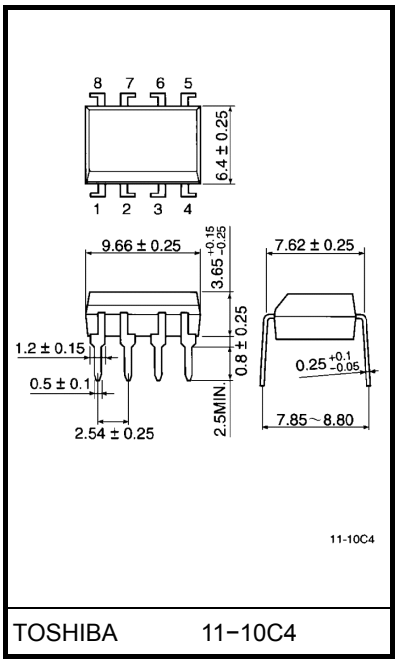
TOSHIBA Photocoupler GaAℓAs Ired & Photo IC

6N135, 6N136

Digital Logic Isolation.
Line Receiver.
Power Supply Control
Switching Power Supply
Transistor Inverter

Unit in mm



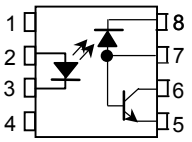
TOSHIBA 11−10C4

Weight: 0.54g

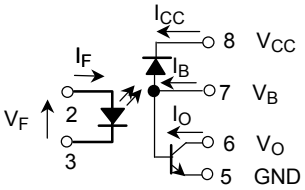
The TOSHIBA 6N135 and 6N136 consists of a high emitting diode and a one chip photo diode−transistor.
Each unit is 8−lead DIP package.

- Isolation voltage: 2500V_{rms} (min.)
- High speed: t_{pHL}, t_{pLH} = 0.5μs (typ.) (R_L = 1.9kΩ)
- TTL compatible
- If base pin is open, output signal will be noisy by environmental condition. For this base, TLP550 is suitable
- UL recognized: UL1577, file no. E67349

Pin Configurations



1 : N.C.
2 : ANODE
3 : CATHODE
4 : N.C.
5 : EMITTER
6 : COLLECTOR
7 : BASE, ANODE
8 : CATHODE



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
	Total pulse 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
	Emitter−base reverse voltage (pin 5−7)		V_{EB}	5	V
	Supply voltage		V_{CC}	−0.5~15	V
	Output voltage		V_O	−0.5~15	V
	Base current (pin 7)		I_B	5	mA
	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		(Note 7)	BV_S	2500	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) R.H. ≤ 60%, AC / 1min.

Electrical Characteristics
Over Recommended Temperature (Ta = 0°C~70°C unless otherwise noted)

Characteristic		Symbol	Test Condition	Min.	(**)Typ.	Max.	Unit
Current transfer ratio	6N135	CTR	I_F = 16mA, V_O = 0.4V, V_{CC} = 4.5V, Ta = 25°C (Note 8)	7	18	—	%
	6N136			19	24	—	%
	6N135	CTR	I_F = 16mA, V_O = 0.5V, V_{CC} = 4.5V (Note 1)	5	13	—	%
	6N136			15	21	—	%
Logic low output voltage	6N135	V_{OL}	I_F = 16mA, I_O = 1.1mA, V_{CC} = 4.5V	—	0.1	0.4	V
	6N136		I_F = 16mA, I_O = 2.4mA, V_{CC} = 4.5V	—	0.1	0.4	V
Logic high output current		I_{OH}	I_F = 0mA, V_O = V_{CC} = 5.5V, Ta = 25°C	—	3	500	nA
			I_F = 0mA, V_O = V_{CC} = 15V, Ta = 25°C	—	0.1	1	μA
		I_{OH}	I_F = 0 mA, V_O = V_{CC} = 15V	—	—	50	μA
Logic low supply current		I_{CCL}	I_F = 16mA, V_O = open, V_{CC} = 15V	—	40	—	μA
Logic high supply current		I_{CCH}	I_F = 0mA, V_O = open, V_{CC} = 15V, Ta = 25°C	—	0.01	1	μA
		I_{CCH}	I_F = 0mA, V_O = open, V_{CC} = 15V	—	—	2	μA
Input forward voltage		V_F	I_F = 16mA, Ta = 25°C	—	1.65	1.7	V
Temperature coefficient of forward voltage		ΔV_F / ΔTa	I_F = 16mA	—	−1.9	—	mV / °C
Input reverse breakdown voltage		BV_R	I_R = 10μA, Ta = 25°C	5	—	—	V
Input capacitance		C_{IN}	f = 1MHz, V_F = 0	—	60	—	pF
Resistance (input−output)		R_{I-O}	V_{I-O} = 500V, R.H. ≤ 60% (Note 9)	—	10^{12}	—	Ω
Capacitance (input−output)		C_{I-O}	f = 1MHz (Note 9)	—	0.6	—	pF
Transistor DC current gain		h_{FE}	V_O = 5V, I_O = 3mA	—	80	—	—

(**) All typicals at Ta = 25°C

Switching Specifications
(unless otherwise specified. Ta = 25°C, V_{CC} = 5V, I_F = 16mA)

Characteristic		Symbol	Test Circuit	Test Condition	Min.	Typ.	Max.	Unit
Propagation delay time to logic low at output	6N135	t_{pHL}	1	R_L = 4.1kΩ	—	0.2	1.5	μs
	6N136			R_L = 1.9kΩ	—	0.2	0.8	μs
Propagation delay time to logic high at output	6N135	t_{pLH}	1	R_L = 4.1kΩ	—	1.0	1.5	μs
	6N136			R_L = 1.9kΩ	—	0.5	0.8	μs
Common mode transient immunity at logic high level output (Note 10)	6N135	CM_H	2	I_F = 0mA V_{CM} = $10V_{p-p}$ R_L = 4.1kΩ	—	1000	—	V / μs
	6N136			I_F = 0mA V_{CM} = $10V_{p-p}$ R_L = 1.9kΩ	—	1000	—	V / μs
Common mode transient immunity at logic low level output (Note 10)	6N135	CM_L	2	V_{CM} = $10V_{p-p}$ R_L = 4.1kΩ I_F = 16mA	—	−1000	—	V / μs
	6N136			V_{CM} = $10V_{p-p}$ R_L = 1.9kΩ I_F = 16mA	—	−1000	—	V / μs
Bandwidth (Note 11)		BW	—	R_L = 100Ω	—	2	—	MHz

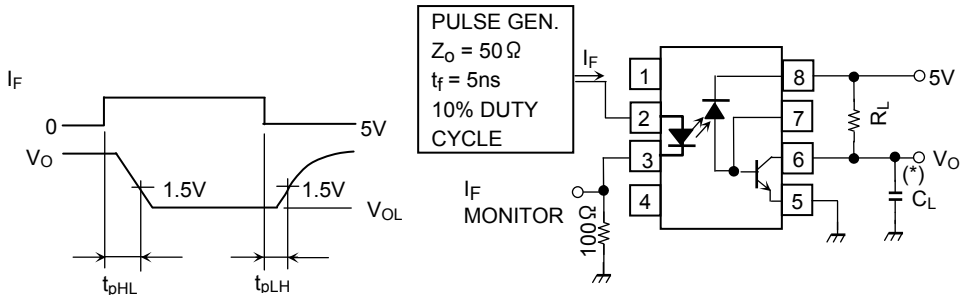
(Note 8) DC current transfer ratio is defined as the ratio of output collector current, I_O, to the forward LED input current, I_F, times 100%.

(Note 9) Device considered a two−terminal device: Pins 1, 2, 3, and 4 shorted together and pins 5, 6, 7 and 8 shorted together.

(Note 10) Common mode transient immunity in logic high level is the maximum tolerable (positive) dv_{CM} / dt on the leading edge of the common mode pulse, V_{CM}, to assure that the output will remain in a logic high state (i.e., V_O > 2.0V).
Common mode transient immunity in logic low level is the maximum tolerable (negative) dv_{CM} / dt on the trailing edge of the common mode pulse signal, V_{CM}, to assure that the output will remain in a logic low state (i.e., V_O < 0.8V).

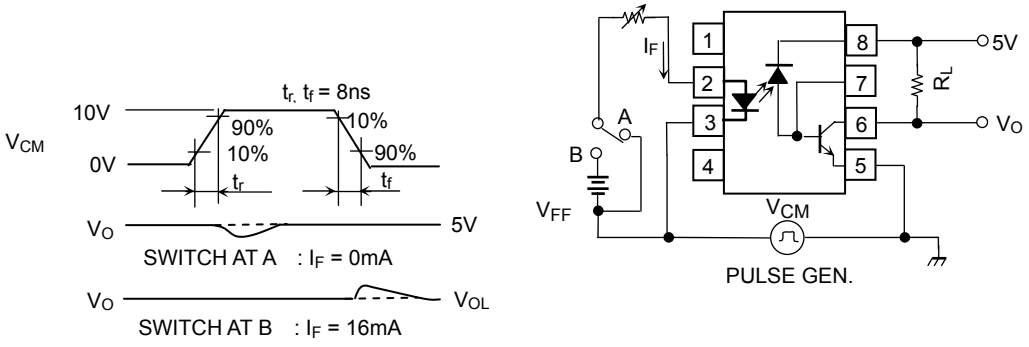
(Note 11) The frequency at which the AC output voltage is 3dB below the low frequency asymptote.

Test Circuit 1.

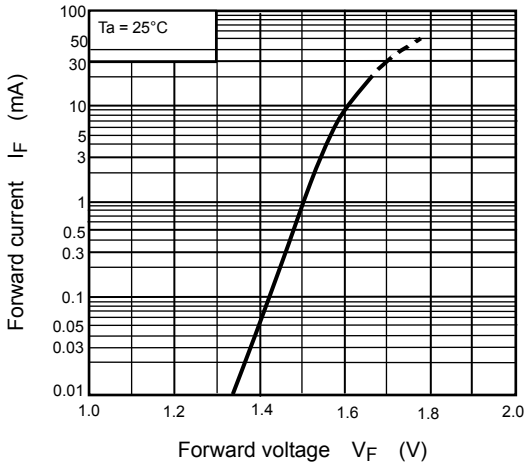


(*) C_L is approximately 15pF which includes probe and stray wiring capacitance.

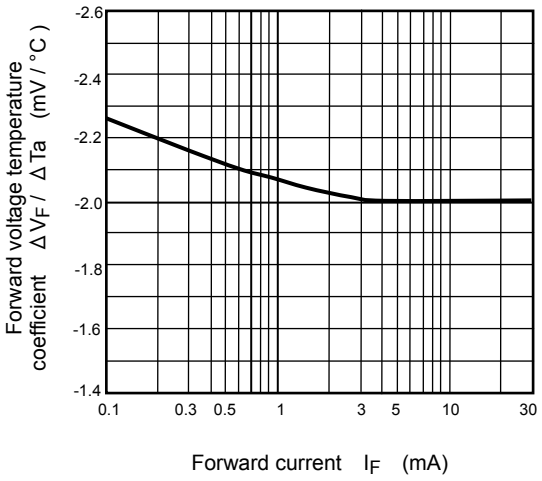
Test Circuit 2.



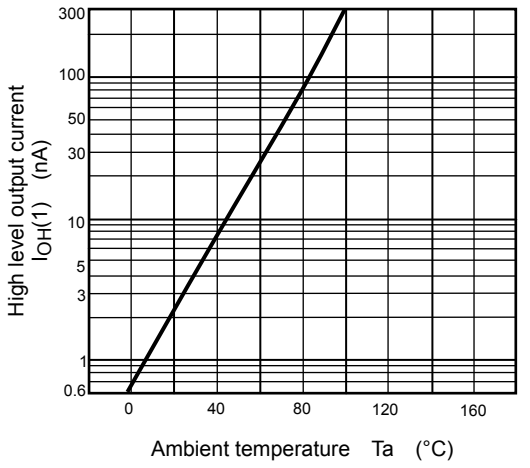
$I_F - V_F$



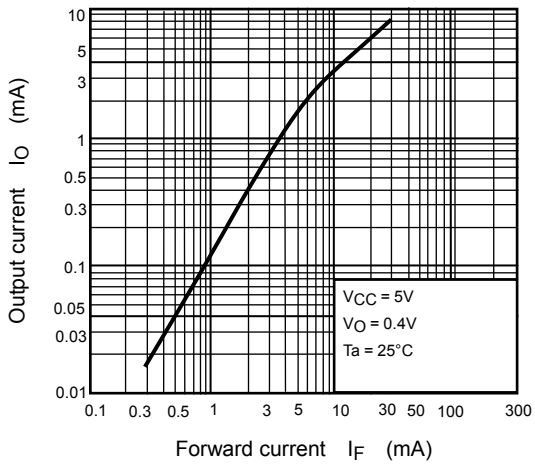
$\Delta V_F / \Delta Ta - I_F$



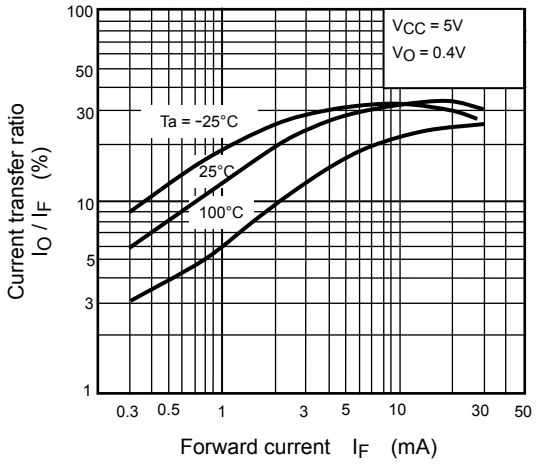
I_{OH} (1) – Ta



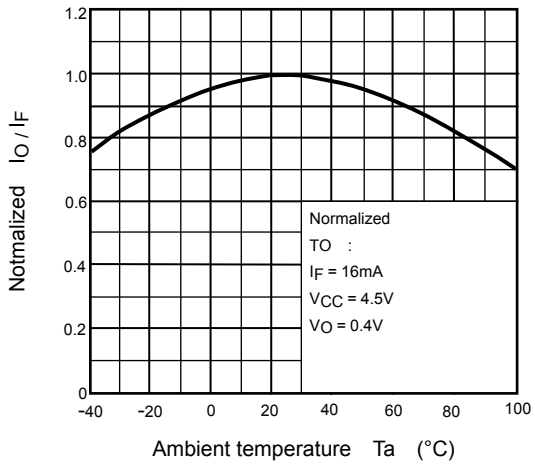
I_O - I_F



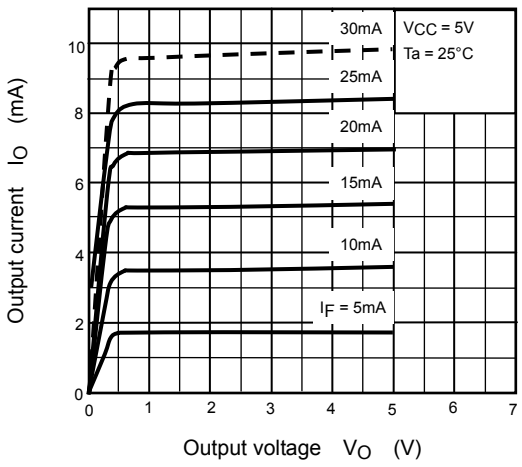
I_O / I_F – I_F



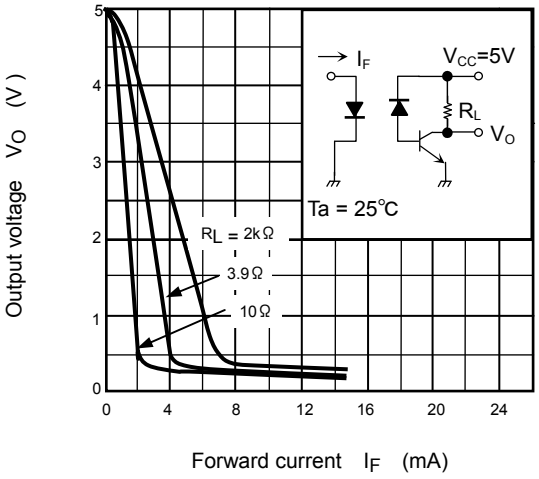
I_O / I_F – Ta



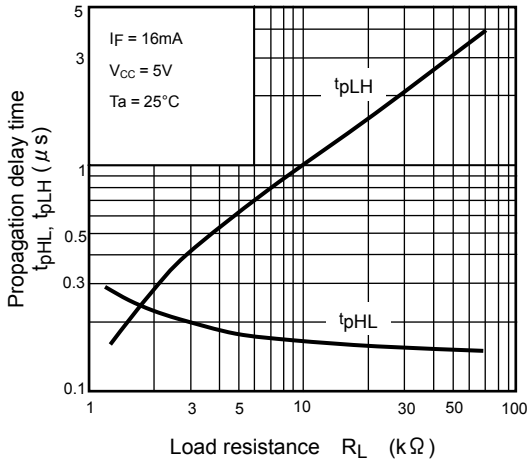
$I_O - V_O$



$V_O - I_F$



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



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.