To our customers,

## Old Company Name in Catalogs and Other Documents

On April 1st, 2010, NEC Electronics Corporation merged with Renesas Technology Corporation, and Renesas Electronics Corporation took over all the business of both companies. Therefore, although the old company name remains in this document, it is a valid Renesas Electronics document. We appreciate your understanding.

Renesas Electronics website: http://www.renesas.com

April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (http://www.renesas.com)

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RENESAS

DATA SHEET

# PHOTOCOUPLER

# PS2561-1,PS2561L-1,PS2561L1-1,PS2561L2-1

## HIGH ISOLATION VOLTAGE SINGLE TRANSISTOR TYPE MULTI PHOTOCOUPLER SERIES

–NEPOC Series–

### DESCRIPTION

The PS2561-1 is optically coupled isolators containing a GaAs light emitting diode and an NPN silicon phototransistor.

The PS2561-1 is in a plastic DIP (Dual In-line Package) and the PS2561L-1 is lead bending type (Gull-wing) for surface mount.

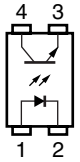
The PS2561L1-1 is lead bending type for long creepage distance.

The PS2561L2-1 is lead bending type for long creepage distance (Gull-wing) for surface mount.

### FEATURES

- High Isolation voltage (BV = 5 000 Vr.m.s.)
- High collector to emitter voltage ($V_{CEO}$ = 80 V)
- High current transfer ratio (CTR = 200% TYP.)
- High-speed switching ($t_r$ = 3 $\mu$s TYP., $t_f$ = 5 $\mu$s TYP.)
- Ordering number of taping product: PS2561L-1-E3, E4, F3, F4, PS2561L2-1-E3, E4
- Safety standards
  - UL approved: No. E72422
  - CSA approved: No. CA 101391
  - BSI approved: No. 7112/7420
  - SEMKO approved: No. 303059, 307244
  - NEMKO approved: No. P03200272, P03200747
  - DEMKO approved: No. 312341, 312340
  - FIMKO approved: No. FI 10620, FI 11898
- <R> DIN EN60747-5-2 (VDE0884 Part2) approved: No. 40008862 (Option)

**PIN CONNECTION**
(Top View)




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

### APPLICATIONS

- Power supply
- Telephone/FAX.
- FA/OA equipment
- Programmable logic controller

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Date Published December 2008 NS
Printed in Japan

The mark <R> shows major revised points.

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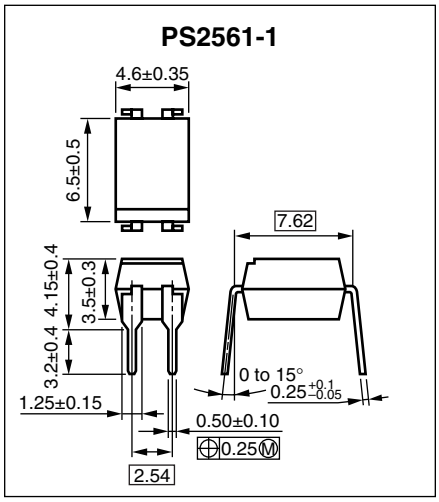
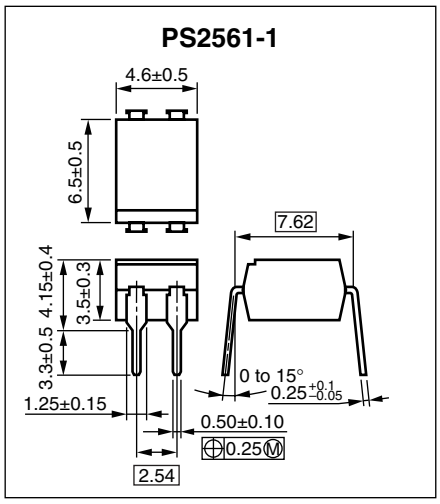
The revised points can be easily searched by copying an "<R>" in the PDF file and specifying it in the "Find what:" field.

## PACKAGE DIMENSIONS (UNIT : mm)

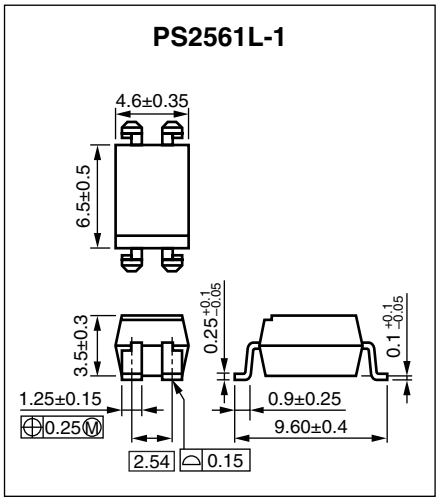
### DIP Type (New package)



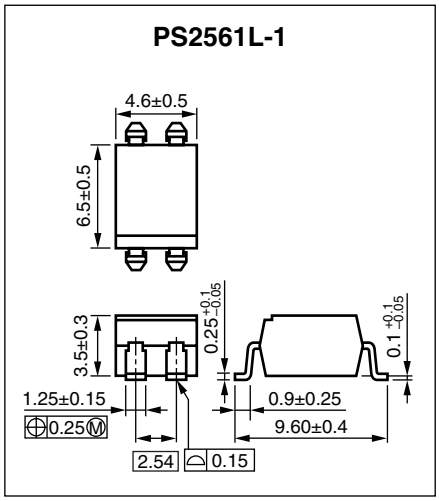

### DIP Type



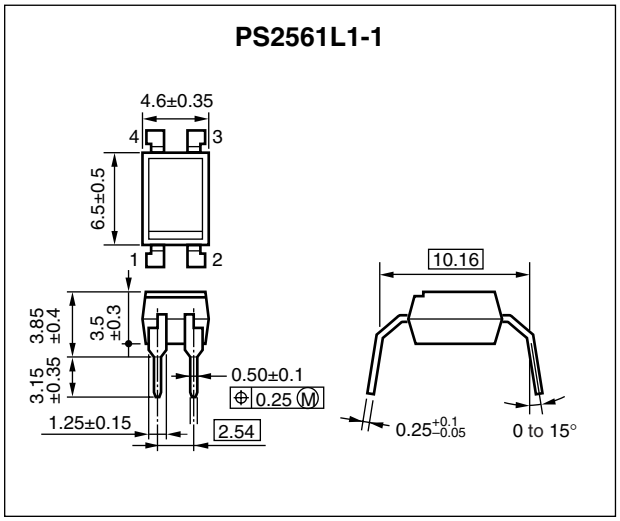
**Lead Bending Type (New package)**



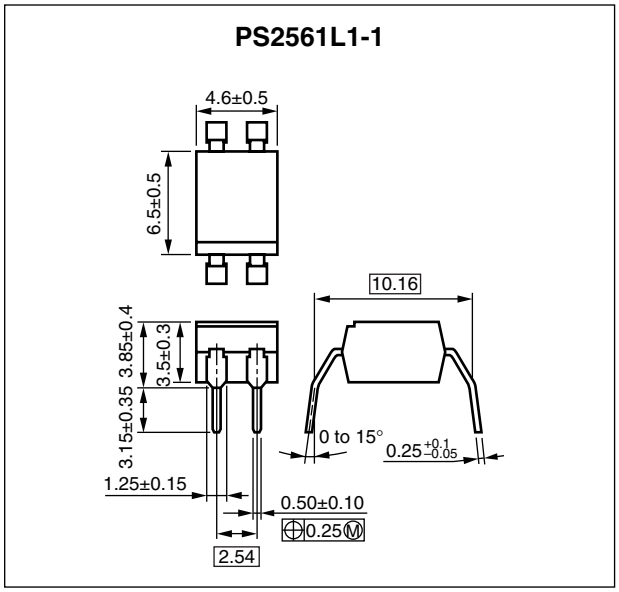

**Lead Bending Type**



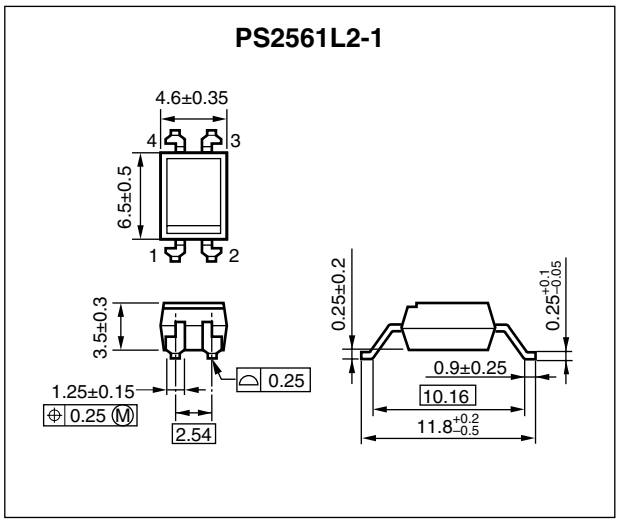
### Lead Bending Type For Long Creepage Distance (New Package)



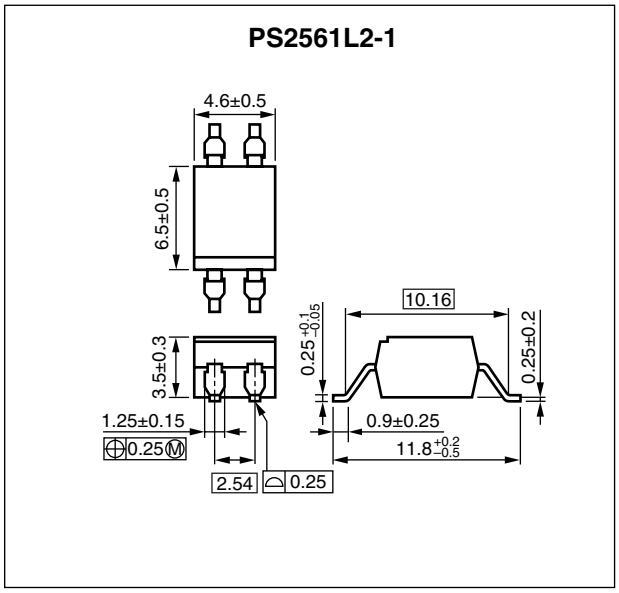

### Lead Bending Type For Long Creepage Distance



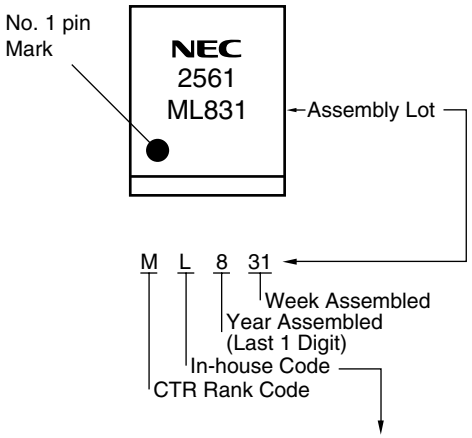
**Lead Bending Type For Long Creepage Distance (Gull-Wing) (New Package)**




**Lead Bending Type For Long Creepage Distance (Gull-Wing)**



<R> **MARKING EXAMPLE**




| | Package | Made in Japan | Made in Taiwan |
|---|---|---|---|
| Pb-Free | Standard PKG | L | N |
| Pb-Free | New PKG | J | K |
| Pb-Free and Halogen Free *1 | New PKG | R | Y |

***1*** Special version

## <R> ORDERING INFORMATION

| Part Number | Order Number | Solder Plating Specification | Packing Style | Safety Standard Approval | Application Part Number *1 |
|---|---|---|---|---|---|
| PS2561-1 | PS2561-1-A | Pb-Free | Magazine case 100 pcs | Standard products (UL, CSA, BSI, NEMKO, SEMKO, DEMKO, FIMKO approved) | PS2561-1 |
| PS2561L-1 | PS2561L-1-A | | | | |
| PS2561L1-1 | PS2561L1-1-A | | | | |
| PS2561L2-1 | PS2561L2-1-A | | | | |
| PS2561L-1-E3 | PS2561L-1-E3-A | | Embossed Tape 1 000 pcs/reel | | |
| PS2561L-1-E4 | PS2561L-1-E4-A | | | | |
| PS2561L-1-F3 | PS2561L-1-F3-A | | Embossed Tape 2 000 pcs/reel | | |
| PS2561L-1-F4 | PS2561L-1-F4-A | | | | |
| PS2561L2-1-E3 | PS2561L2-1-E3-A | | Embossed Tape 1 000 pcs/reel | | |
| PS2561L2-1-E4 | PS2561L2-1-E4-A | | | | |
| PS2561-1-V | PS2561-1-V-A | | Magazine case 100 pcs | DIN EN60747-5-2 (VDE0884 Part2) approved products (Option) | |
| PS2561L-1-V | PS2561L-1-V-A | | | | |
| PS2561L1-1-V | PS2561L1-1-V-A | | | | |
| PS2561L2-1-V | PS2561L2-1-V-A | | | | |
| PS2561L-1-V-E3 | PS2561L-1-V-E3-A | | Embossed Tape 1 000 pcs/reel | | |
| PS2561L-1-V-E4 | PS2561L-1-V-E4-A | | | | |
| PS2561L-1-V-F3 | PS2561L-1-V-F3-A | | Embossed Tape 2 000 pcs/reel | | |
| PS2561L-1-V-F4 | PS2561L-1-V-F4-A | | | | |
| PS2561L2-1-V-E3 | PS2561L2-1-V-E3-A | | Embossed Tape 1 000 pcs/reel | | |
| PS2561L2-1-V-E4 | PS2561L2-1-V-E4-A | | | | |
| PS2561-1 | PS2561-1Y-A | Special version (Pb-Free and Halogen Free) | Magazine case 100 pcs | Standard products (UL, CSA, BSI, NEMKO, SEMKO, DEMKO, FIMKO approved) | PS2561-1 |
| PS2561L-1 | PS2561L-1Y-A | | | | |
| PS2561L1-1 | PS2561L1-1Y-A | | | | |
| PS2561L2-1 | PS2561L2-1Y-A | | | | |
| PS2561L-1-F3 | PS2561L-1Y-F3-A | | Embossed Tape 2 000 pcs/reel | | |
| PS2561L2-1-E3 | PS2561L2-1Y-E3-A | | Embossed Tape 1 000 pcs/reel | | |
| PS2561-1-V | PS2561-1Y-V-A | | Magazine case 100 pcs | DIN EN60747-5-2 (VDE0884 Part2) approved products (Option) | |
| PS2561L-1-V | PS2561L-1Y-V-A | | | | |
| PS2561L1-1-V | PS2561L1-1Y-V-A | | | | |
| PS2561L2-1-V | PS2561L2-1Y-V-A | | | | |
| PS2561L-1-V-F3 | PS2561L-1Y-V-F3-A | | Embossed Tape 2 000 pcs/reel | | |
| PS2561L2-1-V-E3 | PS2561L2-1Y-V-E3-A | | Embossed Tape 1 000 pcs/reel | | |

***1** For the application of the Safety Standard, following part number should be used.

## ABSOLUTE MAXIMUM RATINGS ($T_A$ = 25°C, unless otherwise specified)

| Parameter | | Symbol | Ratings | Unit |
|---|---|---|---|---|
| Diode | Reverse Voltage | $V_R$ | 6 | V |
| | Forward Current (DC) | $I_F$ | 80 | mA |
| | Power Dissipation Derating | $\Delta P_D$/°C | 1.5 | mW/°C |
| | Power Dissipation | $P_D$ | 150 | mW |
| | Peak Forward Current*1 | $I_{FP}$ | 1 | A |
| Transistor | Collector to Emitter Voltage | $V_{CEO}$ | 80 | V |
| | Emitter to Collector Voltage | $V_{ECO}$ | 7 | V |
| | Collector Current | $I_C$ | 50 | mA |
| | Power Dissipation Derating | $\Delta P_C$/°C | 1.5 | mW/°C |
| | Power Dissipation | $P_C$ | 150 | mW |
| Isolation Voltage*2 | | BV | 5 000 | Vr.m.s. |
| Operating Ambient Temperature | | $T_A$ | –55 to +100 | °C |
| Storage Temperature | | $T_{stg}$ | –55 to +150 | °C |

***1** PW = 100 $\mu$s, Duty Cycle = 1%

***2** AC voltage for 1 minute at $T_A$ = 25°C, RH = 60% between input and output
Pins 1-2 shorted together, 3-4 shorted together.

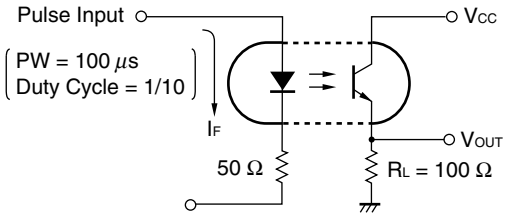
## ELECTRICAL CHARACTERISTICS ($T_A$ = 25°C)

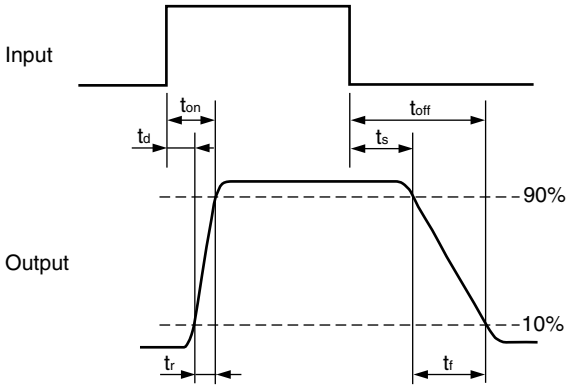
| Parameter | | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|---|---|
| Diode | Forward Voltage | $V_F$ | $I_F$ = 10 mA | | 1.17 | 1.4 | V |
| | Reverse Current | $I_R$ | $V_R$ = 5 V | | | 5 | μA |
| | Terminal Capacitance | $C_t$ | V = 0 V, f = 1.0 MHz | | 50 | | pF |
| Transistor | Collector to Emitter Dark Current | $I_{CEO}$ | $V_{CE}$ = 80 V, $I_F$ = 0 mA | | | 100 | nA |
| Coupled | Current Transfer Ratio ($I_C/I_F$)*1 | CTR | $I_F$ = 5 mA, $V_{CE}$ = 5 V | 80 | 200 | 400 | % |
| | Collector Saturation Voltage | $V_{CE (sat)}$ | $I_F$ = 10 mA, $I_C$ = 2 mA | | | 0.3 | V |
| | Isolation Resistance | $R_{I-O}$ | $V_{I-O}$ = 1.0 $kV_{DC}$ | $10^{11}$ | | | Ω |
| | Isolation Capacitance | $C_{I-O}$ | V = 0 V, f = 1.0 MHz | | 0.5 | | pF |
| | Rise Time*2 | $t_r$ | $V_{CC}$ = 10 V, $I_C$ = 2 mA, $R_L$ = 100 Ω | | 3 | | μs |
| | Fall Time*2 | $t_f$ | | | 5 | | |

***1** CTR rank

L : 200 to 400 (%)
M : 80 to 240 (%)
D : 100 to 300 (%)
H : 80 to 160 (%)
W : 130 to 260 (%)

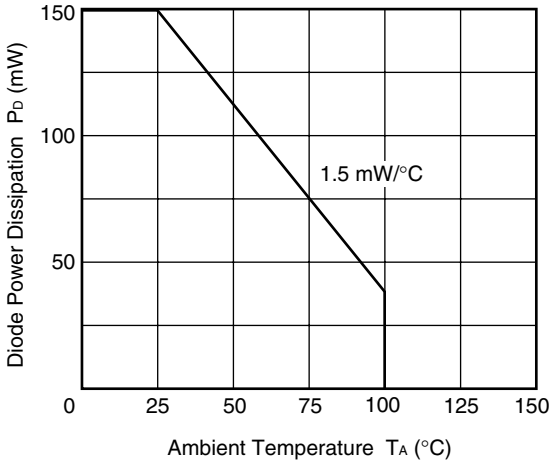
<R> ***2** Test circuit for switching time



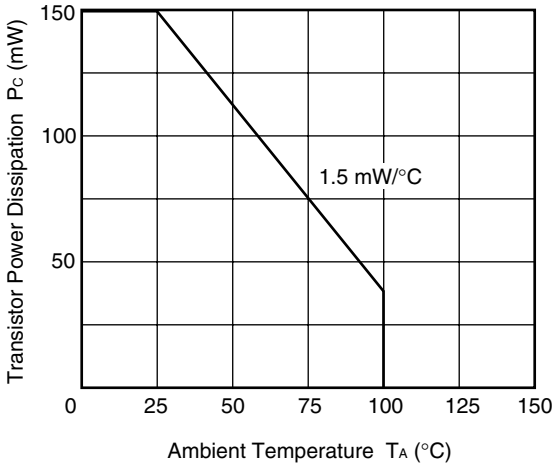



**TYPICAL CHARACTERISTICS ($T_A$ = 25°C, unless otherwise specified)**

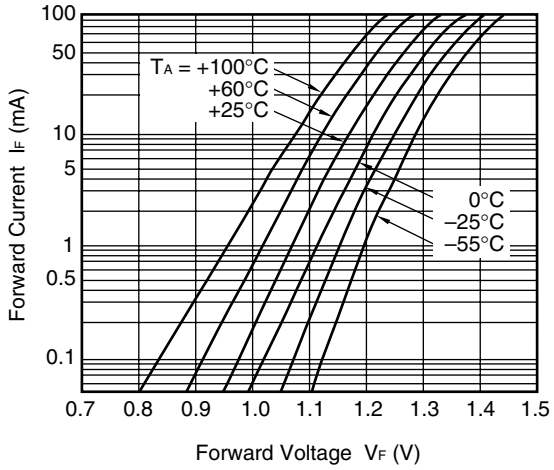
DIODE POWER DISSIPATION vs. AMBIENT TEMPERATURE



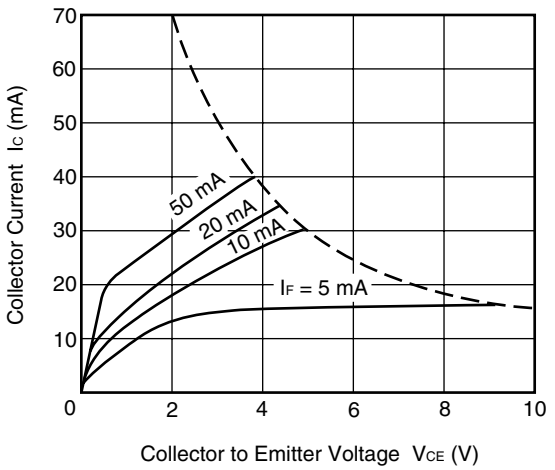

TRANSISTOR POWER DISSIPATION vs. AMBIENT TEMPERATURE



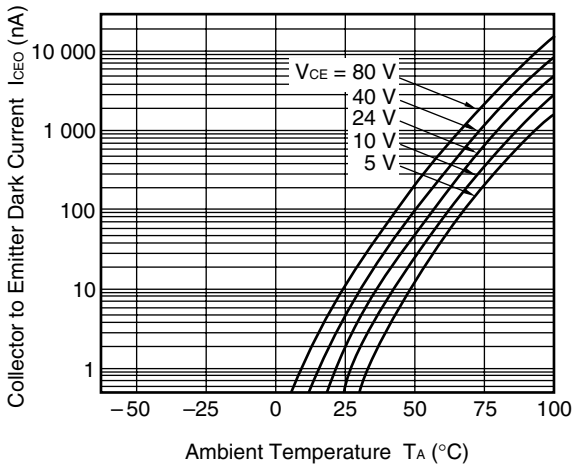

FORWARD CURRENT vs. FORWARD VOLTAGE



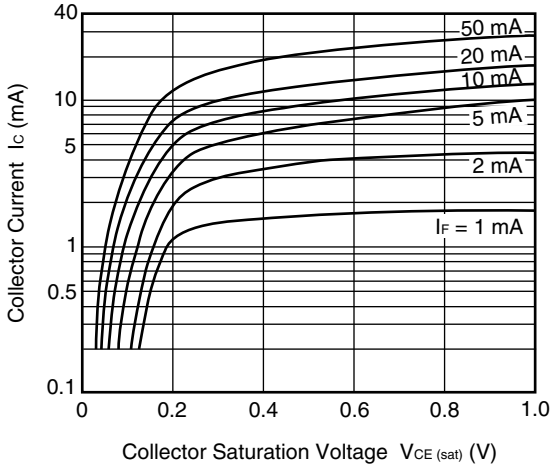

COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE




COLLECTOR TO EMITTER DARK CURRENT vs. AMBIENT TEMPERATURE

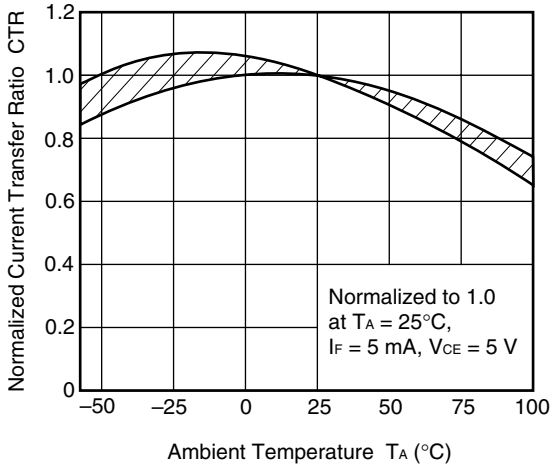



COLLECTOR CURRENT vs. COLLECTOR SATURATION VOLTAGE

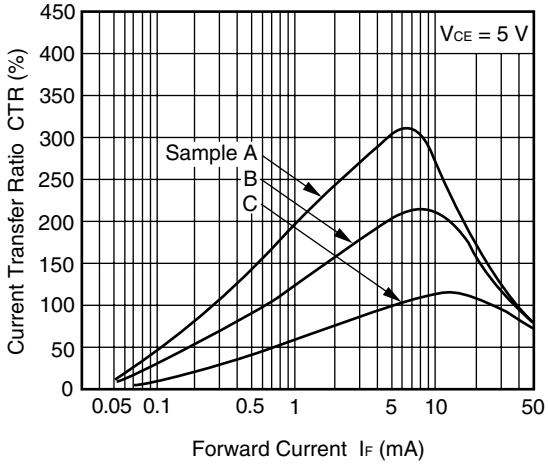



**Remark** The graphs indicate nominal characteristics.

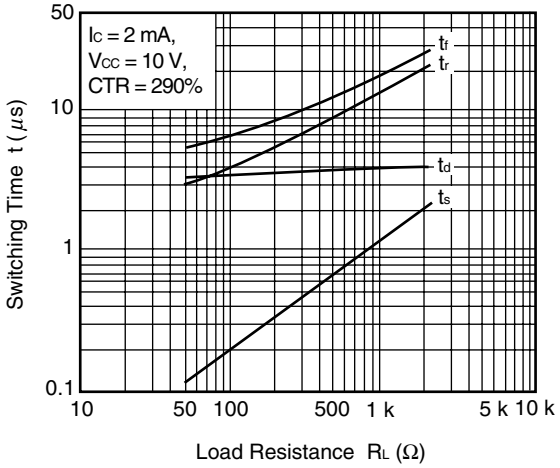
NORMALIZED CURRENT TRANSFER RATIO vs. AMBIENT TEMPERATURE



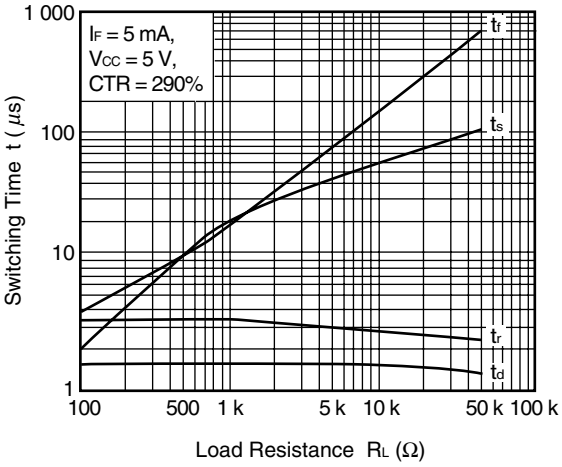

CURRENT TRANSFER RATIO vs. FORWARD CURRENT



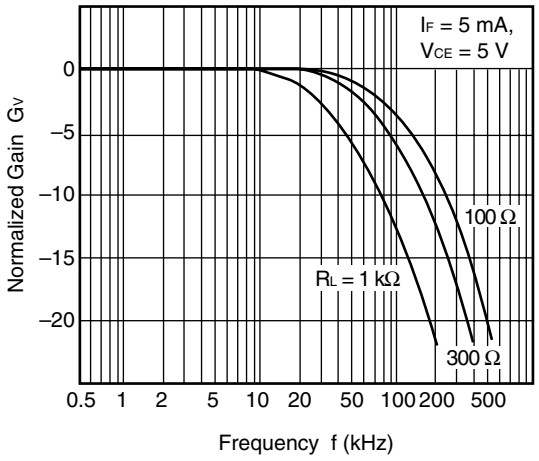

SWITCHING TIME vs. LOAD RESISTANCE



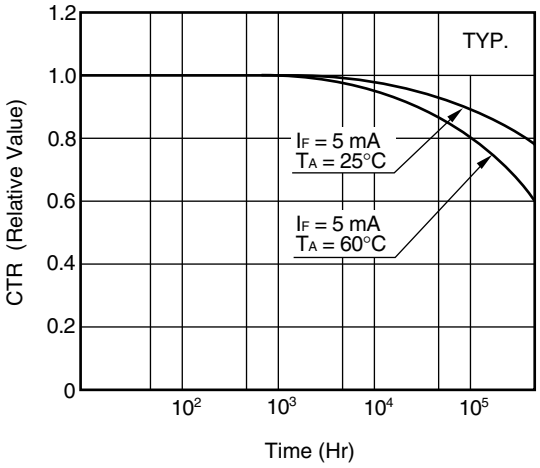

SWITCHING TIME vs. LOAD RESISTANCE




FREQUENCY RESPONSE



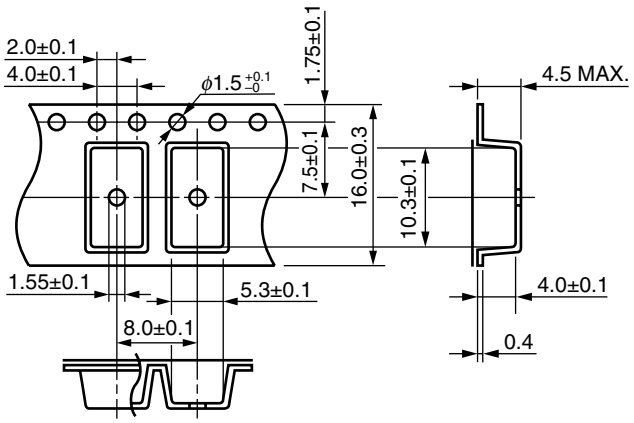

LONG TERM CTR DEGRADATION



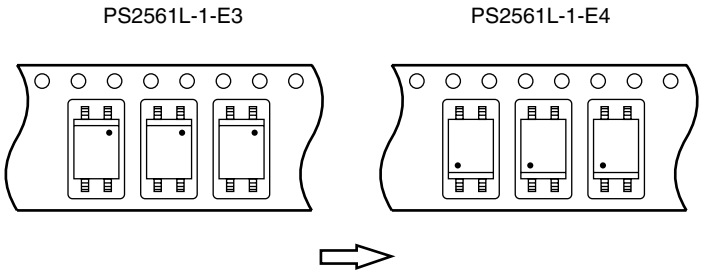

**Remark** The graphs indicate nominal characteristics.

**TAPING SPECIFICATIONS (UNIT : mm)**

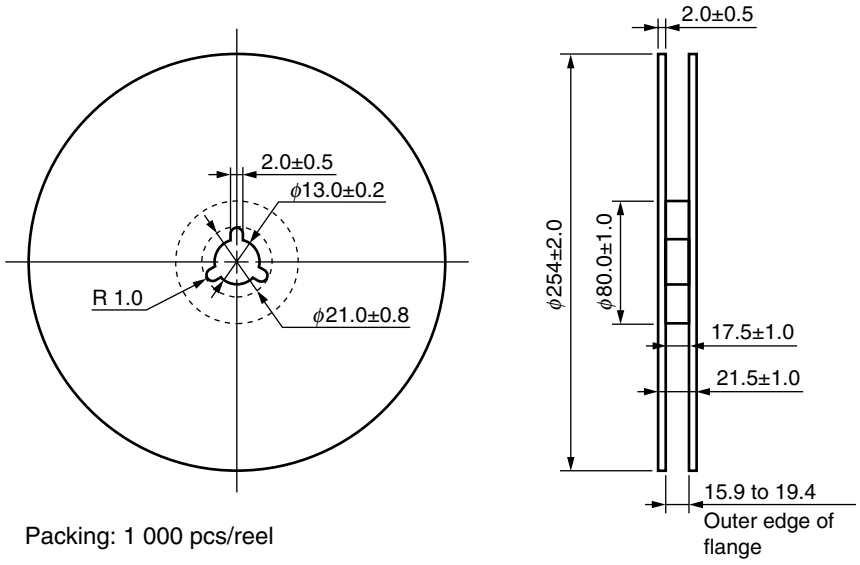
Outline and Dimensions (Tape)




Tape Direction

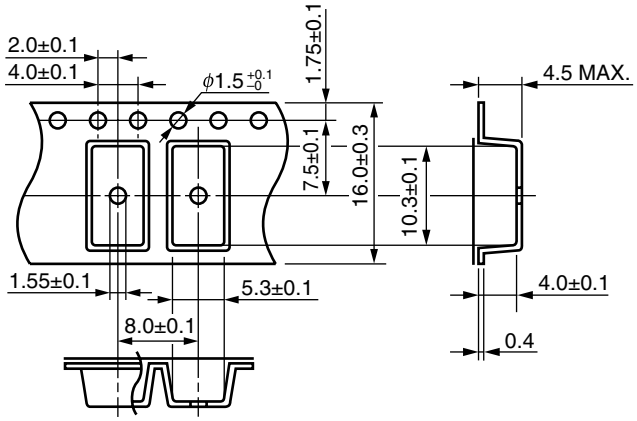



Outline and Dimensions (Reel)




Packing: 1 000 pcs/reel

Outline and Dimensions (Tape)

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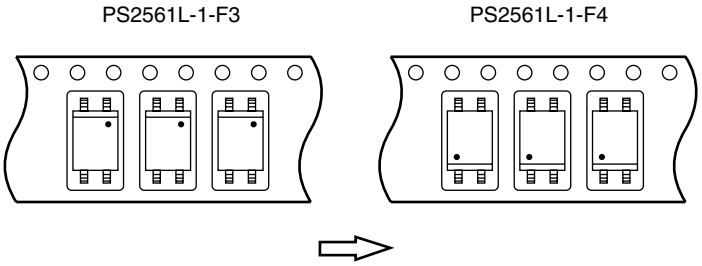
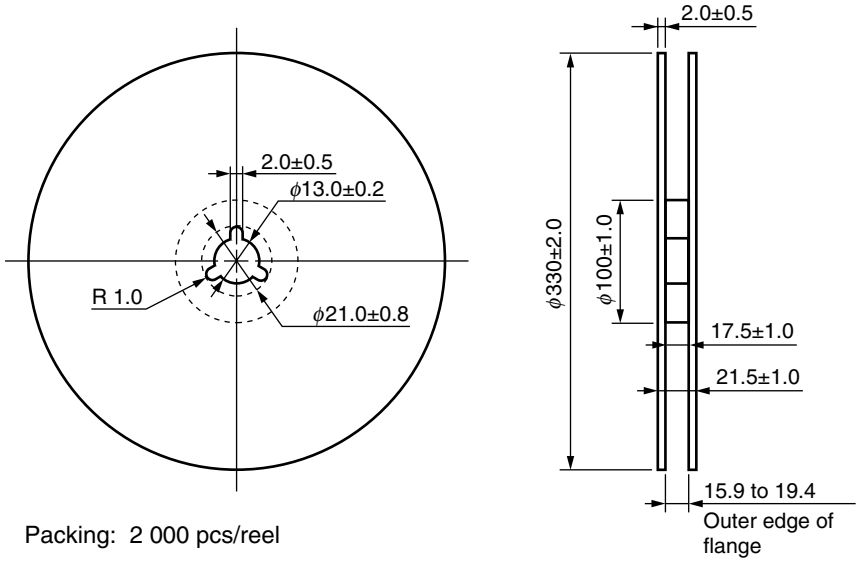
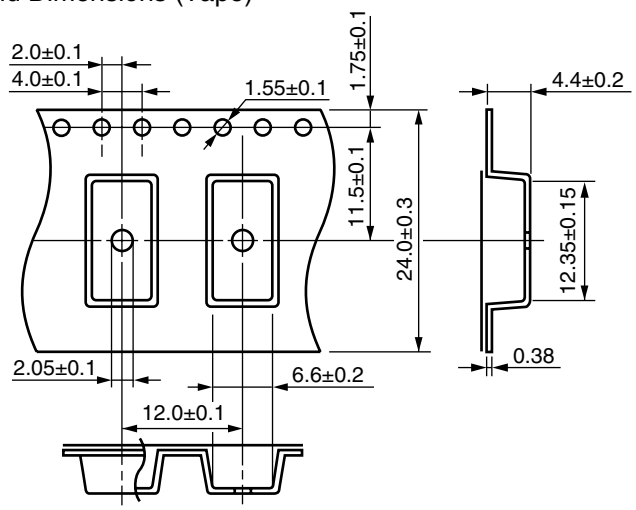



Outline and Dimensions (Reel)

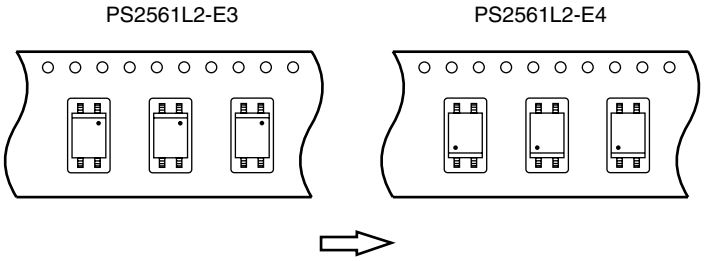



Packing: 2 000 pcs/reel

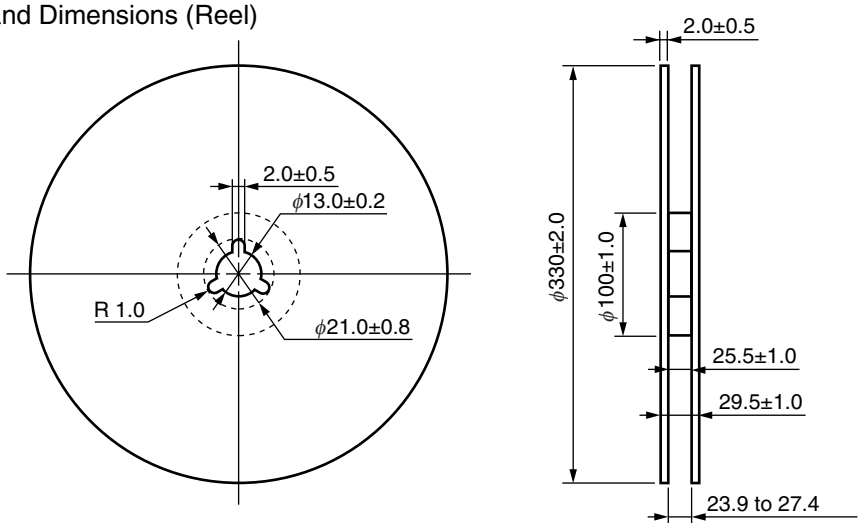
Outline and Dimensions (Tape)




Tape Direction




Outline and Dimensions (Reel)




Packing: 1 000 pcs/reel

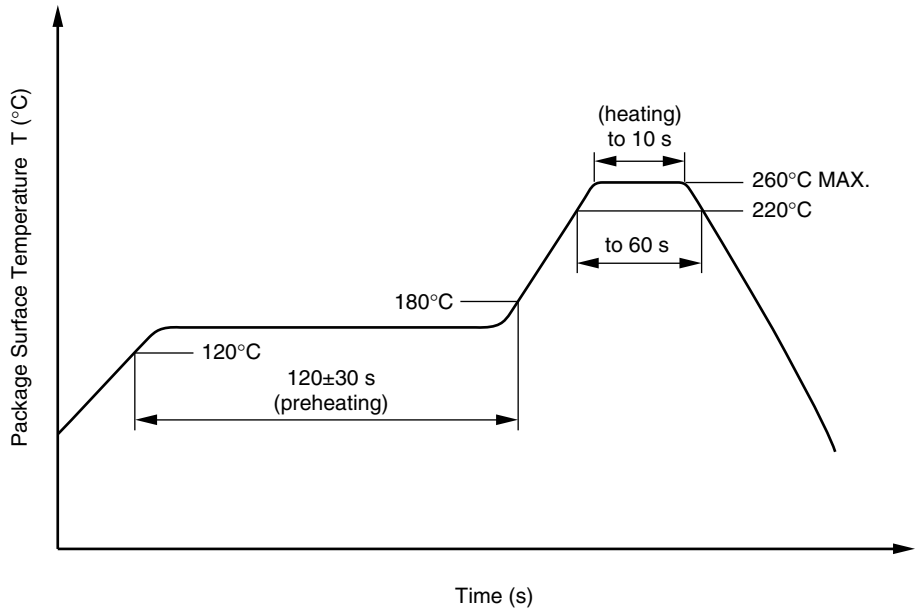
## NOTES ON HANDLING

### 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.

## <R> 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<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 | <br>$U_{IORM}$<br>$U_{pr}$ | <br>890<br>1 335 | <br>$V_{peak}$<br>$V_{peak}$ |
| Test voltage (partial discharge test, procedure b for all devices)<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 | |
| Clearance distance | | >7.0 | mm |
| Creepage distance | | >7.0 | mm |
| 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°C<br>$V_{IO}$ = 500 V dc at $T_A$ MAX. at least 100°C | <br>Ris MIN.<br>Ris MIN. | <br>$10^{12}$<br>$10^{11}$ | <br>Ω<br>Ω |
| Safety maximum ratings (maximum permissible in case of fault, see thermal derating curve)<br>Package temperature<br>Current (input current $I_F$, Psi = 0)<br>Power (output or total power dissipation)<br>Isolation resistance<br>$V_{IO}$ = 500 V dc at $T_A$ = Tsi | <br>Tsi<br>Isi<br>Psi<br><br>Ris MIN. | <br>175<br>400<br>700<br><br>$10^{9}$ | <br>°C<br>mA<br>mW<br><br>Ω |

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