TOSHIBA PHOTOCOUPLER GaAs IRED & PHOTO-TRANSISTOR

TLP291

Power Supplies
Programmable Controllers
Hybrid ICs

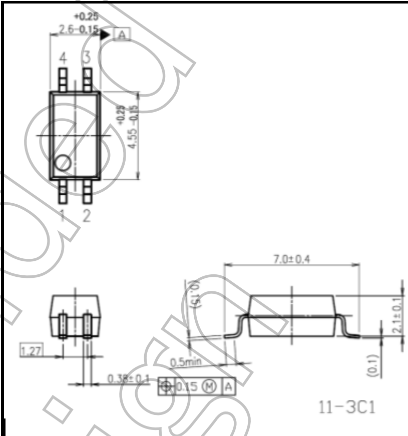
TLP291 consists of photo transistor, optically coupled to a gallium arsenide infrared emitting diode. TLP291 is housed in the SO4 package, very small and thin coupler.
Since TLP291 is guaranteed wide operating temperature (Ta=-55 to 110 ˚C) and high isolation voltage (3750Vrms), it's suitable for high-density surface mounting applications such as small switching power supplies and programmable controllers.

- Collector-Emitter Voltage : 80 V (min)
- Current Transfer Ratio : 50% (min)
  Rank GB : 100% (min)
- Isolation Voltage : 3750 Vrms (min)
- Operation temperature : -55 to 110 ˚C
- UL recognized : UL1577, File No. E67349
- cUL approved : CSA Component Acceptance Service No.5A, File No. 67349
- SEMKO approved: EN 60065: 2002, Approved no. 1200315
  EN 60950-1: 2001, EN 60335-1: 2002,
  Approved no. 1200315
- BSI approved : BS EN 60065: 2002, Approved no. 9036
  : BS EN 60950-1: 2006, Approved no. 9037
- Option (V4)
  VDE approved: EN 60747-5-5 Certificate, No. 40009347
  Maximum operating insulation voltage: 707 Vpk
  Highest permissible over-voltage: 6000 Vpk
  (Note) When EN 60747-5-5 approved type is needed,
  please designate the "Option(V4)"

Construction Mechanical Rating

Creepage distance:	5.0 mm (min)
Clearance:	5.0 mm (min)
Insulation thickness:	0.4 mm (min)

Unit: mm



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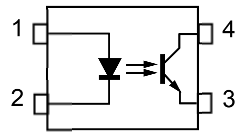
Weight: 0.05 g (typ.)

Pin Configuration

TLP291



1:ANODE
2:CATHODE
3:EMITTER
4:COLLECTOR

Start of commercial production
2012/02

Current Transfer Ratio (CTR) Rank (Unless otherwise specified, Ta = 25°C)

TYPE	Classification (Note1)	Current Transfer Ratio (%) (I_C / I_F) I_F = 5 mA, V_{CE} = 5 V, Ta = 25°C		Marking of Classification
		Min	Max	
TLP291	Blank	50	400	Blank, YE, Y+, GR, GB, G, G+,B
	Rank Y	50	150	YE
	Rank GR	100	300	GR
	Rank GB	100	400	GB
	Rank YH	75	150	Y+
	Rank GRL	100	200	G
	Rank GRH	150	300	G+
	Rank BLL	200	400	B

Note1: Specify both the part number and a rank in this format when ordering

(e.g.) rank GB: TLP291 (GB,E

For safety standard certification, however, specify the part number alone.

(e.g.)TLP291 (GB,E: TLP291

Absolute Maximum Ratings (Note)(Unless otherwise specified, Ta = 25°C)

	CHARACTERISTIC	SYMBOL	NOTE	RATING	UNIT
LED	Input forward current	I_F		50	mA
LED	Input forward current derating (Ta≥90°C)	$\Delta I_F / \Delta Ta$		-1.5	mA /°C
LED	Input forward current (pulsed)	I_{FP}	(Note 2)	1	A
LED	Input reverse voltage	V_R		5	V
LED	Input power dissipation	P_D		100	mW
LED	Input power dissipation derating (Ta ≥ 90°C)	$\Delta P_D / \Delta Ta$		-3.0	mW/°C
LED	Junction temperature	T_j		125	°C
DETECTOR	Collector-emitter voltage	V_{CEO}		80	V
DETECTOR	Emitter-collector voltage	V_{ECO}		7	V
DETECTOR	Collector current	I_C		50	mA
DETECTOR	Collector power dissipation	P_C		150	mW
DETECTOR	Collector power dissipation derating(Ta≥25°C)	$\Delta P_C / \Delta Ta$		-1.5	mW /°C
DETECTOR	Junction temperature	T_j		125	°C
Operating temperature range		T_{opr}		-55 to 110	°C
Storage temperature range		T_{stg}		-55 to 125	°C
Lead soldering temperature		T_{sol}		260 (10s)	°C
Total package power dissipation		P_T		200	mW
Total package power dissipation derating(Ta≥25°C)		$\Delta P_T / \Delta Ta$		-2.0	mW /°C
Isolation voltage		BV_S	(Note3)	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).

Note2: Pulse width ≤ 100μs, frequency 100Hz

Note3: AC, 1 minute, R.H.≤60%, Device considered a two terminal device: LED side pins shorted together and DETECTOR side pins shorted together.

Electrical Characteristics (Unless otherwise specified, Ta = 25°C)

	CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN	TYP.	MAX	UNIT
LED	Input forward voltage	V_F	I_F = 10 mA	1.1	1.25	1.4	V
LED	Input reverse current	I_R	V_R = 5 V	-	-	5	μA
LED	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
DETECTOR	Emitter-collector breakdown voltage	$V_{(BR)\,ECO}$	I_E = 0.1 mA	7	-	-	V
DETECTOR	Dark current	I_{CEO}	V_{CE} = 48 V	-	0.01	0.08	μA
DETECTOR	Dark current	I_{CEO}	V_{CE} = 48 V, Ta = 85°C	-	2	50	μA
DETECTOR	Collector-emitter capacitance	C_{CE}	V = 0 V, f = 1 MHz	-	10	-	pF

Coupled Electrical Characteristics (Unless otherwise specified, Ta = 25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN	TYP.	MAX	UNIT
Current transfer ratio	I_C / I_F	I_F = 5 mA, V_{CE} = 5 V	50	-	400	%
		Rank GB	100	-	400	
Saturated current transfer ratio	I_C / $I_{F\ (sat)}$	I_F = 1 mA, V_{CE} = 0.4 V	-	60	-	%
		Rank GB	30	-	-	
Collector-emitter saturation voltage	$V_{CE\ (sat)}$	I_C = 2.4 mA, I_F = 8 mA	-	-	0.3	V
		I_C = 0.2 mA, I_F = 1 mA	-	0.2	-	
		Rank GB	-	-	0.3	
OFF-state collector current	$I_{C\ (off)}$	V_F = 0.7 V, V_{CE} = 48 V	-	-	10	μA

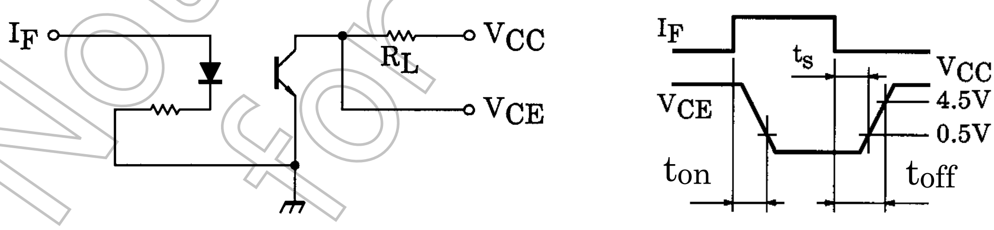
Isolation Characteristics (Unless otherwise specified, Ta = 25°C)

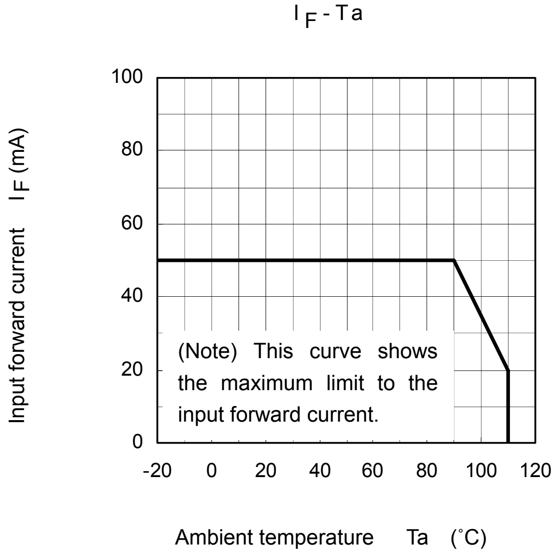
CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN	TYP.	MAX	UNIT
Total capacitance (input to output)	C_S	V_S = 0 V, f = 1 MHz	-	0.8	-	pF
Isolation resistance	R_S	V_S = 500 V, R.H.≤60%	1×10^{12}	10^{14}	-	Ω
Isolation voltage	BV_S	AC , 1 minute	3750	-	-	Vrms
		AC , 1 second, in OIL	-	10000	-	
		DC , 1 minute, in OIL	-	10000	-	Vdc

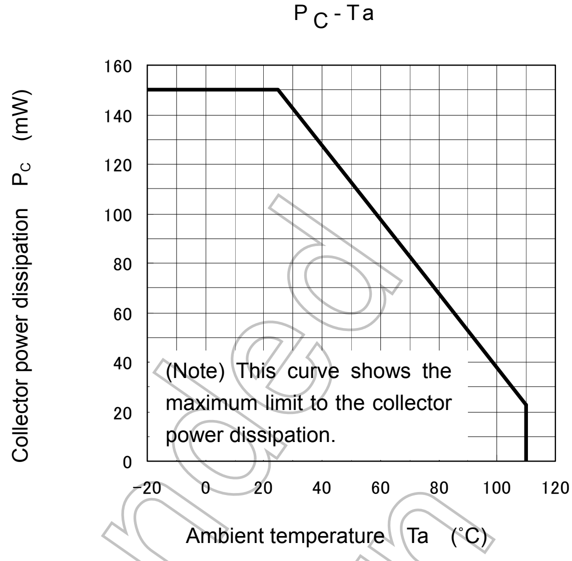
Switching Characteristics (Unless otherwise specified, Ta = 25°C)

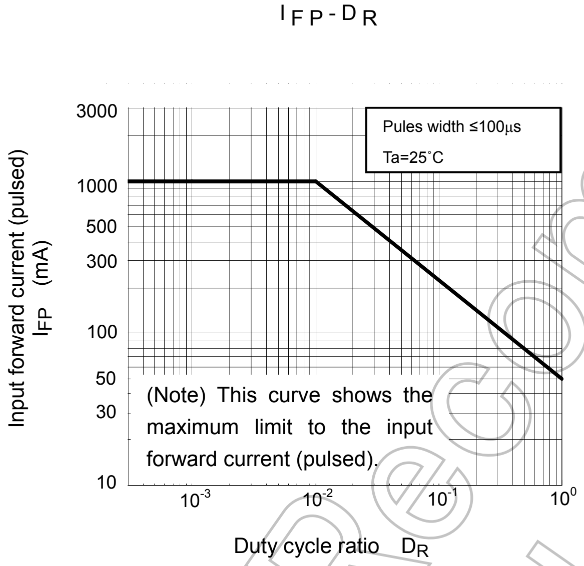
CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN	TYP.	MAX	UNIT
Rise time	t_r	V_{CC} = 10 V, I_C = 2 mA R_L = 100Ω	-	4	-	μs
Fall time	t_f		-	7	-	
Turn-on time	t_{on}		-	7	-	
Turn-off time	t_{off}		-	7	-	
Turn-on time	t_{on}	R_L = 1.9 kΩ (Fig.1) V_{CC} = 5 V, I_F = 16 mA	-	2	-	μs
Storage time	t_s		-	30	-	
Turn-off time	t_{off}		-	60	-	

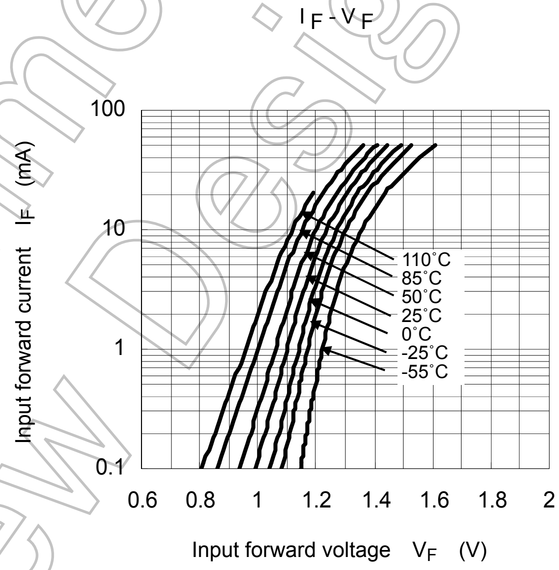
(Fig.1) Switching Time Test Circuit

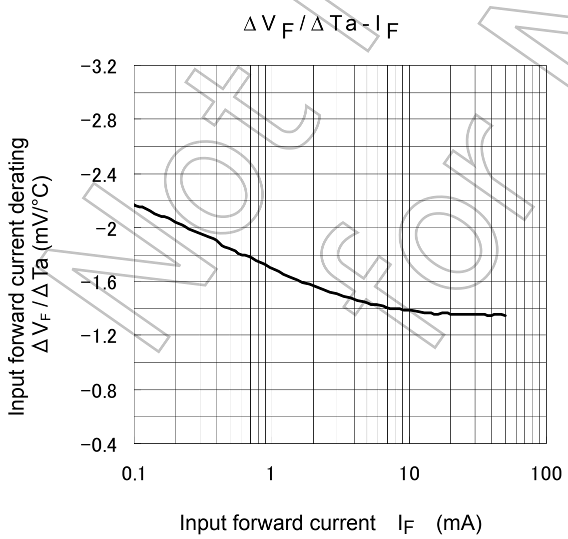


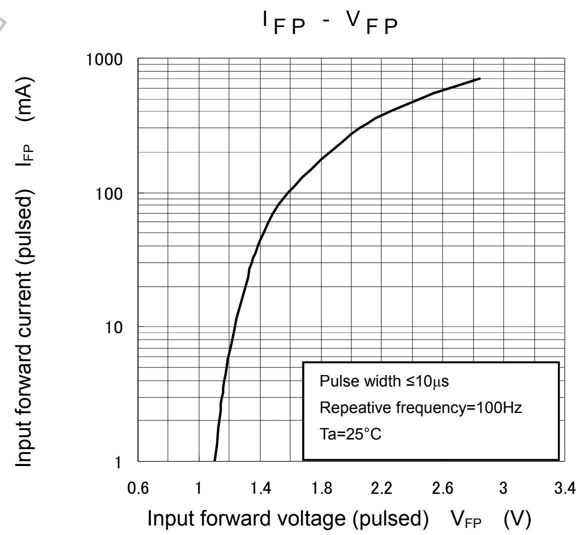






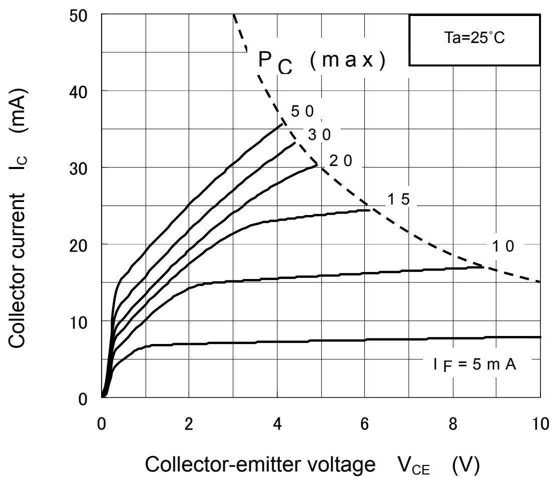




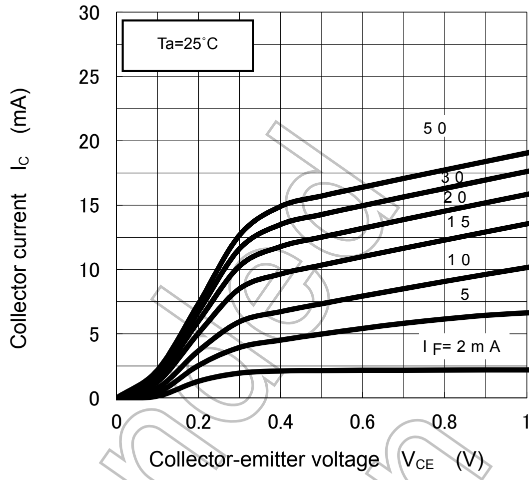


Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

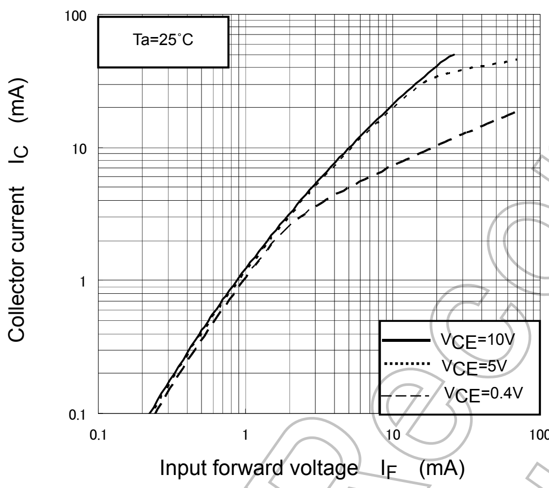
I_C - V_{CE}



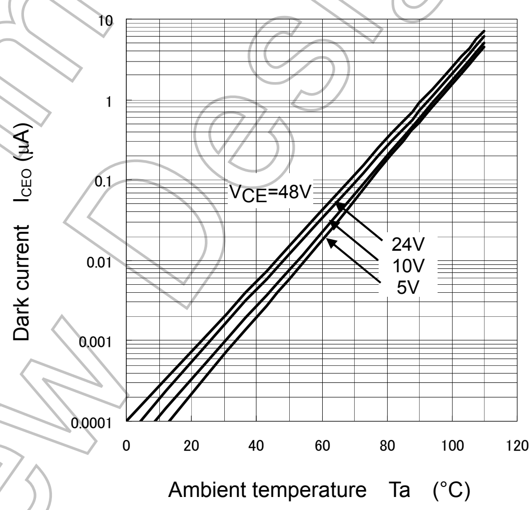
I_C - V_{CE}



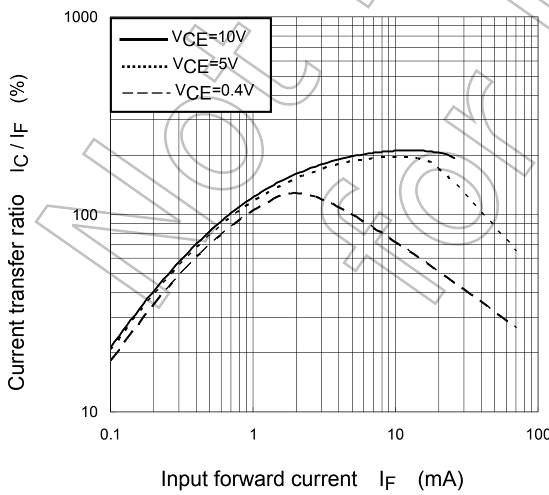
I_C - I_F



I_{CEO} - Ta

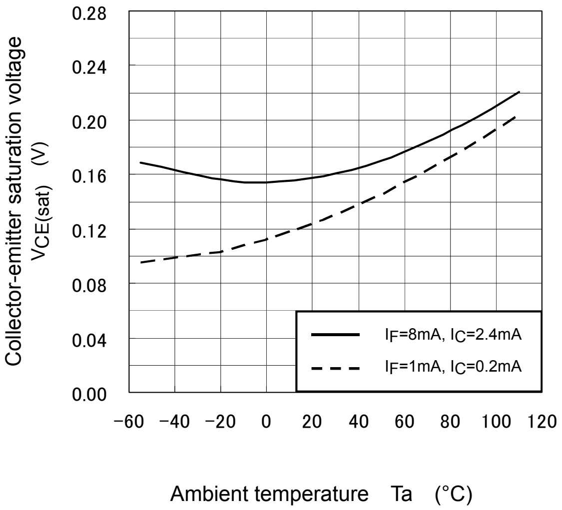


I_C/I_F - I_F

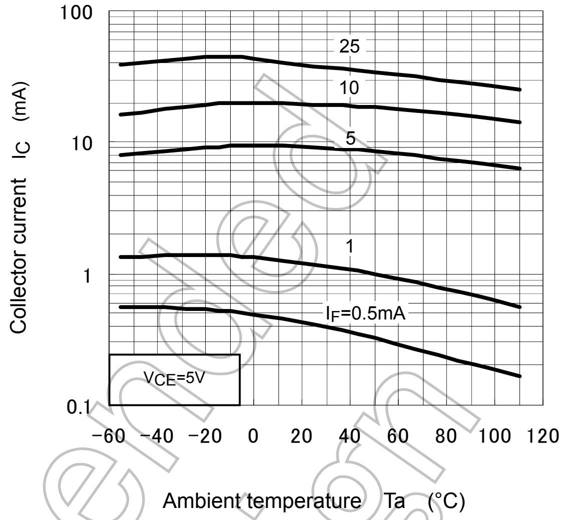


Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

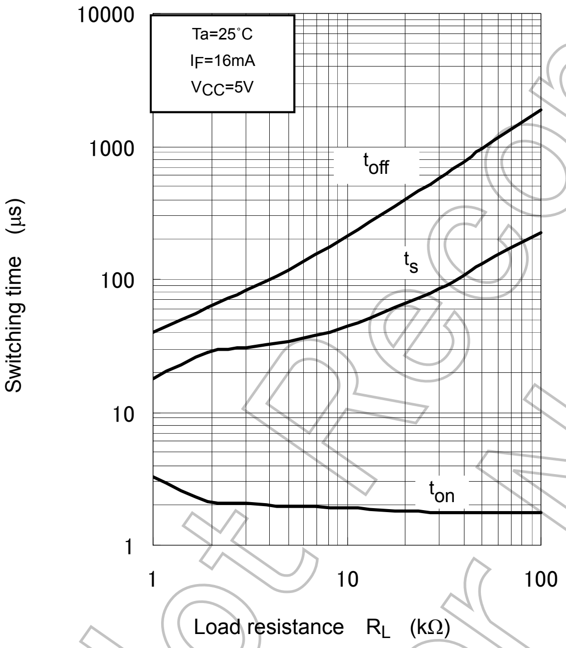
$V_{CE(sat)}$ - Ta



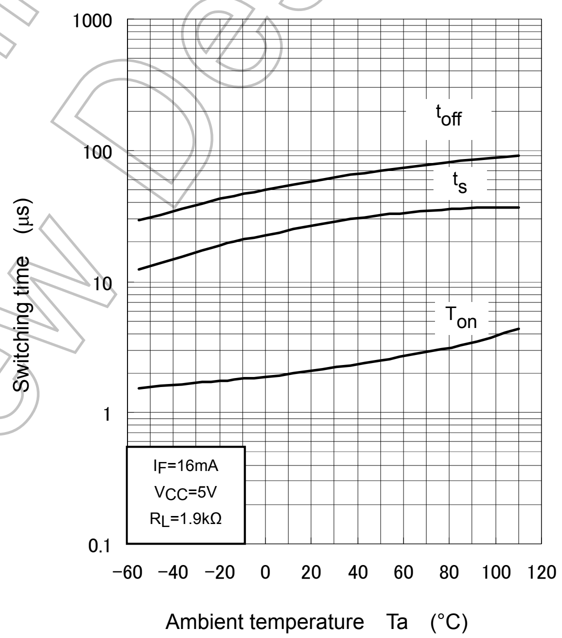
I_C - Ta



Switching time - R_L



Switching time - Ta



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

Soldering and Storage

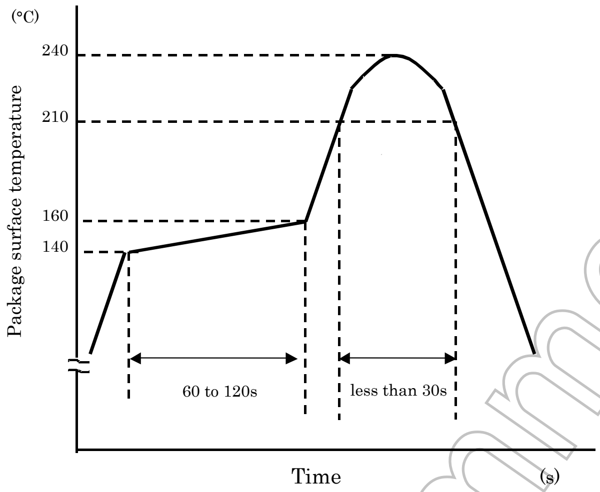
1. Soldering

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.

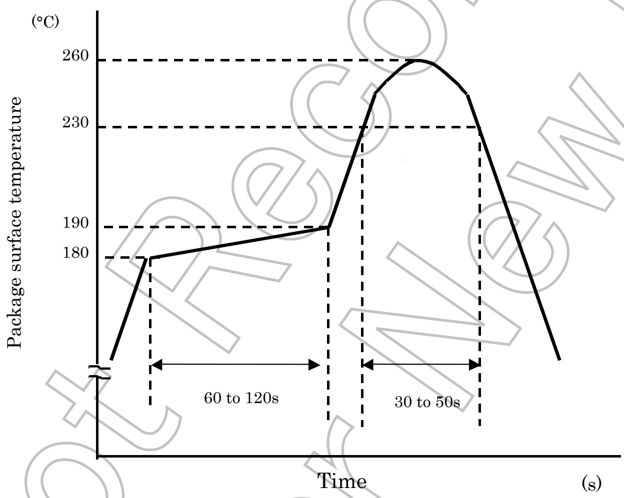
1) Using solder reflow

·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.

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.

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.

EN 60747-5-5 Option:(V4)

Types : TLP291

Type designations for "option: (V4)", which are tested under EN 60747 requirements.

(e.g.): TLP291 (V4GB-TP,E

V4 : EN 60747 option
GB : CTR rank type
TP : Standard tape & reel type
E : [[G]]/RoHS COMPATIBLE (Note4)

Note: Use TOSHIBA standard type number for safety standard application.
(e.g.): TLP291(V4GB-TP,E → TLP291

Note4: Please contact your Toshiba sales representative for details on environmental information such as the product's RoHS compatibility.
RoHS is the Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronics equipment.

EN 60747 Isolation Characteristics

Description	Symbol	Rating	Unit
Application classification for rated mains voltage ≤ 150Vrms for rated mains voltage ≤ 300Vrms		I-IV I-III	-
Climatic classification		55 / 110 / 21	-
Pollution degree		2	-
Maximum operating insulation voltage	V_{IORM}	707	Vpk
Input to output test voltage, Method A $V_{pr}=1.5 \times V_{IORM}$, type and sample test tp=10s, partial discharge<5pC	V_{pr}	1060	Vpk
Input to output test voltage, Method B $V_{pr}=1.875 \times V_{IORM}$, 100% production test tp=1s, partial discharge<5pC	V_{pr}	1325	Vpk
Highest permissible overvoltage (transient overvoltage, tpr=60s)	V_{TR}	6000	Vpk
Safety limiting values (max. permissible ratings in case of fault, also refer to thermal derating curve) current (input current: I_F, Psi=0mW) power (output or total power dissipation) temperature	I_{si} P_{si} T_{si}	250 400 150	mA mW °C
Insulation resistance V_{IO}=500V, Ta=T_{si}	R_{si}	$\geq 10^9$	Ω

Insulation Related Specifications

Minimum creepage distance	Cr	5.0mm
Minimum clearance	Cl	5.0mm
Minimum insulation thickness	ti	0.4mm
Comparative tracking index	CTI	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 centers of 3.5mm). 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 circuit.

VDE test sign: Marking on product for EN 60747 **V**

: Marking on packing for EN 60747 VDE

Marking Example: TLP291

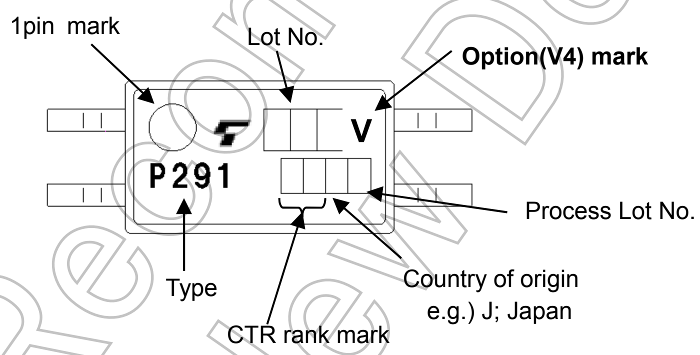


Figure 1 Partial discharge measurement procedure according to EN 60747
Destructive test for qualification and sampling tests.

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

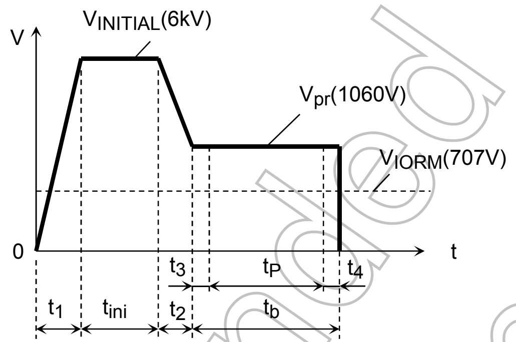


Figure 2 Partial discharge measurement procedure according to EN 60747
Non-destructive test for100% inspection.

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

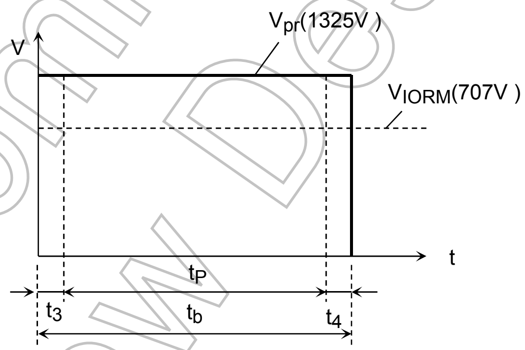
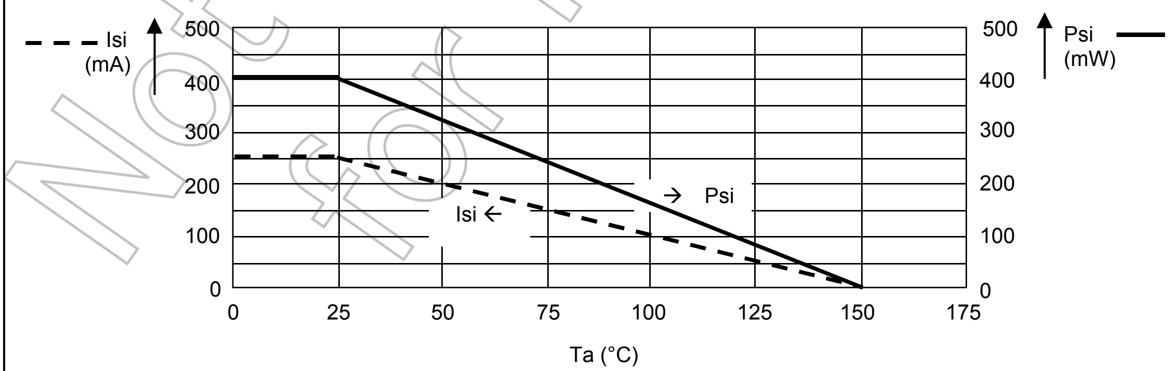


Figure 3 Dependency of maximum safety ratings on ambient temperature



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