

PHOTOCOUPLER NEPOC Series

Preliminary Datasheet

# PS9351L, PS9351L2

HIGH NOISE REDUCTION, 15 Mbps CMOS OUTPUT TYPE

8mm CREEPAGE 6-PIN SDIP PHOTOCOUPLER

## DESCRIPTION

The PS9351L and PS9351L2 are optically coupled isolator containing a GaAlAs LED on the input side and a CMOS output IC on the output side.

The PS9351L and PS9351L2 are in 6-pin plastic SDIP (Shrink Dual In-line Package). The PS9351L2 has 8 mm creepage distance. The mount area of 6-pin plastic SDIP is half size of 8-pin DIP.

This photocoupler is high common mode transient immunity (CMR), a high-speed CMOS output type device designed for high-speed logic interface circuits.

The PS9351L is lead bending type (Gull-wing) for surface mounting.

The PS9351L2 is lead bending type for long creepage distance (Gull-wing) for surface mount.

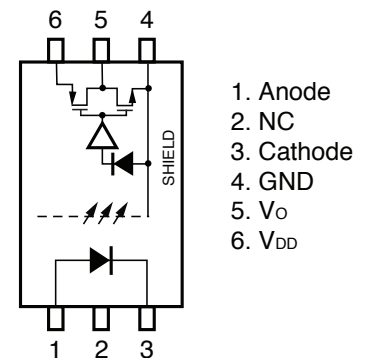
## FEATURES

- High-speed response (15 Mbps)
- Long creepage distance (8mm MIN. : PS9351L2)
- Operable at high temperature (−40 to +100°C)
- High common mode transient immunity ( $CM_H, CM_L = \pm 20 \text{ kV}/\mu\text{s}$  TYP.)
- High isolation voltage ( $BV = 5000 \text{ Vr.m.s.}$ )
- Pulse width distortion ( $|t_{PHL} - t_{PLH}| = 5 \text{ ns}$  TYP.)
- Ordering number of tape product : PS9351L-E3: 2 000 pcs/reel  
: PS9351L2-E3: 2 000 pcs/reel
- Pb-Free product

## APPLICATIONS

- FA Network
- Measurement equipment
- PDP

### PIN CONNECTION (Top View)

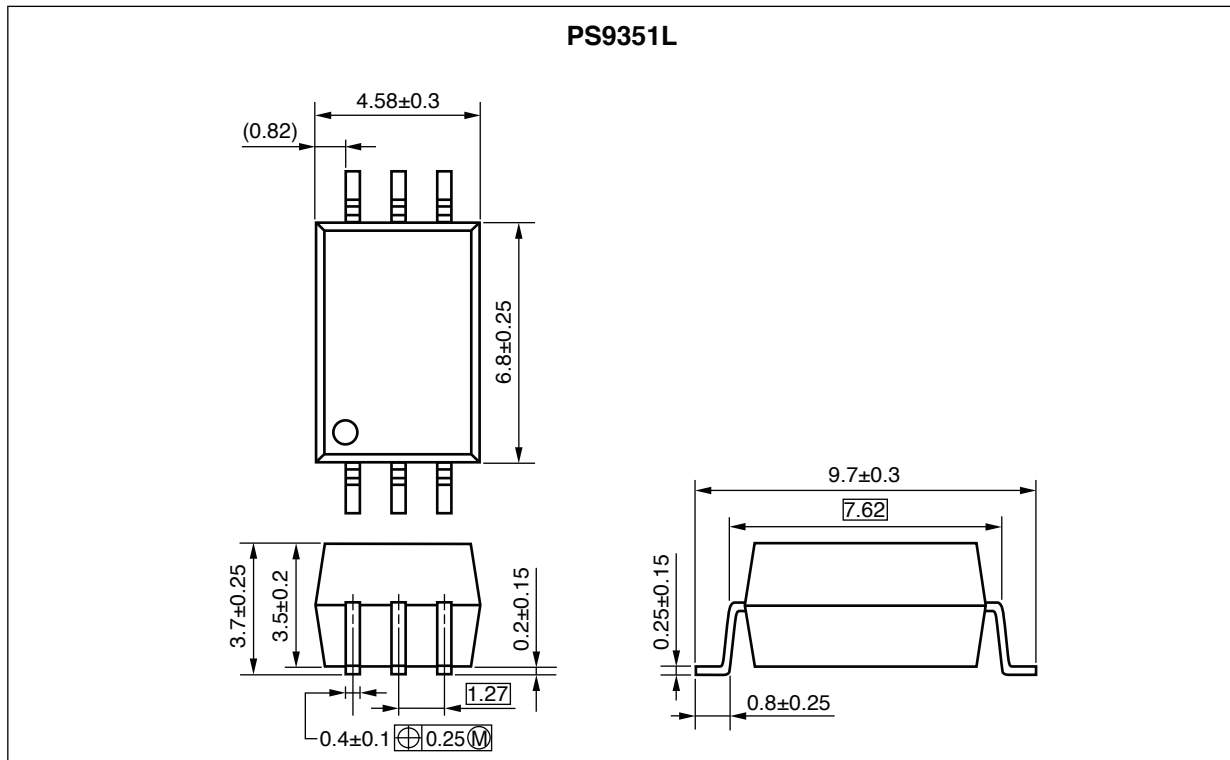


### TRUTH TABLE

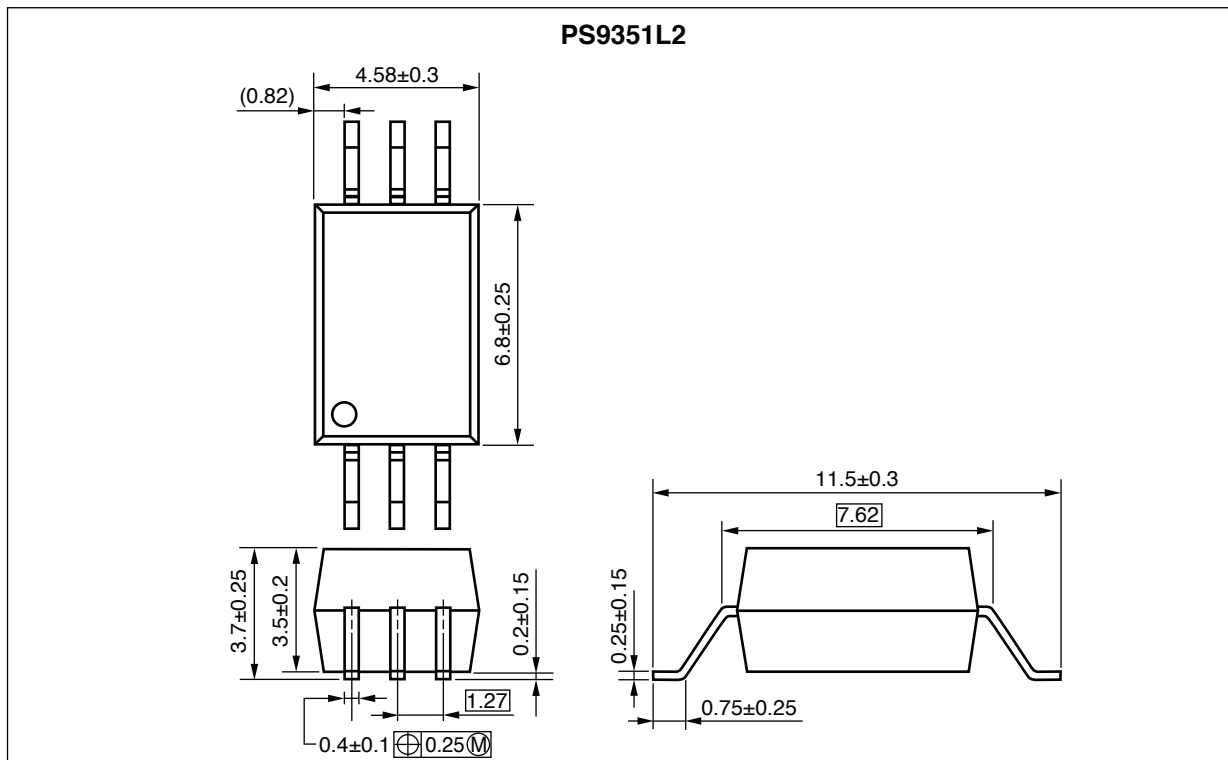
| LED | Output |
|-----|--------|
| ON  | L      |
| OFF | H      |

PACKAGE DIMENSIONS (UNIT: mm)

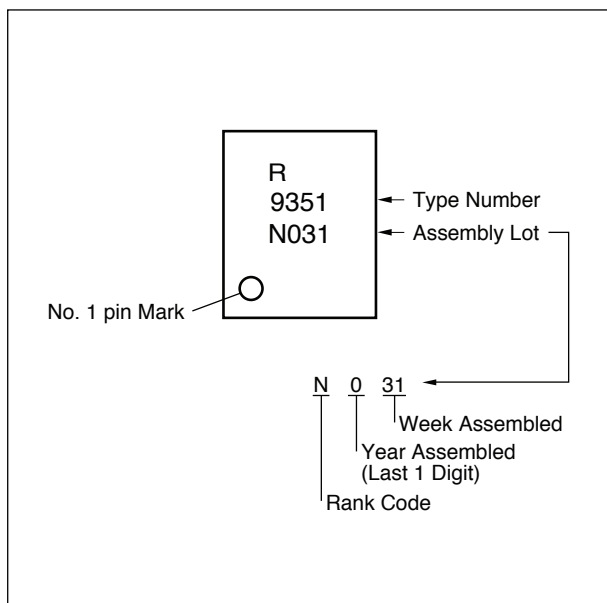
Lead Bending Type (Gull-wing) For Surface Mount



Lead Bending Type For Long Creepage Distance (Gull-wing) For Surface Mount



## MARKING EXAMPLE



## PHOTOCOUPLER CONSTRUCTION

| Parameter                      | PS9351L | PS9351L2 |
|--------------------------------|---------|----------|
| Air Distance (MIN.)            | 7 mm    | 8 mm     |
| Outer Creepage Distance (MIN.) | 7 mm    | 8 mm     |
| Isolation Distance (MIN.)      | 0.4 mm  | 0.4 mm   |

## ORDERING INFORMATION

| Part Number   | Order Number     | Solder Plating Specification | Packing Style                |
|---------------|------------------|------------------------------|------------------------------|
| PS9351L       | PS9351L-AX       | Pb-Free<br>(Ni/Pd/Au)        | 20 pcs (Tape 20 pcs cut)     |
| PS9351L-E3    | PS9351L-E3-AX    |                              | Embossed Tape 2 000 pcs/reel |
| PS9351L2      | PS9351L2-AX      |                              | 20 pcs (Tape 20 pcs cut)     |
| PS9351L2-E3   | PS9351L2-E3-AX   |                              | Embossed Tape 2 000 pcs/reel |
| PS9351L-V     | PS9351L-V-AX     |                              | 20 pcs (Tape 20 pcs cut)     |
| PS9351L-V-E3  | PS9351L-V-E3-AX  |                              | Embossed Tape 2 000 pcs/reel |
| PS9351L2-V    | PS9351L2-V-AX    |                              | 20 pcs (Tape 20 pcs cut)     |
| PS9351L2-V-E3 | PS9351L2-V-E3-AX |                              | Embossed Tape 2 000 pcs/reel |

\*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 *1 | I <sub>F</sub>   | 25                           | mA      |
|                               | Reverse Voltage    | V <sub>R</sub>   | 5                            | V       |
| Detector                      | Supply Voltage     | V <sub>DD</sub>  | 0 to 5.5                     | V       |
|                               | Output Voltage     | V <sub>O</sub>   | -0.5 to V <sub>DD</sub> +0.5 | V       |
|                               | Output Current     | I <sub>O</sub>   | 2                            | mA      |
| Isolation Voltage *2          |                    | BV               | 5000                         | Vr.m.s. |
| Operating Ambient Temperature |                    | T <sub>A</sub>   | -40 to +100                  | °C      |
| Storage Temperature           |                    | T <sub>stg</sub> | -55 to +125                  | °C      |

\*1 Reduced to 0.3 mA/°C at T<sub>A</sub> = 70°C or more.

\*2 AC voltage for 1 minute at T<sub>A</sub> = 25°C, RH = 60% between input and output.  
Pins 1-3 shorted together, 4-6 shorted together.

## RECOMMENDED OPERATING CONDITIONS (T<sub>A</sub> = 25°C)

| Parameter       | Symbol          | MIN. | TYP. | MAX. | Unit |
|-----------------|-----------------|------|------|------|------|
| Forward Current | I <sub>F</sub>  | 10   |      | 16   | mA   |
| Supply Voltage  | V <sub>DD</sub> | 4.5  | 5.0  | 5.5  | V    |

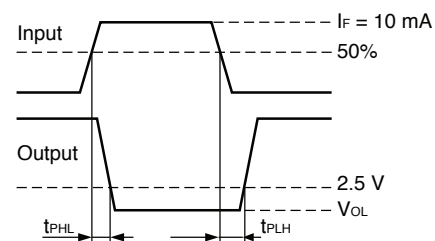
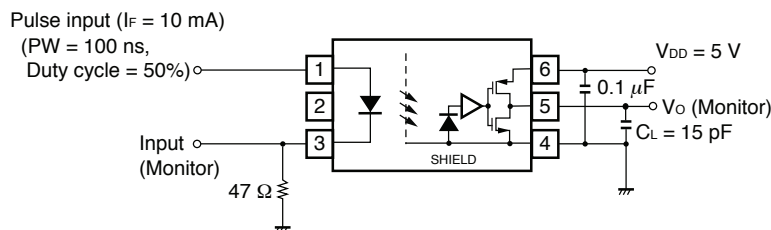
**ELECTRICAL CHARACTERISTICS** ( $T_A = -40$  to  $+100^\circ\text{C}$ ,  $V_{DD} = 4.5$  to  $5.5$  V, unless otherwise specified)

| Parameter |                                                              | Symbol                | Conditions                                                                               | MIN.      | TYP. *1 | MAX. | Unit              |
|-----------|--------------------------------------------------------------|-----------------------|------------------------------------------------------------------------------------------|-----------|---------|------|-------------------|
| Diode     | Forward Voltage                                              | $V_F$                 | $I_F = 10$ mA, $T_A = 25^\circ\text{C}$                                                  | 1.2       | 1.56    | 1.8  | V                 |
|           | Reverse Current                                              | $I_R$                 | $V_R = 3$ V, $T_A = 25^\circ\text{C}$                                                    |           |         | 10   | $\mu\text{A}$     |
|           | Terminal Capacitance                                         | $C_t$                 | $V = 0$ V, $f = 1$ MHz, $T_A = 25^\circ\text{C}$                                         |           | 30      |      | pF                |
| Detector  | High Level Supply Current                                    | $I_{DDH}$             | $I_F = 0$ mA                                                                             |           | 2.5     | 5    | mA                |
|           | Low Level Supply Current                                     | $I_{DDL}$             | $I_F = 10$ mA                                                                            |           | 2       | 5    |                   |
|           | High Level Output Voltage                                    | $V_{OH}$              | $I_O = -20$ $\mu\text{A}$ , $I_F = 0$ mA                                                 | 4.0       | 5.0     |      | V                 |
|           | Low Level Output Voltage *2                                  | $V_{OL}$              | $I_O = 20$ $\mu\text{A}$ , $I_F = 10$ mA                                                 |           | 0       | 0.1  |                   |
| Coupled   | Threshold Input Current                                      | $I_{FHL}$             | $V_O < 1$ V                                                                              |           | 1.9     | 5    | mA                |
|           | Isolation Resistance                                         | $R_{I-O}$             | $V_{I-O} = 1$ kV <sub>DC</sub> , RH = 40 to 60%,<br>$T_A = 25^\circ\text{C}$             | $10^{11}$ |         |      |                   |
|           | Isolation Capacitance                                        | $C_{I-O}$             | $V = 0$ V, $f = 1$ MHz, $T_A = 25^\circ\text{C}$                                         |           | 0.7     |      |                   |
|           | Propagation Delay Time<br>(H $\rightarrow$ L) *3             | $t_{PHL}$             | $I_F = 10$ mA, $V_{DD} = 5$ V,<br>$C_L = 15$ pF, CMOS Levels                             |           | 30      | 60   |                   |
|           | Propagation Delay Time<br>(L $\rightarrow$ H) *3             | $t_{PLH}$             |                                                                                          |           | 35      | 60   |                   |
|           | Pulse Width                                                  | PW                    |                                                                                          | 100       |         |      |                   |
|           | Pulse Width Distortion<br>(PWD) *3                           | $ t_{PHL} - t_{PLH} $ |                                                                                          |           | 5       | 30   |                   |
|           | Propagation Delay Skew                                       | $t_{PSK}$             |                                                                                          |           |         | 40   |                   |
|           | Rise Time                                                    | $t_r$                 |                                                                                          |           | 4       |      |                   |
|           | Fall Time                                                    | $t_f$                 |                                                                                          |           | 4       |      |                   |
|           | Common Mode<br>Transient Immunity at<br>High Level Output *4 | $CM_H$                | $V_{DD} = 5$ V, $I_F = 0$ mA,<br>$V_{CM} = 1$ kV, $V_O > 4$ V, $T_A = 25^\circ\text{C}$  | 15        | 20      |      | kV/ $\mu\text{s}$ |
|           | Common Mode<br>Transient Immunity at<br>Low Level Output *4  | $CM_L$                | $V_{DD} = 5$ V, $I_F = 10$ mA,<br>$V_{CM} = 1$ kV, $V_O < 1$ V, $T_A = 25^\circ\text{C}$ | 15        | 20      |      |                   |

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

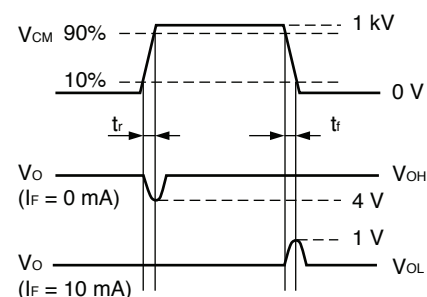
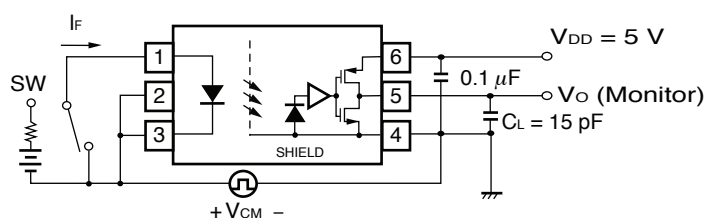
\*2 Because  $V_{OL}$  of 2 V or more may be output when LED current input and when output supply, it is important to confirm the characteristics (operation with the power supply on and off) during design, before using this device.

**\*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 more than 0.1  $\mu\text{F}$  is used between  $V_{DD}$  and GND near device. Also, ensure that the distance between the leads of the photocoupler and capacitor is no more than 10 mm.
3. Pin 2 (which is an NC<sup>\*1</sup> pin) can either be connected directly to the GND pin on the LED side or left open. Unconnected pins should not be used as a bypass for signals or for any other similar purpose because this may degrade the internal noise environment of the device.

<sup>\*1</sup> NC: Not connected (No connection)

4. Avoid storage at a high temperature and high humidity.

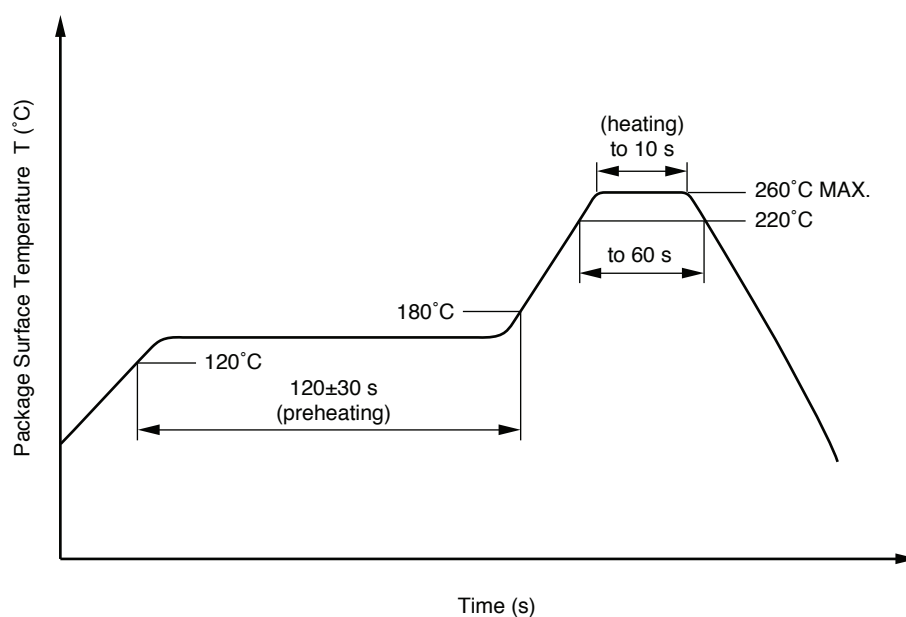
## NOTES ON HANDLING

### 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 at startup, the CMOS IC on output side may enter the on state, even if the voltage is within the absolute maximum ratings.