TOSHIBA Photocoupler GaAs IRED & Photo-Transistor

TLP781, TLP781F

Office Equipment Household Appliances Solid State Relays Switching Power Supplies Various Controllers Signal Transmission Between Different Voltage Circuits

The TOSHIBA TLP781 consists of a silicone photo-transistor optically coupled to a gallium arsenide infrared emitting diode in a four lead plastic DIP (DIP4) with having high isolation voltage (AC: 5kVRMS (min)).

- TLP781 : 7.62mm pitch type DIP4
- TLP781F: 10.16mm pitch type DIP4
- Collector-emitter voltage: 80V (min.)
- Current transfer ratio: 50% (min.) Rank GB: 100% (min.)
- Isolation voltage: 5000V_{rms} (min.)
- UL recognized: UL1577, file No. E67349
- BSI approved: BS EN60065:2002 Approved no.8961 BS EN60950-1:2006
 - Approved no.8962
- SEMKO approval: EN60950-1,EN60065 under plan
- Option(D4)type VDE approved : DIN EN60747-5-2 Certificate No. 40021173 (Note): When an EN60747-5-2 approved type is needed, Please designate "Option (D4)"
- Construction mechanical rating

	7.62mm Pitch Standard Type	10.16mm Pitch TLPxxxF Type
Creepage distance	6.5mm(min)	8.0mm(min)
Clearance	6.5mm(min)	8.0mm(min)
Insulation thickness	0.4mm(min)	0.4mm(min)



Weight: 0.25g (typ.)

Unit in mm



Weight: 0.25g (typ.)

Pin Configurations (top view)



- 2 : Cathode
- 3 : Emitter
- 4 : Collector

Current Transfer Ratio

Туре	Classi– fication (Note 1)	Current Transfer Ratio (%) (I _C / I _F) I _F = 5mA, V _{CE} = 5V, Ta = 25°C Min Max		Marking Of Classification
	(None)	50	600	Blank, Y, Y+, YE,G, G+, B, B+,BL,GB
	Rank Y	50	150	YE
	Rank GR	100	300	GR
	Rank BL	200	600	BL
TLP781	Rank GB	100	600	GB
	Rank YH	75	150	Y+
	Rank GRL	100	200	G
	Rank GRH	150	300	G+
	Rank BLL	200	400	В

(Note 1): Ex. rank GB: TLP781 (GB)

(Note 2): Application type name for certification test, please use standard product type name, i. e. TLP781 (GB): TLP781

Absolute Maximum Ratings (Ta = 25°C)

	Characteristic		Symbol	Rating	Unit
	Forward current		lF	60	mA
	Forward current derating(Ta ≥ 39°C)		ΔI _F / °C	-0.7	mA / °C
	Pulse forward current	(Note 3)	I _{FP}	1	А
ΓED	Power dissipation		PD	100	mW
	Power dissipation derating		ΔP _D / °C	-1.0	mW / °C
	Reverse voltage		V _R	5	V
	Junction temperature		Тj	125	°C
	Collector-emitter voltage		V _{CEO}	80	V
	Emitter-collector voltage		V _{ECO}	7	V
tor	Collector current		Ι _C	50	mA
etec	Power dissipation(single circuit)		P _C	150	mW
	Power dissipation derating (Ta ≥ 25°C)(single circuit)		ΔP _C / °C	-1.5	mW / °C
	Junction temperature		Tj	125	°C
Оре	rating temperature range		T _{opr}	-55~110	°C
Stor	age temperature range		T _{stg}	-55~125	°C
Lea	d soldering temperature (10s)		T _{sol}	260	°C
Tota	I package power dissipation		PT	250	mW
Tota (Ta	I package power dissipation derating ≥ 25°C)		ΔΡ _T / °C	-2.5	mW / °C
Isola	ation voltage	(Note 4)	BVS	5000	V _{rms}

(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 3): 100µs pulse, 100Hz frequency

(Note 4): AC, 1 min., R.H.≤ 60%. Apply voltage to LED pin and detector pin together.

Recommended Operating Conditions

Characteristic	Symbol	Min	Тур.	Max	Unit
Supply voltage	V _{CC}	_	5	24	V
Forward current	١ _F	_	16	25	mA
Collector current	Ι _C	_	1	10	mA
Operating temperature	Topr	-25	_	85	°C

(Note): Recommended operating conditions are given as a design guideline

to obtain expected performance of the device.

Additionally, each item is an independent guideline respectively.

In developing designs using this product, please confirm $% \left({{{\mathbf{r}}_{i}}} \right)$

specified characteristics shown in this document.

Individual Electrical Characteristics (Ta = 25°C)

	Characteristic	Symbol	Test Condition	Min	Тур.	Max	Unit
	Forward voltage	V _F	I _F = 10 mA	1.0	1.15	1.3	V
LED	Reverse current	I _R	V _R = 5 V	_	—	10	μA
	Capacitance	CT	V = 0, f = 1 MHz	_	30	_	pF
	Collector–emitter breakdown voltage	V _(BR) CEO	I _C = 0.5 mA	80	_	_	V
2	Emitter-collector breakdown voltage	V _{(BR) ECO}	I _E = 0.1 mA	7	_	_	V
Detecto	Collector dark ourrent		V _{CE} = 24 V	_	0.01	0.1	μA
		UUCEO)	V _{CE} = 24 V Ta = 85°C	_	0.6	50	μA
	Capacitance (collector to emitter)	C _{CE}	V = 0, f = 1 MHz		10	_	pF

Coupled Electrical Characteristics (Ta = 25°C)

Characteristic	Symbol	Test Condition		Min	Тур.	Max	Unit
Current transfer ratio	lo/In	I _F = 5 mA, V _{CE} = 5 V		50		600	0/2
	IC / IF		Rank GB			600	70
Saturated CTP		IF = 1 mA, V _{CE} = 0.4 V			60	—	0/_
	IC / IF (sat)		Rank GB	30	-	_	70
		I_{C} = 2.4 mA, I_{F} = 8 mA		-	-	0.4	
Collector–emitter saturation voltage	V _{CE (sat)}	I _C = 0.2 mA, I _F = 1 mA		-	0.2	_	V
Ŭ			Rank GB			0.4	

Isolation Characteristics (Ta = 25°C)

Characteristic	Symbol	Test Condition	Min	Тур.	Max	Unit
Capacitance (input to output)	CS	V _S = 0, f = 1 MHz	-	0.8	_	pF
Isolation resistance	R _S	V _S = 500 V		10 ¹⁴	_	Ω
		AC, 1 minute	5000	_	_	V
Isolation voltage	BVS	AC, 1 second, in oil	_	10000	_	v rms
		DC, 1 minute, in oil		10000		Vdc

V_{CC} 4.5V

_0.5V

t_{OF}F

Switching Characteristics (Ta = 25°C)

Characteristics	Symbol	Test Condition	Min	Тур.	Max	Unit
Rise time	tr		_	2	_	
Fall time	t _f	V _{CC} = 10 V, I _C = 2 mA	_	3	_	116
Turn-on time	t _{on}	R _L = 100Ω		3		μο
Turn-off time	t _{off}			3		
Turn-on time	t _{ON}			2		
Storage time	ts	$R_L = 1.9 \text{ k}\Omega$ (Note 5) $V_{CC} = 5 \text{ V}, I_F = 16 \text{ mA}$	_	25	_	μs
Turn-off time	tOFF		_	50	_	



(Note 5): Switching time test circuit

Surface-Mount Lead Form Options





Specifications for Embossed-Tape Packing: (TP6), (TP7)

1. Applicable Package

Package Name	Product Type
DIP4LF6	TLP781
DIP4LF7	TLP781F

2. Product Naming System

Type of package used for shipment is denoted by a symbol suffix after a product number. The method of classification is as below.

(Example 1)



3. Tape Dimensions

3.1 Orientation of Device in Relation to Direction of Tape Movement Device orientation in the recesses is as shown in Figure 1.





Tape feed 🔿

Figure1 Device Orientation

- 3.2 Tape Packing Quantity:2000 devices per reel
- 3.3 Empty Device Recesses Are as Shown in Table 1.

Table1 Empty Device Recesses

	Standard	Remarks
Occurrences of 2 or more successive empty device recesses	0	Within any given 40-mm section of tape, not including leader and trailer
Single empty device recesses	6 devices (max.) per reel	Not including leader and trailer

3.4 Start and End of Tape

The start of the tape has 30 or more empty holes. The end of the tape has 50 or more empty holes.

3.5 Tape Specification

[1] TLP781 (TP6)

(1)Tape material: Plastic

(2)Dimensions: The tape dimensions are as shown in Figure 2.



Figure 2 Tape Forms

[2] TLP781F (TP7)

(1)Tape material: Plastic

(2)Dimensions: The tape dimensions are as shown in Figure 3.





3.6 Reel Specification

[1] TLP781 (TP6)

(1)Material: Plastic

(2)Dimensions: The reel dimensions are as shown in Figure 4.



Figure 4 Reel Forms

[2] TLP781F (TP7)

(1)Material: Plastic

(2)Dimensions: The reel dimensions are as shown in Figure 5.



Figure 5 Reel Forms

4. Packing

One reel of photocouplers is packed in a shipping carton.

5. Label Indication

The carton bears a label indicating the product number, the symbol representing classification of standard, the quantity, the lot number and the Toshiba company name.

6. Ordering Information

When placing an order, please specify the product number, the CTR rank, the tape type and the quantity as shown in the following example.

(Example)



Please contact your nearest Toshiba sales representative for more details.

Soldering and Storage

1. Soldering

1.1 Soldering

When using a soldering iron or medium infrared ray/hot air reflow, avoid a rise in device temperature as much as possible by observing the following conditions.

1) Using solder reflow

·Temperature profile example of lead (Pb) solder



This profile is based on the device's maximum heat resistance guaranteed value.

Set the preheat temperature/heating temperature to the optimum temperature corresponding to the solder paste type used by the customer within the described profile.

·Temperature profile example of using lead (Pb)-free solder



This profile is based on the device's maximum heat resistance guaranteed value.

Set the preheat temperature/heating temperature to the optimum temperature corresponding to the solder paste type used by the customer within the described profile.

2) Using solder flow (for lead (Pb) solder, or lead (Pb)-free solder)

Please preheat it at 150°C between 60 and 120 seconds.

• Complete soldering within 10 seconds below 260°C. Each pin may be heated at most once.

3) Using a soldering iron

Complete soldering within 10 seconds below 260°C, or within 3 seconds at 350°C. Each pin may be heated at most once.

2. Storage

- 1) Avoid storage locations where devices may be exposed to moisture or direct sunlight.
- 2) Follow the precautions printed on the packing label of the device for transportation and storage.

3) Keep the storage location temperature and humidity within a range of 5°C to 35°C and 45% to 75%, respectively.

- 4) Do not store the products in locations with poisonous gases (especially corrosive gases) or in dusty conditions.
- 5) Store the products in locations with minimal temperature fluctuations. Rapid temperature changes during storage can cause condensation, resulting in lead oxidation or corrosion, which will deteriorate the solderability of the leads.
- 6) When restoring devices after removal from their packing, use anti-static containers.
- 7) Do not allow loads to be applied directly to devices while they are in storage.
- 8) If devices have been stored for more than two years under normal storage conditions, it is recommended that you check the leads for ease of soldering prior to use.

EN60747 Isolation Characteristics

Types: TLP781, TLP781F

Type designations for 'option: (D4) ', which are tested under EN60747 requirements. Ex.: TLP781 (D4-GR-LF6) D4: EN60747 option

D4: EN60747 option GR: CTR rank name

LF6: standard lead bend name

Note: Use TOSHIBA standard type number for safety standard application. Ex. TLP781 (D4-GR-LF6) \rightarrow TLP781

Description	Symbol	Rating	Unit
Application classification			
for rated mains voltage \leq 300 V _{rms} for rated mains voltage \leq 600 V _{rms}		I–IV I–III	—
Climatic classification		55 / 115 / 21	_
Pollution degree		2	_
Maximum operating insulation voltage	VIORM	890	Vpk
Input to output test voltage, Vpr = 1.5×V _{IORM} , type and sample test t _p = 10s, partial discharge < 5pC	V _{pr}	1335	Vpk
Input to output test voltage, Vpr = 1.875×V _{IORM} , 100% production test t _p = 1s, partial discharge < 5pC	V _{pr}	1670	Vpk
Highest permissible overvoltage (transient overvoltage, t _{pr} = 60s)	V _{TR}	6000	Vpk
Safety limiting values (max. permissible ratings in case of fault) current (input current I _F , P _{Si} = 0) power (output or total power dissipation) temperature	I _{si} P _{si} T _{si}	300 500 150	mA mW °C
Insulation resistance, V _{IO} = 500V,Ta=25°C	Rsi	≧10 ¹²	Ω

Insulation Related Specifications

		7.62mm pitch TLPxxx type	10.16mm pitch TLPxxxF type
Minimum creepage distance	Cr	6.5mm	8.0mm
Minimum clearance	CI	6.5mm	8.0mm
Minimum insulation thickness	ti	0.4 mm	
Comparative tracking index	СТІ	175	

- (1) If a printed circuit is incorporated, the creepage distance and clearance may be reduced below this value. (e.g.at a standard distance between soldering eye centres of 7.5mm). If this is not permissible, the user shall take suitable measures.
- (2) This photocoupler is suitable for 'safe electrical isolation' only within the safety limit data. Maintenance of the safety data shall be ensured by means of protective circuits.

4

VDE test sign: Marking on product for EN60747

Marking on packing for EN60747



Marking Example: TLP781, TLP781F











*: The above graphs show typical characteristics.



 $I_{\rm C} - V_{\rm CE}$ 80 (mA) 60 Collector current IC 50 40 20 20 IF= 2 mA 0 0 2 4 6 8 10 Collector-emitter voltage V_{CE} (V)



*: The above graphs show typical characteristics.

Forward current IF (mA)





*: The above graphs show typical characteristics.

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20070701-EN

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