

Metal (Oxide) Film Resistors

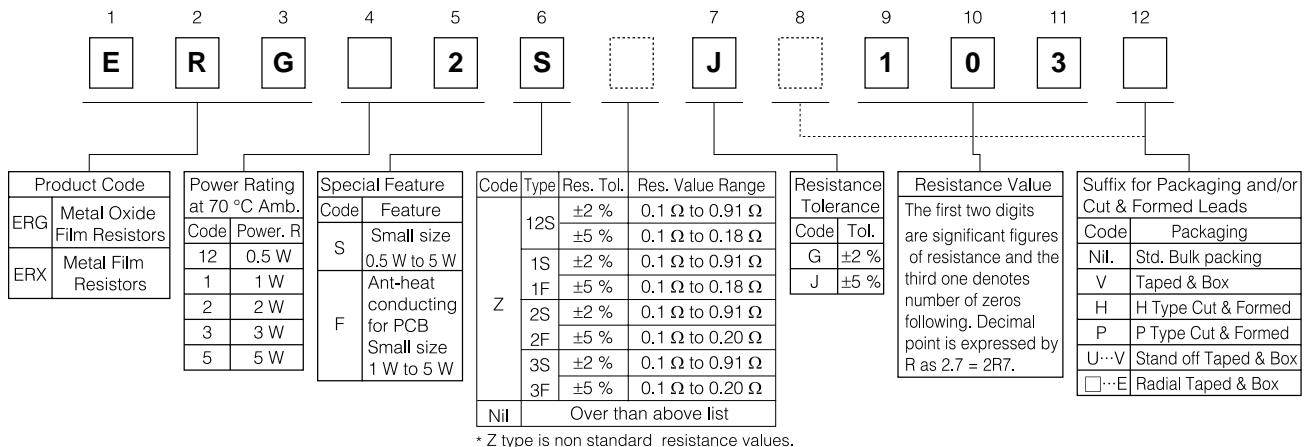
Type: **ERG(X)S (Small size)**
(0.5 W, 1 W, 2 W, 3 W, 5 W)
ERG(X)F (Anti-heat conducting for PCB)
(1 W, 2 W, 3 W, 5 W)



■ Features

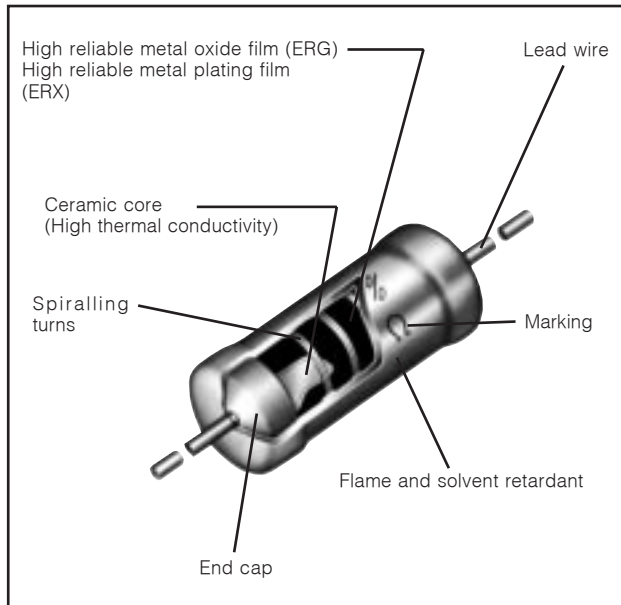
- **Resistance Value Correspondence**
A resistance value range is an electric power type resistor of 0.1 Ω to 100 kΩ.
- **Miniaturization**
About 50 % of small size/measuring were materialized in comparison with an existing model.
- **Noninflammable Nature**
It is a resistor of the noninflammable nature/resistance solvent nature that leads an industry standard.
- **High Reliability**
It is a wide use resistor that prides in a long standing a chievement and confidence.
- **Automatic Insertion**
An automatic insertion is possible with solid structure.
- **Approved under the ISO 9001 system**
- **Reference Standards**
IEC 60115-2, IEC 60115-4, JIS C 5201-4, EIAJ RC-2138

■ Explanation of Part Numbers

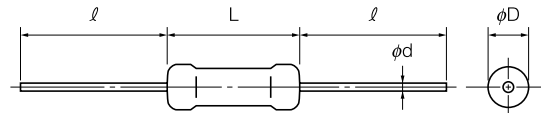


The above example shows a small size metal oxide film resistor, 2 W power rating, resistance value of 10 k ohms, tolerance ±5 %, and package of standard bulk packing.

Construction



Dimensions in mm (not to scale)



Type	Dimensions (mm)				Weight/ 1000 pcs.
	L	φD	l	φd	
ERG12S ERX12S	6.35 ^{+0.65} _{-0.35}	2.3 ^{+0.5} _{-0.3}	30.0 ^{±3.0}	0.65 ^{±0.05}	0.26 kg
ERG1S ERX1S	9.00 ^{+1.50} _{-1.00}	2.8 ^{±0.5}	30.0 ^{±3.0}	0.65 ^{±0.05}	0.33 kg
ERG2S ERX2S	12.00 ^{+1.50} _{-1.00}	4.0 ^{±1.0}	30.0 ^{±3.0}	0.80 ^{±0.05}	0.66 kg
ERG3S ERX3S	15.00 ^{±1.50}	5.5 ^{±1.0}	38.0 ^{±3.0}	0.80 ^{±0.05}	1.47 kg
ERG5S ERX5S	24.00 ^{±1.50}	8.0 ^{±1.0}	38.0 ^{±3.0}	0.80 ^{±0.05}	3.54 kg

Ratings

Type	Power Rating at 70 °C (W)	Limiting Element Voltage (Maximum RCWV) ⁽¹⁾ (V)	Maximum Overload Voltage ⁽²⁾ (V)	Maximum Intermittent Overload Voltage ⁽³⁾ (V)	Dielectric With-standing Voltage (VAC)	Res. Tol. (%) ⁽⁴⁾	Resistance Range (Ω) ⁽⁵⁾		T.C.R. ×10 ⁻⁶ /°C (ppm/°C)	Standard Resistance Value
							min. ⁽⁶⁾	max.		
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 1F	1	350	600	600	350	G (±2)	1	68 k	±350	E24
						J (±5)	0.2	100 k		
ERG(X)2S 2F	2	350	700	1000	600	G (±2)	1	100 k	±350	E24
						J (±5)	0.22	100 k		
ERG(X)3S 3F	3	350	700	1000	1000	G (±2)	1	100 k	±300	E24
						J (±5)	0.22	100 k		
ERG(X)5S 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 (max. RCWV) 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: $\leq 9.1 \Omega$

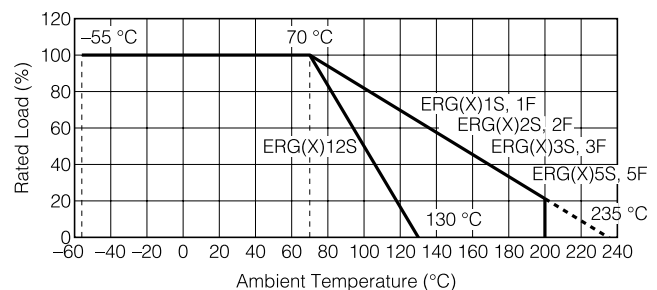
(6) As for the low resistance value range, "Z" is given to the part number. (Refer to the explanation of part numbers.)

* Z type is non standard resistance values.

Code	Type	Res.Tol.	Res. Value Range	Code	Type	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%
	1S	±2%	0.1 to 0.91 Ω		3S		±2%
		±5%	0.1 to 0.18 Ω			3F	±5%

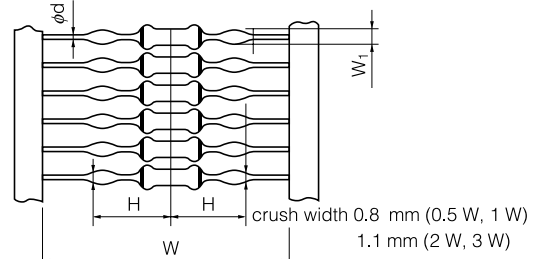
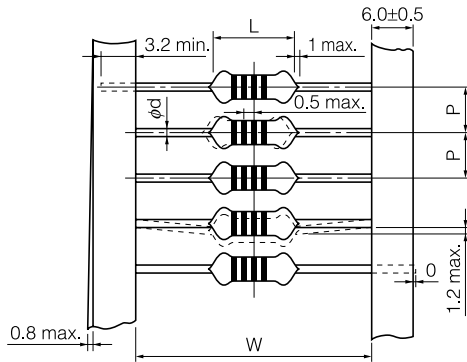
Power Derating Curve

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

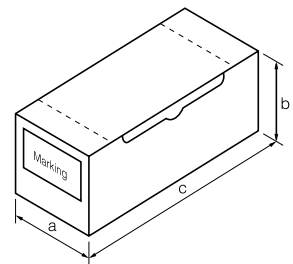


■ Taped & Box: Suffix □□□V

■ Stand-off Taped & Box: Suffix U□□□V

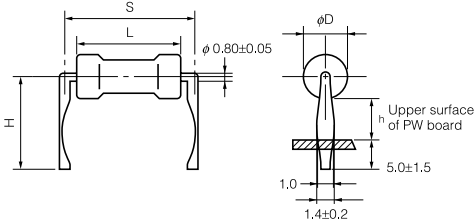


Part Number	Power Rating at 70 °C (W)	Standard Quantity (pcs./box)	Taping (mm)					Box (mm)			
			P	50xP	W	H	W ₁	φd	a	b	c
ERG(X)12S□ □□□V	0.5	2000	5.0 ^{+0.3}	250 ⁺²	52.0 ^{+1.5}	—	—	0.65 ^{+0.05}	85	80	255
ERG(X)12S□U□□□V						11.0 ^{+0.2}	1.2 ^{+0.15}				
ERG(X) 1S□ □□□V	1	2000	5.0 ^{+0.3}	250 ⁺²	52.0 ^{+1.5}	—	—	0.65 ^{+0.05}	85	80	255
ERG(X) 1S□U□□□V						12.0 ^{+0.2}	1.2 ^{+0.15}				
ERG(X) 2S□ □□□V	2	1000	5.0 ^{+0.3}	250 ⁺²	52.0 ^{+1.5}	—	—	0.80 ^{+0.05}	85	80	255
ERG(X) 2S□U□□□V						15.5 ^{+0.2}	1.4 ^{+0.15}				
ERG(X) 3S□ □□□V	3	1000	10.0 ^{+0.5}	500 ⁺²	74.0 ^{+2.0}	—	—	0.80 ^{+0.05}	105	100	325
ERG(X) 3S□U□□□V						23.0 ^{+0.2}	1.4 ^{+0.15}				



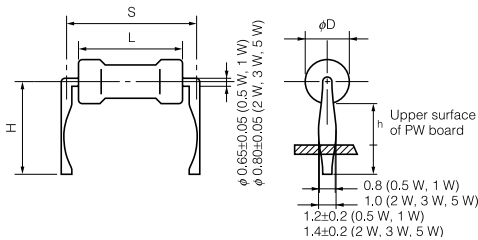
■ Cut & Formed Type

Type "H" (2S to 5S, 2F to 5F)



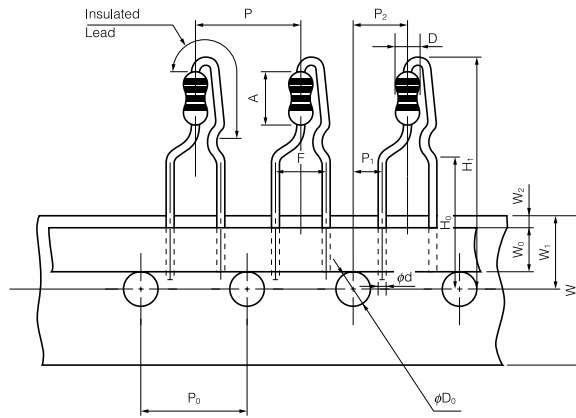
Part Number	Power Rating at 70 °C (W)	Standard Quantity (pcs./box)	Dimensions (mm)				
			L	φD	S	H	h
ERG(X)2S□□□□H	2	1000	12.0 ^{+1.5} _{-1.0}	4.0 ^{+1.0}	15.0 ^{+1.5}	13 ⁺³	6 ⁺²
ERG(X)2F□□□□H			15.0 ^{+1.5}	5.5 ^{+1.0}	20.0 ^{+2.0}	18 ⁺³	10 ⁺²
ERG(X)3S□□□□H	3	1000	15.0 ^{+1.5}	5.5 ^{+1.0}	20.0 ^{+2.0}	18 ⁺³	10 ⁺²
ERG(X)3F□□□□H			24.0 ^{+1.5}	8.0 ^{+1.0}	30.0 ^{+2.0}	19 ⁺³	10 ⁺²
ERG(X)5S□□□□H	5	500	24.0 ^{+1.5}	8.0 ^{+1.0}	30.0 ^{+2.0}	19 ⁺³	10 ⁺²
ERG(X)5F□□□□H							

Type "P" (12S to 5S)



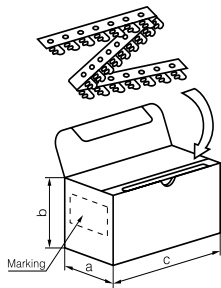
Part Number	Power Rating at 70 °C (W)	Standard Quantity (pcs./box)	Dimensions (mm)				
			L	φD	S	H	h
ERG12S□□□□P	0.5	2000	6.35 ^{+0.65} _{-0.95}	2.3 ^{+0.5} _{-0.3}	10.0 ^{+1.5}	9.5 ^{+3.0}	4.0 ^{+1.5}
ERX12S□□□□P			9.00 ^{+1.50} _{-1.00}	2.8 ^{+0.5}	12.5 ^{+1.5}	9.5 ^{+3.0}	4.0 ^{+1.5}
ERG 1S□□□□P	1	2000	12.00 ^{+1.50} _{-1.00}	4.0 ^{+1.0}	15.0 ^{+1.5}	12.5 ^{+3.0}	6.0 ^{+1.5}
ERX 1S□□□□P			15.00 ^{+1.50}	5.5 ^{+1.0}	20.0 ^{+2.0}	14.0 ^{+3.0}	6.5 ^{+1.5}
ERG 2S□□□□P	2	1000	15.00 ^{+1.50}	5.5 ^{+1.0}	20.0 ^{+2.0}	14.0 ^{+3.0}	6.5 ^{+1.5}
ERX 2S□□□□P			24.00 ^{+1.50}	8.0 ^{+1.0}	30.0 ^{+2.0}	16.0 ^{+3.0}	7.5 ^{+1.5}
ERG 3S□□□□P	3	1000	24.00 ^{+1.50}	8.0 ^{+1.0}	30.0 ^{+2.0}	16.0 ^{+3.0}	7.5 ^{+1.5}
ERX 3S□□□□P							
ERG 5S□□□□P	5	500	24.00 ^{+1.50}	8.0 ^{+1.0}	30.0 ^{+2.0}	16.0 ^{+3.0}	7.5 ^{+1.5}
ERX 5S□□□□P							

■ For Panasert Automatic Insertion Machine Radial Tape & Box
Type ERG(X)□□S□□□□E (12S, 1S, 2S)



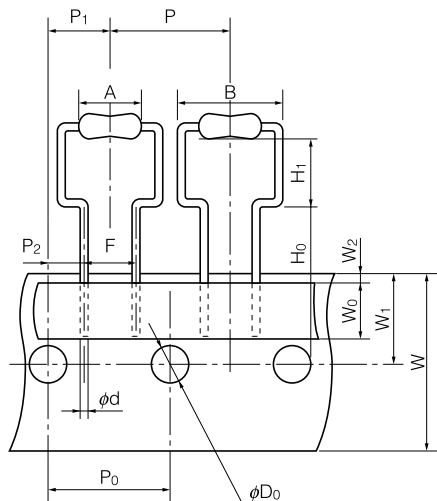
Dimensions (mm)		Dimensions (mm)		Dimensions (mm)		Dimensions (mm)		Dimensions (mm)				
P	12.7±1.0	W	18.0±0.5	H ₁	12S	32 max.	A	12S	6.35 ^{+0.65} _{-0.35}	D	12S	2.3 ^{+0.5} _{-0.3}
P ₀	12.7±0.3	W ₀	5 min.		1S	32 max.		1S	9.0 ^{+1.5} _{-1.0}		1S	2.8±0.5
P ₁	3.85±0.70	W ₁	9.0±0.5		2S	38 max.		2S	12.0 ^{+1.5} _{-1.0}		2S	4.0±1.0
P ₂	6.35±1.00	W ₂	1.5 max.	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	2000
ERG(X) 1S□□□□E	46	130	335	2000
ERG(X) 2S□□□□E	49	100	335	1000

■ For Panasert Automatic Insertion Machine Radial Taped & Box
Type ERG(X)□□S□W□□□□E (12S, 1S, 2S)

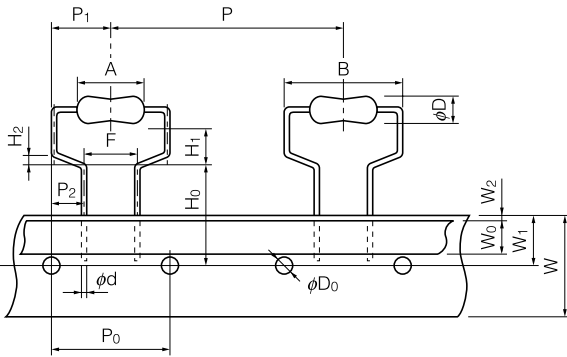


Dimensions (mm)			Dimensions (mm)		
P	12S	12.7±1.0	H ₁	12S	6.5 ^{+0.6} ₀
	1S, 2S	30.0±1.0		1S	6.5 ^{+1.0} ₀
P ₀	12S	12.7±0.3		phi D ₀	2S
	1S, 2S	15.0±0.3	4.0±0.2		
P ₁	12S	6.35±1.00	A	12S	6.35 ^{+0.65} _{-0.35}
	1S, 2S	7.5±1.0		1S	9.0 ^{+1.5} _{-1.0}
P ₂	12S	3.85±0.70		B	2S
	1S, 2S	3.75±0.50	12S		11.2 max.
F	12S	5.0±0.5	phi D	1S	14 max.
	1S, 2S	7.5±0.8		2S	17 max.
W	18.0±0.5			phi D	12S
W ₀	5 min.		1S		2.8±0.5
W ₁	9.0±0.5		2S		4.0±1.0
W ₂	1 max.		phi d	12S	0.65±0.05
	12S	16.0±0.5		1S, 2S	0.80±0.05
H ₀	1S	18.0±1.0			
	2S	18.0±1.0			

Design, Specifications are subject to change without notice. Ask factory for technical specifications before purchase and/or use. Whenever a doubt about safety arises from this product, please inform us immediately for technical consultation without fail.

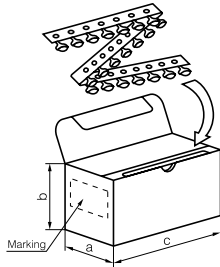
■ For Panasart Automatic Insertion Machine Radial Taped & Box

Type 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 ₀	5 min.		2F 17 max.
W ₁	9.0±0.5		3F 21 max.
W ₂	1 max.	φD	1F 2.8±0.5
H ₀	16.0 ^{+1.0} ₀		2F 4.0±1.0
H ₁	1F 7.0 ^{+0.1} ₀		3F 5.5±1.0
	2F 8.0 ^{+0.1} ₀	φd	0.80±0.05
	3F 9.0 ^{+0.1} ₀		

● Radial Tape Package Specifications



Type	Dimensions (mm)			Standard Quantity (pcs./box)
	a	b	c	
ERG(X)12S	46	145	325	2000
ERG(X)1S, 1F	49	150	317	1000
ERG(X)2S, 2F	49	150	317	500
ERG(X)3F	49	190	315	500

■ Performance Specifications

Characteristics	Specifications	Test Methods
Resistance to Solvent (See more informations on the following page.)	No deterioration of protective coatings and markings.	Specimens shall be immersed in a bath of Isopropyl alcohol completely for 2 minutes with ultrasonic.
Flame Retardant	No evidence of flaming or arcing.	Flame of it blows out a diameter of the mouth 9.5 mm burner by using, a resistor 15 seconds space with 5 times repeatedly to destruction by fire put. 120 % of loads of rated dissipation are done applied for one minute. Voltage that is equal to 16 times of rated dissipation hereafter is done applied.

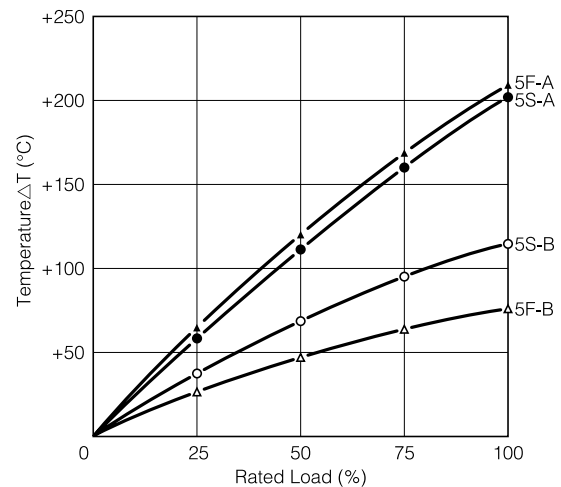
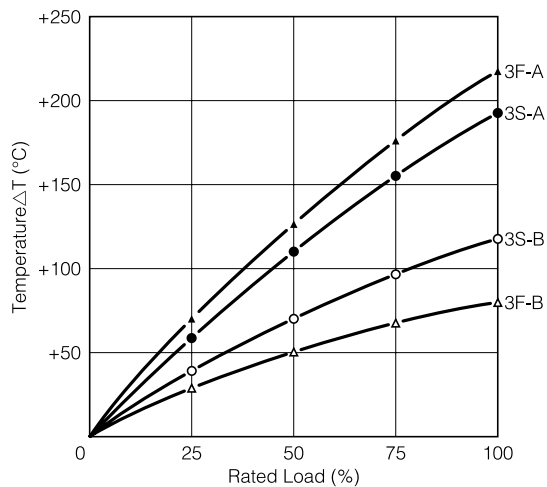
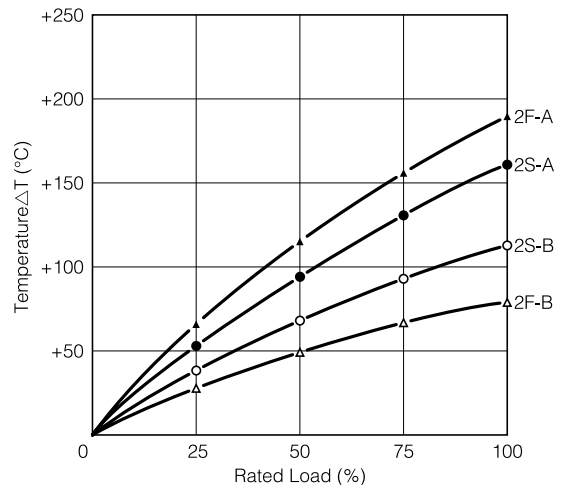
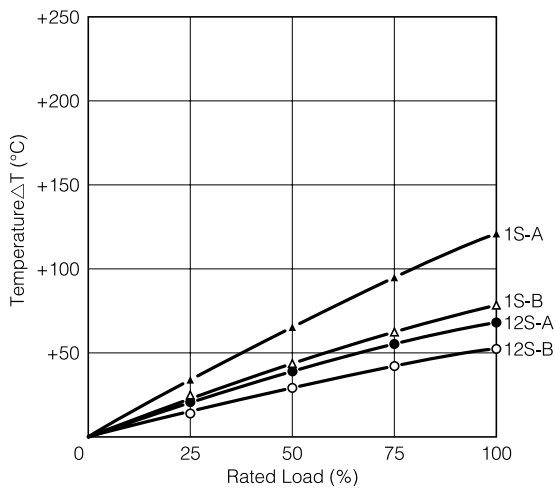
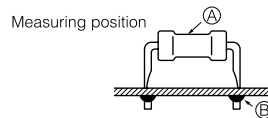
Resistance to Solvents

Matsushita metal oxide film resistors may resist following solvents and test. Any washing solvents used at commercial basis do not affect the original performance characteristics. However, the protective coating and marking may be come off only when they are purposely brushed off or rubbed off with cloth soaked in solvents such as Isopropyl alcohol. And it is also suggested not to heat up print circuit boards just after washing print circuit boards.

Test Method	Solvent	Resistance to Solvent
2 minutes immersion in solvent solution	Isopropyl alcohol	Yes

Hot-spot Temperature (for Reference)

The temperature of resistor body increase with the curve below. A touch of vinyl wire may cause damages to resistor element. It is requested not to place vinyl wires around resistors and to be considered where the resistor shall be placed.



⚠ Cautions for Safety

(1) About transitional phenomena

Regarding impact voltage circuit, transient phenomena like application of high voltage for a short-time or high pulse voltage, confer with the engineer.

(2) Storage method

If the product is stored in the following environments and conditions, the performance and solderability may be badly affected, avoid the storage in the following environments.

- ① Storage in places full of corrosive gases such as sea breeze, Cl₂, H₂S, NH₃, SO₂ and NO₂.
- ② Storage in places exposed to direct sunlight.
- ③ Storage in places outside the temperature range of 5 °C to 35 °C and humidity range of 45 % to 85 %RH.

(3) Precaution for use

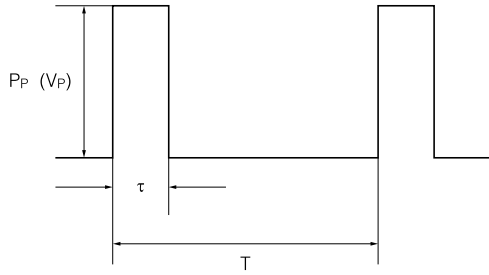
1) The products in this catalog are intended for use in general standard applications for general electronic equipment (AV products, household electric appliances, office equipment, information and communication equipment, etc.); hence, they do not take the use under the following special environments into consideration.

Accordingly, the use in the following special environments, and such environmental conditions may affect the performance of the products; prior to use, verify the performance, reliability, etc. thoroughly.

- ① Use in liquids such as water, oil, chemical, and organic solvent.
 - ② Use under direct sunlight and in outdoor and dusty atmospheres.
 - ③ Use in places full of corrosive gases such as sea breeze, Cl₂, H₂S, NH₃, SO₂, and NO₂.
 - ④ Use in environment with large static electricity and strong electromagnetic waves.
 - ⑤ Where the product is close to a heating component, and where an inflammable such as a polyvinyl chloride wire is arranged close to the product.
 - ⑥ Where the resistor is sealed and coated with resin, etc.
 - ⑦ Where water or a water-soluble detergent is used in cleaning free soldering and in flux cleaning after soldering. (Pay particular attention to soluble flux.)
- 2) The resistor is non-inflammable and is coated with special paint. It is sensitive to external impact. So, care should be taken not to give shocks or vibration to the resistor or not to damage it by holding with pincers.
- 3) Do not apply excessive tension to the lead connection. When bending the lead wire, do not give excessive stress to the resistor but bend it at a natural curvature.
- 4) For cleaning the resistor, do not use a brush as in the solvent resistance test of MIL-STD-202 which may damage the coating. Never use a brush during and after cleaning the resistor.

(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 : Nominal resistance (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

Type	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

■ Pulse Characteristics (Inrush)

[Conditions]

Resistance change $\leq \pm 5\%$ with pulse 1000 cycles as like the figure. (Reference Only)

- 1) Added power and added voltage are within the lower territory of this graph.
- 2) Added in normal temperature and humidity.

[Waveform]

