



**NEC's HIGH CMR, 10 Mbps  
OPEN COLLECTOR OUTPUT TYPE  
5-PIN SOP 3.3V HIGH-SPEED PHOTOCOUPLER**

**PS9121**

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**DESCRIPTION**

The PS9121 is an optically coupled high-speed, isolator containing a GaAlAs LED on the input side and a photodiode and a signal processing circuit on the output side on one chip.

PS9121 is specified high CMR, high CTR and pulse width distortion with operating temperature.

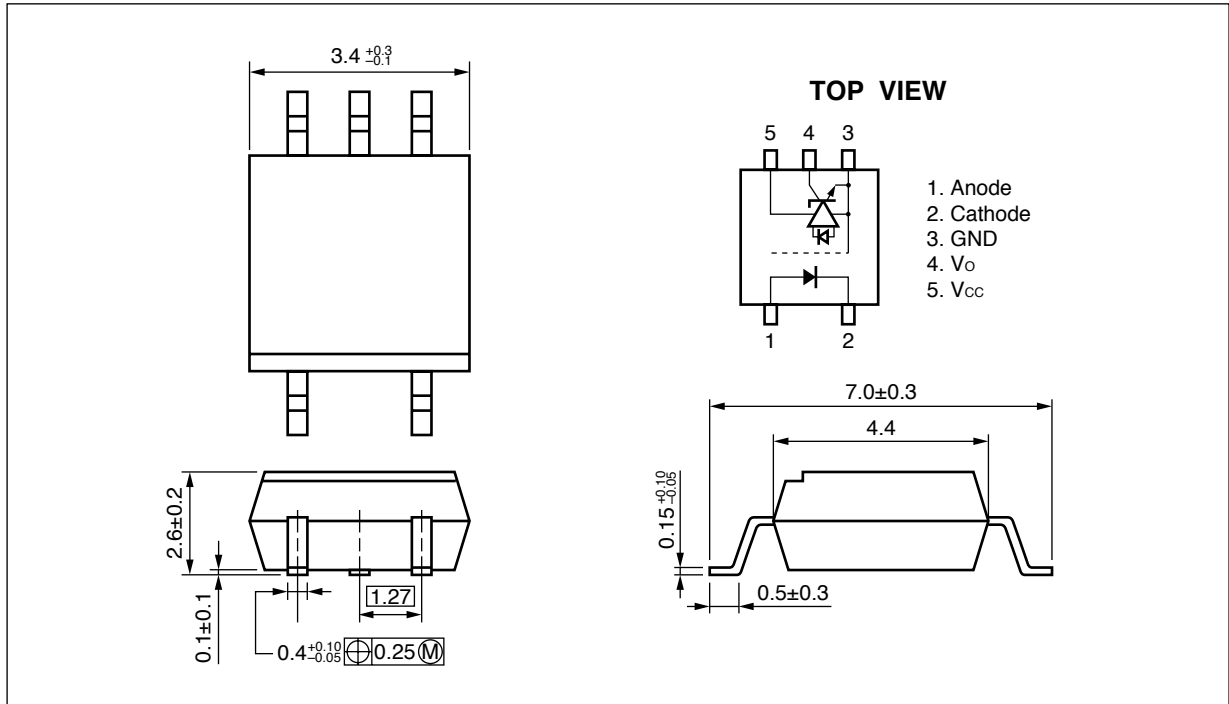
**FEATURES**

- Low Power Consumption ( $V_{CC} : 3.3V$ )
- Extended  $V_{CC}$  Operating Range to 5.5 V, Typical Performance Data included for reference
- High common mode transient immunity ( $CM_H, CM_L = \pm 20 \text{ kV}/\mu\text{s}$  TYP.)
- Pulse width distortion ( $|t_{PHL} - t_{PLH}| = 35 \text{ ns}$  MIN.)
- High-speed (10 Mbps)
- High isolation voltage ( $BV = 2\,500 \text{ Vr.m.s.}$ )
- Open collector output
- Ordering number of taping product: PS9121-F3, F4: 2 500 pcs/reel

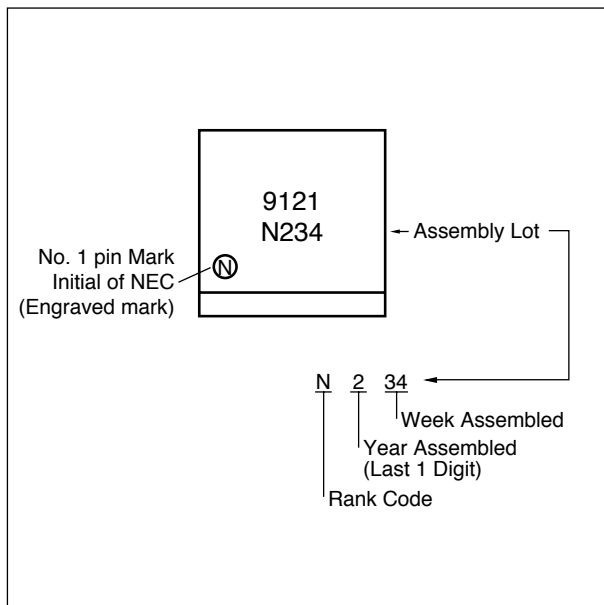
**APPLICATIONS**

- Measurement equipment
- PDP
- FA Network

PACKAGE DIMENSIONS (UNIT: mm)



MARKING



**ORDERING INFORMATION**

Part Number	Package	Packing Style	Application Part Number <sup>*1</sup>
PS9121	5-pin SOP	20 pcs (Tape 20 pcs cut)	PS9121
PS9121-F3		Embossed Tape 2 500 pcs/reel	
PS9121-F4			

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

**ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = 25°C, unless otherwise specified)**

Parameter		Symbol	Ratings	Unit
Diode	Forward Current <sup>*1</sup>	I <sub>F</sub>	30	mA
	Reverse Voltage	V <sub>R</sub>	5	V
Detector	Supply Voltage	V <sub>CC</sub>	7	V
	Output Voltage	V <sub>O</sub>	7	V
	Output Current	I <sub>O</sub>	25	mA
	Power Dissipation <sup>*2</sup>	P <sub>C</sub>	40	mW
Isolation Voltage <sup>*3</sup>		BV	2 500	Vr.m.s.
Operating Ambient Temperature		T <sub>A</sub>	-40 to +85	°C
Storage Temperature		T <sub>stg</sub>	-55 to +125	°C

\*1 Reduced to 0.3 mA/°C at T<sub>A</sub> = 25°C or more.

\*2 Applies to output pin V<sub>O</sub>. Reduced to 1.5 mW/°C at T<sub>A</sub> = 65°C or more.

\*3 AC voltage for 1 minute at T<sub>A</sub> = 25°C, RH = 60% between input and output.

**RECOMMENDED OPERATING CONDITIONS**

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Low Level Input Voltage	V <sub>FL</sub>	0		0.8	V
High Level Input Current	I <sub>FH</sub>	6.3	10	12.5	mA
Supply Voltage	V <sub>CC</sub>	2.7		3.6	V
TTL (R <sub>L</sub> = 1 kΩ, loads)	N			5	
Pull-up resistor	R <sub>L</sub>	330		4 k	Ω

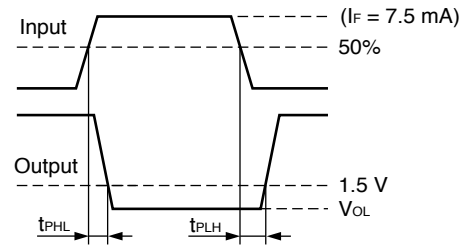
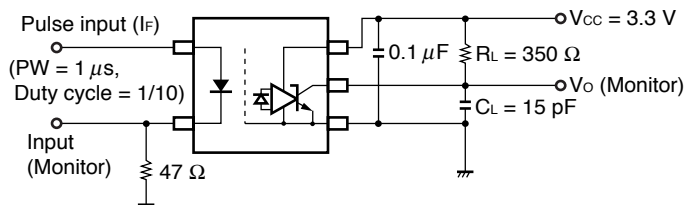
ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = -40 to +85°C, unless otherwise specified)

Parameter		Symbol	Conditions	MIN.	TYP. <sup>*1</sup>	MAX.	Unit
Diode	Forward Voltage	V <sub>F</sub>	I <sub>F</sub> = 10 mA, T <sub>A</sub> = 25°C	1.4	1.65	1.8	V
	Reverse Current	I <sub>R</sub>	V <sub>R</sub> = 3 V, T <sub>A</sub> = 25°C			10	μA
	Terminal Capacitance	C <sub>t</sub>	V = 0 V, f = 1 MHz, T <sub>A</sub> = 25°C		30		pF
Detector	High Level Output Current	I <sub>OH</sub>	V <sub>CC</sub> = V <sub>O</sub> = 3.3 V, V <sub>F</sub> = 0.8 mV		1	80	μA
			V <sub>CC</sub> = V <sub>O</sub> = 5.5 V, V <sub>F</sub> = 0.8 mV		1		
	Low Level Output Voltage <sup>*2</sup>	V <sub>OL</sub>	V <sub>CC</sub> = 3.3 V, I <sub>F</sub> = 5 mA, I <sub>OL</sub> = 13 mA		0.2	0.6	V
			V <sub>CC</sub> = 5.5 V, I <sub>F</sub> = 5 mA, I <sub>OL</sub> = 13 mA		0.2		
	High Level Supply Current	I <sub>CC</sub> H	V <sub>CC</sub> = 3.3 V, I <sub>F</sub> = 0 mA, V <sub>O</sub> = open		4	7	μA
			V <sub>CC</sub> = 5.5 V, I <sub>F</sub> = 0 mA, V <sub>O</sub> = open		5		
Low Level Supply Current	I <sub>CC</sub> L	V <sub>CC</sub> = 3.3 V, I <sub>F</sub> = 10 mA, V <sub>O</sub> = open		7	10		
		V <sub>CC</sub> = 5.5 V, I <sub>F</sub> = 10 mA, V <sub>O</sub> = open		9			
Coupled	Threshold Input Current (H → L)	I <sub>FHL</sub>	V <sub>CC</sub> = 3.3 V, V <sub>O</sub> = 0.8 V, R <sub>L</sub> = 350 Ω		2.5	5	mA
			V <sub>CC</sub> = 5 V, V <sub>O</sub> = 0.8 V, R <sub>L</sub> = 350 Ω		2.5		
	Isolation Resistance	R <sub>I-O</sub>	V <sub>I-O</sub> = 1 kV <sub>DC</sub> , R <sub>H</sub> = 40 to 60%, T <sub>A</sub> = 25°C	10 <sup>11</sup>			Ω
	Isolation Capacitance	C <sub>I-O</sub>	V = 0 V, f = 1 MHz, T <sub>A</sub> = 25°C		0.6		pF
	Propagation Delay Time (H → L) <sup>*3</sup>	t <sub>PHL</sub>	T <sub>A</sub> = 25°C		43	75	ns
			V <sub>CC</sub> = 3.3 V, R <sub>L</sub> = 350 Ω, I <sub>F</sub> = 7.5 mA			100	
			T <sub>A</sub> = 25°C V <sub>CC</sub> = 5 V, R <sub>L</sub> = 350 Ω, I <sub>F</sub> = 7.5 mA		36		
	Propagation Delay Time (L → H) <sup>*3</sup>	t <sub>PLH</sub>	T <sub>A</sub> = 25°C		46	75	
			V <sub>CC</sub> = 3.3 V, R <sub>L</sub> = 350 Ω, I <sub>F</sub> = 7.5 mA			100	
			T <sub>A</sub> = 25°C V <sub>CC</sub> = 5 V, R <sub>L</sub> = 350 Ω, I <sub>F</sub> = 7.5 mA		39		
Rise Time	t <sub>r</sub>	V <sub>CC</sub> = 3.3 V, R <sub>L</sub> = 350 Ω, I <sub>F</sub> = 7.5 mA		20			
		V <sub>CC</sub> = 5 V, R <sub>L</sub> = 350 Ω, I <sub>F</sub> = 7.5 mA					
Fall Time	t <sub>f</sub>	V <sub>CC</sub> = 3.3 V, R <sub>L</sub> = 350 Ω, I <sub>F</sub> = 7.5 mA		10			
		V <sub>CC</sub> = 5 V, R <sub>L</sub> = 350 Ω, I <sub>F</sub> = 7.5 mA					
Pulse Width Distortion (PWD) <sup>*3</sup>	t <sub>PHL</sub> - t <sub>PLH</sub>	V <sub>CC</sub> = 3.3 V, R <sub>L</sub> = 350 Ω, I <sub>F</sub> = 7.5 mA		3	35		
		V <sub>CC</sub> = 5 V, R <sub>L</sub> = 350 Ω, I <sub>F</sub> = 7.5 mA		3			
Propagation Delay Skew	t <sub>PSK</sub>	V <sub>CC</sub> = 3.3 V, R <sub>L</sub> = 350 Ω, I <sub>F</sub> = 7.5 mA			40		
Common Mode Transient Immunity at High Level Output <sup>*4</sup>	CM <sub>H</sub>	R <sub>L</sub> = 350 Ω, T <sub>A</sub> = 25°C, I <sub>F</sub> = 0 mA, V <sub>O(MIN.)</sub> = 2 V, V <sub>CM</sub> = 1 kV		15	20	kV/μs	
Common Mode Transient Immunity at Low Level Output <sup>*4</sup>	CM <sub>L</sub>	R <sub>L</sub> = 350 Ω, T <sub>A</sub> = 25°C, I <sub>F</sub> = 7.5 mA, V <sub>O(MAX.)</sub> = 0.8 V, V <sub>CM</sub> = 1 kV		15	20		

\*1 Typical values at  $T_A = 25^\circ\text{C}$

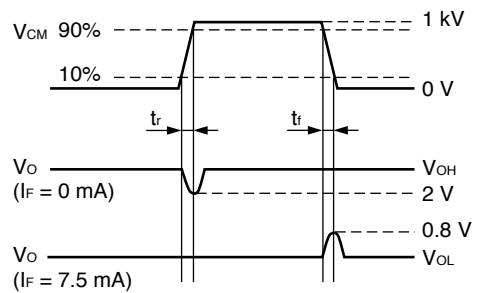
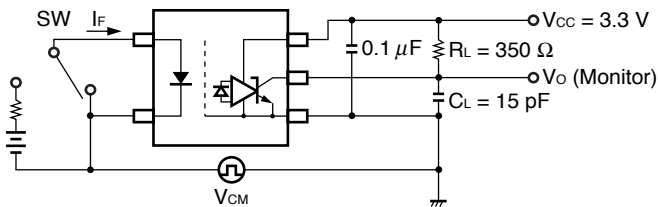
\*2 Because  $V_{OL}$  of 2 V or more may be output when LED current input and when output supply of  $V_{CC} = 2.6\text{ V}$  or less, it is important to confirm the characteristics (operation with the power supply on and off) during design, before using this device.

\*3 Test circuit for propagation delay time



**Remark**  $C_L$  includes probe and stray wiring capacitance.

\*4 Test circuit for common mode transient immunity



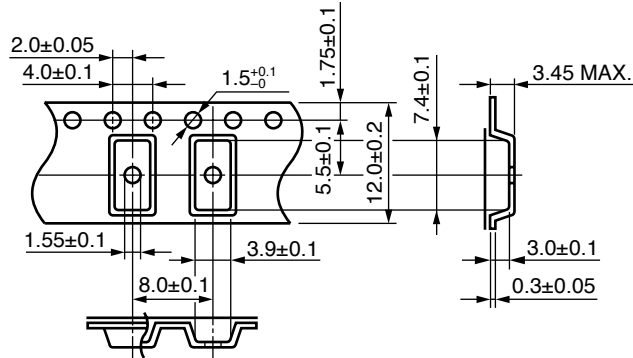
**Remark**  $C_L$  includes probe and stray wiring capacitance.

### USAGE CAUTIONS

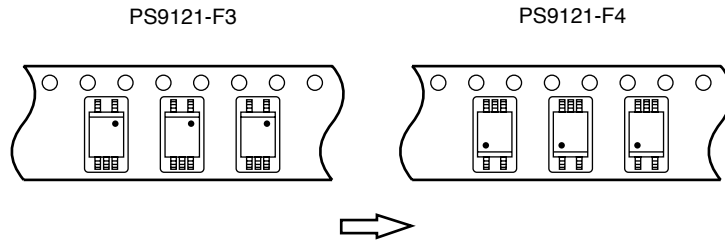
1. This product is weak for static electricity by designed with high-speed integrated circuit so protect against static electricity when handling.
2. By-pass capacitor of  $0.1\ \mu\text{F}$  is used between  $V_{CC}$  and GND near device. Also, ensure that the distance between the leads of the photocoupler and capacitor is no more than 10 mm.
3. Avoid storage at a high temperature and high humidity.

TAPING SPECIFICATIONS (UNIT: mm)

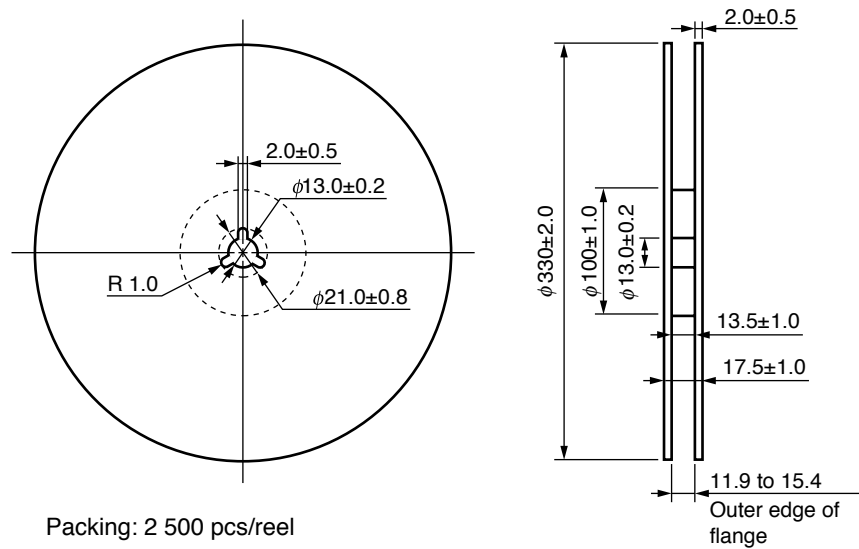
Outline and Dimensions (Tape)



Tape Direction



Outline and Dimensions (Reel)

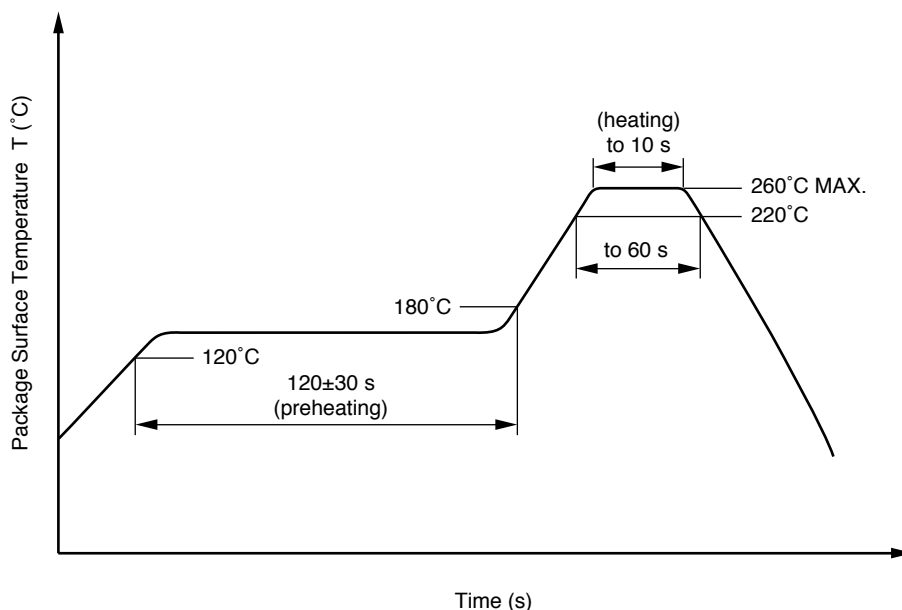


## 1. Recommended soldering conditions

### (1) Infrared reflow soldering

- Peak reflow temperature 260°C or below (package surface temperature)
- Time of peak reflow temperature 10 seconds or less
- Time of temperature higher than 220°C 60 seconds or less
- Time to preheat temperature from 120 to 180°C 120±30 s
- Number of reflows Three
- Flux Rosin flux containing small amount of chlorine (The flux with a maximum chlorine content of 0.2 Wt% is recommended.)

Recommended Temperature Profile of Infrared Reflow



### (2) Wave soldering

- Temperature 260°C or below (molten solder temperature)
- Time 10 seconds or less
- Preheating conditions 120°C or below (package surface temperature)
- Number of times One (Allowed to be dipped in solder including plastic mold portion.)
- Flux Rosin flux containing small amount of chlorine (The flux with a maximum chlorine content of 0.2 Wt% is recommended.)

### (3) Cautions

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

## 2. Cautions regarding noise

Be aware that when voltage is applied suddenly between the photocoupler's input and output or between collector-emitters at startup, the output side may enter the on state, even if the voltage is within the absolute maximum ratings.

### 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.