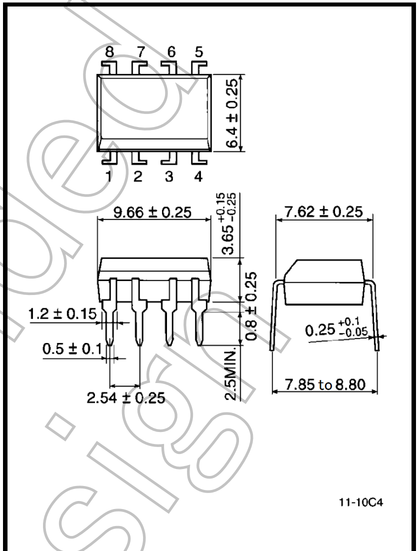
TOSHIBA Photocoupler GaAℓAs Ired & Photo-IC

TLP251

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

Unit: mm



TOSHIBA 11−10C4

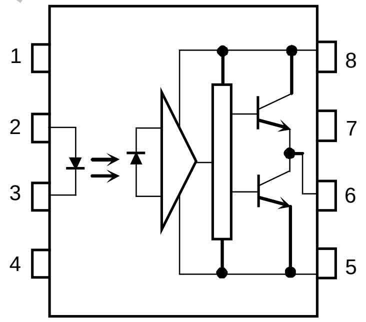
Weight: 0.54 g (typ.)

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. (to 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
- cUL approved:CSA Component Acceptance Service No. 5A, File No.E67349
- Option(D4)
  VDE Approved : DIN EN60747-5-5 (Note)

(Note):When a EN60747-5-5 approved type is needed, Please designate "Option(D4)"

Pin Configuration (top view)

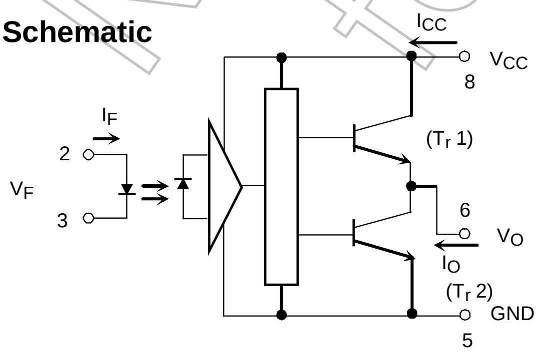


1 : N.C. 5 : GND
2 : Anode 6 : V_O (Output)
3 : Cathode 7 : N.C.
4 : N.C. 8 : V_{CC}

Truth Table

		Tr1	Tr2
Input LED	On	On	Off
	Off	Off	On

Schematic



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

Start of commercial production
1992-01

Absolute Maximum Ratings (Ta = 25°C)

	Characteristic		Symbol	Rating	Unit
LED	Forward current		I_F	20	mA
	Forward current derating (Ta ≥ 70°C)		ΔI_F / ΔTa	− 0.36	mA / °C
	Peak transient forward current (Note 1)		I_{FPT}	1	A
	Reverse voltage		V_R	5	V
	Diode power dissipation		P_D	40	mW
	Diode power dissipation derating (Ta≥70 °C)		ΔP_D/°C	-0.72	mW/°C
	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)		ΔV_O / ΔTa	− 0.73	V / °C
	Supply voltage derating (Ta ≥ 70°C)		ΔV_{CC} / ΔTa	− 0.73	V / °C
	Output Power dissipation		P_O	800	mW
	Output Power dissipation derating (Ta ≥70°C)		ΔP_O / °C	-14.5	mW/°C
	Junction temperature		T_j	125	°C
Operating frequency (Note 3)			f	25	kHz
Operating temperature range			T_{opr}	−20 to 85	°C
Storage temperature range			T_{stg}	−55 to 125	°C
Lead soldering temperature(10s)			T_{sol}	260	°C
Isolation voltage (AC, 1min.,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: Pulse width P_W ≤ 1μs, 300pps

Note 2: Exporential waveform

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

Note 4: Device considerd 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 (Note 1)	$I_{F(ON)}$	7	8	10	mA
Input voltage, off	$V_{F(OFF)}$	0	—	0.8	V
Supply voltage	V_{CC}	10	—	30	V
Peak output current	I_{OPH} / I_{OPL}	—	—	±0.1	A
Operating temperature	T_{opr}	−20	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.

Note 1: Input signal rise time(fall time)<0.5μs.

Electrical Characteristics (Ta = −20 to 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 = 0V , f = 1MHz , Ta = 25°C		—	45	250	pF
Output current	"H" level	I_{OPH}	1	V_{CC}=30V (Note 1)	I_F = 10mA V_{8-6} = 4V	−0.1	−0.25	—	A
	"L" level	I_{OPL}	2		I_F =0mA V_{6-5} = 2.5V	0.1	0.2	—	
Output voltage	"H" level	V_{OH}	3	V_{CC1} = +15V, V_{EE1} = −15V R_L = 200Ω, I_F = 5mA		11	13.2	—	V
	"L" level	V_{OL}	4	V_{CC1} = +15V, V_{EE1} = −15V R_L = 200Ω, V_F = 0.8V		—	−14.5	−12.5	
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	
	"L" level	I_{CCL}	—	V_{CC} = 30V, I_F = 0mA Ta = 25°C		—	8	—	
				V_{CC} = 30V, I_F = 0mA		—	—	11	
Threshold 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_{FHL}	—	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 = 0V , 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

Note : All typical values are at Ta=25°C

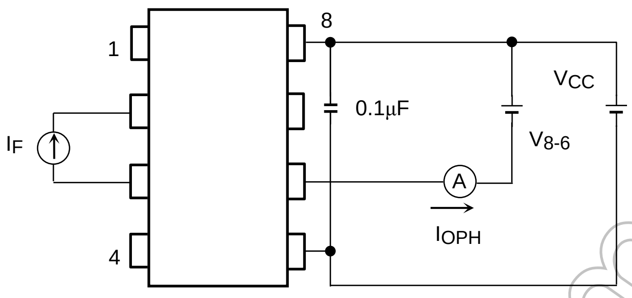
Note 1: Duration of I_O time ≤ 50μs

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

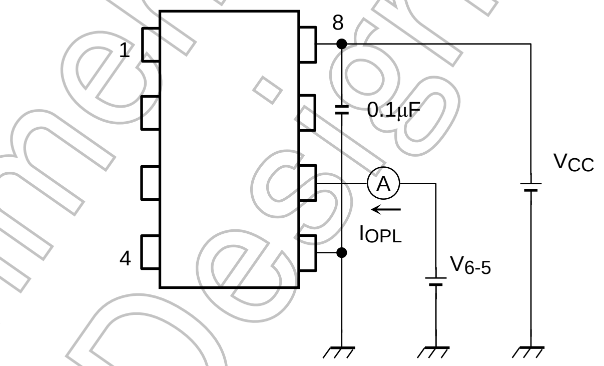
Characteristic		Symbol	Test Cir-cuit	Test Condition	Min.	Typ.*	Max.	Unit
Propagation delay time	L→H	t_{pLH}	5	I_F = 8mA, V_{CC1} = +15V, V_{EE1} = −15V, R_L = 200 Ω	—	0.25	1.0	μs
	H→L	t_{pHL}			—	0.25	1.0	
Common mode transient immunity at high level output		C_{MH}	6	V_{CM} = 600V, I_F = 8mA, V_{CC} = 30V, Ta = 25°C	−5000	—	—	V / μs
Common mode transient immunity at low level output		C_{ML}		V_{CM} = 600V, I_F = 0mA, V_{CC} = 30V, Ta = 25°C	5000	—	—	V / μs

Note: All typical values are at Ta=25°C

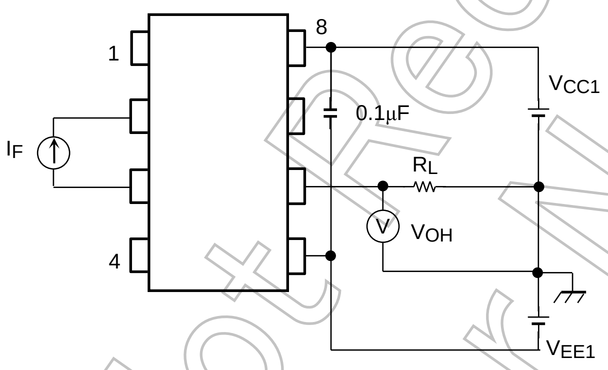
Test Circuit 1 : I_{OPH}



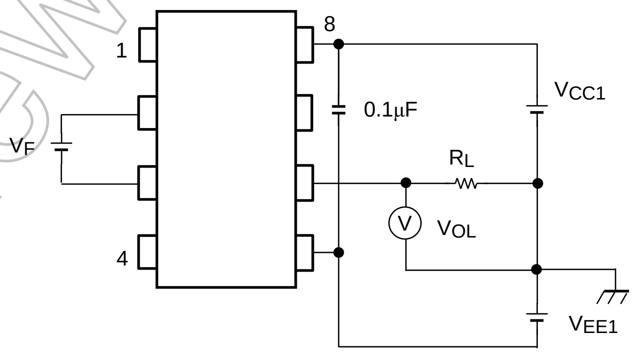
Test Circuit 2 : I_{OPL}



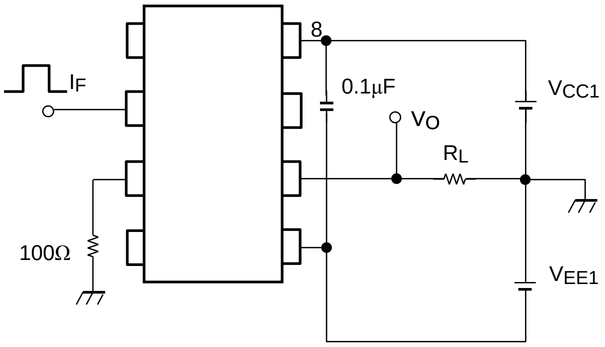
Test Circuit 3 : V_{OH}

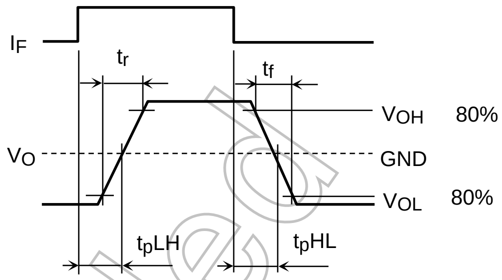


Test Circuit 4 : V_{OL}

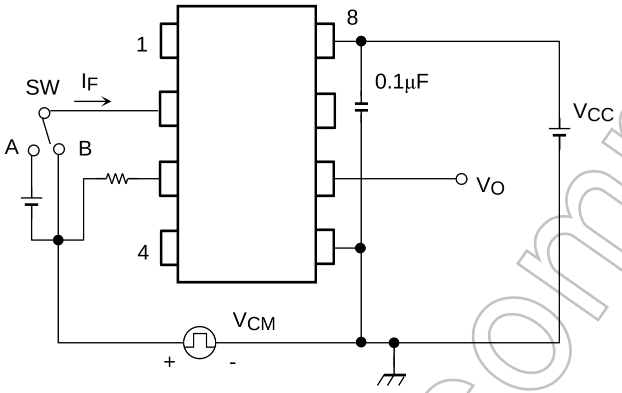


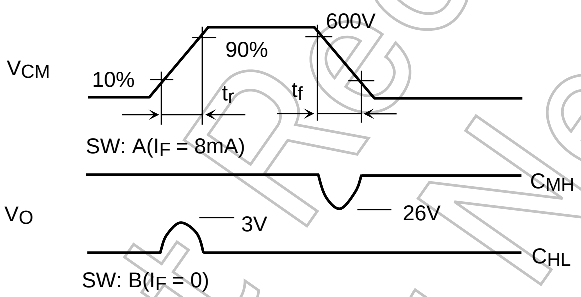
Test Circuit 5: t_{pLH}, t_{pHL}, t_r, t_f





Test Circuit 6: C_{MH}, C_{ML}

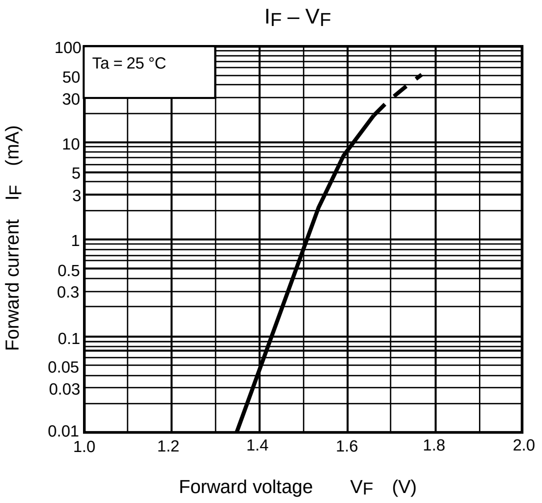


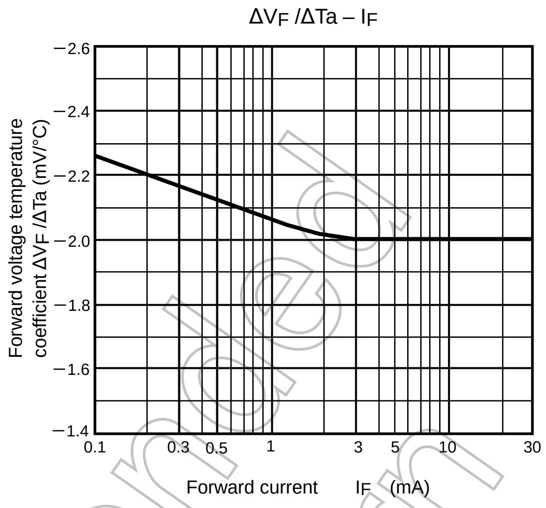


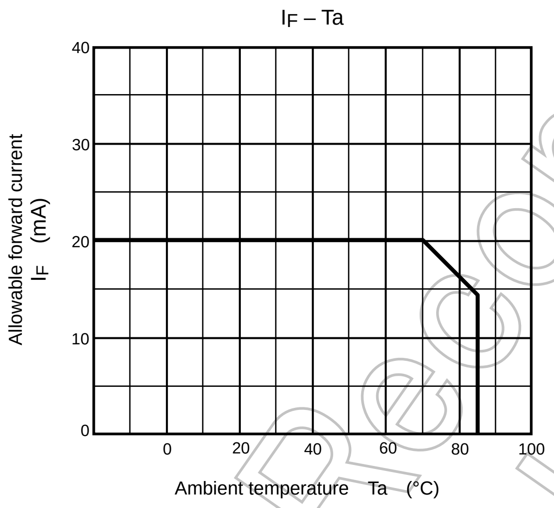
$$C_{ML} = \frac{480(V)}{t_r(\mu s)}$$

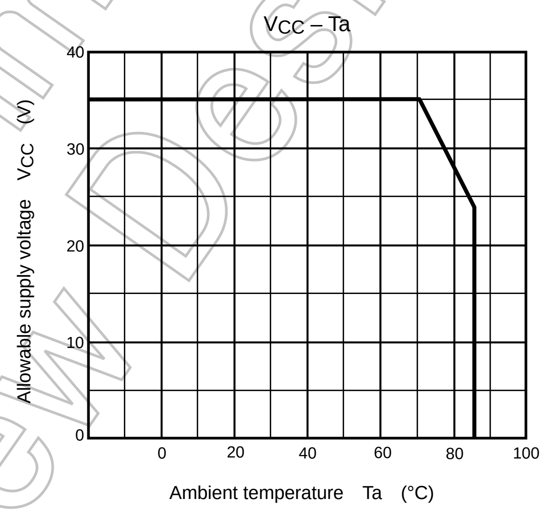
$$C_{MH} = \frac{480(V)}{t_f(\mu s)}$$

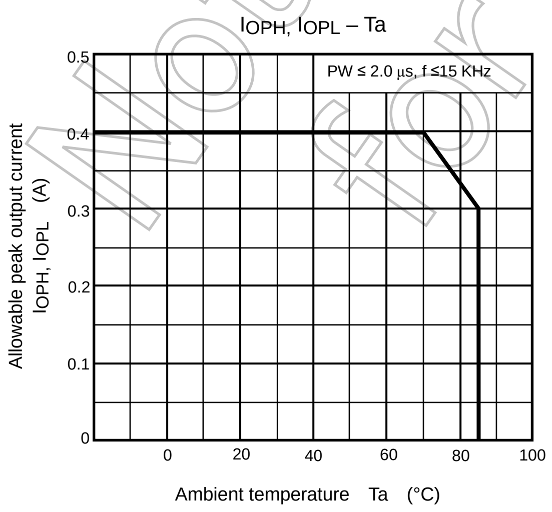
C_{ML} (C_{MH}) is the maximum rate of rise (fall) of the common mode voltage that can be sustained with the output voltage in the low (high) state.


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


ΔVF /ΔTa – IF
Forward voltage temperature coefficient ΔVF /ΔTa (mV/°C)
Forward current IF (mA)
−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


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


VCC – Ta
Allowable supply voltage VCC (V)
Ambient temperature Ta (°C)
40
30
20
10
0
0
20
40
60
80
100


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

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