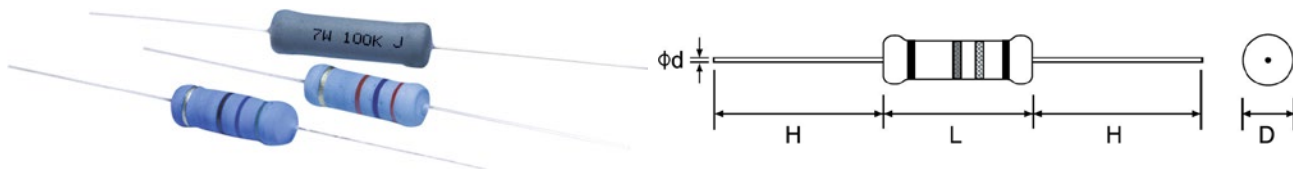


Metal Oxide Film Resistors Axial Connections



Metal Oxide Film Resistors 1/2W, 5% Components



High safety standard, high purity ceramic core

Excellent non-flame coating

Stable performance in diverse environment, meet EIAJ-RC2655A requirements

Too low or too high ohmic value can be supplied on a case to case basis

Solderability: 95%

Temperature Cycling: $\pm(2.0\% + 0.05\Omega)$ Max, with no evidence of mechanical damage

Original package: 5000 pcs

D Max. 3.5 mm

L Max. 10 mm

PT 52 mm

SPECIFICATION:

Rated output	0.5 W
Tolerance	$\pm 5\%$
Temperature coefficient	350 ppm/ $^{\circ}\text{C}$
Rated voltage	400 V
Housing type	Axial

PRODUCT RANGE:

Art. Nr.	Resistance
RND 155MOR0W2J0101A10	100 Ω
RND 155MOR0W2J0102A10	1 k Ω
RND 155MOR0W2J010JA10	1 Ω
RND 155MOR0W2J0153A10	1.5 k Ω
RND 155MOR0W2J0182A10	1.8 k Ω
RND 155MOR0W2J0221A10	220 Ω
RND 155MOR0W2J0224A10	220 k Ω
RND 155MOR0W2J022JA10	2.2 Ω
RND 155MOR0W2J0333A10	33 k Ω
RND 155MOR0W2J0334A10	330 k Ω
RND 155MOR0W2J043JA10	4.3 Ω
RND 155MOR0W2J0473A10	47 Ω
RND 155MOR0W2J047JA10	4.7 Ω
RND 155MOR0W2J047KA10	0.47 Ω
RND 155MOR0W2J0503A10	50 k Ω
RND 155MOR0W2J050KA10	0.5 Ω
RND 155MOR0W2J0513A10	51 k Ω
RND 155MOR0W2J062KA10	0.62 Ω
RND 155MOR0W2J0680A10	68 Ω
RND 155MOR0W2J0682A10	6.8 k Ω

1. Scope:

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

2. Type designation:

The type designation shall be in the following form :

(Ex.)	<u>MOR</u>	<u>1/4W</u>	<u>J</u>	<u>100Ω</u>
	Type	Power Rating	Resistance Tolerance	Nominal Resistance

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	Resistance Range	Operating Temp. Range
Normal size	MO-25	0.25W	250 V	400 V	250 V	0.3Ω--50KΩ	-55°C -- +155°C
	MO-50	0.50 W	250 V	400 V	250 V	0.3Ω--50KΩ	
	MO-100	1 W	350 V	600 V	350 V	0.3Ω--50KΩ	
	MO-200	2 W	350 V	600 V	350 V	0.3Ω--50KΩ	
	MO-300	3 W	500 V	800 V	500 V	5Ω--100KΩ	
	MO-500	5 W	750 V	1,000 V	750 V	5Ω--150KΩ	
	MO-700	7 W	750 V	1,000 V	750 V	20Ω--150KΩ	
	MO-800	8 W	750 V	1,000 V	750 V	30Ω--200KΩ	
Small size	MO-900	9 W	750 V	1,000 V	750 V	50Ω--200KΩ	
	MO-50-S	0.50 W	250 V	400 V	250 V	0.3Ω--50KΩ	
	MO-100-S	1 W	350 V	600 V	350 V	0.3Ω--50KΩ	
	MO-200-S	2 W	350 V	600 V	350 V	0.3Ω--50KΩ	
	MO-300-S	3 W	350 V	600 V	350 V	0.3Ω--50KΩ	
	MO-500-SS	5 W	500 V	800 V	500 V	5Ω--100KΩ	
	MO-500-S	5 W	500 V	800 V	500 V	5Ω--150KΩ	

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 :

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

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

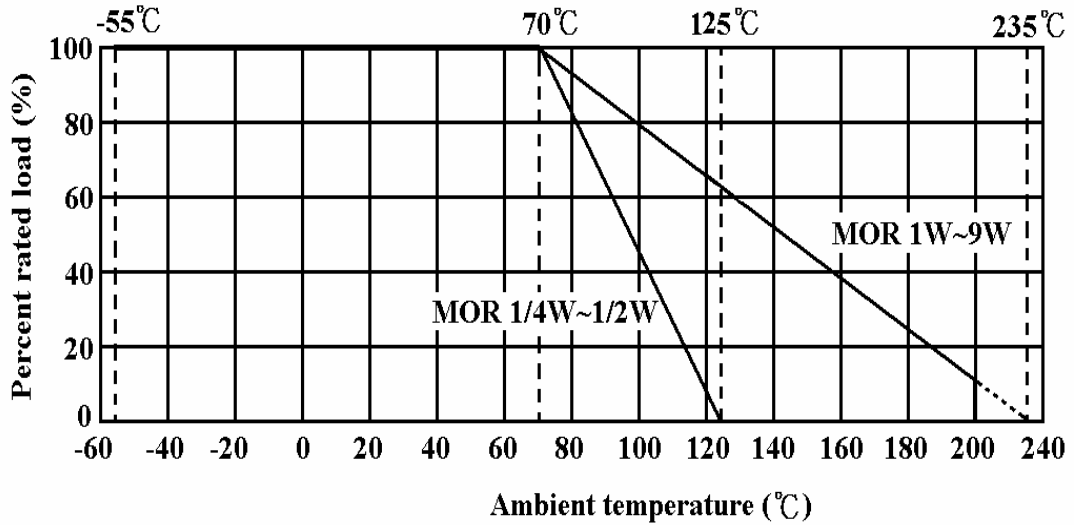
P = Power Rating (watt)

R = Nominal Resistance (ohm)

Metal Oxide Film Fixed Resistors

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

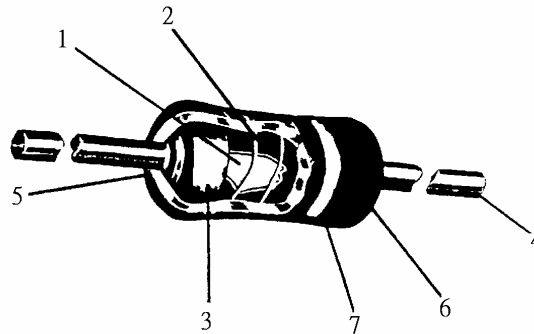
Figure 1.



3.3 Nominal resistance :

Effective figures of nominal resistance shall be in accordance with E-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	0.1Ω ≤ R ≤ 12Ω : CNP film 10Ω ≤ R ≤ 100kΩ : Metal oxide film R > 100kΩ : Carbon 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 size: --Insulated & Non-Flame Paint (Color : Gray) Small size: --Insulated & Non-Flame Paint (Color : Sea-Blue)
7	Color Code	Non-Flame epoxy resin

Metal Oxide 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	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Resis.Range</th> <th style="text-align: center;">T.C.R. (PPM/°C)</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">0.1Ω ~ 12Ω</td> <td style="text-align: center;">±200</td> </tr> <tr> <td style="text-align: center;">12.1Ω ~ 100K</td> <td style="text-align: center;">±350</td> </tr> <tr> <td style="text-align: center;">101K ~ 1M</td> <td style="text-align: center;">-700</td> </tr> <tr> <td style="text-align: center;">1.1M ~ 10M</td> <td style="text-align: center;">-1500</td> </tr> </tbody> </table>	Resis.Range	T.C.R. (PPM/°C)	0.1Ω ~ 12Ω	±200	12.1Ω ~ 100K	±350	101K ~ 1M	-700	1.1M ~ 10M	-1500	5.2 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)
Resis.Range	T.C.R. (PPM/°C)											
0.1Ω ~ 12Ω	±200											
12.1Ω ~ 100K	±350											
101K ~ 1M	-700											
1.1M ~ 10M	-1500											
Short time overload	Resistance change rate is Normal Size : ± (1% + 0.05 Ω) Max. Small Size : ± (2% + 0.05Ω) Max. with no evidence of mechanical damage	5.5 Permanent resistance change after the application of a potential of 2.5 times RCWV or the max. overload voltage respectively specified in the above list, whichever less 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										
Terminal strength	With 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 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										

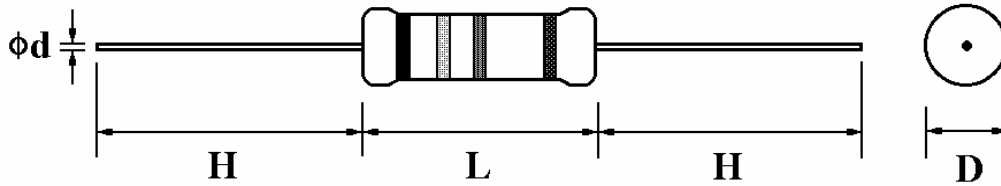
Metal Oxide Film Fixed Resistors

Characteristics	Limits	Test Methods (JIS C 5201-1)															
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 mm to 4.8 mm from the body in $350^{\circ}\text{C} \pm 10^{\circ}\text{C}$ solder for 3 ± 0.5 seconds															
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 : $245^{\circ}\text{C} \pm 3^{\circ}\text{C}$ Dwell time in solder : 2 ~ 3 seconds															
Resistance to solvent	No deterioration of protective coatings and markings	6.9 Specimens shall be immersed in a bath of trichroethane completely for 3 minutes with ultrasonic															
Temperature cycling	Resistance change rate is $\pm (2\% + 0.05 \Omega)$ Max. with no evidence of mechanical damage	7.4 Resistance change after continuous 5 cycles for duty shown below:															
		<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Step</th> <th style="text-align: center;">Temperature</th> <th style="text-align: center;">Time</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">$-55^{\circ}\text{C} \pm 3^{\circ}\text{C}$</td> <td style="text-align: center;">30 mins</td> </tr> <tr> <td style="text-align: center;">2</td> <td style="text-align: center;">Room temp.</td> <td style="text-align: center;">10~15 mins</td> </tr> <tr> <td style="text-align: center;">3</td> <td style="text-align: center;">$+155^{\circ}\text{C} \pm 2^{\circ}\text{C}$</td> <td style="text-align: center;">30 mins</td> </tr> <tr> <td style="text-align: center;">4</td> <td style="text-align: center;">Room temp.</td> <td style="text-align: center;">10~15 mins</td> </tr> </tbody> </table>	Step	Temperature	Time	1	$-55^{\circ}\text{C} \pm 3^{\circ}\text{C}$	30 mins	2	Room temp.	10~15 mins	3	$+155^{\circ}\text{C} \pm 2^{\circ}\text{C}$	30 mins	4	Room temp.	10~15 mins
		Step	Temperature	Time													
		1	$-55^{\circ}\text{C} \pm 3^{\circ}\text{C}$	30 mins													
		2	Room temp.	10~15 mins													
3	$+155^{\circ}\text{C} \pm 2^{\circ}\text{C}$	30 mins															
4	Room temp.	10~15 mins															
Load life in humidity	Resistance value	$\Delta R/R$															
	Less than $100\text{K} \Omega$	$\pm 5 \%$															
	$100\text{K} \Omega$ or more	$\pm 10 \%$															
Load life	Resistance value	$\Delta R/R$															
	Less than $100\text{K} \Omega$	$\pm 5 \%$															
	$100\text{K} \Omega$ or more	$\pm 10 \%$															
Pulse overload	Resistance change rate is Normal Size : $\pm (2\% + 0.05\Omega)$ Max. Small Size : $\pm (5\% + 0.05\Omega)$ Max. with no evidence of mechanical damage	5.8 Resistance change after 10,000 cycles (1 second "on", 25 seconds "off") at 4 times RCWV or the max. pulse overload voltage															

Metal Oxide Film Fixed Resistors

6. Dimension :

Unit : mm

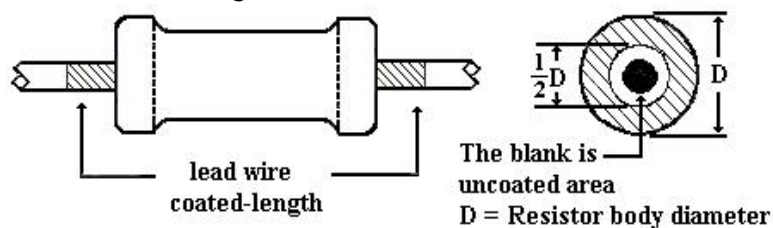


Normal size						
Part No.	Style	Power Rating at 70 °C	Dimension (mm)			
			D (Max.)	L (Max.)	d ± 0.05	H ± 3
MOR0W4	MOR-25	1/4W (0.25W)	2.5	7.5	0.54	28
MOR0W2	MOR-50	1/2W (0.50W)	3.5	10	0.54	28
MOR01W	MOR-100	1W	5	12	0.70	25
MOR02W	MOR-200	2W	5.5	16	0.70	28
MOR03W	MOR-300	3W	6.5	17.5	0.75	28
MOR05W	MOR-500	5W	8.5	26	0.75	38
MOR07W	MOR-700	7W	8.5	32	0.75	38
MOR08W	MOR-800	8W	8.5	41	0.75	38
MOR09W	MOR-900	9W	8.5	54	0.75	38

Small size						
Part No.	Style	Power Rating at 70 °C	Dimension (mm)			
			D (Max.)	L (Max.)	d ± 0.05	H ± 3
MOR0S2	MOR-50-S	1/2W (0.50W)	2.5	7.5	0.54	28
MOR01S	MOR-100-S	1W	3.5	10	0.54	28
MOR02S	MOR-200-S	2W	5	12	0.70	25
MOR03S	MOR-300-S	3W	5.5	16	0.70	28
MOR05U	MOR-500-SS	5W	6.5	17.5	0.75	28
MOR05S	MOR-500-S	5W	8	25	0.75	38

Painting method:

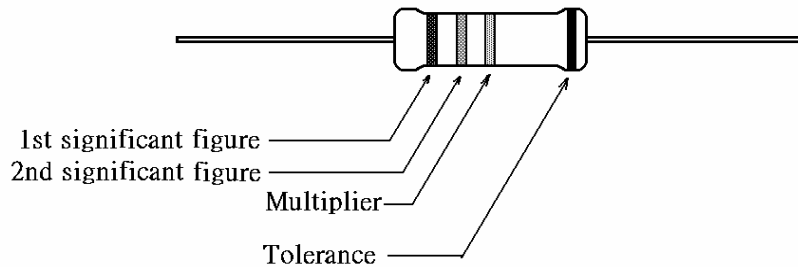
Welding point, terminal and lead wire, is permissible to be exposed without the outer coated cover. The extent should be within 1/2 of the arc angle.



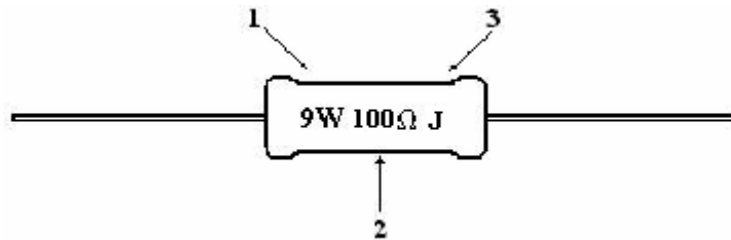
Metal Oxide Film Fixed Resistors

7. Marking :

7.1 For MO 1/4W, 1/2W, 1W, 2W, 3W, 5W and all of small size
Resistors shall be marked with color coding
colors shall be in accordance with JIS C 0802



7.2 For MO 7W, 8W, 9W



Code description and regulation

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

G : $\pm 2\%$

J : $\pm 5\%$

K : $\pm 10\%$

7.3 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

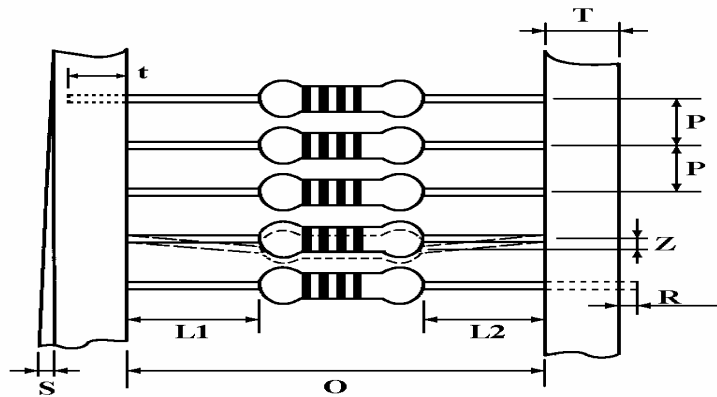
Example :

Metal Oxide Film Fixed Resistors			
Watt :	1/4W	Val :	100R
Q'TY :	5,000	Tol :	5%
Lot :	702312	PPM :	
	ROYALOHM		Pb Free

Metal Oxide Film Fixed Resistors

8. Packing specification :

8.1 Taping dimension :



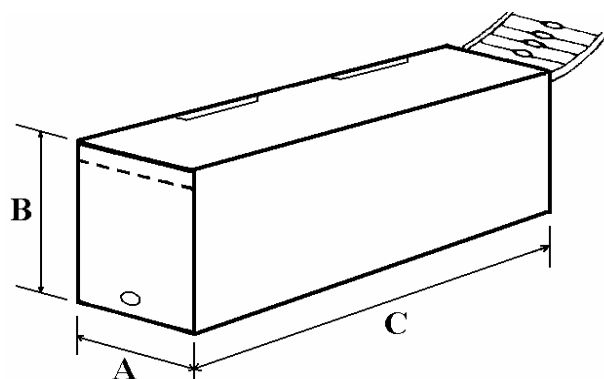
Dimensions (mm)

Normal size										
Part No.	Style	Style	O	P	L1-L2	T	Z	R	t	S
MOR0W4	MOR-25	PT-52	52 ± 1	5 ± 0.3	1 Max.	6 ± 1	1 Max.	0	4 ± 1	0.5 Max.
MOR0W2	MOR-50	PT-52	52 ± 1	5 ± 0.3	1 Max.	6 ± 1	1 Max.	0	4 ± 1	0.5 Max.
MOR01W	MOR-100	PT-52	52 ± 1	5 ± 0.3	1 Max.	6 ± 1	1 Max.	0	4 ± 1	0.5 Max.
MOR02W	MOR-200	PT-64	64 ± 1	10 ± 0.5	1 Max.	6 ± 1	1 Max.	0	5 ± 1	0.5 Max.
MOR03W	MOR-300	PT-64	64 ± 1	10 ± 0.5	1 Max.	6 ± 1	1 Max.	0	5 ± 1	0.5 Max.

Small size										
Part No.	Style	Style	O	P	L1-L2	T	Z	R	t	S
MOR0S2	MOR-50-S	PT-52	52 ± 1	5 ± 0.3	1 Max.	6 ± 1	1 Max.	0	4 ± 1	0.5 Max.
MOR01S	MOR-100-S	PT-52	52 ± 1	5 ± 0.3	1 Max.	6 ± 1	1 Max.	0	4 ± 1	0.5 Max.
MOR02S	MOR-200-S	PT-52	52 ± 1	5 ± 0.3	1 Max.	6 ± 1	1 Max.	0	4 ± 1	0.5 Max.
MOR03S	MOR-300-S	PT-64	64 ± 1	10 ± 0.5	1 Max.	6 ± 1	1 Max.	0	5 ± 1	0.5 Max.
MOR05U	MOR-500-SS	PT-64	64 ± 1	10 ± 0.5	1 Max.	6 ± 1	1 Max.	0	5 ± 1	0.5 Max.

Metal Oxide Film Fixed Resistors

8.2 Tape in box packing :



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

Dimension (mm)

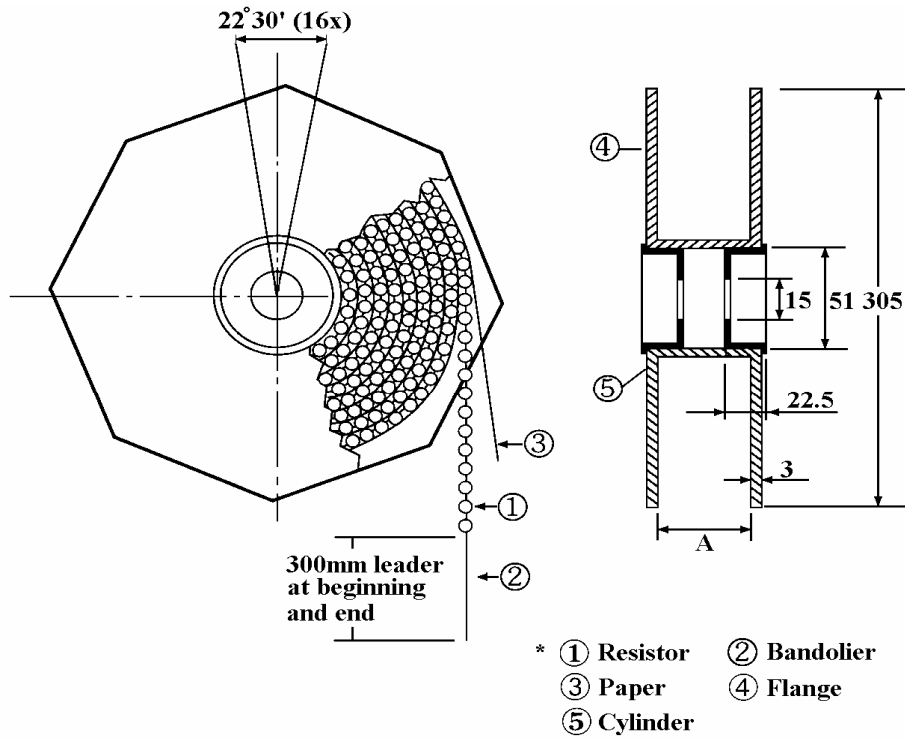
Part No.	Style	Style	L (C) ±5	W (A) ±5	H (B) ±5	Quantity Per Box (pcs.)
MOR0W4	MOR-25	PT-52	250	75	96	5,000
MOR0W2	MOR-50	PT-52	260	85	70	1,000
MOR01W	MOR-100	PT-52	262	86	80	1,000
MOR02W	MOR-200	PT-64	262	92	108	1,000
MOR03W	MOR-300	PT-64	256	92	80	500

Part No.	Style	Style	L (C) ±5	W (A) ±5	H (B) ±5	Quantity Per Box (pcs.)
MOR0S2	MOR-50-S	PT-52	250	75	96	5,000
MOR01S	MOR-100-S	PT-52	260	85	70	1,000
MOR02S	MOR-200-S	PT-52	262	86	80	1,000
MOR03S	MOR-300-S	PT-64	262	92	108	1,000
MOR05U	MOR-500-SS	PT-64	256	92	80	500

"Ammopack" is an abbreviation of "ammunition pack"

Metal Oxide Film Fixed Resistors

8.3 Tape on reel packing :



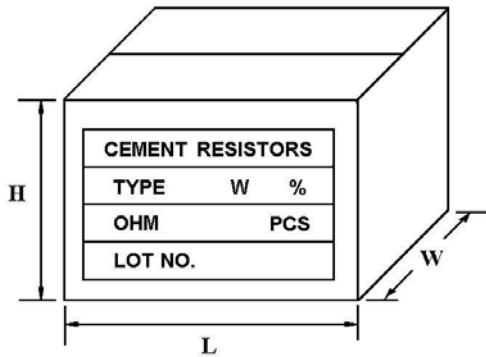
Dimension (mm) :

Normal size				
Part No.	Type	Style	Across Flange (A)	Quantity Per Reel
MOR0W4	MOR-25	PT-52	73 ± 2	5,000
MOR0W2	MOR-50	PT-52	73 ± 2	2,500
MOR01W	MOR-100	PT-52	73 ± 2	2,500
MOR02W	MOR-200	PT-64	81 ± 5	1,000
MOR03W	MOR-300	PT-64	81 ± 5	500

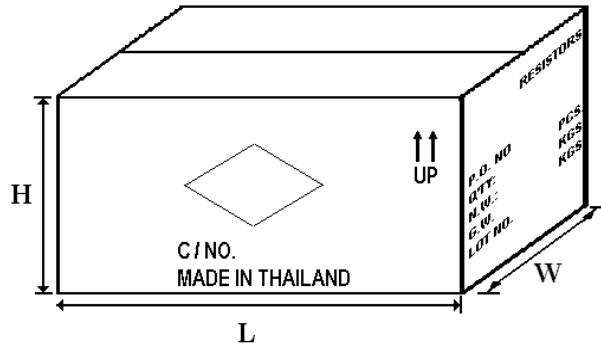
Small size				
Part No.	Type	Style	Across Flange (A)	Quantity Per Reel
MOR0S2	MOR-50-S	PT-52	73 ± 2	5,000
MOR01S	MOR-100-S	PT-52	73 ± 2	2,500
MOR02S	MOR-200-S	PT-52	73 ± 2	2,500
MOR03S	MOR-300-S	PT-64	81 ± 5	1,000
MOR05U	MOR-500-SS	PT-64	81 ± 5	500

Metal Oxide Film Fixed Resistors

8.4 Bulk in inner box packing (in plastic bag)



Inner Box of Plastic bag.



Carton Box

Dimension : Unit : mm

Part No.	Type	Q'ty / Bag (pcs.)	Q'ty / Inner Box (pcs.)	Q'ty / Carton (pcs.)	Inner Box Size L x W x H (±5)	Carton Box Size L x W x H (±5)	Gross Wt. ± 2 Kgs.
MOR07W	MOR-700	8	32	3,200	150 x 75 x 33	392 x 515 x 283	18
MOR08W	MOR-800	10	300	1,800	200 x 171 x 113	520 x 215 x 250	13
MOR09W	MOR-900	10	300	1,800	200 x 171 x 113	520 x 215 x 250	15

Part Number System

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

1 2 3 4 5 6 7 8 9 10 11 12 13 14
M O R 0 W 4 J 0 1 0 1 A 5 0

Product Type:
MOR = Metal Oxide Film
Fixed Resistor

Special Feature:
0 = Standard Product
I = Non-Inductive Product

Wattage:

Normal size:	Small size:
W4 = 1/4W	S2 = 1/2W-S
W2 = 1/2W	1S = 1W-S
1W = 1W	2S = 2W-S
2W = 2W	3S = 3W-S
3W = 3W	5S = 5W-S
5W = 5W	
7W = 7W	
8W = 8W	
9W = 9W	
Extra Small size:	
5U = 5W-SS	

Tolerance:
F ~ ± 1%
G ~ ± 2%
J ~ ± 5%
K ~ ± 10%

Resistance Value:
E-24 series: the 1st digit is "0", the 2nd & 3rd digits are for the significant figures of the resistance and the 4th indicate the number of zeros following:
"J" ~ 0.1, "K" ~ 0.01
Ex.: 4.7Ω ~ 47J, 4.7KΩ ~ 472
E-96 Series: the 1st to 3rd digits are significant figures of resistance and the fourth one denotes number of zeros following:
Ex.: 1.33KΩ = 1331

Packing Quantity:
1 = 1,000pcs
2 = 2,000pcs
3 = 3,000pcs
4 = 4,000pcs
5 = 5,000pcs
A = 500pcs
B = 2,500pcs
C = 10,000pcs
D = 20,000pcs
0 = for Bulk/Box packing

Packing Type:
A = Tape/Box
T = Tape/Reel
B = Bulk/Box
P = Tape/Box of PT-26mm

Addition Information:
0 = PT-52mm, NIL for PT-26mm
8 = PT-58mm
9 = PT-64mm
7 = Lead wire(H) 38mm
A = PT-83mm
C = PT-73mm
D = PT-71mm

Sample: MO 1/4W +/- 5% 100Ω T/B 5,000 PT-52mm → MOR0W4J0101A50

Metal Oxide 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 $25^{\circ}\text{C} \pm 10^{\circ}\text{C}$ and a relative humidity of $60\%\text{RH} \pm 10\%\text{RH}$, chemical and dust free atmosphere

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