Panasonic

# 2015

## CATALOG

## Fixed Resistors

2015.5 | industrial.panasonic.com/

Panasonic

# Fixed Resistors CONTENTS



All products in this catalog comply with the RoHS Directive.

The RoHS Directive is “the Directive (2011/65/EU) on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment “ and its revisions.

## ⚠Safety Precautions (Common precautions for Fixed Resistors)

- When using our products, no matter what sort of equipment they might be used for, be sure to make a written agreement on the specifications with us in advance. The design and specifications in this catalog are subject to change without prior notice.
- Do not use the products beyond the specifications described in this catalog.
- This catalog explains the quality and performance of the products as individual components. Before use, check and evaluate their operations when installed in your products.
- Install the following systems for a failsafe design to ensure safety if these products are to be used in equipment where a defect in these products may cause the loss of human life or other significant damage, such as damage to vehicles (automobile, train, vessel), traffic lights, medical equipment, aerospace equipment, electric heating appliances, combustion/gas equipment, rotating equipment, and disaster/crime prevention equipment.

✻ Systems equipped with a protection circuit and a protection device
✻ Systems equipped with a redundant circuit or other system to prevent an unsafe status in the event of a single fault

### (1) Precautions for use

- These products are designed and manufactured for general and standard use in general electronic equipment (e.g. AV equipment, home electric appliances, office equipment, information and communication equipment)
- These products are not intended for use in the following special conditions. Before using the products, carefully check the effects on their quality and performance, and determine whether or not they can be used.
  1. In liquid, such as water, oil, chemicals, or organic solvent
  2. In direct sunlight, outdoors, or in dust
  3. In salty air or air with a high concentration of corrosive gas, such as $Cl_2$, $H_2S$, $NH_3$, $SO_2$, or $NO_2$
  4. Electric Static Discharge (ESD) Environment
     These components are sensitive to static electricity and can be damaged under static shock (ESD).
     Please take measures to avoid any of these environments.
     Smaller components are more sensitive to ESD environment.
  5. Electromagnetic Environment
     Avoid any environment where strong electromagnetic waves exist.
  6. In an environment where these products cause dew condensation
  7. Sealing or coating of these products or a printed circuit board on which these products are mounted, with resin or other materials
- These products generate Joule heat when energized. Carefully position these products so that their heat will not affect the other components.
- Carefully position these products so that their temperatures will not exceed the category temperature range due to the effects of neighboring heat-generating components. Do not mount or place heat-generating components or inflammables, such as vinyl-coated wires, near these products.
- Note that non-cleaning solder, halogen-based highly active flux, or water-soluble flux may deteriorate the performance or reliability of the products.
- Carefully select a flux cleaning agent for use after soldering. An unsuitable agent may deteriorate the performance or reliability. In particular, when using water or a water-soluble cleaning agent, be careful not to leave water residues. Otherwise, the insulation performance may be deteriorated.

### (2) Precautions for storage

The performance of these products, including the solderability, is guaranteed for a year from the date of arrival at your company, provided that they remain packed as they were when delivered and stored at a temperature of 5 °C to 35 °C and a relative humidity of 45 % to 85 %.

Even within the above guarantee periods, do not store these products in the following conditions. Otherwise, their electrical performance and/or solderability may be deteriorated, and the packaging materials (e.g. taping materials) may be deformed or deteriorated, resulting in mounting failures.

1. In salty air or in air with a high concentration of corrosive gas, such as $Cl_2$, $H_2S$, $NH_3$, $SO_2$, or $NO_2$
2. In direct sunlight

This is all for the common precautions. Also refer to the "CAUTION AND WARNING" section located on the back of the front cover of this catalog and precautions for individual products shown in the subsequent pages.

<Package markings>
Package markings include the product number, quantity, and country of origin.
In principle, the country of origin should be indicated in English.

# Thick Film Chip Resistors

Type: **ERJ XG, 1G, 2G, 3G, 6G, 8G, 14, 12, 12Z, 1T**

## Features

- Small size and lightweight
- High reliability
  Metal glaze thick film resistive element and three layers of electrodes
- Compatible with placement machines
  Taping packaging available
- Suitable for both reflow and flow soldering
- Reference Standards
  IEC 60115-8, JIS C 5201-8, EIAJ RC-2134B
- AEC-Q200 qualified (Exemption ERJXG)
- RoHS compliant

## ■ As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions,

Please see Data Files

## Explanation of Part Numbers

- ERJXGN, 1GN, 2GE, 3GE, 6GE, 8GE, 14, 12, 12Z, 1T Type, ±5 %

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| E | R | J | 3 | G | E | Y | J | 1 | 0 | 2 | V |

**Product Code**

| Thick Film Chip Resistors |
|---|

**Size, Power Rating**

| Code | Inch | Power R. |
|---|---|---|
| XGN | 01005 | 0.031 W |
| 1GN | 0201 | 0.05 W |
| 2GE | 0402 | 0.1 W |
| 3GE | 0603 | 0.1 W |
| 6GE | 0805 | 0.125 W |
| 8GE | 1206 | 0.25 W |
| 14 | 1210 | 0.5 W |
| 12 | 1812 | 0.75 W |
| 12Z | 2010 | 0.75 W |
| 1T | 2512 | 1 W |

**Marking**

| Code | Marking |
|---|---|
| Y | Value Marking on black side |
| *Nil | No marking |

**Resistance Tolerance**

| Code | Tolerance |
|---|---|
| J | ±5 % |
| 0 | Jumper |

**Resistance Value**

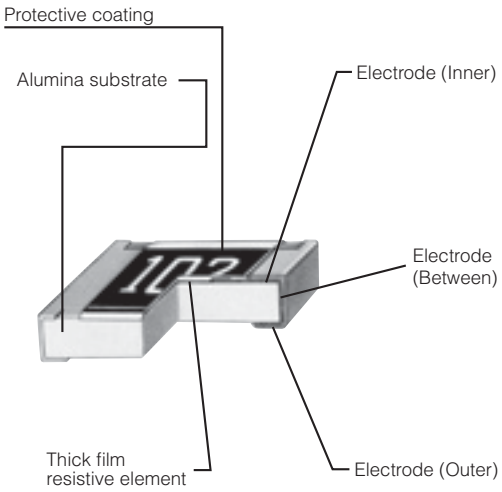
The first two digits are significant figures of resistance and the third one denotes number of zeros following.
Decimal Point is expressed by R as 4.7 = 4R7.
Jumper is expressed by R00.

**Packaging Methods**

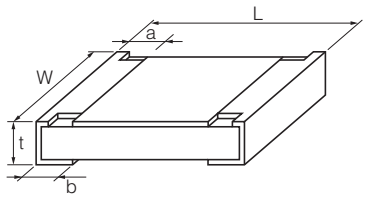
| Code | Packaging | Part No. |
|---|---|---|
| Y | Pressed Carrier Taping W8P2, 20,000 pcs. | ERJXGN |
| U | Embossed Carrier Taping W4P1, 40,000 pcs. | |
| C | Pressed Carrier Taping 2 mm pitch, 15,000 pcs. | ERJ1GN |
| X | Punched Carrier Taping 2 mm pitch, 10,000 pcs. | ERJ2GE |
| Y | Punched Carrier Taping 2 mm pitch, 20,000 pcs. | |
| V | Punched Carrier Taping 4 mm pitch, 5,000 pcs. | ERJ3GE ERJ6GE ERJ8GE |
| U | Embossed Carrier Taping 4 mm pitch, 5,000 pcs. | ERJ14 ERJ12 ERJ12Z |
| | Embossed Carrier Taping 4 mm pitch, 4,000 pcs. | ERJ1T |

✻ When omitted, the rest of the P/N factors shall be moved up respectively.
(Only XGN, 1GN, 2GE type)

## Construction




## Dimensions in mm (not to scale)




| Part No. (inch size) | Dimensions (mm) | | | | | Mass (Weight) (g/1000 pcs.) |
|---|---|---|---|---|---|---|
| | L | W | a | b | t | |
| ERJXG (01005) | $0.40^{\pm0.02}$ | $0.20^{\pm0.02}$ | $0.10^{\pm0.03}$ | $0.10^{\pm0.03}$ | $0.13^{\pm0.02}$ | 0.04 |
| ERJ1G (0201) | $0.60^{\pm0.03}$ | $0.30^{\pm0.03}$ | $0.10^{\pm0.05}$ | $0.15^{\pm0.05}$ | $0.23^{\pm0.03}$ | 0.15 |
| ERJ2G (0402) | $1.00^{\pm0.05}$ | $0.50^{\pm0.05}$ | $0.20^{\pm0.10}$ | $0.25^{\pm0.05}$ | $0.35^{\pm0.05}$ | 0.8 |
| ERJ3G (0603) | $1.60^{\pm0.15}$ | $0.80^{+0.15}_{-0.05}$ | $0.30^{\pm0.20}$ | $0.30^{\pm0.15}$ | $0.45^{\pm0.10}$ | 2 |
| ERJ6G (0805) | $2.00^{\pm0.20}$ | $1.25^{\pm0.10}$ | $0.40^{\pm0.20}$ | $0.40^{\pm0.20}$ | $0.60^{\pm0.10}$ | 4 |
| ERJ8G (1206) | $3.20^{+0.05}_{-0.20}$ | $1.60^{+0.05}_{-0.15}$ | $0.50^{\pm0.20}$ | $0.50^{\pm0.20}$ | $0.60^{\pm0.10}$ | 10 |
| ERJ14 (1210) | $3.20^{\pm0.20}$ | $2.50^{\pm0.20}$ | $0.50^{\pm0.20}$ | $0.50^{\pm0.20}$ | $0.60^{\pm0.10}$ | 16 |
| ERJ12 (1812) | $4.50^{\pm0.20}$ | $3.20^{\pm0.20}$ | $0.50^{\pm0.20}$ | $0.50^{\pm0.20}$ | $0.60^{\pm0.10}$ | 27 |
| ERJ12Z (2010) | $5.00^{\pm0.20}$ | $2.50^{\pm0.20}$ | $0.60^{\pm0.20}$ | $0.60^{\pm0.20}$ | $0.60^{\pm0.10}$ | 27 |
| ERJ1T (2512) | $6.40^{\pm0.20}$ | $3.20^{\pm0.20}$ | $0.65^{\pm0.20}$ | $0.60^{\pm0.20}$ | $0.60^{\pm0.10}$ | 45 |

## Ratings

### [For Resistor]

| Part No. (inch size) | Power Rating at 70 °C (W) | Limiting Element Voltage(1) (V) | Maximum Overload Voltage(2) (V) | Resistance Tolerance (%) | Resistance Range (Ω) | T.C.R. ($\times10^{-6}$/°C) | Category Temperature Range (°C) |
|---|---|---|---|---|---|---|---|
| ERJXG (01005) | 0.031 | 15 | 30 | ±5 | 4.7 to 1 M (E24) | <10 Ω : −100 to +600<br>10 Ω to 100 Ω : ±300<br>100 Ω< : ±200 | −55 to +125 |
| ERJ1G (0201) | 0.05 | 25 | 50 | ±5 | 1 to 10 M (E24) | <10 Ω: −100 to +600<br>10 Ω to 1 MΩ: ±200<br>1 MΩ<: −400 to +150 | −55 to +125 |
| ERJ2G (0402) | 0.1 | 50 | 100 | ±5 | 1 to 10 M (E24) | | −55 to +155 |
| ERJ3G (0603) | 0.1 | 75 | 150 | ±5 | 1 to 10 M (E24) | | −55 to +155 |
| ERJ6G (0805) | 0.125 | 150 | 200 | ±5 | 1 to 10 M (E24) | | −55 to +155 |
| ERJ8G (1206) | 0.25 | 200 | 400 | ±5 | 1 to 10 M (E24) | | −55 to +155 |
| ERJ14 (1210) | 0.5 | 200 | 400 | ±5 | 1 to 10 M (E24) | | −55 to +155 |
| ERJ12 (1812) | 0.75 | 200 | 500 | ±5 | 1 to 10 M (E24) | | −55 to +155 |
| ERJ12Z (2010) | 0.75 | 200 | 500 | ±5 | 1 to 10 M (E24) | | −55 to +155 |
| ERJ1T (2512) | 1 | 200 | 500 | ±5 | 1 to 1 M (E24) | | −55 to +155 |

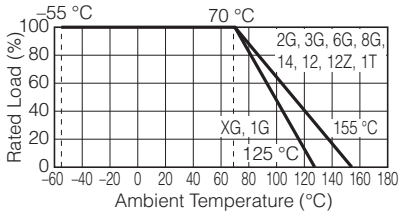
(1) Rated Continuous Working Voltage (RCWV) shall be determined from RCWV=$\sqrt{\text{Power Rating} \times \text{Resistance Values}}$, or Limiting Element Voltage listed above, whichever less.
(2) Overload (Short-time Overload) Test Voltage (SOTV) shall be determined from SOTV=2.5 (Only ERJ2G=2.0) × RCWV or max. Overload Voltage listed above whichever less.

### [For Jumper]

| Part No. (inch size) | Rated Current (A) | Maximum Overload Current (A) |
|---|---|---|
| ERJXG (01005) | 0.5 | 1 |
| ERJ1G (0201) | | |
| ERJ2G (0402) | 1 | 2 |
| ERJ3G (0603) | | |
| ERJ6G (0805) | 2 | 4 |
| ERJ8G (1206) | | |
| ERJ14 (1210) | | |
| ERJ12 (1812) | | |
| ERJ12Z (2010) | | |
| ERJ1T (2512) | | |

### Power Derating Curve

For resistors operated in ambient temperatures above 70 °C, power rating shall be derated in accordance with the figure below.



# Precision Thick Film Chip Resistors

Type: **ERJ XG, 1G**
**ERJ 1R, 2R, 3R, 6R**
**ERJ 3E, 6E, 8E, 14, 12, 1T**


## Features

- Small size and lightweight
- High reliability
  Metal glaze thick film resistive element and three layers of electrodes
- Compatible with placement machines
  Taping packaging available
- Suitable for both reflow and flow soldering
- Low Resistance Tolerance
  ERJXG, 1G, 2R, 3E, 6E, 8E, 14, 12, 1T Type : ±1 %
  ERJ1R, 2R, 3R, 6R Type : ±0.5 %
- Reference Standards
  IEC 60115-8, JIS C 5201-8, EIAJ RC-2134B
- AEC-Q200 qualified (Exemption ERJXG, ERJ1R)
- RoHS compliant

## ■ As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions,

Please see Data Files

## Explanation of Part Numbers

- ERJ1R, 2R, 3R, 6R Type, ±0.5 %

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| E | R | J | 3 | R | B | D | 1 | 0 | 0 | 2 | V |

**Product Code**

| Thick Film Chip Resistors |
|---|

**Size, Power Rating**

| Code | Inch | Power R. |
|---|---|---|
| 1R | 0201 | 0.05 W |
| 2R | 0402 | 0.063 W |
| 3R | 0603 | 0.1 W |
| 6R | 0805 | 0.1 W |

**T.C.R. Marking**

| Code | T.C.R. |
|---|---|
| H | ±50×10$^{-6}$/°C (1R, 2R) |
| B | ±50×10$^{-6}$/°C (3R, 6R) |
| K | ±100×10$^{-6}$/°C (2R) |
| E | ±100×10$^{-6}$/°C (3R, 6R) |

**Resistance Tolerance**

| Code | Tolerance |
|---|---|
| D | ±0.5 % |

**Packaging Methods**

| Code | Packaging | Part No. |
|---|---|---|
| C | Pressed Carrier Taping 2 mm pitch, 15,000 pcs. | ERJ1R |
| X | Punched Carrier Taping 2 mm pitch, 10,000 pcs. | ERJ2R |
| V | Punched Carrier Taping 4 mm pitch, 5,000 pcs. | ERJ3R ERJ6R |

**Resistance Value**

The first three digits are significant figures of resistance and the last one denotes number of zeros following.
Example: 1002 →10 kΩ

● ERJXG, 1G, 2R, 3E, 6E, 8E, 14, 12, 1T Type, ±1 %

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| E | R | J | 8 | E | N | F | 1 | 0 | 0 | 2 | V |

| Product Code |
|---|
| Thick Film Chip Resistors |

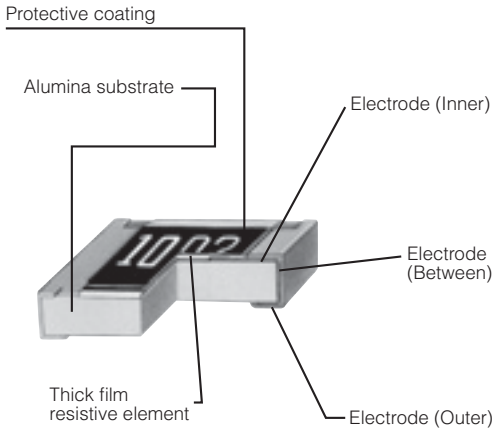
| Size, Power Rating | | |
|---|---|---|
| Code | Inch | Power R. |
| XGN | 01005 | 0.031 W |
| 1GN | 0201 | 0.05 W |
| 2RK | 0402 | 0.1 W |
| 3EK | 0603 | 0.1 W |
| 6EN | 0805 | 0.125 W |
| 8EN | 1206 | 0.25 W |
| 14N | 1210 | 0.5 W |
| 12N | 1812 | 0.75 W |
| 12S | 2010 | 0.75 W |
| 1TN | 2512 | 1 W |

| Resistance Tolerance | |
|---|---|
| Code | Tolerance |
| F | ±1 % |

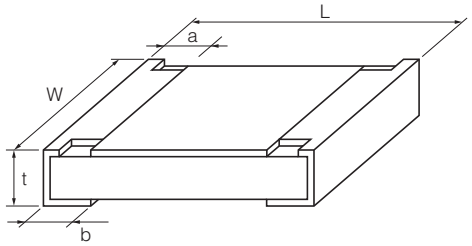
| Resistance Value |
|---|
| The first three digits are significant figures of resistance and the last one denotes number of zeros following.<br>Decimal point is expressed by "R".<br>Example : 1002 → 10 kΩ |

| Packaging Methods | | |
|---|---|---|
| Code | Packaging | Part No. |
| Y | Pressed Carrier Taping 2 mm pitch, 20,000 pcs. | ERJXGN |
| C | Pressed Carrier Taping 2 mm pitch, 15,000 pcs. | ERJ1GN |
| X | Punched Carrier Taping 2 mm pitch, 10,000 pcs. | ERJ2RK |
| V | Punched Carrier Taping 4 mm pitch, 5,000 pcs. | ERJ3EK<br>ERJ6EN<br>ERJ8EN |
| U | Embossed Carrier Taping 4 mm pitch, 5,000 pcs. | ERJ14N<br>ERJ12N<br>ERJ12S |
| | Embossed Carrier Taping 4 mm pitch, 4,000 pcs. | ERJ1TN |

## Construction




## Dimensions in mm (not to scale)




| Part No. (inch size) | Dimensions (mm) | | | | | Mass (Weight) [g/1000 pcs.] |
|---|---|---|---|---|---|---|
| | L | W | a | b | t | |
| ERJXG (01005) | $0.40^{\pm0.02}$ | $0.20^{\pm0.02}$ | $0.10^{\pm0.03}$ | $0.10^{\pm0.03}$ | $0.13^{\pm0.02}$ | 0.04 |
| ERJ1G, 1R (0201) | $0.60^{\pm0.03}$ | $0.30^{\pm0.03}$ | $0.10^{\pm0.05}$ | $0.15^{\pm0.05}$ | $0.23^{\pm0.03}$ | 0.15 |
| ERJ2R□ (0402) | $1.00^{\pm0.05}$ | $0.50^{\pm0.05}$ | $0.20^{\pm0.10}$ | $0.25^{\pm0.05}$ | $0.35^{\pm0.05}$ | 0.8 |
| ERJ3R□ ERJ3EK (0603) | $1.60^{\pm0.15}$ | $0.80^{+0.15}_{-0.05}$ | $0.30^{\pm0.20}$ | $0.30^{\pm0.15}$ | $0.45^{\pm0.10}$ | 2 |
| ERJ6R□ ERJ6EN (0805) | $2.00^{\pm0.20}$ | $1.25^{\pm0.10}$ | $0.40^{\pm0.20}$ | $0.40^{\pm0.20}$ | $0.60^{\pm0.10}$ | 4 |
| ERJ8EN (1206) | $3.20^{+0.05}_{-0.20}$ | $1.60^{+0.05}_{-0.15}$ | $0.50^{\pm0.20}$ | $0.50^{\pm0.20}$ | $0.60^{\pm0.10}$ | 10 |
| ERJ14N (1210) | $3.20^{\pm0.20}$ | $2.50^{\pm0.20}$ | $0.50^{\pm0.20}$ | $0.50^{\pm0.20}$ | $0.60^{\pm0.10}$ | 16 |
| ERJ12N (1812) | $4.50^{\pm0.20}$ | $3.20^{\pm0.20}$ | $0.50^{\pm0.20}$ | $0.50^{\pm0.20}$ | $0.60^{\pm0.10}$ | 27 |
| ERJ12S (2010) | $5.00^{\pm0.20}$ | $2.50^{\pm0.20}$ | $0.60^{\pm0.20}$ | $0.60^{\pm0.20}$ | $0.60^{\pm0.10}$ | 27 |
| ERJ1TN (2512) | $6.40^{\pm0.20}$ | $3.20^{\pm0.20}$ | $0.65^{\pm0.20}$ | $0.60^{\pm0.20}$ | $0.60^{\pm0.10}$ | 45 |

## Ratings

<±0.5 %>

| Part No. (inch size) | Power Rating at 70 °C (W) | Limiting Element Voltage(1) (V) | Maximum Overload Voltage(2) (V) | Resistance Tolerance (%) | Resistance Range (Ω) | T.C.R. ($\times 10^{-6}$/°C) | Category Temperature Range (°C) |
|---|---|---|---|---|---|---|---|
| ERJ1RH (0201) | 0.05 | 15 | 30 | ±0.5 | 1 k to 1 M (E24, E96) | ±50 | –55 to +125 |
| ERJ2RH (0402) | 0.063 | 50 | 100 | ±0.5 | 100 to 100 k (E24, E96) | ±50 | –55 to +125 |
| ERJ2RK (0402) | 0.063 | 50 | 100 | ±0.5 | 10 to 97.6 102 k to 1 M (E24, E96) | ±100 | –55 to +125 |
| ERJ3RB (0603) | 0.1 | 50 | 100 | ±0.5 | 100 to 100 k (E24, E96) | ±50 | –55 to +125 |
| ERJ3RE (0603) | 0.1 | 50 | 100 | ±0.5 | 10 to 97.6 102 k to 1 M (E24, E96) | ±100 | –55 to +125 |
| ERJ6RB (0805) | 0.1 | 150 | 200 | ±0.5 | 100 to 100 k (E24, E96) | ±50 | –55 to +125 |
| ERJ6RE (0805) | 0.1 | 150 | 200 | ±0.5 | 10 to 97.6 102 k to 1 M (E24, E96) | ±100 | –55 to +125 |

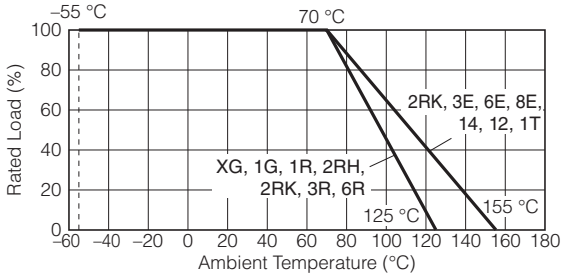
<±1 %>

| Part No. (inch size) | Power Rating at 70 °C (W) | Limiting Element Voltage(1) (V) | Maximum Overload Voltage(2) (V) | Resistance Tolerance (%) | Resistance Range (Ω) | T.C.R. ($\times 10^{-6}$/°C) | Category Temperature Range (°C) |
|---|---|---|---|---|---|---|---|
| ERJXGN (01005) | 0.031 | 15 | 30 | ±1 | 10 to 1 M (E24, E96) | <100 Ω : ±300<br>100 Ω ≦ : ±200 | –55 to +125 |
| ERJ1GN (0201) | 0.05 | 25 | 50 | ±1 | 10 to 1 M(3) (E24, E96) | ±200 | –55 to +125 |
| ERJ2RK (0402) | 0.1 | 50 | 100 | ±1 | 10 to 1 M(3) (E24, E96) | ±100 | –55 to +155 |
| ERJ3EK (0603) | 0.1 | 75 | 150 | ±1 | 10 to 1 M (E24, E96) | ±100 | –55 to +155 |
| ERJ6EN (0805) | 0.125 | 150 | 200 | ±1 | 10 to 2.2 M (E24, E96) | ±100 | –55 to +155 |
| ERJ8EN (1206) | 0.25 | 200 | 400 | ±1 | 10 to 2.2 M (E24, E96) | ±100 | –55 to +155 |
| ERJ14N (1210) | 0.5 | 200 | 400 | ±1 | 10 to 1 M (E24, E96) | ±100 | –55 to +155 |
| ERJ12N (1812) | 0.75 | 200 | 500 | ±1 | 10 to 1 M (E24, E96) | ±100 | –55 to +155 |
| ERJ12S (2010) | 0.75 | 200 | 500 | ±1 | 10 to 1 M (E24, E96) | ±100 | –55 to +155 |
| ERJ1TN (2512) | 1 | 200 | 500 | ±1 | 10 to 1 M (E24, E96) | ±100 | –55 to +155 |

(1) Rated Continuous Working Voltage (RCWV) shall be determined from RCWV=$\sqrt{\text{Power Rating} \times \text{Resistance Values}}$, or Limiting Element Voltage listed above, whichever less.
(2) Overload (Short-time Overload) Test Voltage (SOTV) shall be determined from SOTV=2.5 (Only ERJ2RK ±1% =2.0) × RCWV or max. Overload Voltage listed above whichever less.
(3) Please contact us when you need a type with a resistance of less than 10 Ω.

### Power Derating Curve

For resistors operated in ambient temperatures above 70 °C, power rating shall be derated in accordance with the figure on the right.



# Metal Film (Thin Film) Chip Resistors, High Reliability Type

## Type: ERA 1A, 2A, 3A, 6A, 8A

## Features

- High reliability ····· Stable at high temperature and humidity (85 °C 85 %RH rated load, Category temperature range : –55 to +155 °C)
- High accuracy ····· Small resistance tolerance and Temperature Coefficient of Resistance
- High performance ····· Low current noise, excellent linearity
- Reference Standard ····· IEC 60115-8, JIS C 5201-8, EIAJ RC-2133B
- AEC-Q200 qualified
- RoHS compliant

■ **As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions,** Please see Data Files

## Explanation of Part Numbers

- E24 Series

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|
| E | R | A | 3 | A | E | B | 1 | 0 | 2 | V |

**Product Code**

| Metal Film Chip Resistors |
|---|

**Size, Power Rating**

| Code | Inch | Power Rating |
|---|---|---|
| 1A | 0201 | 0.05 W |
| 2A | 0402 | 0.063 W |
| 3A | 0603 | 0.1 W |
| 6A | 0805 | 0.125 W |
| 8A | 1206 | 0.25 W |

**Temperature Coefficient**

| Code | T.C.R. |
|---|---|
| R | ±10×10$^{-6}$/°C |
| P | ±15×10$^{-6}$/°C |
| E | ±25×10$^{-6}$/°C |
| H | ±50×10$^{-6}$/°C |
| K | ±100×10$^{-6}$/°C |

**Resistance Tolerance**

| Code | Tolerance |
|---|---|
| W | ±0.05 % |
| B | ±0.1 % |
| C | ±0.25 % |
| D | ±0.5 % |

**Packaging Methods**

| Code | Packaging | Part No. |
|---|---|---|
| C | Pressed Carrier Taping 2 mm pitch, 15000 pcs. | ERA1A |
| X | Punched Carrier Taping 2 mm pitch, 10000 pcs. | ERA2A |
| V | Punched CarrierTaping 4 mm pitch, 5000 pcs. | ERA3A ERA6A ERA8A |

**Resistance Value**

Consist of three figures for E24 series resistance value. The first two digits are significant figures of resistance and the third one denotes number of zeros following.
(example) 102 : 1 kΩ

- E96 Series and other Resistance values

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| E | R | A | 3 | A | E | B | 1 | 0 | 5 | 1 | V |

**Product Code**

| Metal Film Chip Resistors |
|---|

**Size, Power Rating**

| Code | Inch | Power Rating |
|---|---|---|
| 1A | 0201 | 0.05 W |
| 2A | 0402 | 0.063 W |
| 3A | 0603 | 0.1 W |
| 6A | 0805 | 0.125 W |
| 8A | 1206 | 0.25 W |

**Temperature Coefficient**

| Code | T.C.R. |
|---|---|
| R | ±10×10$^{-6}$/°C |
| P | ±15×10$^{-6}$/°C |
| E | ±25×10$^{-6}$/°C |
| H | ±50×10$^{-6}$/°C |
| K | ±100×10$^{-6}$/°C |

**Resistance Tolerance**

| Code | Tolerance |
|---|---|
| W | ±0.05 % |
| B | ±0.1 % |
| C | ±0.25 % |
| D | ±0.5 % |

**Packaging Methods**

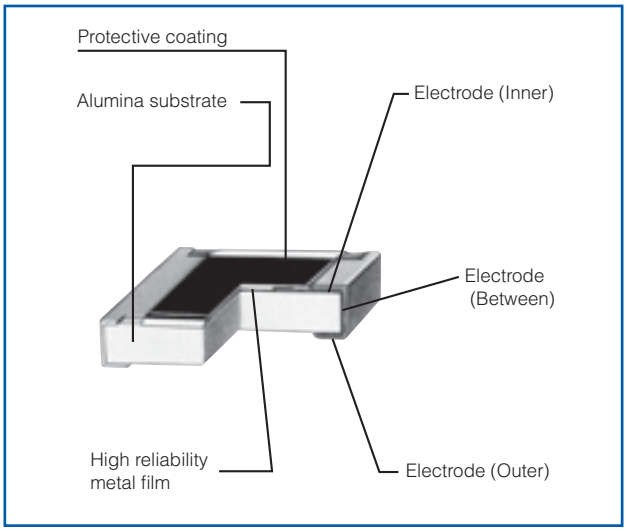
| Code | Packaging | Part No. |
|---|---|---|
| C | Pressed Carrier Taping 2 mm pitch, 15000 pcs. | ERA1A |
| X | Punched Carrier Taping 2 mm pitch, 10000 pcs. | ERA2A |
| V | Punched CarrierTaping 4 mm pitch, 5000 pcs. | ERA3A ERA6A ERA8A |

**Resistance Value**

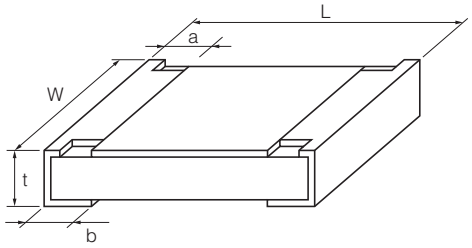
Consist of four figures for E96 series resistance value. The first three digits are significant figures of resistance and the fourth one denotes number of zeros following.
(example) 1051 : 1.05 kΩ

note : Duplicated resistance values as E24 series part numbers shall follow E24 part numbers.
(apply three digit resistance value)

## Construction




## Dimensions in mm (not to scale)




| Part No. (inch size) | Dimensions (mm) L | W | a | b | t | Mass (Weight) [g/1000pcs.] |
|---|---|---|---|---|---|---|
| ERA1A (0201) | $0.60^{\pm0.03}$ | $0.30^{\pm0.03}$ | $0.15^{\pm0.05}$ | $0.15^{\pm0.05}$ | $0.23^{\pm0.03}$ | 0.14 |
| ERA2A (0402) | $1.00^{\pm0.10}$ | $0.50^{+0.10}_{-0.05}$ | $0.15^{\pm0.10}$ | $0.25^{\pm0.10}$ | $0.35^{\pm0.05}$ | 0.6 |
| ERA3A (0603) | $1.60^{\pm0.20}$ | $0.80^{\pm0.20}$ | $0.30^{\pm0.20}$ | $0.30^{\pm0.20}$ | $0.45^{\pm0.10}$ | 2 |
| ERA6A (0805) | $2.00^{\pm0.20}$ | $1.25^{\pm0.10}$ | $0.40^{\pm0.25}$ | $0.40^{\pm0.25}$ | $0.50^{\pm0.10}$ | 4 |
| ERA8A (1206) | $3.20^{\pm0.20}$ | $1.60^{+0.05}_{-0.15}$ | $0.50^{\pm0.25}$ | $0.50^{\pm0.25}$ | $0.60^{\pm0.10}$ | 8 |

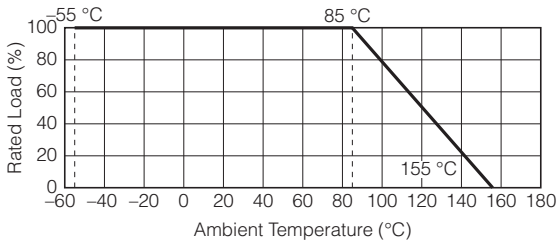
## Ratings

| Part No. (inch size) | Power Rating at 85 °C (W) | Limiting Element Voltage[1] (V) | Maximum Overload Voltage[2] (V) | Part No. (detail) | Resistance Tolerance (%) | T.C.R. ($\times10^{-6}$/°C) | Resistance Range[3][4] (Ω) | Category Temperature Range (°C) |
|---|---|---|---|---|---|---|---|---|
| ERA1A (0201) | 0.05 | 25 | 50 | ERA1AEB | ±0.1 | ±25 | 100 to 10 k (E24, E96) | –55 to +155 |
| | | | | ERA1AEC | ±0.25 | | | |
| ERA2A (0402) | 0.063 | 50 | 100 | ERA2AKD | ±0.5 | ±100 | 10 to 46.4 (E24, E96) | |
| | | | | ERA2AED | ±0.5 | ±25 | 47 to 100 k (E24, E96) | |
| | | | | ERA2AEB | ±0.1 | | | |
| | | | | ERA2APB | ±0.1 | ±15 | 200 to 47 k (E24, E96) | |
| | | | | ERA2ARC | ±0.25 | ±10 | 200 to 47 k (E24, E96) | |
| | | | | ERA2ARB | ±0.1 | | | |
| ERA3A (0603) | 0.1 | 75 | 150 | ERA3AHD | ±0.5 | ±50 | 10 to 46.4 (E24, E96) | |
| | | | | ERA3AED | ±0.5 | ±25 | 47 to 330 k (E24, E96) | |
| | | | | ERA3AEB | ±0.1 | | | |
| | | | | ERA3APB | ±0.1 | ±15 | 470 to 100 k (E24, E96) | |
| | | | | ERA3ARB | ±0.1 | ±10 | 1 k to 100 k (E24, E96) | |
| | | | | ERA3ARW | ±0.05 | | | |
| ERA6A (0805) | 0.125 | 100 | 200 | ERA6AHD | ±0.5 | ±50 | 10 to 46.4 (E24, E96) | |
| | | | | ERA6AED | ±0.5 | ±25 | 47 to 1 M (E24, E96) | |
| | | | | ERA6AEB | ±0.1 | | | |
| | | | | ERA6APB | ±0.1 | ±15 | 470 to 100 k (E24, E96) | |
| | | | | ERA6ARB | ±0.1 | ±10 | 1 k to 100 k (E24, E96) | |
| | | | | ERA6ARW | ±0.05 | | | |
| ERA8A (1206) | 0.25 | 150 | 300 | ERA8AHD | ±0.5 | ±50 | 10 to 46.4 (E24, E96) | |
| | | | | ERA8AED | ±0.5 | ±25 | 47 to 1 M (E24, E96) | |
| | | | | ERA8AEB | ±0.1 | | | |
| | | | | ERA8APB | ±0.1 | ±15 | 470 to 100 k (E24, E96) | |
| | | | | ERA8ARB | ±0.1 | ±10 | 1 k to 100 k (E24, E96) | |
| | | | | ERA8ARW | ±0.05 | | | |

(1) Rated Continuous Working Voltage (RCWV) shall be determined from RCWV=$\sqrt{\text{Rated Power} \times \text{Resistance Values}}$, or Limiting Element Voltage listed above, whichever less.
(2) Overload (Short-time Overload) Test Voltage (SOTV) shall be determined from SOTV=2.5 × RCWV or max. Overload Voltage listed above whichever less.
(3) E192 series resistance values are also available. Please contact us for details.
(4) Duplicated resistance values between E96, E192 and E24 series shall follow E24 Part Numbers. (apply three digit resistance value)

### Power Derating Curve

For resistors operated in ambient temperatures above 85 °C, power rating shall be derated in accordance with the figure on the right.



# Thick Film Chip Resistors / Low Resistance Type

Type: **ERJ 2LW, 3LW**
**2BW, 3BW, 6BW,**
**8BW, 8CW**
**ERJ 2B, 3B, 6B, 8B, 14B,**
**3R, 6R, 8R, 14R,**
**12R, 12Z, 1TR**
**ERJ L03, L06, L08, L14,**
**L12, L1D, L1W**


## Features

- Current Sensing resistor
- Small size and lightweight
- High reliability : Metal glaze thick film resistive element and three layers of electrodes
- Suitable for both reflow and flow soldering
- Improved high-power/resistance to pulse characteristics
  by double-sided resistive elements structure : ERJ2LW, 3LW ,2BW, 3BW, 6BW, 8BW, 8CW
- Low TCR : ±50×$10^{-6}$/°C (ERJ8CW)
- Low Resistance Value
  5 mΩ, 10 mΩ : ERJ3LW
  10 mΩ : ERJ2LW
  10 mΩ to 50 mΩ : ERJ8CW
  10 mΩ to 100 mΩ : ERJ6BW, 8BW
  20 mΩ to 100 mΩ : ERJ3BW, ERJL14, L12
  40 mΩ to 100 mΩ : ERJL1D, L1W
  47 mΩ to 100 mΩ : ERJ2BW, ERJL03, L06, L08
- Reference Standards : IEC 60115-8, JIS C 5201-8, JEITA RC-2144
- AEC-Q200 qualified
- RoHS compliant

■ **As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions,** Please see Data Files

## Explanation of Part Numbers

- ERJ2LW, 3LW, 2BW, 3BW, 6BW, 8BW, 8CW <High power (double-sided resistive elements structure) type>

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| E | R | J | 2 | B | W | G | R | 0 | 4 | 7 | X |

| Product Code |
|---|
| Thick Film Chip Resistors |

| Code | Inch | Power Rating | Resistance Value |
|---|---|---|---|
| 2LW | 0402 | 0.2 W | 10 mΩ |
| 3LW | 0603 | 0.25 W | 5 mΩ,10 mΩ |
| 2BW | 0402 | 0.25 W | 47 mΩ to 100 mΩ |
| 3BW | 0603 | 0.33 W | 20 mΩ to 100 mΩ |
| 6BW | 0805 | 0.5 W | 10 mΩ to 100 mΩ |
| 8BW | 1206 | 1 W | 10 mΩ to 100 mΩ |
| 8CW | 1206 | 1 W | 10 mΩ to 50 mΩ |

| Resistance Tolerance | |
|---|---|
| Code | Tolerance |
| F | ± 1 % |
| G | ± 2 % |
| J | ± 5 % |

| Resistance Value |
|---|
| Shown by 4 digits or letters. (Ex.) R047 : 0.047 Ω=47 mΩ |

| Packaging Methods | | |
|---|---|---|
| Code | Packaging | Part No. |
| X | Pressed Carrier Taping 2 mm pitch, 10,000 pcs. | ERJ2LW<br>ERJ2BW |
| V | Punched Carrier Taping 4 mm pitch, 5,000 pcs. | ERJ3LW<br>ERJ3BW<br>ERJ6BW<br>ERJ8BW<br>ERJ8CW |

● ERJ2BS/2BQ, 3BS/3BQ, 6BS/6BQ, 8BS/8BQ, 14BS/14BQ, 3R, 6R, 8R, 14R, 12R, 12Z, 1TR <High power type/Standard type>

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|
| E | R | J | 8 | R | Q | F | R | 2 | 2 | V |

**Product Code**

| Thick Film Chip Resistors |
|---|

**Size, Power Rating**

| Type | Inch | Power R. |
|---|---|---|
| 2B | 0402 | 0.166 W |
| 3R | 0603 | 0.1 W |
| 3B | 0603 | 0.25 W |
| 6R | 0805 | 0.125 W |
| 6B | 0805 | 0.33 W |
| 8R | 1206 | 0.25 W |
| 8B | 1206 | 0.5 W |
| 14R | 1210 | 0.25 W |
| 14B | 1210 | 0.5 W |
| 12R | 1812 | 0.5 W |
| 12Z | 2010 | 0.5 W |
| 1TR | 2512 | 1 W |

**Resistance Value**

| Code | Res. Value |
|---|---|
| S | 0.1 Ω to 0.2 Ω |
| Q | 0.22 Ω to 9.1 Ω* |

* 2B : 0.22 Ω to 1.0 Ω

**Resistance Tolerance**

| Code | Tolerance |
|---|---|
| F | ± 1 % |
| G | ± 2 % |
| J | ± 5 % |

**Resistance Value**

Shown by 3 digits or letters.
(Ex.) R22 : 0.22 Ω

**Packaging Methods**

| Code | Packaging | Part No. |
|---|---|---|
| X | Punched Carrier Taping 2 mm pitch, 10,000 pcs. | ERJ2B |
| V | Punched Carrier Taping 4 mm pitch, 5,000 pcs. | ERJ3R/3B<br>ERJ6R/6B<br>ERJ8R/8B |
| U | Embossed Carrier Taping 4 mm pitch, 5,000 pcs. | ERJ14R/14B<br>ERJ12R<br>ERJ12Z |
| | Embossed Carrier Taping 4 mm pitch, 4,000 pcs. | ERJ1TR |

● ERJL03, L06, L08, L14, L12, L1D, L1W <Low TCR type>

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| E | R | J | L | 1 | 4 | K | J | 5 | 0 | M | U |

**Product Code**

| Thick Film Chip Resistors |
|---|

**Size, Power Rating**

| Type | Inch | Power R. |
|---|---|---|
| L03 | 0603 | 0.2 W |
| L06 | 0805 | 0.25 W |
| L08 | 1206 | 0.33 W |
| L14 | 1210 | 0.33 W |
| L12 | 1812 | 0.5 W |
| L1D | 2010 | 0.5 W |
| L1W | 2512 | 1 W |

**Code / Res. Value**

| Code | Res. Value |
|---|---|
| K | Std. (20 mΩ, 22 mΩ, 33 mΩ, 39 mΩ, 47 mΩ, 50 mΩ, 100 mΩ)* |
| U | 20 mΩ to 100 mΩ* |

* L03, L06, L08 : 47 mΩ to 100 mΩ
L1D, L1W : 40 mΩ to 100 mΩ

**Resistance Tolerance**

| Code | Tolerance |
|---|---|
| F | ± 1 % |
| J | ± 5 % |

**Resistance Value**

Shown by 3 digits or letters.
(Ex.) 50 M:50 mΩ, 10 C:100 mΩ

**Packaging Methods**

| Code | Packaging | Part No. |
|---|---|---|
| V | Punched Carrier Taping 4 mm pitch, 5,000 pcs. | ERJL03<br>ERJL06<br>ERJL08 |
| U | Embossed Carrier Taping 4 mm pitch, 5,000 pcs. | ERJL14<br>ERJL12<br>ERJL1D |
| | Embossed Carrier Taping 4 mm pitch, 3,000 pcs. | ERJL1W |

## Ratings

<High power (double-sided resistive elements structure) type>

| Part No. (inch size) | Power Rating at 70 °C (W) | Resistance Tolerance (%) | Resistance (1) Range (Ω) | T.C.R. (×10⁻⁶/°C) | Category Temperature Range (°C) |
|---|---|---|---|---|---|
| ERJ2LW (0402) | 0.2 | ±1, ±2, ±5 | 10 m | 0 to 500 | –55 to +125 |
| ERJ3LW (0603) | 0.25 | ±1, ±2, ±5 | 5 m | 0 to 700 | –55 to +125 |
| | | | 10 m | 0 to 300 | –55 to +125 |
| ERJ2BW (0402) | 0.25 | ±1, ±2, ±5 | 47 m to 100 m (E24) | ±300 | –55 to +155 |
| ERJ3BW (0603) | 0.33 | ±1, ±2, ±5 | 20 m to 100 m (E24) | R<39m Ω : ±250<br>R≧39m Ω : ±150 | –55 to +155 |
| ERJ6BW (0805) | 0.5 | ±1, ±2, ±5 | 10 m to 100 m (E24) | R<15m Ω : ±300<br>R≧15m Ω : ±200 | –55 to +155 |
| ERJ8BW (1206) | 1 | ±1, ±2, ±5 | 10 m to 100 m (E24) | 10 mΩ ≦ R < 20 mΩ : ±200<br>20 mΩ ≦ R < 47 mΩ : ±150<br>47 mΩ ≦ R ≦ 100 mΩ : ±100 | –55 to +155 |
| ERJ8CW (1206) | 1 | ±1, ±2, ±5 | 10 m to 50 m (E24) | ±75 | –55 to +155 (10 m to 33 mΩ)<br>–55 to +125 (36 m to 50 mΩ) |

(1) Please contact us when resistors of irregular series are needed.

## Ratings

<High power type>

| Part No. (inch size) | Power Rating at 70 °C (W) | Resistance Tolerance (%) | Resistance [1] Range (Ω) | T.C.R. (×10⁻⁶/°C) | Category Temperature Range (°C) |
|---|---|---|---|---|---|
| ERJ2BS (0402) | 0.166 | ±1, ±2, ±5 | 0.10 to 0.20 (E24) | ±300 | –55 to +125 |
| ERJ2BQ (0402) | | | 0.22 to 1.0 (E24) | ±250 | |
| ERJ3BS (0603) | 0.25 | ±1, ±2, ±5 | 0.10 to 0.20 (E24) | ±300 | –55 to +125 |
| ERJ3BQ (0603) | | | 0.22 to 0.91 (E24) | | |
| | | | 1.0 to 9.1 (E24) | ±200 | |
| ERJ6BS (0805) | 0.33 | ±1, ±2, ±5 | 0.10 to 0.20 (E24) | ±250 | –55 to +125 |
| ERJ6BQ (0805) | | | 0.22 to 0.91 (E24) | | |
| | | | 1.0 to 9.1 (E24) | ±200 | |
| ERJ8BS (1206) | 0.5 | ±1, ±2, ±5 | 0.10 to 0.20 (E24) | ±250 | –55 to +125 |
| ERJ8BQ (1206) | | | 0.22 to 0.91 (E24) | | |
| | | | 1.0 to 9.1 (E24) | ±200 | |
| ERJ14BS (1210) | 0.5 | ±1, ±2, ±5 | 0.10 to 0.20 (E24) | ±200 | –55 to +125 |
| ERJ14BQ (1210) | | | 0.22 to 0.91 (E24) | | |
| | | | 1.0 to 9.1 (E24) | ±100 | |

(1) Please contact us when resistors of irregular series are needed.

<Standard type>

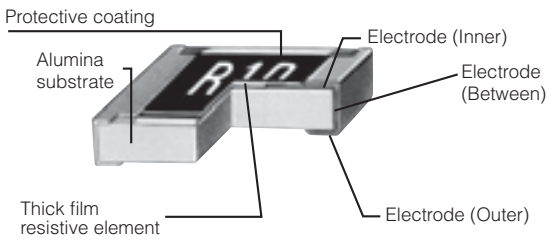
| Part No. (inch size) | Power Rating at 70 °C (W) | Resistance Tolerance (%) | Resistance Range (Ω) | T.C.R. (×10⁻⁶/°C) | Category Temperature Range (°C) |
|---|---|---|---|---|---|
| ERJ3RS (0603) | 0.1 | ±1, ±2, ±5 | 0.10 to 0.20 (E24) | ±300 | –55 to +125 |
| ERJ3RQ (0603) | | | 0.22 to 0.91 (E24) | | |
| | | | 1.0 to 9.1 (E24) | ±200 | |
| ERJ6RS (0805) | 0.125 | ±1, ±2, ±5 | 0.10 to 0.20 (E24) | ±250 | –55 to +125 |
| ERJ6RQ (0805) | | | 0.22 to 0.91 (E24) | | |
| | | | 1.0 to 9.1 (E24) | ±200 | |
| ERJ8RS (1206) | 0.25 | ±1, ±2, ±5 | 0.10 to 0.20 (E24) | ±250 | –55 to +125 |
| ERJ8RQ (1206) | | | 0.22 to 0.91 (E24) | | |
| | | | 1.0 to 9.1 (E24) | ±200 | |
| ERJ14RS (1210) | 0.25 | ±1, ±2, ±5 | 0.10 to 0.20 (E24) | ±200 | –55 to +125 |
| ERJ14RQ (1210) | | | 0.22 to 0.91 (E24) | | |
| | | | 1.0 to 9.1 (E24) | ±100 | |
| ERJ12RS (1812) | 0.5 | ±1, ±2, ±5 | 0.10 to 0.20 (E24) | ±200 | –55 to +125 |
| ERJ12RQ (1812) | | | 0.22 to 0.91 (E24) | | |
| | | | 1.0 to 9.1 (E24) | ±100 | |
| ERJ12ZS (2010) | 0.5 | ±1, ±2, ±5 | 0.10 to 0.20 (E24) | ±200 | –55 to +125 |
| ERJ12ZQ (2010) | | | 0.22 to 0.91 (E24) | | |
| | | | 1.0 to 9.1 (E24) | ±100 | |
| ERJ1TRS (2512) | 1 | ±1, ±2, ±5 | 0.10 to 0.20 (E24) | ±200 | –55 to +125 |
| ERJ1TRQ (2512) | | | 0.22 to 0.91 (E24) | | |
| | | | 1.0 to 9.1 (E24) | ±100 | |

<Low TCR type>

| Part No. (inch size) | Power Rating at 70 °C (W) | Resistance Tolerance (%) | Resistance [1] Range (Ω) | T.C.R. (×10⁻⁶/°C) | Category Temperature Range (°C) |
|---|---|---|---|---|---|
| ERJL03 (0603) | 0.2 | ±1, ±5 | 47 m to 100 m | ±200 | –55 to +125 |
| ERJL06 (0805) | 0.25 | ±1, ±5 | 47 m to 100 m | ±100 | –55 to +125 |
| ERJL08 (1206) | 0.33 | ±1, ±5 | 47 m to 100 m | ±100 | –55 to +125 |
| ERJL14 (1210) | 0.33 | ±1, ±5 | 20 m to 100 m | R<47 mΩ : ±300<br>R≧47 mΩ : ±100 | –55 to +125 |
| ERJL12 (1812) | 0.5 | ±1, ±5 | 20 m to 100 m | | –55 to +125 |
| ERJL1D (2010) | 0.5 | ±1, ±5 | 40 m to 100 m | | –55 to +125 |
| ERJL1W (2512) | 1 | ±1, ±5 | 40 m to 100 m | | –55 to +125 |

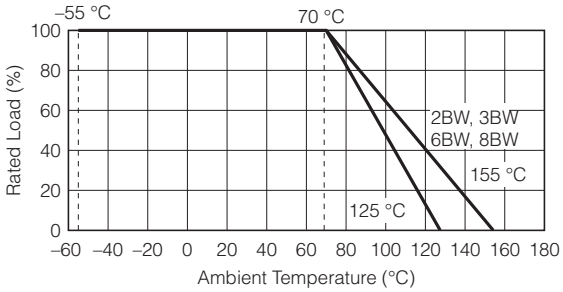
(1) Standard R.V. : 20 mΩ, 22 mΩ, 33 mΩ, 39 mΩ, 47 mΩ, 50 mΩ, 100 mΩ, Custom R.V. : Each 1 mΩ within upper range.

## Construction

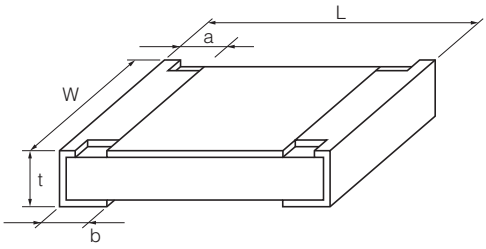



### Power Derating Curve

For resistors operated in ambient temperatures above 70 °C, power rating shall be derated in accordance with the figure below.



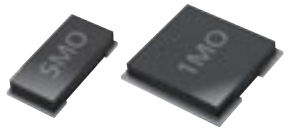

## Dimensions in mm (not to scale)




| Part No. (inch size) | Dimensions (mm) | | | | | Mass(Weight) [g/1000 pcs.] |
|---|---|---|---|---|---|---|
| | L | W | a | b | t | |
| ERJ2LW (0402) | $1.00^{\pm0.10}$ | $0.50^{+0.10}_{-0.05}$ | $0.25^{\pm0.10}$ | $0.25^{\pm0.10}$ | $0.40^{\pm0.05}$ | 0.8 |
| ERJ2BW (0402) | $1.00^{\pm0.10}$ | $0.50^{+0.10}_{-0.05}$ | $0.24^{\pm0.10}$ | $0.24^{\pm0.10}$ | $0.35^{\pm0.05}$ | 0.8 |
| ERJ2BS ERJ2BQ (0402) | $1.00^{\pm0.10}$ | $0.50^{+0.10}_{-0.05}$ | $0.20^{\pm0.10}$ | $0.27^{\pm0.10}$ | $0.35^{\pm0.05}$ | 0.8 |
| ERJ3LW (5 mΩ) (0603) | $1.60^{\pm0.15}$ | $0.80^{\pm0.15}$ | $0.50^{\pm0.20}$ | $0.50^{\pm0.20}$ | $0.55^{\pm010}$ | 3 |
| ERJ3LW (10 mΩ) (0603) ERJ3BW | $1.60^{\pm0.15}$ | $0.80^{\pm0.15}$ | $0.40^{\pm0.20}$ | $0.40^{\pm0.20}$ | $0.55^{\pm010}$ | 3 |
| ERJ3R ERJ3B (0603) ERJL03 | $1.60^{\pm0.15}$ | $0.80^{+0.15}_{-0.05}$ | $0.30^{\pm0.20}$ | $0.30^{\pm0.15}$ | $0.45^{\pm0.10}$ | 2 |
| ERJ6BW (0805) | $2.00^{\pm0.20}$ | $1.25^{\pm0.20}$ | $0.55^{\pm0.20}$ | $0.55^{\pm0.20}$ | $0.65^{\pm0.10}$ | 6 |
| ERJ6R ERJ6B (0805) ERJL06 | $2.00^{\pm0.20}$ | $1.25^{\pm0.10}$ | $0.40^{\pm0.20}$ | $0.40^{\pm0.20}$ | $0.60^{\pm0.10}$ | 4 |
| ERJ8BW (1206) | $3.20^{\pm0.20}$ | $1.60^{\pm0.20}$ | $1.00^{\pm0.20}$ | $1.00^{\pm0.20}$ | $0.65^{\pm0.10}$ | 13 |
| ERJ8CW (10 to 16 mΩ) | $3.20^{\pm0.20}$ | $1.60^{\pm0.20}$ | $1.10^{\pm0.20}$ | $1.10^{\pm0.20}$ | $0.65^{\pm0.10}$ | 13 |
| ERJ8CW (18 to 50 mΩ) | $3.20^{\pm0.20}$ | $1.60^{\pm0.20}$ | $0.60^{\pm0.20}$ | $0.60^{\pm0.20}$ | $0.65^{\pm0.10}$ | 13 |
| ERJ8R ERJ8B (1206) ERJL08 | $3.20^{+0.05}_{-0.20}$ | $1.60^{+0.05}_{-0.15}$ | $0.50^{\pm0.20}$ | $0.50^{\pm0.20}$ | $0.60^{\pm0.10}$ | 10 |
| ERJ14R ERJ14B (1210) ERJL14 | $3.20^{\pm0.20}$ | $2.50^{\pm0.20}$ | $0.50^{\pm0.20}$ | $0.50^{\pm0.20}$ | $0.60^{\pm0.10}$ | 16 |
| ERJ12R ERJL12 (1812) | $4.50^{\pm0.20}$ | $3.20^{\pm0.20}$ | $0.50^{\pm0.20}$ | $0.50^{\pm0.20}$ | $0.60^{\pm0.10}$ | 27 |
| ERJ12Z ERJL1D (2010) | $5.00^{\pm0.20}$ | $2.50^{\pm0.20}$ | $0.60^{\pm0.20}$ | $0.60^{\pm0.20}$ | $0.60^{\pm0.10}$ | 27 |
| ERJ1TR ERJL1W (2512) | $6.40^{\pm0.20}$ | $3.20^{\pm0.20}$ | $0.65^{\pm0.20}$ | $0.60^{\pm0.20}$ | $0.60^{\pm0.10}$ | 45 |
| | $6.40^{\pm0.20}$ | $3.20^{\pm0.20}$ | $0.65^{\pm0.20}$ | $1.30^{\pm0.20}$ | $1.10^{\pm0.10}$ | 79 |

# Current Sensing Resistors, Metal Plate Type

Type: **ERJ MS4, MS6**




## Features

- Ideal for current sensing solution
- Small case size with high power
- Metal plate bonding technology. Excellent long term stability
- Outer Resin with high heat dissipation. Wide temperature range (-65 °C to +170 °C)
- AEC-Q200 qualified
- RoHS compliant

## ■ As for Packaging Methods, Soldering Conditions and Safety Precautions,

Please see Data Files

## Explanation of Part Numbers

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| E | R | J | M | S | 4 | S | F | 2 | M | 0 | U |

| Product Code |
|---|
| Metal Plate Chip Resistors |

| Type Code | | |
|---|---|---|
| Code | Inch size | Electrode type |
| S4S | 2512 | Standard |
| S4H | 2512 | Narrow |
| S6S | 2526 | Standard |

| Resistance Tolerance | |
|---|---|
| Code | Tolerance |
| F | ±1 % |

| Resistance Value |
|---|
| Shown by 3 digits or letters.Decimal point is expressed by M as 2.0 mΩ=2M0, 0.5 mΩ=M50, 10.0 mΩ=10M |

| Packaging Methods | | |
|---|---|---|
| Code | Packaging | Part No. |
| U | Embossed Carrier Taping 4 mm pitch, 2,000 pcs. | ERJMS4 |
| | Embossed Carrier Taping 8 mm pitch, 1,000 pcs. | ERJMS6 |

## Ratings

| Part No. (inch size) | Power Rating at 70 °C (W) | Resistance Range (mΩ) | Resistance Tolerance (%) | T.C.R. ($\times 10^{-6}$/°C) | Category Temperature Range (°C) | Terminal temp. upper limit (°C) |
|---|---|---|---|---|---|---|
| ERJMS4S (2512) | 3 | 1, 2, 3, 4 | F : ±1 | ±75 | –65 to +170 | 130 |
| ERJMS4H (2512) | 3 | 5, 6 | F : ±1 | ±75 | –65 to +170 | 130 |
| | 2 | 7, 8, 9, 10 | F : ±1 | ±75 | –65 to +170 | 100 |
| ERJMS6S (2526) | 5 | 0.5, 1, 2 | F : ±1 | ±75 | –65 to +170 | 130 |

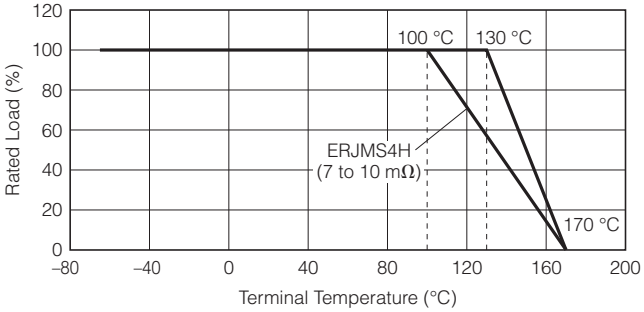
✻ Please contact us when resistors of irregular series are needed.

### Power Derating Curve

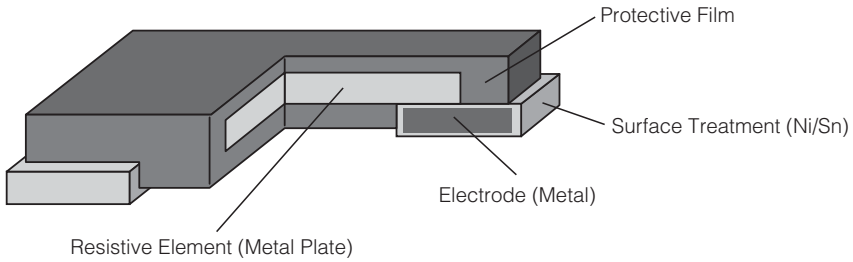
If the terminal temperature of the resistor is more than terminal temperature upper limit value of the rated table, please reduce the rated power according to the Power Derating Curve shown in the figure on the right.

<Supplemented>
In the case of the temperature measurement of the terminal portion of the resistor, Please perform under the following conditions.

1) Tarminal temperature measurement, please apply the temperature of the higher of either the left or right electrode upper surface of the resistor.
2) Please measure the temperature of the resistor in the land pattern printed of circuit board and plan to use by real conditions.

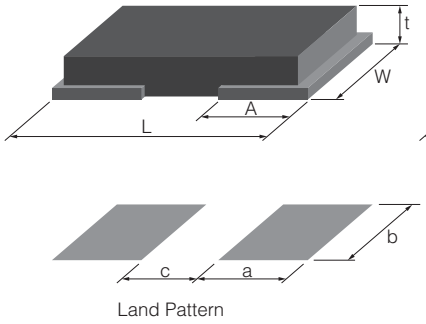


## Construction

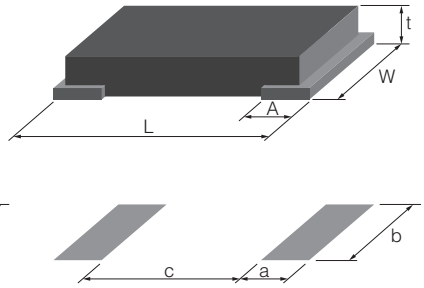



## Dimensions in mm (not to scale), Recommended Land Pattern

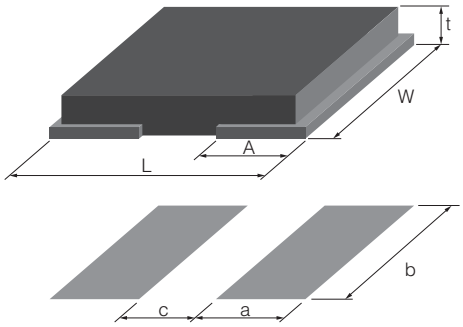
● ERJMS4S




● ERJMS4H

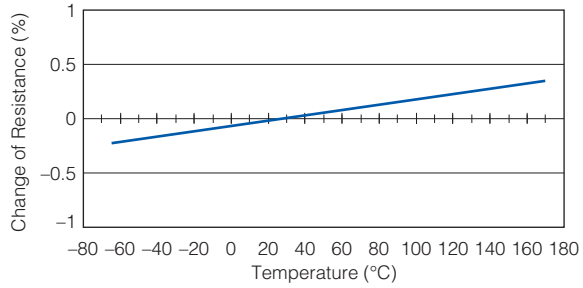



● ERJMS6S

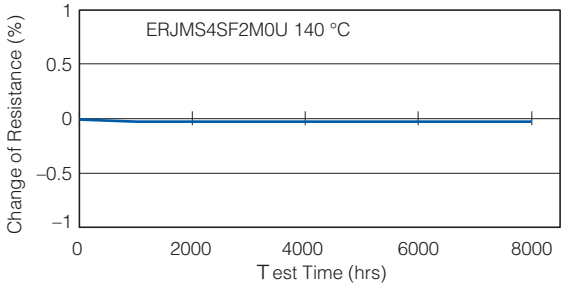



| Part No. (inch size) | Dimension (mm) | | | | Recommended Land Pattern (mm) | | | Mass (Weight) (g/1000 pcs.) |
|---|---|---|---|---|---|---|---|---|
| | L | W | A | t | a | b | c | |
| ERJMS4S (2512) | 6.40±0.25 | 3.20±0.25 | 2.20±0.25 | 1.20±0.15 | 2.7 | 3.4 | 2.0 | 120 |
| ERJMS4H (2512) | 6.40±0.25 | 3.20±0.25 | 1.25±0.25 | 1.20±0.15 | 1.7 | 3.4 | 4.0 | 115 |
| ERJMS6S (2526) | 6.40±0.25 | 6.80±0.25 | 2.20±0.25 | 1.20±0.15 | 2.7 | 7.0 | 2.0 | 260 |

## Typical Temperature dependence of electrical resistance

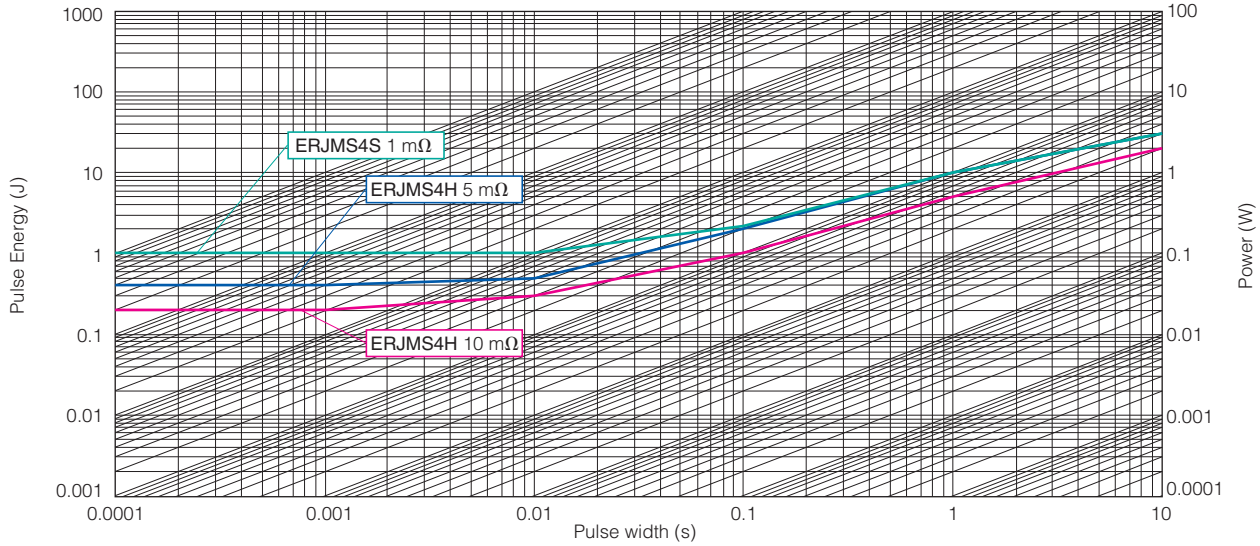



## Long-term stability



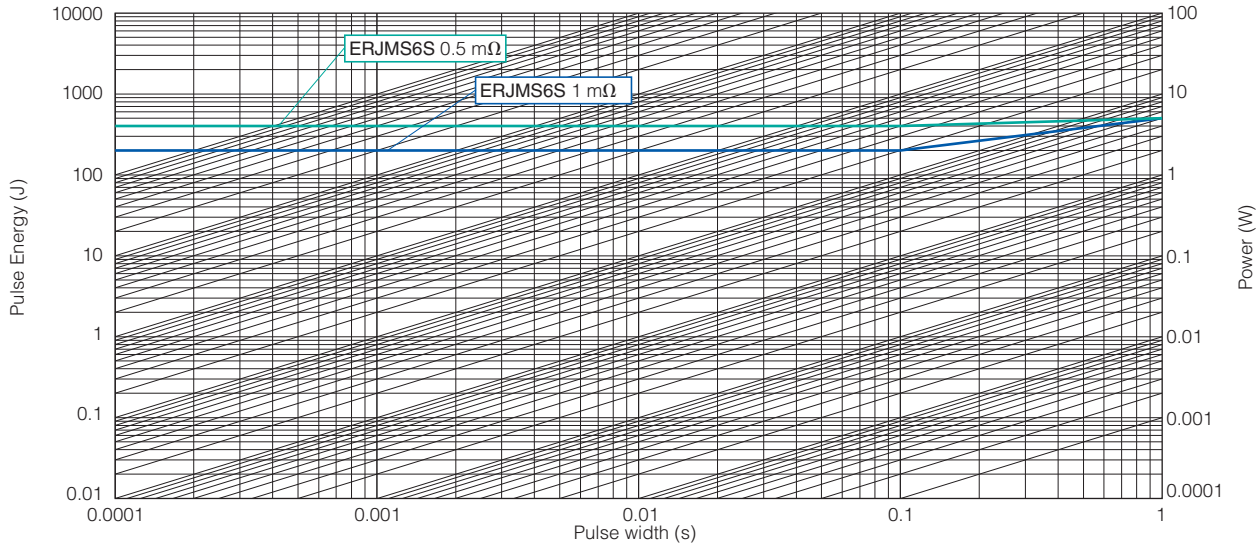

## Maximum pulse energy respectively pulse power for continuous operation

● ERJMS4 type




Referance Data
Condition : Room Temperature, OFF : 10 s, 1000 cycle, Wave form : Square
Change of Resistance=±1 %

● ERJMS6 type




Referance Data
Condition : Room Temperature, OFF : 10 s, 1000 cycle, Wave form : Square
Change of Resistance=±1 %

## Performance (AEC-Q200)

● ERJMS4 type

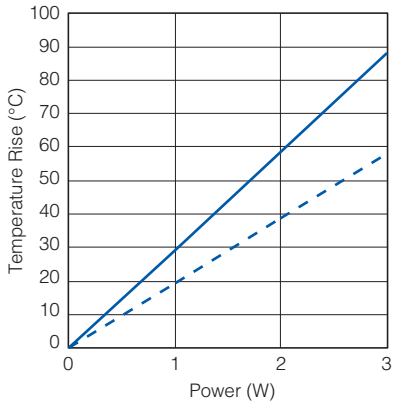
| Test Item | Test Condition | Specification | Typical value |
|---|---|---|---|
| Thermal Shock | MIL-STD-202 method 107 (-55 °C / +125 °C, 25 cycle) | ±0.5 % | 0.05 % |
| Overload | MIL-R-26E (5 x rated power, 5 sec) | ±0.5 % | 0.02 % |
| Solderability | MIL-STD-202 method 208 | > 95% coverage | > 95% coverage |
| Resistance to Solvents | MIL-STD-202 method 215, 2.1a, 2.1d | No damage | No damage |
| Low Temperature Storage and Operation | MIL-STD-26E (-65 °C, 24 h) | ±0.5 % | 0.03 % |
| Resistance to Soldering Heat | MIL-STD-202 method 210 (260 °C, 10s) | ±0.5 % | 0.10 % |
| Moisture Resistance | MIL-STD-202 method 106 | ±0.5 % | 0.20 % |
| Shock | MIL-STD-202 method 213-A | ±0.5 % | 0.10 % |
| Vibration, High Frequency | MIL-STD-202 method 204-B | ±0.5 % | 0.05 % |
| Life | MIL-STD-26E (Rated Power, 1.5 h-ON, 0.5 h-OFF, 2000 h) | ±1 % | 0.30 % |
| Storage Life at Elevated Temperature | MIL-STD-202 method 108-F (170 °C, 2000 h) | ±1 % | 0.30 % |
| High Temperature Characteristics | 140 °C, 2000 h | ±0.5 % | 0.05 % |
| Frequency Characteristics | Inductance | < 2 nH | < 2 nH |

● ERJMS6 type

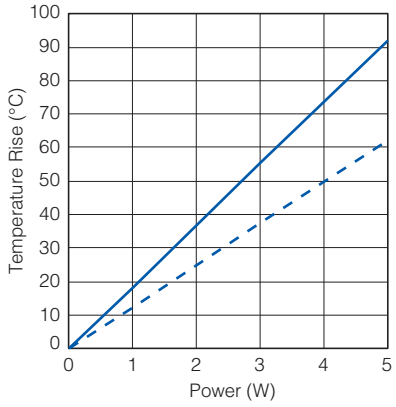
| Test Item | Test Condition | Specification | Typical value |
|---|---|---|---|
| Thermal Shock | MIL-STD-202 method 107 (-55 °C / +125 °C, 25 cycle) | ±0.5 % | 0.10 % |
| Overload | MIL-R-26E (5 x rated power, 5 sec) | ±0.5 % | 0.02 % |
| Solderability | MIL-STD-202 method 208 | > 95% coverage | > 95% coverage |
| Resistance to Solvents | MIL-STD-202 method 215, 2.1a, 2.1d | No damage | No damage |
| Low Temperature Storage and Operation | MIL-STD-26E (-65 °C, 24 h) | ±0.5 % | 0.03 % |
| Resistance to Soldering Heat | MIL-STD-202 method 210 (260 °C, 10s) | ±0.5 % | 0.10 % |
| Moisture Resistance | MIL-STD-202 method 106 | ±0.5 % | 0.10 % |
| Shock | MIL-STD-202 method 213-A | ±0.5 % | 0.10 % |
| Vibration, High Frequency | MIL-STD-202 method 204-B | ±0.5 % | 0.05 % |
| Life | MIL-STD-26E (Rated Power, 1.5 h-ON, 0.5 h-OFF, 2000 h) | ±1 % | 0.20 % |
| Storage Life at Elevated Temperature | MIL-STD-202 method 108-F (170 °C, 2000 h) | ±1 % | 0.30 % |
| High Temperature Characteristics | 140 °C, 2000 h | ±0.5 % | 0.05 % |
| Frequency Characteristics | Inductance | < 2 nH | < 2 nH |

## Temperature Rise

● ERJMS4HF5M0U

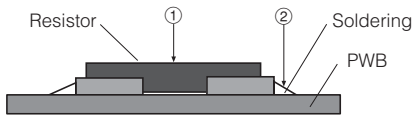



● ERJMS6SF2M0U

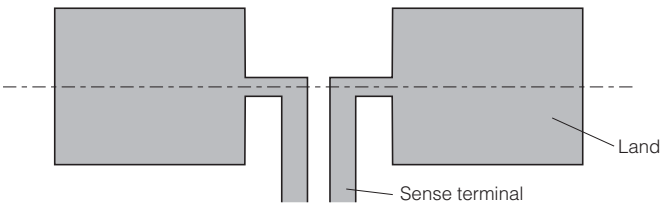




<Condition>
Base material : FR-4 (t1.6mm)
Copper Thickness : 70 µm, Two layer




## Sense terminal-Layout



# Current Sensing Resistors, Metal Plate Type

Type: **ERJM1W**


## Features

- Low resistance values and high precision (1 mΩ to 20 mΩ)
- Stable resistance not influenced by measurement position
- High heat emission
- Low profile, strong body
- Inductance less than 1.0 nH for the metal plate structure
- RoHS compliant

■ **As for Packaging Methods, Soldering Conditions and Safety Precautions,**
Please see Data Files

## Explanation of Part Numbers

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| E | R | J | M | 1 | W | S | F | 3 | M | 0 | U |

| Product Code |
|---|
| Thick Film Chip Resistors |

| Size, Power Rating | | |
|---|---|---|
| Code | Inch | Power R. |
| M1W | 2512 | 1 W |

| Code | Type |
|---|---|
| S | General type |
| T | Wide terminal type |

| Resistance Tolerance | |
|---|---|
| Code | Tolerance |
| F | ± 1 % |
| J | ± 5 % |

| Packaging Methods | |
|---|---|
| Code | Packaging |
| U | Embossed Carrier Taping 4 mm pitch, 3,000 pcs. |

| Resistance Value |
|---|
| Shown by 3 digits or letters. Decimal point is expressed by M as 3 mΩ=3M0, 10 mΩ=10M |

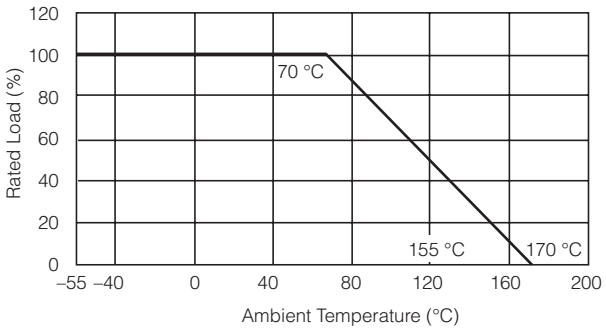
## Ratings

| Part No. (inch size) | Power Rating at 70 °C (W) | Standard Resistance (mΩ) | Resistance Tolerance (%) | T.C.R. ($\times 10^{-6}$/°C) | Category Temperature Range (°C) | Circuit board of use |
|---|---|---|---|---|---|---|
| ERJM1WS (2512) | 1 | 3, 4 | F: ±1, J: ±5 | ±350 | –55 to +170 | You should use the aluminum substrate when the added wattage exceeds 0.5 W. |
| | | 5, 6, 10, 15, 20 | | ±100 | | |
| ERJM1WT (2512) | | 1, 1.5 | | 350±100 | | |
| | | 2, 3, 4 | | 100±50 | | |

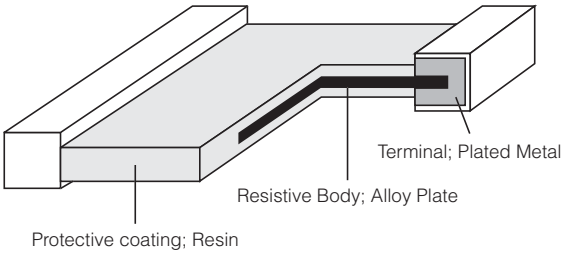
✻ Please contact the factory for other values and the range

### Power Derating Curve

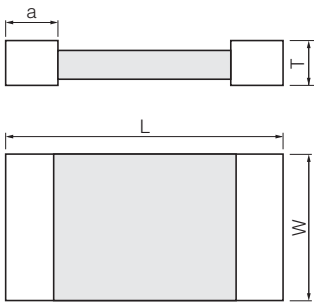
For resistors operated in ambient temperatures above 70 °C, power rating shall be derated in accordance with the figure on the right.



## Construction



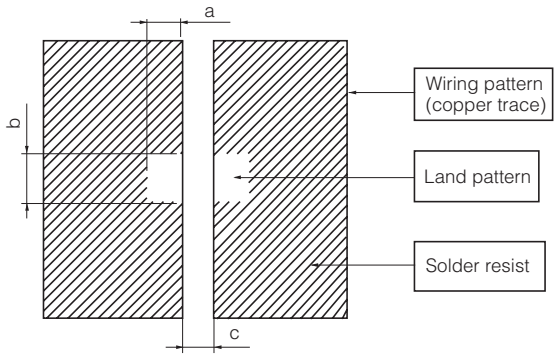

## Dimensions in mm (not to scale)




| Type | Part No. (inch size) | Dimensions (mm) | | | | |
|---|---|---|---|---|---|---|
| | | L | W | T | a | Mass (Weight) [g/1000 pcs.] |
| S Type | ERJM1WS (2512) | $6.40^{\pm0.25}$ | $3.20^{\pm0.25}$ | $0.80^{\pm0.30}$ | $1.00^{\pm0.25}$ | 70 |
| T Type | ERJM1WT (2512) | $6.40^{\pm0.40}$ | | | $2.10^{\pm0.30}$ | 90 |

## Recommended Land Pattern

● An example of a land pattern




| Part No. | Dimensions (mm) | | |
|---|---|---|---|
| | a | b | c |
| ERJM1WS | 2.1 | 3.4 | 4.2 |
| ERJM1WT | 3.1 | 3.4 | 2.2 |

# High Power Chip Resistors / Wide Terminal Type

## Type: ERJ A1, B1, B2, B3

## Features

- High solder-joint reliability by wide terminal construction
- Excellent heat dissipation characteristics by wide terminal construction
- AEC-Q200 qualified
- RoHS compliant

## Recommended Applications

- Automotive electronic circuits including ECUs (Electrical control unit), anti-lock breaking systems and air-bag systems
- Current sensing for power supply circuits in a variety of equipment

■ **As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions,** Please see Data Files

## Explanation of Part Numbers

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|
| E | R | J | A | 1 | A | J | 1 | 0 | 2 | U |

**Product Code**

| |
|---|
| Thick Film Chip Resistors |

**Size, Power Rating**

| Code | Inch | Power R. |
|---|---|---|
| A1 | 1225 | 1.33 W |
| B1 | 1020 | 1 W, (2 W R ≦ 10 Ω) |
| B2 | 0612 | 0.75 W, (1 W R ≦ 10 Ω) |
| B3 | 0508 | 0.33 W, (0.5 W R ≦ 1 Ω) |

**Resistance Value Region**

| | |
|---|---|
| A | 10 Ω ≦ R |
| B | 0.22 Ω ≦ R <10 Ω |
| C | 0.01 Ω ≦ R < 0.22 Ω |
| D | 0.005 Ω ≦ R < 0.01 Ω |

**Resistance Tolerance**

| | |
|---|---|
| F | ± 1 % |
| G | ± 2 % |
| J | ± 5 % |

**Resistance Value**

Shown by 3 digits or letters. Only when it is impossible, shown by 4 digits or letters.
(Ex.) 102 : 1.0 kΩ R01 : 0.01 Ω = 10 mΩ
4R7 : 4.7 Ω R015 : 0.015 Ω = 15 mΩ

**Packaging Methods**

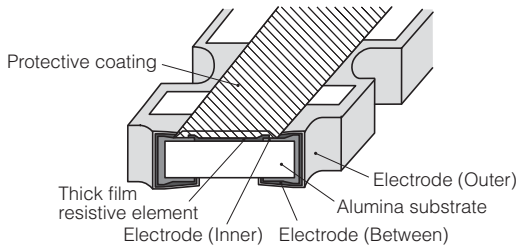
| Code | Packaging | Part No. |
|---|---|---|
| V | Punched Carrier Taping 4 mm pitch, 5,000 pcs. | ERJB2 ERJB3 |
| U | Embossed Carrier Taping 4 mm pitch, 5,000 pcs. | ERJB1 |
| | Embossed Carrier Taping 4 mm pitch, 4,000 pcs. | ERJA1 |

## Ratings

| Part No. (inch size) | Power Rating at 70 °C (W) | Limiting Element Voltage(1) (V) | Maximum Overload Voltage(2) (V) | Resistance Tolerance (%) | Resistance Range (Ω) | T.C.R. (×10⁻⁶/°C) | Category Temperature Range (°C) |
|---|---|---|---|---|---|---|---|
| ERJA1 (1225) | 1.33 | 200 | 400 | ±1 | 100 m to 10 k (E24) | R < 100 mΩ : ±350<br>100 mΩ ≦ R : ±100 (±1%)<br>±200 (±2%, ±5%) | –55 to +155 |
| | | | | ±2, ±5 | 10 m to 10 k (E24) | | |
| ERJB1 (1020) | 1<br>2(R ≦ 10 Ω) | 200 | 400 | ±1, ±2, ±5 | 10 m to 10 k (E24) | R < 22 mΩ : ±350<br>22 mΩ ≦ R < 47 mΩ : ±200<br>47 mΩ ≦ R < 100 mΩ : ±150 (±1%)<br>±200 (±2%, ±5%)<br>100 mΩ ≦ R : ±100 (±1%)<br>±200 (±2%, ±5%) | –55 to +155 |
| ERJB2 (0612) | 0.75<br>1(R ≦ 10 Ω) | 200 | 400 | ±1, ±2 | 10 m to 1 M (E24) | R < 22 mΩ : 0 to +300<br>22 mΩ ≦ R < 47 mΩ : 0 to +200<br>47 mΩ ≦ R < 100 mΩ : 0 to +150<br>100 mΩ ≦ R < 220 mΩ : 0 to +150 (±1%)<br>0 to +200 (±2%, ±5%)<br>220 mΩ ≦ R : ±100 (±1%)<br>±200 (±2%, ±5%) | –55 to +155 |
| | | | | ±5 | 5 m to 1 M (5 m to 9 m : 1mΩ step; 10 m to 1 M : E24) | | |
| ERJB3 (0508) | 0.33<br>0.5(R ≦ 1 Ω) | 150 | 200 | ±1, ±2, ±5 | 20 m to 10 (E24) | R < 47 mΩ : 0 to +300<br>47 mΩ ≦ R ≦ 1 Ω : 0 to +200<br>1 Ω < R : ±100 (±1%)<br>±200 (±2%, ±5%) | –55 to +155 |

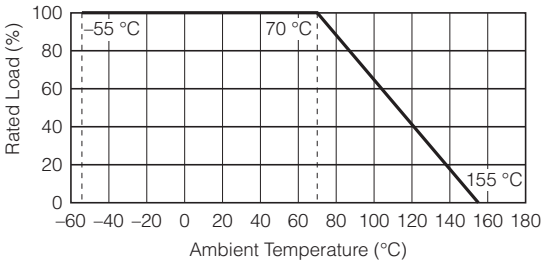
(1) Rated Continuous Working Voltage (RCWV) shall be determined from RCWV=$\sqrt{\text{Power Rating} \times \text{Resistance Values}}$, or Limiting Element Voltage listed above, whichever less.
(2) Overload (Short-time Overload) Test Voltage (SOTV) shall be determined from SOTV=2.5 × RCWV or max. Overload Voltage listed above whichever less.

## Construction (Example : ERJA1 type)



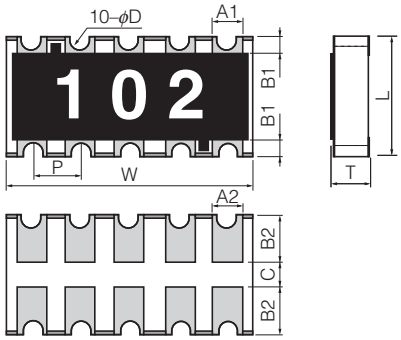

### Power Derating Curve

For resistors operated in ambient temperatures above 70 °C, power rating shall be derated in accordance with the figure below.




## Dimensions in mm (not to scale)

### ERJA1 type



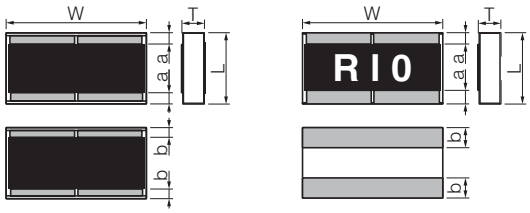

Mass (Weight) [1000 pcs.] : 40 g

| Dimensions (mm) | L | W | T | $A_1$ | $B_1$ |
|---|---|---|---|---|---|
| | 3.20±0.20 | 6.40±0.20 | 0.55±0.10 | 0.70±0.20 | 0.45±0.20 |

| Dimensions (mm) | $A_2$ | $B_2$ | P | φD | C |
|---|---|---|---|---|---|
| | 0.70±0.20 | 1.25±0.15 | 1.27±0.10 | $0.30^{+0.10}_{-0.20}$ | 0.4 min. |

### ERJB2 type

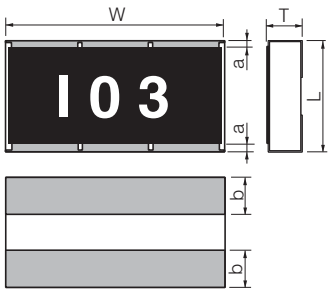
( R< 10 mΩ ) ( 10 mΩ ≦ R ≦ 1 MΩ )




Mass (Weight) [1000 pcs.] : 11 g

| Dimensions (mm) | L | W | T | a | b |
|---|---|---|---|---|---|
| 5 mΩ≦R<10 mΩ | 1.60±0.15 | 3.20±0.20 | 0.65±0.15 | 0.30±0.20 | 0.30±0.20 |
| 10 mΩ≦R<220 mΩ | | | 0.55±0.15 | | 0.50±0.20 |
| 220 mΩ≦R≦1 MΩ | | | | 0.25±0.20 | |

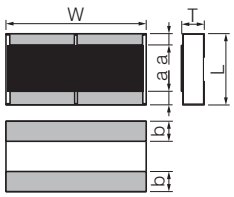
### ERJB1 type




Mass (Weight) [1000 pcs.] : 27 g

| Dimensions (mm) | L | W | T | a | b |
|---|---|---|---|---|---|
| | 2.50±0.20 | 5.00±0.20 | 0.55±0.20 | 0.25±0.20 | 0.90±0.20 |

### ERJB3 type

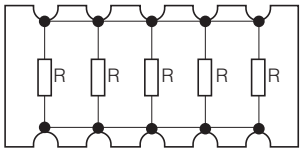



Mass (Weight) [1000 pcs.] : 4.8 g

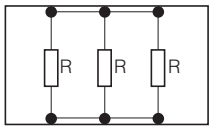
| Dimensions (mm) | L | W | T | a | b |
|---|---|---|---|---|---|
| | 1.25±0.10 | 2.00±0.15 | 0.50±0.10 | 0.25±0.20 | 0.40±0.20 |

## Circuit Configuration

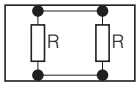
ERJA1 type




ERJB1 type

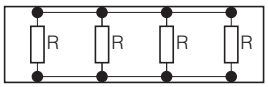



ERJB3 type

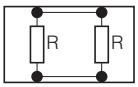



ERJB2 type

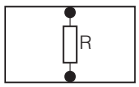
< Less than 10 mΩ >




< Low resistance zone >




< High resistance zone >



# Anti-Surge Thick Film Chip Resistors

## Type: ERJ P03, PA3, P06, P08, P14

## Features

- ESD surge characteristics superior to standard metal film resistors
- High reliability
  Metal glaze thick film resistive element and three layers of electrodes
- Suitable for both reflow and flow soldering
- High power ···0.20 W : 0603 inch / 1608 mm size (ERJP03)
  0.25 W : 0603 inch / 1608 mm size (ERJPA3)
  0.50 W : 0805 inch / 2012 mm size (ERJP06), 1210 inch / 3225 mm size (ERJP14)
  0.66 W : 1206 inch / 3216 mm size (ERJP08)
- Reference Standards··· IEC 60115-8, JIS C 5201-8, EIAJ RC-2134B
- AEC-Q200 qualified
- RoHS compliant

■ **As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions,**
Please see Data Files

## Explanation of Part Numbers

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| E | R | J | P | 0 | 6 | D | 1 | 0 | 0 | 2 | V |

**Product Code**

| Thick Film Chip Resistors |
|---|

**Size, Power Rating**

| Code | Inch | Power R. |
|---|---|---|
| P03 | 0603 | 0.20 W |
| PA3 | 0603 | 0.25 W |
| P06 | 0805 | 0.50 W |
| P08 | 1206 | 0.66 W |
| P14 | 1210 | 0.50 W |

**Resistance Tolerance**

| Code | Tolerance |
|---|---|
| D | ± 0.5 % |
| F | ± 1 % |
| J | ± 5 % |

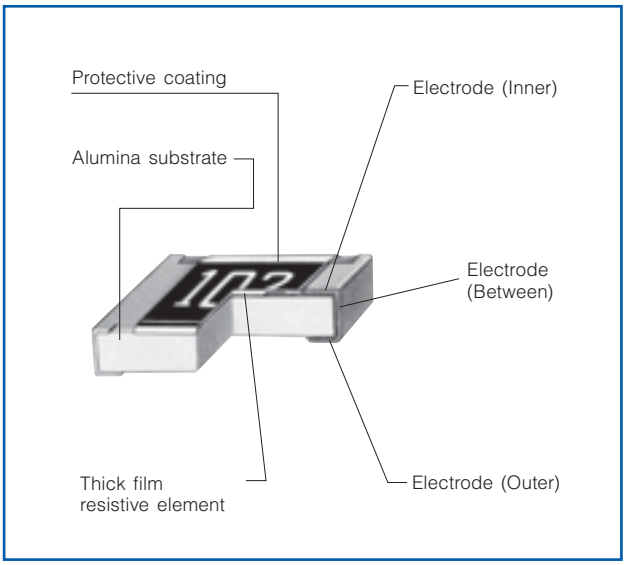
**Resistance Value**

The first two or three digits are significant figures of resistance and the third or 4th one denotes number of zeros following.
Three digit type (±5%),
four digit type (±1%, ±0.5%)
Example: 222→2.2 kΩ, 1002→10 kΩ

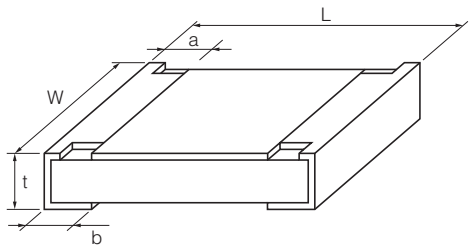
**Packaging Methods**

| Code | Packaging | Part No. |
|---|---|---|
| V | Punched Carrier Taping 4 mm pitch, 5,000 pcs. | ERJP03<br>ERJPA3<br>ERJP06<br>ERJP08 |
| U | Embossed Carrier Taping 4 mm pitch, 5,000 pcs. | ERJP14 |

## Construction




## Dimensions in mm (not to scale)




| Part No. (inch size) | Dimensions (mm) L | W | a | b | t | Mass (Weight) [g/1000 pcs.] |
|---|---|---|---|---|---|---|
| ERJP03 (0603) | $1.60^{\pm0.15}$ | $0.80^{\pm0.15}_{\pm0.05}$ | $0.15^{\pm0.15}_{\pm0.10}$ | $0.30^{\pm0.15}$ | $0.45^{\pm0.10}$ | 2 |
| ERJPA3 (0603) | $1.60^{\pm0.15}$ | $0.80^{\pm0.15}_{\pm0.05}$ | $0.15^{\pm0.15}_{\pm0.10}$ | $0.25^{\pm0.10}$ | $0.45^{\pm0.10}$ | 2 |
| ERJP06 (0805) | $2.00^{\pm0.20}$ | $1.25^{\pm0.10}$ | $0.25^{\pm0.20}$ | $0.40^{\pm0.20}$ | $0.60^{\pm0.10}$ | 4 |
| ERJP08 (1206) | $3.20^{+0.05}_{-0.20}$ | $1.60^{+0.05}_{-0.15}$ | $0.40^{\pm0.20}$ | $0.50^{\pm0.20}$ | $0.60^{\pm0.10}$ | 10 |
| ERJP14 (1210) | $3.20^{\pm0.20}$ | $2.50^{\pm0.20}$ | $0.35^{\pm0.20}$ | $0.50^{\pm0.20}$ | $0.60^{\pm0.10}$ | 16 |

## Ratings

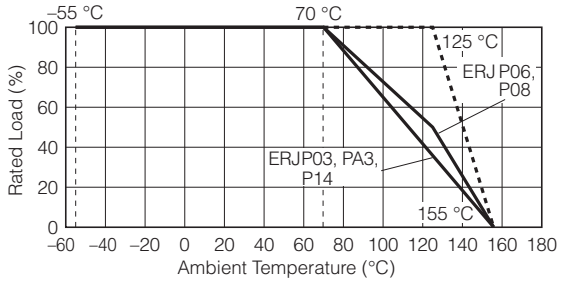
| Part No. (inch size) | Power Rating[3] at 70 °C (W) | Limiting Element Voltage[1] (V) | Maximum Overload Voltage[2] (V) | Resistance Tolerance (%) | Resistance Range (Ω) | T.C.R. (×10$^{-6}$/°C) | Category Temperature Range (°C) |
|---|---|---|---|---|---|---|---|
| ERJP03 (0603) | 0.20 | 150 | 200 | ±0.5 | 10 to1M (E24, E96) | ±150 | –55 to +155 |
| | | | | ±1 | 10 to1M (E24, E96) | ±200 | |
| | | | | ±5 | 1 to1M (E24) | R < 10 Ω: –150 to +400<br>10 Ω ≦ R : ±200 | |
| ERJPA3 (0603) | 0.25 | 150 | 200 | ±0.5, ±1 | 10 to1M (E24, E96) | ±100 | –55 to +155 |
| | | | | ±5 | 1 to1.5M (E24) | ±200 | |
| ERJP06 (0805) | 0.50 | 400 | 600 | ±0.5, ±1 | 10 to1M (E24, E96) | R < 33 Ω : ±300<br>33 Ω ≦ R : ±100 | –55 to +155 |
| | | | | ±5 | 1 to 3.3M (E24) | R < 10 Ω : –100 to +600<br>10 Ω ≦ R < 33 Ω : ±300<br>33 Ω ≦ R : ±200 | |
| ERJP08 (1206) | 0.66 | 500 | 1000 | ±0.5, ±1 | 10 to1M (E24, E96) | ±100 | –55 to +155 |
| | | | | ±5 | 1 to10M (E24) | R < 10 Ω : –100 to +600<br>10 Ω ≦ R : ±200 | |
| ERJP14 (1210) | 0.50 | 200 | 400 | ±0.5, ±1 | 10 to1M (E24, E96) | ±100 | –55 to +155 |
| | | | | ±5 | 1 to1M (E24) | R < 10 Ω : –100 to +600<br>10 Ω ≦ R : ±200 | |

(1) Rated Continuous Working Voltage (RCWV) shall be determined from RCWV=$\sqrt{\text{Power Rating} \times \text{Resistance Values}}$, or Limiting Element Voltage listed above, whichever less.
(2) Overload (Short-time Overload) Test Voltage (SOTV) shall be determined from SOTV=2.5 × RCWV or max. Overload Voltage listed above whichever less.
(3) Use it on the condition that the case temperature is below 155 °C.

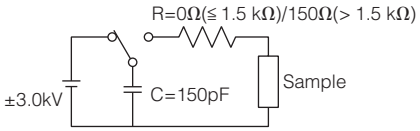
### Power Derating Curve

For resistors operated in ambient temperatures above 70 °C, power rating shall be derated in accordance with the figure on the right.

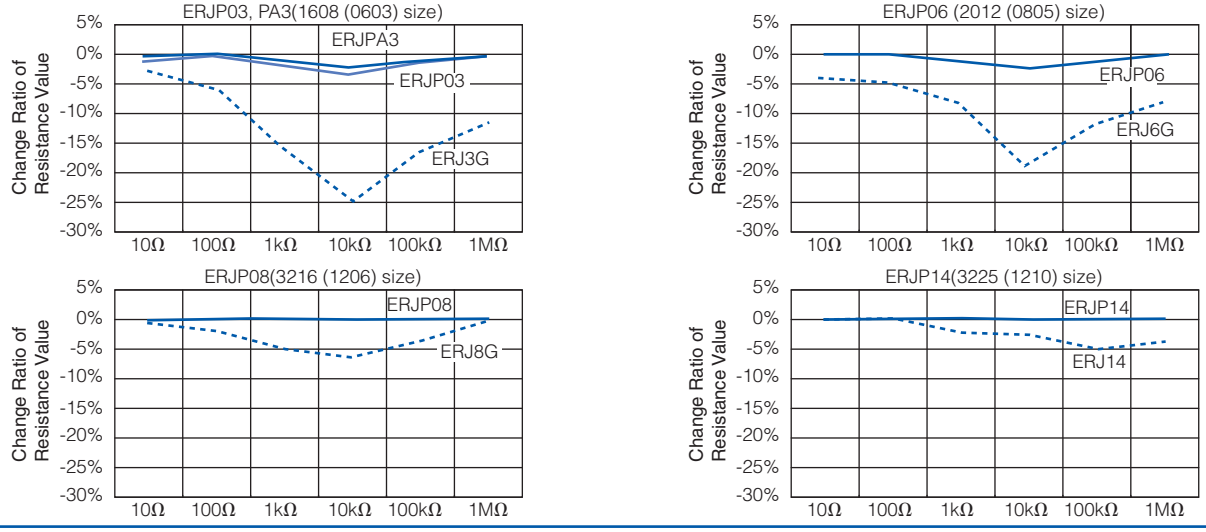
✻ When the temperature of ERJP14 is 155 °C or less, the derating start temperature can be changed to 125 °C. (See the dotted line)




## ESD Characteristic




Anti-Surge Thick Film Chip Resistors(ERJP Type)
Thick Film Chip Resistors(ERJ Type)



# Anti-Pulse
# Thick Film Chip Resistors

## Type: ERJ T06, T08, T14

## Features

- Anti-Pulse characteristics
  High pulse characteristics achieved by the optimized trimming specifications
- High reliability
  Metal glaze thick film resistive element and three layers of electrodes
- Suitable for both reflow and flow soldering
- High power ··· 0.25W : 0805 inch / 2012 mm size (ERJT06)
  0.33W : 1206 inch / 3216 mm size (ERJT08)
  0.50W : 1210 inch / 3225 mm size (ERJT14)
- Reference Standards···IEC 60115-8, JIS C 5201-8, EIAJ RC-2134B
- AEC-Q200 qualified
- RoHS compliant

■ **As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions,**
Please see Data Files

## Explanation of Part Numbers

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|
| E | R | J | T | 0 | 6 | J | 1 | 0 | 0 | V |

| Product Code |
|---|
| Thick Film Chip Resistors |

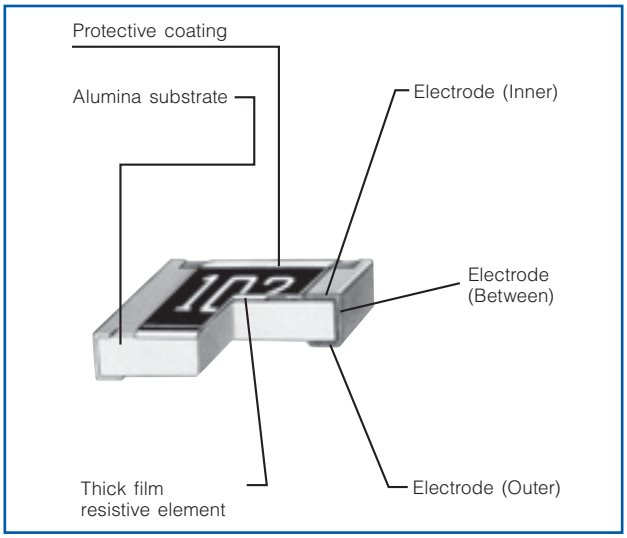
| Size, Power Rating | | |
|---|---|---|
| Code | Inch | Power R. |
| T06 | 0805 | 0.25 W |
| T08 | 1206 | 0.33 W |
| T14 | 1210 | 0.5 W |

| Resistance Tolerance | |
|---|---|
| Code | Tolerance |
| J | ± 5 % |

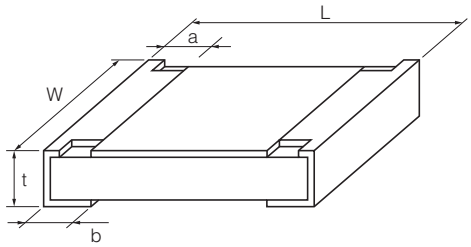
| Packaging Methods | | |
|---|---|---|
| Code | Packaging | Part No. |
| V | Punched Carrier Taping 4 mm pitch, 5,000 pcs. | ERJT06 ERJT08 |
| U | Embossed Carrier Taping 4 mm pitch, 5,000 pcs. | ERJT14 |

| Resistance Value |
|---|
| The first two digits are significant figures of resistance and the third one denotes number of zeros following. Example: 222→2.2 kΩ |

## Construction




## Dimensions in mm (not to scale)




| Part No. (inch size) | Dimensions (mm) | | | | | Mass (Weight) [g/1000 pcs.] |
|---|---|---|---|---|---|---|
| | L | W | a | b | t | |
| ERJT06 (0805) | $2.00^{\pm0.20}$ | $1.25^{\pm0.10}$ | $0.25^{\pm0.20}$ | $0.40^{\pm0.20}$ | $0.60^{\pm0.10}$ | 4 |
| ERJT08 (1206) | $3.20^{+0.05}_{-0.20}$ | $1.60^{+0.05}_{-0.15}$ | $0.40^{\pm0.20}$ | $0.50^{\pm0.20}$ | $0.60^{\pm0.10}$ | 10 |
| ERJT14 (1210) | $3.20^{\pm0.20}$ | $2.50^{\pm0.20}$ | $0.35^{\pm0.20}$ | $0.50^{\pm0.20}$ | $0.60^{\pm0.10}$ | 16 |

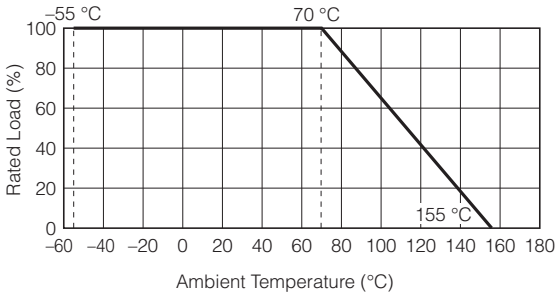
## Ratings

| Part No. (inch size) | Power Rating at 70 °C (W) | Limiting Element Voltage(1) (V) | Maximum Overload Voltage(2) (V) | Resistance Tolerance (%) | Resistance Range (Ω) | T.C.R. ($\times 10^{-6}$/°C) | Category Temperature Range (°C) |
|---|---|---|---|---|---|---|---|
| ERJT06 (0805) | 0.25 | 150 | 200 | ±5 | 1 to 1 M (E24) | Less than 10 Ω : -100 to +600<br>Less than 33 Ω : ±300<br>More than 33 Ω : ±200 | –55 to +155 |
| ERJT08 (1206) | 0.33 | 200 | 400 | ±5 | 1 to 1 M (E24) | Less than 10 Ω : -100 to +600<br>More than 10 Ω : ±200 | –55 to +155 |
| ERJT14 (1210) | 0.50 | 200 | 400 | ±5 | 1 to 1 M (E24) | Less than 10 Ω : -100 to +600<br>More than 10 Ω : ±200 | –55 to +155 |

(1) Rated Continuous Working Voltage (RCWV) shall be determined from RCWV=$\sqrt{\text{Power Rating} \times \text{Resistance Values}}$, or Limiting Element Voltage listed above, whichever less.
(2) Overload (Short-time Overload) Test Voltage (SOTV) shall be determined from SOTV=2.5 × RCWV or max. Overload Voltage listed above whichever less.

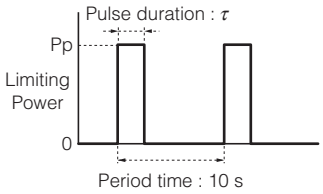
### Power Derating Curve

For resistors operated in ambient temperatures above 70 °C, power rating shall be derated in accordance with the figure on the right.




## Limiting Power Curve

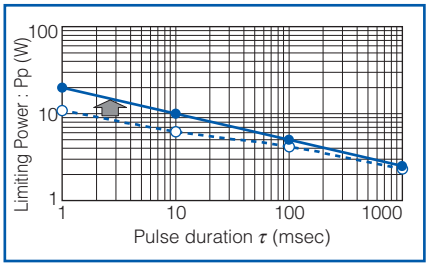
● In rush pulse Characteristic



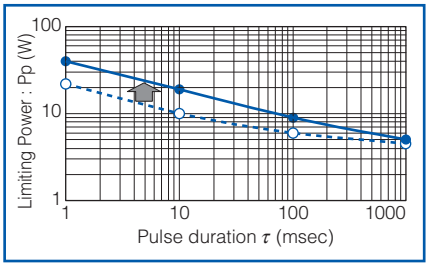

Test cycle : 1000 cycles
Spec : Resistance value = within ±5%

● : Anti-Pulse Thick Film Chip Resistors (ERJT Type)
○ : Thick Film Chip Resistors (ERJ Type)

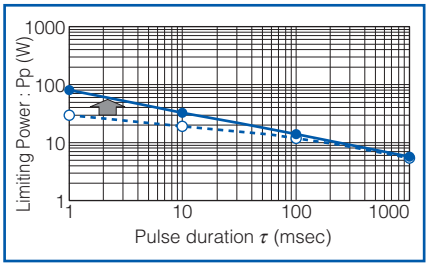
● **ERJT06** (0805 inch/2012 mm size)




● **ERJT08** (1206 inch/3216 mm size)




● **ERJT14** (1210 inch/3225 mm size)



# Anti-Sulfurated Thick Film Chip Resistors


Type: **ERJ S02, S03, S06, S08, S14, S12, S1D, S1T (Au-based inner electrode type)**

Type: **ERJ U01, U02, U03, U06, U08, U14, U12, U1D, U1T, U6S, U6Q (Ag-Pd-based inner electrode type)**

## Features

- High resistance to sulfurization achieved by adopting an Au-based inner electrode (ERJS type) and Ag-Pd-based inner electrode (ERJU type)
- High reliability
  Metal glaze thick film resistive element and three layers of electrodes
- Suitable for both reflow and flow soldering
- Low Resistance type···ERJU6S, U6Q : 0.1 Ω to 1.0 Ω
- Reference Standard···IEC 60115-8, JIS C 5201-8, EIAJ RC-2134B
- AEC-Q200 qualified (Exemption ERJU01)
- RoHS compliant

■ **As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions,** Please see Data Files

## Explanation of Part Numbers

- ERJS0, S1, U0, U1 Type

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| E | R | J | S | 0 | 6 | F | 1 | 0 | 0 | 2 | V |

**Product Code**

| Thick Film Chip Resistors |
|---|

**Size, Power Rating**

| Code | Inch | Power R. | Code | Inch | Power R. |
|---|---|---|---|---|---|
| U01 | 0201 | 0.05 W | S14<br>U14 | 1210 | 0.5 W |
| S02<br>U02 | 0402 | 0.1 W | S12<br>U12 | 1812 | 0.75 W |
| S03<br>U03 | 0603 | 0.1 W | S1D<br>U1D | 2010 | 0.75 W |
| S06<br>U06 | 0805 | 0.125 W | S1T<br>U1T | 2512 | 1 W |
| S08<br>U08 | 1206 | 0.25 W | | | |

**Resistance Tolerance**

| Code | Tolerance |
|---|---|
| F | ± 1 % |
| J | ± 5 % |
| 0 | Jumper |

**Resistance Value**

The first two or three digits are significant figures of resistance and the third or 4th one denotes number of zeros following. Jumper is expressed by R00.
Three digit type (±5%), four digit type (±1%)
Example: 222→2.2 kΩ, 1002→10 kΩ

**Packaging Methods**

| Code | Packaging | Part No. |
|---|---|---|
| C | Pressed Carrier Taping<br>2 mm pitch, 15,000 pcs. | ERJU01 |
| X | Punched Carrier Taping<br>2 mm pitch, 10,000 pcs. | ERJS02, ERJU02 |
| V | Punched Carrier Taping<br>4 mm pitch, 5,000 pcs. | ERJS03, ERJU03<br>ERJS06, ERJU06<br>ERJS08, ERJU08 |
| U | Embossed Carrier Taping<br>4 mm pitch, 5,000 pcs. | ERJS14, ERJU14<br>ERJS12, ERJU12<br>ERJS1D, ERJU1D |
| | Embossed Carrier Taping<br>4 mm pitch, 4,000 pcs. | ERJS1T, ERJU1T |

- ERJU6S, U6Q Type

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|
| E | R | J | U | 6 | S | J | R | 2 | 0 | V |

**Product Code**

| Thick Film Chip Resistors |
|---|

**Size, Power Rating**

| Code | Inch | Power R. |
|---|---|---|
| U6 | 0805 | 0.25 W |

**Resistance Value**

| Code | Res. Value |
|---|---|
| S | 0.1 Ω to 0.2 Ω |
| Q | 0.22 Ω to 1 Ω |

**Resistance Tolerance**

| Code | Tolerance |
|---|---|
| F | ±1 % |
| G | ±2 % |
| J | ±5 % |

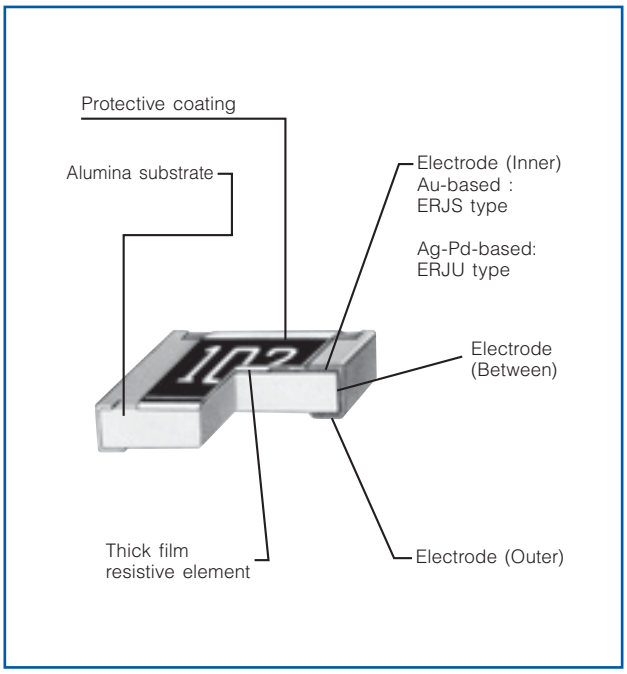
**Resistance Value**

Shown by 3 digits or letters.
(Example)
R20 : 0.20 Ω=200 mΩ
1R0 : 1.00 Ω=1000 mΩ

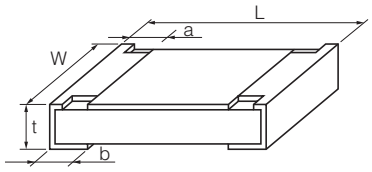
**Packaging Methods**

| Code | Packaging | Part No. |
|---|---|---|
| V | Punched Carrier Taping<br>4 mm pitch, 5,000 pcs. | ERJU6S<br>ERJU6Q |

## Construction




## Dimensions in mm (not to scale)




| Part No. (inch size) | Dimensions (mm) | | | | | Mass (Weight) [g/1000 pcs.] |
|---|---|---|---|---|---|---|
| | L | W | a | b | t | |
| ERJU01 (0201) | $0.60^{\pm0.03}$ | $0.30^{\pm0.03}$ | $0.10^{\pm0.05}$ | $0.15^{\pm0.05}$ | $0.23^{\pm0.03}$ | 0.15 |
| ERJS02 ERJU02 (0402) | $1.00^{\pm0.05}$ | $0.50^{\pm0.05}$ | $0.20^{\pm0.10}$ | $0.25^{\pm0.10}$ | $0.35^{\pm0.05}$ | 0.8 |
| ERJS03 ERJU03 (0603) | $1.60^{\pm0.15}$ | $0.80^{+0.15}_{-0.05}$ | $0.30^{\pm0.20}$ | $0.30^{\pm0.15}$ | $0.45^{\pm0.10}$ | 2 |
| ERJS06 ERJU06 (0805) | $2.00^{\pm0.20}$ | $1.25^{\pm0.10}$ | $0.40^{\pm0.20}$ | $0.40^{\pm0.20}$ | $0.60^{\pm0.10}$ | 4 |
| ERJU6□ (0805) | $2.00^{\pm0.20}$ | $1.25^{\pm0.10}$ | $0.45^{\pm0.20}$ | $0.45^{\pm0.20}$ | $0.55^{\pm0.10}$ | 6 |
| ERJS08 ERJU08 (1206) | $3.20^{+0.05}_{-0.20}$ | $1.60^{+0.05}_{-0.15}$ | $0.50^{\pm0.20}$ | $0.50^{\pm0.20}$ | $0.60^{\pm0.10}$ | 10 |
| ERJS14 ERJU14 (1210) | $3.20^{\pm0.20}$ | $2.50^{\pm0.20}$ | $0.50^{\pm0.20}$ | $0.50^{\pm0.20}$ | $0.60^{\pm0.10}$ | 16 |
| ERJS12 ERJU12 (1812) | $4.50^{\pm0.20}$ | $3.20^{\pm0.20}$ | $0.50^{\pm0.20}$ | $0.50^{\pm0.20}$ | $0.60^{\pm0.10}$ | 27 |
| ERJS1D ERJU1D (2010) | $5.00^{\pm0.20}$ | $2.50^{\pm0.20}$ | $0.60^{\pm0.20}$ | $0.60^{\pm0.20}$ | $0.60^{\pm0.10}$ | 27 |
| ERJS1T ERJU1T (2512) | $6.40^{\pm0.20}$ | $3.20^{\pm0.20}$ | $0.65^{\pm0.20}$ | $0.60^{\pm0.20}$ | $0.60^{\pm0.10}$ | 45 |

## Ratings

| Part No. (inch size) | PowerRating at 70 °C (W) | Limiting Element Voltage(1) (V) | Maximum Overload Voltage(2) (V) | Resistance Tolerance (%) | Resistance Range (Ω) | T.C.R. (×10$^{-6}$/°C ) | Category Temperature Range (°C) |
|---|---|---|---|---|---|---|---|
| ERJU01 (0201) | 0.05 | 25 | 50 | ±1 | 10 to 1 M (E24, E96) | <10 Ω: –100 to +600<br>10 Ω to 1 MΩ: ±200(±5%) ±100(±1%)*<br>*ERJU01, ERJS02, ERJU02 : ±200<br>1 MΩ<: –400 to +150 | -55 to +125 |
| | | | | ±5 | 1 to 1 M (E24) | | |
| ERJS02 ERJU02 (0402) | 0.1 | 50 | 100 | ±1 | 10 to 1 M (E24, E96) | | -55 to +155 |
| | | | | ±5 | 1 to 3.3 M (E24) | | |
| ERJS03 ERJU03 (0603) | 0.1 | 75 | 150 | ±1 | 10 to 1 M (E24, E96) | | -55 to +155 |
| | | | | ±5 | 1 to 10 M (E24) | | |
| ERJS06 ERJU06 (0805) | 0.125 | 150 | 200 | ±1 | 10 to 1 M (E24, E96) | | -55 to +155 |
| | | | | ±5 | 1 to 10 M (E24) | | |
| ERJS08 ERJU08 (1206) | 0.25 | 200 | 400 | ±1 | 10 to 1 M (E24, E96) | | -55 to +155 |
| | | | | ±5 | 1 to 10 M (E24) | | |
| ERJS14 ERJU14 (1210) | 0.5 | 200 | 400 | ±1 | 10 to 1 M (E24, E96) | | -55 to +155 |
| | | | | ±5 | 1 to 10 M (E24) | | |
| ERJS12 ERJU12 (1812) | 0.75 | 200 | 500 | ±1 | 10 to 1 M (E24, E96) | | -55 to +155 |
| | | | | ±5 | 1 to 10 M (E24) | | |
| ERJS1D ERJU1D (2010) | 0.75 | 200 | 500 | ±1 | 10 to 1 M (E24, E96) | | -55 to +155 |
| | | | | ±5 | 1 to 10 M (E24) | | |
| ERJS1T ERJU1T (2512) | 1.0 | 200 | 500 | ±1 | 10 to 1 M (E24, E96) | | -55 to +155 |
| | | | | ±5 | 1 to 10 M (E24) | | |

(1) Rated Continuous Working Voltage (RCWV) shall be determined from RCWV=$\sqrt{\text{Power Rating} \times \text{Resistance Values}}$, or Limiting Element Voltage listed above, whichever less.
(2) Overload (Short-time Overload) Test Voltage (SOTV) shall be determined from SOTV=2.5 × RCWV or max. Overload Voltage listed above whichever less.

### [Low Resistance type]

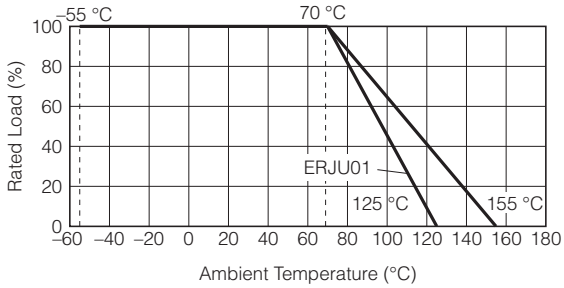
| Part No. (inch size) | PowerRating at 70 °C (W) | Resistance Tolerance (%) | Resistance Range (Ω) | T.C.R. (×10$^{-6}$/°C ) | Category Temperature Range (°C) |
|---|---|---|---|---|---|
| ERJU6S (0805) | 0.25 | ±1, ±2, ±5 | 0.1 to 0.2 (E24) | ±150 | -55 to +155 |
| ERJU6Q (0805) | | | 0.22 to 1 (E24) | | |

[For Jumper]

| Part No. (inch size) | Rated Current (A) | Maximum Overload Current (A) |
|---|---|---|
| ERJU01 (0201) | 0.5 | 1 |
| ERJS02 ERJU02 (0402) | 1 | 2 |
| ERJS03 ERJU03 (0603) | | |
| ERJS06 ERJU06 (0805) | 2 | 4 |
| ERJS08 ERJU08 (1206) | | |
| ERJS14 ERJU14 (1210) | | |
| ERJS12 ERJU12 (1812) | | |
| ERJS1D ERJU1D (2012) | | |
| ERJS1T ERJU1T (2512) | | |

## Power Derating Curve

For resistors operated in ambient temperatures above 70 °C, power rating shall be derated in accordance with the figure below.



# Anti-Sulfurated High Power Chip Resistors / Wide Terminal Type


Type: **ERJ C1**

## Features

- High resistance to sulfurization achieved by adopting Anti-Sulfurated electrode structure and material
- High solder-joint reliability by wide terminal construction
- Excellent heat dissipation characteristics by wide terminal construction
- AEC-Q200 qualified
- RoHS compliant

## Recommended Applications

- Motor control circuit of the industrial equipment
- Automotive electronic circuits including ECUs (Electrical control unit), anti-lock breaking systems and air-bag systems
- Current sensing for power supply circuits in a variety of equipment

■ **As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions,** Please see Data Files

## Explanation of Part Numbers

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|
| E | R | J | C | 1 | C | F | R | 1 | 0 | U |

**Product Code**

| Thick Film Chip Resistors |
|---|

**Size, Power Rating**

| Code | Inch | Power R. |
|---|---|---|
| C1 | 1020 | 2 W |

**Resistance Value Region**

| | |
|---|---|
| B | 220 mΩ ≦ R ≦ 1 Ω |
| C | 10 mΩ ≦ R < 220 mΩ |

**Resistance Tolerance**

| | |
|---|---|
| F | ± 1 % |
| J | ± 5 % |

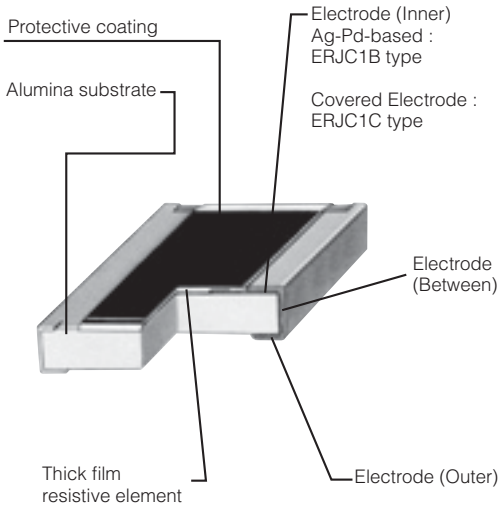
**Packaging Methods**

| Code | Packaging | Part No. |
|---|---|---|
| U | Embossed Carrier Taping 4 mm pitch, 5,000 pcs. | ERJC1 |

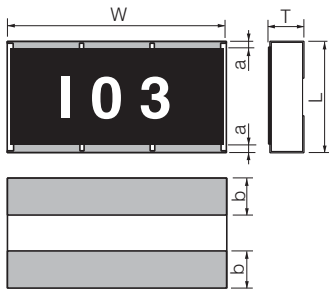
**Resistance Value**

Shown by 3 digits or letters. Only when it is impossible, shown by 4 digits or letters.
(ex.) R01 : 0.01 Ω = 10 mΩ R015 : 0.015 Ω = 15 mΩ

## Construction



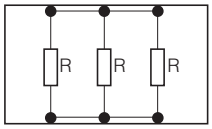

## Dimensions in mm (not to scale)




| Part No. (inch size) | Dimensions (mm) | | | | | Mass (Weight) [g/1000 pcs.] |
|---|---|---|---|---|---|---|
| | L | W | T | a | b | |
| ERJC1B (1020) | 2.50±0.20 | 5.00±0.20 | 0.55±0.20 | 0.35±0.20 | 0.90±0.20 | 27 |
| ERJC1C (1020) | | | | 0.60±0.20 | | |

## Circuit Configuration

Type ERJC1



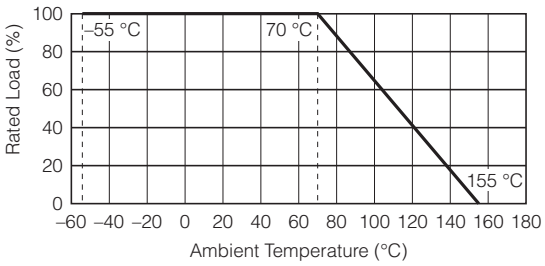

## Ratings

| Part No. (inch size) | Power Rating at 70 °C (1) (W) | Resistance Tolerance (%) | Resistance Range (Ω) | T.C.R. (×10$^{-6}$/°C ) | Category Temperature Range (°C) |
|---|---|---|---|---|---|
| ERJC1 (1020) | 2 | ±1 | 10 m to 1 (E24) | 10 mΩ ≦ R < 22 mΩ : ±350<br>22 mΩ ≦ R < 47 mΩ : ±200<br>47 mΩ ≦ R < 100 mΩ : ±150<br>100 mΩ ≦ R ≦ 1 Ω : ±100 | –55 to +155 |
| | | ±5 | | 10 mΩ ≦ R < 22 mΩ : ±350<br>22 mΩ ≦ R < 1 Ω : ±200 | |

(1) Use it on the condition that the case temperature is below 155 °C.

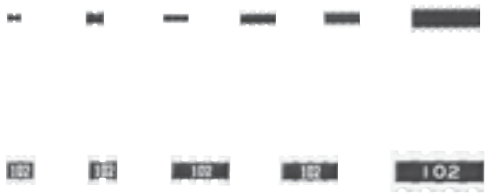
### Power Derating Curve

For resistors operated in ambient temperatures above 70 °C, power rating shall be derated in accordance with the figure on the right.



# Chip Resistor Array

Type: **EXB 14V, 18V, 24V, 28V, N8V, 2HV, 34V, V4V, 38V, V8V, S8V**



## Features

- High density
  2 resistors in 0.8 mm × 0.6 mm size / 0302 inch size : EXB14V
  4 resistors in 1.4 mm × 0.6 mm size / 0502 inch size : EXB18V
  2 resistors in 1.0 mm × 1.0 mm size / 0404 inch size : EXB24V
  4 resistors in 2.0 mm × 1.0 mm size / 0804 inch size : EXB28V, EXBN8V
  8 resistors in 3.8 mm × 1.6 mm size / 1506 inch size : EXB2HV
  2 resistors in 1.6 mm × 1.6 mm size / 0606 inch size : EXB34V, EXBV4V
  4 resistors in 3.2 mm × 1.6 mm size / 1206 inch size : EXB38V, EXBV8V
  4 resistors in 5.1 mm × 2.2 mm size / 2009 inch size : EXBS8V
- Improvement of placement efficiency
  Placement efficiency of Chip Resistor Array is two, four or eight times of the flat type chip resistor
- Reference Standard…IEC 60115-9, JIS C 5201-9, EIAJ RC-2129
- AEC-Q200 qualified (EXB2, EXB3)
- RoHS compliant

**■ As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions,** Please see Data Files

## Explanation of Part Numbers

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|
| E | X | B | V | 8 | V | 4 | 7 | 2 | J | V |

**Product Code**

| |
|---|
| Thick Film Chip Resistor Networks |

**Size and construction**

| Code | Inch | Terminal type |
|---|---|---|
| 1 | 0201 Array | Convex/ Flat Terminal |
| 2 | 0402 Array | Convex Terminal |
| 3 | 0603 Array | |
| N | 0402 Array | Concave Terminal |
| V | 0603 Array | |
| S | 0805 Array | |

**No. of Terminal**

| | |
|---|---|
| 4 | 4 Terminal |
| 8 | 8 Terminal |
| H | 16 Terminal |

**Schematics**

| | |
|---|---|
| V | Isolated type |

**Resistance Value**

The first two digits are significant figures of resistance value and the third one denotes the number of zeros following. Jumper is expressed by R00

Example : 222 → 2.2 kΩ

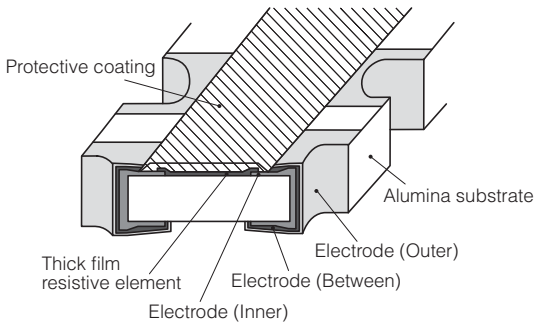
**Resistance Tolerance**

| | |
|---|---|
| J | ±5 % |
| 0 | Jumper |

**Packaging Methods**

| Code | Packaging | Part No. |
|---|---|---|
| Nil | Embossed Carrier Taping 4 mm pitch, 2,500 pcs. | EXBS8V |
| X | Punched Carrier Taping 2 mm pitch, 10,000 pcs. | EXB14V, 18V, 24V, 28V, N8V |
| V | Punched Carrier Taping 4 mm pitch, 5,000 pcs. | EXB2HV, 34V, 38V, V4V, V8V |

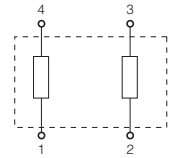
## Construction (Example : Concave Terminal)



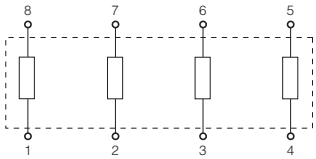

## Schematics

- Isolated type

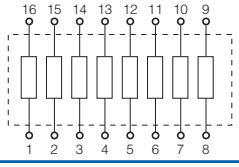
**14V, 24V, 34V, V4V** — 2 resistors




**18V, 28V, N8V, 38V, V8V, S8V** — 4 resistors




**2HV** — 8 resistors



## Ratings

| Item | | Specifications |
|---|---|---|
| Resistance Range | | 10 Ω to 1 MΩ : E24 series |
| Resistance Tolerance | | J : ±5 % |
| Number of Terminals | 14V,24V,V4V,34V | 4 terminal |
| | 18V,28V,N8V,38V,V8V,S8V | 8 terminal |
| | 2HV | 16 terminal |
| Number of Resistors | 14V,24V,V4V,34V | 2 element |
| | 18V,28V,N8V,38V,V8V,S8V | 4 element |
| | 2HV | 8 element |
| Power Rating at 70 °C | 14V,N8V | 0.031 W/element |
| | 18V | 0.031 W/element (0.1 W/package) |
| | 24V,28V,V4V,34V,V8V,38V | 0.063 W/element |
| | S8V | 0.1 W/element |
| | 2HV | 0.063 W/element (0.25 W/package) |

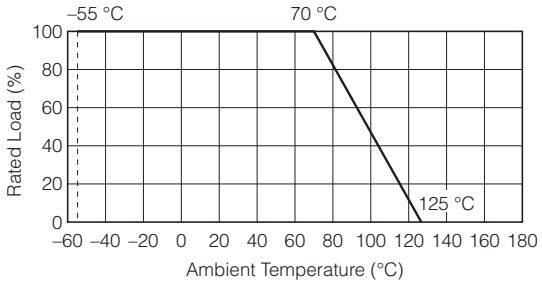
| Item | | Specifications |
|---|---|---|
| Limiting Element Voltage(1) | 14V,18V | 12.5 V |
| | 2HV | 25 V |
| | 24V,28V,N8V,38V,34V,V4V,V8V | 50 V |
| | S8V | 100 V |
| Maximum Overload Voltage (2) | 14V,18V | 25 V |
| | 2HV | 50 V |
| | 24V,28V,N8V,38V,34V,V4V,V8V | 100 V |
| | S8V | 200 V |
| T.C.R. | | ±200×10$^{-6}$/°C |
| Category Temperature Range | | –55 °C to 125 °C |
| Jumper Array — Rated Current | 14V,18V | 0.5 A |
| | 2HV,24V,28V,N8V,38V,34V,V4V,V8V | 1 A |
| | S8V | 2 A |
| Jumper Array — Maximum Overload Current | 14V,18V | 1 A |
| | 2HV,24V,28V,N8V,38V,34V,V4V,V8V | 2 A |
| | S8V | 4 A |

(1) Rated Continuous Working Voltage (RCWV) shall be determined from RCWV=$\sqrt{\text{Power Rating} \times \text{Resistance Value}}$, or Limiting Element Voltage listed above, whichever less.

(2) Overload (Short-time Overload) Test Voltage (SOTV) shall be determined from SOTV=2.5 × RCWV or max. Overload Voltage listed above whichever less.

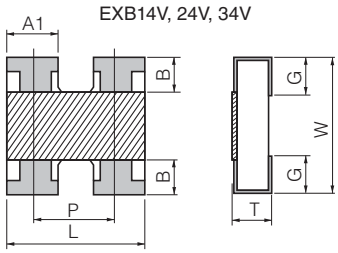
### Power Derating Curve

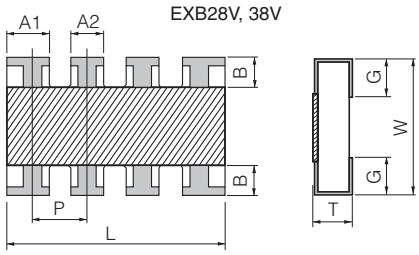
For resistors operated in ambient temperatures above 70 °C, power rating shall be derated in accordance with the figure on the right.

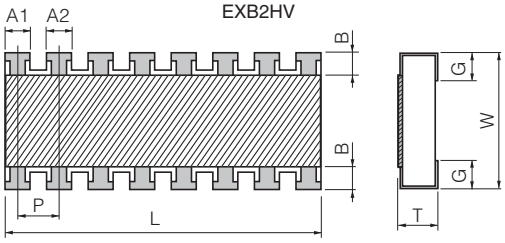


## Dimensions in mm (not to scale)

(1) Convex Terminal type



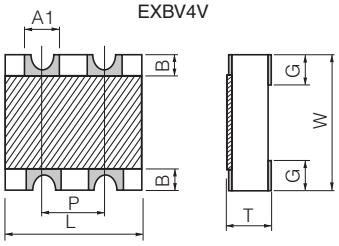



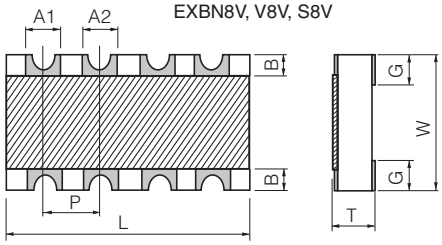




| Part No. (inch size) | Dimensions (mm) | | | | | | | | Mass (Weight) [g/1000 pcs.] |
|---|---|---|---|---|---|---|---|---|---|
| | L | W | T | A1 | A2 | B | P | G | |
| EXB14V (0201×2) | $0.80^{\pm0.10}$ | $0.60^{\pm0.10}$ | $0.35^{\pm0.10}$ | $0.35^{\pm0.10}$ | — | $0.15^{\pm0.10}$ | (0.50) | $0.15^{\pm0.10}$ | 0.5 |
| EXB24V (0402×2) | $1.00^{\pm0.10}$ | $1.00^{\pm0.10}$ | $0.35^{\pm0.10}$ | $0.40^{\pm0.10}$ | — | $0.18^{\pm0.10}$ | (0.65) | $0.25^{\pm0.10}$ | 1.2 |
| EXB28V (0402×4) | $2.00^{\pm0.10}$ | $1.00^{\pm0.10}$ | $0.35^{\pm0.10}$ | $0.45^{\pm0.10}$ | $0.35^{\pm0.10}$ | $0.20^{\pm0.10}$ | (0.50) | $0.25^{\pm0.10}$ | 2.0 |
| EXB2HV (0402×8) | $3.80^{\pm0.10}$ | $1.60^{\pm0.10}$ | $0.45^{\pm0.10}$ | $0.35^{\pm0.10}$ | $0.35^{\pm0.10}$ | $0.30^{\pm0.10}$ | (0.50) | $0.30^{\pm0.10}$ | 9.0 |
| EXB34V (0603×2) | $1.60^{\pm0.20}$ | $1.60^{\pm0.15}$ | $0.50^{\pm0.10}$ | $0.65^{\pm0.15}$ | — | $0.30^{\pm0.20}$ | (0.80) | $0.30^{\pm0.20}$ | 3.5 |
| EXB38V (0603×4) | $3.20^{\pm0.20}$ | $1.60^{\pm0.15}$ | $0.50^{\pm0.10}$ | $0.65^{\pm0.15}$ | $0.45^{\pm0.15}$ | $0.30^{\pm0.20}$ | (0.80) | $0.35^{\pm0.20}$ | 7.0 |

( ) Reference

(2) Concave Terminal type

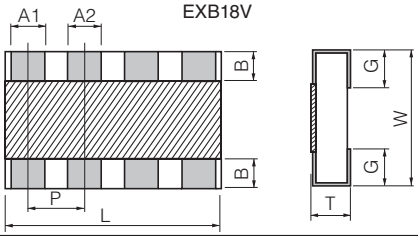



| Part No. (inch size) | Dimensions (mm) | | | | | | | | Mass (Weight) [g/1000 pcs.] |
|---|---|---|---|---|---|---|---|---|---|
| | L | W | T | A1 | A2 | B | P | G | |
| EXBN8V (0402×4) | $2.00^{\pm0.10}$ | $1.00^{\pm0.10}$ | $0.45^{\pm0.10}$ | $0.30^{\pm0.10}$ | $0.30^{\pm0.10}$ | $0.20^{\pm0.15}$ | (0.50) | $0.30^{\pm0.15}$ | 3.0 |
| EXBV4V (0603×2) | $1.60^{+0.20}_{-0.10}$ | $1.60^{+0.20}_{-0.10}$ | $0.60^{\pm0.10}$ | $0.60^{\pm0.10}$ | — | $0.30^{\pm0.15}$ | (0.80) | $0.45^{\pm0.15}$ | 5.0 |
| EXBV8V (0603×4) | $3.20^{+0.20}_{-0.10}$ | $1.60^{+0.20}_{-0.10}$ | $0.60^{\pm0.10}$ | $0.60^{\pm0.10}$ | $0.60^{\pm0.10}$ | $0.30^{\pm0.15}$ | (0.80) | $0.45^{\pm0.15}$ | 10 |
| EXBS8V (0805×4) | $5.08^{+0.20}_{-0.10}$ | $2.20^{+0.20}_{-0.10}$ | $0.70^{\pm0.20}$ | $0.80^{\pm0.15}$ | $0.80^{\pm0.15}$ | $0.50^{\pm0.15}$ | (1.27) | $0.55^{\pm0.15}$ | 30 |

( ) Reference

(3) Flat Terminal type




| Part No. (inch size) | Dimensions (mm) | | | | | | | | Mass (Weight) [g/1000 pcs.] |
|---|---|---|---|---|---|---|---|---|---|
| | L | W | T | A1 | A2 | B | P | G | |
| EXB18V (0201×4) | 1.40±0.10 | 0.60±0.10 | 0.35±0.10 | 0.20±0.10 | 0.20±0.10 | 0.10±0.10 | (0.40) | 0.20±0.10 | 1.0 |

( ) Reference

# Metal Film Chip Resistor Array

Type: **ERA38V**

## Features

- High accuracy ····· Small resistance tolerance and Temperature Coefficient of Resistance (T.C.R.)
- High reliability ····· Stable at high temperature and humidity
  (85 °C 85 % RH rated load, Category temperature range : –55 to +155 °C)
- High performance ····· Low current noise, excellent non-linearity
- Customize ····· Different resistance values are available. Please contact us for details.
- AEC-Q200 qualified
- RoHS compliant

■ **As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions,**
Please see Data Files

## Explanation of Part Numbers

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| E | R | A | 3 | 8 | V | W | X | 1 | 0 | 0 | 1 |

| Product Code |
|---|
| Metal Film Chip Resistors |

| Size and construction | | |
|---|---|---|
| Code | Inch | Terminal type |
| 3 | 0603 Array (1206) | Convex Terminal |

| No. of Terminal | |
|---|---|
| Code | No. of Terminal |
| 8 | 8 Terminals |

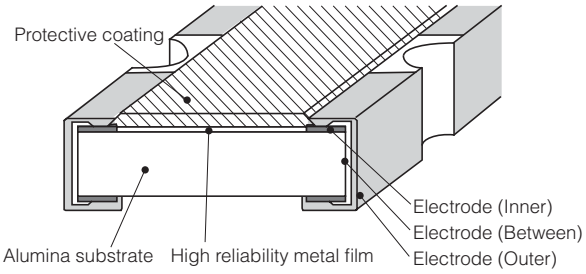
| Circuit Schematics | |
|---|---|
| Code | Type |
| V | Isolated type |

| T.C.R. | | |
|---|---|---|
| Code | Absolute | Tracking |
| W | ±25×10$^{-6}$/° C | 10×10$^{-6}$/° C |
| V | ±25×10$^{-6}$/° C | 15×10$^{-6}$/° C |
| U | ±25×10$^{-6}$/° C | 25×10$^{-6}$/° C |

| Resistance Tolerance | | |
|---|---|---|
| Code | Absolute | Tracking |
| X | ±0.1 % | 0.1 % |
| Y | ±0.25 % | 0.25 % |
| Z | ±0.5 % | 0.5 % |

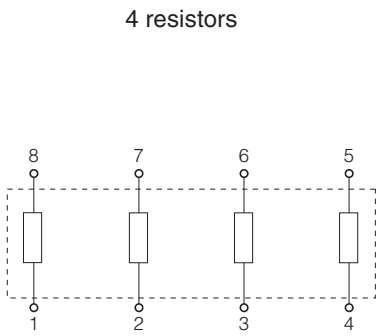
| Resistance Value |
|---|
| The first three digits are significant figures of resistance and the fourth one denotes number of zeros following. (example) 1001: 1 kΩ |

## Construction



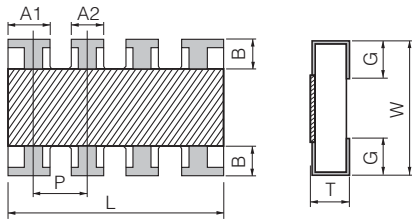

## Schematics

- Isolated type



## Dimensions in mm (not to scale)

Convex Terminal type




1206 inch size

| Dimensions (mm) | L | W | T | $A_1$ |
|---|---|---|---|---|
| | 3.20±0.20 | 1.60±0.15 | 0.50±0.10 | 0.65±0.15 |

| Dimensions (mm) | $A_2$ | B | P | G |
|---|---|---|---|---|
| | 0.45±0.15 | 0.30±0.20 | (0.80) | 0.35±0.20 |

Mass (Weight) [g/1000 pcs.] : 7.0 g

( ) Reference

## Ratings

| Part No. (inch size) | Power Rating at 70 °C (W) | Limiting Element Voltage(1) (V) | Maximum Overload Voltage(2) (V) | T.C.R. (Absolute) T.C.R. (Tracking) (×10$^{-6}$/°C) | Resistance Tolerance (Absolute) Resistance Tolerance (Relative) (%) | Resistance Range(3) (Ω) | Category Temperature Range (°C) |
|---|---|---|---|---|---|---|---|
| ERA38V (0603×4) | 0.063/ element | 75 | 150 | Absolute : ±25 Tracking : 25 (U) | Absolute : ±0.5 Relative : 0.5 (Z) | 100 to 39 k (E24) | –55 to +155 |
| | | | | Absolute : ±25 Tracking : 15 (V) | Absolute : ±0.25 Relative : 0.25 (Y) | 1k to 39 k (E24) | |
| | | | | Absolute : ±25 Tracking : 10 (W) | Absolute : ±0.1 Relative : 0.1 (X) | | |

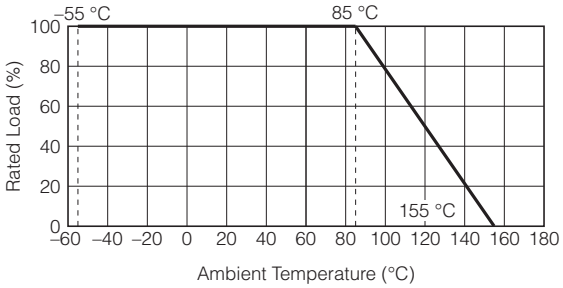
(1) Rated Continuous Working Voltage (RCWV) shall be determined from RCWV=$\sqrt{\text{Power Rating} \times \text{Resistance Value}}$, or Limiting Element Voltage listed above, whichever less.

(2) Overload (Short-time Overload) Test Voltage (SOTV) shall be determined from SOTV=2.5 × RCWV or max. Overload Voltage listed above whichever less.

(3) E96 series resistance values are also available. Please contact us for details.

### Power Derating Curve

For resistors operated in ambient temperatures above 85 °C, power rating shall be derated in accordance with the figure on the right.



# Anti-Sulfurated Chip Resistor Array

## Type: EXB U24, U28, U2H, U34, U38

## Features

- High resistance to sulfurization achieved by adopting an Ag-Pd-based inner electrode
- High density
  2 resistors in 1.0 mm × 1.0 mm size / 0404 inch size : EXBU24
  4 resistors in 2.0 mm × 1.0 mm size / 0804 inch size : EXBU28
  8 resistors in 3.8 mm × 1.6 mm size / 1506 inch size : EXBU2H
  2 resistors in 1.6 mm × 1.6 mm size / 0606 inch size : EXBU34
  4 resistors in 3.2 mm × 1.6 mm size / 1206 inch size : EXBU38
- Improvement of placement efficiency
  Placement efficiency of Chip Resistor Array is two, four or eight times of the flat type chip resistor
- Reference Standard···IEC 60115-9, JIS C 5201-9, EIAJ RC-2129
- AEC-Q200 qualified
- RoHS compliant

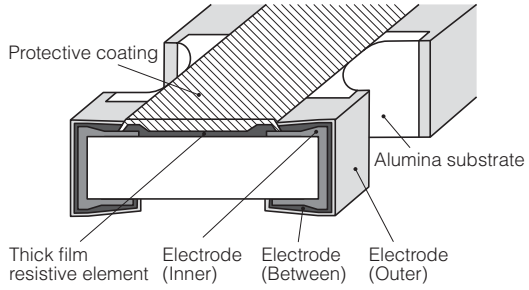
**■ As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions,** Please see Data Files

## Explanation of Part Numbers

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|
| E | X | B | U | 2 | 8 | 4 | 7 | 2 | J | X |

| Product Code | Size, Construction | | No. of Terminal | | Resistance Value | Resistance Tolerance | | Packaging Methods | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Code | Inch | | | | | | Code | Packaging | Part No. |
| Thick Film Chip Resistor Networks | U2 | 0402 Array | 4 | 4 Terminal | The first two digits are significant figures of resistance value and the third one denotes the number of zeros following. Jumper is expressed by R00 | J | ±5 % | X | Punched Carrier Taping 2 mm pitch, 10,000 pcs. | EXBU24, U28 |
| | U3 | 0603 Array | 8 | 8 Terminal | | 0 | Jumper | V | Punched Carrier Taping 4 mm pitch, 5,000 pcs. | EXBU2H, U34, U38 |
| | Anti-Sulfuarted Convex Terminal | | H | 16 Terminal | Example : 222 → 2.2 kΩ | | | | | |

## Construction

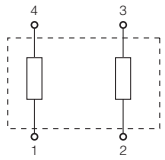



## Schematics

- Isolated type

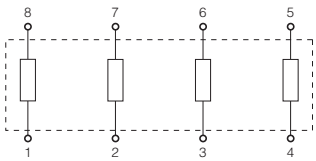
EXBU24, U34

2 resistors



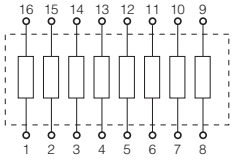

EXBU28, U38

4 resistors



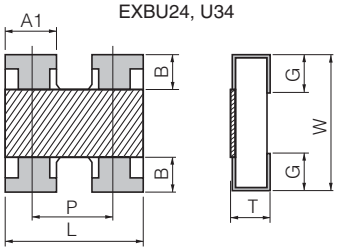

EXBU2H

8 resistors

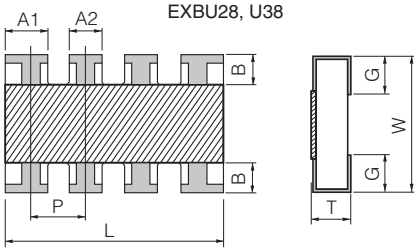


## Dimensions in mm (not to scale)

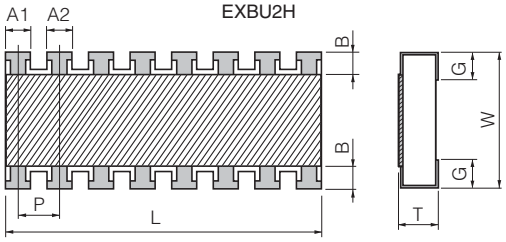
EXBU24, U34




EXBU28, U38




EXBU2H




| Part No. (inch size) | Dimensions (mm) | | | | | | | | Mass (Weight) [g/1000 pcs.] |
|---|---|---|---|---|---|---|---|---|---|
| | L | W | T | A1 | A2 | B | P | G | |
| EXBU24 (0402×2) | $1.00^{\pm0.10}$ | $1.00^{\pm0.10}$ | $0.35^{\pm0.10}$ | $0.40^{\pm0.10}$ | — | $0.18^{\pm0.10}$ | (0.65) | $0.25^{\pm0.10}$ | 1.2 |
| EXBU28 (0402×4) | $2.00^{\pm0.10}$ | $1.00^{\pm0.10}$ | $0.35^{\pm0.10}$ | $0.45^{\pm0.10}$ | $0.35^{\pm0.10}$ | $0.20^{\pm0.10}$ | (0.50) | $0.25^{\pm0.10}$ | 2.0 |
| EXBU2H (0402×8) | $3.80^{\pm0.10}$ | $1.60^{\pm0.10}$ | $0.45^{\pm0.10}$ | $0.35^{\pm0.10}$ | $0.35^{\pm0.10}$ | $0.30^{\pm0.10}$ | (0.50) | $0.30^{\pm0.10}$ | 9.0 |
| EXBU34 (0603×2) | $1.60^{\pm0.20}$ | $1.60^{\pm0.15}$ | $0.50^{\pm0.10}$ | $0.65^{\pm0.15}$ | — | $0.30^{\pm0.20}$ | (0.80) | $0.30^{\pm0.20}$ | 3.5 |
| EXBU38 (0603×4) | $3.20^{\pm0.20}$ | $1.60^{\pm0.15}$ | $0.50^{\pm0.10}$ | $0.65^{\pm0.15}$ | $0.45^{\pm0.15}$ | $0.30^{\pm0.20}$ | (0.80) | $0.35^{\pm0.20}$ | 7.0 |

( ) Reference

## Ratings

| Item | | Specifications |
|---|---|---|
| Resistance Range | | 10 Ω to 1 MΩ<br>E24 series |
| Resistance Tolerance | | J: ±5 % |
| Number of Terminals | U24, U34 | 4 terminal |
| | U28, U38 | 8 terminal |
| | U2H | 16 element |
| Number of Resistors | U24, U34 | 2 element |
| | U28, U38 | 4 element |
| | U2H | 8 element |
| Power Rating at 70 °C | U24, U28, U34, U38 | 0.063 W/element |
| | U2H | 0.063 W/element<br>(0.25 W/package) |

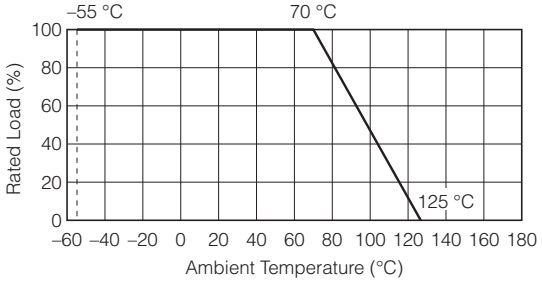
| Item | | Specifications |
|---|---|---|
| Limiting Element Voltage(1) | U2H | 25 V |
| | U24, U28, U34, U38 | 50 V |
| Max. Overload Voltage (2) | U2H | 50 V |
| | U24, U28, U34, U38 | 100 V |
| T.C.R. | | $\pm200\times10^{-6}$/°C |
| Category Temperature Range | | –55 °C to 125 °C |
| Jumper Array Rated Current | U24, U28, U2H, U34, U38 | 1 A |
| Jumper Array Max. Overload Current | U24, U28, U2H, U34, U38 | 2 A |

(1) Rated Continuous Working Voltage (RCWV) shall be determined from RCWV=$\sqrt{\text{Power Rating} \times \text{Resistance Value}}$, or Limiting Element Voltage listed above, whichever less.

(2) Overload (Short-time Overload) Test Voltage (SOTV) shall be determined from SOTV=2.5 × RCWV or max. Overload Voltage listed above whichever less.

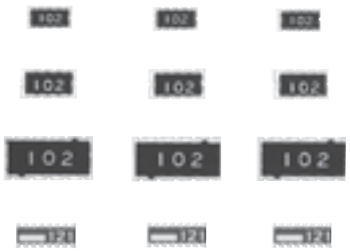
### Power Derating Curve

For resistors operated in ambient temperatures above 70 °C, power rating shall be derated in accordance with the figure on the right.



# Chip Resistor Networks

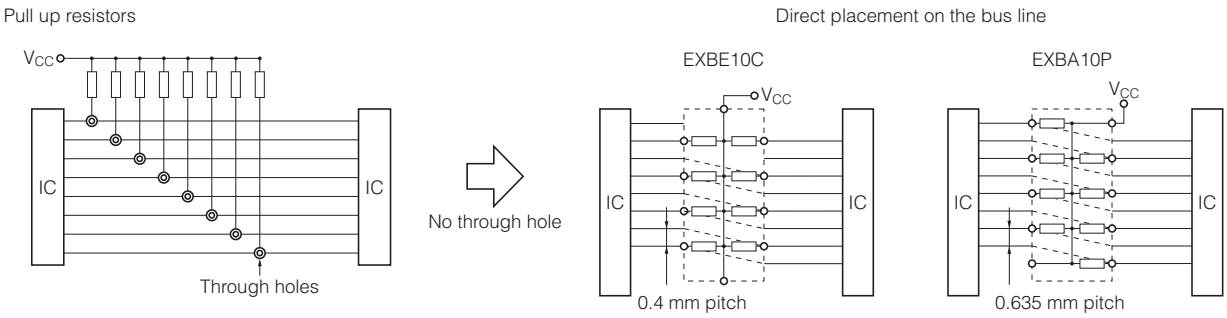
Type: **EXBD**
**EXBE**
**EXBA**
**EXBQ**



## Features

- High density placing for digital signal circuits
  · Bussed 8 or 15 resistors for pull up/down circuits
  EXBD: 3.2 mm × 1.6 mm × 0.55 mm, 0.635 mm pitch
  EXBE: 4.0 mm × 2.1 mm × 0.55 mm, 0.8 mm pitch
  EXBA: 6.4 mm × 3.1 mm × 0.55 mm, 1.27 mm pitch
  EXBQ: 3.8 mm × 1.6 mm × 0.45 mm, 0.5 mm pitch
  · Available direct placing on the bus line by means of half pitch spacing without through-holes on PWB
  ("High density placing" is shown below)
- High speed mounting using conventional placing machine
- Reference Standard…IEC 60115-9, JIS C 5201-9, EIAJ RC-2130
- RoHS compliant

[High density placing]




■ **As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions,**
Please see Data Files

## Explanation of Part Numbers

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| E | X | B | E | 1 | 0 | C | 1 | 0 | 3 | J | |

**Product Code**

| Thick Film Resistor Network |
|---|

**Dimension Code of Chip Resistor Network**

| Code | Inch | Dimensions |
|---|---|---|
| D | 1206 | 3.2 mm×1.6 mm |
| E | 1608 | 4.0 mm×2.1 mm |
| A | 2512 | 6.4 mm×3.1 mm |
| Q | 1506 | 3.8 mm×1.6 mm |

**Number of Terminals**

| |
|---|
| 10(EXBD,E,A) |
| 16(EXBQ) |

**Circuit Configuration**

| Code | Common Terminal Position |
|---|---|
| C | Center common circuit (EXBD, EXBE) |
| P | Diagonal common circuit (Terminal 5 and Terminal 10) (EXBA) |
| P | One side common circuit (Terminal 16) (EXBQ) |
| E | Diagonal common circuit (Terminal 1 and Terminal 6) (EXBA) |

**Resistance Value**

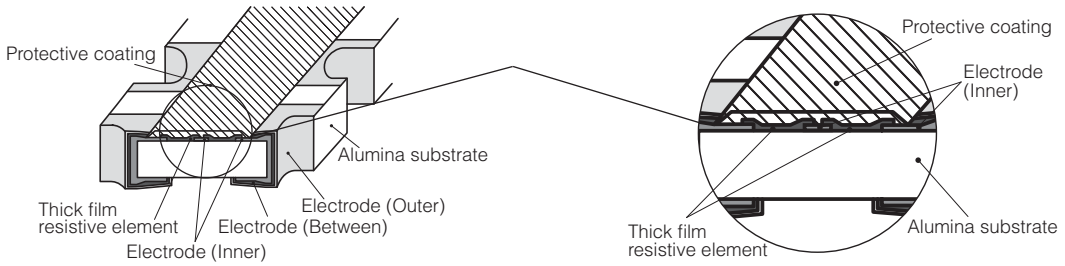
The first two digits are significant figures of resistance value and the third one denotes the number of zeros following.

**Resistance Tolerance**

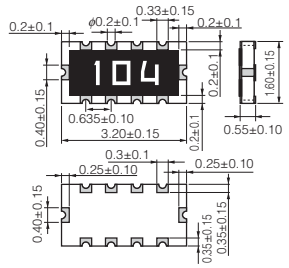
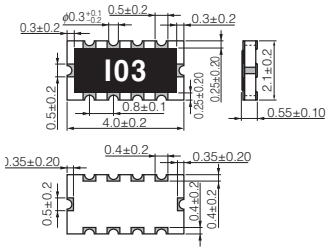
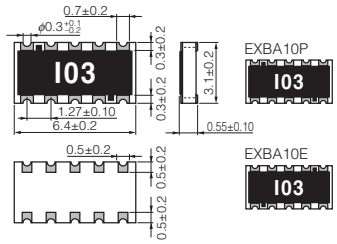
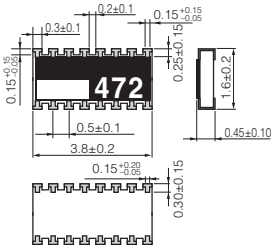
| | |
|---|---|
| J | ±5 % |

**Suffix for Special Requirements**

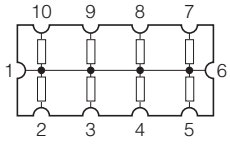
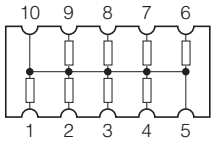
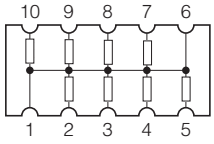
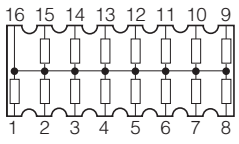
## Construction (Example : EXBD)




## Dimensions in mm (not to scale)

| EXBD | EXBE | EXBA | EXBQ |
|---|---|---|---|
|  |  |  |  |
| Mass (Weight)[1000 pcs.] : 10 g | Mass (Weight)[1000 pcs.] : 16 g | Mass (Weight)[1000 pcs.] : 40 g | Mass (Weight)[1000 pcs.] : 9 g |

## Circuit Configuration

| EXBD, EXBE | EXBA | | EXBQ |
|---|---|---|---|
| | EXBA10P | EXBA10E | |
|  |  |  |  |

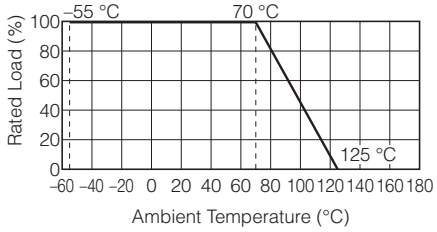
## Ratings

| Item | Specifications | | | |
|---|---|---|---|---|
| Series | EXBD | EXBE | EXBA | EXBQ |
| Resistance Range | 47 Ω to 1 MΩ (E12) | | | 100 Ω to 470 kΩ (E6 series) |
| Resistance Tolerance | ±5% | | | |
| Number of Terminals | 10 terminals | | | 16 terminals |
| Number of Resistors | 8 element | | | 15 element |
| Power Rating at 70 °C | 0.05 W/element | 0.063 W/element | | 0.025 W/element |
| Limiting Element Voltage(1) | 25V | | 50 V | 25V |
| Maximum Overload Voltage(2) | 50 V | | 100 V | 50 V |
| T. C. R. | ±200 × $10^{-6}$/ °C | | | |
| Category Temperature Range | –55 °C to +125 °C | | | |

(1) Rated Continuous Working Voltage (RCWV) shall be determined from RCWV=$\sqrt{\text{Power Rating} \times \text{Resistance Value}}$, or Limiting Element Voltage listed above, whichever less.
(2) Overload (Short-time Overload) Test Voltage (SOTV) shall be determinedfrom SOTV=2.5 × RCWV* or Maximum Overload Voltage listed above whichever less.

### Power Derating Curve

For resistors operated in ambient temperatures above 70 °C, power rating shall be derated in accordance with the figure on the right.



# Chip Attenuator

Type: **EXB 14AT**
**EXB 24AT**

## Features

- Unbalanced π type attenuator circuit in one chip
  EXB14AT (0.8 mm × 0.6 mm), EXB24AT (1.0 mm × 1.0 mm)
- Reduced mounting area :
  EXB14AT : About 60 % smaller than the area of an attenuator circuit consisting of three 0603 chip resistors, almost equal to the area of three 0402 chip resistors
  EXB24AT : About 50 % smaller than the area of an attenuator circuit consisting of three 1005 chip resistors, almost equal to the area of three 0603 chip resistors
- Mounting cost reduction : (Only 1 chip placed as compared to 3)
- Attenuation : 1 dB to 10 dB
- RoHS compliant

## Recommended Applications

- Attenuation / level control / impedance matching of high frequency
  (communication signalling equipment cellular phones(GSM, CDMA, PDC, etc.), PHS, PDAs)

**■ As for Packaging Methods, Land Pattern, Soldering Conditions and Safety Precautions,**
Please see Data Files

## Explanation of Part Numbers

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| E | X | B | 1 | 4 | A | T | 3 | A | R | 3 | X |

**Product Code**
Thick Film Resistor Network

| Code | Dimensions and Circuit Configuration |
|---|---|
| 14AT | 0.8 mm × 0.6 mm (inch size : 0302) π type attenuator |
| 24AT | 1.0 mm × 1.0 mm (inch size : 0404) π type attenuator |

**Attenuation Value**
One-digit number /one letter shows attenuation value
(ex.) 1→1 dB, A→10 dB

**Characteristics Impedance**

| | |
|---|---|
| A | 50 Ω |

**Tolerance**

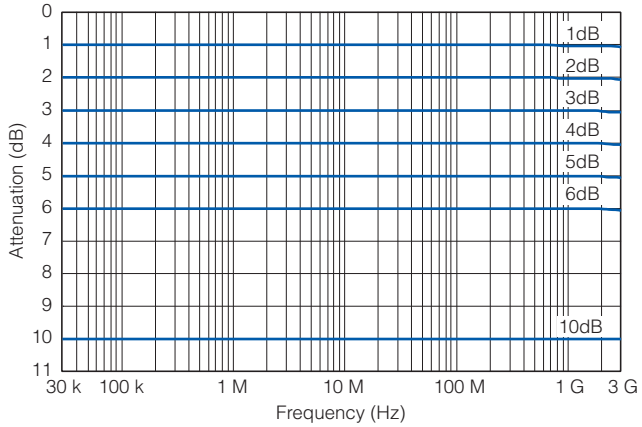
| | |
|---|---|
| R3 | ±0.3 dB |
| R5 | ±0.5 dB |

**Packaging**

| | |
|---|---|
| X | Punched Carrier Taping 2 mm pitch, 10,000 pcs. |

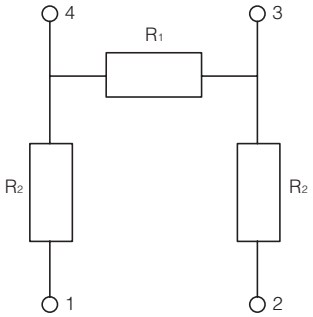
## Attenuation-Frequency Characteristics

(EXB14AT, EXB24AT)



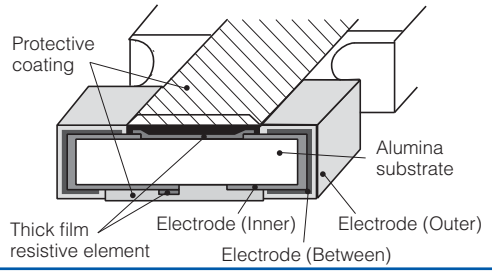

## Circuit Configuration

Unbalanced π type

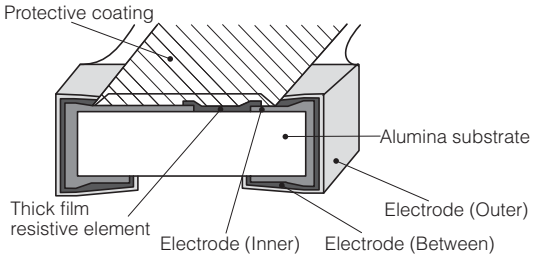


## Construction

### EXB14AT

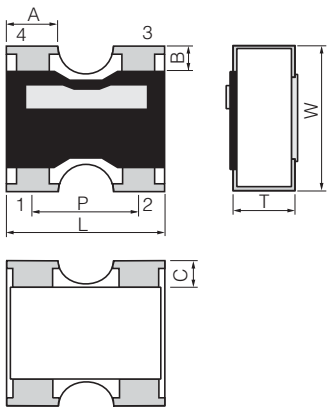



### EXB24AT




## Dimensions in mm (not to scale)

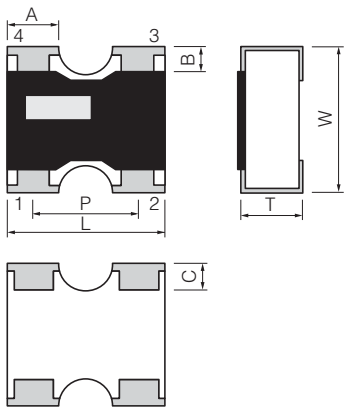
### EXB14AT




| Dimensions (mm) | L | W | T | A | B | C | P (typical value) |
|---|---|---|---|---|---|---|---|
| | $0.80^{\pm0.10}$ | $0.60^{\pm0.10}$ | $0.35^{\pm0.10}$ | $0.35^{\pm0.10}$ | $0.15^{\pm0.10}$ | $0.15^{\pm0.10}$ | 0.50 |

<Marking Configuration>
The bar marking for recognizing terminal direction is located on the side of terminal 3, 4.
Mass (Weight) [1000 pcs.] : 0.7 g

### EXB24AT




| Dimensions (mm) | L | W | T | A | B | C | P (typical value) |
|---|---|---|---|---|---|---|---|
| | $1.00^{\pm0.10}$ | $1.00^{\pm0.10}$ | $0.35^{\pm0.10}$ | $0.40^{\pm0.10}$ | $0.15^{\pm0.10}$ | $0.25^{\pm0.10}$ | 0.65 |

<Marking Configuration>
The bar marking for recognizing terminal direction is located on the side of terminal 4.
Mass (Weight) [1000 pcs.] : 1.1 g

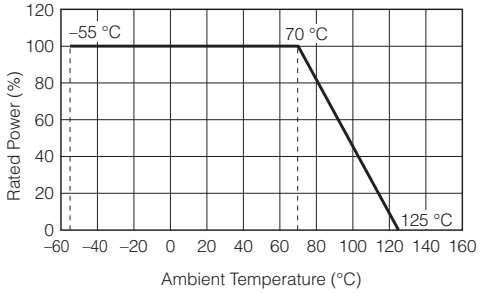
## Ratings

| Part No. | EXB14AT, EXB24AT |
|---|---|
| Attenuation Value | 1 dB, 2 dB, 3 dB, 4 dB, 5 dB, 6 dB, 10 dB* |
| Attenuation Value Tolerance | 1 dB, 2 dB, 3 dB, 4 dB, 5 dB : ±0.3 dB<br>6 dB, 10 dB : ±0.5 dB |
| Characteristic Impedance | 50 Ω |
| Power Rating | 0.04 W /package |
| Frequency Range at 70 °C | DC to 3.0 GHz |
| VSWR (Voltage Standing Wave Ratio) | 1.3 max. |
| Number of Resistors | 3 resistors |
| Number of Terminals | 4 terminals |
| Category Temperature Range | –55 °C to +125 °C |

✻ Please inquire about the other Attenuator value

### Power Derating Curve

For resistors operated in ambient temperatures above 70 °C, power rating shall be derated in accordance with the figure on the right.

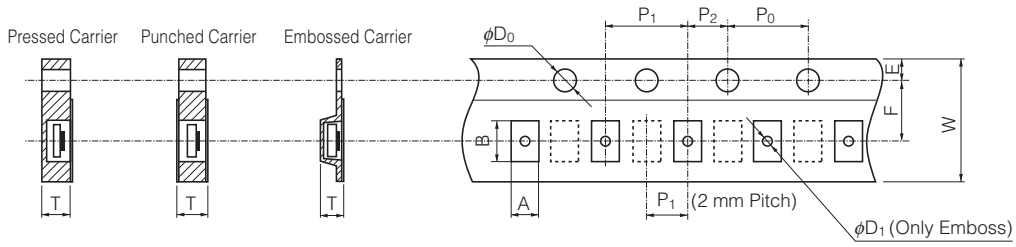


| Surface Mount Resistors Series | | | Packaging (Standard Quantity : pcs./reel) | | | |
|---|---|---|---|---|---|---|
| Products | Part No. | Size mm (inch) | Pressed Carrier Taping (2 mm pitch) | Punched Carrier Taping (2 mm pitch) | Punched Carrier Taping (4 mm pitch) | Embossed Carrier Taping (4 mm pitch) |
| Thick Film Chip Resistors | ERJXGN | 0402(01005) | 20,000 * | — | — | 4,0000 ** |
| | ERJ1GN | 0603(0201) | 15,000 | — | — | — |
| | ERJ2GE | 1005(0402) | — | 10,000, 20,000 | — | — |
| | ERJ3GE | 1608(0603) | — | — | 5,000 | — |
| | ERJ6GE | 2012(0805) | — | — | 5,000 | — |
| | ERJ8GE | 3216(1206) | — | — | 5,000 | — |
| | ERJ14 | 3225(1210) | — | — | — | 5,000 |
| | ERJ12 | 4532(1812) | — | — | — | 5,000 |
| | ERJ12Z | 5025(2010) | — | — | — | 5,000 |
| | ERJ1T | 6432(2512) | — | — | — | 4,000 |
| Precision Thick Film Chip Resistors | ERJXGN | 0402(01005) | 20,000 | — | — | — |
| | ERJ1GN/1RH | 0603(0201) | 15,000 | — | — | — |
| | ERJ2RH/2RK | 1005(0402) | — | 10,000 | — | — |
| | ERJ3RB/3RE/3EK | 1608(0603) | — | — | 5,000 | — |
| | ERJ6RB/6RE/6EN | 2012(0805) | — | — | 5,000 | — |
| | ERJ8EN | 3216(1206) | — | — | 5,000 | — |
| | ERJ14N | 3225(1210) | — | — | — | 5,000 |
| | ERJ12N | 4532(1812) | — | — | — | 5,000 |
| | ERJ12S | 5025(2010) | — | — | — | 5,000 |
| | ERJ1TN | 6432(2512) | — | — | — | 4,000 |
| Metal Film Chip Resistors, High Reliability Type | ERA1A | 0603(0201) | 15,000 | — | — | — |
| | ERA2A | 1005(0402) | — | 10,000 | — | — |
| | ERA3A | 1608(0603) | — | — | 5,000 | — |
| | ERA6A | 2012(0805) | — | — | 5,000 | — |
| | ERA8A | 3216(1206) | — | — | 5,000 | — |
| Thick Film Chip Resistors/ Low Resistance Type | ERJ2LW/2BW | 1005(0402) | 10,000 | — | — | — |
| | ERJ2BS/2BQ | 1005(0402) | — | 10,000 | — | — |
| | ERJ3L/3B/3R/L03 | 1608(0603) | — | — | 5,000 | — |
| | ERJ6B/6R/L06 | 2012(0805) | — | — | 5,000 | — |
| | ERJ8B/8R/8C/L08 | 3216(1206) | — | — | 5,000 | — |
| | ERJ14B/14R/L14 | 3225(1210) | — | — | — | 5,000 |
| | ERJ12R/L12 | 4532(1812) | — | — | — | 5,000 |
| | ERJ12Z/L1D | 5025(2010) | — | — | — | 5,000 |
| | ERJ1TR | 6432(2512) | — | — | — | 4,000 |
| | ERJL1W | 6432(2512) | — | — | — | 3,000 |
| Current Sensing Resistors, Metal Plate Type | ERJMS4 | 6432(2512) | — | — | — | 2,000 |
| | ERJMS6 | 6468(2526) | — | — | — | 1,000 (8 mm Pitch) |
| | ERJM1W | 6432(2512) | — | — | — | 3,000 |
| High Power Chip Resistors/ Wide Terminal Type | ERJA1 | 3264(1225) | — | — | — | 4,000 |
| | ERJB1/ERJC1(1) | 2550(1020) | — | — | — | 5,000 |
| | ERJB2 | 1632(0612) | — | — | 5,000 | — |
| | ERJB3 | 1220(0508) | — | — | 5,000 | — |

* W8P2 : Width 8 mm, Pitch 2 mm, ** W4P1 : Width 4 mm, Pitch 1 mm
(1) Anti-Sulfurated High Power Chip Resistors / Wide Terminal Type

| Surface Mount Resistors Series | | | Packaging (Standard Quantity : pcs./reel) | | | |
|---|---|---|---|---|---|---|
| Products | Part No. | Size mm (inch) | Pressed Carrier Taping (2 mm pitch) | Punched Carrier Taping (2 mm pitch) | Punched Carrier Taping (4 mm pitch) | Embossed Carrier Taping (4 mm pitch) |
| Anti-Surge Thick Film Chip Resistors | ERJP03/PA3 | 1608(0603) | — | — | 5,000 | — |
| | ERJP06 | 2012(0805) | — | — | 5,000 | — |
| | ERJP08 | 3216(1206) | — | — | 5,000 | — |
| | ERJP14 | 3225(1210) | — | — | — | 5,000 |
| Anti-Pulse Thick Film Chip Resistors | ERJT06 | 2012(0805) | — | — | 5,000 | — |
| | ERJT08 | 3216(1206) | — | — | 5,000 | — |
| | ERJT14 | 3225(1210) | — | — | — | 5,000 |
| Anti-Sulfurated Thick Film Chip Resistors | ERJU01 | 0603(0201) | 15,000 | — | — | — |
| | ERJS02/U02 | 1005(0402) | — | 10,000 | — | — |
| | ERJS03/U03 | 1608(0603) | — | — | 5,000 | — |
| | ERJS06/U06<br>ERJU6S/U6Q | 2012(0805) | — | — | 5,000 | — |
| | ERJS08/U08 | 3216(1206) | — | — | 5,000 | — |
| | ERJS14/U14 | 3225(1210) | — | — | — | 5,000 |
| | ERJS12/U12 | 4532(1812) | — | — | — | 5,000 |
| | ERJS1D/U1D | 5025(2010) | — | — | — | 5,000 |
| | ERJS1T/U1T | 6432(2512) | — | — | — | 4,000 |
| Chip Resistor Array | EXB14V | 0806(0302) | — | 10,000 | — | — |
| | EXB24V | 1010(0404) | — | 10,000 | — | — |
| | EXB34V | 1616(0606) | — | — | 5,000 | — |
| | EXBV4V | 1616(0606) | — | — | 5,000 | — |
| | EXB18V | 1406(0502) | — | 10,000 | — | — |
| | EXB28V | 2010(0804) | — | 10,000 | — | — |
| | EXBN8V | 2010(0804) | — | 10,000 | — | — |
| | EXB38V | 3216(1206) | — | — | 5,000 | — |
| | EXBV8V | 3216(1206) | — | — | 5,000 | — |
| | EXBS8V | 5022(2009) | — | — | — | 2,500 |
| | EXB2HV | 3816(1506) | — | — | 5,000 | — |
| Metal Film Chip Resistor Array | ERA38V | 3216(1206) | — | — | 5,000 | — |
| Anti-Sulfurated Chip Resistor Array | EXBU24 | 1010(0404) | — | 10,000 | — | — |
| | EXBU34 | 1616(0606) | — | — | 5,000 | — |
| | EXBU28 | 2010(0804) | — | 10,000 | — | — |
| | EXBU38 | 3216(1206) | — | — | 5,000 | — |
| | EXBU2H | 3816(1506) | — | — | 5,000 | — |
| Chip Resistor Networks | EXBD | 3216(1206) | — | — | 5,000 | — |
| | EXBE | 4021(1608) | — | — | — | 4,000 |
| | EXBA | 6431(2512) | — | — | — | 4,000 |
| | EXBQ | 3816(1506) | — | — | 5,000 | — |
| Chip Attenuator | EXB14AT | 0806(0302) | — | 10,000 | — | — |
| | EXB24AT | 1010(0404) | — | 10,000 | — | — |

## Carrier Tape




## Pressed Carrier Taping (2 mm Pitch)

● Rectangular Type

(Unit : mm)

| Part No. | Size mm (inch) | A | B | W | F | E | $P_1$ | $P_2$ | $P_0$ | $\phi D_0$ | T |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ERJXGN | 0402(01005) | $0.24^{\pm0.03}$ | $0.45^{\pm0.03}$ | $8.00^{\pm0.20}$ | $3.50^{\pm0.05}$ | $1.75^{\pm0.10}$ | $2.00^{\pm0.10}$ | $2.00^{\pm0.05}$ | $4.00^{\pm0.10}$ | $1.50^{+0.10}_{0}$ | $0.31^{\pm0.05}$ |
| ERJ1GN<br>ERJ1R□<br>ERJU01<br>ERA1A | 0603 (0201) | $0.38^{\pm0.05}$ | $0.68^{\pm0.05}$ | | | | | | | | $0.42^{\pm0.05}$ |
| ERJ2LW | 1005(0402) | $0.68^{\pm0.10}$ | $1.20^{\pm0.10}$ | | | | | | | | $0.60^{\pm0.05}$ |
| ERJ2BW | 1005(0402) | $0.67^{\pm0.10}$ | $1.17^{\pm0.10}$ | | | | | | | | $0.61^{\pm0.05}$ |

## Punched Carrier Taping (2 mm Pitch)

● Rectangular Type

(Unit : mm)

| Part No. | Size mm (inch) | A | B | W | F | E | $P_1$ | $P_2$ | $P_0$ | $\phi D_0$ | T |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ERJ2□<br>ERJS02<br>ERJU02<br>ERA2A | 1005 (0402) | $0.67^{\pm0.05}$ | $1.17^{\pm0.05}$ | $8.00^{\pm0.20}$ | $3.50^{\pm0.05}$ | $1.75^{\pm0.10}$ | $2.00^{\pm0.10}$ | $2.00^{\pm0.05}$ | $4.00^{\pm0.10}$ | $1.50^{+0.10}_{0}$ | $0.52^{\pm0.05}$ |

● Chip Resistor Array / Anti-Sulfurated Chip Resistor Array / Chip Attenuator

(Unit : mm)

| Part No. | Size mm (inch) | A | B | W | F | E | $P_1$ | $P_2$ | $P_0$ | $\phi D_0$ | T |
|---|---|---|---|---|---|---|---|---|---|---|---|
| EXB14V<br>EXB14AT | 0806 (0302) | $0.70^{+0.10}_{-0.05}$ | $0.95^{+0.05}_{-0.10}$ | $8.00^{\pm0.20}$ | $3.50^{\pm0.05}$ | $1.75^{\pm0.10}$ | $2.00^{\pm0.10}$ | $2.00^{\pm0.05}$ | $4.00^{\pm0.10}$ | $1.50^{+0.10}_{0}$ | $0.52^{\pm0.05}$ |
| EXB18V | 1406(0502) | | $1.60^{\pm0.10}$ | | | | | | | | |
| EXB24V<br>EXBU24<br>EXB24AT | 1010 (0404) | $1.20^{\pm0.10}$ | $1.20^{\pm0.10}$ | | | | | | | | |
| EXB28V<br>EXBU28<br>EXBN8V | 2010 (0804) | | $2.20^{\pm0.10}$ | | | | | | | | |

## Punched Carrier Taping (4 mm Pitch)

● Rectangular Type

(Unit : mm)

| Part No. | Size mm (inch) | A | B | W | F | E | $P_1$ | $P_2$ | $P_0$ | $\phi D_0$ | T |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ERJ3□<br>ERJ3LW(10 mΩ)<br>ERJ3BW<br>ERJ□□3<br>ERA3A | 1608 (0603) | $1.10^{\pm0.10}$ | $1.90^{\pm0.10}$ | $8.00^{\pm0.20}$ | $3.50^{\pm0.05}$ | $1.75^{\pm0.10}$ | $4.00^{\pm0.10}$ | $2.00^{\pm0.05}$ | $4.00^{\pm0.10}$ | $1.50^{+0.10}_{0}$ | $0.70^{\pm0.05}$ |
| ERJ3LW(5 mΩ) | | | | | | | | | | | $0.84^{\pm0.05}$ |
| ERJ6□<br>ERJ□06<br>ERJU6S, U6Q<br>ERA6A | 2012 (0805) | $1.65^{\pm0.15}$ | $2.50^{\pm0.20}$ | | | | | | | | |
| ERJB3 | 1220(0508) | | | | | | | | | | |
| ERJ6BW | 2012(0805) | $1.55^{\pm0.15}$ | $2.30^{\pm0.20}$ | | | | | | | | |
| ERJ8□<br>ERJ8□W<br>ERJ□08<br>ERA8A | 3216 (1206) | $2.00^{\pm0.15}$ | $3.60^{\pm0.20}$ | | | | | | | | |
| ERJB2 | 1632(0612) | | | | | | | | | | |

● Chip Resistor Array / Metal Film Chip Resistor Array / Anti-Sulfurated Chip Resistor Array / Chip Resistor Networks (Unit : mm)

| Part No. | Size mm (inch) | A | B | W | F | E | $P_1$ | $P_2$ | $P_0$ | $\phi D_0$ | T |
|---|---|---|---|---|---|---|---|---|---|---|---|
| EXB34V<br>EXBU34 | 1616(0606) | $1.95^{\pm0.15}$ | $1.95^{\pm0.20}$ | $8.00^{\pm0.20}$ | $3.50^{\pm0.05}$ | $1.75^{\pm0.10}$ | $4.00^{\pm0.10}$ | $2.00^{\pm0.05}$ | $4.00^{\pm0.10}$ | $1.50^{+0.10}_{0}$ | $0.70^{\pm0.05}$ |
| EXB38V<br>ERA38V<br>EXBU38 | 3216(1206) | | $3.60^{\pm0.20}$ | | | | | | | | |
| EXB2HV<br>EXBU2H | 3816(1506) | | $4.10^{\pm0.15}$ | | | | | | | | |
| EXBV4V | 1616(0606) | | $1.95^{\pm0.20}$ | | | | | | | | $0.84^{\pm0.05}$ |
| EXBV8V | 3216(1206) | | $3.60^{\pm0.20}$ | | | | | | | | |
| EXBD | 3216(1206) | $2.00^{\pm0.20}$ | $3.60^{\pm0.20}$ | | | | | | | | $0.84^{\pm0.10}$ |
| EXBQ | 3816(1506) | $1.90^{\pm0.20}$ | $4.10^{\pm0.20}$ | | | | | | | | $0.64^{\pm0.05}$ |

## Embossed Carrier Taping (1 mm Pitch)

● Rectangular Type (Unit : mm)

| Part No. | Size mm (inch) | A | B | W | F | E | $P_1$ | $P_2$ | $P_0$ | $\phi D_0$ | T |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ERJXGN | 0402(01005) | $0.25^{\pm0.05}$ | $0.45^{\pm0.05}$ | $4.00^{\pm0.20}$ | $1.80^{\pm0.05}$ | $0.90^{\pm0.10}$ | $1.00^{\pm0.10}$ | $1.00^{\pm0.10}$ | $2.00^{\pm0.10}$ | $0.80^{\pm0.10}$ | 0.5 max. |

## Embossed Carrier Taping (4 mm Pitch)

● Rectangular Type (Unit : mm)

| Part No. | Size mm (inch) | A | B | W | F | E | $P_1$ | $P_2$ | $P_0$ | $\phi D_0$ | T | $\phi D_1$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ERJ14□<br>ERJ□14 | 3225<br>(1210) | $2.80^{\pm0.20}$ | $3.50^{\pm0.20}$ | $8.00^{\pm0.30}$ | $3.50^{\pm0.05}$ | $1.75^{\pm0.10}$ | $4.00^{\pm0.10}$ | $2.00^{\pm0.05}$ | $4.00^{\pm0.10}$ | $1.50^{+0.10}_{0}$ | $1.00^{\pm0.10}$ | $1.00^{+0.10}_{0}$ |
| ERJ12□<br>ERJ□12 | 4532<br>(1812) | $3.50^{\pm0.20}$ | $4.80^{\pm0.20}$ | $12.00^{\pm0.30}$ | $5.50^{\pm0.20}$ | | | | | | | 1.5 min. |
| ERJ12Z<br>ERJ12S<br>ERJ□1D | 5025<br>(2010) | $2.80^{\pm0.20}$ | $5.30^{\pm0.20}$ | | | | | | | | | |
| ERJB1<br>ERJC1 | 2550<br>(1020) | | | | | | | | | | | |
| ERJ1T□<br>ERJ□1T | 6432<br>(2512) | $3.60^{\pm0.20}$ | $6.90^{\pm0.20}$ | | | | | | | | | |
| ERJL1W | | | | | | | | | | | $1.60^{\pm0.10}$ | |
| ERJM1W<br>ERJMS4 | | | | | | | | | | | $1.50^{\pm0.20}$ | |
| ERJA1 | 3264(1225) | $3.50^{\pm0.20}$ | $6.80^{\pm0.20}$ | | | | | | | | $1.10^{\pm0.20}$ | |

● Chip Resistor Array / Chip Resistor Networks (Unit : mm)

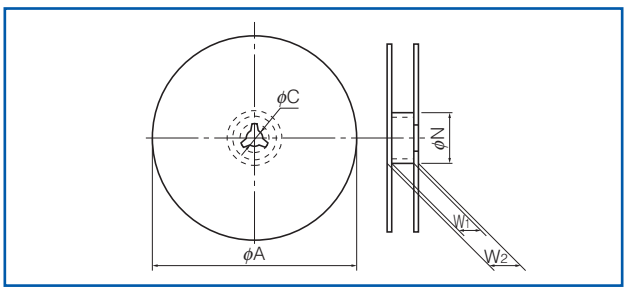
| Part No. | Size mm (inch) | A | B | W | F | E | $P_1$ | $P_2$ | $P_0$ | $\phi D_0$ | T | $\phi D_1$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EXBS8V | 5022(2029) | $2.80^{\pm0.20}$ | $5.70^{\pm0.20}$ | $12.00^{\pm0.30}$ | $5.50^{\pm0.20}$ | $1.75^{\pm0.10}$ | $4.00^{\pm0.10}$ | $2.00^{\pm0.05}$ | $4.00^{\pm0.10}$ | $1.50^{+0.10}_{0}$ | 1.6 max. | 1.5 min. |
| EXBE | 4021(1608) | $2.50^{\pm0.20}$ | $4.40^{\pm0.20}$ | | | | | | | | $1.10^{\pm0.20}$ | |
| EXBA | 6431(2512) | $3.50^{\pm0.20}$ | $6.80^{\pm0.20}$ | | | | | | | | | |

## Embossed Carrier Taping (8 mm Pitch)

● Rectangular Type (Unit : mm)

| Part No. | Size mm (inch) | A | B | W | F | E | $P_1$ | $P_2$ | $P_0$ | $\phi D_0$ | T | $\phi D_1$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ERJMS6 | 6468(2526) | $6.90^{\pm0.20}$ | $7.50^{\pm0.20}$ | $12.00^{\pm0.30}$ | $5.50^{\pm0.05}$ | $1.75^{\pm0.10}$ | $8.00^{\pm0.10}$ | $2.00^{\pm0.05}$ | $4.00^{\pm0.10}$ | $1.50^{+0.10}_{0}$ | $2.10^{\pm0.10}$ | 1.5 min. |

## Taping Reel

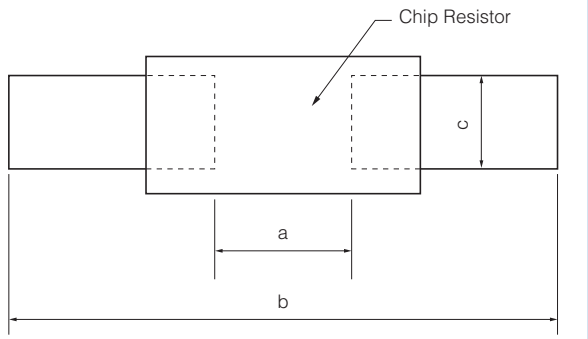



(Unit : mm)

| Tape Width (W) | $\phi A$ | $\phi N$ | $\phi C$ | $W_1$ | $W_2$ |
|---|---|---|---|---|---|
| 4mm Width | $180.0^{\pm3.0}$ | $60.0^{+1.0}_{0}$ | $13.0^{\pm0.2}$ | $4.5^{\pm0.5}$ | $7.0^{\pm0.5}$ |
| 8mm Width | $180.0^{\ 0}_{-1.5}$ | | | $9.0^{+1.0}_{0}$ | $11.4^{\pm1.0}$ |
| 12mm Width | | | | $13.0^{+1.0}_{0}$ | $15.4^{\pm1.0}$ |
| 24mm Width | $380.0^{\pm2.0}$ | $80.0^{\pm1.0}$ | | $25.4^{\pm1.0}$ | $29.4^{\pm1.0}$ |

## Recommended Land Pattern

● An example of a land pattern for the Rectangular Type is shown below.



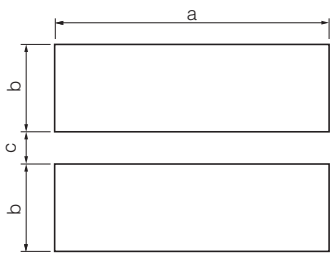

High power (double-sided resistive elements structure) type

| Part No. | Size mm/inch | Dimensions (mm) | | |
|---|---|---|---|---|
| | | a | b | c |
| ERJ2LW/2BW | 1005/0402 | 0.52 | 1.4 to 1.6 | 0.4 to 0.6 |
| ERJ3LW/3BW | 1608/0603 | 0.5 to 0.8 | 2.5 to 2.7 | 0.9 to 1.1 |
| ERJ6BW | 2012/0805 | 0.9 | 3.2 to 3.8 | 1.1 to 1.4 |
| ERJ8BW | 3216/1206 | 1.2 | 4.4 to 5.0 | 1.3 to 1.8 |
| ERJ8CW (10 to 16 mΩ) | | | | |
| ERJ8CW (18 to 50 mΩ) | 3216/1206 | 2.0 to 2.6 | 4.4 to 5.0 | 1.2 to 1.8 |

| Size mm/inch | Dimensions (mm) | | |
|---|---|---|---|
| | a | b | c |
| 0402/01005 | 0.15 to 0.20 | 0.5 to 0.7 | 0.20 to 0.25 |
| 0603/0201 | 0.3 to 0.4 | 0.8 to 0.9 | 0.25 to 0.35 |
| 1005/0402 | 0.5 to 0.6 | 1.4 to 1.6 | 0.4 to 0.6 |
| 1608/0603 | 0.7 to 0.9 | 2.0 to 2.2 | 0.8 to 1.0 |
| 2012/0805 | 1.0 to 1.4 | 3.2 to 3.8 | 0.9 to 1.4 |
| 3216/1206 | 2.0 to 2.4 | 4.4 to 5.0 | 1.2 to 1.8 |
| 3225/1210 | 2.0 to 2.4 | 4.4 to 5.0 | 1.8 to 2.8 |
| 4532/1812 | 3.3 to 3.7 | 5.7 to 6.5 | 2.3 to 3.5 |
| 5025/2010 | 3.6 to 4.0 | 6.2 to 7.0 | 1.8 to 2.8 |
| 6432/2512 | 5.0 to 5.4 | 7.6 to 8.6 | 2.3 to 3.5 |
| 6432/2512* | 3.6 to 4.0 | 7.6 to 8.6 | 2.3 to 3.5 |

✻ ERJL1W

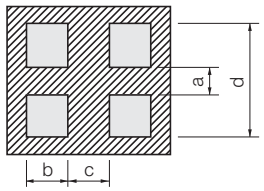
● An example of a land pattern for High Power Chip Resistors / Wide Terminal Type is shown below.

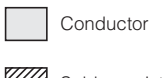


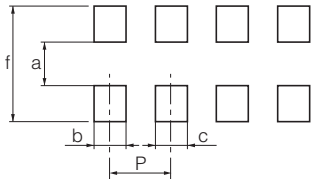

| Part No. | Dimensions (mm) | | |
|---|---|---|---|
| | a | b | c |
| ERJA1 | 6.4 | 1.70 | 0.60 |
| ERJB1 ERJC1(1) | 5.0 | 1.30 | 0.75 |
| ERJB2 | 3.2 | 0.95 | 0.70 |
| ERJB3 | 2.0 | 0.80 | 0.60 |

(1) Anti-Sulfurated High Power Chip Resistors / Wide Terminal Type

● An example of a land pattern for Chip Resistor Array, Metal Film Chip Resistor Array, Anti-Sulfurated Chip Resistor Array and Chip Attenuator is shown below.

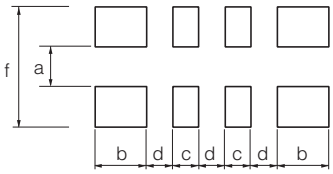


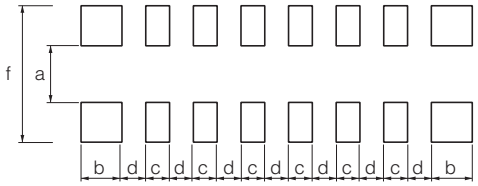




| Part No. | Dimensions (mm) | | | |
|---|---|---|---|---|
| | a | b | c | d |
| EXB14V<br>EXB14A | 0.30 | 0.30 | 0.30 | 0.80 to 0.90 |
| EXB24V<br>EXBU24<br>EXB24A | 0.5 | 0.35 to 0.40 | 0.30 | 1.4 to 1.5 |

| Part No. | Dimensions (mm) | | | | |
|---|---|---|---|---|---|
| | a | b | c | f | P |
| EXB18V | 0.20 to 0.30 | 0.15 to 0.20 | 0.15 to 0.20 | 0.80 to 0.90 | 0.40 |
| EXBV4V,V8V | 0.7 to 0.9 | 0.4 to 0.45 | 0.4 to 0.45 | 2 to 2.4 | 0.80 |
| EXB34V,38V<br>EXBU34,U38<br>ERA38V | 0.7 to 0.9 | 0.4 to 0.5 | 0.4 to 0.5 | 2.2 to 2.6 | 0.80 |
| EXBS8V | 1 to 1.2 | 0.5 to 0.75 | 0.5 to 0.75 | 3.2 to 3.8 | 1.27 |

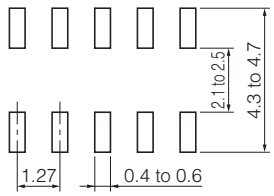
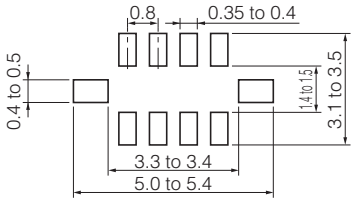
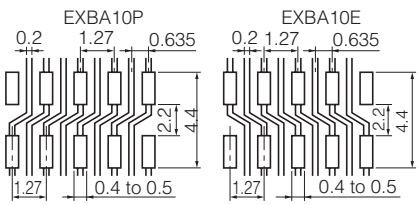
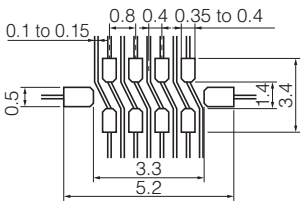
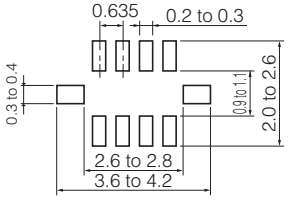
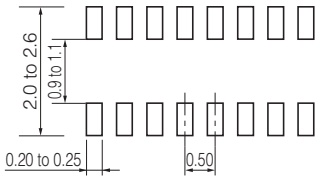



| Part No. | Dimensions (mm) | | | | |
|---|---|---|---|---|---|
| | a | b | c | d | f |
| EXB28V<br>EXBU28 | 0.40 | 0.525 | 0.25 | 0.25 | 1.40 |
| EXBN8V | 0.45 to 0.50 | 0.35 to 0.38 | 0.25 | 0.25 | 1.40 to 2.00 |

| Part No. | Dimensions (mm) | | | | |
|---|---|---|---|---|---|
| | a | b | c | d | f |
| EXB2HV<br>EXBU2H | 1.00 | 0.425 | 0.25 | 0.25 | 2.00 |

● An example of a land pattern for Chip Resistor Networks is shown below.

| | EXBA | EXBE |
|---|---|---|
| For popular pattern | Pitch 1.27 mm   | Pitch 0.8 mm   |
| For high density pattern* | Pitch 0.635 mm<br>Through-hole less   | Pitch 0.4 mm<br>Through-hole less   |
| | EXBD | EXBQ |
| For popular pattern | Pitch 0.635 mm   | Pitch 0.5 mm   |

✻ When designing high density land patterns, examine the reliability of isolation among the lines and adopt the chip resistor networks.

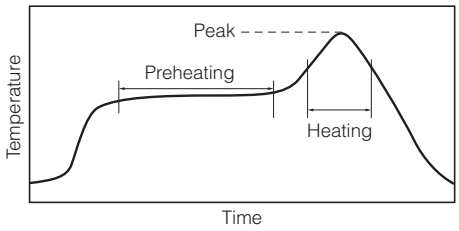
## Recommended Soldering Conditions

Recommendations and precautions are described below.

● Rectagular Type

● Recommended soldering conditions for reflow

· Reflow soldering shall be performed a maximum of two times.
· Please contact us for additional information when used in conditions other than those specified.
· Please measure the temperature of the terminals and study every kind of solder and printed circuit board for solderability before actual use.




For soldering (Example : Sn/Pb)

| | Temperature | Time |
|---|---|---|
| Preheating | 140 °C to 160 °C | 60 s to 120 s |
| Main heating | Above 200 °C | 30 s to 40 s |
| Peak | 235 ± 5 °C | max. 10 s |

For lead-free soldering (Example : Sn/Ag/Cu)

| | Temperature | Time |
|---|---|---|
| Preheating | 150 °C to 180 °C | 60 s to 120 s |
| Main heating | Above 230 °C | 30 s to 40 s |
| Peak | max. 260 °C | max. 10 s |

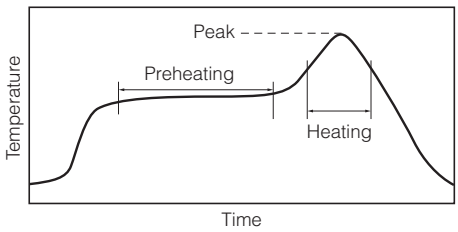
● Recommended soldering conditions for flow

| | For soldering | | For lead-free soldering | |
|---|---|---|---|---|
| | Temperature | Time | Temperature | Time |
| Preheating | 140 °C to 180 °C | 60 s to 120 s | 150 °C to 180 °C | 60 s to 120 s |
| Soldering | 245 ± 5 °C | 20 s to 30 s | max. 260 °C | max. 10 s |

● Chip Resistor Array, Chip Resistor Networks and Chip Attenuator

● Recommended soldering conditions for reflow

· Reflow soldering shall be performed a maximum of two times.
· Please contact us for additional information when used in conditions other than those specified.
· Please measure the temperature of the terminals and study every kind of solder and printed circuit board for solderability before actual use.




For soldering (Example : Sn/Pb)

| | Temperature | Time |
|---|---|---|
| Preheating | 140 °C to 160 °C | 60 s to 120 s |
| Main heating | Above 200 °C | 30 s to 40 s |
| Peak | 235 ± 5 °C | max. 10 s |

For lead-free soldering (Example : Sn/Ag/Cu)

| | Temperature | Time |
|---|---|---|
| Preheating | 150 °C to 180 °C | 60 s to 120 s |
| Main heating | Above 230 °C | 30 s to 40 s |
| Peak | max. 260 °C | max. 10 s |

● Flow soldering

We do not recommend flow soldering, because a solder bridge may form.
Please contact us regarding flow soldering of EXBA series.

## ⚠ Safety Precautions (Common precautions for Surface Mount Resistors)

The following are precautions for individual products. Please also refer to the common precautions for Fixed Resistors in this catalog.

1. Take measures against mechanical stress during and after mounting of Surface Mount Resistors (hereafter called the resistors) so as not to damage their electrodes and protective coatings.
   Be careful not to misplace the resistors on the land patterns. Otherwise, solder bridging may occur.
2. Keep the rated power and ambient temperature within the specified derating curve.
   Some circuit boards, wiring patterns, temperatures of heat generated by adjacent components, or ambient temperatures can become factors in the rise of the temperature of the resistors, regardless of the level of power applied. Therefore, check the conditions before use and optimize them so as not to damage the boards and peripheral components.
   Make sure to contact us before using the resistors under special conditions.
3. If a transient load (heavy load in a short time) like a pulse is expected to be applied, check and evaluate the operations of the resistors when installed in your products before use.
   Never exceed the rated power. Otherwise, the performance and/or reliability of the resistors may be impaired.
4. Before using halogen-based or other high-activity flux, check the possible effects of the flux residues on the performance and reliability of the resistors.
5. When soldering with a soldering iron, never touch the resistors'bodies with the tip of the soldering iron. When using a soldering iron with a high temperature tip, finish soldering as quickly as possible (within three seconds at 350 °C max.).
6. As the amount of applied solder becomes larger, the mechanical stress applied to the resistors increases, causing problems such as cracks and faulty characteristics. Avoid applying an excessive amounts of solder.
7. When the resistors' protective coatings are chipped, flawed, or removed, the characteristics of the resistors may be impaired. Take special care not to apply mechanical shock during automatic mounting or cause damage during handling of the boards with the resistors mounted.
8. Do not apply shock to the resistors or pinch them with a hard tool (e.g. pliers and tweezers). Otherwise, the resistors' protective coatings and bodies may be chipped, affecting their performance.
9. Avoid excessive bending of printed circuit boards in order to protect the resistors from abnormal stress.
10. Do not immerse the resistors in solvent for a long time. Before using solvent, carefully check the effects of immersion.
11. Transient voltage
    If there is a possibility that the transient phenomenon (significantly high voltage applied in a short time) may occur or that a high voltage pulse may be applied, make sure to evaluate and check the characteristics of Fixed Metal (Oxide) Film Resistors mounted on your product rather than only depending on the calculated power limit or steady-state conditions to complete the design or decide to use the resistors.
12. Do not apply excessive tension to the terminals.

# Metal (Oxide) Film Resistors

Type: **ERG(X)S (Small size)**
(0.5 W, 1 W, 2 W, 3 W, 5 W)
**ERG(X)F (Anti-heat conducting for PCB)**
(1 W, 2 W, 3 W, 5 W)

## Features

- Miniaturized
  50 % smaller compared to existing models
- Non-flammable
- High Reliability
- Automatic Insertion
- Reference Standards
  IEC 60115-2, IEC 60115-4, JIS C 5201-4, EIAJ RC-2138
- RoHS compliant

## Explanation of Part Numbers

Ex.1 : ERX type

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| E | R | X | | 2 | S | Z | J | W | 1 | R | 0 | E |

| Product Code | |
|---|---|
| ERX | Metal Film Resistors |

| Power Rating at 70 °C | |
|---|---|
| 12 | 0.5 W |
| 1 | 1 W |
| 2 | 2 W |
| 3 | 3 W |
| 5 | 5 W |

| Style · Specification | |
|---|---|
| S | Small size 0.5 W to 5 W |
| F | Small size Anti-heat conducting type (Fe lead wire) 1 W to 5 W |

| Resistance Tolerance | |
|---|---|
| J | ±5 % |
| G | ±2 % |

**Resistance Value**
The first two digits are significant figures of resistance and the third one denotes number of zeros following.
Decimal point is expressed by
(Ex.) 1R0 : 1.0 Ω

"Z" is added according to resistance.

| Part No. | Resistance Tolerance | Resistance Value Range (Ω) ERX□□SZ | Resistance Value Range (Ω) ERX□□S |
|---|---|---|---|
| ERX12S | ±5 % | 0.10 to 0.18 | 0.20 to 9.1 |
| | ±2 % | 0.10 to 0.91 | 1.0 to 9.1 |
| ERX1S | ±5 % | 0.10 to 0.18 | 0.20 to 9.1 |
| ERX1F | ±2 % | 0.10 to 0.91 | 1.0 to 9.1 |
| ERX2S | ±5 % | 0.10 to 0.20 | 0.22 to 9.1 |
| ERX2F | ±2 % | 0.10 to 0.91 | 1.0 to 9.1 |
| ERX3S | ±5 % | 0.10 to 0.20 | 0.22 to 9.1 |
| ERX3F | ±2 % | 0.10 to 0.91 | 1.0 to 9.1 |
| ERX5S | ±5 % | — | 0.33 to 9.1 |
| ERX5F | ±2 % | | 1.0 to 9.1 |

The matrix of forming and packaging is as shown in the table below.

| Code | Forming / Packaging | Forming & Taping matrix 12S | 1S | 2S | 3S | 5S | 1F | 2F | 3F | 5F |
|---|---|---|---|---|---|---|---|---|---|---|
| □···□ | Straight lead wire type | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| □···P | Cut & Forming type | ○ | ○ | ○ | ○ | ○ | | | | |
| □···V | Axial taping type (Straight lead) | ○ | ○ | ○ | ○ | | ○ | ○ | ○ | |
| U···V | Axial taping type (Stand off) | | ○ | ○ | ○ | | | | | |
| □···E | Radial taping type (E type) | ○ | ○ | ○ | | | | | | |
| W···E | Radial taping type (WE type) | ○ | ○ | ○ | ○ | | | | | |
| □···H | Cut & Forming type | | | | | | ○ | ○ | ○ | ○ |
| S···E | Radial taping type (SE type) | | | | | | ○ | ○ | ○ | |

The above example 1 shows a small metal film resistor, 2 W power rating, resistance value of 1.0 Ω, tolerance ±5 %, and package of radial taping.

Ex.2 : ERG type

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| E | R | G | | 2 | S | J | W | 1 | 0 | 3 | E |

| Product Code | |
|---|---|
| ERG | Metal Oxide Film Resistors |

| Power Rating at 70 °C | |
|---|---|
| 12 | 0.5 W |
| 1 | 1 W |
| 2 | 2 W |
| 3 | 3 W |
| 5 | 5 W |

| Style · Specification | |
|---|---|
| S | Small size 0.5 W to 5 W |
| F | Small size Anti-heat conducting type (Fe lead wire) 1 W to 5 W |

| Resistance Tolerance | |
|---|---|
| J | ±5 % |
| G | ±2 % |

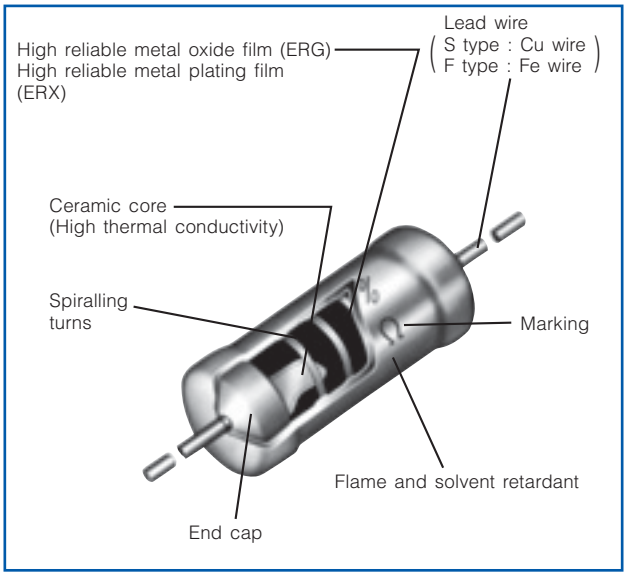
**Resistance Value**
The first two digits are significant figures of resistance and the third one denotes number of zeros following.
Decimal point is expressed by
(Ex.) 103 : 10 kΩ

The matrix of forming and packaging is as shown in the table below.

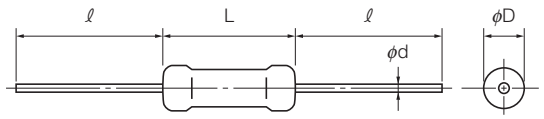
| Code | Forming / Packaging | Forming & Taping matrix 12S | 1S | 2S | 3S | 5S | 1F | 2F | 3F | 5F |
|---|---|---|---|---|---|---|---|---|---|---|
| □···□ | Straight lead wire type | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| □···P | Cut & Forming type | ○ | ○ | ○ | ○ | ○ | | | | |
| □···V | Axial taping type(Straight lead) | ○ | ○ | ○ | ○ | | ○ | ○ | ○ | |
| U···V | Axial taping type(Stand off) | | ○ | ○ | ○ | | | | | |
| □···E | Radial taping type(E type) | ○ | ○ | ○ | | | | | | |
| W···E | Radial taping type(WE type) | ○ | ○ | ○ | ○ | | | | | |
| □···H | Cut & Forming type | | | | | ○ | ○ | ○ | ○ | ○ |
| S···E | Radial taping type(SE type) | | | | | ○ | ○ | ○ | | |

The above example 2 shows a small metal oxide film resistor, 2 W power rating, resistance value of 10 kΩ, tolerance ±5 %, and package of radial taping.

## Construction




## Dimensions in mm (not to scale)




| Part No. | Dimensions (mm) | | | | Mass (Weight) [g/pc.] |
|---|---|---|---|---|---|
| | L | ϕD | ℓ | ϕd | |
| ERG(X)12S | $6.35^{+0.65}_{-0.35}$ | $2.3^{+0.5}_{-0.3}$ | $30.0^{\pm3.0}$ | $0.65^{\pm0.05}$ | 0.26 |
| ERG(X)1S | $9.00^{+1.50}_{-1.00}$ | $2.8^{\pm0.5}$ | $30.0^{\pm3.0}$ | $0.65^{\pm0.05}$ | 0.33 |
| ERG(X)1F | | | | $0.80^{\pm0.05}$ | |
| ERG(X)2S<br>ERG(X)2F | $12.00^{+1.50}_{-1.00}$ | $4.0^{\pm1.0}$ | $30.0^{\pm3.0}$ | $0.80^{\pm0.05}$ | 0.66 |
| ERG(X)3S<br>ERG(X)3F | $15.00^{\pm1.50}$ | $5.5^{\pm1.0}$ | $38.0^{\pm3.0}$ | $0.80^{\pm0.05}$ | 1.47 |
| ERG(X)5S<br>ERG(X)5F | $24.00^{\pm1.50}$ | $8.0^{\pm1.0}$ | $38.0^{\pm3.0}$ | $0.80^{\pm0.05}$ | 3.54 |

## Ratings

| Part No. | Power Rating at 70 °C (W) | Limiting Element Voltage(1) (V) | Maximum Overload Voltage(2) (V) | Maximum Intermittent Overload Voltage(3) (V) | Dielectric Withstanding Voltage (VAC) | Res. Tol. (%)(4) | Resistance Range (Ω)(5) min.(6) | Resistance Range (Ω)(5) max. | T.C.R. (×10⁻⁶/°C) | Standard Resistance Value |
|---|---|---|---|---|---|---|---|---|---|---|
| ERG(X)12S | 0.5 | 300 | 600 | 600 | 350 | G (±2) | 1 | 22 k | ±350 | E24 |
| | | | | | | J (±5) | 0.2 | 47 k | | |
| ERG(X)1S<br>ERG(X)1F | 1 | 350 | 600 | 600 | 350 | G (±2) | 1 | 68 k | ±350 | E24 |
| | | | | | | J (±5) | 0.2 | 100 k | | |
| ERG(X)2S<br>ERG(X)2F | 2 | 350 | 700 | 1000 | 600 | G (±2) | 1 | 100 k | ±350 | E24 |
| | | | | | | J (±5) | 0.22 | 100 k | | |
| ERG(X)3S<br>ERG(X)3F | 3 | 350 | 700 | 1000 | 1000 | G (±2) | 1 | 100 k | ±300 | E24 |
| | | | | | | J (±5) | 0.22 | 100 k | | |
| ERG(X)5S<br>ERG(X)5F | 5 | 500 | 1000 | 1500 | 1000 | G (±2) | 1 | 100 k | ±200 | E24 |
| | | | | | | J (±5) | 0.33 | 100 k | | |

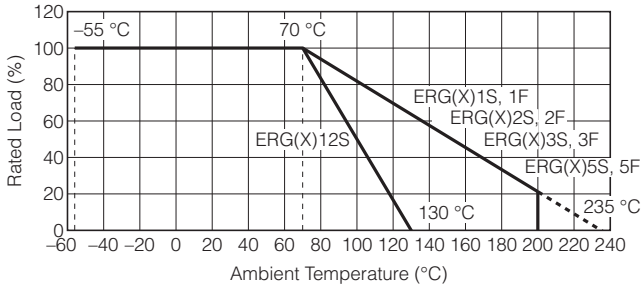
(1) Rated Continuous Working Voltage (RCWV) shall be determined from RCWV=$\sqrt{\text{Power Rating}\times\text{Resistance Value}}$ or Limiting Element Voltage listed above whichever less.
(2) Overload (Short-time Overload) Test Voltage (SOTV) shall be determined from SOTV=2.5×Power Rating or max. Overload Voltage listed above whichever less.
(3) Intermittent Overload Test Voltage (IOTV) shall be determined from IOTV=4.0×Power Rating or max. Intermittent Overload Voltage listed above whichever less.
(4) Resistance tolerance is of use besides range listed, please inquire.
(5) Resistance Range Type ERG : ≧10 Ω
Type ERX : ≦9.1 Ω
(6) As for the low resistance value range, "Z" is given to the part number. (Refer to the explanation of part numbers.)

✻ Z type is non standard resistance values.

| Code | Part No. | Res.Tol. | Res. Value Range | Code | Part No. | Res.Tol. | Res. Value Range |
|---|---|---|---|---|---|---|---|
| Z | 12S | ±2 % | 0.1 to 0.91 Ω | Z | 2S | ±2 % | 0.1 to 0.91 Ω |
| | | ±5 % | 0.1 to 0.18 Ω | | 2F | ±5 % | 0.1 to 0.2 Ω |
| | 1S | ±2 % | 0.1 to 0.91 Ω | | 3S | ±2 % | 0.1 to 0.91 Ω |
| | 1F | ±5 % | 0.1 to 0.18 Ω | | 3F | ±5 % | 0.1 to 0.2 Ω |

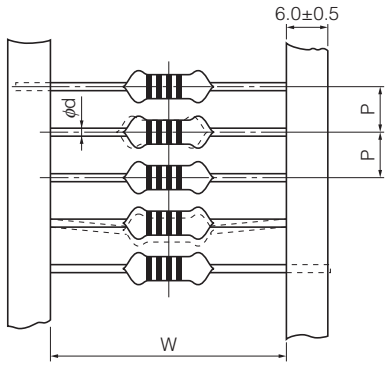
### Power Derating Curve

For resistors operated in ambient temperatures above 70 °C, power rating shall be derated in accordance with the figure on the right.



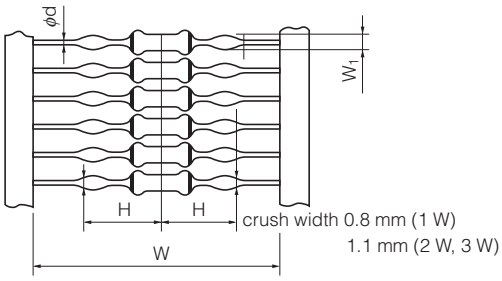
## Taped & Box

ERG(X)□□S□□□□V

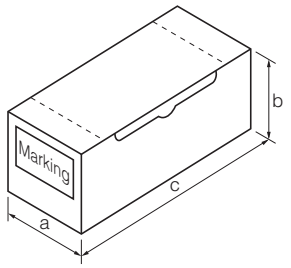



## Stand-off Taped & Box

ERG(X)□□S□U□□□V

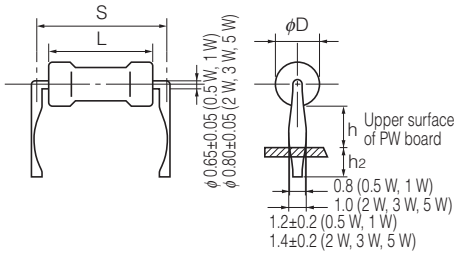



| Part Number | Standard Quantity (pcs./box) | Taping (mm) | | | | | | Box (mm) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | P | 50×P | W | H | W1 | ϕd | a | b | c |
| ERG(X) 12S□□□□□V | 2,000 | $5.0^{\pm0.3}$ | $250^{\pm2}$ | $52.0^{\pm1.5}$ | — | — | $0.65^{\pm0.05}$ | 85 | 80 | 255 |
| ERG(X) 1S□□□□□V | 2,000 | $5.0^{\pm0.3}$ | $250^{\pm2}$ | $52.0^{\pm1.5}$ | — | — | $0.65^{\pm0.05}$ | 85 | 80 | 255 |
| ERG(X) 1S□U□□□V | | | | | $12.0^{0}_{-2.0}$ | $1.20^{+0.15}_{0}$ | | | | |
| ERG(X) 2S□□□□□V | 1,000 | $5.0^{\pm0.3}$ | $250^{\pm2}$ | $52.0^{\pm1.5}$ | — | — | $0.80^{\pm0.05}$ | 85 | 80 | 255 |
| ERG(X) 2S□U□□□V | | | | | $15.5^{0}_{-2.0}$ | $1.40^{+0.15}_{0}$ | | | | |
| ERG(X) 3S□□□□□V | 1,000 | $10.0^{\pm0.5}$ | $500^{\pm2}$ | $74.0^{\pm2.0}$ | — | — | $0.80^{\pm0.05}$ | 105 | 100 | 325 |
| ERG(X) 3S□U□□□V | | | | | $23.0^{0}_{-2.0}$ | $1.4^{+0.15}_{0}$ | | | | |



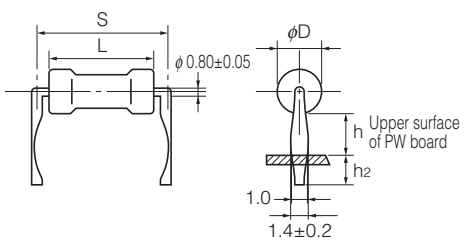

## Cut & Formed Type

ERG(X)□□S□□□□P




| Part Number | Standard Quantity (pcs./box) | Dimensions (mm) | | | | |
|---|---|---|---|---|---|---|
| | | L | ϕD | S | h | h2 |
| ERG(X) 12S□□□□P | 1,000 | $6.35^{+0.65}_{-0.35}$ | $2.3^{+0.5}_{-0.3}$ | $10.0^{\pm1.5}$ | $4.0^{\pm1.5}$ | $4.0^{\pm1.5}$ |
| ERG(X) 1S□□□□P | 1,000 | $9.00^{+1.50}_{-1.00}$ | $2.8^{\pm0.5}$ | $12.5^{\pm1.5}$ | $4.0^{\pm1.5}$ | $4.0^{\pm1.5}$ |
| ERG(X) 2S□□□□P | 1,000 | $12.00^{+1.50}_{-1.00}$ | $4.0^{\pm1.0}$ | $15.0^{\pm1.5}$ | $6.0^{\pm1.5}$ | $4.0^{\pm1.5}$ |
| ERG(X) 3S□□□□P | 1,000 | $15.00^{\pm1.50}$ | $5.5^{\pm1.0}$ | $20.0^{\pm2.0}$ | $6.5^{\pm1.5}$ | $4.0^{\pm1.5}$ |
| ERG(X) 5S□□□□P | 500 | $24.00^{\pm1.50}$ | $8.0^{\pm1.0}$ | $30.0^{\pm2.0}$ | $7.5^{\pm1.5}$ | $4.0^{\pm1.5}$ |

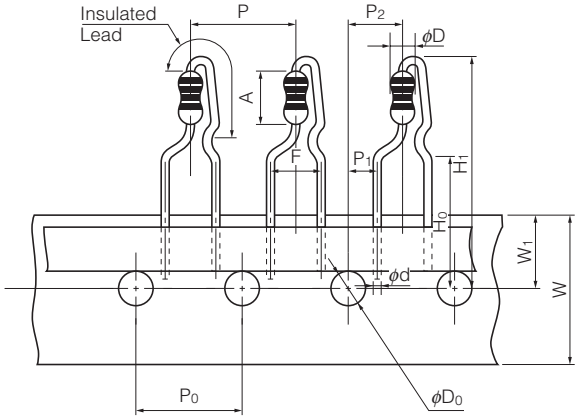
ERG(X)□F□□□□H




| Part Number | Standard Quantity (pcs./box) | Dimensions (mm) | | | | |
|---|---|---|---|---|---|---|
| | | L | ϕD | S | h | h2 |
| ERG(X)1F□□□□H | 1,000 | $9.0^{+1.5}_{-1.0}$ | $2.8^{\pm0.5}$ | $12.5^{\pm1.5}$ | $8^{\pm2}$ | $4.0^{\pm1.5}$ |
| ERG(X)2F□□□□H | 1,000 | $12.0^{+1.5}_{-1.0}$ | $4.0^{\pm1.0}$ | $15.0^{\pm1.5}$ | $6^{\pm2}$ | $5.0^{\pm1.5}$ |
| ERG(X)3F□□□□H | 1,000 | $15.0^{\pm1.5}$ | $5.5^{\pm1.0}$ | $20.0^{\pm2.0}$ | $10^{\pm2}$ | $5.0^{\pm1.5}$ |
| ERG(X)5F□□□□H | 500 | $24.0^{\pm1.5}$ | $8.0^{\pm1.0}$ | $30.0^{\pm2.0}$ | $10^{\pm2}$ | $5.0^{\pm1.5}$ |

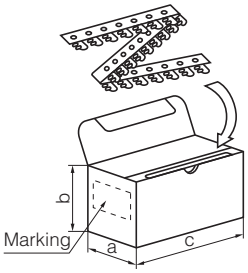
## For Panasert Automatic Insertion Machine Radial Taped & Box

ERG(X)□□S□□□□E (12S, 1S, 2S)




| Dimensions (mm) | | Dimensions (mm) | | Dimensions (mm) | | | Dimensions (mm) | | Dimensions (mm) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| P | 12.7±1.0 | W | 18.0±0.5 | H1 | 12S | 32 max. | A | 12S | $6.35^{+0.65}_{-0.35}$ | φD | 12S | $2.3^{+0.5}_{-0.3}$ |
| P0 | 12.7±0.3 | W1 | 9.0±0.5 | | 1S | 32 max. | | 1S | $9.0^{+1.5}_{-1.0}$ | | 1S | 2.8±0.5 |
| P1 | 3.85±0.70 | | | | 2S | 38 max. | | 2S | $12.0^{+1.5}_{-1.0}$ | | 2S | 4.0±1.0 |
| P2 | 6.35±1.00 | | | H0 | 16.0±0.5 | | φd | 0.65±0.05 | | | | |
| F | 5.0±0.8 | | | φD0 | 4.0±0.2 | | | | | | | |

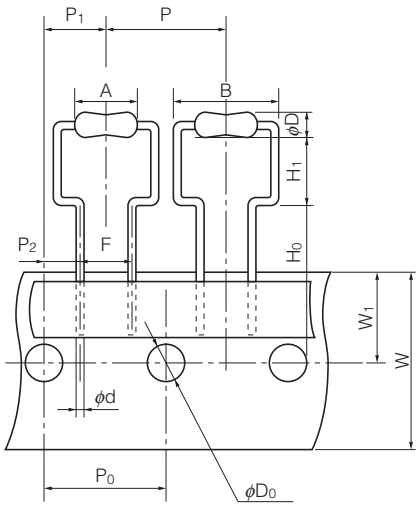
● Radial Tape Package Specifications




| Part Number | Dimensions (mm) | | | Standard Quantity (pcs./box) |
|---|---|---|---|---|
| | a | b | c | |
| ERG(X) 12S□□□□E | 46 | 130 | 335 | 2,000 |
| ERG(X) 1S□□□□E | 46 | 130 | 335 | 2,000 |
| ERG(X) 2S□□□□E | 49 | 100 | 335 | 1,000 |

## For Panasert Automatic Insertion Machine Radial Taped & Box

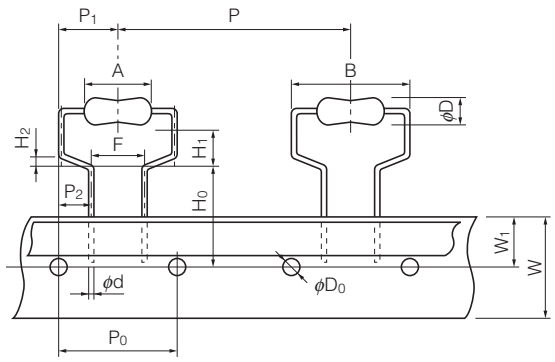
ERG(X)□□S□W□□□E (12S, 1S, 2S, 3S)




| Dimensions (mm) | | | Dimensions (mm) | | |
|---|---|---|---|---|---|
| P | 12S | 12.7±1.0 | φD0 | 12S, 1S, 2S, 3S | 4.0±0.2 |
| | 1S, 2S, 3S | 30.0±1.0 | A | 12S | $6.35^{+0.65}_{-0.35}$ |
| P0 | 12S | 12.7±0.3 | | 1S | $9.0^{+1.5}_{-1.0}$ |
| | 1S, 2S, 3S | 15.0±0.3 | | 2S | $12.0^{+1.5}_{-1.0}$ |
| P1 | 12S | 6.35±1.00 | | 3S | 15.0±1.5 |
| | 1S, 2S, 3S | 7.5±1.0 | B | 12S | 11.2 max. |
| P2 | 12S | 3.85±0.70 | | 1S | 14.0 max. |
| | 1S, 2S, 3S | 3.75±0.50 | | 2S | 17.0 max. |
| F | 12S | 5.0±0.5 | | 3S | 21.0 max. |
| | 1S, 2S, 3S | 7.5±0.8 | φD | 12S | $2.3^{+0.5}_{-0.3}$ |
| W | 12S, 1S, 2S, 3S | 18.0±0.5 | | 1S | 2.8±0.5 |
| W1 | 12S, 1S, 2S, 3S | 9.0±0.5 | | 2S | 4.0±1.0 |
| H0 | 12S | 16.0±0.5 | | 3S | 5.5±1.0 |
| | 1S, 2S | 18.0±1.0 | φd | 12S | φ0.65±0.05 |
| | 3S | 19.0±1.0 | | 1S, 2S, 3S | φ0.80±0.05 |
| H1 | 12S | $6.5^{+0.6}_{0}$ | | | |
| | 1S, 2S | $6.5^{+1.0}_{0}$ | | | |
| | 3S | $8.0^{+1.0}_{0}$ | | | |

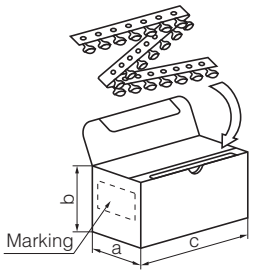
## For Panasert Automatic Insertion Machine Radial Taped & Box

ERG(X)□F□S□□□E (1F, 2F, 3F)




| Dimensions (mm) | | | Dimensions (mm) | | |
|---|---|---|---|---|---|
| P | 30.0±1.0 | | $H_2$ | 1.0±0.3 | |
| $P_0$ | 15.0±0.3 | | $\phi D_0$ | 4.0±0.2 | |
| $P_1$ | 7.5±1.0 | | A | 1F | $9.0^{+1.5}_{-1.0}$ |
| $P_2$ | 3.75±0.50 | | | 2F | $12.0^{+1.5}_{-1.0}$ |
| F | 7.5±0.8 | | | 3F | 15.0±1.5 |
| W | 18.0±0.5 | | B | 1F | 14 max. |
| $W_1$ | 9.0±0.5 | | | 2F | 17 max. |
| $H_0$ | $16.0^{+1.0}_{0}$ | | | 3F | 21 max. |
| $H_1$ | 1F | $7.0^{+1.0}_{0}$ | $\phi D$ | 1F | 2.8±0.5 |
| | 2F | $8.0^{+1.0}_{0}$ | | 2F | 4.0±1.0 |
| | 3F | $9.0^{+1.0}_{0}$ | | 3F | 5.5±1.0 |
| | | | $\phi d$ | 0.80±0.05 | |

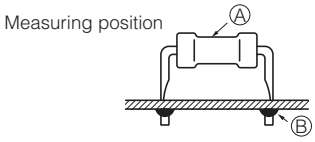
● Radial Tape Package Specifications

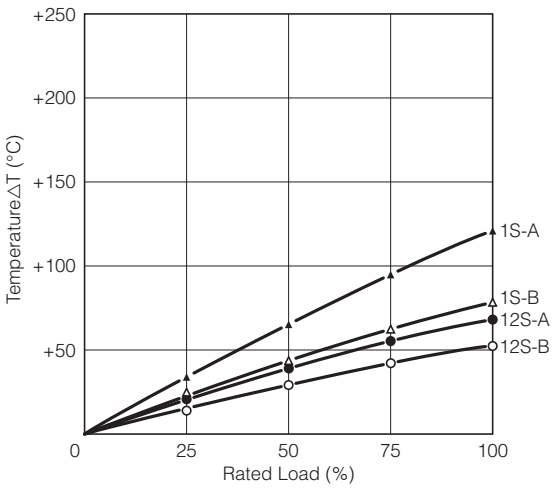


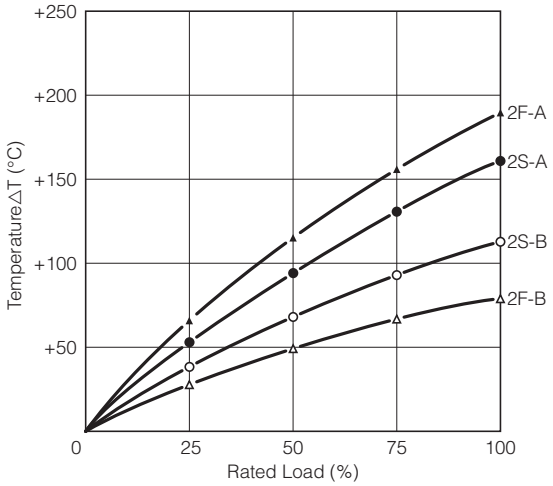

| Part No. | Dimensions (mm) | | | Standard Quantity (pcs./box) |
|---|---|---|---|---|
| | a | b | c | |
| ERG(X)12S□W□□□E | 46 | 145 | 325 | 2,000 |
| ERG(X) 1S□W□□□E | 49 | 150 | 317 | 1,000 |
| ERG(X) 1F□ S□□□E | | | | |
| ERG(X) 2S□W□□□E | 49 | 150 | 317 | 500 |
| ERG(X) 2F□ S□□□E | | | | |
| ERG(X) 3F□ S□□□E | 49 | 190 | 315 | 500 |

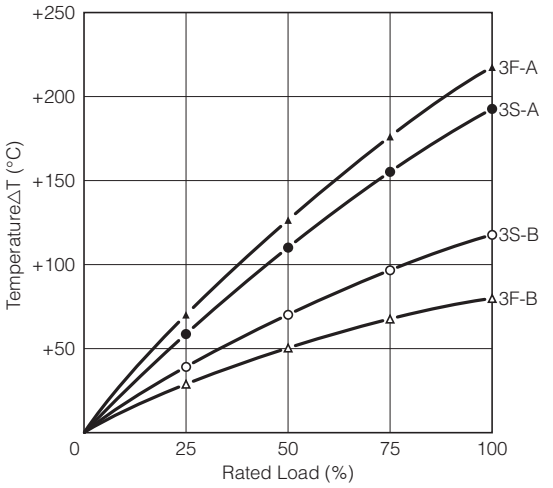
## Hot-spot Temperature (for Reference)

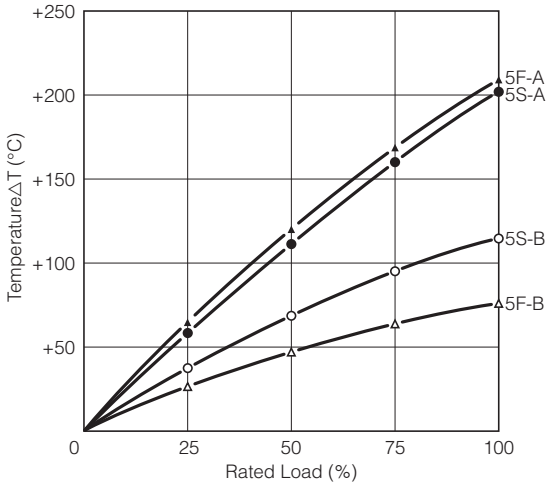
The temperature of the resistor body increases with the curve below. A touching vinyl wire may cause damages to resistor element. Do not place vinyl wires around resistors and be sure to consider where the resistors will be placed.



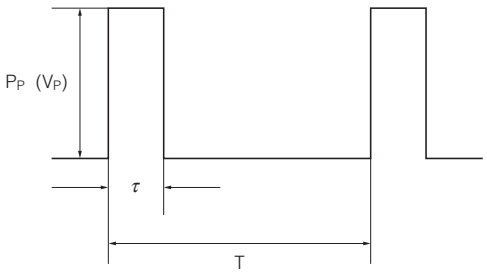

## ⚠ Safety Precautions

The following are precautions for individual products. Please also refer to the common precautions for Fixed Resistors in this catalog.

1. Transient voltage
   If there is a possibility that the transient phenomenon (significantly high voltage applied in a short time) may occur or that a high voltage pulse may be applied, make sure to evaluate and check the characteristics of Metal(Oxide) Film Resistors (hereafter called the resistors) mounted on your product rather than only depending on the calculated power limit or steady-state conditions to complete the design or decide to use the resistors.
2. The resistors are covered with a special coating. Do not apply shock or vibration to them, or pinch them with long-nose pliers. Otherwise, the resistors may be damaged.
3. Do not apply excessive tension to the lead-connected sections. When bending the lead wire, do not apply excessive stress to the resistors and provide the wire with a natural curvature.
4. Do not brush the resistors during or after the cleaning process, which may be conducted after soldering. Otherwise, the coating film may be damaged.

(Data for Reference)

## Pulse Characteristics (Usual)




$P_P$ : Pulse limit power (W)
$V_P$ : Pulse limit voltage (V)
$\tau$ : Pulse continuous time (s)
T : Period (s)
$V_R$ : Rated voltage (V)
P : Rated power (W)
R : Resistance value (Ω)
$V_{p\ max.}$ : Max. pulse limit voltage (V)

Withstand pulse limit power is calculated by the next method.

$P_P = K \cdot P \cdot T/\tau$

$V_P = \sqrt{K \cdot P \cdot R \cdot T/\tau}$

Reference to the right about a fixed number of $V_{P\ max.}$

- T>1(s) → T=1(s)
- $T/\tau$>100 → $T/\tau$=100
- $P_P$<P → P stands for $P_P$
  ($V_P$<$V_R$ → $V_R$ stands for $V_P$)
- Added voltage≦$V_{p\ max.}$
- $P_P$ or $V_P$ is referent value
  Conditions: Pulse added time=1000 h
  Resistance change=±5 %
  Room temperature

| Part No. | K | $V_{P\ max.}$ (V) |
|---|---|---|
| ERG(X) 12S | 0.5 | 600 |
| ERG(X) 1S | 0.5 | 600 |
| ERG(X) 2S | 0.5 | 700 |
| ERG(X) 3S | 0.5 | 700 |
| ERG(X) 5S | 0.5 | 1000 |

# Anti-Pulse Power Resistors

Type: **ERGD**
(0.5 W, 1 W, 2 W, 3 W)

## Features

- Miniaturized
- Non-flammable
- Anti-Pulse Characteristic
- Automatic Insertion
- RoHS compliant

## Explanation of Part Numbers

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| E | R | G | | 2 | D | J | | 2 | 2 | 4 | |

| Product Code |
|---|
| Anti-Pulse Power Resistors |

| Power Rating | |
|---|---|
| 12 | 0.5 W |
| 1 | 1 W |
| 2 | 2 W |
| 3 | 3 W |

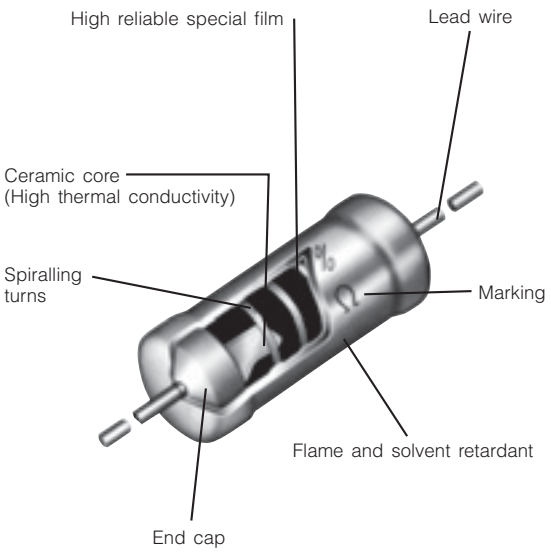
| Resistance Tolerance | |
|---|---|
| G | ±2 % |
| J | ±5 % |

| Resistance Value |
|---|
| The first two digits are significant figures of resistance and the third one denotes number of zeros following.<br><br>(Ex.) 224 : 220 kΩ |

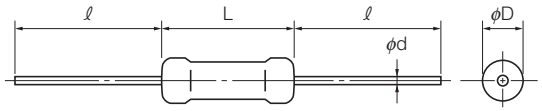
| Code | Forming / Packaging | Forming & Taping matrix | | | |
|---|---|---|---|---|---|
| | | 12D | 1D | 2D | 3D |
| □···□ | Straight lead wire type | ○ | ○ | ○ | ○ |
| □···V | Axial paping type (Straight lead) | ○ | ○ | ○ | ○ |
| □···P | Cut & Forming type | ○ | ○ | ○ | ○ |
| U···V | Axial paping type (Stand off) | | ○ | ○ | |
| □···E | Radial Taping type (E type) | ○ | ○ | ○ | |
| W···E | Radial Taping type (WE type) | ○ | ○ | ○ | ○ |

The above example shows an anti-pulse resistor, 2 W power rating, resistance value of 220 k ohms, tolerance ±5 %, and package of standard bulk packing.

## Construction




## Dimensions in mm (not to scale)




| Part No. | Dimensions (mm) | | | | Mass (Weight) [g/pc.] |
|---|---|---|---|---|---|
| | L | ϕD | ℓ | ϕd | |
| ERG12D | $6.35^{+0.65}_{-0.35}$ | $2.3^{+0.5}_{-0.3}$ | $30.0^{\pm3.0}$ | $0.65^{\pm0.05}$ | 0.26 |
| ERG1D | $9.00^{+1.50}_{-1.00}$ | $2.8^{\pm0.5}$ | $30.0^{\pm3.0}$ | $0.65^{\pm0.05}$ | 0.33 |
| ERG2D | $12.00^{+1.50}_{-1.00}$ | $4.0^{\pm1.0}$ | $30.0^{\pm3.0}$ | $0.80^{\pm0.05}$ | 0.66 |
| ERG3D | $15.00^{\pm1.50}$ | $5.5^{\pm1.0}$ | $38.0^{\pm3.0}$ | $0.80^{\pm0.05}$ | 1.47 |

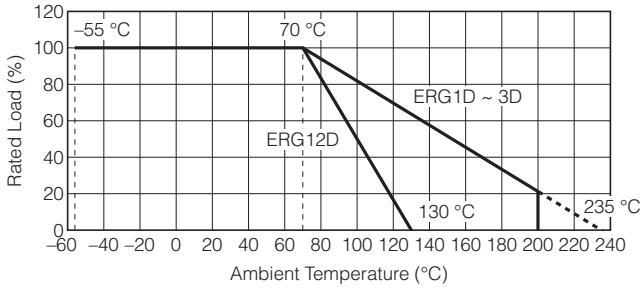
## Ratings

| Part No. | Power Rating at 70 °C (W) | Limiting Element Voltage(1) (V) | Maximum Overload Voltage(2) (V) | Maximum Intermittent Overload Voltage(3) (V) | Dielectric Withstanding Voltage (VAC) | Res. Tol. (%) | Resistance Range (Ω) (4) | | Standard Resistance Value |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | min. | max. | |
| ERG12D | 0.5 | 400 | 800 | 800 | 500 | J (±5)<br>G (±2) | 51 k | 240 k | E24 |
| ERG1D | 1 | 500 | 1000 | 1000 | 500 | J (±5)<br>G (±2) | 110 k | 330 k | E24 |
| ERG2D | 2 | 500 | 1000 | 1000 | 700 | J (±5)<br>G (±2) | 110 k | 510 k | E24 |
| ERG3D | 3 | 500 | 1000 | 1000 | 700 | J (±5)<br>G (±2) | 110 k | 750 k | E24 |

(1) Rated Continuous Working Voltage (RCWV) shall be determined from RCWV=$\sqrt{\text{Power Rating}\times\text{Resistance Value}}$ or Limiting Element Voltage listed above whichever less.
(2) Overload (Short-time Overload) Test Voltage (SOTV) shall be determined from SOTV=2.5×Power Rating or max. Overload Voltage listed above whichever less.
(3) Intermittent Overload Test Voltage (IOTV) shall be determined from IOTV=4.0×Power Rating or max. Intermittent Overload Voltage listed above whichever less.
(4) Resistance tolerance and resistance range is of use besides range listed, please inquire.

### Power Derating Curve

For resistors operated in ambient temperatures above 70 °C, power rating shall be derated in accordance with the figure on the right.




## ■ As for Packaging Methods and / or cut formed leads,

Please see Metal (Oxide) Film Resistors Packaging Methods

### ⚠ Safety Precautions

The following are precautions for individual products. Please also refer to the common precautions for Fixed Resistors in this catalog.

1. Transient voltage
   If there is a possibility that the transient phenomenon (significantly high voltage applied in a short time) may occur or that a high voltage pulse may be applied, make sure to evaluate and check the characteristics of Anti-Pulse Power Resistors (hereafter called the resistors) mounted on your product rather than only depending on the calculated power limit or steady-state conditions to complete the design or decide to use the resistors.
2. The resistors are covered with a special coating. Do not apply shock or vibration to them, or pinch them with long-nose pliers. Otherwise, the resistors may be damaged.
3. Do not apply excessive tension to the lead-connected sections. When bending the lead wire, do not apply excessive stress to the resistors and provide the wire with a natural curvature.
4. Do not brush the resistors during or after the cleaning process, which may be conducted after soldering. Otherwise, the coating film may be damaged.

# Metal Film Resistors

Type: **ERXL (Low Resistance Value)**
(0.5 W, 1 W, 2 W)

## Features

- Miniaturized
- Non-flammable
- Automatic Insertion
- RoHS compliant

## Explanation of Part Numbers

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| E | R | X | | 2 | L | J | | 4 | 7 | M | |

| Product Code | |
|---|---|
| ERX | Metal Film Resistors |

| Power Rating | |
|---|---|
| 12 | 0.5 W |
| 1 | 1 W |
| 2 | 2 W |

| Special Feature | |
|---|---|
| L | Small size Low resistance value |

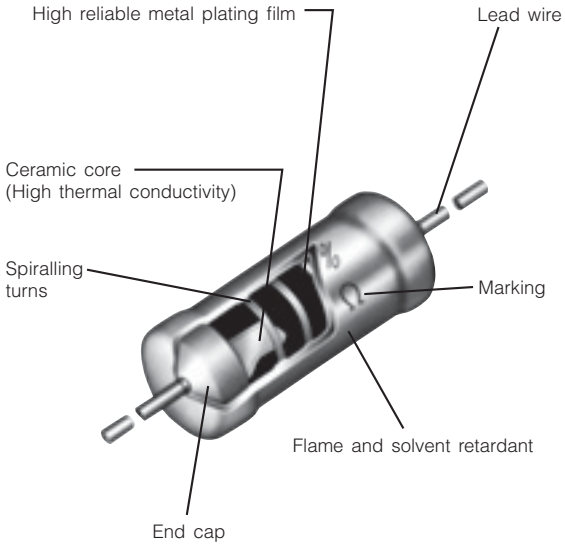
| Resistance Tolerance | |
|---|---|
| J | ±5 % |

| Resistance Value |
|---|
| The first two digits are significant figures of resistance and it shows by the unit of the "mΩ". Decimal point is expressed by M as 47 mΩ = 47M. |

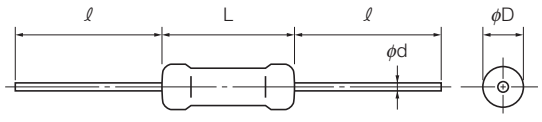
| Code | Forming / Packaging | Forming & Taping matrix | | |
|---|---|---|---|---|
| | | 12L | 1L | 2L |
| □···□ | Straight lead wire type | ○ | ○ | ○ |
| □···V | Axial paping type (Straight lead) | ○ | ○ | ○ |
| □···P | Cut & Forming type | ○ | ○ | ○ |
| □···E | Radial Taping type (E type) | ○ | ○ | ○ |
| W···E | Radial Taping type (WE type) | ○ | ○ | ○ |

The above example shows a small size and low resistance value metal film resistor, 2 W power rating, resistance value of 47 m ohms, tolerance ±5 %, and package of standard bulk packing.

## Construction




## Dimensions in mm (not to scale)




| Part No. | Dimensions (mm) | | | | Mass (Weight) [g/pc.] |
|---|---|---|---|---|---|
| | L | ϕD | ℓ | ϕd | |
| ERX12L | $6.35^{+0.65}_{-0.35}$ | $2.3^{+0.5}_{-0.3}$ | $30.0^{\pm3.0}$ | $0.65^{\pm0.05}$ | 0.26 |
| ERX1L | $9.00^{+1.50}_{-1.00}$ | $2.8^{\pm0.5}$ | $30.0^{\pm3.0}$ | $0.65^{\pm0.05}$ | 0.33 |
| ERX2L | $12.00^{+1.50}_{-1.00}$ | $4.0^{\pm1.0}$ | $30.0^{\pm3.0}$ | $0.80^{\pm0.05}$ | 0.66 |

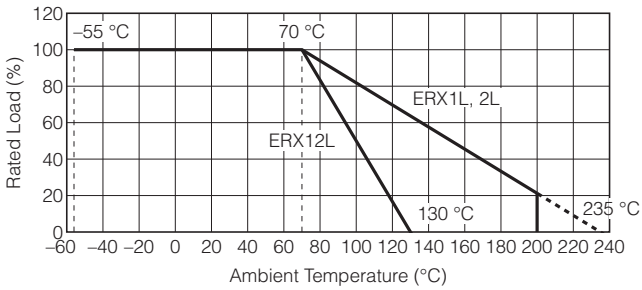
## Ratings

| Part No. | Power Rating at 70 °C (1) (W) | Dielectric Withstanding Voltage (VAC) | Res. Tol. (%) (2) | Resistance Range (Ω) (2) | | T.C.R. ($\times 10^{-6}$/°C) | Standard Resistance Value |
|---|---|---|---|---|---|---|---|
| | | | | min. | max. | | |
| ERX12L | 0.5 | 350 | J (±5) | 22 m | 82 m | 22 to 39 mΩ=±1000<br>47 to 82 mΩ=± 500 | E12 |
| ERX1L | 1 | 350 | J (±5) | 22 m | 82 m | | E12 |
| ERX2L | 2 | 600 | J (±5) | 22 m | 82 m | | E12 |

(1) Rated Continuous Working Voltage (RCWV) shall be determined from RCWV=$\sqrt{\text{Power Rating}\times\text{Resistance Value}}$.
(2) Resistance tolerance and resistance range is of use besides range listed, please inquire.

### Power Derating Curve

For resistors operated in ambient temperatures above 70 °C, power rating shall be derated in accordance with the figure on the right.




## ■ As for Packaging Methods and / or cut formed leads,

Please see Metal (Oxide) Film Resistors Packaging Methods

### ⚠ Safety Precautions

The following are precautions for individual products. Please also refer to the common precautions for Fixed Resistors in this catalog.

1. Transient voltage
   If there is a possibility that the transient phenomenon (significantly high voltage applied in a short time) may occur or that a high voltage pulse may be applied, make sure to evaluate and check the characteristics of Metal Film Resistors (hereafter called the resistors) mounted on your product rather than only depending on the calculated power limit or steady-state conditions to complete the design or decide to use the resistors.
2. The resistors are covered with a special coating. Do not apply shock or vibration to them, or pinch them with long-nose pliers. Otherwise, the resistors may be damaged.
3. Do not apply excessive tension to the lead-connected sections. When bending the lead wire, do not apply excessive stress to the resistors and provide the wire with a natural curvature.
4. Do not brush the resistors during or after the cleaning process, which may be conducted after soldering. Otherwise, the coating film may be damaged.

# Metal Film Fusing Resistors

Type: **ERQA**
**ERQZ**
(0.25 W, 0.5 W, 1 W, 2 W coating type )

## Features

- Accurate fusing
- Small size and lightweight
- Uniform quality, consistent performance and reliability
- Flame retardant, utilizing exclusive silicon insulation material
- Reference Standard
  EIAJ RC-2125
- RoHS compliant

## Explanation of Part Numbers

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| E | R | Q | | 2 | A | B | J | | 1 | 0 | 1 | |

**Product Code**
Metal Film Fusing Resistors

**Power Rating at 70 °C amb.**

| | |
|---|---|
| 14 | 0.25 W |
| 12 | 0.5 W |
| 1 | 1 W |
| 2 | 2 W |

**Special Feature**

| | |
|---|---|
| A | Standard |
| Z | Less than 2 Ω |
| AB | Standard |
| Z | Less than 2 Ω |

**Resistance Tolerance**

| | |
|---|---|
| J | ±5 % |

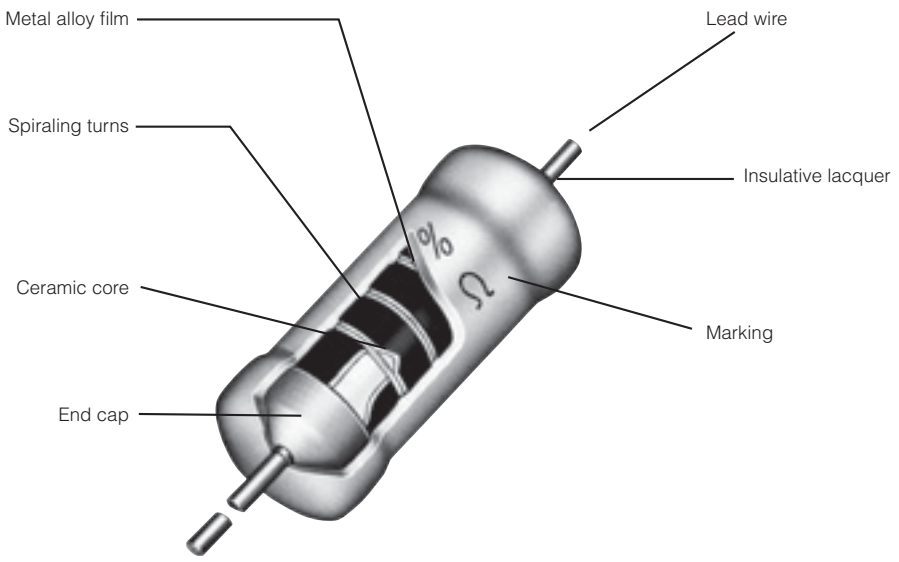
**Resistance Value**
The first two digits are significant figures of resistance and the third one denotes number of zeros following.Decimal point is expressed by R as 2.2=2R2.

**Suffix for Packaging and/or Cut & Formed Leads**

| | |
|---|---|
| Nil | Std.bulk packing |
| P | P type cut & formed |
| P···S | P···S type cut & formed |
| E | Radial Taped & Box |
| W···E | Radial Taped & Box |

The above example shows a standard Metal Film Fusing Resistors, 2 W power rating, resistance value of 100 Ω, tolerance of ±5 %, and package of standard bulk packing.

## Construction



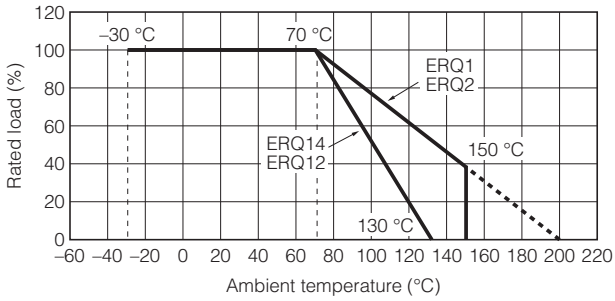
## Ratings

| Part No. | Power Rating at 70°C (W) | Maximum Open Circuit Voltage(1) (V) | Maximum Overload Voltage | Dielectric With-standing Voltage (V) | Resistance Tolerance (%) | Resistance Range (Ω) min. | Resistance Range (Ω) max. | T.C.R. ($\times 10^{-6}$/°C) | Standard Resistance Values | Marking Method on Body | Mass (Weight) [g/pc.] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ERQ14Z | 0.25 | 200 | 3 times of rated voltage(2) | AC 350 | J (± 5) | 1.0 | 1.8 | ±350 | E24 | Color code | 0.24 |
| ERQ14A | | | | | | 2.0 | 470 | | | | |
| ERQ12Z | 0.5 | 250 | | AC 350 | J (± 5) | 1.0 | 1.8 | ±350 | E24 | Stamp | 0.32 |
| ERQ12A | | | | | | 2.0 | 560 | | | Color code | |
| ERQ1Z | 1 | 250 | | AC 600 | J (± 5) | 1.0 | 1.8 | ±350 | E24 | Stamp | 0.64 |
| ERQ1AB | | | | | | 2.0 | 560 | | | | |
| ERQ2Z | 2 | 250 | | AC 1000 | J (± 5) | 1.0 | 1.8 | ±350 | E24 | Stamp | 1.54 |
| ERQ2AB | | | | | | 2.0 | 560 | | | | |

(1) Maximum Open Circuit Voltage: Referring to the maximum value of the voltage applied between terminals of the resistor when the resistor is opened in an electric circuit 1000 times power rating or voltage specified above whichever less is regarded as the maximum open circuit voltage.
(2) Rated Continuous Working Voltage (RCWV) shall be determined from RCWV=$\sqrt{\text{Power Rating} \times \text{Resistance Value}}$

### Power Derating Curve

For resistors operated in ambient temperatures above 70 °C, power rating shall be derated in accordance with the figure on the right.

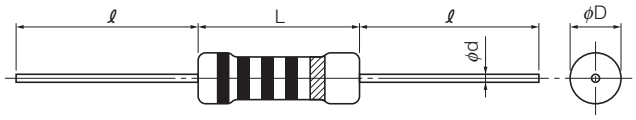



## Performance Specifications

| Characteristics | Specifications | Test Methods |
|---|---|---|
| Fusing Characteristics | See table below | The test potential shall be preadjusted using a dummy resistor and then be subjected to the test specimens. The potential shall be readjusted within two seconds to reach the exact value of specified current. This test shall be made under the conditions at 20 °C and 65 % RH (or at a temperature of 5 °C to 35 °C and 45 to 85 % RH, only when any doubt may not be caused), and the use of stabilized power source is suggested. Fusing time shall be measured as the duration until the circuit current is decreased to a 1/50 the initial test current or less. |

| Rated Power | Res. Value (Ω) | Limit |
|---|---|---|
| 0.25 W<br>0.5 W | 1 to 1.8 | Open within 30 seconds at 30 times the rated power |
| 1 W<br>2 W | | Open within 30 seconds at 25 times the rated power |
| 0.25 W<br>0.5 W<br>1 W<br>2 W | 2 to 9.1 | Open within 30 seconds at 16 times the rated power |
| 0.25 W | 10 to 470 | Open within 30 seconds at 12 times the rated power |
| 0.5 W<br>1 W<br>2 W | 10 to 560 | |

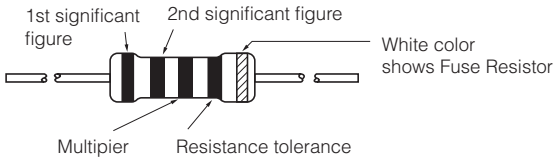
## Dimensions in mm (not to scale)



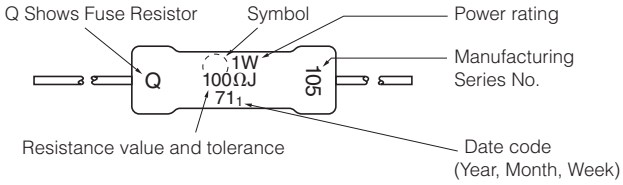

| Part No. | Dimensions (mm) | | | |
|---|---|---|---|---|
| | L | ϕD | ℓ | ϕd |
| ERQ14 | $6.3^{+1.5}_{-1.0}$ | $2.3^{\pm0.5}$ | $30.0^{\pm3.0}$ | $0.65^{\pm0.05}$ |
| ERQ12 | $9.0^{+1.5}_{-1.0}$ | $2.8^{\pm0.5}$ | $30.0^{\pm3.0}$ | $0.65^{\pm0.05}$ |
| ERQ1 | $12.0^{+1.5}_{-1.0}$ | $4.0^{\pm1.0}$ | $30.0^{\pm3.0}$ | $0.80^{\pm0.05}$ |
| ERQ2 | $15.0^{\pm1.5}$ | $5.5^{\pm1.0}$ | $38.0^{\pm3.0}$ | $0.80^{\pm0.05}$ |

## Explanation of Marking

Type ERQ14, ERQ12 (0.25 W, 0.5 W)

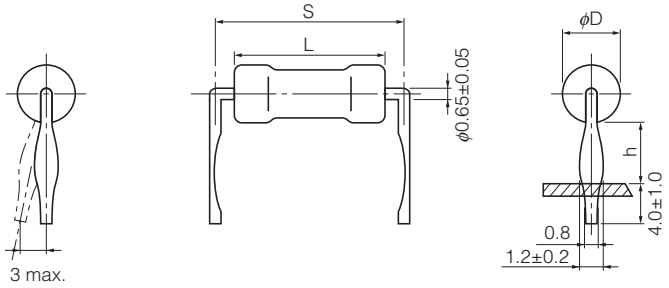



Type ERQ1, ERQ2 (1W, 2W)



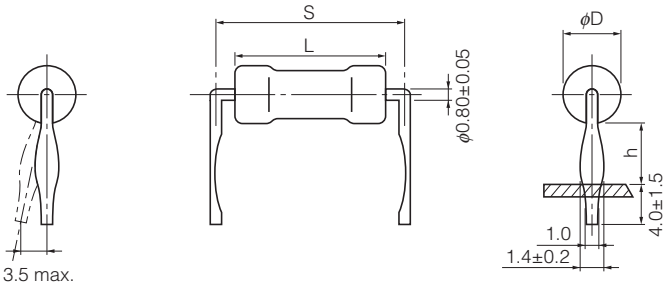

## Cut & Formed Type

ERQ□□AJ□□□P
ERQ□□ZJ□□□P




| Part No. | Power Rating at 70 °C (W) | Standard Q'ty/Packing (pcs.) | Dimensions (mm) | | | |
|---|---|---|---|---|---|---|
| | | | L | ϕD | S | h |
| ERQ14□J□□□P | 0.25 | 2,000 | $6.3^{+1.5}_{-1.0}$ | $2.3^{\pm0.5}$ | $10.0^{\pm1.5}$ | $4.0^{\pm1.5}$ |
| ERQ12□J□□□P | 0.5 | 2,000 | $9.0^{+1.5}_{-1.0}$ | $2.8^{\pm0.5}$ | $12.5^{\pm1.5}$ | $4.0^{\pm1.5}$ |

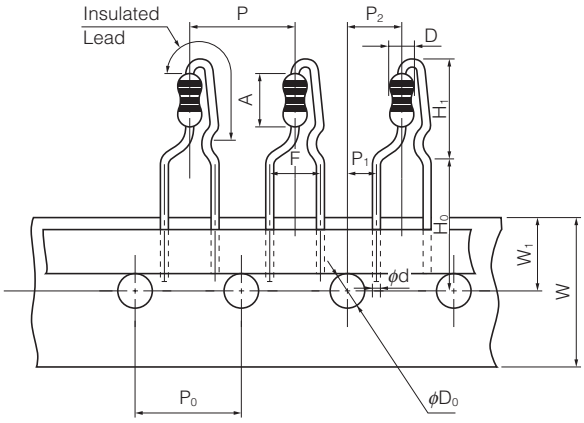
ERQ□ABJP□□□S
ERQ□ZJP□□□S




| Part No. | Power Rating at 70 °C (W) | Standard Q'ty/Packing (pcs.) | Dimensions (mm) | | | |
|---|---|---|---|---|---|---|
| | | | L | ϕD | S | h |
| ERQ1□□JP□□□S | 1 | 1,000 | $12.0^{+1.5}_{-1.0}$ | $4.0^{\pm1.0}$ | $15.0^{\pm1.5}$ | $6.0^{\pm1.5}$ |
| ERQ2□□JP□□□S | 2 | 1,000 | $15.0^{\pm1.5}$ | $5.5^{\pm1.0}$ | $20.0^{\pm2.0}$ | $6.5^{\pm1.5}$ |

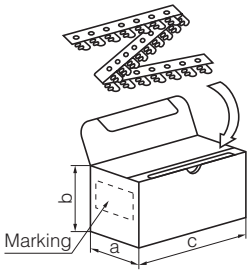
## For Panasert Automatic Insertion Machine Radial Taped & Box

ERQ□□AJ□□□E
ERQ□□ZJ□□□E
(14A/14Z, 12A/12Z, 1AB/1Z)




| Dimensions (mm) | | Dimensions (mm) | | Dimensions (mm) | | | Dimensions (mm) | | | Dimensions (mm) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| P | 12.7±1.0 | W | 18.0±0.5 | $H_1$ | 14A/14Z | 12 max. | A | 14A/14Z | $6.35^{+0.65}_{-0.35}$ | D | 14A/14Z | 2.3±0.5 |
| $P_0$ | 12.7±0.3 | $W_1$ | 9.0±0.5 | | 12A/12Z | 15.5 max. | | 12A/12Z | $9.0^{+1.5}_{-1.0}$ | | 12A/12Z | 2.8±0.5 |
| $P_1$ | 3.85±0.70 | | | | 1AB/1Z | 19 max. | | 1AB/1Z | $12.0^{+1.5}_{-1.0}$ | | 1AB/1Z | 4.0±1.0 |
| $P_2$ | 6.35±1.00 | | | $H_0$ | 16.0±0.5 | | ϕd | 0.65±0.05 | | | | |
| F | 5.0±0.8 | | | $\phi D_0$ | 4.0±0.2 | | | | | | | |

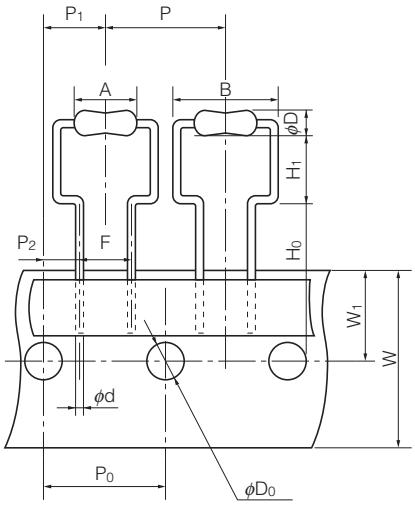
● Radial Tape Packaging Methods




| Part Number | Dimensions (mm) | | | Standard Quantity (pcs./box) |
|---|---|---|---|---|
| | a | b | c | |
| ERQ14AJ□□□E<br>ERQ14ZJ□□□E | 46 | 130 | 335 | 2,000 pcs./box |
| ERQ12AJ□□□E<br>ERQ12ZJ□□□E | 46 | 130 | 335 | 2,000 pcs./box |
| ERQ1ABJ□□□E<br>ERQ1ZJ□□□E | 49 | 100 | 335 | 1,000 pcs./box |

## For Panasert Automatic Insertion Machine Radial Taped & Box

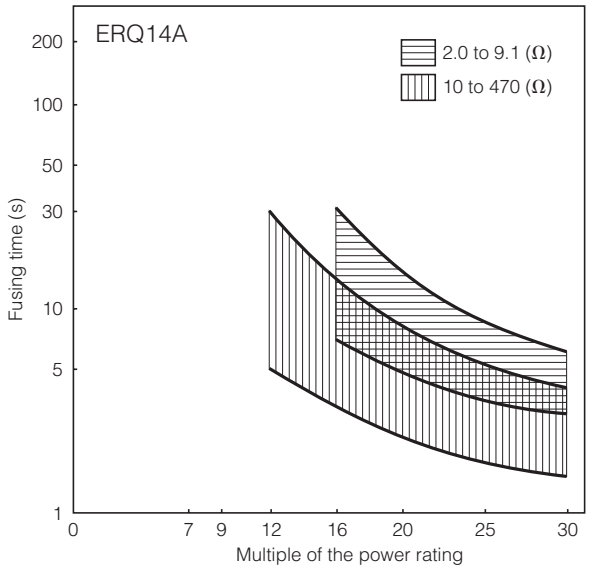
ERQ□□A/ZJW□□□E (14A/14Z, 12A/12Z, 1AB/1Z)

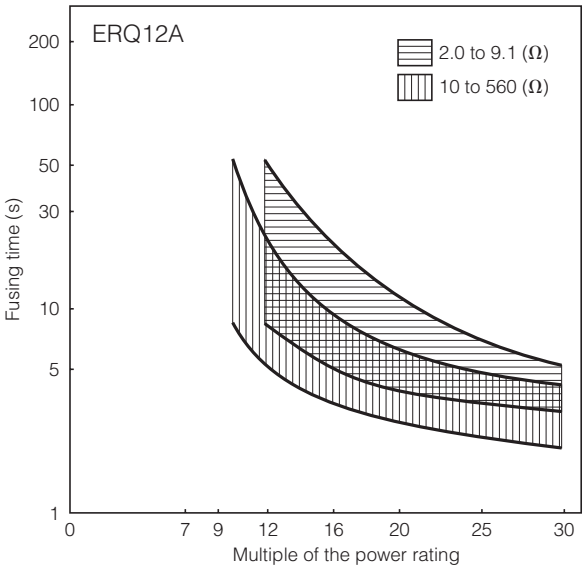


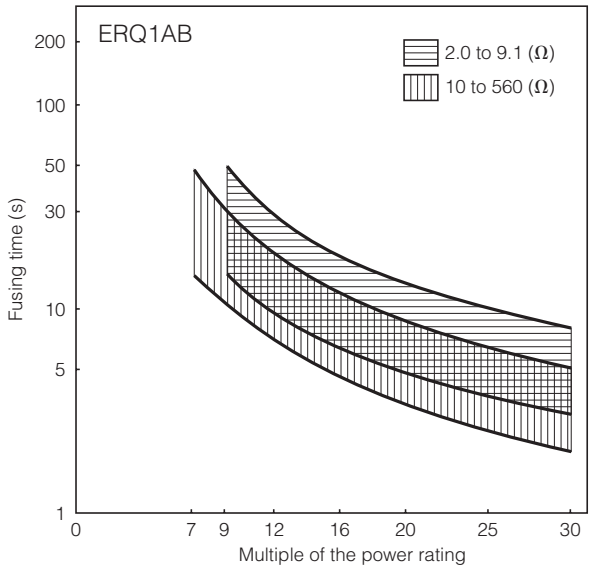

| Dimensions (mm) | | | Dimensions (mm) | | |
|---|---|---|---|---|---|
| P | 14A/14Z | 12.7±1.0 | $H_1$ | 14A/14Z | $6.5^{+0.6}_{0}$ |
| | 12A/12Z, 1AB/1Z | 30.0±1.0 | | 12A/12Z | $6.5^{+1.0}_{0}$ |
| $P_0$ | 14A/14Z | 12.7±0.3 | | 1AB/1Z | $6.5^{+1.0}_{0}$ |
| | 12A/12Z, 1AB/1Z | 15.0±0.3 | $\phi D_0$ | 4.0±0.2 | |
| $P_1$ | 14A/14Z | 6.35±1.00 | A | 14A/14Z | $6.35^{+0.65}_{-0.35}$ |
| | 12A/12Z, 1AB/1Z | 7.5±1.0 | | 12A/12Z | $9.0^{+1.5}_{-1.0}$ |
| $P_2$ | 14A/14Z | 3.85±0.70 | | 1AB/1Z | $12.0^{+1.5}_{-1.0}$ |
| | 12A/12Z, 1AB/1Z | 3.75±0.50 | B | 14A/14Z | 11.2 max. |
| F | 14A/14Z | $5.0^{+0.6}_{-0.2}$ | | 12A/12Z | 14 max. |
| | 12A/12Z, 1AB/1Z | $7.5^{+0.6}_{-0.2}$ | | 1AB/1Z | 17 max. |
| W | 18.0±0.5 | | ϕD | 14A/14Z | $2.3^{+0.5}_{-0.3}$ |
| $W_1$ | 9.0±0.5 | | | 12A/12Z | 2.8±0.5 |
| $H_0$ | 14A/14Z | 16.0±0.5 | | 1AB/1Z | 4.0±1.0 |
| | 12A/12Z | 18.0±1.0 | ϕd | 14A/14Z | 0.65±0.05 |
| | 1AB/1Z | 18.0±1.0 | | 12A/12Z, 1AB/1Z | 0.80±0.05 |

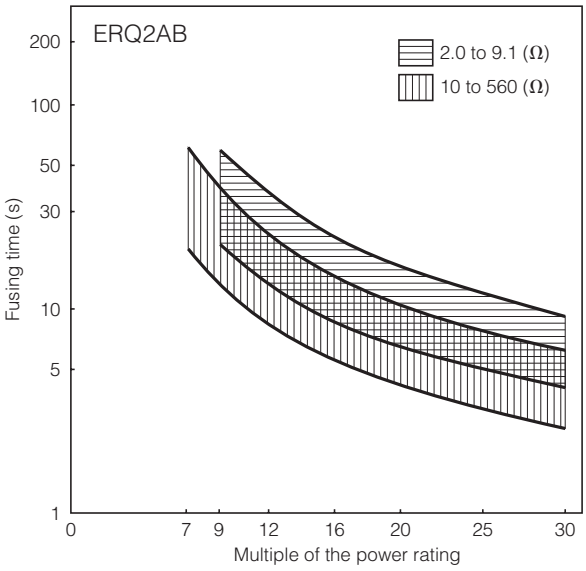
## Fusing Characteristics (Constant Voltage Circuit)

This data is for reference only, specifications should be verified in written form with the engineering division.

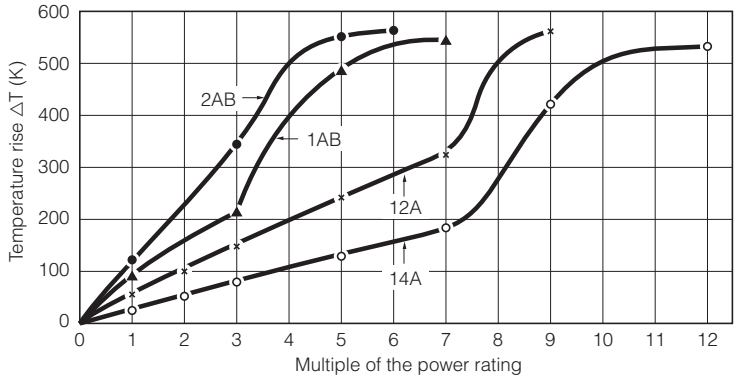


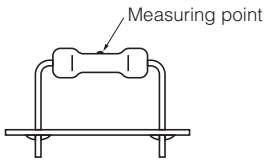




## Hot Spot Temperature (for reference)



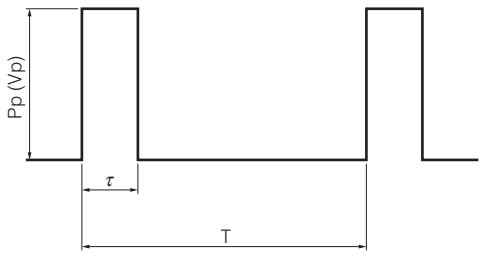
## ⚠ Safety Precautions

The following are precautions for individual products. Please also refer to the common precautions for Fixed Resistors in this catalog.

1. Checking the fusing conditions
   1) Fusing characteristics differ depending on the type, shape, and resistance. Check the fusing conditions before selecting the type of Metal Film Fusing Resistors (hereafter called the fusing resistor) to be used.
   2) Use the fusing resistors under the maximum open circuit voltage. Otherwise, arcing may occur when a voltage much higher than the rated one is applied in the event of an abnormality in the circuit, or when a high voltage is applied after fusing.
   3) Under abnormal conditions of a constant voltage circuit, a current of about 2 or 3 times the initial abnormal current passes through, accelerating the speed at which the fusing resistors blows. When using a constant current circuit, carefully check the conditions because the fusing resistors may not blow in a constant current circuit.
2. Checking for pulse voltage, impact voltage, and transient voltage
   Make sure to evaluate and check the fusing resistors mounted on your product if they are to be mounted on a circuit that generates an impact voltage, or if there is a possibility that the transient phenomenon (significantly high voltage applied in a short time) may occur or that a pulse voltage with a high peak voltage may be applied. Make sure to consult our sales staff before using the fusing resistors under special conditions.
3. Conditions of use in a steady state
   Make sure that the load conditions have a sufficient allowance for the power derating curve. The characteristics of the fusing resistors are set by using a constant voltage circuit.
4. The solvent resistance of the fusing resistors is not assured. If you use a solvent for cleaning after soldering or other processes, make sure to consult our sales staff before use and perform a prior test and evaluation to ensure that the solvent will not affect the reliability of the fusing resistors.

## (Data for Reference)

### Pulse Characteristics (Usual)




$P_P$ : Pulse limit power (W)
$V_P$ : Pulse limit voltage (V)
$\tau$ : Pulse continuous time (s)
T : Period (s)
$V_R$ : Rated voltage (V)
P : Rated power (W)
R : Resistance value (Ω)
$V_{p\,max.}$ : Max. pulse limit voltage (V)

Withstand pulse limit power is calculated by the next method.

$P_P = K \cdot P \cdot T/\tau$

$V_P = \sqrt{K \cdot P \cdot R \cdot T/\tau}$

Reference to the right about a fixed number of $V_{P\,max.}$

| Part No. | K | $V_{p\,max.}$ (V) |
|---|---|---|
| ERQ14A | 0.6 | 200 |
| ERQ12A | 0.6 | 250 |
| ERQ1AB | 0.6 | 250 |
| ERQ2AB | 0.4 | 250 |

- $T>1(s) \rightarrow T=1(s)$
- $T/\tau>100 \rightarrow T/\tau=100$
- $P_P<P \rightarrow P$ stands for $P_P$
  ($V_P<V_R \rightarrow V_R$ stands for $V_P$)
- Added voltage$\leqq V_{p\,max.}$
- $P_P$ or $V_P$ is reference value
  Conditions : Pulse added time=1000 h, Resistance change=±5 %
  Room temperature

Standard for Resistance Value, Resistance Tolerance and Color Code

## Basis Standard

IEC Publication 60062 : Marking codes for resistors and capacitors.
IEC Publication 60063 : Preferred number series for resistors and capacitors.
JIS C 5062 : Marking codes for resistors and capacitors.
JIS C 5063 : Preferred number series for resistors and capacitors.

## Resistance Values

The resistance values are notched by “Ratio” below in each series.

| Series | Resistance Tolerance (Standard) | Ratio | Remarks |
|---|---|---|---|
| E6 | ±20 % | $\sqrt[6]{10}\fallingdotseq1.46$ | Please refer to standard resistance values shown on this catalog. |
| E12 | ±10 % | $\sqrt[12]{10}\fallingdotseq1.21$ | |
| E24 | ± 5 % | $\sqrt[24]{10}\fallingdotseq1.10$ | |
| E48 | ± 2 % | $\sqrt[48]{10}\fallingdotseq1.05$ | |
| E96 | ± 1 % | $\sqrt[96]{10}\fallingdotseq1.02$ | |

## How to express the resistance value with a Panasonic part number

The resistance value expressed in ohms is identified by a three digit number or a four digit number.
The last digit specifies the number of zeroes to follow.
The letter “R” shall be used as the decimal point for less than 10 Ω.

The examples of a three digit number

| Resistance Code | Value in ohms |
|---|---|
| R56 | 0.56 |
| 5R6 | 5.6 |
| 100 | 10 |
| 271 | 270 |
| 102 | 1 k |
| 273 | 27 k |
| 104 | 100 k |
| 275 | 2.7 M |
| 106 | 10 M |
| 107 | 100 M |

The examples of a four digit number

| Resistance Code | Value in ohms |
|---|---|
| R562 | 0.562 |
| 5R62 | 5.62 |
| 56R2 | 56.2 |
| 1000 | 100 |
| 2711 | 2.71 k |
| 1002 | 10 k |
| 2713 | 271 k |
| 1004 | 1 M |
| 2715 | 27.1 M |
| 1006 | 100 M |

## How to express the resistance tolerance with a Panasonic part number

The resistance tolerance is identified by a single letter in accordance with the following table and the code is placed just before the resistance code in the following examples.

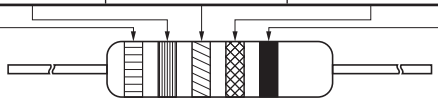
| Tolerance Code | Tolerance (%) | Examples |
|---|---|---|
| W | ±0.05 | W1001 : 1000 Ω±0.05 % |
| B | ±0.1 | B1001 : 1000 Ω±0.1 % |
| C | ±0.25 | C1001 : 1000 Ω±0.25 % |
| D | ±0.5 | D1001 : 1000 Ω±0.5 % |
| F | ±1 | F1001 : 1000 Ω±1 % |
| G | ±2 | G1001 : 1000 Ω±2 % |
| J | ±5 | J101 : 100 Ω±5 % |
| K | ±10 | K101 : 100 Ω±10 % |
| M | ±20 | M101 : 100 Ω±20 % |

## Color code indication for the resistance value and the tolerance

Fixed resistors whose resistance value and tolerance are indicated by color code follow the standard below.

Color code

| Color | First digit | Second digit | Third digit | Multiplier | Resistance tolerance | |
|---|---|---|---|---|---|---|
| | | | | | % | Code |
| Black | 0 | 0 | 0 | 1 | | |
| Brown | 1 | 1 | 1 | 10 | ±1 | F |
| Red | 2 | 2 | 2 | $10^2$ | ±2 | G |
| Orange | 3 | 3 | 3 | $10^3$ | ±0.05 | W |
| Yellow | 4 | 4 | 4 | $10^4$ | | |
| Green | 5 | 5 | 5 | $10^5$ | ±0.5 | D |
| Blue | 6 | 6 | 6 | $10^6$ | ±0.25 | C |
| Violet | 7 | 7 | 7 | $10^7$ | ±0.1 | B |
| Gray | 8 | 8 | 8 | | | |
| White | 9 | 9 | 9 | | | |
| Gold | | | | $10^{-1}$ | ±5 | J |
| Silver | | | | $10^{-2}$ | ±10 | K |
| None | | | | | ±20 | M |



Indication example

Color code of 5 color bands

When the standard resistance value follows E48 series or 96 series, color code of the resistors are indicated by five color bands. Example below is 154 kΩ.

Example 1

| 1st Color | 2nd Color | 3rd Color | 4th Color | 5th Color |
|---|---|---|---|---|
| Brown (1) | Green (5) | Yellow (4) | Orange (1000) | Brown (±1 %) |

Color code of 4 color bands

When the standard resistance value follows E6 series, 12 series or 24 series, color code of the resistors are indicated by four color bands. Example below is 15 kΩ.

Example 2

| 1st Color | 2nd Color | 3rd Color | 4th Color |
|---|---|---|---|
| Brown (1) | Green (5) | Orange (1000) | Gold (±5 %) |

## Standard Resistance Values

| E6 | E12 | E24 | E48 | E96 |
|---|---|---|---|---|
| 10 | 10 | 10 | 100 | 100 |
| | | | | 102 |
| | | | 105 | 105 |
| | | | | 107 |
| | | 11 | 110 | 110 |
| | | | | 113 |
| | | | 115 | 115 |
| | | | | 118 |
| | 12 | 12 | 121 | 121 |
| | | | | 124 |
| | | | 127 | 127 |
| | | 13 | | 130 |
| | | | 133 | 133 |
| | | | | 137 |
| | | | 140 | 140 |
| | | | | 143 |
| | | | 147 | 147 |
| 15 | 15 | 15 | | 150 |
| | | | 154 | 154 |
| | | | | 158 |
| | | 16 | 162 | 162 |
| | | | | 165 |
| | | | 169 | 169 |
| | | | | 174 |
| | | | 178 | 178 |
| | 18 | 18 | | 182 |
| | | | 187 | 187 |
| | | | | 191 |
| | | | 196 | 196 |
| | | 20 | | 200 |
| | | | 205 | 205 |
| | | | | 210 |

| E6 | E12 | E24 | E48 | E96 |
|---|---|---|---|---|
| | | | 215 | 215 |
| 22 | 22 | 22 | | 221 |
| | | | 226 | 226 |
| | | | | 232 |
| | | | 237 | 237 |
| | | 24 | | 243 |
| | | | 249 | 249 |
| | | | | 255 |
| | | | 261 | 261 |
| | | | | 267 |
| | 27 | 27 | 274 | 274 |
| | | | | 280 |
| | | | 287 | 287 |
| | | | | 294 |
| | | 30 | 301 | 301 |
| | | | | 309 |
| | | | 316 | 316 |
| | | | | 324 |
| 33 | 33 | 33 | | 332 |
| | | | 332 | 340 |
| | | | 348 | 348 |
| | | | | 357 |
| | | 36 | | 365 |
| | | | 365 | 374 |
| | | | | 383 |
| | | | 383 | 392 |
| | 39 | 39 | 402 | 402 |
| | | | | 412 |
| | | | 422 | 422 |
| | | 43 | | 432 |
| | | | 442 | 442 |
| | | | | 453 |

| E6 | E12 | E24 | E48 | E96 |
|---|---|---|---|---|
| | | | 464 | 464 |
| 47 | 47 | 47 | | 475 |
| | | | 487 | 487 |
| | | | | 499 |
| | | 51 | 511 | 511 |
| | | | | 523 |
| | | | 536 | 536 |
| | | | | 549 |
| | 56 | 56 | 562 | 562 |
| | | | | 576 |
| | | | 590 | 590 |
| | | | | 604 |
| | | 62 | 619 | 619 |
| | | | | 634 |
| | | | 649 | 649 |
| | | | | 665 |
| 68 | 68 | 68 | 681 | 681 |
| | | | | 698 |
| | | | 715 | 715 |
| | | | | 732 |
| | | 75 | 750 | 750 |
| | | | | 768 |
| | | | 787 | 787 |
| | | | | 806 |
| | 82 | 82 | | 825 |
| | | | 825 | 845 |
| | | | | 866 |
| | | | 866 | 887 |
| | | 91 | | 909 |
| | | | 909 | 931 |
| | | | | 953 |
| | | | 953 | 976 |

## CAUTION AND WARNING

1. The electronic components contained in this catalog are designed and produced for use in home electric appliances, office equipment, information equipment, communications equipment, and other general purpose electronic devices.
   Before use of any of these components for equipment that requires a high degree of safety, such as medical instruments, aerospace equipment, disaster-prevention equipment, security equipment, vehicles (automobile, train, vessel),
   please be sure to contact our sales representative.
2. When applying one of these components for equipment requiring a high degree of safety, no matter what sort of application it might be, be sure to install a protective circuit or redundancy arrangement to enhance the safety of your equipment. In addition, please carry out the safety test on your own responsibility.
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The information in this catalog is valid as of May 2015.