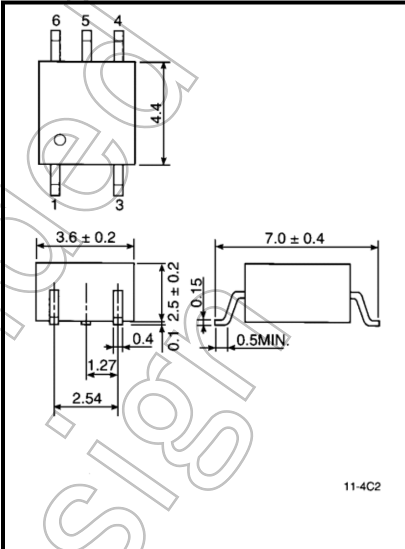
TOSHIBA Photocoupler IRED + Photo−IC

TLP114A(IGM)

Industrial Inverter
Inverter For Air Conditioner
Line Receiver
IPM(intelligent power module) Interfaces

The TOSHIBA mini flat coupler TLP114A(IGM) is a small outline coupler, suitable for surface mount assembly.
TLP114A(IGM) consists of a high output power infrared emitting diode, optically coupled to a high speed detector of one chip photo diode−transistor.
TLP114A(IGM) has no internal base connection, and a faraday shield integrated on the photodetector chip provides an effective common mode noise transient immunity.
TLP114A(IGM) guarantees minimum and maximum of propagation delay time, switching time dispersion, and high common mode transient immunity. There for TLP114A(IGM) is suitable for isolation interface between IPM(intelligent power module) and control IC circuits in motor control application.

Unit : mm



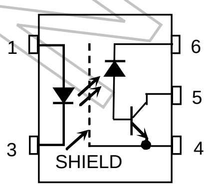
JEDEC	—
JEITA	—
TOSHIBA	11−4C2

Weight: 0.09g (typ.)

- Isolation voltage: 3750V_{rms}(min.)
- Common mode transient immunity: ±10kV/μs(min)
  @V_{CM}=1500V
- Switching time: t_{pHL}, t_{pLH}=0.1μs(min), 0.8μs(max)
  @I_F=10mA, V_{CC}=15V, R_L=20kΩ, Ta=25°C
- Switching time dispersion: 0.7μs(max)
  (|t_{pLH}−t_{pHL}|)
- TTL compatible by connecting external resistance.
- UL-recognized: UL 1577, File No.E67349
- cUL-recognized: CSA Component Acceptance Service No.5A
  File No.E67349
- VDE-approved: EN 60747-5-5 (Note 1)

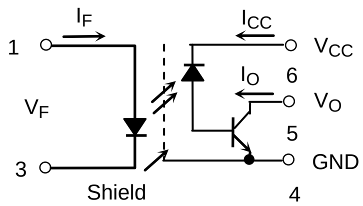
Note 1 : When a VDE approved type is needed,
please designate the **Option(V4)**.

Pin Configuration (top view)



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

Schematic



Start of commercial production
1995-01

Absolute Maximum Ratings (Ta = 25°C)

	Characteristic		Symbol	Rating	Unit
LED	Forward current		I_F	20	mA
LED	Forward current derating	(Ta ≥70 °C)	Δ IF/°C	-0.36	mA/°C
LED	Pulse forward current	(Note 1)	I_{FP}	40	mA
LED	Peak transient forward current	(Note 2)	I_{FPT}	1	A
LED	Reverse voltage		V_R	5	V
LED	Input power dissipation		P_D	45	mW
LED	Diode power dissipation derating	(Ta ≥70 °C)	ΔPD/°C	-0.82	mW/°C
Detector	Output current		I_O	8	mA
Detector	Output current derating	(Ta ≥ 70 °C)	Δ IO/°C	-0.3	mA/°C
Detector	Peak output current		I_{OP}	16	mA
Detector	Supply voltage		V_{CC}	−0.5 to 30	V
Detector	Output voltage		V_O	−0.5 to 20	V
Detector	Output power dissipation		P_O	100	mW
Detector	Power dissipation derating	(Ta ≥ 70 °C)	ΔP_O / °C	-1.82	mW / °C
Operating temperature range			T_{opr}	−55 to 100	°C
Storage temperature range			T_{stg}	−55 to 125	°C
Lead solder temperature(10 s)			T_{sol}	260	°C
Isolation Voltage (AC,60 s, R.H.≤ 60 %)		(Note 3)	BV_S	3750	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): 50 % duty cycle, 1 ms pulse width. Derate 0.72 mA / °C above 70 °C.

(Note 2): Pulse width ≤ 1 μs, 300 pps.

(Note 3): Device considered a two−terminal device: Pins 1 and 3 shorted together, and pins 4, 5 and 6 shorted together.

Electrical Characteristics(Ta = 25°C)

	Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
LED	Forward voltage	V_F	I_F = 16 mA	1.22	1.42	1.72	V
	Forward voltage temperature coefficient	$\Delta V_F / \Delta Ta$	I_F = 16 mA	—	−2	—	mV / °C
	Reverse current	I_R	V_R = 3 V	—	—	10	μA
	Capacitance between terminal	CT	V_F = 0 V, f = 1 MHz	—	30	—	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 current	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 = 16 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 = 10 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 V, f = 1 MHz	—	0.8	—	pF
Isolation resistance	R_S	R.H.≤ 60 %, V_S = 500 V	5×10^{10}	10^{14}	—	Ω
Isolation voltage	BV_S	AC, 60 s	3750	—	—	Vrms

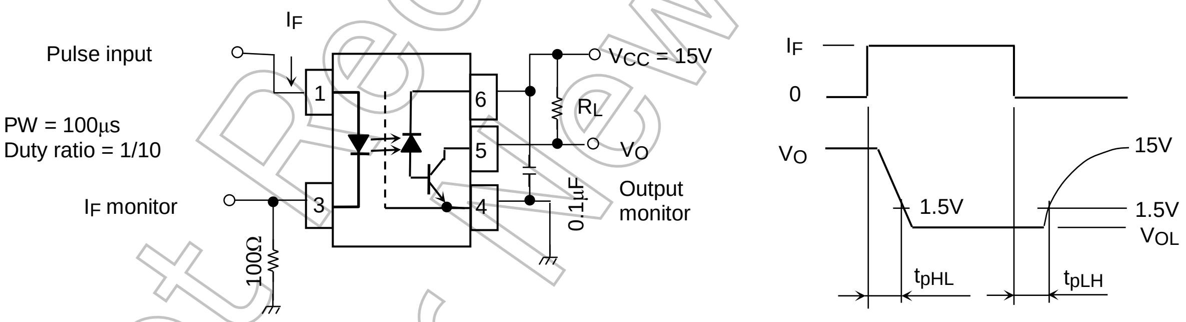
Switching Characteristics(Ta = 25°C, VCC = 15V)

Characteristic	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Propagation delay time (H→ L)	t_{pHL}	1	I_F = 0→ 10 mA, R_L = 20 kΩ	0.1	0.45	0.8	μs
Propagation delay time (L→ H)	t_{pLH}		I_F = 0→ 10 mA, R_L = 20 kΩ Ta = 0 to 85 °C	0.1	0.45	0.9	
			I_F = 0→ 10 mA, R_L = 20 kΩ Ta = −25 to 100 °C	0.1	0.45	1.0	
Switching time dispersion between on and off	$\|t_{pLH}-t_{pHL}\|$		I_F = 10→ 0 mA, R_L = 20 kΩ	—	0.15	0.7	μs
			I_F = 10→ 0 mA, R_L = 20 kΩ Ta = 0 to 85 °C	—	0.25	0.8	
			I_F = 10→ 0 mA, R_L = 20 kΩ Ta = −25 to 100 °C	—	0.25	0.9	
Common mode transient immunity at logic high output (Note 4)	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 4)	CM_L		I_F = 10 mA V_{CM} = 1500 V_{p-p} R_L = 20 kΩ	−10000	−15000	—	V / μs

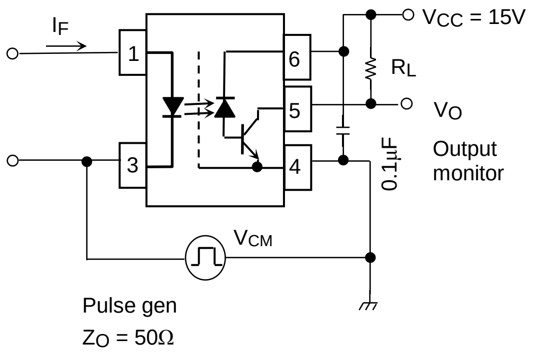
(Note 4): CM_L is the maximum rate of fall of the common mode voltage that can be sustained with the output voltage in the logic low state (V_O<1 V).

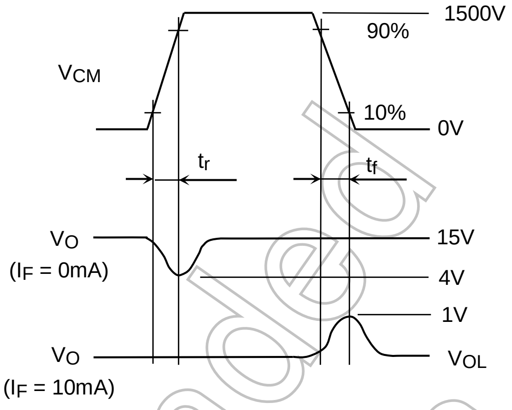
CM_H is the maximum rate of rise of the common mode voltage that can be sustained with the output voltage in the logic high state (V_O>4 V).

Test Circuit 1: Switching Time Test Circuit



Test Circuit 2: Common Mode Noise Immunity Test Circuit





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

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