

## Metal Film Resistors

# General Type

## Normal & Miniature Style [ MFR Series ]



### INTRODUCTION

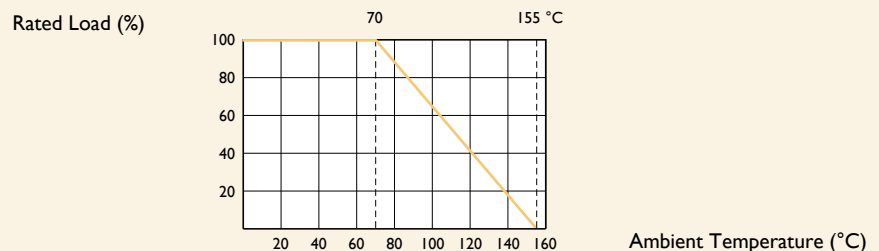
The MFR Series Metal Film Resistors are manufactured using a vacuum sputtering system to deposit multiple layers of mixed metal alloys and passivative materials onto a carefully treated high grade ceramic substrate. After a helical groove has been cut in the resistive layer, tinned connecting leads of electrolytic copper are welded to the end-caps. The resistors are coated with layers of blue color lacquer.

### FEATURES

|                      |                                                                                                                                                |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| Power Rating         | 1/6W, 1/4W, 1/2W, 1W, 2W, 3W                                                                                                                   |
| Resistance Tolerance | $\pm 0.5\%$ , $\pm 1\%$ , $\pm 5\%$                                                                                                            |
| T.C.R.               | $\pm 15\text{ppm}/^\circ\text{C}$ , $\pm 25\text{ppm}/^\circ\text{C}$ , $\pm 50\text{ppm}/^\circ\text{C}$ , $\pm 100\text{ppm}/^\circ\text{C}$ |

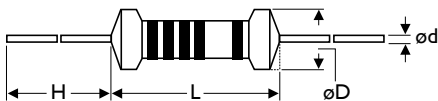
### DERATING CURVE

For resistors operated in ambient temperatures above  $70^\circ\text{C}$ , power rating must be derated in accordance with the curve below.



### DIMENSIONS

Unit: mm



| STYLE  |           | DIMENSION      |               |              |                 |
|--------|-----------|----------------|---------------|--------------|-----------------|
| Normal | Miniature | L              | øD            | H            | ød              |
| MFR-12 | MFR25S    | $3.4 \pm 0.3$  | $1.9 \pm 0.2$ | $28 \pm 2.0$ | $0.45 \pm 0.05$ |
| MFR-25 | MFR50S    | $6.3 \pm 0.5$  | $2.4 \pm 0.2$ | $28 \pm 2.0$ | $0.55 \pm 0.05$ |
| MFR-50 | MFR1WS    | $9.0 \pm 0.5$  | $3.3 \pm 0.3$ | $26 \pm 2.0$ | $0.55 \pm 0.05$ |
| MFR100 | MFR2WS    | $11.5 \pm 1.0$ | $4.5 \pm 0.5$ | $35 \pm 2.0$ | $0.8 \pm 0.05$  |
| MFR200 | MFR3WS    | $15.5 \pm 1.0$ | $5.0 \pm 0.5$ | $33 \pm 2.0$ | $0.8 \pm 0.05$  |

Note:

## ELECTRICAL CHARACTERISTICS

| STYLE                       | MFR-12                                      | MFR25S | MFR-25 | MFR50S | MFR-50 | MFRIWS | MFRI00 | MFR2WS | MFR200 | MFR3WS |
|-----------------------------|---------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Power Rating at 70°C        | 1/6W                                        | 1/4W   |        | 1/2W   |        | 1W     |        | 2W     |        | 3W     |
| Maximum Working Voltage     | 200V                                        |        | 250V   | 300V   | 350V   | 400V   | 500V   |        |        |        |
| Maximum Overload Voltage    | 400V                                        |        | 500V   | 600V   | 700V   | 800V   | 1,000V |        |        |        |
| Voltage Proof on Insulation | 300V                                        | 400V   | 500V   |        |        | 700V   | 1,000V |        |        |        |
| Resistance Range            | 1Ω - 10MΩ & 0Ω for E24 & E96 series value   |        |        |        |        |        |        |        |        |        |
| Operating Temp. Range       | -55°C to +155°C                             |        |        |        |        |        |        |        |        |        |
| Temperature Coefficient     | ±15ppm/°C, ±25ppm/°C, ±50ppm/°C, ±100ppm/°C |        |        |        |        |        |        |        |        |        |

Note: Special value is available on request

## ENVIRONMENTAL CHARACTERISTICS

| PERFORMANCE TEST              | TEST METHOD      |                                                                  | APPRAISE                                  |
|-------------------------------|------------------|------------------------------------------------------------------|-------------------------------------------|
| Short Time Overload           | IEC 60115-1 4.13 | 2.5 times RCWV for 5 Sec.                                        | ±0.25%+0.05Ω                              |
| Voltage Proof on Insulation   | IEC 60115-1 4.7  | in V-block for 60 Sec., test voltage by type                     | By type                                   |
| Temperature Coefficient       | IEC 60115-1 4.8  | -55°C to +155°C                                                  | By type                                   |
| Insulation Resistance         | IEC 60115-1 4.6  | in V-block for 60 Sec.                                           | >10,000MΩ                                 |
| Solderability                 | IEC 60115-1 4.17 | 235±5°C for 3±0.5 Sec.                                           | 95% Min. coverage                         |
| Solvent Resistance of Marking | IEC 60115-1 4.30 | IPA for 5±0.5 Min. with ultrasonic                               | No deterioration of coatings and markings |
| Robustness of Terminations    | IEC 60115-1 4.16 | Direct load for 10 Sec. in the direction of the terminal leads   | ≥2.5kg (24.5N)                            |
| Periodic-pulse Overload       | IEC 60115-1 4.39 | 4 times RCWV 10,000 cycles (1 Sec. on, 25 Sec. off)              | ±1.0%+0.05Ω                               |
| Damp Heat Steady State        | IEC 60115-1 4.24 | 40±2°C, 90-95% RH for 56 days, loaded with 0.1 times RCWV        | ±1.5%+0.05Ω                               |
| Endurance at 70°C             | IEC 60115-1 4.25 | 70±2°C at RCWV for 1,000 Hr. (1.5 Hr. on, 0.5 Hr. off)           | ±1.5%+0.05Ω                               |
| Temperature Cycling           | IEC 60115-1 4.19 | -55°C ⇄ Room Temp. ⇄ +155°C ⇄ Room Temp. (5 cycles)              | ±0.75%+0.05Ω                              |
| Resistance to Soldering Heat  | IEC 60115-1 4.18 | 260±3°C for 10±1 Sec., immersed to a point 3±0.5mm from the body | ±0.25%+0.05Ω                              |

Note: RCWV(Rated Continuous Working Voltage) =  $\sqrt{\text{Power Rating} \times \text{Resistance Value}}$  or Max. working voltage listed above, whichever less.

Revision: 201304



## EXPLANATIONS OF ORDERING CODE

| MFR                                           | -12                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | F                                                                                                                                                                                                                      | T                                                                           | F                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 52-                                                                                                                                                                                                                                                                                                   | 100R                                                                                                   |
|-----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|
| Code 1 - 3<br><b>Series Name</b><br>See Index | Code 4 - 6<br><b>Power Rating</b><br>-05 = $\varnothing$ d0.5mm<br>-06 = $\varnothing$ d0.6mm<br>-07 = $\varnothing$ d0.7mm<br>-08 = $\varnothing$ d0.8mm<br>-10 = $\varnothing$ d1.0mm<br>-14 = $\varnothing$ d1.4mm<br>-12 = 1/6W<br>-25 = 1/4W<br>25S = 1/4WS<br>-50 = 1/2W<br>50S = 1/2WS<br>100 = 1W<br>1WS = 1WS<br>200 = 2W<br>2WS = 2WS<br>204 = 0.4W<br>207 = 0.6W<br>300 = 3W<br>3WS = 3WS<br>3WM = 3WM<br>400 = 4W<br>500 = 5W<br>5WS = 5WS<br>5SS = 5WSS<br>700 = 7W<br>7WS = 7WS<br>10A = 10W<br>20A = 20W<br>30A = 30W<br>40A = 40W<br>50A = 50W<br>10S = 10WS<br>15A = 15W<br>25A = 25W<br>10B = 100W<br>25B = 250W | Code 7<br><b>Tolerance</b><br>P = $\pm 0.02\%$<br>A = $\pm 0.05\%$<br>B = $\pm 0.1\%$<br>C = $\pm 0.25\%$<br>D = $\pm 0.5\%$<br>F = $\pm 1\%$<br>G = $\pm 2\%$<br>J = $\pm 5\%$<br>K = $\pm 10\%$<br>- = Base on Spec. | Code 8<br><b>Packing Style</b><br>T = Tape/Box<br>R = Tape/Reel<br>B = Bulk | Code 9<br><b>Temperature Coef-<br/>ficient of Resistance</b><br>- = Base on Spec.<br>A = $\pm 5$ ppm/ $^{\circ}$ C<br>B = $\pm 10$ ppm/ $^{\circ}$ C<br>C = $\pm 15$ ppm/ $^{\circ}$ C<br>S = $\pm 20$ ppm/ $^{\circ}$ C<br>D = $\pm 25$ ppm/ $^{\circ}$ C<br>E = $\pm 50$ ppm/ $^{\circ}$ C<br>F = $\pm 100$ ppm/ $^{\circ}$ C<br>G = $\pm 200$ ppm/ $^{\circ}$ C<br>H = $\pm 250$ ppm/ $^{\circ}$ C<br>I = $\pm 300$ ppm/ $^{\circ}$ C<br>J = $\pm 350$ ppm/ $^{\circ}$ C | Code 10 - 12<br><b>Forming Type</b><br>26- = 26mm<br>52- = 52.4mm<br>73- = 73mm<br>81- = 81mm<br>91- = 91mm<br>F = F Type<br>FK = FK Type<br>FKK = FKK Type<br>FFK = F-form Kink<br>M = M-Type Forming<br>MB = M-form W/flat<br>MT = MT Type Forming<br>MR = MR Type<br>AV = AVIsert<br>PN = PANAsert | Code 13 - 17<br><b>Resistance Value</b><br>0R1 = 0.1<br>100R = 100<br>10K = 10,000<br>10M = 10,000,000 |

### EXCEPTION:

#### • Cement series:

<Code 8>: Special packing style code

B: Bulk with wirewound or metal oxide sub-assembly for resistance value

W: Bulk with ceramic based wirewound sub-assembly for resistance value

M: Bulk with metal oxide sub-assembly for resistance value

F: Bulk with Fiberglass based wirewound sub-assembly for resistance value

<Code 10-12>: Without forming code

Example: **SQP500JB-10R**

#### • JPW series:

<Code 13-17>: without resistance value code

Example: **JPW-06-T-52-**