

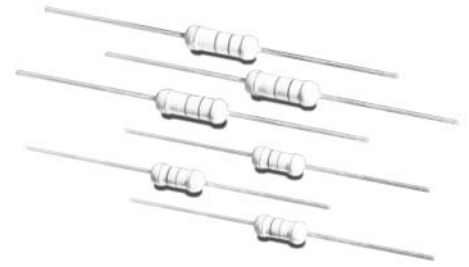


# Metal Oxide Power Resistors

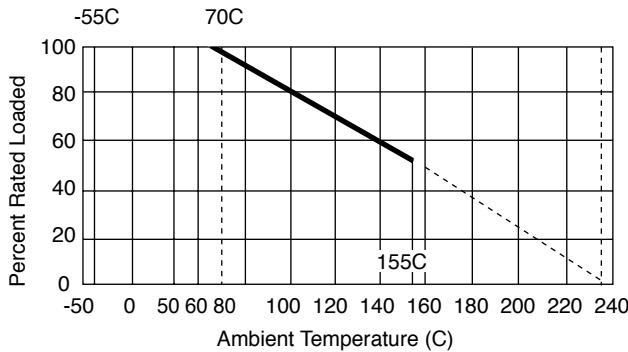
# MO Series

## FEATURES

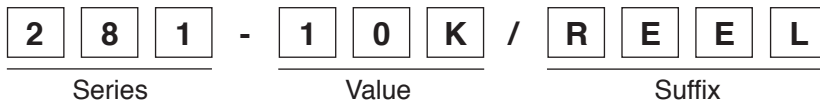
- Temperature Range: -55°C ~ +235°C (derated over 70°C)
- ±5% tolerance
- Excellent flame retardant coating
- Stable performance in diverse environments
- High purity ceramic core
- Other values may be available on request



## DERATING CURVE

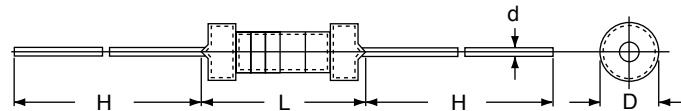


## PART NUMBERING SYSTEM



|              |               |
|--------------|---------------|
| Suffix Code: | Package:      |
| (blank)      | Bulk          |
| REEL         | Tape and Reel |

## SERIES, SIZE, WATTAGE, RANGE OF VALUES, VOLTAGE, AND DIMENSIONS



| Series | Case Size | Watts (W) | Standard Range of Values | Voltage (V) (max.) @ 70°C |          |              | Dimensions (mm) |          |      |              |
|--------|-----------|-----------|--------------------------|---------------------------|----------|--------------|-----------------|----------|------|--------------|
|        |           |           |                          | Working                   | Overload | Withstanding | L (max.)        | D (max.) | H ±3 | d +.02, -.05 |
| 281    | Small     | 1         | 0.1 ~ 1.0M               | 350                       | 600      | 350          | 10              | 4        | 28   | 0.7          |
| 282    | Small     | 2         | 0.1 ~ 1.0M               | 350                       | 600      | 350          | 12              | 5        | 28   | 0.7          |
| 283    | Small     | 3         | 0.1 ~ 1.0M               | 350                       | 600      | 350          | 16              | 5.5      | 28   | 0.8          |
| 286    | Small     | 5         | 0.22 ~ 560K              | 500                       | 800      | 500          | 25              | 8        | 28   | 0.8          |
| 261    | Standard  | 1         | 0.1 ~ 1.0M               | 350                       | 600      | 350          | 12              | 5        | 28   | 0.7          |
| 262    | Standard  | 2         | 0.1 ~ 1.0M               | 350                       | 600      | 350          | 16              | 5.5      | 28   | 0.8          |

## STANDARD STOCKED VALUES (Ω)

|      |      |     |     |     |    |    |    |     |     |     |      |      |      |      |     |     |     |      |      |      |      |
|------|------|-----|-----|-----|----|----|----|-----|-----|-----|------|------|------|------|-----|-----|-----|------|------|------|------|
| 0.47 | 0.82 | 1.6 | 3.3 | 6.2 | 12 | 24 | 47 | 91  | 180 | 360 | 680  | 1.3K | 2.7K | 5.1K | 10K | 20K | 39K | 75K  | 150K | 300K | 560K |
| 0.5  | 0.91 | 1.8 | 3.6 | 6.8 | 13 | 27 | 51 | 100 | 200 | 390 | 750  | 1.5K | 3.0K | 5.6K | 11K | 22K | 43K | 82K  | 160K | 330K | 620K |
| 0.51 | 1.0  | 2.0 | 3.9 | 7.5 | 15 | 30 | 56 | 110 | 220 | 430 | 820  | 1.6K | 3.3K | 6.2K | 12K | 24K | 47K | 91K  | 180K | 360K | 680K |
| 0.56 | 1.1  | 2.2 | 4.3 | 8.2 | 16 | 33 | 62 | 120 | 240 | 470 | 910  | 1.8K | 3.6K | 6.8K | 13K | 27K | 51K | 100K | 200K | 390K | 750K |
| 0.62 | 1.2  | 2.4 | 4.7 | 9.1 | 18 | 36 | 68 | 130 | 270 | 510 | 1.0K | 2.0K | 3.9K | 7.5K | 15K | 30K | 56K | 110K | 220K | 430K | 820K |
| 0.68 | 1.3  | 2.7 | 5.1 | 10  | 20 | 39 | 75 | 150 | 300 | 560 | 1.1K | 2.2K | 4.3K | 8.2K | 16K | 33K | 62K | 120K | 240K | 470K | 910K |
| 0.75 | 1.5  | 3.0 | 5.6 | 11  | 22 | 43 | 82 | 160 | 330 | 620 | 1.2K | 2.4K | 4.7K | 9.1K | 18K | 36K | 68K | 130K | 270K | 510K | 1.0M |



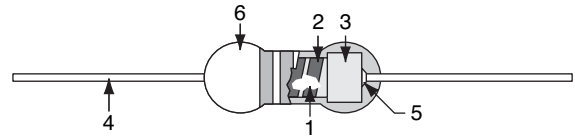


# Metal Oxide Power Resistors

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## CONSTRUCTION

| No. | Name            | Material   |
|-----|-----------------|--|
| 1   | Basic           | BodyRod Type Ceramics  |
| 2   | Resistance Film | Metal Oxide Film   |
| 3   | End Cap         | Steel (Tin plated iron surface)                                |
| 4   | Lead Wire       | Annealed copper wire<br>(Electrosolder plated surface) Pb Free |
| 5   | Joint           | By welding   |
| 6   | Coating         | Insulated & Non-Flame Paint (Color : Sea-Blue )                |
| 7   | Color Code      | Non-Flame epoxy resin  |



## 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         | Within the temperature coefficient specified below<br>$\pm 350$ PPM / °C                       | 5.2 Natural resistance change per temp. degree centigrade.<br>$R_2 - R_1$ $\frac{\text{-----}}{R_1(t_2 - t_1)} \times 10^6 \text{ (PPM/°C)}$ R1: Resistance value at room temperature (t <sub>1</sub> )<br>R2: Resistance value at room temp.plus 100°C (t <sub>2</sub> )  |
| Short time overload             | Resistance change rate is $\pm (2\% + 0.05\Omega)$ Max. with no evidence of mechanical damage  | 5.5 Permanent resistance change after the application of a potential of 2.5 times RCWV 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.   |
| Pulse overload                  | Resistance change rate is $\pm (5\% + 0.05\Omega)$ 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   |
| Terminal strength               | With no evidence of mechanical damage.   | 6.1 <b>Direct load</b><br>Resistance to a 2.5 kgs direct load for 10 secs. in the direction of the longitudinal axis of the terminal leads.<br><b>Twist test :</b><br>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°C solder for 3 $\pm$ 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.<br>Test temp. of solder : 245°C $\pm$ 3°C<br>Dwell time in solder : 2 ~ 3 seconds   |





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## CHARACTERISTICS (Cont.)

| Characteristics       | Limits   |                         | Test Methods ( JIS C 5201-1 )  |                              |             |
|-----------------------|--|-------------------------|--|------------------------------|-------------|
| 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:  |                              |             |
|                       |  |                         | <b>Step</b>  | <b>Temperature</b>           | <b>Time</b> |
|                       |  |                         | 1  | -55°C $\pm 3^\circ\text{C}$  | 30 mins     |
|                       |  |                         | 2  | Room temp.                   | 10~15 mins  |
|                       |  |                         | 3  | +155°C $\pm 2^\circ\text{C}$ | 30 mins     |
| 4                     | Room temp.   | 10~15 mins              |  |                              |             |
| Load life in humidity | Resistance value   | $\Delta R/R$            | 7.9 Resistance change after 1,000 hours operating at RCWV with duty cycle of (1.5 hours "on", 0.5 hour "off") in a humidity test chamber controlled at 40°C $\pm 2^\circ\text{C}$ and 90 to 95 % relative humidity |                              |             |
|                       | < than 100K $\Omega$<br>>100K $\Omega$   | $\pm 5\%$<br>$\pm 10\%$ |  |                              |             |
| Load life             | Resistance value   | $\Delta R/R$            | 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 $\pm 2^\circ\text{C}$ ambient   |                              |             |
|                       | < than 100K $\Omega$<br>> 100K $\Omega$  | $\pm 5\%$<br>$\pm 10\%$ |  |                              |             |
| Non-Flame             | No evidence of flaming or arcing   |                         | 7.12 Resistors shall resist flaming or arcing when overloaded up to 16 times RCWV  |                              |             |





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