Photocouplers GaAs Infrared LED & Photo Triac

TLP265J

1. Applications

- Triac Drivers
- Programmable Logic Controllers (PLCs)
- AC-Output Modules
- Solid-State Relays

2. General

The TLP265J consists of a non zero crossing photo triac, optically coupled to a gallium arsenide infrared emitting diode. The TLP265J is housed in the SO6 package and guarantees a creepage distance of 5.0 mm (min), a clearance of 5.0 mm (min) and insulation thickness of 0.4 mm (min). Therefore, the TLP265J meets the reinforced insulation class requirements of international safety standards.

3. Features

(1) Peak off-state voltage: 600 V (min)
(2) Non zero crossing functionary (NZC)
(3) Trigger LED current: 10 mA (max)
(4) On-state current: 70 mA (max)
(5) Isolation voltage: 3750 Vrms (min)
(6) Safety standards
UL-approved: UL1577 File No.E67349
cUL-approved: CSA Component Acceptance Service No.5A, File No.E67349
VDE-approved: Option (V4) EN60747-5-5 **(Note)**
Maximum operating insulation voltage: 707 Vpeak
Highest permissible overvoltage: 6000 Vpeak

Note: When an EN60747-5-5 approved type is needed, please designate the **Option (V4)**.

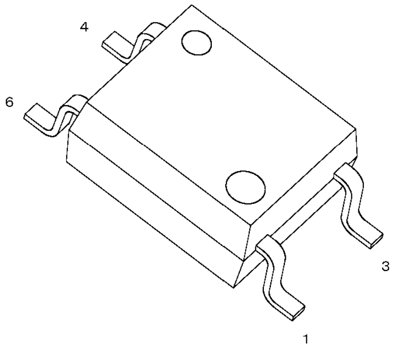
Table Trigger LED Current (Note) (Unless otherwise specified, T_a = 25 °C)

Rank	I_{FT} Rank Marking	Test Condition	Trigger LED Current I_{FT} (min)	Trigger LED Current I_{FT} (max)	Unit
None	10	V_T = 6 V	—	10	mA
(IFT7)	7	V_T = 6 V	—	7	

Note: Specify both the part number and a rank in this format when ordering.
Example: TLP265J (IFT7)
For safety standard certification, however, specify the part number alone.
Example: TLP265J

Start of commercial production
2012-11

4. Packaging and Pin Assignment



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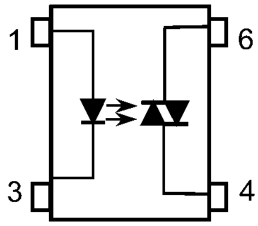


1: Anode
3: Cathode
4: Triac Terminal
6: Triac Terminal

5. Mechanical Parameters

Characteristics	2.54-mm pitch	Unit
Creepage distances	5.0 (min)	mm
Clearance distances	5.0 (min)	
Internal isolation thickness	0.4 (min)	

6. Product Naming Conventions

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

Example) TLP265J(TPL,F(T

Part number: TLP265J
Tape type: TPL **(Note 1)**
[[G]]/RoHS COMPATIBLE: F **(Note 2)**
Domestic ID (Country/Region of origin: Thailand): (T

Note 1: At the part of tape type, below options are used.
TPL, TPR

Note 2: Please contact your Toshiba sales representative for details on environmental information such as the product's RoHS compatibility.
RoHS is the Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronics equipment.

7. Absolute Maximum Ratings (Note) (Unless otherwise specified, T_a = 25 °C)

	Characteristics		Symbol	Note	Rating	Unit
LED	Input forward current		I_F		30	mA
	Input forward current derating	($T_a \geq$ 25 °C)	$\Delta I_F/\Delta T_a$		-0.3	mA/°C
	Input forward current (pulsed)		I_{FP}	(Note 1)	1	A
	Input reverse voltage		V_R		5	V
	Junction temperature		T_j		125	°C
	Input power dissipation		P_D		50	mW
Detector	Off-state output terminal voltage		V_{DRM}		600	V
	R.M.S. on-state current	(T_a = 25 °C)	$I_{T(RMS)}$		70	mA
	R.M.S. on-state current	(T_a = 70 °C)	$I_{T(RMS)}$		40	
	R.M.S. on-state current derating	($T_a \geq$ 25 °C)	$\Delta I_{T(RMS)}/\Delta T_a$		-0.67	mA/°C
	ON-state current (pulsed)		I_{ONP}	(Note 2)	2	A
	Peak non-repetitive surge current		I_{TSM}	(Note 3)	1.2	A
	Junction temperature		T_j		125	°C
	Output power dissipation		P_O		200	mW
Common	Operating temperature		T_{opr}		-40 to 100	°C
	Storage temperature		T_{stg}		-55 to 125	
	Lead soldering temperature	(10 s)	T_{sol}		260	
	Isolation voltage	AC, 60 s, R.H. $\leq$ 60 %	BV_S	(Note 4)	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: Pulse width (PW) $\leq$ 100 μs, 100 pps

Note 2: Pulse width (PW) $\leq$ 100 μs, 120 pps

Note 3: Pulse width (PW) $\leq$ 10 ms

Note 4: This device is considered as a two-terminal device: Pins 1 and 3 are shorted together, and pins 4 and 6 are shorted together.

8. Recommended Operating Conditions (Note)

Characteristics	Symbol	Note	Min	Typ.	Max	Unit
AC mains voltage	V_{AC}		—	—	240	V
Input forward current	I_F		15	20	25	mA
ON-state current (pulsed)	I_{ONP}		—	—	1	A
Operating temperature	T_{opr}		-25	—	85	°C

Note: The recommended operating conditions are given as a design guide necessary to obtain the intended performance of the device. Each parameter is an independent value. When creating a system design using this device, the electrical characteristics specified in this datasheet should also be considered.

9. Electrical Characteristics (Unless otherwise specified, T_a = 25 °C)

	Characteristics	Symbol	Note	Test Condition	Min	Typ.	Max	Unit
LED	Input forward voltage	V_F		I_F = 10 mA	1.0	1.27	1.4	V
	Input reverse current	I_R		V_R = 5 V	—	—	10	µA
	Input capacitance	C_t		V = 0 V, f = 1 MHz	—	30	—	pF
Detector	Peak off-state current	I_{DRM}		V_{DRM} = 600 V	—	10	1000	nA
	Peak on-state voltage	V_{TM}		I_{TM} = 70 mA	—	1.7	2.8	V
	Holding current	I_H		—	—	1.0	—	mA
	Critical rate of rise of off-state voltage	dv/dt		V_{in} = 240 V, T_a = 85 °C See Fig. 9.1	—	500	—	V/µs
	Critical rate of rise of commutating voltage (dv/dt)	dv/dt(c)		V_{in} = 60 Vrms, I_T = 15 mA See Fig. 9.1	—	0.2	—	

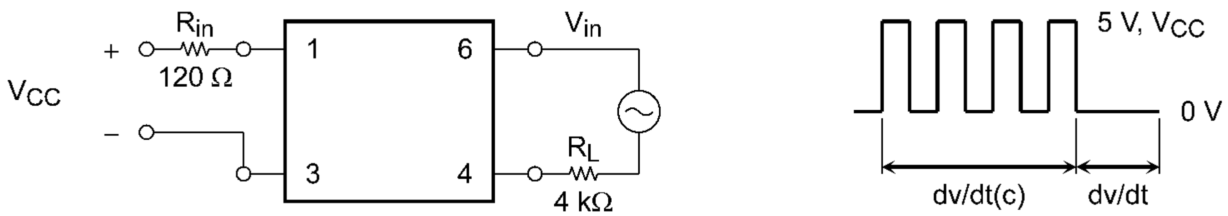


Fig. 9.1 dv/dt Test Circuit

10. Coupled Electrical Characteristics (Unless otherwise specified, T_a = 25 °C)

Characteristics	Symbol	Note	Test Condition	Min	Typ.	Max	Unit
Trigger LED current	I_{FT}		V_T = 6 V	—	—	10	mA
Turn-on time	t_{on}		V_D = 6 → 4 V, R_L = 100 Ω, I_F = Rated I_{FT} × 1.5 mA	—	—	100	µs

11. Isolation Characteristics (Unless otherwise specified, T_a = 25 °C)

Characteristics	Symbol	Note	Test Condition	Min	Typ.	Max	Unit
Total capacitance (input to output)	C_S	(Note 1)	V_S = 0 V, f = 1 MHz	—	0.8	—	pF
Isolation resistance	R_S	(Note 1)	V_S = 500 V, R.H. ≤ 60%	1×10^{12}	10^{14}	—	Ω
Isolation voltage	BV_S	(Note 1)	AC, 60 s	3750	—	—	Vrms
			AC, 1 s, in oil	—	10000	—	
			DC, 60 s, in oil	—	10000	—	Vdc

Note 1: This device is considered as a two-terminal device: Pins 1 and 3 are shorted together, and pins 4 and 6 are shorted together.

12. Characteristics Curves (Note)

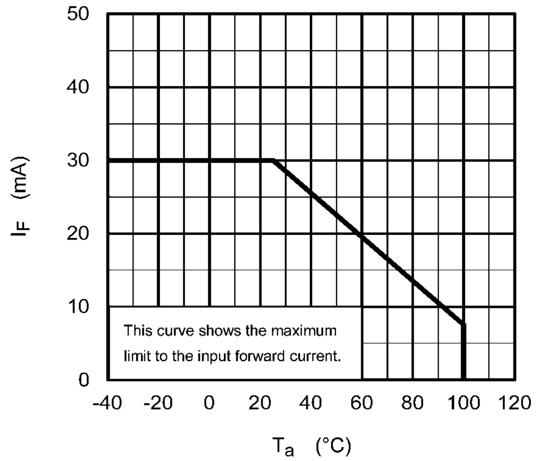


Fig. 12.1 I_F - T_a

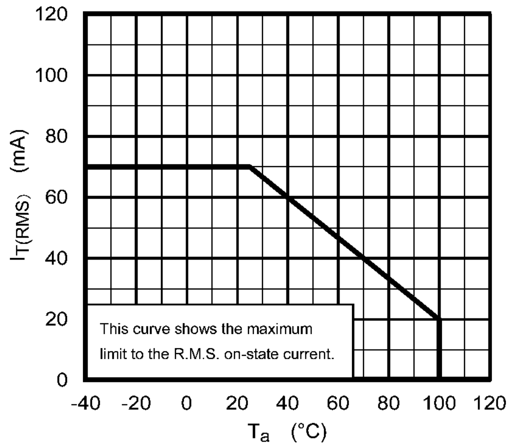


Fig. 12.2 $I_{T(RMS)}$ - T_a

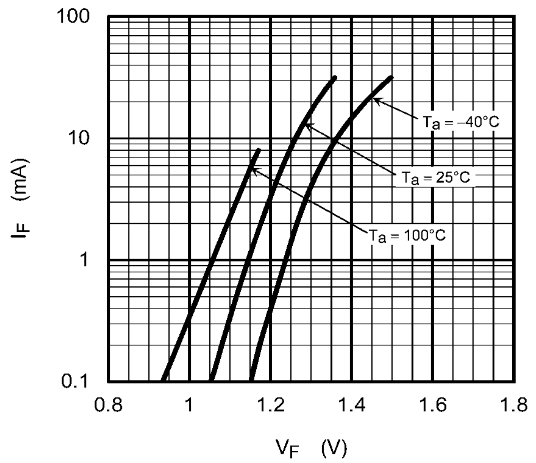


Fig. 12.3 I_F - V_F

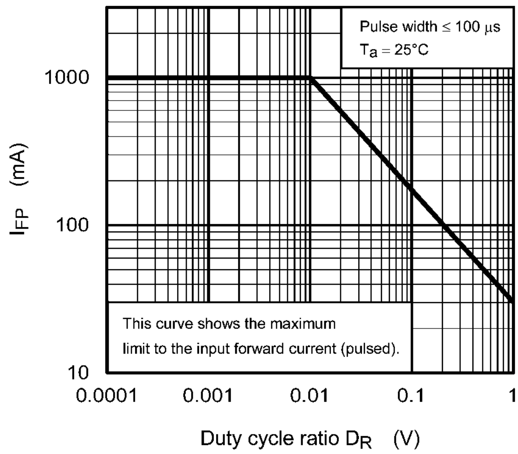


Fig. 12.4 I_{FP} - D_R

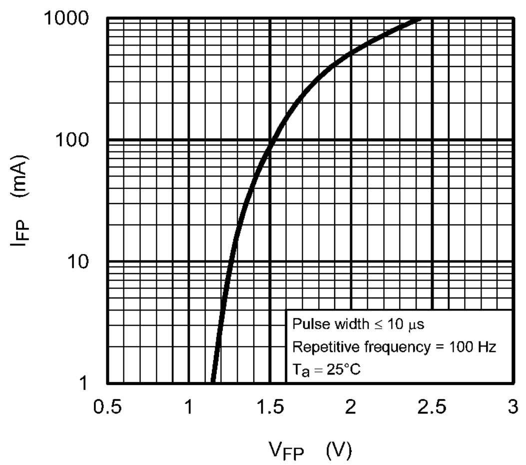


Fig. 12.5 I_{FP} - V_{FP}

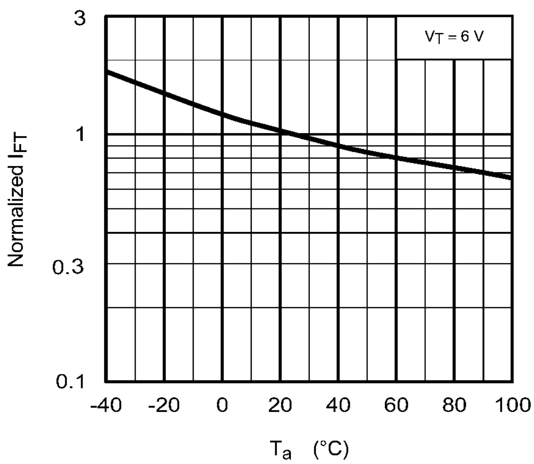


Fig. 12.6 Normalized I_{FT} - T_a

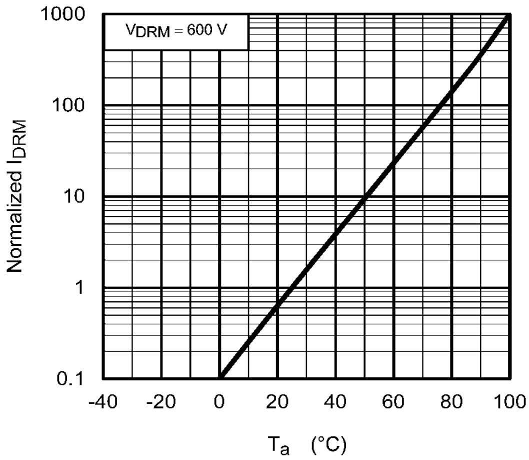


Fig. 12.7 Normalized I_{DRM} - T_a

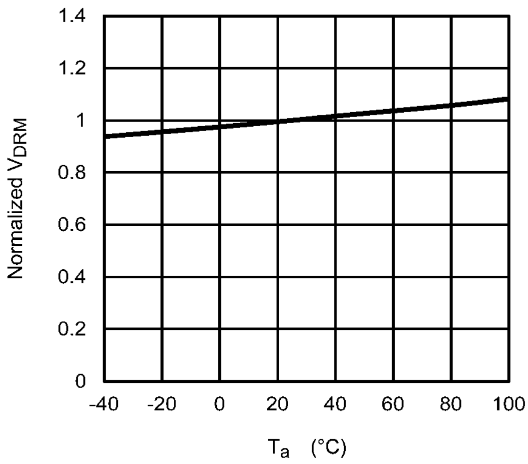


Fig. 12.8 Normalized V_{DRM} - T_a

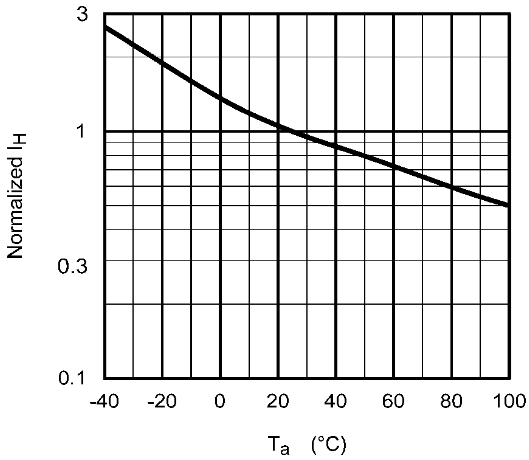


Fig. 12.9 Normalized I_H - T_a

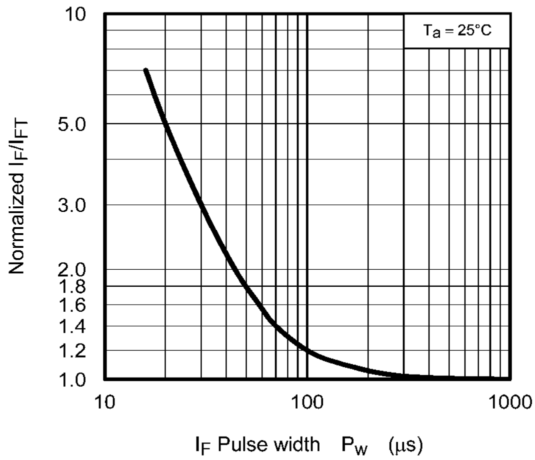


Fig. 12.10 Normalized I_F/I_{FT} - I_F_P_W

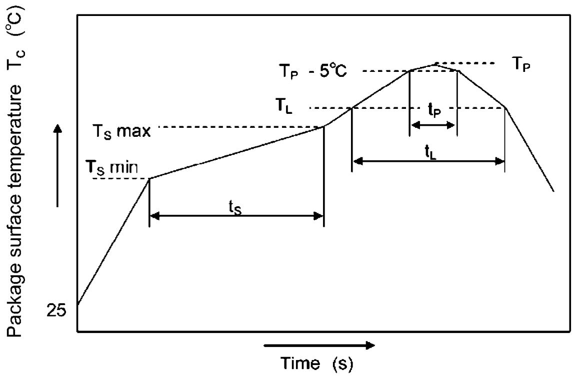
Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

13. Soldering and Storage

13.1. Precautions for Soldering

The soldering temperature should be controlled as closely as possible to the conditions shown below, irrespective of whether a soldering iron or a reflow soldering method is used.

- When using soldering reflow.
  The soldering temperature profile is based on the package surface temperature.
  (See the figure shown below, which is based on the package surface temperature.)
  Reflow soldering must be performed once or twice.
  The mounting should be completed with the interval from the first to the last mountings being 2 weeks.



	Symbol	Min	Max	Unit
Preheat temperature	T_S	150	200	°C
Preheat time	t_S	60	120	s
Ramp-up rate (T_L to T_P)			3	°C/s
Liquidus temperature	T_L	217		°C
Time above T_L	t_L	60	150	s
Peak temperature	T_P		260	°C
Time during which T_c is between (T_P – 5) and T_P	t_P		30	s
Ramp-down rate (T_P to T_L)			6	°C/s

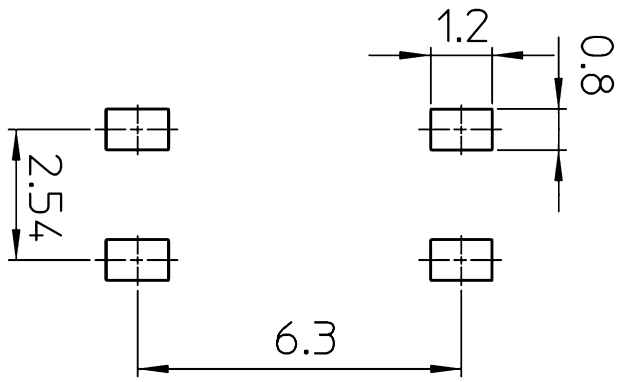
Fig. 13.1.1 An example of a temperature profile when lead(Pb)-free solder is used

- When using soldering flow
  Apply preheating of 150 °C (package surface temperature) for 60 to 120 seconds.
  Mounting condition of 260 °C within 10 seconds is recommended.
  Flow soldering must be performed once.
- When using soldering Iron
  Complete soldering within 10 seconds for lead temperature not exceeding 260 °C or within 3 seconds not exceeding 350 °C Heating by soldering iron must be done only once per lead.

13.2. Precautions for General Storage

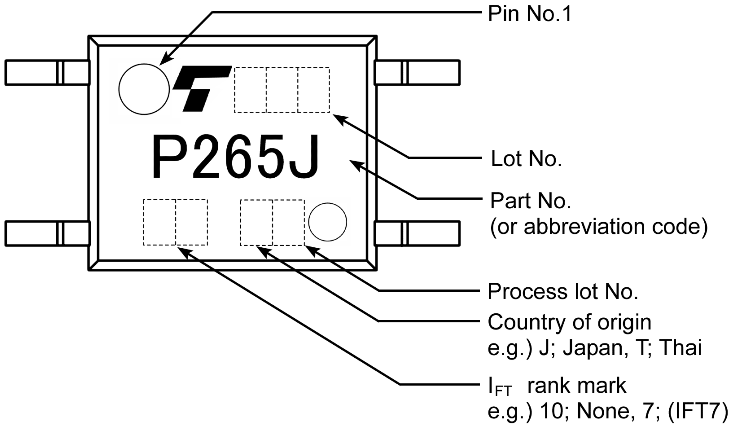
- Avoid storage locations where devices may be exposed to moisture or direct sunlight.
- Follow the precautions printed on the packing label of the device for transportation and storage.
- Keep the storage location temperature and humidity within a range of 5 °C to 35 °C and 45% to 75%, respectively.
- Do not store the products in locations with poisonous gases (especially corrosive gases) or in dusty conditions.
- 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.
- When restoring devices after removal from their packing, use anti-static containers.
- Do not allow loads to be applied directly to devices while they are in storage.
- 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.

14. Land Pattern Dimensions (for reference only)



(Unit: mm)

15. Marking (Note)



Note: A different marking is used for photocouplers that have been qualified according to option (V4) of EN60747. See Fig. 16.4.

16. EN60747-5-5 Option (V4) Specification

- Part number: TLP265J **(Note)**
- The following part naming conventions are used for the devices that have been qualified according to option (V4) of EN60747.

  Example: TLP265J(V4-TPL, E(O

  V4: EN60747 option

  TPL: Tape type

  E: [[G]]/RoHS COMPATIBLE **(Note 1)**

Note: Use TOSHIBA standard type number for safety standard application.
e.g., TLP265J(V4) → TLP265J

Note 1: Please contact your Toshiba sales representative for details on environmental information such as the product's RoHS compatibility.
RoHS is the Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronics equipment.

Description	Symbol	Rating	Unit
Application classification for rated mains voltage ≤ 150 Vrms for rated mains voltage ≤ 300 Vrms		 I-IV I-III	—
Climatic classification		55 / 100 / 21	—
Pollution degree		2	—
Maximum operating insulation voltage	V_{IORM}	707	Vpeak
Input to output test voltage, Method A V_{pr} = 1.6 × V_{IORM}, type and sample test t_p = 10 s, partial discharge < 5 pC	V_{pr}	1131	Vpeak
Input to output test voltage, Method B V_{pr} = 1.875 × V_{IORM}, 100 % production test t_p = 1 s, partial discharge < 5 pC	V_{pr}	1325	Vpeak
Highest permissible overvoltage (transient overvoltage, t_{pr} = 60 s)	V_{TR}	6000	Vpeak
Safety limiting values (max. permissible ratings in case of fault, also refer to thermal derating curve) current (input current I_F, P_{so} = 0) power (output or total power dissipation) temperature	 I_{si} P_{so} T_s	 250 400 150	 mA mW °C
Insulation resistance V_{IO} = 500 V, T_a = 25 °C V_{IO} = 500 V, T_a = 100 °C V_{IO} = 500 V, T_a = T_s	R_{si}	$\geq 10^{12}$ $\geq 10^{11}$ $\geq 10^{9}$	Ω

Fig. 16.1 EN60747 Insulation Characteristics

Minimum creepage distance	Cr	5.0 mm
Minimum clearance	Cl	5.0 mm
Minimum insulation thickness	ti	0.4 mm
Comparative tracking index	CTI	175

Fig. 16.2 Insulation Related Specifications (Note)

Note: 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 centers of 3.5 mm). If this is not permissible, the user shall take suitable measures.

Note: 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.

Fig. 16.3 Marking on packing for EN60747

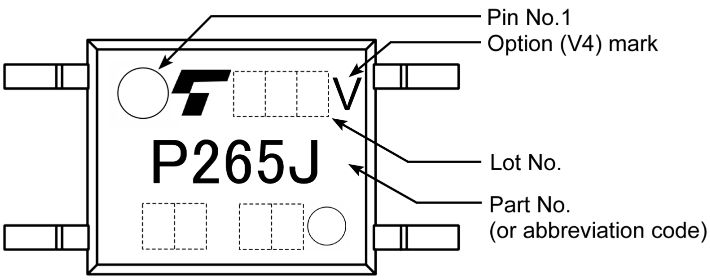


Fig. 16.4 Marking Example (Note)

Note: The above marking is applied to the photocouplers that have been qualified according to option (V4) of EN60747.

Figure 1 Partial discharge measurement procedure according to EN60747
Destructive test for qualification and sampling tests.

<u>Method A</u>

(for type and sampling tests,
destructive tests)

t_1, t_2 = 1 to 10 s
t_3, t_4 = 1 s
t_p (Measuring time for partial discharge) = 10 s
t_b = 12 s
t_{ini} = 60 s

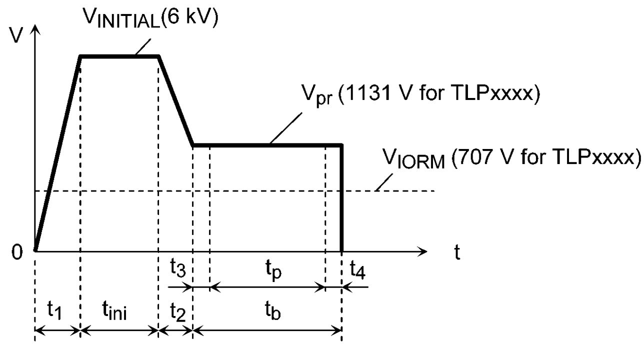


Figure 2 Partial discharge measurement procedure according to EN60747
Non-destructive test for100 % inspection.

<u>Method B</u>

(for sample test, non-destructive test)

t_3, t_4 = 0.1 s
t_p (Measuring time for partial discharge) = 1 s
t_b = 1.2 s

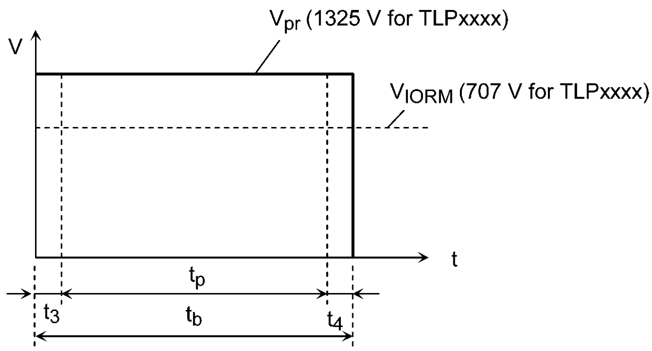


Figure 3 Dependency of maximum safety ratings on ambient temperature

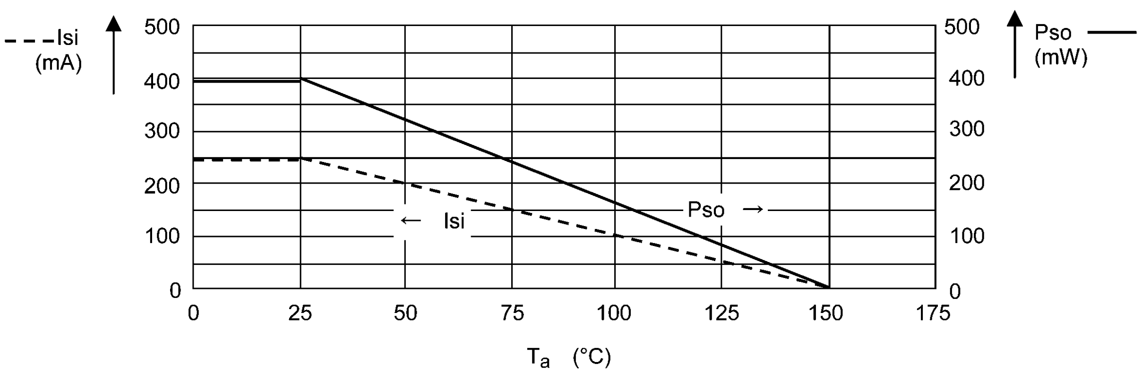
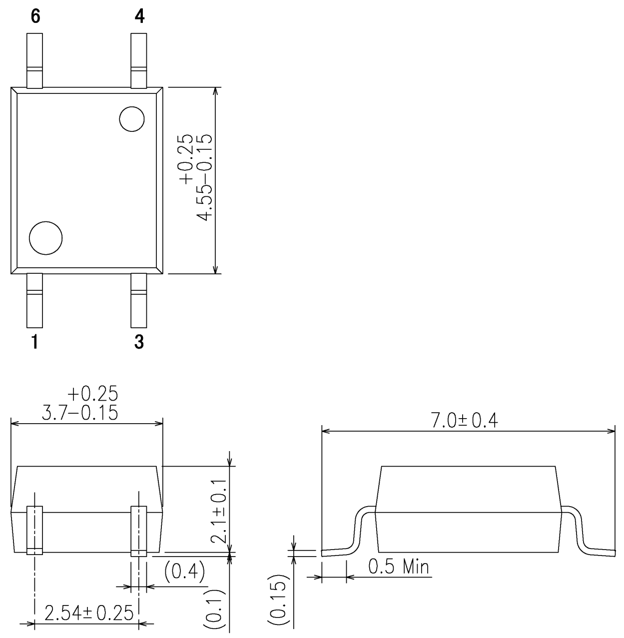


Fig. 16.5 Measurement Procedure

Package Dimensions

Unit: mm



Weight: 0.08 g (typ.)

Package Name(s)
TOSHIBA: 11-4M1S

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