

PS2913-1

SINGLE Tr. OUTPUT, HIGH COLLECTOR TO EMITTER VOLTAGE
4-PIN ULTRA SMALL FLAT-LEAD
PHOTOCOUPLER

R08DS0113EJ0201
Rev.2.01
Sep 27, 2019

DESCRIPTION

The PS2913-1 is an optically coupled isolator containing a GaAs light emitting diode and an NPN silicon phototransistor in one package for high density mounting applications.

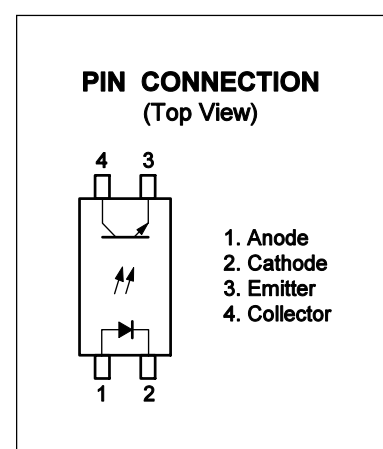
An ultra small flat-lead package has been provided which realizes a reduction in mounting area of about 30% compared with the PS28xx series.

FEATURES

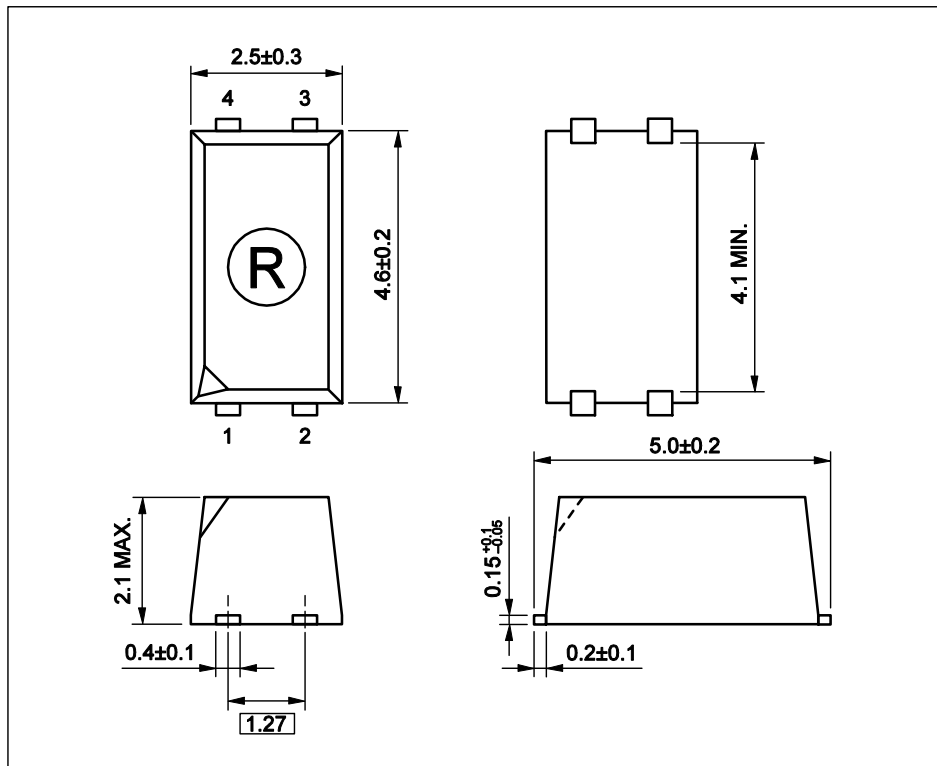
- Ultra small flat-lead package (4.6 (L) × 2.5 (W) × 2.1 (H) mm)
- High collector to emitter voltage ($V_{CEO} = 120\text{ V}$)
- High isolation voltage ($BV = 2\,500\text{ Vr.m.s.}$)
- Ordering number of taping product: PS2913-1-F3: 3 500 pcs/reel
- Safety standards
 - UL approved: UL1577, Single protection
 - BSI approved: BS EN 62368-1, Supplementary insulation
 - VDE approved: DIN EN 60747-5-5 (Option)

APPLICATIONS

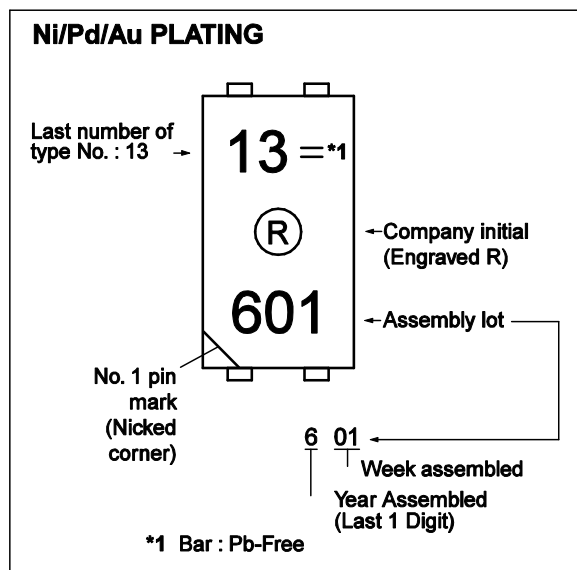
- DC/DC converter
- Modem/PC card



PACKAGE DIMENSIONS (UNIT: mm)



MARKING EXAMPLE



PHOTOCOUPLER CONSTRUCTION

Parameter	MIN.
Air Distance	4 mm
Creepage Distance	4 mm
Isolation Distance	0.4 mm

ORDERING INFORMATION

Part Number	Order Number	Solder Plating Specification	Packing Style	Safety Standard Approval	Application Part Number*1
PS2913-1	PS2913-1-AX	Pb-Free (Ni/Pd/Au)	50 pcs (Tape 50 pcs cut)	Standard products (UL, BSI approved)	PS2913-1
PS2913-1-F3	PS2913-1-F3-AX		Embossed Tape 3 500 pcs/reel		
PS2913-1-V	PS2913-1-V-AX		50 pcs (Tape 50 pcs cut)	UL, BSI, DIN EN 60747-5-5 approved	
PS2913-1-V-F3	PS2913-1-V-F3-AX		Embossed Tape 3 500 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	I_F	50	mA
	Forward Current Derating	$\Delta I_F/^\circ\text{C}$	0.5	mA/ $^\circ\text{C}$
	Peak Forward Current ^{*1}	I_{FP}	0.5	A
	Power Dissipation	P_D	60	mW
	Reverse Voltage	V_R	6	V
Detector	Collector to Emitter Voltage	V_{CEO}	120	V
	Emitter to Collector Voltage	V_{ECO}	6	V
	Collector Current	I_C	30	mA
	Power Dissipation Derating	$\Delta P_C/^\circ\text{C}$	1.2	mW/ $^\circ\text{C}$
	Power Dissipation	P_C	120	mW
Isolation Voltage ^{*2}		BV	2 500	Vr.m.s.
Total Power Dissipation		P_T	160	mW
Operating Ambient Temperature		T_A	-55 to +100	$^\circ\text{C}$
Storage Temperature		T_{stg}	-55 to +150	$^\circ\text{C}$

Notes: *1. PW = 100 μs , Duty Cycle = 1%

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

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

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$)

	Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Diode	Forward Voltage	V_F	$I_F = 1\text{ mA}$	0.9	1.1	1.3	V
	Reverse Current	I_R	$V_R = 5\text{ V}$			5	μA
	Terminal Capacitance	C_t	$V = 0\text{ V}, f = 1\text{ MHz}$		15		pF
Transistor	Collector to Emitter Dark Current	I_{CEO}	$I_F = 0\text{ mA}, V_{CE} = 120\text{ V}$			100	nA
Coupled	Current Transfer Ratio (I_C/I_F) *1	CTR	$I_F = 1\text{ mA}, V_{CE} = 5\text{ V}$	50	100	200	%
	Collector Saturation Voltage	$V_{CE(SAT)}$	$I_F = 1\text{ mA}, I_C = 0.2\text{ mA}$		0.13	0.3	V
	Isolation Resistance	R_{I-O}	$V_{I-O} = 1\text{ kV}_{DC}$	10^{11}			Ω
	Isolation Capacitance	C_{I-O}	$V = 0\text{ V}, f = 1\text{ MHz}$		0.4		pF
	Rise Time *2	t_r	$V_{CC} = 5\text{ V}, I_C = 2\text{ mA}, R_L = 100\ \Omega$		10		μs
	Fall Time *2	t_f			10		
	Turn-on Time *2	t_{on}	$V_{CC} = 5\text{ V}, I_F = 1\text{ mA}, R_L = 5\text{ k}\Omega$		80		μs
	Storage Time *2	t_s			5		
	Turn-off Time *2	t_{off}			50		

Notes: *1. CTR rank

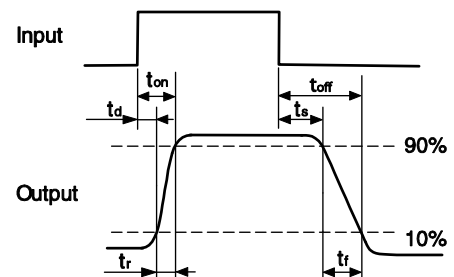
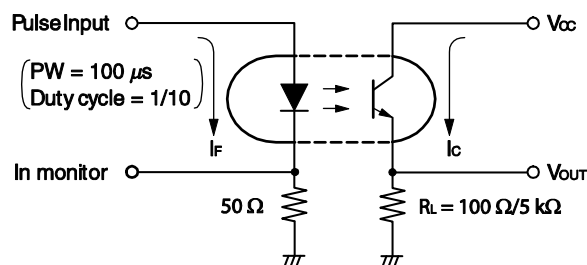
N : 50 to 200 (%)

K : 100 to 200 (%)

L : 75 to 150 (%)

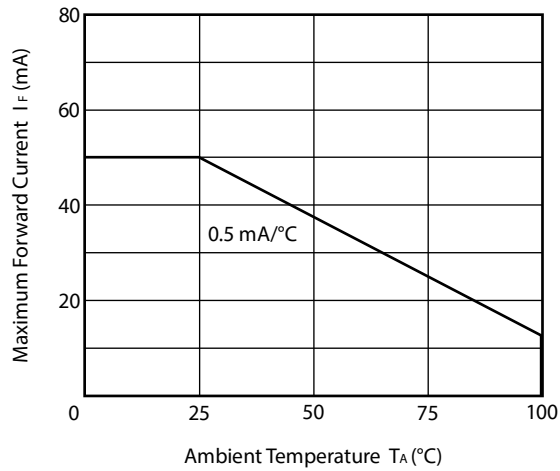
M : 50 to 100 (%)

*2. Test circuit for switching time

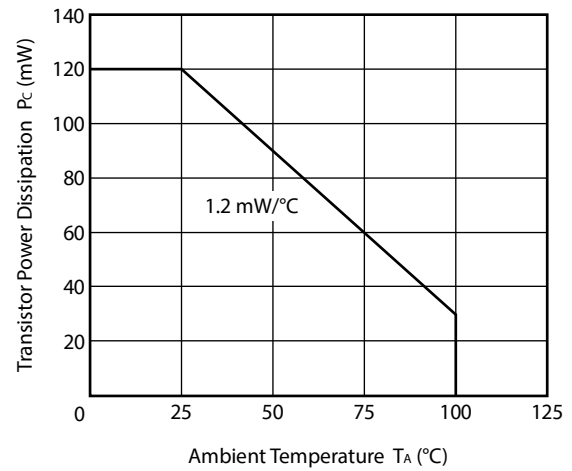


TYPICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$, unless otherwise specified)

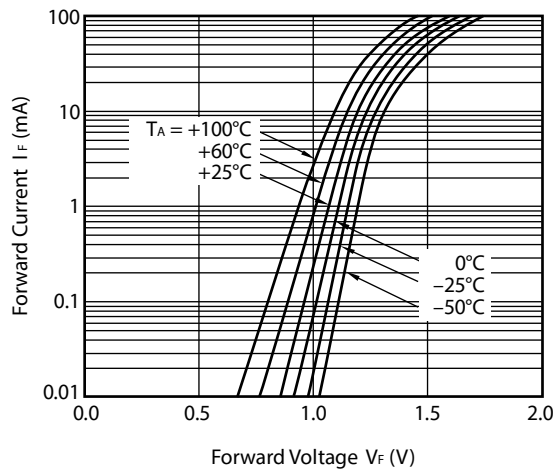
MAXIMUM FORWARD CURRENT vs.
AMBIENT TEMPERATURE



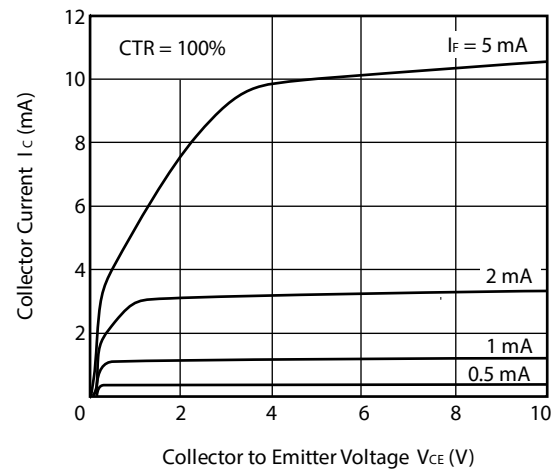
TRANSISTOR POWER DISSIPATION
vs. AMBIENT TEMPERATURE



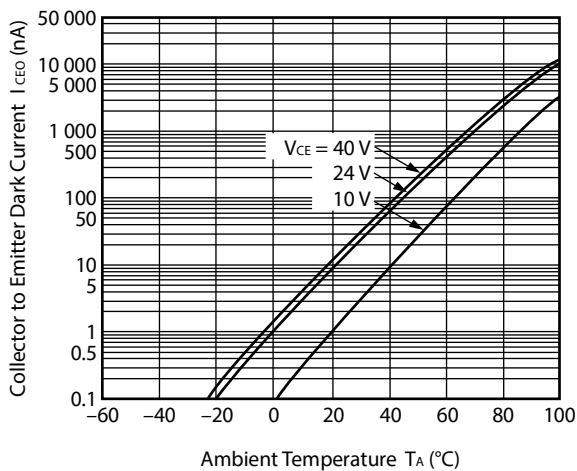
FORWARD CURRENT vs.
FORWARD VOLTAGE



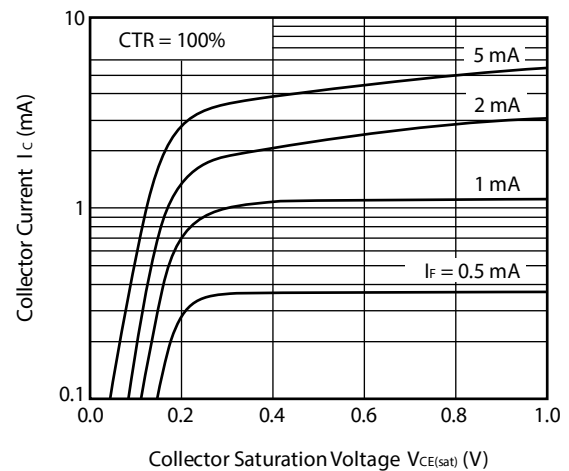
COLLECTOR CURRENT vs.
COLLECTOR TO EMITTER VOLTAGE



COLLECTOR TO EMITTER DARK
CURRENT vs. AMBIENT TEMPERATURE

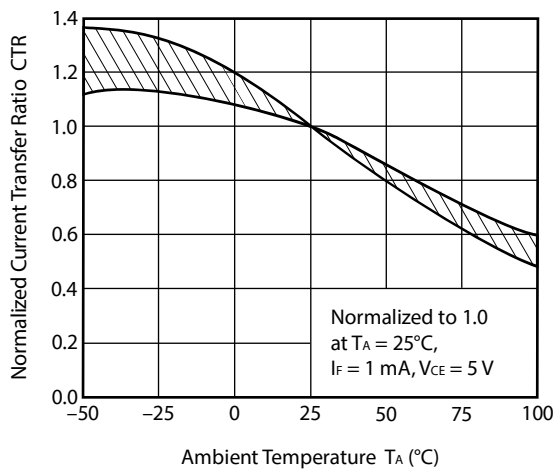


COLLECTOR CURRENT vs.
COLLECTOR SATURATION VOLTAGE

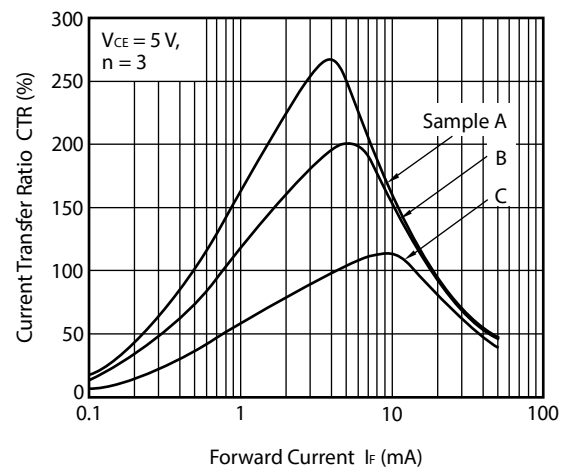


Remark The graphs indicate nominal characteristics.

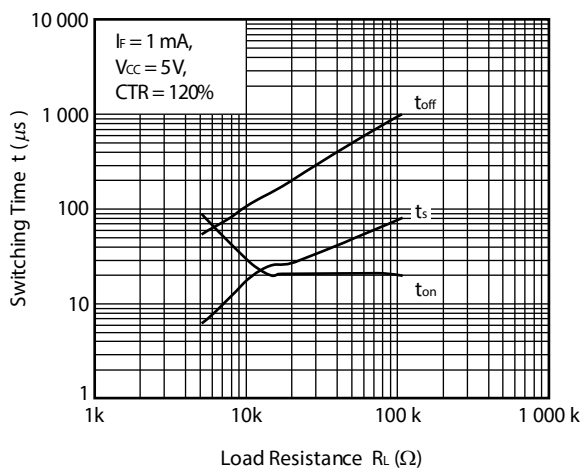
NORMALIZED CURRENT TRANSFER RATIO vs. AMBIENT TEMPERATURE



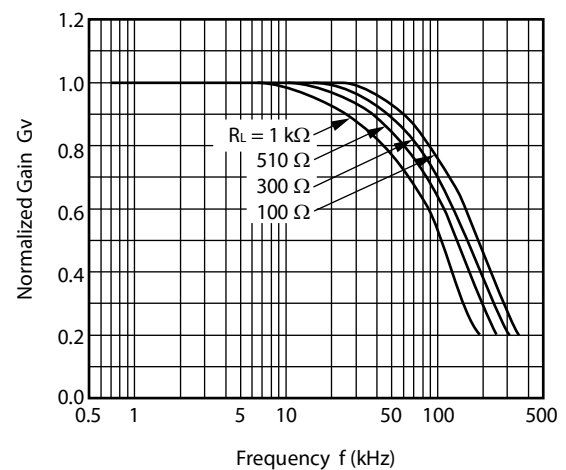
CURRENT TRANSFER RATIO vs. FORWARD CURRENT



SWITCHING TIME vs. LOAD RESISTANCE



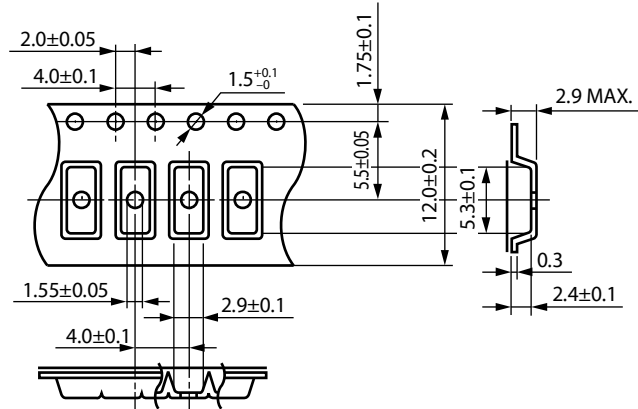
FREQUENCY RESPONSE



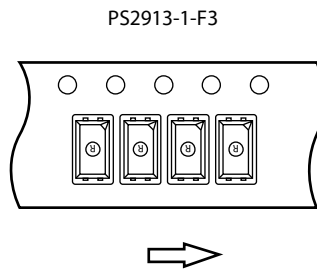
Remark The graphs indicate nominal characteristics.

TAPING SPECIFICATIONS (UNIT: mm)

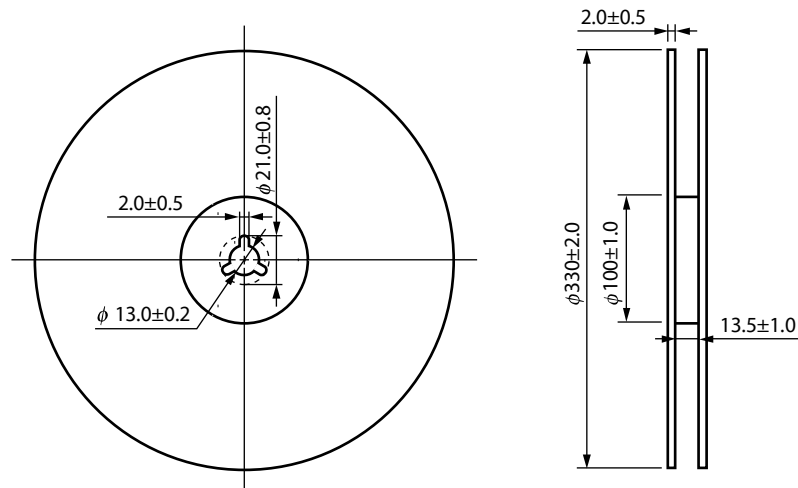
Outline and Dimensions (Tape)



Tape Direction

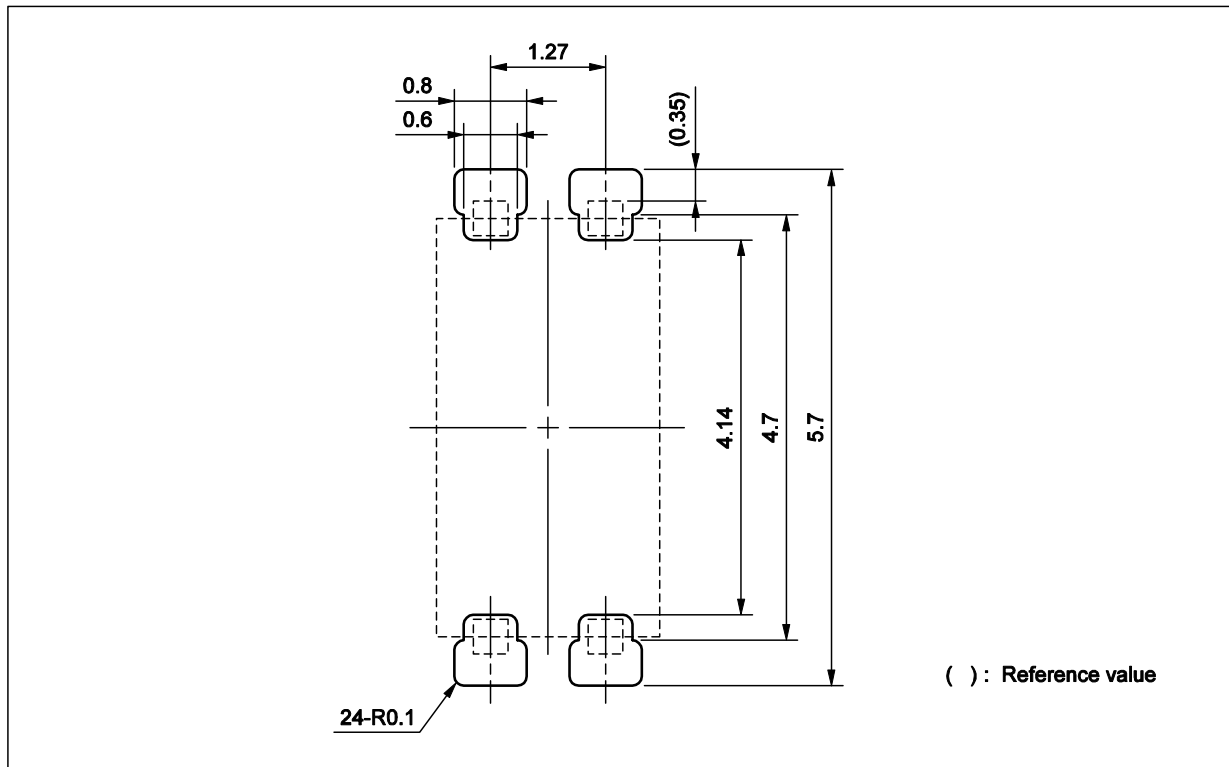


Outline and Dimensions (Reel)



Packing: 3 500 pcs/reel

RECOMMENDED MOUNT PAD DIMENSIONS (UNIT: mm)



Remark This drawing is considered to meet air and outer creepage distance 4.0 mm minimum. All dimensions in this figure must be evaluated before use.

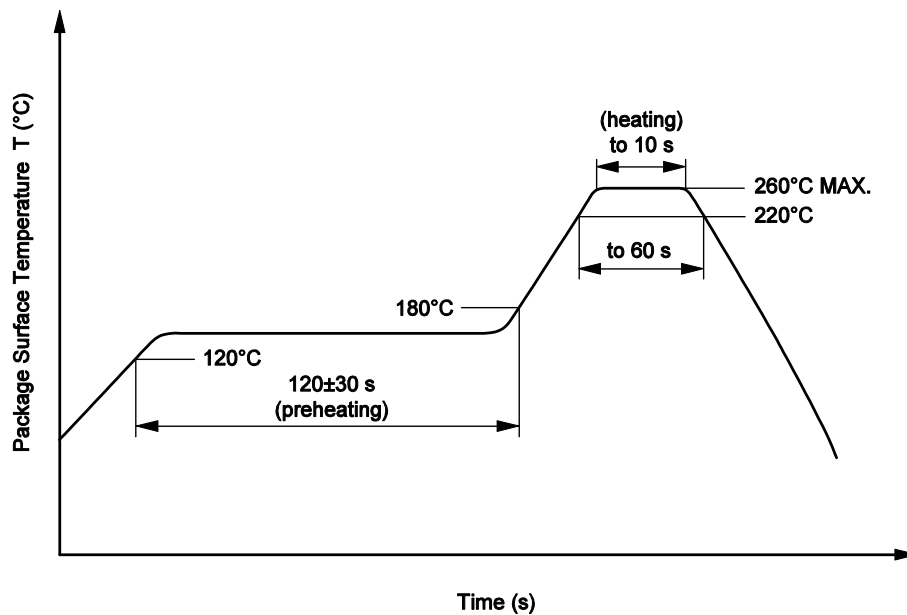
NOTES ON HANDLING

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 or less |
| • Flux | Rosin flux containing small amount of chlorine (The flux with a maximum chlorine content of 0.2 Wt% or less 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% or less is recommended.) |

(3) Soldering by Soldering Iron

- | | |
|--|--|
| • Peak Temperature (lead part temperature) | 350°C or below |
| • Time (each pin) | 3 seconds or less |
| • Flux | Rosin flux containing small amount of chlorine (The flux with a maximum chlorine content of 0.2 Wt% or less 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

- 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.

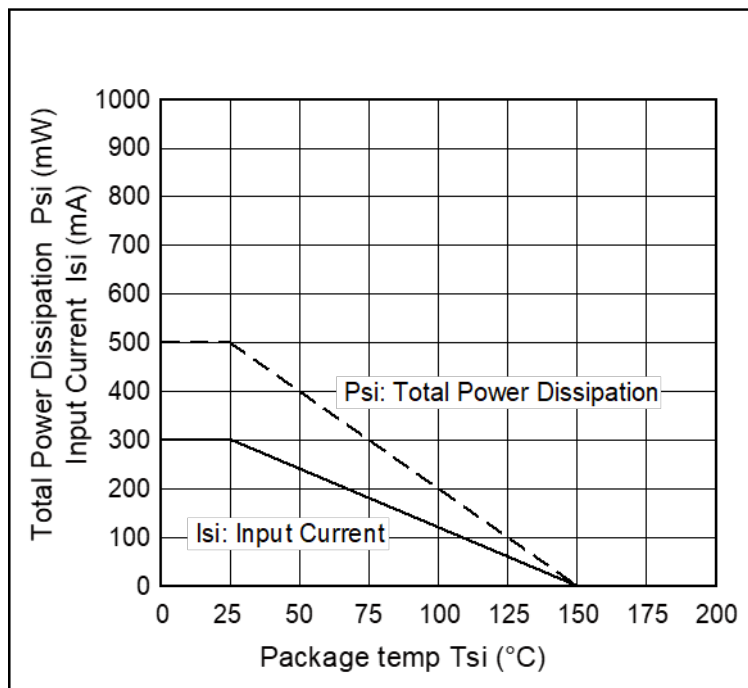
USAGE CAUTIONS

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

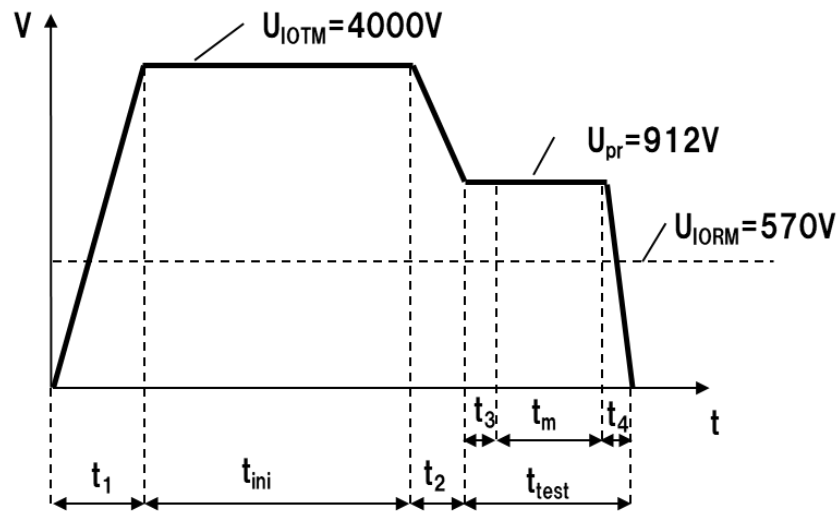
SPECIFICATION OF VDE MARKS LICENSE DOCUMENT

Parameter	Symbol	Rating	Unit
Climatic test class (IEC 60068-1/DIN EN 60068-1)		55/100/21	
Dielectric strength			
maximum operating isolation voltage	U_{IORM}	570	V_{peak}
Test voltage (partial discharge test, procedure a for type test and random test)	U_{pr}	912	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}	1 068	V_{peak}
$U_{pr} = 1.875 \times U_{IORM}$, $P_d < 5 \text{ pC}$			
Highest permissible overvoltage	U_{TR}	4 000	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 $T_A = 25^\circ\text{C}$	$R_{is \text{ MIN.}}$	10^{12}	Ω
$V_{IO} = 500 \text{ V dc}$ at $T_A \text{ MAX.}$ at least 100°C	$R_{is \text{ MIN.}}$	10^{11}	Ω
Safety maximum ratings (maximum permissible in case of fault, see thermal derating curve)			
Package temperature	T_{si}	150	°C
Current (input current I_F , $\Psi_i = 0$)	I_{si}	300	mA
Power (output or total power dissipation)	Ψ_i	500	mW
Isolation resistance			
$V_{IO} = 500 \text{ V dc}$ at $T_A = T_{si}$	$R_{is \text{ MIN.}}$	10^9	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

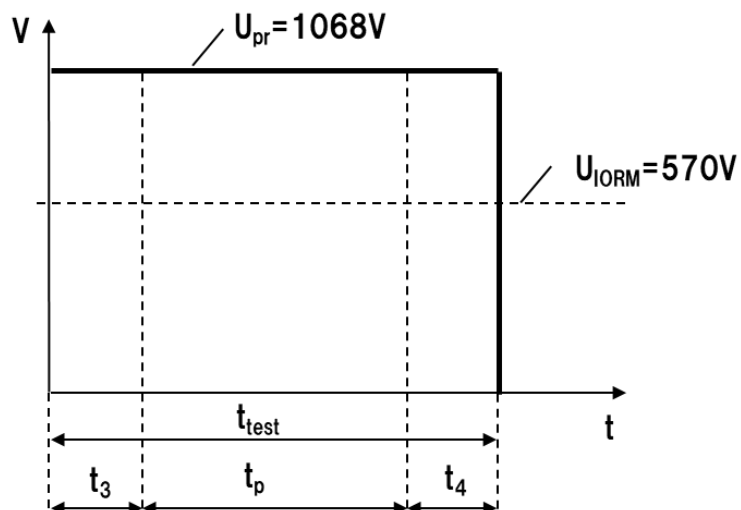
$t_3, t_4 = 1$ sec

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_p (PARTIAL DISCHARGE) = 1.0 sec

$t_{test} = 1.2$ 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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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

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Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: info@moschip.ru

Skype отдела продаж:

moschip.ru

moschip.ru_4

moschip.ru_6

moschip.ru_9