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TLP557

Transistor Inverter
 Inverter for Air Conditioner
 Power Transistor Base Drive

The TOSHIBA TLP557 consists of a GaAlAs light emitting diode and an integrated photodetector.

This unit is 8-lead DIP package.

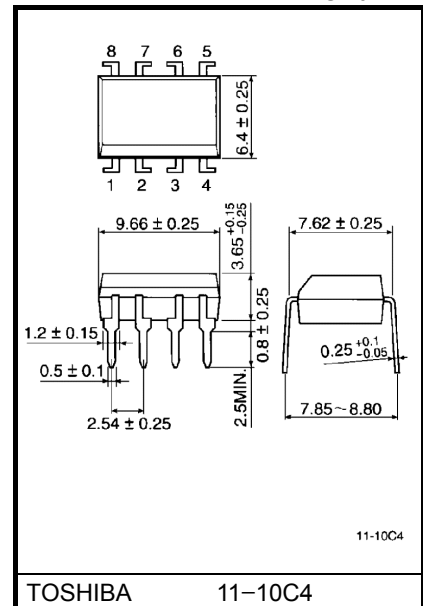
TLP557 is suitable for base driving circuit of power transistor module up to 20A.

External resistor needs to connect between pin 6 and pin 7.

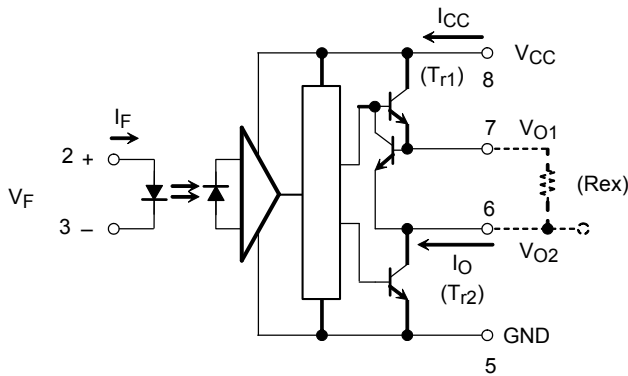
This is for constant current driving.

- Input threshold current: $I_F = 5 \text{ mA (max)}$
- Guaranteed performance temperature range: $-30 \sim 70^\circ\text{C}$
- Supply voltage: 16 V (max)
- Output current: $\pm 0.3 \text{ A (max)}$
- Switching time (t_{pLH} / t_{pHL}): $5 \mu\text{s (max)}$
- Isolation voltage: $2500 \text{ V}_{\text{RMS (min)}}$
- UL recognized: UL1577, file No. E67349

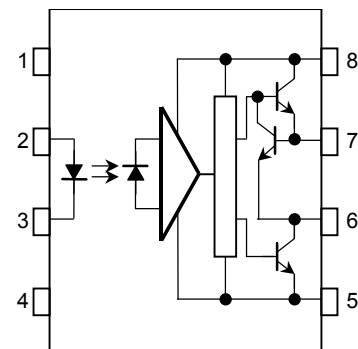
Unit: mm



Schematic



Pin Configuration (top view)



- 1 : N.C.
- 2 : Anode
- 3 : Cathode
- 4 : N.C.
- 5 : GND
- 6 : V_{O2} (Output)
- 7 : V_{O1} (Rex Terminal)
- 8 : V_{CC}

Truth Table

| | | Tr1 | Tr2 |
|-----------|-----|-----|-----|
| Input LED | On | On | Off |
| | Off | Off | On |

Start of commercial production
 1987/06

Absolute Maximum Ratings

| Characteristic | | Symbol | Rating | Unit |
|--|---|------------|---------------|------|
| LED | Forward current | I_F | 25 | mA |
| | Peak transient forward current (Note 1) | I_{FPT} | 1 | A |
| | Reverse voltage | V_R | 5 | V |
| | Junction temperature | (T_j) | 125 | °C |
| Detector | Output current ($f \leq 5\text{kHz}$, Duty $\leq 50\%$) | I_O | +0.32 / -0.32 | A |
| | Peak output current ($P_W \leq 10\mu\text{s}$, $f \leq 5\text{kHz}$) | I_{OP} | +2 / -0.5 | A |
| | Output voltage | V_O | 16 | V |
| | Supply voltage | V_{CC} | 16 | V |
| | O ₁ terminal to O ₂ terminal (pin 7–pin 6) voltage | V_{1-2} | 1.5 | V |
| | O ₂ terminal to O ₁ terminal (pin 6–pin 7) voltage | V_{2-1} | 5 | V |
| | Power dissipation (Note 2) | P_O | 0.5 | W |
| | Junction temperature | (T_j) | 125 | °C |
| Total package power dissipation (Note 3) | P_{OT} | 0.55 | W | |
| Operating temperature range | T_{opr} | -30 to 70 | °C | |
| Storage temperature range | T_{stg} | -55 to 125 | °C | |
| Lead solder temperature (10 s) | T_{sol} | 260 | °C | |
| Isolation voltage (AC, 1 minute, R.H. $\leq 60\%$, $T_a=25^\circ\text{C}$) (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 $PW \leq 1\mu\text{s}$, 300pps

(Note 2) $\Delta P_O / ^\circ\text{C} = -6.7\text{mW} / ^\circ\text{C}$ ($T_a \geq 50^\circ\text{C}$)

(Note 3) $\Delta P_{OT} / ^\circ\text{C} = -7.4\text{mW} / ^\circ\text{C}$ ($T_a \geq 50^\circ\text{C}$)

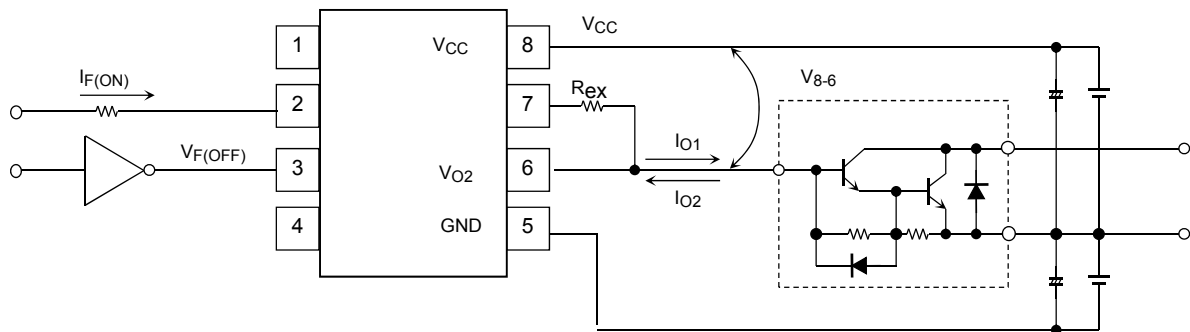
(Note 4) Device considered a two terminal device: Pins 1, 2, 3 and 4 shorted together, and pins 5, 6, 7 and 8 shorted together.

Recommended Operating Conditions

| Characteristic | Symbol | Min | Typ. | Max | Unit |
|--|------------|-----|---------------------------|-----------------------------|-------------|
| Input current on | $I_F(ON)$ | 7 | 8 | 20 | mA |
| Input voltage off | $V_F(OFF)$ | 0 | — | 0.8 | V |
| Supply voltage | V_{CC} | 5 | 6 | 13 | V |
| I_{B1} Drive current | I_{O1} | — | 0.15 | 0.25 | A |
| I_{B2} Drive current | I_{O2} | — | — | 0.5 | A |
| External resistance | R_{ex} | 2.7 | 4.3 | — | Ω |
| $V_{CC}-V_{O2}$ (pin 8–pin 6) ON voltage | V_{8-6} | 2.3 | 3 ($I_{O1} = 0.15A$) | 2.5 ($I_{O1} = 0.25A$) | V |
| Operating temperature | T_{opr} | -30 | 25 | 70 | $^{\circ}C$ |

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.

(R_{ex} is for constant current driving)



Electrical Characteristics (Ta = -30~70°C, unless otherwise specified)

| Characteristic | Symbol | Test Condition | Min | Typ.* | Max | Unit | Test Circuit | |
|--|-----------------------|--|-----------------------|------------------|------|---------|--------------|---|
| Input forward voltage | V _F | I _F = 5mA, Ta = 25°C | — | 1.55 | 1.7 | V | | |
| Temperature coefficient of forward voltage | ΔV _F / ΔTa | I _F = 5mA | — | -2.0 | — | mV / °C | | |
| Input reverse current | I _R | V _R = 5V, Ta = 25°C | — | — | 10 | μA | | |
| Input capacitance | C _T | V = 0, f = 1MHz, Ta = 25°C | — | — | 250 | pF | | |
| O ₁ Output leakage current | I _{O1L} | V _{CC} = 16V, V _{O1} = 0, V _F = 0.8V | — | 0.01 | 200 | μA | 1 | |
| O ₂ Output leakage current | I _{O2L} | V _{CC} = 16V, V _{O2} = 16V, I _F = 5mA | — | 0.2 | 200 | μA | 2 | |
| O ₁ Output current | I _O | V ₈₋₆ = 2.3V R _{ex} = 2.7Ω I _F = 5mA, Ta = 25°C | V _{CC} = 6V | 0.22 | 0.27 | 0.32 | A | 3 |
| | | | V _{CC} = 16V | 0.22 | 0.27 | 0.32 | | |
| O ₂ High level output voltage | V _{OH} | V _{CC} = 6V, R _{ex} = 2.7Ω I _F = 5mA | 3.5 | 5.5 | — | V | 4 | |
| O ₂ Low level output voltage | V _{OL} | V _F = 0.8V, R _{ex} = 2.7Ω I _O = 0.25A, Ta = 25°C | V _{CC} = 6V | — | 0.2 | 0.4 | V | 5 |
| | | | V _{CC} = 16V | — | 0.2 | 0.4 | | |
| | | V _F = 0.8V, R _{ex} = 2.7Ω I _O = 0.5A (*1) Ta = 25°C | V _{CC} = 6V | — | 0.4 | — | V | |
| | | | V _{CC} = 16V | — | 0.4 | — | | |
| High level supply current | I _{CCH} | V _{CC} = 6V, I _F = 5mA R _{ex} = 2.7Ω, Ta = 25°C | — | 3.8 | 10 | mA | | |
| | | V _{CC} = 6V, I _F = 5mA, R _{ex} = 2.7Ω | — | — | 13 | | | |
| | | V _{CC} = 16V, I _F = 5mA, R _{ex} = 2.7Ω | — | 5.2 | 17 | | | |
| Low level supply current | I _{CCL} | V _{CC} = 6V, I _F = 0mA R _{ex} = 2.7Ω, Ta = 25°C | — | 11 | 17 | mA | | |
| | | V _{CC} = 6V, I _F = 0mA, R _{ex} = 2.7Ω | — | — | 22 | | | |
| | | V _{CC} = 16V, I _F = 0mA, R _{ex} = 2.7Ω | — | 13 | 25 | | | |
| "Output L→H" threshold input current | I _{FLH} | R _{ex} = 2.7Ω I _O = 0.25A V _{O2} > 3V | V _{CC} = 6V | — | 2.5 | 5 | mA | |
| | | | V _{CC} = 16V | — | — | 5 | | |
| "Output H→L" threshold input current | V _{FHL} | R _{ex} = 2.7Ω I _O = 0.25A V _{O2} < 0.4V | V _{CC} = 6V | 0.8 | — | — | V | |
| | | | V _{CC} = 16V | 0.8 | — | — | | |
| Input current hysteresis | I _{HYS} | V _{CC} = 6V, R _{ex} = 2.7Ω, Ta = 25°C | — | 0.05 | — | mA | | |
| Supply voltage | V _{CC} | | 5 | — | 16 | V | | |
| Capacitance (input-output) | C _S | V _S = 0, f = 1MHz, Ta = 25°C | — | 1.0 | 2.0 | pF | | |
| Resistance (input-output) | R _S | V _S = 500V, Ta = 25°C, R.H. ≤ 60% | 5×10 ¹⁰ | 10 ¹² | — | Ω | | |

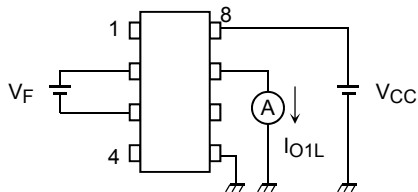
* All typical values are at Ta = 25°C (*1): Duration of I_O time ≤ 100μs

Switching Characteristics (Ta = -30~70°C unless otherwise specified)

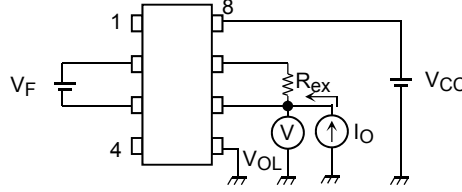
| Characteristic | Symbol | Test Condition | Min | Typ.* | Max | Unit | Test Circuit |
|---|-----------|--|-------|-------|-----|-------------|--------------|
| Propagation delay time, L→H | t_{pLH} | $V_{CC} = 6V, I_F = 8mA$ $R_{ex} = 2.7\Omega$ $f = 5kHz, Duty = 10\%$ | — | 1 | 5 | μs | 6 |
| Propagation delay time, H→L | t_{pHL} | | — | 1 | 5 | μs | |
| Output rise time | t_r | | — | 0.05 | — | μs | |
| Output fall time | t_f | | — | 0.05 | — | μs | |
| Common mode transient immunity at high level output | CM_H | $V_{CM} = 600V, I_F = 8mA$ $V_{CC} = 6V, R_{ex} = 270\Omega$ $R = 1k\Omega, Ta = 25^\circ C$ | -2000 | — | — | $V / \mu s$ | 7 |
| Common mode transient immunity at low level output | CM_L | $V_{CM} = 600V, I_F = 0mA$ $V_{CC} = 6V, R_{ex} = 270\Omega$ $R = 1k\Omega, Ta = 25^\circ C$ | 2000 | — | — | $V / \mu s$ | 7 |

* All typical values are at Ta = 25°C.

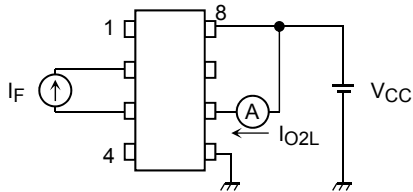
Test Circuit 1: I_{O1L}



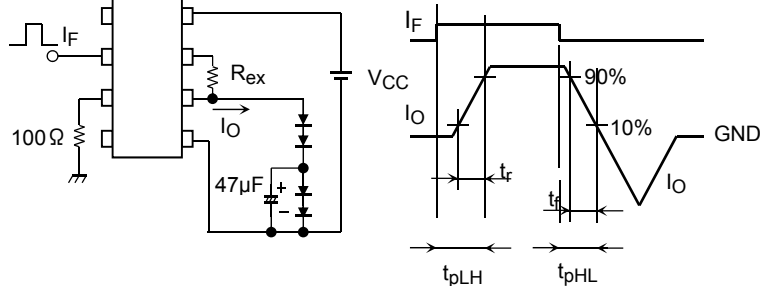
Test Circuit 5: V_{OL}



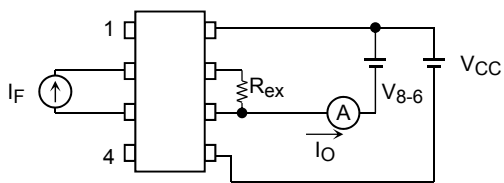
Test Circuit 2: I_{O2L}



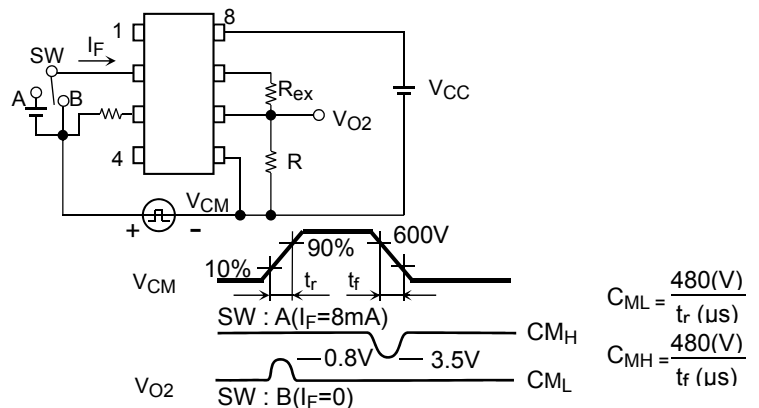
Test Circuit 6: $t_{pLH}, t_{pHL}, t_r, t_f$



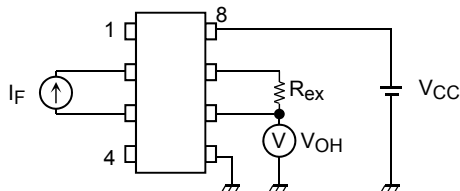
Test Circuit 3: I_O



Test Circuit 7: CM_H, CM_L



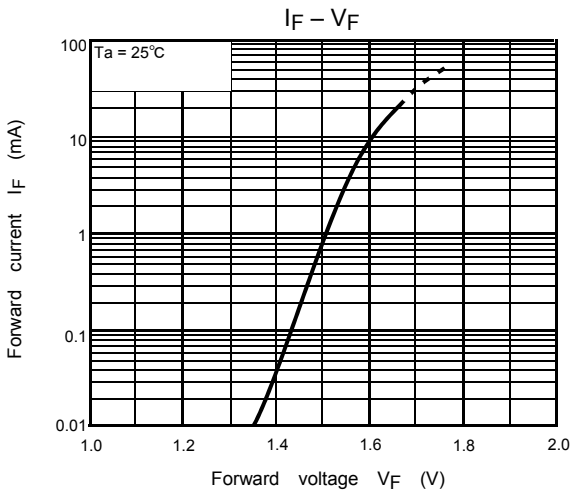
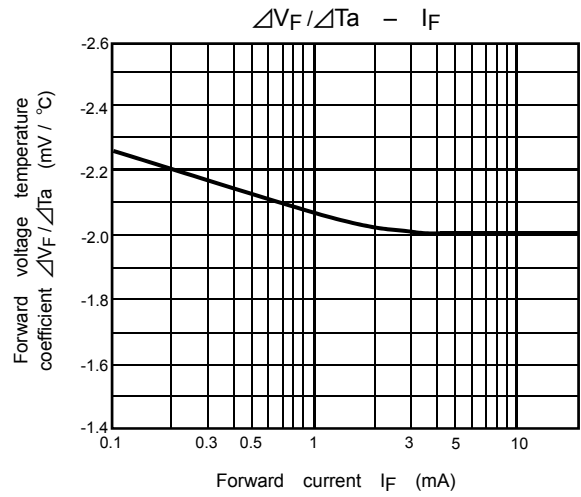
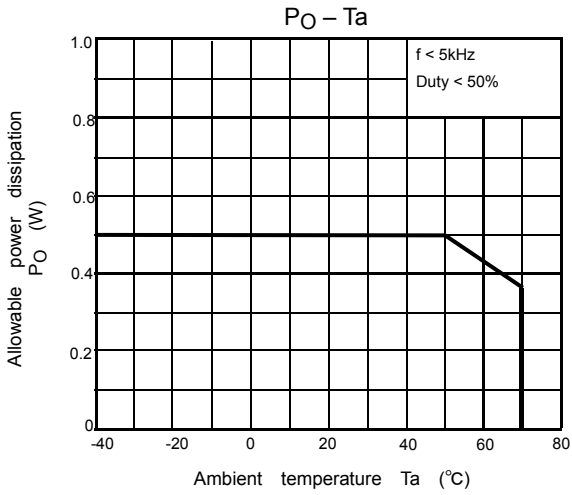
Test Circuit 4: V_{OH}



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

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

CM_L (CM_H) 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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