

HIGH ISOLATION VOLTAGE SSOP PHOTOCOUPLER

–NEPOC Series–

DESCRIPTION

The PS2801-1 and PS2801-4 are optically coupled isolators containing a GaAs light emitting diode and an NPN silicon phototransistor in a plastic SSOP for high density applications.

This package has shield effect to cut off ambient light.

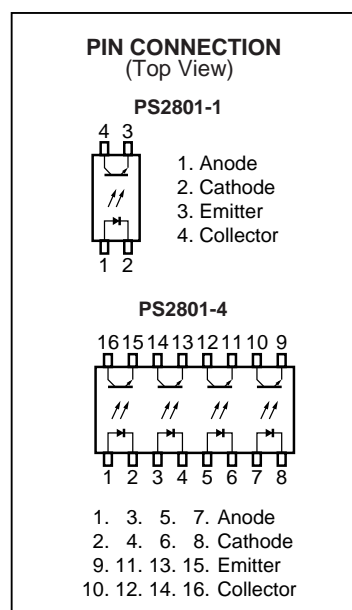
FEATURES

- High isolation voltage ($BV = 2\ 500\ V_{r.m.s.}$)
- Small and thin package (4,16-pin SSOP, Pin pitch 1.27 mm)
- High collector to emitter voltage ($V_{CE0} = 80\ V$)
- High-speed switching ($t_r = 3\ \mu s\ TYP.$, $t_f = 5\ \mu s\ TYP.$)
- Ordering number of tape product: PS2801-1-F3, F4, PS2801-4-F3, F4
- Pb-Free product
- Safety standards: PS2801-1, -4
 - UL approved: No. E72422
 - BSI approved: No. 8188, 8189
 - CSA approved: No. CA 101391
 - DIN EN60747-5-2 (VDE0884 Part2) approved: No. 40008902 (Option)

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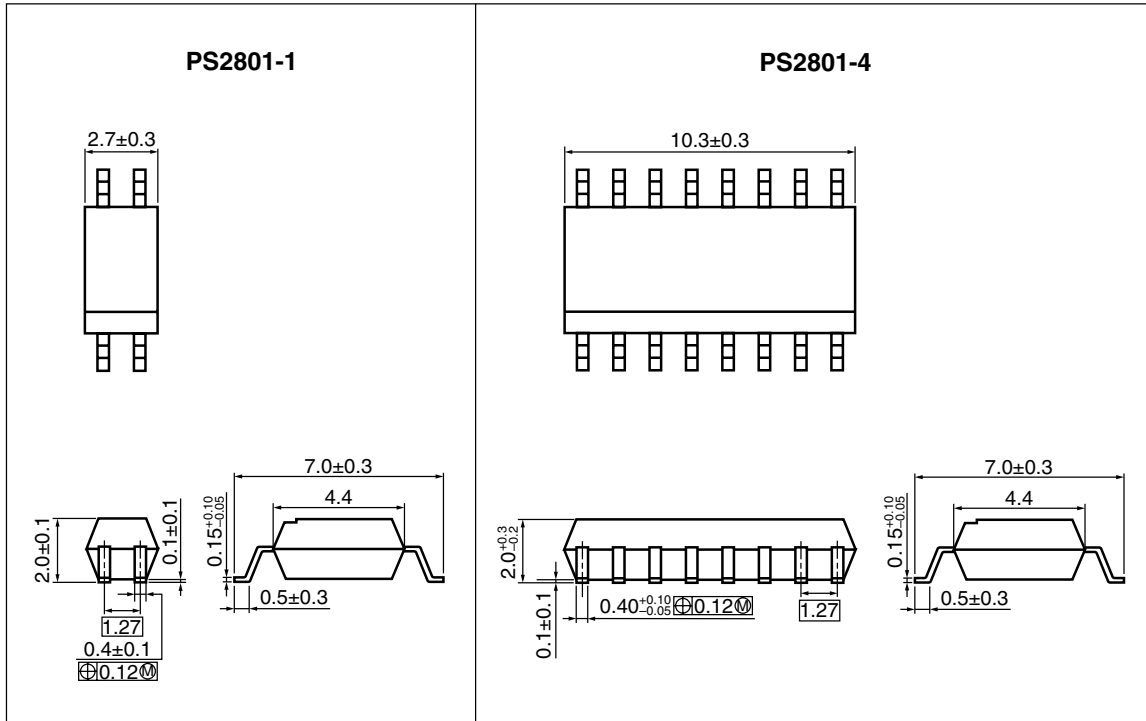
APPLICATIONS

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



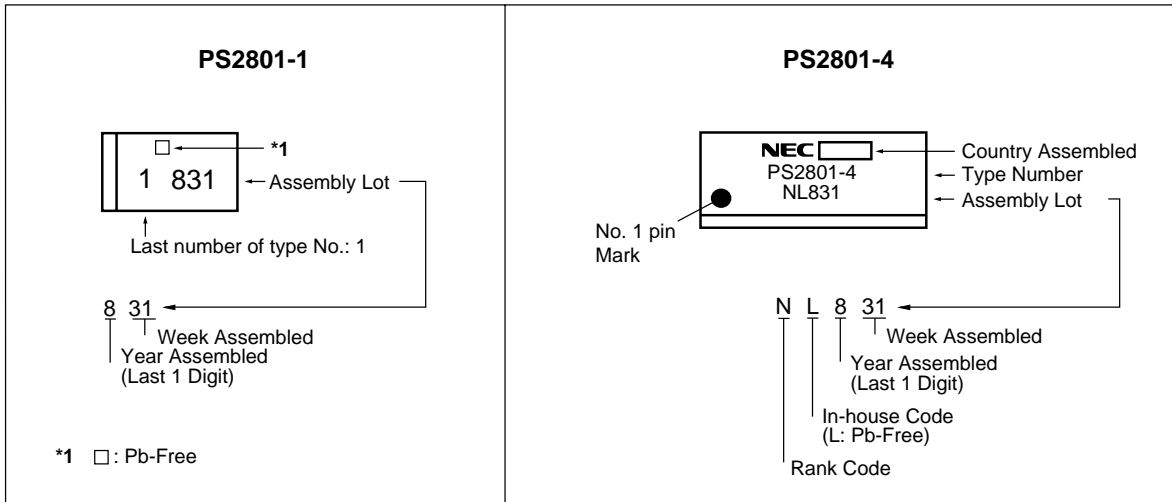
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PACKAGE DIMENSIONS (UNIT: mm)

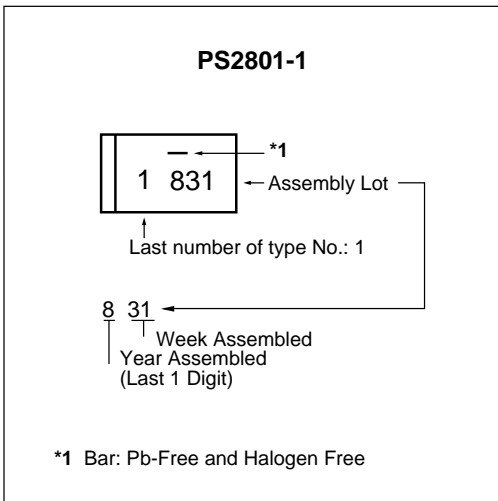


<R> MARKING EXAMPLE

Pb-Free



Special version (Pb-Free and Halogen Free)



<R> ORDERING INFORMATION

| Part Number | Order Number | Solder Plating Specification | Packing Style | Safety Standard Approval | Application Part Number ^{*1} | |
|---------------|------------------|---|---|---|---|----------|
| PS2801-1 | PS2801-1-A | Pb-Free | 50 pcs (Tape 50 pcs cut) | Standard products (UL, BSI, CSA approved) | PS2801-1 | |
| PS2801-1-F3 | PS2801-1-F3-A | | Embossed Tape 3 500 pcs/reel | | | |
| PS2801-1-F4 | PS2801-1-F4-A | | | | | |
| PS2801-1-V | PS2801-1-V-A | | 50 pcs (Tape 50 pcs cut) | DIN EN60747-5-2 (VDE0884 Part2) Approved (Option) | | |
| PS2801-1-V-F3 | PS2801-1-V-F3-A | | Embossed Tape 3 500 pcs/reel | | | |
| PS2801-1-V-F4 | PS2801-1-V-F4-A | | | | | |
| PS2801-4 | PS2801-4-A | | Special version (Pb-Free and Halogen Free) | Magazine Case 45 pcs | Standard products (UL, BSI, CSA approved) | PS2801-4 |
| PS2801-4-F3 | PS2801-4-F3-A | | | Embossed Tape 2 500 pcs/reel | | |
| PS2801-4-F4 | PS2801-4-F4-A | | | | | |
| PS2801-4-V | PS2801-4-V-A | | | Magazine Case 45 pcs | DIN EN60747-5-2 (VDE0884 Part2) Approved (Option) | |
| PS2801-4-V-F3 | PS2801-4-V-F3-A | | | Embossed Tape 2 500 pcs/reel | | |
| PS2801-4-V-F4 | PS2801-4-V-F4-A | | | | | |
| PS2801-1 | PS2801-1Y-A | Special version (Pb-Free and Halogen Free) | | 50 pcs (Tape 50 pcs cut) | Standard products (UL, BSI, CSA approved) | PS2801-1 |
| PS2801-1-F3 | PS2801-1Y-F3-A | | | Embossed Tape 3 500 pcs/reel | | |
| PS2801-1-V | PS2801-1Y-V-A | | 50 pcs (Tape 50 pcs cut) | DIN EN60747-5-2 (VDE0884 Part2) Approved (Option) | | |
| PS2801-1-V-F3 | PS2801-1Y-V-F3-A | | Embossed Tape 3 500 pcs/reel | | | |

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

ABSOLUTE MAXIMUM RATINGS (Unless otherwise specified, T_A = 25°C)

| Parameter | | Symbol | Ratings | | Unit |
|---------------------------------|------------------------------------|---------------------|-------------|----------|---------|
| | | | PS2801-1 | PS2801-4 | |
| Diode | Forward Current (DC) | I _F | 50 | | mA/ch |
| | Reverse Voltage | V _R | 6 | | V |
| | Power Dissipation Derating | ΔP _D /°C | 0.6 | 0.8 | mW/°C |
| | Power Dissipation | P _D | 60 | 80 | mW/ch |
| | Peak Forward Current ^{*1} | I _{FP} | 1 | | A/ch |
| Transistor | Collector to Emitter Voltage | V _{CEO} | 80 | | V |
| | Emitter to Collector Voltage | V _{ECO} | 6 | | V |
| | Collector Current | I _C | 50 | | mA/ch |
| | Power Dissipation Derating | ΔP _C /°C | 1.2 | | mW/°C |
| | Power Dissipation | P _C | 120 | | mW/ch |
| Isolation Voltage ^{*2} | | BV | 2 500 | | Vr.m.s. |
| Operating Ambient Temperature | | T _A | -55 to +100 | | °C |
| Storage Temperature | | T _{stg} | -55 to +150 | | °C |

*1 PW = 100 μs, 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 (PS2801-1).

Pins 1-8 shorted together, 9-16 shorted together (PS2801-4).

ELECTRICAL CHARACTERISTICS (T_A = 25°C)

| Parameter | | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|------------|--|----------------------|--|------------------|------|------|------|
| Diode | Forward Voltage | V _F | I _F = 5 mA | | 1.1 | 1.4 | V |
| | Reverse Current | I _R | V _R = 5 V | | | 5 | μA |
| | Terminal Capacitance | C _t | V = 0 V, f = 1.0 MHz | | 15 | | 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 | | 600 | % |
| | 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 | | 0.4 | | pF |
| | Rise Time ^{*2} | t _r | V _{CC} = 5 V, I _c = 2 mA, R _L = 100 Ω | | 3 | | μs |
| | Fall Time ^{*2} | t _f | | | 5 | | |

*1 CTR rank (PS2801-1 only)

K : 300 to 600 (%)

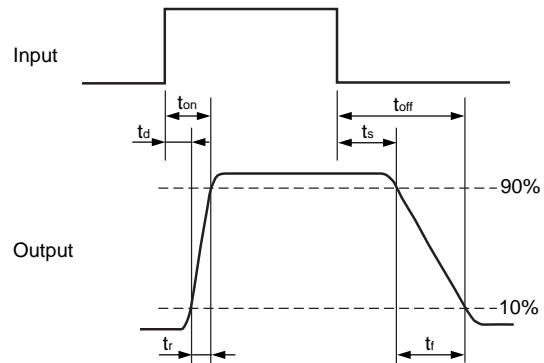
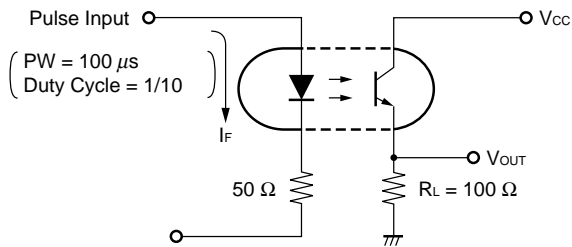
P : 150 to 300 (%)

L : 100 to 300 (%)

N : 80 to 600 (%)

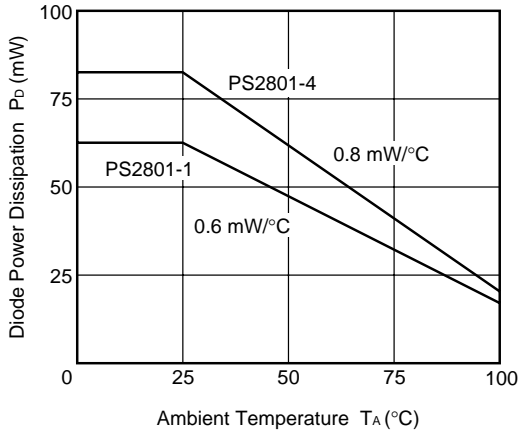
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*2 Test circuit for switching time

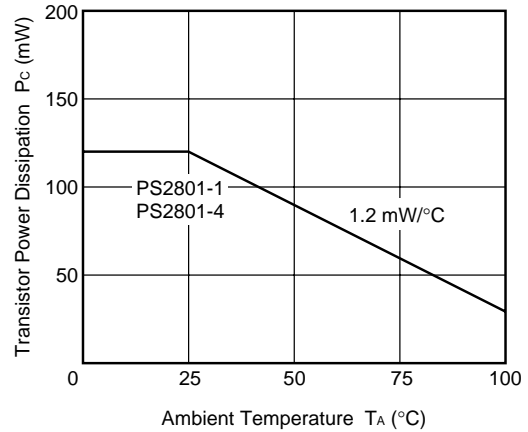


TYPICAL CHARACTERISTICS (Unless otherwise specified, $T_A = 25^\circ\text{C}$)

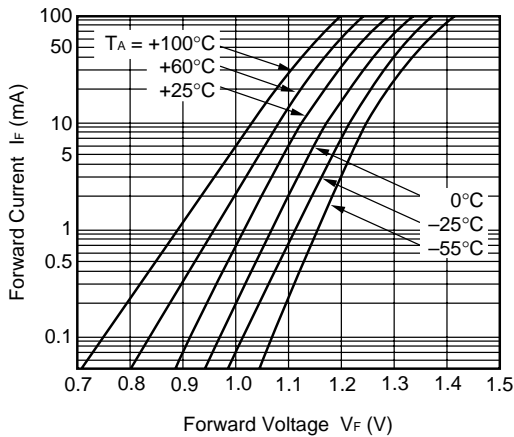
DIODE POWER DISSIPATION vs. AMBIENT TEMPERATURE



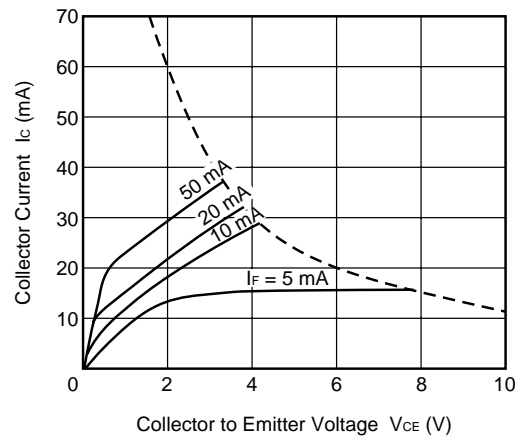
TRANSISTOR POWER DISSIPATION vs. AMBIENT TEMPERATURE



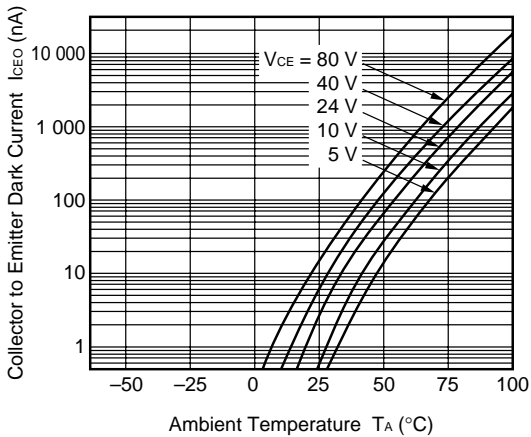
FORWARD CURRENT vs. FORWARD VOLTAGE



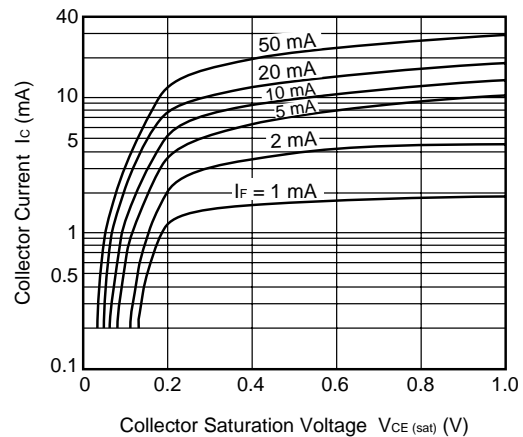
COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE



COLLECTOR TO EMITTER DARK CURRENT vs. AMBIENT TEMPERATURE

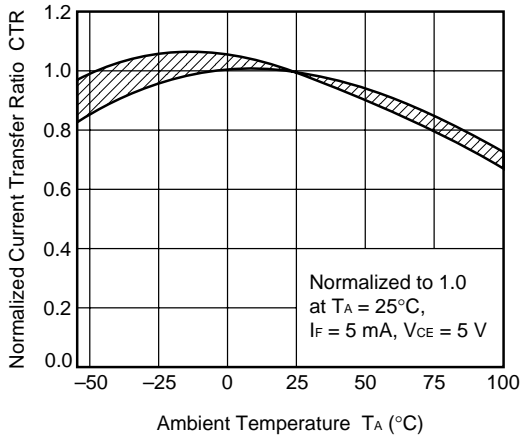


COLLECTOR CURRENT vs. COLLECTOR SATURATION VOLTAGE

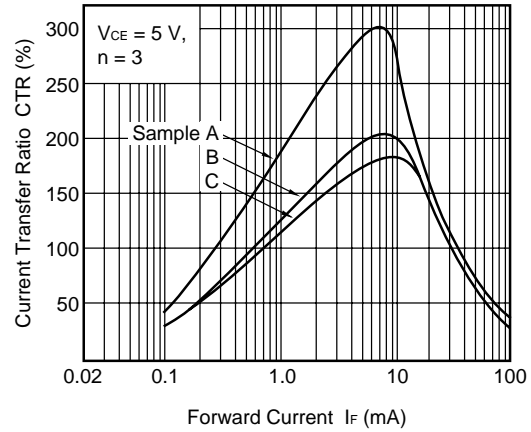


Remark The graphs indicate nominal characteristics.

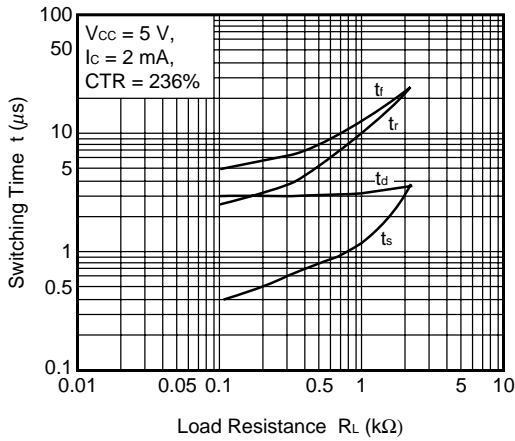
NORMALIZED CURRENT TRANSFER RATIO vs. AMBIENT TEMPERATURE



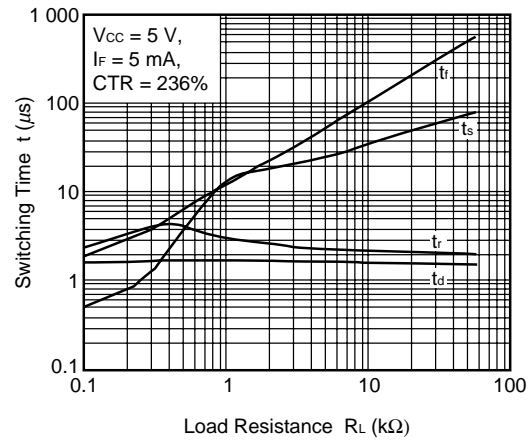
CURRENT TRANSFER RATIO vs. FORWARD CURRENT



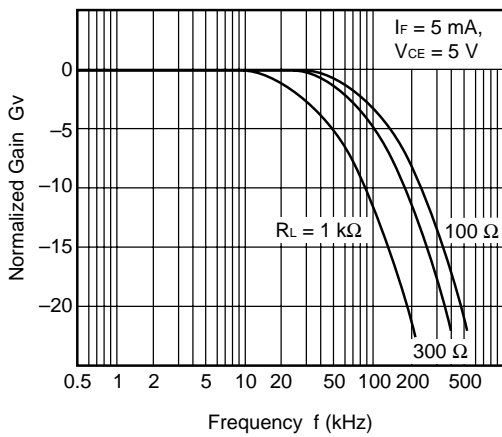
SWITCHING TIME vs. LOAD RESISTANCE



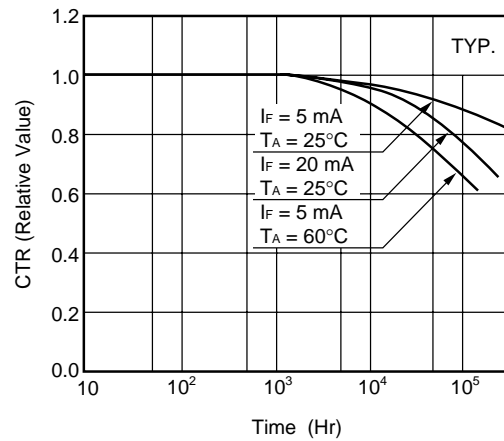
SWITCHING TIME vs. LOAD RESISTANCE



FREQUENCY RESPONSE



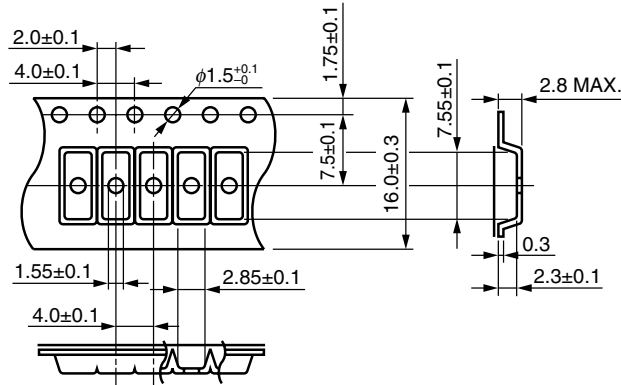
LONG TERM CTR DEGRADATION



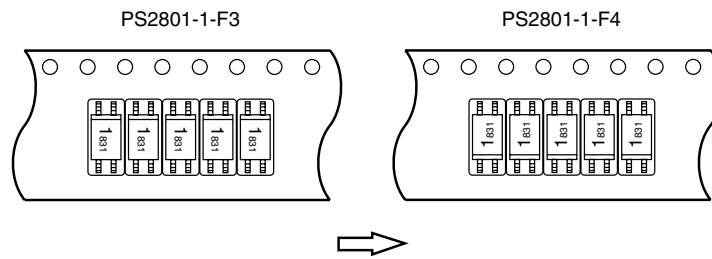
Remark The graphs indicate nominal characteristics.

TAPING SPECIFICATIONS (UNIT: mm)

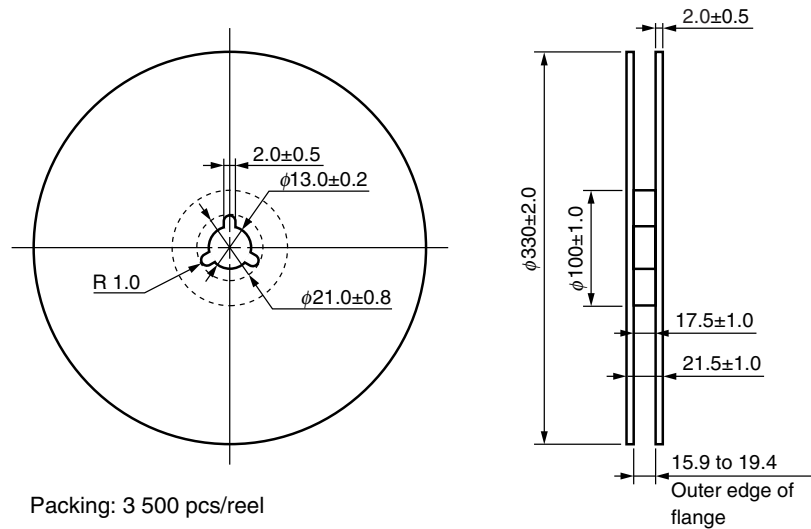
Outline and Dimensions (Tape)



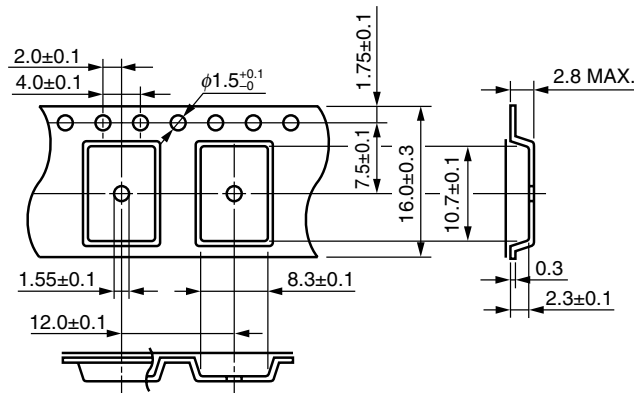
Tape Direction



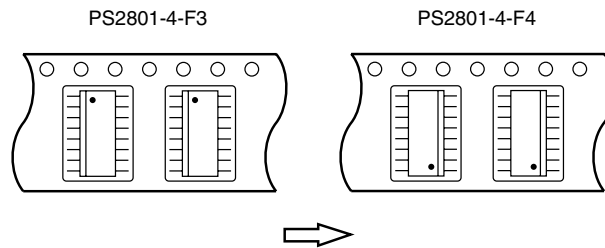
Outline and Dimensions (Reel)



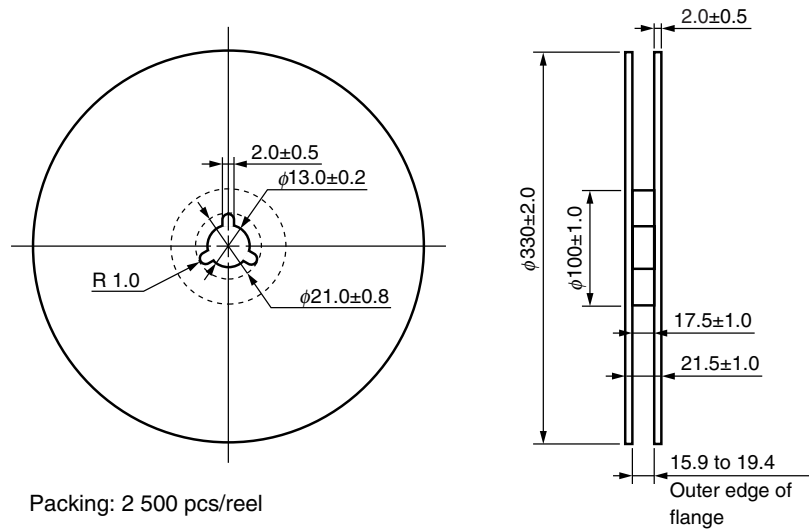
Outline and Dimensions (Tape)



Tape Direction



Outline and Dimensions (Reel)



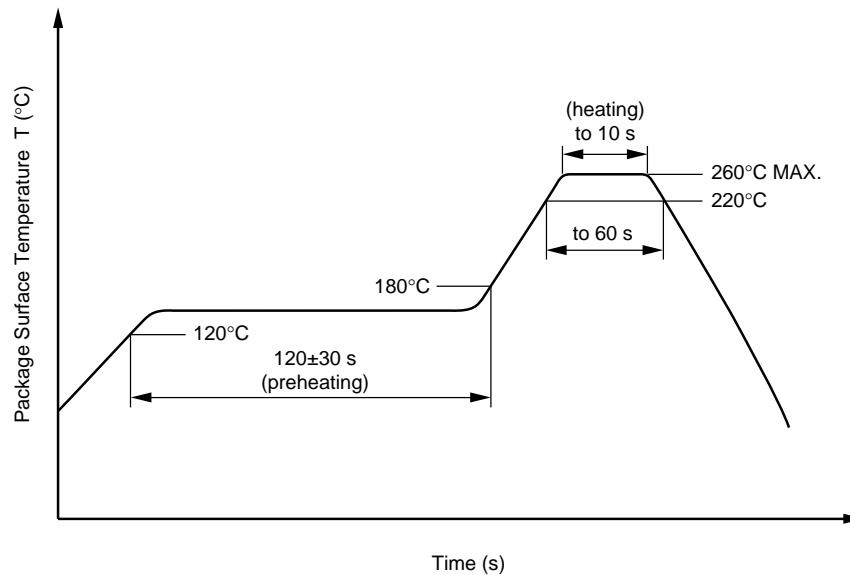
NOTES ON HANDLING

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. This tendency may sometimes be obvious, especially below $I_F = 1$ mA.

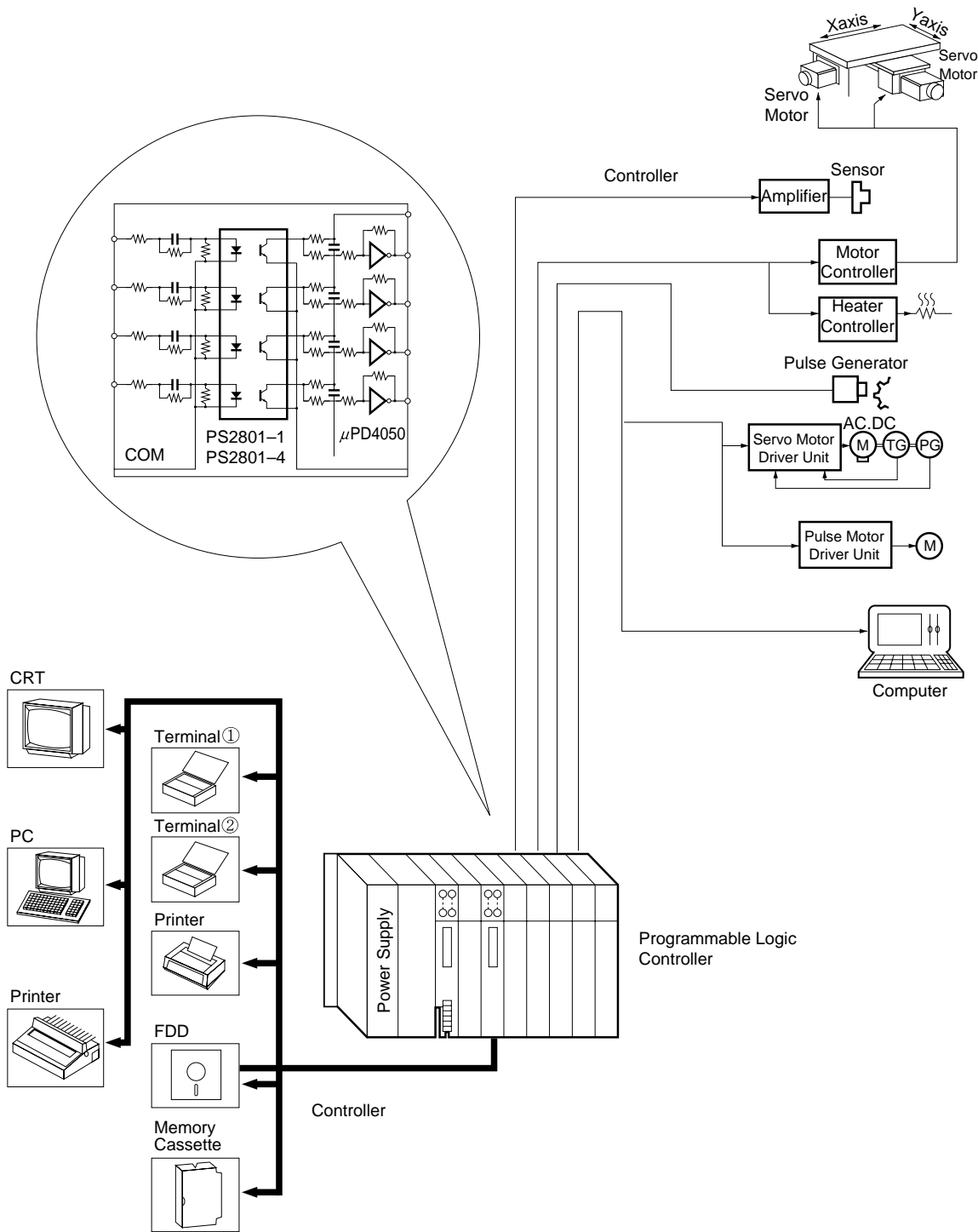
Therefore, check the characteristics under the actual operating conditions and thoroughly take variations or the like into consideration before use.

USAGE CAUTIONS

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

PROGRAMMABLE LOGIC CONTROLLERS EXAMPLE

Purpose: In-out interface



<R> SPECIFICATION OF VDE MARKS LICENSE DOCUMENT

| Parameter | Symbol | Spec. | Unit |
|--|--|-----------------------------|----------------------------|
| Climatic test class (IEC 60068-1/DIN EN 60068-1) | | 55/110/21 | |
| Dielectric strength maximum operating isolation voltage Test voltage (partial discharge test, procedure a for type test and random test) $U_{pr} = 1.5 \times U_{IORM}, P_d < 5 \text{ pC}$ | U_{IORM} U_{pr} | 705 1 058 | V_{peak} V_{peak} |
| Test voltage (partial discharge test, procedure b for all devices) $U_{pr} = 1.875 \times U_{IORM}, P_d < 5 \text{ pC}$ | U_{pr} | 1 322 | V_{peak} |
| Highest permissible overvoltage | U_{TR} | 6 000 | V_{peak} |
| Degree of pollution (DIN EN 60664-1 VDE0110 Part 1) | | 2 | |
| Clearance distance | | >5.0 | mm |
| Creepage distance | | >5.0 | 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 +110 | °C |
| Isolation resistance, minimum value $V_{IO} = 500 \text{ V dc at } T_A = 25^\circ\text{C}$ $V_{IO} = 500 \text{ V dc at } T_A \text{ MAX. at least } 100^\circ\text{C}$ | Ris MIN. Ris MIN. | 10^{12} 10^{11} | Ω Ω |
| Safety maximum ratings (maximum permissible in case of fault, see thermal derating curve) Package temperature Current (input current I_F , $P_{Si} = 0$) Power (output or total power dissipation) Isolation resistance $V_{IO} = 500 \text{ V dc at } T_A = T_{Si}$ | T_{Si} I_{Si} P_{Si} Ris MIN. | 150 300 500 10^9 | °C mA mW Ω |

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M8E 02.11-1

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|-----------------------|----------------------|---|
| <p>Caution</p> | <p>GaAs Products</p> | <p>This product uses gallium arsenide (GaAs). GaAs vapor and powder are hazardous to human health if inhaled or ingested, so please observe the following points.</p> <ul style="list-style-type: none"> • Follow related laws and ordinances when disposing of the product. If there are no applicable laws and/or ordinances, dispose of the product as recommended below. <ol style="list-style-type: none"> 1. Commission a disposal company able to (with a license to) collect, transport and dispose of materials that contain arsenic and other such industrial waste materials. 2. Exclude the product from general industrial waste and household garbage, and ensure that the product is controlled (as industrial waste subject to special control) up until final disposal. <ul style="list-style-type: none"> • Do not burn, destroy, cut, crush, or chemically dissolve the product. • Do not lick the product or in any way allow it to enter the mouth. |
|-----------------------|----------------------|---|