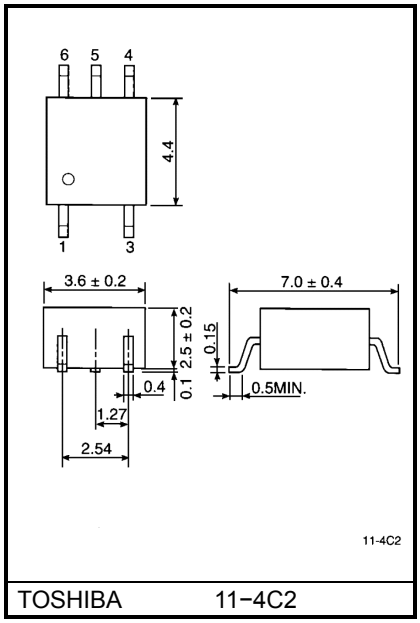
TOSHIBA Photocoupler GaAℓAs IRed & Photo−IC

TLP113

Isolated Line Receiver
Simplex / Multiplex Data Transmission
Computer−Peripheral Interface
Microprocessor System Interface
Digital Isolation For A / D, D / A Conversion

Unit in mm



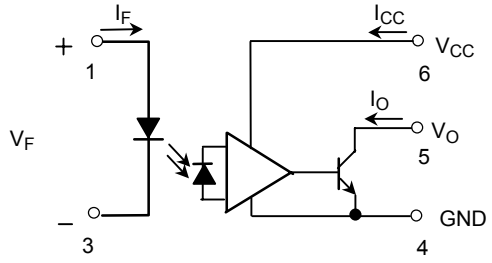
TOSHIBA 11−4C2

Weight: 0.09g

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.

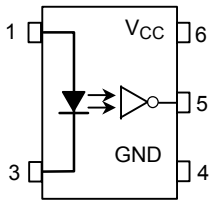
- Input current thresholds: I_F=10mA(max.)
- Switching speed: 10MBd(typ.)
- TTL / LSTTL compatible: V_{CC}=5V
- Guaranteed performance over temp.: 0~70°C
- Isolation voltage: 2500Vrms(min.)
- UL recognized: UL1577 file no. E67349

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 : Output
(Open collector)
6 : V_{CC}

TRUTH TABLE (Positive Logic)

INPUT	OUTPUT
H	L
L	H

Maximum Ratings(Ta = 25°C)

Characteristic			Symbol	Rating	Unit
LED	Forward current		I_F	20	mA
	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
Detector	Output current		I_O	25	mA
	Output voltage		V_O	7	V
	Supply voltage (1 minute maximum)		V_{CC}	7	V
	Output power dissipation		P_O	40	mW
Operating temperature range			T_{opr}	−40~85	°C
Storage temperature range			T_{stg}	−55~125	°C
Lead solder temperature (10s)			T_{sol}	260	°C
Isolation voltage (AC, 1 min., RH ≤ 60%,		Note 4)	BV_S	2500	Vrms

(Note 1) 50% duty cycle, 1ms pulse width.

(Note 2) Pulse width≤1μs, 300pps.

Recommende Operating Conditions

Characteristic	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, each channel)	N	—	—	8	—
Operating temperature	T_{opr}	0	—	70	°C

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

Initial input current threshold value is 10mA or less.

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

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

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

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

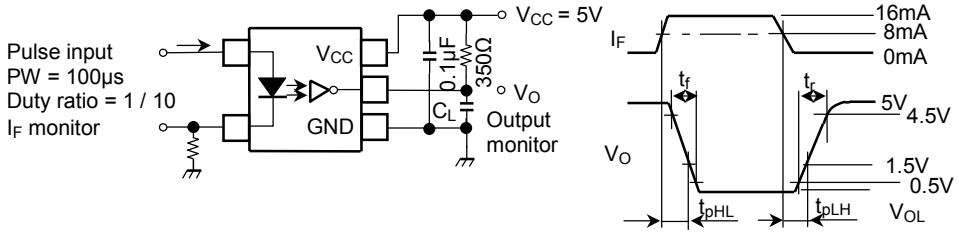
Characteristic	Symbol	Test Circuit	Test Condition	Min.	Typ.	Max.	Unit
Propagation delay time (H→L)	t_pHL	1	I_F=0→16mA C_L=15pF, R_L=350Ω	—	60	120	ns
Propagation delay time (L→H)	t_pLH	1	I_F=16→0mA C_L=15pF, R_L=350Ω	—	60	120	ns
Output rise−fall time (10−90%)	t_r, t_f	2	R_L=350Ω, C_L=15pF I_F=0⇄16mA	—	30	—	ns
Common mode transient imunity at high output level	CM_H	2	I_F=0mA, V_{CM}=200V_{p-p} $V_{O(min)}$=2V, R_L=350Ω	—	200	—	V / μs
Common mode transient imunity at low output level	CM_L	2	I_F=16mA, V_{CM}=200V_{p-p} $V_{O(max)}$=0.8V, R_L=350Ω	—	−500	—	V / μs

(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 0.1μF 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.

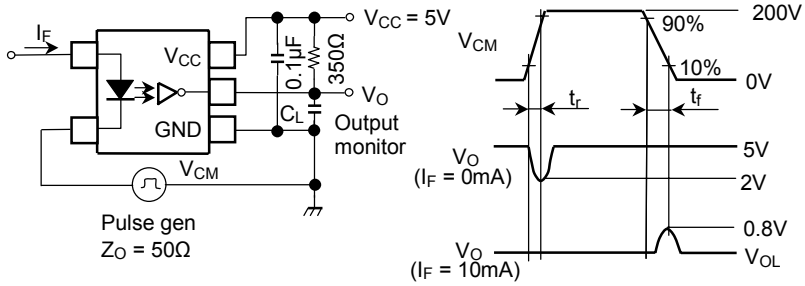
(Note 6) Maximum electrostatic discharge voltage for any pins: 180V(C=200pF, R=0)

Test Circuit 1: Switching Time Test Circuit



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

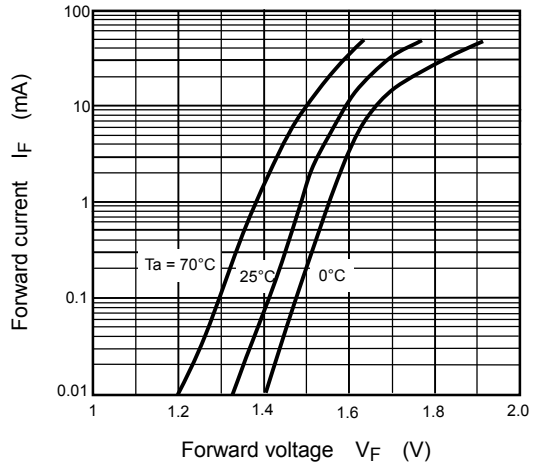
Test Circuit 2: Common Mode Transient Immunity Test Circuit



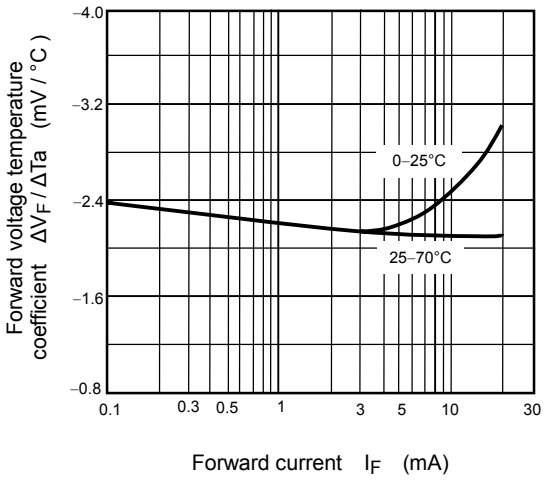
$$CM_H = \frac{160(V)}{t_r(\mu s)}, CM_L = \frac{160(V)}{t_f(\mu s)}$$

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

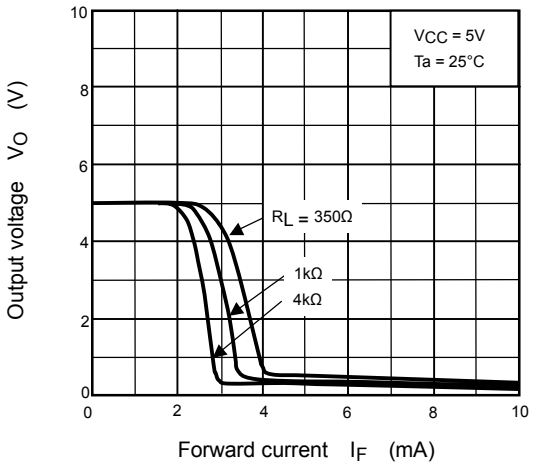
$I_F - V_F$



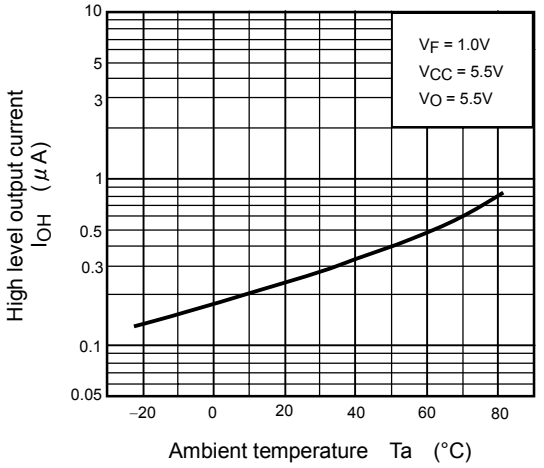
$\Delta V_F / \Delta Ta - I_F$



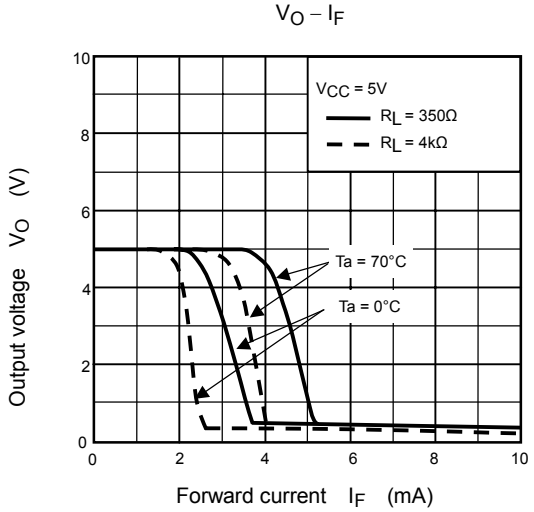
$V_O - I_F$



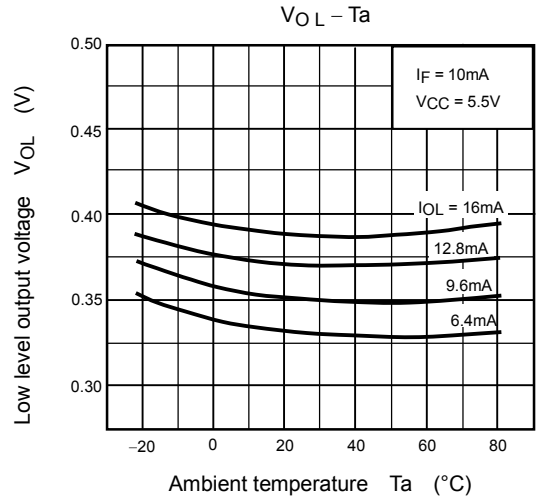
$I_{OH} - Ta$



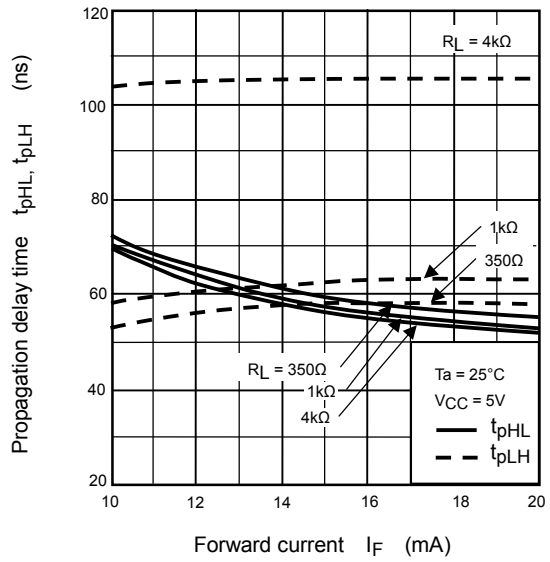
$V_O - I_F$



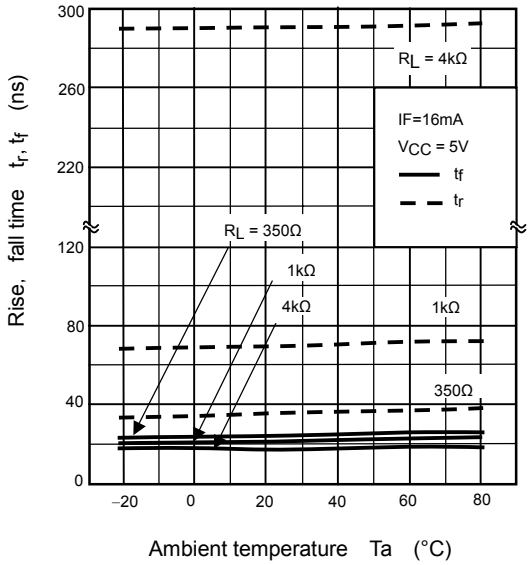
$V_{OL} - Ta$



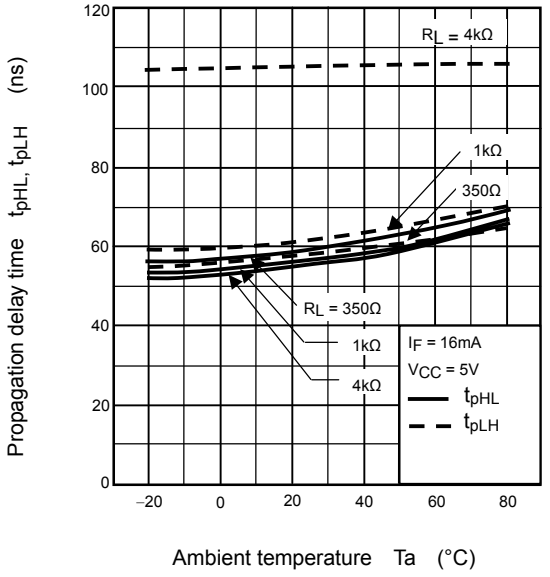
t_{pHL} , t_{pLH} – I_F



t_r, t_f – T_a



t_{pHL} , t_{pLH} – Ta



RESTRICTIONS ON PRODUCT USE

000707EBC

- TOSHIBA is continually working to improve the quality and reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to comply with the standards of safety in making a safe design for the entire system, and to avoid situations in which a malfunction or failure of such TOSHIBA products could cause loss of human life, bodily injury or damage to property.
  In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent TOSHIBA products specifications. Also, please keep in mind the precautions and conditions set forth in the “Handling Guide for Semiconductor Devices,” or “TOSHIBA Semiconductor Reliability Handbook” etc..
- The TOSHIBA products listed in this document are intended for usage in general electronics applications (computer, personal equipment, office equipment, measuring equipment, industrial robotics, domestic appliances, etc.). These TOSHIBA products are neither intended nor warranted for usage in equipment that requires extraordinarily high quality and/or reliability or a malfunction or failure of which may cause loss of human life or bodily injury (“Unintended Usage”). Unintended Usage include atomic energy control instruments, airplane or spaceship instruments, transportation instruments, traffic signal instruments, combustion control instruments, medical instruments, all types of safety devices, etc.. Unintended Usage of TOSHIBA products listed in this document shall be made at the customer’s own risk.
- Gallium arsenide (GaAs) is a substance used in the products described in this document. GaAs dust and fumes are toxic. Do not break, cut or pulverize the product, or use chemicals to dissolve them. When disposing of the products, follow the appropriate regulations. Do not dispose of the products with other industrial waste or with domestic garbage.
- The products described in this document are subject to the foreign exchange and foreign trade laws.
- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA CORPORATION for any infringements of intellectual property or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any intellectual property or other rights of TOSHIBA CORPORATION or others.
- The information contained herein is subject to change without notice.