

# PS2861B-1

R08DS0100EJ0300

Rev.3.00

4-PIN SSOP PHOTOCOUPLER OPERATING AMBIENT TEMPERATURE 110°C

Jan 23, 2013

## DESCRIPTION

The PS2861B-1 is an optically coupled isolator containing a GaAs light emitting diode and an NPN silicon phototransistor.

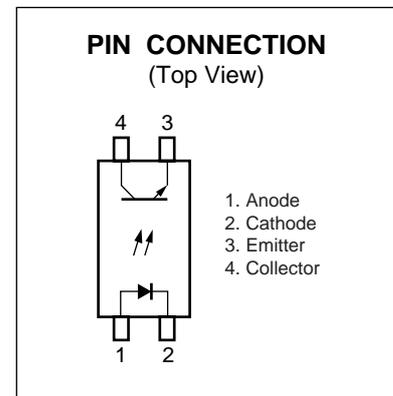
The package has a shield effect to cut off ambient light, and is mounted in a Shrink SOP (Small Outline Package) for high density applications.

Due to the high isolation voltage between the input and output, the PS2861B-1 is suitable for interface and signal transfer circuits that require surface or high-density mounting.

## FEATURES

- Operating ambient temperature: 110°C
- Isolation distance (0.4 mm MIN.)
- High isolation voltage (BV = 3 750 Vr.m.s.)
- Shrink SOP (Small Outline Package) type
- High-speed switching ( $t_r = 4\mu\text{s}$  TYP.,  $t_f = 5\mu\text{s}$  TYP.)
- Embossed tape product: PS2861B-1-F3: 3 500 pcs/reel
- Pb-Free product
- Safety standards
  - UL approved: No. E72422
  - CSA approved: No. CA 101391 (CA5A, CAN/CSA-C22.2 60065, 60950)
  - BSI approved (BS EN 60065, BS EN 60950)
  - SEMKO, NEMKO, DEMKO, FIMKO approved (EN 60065, EN60950)
  - CQC approved (GB8898, GB4943)
  - DIN EN 60747-5-5 (VDE 0884-5) approved (Option)

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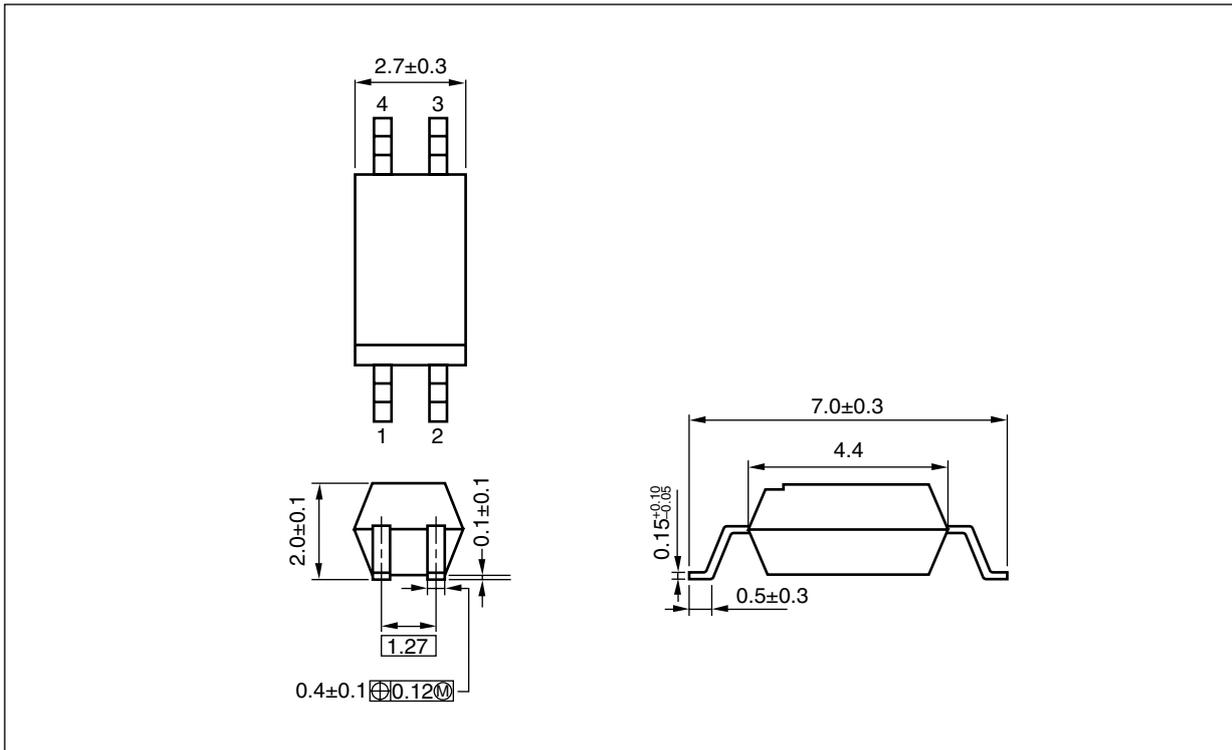
## APPLICATIONS

- Power supply
- Programmable logic controllers

The mark <R> shows major revised points.

The revised points can be easily searched by copying an "<R>" in the PDF file and specifying it in the "Find what:" field.

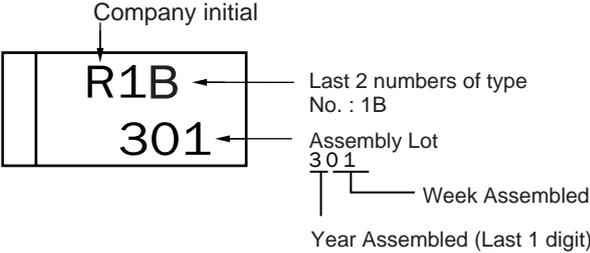
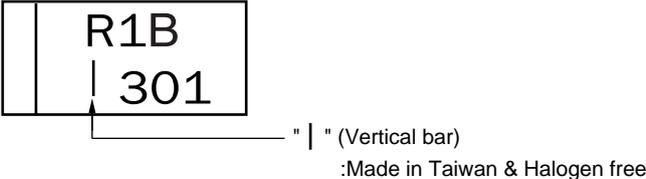
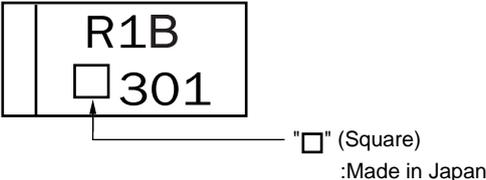
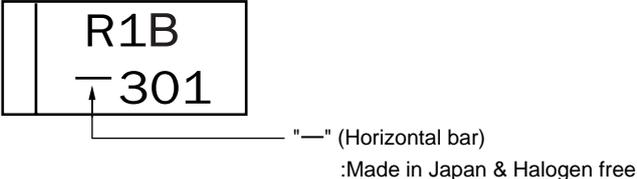
**PACKAGE DIMENSIONS (UNIT: mm)**



**PHOTOCOUPLER CONSTRUCTION**

Parameter	Unit (MIN.)
Air Distance	5.0 mm
Creepage Distance	5.0 mm
Isolation Distance	0.4 mm

<R> MARKING EXAMPLE

<p><b>Made in Taiwan</b></p>	
<p><b>Made in Taiwan Halogen free</b></p>	
<p><b>Made in Japan</b></p>	
<p><b>Made in Japan Halogen free</b></p>	

## &lt;R&gt; ORDERING INFORMATION

Part Number	Order Number	Solder Plating Specification	Packing Style	Safety Standard Approval	Application Part Number <sup>*1</sup>
PS2861B-1-F3	PS2861B-1Y-F3-A	Pb-Free and Halogen Free	Embossed Tape 3 500 pcs/reel	Standard products (UL, CSA, BSI, SEMKO, NEMKO, DEMKO, FIMKO, CQC approved)	PS2861B-1
PS2861B-1-V-F3	PS2861B-1Y-V-F3-A		Embossed Tape 3 500 pcs/reel	DIN EN 60747-5-5 (VDE 0884-5) approved (Option)	

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

**ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = 25°C, unless otherwise specified)**

Parameter		Symbol	Ratings	Unit
Diode	Forward Current (DC)	I <sub>F</sub>	50	mA
	Reverse Voltage	V <sub>R</sub>	6	V
	Power Dissipation Derating	ΔP <sub>D</sub> /°C	0.6	mW/°C
	Power Dissipation	P <sub>D</sub>	60	mW
	Peak Forward Current <sup>*1</sup>	I <sub>FP1</sub>	2.5	A
	Peak Forward Current <sup>*2</sup>	I <sub>FP2</sub>	1.0	
Transistor	Collector to Emitter Voltage	V <sub>CEO</sub>	70	V
	Emitter to Collector Voltage	V <sub>ECO</sub>	5	V
	Collector Current	I <sub>C</sub>	50	mA
	Power Dissipation Derating	ΔP <sub>D</sub> /°C	1.2	mW/°C
	Power Dissipation	P <sub>C</sub>	120	mW
Isolation Voltage <sup>*3</sup>		BV	3 750	Vr.m.s.
Operating Ambient Temperature		T <sub>A</sub>	-55 to +110	°C
Storage Temperature		T <sub>stg</sub>	-55 to +150	°C

Notes: \*1. PW = 10 μs, Duty Cycle = 1%

\*2. PW = 100 μs, Duty Cycle = 1%

\*3. AC voltage for 1 minute at T<sub>A</sub> = 25°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
	Reverse Current	I <sub>R</sub>	V <sub>R</sub> = 5 V			5	μA
	Terminal Capacitance	C <sub>t</sub>	V = 0 V, f = 1 MHz		15		pF
Transistor	Collector to Emitter Dark Current	I <sub>CEO</sub>	I <sub>F</sub> = 0 mA, V <sub>CE</sub> = 24 V			100	nA
Coupled	Current Transfer Ratio (I <sub>C</sub> /I <sub>F</sub> ) <sup>*1</sup>	CTR	I <sub>F</sub> = 5 mA, V <sub>CE</sub> = 5 V	50	150	300	%
			I <sub>F</sub> = 1 mA, V <sub>CE</sub> = 5 V	10	50		
	Collector Saturation Voltage	V <sub>CE(sat)</sub>	I <sub>F</sub> = 10 mA, I <sub>C</sub> = 2 mA			0.3	V
	Isolation Resistance	R <sub>I-O</sub>	V <sub>I-O</sub> = 1 kV <sub>DC</sub>	10 <sup>11</sup>			Ω
	Isolation Capacitance	C <sub>I-O</sub>	V = 0 V, f = 1 MHz		0.4		pF
	Rise Time <sup>*2</sup>	t <sub>r</sub>	V <sub>CC</sub> = 5 V, I <sub>C</sub> = 2 mA, R <sub>L</sub> = 100 Ω		4		μs
	Fall Time <sup>*2</sup>	t <sub>f</sub>			5		
	Turn-on Time <sup>*2</sup>	t <sub>on</sub>			5		
	Turn-off Time <sup>*2</sup>	t <sub>off</sub>			5		

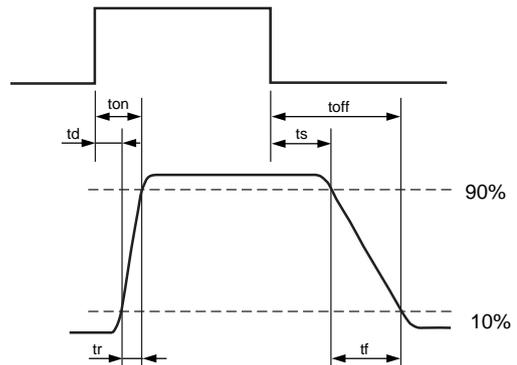
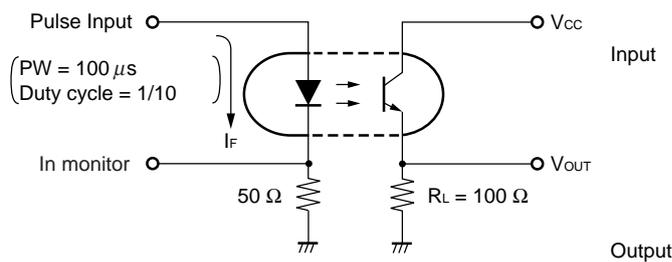
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Notes: \*1. CTR rank

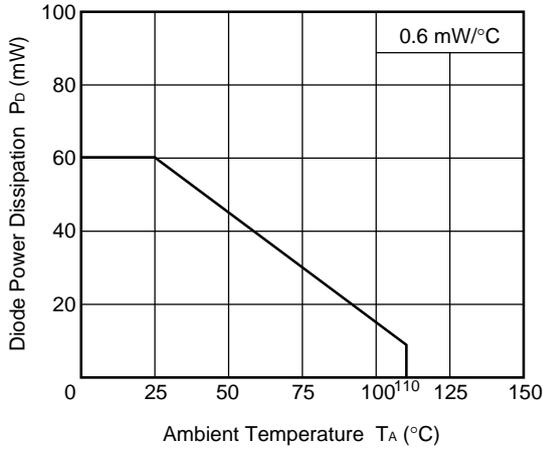
CTR rank	CTR (%)	Conditions
L	100 to 300	I <sub>F</sub> = 5 mA, V <sub>CE</sub> = 5 V
	20 and larger	I <sub>F</sub> = 1 mA, V <sub>CE</sub> = 5 V
M	50 to 150	I <sub>F</sub> = 5 mA, V <sub>CE</sub> = 5 V
	10 and larger	I <sub>F</sub> = 1 mA, V <sub>CE</sub> = 5 V
N	50 to 300	I <sub>F</sub> = 5 mA, V <sub>CE</sub> = 5 V
	10 and larger	I <sub>F</sub> = 1 mA, V <sub>CE</sub> = 5 V

\*2. Test Circuit for Switching Time

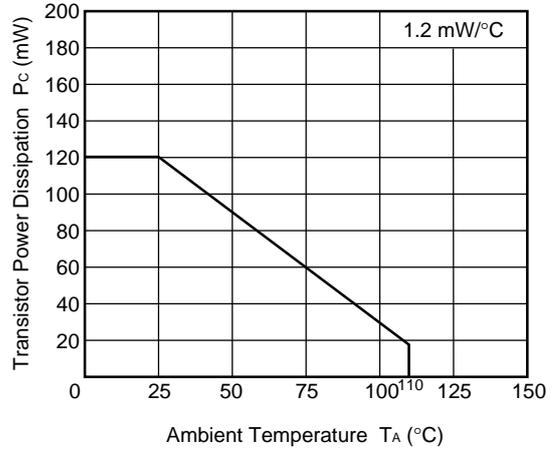


**TYPICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ , unless otherwise specified)**

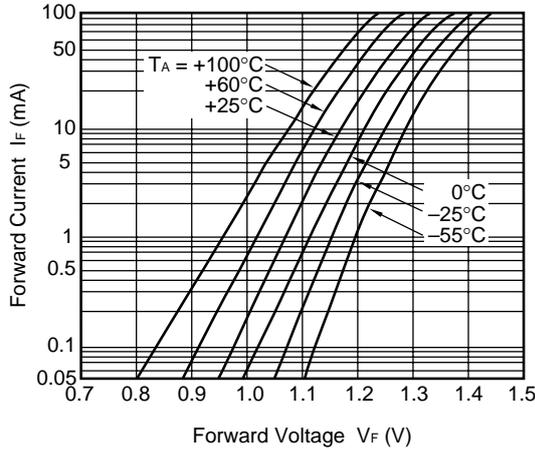
**DIODE POWER DISSIPATION vs. AMBIENT TEMPERATURE**



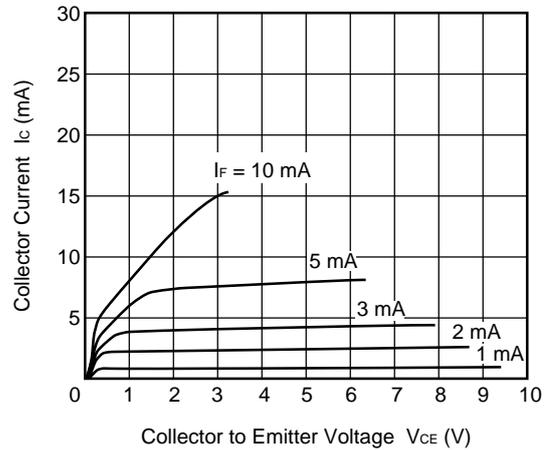
**TRANSISTOR POWER DISSIPATION vs. AMBIENT TEMPERATURE**



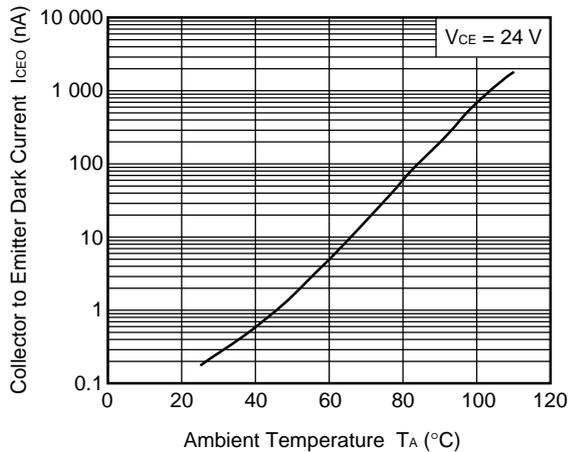
**FORWARD CURRENT vs. FORWARD VOLTAGE**



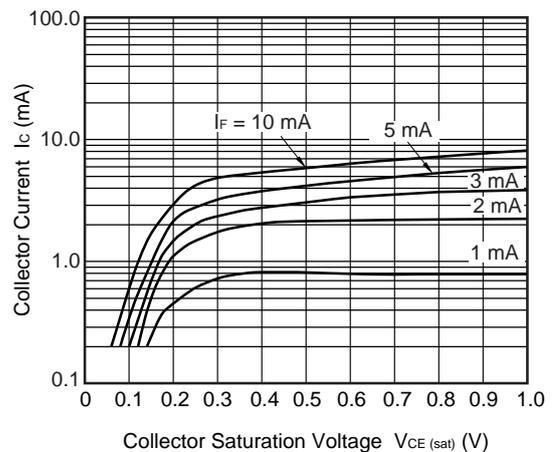
**COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE**



**COLLECTOR TO EMITTER DARK CURRENT vs. AMBIENT TEMPERATURE**

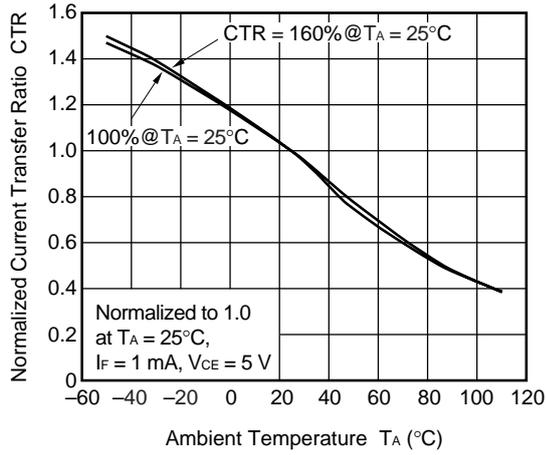


**COLLECTOR CURRENT vs. COLLECTOR SATURATION VOLTAGE**

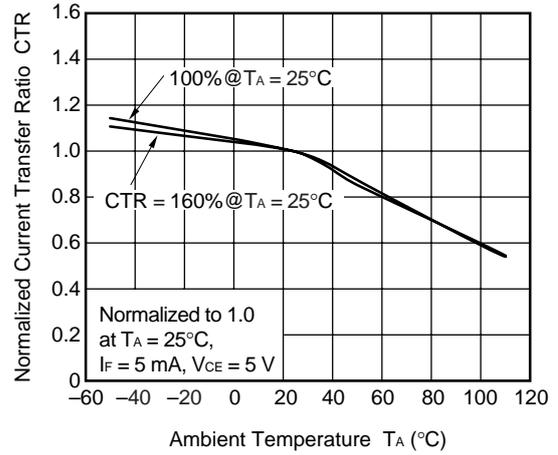


**Remark** The graphs indicate nominal characteristics.

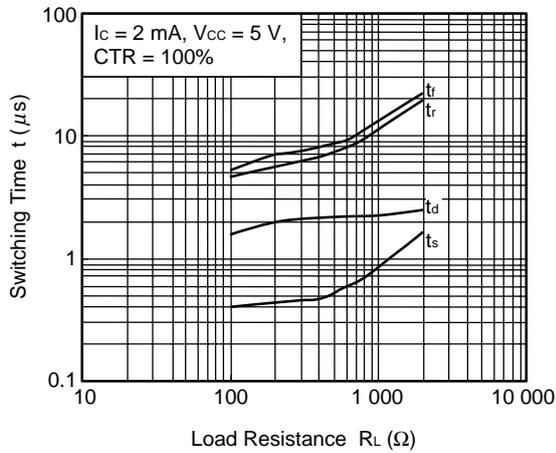
NORMALIZED CURRENT TRANSFER RATIO vs. AMBIENT TEMPERATURE



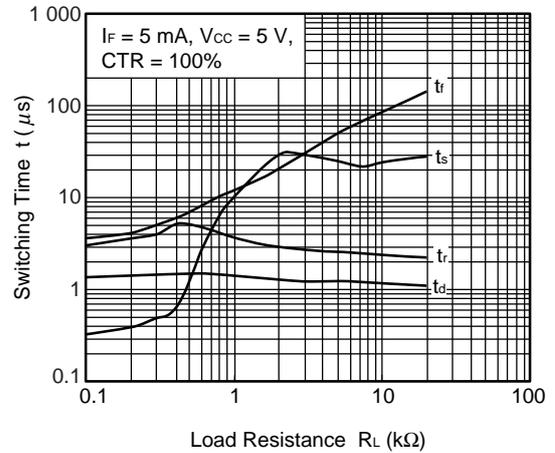
NORMALIZED CURRENT TRANSFER RATIO vs. AMBIENT TEMPERATURE



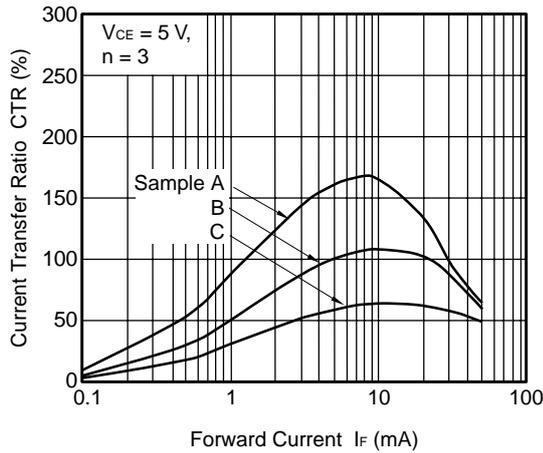
SWITCHING TIME vs. LOAD RESISTANCE



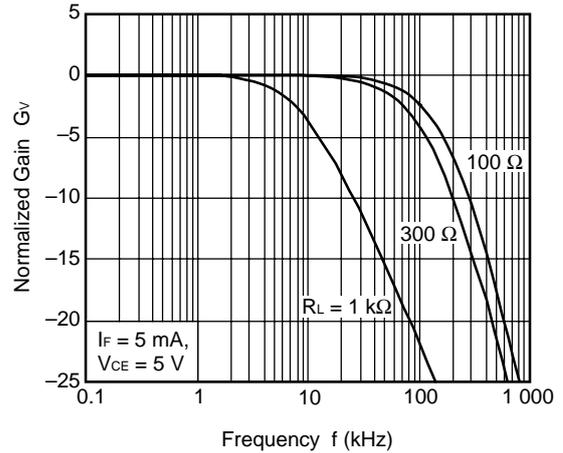
SWITCHING TIME vs. LOAD RESISTANCE



CURRENT TRANSFER RATIO vs. FORWARD CURRENT



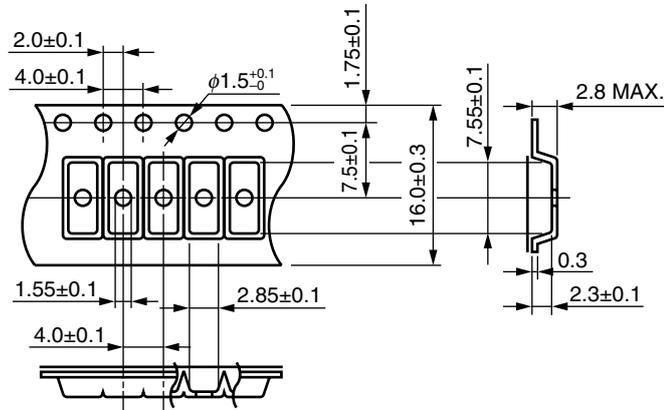
FREQUENCY RESPONSE



**Remark** The graphs indicate nominal characteristics.

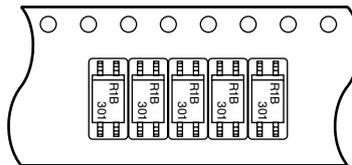
TAPING SPECIFICATIONS (UNIT: mm)

Outline and Dimensions (Tape)

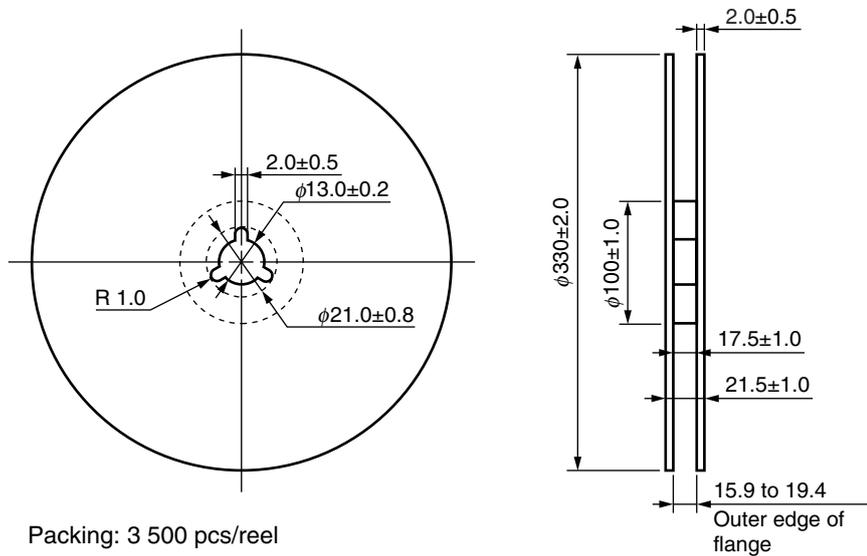


Tape Direction

PS2861B-1-F3

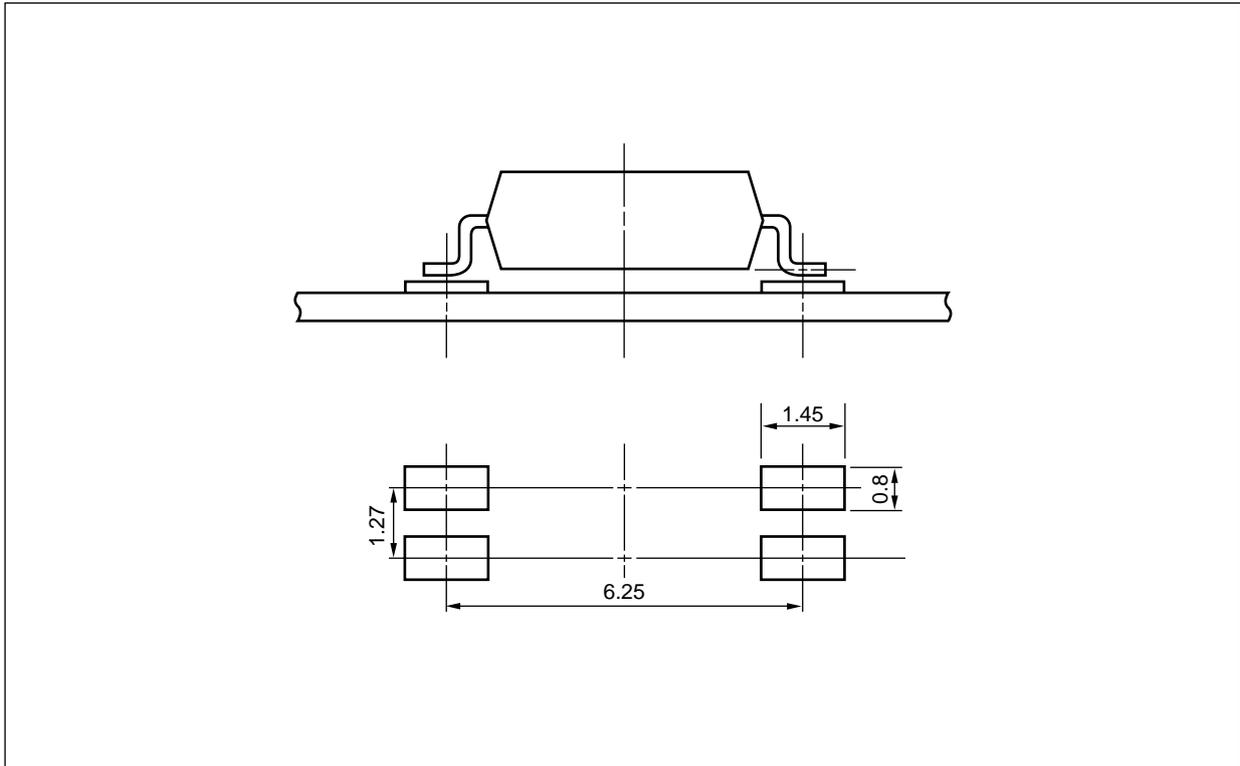


Outline and Dimensions (Reel)



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## RECOMMENDED MOUNT PAD DIMENSIONS (UNIT: mm)



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

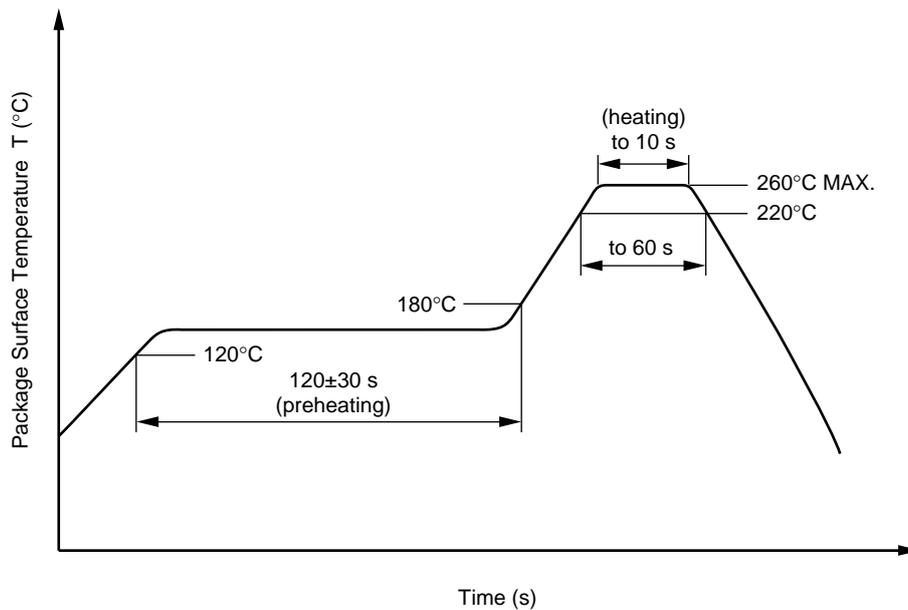
## NOTES ON HANDLING

### 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 pin) 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

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#### (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)		55/110/21	
Dielectric strength			
maximum operating isolation voltage	$U_{IORM}$	710	$V_{peak}$
Test voltage (partial discharge test, procedure a for type test and random test)	$U_{pr}$	1 136	$V_{peak}$
$U_{pr} = 1.6 \times U_{IORM}, P_d < 5 \text{ pC}$			
Test voltage (partial discharge test, procedure b for all devices)	$U_{pr}$	1 331	$V_{peak}$
$U_{pr} = 1.875 \times U_{IORM}, P_d < 5 \text{ pC}$			
Highest permissible overvoltage	$U_{TR}$	6 000	$V_{peak}$
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	$T_{stg}$	-55 to +150	°C
Operating temperature range	$T_A$	-55 to +110	°C
Isolation resistance, minimum value			
$V_{IO} = 500 \text{ V dc at } T_A = 25^\circ\text{C}$	Ris MIN.	$10^{12}$	$\Omega$
$V_{IO} = 500 \text{ V dc at } T_A \text{ MAX. at least } 100^\circ\text{C}$	Ris MIN.	$10^{11}$	$\Omega$
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.	$10^9$	$\Omega$

<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.<ol style="list-style-type: none"><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></ol></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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**Revision History****PS2861B-1 Data Sheet**

Rev.	Date	Description	
		Page	Summary
1.00	Jan 28, 2009	–	This data sheet was released as PN10742EJ01V0DS
3.00	Jan 23, 2013	Throughout	Renesas format is applied to this data sheet.
		p.1	The safety standards are revised.
		p.3	The explanation in MARKING EXAMPLE is revised.
		p.4	ORDERING INFORMATION is modified with the revision of the safety standards.
		p.5	Turn-on Time ( $t_{on}$ ) and Turn-off Time( $t_{off}$ ) are added to the table in ELECTRICAL CHARACTERISTICS.
		p.8	The image in Tape Direction is revise.
		p.10	The note about temperature condition of the recommended soldering conditions is deleted.
		p.12	The value of $U_{pr}$ is changed from the value, 1 065 and the factor, 1.5 of $U_{IORM}$ is changed from 1 136 and 1.6, respectively.

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