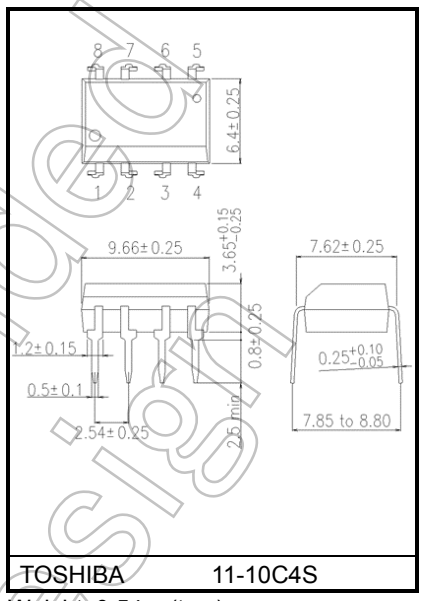
TOSHIBA Photocoupler IRED & Photo IC

TLP2530, TLP2531

Digital Logic Isolation
Line Receiver
Power Supply Control
Switching Power Supply
Industrial Inverter

Unit: mm



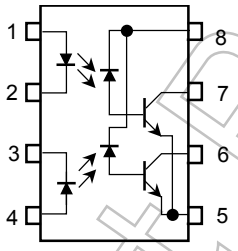
TOSHIBA 11-10C4S

Weight: 0.54 g (typ.)

The TOSHIBA TLP2530 and TLP2531 dual photocouplers consist of a pair of infrared 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.

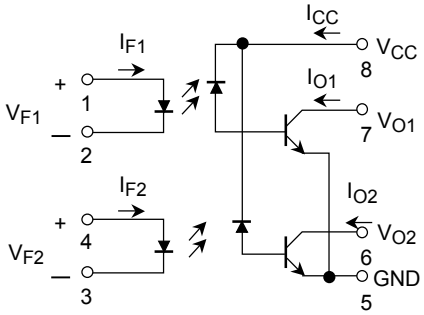
- TTL compatible
- Switching speed: t_{pHL} = 0.2 μs, t_{pLH} = 0.3 μs (typ.)
  (@R_L = 1.9 kΩ)
- Guaranteed performance over temp: 0°C to 70°C
- Isolation voltage: 2500 Vrms (min)
- UL-recognized: UL1577, File No.E67349
- cUL-recognized: CSA Component Acceptance Service No.5A
  File No.E67349

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



Start of commercial production
1986-03

Absolute Maximum Ratings (Ta = 25°C)

	Characteristic		Symbol	Rating	Unit
LED	Forward current (each channel)		I_F	25	mA
	Forward current derating (each channel) (Ta> 70 °C)		ΔIF/Ta	-0.8	mA / °C
	Pulse forward current (each channel)	(Note 1)	I_{FP}	50	mA
	Pulse forward current derating (each channel) (Ta> 70 °C)		ΔIFP/Ta	-1.6	mA / °C
	Total pulse forward current (each channel)	(Note 2)	I_{FPT}	1	A
	Reverse voltage (each channel)		V_R	5	V
	Diode power dissipation (each channel)		P_D	45	mW
	Diode power dissipation derating (each channel) (Ta> 70 °C)		ΔPD/Ta	-0.8	mW / °C
Detector	Output current(each channel)		I_O	8	mA
	Peak output current (each channel)		I_{OP}	16	mA
	Output voltage(each channel)		V_O	-0.5 to 15	V
	Supply voltage		V_{CC}	-0.5 to 15	V
	Output power dissipation (each channel)		P_O	35	mW
	Output power dissipation derating (each channel) (Ta> 70 °C)		ΔPo/Ta	-0.6	mW / °C
Operating temperature range			T_{opr}	-55 to 100	°C
Storage temperature range			T_{stg}	-55 to 125	°C
Lead solder temperature(10 s)		(Note 3)	T_{sol}	260	°C
Isolation voltage (AC, 60 s, R.H. ≤ 60 %)		(Note 4)	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: 50 % duty cycle, 1 ms pulse width.
Note 2: Pulse width ≤ 1 μs, 300 pps.
Note 3: 2 mm below seating plane.
Note 4: Device considered a two-terminal device: Pins 1, 2, 3 and 4 shorted together and pins 5, 6, 7 and 8 shorted together.

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

Note: Recommended operating conditions are given as a design guideline to obtain expected performance of the device. Additionally, each item is an independent guideline respectively. In developing designs using this product, please confirm specified characteristics shown in this document.

Electrical Characteristics (Ta = 0°C to 70°C, unless otherwise noted)

Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
Input forward voltage (each channel)		V_F	I_F = 16 mA, Ta = 25 °C	—	1.65	1.7	V
Temperature coefficent of forward voltage (each channel)		$\Delta V_F / \Delta Ta$	I_F = 16 mA	—	-2	—	mV/°C
Input reverse breakdown voltage (each channel)		BV_R	I_R = 10 μA, Ta = 25 °C	5	—	—	V
Input capacitance (each channel)		C_T	f = 1 MHz, V_F = 0 V	—	45	—	pF
Logic high output current (each channel)		I_{OH}	I_F = 0 mA, V_O = V_{CC} = 5.5 V Ta = 25 °C	—	3	500	nA
			I_F = 0 mA, V_O = V_{CC} = 15 V	—	—	50	μA
Logic low supply current		I_{CCL}	I_{F1} = I_{F2} = 16 mA V_{O1} = V_{O2} = Open V_{CC} = 15 V	—	160	—	μA
Logic high supply current		I_{CCH}	I_{F1} = I_{F2} = 0 mA V_{O1} = V_{O2} = Open V_{CC} = 15 V	—	0.05	4	μA
Current transfer ratio (each channel)	TLP2530	I_O / I_F	I_F = 16 mA, V_O = 0.4 V V_{CC} = 4.5 V, Ta = 25 °C	7	30	—	%
	TLP2531			19	30	—	
	TLP2530	I_O / I_F	I_F = 16 mA, V_O = 0.4 V V_{CC} = 4.5 V	5	—	—	%
	TLP2531			15	—	—	
Logic low output voltage (each channel)	TLP2530	V_{OL}	I_F = 16 mA, I_O = 1.1 mA V_{CC} = 4.5 V	—	0.1	0.4	V
	TLP2531		I_F = 16 mA, I_O = 2.4 mA V_{CC} = 4.5 V	—	0.1	0.4	V
Resistance (input-output)		R_S	V_S = 500 V R.H. ≤ 60 % (Note 1)	5×10^{10}	10^{14}	—	Ω
Capacitance (input-output)		C_S	f = 1 MHz (Note 1)	—	0.6	—	pF
Resistance (input-input)		R_{I-I}	V_{I-I} = 500 V (Note 1)	—	10^{11}	—	Ω
Capacitance (input-iutput)		C_{I-I}	f = 1 MHz (Note 1)	—	0.25	—	pF

Note: All typicals at Ta = 25 °C.

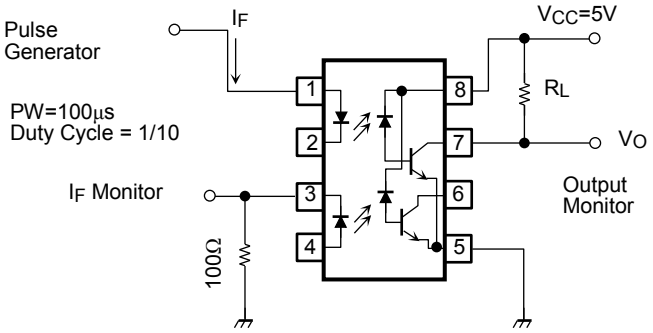
Note 1: Device considered a two-terminal device: Pins 1, 2, 3 and 4 shorted together and pins 5, 6, 7 and 8 shorted together.

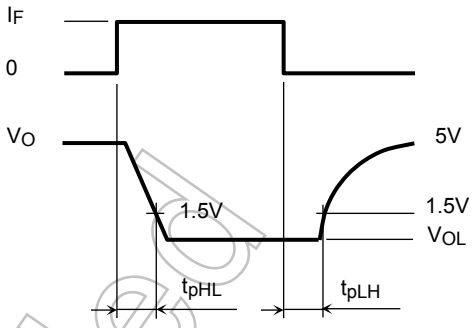
Switching Characteristics (unless otherwise specified, Ta = 25°C, V_{CC} = 5V, I_F = 16mA)

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

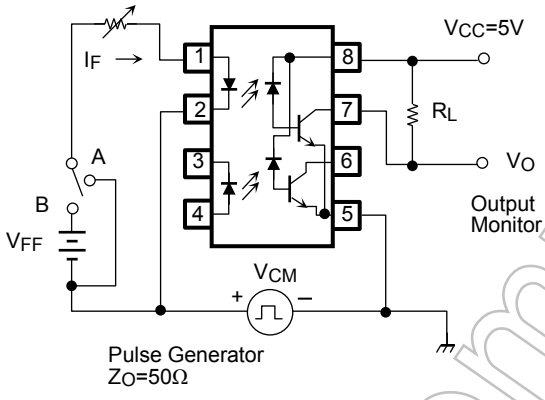
Note 1: Common mode transient immunity in logic high level is the maximum tolerable (positive) dVcm / dt on the leading egde of the common mode pulse, Vcm, to assure that the output will remain in a logic high state (i.e., V_O > 2.0 V).
Common mode transient immunity in logic low Level is the maximum 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 < 0.8 V).

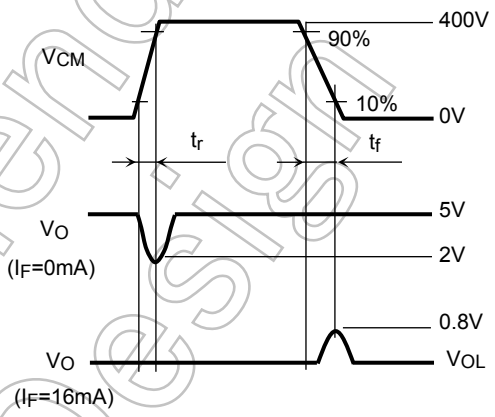
Test Circuit 1: Switching Time, t_{pHL}, t_{pLH}





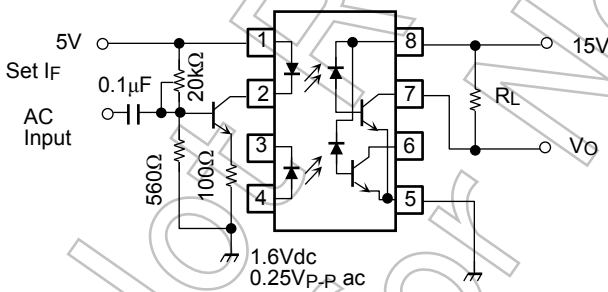
Test Circuit 2: Common mode transient Immunity and Typical Waveform



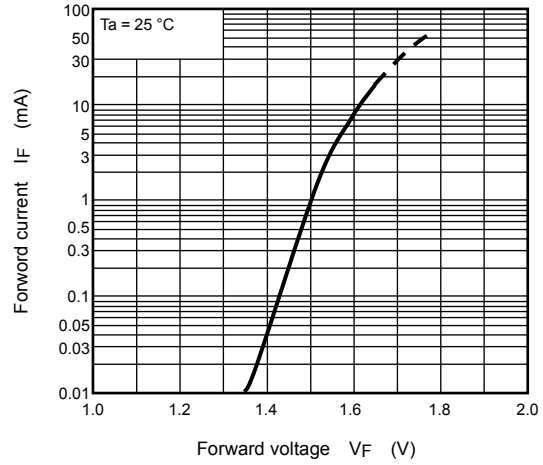


$$CM_H = \frac{320(V)}{t_r(\mu s)}, CM_L = \frac{320(V)}{t_f(\mu s)}$$

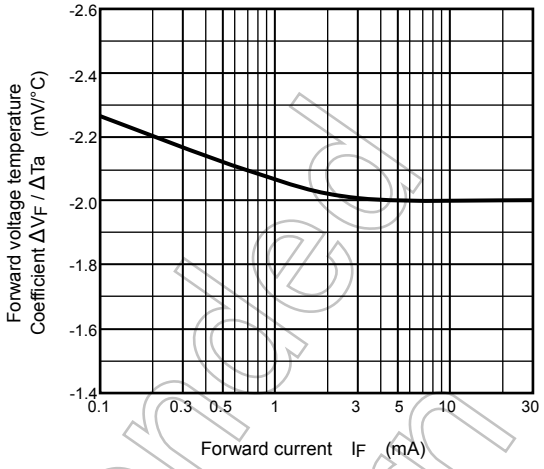
Test Circuit 3: Frequency Response



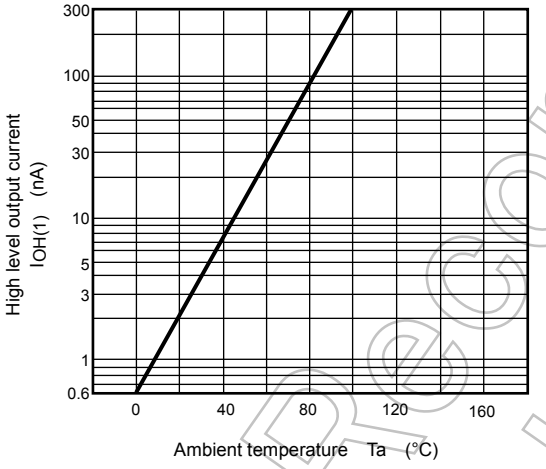
$I_F - V_F$



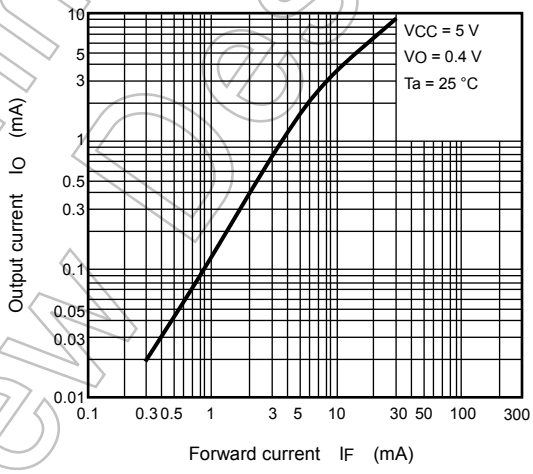
$\Delta VF / \Delta Ta - I_F$



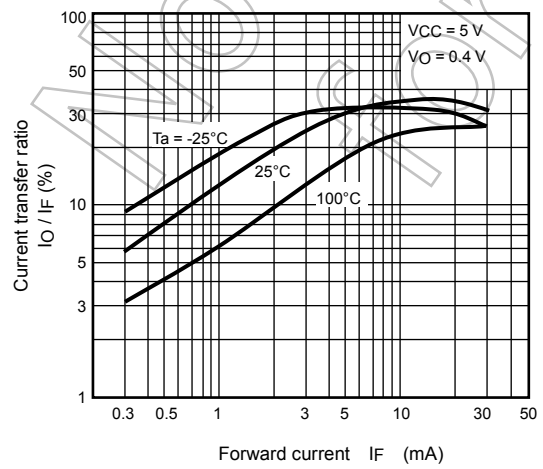
$I_{OH(1)} - Ta$



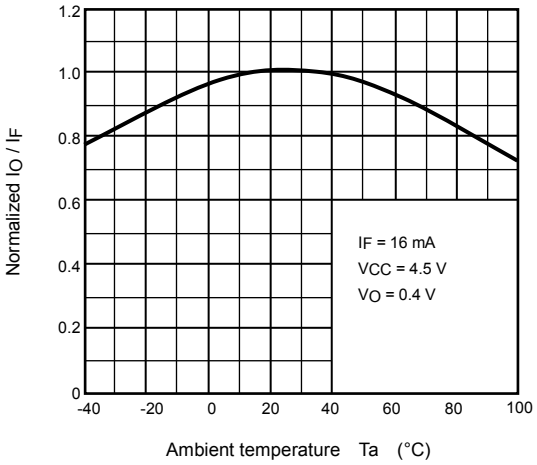
$I_O - I_F$



$I_O / I_F - I_F$

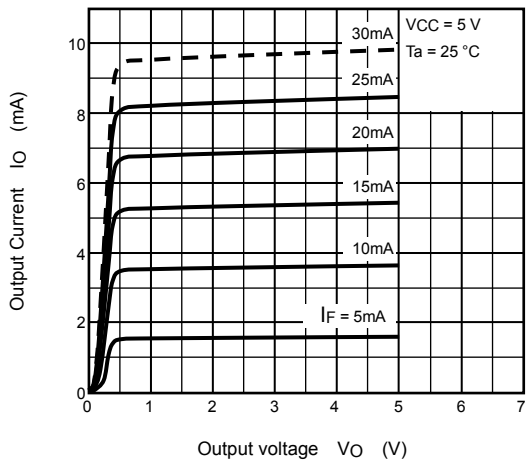


$I_O / I_F - Ta$

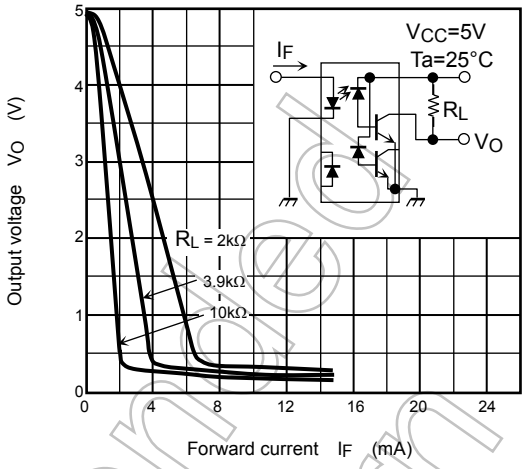


NOTE: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

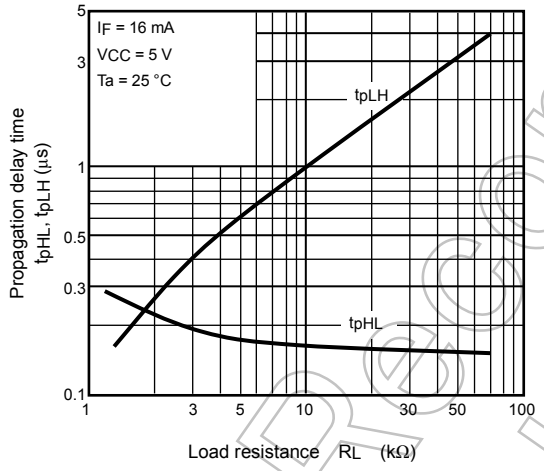
$I_O - V_O$



$V_O - I_F$



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



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