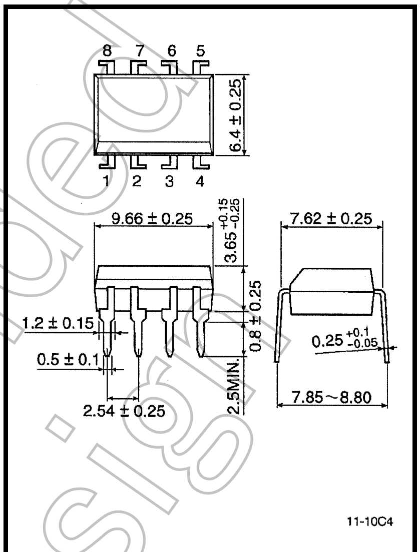
TOSHIBA Photocoupler GaAℓAs Ired & Photo IC

TLP559(IGM)

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

Unit: mm



TOSHIBA	11−10C4

Weight: 0.54 g (typ.)

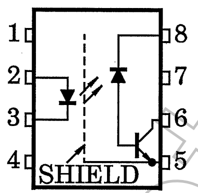
The TOSHIBA TLP559(IGM) consists of a high-output GaAℓAs light emitting diode optically coupled to a high-speed photodiode with a transistor amplifier.

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.

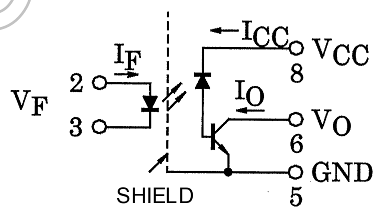
- Isolation Voltage: 2500 Vrms (min)
- Common-Mode Transient Immunity: ±10 kV/μs (min) @V_{CM} = 1500 V
- Switching Time: t_{pHL}, t_{pLH} = 0.1μs (min), = 0.8μs (max) @I_F = 10 mA, V_{CC} = 15 V, R_L = 20 kΩ, Ta = 25°C
- Switching Time Dispersion: 0.7 μs (max)
  (|tpLH−tpHL|)
- TTL Compatible
- UL Recognized: UL1577, File No. E67349

Pin Configuration (Top view)



1: NC
2: Anode
3: Cathode
4: NC
5: Emitter (GND)
6: Collector (Output)
7: NC
8: V_{CC}

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	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) 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
LED	Forward Voltage Temperature Coefficient	$\Delta V_F / \Delta Ta$	I_F = 16 mA	—	−2	—	mV /°C
LED	Reverse Current	I_R	V_R = 5 V	—	—	10	μA
LED	Capacitance between Terminal	CT	V = 0, 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
DETECTOR	High Level Output Current	$I_{OH\ (2)}$	I_F = 0 mA, V_{CC} = 30 V V_O = 20 V	—	—	5	μA
DETECTOR	High Level Output Current	I_{OH}	I_F = 0 mA, V_{CC} = 30 V V_O = 20 V, Ta = 70°C	—	—	50	μA
DETECTOR	High Level Supply Voltage	I_{CCH}	I_F = 0 mA, V_{CC} = 30 V	—	0.01	1	μA
DETECTOR	Supply Voltage	V_{CC}	I_{CC} = 0.01 mA	30	—	—	V
DETECTOR	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 = 0, 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	—	—	Vrms
		AC, 1 second, in oil	—	5000	—	Vrms
		DC, 1 minute, in oil	—	5000	—	Vdc

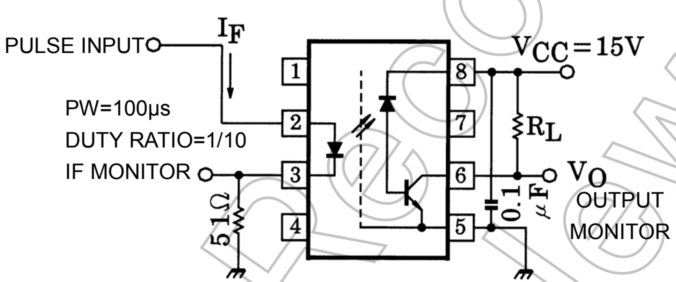
Switching Characteristics (Ta = 25°C, V_{CC} = 15 V)

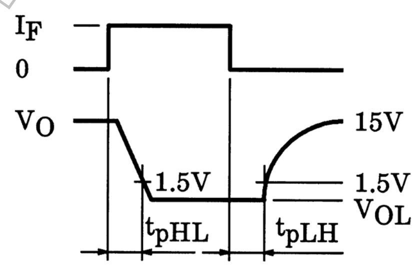
CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN	TYP.	MAX	UNIT
Propagation Delay Time (H→L) Propagation Delay Time (L→H)	t_{pHL} t_{pLH}	1	I_F = 10 mA, R_L = 20 kΩ	0.1	0.45	0.8	μs
			I_F = 10 mA, R_L = 20 kΩ Ta = 0~85°C	0.1	0.45	0.9	
			I_F = 10 mA, R_L = 20 kΩ Ta = −25~100°C	0.1	0.45	1.0	
Switching Time Dispersion between ON and OFF	$\|t_{pLH}-t_{pHL}\|$		I_F = 10 mA, R_L = 20 kΩ	—	0.25	0.7	μs
			I_F = 10 mA, R_L = 20 kΩ Ta = 0~85°C	—	0.25	0.8	
			I_F = 20 mA, R_L = 20 kΩ Ta = −25~100°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(Vo<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(Vo>4V).

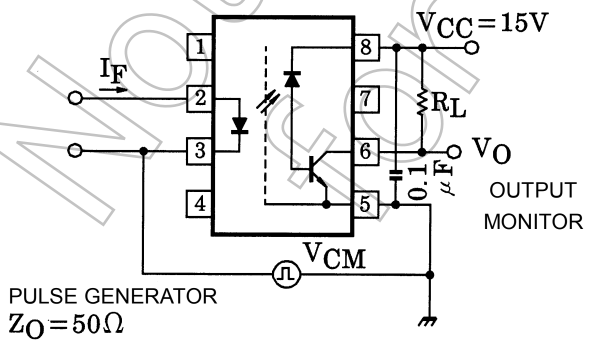
(Note 9) Maximum electrostatic discharge voltage for any pins: 100V(C ≤ 200pF, R=0)

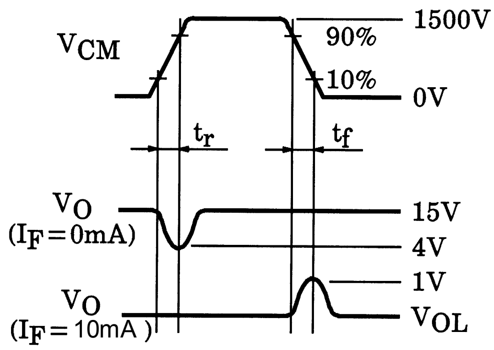
Test Circuit 1: Switching time test circuit





Test Circuit 2: Common mode noise immunity test circuit





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

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