

## Data Sheet

**Customer:**

**Product:** Metal Foil Chip Fixed Resistor - MF Series

**Sizes:** 0402/0603/0805/1206/2010/2512

**Issued Date:** 31-Mar-25

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|---------------------|-----------------|---------------------|------------------------|---------------------------|
| 31-Mar-25           | 31-Mar-25       | 31-Mar-25           |                        |                           |
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## Metal Foil Chip Fixed Resistor

### Features

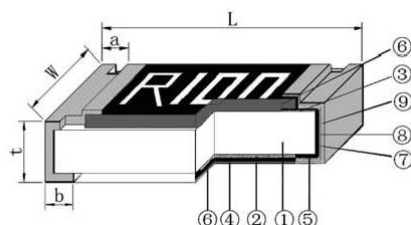
- High power rating up to 2 Watts
- Low TCR down to  $\pm 50$  PPM/ $^{\circ}\text{C}$
- Current detecting resistors
- Superior mechanical and frequency characteristics
- Compliant with RoHS directive
- Halogen free requirement



### Applications

- Switching Power Supply, Over Current Protection
- Voltage Regulation Module (VRM)
- DC-DC Converter, Charger
- Portable Devices etc

### Construction



|                     |                      |                      |
|---------------------|----------------------|----------------------|
| ① Ceramic Substrate | ④ Primary Overcoat   | ⑦ Edge Electrode     |
| ② Alloy Plate       | ⑤ Cu Plating         | ⑧ Barrier Layer      |
| ③ Top Electrode     | ⑥ Secondary Overcoat | ⑨ External Electrode |

### Dimensions

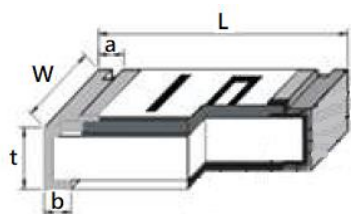


Figure1

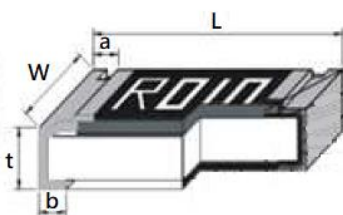


Figure2

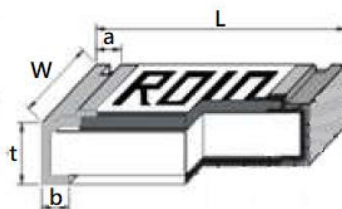


Figure3

| Type | Size (Inch) | Resistance (mΩ) | L mm            | W mm            | t mm            | a mm            | b mm            |
|------|-------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| MF02 | 0402        | 10              | 1.00 $\pm$ 0.10 | 0.50 $\pm$ 0.10 | 0.40 $\pm$ 0.10 | $\leq$ 0.35     | 0.30 $\pm$ 0.15 |
| MF03 | 0603        | $\geq 5$        | 1.60 $\pm$ 0.20 | 0.80 $\pm$ 0.20 | 0.70 $\pm$ 0.15 | $\leq$ 0.60     | 0.35 $\pm$ 0.20 |
| MF05 | 0805        | 3-4             | 2.00 $\pm$ 0.20 | 1.25 $\pm$ 0.20 | 0.70 $\pm$ 0.15 | 0.40 $\pm$ 0.25 | 0.70 $\pm$ 0.30 |
|      |             | $\geq 5$        |                 |                 |                 |                 | 0.40 $\pm$ 0.30 |
| MF06 | 1206        | 3-4             | 3.20 $\pm$ 0.20 | 1.60 $\pm$ 0.20 | 0.75 $\pm$ 0.15 | 0.50 $\pm$ 0.30 | 0.90 $\pm$ 0.30 |
|      |             | $\geq 5$        |                 |                 |                 |                 | 0.50 $\pm$ 0.30 |
| MF10 | 2010        | 2               | 5.00 $\pm$ 0.20 | 2.50 $\pm$ 0.20 | 0.75 $\pm$ 0.20 | 0.60 $\pm$ 0.30 | 1.80 $\pm$ 0.30 |
|      |             | 3               |                 |                 |                 |                 | 1.60 $\pm$ 0.30 |
|      |             | 4-5             |                 |                 |                 |                 | 1.30 $\pm$ 0.30 |
|      |             | >5              |                 |                 |                 |                 | 0.80 $\pm$ 0.30 |
| MF12 | 2512        | 2               | 6.40 $\pm$ 0.20 | 3.20 $\pm$ 0.20 | 0.75 $\pm$ 0.20 | 0.90 $\pm$ 0.30 | 2.30 $\pm$ 0.30 |
|      |             | 3               |                 |                 |                 |                 | 1.90 $\pm$ 0.30 |
|      |             | 4               |                 |                 |                 |                 | 1.70 $\pm$ 0.30 |
|      |             | 5-6             |                 |                 |                 |                 | 1.20 $\pm$ 0.30 |
|      |             | 7               |                 |                 |                 |                 | 1.10 $\pm$ 0.30 |
|      |             | >7              |                 |                 |                 |                 | 0.90 $\pm$ 0.30 |

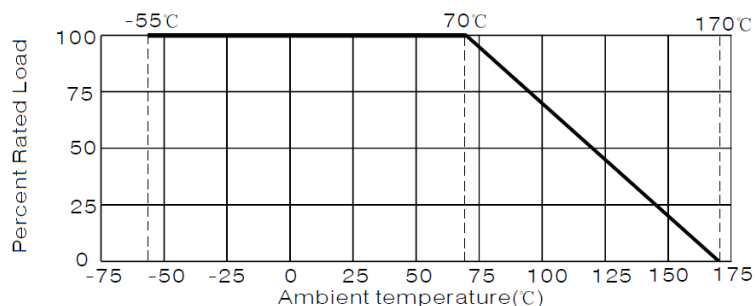
■ Figure 1 for MF03 type ; Figure 2 for MF05 $\geq$ 10mΩ / MF06 type / MF12 type ; Figure 3 for MF05 $<$ 10mΩ / MF10 type

■ MF02 chip resistor is without marking

## Part Numbering

| MF           | 06                                                                   | J                          | T              | E                            | U                                                                     | R005                                      |
|--------------|----------------------------------------------------------------------|----------------------------|----------------|------------------------------|-----------------------------------------------------------------------|-------------------------------------------|
| Product Type | Dimensions (L×W)                                                     | Resistance Tolerance       | Packaging Code | TCR (PPM/°C)                 | Power Rating                                                          | Resistance                                |
|              | 02: 0402<br>03: 0603<br>05: 0805<br>06: 1206<br>10: 2010<br>12: 2512 | F: ±1%<br>G: ±2%<br>J: ±5% | T: Taping Reel | D: ±50<br>E: ±100<br>F: ±200 | P: 1/5W<br>V: 1/4W<br>O: 1/3W<br>U: 1/2W<br>Q: 3/4W<br>T: 1W<br>S: 2W | R005: 0.005Ω<br>R010: 0.01Ω<br>R100: 0.1Ω |

## Derating Curve



## Standard Electrical Specifications

| Item<br>Type | Power<br>Rating<br>at 70°C | Operating<br>Temp. Range | Limiting<br>Element Current | Max.<br>Overload Current | Resistance Range(mΩ) |     |     | TCR<br>(PPM/°C) |
|--------------|----------------------------|--------------------------|-----------------------------|--------------------------|----------------------|-----|-----|-----------------|
|              |                            |                          |                             |                          | ±1%                  | ±2% | ±5% |                 |
| MF02         | 1/5W                       | -55 ~ +170°C             | 4.5A                        | 10A                      | 10                   |     |     | ±100            |
| MF03         | 1/2W                       | -55 ~ +170°C             | 12.9A                       | 28.9A                    | 5 - 9                |     |     | ±200            |
|              |                            |                          |                             |                          | 10 - 30              |     |     | ±100            |
| MF05         | 3/4W                       | -55 ~ +170°C             | 15.8A                       | 35.4A                    | 3 - 9                |     |     | ±100            |
|              |                            |                          |                             |                          | 10                   |     |     | ±50             |
|              | 1/4W, 1/3W,<br>1/2W        |                          | 12.9A                       | 28.9A                    | 3 - 9                |     |     | ±100            |
|              |                            |                          |                             |                          | 10 - 50              |     |     | ±50             |
| MF06         | 1/2W, 1W                   | -55 ~ +170°C             | 18.3A                       | 40.8A                    | 3 - 4                |     |     | ±100            |
|              |                            |                          |                             |                          | 5 - 9                |     |     | ±50<br>±100     |
|              |                            |                          |                             |                          | 10 - 68              |     |     | ±50             |
| MF10         | 1W                         | -55 ~ +170°C             | 22.4A                       | 50A                      | 2                    |     |     | ±200            |
|              |                            |                          |                             |                          | 3 - 9                |     |     | ±100            |
|              |                            |                          |                             |                          | 10 - 100             |     |     | ±50             |
| MF12         | 1W                         | -55 ~ +170°C             | 3.2A                        | 7.1A                     | 101 - 200            |     |     | ±50             |
|              | 2W                         |                          | 31.6A                       | 63.3A                    | 2                    |     |     | ±200            |
|              |                            |                          |                             |                          | 3 - 9                |     |     | ±100            |
|              |                            |                          |                             |                          | 10 - 100             |     |     | ±50             |

Current of DC or AC RMS value.

Rated current= $\sqrt{P/R}$  or Limiting element voltage whichever is lower.

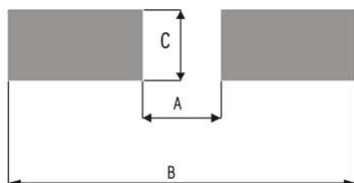
## Environmental Characteristics

| Item                                           | Requirement                                     | Test Method                                                                                                                                    |
|------------------------------------------------|-------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| Temperature Coefficient of Resistance (T.C.R.) | As Spec.                                        | IEC 60115-1 4.8<br>+20/+125/+20°C                                                                                                              |
| Short Time Overload                            | No mechanical damage<br>$\Delta R \leq \pm 1\%$ | IEC 60115-1 4.13<br>1/5W ~ 1W: 5x rated power for 5s; 2W: 4x rated power for 5s                                                                |
| Endurance                                      |                                                 | IEC 60115-1 4.25.1<br>70±2°C, 1000 hrs, rated current or limiting element current whichever is lower for 1.5 hrs "ON" and 0.5 hr "OFF"         |
| Endurance at upper Category Temperature        |                                                 | IEC 60115-1 4.25.3<br>at 170±2°C for 1000 hrs                                                                                                  |
| Damp Heat Steady State                         |                                                 | IEC 60115-1 4.24<br>40±2°C, 93±3% RH, 1000 hrs, rated current or limiting element current whichever is lower for 1.5 hrs "ON" and 0.5 hr "OFF" |
| Rapid Change of Temperature                    |                                                 | IEC 60115-1 4.19<br>-55°C(30min) → normal temperature(5min) → 125°C(30min), 100 cycles                                                         |
| Solderability                                  | 95% min. coverage                               | IEC 60115-1 4.17<br>245±5°C for 3±0.3 seconds                                                                                                  |
| Resistance to Soldering Heat                   | No mechanical damage<br>$\Delta R \leq \pm 1\%$ | IEC 60115-1 4.18<br>270±5°C for 10±1 seconds                                                                                                   |
| Substrate Bending Test                         |                                                 | IEC 60115-1 4.33<br>2010, 2512 sizes: 2mm Other sizes: 3mm<br>Duration: 60±5 seconds                                                           |
| Insulation Resistance                          | >1000MΩ                                         | IEC 60115-1 4.6<br>Apply DC 100V±15V between substrate and terminations for 1min, then check insulation resistance                             |
| Voltage Proof                                  | No breakdown or flashover                       | IEC 60115-1 4.7<br>Apply max. overload voltage of AC RMS at a rate of approximately 100V/s between substrate and terminations for 60±5 seconds |
| Component Solvent Resistance                   | No mechanical damage<br>$\Delta R \leq \pm 1\%$ | IEC 60115-1 4.29<br>Iso-propyl alcohol (IPA), 23±5°C, 10hrs                                                                                    |

■ Storage Temperature: 5~30°C; Humidity 30~70%RH

■ Shelf life: 6 months max

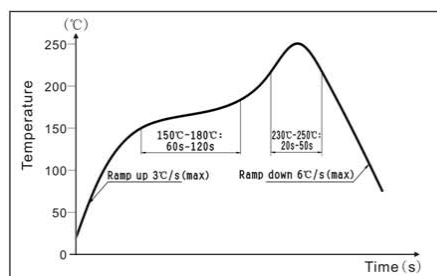
## Recommend Land Pattern



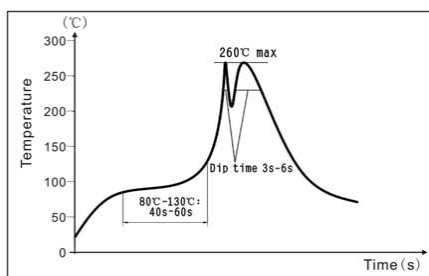
| Type | Resistance   | A mm | B mm | C mm |
|------|--------------|------|------|------|
| MF02 | 10mΩ         | 0.35 | 1.45 | 0.6  |
| MF03 | 5mΩ - 30mΩ   | 0.6  | 2.8  | 1.0  |
| MF05 | 3mΩ - 4mΩ    | 0.5  | 3.2  | 1.4  |
|      | 5mΩ - 50mΩ   | 0.8  |      |      |
| MF06 | 3mΩ - 4mΩ    | 0.8  | 4.4  | 1.8  |
|      | 5mΩ - 68mΩ   | 1.8  |      |      |
| MF10 | 2mΩ          | 1.0  | 6.3  | 2.9  |
|      | 3mΩ - 9mΩ    | 1.6  |      |      |
|      | 10mΩ - 100mΩ | 2.7  |      |      |
| MF12 | 2mΩ - 4mΩ    | 1.0  | 8.0  | 3.4  |
|      | 5mΩ - 200mΩ  | 3.8  |      |      |

## Soldering Condition

Recommended reflow profile



Recommended wave solder profile

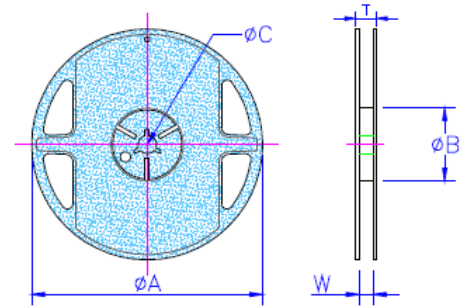


## Packaging

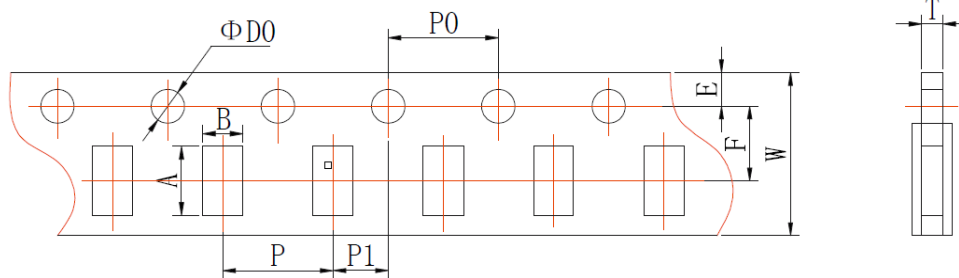
### Packing Quantity & Reel Specifications

Unit : mm

| Type | ØA        | ØB       | ØC       | W        | T        | Paper Tape (EA) | Emboss Plastic Tape (EA) |
|------|-----------|----------|----------|----------|----------|-----------------|--------------------------|
| MF02 | 178.0±2.0 | 58.0±2.0 | 13.0±0.5 | 9.5±1.0  | 12.5±1.5 | 10,000          | -                        |
| MF03 | 178.0±2.0 | 58.0±2.0 | 13.0±0.5 | 9.5±1.0  | 12.5±1.5 | 5,000           | -                        |
| MF05 | 178.0±2.0 | 58.0±2.0 | 13.0±0.5 | 9.5±1.0  | 12.5±1.5 | 5,000           | -                        |
| MF06 | 178.0±2.0 | 58.0±2.0 | 13.0±0.5 | 9.5±1.0  | 12.5±1.5 | 5,000           | -                        |
| MF10 | 178.0±2.0 | 57.0±2.0 | 13.0±0.5 | 13.0±0.5 | 15.5±1.5 | -               | 4,000                    |
| MF12 | 178.0±2.0 | 57.0±2.0 | 13.0±0.5 | 13.0±0.5 | 15.5±1.5 | -               | 4,000                    |



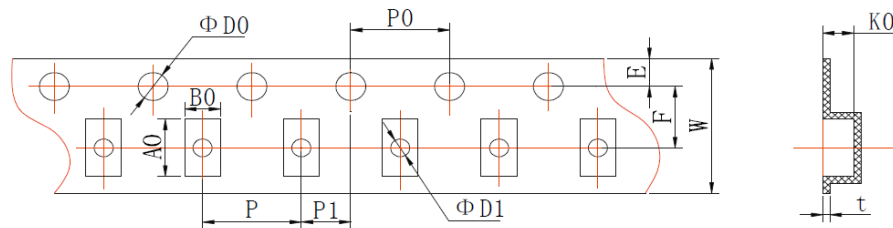
### Paper Tape Specifications



Unit: mm

| Type | A         | B         | W         | F         | E         | P         | P0        | P1        | ØD0       | T         |
|------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| MF02 | 1.15±0.10 | 0.65±0.10 | 8.00±0.20 | 3.50±0.05 | 1.75±0.10 | 2.00±0.05 | 4.00±0.10 | 2.00±0.05 | 1.50±0.10 | 0.44±0.05 |
| MF03 | 1.80±0.10 | 1.05±0.10 | 8.00±0.20 | 3.50±0.05 | 1.75±0.10 | 4.00±0.10 | 4.00±0.10 | 2.00±0.05 | 1.50±0.10 | 0.75±0.10 |
| MF05 | 2.30±0.10 | 1.50±0.10 | 8.00±0.20 | 3.50±0.05 | 1.75±0.10 | 4.00±0.10 | 4.00±0.10 | 2.00±0.05 | 1.50±0.10 | 0.95±0.10 |
| MF06 | 3.50±0.20 | 1.90±0.20 | 8.00±0.20 | 3.50±0.05 | 1.75±0.10 | 4.00±0.10 | 4.00±0.10 | 2.00±0.05 | 1.50±0.10 | 0.95±0.10 |

### Emboss Plastic Tape Specifications



Unit: mm

| Type | A0        | B0        | W         | F         | E         | t         | P         | P0        | P1        | D0               | D1        | K0        |
|------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------------------|-----------|-----------|
| MF10 | 5.50±0.15 | 2.82±0.15 | 12.0±0.10 | 5.50±0.10 | 1.75±0.10 | 0.25±0.05 | 4.00±0.10 | 4.00±0.10 | 2.00±0.05 | 1.50<br>+0.10/-0 | 1.50±0.10 | 0.84±0.10 |
| MF12 | 6.78±0.15 | 3.45±0.15 | 12.0±0.10 | 5.50±0.10 | 1.75±0.10 | 0.25±0.05 | 4.00±0.10 | 4.00±0.10 | 2.00±0.05 | 1.50<br>+0.10/-0 | 1.50±0.10 | 1.00±0.10 |

**REVISION HISTORY**

| <b><u>REVISION</u></b> | <b><u>DATE</u></b> | <b><u>CHANGE NOTIFICATION</u></b> | <b><u>DESCRIPTION</u></b> |
|------------------------|--------------------|-----------------------------------|---------------------------|
| Version A7             | Mar 31,2025        |                                   | -Add Shelf life.          |