

# PS2533-1, PS2533L-1

## HIGH COLLECTOR TO EMITTER VOLTAGE HIGH ISOLATION VOLTAGE MULTI PHOTOCOUPLER SERIES

—NEPOC Series—

### DESCRIPTION

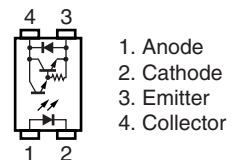
The PS2533-1 and PS2533L-1 are optically coupled isolators containing a GaAs light emitting diode and an NPN silicon darlington connected phototransistor.

The PS2533-1 is in a plastic DIP (Dual In-line Package) and the PS2533L-1 is lead bending type (Gull-wing) for surface mount.

### FEATURES

- High collector to emitter voltage ( $V_{CE0} = 350\text{ V}$ )
- High Isolation voltage ( $BV = 5\,000\text{ V r.m.s.}$ )
- High current transfer ratio ( $CTR = 4\,000\%$  TYP.)
- High-speed switching ( $t_r, t_f = 100\text{ }\mu\text{s}$  TYP.)
- <R> • Ordering number of tape product: PS2533L-1-F3: 2 000 pcs/reel
- <R> • Safety standards
  - UL approved: No. E72422
  - CSA approved: No. CA 101391 (CA5A, CAN/CSA-C22.2 60065, 60950)
  - BSI approved: No. 8221/8222
  - SEMKO approved: No. 903238
  - NEMKO approved: No. P09210868
  - DEMKO approved: No. 314999
  - FIMKO approved: No. FI 25119
  - DIN EN60747-5-2 (VDE0884 Part2) approved: No. 40008862 (Option)

### PIN CONNECTION (Top View)



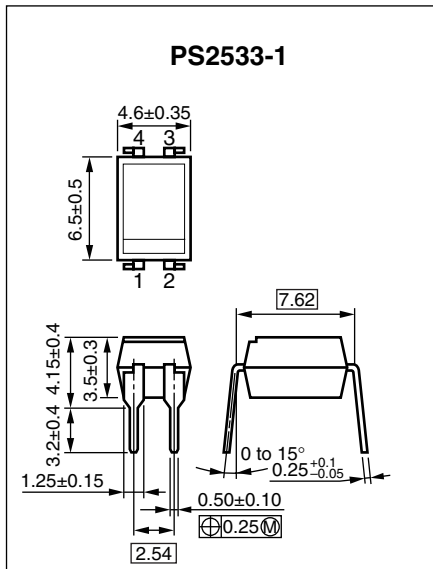
### APPLICATIONS

- Telephone, Exchange equipment
- FAX/MODEM

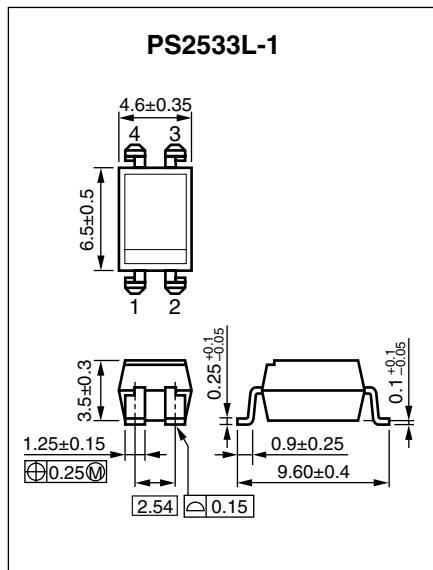
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<R> PACKAGE DIMENSIONS (Unit : mm)

DIP Type



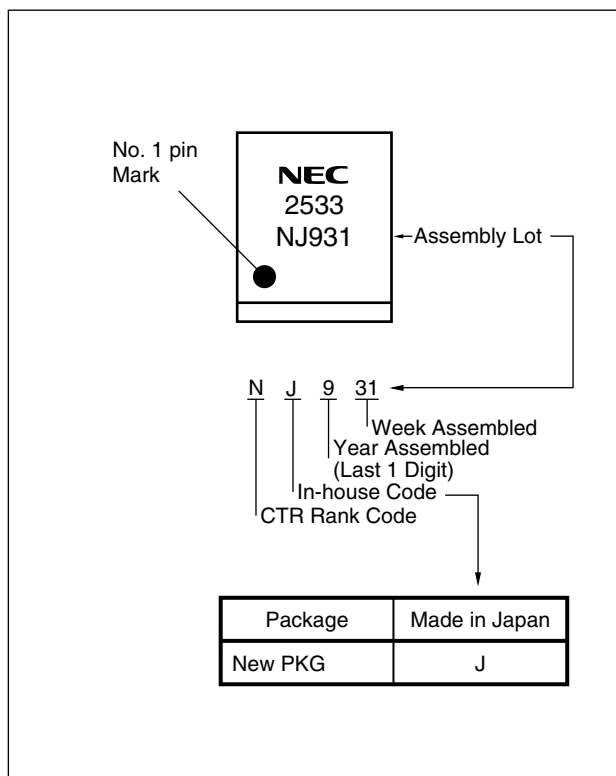
Lead Bending Type



<R> PHOTOCOUPLER CONSTRUCTION

| Parameter               | Unit (MIN.) |
|-------------------------|-------------|
| Air Distance            | 7 mm        |
| Outer Creepage Distance | 7 mm        |
| Inner Creepage Distance | 4 mm        |
| Isolation Thickness     | 0.4 mm      |

<R> MARKING EXAMPLE



<R> ORDERING INFORMATION

| Part Number    | Order Number     | Solder Plating Specification | Packing Style                | Safety Standard Approval                                                          | Application Part Number <sup>*1</sup> |
|----------------|------------------|------------------------------|------------------------------|-----------------------------------------------------------------------------------|---------------------------------------|
| PS2533-1       | PS2533-1-A       | Pb-Free                      | Magazine case 100 pcs        | Standard products<br>(UL, CSA, BSI,<br>SEMKO, NEMKO,<br>DEMKO, FIMKO<br>approved) | PS2533-1                              |
| PS2533L-1      | PS2533L-1-A      |                              |                              |                                                                                   |                                       |
| PS2533L-1-F3   | PS2533L-1-F3-A   |                              | Embossed Tape 2 000 pcs/reel |                                                                                   |                                       |
|                |                  |                              |                              |                                                                                   |                                       |
| PS2533-1-V     | PS2533-1-V-A     |                              | Magazine case 100 pcs        | DIN EN60747-5-2<br>(VDE0884 Part2)                                                |                                       |
| PS2533L-1-V    | PS2533L-1-V-A    |                              |                              |                                                                                   |                                       |
| PS2533L-1-V-F3 | PS2533L-1-V-F3-A |                              | Embossed Tape 2 000 pcs/reel | Approved (Option)                                                                 |                                       |

\*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                   |
|---------------------------------|------------------------------------|-------------------------------|-------------|------------------------|
| Diode                           | Forward Current (DC)               | $I_F$                         | 80          | mA                     |
|                                 | Reverse Voltage                    | $V_R$                         | 6           | V                      |
|                                 | Power Dissipation Derating         | $\Delta P_D/^{\circ}\text{C}$ | 1.5         | mW/ $^{\circ}\text{C}$ |
|                                 | Power Dissipation                  | $P_D$                         | 150         | mW                     |
|                                 | Peak Forward Current <sup>*1</sup> | $I_{FP}$                      | 1           | A                      |
| Transistor                      | Collector to Emitter Voltage       | $V_{CEO}$                     | 350         | V                      |
|                                 | Emitter to Collector Voltage       | $V_{ECO}$                     | 0.6         | V                      |
|                                 | Collector Current                  | $I_C$                         | 150         | mA                     |
|                                 | Power Dissipation Derating         | $\Delta P_C/^{\circ}\text{C}$ | 3.0         | mW/ $^{\circ}\text{C}$ |
|                                 | Power Dissipation                  | $P_C$                         | 300         | mW                     |
| Isolation Voltage <sup>*2</sup> |                                    | BV                            | 5 000       | Vr.m.s.                |
| Operating Ambient Temperature   |                                    | $T_A$                         | -55 to +100 | $^{\circ}\text{C}$     |
| Storage Temperature             |                                    | $T_{stg}$                     | -55 to +150 | $^{\circ}\text{C}$     |

<sup>\*1</sup> PW = 100  $\mu\text{s}$ , Duty Cycle = 1%

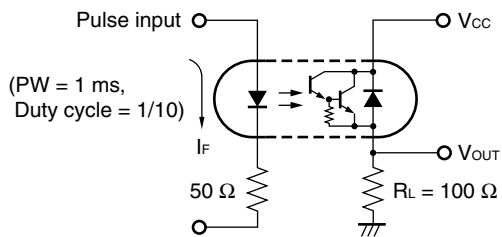
<sup>\*2</sup> AC voltage for 1 minute at  $T_A = 25^{\circ}\text{C}$ , RH = 60% between input and output.

Pins 1-2 shorted together, 3-4 shorted together.

**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)**

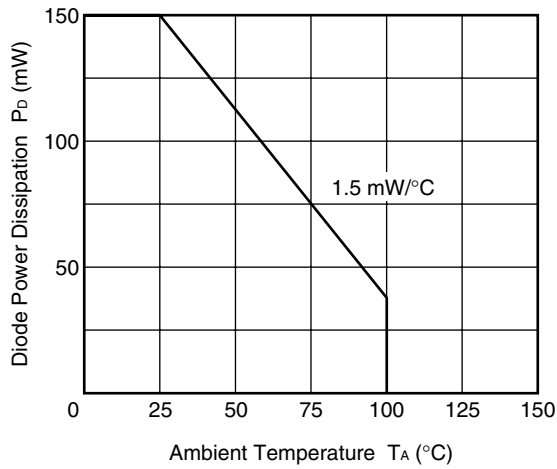
| Parameter  |                                                          | Symbol               | Conditions                                                            | MIN.             | TYP.  | MAX.  | Unit |
|------------|----------------------------------------------------------|----------------------|-----------------------------------------------------------------------|------------------|-------|-------|------|
| Diode      | Forward Voltage                                          | V <sub>F</sub>       | I <sub>F</sub> = 10 mA                                                |                  | 1.15  | 1.40  | 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                                                  |                  | 30    |       | pF   |
| Transistor | Collector to Emitter Dark Current                        | I <sub>CEO</sub>     | V <sub>CE</sub> = 350 V, I <sub>F</sub> = 0 mA                        |                  |       | 400   | nA   |
| Coupled    | Current Transfer Ratio (I <sub>c</sub> /I <sub>F</sub> ) | CTR                  | I <sub>F</sub> = 1 mA, V <sub>CE</sub> = 2 V                          | 1 500            | 4 000 | 6 500 | %    |
|            | Collector Saturation Voltage                             | V <sub>CE(sat)</sub> | I <sub>F</sub> = 1 mA, I <sub>c</sub> = 2 mA                          |                  |       | 1.0   | 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                                                  |                  | 0.6   |       | pF   |
|            | Rise Time <sup>*1</sup>                                  | t <sub>r</sub>       | V <sub>CC</sub> = 5 V, I <sub>c</sub> = 10 mA, R <sub>L</sub> = 100 Ω |                  | 100   |       | μs   |
|            | Fall Time <sup>*1</sup>                                  | t <sub>f</sub>       |                                                                       |                  | 100   |       |      |

**\*1** Test circuit for switching time

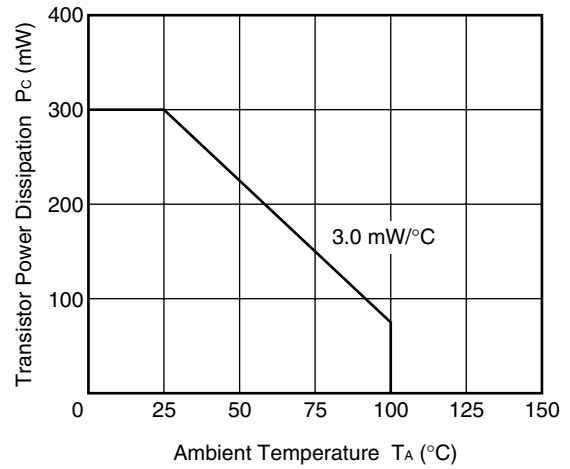


**TYPICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ , unless otherwise specified)**

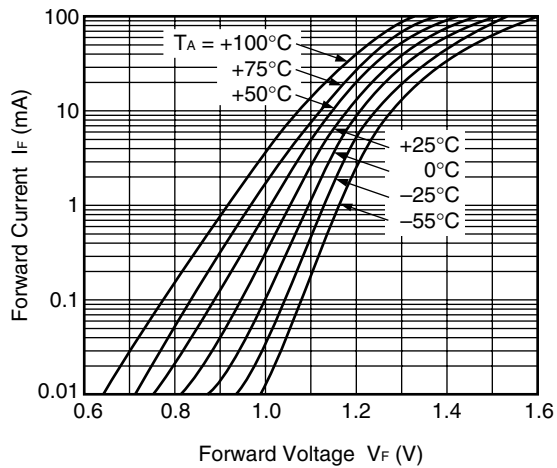
**DIODE POWER DISSIPATION vs. AMBIENT TEMPERATURE**



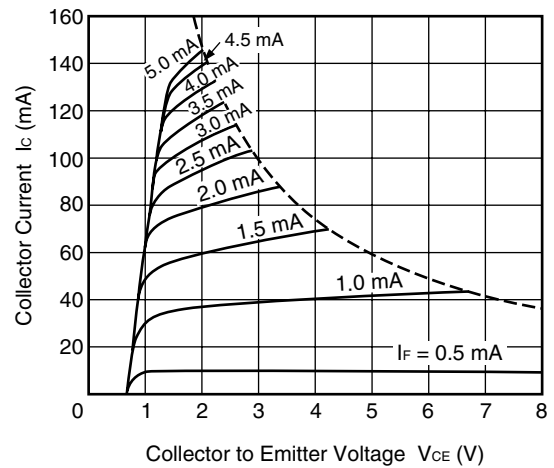
**TRANSISTOR POWER DISSIPATION vs. AMBIENT TEMPERATURE**



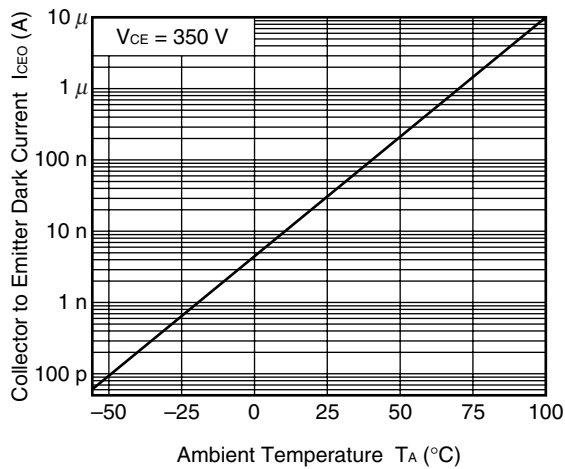
**FORWARD CURRENT vs. FORWARD VOLTAGE**



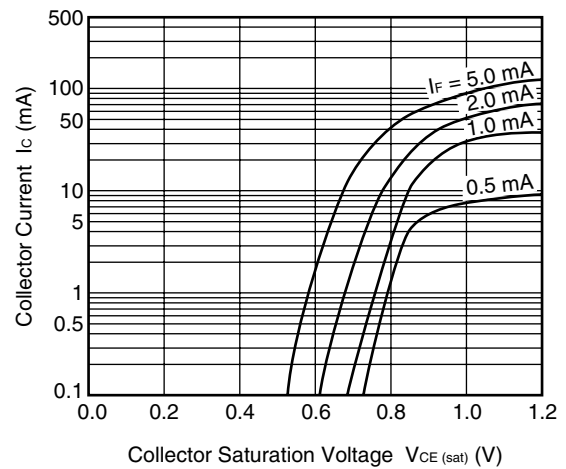
**COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE**



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

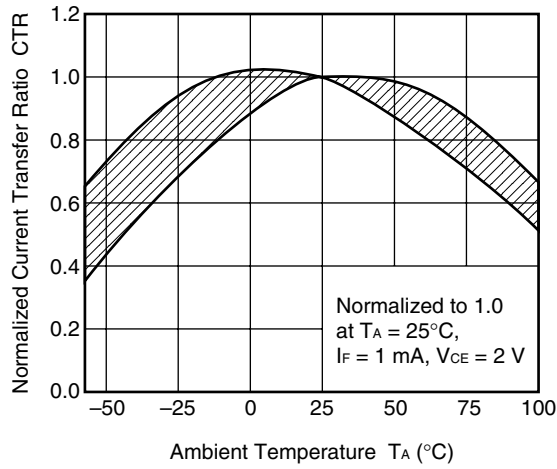


**COLLECTOR CURRENT vs. COLLECTOR SATURATION VOLTAGE**

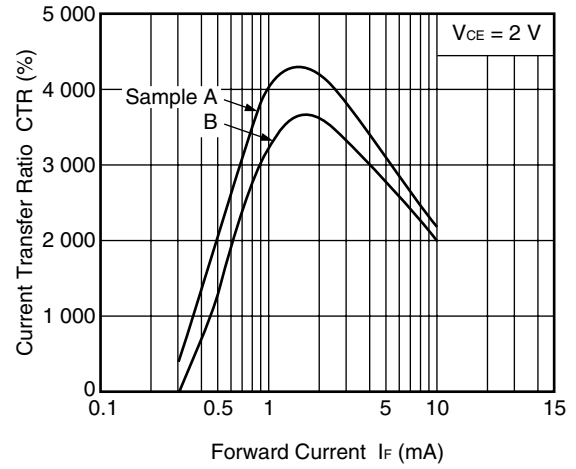


**Remark** The graphs indicate nominal characteristics.

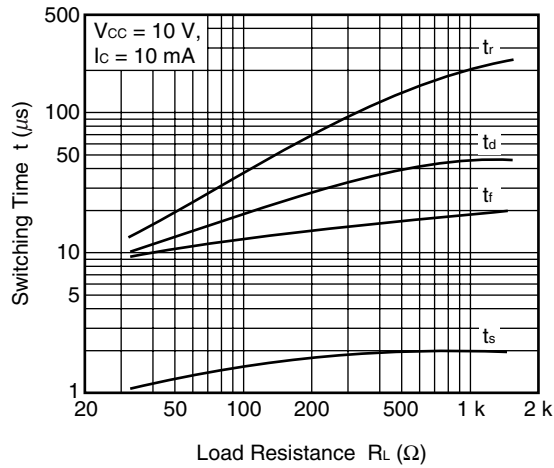
NORMALIZED CURRENT TRANSFER RATIO vs. AMBIENT TEMPERATURE



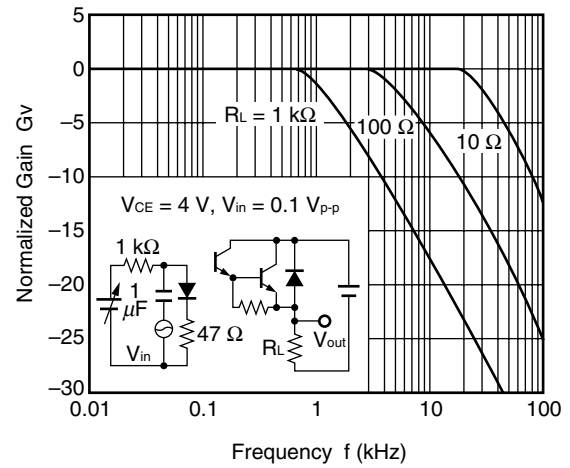
CURRENT TRANSFER RATIO vs. FORWARD CURRENT



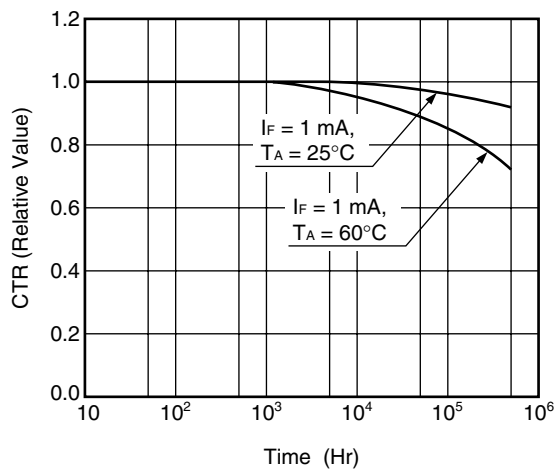
SWITCHING TIME vs. LOAD RESISTANCE



FREQUENCY RESPONSE



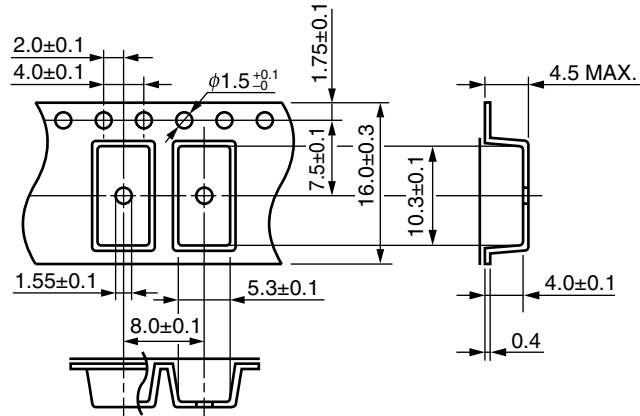
LONG TERM CTR DEGRADATION



**Remark** The graphs indicate nominal characteristics.

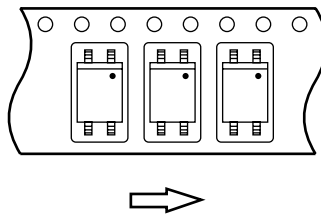
<R> TAPING SPECIFICATIONS (Unit : mm)

Outline and Dimensions (Tape)

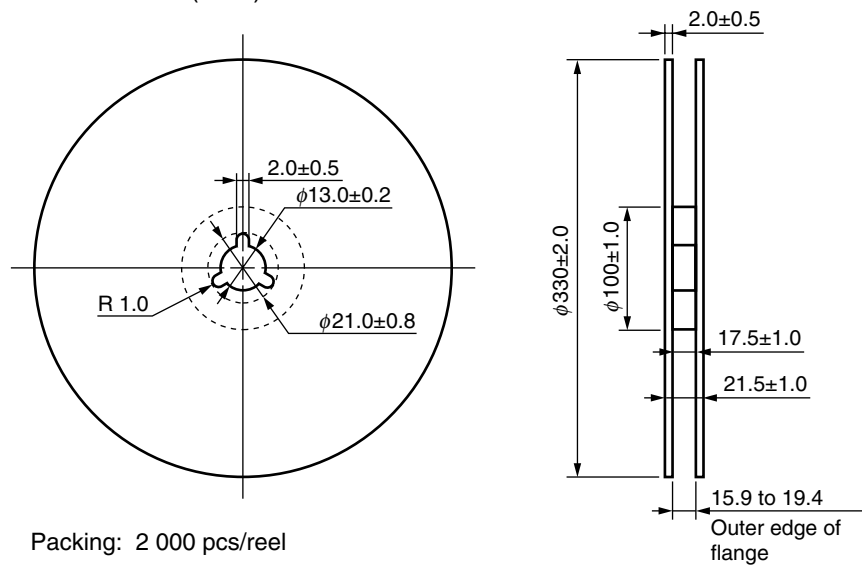


Tape Direction

PS2533L-1-F3



Outline and Dimensions (Reel)



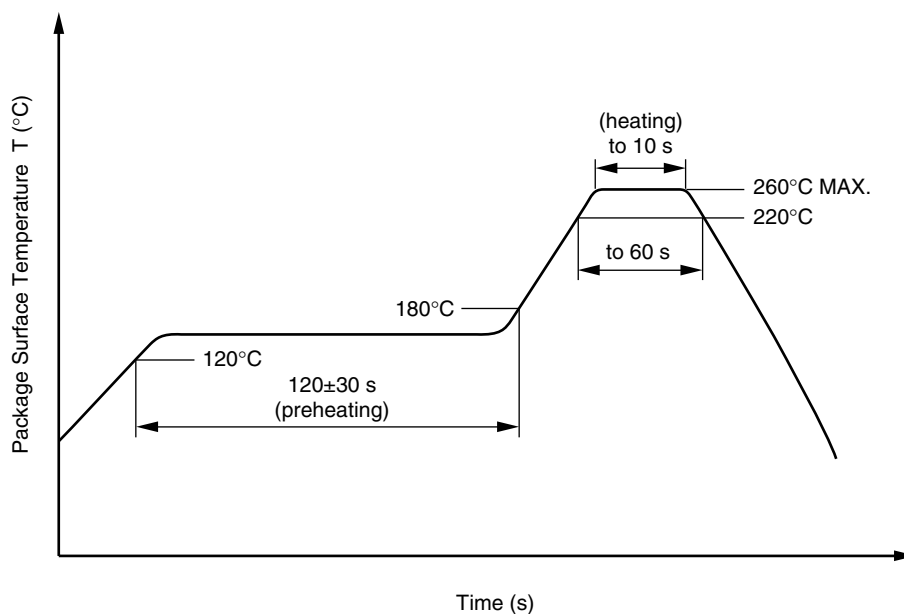
## NOTES ON HANDLING

### 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. 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.

<R> SPECIFICATION OF VDE MARKS LICENSE DOCUMENT (VDE0884)

| Parameter                                                                                                                                                                                                                                                                                               | Symbol                                            | Spec                        | Unit                       |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|-----------------------------|----------------------------|
| Climatic test class (IEC 60068-1/DIN EN 60068-1)                                                                                                                                                                                                                                                        |                                                   | 55/100/21                   |                            |
| Dielectric strength<br>maximum operating isolation voltage<br>Test voltage (partial discharge test, procedure a for type test and random test)<br>$U_{pr} = 1.5 \times U_{IORM}$ , $P_d < 5$ pC                                                                                                         | $U_{IORM}$<br>$U_{pr}$                            | 890<br>1 335                | $V_{peak}$<br>$V_{peak}$   |
| Test voltage (partial discharge test, procedure b for all devices test)<br>$U_{pr} = 1.875 \times U_{IORM}$ , $P_d < 5$ pC                                                                                                                                                                              | $U_{pr}$                                          | 1 669                       | $V_{peak}$                 |
| Highest permissible overvoltage                                                                                                                                                                                                                                                                         | $U_{TR}$                                          | 8 000                       | $V_{peak}$                 |
| 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>$V_{IO} = 500$ V dc at $T_A = 25^\circ\text{C}$<br>$V_{IO} = 500$ V dc at $T_A$ MAX. at least $100^\circ\text{C}$                                                                                                                                                | $R_{is}$ MIN.<br>$R_{is}$ MIN.                    | $10^{12}$<br>$10^{11}$      | $\Omega$<br>$\Omega$       |
| Safety maximum ratings (maximum permissible in case of fault, see thermal derating curve)<br>Package temperature<br>Current (input current $I_F$ , $P_{si} = 0$ )<br>Power (output or total power dissipation)<br>Isolation resistance<br>$V_{IO} = 500$ V dc at $T_A = 175^\circ\text{C}$ ( $T_{si}$ ) | $T_{si}$<br>$I_{si}$<br>$P_{si}$<br>$R_{is}$ MIN. | 175<br>400<br>700<br>$10^9$ | °C<br>mA<br>mW<br>$\Omega$ |

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|----------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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|----------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

To our customers,

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## Old Company Name in Catalogs and Other Documents

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April 1<sup>st</sup>, 2010  
Renesas Electronics Corporation

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