High performance chip resistor

Small size & High power type
High precision type
Current sensing type
Anti-Sulfurated series
Guidelines and precautions regarding the technical information and use of our products described in this online catalog.

- If you want to use our products described in this online catalog for applications requiring special qualities or reliability, or for applications where the failure or malfunction of the products may directly jeopardize human life or potentially cause personal injury (e.g., aircraft and aerospace equipment, traffic and transportation equipment, combustion equipment, medical equipment, accident prevention, anti-crime equipment, and/or safety equipment), it is necessary to verify whether the specifications of our products fit to such applications. Please ensure that you will ask and check with our inquiry desk as to whether the specifications of our products fit to such applications use before you use our products.

- The quality and performance of our products as described in this online catalog only apply to our products when used in isolation. Therefore, please ensure you evaluate and verify our products under the specific circumstances in which our products are assembled in your own products and in which our products will actually be used.

- If you use our products in equipment that requires a high degree of reliability, regardless of the application, it is recommended that you set up protection circuits and redundancy circuits in order to ensure safety of your equipment.

- The products and product specifications described in this online catalog are subject to change for improvement without prior notice. Therefore, please be sure to request and confirm the latest product specifications which explain the specifications of our products in detail, before you finalize the design of your applications, purchase, or use our products.

- The technical information in this online catalog provides examples of our products' typical operations and application circuits. We do not guarantee the non-infringement of third party's intellectual property rights and we do not grant any license, right, or interest in our intellectual property.

- If any of our products, product specifications and/or technical information in this online catalog is to be exported or provided to non-residents, the laws and regulations of the exporting country, especially with regard to security and export control, shall be observed.

<Regarding the Certificate of Compliance the EU RoHS Directive/REACH Regulations>

- The switchover date for compliance with the RoHS Directive/REACH Regulations varies depending on the part number or series of our products.

- If you are not sure whether it applies to RoHS/REACH directive or not when using stock items, please do not hesitate to contact our sales representative.

AEC-Q200 compliant
The products are tested based on all or part of the test conditions and methods defined in AEC-Q200. Please consult with Panasonic for the details of the product specification and specific evaluation test results, etc., and please review and approve Panasonic's product specification before ordering.

We do not take any responsibility for the use of our products outside the scope of the specifications, descriptions, guidelines and precautions described in this online catalog.
Panasonic has produced resistors for more than 85 years. Based on the concept, "Good products begin with Good components." by our founder Konosuke Matsushita, Panasonic started manufacturing fixed carbon film resistors for radio receivers in 1933 and reached the milestone of accumulative 2 trillion pieces production by 2013.

By lining up with this number of resistors, standard 1608 mm size, we can make a round trip to the moon (244,198 miles).
Panasonic chip resistors, product line-up

Chip resistors

Thin film type
- Thin film chip resistors, High reliability type / Anti-Surge type

Thick film type
- High precision thick film type
- Low TCR high power / wide terminal type
- Double-sided resistive elements structure type

Metal plate type
- Anti-Surge type
- Wide terminal type

Standard

High performance

Resistor network

※ Products listed in this catalog

- Small size & High power
  - Anti-Surge type
  - Wide terminal type

- High precision
  - High precision thick film type

- Current sensing
  - Low TCR high power / wide terminal type
  - Double-sided resistive elements structure type

- Anti-Sulfurated
  - Normal
  - Array
  - Low resistance
  - Small size & High power
## INDEX

<table>
<thead>
<tr>
<th>Small size &amp; High power</th>
<th>ERJPA/P0 series</th>
<th>P5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Anti-Surge type</td>
<td></td>
</tr>
<tr>
<td>ERJB series</td>
<td>Wide terminal type</td>
<td>P6</td>
</tr>
<tr>
<td>ERJPA/P0 series</td>
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<td></td>
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<tr>
<td></td>
<td>Anti-Surge type</td>
<td></td>
</tr>
<tr>
<td>ERJPB series</td>
<td>High precision thick film type</td>
<td>P8</td>
</tr>
<tr>
<td>ERJD series</td>
<td>Low TCR high power / wide terminal type</td>
<td>P9</td>
</tr>
<tr>
<td>ERJ*BW series</td>
<td>Double-sided resistive elements structure type</td>
<td>P10</td>
</tr>
<tr>
<td>Anti-Sulfurated series</td>
<td></td>
<td></td>
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<tr>
<td>Normal : ERJS/U series</td>
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<td>Array : EXBU series</td>
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<tr>
<td>Low resistance : ERJU*S/Q series</td>
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<td>Small size &amp; High power : ERJC/ERJUP series</td>
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<td>Current sensing</td>
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<tr>
<td>Anti-Sulfurated series</td>
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<tr>
<td>Characteristics of Panasonic thick film chip resistors (Anti-Solder joint crack)</td>
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</table>

### Main locations [Description of the icon]

- **Downsizing**: Reducing size with same power rating
- **Anti-Surge**: Improving durability for overloading
- **High precision**: Reaching same total tolerance level as thin film
- **Anti-Sulfurated**: Reducing anti-solder joint crack in heat cycle environment
- **Low TCR**: Reaching higher power rating with same size
- **High power**: Reducing variation of resistance value under temperature variation
- **Anti-Sulfurated**: Reducing variation of resistance value under sulfur environment
- **AEC-Q200**: Conforming AEC-Q200 Grade 0

*ERJPA2 : Grade 1*
Small size & High power Anti-Surge type

ERJPA/P0 series

Improve improvement of High power & Anti-Surge rating

PCB area reduction

1. Down sizing
2. Weight saving
3. Cost saving

High Anti-Surge performance

1. Failure reduction
2. Design margin securing

Surge distribution by unique resistive material / trimming

・Unique “Double-C shaped trimming” for surge distribution.
・Achieved small size & high power and overload characteristics.

Specifications

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Size (mm)</th>
<th>Power rating (W)</th>
<th>Limiting element voltage (V)</th>
<th>Resistance tolerance (%)</th>
<th>Resistance range (Ω)</th>
<th>TCR (x10⁻⁶/℃)</th>
<th>Category temp. range (℃)</th>
<th>Power rating up to 105 ℃</th>
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<td>1005</td>
<td>0.20</td>
<td>50</td>
<td>± 0.5, ± 1</td>
<td>10 to 1 M</td>
<td>± 100</td>
<td>-55 to 155</td>
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<td>150</td>
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<td>± 100</td>
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<td>± 300</td>
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<td>33Ω≤R</td>
<td>± 100</td>
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</table>

※1 : ERJPA : AEC-Q200 Grade 1
※2 : Power rating up to 105 ℃

Please visit our website for details!
**Small size & High power**

**Wide terminal type**

**ERJB series**

*Improvement of High power & Anti-Surge rating*

- **Number of pieces reduction**
  1. Down sizing
  2. Weight saving
  3. Cost saving

- **High Anti-Surge performance**
  1. Failure reduction
  2. Design margin securing

### Point

Higher power rating by wide termination structure with separated resistive elements

- Separated resistive elements for surge distribution.
- Achieved small size & high power and overload characteristics.

#### Specifications

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Size (mm)</th>
<th>Power rating (W)</th>
<th>Limiting element voltage (V)</th>
<th>Resistance tolerance (%)</th>
<th>Resistance range (Ω)</th>
<th>TCR (x10⁻⁶/ ℃)</th>
<th>Category temp. range (℃)</th>
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<td>10 m to 10 k</td>
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<td>-55 to 155</td>
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<td>ERJB2</td>
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<td>200</td>
<td>± 1</td>
<td>10 m to 10 M</td>
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<td>-55 to 155</td>
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<td>(1/2)</td>
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</tr>
<tr>
<td>ERJB3</td>
<td>1220</td>
<td>0.33</td>
<td>150</td>
<td>± 1</td>
<td>20 m to 10</td>
<td></td>
<td>-55 to 155</td>
</tr>
</tbody>
</table>

*1: Power rating up to 105 ℃
2: Resistance value 10.2 Ω or more, Power rating 1.0 W
3: Resistance value 10.2 Ω or more, Power rating 0.75 W

Please visit our website for details!
By the replacement with high power resistors from standard resistors, “Panasonic contributes to make PCB smaller.”

<table>
<thead>
<tr>
<th>Power (W)</th>
<th>1005</th>
<th>1608</th>
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<th>3216 (Wide terminal)</th>
<th>3225</th>
<th>5025 (Wide terminal)</th>
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</table>

※ “ ” means down sizing rate(%) of PCB.
High precision thick film type
ERJPB series

Same tolerance level as thin film by thick film

- Resistance tolerance ± 0.1%
- TCR ± 50 ppm/℃
- Endurance test tolerance ± 0.5%

Cut the total tolerance to 1/5

1. Design margin securing
2. Improvement of reliability
3. Cost saving for IC by reducing correction circuit

Achieved high precision resistance tolerance : ±0.1% by unique resistive material and trimming

---

**Point**

By unique “Double L-shaped trimming” process, we can make slight adjustments of resistance value.
(2nd small L-shaped trimming has low adjustment rate)

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### Specifications

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Size (mm)</th>
<th>Power rating (W)</th>
<th>Limiting element voltage (V)</th>
<th>Resistance tolerance (%)</th>
<th>Resistance range (Ω)</th>
<th>TCR (x10^-6/℃)</th>
<th>Category temp. range (℃)</th>
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<tbody>
<tr>
<td>ERJPB3B</td>
<td>1608</td>
<td>0.20</td>
<td>150</td>
<td>± 0.1, ± 0.5</td>
<td>200 to 100 k</td>
<td>± 50</td>
<td>-55 to 155</td>
</tr>
<tr>
<td>ERJPB6B</td>
<td>2012</td>
<td>0.25</td>
<td>150</td>
<td>± 0.1, ± 0.5</td>
<td>200 to 1M</td>
<td>± 50</td>
<td>-55 to 155</td>
</tr>
</tbody>
</table>

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Please visit our website for details!
Current sensing
Low TCR high power / wide terminal type

ERJD series

Achieved low-resistance/low-TCR by thick film
~ VA proposal for metal shunt resistors ~

[ Achieved TCR 350 ppm/℃ → 100 ppm/℃ in 10 mΩ ]

Achieved same level performance as metal shunt resistor

1. Design margin securing
2. Improvement of reliability
3. Cost saving

Achieved low resistance TCR
by unique resistive material

- Reducing low resistance TCR by applying Pd-Ag resistive element on the high resistance value, CuNi resistive material on the low.
- Achieved low TCR as same level as metal shunt resistors at more than 10Ω.

Point

Reducing resistance value on the electrode

<table>
<thead>
<tr>
<th>Specifications</th>
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<td>Part No.</td>
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<td>ERJD1</td>
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<tr>
<td>ERJD2</td>
</tr>
</tbody>
</table>

Please visit our website for details!
Current sensing
**Double-sided resistive elements structure type**

**ERJ*BW series**

Small case size, low resistance, and high power by double-sided resistive elements structure

---

1. **Down sizing**
2. **Weight saving**
3. **Cost saving**

[ Achieved smaller case size(3216→2012) than conventional type for 10 mΩ ]

**PCB area reduction**

- Down sizing
- Weight saving
- Cost saving

---

**Point**

Realized small current sensing resistors by double-sided resistive elements structure

**Double-sided resistive elements structure**

- By original double sided resistive trimming “The front and back symmetrical double L-shaped trimming” process, load concentration can be avoided.
- Achieved small size & high power and overload characteristics.

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**Specifications**

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Size (mm)</th>
<th>Power rating (W)</th>
<th>Resistance tolerance (%)</th>
<th>Resistance range (Ω)</th>
<th>TCR (x10⁻⁶ / ℃)</th>
<th>Category temp. range (℃)</th>
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<td>ERJ2BW</td>
<td>1005</td>
<td>0.25</td>
<td>± 1, ± 2, ± 5</td>
<td>47 m to 100 m</td>
<td>0 to + 300</td>
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<td>± 1, ± 2, ± 5</td>
<td>20 m to 200 m</td>
<td>0 to + 250</td>
<td>0 to + 150</td>
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<td>ERJ6BW</td>
<td>2012</td>
<td>0.5</td>
<td>± 1, ± 2, ± 5</td>
<td>10 m to 100 m</td>
<td>0 to + 300</td>
<td>0 to + 200</td>
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<tr>
<td>ERJ8BW</td>
<td>3216</td>
<td>1.0</td>
<td>± 1, ± 2, ± 5</td>
<td>10 m to 100 m</td>
<td>0 to + 200</td>
<td>0 to + 150</td>
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</tbody>
</table>

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Please visit our website for details!
Sulfurated Ag needle crystal

Oil immersion time (h)

Breakage rate (%) vs Oil immersion time (h)

Anti-Sulfurated terminal reduces variation in the resistance value under harsh environment (sulfur)

- Sulfurized oil immersion test of chip resistors

- Sulfurized oil immersion test of Au terminal and high Pd-Ag terminal

Covered with nickel plating layers, there is no anti-sulfurated characteristic difference between Au terminal and Pd-Ag terminal.

While Pd-Ag terminal has some variations in resistance value, Au terminal has very little variations in sulfurized oil immersion test. It shows that Au terminal has higher anti-sulfurated characteristics of terminal itself.

With Anti-Sulfurated characteristics,
1. High reliability by reducing sulfurated breakage
2. Improve reliability of device at harsh environment
3. Cost reduction by unnecessary of sealing substrate
### Anti-Sulfurated series Line-up

<table>
<thead>
<tr>
<th>Size (mm)</th>
<th>Type</th>
<th>0603</th>
<th>1005</th>
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</tbody>
</table>
**Anti-Solder joint crack**

Reduces solder joint crack progression by own-developed soft terminal

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**Reduce solder joint crack on the substrate**

1. Long life for the set of device
2. Improvement of reliability

---

**Soft termination technology adopted**

- Cooling and heating cycle lightens the stress

---

Maintain excellent solder connection reliability even in harsh temperature environment such as for automotive.
Main locations

■ Japan bases

- Sales office
- Production base

■ Overseas bases
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