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

<table>
<thead>
<tr>
<th>Power Rating</th>
<th>1/6W, 1/4W, 1/2W, 1W, 2W, 3W</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resistance Tolerance</td>
<td>±0.5%, ±1%, ±5%</td>
</tr>
<tr>
<td>T.C.R.</td>
<td>±15ppm/°C, ±25ppm/°C, ±50ppm/°C, ±100ppm/°C</td>
</tr>
</tbody>
</table>

DERATING CURVE

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

<table>
<thead>
<tr>
<th>Rated Load (%)</th>
<th>Ambient Temperature (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>160</td>
</tr>
<tr>
<td>80</td>
<td>140</td>
</tr>
<tr>
<td>60</td>
<td>120</td>
</tr>
<tr>
<td>40</td>
<td>100</td>
</tr>
<tr>
<td>20</td>
<td>80</td>
</tr>
</tbody>
</table>

DIMENSIONS

<table>
<thead>
<tr>
<th>STYLE</th>
<th>DIMENSION</th>
<th>Unit: mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>Miniature</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>øD</td>
<td>H</td>
</tr>
<tr>
<td>MFR-12</td>
<td>MFR25S</td>
<td>3.4±0.3</td>
</tr>
<tr>
<td>MFR-25</td>
<td>MFR50S</td>
<td>6.3±0.5</td>
</tr>
<tr>
<td>MFR-50</td>
<td>MFR1WS</td>
<td>9.0±0.5</td>
</tr>
<tr>
<td>MFR100</td>
<td>MFR2WS</td>
<td>11.5±1.0</td>
</tr>
<tr>
<td>MFR200</td>
<td>MFR3WS</td>
<td>15.5±1.0</td>
</tr>
</tbody>
</table>
### ELECTRICAL CHARACTERISTICS

<table>
<thead>
<tr>
<th>STYLE</th>
<th>MFR-12</th>
<th>MFR25S</th>
<th>MFR-25</th>
<th>MFR50S</th>
<th>MFR-50</th>
<th>MFR1WS</th>
<th>MFR100</th>
<th>MFR2WS</th>
<th>MFR200</th>
<th>MFR3WS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Rating at 70°C</td>
<td>1/6W</td>
<td>1/4W</td>
<td>1/2W</td>
<td>1W</td>
<td>2W</td>
<td>3W</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Working Voltage</td>
<td>200V</td>
<td>250V</td>
<td>300V</td>
<td>350V</td>
<td>400V</td>
<td>500V</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Overload Voltage</td>
<td>400V</td>
<td>500V</td>
<td>600V</td>
<td>700V</td>
<td>800V</td>
<td>1,000V</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voltage Proof on Insulation</td>
<td>300V</td>
<td>400V</td>
<td>500V</td>
<td>700V</td>
<td>1,000V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resistance Range</td>
<td>1Ω - 10MΩ</td>
<td>&amp; 0Ω</td>
<td>for E24 &amp; E96 series value</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating Temp. Range</td>
<td>-55°C to +155°C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature Coefficient</td>
<td>±15ppm/°C, ±25ppm/°C, ±50ppm/°C, ±100ppm/°C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Special value is available on request.

### ENVIRONMENTAL CHARACTERISTICS

<table>
<thead>
<tr>
<th>PERFORMANCE TEST</th>
<th>TEST METHOD</th>
<th>APPRAISE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short Time Overload</td>
<td>IEC 60115-1 4.13</td>
<td>±0.25%+0.05Ω</td>
</tr>
<tr>
<td>Voltage Proof on Insulation</td>
<td>IEC 60115-1 4.7</td>
<td>By type</td>
</tr>
<tr>
<td>Temperature Coefficient</td>
<td>IEC 60115-1 4.8</td>
<td>By type</td>
</tr>
<tr>
<td>Insulation Resistance</td>
<td>IEC 60115-1 4.6</td>
<td>&gt;10,000MΩ</td>
</tr>
<tr>
<td>Solderability</td>
<td>IEC 60115-1 4.17</td>
<td>95% Min. coverage</td>
</tr>
<tr>
<td>Solvent Resistance of Marking</td>
<td>IEC 60115-1 4.30</td>
<td>No deterioration of coatings and markings</td>
</tr>
<tr>
<td>Robustness of Terminations</td>
<td>IEC 60115-1 4.16</td>
<td>≥2.5kg (24.5N)</td>
</tr>
<tr>
<td>Periodic-pulse Overload</td>
<td>IEC 60115-1 4.39</td>
<td>±1.0%+0.05Ω</td>
</tr>
<tr>
<td>Damp Heat Steady State</td>
<td>IEC 60115-1 4.24</td>
<td>±1.5%+0.05Ω</td>
</tr>
<tr>
<td>Endurance at 70°C</td>
<td>IEC 60115-1 4.25</td>
<td>±1.5%+0.05Ω</td>
</tr>
<tr>
<td>Temperature Cycling</td>
<td>IEC 60115-1 4.19</td>
<td>±0.75%+0.05Ω</td>
</tr>
<tr>
<td>Resistance to Soldering Heat</td>
<td>IEC 60115-1 4.18</td>
<td>±0.25%+0.05Ω</td>
</tr>
</tbody>
</table>

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

Revision: 201304
EXPLANATIONS OF ORDERING CODE

**MFR -12 F T F 52- 100R**

- **MFR**
  - Code 1 - 3
  - Series Name
  - See Index

- **Code 4 - 6**
  - Power Rating
    - -05 = ød0.5mm
    - -06 = ød0.6mm
    - -07 = ød0.7mm
    - -08 = ød0.8mm
    - -10 = ød1.0mm
    - -14 = ød1.4mm
    - -12 = 1/6W
    - -25 = 1/4W
    - 25S = 1/4WS
    - -50 = 1/2W
    - 50S = 1/2WS
    - 100 = 1W
    - 1WS = 1WS
    - 200 = 2W
    - 2WS = 2WS
    - 204 = 0.4W
    - 207 = 0.6W
    - 300 = 3W
    - 3WS = 3WS
    - 3WM = 3WM
    - 400 = 4W
    - 500 = 5W
    - 5WS = 5WS
    - 55S = 5WSs
    - 700 = 7W
    - 7WS = 7WS
    - 10A = 10W
    - 20A = 20W
    - 30A = 30W
    - 40A = 40W
    - 50A = 50W
    - 10S = 10WS
    - 15A = 15W
    - 25A = 25W
    - 10B = 100W
    - 25B = 250W

- **Code 7**
  - Tolerance
    - P = ±0.02 %
    - A = ±0.05 %
    - B = ±0.1 %
    - C = ±0.25%
    - D = ±0.5 %
    - F = ±1 %
    - G = ±2 %
    - J = ±5 %
    - K = ±10 %
    - = Base on Spec.

- **Code 8**
  - Packing Style
    - T = Tape/Box
    - R = Tape/Reel
    - B = Bulk

- **Code 9**
  - Temperature Coefficient of Resistance
    - A = ±5 ppm/°C
    - B = ±10 ppm/°C
    - C = ±15 ppm/°C
    - D = ±20 ppm/°C
    - E = ±25 ppm/°C
    - F = ±50 ppm/°C
    - G = ±100 ppm/°C
    - H = ±200 ppm/°C
    - I = ±300 ppm/°C
    - J = ±350 ppm/°C
    - = Base on Spec.

- **Code 10 - 12**
  - Forming Type
    - 26- = 26mm
    - 52- = 52.4mm
    - 73- = 73mm
    - 81- = 81mm
    - 91- = 91mm
    - F = F Type
    - FK = FK Type
    - FKK = FKK Type
    - FFS = F-form Kink
    - M = M-Type Forming
    - MB = M-form W/flat
    - MT = MT Type Forming
    - MR = MR Type
    - AV = AVIsert
    - PN = PANAsert

- **Code 13 - 17**
  - Resistance Value
    - OR1 = 0.1
    - 100R = 100
    - 10K = 10,000
    - 10M = 10,000,000

**EXCEPTION:**

- **Cement series:**
  - <Code B>: 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: SQP500B-10R

- **JPW series:**
  - <Code 13-17>: without resistance value code
    - Example: JPW-06-T-52-