

**4-PIN LSOP PHOTOCOUPLER
OPERATING AMBIENT TEMPERATURE 115°C**

–NEPOC Series–

DESCRIPTION

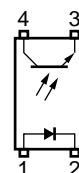
The PS2381-1 is an optically coupled isolator containing a GaAs light emitting diode and an NPN silicon phototransistor.

This package is mounted in a plastic 4-LSOP (Long Mini-Flat Small Outline Package) for high density applications.

The package has shield effect to cut off ambient light.

FEATURES

- Operating ambient temperature: 115°C
- Isolation distance (0.4 mm MIN.)
- High isolation voltage (BV = 5 000 Vr.m.s.)
- 4-pin LSOP (Long Mini-Flat Small Outline Package) type
- High-speed switching ($t_r = 4 \mu s$ TYP., $t_f = 5 \mu s$ TYP.)
- Embossed tape product: PS2381-1-F3: 3 000 pcs/reel
- Pb-Free product
- Safety standards
 - UL approved: No. E72422
 - CSA approved: No. CA 101391 (CA5A, CAN/CSA-C22.2 60065, 60950)
 - SEMKO approved: No. 911049
 - DIN EN60747-5-2 (VDE0884 Part2) approved: No. 40028917 (Option)
 - CQC approved: CQC10001041058 for GB4943-2001
CQC10001041059 for GB8898-2001

**PIN CONNECTION
(Top View)**

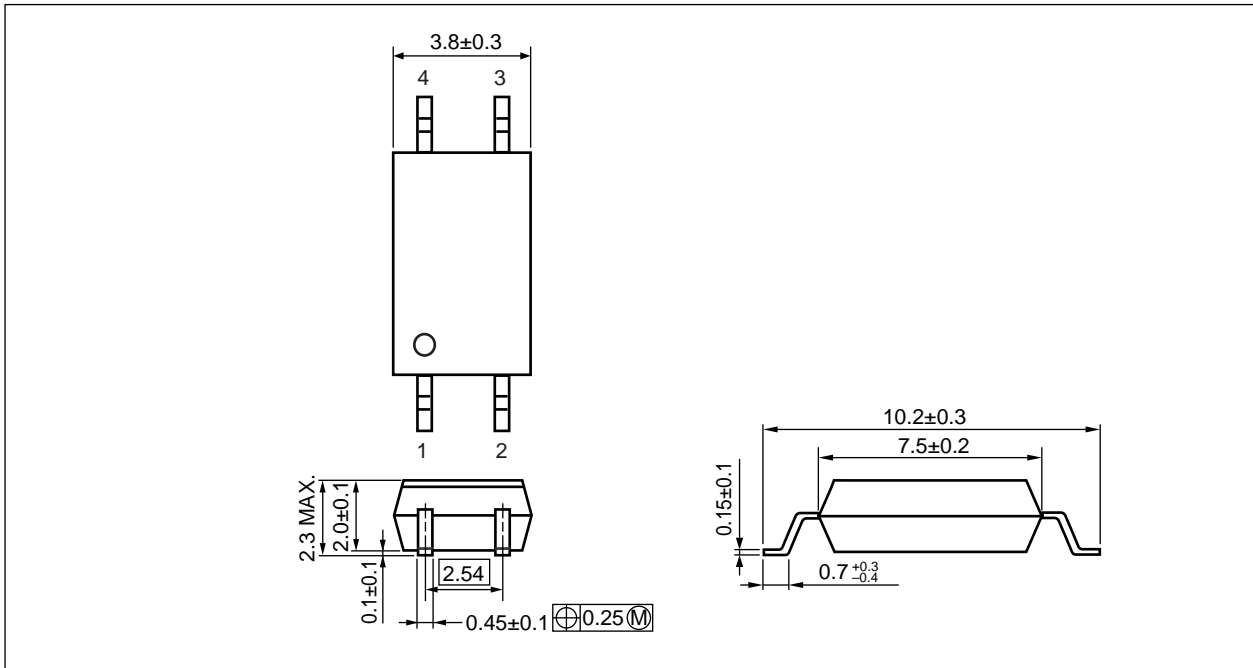
1. Anode
2. Cathode
3. Emitter
4. Collector

APPLICATIONS

- Power supply
- FA/OA equipment

The information in this document is subject to change without notice. Before using this document, please confirm that this is the latest version.

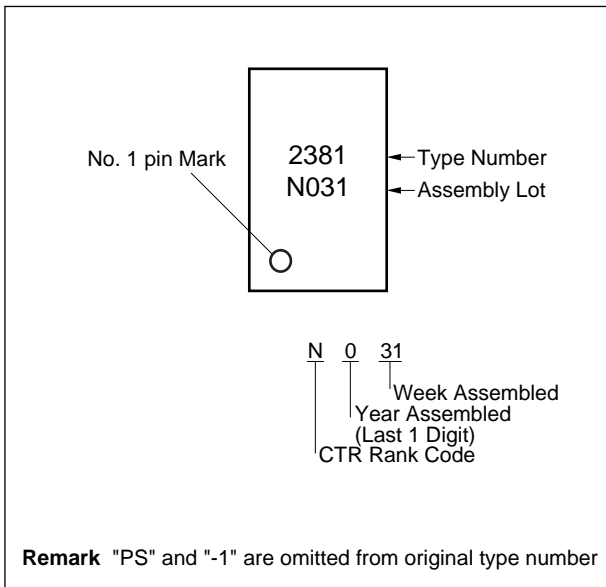
PACKAGE DIMENSIONS (Unit: mm)



PHOTOCOUPLER CONSTRUCTION

Parameter	Unit (MIN.)
Air Distance	8 mm
Outer Creepage Distance	8 mm
Isolation Distance	0.4 mm

MARKING EXAMPLE



ORDERING INFORMATION

Part Number	Order Number	Solder Plating Specification etc.	Packing Style	Safety Standard Approval	Application Part Number ^{*1}
PS2381-1	PS2381-1Y-AX	Pb-Free and	20 pcs (Tape 20 pcs cut)	Standard products (UL, CSA, SEMKO approved)	PS2381-1
PS2381-1-F3	PS2381-1Y-F3-AX	Halogen Free	Embossed Tape 3 000 pcs/reel		
PS2381-1-V	PS2381-1Y-V-AX		20 pcs (Tape 20 pcs cut)	DIN EN60747-5-2	
PS2381-1-V-F3	PS2381-1Y-V-F3-AX		Embossed Tape 3 000 pcs/reel	(VDE0884 Part2) Approved (Option)	

*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	Forward Current (DC)	I _F	60	mA
	Reverse Voltage	V _R	6	V
	Power Dissipation Derating ^{*1}	ΔP _D /°C	1.0	mW/°C
	Power Dissipation	P _D	100	mW
	Peak Forward Current ^{*2}	I _{FP}	1.5	A
Transistor	Collector to Emitter Voltage	V _{CEO}	80	V
	Emitter to Collector Voltage	V _{ECO}	7	V
	Collector Current	I _C	50	mA
	Power Dissipation Derating ^{*1}	ΔP _C /°C	1.5	mW/°C
	Power Dissipation	P _C	150	mW
Isolation Voltage ^{*3}		BV	5 000	Vr.m.s.
Total Power Dissipation		P _T	250	mW
Operating Ambient Temperature		T _A	-40 to +115	°C
Storage Temperature		T _{stg}	-40 to +125	°C

*1 Derating from T_A = 25°C.

*2 PW = 100 μs, Duty Cycle = 1%

*3 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.

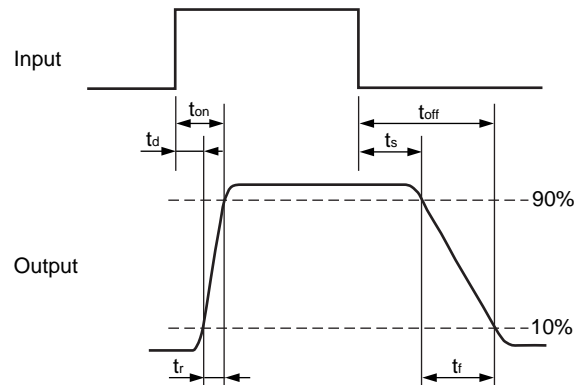
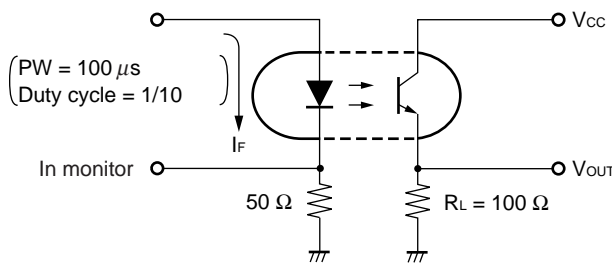
ELECTRICAL CHARACTERISTICS (T_A = 25°C)

Parameter		Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Diode	Forward Voltage	V _F	I _F = 5 mA		1.1	1.4	V
	Reverse Current	I _R	V _R = 5 V			5	μA
	Terminal Capacitance	C _t	V = 0 V, f = 1 MHz		15		pF
Transistor	Collector to Emitter Dark Current	I _{CEO}	I _F = 0 mA, V _{CE} = 24 V			100	nA
Coupled	Current Transfer Ratio (I _c /I _F) ^{*1}	CTR	I _F = 5 mA, V _{CE} = 5 V	50	100	400	%
			I _F = 1 mA, V _{CE} = 5 V	10	50		
	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 kV _{DC}	10 ¹¹			Ω
	Isolation Capacitance	C _{I-O}	V = 0 V, f = 1 MHz		0.4		pF
	Rise Time ^{*2}	t _r	V _{CC} = 5 V, I _c = 2 mA, R _L = 100 Ω		4		μs
	Fall Time ^{*2}	t _f			5		

*1 CTR rank

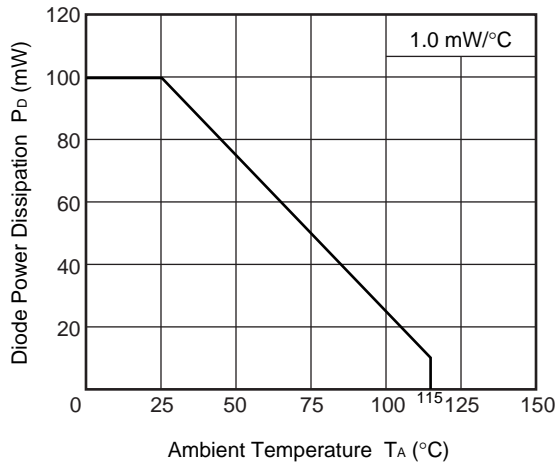
CTR rank	CTR (%)	Conditions
W	130 to 260	I _F = 5 mA, V _{CE} = 5 V
	20 to	I _F = 1 mA, V _{CE} = 5 V
L	100 to 300	I _F = 5 mA, V _{CE} = 5 V
	20 to	I _F = 1 mA, V _{CE} = 5 V
M	50 to 150	I _F = 5 mA, V _{CE} = 5 V
	10 to	I _F = 1 mA, V _{CE} = 5 V
N	50 to 400	I _F = 5 mA, V _{CE} = 5 V
	10 to	I _F = 1 mA, V _{CE} = 5 V

*2 Test circuit for switching time

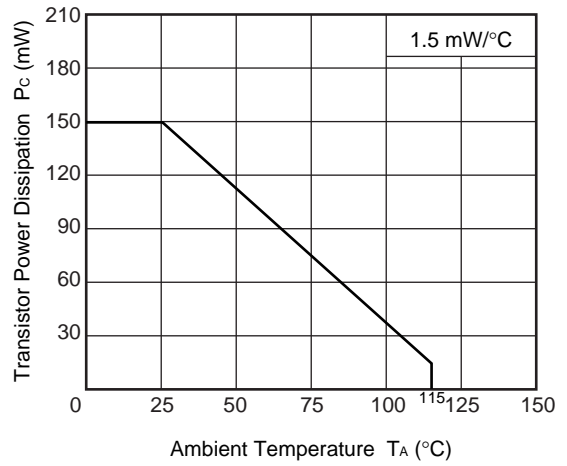


TYPICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$, unless otherwise specified)

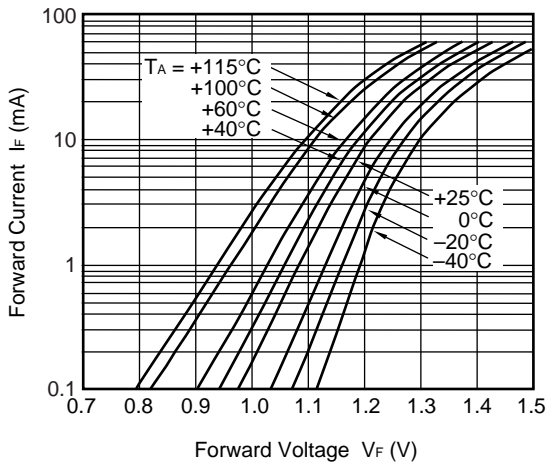
DIODE POWER DISSIPATION vs. AMBIENT TEMPERATURE



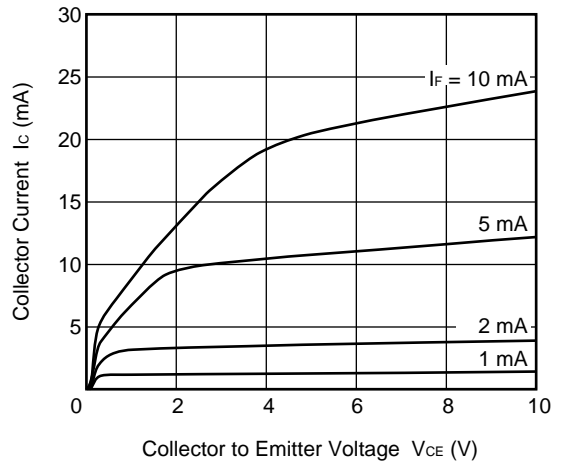
TRANSISTOR POWER DISSIPATION vs. AMBIENT TEMPERATURE



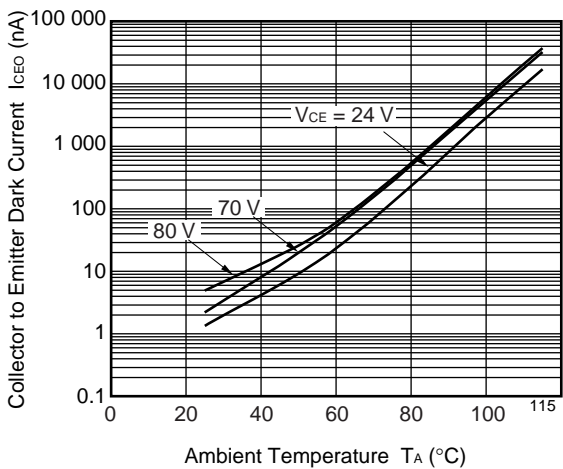
FORWARD CURRENT vs. FORWARD VOLTAGE



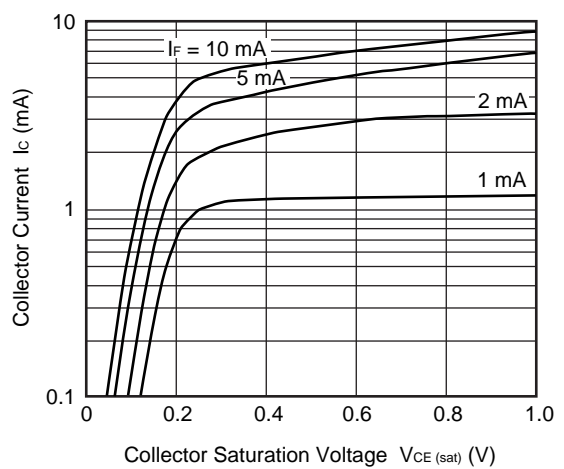
COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE



COLLECTOR TO EMITTER DARK CURRENT vs. AMBIENT TEMPERATURE

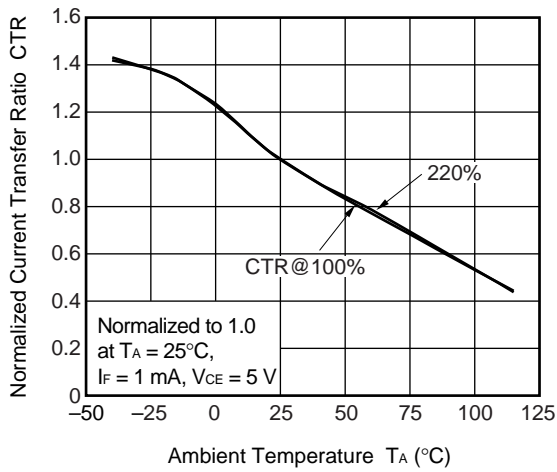


COLLECTOR CURRENT vs. COLLECTOR SATURATION VOLTAGE

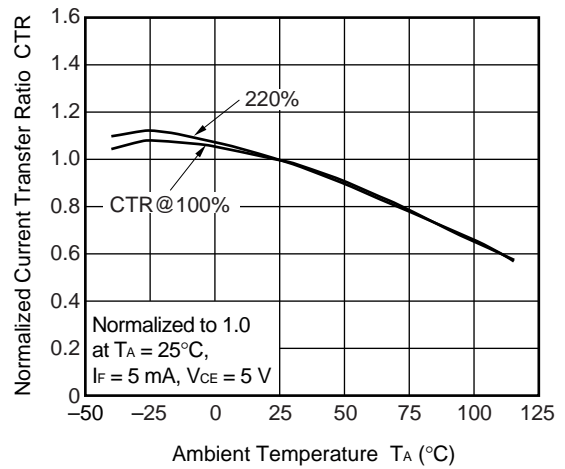


Remark The graphs indicate nominal characteristics.

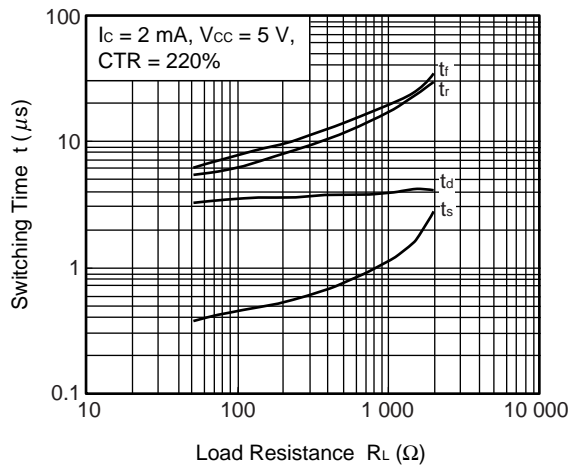
NORMALIZED CURRENT TRANSFER RATIO vs. AMBIENT TEMPERATURE



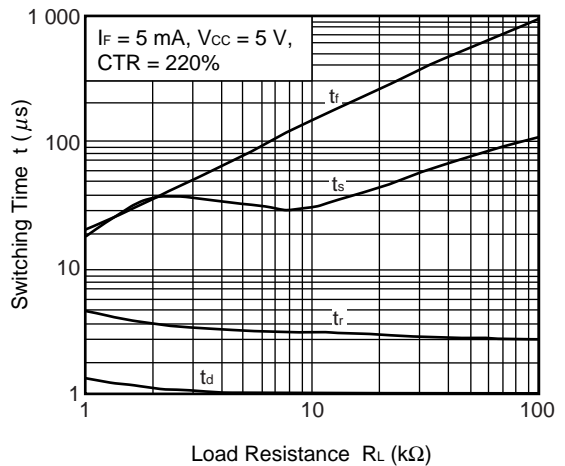
NORMALIZED CURRENT TRANSFER RATIO vs. AMBIENT TEMPERATURE



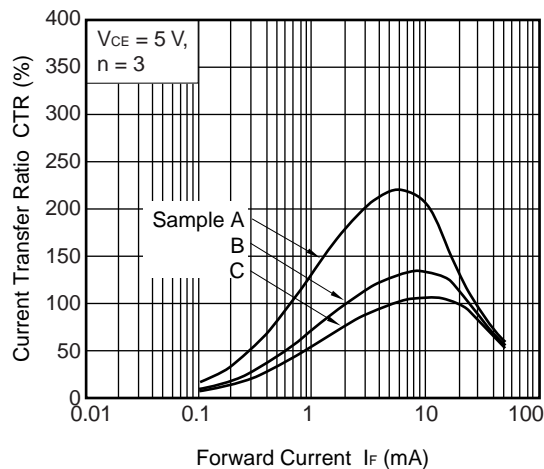
SWITCHING TIME vs. LOAD RESISTANCE



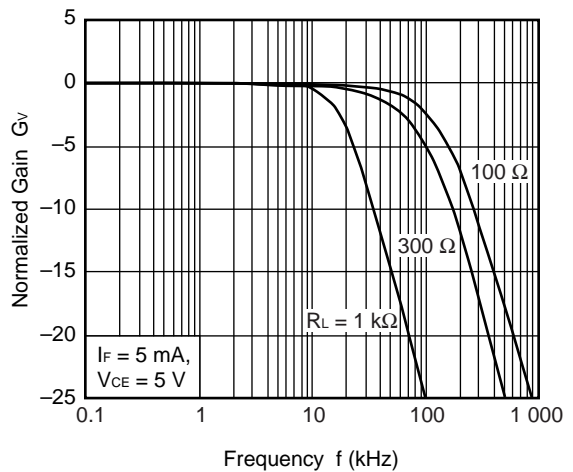
SWITCHING TIME vs. LOAD RESISTANCE



CURRENT TRANSFER RATIO vs. FORWARD CURRENT



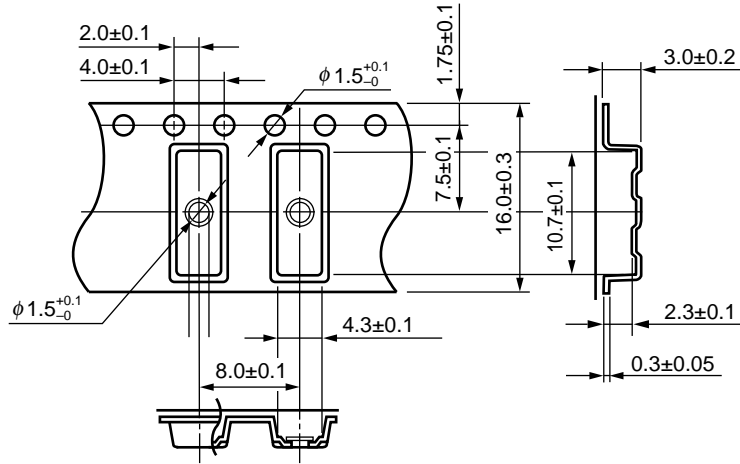
FREQUENCY RESPONSE



Remark The graphs indicate nominal characteristics.

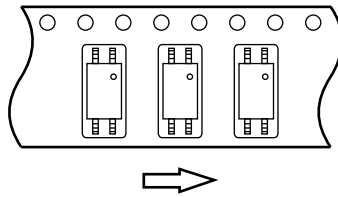
TAPING SPECIFICATIONS (UNIT: mm)

Outline and Dimensions (Tape)

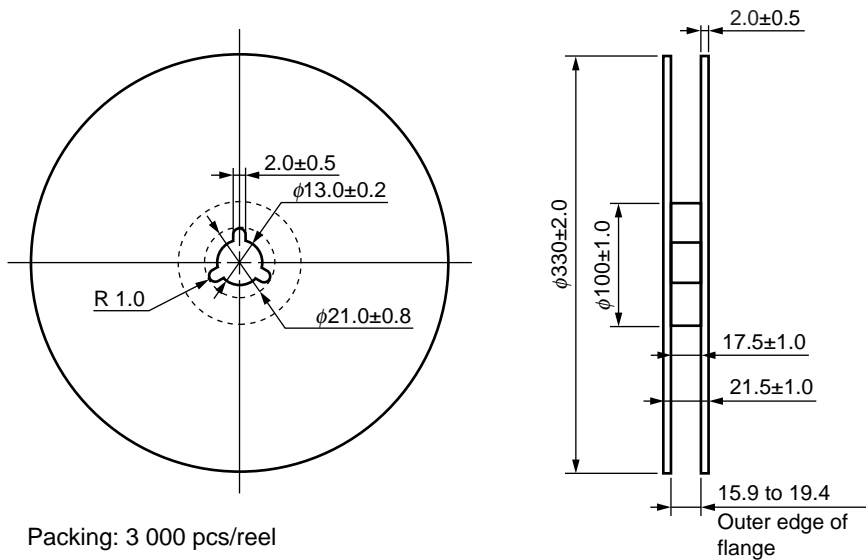


Tape Direction

PS2381-1-F3

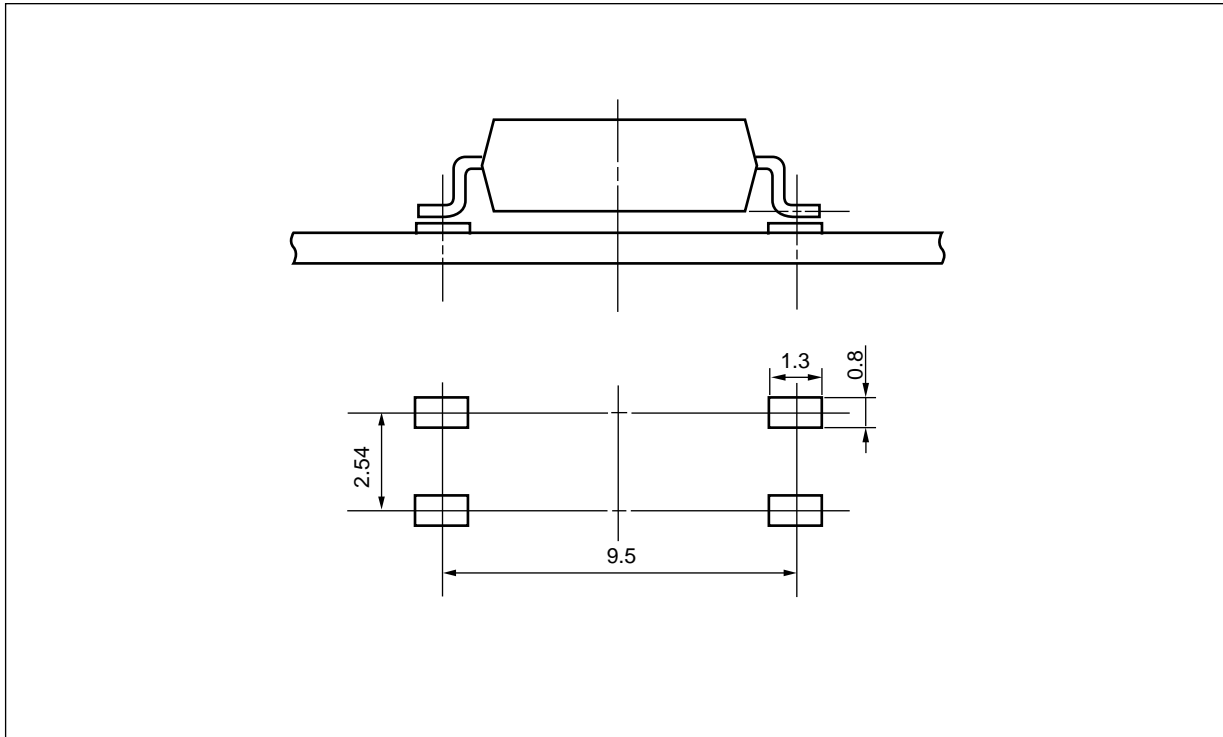


Outline and Dimensions (Reel)



Packing: 3 000 pcs/reel

RECOMMENDED MOUNT PAD DIMENSIONS (UNIT: mm)



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

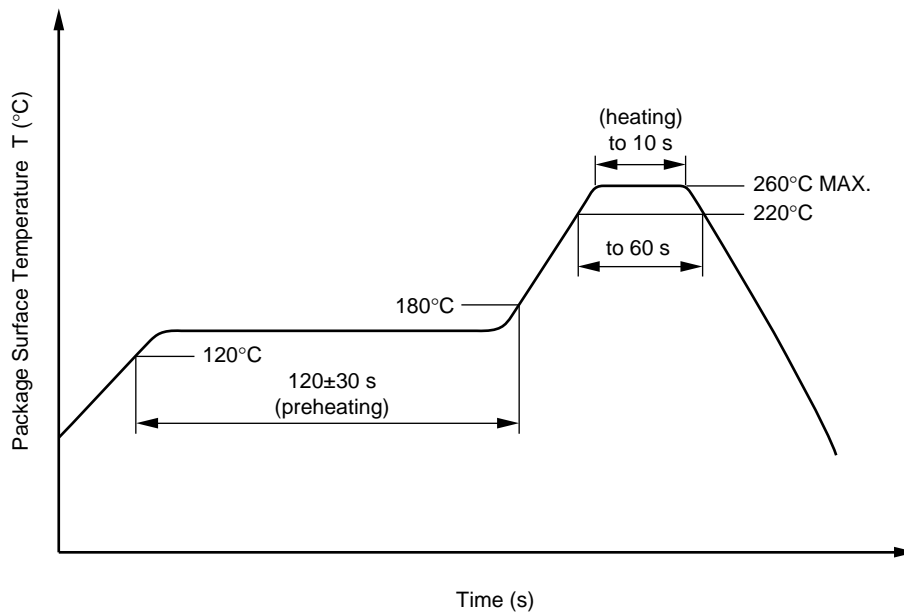
NOTES ON HANDLING

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

- Fluxes

Avoid removing the residual flux with freon-based and 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 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	Spec.	Unit
Climatic test class (IEC 60068-1/DIN EN 60068-1)		40/115/21	
Dielectric strength maximum operating isolation voltage	U_{IORM}	1 130	V_{peak}
Test voltage (partial discharge test, procedure a for type test and random test) $U_{pr} = 1.5 \times U_{IORM}, P_d < 5 \text{ pC}$	U_{pr}	1 695	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}	2 119	V_{peak}
Highest permissible overvoltage	U_{TR}	8 000	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}	-40 to +125	°C
Operating temperature range	T_A	-40 to +115	°C
Isolation resistance, minimum value $V_{IO} = 500 \text{ V dc at } T_A = 25^\circ\text{C}$ $V_{IO} = 500 \text{ V dc at } T_A \text{ MAX. at least } 100^\circ\text{C}$	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	T_{si}	175	°C
Current (input current I_F , $P_{si} = 0$)	I_{si}	400	mA
Power (output or total power dissipation)	P_{si}	700	mW
Isolation resistance $V_{IO} = 500 \text{ V dc at } T_A = T_{si}$	Ris MIN.	10^9	Ω

<p>Caution</p>	<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"> • 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. <ol style="list-style-type: none"> 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.
-----------------------	----------------------	---

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 of these circuits, software, and information in the design of your equipment. California Eastern Laboratories and Renesas Electronics assumes no responsibility for any losses incurred by you or third parties arising from the use of these circuits, software, or information.
2. California Eastern Laboratories has used reasonable care in preparing the information included in this document, but California Eastern Laboratories does not warrant that such information is error free. California Eastern Laboratories and Renesas Electronics assumes no liability whatsoever for any damages incurred by you resulting from errors in or omissions from the information included herein.
3. California Eastern Laboratories and Renesas Electronics do not assume any liability for infringement of 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. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of California Eastern Laboratories or Renesas Electronics or others.
4. You should not alter, modify, copy, or otherwise misappropriate any Renesas Electronics product, whether in whole or in part. California Eastern Laboratories and Renesas Electronics assume no responsibility for any losses incurred by you or third parties arising from such alteration, modification, copy or otherwise misappropriation of Renesas Electronics product.
5. Renesas Electronics products are classified according to the following two quality grades: "Standard" and "High Quality". The recommended 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; and industrial robots etc. "High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control systems; anti-disaster systems; anti-crime systems; and safety equipment etc. Renesas Electronics products are neither intended nor 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 damages (nuclear reactor control systems, military equipment etc.). You must check the quality grade of each Renesas Electronics product before using it in a particular application. You may not use any Renesas Electronics product for any application for which it is not intended. California Eastern Laboratories and Renesas Electronics shall not be in any way liable for any damages or losses incurred by you or third parties arising from the use of any Renesas Electronics product for which the product is not intended by California Eastern Laboratories or Renesas Electronics.
6. You should use the Renesas Electronics products described in this document within the range specified by California Eastern Laboratories, especially with respect to the maximum rating, operating supply voltage range, movement power voltage range, heat radiation characteristics, installation and other product characteristics. California Eastern Laboratories shall have no liability for malfunctions or damages arising out of the use of Renesas Electronics products beyond such specified ranges.
7. Although Renesas Electronics endeavors to improve the quality and reliability of its products, semiconductor products have specific characteristics such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Further, Renesas Electronics products are not subject to radiation resistance design. Please be sure to implement safety measures to guard them against the possibility of physical injury, and injury or damage caused by fire in the event of the failure of a Renesas Electronics product, 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, please evaluate the safety of the final products or systems manufactured by you.
8. Please contact a California Eastern Laboratories sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. Please use Renesas Electronics products in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. California Eastern Laboratories and Renesas Electronics assume no liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
9. Renesas Electronics products and technology may 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 should not use Renesas Electronics products or technology described in this document for any purpose relating to military applications or use by the military, including but not limited to the development of weapons of mass destruction. When exporting the Renesas Electronics products or technology described in this document, you should comply with the applicable export control laws and regulations and follow the procedures required by such laws and regulations.
10. It is the responsibility of the buyer or distributor of California Eastern Laboratories, who distributes, disposes of, or otherwise places the Renesas Electronics product with a third party, to notify such third party in advance of the contents and conditions set forth in this document, California Eastern Laboratories and Renesas Electronics assume no responsibility for any losses incurred by you or third parties as a result of unauthorized use of Renesas Electronics products.
11. This document may not be reproduced or duplicated in any form, in whole or in part, without prior written consent of California Eastern Laboratories.
12. Please contact a California Eastern Laboratories sales office if you have any questions regarding the information contained in this document or Renesas Electronics products, or if you have any other inquiries.

NOTE 1: "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its majority-owned subsidiaries.

NOTE 2: "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics.

NOTE 3: Products and product information are subject to change without notice.

CEL Headquarters • 4590 Patrick Henry Drive, Santa Clara, CA 95054 • Phone (408) 919-2500 • www.cel.com

For a complete list of sales offices, representatives and distributors,
Please visit our website: www.cel.com/contactus