

Preliminary

TOSHIBA Photocoupler GaAlAs IRED & Photo-IC

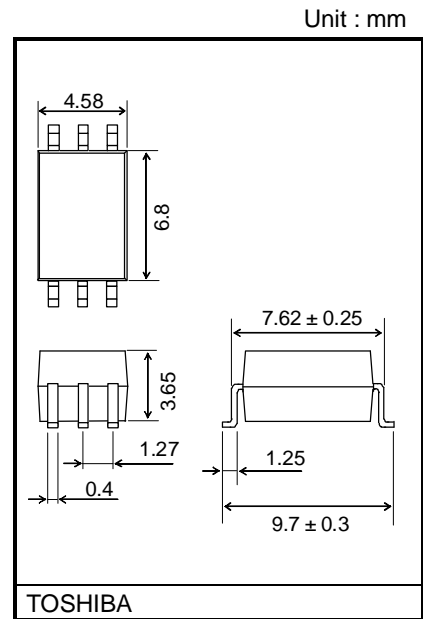
TLP716

- Digital Isolation for A/D,D/A Conversion.
- High Speed Line Receiver.
- Microprocessor System Interfaces.
- Plasma display panel.

The TOSHIBA TLP716 consists of a GaAlAs light emitting diode and a high speed photodetector. This unit is 6-lead SDIP. TLP716 is 50% smaller than 8PIN DIP and has suited the safety standard reinforced insulation class. So mounting area in safety standard required equipment can be reduced.

- Inverter Logic (totempole output)
- Package Type : SDIP6
- Guaranteed Performance Over Temperature : -40~100°C
- Power Supply Voltage : 4.5~5.5V
- Input Thresholds Current : IFHL=6.5mA(max.)
- Propagation delay Time (tpHL/ tpLH) : 75ns(max.)
- Switching speed : 20MBd(typ.) (NRZ)
- Common mode transient immunity : 10kV/us
- Isolation Voltage : 5000Vrms
- Construction Mechanical Rating

| | 7.62 mm pich standard type | 10.16 mm pich TLPXXXF type |
|----------------------|-------------------------------|-------------------------------|
| Creepage Distance | 7.0 mm (min) | 8.0 mm (min) |
| Clearance | 7.0 mm (min) | 8.0 mm (min) |
| Insulation Thickness | 0.4 mm (min) | 0.4 mm (min) |

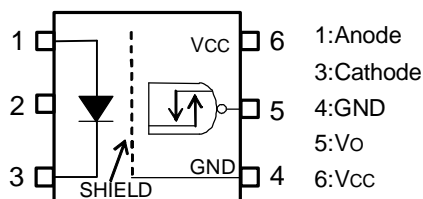


Weight: 0.26g

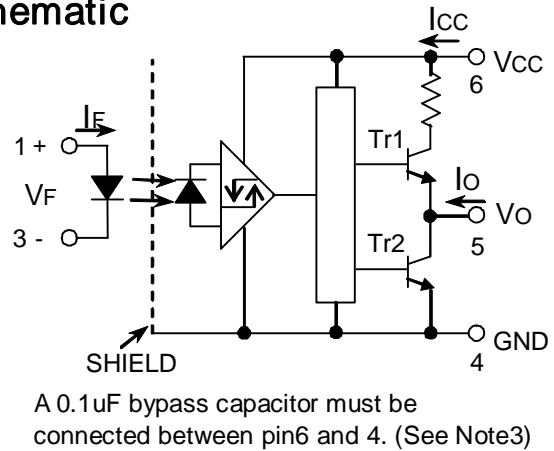
Truth Table

| Input | LED | Tr1 | Tr2 | Output |
|-------|-----|-----|-----|--------|
| H | ON | OFF | ON | L |
| L | OFF | ON | OFF | H |

Pin Configuration (top view)



Schematic



Maximum Ratings (Ta=25°C)

| CHARACTERISTIC | | SYMBOL | RATING | UNIT |
|--|--|--------|---------|------|
| LED | Forward Current | IF | 20 | mA |
| | Peak Transient Forward Current (Note1) | IFPT | | A |
| | Reverse Voltage | VR | 5 | V |
| DETECTOR | Output Current | IO | 10 | mA |
| | Output Voltage | VO | 6 | V |
| | Supply Voltage | VCC | 6 | V |
| | Output power dissipation | PO | 40 | mW |
| Operating Temperature Range | | Topr | -40~100 | °C |
| Storage Temperature Range | | Tstg | -55~125 | °C |
| Lead Solder Temperature(10s) | | Tsol | 260 | °C |
| Isolation Voltage (AC,1min.,R.H.≤60%,Ta=25°C) (Note2) | | BVs | 5000 | Vrms |

Note1 : Pulse width PW≤10us,300pps.

Note2 : Device Considered a two terminal device : pins 1,2 and 3 shorted together and pins 4,5 and 6 shorted together.

Note3 : A ceramic capacitor(0.1 μF) should be connected from pin 6 to pin 4 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 1 cm.

Recommended Operating Conditions

| CHARACTERISTIC | SYMBOL | MIN. | TYP. | MAX. | UNIT |
|-----------------------|---------|------|------|------|------|
| Input Current , ON | IF(ON) | 8 | 12 | 18 | mA |
| Input Voltage , OFF | VF(OFF) | 0 | — | 0.8 | V |
| Supply Voltage | VCC | 4.5 | 5 | 5.5 | V |
| Operating Temperature | Topr | -40 | — | 100 | °C |

The correlation between input current and switching speed and drive circuit (reference information).

| Input Current (IF) | TEST CIRCUIT | Typical Switching Speed |
|--------------------|---------------------------------------|-------------------------|
| 12mA | 1 (Page 4) | 18 – 20 MBd |
| 8mA | 1 (Page 4) | 16 – 18 MBd |
| 8mA | 2 (Page 4,With Speed up capacitor) | 20 – 22 MBd |

Electrical Characteristics

(Unless otherwise specified, Ta=-40 to 100°C, Vcc=4.5~5.5V)

| CHARACTERISTIC | SYMBOL | CONDITION | MIN. | TYP. | MAX. | UNIT |
|--|-----------------------|-------------------------------|------|------|------|-------|
| Input Forward Voltage | VF | IF=10mA, Ta=25°C | — | 1.65 | 1.8 | V |
| Temperature Coefficient of Forward Voltage | $\Delta VF/\Delta Ta$ | IF=10mA | — | -2.0 | — | mV/°C |
| Input Reverse Current | IR | VR=5V, Ta=25°C | — | — | 10 | μA |
| Input Capacitance | CT | V=0V, f=1MHz, Ta=25°C | — | — | — | pF |
| Logic Low Output Voltage | VOL | IOL=1.6mA, IF=12mA, VCC=5V | — | — | 0.4 | V |
| Logic High Output Voltage | VOH | IOH=-0.02mA, VF=1.05V, VCC=5V | 4.0 | — | — | V |
| Logic Low Supply Current | ICCL | IF=12mA | — | — | 5.0 | mA |
| Logic High Supply Current | ICCH | VF=0V (Note4) | — | — | 5.0 | mA |
| Input Current Logic Low Output | IFHL | IO=1.6mA, VO<0.4V | — | — | 6.5 | mA |
| Input Voltage Logic High Output | VFLH | IO=-0.02mA, VO>4.0V | 0.8 | — | — | V |

*All typical values are at Ta=25°C, VCC=5V, IF(ON)=12mA unless otherwise specified

Note4 : The Photodetector needs VCC of 4.5V or more for the stability operation.

In the VCC domain not more than this, since ICCH may increase in part, please use it after checking operation at the time of power supply current, power supply ON, and OFF.

Isolation Characteristics (Ta = 25°C)

| CHARACTERISTIC | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|-----------------------------|--------|--------------------------------|--------------------|-----------|------|------|
| Capacitance input to output | CS | VS = 0V, f = 1MHz (Note 2) | — | 0.8 | — | pF |
| Isolation resistance | RS | R.H. ≤ 60%, VS = 500V (Note 2) | 1×10^{12} | 10^{14} | — | Ω |
| Isolation voltage | BVS | AC, 1 minute | 5000 | — | — | Vrms |
| | | AC, 1 second, in oil | — | 10000 | — | Vdc |
| | | DC, 1 minute, in oil | — | 10000 | — | |

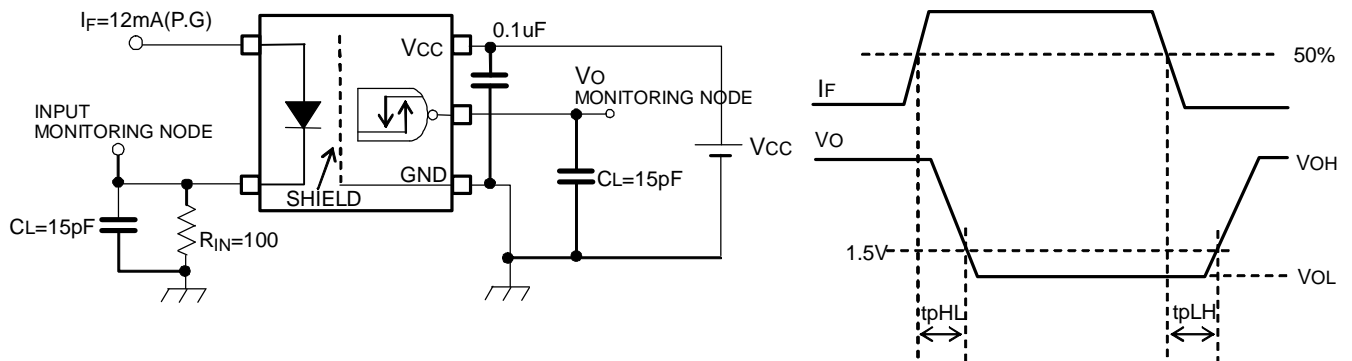
Switching Characteristics
 (Unless otherwise specified, $T_a = -40$ to 100 , $V_{CC} = 4.5 \sim 5.5V$)

| CHARACTERISTIC | SYMBOL | TEST -CIRCUIT | CONDITION | | MIN. | TYP. | MAX. | UNIT |
|---|-----------|---------------|--|---|--------|------|------|------|
| propagation Delay Time to Logic High output | tpLH | 1 | IF=0→12mA | RIN=100Ω CL=15pF (Note 5) | — | — | 75 | ns |
| propagation Delay Time to Logic Low output | tpHL | | IF=12→0mA | | — | — | 75 | ns |
| propagation Delay Time to Logic High output | tpLH | 2 | VIN=5→0V (IF=8→0mA) | RIN=430Ω CIN=33pF CL=15pF (Note 5) | — | — | 65 | ns |
| propagation Delay Time to Logic Low output | tpHL | | VIN=0→5V (IF=0→8mA) | | — | — | 65 | ns |
| Switching Time Dispersion between ON and OFF | tpHL-tpLH | 1 | RIN=100Ω, CL=15pF (Note 5) | | — | — | 45 | ns |
| Output Rise Time | tr | | IF=12→0mA | RIN=100Ω CL=15pF | — | 15 | — | ns |
| Output Fall Time | tf | | IF=0→12mA | (Note 5) | — | 15 | — | ns |
| Common Mode transient Immunity at High Level Output | CMH | 3 | VCM=1000Vp-p, IF=0mA, VO(Min)=4V, Ta=25°C | | -10000 | — | — | V/us |
| Common Mode transient Immunity at Low Level Output | CML | | VCM=1000Vp-p, IF=12mA, VO(Max)=0.4V, Ta=25°C | | 10000 | — | — | V/us |

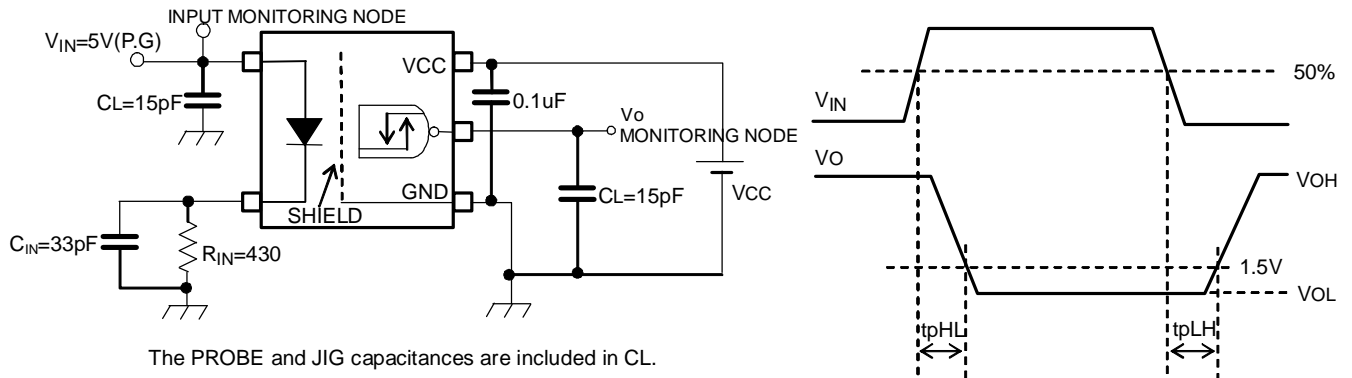
*All typical values are at $T_a = 25^\circ C$

Note 5 : Capacity of a probe and a wire.

TEST CIRCUIT 1 : tpLH , tpHL

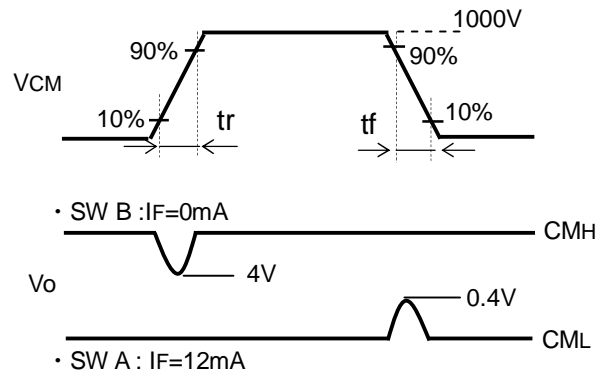
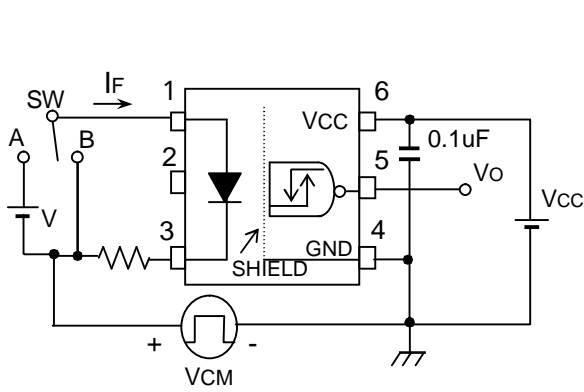


TEST CIRCUIT 2 : tpLH , tpHL



The PROBE and JIG capacitances are included in CL.
 (P.G) : Pulse Generator

TEST CIRCUIT 3 : CMH , CML



$$CMH = \frac{800(V)}{tr(\mu s)} \quad CML = - \frac{800(V)}{tf(\mu s)}$$

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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