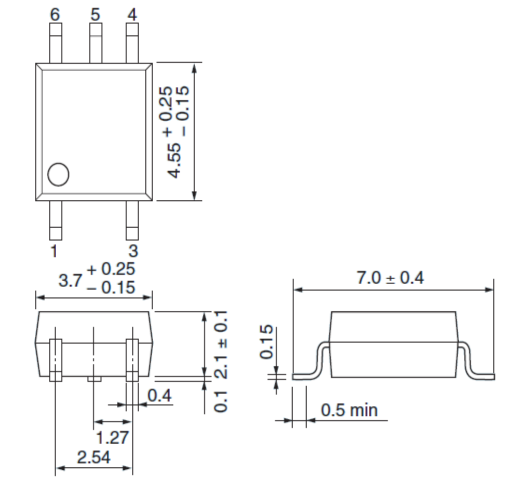
TOSHIBA Photocoupler IRED & Photo-IC

TLP109

Programmable Controllers
Industrial Inverters
Switching Power Supplies

Unit: mm



JEDEC	―
JEITA	―
TOSHIBA	11-4L1

Weight: 0.08 g (typ.)

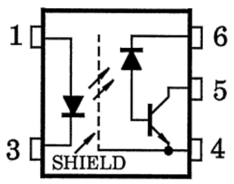
The Toshiba TLP109 mini-flat coupler is a small-outline coupler suitable for surface-mount assembly. The TLP109 consists of a high-output-power infrared LED optically coupled to a high-speed photodiode-transistor chip.
The TLP109 is housed in the SO6 package and guarantees a creepage distance of ≥ 5.0 mm, a clearance of ≥ 5.0 mm and an insulation thickness of ≥ 0.4 mm. Therefore, the TLP109 meets the reinforced insulation class requirements of international safety standards.

- Isolation voltage: 3750 Vrms (min)
- Switching speed: t_{pHL} = 0.8 μs, t_{pLH} = 0.8 μs (max)
  @R_L = 1.9 kΩ
- TTL-compatible
- UL-recognized : UL 1577, File No.E67349
- cUL-recognized : CSA Component Acceptance Service No.5A File No.E67349
- VDE-approved: EN 60747-5-5, EN 62368-1 (Note 1)
- CQC-approved: GB4943.1, GB8898 Thailand Factory

仅适用于海拔 2000m 以下地区安全使用

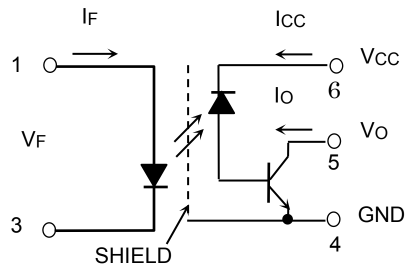
Note 1 : When a VDE approved type is needed, please designate the **Option(V4)**.

Pin Configuration (Top View)



1: ANODE
3: CATHODE
4: EMITTER (GND)
5: COLLECTOR (OUTPUT)
6: V_{CC}

Schematic



Construction Mechanical Ratings

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

Start of commercial production
2008-07

Absolute Maximum Ratings (Ta = 25°C)

	Characteristic	Symbol	Rating	Unit
LED	Forward current	I_F	20	mA
	Forward Current Derating (Ta ≥ 95 °C)	Δ IF/°C	-0.36	mA/°C
	Pulse forward current (Note 1)	I_{FP}	40	mA
	Peak transient forward current (Note 2)	I_{FPT}	1	A
	Reverse voltage	V_R	5	V
	Power dissipation (Note 3)	P_D	40	mW
Detector	Output current	I_O	8	mA
	Output Current Derating (Ta ≥ 95 °C)	Δ IO/°C	-0.3	mA/°C
	Peak output current	I_{OP}	16	mA
	Supply voltage	V_{CC}	−0.5 to 30	V
	Output voltage	V_O	−0.5 to 20	V
	Output power dissipation (Note 4)	P_O	100	mW
Operating temperature range		T_{opr}	−55 to 125	°C
Storage temperature range		T_{stg}	−55 to 125	°C
Lead solder temperature (10 s)		T_{sol}	260	°C
Isolation Voltage (AC, 60 s, R.H. ≤ 60 %) (Note 5)		BV_S	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: 50 % duty cycle, 1 ms pulse width. Derate 0.72 mA / °C above 95 °C.

Note 2: Pulse width ≤ 1 μs, 300 pps.

Note 3: Derate 0.72 mW / °C above 95 °C.

Note 4: Derate 1.8 mW / °C above 95 °C.

Note 5: Device considered a two−terminal device: Pins 1 and 3 shorted together, and pins 4, 5 and 6 shorted together.

Electrical Characteristics (Ta = 25°C)

	Characteristic	Symbol	Test Condition	Min	Typ.	Max	Unit
LED	Forward voltage	V_F	I_F = 16 mA	1.50	1.64	1.85	V
LED	Forward voltage temperature coefficient	$\Delta V_F / \Delta Ta$	I_F = 16 mA	—	−1.6	—	mV /°C
LED	Reverse current	I_R	V_R = 3 V	—	—	10	μA
LED	Capacitance between terminals	C_T	V_F = 0 V, f = 1 MHz	—	60	—	pF
Detector	High level output current	$I_{OH\ (1)}$	I_F = 0 mA, V_{CC} = V_O = 5.5 V	—	3	500	nA
Detector	High level output current	$I_{OH\ (2)}$	I_F = 0 mA, V_{CC} = 30 V V_O = 20 V	—	—	5	μA
Detector	High level output current	I_{OH}	I_F = 0 mA, V_{CC} = 30 V V_O = 20 V, Ta = 100 °C	—	—	50	μA
Detector	High level supply current	I_{CCH}	I_F = 0 mA, V_{CC} = 30 V	—	0.01	1	μA
Current transfer ratio		I_O / I_F	I_F = 16 mA, V_{CC} = 4.5 V V_O = 0.4 V	20	—	—	%
Low level output voltage		V_{OL}	I_F = 16 mA, V_{CC} = 4.5 V I_O = 2.4 mA	—	—	0.4	V

Isolation Characteristics (Ta = 25°C)

Characteristic	Symbol	Test Conditions	Min	Typ.	Max	Unit
Capacitance input to output	C_S	V = 0 V, f = 1 MHz (Note 5)	—	0.8	—	pF
Isolation resistance	R_S	R.H. ≤ 60 %, V_S = 500 V (Note 5)	10^{12}	10^{14}	—	Ω
Isolation voltage	BV_S	AC, 60 s (Note 5)	3750	—	—	V_{rms}

Switching Characteristics (Ta = 25°C, V_{CC} = 5 V)

Characteristic	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Propagation delay time (H→ L)	t_{pHL}	Figure 1	I_F = 0→ 16 mA R_L = 1.9 kΩ	—	—	0.8	μs
Propagation delay time (L→ H)	t_{pLH}	Figure 1	I_F = 16→ 0 mA R_L = 1.9 kΩ	—	—	0.8	μs
Common mode transient immunity at high output level (Note 6)	CM_H	Figure 2	I_F = 0 mA, V_{CM} = 400 V_{p-p} R_L = 4.1 kΩ	5000	10000	—	V / μs
Common mode transient Immunity at low output level (Note 6)	CM_L	Figure 2	I_F = 16 mA, V_{CM} = 400 V_{p-p} R_L = 4.1 kΩ	−5000	−10000	—	V / μs

Note 6: CM_L is the maximum rate of fall of the common mode voltage that can be sustained with the output voltage in the logic low state (V_O < 0.8 V).
CM_H is the maximum rate of rise of the common mode voltage that can be sustained with the output voltage in the logic high state (V_O > 2.0 V)

Figure 1: Switching Time Test Circuit and Waveform

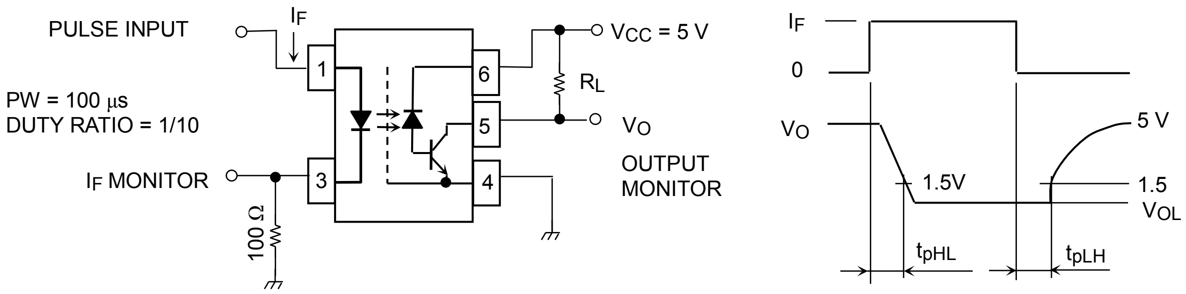
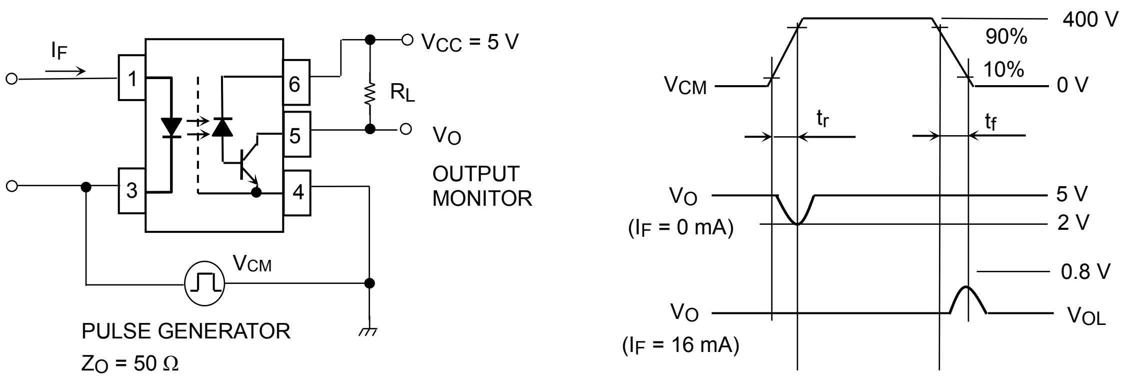
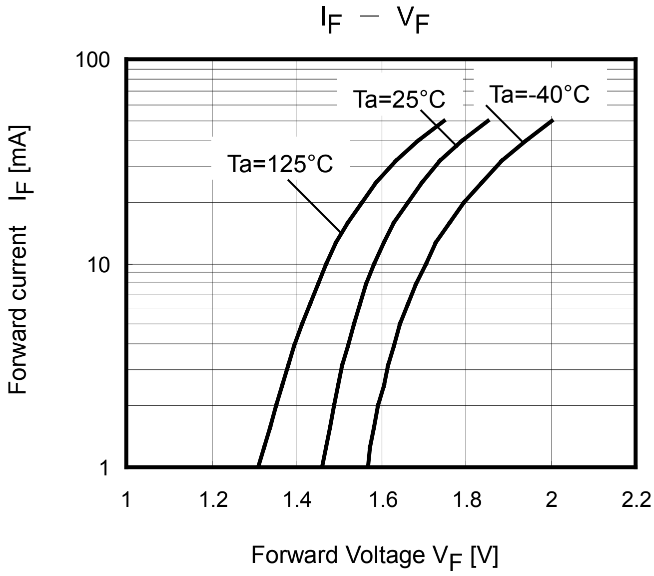
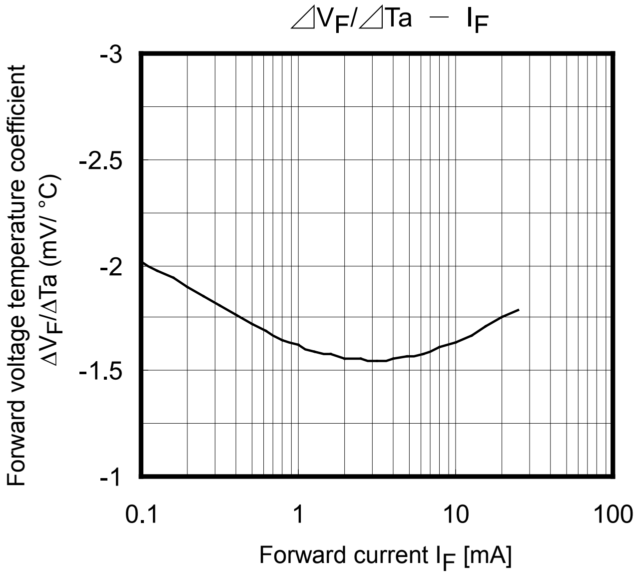


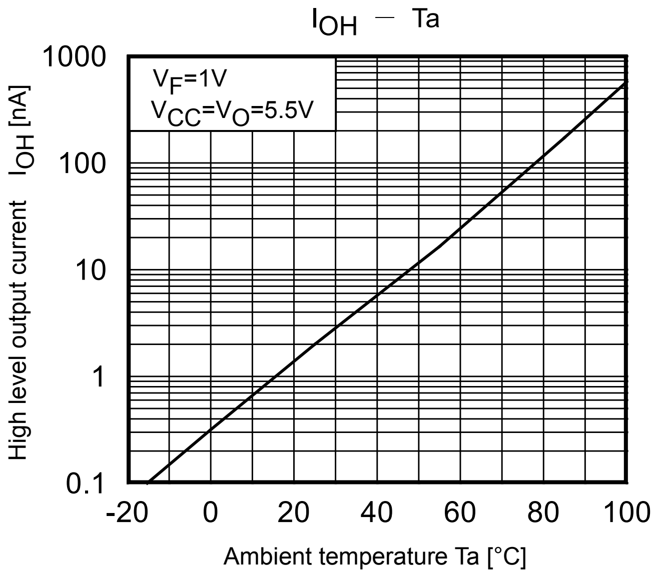
Figure 2: Common Mode Transient Immunity Test Circuit and Waveform

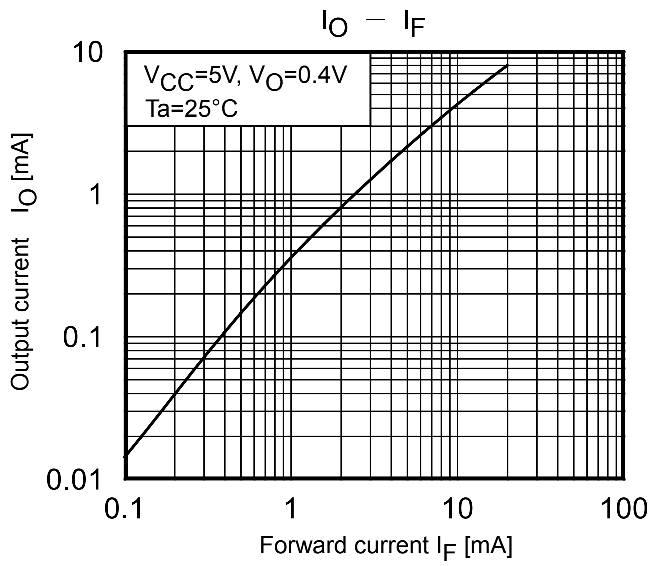


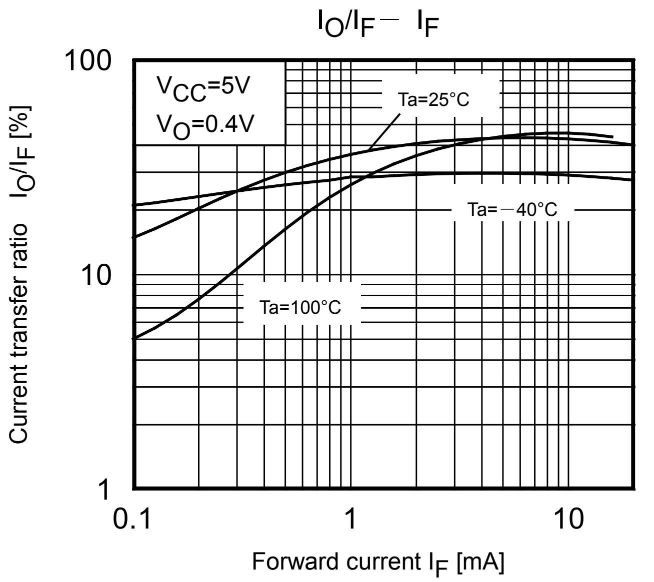
$CM_H = \frac{320(V)}{t_r(\mu s)}$, $CM_L = \frac{320(V)}{t_r(\mu s)}$

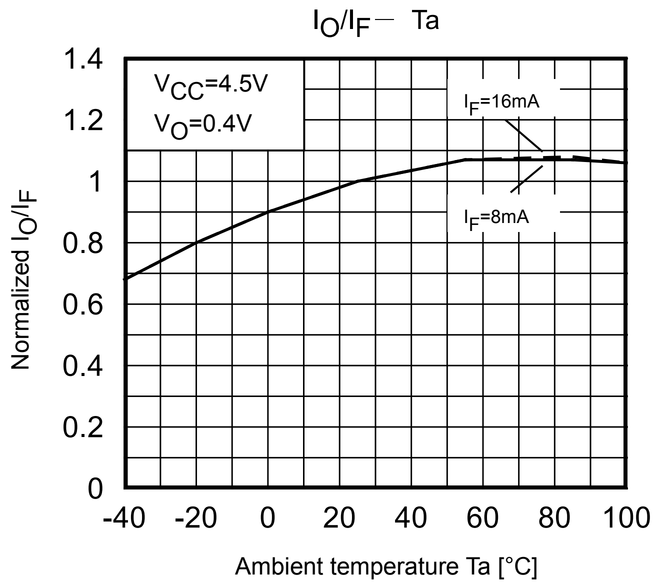




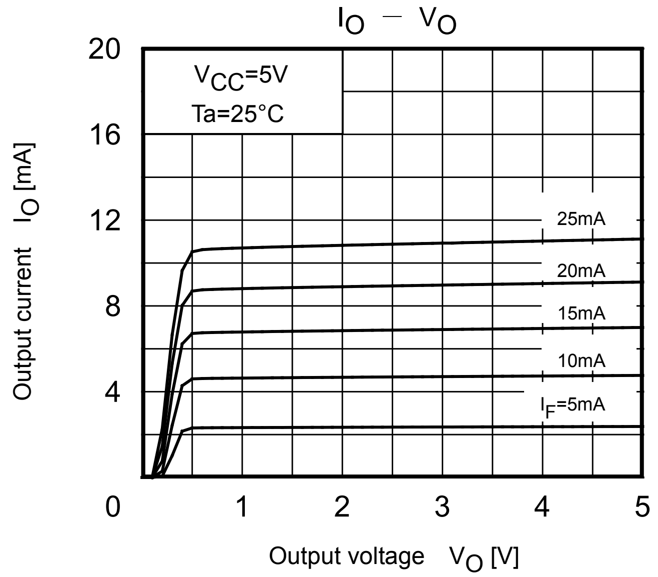


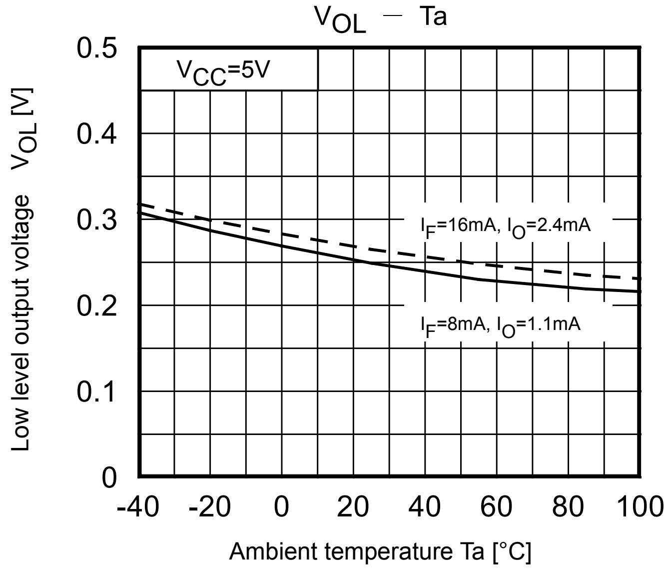


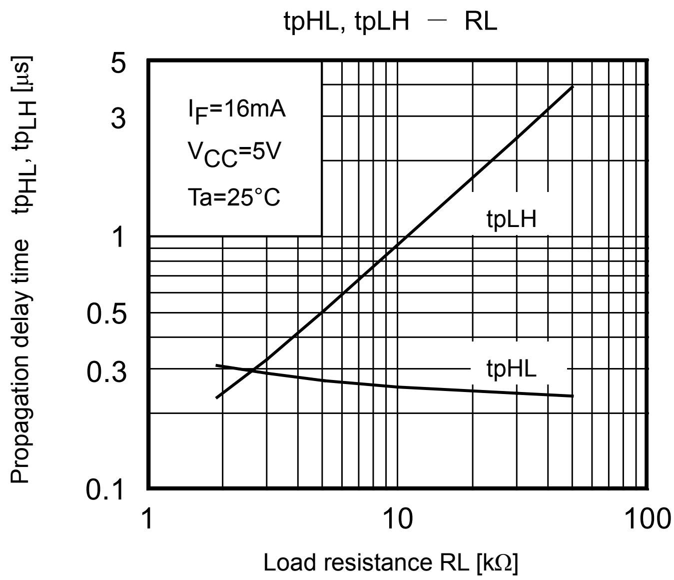


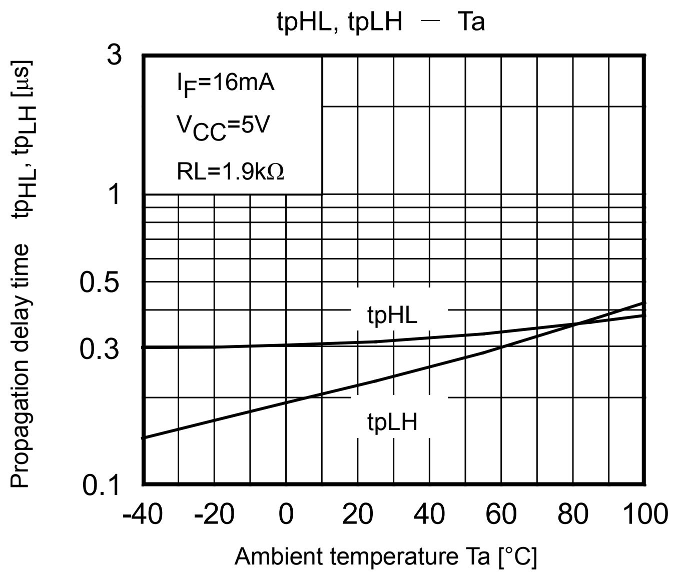


NOTE: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.









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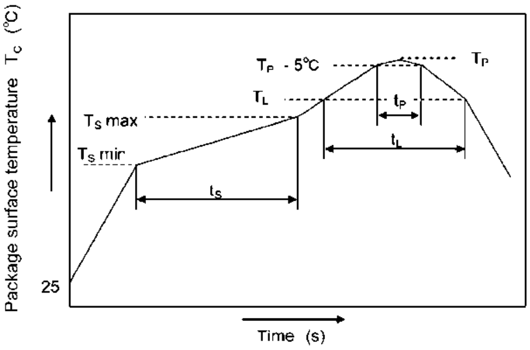
PRECAUTIONS OF SURFACE MOUNTING TYPE PHOTOCOUPLER SOLDERING & GENERAL STORAGE

(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.

1) When Using Soldering Reflow

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



	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

- 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..

2) 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.

3) 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 only once per 1 lead

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