TOSHIBA Photocoupler GaAℓAs Ired + Photo−IC

# TLP114A(IGM)

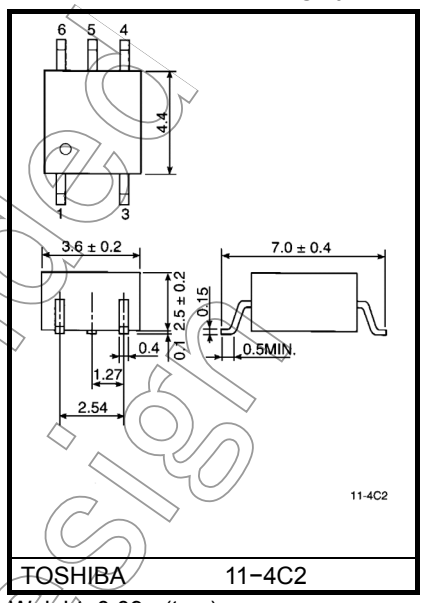
Transistor Inverter

Inverter For Air Conditioner

Line Receiver

Ipm Interfaces

Unit in mm



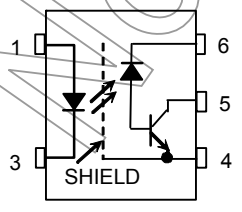

TOSHIBA 11−4C2

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 photo diode−transistor.
TLP114A(IGM) has no internal base connection, and a faraday shield integrated on the photodetector chip provides an effective common mode noise transient immunity.
TLP114A(IGM) guarantees minimum and maximum of propagation delay time, switching time dispersion, and high common mode transient immunity. There for TLP114A(IGM) is suitable for isolation interface between IPM(intelligent power module) and control IC circuits in motor control application.

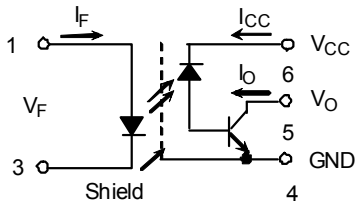
- Isolation voltage: 3750$V_{rms}$(min.)
- Common mode transient immunity
  : ±10kV/μs(min.)
  @$V_{CM}$=1500V
- Switching time: $t_{pHL}$, $t_{pLH}$=0.1μs(min.)
  =0.8μs(max.)
  @$I_F$=10mA, $V_{CC}$=15V,
  $R_L$=20kΩ, Ta=25°C
- Switching time dispersion: 0.7μs(max.)
  ($|t_{pLH}-t_{pHL}|$)
- TTL compatible
- 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 |
| | Output voltage | | $V_O$ | −0.5~20 | V |
| | Supply voltage | | $V_{CC}$ | −0.5~30 | V |
| | Output power dissipation | (Note 4) | $P_O$ | 100 | mW |
| Operating temperature range | | | $T_{opr}$ | −55~100 | °C |
| Storage temperature range | | | $T_{stg}$ | −55~125 | °C |
| Lead soldering temperature(10s) | | | $T_{sol}$ | 260 | °C |
| Isolation voltage(AC, 1min., R.H.≤60%, Ta=25°C) | | (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 above 70°C.

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

(Note 3): Pulse width PW ≤ 1μs, 300pps.

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

(Note 5): Device considerd a two terminal device: pins1, 3 shorted together and pins4, 5, 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 terminal | CT | $V_F$=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 |
| | Supply voltage | $V_{CC}$ | $I_{CC}$=0.01mA | 30 | — | — | V |
| | Output voltage | $V_O$ | $I_O$=0.5mA | 20 | — | — | V |

## Coupled Electrical Characteristics(Ta = 25°C)

| Characteristic | Symbol | Test Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Current transfer ratio | $I_O / I_F$ | $I_F$=10mA, $V_{CC}$=4.5V $V_O$=0.4V | 25 | 35 | 75 | % |
| | | $I_F$=16mA, $V_{CC}$=4.5V $V_O$=0.4V, Ta=−25~100°C | 15 | — | — | |
| Low level output voltage | $V_{OL}$ | $I_F$=10mA, $V_{CC}$=4.5V $I_O$=2.4mA | — | — | 0.4 | V |

## Isolation Characteristics(Ta = 25°C)

| Characteristic | Symbol | Test Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Capacitance input to output | $C_S$ | V=0, f=1MHz (Note 5) | — | 0.8 | — | pF |
| Isolation resistance | $R_S$ | R.H.≤60%, $V_S$=500V (Note 5) | $5\times10^{10}$ | $10^{14}$ | — | Ω |
| Isolation voltage | $BV_S$ | AC, 1 minute | 3750 | — | — | Vrms |
| | | AC, 1 second, in oil | — | 10000 | — | |
| | | DC, 1 minute, in oil | — | 10000 | — | Vdc |

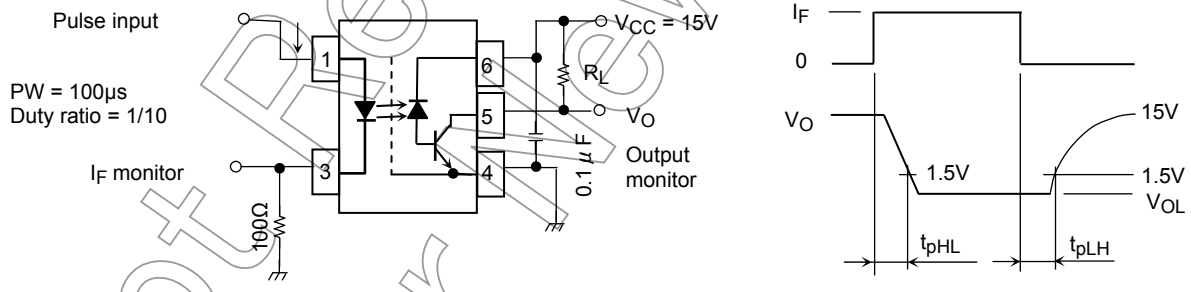
## Switching Characteristics(Ta = 25°C, $V_{CC}$ = 15V)

| Characteristic | Symbol | Test Cir- Cuit | Test Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| Propagation delay time (H→ L) | $t_{pHL}$ | 1 | $I_F$=0→ 10mA, $R_L$=20kΩ | 0.1 | 0.45 | 0.8 | μs |
| | | | $I_F$=0→ 10mA, $R_L$=20kΩ Ta=0~85°C | 0.1 | 0.45 | 0.9 | |
| Propagation delay time (L→ H) | $t_{pLH}$ | | $I_F$=0→ 10mA, $R_L$=20kΩ Ta=−25~100°C | 0.1 | 0.45 | 1.0 | |
| Switching time dispersion between on and off | $\|t_{pLH}-t_{pHL}\|$ | | $I_F$=10→ 0mA, $R_L$=20kΩ | — | 0.15 | 0.7 | μs |
| | | | $I_F$=10→ 0mA, $R_L$=20kΩ Ta=0~85°C | — | 0.25 | 0.8 | |
| | | | $I_F$=10→ 0mA, $R_L$=20kΩ Ta=−25~100°C | — | 0.25 | 0.9 | |
| Common mode transient immunity at logic high output (Note 6) | $CM_H$ | 2 | $I_F$=0mA $V_{CM}$=1500$V_{p-p}$ $R_L$=20kΩ | 10000 | 15000 | — | V / μs |
| Common mode transient immunity at logic low output (Note 6) | $CM_L$ | | $I_F$=10mA $V_{CM}$=1500$V_{p-p}$ $R_L$=20kΩ | −10000 | −15000 | — | V / μs |

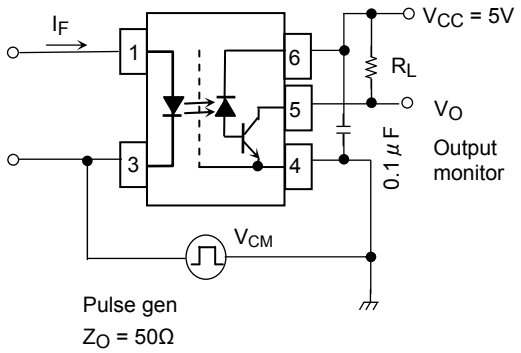
(Note 6): $CM_L$ is the maximum rate of fall of the common mode voltage that can be sustained with the output voltage in the logic low state ($V_O$<1V).
$CM_H$ is the maximum rate of rise of the common mode voltage that can be sustained with the output voltage in the logic high state ($V_O$<4V).

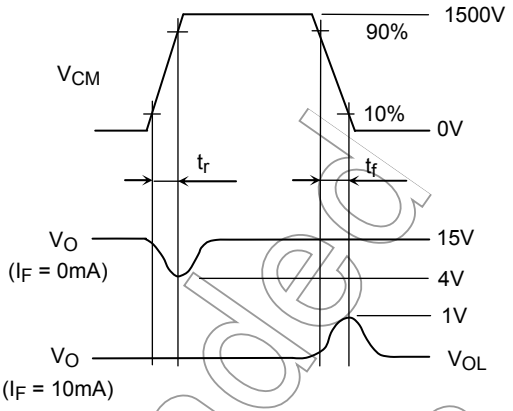
(Note 7): Maximum electrostatic discharge voltage for any pins: 100V (C=200pF, R=0).

## Test Circuit 1: Switching Time Test Circuit



**Test Circuit 2: Common Mode Noise Immunity Test Circuit**




$$CM_H = \frac{1200(V)}{t_r(\mu s)}, CM_L = \frac{1200(V)}{t_f(\mu s)}$$

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