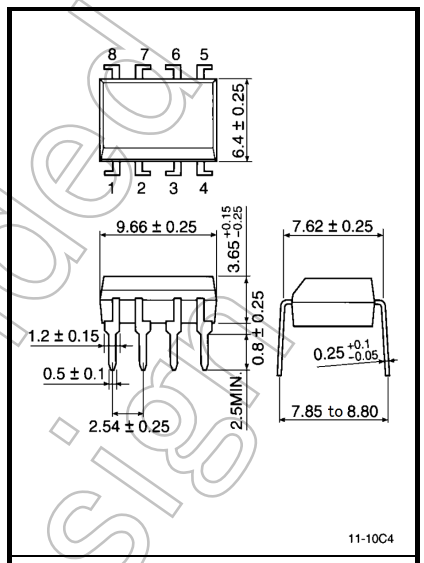
TOSHIBA Photocoupler GaAℓAs Ired & Photo IC

TLP559

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

Unit: mm



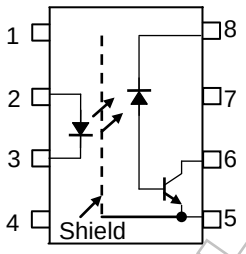
TOSHIBA 11−10C4

Weight: 0.54 g (typ.)

The TOSHIBA TLP559 consists of a GaAℓAs high−output light emitting diode and a high speed detector of one chip photo diode−transistor. This unit is 8−lead DIP package.
TLP559 has no internal base connection, and a Faraday shield integrated on the photodetector chip provides an effective common mode noise transient immunity.
So this is suitable for application in noisy environmental condition.

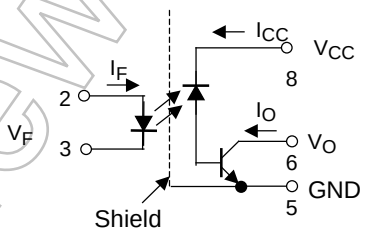
- Isolation voltage: 2500 Vrms (min)
- Switching speed: t_{pHL} = 0.2μs (typ.)
  t_{pLH} = 0.3μs (typ.) (R_L = 1.9kΩ)
- TTL compatible
- UL recognized: UL1577, file No.E67349.
- cUL approved: CSA Component Acceptance Service No.5A, file No.E67349.

Pin Configuration (top view)



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

Schematic



Start of commercial production
1987/09

Absolute Maximum Ratings (Ta = 25°C)

Characteristic			Symbol	Rating	Unit
LED	Forward current	(Note 1)	I_F	25	mA
	Pulse forward current	(Note 2)	I_{FP}	50	mA
	Peak transient forward current	(Note 3)	I_{FPT}	1	A
	Reverse voltage		V_R	5	V
	Diode power dissipation	(Note 4)	P_D	45	mW
Detector	Output current		I_O	8	mA
	Peak output current		I_{OP}	16	mA
	Output voltage		V_O	−0.5 to 15	V
	Supply voltage		V_{CC}	−0.5 to 15	V
	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)		(Note 6)	T_{sol}	260	°C
Isolation voltage (AC, 1 minute, R.H. ≤ 60%)		(Note 7)	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) Soldering portion of lead: up to 2mm from body of the devise.

(Note 7) Device considered a two-terminal device: Pins 1, 2, 3 and 4 shorted together and pins 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 = 16mA	—	1.65	1.85	V
	Forward voltage temperature coefficient	$\Delta V_F / \Delta Ta$	I_F = 16mA	—	−2	—	mV / °C
	Reverse current	I_R	V_R = 5V	—	—	10	μA
	Capacitance between terminal	C_T	V_F = 0V, f = 1MHz	—	45	—	pF
Detector	High level output current	$I_{OH\ (1)}$	I_F = 0mA, V_{CC} = V_O = 5.5V	—	3	500	nA
		$I_{OH\ (2)}$	I_F = 0mA, V_{CC} = V_O = 15V	—	—	5	μA
		I_{OH}	I_F = 0mA, V_{CC} = 15V, V_O = 15V, Ta = 70°C	—	—	50	
	High level supply voltage	I_{CCH}	I_F = 0mA, V_{CC} = 15V	—	0.01	1	μA
	Supply voltage	V_{CC}	I_{CC} = 0.01 mA	15	—	—	V
	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} = 4.5 V, V_O = 0.4 V	20	40	—	%
		I_F = 16 mA, V_{CC} = 4.5 V, V_O = 0.4 V, Ta = 0 to 70°C	15	—	—	
Low level output voltage	V_{OL}	I_F = 16 mA, V_{CC} = 4.5 V, I_O = 2.4 mA	—	—	0.4	V

Isolation Characteristics (Ta = 25°C)

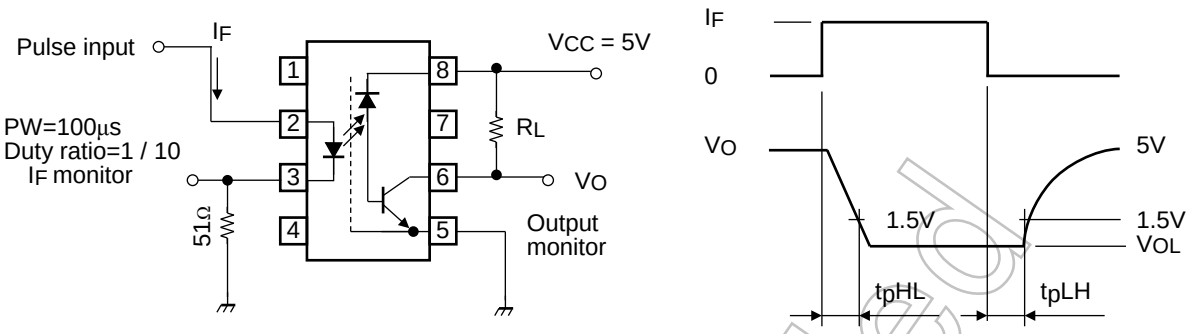
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Capacitance (input-output)	(Note 7)	C_S	V_S = 0V, f = 1 MHz	—	0.8	—	pF
Resistance (input-output)	(Note 7)	R_S	R.H. ≤ 60%, V_S = 500 V_{DC}	5×10^{10}	10^{14}	—	Ω
Isolation voltage	(Note 7)	BV_S	AC, 1 minute	2500	—	—	V_{rms}
			AC, 1 second, in oil	—	5000	—	
			DC, 1 minute, in oil	—	5000	—	V_{dc}

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

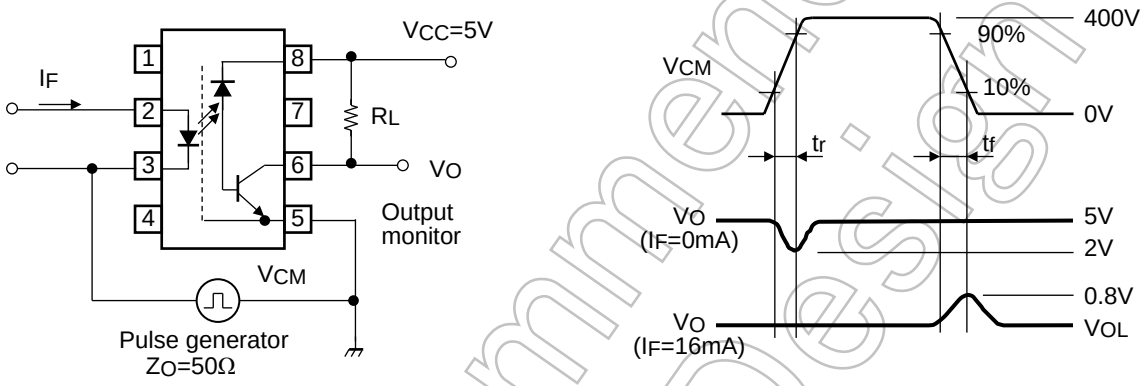
Characteristic	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Propagation delay time (H→ L)	t_{pHL}	1	I_F = 16mA, R_L = 1.9kΩ	—	0.2	0.8	μs
Propagation delay time (L→ H)	t_{pLH}			—	0.3	0.8	μs
Common mode transient immunity at logic high output (Note 8)	CM_H	2	I_F = 0mA, V_{CM} = 400V_{p-p}, R_L = 4.1kΩ	2000	10000	—	V / μs
Common mode transient immunity at logic high output (Note 8)	CM_L		I_F =16mA, V_{CM} = 400V_{p-p}, R_L = 4.1kΩ	−2000	−10000	—	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

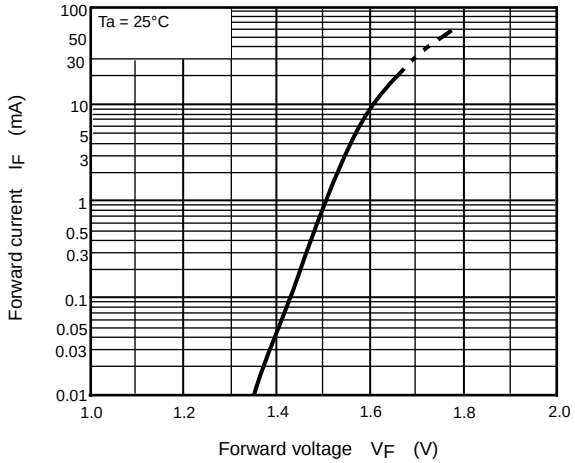


Test Circuit 2: Common Mode Noise Immunity Test Circuit

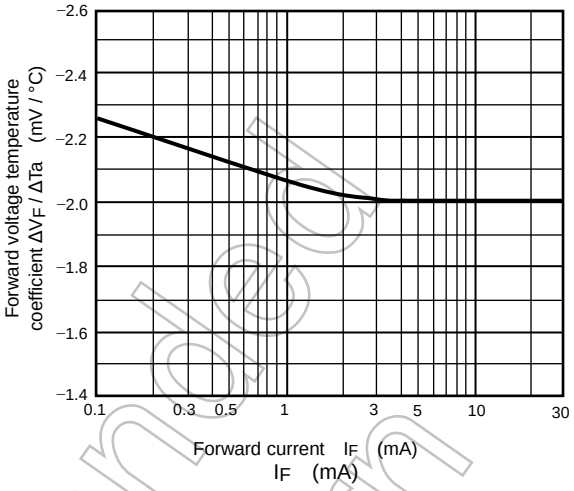


$$CM_H = \frac{320(V)}{t_r(\mu s)}, CM_L = \frac{320(V)}{t_f(\mu s)}$$

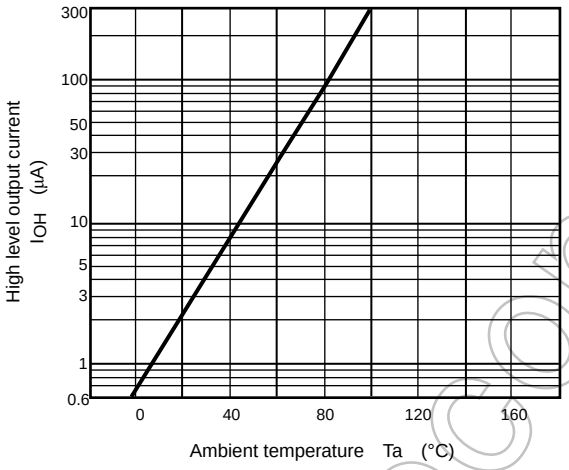
$I_F - V_F$



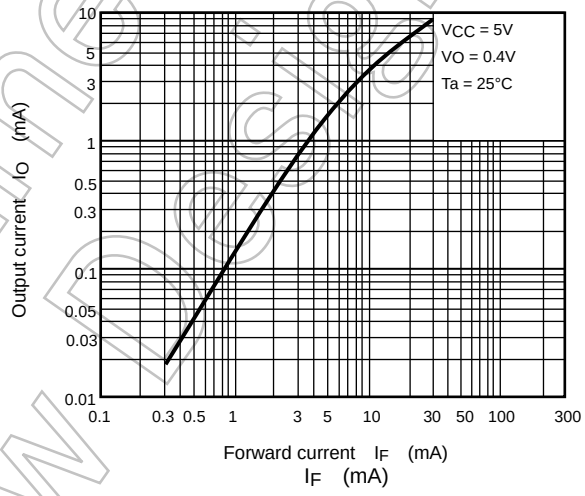
$\Delta V_F / \Delta Ta - I_F$



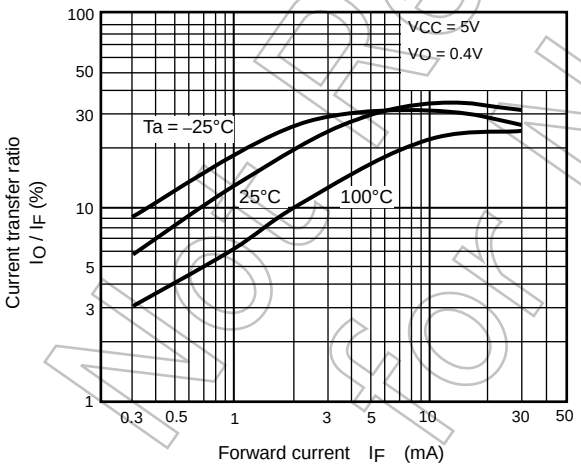
I_{OH} (1) – Ta



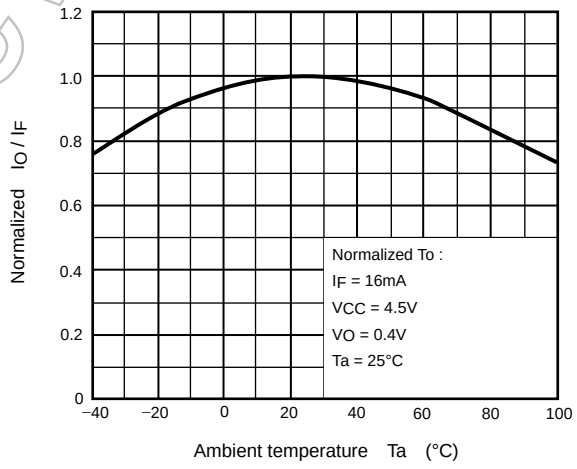
$I_O - I_F$



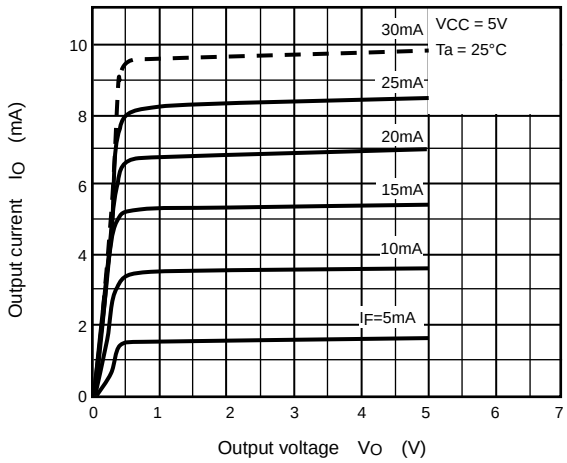
$I_O / I_F - I_F$



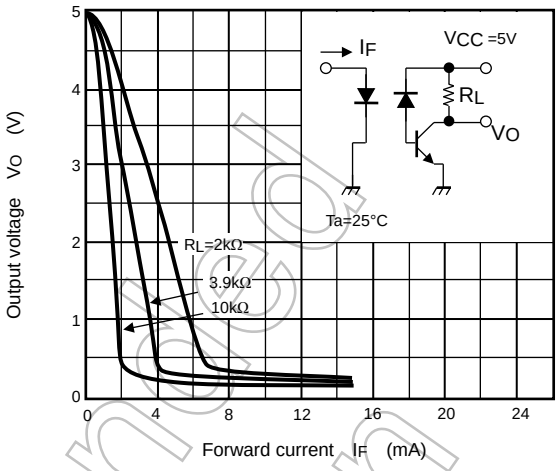
$I_O / I_F - Ta$



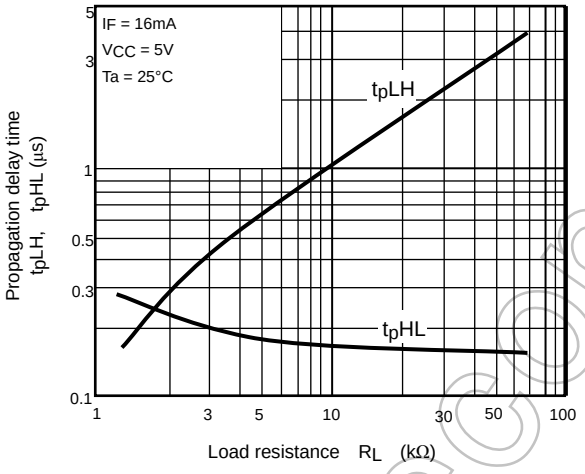
$I_O - V_O$



$V_O - I_F$



$t_{pHL}, t_{pLH} - R_L$



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