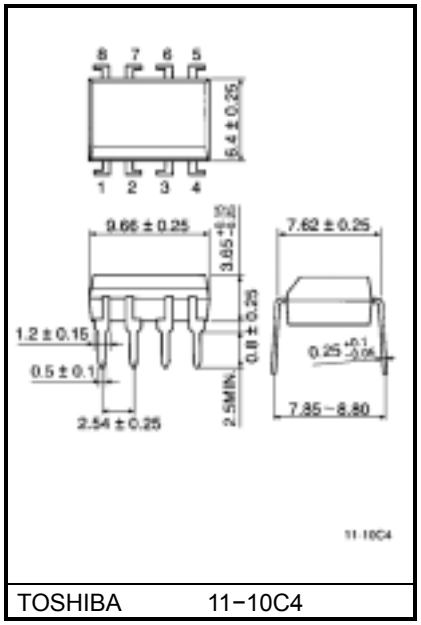
TOSHIBA Photocoupler GaAlAs Ired & Photo−IC

# TLP250

Transistor Inverter
Inverter For Air Conditionor
IGBT Gate Drive
Power MOS FET Gate Drive

Unit in mm




TOSHIBA 11−10C4

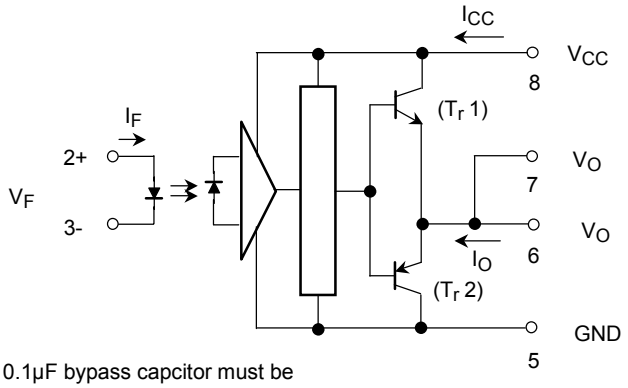
Weight: 0.54 g

The TOSHIBA TLP250 consists of a GaAlAs light emitting diode and a integrated photodetector.
This unit is 8−lead DIP package.
TLP250 is suitable for gate driving circuit of IGBT or power MOS FET.

- Input threshold current: $I_F$=5mA(max.)
- Supply current ($I_{CC}$): 11mA(max.)
- Supply voltage ($V_{CC}$): 10−35V
- Output current ($I_O$): ±1.5A (max.)
- Switching time ($t_{pLH}/t_{pHL}$): 1.5μs(max.)
- Isolation voltage: 2500$V_{rms}$(min.)
- UL recognized: UL1577, file No.E67349
- Option (D4) type
  VDE approved: DIN VDE0884/06.92,certificate No.76823
  Maximum operating insulation voltage: 630$V_{PK}$
  Highest permissible over voltage: 4000$V_{PK}$

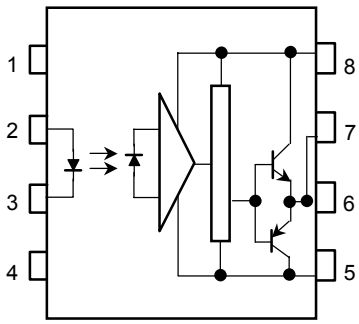
  **(Note) When a VDE0884 approved type is needed, please designate the "option (D4)"**
- Creepage distance: 6.4mm(min.)
  Clearance: 6.4mm(min.)

## Schmatic




A 0.1μF bypass capcitor must be connected between pin 8 and 5 (See Note 5).

## Pin Configuration (top view)




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

## Truth Table

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

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

| Characteristic | | | Symbol | Rating | Unit |
|---|---|---|---|---|---|
| LED | Forward current | | $I_F$ | 20 | mA |
| | Forward current derating (Ta ≥ 70°C) | | $\Delta I_F / \Delta Ta$ | −0.36 | mA / °C |
| | Peak transient forward curent | (Note 1) | $I_{FPT}$ | 1 | A |
| | Reverse voltage | | $V_R$ | 5 | V |
| | Junction temperature | | Tj | 125 | °C |
| Detector | "H"peak output current ($P_W$ ≤ 2.5μs,f ≤ 15kHz) | (Note 2) | $I_{OPH}$ | −1.5 | A |
| | "L"peak output current ($P_W$ ≤ 2.5μs,f ≤ 15kHz) | (Note 2) | $I_{OPL}$ | +1.5 | 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) | | $\Delta V_O / \Delta Ta$ | −0.73 | V / °C |
| | Supply voltage derating (Ta ≥ 70°C) | | $\Delta V_{CC} / \Delta Ta$ | −0.73 | V / °C |
| | Junction temperature | | Tj | 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 (10 s) | | (Note 4) | $T_{sol}$ | 260 | °C |
| Isolation voltage (AC, 1 min., R.H.≤ 60%) | | (Note 5) | $BV_S$ | 2500 | Vrms |

Note 1: Pulse width $P_W$ ≤ 1μs, 300pps

Note 2: Exporenential wavefom

Note 3: Exporenential wavefom, $I_{OPH}$ ≤ −1.0A( ≤ 2.5μs), $I_{OPL}$ ≤ +1.0A( ≤ 2.5μs)

Note 4: It is 2 mm or more from a lead root.

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

Note 6: 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 proparty. The total lead length between capacitor and coupler should not exceed 1cm.

## Recommended Operating Conditions

| Characteristic | | Symbol | Min. | Typ. | Max. | | Unit |
|---|---|---|---|---|---|---|---|
| Input current, on | (Note 7) | $I_{F(ON)}$ | 7 | 8 | 10 | | mA |
| Input voltage, off | | $V_{F(OFF)}$ | 0 | — | 0.8 | | V |
| Supply voltage | | $V_{CC}$ | 15 | — | 30 | 20 | V |
| Peak output current | | $I_{OPH}/I_{OPL}$ | — | — | ±0.5 | | A |
| Operating temperature | | $T_{opr}$ | −20 | 25 | 70 | 85 | °C |

Note 7: Input signal rise time (fall time) < 0.5 μs.

## Electrical Characteristics (Ta = −20~70°C, unless otherwise specified)

| Characteristic | | Symbol | Test Cir−cuit | Test Condition | | Min. | Typ.* | Max. | Unit |
|---|---|---|---|---|---|---|---|---|---|
| Input forward voltage | | $V_F$ | — | $I_F$ = 10 mA , Ta = 25°C | | | 1.6 | 1.8 | V |
| Temperature coefficient of forward voltage | | $\Delta V_F / \Delta Ta$ | — | $I_F$ = 10 mA | | — | −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 | | — | 45 | 250 | pF |
| Output current | "H" level | $I_{OPH}$ | 3 | $V_{CC}$ = 30V (*1) | $I_F$ = 10 mA $V_{8-6}$ = 4V | −0.5 | −1.5 | — | A |
| | "L" level | $I_{OPL}$ | 2 | | $I_F$ = 0 $V_{6-5}$ = 2.5V | 0.5 | 2 | — | |
| Output voltage | "H" level | $V_{OH}$ | 4 | $V_{CC1}$ = +15V, $V_{EE1}$ = −15V $R_L$ = 200Ω, $I_F$ = 5mA | | 11 | 12.8 | — | V |
| | "L" level | $V_{OL}$ | 5 | $V_{CC1}$ = +15V, $V_{EE1}$ = −15V $R_L$ = 200Ω, $V_F$ = 0.8V | | — | −14.2 | −12.5 | |
| Supply current | "H" level | $I_{CCH}$ | — | $V_{CC}$ = 30V, $I_F$ = 10mA Ta = 25°C | | — | 7 | — | mA |
| | | | | $V_{CC}$ = 30V, $I_F$ = 10mA | | — | — | 11 | |
| | "L" level | $I_{CCL}$ | — | $V_{CC}$ = 30V, $I_F$ = 0mA Ta = 25°C | | — | 7.5 | — | |
| | | | | $V_{CC}$ = 30V, $I_F$ = 0mA | | — | — | 11 | |
| Threshold input current | "Output L→H" | $I_{FLH}$ | — | $V_{CC1}$ = +15V, $V_{EE1}$ = −15V $R_L$ = 200Ω, $V_O$ > 0V | | — | 1.2 | 5 | mA |
| Threshold input voltage | "Output H→L" | $I_{FHL}$ | — | $V_{CC1}$ = +15V, $V_{EE1}$ = −15V $R_L$ = 200Ω, $V_O$ < 0V | | 0.8 | — | — | V |
| Supply voltage | | $V_{CC}$ | — | | | 10 | — | 35 | V |
| Capacitance (input−output) | | $C_S$ | — | $V_S$ = 0 , f = 1MHz Ta = 25℃ | | — | 1.0 | 2.0 | pF |
| Resistance(input−output) | | $R_S$ | — | $V_S$ = 500V , Ta = 25°C R.H.≤ 60% | | $1\times10^{12}$ | $10^{14}$ | — | Ω |

* All typical values are at Ta = 25°C (*1): Duration of $I_O$ time ≤ 50μs

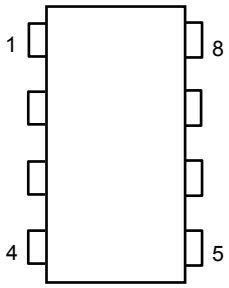
## Switching Characteristics (Ta = −20~70°C , unless otherwise specified)

| Characteristic | | Symbol | Test Cir−cuit | Test Condition | Min. | Typ.* | Max. | Unit |
|---|---|---|---|---|---|---|---|---|
| Propagation delay time | L→H | $t_{pLH}$ | 6 | $I_F$ = 8mA (Note 7)<br>$V_{CC1}$ = +15V, $V_{EE1}$ = −15V<br>$R_L$ = 200Ω | — | 0.15 | 0.5 | μs |
| | H→L | $t_{pHL}$ | | | — | 0.15 | 0.5 | |
| 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, Ta = 25°C | −5000 | — | — | V / μs |
| Common mode transient immunity at low level output | | $C_{ML}$ | 7 | $V_{CM}$ = 600V, $I_F$ = 0mA<br>$V_{CC}$ = 30V, Ta = 25°C | 5000 | — | — | V / μs |

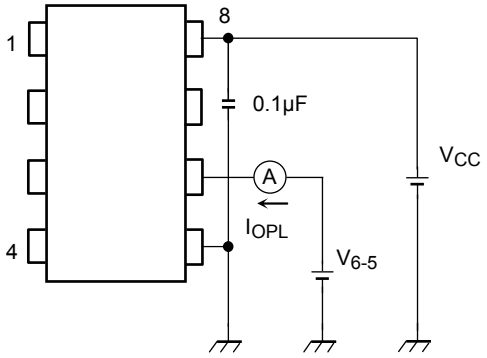
* All typical values are at Ta = 25°C

Note 7: Input signal rise time (fall time) < 0.5 μs.

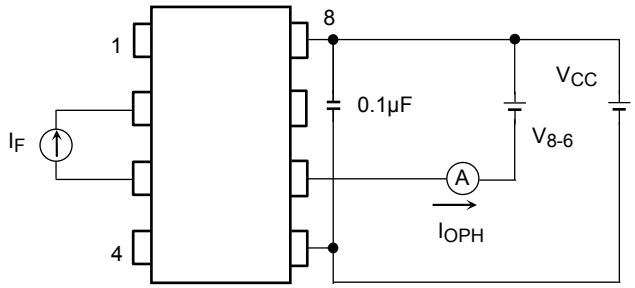
Test Circuit 1 :



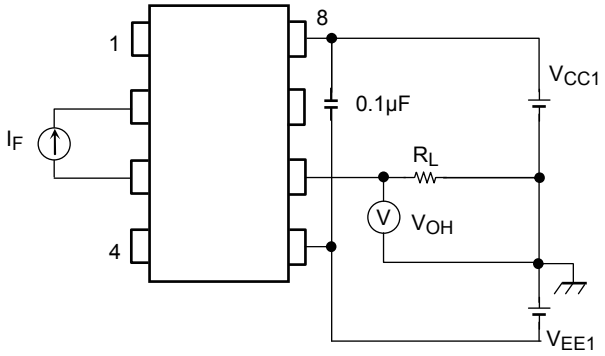

Test Circuit 2 : IOPL



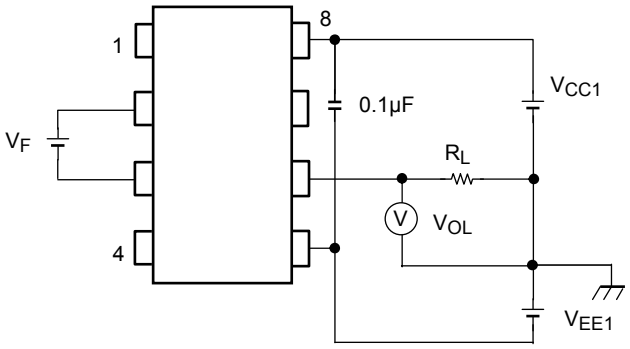

Test Circuit 3 : IOPH



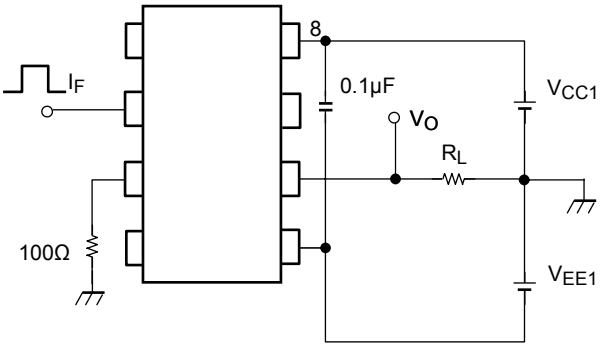

Test Circuit 4 : VOH

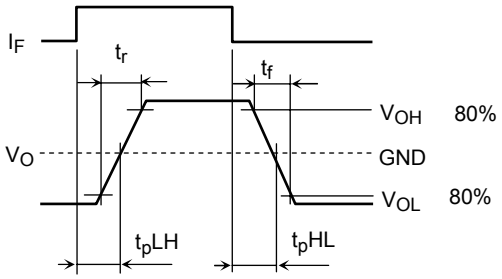



Test Circuit 5 : $V_{OL}$

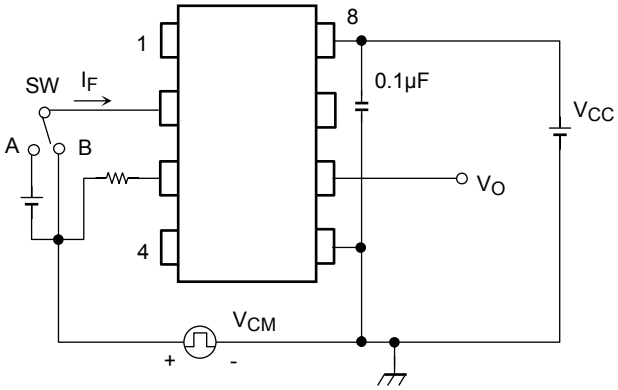


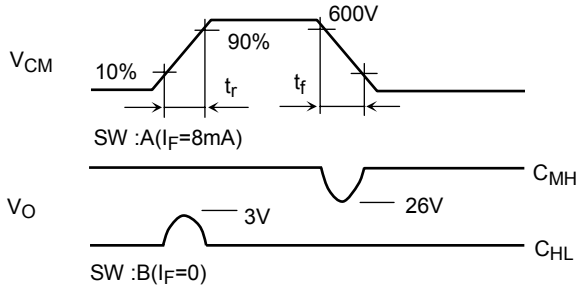
Test Circuit 6: $t_{pLH}$, $t_{pHL}$, $t_r$ $t_f$




Test Circuit 7: $C_{MH}$, $C_{ML}$



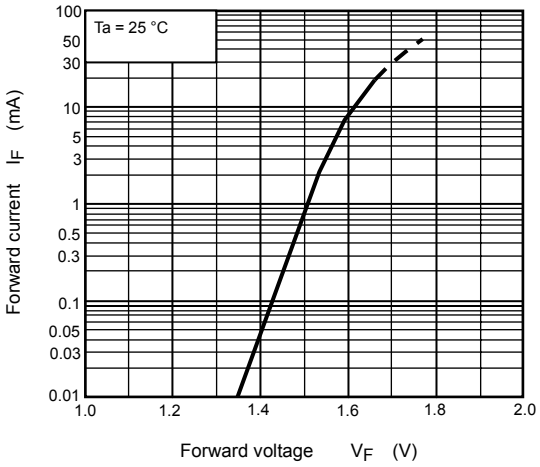




$$C_{ML} = \frac{480\ (V)}{t_{r\ (\mu s)}}$$

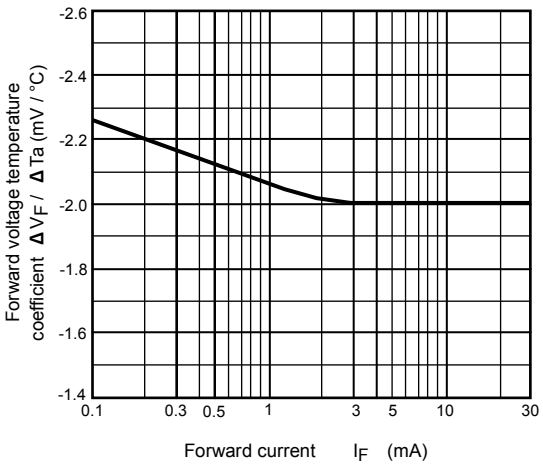
$$C_{MH} = \frac{480\ (V)}{t_{f\ (\mu s)}}$$

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

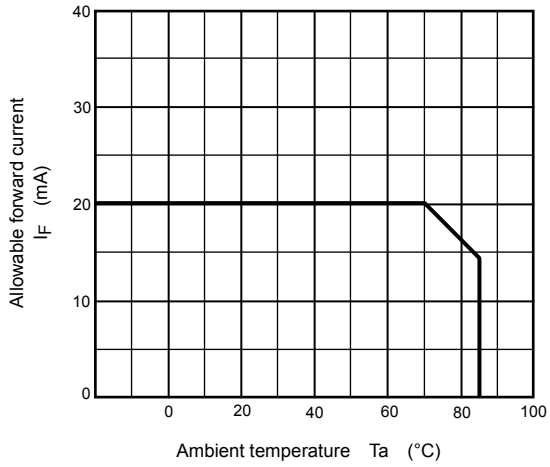
$I_F - V_F$



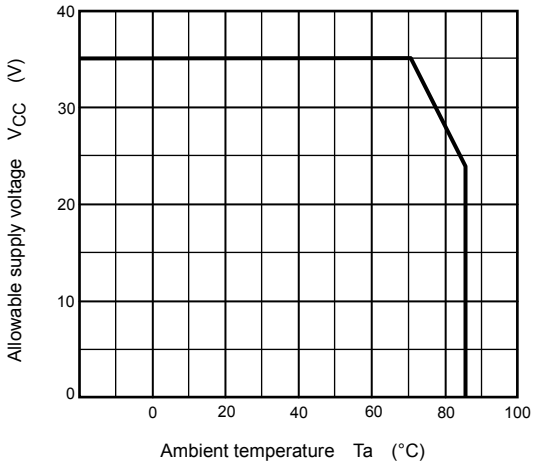

$\Delta V_F / \Delta Ta - I_F$



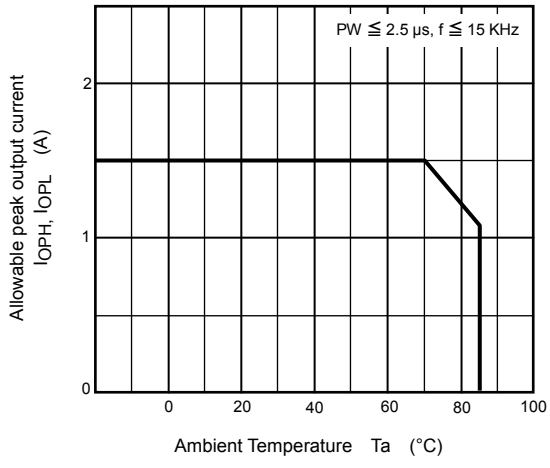

$I_F - Ta$




$V_{CC} - Ta$




$I_{OPH}, I_{OPL} - Ta$



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