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TLP109

Programmable Controllers
Industrial Inverters
Switching Power Supplies

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.

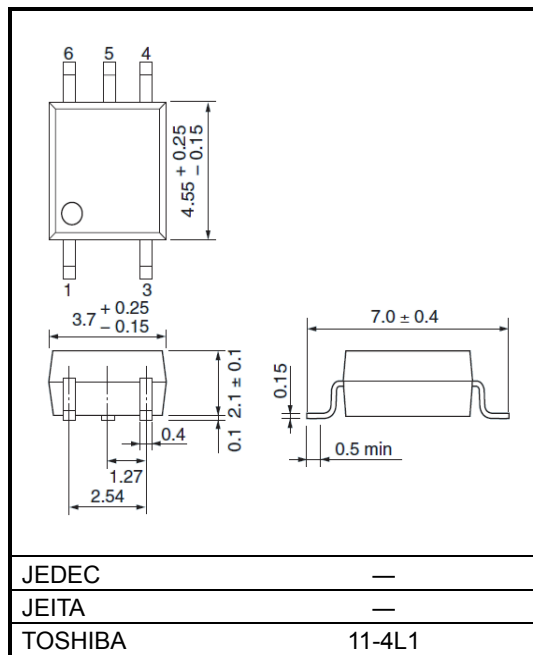
- Isolation voltage: 3750 Vrms (min)
- Switching speed: $t_{pHL} = 0.8 \mu s$, $t_{pLH} = 0.8 \mu s$ (max)
@ $R_L = 1.9 k\Omega$
- TTL-compatible
- UL-recognized : UL 1577, File No.E67349
- cUL-recognized : CSA Component Acceptance Service No.5A
File No.E67349
- VDE-approved: EN 60747-5-5, EN 62368-1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



仅适用于海拔 2000m 以下地区安全使用

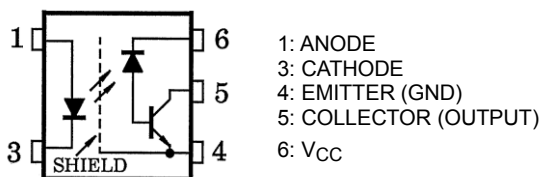
Note 1 : When a VDE approved type is needed, please designate the **Option(V4)**.

Unit: mm

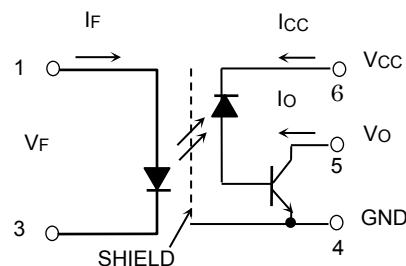


Weight: 0.08 g (typ.)

Pin Configuration (Top View)



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)	ΔI _F /°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)	ΔI _O /°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)		BVs	3750	V _{rms}

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

Isolation Characteristics (Ta = 25°C)

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

Switching Characteristics (Ta = 25°C, Vcc = 5 V)

Characteristic	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Propagation delay time (H→L)	t_{pHL}	Figure 1	$I_F = 0 \rightarrow 16 \text{ mA}$ $R_L = 1.9 \text{ k}\Omega$	—	—	0.8	μs
Propagation delay time (L→H)	t_{pLH}	Figure 1	$I_F = 16 \rightarrow 0 \text{ mA}$ $R_L = 1.9 \text{ k}\Omega$	—	—	0.8	μs
Common mode transient immunity at high output level (Note 6)	CM_H	Figure 2	$I_F = 0 \text{ mA}, V_{CM} = 400 \text{ V}_{p-p}$ $R_L = 4.1 \text{ k}\Omega$	5000	10000	—	V / μs
Common mode transient immunity at low output level (Note 6)	CM_L	Figure 2	$I_F = 16 \text{ mA}, V_{CM} = 400 \text{ V}_{p-p}$ $R_L = 4.1 \text{ k}\Omega$	-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 ($V_O < 0.8 \text{ V}$).
 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 ($V_O > 2.0 \text{ V}$)

Figure 1: Switching Time Test Circuit and Waveform

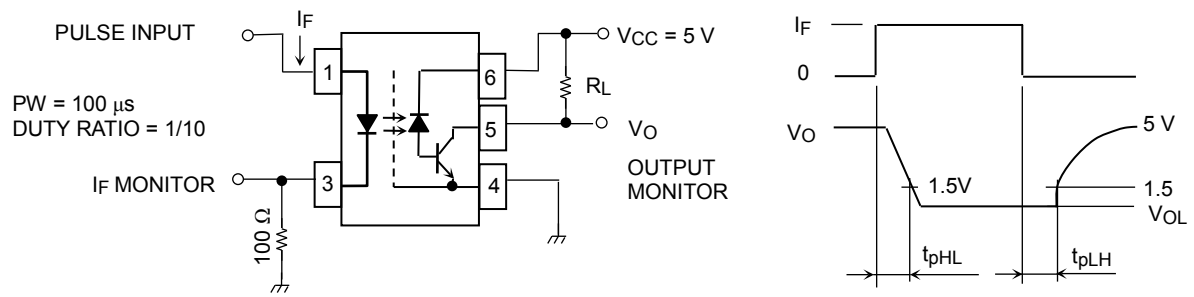
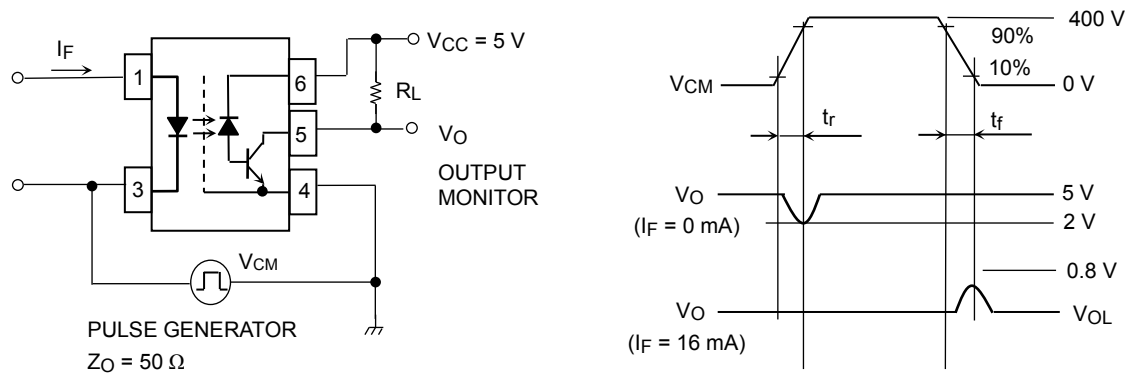
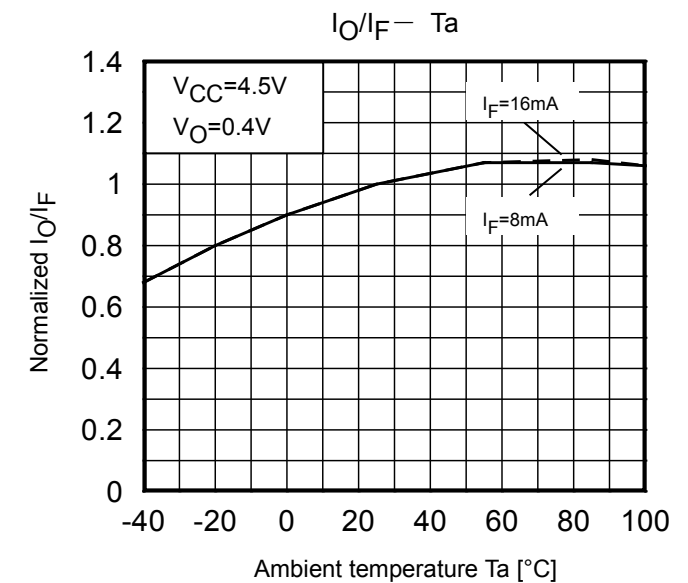
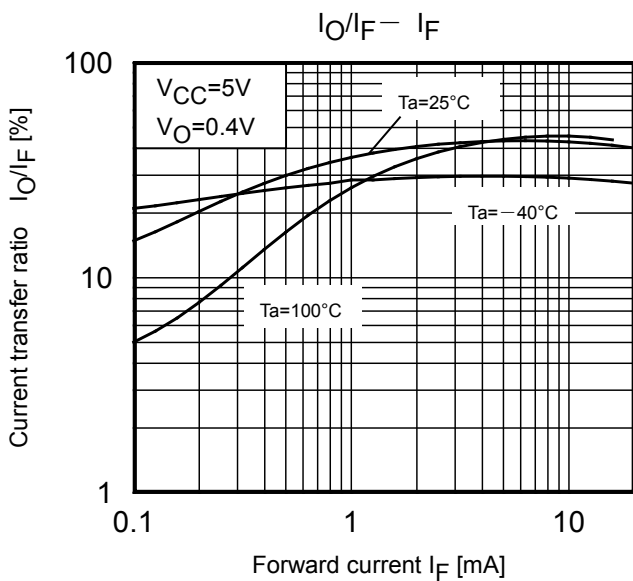
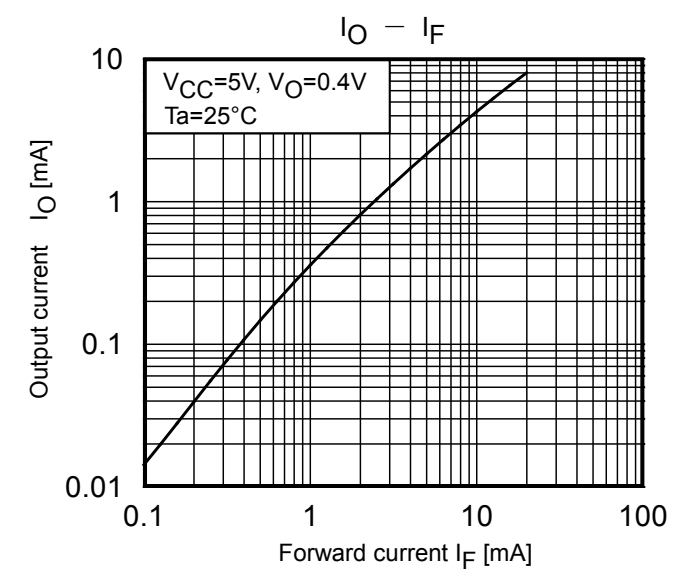
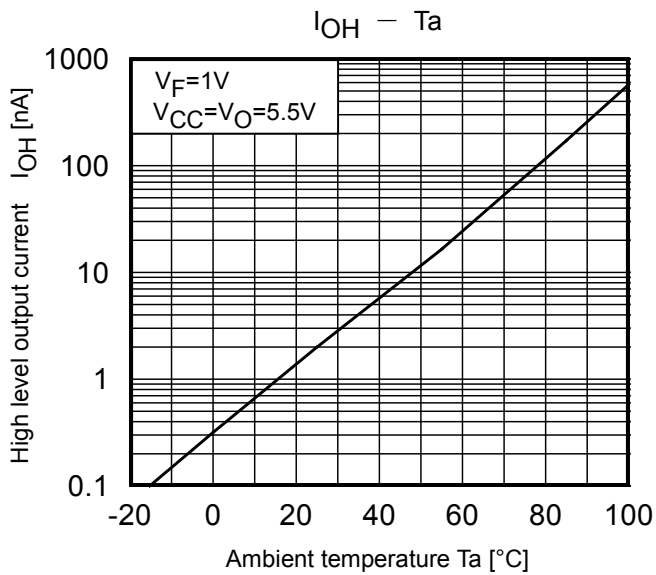
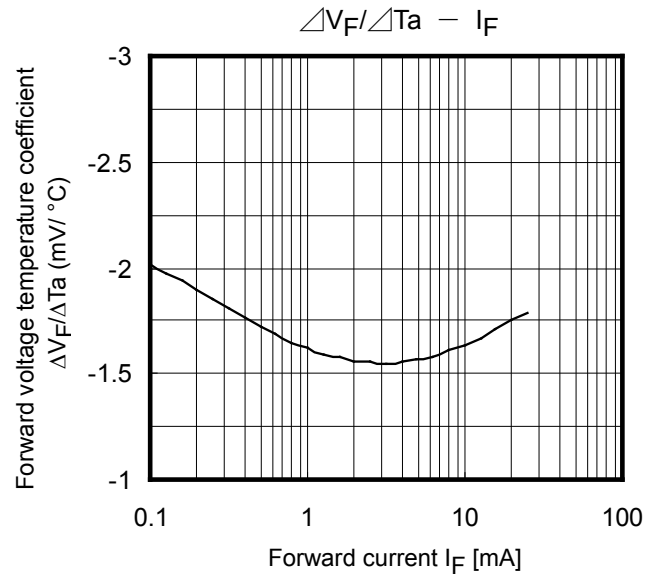
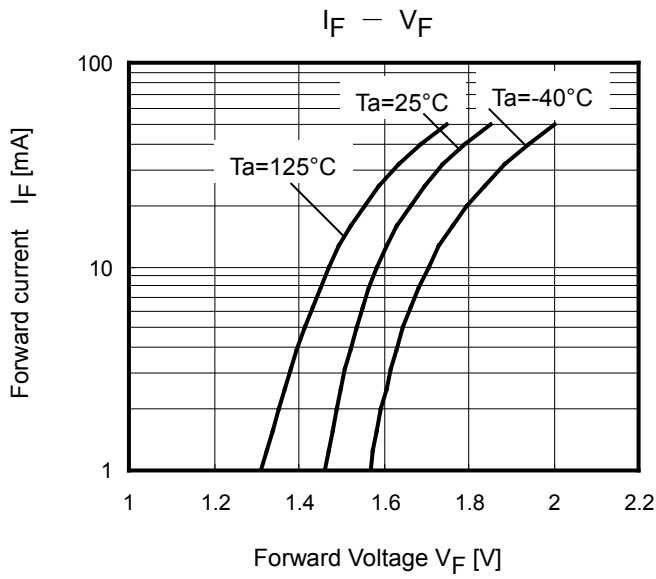


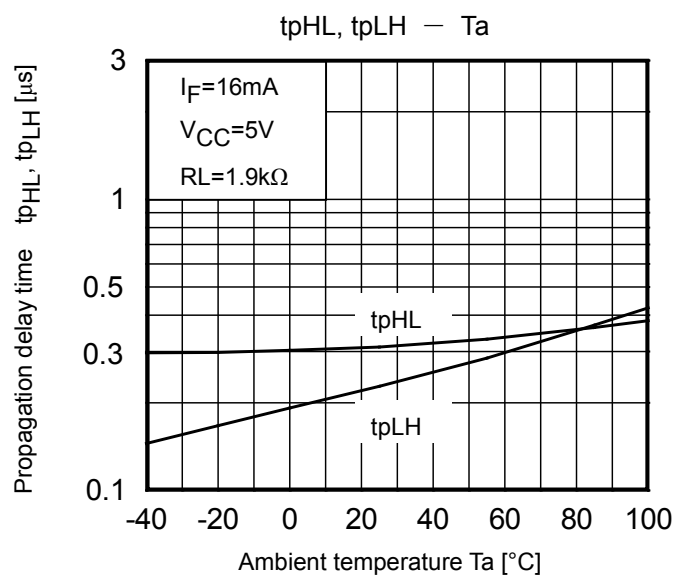
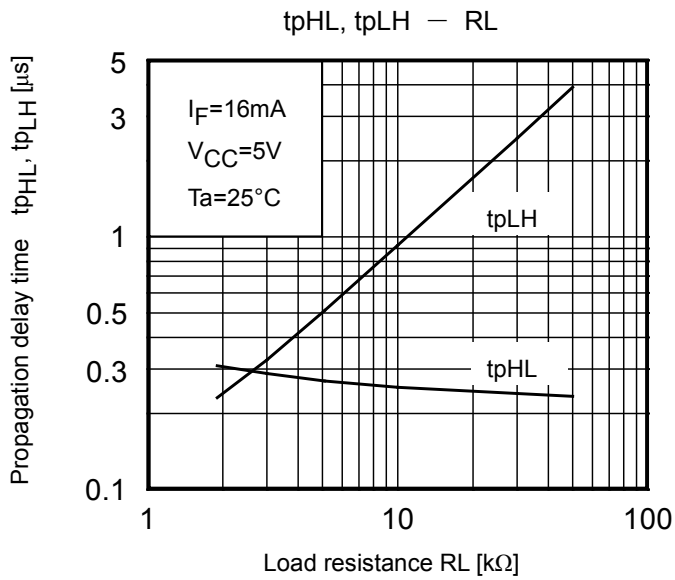
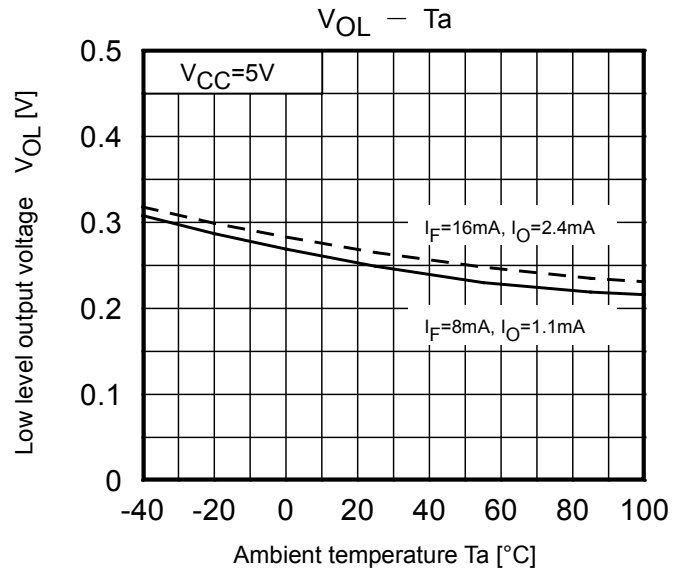
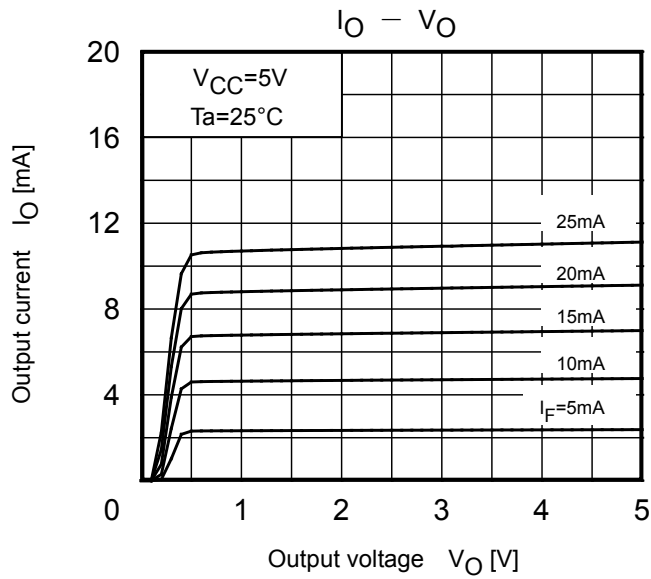
Figure 2: Common Mode Transient Immunity Test Circuit and Waveform



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



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



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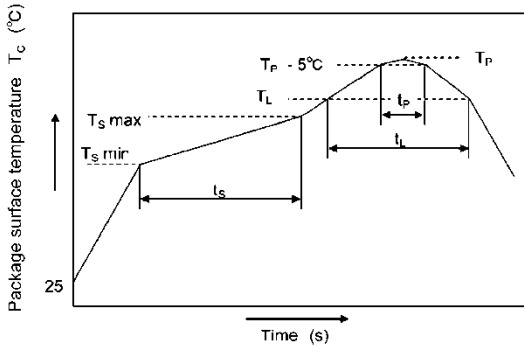
PRECAUTIONS OF SURFACE MOUNTING TYPE PHOTOCOUPLER SOLDERING & GENERAL STORAGE

(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	$^{\circ}\text{C}$
Preheat time	t_s	60	120	s
Ramp-up rate (T_L to T_P)			3	$^{\circ}\text{C/s}$
Liquidus temperature	T_L	217		$^{\circ}\text{C}$
Time above T_L	t_L	60	150	s
Peak temperature	T_P		260	$^{\circ}\text{C}$
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	$^{\circ}\text{C/s}$

- 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 $^{\circ}\text{C}$ (package surface temperature) for 60 to 120 seconds.
- Mounting condition of 260 $^{\circ}\text{C}$ 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 $^{\circ}\text{C}$ or within 3 seconds not exceeding 350 $^{\circ}\text{C}$.
- Heating by soldering iron must be only once per 1 lead

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