TOSHIBA Photocoupler GaAℓAs Ired & Photo IC

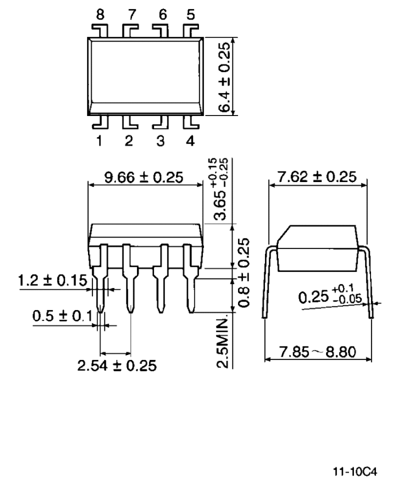
TLP2530, TLP2531

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.

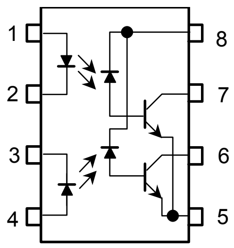
- TTL compatibel
- Switching speed: t_{pHL}=0.3μs, t_{pLH}=0.3μs(typ.) (@R_L=1.9kΩ)
- Guaranteed performance over temp: 0~70°C
- Isolation voltage: 2500 Vrms(min.)
- UL recognized: UL1577, file no. E67349

Unit in mm



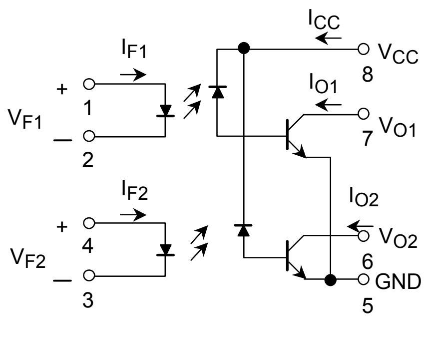
TOSHIBA 11−10C4
Weight: 0.54g

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%.

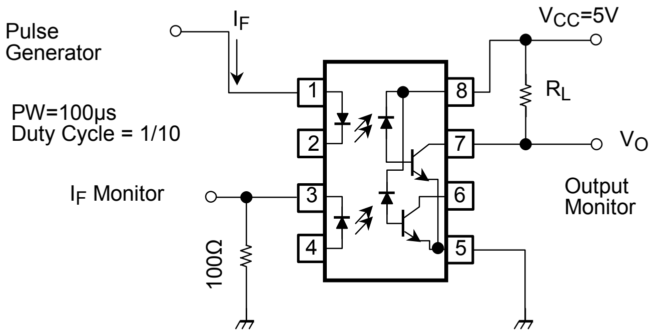
(Note 7) Device considered a two−terminal device: Pins 1, 2, 3 and 4 shorted together and pins 5, 6, 7, and 8 shorted together.

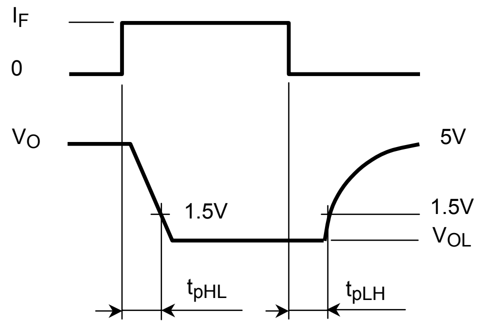
(Note 8) Measured between pins 1 and 2 shorted together, and pins 3 and 4 shorted together.

(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).

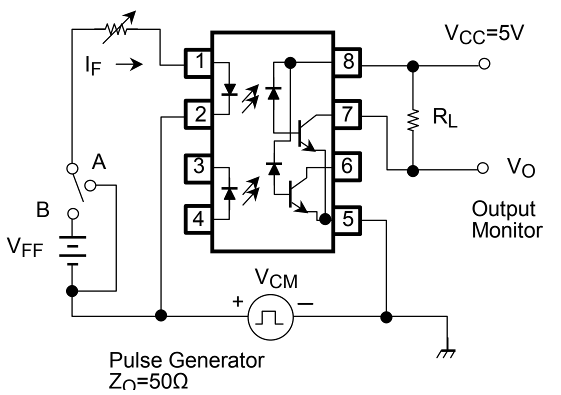
(Note 10) The frequency at which the ac output voltage is 3dB below the low frequency asymptote.

Test Circuit 1: Switching Time, t_pHL, t_pLH

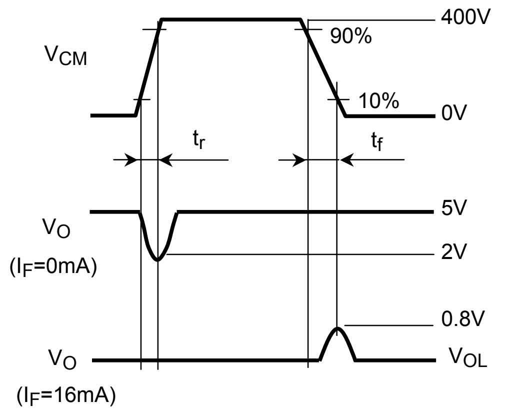




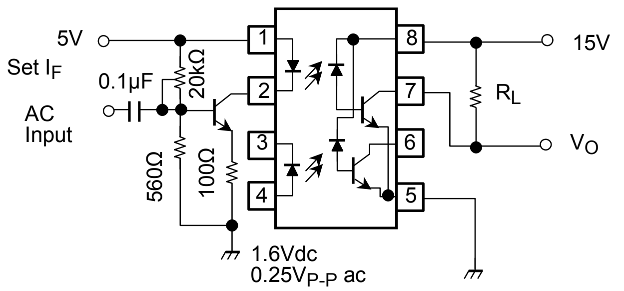
Test Circuit 2: Transient Immunity And Typical Waveform

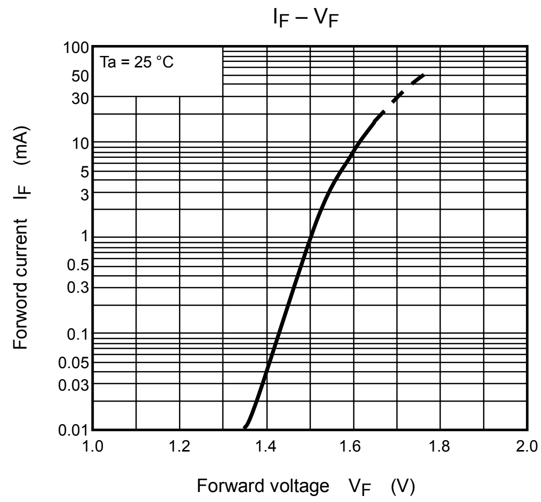


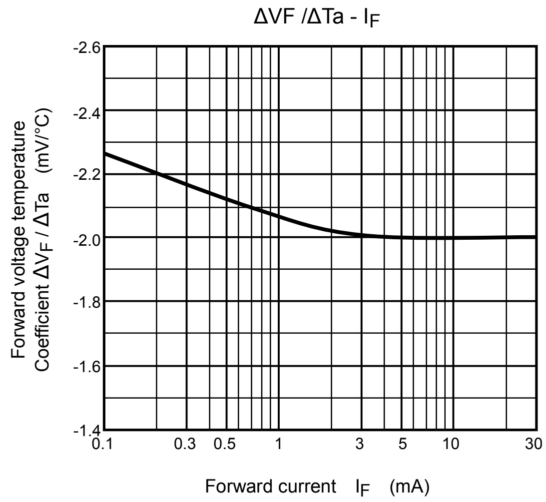
$CM_H = \frac{320(V)}{t_r(\mu s)}$, $CM_L = \frac{320(V)}{t_f(\mu s)}$

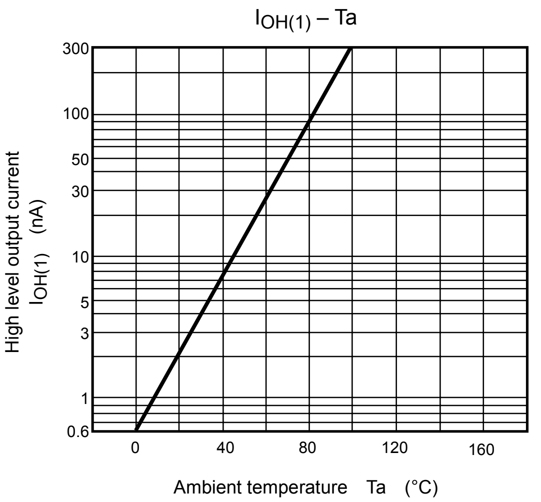


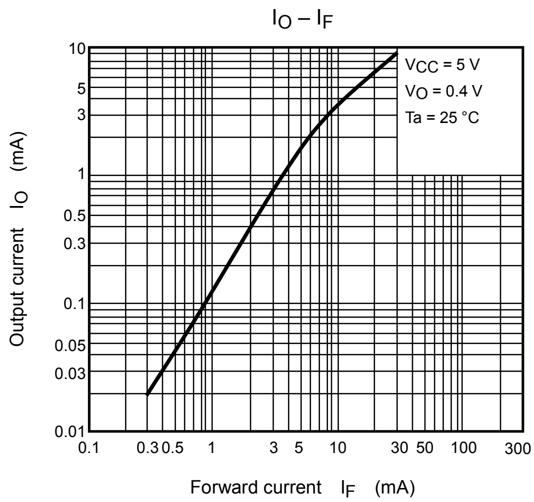
Test Circuit 3: Frequency Responce

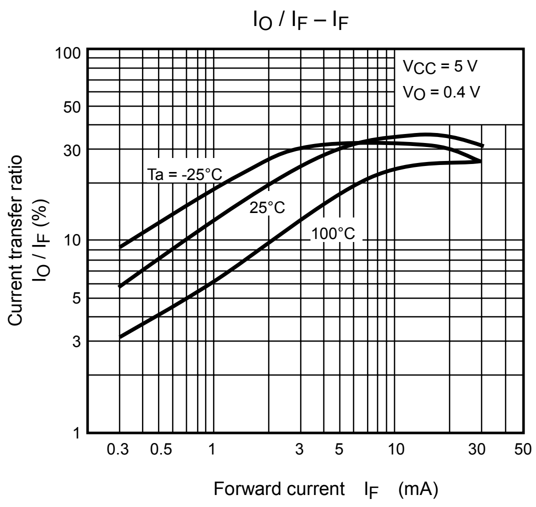


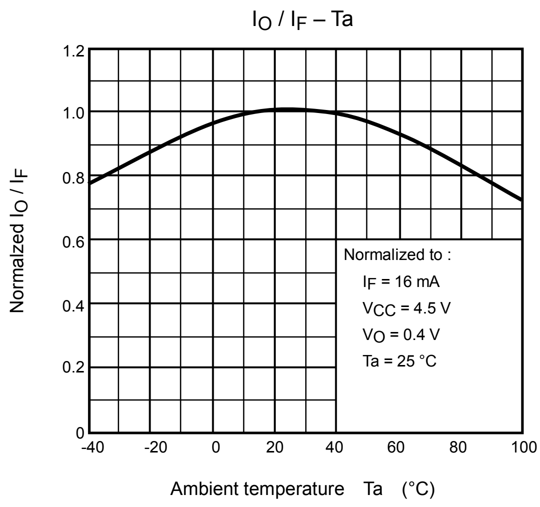

IF – VF
Ta = 25 °C
Forword current IF (mA)
Forward voltage VF (V)

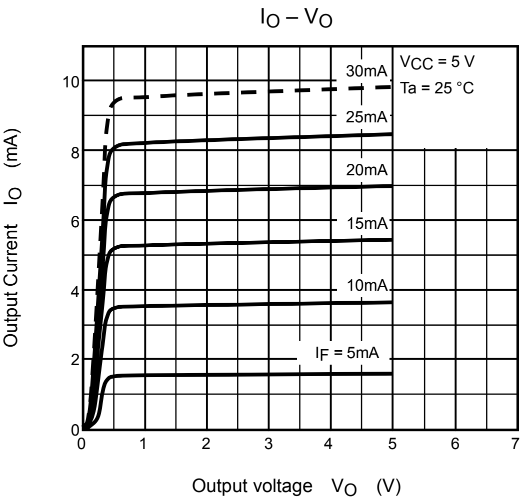

ΔVF /ΔTa - IF
Forward voltage temperature Coefficient ΔVF / ΔTa (mV/°C)
Forward current IF (mA)

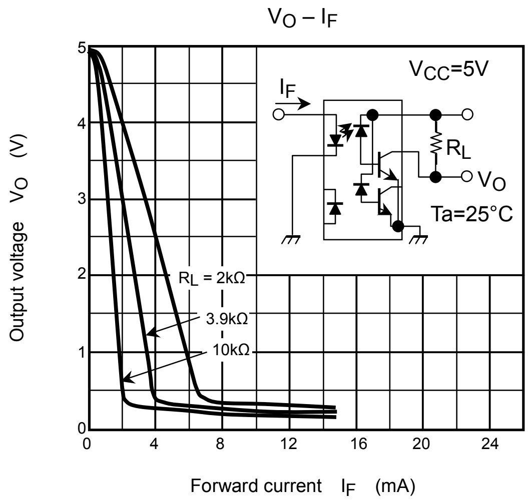

IOH(1) – Ta
High level output current IOH(1) (nA)
Ambient temperature Ta (°C)

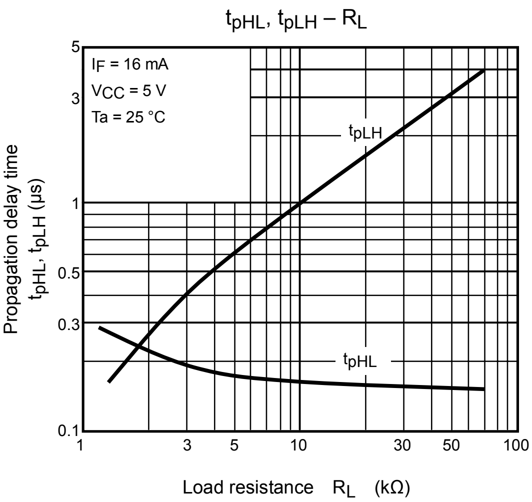

IO – IF
VCC = 5 V
VO = 0.4 V
Ta = 25 °C
Output current IO (mA)
Forward current IF (mA)


IO / IF – IF
VCC = 5 V
VO = 0.4 V
Ta = -25°C
25°C
100°C
Current transfer ratio IO / IF (%)
Forward current IF (mA)


IO / IF – Ta
Normalized to :
IF = 16 mA
VCC = 4.5 V
VO = 0.4 V
Ta = 25 °C
Normalzed IO / IF
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)

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