TOSHIBA Photocoupler GaAℓAs Ired & Photo IC

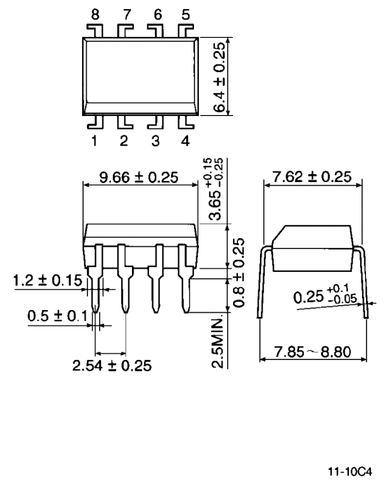
TLP2530, TLP2531

Degital Logic Isolation
Line Receiver
Power Supply Control
Switching Power Supply
Transistor Inverter

The TOSHIBA TLP2530 and TLP2531 dual photocouplers consist of a pair of GaAℓAs light emitting diode and integrated photodetector.
This unit is 8−lead DIP.
Separate connection for the photodiode bias and output transistor collectors improve the speed up to a hundred times that of a conventional phototransistor coupler by reducing the base−collector capacitance.

- TTL compatibel
- Switching speed: t_{pHL}=0.3μs, t_{pLH}=0.3μs(typ.) (@R_L=1.9kΩ)
- Guaranteed performance over temp: 0~70°C
- Isolation voltage: 2500 Vrms(min.)
- UL recognized: UL1577, file no. E67349

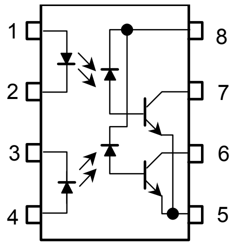
Unit in mm



TOSHIBA 11−10C4

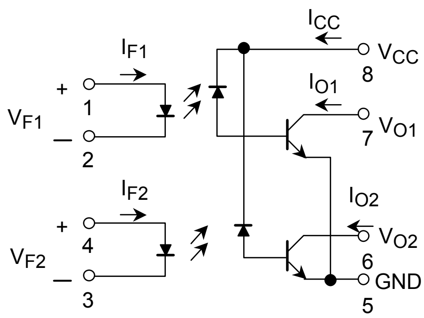
Weight: 0.54g

Pin Configuration (top view)



1. : Anode.1
2. : Cathode.1
3. : Cathode.2
4. : Anode.2
5. : Gnd
6. : V_{O2}(output 2)
7. : V_{O1}(output 1)
8. : V_{CC}

Schematic



Maximum Ratings

	Characteristic	Symbol	Rating	Unit
LED	Forward current(each channel) (Note 1)	I_F	25	mA
	Pulse forward current (Each Channel) (Note 2)	I_{FP}	50	mA
	Total pulse forward current (each channel) (Note 3)	I_{FPT}	1	A
	Reverse voltage(each channel)	V_R	5	V
	Diode power dissipation (each channel) (Note 4)	P_D	45	mW
Detector	Output current(each channel)	I_O	8	mA
	Peak output current (each channel)	I_{OP}	16	mA
	Supply voltage	V_{CC}	−0.5~15	V
	Output voltage(each channel)	V_O	−0.5~15	V
	Output power dissipation (each channel) (Note 5)	P_O	35	mW
Operating temperature range		T_{opr}	−55~100	°C
Storage temperature range		T_{stg}	−55~125	°C
Lead solder temperature(10s)**		T_{sol}	260	°C
Isolation voltage (AC, 1min., R.H.≤ 60%) (Note 7)		BV_S	2500	Vrms

(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 1mW / °C above 70°C.

**2mm below seating plane.

Recommended Operating Conditions

Characteristic	Symbol	Min.	Typ.	Max.	Unit
Supply voltage	V_{CC}	0	—	12	V
Forward current, each channel	I_F	—	16	25	mA
Operating temperature	T_{opr}	−25	—	85	°C

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

Characteristic		Symbol	Test Condition	Min.	Typ.**	Max.	Unit
Current transfer ratio (each channel)	TLP2530	CTR	I_F = 16mA, V_O = 0.4V V_{CC} = 4.5V, Ta = 25°C (Note 6)	7	30	—	%
	TLP2531			19	30	—	
	TLP2530	CTR	I_F = 16mA, V_O = 0.5V V_{CC} = 4.5V (Note 6)	5	—	—	%
	TLP2531			15	—	—	
Logic low output voltage (each channel)	TLP2530	V_{OL}	I_F = 16mA, I_O = 1.1mA V_{CC} = 4.5V	—	0.1	0.4	V
	TLP2531		I_F = 16mA, I_O = 2.4mA V_{CC} = 4.5V	—	0.1	0.4	V
Logic high output current (each channel)		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	—	—	50	μA
Logic low supply current		I_{CCL}	I_{F1} = I_{F2} = 16mA V_{O1} = V_{O2} = Open V_{CC} = 15V	—	160	—	μA
Logic high supply current		I_{CCH}	I_{F1} = I_{F2} = 0mA V_{O1} = V_{O2} = Open V_{CC} = 15V	—	0.05	4	μA
Input forward voltage (each channel)		V_F	I_F = 16mA, Ta = 25°C	—	1.65	1.7	V
Temperature coefficent of forward voltage(each channel)		$\Delta V_F / \Delta Ta$	I_F = 16mA	—	−2	—	mV/°C
Input reverse breakdown voltage(each channel)		BV_R	IR = 10μA, Ta = 25°C	5	—	—	V
Input capacitance (each channel)		C_{IN}	f = 1MHz, V_F = 0	—	60	—	pF
Input-output insulation leakage current		I_{I-O}	Relative humidity = 45% t = 5s, V_{I-O} = 3000V_{dc} Ta = 25°C (Note 7)	—	—	1.0	μA
Resistance (input−output)		R_{I-O}	V_{I-O} = 500V_{dc} (Note 7)	—	10^{12}	—	Ω
Capacitance (input−output)		C_{I-O}	f = 1MHz (Note 7)	—	0.6	—	pF
Input-input leakage current		I_{I-I}	Relative humidity = 45% t = 5s, V_{I-I} = 500V (Note 8)	—	0.005	—	μA
Resistance (input−input)		R_{I-I}	V_{I-I} = 500V_{dc} (Note 8)	—	10^{11}	—	Ω
Capacitance (input−iutput)		C_{I-I}	f = 1MHz (Note 8)	—	0.25	—	pF

**All typicals at Ta = 25°C.

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

Characteristic		Symbol	Test Cir–cuit	Test Condition	Min.	Typ.	Max.	Unit
Propagation delay time to logic low at output (each channel)	TLP2530	t_{pHL}	1	R_L = 4.1kΩ	—	0.3	1.5	μs
	TLP2531			R_L = 1.9kΩ	—	0.2	0.8	
Propagation delay time to logic high at output (each channel)	TLP2530	t_{pLH}	1	R_L = 4.1kΩ	—	0.5	1.5	μs
	TLP2531			R_L = 1.9kΩ	—	0.3	0.8	
Common mode transient immunity at logic high level output (each channel, Note 9)	TLP2530	CM_H	2	I_F = 0mA, V_{CM} = 400V_{p-p} R_L = 4.1kΩ	—	1500	—	V / μs
	TLP2531			I_F = 0mA, V_{CM} = 400V_{p-p} R_L = 1.9kΩ	—	1500	—	
Common mode transient immunity at logic low level output (each channel, Note 9)	TLP2530	CM_L	2	V_{CM} = 400V_{p-p} R_L = 4.1kΩ, I_F = 16mA	—	−1500	—	V / μs
	TLP2531			V_{CM} = 400$_{p-p}$ R_L = 1.9kΩ, I_F = 16mA	—	−1500	—	
Bandwidth (each channel, Note 10)		BW	3	R_L = 100Ω	—	2	—	MH_Z

(Note 6) 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%.

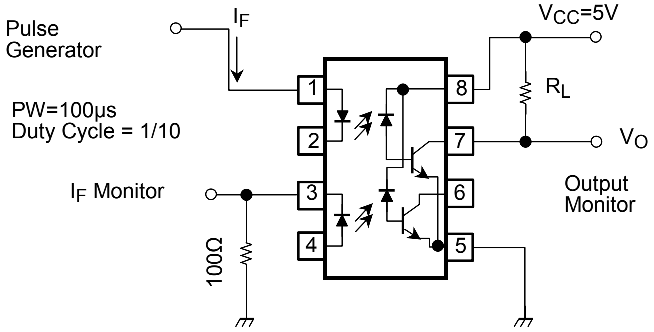
(Note 7) Device considered a two−terminal device: Pins 1, 2, 3 and 4 shorted together and pins 5, 6, 7, and 8 shorted together.

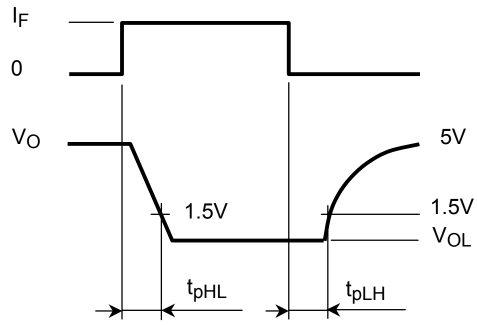
(Note 8) Measured between pins 1 and 2 shorted together, and pins 3 and 4 shorted together.

(Note 9) Common mode transient immunity in logic high level is the maximum tolerable (positive) dVcm / dt on the leading egde of the common mode pulse, Vcm, 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) dVcm / dt on the trailing edge of the common mode pulse signal, Vcm, to assure that the output will remain in logic low state(i.e., V_O > 0.8V).

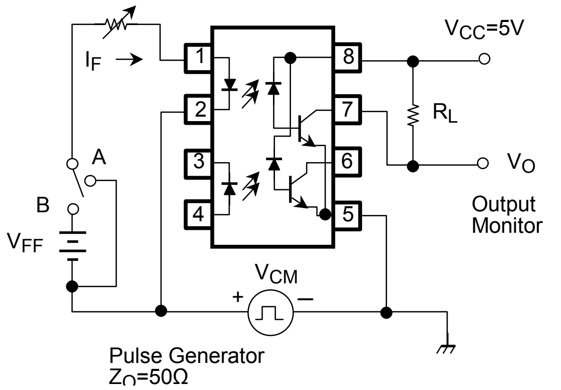
(Note 10) The frequency at which the ac output voltage is 3dB below the low frequency asymptote.

Test Circuit 1: Switching Time, t_pHL, t_pLH

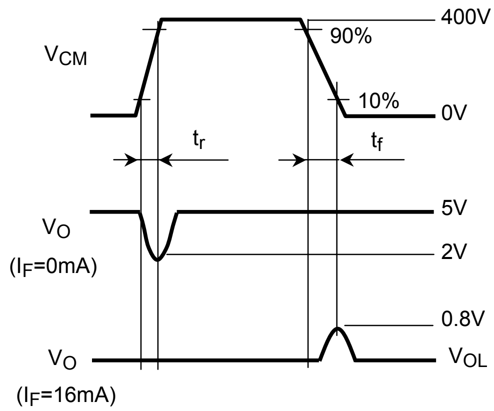




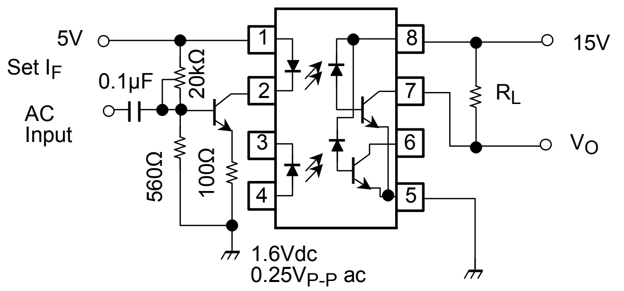
Test Circuit 2: Transient Immunity And Typical Waveform

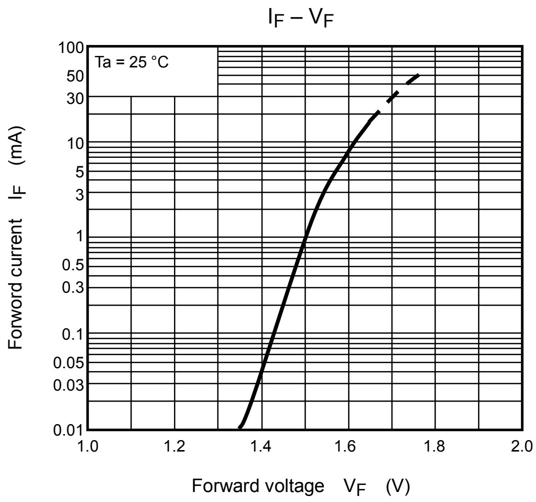


$$CM_H = \frac{320(V)}{t_r(\mu s)}, \quad CM_L = \frac{320(V)}{t_f(\mu s)}$$

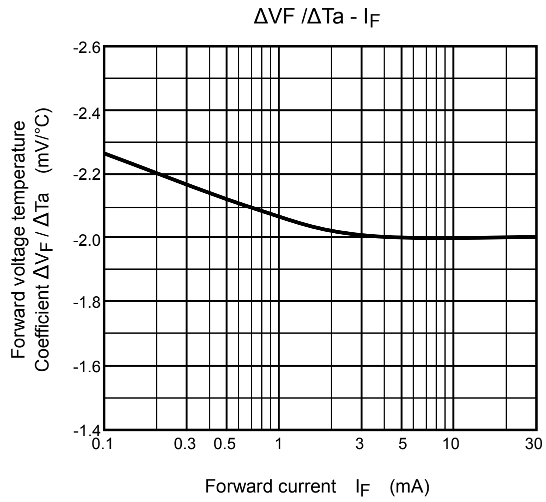


Test Circuit 3: Frequency Responce

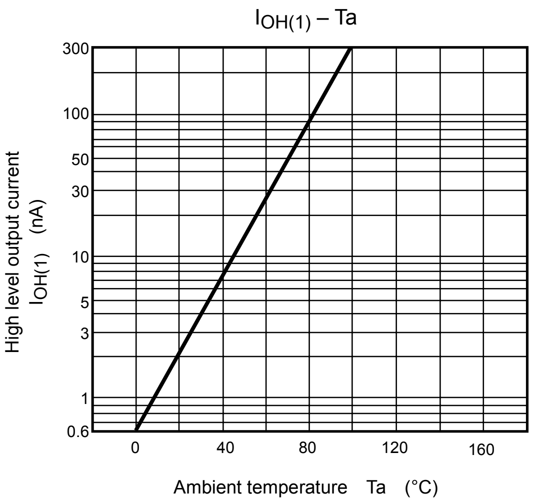




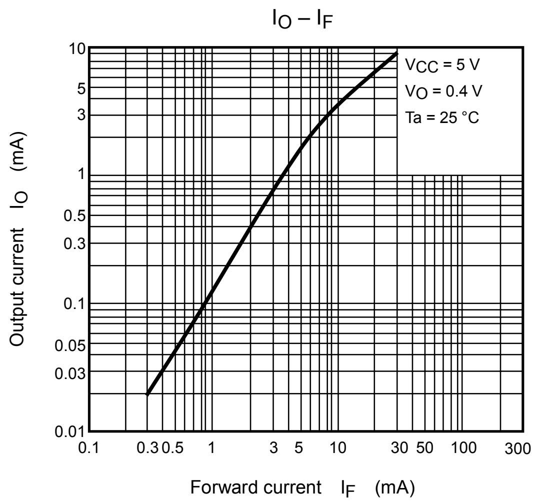
I_F – V_F
Ta = 25 °C
Forword current I_F (mA)
Forward voltage V_F (V)



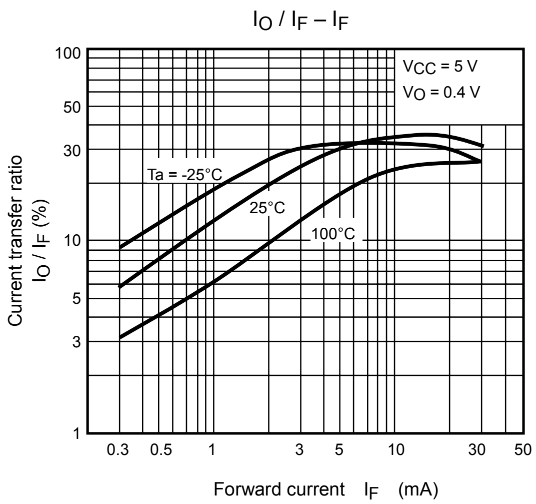
ΔVF /ΔTa - I_F
Forward voltage temperature Coefficient $\Delta V_F / \Delta Ta$ (mV/°C)
Forward current I_F (mA)



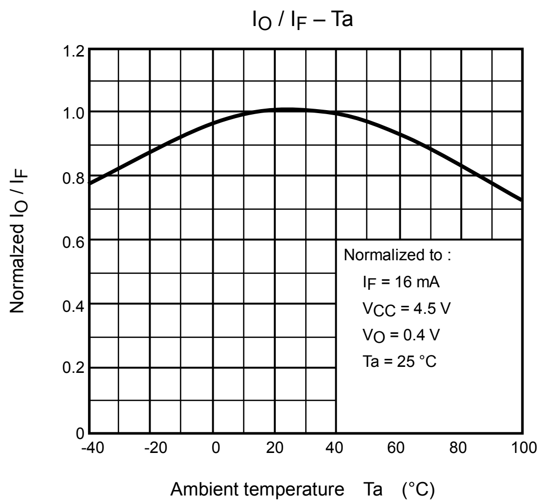
$I_{OH(1)}$ – Ta
High level output current $I_{OH(1)}$ (nA)
Ambient temperature Ta (°C)



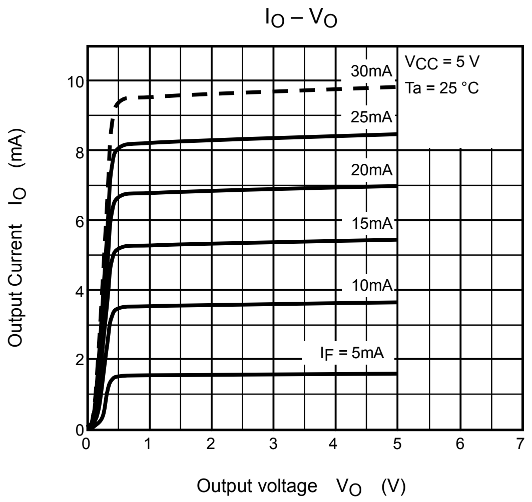
I_O – I_F
V_{CC} = 5 V
V_O = 0.4 V
Ta = 25 °C
Output current I_O (mA)
Forward current I_F (mA)

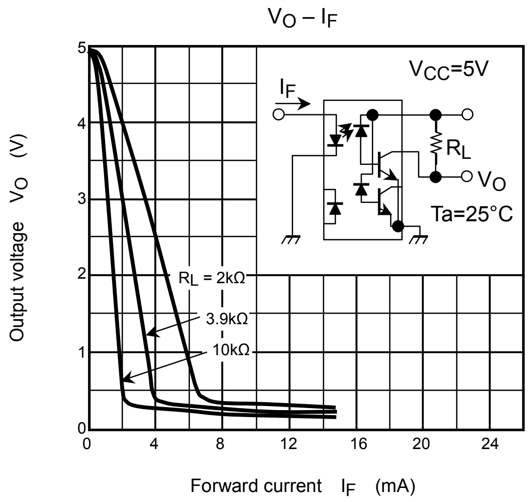


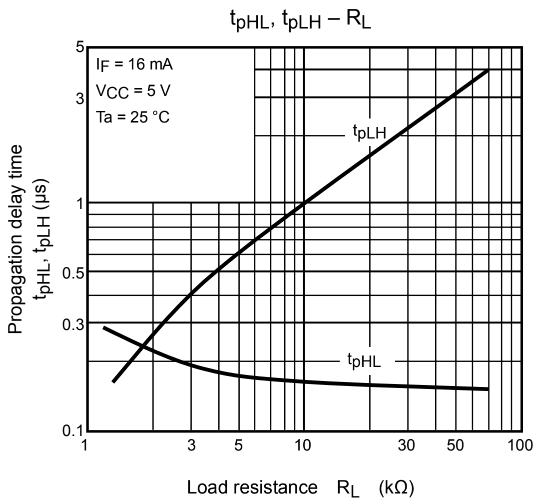
I_O / I_F – I_F
V_{CC} = 5 V
V_O = 0.4 V
Ta = -25°C
25°C
100°C
Current transfer ratio I_O / I_F (%)
Forward current I_F (mA)



I_O / I_F – Ta
Normalized to :
I_F = 16 mA
V_{CC} = 4.5 V
V_O = 0.4 V
Ta = 25 °C
Normalzed I_O / I_F
Ambient temperature Ta (°C)


I_O – V_O
V_{CC} = 5 V
Ta = 25 °C
30mA
25mA
20mA
15mA
10mA
I_F = 5mA
Output Current I_O (mA)
Output voltage V_O (V)


V_O – I_F
V_{CC}=5V
I_F
R_L
V_O
Ta=25°C
R_L = 2kΩ
3.9kΩ
10kΩ
Output voltage V_O (V)
Forward current I_F (mA)


t_{pHL}, t_{pLH} – R_L
I_F = 16 mA
V_{CC} = 5 V
Ta = 25 °C
t_{pLH}
t_{pHL}
Propagation delay time t_{pHL}, t_{pLH} (μs)
Load resistance R_L (kΩ)

RESTRICTIONS ON PRODUCT USE

000707EBC

- 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 this document shall be made at the customer's own risk.
- Gallium arsenide (GaAs) is a substance used in the products described in this document. GaAs dust and fumes are toxic. Do not break, cut or pulverize the product, or use chemicals to dissolve them. When disposing of the products, follow the appropriate regulations. Do not dispose of the products with other industrial waste or with domestic garbage.
- The products described in this document are subject to the foreign exchange and foreign trade laws.
- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA CORPORATION for any infringements of intellectual property or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any intellectual property or other rights of TOSHIBA CORPORATION or others.
- The information contained herein is subject to change without notice.