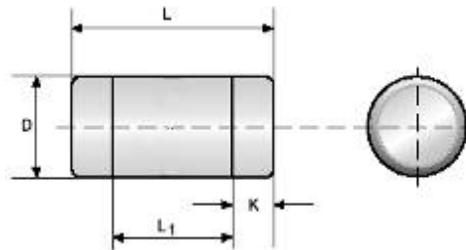


- Features:
- Thin Film Technology for precision and stability
  - Excellent power to size ratio
  - Exhibits good pulse power characteristics
  - RoHS compliant / lead-free



Electrical Specifications									
Type / Code	Package Size	Power Rating (Watts) @ 70°C	Maximum Working Voltage <sup>(1)</sup>	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 ±25 ppm/°C ±50 ppm/°C ±100 ppm/°C	100 - 56K			
						100 - 82K	49.9 - 200K	49.9 - 390K	
						-	1 - 1M		-
						-	0.22 - 2M		-
MLFM15	0102	0.2W	200V	400V	±15 ppm/°C ±25 ppm/°C ±50 ppm/°C ±100 ppm/°C	100 - 56K			
						100 - 82K	49.9 - 200K	49.9 - 390K	
						-	1 - 1M		-
						-	0.5 - 2M		-
MLF14	0204	0.25W	200V	400V	±10 ppm/°C ±15 ppm/°C ±25 ppm/°C ±50 ppm/°C ±100 ppm/°C	10 - 20K			
						10 - 300K			
						10 - 1M		10 - 4.7M	
						10 - 1M	1 - 1M	0.2 - 10M	
MLF12	0207	0.5W	300V	600V	±10 ppm/°C ±15 ppm/°C ±25 ppm/°C ±50 ppm/°C ±100 ppm/°C	10 - 20K			
						10 - 300K			
						10 - 1M		10 - 4.7M	
						10 - 1M	1 - 1M	0.2 - 10M	
MLFM1	0207	1W	350V	700V	±15 ppm/°C ±25 ppm/°C ±50 ppm/°C ±100 ppm/°C	49.9 - 100K			
						10 - 1M			
						10 - 1M	1 - 1M	0.2 - 10M	
						-	0.1 - 10M		-

Note: (1) Lesser of √PR or maximum working voltage

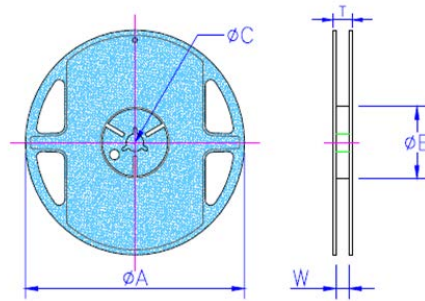


Mechanical Specifications							
Type / Code	Weight (1000 pc) (g)	L		D	L1	K	Unit
		Body Length		Body Diameter	Inner Body	Termination	
MLF18 (0102)	7.2	0.079 ± 0.004		0.051 ± 0.002	0.031	0.020 ± 0.004	inches
		2.00 ± 0.10		1.30 ± 0.05	0.80	0.50 ± 0.10	mm
MLFM15 (0102)	7.2	0.079 ± 0.004		0.051 ± 0.002	0.031	0.020 ± 0.004	inches
		2.00 ± 0.10		1.30 ± 0.05	0.80	0.50 ± 0.10	mm
MLF14 (0204)	18.7	0.138 ± 0.008		0.055 ± 0.006	0.091	0.020 ± 0.004	inches
		3.50 ± 0.20		1.40 ± 0.15	2.30	0.50 ± 0.10	mm
MLF12 (0207)	80.9	0.232 ± 0.008		0.087 ± 0.008	0.185	0.020 ± 0.004	inches
		5.90 ± 0.20		2.20 ± 0.20	4.70	0.50 ± 0.10	mm
MLFM1 (0207)	80.9	0.232 ± 0.008		0.087 ± 0.008	0.185	0.020 ± 0.004	inches
		5.90 ± 0.20		2.20 ± 0.20	4.70	0.50 ± 0.10	mm

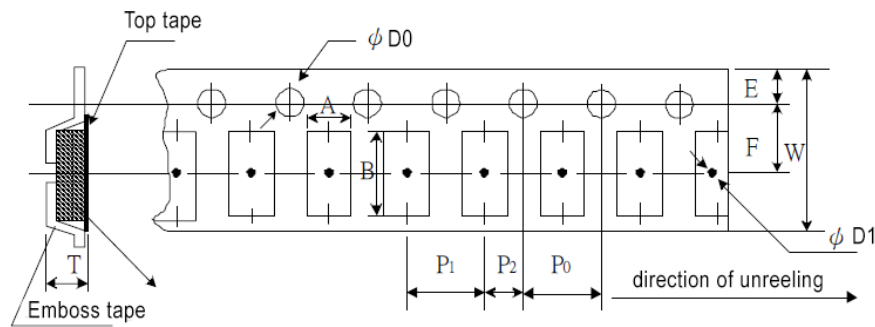
Performance Characteristics		
Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As specified	JIS-C-5201-1 4.8 IEC-60115-1 4.8 -55°C ~ +125°C, 25°C is the reference temperature
Short Time Overload	0204/0207: $\pm (0.15\% + 0.05\Omega)$ 0102: $\pm (0.5\% + 0.05\Omega)$	JIS-C-5201-1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

RCWV (rated continuous working voltage) =  $\sqrt{P \cdot R}$  or max. operating voltage whichever is lower.

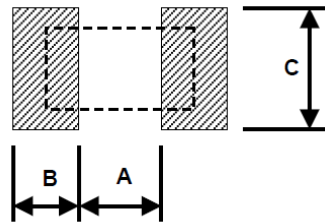
Storage temperature: 25  $\pm$  3°C, humidity < 80% R.H.



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

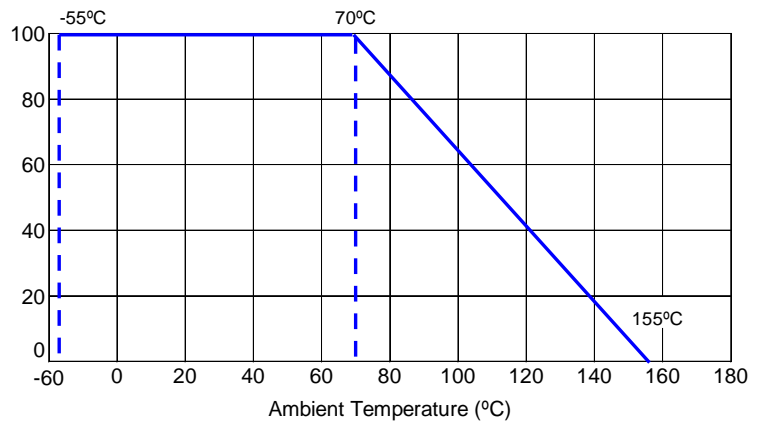


Emboss Plastic Tape Specifications							
Type / Code	A	B	W	E	F	P0	Unit
MLF18	0.059 ± 0.004	0.091 ± 0.004	0.315 ± 0.004	0.069 ± 0.004	0.138 ± 0.002	0.157 ± 0.004	inches
	1.50 ± 0.10	2.30 ± 0.10	8.00 ± 0.10	1.75 ± 0.10	3.50 ± 0.05	4.00 ± 0.10	mm
MLFM15	0.059 ± 0.004	0.091 ± 0.004	0.315 ± 0.004	0.069 ± 0.004	0.138 ± 0.002	0.157 ± 0.004	inches
	1.50 ± 0.10	2.30 ± 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
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.	0.067 ± 0.004	inches	
	4.00 ± 0.10	2.00 ± 0.05	1.50 ± 0.10	0.90 min.	1.70 ± 0.10	mm	
MLFM15	0.157 ± 0.004	0.079 ± 0.002	0.059 ± 0.004	0.035 min.	0.067 ± 0.004	inches	
	4.00 ± 0.10	2.00 ± 0.05	1.50 ± 0.10	0.90 min.	1.70 ± 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	
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
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

**Power Derating Curve:**



**How to Order**

1	2	3	4	5	6	7	8	9	10	11	12
<b>M</b>	<b>L</b>	<b>F</b>	<b>1</b>	<b>2</b>	<b>D</b>	<b>T</b>	<b>E</b>	<b>4</b>	<b>K</b>	<b>7</b>	<b>5</b>

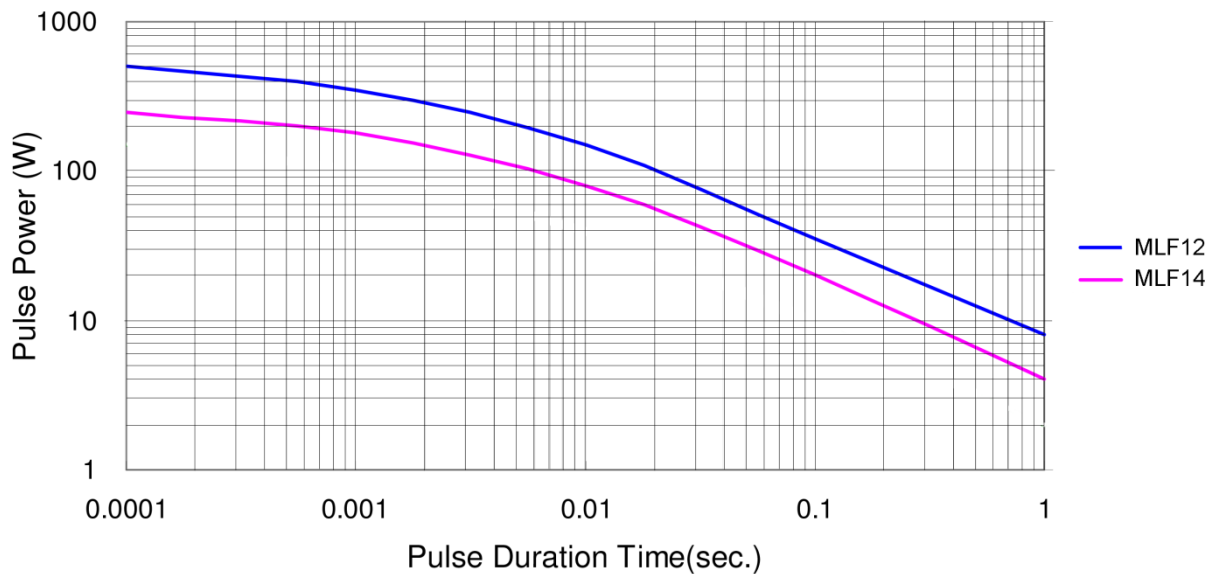
  

Product Series		Size	Power	Tolerance			Packaging			TCR		Resistance Value	
MLF	Standard			Code	Tol	Value	Code	Description	Size	Quantity	Code		ppm
MLFM	Mini	18	0.125W	B	0.1%	E96, E24	T	7" Reel	18, 15, 14	3,000	T	10	Four characters with the multiplier used as the decimal holder.  10 ohm = 10R0 100 ohm = 100R 1 Kohm = 1K00 560 Kohm = 560K zero ohm jumper = 0R00
		14	0.25W	D	0.5%				Plastic Tape	12, 1	2,000	S	
		12	0.5W	F	1%						E	25	
		1	1W	J	5%	E24					C	50	
				Z	jumper						D	100	

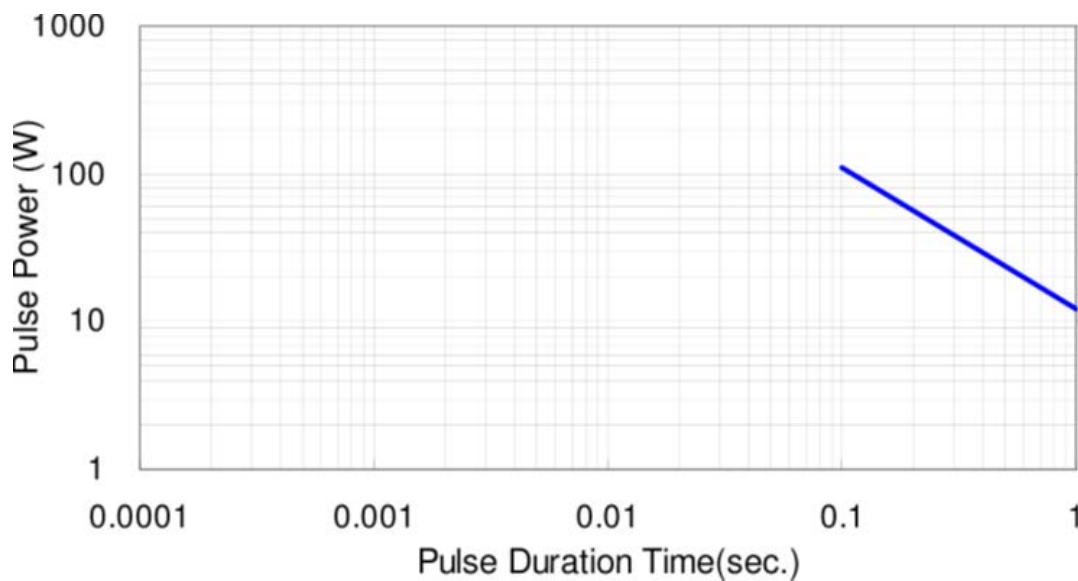
**Pulse withstanding capacity**

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.

**MLF Series Single Pulse (100 Ohm)**



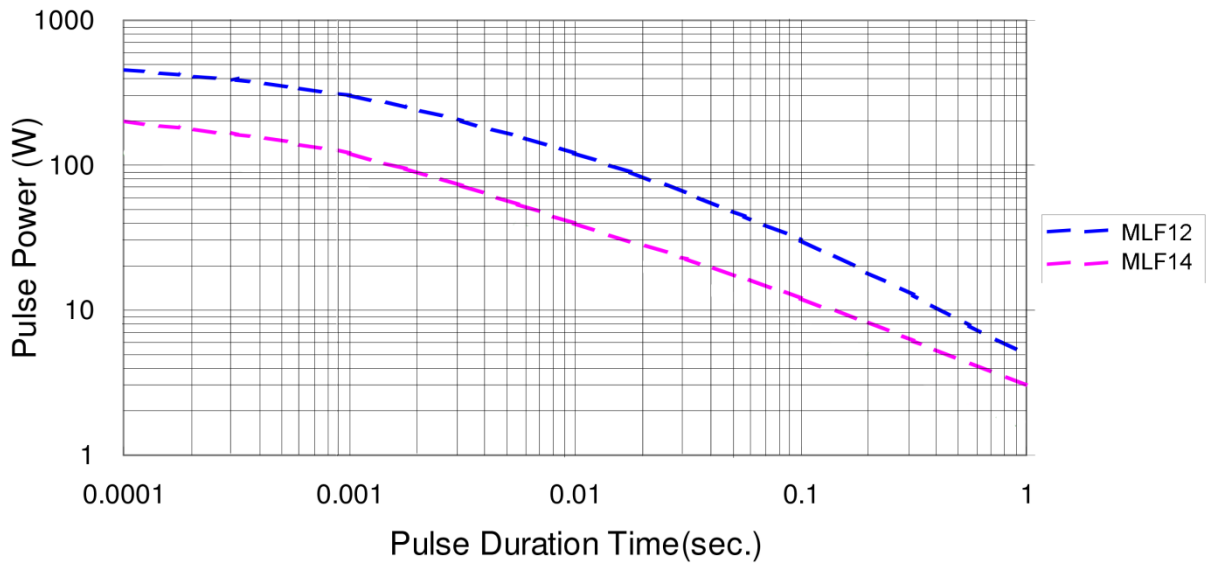
**MLFM1 Single Pulse (1 Kohm)**



### 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.

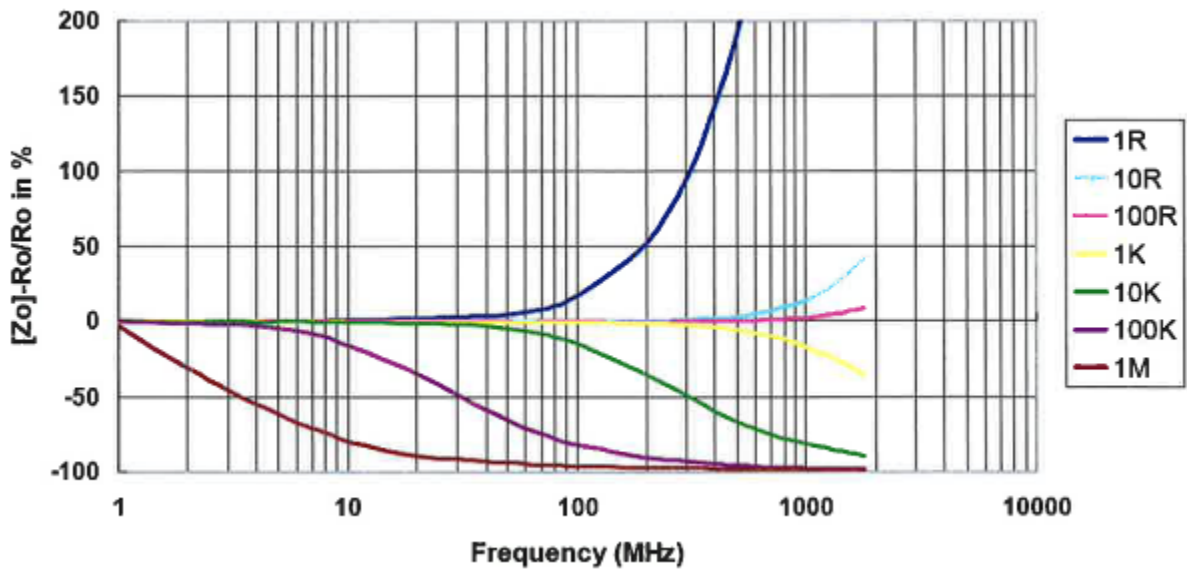
**MLF Series Continuous Pulse (100 Ohm)**



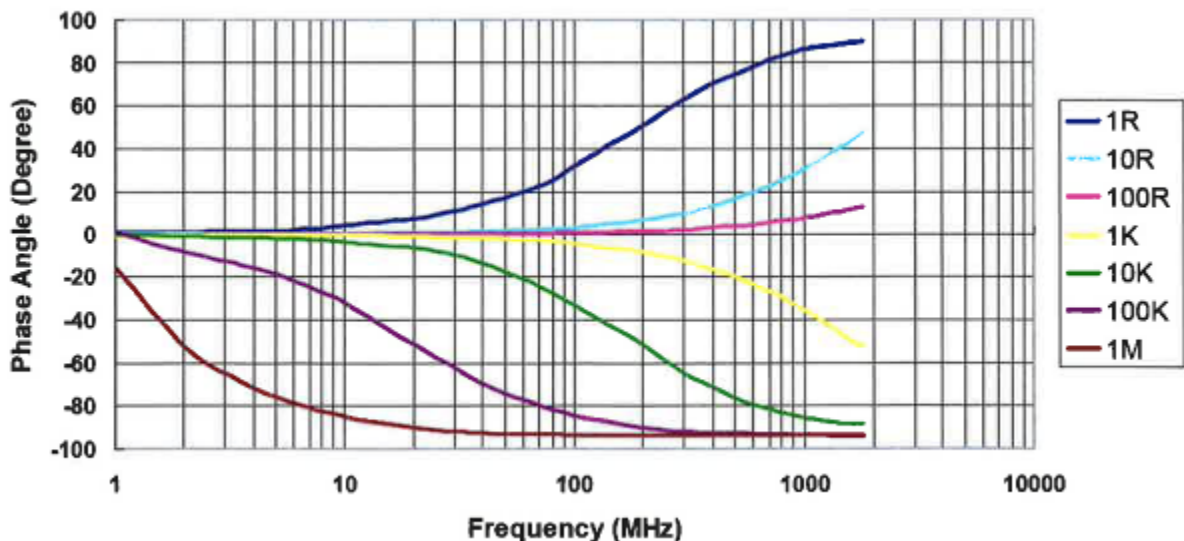
**Frequency behavior**

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.

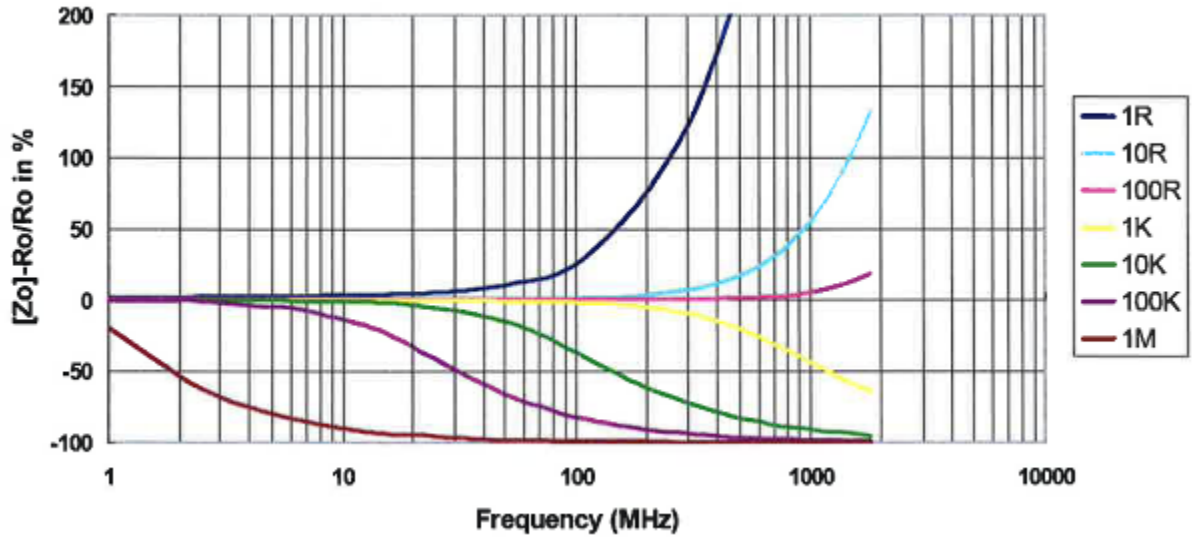
**Frequency versus Impedance  
MLF14**



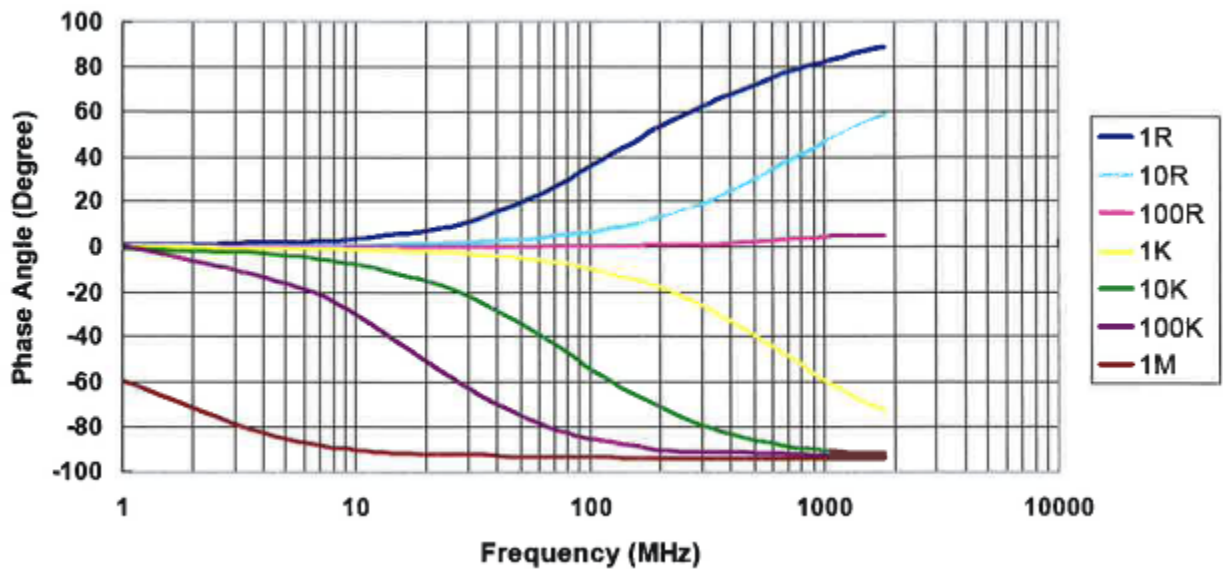
**Frequency versus Phase Angle  
MLF14**



**Frequency versus Impedance  
MLF12**



**Frequency versus Phase Angle  
MLF12**

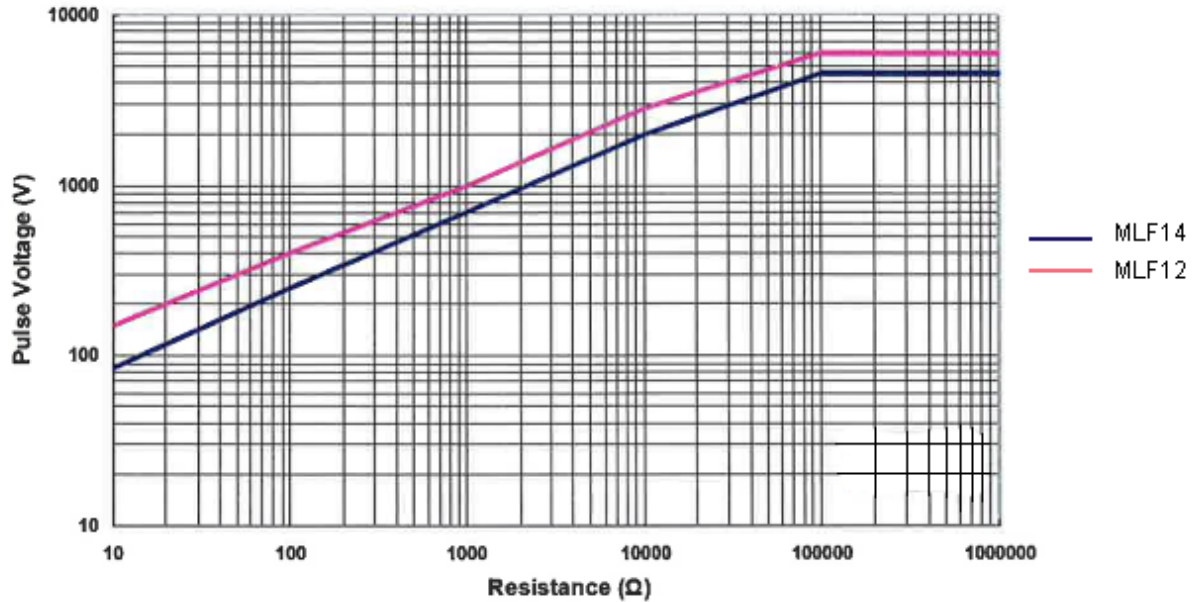




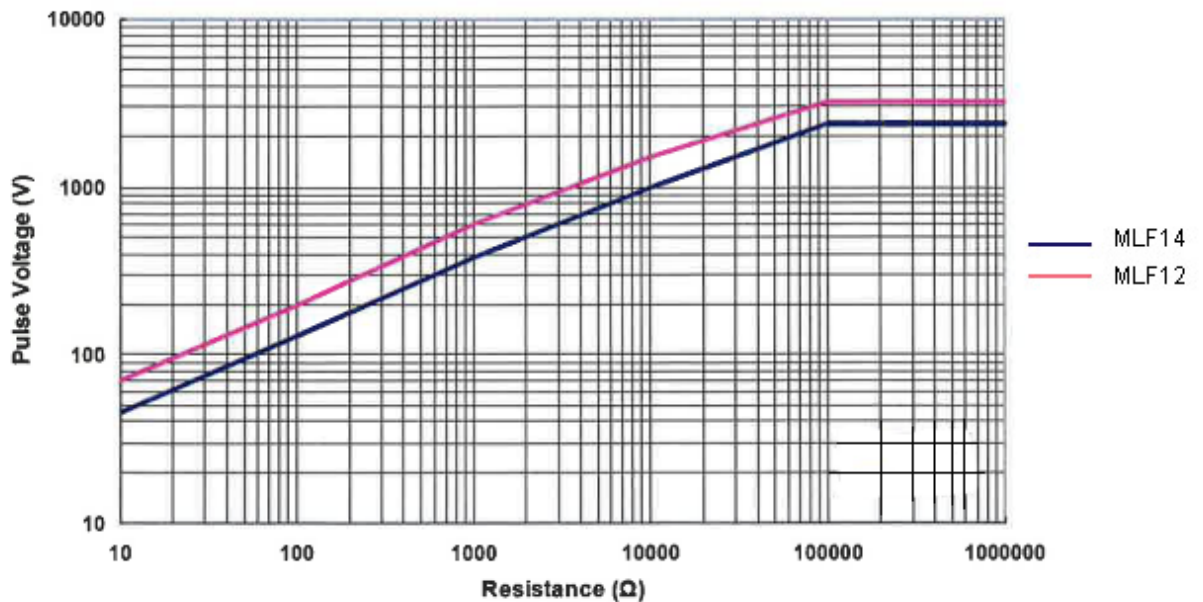
**Lightning Surge**

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**



**10/700µs Lightning Surge**



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