

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

–NEPOC Series–

**DESCRIPTION**

The PS2533-1, -2, -4 and PS2533L-1, -2, -4 are optically coupled isolators containing a GaAs light emitting diode and an NPN silicon darlington connected phototransistor.

The PS2533-1, -2, -4 are in a plastic DIP (Dual In-line Package) and the PS2533L-1, -2, -4 are lead bending type (Gull-wing) for surface mount.

**FEATURES**

- High collector to emitter voltage ( $V_{CEO} = 350\text{ V}$ )
- High Isolation voltage ( $BV = 5\,000\text{ V r.m.s.}$ )
- High current transfer ratio ( $CTR = 4\,000\% \text{ TYP.}$ )
- High-speed switching ( $t_r, t_f = 100\text{ }\mu\text{s TYP.}$ )
- Ordering number of tape product: PS2533L-1-E3, E4, F3, F4, PS2533L-2-E3, E4
- Safety standards
  - UL approved: File No. E72422 (S)
  - BSI approved: No. 8221/8222
  - CSA approved: No. CA 101391
  - NEMKO approved: No. P98101708
  - SEMKO approved: No. 9824187/01-02
  - DEMKO approved: No. 307863
  - FIMKO approved: No. F1 11397
  - VDE0884 approved (Option)

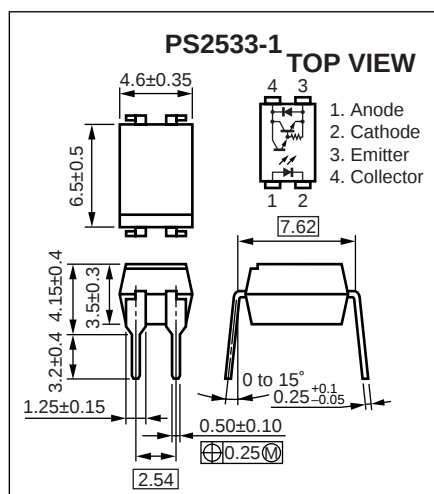
**APPLICATIONS**

- Telephone, Exchange equipment
- FAX/MODEM

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Not all devices/types available in every country. Please check with local NEC Compound Semiconductor Devices representative for availability and additional information.

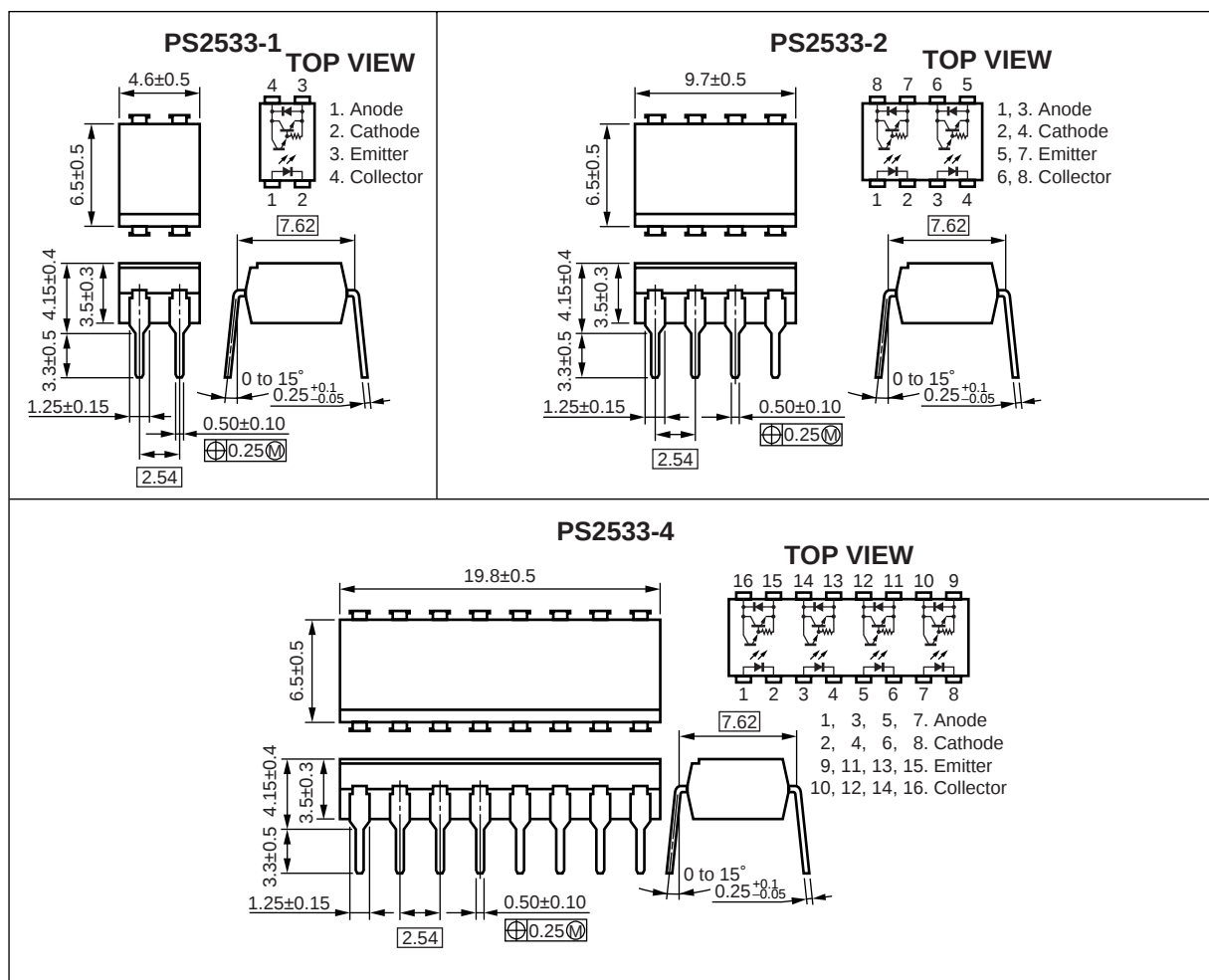
★ PACKAGE DIMENSIONS (Unit : mm)

DIP Type (New package)

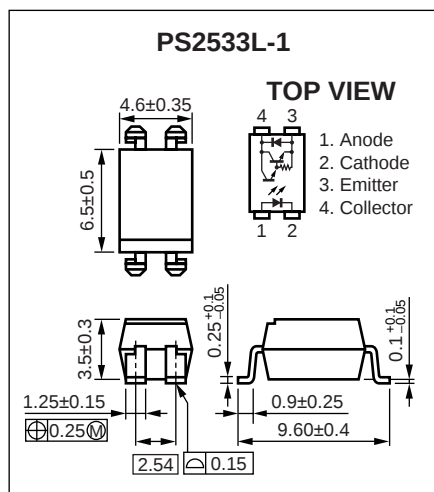


Caution New package 1-ch only

DIP Type

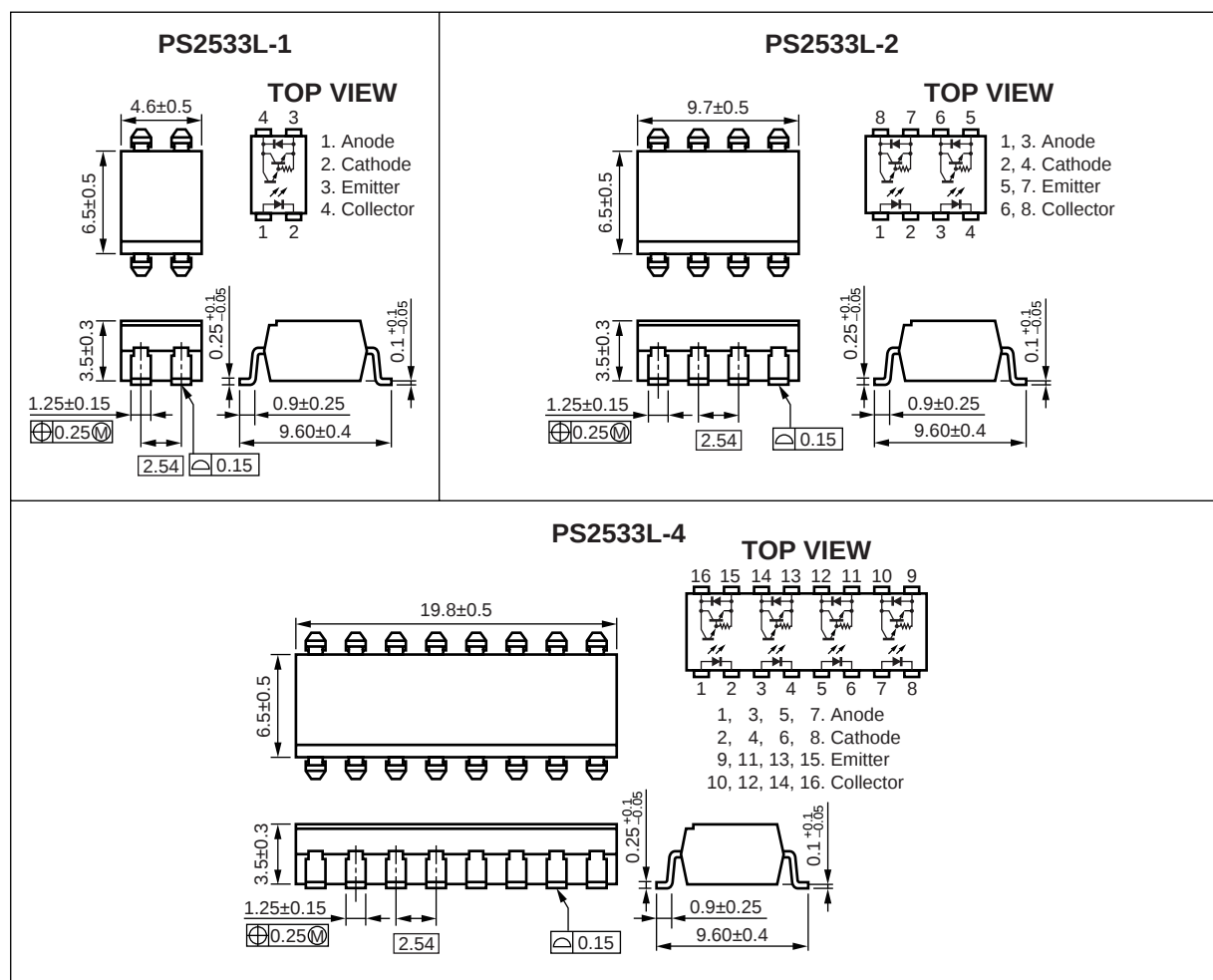


Lead Bending Type (New package)

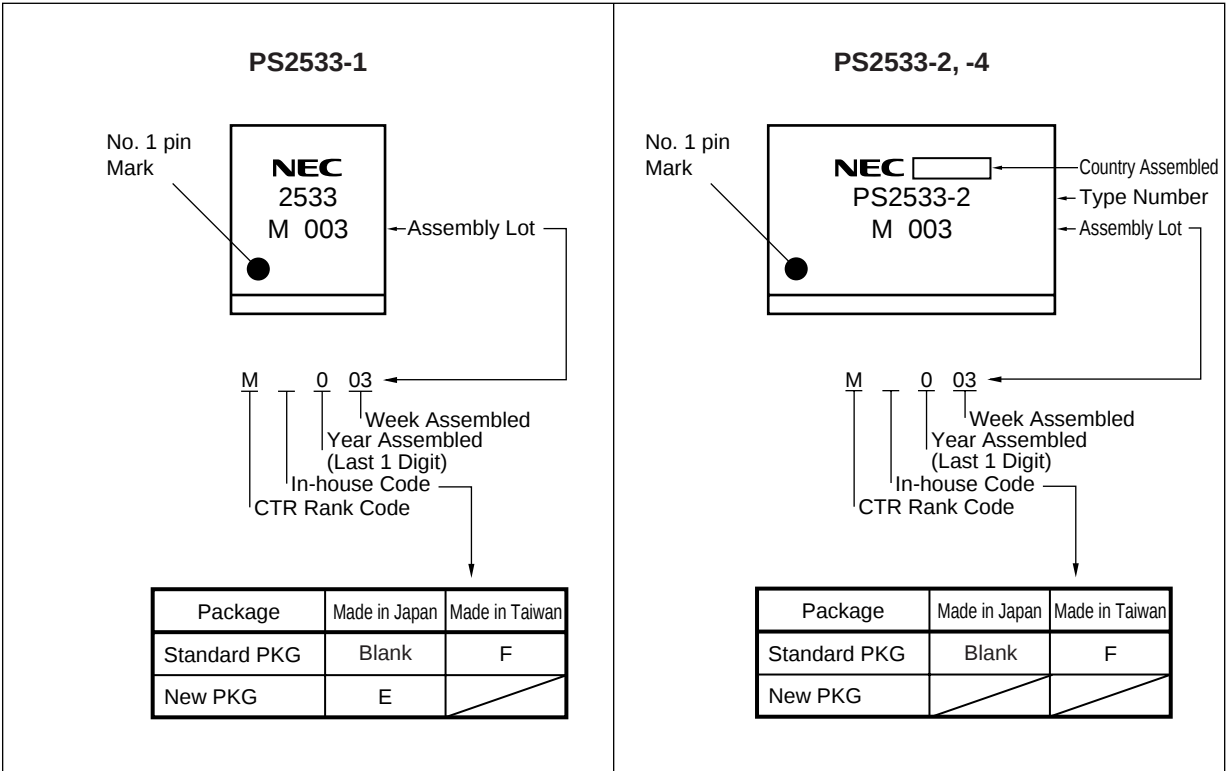


Caution New package 1-ch only

Lead Bending Type



MARKING EXAMPLE



ORDERING INFORMATION

| Part Number    | Package    | Packing Style                | Safety Standard Approval                                                          | Application Part Number <sup>*1</sup> |
|----------------|------------|------------------------------|-----------------------------------------------------------------------------------|---------------------------------------|
| PS2533-1       | 4-pin DIP  | Magazine case 100 pcs        | Standard products<br>(UL, CSA, BSI,<br>NEMKO, SEMKO,<br>DEMKO, FIMKO<br>approved) | PS2533-1                              |
| PS2533L-1      |            |                              |                                                                                   |                                       |
| PS2533L-1-E3   |            | Embossed Tape 1 000 pcs/reel |                                                                                   |                                       |
| PS2533L-1-E4   |            |                              |                                                                                   |                                       |
| PS2533L-1-F3   |            | Embossed Tape 2 000 pcs/reel |                                                                                   |                                       |
| PS2533L-1-F4   |            |                              |                                                                                   |                                       |
| PS2533-2       | 8-pin DIP  | Magazine case 45 pcs         |                                                                                   | PS2533-2                              |
| PS2533L-2      |            |                              |                                                                                   |                                       |
| PS2533L-2-E3   |            | Embossed Tape 1 000 pcs/reel |                                                                                   |                                       |
| PS2533L-2-E4   |            |                              |                                                                                   |                                       |
| PS2533-4       | 16-pin DIP | Magazine case 20 pcs         |                                                                                   | PS2533-4                              |
| PS2533L-4      |            |                              |                                                                                   |                                       |
| PS2533-1-V     | 4-pin DIP  | Magazine case 100 pcs        | VDE0884 approved<br>products (Option)                                             | PS2533-1                              |
| PS2533L-1-V    |            |                              |                                                                                   |                                       |
| PS2533L-1-V-E3 |            | Embossed Tape 1 000 pcs/reel |                                                                                   |                                       |
| PS2533L-1-V-E4 |            |                              |                                                                                   |                                       |
| PS2533L-1-V-F3 |            | Embossed Tape 2 000 pcs/reel |                                                                                   |                                       |
| PS2533L-1-V-F4 |            |                              |                                                                                   |                                       |
| PS2533L-2-V    | 8-pin DIP  | Magazine case 45 pcs         |                                                                                   | PS2533-2                              |
| PS2533L-2-V    |            |                              |                                                                                   |                                       |
| PS2533L-2-V-E3 |            | Embossed Tape 1 000 pcs/reel |                                                                                   |                                       |
| PS2533L-2-V-E4 |            |                              |                                                                                   |                                       |
| PS2533-4-V     | 16-pin DIP | Magazine case 20 pcs         |                                                                                   | PS2533-4                              |
| PS2533L-4-V    |            |                              |                                                                                   |                                       |

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

**ABSOLUTE MAXIMUM RATINGS ( $T_A = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)**

| Parameter                       |                                    | Symbol                        | Ratings                |                                | Unit                   |
|---------------------------------|------------------------------------|-------------------------------|------------------------|--------------------------------|------------------------|
|                                 |                                    |                               | PS2533-1,<br>PS2533L-1 | PS2533-2, -4,<br>PS2533L-2, -4 |                        |
| 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                    | 1.2                            | mW/ $^{\circ}\text{C}$ |
|                                 | Power Dissipation                  | $P_D$                         | 150                    | 120                            | mW/ch                  |
|                                 | 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/ch                  |
|                                 | Power Dissipation Derating         | $\Delta P_C/^{\circ}\text{C}$ | 3.0                    | 2.4                            | mW/ $^{\circ}\text{C}$ |
|                                 | Power Dissipation                  | $P_C$                         | 300                    | 240                            | mW/ch                  |
| 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            |                                | $^{\circ}\text{C}$     |

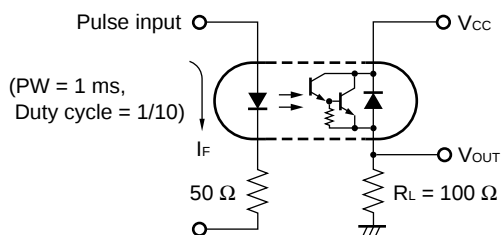
**\*1** PW = 100  $\mu\text{s}$ , Duty Cycle = 1 %

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

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

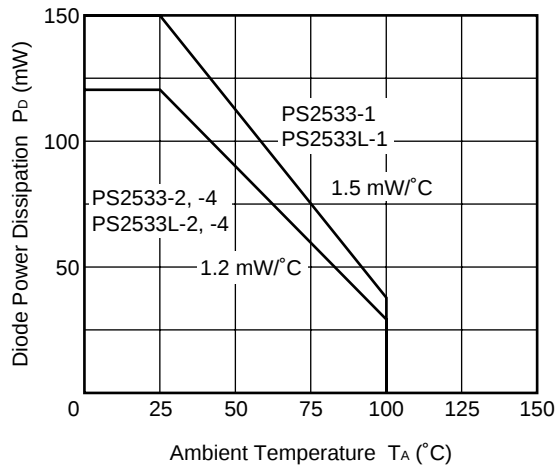
| Parameter  |                                                          | Symbol               | Conditions                                                            | MIN.             | TYP.  | MAX.  | Unit |
|------------|----------------------------------------------------------|----------------------|-----------------------------------------------------------------------|------------------|-------|-------|------|
| 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

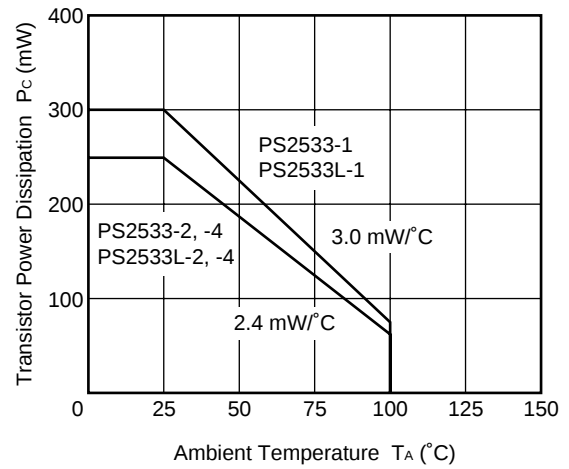


TYPICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ , unless otherwise specified)

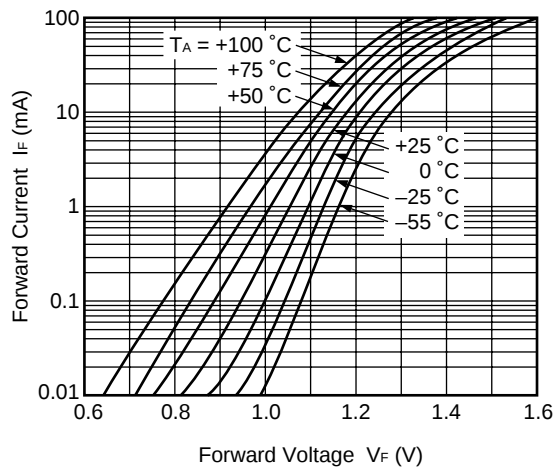
DIODE POWER DISSIPATION vs. AMBIENT TEMPERATURE



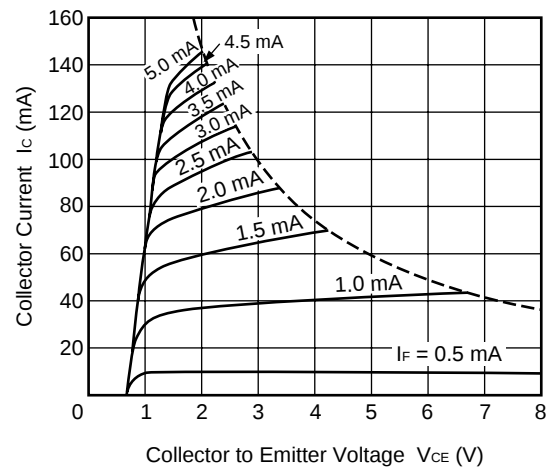
TRANSISTOR POWER DISSIPATION vs. AMBIENT TEMPERATURE



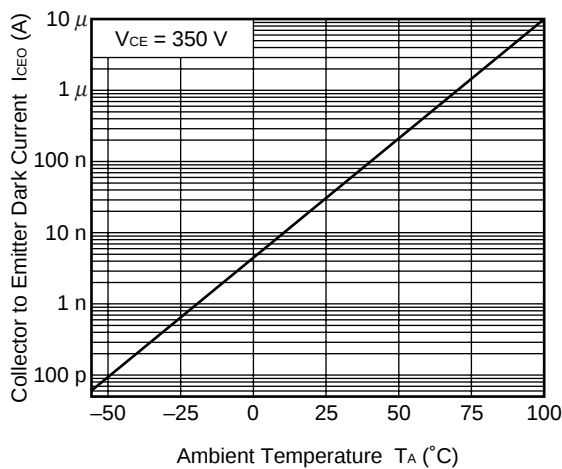
FORWARD CURRENT vs. FORWARD VOLTAGE



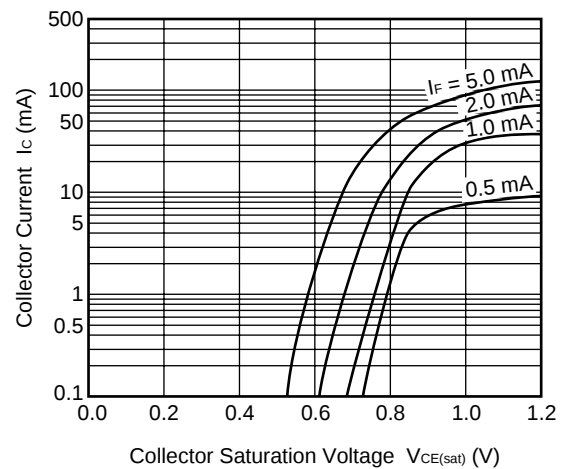
COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE



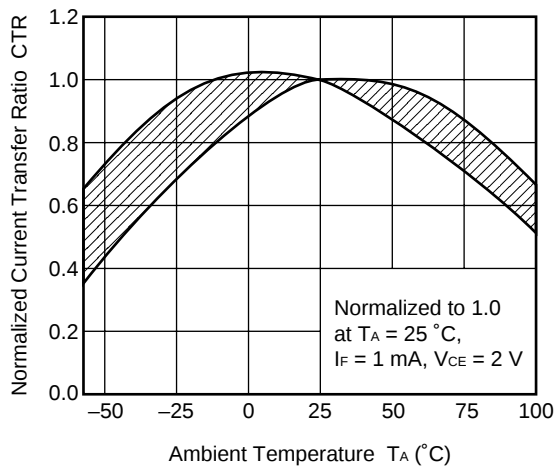
COLLECTOR TO EMITTER DARK CURRENT vs. AMBIENT TEMPERATURE



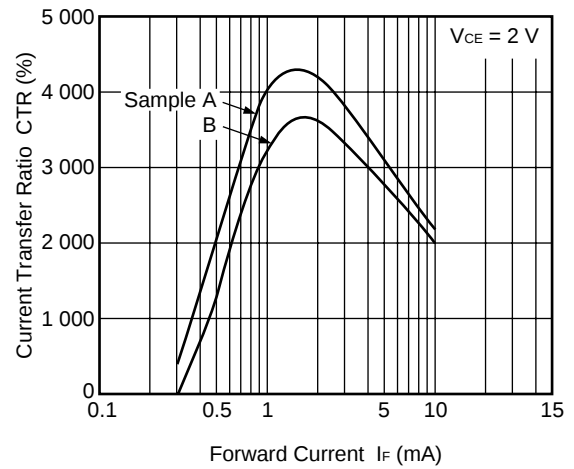
COLLECTOR CURRENT vs. COLLECTOR SATURATION VOLTAGE



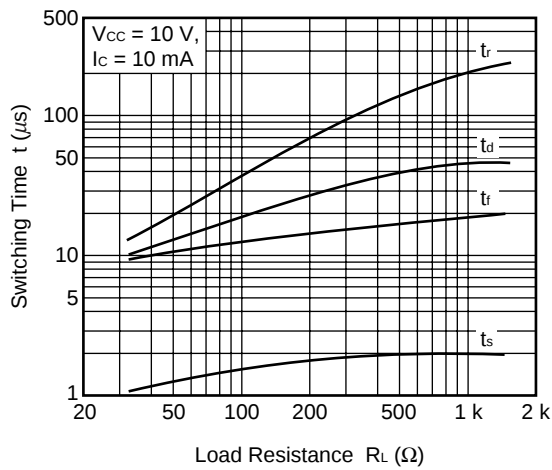
NORMALIZED CURRENT TRANSFER RATIO vs. AMBIENT TEMPERATURE



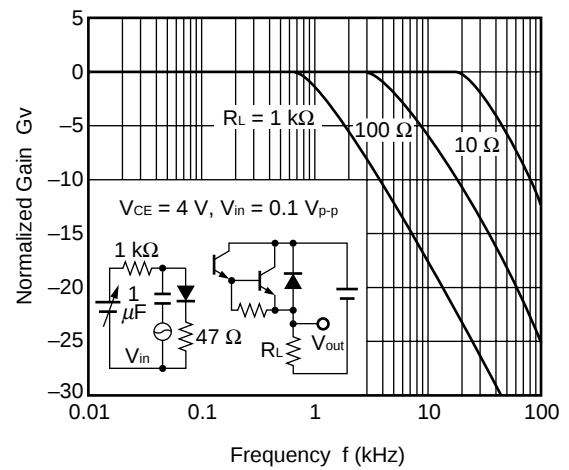
CURRENT TRANSFER RATIO vs. FORWARD CURRENT



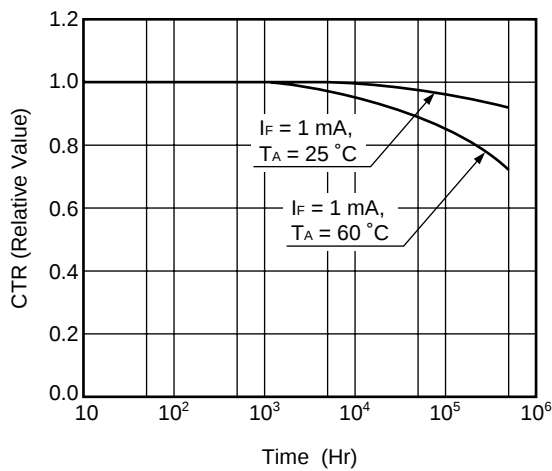
SWITCHING TIME vs. LOAD RESISTANCE



FREQUENCY RESPONSE



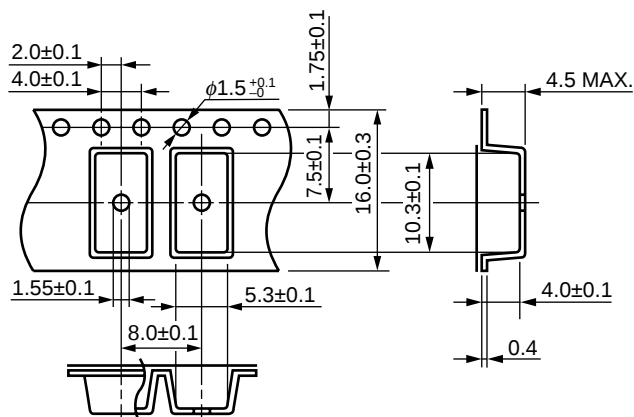
LONG TERM CTR DEGRADATION



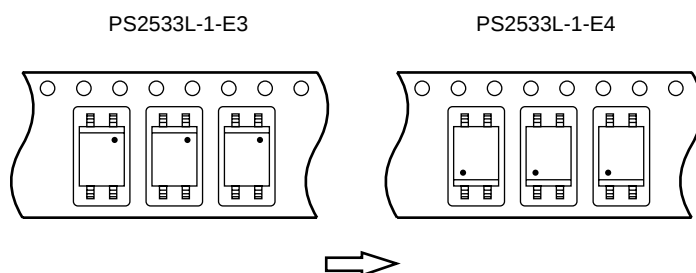
**Remark** The graphs indicate nominal characteristics.

★ TAPING SPECIFICATIONS (Unit : mm)

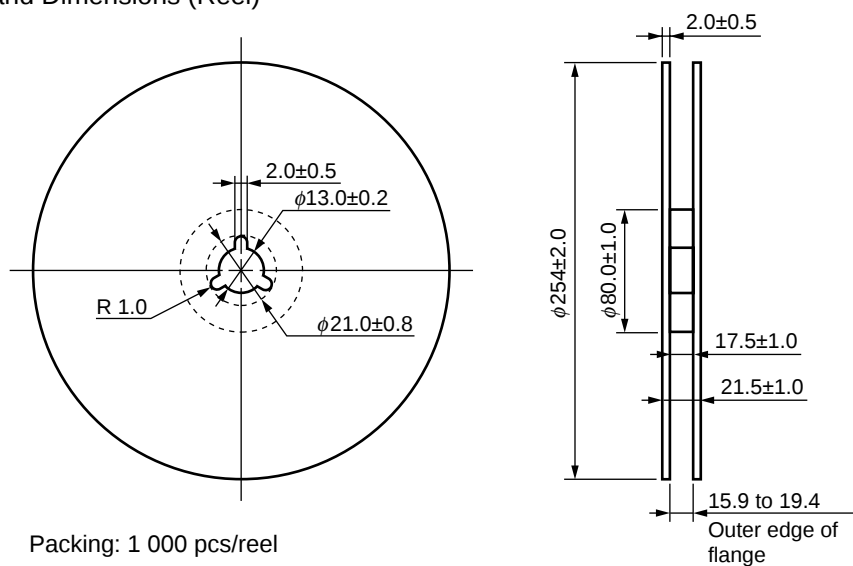
Outline and Dimensions (Tape)



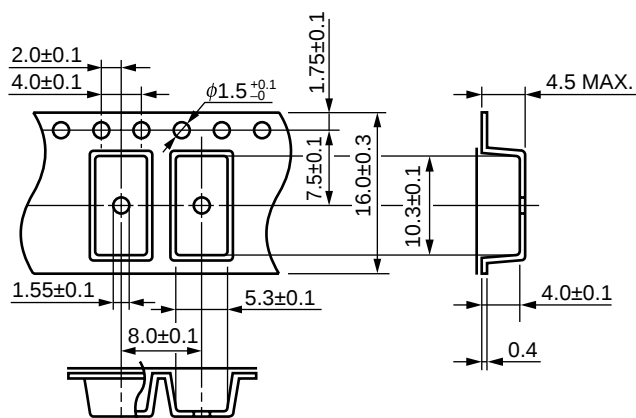
Tape Direction



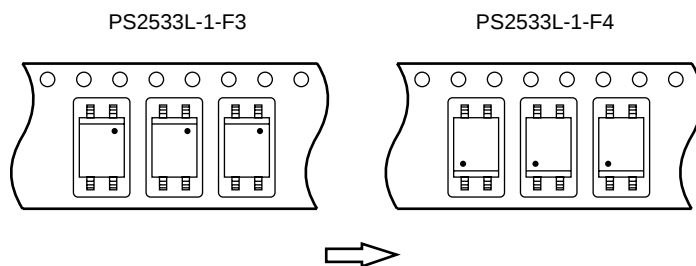
Outline and Dimensions (Reel)



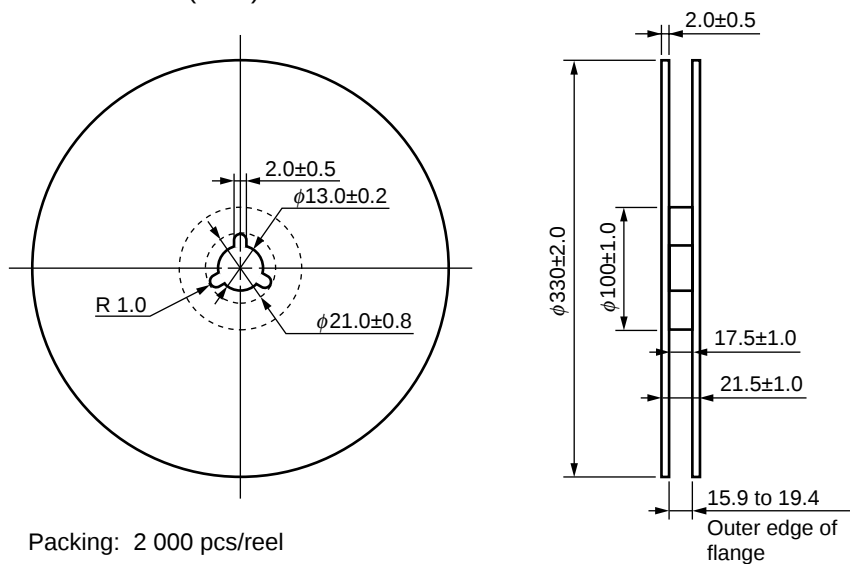
# Outline and Dimensions (Tape)



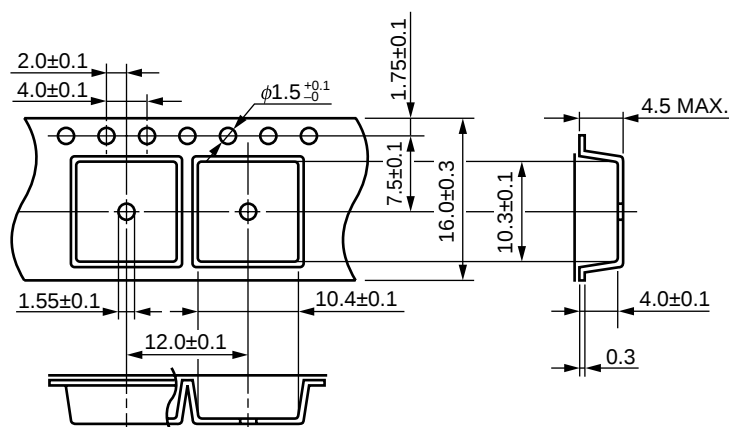
## Tape Direction



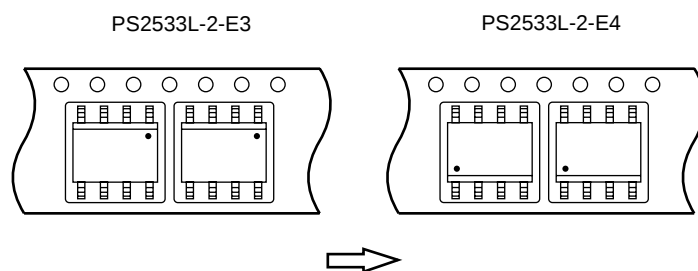
# Outline and Dimensions (Reel)



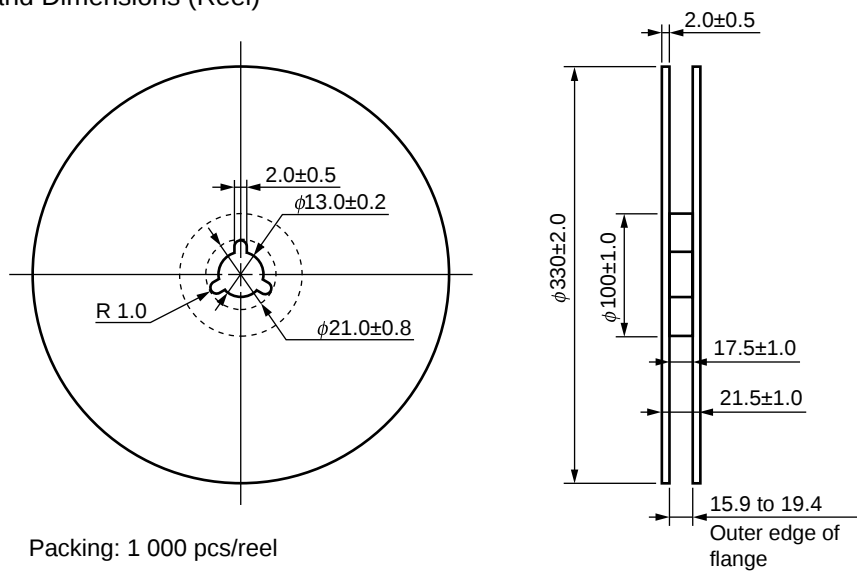
# Outline and Dimensions (Tape)



## Tape Direction



# Outline and Dimensions (Reel)



Packing: 1 000 pcs/reel

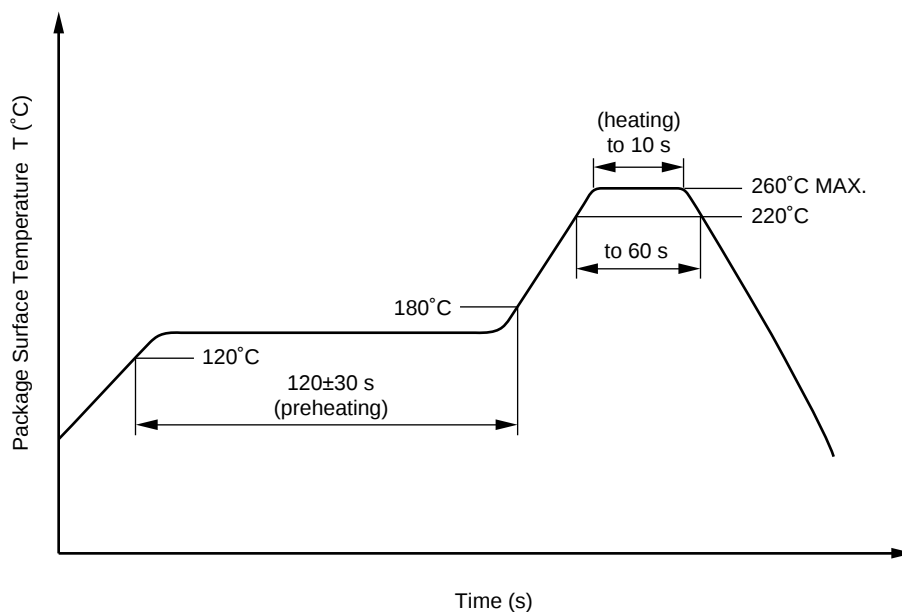
★ NOTES ON HANDLING

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) 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 side may enter the on state, even if the voltage is within the absolute maximum ratings.

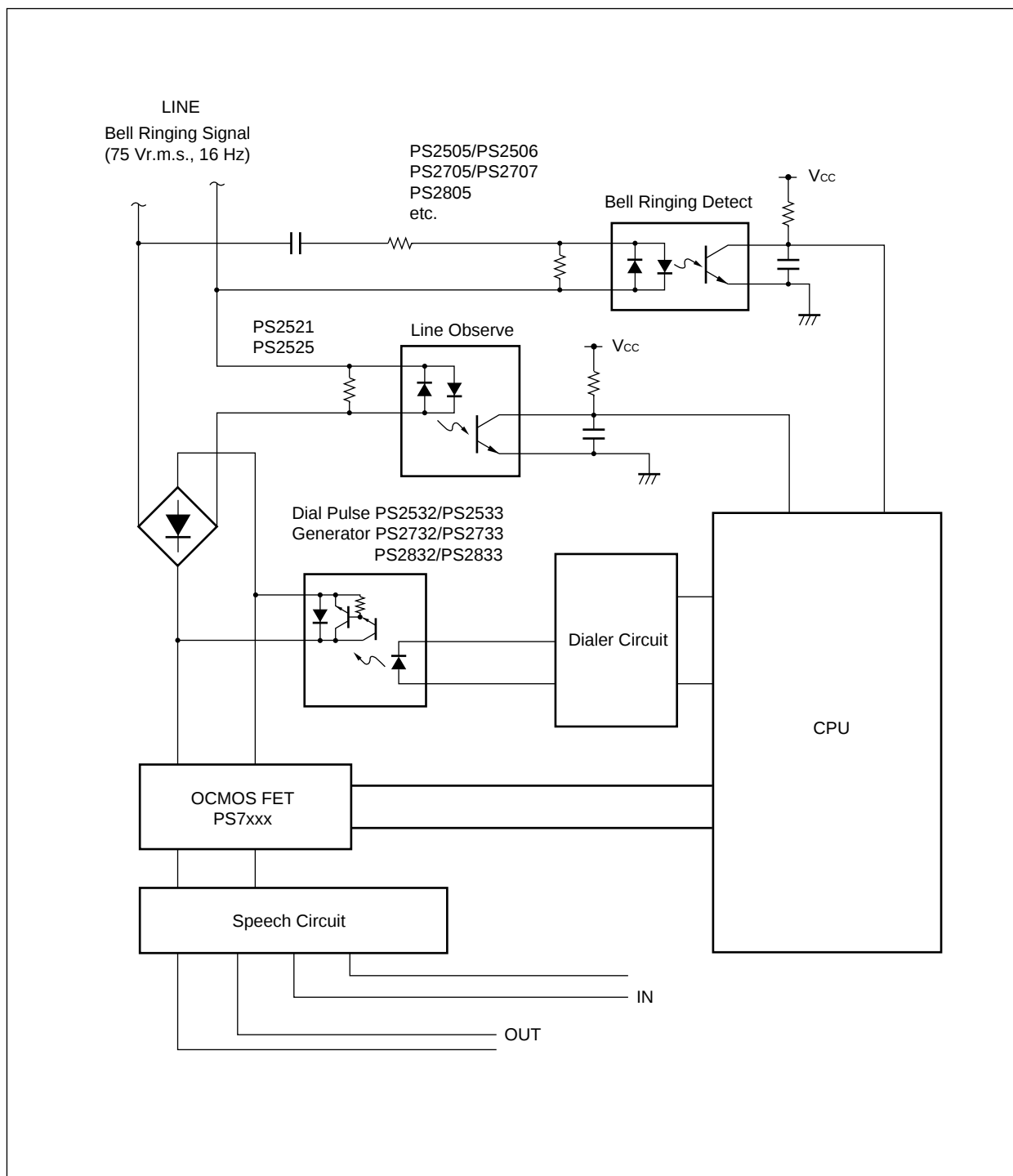
**★ USAGE CAUTIONS**

1. Protect against static electricity when handling.
2. Avoid storage at a high temperature and high humidity.

SPECIFICATION OF VDE MARKS LICENSE DOCUMENT (VDE0884)

| Parameter                                                                                                                                                                                                                                                                                    | Symbol                                            | Speck                       | Unit                       |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|-----------------------------|----------------------------|
| Application classification (DIN VDE 0109)<br>for rated line voltages $\leq 300$ Vr.m.s.<br>for rated line voltages $\leq 600$ Vr.m.s.                                                                                                                                                        |                                                   | IV<br>III                   |                            |
| Climatic test class (DIN IEC 68 Teil 1/09.80)                                                                                                                                                                                                                                                |                                                   | 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>$U_{pr} = 1.2 \times U_{IORM}$ , $P_d < 5$ pC                                                                                              | $U_{IORM}$<br>$U_{pr}$                            | 890<br>1 068                | $V_{peak}$<br>$V_{peak}$   |
| ★ Test voltage (partial discharge test, procedure b for all devices test)<br>$U_{pr} = 1.6 \times U_{IORM}$ , $P_d < 5$ pC                                                                                                                                                                   | $U_{pr}$                                          | 1 424                       | $V_{peak}$                 |
| Highest permissible overvoltage                                                                                                                                                                                                                                                              | $U_{TR}$                                          | 6 000                       | $V_{peak}$                 |
| Degree of pollution (DIN VDE 0109)                                                                                                                                                                                                                                                           |                                                   | 2                           |                            |
| Clearance distance                                                                                                                                                                                                                                                                           |                                                   | $> 7.0$                     | mm                         |
| Creepage distance                                                                                                                                                                                                                                                                            |                                                   | $> 7.0$                     | mm                         |
| Comparative tracking index (DIN IEC 112/VDE 0303 part 1)                                                                                                                                                                                                                                     | CTI                                               | 175                         |                            |
| Material group (DIN VDE 0109)                                                                                                                                                                                                                                                                |                                                   | 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                                                                                                                                                             | $R_{is}$ 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 $T_A = 175$ °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>$\Omega$ |

APPLICATION FOR TELEPHONE (EXAMPLE)



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M8E 00.4-0110

**SAFETY INFORMATION ON THIS PRODUCT**

|                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <div data-bbox="177 271 288 315" data-label="Section-Header"> <p><b>Caution</b></p> </div> <div data-bbox="300 277 448 302" data-label="Text"> <p>GaAs Products</p> </div> | <p>The product contains gallium arsenide, GaAs.<br/>GaAs vapor and powder are hazardous to human health if inhaled or ingested.</p> <ul style="list-style-type: none"> <li>• Do not destroy or burn the product.</li> <li>• Do not cut or cleave off any part of the product.</li> <li>• Do not crush or chemically dissolve the product.</li> <li>• Do not put the product in the mouth.</li> </ul> <p>Follow related laws and ordinances for disposal. The product should be excluded from general industrial waste or household garbage.</p> |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

► For further information, please contact

**NEC Compound Semiconductor Devices, Ltd.**

5th Sales Group, Sales Division TEL: +81-44-435-1588 FAX: +81-44-435-1579 E-mail: salesinfo@csd-nec.com

**NEC Compound Semiconductor Devices Hong Kong Limited**

Hong Kong Head Office TEL: +852-3107-7303 FAX: +852-3107-7309  
Taipei Branch Office TEL: +886-2-8712-0478 FAX: +886-2-2545-3859  
Korea Branch Office TEL: +82-2-558-2120 FAX: +82-2-558-5209

**NEC Electronics (Europe) GmbH** <http://www.ee.nec.de/>

TEL: +49-211-6503-01 FAX: +49-211-6503-487

**California Eastern Laboratories, Inc.** <http://www.cel.com/>

TEL: +1-408-988-3500 FAX: +1-408-988-0279