

# PS2503-1, PS2503L-1

R08DS0204EJ0100

Rev.1.00

Dec 25, 2020

LOW INPUT CURRENT, HIGH SPEED SWITCHING

## DESCRIPTION

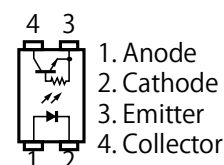
The PS2503-1 and PS2503L-1 are optically coupled isolator containing a GaAs light emitting diode and an NPN silicon phototransistor.

The PS2503-1 is in a plastic DIP (Dual In-line Package) and the PS2503L-1 is lead bending type (Gull-wing) for surface mount.

## FEATURES

- High isolation voltage ( $BV = 5\,000\text{ Vr.m.s.}$ )
- High-speed switching ( $t_r = 20\ \mu\text{s TYP.}$ ,  $t_f = 30\ \mu\text{s TYP.}$ )
- Ordering number of taping product: PS2503L-1-F3 : 2 000 pcs/reel
- Pb-Free product
- Safety standards
  - UL approved: UL1577, Double protection
  - CSA approved: CAN/CSA-C22.2 No. 62368-1, Reinforced insulation

### PIN CONNECTION (Top View)

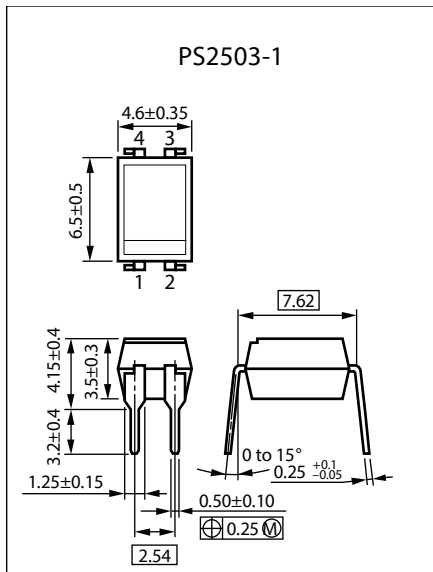


## APPLICATIONS

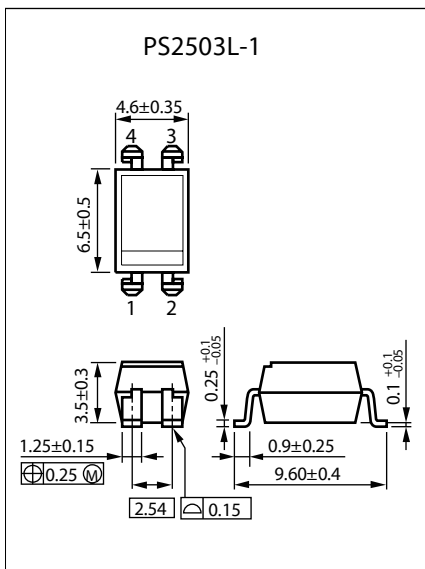
- Measurement equipment
- Programmable logic controller
- Telephone/Telegraph Receiver
- Power supply

## PACKAGE DIMENSIONS (UNIT: mm)

### DIP Type



### Lead Bending Type For Surface Mount

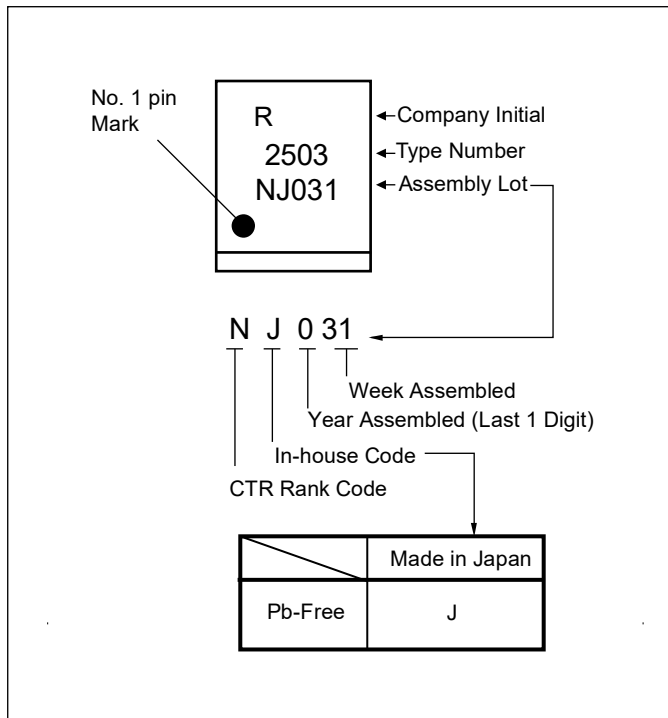


Weight ( 4-pin DIP ) : 0.26 g (typ.)

## PHOTOCOUPLER CONSTRUCTION

| Parameter                 | PS2503-1, PS2503L-1 |
|---------------------------|---------------------|
| Air Distance (MIN.)       | 7 mm                |
| Creepage Distance (MIN.)  | 7 mm                |
| Isolation Distance (MIN.) | 0.3 mm              |

## MARKING EXAMPLE



## ORDERING INFORMATION

| Part Number  | Order Number *1 | Solder Plating Specification | Packing Style                | Safety Standard Approval             | Application Part Number *2 |
|--------------|-----------------|------------------------------|------------------------------|--------------------------------------|----------------------------|
| PS2503-1     | PS2503-1-A      | Pb-Free                      | Magazine case 100 pcs        | Standard products (UL, CSA approved) | PS2503-1                   |
| PS2503L-1    | PS2503L-1-A     |                              |                              |                                      | PS2503L-1                  |
| PS2503L-1-F3 | PS2503L-1-F3-A  |                              | Embossed Tape 2 000 pcs/reel |                                      | PS2503L-1                  |

Notes: \*1. When specifying CTR rank, please add "/CTR rank" after Order Number.

ex. L rank : PS2503-1-A/L

Notes: \*2. 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                   |
|-------------------------------|------------------------------|-------------------------------|-------------|------------------------|
| Diode                         | Reverse Voltage              | $V_R$                         | 6           | V                      |
|                               | Forward Current (DC)         | $I_F$                         | 80          | mA                     |
|                               | Power Dissipation Derating   | $\Delta P_D/^{\circ}\text{C}$ | 1.5         | mW/ $^{\circ}\text{C}$ |
|                               | Power Dissipation            | $P_D$                         | 150         | mW                     |
|                               | Peak Forward Current*1       | $I_{FP}$                      | 1           | A                      |
| Transistor                    | Collector to Emitter Voltage | $V_{CEO}$                     | 40          | V                      |
|                               | Emitter to Collector Voltage | $V_{ECO}$                     | 0.6         | V                      |
|                               | Collector Current            | $I_C$                         | 30          | mA                     |
|                               | Power Dissipation Derating   | $\Delta P_C/^{\circ}\text{C}$ | 1.5         | mW/ $^{\circ}\text{C}$ |
|                               | Power Dissipation            | $P_C$                         | 150         | mW                     |
| Isolation Voltage*2           |                              | BV                            | 5 000       | Vr.m.s.                |
| Operating Ambient Temperature |                              | $T_A$                         | -55 to +100 | $^{\circ}\text{C}$     |
| Storage Temperature           |                              | $T_{stg}$                     | -55 to +150 | $^{\circ}\text{C}$     |

Note: \*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.

Pins 1-2 shorted together, 3-4 shorted together.

**ELECTRICAL CHARACTERISTICS ( $T_A = 25\text{ }^{\circ}\text{C}$ )**

|            | Parameter                            | Symbol        | Conditions                                                        | MIN.      | TYP. | MAX. | Unit          |
|------------|--------------------------------------|---------------|-------------------------------------------------------------------|-----------|------|------|---------------|
| Diode      | Forward Voltage                      | $V_F$         | $I_F = 1\text{ mA}$                                               |           | 1.1  | 1.3  | V             |
|            | Reverse Current                      | $I_R$         | $V_R = 5\text{ V}$                                                |           |      | 5    |               |
|            | Terminal Capacitance                 | $C_t$         | $V = 0\text{ V}, f = 1.0\text{ MHz}$                              |           | 50   |      | pF            |
| Transistor | Collector to Emitter Dark Current    | $I_{CEO}$     | $V_{CE} = 40\text{ V}, I_F = 0\text{ mA}$                         |           |      | 100  | nA            |
| Coupled    | Current Transfer Ratio ( $I_C/I_F$ ) | CTR           | $I_F = 1\text{ mA}, V_{CE} = 5\text{ V}$                          | 100       | 200  | 400  | %             |
|            | Collector Saturation Voltage         | $V_{CE(sat)}$ | $I_F = 1\text{ mA}, I_C = 0.2\text{ mA}$                          |           |      | 0.25 | V             |
|            | Isolation Resistance                 | $R_{I-O}$     | $V_{I-O} = 1.0\text{ kV}_{DC}$                                    | $10^{11}$ |      |      | $\Omega$      |
|            | Isolation Capacitance                | $C_{I-O}$     | $V = 0\text{ V}, f = 1.0\text{ MHz}$                              |           | 0.5  |      | pF            |
|            | Rise Time*2                          | $t_r$         | $V_{CC} = 5\text{ V}, I_F = 1\text{ mA}, R_L = 10\text{ k}\Omega$ |           | 20   |      | $\mu\text{s}$ |
|            | Fall Time*2                          | $t_f$         |                                                                   |           | 20   |      |               |

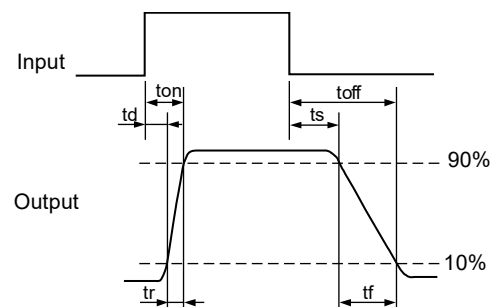
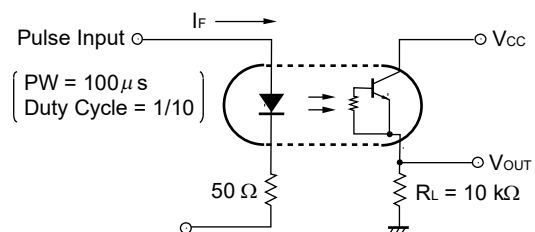
Note: \*1. CTR rank

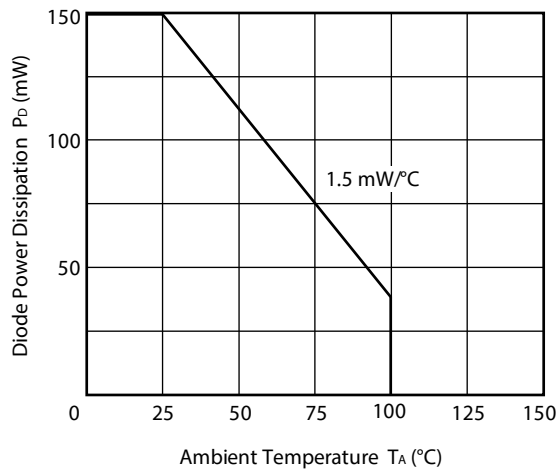
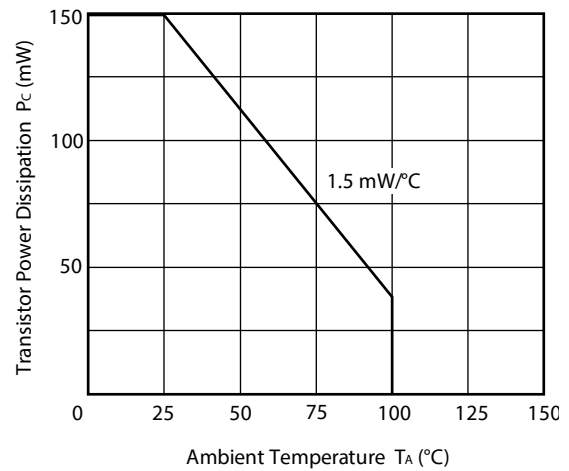
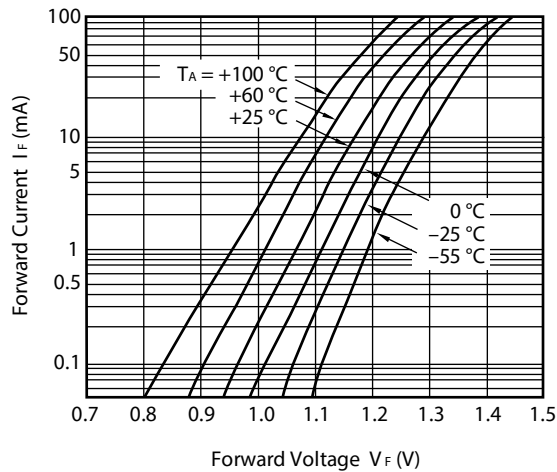
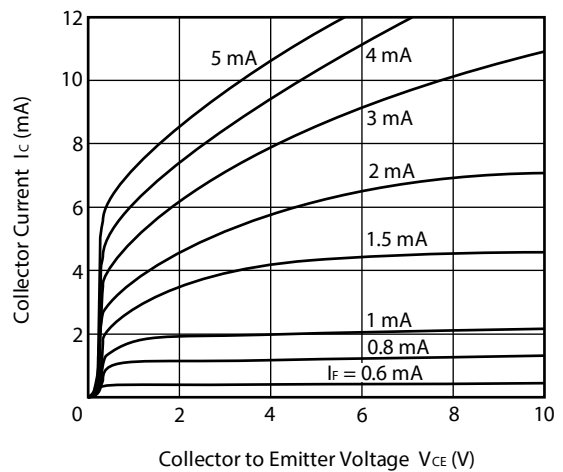
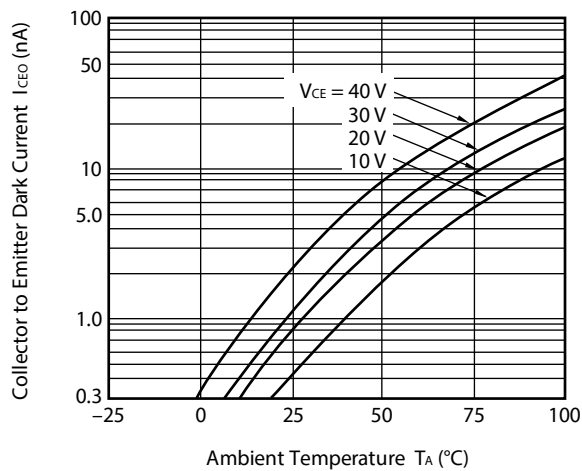
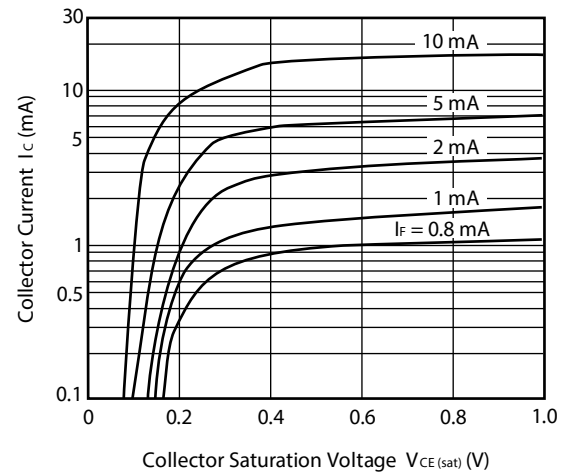
K : 200 to 400 (%)

L : 150 to 300 (%)

M : 100 to 200 (%)

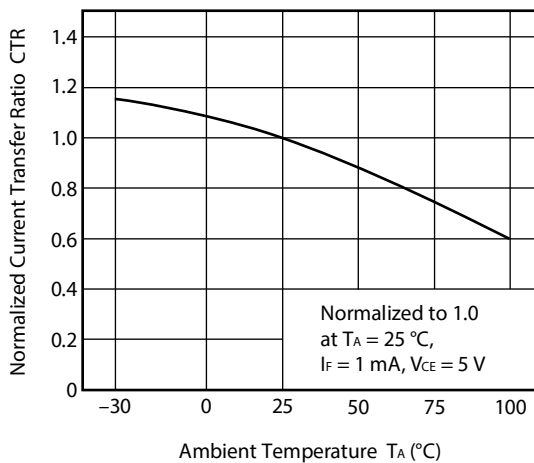
\*2. Test Circuit for Switching Time



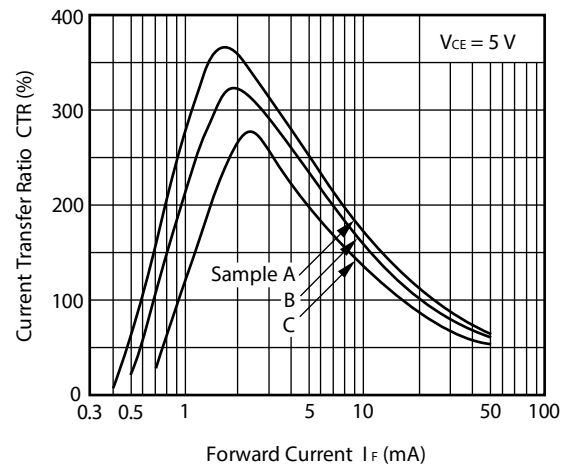
**TYPICAL CHARACTERISTICS ( $T_A = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)**
**DIODE POWER DISSIPATION vs.  
AMBIENT TEMPERATURE**

**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**


**Remark** The graphs indicate nominal characteristics.

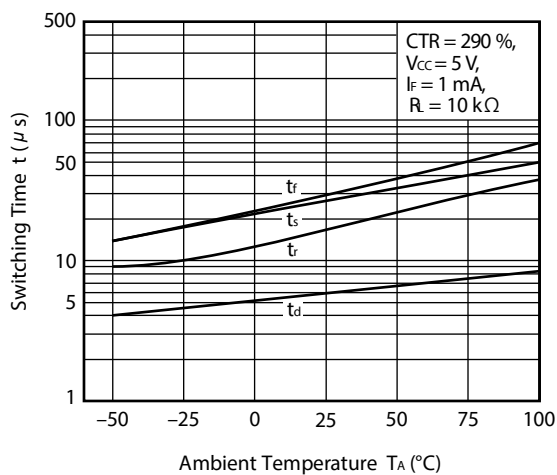
NORMALIZED CURRENT TRANSFER RATIO vs. AMBIENT TEMPERATURE



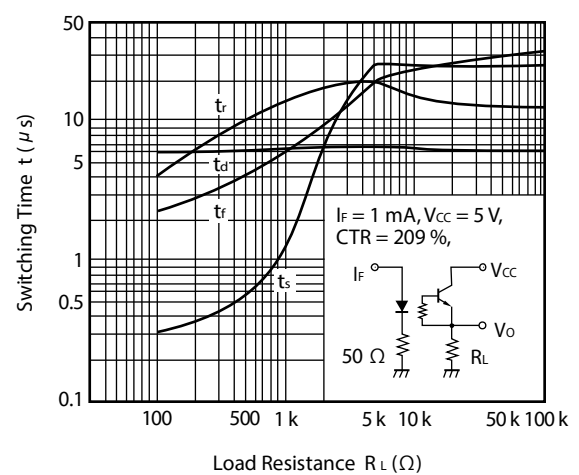
CURRENT TRANSFER RATIO vs. FORWARD CURRENT



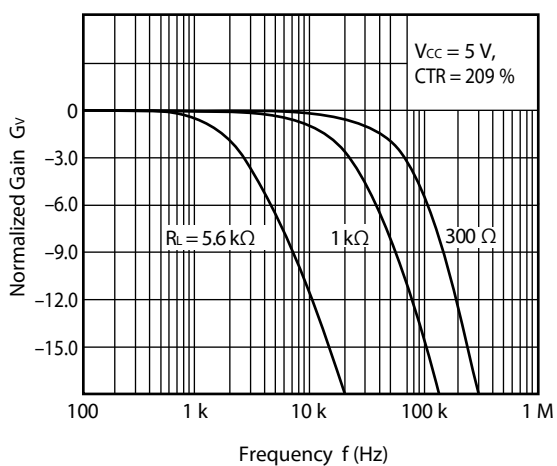
SWITCHING TIME vs. AMBIENT TEMPERATURE



SWITCHING TIME vs. LOAD RESISTANCE



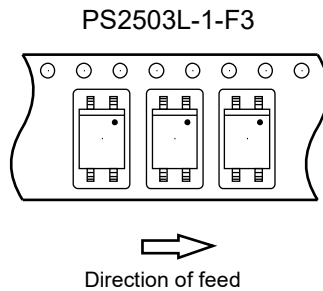
FREQUENCY RESPONSE



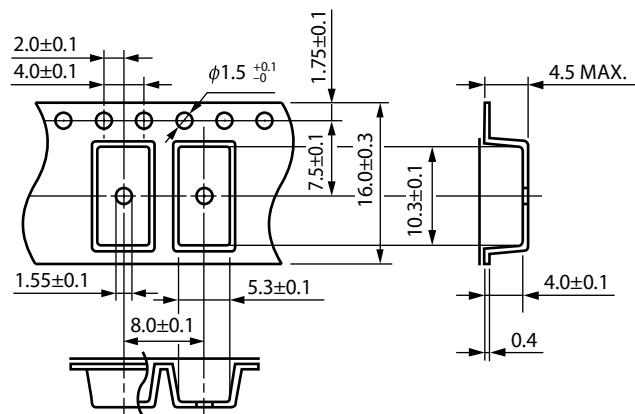
**Remark** The graphs indicate nominal characteristics.

## TAPING SPECIFICATIONS (UNIT: mm)

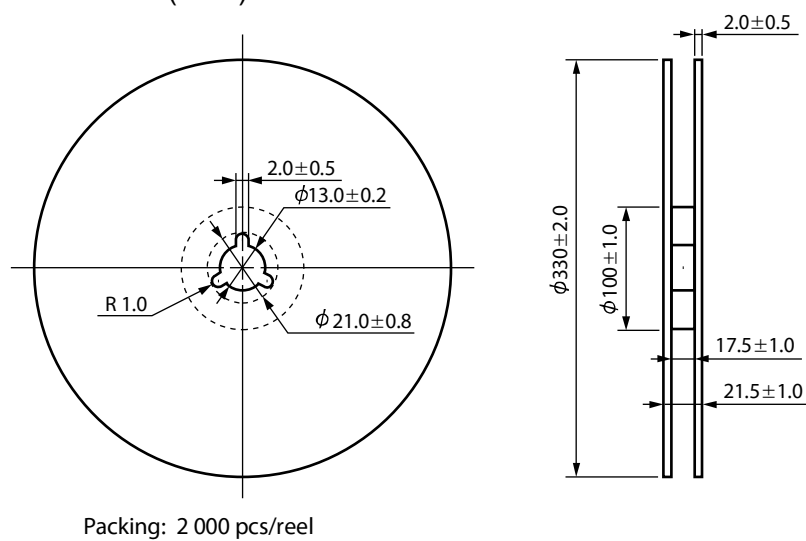
## Taping Direction



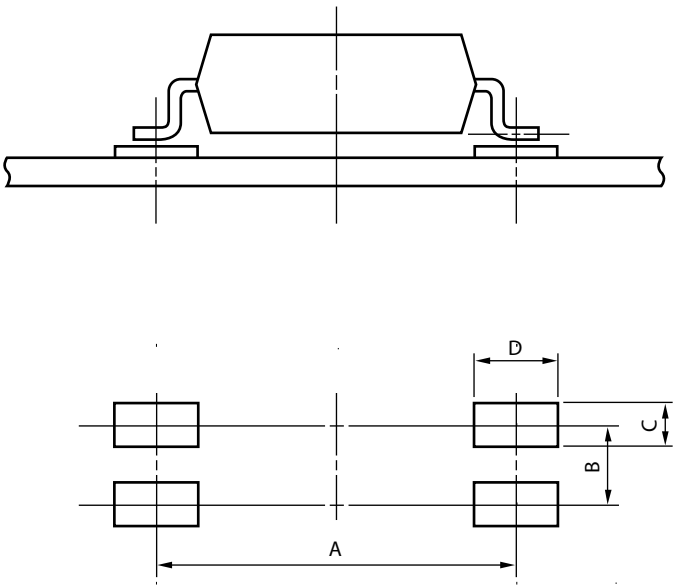
## Outline and Dimensions (Tape)



## Outline and Dimensions (Reel)



RECOMMENDED MOUNT PAD DIMENSIONS (UNIT: mm)



| Part Number | Lead Bending                        | A   | B    | C   | D   |
|-------------|-------------------------------------|-----|------|-----|-----|
| PS2503L     | Lead Bending Type For Surface Mount | 8.2 | 2.54 | 1.7 | 2.2 |

**Remark** All dimensions in this figure must be evaluated before use.

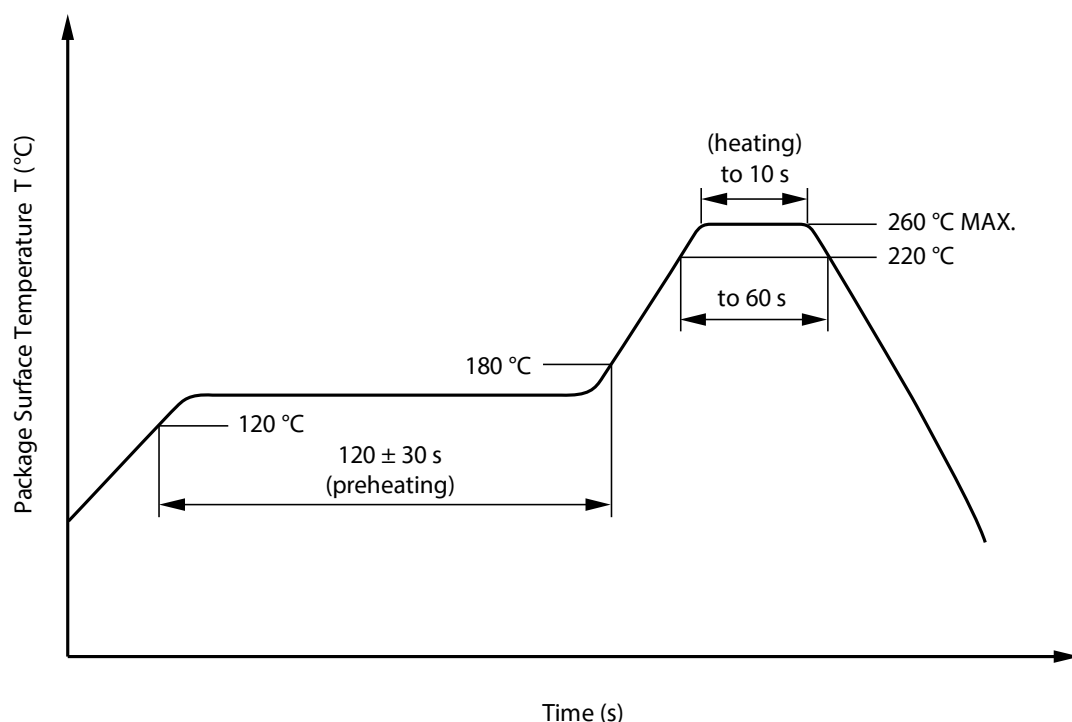
## NOTES ON HANDLING

### 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<br>(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<br>(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

- Flux Cleaning  
Avoid cleaning with Freon based or halogen-based (chlorinated etc.) solvents.
- Do not use fixing agents or coatings containing halogen-based substances.

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. 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.
3. Avoid cleaning with Freon based or halogen-based (chlorinated etc.) solvents.
4. Do not use fixing agents or coatings containing halogen-based substances.

**Caution**

GaAs Products

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.

- 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.
  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.
- 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.

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