

TOSHIBA Photocoupler GaAlAs Ired & Photo-IC

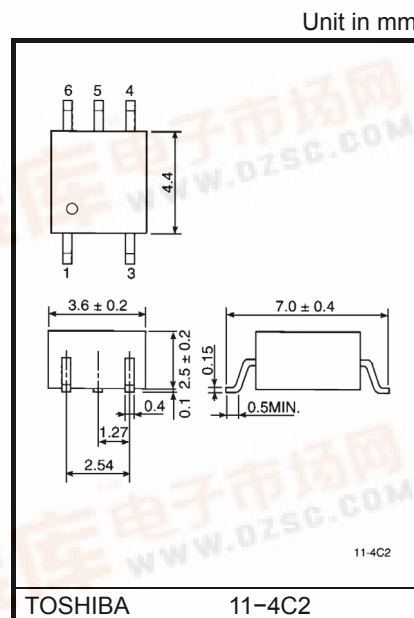
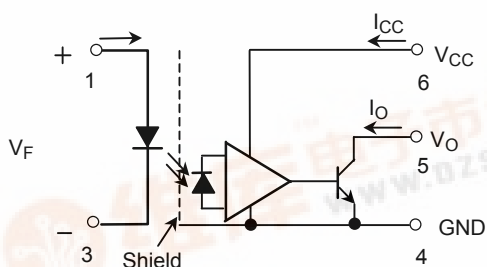
TLP115A

- High Speed, Long Distance Isolated Line Receiver
- Microprocessor System Interfaces
- Digital Isolation For A / D, D / A Conversion
- Computer-Peripheral Interfaces
- Ground Loop Elimination

The TOSHIBA mini flat coupler TLP115A is a small outline coupler, suitable for surface mount assembly. TLP115A consists of a high output power GaAlAs light emitting diode, optically coupled to an integrated high gain, high speed shielded photo detector whose output is an open collector schottky clamped transistor. The shield, which shunts capacitively coupled common noise to ground, provides a guaranteed transient immunity specification of 1000V / μ s.

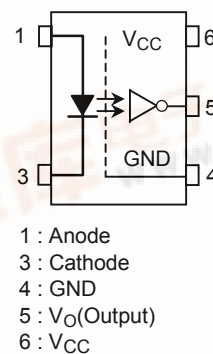
- Input current thresholds: IF = 5mA (max.)
- Switching speed: 10MBd (typ.)
- Common mode transient immunity: $\pm 1000\text{V} / \mu\text{s}$ (min.)
- Guaranteed performance over temp. : 0~70°C
- Isolation voltage: 2500Vrms (min.)
- UL recognized: UL1577, file no. E67349

Schematic



Weight: 0.09g

Pin Configuration (top view)



Truth Table (positive logic)

| Input | Output |
|-------|--------|
| H | L |
| L | H |

Note. A 0.1 μ F bypass capacitor must be connected between pins 4 and 6.

Absolute Maximum Ratings (Ta = 25°C)

| Characteristic | | Symbol | Rating | Unit |
|--|---|------------------|---------|------|
| LED | Forward current (Note 1) | I _F | 20 | mA |
| | Pulse forward current (Note 2) | I _{FP} | 40 | mA |
| | Peak transient forward current (Note 3) | I _{FPT} | 1 | A |
| | Reverse voltage | V _R | 5 | V |
| Detector | Output current | I _O | 25 | mA |
| | Output voltage | V _O | 7 | V |
| | Supply voltage(1 minute maximum) | V _{CC} | 7 | V |
| | Output power dissipation | P _O | 40 | mW |
| Operating temperature range | | T _{opr} | −40~85 | °C |
| Storage temperature range | | T _{stg} | −55~125 | °C |
| Lead solder temperature(10 sec.) | | T _{sol} | 260 | °C |
| Isolation voltage(AC, 1 min., RH≤ 60%, 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) Derate 0.36mA / °C above 70°C.

(Note 2) 50% duty cycle, 1ms pulse width. Derate 0.72mA / °C above 70°C.

(Note 3) Pulse width ≤ 1μs, 300pps.

Recommended Operating Conditions

| Characteristic | Symbol | Min. | Typ. | Max. | Unit |
|----------------------------------|------------------|------|------|------|------|
| Input voltage, low level | V _{FL} | −3 | 0 | 1.0 | V |
| Input current, high level | I _{FH} | 6.3 | 8 | 20 | mA |
| Supply voltage | V _{CC} | 4.5 | 5 | 5.5 | V |
| Fan out (TTL load, each channel) | N | — | — | 8 | — |
| Operating temperature | T _{opr} | 0 | — | 70 | °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.

Electrical Characteristics (unless otherwise specified, Ta = 0~70°C, VCC = 4.5 ~ 5.5V, VFL ≤ 1.0V)

| Characteristic | Symbol | Test Condition | Min. | Typ. | Max. | Unit |
|---|---------------------|--|--------------------|------------------|------|---------|
| Forward voltage | V _F | I _F = 10mA, Ta = 25°C | 1.2 | 1.4 | 1.7 | V |
| Forward voltage temperature coefficient | V _F / Ta | I _F = 10mA | — | −2 | — | mV / °C |
| Reverse current | I _R | V _R = 3V, Ta = 25°C | — | — | 10 | μA |
| Capacitance between terminals | C _T | V _F = 0, f = 1MHz, Ta = 25°C | — | 30 | — | pF |
| High level output voltage | I _{OH} | V _F = 1.0, V _O = 5.5V | — | — | 250 | μA |
| | | V _F = 1.0, V _O = 5.5V, Ta = 25°C | — | 0.5 | 10 | |
| Low level output current | V _{OL} | I _F = 5mA I _{OL} = 13mA (sinking) | — | 0.4 | 0.6 | V |
| "H level output→L level output" input current | I _{FH} | I _{OL} = 13mA (sinking) V _{OL} = 0.6V | — | — | 5 | mA |
| High level supply current | I _{CCH} | V _{CC} = 5.5V, I _F = 0 | — | 7 | 15 | mA |
| Low level supply current | I _{CCL} | V _{CC} = 5.5V, I _F = 10mA | — | 12 | 19 | mA |
| Input-output insulation leakage current | I _S | V _S = 3540V, t = 5s Ta = 25°C (Note 4) | — | — | 100 | μA |
| Isolation resistance | R _S | R.H. ≤ 60%, V _S = 500V DC Ta = 25°C (Note 4) | 5×10 ¹⁰ | 10 ¹⁴ | — | Ω |
| Stray capacitance between input to output | C _S | V _S = 0, f = 1MHz Ta = 25°C (Note 4) | — | 0.8 | — | pF |

* All typical values are V_{CC} = 5V, Ta = 25°C.

Switching Characteristics ($V_{CC} = 5V$, $T_a = 25^\circ C$)

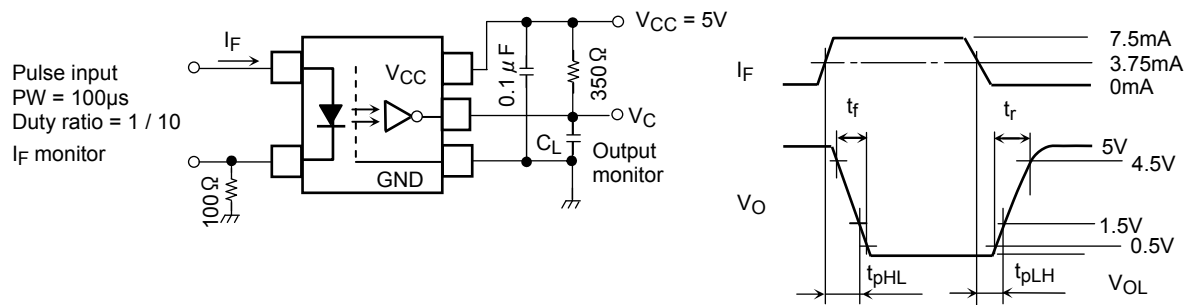
| Characteristic | Symbol | Test Circuit | Test Condition | Min. | Typ. | Max. | Unit |
|---|---------------|--------------|--|-------|------|------|-------------|
| Propagation delay time (H→L) | t_{pHL} | 1 | $I_F = 0 \rightarrow 7.5mA$ $C_L = 15pF$, $R_L = 350\Omega$ | — | 60 | 120 | ns |
| Propagation delay time (L→H) | t_{pLH} | 1 | $I_F = 7.5 \rightarrow 0mA$ $C_L = 15pF$, $R_L = 350\Omega$ | — | 60 | 120 | ns |
| Output rise fall time(10–90%) | t_r , t_f | 2 | $R_L = 350$, $C_L = 15pF$ $I_F = 0 \leftrightarrow 7.5mA$ | — | 30 | — | ns |
| Common mode transient immunity at high output level | CM_H | 2 | $I_F = 0 mA$, $V_{CM} = 400V_{p-p}$, $V_{O(MIN)}=2V$ $R_L = 350\Omega$ | 1000 | — | — | V / μs |
| Common mode transient immunity at low output level | CM_L | 2 | $I_F = 7.5 mA$, $V_{CM} = 400V_{p-p}$ $V_{O(MAX)} = 0.8V$, $R_L = 350\Omega$ | –1000 | — | — | V / μs |

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

(Note 5) The V_{CC} supply voltage to each TLP115A isolator must be bypassed by 0.1 μF capacitor. This can be either a ceramic or solid tantalum capacitor with good high frequency characteristic and should be connected as close as possible to package V_{CC} and GND pins of each device.

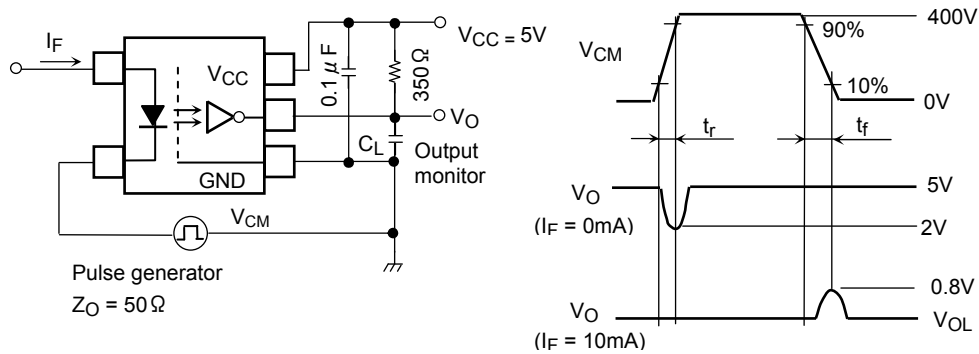
(Note 6) Maximum electrostatic discharge voltage for any pins: 180V(C = 200pF, R = 0)

Test Circuit 1: Switching Time Test Circuit



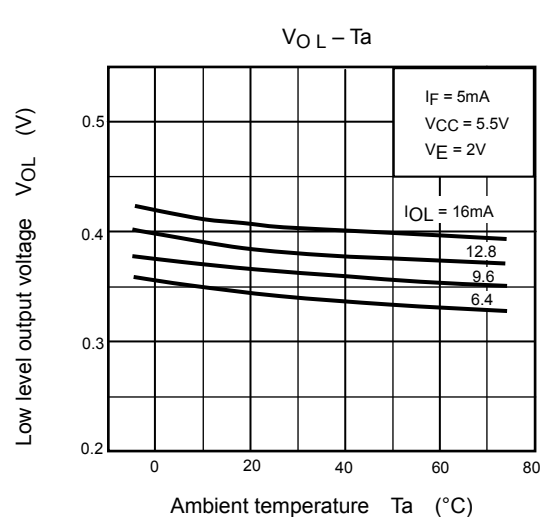
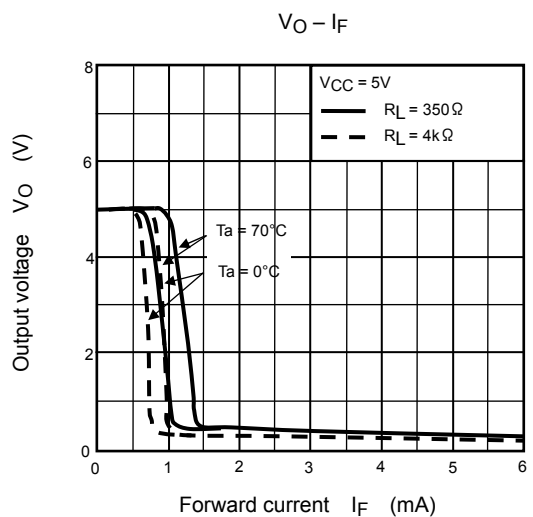
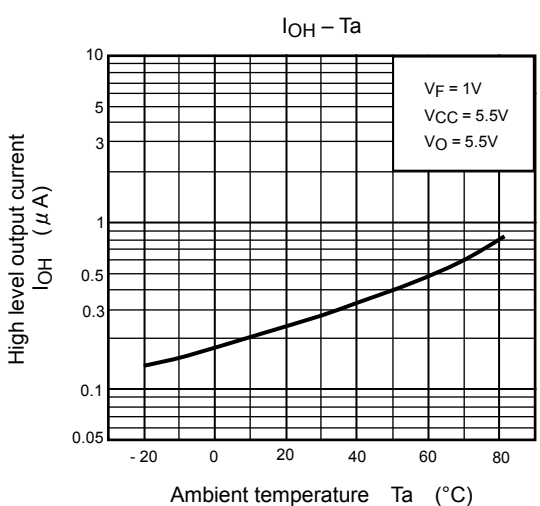
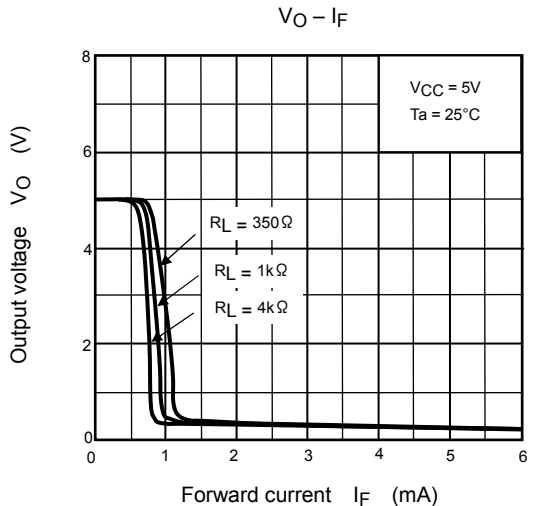
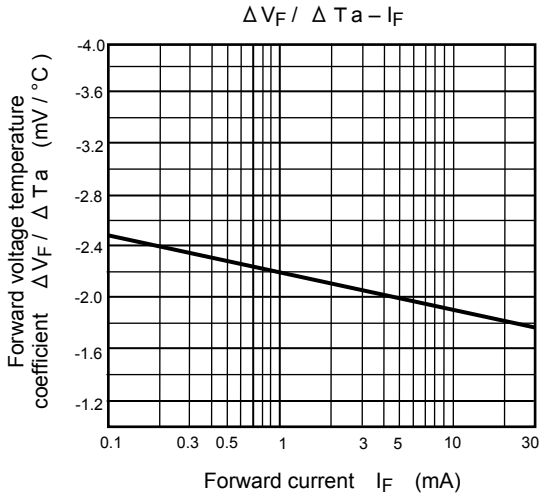
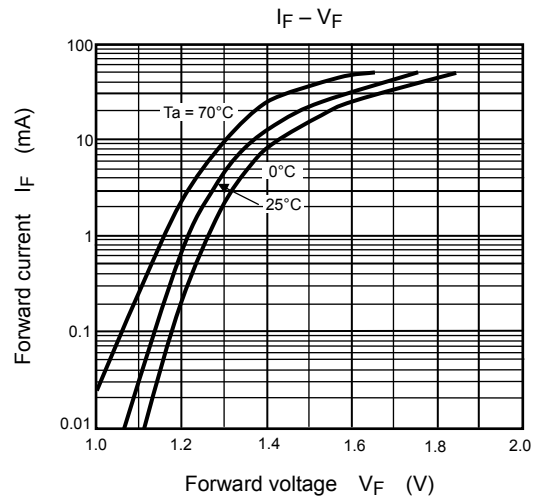
C_L is approximately 15pF which includes probe and stray wiring capacitance.

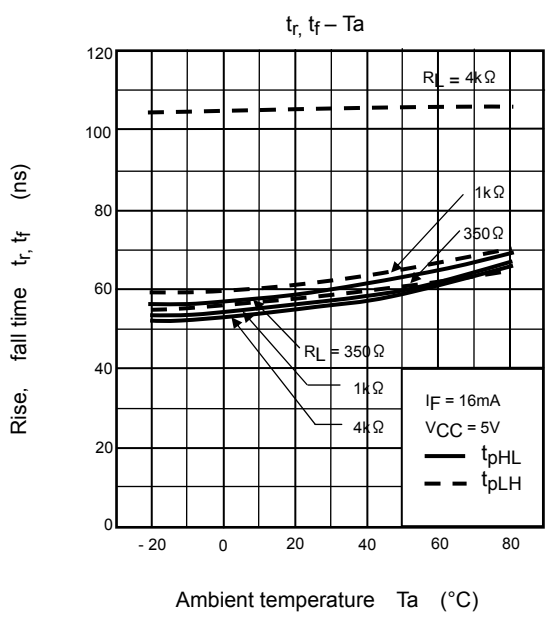
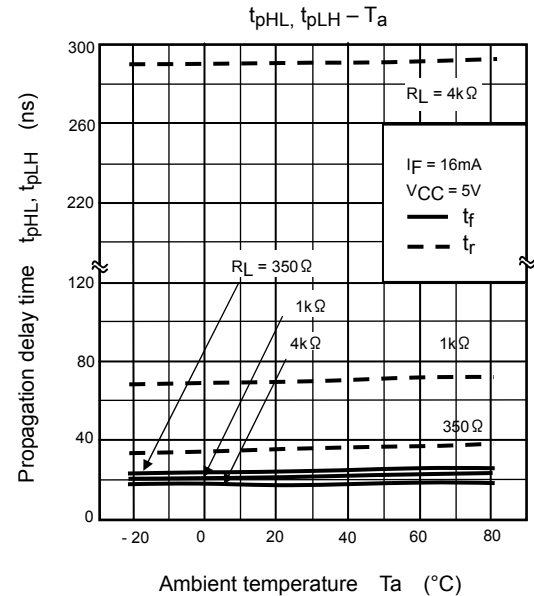
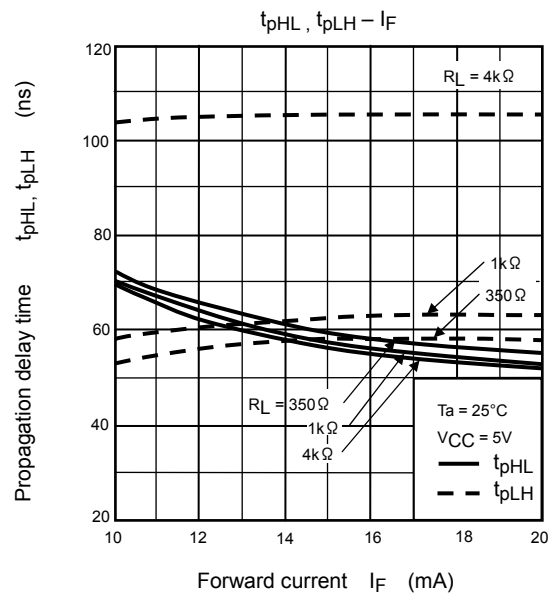
Test Circuit 2: Common Mode Transient Immunity Test Circuit



$$CM_H = \frac{320 \text{ (V)}}{t_r (\mu\text{s})}, CM_L = \frac{320 \text{ (V)}}{t_f (\mu\text{s})}$$

C_L is approximately 15pF which includes probe and stray wiring capacitance.





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