

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

–NEPOC Series–

### DESCRIPTION

The 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.

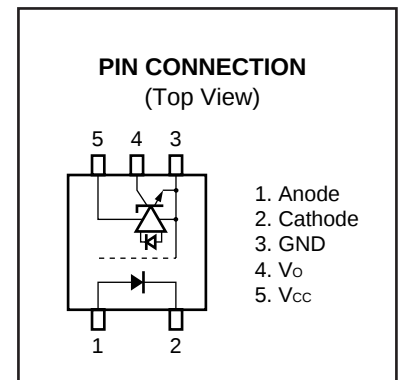
The PS9114 is specified high CMR, high CTR and pulse width distortion with operating temperature.

### FEATURES

- High common mode transient immunity ( $CM_H, CM_L = \pm 20 \text{ kV}/\mu\text{s}$  TYP.)
- ★ • Small package (5-pin SOP)
- Pulse width distortion ( $|t_{PHL} - t_{PLH}| = 3 \text{ ns}$  TYP.)
- High-speed (10 Mbps)
- High isolation voltage ( $BV = 2\,500 \text{ Vr.m.s.}$ )
- Open collector output
- Ordering number of taping product: PS9114-F3, F4: 2 500 pcs/reel
- ★ • Pb-Free product
- ★ • Safety standards
  - UL approved: File No. E72422
  - DIN EN60747-5-2 (VDE0884 Part2) approved No. 40008902 (Option)

### APPLICATIONS

- Measurement equipment
- PDP
- FA Network

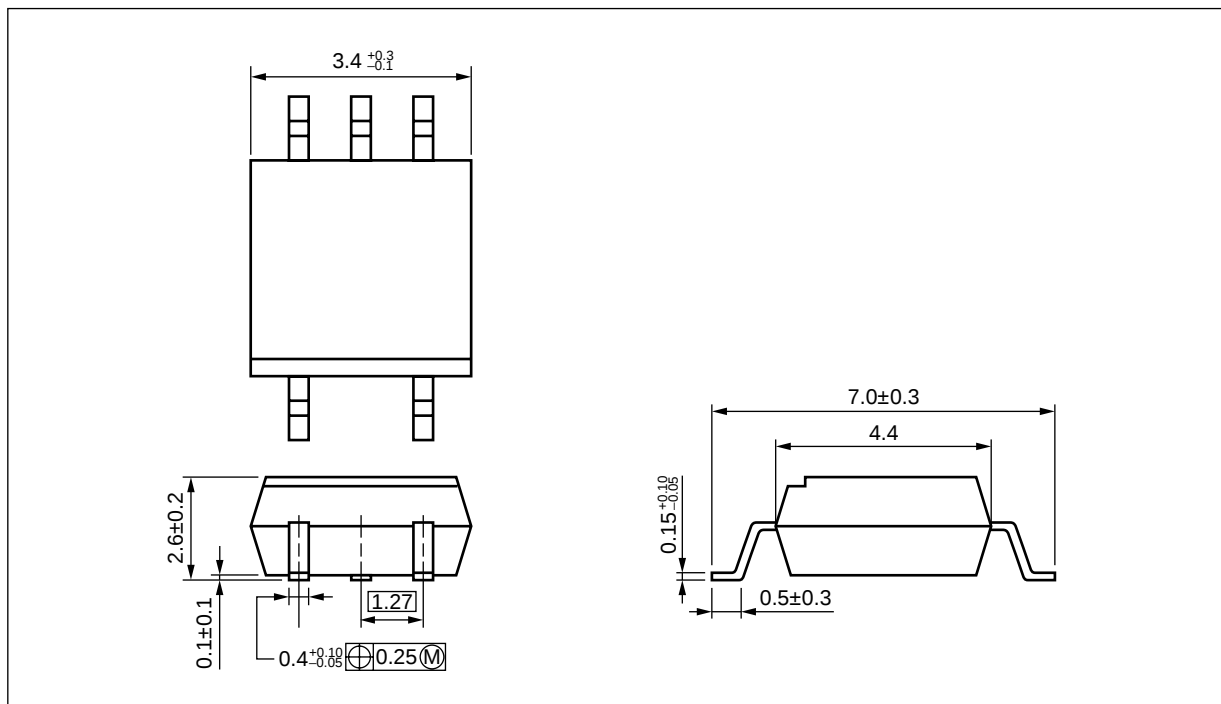


### TRUTH TABLE

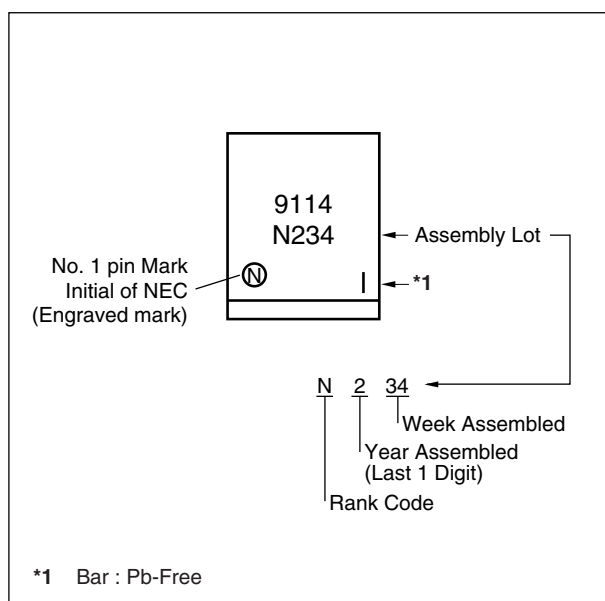
| LED | Output |
|-----|--------|
| ON  | L      |
| OFF | H      |

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Not all devices/types available in every country. Please check with local NEC Compound Semiconductor Devices representative for availability and additional information.

PACKAGE DIMENSIONS (UNIT: mm)



★ MARKING



★ ORDERING INFORMATION

| Part Number | Order Number  | Solder Plating Specification | Packing Style                | Safety Standard Approval                                | Application Part Number <sup>*1</sup> |
|-------------|---------------|------------------------------|------------------------------|---------------------------------------------------------|---------------------------------------|
| PS9114      | PS9114-A      | Pb-Free <sup>*2</sup>        | Magazine case 100 pcs        | Standard products<br>(UL approved)                      | PS9114                                |
| PS9114-F3   | PS9114-F3-A   |                              | Embossed Tape 2 500 pcs/reel |                                                         |                                       |
| PS9114-F4   | PS9114-F4-A   |                              |                              |                                                         |                                       |
| PS9114-V    | PS9114-V-A    |                              | Magazine case 100 pcs        | DIN EN60747-5-2<br>(VDE0884 Part2)<br>Approved (Option) |                                       |
| PS9114-V-F3 | PS9114-V-F3-A |                              | Embossed Tape 2 500 pcs/reel |                                                         |                                       |
| PS9114-V-F4 | PS9114-V-F4-A |                              |                              |                                                         |                                       |

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

<sup>\*2</sup> With regards to terminal solder (the solder contains lead) plated products (conventionally plated), contact your nearby sales office.

**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      |

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

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

<sup>\*3</sup> AC voltage for 1 minute at T<sub>A</sub> = 25°C, RH = 60% between input and output.  
Pins 1-2 shorted together, 3-4 shorted together.

**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> | 4.5  | 5.0  | 5.5  | V    |
| TTL (R <sub>L</sub> = 1 kΩ, loads) | N               |      |      | 5    |      |
| Pull-up resistor                   | R <sub>L</sub>  | 330  |      | 4 k  | Ω    |

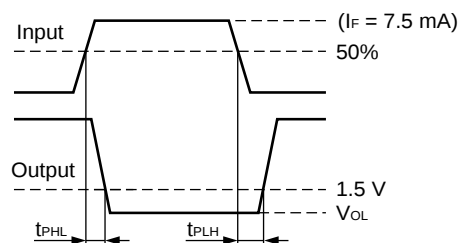
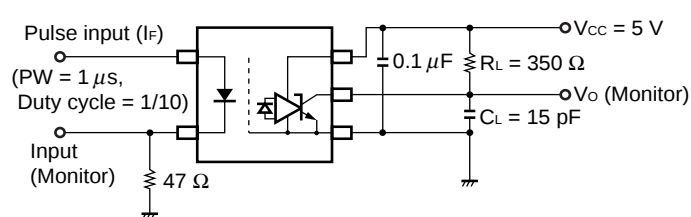
**ELECTRICAL CHARACTERISTICS (Unless otherwise specified,  $T_A = -40$  to  $+85^\circ\text{C}$ )**

| Parameter |                                                                         | Symbol                | Conditions                                                                                                                        | MIN.      | TYP. <sup>*1</sup> | MAX. | Unit              |
|-----------|-------------------------------------------------------------------------|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------|-----------|--------------------|------|-------------------|
| Diode     | Forward Voltage                                                         | $V_F$                 | $I_F = 10\text{ mA}$ , $T_A = 25^\circ\text{C}$                                                                                   | 1.4       | 1.65               | 1.9  | V                 |
|           | Reverse Current                                                         | $I_R$                 | $V_R = 3\text{ V}$ , $T_A = 25^\circ\text{C}$                                                                                     |           |                    | 10   | $\mu\text{A}$     |
|           | Terminal Capacitance                                                    | $C_t$                 | $V = 0\text{ V}$ , $f = 1\text{ MHz}$ , $T_A = 25^\circ\text{C}$                                                                  |           | 30                 |      | pF                |
| Detector  | High Level Output Current                                               | $I_{OH}$              | $V_{CC} = V_O = 5.5\text{ V}$ , $V_F = 0.8\text{ V}$                                                                              |           | 0.02               | 250  | $\mu\text{A}$     |
|           | Low Level Output Voltage <sup>*2</sup>                                  | $V_{OL}$              | $V_{CC} = 5.5\text{ V}$ , $I_F = 5\text{ mA}$ , $I_{OL} = 13\text{ mA}$                                                           |           | 0.15               | 0.6  | V                 |
|           | High Level Supply Current                                               | $I_{CCH}$             | $V_{CC} = 5.5\text{ V}$ , $I_F = 0\text{ mA}$ , $V_O = \text{open}$                                                               |           | 3                  | 8    | mA                |
|           | Low Level Supply Current                                                | $I_{CCL}$             | $V_{CC} = 5.5\text{ V}$ , $I_F = 10\text{ mA}$ , $V_O = \text{open}$                                                              |           | 7.0                | 11   | mA                |
| Coupled   | Threshold Input Current<br>(H $\rightarrow$ L)                          | $I_{FHL}$             | $V_{CC} = 5\text{ V}$ , $V_O = 0.8\text{ V}$ , $R_L = 350\ \Omega$                                                                |           | 2                  | 5    | mA                |
|           | Isolation Resistance                                                    | $R_{I-O}$             | $V_{I-O} = 1\text{ kV}_{DC}$ , $R_H = 40$ to $60\%$ ,<br>$T_A = 25^\circ\text{C}$                                                 | $10^{11}$ |                    |      | $\Omega$          |
|           | Isolation Capacitance                                                   | $C_{I-O}$             | $V = 0\text{ V}$ , $f = 1\text{ MHz}$ , $T_A = 25^\circ\text{C}$                                                                  |           | 0.6                |      | pF                |
|           | Propagation Delay Time<br>(H $\rightarrow$ L) <sup>*3</sup>             | $t_{PHL}$             | $T_A = 25^\circ\text{C}$<br>$V_{CC} = 5\text{ V}$ , $R_L = 350\ \Omega$ , $I_F = 7.5\text{ mA}$                                   |           | 54                 | 75   | ns                |
|           | Propagation Delay Time<br>(L $\rightarrow$ H) <sup>*3</sup>             | $t_{PLH}$             | $T_A = 25^\circ\text{C}$<br>$V_{CC} = 5\text{ V}$ , $R_L = 350\ \Omega$ , $I_F = 7.5\text{ mA}$                                   |           | 51                 | 75   |                   |
|           | Rise Time                                                               | $t_r$                 | $V_{CC} = 5\text{ V}$ , $R_L = 350\ \Omega$ , $I_F = 7.5\text{ mA}$                                                               |           | 20                 |      | ns                |
|           | Fall Time                                                               | $t_f$                 | $V_{CC} = 5\text{ V}$ , $R_L = 350\ \Omega$ , $I_F = 7.5\text{ mA}$                                                               |           | 10                 |      |                   |
|           | Pulse Width Distortion<br>(PWD) <sup>*3</sup>                           | $ t_{PHL} - t_{PLH} $ | $V_{CC} = 5\text{ V}$ , $R_L = 350\ \Omega$ , $I_F = 7.5\text{ mA}$                                                               |           | 3                  | 50   | ns                |
|           | Propagation Delay Skew                                                  | $t_{PSK}$             | $V_{CC} = 5\text{ V}$ , $R_L = 350\ \Omega$ , $I_F = 7.5\text{ mA}$                                                               |           |                    | 60   |                   |
|           | Common Mode<br>Transient Immunity at High<br>Level Output <sup>*4</sup> | $CM_H$                | $R_L = 350\ \Omega$ , $T_A = 25^\circ\text{C}$ , $I_F = 0\text{ mA}$ ,<br>$V_{O(MIN.)} = 2\text{ V}$ , $V_{CM} = 1\text{ kV}$     | 10        | 20                 |      | kV/ $\mu\text{s}$ |
|           | Common Mode<br>Transient Immunity at Low<br>Level Output <sup>*4</sup>  | $CM_L$                | $R_L = 350\ \Omega$ , $T_A = 25^\circ\text{C}$ , $I_F = 7.5\text{ mA}$ ,<br>$V_{O(MAX.)} = 0.8\text{ V}$ , $V_{CM} = 1\text{ kV}$ | 10        | 20                 |      | kV/ $\mu\text{s}$ |

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

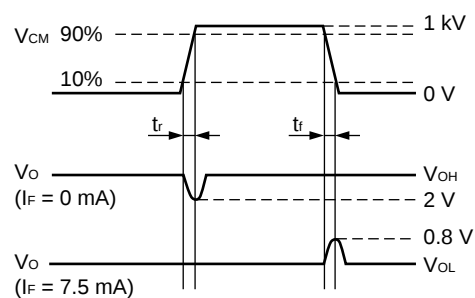
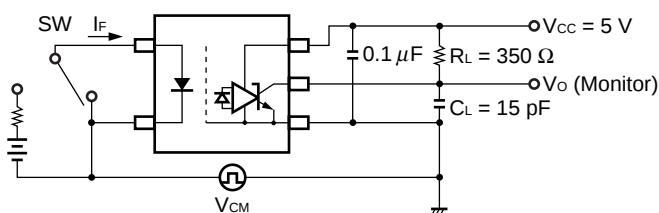
\*2 Because  $V_{OL}$  of 2 V or more may be output when LED current input and when output supply of  $V_{CC} = 2.6\text{ V}$  or less, it is important to confirm the characteristics (operation with the power supply on and off) during design, before using this device.

\*3 Test circuit for propagation delay time



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

\*4 Test circuit for common mode transient immunity



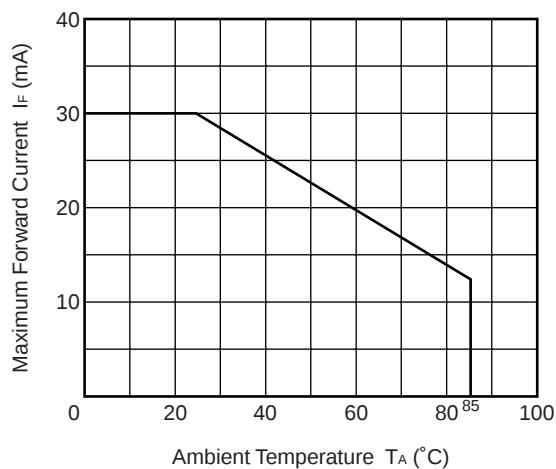
**Remark**  $C_L$  includes probe and stray wiring capacitance.

## USAGE CAUTIONS

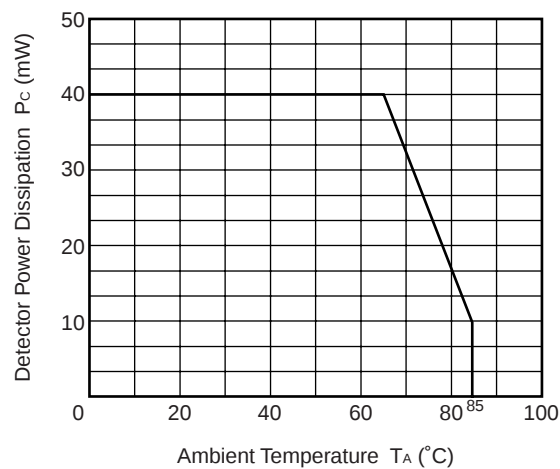
1. This product is weak for static electricity by designed with high-speed integrated circuit so protect against static electricity when handling.
2. By-pass capacitor of  $0.1\text{ }\mu\text{F}$  is used between  $V_{CC}$  and GND near device. Also, ensure that the distance between the leads of the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

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

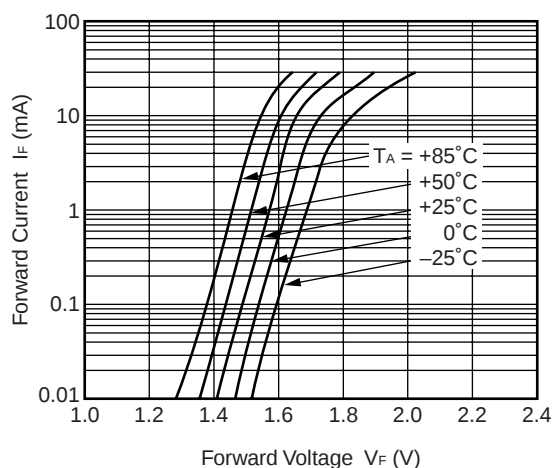
**MAXIMUM FORWARD CURRENT  
vs. AMBIENT TEMPERATURE**



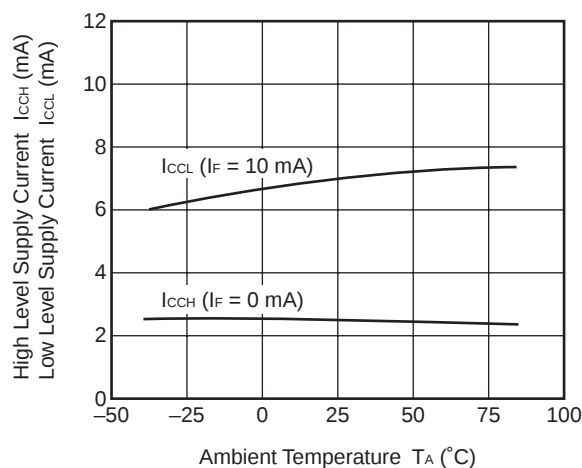
**DETECTOR POWER DISSIPATION  
vs. AMBIENT TEMPERATURE**



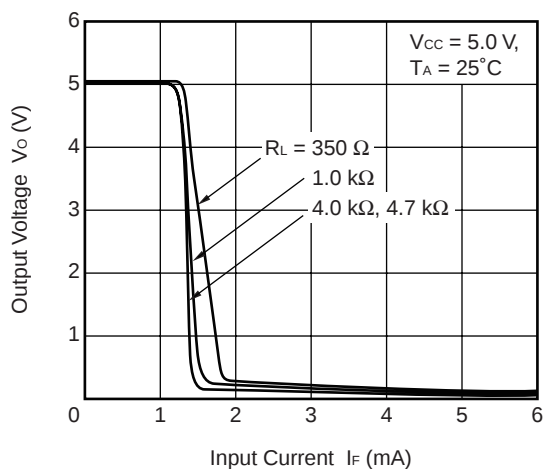
**FORWARD CURRENT vs.  
FORWARD VOLTAGE**



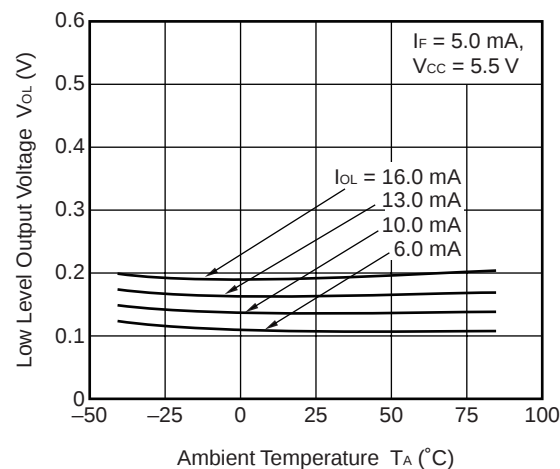
**SUPPLY CURRENT vs.  
AMBIENT TEMPERATURE**



**OUTPUT VOLTAGE vs. INPUT CURRENT**

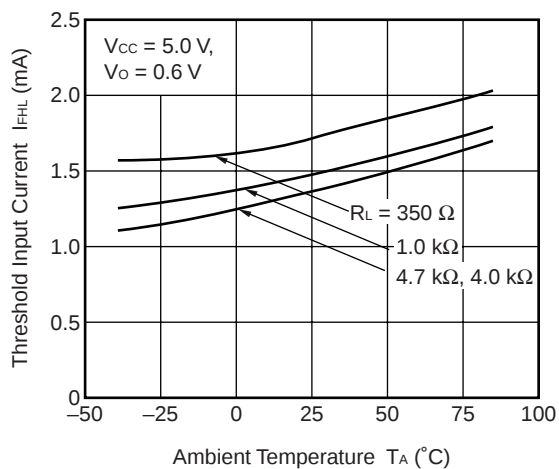


**LOW LEVEL OUTPUT VOLTAGE vs.  
AMBIENT TEMPERATURE**

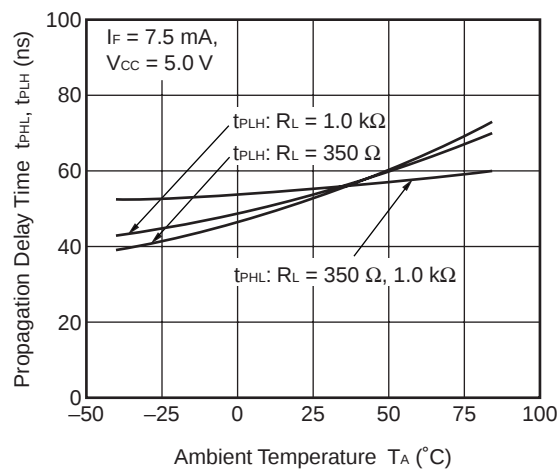


**Remark** The graphs indicate nominal characteristics.

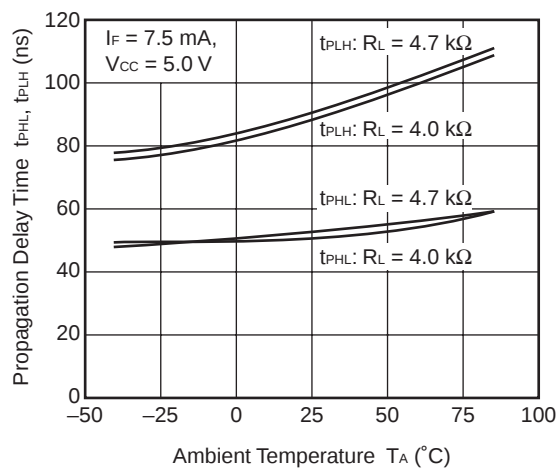
THRESHOLD INPUT CURRENT vs. AMBIENT TEMPERATURE



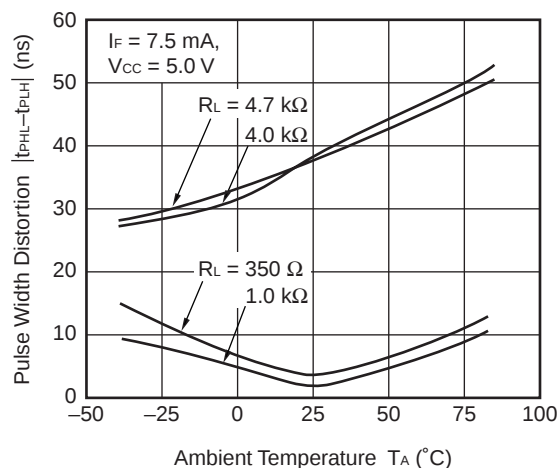
PROPAGATION DELAY TIME vs. AMBIENT TEMPERATURE



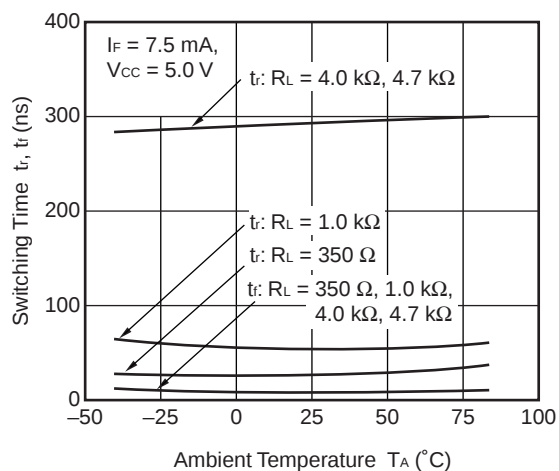
PROPAGATION DELAY TIME vs. AMBIENT TEMPERATURE



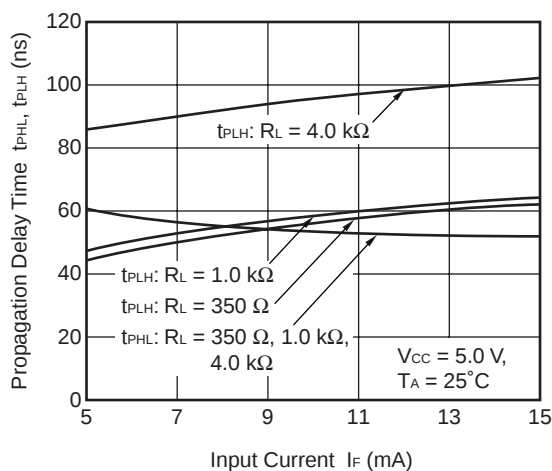
PULSE WIDTH DISTORTION vs. AMBIENT TEMPERATURE



SWITCHING TIME vs. AMBIENT TEMPERATURE



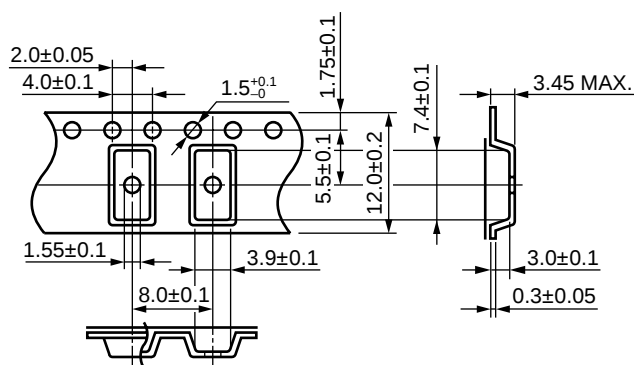
PROPAGATION DELAY TIME vs. INPUT CURRENT



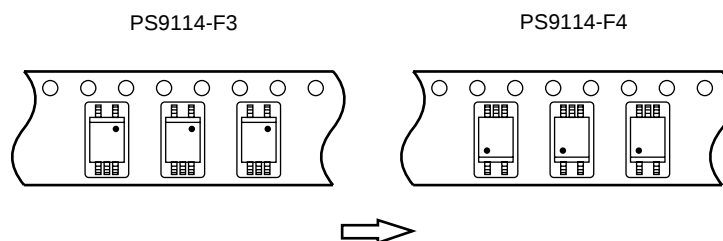
**Remark** The graphs indicate nominal characteristics.

TAPING SPECIFICATIONS (UNIT: mm)

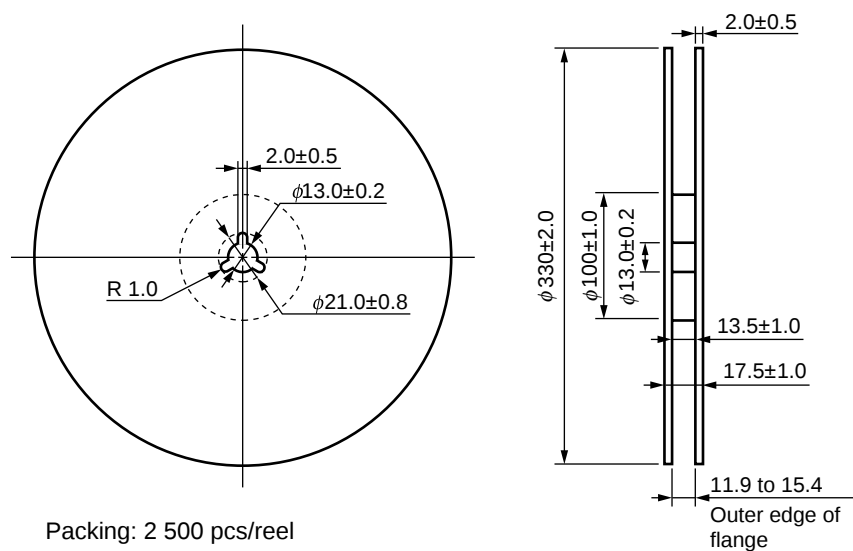
Outline and Dimensions (Tape)



Tape Direction



Outline and Dimensions (Reel)



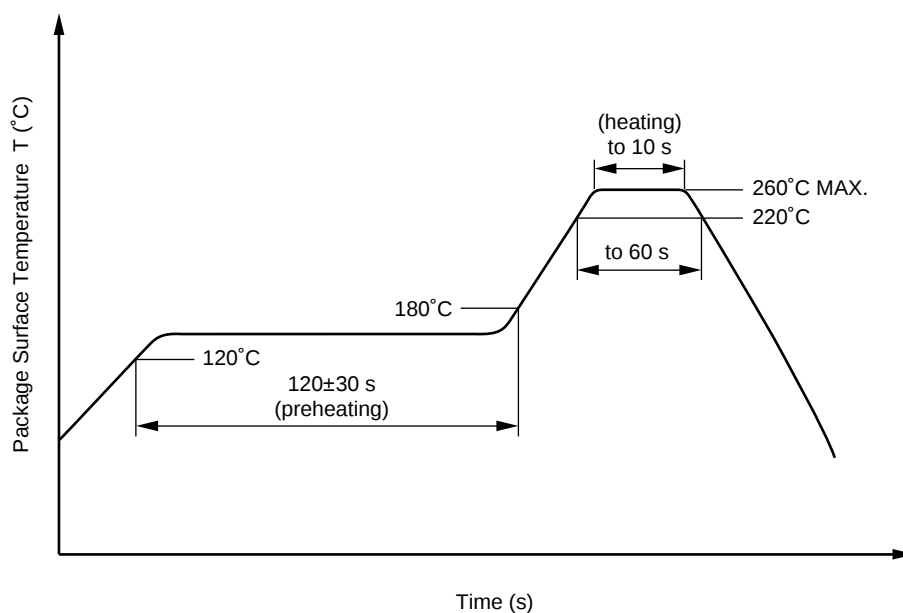
## NOTES ON HANDLING

### 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) Soldering by Soldering Iron

- Peak Temperature (lead part temperature) 350°C or below
- Time (each pins) 3 seconds or less
- Flux Rosin flux containing small amount of chlorine (The flux with a maximum chlorine content of 0.2 Wt% is recommended.)

(a) Soldering of leads should be made at the point 1.5 to 2.0 mm from the root of the lead

(b) Please be sure that the temperature of the package would not be heated over 100°C

**(4) 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 transistor may enter the on state, even if the voltage is within the absolute maximum ratings.

**★ USAGE CAUTIONS**

1. Protect against static electricity when handling.
2. Avoid storage at a high temperature and high humidity.

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M8E 00.4-0110

|                    |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|--------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <div>Caution</div> | GaAs Products | <p>This product uses gallium arsenide (GaAs). GaAs vapor and powder are hazardous to human health if inhaled or ingested, so please observe the following points.</p> <ul style="list-style-type: none"> <li>• Follow related laws and ordinances when disposing of the product. If there are no applicable laws and/or ordinances, dispose of the product as recommended below.               <ol style="list-style-type: none"> <li>1. Commission a disposal company able to (with a license to) collect, transport and dispose of materials that contain arsenic and other such industrial waste materials.</li> <li>2. Exclude the product from general industrial waste and household garbage, and ensure that the product is controlled (as industrial waste subject to special control) up until final disposal.</li> </ol> </li> <li>• Do not burn, destroy, cut, crush, or chemically dissolve the product.</li> <li>• Do not lick the product or in any way allow it to enter the mouth.</li> </ul> |
|--------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

► For further information, please contact

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