



# MFF Series Metal Foil Four Terminal Low-Resistance Resistor Product Specifications

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## ■ Metal Foil Four Terminal Low Resistance Chip Resistor — MFF Series

### ■ Application

- Entertainment
- Power supply
- Measuring instrument
- Industrial
- Battery management system

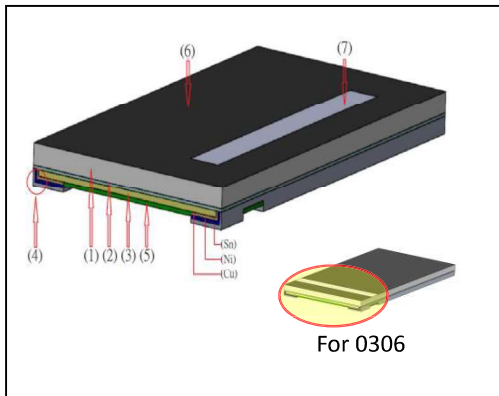
### ■ Features

- Low Resistance / TCR / EMF / Inductance
- Excellent long term stability
- RoHs compliant and halogen free.
- Lead free.
- High precision current sensing and voltage division.

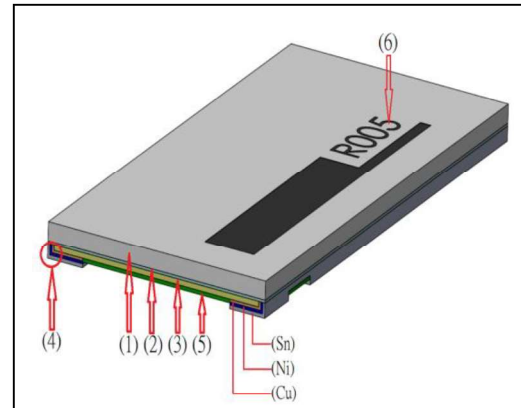
### ■ Product structure:

- (1) - Substrate : Alumina Ceramic
- (2) - Adhesive : Epoxy
- (3) - Resistive element : MnCu – alloy
- (4) - Terminal electrode : Cu, Ni, Sn
- (5) - Protective coating : Flame-retardant epoxy, meets UL- 94-V0 requirements(green)
- (6) - Marking coating : Flame-retardant epoxy, meets UL- 94-V0 requirements (black)
- (7) - Marking coating : Flame-retardant epoxy, meets UL- 94-V0 requirements (white)

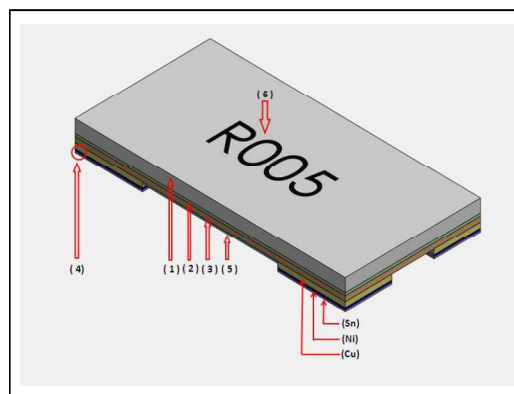
#### For 0306/0612 Type



#### For 1225/2139 Type



#### For 1206/2512/3921 Type



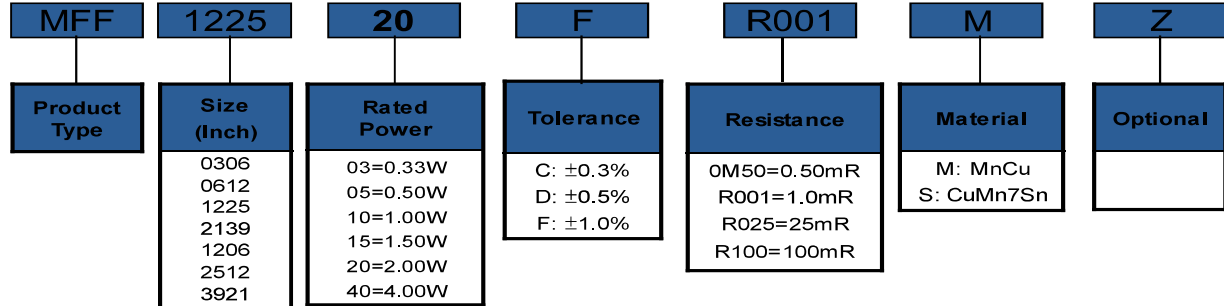


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### ■ Parts Number Explanation

Example:



### ■ Standard Electrical Specifications

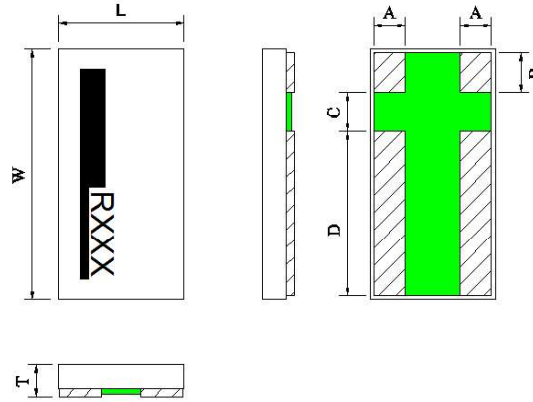
Type	Rating Power at 70°C	T.C.R. (ppm/°C) (20-60°C)	T.C.R. (ppm/°C) (25-125°C)	Max. Rating Current	Max. Overload Current	Resistance Range (mΩ)			Material	Operating Temperature Range (°C)
						0.3% (C)	0.5% (D)	1.0% (F)		
MFF0306	0.33W	—	±100	18.16A	28.72A	—		1~4	MnCu	-55°C~155°C
		—	±50	8.12A	12.84A	—		5~25		
MFF0612	1W	—	±150	44.72A	70.71A	—		0.5~0.75		
		—	±100	31.62A	50A	—	1~4			
MFF1225	2W	—	±50	14.14A	22.36A	—	5~25			
		—	±100	44.72A	70.71A	—		1~4		
MFF2139	4W	—	±50	20A	31.62A	—		5~25		
		—	±100	63.24A	100A	—		1~4		
MFF1206	0.5W	—	±100	28.28A	44.72A	—	5~25			
		—	±50	10.00A	15.81A	—		5~9		
MFF2512	1W	—	±50	7.07A	11.18A	10~100		—		
MFF2512	1W	—	±50	18.26A	28.87A	—	3~4			
MFF2512	1W	—	±30	14.14A	22.36A	—	5~100			
MFF3921	1.5W	±30	—	22.36A	35.35A	3		—		
MFF3921	2W	±20	—	22.36A	35.35A	4~5		—		



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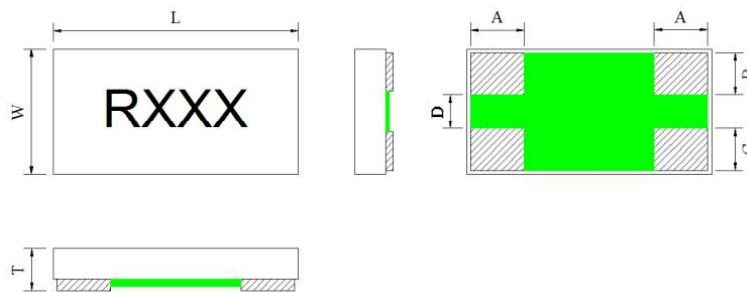
## ■ Type Dimension



## ■ Dimension

Unit : mm

	Power Rating	Resistance Range	W	L	A	B	C	D	T
MFF0306	0.33W	1~25mΩ	1.60±0.20	0.80±0.15	0.18±0.10	0.23±0.10	0.40±0.10	0.93±0.20	0.55±0.10
MFF0612	1W	0.5~25mΩ	3.20±0.20	1.60±0.20	0.41±0.20	0.46±0.20	0.50±0.20	2.16±0.20	0.50±0.20
MFF1225	2W	1~25mΩ	6.30±0.20	3.10±0.20	0.50±0.20	0.62±0.20	0.50±0.20	5.12±0.20	0.60±0.20
MFF2139	4W	1~25mΩ	11.0±0.30	5.00±0.30	0.70±0.20	1.40±0.20	1.05±0.20	8.50±0.30	0.60±0.20



## ■ Dimension

Unit : mm

	Power Rating	Resistance Range	W	L	A	B	C	D	T
MFF1206	0.5W	5~100mΩ	1.60±0.20	3.20±0.20	0.60±0.20	0.55±0.20	0.55±0.20	0.50±0.20	0.60±0.20
MFF2512	1W	3~100mΩ	3.10±0.20	6.30±0.20	0.95±0.20	1.05±0.20	1.05±0.20	1.00±0.20	0.60±0.20
MFF3921	1.5W 2W	3~5mΩ	5.00±0.30	11.0±0.30	2.00±0.30	1.70±0.20	1.70±0.20	1.50±0.20	0.80±0.20



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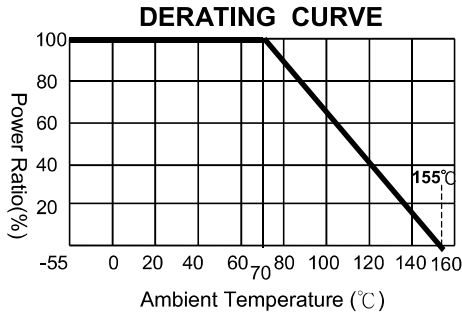
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## ■ Performance Characteristics

### Power Derating Curve

The Operating Temperature Range: -55°C ~+155°C.

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



## ■ Rating Current

The following equation may be used to determine the DC (Direct Current) or AC (Alternating Current) (RMS, root mean square value) of normal rated power. However, if the result value exceeds the highest current of regulated standards (paragraph 5), the highest normal rated power is to be used

$$I = \sqrt{P/R}$$

I = Rating current (A)  
P= Rating Power (W)  
R= Resistance(Ω)

## ■ Reliability Test and Requirement

Test Item	Test Method	Procedure	Requirements
Temperature Coefficient of Resistance (T.C.R)	JIS-C-5201-1 4.8 IEC-60115-1 4.8	At 25°C/+125°C, 25°C is the reference temperature At 20°C/+60°C, 20°C is the reference temperature	Refer to Ratings
Short Time Overload	JIS-C-5201-1 4.13 IEC-60115-1 4.13	The number of rated power are as follows: 2.5 times of rated power for 5 seconds.	±1.0%+0.5mΩ
High Temperature Exposure	JIS-C5201-1 4.25 IEC 60068-2-2	At 155°C for 1000 hours.	±1.0%+0.5mΩ
Low Temperature Storage	JIS-C-5201-1 4.23.4 IEC60115-1 4.23.4	At -55°C for 1000 hours	±1.0%+0.5mΩ
Resistance to Soldering Heat	JIS-C-5201-1 4.18 IEC-60115-1 4.18	260±5°C for 10 seconds.	±1.0%+0.5mΩ
Damp Heat with Load	JIS-C-5201-1 4.24 IEC-60115-1 4.24	40±2°C, 90~95% R.H. RCWV or Max. working voltage whichever is less for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF" .	±2.0%+0.5mΩ
Rapid Change of Temperature	JIS-C-5201-1 4.19 IEC-60115-1 4.19	-55°C to +155°C, 100 cycles	±1.0%+0.5mΩ



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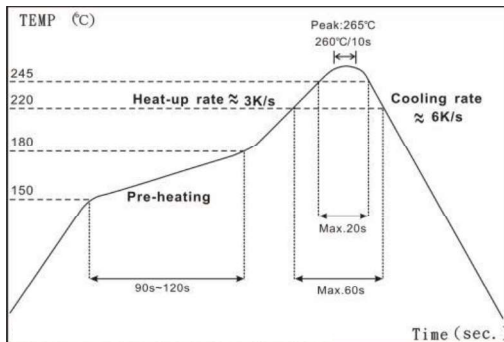
Load Life (Endurance)	JIS-C-5201-1 4.25 IEC-60115-1 4.25.1	70±2 °C , RCWV or Max. working voltage whichever is less for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF" .	±2.0%+0.5mΩ
Solderability	JIS-C-5201-1 4.17 IEC-60115-1 4.17	245±5°C for 3 seconds.	The covered area >95%
Mechanical Shock	JIS C 5202 6.7	a =50G , t =11ms, 5 times shock	±1.0%+0.5mΩ
Bending Strength	JIS-C-5201-1 4.33 IEC-60115-1 4.33	Bending once 2mm for 10 seconds	±1.0%+0.5mΩ

### ■ Marking Format:

- 0306/0612 type products no marking.  
Other requirements can be contact with the business staff
- 1225/2139/1206/2512/3921 type products marking are 4 digits.  
"R" designates the decimal location in ohms  
e.g. 1mΩ the product marking is R001.  
20mΩ the product marking is R020.  
"M" designates the decimal location in milli-ohms  
e.g. 0.5mΩ the product marking is 0M50.
- The criteria to distinguishing the mark on the surface of products are that characters can be identified.

### ● Recommended Customer Soldering Parameters

#### ■ Solder reflow Temperature condition



#### ■ Rework temperature ( hot air equipment ) : 350°C , 3~5seconds

#### ■ Recommended reflow methods

IR, vapor phase oven, hot air oven

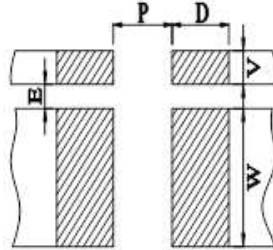
If reflow temperatures exceed the recommended profile, devices may not meet the performance requirements.



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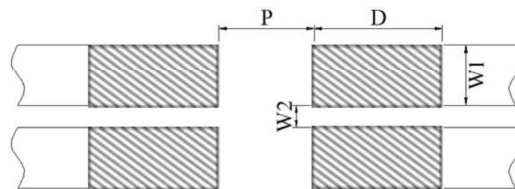
### Recommend Land Pattern Design



### Dimension

Unit: mm

TYPE	Resistance Range	P	W	D	V	E
MFF0306 – 0.33W	1mΩ~25mΩ	0.35	1.30	0.40	0.40	0.20
MFF0612 – 1W	0.5mΩ~25mΩ	0.762	2.29	1.014	0.762	0.381
MFF1225 – 2W	1mΩ~25mΩ	2.00	5.10	1.00	0.70	0.50
MFF2139– 4W	1mΩ~25mΩ	3.30	8.90	1.50	1.70	0.80



### Dimension

Unit: mm

TYPE	Resistance Range	P	D	W1	W2
MFF1206 – 0.5W	5mΩ~100mΩ	1.20	1.80	1.10	0.30
MFF2512 – 1.0W	3mΩ~100mΩ	3.10	2.00	1.40	0.70
MFF3921 – 1.5W/2.0W	3mΩ~5mΩ	4.50	4.00	2.40	1.00

### Packing Quantity

TYPE	PCS /Reel
MFF0306	5000
MFF0612 / MFF1206	5000
MFF1225 / MFF2512	4000
MFF2139 / MFF3921	2000



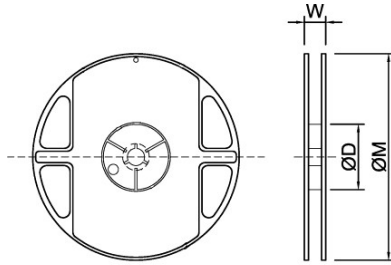
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**Appendix For SMD Chip Resistor**

**● Packaging Information**

**■ Reel Dimensions**

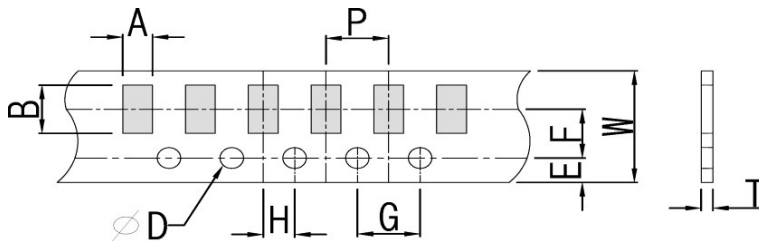


**■ Dimension**

**Unit: mm**

TYPE	$\phi D$	W	$\phi M$
MFF0306	60±2	9.0±1	178±5
MFF0612 / MFF1206		9.0±1	
MFF1225 / MFF2512		13.0±1	
MFF2139 / MFF3921		24.5±1	

**■ Paper tape Dimensions**



**■ Dimension**

**Unit: mm**

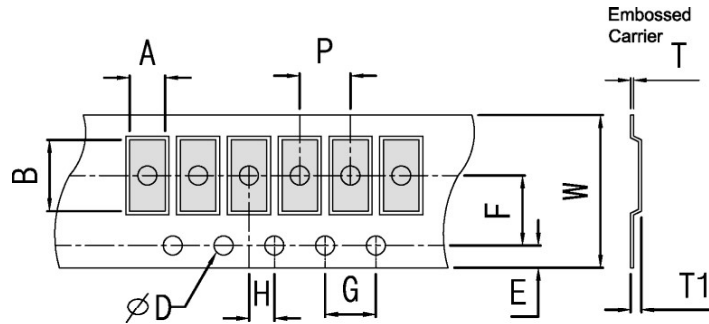
Item	W	P	E	F	$\phi D$	G	H	A	B	T
MFF0306	8.0±0.30	4.0±0.10	1.75±0.10	3.5±0.10	1.50 <sup>+0.1</sup> <sub>0</sub>	4.0±0.10	2.0±0.10	1.18±0.20	1.98±0.20	0.75±0.20



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■ **Embossed Dimensions**



■ **Dimension**

**Unit: mm**

Item	W	P	E	F	$\phi D$	G	H	A	B	T1	T
MFF0612 / MFF1206	8.0±0.30	4.0±0.10	1.75±0.10	3.50±0.10	1.50 <sup>+0.1</sup> <sub>-0</sub>	4.0±0.10	2.0±0.10	2.05±0.20	3.65±0.20	0.85±0.20	0.20±0.10
MFF1225 / MFF2512	12.0±0.30	4.0±0.10		5.5±0.10				3.40±0.20	6.75±0.20	1.00±0.20	0.25±0.10
MFF2139 / MFF3921	24.0±0.30	8.0±0.10		11.50±0.10				5.50±0.20	11.50±0.20	0.90±0.20	0.30±0.10

■ **Peeling Strength of Seal Tape**

Peeling Strength: 0.1 – 1.0N (10 - 100gf )

■ **Storage Temperature**

Temperature : 25±5°C, Humidity : 60±20%