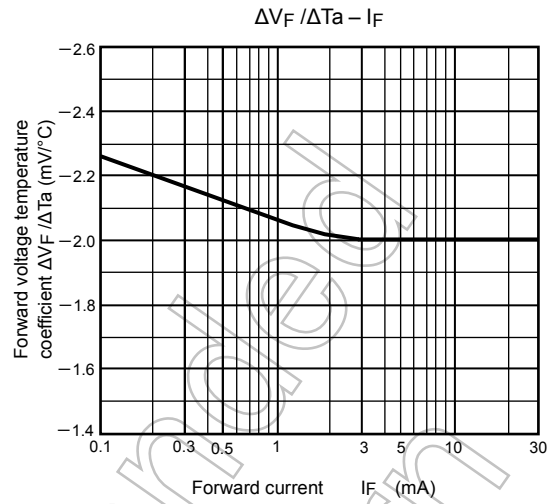
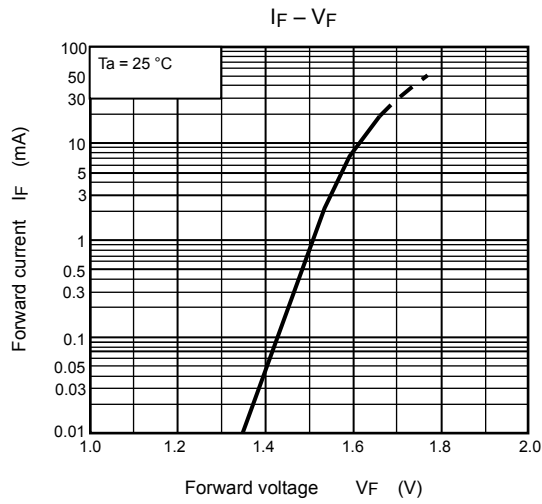
### Test Circuit 6: $C_{MH}$ , $C_{ML}$



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

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

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