



NEC's 1 Mbps, OPEN-COLLECTOR OUTPUT FOR GATE DRIVE INTERFACE INTELLIGENT POWER MODULE 8-PIN DIP PHOTOCOUPLER

PS9613
PS9613L

FEATURES

- **HIGH INSTANTANEOUS COMMON MODE REJECTION VOLTAGE**
 $CMH, CML = \pm 15 \text{ kV}/\mu\text{s MIN}$
- **HIGH SPEED RESPONSE**
 $t_{PHL} = 500 \text{ ns MAX}, t_{PLH} = 750 \text{ ns MAX}$
- **MAXIMUM PROPAGATION DELAYS**
 $t_{PHL} - t_{PLH} = 270 \text{ ns TYP}$
- **PULSE WIDTH DISTORTION**
 $|t_{PHL} - t_{PLH}| = 270 \text{ ns TYP}$
- **TAPING PRODUCT NUMBER**
PS9613L-E3, E4: 1000 pcs/reel



ESD SENSITIVE

DESCRIPTION

NEC's PS9613 and PS9613L are optically coupled isolator containing a GaAlAs LED on the input side and a photo diode and a signal processing circuit on the output side on one chip.

The PS9613 is in a plastic DIP (Dual In-line Package) and the PS9613L is lead bending type (Gull-wing) for surface mounting.

APPLICATIONS

- **IPM DRIVER**
- **GENERAL PURPOSE INVERTER**

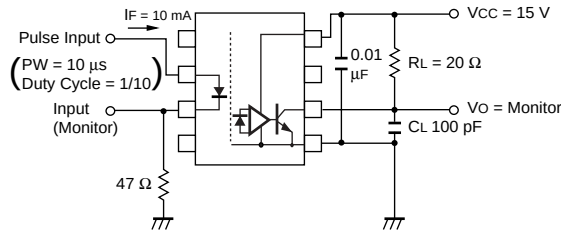
ELECTRICAL CHARACTERISTICS¹ ($T_A = -40 \text{ to } +100^\circ\text{C}$, $V_{CC} = 15 \text{ V}$, unless otherwise specified)

PART NUMBER				PS9613, PS9613L		
SYMBOL		PARAMETERS	UNITS	MIN	TYP	MAX
Diode	V_F	Forward Voltage, $I_F = 10 \text{ mA}$	V	1.3	1.65	2.1
	I_R	Reverse Current, $V_R = 3 \text{ V}$	μA			200
	C_t	Terminal Capacitance, $V = 0$, $f = 1 \text{ MHz}$, $T_A = 25^\circ\text{C}$	pF		30	
Detector	V_{OL}	Low Level Output Voltage $I_F = 10 \text{ mA}$, $V_{CC} = 5 \text{ V}$, $I_O = 2.4 \text{ mA}$	V		0.13	0.6
	I_{OH}	High Level Output Current $V_{CC} = 30 \text{ V}$, $V_F = 0.8 \text{ V}$	μA		1.0	50
	I_{CCH}	High Level Supply Current, $V_{CC} = 30 \text{ V}$, $V_F = 0.8 \text{ V}$, $V_O = \text{open}$	mA		0.6	1.3
	I_{CCL}	Low Level Supply Current, $V_{CC} = 30 \text{ V}$, $I_F = 10 \text{ mA}$, $V_O = \text{open}$	mA		0.6	1.3
Coupled	I_{FHL}	Threshold Input Current (High $\rightarrow$ Low), $V_O = 0.8 \text{ V}$, $I_O = 0.75 \text{ V}$	mA		1.5	5.0
	CTR	Current Transfer Ratio, $I_F = 10 \text{ mA}$, $V_O = 0.6 \text{ V}$	%	44	110	
	R_{I-O}	Isolation Resistance, $V_{I-O} = 1 \text{ k V}_{DC}$, $R_H = 40 \text{ to } 60\%$, $T_A = 25^\circ\text{C}$	Ω	10^{11}		
	C_{I-O}	Isolation Capacitance, $V = 0$, $f = 1 \text{ MHz}$, $T_A = 25^\circ\text{C}$	pF		0.6	
	t_{PHL}	Propagation Delay Time ² , High $\rightarrow$ Low $I_F = 10 \text{ mA}$, $R_L = 20 \text{ k}\Omega$, $C_L = 100 \text{ pF}$, $V_{THHL} = 1.5 \text{ V}$, $V_{THLH} = 2.0 \text{ V}$	ns		250	500
	t_{PLH}	Propagation Delay Time ² , High $\rightarrow$ Low $I_F = 10 \text{ mA}$, $R_L = 20 \text{ k}\Omega$, $C_L = 100 \text{ pF}$, $V_{THHL} = 1.5 \text{ V}$, $V_{THLH} = 2.0 \text{ V}$	ns		520	750
	$t_{PLH-t_{PHL}}$	Maximum Propagation Delays $I_F = 10 \text{ mA}$, $R_L = 20 \text{ k}\Omega$, $C_L = 100 \text{ pF}$, $V_{THHL} = 1.5 \text{ V}$, $V_{THLH} = 2.0 \text{ V}$	ns	-200	270	650
	$ t_{PHL-t_{PLH}} $	Pulse Width Distortion $I_F = 10 \text{ mA}$, $R_L = 20 \text{ k}\Omega$, $C_L = 100 \text{ pF}$, $V_{THHL} = 1.5 \text{ V}$, $V_{THLH} = 2.0 \text{ V}$	ns		270	650
	CMH	Instantaneous Common Mode Rejection Voltage (Output:High) ³ $T_A = 25^\circ\text{C}$, $I_F = 0 \text{ mA}$, $V_O > 3.0 \text{ V}$, $V_{CM} = 1.5 \text{ kV}$, $R_L = 20 \Omega$, $C_L = 100 \text{ pF}$	$\text{kV}/\mu\text{s}$	15		
	CML	Instantaneous Common Mode Rejection Voltage (Output:High) ³ $T_A = 25^\circ\text{C}$, $I_F = 10 \text{ mA}$, $V_O < 1.0 \text{ V}$, $V_{CM} = 1.5 \text{ kV}$, $R_L = 20 \Omega$, $C_L = 100 \text{ pF}$	$\text{kV}/\mu\text{s}$	15		

Notes: See Next Page

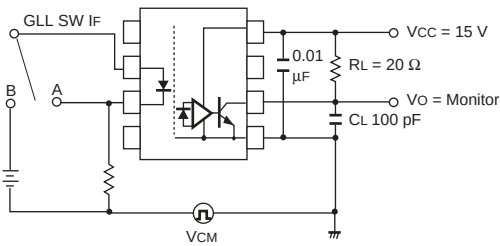
Notes:

1. Typical values at $T_A = 25^\circ\text{C}$
2. Test Circuit for Propagation delay time

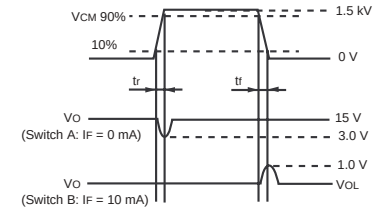
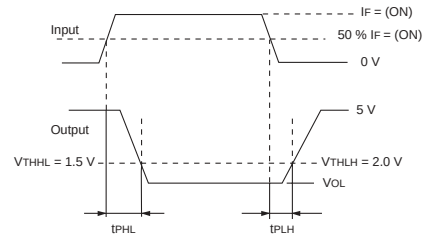


*CL is approximately 15 pF, which includes probe and stray wiring capacitance.

3. Test circuit for common mode transient immunity



*CL is approximately 15 pF, which includes probe and stray wiring capacitance.



ABSOLUTE MAXIMUM RATINGS¹ ($T_A = 25^\circ\text{C}$)

SYMBOLS	PARAMETERS	UNITS	RATINGS
Diode			
I_F	Forward Current	mA	25
V_R	Reverse Voltage	V	3.0
Detector			
V_{CC}	Supply Voltage	V	-0.5 to +35
V_O	Output Voltage	V	-0.5 to +35
I_O	Output Current	mA	15
P_C	Power Dissipation	mW	100
Coupler			
BV	Isolation Voltage ²	$V_{r.m.s.}$	5000
T_{OP}	Operating Temperature	$^\circ\text{C}$	-40 to +100
T_{STG}	Storage Temperature	$^\circ\text{C}$	-55 to +125

Notes:

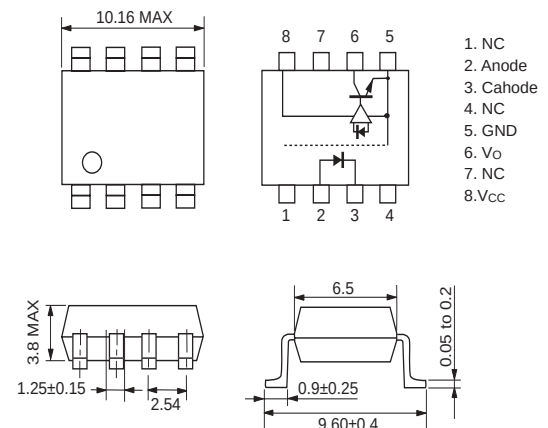
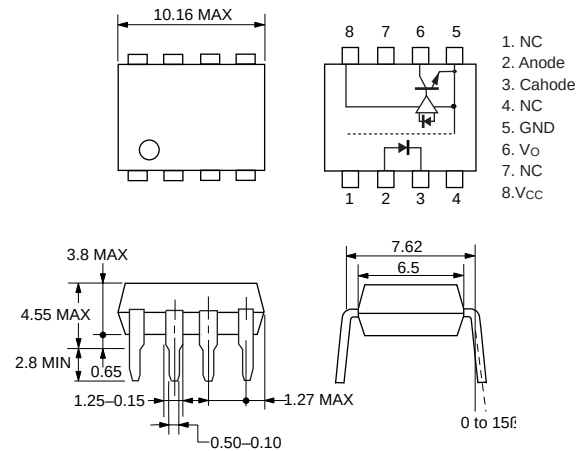
1. Operation in excess of any one of these parameters may result in permanent damage.
2. AC voltage for 1 minute at $T_A = 25^\circ\text{C}$, $RH = 60\%$ between input and output.

RECOMMENDED OPERATING CONDITIONS

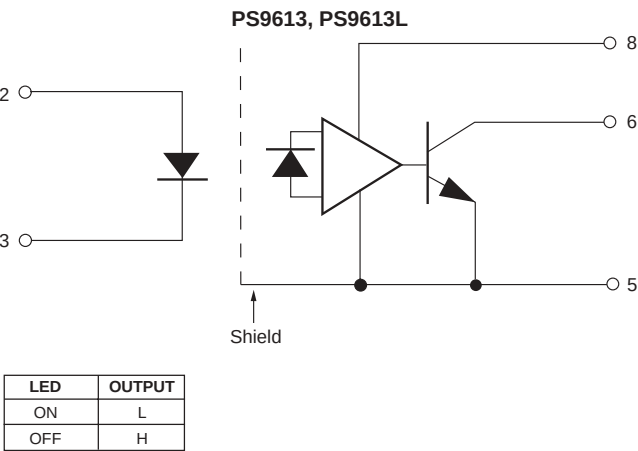
PART NUMBER			PS9716		
SYMBOLS	PARAMETERS	UNITS	MIN	TYP	MAX
I_{FH}	High Level Input Current	mA	10		20
V_O	Output Voltage	V	0		30
V_{CC}	Supply Voltage	V	4.5		30
V_F	LED off Voltage	V	0		0.8

OUTLINE DIMENSIONS (Units in mm)

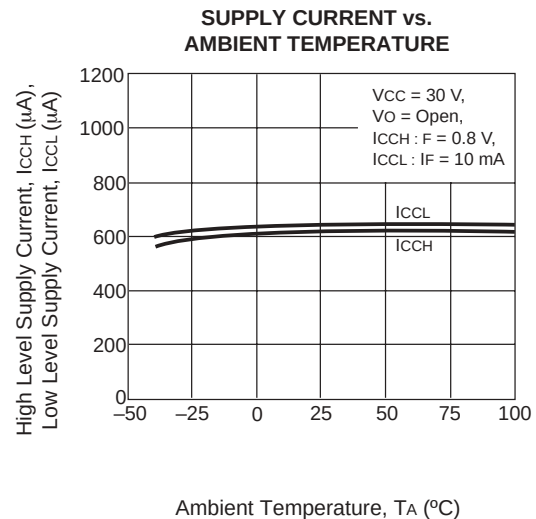
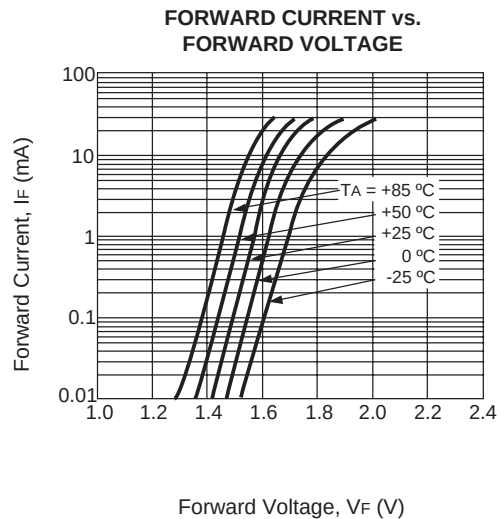
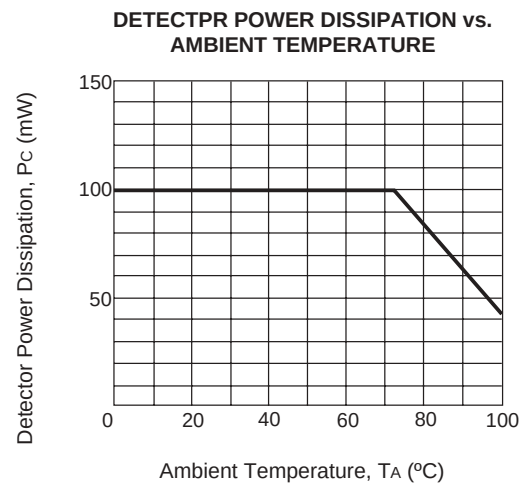
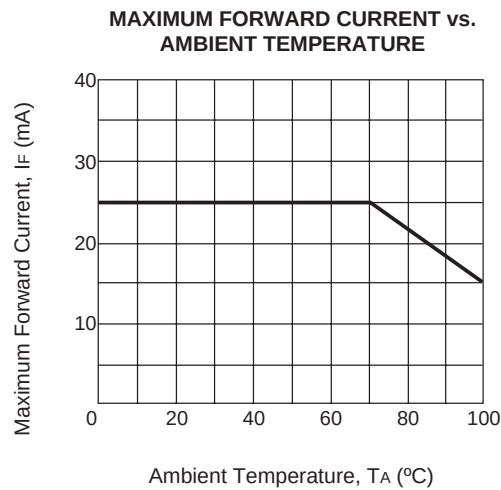
PS9613, PS9613L



FUNCTIONAL DIAGRAM



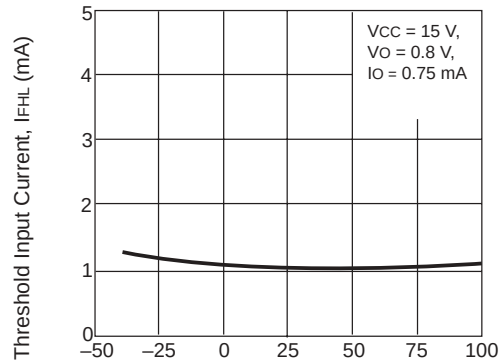
TYPICAL PERFORMANCE CURVES (TA = 25°C, unless otherwise specified)



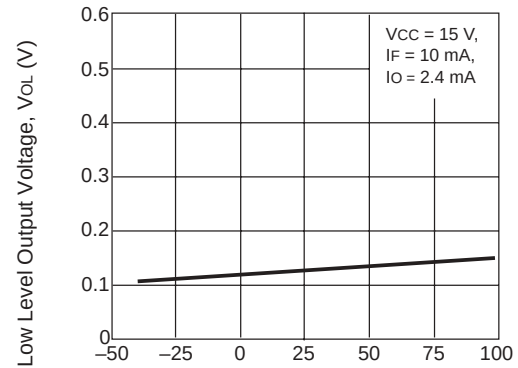
Remarks: The graphs indicate nominal characteristics.

TYPICAL PERFORMANCE CURVES ($T_A = 25^\circ\text{C}$, unless otherwise specified)

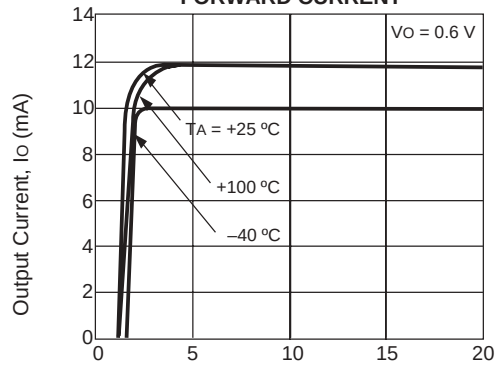
THRESHOLD INPUT CURRENT vs. AMBIENT TEMPERATURE

Ambient Temperature, T_A ($^\circ\text{C}$)

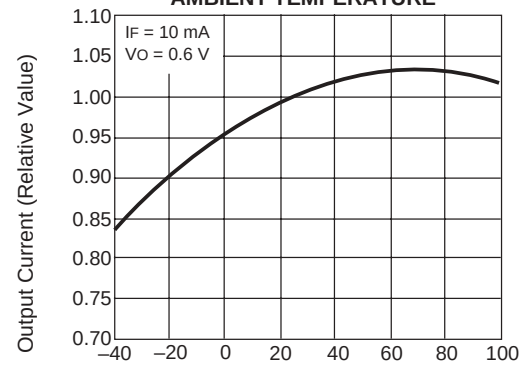
LOW LEVEL OUTPUT VOLTAGE vs. AMBIENT TEMPERATURE

Ambient Temperature, T_A ($^\circ\text{C}$)

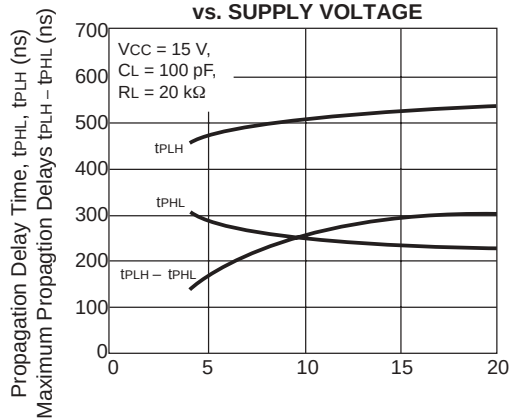
OUTPUT CURRENT vs. FORWARD CURRENT

Forward Current, I_F (mA)

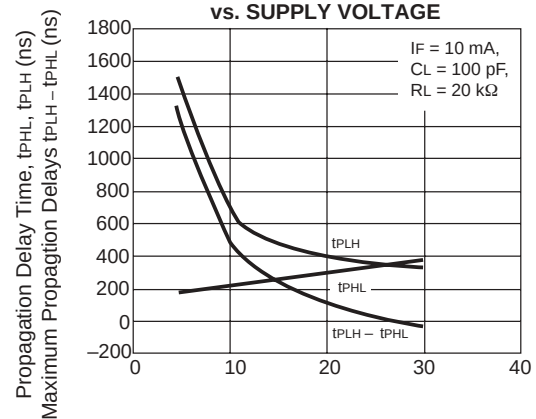
OUTPUT CURRENT vs. AMBIENT TEMPERATURE

Ambient Temperature, T_A ($^\circ\text{C}$)

PROPAGATION DELAY TIME, MAXIMUM PROPAGATION DELAYS vs. SUPPLY VOLTAGE

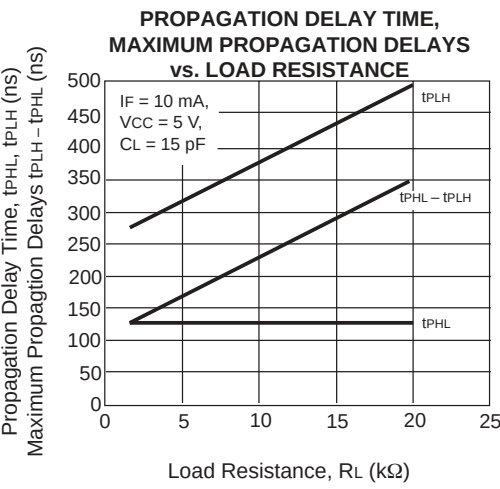
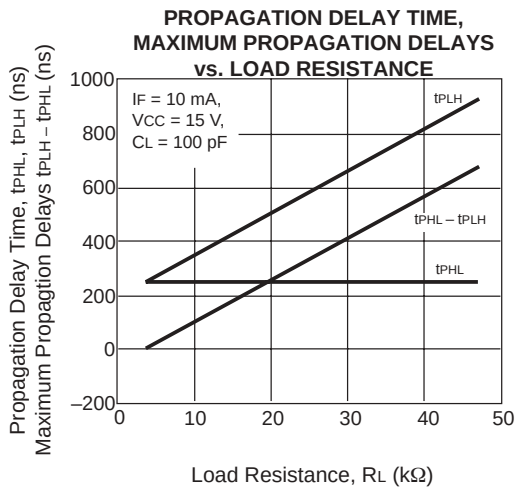
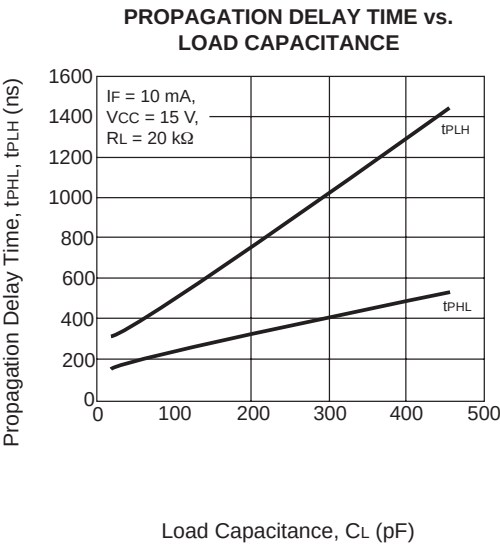
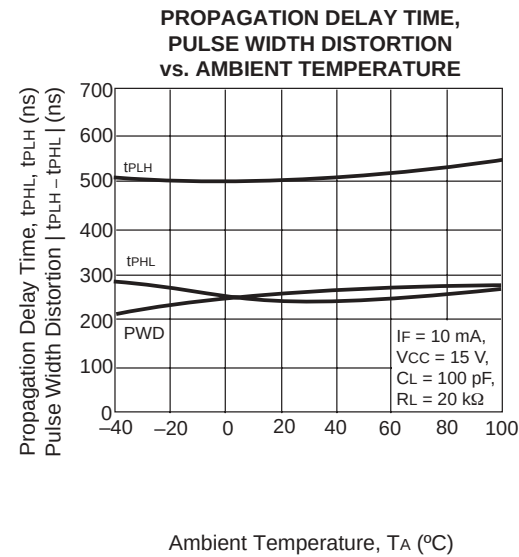
Forward Current, I_F (mA)

PROPAGATION DELAY TIME, MAXIMUM PROPAGATION DELAYS vs. SUPPLY VOLTAGE

Supply Voltage, V_{CC} (V)

Remarks: The graphs indicate nominal characteristics.

TYPICAL PERFORMANCE CURVES (TA = 25°C)



Remarks: The graphs indicate nominal characteristics.

ORDERING INFORMATION

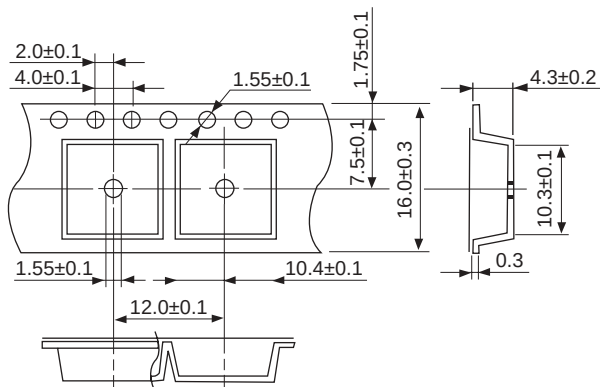
PART NUMBER	PACKAGE	PACKING STYLE	SAFETY STANDARDS	APPLICATION PART NUMBER ¹
PS9613	8 – pin DIP	Magazine case 50 pcs	UL approved	PS9613
PS9613L				PS9613L
PS9613L-E3		Embossed Tape 1000 pcs/reel		
PS9613L-E4			VDE0884 approved	PS9613
PS9613-V		Magazine case 50 pcs		PS9613L
PS9613L-V				
PS9613L-V-E3		Embossed Tape 1000 pcs/reel		
PS9613L-V-E4				

Notes:

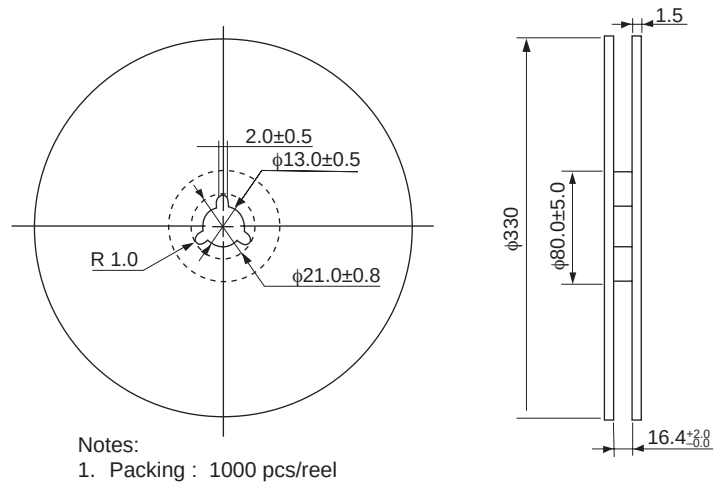
1. For the application of the Safety Standard, following part number should be used.

TAPING SPECIFICATIONS (Units in mm)

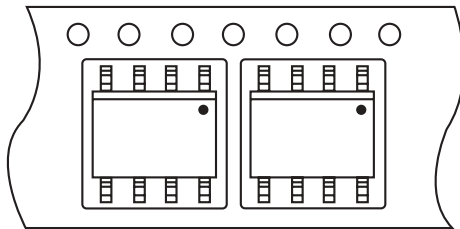
OUTLINE AND DIMENSIONS (TAPE)



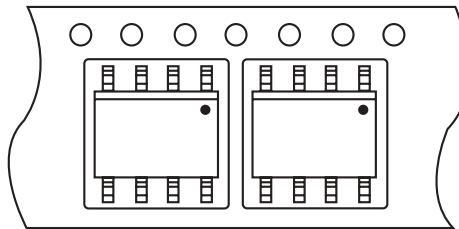
OUTLINE AND DIMENSIONS (REEL)



TAPE DIRECTION PS9613L-E3



PS9613L3-E4

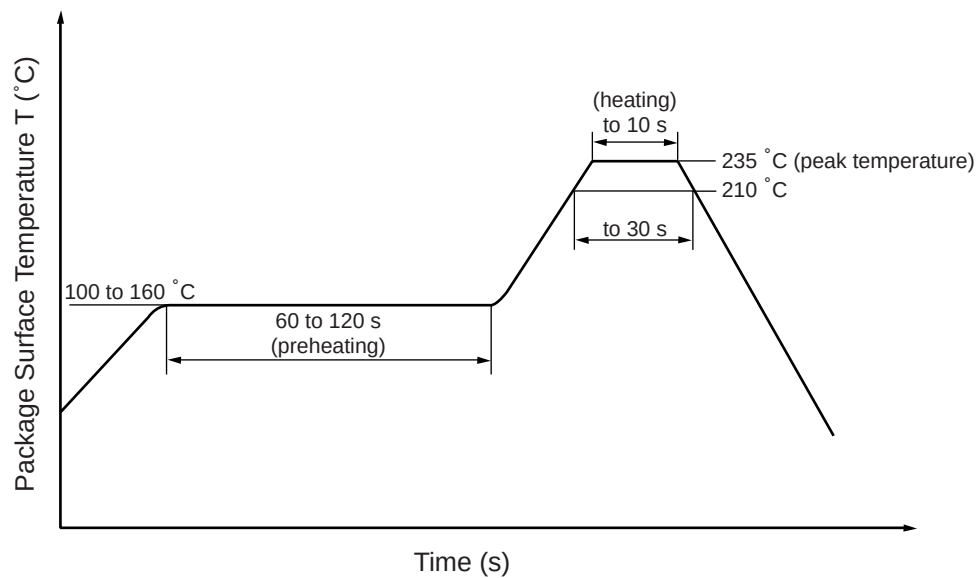


RECOMMENDED SOLDERING CONDITIONS

(1) Infrared reflow soldering

- **Peak reflow temperature**
235 °C or below (plastic surface temperature)
- **Reflow time**
30 seconds or less (Time period during which the plastic surface temperature is higher than 210 °C)
- **Number of reflows Processes**
Three
- **Flux**
Rosin flux containing small amount of chlorine (The flux with a max. chlorine content of 0.2 Wt % is recommended.)

INFRARED RAY REFLOW TEMPERATURE PROFILE



(2) Dip soldering

- **Temperature**
260 °C or below (molten solder temperature)
- **Time**
10 seconds or less
- **Flux**
Rosin flux containing small amount of chlorine (The flux with a max. chlorine content of 0.2 Wt % is recommended.)

(3) Cautions

- **Fluxes**
Avoid removing the residual flux with freon-based and chlorine-based cleaning solvent.

Life Support Applications

These NEC products are not intended for use in life support devices, appliances, or systems where the malfunction of these products can reasonably be expected to result in personal injury. The customers of CEL using or selling these products for use in such applications do so at their own risk and agree to fully indemnify CEL for all damages resulting from such improper use or sale.

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