

**CEL**

# 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 =  $\pm 15$  kV/ $\mu$ s MIN
- **HIGH SPEED RESPONSE**  
tPHL= 500 ns MAX, tPLH = 750 ns MAX
- **MAXIMUM PROPAGATION DELAYS**  
tPHL- tPLH = 270 ns TYP
- **PULSE WIDTH DISTORTION**  
| tPHL- tPLH | = 270 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**

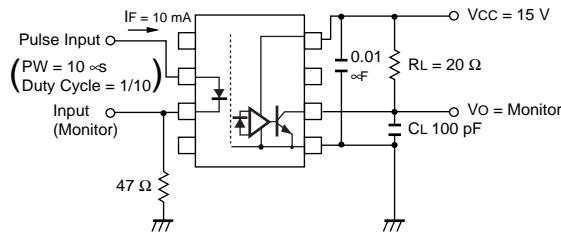
## ELECTRICAL CHARACTERISTICS<sup>1</sup> (TA = -40 to +100°C, VCC = 15 V, unless otherwise specified)

PART NUMBER			PS9613, PS9613L			
SYMBOL	PARAMETERS	UNITS	MIN	TYP	MAX	
Diode	V <sub>F</sub>	Forward Voltage, I <sub>F</sub> = 10 mA	V	1.3	2.1	
	I <sub>R</sub>	Reverse Current, V <sub>R</sub> = 3 V	$\mu$ A		200	
	C <sub>t</sub>	Terminal Capacitance, V = 0, f = 1 MHz, T <sub>A</sub> = 25 °C	pF		30	
Detector	V <sub>OL</sub>	Low Level Output Voltage I <sub>F</sub> = 10 mA, V <sub>CC</sub> = 5 V, I <sub>O</sub> = 2.4 mA	V	0.13	0.6	
	I <sub>OH</sub>	High Level Output Current V <sub>CC</sub> = 30 V, V <sub>F</sub> = 0.8 V	$\mu$ A	1.0	50	
	I <sub>CCH</sub>	High Level Supply Current, V <sub>CC</sub> = 30 V, V <sub>F</sub> = 0.8 V, V <sub>O</sub> = open	mA	0.6	1.3	
	I <sub>CCL</sub>	Low Level Supply Current, V <sub>CC</sub> = 30 V, I <sub>F</sub> = 10 mA, V <sub>O</sub> = open	mA	0.6	1.3	
Coupled	I <sub>FHL</sub>	Threshold Input Current (High $\rightarrow$ Low), V <sub>O</sub> = 0.8 V, I <sub>O</sub> = 0.75 V	mA	1.5	5.0	
	CTR	Current Transfer Ratio, I <sub>F</sub> = 10 mA, V <sub>O</sub> = 0.6 V	%	44	110	
	R <sub>I-O</sub>	Isolation Resistance, V <sub>I-O</sub> = 1 k V <sub>DC</sub> , R <sub>H</sub> = 40 to 60%, T <sub>A</sub> = 25 °C	$\Omega$	10 <sup>11</sup>		
	C <sub>I-O</sub>	Isolation Capacitance, V = 0, f = 1 MHz, T <sub>A</sub> = 25 °C	pF		0.6	
	t <sub>PHL</sub>	Propagation Delay Time <sup>2</sup> , High $\rightarrow$ Low I <sub>F</sub> = 10 mA, R <sub>L</sub> = 20 k $\Omega$ , C <sub>L</sub> = 100 pF, V <sub>THHL</sub> = 1.5 V, V <sub>THLH</sub> = 2.0 V	ns		250	500
	t <sub>PLH</sub>	Propagation Delay Time <sup>2</sup> , High $\rightarrow$ Low I <sub>F</sub> = 10 mA, R <sub>L</sub> = 20 k $\Omega$ , C <sub>L</sub> = 100 pF, V <sub>THHL</sub> = 1.5 V, V <sub>THLH</sub> = 2.0 V	ns		520	750
	t <sub>PLH-tPHL</sub>	Maximum Propagation Delays I <sub>F</sub> = 10 mA, R <sub>L</sub> = 20 k $\Omega$ , C <sub>L</sub> = 100 pF, V <sub>THHL</sub> = 1.5 V, V <sub>THLH</sub> = 2.0 V	ns	-200	270	650
	t <sub>PHL-tPLH</sub>	Pulse Width Distortion I <sub>F</sub> = 10 mA, R <sub>L</sub> = 20 k $\Omega$ , C <sub>L</sub> = 100 pF, V <sub>THHL</sub> = 1.5 V, V <sub>THLH</sub> = 2.0 V	ns		270	650
	CMH	Instantaneous Common Mode Rejection Voltage (Output:High) <sup>3</sup> T <sub>A</sub> = 25°C, I <sub>F</sub> = 0 mA, V <sub>O</sub> > = 3.0 V, V <sub>CM</sub> = 1.5 kV, R <sub>L</sub> = 20 $\Omega$ , C <sub>L</sub> = 100 pF	kV/ $\mu$ s	15		
	CML	Instantaneous Common Mode Rejection Voltage (Output:High) <sup>3</sup> T <sub>A</sub> = 25°C, I <sub>F</sub> = 10 mA, V <sub>O</sub> < = 1.0 V, V <sub>CM</sub> = 1.5 kV, R <sub>L</sub> = 20 $\Omega$ , C <sub>L</sub> = 100 pF	kV/ $\mu$ s	15		

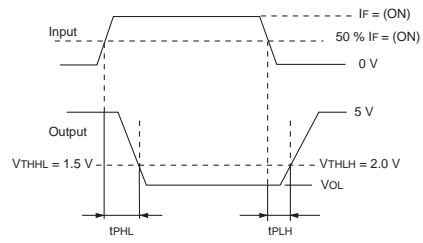
Notes: See Next Page

Notes:

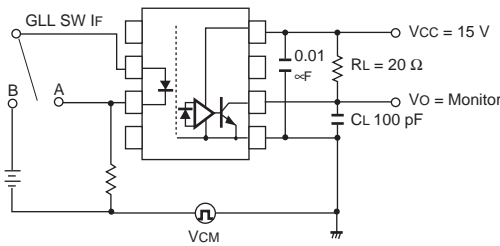
1. Typical values at  $T_A = 25\text{ }^\circ\text{C}$
2. Test Circuit for Propagation delay time



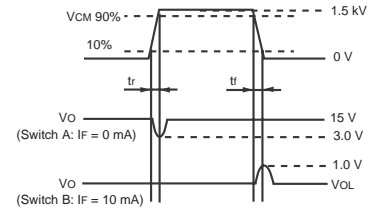
\*CL is approximately 15 pF, which includes probe and stray wiring capacitance.



3. Test circuit for common mode transient immunity



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



**ABSOLUTE MAXIMUM RATINGS<sup>1</sup>** ( $T_A = 25\text{ }^\circ\text{C}$ )

SYMBOLS	PARAMETERS	UNITS	RATINGS
<b>Diode</b>			
$I_F$	Forward Current	mA	25
$V_R$	Reverse Voltage	V	3.0
<b>Detector</b>			
$V_{CC}$	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
<b>Coupler</b>			
$BV$	Isolation Voltage <sup>2</sup>	V <sub>r.m.s.</sub>	5000
$T_{OP}$	Operating Temperature	$^\circ\text{C}$	-40 to +100
$T_{STG}$	Storage Temperature	$^\circ\text{C}$	-55 to +125

Notes:

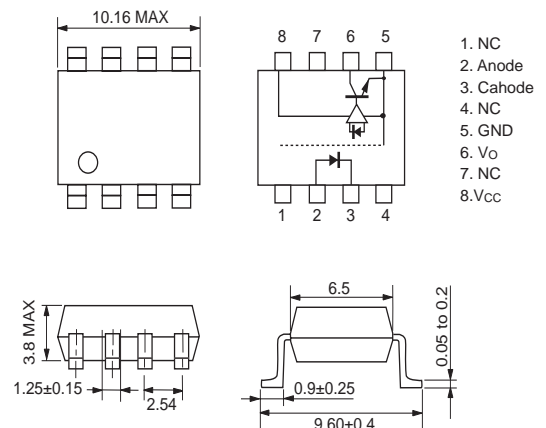
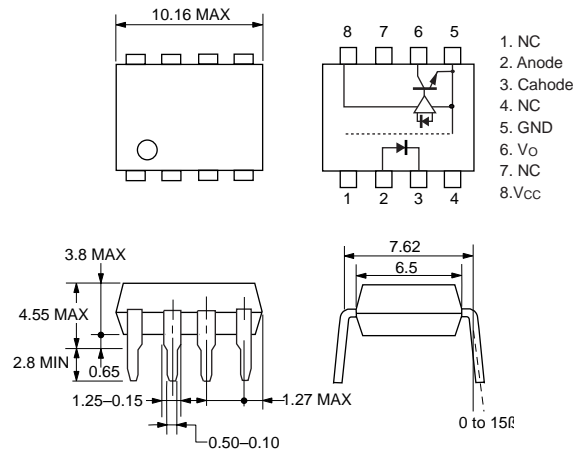
1. Operation in excess of any one of these parameters may result in permanent damage.
2. AC voltage for 1 minute at  $T_A = 25\text{ }^\circ\text{C}$ , RH = 60% between input and output.

**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

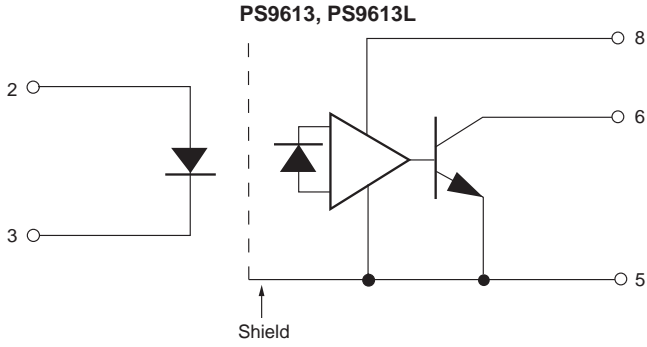
**OUTLINE DIMENSIONS** (Units in mm)

PS9613, PS9613L



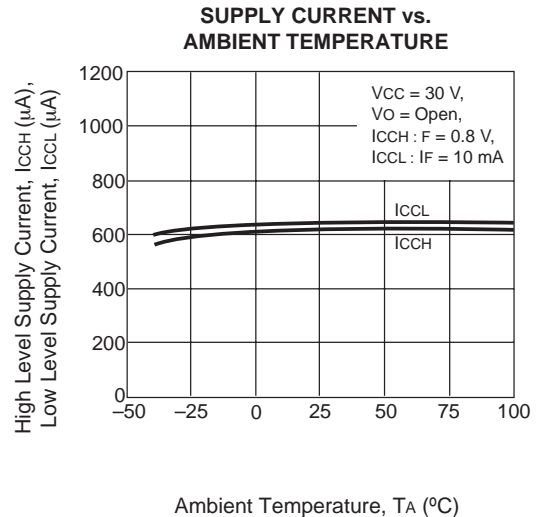
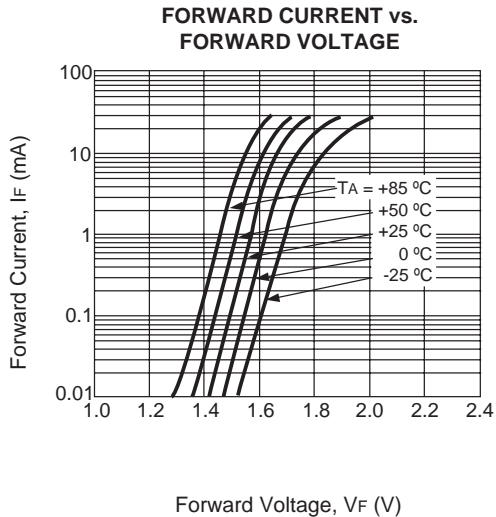
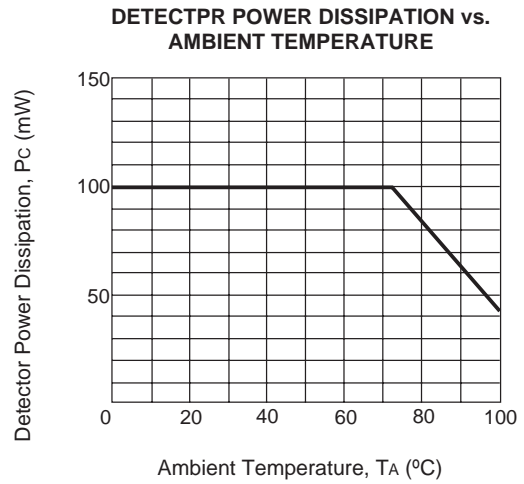
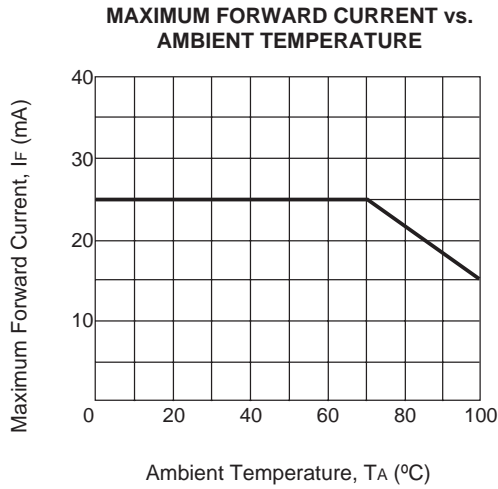
# PS9613, PS9613L

## FUNCTIONAL DIAGRAM



LED	OUTPUT
ON	L
OFF	H

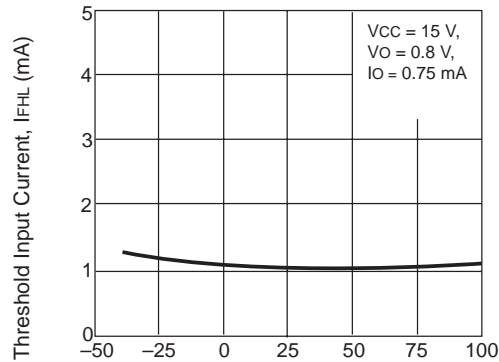
## TYPICAL PERFORMANCE CURVES (T<sub>A</sub> = 25°C, unless otherwise specified)



**Remarks:** The graphs indicate nominal characteristics.

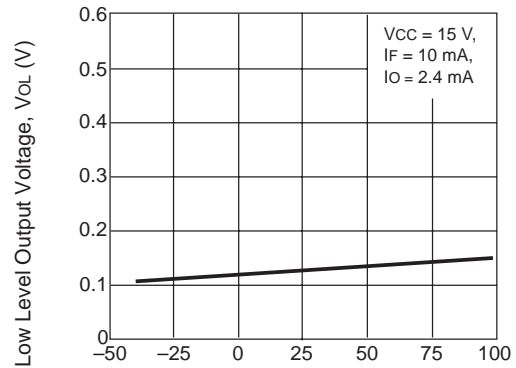
**TYPICAL PERFORMANCE CURVES** ( $T_A = 25^\circ\text{C}$ , unless otherwise specified)

**THRESHOLD INPUT CURRENT vs. AMBIENT TEMPERATURE**



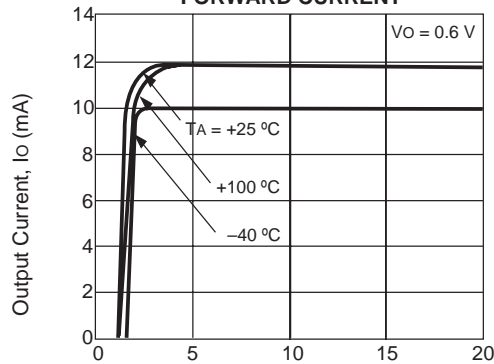
Ambient Temperature,  $T_A$  ( $^\circ\text{C}$ )

**LOW LEVEL OUTPUT VOLTAGE vs. AMBIENT TEMPERATURE**



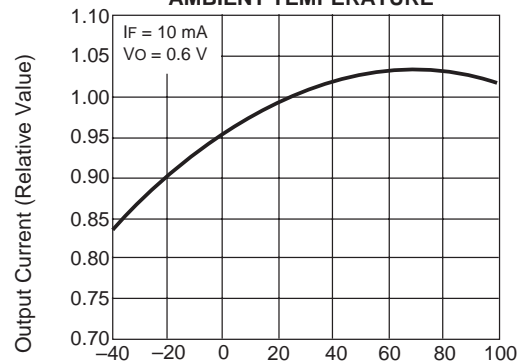
Ambient Temperature,  $T_A$  ( $^\circ\text{C}$ )

**OUTPUT CURRENT vs. FORWARD CURRENT**



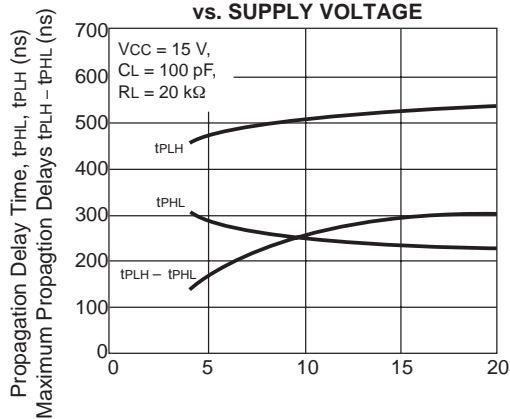
Forward Current,  $I_F$  (mA)

**OUTPUT CURRENT vs. AMBIENT TEMPERATURE**



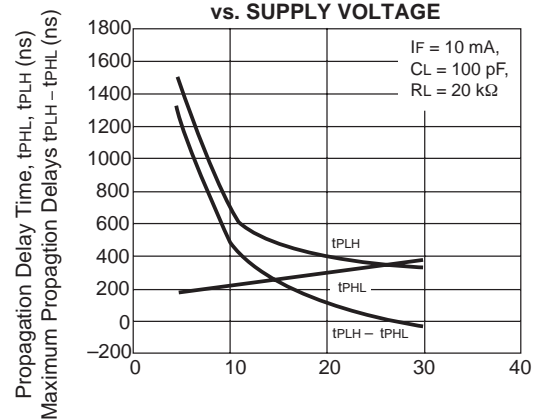
Ambient Temperature,  $T_A$  ( $^\circ\text{C}$ )

**PROPAGATION DELAY TIME, MAXIMUM PROPAGATION DELAYS vs. SUPPLY VOLTAGE**



Forward Current,  $I_F$  (mA)

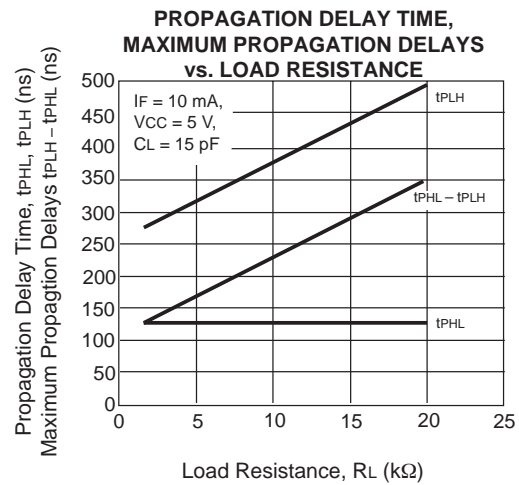
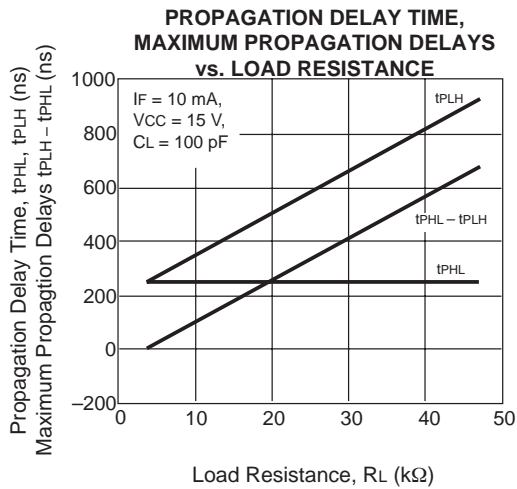
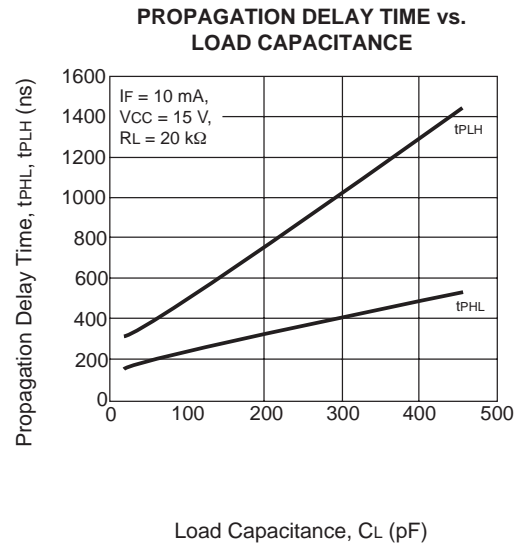
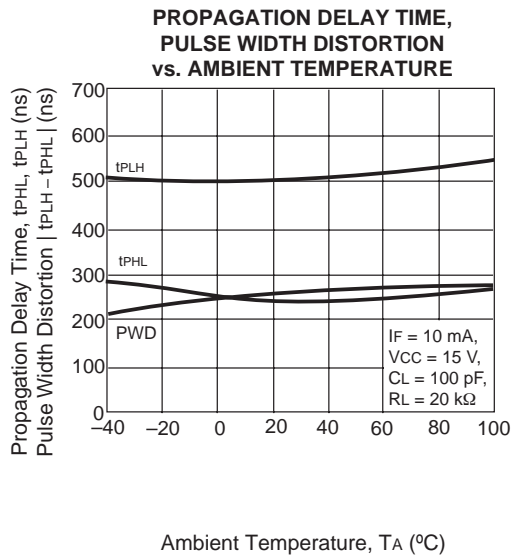
**PROPAGATION DELAY TIME, MAXIMUM PROPAGATION DELAYS vs. SUPPLY VOLTAGE**



Supply Voltage,  $V_{CC}$  (V)

**Remarks:** The graphs indicate nominal characteristics.

**TYPICAL PERFORMANCE CURVES** ( $T_A = 25^\circ\text{C}$ )



Remarks: The graphs indicate nominal characteristics.

**ORDERING INFORMATION**

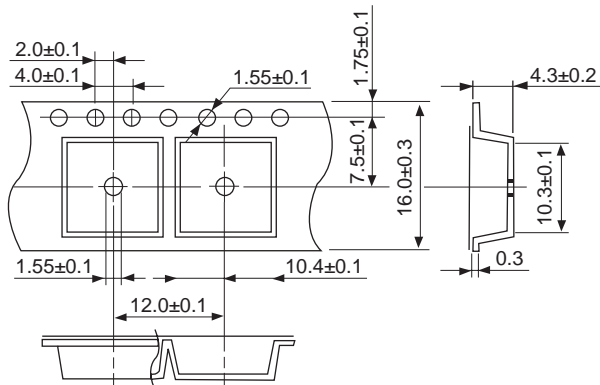
PART NUMBER	PACKAGE	PACKING STYLE	SAFETY STANDARDS	APPLICATION PART NUMBER <sup>1</sup>
PS9613	8 – pin DIP	Magazine case 50 pcs	UL approved	PS9613
PS9613L		Embossed Tape 1000 pcs/reel		PS9613L
PS9613L-E3			Magazine case 50 pcs	VDE0884 approved
PS9613L-E4		Embossed Tape 1000 pcs/reel		
PS9613-V				
PS9613L-V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

Notes:

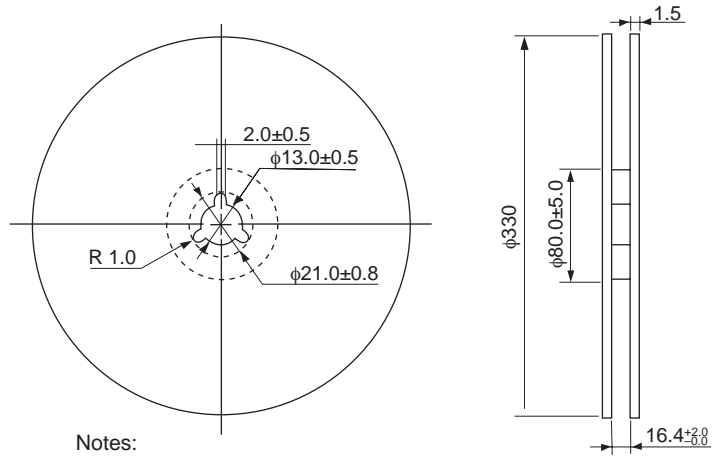
1. For the application of the Safety Standard, following part number should be used.

**TAPING SPECIFICATIONS** (Units in mm)

**OUTLINE AND DIMENSIONS (TAPE)**

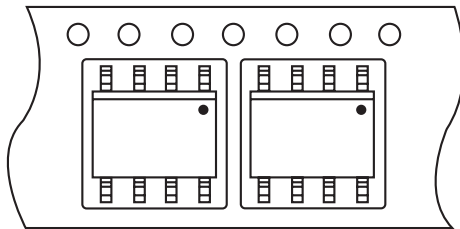


**OUTLINE AND DIMENSIONS (REEL)**

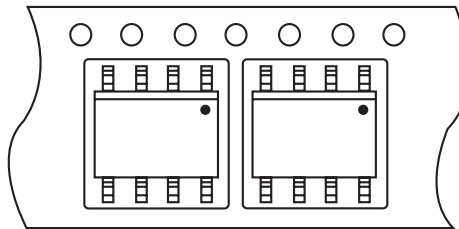


Notes:  
1. Packing : 1000 pcs/reel

**TAPE DIRECTION**  
PS9613L-E3



PS9613L3-E4

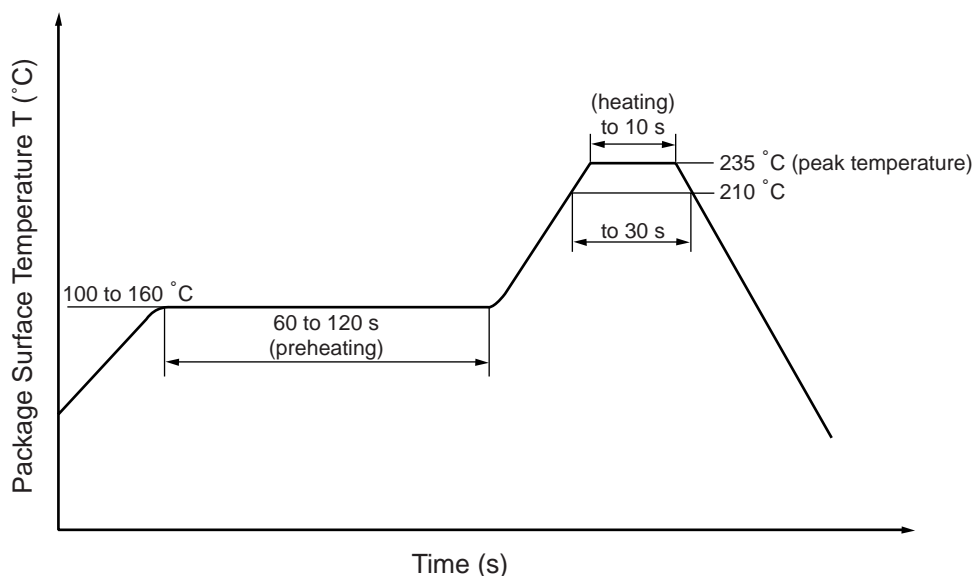


## RECOMMENDED SOLDERING CONDITIONS

### (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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