To our customers,

Old Company Name in Catalogs and Other Documents

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Renesas Electronics website: http://www.renesas.com

April 1\textsuperscript{st}, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (http://www.renesas.com)

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PHOTOCOUPLER

PS2501-1,-4, PS2501L-1,-4

HIGH ISOLATION VOLTAGE
SINGLE TRANSISTOR TYPE
MULTI PHOTOCOUPLER SERIES

DESCRIPTION

The PS2501-1, -4 and PS2501L-1, -4 are optically coupled isolators containing a GaAs light emitting diode and an NPN silicon phototransistor.

The PS2501-1, -4 are in a plastic DIP (Dual In-line Package) and the PS2501L-1, -4 are 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} = 80 V)
- High-speed switching (t_r = 3 \mu s TYP., t_f = 5 \mu s TYP.)
- Ordering number of tape product: PS2501L-1-F3: 2 000 pcs/reel
- Safety standards
  - UL approved: No. E72422

APPLICATIONS

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

PIN CONNECTION

(Top View)

PS2501-1, PS2501L-1
1. Anode
2. Cathode
3. Emitter
4. Collector

PS2501-4, PS2501L-4
1, 3, 5, 7. Anode
2, 4, 6, 8. Cathode
9, 11, 13, 15. Emitter
10, 12, 14, 16. Collector

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PACKAGE DIMENSIONS (UNIT : mm)

DIP Type

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit (MIN.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Distance</td>
<td>7 mm</td>
</tr>
<tr>
<td>Outer Creepage Distance</td>
<td>7 mm</td>
</tr>
<tr>
<td>Inner Creepage Distance</td>
<td>3.5 mm</td>
</tr>
<tr>
<td>Isolation Distance</td>
<td>0.3 mm</td>
</tr>
</tbody>
</table>
MARKING EXAMPLE

<table>
<thead>
<tr>
<th>Package</th>
<th>Made in Japan</th>
<th>Made in Taiwan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pb-Free</td>
<td>New PKG</td>
<td>J</td>
</tr>
<tr>
<td>Pb-Free and</td>
<td>New PKG</td>
<td>R</td>
</tr>
<tr>
<td>Halogen Free</td>
<td></td>
<td>Y</td>
</tr>
</tbody>
</table>

*1 Special version
## ORDERING INFORMATION

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Order Number</th>
<th>Solder Plating Specification</th>
<th>Packing Style</th>
<th>Safety Standard Approval</th>
<th>Application Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>PS2501-1</td>
<td>PS2501-1-A</td>
<td>Pb-Free</td>
<td>Magazine case 100 pcs</td>
<td>Standard products (UL approved)</td>
<td>PS2501-1</td>
</tr>
<tr>
<td>PS2501L-1</td>
<td>PS2501L-1-A</td>
<td></td>
<td>Embossed Tape 2 000 pcs/reel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PS2501L-1-F3</td>
<td>PS2501L-1-F3-A</td>
<td></td>
<td>Magazine case 20 pcs</td>
<td>Standard products (UL approved)</td>
<td>PS2501-4</td>
</tr>
<tr>
<td>PS2501-4</td>
<td>PS2501-4-A</td>
<td></td>
<td>Embossed Tape 2 000 pcs/reel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PS2501L-4</td>
<td>PS2501L-4-A</td>
<td></td>
<td>Magazine case 20 pcs</td>
<td>Standard products (UL approved)</td>
<td>PS2501-1</td>
</tr>
<tr>
<td>PS2501-1</td>
<td>PS2501-1Y-A</td>
<td>Special version (Pb-Free and Halogen Free)</td>
<td>Magazine case 100 pcs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PS2501L-1</td>
<td>PS2501L-1Y-A</td>
<td></td>
<td>Embossed Tape 2 000 pcs/reel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PS2501L-1-F3</td>
<td>PS2501L-1Y-F3-A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*1 For the application of the Safety Standard, following part number should be used.
### ABSOLUTE MAXIMUM RATINGS (Unless otherwise specified, $T_A = 25^\circ$C)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Ratings</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diode</td>
<td></td>
<td>PS2501-1, PS2501L-1</td>
<td>PS2501-4, PS2501L-4</td>
</tr>
<tr>
<td>Reverse Voltage</td>
<td>$V_R$</td>
<td>6</td>
<td>V</td>
</tr>
<tr>
<td>Forward Current (DC)</td>
<td>$I_F$</td>
<td>80</td>
<td>mA/ch</td>
</tr>
<tr>
<td>Power Dissipation Derating</td>
<td>$\Delta P_D/\degree C$</td>
<td>1.5</td>
<td>1.2  mW/°C</td>
</tr>
<tr>
<td>Power Dissipation</td>
<td>$P_D$</td>
<td>150</td>
<td>120  mW/ch</td>
</tr>
<tr>
<td>Peak Forward Current$^1$</td>
<td>$I_{FP}$</td>
<td>1</td>
<td>A/ch</td>
</tr>
<tr>
<td>Transistor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collector to Emitter Voltage</td>
<td>$V_{CEO}$</td>
<td>80</td>
<td>V</td>
</tr>
<tr>
<td>Emitter to Collector Voltage</td>
<td>$V_{ECO}$</td>
<td>7</td>
<td>V</td>
</tr>
<tr>
<td>Collector Current</td>
<td>$I_C$</td>
<td>50</td>
<td>mA/ch</td>
</tr>
<tr>
<td>Power Dissipation Derating</td>
<td>$\Delta P_C/\degree C$</td>
<td>1.5</td>
<td>1.2  mW/°C</td>
</tr>
<tr>
<td>Power Dissipation</td>
<td>$P_C$</td>
<td>150</td>
<td>120  mW/ch</td>
</tr>
<tr>
<td>Isolation Voltage$^2$</td>
<td>$BV$</td>
<td>5 000</td>
<td>Vrms</td>
</tr>
<tr>
<td>Operating Ambient Temperature</td>
<td>$T_A$</td>
<td>−55 to +100</td>
<td>℃</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>$T_{stg}$</td>
<td>−55 to +150</td>
<td>℃</td>
</tr>
</tbody>
</table>

$^1$ PW = 100 μs, 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 (PS2501-1, PS2501L-1).
   Pins 1-8 shorted together, 9-16 shorted together (PS2501-4, PS2501L-4).
### ELECTRICAL CHARACTERISTICS (TA = 25°C)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Conditions</th>
<th>MIN.</th>
<th>TYP.</th>
<th>MAX.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diode Diode Forward Voltage</td>
<td>V_F</td>
<td>I_F = 10 mA</td>
<td>1.17</td>
<td>1.4</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Diode Reverse Current</td>
<td>I_R</td>
<td>V_R = 5 V</td>
<td>5</td>
<td>µA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Terminal Capacitance</td>
<td>C_T</td>
<td>V = 0 V, f = 1.0 MHz</td>
<td>50</td>
<td>pF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transistor Collector to Emitter Dark Current</td>
<td>I_CED</td>
<td>V_CE = 80 V, I_F = 0 mA</td>
<td>100</td>
<td>nA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coupled Current Transfer Ratio (Ic/Ib)(^*1^)</td>
<td>CTR</td>
<td>I_F = 5 mA, V_CE = 5 V</td>
<td>80</td>
<td>300</td>
<td>600</td>
<td>%</td>
</tr>
<tr>
<td>Coupled Collector Saturation Voltage</td>
<td>V_CE_sat</td>
<td>I_F = 10 mA, I_C = 2 mA</td>
<td></td>
<td>0.3</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Coupled Isolation Resistance</td>
<td>R_I-O</td>
<td>V_I-O = 1.0 kVDC</td>
<td></td>
<td>10(^{11})</td>
<td></td>
<td>Ω</td>
</tr>
<tr>
<td>Coupled Isolation Capacitance</td>
<td>C_I-O</td>
<td>V = 0 V, f = 1.0 MHz</td>
<td></td>
<td>0.5</td>
<td>pF</td>
<td></td>
</tr>
<tr>
<td>Coupled Rise Time(^*2)</td>
<td>b</td>
<td>V_CC = 10 V, I_C = 2 mA, R_L = 100 Ω</td>
<td></td>
<td>3</td>
<td></td>
<td>µs</td>
</tr>
<tr>
<td>Coupled Fall Time(^*2)</td>
<td>b</td>
<td></td>
<td></td>
<td>5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^*1\) CTR rank (\(^*\) : only PS2501-1, PS2501L-1)
- K*: 300 to 600 (%)
- L*: 200 to 400 (%)
- M*: 80 to 240 (%)
- D*: 100 to 300 (%)
- H*: 80 to 160 (%)
- W*: 130 to 260 (%)
- Q*: 100 to 200 (%)
- N*: 80 to 600 (%)

\(<R>\) *2 Test circuit for switching time

![Test Circuit for Switching Time](image_url)
TYPICAL CHARACTERISTICS (Unless otherwise specified, $T_A = 25^\circ$C)

**DIODE POWER DISSIPATION vs. AMBIENT TEMPERATURE**

![Diode Power Dissipation vs. Ambient Temperature Graph]

**TRANSISTOR POWER DISSIPATION vs. AMBIENT TEMPERATURE**

![Transistor Power Dissipation vs. Ambient Temperature Graph]

**FORWARD CURRENT vs. FORWARD VOLTAGE**

![Forward Current vs. Forward Voltage Graph]

**COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE**

![Collector Current vs. Collector to Emitter Voltage Graph]

**COLLECTOR TO EMITTER DARK CURRENT vs. AMBIENT TEMPERATURE**

![Collector to Emitter Dark Current vs. Ambient Temperature Graph]

**COLLECTOR CURRENT vs. COLLECTOR SATURATION VOLTAGE**

![Collector Current vs. Collector Saturation Voltage Graph]

**Remark** The graphs indicate nominal characteristics.
Remark: The graphs indicate nominal characteristics.
TAPING SPECIFICATIONS (UNIT: mm)

Outline and Dimensions (Tape)

Tape Direction

Outline and Dimensions (Reel)

Packing: 2 000 pcs/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 refloows: 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 $I_F = 1\, \text{mA}$.
   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.
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GaaS Products  

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- 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.