TOSHIBA PHOTOCOUPLER GaAℓAs IRED & PHOTO-IC

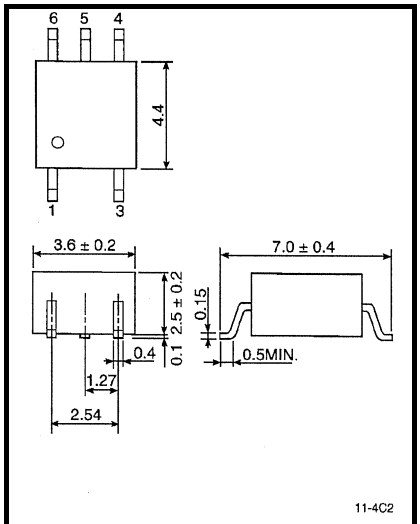
TLP108

Isolated bus drivers

High speed line receivers

Microprocessor system interfaces

Unit in mm



JEDEC	—
TOSHIBA	11-4C2

Weight: 0.09 g (typ.)

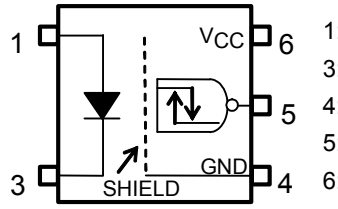
The Toshiba TLP108 consists of a GaAℓAs light emitting diode optically coupled to a high-gain, high-speed photodetector.
The TLP108 is housed in a 6-pin MFSOP.
With a totem-pole output, the TLP108 is capable of both sinking and sourcing current.
The TLP108 has an internal Faraday shield, which provides a guaranteed common-mode transient immunity of ±10 kV/μs.
The TLP108 has an inverting output. A noninverting-output version, the TLP105, is also available.

- Inverter logic type (totem-pole output)
- Guaranteed Performance Over temperature: -40 to 100°C
- Power Supply Voltage: 4.5 to 20 V
- Input Threshold Current: I_{FHL} =1.6 mA (max)
- Switching Time (t_{pLH}/t_{pHL}): 250 ns (max)
- Common mode transient immunity: ±10 kV/μs
- Isolation Voltage: 3750 Vrms

Truth Table

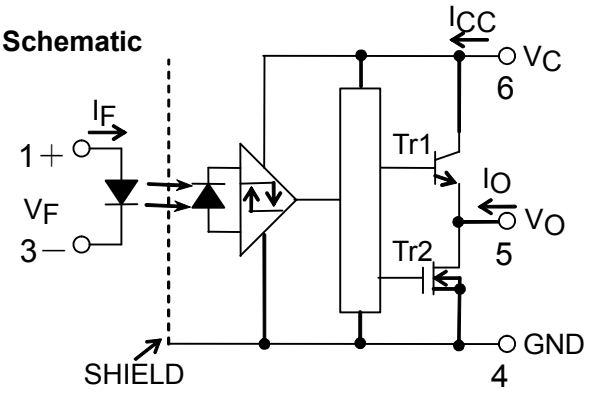
Input	LED	Tr1	Tr2	Output
H	ON	OFF	ON	L
L	OFF	ON	OFF	H

Pin Configuration (top View)



1:ANODE
3:CATHODE
4:GND
5:V_O(Output)
6:V_{CC}

Schematic



0.1 μF bypass capacitor must be connected between pin 6 and 4.

Recommended Operating Conditions

CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX	UNIT
Input Current , ON	$I_{F(ON)}$	2	—	10	mA
Input Voltage , OFF	$V_{F(OFF)}$	0	—	0.8	V
Supply Voltage*	V_{CC}	4.5	—	20	V
Operating Temperature	T_{opr}	-40	—	100	°C
Fan-out (TTL Load)	N	—	—	4	—

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

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.

Absolute Maximum Ratings (Ta = 25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
LED	Forward Current	I_F	20	mA
	Peak Transient Forward Current (Note1)	I_{FPT}	1	A
	Reverse Voltage	V_R	5	V
DETECTOR	Output Current 1 (Ta ≤ 25°C)	I_{O1}	25/-15	mA
	Output Current 2 (Ta ≤ 100°C)	I_{O2}	5/-5	mA
	Peak Output Current (Note2)	I_{OP}	50/-50	mA
	Output Voltage	V_O	-0.5 to 20	V
	Supply Voltage	V_{CC}	-0.5 to 20	V
Operating Temperature Range		T_{opr}	-40 to 100	°C
Storage Temperature Range		T_{stg}	-55 to 125	°C
Lead Solder Temperature (10s)		T_{sol}	260	°C
Isolation Voltage (AC,1min.,R.H. ≤ 60%,Ta=25°C) (Note3)		BV_S	3750	V_{rms}

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: Pulse width ≤ 1μs, 300pps.

Note 2: Pulse width ≤ 5μs, duty cycle ≤ 0.025

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

Electrical Characteristics
(Unless otherwise specified, Ta = -40 to 100°C, V_{CC} = 4.5 to 20 V)

CHARACTERISTIC	SYMBOL	TEST CIRCUIT	CONDITION		MIN	TYP.	MAX	UNIT
Input Forward Voltage	V_F	—	I_F=10 mA , Ta=25°C		1.45	1.57	1.75	V
Temperature Coefficient of Forward Voltage	$\Delta V_F/\Delta Ta$	—	I_F=10 mA		—	-2.0	—	mV/°C
Input Reverse Current	I_R	—	V_R=5 V , Ta=25°C		—	—	10	μA
Input Capacitance	C_T	—	V=0 , f=1 MHz , Ta=25°C		—	100	—	pF
Logic Low Output Voltage	V_{OL}	1	I_{OL}=3.5 mA , I_F=5 mA		—	0.2	0.6	V
Logic High Output Voltage	V_{OH}	2	I_{OH}=-2.6 mA, V_F=0.8 V	V_{CC}=4.5 V	2.7	4.0	—	V
				V_{CC}=20 V	17.4	19.0	—	
Logic Low Supply Current	I_{CCL}	3	I_F=5 mA	V_{CC}=20 V	—	—	3.0	mA
				V_{CC}=5.5 V	—	—	3.0	
Logic High Supply Current	I_{CCH}	4	V_F=0 V	V_{CC}=20 V	—	—	3.0	mA
				V_{CC}=5.5 V	—	—	3.0	
Logic Low Short Circuit Output Current (Note4)	I_{OSL}	5	I_F=5 mA V_O=GND	V_{CC}=VO=5.5 V	15	80	—	mA
				V_{CC}=VO=20 V	20	90	—	
Logic High Short Circuit Output Current (Note4)	I_{OSH}	6	V_F=0 V	V_{CC}=5.5 V	-5	-15	—	mA
				V_{CC}=20 V	-10	-20	—	
Input Current Logic Low Output	I_{FHL}	—	I_O=3.5 mA,V_O<0.4 V		—	0.4	1.6	mA
Input Voltage Logic High Output	V_{FLH}	—	I_O=-2.6 mA,V_O>2.4 V		0.8	—	—	V
Input Current Hysteresis	I_{HYS}	—	V_{CC}=5 V		—	0.05	—	mA

*All typical values are at Ta=25°C

Note 4: Duration of output short circuit time should not exceed 10 ms.

Isolation Characteristics (Ta = 25°C)

Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Capacitance input to output	C_S	V_S = 0,f = 1 MHz (Note 3)	—	0.8	—	pF
Isolation resistance	R_S	R.H. ≤ 60%,V_S = 500 V (Note 3)	1×10^{12}	10^{14}	—	Ω
Isolation voltage	BV_S	AC,1 minute	3750	—	—	V_{rms}
		AC,1 second,in oil	—	10000	—	
		DC,1 minute,in oil	—	10000	—	V_{dc}

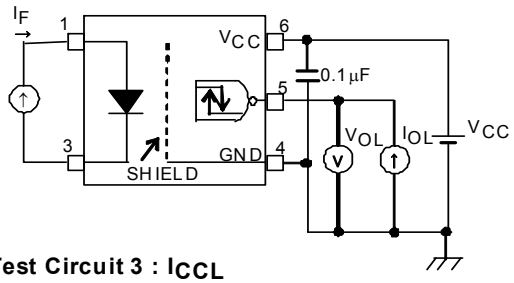
Note 5: A ceramic capacitor (0.1μA) should be connected from pin 6 to pin 4 to stabilize the operation of the high gain linear amplifier. Failure to provide the bypassing may impair the switching property. The total lead length between capacitor and coupler should not exceed 1 cm.

Switching Characteristics
(Unless otherwise specified, Ta = -40 to 100°C, V_{CC} = 4.5 to 20 V)

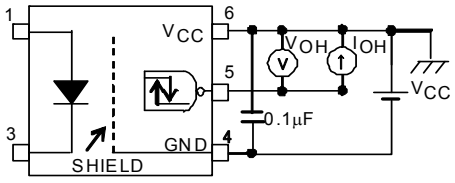
CHARACTERISTIC	SYMBOL	TEST CIRCUIT	CONDITION	MIN.	TYP.	MAX.	UNIT
Propagation Delay Time to Logic High output	t_{pLH}	7, 8	I_F=3→0mA	30	150	250	ns
Propagation Delay Time to Logic Low output	t_{pHL}		I_F=0→3mA	30	150	250	ns
Switching Time Dispersion between ON and OFF	$\|t_{pHL}-t_{pLH}\|$		—	—	—	220	ns
Rise Time (10 – 90 %)	t_r		I_F=3→0mA , V_{CC}=5V	—	30	75	ns
Fall Time (90 – 10 %)	t_f		I_F=0→3mA , V_{CC}=5V	—	30	75	ns
Common Mode transient Immunity at High Level Output	CM_H	9	V_{CM}=1000V_{p-p}, I_F=0mA, V_{CC}=20V,Ta=25°C	-10000	—	—	V/μs
Common Mode transient Immunity at Low Level Output	CM_L		V_{CM}=1000V_{p-p}, I_F=5mA, V_{CC}=20V,Ta=25°C	10000	—	—	V/μs

*All typical values are at Ta=25°C

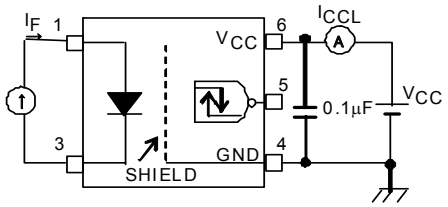
Test Circuit 1 : V_{OL}



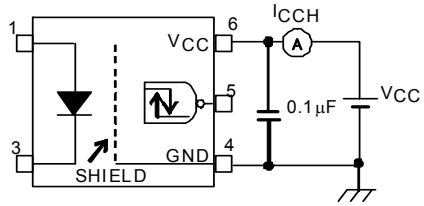
Test Circuit 2 : V_{OH}



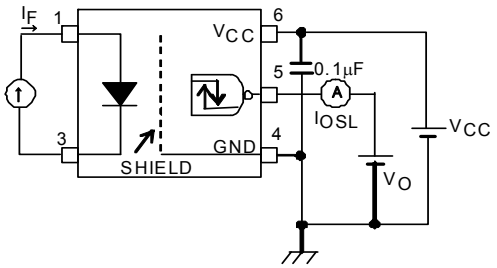
Test Circuit 3 : I_{CCL}



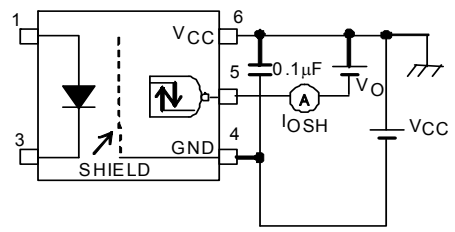
Test Circuit 4 : I_{CCH}



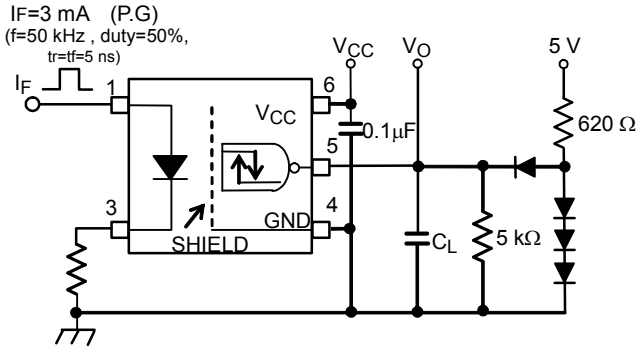
Test Circuit 5 : I_{OSL}



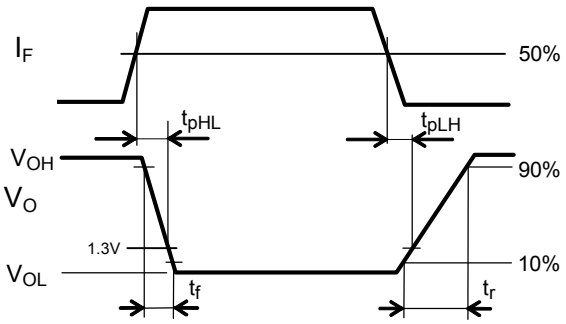
Test Circuit 6 : I_{OSH}



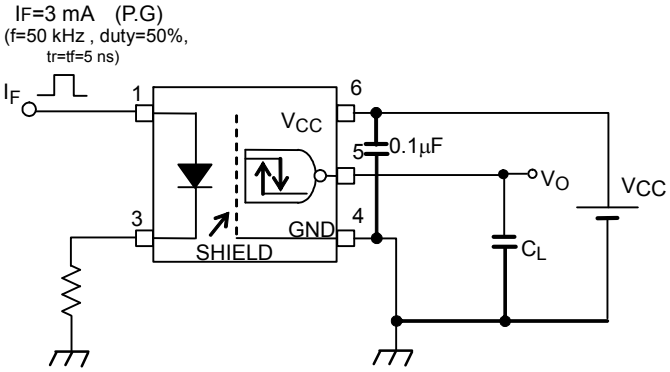
Test Circuit 7: Switching Time Test Circuit



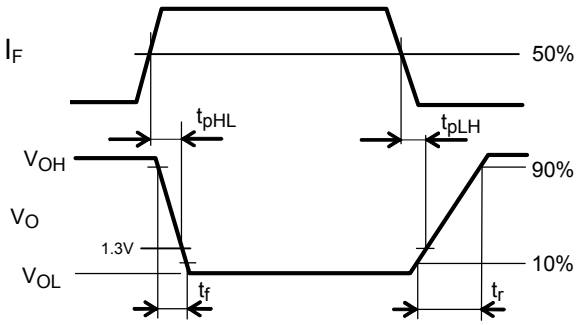
C_L is approximately 15 pF which includes probe and stray wiring capacitance.
P.G.: Pulse generator



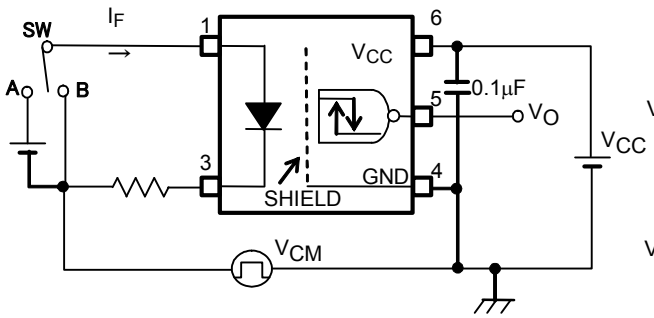
Test Circuit 8: Switching Time Test Circuit

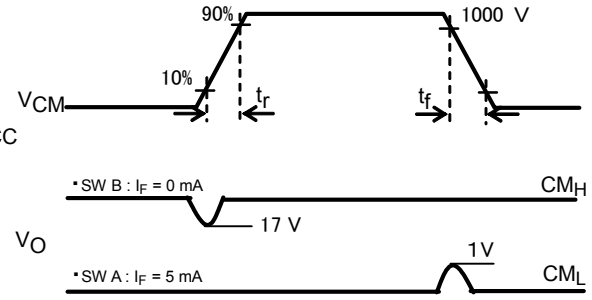


C_L is approximately 15 pF which includes probe and stray wiring capacitance.
P.G.: Pulse generator



Test Circuit 9: Common Mode Transient Immunity Test Circuit





$$CM_H = \frac{800(V)}{t_f(\mu s)} \qquad CM_L = \frac{800(V)}{t_r(\mu s)}$$

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