

# PS2514-1, PS2514L-1

R08DS0012EJ0200

Rev.2.00

HIGH-SPEED SWITCHING/HIGH ISOLATION VOLTAGE PHOTOCOUPLER SERIES

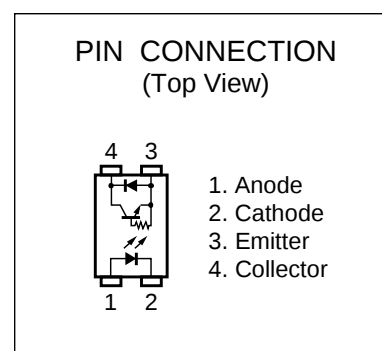
Oct. 27, 2023

## DESCRIPTION

The PS2514-1 and PS2514L-1 are optically coupled isolator containing a GaAs light emitting diode and an NPN silicon phototransistor, enabling relatively high switching speed with high load resistor of several k $\Omega$ . The PS2514-1 is in a plastic DIP (Dual In-line Package) and the PS2514L-1 is lead bending type (Gull-wing) for surface mount.

## FEATURES

- High isolation voltage (BV = 5 000 Vr.m.s.)
- High collector to emitter voltage ( $V_{CEO} = 40$  V)
- Guaranteed maximum switching speed  
( $t_{off} \leq 25 \mu s$  @  $I_F = 5$  mA,  $V_{CC} = 5$  V,  $R_L = 5$  k $\Omega$ )
- High-speed switching
  - ( $t_{on} = 15 \mu s$  TYP. @  $I_F = 5$  mA,  $V_{CC} = 5$  V,  $R_L = 5$  k $\Omega$ )
  - ( $t_{off} = 15 \mu s$  TYP. @  $I_F = 5$  mA,  $V_{CC} = 5$  V,  $R_L = 5$  k $\Omega$ )
- Embossed tape product: PS2514L-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, Basic insulation, Reinforced insulation
  - CQC approved: GB4943.1, Basic insulation
  - VDE approved: DIN EN IEC 60747-5-5 (Option)

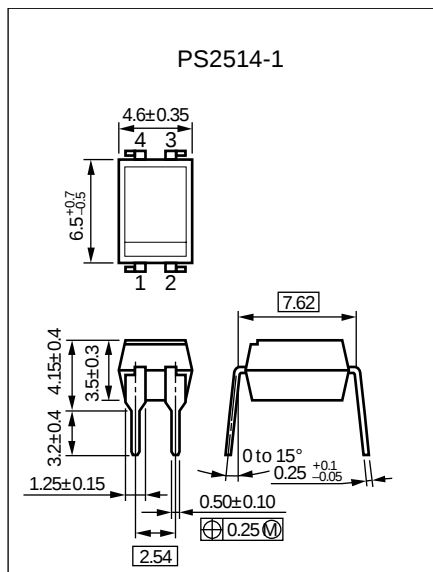


## APPLICATIONS

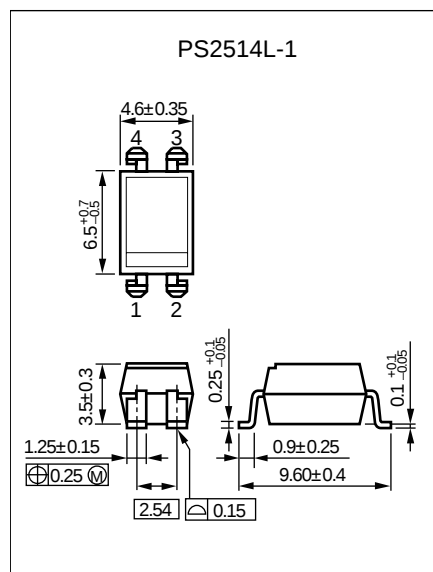
- Power supply
- FA equipment
- Electronic electricity meter

## PACKAGE DIMENSIONS (UNIT: mm)

## DIP Type



## Lead Bending Type For Surface Mount

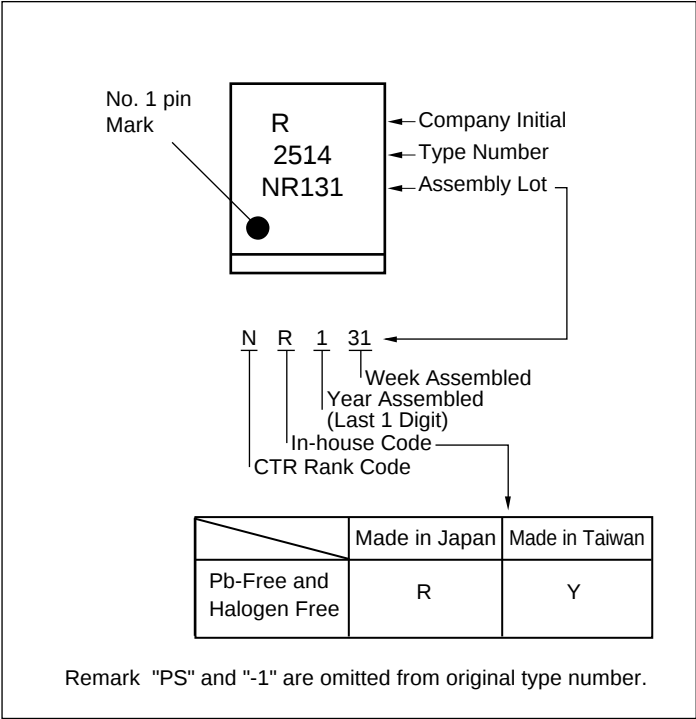


Weight ( 4-pin DIP ) : 0.26 g (TYP.)

## PHOTOCOUPLER CONSTRUCTION

| Parameter                 | PS2514-1, PS2514L-1 |
|---------------------------|---------------------|
| Air Distance (MIN.)       | 7 mm                |
| Creepage Distance (MIN.)  | 7 mm                |
| Isolation Distance (MIN.) | 0.4 mm              |

MARKING EXAMPLE



ORDERING INFORMATION

| Part Number    | Order Number      | Solder Plating Specification | Packing Style         | Safety Standard Approval                  | Application Part Number *2 |
|----------------|-------------------|------------------------------|-----------------------|-------------------------------------------|----------------------------|
| PS2514-1       | PS2514-1Y-A       | Pb-Free and Halogen Free     | Magazine case 100 pcs | Standard Products (UL, CSA, CQC Approved) | PS2514-1                   |
| PS2514L-1      | PS2514L-1Y-A      |                              |                       |                                           | PS2514L-1                  |
| PS2514L-1-F3   | PS2514L-1Y-F3-A   |                              |                       |                                           | PS2514L-1                  |
| PS2514-1-V     | PS2514-1Y-V-A     |                              | Magazine case 100 pcs | UL, CSA, CQC, VDE Approved                | PS2514-1                   |
| PS2514L-1-V    | PS2514L-1Y-V-A    |                              |                       |                                           | PS2514L-1                  |
| PS2514L-1-V-F3 | PS2514L-1Y-V-F3-A |                              |                       |                                           | PS2514L-1                  |

Notes: \*1. For the application of the safety standard, the 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)         | $I_F$                         | 30          | 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      | $I_{FP}$                      | 0.5         | A                      |
| Transistor                    | Collector to Emitter Voltage | $V_{CEO}$                     | 40          | V                      |
|                               | Emitter to Collector Voltage | $V_{ECO}$                     | 0.6         | V                      |
|                               | Collector Current            | $I_C$                         | 20          | 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.

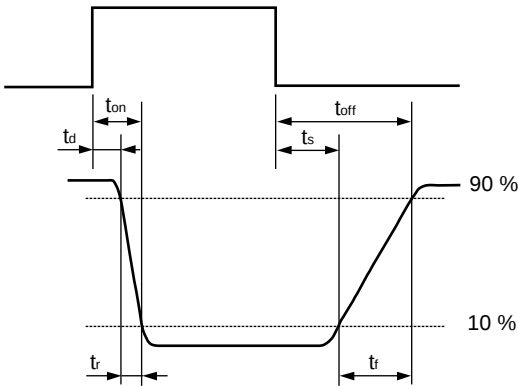
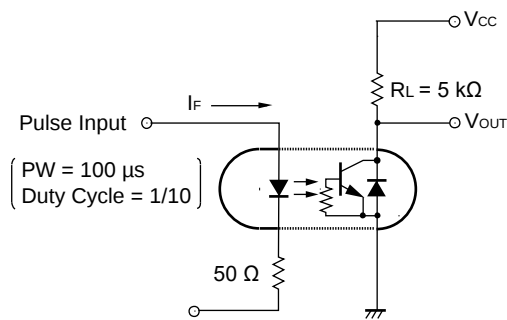
**RECOMMENDED OPERATING CONDITIONS**

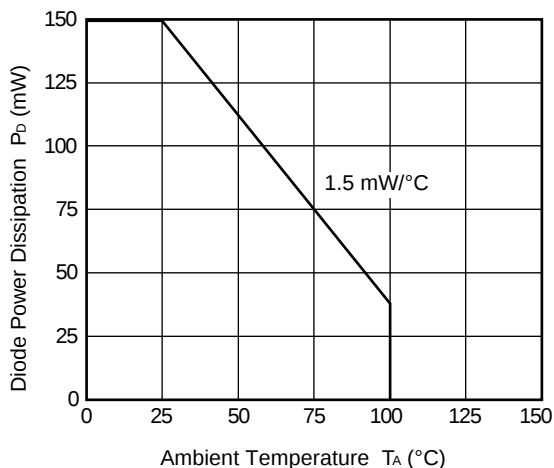
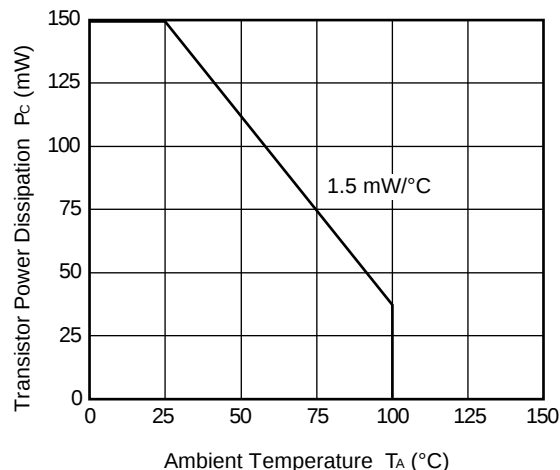
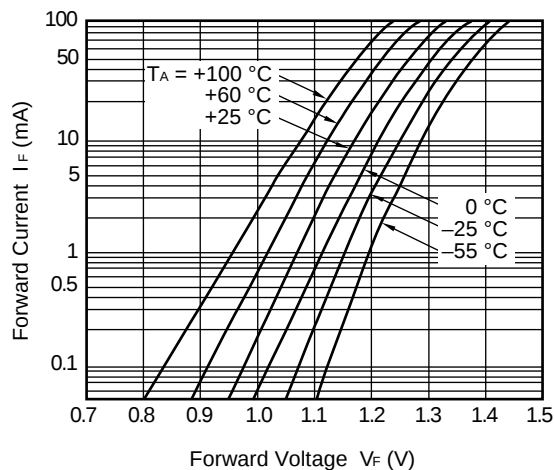
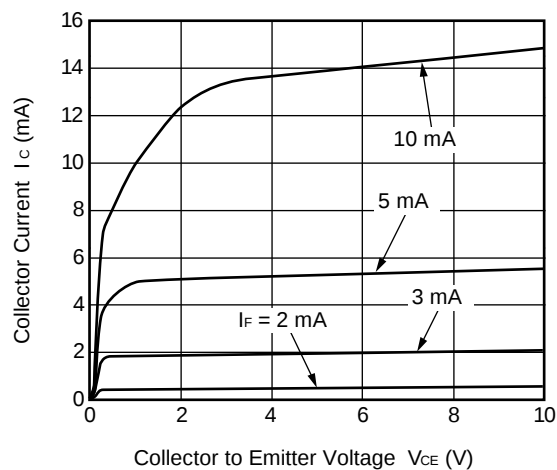
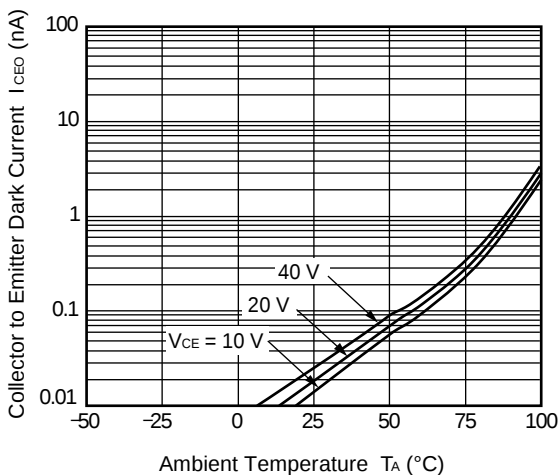
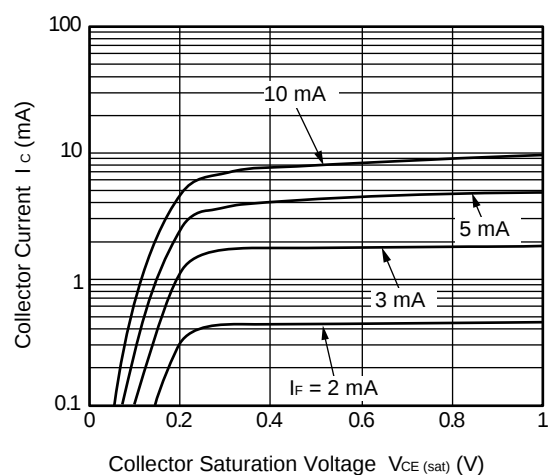
| Parameter     | Symbol | MIN. | TYP. | MAX. | Unit |
|---------------|--------|------|------|------|------|
| Input Current | $I_F$  | 5    | 6    | 7    | mA   |

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  | 1.3  | 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                                                |                  | 10   |      | pF   |
| Transistor | Collector to Emitter Dark Current                        | I <sub>CEO</sub>     | V <sub>CE</sub> = 40 V, I <sub>F</sub> = 0 mA                       |                  |      | 100  | nA   |
| Coupled    | Current Transfer Ratio (I <sub>c</sub> /I <sub>F</sub> ) | CTR                  | I <sub>F</sub> = 5 mA, V <sub>CE</sub> = 5 V                        | 50               | 125  | 200  | %    |
|            | Collector Saturation Voltage                             | V <sub>CE(sat)</sub> | I <sub>F</sub> = 5 mA, I <sub>c</sub> = 1 mA                        |                  |      | 0.35 | V    |
|            | Isolation Resistance                                     | R <sub>I-O</sub>     | V <sub>I-O</sub> = 1.0 kV <sub>bc</sub>                             | 10 <sup>11</sup> |      |      | Ω    |
|            | Isolation Capacitance                                    | C <sub>I-O</sub>     | V = 0 V, f = 1.0 MHz                                                |                  | 0.5  |      | pF   |
|            | Turn-on Time *1                                          | t <sub>on</sub>      | V <sub>CC</sub> = 5 V, I <sub>F</sub> = 5 mA, R <sub>L</sub> = 5 kΩ |                  | 15   | 25   | μs   |
|            | Turn-off Time *1                                         | t <sub>off</sub>     |                                                                     |                  | 15   | 25   |      |

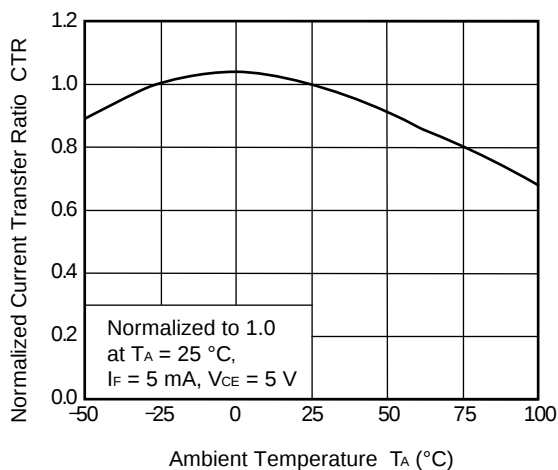
Note: \*1. Test Circuit for Switching Time



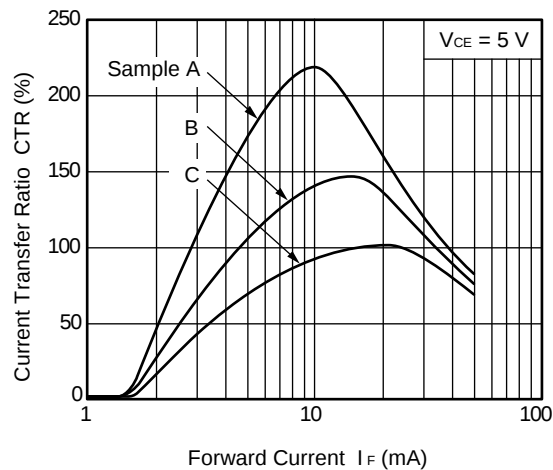
TYPICAL CHARACTERISTICS ( $T_A = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)DIODE POWER DISSIPATION vs.  
AMBIENT TEMPERATURETRANSISTOR POWER DISSIPATION  
vs. AMBIENT TEMPERATUREFORWARD CURRENT vs.  
FORWARD VOLTAGECOLLECTOR CURRENT vs.  
COLLECTOR TO EMITTER VOLTAGECOLLECTOR TO EMITTER DARK  
CURRENT vs. AMBIENT TEMPERATURECOLLECTOR CURRENT vs.  
COLLECTOR SATURATION VOLTAGE

**Remark** The graphs indicate nominal characteristics.

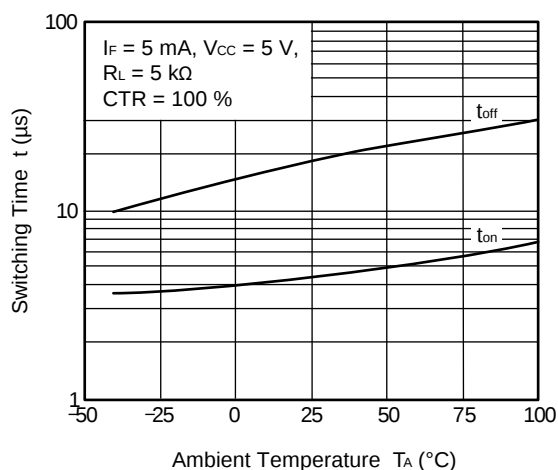
NORMALIZED CURRENT TRANSFER RATIO vs. AMBIENT TEMPERATURE



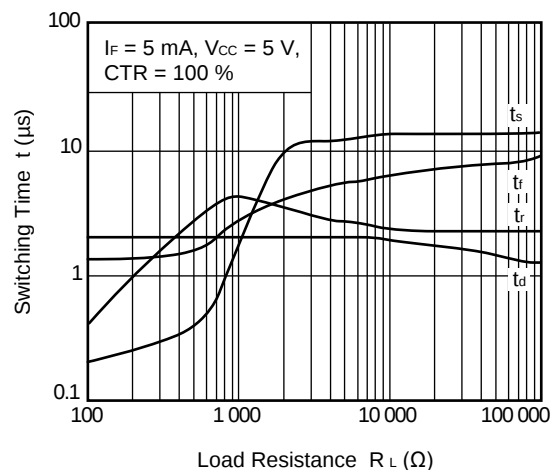
CURRENT TRANSFER RATIO vs. FORWARD CURRENT



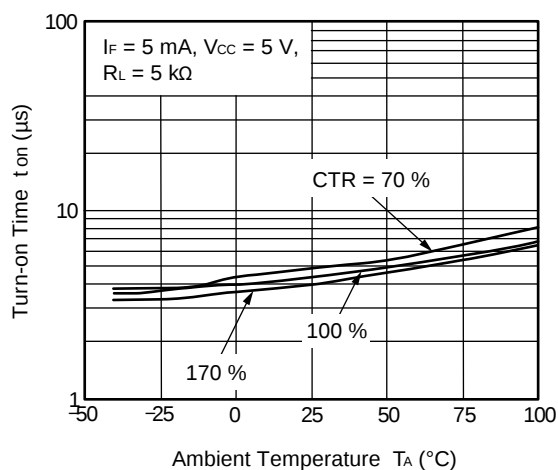
SWITCHING TIME vs. LOAD RESISTANCE



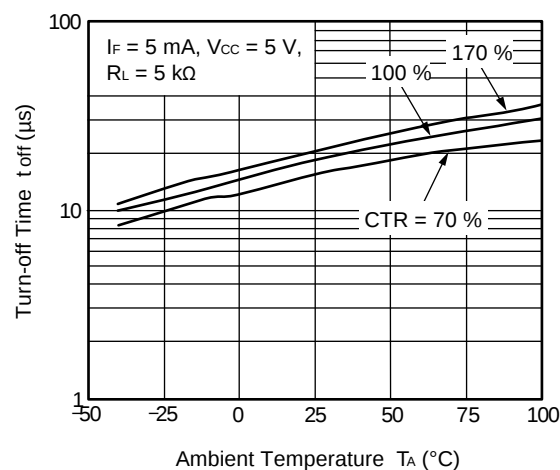
SWITCHING TIME vs. LOAD RESISTANCE



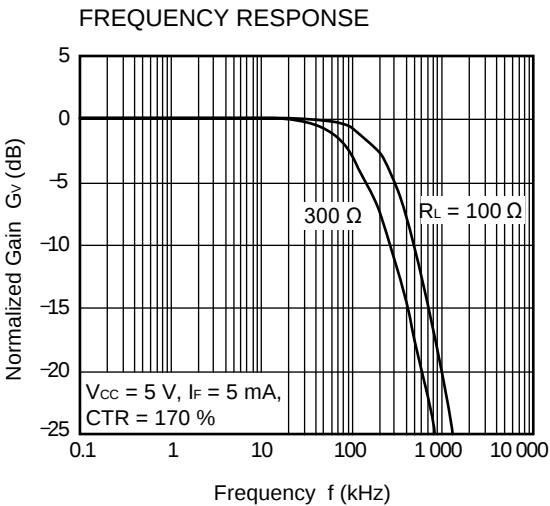
TURN-ON TIME vs. AMBIENT TEMPERATURE



TURN-OFF TIME vs. AMBIENT TEMPERATURE



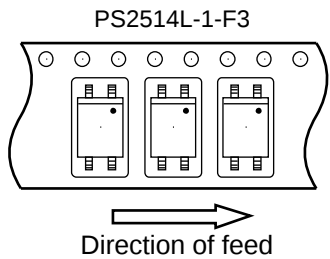
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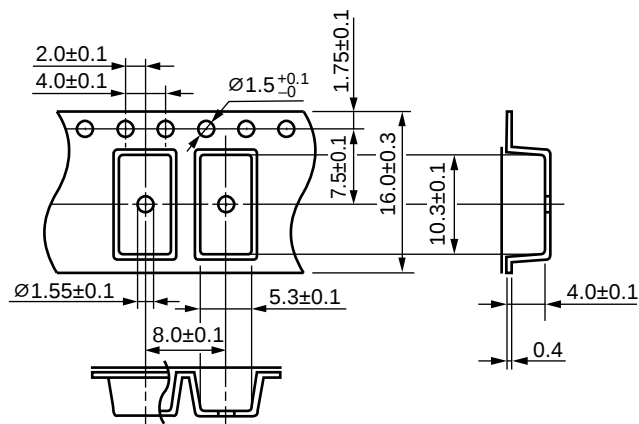
TAPING SPECIFICATIONS (UNIT: mm)

Tape Direction



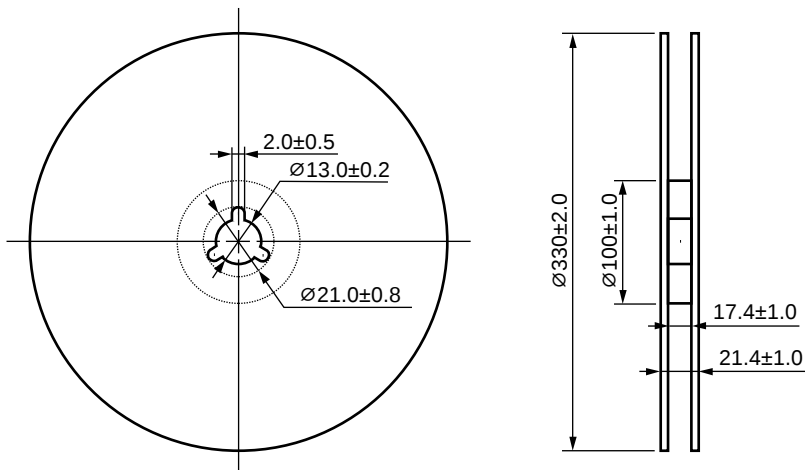
Outline and Dimensions (Tape)

Unit : mm



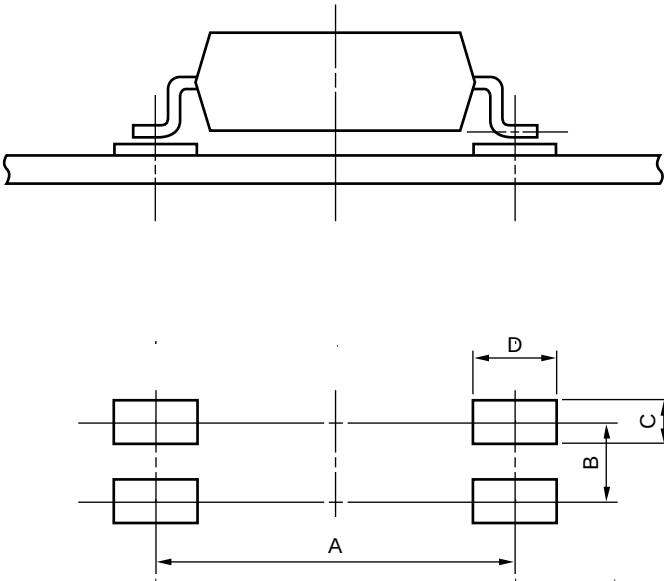
Outline and Dimensions (Reel)

Unit : mm



Packing: 2 000 pcs/reel

RECOMMENDED MOUNT PAD DIMENSIONS (UNIT: mm)



| Part Number | Lead Bending                        | A   | B    | C   | D   |
|-------------|-------------------------------------|-----|------|-----|-----|
| PS2514L     | 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.

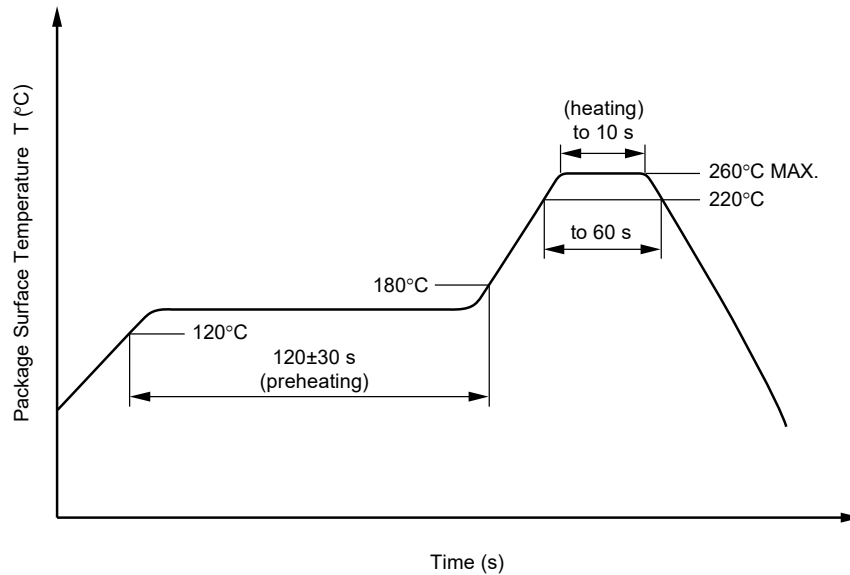
## NOTES ON HANDLING

### 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 (per one side)                      | 3 s or less                                                                                                             |
| • Flux                                     | Rosin flux containing small amount of chlorine<br>(The flux with a maximum chlorine content of 0.2 Wt% is recommended.) |
| • Place                                    | 1.5 to 2.0 mm or more away from the root of the lead                                                                    |

#### (4) Cautions

|                  |                                                                          |
|------------------|--------------------------------------------------------------------------|
| • Flux cleaning  | Avoid cleaning with Freon- or halogen-based (chlorinated etc.) solvents. |
| • Fixing/Coating | 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.

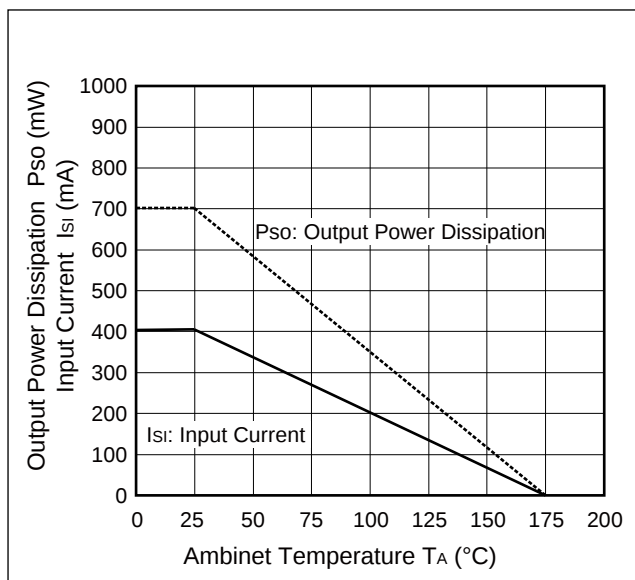
## **USAGE CAUTIONS**

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.

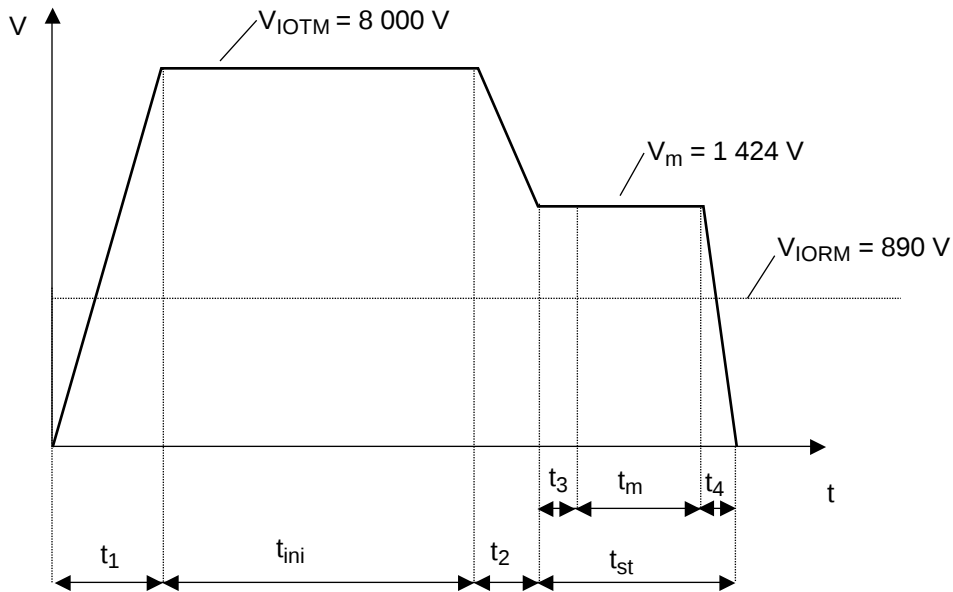
## SPECIFICATION OF VDE MARKS LICENSE DOCUMENT

| Parameter                                                                                                                                 | Symbol                 | Rating      | Unit       |
|-------------------------------------------------------------------------------------------------------------------------------------------|------------------------|-------------|------------|
| Climatic test class (IEC 60068-1/DIN EN 60068-1)                                                                                          |                        | 55/100/21   |            |
| Dielectric strength                                                                                                                       |                        |             |            |
| maximum operating isolation voltage                                                                                                       | $V_{IORM}$             | 890         | $V_{peak}$ |
| Test voltage (partial discharge test, procedure a for type test and random test)<br>$V_m = 1.6 \times V_{IORM}$ , $q_{pd} < 5 \text{ pC}$ | $V_m$                  | 1 424       | $V_{peak}$ |
| Test voltage (partial discharge test, procedure b for all devices)<br>$V_m = 1.875 \times V_{IORM}$ , $q_{pd} < 5 \text{ pC}$             | $V_m$                  | 1 669       | $V_{peak}$ |
| Highest permissible overvoltage                                                                                                           | $V_{IOTM}$             | 8 000       | $V_{peak}$ |
| Degree of pollution (IEC 60664-1/DIN EN 60664-1 (VDE 0110-1))                                                                             |                        | 2           |            |
| Comparative tracking index (IEC 60112/DIN EN 60112 (VDE 0303-11))                                                                         | CTI                    | 175         |            |
| Material group (IEC 60664-1/DIN EN 60664-1 (VDE 0110-1))                                                                                  |                        | 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>$V_{I-O} = 500 \text{ V dc}$ , $T_A = 25 \text{ °C}$                                               | $R_{I-O} \text{ MIN.}$ | $10^{12}$   | $\Omega$   |
| $V_{I-O} = 500 \text{ V dc}$ , $T_A = \text{maximum temperature of rating, at least } 100 \text{ °C}$                                     | $R_{I-O} \text{ MIN.}$ | $10^{11}$   | $\Omega$   |
| Safety maximum ratings (maximum permissible in case of fault, see thermal derating curve)                                                 |                        |             |            |
| Maximum ambient temperature                                                                                                               | $T_S$                  | 175         | °C         |
| Maximum input current                                                                                                                     | $I_{SI}$               | 400         | mA         |
| Maximum output power dissipation                                                                                                          | $P_{SO}$               | 700         | mW         |
| Isolation resistance, minimum value at $V_{I-O} = 500 \text{ V dc}$ , $T_A = T_S$                                                         | $R_{I-O} \text{ MIN.}$ | $10^9$      | $\Omega$   |

## Dependence of maximum safety ratings with package temperature

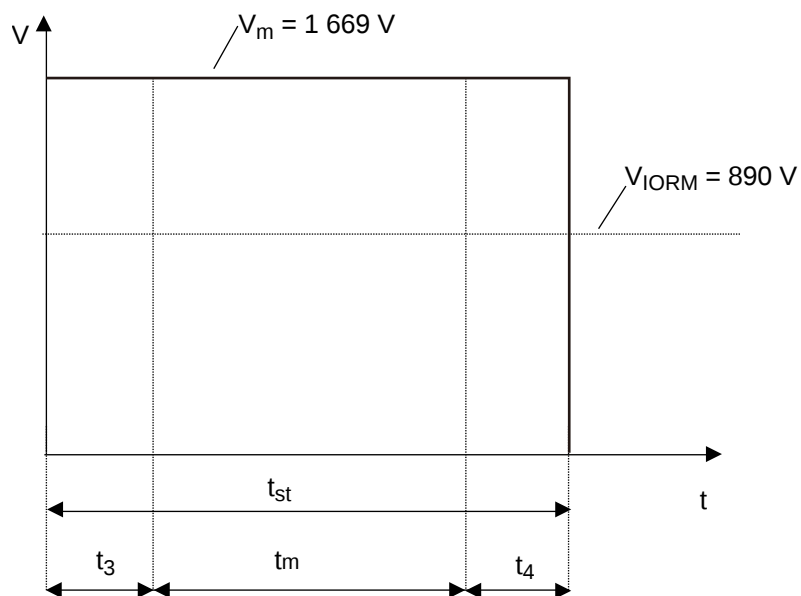


## Method a) Destructive Test, Type and Sample Test



$t_1, t_2 = 1 \text{ to } 10 \text{ sec}$   
 $t_3, t_4 = 1 \text{ sec}$   
 $t_m = 10 \text{ sec}$   
 $t_{st} = 12 \text{ sec}$   
 $t_{ini} = 60 \text{ sec}$

## Method b) Non-destructive Test, 100 % Production Test



$t_3, t_4 = 0.1 \text{ sec}$   
 $t_m = 1.0 \text{ sec}$   
 $t_{st} = 1.2 \text{ sec}$

|                |                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|----------------|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Caution</b> | <p>GaAs Products</p> | <p>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.</p> <ul style="list-style-type: none"><li>• 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.</li></ul> <ol style="list-style-type: none"><li>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.</li><li>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.</li></ol> <ul style="list-style-type: none"><li>• Do not burn, destroy, cut, crush, or chemically dissolve the product.</li><li>• Do not lick the product or in any way allow it to enter the mouth.</li></ul> |
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|                                                                                       |
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