

# PHOTOCOUPLER

## PS2701-1, PS2701-2, PS2701-4

### HIGH ISOLATION VOLTAGE SOP MULTI PHOTOCOUPLER

–NEPOC™ Series–

#### DESCRIPTION

The PS2701-1, PS2701-2, PS2701-4, are optically coupled isolators containing a GaAs light emitting diode and an NPN silicon phototransistor.

This package is SOP (Small Outline Package) type and has shield effect to cut off ambient light.

It is designed for high density mounting applications.

#### FEATURES

- High isolation voltage (BV = 3 750 Vr.m.s.)
- SOP (Small Outline Package) type
- High-speed switching ( $t_r = 3 \mu s$  TYP.,  $t_f = 5 \mu s$  TYP.)
- Ordering number of taping product (only 1-channel type) : PS2701-1-E3, E4, F3, F4
- UL approved: File No. E72422 (S)
- VDE0884 approved (Option)

#### APPLICATIONS

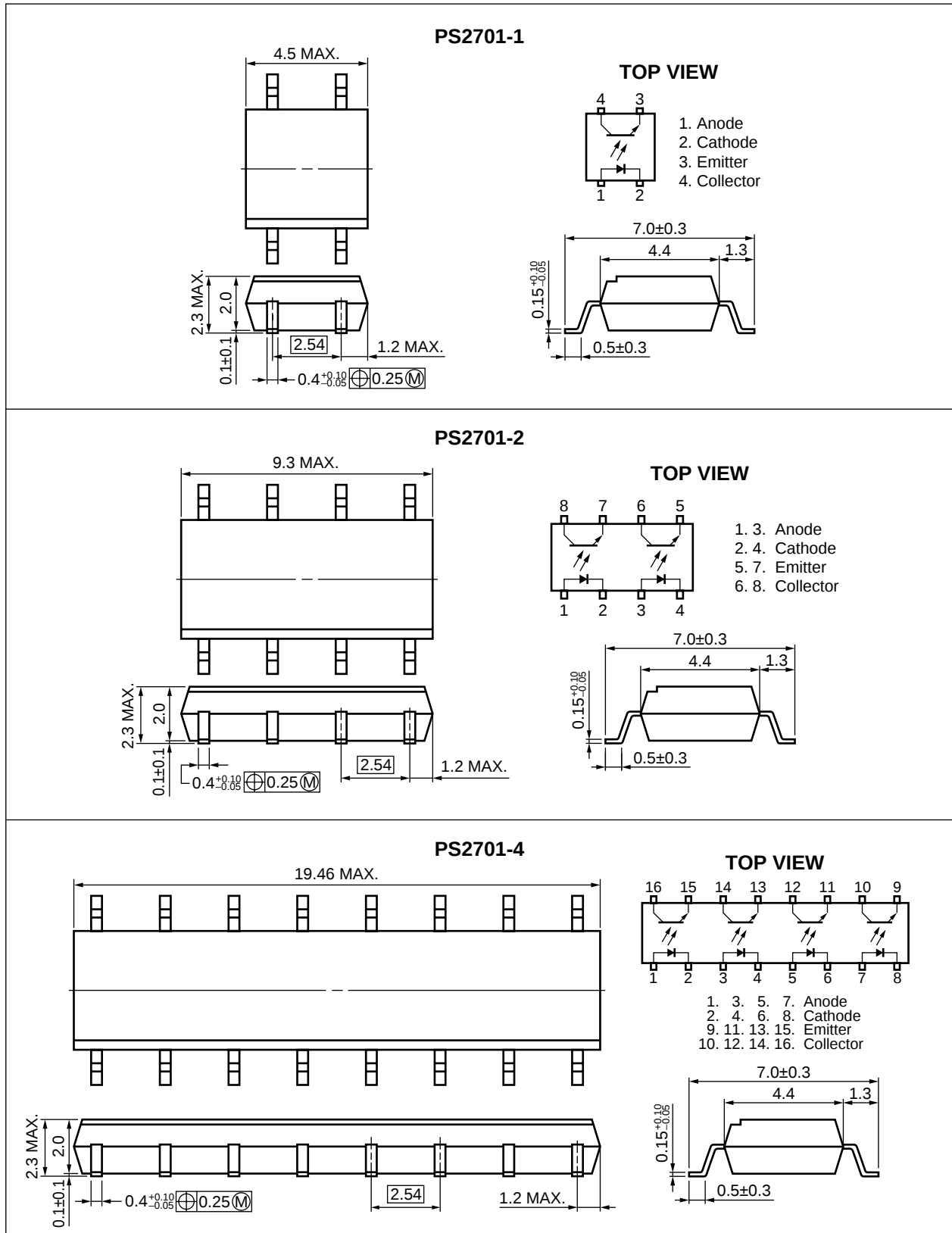
- Hybrid IC
- Measuring instruments
- Power supply
- Programmable logic controllers

#### ORDERING INFORMATION

| Part Number | Package    | Safety Standard Approval           |
|-------------|------------|------------------------------------|
| PS2701-1    | 4-pin SOP  | Standard products<br>• UL approved |
| PS2701-2    | 8-pin SOP  |                                    |
| PS2701-4    | 16-pin SOP |                                    |
| PS2701-1-V  | 4-pin SOP  | VDE0884 approved products (Option) |
| PS2701-2-V  | 8-pin SOP  |                                    |
| PS2701-4-V  | 16-pin SOP |                                    |

The information in this document is subject to change without notice.

PACKAGE DIMENSIONS (in millimeters)



**ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = 25 °C, unless otherwise specified)**

| Parameter                       |                                    | Symbol              | Ratings     |                       | Unit    |
|---------------------------------|------------------------------------|---------------------|-------------|-----------------------|---------|
|                                 |                                    |                     | PS2701-1    | PS2701-2,<br>PS2701-4 |         |
| Diode                           | Forward Current (DC)               | I <sub>F</sub>      | 50          |                       | mA      |
|                                 | Reverse Voltage                    | V <sub>R</sub>      | 6           |                       | V       |
|                                 | Power Dissipation Derating         | ΔP <sub>D</sub> /°C | 0.8         |                       | mW/°C   |
|                                 | Power Dissipation                  | P <sub>D</sub>      | 80          |                       | mW/ch   |
|                                 | Peak Forward Current <sup>*1</sup> | I <sub>FP</sub>     | 1           |                       | A       |
| Transistor                      | Collector to Emitter Voltage       | V <sub>CEO</sub>    | 40          |                       | V       |
|                                 | Emitter to Collector Voltage       | V <sub>ECO</sub>    | 6           |                       | V       |
|                                 | Collector Current                  | I <sub>C</sub>      | 80          |                       | mA/ch   |
|                                 | Power Dissipation Derating         | ΔP <sub>C</sub> /°C | 1.5         | 1.2                   | mW/°C   |
|                                 | Power Dissipation                  | P <sub>C</sub>      | 150         | 120                   | mW/ch   |
| Isolation Voltage <sup>*2</sup> |                                    | BV                  | 3 750       |                       | Vr.m.s. |
| Operating Ambient Temperature   |                                    | T <sub>A</sub>      | -55 to +100 |                       | °C      |
| Storage Temperature             |                                    | T <sub>stg</sub>    | -55 to +150 |                       | °C      |

**\*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

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> = 5 mA                                                |                  | 1.1  | 1.4  | 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 MHz                                                   |                  | 30   |      | pF   |
| Transistor | Collector to Emitter Current         | I <sub>CEO</sub>     | I <sub>F</sub> = 0 mA, V <sub>CE</sub> = 40 V                        |                  |      | 100  | nA   |
| Coupled    | Current Transfer Ratio <sup>*1</sup> | CTR                  | I <sub>F</sub> = 5 mA, V <sub>CE</sub> = 5 V                         | 50               | 100  | 300  | %    |
|            | Collector Saturation Voltage         | V <sub>CE(sat)</sub> | I <sub>F</sub> = 10 mA, I <sub>C</sub> = 2 mA                        |                  |      | 0.3  | V    |
|            | Isolation Resistance                 | R <sub>I-O</sub>     | V <sub>I-O</sub> = 1 kV <sub>DC</sub>                                | 10 <sup>11</sup> |      |      | Ω    |
|            | Isolation Capacitance                | C <sub>I-O</sub>     | V = 0 V, f = 1 MHz                                                   |                  | 0.4  |      | pF   |
|            | Rise Time <sup>*2</sup>              | t <sub>r</sub>       | V <sub>CC</sub> = 5 V, I <sub>C</sub> = 2 mA, R <sub>L</sub> = 100 Ω |                  | 3    |      | μs   |
|            | Fall Time <sup>*2</sup>              | t <sub>f</sub>       |                                                                      |                  | 5    |      |      |

\*1 CTR rank (only PS2701-1)

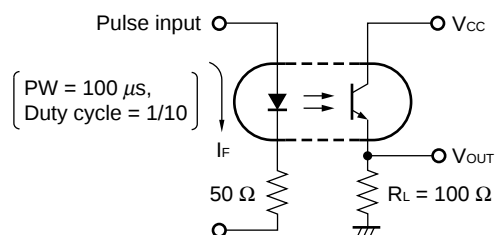
★

P: 150 to 300 (%)

L: 100 to 300 (%)

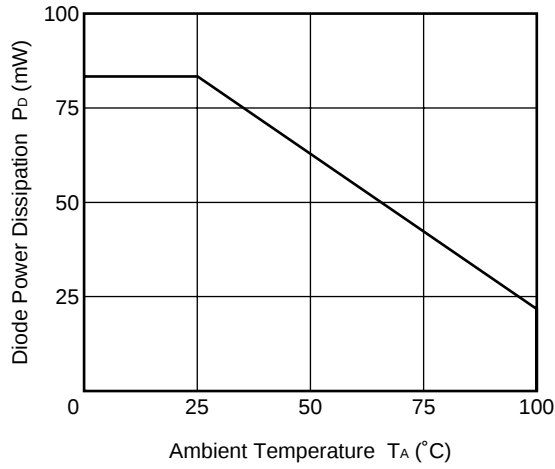
M: 50 to 150 (%)

\*2 Test circuit for switching time

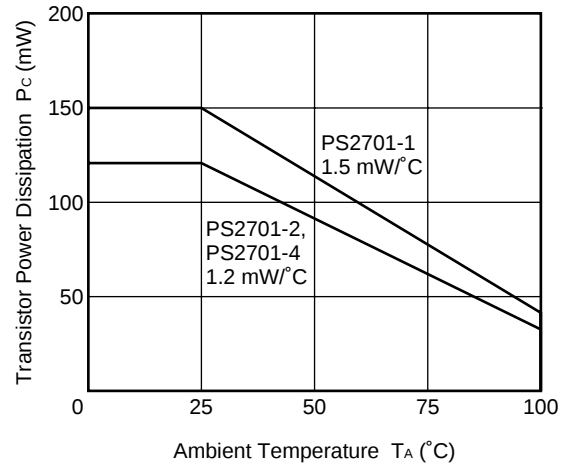


★ TYPICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ , unless otherwise specified)

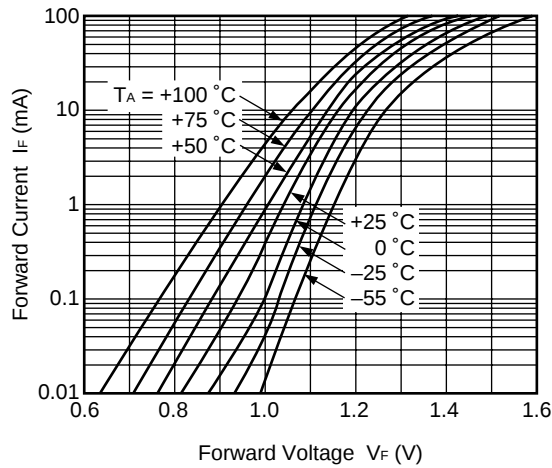
DIODE POWER DISSIPATION vs.  
AMBIENT TEMPERATURE



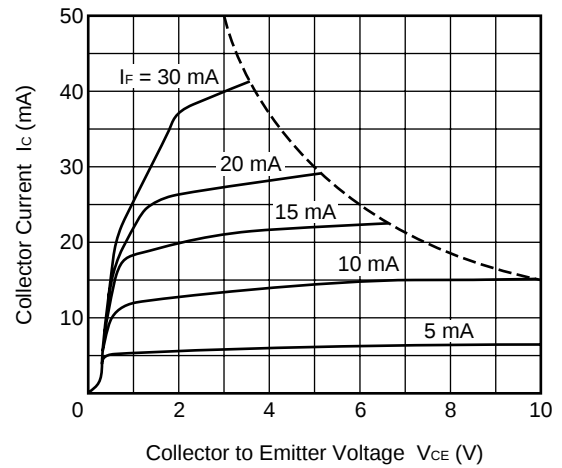
TRANSISTOR POWER DISSIPATION vs.  
AMBIENT TEMPERATURE



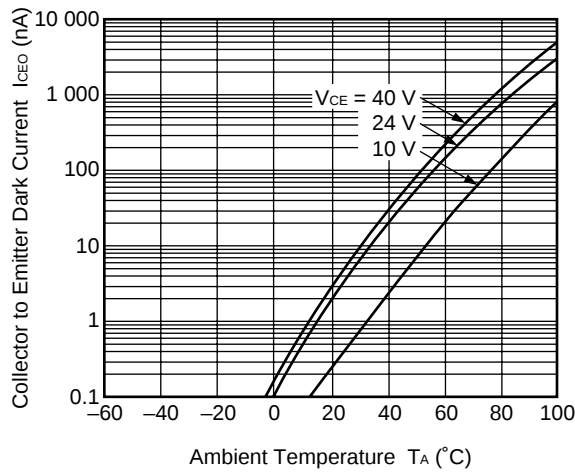
FORWARD CURRENT vs.  
FORWARD VOLTAGE



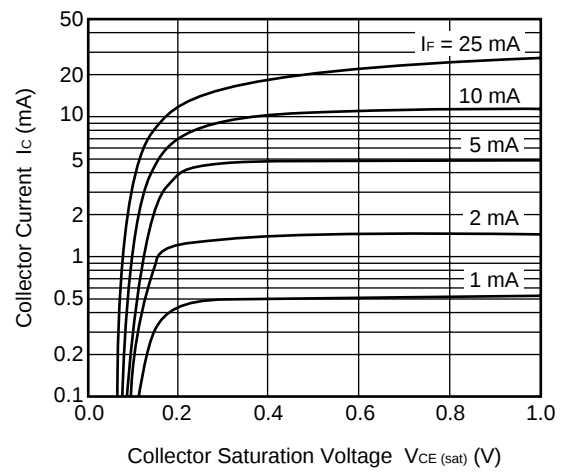
COLLECTOR CURRENT vs.  
COLLECTOR TO EMITTER VOLTAGE



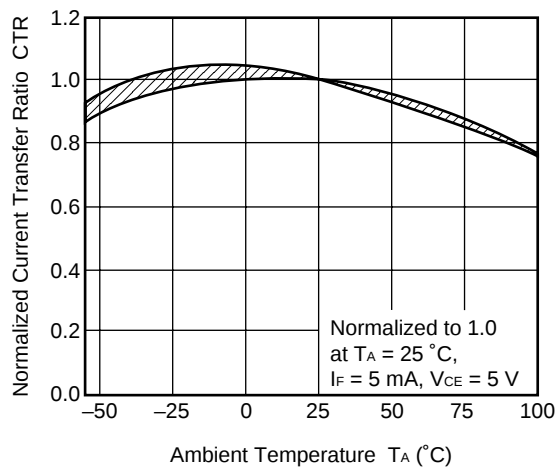
COLLECTOR TO EMITTER DARK  
CURRENT vs. AMBIENT TEMPERATURE



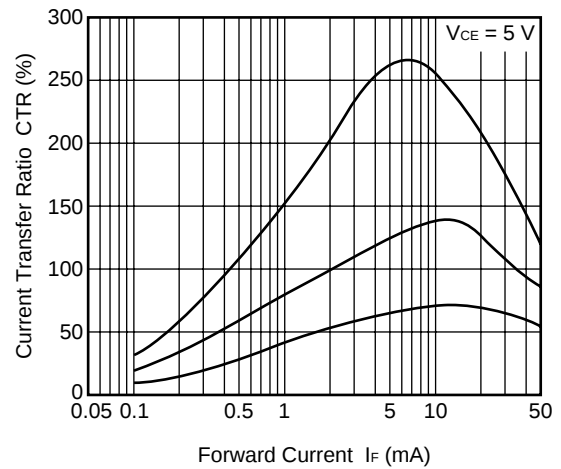
COLLECTOR CURRENT vs.  
COLLECTOR SATURATION VOLTAGE



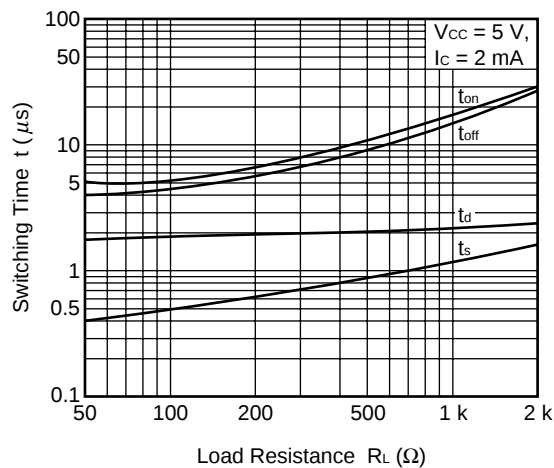
NORMALIZED CURRENT TRANSFER RATIO vs. AMBIENT TEMPERATURE



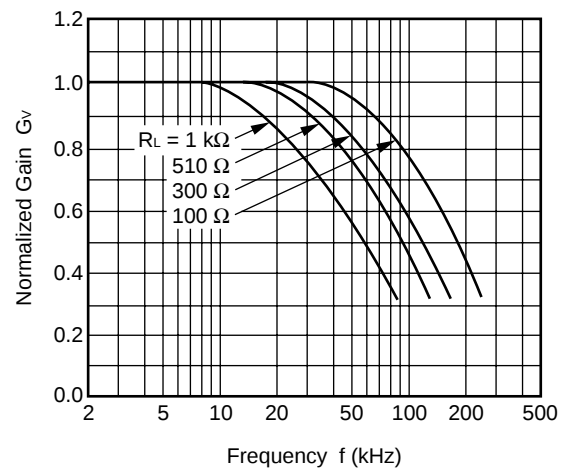
CURRENT TRANSFER RATIO vs. FORWARD CURRENT



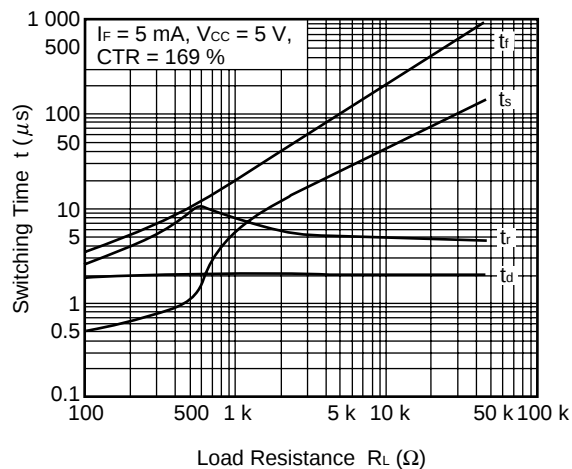
SWITCHING TIME vs. LOAD RESISTANCE



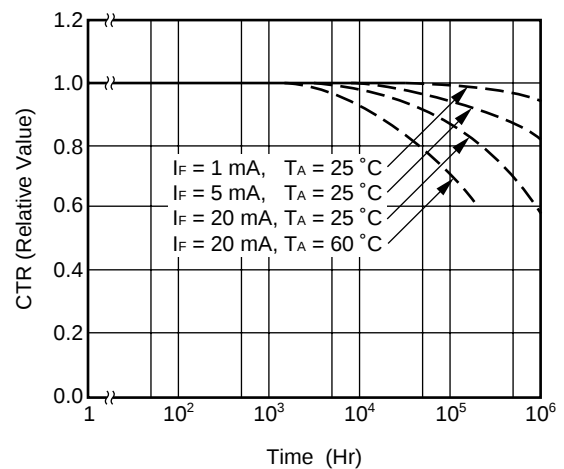
FREQUENCY RESPONSE



SWITCHING TIME vs. LOAD RESISTANCE



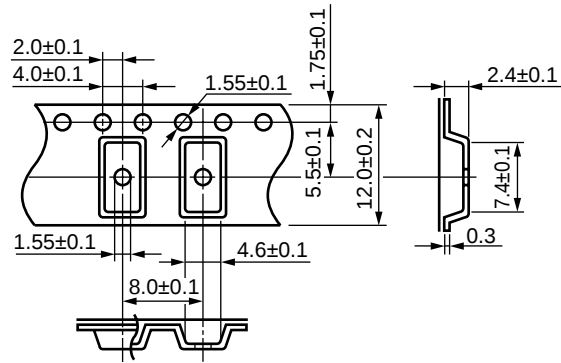
LONG TERM CTR DEGRADATION



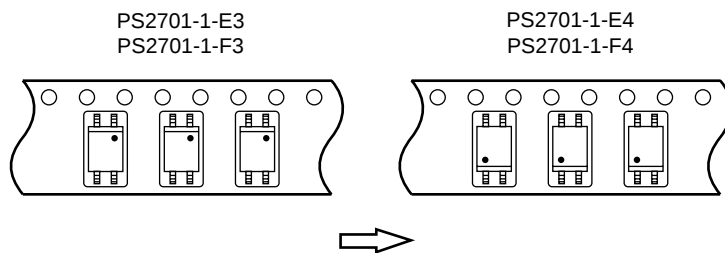
**Remark** The measurement of TYPICAL CHARACTERISTICS are only for reference, not guaranteed.

TAPING SPECIFICATIONS (in millimeters)

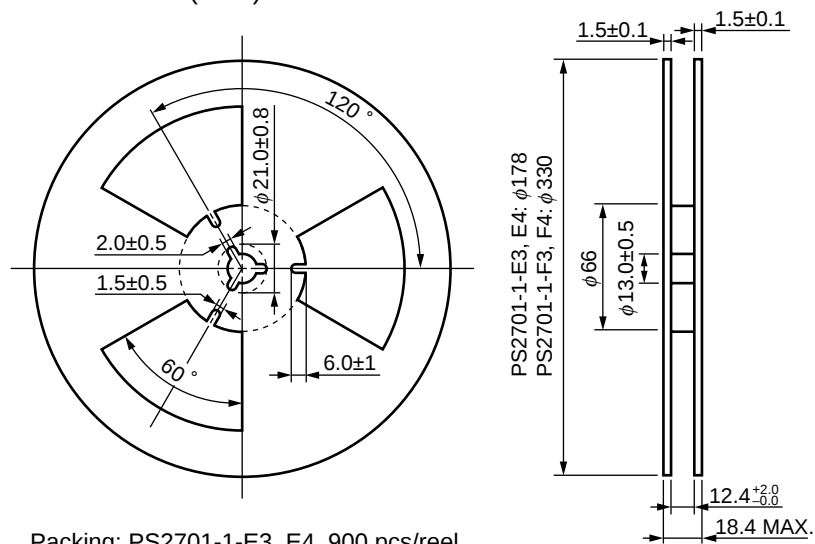
Outline and Dimensions (Tape)



Tape Direction



Outline and Dimensions (Reel)



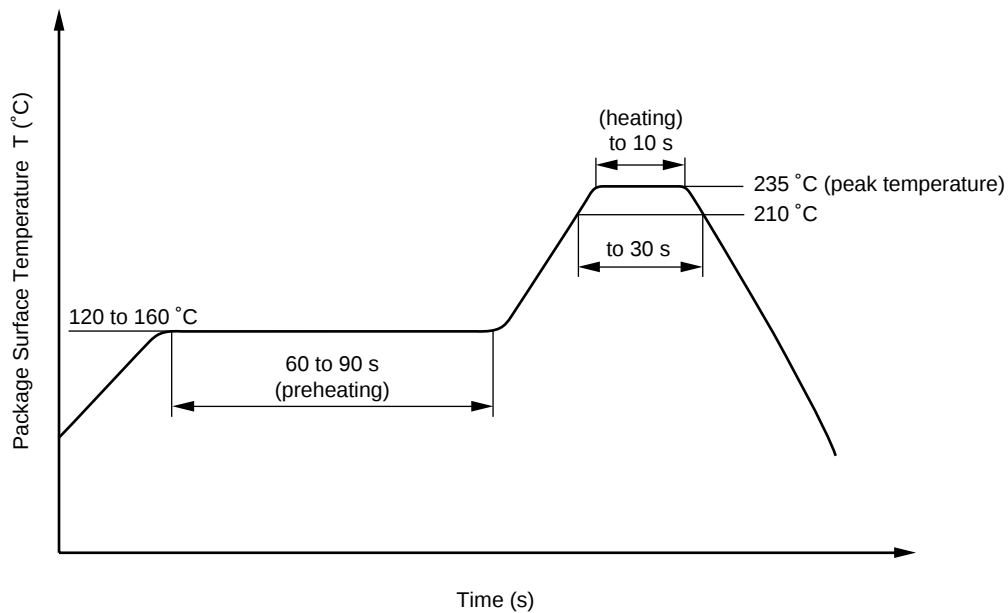
Packing: PS2701-1-E3, E4 900 pcs/reel  
PS2701-1-F3, F4 3 500 pcs/reel

## RECOMMENDED SOLDERING CONDITIONS

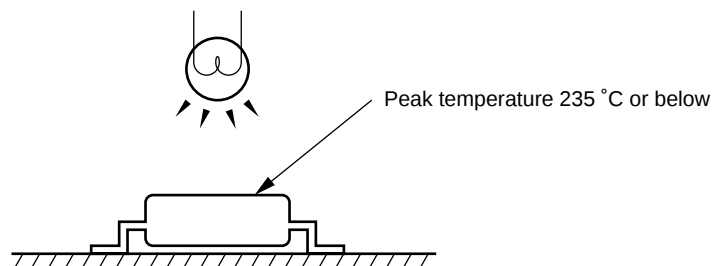
### (1) Infrared reflow soldering

- Peak reflow temperature 235 °C (package surface temperature)
- Time of temperature higher than 210 °C 30 seconds or less
- 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



**Caution** Please avoid to removed the residual flux by water after the first reflow processes.



### (2) Dip soldering

- Temperature 260 °C or below (molten solder temperature)
- Time 10 seconds or less
- Number of times One
- Flux Rosin flux containing small amount of chlorine (The flux with a maximum chlorine content of 0.2 Wt % is recommended.)

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>$U_{pr}$                       | 710<br>850                  | $V_{peak}$<br>$V_{peak}$   |
| Test voltage (partial discharge test, procedure b for random test)<br>$U_{pr} = 1.6 \times U_{IORM}$ , $P_d < 5$ pC                                                                                                                                                                             | $U_{pr}$                                     | 1 140                       | $V_{peak}$                 |
| Highest permissible overvoltage                                                                                                                                                                                                                                                                 | $U_{TR}$                                     | 6 000                       | $V_{peak}$                 |
| Degree of pollution (DIN VDE 0109)                                                                                                                                                                                                                                                              |                                              | 2                           |                            |
| Clearance distance                                                                                                                                                                                                                                                                              |                                              | > 5                         | mm                         |
| Creepage distance                                                                                                                                                                                                                                                                               |                                              | > 5                         | 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                                                                                                                                                                | Ris MIN.<br>Ris MIN.                         | $10^{12}$<br>$10^{11}$      | $\Omega$<br>$\Omega$       |
| Safety maximum ratings<br>(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>Ris MIN. | 150<br>200<br>300<br>$10^9$ | °C<br>mA<br>mW<br>$\Omega$ |

[MEMO]

[MEMO]

## **CAUTION**

**Within this device there exists GaAs (Gallium Arsenide) material which is a harmful substance if ingested. Please do not under any circumstances break the hermetic seal.**

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Special: Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support)

Specific: Aircrafts, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems or medical equipment for life support, etc.

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Anti-radioactive design is not implemented in this product.