

# PS2706-1

R08DS0159EJ0100

Rev.1.00

May 31, 2019

AC INPUT RESPONSE DARLINGTON TRANSISTOR SOP MULTI PHOTOCOUPLER SERIES

## DESCRIPTION

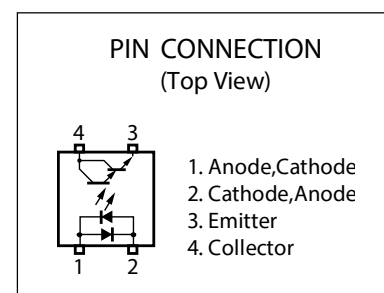
The PS2706-1 is an optically coupled isolator containing a GaAs light emitting diode and an NPN silicon darlington-connected phototransistor.

This is mounted in a plastic SOP (Small Out-line Package) for high density applications.

This package has shield effect to cut off ambient light.

## FEATURES

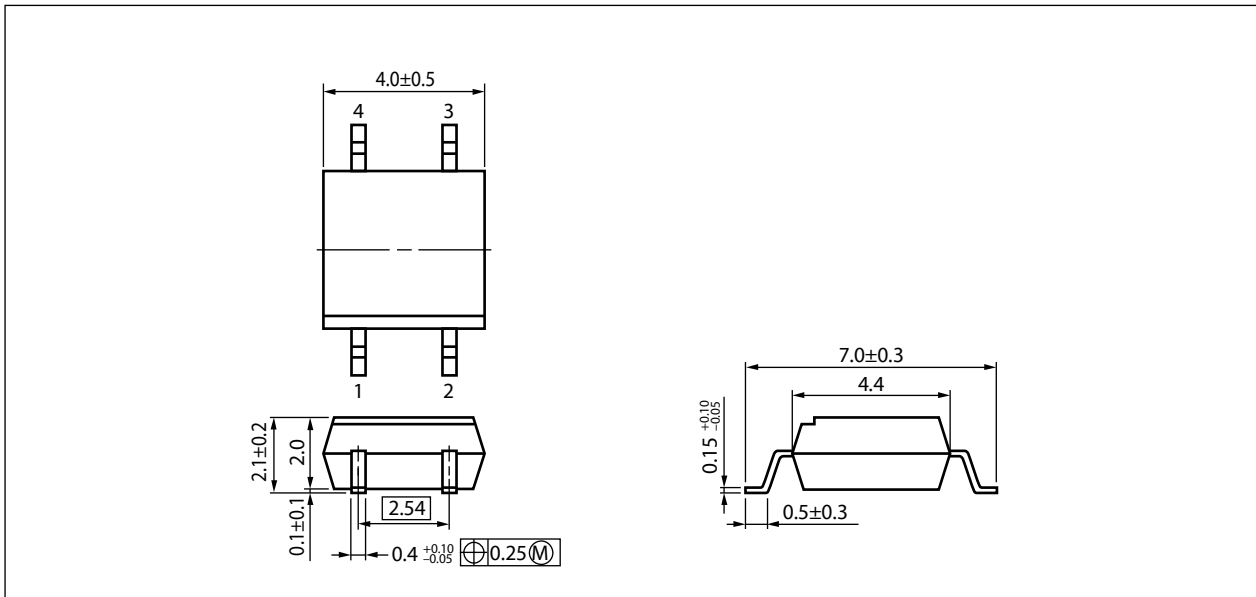
- AC input response
- High current transfer ratio (CTR = 2 000% TYP.)
- High isolation voltage (BV = 3 750 Vr.m.s.)
- SOP (Small Outline Package) type
- High-speed switching ( $t_r$ ,  $t_f$  = 200  $\mu$ s TYP.)
- Ordering number of taping product: PS2706-1-F3: 3 500 pcs/reel
- Pb-Free product
- Safety standards
  - UL approved: UL1577, Single protection
  - CSA approved: CAN/CSA-C22.2 No. 62368-1, Basic/Supplementary insulation
  - BSI approved: BS EN 62368-1, Basic/Supplementary insulation
  - VDE approved: DIN EN 60747-5-5 (Option)



## APPLICATIONS

- Hybrid IC
- Telephone, Exchange equipment.
- FA/OA equipment
- Programmable logic controllers

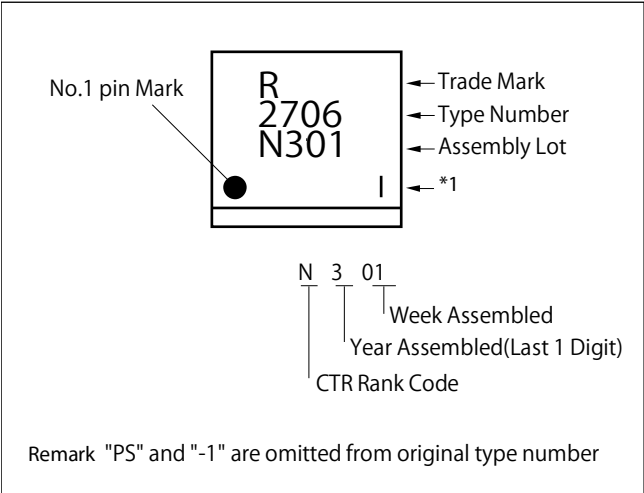
## PACKAGE DIMENSIONS (UNIT: mm)



## PHOTOCOUPLER CONSTRUCTION

Parameter	Unit (MIN.)
Air Distance	5 mm
Creepage Distance	5 mm
Isolation Distance	0.3 mm

MARKING EXAMPLE



Note: Bar indication contents of \*1.

<p><b>Made in Japan</b> ( *1: "   " (Vertical bar) )</p>	<p>The diagram shows a square marking area with a black dot in the bottom-left corner. Inside the square, the text "R", "2706", and "N301" are stacked vertically. To the right of the square, an arrow points to the vertical bar with the label: "   " (Vertical bar) :Made in Japan".</p>
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## ORDERING INFORMATION

Part Number	Order Number	Solder Plating Specification	Packing Style	Safety Standard Approval	Application Part Number <sup>*1</sup>
PS2706-1-F3	PS2706-1-F3-A	Pb-Free	Embossed Tape 3 500 pcs/reel	Standard products (UL, CSA, BSI approved)	PS2706-1
PS2706-1-V-F3	PS2706-1-V-F3-A		Embossed Tape 3 500 pcs/reel	UL, CSA, BSI, DIN EN 60747-5-5 approved	

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 (DC)	$I_F$	$\pm 50$	mA
	Power Dissipation Derating	$\Delta P_D/^\circ\text{C}$	0.8	mW/ $^\circ\text{C}$
	Power Dissipation	$P_D$	80	mW
	Peak Forward Current <sup>*1</sup>	$I_{FP}$	$\pm 1$	A
Transistor	Collector to Emitter Voltage	$V_{CEO}$	40	V
	Emitter to Collector Voltage	$V_{ECO}$	6	V
	Collector Current	$I_C$	200	mA
	Power Dissipation Derating	$\Delta P_C/^\circ\text{C}$	1.5	mW/ $^\circ\text{C}$
	Power Dissipation	$P_C$	150	mW
Isolation Voltage <sup>*2</sup>		BV	3 750	Vr.m.s.
Operating Ambient Temperature		$T_A$	-55 to +100	$^\circ\text{C}$
Storage Temperature		$T_{stg}$	-55 to +150	$^\circ\text{C}$

Note: <sup>\*1</sup>. PW = 100  $\mu\text{s}$ , Duty Cycle = 1%

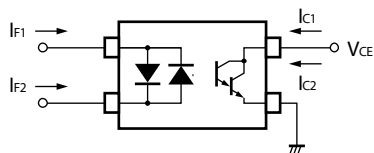
<sup>\*2</sup>. AC voltage for 1 minute at  $T_A = 25^\circ\text{C}$ , RH = 60% between input and output.

Pins 1-2 shorted together, 3-4 shorted together.

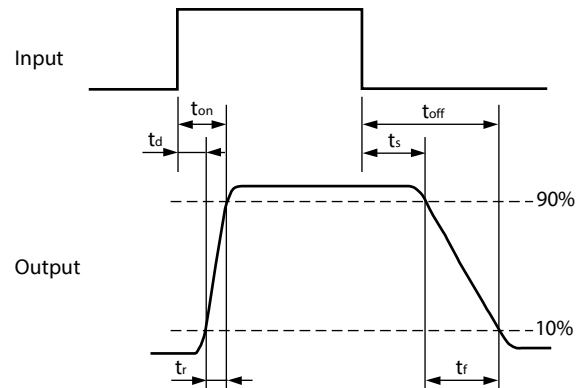
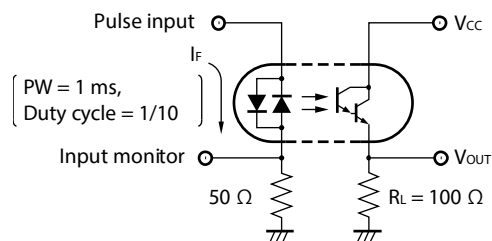
**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)**

	Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Diode	Forward Voltage	V <sub>F</sub>	I <sub>F</sub> = ±5 mA		1.1	1.4	V
	Terminal Capacitance	C <sub>t</sub>	V = 0 V, f = 1.0 MHz		60		pF
Transistor	Collector to Emitter Dark Current	I <sub>CEO</sub>	I <sub>F</sub> = 0 mA, V <sub>CE</sub> = 40 V			400	nA
Coupled	Current Transfer Ratio (I <sub>C</sub> /I <sub>F</sub> )	CTR	I <sub>F</sub> = ±1 mA, V <sub>CE</sub> = 2 V	200	2000		%
	CTR Ratio*1	CTR1/ CTR2	I <sub>F</sub> = ±1 mA, V <sub>CE</sub> = 2 V	0.3	1.0	3.0	
	Collector Saturation Voltage	V <sub>CE(sat)</sub>	I <sub>F</sub> = ±1 mA, I <sub>C</sub> = 2 mA			1.0	V
	Isolation Resistance	R <sub>I-O</sub>	V <sub>I-O</sub> = 1.0 kV <sub>DC</sub>	10 <sup>11</sup>			Ω
	Isolation Capacitance	C <sub>I-O</sub>	V = 0 V, f = 1.0 MHz		0.4		pF
	Rise Time*2	t <sub>r</sub>	V <sub>CC</sub> = 5 V, I <sub>C</sub> = 2 mA, R <sub>L</sub> = 100 Ω		200		μs
	Fall Time*2	t <sub>f</sub>			200		

Note: \*1. CTR1 = I<sub>C1</sub>/I<sub>F1</sub>, CTR2 = I<sub>C2</sub>/I<sub>F2</sub>

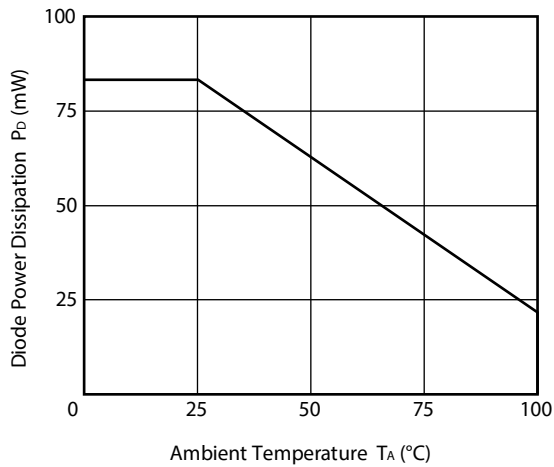


\*2. Test Circuit for Switching Time

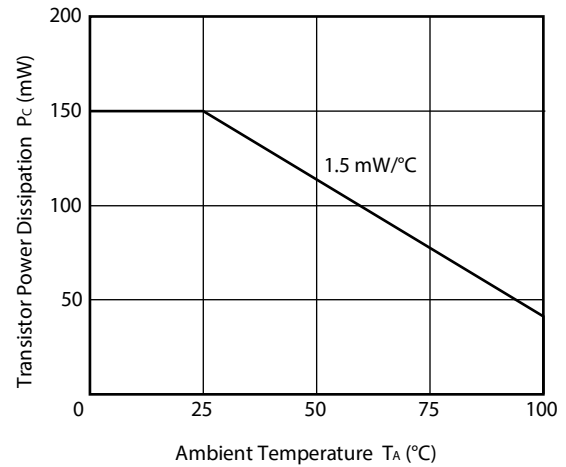


# TYPICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ , unless otherwise specified)

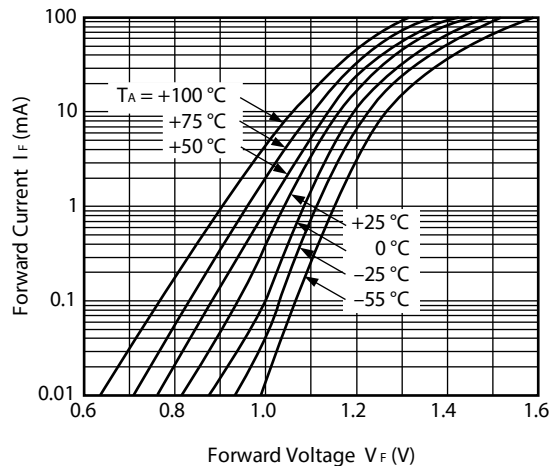
DIODE POWER DISSIPATION vs.  
AMBIENT TEMPERATURE



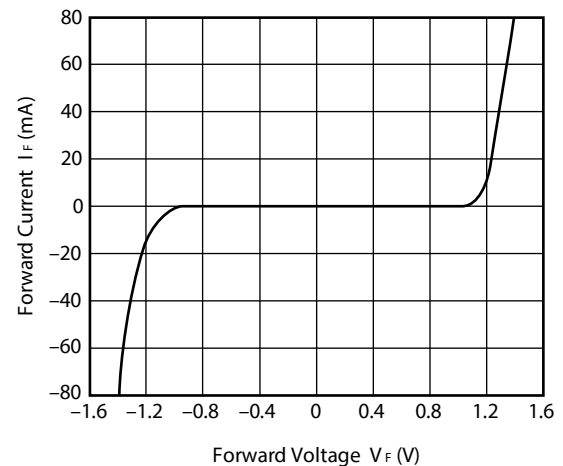
TRANSISTOR POWER DISSIPATION vs.  
AMBIENT TEMPERATURE



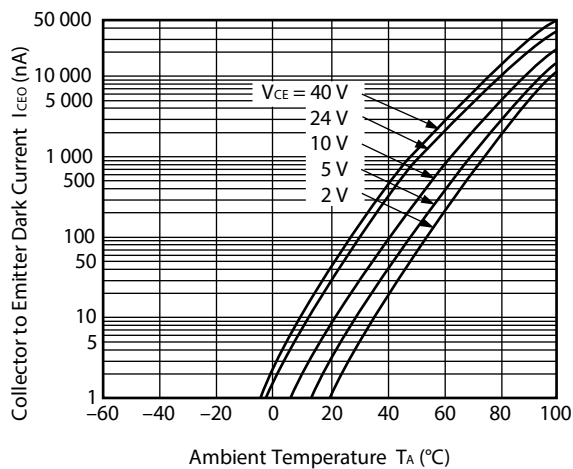
FORWARD CURRENT vs.  
FORWARD VOLTAGE



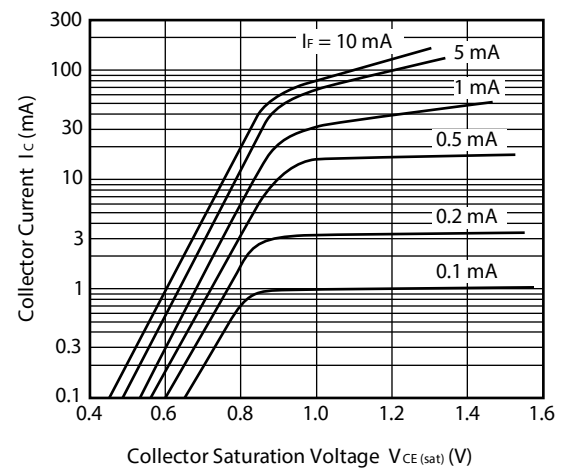
FORWARD CURRENT vs.  
FORWARD VOLTAGE



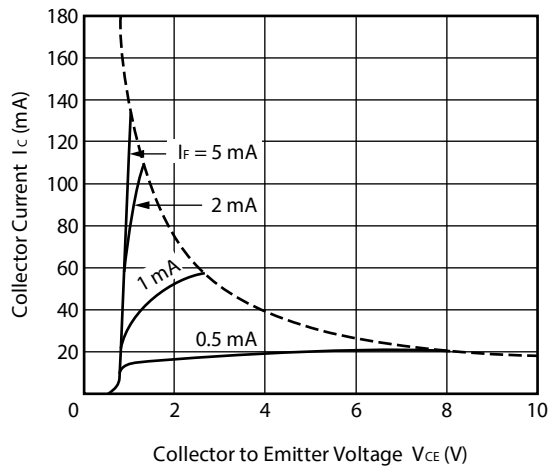
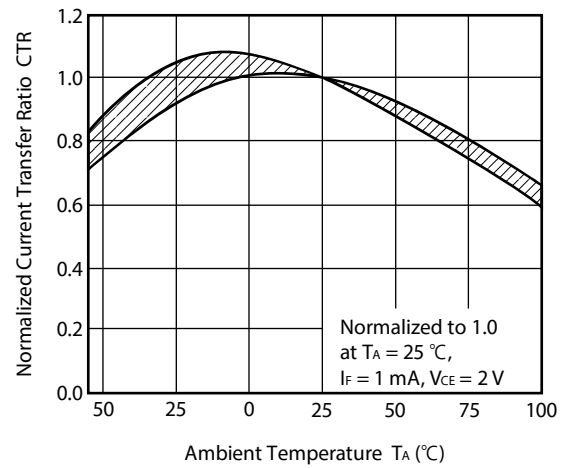
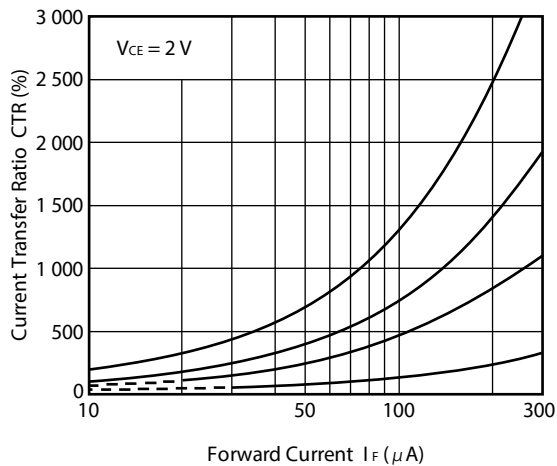
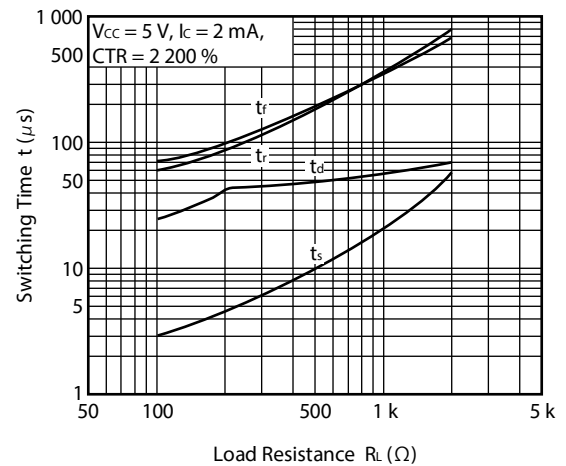
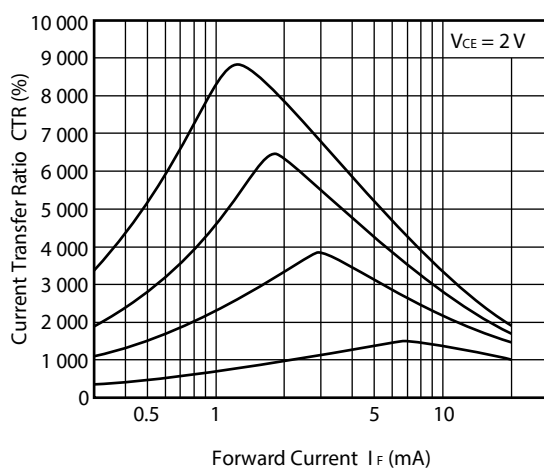
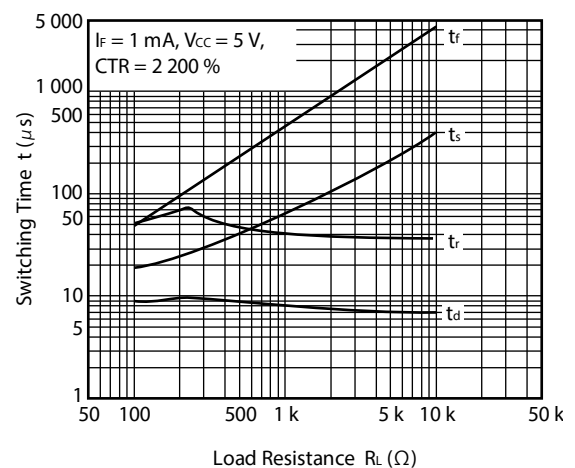
COLLECTOR TO EMITTER DARK  
CURRENT vs. AMBIENT TEMPERATURE



COLLECTOR CURRENT vs.  
COLLECTOR SATURATION VOLTAGE



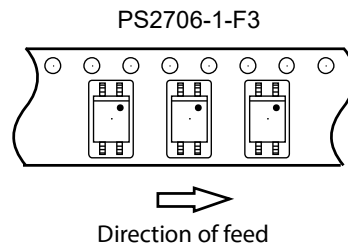
**Remark** The graphs indicate nominal characteristics.

COLLECTOR CURRENT vs.  
COLLECTOR TO EMITTER VOLTAGENORMALIZED CURRENT TRANSFER  
RATIO vs. AMBIENT TEMPERATURECURRENT TRANSFER RATIO vs.  
FORWARD CURRENTSWITCHING TIME vs.  
LOAD RESISTANCECURRENT TRANSFER RATIO vs.  
FORWARD CURRENTSWITCHING TIME vs.  
LOAD RESISTANCE

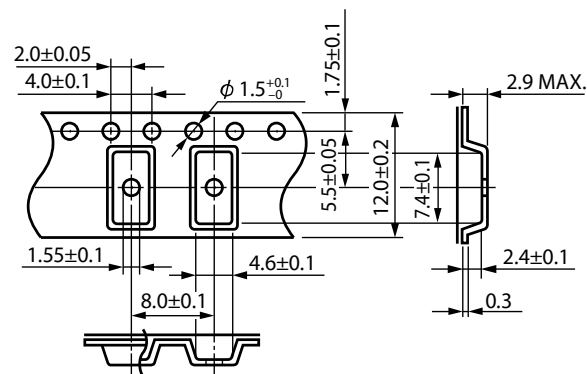
**Remark** The graphs indicate nominal characteristics.

## TAPING SPECIFICATIONS (UNIT: mm)

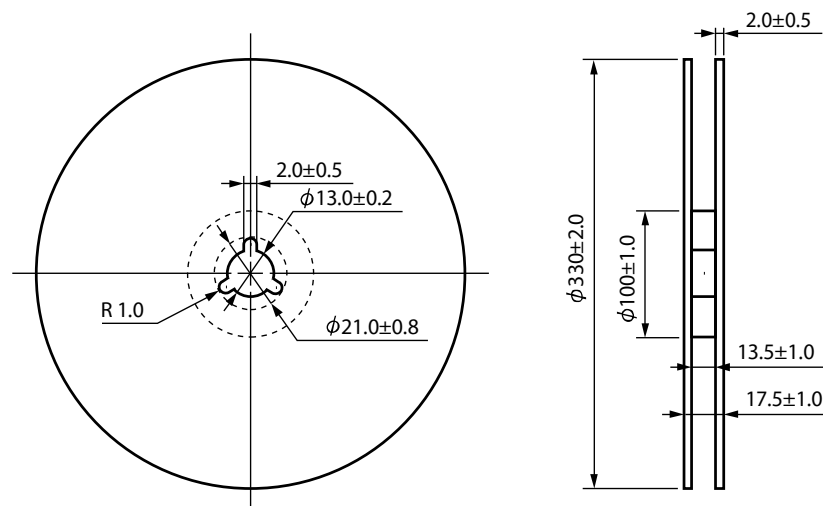
Tape Direction



Outline and Dimensions (Tape)



Outline and Dimensions (Reel)



Packing: 3 500 pcs/reel



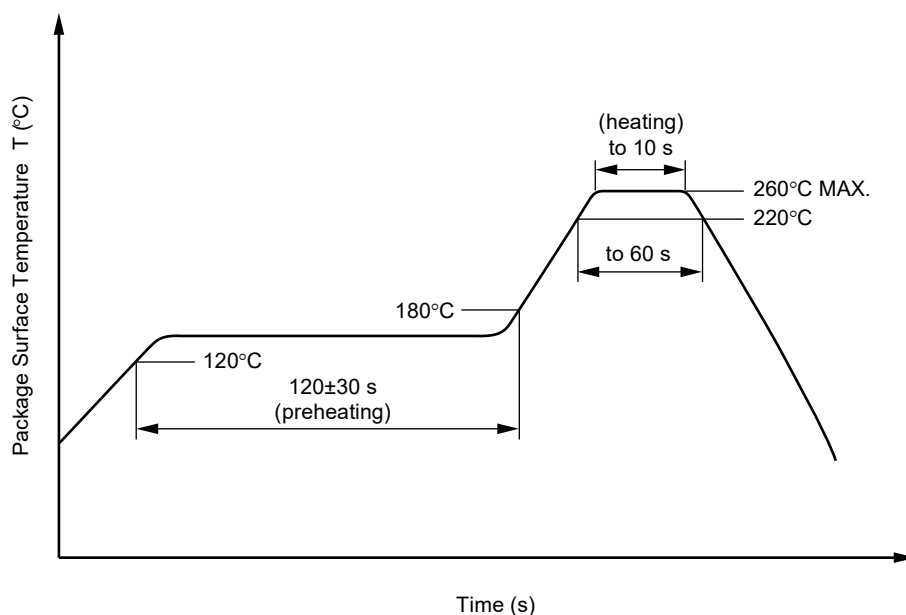
## NOTES ON HANDLING

### 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<br>(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<br>(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

- Flux Cleaning  
Avoid cleaning with Freon based or halogen-based (chlorinated etc.) solvents.
- Do not use fixing agents or coatings containing halogen-based substances.

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

**3. Measurement conditions of current transfer ratios (CTR), which differ according to photocoupler**

Check the setting values before use, since the forward current conditions at CTR measurement differ according to product.

When using products other than at the specified forward current, the characteristics curves may differ from the standard curves due to CTR value variations or the like. Therefore, check the characteristics under the actual operating conditions and thoroughly take variations or the like into consideration before use.

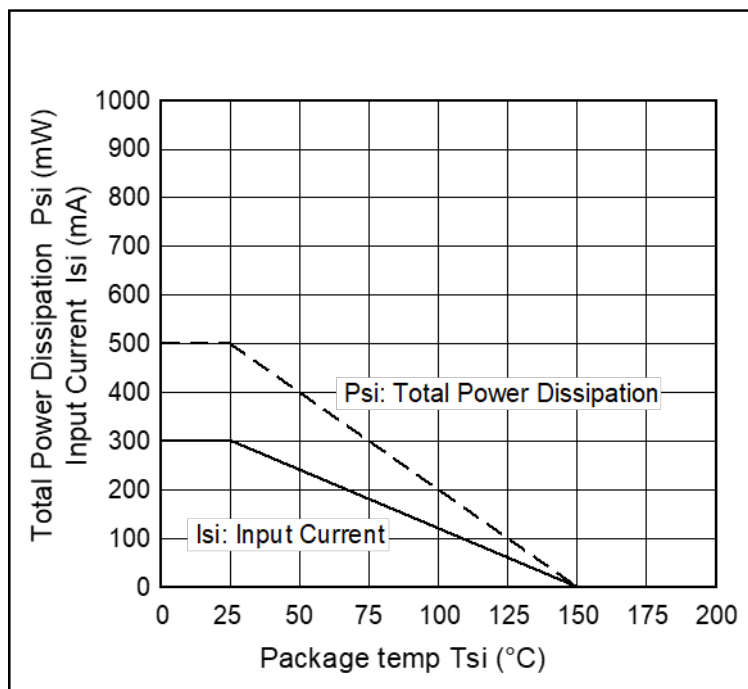
**USAGE CAUTIONS**

1. Protect against static electricity when handling.
2. Avoid storage at a high temperature and high humidity.

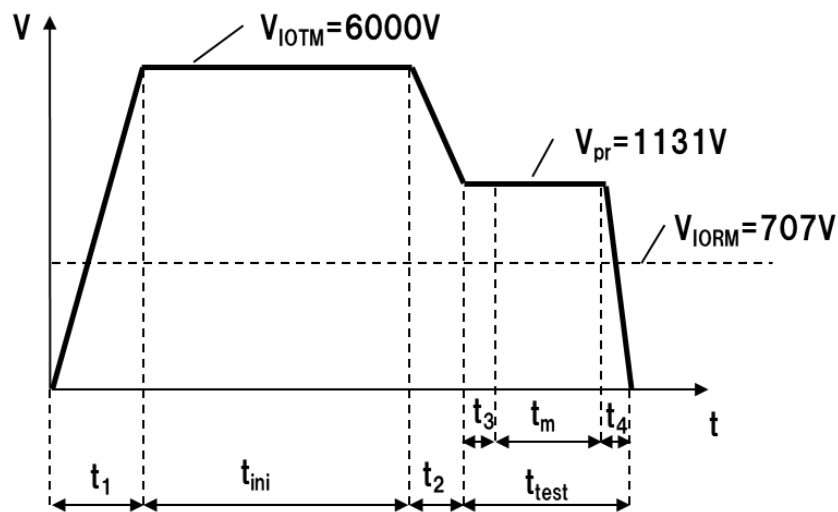
## SPECIFICATION OF VDE MARKS LICENSE DOCUMENT

Parameter	Symbol	Rating	Unit
Climatic test class (IEC 60068-1/DIN EN 60068-1)		55/100/21	
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) $U_{pr} = 1.875 \times U_{IORM}$ , $P_d < 5 \text{ pC}$	$U_{pr}$	1 325	$V_{peak}$
Highest permissible overvoltage	$U_{IOTM}$	6 000	$V_{peak}$
Degree of pollution (IEC 60664-1/DIN EN 60664-1 (VDE 0110-1))		2	
Comparative tracking index (IEC 60112/DIN EN 60112 (VDE 0303-11))	CTI	175	
Material group (IEC 60664-1/DIN EN 60664-1 (VDE 0110-1))		III a	
Storage temperature range	$T_{stg}$	-55 to +150	°C
Operating temperature range	$T_A$	-55 to +100	°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 $100^\circ\text{C}$	$R_{is \text{ MIN.}}$ $R_{is \text{ MIN.}}$	$10^{12}$ $10^{11}$	$\Omega$ $\Omega$
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 $T_A = T_{si}$	$T_{si}$ $I_{si}$ $\Psi_i$ $R_{is \text{ MIN.}}$	150 300 500 $10^9$	°C mA mW $\Omega$

## Dependence of maximum safety ratings with package temperature



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



$$t_1, t_2 = 1 \text{ to } 10 \text{ sec}$$

$$t_3, t_4 = 1 \text{ sec}$$

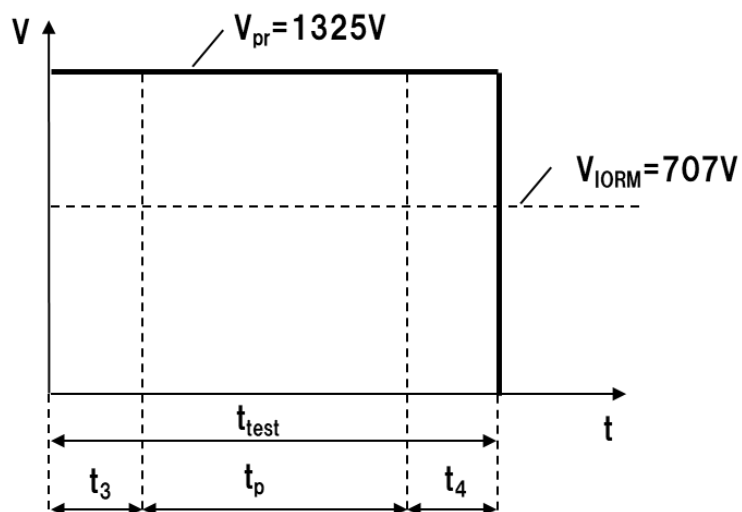
$$t_m \text{ (PARTIAL DISCHARGE)} = 10 \text{ sec}$$

$$t_{\text{test}} = 12 \text{ sec}$$

$$t_{\text{ini}} = 60 \text{ sec}$$

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

<R>



$$t_3, t_4 = 0.1 \text{ sec}$$

$$t_p \text{ (PARTIAL DISCHARGE)} = 1.0 \text{ sec}$$

$$t_{\text{test}} = 1.2 \text{ sec}$$

**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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(Rev.4.0-1 November 2017)



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**Renesas Electronics Corporation**  
TOYOSU FORESIA, 3-2-24 Toyosu, Koto-ku, Tokyo 135-0061, Japan

**Renesas Electronics America Inc.**  
1001 Murphy Ranch Road, Milpitas, CA 95035, U.S.A.  
Tel: +1-408-432-8888, Fax: +1-408-434-5351

**Renesas Electronics Canada Limited**  
9251 Yonge Street, Suite 8309 Richmond Hill, Ontario Canada L4C 9T3  
Tel: +1-905-237-2004

**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 101-T01, Floor 1, Building 7, Yard No. 7, 8th Street, Shangdi, Haidian District, Beijing 100085, 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, 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 No 3A-1 Level 3A Tower 8 UOA Business Park, No 1 Jalan Pengaturcara U1/51A, Seksyen U1, 40150 Shah Alam, Selangor, Malaysia  
Tel: +60-3-5022-1288, Fax: +60-3-5022-1290

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

**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