

# PS2911-1

## Data Sheet

R08DS0110EJ0300

Rev.3.00

May 24, 2013

HIGH CTR, 4-PIN ULTRA SMALL PACKAGE FLAT-LEAD PHOTOCOUPLER

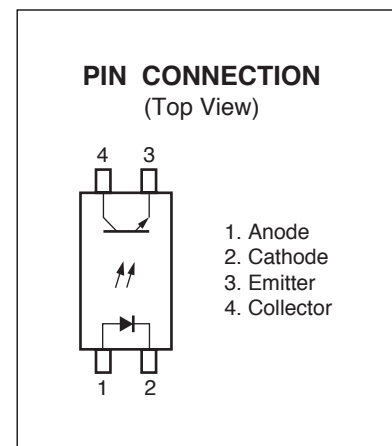
### DESCRIPTION

The PS2911-1 is an optically coupled isolator containing a GaAs light emitting diode and an NPN silicon phototransistor in one package for high density mounting applications.

An ultra small flat-lead package has been provided which realizes a reduction in mounting area of about 30% compared with the PS28xx series.

### FEATURES

- Ultra small flat-lead package (4.6 (L) × 2.5 (W) × 2.1 (H) mm)
- High current transfer ratio (CTR = 200% TYP. @  $I_F = 1 \text{ mA}$ ,  $V_{CE} = 5 \text{ V}$ )
- High isolation voltage (BV = 2 500 Vr.m.s.)
- Ordering number of taping product: PS2911-1-F3: 3 500 pcs/reel
- <R> • Safety standards
  - UL approved: No. E72422
  - BSI approved (BS EN 60065, BS EN 60950)
  - DIN EN 60747-5-5 (VDE 0884-5) approved (Option)



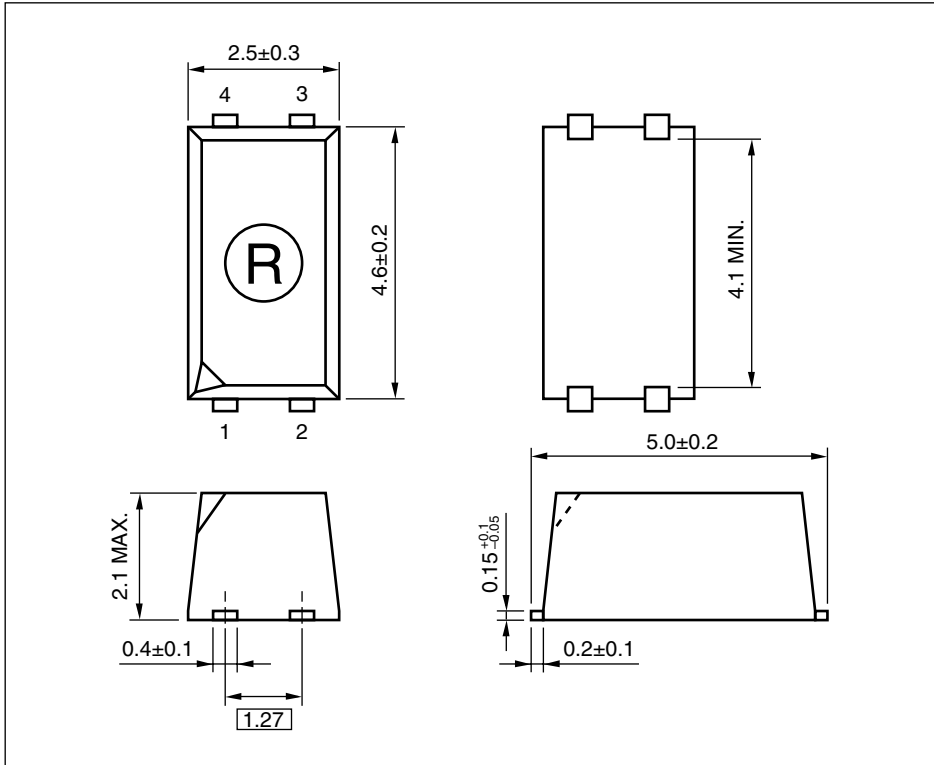
### APPLICATIONS

- DC/DC converter
- Modem/PC card

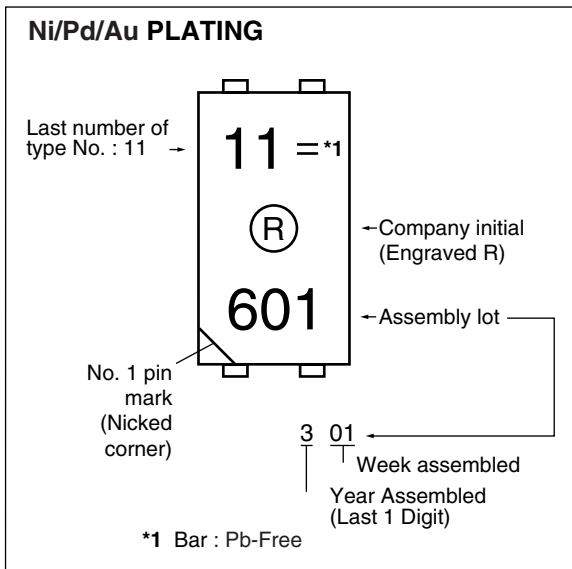
The mark <R> shows major revised points.

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

<R> **PACKAGE DIMENSIONS (UNIT: mm)**



<R> **MARKING EXAMPLE**



**PHOTOCOUPLER CONSTRUCTION**

| Parameter          | MIN.   |
|--------------------|--------|
| Air Distance       | 4 mm   |
| Creepage Distance  | 4 mm   |
| Isolation Distance | 0.4 mm |

## &lt;R&gt; ORDERING INFORMATION

| Part Number   | Order Number     | Solder Plating Specification | Packing Style                | Safety Standard Approval                              | Application Part Number <sup>*1</sup> |
|---------------|------------------|------------------------------|------------------------------|---|---------------------------------------|
| PS2911-1      | PS2911-1-AX      | Pb-Free<br>(Ni/Pd/Au)        | 50 pcs (Tape 50 pcs cut)     | Standard products<br>(UL, BSI approved)               | PS2911-1                              |
| PS2911-1-F3   | PS2911-1-F3-AX   |                              | Embossed Tape 3 500 pcs/reel |   |                                       |
| PS2911-1-V    | PS2911-1-V-AX    |                              | 50 pcs (Tape 50 pcs cut)     | DIN EN 60747-5-5<br>(VDE 0884-5)<br>Approved (Option) |                                       |
| PS2911-1-V-F3 | PS2911-1-V-F3-AX |                              | Embossed Tape 3 500 pcs/reel |   |                                       |

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                    | I <sub>F</sub>                | 50          | mA      |
|                                 | Forward Current Derating           | $\Delta I_F / ^\circ\text{C}$ | 0.5         | mA/°C   |
|                                 | Peak Forward Current <sup>*1</sup> | I <sub>FP</sub>               | 0.5         | A       |
|                                 | Power Dissipation                  | P <sub>D</sub>                | 60          | mW      |
|                                 | Reverse Voltage                    | V <sub>R</sub>                | 6           | V       |
| Detector                        | Collector to Emitter Voltage       | V <sub>CEO</sub>              | 40          | V       |
|                                 | Emitter to Collector Voltage       | V <sub>ECO</sub>              | 5           | V       |
|                                 | Collector Current                  | I <sub>C</sub>                | 40          | mA      |
|                                 | Power Dissipation Derating         | $\Delta P_C / ^\circ\text{C}$ | 1.2         | mW/°C   |
|                                 | Power Dissipation                  | P <sub>C</sub>                | 120         | mW      |
| Isolation Voltage <sup>*2</sup> |                                    | BV                            | 2 500       | Vr.m.s. |
| Total Power Dissipation         |                                    | P <sub>T</sub>                | 160         | mW      |
| 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.

<R> ELECTRICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ )

|                             | Parameter  | Symbol        | Conditions  | MIN.      | TYP. | MAX. | Unit          |
|-----------------------------|--|---------------|---|-----------|------|------|---------------|
| Diode                       | Forward Voltage                                    | $V_F$         | $I_F = 1 \text{ mA}$  | 0.9       | 1.1  | 1.3  | V             |
|                             | Reverse Current                                    | $I_R$         | $V_R = 5 \text{ V}$   |           |      | 5    | $\mu\text{A}$ |
|                             | Terminal Capacitance                               | $C_t$         | $V = 0 \text{ V}, f = 1 \text{ MHz}$                                |           | 15   |      | pF            |
| Transistor                  | Collector to Emitter Dark Current                  | $I_{CEO}$     | $I_F = 0 \text{ mA}, V_{CE} = 40 \text{ V}$                         |           |      | 100  | nA            |
| Coupled                     | Current Transfer Ratio ( $I_C/I_F$ ) <sup>*1</sup> | CTR           | $I_F = 1 \text{ mA}, V_{CE} = 5 \text{ V}$                          | 100       | 200  | 400  | %             |
|                             | Collector Saturation Voltage                       | $V_{CE(SAT)}$ | $I_F = 1 \text{ mA}, I_C = 0.2 \text{ mA}$                          |           | 0.13 | 0.3  | V             |
|                             | Isolation Resistance                               | $R_{I-O}$     | $V_{I-O} = 1 \text{ kV}_{DC}$                                       | $10^{11}$ |      |      | $\Omega$      |
|                             | Isolation Capacitance                              | $C_{I-O}$     | $V = 0 \text{ V}, f = 1 \text{ MHz}$                                |           | 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>                            | $t_f$         |   |           | 10   |      |               |
|                             | Turn-on Time <sup>*2</sup>                         | $t_{on}$      | $V_{CC} = 5 \text{ V}, I_F = 1 \text{ mA}, R_L = 5 \text{ k}\Omega$ |           | 40   |      | $\mu\text{s}$ |
|                             | Storage Time <sup>*2</sup>                         | $t_s$         |   |           | 10   |      |               |
| Turn-off Time <sup>*2</sup> | $t_{off}$  |               |   | 120       |      |      |               |

Notes: \*1. CTR rank

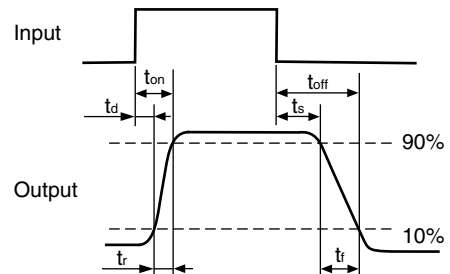
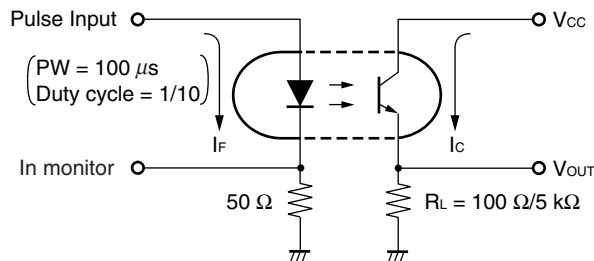
N : 100 to 400 (%)

K : 200 to 400 (%)

L : 150 to 300 (%)

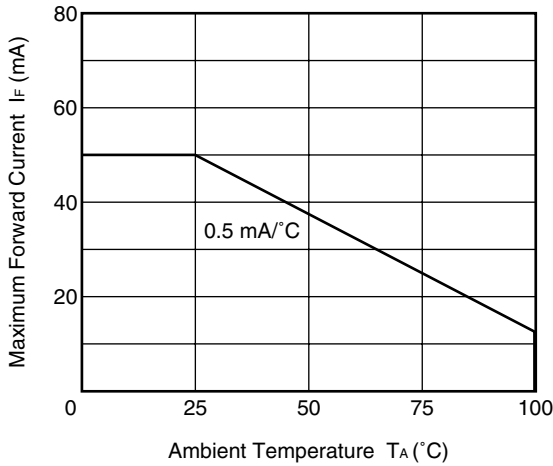
M : 100 to 200 (%)

\*2. Test circuit for switching time

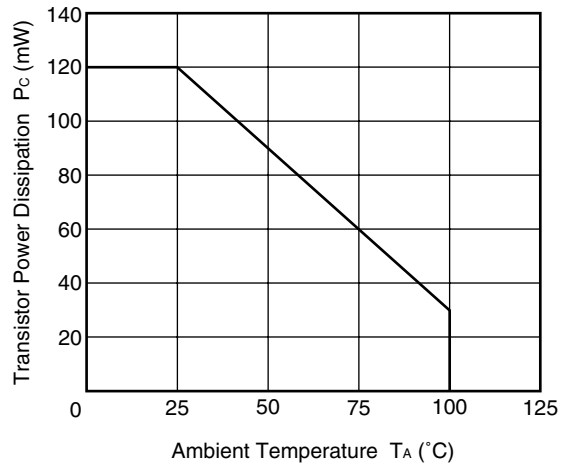


<R> **TYPICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ , unless otherwise specified)**

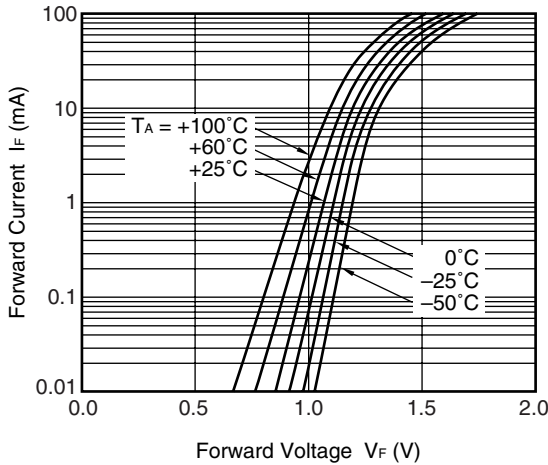
MAXIMUM FORWARD CURRENT vs. AMBIENT TEMPERATURE



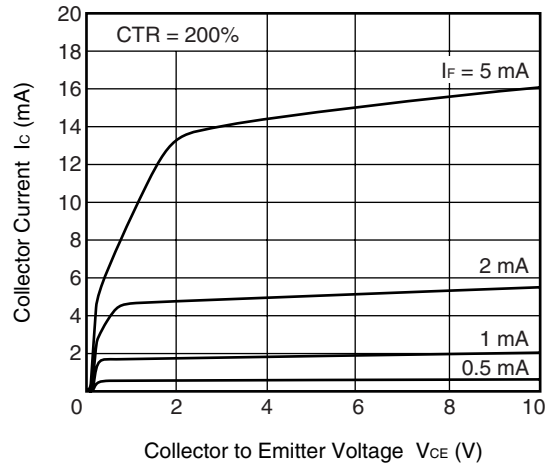
TRANSISTOR POWER DISSIPATION vs. AMBIENT TEMPERATURE



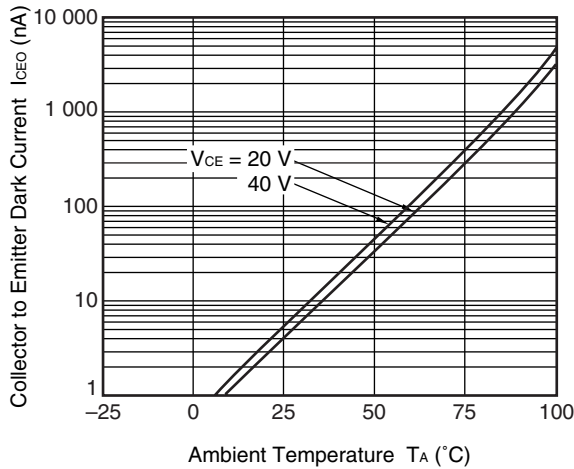
FORWARD CURRENT vs. FORWARD VOLTAGE



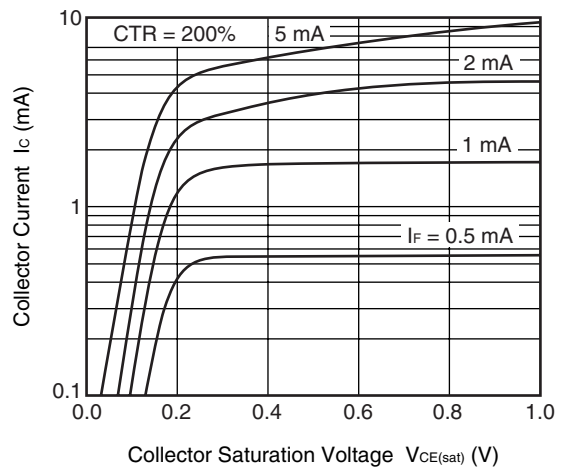
COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE



COLLECTOR TO EMITTER DARK CURRENT vs. AMBIENT TEMPERATURE

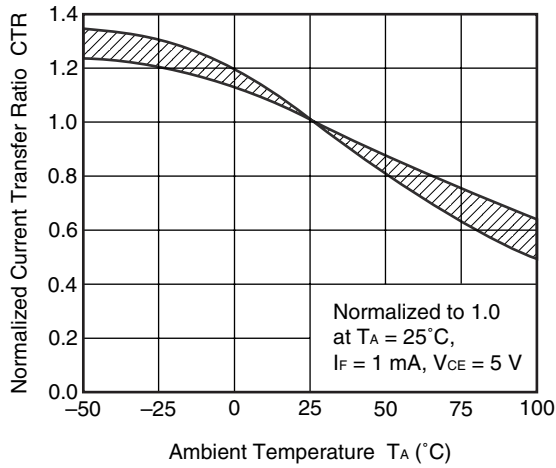


COLLECTOR CURRENT vs. COLLECTOR SATURATION VOLTAGE

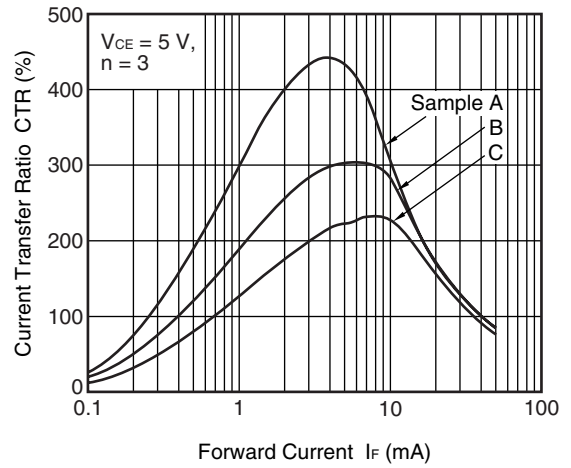


**Remark** The graphs indicate nominal characteristics.

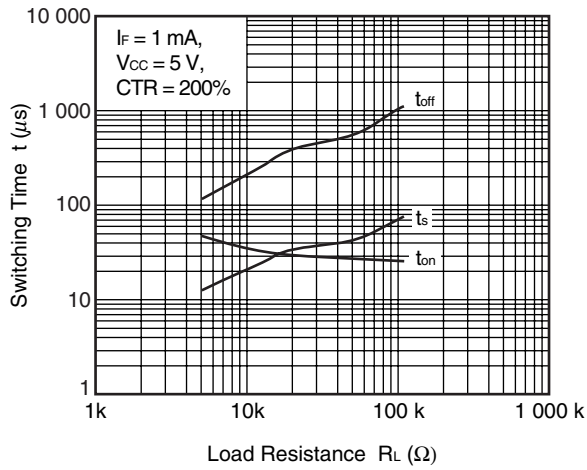
**NORMALIZED CURRENT TRANSFER RATIO vs. AMBIENT TEMPERATURE**



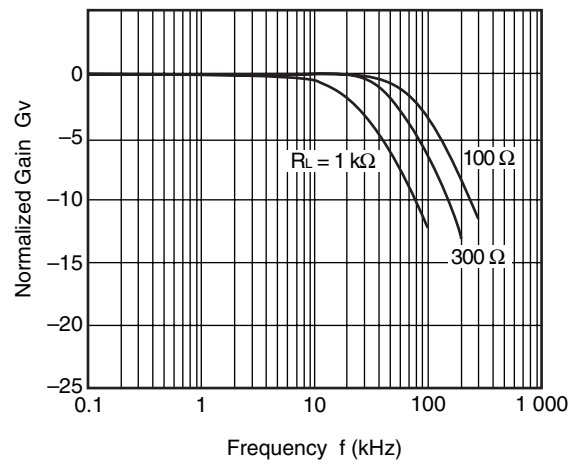
**CURRENT TRANSFER RATIO vs. FORWARD CURRENT**



**SWITCHING TIME vs. LOAD RESISTANCE**



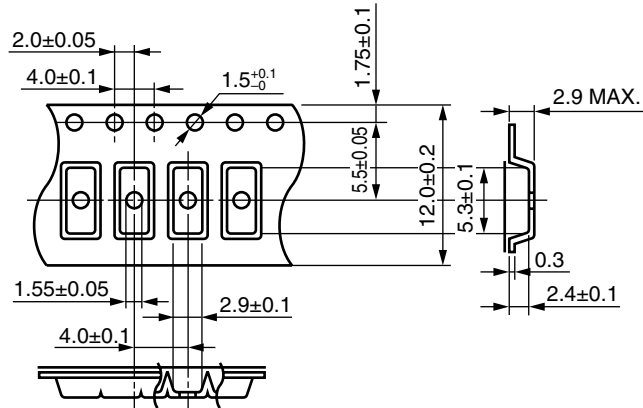
**FREQUENCY RESPONSE**



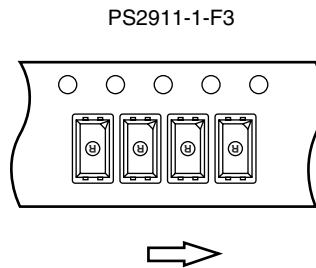
**Remark** The graphs indicate nominal characteristics.

<R> TAPING SPECIFICATIONS (UNIT: mm)

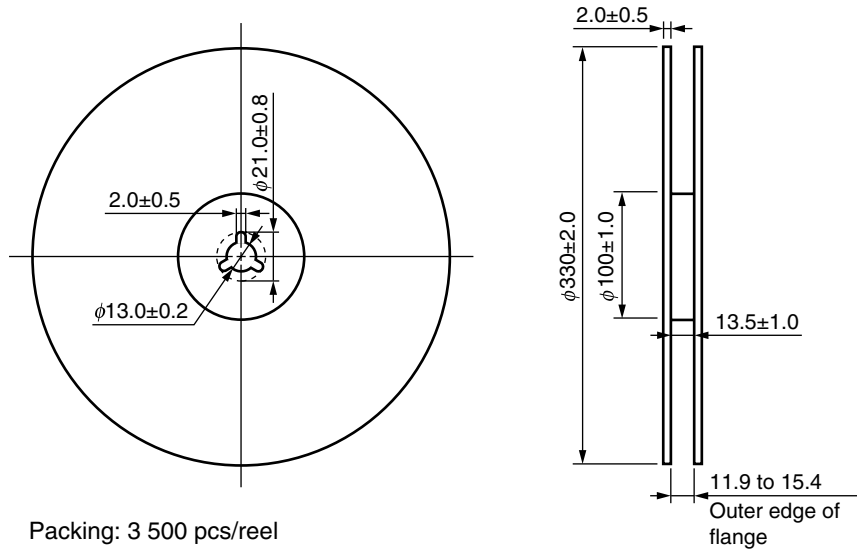
Outline and Dimensions (Tape)



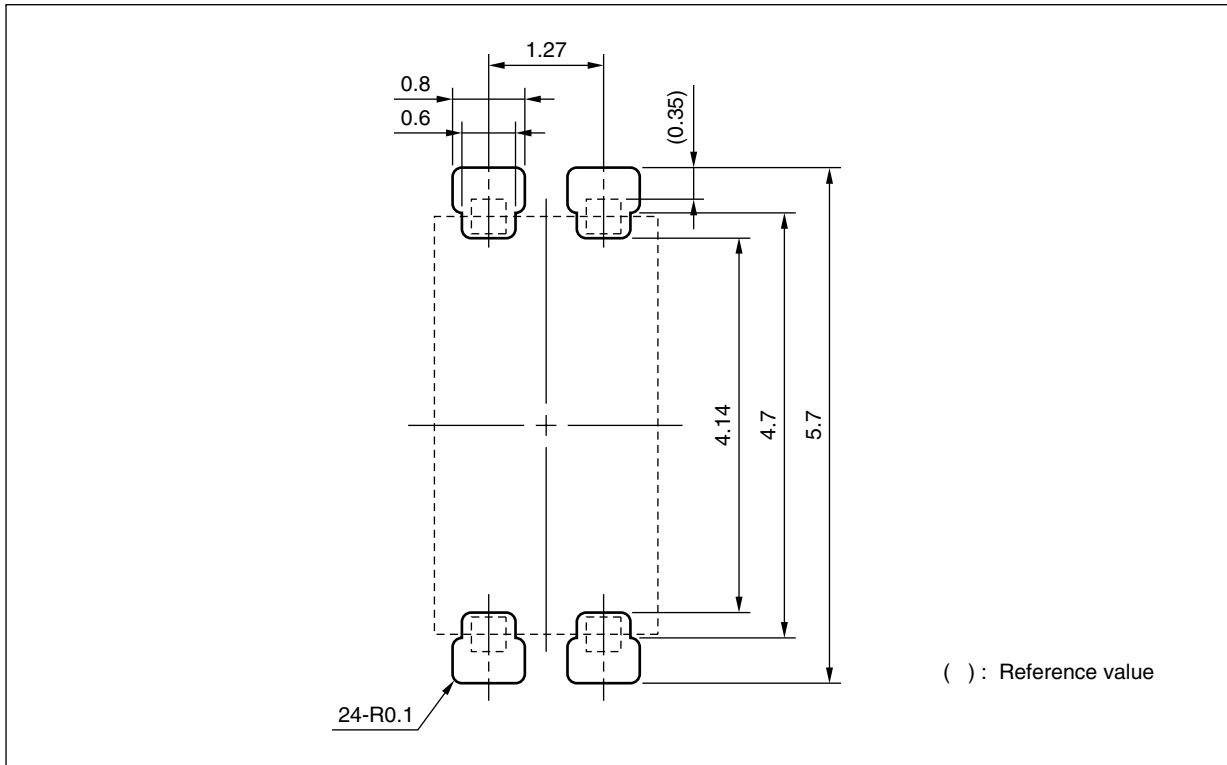
Tape Direction



Outline and Dimensions (Reel)



## RECOMMENDED MOUNT PAD DIMENSIONS (UNIT: mm)



**Remark** This drawing is considered to meet air and outer creepage distance 4.0 mm minimum. All dimensions in this figure must be evaluated before use.



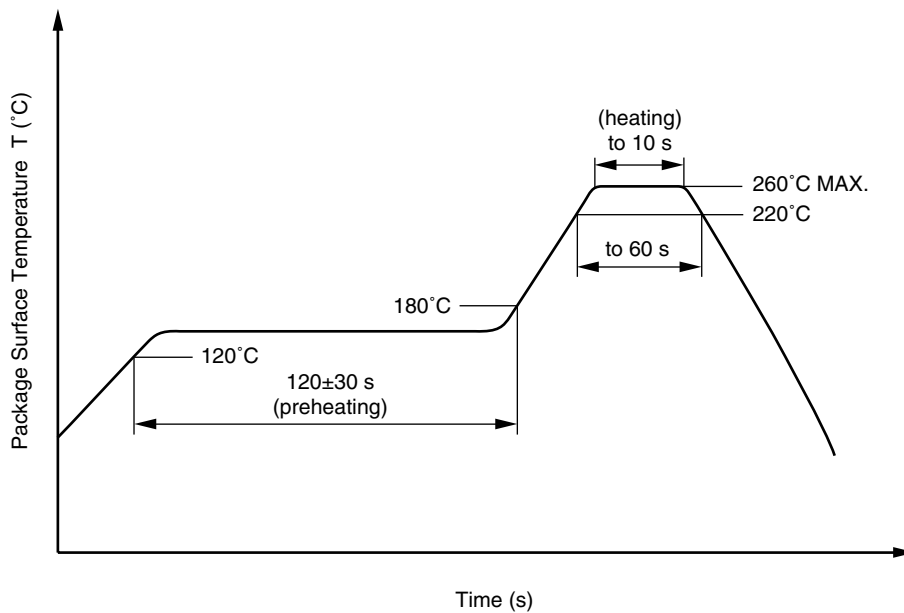
<R> **NOTES ON HANDLING**

## 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 or less
- Flux Rosin flux containing small amount of chlorine (The flux with a maximum chlorine content of 0.2 Wt% or less 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% or less 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% or less 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. 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<br>maximum operating isolation voltage  | $U_{IORM}$           | 570                    | $V_{peak}$           |
| Test voltage (partial discharge test, procedure a for type test and random test)<br>$U_{pr} = 1.6 \times U_{IORM}, P_d < 5 \text{ pC}$  | $U_{pr}$             | 912                    | $V_{peak}$           |
| Test voltage (partial discharge test, procedure b for all devices)<br>$U_{pr} = 1.875 \times U_{IORM}, P_d < 5 \text{ pC}$  | $U_{pr}$             | 1 068                  | $V_{peak}$           |
| Highest permissible overvoltage   | $U_{TR}$             | 4 000                  | $V_{peak}$           |
| 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 +100            | °C                   |
| Isolation resistance, minimum value<br>$V_{IO} = 500 \text{ V dc at } T_A = 25^\circ\text{C}$<br>$V_{IO} = 500 \text{ V dc at } T_A \text{ MAX. at least } 100^\circ\text{C}$ | Ris MIN.<br>Ris MIN. | $10^{12}$<br>$10^{11}$ | $\Omega$<br>$\Omega$ |
| 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<br>$V_{IO} = 500 \text{ V dc at } T_A = T_{si}$  | 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> |
|------------------------------|--|

**Revision History****PS2911-1 Data Sheet**

| Rev. | Date  | Description |   |
|------|---|-------------|---|
|      |   | Page        | Summary                                       |
| 2.00 | May 25, 2006  | –           | First edition issued                          |
| 3.00 | May 24, 2013  | Throughout  | Renesas format is applied to this data sheet. |
|      |   | p.1         | Modification of FEATURES                      |
|      |   | p.2         | Modification of PACKAGE DIMENSIONS            |
|      |   |             | Modification of MARKING EXAMPLE               |
|      |   | p.3         | Modification of ORDERING INFORMATION          |
|      |   | p.4         | Modification of ELECTRICAL CHARACTERISTICS    |
|      |   | p.7         | Modification of TAPING SPECIFICATIONS         |
|      |   | p.9         | Modification of NOTES ON HANDLING             |
| p.11 | Addition of SPECIFICATION OF VDE MARKS LICENSE DOCUMENT |             |   |

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