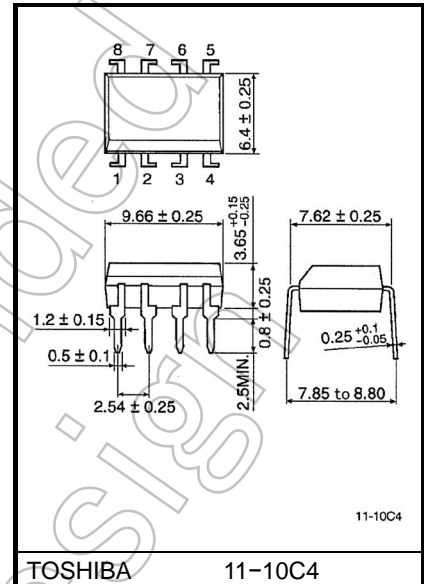


TOSHIBA Photocoupler GaAs Ired & Photo IC

TLP559(IGM)

- Transistor Inverters
- Air Conditioner Inverters
- Line Receivers
- Intelligent Power Modules (IPMs) Interfaces

Unit: mm



Weight: 0.54 g (typ.)

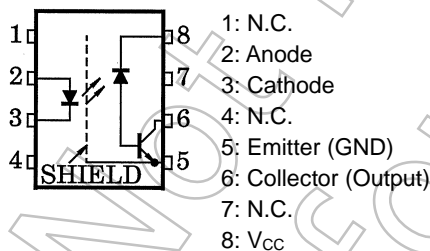
The TOSHIBA TLP559(IGM) consists of a high-output GaAs light emitting diode optically coupled to a high-speed photodiode with a transistor amplifier.

The TLP559(IGM) has no internal base connection. The Faraday shield in the photodetector chip provides an effective common-mode noise transient immunity.

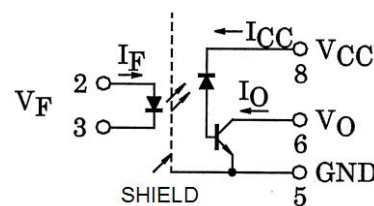
The TLP559(IGM) guarantees minimum and maximum propagation delay time, a relative time difference between the rise and fall time, and common-mode transient immunity. Therefore, the TLP559(IGM) is suitable for an isolation interface between an Intelligent Power Module (IPM) and a control IC in motor control applications.

- Isolation Voltage: 2500 Vrms (min)
- Common-Mode Transient Immunity: ± 10 kV/ μ s (min) @ $V_{CM} = 1500$ V_{p-p}
- Switching Time: tpHL, tpLH = 0.1 μ s (min), = 0.8 μ s (max)
@ $I_F = 10$ mA, $V_{CC} = 15$ V, $R_L = 20$ k Ω , $T_a = 25^\circ\text{C}$
- Switching Time Dispersion: 0.7 μ s (max)
(|tpLH - tpHL|)
- TTL Compatible
- UL Recognized: UL1577, File No. E67349
- cUL approved: CSA Component Acceptance Service No.5A,
File No. E67349

Pin Configuration (Top view)



Schematic



Start of commercial production
1995/01

Absolute Maximum Ratings (Ta = 25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
LED	Forward Current (Note 1)	I _F	25	mA
	Pulse Forward Current (Note 2)	I _{FP}	50	mA
	Peak Transient Forward Current (Note 3)	I _{FPT}	1	A
	Reverse Voltage	V _R	5	V
	Diode Power Dissipation (Note 4)	P _D	45	mW
DETECTOR	Output Current	I _O	8	mA
	Peak Output Current	I _{OP}	16	mA
	Output Voltage	V _O	-0.5 to 20	V
	Supply Voltage	V _{CC}	-0.5 to 30	V
	Output Power Dissipation (Note 5)	P _O	100	mW
Operating Temperature Range		T _{opr}	-55 to 100	°C
Storage Temperature Range		T _{stg}	-55 to 125	°C
Lead Solder Temperature(10s) (Note 6)		T _{sol}	260	°C
Isolation Voltage(AC, 1 minute, R.H.≤60%, Ta=25°C) (Note 7)		BV _S	2500	V _{rms}

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) Derate 0.8 mA above 70°C.

(Note 2) 50% duty cycle, 1 ms pulse width. Derate 1.6 mA/°C above 70°C.

(Note 3) Pulse width PW ≤ 1μs, 300 pps.

(Note 4) Derate 0.9 mW/°C above 70°C.

(Note 5) Derate 2 mW/°C above 70°C.

(Note 6) Soldering portion of lead : up to 2mm from the body of the device.

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

Electrical Characteristics (Ta = 25°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN	TYP.	MAX	UNIT
LED	Forward Voltage	V _F	I _F = 16 mA	—	1.65	1.85	V
	Forward Voltage Temperature Coefficient	ΔV _F / ΔTa	I _F = 16 mA	—	-2	—	mV / °C
	Reverse Current	I _R	V _R = 5 V	—	—	10	μA
	Capacitance between Terminal	CT	V = 0V, f = 1 MHz	—	45	—	pF
DETECTOR	High Level Output Current	I _{OH} (1)	I _F = 0 mA, V _{CC} = V _O = 5.5 V	—	3	500	nA
		I _{OH} (2)	I _F = 0 mA, V _{CC} = 30 V V _O = 20 V	—	—	5	μA
		I _{OH}	I _F = 0 mA, V _{CC} = 30 V V _O = 20 V, Ta = 70°C	—	—	50	
	High Level Supply Voltage	I _{CCH}	I _F = 0 mA, V _{CC} = 30 V	—	0.01	1	μA
	Supply Voltage	V _{CC}	I _{CC} = 0.01 mA	30	—	—	V
	Output Voltage	V _O	I _O = 0.5 mA	20	—	—	V

Coupled Electrical Characteristics (Ta = 25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN	TYP.	MAX	UNIT
Current Transfer Ratio	I _O / I _F	I _F = 10 mA, V _{CC} = 4.5 V V _O = 0.4 V	25	35	75	%
		I _F = 10 mA, V _{CC} = 4.5 V V _O = 0.4 V, Ta = -25 to 100°C	15	—	—	
Low Level Output Voltage	V _{OL}	I _F = 16 mA, V _{CC} = 4.5 V I _O = 2.4 mA	—	—	0.4	V

Isolation Characteristics (Ta = 25°C)

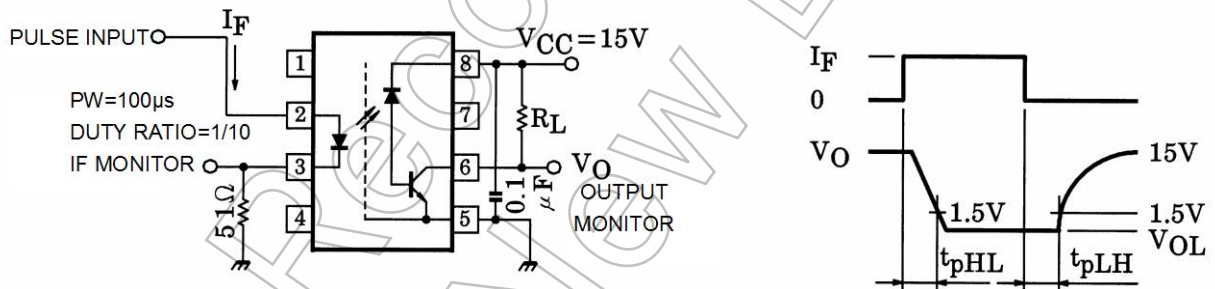
CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN	TYP.	MAX	UNIT
Capacitance Input to Output	C _S	V = 0V, f = 1 MHz (Note 7)	—	0.8	—	pF
Isolation Resistance	R _S	R.H. ≤ 60%, V _S = 500 V (Note 7)	5×10 ¹⁰	10 ¹⁴	—	Ω
Isolation Voltage	BV _S	AC, 1 minute	2500	—	—	V _{rms}
		AC, 1 second, in oil	—	5000	—	V _{dc}
		DC, 1 minute, in oil	—	5000	—	

Switching Characteristics (Ta = 25°C, Vcc = 15 V)

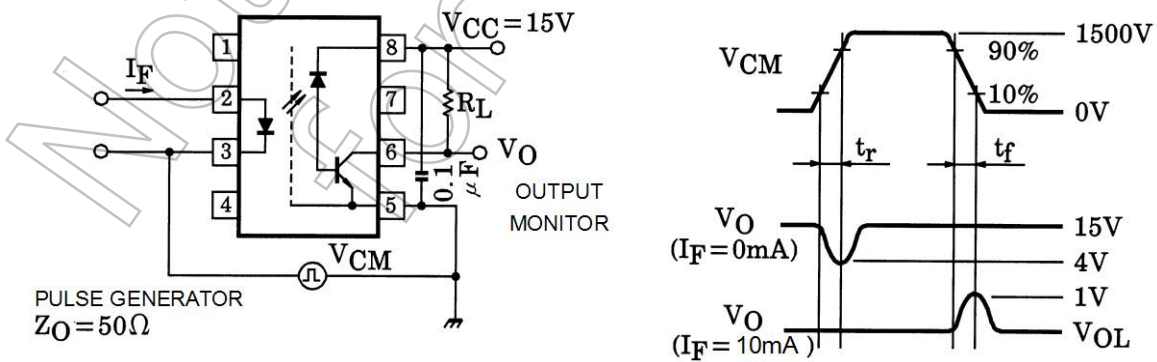
CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN	TYP.	MAX	UNIT
Propagation Delay Time (H→L) Propagation Delay Time (L→H)	t _{pHL} t _{pLH}	1	I _F = 10 mA, R _L = 20 kΩ	0.1	0.45	0.8	μs
			I _F = 10 mA, R _L = 20 kΩ Ta = 0 to 85°C	0.1	0.45	0.9	
			I _F = 10 mA, R _L = 20 kΩ Ta = -25 to 100°C	0.1	0.45	1.0	
Switching Time Dispersion between ON and OFF	t _{pLH} -t _{pHL}	1	I _F = 10 mA, R _L = 20 kΩ	—	0.25	0.7	μs
			I _F = 10 mA, R _L = 20 kΩ Ta = 0 to 85°C	—	0.25	0.8	
			I _F = 20 mA, R _L = 20 kΩ Ta = -25 to 100°C	—	0.25	0.9	
Common Mode Transient Immunity at Logic High Output (Note 8)	CM _H	2	I _F = 0 mA, V _{CM} = 1500 V _{p-p} , R _L = 20 kΩ	10000	15000	—	V / μs
Common Mode Transient Immunity at Logic Low Output (Note 8)	CM _L		I _F = 10 mA, V _{CM} = 1500 V _{p-p} , R _L = 20 kΩ	-10000	-15000	—	V / μs

(Note 8) CM_L is the maximum rate of fall of the common mode voltage that can be sustained with the output voltage in the logic low state (V_O < 1V).
CM_H is the maximum rate of rise of the common mode voltage that can be sustained with the output voltage in the logic high state (V_O > 4V).

Test Circuit 1: Switching time test circuit



Test Circuit 2: Common mode noise immunity test circuit



$$CM_H = \frac{1200(V)}{t_r(\mu s)}, \quad CM_L = \frac{1200(V)}{t_f(\mu s)}$$

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