

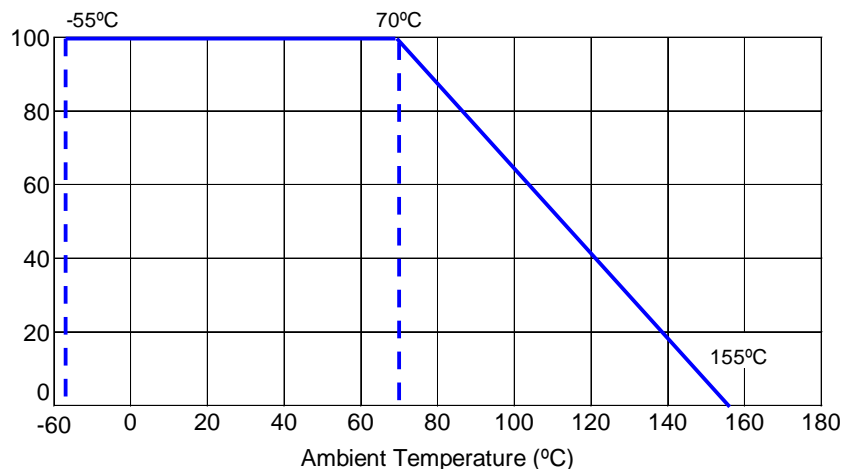
- Features:
- Thin Film Technology for precision and stability
 - Excellent power to size ratio
 - Exhibits good pulse power characteristics
 - RoHS compliant / lead-free



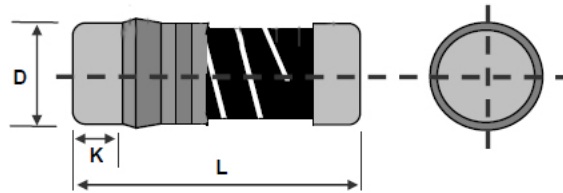
Electrical Specifications									
Type / Code	Package Size	Power Rating (Watts) @ 70°C	Maximum Working Voltage ⁽¹⁾	Maximum Overload Voltage	Resistance Temperature Coefficient	Ohmic Range (Ω) and Tolerance			
						0.1%	0.5%	1%	5%
MLF18	0102	0.125W	150V	300V	±15 ppm/°C	100 - 56K			-
					±25 ppm/°C	100 - 82K	49.9 - 200K	49.9 - 390K	-
					±50 ppm/°C	-	40 - 1M		
					±100 ppm/°C	-	40 - 1M		
MLFM15	0102	0.2W	200V	400V	±15 ppm/°C	100 - 56K			-
					±25 ppm/°C	100 - 82K	49.9 - 200K	49.9 - 390K	-
					±50 ppm/°C	-	40 - 1M		
					±100 ppm/°C	-	40 - 1M		
MLF14	0204	0.25W	200V	400V	±10 ppm/°C	10 - 20K			
					±15 ppm/°C	10 - 300K			
					±25 ppm/°C	10 - 1M		10 - 4.7M	
					±50 ppm/°C	10 - 1M	1 - 1M	0.2 - 10M	
					±100 ppm/°C	-	0.1 - 10M		
MLFM25	0204	0.4W	200V	400V	±15 ppm/°C	10 - 100K			
					±25 ppm/°C	10 - 1M			
					±50 ppm/°C	10 - 1M	1 - 1M	0.2 - 1M	
					±100 ppm/°C	-	0.1 - 1M		
MLF12	0207	0.5W	300V	600V	±10 ppm/°C	10 - 20K			
					±15 ppm/°C	10 - 300K			
					±25 ppm/°C	10 - 1M		10 - 4.7M	
					±50 ppm/°C	10 - 1M	1 - 1M	0.2 - 10M	
					±100 ppm/°C	-	0.1 - 10M		
MLFM1	0207	1W	350V	700V	±15 ppm/°C	49.9 - 100K			
					±25 ppm/°C	10 - 1M			
					±50 ppm/°C	10 - 1M	1 - 1M	0.2 - 10M	
					±100 ppm/°C	-	0.1 - 10M		

Note: (1) Lesser of $\sqrt{P \cdot R}$ or maximum working voltage

Power Derating Curve:

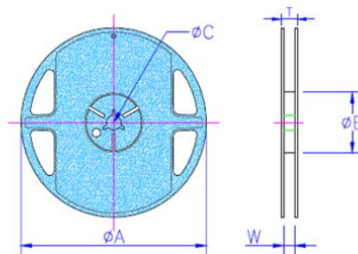


Mechanical Specifications



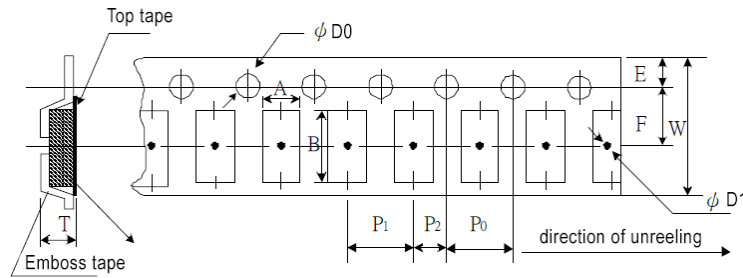
Type / Code	Weight (1000 pc) (g)	L Body Length	D Body Diameter	K Termination	Unit
MLF18 (0102)	7.7	0.087 ± 0.004 2.20 ± 0.10	0.043 ± 0.004 1.10 ± 0.10	0.018 ± 0.002 0.45 ± 0.05	inches mm
MLFM15 (0102)	7.7	0.087 ± 0.004 2.20 ± 0.10	0.043 ± 0.004 1.10 ± 0.10	0.018 ± 0.002 0.45 ± 0.05	inches mm
MLF14 (0204)	18.7	0.138 ± 0.008 3.50 ± 0.20	0.055 ± 0.006 1.40 ± 0.15	0.031 ± 0.004 0.80 ± 0.10	inches mm
MLFM25 (0204)	18.7	0.138 ± 0.008 3.50 ± 0.20	0.055 ± 0.006 1.40 ± 0.15	0.031 ± 0.004 0.80 ± 0.10	inches mm
MLF12 (0207)	80.9	0.232 ± 0.008 5.90 ± 0.20	0.087 ± 0.008 2.20 ± 0.20	0.051 ± 0.004 1.30 ± 0.10	inches mm
MLFM1 (0207)	80.9	0.232 ± 0.008 5.90 ± 0.20	0.087 ± 0.008 2.20 ± 0.20	0.051 ± 0.004 1.30 ± 0.10	inches mm

Reel Specification



Type / Code	φA	φB	φC	W	T	Unit
MLF18	7.028 ± 0.059 178.50 ± 1.50	2.362 ± 0.039 60.00 ± 1.00	0.512 ± 0.008 13.00 ± 0.20	0.354 ± 0.020 9.00 ± 0.50	0.492 ± 0.020 12.50 ± 0.50	inches mm
MLFM15	7.028 ± 0.059 178.50 ± 1.50	2.362 ± 0.039 60.00 ± 1.00	0.512 ± 0.008 13.00 ± 0.20	0.354 ± 0.020 9.00 ± 0.50	0.492 ± 0.020 12.50 ± 0.50	inches mm
MLF14	7.028 ± 0.059 178.50 ± 1.50	2.362 ± 0.039 60.00 ± 1.00	0.512 ± 0.008 13.00 ± 0.20	0.354 ± 0.020 9.00 ± 0.50	0.492 ± 0.020 12.50 ± 0.50	inches mm
MLFM25	7.028 ± 0.059 178.50 ± 1.50	2.362 ± 0.039 60.00 ± 1.00	0.512 ± 0.008 13.00 ± 0.20	0.354 ± 0.020 9.00 ± 0.50	0.492 ± 0.020 12.50 ± 0.50	inches mm
MLF12	7.028 ± 0.059 178.50 ± 1.50	2.362 ± 0.039 60.00 ± 1.00	0.512 ± 0.020 13.00 ± 0.50	0.512 ± 0.020 13.00 ± 0.50	0.610 ± 0.020 15.50 ± 0.50	inches mm
MLFM1	7.028 ± 0.059 178.50 ± 1.50	2.362 ± 0.039 60.00 ± 1.00	0.512 ± 0.020 13.00 ± 0.50	0.512 ± 0.020 13.00 ± 0.50	0.610 ± 0.020 15.50 ± 0.50	inches mm

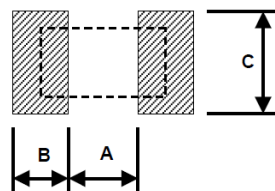
Embossed Plastic Tape Specification



Type / Code	A	B	W	E	F	P0	Unit
MLF18	0.051 ± 0.004	0.094 ± 0.004	0.315 ± 0.004	0.069 ± 0.004	0.138 ± 0.002	0.157 ± 0.004	inches
	1.30 ± 0.10	2.40 ± 0.10	8.00 ± 0.10	1.75 ± 0.10	3.50 ± 0.05	4.00 ± 0.10	mm
MLFM15	0.051 ± 0.004	0.094 ± 0.004	0.315 ± 0.004	0.069 ± 0.004	0.138 ± 0.002	0.157 ± 0.004	inches
	1.30 ± 0.10	2.40 ± 0.10	8.00 ± 0.10	1.75 ± 0.10	3.50 ± 0.05	4.00 ± 0.10	mm
MLF14	0.061 ± 0.004	0.144 ± 0.004	0.315 ± 0.004	0.069 ± 0.004	0.138 ± 0.002	0.157 ± 0.004	inches
	1.55 ± 0.10	3.65 ± 0.10	8.00 ± 0.10	1.75 ± 0.10	3.50 ± 0.05	4.00 ± 0.10	mm
MLFM25	0.061 ± 0.004	0.144 ± 0.004	0.315 ± 0.004	0.069 ± 0.004	0.138 ± 0.002	0.157 ± 0.004	inches
	1.55 ± 0.10	3.65 ± 0.10	8.00 ± 0.10	1.75 ± 0.10	3.50 ± 0.05	4.00 ± 0.10	mm
MLF12	0.094 ± 0.004	0.242 ± 0.004	0.472 ± 0.004	0.069 ± 0.004	0.217 ± 0.002	0.157 ± 0.004	inches
	2.40 ± 0.10	6.15 ± 0.10	12.00 ± 0.10	1.75 ± 0.10	5.50 ± 0.05	4.00 ± 0.10	mm
MLFM1	0.094 ± 0.004	0.242 ± 0.004	0.472 ± 0.004	0.069 ± 0.004	0.217 ± 0.002	0.157 ± 0.004	inches
	2.40 ± 0.10	6.15 ± 0.10	12.00 ± 0.10	1.75 ± 0.10	5.50 ± 0.05	4.00 ± 0.10	mm

Type / Code	P1	P2	D0	D1	T	Unit
MLF18	0.157 ± 0.004	0.079 ± 0.002	0.059 ± 0.004	0.035 min.	0.059 ± 0.004	inches
	4.00 ± 0.10	2.00 ± 0.05	1.50 ± 0.10	0.90 min.	1.50 ± 0.10	mm
MLFM15	0.157 ± 0.004	0.079 ± 0.002	0.059 ± 0.004	0.035 min.	0.059 ± 0.004	inches
	4.00 ± 0.10	2.00 ± 0.05	1.50 ± 0.10	0.90 min.	1.50 ± 0.10	mm
MLF14	0.157 ± 0.004	0.079 ± 0.002	0.059 ± 0.004	0.035 min.	0.071 ± 0.004	inches
	4.00 ± 0.10	2.00 ± 0.05	1.50 ± 0.10	0.90 min.	1.80 ± 0.10	mm
MLFM25	0.157 ± 0.004	0.079 ± 0.002	0.059 ± 0.004	0.035 min.	0.071 ± 0.004	inches
	4.00 ± 0.10	2.00 ± 0.05	1.50 ± 0.10	0.90 min.	1.80 ± 0.10	mm
MLF12	0.157 ± 0.004	0.079 ± 0.002	0.059 ± 0.004	0.055 min.	0.106 ± 0.004	inches
	4.00 ± 0.10	2.00 ± 0.05	1.50 ± 0.10	1.40 min.	2.70 ± 0.10	mm
MLFM1	0.157 ± 0.004	0.079 ± 0.002	0.059 ± 0.004	0.055 min.	0.106 ± 0.004	inches
	4.00 ± 0.10	2.00 ± 0.05	1.50 ± 0.10	1.40 min.	2.70 ± 0.10	mm

Recommended Land Pattern

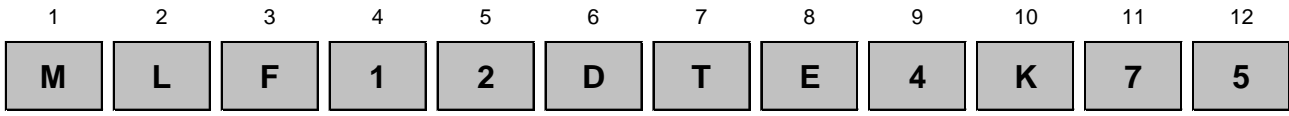


Type / Code	A	B	C	Unit
MLF18	0.039	0.031	0.059	inches
	1.00	0.80	1.50	mm
MLFM15	0.039	0.031	0.059	inches
	1.00	0.80	1.50	mm
MLF14	0.063	0.047	0.063	inches
	1.60	1.20	1.60	mm
MLFM25	0.063	0.047	0.063	inches
	1.60	1.20	1.60	mm
MLF12	0.118	0.067	0.094	inches
	3.00	1.70	2.40	mm
MLFM1	0.118	0.067	0.094	inches
	3.00	1.70	2.40	mm

Performance Characteristics		
Test	Test Method	Test Specification
Temperature Coefficient of Resistance (T.C.R.)	JIS-C-5201-1 4.8 IEC-60115-1 4.8 -55°C ~ +125°C, 25°C is the reference temperature	As specified
Short Time Overload	JIS-C-5201-1 4.13 IEC-60115-1 4.13 RCWV*2.5 or max. overload voltage whichever is lower for 5 seconds	0204/0207: ± (0.15% + 0.05Ω) 0102: ± (0.5% + 0.05Ω)
Insulation Resistance	JIS-C-5201-1 4.6 IEC-60115-1 4.6 Max. overload voltage for 1 minute	≥10G
Endurance	JIS-C-5201-1 4.25 IEC-60115-1 4.25.1 70 ± 2°C, RCWV for 1000 h. with 1.5 h. "ON" and 0.5 h. "OFF"	0204/0207: ± (0.15% + 0.05Ω) 0102: ± (0.5% + 0.05Ω)
Damp Heat with Load	JIS-C-5201-1 4.24 IEC-60115-1 4.24 40 ± 2°C, 90~95% R.H., RCWV for 1000 h. with 1.5 h. "ON" and 0.5 h. "OFF"	0204/0207: ± (1.0% + 0.05Ω) 0102: ± (1.5% + 0.05Ω)
Dry Heat	JIS-C-5201-1 4.23 IEC-60115-1 4.23.2 at +155°C for 1000 h.	0204/0207: ± (1.0% + 0.05Ω) 0102: ± (1.5% + 0.05Ω)
Bending Strength	JIS-C-5201-1 4.33 IEC-60115-1 4.33 Bending once for 5 seconds with 2mm	± (0.5% + 0.05Ω)
Solderability	JIS-C-5201-1 4.17 IEC-60115-1 4.17 245 ± 5°C for 3 seconds	95% min. coverage
Resistance to Soldering Heat	JIS-C-5201-1 4.18 IEC-60115-1 4.18 260 ± 5°C for 10 seconds	± (0.5% + 0.05Ω)
Voltage Proof	JIS-C-5201-1 4.7 IEC-60115-1 4.7 1.42 times max. operating voltage for 1 minute	No breakdown or flashover
Leaching	JIS-C-5201-1 4.18 IEC-60068-2-58 8.2.1 260 ± 5°C for 30 seconds	Individual leaching area ≤ 5% Total Leaching area ≤ 10%
Rapid Change of Temperature	JIS-C-5201-1 4.19 IEC-60115-1 4.19 -55°C to +155°C, 5 cycles	± (0.5% + 0.05Ω)

RCWV (rated continuous working voltage) = $\sqrt{P \cdot R}$ or max. operating voltage whichever is lower.
Storage temperature: 25 ± 3°C, humidity < 80% R.H.

How to Order



Product Series	
MLF	Standard
MLFM	Mini

Size	Power
18	0.125W
15	0.2W
14	0.25W
25	0.4W
12	0.5W
1	1W

Tolerance		
Code	Tol	Value
B	0.1%	E96, E24
D	0.5%	
F	1%	E24
J	5%	
Z	jumper	

Packaging			
Code	Description	Size	Quantity
T	7" Reel Plastic Tape	18, 15	3,000
		14, 25	
		12, 1	2,000

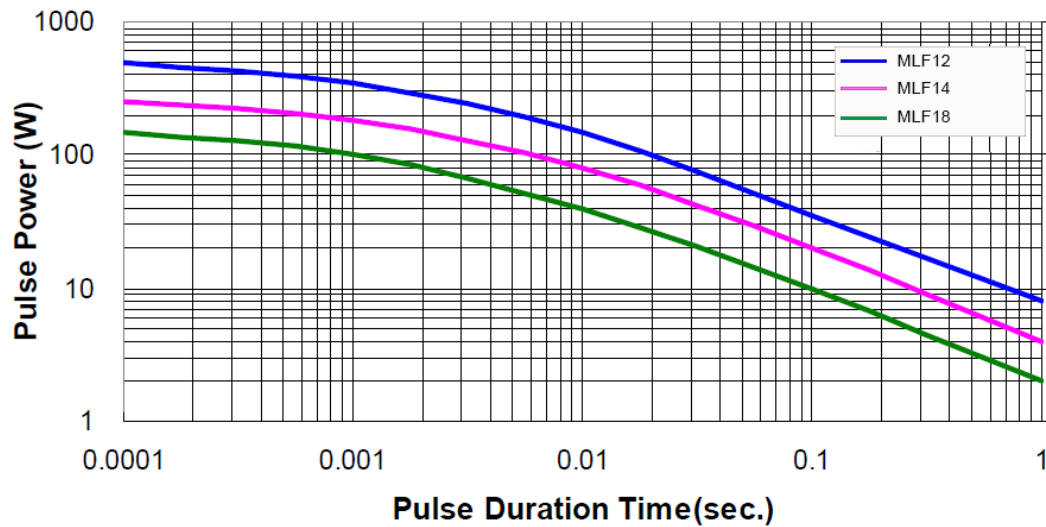
TCR	
Code	ppm
T	10
S	15
E	25
C	50
D	100

Resistance Value
Four characters with the multiplier used as the decimal holder.
10 ohm = 10R0
100 ohm = 100R
1 Kohm = 1K00
560 Kohm = 560K
zero ohm jumper = 0R00

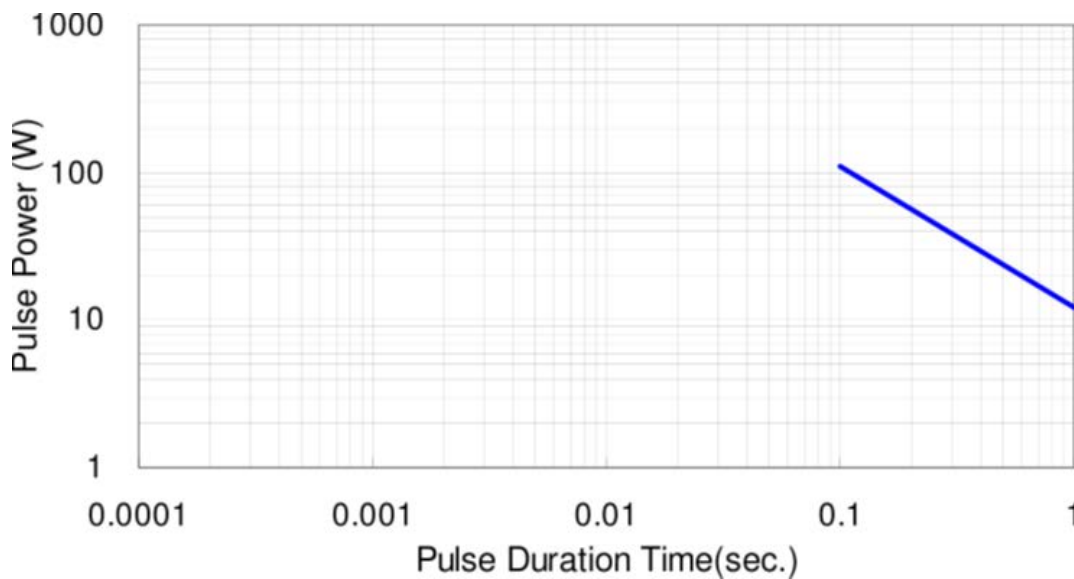
Pulse withstanding capacity

The single impulse graph is the result of 50 impulses of rectangular shape applied at one-minute intervals. The limit of acceptance was a shift in resistance of less than 1% from the initial value. The power applied was subject to the restrictions of the maximum permissible impulse voltage graph shown.

Single Pulse

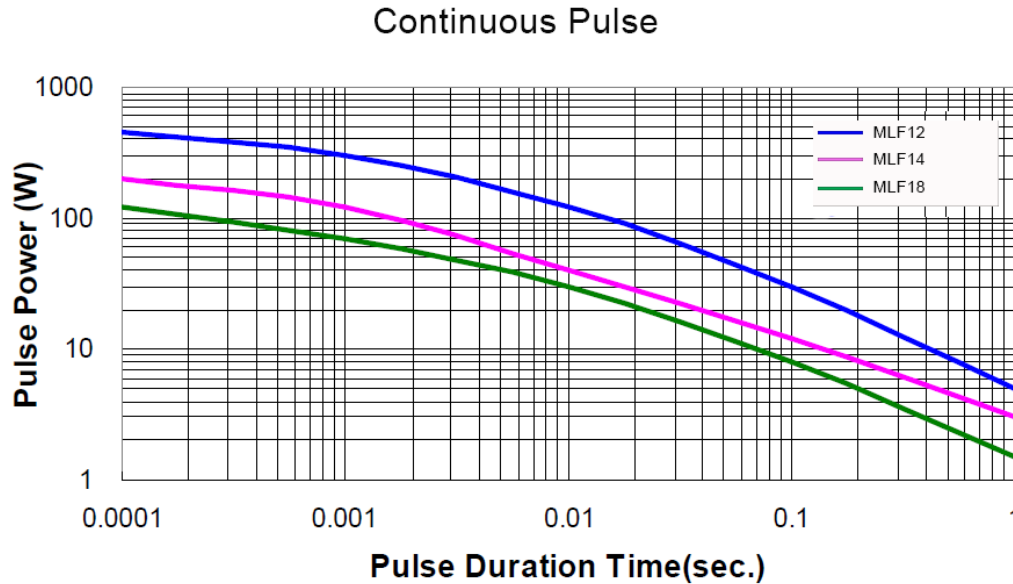


MLFM1 Single Pulse (1 Kohm)



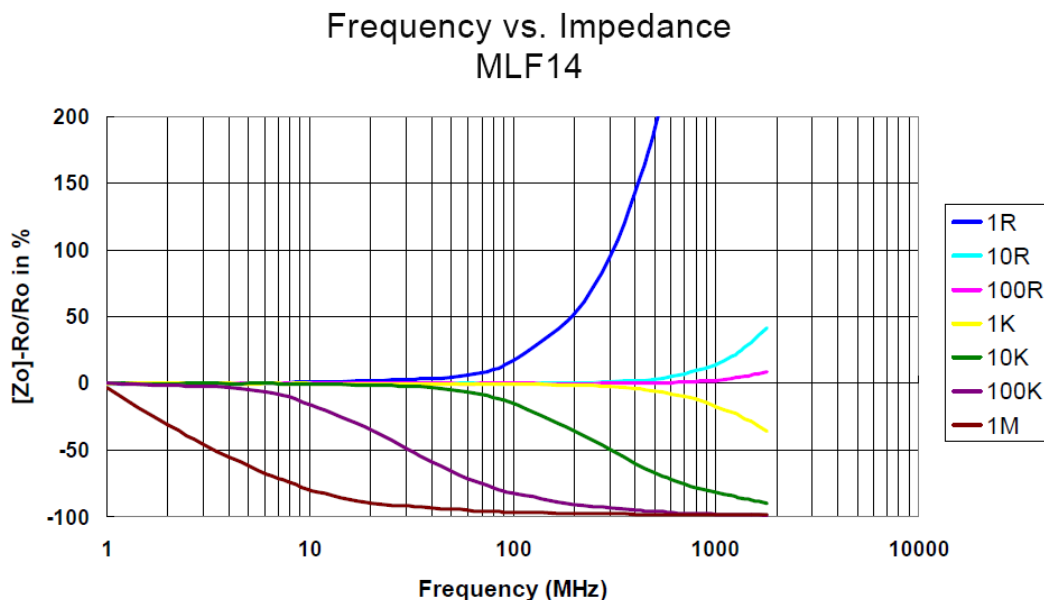
Continuous Pulse

The continuous load graph was obtained by applying repetitive rectangular pulses where the pulse period was adjusted so that the average power dissipated in the resistor was equal to its rated power at 70°C. Again the limit of acceptance was a shift in resistance of less than 1% from the initial value.

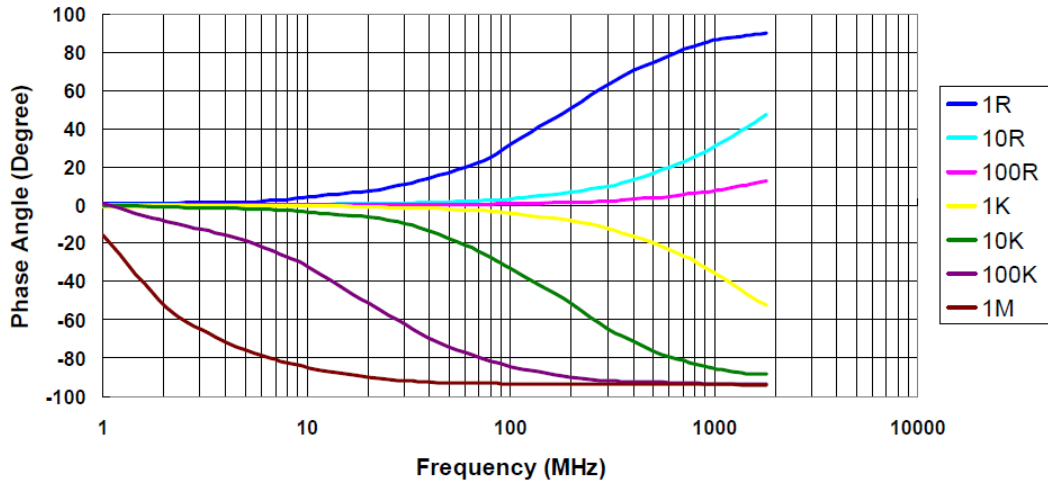


Frequency behavior

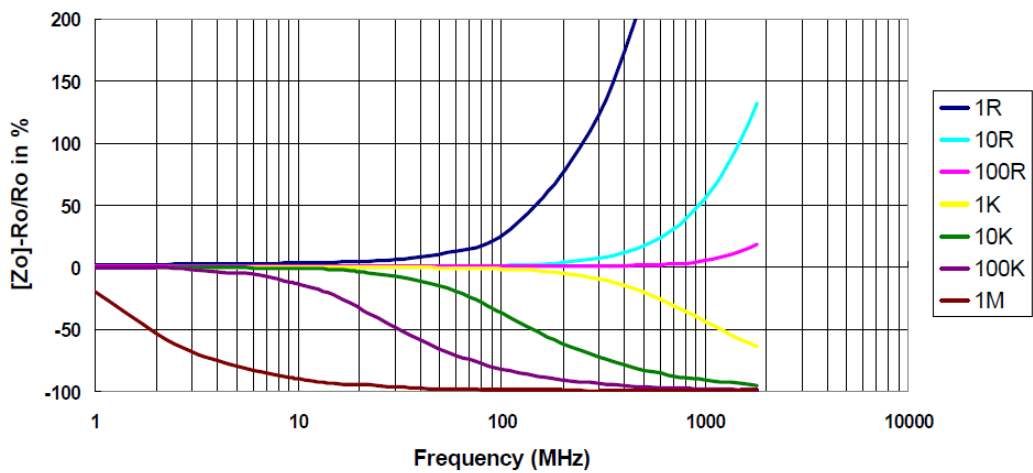
Resistors are designed to function according to ohmic laws. This is basically true of resistors for frequencies up to 100 kHz. At higher frequencies, there is an additional contribution to the impedance by an ideal resistor switched in series with a coil and both switched parallel to a capacitor. The values of the capacitance and inductance are mainly determined by the dimensions of the terminations and the conductive path length. The environment surrounding components has a large influence on the behavior of the component on the printed-circuit board.



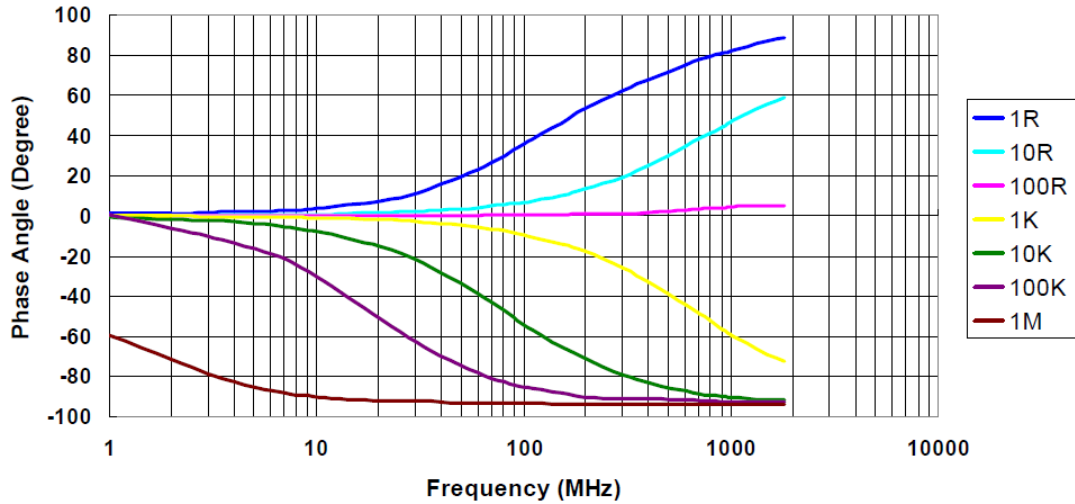
Frequency vs. Phase Angle
MLF14



Frequency vs. Impedance
MLF12



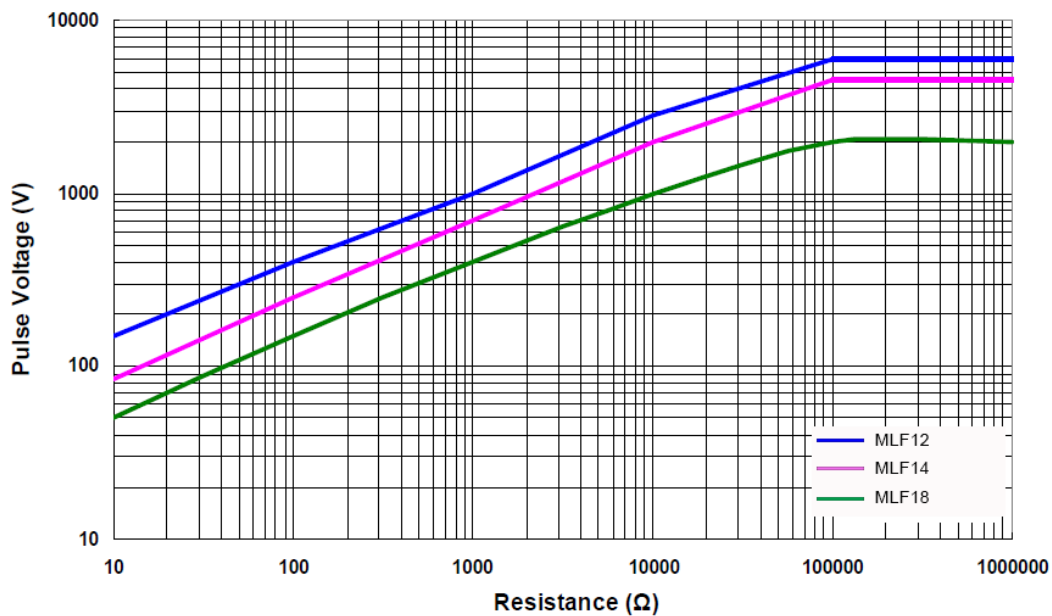
Frequency vs. Phase Angle
MLF12



Lightning Surge

Resistors are tested in accordance with IEC 60 115-1 using both 1.2/50us and 10/700us pulse shapes. The limit of acceptance is a shift in resistance of less than 0.5% from the initial value.

1.2/50µs Lightning Surge



10/700 μ s Lightning Surge

