

# TLP113

Isolated Line Receiver

Simplex / Multiplex Data Transmission

Computer-Peripheral Interface

Microprocessor System Interface

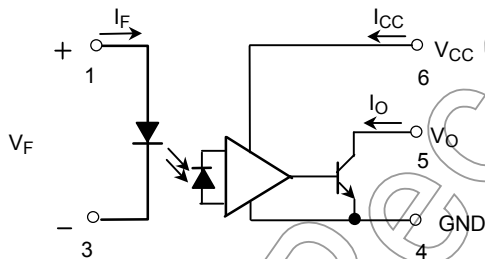
Digital Isolation For A / D, D / A Conversion

The TOSHIBA mini flat coupler TLP113 is a small outline coupler, suitable for surface mount assembly.

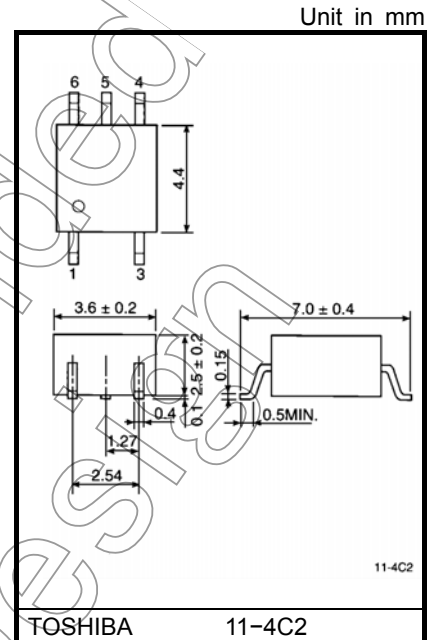
TLP113 consists of a GaAlAs light emitting diode, optically coupled to an integrated high gain, high speed photodetector whose output is an open collector, schottky clamped transistor.

- Input current thresholds:  $I_F=10\text{mA}(\text{max.})$
- Switching speed:  $10\text{MBd}(\text{typ.})$
- TTL / LSTTL compatible:  $V_{CC}=5\text{V}$
- Guaranteed performance over temp.:  $0\sim70^\circ\text{C}$
- Isolation voltage:  $2500\text{Vrms}(\text{min.})$
- UL recognized: UL1577 file no. E67349

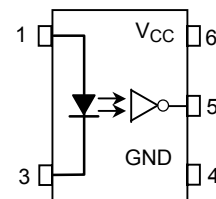
## Schematic



(Note) A  $0.1\mu\text{F}$  bypass capacitor must be connected between pins 4 and 6.



## Pin Configuration(top view)



- 1 : Anode
- 3 : Cathode
- 4 : GND
- 5 : Output (Open collector)
- 6 :  $V_{CC}$

## TRUTH TABLE (Positive Logic)

| INPUT | OUTPUT |
|-------|--------|
| H     | L      |
| L     | H      |

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

| Characteristic                                   |                                         | Symbol           | Rating  | Unit             |
|--------------------------------------------------|-----------------------------------------|------------------|---------|------------------|
| LED                                              | Forward current                         | I <sub>F</sub>   | 20      | mA               |
|                                                  | Pulse forward current (Note 1)          | I <sub>FP</sub>  | 40      | mA               |
|                                                  | Peak transient forward current (Note 2) | I <sub>FPT</sub> | 1       | A                |
|                                                  | Reverse voltage                         | V <sub>R</sub>   | 5       | V                |
| Detector                                         | Output current                          | I <sub>O</sub>   | 25      | mA               |
|                                                  | Output voltage                          | V <sub>O</sub>   | 7       | V                |
|                                                  | Supply voltage (1 minute maximum)       | V <sub>CC</sub>  | 7       | V                |
|                                                  | Output power dissipation                | P <sub>O</sub>   | 40      | mW               |
| Operating temperature range                      |                                         | T <sub>opr</sub> | -40~85  | °C               |
| Storage temperature range                        |                                         | T <sub>stg</sub> | -55~125 | °C               |
| Lead solder temperature (10s)                    |                                         | T <sub>sol</sub> | 260     | °C               |
| Isolation voltage (AC, 1 min., RH ≤ 60%, Note 4) |                                         | BV <sub>S</sub>  | 2500    | V <sub>rms</sub> |

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 and the operating ranges.

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) 50% duty cycle, 1ms pulse width.

(Note 2) Pulse width ≤ 1μs, 300pps.

## Recommended Operating Conditions

| Characteristic                   | Symbol           | Min. | Typ. | Max. | Unit |
|----------------------------------|------------------|------|------|------|------|
| Input voltage, low level         | V <sub>FL</sub>  | -3   | 0    | 1.0  | V    |
| Input current, high level        | I <sub>FH</sub>  | 13*  | 16   | 20   | mA   |
| Supply voltage**                 | V <sub>CC</sub>  | 4.5  | 5    | 5.5  | V    |
| Fan out (TTL load, each channel) | N                | —    | —    | 8    | —    |
| Operating temperature            | T <sub>opr</sub> | 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.

\* 13mA is a guard banded value which allows for at least 20% CTR degradation.

Initial input current threshold value is 10mA or less.

\*\*This item denotes operating ranges, not meaning of recommended operating conditions.

**Electrical Characteristics**(unless otherwise specified,  $T_a=0\sim70^{\circ}\text{C}$ ,  $V_{CC}=4.5\sim5.5\text{V}$ ,  $V_{FL}\leq 1.0\text{V}$ )

| Characteristic                                 | Symbol      | Test Condition                                                               | Min.              | Typ.      | Max. | Unit                    |
|------------------------------------------------|-------------|------------------------------------------------------------------------------|-------------------|-----------|------|-------------------------|
| Forward voltage                                | $V_F$       | $I_F=10\text{mA}$ , $T_a=25^{\circ}\text{C}$                                 | —                 | 1.65      | 1.80 | V                       |
| Forward voltage temperature coefficient        | $V_F / T_a$ | $I_F=10\text{mA}$                                                            | —                 | -2        | —    | mV / $^{\circ}\text{C}$ |
| Reverse current                                | $I_R$       | $V_R=5\text{V}$ , $T_a=25^{\circ}\text{C}$                                   | —                 | —         | 10   | $\mu\text{A}$           |
| Capacitance between terminals                  | $C_T$       | $V_F=0$ , $f=1\text{MHz}$ , $T_a=25^{\circ}\text{C}$                         | —                 | 45        | —    | pF                      |
| High level output current                      | $I_{OH}$    | $V_F=1.0$ , $V_O=5.5\text{V}$                                                | —                 | —         | 250  | $\mu\text{A}$           |
|                                                |             | $V_F=1.0$ , $V_O=5.5\text{V}$ , $T_a=25^{\circ}\text{C}$                     | —                 | 0.5       | 10   |                         |
| Low level output voltage                       | $V_{OL}$    | $I_F=10\text{mA}$<br>$I_{OL}=13\text{mA}$ (sinking)                          | —                 | 0.4       | 0.6  | V                       |
| "H level output→ L level output" input current | $I_{FH}$    | $I_{OL}=13\text{mA}$ (sinking)<br>$V_{OL}=0.6\text{V}$                       | —                 | —         | 10   | mA                      |
| High level supply current                      | $I_{CCH}$   | $V_{CC}=5.5\text{V}$ , $I_F=0$                                               | —                 | 7         | 15   | mA                      |
| Low level supply current                       | $I_{CCL}$   | $V_{CC}=5.5\text{V}$ , $I_F=16\text{mA}$                                     | —                 | 12        | 18   | mA                      |
| Input-output insulation leakage current        | $I_S$       | $V_S=3540\text{V}$ , $t=5\text{s}$<br>$T_a=25^{\circ}\text{C}$ (Note 4)      | —                 | —         | 100  | $\mu\text{A}$           |
| Isolation resistance                           | $R_S$       | R.H. $\leq 60\%$ , $V_S=500\text{V DC}$<br>$T_a=25^{\circ}\text{C}$ (Note 4) | $5\times 10^{10}$ | $10^{14}$ | —    | $\Omega$                |
| Stray capacitance between input to output      | $C_S$       | $V_S=0$ , $f=1\text{MHz}$<br>$T_a=25^{\circ}\text{C}$ (Note 4)               | —                 | 0.8       | —    | pF                      |

\* All typical values are  $V_{CC}=5\text{V}$ ,  $T_a=25^{\circ}\text{C}$

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

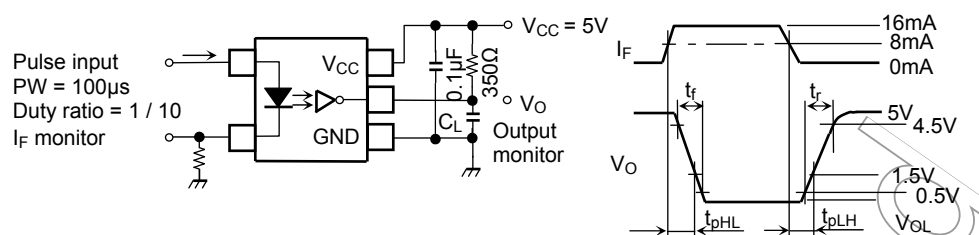
| Characteristic                                      | Symbol        | Test Cir-cuit | Test Condition                                                          | Min. | Typ. | Max. | Unit        |
|-----------------------------------------------------|---------------|---------------|-------------------------------------------------------------------------|------|------|------|-------------|
| Propagation delay time (H→L)                        | $t_{pHL}$     | 1             | $I_F=0 \rightarrow 16mA$<br>$C_L=15pF$ , $R_L=350\Omega$                | —    | 60   | 120  | ns          |
| Propagation delay time (L→H)                        | $t_{pLH}$     | 1             | $I_F=16 \rightarrow 0mA$<br>$C_L=15pF$ , $R_L=350\Omega$                | —    | 60   | 120  | ns          |
| Output rise-fall time (10–90%)                      | $t_r$ , $t_f$ | 2             | $R_L=350\Omega$ , $C_L=15pF$<br>$I_F=0 \rightleftharpoons 16mA$         | —    | 30   | —    | ns          |
| Common mode transient immunity at high output level | $CM_H$        | 2             | $I_F=0mA$ , $V_{CM}=200V_{p-p}$<br>$V_{O(min)}=2V$ , $R_L=350\Omega$    | —    | 200  | —    | V / $\mu s$ |
| Common mode transient immunity at low output level  | $CM_L$        | 2             | $I_F=16mA$ , $V_{CM}=200V_{p-p}$<br>$V_{O(max)}=0.8V$ , $R_L=350\Omega$ | —    | 500  | —    | V / $\mu s$ |

(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 TLP113 isolator must be bypassed by 0.1 $\mu F$  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.

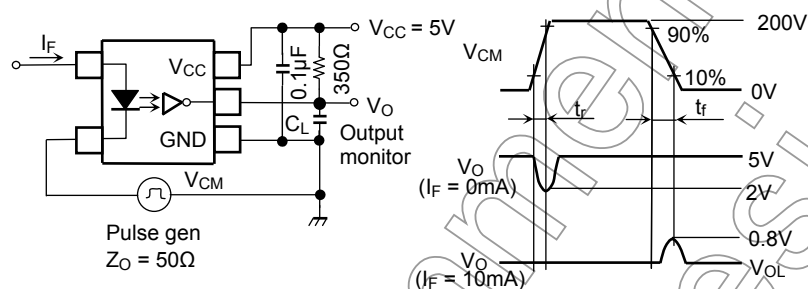
(Note 6) Maximum electrostatic discharge voltage for any pins: 180V(C=200pF, R=0)

## Test Circuit 1: Switching Time Test Circuit



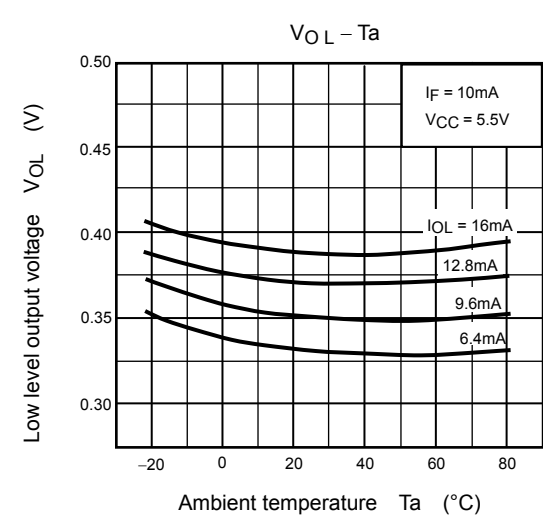
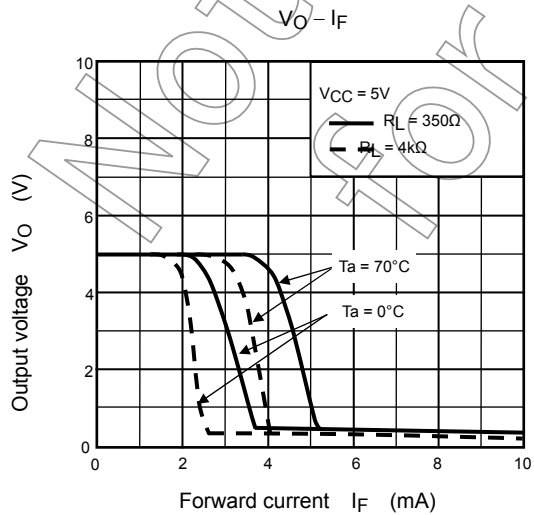
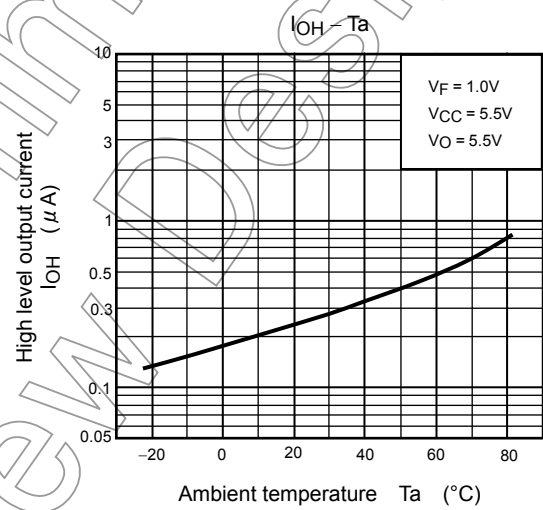
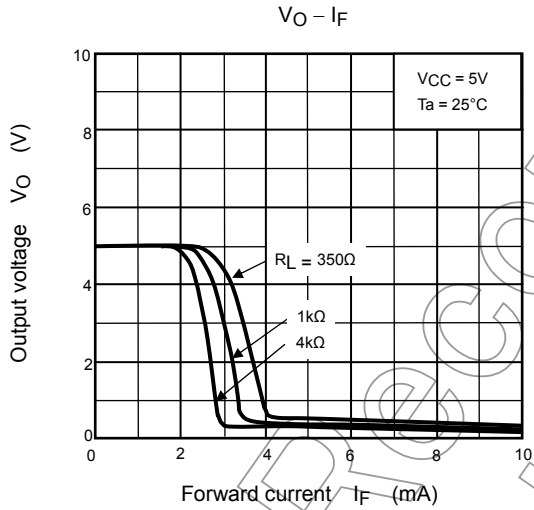
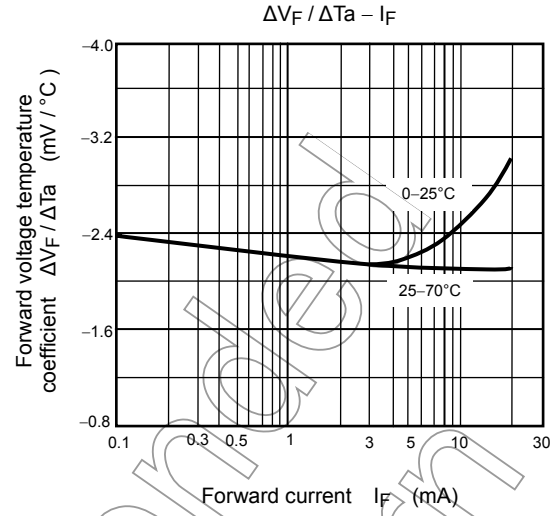
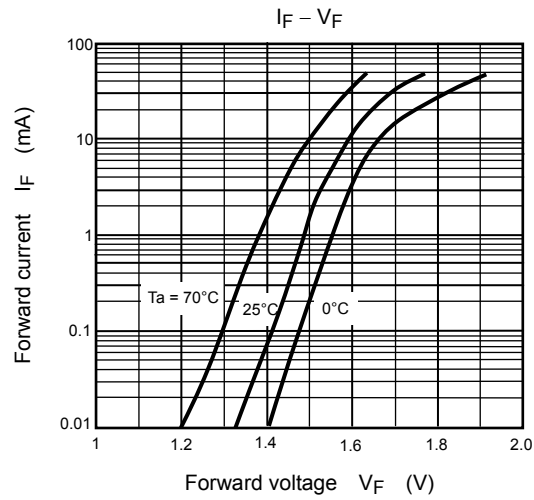
C<sub>L</sub> is approximately 15pF which includes probe and stray wiring capacitance.

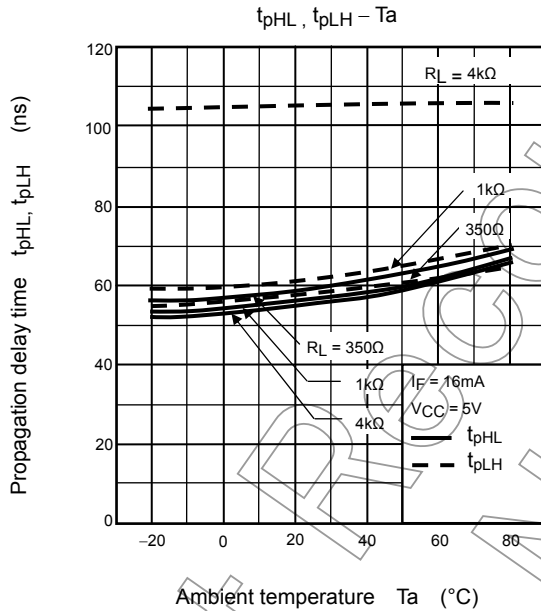
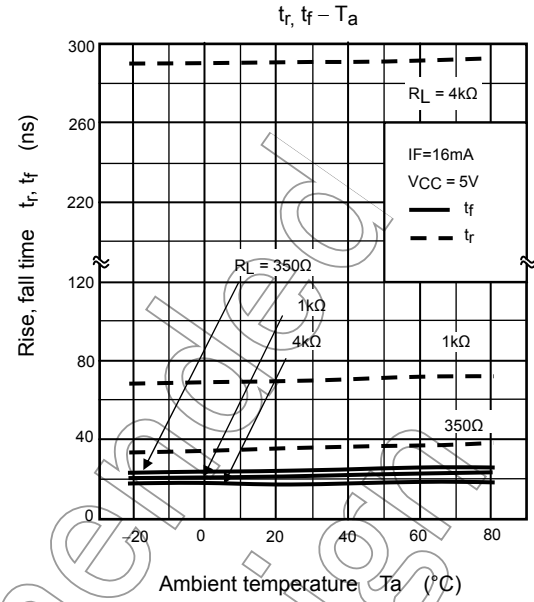
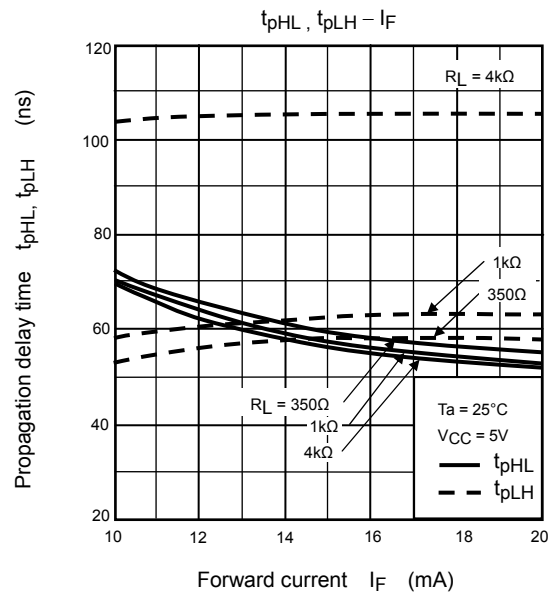
## Test Circuit 2: Common Mode Transient Immunity Test Circuit



$$CM_H = \frac{160(V)}{t_r(\mu s)}, CM_L = \frac{160(V)}{t_f(\mu s)}$$

C<sub>L</sub> is approximately 15pF which includes probe and stray wiring capacitance.





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