TOSHIBA Photocoupler InGaAs Infrared LED & Photo-Transistor

TLP292

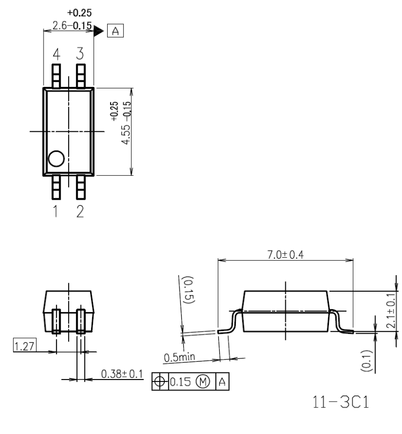
Programmable Controllers
AC/DC-Input Module
Hybrid ICs

TLP292 consist of photo transistor, optically coupled to two InGaAs infrared emitting diode connected inverse parallel, and can operate directly by AC input current
TLP292 is housed in the SO4 package, very small and thin coupler.
Since TLP292 are guaranteed wide operating temperature (Ta=-55 to 125 ˚C) and high isolation voltage (3750Vrms), it's suitable for high-density surface mounting applications such as programmable controllers and hybrid ICs.

- Collector-Emitter voltage: 80 V (min)
- Current transfer ratio: 50% (min)
  Rank GB: 100% (min)
- Isolation voltage : 3750 Vrms (min)
- Operating temperature range: -55 to 125 ˚C
- UL recognized : UL1577, File No. E67349
- cUL approved : CSA Component Acceptance Service No.5A,
  File No. E67349
- Option (V4)
  VDE approved : DIN EN 60747-5-5, File No. 40009347
  (Note) When an 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)
Insultion thickness: 0.4 mm (min)

Unit: mm

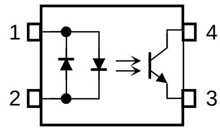


JEDEC	-
JIETA	-
TOSHIBA	11-3C1

Weight: 0.05 g (typ.)

Pin Configuration

TLP292



1: Anode
Cathode
2: Cathode
Anode
3: Emitter
4: Collector

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

Rank (Note 1)	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	600	Blank, YE, GR, GB, BL	%
	I_F = ±0.5 mA, V_{CE} = 5 V				
Y	I_F = ±5 mA, V_{CE} = 5 V	50	150	YE	
	I_F = ±0.5 mA, V_{CE} = 5 V				
GR	I_F = ±5 mA, V_{CE} = 5 V	100	300	GR	
	I_F = ±0.5 mA, V_{CE} = 5 V				
GB	I_F = ±5 mA, V_{CE} = 5 V	100	600	GB	
	I_F = ±0.5 mA, V_{CE} = 5 V				
BL	I_F = ±5 mA, V_{CE} = 5 V	200	600	BL	
	I_F = ±0.5 mA, V_{CE} = 5 V				

Note 1: Specify both the part number and a rank in this format when ordering

(e.g.) rank GB: TLP292 (GB,E

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

(e.g.)TLP292 (GB,E: TLP292

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

	Characteristic	Symbol	Note	Rating	Unit
LED	R.M.S. forward current	$I_{F(RMS)}$		±50	mA
	Input forward current derating (Ta ≥ 90°C)	$\Delta I_F / \Delta Ta$		-1.5	mA /°C
	Input forward current (pulsed)	I_{FP}	(Note 2)	±1	A
	Junction temperature	T_j		125	°C
Detector	Collector-emitter voltage	V_{CEO}		80	V
	Emitter-collector voltage	V_{ECO}		7	V
	Collector current	I_C		50	mA
	Collector power dissipation	P_C		150	mW
	Collector power dissipation derating (Ta ≥ 25°C)	$\Delta P_C / \Delta Ta$		-1.5	mW /°C
	Junction temperature	T_j		125	°C
Operating temperature range		T_{opr}		-55 to 125	°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, 1min., 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)

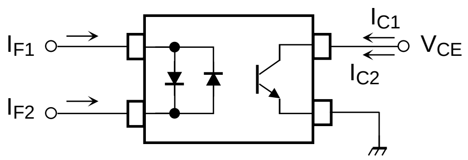
	Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
LED	Input forward voltage	V_F	I_F = ±10 mA	1.1	1.25	1.4	V
	Input capacitance	C_T	V = 0 V, f = 1 MHz	-	60	-	pF
Detector	Collector-emitter breakdown voltage	$V_{(BR)\ CEO}$	I_C = 0.5 mA	80	-	-	V
	Emitter-collector breakdown voltage	$V_{(BR)\ ECO}$	I_E = 0.1 mA	7	-	-	V
	Dark current	I_{DARK}	V_{CE} = 48 V,	-	0.01	0.08	μA
			V_{CE} = 48 V, Ta = 85°C	-	2	50	μA
	Collector-emitter capacitance	C_{CE}	V = 0 V, f = 1 MHz	-	10	-	pF

Coupled Electrical Characteristics (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	-	600	%
		Rank GB	100	-	600	
		I_F = ±0.5 mA, V_{CE} = 5 V	50	-	600	
		Rank GB	100	-	600	
Saturated CTR	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	-	1	10	μA
CTR symmetry	$I_{C\ (ratio)}$	I_C (I_F = -5 mA) / I_C (I_F = 5 mA) (Fig. 1)	0.33	-	3	-

Fig.1: Collector current ratio test circuit

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



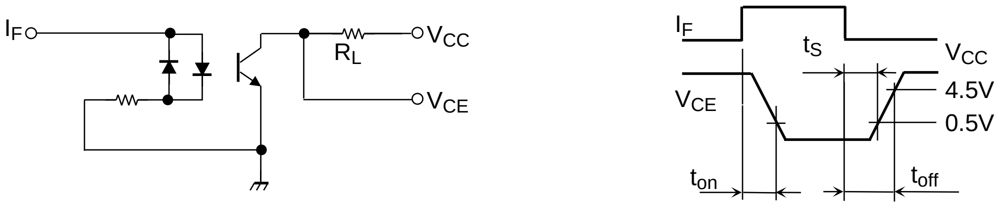
Isolation Characteristics (Unless otherwise specified, Ta = 25°C)

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	-	-	V_{rms}
		AC, 1 second, in oil	-	10000	-	
		DC, 1 minute, in oil	-	10000	-	V_{dc}

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

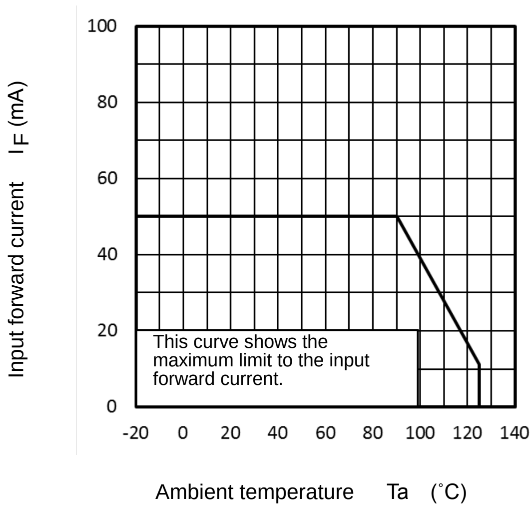
Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
Rise time	t_r	V_{CC} = 10 V, I_C = 2 mA R_L = 100 Ω	-	2	-	μs
Fall time	t_f		-	3	-	
Turn-on time	t_{on}		-	3	-	
Turn-off time	t_{off}		-	3	-	
Turn-on time	ton	R_L = 1.9 kΩ (Fig.2) V_{CC} = 5 V, I_F = ±16 mA	-	0.4	-	μs
Storage time	ts		-	20	-	
Turn-off time	toff		-	35	-	
Turn-on time	t_{on}	R_L = 4.7 kΩ (Fig.2) V_{CC} = 5 V, I_F = ±1.6 mA	-	4	-	μs
Storage time	t_s		-	7	-	
Turn-off time	t_{off}		-	30	-	

(Fig. 2): Switching time test circuit

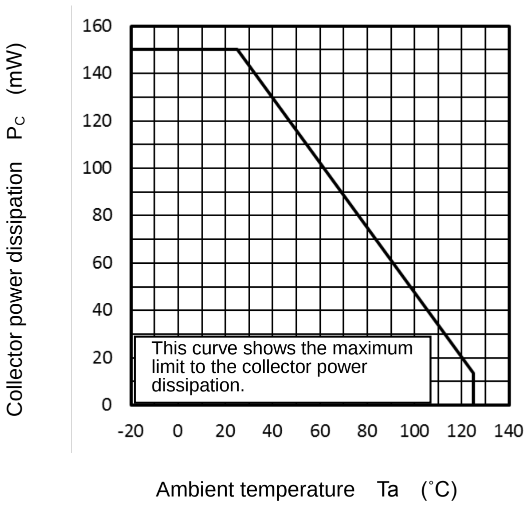


Characteristics Curves (Note)

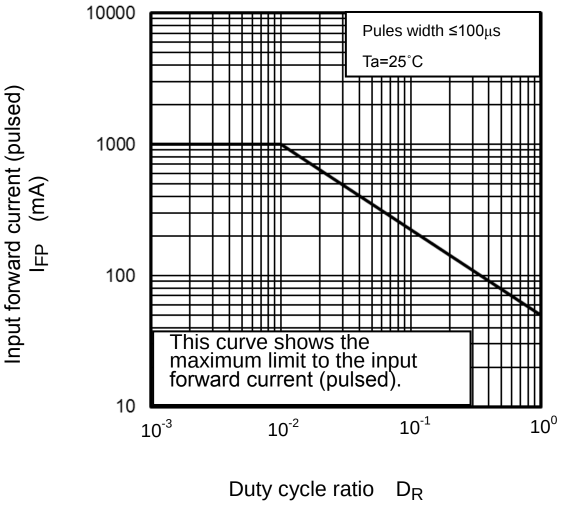
I_F - Ta



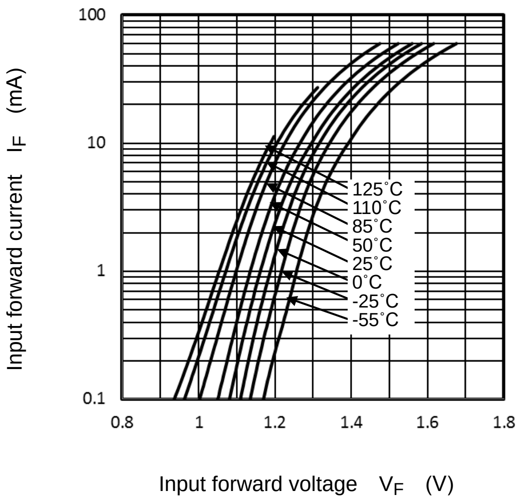
P_C - Ta



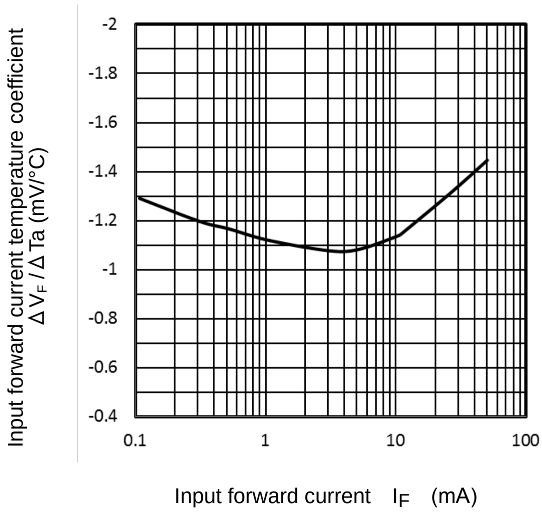
I_{FP} - D_R



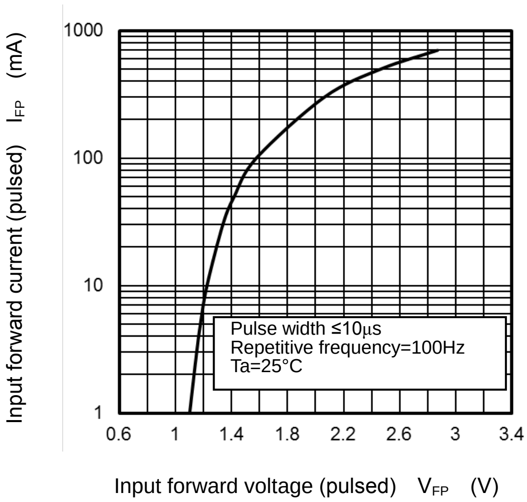
I_F - V_F



$\Delta V_F / \Delta Ta$ - I_F

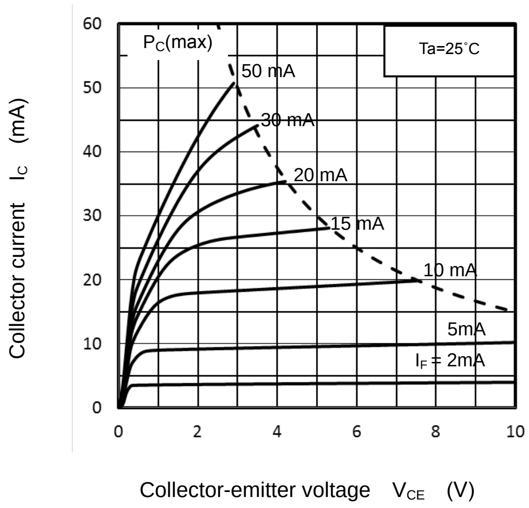


I_{FP} – V_{FP}

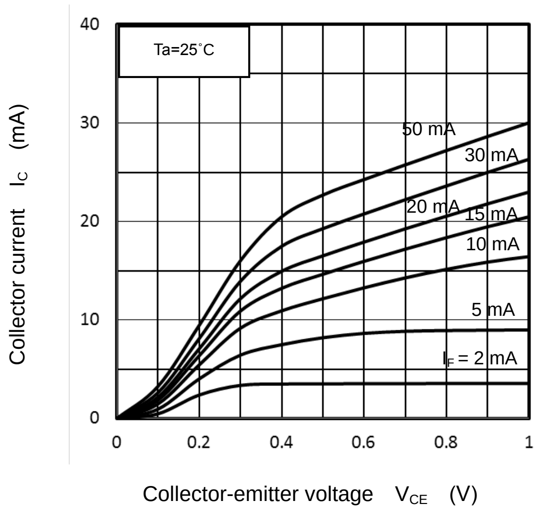


Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

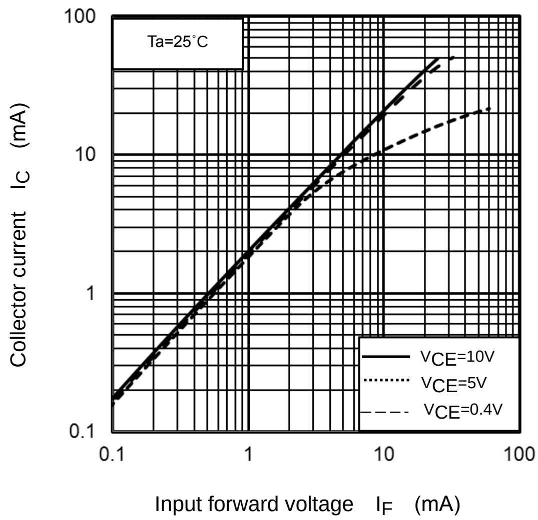
I C - V C E



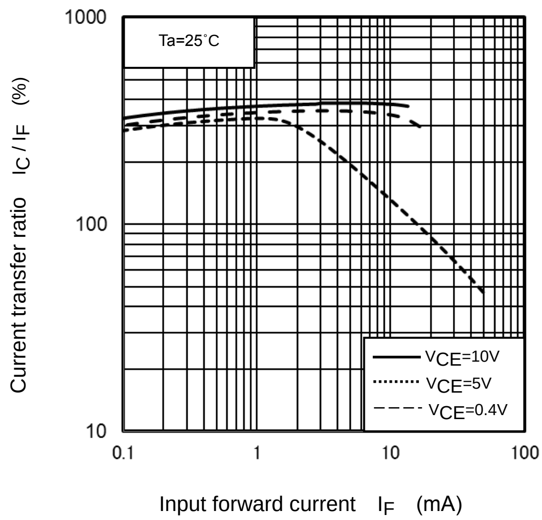
I C - V C E



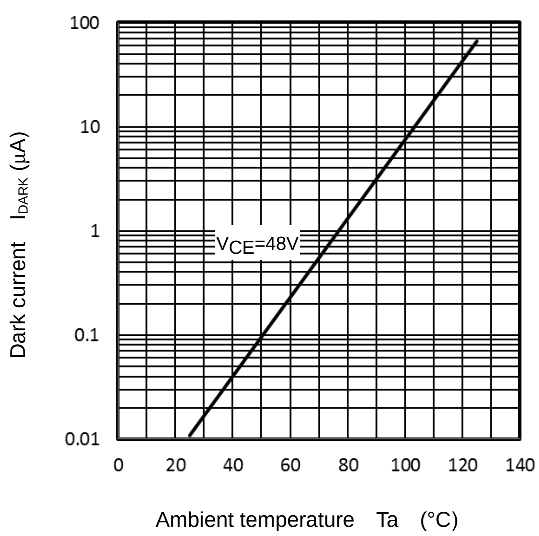
I C - I F



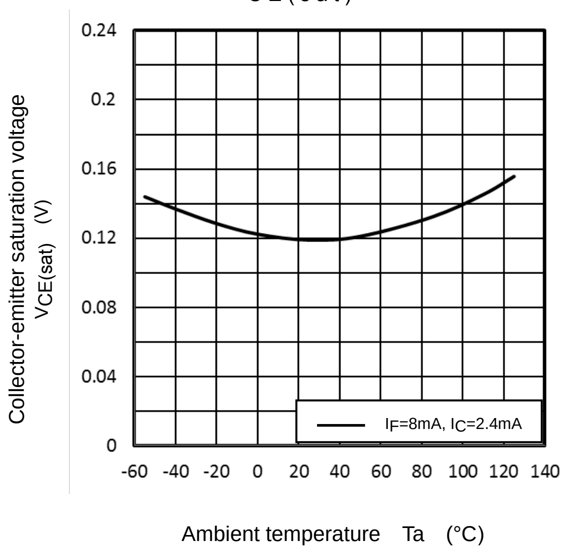
I C / I F - I F



I DARK - Ta



V CE(sat) - Ta



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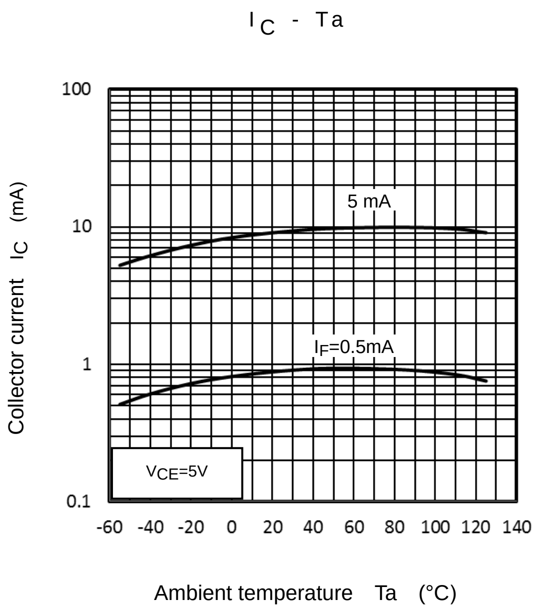

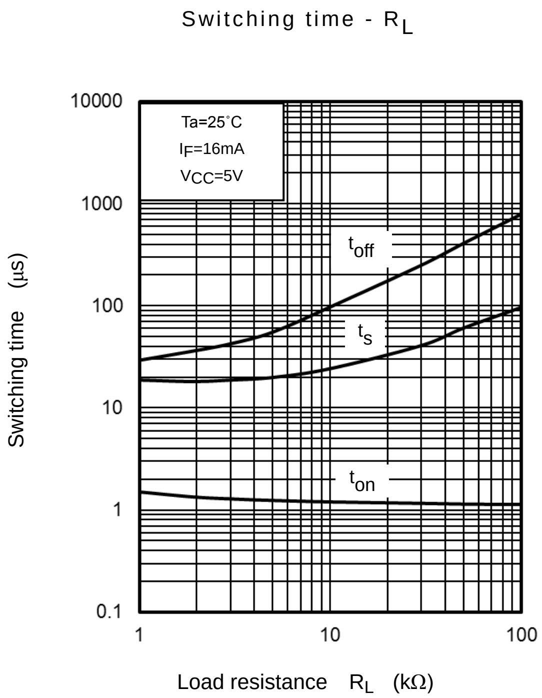

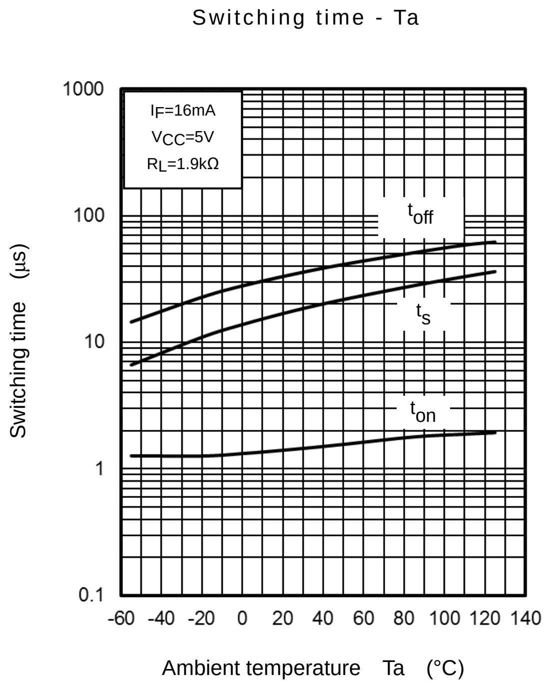

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Soldering and Storage

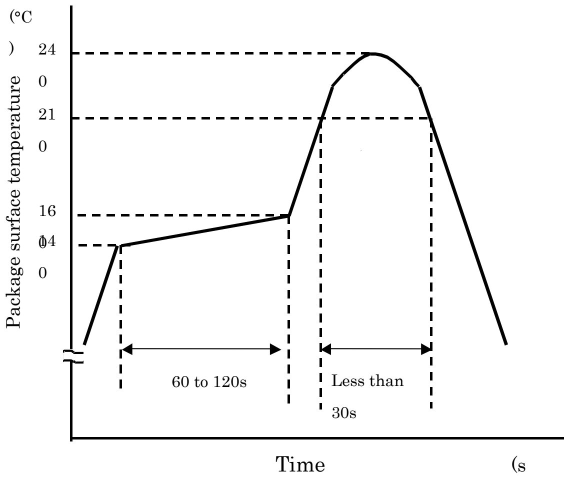
1. Soldering

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.

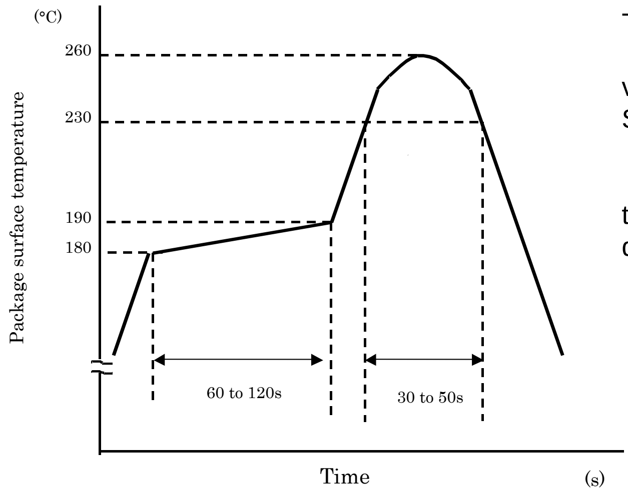
1) Using solder reflow

·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.
- Flow soldering must be performed 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.

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