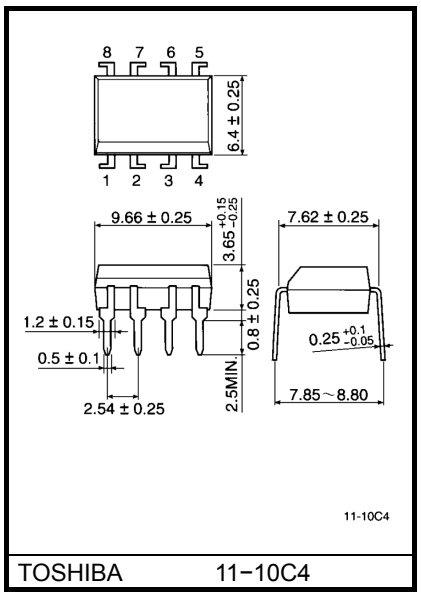
TOSHIBA Photocoupler GaAℓAs IRed & Photo−IC

TLP651

Digital Logic Ground Isolation
Line Receiver
Microprocessor System Interfaces
Switching Power Supply Feedback Control
Analog Signal Isolation

Unit in mm



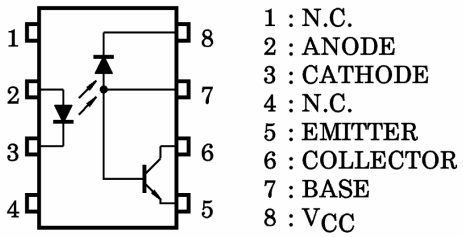
TOSHIBA 11−10C4

Weight: 0.54g

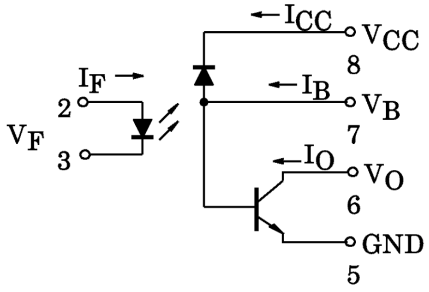
The TOSHIBA TLP651 consists of a GaAℓAs high−output light emitting diode and a high speed detector of one chip photo diode−transistor.
This unit is 8−lead DIP.
TLP651 has internal base connection. This base pin should be used for analog application or enable operation. If base pin is open, output signal will be noisy by environmental condition. For this case, TLP650 is suitable.

- Isolation voltage: 5000V_{rms} (min.)
- Switching speed: t_{pHL} = 0.3μs (typ.)
  t_{pLH} = 0.5μs (typ.) (R_L = 1.9kΩ)
- TTL compatible
- UL recognized: UL1577, file no. E67349
- BSI approved: BS EN60065: 2002
  Certificate no. 7613
  BS EN60950-1: 2002
  Certificate no. 7614

Pin Configuration (top view)



Schematic



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	−0.5~15	V
	Supply voltage		V_{CC}	−0.5~15	V
	Base current		I_B	5	mA
	Emitter−base reverse voltage		V_{EB}	5	V
	Output power dissipation	(Note 5)	P_O	100	mW
Operating temperature range			T_{opr}	−55~100	°C
Storage temperature range			T_{stg}	−55~125	°C
Lead solder temperature (10s)		(Note 6)	T_{sol}	260	°C
Isolation voltage (AC, 1min., R.H.≤ 60%)		(Note 7)	BV_S	5000	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) 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 the body of the device.

(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 = 0, 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} = V_O = 15V Ta = 70°C		—	—	250	μA
	High level supply voltage	I_{CCH}	I_F = 0mA, V_{CC} = 15V		—	0.01	1	μA
Coupled	Current transfer ratio	I_O / I_F	I_F = 16mA V_{CC} = 4.5V V_O = 0.4V	Ta = 25°C	10	30	—	%
				Rank: O	19	30	—	
				Ta = 0~70°C	5	—	—	
				Rank: O	15	—	—	
	Low level output voltage	V_{OL}	I_F = 16mA, V_{CC} = 4.5V, I_O = 1.1mA (Rank 0: I_O = 2.4mA)		—	—	0.4	V
	Isolation resistance	R_S	R.H.≤ 60%, V_S = 500V_{DC} (Note 7)		5×10^{10}	10^{14}	—	Ω
	Capacitance between input to output	C_S	V_S = 0, f = 1MHz (Note 7)		—	0.8	—	pF

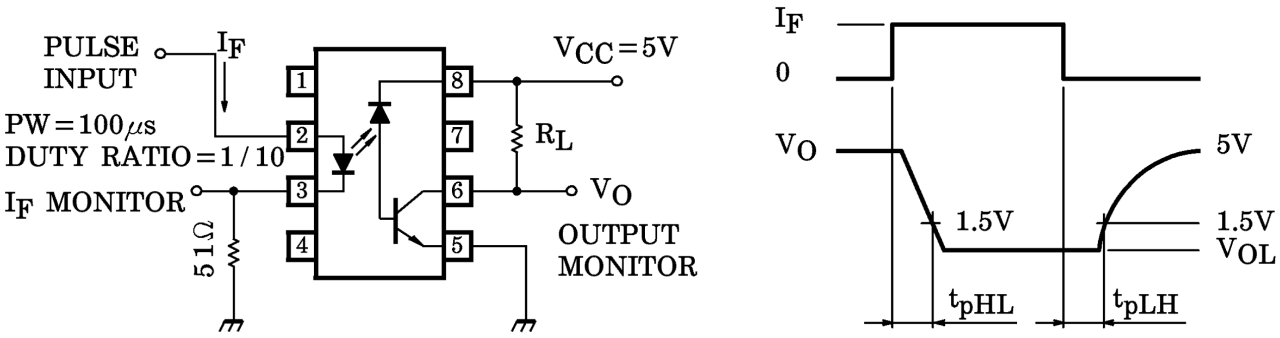
Switching Characteristics (Ta = 25°C, V_{CC} = 5V)

Characteristic	Symbol	Test Cir–cuit	Test Condition		Min.	Typ.	Max.	Unit
Propagation delay time (H→L)	t_{pHL}	1	I_F = 0→16mA, V_{CC} = 5V,		—	0.2	0.8	μs
			R_L=4.1kΩ	Rank O: R_L=1.9kΩ	—	0.3	0.8	
Propagation delay time (L→H)	t_{pLH}		I_F = 16→ 0mA, V_{CC} = 5V,		—	1.0	2.0	μs
			R_L=4.1kΩ	Rank O: R_L=1.9kΩ	—	0.5	1.2	
Common mode transient immunity at logic high output (Note 8)	C_{MH}	2	I_F = 0mA, V_{CM} = 200V_{p-p} R_L = 4.1kΩ (Rank O: R_L = 1.9kΩ)		—	400	—	V / μs
Common mode transient immunity at logic low output (Note 8)	C_{ML}		I_F =16mA, V_{CM} = 200V_{p-p} R_L = 4.1kΩ (Rank O: R_L = 1.9kΩ)		—	−1000	—	V / μs

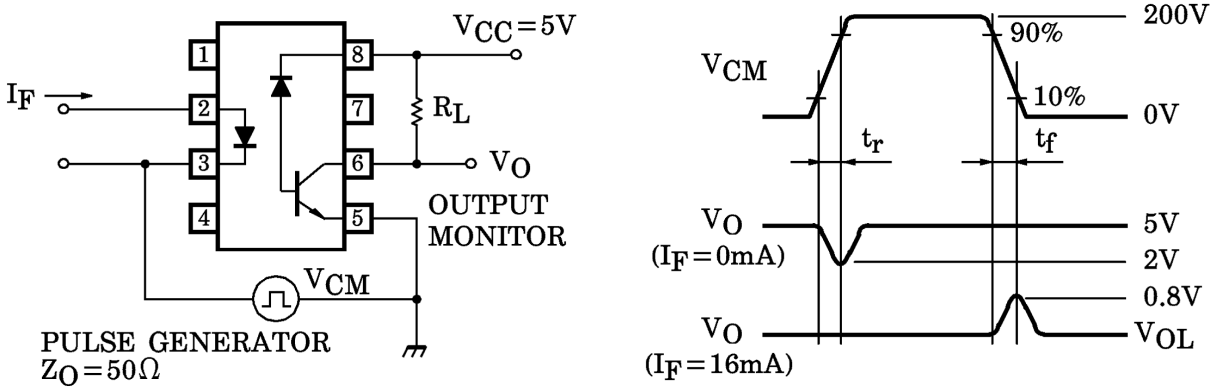
(Note 8) CM_L is the maximum rate of fall of the common mode voltage that can be sustained with the output voltage in the logic low state (V_O < 0.8V).
CM_H is the maximum rate of rise of the common mode voltage that can be sustained with the output voltage in the logic high state (V_O > 2.0V).

(Note 9) Maximum electrostatic discharge voltage for any pins: 100V (C = 200pF, R = 0).

Test Circuit 1: Switching Time Test Circuit

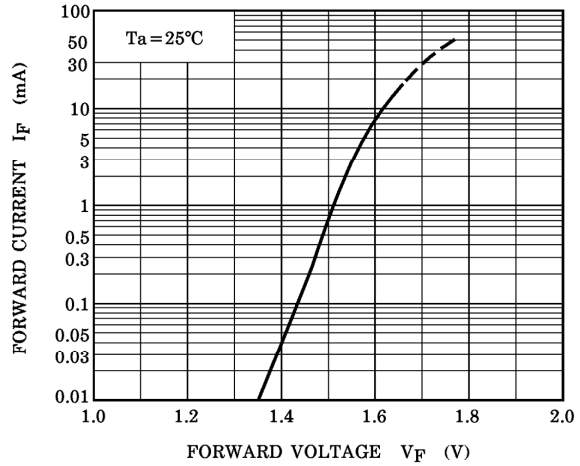


Test Circuit 2: Common Mode Noise Immunity Test Circuit

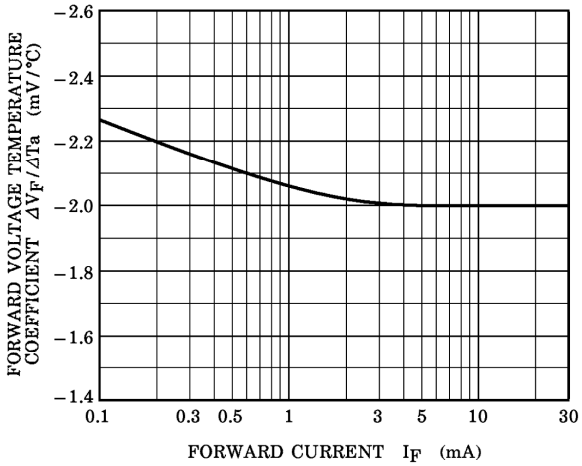


$$CM_H = \frac{160\,(V)}{t_r\,(\mu s)},\ CM_L = \frac{160\,(V)}{t_f\,(\mu s)}$$

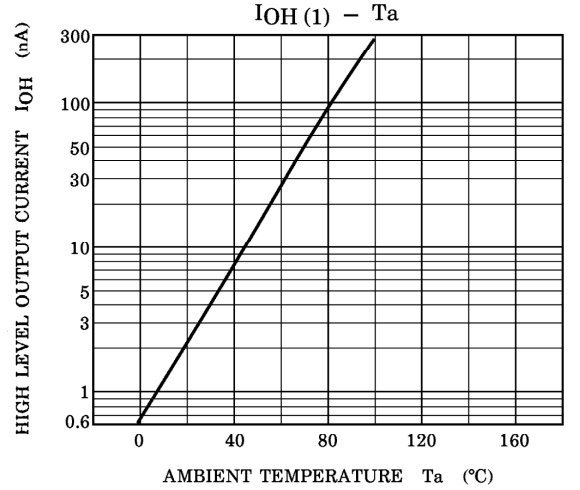
$I_F - V_F$



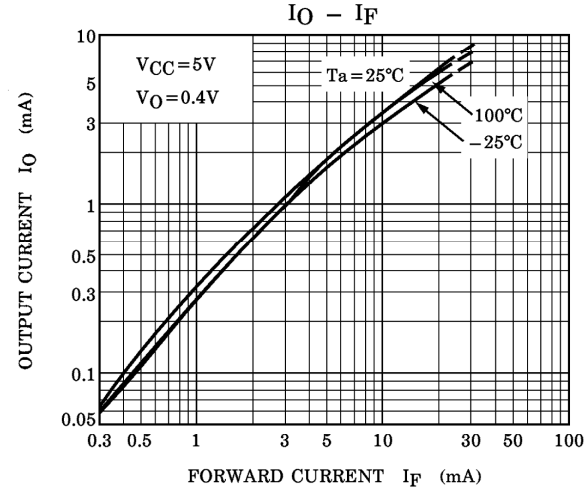
$\Delta V_F / \Delta Ta - I_F$



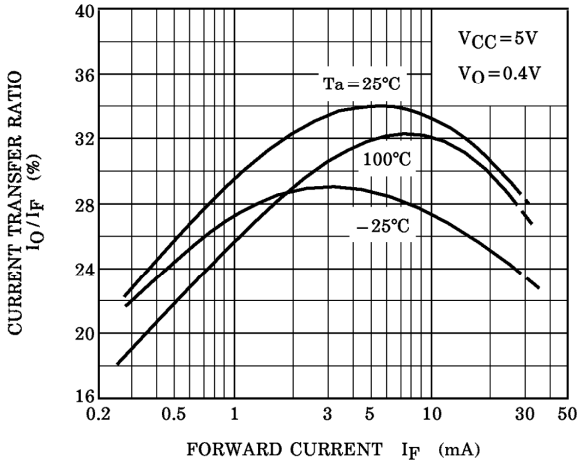
$I_{OH\ (1)} - Ta$



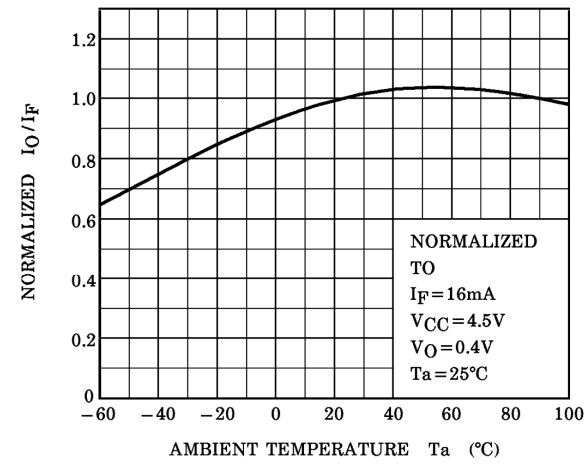
$I_O - I_F$



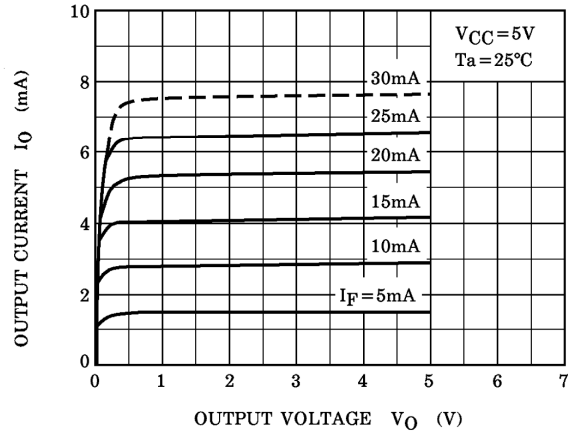
$I_O / I_F - I_F$



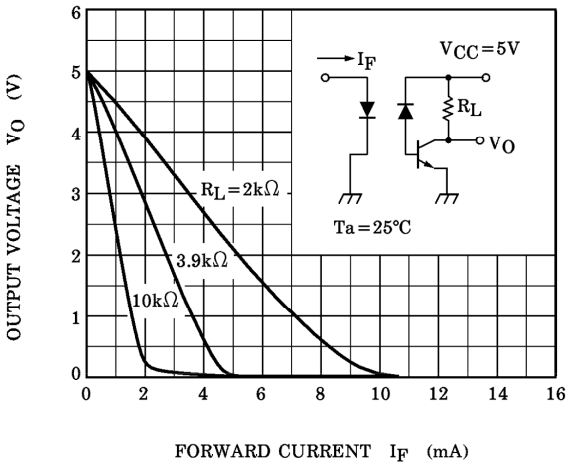
$I_O / I_F - Ta$



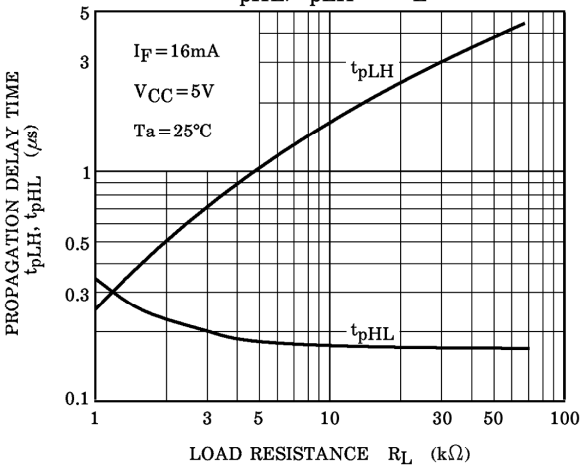
$I_O - V_O$



$V_O - I_F$



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



RESTRICTIONS ON PRODUCT USE

20070701-EN

- The information contained herein is subject to change without notice.
- TOSHIBA is continually working to improve the quality and reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to comply with the standards of safety in making a safe design for the entire system, and to avoid situations in which a malfunction or failure of such TOSHIBA products could cause loss of human life, bodily injury or damage to property.
  In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent TOSHIBA products specifications. Also, please keep in mind the precautions and conditions set forth in the “Handling Guide for Semiconductor Devices,” or “TOSHIBA Semiconductor Reliability Handbook” etc.
- The TOSHIBA products listed in this document are intended for usage in general electronics applications (computer, personal equipment, office equipment, measuring equipment, industrial robotics, domestic appliances, etc.).These TOSHIBA products are neither intended nor warranted for usage in equipment that requires extraordinarily high quality and/or reliability or a malfunction or failure of which may cause loss of human life or bodily injury (“Unintended Usage”). Unintended Usage include atomic energy control instruments, airplane or spaceship instruments, transportation instruments, traffic signal instruments, combustion control instruments, medical instruments, all types of safety devices, etc.. Unintended Usage of TOSHIBA products listed in his document shall be made at the customer’s own risk.
- The products described in this document shall not be used or embedded to any downstream products of which manufacture, use and/or sale are prohibited under any applicable laws and regulations.
- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA for any infringements of patents or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any patents or other rights of TOSHIBA or the third parties.
- GaAs(Gallium Arsenide) is used in this product. The dust or vapor is harmful to the human body. Do not break, cut, crush or dissolve chemically.
- Please contact your sales representative for product-by-product details in this document regarding RoHS compatibility. Please use these products in this document in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances. Toshiba assumes no liability for damage or losses occurring as a result of noncompliance with applicable laws and regulations.