

## HIGH ISOLATION VOLTAGE SSOP PHOTOCOUPLER

—NEPOC Series—

### DESCRIPTION

The PS2801C-1 and PS2801C-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

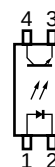
- High isolation voltage ( $BV = 2\,500\text{ Vr.m.s.}$ )
- Small and thin package (4, 16-pin SSOP, Pin pitch 1.27 mm)
- $V_{CEO} : 80\text{ V}$
- Ordering number of tape product: PS2801C-1-F3, F4, PS2801C-4-F3, F4
- Pb-Free product
- Safety standards
  - UL approved: File No. E72422
  - DIN EN60747-5-2 (VDE0884 Part2) approved (Option)

### APPLICATIONS

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

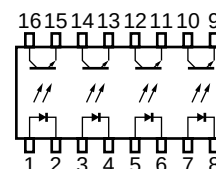
#### PIN CONNECTION (Top View)

##### PS2801C-1



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

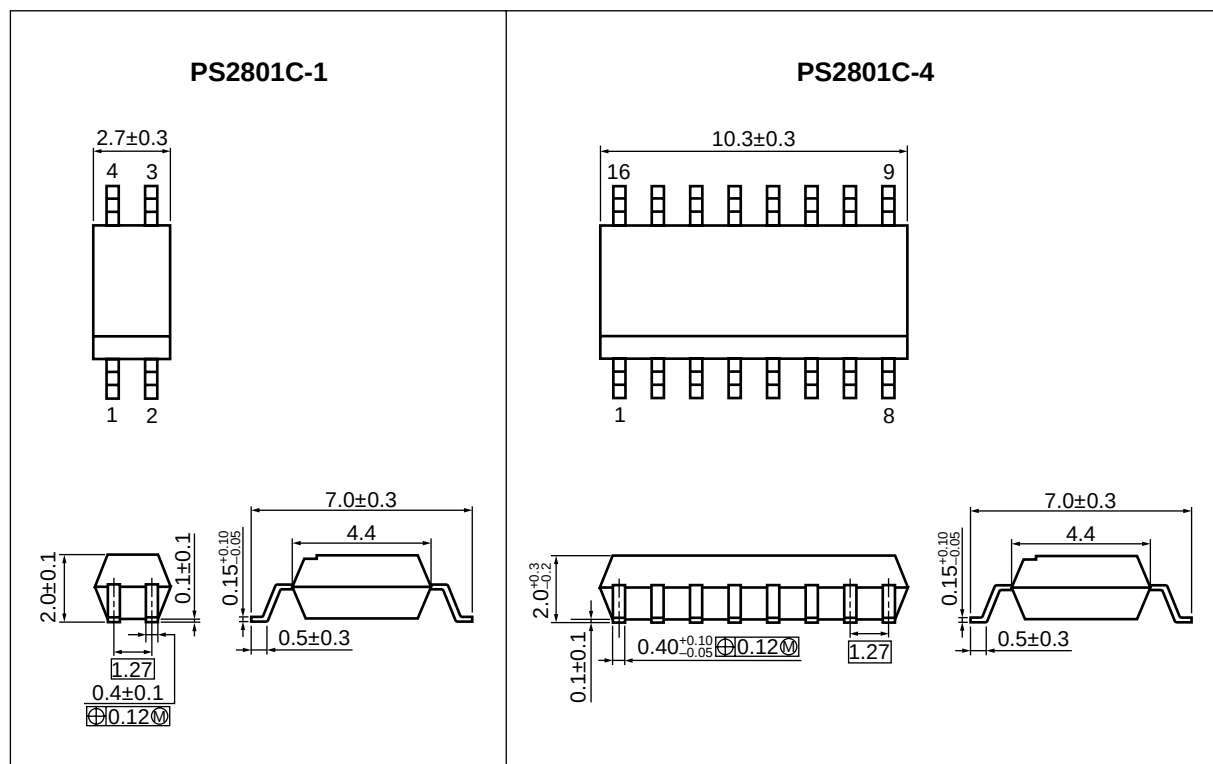
##### PS2801C-4



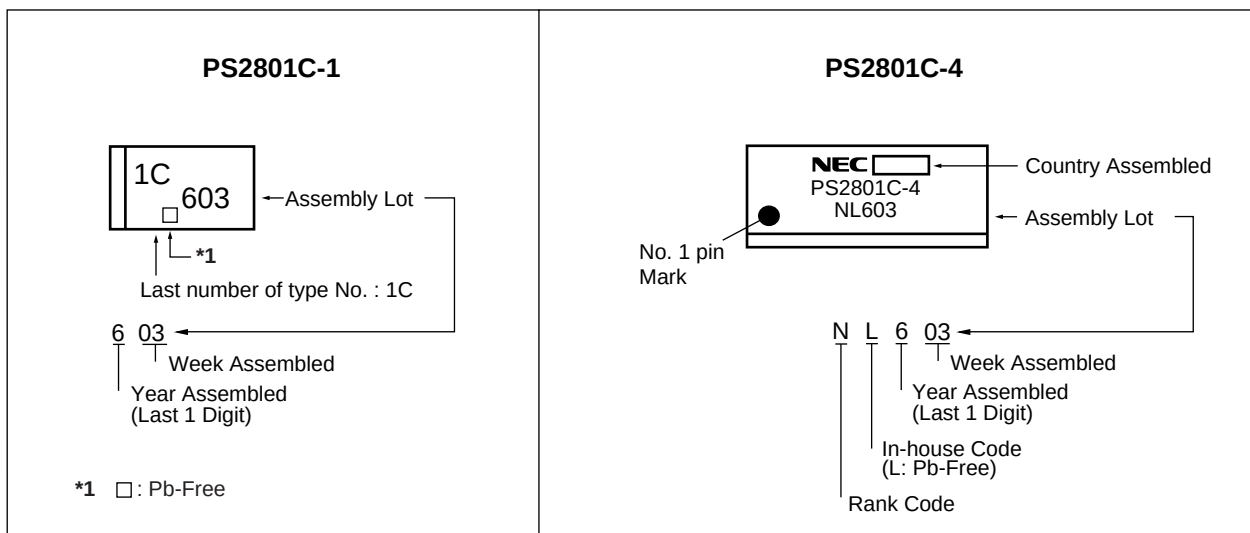
1. 3. 5. 7. Anode
2. 4. 6. 8. Cathode
9. 11. 13. 15. Emitter
10. 12. 14. 16. Collector

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)**



**MARKING EXAMPLE**



**ORDERING INFORMATION**

| Part Number    | Order Number     | Solder Plating Specification | Packing Style                | Safety Standard Approval                                | Application Part Number <sup>*1</sup> |
|----------------|------------------|------------------------------|------------------------------|---------------------------------------------------------|---------------------------------------|
| PS2801C-1      | PS2801C-1-A      | Pb-Free                      | 50 pcs (Tape 50 pcs cut)     | Standard products<br>(UL approved)                      | PS2801C-1                             |
| PS2801C-1-F3   | PS2801C-1-F3-A   |                              | Embossed Tape 3 500 pcs/reel |                                                         | PS2801C-4                             |
| PS2801C-1-F4   | PS2801C-1-F4-A   |                              |                              |                                                         |                                       |
| PS2801C-4      | PS2801C-4-A      |                              | Magazine Case 45 pcs         |                                                         |                                       |
| PS2801C-4-F3   | PS2801C-4-F3-A   |                              | Embossed Tape 2 500 pcs/reel | DIN EN60747-5-2<br>(VDE0884 Part2)<br>Approved (Option) | PS2801C-1                             |
| PS2801C-4-F4   | PS2801C-4-F4-A   |                              |                              |                                                         |                                       |
| PS2801C-1-V    | PS2801C-1-V-A    |                              | 50 pcs (Tape 50 pcs cut)     |                                                         |                                       |
| PS2801C-1-V-F3 | PS2801C-1-V-F3-A |                              | Embossed Tape 3 500 pcs/reel |                                                         |                                       |
| PS2801C-1-V-F4 | PS2801C-1-V-F4-A |                              |                              |                                                         | PS2801C-4                             |
| PS2801C-4-V    | PS2801C-4-V-A    |                              | Magazine Case 45 pcs         |                                                         |                                       |
| PS2801C-4-V-F3 | PS2801C-4-V-F3-A |                              | Embossed Tape 2 500 pcs/reel |                                                         |                                       |
| PS2801C-4-V-F4 | PS2801C-4-V-F4-A |                              |                              |                                                         |                                       |

**\*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                   |
|---------------------------------|------------------------------------|-------------------------------|-------------|-----------|------------------------|
|                                 |                                    |                               | PS2801C-1   | PS2801C-4 |                        |
| Diode                           | Forward Current (DC)               | $I_F$                         | 30          |           | mA/ch                  |
|                                 | Reverse Voltage                    | $V_R$                         | 6           |           | V                      |
|                                 | Power Dissipation Derating         | $\Delta P_D/^{\circ}\text{C}$ | 0.6         | 0.8       | mW/ $^{\circ}\text{C}$ |
|                                 | Power Dissipation                  | $P_D$                         | 60          | 80        | mW/ch                  |
|                                 | Peak Forward Current <sup>*1</sup> | $I_{FP}$                      | 0.5         |           | A/ch                   |
| Transistor                      | Collector to Emitter Voltage       | $V_{CEO}$                     | 80          |           | V                      |
|                                 | Emitter to Collector Voltage       | $V_{ECO}$                     | 5           |           | V                      |
|                                 | Collector Current                  | $I_C$                         | 30          |           | mA/ch                  |
|                                 | Power Dissipation Derating         | $\Delta P_C/^{\circ}\text{C}$ | 1.2         |           | mW/ $^{\circ}\text{C}$ |
|                                 | Power Dissipation                  | $P_C$                         | 120         |           | mW/ch                  |
| Isolation Voltage <sup>*2</sup> |                                    | BV                            | 2 500       |           | Vr.m.s.                |
| Operating Ambient Temperature   |                                    | $T_A$                         | -55 to +100 |           | $^{\circ}\text{C}$     |
| Storage Temperature             |                                    | $T_{stg}$                     | -55 to +150 |           | $^{\circ}\text{C}$     |

**\*1** PW = 100  $\mu\text{s}$ , 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 (PS2801C-1).

Pins 1-8 shorted together, 9-16 shorted together (PS2801C-4).

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

| Parameter  |                                        | Symbol        | Conditions                                                  | MIN.      | TYP. | MAX. | Unit          |
|------------|----------------------------------------|---------------|-------------------------------------------------------------|-----------|------|------|---------------|
| Diode      | Forward Voltage                        | $V_F$         | $I_F = 5\text{ mA}$                                         |           | 1.2  | 1.4  | V             |
|            | Reverse Current                        | $I_R$         | $V_R = 5\text{ V}$                                          |           |      | 5    | $\mu\text{A}$ |
|            | Terminal Capacitance                   | $C_t$         | $V = 0\text{ V}, f = 1.0\text{ MHz}$                        |           | 10   |      | pF            |
| Transistor | Collector to Emitter Dark Current      | $I_{CEO}$     | $V_{CE} = 80\text{ V}, I_F = 0\text{ mA}$                   |           |      | 100  | nA            |
| Coupled    | Current Transfer Ratio ( $I_C/I_F$ )*1 | CTR           | $I_F = 5\text{ mA}, V_{CE} = 5\text{ V}$                    | 50        |      | 400  | %             |
|            | Collector Saturation Voltage           | $V_{CE(sat)}$ | $I_F = 10\text{ mA}, I_C = 2\text{ mA}$                     |           | 0.13 | 0.3  | V             |
|            | Isolation Resistance                   | $R_{I-O}$     | $V_{I-O} = 1.0\text{ kV}_{DC}$                              | $10^{11}$ |      |      | $\Omega$      |
|            | Isolation Capacitance                  | $C_{I-O}$     | $V = 0\text{ V}, f = 1.0\text{ MHz}$                        |           | 0.4  |      | pF            |
|            | Rise Time*2                            | $t_r$         | $V_{CC} = 5\text{ V}, I_C = 2\text{ mA}, R_L = 100\ \Omega$ |           | 5    |      | $\mu\text{s}$ |
|            | Fall Time*2                            | $t_f$         |                                                             |           | 7    |      |               |

**\*1 CTR rank**

PS2801C-1

N : 50 to 400 (%)

P : 150 to 300 (%)

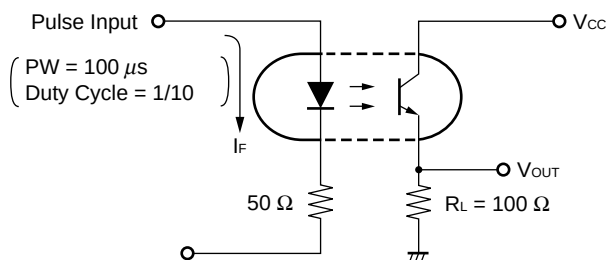
L : 100 to 300 (%)

M : 100 to 400 (%)

PS2801C-4

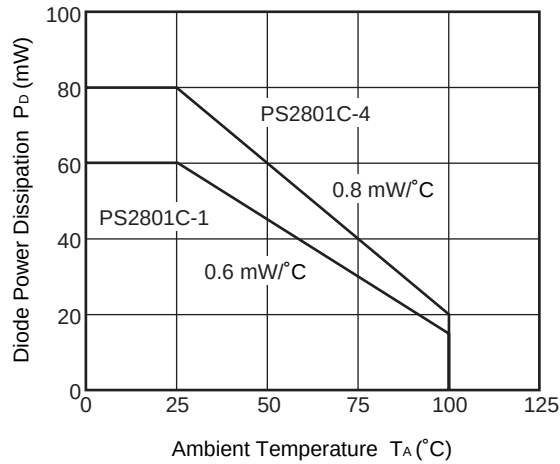
N : 50 to 400 (%)

M : 100 to 400 (%)

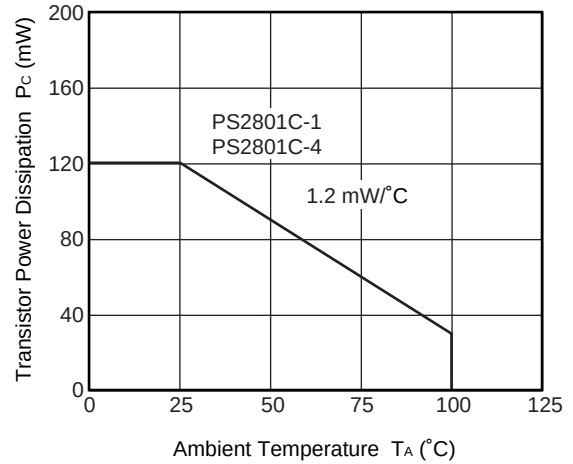
**\*2 Test circuit for switching time**


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

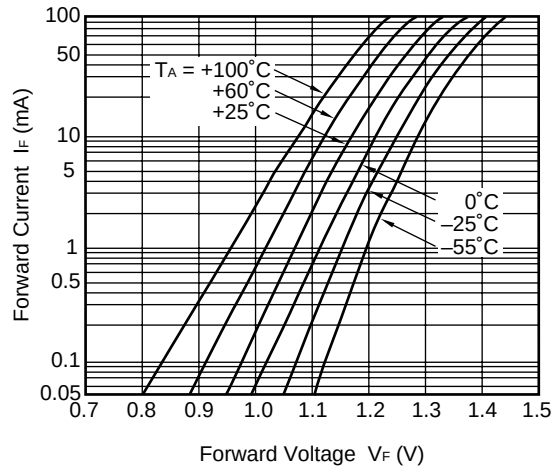
**DIODE POWER DISSIPATION vs. AMBIENT TEMPERATURE**



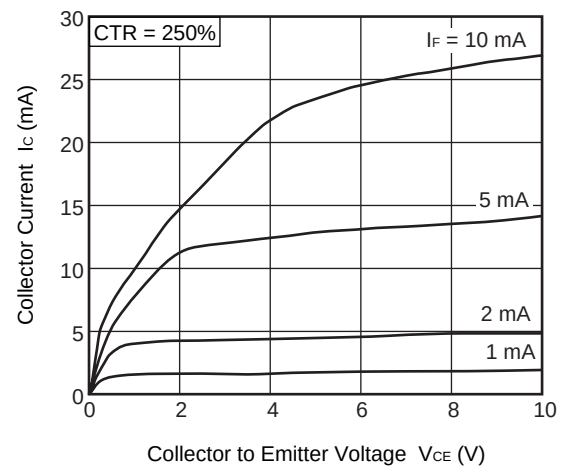
**TRANSISTOR POWER DISSIPATION vs. AMBIENT TEMPERATURE**



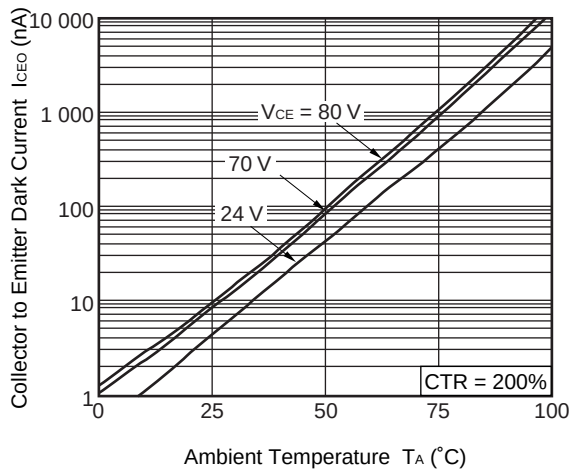
**FORWARD CURRENT vs. FORWARD VOLTAGE**



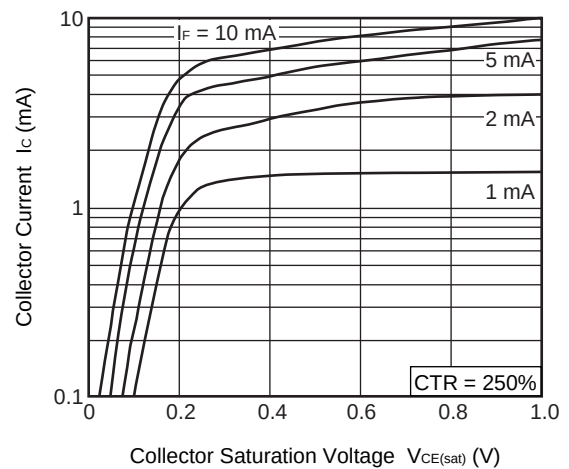
**COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE**



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

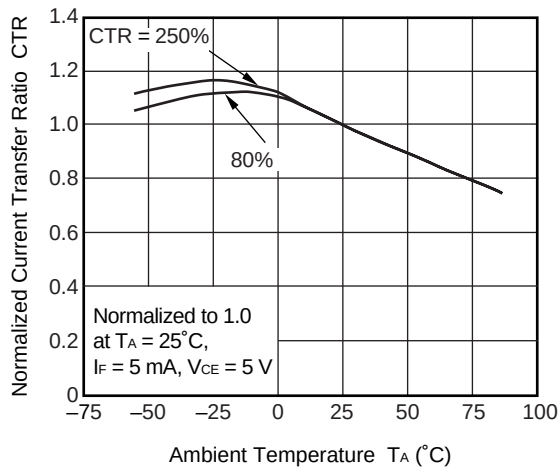


**COLLECTOR CURRENT vs. COLLECTOR SATURATION VOLTAGE**

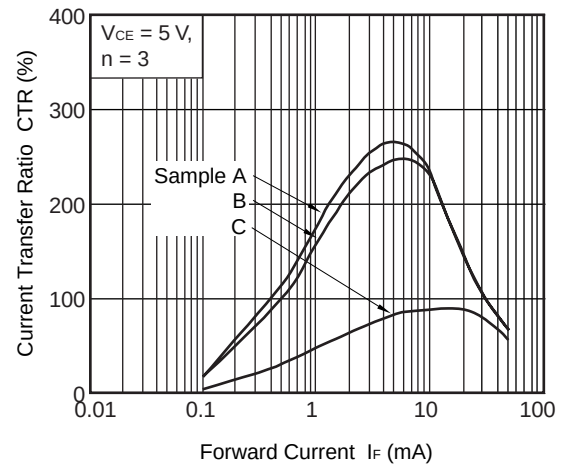


**Remark** The graphs indicate nominal characteristics.

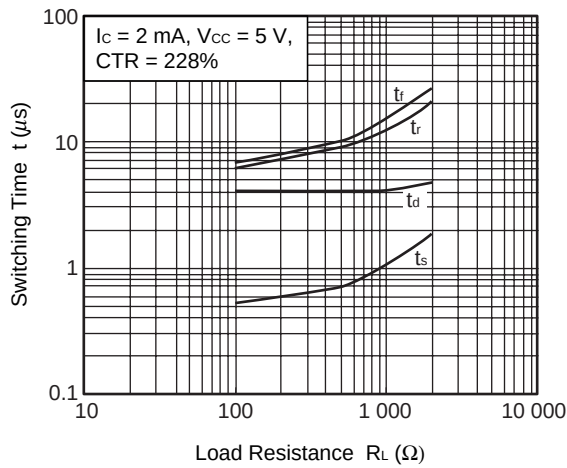
NORMALIZED CURRENT TRANSFER RATIO vs. AMBIENT TEMPERATURE



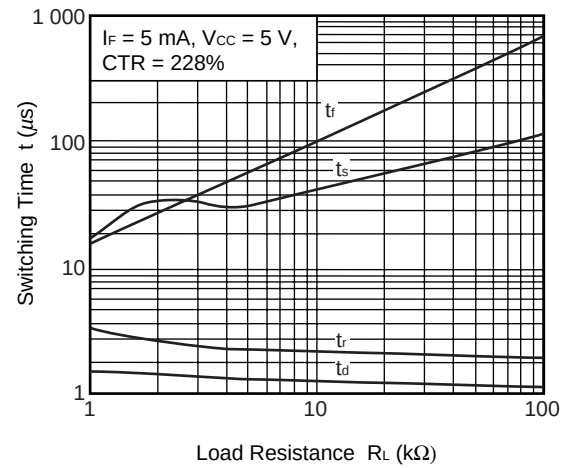
CURRENT TRANSFER RATIO vs. FORWARD CURRENT



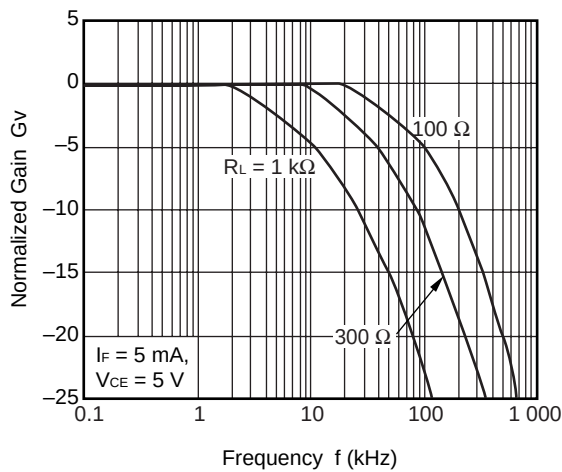
SWITCHING TIME vs. LOAD RESISTANCE



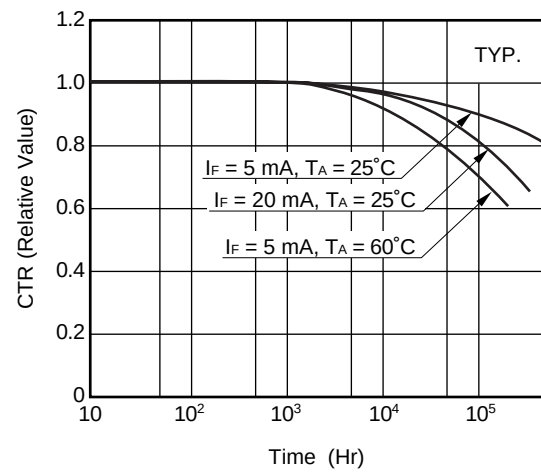
SWITCHING TIME vs. LOAD RESISTANCE



FREQUENCY RESPONSE



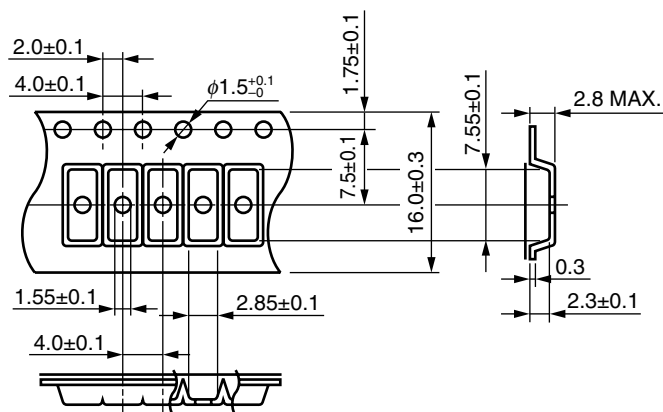
LONG TERM CTR DEGRADATION



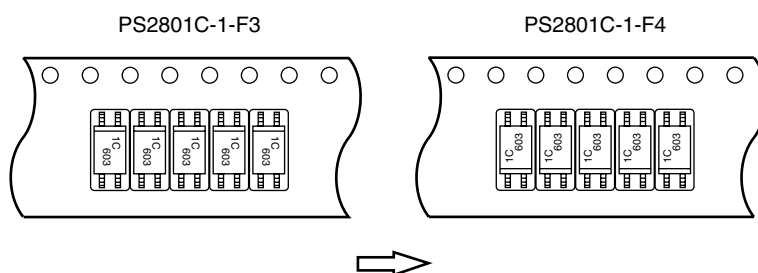
**Remark** The graphs indicate nominal characteristics.

TAPING SPECIFICATIONS (UNIT: mm)

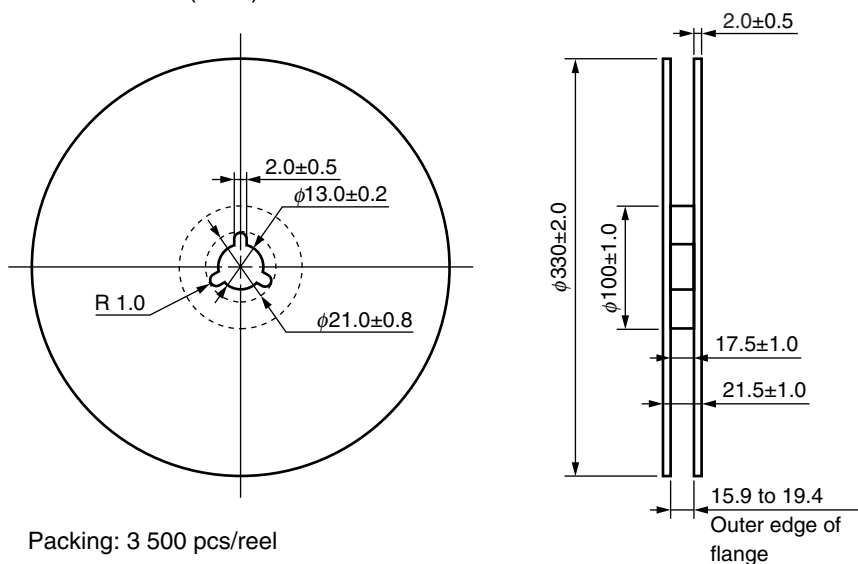
Outline and Dimensions (Tape)



Tape Direction



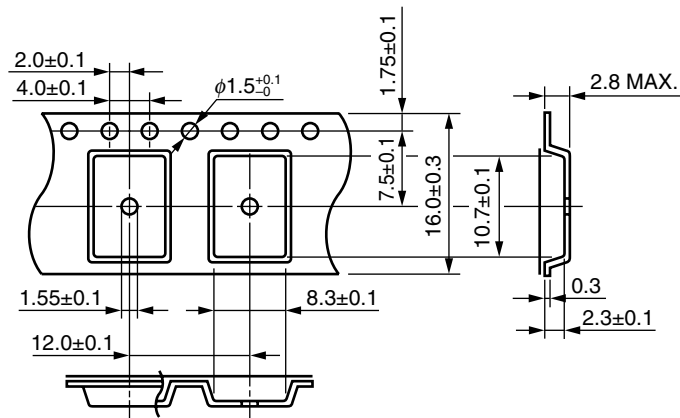
Outline and Dimensions (Reel)



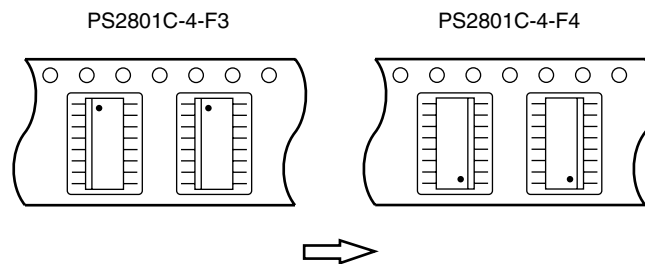
Packing: 3 500 pcs/reel



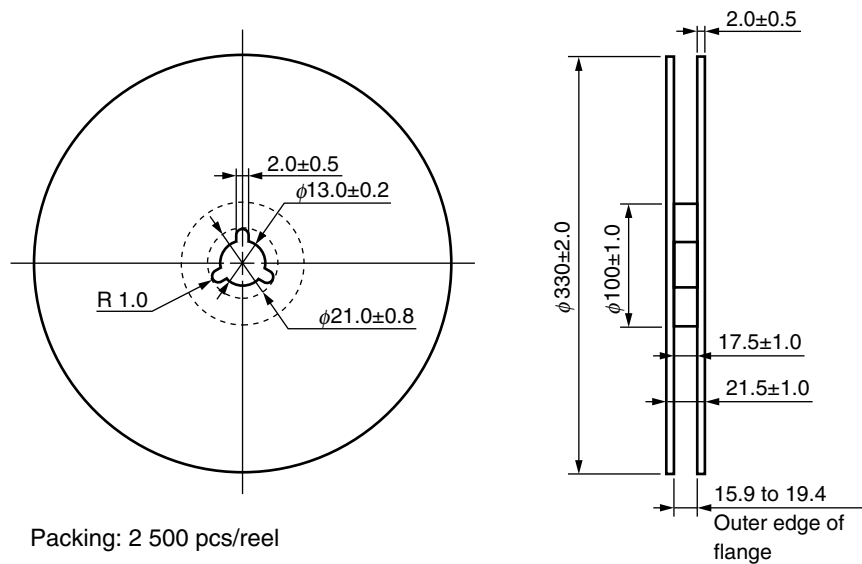
### Outline and Dimensions (Tape)



### Tape Direction



### Outline and Dimensions (Reel)



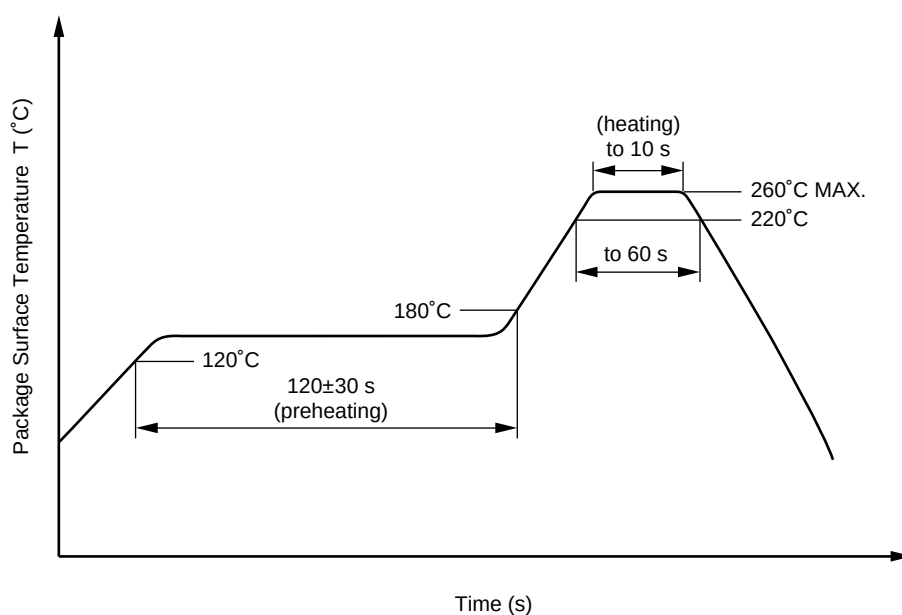
## NOTES ON HANDLING

## 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. This tendency may sometimes be obvious, especially below  $I_F = 1$  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.

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**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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► For further information, please contact

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**NEC Electronics Corporation**

URL: <http://www.ncsd.necel.com/>

Subject: Compliance with EU Directives

CEL certifies, to its knowledge, that semiconductor and laser products detailed below are compliant with the requirements of European Union (EU) Directive 2002/95/EC Restriction on Use of Hazardous Substances in electrical and electronic equipment (RoHS) and the requirements of EU Directive 2003/11/EC Restriction on Penta and Octa BDE.

CEL Pb-free products have the same base part number with a suffix added. The suffix –A indicates that the device is Pb-free. The –AZ suffix is used to designate devices containing Pb which are exempted from the requirement of RoHS directive (\*). In all cases the devices have Pb-free terminals. All devices with these suffixes meet the requirements of the RoHS directive.

This status is based on CEL's understanding of the EU Directives and knowledge of the materials that go into its products as of the date of disclosure of this information.

| Restricted Substance<br>per RoHS | Concentration Limit per RoHS<br>(values are not yet fixed) | Concentration contained<br>in CEL devices |     |
|----------------------------------|------------------------------------------------------------|-------------------------------------------|-----|
|                                  |                                                            | -A                                        | -AZ |
| Lead (Pb)                        | < 1000 PPM                                                 | Not Detected                              | (*) |
| Mercury                          | < 1000 PPM                                                 | Not Detected                              |     |
| Cadmium                          | < 100 PPM                                                  | Not Detected                              |     |
| Hexavalent Chromium              | < 1000 PPM                                                 | Not Detected                              |     |
| PBB                              | < 1000 PPM                                                 | Not Detected                              |     |
| PBDE                             | < 1000 PPM                                                 | Not Detected                              |     |

If you should have any additional questions regarding our devices and compliance to environmental standards, please do not hesitate to contact your local representative.

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- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

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- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



#### Как с нами связаться

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