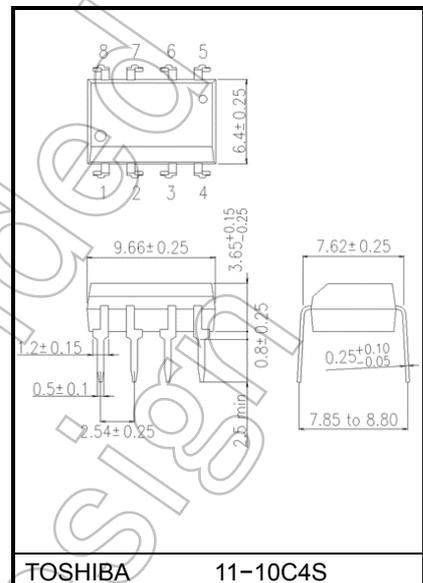


# TLP559(IGM)

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

Unit: mm



Weight: 0.54 g (typ.)

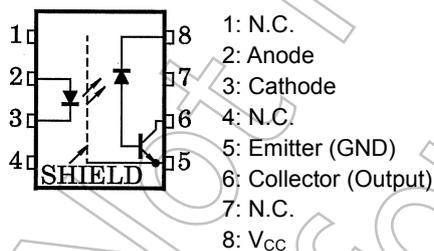
The TOSHIBA TLP559(IGM) consists of a high-output infrared emitting diode optically coupled to a high-speed photodiode with a transistor amplifier.

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

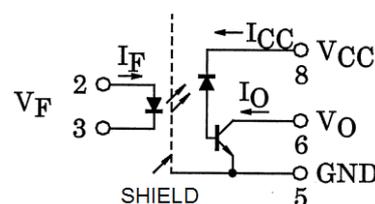
The TLP559(IGM) guarantees minimum and maximum propagation delay time, a relative time difference between the rise and fall time, and common-mode transient immunity. Therefore, the TLP559(IGM) is suitable for an isolation interface between an Intelligent Power Module (IPM) and a control IC in motor control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

- Isolation Voltage: 2500 Vrms (min)
- Common-Mode Transient Immunity:  $\pm 10 \text{ kV}/\mu\text{s}$  (min) @  $V_{CM} = 1500 \text{ V}_{p-p}$
- Switching Time:  $t_{pHL}, t_{pLH} = 0.1 \mu\text{s}$  (min),  $= 0.8 \mu\text{s}$  (max)  
@  $I_F = 10 \text{ mA}$ ,  $V_{CC} = 15 \text{ V}$ ,  $R_L = 20 \text{ k}\Omega$ ,  $T_a = 25^\circ\text{C}$
- Switching Time Dispersion:  $0.7 \mu\text{s}$  (max)  
( $|t_{pLH} - t_{pHL}|$ )
- TTL Compatible
- UL-recognized: UL 1577, File No.E67349
- cUL-recognized: 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 <sub>F</sub>	25	mA
	Pulse Forward Current (Note 2)	I <sub>FP</sub>	50	mA
	Peak Transient Forward Current (Note 3)	I <sub>FPT</sub>	1	A
	Reverse Voltage	V <sub>R</sub>	5	V
	Diode Power Dissipation (Note 4)	P <sub>D</sub>	45	mW
DETECTOR	Output Current	I <sub>O</sub>	8	mA
	Peak Output Current	I <sub>OP</sub>	16	mA
	Output Voltage	V <sub>O</sub>	-0.5 to 20	V
	Supply Voltage	V <sub>CC</sub>	-0.5 to 30	V
	Output Power Dissipation (Note 5)	P <sub>O</sub>	100	mW
Operating Temperature Range		T <sub>opr</sub>	-55 to 100	°C
Storage Temperature Range		T <sub>stg</sub>	-55 to 125	°C
Lead Solder Temperature(10 s) (Note 6)		T <sub>sol</sub>	260	°C
Isolation Voltage(AC, 60 s, R.H.≤60 %)		BV <sub>s</sub>	2500	V <sub>rms</sub>

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 <sub>F</sub>	I <sub>F</sub> = 16 mA	—	1.65	1.85	V
	Forward Voltage Temperature Coefficient	ΔV <sub>F</sub> / ΔTa	I <sub>F</sub> = 16 mA	—	-2	—	mV / °C
	Reverse Current	I <sub>R</sub>	V <sub>R</sub> = 5 V	—	—	10	μA
	Capacitance between Terminal	CT	V = 0 V, f = 1 MHz	—	45	—	pF
DETECTOR	High Level Output Current	I <sub>OH</sub> (1)	I <sub>F</sub> = 0 mA, V <sub>CC</sub> = V <sub>O</sub> = 5.5 V	—	3	500	nA
		I <sub>OH</sub> (2)	I <sub>F</sub> = 0 mA, V <sub>CC</sub> = 30 V V <sub>O</sub> = 20 V	—	—	5	μA
		I <sub>OH</sub>	I <sub>F</sub> = 0 mA, V <sub>CC</sub> = 30 V V <sub>O</sub> = 20 V, Ta = 70 °C	—	—	50	
	High Level Supply Voltage	I <sub>CCH</sub>	I <sub>F</sub> = 0 mA, V <sub>CC</sub> = 30 V	—	0.01	1	μA
	Supply Voltage	V <sub>CC</sub>	I <sub>CC</sub> = 0.01 mA	30	—	—	V
	Output Voltage	V <sub>O</sub>	I <sub>O</sub> = 0.5 mA	20	—	—	V

### Coupled Electrical Characteristics (Ta = 25°C)

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

### Isolation Characteristics (Ta = 25°C)

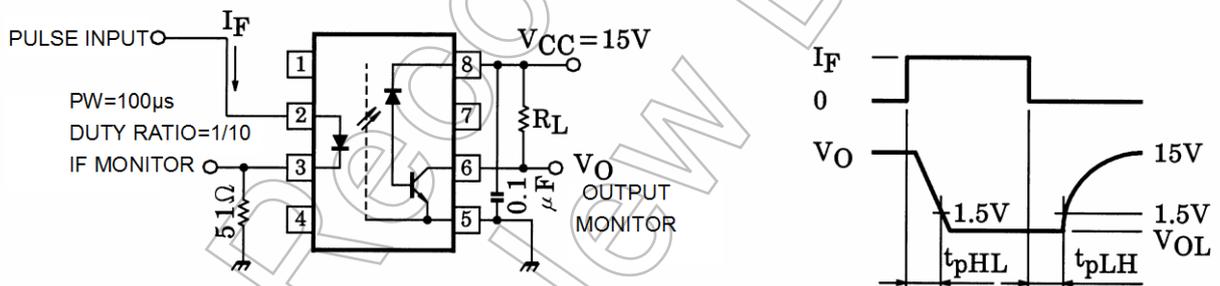
CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN	TYP.	MAX	UNIT
Capacitance Input to Output	C <sub>S</sub>	V = 0 V, f = 1 MHz (Note 7)	—	0.8	—	pF
Isolation Resistance	R <sub>S</sub>	R.H. ≥ 60 %, V <sub>S</sub> = 500 V (Note 7)	5×10 <sup>10</sup>	10 <sup>14</sup>	—	Ω
Isolation Voltage	BV <sub>S</sub>	AC, 60 s (Note 7)	2500	—	—	V <sub>rms</sub>

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

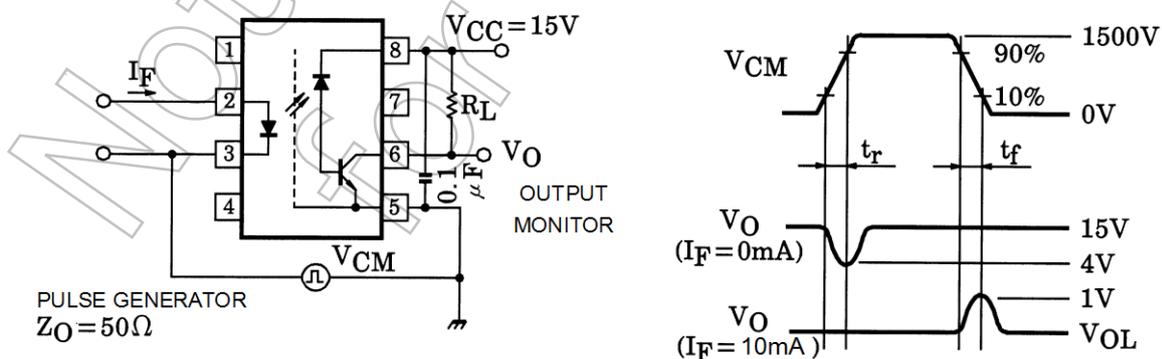
CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN	TYP.	MAX	UNIT
Propagation Delay Time (H→L)	t <sub>pHL</sub>	1	I <sub>F</sub> = 10 mA, R <sub>L</sub> = 20 kΩ	0.1	0.45	0.8	μs
Propagation Delay Time (L→H)			t <sub>pLH</sub>	I <sub>F</sub> = 10 mA, R <sub>L</sub> = 20 kΩ Ta = 0 to 85 °C	0.1	0.45	
Propagation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

(Note 8) CM<sub>L</sub> 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<sub>O</sub> < 1 V).  
 CM<sub>H</sub> 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<sub>O</sub> > 4 V).

#### 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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