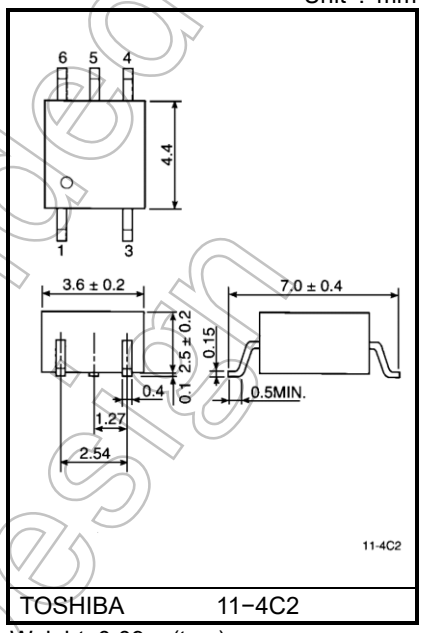
TOSHIBA Photocoupler IRED & Photo−IC

TLP115

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

Unit : mm



TOSHIBA 11−4C2

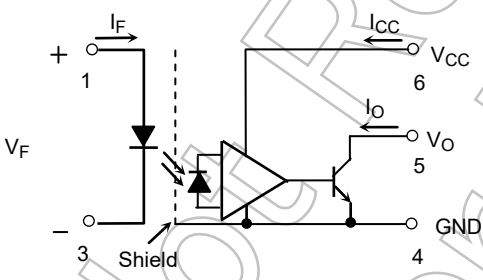
Weight: 0.09 g (typ.)

The TOSHIBA mini flat coupler TLP115 is small outline coupler, suitable for surface mount assembly.TLP115 consists of an infrared 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 / μs.

TLP115 : Mini Flat Package, 5Pin, one circuit.

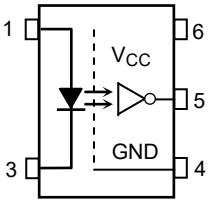
- Input current thresholds: I_F=10mA (max)
- Switching speed: 10MBd (typ.)
- Common mode transient immunity: ±1000V / μs (min)
- Guaranteed performance over temp.: 0 to 70°C
- Isolation voltage: 2500Vrms (min)
- UL-recognized: UL 1577, File No.E67349
- cUL-recognized: CSA Component Acceptance Service No.5A
  File No.E67349

Schematic



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

Pin Configuration(top view)



1 : Anode
3 : Cathode
4 : GND
5 : V_O(Output)
6 : V_{CC}

Truth Table(positive logic)

Input	Output
H	L
L	H

Start of commercial production
1988-04

Absolute Maximum Ratings (Ta = 25°C)

Characteristics			Symbol	Rating	Unit
LED	Forward current		I_F	20	mA
	Forward current derating	(Ta≥85 °C)	ΔIF/°C	-1.6	mA/°C
	Pulse forward current	(Note 1)	I_{FP}	40	mA
	Peak transient forward current	(Note 2)	I_{FPT}	1	A
	Reverse voltage		V_R	5	V
	Input power dissipation		P_D	40	mW
	Input power dissipation derating	(Ta≥85 °C)	ΔPD/°C	-1.0	mW/°C
Detector	Output current		I_O	25	mA
	Output voltage		V_O	7	V
	Supply voltage	(60 s maximum)	V_{CC}	7	V
	Output power dissipation		Po	40	mW
	Output power dissipation derating	(Ta≥85 °C)	ΔPO/°C	-2.6	mW/°C
Operating temperature range			T_{opr}	−40 to 85	°C
Storage temperature range			T_{stg}	−55 to 125	°C
Lead solder temperature	(10 s)		T_{sol}	260	°C
Isolation voltage (AC, 60 s., RH ≤ 60 %)		(Note 3)	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): 50 % duty cycle, 1 ms pulse width.

(Note 2): Pulse width ≤ 1 μs, 300 pps.

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

Recommended Operating Conditions

Characteristics	Symbol	Min	Typ.	Max	Unit
Input voltage, low level	V_{FL}	−3	0	1.0	V
Input current, high level	I_{FH}	13*	16	20	mA
Supply voltage	V_{CC}	4.5	5	5.5	V
Fan out (TTL load)	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.

*: 13 mA is a value considering 20 % I_{FH} deterioration.
Initial input current threshold value is 10mA or less.

Electrical Characteristics

(unless otherwise specified, Ta = 0 to 70°C, V_{CC} = 4.5 to 5.5V, V_{FL} ≤ 1.0V)

Characteristics	Symbol	Test Condition	Min	Typ.*	Max	Unit
Forward voltage	V_F	I_F = 10 mA, Ta = 25 °C	—	1.65	1.80	V
Forward voltage temperature coefficient	$\Delta V_F/\Delta Ta$	I_F = 10 mA	—	−2.0	—	mV / °C
Reverse current	I_R	V_R = 5 V, Ta = 25 °C	—	—	10	μA
Capacitance between terminals	C_T	V_F = 0 V, f = 1 MHz, Ta = 25 °C	—	45	—	pF
High level output current	I_{OH}	V_F = 1 V, V_O = 5.5 V	—	—	250	μA
		V_F = 1 V, V_O = 5.5 V, Ta = 25 °C	—	0.5	10	
Low level output voltage	V_{OL}	I_F = 10 mA I_{OL} = 13 mA(sinking)	—	0.4	0.6	V
"H level output→ L level output" input current	I_{FH}	I_{OL} = 13 mA(sinking) V_{OL} = 0.6 V	—	—	10	mA
High level supply current	I_{CCH}	V_{CC} = 5.5 V, I_F = 0 mA	—	7	15	mA
Low level supply current	I_{CCL}	V_{CC} = 5.5 V, I_F = 16mA	—	12	18	mA
Isolation resistance	R_S	R.H.≤ 60 %, V_S = 500 VDC Ta = 25 °C (Note 1)	5×10^{10}	10^{14}	—	Ω
Stray capacitance between input to output	C_S	V_S = 0 V, f = 1 MHz Ta = 25 °C (Note 1)	—	0.8	—	pF

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

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

Switching Characteristics(V_{CC} = 5V, Ta = 25°C)

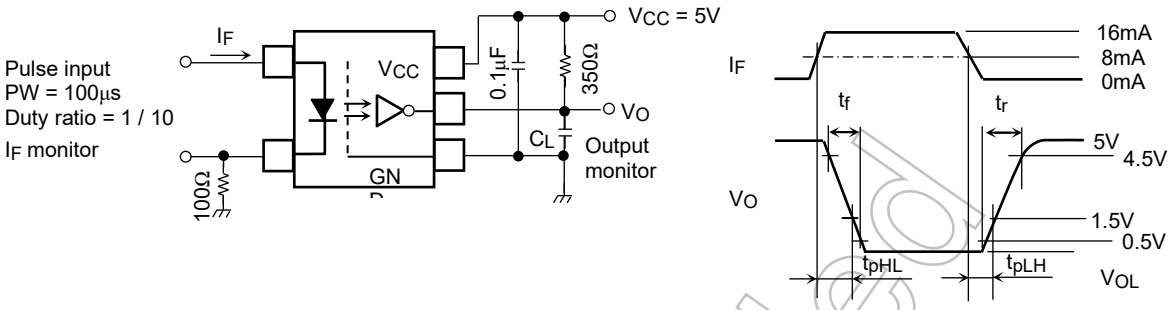
Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Propagation delay time (H→L)	t_{pHL}	1	I_F = 0→ 16 mA C_L = 15 pF, R_L = 350 Ω	—	60	120	ns
Propagation delay time (L→H)	t_{pLH}	1	I_F = 16→ 0 mA C_L = 15 pF, R_L = 350 Ω	—	60	120	ns
Output rise fall time (10−90%)	t_r, t_f	1	R_L = 350 Ω, C_L = 15 pF I_F = 0 ⇄ 16 mA	—	30	—	ns
Common mode transient immunity at high output level	CM_H	2	I_F =0 mA, V_{CM} = 400 V_{p-p} $V_{O(min)}$ = 2 V, R_L = 350 Ω (Note 1)	1000	—	—	V / μs
Common mode transient immunity at low output level	CM_L	2	I_F = 16 mA, V_{CM} = 400V $_{p-p}$ $V_{O(max)}$ = 0.8 V,R_L = 350 Ω (Note 2)	−1000	—	—	V / μs

(Note): The V_{CC} supply voltage to each TLP115 isolator must be bypassed by 0.1 μF capacitor. This can be either a ceramic or solid tantalum capacitor with good high frequency characterstic and should be connected as close as possible to package V_{CC} and GND pins of each device.

(Note 1): CMH is the maximum rising common mode voltage waveform (voltage/time) that can keep high level (V_O> 2.0 V).

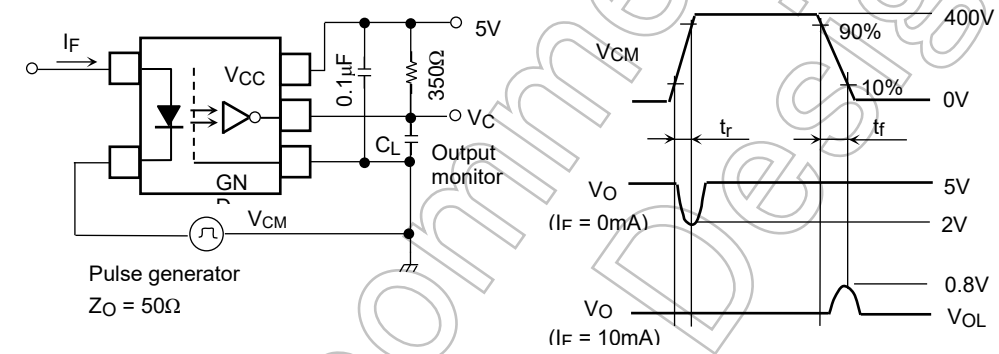
(Note 2): CML is the maximum falling common mode voltage waveform (voltage/time) that can keep low level (V_O < 0.8 V).

Test Circuit 1: Switching Time Test Circuit



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

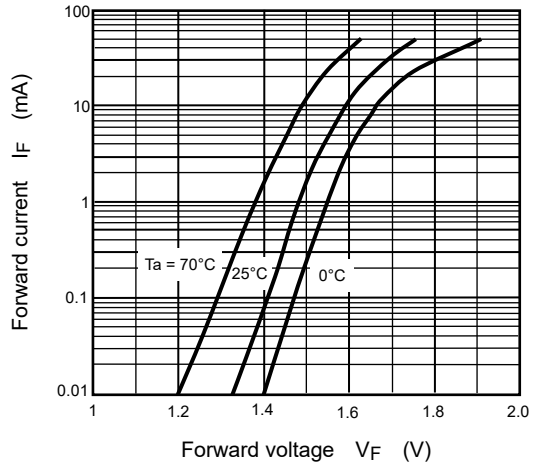
Test Circuit 2: Common Mode Transient Immunity Test Circuit



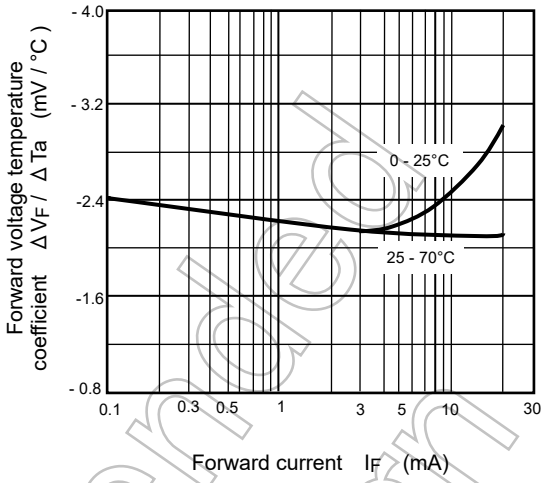
$$CM_H = \frac{320(V)}{t_r(\mu s)}, CM_L = \frac{320(V)}{t_f(\mu s)}$$

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

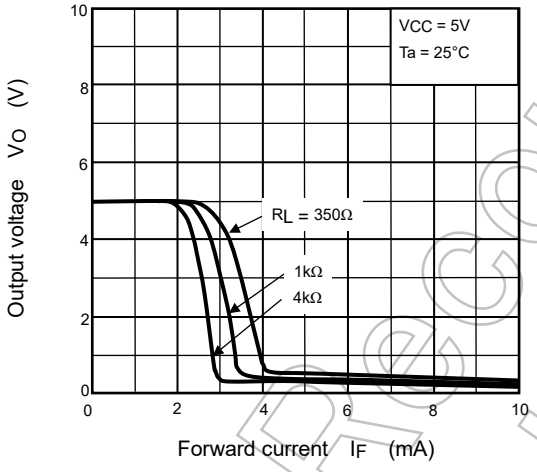
$I_F - V_F$



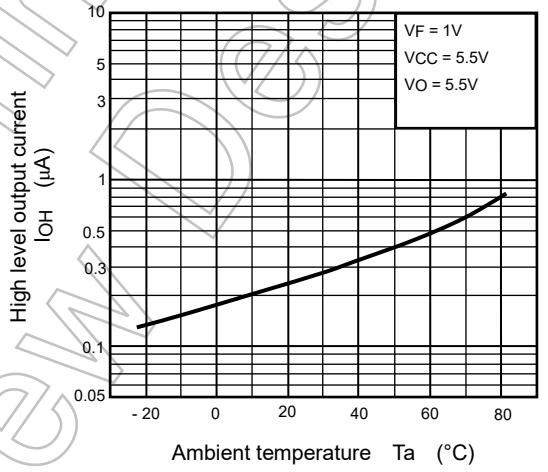
$\Delta V_F / \Delta Ta - I_F$



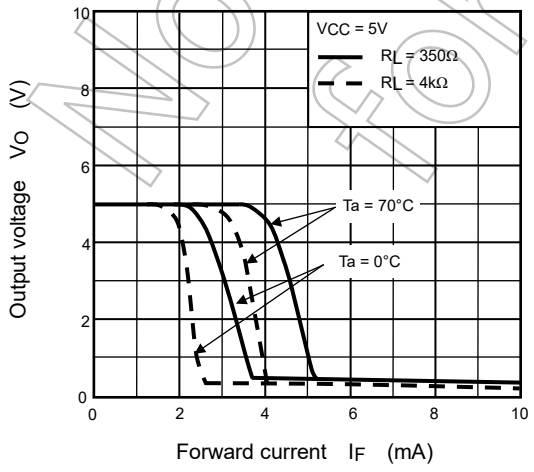
$V_O - I_F$



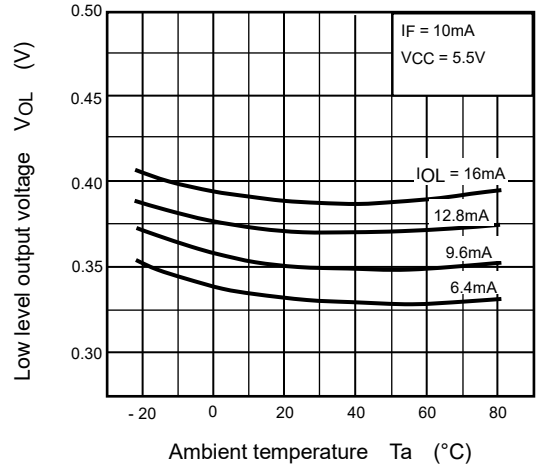
I_{OH} - Ta



$V_O - I_F$

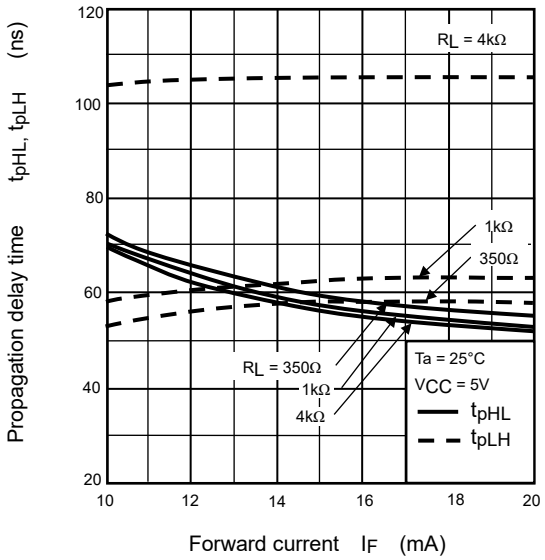


$V_{OL} - Ta$

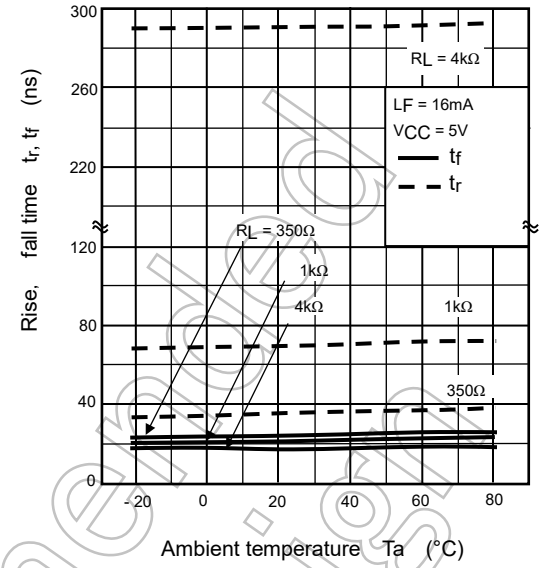


NOTE: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

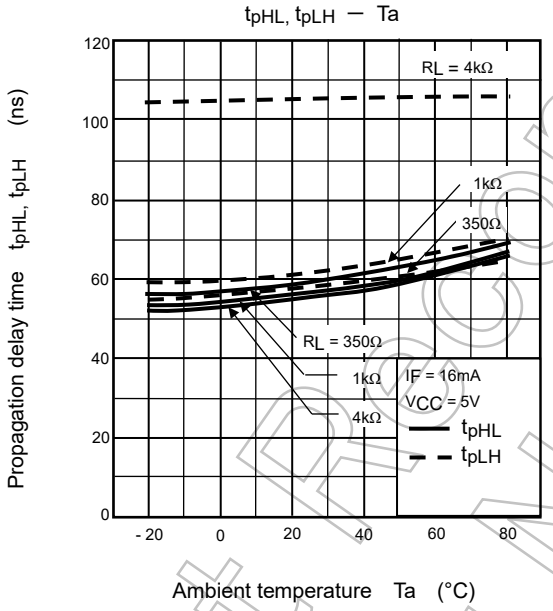
t_{pHL}, t_{pLH} – I_F



t_r, t_f – T_a



t_{pHL}, t_{pLH} – Ta



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