TOSHIBA PHOTOCOUPLER IRED & PHOTO-IC

TLP105

Isolated bus drivers

High-speed line receivers

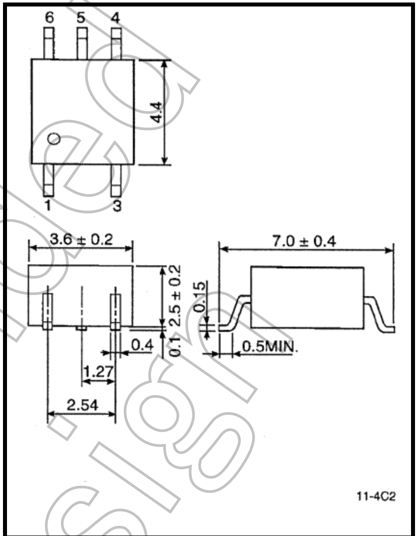
Microprocessor system interfaces

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

- Buffer 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_{FLH} =1.6 mA (max)
- Switching Time (t_{pLH}/t_{pHL}): 250 ns (max)
- Common mode transient immunity: ±10 kV/μs
- Isolation Voltage: 3750 Vrms
- UL-recognized: UL 1577, File No.E67349
- cUL-recognized: CSA Component Acceptance Service No.5A File No.E67349
- VDE-approved: EN 60747-5-5 (Note 1)

Note 1 : When a VDE approved type is needed, please designate the **Option(V4)**.

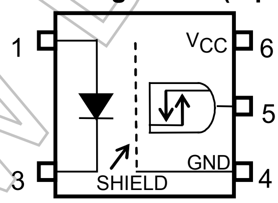
Unit: mm



JEDEC	―
JEITA	―
TOSHIBA	11−4C2

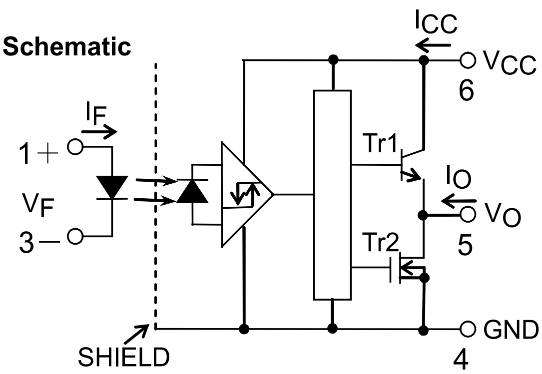
Weight: 0.09 g (typ.)

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.

Truth Table

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

Start of commercial production
2008-05

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
	Forward Current Derating (Ta ≥ 83°C)		ΔIF/°C	-0.48	mA/°C
	Peak Transient Forward Current	(Note1)	I_{FPT}	1	A
	Reverse Voltage		V_R	5	V
	Input Power Dissipation		P_D	40	mW
	Input Power Dissipation derating (Ta ≥ 83°C)		ΔPD/°C	-0.95	mW/°C
DETECTOR	Output Current 1 (Ta ≤ 25°C)		I_{O1}	25/-15	mA
	Output Current 2 (Ta ≤ 100°C)		I_{O2}	5/-5	mA
	Output Current Derating (Ta ≥ 25°C)		ΔIO1/°C	-0.26/-0.13	mA/°C
	Peak Output Current	(Note2)	I_{OP}	50/-50	mA
	Output Voltage		V_O	-0.5 to 20	V
	Output Power Dissipation		P_O	75	mW
	Output Power Dissipation Derating (Ta ≥ 25°C)		ΔP_O /°C	-0.75	mW/°C
	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 (10 s)			T_{sol}	260	°C
Isolation Voltage (AC, 60 s, R.H. ≤ 60 %)		(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 ≤ 1 μs, 300 pps.

Note 2: Pulse width ≤ 5 μs, 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 V, f = 1 MHz, Ta = 25 °C		—	100	-	pF
Logic Low Output Voltage	V_{OL}	1	I_{OL} = 3.5 mA, V_F = 0.8 V		—	0.2	0.6	V
Logic High Output Voltage	V_{OH}	2	I_{OH} = −2.6 mA, I_F = 5 mA	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	V_F = 0 V	V_{CC} = 20 V	—	—	3.0	mA
				V_{CC} = 5.5 V	—	—	3.0	
Logic High Supply Current	I_{CCH}	4	I_F = 5 mA	V_{CC} = 20 V	—	—	3.0	mA
				V_{CC} = 5.5 V	—	—	3.0	
Logic Low Short Circuit Output Current (Note 1)	I_{OSL}	5	V_F = 0 V	V_{CC} = V_O = 5.5 V	15	80	—	mA
				V_{CC} = V_O = 20 V	20	90	—	
Logic High Short Circuit Output Current (Note 1)	I_{OSH}	6	I_F = 5 mA, V_O = GND	V_{CC} = 5.5 V	−5	−15	—	mA
				V_{CC} = 20 V	−10	−20	—	
Input Current Logic High Output	I_{FLH}	—	I_O = -2.6 mA, V_O > 2.4 V		—	0.4	1.6	mA
Input Voltage Logic Low Output	V_{FHL}	—	I_O = 3.5 mA, V_O < 0.4 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 1: Duration of output short circuit time should not exceed 10 ms.

Note : A ceramic capacitor (0.1 μA) 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.

Isolation Characteristics (Ta = 25°C)

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

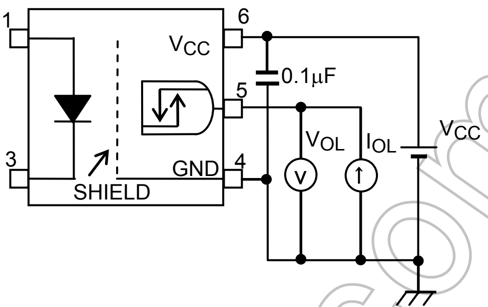
Switching Characteristics

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

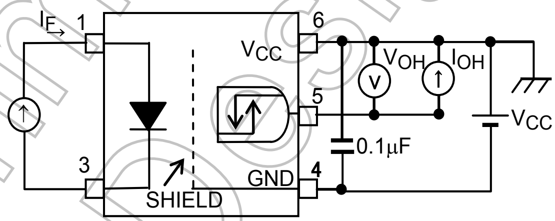
CHARACTERISTIC	SYMBOL	TEST CIRCUIT	CONDITION	MIN	TYP.	MAX	UNIT
Propagation Delay Time to Logic High output	t_{pLH}	7, 8	I_F = 0→3 mA	30	150	250	ns
Propagation Delay Time to Logic Low output	t_{pHL}		I_F = 3→0 mA	30	150	250	ns
Switching Time Dispersion between ON and OFF	$\|t_{pHL}-t_{pLH}\|$		—	—	—	220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

*All typical values are at Ta = 25 °C

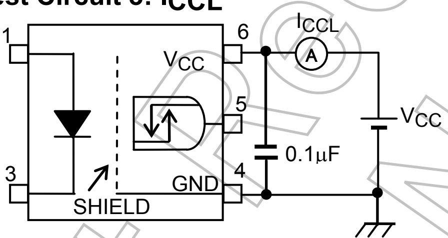
Test Circuit 1: V_{OL}



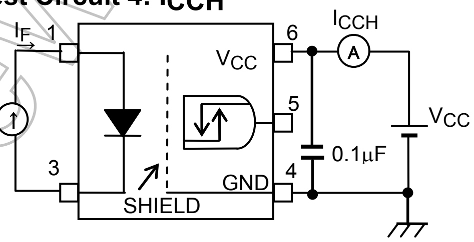
Test Circuit 2: V_{OH}



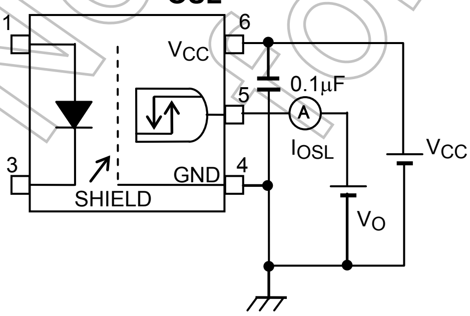
Test Circuit 3: I_{CCL}



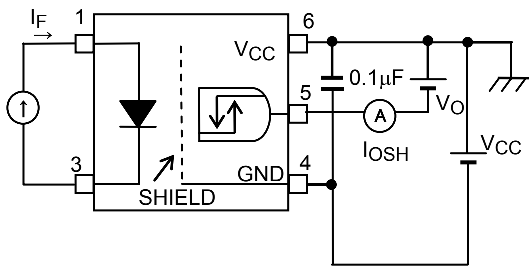
Test Circuit 4: I_{CCH}



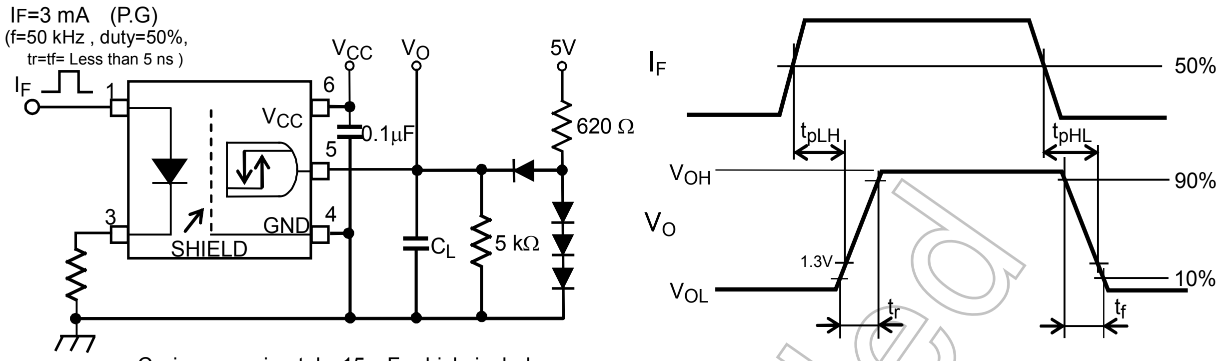
Test Circuit 5: I_{OSL}



Test Circuit 6: I_{OSH}

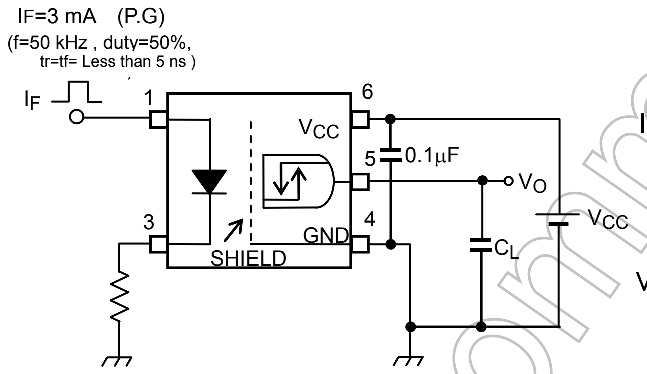


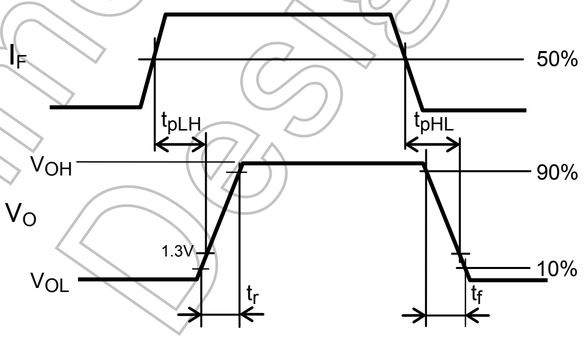
Test Circuit 7: Switching Time Test Circuit



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

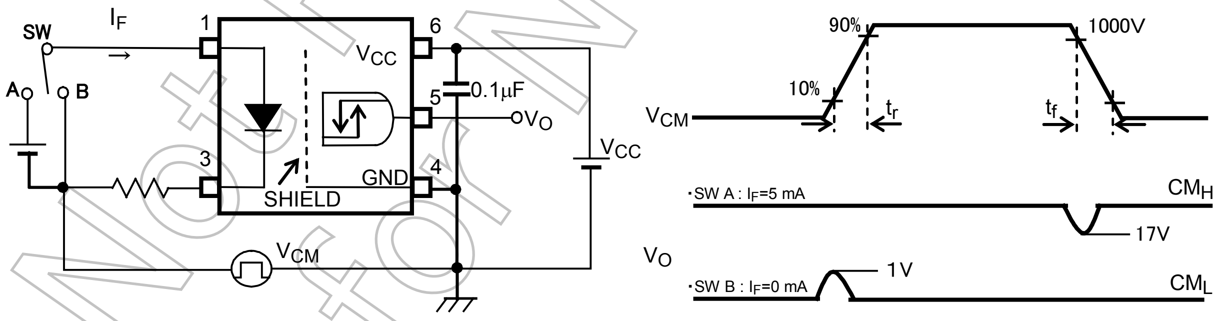
Test Circuit 8: Switching Time Test Circuit





C_L is approximately 15 pF which includes probe and stray 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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