

**TLP251**

GaAlAs IRED & PHOTO-IC

(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.

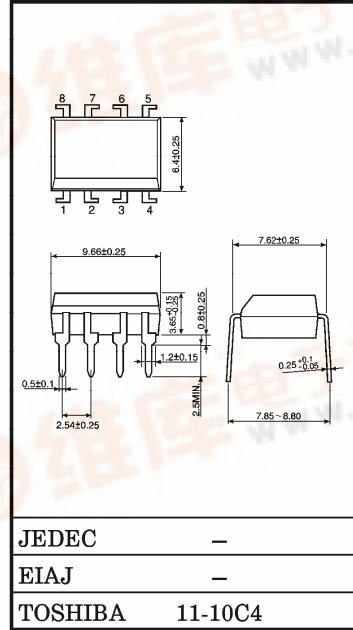
This unit is 8-lead DIP package.

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)

**\* Target Specifications \***

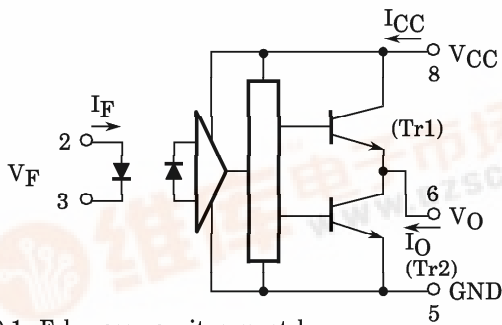
- Input Threshold Current :  $I_F = 5\text{mA (Max.)}$
- Supply Current ( $I_{CC}$ ) :  $11\text{mA (Max.)}$
- Supply Voltage ( $V_{CC}$ ) :  $10\text{--}35\text{V}$
- Output Current ( $I_O$ ) :  $\pm 0.1\text{A (Min.)}$
- Switching Time ( $t_{pLH}/t_{pHL}$ ) :  $1\mu\text{s (Max.)}$
- Isolation Voltage :  $2500\text{Vrms (Min.)}$

Unit in mm



Weight : 0.54g

**SCHMATIC**

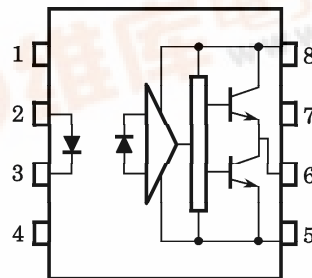


A  $0.1\mu\text{F}$  bypass capacitor must be connected between pin 8 and 5 (See note 5).

**TRUTH TABLE**

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

**PIN CONFIGURATION (TOP VIEW)**



- 1 : N.C.
- 2 : ANODE
- 3 : CATHODE
- 4 : N.C.
- 5 : GND
- 6 :  $V_O$  (OUTPUT)
- 7 : N.C.
- 8 :  $V_{CC}$

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TLP251 - 1

1996 - 4 - 8

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(TLP251)

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       |   |
|   | 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  |   |
| Junction Temperature  | (T <sub>j</sub> )   | 125                    | °C               |         |   |
| Operating Frequency (Note 3)                                  | f   | 25                     | kHz              |         |   |
| Operating Temperature Range                                   | T <sub>opr</sub>  | -20~85                 | °C               |         |   |
| Storage Temperature Range                                     | T <sub>stg</sub>  | -55~125                | °C               |         |   |
| Lead Solder Temperature (10s)                                 | T <sub>sol</sub>  | 260                    | °C               |         |   |
| Isolation Voltage (AC, 1min., R.H. ≤ 60%, Ta = 25°C) (Note 4) | BV <sub>S</sub>   | 2500                   | V <sub>rms</sub> |         |   |

Note 1 : Pulse width P<sub>W</sub> ≤ 1μs, 300pps

Note 2 : Exponential Waveform

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

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 (0.1μF) 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.

RECOMMENDED OPERATING CONDITIONS

| CHARACTERISTIC        | SYMBOL                              | MIN. | TYP. | MAX.    | UNIT |
|-----------------------|-------------------------------------|------|------|---------|------|
| Input Current, ON     | I <sub>F</sub> (ON)                 | 7    | 8    | 10      | mA   |
| Input Voltage, OFF    | V <sub>F</sub> (OFF)                | 0    | —    | 0.8     | V    |
| Supply Voltage        | V <sub>CC</sub>                     | 10   | —    | 30   20 | V    |
| Peak Output Current   | I <sub>OPH</sub> / I <sub>OPL</sub> | —    | —    | ±0.1    | A    |
| Operating Temperature | T <sub>opr</sub>                    | -20  | 25   | 70   85 | °C   |

TLP251 - 2

1996 - 4 - 8

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(TLP251)

ELECTRICAL CHARACTERISTICS (Ta = -20~70°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> = 10mA, Ta = 25°C               | —  | 1.6              | 1.8   | V       |    |
| Temperature Coefficient of Forward Voltage | ΔV <sub>F</sub> / ΔTa | —                | I <sub>F</sub> = 10mA                          | —  | -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, f = 1MHz, Ta = 25°C                     | —  | 45               | 250   | pF      |    |
| Output Current                             | “H” Level             | I <sub>OPH</sub> | 3  | V <sub>CC</sub> = 30V<br>(*1)<br>I <sub>F</sub> = 10mA<br>V <sub>8-6</sub> = 4V<br>I <sub>F</sub> = 0<br>V <sub>6-5</sub> = 2.5V | -0.1             | -0.25 | —       | A  |
|  | “L” Level             | I <sub>OPL</sub> | 2  |  | 0.1              | 0.2   | —       |    |
| Output Voltage                             | “H” Level             | V <sub>OH</sub>  | 4  | V <sub>CC1</sub> = +15V, V <sub>EE1</sub> = -15V<br>R <sub>L</sub> = 200Ω, I <sub>F</sub> = 5mA                                  | 11               | 13.2  | —       | V  |
|  | “L” Level             | V <sub>OL</sub>  | 5  | V <sub>CC1</sub> = +15V, V <sub>EE1</sub> = -15V<br>R <sub>L</sub> = 200Ω, V <sub>F</sub> = 0.8V                                 | —                | -14.5 | -12.5   |    |
| Supply Current                             | “H” Level             | I <sub>CCH</sub> | —  | V <sub>CC</sub> = 30V, I <sub>F</sub> = 10mA<br>Ta = 25°C  | —                | 7.5   | —       | 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<br>Ta = 25°C   | —                | 8     | —       |    |
|  |                       |                  |  | 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<br>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<br>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, f = 1MHz<br>Ta = 25°C      | —  | 1.0              | 2.0   | pF      |    |
| Resistance (Input-Output)                  | R <sub>S</sub>        | —                | V <sub>S</sub> = 500V, Ta = 25°C<br>R.H. ≤ 60% | 5 × 10 <sup>10</sup>   | 10 <sup>12</sup> | —     | Ω       |    |

\* All typical values are at Ta = 25°C (\*1) : Duration of I<sub>O</sub> time ≤ 50μs



(TLP251)

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             | $I_F = 8mA$<br>$V_{CC1} = +15V, V_{EE1} = -15V$<br>$R_L = 200\Omega$ | —     | 0.25  | 1.0  | $\mu s$     |
|   | 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             | $V_{CM} = 600V, I_F = 8mA$<br>$V_{CC} = 30V, T_a = 25^\circ C$       | -5000 | —     | —    | $V / \mu s$ |
| Common Mode Transient Immunity at Low Level Output  |     | $C_{ML}$  | 7             | $V_{CM} = 600V, I_F = 0mA$<br>$V_{CC} = 30V, T_a = 25^\circ C$       | 5000  | —     | —    | $V / \mu s$ |

\* All typical values are at Ta=25°C

TLP251 - 4

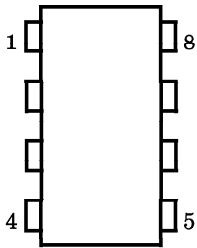
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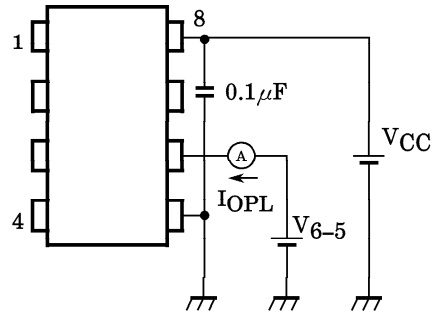


(TLP251)

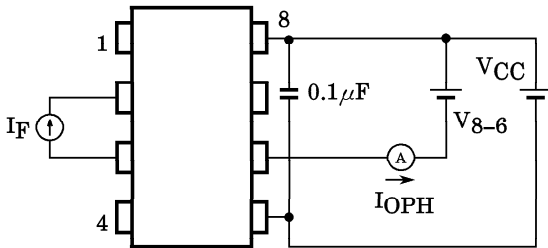
TEST CIRCUIT 1 :



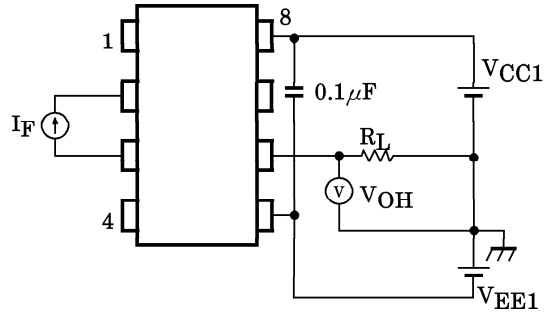
TEST CIRCUIT 2 :  $I_{OPL}$



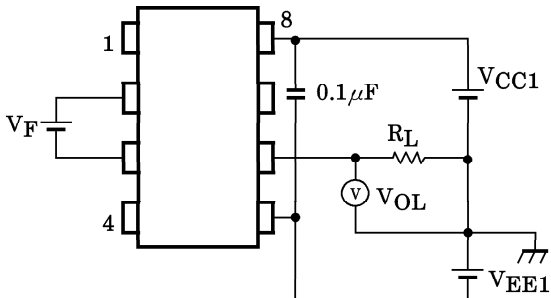
TEST CIRCUIT 3 :  $I_{OPH}$



TEST CIRCUIT 4 :  $V_{OH}$



TEST CIRCUIT 5 :  $V_{OL}$



TLP251 - 5

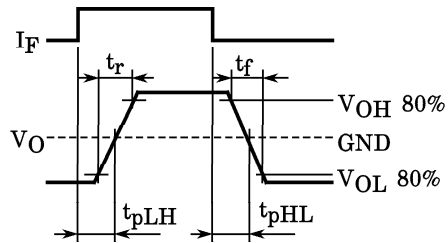
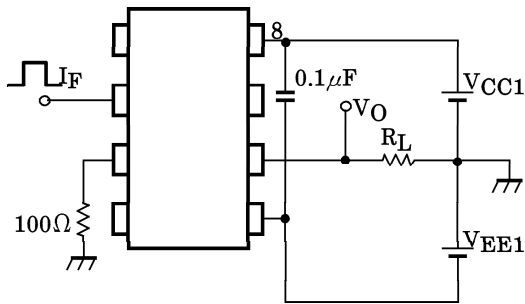
1996 - 4 - 8

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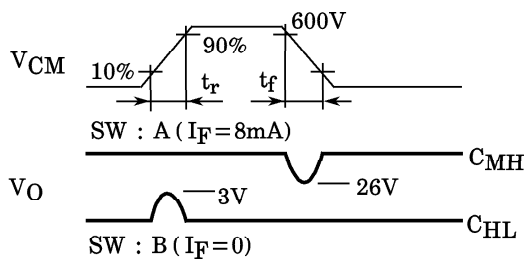
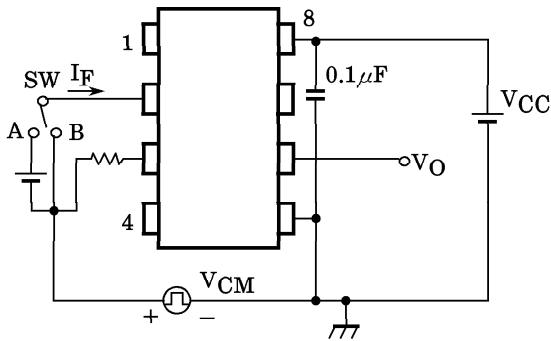


(TLP251)

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



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



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

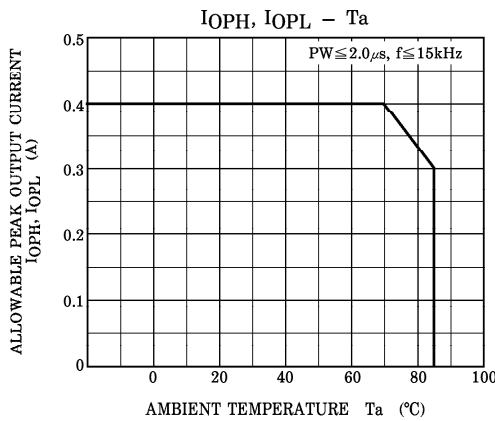
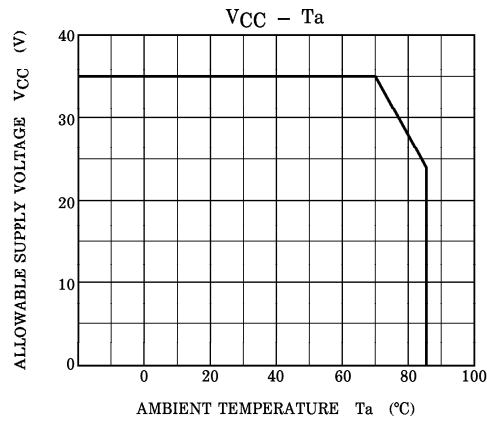
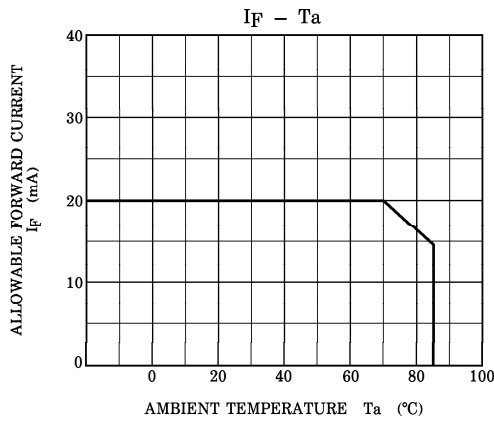
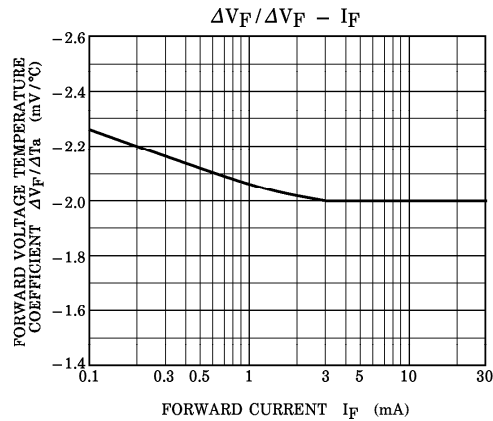
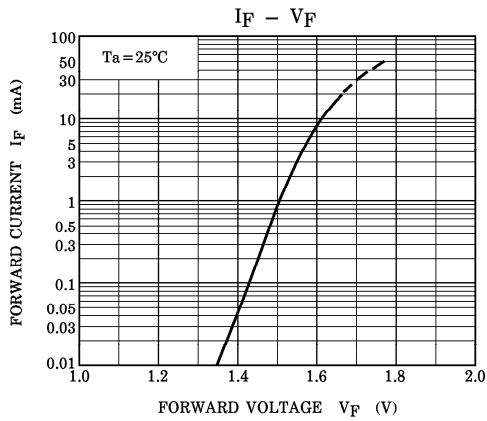
$$C_{MH} = \frac{480(V)}{t_f(\mu s)}$$

$C_{ML}$  ( $C_{MH}$ ) 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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| TLP251 - 6                 |
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(TLP251)



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