CEL

# PHOTOCOUPLER
# PS8802-1,-2

## 1 Mbps HIGH CMR ANALOG OUTPUT TYPE 8-PIN SSOP (SO-8) HIGH-SPEED PHOTOCOUPLER

–NEPOC Series–

### DESCRIPTION

The PS8802-1, -2 are optically coupled isolators containing a GaAlAs LED on the light emitting diode (input side) and a PIN photodiode and a high-speed amplifier transistor on the output side on one chip.

The PS8802-1, -2 are designed specifically for high common mode transient immunity (CMR), the PS8802-2 is suitable for high density applications.

### FEATURES

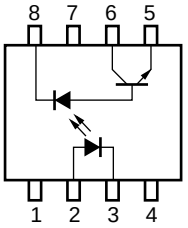
- 40% reduction of mounting area (5-pin SOP × 2)
- High common mode transient immunity ($C_{MH}$, $C_{ML}$ = ±15 kV/μs MIN.)
- High supply voltage ($V_{CC}$ = 35 V)
- High isolation voltage (BV = 2 500 Vr.m.s.)
- High-speed response ($t_{PHL}$ = 0.8 μs MAX., $t_{PLH}$ = 1.2 μs MAX.)
- Ordering number of tape product: PS8802-1-F3, F4: 1 500 pcs/reel
  : PS8802-2-F3, F4: 1 500 pcs/reel
- Pb-Free product
- Safety standards
  - UL approved: File No. E72422
  - DIN EN60747-5-2 (VDE0884 Part2) approved (option)

### APPLICATIONS

- Computer and peripheral manufactures
- General purpose inverter
- Substitutions for relays and pulse transformers
- Power supply

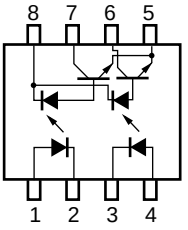
### PIN CONNECTION
(Top View)

**PS8802-1**




1. NC
2. Anode
3. Cathode
4. NC
5. GND
6. $V_O$
7. NC
8. $V_{CC}$

**PS8802-2**




1. Anode1
2. Cathode1
3. Cathode2
4. Anode2
5. GND
6. $V_O2$
7. $V_O1$
8. $V_{CC}$



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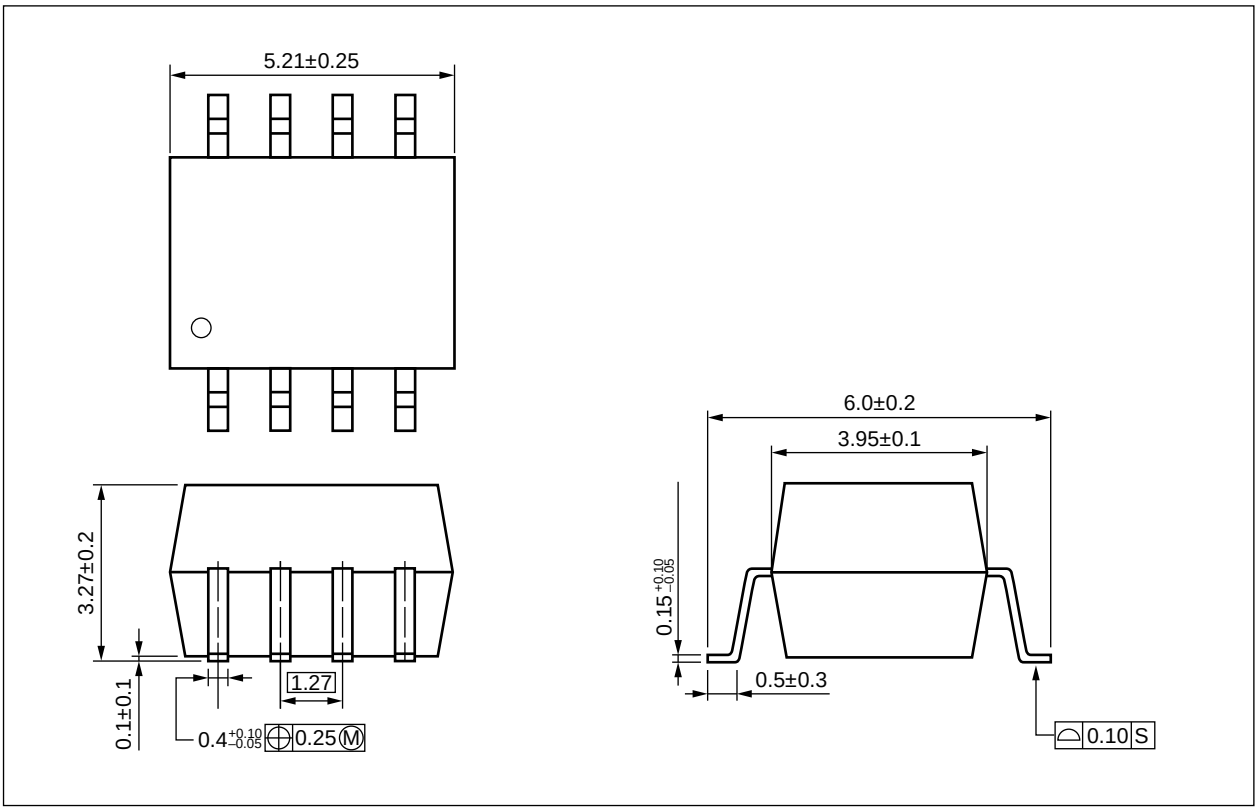
The mark <R> shows major revised points.



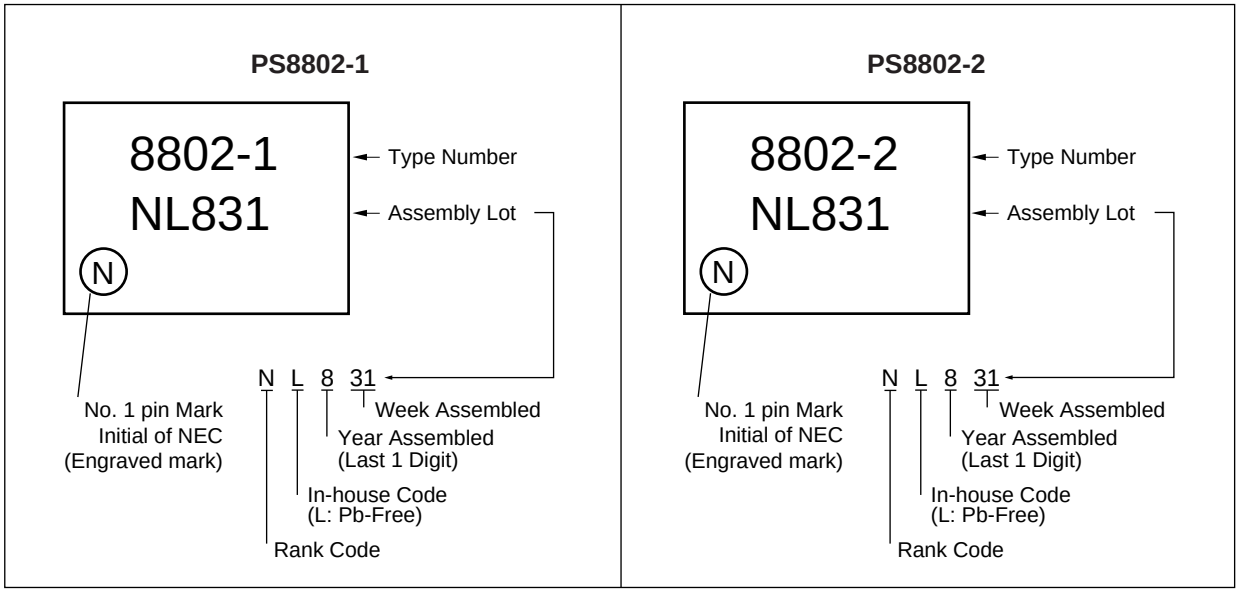
The revised points can be easily searched by copying an "<R>" in the PDF file and specifying it in the "Find what:" field.

**PACKAGE DIMENSIONS (UNIT: mm)**

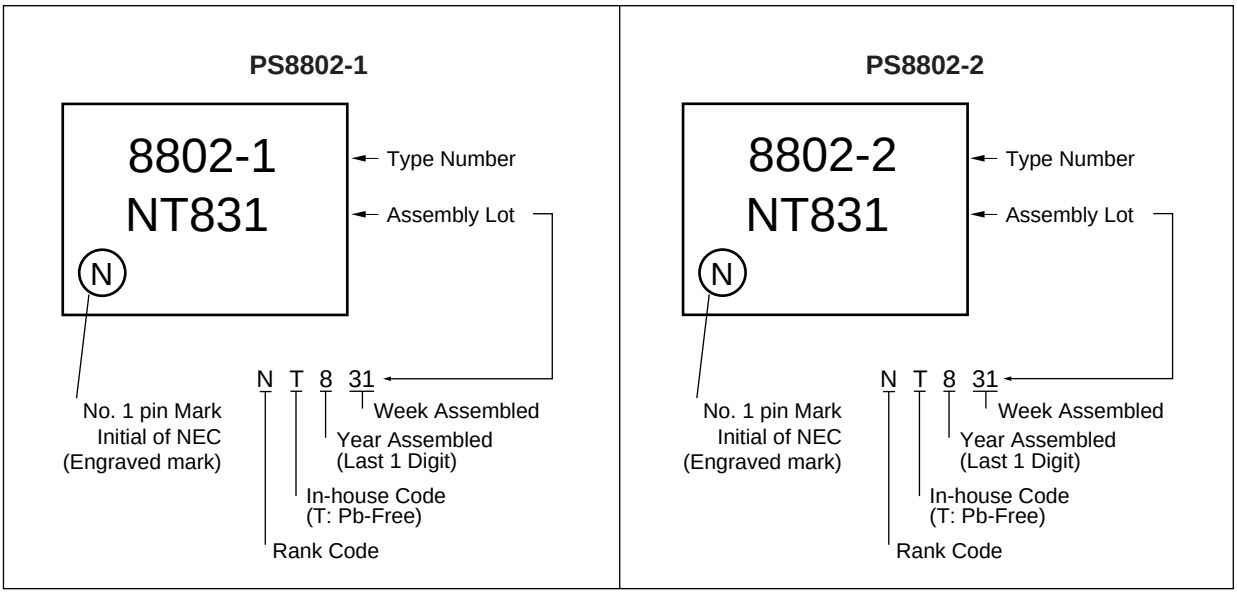


<R> **MARKING EXAMPLE**

**SnBi PLATING**




**Ni/Pd/Au PLATING**



<R> **ORDERING INFORMATION**

| Part Number | Order Number | Solder Plating Specification | Packing Style | Safety Standard Approval | Application Part Number*1 |
|---|---|---|---|---|---|
| PS8802-1 | PS8802-1-A | Pb-Free | 20 pcs (Tape 20 pcs cut) | Standard products | PS8802-1 |
| PS8802-1-F3 | PS8802-1-F3-A | (SnBi) | Embossed Tape 1 500 pcs/reel | (UL approved) | |
| PS8802-1-F4 | PS8802-1-F4-A | | | | |
| PS8802-2 | PS8802-2-A | | 20 pcs (Tape 20 pcs cut) | | PS8802-2 |
| PS8802-2-F3 | PS8802-2-F3-A | | Embossed Tape 1 500 pcs/reel | | |
| PS8802-2-F4 | PS8802-2-F4-A | | | | |
| PS8802-1-V | PS8802-1-V-A | | 20 pcs (Tape 20 pcs cut) | DIN EN60747-5-2 | PS8802-1 |
| PS8802-1-V-F3 | PS8802-1-V-F3-A | | Embossed Tape 1 500 pcs/reel | (VDE0884 Part2) | |
| PS8802-1-V-F4 | PS8802-1-V-F4-A | | | Approved (Option) | |
| PS8802-2-V | PS8802-2-V-A | | 20 pcs (Tape 20 pcs cut) | | PS8802-2 |
| PS8802-2-V-F3 | PS8802-2-V-F3-A | | Embossed Tape 1 500 pcs/reel | | |
| PS8802-2-V-F4 | PS8802-2-V-F4-A | | | | |
| PS8802-1 | PS8802-1-AX | Pb-Free | 20 pcs (Tape 20 pcs cut) | Standard products | PS8802-1 |
| PS8802-1-F3 | PS8802-1-F3-AX | (Ni/Pd/Au) | Embossed Tape 1 500 pcs/reel | (UL approved) | |
| PS8802-1-F4 | PS8802-1-F4-AX | | | | |
| PS8802-2 | PS8802-2-AX | | 20 pcs (Tape 20 pcs cut) | | PS8802-2 |
| PS8802-2-F3 | PS8802-2-F3-AX | | Embossed Tape 1 500 pcs/reel | | |
| PS8802-2-F4 | PS8802-2-F4-AX | | | | |
| PS8802-1-V | PS8802-1-V-AX | | 20 pcs (Tape 20 pcs cut) | DIN EN60747-5-2 | PS8802-1 |
| PS8802-1-V-F3 | PS8802-1-V-F3-AX | | Embossed Tape 1 500 pcs/reel | (VDE0884 Part2) | |
| PS8802-1-V-F4 | PS8802-1-V-F4-AX | | | Approved (Option) | |
| PS8802-2-V | PS8802-2-V-AX | | 20 pcs (Tape 20 pcs cut) | | PS8802-2 |
| PS8802-2-V-F3 | PS8802-2-V-F3-AX | | Embossed Tape 1 500 pcs/reel | | |
| PS8802-2-V-F4 | PS8802-2-V-F4-AX | | | | |

***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 | Forward Current | $I_F$ | 25 | mA/ch |
| | Reverse Voltage | $V_R$ | 5.0 | V/ch |
| | Power Dissipation*1 | $P_D$ | 45 | mW/ch |
| Detector | Supply Voltage | $V_{CC}$ | 35 | V |
| | Output Voltage | $V_O$ | 35 | V/ch |
| | Output Current | $I_O$ | 8.0 | mA/ch |
| | Power Dissipation*2 | $P_C$ | 100 | mW/ch |
| Isolation Voltage*3 | | BV | 2 500 | Vr.m.s. |
| Operating Ambient Temperature | | $T_A$ | –55 to +100 | °C |
| Storage Temperature | | $T_{stg}$ | –55 to +125 | °C |

***1** Reduced to 0.45 mW/°C at $T_A$ = 25°C or more.

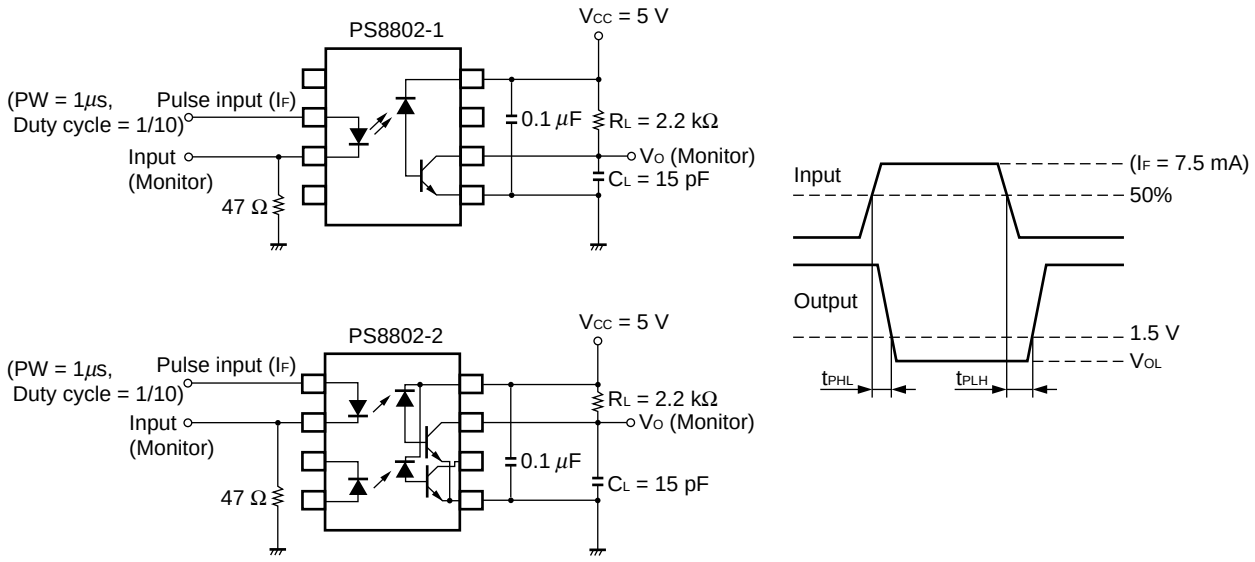
***2** Reduced to 1.00 mW/°C at $T_A$ = 25°C or more.

***3** AC voltage for 1 minute at $T_A$ = 25°C, RH = 60% between input and output.
Pins 1-4 shorted together, 5-8 shorted together.

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

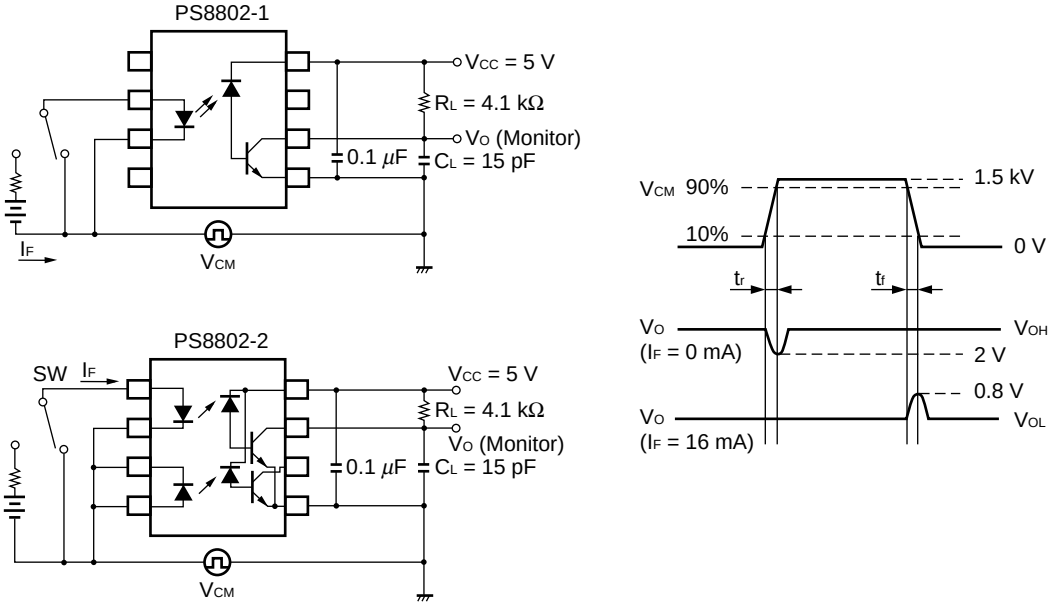
| Parameter | | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|---|---|
| Diode | Forward Voltage | $V_F$ | $I_F$ = 16 mA | | 1.7 | 2.2 | V |
| | Reverse Current | $I_R$ | $V_R$ = 3 V | | | 10 | μA |
| | Forward Voltage Temperature Coefficient | $\Delta V_F/\Delta T_A$ | $I_F$ = 16 mA | | −2.1 | | mV/°C |
| | Terminal Capacitance | $C_t$ | V = 0 V, f = 1 MHz | | 30 | | pF |
| Detector | High Level Output Current | $I_{OH}$ (1) | $I_F$ = 0 mA, $V_{CC}$ = $V_O$ = 5.5 V | | 10 | 500 | nA |
| | High Level Output Current | $I_{OH}$ (2) | $I_F$ = 0 mA, $V_{CC}$ = $V_O$ = 30 V | | | 100 | μA |
| | Low Level Output Voltage | $V_{OL}$ | $I_F$ = 16 mA, $V_{CC}$ = 4.5 V, $I_{OL}$ = 1.2 mA | | 0.1 | 0.4 | V |
| | High Level Supply Current (PS8802-1) | $I_{CCH}$ | $I_F$ = 0 mA, $V_O$ = open, $V_{CC}$ = 30 V | | 0.1 | 2 | μA |
| | High Level Supply Current (PS8802-2) | | | | 0.2 | 4 | |
| | Low Level Supply Current (PS8802-1) | $I_{CCL}$ | $I_F$ = 16 mA, $V_O$ = open, $V_{CC}$ = 30 V | | 100 | | |
| | Low Level Supply Current (PS8802-2) | | | | 200 | | |
| Coupled | Current Transfer Ratio | CTR | $I_F$ = 16 mA, $V_{CC}$ = 4.5 V, $V_O$ = 0.4 V | 15 | 25 | 45 | % |
| | Input-Output Isolation Resistance | $R_{I-O}$ | $V_{I-O}$ = 1 $kV_{DC}$, RH = 40 to 60% | $10^{11}$ | | | Ω |
| | Insulation Resistance (Input-Input), (PS8802-2) | $R_{I-I}$ | $V_{I-I}$ = 1 $kV_{DC}$, RH = 40 to 60% | $10^{10}$ | | | |
| | Input-Output Isolation Capacitance | $C_{I-O}$ | V = 0 V, f = 1 MHz | | 0.6 | | pF |
| | Insulation Capacitance (Input-Input), (PS8802-2) | $C_{I-I}$ | | | 0.3 | | |
| | Propagation Delay Time (H → L)[*1] | $t_{PHL}$ | $I_F$ = 16 mA, $V_{CC}$ = 5 V, $R_L$ = 2.2 kΩ, $C_L$ = 15 pF | | 0.3 | 0.8 | μs |
| | Propagation Delay Time (L → H)[*1] | $t_{PLH}$ | | | 0.6 | 1.2 | |
| | Common Mode Transient Immunity at High Level Output[*2] | $C_{MH}$ | $I_F$ = 0 mA, $V_{CC}$ = 5 V, $R_L$ = 4.1 kΩ, $V_{CM}$ = 1.5 kV | 15 | | | kV/μs |
| | Common Mode Transient Immunity at Low Level Output[*2] | $C_{ML}$ | $I_F$ = 16 mA, $V_{CC}$ = 5 V, $R_L$ = 4.1 kΩ, $V_{CM}$ = 1.5 kV | −15 | | | |

***1** Test circuit for propagation delay time




**Remark** $C_L$ is approximately 15 pF which includes probe and stray wiring capacitance.

***2** Test circuit for common mode transient immunity

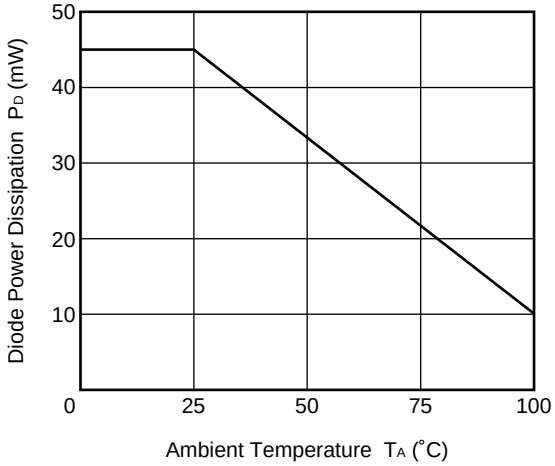



## USAGE CAUTIONS

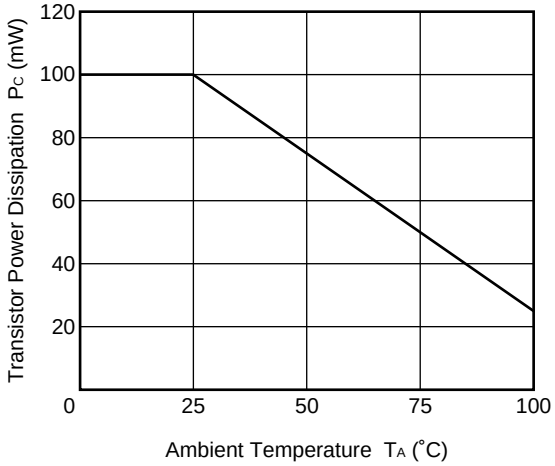
1. This product is weak for static electricity by designed with high-speed integrated circuit so protect against static electricity when handling.
2. By-pass capacitor of 0.1 μF is used between $V_{CC}$ and GND near device. Also, ensure that the distance between the leads of the photocoupler and capacitor is no more than 10 mm.
3. Avoid storage at a high temperature and high humidity.

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

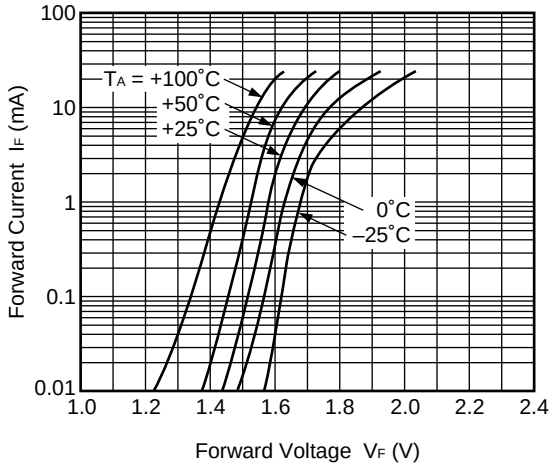
DIODE POWER DISSIPATION vs. AMBIENT TEMPERATURE



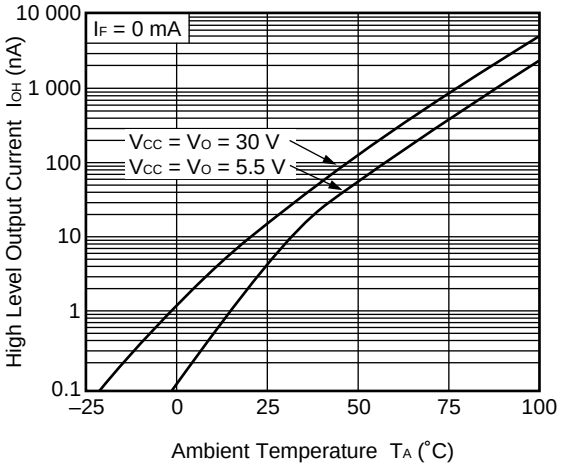

TRANSISTOR POWER DISSIPATION vs. AMBIENT TEMPERATURE



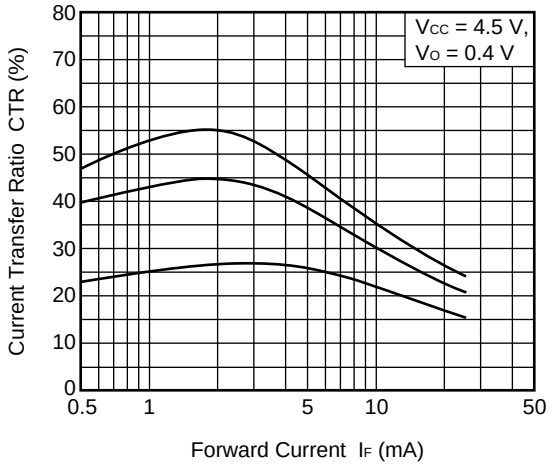

FORWARD CURRENT vs. FORWARD VOLTAGE



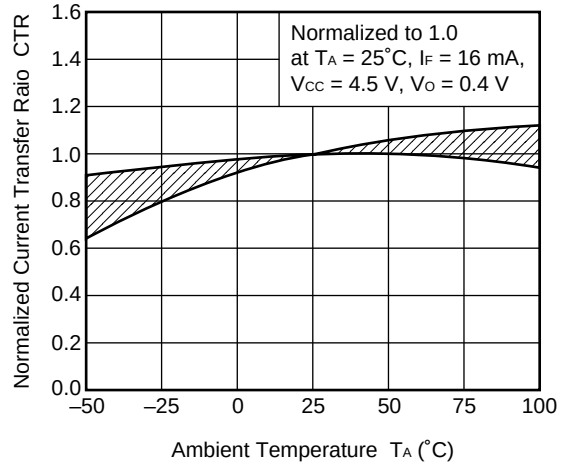

HIGH LEVEL OUTPUT CURRENT vs. AMBIENT TEMPERATURE




CURRENT TRANSFER RATIO vs. FORWARD CURRENT

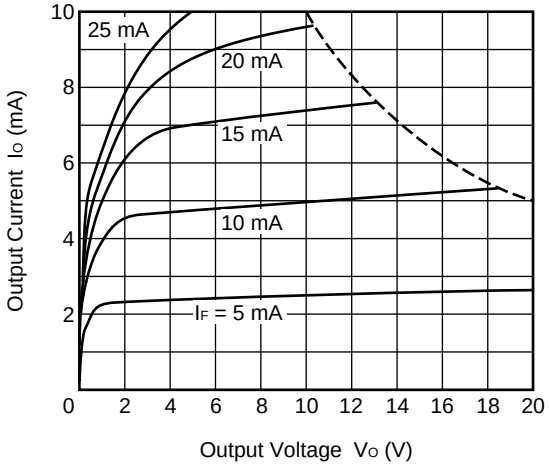



NORMALIZED CURRENT TRANSFER RATIO vs. AMBIENT TEMPERATURE

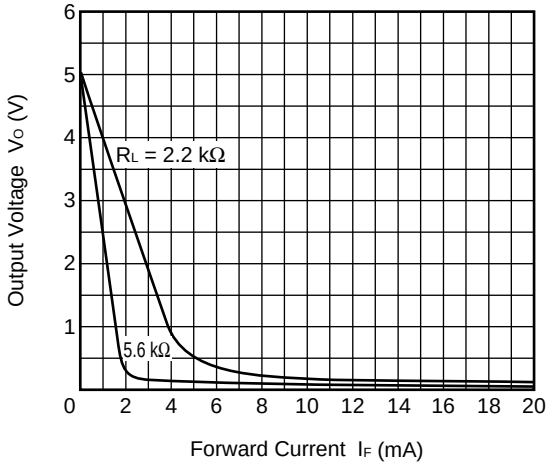



**Remark** The graphs indicate nominal characteristics.

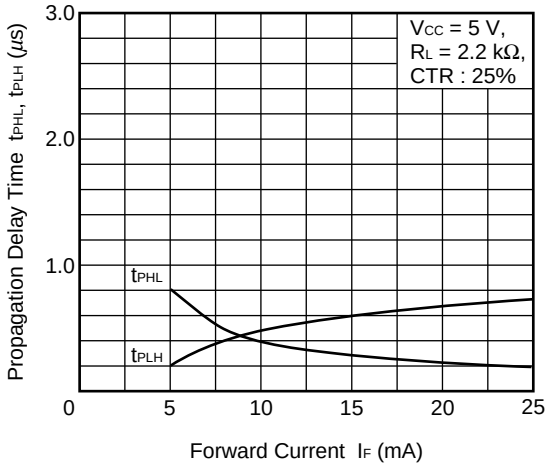
OUTPUT CURRENT vs.
OUTPUT VOLTAGE



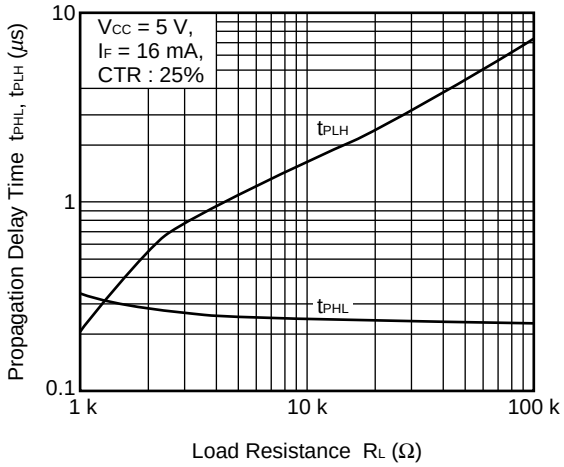

OUTPUT VOLTAGE vs.
FORWARD CURRENT



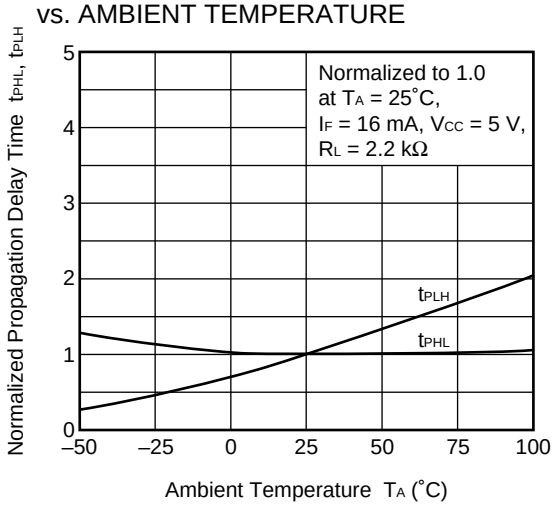

PROPAGATION DELAY TIME vs.
FORWARD CURRENT




PROPAGATION DELAY TIME vs.
LOAD RESISTANCE



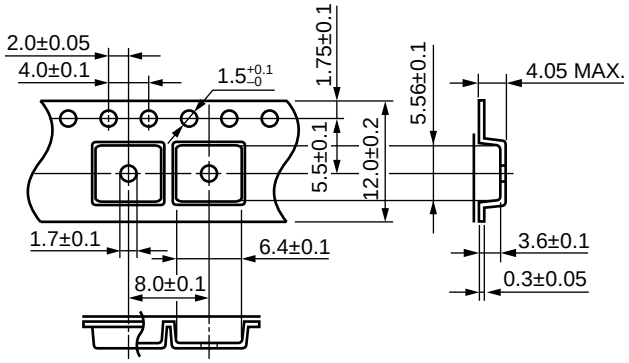

NORMALIZED PROPAGATION DELAY TIME
vs. AMBIENT TEMPERATURE



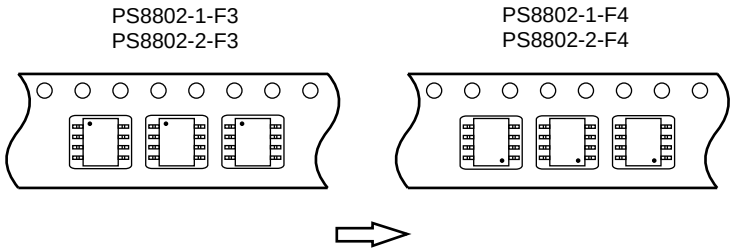

**Remark** The graphs indicate nominal characteristics.

**TAPING SPECIFICATIONS (UNIT: mm)**

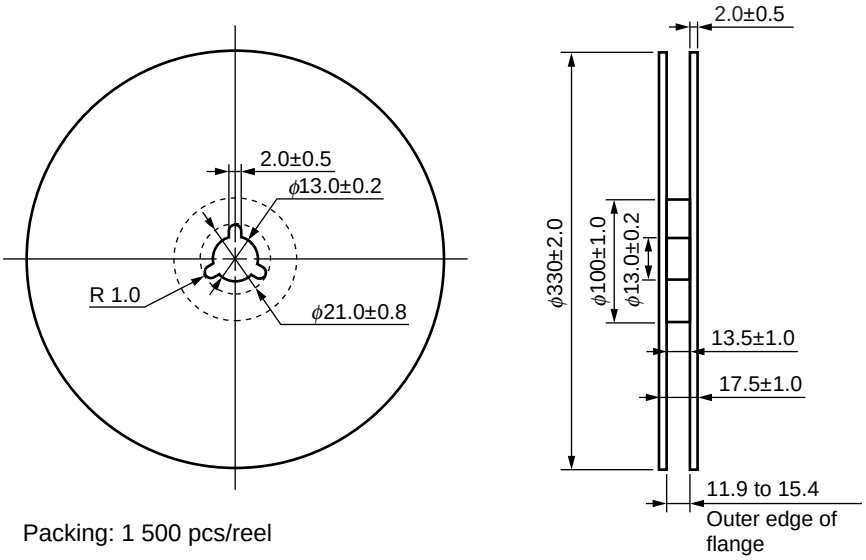
Outline and Dimensions (Tape)




Taping Direction

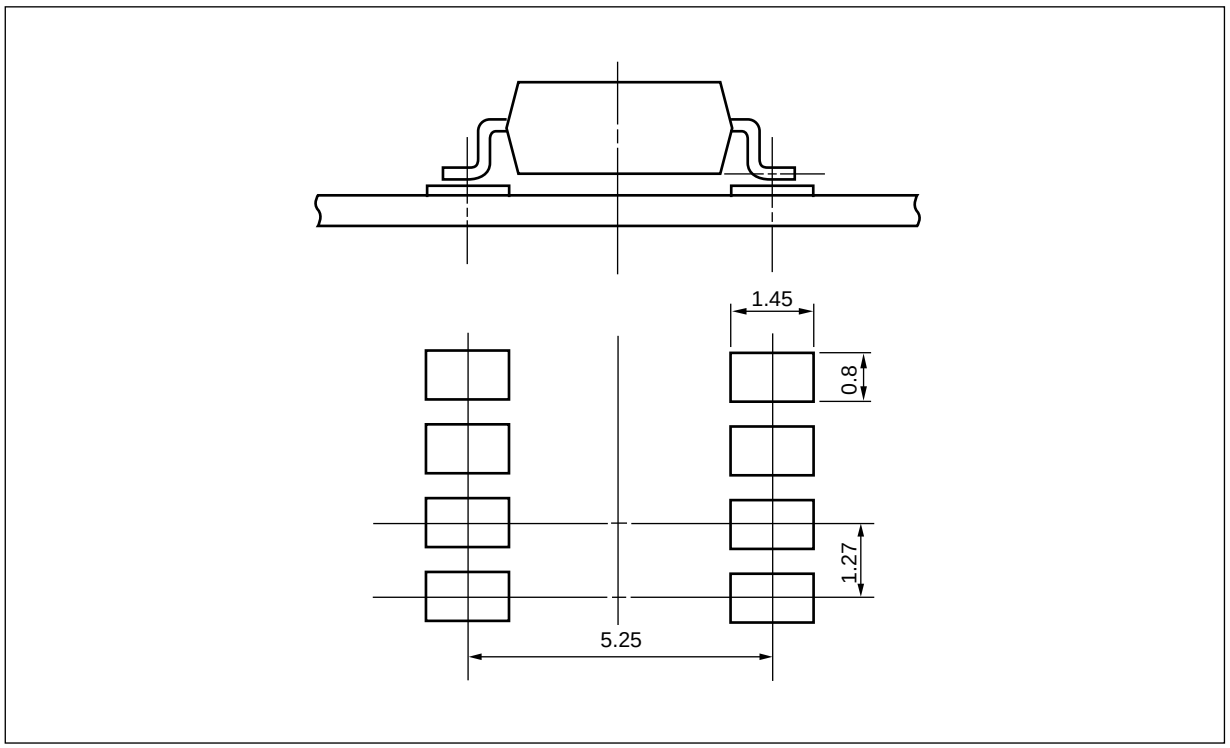



Outline and Dimensions (Reel)




Packing: 1 500 pcs/reel

**RECOMMENDED MOUNT PAD DIMENSIONS (UNIT: mm)**



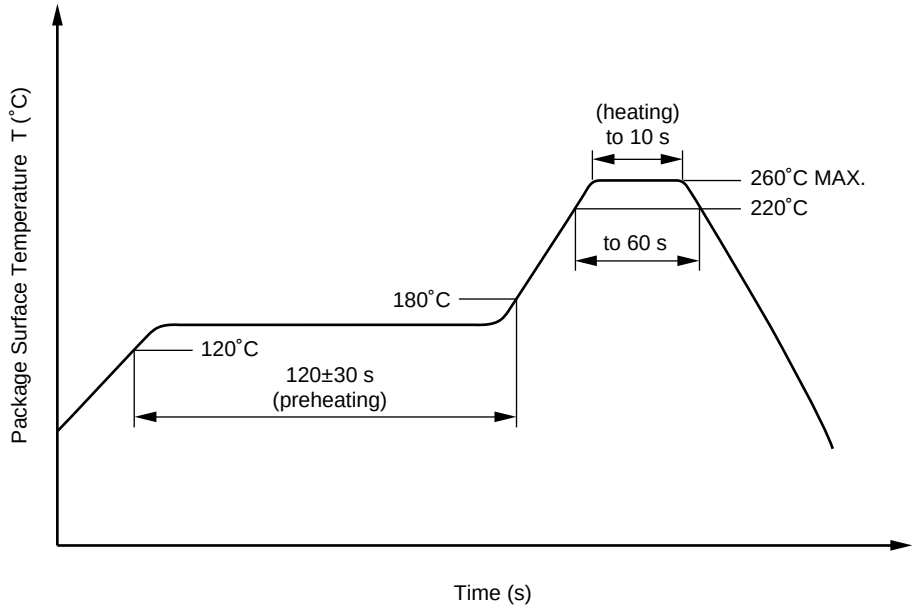
## NOTES ON HANDLING

### 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.

## 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 | Speck | Unit |
|---|---|---|---|
| Application classification (DIN EN 60664-1 VDE0110 Part 1)<br>for rated line voltages ≤ 300 Vr.m.s.<br>for rated line voltages ≤ 600 Vr.m.s. | | <br>IV<br>III | |
| Climatic test class (DIN EN 60664-1 VDE0110) | | 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>566<br>849 | <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 | $U_{pr}$ | 1 061 | $V_{peak}$ |
| Highest permissible overvoltage | $U_{TR}$ | 4 000 | $V_{peak}$ |
| Degree of pollution (DIN EN 60664-1 VDE0110 Part 1) | | 2 | |
| Clearance distance | | >4.0 | mm |
| Creepage distance | | >4.0 | mm |
| Comparative tracking index (DIN IEC 112/VDE 0303 Part 1) | CTI | 175 | |
| Material group (DIN EN 60664-1 VDE0110 Part 1) | | III a | |
| Storage temperature range | $T_{stg}$ | –55 to +125 | °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>150<br>150<br>600<br><br>$10^9$ | <br>°C<br>mA<br>mW<br><br>Ω |

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- NEC Electronics products are classified into the following three quality grades: "Standard", "Special" and "Specific".
  The "Specific" quality grade applies only to NEC Electronics products developed based on a customer-designated "quality assurance program" for a specific application. The recommended applications of an NEC Electronics product depend on its quality grade, as indicated below. Customers must check the quality grade of each NEC Electronics product before using it in a particular application.
  "Standard": Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots.
  "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": Aircraft, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems and medical equipment for life support, etc.

The quality grade of NEC Electronics products is "Standard" unless otherwise expressly specified in NEC Electronics data sheets or data books, etc. If customers wish to use NEC Electronics products in applications not intended by NEC Electronics, they must contact an NEC Electronics sales representative in advance to determine NEC Electronics' willingness to support a given application.

(Note)
(1) "NEC Electronics" as used in this statement means NEC Electronics Corporation and also includes its majority-owned subsidiaries.
(2) "NEC Electronics products" means any product developed or manufactured by or for NEC Electronics (as defined above).

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| **Caution** GaAs Products | This product uses gallium arsenide (GaAs).<br>GaAs vapor and powder are hazardous to human health if inhaled or ingested, so please observe the following points.<br>• 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.<br>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.<br>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.<br>• Do not burn, destroy, cut, crush, or chemically dissolve the product.<br>• Do not lick the product or in any way allow it to enter the mouth. |