

ROYALOHM

C O N F I D E N T I A L D O C U M E N T

SPECIFICATION FOR APPROVAL

TRELIK

Description : Metal Film Fixed Resistors

Royalohm Part no.:

MF006FJxxxxA50 (MF 0.6W-S +/-1% T/B-5,000 200PPM)

Approved by

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

Royal Electronic Factory (Thailand) Co., Ltd.

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Approved	Checked	Prepared
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Issue Date: 2014/12/10

Customer: TRELIK

Part No.: MF006FJxxxxA50

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 :

(Ex.)	MF	0.6W-S	F	0.1Ω
	Type	Power Rating	Resistance Tolerance	Nominal Resistance

3. Ratings:

Ratings shall be shown in the table 1.

Table 1

Type	MF
Rated Power	0.6W at 70 °C
Max. Working Voltage	250 V
Max. Overload Voltage	500 V
Dielectric Withstanding Voltage	500 V
Rated Ambient Temp.	70 °C
Operating Temp. Range	-55 °C --- +155 °C
Resistance Tolerance	± 1%
Resistance Range	0.1Ω ~ 0.99Ω

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)

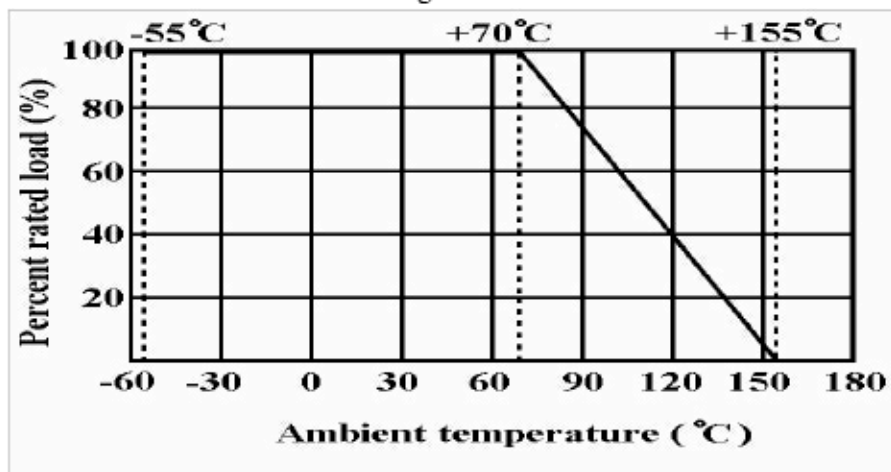
P = Power Rating (watt)

R = Nominal Resistance (ohm)

Metal Film Fixed Resistors

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

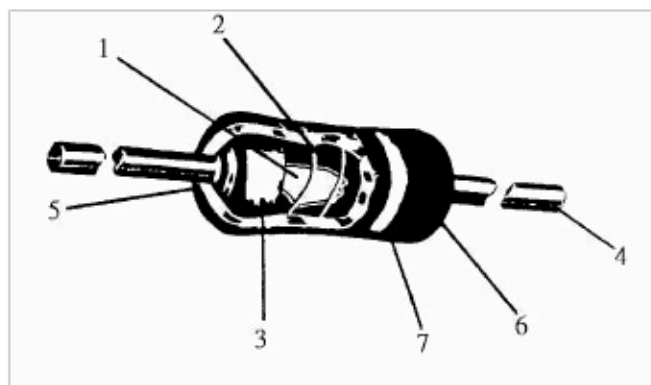
Figure 1.



3.3 Nominal resistance :

Effective figures of nominal resistance shall be in accordance with E-96 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	Insulated epoxy resin (Color : Sky blue)
7	Color Code	Epoxy Resin

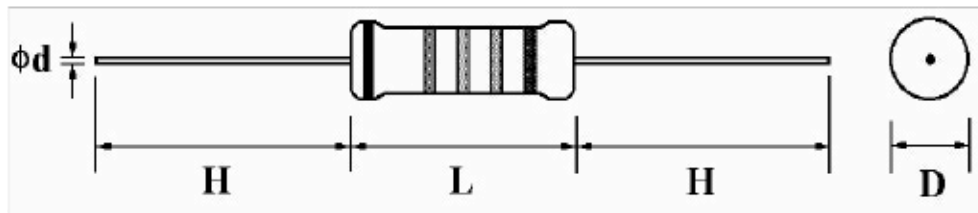
Metal Film Fixed Resistors		
5. Characteristics :		
Characteristics	Limits	Test Methods (JIS C 5201-1)
DC. Resistance	Must be within the specified tolerance	5.1 The limit of error of measuring apparatus shall not exceed allowable range or 5% of resistance tolerance
Temperature coefficient	$\pm 200 \text{ PPM}/^{\circ}\text{C}$	5.2 Natural resistance change per temp. degree centigrade $\frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6 \text{ (PPM}/^{\circ}\text{C})$ R1: Resistance value at room temperature (t1) R2: Resistance value at room temp. plus 100 °C (t2)
Short time overload	Resistance change rate is $\pm (0.5\% + 0.05 \Omega)$ Max. with no evidence of mechanical damage	5.5 Permanent resistance change after the application of a potential of 2.5 times RCWV for 5 seconds
Dielectric withstanding voltage	No evidence of flashover mechanical damage, arcing or insulation break down	5.7 Resistors shall be clamped in the trough of a 90° metallic V-block and shall be tested at AC potential respectively specified in the table 1. for 60 + 10/ -0 seconds
Pulse overload	Resistance change rate is $\pm (1\% + 0.05 \Omega)$ Max. with no evidence of mechanical damage	5.8 Resistance change after 10,000 cycles (1 sec. "on" , 25 secs. "off") at 4 times RCWV
Terminal strength	No evidence of mechanical damage	6.1 Direct load : Resistance to a 2.5 kgs direct load for 10 secs. in the direction of the longitudinal axis of the terminal leads Twist test : 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
Resistance to soldering heat	Resistance change rate is $\pm (1\% + 0.05 \Omega)$ Max. with no evidence of mechanical damage	6.4 Permanent resistance change when leads immersed to 3.2 to 4.8 mm from the body in 350°C $\pm 10^{\circ}\text{C}$ solder for 3 ± 0.5 seconds

Metal Film Fixed Resistors					
Characteristics	Limits		Test Methods (JIS C 5201-1)		
Solderability	95 % coverage Min.		6.5 The area covered with a new, smooth, clean, shiny and continuous surface free from concentrated pinholes. Test temp. of solder : 245℃ ± 3℃ Dwell time in solder : 2 ~ 3 seconds		
Resistance to solvent	No deterioration of protective coatings and markings		6.9 Specimens shall be immersed in bath of trichroethane completely for 3 mins. with ultrasonic		
Temperature cycling	Resistance change rate is ± (1% + 0.05 Ω) Max. with no evidence of mechanical damage		7.4 Resistance change after continuous 5 cycles for duty shown below:		
			Step	Temperature	Time
			1	-55℃ ± 3℃	30 mins
			2	Room temp.	10~15 mins
			3	+155℃ ± 2℃	30 mins
			4	Room temp.	10~15 mins
Load life in humidity			7.9 Resistance change after 1,000 hours (1.5 hours "on", 0.5 hour "off") at RCWV in a humidity test chamber controlled at 40 ℃ ± 2 ℃ and 90 to 95 % relative humidity		
	Resistance value	△ R/R			
	Normal type	± 1.5 %			
Load life			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℃ ± 2℃ ambient		
	Resistance value	△ R/R			
	Normal type	± 1.5 %			

Metal Film Fixed Resistors

6. Dimension :

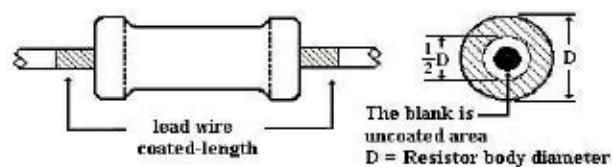
Unit :mm



Type	Power Rating	D (Max.)	L (Max.)	$d \pm 0.05$	$H \pm 3$
MF	0.6W-S	2.5 mm	6.8 mm	0.54 mm	28 mm

Painting method:

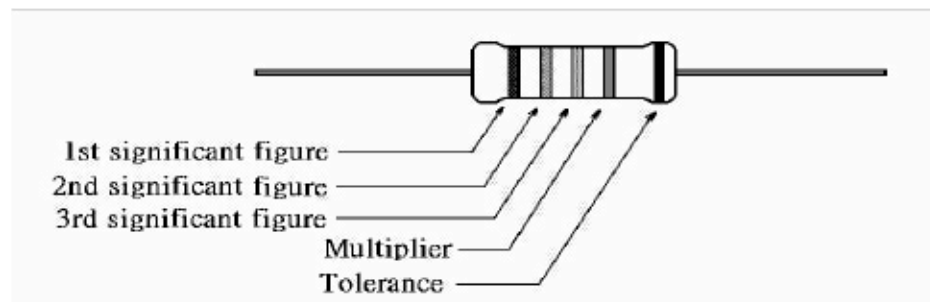
Welding point, terminal and lead wire, is permissible to be exposed without the outer coated cover.
The extent should be within $1/2$ of the arc angle.



7. Marking :

7.1 Resistor :

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



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

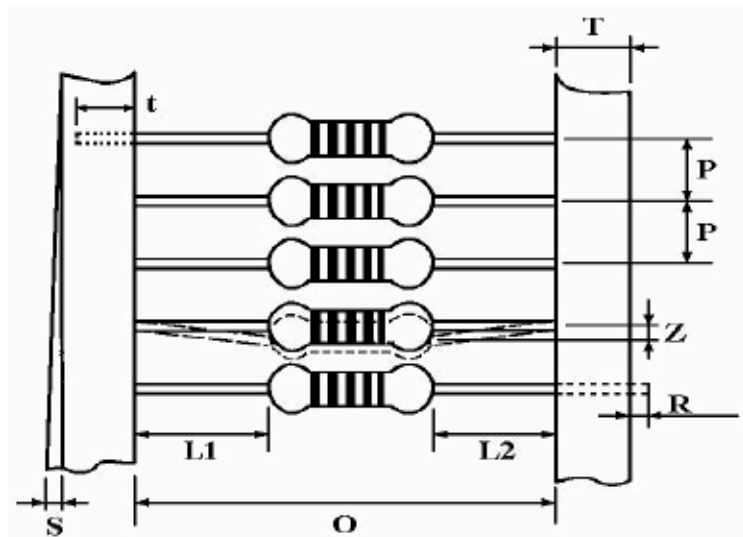
Ex.

Metal Film Fixed Resistors			
Watt :	0.6W-S	Val :	0E1
Q'TY :	5,000	Tol :	1%
Lot :	813478	PPM :	200
ROYALOHM		Pb Free	

Metal Film Fixed Resistors

8. Packing specification :

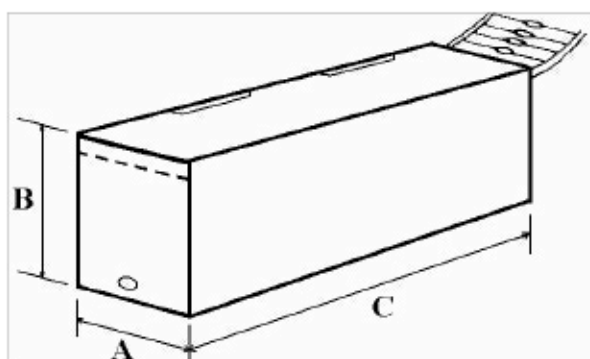
8.1 Taping dimension :



Dimensions (mm)

Type	Style	O	P	L1-L2	T	Z	R	t	S
MF-60-S	PT-52	52 ± 1	5 ± 0.3	1 Max.	6 ± 1	1 Max.	0	4 ± 1	0.5 Max.

8.2 Tape in box packing :



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

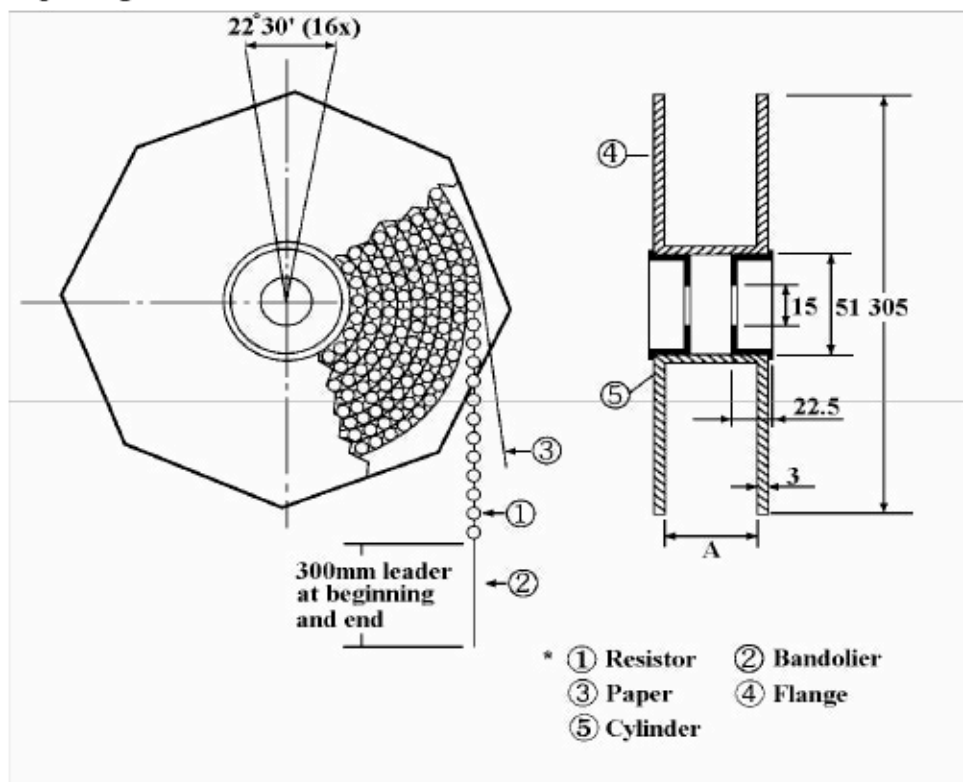
Dimension (mm)

Type	Style	L (C) ± 5	W (A) ± 5	H (B) ± 5	Quantity Per Box (pcs.)
MF-60-S	PT-52	250	75	96	5,000

"Ammopack" is an abbreviation of "ammunition pack"

Metal Film Fixed Resistors

8.3 Tape on reel packing :

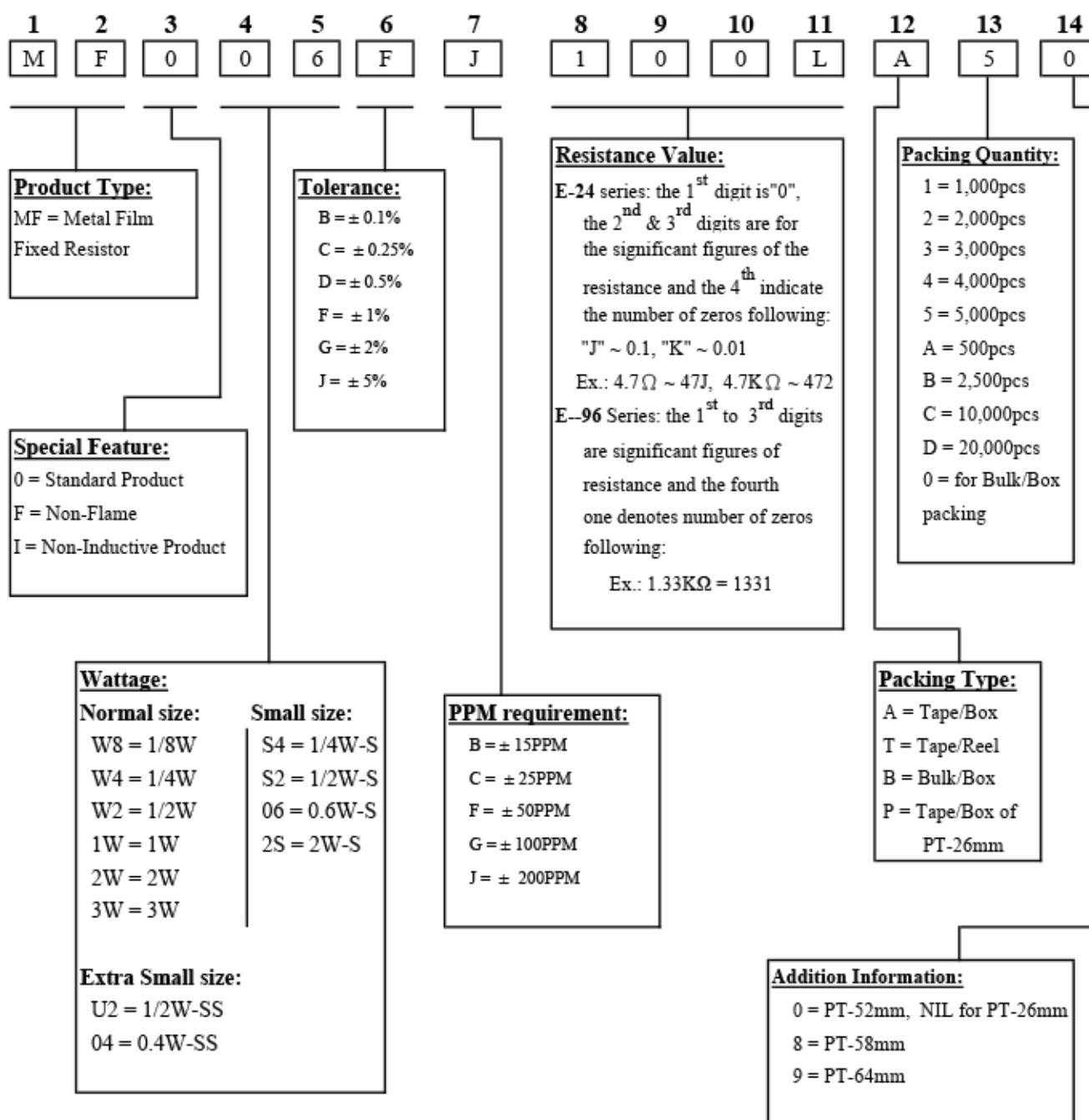


Dimension (mm) :

Type	Style	Across Flange (A)	Quantity Per Reel
MF-60-S	PT-52	73 ± 2	5,000 pcs.

Part Number System

Explanation of Part Number System (Metal Film Fixed Resistors)



Sample: MF 0.6W-S $\pm 1\%$ 200ppm 0.1 Ω T/B 5,000 \rightarrow MF006FJ100LA50

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 Cl_2 , H_2S , NH_3 , SO_2 , or NO_2
2. In direct sunlight

ROYALOHM

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1. Scope:

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2. Type designation:

The type designation shall be in the following form :

(Ex.)	MF	0.6W-S	F	1Ω
	Type	Power Rating	Resistance Tolerance	Nominal Resistance

3. Ratings:

Ratings shall be shown in the table 1.

Table 1

Type	MF
Rated Power	0.6W at 70°C
Max. Working Voltage	250 V
Max. Overload Voltage	500 V
Dielectric Withstanding Voltage	500 V
Rated Ambient Temp.	70 °C
Operating Temp. Range	-55°C --- +155°C
Resistance Tolerance	± 1%
Resistance Range	1Ω ~ 9.76Ω

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)

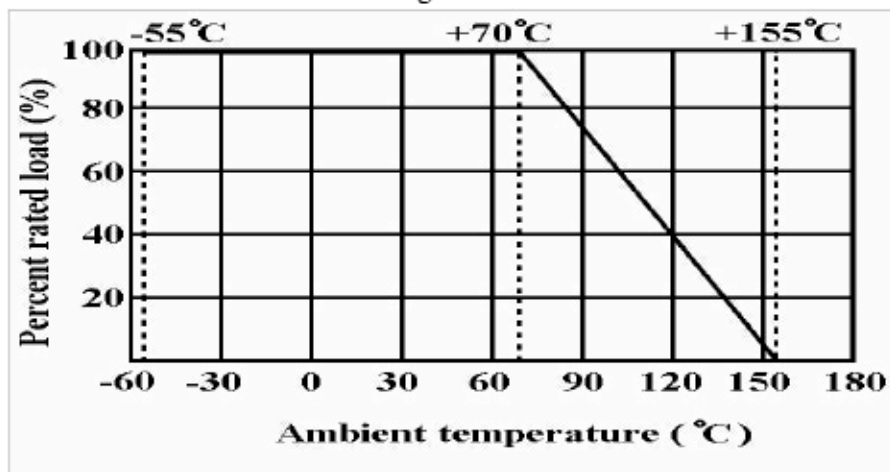
P = Power Rating (watt)

R = Nominal Resistance (ohm)

Metal Film Fixed Resistors

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

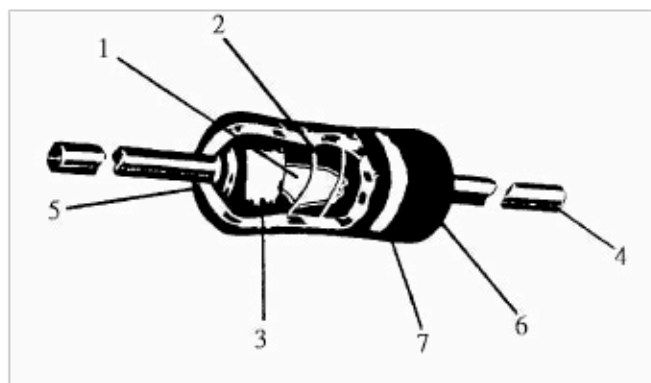
Figure 1.



3.3 Nominal resistance :

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

4. Construction :



No.	Name	Material
1	Basic Body	Rod Type Ceramics
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3	End Cap	Steel (Tin plated iron surface)
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6	Coating	Insulated epoxy resin (Color : Sky blue)
7	Color Code	Epoxy Resin

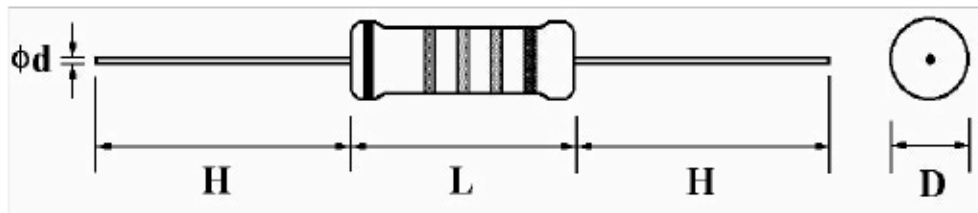
Metal Film Fixed Resistors		
5. Characteristics :		
Characteristics	Limits	Test Methods (JIS C 5201-1)
DC. Resistance	Must be within the specified tolerance	5.1 The limit of error of measuring apparatus shall not exceed allowable range or 5% of resistance tolerance
Temperature coefficient	$\pm 200 \text{ PPM}/^{\circ}\text{C}$	5.2 Natural resistance change per temp. degree centigrade $\frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6 \text{ (PPM}/^{\circ}\text{C})$ R1: Resistance value at room temperature (t1) R2: Resistance value at room temp. plus 100 °C (t2)
Short time overload	Resistance change rate is $\pm (0.5\% + 0.05 \Omega)$ Max. with no evidence of mechanical damage	5.5 Permanent resistance change after the application of a potential of 2.5 times RCWV for 5 seconds
Dielectric withstanding voltage	No evidence of flashover mechanical damage, arcing or insulation break down	5.7 Resistors shall be clamped in the trough of a 90° metallic V-block and shall be tested at AC potential respectively specified in the table 1. for 60 + 10/ -0 seconds
Pulse overload	Resistance change rate is $\pm (1\% + 0.05 \Omega)$ Max. with no evidence of mechanical damage	5.8 Resistance change after 10,000 cycles (1 sec. "on" , 25 secs. "off") at 4 times RCWV
Terminal strength	No evidence of mechanical damage	6.1 Direct load : Resistance to a 2.5 kgs direct load for 10 secs. in the direction of the longitudinal axis of the terminal leads Twist test : 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
Resistance to soldering heat	Resistance change rate is $\pm (1\% + 0.05 \Omega)$ Max. with no evidence of mechanical damage	6.4 Permanent resistance change when leads immersed to 3.2 to 4.8 mm from the body in 350°C $\pm 10^{\circ}\text{C}$ solder for 3 ± 0.5 seconds

Metal Film Fixed Resistors					
Characteristics	Limits		Test Methods (JIS C 5201-1)		
Solderability	95 % coverage Min.		6.5 The area covered with a new, smooth, clean, shiny and continuous surface free from concentrated pinholes. Test temp. of solder : 245℃ ± 3℃ Dwell time in solder : 2 ~ 3 seconds		
Resistance to solvent	No deterioration of protective coatings and markings		6.9 Specimens shall be immersed in bath of trichroethane completely for 3 mins. with ultrasonic		
Temperature cycling	Resistance change rate is ± (1% + 0.05 Ω) Max. with no evidence of mechanical damage		7.4 Resistance change after continuous 5 cycles for duty shown below:		
			Step	Temperature	Time
			1	-55℃ ± 3℃	30 mins
			2	Room temp.	10 ~ 15 mins
			3	+155℃ ± 2℃	30 mins
			4	Room temp.	10 ~ 15 mins
Load life in humidity			7.9 Resistance change after 1,000 hours (1.5 hours "on", 0.5 hour "off") at RCWV in a humidity test chamber controlled at 40 ℃ ± 2 ℃ and 90 to 95 % relative humidity		
	Resistance value	△ R/R			
	Normal type	± 1.5 %			
Load life			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℃ ± 2℃ ambient		
	Resistance value	△ R/R			
	Normal type	± 1.5 %			

Metal Film Fixed Resistors

6. Dimension :

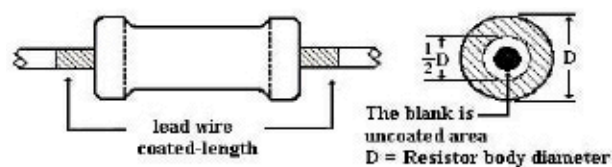
Unit :mm



Type	Power Rating	D (Max.)	L (Max.)	$d \pm 0.05$	$H \pm 3$
MF	0.6W-S	2.5 mm	6.8 mm	0.54 mm	28 mm

Painting method:

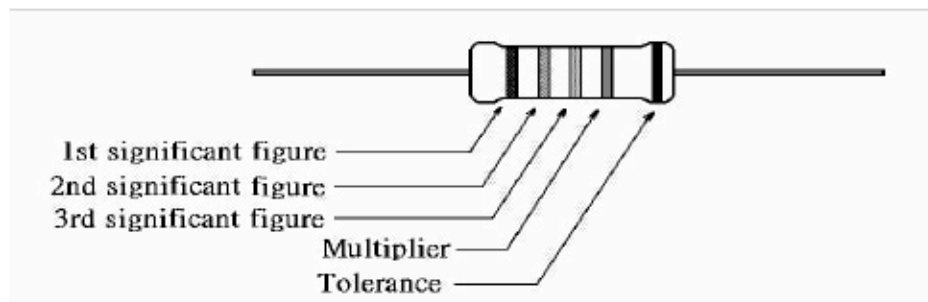
Welding point, terminal and lead wire, is permissible to be exposed without the outer coated cover.
The extent should be within $1/2$ of the arc angle.



7. Marking :

7.1 Resistor :

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



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

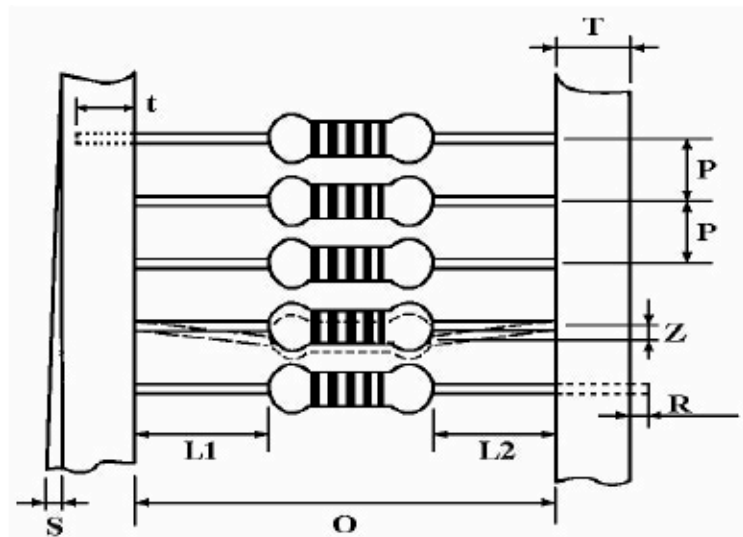
Ex.

Metal Film Fixed Resistors			
Watt :	0.6W-S	Val :	1E
Q'TY :	5,000	Tol :	1%
Lot :	813478	PPM :	200
ROYALOHM		Pb Free	

Metal Film Fixed Resistors

8. Packing specification :

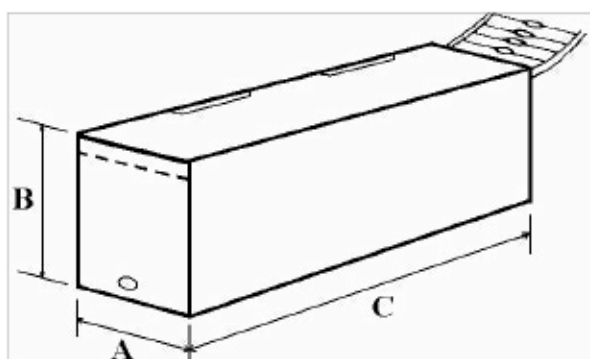
8.1 Taping dimension :



Dimensions (mm)

Type	Style	O	P	L1-L2	T	Z	R	t	S
MF-60-S	PT-52	52 ± 1	5 ± 0.3	1 Max.	6 ± 1	1 Max.	0	4 ± 1	0.5 Max.

8.2 Tape in box packing :



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

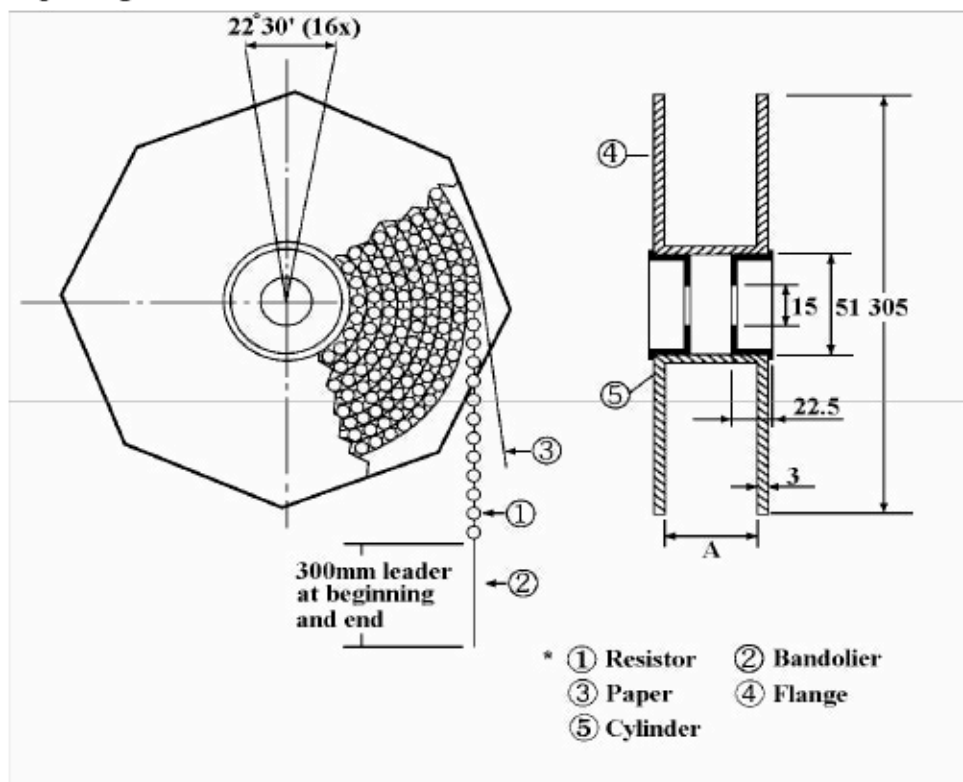
Dimension (mm)

Type	Style	L (C) ± 5	W (A) ± 5	H (B) ± 5	Quantity Per Box (pcs.)
MF-60-S	PT-52	250	75	96	5,000

"Ammopack" is an abbreviation of "ammunition pack"

Metal Film Fixed Resistors

8.3 Tape on reel packing :

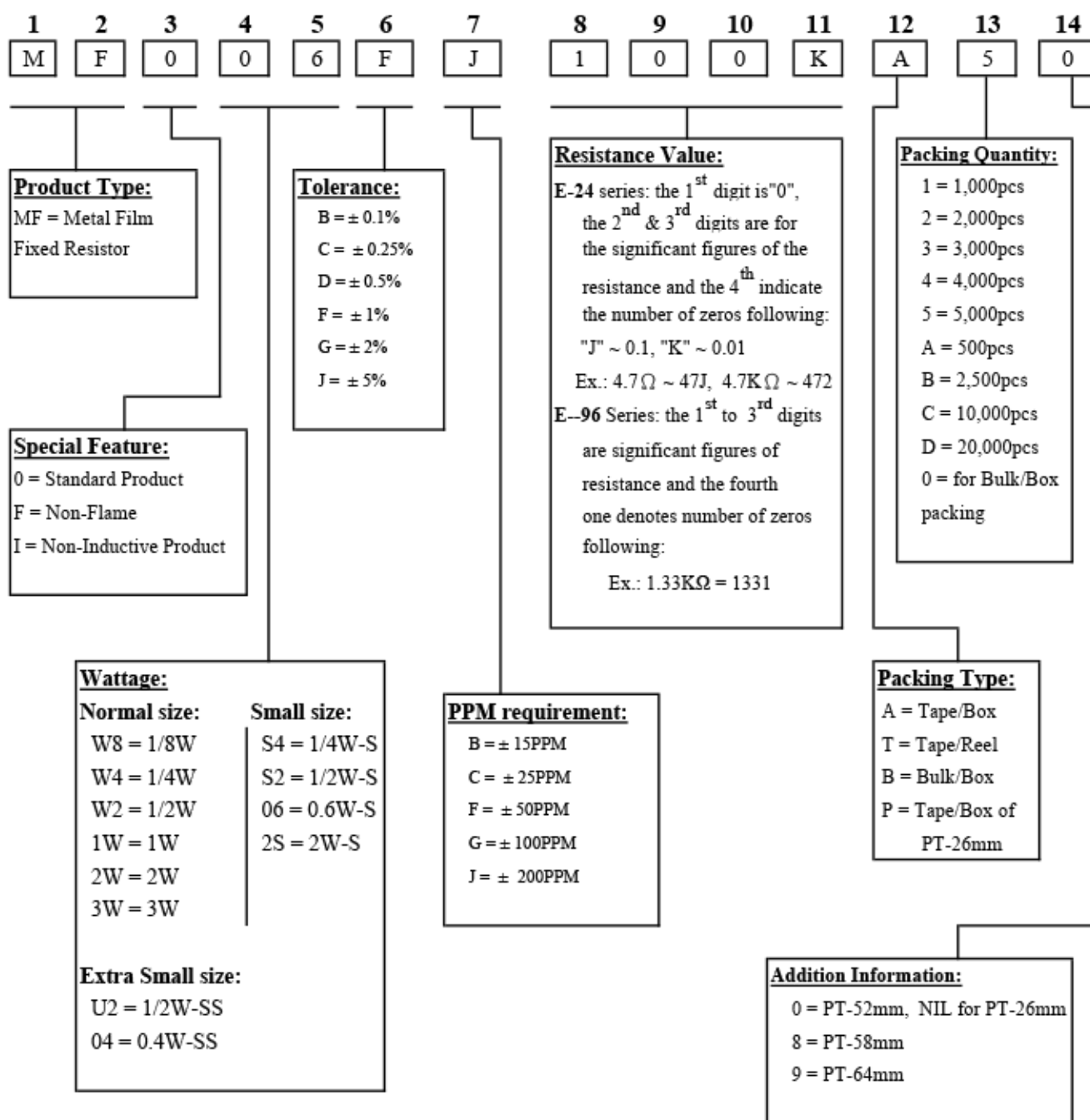


Dimension (mm) :

Type	Style	Across Flange (A)	Quantity Per Reel
MF-60-S	PT-52	73 ± 2	5,000 pcs.

Part Number System

Explanation of Part Number System (Metal Film Fixed Resistors)



Sample: MF 0.6W-S +/- 1% 200ppm 1 Ω T/B 5,000 → MF006FJ100KA50

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 Cl_2 , H_2S , NH_3 , SO_2 , or NO_2
2. In direct sunlight