

Preliminary

TOSHIBA Photocoupler GaAlAs IRED + Photo IC

TLP350

Inverter for Air Conditioner

IGBT/Power MOS FET Gate Drive

Industrial Inverter

The TOSHIBA TLP350 consists of a GaAlAs light emitting diode and a integrated photodetector.

This unit is 8-lead DIP package.

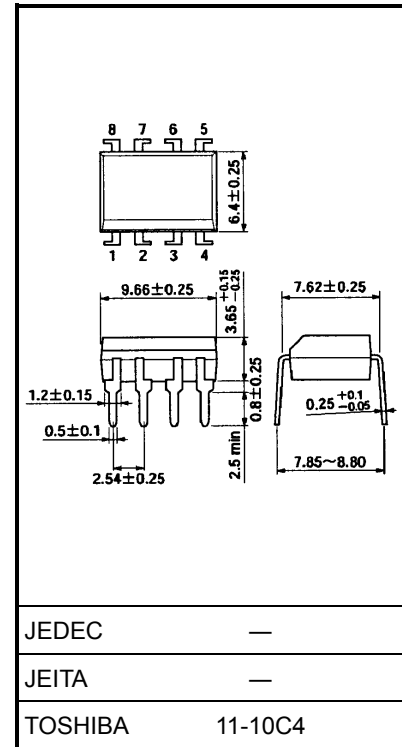
TLP350 is suitable for gate driving circuit of IGBT or power MOS FET..

- Peak output current: $I_O = \pm 2.0$ A (max)
- Guaranteed performance over temperature: -40 to 100°C
- Supply current: $I_{CC} = 2$ mA (max)
- Power supply voltage: $V_{CC} = 15$ to 30 V
- Threshold input current : $I_{FLH} = 5$ mA (max)
- Switching time (t_{pLH}/t_{pHL}) : 500 ns (max)
- Common mode transient immunity: 15 kV/ μs
- Isolation voltage: 3750 Vrms

Truth Table

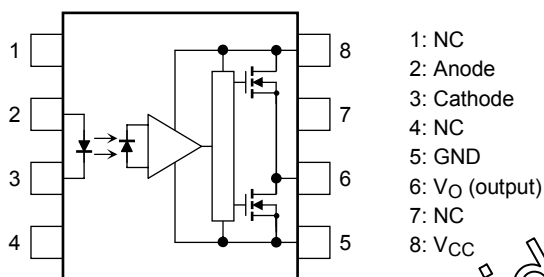
Input	LED	Tr1	Tr2	Output
H	ON	ON	OFF	H
L	OFF	OFF	ON	L

Unit: mm

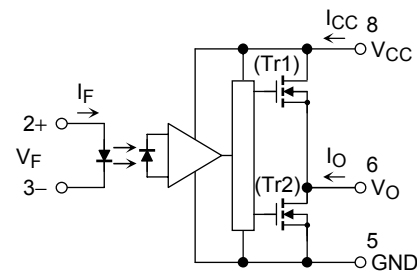


Weight: 0.54 g (typ.)

Pin Configuration (top view)



Schematic



A 0.1 μF bypass capacitor must be connected between pin 8 and 5. (See Note 6)

Development idea
Not fixed yet

Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating	Unit
LED	Forward current	I_F	20	mA
	Forward current derating (Ta ≥ 85°C)	$\Delta I_F / \Delta T_a$	-0.54	mA/°C
	Peak transient forward current (Note 1)	I_{FP}	1	A
	Reverse voltage	V_R	5	V
	Junction temperature	T_j	125	°C
Detector	"H" peak output current (Note 2)	I_{OPH}	-2.0	A
	"L" peak output current (Note 2)	I_{OPL}	2.0	A
	Output voltage (Note 3)	V_O	35	V
	Supply voltage (Note 3)	V_{CC}	35	V
	Junction temperature	T_j	125	°C
Operating frequency (Note 4)		f		kHz
Storage temperature range		T_{stg}	-55 to 125	°C
Operating temperature range		T_{opr}	-40 to 100	°C
Lead soldering temperature (10 s) (Note 5)		T_{sol}	260	°C
Isolation voltage (AC, 1 minute, R.H. ≤ 60%) (Note 6)		BV_S	3750	Vrms

Note 1: Pulse width $P_W \leq 1 \mu s$, 300 pps

Note 2: Exponential waveform pulse width $P_W \leq \mu s$, $f \leq$ kHz

Note 3: Ta ≤ 100 °C

Note 4: Exponential waveform $I_{OPH} \leq$ A ($\leq \mu s$), $I_{OPL} \leq +$ A ($\leq \mu s$), Ta = °C

Note 5: It is 2 mm or more from a lead root.

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

Note 7: A ceramic capacitor(0.1 μF) should be connected from pin 8 to pin 5 to stabilize the operation of the high gain linear amplifier. Failure to provide the bypassing may impair the switching property.
The total lead length between capacitor and coupler should not exceed 1 cm.

Recommended Operating Conditions

Characteristics	Symbol	Min	Typ.	Max	Unit
Input current, ON (Note 8)	$I_F (ON)$	7.5	—	10	mA
Input voltage, OFF	$V_F (OFF)$	0	—	0.8	V
Supply voltage	V_{CC}	15	—	30	V
Peak output current	I_{OPH}/I_{OPL}	—	—	±1.0	A
Operating temperature	T_{opr}	-40	—	100	°C

Note 8: Input signal rise time (fall time) < 0.5 μs .

Electrical Characteristics (Ta = -40 to 100°C, unless otherwise specified)

Characteristics		Symbol	Test Circuit	Test Condition		Min	Typ.*	Max	Unit
Forward voltage		V_F	—	$I_F = 5 \text{ mA}$, $T_a = 25^\circ\text{C}$		—	1.55	1.70	V
Temperature coefficient of forward voltage		$\Delta V_F / \Delta T_a$	—	$I_F = 5 \text{ mA}$		—	-2.0	—	mV/°C
Input reverse current		I_R	—	$V_R = 5 \text{ V}$, $T_a = 25^\circ\text{C}$		—	—	10	μA
Input capacitance		C_T	—	$V = 0$, $f = 1 \text{ MHz}$, $T_a = 25^\circ\text{C}$		—	45	—	pF
Output current (Note 9)	“H” Level	I_{OPH1}	1	$V_{CC} = 30 \text{ V}$ $I_F = 5 \text{ mA}$	$V_{8-6} = 4.0 \text{ V}$	-1.0	-1.5	—	A
		I_{OPH2}			$V_{8-6} =$			—	
	“L” Level	I_{OPL1}	2	$V_{CC} = 30 \text{ V}$ $I_F = 0 \text{ mA}$	$V_{6-5} = 2.0 \text{ V}$	1.0	2.0	—	
		I_{OPL2}			$V_{6-5} =$			—	
Output voltage	“H” Level	V_{OH}	3	$V_{CC} 1 = +15 \text{ V}$	$I_O = -100 \text{ mA}$, $I_F = 5 \text{ mA}$	11		—	V
	“L” Level	V_{OL}	4	$V_{EE} 1 = -15 \text{ V}$	$I_O = 100 \text{ mA}$, $V_F = 0.8 \text{ V}$	—		1.0	
Supply current	“H” Level	I_{CCH}	5	$V_{CC} = 30 \text{ V}$ V_O open	$I_F = 10 \text{ mA}$	—		2.0	mA
	“L” Level	I_{CCL}	6		$I_F = 0 \text{ mA}$	—		2.0	
Threshold input current	L → H	I_{FLH}	—	$V_{CC} 1 = +15 \text{ V}$ $V_{EE} 1 = -15 \text{ V}$, $V_O > 0 \text{ V}$		—		5	mA
Threshold input voltage	H → L	V_{FHL}	—	$V_{CC} 1 = +15 \text{ V}$ $V_{EE} 1 = -15 \text{ V}$, $V_O < 0 \text{ V}$		0.8	—	—	V
Supply voltage		V_{CC}	—	—		15	—	30	V
UVLO thresh hold		V_{UVLO+}	—	$V_O > 2.5 \text{ V}$, $I_F = 5 \text{ mA}$, $I_O = 100 \text{ mA}$		11.0	—	13.5	V
		V_{UVLO-}	—			9.5	—	12.0	V

*: All typical values are at $T_a = 25^\circ\text{C}$

Note 9: Duration of I_O time $\leq 50 \mu\text{s}$

Note 10: This product is more sensitive than the conventional product to static electricity (ESD) because of a lowest power consumption design.

General precaution to static electricity (ESD) is necessary for handling this component.

Isolation Characteristics (Ta = 25°C)

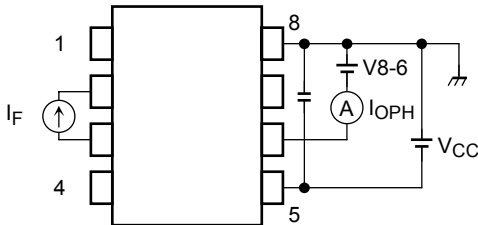
Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Capacitance input to output	C_S	$V = 0$, $f = 1 \text{ MHz}$ (Note6)	—	0.8	—	pF
Isolation resistance	R_S	$V_S = 500 \text{ V}$, $T_a = 25^\circ\text{C}$, $R.H. \leq 60\%$ (Note6)	1×10^{12}	10^{14}	—	Ω
Isolation voltage	BV_S	AC, 1 minute	3750	—	—	V_{rms}
		AC, 1 second, in oil	—	10000	—	
		DC, 1 minute, in oil	—	10000	—	Vdc

Switching Characteristics (Ta = -40 to 100°C, unless otherwise specified)

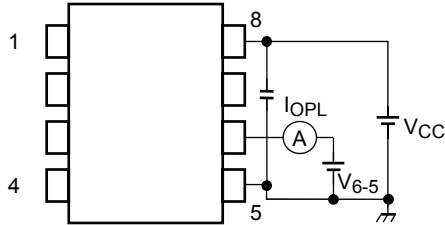
Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.*	Max	Unit
Propagation delay time	L → H	7	$V_{CC1} = +15\text{ V}$ $V_{EE1} = -15\text{ V}$ $R_g = 20\ \Omega$ $C_g = 10\text{ nF}$	50	250	500	ns
	H → L						
Propagation delay difference between any two parts or channels	PDD $ t_{pHL} - t_{pLH} $	7	$V_{CC1} = +15\text{ V}$, $V_{EE1} = -15\text{ V}$, $R_g = 20\ \Omega$, $C_g = 10\text{ nF}$	—	—	450	ns
Output rise time (10-90%)	t_r	8	$V_{CC1} = +15\text{ V}$ $V_{EE1} = -15\text{ V}$ $R_g = 20\ \Omega$ $C_g = 10\text{ nF}$	—	—	—	ns
Output fall time (90-10%)	t_f						
Common mode transient immunity at high level output	CM_H	8	$V_{CM} = 1000\text{ V}_{p-p}$ $T_a = 25^\circ\text{C}$ $V_{CC} = 30\text{ V}$	$I_F = 5\text{ mA}$ $V_O(\text{min}) = 26\text{ V}$	—	—	V/ μs
Common mode transient immunity at low level output	CM_L			$I_F = 0\text{ mA}$ $V_O(\text{max}) = 1\text{ V}$	—	—	

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

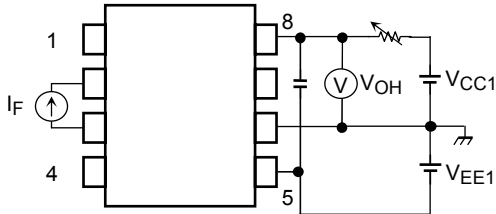
Test Circuit 1: I_{OPH}



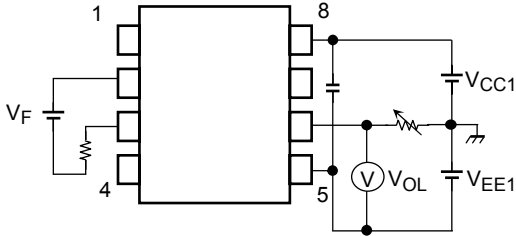
Test Circuit 2: I_{OPL}



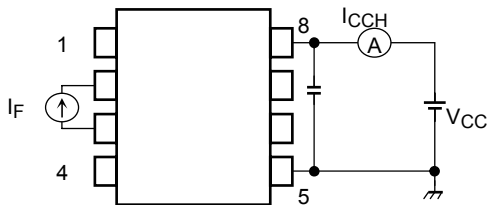
Test Circuit 3: V_{OH}



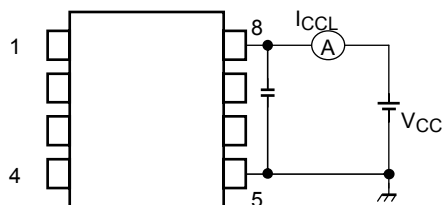
Test Circuit 4: V_{OL}



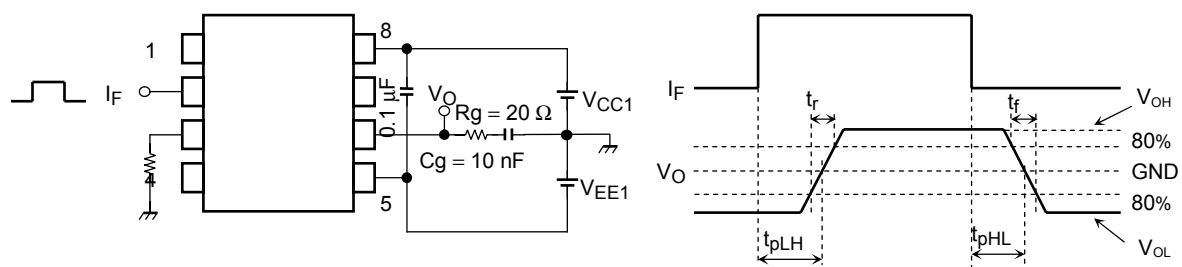
Test Circuit 5: I_{CCH}



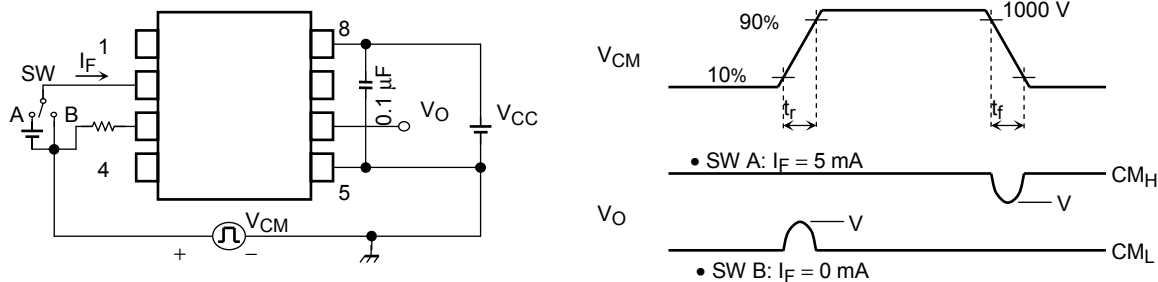
Test Circuit 6: I_{CCL}



Test Circuit 7: t_{pLH} , t_{pHL} , t_r , t_f , PDD



Test Circuit 8: CM_H , CM_L



$$CM_L = \frac{800\ \text{V}}{t_f\ (\mu\text{s})}$$

$$CM_H = \frac{800\ \text{V}}{t_r\ (\mu\text{s})}$$

CM_L (CM_H) 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.

RESTRICTIONS ON PRODUCT USE

030619EBC

- The information contained herein is subject to change without notice.
- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA for any infringements of patents or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of TOSHIBA or others.
- TOSHIBA is continually working to improve the quality and reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to comply with the standards of safety in making a safe design for the entire system, and to avoid situations in which a malfunction or failure of such TOSHIBA products could cause loss of human life, bodily injury or damage to property.
In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent TOSHIBA products specifications. Also, please keep in mind the precautions and conditions set forth in the "Handling Guide for Semiconductor Devices," or "TOSHIBA Semiconductor Reliability Handbook" etc..
- The TOSHIBA products listed in this document are intended for usage in general electronics applications (computer, personal equipment, office equipment, measuring equipment, industrial robotics, domestic appliances, etc.). These TOSHIBA products are neither intended nor warranted for usage in equipment that requires extraordinarily high quality and/or reliability or a malfunction or failure of which may cause loss of human life or bodily injury ("Unintended Usage"). Unintended Usage include atomic energy control instruments, airplane or spaceship instruments, transportation instruments, traffic signal instruments, combustion control instruments, medical instruments, all types of safety devices, etc.. Unintended Usage of TOSHIBA products listed in this document shall be made at the customer's own risk.
- The products described in this document are subject to the foreign exchange and foreign trade laws.
- TOSHIBA products should not be embedded to the downstream products which are prohibited to be produced and sold, under any law and regulations.
- GaAs(Gallium Arsenide) is used in this product. The dust or vapor is harmful to the human body. Do not break, cut, crush or dissolve chemically.