

# PS2801A-1, PS2801A-4

R08DS0097EJ0400

Rev.4.00

HIGH ISOLATION VOLTAGE SSOP PHOTOCOUPLER

Jan 29, 2013

## DESCRIPTION

The PS2801A-1 and PS2801A-4 are optically coupled isolators containing a GaAs light emitting diode and an NPN silicon phototransistor in a plastic SSOP for high density applications to realize an excellent cost performance.

This package has shield effect to cut off ambient light.

## FEATURES

- High isolation voltage ( $BV = 2\,500\text{ V r.m.s.}$ )
- Small and thin package (4, 16-pin SSOP, Pin pitch 1.27 mm)
- <R> • Ordering number of tape product: PS2801A-1-F3, PS2801A-4-F3
- Pb-Free product
- <R> • Safety standards
  - UL approved: No. E72422
  - CSA approved: No. CA 101391(CA5A, CAN/CSA-C22.2 60065, 60950)
  - DIN EN 60747-5-5 (VDE 0884-5) approved (Option)

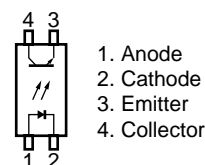
## APPLICATIONS

- Programmable logic controllers
- Measuring instruments
- Power supply
- Hybrid IC

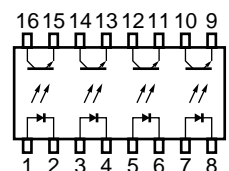
### PIN CONNECTION

(Top View)

#### PS2801A-1



#### PS2801A-4

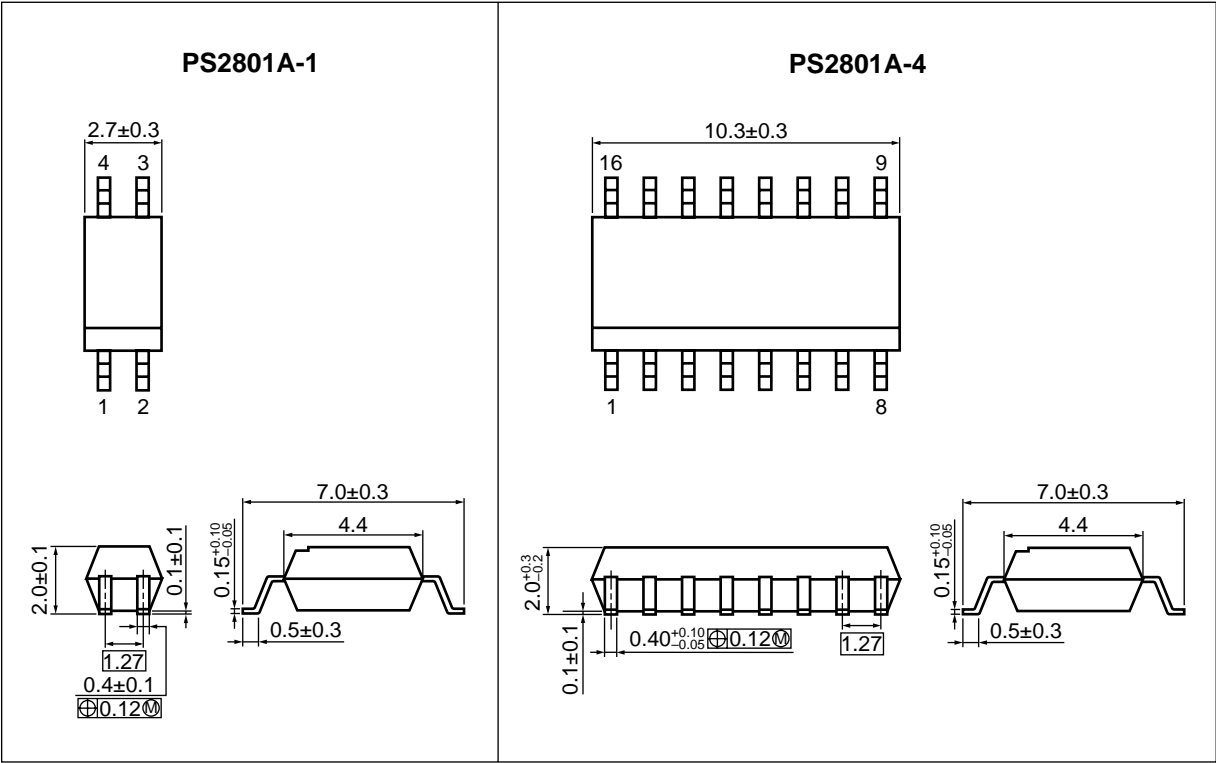


- 1. 3. 5. 7. Anode
- 2. 4. 6. 8. Cathode
- 9. 11. 13. 15. Emitter
- 10. 12. 14. 16. Collector

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)

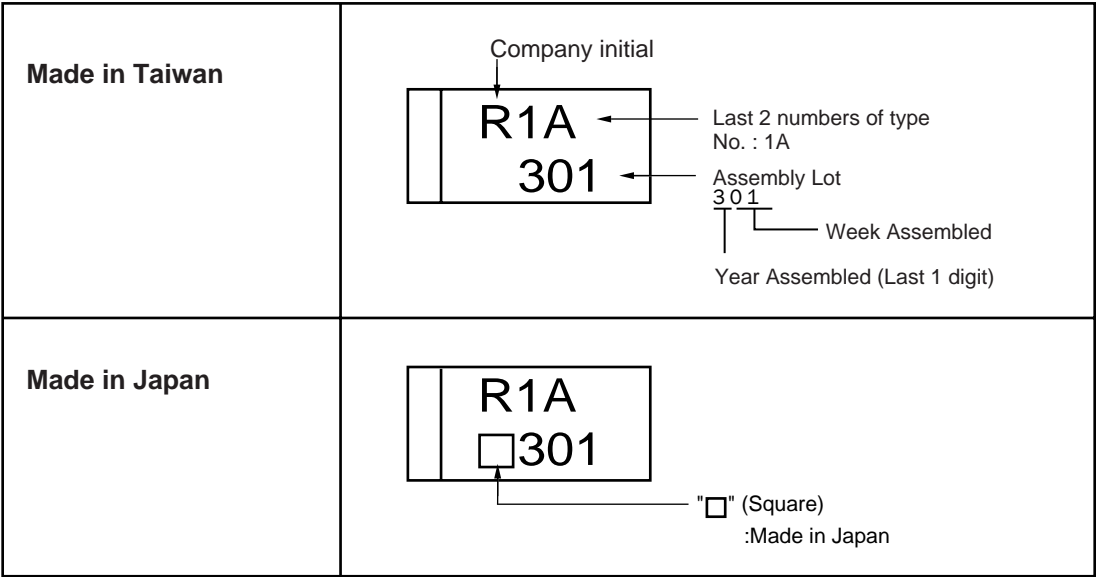


<R> PHOTOCOUPLER CONSTRUCTION

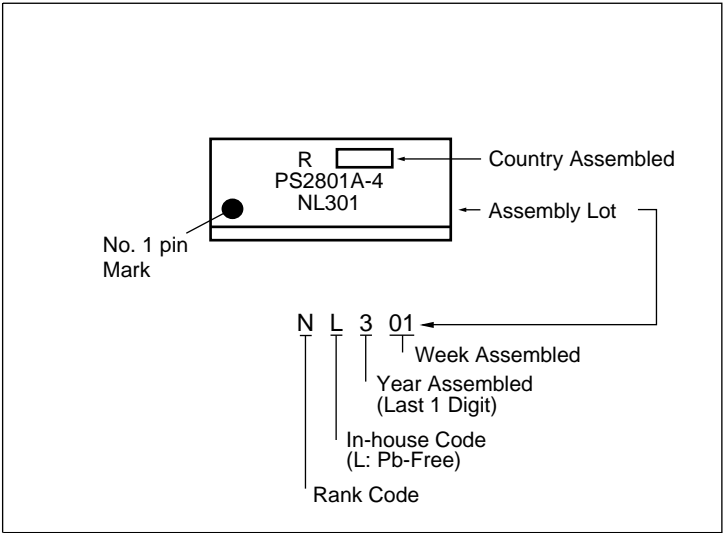
Parameter	Unit (MIN.)
Air Distance	4.5 mm
Outer Creepage Distance	4.5 mm
Inner Creepage Distance	2.5 mm
Isolation Thickness	0.1 mm

<R> MARKING EXAMPLE

PS2801A-1



PS2801A-4



## &lt;R&gt; ORDERING INFORMATION

Part Number	Order Number	Solder Plating Specification	Packing Style	Safety Standard Approval	Application Part Number <sup>*1</sup>
PS2801A-1-F3	PS2801A-1-F3-A	Pb-Free	Embossed Tape 3 500 pcs/reel	Standard products (UL, CSA approved)	PS2801A-1
PS2801A-4-F3	PS2801A-4-F3-A		Embossed Tape 2 500 pcs/reel		PS2801A-4
PS2801A-1-V-F3	PS2801A-1-V-F3-A		Embossed Tape 3 500 pcs/reel	DIN EN 60747-5-5 (VDE 0884-5) Approved (Option)	PS2801A-1
PS2801A-4-V-F3	PS2801A-4-V-F3-A		Embossed Tape 2 500 pcs/reel		PS2801A-4

Note: <sup>\*1</sup>. 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
			PS2801A-1	PS2801A-4	
Diode	Forward Current (DC)	I <sub>F</sub>	30		mA/ch
	Reverse Voltage	V <sub>R</sub>	6		V
	Power Dissipation Derating	ΔP <sub>D</sub> /°C	0.6	0.8	mW/°C
	Power Dissipation	P <sub>D</sub>	60	80	mW/ch
	Peak Forward Current <sup>*1</sup>	I <sub>FP</sub>	0.5		A/ch
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>	30		mA/ch
	Power Dissipation Derating	ΔP <sub>D</sub> /°C	1.2		mW/°C
	Power Dissipation	P <sub>C</sub>	120		mW/ch
Isolation Voltage <sup>*2</sup>		BV	2 500		Vr.m.s.
Operating Ambient Temperature		T <sub>A</sub>	-55 to +100		°C
Storage Temperature		T <sub>stg</sub>	-55 to +150		°C

Notes: <sup>\*1</sup>. PW = 100 μs, Duty Cycle = 1%

<sup>\*2</sup>. 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 (PS2801A-1).

Pins 1-8 shorted together, 9-16 shorted together (PS2801A-4).

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		1.2	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 = 1.0 MHz		10		pF
Transistor	Collector to Emitter Dark Current	I <sub>CEO</sub>	V <sub>CE</sub> = 70 V, I <sub>F</sub> = 0 mA			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		400	%
	Collector Saturation Voltage	V <sub>CE(sat)</sub>	I <sub>F</sub> = 10 mA, I <sub>C</sub> = 2 mA		0.13	0.3	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 <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		5		μs
	Fall Time <sup>*2</sup>	t <sub>f</sub>			7		
	Turn-on Time <sup>*2</sup>	t <sub>on</sub>			10		
	Turn-off Time <sup>*2</sup>	t <sub>off</sub>			7		

Notes: <sup>\*1</sup> 1. CTR rank

PS2801A-1

N : 50 to 400 (%)

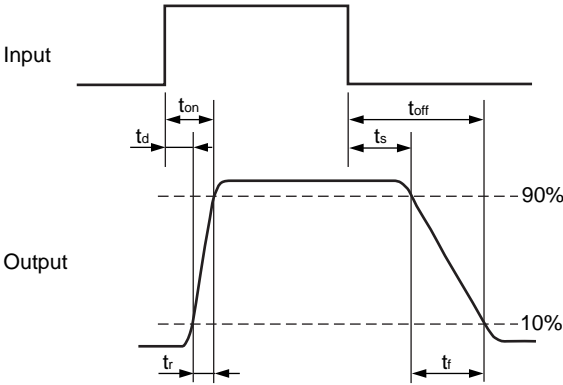
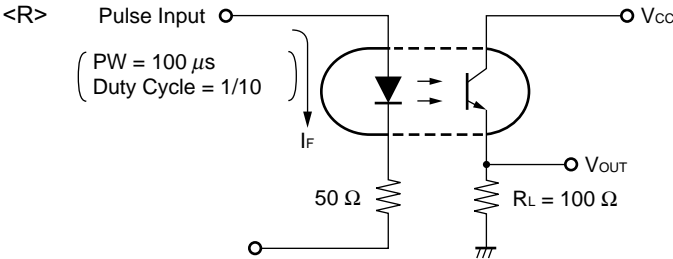
P : 150 to 300 (%)

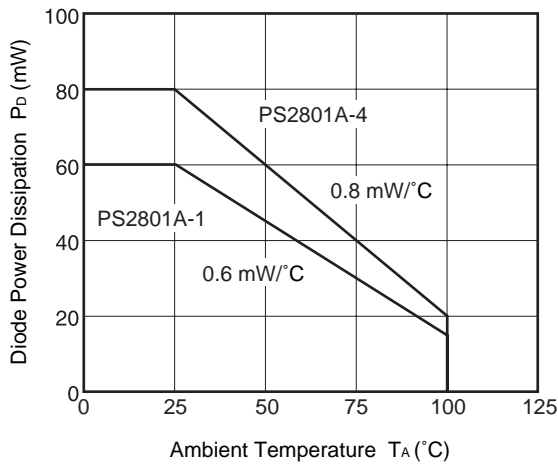
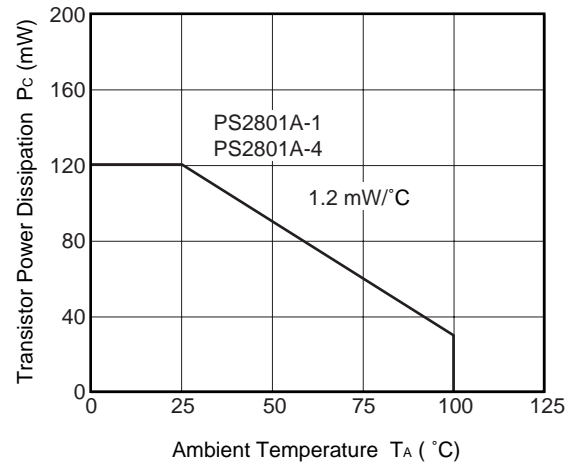
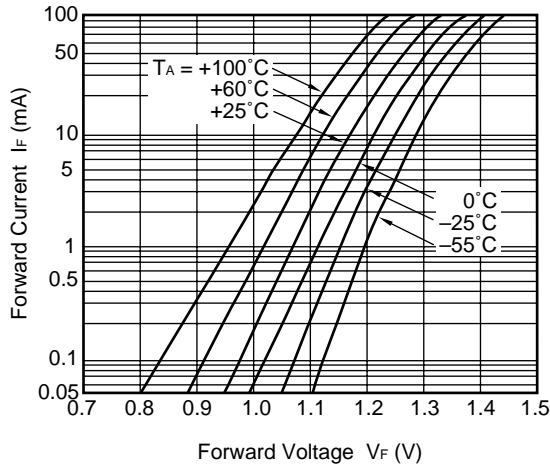
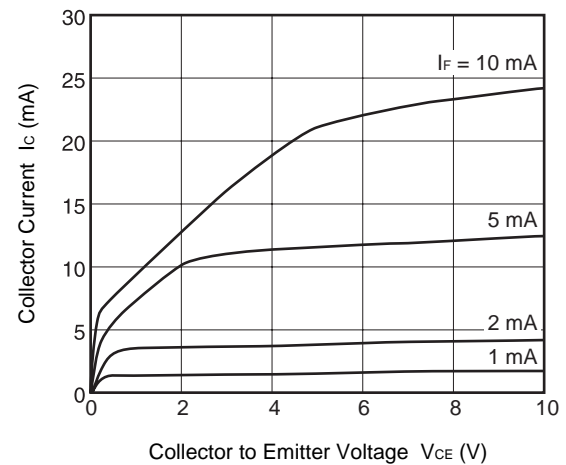
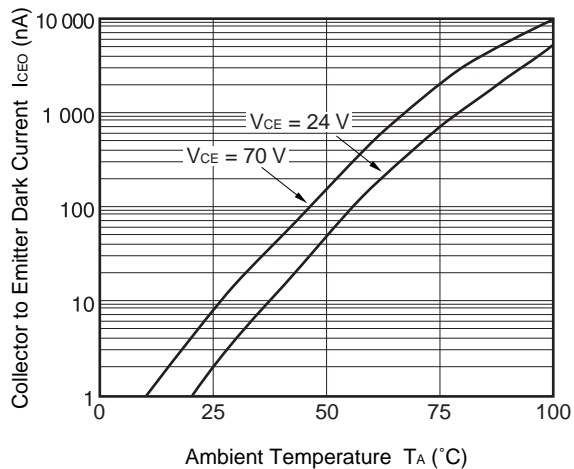
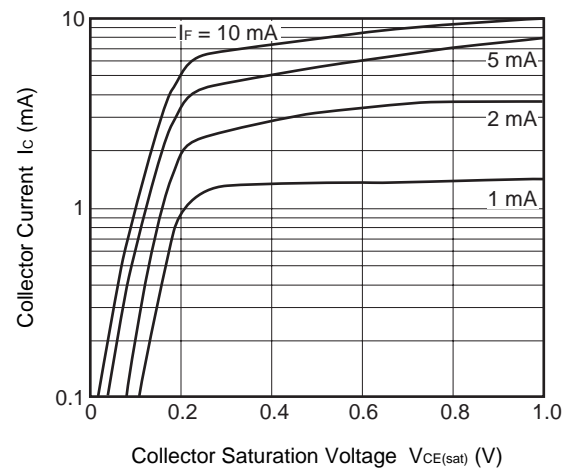
L : 100 to 300 (%)

PS2801A-4

N : 50 to 400 (%)

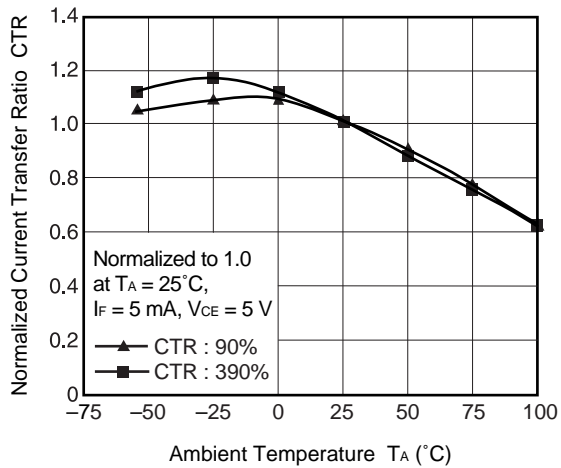
<sup>\*2</sup> 2. Test circuit for switching time



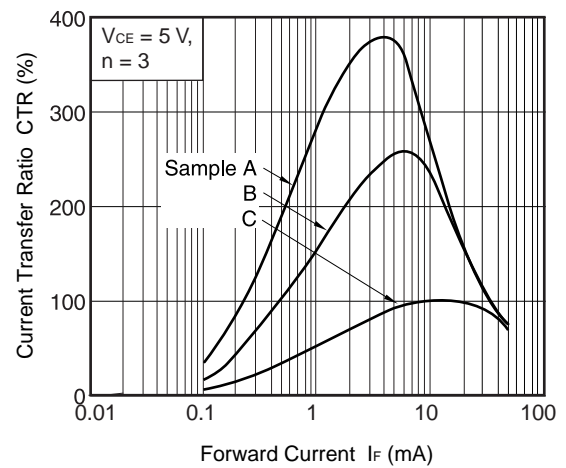
<R> **TYPICAL CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$ , unless otherwise specified)**DIODE POWER DISSIPATION vs. AMBIENT TEMPERATURE****TRANSISTOR POWER DISSIPATION vs. AMBIENT TEMPERATURE****FORWARD CURRENT vs. FORWARD VOLTAGE****COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE****COLLECTOR TO EMITTER DARK CURRENT vs. AMBIENT TEMPERATURE****COLLECTOR CURRENT vs. COLLECTOR SATURATION VOLTAGE**

**Remark** The graphs indicate nominal characteristics.

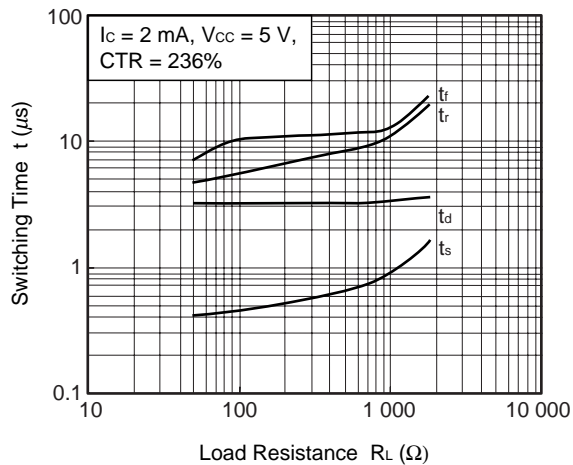
NORMALIZED CURRENT TRANSFER RATIO vs. AMBIENT TEMPERATURE



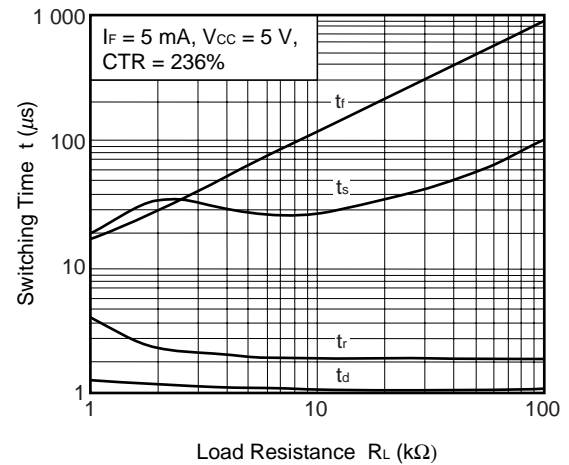
CURRENT TRANSFER RATIO vs. FORWARD CURRENT



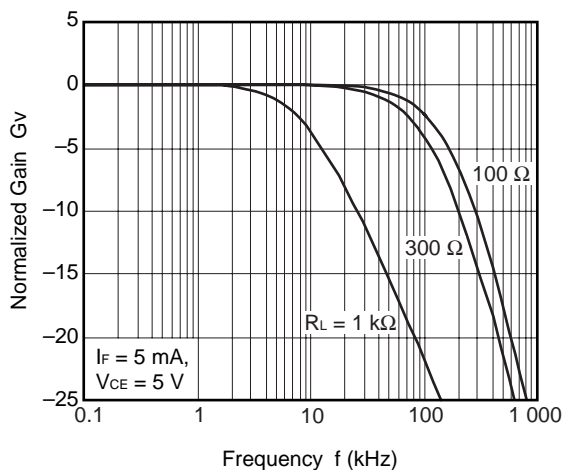
SWITCHING TIME vs. LOAD RESISTANCE



SWITCHING TIME vs. LOAD RESISTANCE



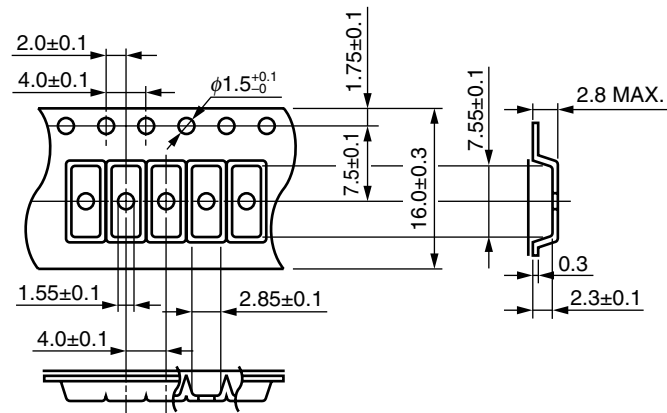
FREQUENCY RESPONSE



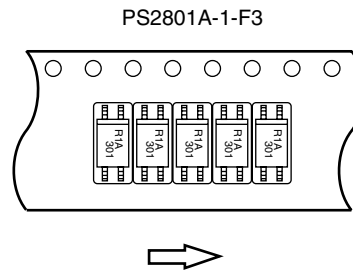
**Remark** The graphs indicate nominal characteristics.

## &lt;R&gt; TAPING SPECIFICATIONS (UNIT: mm)

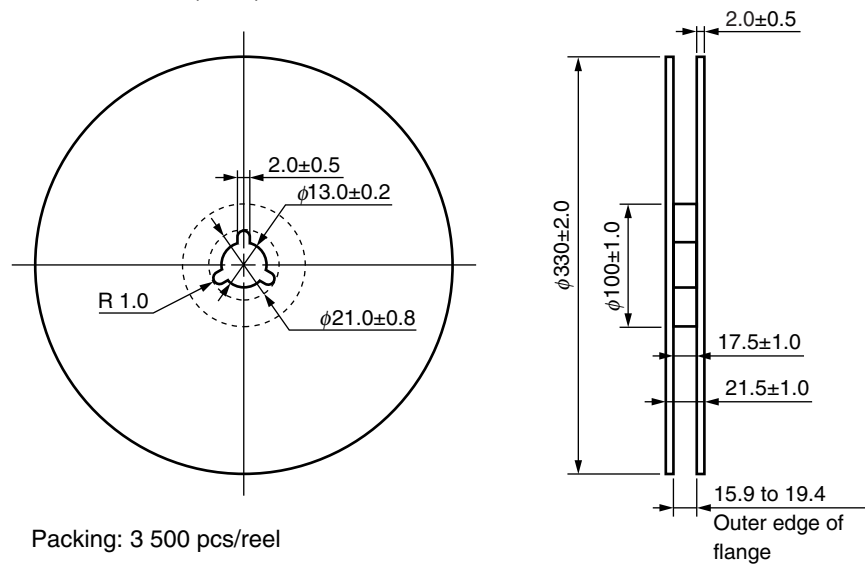
## Outline and Dimensions (Tape)



## Tape Direction



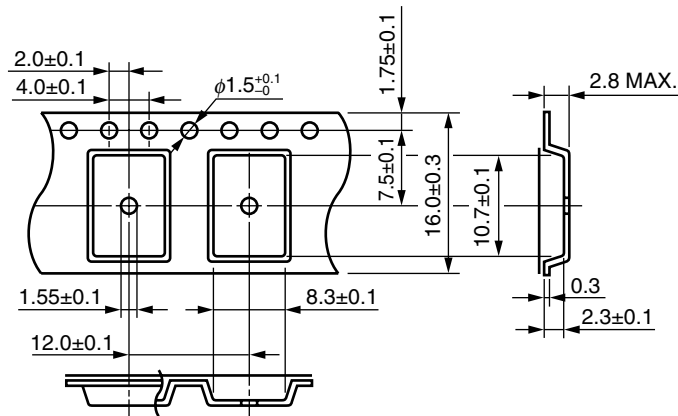
## Outline and Dimensions (Reel)



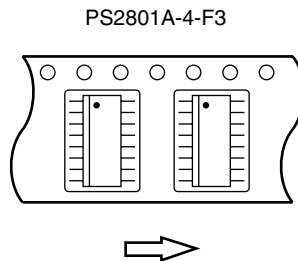
Packing: 3 500 pcs/reel



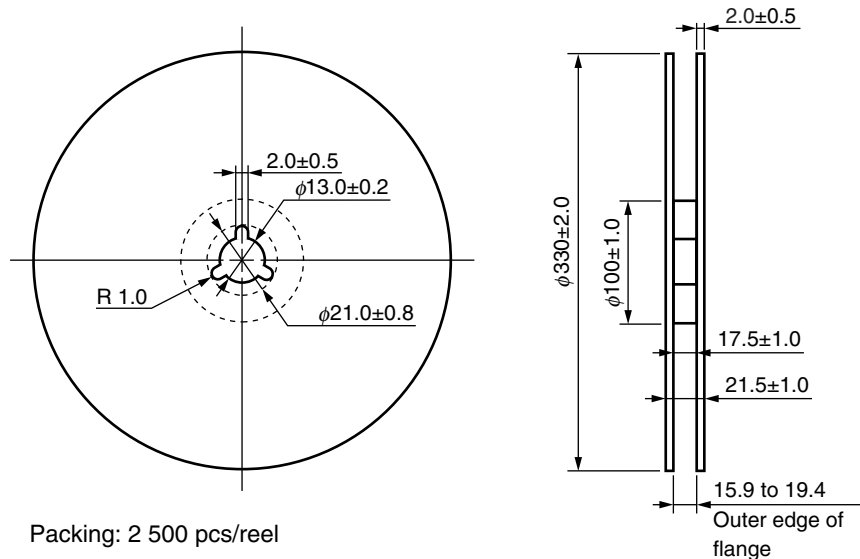
Outline and Dimensions (Tape)



Tape Direction

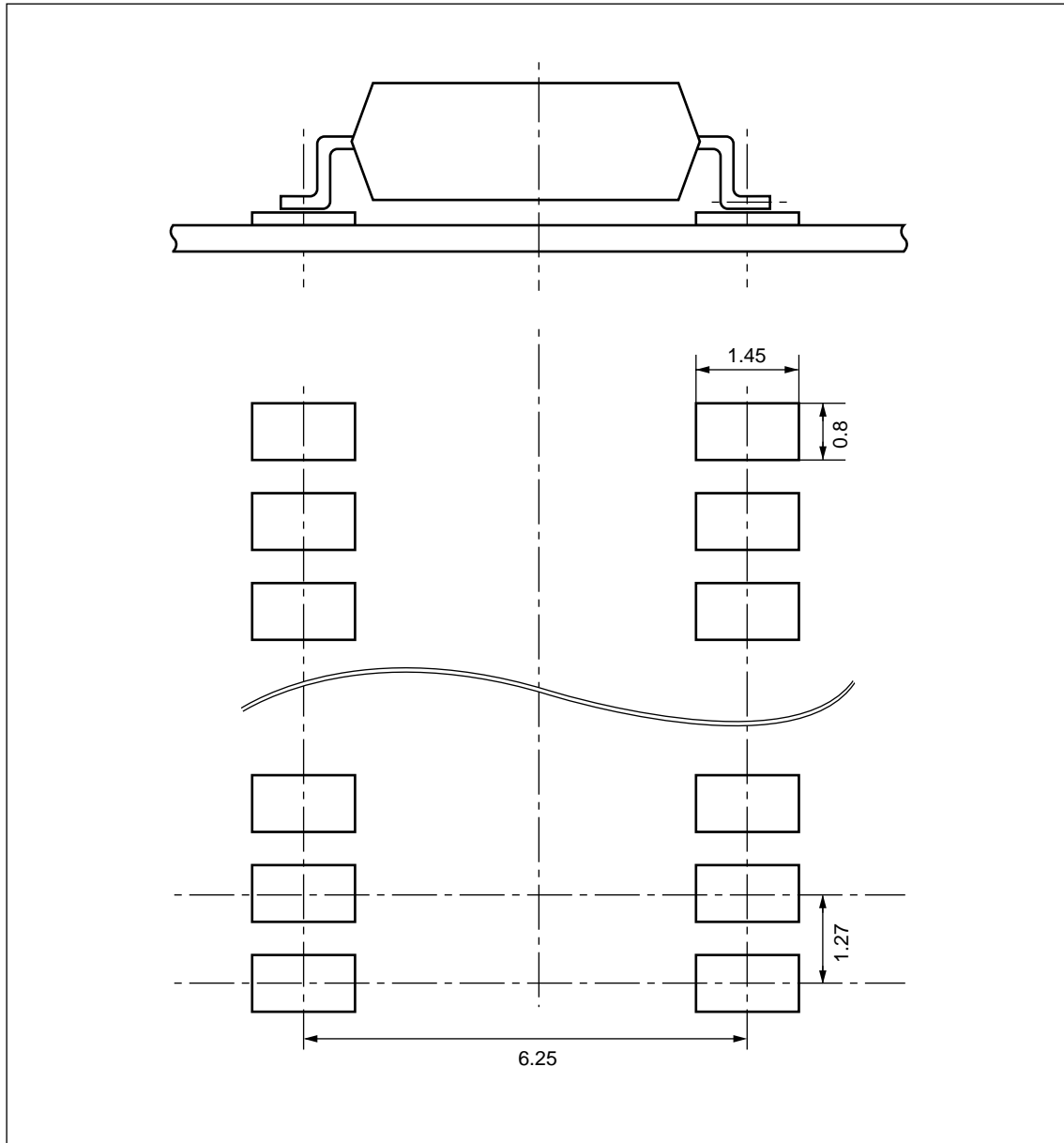


Outline and Dimensions (Reel)



Packing: 2 500 pcs/reel

## &lt;R&gt; RECOMMENDED MOUNT PAD DIMENSIONS (UNIT: mm)



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

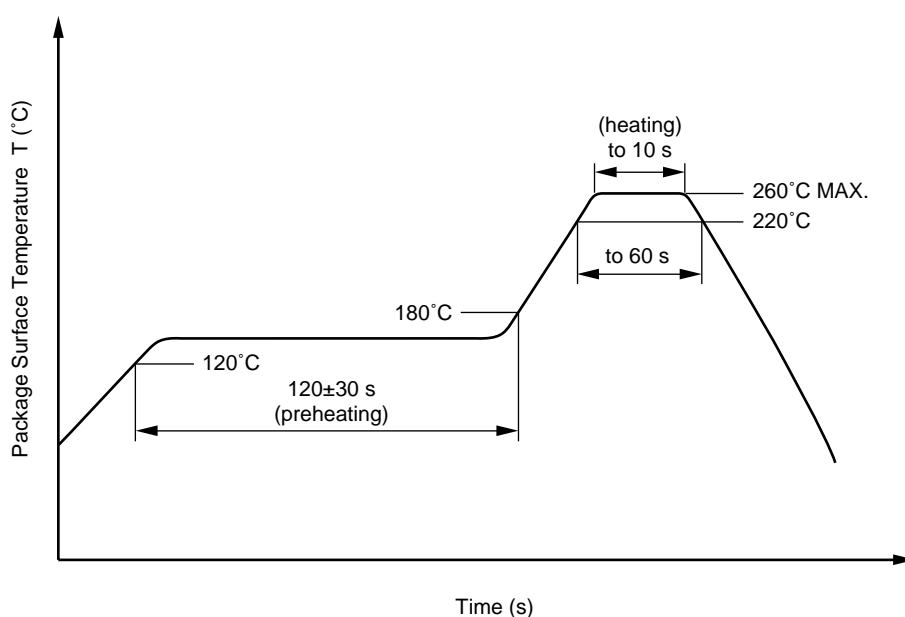
## NOTES ON HANDLING

### 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.) |

<R> (a) Soldering of leads should be made at the point 1.5 to 2.0 mm from the root of the lead

#### (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. This tendency may sometimes be obvious, especially below  $I_F = 1 \text{ mA}$ .

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.

## &lt;R&gt; SPECIFICATION OF VDE MARKS LICENSE DOCUMENT

Parameter	Symbol	Spec.	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) $U_{pr} = 1.6 \times U_{IORM}, P_d < 5 \text{ pC}$	$U_{IORM}$ $U_{pr}$	705 1 128	$V_{peak}$ $V_{peak}$
Test voltage (partial discharge test, procedure b for all devices) $U_{pr} = 1.875 \times U_{IORM}, P_d < 5 \text{ pC}$	$U_{pr}$	1 322	$V_{peak}$
Highest permissible overvoltage	$U_{TR}$	6 000	$V_{peak}$
Degree of pollution (DIN EN 60664-1 VDE 0110 Part 1)		2	
Comparative tracking index (IEC 60112/DIN EN 60112 (VDE 0303 Part 11))	CTI	175	
Material group (DIN EN 60664-1 VDE 0110 Part 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 $V_{IO} = 500 \text{ V dc at } T_A = 25^\circ\text{C}$ $V_{IO} = 500 \text{ V dc at } T_A \text{ MAX. at least } 100^\circ\text{C}$	Ris MIN. Ris 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 $I_F$ , $P_{si} = 0$ ) Power (output or total power dissipation) Isolation resistance $V_{IO} = 500 \text{ V dc at } T_A = T_{si}$	$T_{si}$ $I_{si}$ $P_{si}$  Ris MIN.	150 300 500  $10^9$	°C mA mW  $\Omega$

<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.</li></ul> <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> <ul style="list-style-type: none"><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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<b>Revision History</b>	<b>PS2801A-1, PS2801A-4 Data Sheet</b>
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Rev.	Date	Description	
		Page	Summary
1.00	Mar 20, 2004	–	This data sheet was released as PN10398EJ01V0DS
4.00	Jan 29, 2013	Throughout	Renesas format is applied to this data sheet.
		p.1	The ordering number and safety standards are revised.
		p.2	PHOTOCOUPLER CONSTRUCTION is added.
		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.5	The timing chart is added in the note *2.
		p.6	The graph of LONG TERM CTR DEGRADATION is deleted from those in TYPICAL CHARACTERISTICS.
		p.8	PS2801A-1-F4 is deleted from Tape Direction image in TAPING SPECIFICATIONS.
		p.9	PS2801A-4-F4 is deleted from Tape Direction image in TAPING SPECIFICATIONS.
		p.10	RECOMMENDED MOUNT PAD DIMENSIONS is added.
		p.11	The note about temperature condition of the recommended soldering conditions is deleted.
		p.13	SPECIFICATION OF VDE MARKS LICENSE DOCUMENT same as PS2805C is added.

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