PS2513-1, PS2513L-1

R08DS0206EJ0100
Rev.1.00
Dec 25, 2020

LOW INPUT CURRENT, HIGH SPEED SWITCHING

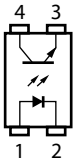
DESCRIPTION

The PS2513-1 and PS2513L-1 are optically coupled isolator containing a GaAs light emitting diode and an NPN silicon phototransistor.
The PS2513-1 is in a plastic DIP (Dual In-line Package) and the PS2513L-1 is lead bending type (Gull-wing) for surface mount.

FEATURES

- High isolation voltage (BV = 5 000 Vr.m.s.)
- High collector to emitter voltage (V_{CEO} = 120 V)
- Guaranteed maximum switching speed
- ($t_{off} \leq 60$ μs @ I_F = 5 mA, V_{CC} = 5 V, R_L = 1.9 kΩ)
- High-speed switching (t_{on} = 5 μs TYP. @ I_F = 5 mA, V_{CC} = 5 V, R_L = 1.9 kΩ)
- (t_{off} = 25 μs TYP. @ I_F = 5 mA, V_{CC} = 5 V, R_L = 1.9 kΩ)
- Ordering number of taping product: PS2513L-1-F3 : 2 000 pcs/reel
- Pb-Free product
- Safety standards
  - UL approved: UL1577, Double protection
  - VDE approved: DIN EN 60747-5-5 (Option)

PIN CONNECTION
(Top View)



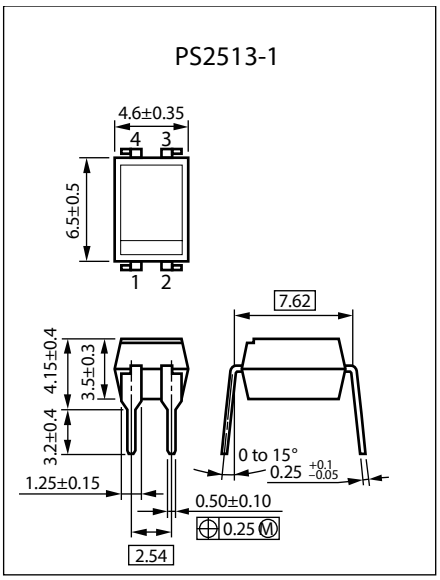
1. Anode
2. Cathode
3. Emitter
4. Collector

APPLICATIONS

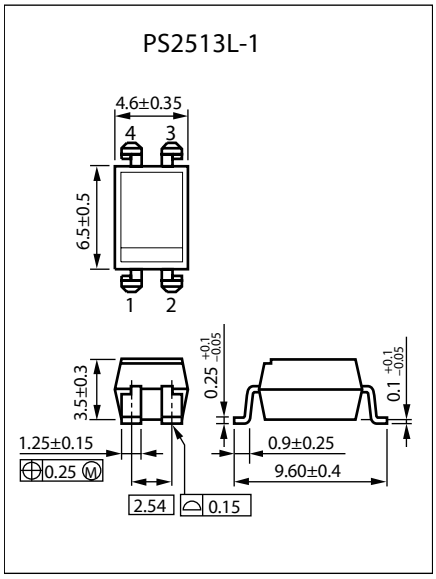
- Power supply
- Air conditioner
- FA equipment

PACKAGE DIMENSIONS (UNIT: mm)

DIP Type



Lead Bending Type For Surface Mount

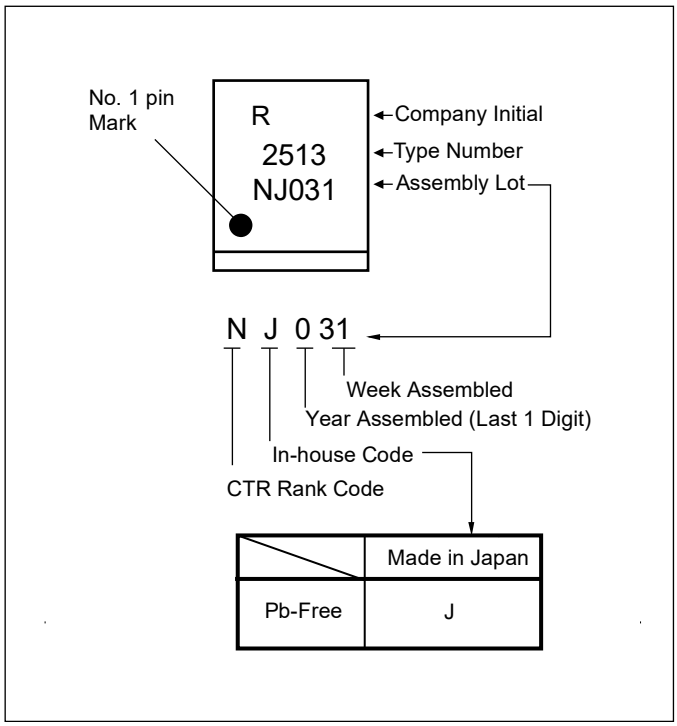


Weight (4-pin DIP) : 0.26 g (typ.)

PHOTOCOUPLER CONSTRUCTION

Parameter	PS2513-1, PS2513L-1
Air Distance (MIN.)	7 mm
Creepage Distance (MIN.)	7 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 *1
PS2513-1	PS2513-1-A	Pb-Free	Magazine case 100 pcs	Standard products (UL approved)	PS2513-1
PS2513L-1	PS2513L-1-A				PS2513L-1
PS2513L-1-F3	PS2513L-1-F3-A		Embossed Tape 2 000 pcs/reel		PS2513L-1
PS2513-1-V	PS2513-1-V-A		Magazine case 100 pcs	UL, DIN EN 60747-5-5 approved	PS2513-1
PS2513L-1-V	PS2513L-1-V-A				PS2513L-1
PS2513L-1-V-F3	PS2513L-1-V-F3-A		Embossed Tape 2 000 pcs/reel		PS2513L-1

Notes: *1. For the application of the Safety Standard, following part number should be used.

ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C, unless otherwise specified)

Parameter		Symbol	Ratings	Unit
Diode	Reverse Voltage	V_R	6	V
	Forward Current (DC)	I_F	60	mA
	Power Dissipation Derating	ΔP_D/°C	1.5	mW/°C
	Power Dissipation	P_D	150	mW
	Peak Forward Current*1	I_{FP}	1	A
Transistor	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	ΔP_C/°C	1.5	mW/°C
	Power Dissipation	P_C	150	mW
Isolation Voltage*2		BV	5 000	Vr.m.s.
Operating Ambient Temperature		T_A	–55 to +100	°C
Storage Temperature		T_{stg}	–55 to +150	°C

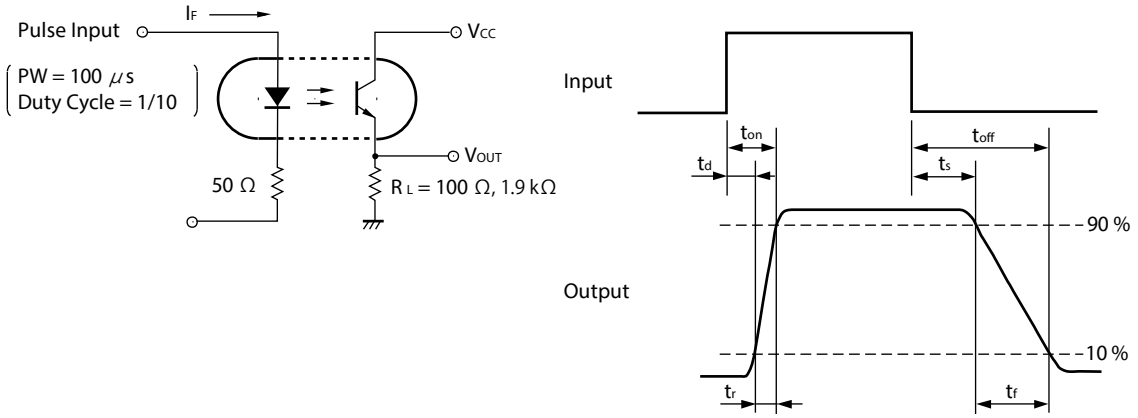
Note: *1. PW = 100 μs, Duty Cycle = 1 %

*2. AC voltage for 1 minute at T_A = 25 °C, RH = 60 % between input and output.
Pins 1-2 shorted together, 3-4 shorted together.

ELECTRICAL CHARACTERISTICS (T_A = 25 °C)

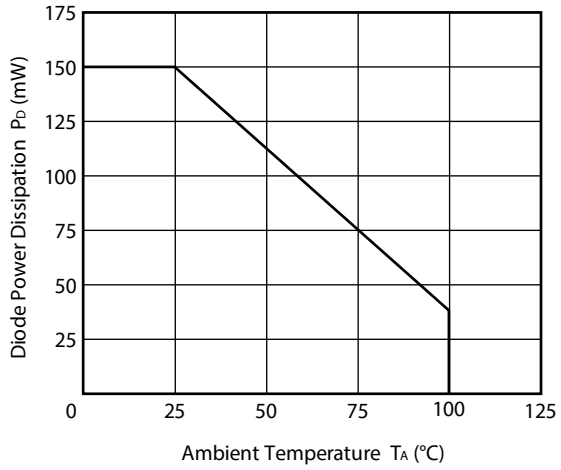
Parameter		Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Diode	Forward Voltage	V_F	I_F = 5 mA		1.1	1.3	V
	Reverse Current	I_R	V_R = 5 V			5	μA
	Terminal Capacitance	C_t	V = 0 V, f = 1.0 MHz		30		pF
Transistor	Collector to Emitter Dark Current	I_{CEO}	V_{CE} = 120 V, I_F = 0 mA			100	nA
Coupled	Current Transfer Ratio (I_C/I_F)	CTR1	I_F = 1 mA, V_{CE} = 5 V	25	75	100	%
		CTR2	I_F = 5 mA, V_{CE} = 5 V	50	125	200	
	Collector Saturation Voltage	$V_{CE (sat)}$	I_F = 10 mA, I_C = 2 mA			0.3	V
	Isolation Resistance	R_{I-O}	V_{I-O} = 1.0 kV_{DC}	10^{11}			Ω
	Isolation Capacitance	C_{I-O}	V = 0 V, f = 1.0 MHz		0.5		pF
	Rise Time*1	t_r	V_{CC} = 5 V, I_C = 2 mA, R_L = 100 Ω		3		μs
	Fall Time*1	t_f			5		
	Turn-on Time*1	t_{on}	V_{CC} = 5 V, I_F = 5 mA, R_L = 1.9 kΩ		5	60	μs
	Turn-off Time*1	t_{off}			25	60	

Note: *1. Test Circuit for Switching Time

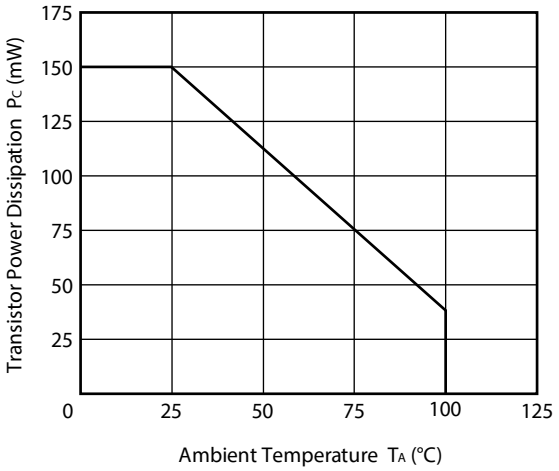


TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise specified)

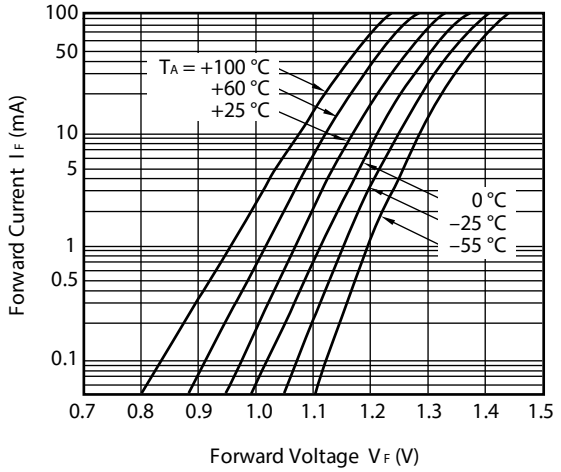
DIODE POWER DISSIPATION vs. AMBIENT TEMPERATURE



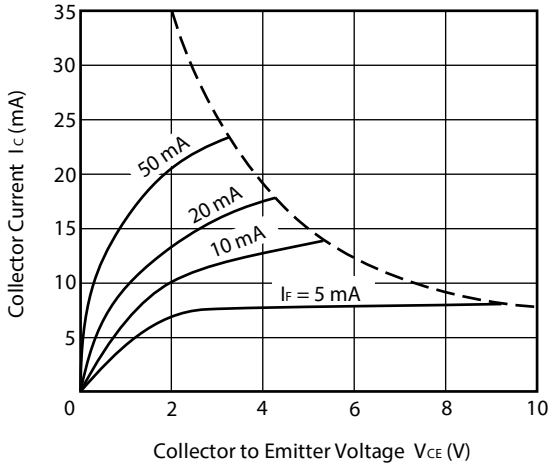
TRANSISTOR POWER DISSIPATION vs. AMBIENT TEMPERATURE



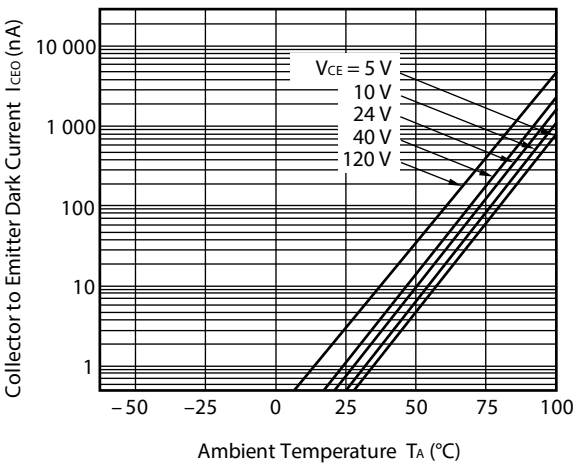
FORWARD CURRENT vs. FORWARD VOLTAGE



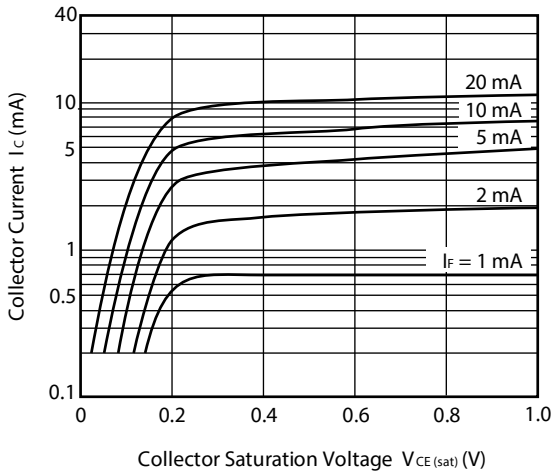
COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE



COLLECTOR TO EMITTER DARK CURRENT vs. AMBIENT TEMPERATURE

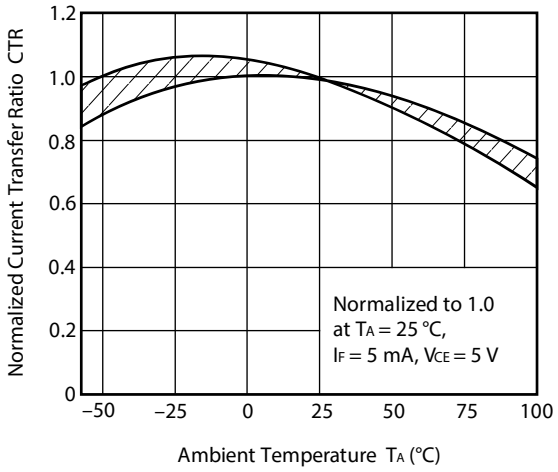


COLLECTOR CURRENT vs. COLLECTOR SATURATION VOLTAGE

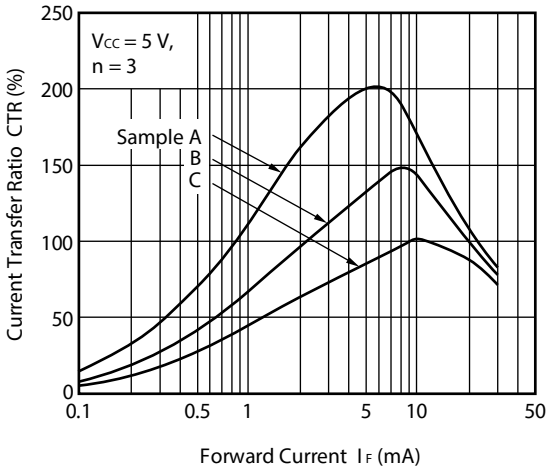


Remark The graphs indicate nominal characteristics.

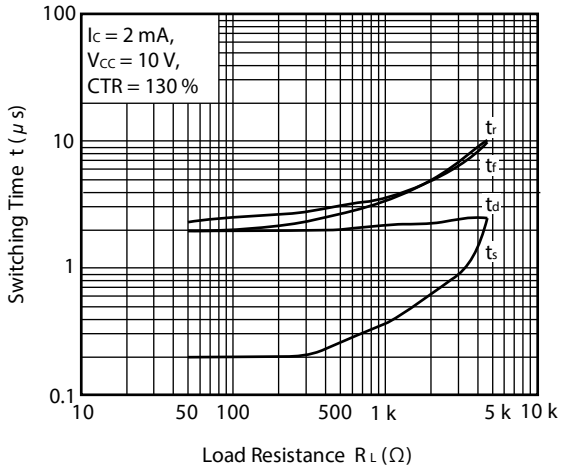
NORMALIZED CURRENT TRANSFER RATIO vs. AMBIENT TEMPERATURE



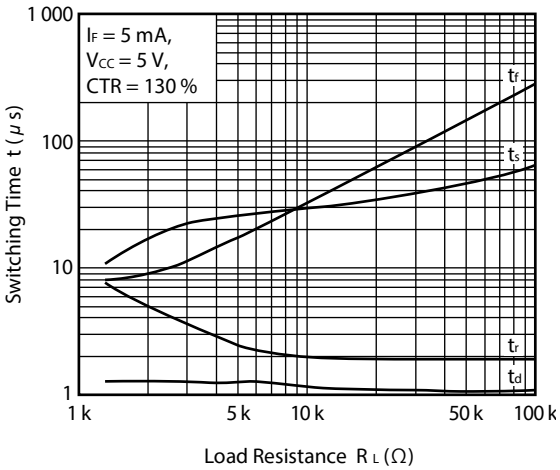
CURRENT TRANSFER RATIO vs. FORWARD CURRENT



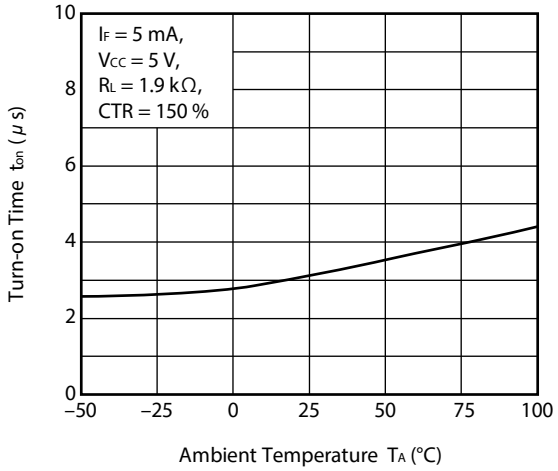
SWITCHING TIME vs. LOAD RESISTANCE



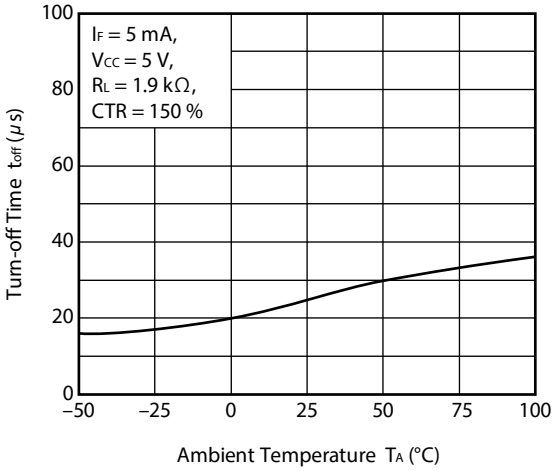
SWITCHING TIME vs. LOAD RESISTANCE



TURN-ON TIME vs. AMBIENT TEMPERATURE



TURN-OFF TIME vs. AMBIENT TEMPERATURE

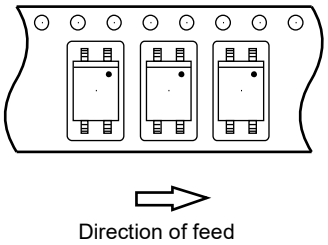


Remark The graphs indicate nominal characteristics.

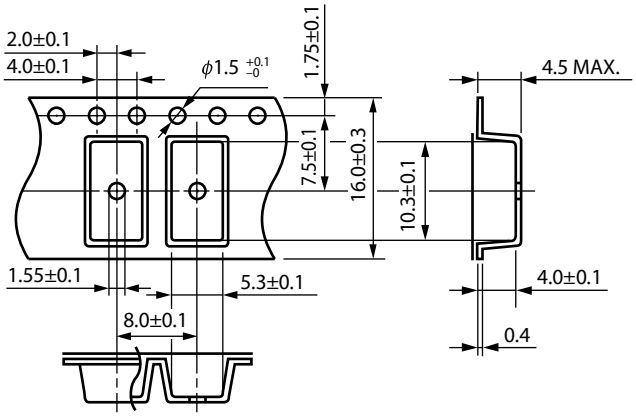
TAPING SPECIFICATIONS (UNIT: mm)

Taping Direction

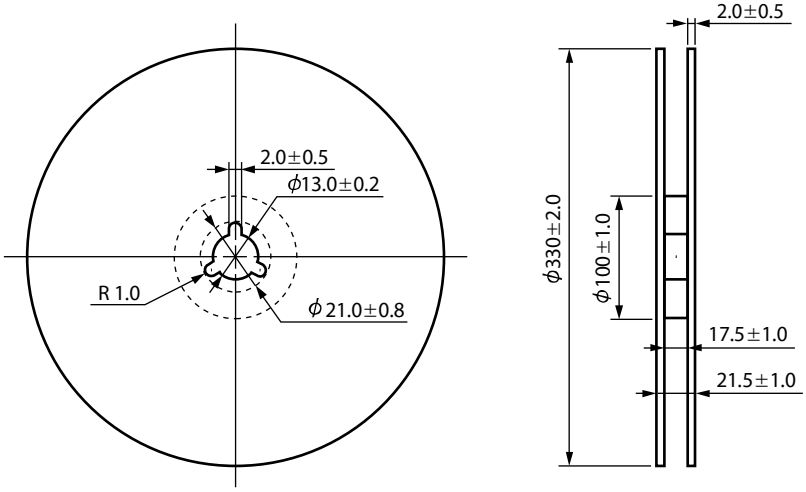
PS2513L-1-F3



Outline and Dimensions (Tape)

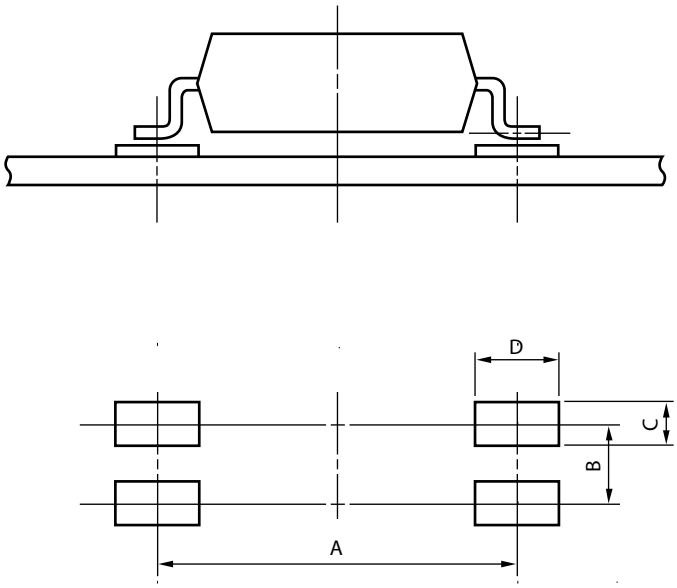


Outline and Dimensions (Reel)



Packing: 2 000 pcs/reel

RECOMMENDED MOUNT PAD DIMENSIONS (UNIT: mm)



Part Number	Lead Bending	A	B	C	D
PS2513L	Lead Bending Type For Surface Mount	8.2	2.54	1.7	2.2

Remark All dimensions in this figure must be evaluated before use.

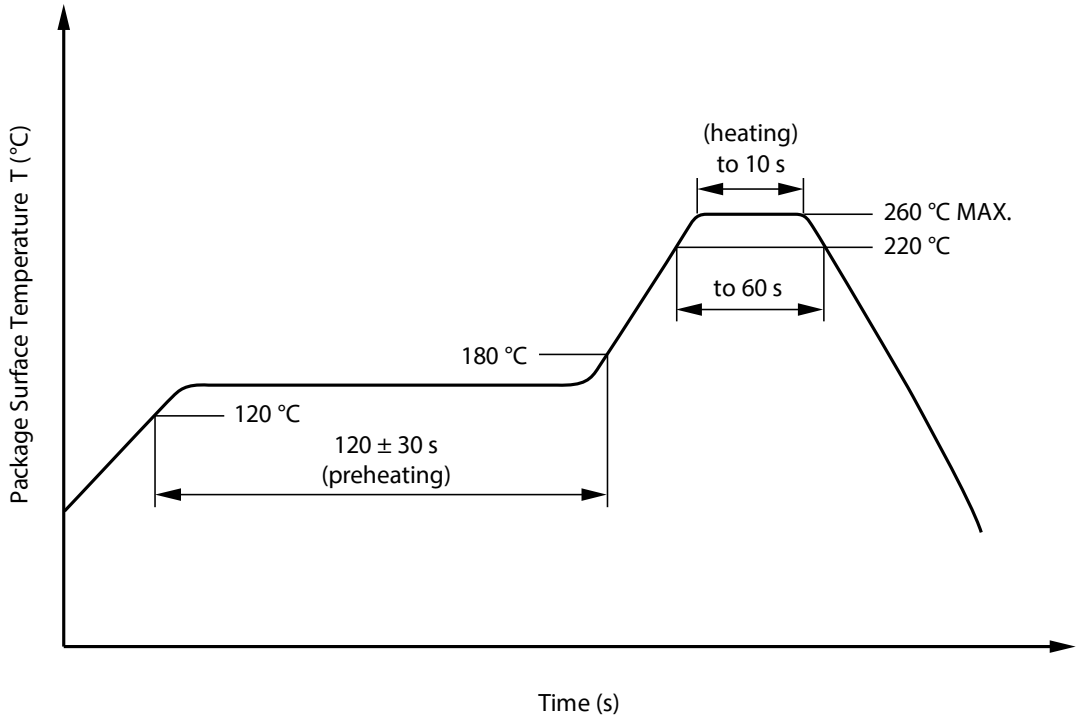
NOTES ON HANDLING

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
• 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

• 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.

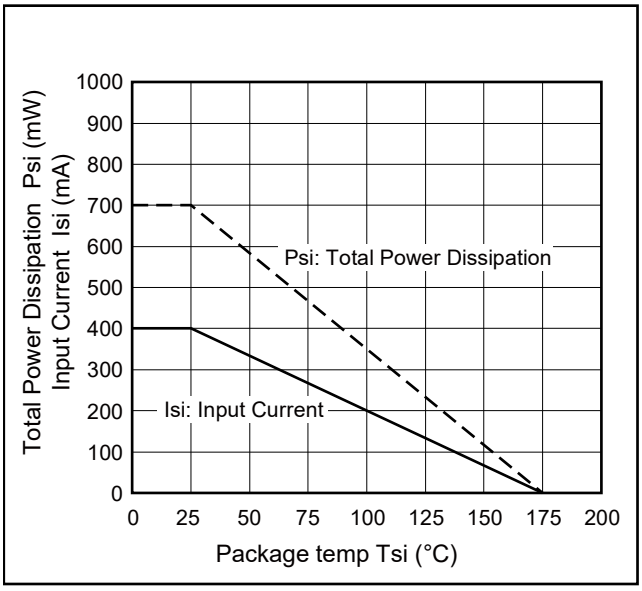
USAGE CAUTIONS

1. Protect against static electricity when handling.
2. Avoid storage at a high temperature and high humidity.
3. Avoid cleaning with Freon based or halogen-based (chlorinated etc.) solvents.
4. Do not use fixing agents or coatings containing halogen-based substances.

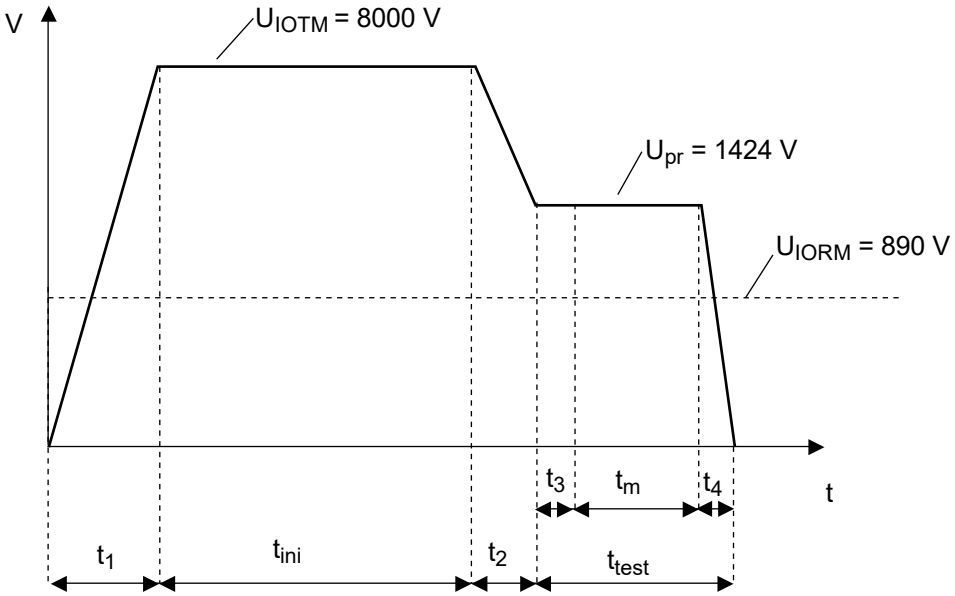
SPECIFICATION OF VDE MARKS LICENSE DOCUMENT

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 × U_{IORM}, P_d < 5 pC	 U_{IORM} U_{pr}	 890 1 424	 V_{peak} V_{peak}
Test voltage (partial discharge test, procedure b for all devices) U_{pr} = 1.875 × U_{IORM}, P_d < 5 pC	U_{pr}	1 669	V_{peak}
Highest permissible overvoltage	U_{IOTM}	8 000	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 V dc at T_A = 25°C V_{IO} = 500 V dc at T_A MAX. at least 100°C	 Ris MIN. Ris MIN.	 10^{12} 10^{11}	 Ω Ω
Safety maximum ratings (maximum permissible in case of fault, see thermal derating curve) Package temperature Current (input current I_F, Psi = 0) Power (output or total power dissipation) Isolation resistance V_{IO} = 500 V dc at T_A = Tsi	 Tsi Isi Psi Ris MIN.	 175 400 700 10^9	 °C mA mW Ω

Dependence of maximum safety ratings with package temperature

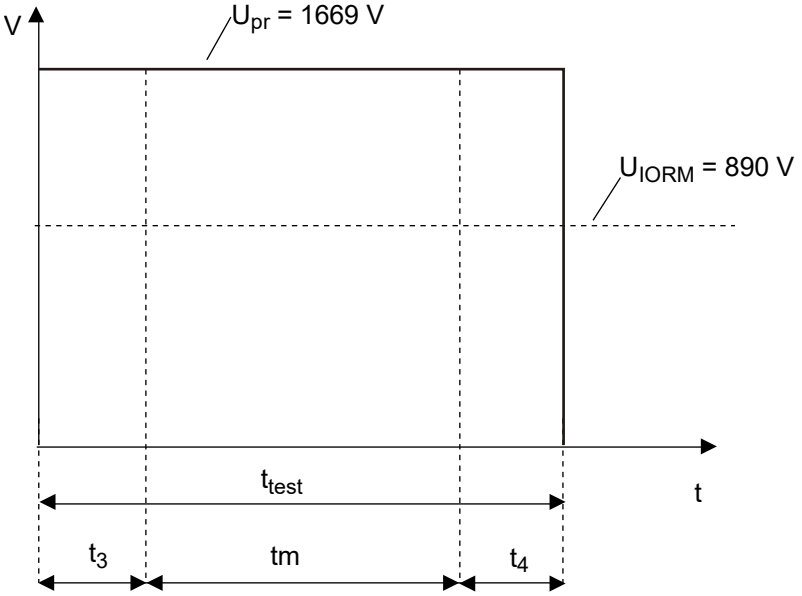


Method a) Destructive Test, Type and Sample Test



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

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 i 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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