



# THE DATASHEET OF TLP559(IGM,F)



# TLP559(IGM)

**TRANSISTOR INVERTER  
INVERTER FOR AIR CONDITIONER  
LINE RECEIVER  
IPM INTERFACES**

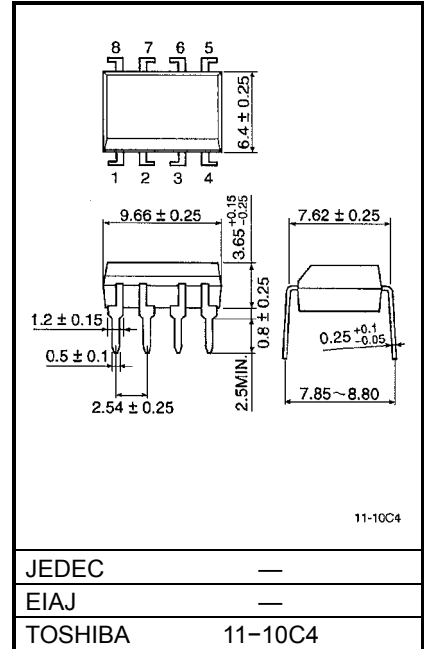
Unit: mm

The TOSHIBA TLP559(IGM) consists of a GaAlAs high-output light emitting diode and a high speed detector of one chip photo diode-transistor.

This unit is 8-lead DIP package.

TLP559(IGM) has no internal base connection, and a Faraday shield integrated on the photodetector chip provides an effective common mode noise transient immunity.

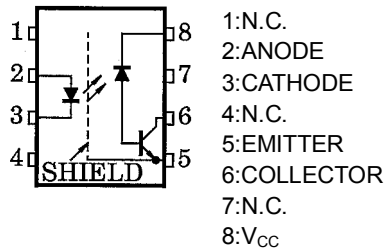
TLP559(IGM) guarantees minimum and maximum of propagation delay time, switching time dispersion, and high common mode transient immunity. There for TLP559(IGM) is suitable for isolation interface between IPM(Intelligent Power Module) and control IC circuits in motor control application.



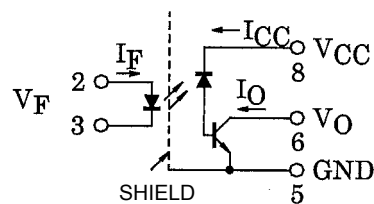
Weight: 0.54 g

- Isolation Voltage : 2500 Vrms (Min)
- Common Mode Transient Immunity : ±10kV/μs (Min)  
@V<sub>CM</sub> = 1500 V
- Switching Time : t<sub>pHL</sub>, t<sub>pLH</sub> = 0.1μs (Min)  
= 0.8μs (Max)  
@I<sub>F</sub> = 10 mA, V<sub>CC</sub> = 15 V, R<sub>L</sub> = 20 kΩ, T<sub>a</sub> = 25°C
- Switching Time Dispersion : 0.7μs (Max)  
(|t<sub>pLH</sub> - t<sub>pHL</sub>|)
- TTL Compatible
- UL Recognized : UL1577, File No. E67349

## PIN CONFIGURATION(Top view)



## SCHEMATIC



## 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	$V_O$	-0.5~20	V
	Supply Voltage	$V_{CC}$	-0.5~30	V
	Output Power Dissipation (Note 5)	$P_O$	100	mW
Operating Temperature Range		$T_{opr}$	-55~100	°C
Storage Temperature Range		$T_{stg}$	-55~125	°C
Lead Solder Temperature(10s) (Note 6)		$T_{sol}$	260	°C
Isolation Voltage(AC, 1min., R.H.≤60%, Ta=25°C) (Note 7)		$BV_S$	2500	Vrms

(Note 1) Derate 0.5mA above 70°C.

(Note 2) 50% duty cycle, 1ms pulse width.

Derate -1.0mA/°C above 70°C.

(Note 3) Pulse width  $PW \leq 1\mu s$ , 300pps.

(Note 4) Derate 0.9mW/°C above 70°C.

(Note 5) Derate 2mW/°C above 70°C.

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

(Note 7) Device considered 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	$V_F$	$I_F = 16 \text{ mA}$	—	1.65	1.85	V
	Forward Voltage Temperature Coefficient	$\Delta V_F / \Delta T_a$	$I_F = 16 \text{ mA}$	—	-2	—	mV / °C
	Reverse Current	$I_R$	$V_R = 5 \text{ V}$	—	—	10	μA
	Capacitance between Terminal	CT	$V = 0, f = 1 \text{ MHz}$	—	45	—	pF
DETECTOR	High Level Output Current	$I_{OH(1)}$	$I_F = 0 \text{ mA}, V_{CC} = V_O = 5.5 \text{ V}$	—	3	500	nA
		$I_{OH(2)}$	$I_F = 0 \text{ mA}, V_{CC} = 30 \text{ V}$ $V_O = 20 \text{ V}$	—	—	5	μA
		$I_{OH}$	$I_F = 0 \text{ mA}, V_{CC} = 30 \text{ V}$ $V_O = 20 \text{ V}, T_a = 70^\circ\text{C}$	—	—	50	
	High Level Supply Voltage	$I_{CCH}$	$I_F = 0 \text{ mA}, V_{CC} = 30 \text{ V}$	—	0.01	1	μA
	Supply Voltage	$V_{CC}$	$I_{CC} = 0.01 \text{ mA}$	30	—	—	V
	Output Voltage	$V_O$	$I_O = 0.5 \text{ mA}$	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 = -25~100°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, f = 1 MHz	—	0.8	—	pF
Isolation Resistance	R <sub>S</sub>	R.H. ≤ 60%, V <sub>S</sub> = 500 V	5 × 10 <sup>10</sup>	10 <sup>14</sup>	—	Ω
Isolation Voltage	BV <sub>S</sub>	AC, 1minute	2500	—	—	Vrms
		AC, 1second, in oil	—	5000	—	
		DC, 1minute, in oil	—	5000	—	Vdc

## SWITCHING CHARACTERISTICS (Ta = 25°C, V<sub>CC</sub> = 15 V)

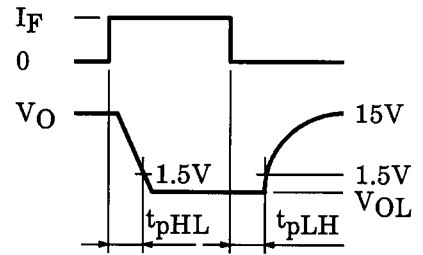
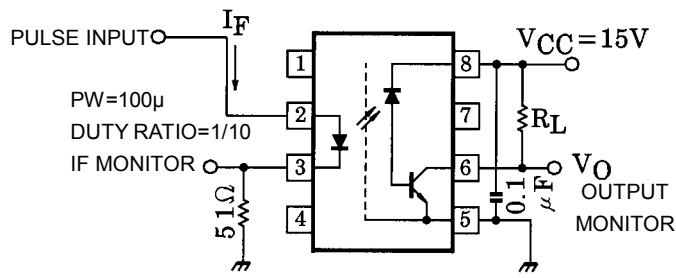
CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Propagation Delay Time (H→L)	t <sub>pHL</sub>	1	I <sub>F</sub> = 10 mA, R <sub>L</sub> = 20 kΩ	0.1	0.45	0.8	μs
Propagation Delay Time (L→H)	t <sub>pLH</sub>		I <sub>F</sub> = 10 mA, R <sub>L</sub> = 20 kΩ Ta = 0~85°C	0.1	0.45	0.9	
			I <sub>F</sub> = 10 mA, R <sub>L</sub> = 20 kΩ Ta = -25~100°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	—	0.15	0.7	μs
			I <sub>F</sub> = 10 mA, R <sub>L</sub> = 20 kΩ Ta = 0~85°C	—	0.25	0.8	
			I <sub>F</sub> = 20 mA, R <sub>L</sub> = 20 kΩ Ta = -25~100°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> < 1V).

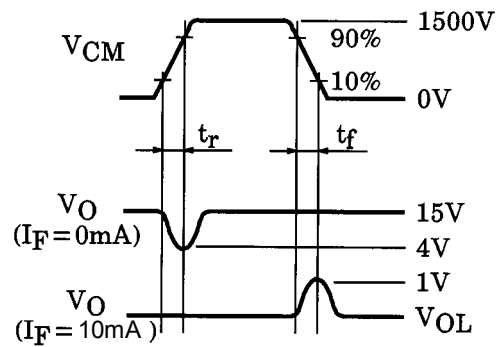
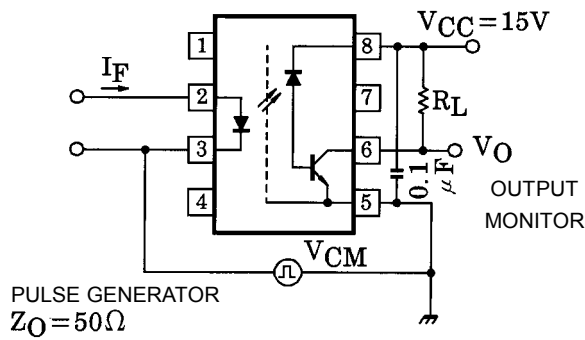
CM<sub>H</sub> is the maximum rate of rise of the common mode voltage that can be sustained with the output voltage in the logic high state (V<sub>O</sub> > 4V).

(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



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

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