



# NEC's HIGH CMR, 10 Mbps OPEN COLLECTOR OUTPUT TYPE 5-PIN SOP PHOTOCOUPLER

PS9114

## FEATURES

- **HIGH COMMON MODE TRANSIENT IMMUNITY**  
CMH, CML =  $\pm 20$  kV/ $\mu$ s TYP
- **SMALL PACKAGE**  
5-pin SOP
- **HIGH SPEED**  
10 Mbps
- **PULSE WIDTH DISTORTION**  
 $|t_{PHL} - t_{PLH}| = 3$  ns TYP
- **HIGH ISOLATION VOLTAGE**  
BV = 2500 Vr.m.s.
- **OPEN COLLECTOR OUTPUT**
- **AVAILABLE IN TAPE AND REEL**  
PS9114-F3, F4: 2500 pcs/reel

## DESCRIPTION

NEC's PS9114 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.

## APPLICATIONS

- **FACTORY AUTOMATION NETWORK**
- **MEASUREMENT EQUIPMENT**
- **MOTOR DRIVE / INVERTER**

## ELECTRICAL CHARACTERISTICS (TA = 0 to +85°C, Unless otherwise specified)

| PART NUMBER |                  |  |          | PS9114           |      |           |
|-------------|------------------|--|----------|------------------|------|-----------|
| SYMBOL      | PARAMETERS       | UNITS  | MIN      | TYP <sup>1</sup> | MAX  |           |
| Diode       | V <sub>F</sub>   | Forward Voltage, I <sub>F</sub> = 10 mA, T <sub>A</sub> = 25°C   | V        | 1.4              | 1.65 | 1.9       |
|             | I <sub>R</sub>   | Reverse Current, V <sub>R</sub> = 3 V, T <sub>A</sub> = 25°C   | $\mu$ A  |                  |      | 10        |
|             | C <sub>t</sub>   | Capacitance, V = 0, f = 1 MHz, T <sub>A</sub> = 25°C   | pF       |                  | 30   |           |
| Detector    | I <sub>OH</sub>  | High Level Output Current<br>V <sub>CC</sub> = V <sub>O</sub> = 5.5 V, V <sub>F</sub> = 0.8 V  | $\mu$ A  |                  | 0.02 | 250       |
|             | V <sub>OL</sub>  | Low Level Output Voltage <sup>2</sup><br>V <sub>CC</sub> = 5.5 V, I <sub>F</sub> = 5 mA, I <sub>OL</sub> = 13 mA                               | V        |                  | 0.15 | 0.6       |
|             | I <sub>CCH</sub> | High Level Supply Current, V <sub>CC</sub> = 5.5 V, I <sub>F</sub> = 0 mA  | mA       |                  | 3    | 8         |
|             | I <sub>ACL</sub> | Low Level Supply Current, V <sub>CC</sub> = 5.5 V, I <sub>F</sub> = 10 mA  | mA       |                  | 7.0  | 11        |
| Coupled     | I <sub>FHL</sub> | Threshold Input Current, High $\rightarrow$ Low, V <sub>CC</sub> = 5 V, V <sub>O</sub> = 0.8V, R <sub>L</sub> = 350 $\Omega$                   | mA       |                  | 2    | 5         |
|             | 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>3</sup> , High $\rightarrow$ Low<br>V <sub>CC</sub> = 5 V, R <sub>L</sub> = 350 $\Omega$ , I <sub>F</sub> = 7.5 mA | ns       |                  | 54   | 75<br>100 |
|             | t <sub>PLH</sub> | Propagation Delay Time <sup>3</sup> , Low $\rightarrow$ High<br>V <sub>CC</sub> = 5 V, R <sub>L</sub> = 350 $\Omega$ , I <sub>F</sub> = 7.5 mA | ns       |                  | 51   | 75<br>100 |
|             | t <sub>r</sub>   | Rise Time, V <sub>CC</sub> = 5 V, R <sub>L</sub> = 350 $\Omega$ , I <sub>F</sub> = 7.5 mA  | mA       |                  | 20   |           |
|             | t <sub>f</sub>   | Fall Time, V <sub>CC</sub> = 5 V, R <sub>L</sub> = 350 $\Omega$ , I <sub>F</sub> = 7.5 mA  | mA       |                  | 10   |           |

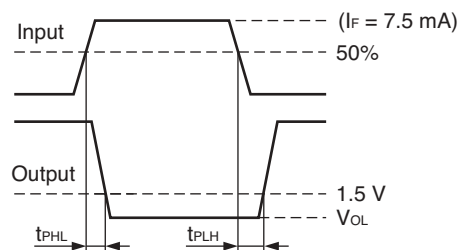
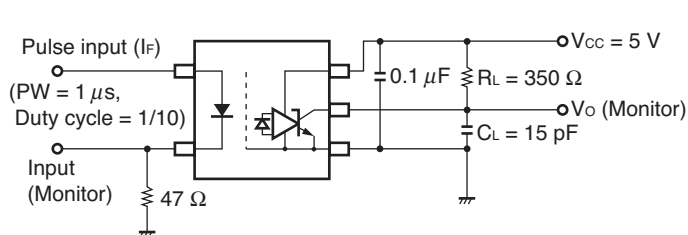
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## ELECTRICAL CHARACTERISTICS ( $T_A = 0$ to $+85^\circ\text{C}$ , Unless otherwise specified), Continued

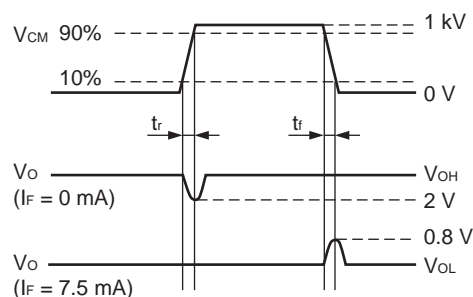
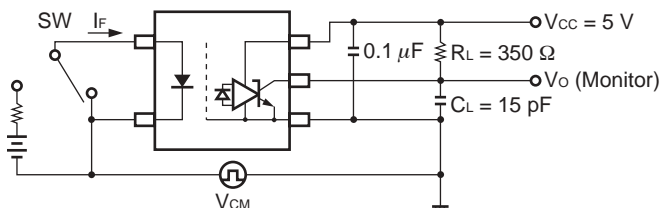
|         |                       | PART NUMBER  |                   |     | PS9114 |     |  |
|---------|-----------------------|--|-------------------|-----|--------|-----|--|
| SYMBOL  |                       | PARAMETERS   | UNITS             | MIN | TYP    | MAX |  |
| Coupled | $ t_{PHL} - t_{PLH} $ | Pulse Width Distortion, (PWD) <sup>3</sup> , $V_{CC} = 5\text{ V}$ , $R_L = 350\ \Omega$ , $I_F = 7.5\text{ mA}$   | ns                |     | 3      | 50  |  |
|         | $t_{PSK}$             | Propagation Delay Skew, $V_{CC} = 5\text{ V}$ , $R_L = 350\ \Omega$ , $I_F = 7.5\text{ mA}$  | ns                |     |        | 60  |  |
|         | CMH                   | Common Mode Transient Immunity at High Level Output <sup>4</sup> , $V_{CC} = 5\text{ V}$ , $T_A = 25^\circ\text{C}$ , $I_F = 0\text{ mA}$ , $V_O(\text{MIN}) = 2\text{ V}$ , $V_{CM} = 1\text{ kV}$    | kV/ $\mu\text{s}$ | 10  | 20     |     |  |
|         | CML                   | Common Mode Transient Immunity at Low Level Output <sup>4</sup> , $V_{CC} = 5\text{ V}$ , $T_A = 25^\circ\text{C}$ , $I_F = 7.5\text{ mA}$ , $V_O(\text{MAX}) = 0.8\text{ V}$ , $V_{CM} = 1\text{ kV}$ | kV/ $\mu\text{s}$ | 10  | 20     |     |  |

## Notes:

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



## 4. Test Circuit for common mode transient immunity



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

## USAGE CAUTIONS

- This device is ESD sensitive.
- Bypass capacitor of more than  $0.1\ \mu\text{F}$  must be used between  $V_{CC}$  and GND within 10 mm of the device.

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

| SYMBOLS   | PARAMETERS                     | UNITS            | RATINGS     |
|-----------|--------------------------------|------------------|-------------|
| Diode     |                                |                  |             |
| $I_F$     | Forward Current                | mA               | 30          |
| $V_R$     | Reverse Voltage                | V                | 5           |
| Detector  |                                |                  |             |
| $V_{CC}$  | Supply Voltage                 | V                | 7           |
| $V_O$     | Output Voltage                 | V                | 7           |
| $I_O$     | Output Current                 | mA               | 25          |
| $P_C$     | Power Dissipation <sup>2</sup> | mW               | 40          |
| Coupled   |                                |                  |             |
| BV        | Isolation Voltage <sup>3</sup> | $V_{r.m.s.}$     | 2500        |
| $T_A$     | Operating Temperature          | $^\circ\text{C}$ | -40 to +85  |
| $T_{STG}$ | Storage Temperature            | $^\circ\text{C}$ | -55 to +125 |

## Notes:

- Operation in excess of any one of these parameters may result in permanent damage.
- Applies to output pin  $V_O$ . Reduced to  $1.5\text{ mW}/^\circ\text{C}$  at  $T_A = 65^\circ\text{C}$  or more.
- AC voltage for 1 minute at  $T_A = 25^\circ\text{C}$ ,  $RH = 60\%$  between input and output.

## RECOMMENDED OPERATING CONDITIONS

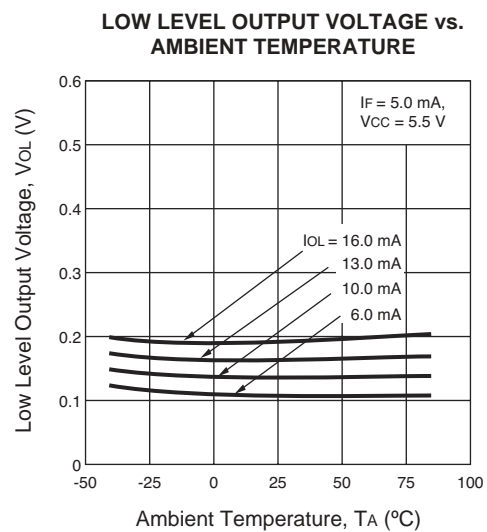
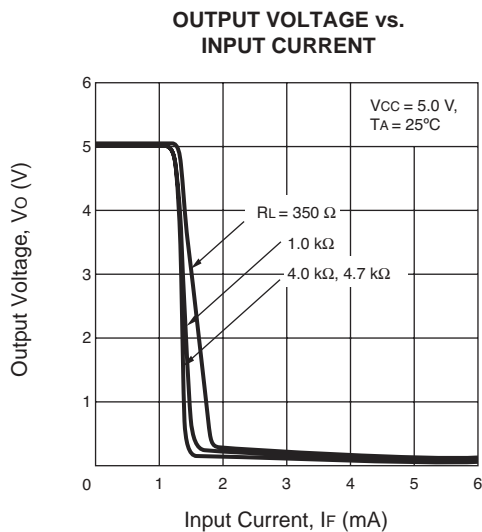
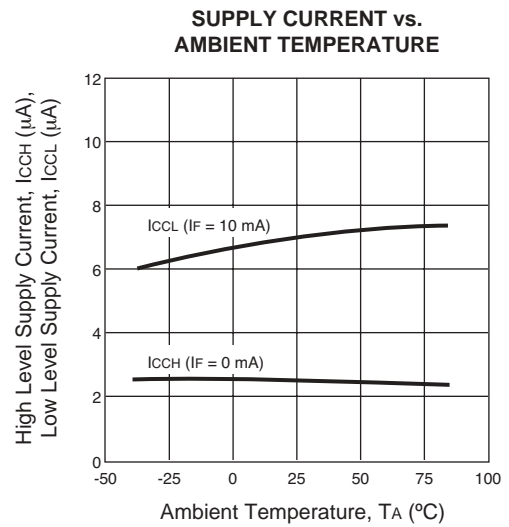
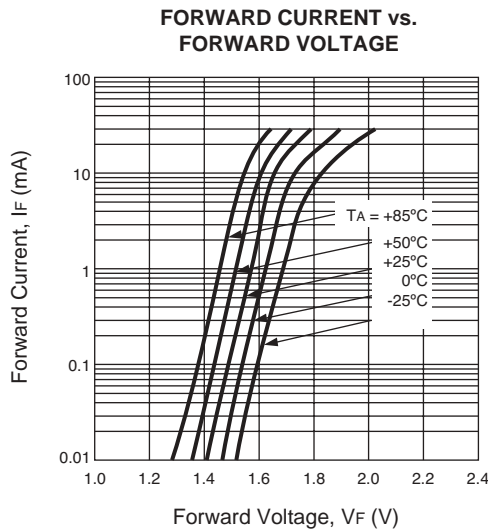
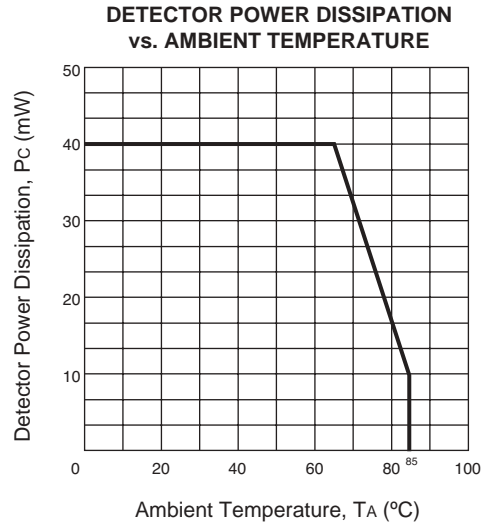
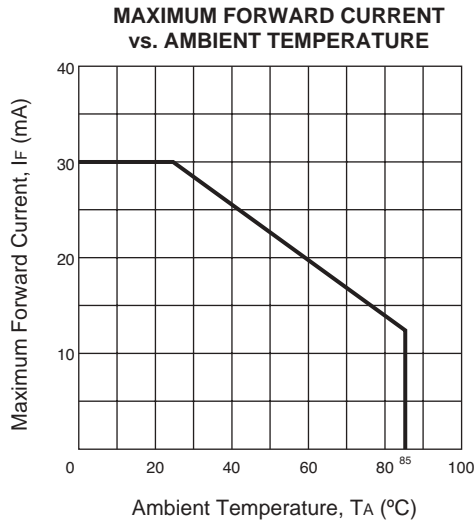
| PART NUMBER |                                      |          | PS9114 |     |      |
|-------------|--------------------------------------|----------|--------|-----|------|
| SYMBOLS     | PARAMETERS                           | UNITS    | MIN    | TYP | MAX  |
| $V_{FL}$    | Low Level Input Voltage              | mA       | 0      |     | 0.8  |
| $I_{FH}$    | High Level Input Current             | mA       | 6.3    | 10  | 12.5 |
| $V_{CC}$    | Supply Voltage                       | V        | 4.5    | 5.0 | 5.5  |
| N           | TTL( $R_L = 1\text{ k}\Omega$ loads) |          |        |     | 5    |
| $R_L$       | Operating Temperature                | $\Omega$ | 300    |     | 4 k  |

## ORDERING INFORMATION

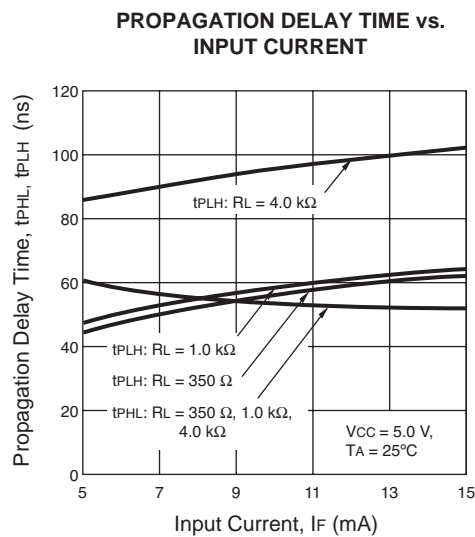
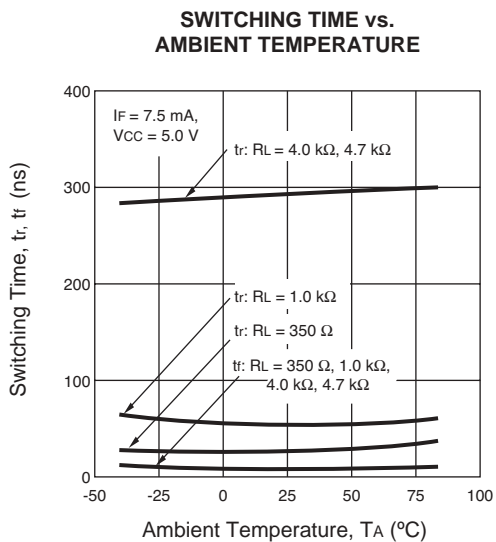
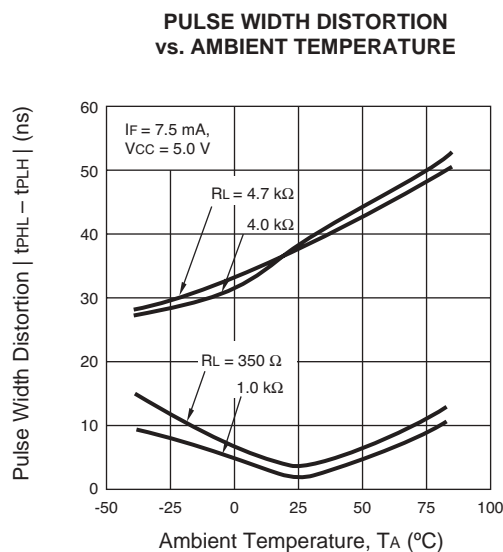
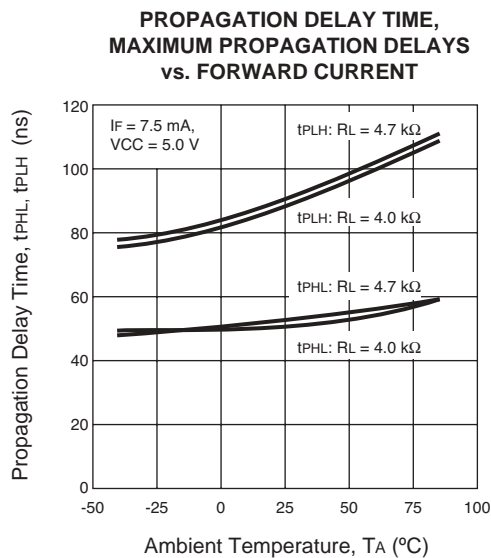
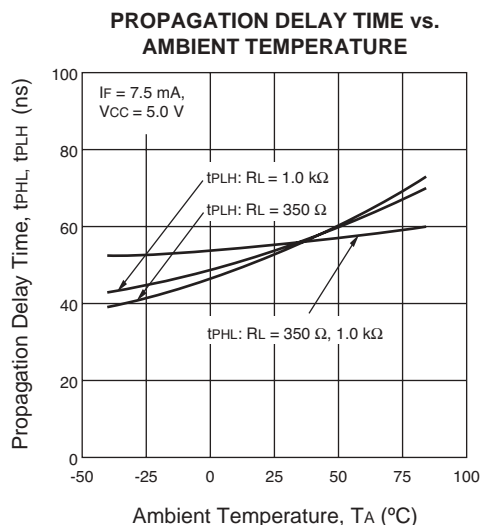
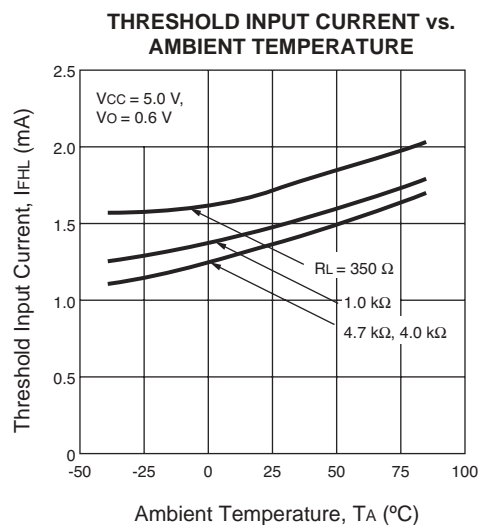
| PART NUMBER | PACKAGE   | PACKAGE STYLE                  | APPLICATION PART NUMBER* |
|-------------|-----------|--------------------------------|--------------------------|
| PS9114      | 5-pin SOP | Magazine case<br>100 PCS       | PS9114                   |
| PS9114-F3   |           | Embossed Tape<br>2500 pcs/reel |                          |
| PS9114-F4   |           |                                |                          |

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

TYPICAL PERFORMANCE CURVES (TA = 25°C)



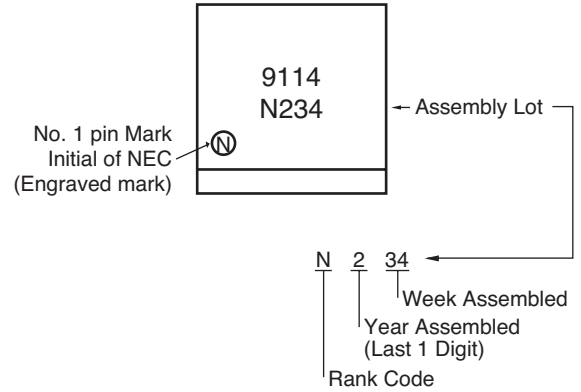
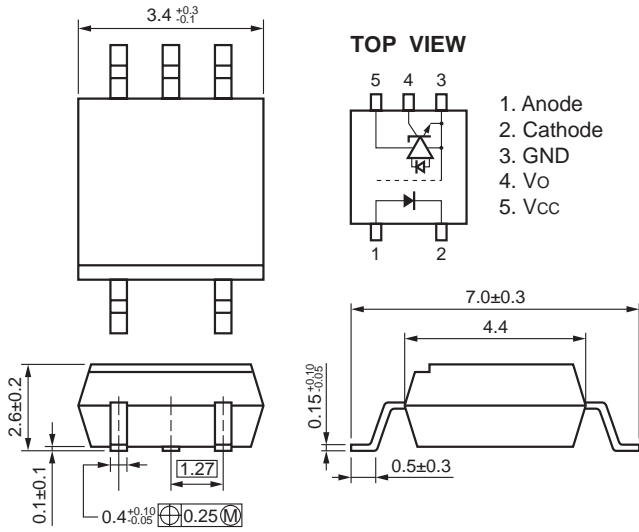
TYPICAL PERFORMANCE CURVES (TA = 25°C)



**OUTLINE DIMENSIONS** (Units in mm)

**MARKING**

PS9114



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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