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April 1<sup>st</sup>, 2010 Renesas Electronics Corporation

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# Renesas

## DATA SHEET

# PHOTOCOUPLER

# PS2561-1,PS2561L-1,PS2561L1-1,PS2561L2-1

## HIGH ISOLATION VOLTAGE SINGLE TRANSISTOR TYPE MULTI PHOTOCOUPLER SERIES

-NEPOC Series-

#### DESCRIPTION

The PS2561-1 is optically coupled isolators containing a GaAs light emitting diode and an NPN silicon phototransistor.

The PS2561-1 is in a plastic DIP (Dual In-line Package) and the PS2561L-1 is lead bending type (Gull-wing) for surface mount.

The PS2561L1-1 is lead bending type for long creepage distance.

The PS2561L2-1 is lead bending type for long creepage distance (Gull-wing) for surface mount.

#### FEATURES

- High Isolation voltage (BV = 5 000 Vr.m.s.)
- High collector to emitter voltage (VCEO = 80 V)
- High current transfer ratio (CTR = 200% TYP.)
- High-speed switching ( $t_r = 3 \mu s$  TYP.,  $t_f = 5 \mu s$  TYP.)
- Ordering number of taping product: PS2561L-1-E3, E4, F3, F4, PS2561L2-1-E3, E4
- Safety standards
  - UL approved: No. E72422
  - CSA approved: No. CA 101391
  - BSI approved: No. 7112/7420
  - SEMKO approved: No. 303059, 307244
  - NEMKO approved: No. P03200272, P03200747
  - DEMKO approved: No. 312341, 312340
  - FIMKO approved: No. FI 10620, FI 11898
  - DIN EN60747-5-2 (VDE0884 Part2) approved: No. 40008862 (Option)

#### APPLICATIONS

Power supply

<R>

- Telephone/FAX.
- FA/OA equipment
- Programmable logic controller

PIN CONNECTION (Top View) 4 3 1. Anode 2. Cathode 3. Emitter 4. Collector

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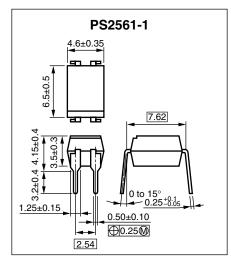
The mark <R> shows major revised points.

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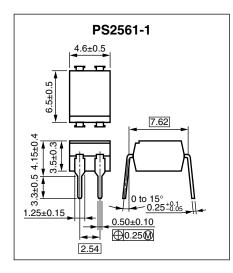
The revised points can be easily searched by copying an "<R>" in the PDF file and specifying it in the "Find what:" field.

### PACKAGE DIMENSIONS (UNIT : mm)

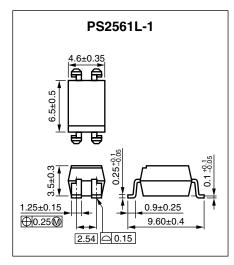
### DIP Type (New package)



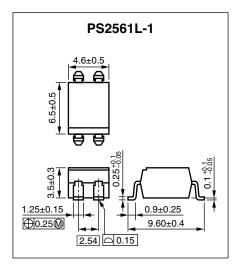


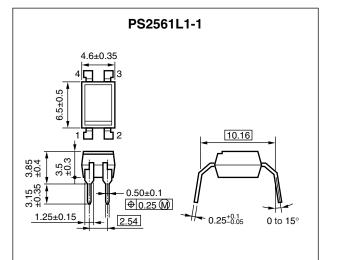


#### Lead Bending Type (New package)



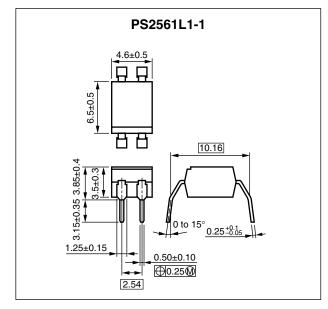
#### Lead Bending Type

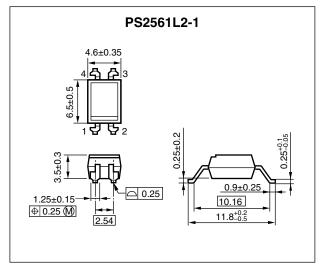




Lead Bending Type For Long Creepage Distance (New Package)

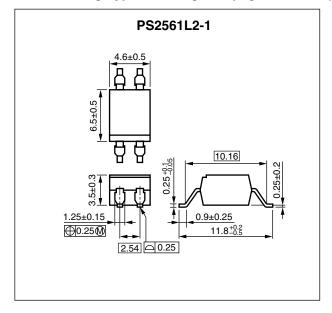
#### Lead Bending Type For Long Creepage Distance





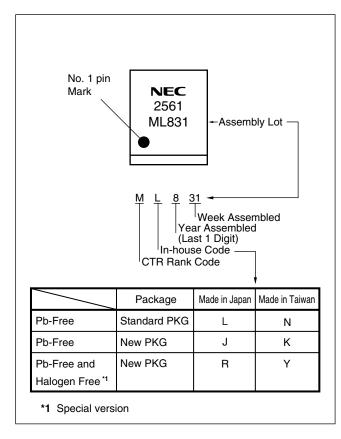
Lead Bending Type For Long Creepage Distance (Gull-Wing) (New Package)

#### Lead Bending Type For Long Creepage Distance (Gull-Wing)



## NEC

#### <R> MARKING EXAMPLE



#### <R> ORDERING INFORMATION

| Part Number     | Order Number       | Solder Plating<br>Specification | Packing Style                | Safety Standard<br>Approval | Application Part<br>Number <sup>™</sup> |
|-----------------|--------------------|---------------------------------|------------------------------|-----------------------------|---|
| PS2561-1        | PS2561-1-A         | Pb-Free                         | Magazine case 100 pcs        | Standard products           | PS2561-1                                |
| PS2561L-1       | PS2561L-1-A        |                                 |                              | (UL, CSA, BSI,              |   |
| PS2561L1-1      | PS2561L1-1-A       |                                 |                              | NEMKO, SEMKO,               |   |
| PS2561L2-1      | PS2561L2-1-A       |                                 |                              | DEMKO, FIMKO                |   |
| PS2561L-1-E3    | PS2561L-1-E3-A     |                                 | Embossed Tape 1 000 pcs/reel | approved)                   |   |
| PS2561L-1-E4    | PS2561L-1-E4-A     |                                 |                              |                             |   |
| PS2561L-1-F3    | PS2561L-1-F3-A     |                                 | Embossed Tape 2 000 pcs/reel |                             |   |
| PS2561L-1-F4    | PS2561L-1-F4-A     |                                 |                              |                             |   |
| PS2561L2-1-E3   | PS2561L2-1-E3-A    |                                 | Embossed Tape 1 000 pcs/reel |                             |   |
| PS2561L2-1-E4   | PS2561L2-1-E4-A    |                                 |                              |                             |   |
| PS2561-1-V      | PS2561-1-V-A       |                                 | Magazine case 100 pcs        | DIN EN60747-5-2             |   |
| PS2561L-1-V     | PS2561L-1-V-A      |                                 |                              | (VDE0884 Part2)             |   |
| PS2561L1-1-V    | PS2561L1-1-V-A     |                                 |                              | approved products           |   |
| PS2561L2-1-V    | PS2561L2-1-V-A     |                                 |                              | (Option)                    |   |
| PS2561L-1-V-E3  | PS2561L-1-V-E3-A   |                                 | Embossed Tape 1 000 pcs/reel |                             |   |
| PS2561L-1-V-E4  | PS2561L-1-V-E4-A   |                                 |                              |                             |   |
| PS2561L-1-V-F3  | PS2561L-1-V-F3-A   |                                 | Embossed Tape 2 000 pcs/reel |                             |   |
| PS2561L-1-V-F4  | PS2561L-1-V-F4-A   |                                 |                              |                             |   |
| PS2561L2-1-V-E3 | PS2561L2-1-V-E3-A  |                                 | Embossed Tape 1 000 pcs/reel |                             |   |
| PS2561L2-1-V-E4 | PS2561L2-1-V-E4-A  |                                 |                              |                             |   |
| PS2561-1        | PS2561-1Y-A        | Special version                 | Magazine case 100 pcs        | Standard products           | PS2561-1                                |
| PS2561L-1       | PS2561L-1Y-A       | (Pb-Free and                    |                              | (UL, CSA, BSI,              |   |
| PS2561L1-1      | PS2561L1-1Y-A      | Halogen Free)                   |                              | NEMKO, SEMKO,               |   |
| PS2561L2-1      | PS2561L2-1Y-A      |                                 |                              | DEMKO, FIMKO                |   |
| PS2561L-1-F3    | PS2561L-1Y-F3-A    |                                 | Embossed Tape 2 000 pcs/reel | approved)                   |   |
| PS2561L2-1-E3   | PS2561L2-1Y-E3-A   |                                 | Embossed Tape 1 000 pcs/reel |                             |   |
| PS2561-1-V      | PS2561-1Y-V-A      |                                 | Magazine case 100 pcs        | DIN EN60747-5-2             |   |
| PS2561L-1-V     | PS2561L-1Y-V-A     |                                 |                              | (VDE0884 Part2)             |   |
| PS2561L1-1-V    | PS2561L1-1Y-V-A    |                                 |                              | approved products           |   |
| PS2561L2-1-V    | PS2561L2-1Y-V-A    |                                 |                              | (Option)                    |   |
| PS2561L-1-V-F3  | PS2561L-1Y-V-F3-A  |                                 | Embossed Tape 2 000 pcs/reel |                             |   |
| PS2561L2-1-V-E3 | PS2561L2-1Y-V-E3-A |                                 | Embossed Tape 1 000 pcs/reel |                             |   |

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

| Parameter                       |                                    | Symbol | Ratings     | Unit    |
|---------------------------------|------------------------------------|--------|-------------|---------|
| Diode                           | Reverse Voltage                    | VR     | 6           | V       |
|                                 | Forward Current (DC)               | lf     | 80          | mA      |
|                                 | Power Dissipation Derating         | ⊿Po/°C | 1.5         | mW/°C   |
|                                 | Power Dissipation                  | PD     | 150         | mW      |
|                                 | Peak Forward Current <sup>*1</sup> | IFP    | 1           | А       |
| Transistor                      | Collector to Emitter Voltage       | VCEO   | 80          | V       |
|                                 | Emitter to Collector Voltage       | VECO   | 7           | V       |
|                                 | Collector Current                  | lc     | 50          | mA      |
|                                 | Power Dissipation Derating         | ⊿Pc/°C | 1.5         | mW/°C   |
|                                 | Power Dissipation                  | Pc     | 150         | mW      |
| Isolation Voltage <sup>*2</sup> |                                    | BV     | 5 000       | Vr.m.s. |
| Operating Ambient Temperature   |                                    | TA     | –55 to +100 | °C      |
| Storage Temperature             |                                    | Tstg   | –55 to +150 | °C      |

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

\*1 PW = 100  $\mu$ s, Duty Cycle = 1%

\*2 AC voltage for 1 minute at  $T_A = 25^{\circ}$ C, RH = 60% between input and output Pins 1-2 shorted together, 3-4 shorted together.

Coupled

200

0.5

3

5

80

10<sup>11</sup>

MAX.

1.4 5

100

400

0.3

Unit ۷

μA

pF

nA

%

v

Ω

pF

μs

|            | Parameter                            | Symbol | Conditions  | MIN. | TYP. |
|------------|--------------------------------------|--------|---|------|------|
| Diode      | Forward Voltage                      | VF     | IF = 10 mA  |      | 1.17 |
|            | Reverse Current                      | IR     | $V_{R} = 5 V$                                       |      |      |
|            | Terminal Capacitance                 | Ct     | V = 0 V, f = 1.0 MHz                                |      | 50   |
| Transistor | Collector to Emitter Dark<br>Current | ICEO   | $V_{CE} = 80 \text{ V}, \text{ I}_F = 0 \text{ mA}$ |      |      |

 $I_F = 5 \text{ mA}, V_{CE} = 5 \text{ V}$ 

IF = 10 mA, Ic = 2 mA

V = 0 V, f = 1.0 MHz

V cc = 10 V, Ic = 2 mA, RL = 100  $\Omega$ 

 $V_{I-O} = 1.0 \text{ kV}_{DC}$ 

CTR

VCE (sat)

RI-0

CI-0

tr

tſ

#### **ELECTRICAL CHARACTERISTICS (TA = 25°C)**

Current Transfer Ratio

**Collector Saturation** 

Isolation Resistance

**Isolation Capacitance** 

(lc/l<sub>F</sub>)<sup>\*1</sup>

Voltage

\*1 CTR rank

<R>

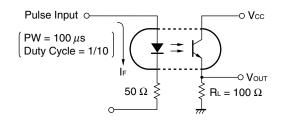
L : 200 to 400 (%)

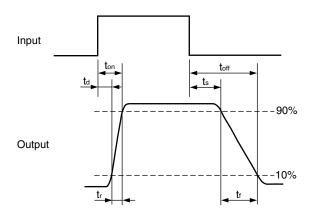
Rise Time<sup>\*2</sup>

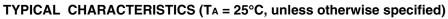
Fall Time\*2

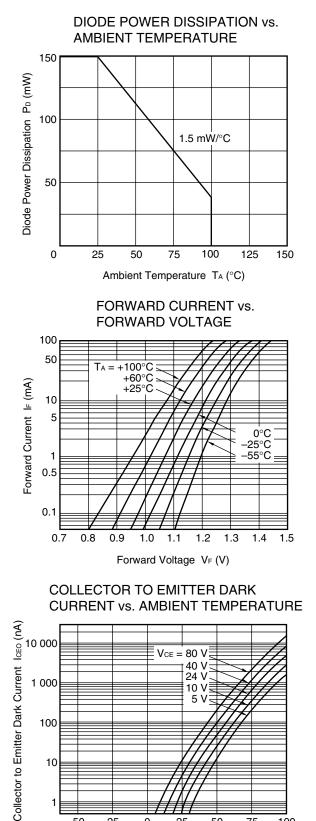
- 80 to 240 (%) M :
- D : 100 to 300 (%)
- 80 to 160 (%) Η :
- W: 130 to 260 (%)

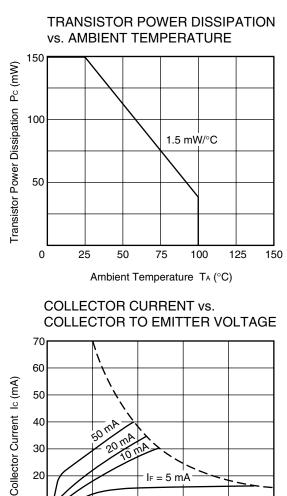
\*2 Test circuit for switching time

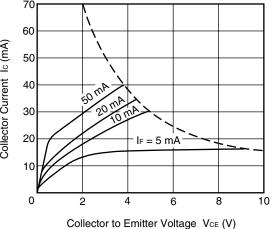




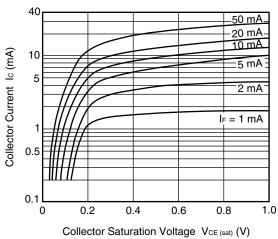








COLLECTOR CURRENT vs. COLLECTOR SATURATION VOLTAGE





25

Ambient Temperature T<sub>A</sub> (°C)

50

75

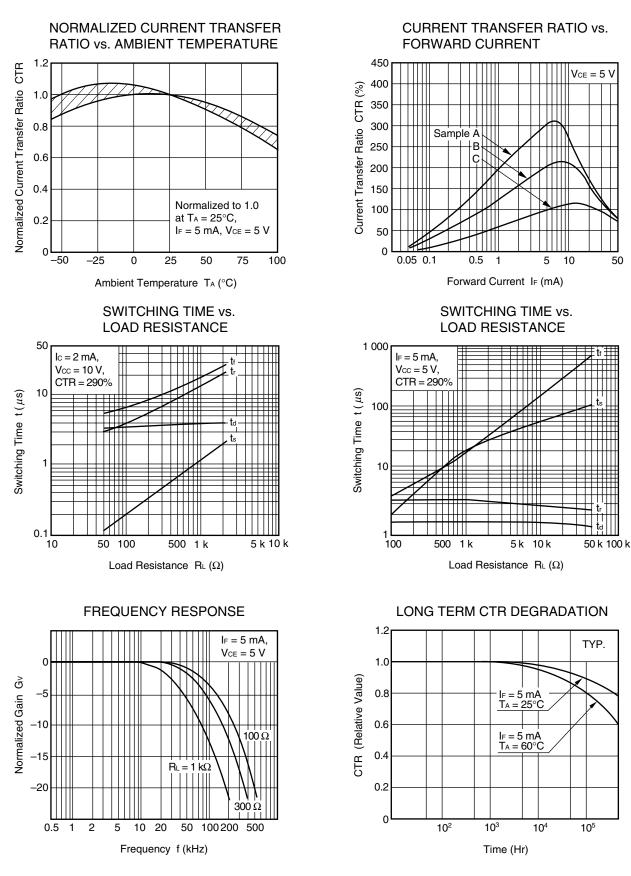
100

-25

0

-50

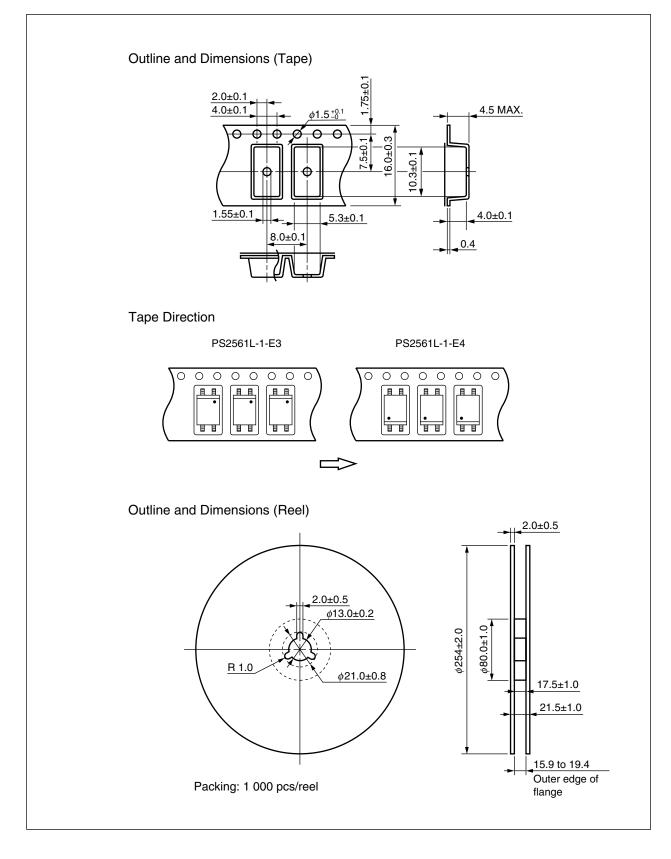
Data Sheet PN10234EJ04V0DS

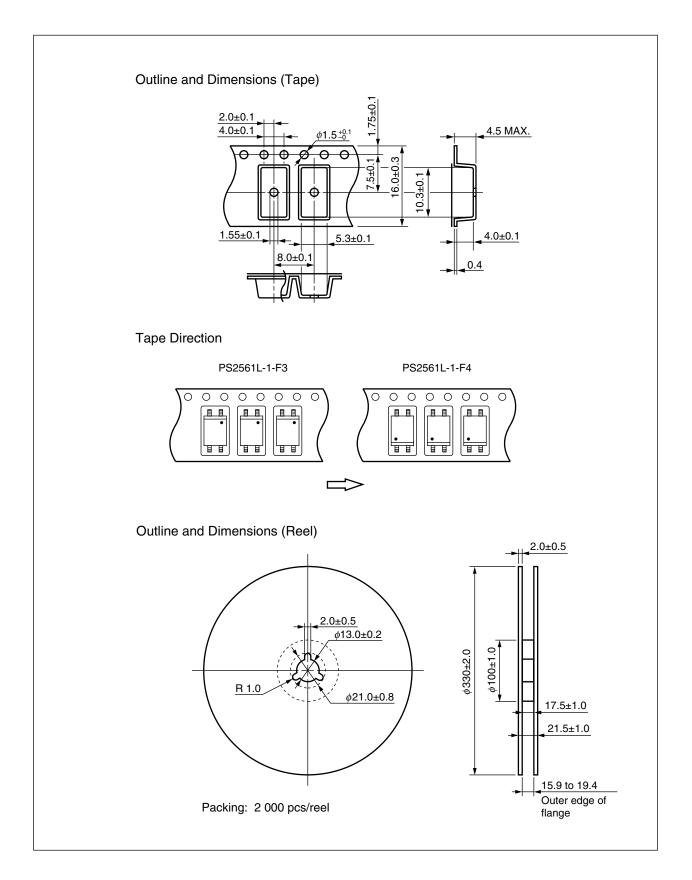


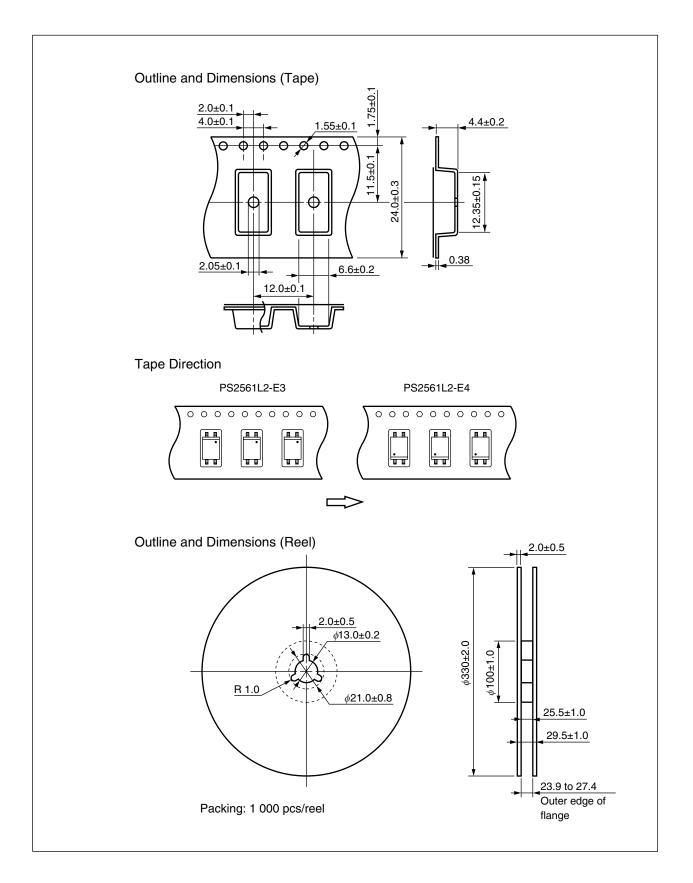
Remark The graphs indicate nominal characteristics.

50

#### TAPING SPECIFICATIONS (UNIT : mm)







#### NOTES ON HANDLING

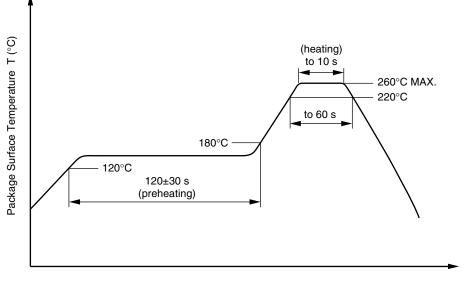
#### 1. Recommended soldering conditions

#### (1) Infrared reflow soldering

- Peak reflow temperature
- Time of peak reflow temperature
- Time of temperature higher than 220°C
- Time to preheat temperature from 120 to 180°C
- Number of reflows
- Flux

260°C or below (package surface temperature) 10 seconds or less 60 seconds or less 120±30 s Three 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



Time (s)

#### (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

| <ul> <li>Peak temperature (lead part temperature)</li> </ul> | 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.

#### <R> SPECIFICATION OF VDE MARKS LICENSE DOCUMENT

| Parameter  | Symbol               | Spec.                                | Unit                                   |
|--|----------------------|--------------------------------------|--|
| Climatic test class (IEC 60068-1/DIN EN 60068-1)   |                      | 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>$U_{pr} = 1.5 \times U_{IORM}, P_d < 5 pC$ | Uiorm<br>Upr         | 890<br>1 335                         | V <sub>peak</sub><br>V <sub>peak</sub> |
| Test voltage (partial discharge test, procedure b for all devices) $U_{pr}$ = 1.875 × U <sub>IORM</sub> , Pd < 5 pC  | Upr                  | 1 669                                | Vpeak                                  |
| Highest permissible overvoltage  | Utr                  | 8 000                                | Vpeak                                  |
| Degree of pollution (DIN EN 60664-1 VDE0110 Part 1)  |                      | 2                                    |  |
| Clearance distance   |                      | >7.0                                 | mm                                     |
| Creepage distance  |                      | >7.0                                 | 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  | Tstg                 | -55 to +150                          | °C                                     |
| Operating temperature range  | TA                   | -55 to +100                          | °C                                     |
| Isolation resistance, minimum value<br>$V_{IO} = 500 \text{ V dc at } T_A = 25^{\circ}\text{C}$<br>$V_{IO} = 500 \text{ V dc at } T_A MAX. at least 100^{\circ}\text{C}$                     | Ris MIN.<br>Ris MIN. | 10 <sup>12</sup><br>10 <sup>11</sup> | Ω<br>Ω                                 |
| Safety maximum ratings (maximum permissible in case of fault, see thermal derating curve)  |                      |                                      |  |
| Package temperature  | Tsi                  | 175                                  | °C                                     |
| Current (input current IF, Psi = 0)<br>Power (output or total power dissipation)<br>Isolation resistance   | lsi<br>Psi           | 400<br>700                           | mA<br>mW                               |
| $V_{IO} = 500 \text{ V} \text{ dc} \text{ at } T_A = T \text{si}$  | Ris MIN.             | 10 <sup>9</sup>                      | Ω                                      |

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|-----------------------|--|
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|                       | <ol> <li>Commission a disposal company able to (with a license to) collect, transport and dispose of<br/>materials that contain arsenic and other such industrial waste materials.</li> </ol>                      |
|                       | <ol><li>Exclude the product from general industrial waste and household garbage, and ensure that the<br/>product is controlled (as industrial waste subject to special control) up until final disposal.</li></ol> |
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Общество с ограниченной ответственностью «МосЧип» ИНН 7719860671 / КПП 771901001 Адрес: 105318, г.Москва, ул.Щербаковская д.З, офис 1107

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#### Офис по работе с юридическими лицами:

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

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E-mail: info@moschip.ru

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