

# ROYALOHM

CONFIDENTIAL DOCUMENT

## SPECIFICATION FOR APPROVAL

### SPARK

Description : Metal Film Fixed Resistors

#### Royalohm Part no.:

<u>Normal Size</u>	MF0W8xxxxxxxxx	(MF 1/8W (+/- 1%, +/- 2%, +/- 5%), (50ppm, 100ppm, 200ppm))
	MF0W4xxxxxxxxx	(MF 1/4W (+/- 1%, +/- 2%, +/- 5%), (50ppm, 100ppm, 200ppm))
	MF0W2xxxxxxxxx	(MF 1/2W (+/- 1%, +/- 2%, +/- 5%), (50ppm, 100ppm, 200ppm))
	MF01Wxxxxxxxxx	(MF 1W (+/- 1%, +/- 2%, +/- 5%), (50ppm, 100ppm, 200ppm))
	MF02Wxxxxxxxxx	(MF 2W (+/- 1%, +/- 2%, +/- 5%), (50ppm, 100ppm, 200ppm))
	MF03Wxxxxxxxxx	(MF 3W (+/- 1%, +/- 2%, +/- 5%), (50ppm, 100ppm, 200ppm))
<u>Small Size</u>	MF0S4xxxxxxxxx	(MF 1/4W-S (+/- 1%, +/- 2%, +/- 5%), (50ppm, 100ppm, 200ppm))
	MFF04xxxxxxxxx	(MF 0.4W-SS (+/- 1%, +/- 2%, +/- 5%), (50ppm, 100ppm, 200ppm))
	MFFU2xxxxxxxxx	(MF 1/2W-SS (+/- 1%, +/- 2%, +/- 5%), (50ppm, 100ppm, 200ppm))
	MF0S2xxxxxxxxx	(MF 1/2W-S (+/- 1%, +/- 2%, +/- 5%), (50ppm, 100ppm, 200ppm))
	MF006xxxxxxxxx	(MF 0.6W-S (+/- 1%, +/- 2%, +/- 5%), (50ppm, 100ppm, 200ppm))
	MF0M7xxxxxxxxx	(MF 0.75W-S (+/- 1%, +/- 2%, +/- 5%), (50ppm, 100ppm, 200ppm))
	MF01Sxxxxxxxxx	(MF 1W-S (+/- 1%, +/- 2%, +/- 5%), (50ppm, 100ppm, 200ppm))
	MF02Sxxxxxxxxx	(MF 2W-S (+/- 1%, +/- 2%, +/- 5%), (50ppm, 100ppm, 200ppm))
	MF03Sxxxxxxxxx	(MF 3W-S (+/- 1%, +/- 2%, +/- 5%), (50ppm, 100ppm, 200ppm))

Approved by

Parts corresponding to RoHS Compliant: 2005-Apr.-1

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Issued Date: 2013/08/15



## CHANGE NOTIFICATION HISTORY

[illegible]

## For SPARK

### 1. Scope:

This specification for approval relates to Metal Film Fixed Resistors manufactured by ROYALOHM 's specifications.

### 2. Type designation:

The type designation shall be in the following form :

Type	Power Rating	Resistance tolerance	Nominal Resistance
MF	1/8W	F, G, J	1K $\Omega$
	1/4W, 1/4W-S		
	0.4W-SS		
	1/2W, 1/2W-S, 1/2W-SS		
	0.6W-S		
	3/4W-S		
	1W, 1W-S		
	2W, 2W-S		
	3W, 3W-S		

### 3. Ratings:

Ratings shall be shown in the table 1. Table 1

Type	Rated Power at 70°C	Max. Working Voltage	Max. Overload Voltage	Dielectric Withstanding Voltage	Resistance Tolerance	T.C.R (PPM/°C)	Resistance Range	Operating Temp. Range
Normal size	MF-12 (0.125W)	200 V	400 V	400 V	± 5	± 200	1 $\Omega$ --1M $\Omega$	-55°C--+155°C
					± 2	± 100	10 $\Omega$ --1M $\Omega$	
					± 1	± 50	10 $\Omega$ --1M $\Omega$	
	MF-25 (0.25W)	250 V	500 V	500 V	± 5	± 200	1 $\Omega$ --1M $\Omega$	
					± 2	± 100	10 $\Omega$ --1M $\Omega$	
					± 1	± 50	10 $\Omega$ --1M $\Omega$	
	MF-50 (0.50W)	350 V	700 V	700 V	± 5	± 200	1 $\Omega$ --1M $\Omega$	
					± 2	± 100	10 $\Omega$ --1M $\Omega$	
					± 1	± 50	10 $\Omega$ --1M $\Omega$	
	MF-100	500 V	1,000 V	1,000 V	± 5	± 200	10 $\Omega$ --1M $\Omega$	
					± 2	± 100	51.1 $\Omega$ --1M $\Omega$	
					± 1	± 50	51.1 $\Omega$ --1M $\Omega$	
	MF-200	500 V	1,000 V	1,000 V	± 5	± 200	10 $\Omega$ --1M $\Omega$	
					± 2	± 100	51.1 $\Omega$ --1M $\Omega$	
					± 1	± 50	51.1 $\Omega$ --1M $\Omega$	
	MF-300	500 V	1,000 V	1,000 V	± 5	± 200	10 $\Omega$ --1M $\Omega$	
					± 2	± 100	51.1 $\Omega$ --1M $\Omega$	
					± 1	± 50	51.1 $\Omega$ --1M $\Omega$	
Small size	MF-25s (0.25W)	200 V	400 V	400 V	± 5	± 200	1 $\Omega$ --1M $\Omega$	
					± 2	± 100	10 $\Omega$ --1M $\Omega$	
					± 1	± 50	10 $\Omega$ --1M $\Omega$	
	MF-40ss	200 V	400 V	200 V	± 5	± 200	1 $\Omega$ --1M $\Omega$	
					± 2	± 100	10 $\Omega$ --1M $\Omega$	
					± 1	± 50	10 $\Omega$ --1M $\Omega$	
	MF-50ss (0.50W)	250 V	500 V	250 V	± 5	± 200	1 $\Omega$ --1M $\Omega$	
					± 2	± 100	10 $\Omega$ --1M $\Omega$	
					± 1	± 50	10 $\Omega$ --1M $\Omega$	
	MF-60s	250 V	500 V	500 V	± 5	± 200	1 $\Omega$ --1M $\Omega$	
					± 2	± 100	10 $\Omega$ --1M $\Omega$	
					± 1	± 50	10 $\Omega$ --1M $\Omega$	
	MF-50s (0.50W)	350 V	700 V	700 V	± 5	± 200	1 $\Omega$ --1M $\Omega$	
					± 2	± 100	10 $\Omega$ --1M $\Omega$	
					± 1	± 50	10 $\Omega$ --1M $\Omega$	
	MF-75s (0.75W)	350 V	700 V	700 V	± 5	± 200	1 $\Omega$ --1M $\Omega$	
					± 2	± 100	10 $\Omega$ --1M $\Omega$	
					± 1	± 50	10 $\Omega$ --1M $\Omega$	
	MF-100s	350 V	700 V	700 V	± 5	± 200	1 $\Omega$ --1M $\Omega$	
					± 2	± 100	10 $\Omega$ --1M $\Omega$	
					± 1	± 50	10 $\Omega$ --1M $\Omega$	
	MF-200s	500 V	1,000 V	1,000 V	± 5	± 200	10 $\Omega$ --1M $\Omega$	
					± 2	± 100	51.1 $\Omega$ --1M $\Omega$	
					± 1	± 50	51.1 $\Omega$ --1M $\Omega$	
	MF-300s	500 V	1,000 V	1,000 V	± 5	± 200	10 $\Omega$ --1M $\Omega$	
					± 2	± 100	51.1 $\Omega$ --1M $\Omega$	
					± 1	± 50	51.1 $\Omega$ --1M $\Omega$	

## Metal Film Fixed Resistors

### 3.1 Power rating:

Resistors shall have a power rating based on continuous full load operation at an ambient temperature of 70 °C. For temperature in excess of 70 °C , the load shall be derated as shown in the figure 1.

### 3.2 Voltage rating:

Resistors shall have a rated direct-current (DC) continuous working voltage or an approximate sine-wave root-mean-square (RMS) alternating-current (AC) continuous working voltage at commercial-line frequency and waveform corresponding to the power rating , as determined from the following formula :

$$RCWV = \sqrt{P \times R}$$

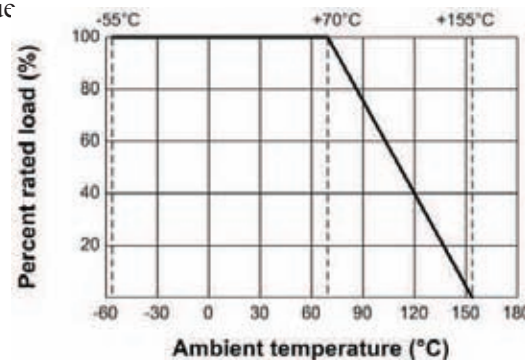
Where : RCWV = Rated DC or RMS AC continuous working voltage at commercial-line frequency and waveform (volt)

P = Power Rating (watt)

R = Nominal Resistance (ohm)

In no case shall the rated DC or RMS AC continuous working voltage be greater than the applicable maximum value

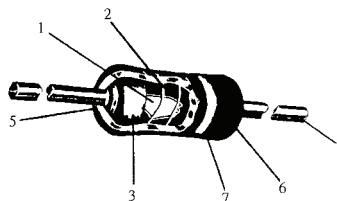
Figure 1.



### 3.3 Nominal resistance :

Effective figures of nominal resistance shall be in accordance with E-96,E-24 series, and resistance tolerance shall be shown by table 1.

### 4. Construction :



No.	Name	Material
1	Basic Body	Rod Type Ceramics
2	Resistance Film	Metal Film
3	End Cap	Steel (Tin plated iron surface)
4	Lead Wire	Annealed copper wire coated with tin
5	Joint	By Welding
6	Coating	Normal type: Normal size and small size (1/2W-S only): --Insulated resin ( Color : Sky blue ) Small size: --Insulated epoxy resin ( Color : Apple Green ) Non-Flame type: --Insulated & Non-Flame Paint ( Color : Green Meeting U L 94 V O Standard )
7	Color Code	Normal type: --Epoxy Resin Non-Flame type: --Non-Flame Paint Epoxy Resin

## Metal Film Fixed Resistors

### 5. Characteristics :

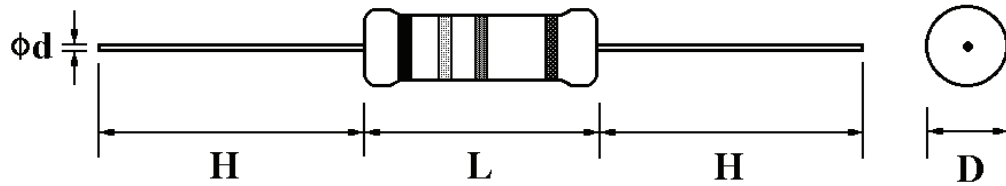
Characteristics	Limits	Test Methods ( JIS C 5201-1 )
DC. resistance	Must be within the specified tolerance	The limit of error of measuring apparatus shall not exceed allowable range or resistance tolerance of specification. (Sub-clause 4.5)
Insulation resistance	Insulation resistance is 10,000 MΩ Min	Resistors shall be clamped in the trough of a 90° metallic V-block or foil method use a metal foil shall be wrapped closely around the body of the resistor. After that shall be tested at DC potential respectively specified in the above list for 60 +10/-0 secs. (Sub-clause 4.6)
Dielectric withstanding voltage	No evidence of flashover mechanical damage, arcing or insulation break down	Resistors shall be clamped in the trough of a 90° metallic V-block or foil method use a metal foil shall be wrapped closely around the body of the resistor. After that shall be tested at AC potential respectively specified in the table 1. for 60 +10/-0 secs. (Sub-clause 4.7)
Temperature coefficient	As spec in page.1	Natural resistance change per temp. degree centigrade $\frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6 \quad (\text{PPM}/^\circ\text{C})$ R1: Resistance value at room temperature (t1) R2: Resistance value at room temp. plus 100 °C (t2) (Sub-clause 4.8)
Short time overload	Resistance change rate is ± (0.5% + 0.05 Ω) Max. with no evidence of mechanical damage	Permanent resistance change after the application of a potential of 2.5 times RCWV for 5 seconds (Sub-clause 4.13)
Terminal strength	No evidence of mechanical damage	<b>Direct load :</b> Resistance to a 2.5 kgs direct load for 10 secs. in the direction of the longitudinal axis of the terminal leads <b>Twist test :</b> Terminal leads shall be bent through 90 ° at a point of about 6mm from the body of the resistor and shall be rotated through 360° about the original axis of the bent terminal in alternating direction for a total of 3 rotations (Sub-clause 4.16)
Solderability	95 % coverage Min.	The area covered with a new, smooth, clean, shiny and continuous surface free from concentrated pinholes. Test temp. of solder : 245°C ± 3°C Dwell time in solder : 2 ~ 3 seconds (Sub-clause 4.17)

Metal Film Fixed Resistors					
Characteristics	Limits		Test Methods ( JIS C 5201-1 )		
Soldering temp. reference	Electrical characteristics shall be satisfied. Without distinct deformation in appearance. (95 % coverage Min.)		The leads immersed into solder bath to 3.2 to 4.8 mm. from the body. Permanent resistance change shall be checked. <u>Wave soldering condition: (2 cycles Max.)</u> Pre-heat : 100 ~ 120 °C , 30 ± 5 sec. Suggestion solder temp.: 235 ~ 255 °C , 10 sec. (Max.) Peak temp.: 260 °C <u>Hand soldering condition:</u> Hand Soldering bit temp. : 380 ± 10 °C Dwell time in solder : 3 +1/-0 sec.		
Resistance to soldering heat	Resistance change rate is ± (1% + 0.05 Ω ) Max. with no evidence of mechanical damage		Permanent resistance change when leads immersed to 3.2 to 4.8 mm from the body in 350°C ± 10 °C solder for 3 ± 0.5 seconds (Sub-clause 4.18)		
Temperature cycling	Resistance change rate is ± (1% + 0.05 Ω ) Max. with no evidence of mechanical damage		Resistance change after continuous 5 cycles for duty shown below:		
			<b>Step</b>	<b>Temperature</b>	<b>Time</b>
			1	-55°C ± 3°C	30 mins
			2	Room temp.	10~15 mins
			3	+155°C ± 2°C	30 mins
			4	Room temp.	10~15 mins
(Sub-clause 4.19)					
Vibration	Resistance change rate is ± (1% + 0.05 Ω ) Max.		55Hz, 3 planes 2hrs each Total amplitude = 1.5mm (Sub-clause 4.22)		
Load life in humidity	<b>Resistance value</b>	<b>△ R/R</b>	Resistance change after 1,000 hours (1.5 hours "on", 0.5 hour "off") at RCWV in a humidity test chamber controlled at 40 °C ± 2 °C and 90 to 95 % relative humidity (Sub-clause 4.24.2.1)		
	Normal type	± 1.5 %			
	Non-flame type	± 5 %			
Load life	<b>Resistance value</b>	<b>△ R/R</b>	7.10 Permanent resistance change after 1,000 hours operating at RCWV with duty cycle of (1.5 hours "on", 0.5 hour "off") at 70°C ± 2°C ambient (Sub-clause 4.25.1)		
	Normal type	± 1.5 %			
	Non-flame type	± 5 %			
Resistance to solvent	No deterioration of protective coatings and markings		Specimens shall be immersed in a bath of trichroethane completely for 3 minutes with ultrasonic (Sub-clause 4.30)		
Pulse overload	Resistance change rate is ± (1% + 0.05 Ω ) Max. with no evidence of mechanical damage		Resistance change after 10,000 cycles (1 sec. "on" , 25 secs. "off" ) at 4 times RCWV (Sub-clause 5.8)		

## Metal Film Fixed Resistors

6. Dimension :

Unit : mm



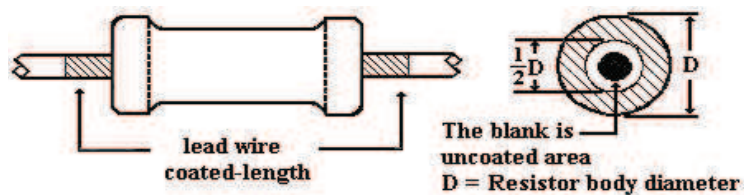
Normal size						
Part No.	Style	Power Rating at 70 °C	Dimension (mm)			
			D (Max.)	L (Max.)	d ± 0.05	H ± 3
MF0W8	MF-12	1/8W (0.125W)	1.85	3.5	0.45	28
MF0W4	MF-25	1/4W (0.25W)	2.5	6.8	0.54	28
MF0W2	MF-50	1/2W (0.50W)	3.5	10.0	0.54	28
MF01W	MF-100	1W	5.0	12.0	0.70	25
MF02W	MF-200	2W	5.5	16.0	0.70	28
MF03W	MF-300	3W	6.5	17.5	0.75	28

Small size						
Part No.	Style	Power Rating at 70 °C	Dimension (mm)			
			D (Max.)	L (Max.)	d ± 0.05	H ± 3
MF0S4	MF-25s	1/4W (0.25W)	1.85	3.5	0.45	28
MFF04	MF-40ss	0.4W	1.90	3.7	0.45	28
MFFU2	MF-50ss	1/2W (0.50W)	2.5	6.8	0.54	28
MF006	MF-60s	0.6W	2.5	6.8	0.54	28
MF0S2	MF-50s	1/2W (0.50W)	3.0	9.0	0.54	28
MF0M7	MF-75s	0.75W	3.5	10.0	0.54	28
MF01S	MF-100s	1W	3.5	10.0	0.54	28
MF02S	MF-200s	2W	5.0	12.0	0.70	25
MF03S	MF-300s	3W	5.5	16.0	0.70	28

### Painting method:

Welding point, terminal and lead wire, is permissible to be exposed without the outer coated cover.

The extent should be within 1/2 of the are angle.





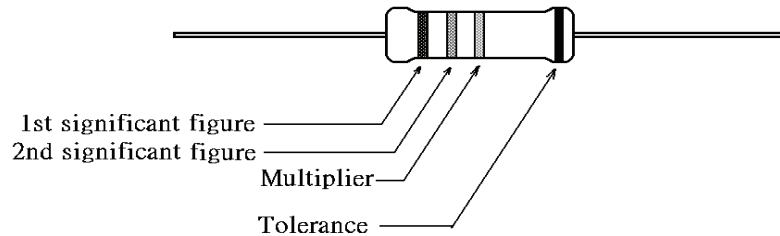
## Metal Film Fixed Resistors

### 7. Marking :

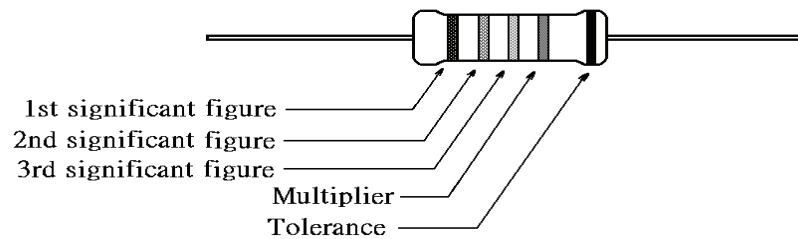
#### 7.1 Resistor :

Resistors shall be marked with color coding  
colors shall be in accordance with JIS C 0802

##### 5%: 4 Color band



##### 1%: 5 Color band



#### Code description and regulation

1. Wattage rating.
2. Nominal resistance value.
3. Resistance Tolerance.

F :  $\pm 1\%$

G :  $\pm 2\%$

J :  $\pm 5\%$

#### 7.2 Label :

Label shall be marked with following items:

- (1) Type and style
- (2) Nominal resistance
- (3) Resistance tolerance
- (4) Quantity
- (5) Lot number
- (6) PPM

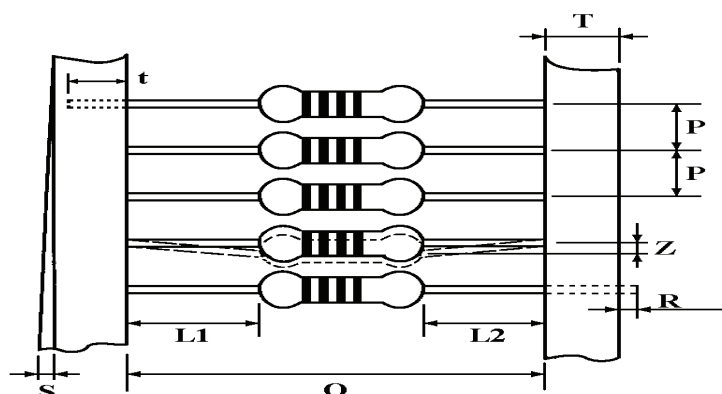
Example :

Metal Film Fixed Resistors			
Watt :	0.6W-S	Val :	27E
Q'TY :	5,000	Tol :	1%
Lot :	319022	PPM :	50
ROYALOHM		Pb-Free	

## Metal Film Fixed Resistors

### 8. Packing specification :

#### 8.1 Taping dimension :



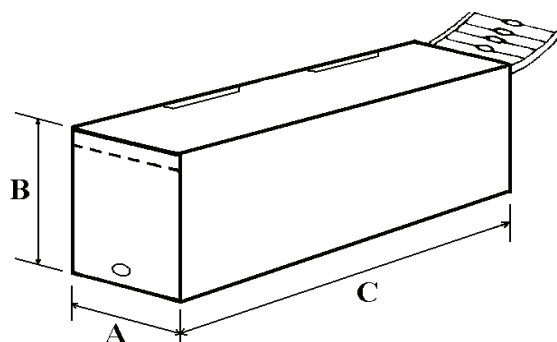
Dimensions (mm)

Normal size										
Part No.	Style	Style	O	P	L1-L2	T	Z	R	t	S
MF0W8	MF-12	PT-52	$52 \pm 1$	$5 \pm 0.3$	1 Max.	$6 \pm 1$	1 Max.	0	$4 \pm 1$	0.5 Max.
MF0W4	MF-25	PT-52	$52 \pm 1$	$5 \pm 0.3$	1 Max.	$6 \pm 1$	1 Max.	0	$4 \pm 1$	0.5 Max.
MF0W2	MF-50	PT-52	$52 \pm 1$	$5 \pm 0.3$	1 Max.	$6 \pm 1$	1 Max.	0	$4 \pm 1$	0.5 Max.
MF01W	MF-100	PT-52	$52 \pm 1$	$5 \pm 0.3$	1 Max.	$6 \pm 1$	1 Max.	0	$4 \pm 1$	0.5 Max.
MF02W	MF-200	PT-64	$64 \pm 1$	$10 \pm 0.5$	1 Max.	$6 \pm 1$	1 Max.	0	$5 \pm 1$	0.5 Max.
MF03W	MF-300	PT-64	$64 \pm 1$	$10 \pm 0.5$	1 Max.	$6 \pm 1$	1 Max.	0	$5 \pm 1$	0.5 Max.

Small size										
Part No.	Style	Style	O	P	L1-L2	T	Z	R	t	S
MF0S4	MF-25s	PT-52	$52 \pm 1$	$5 \pm 0.3$	1 Max.	$6 \pm 1$	1 Max.	0	$4 \pm 1$	0.5 Max.
MFF04	MF-40ss	PT-52	$52 \pm 1$	$5 \pm 0.3$	1 Max.	$6 \pm 1$	1 Max.	0	$4 \pm 1$	0.5 Max.
MFFU2	MF-50ss	PT-52	$52 \pm 1$	$5 \pm 0.3$	1 Max.	$6 \pm 1$	1 Max.	0	$4 \pm 1$	0.5 Max.
MF006	MF-60s	PT-52	$52 \pm 1$	$5 \pm 0.3$	1 Max.	$6 \pm 1$	1 Max.	0	$4 \pm 1$	0.5 Max.
MF0S2	MF-50s	PT-52	$52 \pm 1$	$5 \pm 0.3$	1 Max.	$6 \pm 1$	1 Max.	0	$4 \pm 1$	0.5 Max.
MF0M7	MF-75s	PT-52	$52 \pm 1$	$5 \pm 0.3$	1 Max.	$6 \pm 1$	1 Max.	0	$4 \pm 1$	0.5 Max.
MF01S	MF-100s	PT-52	$52 \pm 1$	$5 \pm 0.3$	1 Max.	$6 \pm 1$	1 Max.	0	$4 \pm 1$	0.5 Max.
MF02S	MF-200s	PT-52	$52 \pm 1$	$5 \pm 0.3$	1 Max.	$6 \pm 1$	1 Max.	0	$4 \pm 1$	0.5 Max.
MF03S	MF-300s	PT-64	$64 \pm 1$	$10 \pm 0.5$	1 Max.	$6 \pm 1$	1 Max.	0	$5 \pm 1$	0.5 Max.

## Metal Film Fixed Resistors

### 8.2 Tape in box packing :



Bandoliers may also be contained in a cardboard box ("Ammopack")

Dimension (mm)

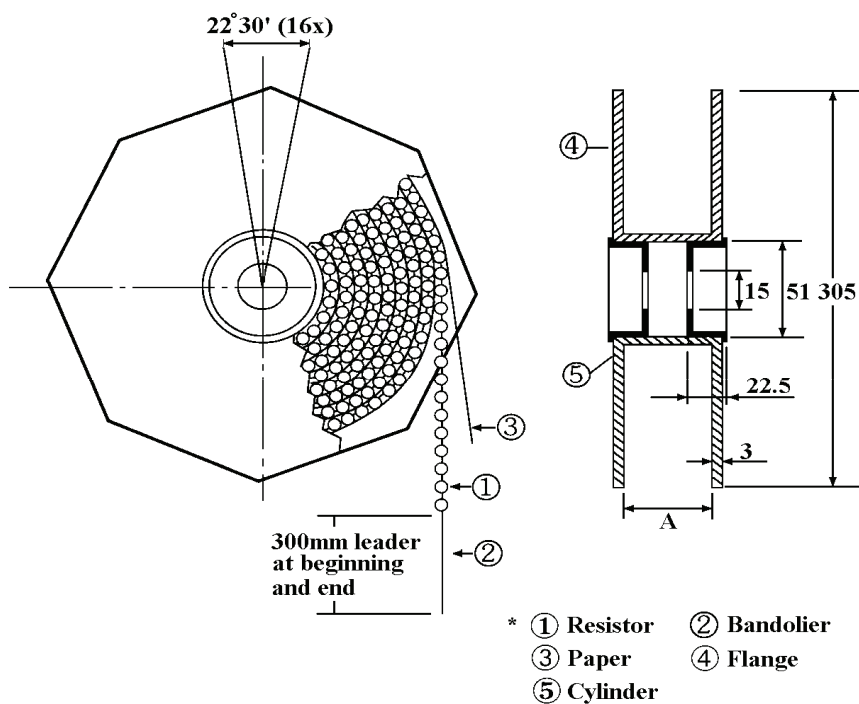
Normal size						
Part No.	Style	Style	L (C) ±5	W (A) ±5	H (B) ±5	Quantity Per Box (pcs.)
MF0W8	MF-12	PT-52	250	75	66	5,000
MF0W4	MF-25	PT-52	250	75	96	5,000
MF0W2	MF-50	PT-52	255	75	43	1,000
MF01W	MF-100	PT-52	255	79	73	1,000
MF02W	MF-200	PT-64	260	94	87	1000
MF03W	MF-300	PT-64	262	96	69	500

Small size						
Part No.	Style	Style	L (C) ±5	W (A) ±5	H (B) ±5	Quantity Per Box (pcs.)
MF0S4	MF-25s	PT-52	250	75	66	5,000
MFF04	MF-40ss	PT-52	250	75	66	5,000
MFFU2	MF-50ss	PT-52	250	75	96	5,000
MF006	MF-60s	PT-52	250	75	96	5,000
MF0S2	MF-50s	PT-52	255	75	56	2,000
MF0M7	MF-75s	PT-52	255	75	43	1,000
MF01S	MF-100s	PT-52	255	75	43	1,000
MF02S	MF-200s	PT-52	255	79	73	1,000
MF03S	MF-300s	PT-64	260	94	87	1000

"Ammopack" is an abbreviation of "ammunition pack"

## Metal Film Fixed Resistors

### 8.3 Tape on reel packing :



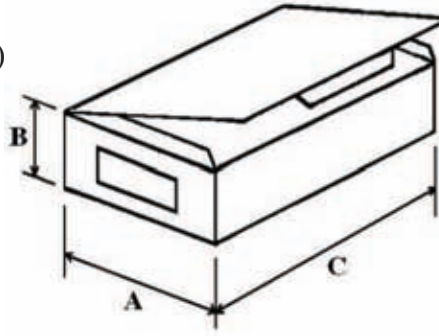
Dimension (mm) :

Normal size				
Part No.	Type	Style	Across Flange (A)	Quantity Per Reel
MF0W8	MF-12	PT-52	73 ± 2	5,000
MF0W4	MF-25	PT-52	73 ± 2	5,000
MF0W2	MF-50	PT-52	73 ± 2	2,500
MF01W	MF-100	PT-52	73 ± 2	2,500
MF02W	MF-200	PT-64	81 ± 5	1000
MF03W	MF-300	PT-64	81 ± 5	500

Small size				
Part No.	Type	Style	Across Flange (A)	Quantity Per Reel
MF0S4	MF-25s	PT-52	73 ± 2	5,000
MFF04	MF-40ss	PT-52	73 ± 2	5,000
MFFU2	MF-50ss	PT-52	73 ± 2	5,000
MF006	MF-60s	PT-52	73 ± 2	5,000
MF0S2	MF-50s	PT-52	73 ± 2	5,000
MF0M7	MF-75s	PT-52	73 ± 2	2,500
MF01S	MF-100s	PT-52	73 ± 2	2,500
MF02S	MF-200s	PT-52	73 ± 2	2,500
MF03S	MF-300s	PT-64	81 ± 5	1000

## Metal Film Fixed Resistors

### 8.4 Bulk in box packing ( in plastic bag )

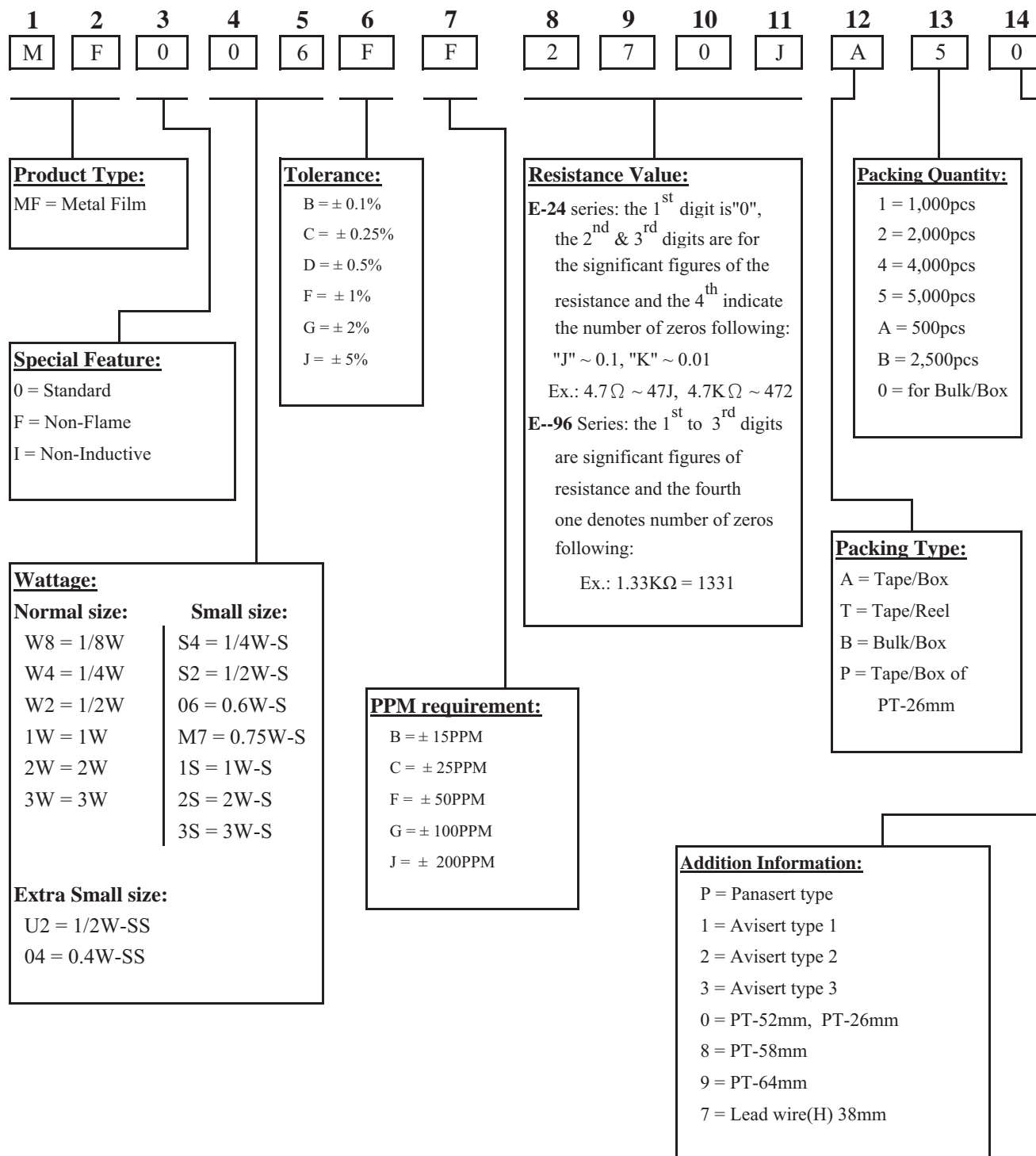


Normal size					
Part No.	Type	L(C) ± 5	W(A) ± 5	H(B) ± 5	Quantity Per Bag (Pcs.)
MF0W8	MF-12	150	77	33	500 / 1,000
MF0W4	MF-25	150	77	33	500 / 1,000
MF0W2	MF-50	150	75	67	100 / 1,000
MF01W	MF-100	155	95	53	100 / 500
MF02W	MF-200	155	95	53	100 / 500
MF03W	MF-300	155	95	53	100 / 400

Small size					
Part No.	Type	L(C) ± 5	W(A) ± 5	H(B) ± 5	Quantity Per Bag (Pcs.)
MF0S4	MF-25s	150	77	33	500 / 1,000
MFF04	MF-40ss	150	77	33	500 / 1,000
MFFU2	MF-50ss	150	77	33	500 / 1,000
MF006	MF-60s	150	77	33	500 / 1,000
MF0S2	MF-50s	150	75	67	100 / 1000
MF0M7	MF-75s	150	75	67	100 / 1,000
MF01S	MF-100s	150	75	67	100 / 1,000
MF02S	MF-200s	155	95	53	100 / 500
MF03S	MF-300s	155	95	53	100 / 500

## Part Number System

### Explanation of Part Number System (Metal Film Fixed Resistors)



Sample: MF 0.6W-S +/- 1% 50ppm  $27\Omega$  T/B 5,000 → MF006FF270JA50

## Metal Film Fixed Resistors

### Environment Related Substance

This product complies to EU RoHS directive, EU PAHs directive, EU PFOS directive and Halogen free.

Ozone layer depleting substances.

Ozone depleting substances are not used in our manufacturing process of this product.

This product is not manufactured using Chloro fluorocarbons (CFCs), Hydrochlorofluorocarbons (HCFCs), Hydrobromofluorocarbons (HBFCs) or other ozone depleting substances in any phase of the manufacturing process.

### Storage Condition

The performance of these products, including the solderability, is guaranteed for a year from the date of arrival at your company, provided that they remain packed as they were when delivered and stored at a temperature of  $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$  and a relative humidity of  $60\%\text{RH} \pm 10\%\text{RH}$

Even within the above guarantee periods, do not store these products in the following conditions. Otherwise, their electrical performance and/or solderability may be deteriorated, and the packaging materials (e.g. taping materials) may be deformed or deteriorated, resulting in mounting failures.

1. In salty air or in air with a high concentration of corrosive gas, such as  $\text{Cl}_2$ ,  $\text{H}_2\text{S}$ ,  $\text{NH}_3$ ,  $\text{SO}_2$ , or  $\text{NO}_2$
2. In direct sunlight