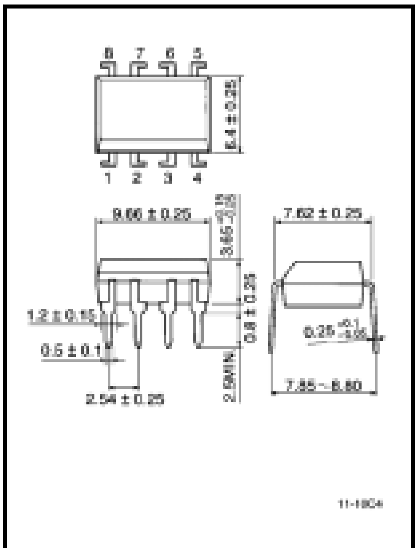
TOSHIBA Photocoupler GaAℓAs Ired & Photo-IC

TLP251

Inverter For Air Conditionor
Induction Heating
Transistor Inverter
Power MOS FET Gate Drive
IGBT Gate Drive

Unit in mm



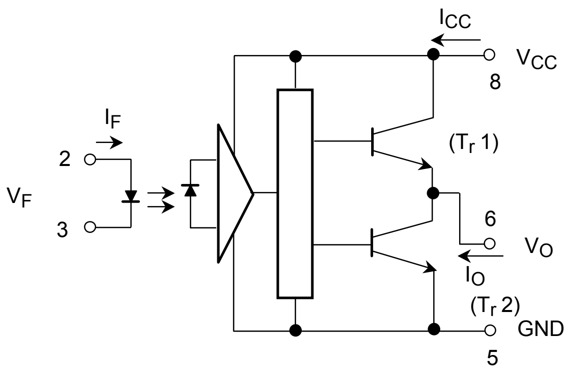
TOSHIBA 11−10C4

Weight: 0.54g

The TOSHIBA TLP251 consists of a GaAℓAs light emitting diode and a integrated photodetector.
This unit is 8-lead DIP package.
TLP251 is suitable for gate driving circuit of IGBT or power MOS FET.
Especially TLP251 is capable of "direct" gate drive of lower power IGBTs. (~15A)

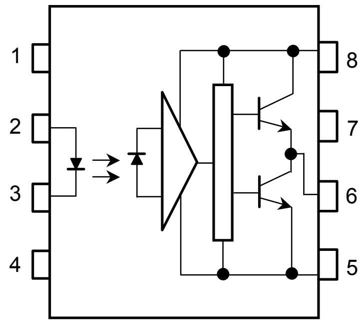
- Input threshold current: I_F=5mA(max.)
- Supply current (I_{CC}): 11mA(max.)
- Supply voltage (V_{CC}): 10−35V
- Output current (I_O): ±0.4A(max.)
- Switching time (t_{pLH} / t_{pHL}): 1μs(max.)
- Isolation voltage: 2500Vrms(min.)
- UL recognized: UL1577, file no.E67349

Schematic



A 0.1μF bypass capcitor must be connected between pin 8 and 5(see Note 5).

Pin Configuration (top view)



1 : N.C.
2 : Anode
3 : Cathode
4 : N.C.
5 : Gnd
6 : V_O (Output)
7 : N.C.
8 : V_{CC}

Truth Table

		Tr1	Tr2
Input LED	On	On	Off
	Off	Off	On

Maximum Ratings (Ta = 25°C)

	Characteristic		Symbol	Rating	Unit
LED	Forward current		I_F	20	mA
	Forward current derating (Ta ≥ 70°C)		$\Delta I_F / \Delta Ta$	− 0.36	mA / °C
	Peak transient forward current (Note 1)		I_{FPT}	1	A
	Reverse voltage		V_R	5	V
	Junction temperature		T_j	125	°C
Detector	"H" peak output current (P_W ≤ 2.0μs, f ≤ 15kHz) (Note 2)		I_{OPH}	− 0.4	A
	"L" peak output current (P_W ≤ 2.0μs, f ≤ 15kHz) (Note 2)		I_{OPL}	0.4	A
	Output voltage	(Ta ≤ 70°C)	V_O	35	V
		(Ta = 85°C)		24	
	Supply voltage	(Ta ≤ 70°C)	V_{CC}	35	V
		(Ta = 85°C)		24	
	Output voltage derating (Ta ≥ 70°C)		$\Delta V_O / \Delta Ta$	− 0.73	V / °C
	Supply voltage derating (Ta ≥ 70°C)		$\Delta V_{CC} / \Delta Ta$	− 0.73	V / °C
	Junction temperature		T_j	125	°C
Operating frequency (Note 3)			f	25	kHz
Operating temperature range			T_{opr}	−20~85	°C
Storage temperature range			T_{stg}	−55~125	°C
Lead soldering temperature(10s) (Note 4)			T_{sol}	260	°C
Isolation voltage (AC, 1min., R.H.≤ 60%) (Note 5)			BV_S	2500	Vrms

Note 1: Pulse width P_W ≤ 1μs, 300pps

Note 2: Expornential waveform

Note 3: Expornential waveform, I_{OPH} ≤ −0.25A(≤ 2.0μs), I_{OPL} ≤ +0.25A(≤2.0μs)

Note 4: It is 2 mm or more from a lead root.

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

Note 6: A ceramic capacitor(0.1μF)should be connected from pin 8 to pin 5 to stabilize the operation of the high gain linear ampifier. Failure to provide the bypassing may impair the swiching property.The total lead length between capacitor and coupler should not exceed 1cm.

Recommended Operating Conditions

Characteristic	Symbol	Min.	Typ.	Max.		Unit
Input current, on (Note 7)	$I_{F(ON)}$	7	8	10		mA
Input voltage, off	$V_{F(OFF)}$	0	—	0.8		V
Supply voltage	V_{CC}	10	—	30	20	V
Peak output current	I_{OPH} / I_{OPL}	—	—	±0.1		A
Operating temperature	T_{opr}	−20	25	70	85	°C

Note 7: Input signal rise time (fall time) < 0.5 µs.

Electrical Characteristics (Ta = −20~70°C, unless otherwise specified)

Characteristic		Symbol	Test Circuit	Test Condition	Min.	Typ.*	Max.	Unit
Input forward voltage		V_F	—	I_F = 10 mA , Ta = 25°C	—	1.6	1.8	V
Temperature coefficient of forward voltage		ΔV_F / ΔTa	—	I_F = 10 mA	—	−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	—	45	250	pF
Output current	"H" level	I_{OPH}	3	V_{CC}=30V (*1), I_F = 10mA, V_{8-6} = 4V	−0.1	−0.25	—	A
	"L" level	I_{OPL}	2	V_{CC}=30V (*1), I_F =0, V_{6-5} = 2.5V	0.1	0.2	—	A
Output voltage	"H" level	V_{OH}	4	V_{CC1} = +15V, V_{EE1} = −15V, R_L = 200Ω, I_F = 5mA	11	13.2	—	V
	"L" level	V_{OL}	5	V_{CC1} = +15V, V_{EE1} = −15V, R_L = 200Ω, V_F = 0.8V	—	−14.5	−12.5	V
Supply current	"H" level	I_{CCH}	—	V_{CC} = 30V, I_F = 10mA, Ta = 25°C	—	7.5	—	mA
				V_{CC} = 30V, I_F = 10mA	—	—	11	mA
	"L" level	I_{CCL}	—	V_{CC} = 30V, I_F = 0mA, Ta = 25°C	—	8	—	mA
				V_{CC} = 30V, I_F = 0mA	—	—	11	mA
Threshould input current	"Output L → H"	I_{FLH}	—	V_{CC1} = +15V, V_{EE1} = −15V, R_L = 200Ω, V_O > 0V	—	1.2	5	mA
Threshold input voltage	"Output H → L"	V_{FLH}	—	V_{CC1} = +15V, V_{EE1} = −15V, R_L = 200Ω, V_O < 0V	0.8	—	—	V
Supply voltage		V_{CC}	—		10	—	35	V
Capacitance (input–output)		C_s	—	Vs = 0 , f = 1MHz, Ta = 25°C	—	1.0	2.0	pF
Resistance (input–output)		R_s	—	Vs = 500V, Ta = 25°C, R.H. ≤ 60%	1×10^{12}	10^{14}	—	Ω

* All typical values are at Ta=25°C (*1): Duration of I_O time ≤ 50µs

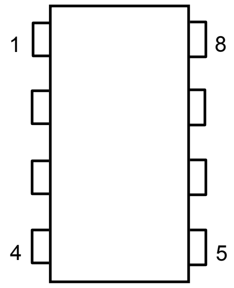
Switching Characteristics (Ta = −20~70°C, unless otherwise specified)

Characteristic		Symbol	Test Cir–cuit	Test Condition	Min.	Typ.*	Max.	Unit
Propagation delay time	L→H	t_{pLH}	6	I_F = 8mA (Note 7) V_{CC1} = +15V, V_{EE1} = −15V R_L = 200 Ω	—	0.25	1.0	μs
	H→L	t_{pHL}			—	0.25	1.0	
Output rise time		t_r			—	—	—	
Output fall time		t_f			—	—	—	
Common mode transient immunity at high level output		C_{MH}	7	V_{CM} = 600V, I_F = 8mA, V_{CC} = 30V, Ta = 25°C	−5000	—	—	V / μs
Common mode transient immunity at low level output		C_{ML}	7	V_{CM} = 600V, I_F = 0mA, V_{CC} = 30V, Ta = 25°C	5000	—	—	V / μs

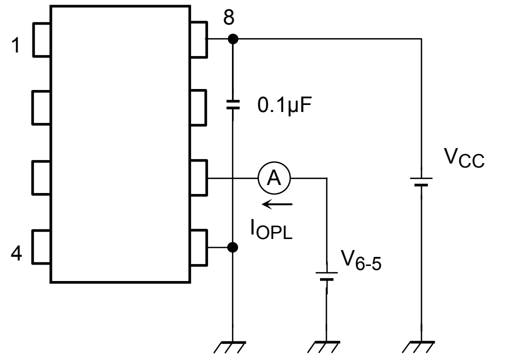
*All typical values are at Ta=25°C

Note 7: Input signal rise time (fall time) < 0.5 μs.

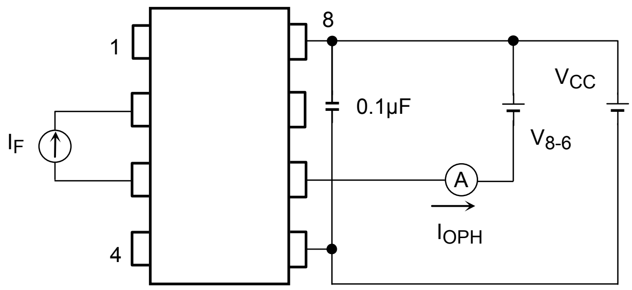
Test Circuit 1:



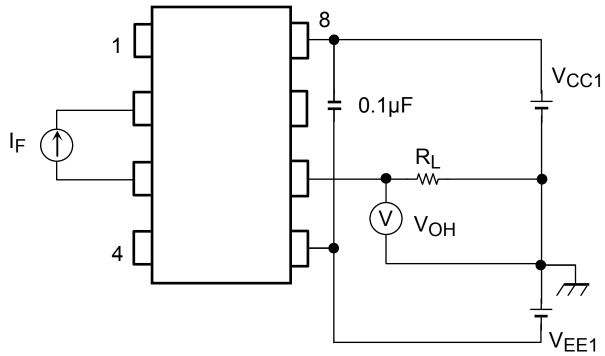
Test Circuit 2: I_{OPL}



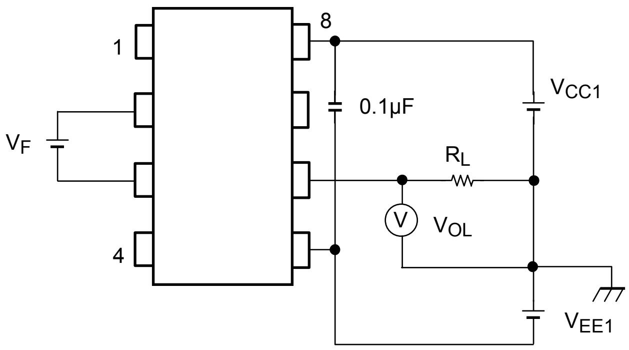
Test Circuit 3: I_{OPH}



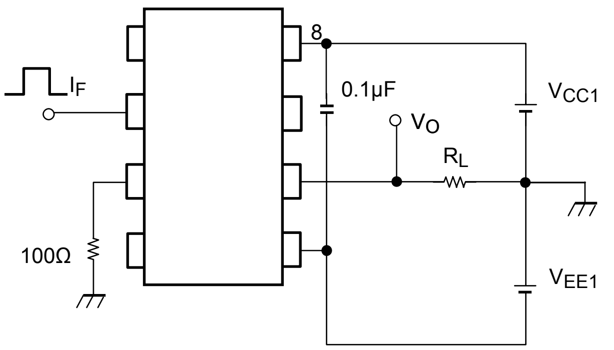
Test Circuit 4: V_{OH}

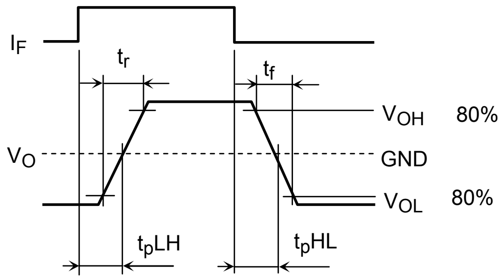


Test Circuit 5: V_{OL}

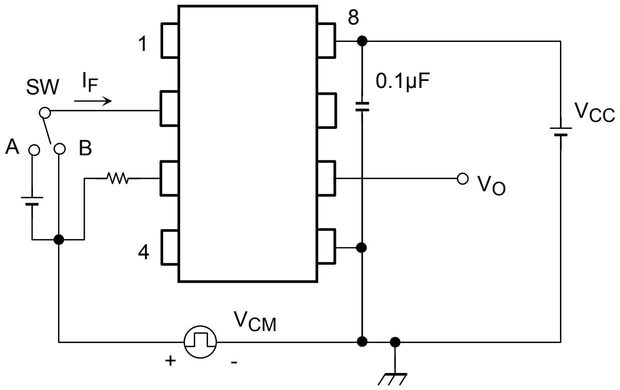


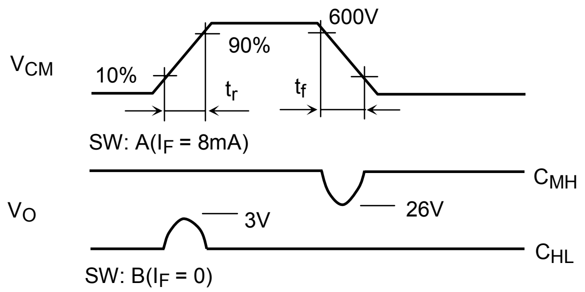
Test Circuit 6: t_{pLH}, t_{pHL}, t_r, t_f





Test Circuit 7: C_{MH}, C_{ML}

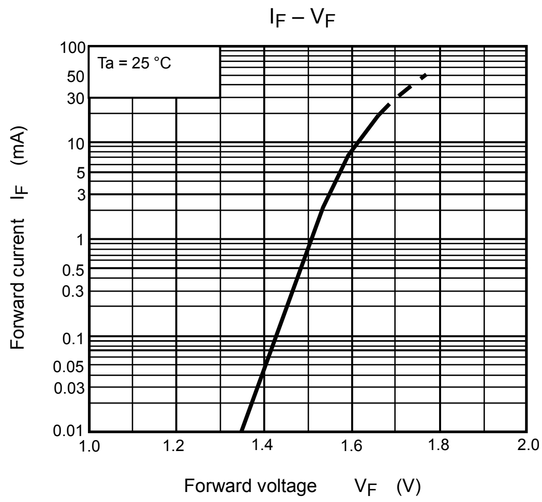


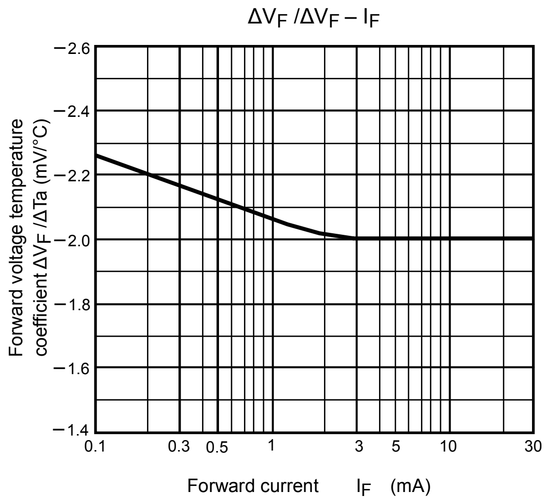


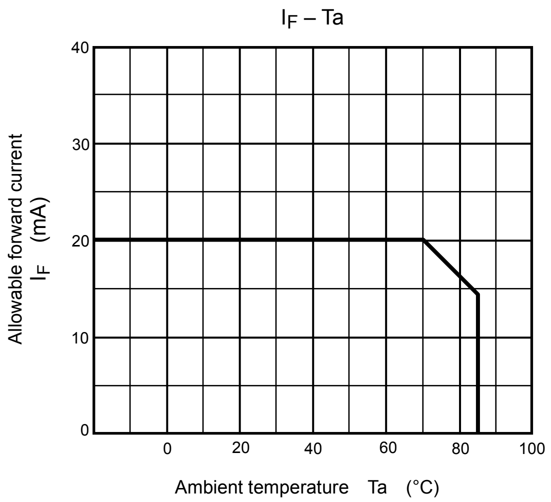
$$C_{ML} = \frac{480(V)}{t_r(\mu s)}$$

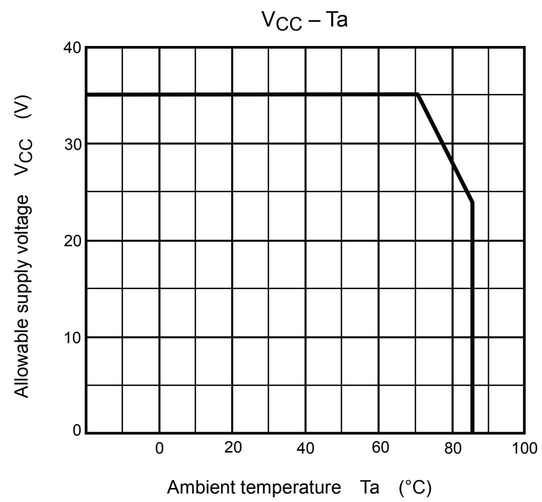
$$C_{MH} = \frac{480(V)}{t_f(\mu s)}$$

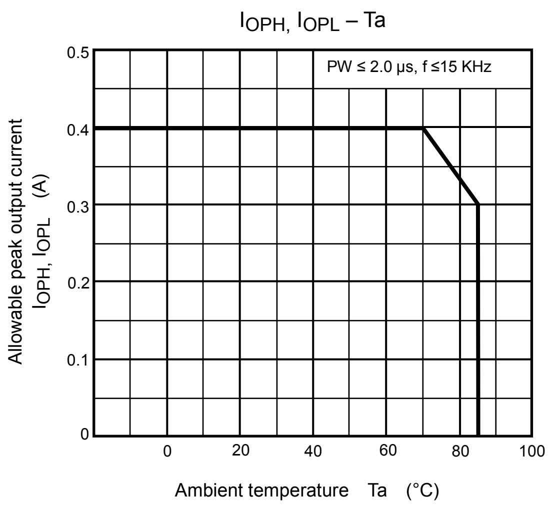
C_{ML} (C_{MH}) is the maximum rate of rise (fall) of the common mode voltage that can be sustained with the output voltage in the low (high) state.


$I_F – V_F$
Ta = 25 °C
100
50
30
10
5
3
1
0.5
0.3
0.1
0.05
0.03
0.01
1.0
1.2
1.4
1.6
1.8
2.0
Forward current I_F (mA)
Forward voltage V_F (V)


$ΔV_F / ΔV_F – I_F$
−2.6
−2.4
−2.2
−2.0
−1.8
−1.6
−1.4
0.1
0.3
0.5
1
3
5
10
30
Forward voltage temperature coefficient $ΔV_F / ΔTa$ (mV/°C)
Forward current I_F (mA)


$I_F – Ta$
40
30
20
10
0
0
20
40
60
80
100
Allowable forward current I_F (mA)
Ambient temperature Ta (°C)


$V_{CC} – Ta$
40
30
20
10
0
0
20
40
60
80
100
Allowable supply voltage V_{CC} (V)
Ambient temperature Ta (°C)


$I_{OPH}, I_{OPL} – Ta$
PW ≤ 2.0 μs, f ≤15 KHz
0.5
0.4
0.3
0.2
0.1
0
0
20
40
60
80
100
Allowable peak output current I_{OPH}, I_{OPL} (A)
Ambient temperature Ta (°C)

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