Photocouplers Infrared LED & Photo Transistor

TLP290-4

1. Applications

- Programmable Logic Controllers (PLCs)
- Switching Power Supplies
- Simplex/Multiplex Data Transmission

2. General

The Toshiba TLP290-4 consists of phototransistors optically coupled to an infrared LED. The TLP290-4 Photocoupler is housed in the very small and thin SO16 package.

Since the TLP290-4 is guaranteed over a wide operating temperature range (T_a = -55 to 110 ℃), it is suitable for high-density surface mount applications such as programmable controllers.

3. Features

(1) Collector-emitter voltage: 80 V (min)

(2) Current transfer ratio: 50 % (min)
GB Rank: 100 % (min)

(3) Isolation voltage: 2500 Vrms (min)

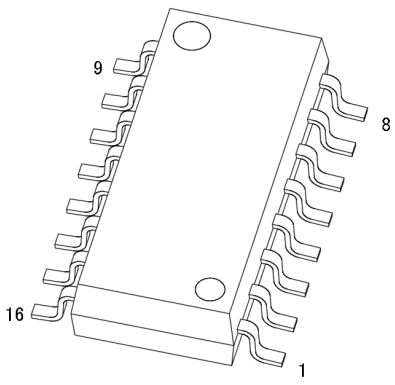
(4) Operating temperature: -55 to 110 ℃

(5) Safety standards
UL-recognized: UL 1577, File No.E67349
cUL-recognized: CSA Component Acceptance Service No.5A File No.E67349
VDE-approved: EN IEC 60747-5-5 **(Note 1)**
CQC-approved: GB4943.1 Thailand Factory

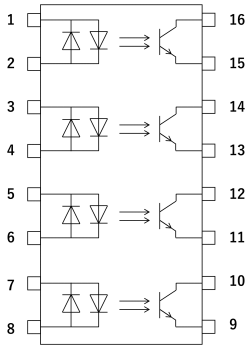
Can only be safely used in areas below 2000m above sea level.

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

4. Packaging and Pin Assignment



11-11F1



1, 3, 5, 7: Cathode, anode
2, 4, 6, 8: Anode, cathode
9, 11, 13, 15: Emitter
10, 12, 14, 16: Collector

Start of commercial production
2012-03

©2015-2026
Toshiba Electronic Devices & Storage Corporation

5. Principle of Operation

5.1. Mechanical Parameters

Characteristics	Min	Unit
Creepage distances	5.0	mm
Clearance	5.0	
Internal isolation thickness	0.1	

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

	Characteristics		Symbol	Note	Rating	Unit
LED	R.M.S. forward current		$I_{F(RMS)}$		±50	mA
	Input forward current derating	($T_a \geq$ 50 °C)	$\Delta I_F/\Delta T_a$		-0.67	mA/°C
	Input forward current (pulsed)		I_{FP}	(Note 1)	±1	A
	Input power dissipation		P_D		70	mW
	Input power dissipation derating (1 circuit)	($T_a \geq$ 50 °C)	$\Delta P_D/\Delta T_a$		-0.93	mW/°C
	Junction temperature		T_j		125	°C
Detector	Collector-emitter voltage		V_{CEO}		80	V
	Emitter-collector voltage		V_{ECO}		7	
	Collector current		I_C		50	mA
	Collector power dissipation		P_C		100	mW
	Collector power dissipation derating (1 circuit)	($T_a \geq$ 25 °C)	$\Delta P_C/\Delta T_a$		-1.0	mW/°C
	Junction temperature		T_j		125	°C
Common	Operating temperature		T_{opr}		-55 to 110	°C
	Storage temperature		T_{stg}		-55 to 125	
	Lead soldering temperature	(10 s)	T_{sol}		260	
	Total power dissipation (1 circuit)		P_T		170	mW
	Isolation voltage	(AC, 60 s, R.H. ≤ 60 %)	BV_S	(Note 2)	2500	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) ≤ 100 μs, f = 100 Hz

Note 2: This device is considered as a two-terminal device: All pins on the LED side are shorted together, and all pin on the photodetector side are shorted together.

©2015-2026
Toshiba Electronic Devices & Storage Corporation

7. 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	1.1	1.20	1.4	V
	Input capacitance	C_t		V = 0 V, f = 1 MHz	—	30	—	pF
Detector	Collector-emitter breakdown voltage	$V_{(BR)CEO}$		I_C = 0.5 mA	80	—	—	V
	Emitter-collector breakdown voltage	$V_{(BR)ECO}$		I_E = 0.1 mA	7	—	—	
	Dark Current	I_{DARK}		V_{CE} = 48 V	—	0.001	0.1	μA
				V_{CE} = 48 V, T_a = 85 °C	—	1	50	
	Collector-emitter capacitance	C_{CE}		V = 0 V, f = 1 MHz	—	10	—	pF

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

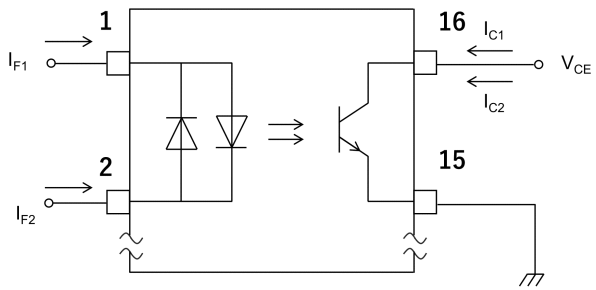
Characteristics	Symbol	Note	Test Condition	Min	Typ.	Max	Unit
Current transfer ratio	I_C/I_F	(Note 1)	I_F = ±5 mA, V_{CE} = 5 V, Blank Rank	50	—	400	%
			I_F = ±5 mA, V_{CE} = 5 V, GB Rank	100	—	400	
Saturated current transfer ratio	$I_C/I_{F(sat)}$		I_F = ±1 mA, V_{CE} = 0.4 V	—	60	—	
			I_F = ±1 mA, V_{CE} = 0.4 V, GB Rank	30	—	—	
Collector-emitter saturation voltage	$V_{CE(sat)}$		I_C = 2.4 mA, I_F = ±8 mA	—	—	0.4	V
			I_C = 0.2 mA, I_F = ±1 mA	—	0.2	—	
			I_C = 0.2 mA, I_F = ±1 mA, GB Rank	—	—	0.4	
OFF-state collector current	$I_{C(off)}$		V_F = ±0.7 V, V_{CE} = 48 V	—	—	10	μA
Collector current ratio	I_C(ratio)		See Fig. 8.1. $I_C(I_F$ = -5 mA)/$I_C(I_F$ = 5 mA)	0.33	—	3	—

Note 1: See Table 8.1 for current transfer ratio.

Table 8.1 Current transfer ratio (CTR) Rank (Note) (Unless otherwise specified, T_a = 25 °C)

Rank	Test Condition	Current transfer ratio I_C/I_F Min	Current transfer ratio I_C/I_F Max	Marking of Classification	Unit
Blank	I_F = ±5 mA, V_{CE} = 5 V	50	400	Blank, GB	%
GB		100	400	GB	

Note: Specify both the part number and a rank in this format when ordering.
Example: TLP290-4(GB,E
For safety standard certification, however, specify the part number alone.
Example: TLP290-4(GB,E: TLP290-4



$$I_C\,(\text{ratio}) = \frac{I_{C2}\,(I_F = I_{F2},\ V_{CE} = 5\ V)}{I_{C1}\,(I_F = I_{F1},\ V_{CE} = 5\ V)}$$

Fig. 8.1 Collector Current Ratio Test Circuit

©2015-2026
Toshiba Electronic Devices & Storage Corporation

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

Characteristics	Symbol	Note	Test Conditions	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 %	10^{12}	10^{14}	—	Ω
Isolation voltage	BV_S	(Note 1)	AC, 60 s	2500	—	—	Vrms

Note 1: This device is considered as a two-terminal device: All pins on the LED side are shorted together, and all pin on the photodetector side are shorted together.

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

Characteristics	Symbol	Note	Test Condition	Min	Typ.	Max	Unit
Rise time	t_r		V_{CC} = 10 V, I_C = 2 mA, R_L = 100 Ω	—	2	—	μs
Fall time	t_f			—	3	—	
Turn-on time	t_{on}			—	3	—	
Turn-off time	t_{off}			—	3	—	
Turn-on time	t_{on}		See Figure 10.1 R_L = 1.9 kΩ, V_{CC} = 5 V, I_F = 16 mA	—	2	—	
Storage time	t_s			—	25	—	
Turn-off time	t_{off}			—	60	—	

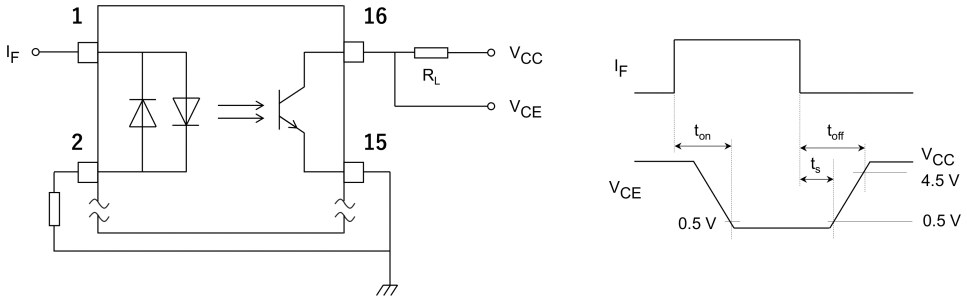


Fig. 10.1 Switching Time Test Circuit and Waveform

©2015-2026
Toshiba Electronic Devices & Storage Corporation

11. Characteristics Curves (Note)

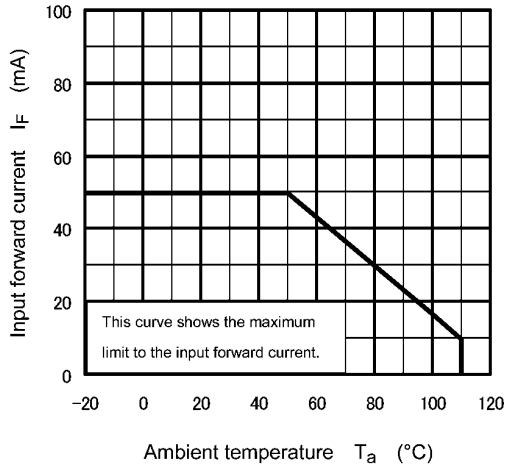


Fig. 11.1 I_F - T_a

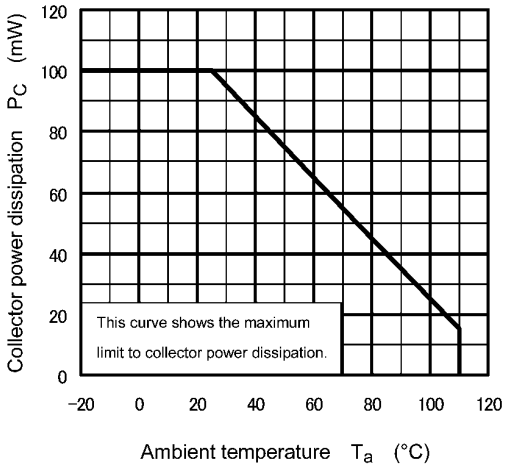


Fig. 11.2 P_C - T_a

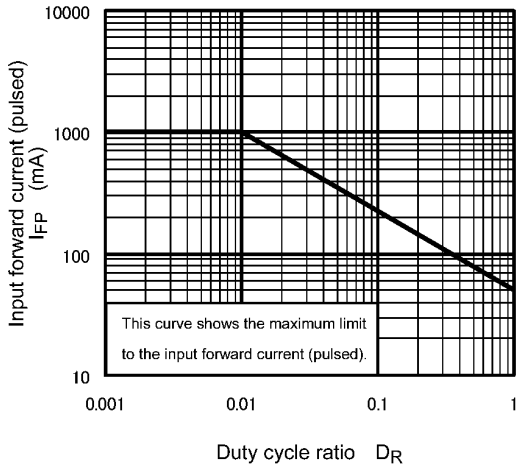


Fig. 11.3 I_{FP} - D_R

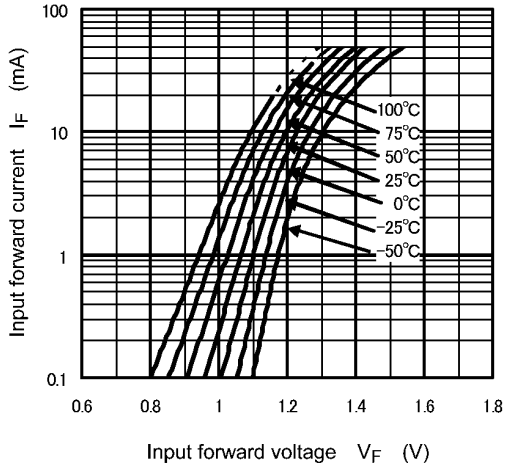


Fig. 11.4 I_F - V_F

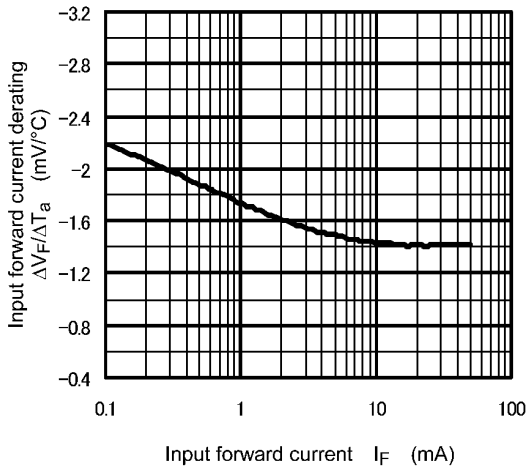


Fig. 11.5 $\Delta V_F/\Delta T_a$ - I_F

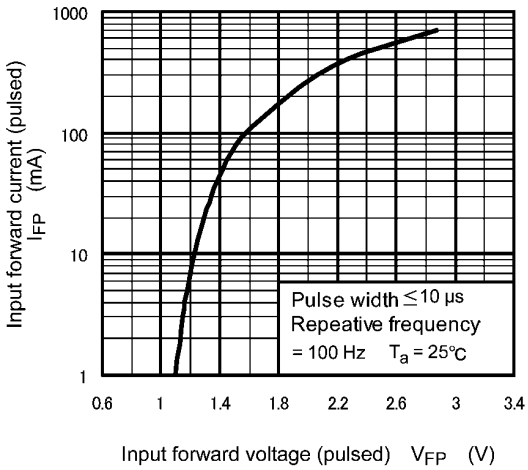


Fig. 11.6 I_{FP} - V_{FP}

©2015-2026
Toshiba Electronic Devices & Storage Corporation

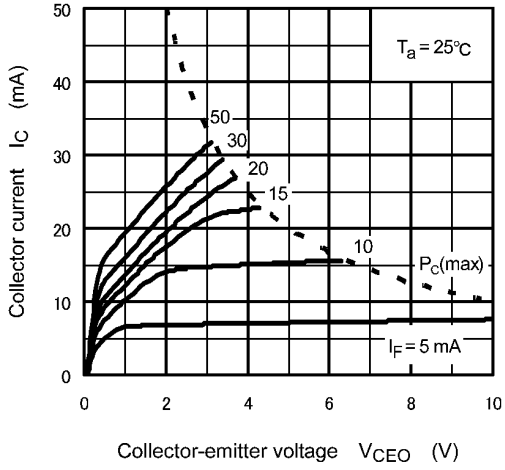


Fig. 11.7 I_C - V_{CEO}

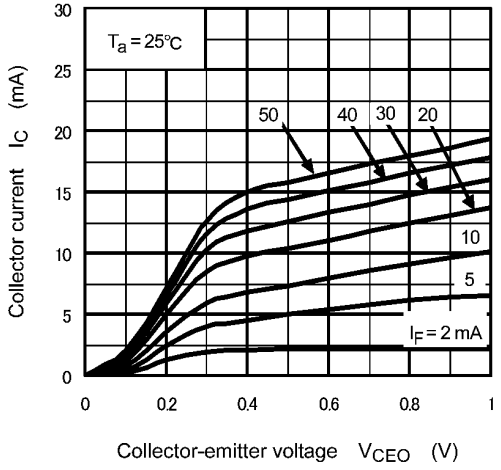


Fig. 11.8 I_C - V_{CEO}

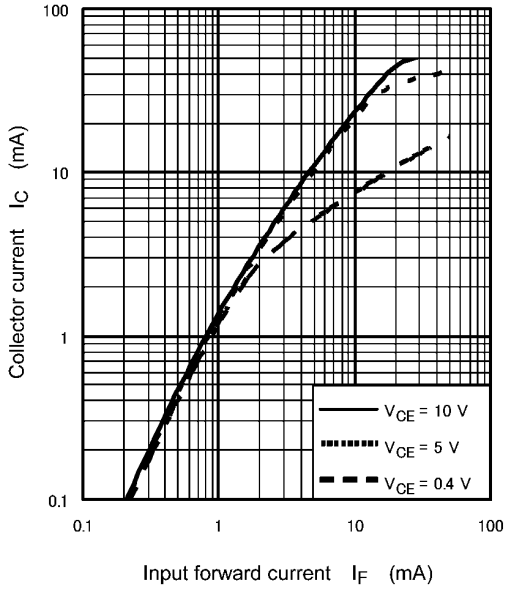


Fig. 11.9 I_C - I_F

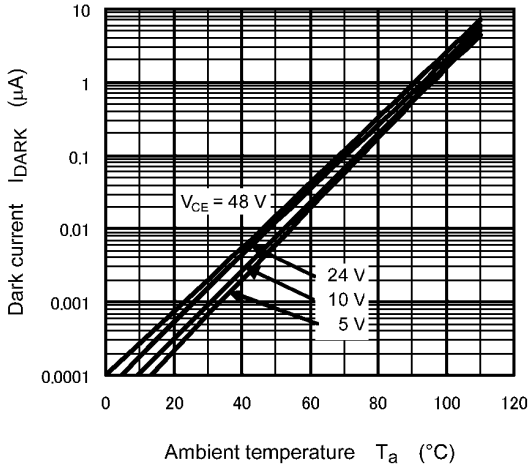


Fig. 11.10 I_{DARK} - T_a

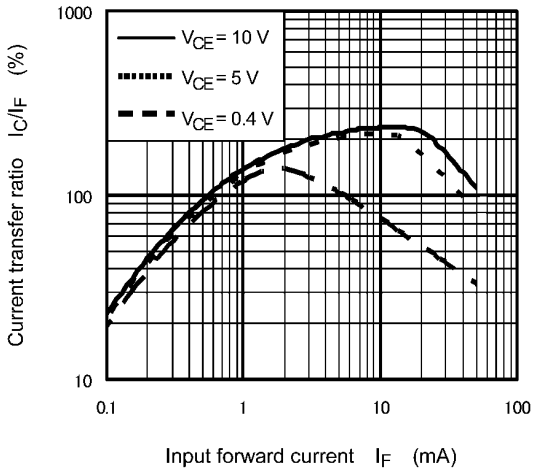


Fig. 11.11 I_C/I_F - I_F

©2015-2026
Toshiba Electronic Devices & Storage Corporation

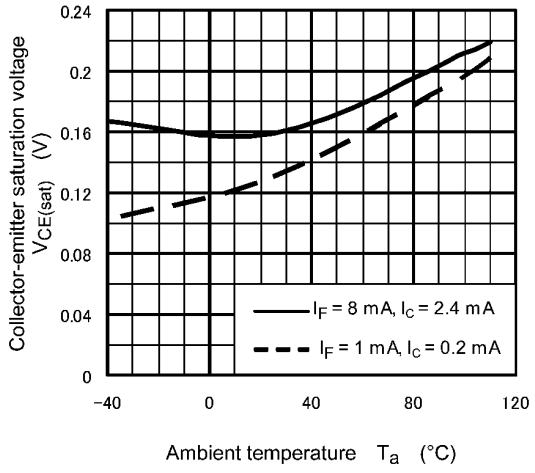


Fig. 11.12 $V_{CE(sat)}$ - T_a

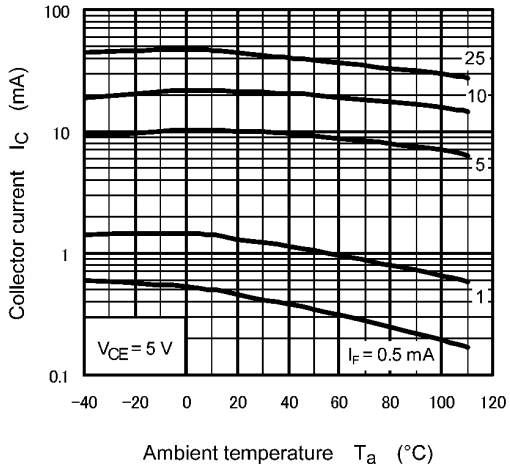


Fig. 11.13 I_C - T_a

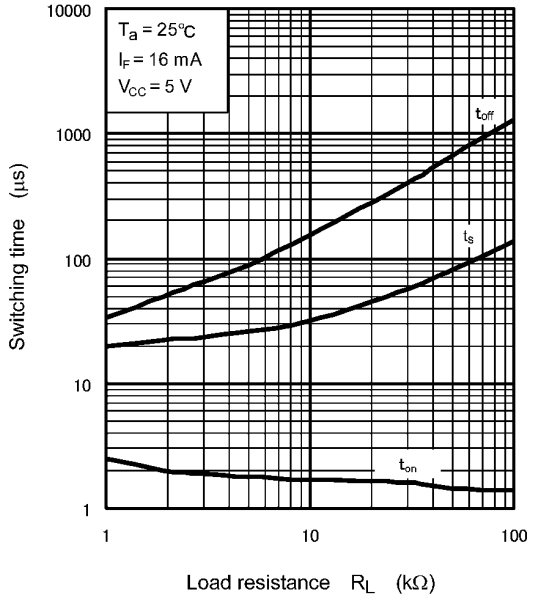


Fig. 11.14 Switching Time - R_L

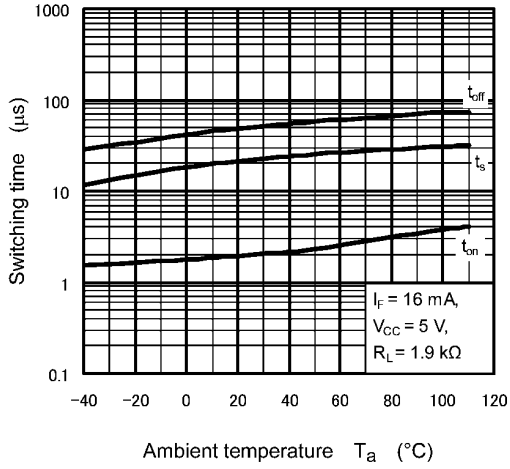


Fig. 11.15 Switching Time - T_a

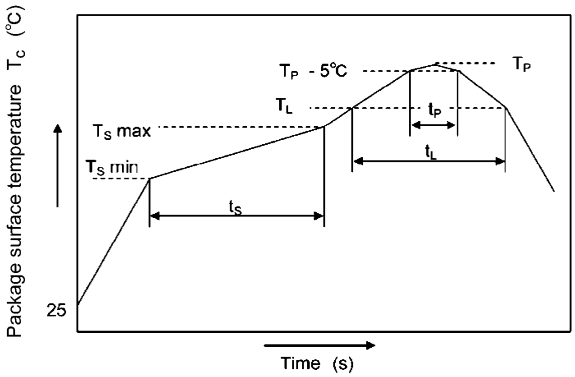
Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

12. Soldering and Storage

12.1. 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

An Example of a Temperature Profile When Lead(Pb)-Free Solder Is Used

- When using soldering flow
  Preheat the device at a temperature 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.

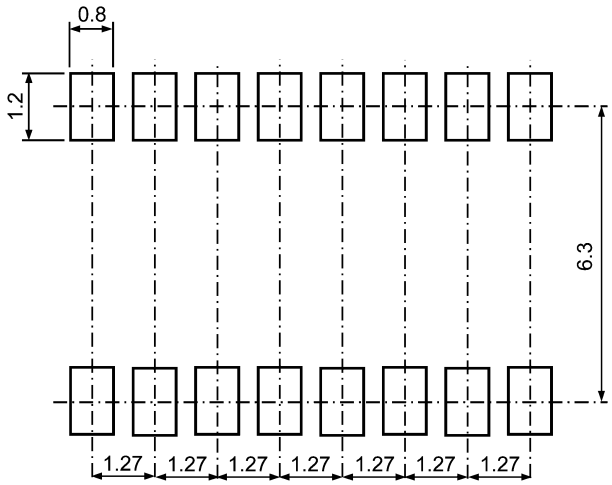
12.2. Precautions for General Storage

- 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 devices in locations with poisonous gases (especially corrosive gases) or in dusty conditions.

- Store the devices 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.

©2015-2026
Toshiba Electronic Devices & Storage Corporation

13. Land Pattern Dimensions (for reference only)



Unit: mm

14. Marking

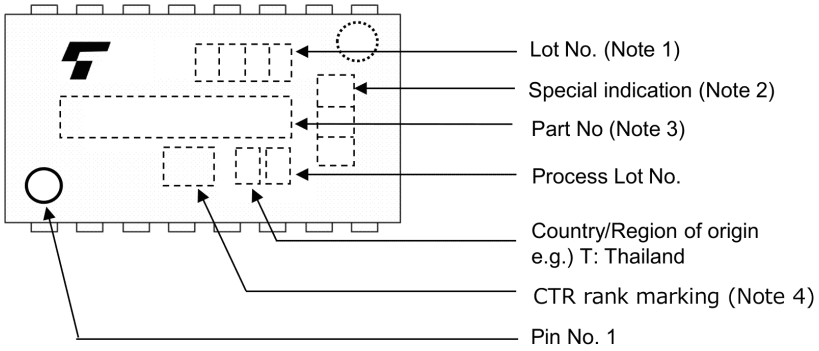


Fig. 14.1 Marking Example

Note 1: If the lot number is expressed with four characters,
it indicates "manufacturing year (2 characters) + manufacturing week (2 characters)".
For example, if the lot number shown on the product is "1841", it means the product was manufactured in the 41st week of a year ending in 18.

Note 2: Special indication is put for the traceability enhancement.
Information of special indication
e.g. A01
A: Factory administration number
01: A counting of the number is started on every week from 01.
and reset when Lot No or weekly code is changed.

Note 3: TLP290-4

Note 4: For the CTR rank mark, please refer to the marking of classification in table 8.1 CTR rank table.

©2015-2026
Toshiba Electronic Devices & Storage Corporation

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

- Part number: TLP290-4 **(Note 1)**
- The following part naming conventions are used for the devices that have been qualified according to option (V4) of EN IEC 60747.

  Example: TLP290-4(V4GBTPE

  V4: EN IEC 60747 option
  GB: CTR rank
  TP: Tape type
  E: [[G]]/RoHS COMPATIBLE **(Note 2)**

Note 1: Use TOSHIBA standard type number for safety standard application.
e.g., TLP290-4(V4GBTPE → TLP290-4

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 electronic 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 / 110 / 21	—
Pollution degree		2	—
Maximum operating insulation voltage	V_{IORM}	565	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}	904	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}	1060	Vpeak
Highest permissible overvoltage (transient overvoltage, t_{pr} = 60 s)	V_{TR}	4000	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}	≥ 10^{12} ≥ 10^{11} ≥ 10^9	Ω

Fig. 15.1 EN IEC 60747 Insulation Characteristics

©2015-2026
Toshiba Electronic Devices & Storage Corporation

Insulation Related Parameters	Symbol	TLP290-4
Minimum creepage distance	Cr	5.0mm
Minimum clearance	Cl	5.0mm
Minimum insulation thickness	ti	0.1mm
Comparative tracking index	CTI	500

Fig. 15.2 Insulation Related Specifications (Note)

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. 15.3 Marking on packing for EN IEC 60747

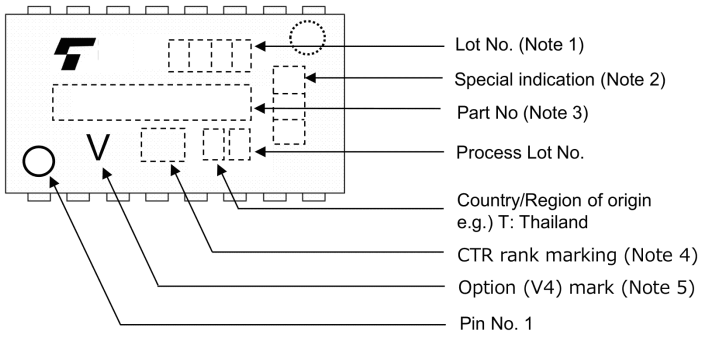


Fig. 15.4 Marking Example

Note 1: If the lot number is expressed with four characters,
it indicates "manufacturing year (2 characters) + manufacturing week (2 characters)".
For example, if the lot number shown on the product is "1841", it means the product was manufactured in the 41st week of a year ending in 18.

Note 2: Special indication is put for the traceability enhancement.
Information of special indication
e.g. A01
A: Factory administration number
01: A counting of the number is started on every week from 01.
and reset when Lot No or weekly code is changed.

Note 3: TLP290-4

Note 4: For the CTR rank mark, please refer to the marking of classification in table 8.1 CTR rank table.

Note 5: The above marking is applied to the photocouplers that have been qualified according to option (V4) of EN IEC 60747.

©2015-2026
Toshiba Electronic Devices & Storage Corporation

Figure 1 Partial discharge measurement procedure according to EN IEC 60747
Destructive test for qualification and sampling tests.

Method A

(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

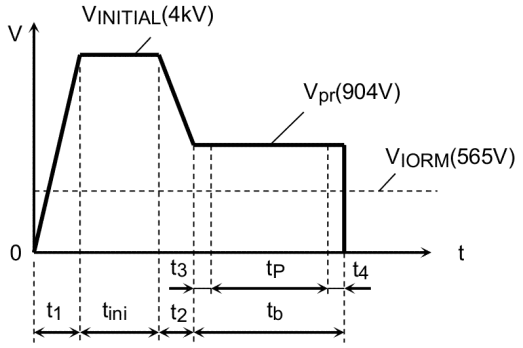


Figure 2 Partial discharge measurement procedure according to EN IEC 60747
Non-destructive test for100% inspection.

Method B

(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

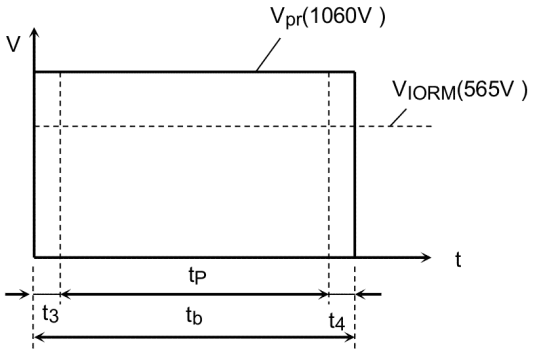


Figure 3 Dependency of maximum safety ratings on ambient temperature

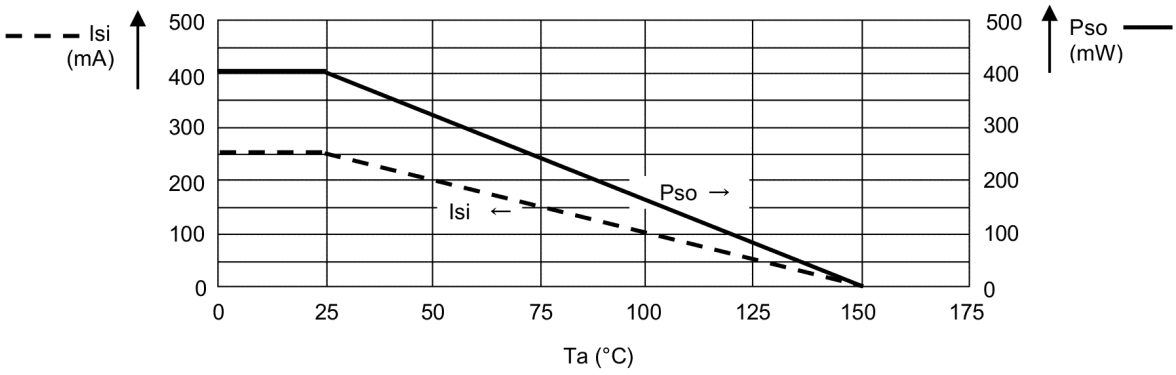


Fig. 15.5 Measurement Procedure

©2015-2026
Toshiba Electronic Devices & Storage Corporation

16. Ordering Information

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

Example) TLP290-4(GB-TP,E 2000 pcs

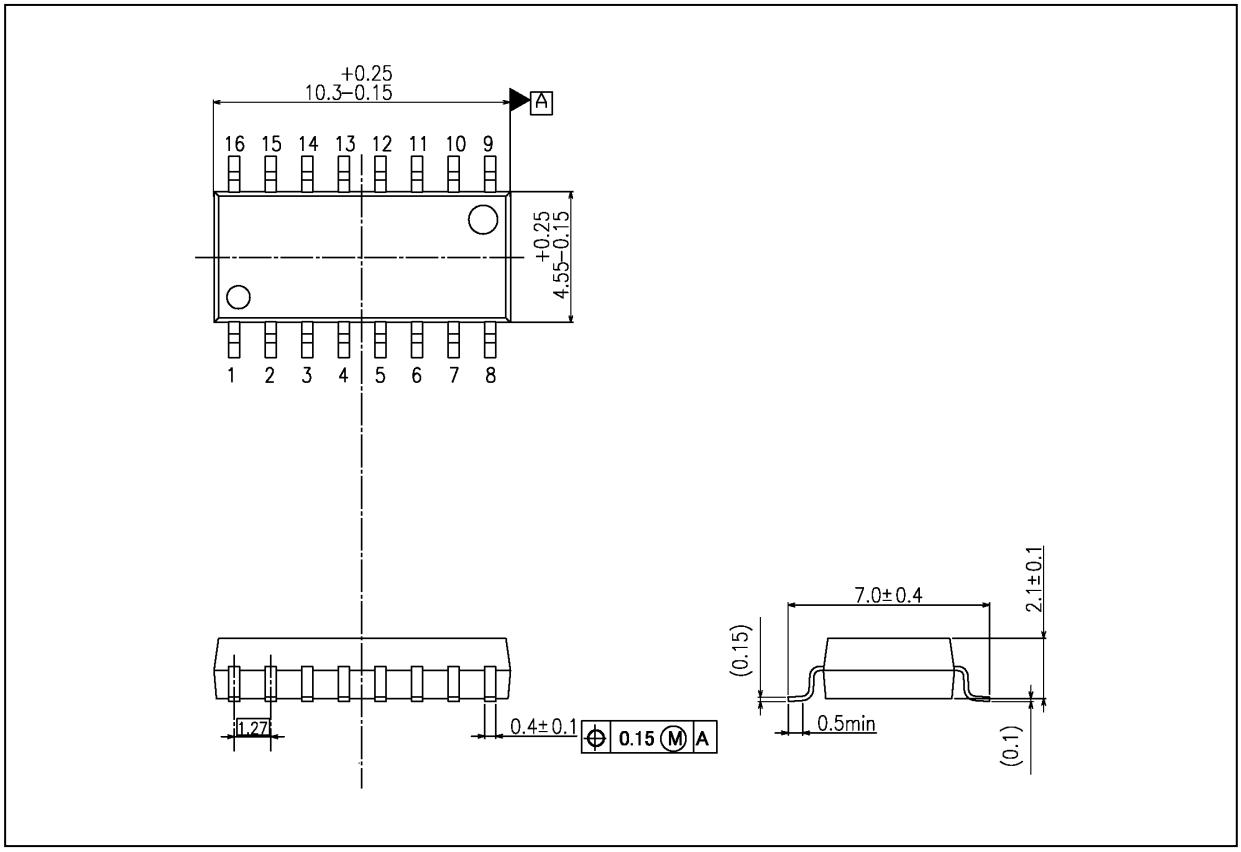
Part number: TLP290-4
CTR rank: (GB
Tape type: TP
[[G]]/RoHS COMPATIBLE: E **(Note 1)**
Quantity (must be a multiple of 2000): 2000 pcs

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 electronic equipment.

©2015-2026
Toshiba Electronic Devices & Storage Corporation

Package Dimensions

Unit: mm



Weight: 0.19 g (typ.)

Package Name(s)
TOSHIBA: 11-11F1

RESTRICTIONS ON PRODUCT USE

Toshiba Corporation and its subsidiaries and affiliates are collectively referred to as "TOSHIBA".
Hardware, software and systems described in this document are collectively referred to as "Product".

- TOSHIBA reserves the right to make changes to the information in this document and related Product without notice.
- This document and any information herein may not be reproduced without prior written permission from TOSHIBA. Even with TOSHIBA's written permission, reproduction is permissible only if reproduction is without alteration/omission.
- Though TOSHIBA works continually to improve Product's quality and reliability, Product can malfunction or fail. Customers are responsible for complying with safety standards and for providing adequate designs and safeguards for their hardware, software and systems which minimize risk and avoid situations in which a malfunction or failure of Product could cause loss of human life, bodily injury or damage to property, including data loss or corruption. Before customers use the Product, create designs including the Product, or incorporate the Product into their own applications, customers must also refer to and comply with (a) the latest versions of all relevant TOSHIBA information, including without limitation, this document, the specifications, the data sheets and application notes for Product and the precautions and conditions set forth in the "TOSHIBA Semiconductor Reliability Handbook" and (b) the instructions for the application with which the Product will be used with or for. Customers are solely responsible for all aspects of their own product design or applications, including but not limited to (a) determining the appropriateness of the use of this Product in such design or applications; (b) evaluating and determining the applicability of any information contained in this document, or in charts, diagrams, programs, algorithms, sample application circuits, or any other referenced documents; and (c) validating all operating parameters for such designs and applications. **TOSHIBA ASSUMES NO LIABILITY FOR CUSTOMERS' PRODUCT DESIGN OR APPLICATIONS.**
- **PRODUCT IS NEITHER INTENDED NOR WARRANTED FOR USE IN EQUIPMENTS OR SYSTEMS THAT REQUIRE EXTRAORDINARILY HIGH LEVELS OF QUALITY AND/OR RELIABILITY, AND/OR A MALFUNCTION OR FAILURE OF WHICH MAY CAUSE LOSS OF HUMAN LIFE, BODILY INJURY, SERIOUS PROPERTY DAMAGE AND/OR SERIOUS PUBLIC IMPACT ("UNINTENDED USE").** Except for specific applications as expressly stated in this document, Unintended Use includes, without limitation, equipment used in nuclear facilities, equipment used in the aerospace industry, Class 3 medical devices, equipment used for automobiles, and military vehicles and munitions. **IF YOU USE PRODUCT FOR UNINTENDED USE, TOSHIBA ASSUMES NO LIABILITY FOR PRODUCT.** For details, please contact your TOSHIBA sales representative or contact us via our website.
- Do not disassemble, analyze, reverse-engineer, alter, modify, translate or copy Product, whether in whole or in part.
- Product shall not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable laws or regulations.
- The information contained herein is presented only as guidance for Product use. No responsibility is assumed by TOSHIBA for any infringement of patents or any other intellectual property rights of third parties that may result from the use of Product. No license to any intellectual property right is granted by this document, whether express or implied, by estoppel or otherwise.
- **ABSENT A WRITTEN SIGNED AGREEMENT, EXCEPT AS PROVIDED IN THE RELEVANT TERMS AND CONDITIONS OF SALE FOR PRODUCT, AND TO THE MAXIMUM EXTENT ALLOWABLE BY LAW, TOSHIBA (1) ASSUMES NO LIABILITY WHATSOEVER, INCLUDING WITHOUT LIMITATION, INDIRECT, CONSEQUENTIAL, SPECIAL, OR INCIDENTAL DAMAGES OR LOSS, INCLUDING WITHOUT LIMITATION, LOSS OF PROFITS, LOSS OF OPPORTUNITIES, BUSINESS INTERRUPTION AND LOSS OF DATA, AND (2) DISCLAIMS ANY AND ALL EXPRESS OR IMPLIED WARRANTIES AND CONDITIONS RELATED TO SALE, USE OF PRODUCT, OR INFORMATION, INCLUDING WARRANTIES OR CONDITIONS OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, ACCURACY OF INFORMATION, OR NONINFRINGEMENT.**
- GaAs (Gallium Arsenide) is used in Product. GaAs is harmful to humans if consumed or absorbed, whether in the form of dust or vapor. Handle with care and do not break, cut, crush, grind, dissolve chemically or otherwise expose GaAs in Product.
- Do not use or otherwise make available Product or related software or technology for any military purposes, including without limitation, for the design, development, use, stockpiling or manufacturing of nuclear, chemical, or biological weapons or missile technology products (mass destruction weapons). Product and related software and technology may be controlled under the applicable export laws and regulations including, without limitation, the Japanese Foreign Exchange and Foreign Trade Law and the U.S. Export Administration Regulations. Export and re-export of Product or related software or technology are strictly prohibited except in compliance with all applicable export laws and regulations.
- Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product. Please use Product in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. **TOSHIBA ASSUMES NO LIABILITY FOR DAMAGES OR LOSSES OCCURRING AS A RESULT OF NONCOMPLIANCE WITH APPLICABLE LAWS AND REGULATIONS.**

©2015-2026
Toshiba Electronic Devices & Storage Corporation