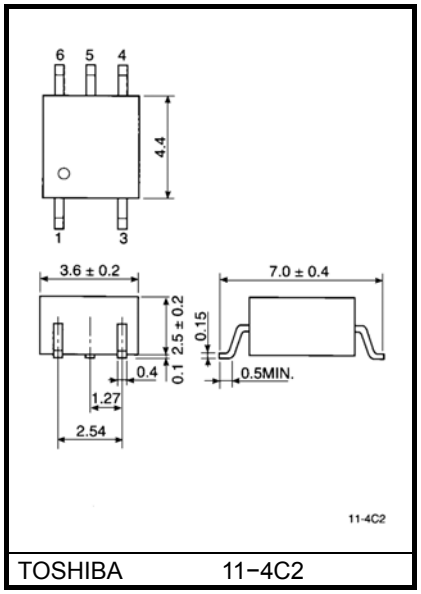
TOSHIBA Photocoupler GaAℓAs Ired & Photo-IC

# TLP114A

Digital Logic Isolation
Line Receiver
Power Supply Control Feedback Control
Switching Power Supply
Transistor Inverter

Unit in mm



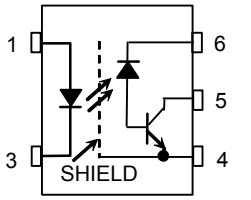

TOSHIBA 11−4C2

Weight: 0.09g (Typ.)

The TOSHIBA mini flat coupler TLP114A is a small outline coupler, suitable for surface mount assembly.
TLP114A consists of a high output power GaAℓAs light emitting diode, optically coupled to a high speed detector of one chip photodiode-transistor.

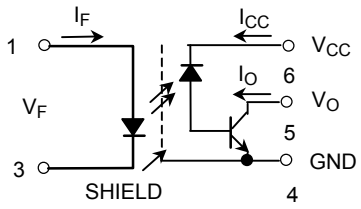
- Isolation voltage: 3750 Vrms (min)
- Switching speed: $t_{pHL}$ = 0.8μs, $t_{pLH}$ = 0.8μs (max) ($R_L$ = 1.9 kΩ)
- TTL compatible
- UL recognized: UL1577, file no. E67349

## Pin Configuration (top view)




1 : ANODE
3 : CATHODE
4 : EMITTER (GND)
5 : COLLECTOR (OUTPUT)
6 : $V_{CC}$

## Schematic



## 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 | | $I_O$ | 8 | mA |
| | Peak output current | | $I_{OP}$ | 16 | mA |
| | Supply voltage | | $V_{CC}$ | −0.5 to 30 | V |
| | Output voltage | | $V_O$ | −0.5 to 20 | V |
| | Output power dissipation | (Note 4) | $P_O$ | 100 | mW |
| Operating temperature range | | | $T_{opr}$ | −55 to 100 | °C |
| Storage temperature range | | | $T_{stg}$ | −55 to 125 | °C |
| Lead solder temperature(10 sec.) | | | $T_{sol}$ | 260 | °C |
| Isolation Voltage (AC,1 min., R.H.≤ 60°%) | | (Note 5) | $BV_S$ | 3750 | 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, Ims pulse width.

Derate 0.72mA / °C above 70°C.

(Note 3) Pulse width ≤ 1μs, 300pps.

(Note 4) Derate 1.8mW / °C above 70°C.

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

## Electrical Characteristics (Ta = 25°C)

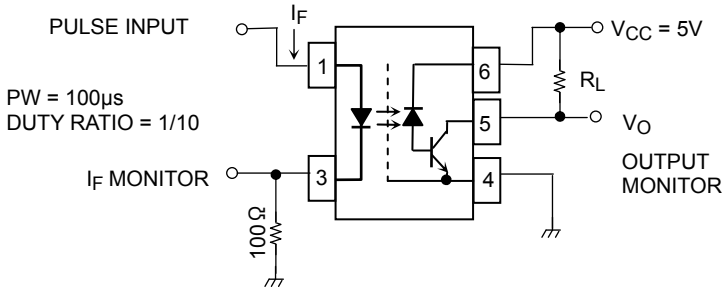
| | Characteristic | Symbol | Test Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| LED | Forward voltage | $V_F$ | $I_F$ = 16mA | 1.22 | 1.42 | 1.72 | V |
| | Forward voltage temperature coefficient | $\Delta V_F / \Delta Ta$ | $I_F$ = 16mA | — | −2 | — | mV /°C |
| | Reverse current | $I_R$ | $V_R$ = 3V | — | — | 10 | μA |
| | Capacitance between terminals | $C_T$ | $V_F$ = 0, f = 1MHz | — | 30 | — | pF |
| Detector | High level output current | $I_{OH\ (1)}$ | $I_F$ = 0mA, $V_{CC}$ = $V_O$ = 5.5V | — | 3 | 500 | nA |
| | | $I_{OH\ (2)}$ | $I_F$ = 0mA, $V_{CC}$ = 30V, $V_O$ = 20V | — | — | 5 | μA |
| | | $I_{OH}$ | $I_F$ = 0mA, $V_{CC}$ = 30V, $V_O$ = 20V, Ta = 70°C | — | — | 50 | |
| | High level supply current | $I_{CCH}$ | $I_F$ = 0mA, $V_{CC}$ = 30V | — | 0.01 | 1 | μA |
| Coupled | Current transfer ratio | $I_O / I_F$ | $I_F$ = 16mA, $V_{CC}$ = 4.5V, $V_O$ = 0.4V | 20 | — | — | % |
| | Low level output voltage | $V_{OL}$ | $I_F$ = 16mA, $V_{CC}$ = 4.5V, $I_O$ = 2.4 mA | — | — | 0.4 | V |
| | Isolation resistance | $R_S$ | R.H.≤ 60%, $V_S$ = 500V (Note 5) | $5\times10^{10}$ | $10^{14}$ | — | Ω |
| | Stray capacitance between input to output | $C_S$ | $V_S$= 0, f = 1MHz (Note 5) | — | 0.8 | — | pF |

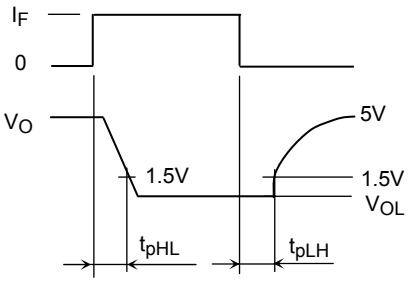
## Switching Characteristics (Ta = 25°C, VCC = 5V)

| Characteristic | Symbol | Test Cir−cuit | Test Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| Propagation delay time (H→ L) | $t_{pHL}$ | 1 | $I_F$ = 0→ 16mA, $V_{CC}$ = 5V, $R_L$ = 1.9kΩ | — | — | 0.8 | μs |
| Propagation delay time (L→ H) | $t_{pLH}$ | 1 | IF = 16→ 0mA, $V_{CC}$ = 5V, $R_L$ = 1.9kΩ | — | — | 0.8 | μs |
| Common mode transient immunity at high output level | $C_{MH}$ | 2 | $I_F$ = 0mA, $V_{CM}$ = 400$V_{p-p}$, $R_L$ = 4.1kΩ | 5000 | 10000 | — | V / μs |
| Common mode transient immunity at low output level | $C_{ML}$ | 2 | $I_F$ = 16mA, $V_{CM}$ = 400$V_{p-p}$, $R_L$ = 4.1kΩ | −5000 | −10000 | — | V / μs |

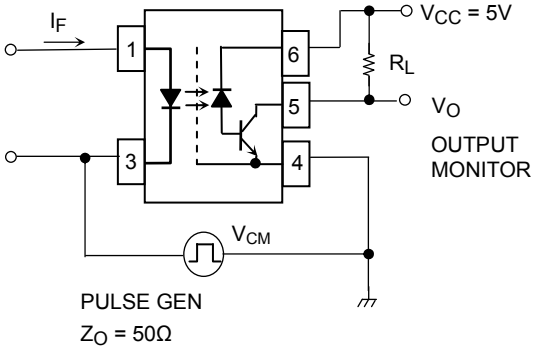
(Note 6) Maximum electrostatic discharge voltage for any pins: 100V (C=200pF, R=0)

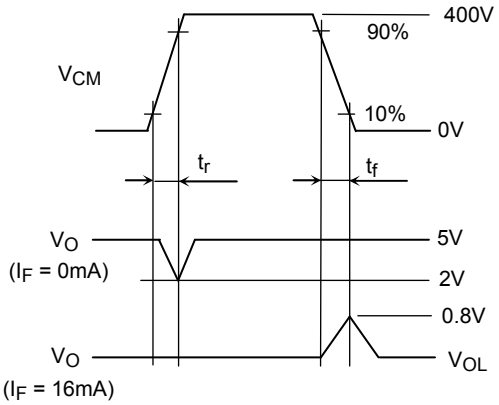
## Test Circuit 1: Switching Time Test Circuit



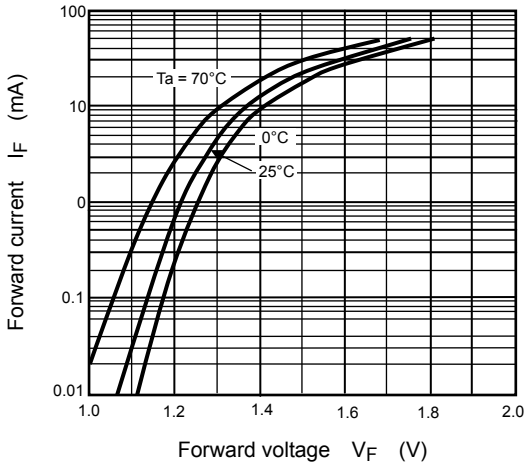

## Test Circuit =2: Common Mode Transient Immunity Test Circuit



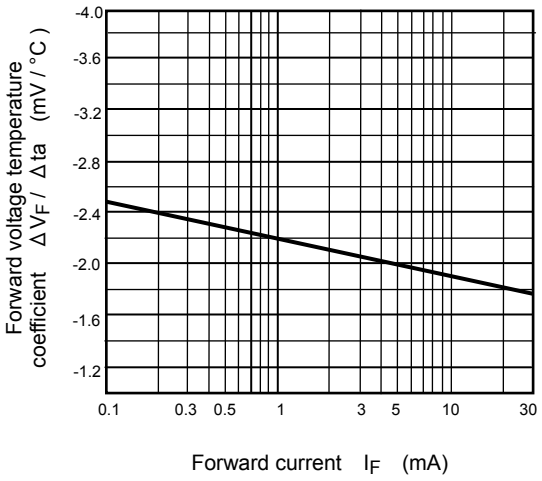




$$CM_H = \frac{320(V)}{t_r(\mu s)},\ CM_L = \frac{320(V)}{t_r(\mu s)}$$

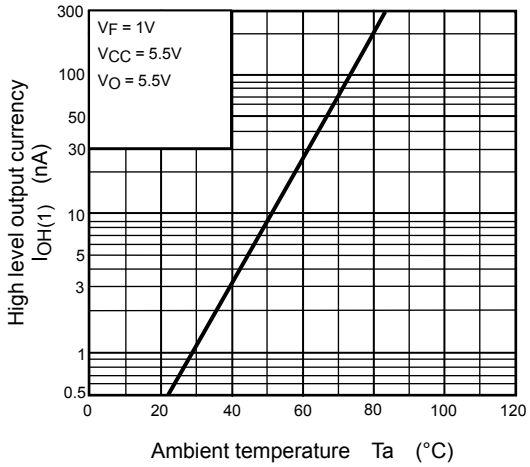
$I_F - V_F$



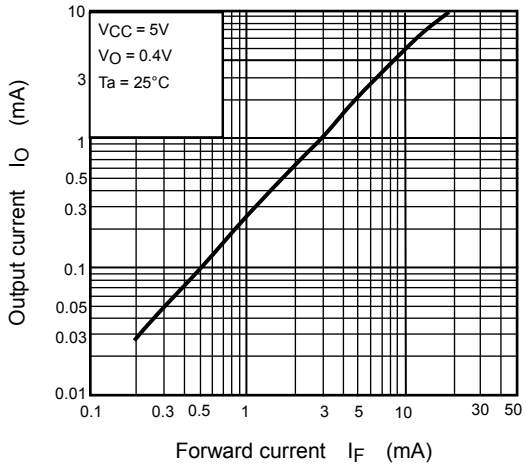

$\Delta V_F / \Delta ta - I_F$



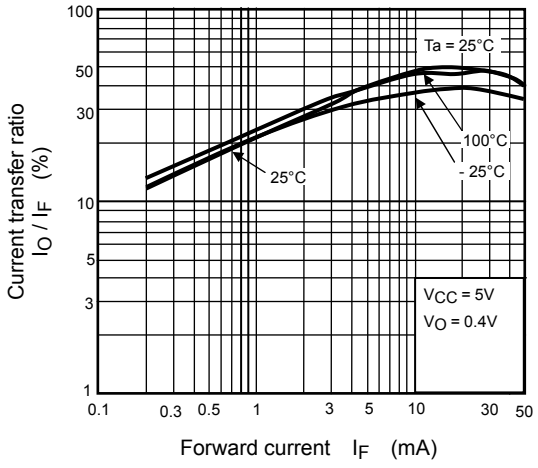

$I_{OH(1)} - Ta$



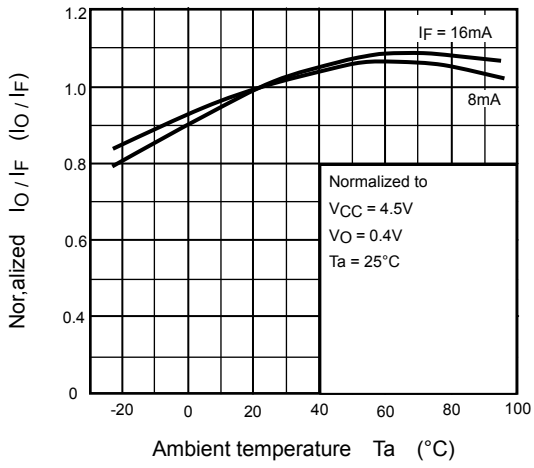

$I_O - I_F$



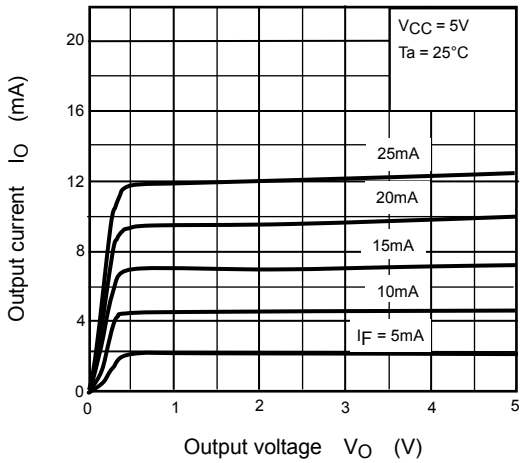

$I_O / I_F - I_F$



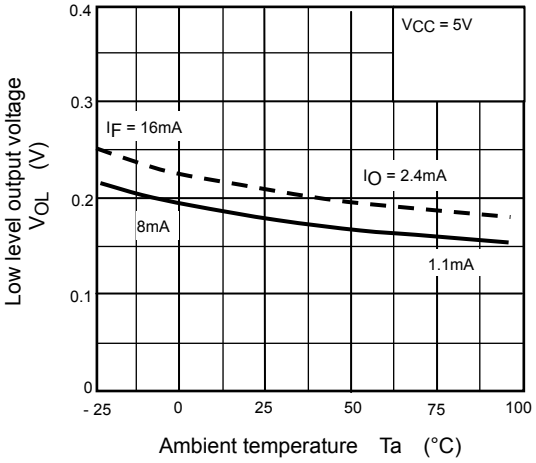

$I_O / I_F - Ta$



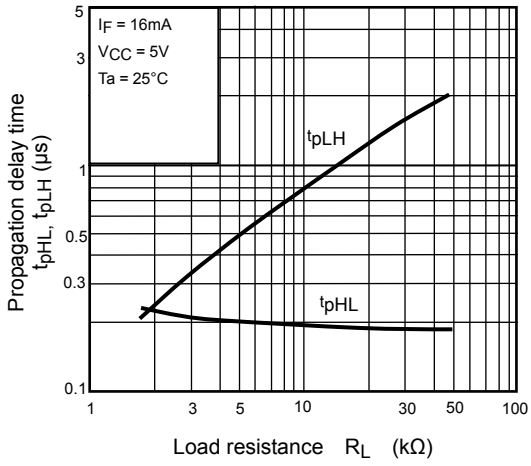
$I_O - V_O$



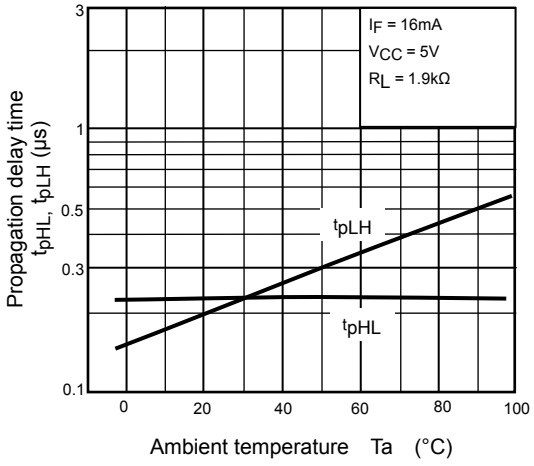

$V_{O\,L} - Ta$




$t_{pHL}, t_{pLH} - R_L$




$t_{pHL}, t_{pLH} - Ta$



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