

# Type MM and ML Precision Film Resistors

## High Temperature Resistors for Geophysical, Industrial, and Military Requirements

Type MM and ML resistors have a proven performance history in industrial and military applications. Utilizing our proven Micronox® resistance films, these resistors are available with power ratings up to 1 Watt and resistance values to 10 Megohms. These resistors are ideal for applications requiring tolerances as close as 0.1% and extended life stability of 0.1% per 1,000 hours.

Some models of Type MM and ML resistors are manufactured with Caddock's Non-Inductive Design that provides for neighboring lines to carry current in opposite directions. This efficient non-inductive construction is accomplished without derating of any performance advantages.



### Type MM features:

- Max. Operating Temperature to +275°C.
- High Power Rating at +125°C.
- TC of 50 ppm/°C from -15°C to +105°C.
- Non-Inductive Performance Available.

### Type ML features:

- TC of 50 ppm/°C from -15°C to +105°C.
- Non-Inductive Performance Available.

MM112, ML104	
MM125, ML114	
MM152, ML124	
MM177, ML131	
MM215, ML181	

Model No.	Wattage	Max. Voltage	Oper. Temp. (Max.)	Dielect. Strength	Resistance		Dimensions in inches and (millimeters)		
					Min.	Max.	A	B	C
MM112	0.12	200	275°C	400	45 Ω	500 K	.160 ±.010 (4.06 ±.26)	.065 ±.010 (1.65 ±.26)	.018 ±.004 (.48 ±.10)
MM125	0.25	200	275°C	500	30 Ω	1 Meg	.188 ±.020 (4.78 ±.51)	.070 ±.015 (1.78 ±.38)	.020 ±.002 (.51 ±.05)
MM152	0.4	300	275°C	750	30 Ω	2 Meg	.250 ±.020 (6.35 ±.51)	.094 ±.006 (2.39 ±.15)	.025 ±.002 (.64 ±.05)
MM177	0.6	500	275°C	750	45 Ω	5 Meg	.313 ±.020 (7.95 ±.51)	.094 ±.006 (2.39 ±.15)	.025 ±.002 (.64 ±.05)
MM215	1.0	800	275°C	1,000	45 Ω	10 Meg	.400 ±.020 (10.16 ±.51)	.150 ±.010 (3.81 ±.26)	.025 ±.002 (.64 ±.05)
ML104	0.08	200	175°C	400	50 Ω	300 K	.160 ±.010 (4.06 ±.26)	.065 ±.010 (1.65 ±.26)	.018 ±.004 (.48 ±.10)
ML114	0.15	200	175°C	500	50 Ω	500 K	.188 ±.020 (4.78 ±.51)	.070 ±.015 (1.78 ±.38)	.020 ±.002 (.51 ±.05)
ML124	0.25	300	175°C	750	50 Ω	600 K	.250 ±.020 (6.35 ±.51)	.094 ±.006 (2.39 ±.15)	.025 ±.002 (.64 ±.05)
ML131	0.4	500	175°C	750	50 Ω	1 Meg	.313 ±.020 (7.95 ±.51)	.094 ±.006 (2.39 ±.15)	.025 ±.002 (.64 ±.05)
ML181	0.6	600	175°C	750	50 Ω	5 Meg	.400 ±.020 (10.16 ±.51)	.150 ±.010 (3.81 ±.26)	.025 ±.002 (.64 ±.05)

Models with low inductance construction are in shaded areas.  
 Models with Caddock's Non-Inductive Resistance Pattern are in non-shaded areas.

### Replacement Notes:

Model MM216 replaced by MS221  
 Model MM217 replaced by MS223  
 Model MM224 replaced by MS244  
 Model MM225 replaced by MS245  
 Model MM236 replaced by MS260

Model ML212 replaced by MS221  
 Model ML213 replaced by MS223  
 Model ML218 replaced by MS244  
 Model ML219 replaced by MS245  
 Model ML226 replaced by MS260

### Ordering Information:

Model Number: ML124 - 20.0K - 1% Tolerance  
 Resistor Value: \_\_\_\_\_

**Note:** The MM and ML resistors are intended for high performance electronics applications that are outside the scope of the RoHS directive. Contact Caddock Applications Engineering for an RoHS compliant alternative.

### Specifications:

**Resistance Tolerance:** ±1% (tolerances to 0.1% on special order).

**Temperature Coefficient:** 50 ppm/°C referenced to +25°C, ΔR taken at -15°C and +105°C.

**Insulation Resistance:** 10,000 Megohms, min.

**Overload/Overvoltage:** 5 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds, ΔR 0.5% max. or 0.5 ohm max., whichever is greater.

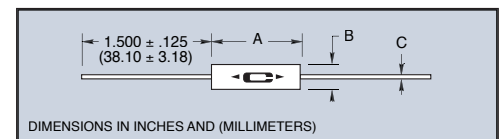
**Thermal Shock:** Mil-Std-202, Method 107, Cond. F, ΔR 0.2% max. or 0.5 ohm max., whichever is greater.

**Moisture Resistance:** Mil-Std-202, Method 106, ΔR 0.5% max. or 0.5 ohm max., whichever is greater.

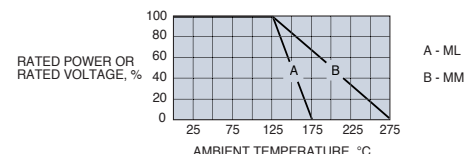
**Loadlife:** 1,000 hours at +125°C at rated power, not to exceed rated voltage, ΔR 0.5% max. or 0.5 ohm max., whichever is greater.

**Solderable leads**

**Encapsulation:** Transfer Molded.



### Derating Curve:



Applications Engineering  
 17271 North Umpqua Hwy.  
 Roseburg, Oregon 97470-9422  
 Phone: (541) 496-0700  
 Fax: (541) 496-0408

**CADDOCK ELECTRONICS, INC.**

e-mail: caddock@caddock.com • web: www.caddock.com  
 For Caddock Distributors listed by country see caddock.com/contact/dist.html

Sales and Corporate Office  
 1717 Chicago Avenue  
 Riverside, California 92507-2364  
 Phone: (951) 788-1700  
 Fax: (951) 369-1151