

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 % |

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

| Part No. | Resistance Tolerance | Resistance Value Range (Ω) | |
|----------|----------------------|----------------------------|-------------|
| | | ERX□□SZ | ERX□□S |
| ERX12S | ±5 % | 0.10 to 0.18 | 0.20 to 9.1 |
| ERX12S | ±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 |

| 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 % |

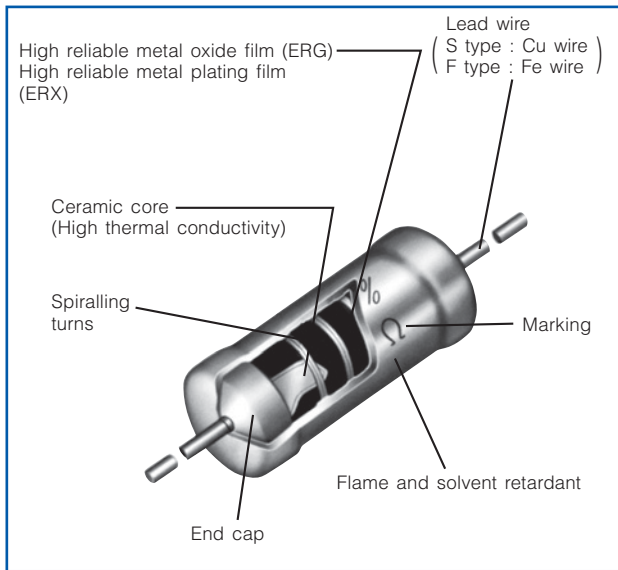
The first two digits are significant figures of resistance and the third one denotes number of zeros following. Decimal point is expressed by (Ex.) 103 : 10 kΩ

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

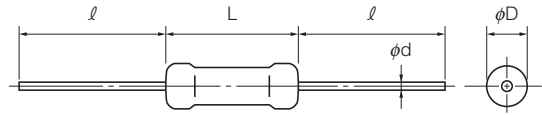
| Code | Forming / Packaging | Forming & Taping matrix | | | | | | | | |
|------|-----------------------------------|-------------------------|----|----|----|----|----|----|----|----|
| | | 12S | 1S | 2S | 3S | 5S | 1F | 2F | 3F | 5F |
| □··□ | Straight lead wire type | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| □··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 | $6.35^{+0.65}_{-0.35}$ | $2.3^{+0.5}_{-0.3}$ | $30.0^{\pm 3.0}$ | $0.65^{\pm 0.05}$ | 0.26 |
| ERG(X)1S | $9.00^{+1.50}_{-1.00}$ | $2.8^{\pm 0.5}$ | $30.0^{\pm 3.0}$ | $0.65^{\pm 0.05}$ | 0.33 |
| ERG(X)1F | | | | $0.80^{\pm 0.05}$ | |
| ERG(X)2S ERG(X)2F | $12.00^{+1.50}_{-1.00}$ | $4.0^{\pm 1.0}$ | $30.0^{\pm 3.0}$ | $0.80^{\pm 0.05}$ | 0.66 |
| ERG(X)3S ERG(X)3F | $15.00^{\pm 1.50}$ | $5.5^{\pm 1.0}$ | $38.0^{\pm 3.0}$ | $0.80^{\pm 0.05}$ | 1.47 |
| ERG(X)5S ERG(X)5F | $24.00^{\pm 1.50}$ | $8.0^{\pm 1.0}$ | $38.0^{\pm 3.0}$ | $0.80^{\pm 0.05}$ | 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⁾ | | T.C.R. ($\times 10^{-6}/^{\circ}\text{C}$) | Standard Resistance Value |
|----------------------|---------------------------|---|---|--|---------------------------------------|--------------------------------|--|----------------|--|---------------------------|
| | | | | | | | min. ⁽⁶⁾ | max. | | |
| ERG(X)12S | 0.5 | 300 | 600 | 600 | 350 | G (± 2) J (± 5) | 1 0.2 | 22 k 47 k | ± 350 | E24 |
| ERG(X)1S ERG(X)1F | 1 | 350 | 600 | 600 | 350 | G (± 2) J (± 5) | 1 0.2 | 68 k 100 k | ± 350 | E24 |
| ERG(X)2S ERG(X)2F | 2 | 350 | 700 | 1000 | 600 | G (± 2) J (± 5) | 1 0.22 | 100 k 100 k | ± 350 | E24 |
| ERG(X)3S ERG(X)3F | 3 | 350 | 700 | 1000 | 1000 | G (± 2) J (± 5) | 1 0.22 | 100 k 100 k | ± 300 | E24 |
| ERG(X)5S ERG(X)5F | 5 | 500 | 1000 | 1500 | 1000 | G (± 2) J (± 5) | 1 0.33 | 100 k 100 k | ± 200 | 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 $SOTV = 2.5 \times \text{Power Rating}$ or max. Overload Voltage listed above whichever less.
- (3) Intermittent Overload Test Voltage (IOTV) shall be determined from $IOTV = 4.0 \times \text{Power Rating}$ or max. Intermittent Overload Voltage listed above whichever less.

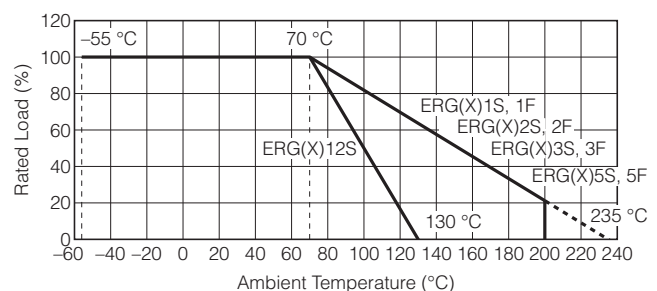
- (4) Resistance tolerance is of use besides range listed, please inquire.
- (5) Resistance Range Type ERG : $\geq 10 \Omega$
Type ERX : $\leq 9.1 \Omega$
- (6) As for the low resistance value range, "Z" is given to the part number. (Refer to the explanation of part numbers.)

* 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 | $\pm 2\%$ | 0.1 to 0.91 Ω | Z | 2S | $\pm 2\%$ | 0.1 to 0.91 Ω |
| | | $\pm 5\%$ | 0.1 to 0.18 Ω | | 2F | $\pm 5\%$ | 0.1 to 0.2 Ω |
| | 1S 1F | $\pm 2\%$ | 0.1 to 0.91 Ω | | 3S | $\pm 2\%$ | 0.1 to 0.91 Ω |
| | | $\pm 5\%$ | 0.1 to 0.18 Ω | | 3F | $\pm 5\%$ | 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.



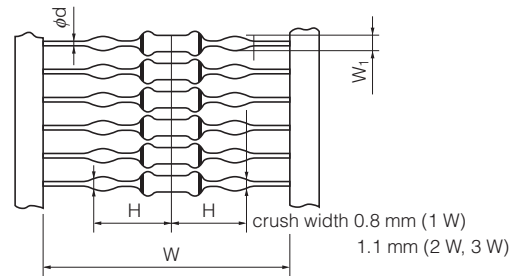
Taped & Box

ERG(X)□□S□□□□V



Stand-off Taped & Box

ERG(X)□□S□□□□V

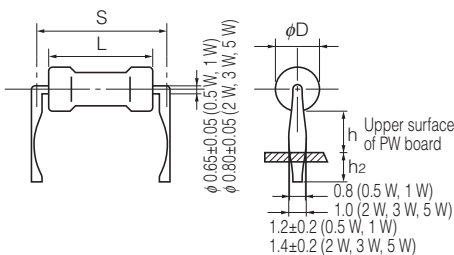


| Part Number | Standard Quantity (pcs./box) | Taping (mm) | | | | | | Box (mm) | | |
|------------------|------------------------------|----------------------|-------------------|----------------------|----------------------|------------------------------------|-----------------------|----------|-----|-----|
| | | P | 50×P | W | H | W ₁ | φd | a | b | c |
| ERG(X) 12S□□□□□V | 2,000 | 5.0 ^{+0.3} | 250 ⁺² | 52.0 ^{+1.5} | — | — | 0.65 ^{+0.05} | 85 | 80 | 255 |
| ERG(X) 1S□□□□□V | 2,000 | 5.0 ^{+0.3} | 250 ⁺² | 52.0 ^{+1.5} | — | — | 0.65 ^{+0.05} | 85 | 80 | 255 |
| ERG(X) 1S□□□□□V | | | | | 12.0 ^{-0.2} | 1.20 ^{+0.15} ₀ | | | | |
| ERG(X) 2S□□□□□V | 1,000 | 5.0 ^{+0.3} | 250 ⁺² | 52.0 ^{+1.5} | — | — | 0.80 ^{+0.05} | 85 | 80 | 255 |
| ERG(X) 2S□□□□□V | | | | | 15.5 ^{-0.2} | 1.40 ^{+0.15} ₀ | | | | |
| ERG(X) 3S□□□□□V | 1,000 | 10.0 ^{+0.5} | 500 ⁺² | 74.0 ^{+2.0} | — | — | 0.80 ^{+0.05} | 105 | 100 | 325 |
| ERG(X) 3S□□□□□V | | | | | 23.0 ^{-0.2} | 1.4 ^{+0.15} ₀ | | | | |



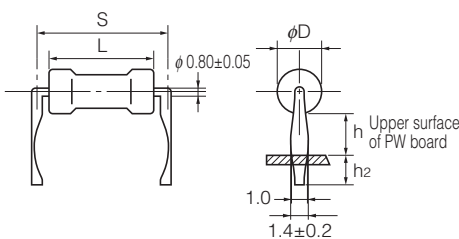
Cut & Formed Type

ERG(X)□□S□□□□P



| Part Number | Standard Quantity (pcs./box) | Dimensions (mm) | | | | |
|------------------|------------------------------|---|------------------------------------|----------------------|---------------------|---------------------|
| | | L | φD | S | h | h ₂ |
| ERG(X) 12S□□□□□P | 1,000 | 6.35 ^{+0.65} _{-0.35} | 2.3 ^{+0.5} _{0.3} | 10.0 ^{+1.5} | 4.0 ^{+1.5} | 4.0 ^{+1.5} |
| ERG(X) 1S□□□□□P | 1,000 | 9.00 ^{+1.50} _{-1.00} | 2.8 ^{+0.5} | 12.5 ^{+1.5} | 4.0 ^{+1.5} | 4.0 ^{+1.5} |
| ERG(X) 2S□□□□□P | 1,000 | 12.00 ^{+1.50} _{-1.00} | 4.0 ^{+1.0} | 15.0 ^{+1.5} | 6.0 ^{+1.5} | 4.0 ^{+1.5} |
| ERG(X) 3S□□□□□P | 1,000 | 15.00 ^{+1.50} | 5.5 ^{+1.0} | 20.0 ^{+2.0} | 6.5 ^{+1.5} | 4.0 ^{+1.5} |
| ERG(X) 5S□□□□□P | 500 | 24.00 ^{+1.50} | 8.0 ^{+1.0} | 30.0 ^{+2.0} | 7.5 ^{+1.5} | 4.0 ^{+1.5} |

ERG(X)□□F□□□□□H



| Part Number | Standard Quantity (pcs./box) | Dimensions (mm) | | | | |
|-----------------|------------------------------|--------------------------------------|---------------------|----------------------|------------------|---------------------|
| | | L | φD | S | h | h ₂ |
| ERG(X) 1F□□□□□H | 1,000 | 9.0 ^{+1.5} _{-1.0} | 2.8 ^{+0.5} | 12.5 ^{+1.5} | 8 ⁺² | 4.0 ^{+1.5} |
| ERG(X) 2F□□□□□H | 1,000 | 12.0 ^{+1.5} _{-1.0} | 4.0 ^{+1.0} | 15.0 ^{+1.5} | 6 ⁺² | 5.0 ^{+1.5} |
| ERG(X) 3F□□□□□H | 1,000 | 15.0 ^{+1.5} | 5.5 ^{+1.0} | 20.0 ^{+2.0} | 10 ⁺² | 5.0 ^{+1.5} |
| ERG(X) 5F□□□□□H | 500 | 24.0 ^{+1.5} | 8.0 ^{+1.0} | 30.0 ^{+2.0} | 10 ⁺² | 5.0 ^{+1.5} |

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 | H ₁ | 12S | 32 max. | A | 12S | 6.35 ^{+0.65} _{-0.35} |
| P ₀ | 12.7±0.3 | W ₁ | 9.0±0.5 | | 1S | 32 max. | | 1S | 9.0 ^{+1.5} _{-1.0} |
| P ₁ | 3.85±0.70 | | | | 2S | 38 max. | | 2S | 12.0 ^{+1.5} _{-1.0} |
| P ₂ | 6.35±1.00 | | | H ₀ | 16.0±0.5 | | phi d | 0.65±0.05 | |
| F | 5.0±0.8 | | | phi D ₀ | 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

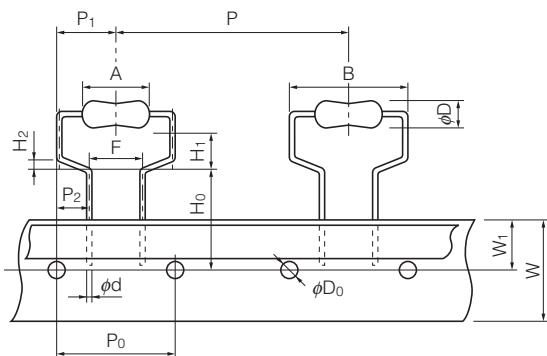
ERG(X)□□S□W□□□□E (12S, 1S, 2S, 3S)



| P | Dimensions (mm) | | Dimensions (mm) | | |
|----------------|-----------------|----------------------------------|--------------------|-----------------|--|
| | | | phi D ₀ | | |
| P | 12S | 12.7±1.0 | A | 12S, 1S, 2S, 3S | 4.0±0.2 |
| | 1S, 2S, 3S | 30.0±1.0 | | 12S | 6.35 ^{+0.65} _{-0.35} |
| P ₀ | 12S | 12.7±0.3 | A | 1S | 9.0 ^{+1.5} _{-1.0} |
| | 1S, 2S, 3S | 15.0±0.3 | | 2S | 12.0 ^{+1.5} _{-1.0} |
| P ₁ | 12S | 6.35±1.00 | B | 3S | 15.0±1.5 |
| | 1S, 2S, 3S | 7.5±1.0 | | 12S | 11.2 max. |
| P ₂ | 12S | 3.85±0.70 | B | 1S | 14.0 max. |
| | 1S, 2S, 3S | 3.75±0.50 | | 2S | 17.0 max. |
| F | 12S | 5.0±0.5 | B | 3S | 21.0 max. |
| | 1S, 2S, 3S | 7.5±0.8 | | 12S | 2.3 ^{+0.5} _{-0.3} |
| W | 12S, 1S, 2S, 3S | 18.0±0.5 | phi D | 1S | 2.8±0.5 |
| W ₁ | 12S, 1S, 2S, 3S | 9.0±0.5 | | 2S | 4.0±1.0 |
| H ₀ | 12S | 16.0±0.5 | phi d | 3S | 5.5±1.0 |
| | 1S, 2S | 18.0±1.0 | | 12S | phi 0.65±0.05 |
| | 3S | 19.0±1.0 | | 1S, 2S, 3S | phi 0.80±0.05 |
| H ₁ | 12S | 6.5 ^{+0.6} ₀ | | | |
| | 1S, 2S | 6.5 ^{+1.0} ₀ | | | |
| | 3S | 8.0 ^{+1.0} ₀ | | | |

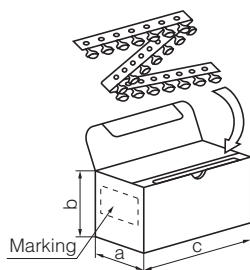
For Panasert Automatic Insertion Machine Radial Taped & Box

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 | φD 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 | φD | 1F 2.8±0.5 |
| | 2F | | 2F 4.0±1.0 |
| | 3F | | 3F 5.5±1.0 |
| | | φd | 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.

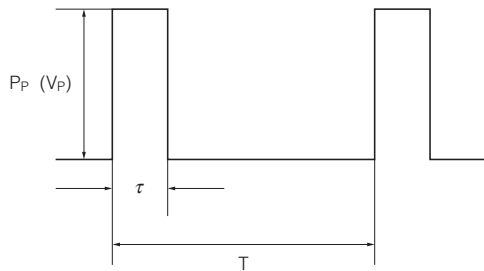
1. Transient voltage

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.

- 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.
- 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.
- 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)
 τ : 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 $V_{p\ max.}$

- $T > 1(s) \rightarrow T = 1(s)$
- $T / \tau > 100 \rightarrow T / \tau = 100$
- $P_p < P \rightarrow P$ stands for P_p
($V_p < V_R \rightarrow V_R$ stands for V_p)
- Added voltage $\leq V_{p\ max.}$
- P_p or V_p is referent value
Conditions: Pulse added time=1000 h
Resistance change= $\pm 5\%$
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 |

⚠ 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 Cl₂, H₂S, NH₃, SO₂, or NO₂
 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 Cl₂, H₂S, NH₃, SO₂, or NO₂
2. In direct sunlight

<Package markings>

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

Guidelines and precautions regarding the technical information and use of our products described in this online catalog.

- If you want to use our products described in this online catalog for applications requiring special qualities or reliability, or for applications where the failure or malfunction of the products may directly jeopardize human life or potentially cause personal injury (e.g. aircraft and aerospace equipment, traffic and transportation equipment, combustion equipment, medical equipment, accident prevention, anti-crime equipment, and/or safety equipment), it is necessary to verify whether the specifications of our products fit to such applications. Please ensure that you will ask and check with our inquiry desk as to whether the specifications of our products fit to such applications use before you use our products.
- The quality and performance of our products as described in this online catalog only apply to our products when used in isolation. Therefore, please ensure you evaluate and verify our products under the specific circumstances in which our products are assembled in your own products and in which our products will actually be used.
- If you use our products in equipment that requires a high degree of reliability, regardless of the application, it is recommended that you set up protection circuits and redundancy circuits in order to ensure safety of your equipment.
- The products and product specifications described in this online catalog are subject to change for improvement without prior notice. Therefore, please be sure to request and confirm the latest product specifications which explain the specifications of our products in detail, before you finalize the design of your applications, purchase, or use our products.
- The technical information in this online catalog provides examples of our products' typical operations and application circuits. We do not guarantee the non-infringement of third party's intellectual property rights and we do not grant any license, right, or interest in our intellectual property.
- If any of our products, product specifications and/or technical information in this online catalog is to be exported or provided to non-residents, the laws and regulations of the exporting country, especially with regard to security and export control, shall be observed.

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

- The switchover date for compliance with the RoHS Directive/REACH Regulations varies depending on the part number or series of our products.
- When you use the inventory of our products for which it is unclear whether those products are compliant with the RoHS Directive/REACH Regulation, please select "Sales Inquiry" in the website inquiry form and contact us.

We do not take any responsibility for the use of our products outside the scope of the specifications, descriptions, guidelines and precautions described in this online catalog.
