

# PS9351L, PS9351L2

Data Sheet

R08DS0127EJ0100

HIGH NOISE REDUCTION, 15 Mbps CMOS  
 OUTPUT TYPE 8mm CREEPAGE 6-PIN SDIP  
 PHOTOCOUPLER

Rev.1.00

Apr 24, 2015

## 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.

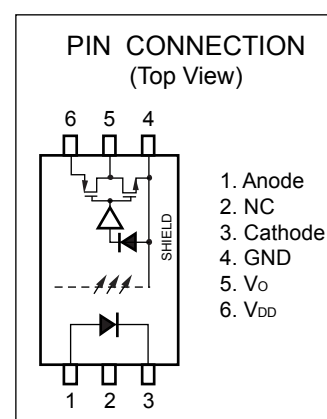
This photocoupler is high common mode transient immunity (CMR), a high-speed CMOS output type device designed for high-speed logic interface circuits.

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<sub>H</sub>, CM<sub>L</sub> = ±20 kV/μs TYP.)
- High isolation voltage (BV = 5000 Vr.m.s.)
- Pulse width distortion (|t<sub>PHL</sub>-t<sub>PLH</sub>| = 5 ns TYP.)
- Ordering number of tape product : PS9351L-E3: 2,000 pcs/reel  
   : PS9351L2-E3: 2,000 pcs/reel
- Pb-Free product
- Safety standards
  - UL approved : No. E72422
  - CSA approved : No. CA 101391 (CA5A, CAN/CSA-22.2 60065, 60950)
  - DIN EN 60747-5-5 (VDE0884-5) approved (Option)



## TRUTH TABLE

LED	Output
ON	L
OFF	H

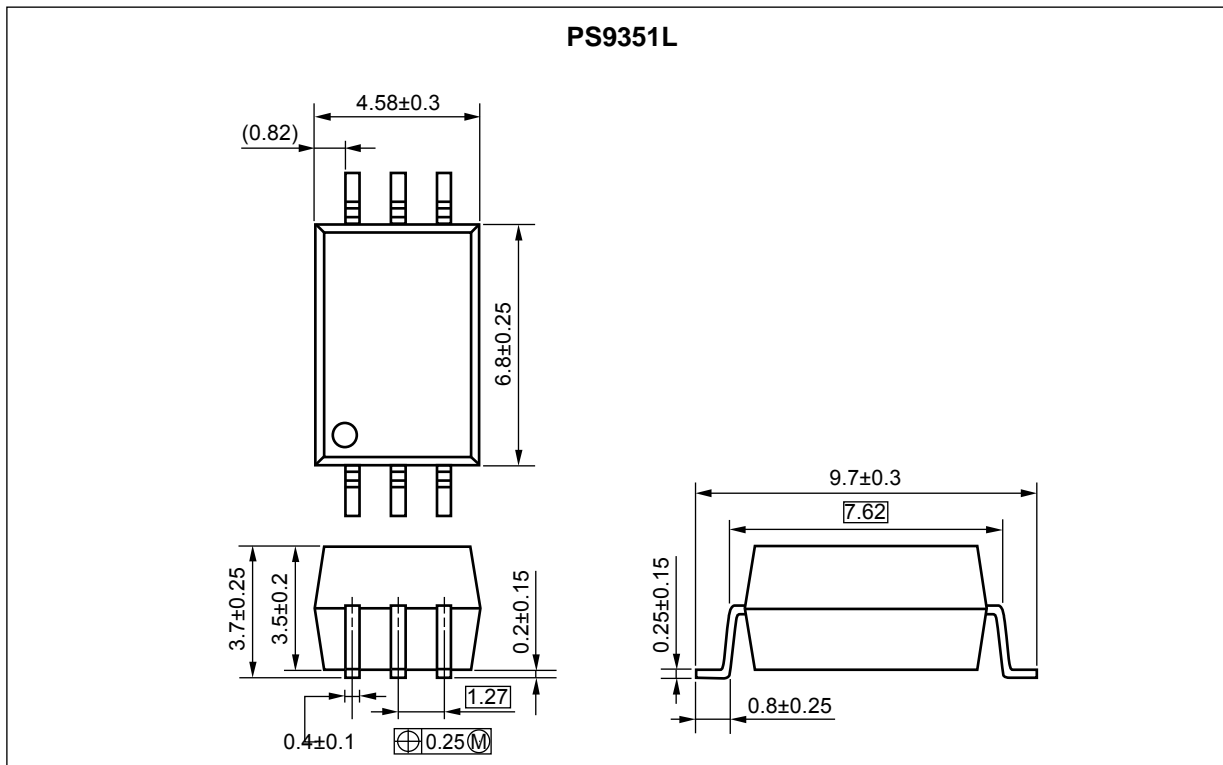
## APPLICATIONS

- FA Network
- Measurement equipment
- PDP

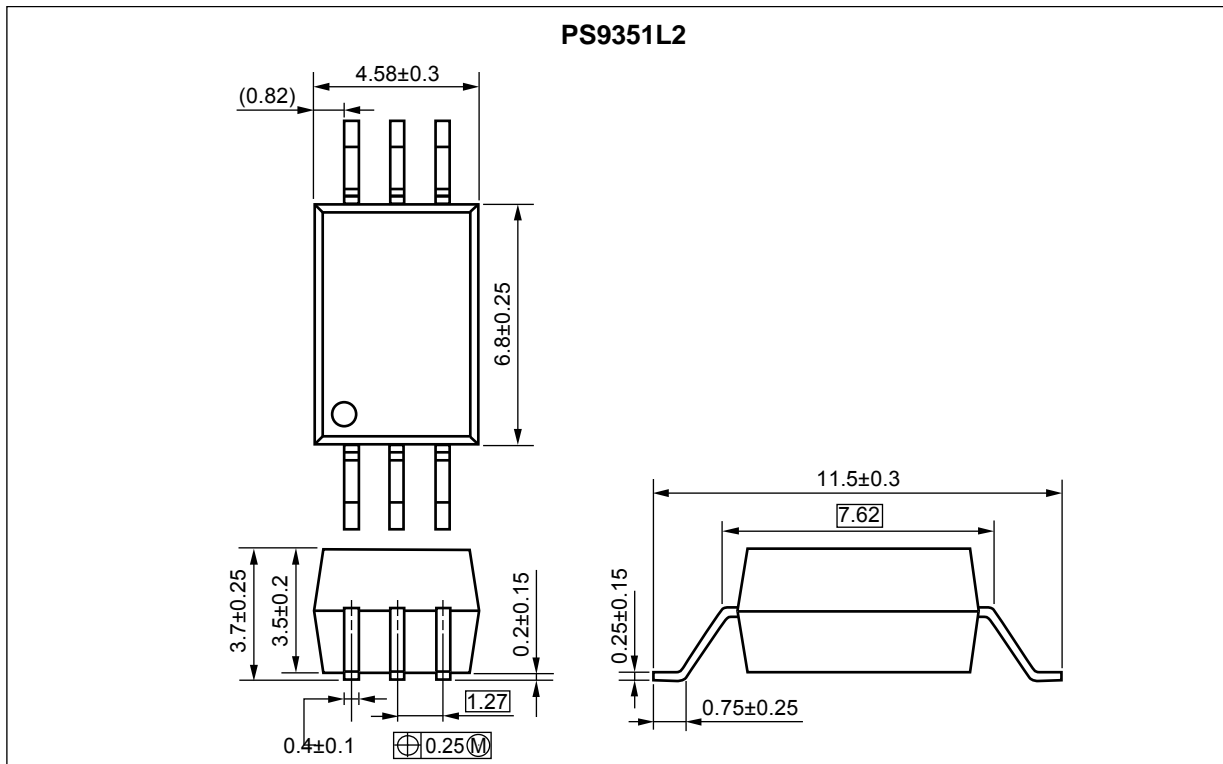
**PS9351L, PS9351L2**

**PACKAGE DIMENSIONS (UNIT: mm)**

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

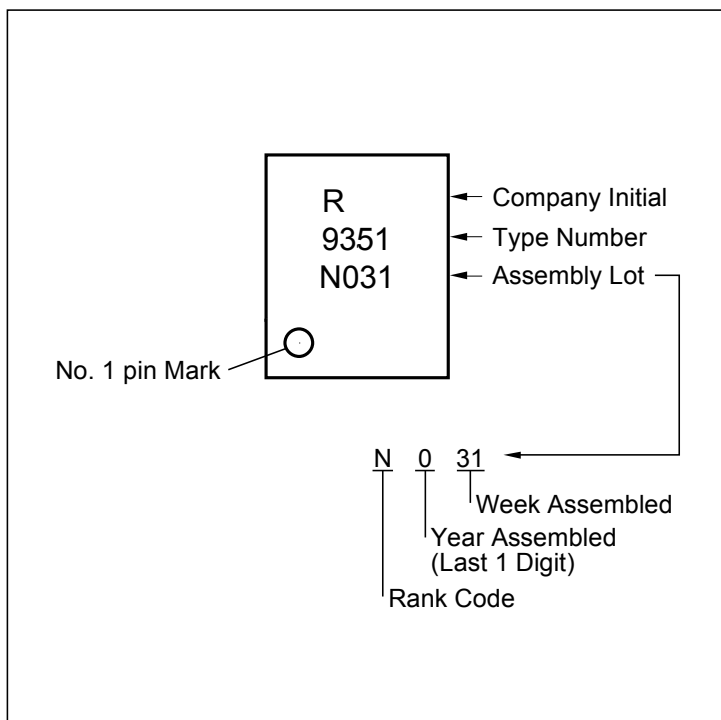


- Lead Bending Type (Gull-wing) For Long Creepage Distance (Surface Mount)



**PS9351L, PS9351L2**

**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

## PS9351L, PS9351L2

### ORDERING INFORMATION

Part Number	Order Number	Solder Plating Specification	Packing Style	Safety Standard Approval	Application Part Number <sup>*1</sup>
PS9351L	PS9351L-AX	Pb-Free (Ni/Pd/Au)	20 pcs (Tape 20 pcs cut)	Standard products UL, CSA approved	PS9351L
PS9351L-E3	PS9351L-E3-AX		Embossed Tape 2 000 pcs/reel		
PS9351L2	PS9351L2-AX		20 pcs (Tape 20 pcs cut)	Standard products UL, CSA approved	PS9351L2
PS9351L2-E3	PS9351L2-E3-AX		Embossed Tape 2 000 pcs/reel		
PS9351L-V	PS9351L-V-AX		20 pcs (Tape 20 pcs cut)	DIN EN60747-5-5 (VDE0884-5) approved (Option)	PS9351L
PS9351L-V-E3	PS9351L-V-E3-AX		Embossed Tape 2 000 pcs/reel		
PS9351L2-V	PS9351L2-V-AX		20 pcs (Tape 20 pcs cut)	DIN EN60747-5-5 (VDE0884-5) approved (Option)	PS9351L2
PS9351L2-V-E3	PS9351L2-V-E3-AX		Embossed Tape 2 000 pcs/reel		

Note: \*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>	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 <sup>*2</sup>		BV	5 000	Vr.m.s.
Operating Ambient Temperature		T <sub>A</sub>	-40 to +100	°C
Storage Temperature		T <sub>stg</sub>	-55 to +125	°C

Notes: \*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

## PS9351L, PS9351L2

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

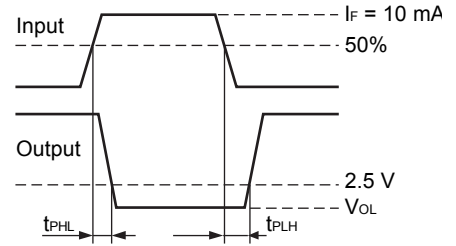
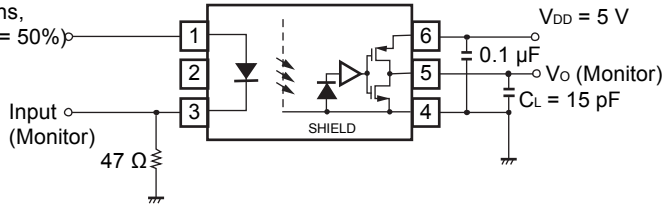
Parameter		Symbol	Conditions	MIN.	TYP. *1	MAX.	Unit
Diode	Forward Voltage	$V_F$	$I_F = 10$ mA, $T_A = 25^\circ\text{C}$	1.2	1.56	1.8	V
	Reverse Current	$I_R$	$V_R = 3$ V, $T_A = 25^\circ\text{C}$			10	$\mu\text{A}$
	Terminal Capacitance	$C_t$	$V = 0$ V, $f = 1$ MHz, $T_A = 25^\circ\text{C}$		30		pF
Detector	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%, $T_A = 25^\circ\text{C}$	$10^{11}$			
	Isolation Capacitance	$C_{I-O}$	$V = 0$ V, $f = 1$ MHz, $T_A = 25^\circ\text{C}$		0.7		pF
	Propagation Delay Time (H $\rightarrow$ L) *3	$t_{PHL}$	$I_F = 10$ mA, $V_{DD} = 5$ V, $C_L = 15$ pF, CMOS Levels		30	60	
	Propagation Delay Time (L $\rightarrow$ H) *3	$t_{PLH}$			35	60	
	Pulse Width Distortion (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 Transient Immunity at High Level Output*4	$CM_H$		$V_{DD} = 5$ V, $I_F = 0$ mA, $V_{CM} = 1$ kV, $V_O > 4$ V, $T_A = 25^\circ\text{C}$	15	20	
Common Mode Transient Immunity at Low Level Output*4	$CM_L$	$V_{DD} = 5$ V, $I_F = 10$ mA, $V_{CM} = 1$ kV, $V_O < 1$ V, $T_A = 25^\circ\text{C}$	15	20			

Notes: \*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.

**PS9351L, PS9351L2**

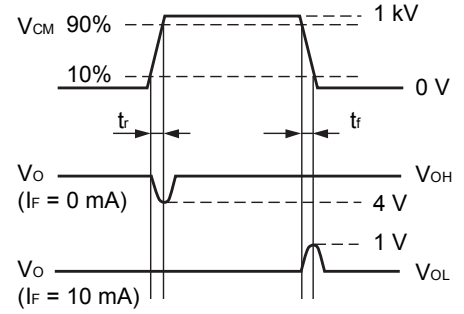
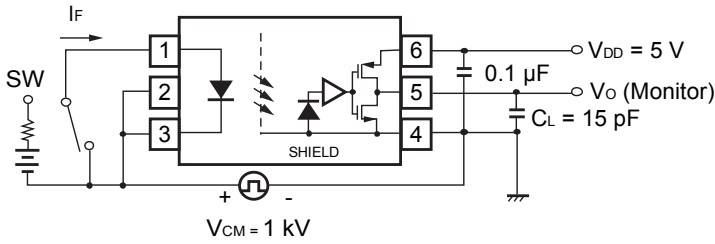
**\*3 Test circuit for propagation delay time**

Pulse input ( $I_F = 10 \text{ mA}$ )  
 (PW = 100 ns,  
 Duty cycle = 50%)



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

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

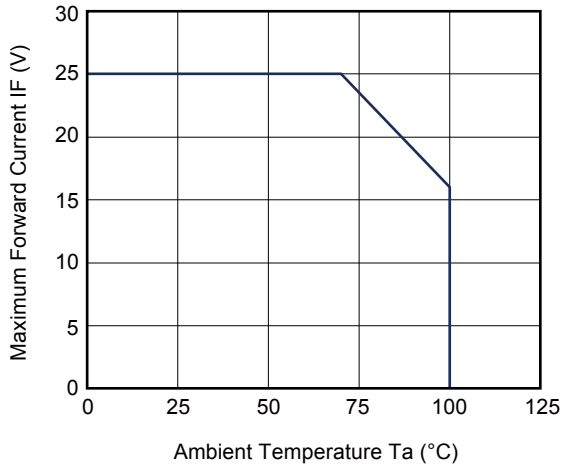


**Remark**  $C_L$  includes probe and stray wiring capacitance.

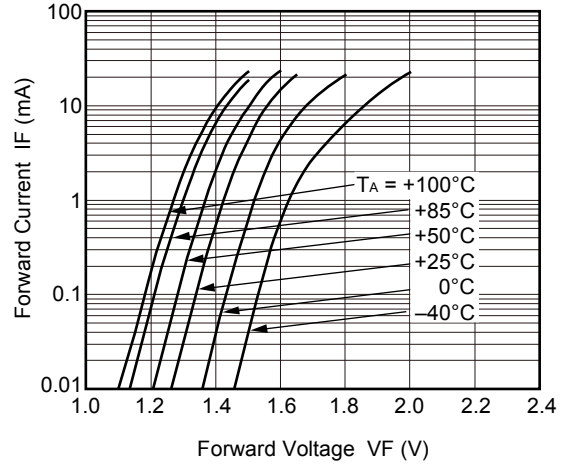
**PS9351L, PS9351L2**

**TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25°C unless otherwise specified)**

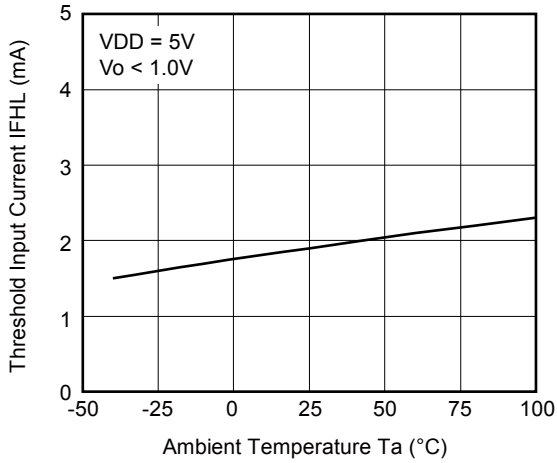
MAXIMUM FORWARD CURRENT vs. AMBIENT TEMPERATURE



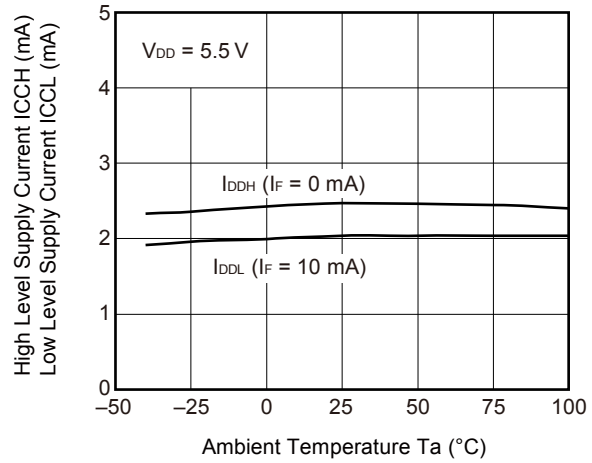
FORWARD CURRENT vs. FORWARD VOLTAGE



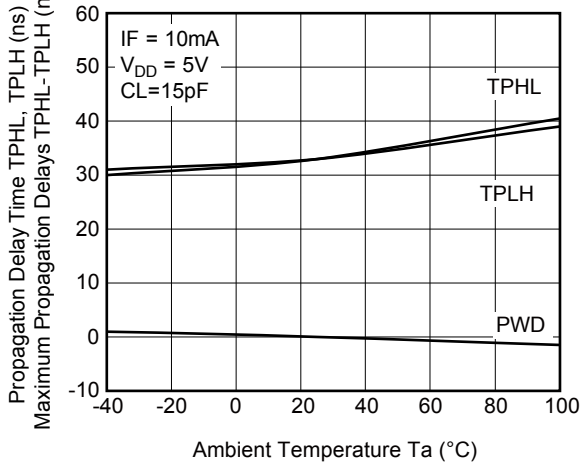
THRESHOLD INPUT CURRENT vs. AMBIENT TEMPERATURE



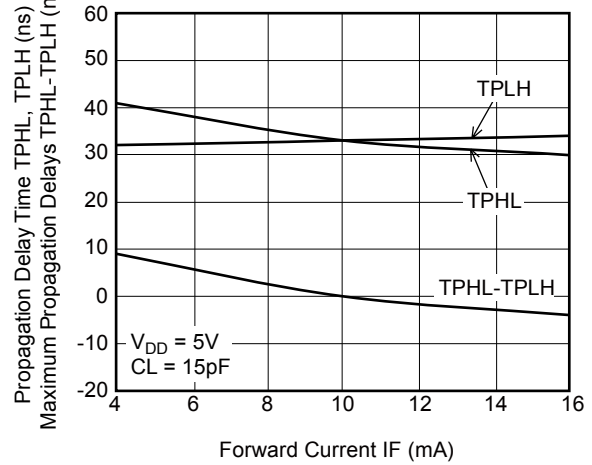
SUPPLY CURRENT vs. AMBIENT TEMPERATURE



PROPAGATION DELAY TIME, MAXIMUM PROPAGATION DELAYS vs. AMBIENT TEMPERATURE



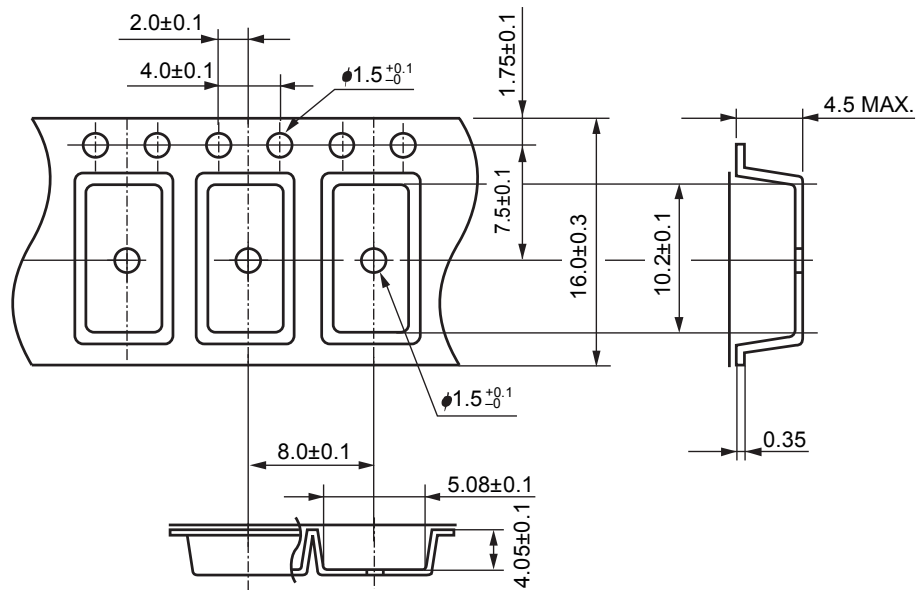
PROPAGATION DELAY TIME, MAXIMUM PROPAGATION DELAYS vs. FORWARD CURRENT



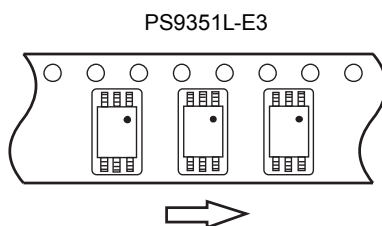
**PS9351L, PS9351L2**

**TAPING SPECIFICATIONS (UNIT:mm)**

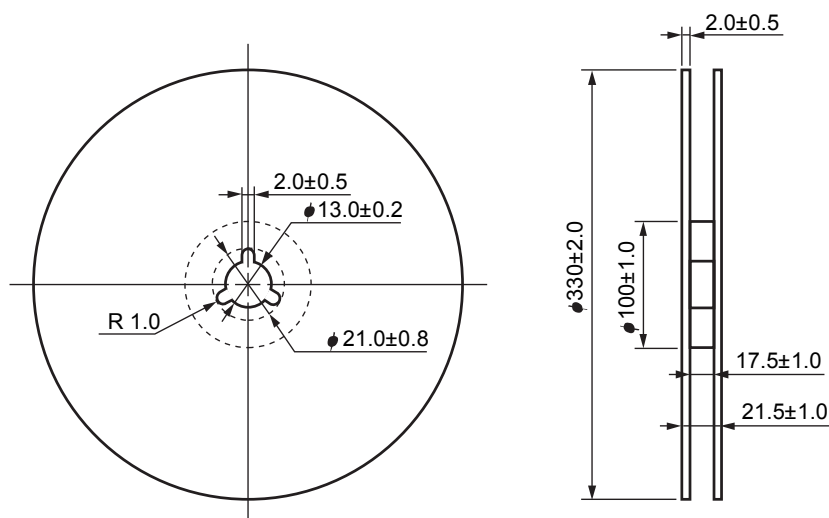
**Outline and Dimensions (Tape)**



**Tape Direction**



**Outline and Dimensions (Reel)**

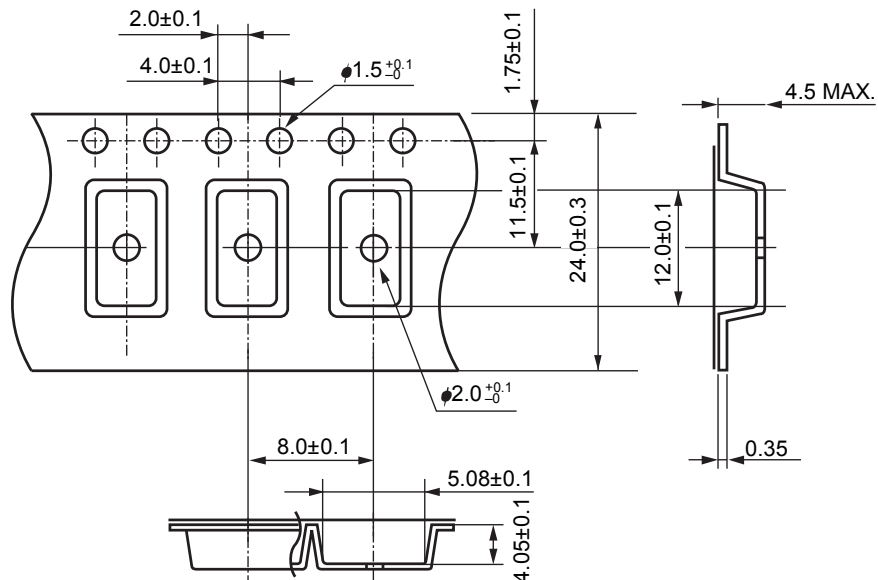


Packing: 2 000 pcs/reel

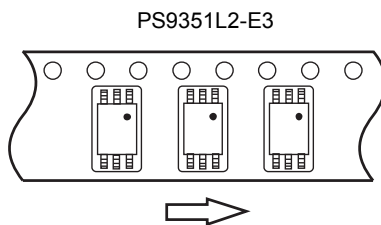


**PS9351L, PS9351L2**

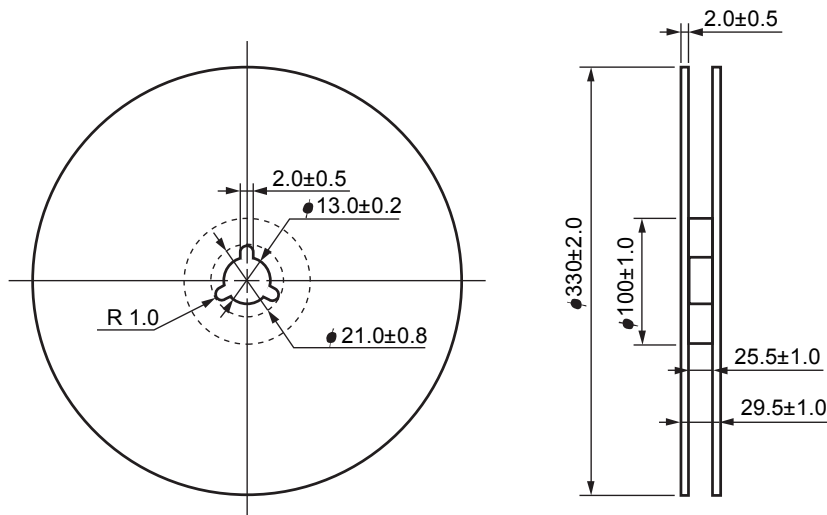
**Outline and Dimensions (Tape)**



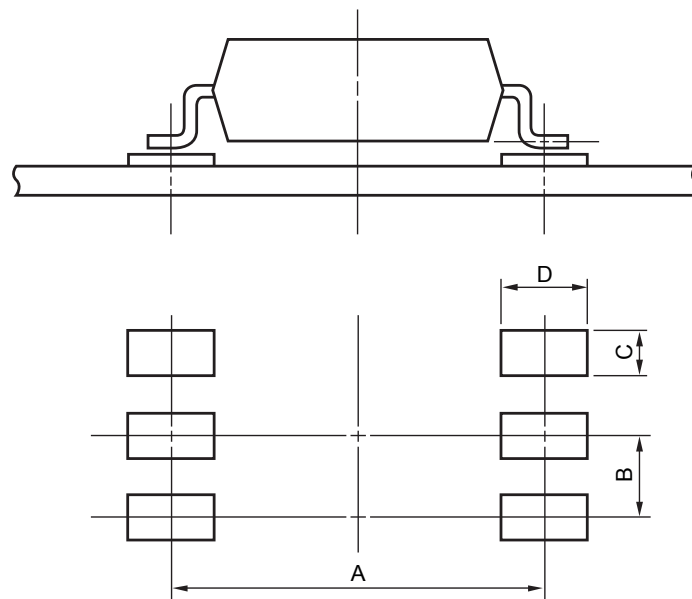
**Tape Direction**



**Outline and Dimensions (Reel)**



Packing: 2 000 pcs/reel

**PS9351L, PS9351L2**
**RECOMMENDED MOUNT PAD DIMENSIONS (UNIT:mm)**


Part Number	Lead Bending	A	B	C	D
PS9351L	lead bending type (Gull-wing) for surface mount	9.2	1.27	0.8	2.2
PS9351L2	lead bending type (Gull-wing) for long creepage distance (surface mount)	10.2	1.27	0.8	2.2

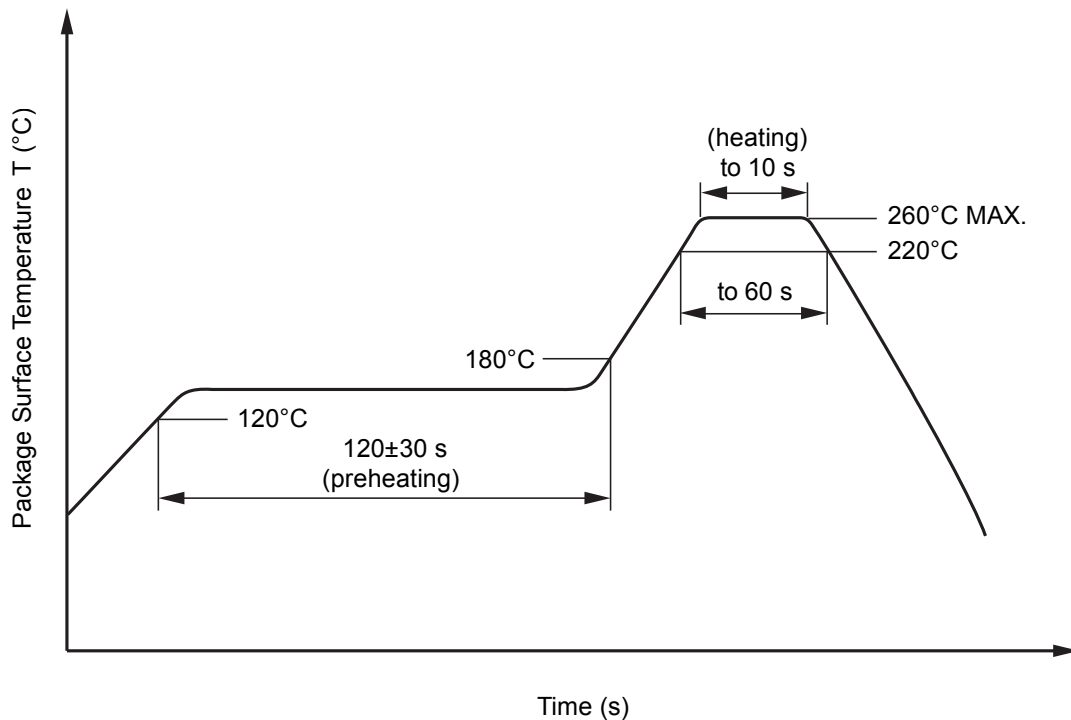
## NOTES ON HANDLING

### 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

## PS9351L, PS9351L2

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

## 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  $V_{\text{DD}}$  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.  
\*1 NC: Not connected (No connection)
4. Avoid storage at a high temperature and high humidity.

## SPECIFICATION OF VDE MARKS LICENSE DOCUMENT

Parameter	Symbol	Spec.	Unit
Climatic test class (IEC 60068-1/DIN EN 60068-1)		40/100/21	
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	$^{\circ}\text{C}$
Operating temperature range	$T_A$	-40 to +100	$^{\circ}\text{C}$
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	$^{\circ}\text{C}$
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.	$10^9$	$\Omega$

**Caution**

GaAs Products

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.

- 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.
  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.
  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.
- Do not burn, destroy, cut, crush, or chemically dissolve the product.
- Do not lick the product or in any way allow it to enter the mouth.

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