

# PS2801C-1, PS2801C-4

## Data Sheet

R08DS0072EJ0400

Rev.4.00

Jan 9, 2013

HIGH ISOLATION VOLTAGE SSOP PHOTOCOUPLER

### DESCRIPTION

These products 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

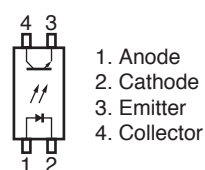
- High isolation voltage ( $BV = 2\,500\text{ V}_{r.m.s.}$ )
- Small and thin package (4, 16-pin SSOP, Pin pitch 1.27 mm)
- High collector to emitter voltage ( $V_{CEO} : 80\text{ V}$ )
- <R> • Ordering number of tape product: PS2801C-1-F3, PS2801C-4-F3
- Pb-Free product
- <R> • Safety standards
  - UL approved: File No. E72422
  - CSA approved: No. CA 101391 (CA5A, CAN/CSA-C22.2 60065, 60950)
  - BSI approved (BS EN 60065, BS EN 60950) (PS2801C-1 only)
  - DIN EN 60747-5-5 (VDE 0884-5) approved (Option)

### APPLICATIONS

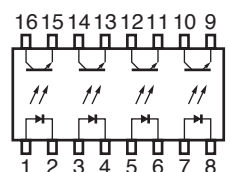
- Programmable logic controllers
- Measuring instruments
- Power supply
- Hybrid IC

#### PIN CONNECTION (Top View)

##### PS2801C-1



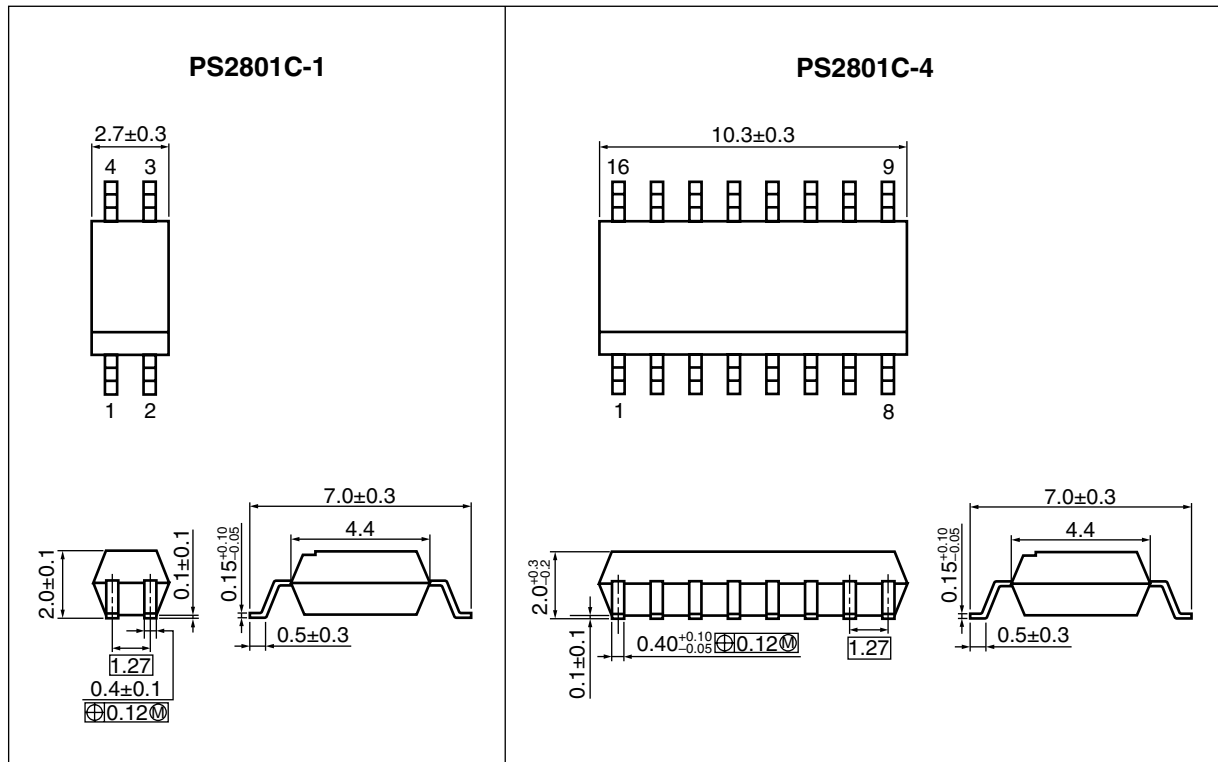
##### PS2801C-4



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

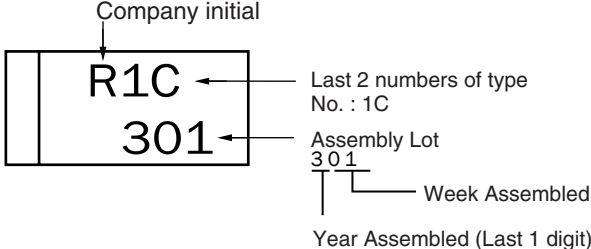
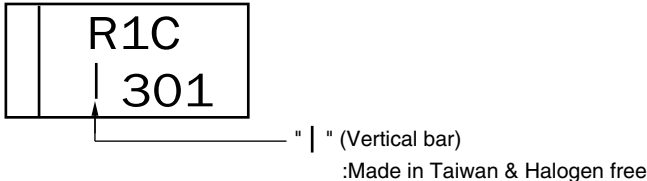
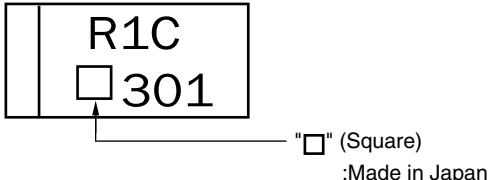
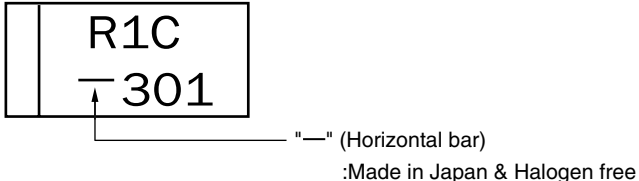
The mark <R> shows major revised points.

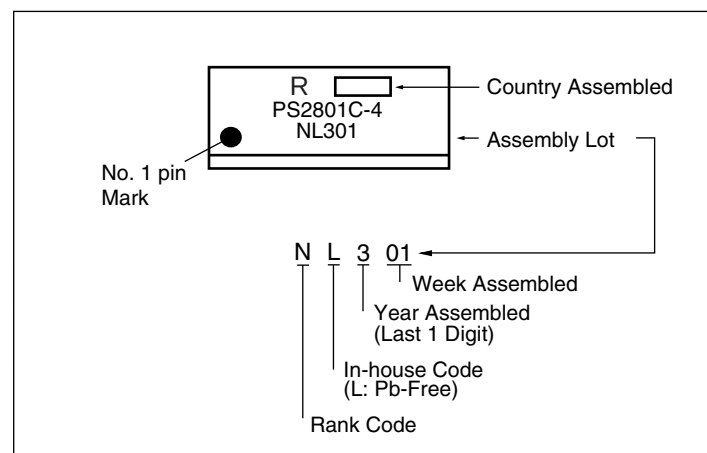
The revised points can be easily searched by copying an "<R>" in the PDF file and specifying it in the "Find what:" field.

**PS2801C-1, PS2801C-4****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 Distance      | 0.1 mm      |

**PS2801C-1, PS2801C-4**<R> **MARKING EXAMPLE****PS2801C-1**

|                                        |                                                                                      |
|----------------------------------------|--------------------------------------------------------------------------------------|
| <b>Made in Taiwan</b>                  |    |
| <b>Made in Taiwan<br/>Halogen free</b> |    |
| <b>Made in Japan</b>                   |   |
| <b>Made in Japan<br/>Halogen free</b>  |  |

**PS2801C-4**

**PS2801C-1, PS2801C-4**<R> **ORDERING INFORMATION**

| Part Number    | Order Number      | Solder Plating Specification etc.          | Packing Style                | Safety Standard Approval                       | Application Part Number <sup>*1</sup> |
|----------------|-------------------|--------------------------------------------|------------------------------|------------------------------------------------|---------------------------------------|
| PS2801C-1-F3   | PS2801C-1-F3-A    | Pb-Free                                    | Embossed Tape 3 500 pcs/reel | Standard products (UL, CSA, BSI approved)      | PS2801C-1                             |
| PS2801C-4-F3   | PS2801C-4-F3-A    |                                            | Embossed Tape 2 500 pcs/reel |                                                | PS2801C-4                             |
| PS2801C-1-V-F3 | PS2801C-1-V-F3-A  |                                            | Embossed Tape 3 500 pcs/reel | DIN EN 60747-5-5 (VDE0884-5) Approved (Option) | PS2801C-1                             |
| PS2801C-4-V-F3 | PS2801C-4-V-F3-A  |                                            | Embossed Tape 2 500 pcs/reel |                                                | PS2801C-4                             |
| PS2801C-1-F3   | PS2801C-1Y-F3-A   | Special version (Pb-Free and Halogen Free) | Embossed Tape 3 500 pcs/reel | Standard products (UL, CSA, BSI approved)      | PS2801C-1                             |
| PS2801C-1-V-F3 | PS2801C-1Y-V-F3-A |                                            | Embossed Tape 3 500 pcs/reel | DIN EN 60747-5-5 (VDE0884-5) 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    |
|---------------------------------|------------------------------------|---------------------|-------------|-----------|---------|
|                                 |                                    |                     | PS2801C-1   | PS2801C-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>    | 80          |           | 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: \*1. PW = 100 μs, Duty Cycle = 1%

\*2. 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 (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 ( $I_C/I_F$ ) <sup>*1</sup> | 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 <sup>*2</sup>                            | $t_r$         | $V_{CC} = 5\text{ V}, I_C = 2\text{ mA}, R_L = 100\ \Omega$ |           | 5    |      | $\mu\text{s}$ |
|            | Fall Time <sup>*2</sup>                            | $t_f$         |                                                             |           | 7    |      |               |
|            | Turn-on Time <sup>*2</sup>                         | $t_{on}$      |                                                             |           | 10   |      |               |
|            | Turn-off Time <sup>*2</sup>                        | $t_{off}$     |                                                             |           | 7    |      |               |

&lt;R&gt;

&lt;R&gt;

Notes: \*1. CTR rank

PS2801C-1

N : 50 to 400 (%)

P : 150 to 300 (%)

L : 100 to 300 (%)

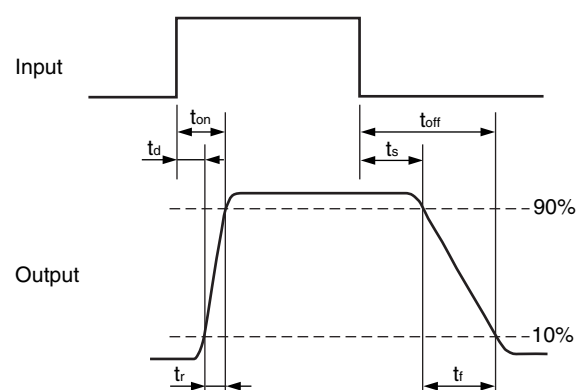
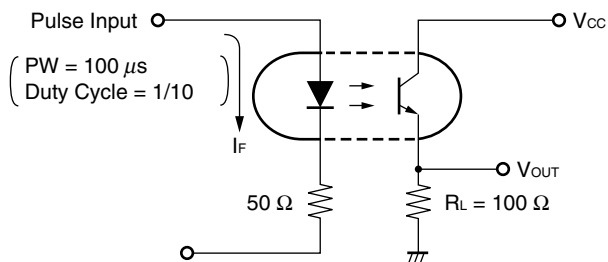
M : 100 to 400 (%)

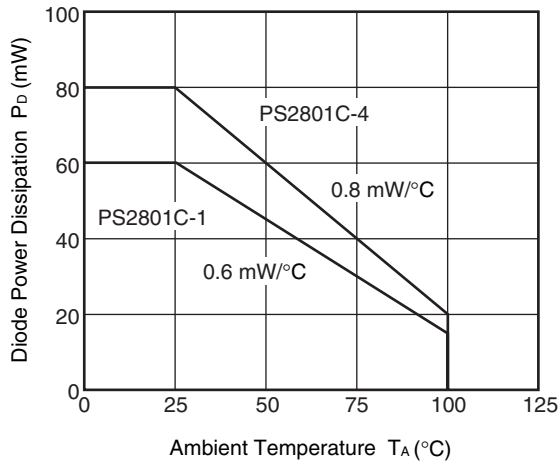
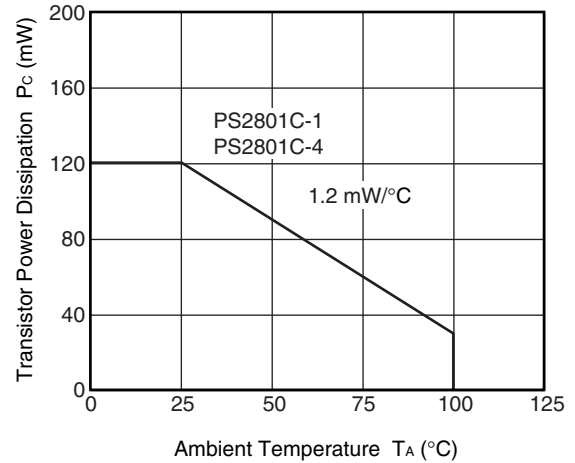
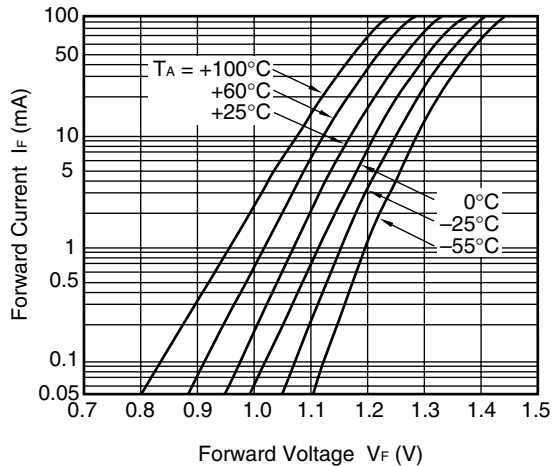
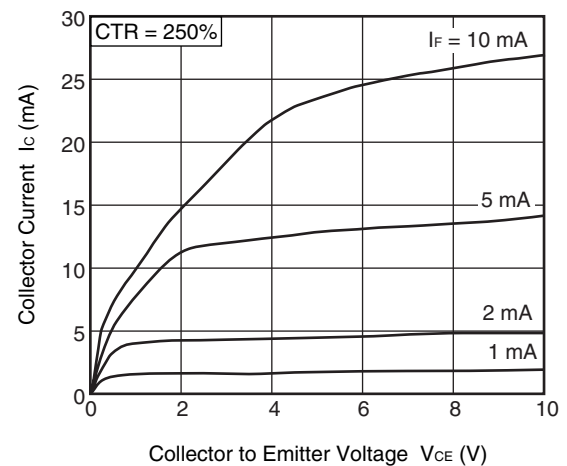
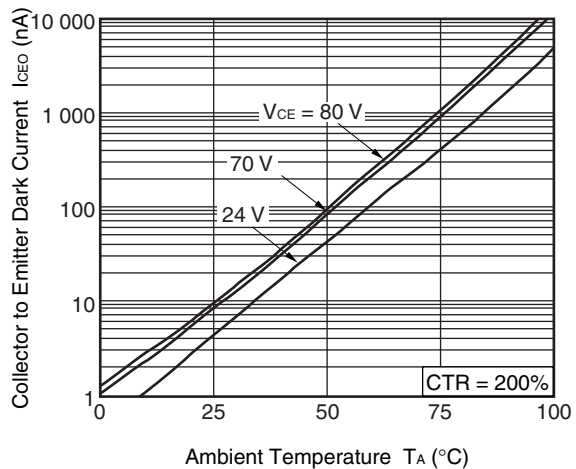
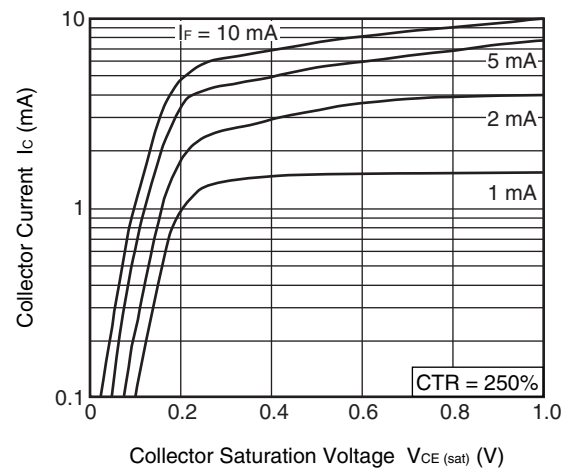
PS2801C-4

N : 50 to 400 (%)

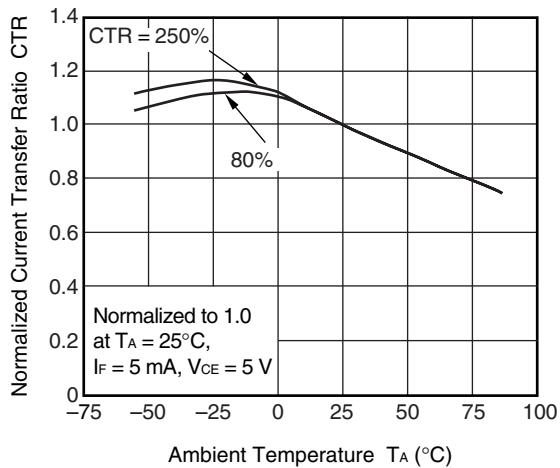
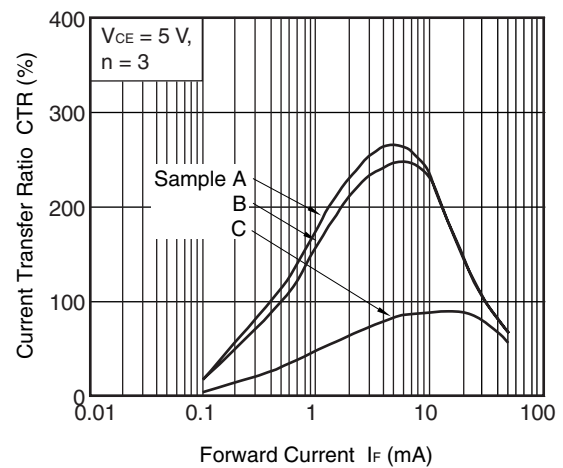
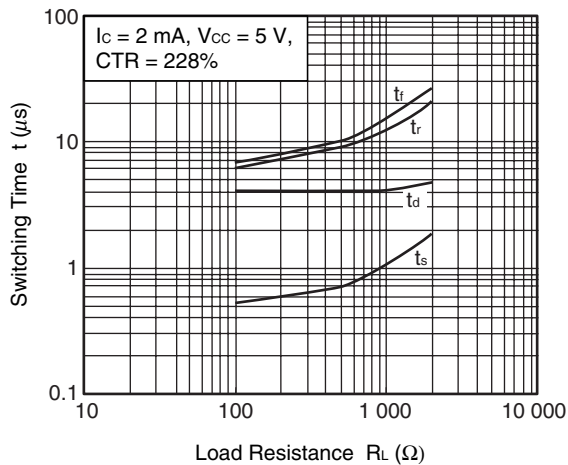
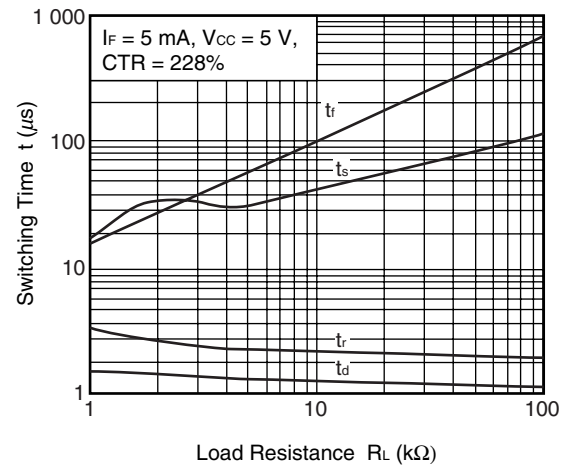
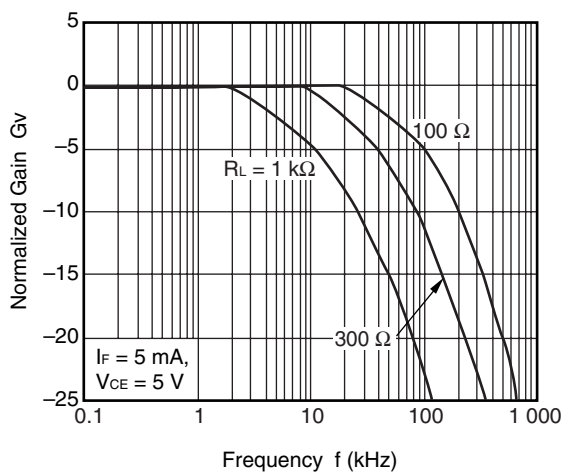
M : 100 to 400 (%)

\*2. Test circuit for switching time

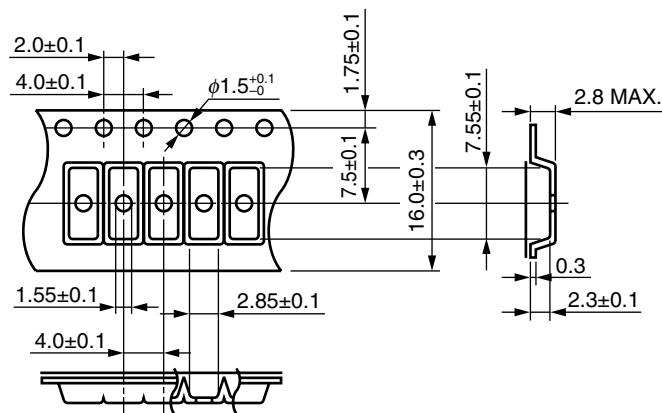


**PS2801C-1, PS2801C-4****<R> TYPICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ , unless otherwise specified)****DIODE POWER DISSIPATION vs. AMBIENT TEMPERATURE****TRANSISTOR POWER DISSIPATION vs. AMBIENT TEMPERATURE****FORWARD CURRENT vs. FORWARD VOLTAGE****COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE****COLLECTOR TO EMITTER DARK CURRENT vs. AMBIENT TEMPERATURE****COLLECTOR CURRENT vs. COLLECTOR SATURATION VOLTAGE**

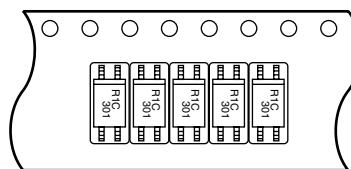
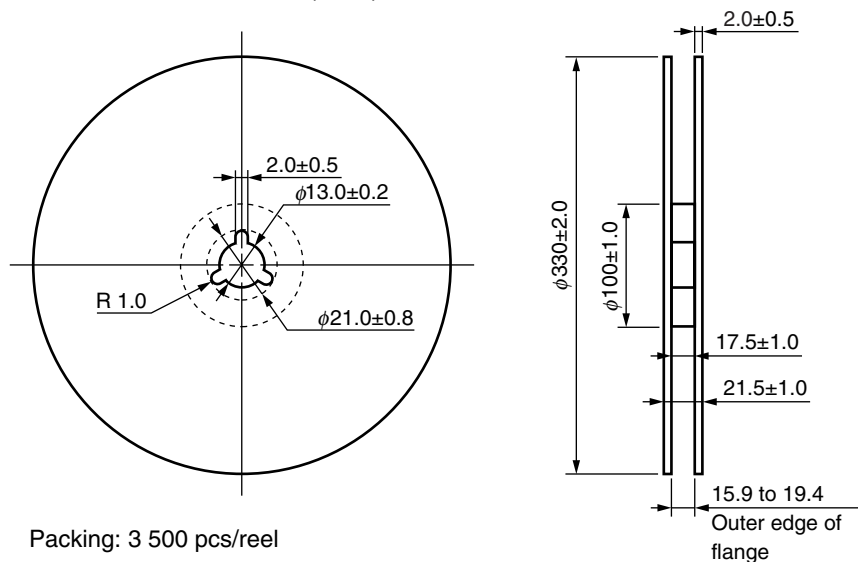
**Remark** The graphs indicate nominal characteristics.

**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**

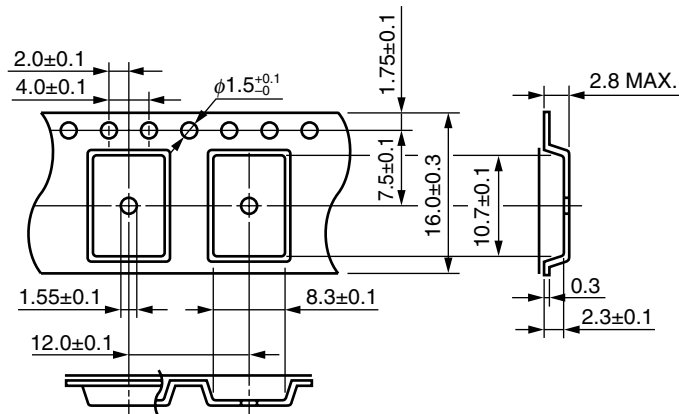
**Remark** The graphs indicate nominal characteristics.

**<R> TAPING SPECIFICATIONS (UNIT: mm)****Outline and Dimensions (Tape)****Tape Direction**

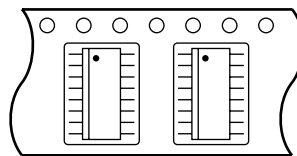
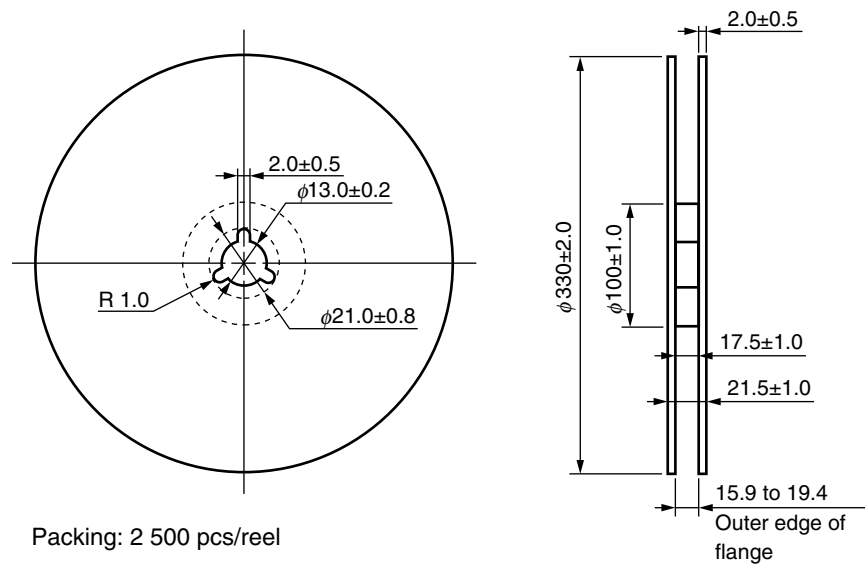
PS2801C-1-F3

**Outline and Dimensions (Reel)**



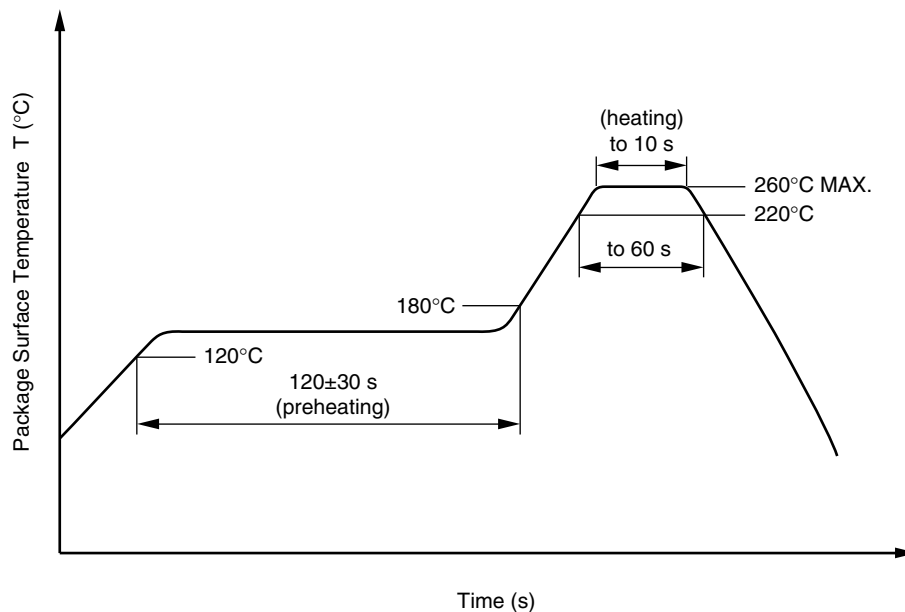
**Outline and Dimensions (Tape)****Tape Direction**

PS2801C-4-F3

**Outline and Dimensions (Reel)**

**<R> 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

**(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.

**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                                                       | $U_{IORM}$ | 705         | $V_{peak}$ |
| <R> | Test voltage (partial discharge test, procedure a for type test and random test)          | $U_{pr}$   | 1 128       | $V_{peak}$ |
| <R> | $U_{pr} = 1.6 \times U_{IORM}$ , $P_d < 5 \text{ pC}$                                     |            |             |            |
|     | Test voltage (partial discharge test, procedure b for all devices)                        | $U_{pr}$   | 1 322       | $V_{peak}$ |
|     | $U_{pr} = 1.875 \times U_{IORM}$ , $P_d < 5 \text{ pC}$                                   |            |             |            |
|     | Highest permissible overvoltage                                                           | $U_{TR}$   | 6 000       | $V_{peak}$ |
|     | Degree of pollution (DIN EN 60664-1 VDE0110 Part 1)                                       |            | 2           |            |
| <R> | 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 +100 | °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                                                                       | $T_{si}$   | 150         | °C         |
|     | Current (input current $I_F$ , $P_{si} = 0$ )                                             | $I_{si}$   | 300         | mA         |
|     | Power (output or total power dissipation)                                                 | $P_{si}$   | 500         | mW         |
|     | Isolation resistance                                                                      |            |             |            |
|     | $V_{IO} = 500 \text{ V dc at } T_A = T_{si}$                                              | Ris MIN.   | $10^9$      | $\Omega$   |

|                         |                                        |
|-------------------------|----------------------------------------|
| <b>Revision History</b> | <b>PS2801C-1, PS2801C-4 Data Sheet</b> |
|-------------------------|----------------------------------------|

| Rev. | Date         | Description |                                                                                                                                                                                                                                                                                                  |
|------|--------------|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|      |              | Page        | Summary                                                                                                                                                                                                                                                                                          |
| 1.00 | May 30, 2006 | –           | This data sheet was released as PN10610EJ01V0DS                                                                                                                                                                                                                                                  |
| 4.00 | Jan 9, 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 as each distance of this device.                                                                                                                                                                                                                              |
|      |              | 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.7         | The graph of LONG TERM CTR DEGRADATION is deleted from those in TYPICAL CHARACTERISTICS.                                                                                                                                                                                                         |
|      |              | p.8         | PS2801C-1-F4 is deleted form Tape Direction image in TAPING SPECIFICATIONS.                                                                                                                                                                                                                      |
|      |              | p.9         | PS2801C-4-F4 is deleted form Tape Direction image in TAPING SPECIFICATIONS.                                                                                                                                                                                                                      |
|      |              | p.10        | The note about temperature condition of the recommended soldering conditions is deleted.                                                                                                                                                                                                         |
|      |              | p.12        | The values in SPECIFICATION OF VDE MARKS LICENSE DOCUMENT are changed as follows.<br>-- Test voltage is changed from the factor, 1.5, and the value, 1058, to 1.6 and 1128, respectively.<br>-- Clearance distance is moved to PHOTOCOUPLER CONSTRUCTION with changing 5.0 (min.) to 4.5 (min.). |