Specification for Approval

Customer	深圳市嘉立創科技發展有限公司
Product Name	LEAD-FREE METAL OXIDE FILM FIXED RESISTORS
Part Name	MOR SERIES ±5%

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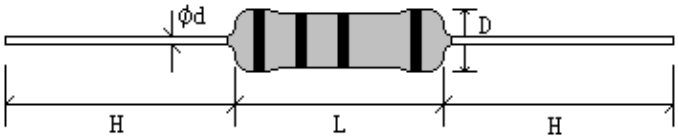
File Name: MO SERIES ±5%		Date	2015.11.07	Edition No.	1
Amendment Record				Signature	
Edition	Prescription of amendment	Amend Page	Amend Date	Amended by	Checked by

1.0 Scope:

This specification for approve Lead-Free Metal Oxide Film Fixed Resistors manufactured by UNIOHM.

2.0 Ratings & dimension:



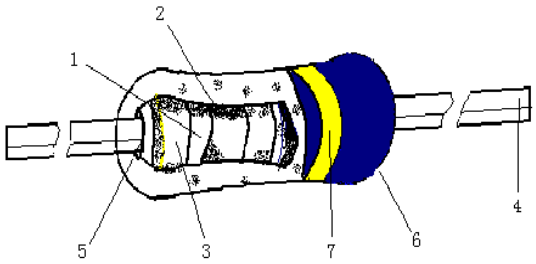
2.1 Normal size

Type	Dimension(mm)				Max working voltage	Max overload voltage	Dielectric withstanding voltage	Tolerance	Resistance range
	D	L	d±0.05	H±3					
MO1/4W	2.2±0.5	6.5±1.0	0.54	28	250V	400V	250V	±5%	0.1Ω~470KΩ
MO1/2W	3.0±0.6	9.5±1.0	0.54	28	250V	400V	250V	±5%	0.1Ω~560KΩ
MO1W	4.0±0.6	11.5±1.0	0.65	28	350V	600V	350V	±5%	0.1Ω~560KΩ
MO2W	5.0±0.6	15.5±1.0	0.70	28	350V	600V	350V	±5%	0.1Ω~560KΩ
MO3W	6.0±0.6	17.5±1.0	0.75	28	500V	800V	500V	±5%	0.1Ω~560KΩ
MO5W	8.0±0.6	24.5±1.0	0.75	38	750V	1000V	750V	±5%	0.1Ω~680KΩ
MO7W	8.0±0.6	29.5±1.0	0.75	38	750V	1000V	750V	±5%	20Ω~150KΩ
MO8W	8.0±0.6	39.5±1.0	0.75	38	750V	1000V	750V	±5%	30Ω~200KΩ
MO9W	8.0±0.6	52.5±1.0	0.75	38	750V	1000V	750V	±5%	50Ω~200KΩ

2.2 Small Size & Extra Small Size

Type	Dimension(mm)				Max Working Voltage	Max overload Voltage	Dielectric withstanding voltage	Tolerance	Resistance Range
	D	L	d±0.05	H±3					
MO1/2WS	2.2±0.5	6.5±1.0	0.54	28	250V	400V	250V	±5%	0.1Ω~470KΩ
MO1WS	3.5±0.6	9.5±1.0	0.60	28	350V	600V	350V	±5%	0.1Ω~560KΩ
MO2WS	4.5±0.6	11.5±1.0	0.65	28	350V	600V	350V	±5%	0.1Ω~560KΩ
MO3WS	5.0±0.6	15.5±1.0	0.70	28	350V	600V	350V	±5%	0.1Ω~560KΩ
MO5WSS	6.0±0.6	17.5±1.0	0.75	28	500V	800V	500V	±5%	0.1Ω~560KΩ
MO5WS	8.0±0.6	24.5±1.0	0.75	38	500V	800V	500V	±5%	0.1Ω~680KΩ

3.0 Structure:

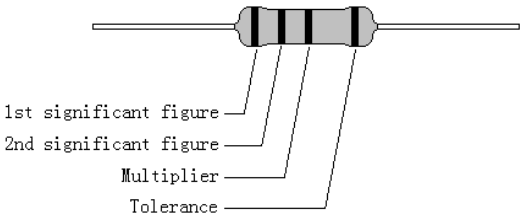


No.	Name	Component
1	Basic body	Ceramic
2	Resistor layer	Metal Oxide Film
3	End cap	Steel (Tinned iron cap)
4	Lead wire	Tinned copper wire
5	Joint	By welding
6	Coating	Silicon resin with different color ①Gray (Normal size) ② Sea blue (Small size)
7	Color code	Epoxy resin

4.0 Mark

Resistors shall be marked with color coding

Colors shall be in accordance with JIS C 0802



4.1 Label:

Label shall have some items as below:

1 Type and style

2 Nominal resistances

3 Resistance tolerances

4 Quantities

5 Lot number

6 PPM

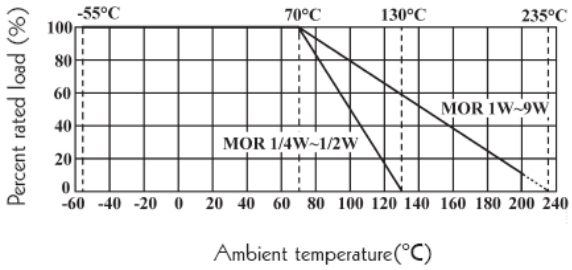
Example:

METAL OXIDE FILM FIXED RESISTORS	
WATT: 2WS	VAL:100KΩ
Q'TY: 1,000	TOL: 5%
LOT: 3021548	PPM:

5.0 Derating Curve:

Resistors shall have a power rating based on continuous load operation at an ambient temperature from -55°C to 70°C. For temperature in excess of 70°C, the power would be derate as shown in figure 1

Figure1



6.0 Voltage rating:

Resistors should have a direct-current (DC) continuous voltage rating and an alternating-current (AC) continuous voltage rating relates to Power Rating, formula shown as below:

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

RCWV: Rated DC or RMS ac continuous working voltage at commercial-line frequency and waveform (Volt.)

P: Power Rating (Watt.)

R: Nominal Resistance (Ohm)

Resistors would be burned out if it overloaded, such as higher than the maximum value of series' RCWV. And we named 2.5 times RCWV is OVERLOAD Voltage.

7.0 Performance specification:

Item	Limits	Test Method (JIS-C-5201&5202)
Temperature Coefficient	**1/4W 1/2WS** ≦100KΩ: ±350PPM/°C 100KΩ<R≦470KΩ: 0 ~ -700PPM/°C **1/2W、1WS:** ≦120KΩ: ±350PPM/°C 120KΩ<R≦560KΩ 0~ -700PPM/°C **1W、 2W、 2WS、3W、3WS、5WSS** ≦150KΩ: ±350PPM/°C 150KΩ<R≦560KΩ 0~ -700PPM/°C **5W 5WS** ≦180KΩ: ±350PPM/°C 180KΩ<R≦680KΩ 0 ~ -700PPM/°C **7W、8W、9W:** ±350PPM/°C	4.8 Natural resistance changes per temp. Degree centigrade $\frac{R_2 - R_1}{R_1(T_2 - T_1)} * 10^6 (PPM/°C)$ R1: resistance value at room temp. (T1) R2: resistance value at room temp. +100°C (Tt2) Test pattern: room temp. (T1), room temp. +100°C(T2)
Short-time overload	Resistance change rate is: ± (1%+0.05Ω) Max for normal size. ± (2%+0.05Ω) Max for small size. With no evidence of mechanical damage.	4.13 Permanent resistance change after the application of a potential of 2.5 times RCWV for 5 seconds.

Item	Limits	Test Method (JIS-C-5201&5202)
Dielectric withstanding voltage	No evidence of flashover mechanical damage, arcing or insulation break down.	4.7 Resistors shall be clamped in the trough of a 90°metallic V-block and shall be tested at AC potential respectively specified in the above list for 60-70 seconds.
Pulse overload	Resistance change rate is: ± (2%+0.05Ω) Max for normal size. ± (5%+0.05Ω) Max for small size. With no evidence of mechanical damage.	4.28 Resistance change after 10,000 cycles (1 second "ON ", 25 seconds "OFF ") at 4 times RCWV.
Terminal strength	No evidence of mechanical damage	4.16 Direct load: Resistance to a 2.5Kg direct load for 10 seconds 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: ± (1%+0.05Ω) Max. With no evidence of mechanical damage	4.18 Permanent resistance change when leads immersed to a point 2.0-2.5mm from the body in 260℃±5℃ solder for 10±1 seconds.
Solderability	95% coverage Min.	4.17 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: 2~3seconds.
Resistance to solvent	No deterioration of protective coatings & markings	4.29 Specimens shall be immersed in a bath of trichloroethylene completely for 3 min. With ultrasonic
Temperature cycling	Resistance change rate is: ±(2%+0.05Ω) Max.. With no evidence of mechanical damage.	4.19 Resistance change after continuous five cycles for duty cycle specified: 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 *Step1-4 Continuous 5 cycles
Humidity (steady state)	Resistance change rate is: ± (2%+0.05Ω) Max. With no evidence of mechanical damage	4.24 temporary resistance changes after a 240 hours exposure in a humidity test chamber controlled at 40℃ ± 2℃ and 90 to 95% relative humidity.
Load life in humidity	ΔR/R: ≦ ±5% for ＜100KΩ; ≦ ±10% for ≧100KΩ;	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.
Load life	ΔR/R: ≦ ±5% for ＜100KΩ; ≦ ±10% for ≧100KΩ;	4.25.1 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.

Item	Limits	Test Method (JIS-C-5201&5202)
Flame retardant	Resistor insulation is self-extinguishing within 10 seconds after externally applied flame is removed.	4.26 The burner is placed remote fro, resistor ignited and adjusted to produce a blue flame 38mm in height and a top of flame 127mm above the top of burner tube. Resistor is supported from its lead at 45° from the horizontal so that the lower end of resistor is the top of blue flame. The test flame is placed to remain for 15 seconds and removed for 15 seconds. The operation is to be repeated until resistor has been subjected to 5 application of test flame.

8.0 Explanation of Part No. system:

The standard Part No. contains 14 codes.

8.1 1st~3rd codes: Product type

8.2 4th code: Special feature.

Example: MOR0=Metal Oxide Film Fixed Resistors

8.3 5th~6th codes: Power rating

8.3.1 The 5th code would be "W", "S", or "U" if the resistors' power rating is lower than 1W.

8.3.2 The 6th code would be "W", "S", or "U" if the resistors' power rating is greater than 1W.

8.3.3 We named "W" to indicate "normal size", "S" for "small size", and "U" for "ultra-small size".

1/16W~1/2W (＜1W)

Wattage	1/2	1/3	1/4	1/5	1/6	1/8	1/10	1/16
Normal size	W2	W3	W4	W5	W6	W8	WA	WG
Small size	S2	S3	S4	S5	S6	S8	SA	SG
Ultra-small size	U2	U3	U4	U5	U6	U8	UA	UG

1W~16W (≧1W)

Wattage	1	2	3	5	7	8	9	10	15
Normal size	1W	2W	3W	5W	7W	8W	9W	AW	FW
Small size	1S	2S	3S	5S	7S	8S	9S	AS	FS
Ultra-small size	1U	2U	3U	5U	7U	8U	9U	AU	FU

8.4 7th code: Resistance Tolerance.

F=±1% G=±2% J=±5% K= ±10%

8.5 8th~11th codes: Resistance Value.

8.5.1 For the standard resistance values of E-24 series in 5% and 10% tolerance, 8th code would be "0", 9th~10th codes would be the significant figures of the resistance, and 11th code is the power of ten.

For the standard resistance values of E-96 series in ≤2% tolerance, 8th~10th codes would be the significant figures of the resistance, and 11th code is the power of ten.

8.5.2 As mentioned above, 11th code would be the power of ten, so we use those code in 11th digit shown as following:

$0=10^0$ $1=10^1$ $2=10^2$ $3=10^3$ $4=10^4$ $5=10^5$

$6=10^6$ $J=10^{-1}$ $K=10^{-2}$ $L=10^{-3}$ $M=10^{-4}$

8.6 12th~14th codes

8.6.1 12th code: Packaging Type

A=Tape/Box (Ammo pack) B=Bulk/Box

T=Tape/Reel P=Tape/Box of PT-26 products

8.6.2 13th code: Standard Packing Quantity of Tape/Box & Tape/Reel packaging types.

If the packing type is Bulk packing, this digit should be "0".

A=500pcs B=2500pcs 1=1000pcs 2=2000pcs

8.6.3 For the FORMED type products, 13th~14th codes would be forming types shown as below:

MF=M-type with flattened lead wire MK= M-type with kinked lead wire

ML= M-type with normal lead wire

MC= M type with kinked lead and narrow pitch wire

F0= F-type F1= F1-type F2= F2-type F3= F3-type

8.6.4 14th code: Special features for additional information.

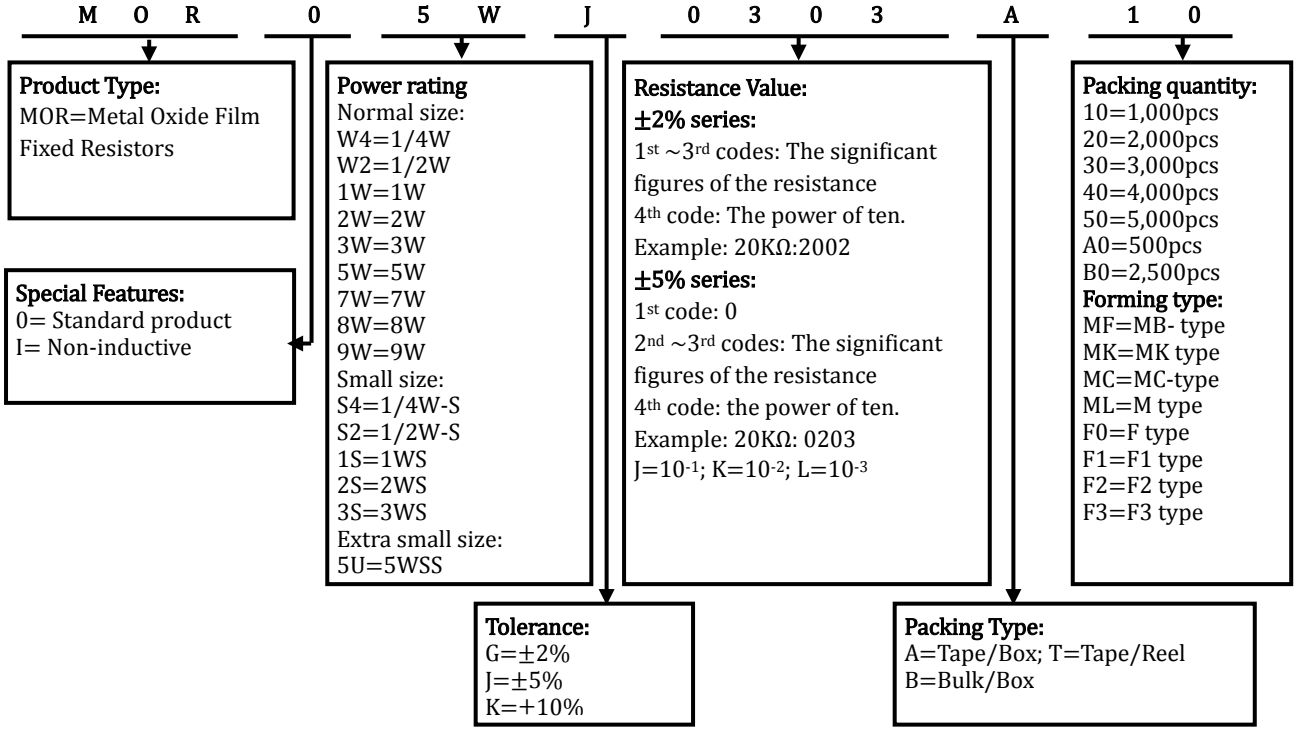
P=Panasert type 1=Avisert type 1 2=Avisert type 2

3=Avisert type 3

A=Cutting type CO 1/4W-A type

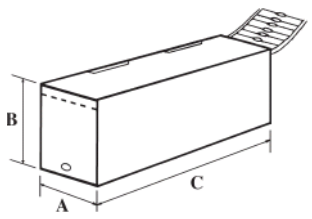
B= Cutting type CO 1/4W-B type

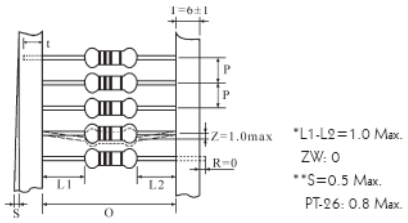
9.0 Ordering Procedure (Example: MOR 5W ±5% 30KΩ T/B-1000)



10.0 Standard Packing:

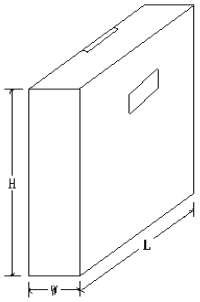
10.1 Tapes in Box Packing: Unit: T/B (mm)

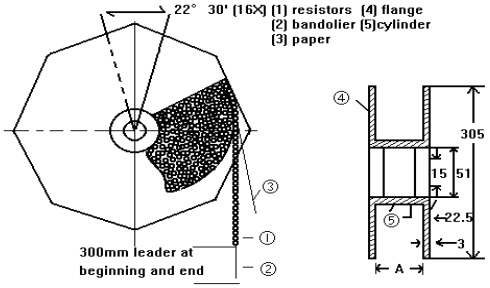




Part No.	O	P	A±5	B±5	C±5	Qty/Box
MO 1/4W	52±1	5±0.3	75	116	255	5,000pcs
MO 1/2WS	52±1	5±0.3	75	116	255	5,000pcs
MO 1/2W	52±1	5±0.3	75	70	255	1,000pcs
MO 1WS	58±1	5±0.3	80	70	255	1,000pcs
MO 1W	58±1	5±0.3	80	82	255	1,000pcs
MO 2WS	58±1	5±0.3	80	82	255	1,000pcs
MO 2W	65±1	10±0.5	90	119	255	1,000pcs
MO 3WS	65±1	10±0.5	90	119	255	1,000pcs
MO 3W	65±5	10±0.5	90	88	255	500pcs
MO 5WSS	65±5	10±0.5	90	88	255	500pcs
MO 5WS	90±5	10±0.5	115	124	500	500pcs

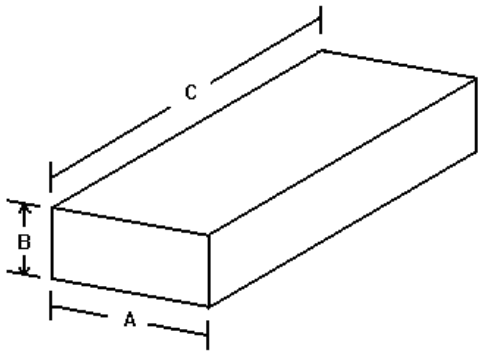
10.2 Tapes in Reel Packing: Unit: Reel (mm)



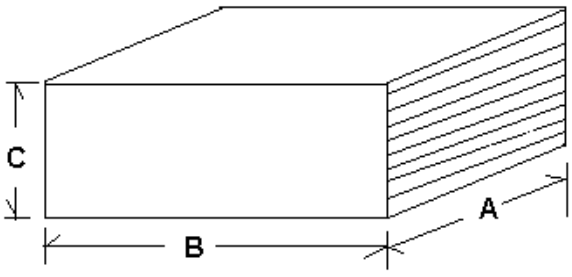


Part No.	A	W±5	H±5	L±5	Qty/Box
MO 1/4W	73±2	85	295	293	5,000pcs
MO 1/2WS	73±2	85	295	293	5,000pcs
MO 1/2W	73±2	85	295	293	3,500pcs
MO 1WS	73±2	85	295	293	2,500pcs
MO 1W	73±2	85	295	293	2,500pcs
MO 2WS	73±2	85	295	293	2,500pcs
MO 2W	80±5	95	295	293	1,000pcs
MO 3WS	80±5	95	295	293	1,000pcs
MO 3W	80±5	95	295	293	1,000pcs
MO 5WSS	80±5	95	295	293	1,000pcs

10.3 Bulk in Box Packing: Unit: Box (mm)



Part No.	A±5	B±5	C±5	Qty. of Bag/Box
MO 1/4W	140	80	240	250/10,000pcs
MO 1/2WS	140	80	240	250/10,000pcs
MO 1/2W	140	80	240	200/4,000pcs
MO 1WS	140	80	240	200/4,000pcs
MO 1W	140	80	240	100/2,500pcs
MO 2WS	140	80	240	100/2,500pcs
MO 2W	140	80	240	100/1,500pcs
MO 3WS	140	80	240	100/1,500pcs
MO 3W	140	80	240	100/1,000pcs
MO 5WSS	140	80	240	100/1,000pcs



Part No.	A±5	B±5	C±5	Qty/Box
MO 5WS	140	80	240	25/400pcs
MO 5W	140	80	240	25/400pcs
MO 7W	140	80	240	25/300pcs

11.0 Precaution for storage/Transportation:

11.1 We strongly recommend the storage condition:

Temperature: 15℃~35℃; Humidity: 25%~75%.

Even under the storage condition mentioned above, solderability of products would degrade if stored over 1 year.

11.2 Store / transport cartons in the correct direction which signed on a carton side. Otherwise bent leads may occur due to excessive stress applied when dropping of a carton.

11.3 Product performance and soldered connections may deteriorate if the products are stored in the following places:

11.3.1 In high electrostatic;

11.3.2 In direct sunshine, rain, snow or condensation;

11.3.3 Exposed to sea winds or corrosive gases, including Cl_2, H_2S, NH_3, SO_2, and NO_2.

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