

# PS9151

R08DS0108EJ0301

Rev.3.01

HIGH NOISE REDUCTION, 15 Mbps CMOS OUTPUT TYPE, 5-PIN SOP (SO-5) PHOTOCOUPLER May 30, 2018

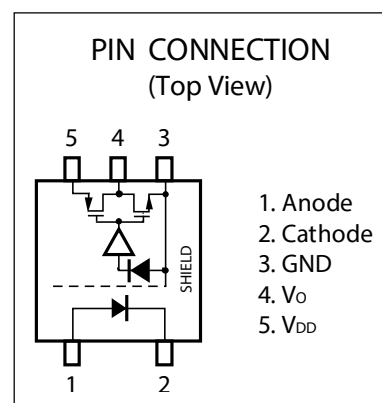
## DESCRIPTION

The PS9151 is an optically coupled isolator containing an AlGaAs LED on the input side and a CMOS output IC on the output side.

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

## FEATURES

- High-speed response (15 Mbps)
- Operable at high temperature ( $-40$  to  $+100^{\circ}\text{C}$ )
- High common mode transient immunity ( $\text{CM}_\text{H}$ ,  $\text{CM}_\text{L} = \pm 20 \text{ kV}/\mu\text{s}$  TYP.)
- High isolation voltage ( $\text{BV} = 3\,750 \text{ V r.m.s.}$ )
- Pulse width distortion ( $|t_{\text{PHL}} - t_{\text{PLH}}| = 3 \text{ ns}$  TYP.)
- Ordering number of tape product : PS9151-F3: 2 500 pcs/reel
- Pb-Free product
- Safety standards
  - UL approved: UL1577, Single protection
  - VDE approved: DIN EN 60747-5-5 (Option)

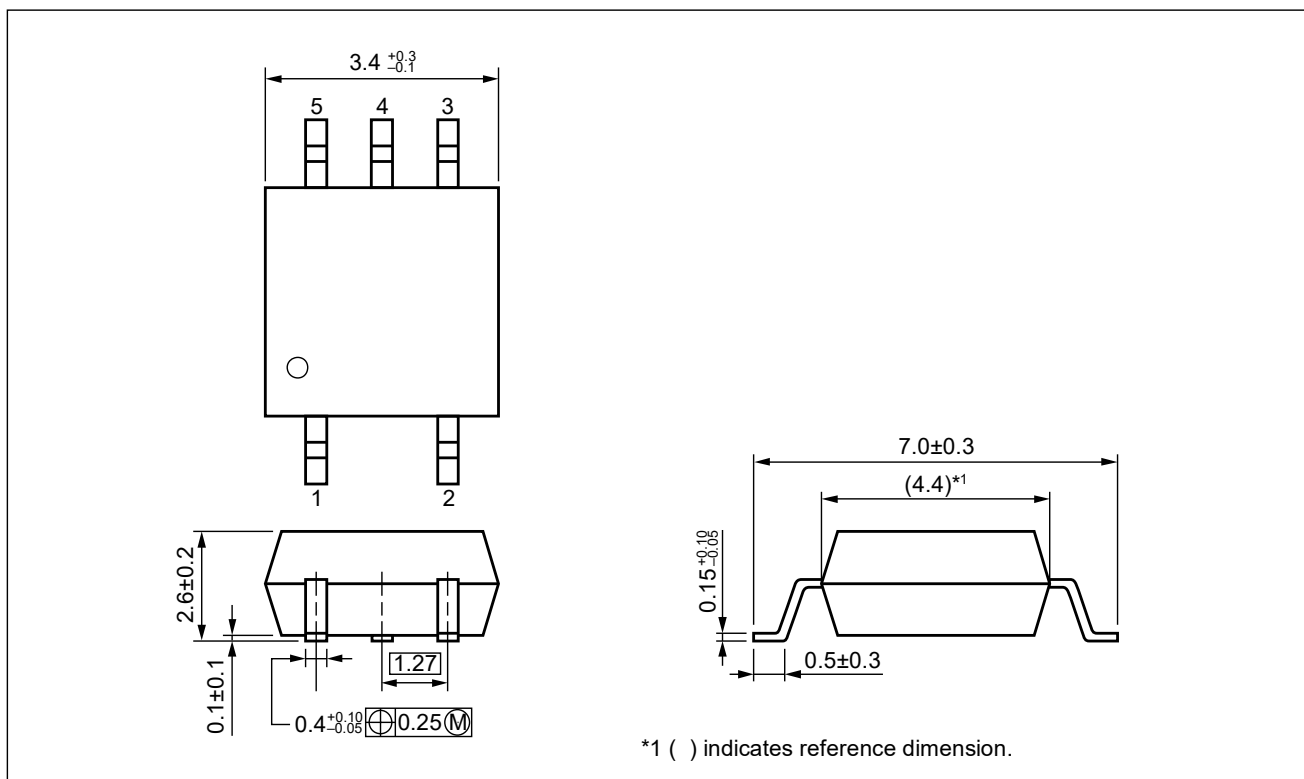


## APPLICATIONS

- FA Network
- Measurement equipment

Start of mass production  
Jun.2006

## PACKAGE DIMENSIONS (UNIT: mm)

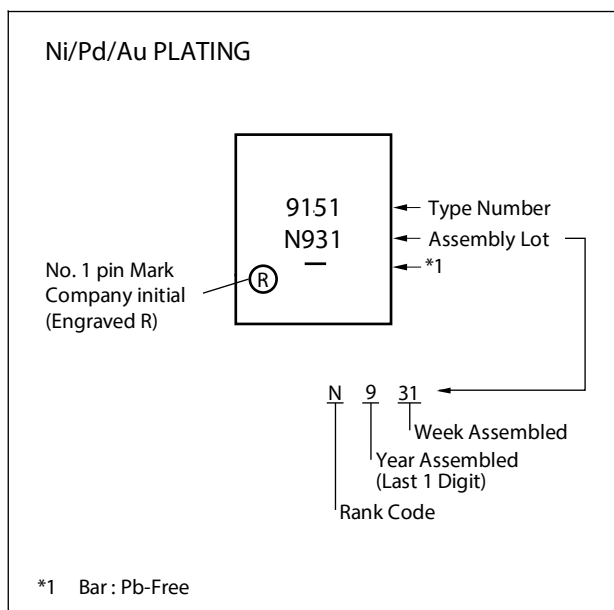


Weight: 0.08g (typ.)

## PHOTOCOUPLER CONSTRUCTION

Parameter	PS9151
Air Distance (MIN.)	4.2 mm
Creepage Distance (MIN.)	4.2 mm
Isolation Distance (MIN.)	0.2 mm

## MARKING EXAMPLE



## ORDERING INFORMATION

Part Number	Order Number	Solder Plating Specification	Packing Style	Safety Standard Approval	Application Part Number* <sup>1</sup>
PS9151	PS9151-AX	Pb-Free (Ni/Pd/Au)	20 pcs (Tape 20 pcs cut)	Standard products (UL, approved)	PS9151
PS9151-F3	PS9151-F3-AX		Embossed Tape 2 500 pcs/reel		
PS9151-V	PS9151-V-AX		20 pcs (Tape 20 pcs cut)	UL, DIN EN 60747-5-5 approved	
PS9151-V-F3	PS9151-V-F3-AX		Embossed Tape 2 500 pcs/reel		

Note: \*1. 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	$V_{DD}$	0 to 5.5	V
	Output Voltage	$V_O$	-0.5 to $V_{DD}+0.5$	V
	Output Current	$I_O$	2	mA
Isolation Voltage <sup>*2</sup>		BV	3 750	Vr.m.s.
Operating Ambient Temperature		$T_A$	-40 to +100	$^\circ\text{C}$
Storage Temperature		$T_{stg}$	-55 to +125	$^\circ\text{C}$

Notes: \*1. Reduced to 0.8 mA/ $^\circ\text{C}$  at  $T_A = 95^\circ\text{C}$  or more.

\*2. AC voltage for 1 minute at  $T_A = 25^\circ\text{C}$ , RH = 60% between input and output.

Pins 1-2 shorted together, 3-5 shorted together.

## RECOMMENDED OPERATING CONDITIONS

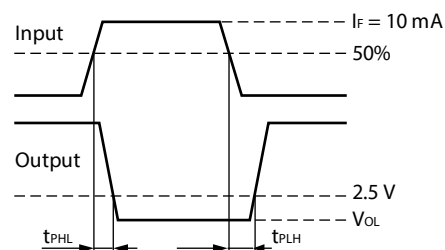
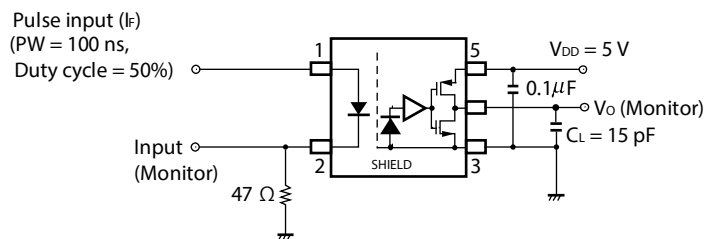
Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Forward Current	$I_F$	10		16	mA
Supply Voltage	$V_{DD}$	4.5	5.0	5.5	V

**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, $T_A = 25^\circ\text{C}$	1.4	1.65	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	$I_{CCH}$	$I_O = -20$ $\mu\text{A}$ , $I_F = 0$ mA	4	5		V
	Low Level Output Voltage	$V_{OL}$	$I_O = 20$ $\mu\text{A}$ , $I_F = 10$ mA		0	0.1	
Coupled	Threshold Input Voltage	$I_{FHL}$	$V_O < 1$ V		2.2	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, $T_A = 25^\circ\text{C}$		0.6		pF
	Propagation Delay Time (H $\rightarrow$ L)*2	$t_{PHL}$	$I_F = 10$ mA, $V_{DD} = 5$ V, $C_L = \text{pF}$ , CMOS Levels		35	60	ns
	Propagation Delay Time (L $\rightarrow$ H)*2	$t_{PLH}$			35	60	
	Pulse Width Distortion (PWD)*2	$ t_{PHL} - t_{PLH} $			3	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*3	$ 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		kV/ $\mu\text{s}$
	Common Mode Transient Immunity at Low Level Output*3	$ 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		

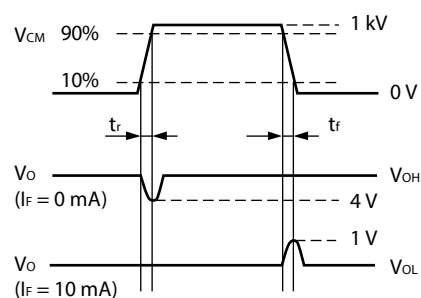
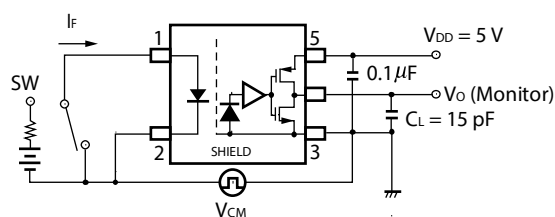
Notes: \*1. Typical values at  $T_A = 25^\circ\text{C}$

\*2. Test circuit for propagation delay time



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

\*3. Test circuit for common mode transient immunity



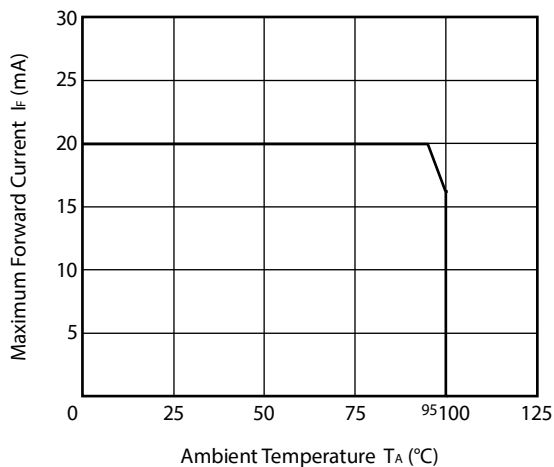
**Remark**  $C_L$  includes probe and stray wiring capacitance.

## USAGE CAUTIONS

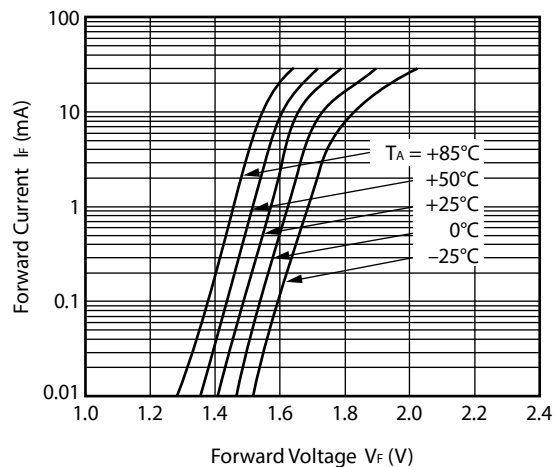
1. This product is weak for static electricity by designed with high-speed integrated circuit so protect against static electricity when handling.
2. By-pass capacitor of 0.1  $\mu\text{F}$  or more is used between  $V_{CC}$  and GND near device. Also, ensure that the distance between the leads of the photocoupler and capacitor is 10 mm or less.
3. When  $V_{DD}$  is lower than around 2 V, the output( $V_o$ ) of this product is unstable, and this might produce undesirable operation. Be sure to check the operation of an IC or a discrete component that is connected to this product during Power-up and Power-down process. And we recommend to use a disable function (shutdown function) of the connected IC or a reset IC to avoid this undesirable operation.
4. Avoid storage at a high temperature and high humidity.
5. Do not use adhesives or coating materials including halogens to fix this device.

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

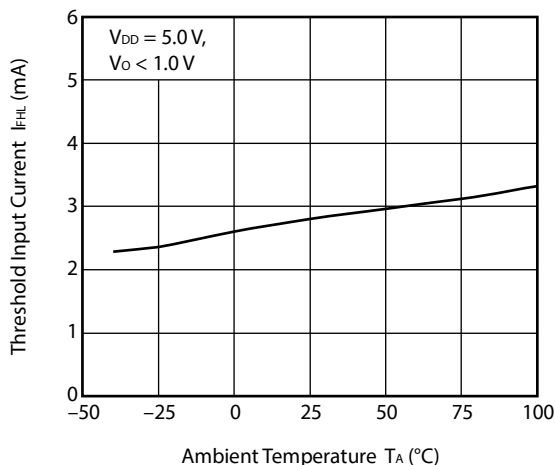
MAXIMUM FORWARD CURRENT  
vs. AMBIENT TEMPERATURE



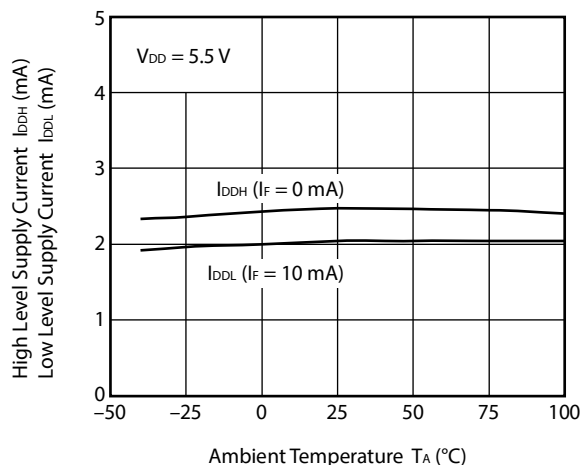
FORWARD CURRENT vs.  
FORWARD VOLTAGE



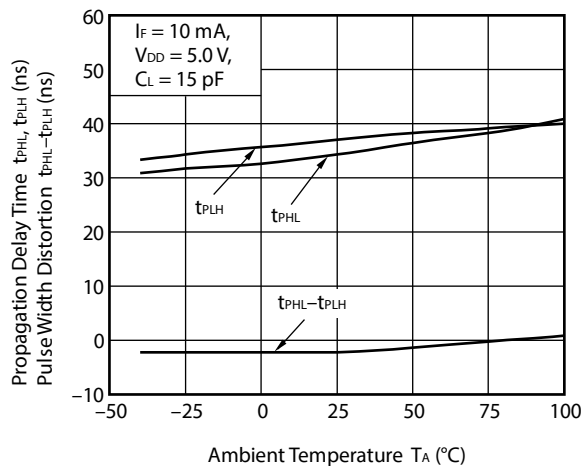
THRESHOLD INPUT CURRENT vs.  
AMBIENT TEMPERATURE



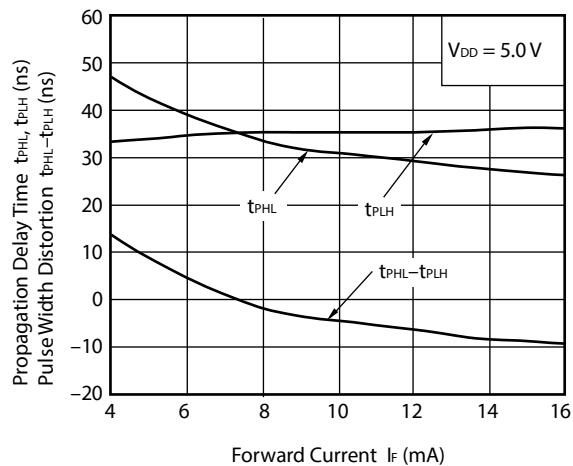
SUPPLY CURRENT vs.  
AMBIENT TEMPERATURE



PROPAGATION DELAY TIME,  
PULSE WIDTH DISTORTION  
vs. AMBIENT TEMPERATURE



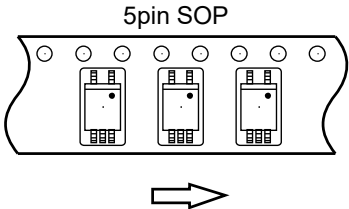
PROPAGATION DELAY TIME,  
PULSE WIDTH DISTORTION  
vs. FORWARD CURRENT



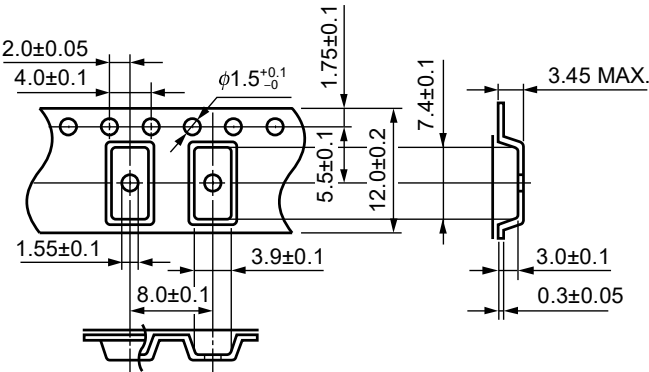
**Remark** The graphs indicate nominal characteristics.

TAPING SPECIFICATIONS (UNIT: mm)

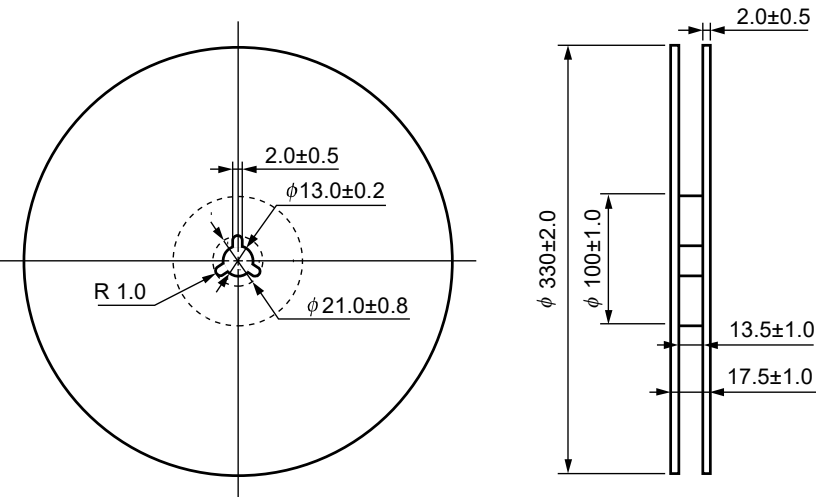
Tape Direction



Outline and Dimensions (Tape)

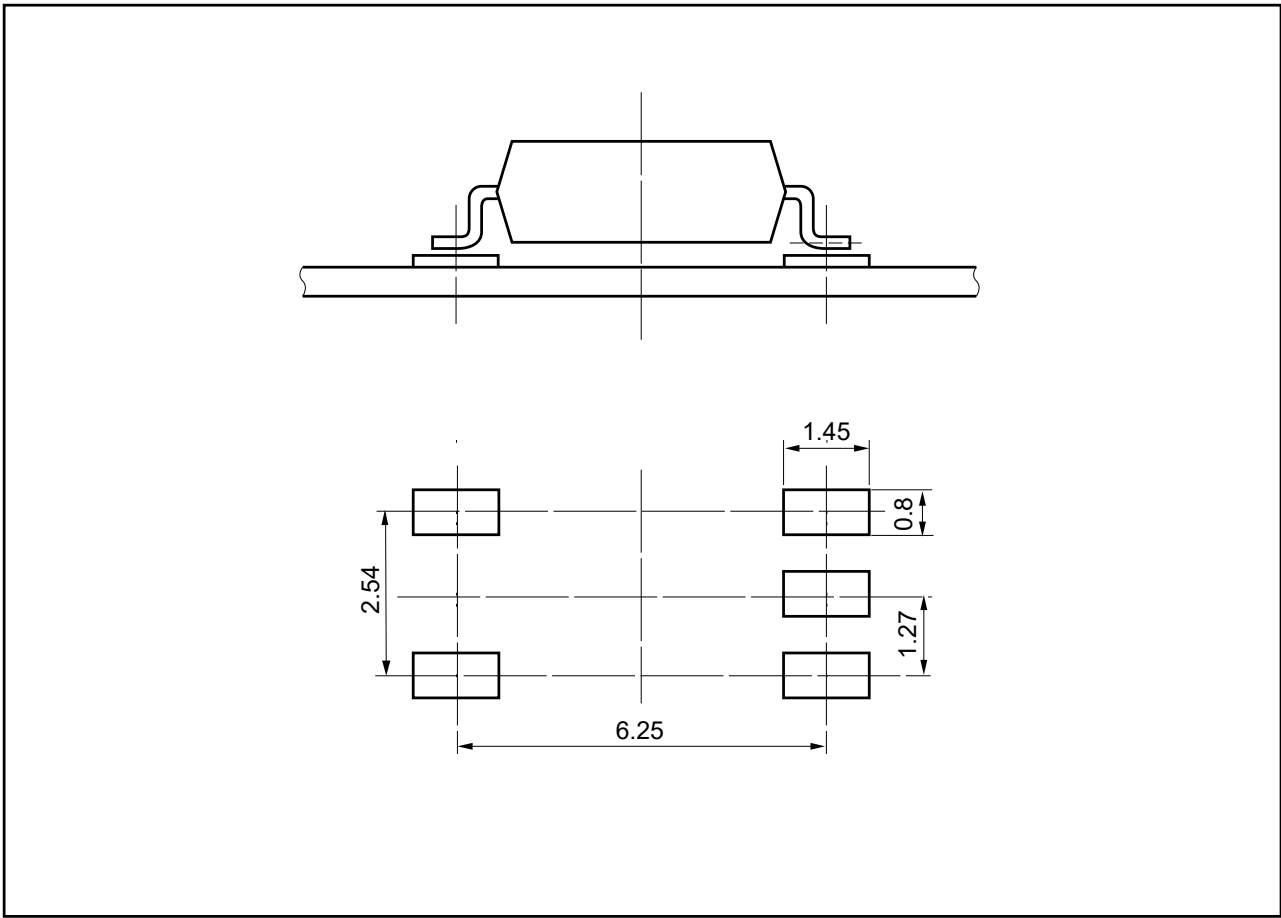


Outline and Dimensions (Reel)



Packing: 2 500 pcs/reel

RECOMMENDED MOUNT PAD DIMENSIONS (UNIT: mm)



【5pin SOP】



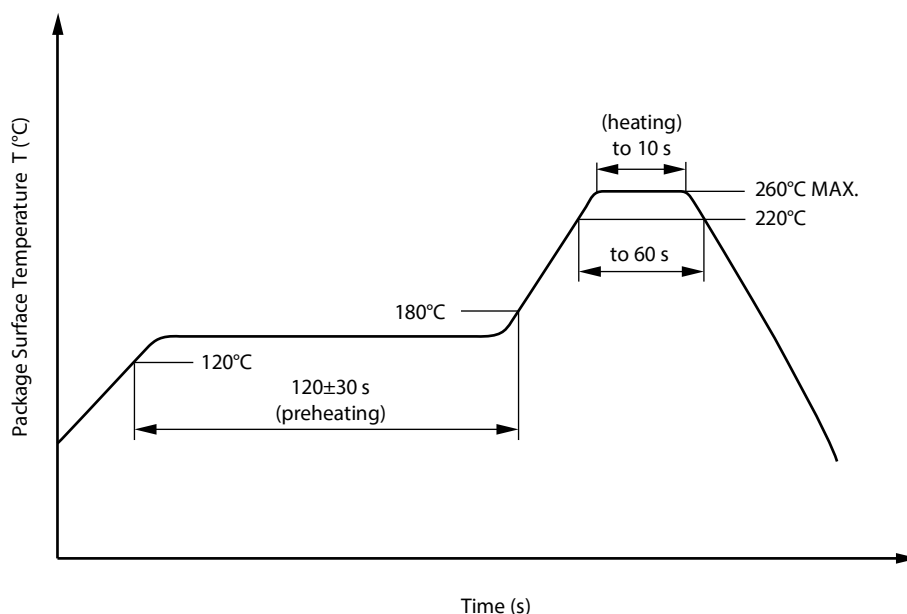
## NOTES ON HANDLING

### 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

#### (4) Cautions

- Fluxes  
Avoid removing the residual flux with freon-based and halogens-based (chlorine-based) cleaning solvent .

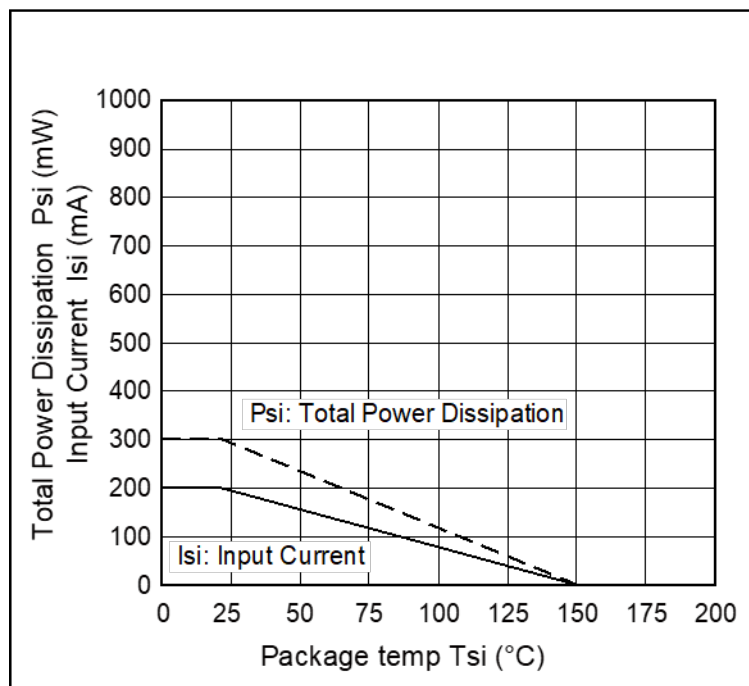
### 2. Cautions regarding noise

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.

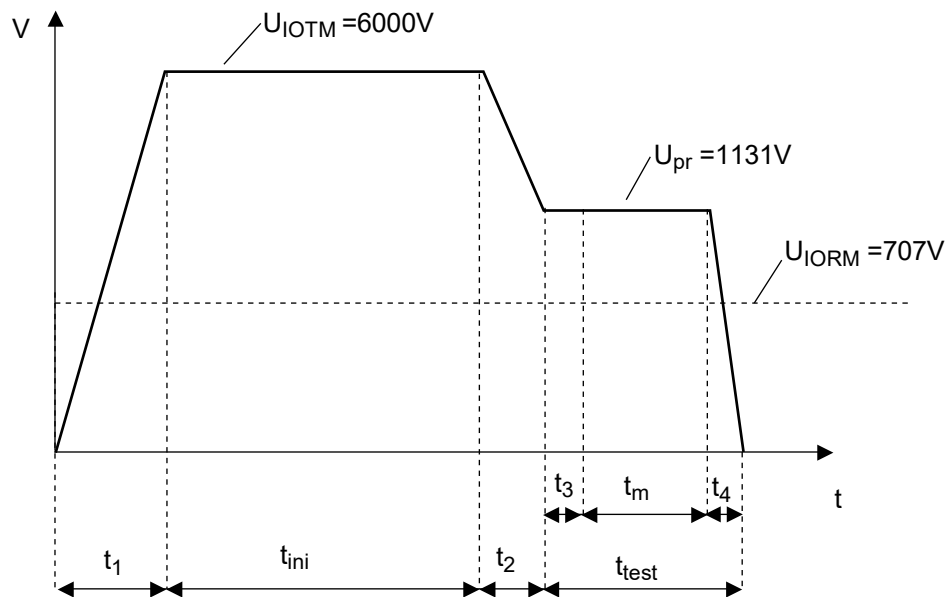
## SPECIFICATION OF VDE MARKS LICENSE DOCUMENT

Parameter	Symbol	Rating	Unit
Climatic test class (IEC 60068-1/DIN EN 60068-1)		40/100/21	
Dielectric strength			
maximum operating isolation voltage	$U_{IORM}$	707	$V_{peak}$
Test voltage (partial discharge test, procedure a for type test and random test)	$U_{pr}$	1 131	$V_{peak}$
$U_{pr} = 1.6 \times U_{IORM}$ , $P_d < 5 \text{ pC}$			
Test voltage (partial discharge test, procedure b for all devices)	$U_{pr}$	1 326	$V_{peak}$
$U_{pr} = 1.875 \times U_{IORM}$ , $P_d < 5 \text{ pC}$			
Highest permissible overvoltage	$U_{TR}$	6 000	$V_{peak}$
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 +100	°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	$T_{si}$	150	°C
Current (input current $I_F$ , $P_{si} = 0$ )	$I_{si}$	200	mA
Power (output or total power dissipation)	$P_{si}$	300	mW
Isolation resistance			
$V_{IO} = 500 \text{ V dc at } T_A = T_{si}$	Ris MIN.	$10^9$	$\Omega$

## Dependence of maximum safety ratings with package temperature

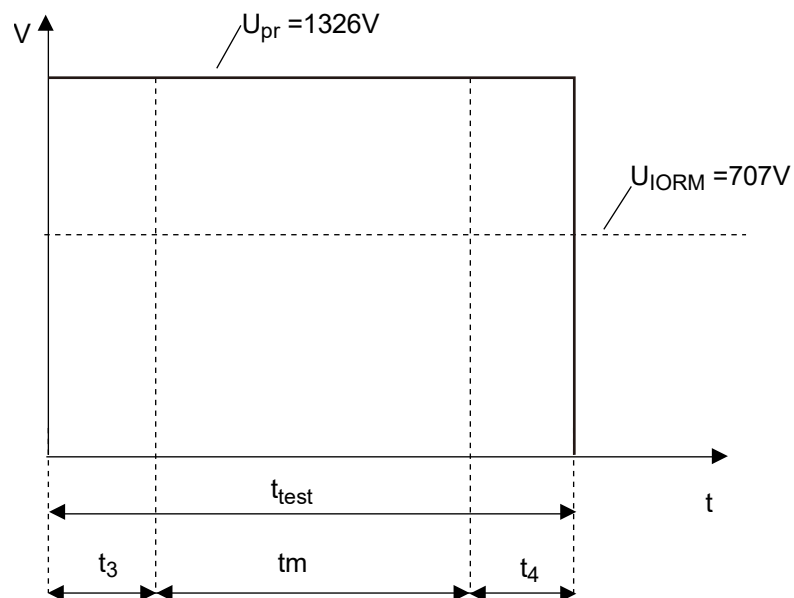


## Method a) Destructive Test, Type and Sample Test



$t_1, t_2 = 1 \text{ to } 10 \text{ sec}$   
 $t_3, t_4 = 1 \text{ sec}$   
 $t_m(\text{PARTIAL DISCHARGE}) = 10 \text{ sec}$   
 $t_{test} = 12 \text{ sec}$   
 $t_{ini} = 60 \text{ sec}$

## Method b) Non-destructive Test, 100% Production Test



$t_3, t_4 = 0.1 \text{ sec}$   
 $t_m(\text{PARTIAL DISCHARGE}) = 1.0 \text{ sec}$   
 $t_{test} = 1.2 \text{ sec}$

<b>Caution</b>	<p>GaAs Products</p>	<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.</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>
----------------	----------------------	---

---

All trademarks and registered trademarks are the property of their respective owners.

## Notice

1. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation or any other use of the circuits, software, and information in the design of your product or system. Renesas Electronics disclaims any and all liability for any losses and damages incurred by you or third parties arising from the use of these circuits, software, or information.
  2. Renesas Electronics hereby expressly disclaims any warranties against and liability for infringement or any other claims involving patents, copyrights, or other intellectual property rights of third parties, by or arising from the use of Renesas Electronics products or technical information described in this document, including but not limited to, the product data, drawings, charts, programs, algorithms, and application examples.
  3. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
  4. You shall not alter, modify, copy, or reverse engineer any Renesas Electronics product, whether in whole or in part. Renesas Electronics disclaims any and all liability for any losses or damages incurred by you or third parties arising from such alteration, modification, copying or reverse engineering.
  5. Renesas Electronics products are classified according to the following two quality grades: "Standard" and "High Quality". The intended applications for each Renesas Electronics product depends on the product's quality grade, as indicated below.

"Standard": Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; industrial robots; etc.

"High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control (traffic lights); large-scale communication equipment; key financial terminal systems; safety control equipment; etc.

Unless expressly designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not intended or authorized for use in products or systems that may pose a direct threat to human life or bodily injury (artificial life support devices or systems; surgical implantations; etc.), or may cause serious property damage (space system; undersea repeaters; nuclear power control systems; aircraft control systems; key plant systems; military equipment; etc.). Renesas Electronics disclaims any and all liability for any damages or losses incurred by you or any third parties arising from the use of any Renesas Electronics product that is inconsistent with any Renesas Electronics data sheet, user's manual or other Renesas Electronics document.
  6. When using Renesas Electronics products, refer to the latest product information (data sheets, user's manuals, application notes, "General Notes for Handling and Using Semiconductor Devices" in the reliability handbook, etc.), and ensure that usage conditions are within the ranges specified by Renesas Electronics with respect to maximum ratings, operating power supply voltage range, heat dissipation characteristics, installation, etc. Renesas Electronics disclaims any and all liability for any malfunctions, failure or accident arising out of the use of Renesas Electronics products outside of such specified ranges.
  7. Although Renesas Electronics endeavors to improve the quality and reliability of Renesas Electronics products, semiconductor products have specific characteristics, such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Unless designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not subject to radiation resistance design. You are responsible for implementing safety measures to guard against the possibility of bodily injury, injury or damage caused by fire, and/or danger to the public in the event of a failure or malfunction of Renesas Electronics products, such as safety design for hardware and software, including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult and impractical, you are responsible for evaluating the safety of the final products or systems manufactured by you.
  8. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. You are responsible for carefully and sufficiently investigating applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive, and using Renesas Electronics products in compliance with all these applicable laws and regulations. Renesas Electronics disclaims any and all liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
  9. Renesas Electronics products and technologies shall not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations. You shall comply with any applicable export control laws and regulations promulgated and administered by the governments of any countries asserting jurisdiction over the parties or transactions.
  10. It is the responsibility of the buyer or distributor of Renesas Electronics products, or any other party who distributes, disposes of, or otherwise sells or transfers the product to a third party, to notify such third party in advance of the contents and conditions set forth in this document.
  11. This document shall not be reprinted, reproduced or duplicated in any form, in whole or in part, without prior written consent of Renesas Electronics.
  12. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products.
- (Note 1) "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its directly or indirectly controlled subsidiaries.
- (Note 2) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics.

(Rev.4.0-1 November 2017)



### SALES OFFICES

### Renesas Electronics Corporation

<http://www.renesas.com>

Refer to "<http://www.renesas.com/>" for the latest and detailed information.

**California Eastern Laboratories, Inc.**  
4590 Patrick Henry Drive, Santa Clara, California 95054-1817, U.S.A.  
Tel: +1-408-919-2500, Fax: +1-408-988-0279

**Renesas Electronics Europe Limited**  
Dukes Meadow, Millboard Road, Boume End, Buckinghamshire, SL8 5FH, U.K.  
Tel: +44-1628-651-700, Fax: +44-1628-651-804

**Renesas Electronics Europe GmbH**  
Arcadiastrasse 10, 40472 Düsseldorf, Germany  
Tel: +49-211-6503-0, Fax: +49-211-6503-1327

**Renesas Electronics (China) Co., Ltd.**  
Room 1709 Quantum Plaza, No.27 ZhichunLu, Haidian District, Beijing, 100191 P. R. China  
Tel: +86-10-8235-1155, Fax: +86-10-8235-7679

**Renesas Electronics (Shanghai) Co., Ltd.**  
Unit 301, Tower A, Central Towers, 555 Langao Road, Putuo District, Shanghai, 200333 P. R. China  
Tel: +86-21-2226-0888, Fax: +86-21-2226-0999

**Renesas Electronics Hong Kong Limited**  
Unit 1601-1611, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong  
Tel: +852-2265-6688, Fax: +852 2886-9022

**Renesas Electronics Taiwan Co., Ltd.**  
13F, No. 363, Fu Shing North Road, Taipei 10543, Taiwan  
Tel: +886-2-8175-9600, Fax: +886 2-8175-9670

**Renesas Electronics Singapore Pte. Ltd.**  
80 Bendemeer Road, Unit #06-02 Hyflux Innovation Centre, Singapore 339949  
Tel: +65-6213-0200, Fax: +65-6213-0300

**Renesas Electronics Malaysia Sdn.Bhd.**  
Unit 1207, Block B, Menara Amcorp, Amcorp Trade Centre, No. 18, Jln Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia  
Tel: +60-3-7955-9390, Fax: +60-3-7955-9510

**Renesas Electronics India Pvt. Ltd.**  
No.777C, 100 Feet Road, HAL 2nd Stage, Indiranagar, Bangalore 560 038, India  
Tel: +91-80-67208700, Fax: +91-80-67208777

**Renesas Electronics Korea Co., Ltd.**  
17F, KAMCO Yangjae Tower, 262, Gangnam-daero, Gangnam-gu, Seoul, 06265 Korea  
Tel: +82-2-558-3737, Fax: +82-2-558-5338

# Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[Renesas Electronics:](#)

[PS9151-F3-AX](#) [PS9151-V-F3-AX](#) [PS9151-AX](#) [PS9151-V-AX](#)