

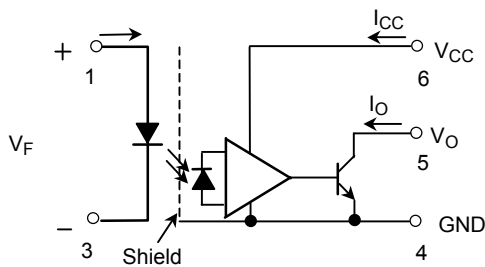
# TLP115A

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 /  $\mu$ s.

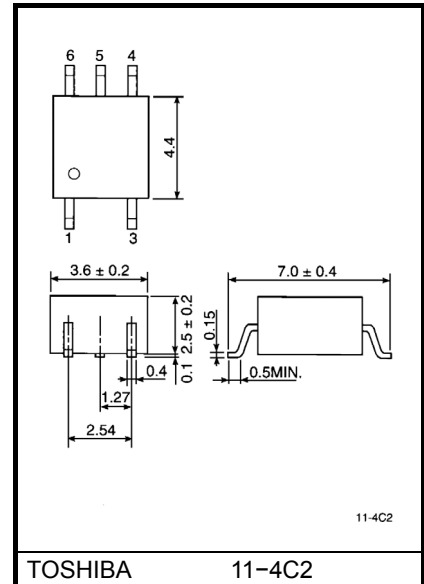
- Input current thresholds:  $I_F = 5\text{mA}$  (max.)
- Switching speed: 10MBd (typ.)
- Common mode transient immunity:  $\pm 1000\text{V} / \mu\text{s}$  (min.)
- Guaranteed performance over temp. : 0~70°C
- Isolation voltage: 2500Vrms (min.)
- UL recognized: UL1577, file no. E67349

### Schematic



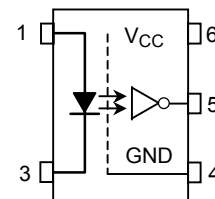
Note. A 0.1 $\mu$ F bypass capacitor must be connected between pins 4 and 6.

Unit in mm



TOSHIBA 11-4C2  
 Weight: 0.09g

### Pin Configuration (top view)



- 1 : Anode
- 3 : Cathode
- 4 : GND
- 5 : V<sub>O</sub>(Output)
- 6 : V<sub>CC</sub>

### Truth Table (positive logic)

Input	Output
H	L
L	H

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

Characteristic		Symbol	Rating	Unit
LED	Forward current (Note 1)	I <sub>F</sub>	20	mA
	Pulse forward current (Note 2)	I <sub>FP</sub>	40	mA
	Peak transient forward current (Note 3)	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(10 sec.)		T <sub>sol</sub>	260	°C
Isolation voltage(AC, 1 min., RH≤ 60%, Note 4)		BV <sub>S</sub>	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 <sub>FL</sub>	-3	0	1.0	V
Input current, high level	I <sub>FH</sub>	6.3	8	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.

## Electrical Characteristics (unless otherwise specified, $T_a = 0\sim 70^\circ\text{C}$ , $V_{CC} = 4.5 \sim 5.5\text{V}$ , $V_{FL} \leq 1.0\text{V}$ )

Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Forward voltage	$V_F$	$I_F = 10\text{mA}$ , $T_a = 25^\circ\text{C}$	1.2	1.4	1.7	V
Forward voltage temperature coefficient	$V_F / T_a$	$I_F = 10\text{mA}$	—	-2	—	mV / °C
Reverse current	$I_R$	$V_R = 3\text{V}$ , $T_a = 25^\circ\text{C}$	—	—	10	$\mu\text{A}$
Capacitance between terminals	$C_T$	$V_F = 0$ , $f = 1\text{MHz}$ , $T_a = 25^\circ\text{C}$	—	30	—	pF
High level output voltage	$I_{OH}$	$V_F = 1.0$ , $V_O = 5.5\text{V}$	—	—	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 current	$V_{OL}$	$I_F = 5\text{mA}$ $I_{OL} = 13\text{mA}$ (sinking)	—	0.4	0.6	V
"H level output→L level output" input current	$I_{FH}$	$I_{OL} = 13\text{mA}$ (sinking) $V_{OL} = 0.6\text{V}$	—	—	5	mA
High level supply current	$I_{CCH}$	$V_{CC} = 5.5\text{V}$ , $I_F = 0$	—	7	15	mA
Low level supply current	$I_{CCL}$	$V_{CC} = 5.5\text{V}$ , $I_F = 10\text{mA}$	—	12	19	mA
Input-output insulation leakage current	$I_S$	$V_S = 3540\text{V}$ , $t = 5\text{s}$ $T_a = 25^\circ\text{C}$ (Note 4)	—	—	100	$\mu\text{A}$
Isolation resistance	$R_S$	R.H. $\leq 60\%$ , $V_S = 500\text{V DC}$ $T_a = 25^\circ\text{C}$ (Note 4)	$5 \times 10^{10}$	$10^{14}$	—	$\Omega$
Stray capacitance between input to output	$C_S$	$V_S = 0$ , $f = 1\text{MHz}$ $T_a = 25^\circ\text{C}$ (Note 4)	—	0.8	—	pF

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

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

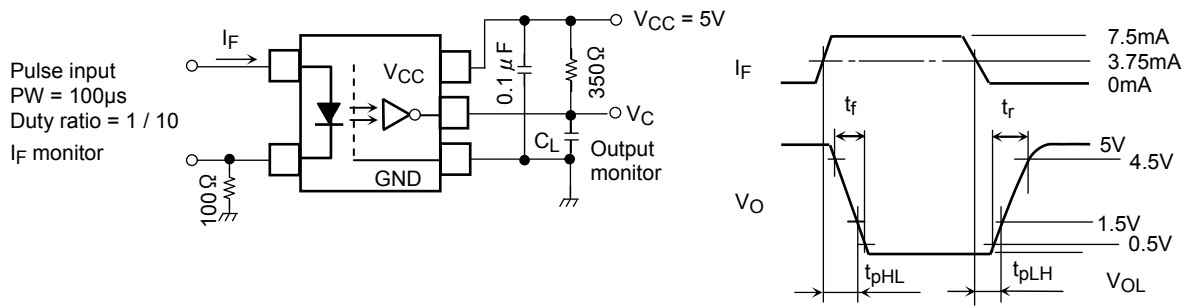
Characteristic	Symbol	Test Circuit	Test Condition	Min.	Typ.	Max.	Unit
Propagation delay time (H→L)	$t_{pHL}$	1	$I_F = 0 \rightarrow 7.5mA$ $C_L = 15pF$ , $R_L = 350\Omega$	—	60	120	ns
Propagation delay time (L→H)	$t_{pLH}$	1	$I_F = 7.5 \rightarrow 0mA$ $C_L = 15pF$ , $R_L = 350\Omega$	—	60	120	ns
Output 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 / $\mu s$
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 / $\mu s$

(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 TLP115A 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.

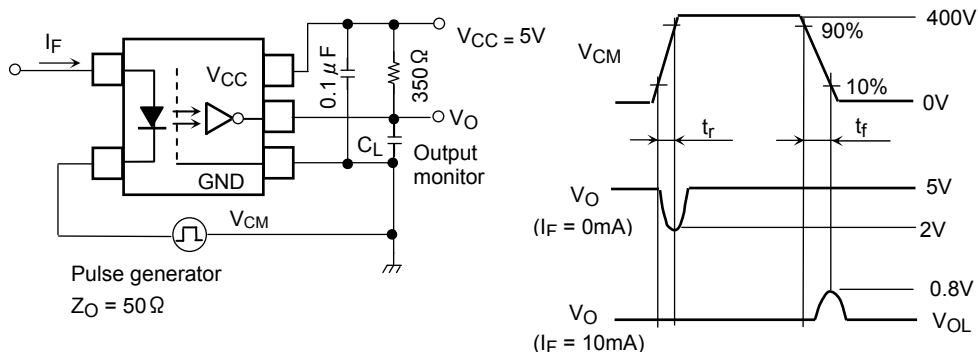
(Note 6) Maximum electrostatic discharge voltage for any pins: 180V(C = 200pF, R = 0)

**Test Circuit 1: Switching Time Test Circuit**



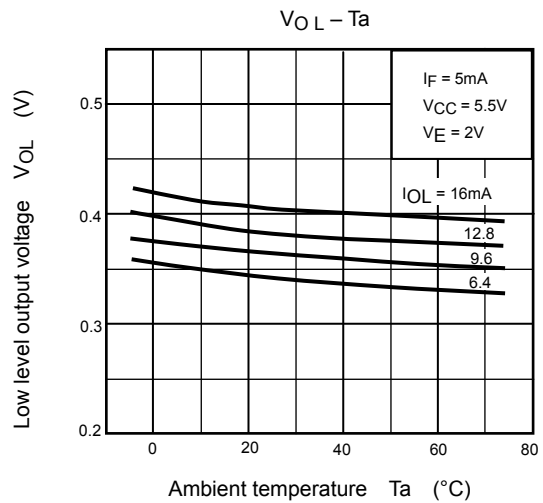
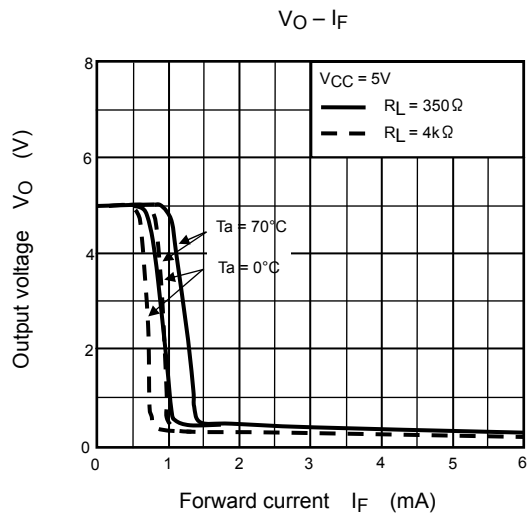
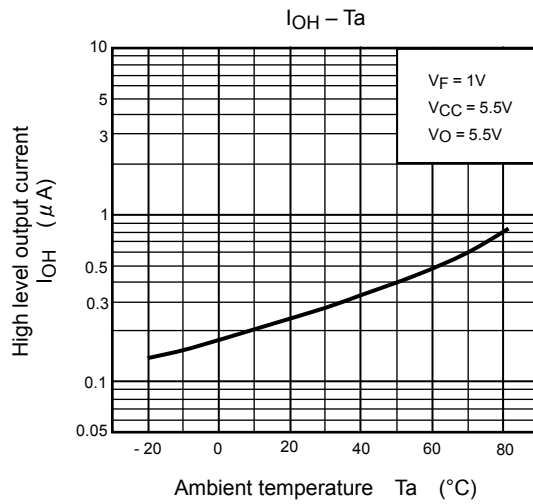
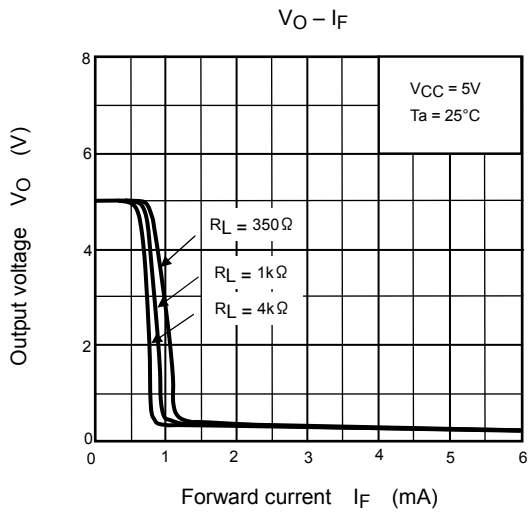
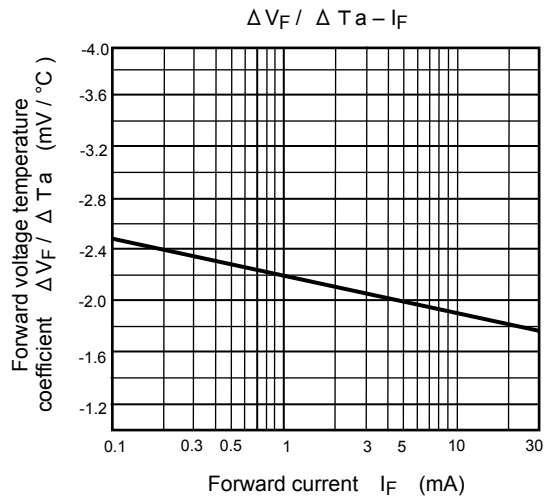
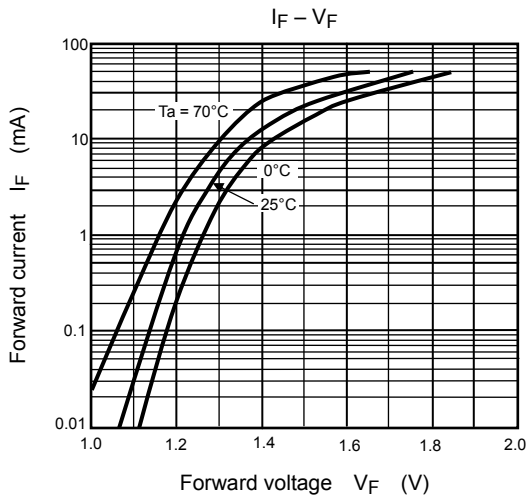
C<sub>L</sub> is approximately 15pF which includes probe and stray wiring capacitance.

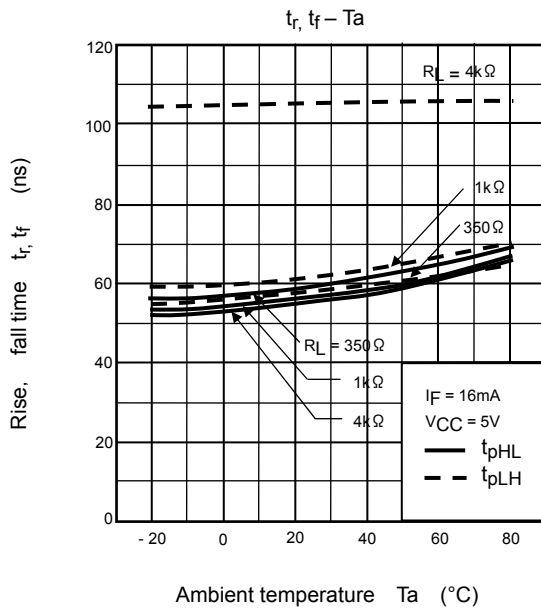
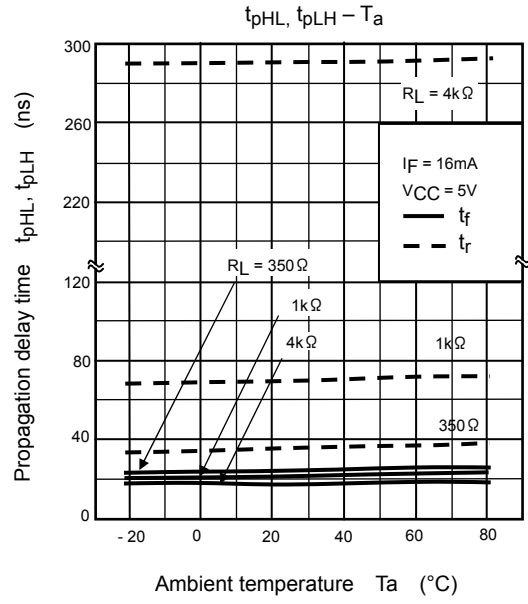
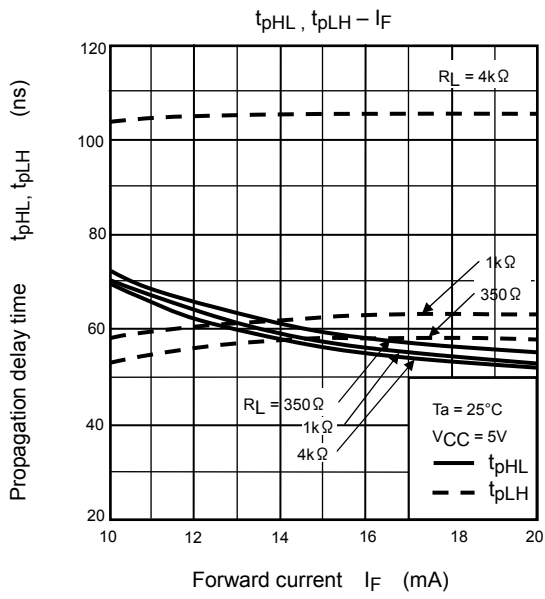
**Test Circuit 2: Common Mode Transient Immunity Test Circuit**



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

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





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20070701-EN

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