

TLP251

INVERTER FOR AIR CONDITIONOR
 INDUCTION HEATING
 TRANSISTOR INVERTER
 POWER MOS FET GATE DRIVE
 IGBT GATE DRIVE

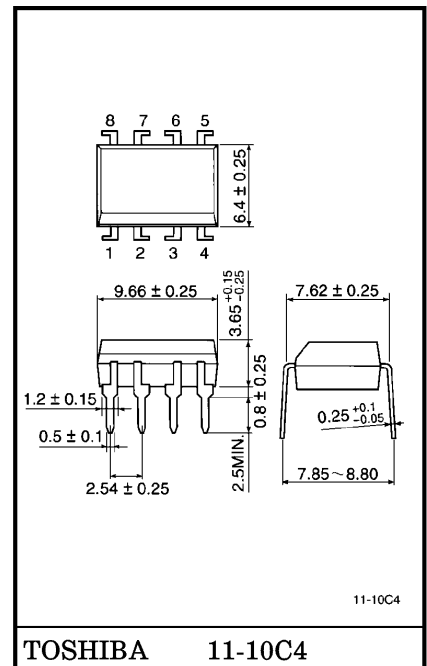
The TOSHIBA TLP251 consists of a GaAlAs light emitting diode and a integrated photodetector.

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)

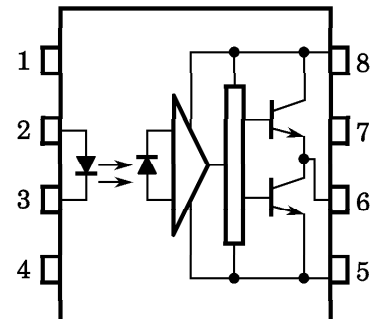
- Input Threshold Current : $I_F = 5\text{mA}$ (Max.)
- Supply Current (I_{CC}) : 11mA (Max.)
- Supply Voltage (V_{CC}) : 10–35V
- Output Current (I_O) : $\pm 0.4\text{A}$ (Max.)
- Switching Time (t_{pLH}/t_{pHL}) : $1\mu\text{s}$ (Max.)
- Isolation Voltage : 2500Vrms (Min.)
- UL Recognized : UL1577, File No. E67349

Unit in mm



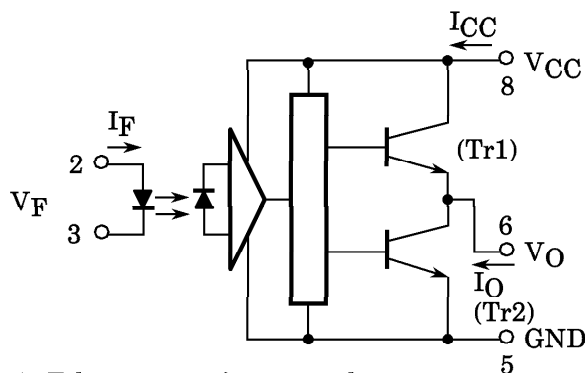
Weight : 0.54g

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}

SCHMATIC



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

TRUTH TABLE

| | | Tr1 | Tr2 |
|-----------|-----|-----|-----|
| Input LED | ON | ON | OFF |
| | OFF | OFF | ON |

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 | |
| | Junction Temperature | T_j | 125 | °C | |
| DETECTOR | “H” Peak Output Current ($P_W \leq 2.0 \mu s$, $f \leq 15 \text{kHz}$) (Note 2) | I_{OPH} | -0.4 | A | |
| | “L” Peak Output Current ($P_W \leq 2.0 \mu s$, $f \leq 15 \text{kHz}$) (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) | $\Delta V_O / \Delta T_a$ | -0.73 | V / °C | |
| | Supply Voltage Derating (Ta ≥ 70°C) | $\Delta V_{CC} / \Delta T_a$ | -0.73 | V / °C | |
| Junction Temperature | T_j | 125 | °C | | |
| Operating Frequency (Note 3) | f | 25 | kHz | | |
| 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 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 (0.1 μ F) 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 | 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 |

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 | — | $I_F = 10\text{mA}$, $T_a = 25^\circ\text{C}$ | — | 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 | μA | | |
| Input Capacitance | C_T | — | $V = 0$, $f = 1\text{MHz}$, $T_a = 25^\circ\text{C}$ | — | 45 | 250 | pF | | |
| Output Current | “H” Level | I_{OPH} | 3 | $V_{CC} = 30\text{V}$ (*1) | $I_F = 10\text{mA}$ $V_{8-6} = 4\text{V}$ | -0.1 | -0.25 | — | A |
| | “L” Level | I_{OPL} | 2 | | $I_F = 0$ $V_{6-5} = 2.5\text{V}$ | 0.1 | 0.2 | | |
| Output Voltage | “H” Level | V_{OH} | 4 | $V_{CC1} = +15\text{V}$, $V_{EE1} = -15\text{V}$ $R_L = 200\Omega$, $I_F = 5\text{mA}$ | 11 | 13.2 | — | V | |
| | “L” Level | V_{OL} | 5 | $V_{CC1} = +15\text{V}$, $V_{EE1} = -15\text{V}$ $R_L = 200\Omega$, $V_F = 0.8\text{V}$ | — | -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→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→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 | — | $V_s = 0$, $f = 1\text{MHz}$ $T_a = 25^\circ\text{C}$ | — | 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 | | |

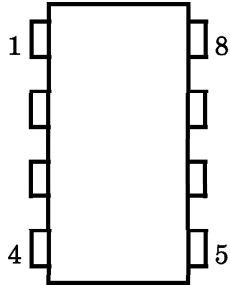
* All typical values are at $T_a = 25^\circ\text{C}$ (*1) : Duration of I_O time $\leq 50\mu\text{s}$

SWITCHING CHARACTERISTICS (Ta = -20~70°C, Unless otherwise specified)

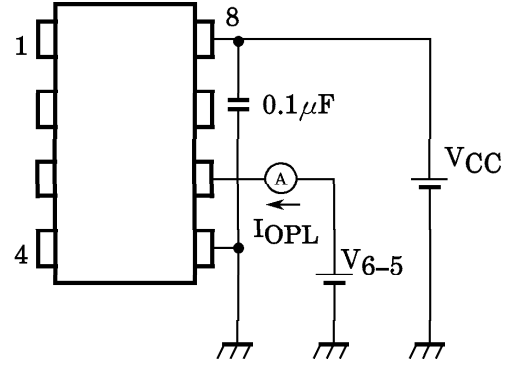
| CHARACTERISTIC | | SYMBOL | TEST CIR-CUIT | TEST CONDITION | MIN. | TYP.* | MAX. | UNIT |
|---|-----|------------------|---------------|---|-------|-------|------|--------|
| Propagation Delay Time | L→H | t _{pLH} | 6 | I _F = 8mA V _{CC1} = +15V, V _{EE1} = -15V R _L = 200Ω | — | 0.25 | 1.0 | μs |
| | 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} | 7 | V _{CM} = 600V, I _F = 8mA V _{CC} = 30V, Ta = 25°C | -5000 | — | — | V / μs |
| Common Mode Transient Immunity at Low Level Output | | C _M L | 7 | V _{CM} = 600V, I _F = 0mA V _{CC} = 30V, Ta = 25°C | 5000 | — | — | V / μs |

* All typical values are at Ta = 25°C

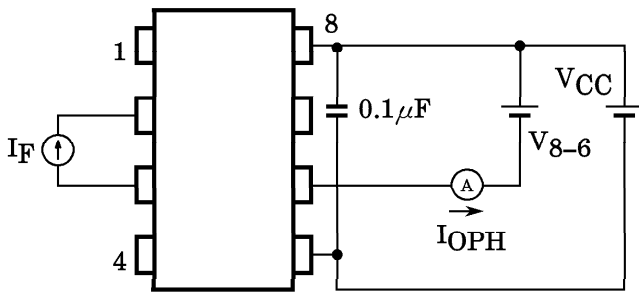
TEST CIRCUIT 1 :



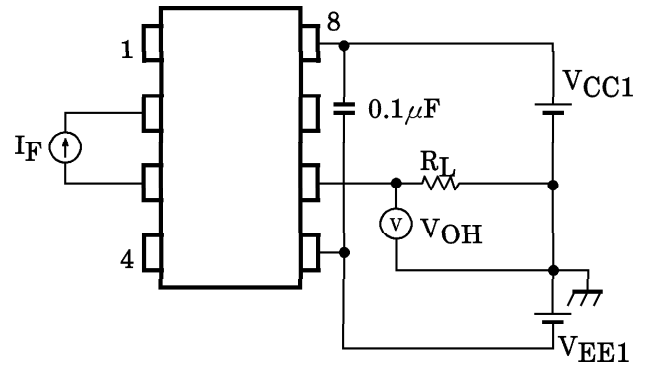
TEST CIRCUIT 2 : I_{OPL}



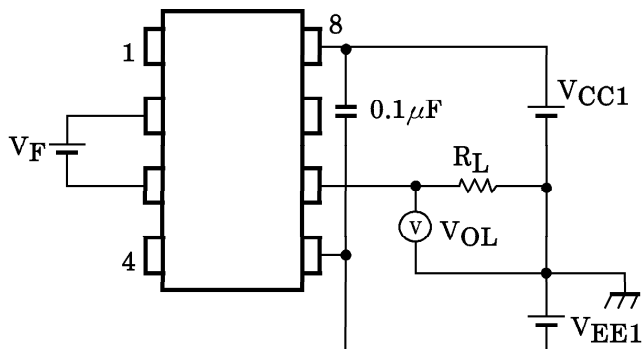
TEST CIRCUIT 3 : I_{OPH}



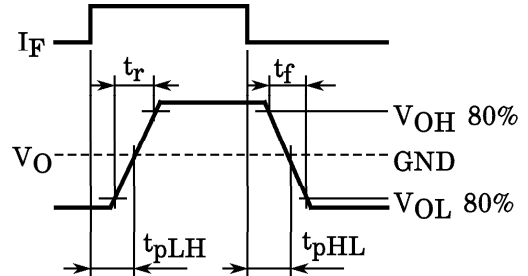
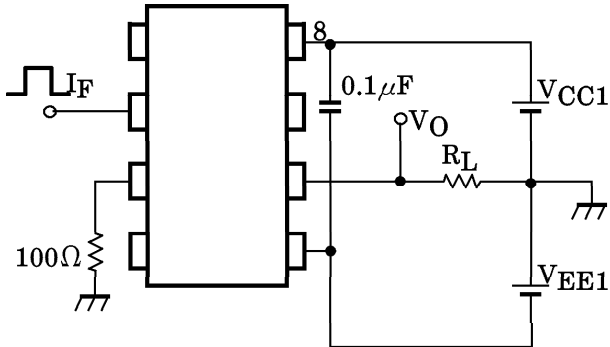
TEST CIRCUIT 4 : V_{OH}



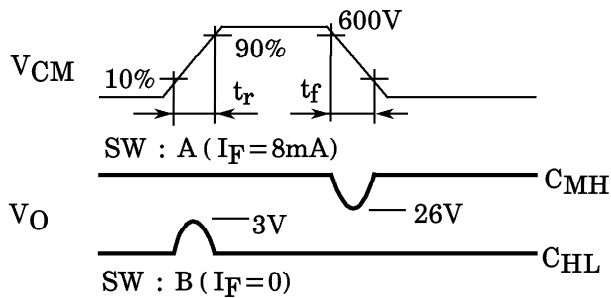
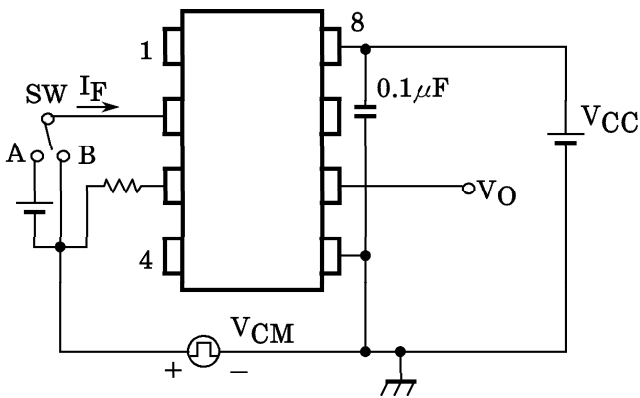
TEST CIRCUIT 5 : V_{OL}



TEST CIRCUIT 6 : t_{pLH} , t_{pHL} , t_r , t_f



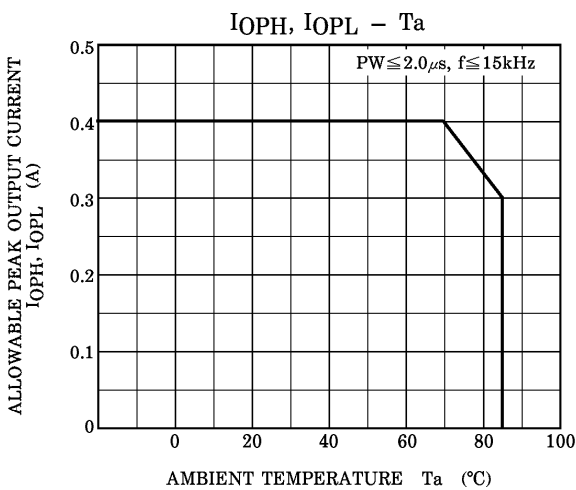
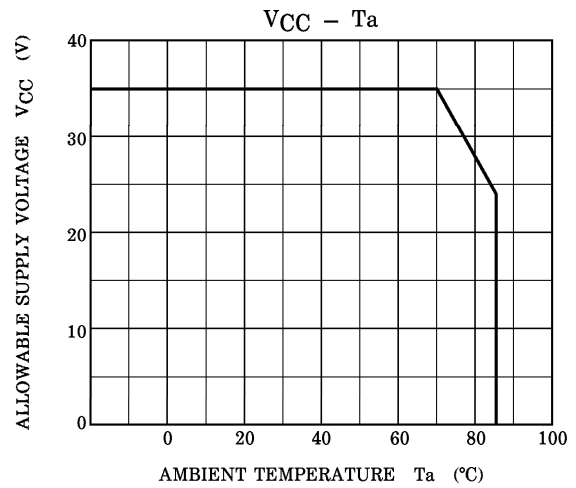
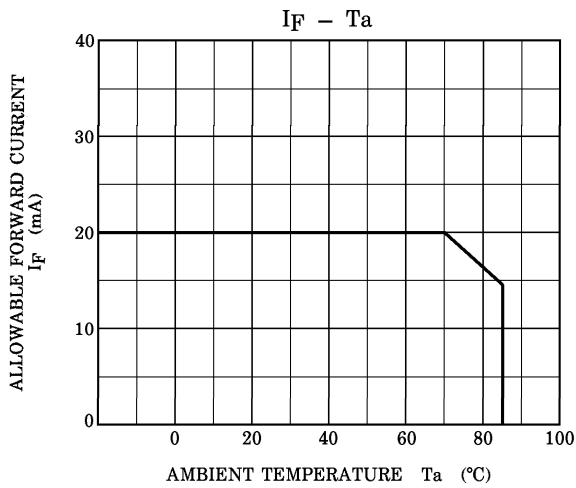
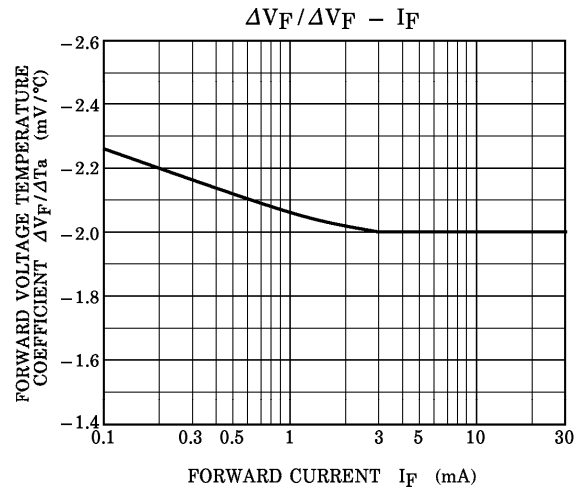
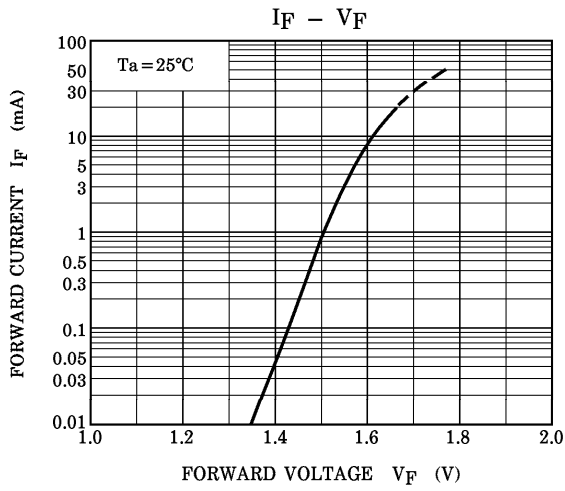
TEST CIRCUIT 7 : C_{MH} , C_{ML}



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

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

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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