

# PS9117A

HIGH CMR 10 Mbps, OPEN COLLECTOR OUTPUT TYPE  
5-PIN SOP (SO-5) HIGH-SPEED PHOTOCOUPLED

R08DS0139EJ0100

Rev.1.0

Oct.29.2018

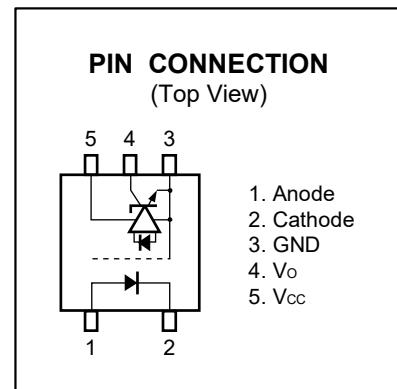
## DESCRIPTION

The PS9117A is an optically coupled high-speed, active low type isolator containing an AlGaAs LED on the input side and a photodiode and a signal processing circuit on the output side on one chip.

The PS9117A is designed specifically for high common mode transient immunity (CMR) and low pulse width distortion. The PS9117A is suitable for high density application.

## FEATURES

- Pulse width distortion ( $|t_{PHL} - t_{PLH}| = 35$  ns MAX.)
- High common mode transient immunity ( $CM_H, CM_L = \pm 15$  kV/ $\mu$ s MIN.)
- Small package (SO-5)
- High-speed (10 Mbps)
- High isolation voltage ( $BV = 3750$  Vr.m.s.)
- Open collector output
- Ordering number of taping product: PS9117A-F3 : 2500 pcs/reel
- Pb-Free product
- Safety standards
  - UL approved: UL1577, Single protection
  - CSA approved: CAN/CSA-C22.2 No. 62368-1, Basic insulation
  - VDE approved: DIN EN 60747-5-5 (Option)



## APPLICATIONS

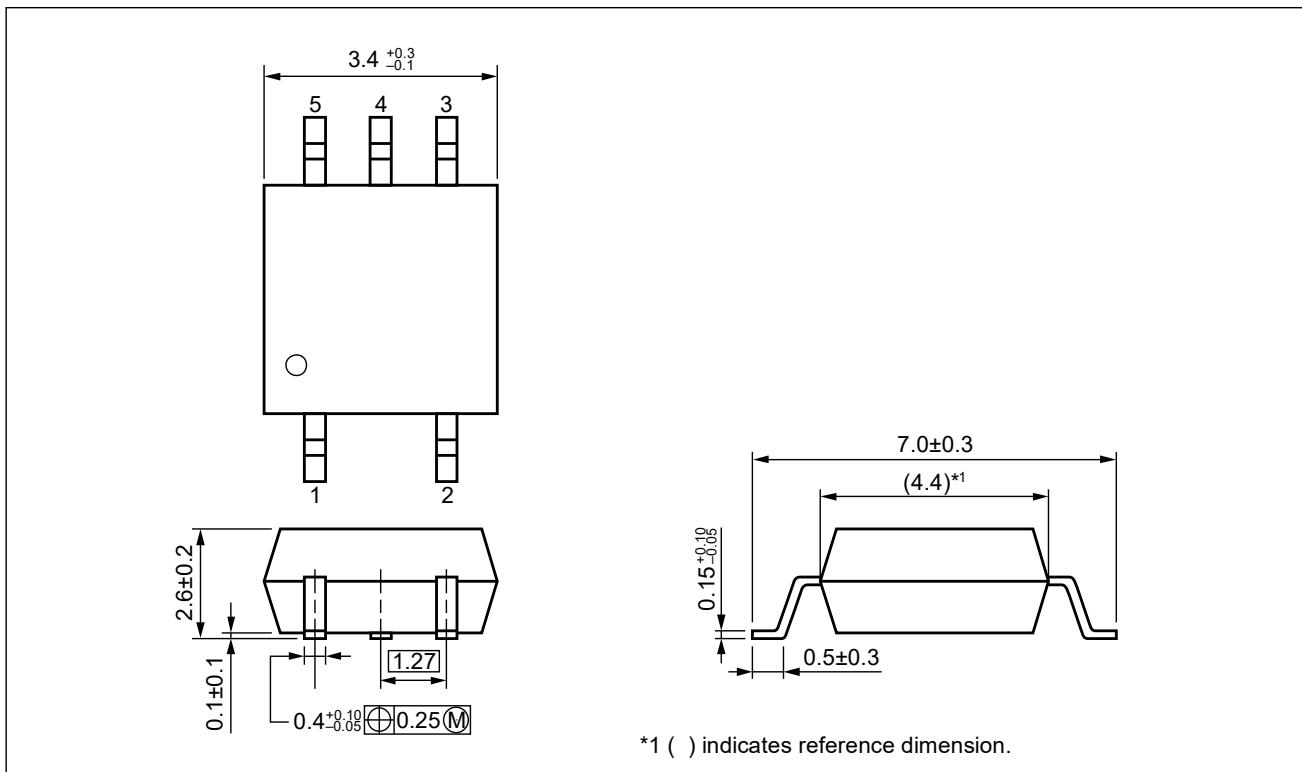
- Measurement equipment
- PDP
- FA Network

## TRUTH TABLE

LED	Output
ON	L
OFF	H

Start of mass production  
Sep.2006

## PACKAGE DIMENSIONS (UNIT: mm)

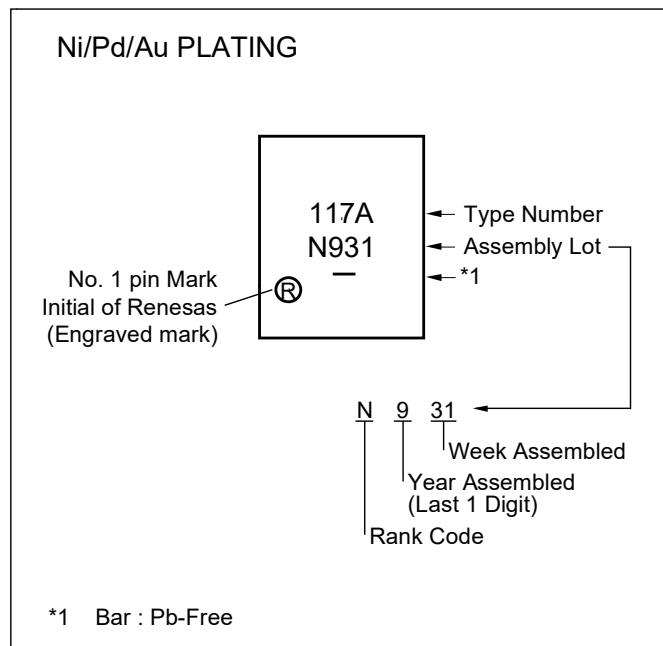


Weight: 0.08g (typ.)

## PHOTOCOUPLED CONSTRUCTION

Parameter	PS9117A
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>
PS9117A	PS9117A-AX	Pb-Free (Ni/Pd/Au)	20 pcs (Tape 20 pcs cut)	Standard products (UL, CSA approved)	PS9117A
PS9117A-F3	PS9117A-F3-AX		Embossed Tape 2500 pcs/reel		
PS9117A-V	PS9117A-V-AX		20 pcs (Tape 20 pcs cut)	UL, CSA,	
PS9117A-V-F3	PS9117A-V-F3-AX		Embossed Tape 2 500 pcs/reel	DIN EN 60747-5-5 approved	

Notes: \*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>	$I_F$	30	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>		$BV$	3 750	Vr.m.s.
Operating Ambient Temperature		$T_A$	-40 to +85	°C
Storage Temperature		$T_{stg}$	-55 to +125	°C

Notes: \*1. Reduced to 0.3 mA/°C at  $T_A = 25^\circ\text{C}$  or more.

\*2. Applies to output pin  $V_o$  (collector pin). Reduced to 1.5 mW/°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 1-2 shorted together, 3-5 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	$I_{FH}$	6.3	10	12.5	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	$\Omega$

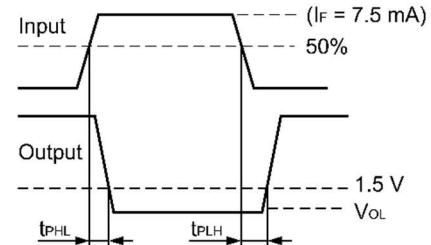
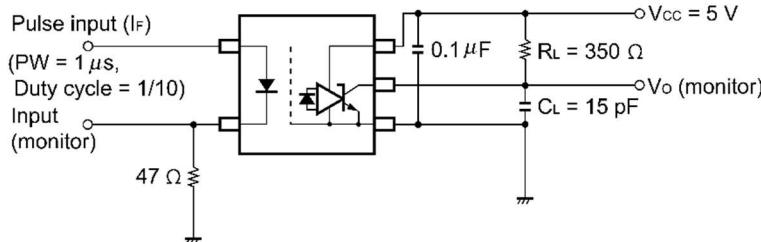
ELECTRICAL CHARACTERISTICS ( $T_A = -40$  to  $+85^\circ\text{C}$ , unless otherwise specified)

Parameter	Symbol	Conditions	MIN.	TYP. <sup>*1</sup>	MAX.	Unit
Diode	Forward Voltage	$V_F$	$I_F = 16\text{ mA}, T_A = 25^\circ\text{C}$	1.4	1.65	1.8
	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 <sup>*2</sup>	$V_{OL}$	$V_{CC} = 5.5\text{ V}, I_F = 5\text{ mA}, I_{OL} = 13\text{ mA}$		0.2	0.6
	High Level Supply Current	$I_{CCH}$	$V_{CC} = 5.5\text{ V}, I_F = 0\text{ mA}, V_O = \text{open}$		4	7
	Low Level Supply Current	$I_{CCL}$	$V_{CC} = 5.5\text{ V}, I_F = 10\text{ mA}, V_O = \text{open}$		6	10
Coupled	Threshold Input Current ( $H \rightarrow L$ )	$I_{FHL}$	$V_{CC} = 5\text{ V}, V_O = 0.8\text{ V}, R_L = 350\text{ }\Omega$		2	5
	Isolation Resistance	$R_{I-O}$	$V_{I-O} = 1\text{ kV}_{DC}, RH = 40$ to $60\%$ , $T_A = 25^\circ\text{C}$	$10^{11}$		$\Omega$
	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 ( $H \rightarrow L$ ) <sup>*3</sup>	$t_{PHL}$	$T_A = 25^\circ\text{C}$		40	75
	Propagation Delay Time ( $L \rightarrow H$ ) <sup>*3</sup>	$t_{PLH}$				100
	Rise Time	$t_r$	$V_{CC} = 5\text{ V}, R_L = 350\text{ }\Omega, I_F = 7.5\text{ mA}, V_{THHL} = V_{THLH} = 1.5\text{ V}$		45	75
	Fall Time	$t_f$				100
	Pulse Width Distortion (PWD) <sup>*3</sup>	$ t_{PHL}-t_{PLH} $			20	
	Propagation Delay Skew	$t_{PSK}$			5	35
	Common Mode Transient Immunity at High Level Output <sup>*4</sup>	$C_{MH}$	$V_{CC} = 5\text{ V}, R_L = 350\text{ }\Omega, T_A = 25^\circ\text{C}$ $I_F = 0\text{ mA}, V_O > 2\text{ V}, V_{CM} = 1\text{ kV}$	15	20	$\text{kV}/\mu\text{s}$
	Common Mode Transient Immunity at Low Level Output <sup>*4</sup>	$C_{ML}$	$V_{CC} = 5\text{ V}, R_L = 350\text{ }\Omega, T_A = 25^\circ\text{C}$ $I_F = 16\text{ mA}, V_O < 0.8\text{ V}, V_{CM} = 1\text{ kV}$	-15	-20	

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

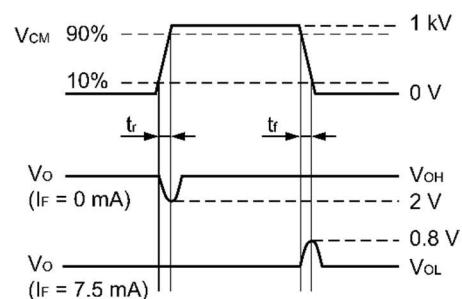
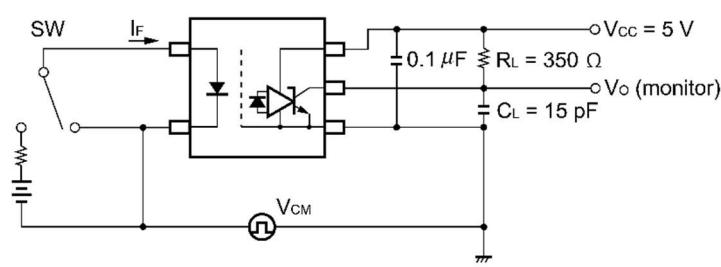
2. Because  $V_{OL}$  of 2 V or more may be output when LED current input and when output supply of  $V_{CC} = 2.6\text{ V}$  or less, it is important to confirm the characteristics (operation with the power supply on and off) during design, before using this device.

3. Test circuit for propagation delay time



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

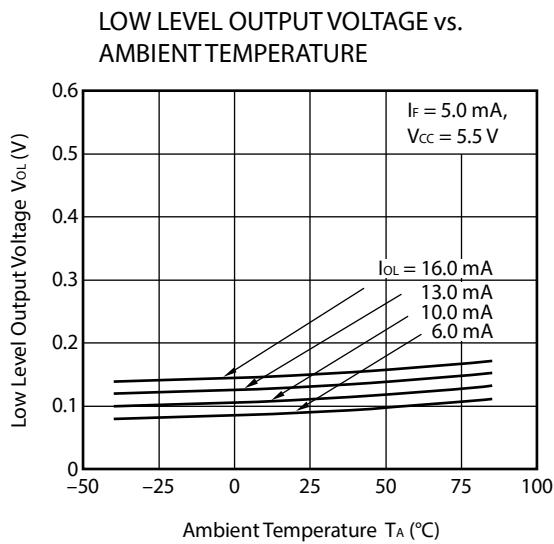
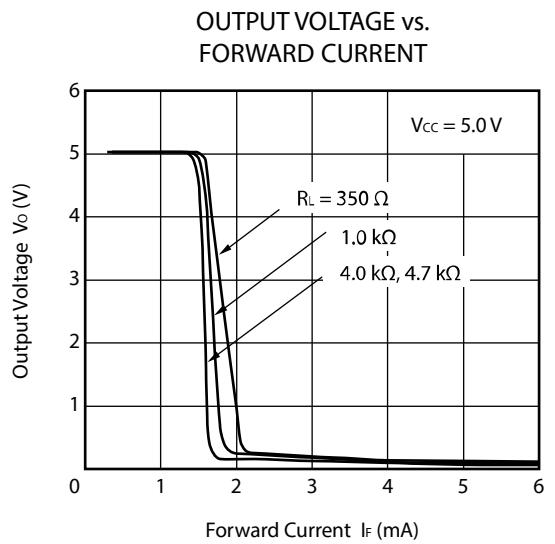
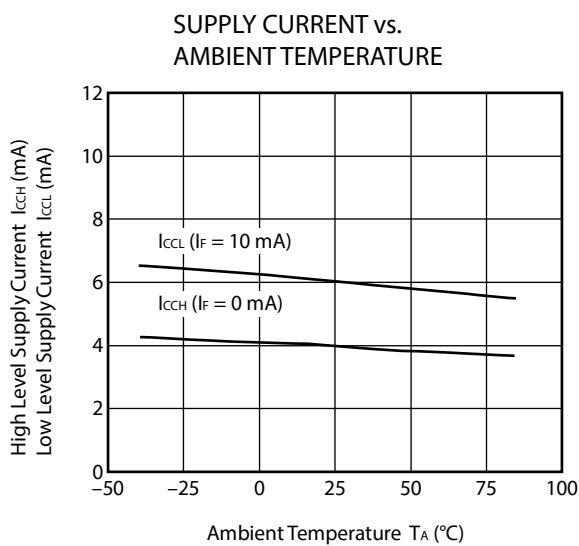
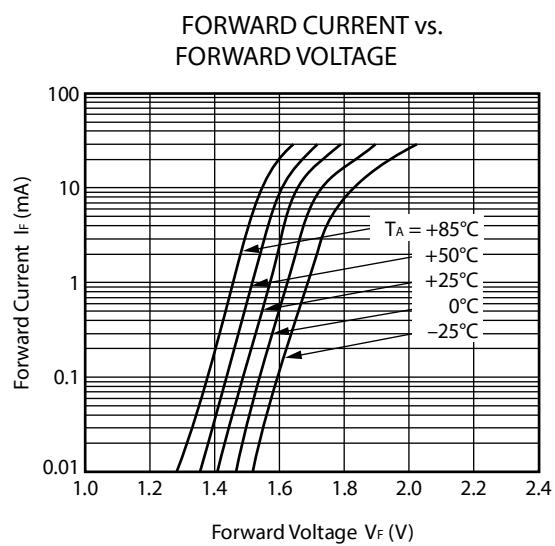
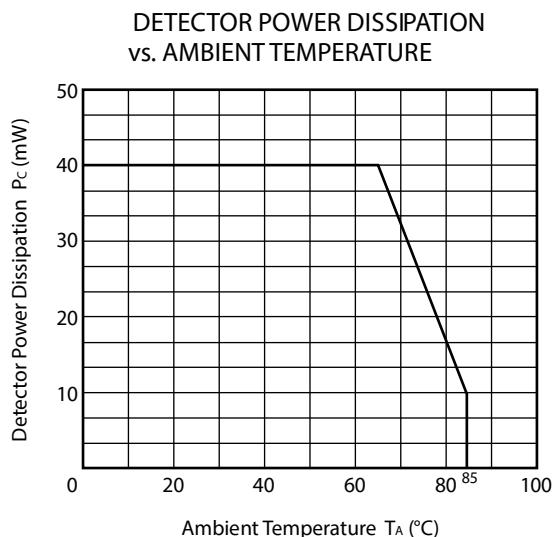
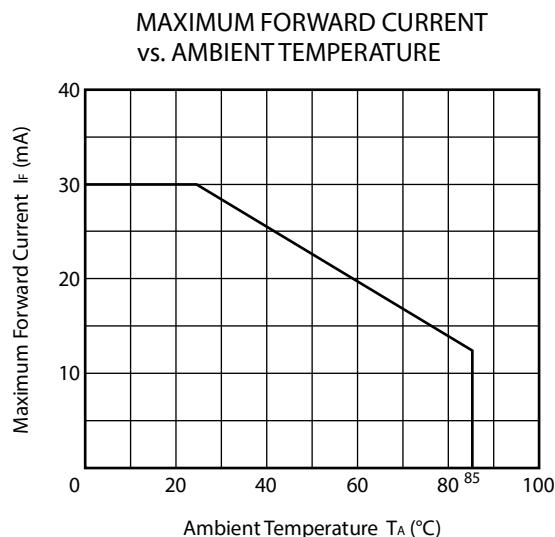
4. Test circuit for common mode transient immunity



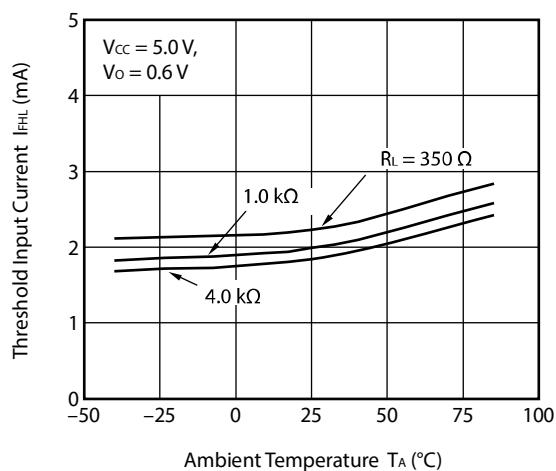
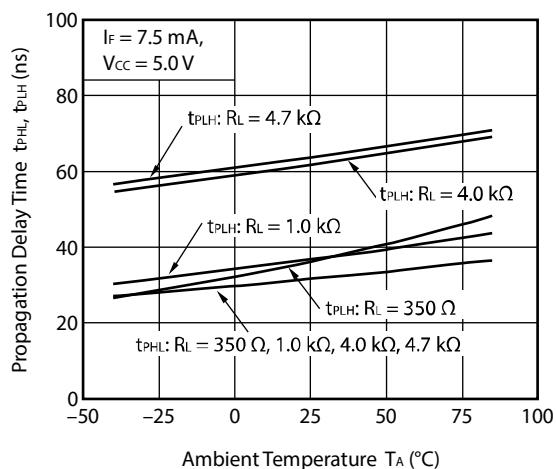
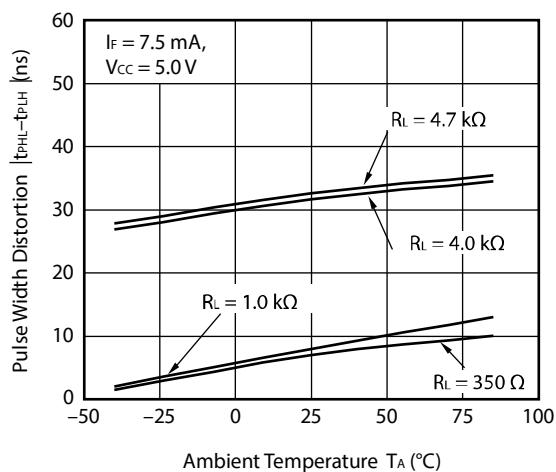
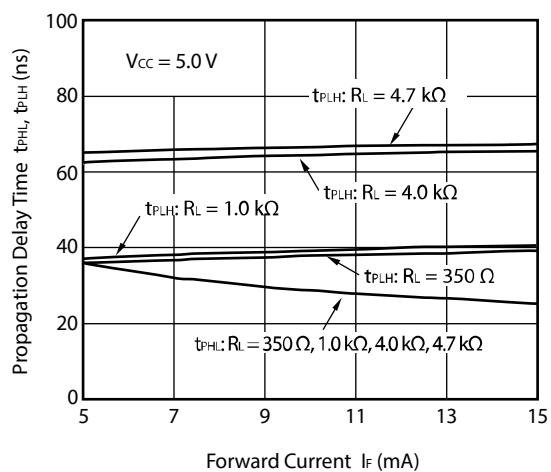
**Remark**  $C_L$  includes probe and stray wiring capacitance.

## 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 more than  $0.1\text{ }\mu\text{F}$  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.
4. Do not use adhesives or coating materials including halogens to fix this device.

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

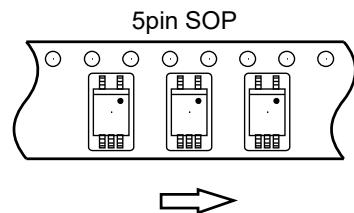
**Remark** The graphs indicate nominal characteristics.

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

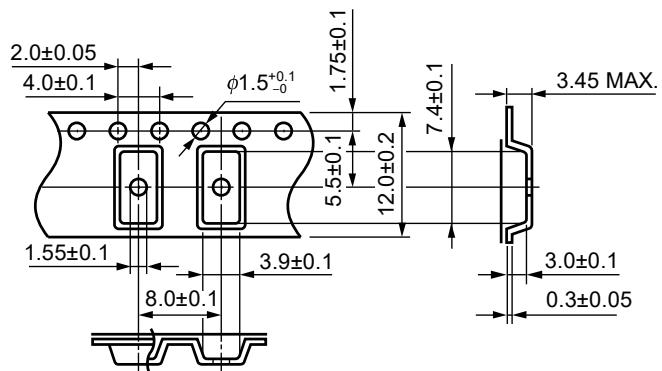
**Remark** The graphs indicate nominal characteristics.

**TAPING SPECIFICATIONS (UNIT: mm)**

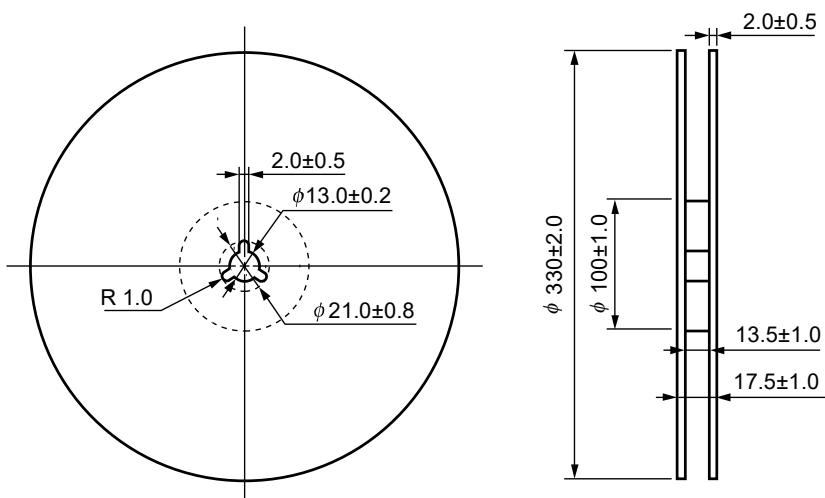
Tape Direction



Outline and Dimensions (Tape)

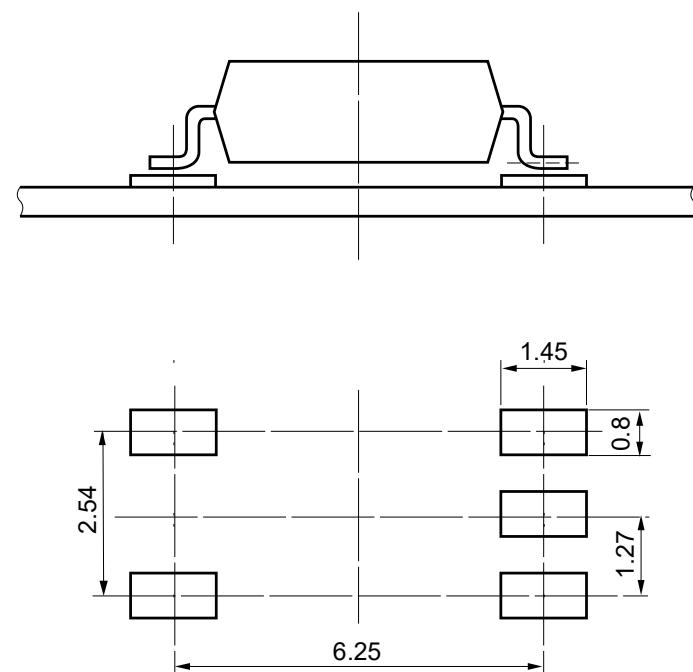


Outline and Dimensions (Reel)



Packing: 2 500 pcs/reel

## RECOMMENDED MOUNT PAD DIMENSIONS (UNIT: mm)



【5pin SOP】

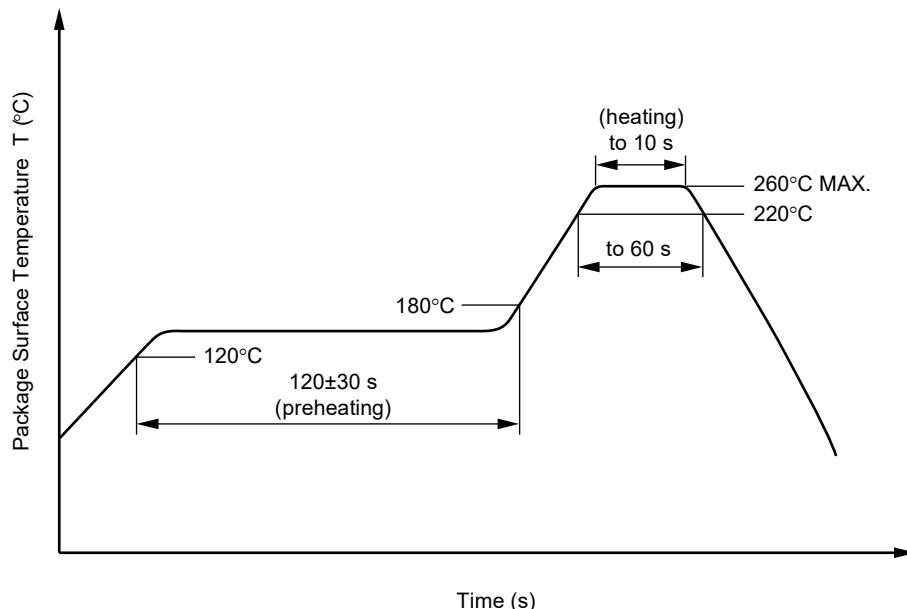
## NOTES ON HANDLING

### 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

(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 halogens-based (chlorine-based) cleaning solvent.

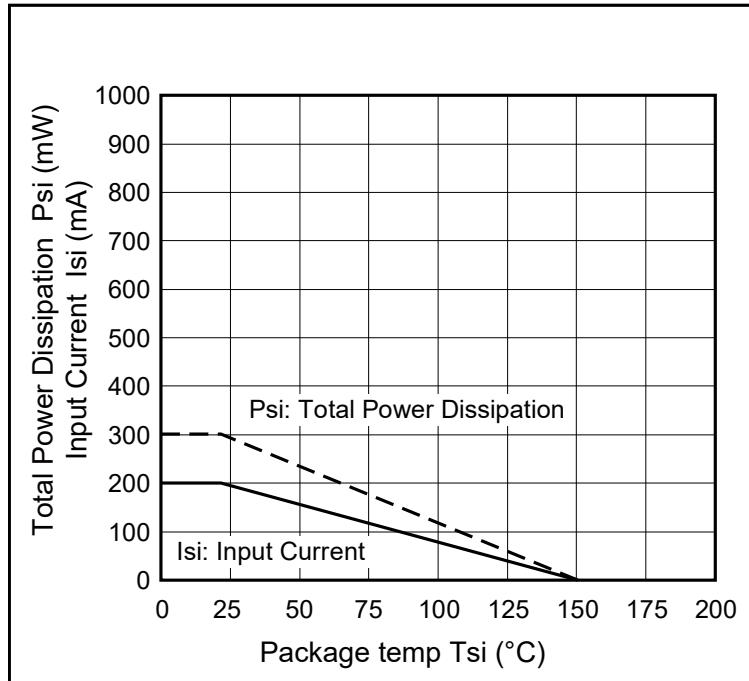
### 2. Cautions regarding noise

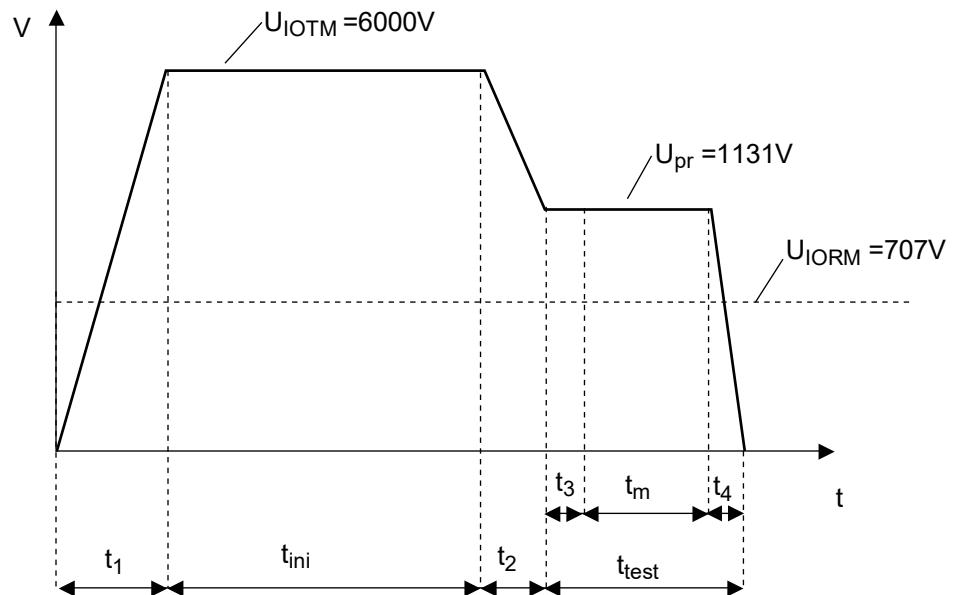
Be aware that when voltage is applied suddenly between the photocoupler's input and output or between  $V_{CC}$ -GND at startup, the output transistor may enter the on state, even if the voltage is within the absolute maximum ratings.

## SPECIFICATION OF VDE MARKS LICENSE DOCUMENT

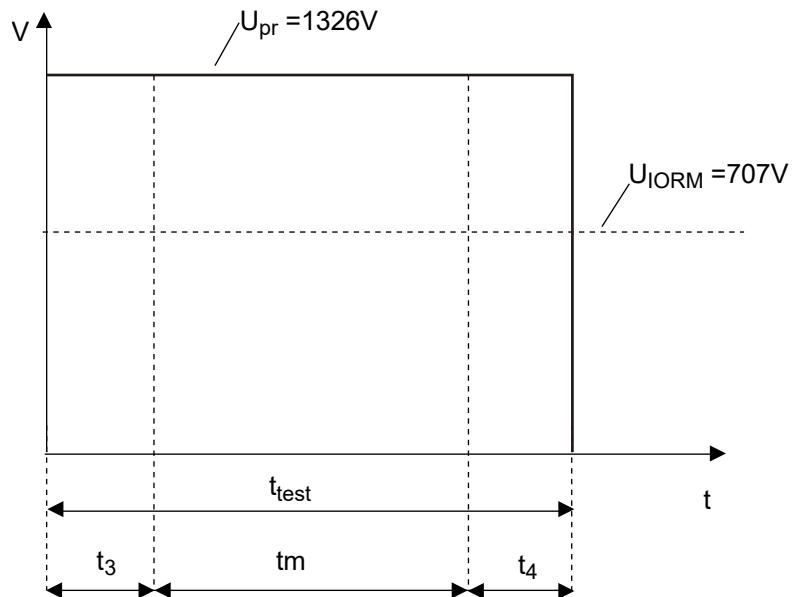
Parameter	Symbol	Rating	Unit
Climatic test class (IEC 60068-1/DIN EN 60068-1)		40/85/21	
Dielectric strength maximum operating isolation voltage Test voltage (partial discharge test, procedure a for type test and random test) $U_{pr} = 1.6 \times U_{IORM}$ , $P_d < 5 \text{ pC}$	$U_{IORM}$ $U_{pr}$	707 1 131	$V_{peak}$ $V_{peak}$
Test voltage (partial discharge test, procedure b for all devices) $U_{pr} = 1.875 \times U_{IORM}$ , $P_d < 5 \text{ pC}$	$U_{pr}$	1 326	$V_{peak}$
Highest permissible overvoltage	$U_{TR}$	6 000	$V_{peak}$
Degree of pollution (DIN EN 60664-1 VDE 0110 Part 1)		2	
Comparative tracking index (IEC 60112/DIN EN 60112 (VDE 0303 Part 11))	CTI	175	
Material group (DIN EN 60664-1 VDE 0110 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 $V_{IO} = 500 \text{ V dc at } T_A = 25^\circ\text{C}$ $V_{IO} = 500 \text{ V dc at } T_A \text{ MAX. at least } 100^\circ\text{C}$	$R_{is MIN.}$ $R_{is MIN.}$	$10^{12}$ $10^{11}$	Ω
Safety maximum ratings (maximum permissible in case of fault, see thermal derating curve) Package temperature Current (input current $I_F$ , $\Psi_i = 0$ ) Power (output or total power dissipation) Isolation resistance $V_{IO} = 500 \text{ V dc at } T_A = T_{si}$	$T_{si}$ $I_{si}$ $\Psi_i$ $R_{is MIN.}$	150 200 300 $10^9$	°C mA mW Ω

## Dependence of maximum safety ratings with package temperature



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

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

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

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

<b>Caution</b>	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.</li><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><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>
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(Rev.4.0-1 November 2017)



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#### 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, Bourne End, Buckinghamshire, SL8 5FH, U.K.  
Tel: +44-1628-651-700, Fax: +44-1628-651-804

#### Renesas Electronics Europe GmbH

Arcadistraße 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

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80 Bendemeer Road, Unit #06-02 Hyflux Innovation Centre, Singapore 339949  
Tel: +65-6213-0200, Fax: +65-6213-0300

#### Renesas Electronics Malaysia Sdn.Bhd.

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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  
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