

# TLP555

- Isolated Bus Driver
- High Speed Line Receiver
- Microprocessor System Interfaces
- MOS FET Gate Driver
- Transistor Inverter

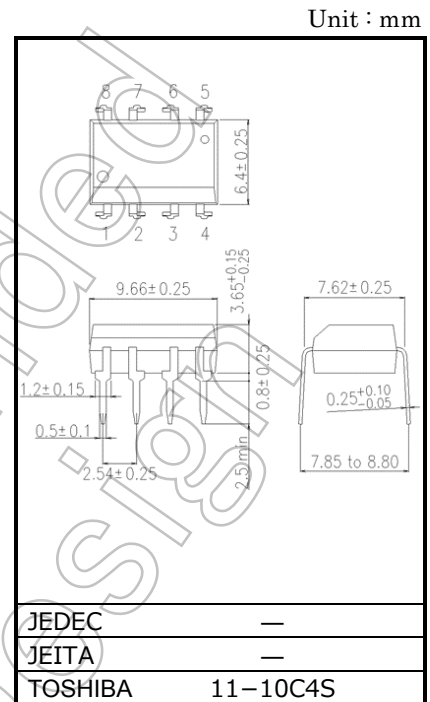
The TOSHIBA TLP555 consists of an infrared emitting diode and integrated high gain, high speed photodetector. This unit is 8-lead DIP package.

The detector has a three state output stage that eliminates the need for pull-up resistor, and built-in Schmitt trigger. The detector has a Schmitt trigger circuit and 3 State output circuit, so both-directions of source and sink drive can be performed.

The detector IC has an internal shield that provides a guaranteed common mode transient immunity of 1000V /  $\mu$ s.

TLP555 is a buffer logic type. When an inverter logic type is required, there is TLP558.

- Input current :  $I_F = 1.6$  mA (max.)
- Power supply voltage :  $V_{CC} = 4.5$  to 20 V
- Switching speed :  $t_{pHL}, t_{pLH} = 400$  ns (max.)
- Common mode transient immunity :  $\pm 1000V / \mu$ s (Min.)
- Guaranteed performance over temperature :  $-25$  to  $85^\circ C$
- Isolation voltage : 2500 Vrms (min)
- UL-recognized: UL 1577, File No.E67349
- cUL-recognized: CSA Component Acceptance Service No.5A File No.E67349

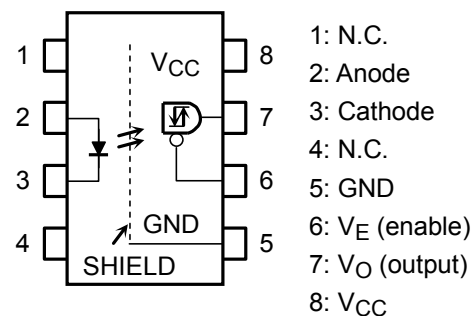


Weight: 0.54 g (typ.)

### Truth Table (positive logic)

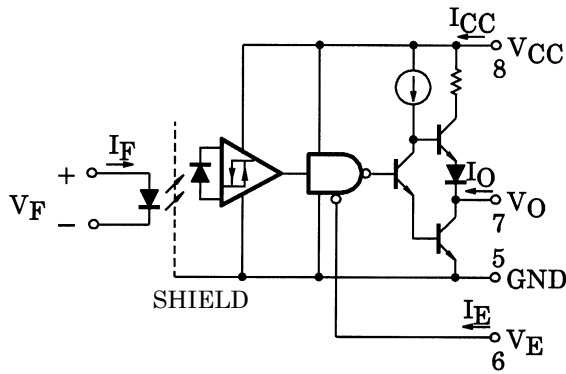
Input	Enable	Output
H	H	Z
L	H	Z
H	L	H
L	L	L

### Pin Configuration (top view)



Start of commercial production  
1986-07

## Schematic



Note : 0.1- $\mu$ F bypass capacitor must be connected between pin 8 and pin 5.

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

Characteristics		Symbol	Rating	Unit
LED	Input forward current	$I_F$	10	mA
	Peak transient input forward current (Note 1)	$I_{FPT}$	1	A
	Input reverse voltage	$V_R$	5	V
	Input power dissipation(Ta= to 85°C)	$P_b$	45	mW
Detector	Output current	$I_O$	40 / -25	mA
	Peak output current (Note 2)	$I_{OP}$	80 / -50	mA
	Output voltage	$V_O$	-0.5 to 20	V
	Supply voltage	$V_{CC}$	-0.5 to 20	V
	Three state enable voltage	$V_E$	-0.5 to 20	V
	Output power dissipation (Note 3)	$P_O$	100	mW
Common	Total package power dissipation (Note 4)	$P_T$	200	mW
	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, R.H. $\leq$ 60 %) (Note 5)	$BV_S$	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: Pulse width (PW)  $\leq$  1  $\mu$ s, 300 pps

Note 2: PW  $\leq$  5  $\mu$ s, Duty  $\leq$  0.025%

Note 3: Derate 1.8 mW / °C above 70 °C ambient temperature.

Note 4: Derate 3.6 mW / °C above 70 °C ambient temperature.

Note 5: Device considered a two terminal device: Pins 1, 2, 3 and 4 shorted together, and pins 5,6,7 and 8 shorted together

\*\* : More than 2 mm from the root of a lead.

## Recommended Operating Conditions

Characteristics	Symbol	Min.	Typ.	Max	Unit
Input on-state current	$I_F$ (ON)	2*	—	5	mA
Input off-state voltage	$V_F$ (OFF)	0	—	0.8	V
Supply voltage	$V_{CC}$	4.5	—	20	V
Enable voltage high	$V_{EH}$	2.0	—	20	V
Enable voltage low	$V_{EL}$	0	—	0.8	V
Fan out (TTL load)	N	—	—	4	—
Operating temperature	$T_{opr}$	-25	—	85	°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.

\*:2 mA is a value at the time of taking into consideration 20 % of IFH degradation.

An input hreshold is an initial value and is below 1.6 mA.

Not Recommended for New Design

## Electrical Characteristics

(Unless otherwise specified, Ta = -25 to 85°C, VCC = 4.5 to 20 V)

Characteristics	Symbol	Test Condition	Min.	Typ.(*)	Max	Unit	
Input forward voltage	V <sub>F</sub>	I <sub>F</sub> = 5 mA, Ta = 25 °C	—	1.55	1.7	V	
Input forward voltage temperature coefficient	ΔV <sub>F</sub> / ΔTa	I <sub>F</sub> = 5 mA	—	-2.0	—	mV / °C	
Input reverse current	I <sub>R</sub>	V <sub>R</sub> = 5 V, Ta = 25 °C	—	—	10	μA	
Input capacitance	C <sub>T</sub>	V <sub>F</sub> = 0 V, f = 1 MHz, Ta = 25 °C	—	45	—	pF	
Output leakage current (V <sub>O</sub> > V <sub>CC</sub> )	I <sub>OHH</sub>	I <sub>F</sub> = 5 mA, V <sub>CC</sub> = 4.5 V, V <sub>E</sub> = GND	V <sub>O</sub> = 5.5 V	—	—	100	μA
			V <sub>O</sub> = 20 V	—	2	500	
Logic low output voltage	V <sub>OL</sub>	I <sub>OL</sub> = 6.4 mA, V <sub>F</sub> = 0.8 V, V <sub>E</sub> = 0.8 V	—	0.4	0.5	V	
Logic high output voltage	V <sub>OH</sub>	I <sub>OH</sub> = -2.6 mA, I <sub>F</sub> = 1.6 mA, V <sub>E</sub> = 0.8 V	2.4	3.3	—	V	
Logic low enable current	I <sub>EL</sub>	V <sub>E</sub> = 0.4 V	—	-0.13	-0.32	mA	
Logic high enable current	I <sub>EH</sub>	V <sub>E</sub> = 2.7 V	—	—	20	μA	
		V <sub>E</sub> = 5.5 V	—	—	100		
		V <sub>E</sub> = 20 V	—	0.01	250		
Logic low enable voltage	V <sub>EL</sub>	—	—	—	0.8	V	
Logic high enable voltage	V <sub>EH</sub>	—	2.0	—	—	V	
Logic low supply current	I <sub>CCL</sub>	V <sub>F</sub> = 0 V, V <sub>E</sub> = GND	V <sub>CC</sub> = 5.5 V	—	5	6.0	mA
			V <sub>CC</sub> = 20 V	—	5.6	7.5	
Logic high supply current	I <sub>CCH</sub>	I <sub>F</sub> = 5 mA, V <sub>E</sub> = GND	V <sub>CC</sub> = 5.5 V	—	2.5	4.5	mA
			V <sub>CC</sub> = 20 V	—	2.8	6.0	
High impedance state output current	I <sub>OZL</sub>	I <sub>F</sub> = 5 mA, V <sub>E</sub> = 2 V	V <sub>O</sub> = 0.4 V	—	1	-20	μA
			V <sub>O</sub> = 2.4 V	—	—	20	
	I <sub>OZH</sub>	V <sub>F</sub> = 0 V, V <sub>E</sub> = 2 V	V <sub>O</sub> = 5.5 V	—	—	100	
			V <sub>O</sub> = 20 V	—	0.01	500	
Logic low short circuit output current (Note 6)	I <sub>OSL</sub>	V <sub>F</sub> = 0 V, V <sub>E</sub> = 0.8 V	V <sub>O</sub> = V <sub>CC</sub> = 5.5 V	25	55	—	mA
			V <sub>O</sub> = V <sub>CC</sub> = 20 V	40	80	—	
Logic high short circuit output current (Note 6)	I <sub>OSH</sub>	I <sub>F</sub> = 5 mA, V <sub>O</sub> = GND, V <sub>E</sub> = 0.8 V	V <sub>CC</sub> = 5.5 V	-10	-25	—	mA
			V <sub>CC</sub> = 20 V	-25	-60	—	
Threshold input current (L/H)	I <sub>FH</sub>	V <sub>E</sub> = 0.8 V, I <sub>O</sub> = -2.6 mA, V <sub>O</sub> > 2.4 V	—	0.4	1.6	mA	
Threshold input voltage (H/L)	V <sub>FH</sub>	V <sub>E</sub> = 0.8 V, I <sub>O</sub> = 6.4 mA, V <sub>O</sub> < 0.4 V	0.8	—	—	V	
Input current hysteresis	I <sub>HYS</sub>	V <sub>CC</sub> = 5 V, V <sub>E</sub> = GND	—	0.05	—	mA	
Isolation resistance	R <sub>S</sub>	V <sub>S</sub> = 500 V, R.H. ≤ 60 %, Ta = 25 °C (Note 5)	5 × 10 <sup>10</sup>	10 <sup>14</sup>	—	Ω	
Total capacitance (input to output)	C <sub>S</sub>	V <sub>S</sub> = 0 V, f = 1 MHz, Ta = 25 °C (Note 5)	—	1.0	—	pF	

\* : All typ. values are at Ta = 25 °C, V<sub>CC</sub> = 5 V, I<sub>F(ON)</sub> = 3 mA unless otherwise specified.

Note 6 : Duration of output short circuit time should not exceed 10 ms.

## Switching Characteristics (unless otherwise specified, $T_a = 25^\circ\text{C}$ , $V_{CC} = 4.5$ to $20\text{ V}$ )

Characteristic	Symbol	Test Circuit	Test Condition	Min.	Typ. (*)	Max.	Unit
Propagation delay time to logic high output level ( L $\rightarrow$ H ) ( Note 7 )	$t_{pLH}$	1	$I_F = 0 \rightarrow 3\text{ mA}$	—	235	400	ns
Propagation delay time to logic low output level ( H $\rightarrow$ L ) ( Note 7 )	$t_{pHL}$		$I_F = 3 \rightarrow 0\text{ mA}$	—	250	400	ns
Output rise time (10–90%)	$t_r$		$I_F = 0 \rightarrow 3\text{ mA}$ , $V_{CC} = 5\text{ V}$	—	35	75	ns
Output fall time (90–10%)	$t_f$		$I_F = 3 \rightarrow 0\text{ mA}$ , $V_{CC} = 5\text{ V}$	—	20	75	ns
Common mode transient immunity at logic high output ( Note 8 )	$CM_H$	3	$I_F = 1.6\text{ mA}$ , $V_{CM} = 50\text{ V}$ $V_{O(\text{min})} = 2\text{ V}$	$\geq 1000$	—	—	V / $\mu\text{s}$
Common mode transient immunity at logic low output ( Note 8 )	$CM_L$		$I_F = 0\text{ mA}$ , $V_{CM} = 50\text{ V}$ $V_{O(\text{max})} = 0.8\text{ V}$	1000	—	—	V / $\mu\text{s}$

\*: All typ. values are at  $T_a = 25^\circ\text{C}$ ,  $V_{CC} = 5\text{ V}$  unless otherwise specified.

Note 7: The  $t_{pLH}$  propagation delay is measured from the 50 % point on the leading edge of the input pulse to the 1.3 V point on the leading edge of the output pulse.

The  $t_{pHL}$  propagation delay is measured from the 50 % point on the trailing edge of the input pulse to the 1.3 V point on the trailing edge of the output pulse.

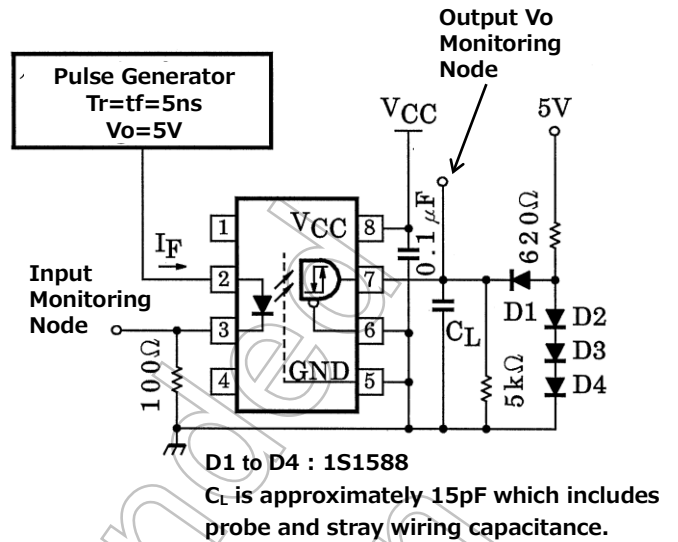
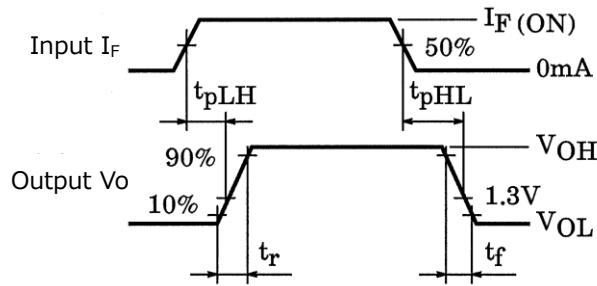
Note 8:  $CM_L$  is the maximum rate of rise of the common mode voltage that can be sustained with the output voltage in the logic low state ( $V_O \leq 0.8\text{ V}$ ).

$CM_H$  is the maximum rate of fall of the common mode voltage that can be sustained with the output voltage in the logic high state ( $V_O \geq 2.0\text{ V}$ ).

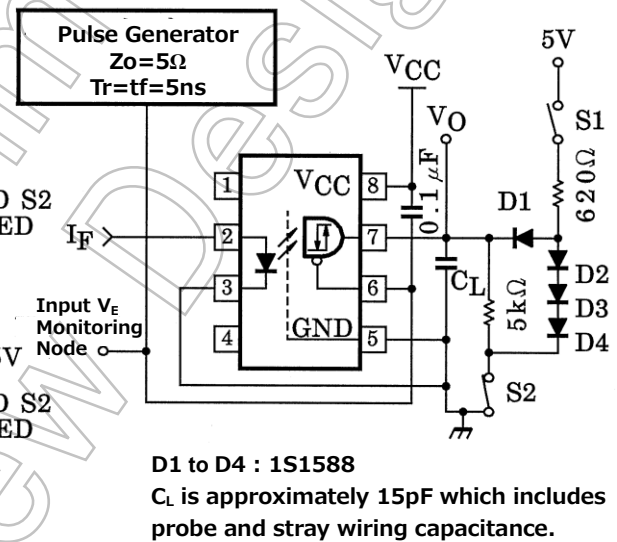
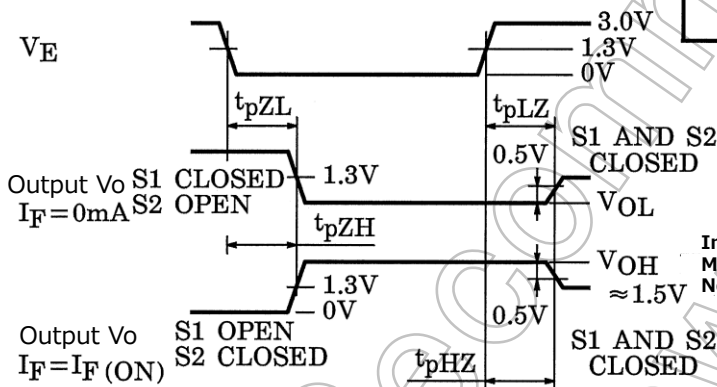
Note 9: Output photo IC should build in the amplifier of high sensitivity very much, and should attach bypass capacitor 0.1  $\mu\text{F}$  with a sufficient high frequency characteristic to the place within 1 cm from a pin between the pin 8 ( $V_{CC}$ ) and the pin 5 ( $GND$ ) as an object for oscillation prevention.

When there is nothing, normal operation of speed, or ON/OFF may not be carried out.

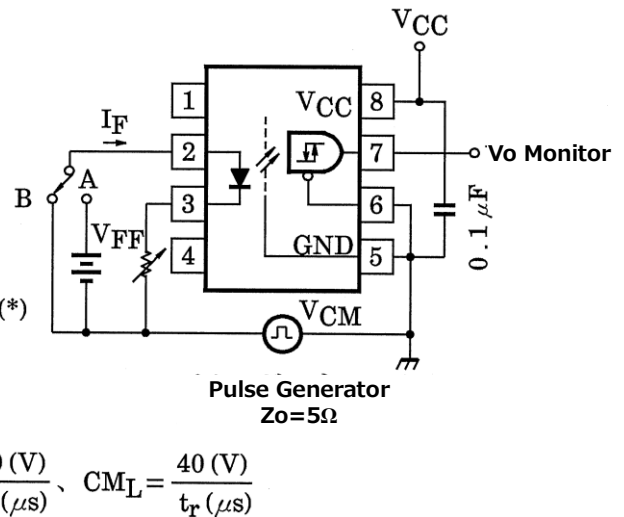
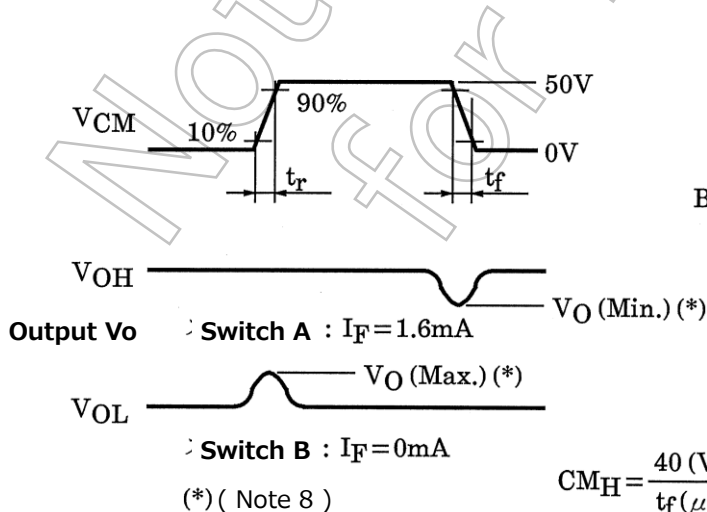
### Test Circuit 1 $t_{pHL}$ , $t_{pLH}$ , $t_r$ and $t_f$



### Test Circuit 2 $t_{pHZ}$ , $t_{pZH}$ , $t_{pLZ}$ , and $t_{pZL}$



### Test Circuit 3 Common Mode Transient Immunity



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