

# PS9317L, PS9317L2

R08DS0135EJ0500

Rev.5.00

Oct 30, 2015

HIGH CMR, 10 Mbps, OPEN COLLECTOR OUTPUT TYPE,  
8 mm CREEPAGE 6-PIN SDIP PHOTOCOUPLER

## DESCRIPTION

The PS9317L and PS9317L2 are optical coupled high-speed, active low type isolators containing a GaAlAs LED on the input side and a photodiode and a signal processing circuit on the output side on one chip.

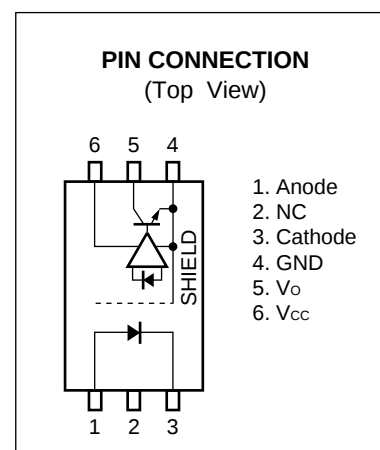
The PS9317L and PS9317L2 are designed specifically for high common mode transient immunity (CMR) and low pulse width distortion.

The PS9317L is lead bending type (Gull-wing) for surface mounting.

The PS9317L2 is lead bending type for long creepage distance (Gull-wing) for surface mount.

## FEATURES

- Pulse width distortion ( $|t_{PHL} - t_{PLH}| = 35 \text{ ns MAX.}$ )
- High common mode transient immunity ( $CM_H, CM_L = \pm 15 \text{ kV}/\mu\text{s MIN.}$ )
- Half size of 8-pin DIP
- Long creepage distance (8 mm MIN. : PS9317L2)
- High-speed (10 Mbps)
- High isolation voltage ( $BV = 5\,000 \text{ Vr.m.s.}$ )
- Open collector output
- Pb-Free product
- Safety standards
  - UL approved: No. E72422
  - CSA approved: No. CA 101391 (CA5A, CAN/CSA-C22.2 60065, 60950)
  - DIN EN 60747-5-5 (VDE 0884-5) approved (Option)



## APPLICATIONS

- Measurement equipment
- PDP
- FA Network

## TRUTH TABLE

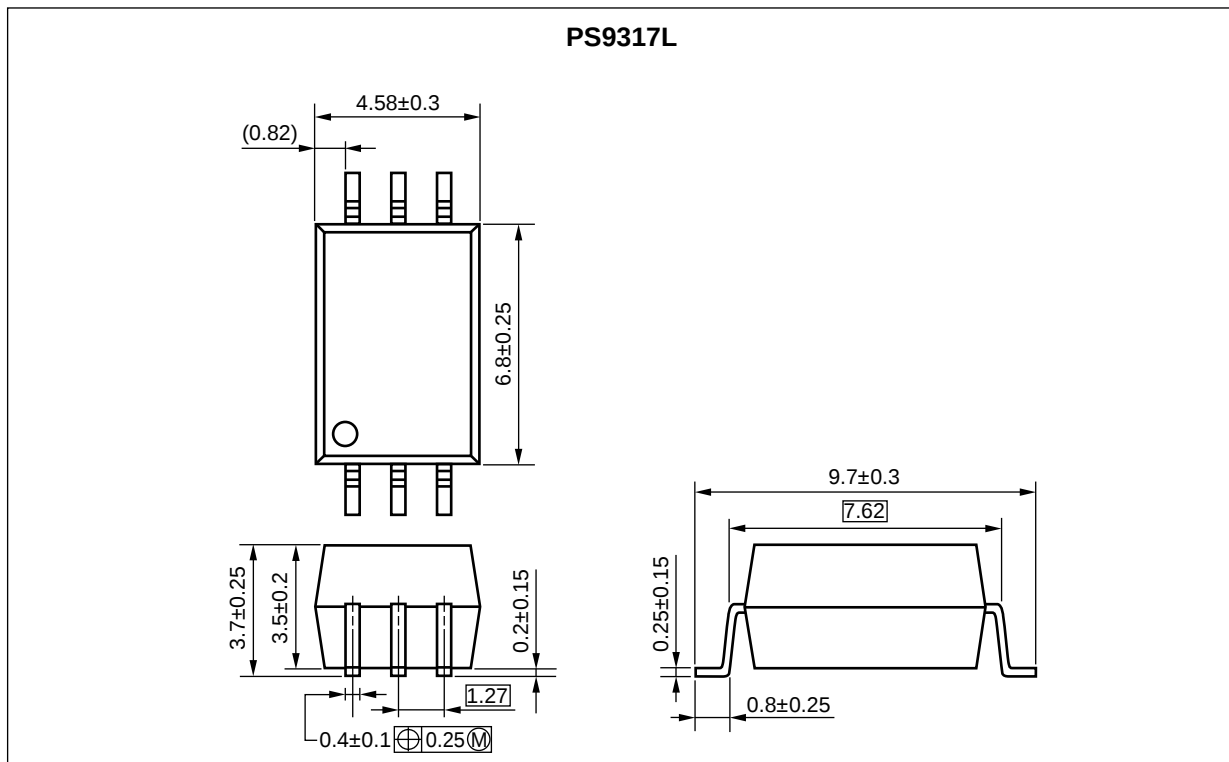
| LED | Output |
|-----|--------|
| ON  | L      |
| OFF | H      |

The mark <R> shows major revised points.

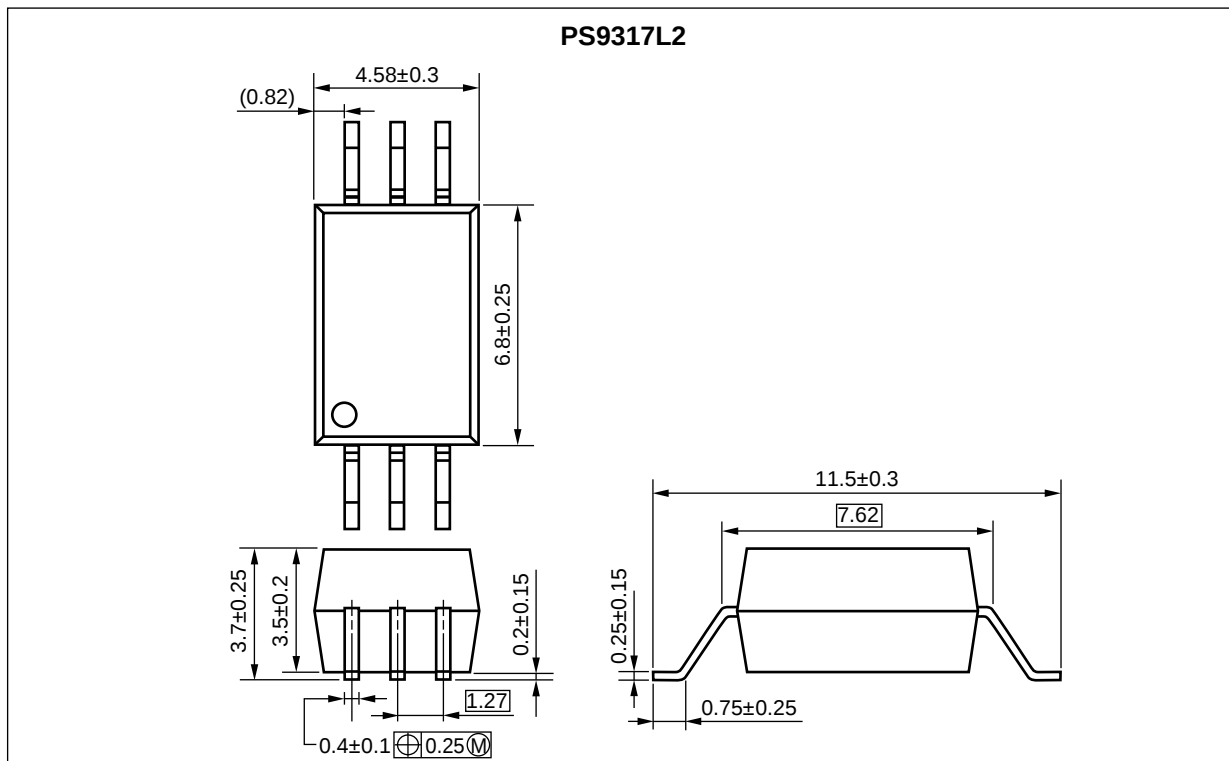
The revised points can be easily searched by copying an "<R>" in the PDF file and specifying it in the "Find what:" field.

## PACKAGE DIMENSIONS (UNIT: mm)

## Lead Bending Type (Gull-wing) For Surface Mount



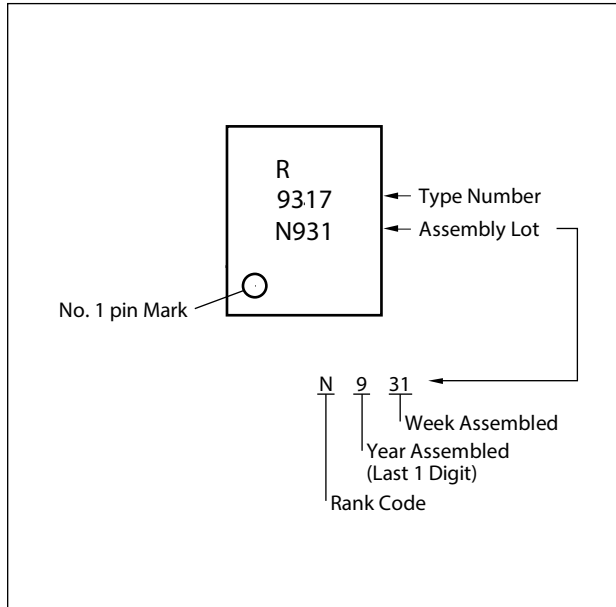
## Lead Bending Type For Long Creepage Distance (Gull-wing) For Surface Mount



## PHOTOCOUPLER CONSTRUCTION

| Parameter                      | PS9317L | PS9317L2 |
|--------------------------------|---------|----------|
| Air Distance (MIN.)            | 7 mm    | 8 mm     |
| Outer Creepage Distance (MIN.) | 7 mm    | 8 mm     |
| Isolation Distance (MIN.)      | 0.4 mm  | 0.4 mm   |

## MARKING EXAMPLE



## ORDERING INFORMATION

| Part Number   | Order Number     | Solder Plating Specification | Packing Style                | Safety Standard Approval                | Application Part Number <sup>*1</sup> |
|---------------|------------------|------------------------------|------------------------------|-----------------------------------------|---------------------------------------|
| PS9317L       | PS9317L-AX       | Pb-Free<br>(Ni/Pd/Au)        | 20 pcs (Tape 20 pcs cut)     | Standard products<br>(UL, CSA approved) | PS9317L                               |
| PS9317L-E3    | PS9317L-E3-AX    |                              | Embossed Tape 2 000 pcs/reel |                                         |                                       |
| PS9317L2      | PS9317L2-AX      |                              | 20 pcs (Tape 20 pcs cut)     | UL, CSA approved                        | PS9317L2                              |
| PS9317L2-E3   | PS9317L2-E3-AX   |                              | Embossed Tape 2 000 pcs/reel |                                         |                                       |
| PS9317L-V     | PS9317L-V-AX     |                              | 20 pcs (Tape 20 pcs cut)     | DIN EN 60747-5-5                        | PS9317L                               |
| PS9317L-V-E3  | PS9317L-V-E3-AX  |                              | Embossed Tape 2 000 pcs/reel | 2011-11 approved<br>(Option)            |                                       |
| PS9317L2-V    | PS9317L2-V-AX    |                              | 20 pcs (Tape 20 pcs cut)     |                                         | PS9317L2                              |
| PS9317L2-V-E3 | PS9317L2-V-E3-AX |                              | Embossed Tape 2 000 pcs/reel |                                         |                                       |

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

**ABSOLUTE MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ , unless otherwise specified)**

| Parameter                       |                                 | Symbol    | Ratings     | Unit             |
|---------------------------------|---------------------------------|-----------|-------------|------------------|
| Diode                           | Forward Current* <sup>1</sup>   | $I_F$     | 20          | mA               |
|                                 | Reverse Voltage                 | $V_R$     | 5           | V                |
| Detector                        | Supply Voltage                  | $V_{CC}$  | 7           | V                |
|                                 | Output Voltage                  | $V_O$     | 7           | V                |
|                                 | Output Current                  | $I_O$     | 25          | mA               |
|                                 | Power Dissipation* <sup>2</sup> | $P_C$     | 40          | mW               |
| Isolation Voltage* <sup>3</sup> |                                 | BV        | 5 000       | Vr.m.s.          |
| Operating Ambient Temperature   |                                 | $T_A$     | -40 to +85  | $^\circ\text{C}$ |
| Storage Temperature             |                                 | $T_{stg}$ | -55 to +125 | $^\circ\text{C}$ |

Notes: \*1. Reduced to 0.3 mA/ $^\circ\text{C}$  at  $T_A = 65^\circ\text{C}$  or more.

\*2. Applies to output pin  $V_O$  (collector pin). Reduced to 1.5 mW/ $^\circ\text{C}$  at  $T_A = 65^\circ\text{C}$  or more.

\*3. AC voltage for 1 minute at  $T_A = 25^\circ\text{C}$ , RH = 60% between input and output.  
Pins 1-3 shorted together, 4-6 shorted together.

**RECOMMENDED OPERATING CONDITIONS**

| Parameter                               | Symbol   | MIN. | TYP. | MAX. | Unit     |
|-----------------------------------------|----------|------|------|------|----------|
| Low Level Input Voltage                 | $V_{FL}$ | 0    |      | 0.8  | V        |
| High Level Input Current                | $I_{FH}$ | 6    |      | 12   | mA       |
| Supply Voltage                          | $V_{CC}$ | 4.5  | 5.0  | 5.5  | V        |
| TTL ( $R_L = 1\text{ k}\Omega$ , loads) | N        |      |      | 5    |          |
| Pull-up Resistor                        | $R_L$    | 330  |      | 4 k  | $\Omega$ |

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

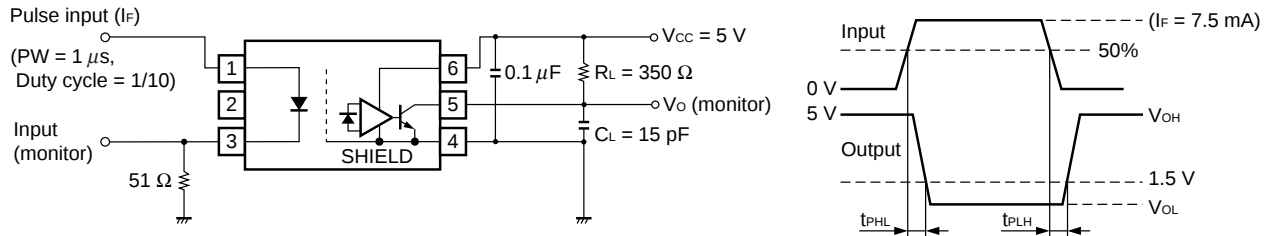
| Parameter |                                                             | Symbol                | Conditions                                                                                                                                          | MIN.      | TYP.*1 | MAX. | Unit              |
|-----------|-------------------------------------------------------------|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|-----------|--------|------|-------------------|
| Diode     | Forward Voltage                                             | $V_F$                 | $I_F = 10\text{ mA}$ , $T_A = 25^\circ\text{C}$                                                                                                     | 1.2       | 1.56   | 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                                   | $I_{OH}$              | $V_{CC} = V_O = 5.5\text{ V}$ , $V_F = 0.8\text{ V}$                                                                                                |           | 1      | 100  | $\mu\text{A}$     |
|           | Low Level Output Voltage*2                                  | $V_{OL}$              | $V_{CC} = 5.5\text{ V}$ , $I_F = 5\text{ mA}$ ,<br>$I_{OL} = 13\text{ mA}$                                                                          |           | 0.16   | 0.6  | V                 |
|           | High Level Supply Current                                   | $I_{CCH}$             | $V_{CC} = 5.5\text{ V}$ , $I_F = 0\text{ mA}$ , $V_O = \text{open}$                                                                                 |           | 3.5    | 7    | mA                |
|           | Low Level Supply Current                                    | $I_{CCL}$             | $V_{CC} = 5.5\text{ V}$ , $I_F = 10\text{ mA}$ , $V_O = \text{open}$                                                                                |           | 6.5    | 10   | 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                                       | $C_{I-O}$             | $V = 0\text{ V}$ , $f = 1\text{ MHz}$ , $T_A = 25^\circ\text{C}$                                                                                    |           | 0.7    |      | pF                |
|           | Propagation Delay Time<br>(H $\rightarrow$ L)*3             | $t_{PHL}$             | $V_{CC} = 5\text{ V}$ , $R_L = 350\ \Omega$ , $C_L = 15\text{ pF}$ ,<br>$I_F = 7.5\text{ mA}$ , $V_{THHL} = V_{THLH} = 1.5\text{ V}$                |           | 40     | 75   | ns                |
|           | Propagation Delay Time<br>(L $\rightarrow$ H)*3             | $t_{PLH}$             |                                                                                                                                                     |           | 35     | 75   |                   |
|           | Rise Time                                                   | $t_r$                 |                                                                                                                                                     |           | 20     |      |                   |
|           | Fall Time                                                   | $t_f$                 |                                                                                                                                                     |           | 5      |      |                   |
|           | Pulse Width Distortion<br>(PWD)                             | $ t_{PHL} - t_{PLH} $ |                                                                                                                                                     |           | 5      | 35   |                   |
|           | Propagation Delay Skew                                      | $t_{PSK}$             |                                                                                                                                                     |           |        | 40   |                   |
|           | Common Mode<br>Transient Immunity at High<br>Level Output*4 | $CM_H$                | $V_{CC} = 5\text{ V}$ , $R_L = 350\ \Omega$ , $T_A = 25^\circ\text{C}$ ,<br>$I_F = 0\text{ mA}$ , $V_O > 2\text{ V}$ , $V_{CM} = 1.5\text{ kV}$     | 15        |        |      | kV/ $\mu\text{s}$ |
|           | Common Mode<br>Transient Immunity at Low<br>Level Output*4  | $CM_L$                | $V_{CC} = 5\text{ V}$ , $R_L = 350\ \Omega$ , $T_A = 25^\circ\text{C}$ ,<br>$I_F = 7.5\text{ mA}$ , $V_O < 0.8\text{ V}$ , $V_{CM} = 1.5\text{ kV}$ | 15        |        |      | kV/ $\mu\text{s}$ |

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

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

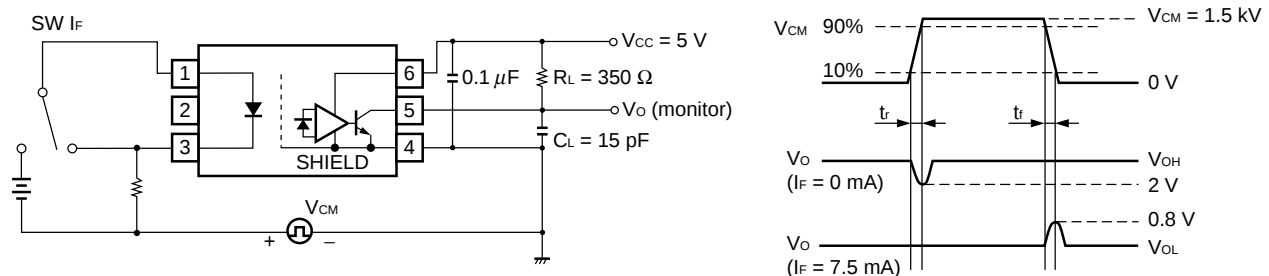
\*3. Test circuit for propagation delay time

\*4.  $V_{OH}$  is measured with the DC load current in this testing (Maximum pulse width = 2 ms, Maximum duty cycle = 20%).



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

#### \*4 Test circuit for common mode transient immunity



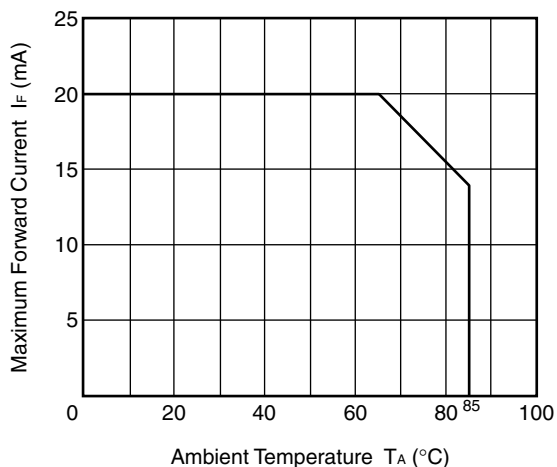
**Remark**  $C_L$  includes probe and stray wiring capacitance.

## USAGE CAUTIONS

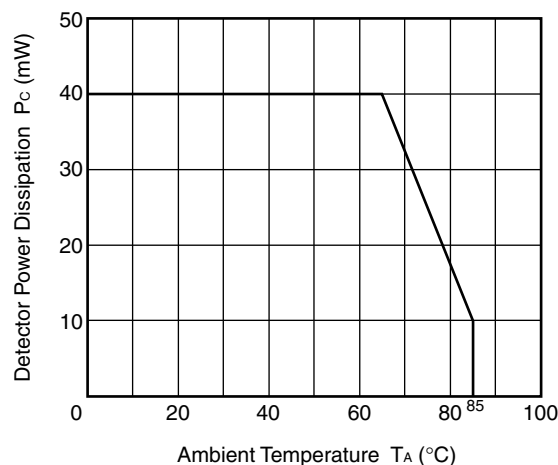
1. This product is weak for static electricity by designed with high-speed integrated circuit so protect against static electricity when handling.
2. By-pass capacitor of more than  $0.1 \mu\text{F}$  is used between  $V_{CC}$  and GND near device. Also, ensure that the distance between the leads of the photocoupler and capacitor is no more than 10 mm.
3. Pin 2 (which is an NC\*1 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.  
\*1 NC: Not connected (No connection)
4. Avoid storage at a high temperature and high humidity.

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

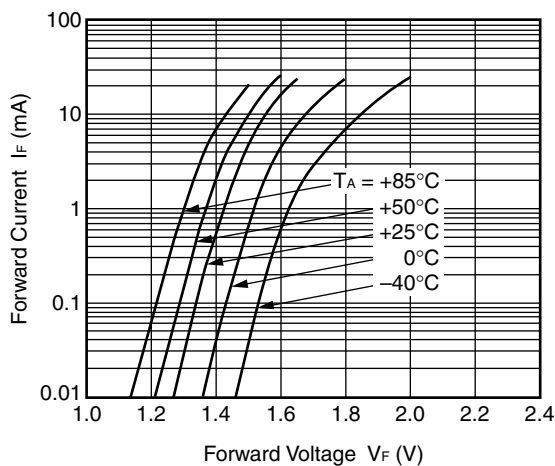
MAXIMUM FORWARD CURRENT  
vs. AMBIENT TEMPERATURE



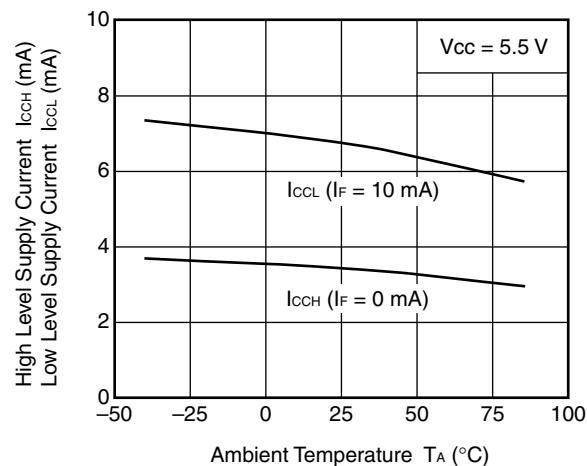
DETECTOR POWER DISSIPATION  
vs. AMBIENT TEMPERATURE



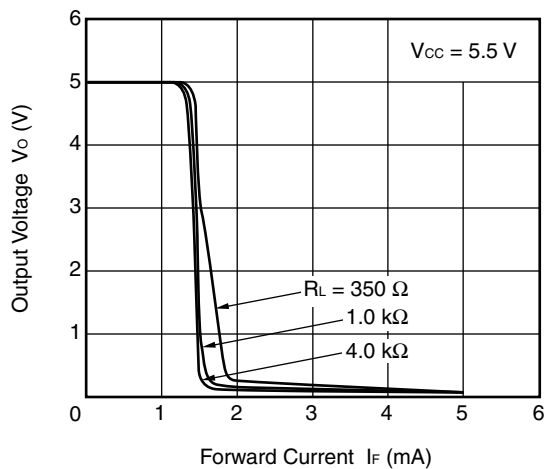
FORWARD CURRENT vs.  
FORWARD VOLTAGE



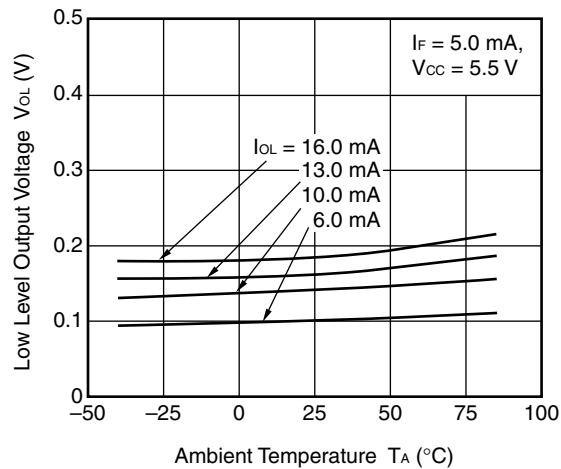
SUPPLY CURRENT vs.  
AMBIENT TEMPERATURE



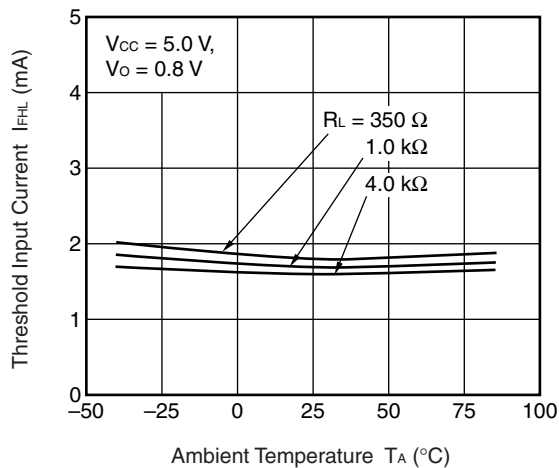
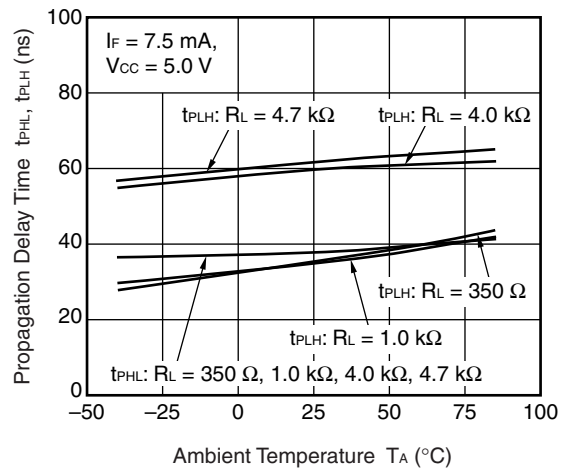
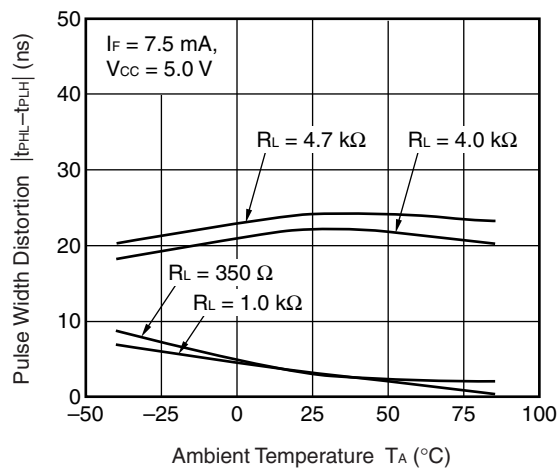
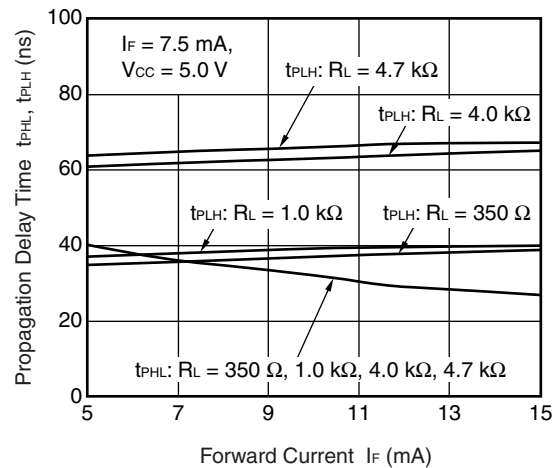
OUTPUT VOLTAGE vs.  
FORWARD CURRENT



LOW LEVEL OUTPUT VOLTAGE vs.  
AMBIENT TEMPERATURE



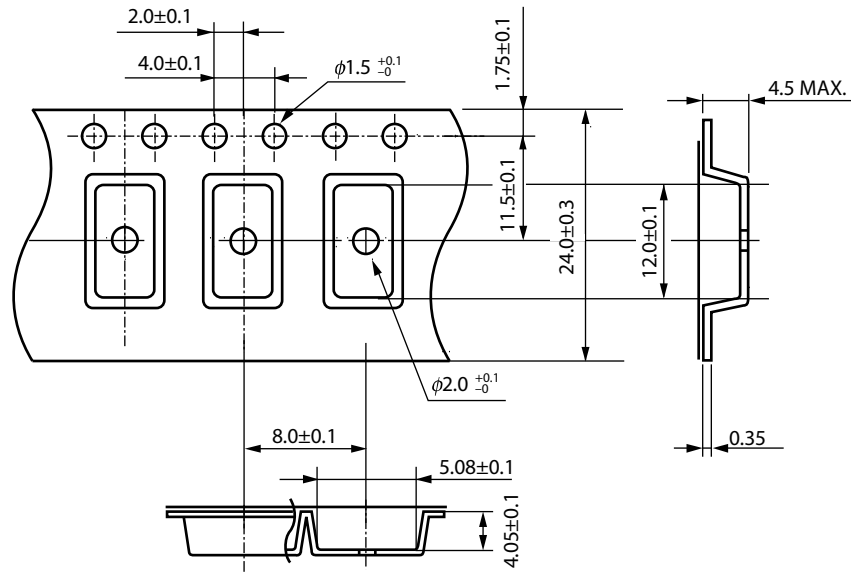
**Remark** The graphs indicate nominal characteristics.

THRESHOLD INPUT CURRENT vs.  
AMBIENT TEMPERATUREPROPAGATION DELAY TIME vs.  
AMBIENT TEMPERATUREPULSE WIDTH DISTORTION vs.  
AMBIENT TEMPERATUREPROPAGATION DELAY TIME vs.  
FORWARD CURRENT

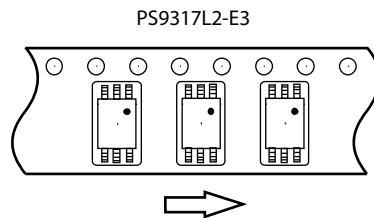
**Remark** The graphs indicate nominal characteristics.



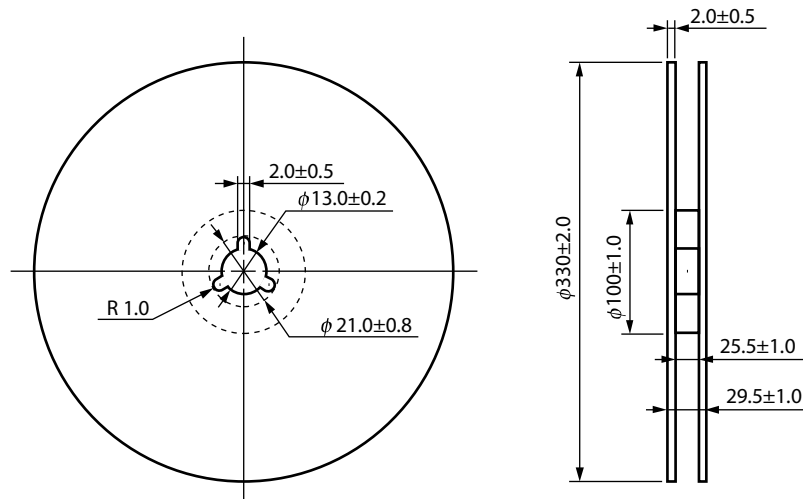
### Outline and Dimensions (Tape)



### Tape Direction

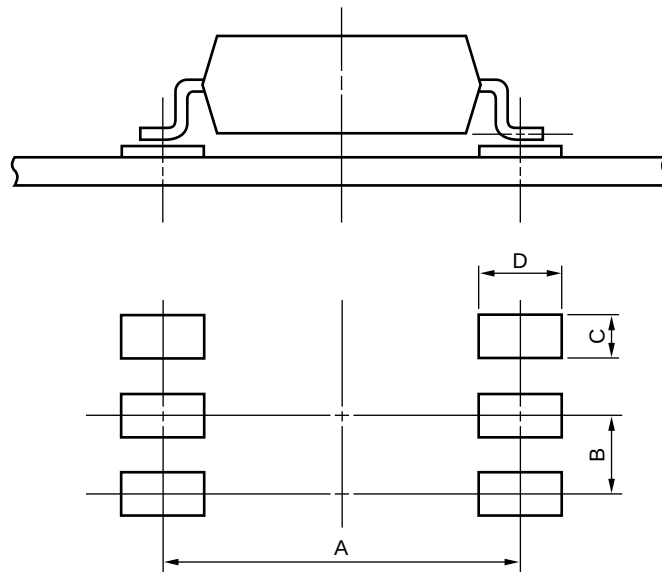


### Outline and Dimensions (Reel)



Packing: 2 000 pcs/reel

## RECOMMENDED MOUNT PAD DIMENSIONS (UNIT: mm)



| Part Number | Lead Bending                                                                | A    | B    | C   | D   |
|-------------|-----------------------------------------------------------------------------|------|------|-----|-----|
| PS9317L     | lead bending type (Gull-wing)<br>for surface mount                          | 8.2  | 1.27 | 0.8 | 2.2 |
| PS9317L2    | lead bending type (Gull-wing)<br>for long creepage distance (surface mount) | 10.2 | 1.27 | 0.8 | 2.2 |

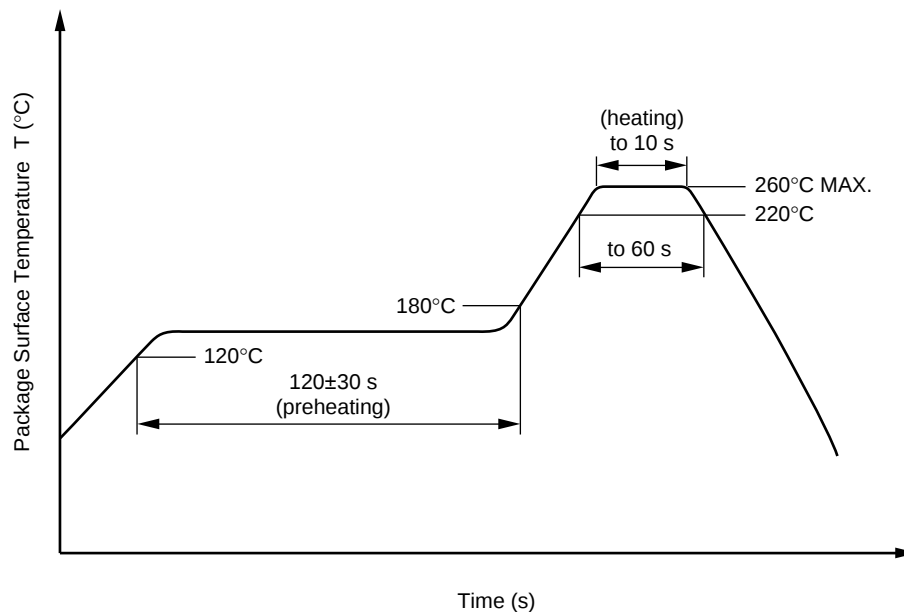
## NOTES ON HANDLING

### 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 side may enter the on state, even if the voltage is within the absolute maximum ratings.

## SPECIFICATION OF VDE MARKS LICENSE DOCUMENT

| Parameter                                                                                 | Symbol     | Spec.       | Unit       |
|-------------------------------------------------------------------------------------------|------------|-------------|------------|
| Climatic test class (IEC 60068-1/DIN EN 60068-1)                                          |            | 40/85/21    |            |
| Dielectric strength                                                                       |            |             |            |
| maximum operating isolation voltage                                                       | $U_{IORM}$ | 1 130       | $V_{peak}$ |
| Test voltage (partial discharge test, procedure a for type test and random test)          | $U_{pr}$   | 1 808       | $V_{peak}$ |
| $U_{pr} = 1.6 \times U_{IORM}$ , $P_d < 5 \text{ pC}$                                     |            |             |            |
| Test voltage (partial discharge test, procedure b for all devices)                        | $U_{pr}$   | 2 119       | $V_{peak}$ |
| $U_{pr} = 1.875 \times U_{IORM}$ , $P_d < 5 \text{ pC}$                                   |            |             |            |
| Highest permissible overvoltage                                                           | $U_{TR}$   | 8 000       | $V_{peak}$ |
| Degree of pollution (DIN EN 60664-1 VDE0110 Part 1)                                       |            | 2           |            |
| Comparative tracking index (IEC 60112/DIN EN 60112 (VDE 0303 Part 11))                    | CTI        | 175         |            |
| Material group (DIN EN 60664-1 VDE0110 Part 1)                                            |            | III a       |            |
| Storage temperature range                                                                 | $T_{stg}$  | -55 to +125 | °C         |
| Operating temperature range                                                               | $T_A$      | -40 to +85  | °C         |
| Isolation resistance, minimum value                                                       |            |             |            |
| $V_{IO} = 500 \text{ V dc}$ at $T_A = 25^\circ\text{C}$                                   | Ris MIN.   | $10^{12}$   | $\Omega$   |
| $V_{IO} = 500 \text{ V dc}$ at $T_A \text{ MAX.}$ at least $100^\circ\text{C}$            | Ris MIN.   | $10^{11}$   | $\Omega$   |
| Safety maximum ratings (maximum permissible in case of fault, see thermal derating curve) |            |             |            |
| Package temperature                                                                       | $T_{si}$   | 175         | °C         |
| Current (input current $I_F$ , $P_{si} = 0$ )                                             | $I_{si}$   | 400         | mA         |
| Power (output or total power dissipation)                                                 | $P_{si}$   | 700         | mW         |
| Isolation resistance                                                                      |            |             |            |
| $V_{IO} = 500 \text{ V dc}$ at $T_A = T_{si}$                                             | Ris MIN.   | $10^9$      | $\Omega$   |

|                |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|----------------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Caution</b> | GaAs Products | <p>This product uses gallium arsenide (GaAs).<br/>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.</li></ul> <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> <ul style="list-style-type: none"><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> |
|----------------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                         |                                     |
|-------------------------|-------------------------------------|
| <b>Revision History</b> | <b>PS9317L, PS9317L2 Data Sheet</b> |
|-------------------------|-------------------------------------|

| Rev. | Date         | Description |                      |
|------|--------------|-------------|----------------------|
|      |              | Page        | Summary              |
| 5.00 | Oct 30, 2015 | –           | First edition issued |

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