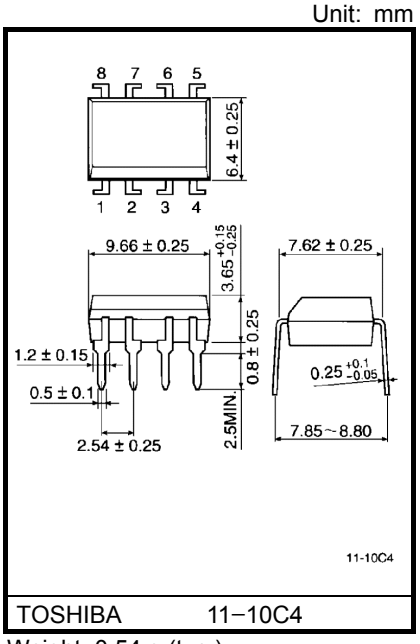
TOSHIBA Photocoupler GaAℓAs Ired & Photo−IC

TLP557

Transistor Inverter
Inverter for Air Conditioner
Power Transistor Base Drive

Unit: mm



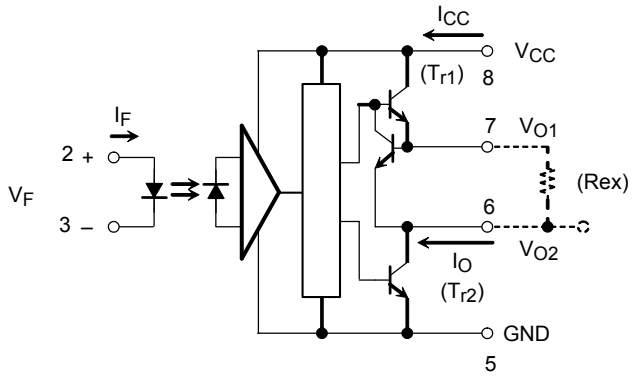
TOSHIBA	11−10C4

Weight: 0.54 g (typ.)

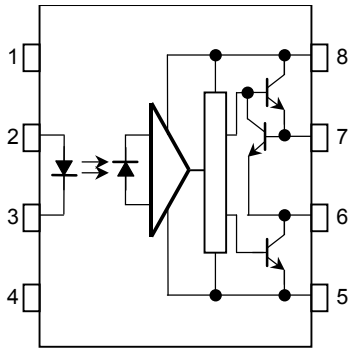
The TOSHIBA TLP557 consists of a GaAℓAs light emitting diode and an integrated photodetector.
This unit is 8−lead DIP package.
TLP557 is suitable for base driving circuit of power transistor module up to 20A.
External resistor needs to connect between pin 6 and pin 7.
This is for constant current driving.

- Input threshold current: I_F = 5 mA (max)
- Guaranteed performance temperature range: −30~70°C
- Supply voltage: 16 V (max)
- Output current: ±0.3 A (max)
- Switching time (t_{pLH} / t_{pHL}): 5 μs (max)
- Isolation voltage: 2500 V_{rms} (min)
- UL recognized: UL1577, file No. E67349

Schematic



Pin Configuration (top view)



1 : N.C.
2 : Anode
3 : Cathode
4 : N.C.
5 : GND
6 : V_{O2}(Output)
7 : V_{O1}(Rex Terminal)
8 : V_{CC}

Truth Table

		Tr1	Tr2
Input LED	On	On	Off
	Off	Off	On

Start of commercial production
1987/06

Absolute Maximum Ratings

Characteristic			Symbol	Rating	Unit
LED	Forward current		I_F	25	mA
	Peak transient forward current	(Note 1)	I_{FPT}	1	A
	Reverse voltage		V_R	5	V
	Junction temperature		(T_j)	125	°C
Detector	Output current (f ≤ 5kHz, Duty ≤ 50%)		I_O	+0.32 / −0.32	A
	Peak output current (P_W ≤ 10μs, f ≤ 5kHz)		I_{OP}	+2 / −0.5	A
	Output voltage		V_O	16	V
	Supply voltage		V_{CC}	16	V
	O_1 terminal to O_2 terminal (pin 7−pin 6) voltage		V_{1-2}	1.5	V
	O_2 terminal to O_1 terminal (pin 6−pin 7) voltage		V_{2-1}	5	V
	Power dissipation	(Note 2)	P_O	0.5	W
	Junction temperature		(T_j)	125	°C
Total package power dissipation		(Note 3)	P_{OT}	0.55	W
Operating temperature range			T_{opr}	−30 to 70	°C
Storage temperature range			T_{stg}	−55 to 125	°C
Lead solder temperature (10 s)			T_{sol}	260	°C
Isolation voltage (AC, 1 minute, R.H.≤ 60%, Ta=25°C)		(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) Pulse width PW ≤ 1μs, 300pps

(Note 2) ΔP_O / °C=−6.7mW / °C (Ta ≥ 50°C)

(Note 3) ΔP_{OT} / °C=−7.4mW / °C (Ta ≥ 50°C)

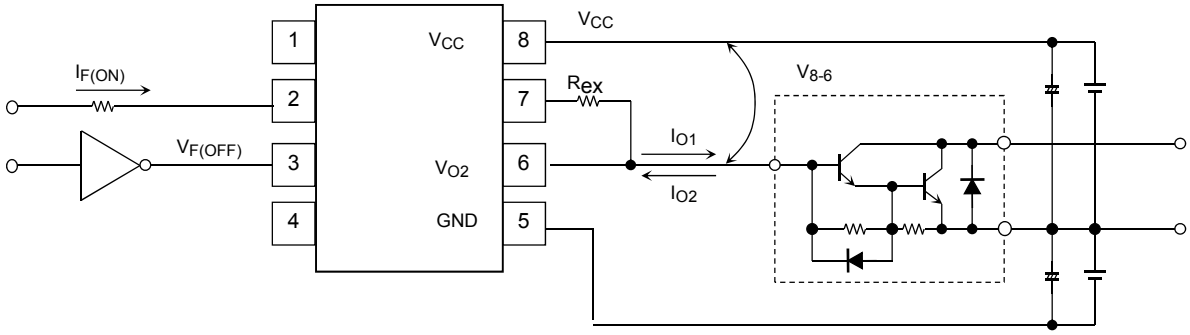
(Note 4) Device considered a two terminal device: Pins 1, 2, 3 and 4 shorted together, and pins 5, 6, 7 and 8 shorted together.

Recommended Operating Conditions

Characteristic	Symbol	Min	Typ.	Max	Unit
Input current on	I_F(ON)	7	8	20	mA
Input voltage off	V_F(OFF)	0	—	0.8	V
Supply voltage	V_{CC}	5	6	13	V
I_{B1} Drive current	I_{O1}	—	0.15	0.25	A
I_{B2} Drive current	I_{O2}	—	—	0.5	A
External resistance	Rex	2.7	4.3	—	Ω
V_{CC}–V_{O2} (pin 8–pin 6) ON voltage	V_{8-6}	2.3	3 (I_{O1} = 0.15A)	2.5 (I_{O1} = 0.25A)	V
Operating temperature	Topr	−30	25	70	°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.

(Rex is for constant current driving)



Electrical Characteristics (Ta = −30~70°C, unless otherwise specified)

Characteristic	Symbol	Test Condition		Min	Typ.*	Max	Unit	Test Circuit
Input forward voltage	V_F	I_F = 5mA , Ta = 25°C		—	1.55	1.7	V	
Temperature coefficient of forward voltage	$\Delta V_F / \Delta Ta$	I_F = 5mA		—	−2.0	—	mV / °C	
Input reverse current	I_R	V_R = 5V, Ta = 25°C		—	—	10	μA	
Input capacitance	C_T	V = 0 , f = 1MHz , Ta = 25°C		—	—	250	pF	
O_1 Output leakage current	I_{O1L}	V_{CC} = 16V, V_{O1} = 0, V_F = 0.8V		—	0.01	200	μA	1
O_2 Output leakage current	I_{O2L}	V_{CC} = 16V, V_{O2} = 16V, I_F = 5mA		—	0.2	200	μA	2
O_1 Output current	I_O	V_{8-6} = 2.3V Rex = 2.7Ω I_F = 5mA, Ta = 25°C	V_{CC} = 6V	0.22	0.27	0.32	A	3
			V_{CC} = 16V	0.22	0.27	0.32		
O_2 High level output voltage	V_{OH}	V_{CC} = 6V, Rex = 2.7Ω I_F = 5mA		3.5	5.5	—	V	4
O_2 Low level output voltage	V_{OL}	V_F = 0.8V, Rex = 2.7Ω I_O = 0.25A, Ta = 25°C	V_{CC} = 6V	—	0.2	0.4	V	5
			V_{CC} = 16V	—	0.2	0.4		
		V_F = 0.8V, Rex = 2.7Ω I_O = 0.5A (*1) Ta = 25°C	V_{CC} = 6V	—	0.4	—	V	
			V_{CC} = 16V	—	0.4	—		
High level supply current	I_{CCH}	V_{CC} = 6V, I_F = 5mA Rex = 2.7Ω, Ta = 25°C		—	3.8	10	mA	
		V_{CC} = 6V, I_F = 5mA, Rex = 2.7Ω		—	—	13		
		V_{CC} = 16V, I_F = 5mA, Rex = 2.7Ω		—	5.2	17		
Low level supply current	I_{CCL}	V_{CC} = 6V, I_F = 0mA Rex = 2.7Ω, Ta = 25°C		—	11	17	mA	
		V_{CC} = 6V, I_F = 0mA, Rex = 2.7Ω		—	—	22		
		V_{CC} = 16V, I_F = 0mA, Rex = 2.7Ω		—	13	25		
“Output L→H” threshold input current	I_{FLH}	Rex = 2.7Ω I_O = 0.25A V_{O2} > 3V	V_{CC} = 6V	—	2.5	5	mA	
			V_{CC} = 16V	—	—	5		
“Output H→L” threshold input current	V_{FHL}	Rex = 2.7Ω I_O = 0.25A V_{O2} < 0.4V	V_{CC} = 6V	0.8	—	—	V	
			V_{CC} = 16V	0.8	—	—		
Input current hysteresis	I_{HYS}	V_{CC} = 6V, Rex = 2.7Ω, Ta = 25°C		—	0.05	—	mA	
Supply voltage	V_{CC}			5	—	16	V	
Capacitance (input−output)	C_S	V_S = 0, f = 1MHz, Ta = 25°C		—	1.0	2.0	pF	
Resistance (input−output)	R_S	V_S = 500V , Ta = 25°C, R.H.≤ 60%		5×10^{10}	10^{12}	—	Ω	

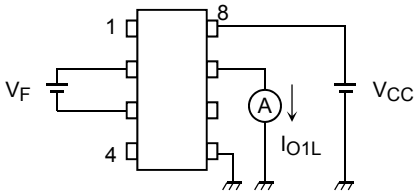
* All typical values are at Ta = 25°C (*1): Duration of I_O time ≤ 100μs

Switching Characteristics (Ta = −30~70°C unless otherwise specified)

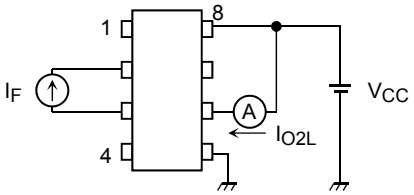
Characteristic	Symbol	Test Condition	Min	Typ.*	Max	Unit	Test Circuit
Propagation delay time, L→H	t_{pLH}	V_{CC} = 6V, I_F = 8mA Rex = 2.7Ω f = 5kHz, Duty = 10%	—	1	5	μs	6
Propagation delay time, H→L	t_{pHL}		—	1	5	μs	
Output rise time	t_r		—	0.05	—	μs	
Output fall time	t_f		—	0.05	—	μs	
Common mode transient immunity at high level output	CM_H	V_{CM} = 600V, I_F = 8mA V_{CC} = 6V, Rex = 270Ω R = 1kΩ, Ta = 25°C	−2000	—	—	V / μs	7
Common mode transient immunity at low level output	CM_L	V_{CM} = 600V, I_F = 0mA V_{CC} = 6V, Rex = 270Ω R = 1kΩ, Ta = 25°C	2000	—	—	V / μs	7

* All typical values are at Ta = 25°C.

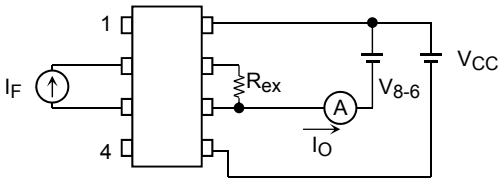
Test Circuit 1: I_{O1L}



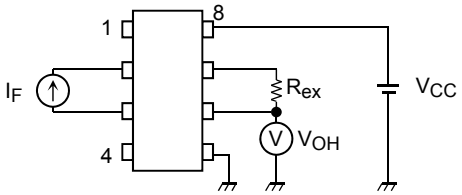
Test Circuit 2: I_{O2L}



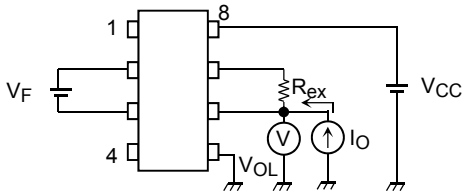
Test Circuit 3: I_O



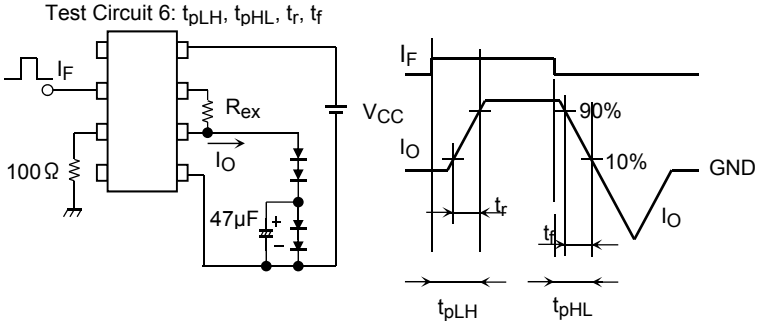
Test Circuit 4: V_{OH}



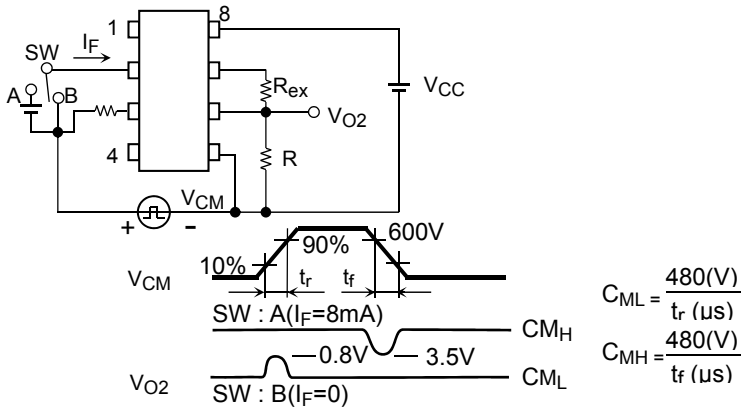
Test Circuit 5: V_{OL}



Test Circuit 6: t_{pLH}, t_{pHL}, t_r, t_f

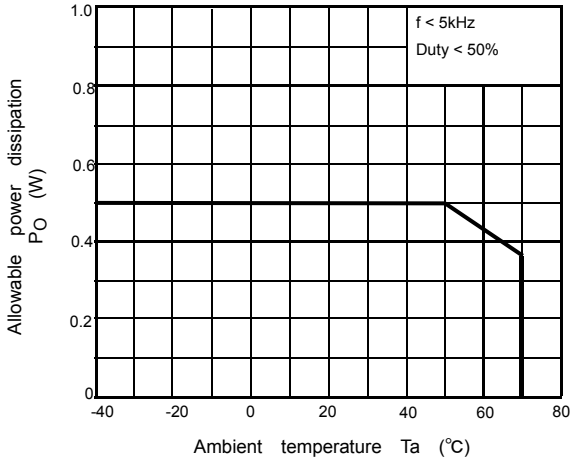


Test Circuit 7: CM_H, CM_L

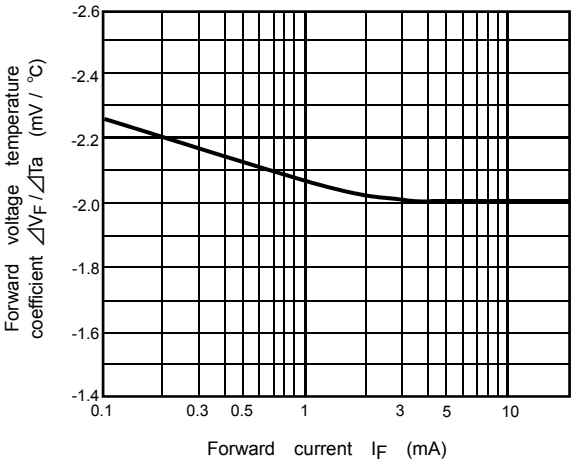


CM_L (CM_H) is the maximum rate of rise (fall) of the common mode voltage that can be sustained with the output voltage in the low (high) state.

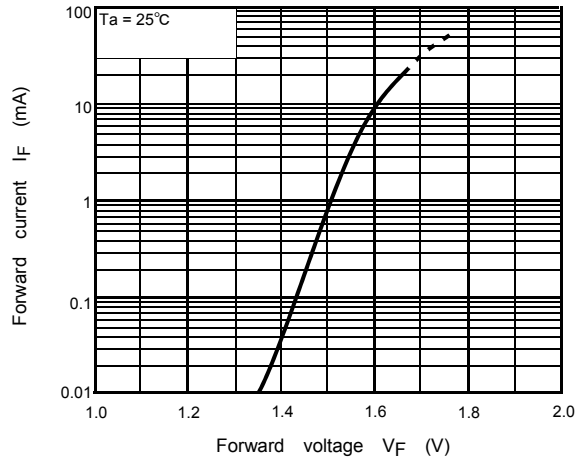
P_O – Ta



$\Delta V_F / \Delta Ta$ – I_F



I_F – V_F



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