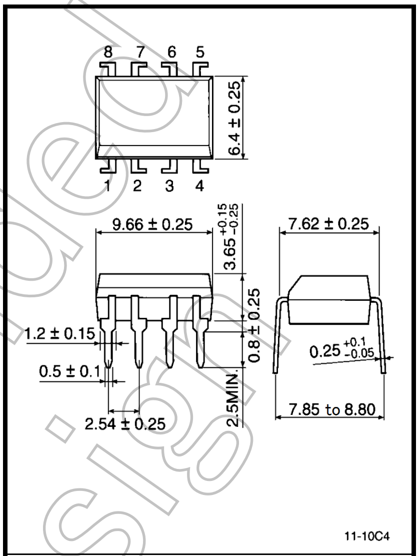
TOSHIBA Photocoupler GaAℓAs Ired & Photo IC

TLP550

Microprocessor System Interfaces
Digital Logic Ground Isolation
Line Receiver
Switching Power Supply Feedback Control
Transistor Inverter

Unit: mm



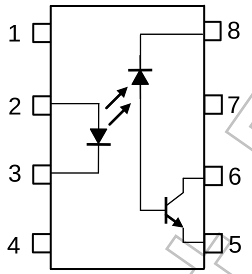
TOSHIBA 11−10C4

Weight: 0.54 g (typ.)

TLP550 consists of a high emitting diode and a one chip photo diode−transistor.
TLP550 has no base connection, and is suitable for application at noisy environmental condition.
This unit is 8−lead DIP package.

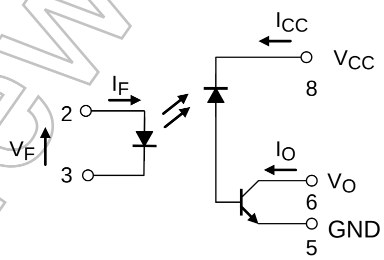
- Isolation voltage : 2500 Vrms (min)
- Propagation delay time (t_{pHL} / t_{pLH}):
  t_{pHL} = 0.5μs (typ.),
  t_{pLH} = 0.6μs (typ.)
  (R_L=1.9 kΩ)
- TTL compatible
- UL recognized: UL1577, file No. E67349
- cUL approved: CSA Component Acceptance Service No.5A, file No. E67349

Pin Configuration (top view)



1 : N.C.
2 : Anode
3 : Cathode
4 : N.C.
5 : Emitter
6 : Collector
7 : N.C.
8 : Cathode

Schematic



Start of commercial production
1981/09

Current Transfer Ratio

Classification	Current Transfer Ratio (%) (I_C/I_F)		Marking of Classification
	Min	Max	
(None)	10	—	Blank, O, Y
Rank O	19	—	O
Rank Y	35	—	Y

Absolute Maximum Ratings (Ta = 25°C)

	Characteristic		Symbol	Rating	Unit
LED	Forward current	(Note 1)	I_F	25	mA
LED	Pulse forward current	(Note 2)	I_{FP}	50	mA
LED	Peak transient forward current	(Note 3)	I_{FPT}	1	A
LED	Reverse voltage		V_R	5	V
LED	Diode power dissipation	(Note 4)	P_D	45	mW
Detector	Output current		I_O	8	mA
Detector	Peak output current		I_{OP}	16	mA
Detector	Supply voltage		V_{CC}	−0.5 to 15	V
Detector	Output voltage		V_O	−0.5 to 15	V
Detector	Output power dissipation	(Note 5)	P_O	100	mW
Operating temperature range			T_{opr}	−55 to 100	°C
Storage temperature range			T_{stg}	−55 to 125	°C
Lead solder temperature (10s)			T_{sol}	260	°C
Isolation voltage (AC, 1minute, R.H. ≤ 60%)		(Note 6)	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) Derate 0.8mA above 70°C.

(Note 2) 50% duty cycle, 1ms pulse width. Derate 1.6mA / °C above 70°C.

(Note 3) Pulse width 1μs, 300pps.

(Note 4) Derate 0.9mW / °C above 70°C.

(Note 5) Derate 2mW / °C above 70°C.

(Note 6) Device considered two−terminal device: Pins 1, 2, 3 and 4 shorted together and pin 5, 6, 7 and 8 shorted together.

Electrical Characteristics (Ta = 25°C)

	Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
LED	Forward voltage	V_F	I_F = 16 mA	1.45	1.65	1.85	V
LED	Forward voltage temperature coefficient	$\Delta V_F / \Delta Ta$	I_F = 16 mA	—	−2	—	mV / °C
LED	Reverse current	I_R	V_R = 5 V	—	—	10	μA
LED	Capacitance between terminal	C_T	V_F = 0 V, f = 1 MHz	—	60	—	pF
Detector	High level output current	$I_{OH\,(1)}$	I_F = 0 mA, V_{CC} = V_O = 5.5 V	—	3	500	nA
Detector	High level output current	$I_{OH\,(2)}$	I_F = 0 mA, V_{CC} = V_O = 15 V	—	—	5	μA
Detector	High level output current	I_{OH}	I_F = 0 mA, V_{CC} = 15 V, V_O = 15 V, Ta = 70 °C	—	—	50	μA
Detector	High level supply voltage	I_{CCH}	I_F = 0 mA, V_{CC} = 15 V	—	0.01	1	μA
Detector	Supply voltage	V_{CC}	I_{CC} = 0.01 mA	15	—	—	V
Detector	Output voltage	V_O	I_O = 0.5 mA	15	—	—	V

Coupled Electrical Characteristics (Ta = 25°C)

Characteristics	Symbol	Test Condition		Min	Typ.	Max	Unit
Current transfer ratio	I_O / I_F	I_F = 16 mA, V_{CC} = 4.5V, V_O = 0.4 V		10	40	—	%
			Rank O	19	40	—	%
			Rank Y	35	50	—	%
		I_F = 16 mA, V_{CC} = 4.5 V, V_O = 0.4 V, Ta = 0 to 70°C		5	—	—	%
			Rank O, Y	15	—	—	%
Low level output voltage	V_{OL}	I_F = 16 mA, V_{CC} = 4.5 V, I_O = 1.1 mA (Rank O: I_O = 2.4 mA)		—	—	0.4	V

Isolation Characteristics (Ta = 25°C)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Capacitance (input-output) (Note 7)	C_S	V_S = 0 V, f = 1 MHz	—	0.8	—	pF
Resistance (input-output) (Note 7)	R_S	R.H. ≤ 60 %, V_S = 1 kV_{DC}	5×10^{10}	10^{14}	—	Ω
Isolation voltage (Note 7)	BV_S	AC, 1 minute	2500	—	—	V_{rms}
		AC, 1 second, in oil	—	5000	—	V_{rms}
		DC, 1 minute, in oil	—	5000	—	V_{dc}

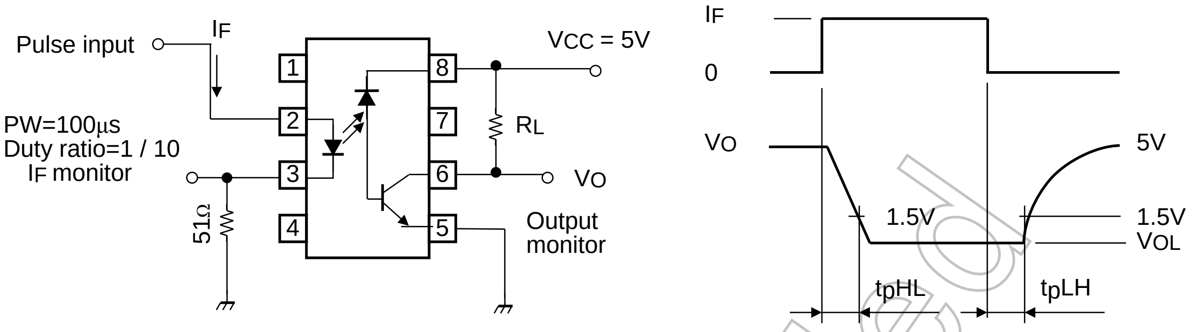
(Note 7) Device considered two−terminal device: Pins 1, 2, 3 and 4 shorted together and pin 5, 6, 7 and 8 shorted together.

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

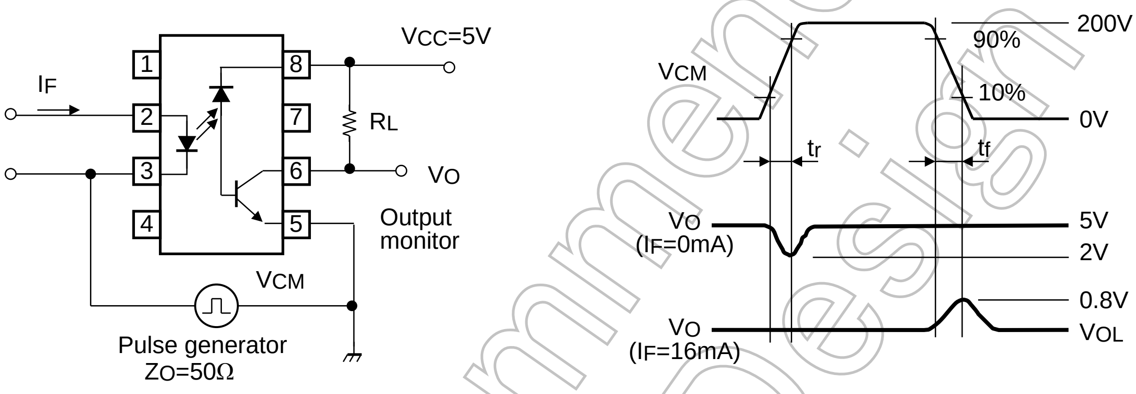
Characteristic	Symbol	Test Circuit.	Test Condition	Min	Typ.	Max	Unit
Propagation delay time (H→ L)	t_{pHL}	1	I_F = 0→ 16 mA, V_{CC} = 5 V, R_L = 4.1 kΩ	—	0.3	0.8	μs
			Rank O: R_L = 1.9 kΩ	—	0.5	0.8	
Propagation delay time (L→ H)	t_{pLH}		I_F = 16→ 0 mA, V_{CC} = 5 V, R_L = 4.1 kΩ	—	1	2	μs
			Rank O: R_L = 1.9 kΩ	—	0.6	1.2	
Common mode transient immunity at high output level	C_{MH}	2	I_F = 0 mA, V_{CM} = 200 V_{p-p} R_L = 4.1 kΩ (rank O: R_L = 1.9 kΩ) (Note 8)	—	1500	—	V /μs
Common mode transient immunity at low output level	C_{ML}		I_F = 16 mA, V_{CM} = 200 V_{p-p} R_L = 4.1 kΩ (rank O: R_L = 1.9 kΩ) (Note 8)	—	−1500	—	V /μs

(Note 8) CM_L is the maximum rate of fall of the common mode voltage that can be sustained with the output voltage in the logic low state (V_O < 0.8V).
CM_H is the maximum rate of rise of the common mode voltage that can be sustained with the output voltage in the logic high state (V_O > 2.0V).

Test Circuit 1: Switching Time Test Circuit

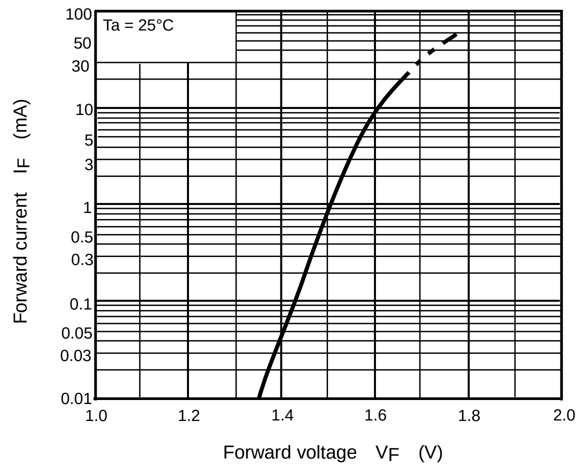


Test Circuit 2: Common Mode Noise Immunity Test Circuit

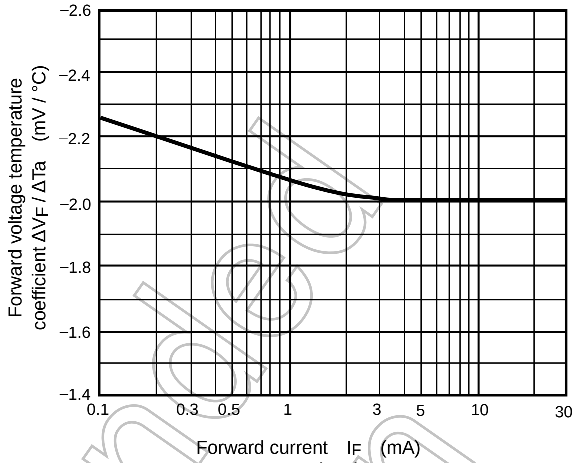


$$CM_H = \frac{160(V)}{t_r(\mu s)}, CM_L = \frac{160(V)}{t_f(\mu s)}$$

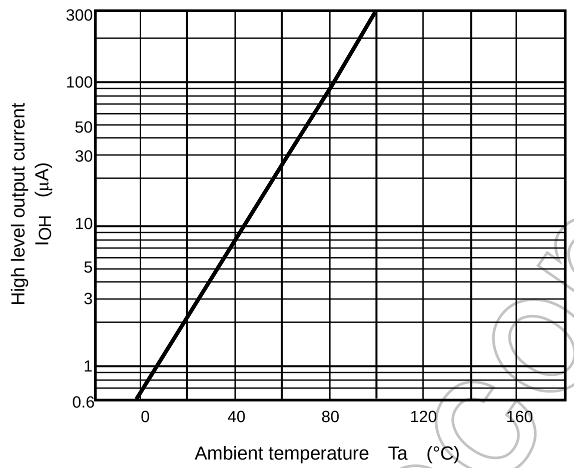
I_F – V_F



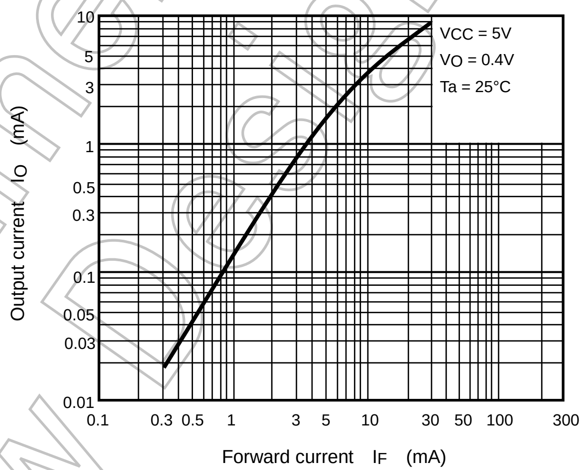
$\Delta V_F / \Delta Ta$ – I_F



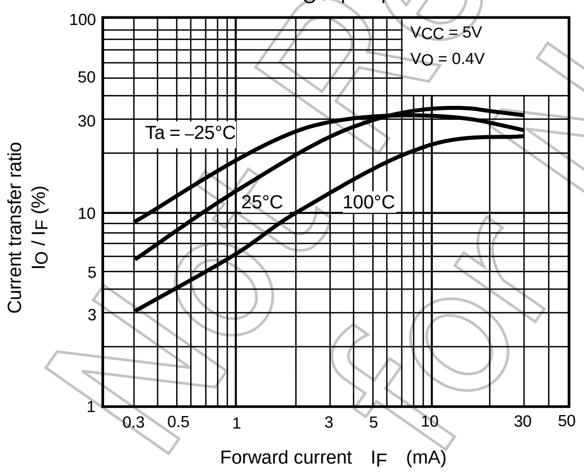
I_{OH} (1) – Ta



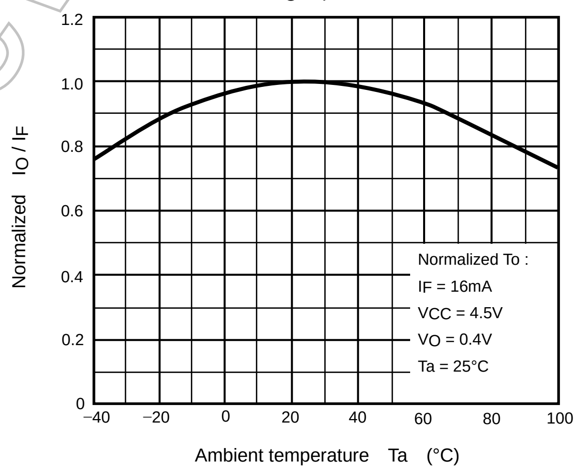
I_O – I_F

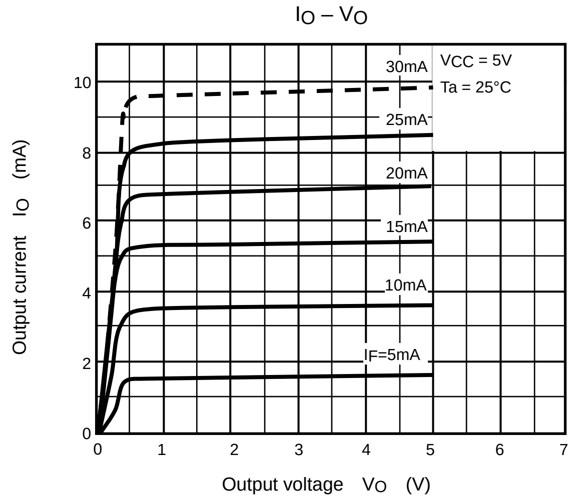


I_O / I_F – I_F

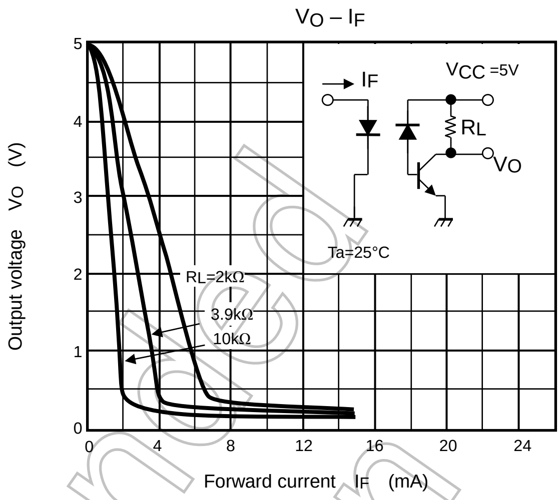


I_O / I_F – Ta

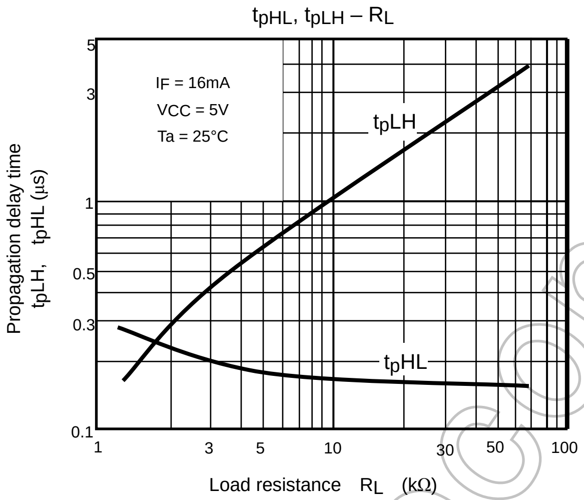




I_O – V_O
VCC = 5V
Ta = 25°C
30mA
25mA
20mA
15mA
10mA
IF=5mA
Output current IO (mA)
Output voltage VO (V)



V_O – I_F
IF
VCC =5V
RL
VO
Ta=25°C
RL=2kΩ
3.9kΩ
10kΩ
Output voltage VO (V)
Forward current IF (mA)



t_{pHL}, t_{pLH} – R_L
IF = 16mA
VCC = 5V
Ta = 25°C
tpLH
tpHL
Propagation delay time tpLH, tpHL (μs)
Load resistance RL (kΩ)

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