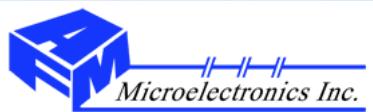


AFM MICROELECTRONICS INC



CERAMIC CAPACITORS:
HIGH Q HIGH RF POWER
HIGH TEMPERATURE
HIGH VOLTAGE



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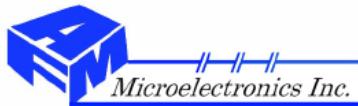
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Company Overview

American Function Materials Inc (AFM Inc) founded at Alhambra, California in 2002, is now located at in San Diego California.

AFM designs, develops, manufactures and markets RF/microwave Multilayer Capacitors, High Power High current Multilayer Capacitors, High Temperature High Voltage Multilayer Capacitors, GBBL(Grain Boundary Barrier Layer), High K substrates for Single Layer Capacitors, Ultra Low Fire Dielectric powder for multilayer capacitors. Capacitors produced range in size from 0505 to 13560, with operating voltages from 25 volts to 50,000 volts. The AFM capacitors find wide use in the wireless communications infrastructure, fiber optic, medical electronics, and semiconductor manufacturing equipment, defense, aerospace, and satellite communications markets.

AFM operates a state of the art multilayer ceramic capacitor (MLCC), manufacturing line including ceramic slip casting, automated tight-tolerance printing-stacking, iso-static pressing, automated termination, automated test and sorting process, and plating process.

AFM has a full complement of test tools:

T.C.C. Test System,

Particle analyzer,

Thin film sputter

High frequency Q and ESR test system.

The AFM engineering team has been working in the ceramic capacitor industry more than 25 years. They have accumulated the comprehensive knowledge of the technology involved in manufacturing electronic ceramics, from formulation and processing to environment conditioning, life testing, product burn-in, acceleration and etc.

AFM capacitors with their competitive price and their short lead times are an exceptional value in today's electronic market place. In addition to the AFM standard capacitor products AFM is also interested in pursuing custom capacitor designs and will work with customers to develop special products in electronic ceramics.

For more information visit our website at www.afmmicroelectronics.com

Multilayer Capacitors

- **RF/UHF/Microwave Capacitors**

- Porcelain Capacitors
- Medium and High Power High Frequency Capacitors
- Non Magnetic Fixed Capacitors for Medical Imaging Equipment
- Multilayer Ceramic Capacitors for RF and Microwave

- **High Temperature Multilayer Ceramic Capacitors (“T” Series)**

- RF/Microwave (200°C) Chip and Leaded Capacitors
- High Temperature (200°C) Multilayer Ceramic Chip Capacitors
- High Temperature(200°C) Leaded Capacitors, X7R & NPO
- High Temperature, High Voltage (500V to 5000V) Leaded Capacitors

- **High Voltage Capacitors**

- High Voltage Surface Mount Chip Capacitors
- High Voltage Leaded Capacitors
- High Temperature, High Voltage Leaded Capacitors

Dielectrics Substrate and Low Fired Powder

Dielectric substrate is Grain Boundary Layer (GBL) material, which equal to AVX's MAXI material has highest dielectric constant in ceramic capacitor industry. Because of the low insert loss of GBL material at high frequency, it has been used in microwave device such as microwave amplifier, microwave module, IC package, blue tooth module and communication module etc.

Dielectric ceramic powder is Ultra Low fired material that can be fired at lower than 920°C. This low fired temperature allows manufacture to use low cost electrode system such as 95Ag/5Pd or 100% Silver to make Multilayer Ceramic Capacitor (MLCC). The ceramic powder includes COG and X7R formulation. The COG formulation has high Q at high frequency and can be used for making MLCC of cellular phone and other high frequency applications.

AFM has the most advanced test, and diagnostic equipment available for test and diagnostic material characterization and component electrical characteristics. The ability of our combined technical staff is unsurpassed.

Features

- Capacitance Range: 0.1pF to 100pF
- High Q Low ESR/ESL
- High Power
- Ultra Stable Performance
- High Self-Resonance
- Operating Voltages
 - DC Voltage: 150V
- Extended WVDC up to 250VDC

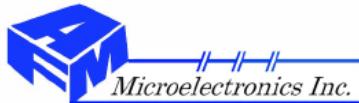


Applications

Typical Functional Applications: Bypass, Coupling, Tuning, Feedback, Impedance Matching and DC Blocking in circuits such as RF amplifiers, filters and timing circuits.

AFM Part Number Code

M	P	R	11	W	101	J	E	C	B	B
Product Series: M: High Frequency	Product Type: R: Chip			Termination Code: C: Pd/Ag Term G: Ag Term, Ni/Au Plated N: Non Magnetic Term (Ag Term, Cu/Sn Plated) P: Solder Dipped W Term in 60/40 Sn/Pb T: Ag Term, Ni/100% Sn Plated (Pb Free) W: Ag Term, Ni Barrier, 90/10 Sn/Pb Plated		Tolerance: B: $\pm 0.1\text{pF}$ C: $\pm 0.25\text{pF}$ D: $\pm 0.5\text{pF}$ F: $\pm 1\%$ G: $\pm 2\%$ J: $\pm 5\%$ K: $\pm 10\%$ M: $\pm 20\%$		Test Code: C: Commercial Test S: Special (Customer Defined) M: Hi-Rel		Packaging: B: Bulk T: Tape & Reel W: Waffle Pack
Dielectrics: P: Porcelain			11: 0505							
				Capacitance Code: 1st two digits are significant: Third digit denotes number of zero(s); R=Decimal point 2R0=2.0pF 101=100pF			Voltage: E: 150 Vdc F: 200 Vdc G: 250 Vdc		Marking: B: Not Marked M: Marked (Cap code and tolerance) S: Special Marking	



MPR 11

RF/Microwave Porcelain Multilayer Capacitors

Chip Dimensions and Termination Options

AFM Series	Term Code	Type	MIL-PRF-55681	Outlines	Body Dimensions Inches (mm)			Lead and Termination Dimensions and Materials	
					Length (L)	Width (W)	Thickness (T)	B	Materials
MPR11	W	Solder Plate	CDR12BG		.055 +.015-.010 (1.40 +.38-.25)	.055±.015 (1.4±.38)	.057 (1.45) max	.015 (.38) ±.010 (.25) max	Solder Plated Over Nickel Barrier Termination 90 Sn/ 10 Pb
	P	Pellet	CDR12BG						W Termination with Sn/Pb Solder Dip
	T	Lead Free Solder Plated	N/A						Lead-Free and RoHS Compliant Tin Plated Over Nickel Barrier Termination
	G	Gold Plated	CDR11BG						Lead-Free and RoHS Compliant Gold Plated Over Nickel Barrier Termination
	C	Pd/Ag	CDR11BG						Palladium/Silver Termination
	N	Non Magnetic Term.(Ag Term., Cu/Sn Plated	N/A						Cu/Sn Plated Over Silver Termination

Standard Capacitance Values

*STD.:Standard Voltage; EXT.: Extended Voltage

CAP CODE	CAP (pF)	TOL	RATED WVdc		CAP CODE	CAP (pF)	TOL	RATED WVdc		CAP CODE	CAP (pF)	TOL	RATED WVdc	
			STD.*	EXT.*				STD.	EXT.				STD.	EXT.
0R1	0.1	B			1R7	1.7		6R2	6.2	B, C, D		270	27	
0R2	0.2				1R8	1.8		6R8	6.8			300	30	
0R3	0.3	B, C			1R9	1.9		7R5	7.5	B, C, J,		330	33	
0R4	0.4				2R0	2.0		8R2	8.2	K, M		360	36	
0R5	0.5				2R1	2.1		9R1	9.1			390	39	
0R6	0.6				2R2	2.2		100	10			430	43	
0R7	0.7				2R4	2.4		110	11			470	47	
0R8	0.8				2R7	2.7		120	12			510	51	F, G, J,
0R9	0.9		150	250	3R0	3.0	B, C, D	130	13	K, M		560	56	K, M
1R0	1.0	B, C, D			3R3	3.3		150	15			620	62	
1R1	1.1				3R6	3.6		160	16			680	68	
1R2	1.2				3R9	3.9		180	18			750	75	
1R3	1.3				4R3	4.3		200	20			820	82	
1R4	1.4				4R7	4.7		220	22			910	91	
1R5	1.5				5R1	5.1		240	24			101	100	
1R6	1.6				5R6	5.6								

AFM Microelectronics Inc

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www.afmmicroelectronics.com

Specification and Performance

Piezoelectric and Aging Effect:	None
Temperature Range:	-55°C to +125°C
Temperature Coefficient of Capacitance(TCC):	+90±20ppm/°C (-55°C to +125°C)
Quality Factor (Q) :	>10,000 at 1MHz
Insulation Resistance (IR, at Rated Voltage):	0.1pF~100pF: 10 ⁶ MΩ min. at +25°C at rated WVDC 10 ⁵ MΩ min. at +125°C at rated WVDC
Dielectric Withstand Voltage (DWV):	250% of rated WVDC for 5 secs
Capacitance Drift:	±0.02% or ±0.02pF, whichever is greater

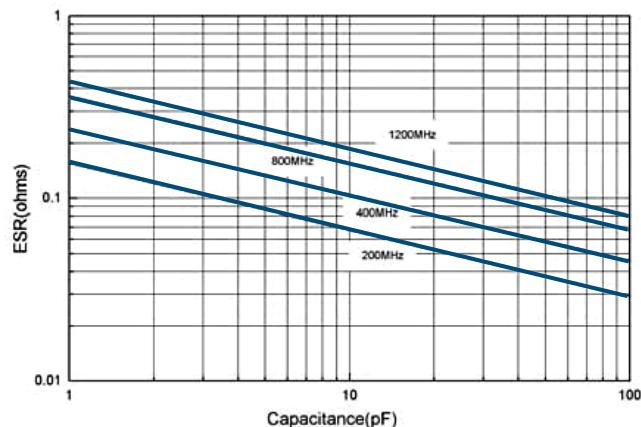
Environmental Tests

MPR11 Series Capacitors are designed and manufactured to meet and exceed the requirements of EIA-198, MIL-PRF-55681 and MIL-PRF-123.

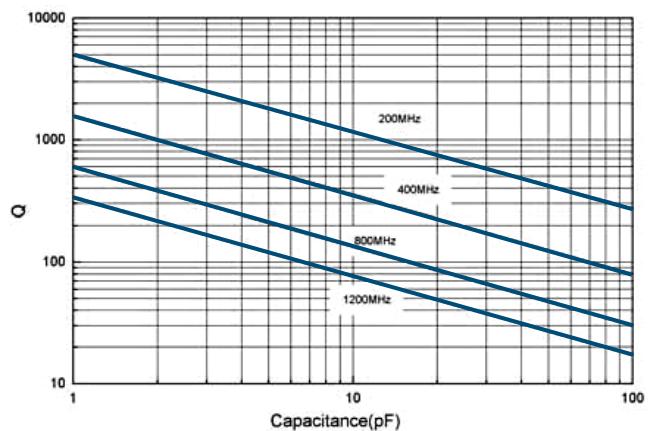
Item	Specifications	Method
Thermal Shock	DWV: the initial value IR: shall be not less than 30% the initial value Capacitance Change: no more than 0.5% or 0.5pF	MIL-STD-202, Method 107, Condition A. At the maximum rated temperature (-55°C and +125°C) stay 30 minutes, the time of removing shall be not more than 3 minutes. Perform the five cycles.
Moisture Resistance		MIL-STD-202, Method 106
Humidity (steady state)	DWV: the initial value IR: the initial value Capacitance Change: no more than 0.3% or 0.3pF	MIL-STD-202, Method 103, Condition A, with 1.5 volts D.C. applied while subjected to an environment of 85°C with 85% relative humidity for 240 hours min.
Life	IR: shall be not less than 30% the initial value Capacitance Change: no more than 0.2%	MIL-STD-202, Method 108, for 2000 hours, at 125°C. 200% Rated Voltage D.C. applied.

Performance Curve

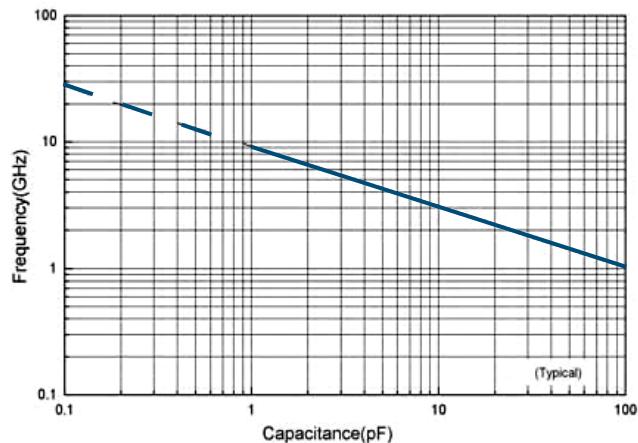
ESR vs. Capacitance



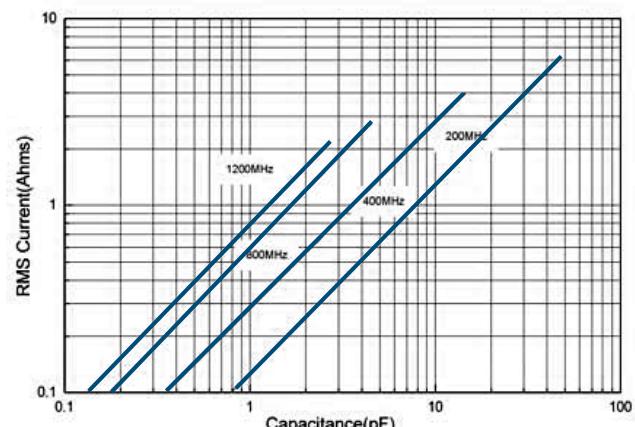
Q vs. Capacitance



Resonance



Current Rating vs. Capacitance



Features

- Capacitance Range: 0.1pF to 1000pF
- High Q Low ESR/ESL
- High Power
- Ultra Stable Performance
- High Self-Resonance
- Operating Voltages
 - DC Voltage: 50V to 500V
- Extended WVDC up to 1500VDC



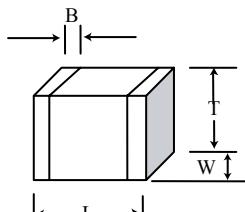
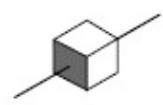
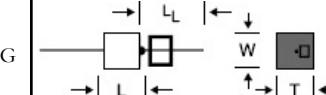
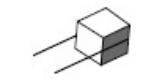
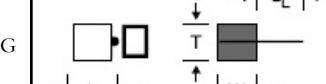
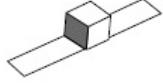
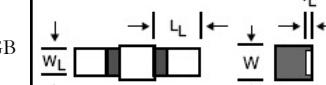
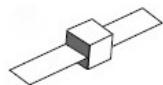
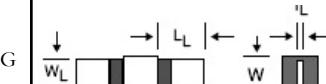
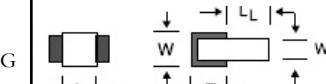
Applications

Typical Functional Applications: Bypass, Coupling, Tuning, Feedback, Impedance Matching and DC Blocking in Circuits Such as RF Amplifiers, Filters and Timing Circuits.

AFM Part Number Code

M	P	R	12	W	101	J	B	C	B	B
Product Series: M: High Frequency		Product Type: R: Chip		Termination Code: A: Axial Wire; AN: Non-Mag Axial Wire B: Axial Ribbon BN: Non-Mag Axial Ribbon C: Pd/Ag Term G: Ag Term, Ni/Au Plated M: Microstrip MN: Non-Mag Microstrip N: Non Magnetic Term (Ag Term., Cu/Sn Plated) P: Solder Dipped W Term in 60/40 Sn/Pb Q: Radial Wire QN: Non-Mag Radial Wire T: Ag Term, Ni/100% Sn Plated (Pb Free) W: Ag Term, Ni Barrier, 90/10 Sn/Pb Plated		Tolerance: B: $\pm 0.1\text{pF}$ C: $\pm 0.25\text{pF}$ D: $\pm 0.5\text{pF}$ F: $\pm 1\%$ G: $\pm 2\%$ J: $\pm 5\%$ K: $\pm 10\%$ M: $\pm 20\%$		Test Code: C: Commercial Test S: Special (Customer Defined) M: Hi-Rel		Packaging: B: Bulk T: Tape & Reel W: Waffle Pack
Dielectrics: P: Porcelain		Chip Size: 12: 1111				Capacitance Code: 1st two digits are significant: Third digit denotes number of zero(s); R=Decimal point 2R0=2.0pF 101=100pF		Voltage: B: 50 Vdc D: 100 Vdc F: 200 Vdc H: 300 Vdc J: 500 Vdc L: 1000Vdc N:1500Vdc P: 2500Vdc		Marking: B: Not Marked M: Marked (Cap code and tolerance) S: Special Marking

Chip Dimensions and Termination Options

Term Code	Type	MIL-PRF-55681	Outlines	Body Dimensions Inches (mm)			Lead and Termination Dimensions and Materials		
				Length (L)	Width (W)	Thickness (T)	B	Materials	
W	Solder Plate	CDR14BG		.110 .020-.010 (2.79 +.51-.25)	.110±.015 (2.79±.038)	.102 (2.59) max	.015 (.38) ±.010 (.25) max	Solder Plated Over Nickel Barrier Termination 90 Sn/10 Pb	
P	Pellet	CDR14BG		.110 .035-.010 (2.79 +.89-.25)	.110±.015 (2.79±.038)			W Termination with Sn/Pb Solder Dip	
T	Lead Free Solder Plated	N/A		Lead-Free and RoHS Compliant Tin Plated Over Nickel Barrier Termination					
G	Gold Plated	CDR13BG		.110 .020-.010 (2.79 +.51-.25)	Lead-Free and RoHS Compliant Gold Plated Over Nickel Barrier Termination				
C	Pd/Ag	CDR13BG		Palladium/Silver Termination					
N	Non Magnetic Term.(Ag Term, Cu/Sn Plated)	N/A		Cu/Sn Plated Over Silver Termination					
							Length (L ₁)	Width (W ₁)	Thickness (T ₁)
A/AN		CDR25BG		.145±.020 (3.68±.51)	.102 (2.59) max.	.500 (12.7) min.	#26 AWG, .016(.406) dia. nominal		
Q/QN		CDR23BG							
M/MN		CDR21GB			.110±.015 (2.79±.038)	.120 (3.05) max.	.093 ±.0 05 inches (2.36 ±.0 13 mm)	.004 ±.0 01 inches (0.102 ±.0 025 mm)	
B/BN		CDR22BG							
R		CDR24BG							

Standard Capacitance Values

CAP CODE	CAP (pF)	TOL	RATED WVdc		CAP CODE	CAP (pF)	TOL	RATED WVdc		CAP CODE	CAP (pF)	TOL	RATED WVdc					
			STD.*	EXT.*				STD.	EXT.				STD.	EXT.				
0R1	0.1	B	500	1500	2R4	2.4	B, C, D	500	1500	200	20	F, G, J, K, M	151	150				
0R2	0.2				2R7	2.7				220	22		161	160				
0R3	0.3				3R0	3.0				240	24		181	180				
0R4	0.4				3R3	3.3				270	27		201	200				
0R5	0.5				3R6	3.6				300	30		221	220				
0R6	0.6				3R9	3.9				330	33		241	240				
0R7	0.7				4R3	4.3				360	36		271	270				
0R8	0.8				4R7	4.7				390	39		301	300				
0R9	0.9				5R1	5.1				430	43		331	330				
1R0	1.0				5R6	5.6				470	47		361	360				
1R1	1.1	B, C, D			6R2	6.2				510	51		391	390				
1R2	1.2				6R8	6.8	B, C, J, K, M	500	1500	560	56		431	430				
1R3	1.3				7R5	7.5				620	62		471	470				
1R4	1.4				8R2	8.2				680	68		511	510				
1R5	1.5				9R1	9.1				750	75		561	560				
1R6	1.6				100	10				820	82		621	620				
1R7	1.7				110	11				910	91		681	680				
1R8	1.8				120	12	F, G, J, K, M			101	100		751	750				
1R9	1.9				130	13				111	110		821	820				
2R0	2.0				150	15				121	120		911	910				
2R1	2.1				160	16				131	130		102	1000				
2R2	2.2				180	18												

*STD.:Standard Voltage; EXT.: Extended Voltage

Specification and Performance

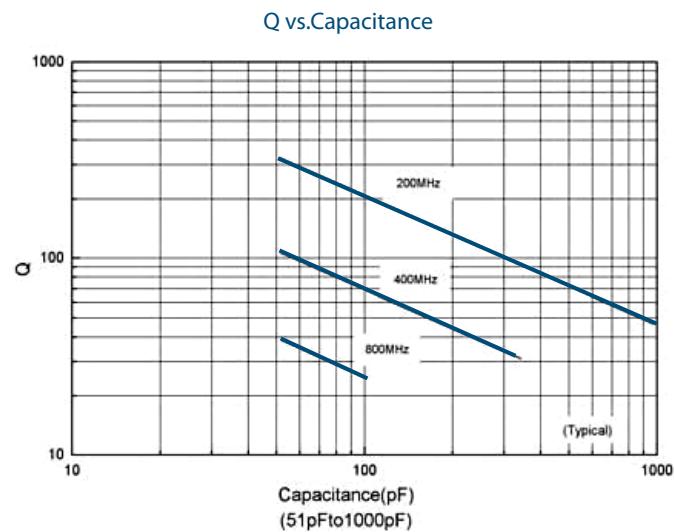
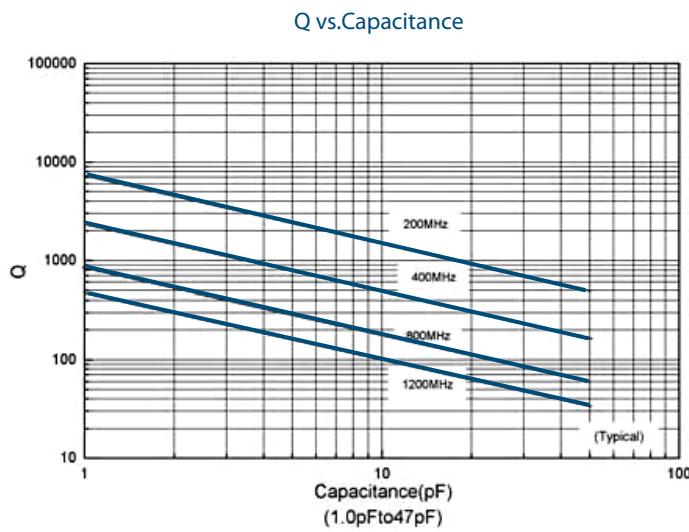
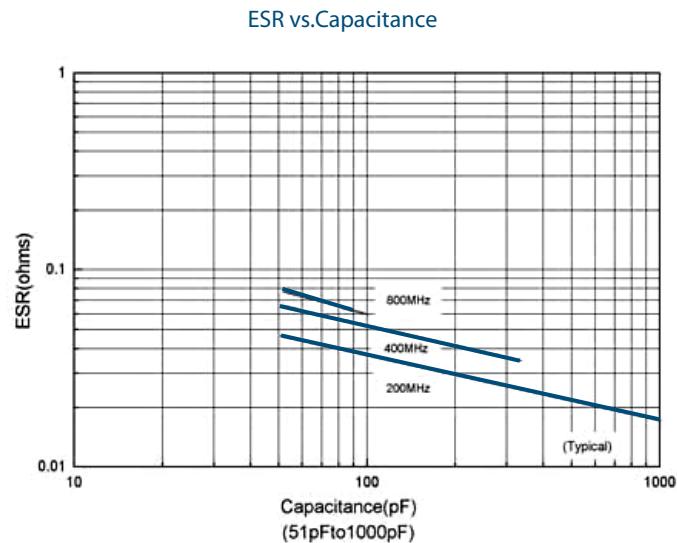
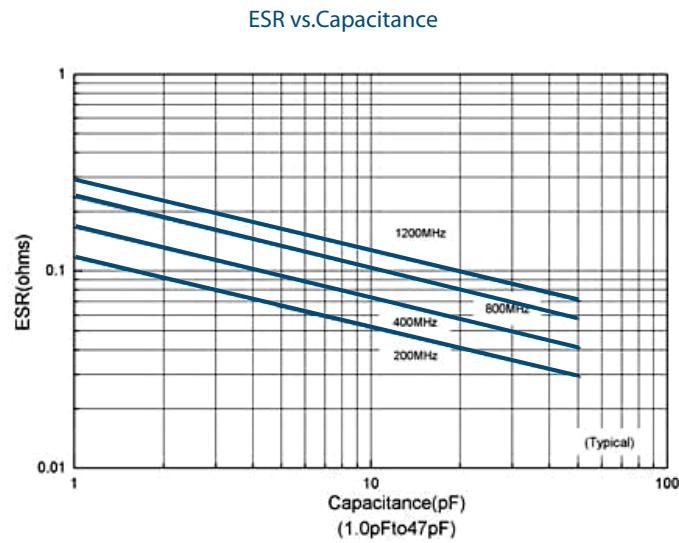
Piezoelectric and Aging Effect:	None
Temperature Range:	0.1pF~330pF: -55°C to +175°C 360pF~1000pF: -55°C to +125°C
Temperature Coefficient of Capacitance(TCC):	+90±20ppm/°C (-55°C to +125°C) +90±30ppm/°C (125°C to +175°C)
Quality Factor (Q) :	>10,000 at 1MHz
Insulation Resistance (IR, at Rated Voltage):	0.1pF~470pF: 10 ⁶ MΩ min. at +25°C at rated WVDC 10 ⁵ MΩ min. at +125°C at rated WVDC 510pF~1000pF: 10 ⁵ MΩ min. at +25°C at rated WVDC 10 ⁴ MΩ min. at +125°C at rated WVDC
Dielectric Withstand Voltage (DWV):	250% of rated WVDC for 5 secs
Capacitance Drift:	±0.02% or ±0.02pF, whichever is greater

Environmental Tests

MPR12 Series Capacitors are designed and manufactured to meet and exceed the requirements of EIA-198, MIL-PRF-55681 and MIL-PRF-123.

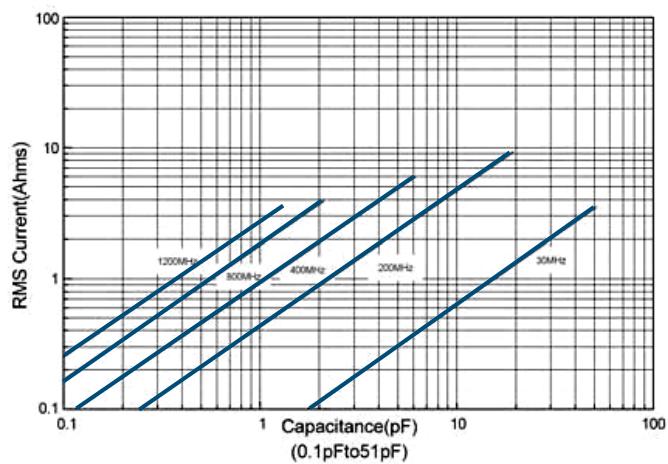
Item	Specifications	Method
Thermal Shock	DWV: the initial value IR: shall be not less than 30% the initial value Capacitance Change: no more than 0.5% or 0.5pF	MIL-STD-202, Method 107, Condition A. At the maximum rated temperature (-55°C and +125°C) stay 30 minutes, the time of removing shall be not more than 3 minutes. Perform the five cycles.
Moisture Resistance		MIL-STD-202, Method 106
Humidity (steady state)	DWV: the initial value IR: the initial value Capacitance Change: no more than 0.3% or 0.3pF	MIL-STD-202, Method 103, Condition A, with 1.5 volts D.C. applied while subjected to an environment of 85°C with 85% relative humidity for 240 hours min.
Life	IR: shall be not less than 30% the initial value Capacitance Change: no more than 0.2%	MIL-STD-202, Method 108, for 2000 hours, at 125°C. Rated voltage≤500V: 200% Rated Voltage D.C. applied. 500V≤Rated Voltage≤1250V: 120% Rated Voltage D.C. applied. Rated voltage >1250V: 100% Rated Voltage D.C. applied.

Performance Curve

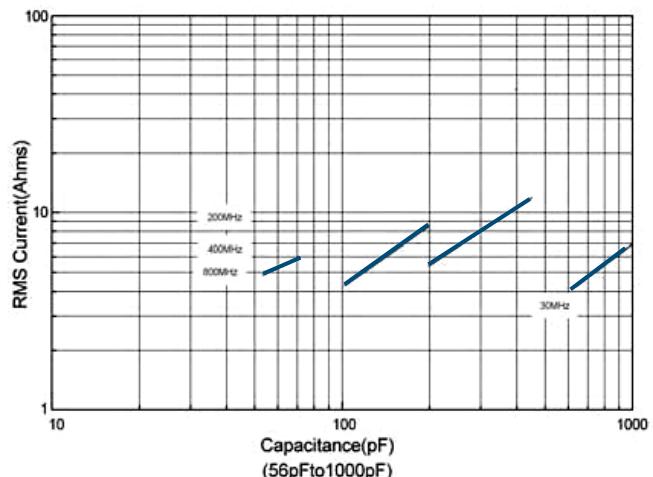


Performance Curve

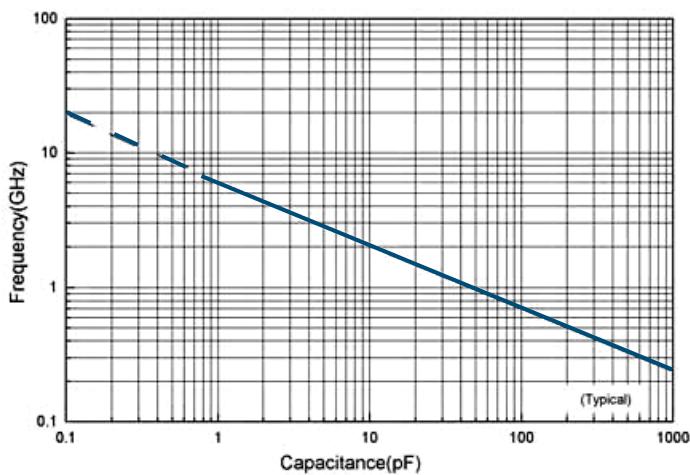
Current Rating vs. Capacitance



Current Rating vs. Capacitance



Resonance vs. Capacitance



Features

- Capacitance Range: 0.1pF to 1000pF
- High Q Low ESR/ESL
- High Power
- Ultra Stable Performance
- High Self-Resonance
- Operating Voltages
 - DC Voltage: 50V and 150V
- Extended WVDC up to 250VDC



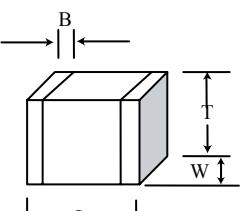
Applications

Typical Functional Applications: Bypass, Coupling, Tuning, Feedback, Impedance Matching and DC Blocking. Devices such as RF oscillators and precision timing circuits requiring a predictable temperature coefficient are examples of devices utilizing these capacitors.

AFM Part Number Code

M	N	R	11	W	101	J	B	C	B	B
Product Series: M: High Frequency		Product Type: R: Chip		Termination Code: C: Pd/Ag Term G: Ag Term, Ni/Au Plated N: Non Magnetic Term (AgTerm, Cu/Sn Plated) P: Solder Dipped W Term in 60/40 Sn/Pb T: Ag Term, Ni/100% Sn Plated (Pb Free) W: Ag Term, Ni Barrier, 90/10 Sn/Pb Plated		Tolerance: B: $\pm 0.1\text{pF}$ C: $\pm 0.25\text{pF}$ D: $\pm 0.5\text{pF}$ F: $\pm 1\%$ G: $\pm 2\%$ J: $\pm 5\%$ K: $\pm 10\%$ M: $\pm 20\%$		Test Code: C: Commercial Test S: Special (Customer Defined) M: Hi-Rel		Packaging: B: Bulk T: Tape & Reel W: Waffle Pack
Dielectrics: N: NPO		Chip Size: 11: 0505			Capacitance Code: 1st two digits are significant: Third digit denotes number of zero(s); R=Decimal point 2R0=2.0pF 101=100pF		Voltage: B: 50 Vdc E: 150 Vdc F: 200 Vdc G: 250Vdc		Marking: B: Not Marked M: Marked (Cap code and tolerance) S: Special Marking	

Chip Dimensions and Termination Options

AFM Series	Term Code	Type	MIL-PRF-55681	Outlines	Body Dimensions Inches (mm)			Lead and Termination Dimensions and Materials	
					Length (L)	Width (W)	Thickness (T)	B	Materials
MPR11	W	Solder Plate	CDR12BP		.055 +.015-.010 (1.40 +0.38-0.25)	.055±.015 (1.4±0.38)	.057 (1.45) max	.010 (.38) ±.010 (.25) max	Solder Plated Over Nickel Barrier Termination 90 Sn/10 Pb
	P	Pellet	CDR12BP						W Termination with Sn/Pb Solder Dip
	T	Lead Free Solder Plated	N/A						Lead-Free and RoHS Compliant Tin Plated Over Nickel Barrier Termination
	G	Gold Plated	CDR11BP						Lead-Free and RoHS Compliant Gold Plated Over Nickel Barrier Termination
	C	Pd/Ag	CDR11BP						Palladium/Silver Termination
	N	Non Magnetic Term.(Ag Term, Cu/Sn Plated)	N/A						Cu/Sn Plated Over Silver Termination

Standard Capacitance Values

*STD.:Standard Voltage; EXT.: Extended Voltage

CAP CODE	CAP (pF)	TOL	RATED WVdc		CAP-CODE	CAP (pF)	TOL	RATED WVdc		CAP CODE	CAP (pF)	TOL	RATED WVdc	
			STD.*	EXT.*				STD.	EXT.				STD.	EXT.
0R1	0.1	B			2R4	2.4		200	20				151	150
0R2	0.2				2R7	2.7		220	22				161	160
0R3	0.3				3R0	3.0		240	24				181	180
0R4	0.4	B, C			3R3	3.3		270	27				201	200
0R5	0.5				3R6	3.6		300	30				221	220
0R6	0.6				3R9	3.9		330	33				241	240
0R7	0.7				4R3	4.3	B, C, D	360	36				271	270
0R8	0.8				4R7	4.7		390	39				301	300
0R9	0.9				5R1	5.1		430	43				331	330
1R0	1.0				5R6	5.6		470	47				361	360
1R1	1.1		150	250	6R2	6.2		510	51	F, G, J, K, M	150		391	390
1R2	1.2				6R8	6.8		560	56				431	430
1R3	1.3	B, C, D			7R5	7.5		620	62				471	470
1R4	1.4				8R2	8.2	B, C, J, K, M	680	68				511	510
1R5	1.5				9R1	9.1		750	75				561	560
1R6	1.6				100	10		820	82				621	620
1R7	1.7				110	11		910	91				681	680
1R8	1.8				120	12		101	100				751	750
1R9	1.9				130	13	F, G, J, K, M	111	110				821	820
2R0	2.0				150	15		121	120				911	910
2R1	2.1				160	16		131	130				102	1000
2R2	2.2				180	18								50

Specification and Performance

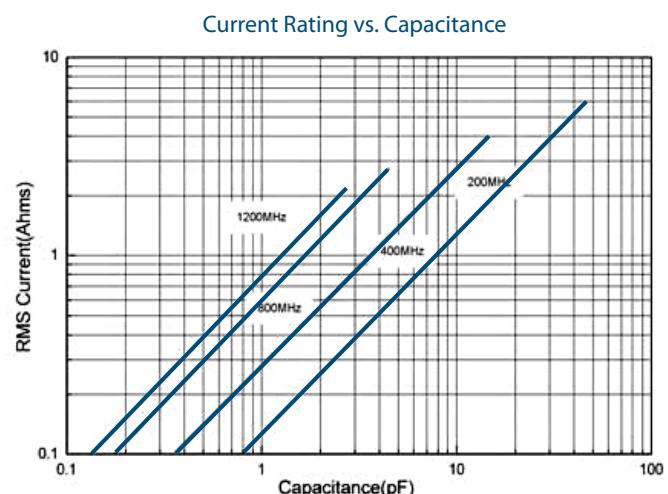
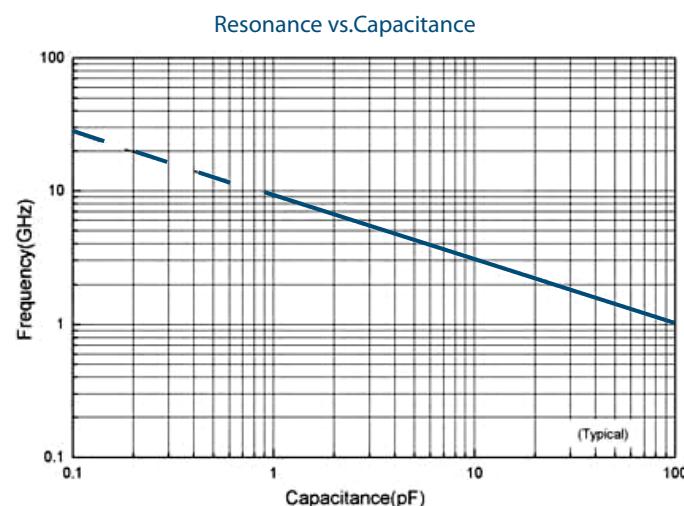
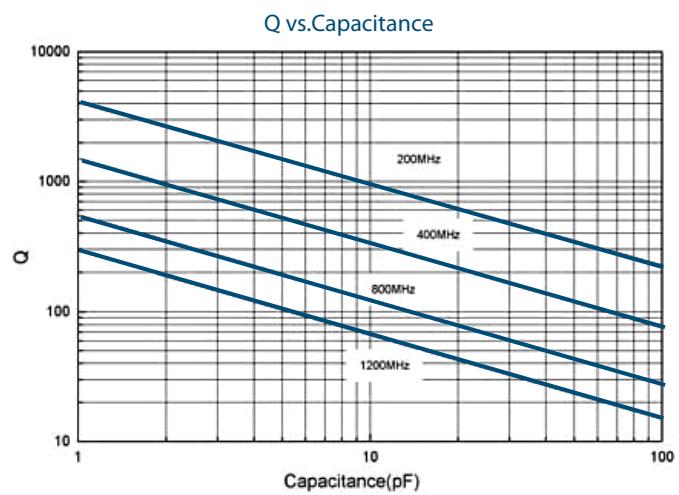
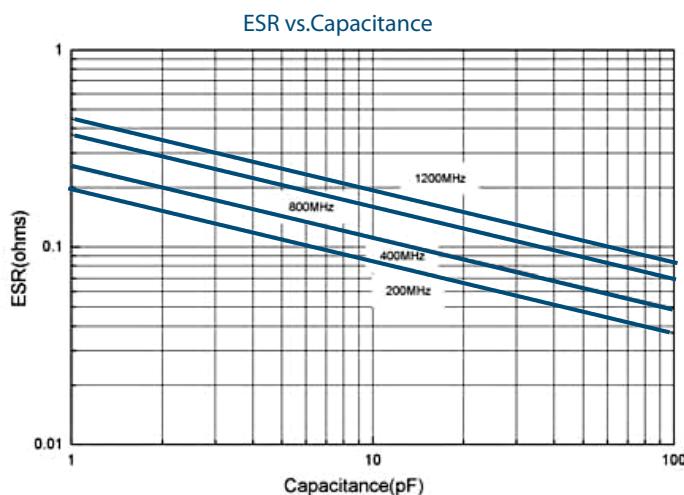
Piezoelectric and Aging Effect:	None
Temperature Range:	-55°C to +125°C
Temperature Coefficient of Capacitance:	0±30ppm/°C
Quality Factor (Q) :	>10,000 (0.1pF~100pF) at 1MHz >2000 (110pF~1000pF) at 1MHz
Insulation Resistance (IR, at Rated Voltage):	0.1pF~470pF: 10 ⁶ MΩ min. at +25°C at rated WVDC 10 ⁵ MΩ min. at +125°C at rated WVDC 510pF~1000pF: 10 ⁵ MΩ min. at +25°C at rated WVDC 10 ⁴ MΩ min. at +125°C at rated WVDC
Dielectric Withstand Voltage (DWV):	250% of rated WVDC for 5 secs
Capacitance Drift:	±0.02% or ±0.02pF, whichever is greater

Environmental Tests

MNR11 Series Capacitors are designed and manufactured to meet and exceed the requirements of EIA-198, MIL-PRF-55681 and MIL-PRF-123.

Item	Specifications	Method
Thermal Shock	DWV: the initial value IR: shall be not less than 30% the initial value Capacitance Change: no more than 0.5% or 0.5pF	MIL-STD-202, Method 107, Condition A. At the maximum rated temperature (-55°C and +125°C) stay 30 minutes, the time of removing shall be not more than 3 minutes. Perform the five cycles.
Moisture Resistance		MIL-STD-202, Method 106
Humidity (steady state)	DWV: the initial value IR: the initial value Capacitance Change: no more than 0.3% or 0.3pF	MIL-STD-202, Method 103, Condition A, with 1.5 volts D.C. applied while subjected to an environment of 85°C with 85% relative humidity for 240 hours min.
Life	IR: shall be not less than 30% the initial value Capacitance Change: no more than 0.2%	MIL-STD-202, Method 108, for 2000 hours, at 125°C. 200% Rated Voltage D.C. applied.

Performance Curve



Features

- Capacitance Range: 0.1pF to 5100pF
- High Q Low ESR/ESL
- High Power
- Ultra Stable Performance
- High Self-Resonance
- Operating Voltages
 - DC Voltage: 50V to 500V
- Extended WVDC up to 1500 Vdc
- Available with Encapsulation Option



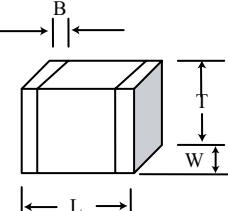
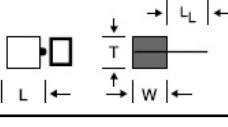
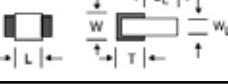
Applications

Typical Functional Applications: Bypass, Coupling, Tuning, Feedback, Impedance Matching and DC Blocking. Devices such as RF oscillators and precision timing circuits requiring a predictable temperature coefficient are examples of devices utilizing these capacitors.

AFM Part Number Code

M	N	R	12	W	101	J	B	C	B	B
Product Series: M: High Frequency	Product Type: R: Chip			Termination Code: A: Axial Wire; AN: Non-Mag Axial Wire B: Axial Ribbon BN: Non-Mag Axial Ribbon C: Pd/Ag Term G: Ag Term, Ni/Au Plated M: Microstrip MN: Non-Mag Microstrip N: Non Magnetic Term (Ag Term., Cu/Sn Plated) P: Solder Dipped W Term in 60/40 Sn/Pb Q: Radial Wire QN: Non-Mag Radial Wire T: Ag Term, Ni/100% Sn Plated (Pb Free) W: Ag Term, Ni Barrier, 90/10 Sn/Pb Plated		Tolerance: B: $\pm 0.1\text{pF}$ C: $\pm 0.25\text{pF}$ D: $\pm 0.5\text{pF}$ F: $\pm 1\%$ G: $\pm 2\%$ J: $\pm 5\%$ K: $\pm 10\%$ M: $\pm 20\%$		Test Code: C: Commercial Test S: Special (Customer Defined) M: Hi-Rel		Packaging: B: Bulk T: Tape & Reel W: Waffle Pack
Dielectrics: N: NPO							Voltage: B: 50 Vdc D: 100 Vdc F: 200 Vdc H: 300 Vdc J: 500 Vdc L: 1000 Vdc N: 1500 Vdc		Marking: B: Not Marked M: Marked (Cap code and tolerance) S: Special Marking	
			Chip Size: 12: 1111		Capacitance Code: 1st two digits are significant: Third digit denotes number of zero(s); R=Decimal point 2R0=2.0pF 101=100pF					

Chip Dimensions and Termination Options

AFM Series	Term Code	Type	MIL-PRF-55681	Outlines	Body Dimensions Inches (mm)			Lead and Termination Dimensions and Materials								
					Length(L)	Width(W)	Thickness(T)	B	Materials							
MNR12	W	Solder Plate	CDR14BP		.110 $+.020-.010$ (2.79 $+.51-.25$)	$.110 \pm .015$ (2.79 ± 0.38)	$.102 (2.59)$ max	$.015 (0.38)$ $\pm .010 (0.25)$ max	Solder Plated Over Nickel Barrier Termination 90 Sn/10 Pb							
	P	Pellet	CDR14BP						W Termination with Sn/Pb Solder Dip							
	T	Lead Free Solder Plated	N/A						Lead-Free and RoHS Compliant Tin Plated Over Nickel Barrier Termination							
	Q/ QN	 Radial Wire/ Non-Magnetic	CDR23BP						Length(L ₁)	Width(W ₁)	Thickness(T ₁)					
									.500 (12.7) min.	#26 AWG., .016 (0.406) dia. nominal						
	R	 Radial Ribbon	CDR24BP						.135 ± .015 (3.43 ± 0.38)	.025 (6.35) min.	.093 ± .005 (2.36 ± 0.13)	.004 ± .001 (0.102 ± 0.25)				

Standard Capacitance Values

*STD.:Standard Voltage; EXT.: Extended Voltage

CAP CODE	CAP (pF)	TOL	RATED WVdc		CAP CODE	CAP (pF)	TOL	RATED WVdc		CAP CODE	CAP (pF)	TOL	RATED WVdc	
			STD.*	EXT.*				STD.	EXT.				STD.	EXT.
0R1	0.1	B	3R3	3.3				360	36				391	390
0R2	0.2		3R6	3.6				390	39				431	430
0R3	0.3	B, C	3R9	3.9	B, C, D	4.3	500	430	43	1500	471	470	511	510
0R4	0.4		4R3	4.3				470	47				561	560
0R5	0.5	1500	4R7	4.7		B, C, J, K, M	1500	510	51	500	621	620	681	680
0R6	0.6		5R1	5.1				560	56				751	750
0R7	0.7		5R6	5.6				620	62				821	820
0R8	0.8		6R2	6.2				680	68				911	910
0R9	0.9		6R8	6.8				750	75				102	1000
1R0	1.0		7R5	7.5				820	82				112	1100
1R1	1.1		8R2	8.2				910	91				122	1200
1R2	1.2		9R1	9.1				101	100				152	1500
1R3	1.3	B, C, D	100	10	F, G, J, K, M	500	1500	111	110	F, G, J, K, M	300	N/A	182	1800
1R4	1.4		110	11				121	120				222	2200
1R5	1.5		120	12				131	130				272	2700
1R6	1.6		130	13				151	150				302	3000
1R7	1.7		150	15				161	160				332	3300
1R8	1.8		160	16				181	180				392	3900
1R9	1.9		180	18				201	200				472	4700
2R0	2.0		200	20				221	220				512	5100
2R1	2.1		220	22				241	240					
2R2	2.2		240	24				271	270					
2R4	2.4		270	27				301	300					
2R7	2.7		300	30				331	330					
3R0	3.0		330	33				361	360					

Specification and Performance

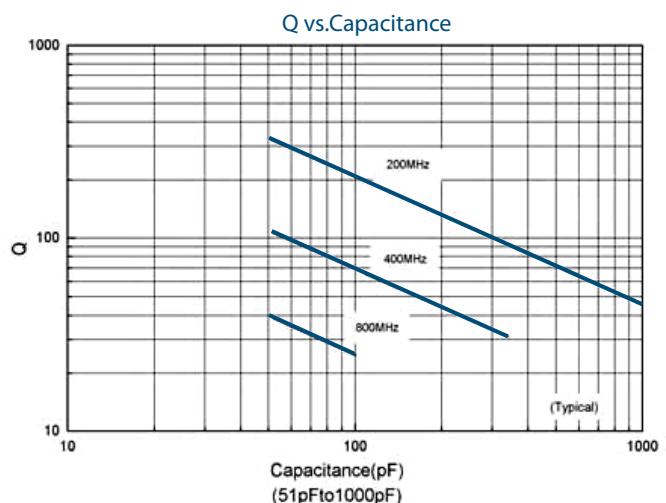
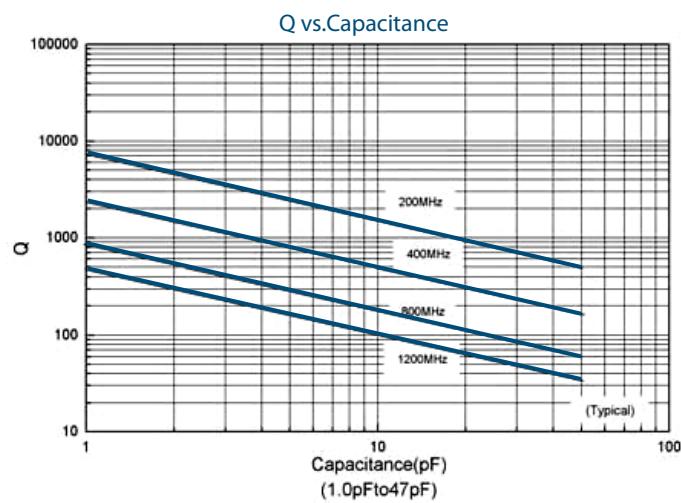
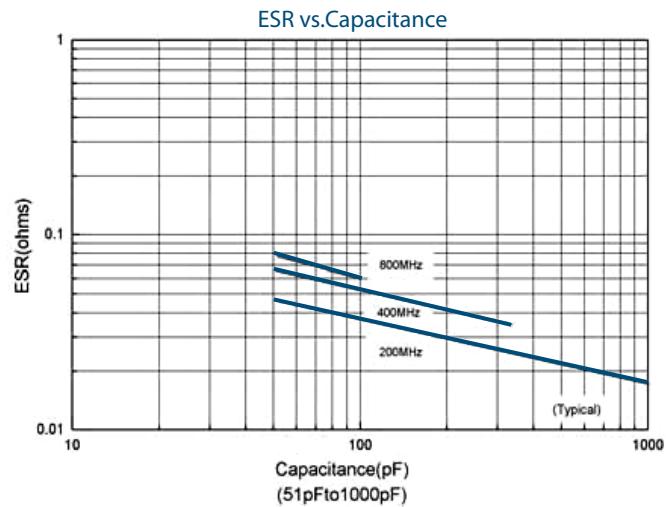
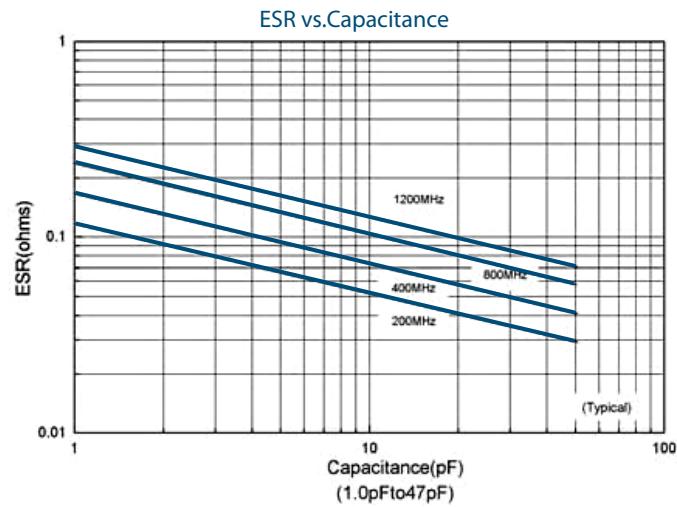
Piezoelectric and Aging Effect:	None
Temperature Range:	-55°C to +125°C
Temperature Coefficient of Capacitance:	0±30ppm/°C
Quality Factor (Q) :	>10,000 (1pF~200pF) at 1MHz >2000 (220pF~1000pF) at 1MHz >2000 (1100pF~5100pF) at 1KHz
Insulation Resistance (IR, at Rated Voltage):	0.1pF~470pF: 10 ⁶ MΩ min. at +25°C at rated WVDC 10 ⁵ MΩ min. at +125°C at rated WVDC 510pF~5100pF: 10 ⁵ MΩ min. at +25°C at rated WVDC 10 ⁴ MΩ min. at +125°C at rated WVDC
Dielectric Withstand Voltage (DWV):	250% of rated WVDC for 5 secs
Capacitance Drift:	±0.02% or ±0.02pF, whichever is greater

Environmental Tests

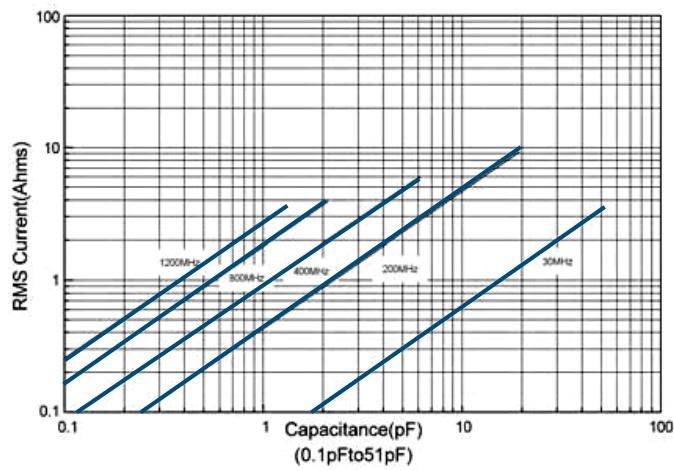
MNR12 Series Capacitors are designed and manufactured to meet and exceed the requirements of EIA-198, MIL-PRF-55681 and MIL-PRF-123.

Item	Specifications	Method
Thermal Shock	DWV: the initial value IR: shall be not less than 30% the initial value Capacitance Change: no more than 0.5% or 0.5pF	MIL-STD-202, Method 107, Condition A. At the maximum rated temperature (-55°C and +125°C) stay 30 minutes, the time of removing shall be not more than 3 minutes. Perform the five cycles.
Moisture Resistance		MIL-STD-202, Method 106
Humidity (steady state)	DWV: the initial value IR: the initial value Capacitance Change: no more than 0.3% or 0.3pF	MIL-STD-202, Method 103, Condition A, with 1.5 volts D.C. applied while subjected to an environment of 85°C with 85% relative humidity for 240 hours min.
Life	IR: shall be not less than 30% the initial value Capacitance Change: no more than 0.2%	MIL-STD-202, Method 108, for 2000 hours, at 125°C. Rated voltage≤500V: 200% Rated Voltage D.C. applied. 500V≤Rated Voltage≤1250V: 120% Rated Voltage D.C. applied. Rated voltage >1250V: 100% Rated Voltage D.C. applied.

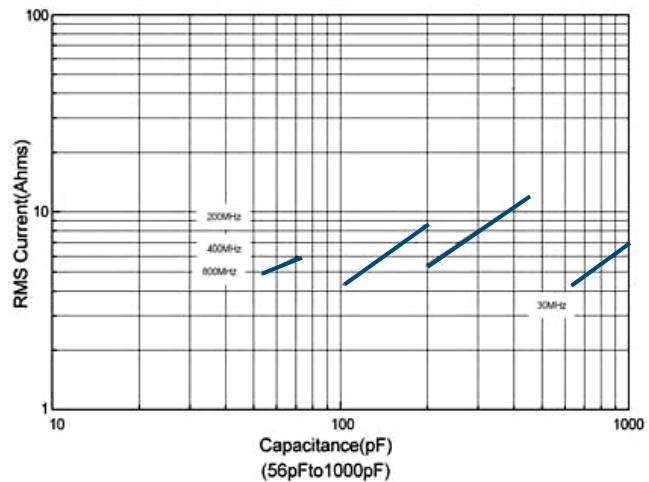
Performance Curve



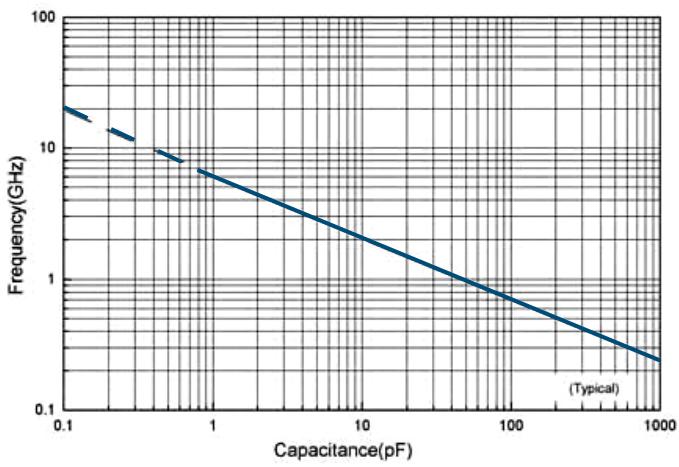
Current Rating vs.Capacitance



Current Rating vs.Capacitance



Resonance vs.Capacitance



Features

- Capacitance Range: 0.1pF to 27pF
- High Q Low ESR/ESL
- High Power
- Ultra Stable Performance
- High Self-Resonance
- Operating Voltages
 - DC Voltage: 250Vdc



Applications

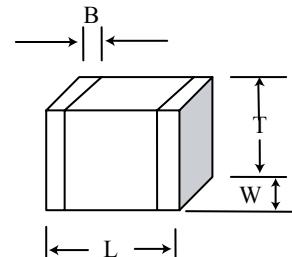
Typical Functional Applications: Bypass, Coupling, Tuning, Feedback, Impedance Matching and DC Blocking. Devices such as RF oscillators and precision timing circuits requiring a predictable temperature coefficient are examples of devices utilizing these capacitors.

AFM Part Number Code

M	N	R	02	W	101	J	F	C	B	B
Product Series: M: High Frequency	Product Type: R: Chip			Termination Code: C: Pd/Ag Term T: Ag Term, Ni/100% Sn Plated (Pb Free) W: Ag Term, Ni Barrier, 90/10 Sn/Pb Plated		Tolerance: B: $\pm 0.1\text{pF}$ C: $\pm 0.25\text{pF}$ D: $\pm 0.5\text{pF}$ F: $\pm 1\%$ G: $\pm 2\%$ J: $\pm 5\%$ K: $\pm 10\%$ M: $\pm 20\%$		Test Code: C: Commercial Test S: Special (Customer Defined) M: Hi-Rel		Packaging: B: Bulk T: Tape & Reel W: Waffle Pack
Dielectrics: N: NPO			Chip Size: 02: 0402		Capacitance Code: 1st two digits are significant: Third digit denotes number of zero(s); R=Decimal point 2R0=2.0pF 101=100pF		Voltage: F: 200Vdc		Marking: B: Not Marked	

Chip Dimensions

Length	.040 ±.004in (1.02±0.1mm)
Width	.020±.004in (0.51±0.1mm)
Thickness	.024....+.005~-.003in (0.61....+0.13~-0.08mm)
Band	.015in (0.38mm)



Standard Capacitance Values

CAP CODE	CAP (pF)	TOL	RATED WVdc	CAP CODE	CAP (pF)	TOL	RATED WVdc	CAP CODE	CAP (pF)	TOL	RATED WVdc		
0R1	0.1	B	200	1R6	1.6	A, B, C, D	200	6R2	6.2	A, B, C, D	200		
0R2	0.2			1R8	1.8			6R8	6.8	B, C, J, K			
0R3	0.3			2R0	2.0			7R5	7.5				
0R4	0.4			2R2	2.2			8R2	8.2				
0R5	0.5			2R4	2.4			9R1	9.1				
0R6	0.6			2R7	2.7			100	10	F, G, J, K, M			
0R7	0.7			3R0	3.0			110	11				
0R8	0.8			3R3	3.3			120	12				
0R9	0.9			3R6	3.6			150	15				
1R0	1.0			3R9	3.9			180	18				
1R1	1.1	A, B,C,D		4R3	4.3			200	20				
1R2	1.2			4R7	4.7			220	22				
1R3	1.3			5R1	5.1			240	24				
1R5	1.5			5R6	5.6			270	27				

Specification and Performance

Piezoelectric and Aging Effect:	None
Temperature Range:	-55°C to +125°C
Temperature Coefficient of Capacitance:	0±30ppm/°C
Quality Factor (Q) :	2,000 min.
Insulation Resistance (IR, at Rated Voltage):	10 ⁵ MΩ min. at +25°C at rated WVDC 10 ⁴ MΩ min. at +125°C at rated WVDC
Dielectric Withstand Voltage (DWV):	250% of rated WVDC for 5 secs
Capacitance Drift:	±0.02% or ±0.02pF, whichever is greater

Features

- Capacitance Range: 0.1pF to 100pF
- High Q Low ESR/ESL
- High Power
- Ultra Stable Performance
- High Self-Resonance
- Operating Voltages
 - DC Voltage: 250Vdc



Applications

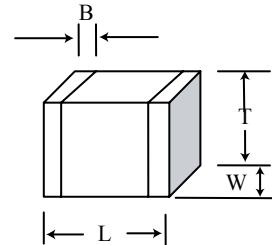
Typical Functional Applications: Bypass, Coupling, Tuning, Feedback, Impedance Matching and DC Blocking. Devices such as RF oscillators and precision timing circuits requiring a predictable temperature coefficient are examples of devices utilizing these capacitors.

AFM Part Number Code

M	N	R	03	W	101	J	G	C	B	B
Product Series: M: High Frequency	Product Type: R: Chip			Termination Code: C: Pd/Ag Term T: Ag Term, Ni/100% Sn Plated (Pb Free) W: Ag Term, Ni Barrier, 90/10 Sn/Pb Plated		Tolerance: B: $\pm 0.1\text{pF}$ C: $\pm 0.25\text{pF}$ D: $\pm 0.5\text{pF}$ F: $\pm 1\%$ G: $\pm 2\%$ J: $\pm 5\%$ K: $\pm 10\%$ M: $\pm 20\%$		Test Code: C: Commercial Test S: Special (Customer Defined) M: Hi-Rel		Packaging: B: Bulk T: Tape & Reel W: Waffle Pack
Dielectrics: N: NPO			03: 0603		Capacitance Code: 1st two digits are significant: Third digit denotes number of zero(s); R=Decimal point 2R0=2.0pF 101=100pF		Voltage: D: 100 Vdc G: 250 Vdc		Marking: B: Not Marked	

Chip Dimensions

Length	.063 ±.006in (1.60±0.15mm)
Width	.032±.006in (0.81±0.15mm)
Thickness	.030....+.005~-..003in (0.76....+0.13~-0.08mm)
Band	.015in (0.38mm)



Standard Capacitance Values

CAP CODE	CAP (pF)	TOL	RATED WVdc	CAP-CODE	CAP (pF)	TOL	RATED WVdc	CAP CODE	CAP (pF)	TOL	RATED WVdc	CAP CODE	CAP (pF)	TOL	RATED WVdc
0R1	0.1			1R7	1.7			6R2	6.2	A,B,C,D		270	27		
0R2	0.2			1R8	1.8			6R8	6.8			300	30		
0R3	0.3			1R9	1.9			7R5	7.5	B, C, J, K,		330	33		
0R4	0.4			2R0	2.0			8R2	8.2			360	36		
0R5	0.5			2R1	2.1			9R1	9.1			390	39		
0R6	0.6			2R2	2.2			100	10			430	43		
0R7	0.7			2R4	2.4			110	11			470	47		
0R8	0.8	A, B, C, D	250	2R7	2.7	A, B, C, D	250	120	12		250	510	51	F, G, J, K, M	250
0R9	0.9			3R0	3.0			130	13			560	56		
1R0	1.0			3R3	3.3			150	15	F, G, J, K, M		620	62		
1R1	1.1			3R6	3.6			160	16			680	68		
1R2	1.2			3R9	3.9			180	18			750	75		
1R3	1.3			4R3	4.3			200	20			820	82		
1R4	1.4			4R7	4.7			220	22			910	91		
1R5	1.5			5R1	5.1			240	24			101	100		
1R6	1.6			5R6	5.6										

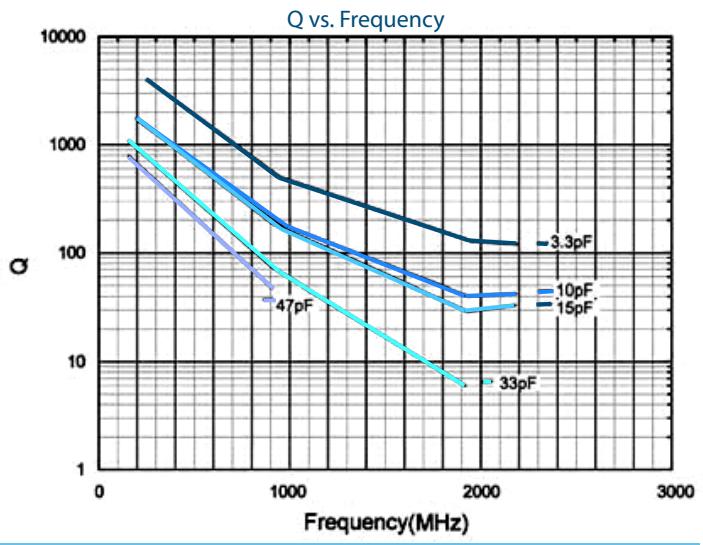
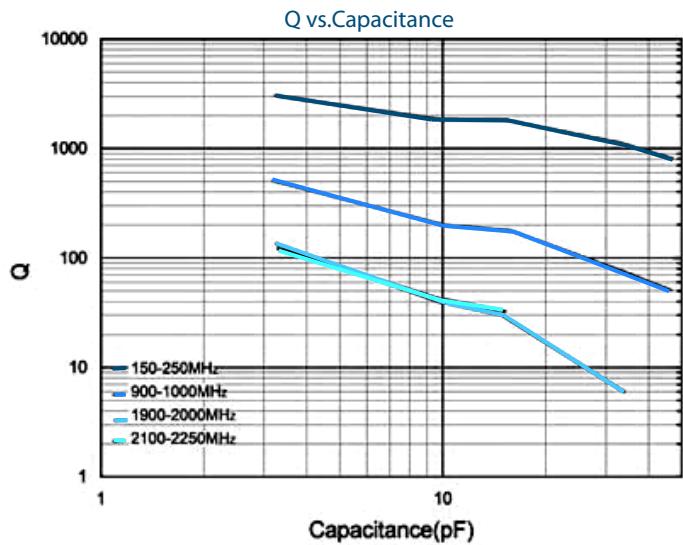
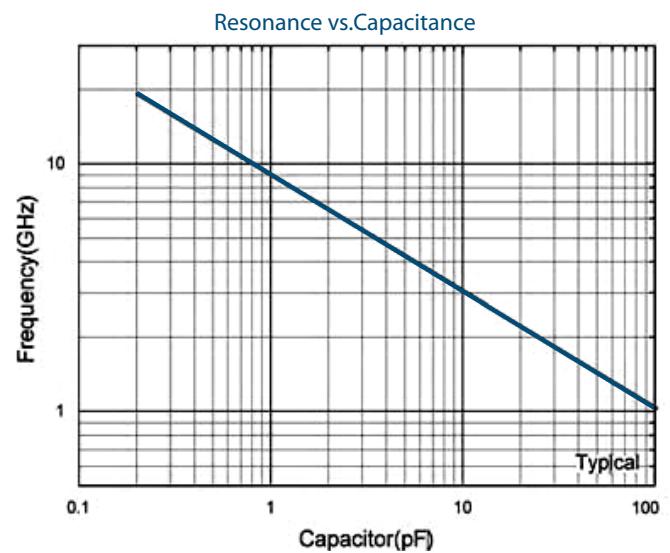
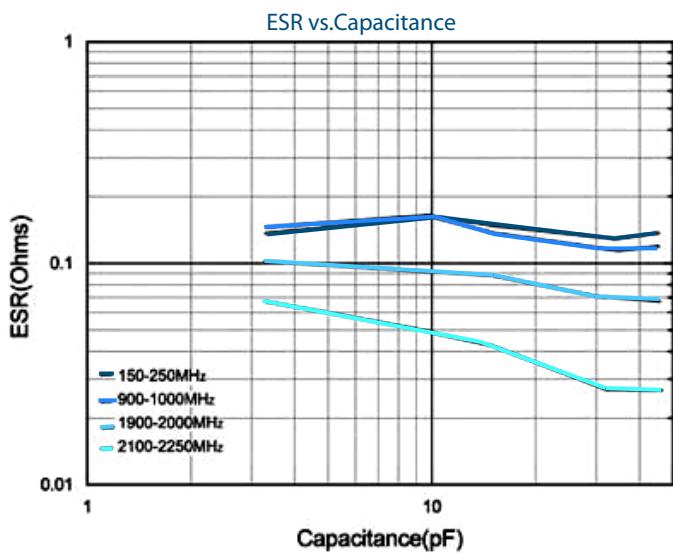
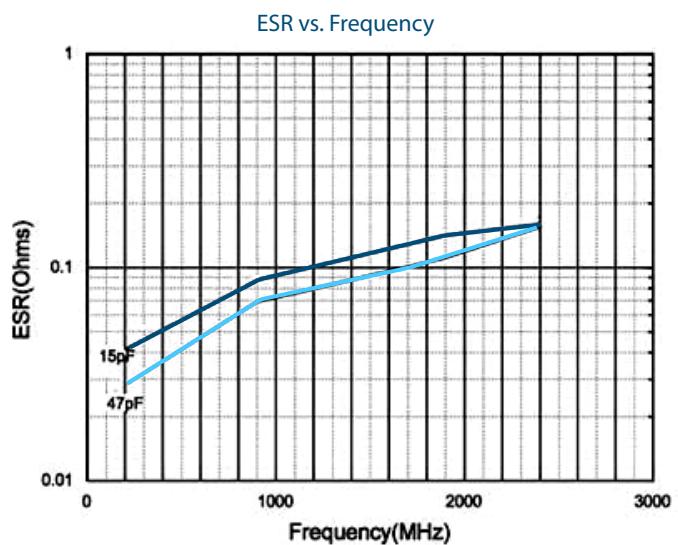
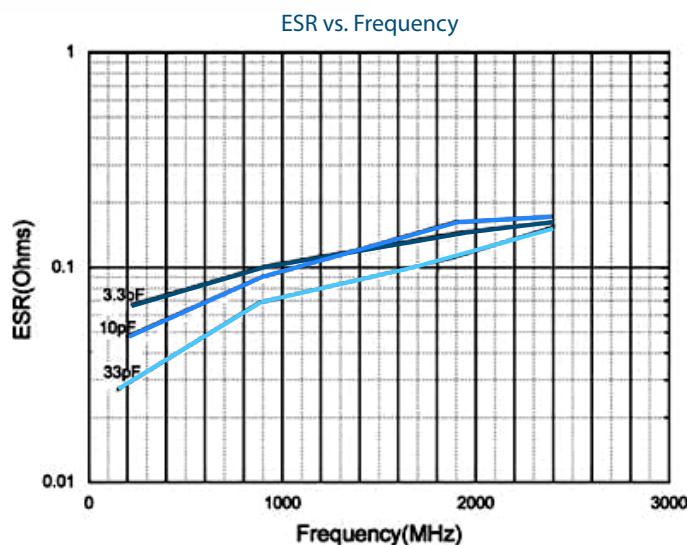
Specification and Performance

Piezoelectric and Aging Effect:	None
Temperature Range:	-55°C to +125°C
Temperature Coefficient of Capacitance:	0±30ppm/°C
Quality Factor (Q) :	2,000 min.
Insulation Resistance (IR, at Rated Voltage):	10 ⁵ MΩ min. at +25°C at rated WVDC 10 ⁴ MΩ min. at +125°C at rated WVDC
Dielectric Withstand Voltage (DWV):	250% of rated WVDC for 5 secs
Capacitance Drift:	±0.02% or ±0.02pF, whichever is greater

Environmental Tests

MNR03 Series Capacitors are designed and manufactured to meet and exceed the requirements of EIA-198, MIL-PRF-55681 and MIL-PRF-123.

Item	Specifications	Method
Terminal Adhesion	Termination should not pull off, ceramic should remain undamaged.	Linear pull force exerted on axial leads soldered to each terminal 2.0lbs.
Resistance to soldering heat	No mechanical damage Capacitance change: -1.0%~+2.0% $Q > 500$ I.R.>10G Ohms Breakdown voltage: 2.5 x WVDC	Preheat device to 150°C-180°C for 60 sec. Dip in 260°C±5°C solder for 10±1 sec. Measure after 24±2 hour cooling period
Thermal Shock		MIL-STD-202, Method 107, Condition A. At the maximum rated temperature (-55°C and +125°C) stay 30 minutes, the time of removing shall be not more than 3 minutes. Perform the five cycles.
Humidity (steady state)	No mechanical damage Capacitance change: ±0.5% or 0.5pF max. $Q > 300$ I.R.>1G Ohms Breakdown voltage: 2.5 x WVDC	MIL-STD-202, Method 106
Low Voltage Humidity	No mechanical damage Capacitance change: ±0.3% or 0.3pF max. $Q > 300$ I.R.>1G Ohms Breakdown voltage: 2.5 x WVDC	MIL-STD-202, Method 103, Condition A, with 1.5 volts D.C. applied while subjected to an environment of 85°C with 85% relative humidity for 240 hours min.
Life	No mechanical damage Capacitance change: ±2.0% or 0.5pF max. $Q > 500$ I.R.>1G Ohms Breakdown voltage: 2.5 x WVDC	MIL-STD-202, Method 108, for 1000 hours, at 125°C. 200% Rated Voltage D.C. applied.



Features

- Capacitance Range: 0.1pF to 240pF
- High Q Low ESR/ESL
- High Power
- Ultra Stable Performance
- High Self-Resonance
- Operating Voltages
 - DC Voltage: 250Vdc



Applications

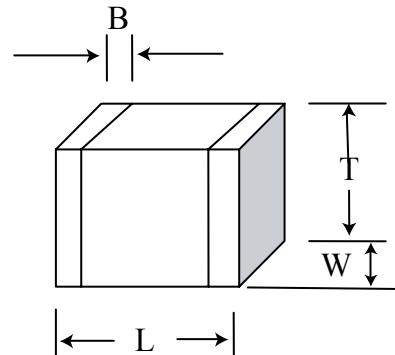
Typical Functional Applications: Bypass, Coupling, Tuning, Feedback, Impedance Matching and DC Blocking. Devices such as RF oscillators and precision timing circuits requiring a predictable temperature coefficient are examples of devices utilizing these capacitors.

AFM Part Number Code

M	N	R	05	W	101	J	F	C	B	B
Product Series: M: High Frequency		Product Type: R: Chip		Termination Code: C: Pd/Ag Term T: Ag Term, Ni/100% Sn Plated (Pb Free) W: Ag Term, Ni Barrier, 90/10 Sn/Pb Plated		Tolerance: B: $\pm 0.1\text{pF}$ C: $\pm 0.25\text{pF}$ D: $\pm 0.5\text{pF}$ F: $\pm 1\%$ G: $\pm 2\%$ J: $\pm 5\%$ K: $\pm 10\%$ M: $\pm 20\%$		Test Code: C: Commercial Test S: Special (Customer Defined) M: Hi-Rel		Packaging: B: Bulk T: Tape & Reel W: Waffle Pack
Dielectrics: N: NPO		Chip Size: 05:0805								
				Capacitance Code: 1st two digits are significant: Third digit denotes number of zero(s); R=Decimal point 2R0=2.0pF 101=100pF		Voltage: G: 250 Vdc				
								Marking: B: Not Marked M: Marked (Cap code and tolerance) S: Special Marking		

Chip Dimensions

Length	.080±.010in (2.00±0.25mm)
Width	.050±.010in (1.20±0.25mm)
Thickness	.057in (1.45mm)
Band	.015in (0.38mm)



Standard Capacitance Values

CAP CODE	CAP (pF)	TOL	WVDC V	CAP CODE	CAP (pF)	TOL	WVDC V	CAP CODE	CAP (pF)	TOL	WVDC V
0R1	0.1			3R3	3.3			300	30		
0R2	0.2	A, B		3R6	3.6			330	33		
0R3	0.3			3R9	3.9			360	36		
0R4	0.4			4R3	4.3			390	39		
0R5	0.5			4R7	4.7	B, C, D		430	43		
0R6	0.6	A, B, C		5R1	5.1			470	47		
0R7	0.7			5R6	5.6			510	51		
0R8	0.8			6R2	6.2			560	56		
0R9	0.9			6R8	6.8			620	62		
1R0	1.0			7R5	7.5			680	68		
1R1	1.1			8R2	8.2	B,C,J,K		750	75	F, G, J, K, M	250
1R2	1.2			9R1	9.1			820	82		
1R3	1.3			100	10			910	91		
1R5	1.5			110	11			101	100		
1R6	1.6	A, B, C,		120	12			111	110		
1R8	1.8	D		150	15			121	120		
2R0	2.0			180	18	F, G, J, K, M		151	150		
2R2	2.2			200	20			181	180		
2R4	2.4			220	22			201	200		
2R7	2.7			240	24			221	220		
3R0	3.0			270	27			241	240		

Specification and Performance

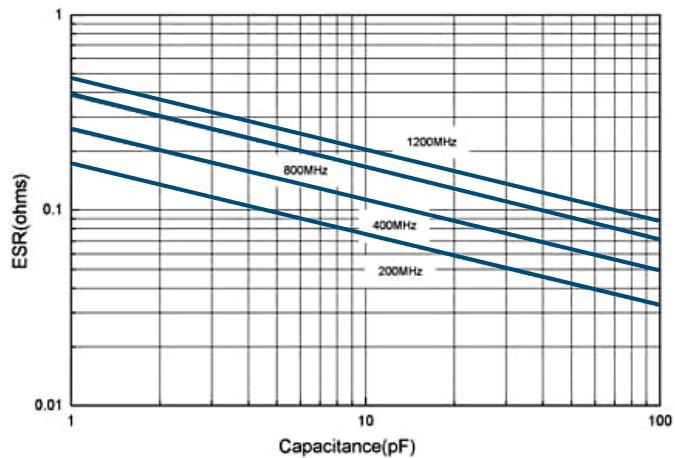
Piezoelectric and Aging Effect:	None
Temperature Range:	-55°C to +125°C
Temperature Coefficient of Capacitance:	+20~+70ppm/°C
Quality Factor (Q) :	>10,000 at 1MHz
Insulation Resistance (IR, at Rated Voltage):	10 ⁶ MΩ min. at +25°C at rated WVDC 10 ⁵ MΩ min. at +125°C at rated WVDC
Dielectric Withstand Voltage (DWV):	250% of rated WVDC for 5 secs
Capacitance Drift:	±0.02% or ±0.02pF, whichever is greater

Environmental Tests

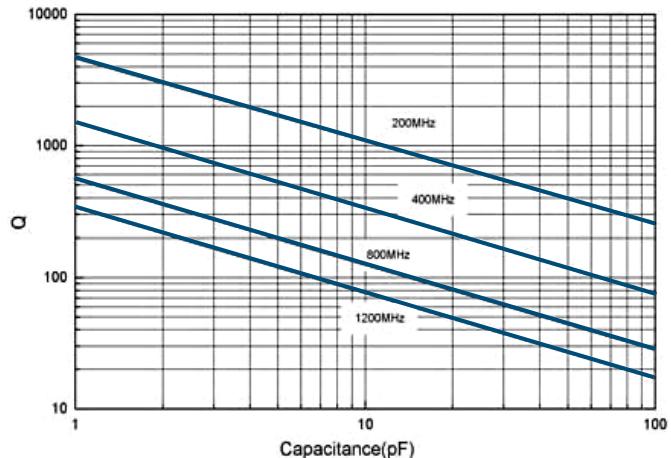
Item	Specifications	Method
Thermal Shock	DWV: the initial value IR: shall be not less than 30% the initial value Capacitance Change: no more than 0.5% or 0.5pF	MIL-STD-202, Method 107, Condition A. At the maximum rated temperature (-55°C and +125°C) stay 30 minutes, the time of removing shall be not more than 3 minutes. Perform the five cycles.
Moisture Resistance		MIL-STD-202, Method 106
Humidity (steady state)	DWV: the initial value IR: the initial value Capacitance Change: no more than 0.3% or 0.3pF	MIL-STD-202, Method 103, Condition A, with 1.5 volts D.C. applied while subjected to an environment of 85°C with 85% relative humidity for 240 hours min.
Life	IR: shall be not less than 30% the initial value Capacitance Change: no more than 0.2%	MIL-STD-202, Method 108, for 2000 hours, at 125°C. 200% Rated Voltage D.C. applied.

Performance Curve

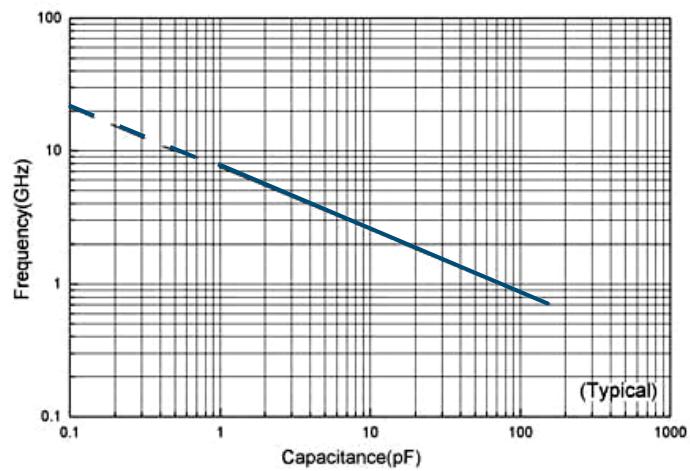
ESR vs.Capacitance



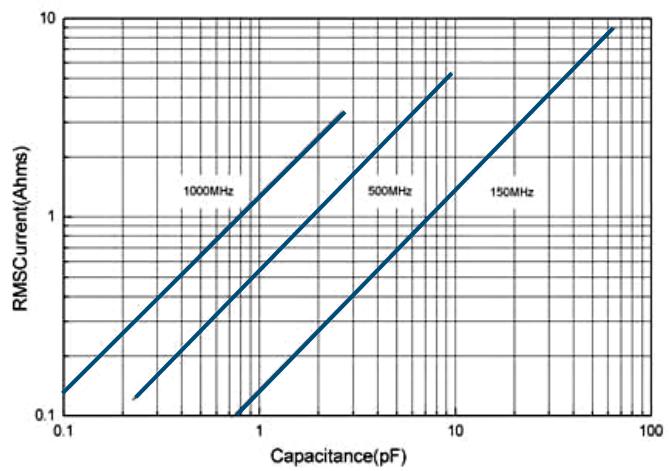
Q vs.Capacitance



Resonance vs.Capacitance



Current Rating vs.Capacitance



Features

- Capacitance Range: 510pF to 0.01μF
- Operating Temperature Range: -55°C to +125°C
- Rated Voltage: 50V
- High Permittivity Low Loss Dielectric
- X7R Temp Characteristics
- Low ERS/ESL
- Low Loss



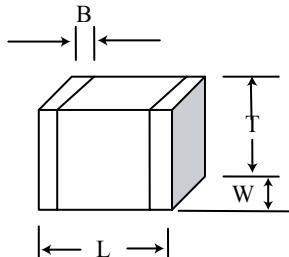
Applications

Typical Functional Applications: bypass, coupling, dc blocking and in switch mode power supplies and other high power circuits.

AFM Part Number Code

M	X	R	11	W	101	K	B	C	B	B
Product Series: M: High Frequency		Product Type: R: Chip		Termination Code: C: Pd/Ag Term G: Ag Term, Ni/Au Plated N: Non Magnetic Term (Ag Term, Cu/Sn Plated) P: Solder Dipped W Term in 60/40 Sn/Pb T: Ag Term, Ni/100% Sn Plated (Pb Free) W: Ag Term, Ni Barrier, 90/10 Sn/Pb Plated		Tolerance: K: ±10% M: ±20% N: ±30%		Test Code: C: Commercial Test M: Hi-Rel S: Special (Customer Defined)		Packaging: B: Bulk T: Tape & Reel W: Waffle Pack
Dielectrics: X: X7R		Chip Size: 11: 0505		Capacitance Code: 1st two digits are significant: Third digit denotes number of zero(s); R=Decimal point 2R0=2.0pF 101=100pF		Voltage: B: 50Vdc		Marking: B: Not Marked M: Marked (Cap code and tolerance) S: Special Marking		

Chip Dimensions



Length	.057in (1.5mm)
Width	.055in (1.4mm)
Thickness	.055in (1.4mm)
Band	.015in (0.38mm)

Standard Capacitance Values

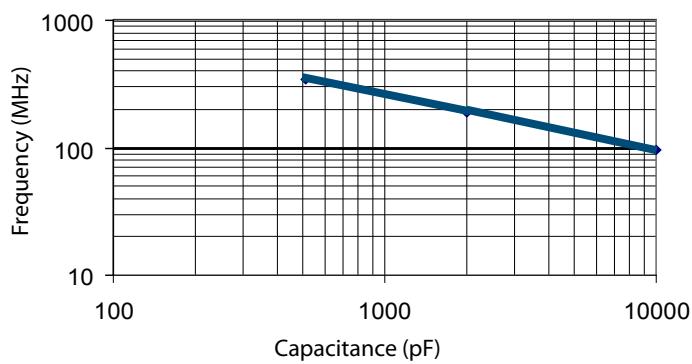
CAP Code	Cap (pF)	Tol	WVdc	CAP Code	Cap	Tol	WVdc
511	510	K, M, N	50	202	2000pF	K, M, N	50
561	560			222	2200pF		
621	620			272	2700pF		
681	680			332	3300pF		
751	750			392	3900pF		
821	820			472	4700pF		
911	910			502	5000pF		
102	1000			562	5600pF		
122	1200			682	6800pF		
152	1500			822	8200pF		
182	1800			103	0.01μF		

Specification and Performance

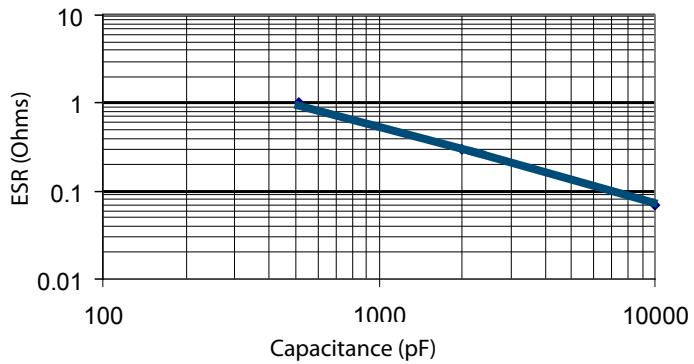
Piezoelectric and Aging Effect:	3% Per Decade
Temperature Range:	-55°C to +125°C
Temperature Coefficient of Capacitance:	0±15% Max
Dissipation Factor:	0.025 max at 1KHz and +25°C
Insulation Resistance (IR, at Rated Voltage):	>10 ⁴ MΩ at +25°C >10 ³ MΩ at +125°C
Dielectric Withstand Voltage (DWV):	250% of rated WVDC for 5 secs
Capacitance Drift:	±0.02% or ±0.02pF, whichever is greater
Dielectric Absorption:	≤2%

Performance Curve

Resonance vs. Capacitance



ESR vs. Capacitance



Features

- Capacitance Range: 5000pF to 0.10μF
- Operating Temperature: -55°C to +125°C
- Rated Voltage: 50V
- Encapsulation Options for Leaded MXR12 Series
- High Permittivity Low Loss Dielectric
- X7R Temperature Characteristics
- Low ERS/ESL
- Low Loss



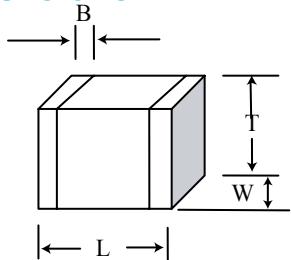
Applications:

Typical Functional Applications: bypass, coupling, dc blocking and in switch mode power supplies and other high power circuits.

AFM Part Number Code

M	X	R	12	W	101	K	B	C	B	B
Product Series: M: High Frequency		Product Type: R: Chip		Termination Code: A: Axial Wire B: Axial Ribbon C: Pd/Ag Term G: Ag Term, Ni/Au Plated N: Non Magnetic Term (Ag Term, Cu/Sn Plated) P: Solder Dipped W Term in 60/40 Sn/Pb Q: Radial Wire R: Radial Ribbon T: Ag Term, Ni/100% Sn Plated (Pb Free) W: Ag Term, Ni Barrier, 90/10 Sn/Pb Plated		Tolerance: K: ±10% M: ±20% N: ±30%		Test Code: C: Commercial Test M: Hi-Rel S: Special (Customer Defined)		Packaging: B: Bulk T: Tape & Reel W: Waffle Pack
Dielectrics: X: X7R		Chip Size: 12: 1111			Capacitance Code: 1st two digits are significant: Third digit denotes number of zero(s); R=Decimal point 2R0=2.0pF 101=100pF		Voltage: B: 50 Vdc		Marking: B: Not Marked M: Marked (Cap code and tolerance) S: Special Marking	

Chip Dimensions



Length	.110in (2.79mm)
Width	.110in (2.79mm)
Thickness	.102in (2.59mm)
Band	.015in (0.38mm)

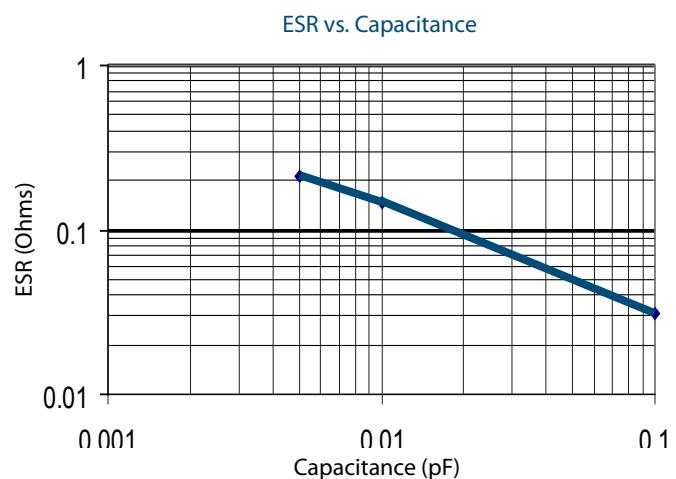
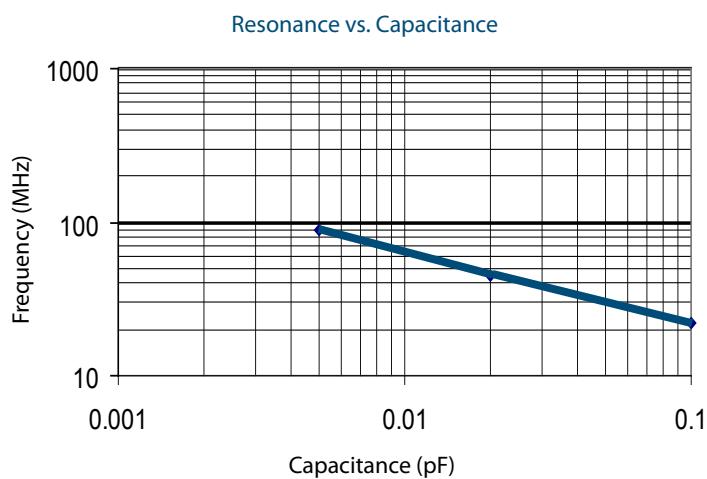
Standard Capacitance Values

CAP Code	Cap	Tol	WVdc	CAP Code	Cap	Tol	WVdc
502	5000pF	K, M, N	50	273	0.027µF	K, M, N	50
562	5600pF			333	0.033µF		
682	6800pF			393	0.039µF		
822	8200pF			473	0.047µF		
103	0.010µF			503	0.050µF		
123	0.012µF			563	0.056µF		
153	0.015µF			683	0.068µF		
183	0.018µF			823	0.082µF		
203	0.020µF			104	0.100µF		
223	0.022µF						

Specification and Performance

Piezoelectric and Aging Effect:	3% Per Decade
Temperature Range:	-55°C to +125°C
Temperature Coefficient of Capacitance:	0±15% Max
Dissipation Factor:	0.025 max at 1KHz and +25°C
Insulation Resistance (IR, at Rated Voltage):	>10 ⁴ MΩ at +25°C >10 ³ MΩ at +125°C
Dielectric Withstand Voltage (DWV):	250% of rated WVDC for 5 secs
Capacitance Drift:	±0.02% or ±0.02pF, whichever is greater
Dielectric Absorption:	≤2%

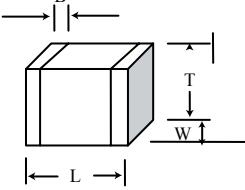
Performance Curve



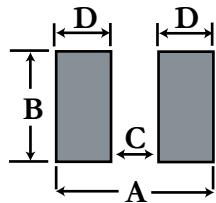
Termination Options

Case Size 11 (0.055"x 0.057")

Termination Options Case Size 11 (0.055"x 0.057")

AFM Series	Term Code	Type	Outlines	Body Dimensions Inches (mm)			Lead and Termination Dimensions and Materials	
				Length (L)	Width (W)	Thickness (T)	(B)	Materials
CASE SIZE 11	W	Solder Plate		.057 +.020-.010 inches (1.5 +0.51-0.25mm)	.055 +.020-.010 inches (1.4 +0.51-0.25mm)	.055 (1.4 mm) max	.015 (0.38) ±.010 (0.25) max	Solder Plated Over Nickel Barrier Termination 90 Sn/10 Pb
	P	Pellet		.057 +.035-.010 inches (1.5 +0.89-0.25mm)	.055 +.035-.010 inches (1.4 +0.89-0.25mm)			W Termination with Sn/Pb Solder Dip
	T	Lead Free Solder Plated						Lead-Free and RoHS Compliant Tin Plated Over Nickel Barrier Termination
	G	Gold Plated						Lead-Free and RoHS Compliant Gold Plated Over Nickel Barrier Termination
	C	Pd/Ag						Palladium/Silver Termination
	N	Non Magnetic (Ag Term, Cu/Sn Plated)						Non-Magnetic Termination Silver Termination Copper/Tin Plating

Recommended Pad Spacing Dimensions for the Size 11 Capacitors



Size	Internal Electrode Orientation	A	B	C	D
11	Horizontal	.125 (3.18)	.075 (1.91)	.025 (0.64)	.05 (1.27)
	Vertical	.125 (3.18)	.060 (1.52)	.025 (0.64)	.05 (1.27)

All Dimensions are in Inches (mm)

*NOTE: A= Max Length +0.030"

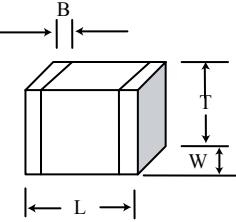
B= Max Width +0.010"

C= Min Length - 2 x Solder Band

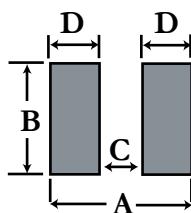
Termination Options

Case Size 12 (0.110"x0.110")

Termination Options Case Size 12 (0.110"x0.110")

AFM Series	Term Code	Type	Outlines	Body Dimensions Inches (mm)			Lead and Termination Dimensions and Materials	
				Length (L)	Width (W)	Thickness (T)	B	Materials
CASE SIZE 12	W	Solder Plate		.110 .020-.010 inches (2.79 +.051-.025mm)	.110±.015 inches (2.79±.038mm)	.102 (2.59) max	.015 (0.38) ±.010 (0.25) max	Solder Plated Over Nickel Barrier Termination 90 Sn/10 Pb
	P	Pellet		.110 .035-.010 inches (2.79 +.089-.025mm)	.110±.015 inches (2.79±.038mm)			W Termination with Sn/Pb Solder Dip
	T	Lead Free Solder Plated		Lead-Free and RoHS Compliant Tin Plated Over Nickel Barrier Termination				
	G	Gold Plated		Lead-Free and RoHS Compliant Gold Plated Over Nickel Barrier Termination				
	C	Pd/Ag		Palladium/Silver Termination				
	N	Non Magnetic (Ag Term, Cu/Sn Plated)		Non-Magnetic Termination Silver Termination Copper/Tin Plating				

Recommended Pad Spacing Dimensions for Size 12 Capacitors



Size	Internal Electrode Orientation	A	B	C	D
12	Horizontal	.170 (4.32)	.140 (3.56)	.070 (1.78)	.050 (1.27)
	Vertical	.170 (4.32)	.115 (2.92)	.070 (1.78)	.050 (1.27)

All Dimensions are in Inches (mm)

*NOTE: A= Max. Length +0.030"

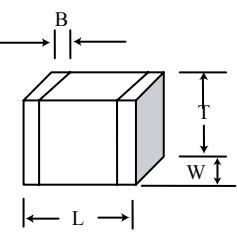
B= Max. Width +0.010"

C= Min. Length - 2 x Solder Band

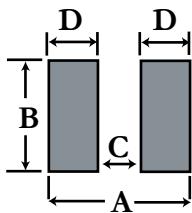
Termination Options

Case Size 03 (0.032"x0.063")

Termination Options Case Size 03 (0.032"x0.063")

AFM Series	Term Code	Type	Outlines	Body Dimensions Inches (mm)			Lead and Termination Dimensions and Materials	
				Length (L)	Width (W)	Thickness (T)	(B)	Materials
CASE SIZE 03	W	Solder Plate		.063 ±.006 inches (1.60 ±0.15mm)	.032±.006 inches (0.81±0.15 mm) .035 inches (0.89mm) max	.015 ±.01 inches (0.38±0.25 mm) max	Solder Plated Over Nickel Barrier Termination 90 Sn/10 Pb	
	P	Pellet		.063 ±.015 inches (1.60 ±0.38mm)				
	T	Lead Free Solder Plated		.063 ±.006 inches (1.60 ±0.15mm)				
	G	Gold Plated		.063 ±.006 inches (1.60 ±0.15mm)				
	C	Pd/Ag		.063 ±.006 inches (1.60 ±0.15mm)				
	N	Non Magnetic (Ag Term, Cu/Sn Plated)		.063 ±.006 inches (1.60 ±0.15mm)				

Recommended Pad Spacing Dimensions for Size 03 Capacitors



Size	Internal Electrode Orientation	A	B	C	D
03	Horizontal	.110 (2.79)	.040 (1.02)	.024 (.610)	.055 (1.40)
	Vertical	.110 (2.79)	.040 (1.02)	.024 (.610)	.055 (1.40)

All Dimensions are in Inches (mm)

*NOTE:

A= Max. Length +0.030"

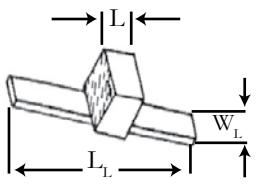
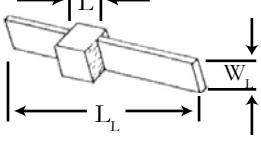
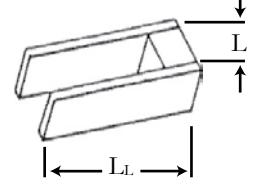
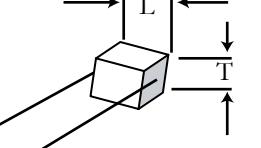
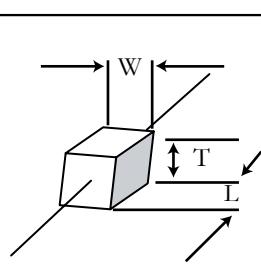
B= Max. Width +0.010"

C= Min. Length - 2 x Solder Band

Lead Options

Case Size 12 (0.110"x0.110")

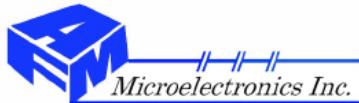
Lead Options Case Size 12 (0.110"x0.110")

Case Size	Term Code	Style	Outlines	Body Dimensions Inches (mm)			Lead and Termination Dimensions and Materials		
				Length (L)	Width (W)	Thickness (T)	Materials		
12	M/MN	Microstrip/ Non-Magnetic		.135±.015 inches (3.43±0.38) mm	.110±.015 inches (2.79 ±0.38) mm	.120 (3.05) max.	Length (L _L)	Width (W _L)	Thickness (T _L)
	B/BN	Axial Ribbon/ Non-Magnetic					.250 (6.35) min	.093±.005 (2.36 ±0.13)	.004±.001 (.102 ±.025)
	R/RN	Radial Ribbon/ Non-Magnetic					.102 (2.59) max.		
	Q/QN	Radial Wire/ Non-Magnetic				.145 ±.020 inches (3.68±0.51) mm	.500 (12.7) min	#26 AWG., .016 (.406) dia nominal	
	A/AN	Axial Wire/ Non-Magnetic							

Terminal Strength:

(Excluding Non-Magnetic Types)

Leaded types shall withstand a lead pull of 22.25 Newton (5lbs) for 5 seconds, in the direction of the lead in accordance with IEC 68-2-21 and MIL-STD-202 method 211.



Engineering Kit Information

AFM offers design engineering kits for its RF/Microwave multilayer chip capacitor series. Each kit contains a range of the most popular values of our Microporcelain and COG (NPO) dielectric systems. These engineering kits are offered in three different sizes: MPR and MNR Series 11 (0.055" x 0.055"), MPR and MNR Series 12 (0.110" x 0.110") and MNR Series 03 (0.063" x 0.032"). These engineering kits are to allow circuit designers to rapidly breadboard and optimize their circuits by having a variety of capacitance values on hand.

These kits are normally in stock but may take several weeks ARO.

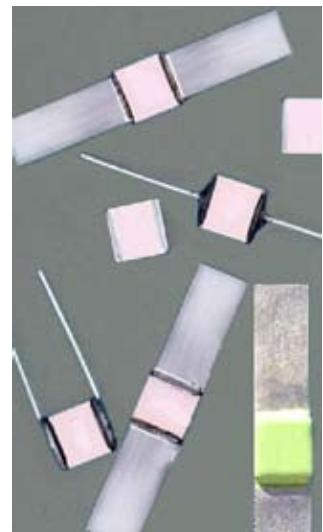
Kit No.	Part No.	Description	Cap Range (pF)	Cap Values (pF)	Tolerance (pF)	Price \$US
Kit 1	TEK001	MPR11 Microporcelain Chip, 16 Values, 15 Pcs. Each Termination Option: "W"	0.1 to 2.0	0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0, 1.1, 1.2, 1.5	±0.1	\$120.00
				1.6, 1.8, 2.0	±0.25	
Kit 2	TEK002	MPR11 Microporcelain Chip, 16 Values, 15 Pcs. Each Termination Option: "W"	1.0 to 10	1.0, 1.2, 1.5, 1.8, 2.0, 2.2, 2.4, 2.7, 3.0, 3.3	±0.1	\$120.00
				3.9, 4.7, 5.6, 6.8, 8.2	±0.25	
				10	±5%	
Kit 3	TEK003	MPR11 Microporcelain Chip, 16 Values, 15 Pcs. Each Termination Option: "W"	10 to 100	10, 12, 15, 18, 20, 22, 24, 27, 30, 33, 39, 47, 56, 68, 82, 100	±5%	\$120.00
Kit 4	TEK004	MPR12 Microporcelain Chip, 16 Values, 15 Pcs. Each Termination Option: "W"	1.0 to 10	1.0, 1.2, 1.5, 1.8, 2.0, 2.2, 2.4, 2.7, 3.0, 3.3	±0.1	\$150.00
				3.9, 4.7, 5.6, 6.8, 8.2	±0.25	
				10	±5%	
Kit 5	TEK005	MPR12 Microporcelain Chip, 16 Values, 15 Pcs. Each Termination Option: "W"	10 to 100	10, 12, 15, 18, 20, 22, 24, 27, 30, 33, 39, 47, 56, 68, 82, 100	±5%	\$150.00
Kit 6	TEK006	MPR12 Microporcelain Chip, 16 Values, 15 Pcs. Each Termination Option: "W"	100 to 1000	100, 120, 150, 180, 200, 220, 240, 270, 300, 330, 390, 470	±5%	\$150.00
				560, 680, 820, 1000	±10%	
Kit 7	TEK007	MNR03 COG (NPO) Low ESR 0603 Capacitors 16 Values, 15 Pcs. Each Termination Option: "W"	0.1 to 2.0	0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0, 1.1, 1.2, 1.5	±0.1	\$90.00
				1.6, 1.8, 2.0	±0.25	
Kit 8	TEK008	MNR03 COG (NPO) Low ESR 0603 Capacitors 16 Values, 15 Pcs. Each Termination Option: "W"	1.0 to 10	1.0, 1.2, 1.5, 1.8, 2.0, 2.2, 2.4, 2.7, 3.0, 3.3	±0.1	\$90.00
				3.9, 4.7, 5.6, 6.8, 8.2	±0.25	
				10	±5%	
Kit 9	TEK009	MNR03 COG (NPO) Low ESR 0603 Capacitors 16 Values, 15 Pcs. Each Termination Option: "W"	10 to 100	10, 12, 15, 18, 20, 22, 24, 27, 30, 33, 39, 47, 56, 68, 82, 100	±5%	\$90.00



MPH Series Overview

High Power, High Current Capacitors

The MPH Series of capacitors are the updated version of Microelectronics Group MHP series and designed specifically for high voltage and high RF current applications. They are offered either in chip form, with axial or radial wire leads or axial silver ribbon leads. This configuration assures low ESR, minimum inductance and high RF current capabilities. Glass or epoxy encapsulation is available to protect the capacitors against contaminants and humidity and to minimize partial discharge activity. Non standard capacitance values, special tolerances and voltages, alternative dielectrics and other mechanical configurations are available. The MPH Series can be supplied compliant to the EU's **RoHS** standard.



Features

- Capacitance Range: 1pF to 5100pF
- High Operating Voltages
 - DC Voltage: 300Vdc to 7KVdc
 - RF Voltage: 200Vrms to 5000Vrms
- RF Current Rating up to 12A rms
- Ultra Low ESR
- High Q
- Chip and Leaded Configurations Available
- Encapsulation Options Available
- High Reliability

Applications

- MRI Coils
- HF/RF Power Amplifiers
- Plasma Chambers
- Antenna Tuning
- High Power RF Transmitters
- Inductive Heating
- Semiconductor Equipment

Specification and Performance

Piezoelectric and Aging Effects:	None
Temperature Range:	-55°C to +125°C
Temperature Coefficient of Capacitance (TCC):	+90±30ppm/°C (-55°C to +125°C)
Q:	>10,000 (1.0pF to 1000pF) at 1 MHz >10,000 (>1000pF) at 1KHz
Insulation Resistance:	>10 ⁵ MΩ at 25°C , at 500VDC >10 ⁴ MΩ at 125°C , at 500VDC
Drift and Retrace:	±0.02% or 0.02pF Whichever is Greater

MPH Series Overview

High Power, High Current Capacitors

Condensed Data for MPH RF Power Capacitors

Series		MPH																				
Range (Case Size Format)		MPH25					MPH1				MPH2		MPH3									
Electrical Characteristics	Capacitance Range (pF)	1-2700					1-5100				10-75	82-620										
	Standard Capacitance Values	E-24					E-24				E-24	E-24										
	Capacitance Tolerances	B, C, D for capacitance C<10pF; F, G, J, K, M for capacitance C≥10pF;																				
	Capacitance Range (pF) for Voltage Range	1-270	300 470	510 1200	1300 1800	2000 2700	1-390	430 680	750 2200	2400 5100	10-75	82-155	160-330 360-620									
	VR Rated Voltage Vdc	2500	1500	1000	500	300	3600*	2500	1000	600	7000	7000	5000 3600									
	RF Rated Voltage Vrms	1768	1060	707	354	212	2500	1800	700	425	5000	5000	3500 2500									
	Test Voltage Vdc	3000	1800	1500	750	450	4320	3000	1500	900	8400	8400	6000 4320									
	Reactive Power (KVAR) Rating (kw)	4	2.2	1.5	1.2	1.0	12	6	6	3	18	18	18 12									
	RF Current Rating (Arms)	6					12															
Dimensional Data	Length of Chip (L) in (mm)	.230 (5.84) (Non-Encapsulated)					.380 (9.65)				.760 (19.30)											
	Width of Chip (W) in (mm)	.250 (6.35) (Non-Encapsulated)					.380 (9.65)				.760 (19.30)											
	Thickness of Chip (T) in (mm) (Encapsulated) (max)	.145 (3.68) for Capacitance Value ≤680pF .165 (4.19) for Capacitance Value ≥680pF					.177 (4.50) may Increase to .236 (6.0) Max. After Glass Encapsulation															
	Ribbon Lead Dimension in (mm)	Length: .500 (12.7) min Width: .24 (6.1) Thickness: .01 (0.25)					Length: .750 (19.05) min Width: .350 (8.89) Thickness: .010 (0.25)															
Construction Features	Ribbon Leaded	Lead Material	Pure Silver (99.9%)					Tin plated copper														
		Lead Bonding	Silver Brazed					280°C Solder														
		Encapsulation	Glass-Ceramic Coated on all 6 Sides High Frequency Polymer Optional					Glass-Ceramic Coated on 4 Sides High Frequency Polymer Optional														
	Wire Leaded MPH25 Only	Lead Material	Solder Coated Copper																			
		Lead Bonding	High Temperature Solder																			
		Encapsulation	Glass-Ceramic Coated on all 6 Sides High Frequency Polymer Optional																			
		Lead Dimension	Dia=0.024±0.002 (0.61±0.051) Lenth=0.5 (12.7) min																			

* 1-100pF with extended working voltage 7000Vdc



MPH 25(MHPO25)

High Voltage High Current, High RF Power Capacitors

Features

- Capacitance Range: 1pF to 2700pF
- High Q Low ESR/ESL
- High RF Power
- Ultra Stable Performance
- Operating Voltages
 - DC Voltage: 300Vdc to 2500Vdc
 - RF Voltage: 200Vrms to 1800Vrms
- RF Current Rating 6A rms
- Available with Encapsulation Option

Applications

- MRI Coils
- HF/RF Power Amplifiers
- Plasma Chambers
- Antenna Tuning
- High Power RF Transmitters
- Inductive Heating
- Semiconductor Equipment

AFM Part Number Code

M Product Series: M: High Frequency	P Product Type: H: High Power	25	W Termination Code: A: Axial Wire; AN: Non-Mag Axial Wire B: Axial Ribbon BN: Non-Mag Axial Ribbon C: Pd/Ag Term G: Ag Term, Ni/Au Plated M: Microstrip MN: Non-Mag Microstrip N: Non Magnetic Term (Ag Term, Cu/Sn Plated) P: Solder Dipped W Term in 60/40 Sn/Pb Q: Radial Wire QN: Non-Mag Radial Wire T: Ag Term, Ni/100% Sn Plated (Pb Free) W: Ag Term, Ni Barrier, 90/10 Sn/Pb Plated	101	J Tolerance: B: $\pm 0.1\text{pF}$ C: $\pm 0.25\text{pF}$ D: $\pm 0.5\text{pF}$ F: $\pm 1\%$ G: $\pm 2\%$ J: $\pm 5\%$ K: $\pm 10\%$ M: $\pm 20\%$ *B,C,D for C<10pF	H Test Code: C: Commercial Test S: Special (Customer Defined) M: Hi-Rel	B Packaging: B: Bulk T: Tape & Reel W: Waffle Pack
Dielectrics: P: Porcelain	Chip Size: 25: 2325			Capacitance Code: 1st two digits are significant: Third digit denotes number of zero(s); R=Decimal point 2R0=2.0pF 101=100pF	Voltage: H: 300 Vdc J: 500 Vdc L: 1000 Vdc N: 1500 Vdc P: 2500 Vdc	Marking: B: Not Marked M: Marked (Cap code and tolerance) S: Special Marking	

Standard Capacitance Values

Cap. Code	Cap. pF	Tol.	WVDC V	Cap Code	Cap. pF	Tol.	WVDC V	Cap Code	Cap. pF	Tol.	WVDC V
1R0	1.0	B, C, D	2500	180	18	F, G, J, K, M	2500	331	330	F, G, J, K, M	1500
1R2	1.2			220	22			391	390		
1R5	1.5			270	27			471	470		
1R8	1.8			330	33			561	560		
2R2	2.2			390	39			681	680		
2R7	2.7			470	47			821	820		
3R3	3.3			560	56			102	1000		
3R9	3.9			680	68			122	1200		
4R7	4.7			820	82			152	1500		
5R6	5.6			101	100			182	1800		
6R8	6.8			121	120			222	2200		
8R2	8.2			151	150			272	2700		
100	10	F, G, J, K, M		181	180						
120	12			221	220						
150	15			271	270						

* Special capacitance, tolerances and WVDC are available, please consult with AFM.

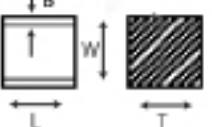
Specification and Performance

Piezoelectric and Aging Effect:	None
Temperature Range:	-55°C to +125°C
Temperature Coefficient of Capacitance:	+90±20ppm/°C
Quality Factor (Q) :	>10,000 (1pF~1000pF) at 1MHz >10,000 (1100pF~2700pF) at 1KHz
Insulation Resistance (IR, at Rated Voltage):	10 ⁵ MΩ min. at +25°C at rated WVDC 10 ⁴ MΩ min. at +125°C at rated WVDC
Dielectric Withstand Voltage (DWV):	1pF~470pF: 120% of rated WVDC for 5 secs; 560pF~1200pF: 150% of rated WVDC for 5 secs; 1500pF~2700pF: 250% of rated WVDC for 5 secs;
Capacitance Drift:	±0.02% or ±0.02pF, whichever is greater

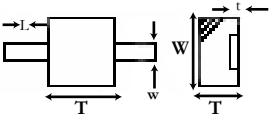
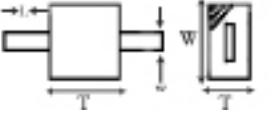
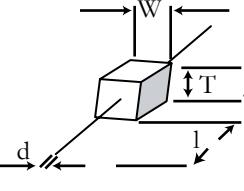
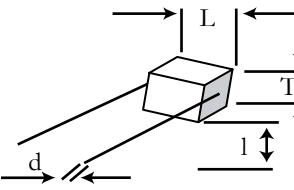
MPH 25(MHPO25)

High Voltage High Current, High RF Power Capacitors

Chip Dimensions

Termination	Outline	L in (mm)	W in (mm)	T in (mm)		B in (mm)
				min	max	
MPH25C, MPH25G, MPH25N, MPH25T, MPH25W		.230 +.020~-,.010 (5.84 +0.51~- 0.25))	.250±.015 (6.35±0.38)	.138 (3.50)	.165 (4.19)	.040 (1.02) max
MPH25P						

Lead Options

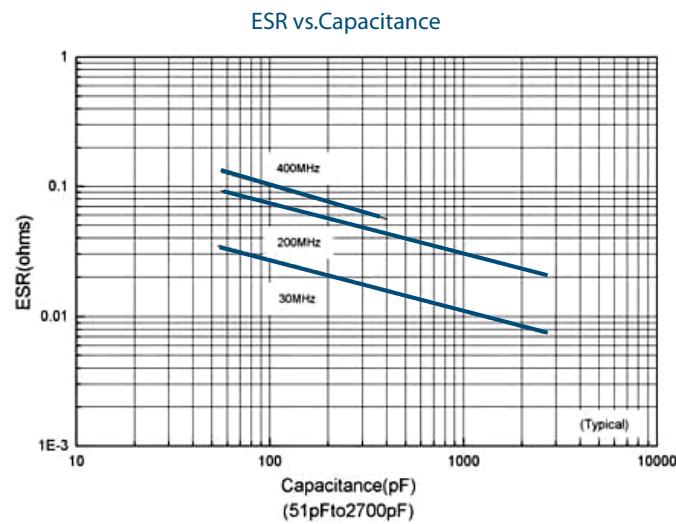
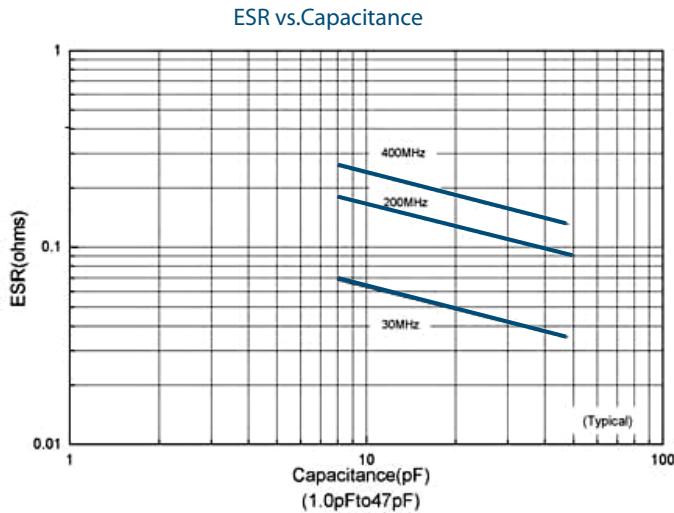
Term Code	Type	Outline	Dimensions in (mm)				Lead Style Designation
			Add .070 inches (1.77mm) if Encapsulated	L	W	T	
M/MN	Microstrip/ Non-Magnetic		.245±.025 (6.22±0.64)	.250±.015 (6.35±0.38)	.145(3.68) Max for C≤680pF		1. Silver Braced leads attached for 99.9% Silver Leads l: .500(12.7)min W: .240±.005 (6.10±0.127) t: .010±.001 (0.25±0.025)
B/BN	Axial Ribbon/Non-Magnetic		.245±.025 (6.22±0.64)	.250±.015 (6.35±0.38)	.165(4.19) Max for C>680pF		2. Leads Attached with High Melting Temperature Solder plated copper lead
A/AN	Axial Wire/Non-Magnetic		.245±.025 (6.22±0.64)	.250±.015 (6.35±0.38)	.145(3.68) Max for C≤680pF	.024 (.61) Dia. Nominal	Solder Coated Copper l: .500(12.7)min d: .024±.002 (0.610±0.051)
Q/QN	Radial Wire/Non-Magnetic		.245±.025 (6.22±0.64)	.250±.015 (6.35±0.38)	.165(4.19) Max for C>680pF		Leads Attached with High Melting Temperature Solder Alloy

Environmental Tests

MPH25 Series Capacitors are designed and manufactured to meet and exceed the requirements of EIA-198, MIL-PRF-55681 and MIL-PRF-123.

Item	Specifications	Method
Thermal Shock	DWV: the initial value IR: shall be not less than 30% the initial value Capacitance Change: no more than 0.5% or 0.5pF	MIL-STD-202, Method 107, Condition A. At the maximum rated temperature (-55°C and +125°C) stay 30 minutes, the time of removing shall be not more than 3 minutes. Perform the five cycles.
Moisture Resistance		MIL-STD-202, Method 106
Humidity (steady state)	DWV: the initial value IR: the initial value Capacitance Change: no more than 0.3% or 0.3pF	MIL-STD-202, Method 103, Condition A, with 1.5 volts D.C. applied while subjected to an environment of 85°C with 85% relative humidity for 240 hours min.
Life	IR: shall be not less than 30% the initial value Capacitance Change: no more than 0.2%	MIL-Std-202, Method 108, for 2000 hours, at 125°C. no less than 1500V, 120% Rated voltage D.C. applied; less than 1500V, 150% rated voltage D.C. applied.

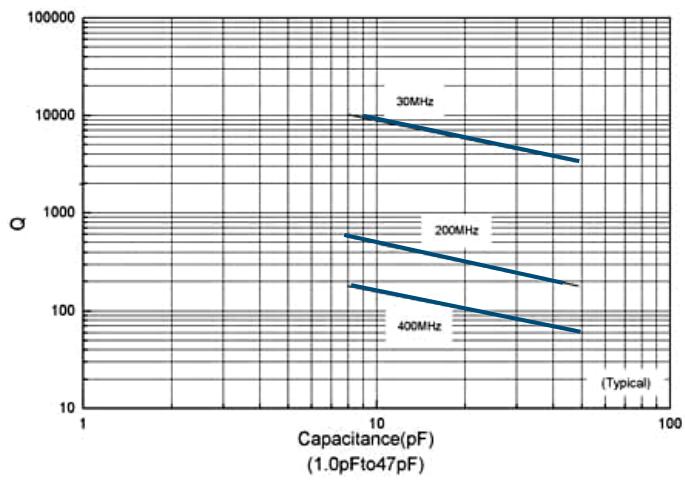
Performance Curve



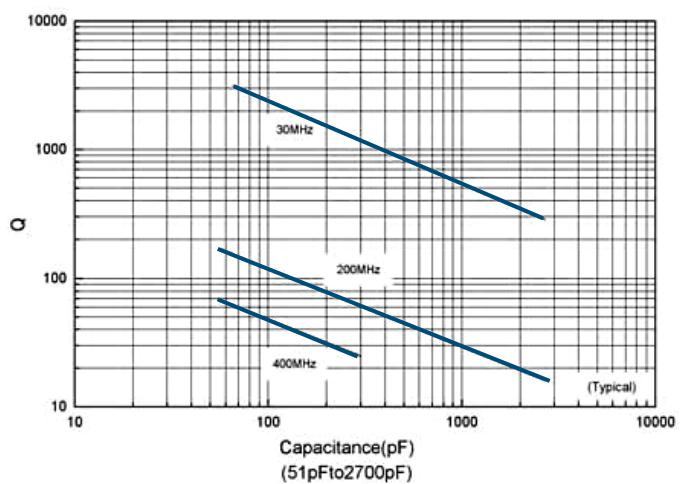
MPH 25(MHPO25)

High Voltage High Current, High RF Power Capacitors

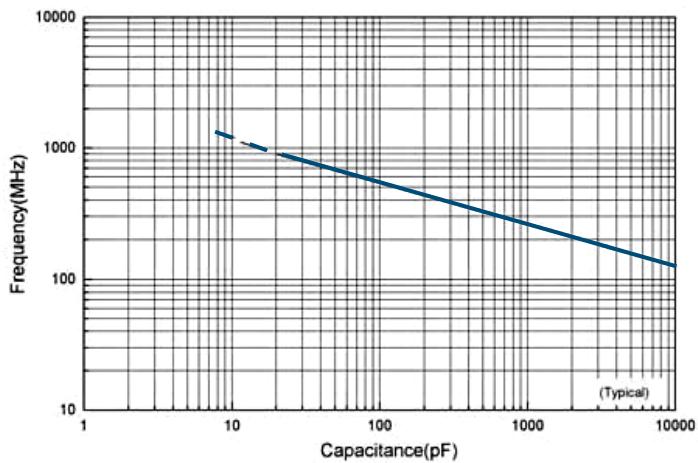
Q vs.Capacitance



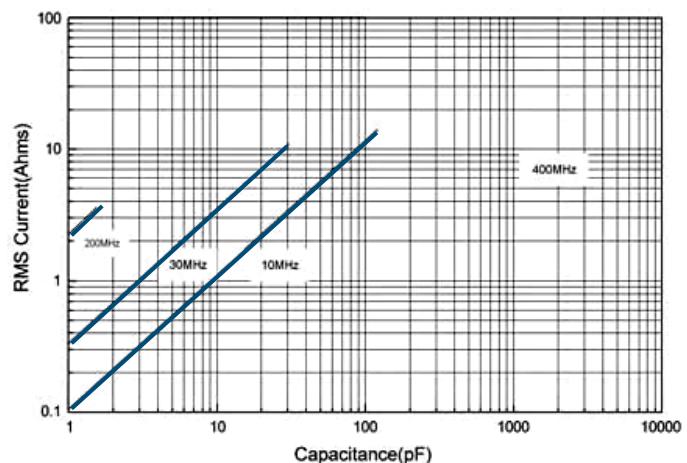
Q vs.Capacitance



Resonance vs.Capacitance



Current Rating vs.Capacitance



MPH 1 (MHP1-MHPU1)

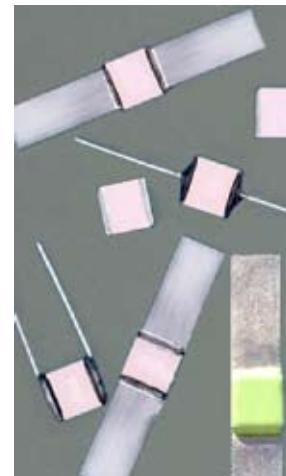
High Voltage High Current, High RF Power Capacitors

Features

- Capacitance Range: 1pF to 5100pF
- High Q Low ESR/ESL
- High RF Power
- Ultra Stable Performance
- Operating Voltages
 - DC Voltage: 600Vdc to 3600Vdc
 - RF Voltage: 425Vrms to 2500Vrms
- Extended WVDC up to 7200 Vdc
- RF Current Rating 12A rms
- Available with Encapsulation Option

Applications

- MRI Coils
- HF/RF Power Amplifiers
- Plasma Chambers
- Antenna Tuning
- High Power RF Transmitters
- Inductive Heating
- Semiconductor Equipment



AFM Part Number Code

M	P	H	U	1	B	101	J	R	C	M	B	G
Product Series: M: High Frequency		Product Type: H: High Power			Termination Code: A: Axial Wire; AN: Non-Mag Axial Wire B: Axial Ribbon BN: Non-Mag Axial Ribbon C: Pd/Ag Term G: Ag Term, Ni/Au Plated M: Microstrip MN: Non-Mag Microstrip N: Non Magnetic Term (Ag Term., Cu/Sn Plated) P: Solder Dipped W Term in 60/40 Sn/Pb Q: Radial Wire QN: Non-Mag Radial Wire T: Ag Term, Ni/100% Sn Plated (Pb Free) W: Ag Term, Ni Barrier, 90/10 Sn/Pb Plated	Tolerance: F: ±1% G: ±2% J: ±5% K: ±10% M: ±20%			Test Code: C: Commercial Test S: Special (Customer Defined) M: Hi-Rel		Packaging: B: Bulk W: Waffle Pack	
					Blank: with encapsulated U: Without encapsulated							
Dielectrics: P: Porcelain								Voltage: J: 500 Vdc L: 1000 Vdc P: 2500 Vdc R: 3600 Vdc T: 5000 Vdc U: 7200 Vdc		Marking: B: Not Marked M: Marked (Cap code and tolerance) S: Special Marking		Encapsulation: Blank: Without Encapsulated G: Glass encapsulated E: Epoxy encapsulated U: Polymer Coating
					Case Size: 1: 3838	Capacitance Code: 1st two digits are significant: Third digit denotes number of zero(s); R=Decimal point 2R0=2.0pF 101=100pF						

Standard Capacitance Values

*STD.:Standard Voltage; EXT.: Extended Voltage

CAP CODE	CAP (pF)	TOL	RATED WVdc		CAP CODE	CAP (pF)	TOL	RATED WVdc		CAP CODE	CAP (pF)	TOL	RATED WVdc	
			STD.*	EXT.*				STD.	EXT.				STD.	EXT.
1R0	1.0	B, C, D	3600	7200	220	22	F, G, J, K, M	3600	7200	471	470	F, G, J, K, M	3600	NA
1R2	1.2				270	27				561	560			
1R5	1.5				330	33				681	680			
1R8	1.8				390	39				821	820			
2R2	2.2				470	47				102	1000			
2R7	2.7				560	56				122	1200			
3R3	3.3				680	68				152	1500			
3R9	3.9				820	82				182	1800			
4R7	4.7				101	100				222	2200			
5R6	5.6				121	120				272	2700	G, J, K, M	500	NA
6R8	6.8				151	150				332	3300			
8R2	8.2				181	180				472	4700			
100	10	F, G, J, K, M	NA	NA	221	220	NA	NA	NA	512	5100			
120	12				271	270								
150	15				331	330								
180	18				391	390								

* Special capacitance, tolances and WVDC are available, please consult with AFM.

Specification and Performance

Piezoelectric and Aging Effect:	None
Temperature Range:	-55°C to +125°C
Temperature Coefficient of Capacitance:	+90±30ppm/°C
Quality Factor (Q) :	>10,000 (1pF~1000pF) at 1MHz >10,000 (1100pF~5100pF) at 1KHz
Insulation Resistance (IR, at Rated Voltage):	10 ⁵ MΩ min. at +25°C at rated WVDC 10 ⁴ MΩ min. at +125°C at rated WVDC
Dielectric Withstand Voltage (DWV):	1pF~680pF: 120% of rated WVDC for 5 secs; 820pF~2200pF: 150% of rated WVDC for 5 secs; 2700pF~5100pF: 250% of rated WVDC for 5 secs;
Capacitance Drift:	±0.02% or ±0.02pF, whichever is greater

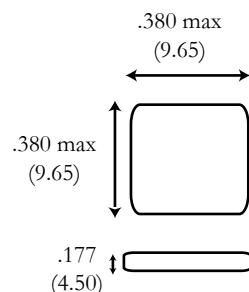
MPH 1 (MHP1-MHPU1)

High Voltage, High Current, High RF Power Capacitors

Chip Dimensions

All Dimensions are in Inches (mm)

Dimensional Data	Length of Chip / Encapsulated (L) in (mm)	.380 (9.65) /.550(13.97) max after encapsulation
	Width of Chip/ Encapsulated (W) in (mm)	.380 (9.65) /.550(13.97) max after encapsulation
	Thickness of Chip (T) in (mm) (Encapsulated) (max)	.177 (4.50) may increase to .236 (5.99) max. after glass encapsulation



Lead Options

All Dimensions are in Inches (mm)

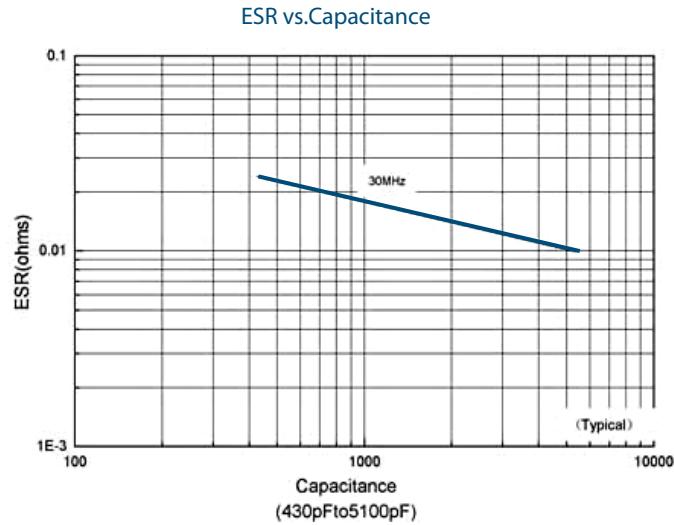
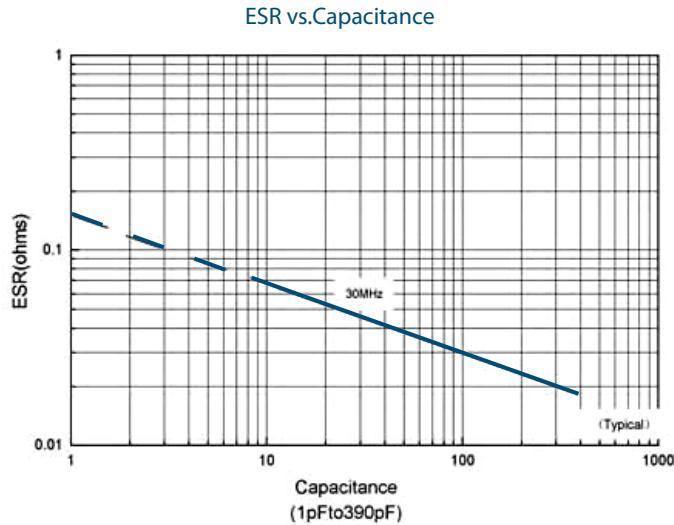
Term Code	Type	Outlines	Capacitor Dimensions			Lead Dimensions			Lead Material	
			Length (Lc)	Width (Wc)	Thickness (Tc)	Length (Lc)	Width (Wc)	Thickness (Tc)		
M/MN	Microstrip/ Non-Magnetic					.750 (19.05) min	.350 ±.010 (8.89 ±.25)	.010 ±.005 (0.25 ±.13)	Solder-plated Copper leaded (Pure Silver Ribbon with Glass Encapsulation)	
B/BN	Axial Ribbon/ Non-Magnetic									
R	Radial Ribbon		.380 +.015~-.010 (9.65 +.38~-.25)	.038 ±.010 (9.65±.25)	.177 (4.5) max	.394 ±.039 (10 ±1)	.114 ±.005 (2.9 ±.13)	.012 ±.002 (0.3 ±.05)		
Q/QN	Radial Wire/ Non-Magnetic					.787 (20) min	Dia.=.031 ±.004 (0.8 ±.1)			
A/AN	Axial Wire/ Non-Magnetic					1.18 (30) min				

Environmental Tests

MPH1 Series Capacitors are designed and manufactured to meet and exceed the requirements of EIA-198, MIL-PRF-55681 and MIL-PRF-123.

Item	Specifications	Method
Thermal Shock	DWV: the initial value IR: shall be not less than 30% the initial value Capacitance Change: no more than 0.5% or 0.5pF	MIL-STD-202, Method 107, Condition A. At the maximum rated temperature (-55°C and +125°C) stay 30 minutes, the time of removing shall be not more than 3 minutes. Perform the five cycles.
Moisture Resistance		MIL-STD-202, Method 106
Humidity (steady state)	DWV: the initial value IR: the initial value Capacitance Change: no more than 0.3% or 0.3pF	MIL-STD-202, Method 103, Condition A, with 1.5 volts D.C. applied while subjected to an environment of 85°C with 85% relative humidity for 240 hours min.
Life	IR: shall be not less than 30% the initial value Capacitance Change: no more than 0.2%	MIL-STD-202, Method 108, for 2000 hours, at 125°C. Rated voltage \geq 7200V: 100% Rated Voltage D.C. applied. $1500V \leq$ Rated Voltage $<$ 7200V: 120% Rated Volatge D.C. applied. Rated voltage $>$ 1500V: 150% Rated Voltage D.C. applied.

Performance Curve

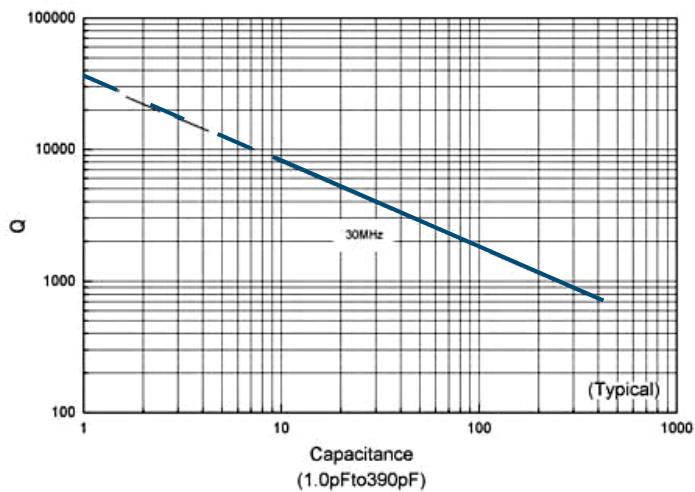




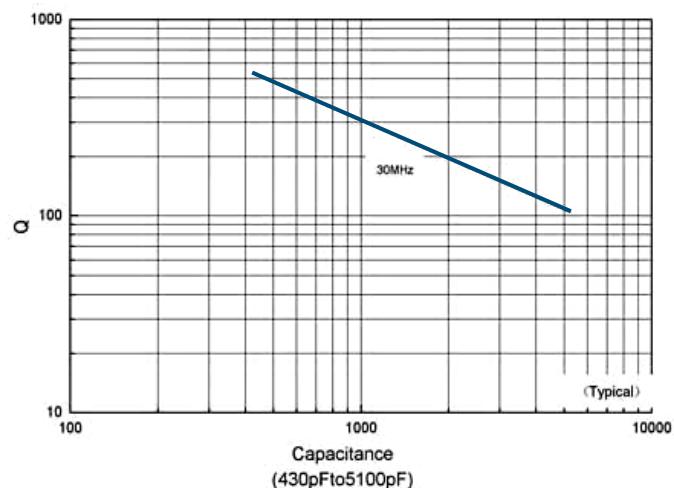
MPH 1 (MHP1-MHPU1)

High Voltage, High Current, High RF Power Capacitors

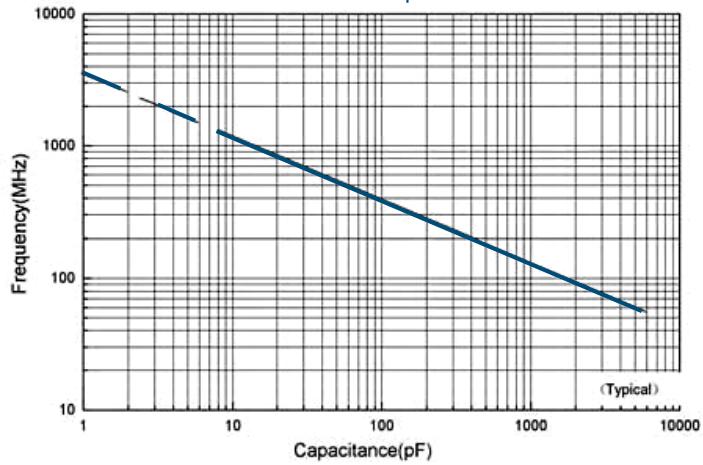
Q vs.Capacitance



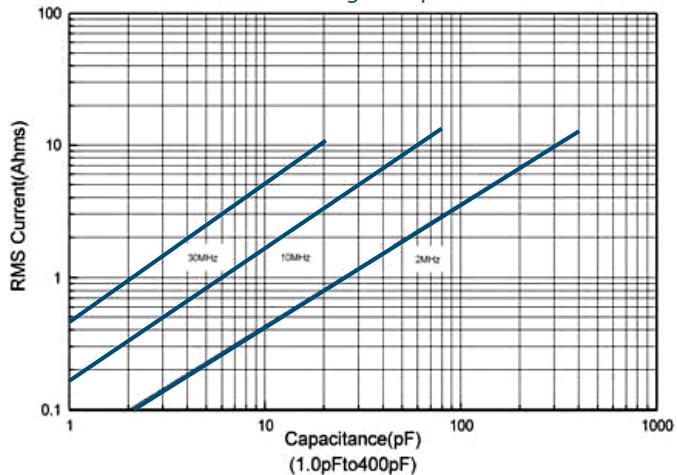
Q vs.Capacitance



Resonance vs.Capacitance



Current Rating vs.Capacitance

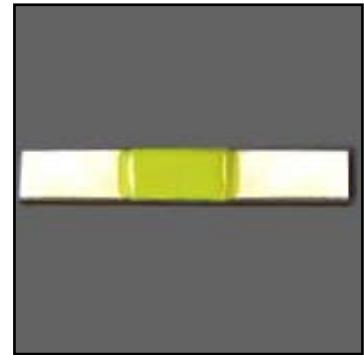


Features

- Capacitance Range: 10pF to 75pF
- High Q Low ESR/ESL
- High RF Power
- Ultra Stable Performance
- Operating Voltages
 - DC Voltage: 7000Vdc
 - RF Voltage: 5000Vrms
- RF Current Rating: 12A rms
- Available with Encapsulation Option

Applications

- MRI Coils
- HF/RF Power Amplifiers
- Plasma Chambers
- Antenna Tuning
- High Power RF Transmitters
- Inductive Heating
- Semiconductor Equipment

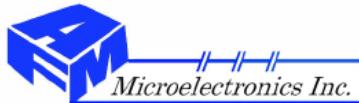


AFM Part Number Code

M	P	H	U	2	B	101	J	K	C	M	B	G
Product Series: M: High Frequency	Product Type: H: High Power				Termination Code: B: Axial Ribbon C: Pd/Ag Term N: Non Magnetic Term (Ag Term, Cu/Sn Plated) P: Solder Dipped W Term in 60/40		Tolerance: F: $\pm 1\%$ G: $\pm 2\%$ J: $\pm 5\%$ K: $\pm 10\%$ M: $\pm 20\%$		Test Code: C: Commercial Test S: Special (Customer Defined) M: Hi-Rel		Packaging: B: Bulk W: Waffle Pack	
Dielectrics: P: Porcelain		Blank: with encapsulated	U: Without encapsulated		Case Size: Sn/Pb 2: 7638		Capacitance Code: 1st two digits are significant: Third digit denotes number of zero(s); R=Decimal point 2R0=2.0pF 101=100pF	Voltage: U: 7000 Vdc		Marking: B: Not Marked M: Marked (Cap code and tolerance) S: Special Marking		Encapsulation: Blank: Without Encapsulated G: Glass encapsulated E: Epoxy encapsulated U: Other polymer encapsulated
					T: Ag Term, Ni/100% Sn Plated (Pb Free) U: Unencapsulated W: Ag Term, Ni Barrier, 90/10 Sn/ Pb Plated							

Specification and Performance

Piezoelectric and Aging Effect:	None
Temperature Range:	-55°C to +125°C
Temperature Coefficient of Capacitance:	+90 \pm 30ppm/°C
Quality Factor (Q) :	>10,000 (1pF \sim 1000pF) at 1MHz; >10,000 (1100pF \sim 5100pF) at 1KHz
Insulation Resistance (IR, Test Voltage 500V):	10 ⁵ MΩ min. at +25°C at rated WVDC; 10 ⁴ MΩ min. at +125°C at rated WVDC
Capacitance Drift:	$\pm 0.02\%$ or ± 0.02 pF, whichever is greater



MPH 2 (MHP2-MHPU2)

High Power, High Current, Silver Ribbon Leaded Capacitors

Standard Capacitance Values

CAP CODE	CAP (pF)	TOL	WVDC V	CAP CODE	CAP (pF)	TOL	WVDC V
100	10			330	33		
110	11			360	36		
120	12			390	39		
130	13			430	43		
150	15			470	47		
160	16			510	51		
180	18	F, G, J, K, M	7000	560	56	F, G, J, K, M	7000
200	20			620	62		
220	22			680	68		
240	24			750	75		
270	27						
300	30						

Chip Dimensions

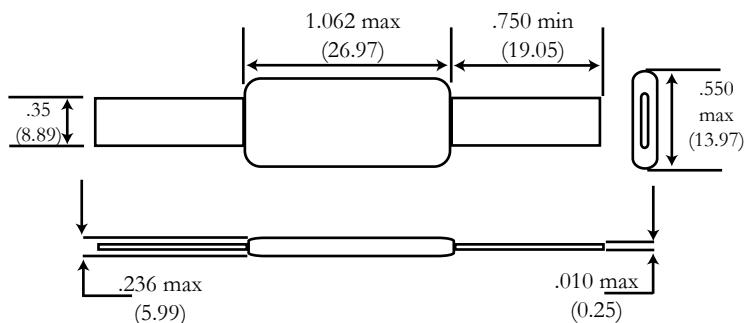
All Dimensions are in Inches (mm)

Dimensional Data	Length of Chip / Encapsulated (L) in (mm)	.760 (19.3)/ 1.062 (26.97) max after encapsulation	.760 max (19.3)
	Width of Chip/ Encapsulated (W) in (mm)	.380 (9.65)/ .550 (13.97) max after encapsulation	.380 max (9.65)
	Thickness of Chip (T) in (mm) (Encapsulated) (max)	.177 (4.50) may increase to .236 (5.99) max. after glass encapsulation	.177 (4.50)
	Ribbon Lead (Axial) in (mm)	Length: .750 (19.05) Width: .350 (8.89) Thickness: .010 (0.25)	.010 max (0.25)

Lead Options

All Dimensions are in Inches (mm)

Construction Features	Ribbon Leaded	Lead Material	Pure Silver (99.9%)	Solder Plated Copper
		Lead Bonding	Silver Brazed	280°C Solder
		Encapsulation	Glass-Ceramic Coated on all 6 Sides	Glass-Ceramic Coated on all 4 Sides

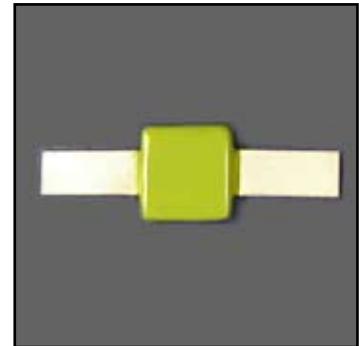


Features

- Capacitance Range: 82pF to 620pF
- High Q Low ESR/ESL
- High RF Power
- Ultra Stable Performance
- Operating Voltages
 - DC Voltage: 3600Vdc to 7000Vdc
 - RF Voltage: 2500Vrms to 5000Vrms
- RF Current Rating 12A rms
- Available with Encapsulation Option, Chip and Leaded Configurations

Applications

- MRI Coils
- HF/RF Power Amplifiers
- Plasma Chambers
- Antenna Tuning
- High Power RF Transmitters
- Inductive Heating
- Semiconductor Equipment

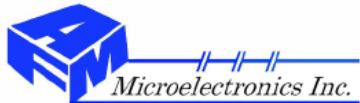


AFM Part Number Code

M	P	H	U	3	B	101	J	K	C	M	B	G
Product Series: M: High Frequency	Product Type: H: High Power				Termination Code: B: Axial Ribbon C: Pd/Ag Term N: Non Magnetic Term (Ag Term, Cu/Sn Plated) P: Solder Dipped W Term in 60/40		Tolerance: F: ±1% G: ±2% J: ±5% K: ±10% M: ±20%		Test Code: C: Commercial Test S: Special (Customer Defined) M: Hi-Rel		Packaging: B: Bulk W: Waffle Pack	
Dielectrics: P: Porcelain		Blank: with encapsulated	U: Without encapsulated		Sn/Pb T: Ag Term, Ni/100% Sn Plated (Pb Free) U: Unencapsulated W: Ag Term, Ni Barrier, 90/10 Sn/ Pb Plated	Case Size: 3: 7676	Capacitance Code: 1st two digits are significant; Third digit denotes number of zero(s); R=Decimal point 2R0=2.0pF 101=100pF	Voltage: R: 3600 Vdc T: 5000 Vdc U: 7000 Vdc		Marking: B: Not Marked M: Marked (Cap code and tolerance) S: Special Marking		Encapsulation: Blank: Without Encapsulated G: Glass encapsulated E: Epoxy encapsulated U: Other polymer encapsulated

Specification and Performance:

Piezoelectric and Aging Effect:	None Exhibited	
Temperature Range:	-55°C to +125°C	
Temperature Coefficient of Capacitance:	+90±30ppm/°C	
Quality Factor (Q) :	>10,000 (1pF~1000pF) at 1MHz; >10,000 (1100pF~5100pF) at 1KHz	
Insulation Resistance (IR, at Rated Voltage):	10 ⁵ MΩ min. at +25°C at rated WVDC; 10 ⁴ MΩ min. at +125°C at rated WVDC	
Capacitance Drift:	±0.02% or ±0.02pF, whichever is greater	



MPH 3 (MHP3-MHPU3)

High Power, High Current, Silver Ribbon Leaded Capacitors

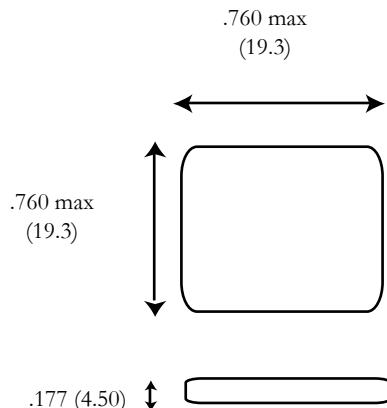
Standard Capacitance Values

CAP CODE	CAP (pF)	TOL	WVDC V	CAP CODE	CAP (pF)	TOL	WVDC V
820	82			271	270		
910	91			301	300		5000
101	100			331	330		
111	110		7000	361	360		
121	120			391	390		
131	130	F, G, J, K, M		431	430		
151	150			471	470	F, G, J, K, M	
161	160			511	510		3600
181	180			561	560		
201	200		5000	621	620		
221	220						
241	240						

Chip Dimensions

All Dimensions are in Inches (mm)

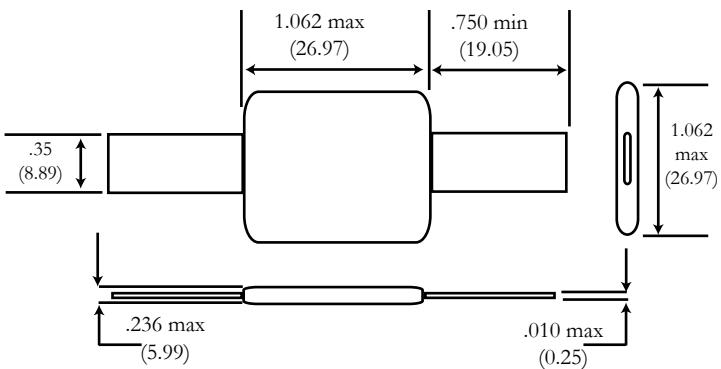
Dimensional Data	Length of Chip / Encapsulated (L) in (mm)	.760 (19.3) / 1.062 (26.97) max after encapsulation
	Width of Chip / Encapsulated (W) in (mm)	.760 (19.3) / 1.062 (26.97) max after encapsulation
	Thickness of Chip (T) in (mm) (Encapsulated) (max)	.177 (4.50) May Increase to .236 (5.99) Max. After Glass Encapsulation
	Ribbon Lead (Axial) in (mm)	Length: .750 (19.05) Width: .350 (8.89) Thickness: .010 (0.25)



Lead Options

All Dimensions are in Inches (mm)

Construction Features	Ribbon Leaded	Lead Material	Pure Silver (99.9%)
		Lead Bonding	Silver Brazed
		Encapsulation	Glass-Ceramic Coated on all 6 Sides Epoxy Encapsulation Optional



AFM Microelectronics Inc

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www.afmmicroelectronics.com



MNH 25

High Voltage, High Current, High RF Power Capacitors

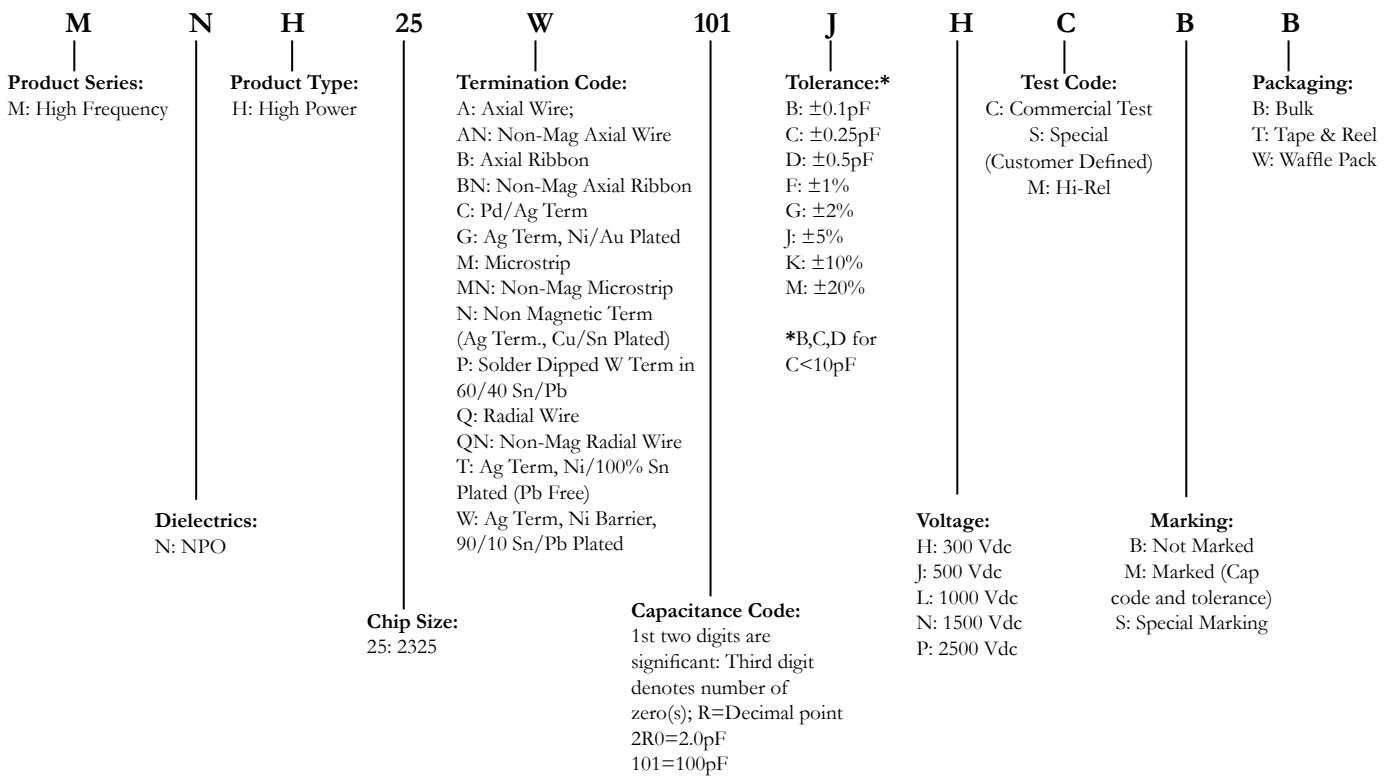
Features

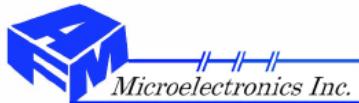
- Capacitance Range: 1pF to 2700pF
 - High Q Low ESR/ESL
 - High RF Power
 - Ultra Stable Performance
 - Operating Voltages
 - DC Voltage: 300Vdc to 2500Vdc
 - RF Voltage: 200Vrms to 1800Vrms
 - RF Current Rating 6A rms
 - Available with Encapsulation Option

Applications

- MRI Coils
 - HF/RF Power Amplifiers
 - Plasma Chambers
 - Antenna Tuning
 - High Power RF Transmitters
 - Inductive Heating
 - Semiconductor Equipment

AFM Part Number Code





MNH 25

High Voltage, High Current, High RF Power Capacitors

Standard Capacitance Values

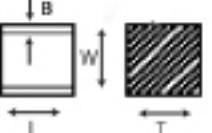
Cap. Code	Cap. pF	Tol.	WVDC V	Cap Code	Cap. pF	Tol.	WVDC V	Cap Code	Cap. pF	Tol.	WVDC V
1R0	1.0	C, D	2500	180	18	G, J, K, M	2500	331	330	G, J, K, M	1500
1R2	1.2			220	22			391	390		
1R5	1.5			270	27			471	470		
1R8	1.8			330	33			561	560		
2R2	2.2			390	39			681	680		
2R7	2.7			470	47			821	820		
3R3	3.3			560	56			102	1000		
3R9	3.9			680	68			122	1200		
4R7	4.7			820	82			152	1500		
5R6	5.6			101	100			182	1800		
6R8	6.8			121	120			222	2200		
8R2	8.2			151	150			272	2700		
100	10	G, J, K, M		181	180						
120	12			221	220						
150	15			271	270						

* Special capacitance, tolances and WVDC are available, please consult with AFM.

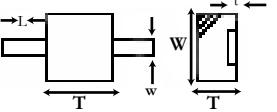
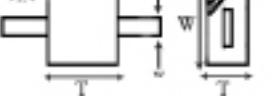
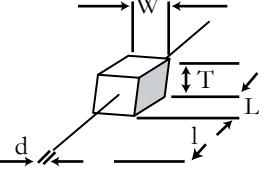
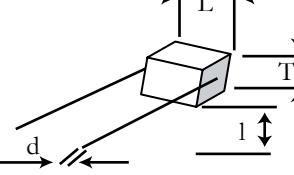
Specification and Performance

Piezoelectric and Aging Effect:	None
Temperature Range:	-55°C to +125°C
Temperature Coefficient of Capacitance:	0±30ppm/°C
Quality Factor (Q) :	>10,000 (1pF~1000pF) at 1MHz >10,000 (1100pF~2700pF) at 1KHz
Insulation Resistance (IR, at Rated Voltage):	1pF~2700pF: 10 ⁵ MΩ min. at +25°C at rated WVDC 10 ⁴ MΩ min. at +125°C at rated WVDC Max. test voltage is 500VDC.
Dielectric Withstand Voltage (DWV):	1pF~470pF: 120% of rated WVDC for 5 secs; 560pF~1200pF: 150% of rated WVDC for 5 secs; 1500pF~2700pF: 250% of rated WVDC for 5 secs;
Capacitance Drift:	±0.02% or ±0.02pF, whichever is greater

Chip Dimensions

Termination	Outline	L in (mm)	W in (mm)	T in (mm)		B in(mm)
				min	max	
MNH25C, MNH25G, MNH25N, MNH25T, MNH25W		.230 $.020 \sim .010$ (5.84 $.51 \sim .25$))	$.250 \pm .015$ (6.35 ± 0.38)	.138 (3.50)	.165 (4.19)	.040 (1.02) max
MNH25P		230 $.070 \sim .010$ (5.84 $.78 \sim .25$)				

Lead Options

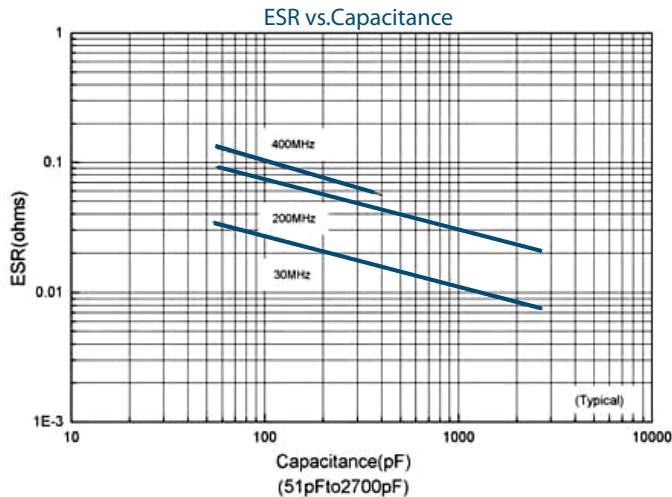
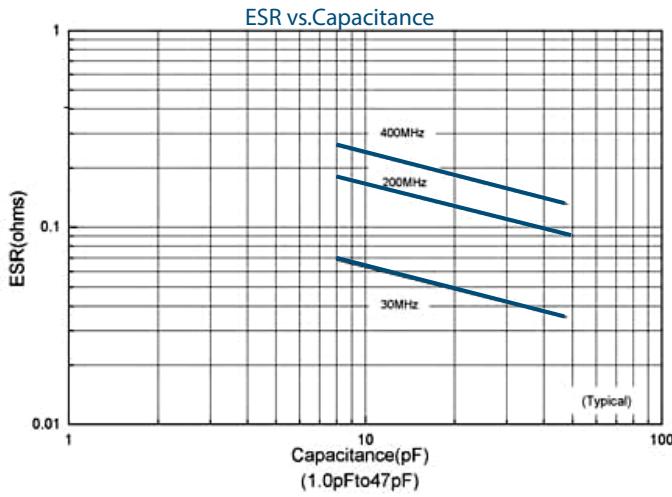
Term Code	Type	Outline	Dimensions in (mm)				Lead Style Designation
			Add .070 inches (1.77mm) if Encapsulated	L	W	T	
M/MN	Microstrip/ Non-Magnetic			$.245 \pm .025$ (6.22 ± 0.64)	$.250 \pm .015$ (6.35 ± 0.38)	.145(3.68) Max for $C \leq 680\text{pF}$	1. Silver Braced leads attached for 99.9% Silver Leads l: .500(12.7)min W: $.240 \pm .005$ (6.10 ± 0.127) t: $.010 \pm .001$ (0.25 ± 0.025)
B/BN	Axial Ribbon/Non-Magnetic					.165(4.19) Max for $C > 680\text{pF}$	
A/AN	Axial Wire/ Non-Magnetic			$.245 \pm .025$ (6.22 ± 0.64)	$.250 \pm .015$ (6.35 ± 0.38)	.145(3.68) Max for $C \leq 680\text{pF}$	Solder Coated Copper l: .500(12.7)min d: $.024 \pm .002$ (0.610 ± 0.051)
Q/QN	Radial Wire/ Non-Magnetic					.165(4.19) Max for $C > 680\text{pF}$	Leads Attached with High Melting Temperature Solder Alloy

Environmental Tests

MNH25 Series Capacitors are designed and manufactured to meet and exceed the requirements of EIA-198, MIL-PRF-55681 and MIL-PRF-123.

Item	Specifications	Method
Thermal Shock	DWV: the initial value IR: shall be not less than 30% the initial value Capacitance Change: no more than 0.5% or 0.5pF	MIL-STD-202, Method 107, Condition A. At the maximum rated temperature (-55°C and +125°C) stay 30 minutes, the time of removing shall be not more than 3 minutes. Perform the five cycles.
Moisture Resistance		MIL-STD-202, Method 106
Humidity (steady state)	DWV: the initial value IR: the initial value Capacitance Change: no more than 0.3% or 0.3pF	MIL-STD-202, Method 103, Condition A, with 1.5 volts D.C. applied while subjected to an environment of 85°C with 85% relative humidity for 240 hours min.
Life	IR: shall be not less than 30% the initial value Capacitance Change: no more than 0.2%	MIL-Std-202, Method 108, for 2000 hours, at 125°C. no less than 1500V, 120% Rated voltage D.C. applied; less than 1500V, 150% rated voltage D.C. applied.

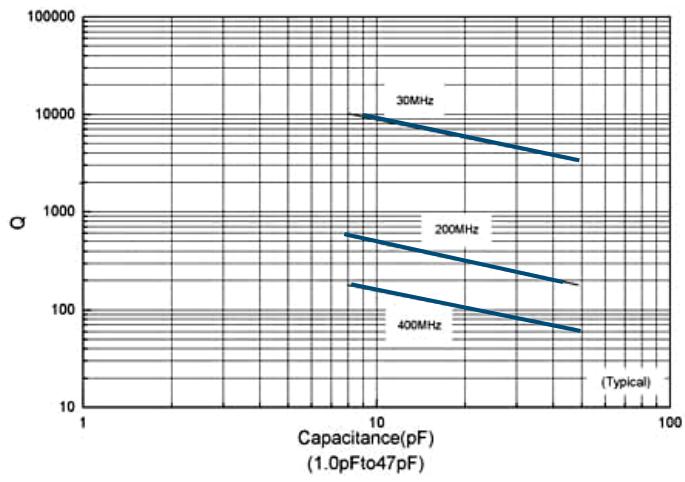
Performance Curve



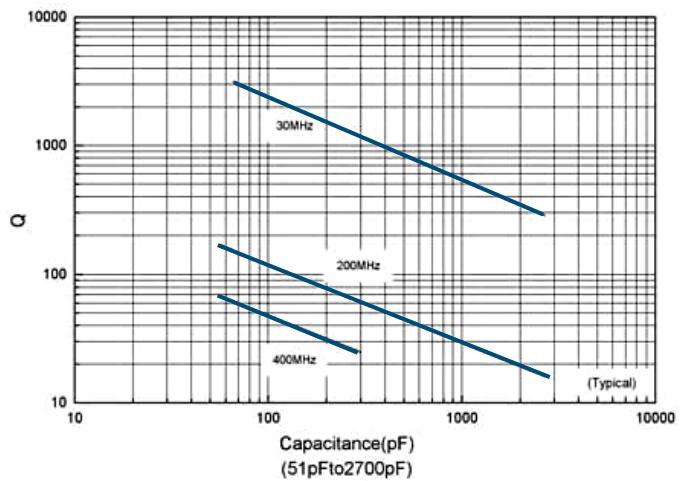
MNH 25

High Voltage, High Current, High RF Power Capacitors

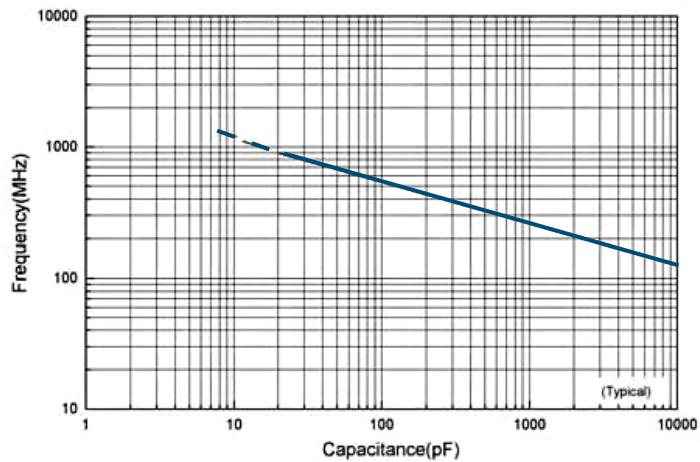
Q vs.Capacitance



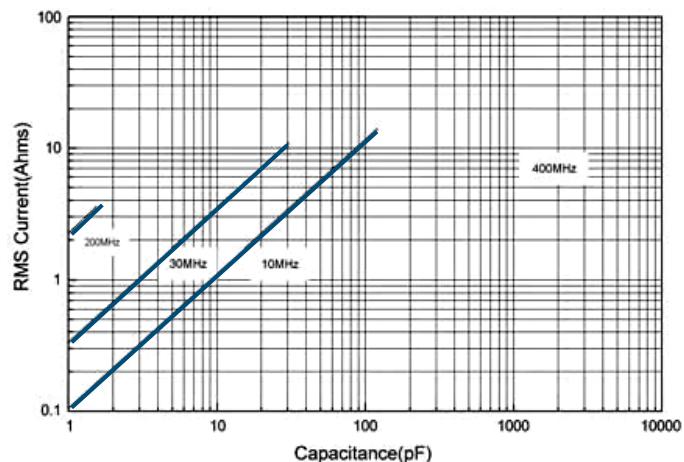
Q vs.Capacitance



Resonance vs.Capacitance



Current Rating vs.Capacitance

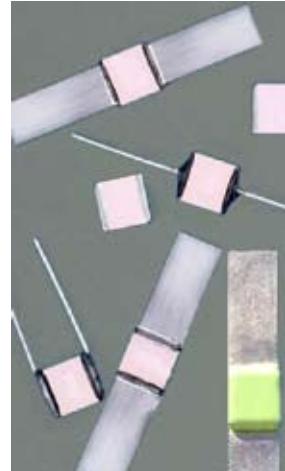


Features

- Capacitance Range: 1pF to 2200pF
- High Q Low ESR/ESL
- High RF Power
- Ultra Stable Performance
- Operating Voltages
 - DC Voltage: 1000Vdc to 3600Vdc
 - RF Voltage: 425Vrms to 2500Vrms
- Extended WVDC up to 7200 Vdc
- RF Current Rating 12A rms
- Available with Encapsulation Option

Applications

- MRI Coils
- HF/RF Power Amplifiers
- Plasma Chambers
- Antenna Tuning
- High Power RF Transmitters
- Inductive Heating
- Semiconductor Equipment



AFM Part Number Code

M	N	H	U	1	B	101	J	R	C	M	B	G
Product Series: M: High Frequency	Product Type: H: High Power				Termination Code: A: Axial Wire; AN: Non-Mag Axial Wire B: Axial Ribbon BN: Non-Mag Axial Ribbon C: Pd/Ag Term G: Ag Term, Ni/Au Plated M: Microstrip MN: Non-Mag Microstrip N: Non Magnetic Term (Ag Term., Cu/Sn Plated) P: Solder Dipped W Term in 60/40 Sn/Pb Q: Radial Wire QN: Non-Mag Radial Wire T: Ag Term, Ni/100% Sn Plated (Pb Free) W: Ag Term, Ni Barrier, 90/10 Sn/Pb Plated	Tolerance: F: ±1% G: ±2% J: ±5% K: ±10% M: ±20%			Test Code: C: Commercial Test S: Special (Customer Defined) M: Hi-Rel		Packaging: B: Bulk W: Waffle Pack	
Blank: with encapsulated U: Without encapsulated								Voltage: J: 500 Vdc L: 1000 Vdc P: 2500 Vdc R: 3600 Vdc T: 5000 Vdc U: 7200 Vdc		Marking: B: Not Marked M: Marked (Cap code and tolerance) S: Special Marking		Encapsulation: Blank: Without Encapsulated G: Glass encapsulated E: Epoxy encapsulated U: Polymer Coating
Dielectrics: P: NPO					Capacitance Code: 1st two digits are significant; Third digit denotes number of zero(s); R=Decimal point 2R0=2.0pF 101=100pF							
Case Size: 1: 3838												

Standard Capacitance Values

*STD.:Standard Voltage; EXT.: Extended Voltage

CAP CODE	CAP (pF)	TOL	RATED WVdc		CAP CODE	CAP (pF)	TOL	RATED WVdc		CAP CODE	CAP (pF)	TOL	RATED WVdc						
			STD.*	EXT.*				STD.	EXT.				STD.	EXT.					
1R0	1.0	B, C, D	3600	7200	220	22	F, G, J, K, M	3600	7200	471	470	F, G, J, K, M	1000	NA					
1R2	1.2				270	27				561	560		3600						
1R5	1.5				330	33				681	680								
1R8	1.8				390	39				821	820								
2R2	2.2				470	47				102	1000								
2R7	2.7				560	56				122	1200								
3R3	3.3				680	68				152	1500								
3R9	3.9				820	82				182	1800								
4R7	4.7				101	100				222	2200								
5R6	5.6				121	120				272	2700	G, J, K, M	500						
6R8	6.8				151	150				332	3300								
8R2	8.2				181	180				472	4700								
100	10	F, G, J, K, M			221	220	NA			512	5100								
120	12				271	270													
150	15				331	330													
180	18				391	390													

* Special capacitance, tolerances and WVDC are available, please consult with AFM.

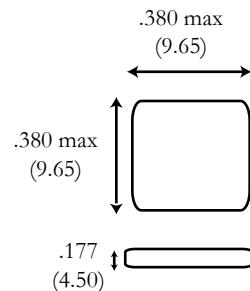
Specification and Performance

Piezoelectric and Aging Effect:	None
Temperature Range:	-55°C to +125°C
Temperature Coefficient of Capacitance:	0±30ppm/°C
Quality Factor (Q) :	>10,000 (1pF~1000pF) at 1MHz >10,000 (1100pF~5100pF) at 1KHz
Insulation Resistance (IR, at Rated Voltage):	10 ⁵ MΩ min. at +25°C at rated WVDC 10 ⁴ MΩ min. at +125°C at rated WVDC
Dielectric Withstand Voltage (DWV):	1pF~680pF: 120% of rated WVDC for 5 secs; 820pF~2200pF: 150% of rated WVDC for 5 secs; 2700pF~5100pF: 250% of rated WVDC for 5 secs;
Capacitance Drift:	±0.02% or ±0.02pF, whichever is greater

Chip Dimensions

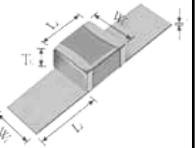
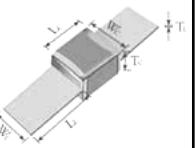
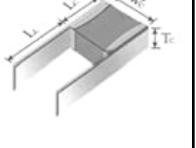
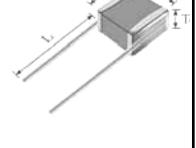
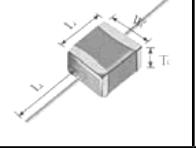
All Dimensions are in Inches (mm)

Dimensional Data	Length of Chip / Encapsulated (L) in (mm)	.380 (9.65) / .550(13.97) max after encapsulation
	Width of Chip / Encapsulated (W) in (mm)	.380 (9.65) / .550(13.97) max after encapsulation
	Thickness of Chip (T) in (mm) (Encapsulated) (max)	.177 (4.50) may increase to .236 (5.99) max. after glass encapsulation



Lead Options

All Dimensions are in Inches (mm)

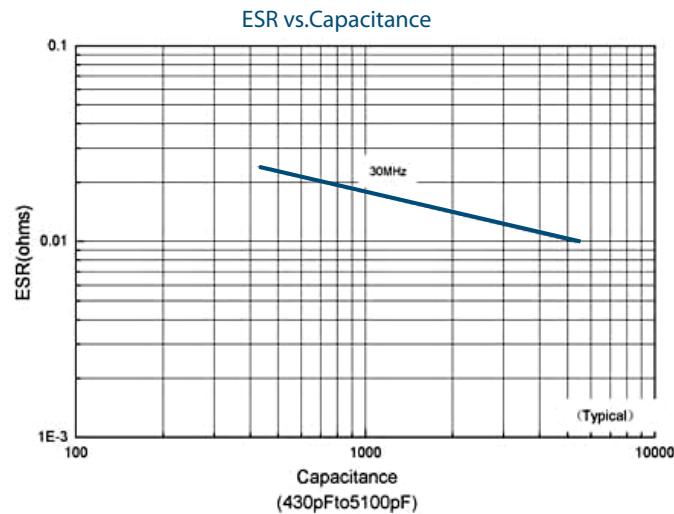
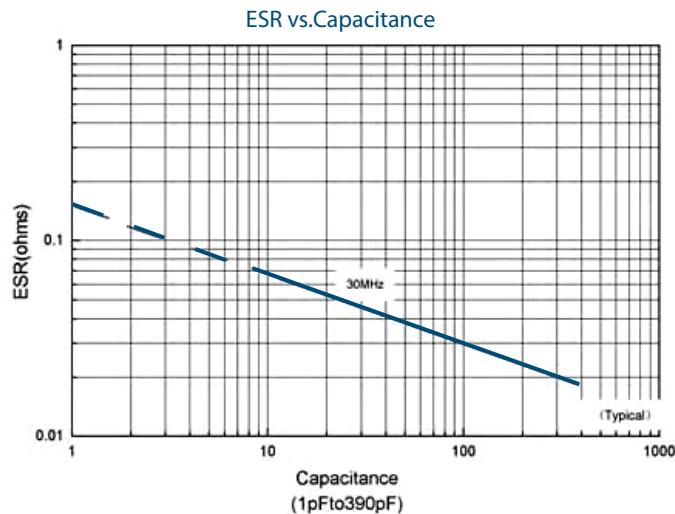
Term Code	Type	Outlines	Capacitor Dimensions			Lead Dimensions			Lead Material	
			Length (Lc)	Width (Wc)	Thickness (Tc)	Length (Lc)	Width (Wc)	Thickness (Tc)		
M/MN	Microstrip/ Non-Magnetic		.380 +.015~-.010 (9.65 +0.38~-0.25)	.038 ±.010 (9.65±0.25)	.177 (4.5) max	.750 (19.05) min	.350 ±.010 (8.89 ±0.25)	.010 ±.005 (0.25 ±0.13)	Solder-plated Copper leaded (Pure Silver Ribbon with Glass Encapsulation)	
B/BN	Axial Ribbon/ Non-Magnetic					.394 ±.039 (10 ±1)	.114 ±.005 (2.9 ±0.13)	.012 ±.002 (0.3 ±0.05)		
R	Radial Ribbon					.787 (20) min	Dia.=.031 ±.004 (0.8 ±0.1)			
Q/QN	Radial Wire/ Non-Magnetic					1.18 (30) min				
A/AN	Axial Wire/ Non-Magnetic									

Environmental Tests

MNH1 Series Capacitors are designed and manufactured to meet and exceed the requirements of EIA-198, MIL-PRF-55681 and MIL-PRF-123.

Item	Specifications	Method
Thermal Shock	DWV: the initial value IR: shall be not less than 30% the initial value Capacitance Change: no more than 0.5% or 0.5pF	MIL-STD-202, Method 107, Condition A. At the maximum rated temperature (-55°C and +125°C) stay 30 minutes, the time of removing shall be not more than 3 minutes. Perform the five cycles.
Moisture Resistance		MIL-STD-202, Method 106
Humidity (steady state)	DWV: the initial value IR: the initial value Capacitance Change: no more than 0.3% or 0.3pF	MIL-STD-202, Method 103, Condition A, with 1.5 volts D.C. applied while subjected to an environment of 85°C with 85% relative humidity for 240 hours min.
Life	IR: shall be not less than 30% the initial value Capacitance Change: no more than 0.2%	MIL-STD-202, Method 108, for 2000 hours, at 125°C. Rated voltage \geq 7200V: 100% Rated Voltage D.C. applied. $1500V \leq \text{Rated Voltage} < 7200V$: 120% Rated Voltage D.C. applied. Rated voltage $>$ 1500V: 150% Rated Voltage D.C. applied.

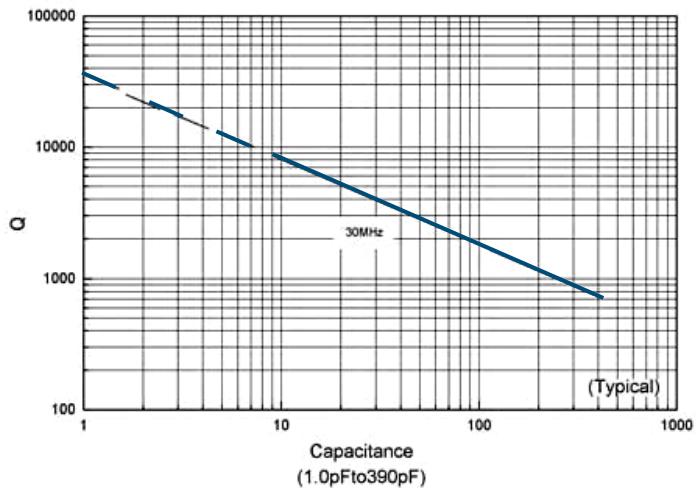
Performance Curve



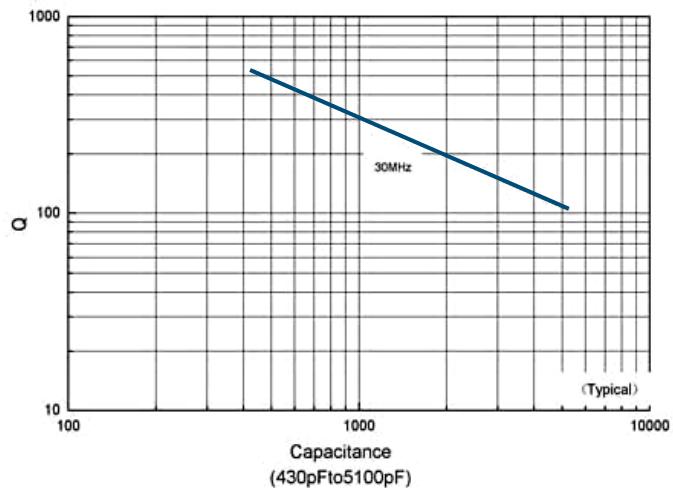
MNH 1

High Voltage, High Current, High RF Power Capacitors

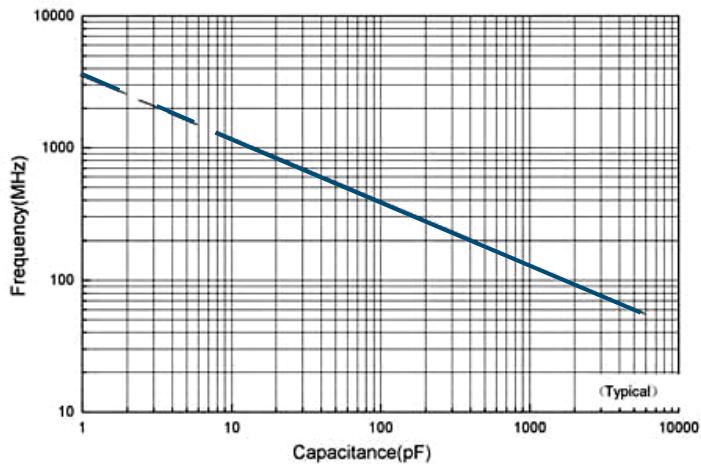
Q vs.Capacitance



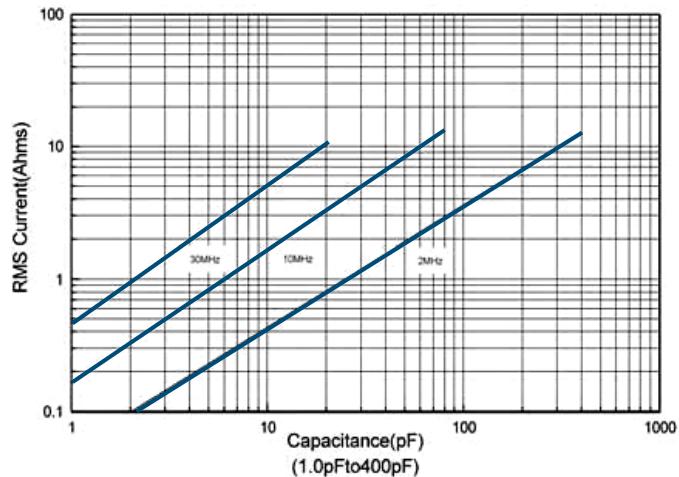
Q vs.Capacitance

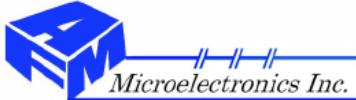


Resonance vs.Capacitance



Current Rating vs.Capacitance



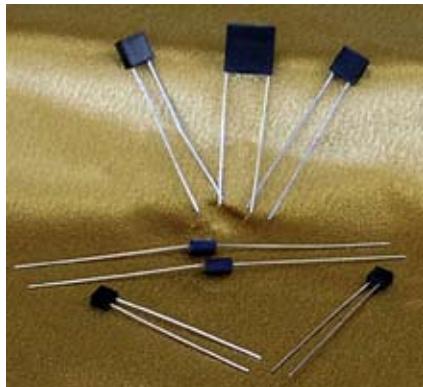


HNT

High Temperature 200°C "T" Series Axial and Radial Leaded NPO Capacitors

Features

- Capacitance Range: 1.0pF to .15μF
 - Operating Temperature: -55°C to +200°C
 - Rated Voltage: 100V and 200V
 - Ultra-Stable Performance
 - Unique Polymer (300°C) Case
 - Conformal Coated Option

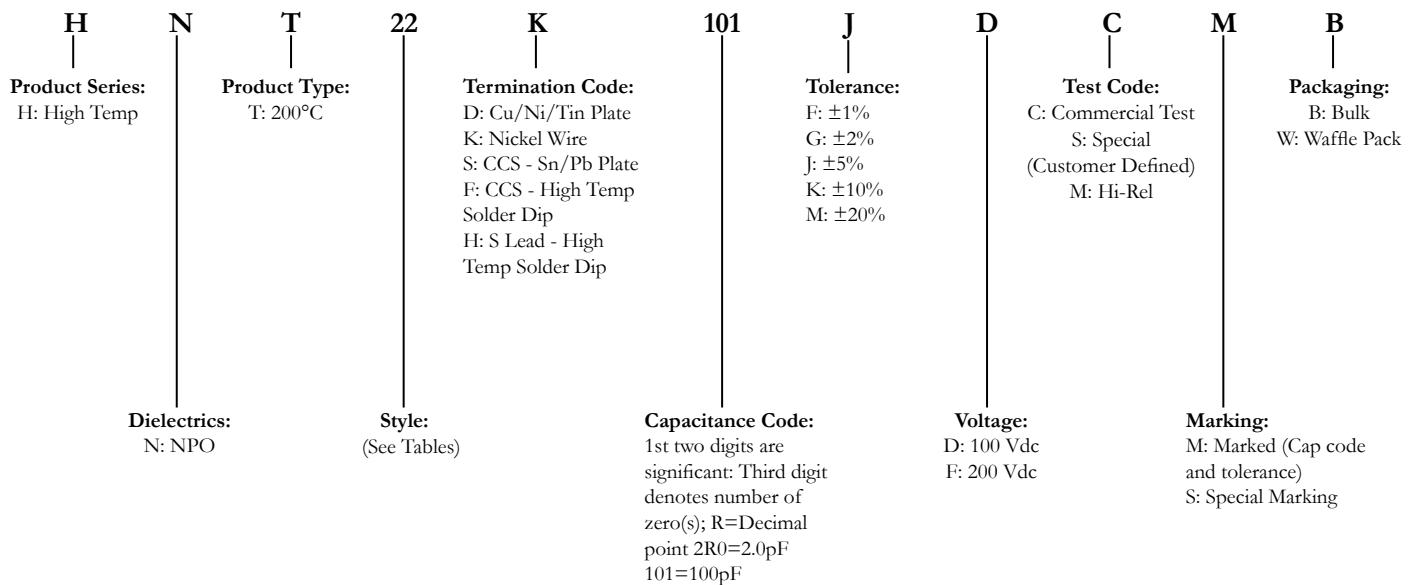


The HNT Series is designed using an ultra-stable, high insulation resistance, and low loss NPO (COG) dielectric system which exhibits little change in capacitance over the operating temperature range. These high temperature capacitors are capable of continuous operating at 200°C. Available in both axial and radial lead configurations, the HNT comes standard in 100Vdc and 200Vdc voltage ratings. Higher operating voltages, higher capacitance values and extended sizes are available upon request.

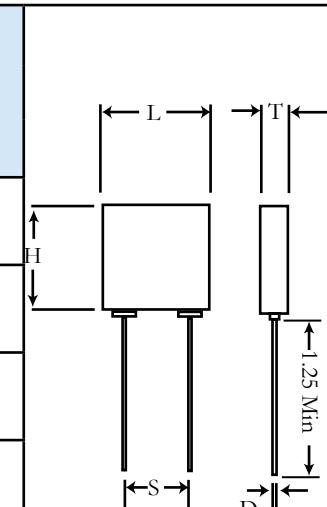
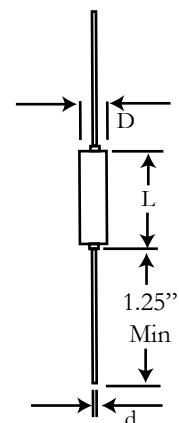
Applications

Typical Functional Applications: Bypass, Coupling, Tuning, Feedback, Impedance Matching and DC Blocking. Devices such as RF oscillators and precision timing circuits requiring a predictable temperature coefficient are examples of devices utilizing these capacitors.

AFM Part Number Code



NPO Dielectric Capacitance Ranges and Size Information

Style	Capacitance Ranges				Sizes (Max) Inches (mm)				Lead Spacing ±0.30 (S)	 <p>Diagram showing dimensions for radial leaded NPO capacitors. Labels include: L (lead length), T (lead spacing), H (height), D (diameter), and S (lead spacing). Dimensions are given in inches and millimeters.</p>		
	100 Vdc		200 Vdc		Width (W)	Height (H)	Thickness (T)	Diameter (D)				
	Min	Max	Min	Max								
12	1.0pF	.010μF	1.0pF	8200pF	.200 (5.08)	.200 (5.08)	.100 (2.54)	.025 (.635) ±.002 (.051)	.200 (5.08)			
22	100pF	.033μF	470pF	.027μF	.300 (7.62)	.300 (7.62)	.100 (2.54)	.025 (.635) ±.002 (.051)	.200 (5.08)			
25	270pF	.047μF	560pF	.039μF	.300 (7.62)	.300 (7.62)	.150 (3.81)	.025 (.635) ±.002 (.051)	.200 (5.08)			
38	.010μF	.100μF	.010μF	.100μF	.500 (12.70)	.500 (12.70)	.250 (6.35)	.025 (.635) ±.002 (.051)	.400 (10.16)			
45	.010μF	.150μF	.010μF	.120μF	.675 (17.15)	.500 (12.70)	.250 (6.35)	.025 (.635) ±.002 (.051)	.400 (10.16)			
Axial Leaded NPO Capacitors						Diameter (D)	Length (L)	Lead Diameter (d)	 <p>Diagram showing dimensions for axial leaded NPO capacitors. Labels include: D (diameter), L (length), and d (lead diameter). Dimensions are given in inches and millimeters.</p>			
	10	12pF	1000pF	10pF	820pF	.100 (2.54)	.170 (4.32)	.025 (.635) ±.002 (.051)				
	17	16pF	.010μF	16pF	8200pF	.135 (3.43)	.260 (6.60)	.025 (.635) ±.002 (.051)				
	30	1000pF	.033μF	1000pF	.027μF	.155 (3.94)	.400 (10.16)	.025 (.635) ±.002 (.051)				
	40	.010μF	.047μF	.010μF	.039μF	.200 (5.08)	.500 (12.70)	.025 (.635) ±.002 (.051)				
	49	.010μF	.100μF	.010μF	.082μF	.375 (9.52)	.750 (19.05)	.025 (.635) ±.002 (.051)				

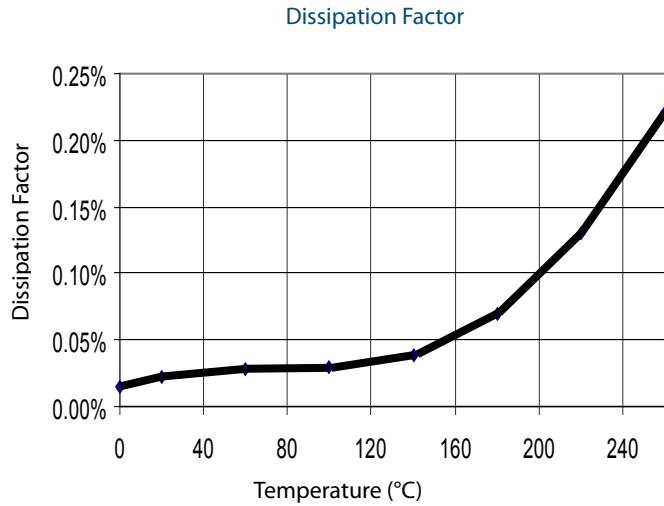
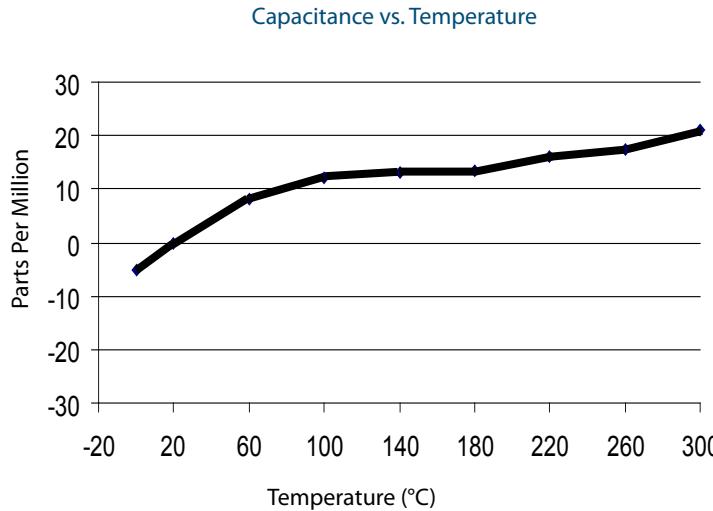
Testing and Burn In

100% of AFM's high temperature capacitors undergo standard commercial testing. High reliability testing, customer SCD test protocols, and optional extended tests are also available. For more information see testing pages at the end of the catalog. AFM has the test facilities to perform electrical characterization measurements and burn in up to 300°C.

Specification and Performance

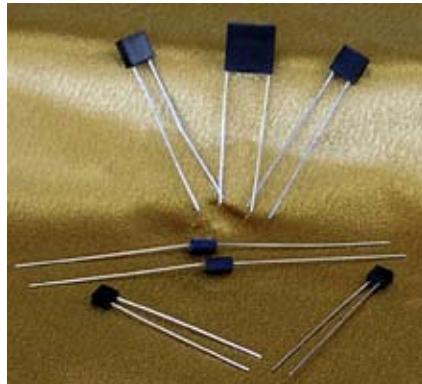
Piezoelectric and Aging Effect:	None
Temperature Range:	-55°C to +200°C
Temperature Coefficient of Capacitance:	0±30ppm/°C
Dissipation Factor:	0.15% max at 200°C
Insulation Resistance (IR, at Rated Voltage):	>10 ⁴ MΩ at 200°C or 100MΩμF Whichever is Less
Dielectric Withstand Voltage (DWV):	150% of Rated Voltage
Capacitance Drift:	±0.02% or ±0.02pF

Performance Curve



Features

- Capacitance Range: 1000pF to 2.2μF
- Operating Temperature: -55°C to +200°C
- Rated Voltage: 100V and 200V
- Conformal Coated
- Unique High Temperature 300°C Polymer Case



The HXT Series is designed using a high insulation resistance, high dielectric constant barium titanate for high capacitance per unit volume. These high temperature capacitors are capable of continuous operating at 200°C. The dissipation factor of these capacitors improve five-fold at elevated temperature when compared to the dielectric loss at 25°C. The HXT comes standard with a 100Vdc and 200Vdc voltage rating. Higher voltage ratings are available upon request. See AFM's VXT line of 200°C rated 1kV to 4kV capacitors.

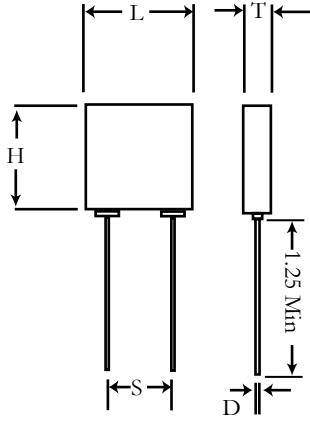
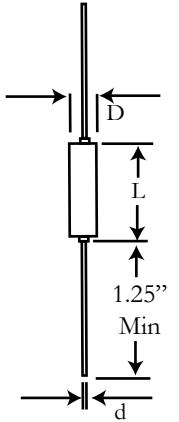
Applications

Typical Functional Applications: Bypass, Coupling, Tuning, Feedback, Impedance Matching and DC Blocking. Devices such as RF oscillators and precision timing circuits requiring a predictable temperature coefficient are examples of devices utilizing these capacitors.

AFM Part Number Code

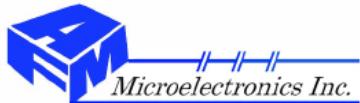
H	X	T	22	D	101	J	D	C	M	B
Product Series: H: High Temp		Product Type: T: 200°C		Termination Code: D: Cu/Ni/Tin Plate K: Nickel Wire S: CCS - Sn/Pb Plate F: CCS - High Temp Solder Dip H: S Lead - High Temp Solder Dip		Tolerance: J: ±5% K: ±10% M: ±20%		Test Code: C: Commercial Test S: Special (Customer Defined) M: Hi-Rel		Packaging: B: Bulk W: Waffle Pack
Dielectrics: X: X7R			Style: (See Tables)		Capacitance Code: 1st two digits are significant: Third digit denotes number of zero(s); R=Decimal point 2R0=2.0pF 101=100pF		Voltage: D: 100V F: 200V		Marking: M: Marked (Cap code and tolerance) S: Special Marking	

X7R Dielectric Capacitance Ranges and Size Information

Style	Capacitance Ranges				Sizes (Max) Inches (mm)				Lead Spacing ±0.30 (S)	 <p>Diagram showing dimensions for radial leaded X7R capacitors. Labels include: L (lead length), T (lead spacing), H (height), S (lead spacing between leads), and D (diameter). A note indicates 1.25 Min.</p>		
	100 Vdc		200 Vdc		Width (W)	Height (H)	Thickness (T)	Diameter (D)				
	Min	Max	Min	Max								
12	1000pF	.027μF	1000pF	.018μF	.200 (5.08)	.200 (5.08)	.100 (2.54)	.025 (.635) ±.002 (.051)	.200 (5.08)			
22	1000pF	.033μF	1000pF	.120μF	.300 (7.62)	.300 (7.62)	.100 (2.54)	.025 (.635) ±.002 (.051)	.200 (5.08)			
25	.010μF	.047μF	.010μF	.150μF	.300 (7.62)	.300 (7.62)	.150 (3.81)	.025 (.635) ±.002 (.051)	.200 (5.08)			
38	.010μF	1.5μF	.010μF	.500μF	.500 (12.70)	.500 (12.70)	.250 (6.35)	.025 (.635) ±.002 (.051)	.400 (10.16)			
45	.100μF	2.2μF	.100μF	1.0μF	.675 (17.15)	.500 (12.70)	.250 (6.35)	.025 (.635) ±.002 (.051)	.400 (10.16)			
Axial Leaded X7R Capacitors	Capacitance Ranges					Diameter (D)	Length (L)	Lead Diameter (d)	 <p>Diagram showing dimensions for axial leaded X7R capacitors. Labels include: D (diameter), L (length), and d (lead diameter). A note indicates 1.25 Min.</p>			
	10	1000pF	.022μF	1000pF	.018μF	.100 (2.54)	.170 (4.32)	.025 (.635) ±.002 (.051)				
	17	1000pF	.100μF	1000pF	.027μF	.135 (3.43)	.260 (6.60)	.025 (.635) ±.002 (.051)				
	30	.010μF	.180μF	.015μF	.056μF	.155 (3.94)	.400 (10.16)	.025 (.635) ±.002 (.051)				
	40	.010μF	.560μF	.027μF	.390μF	.200 (5.08)	.500 (12.70)	.025 (.635) ±.002 (.051)				
	49	.100μF	1.0μF	.100μF	.680μF	.375 (9.52)	.750 (19.05)	.025 (.635) ±.002 (.051)				

Testing and Burn In

100% of AFM's high temperature capacitors undergo standard commercial testing. High reliability testing, customer SCD test protocols, and optional extended tests are also available. For more information see testing pages at the end of the catalog. AFM has the test facilities to perform electrical characterization measurements and burn in up to 300°C.



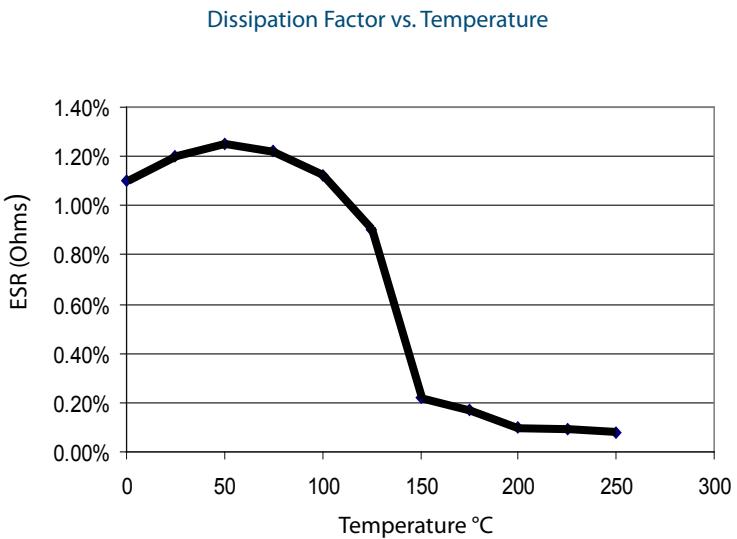
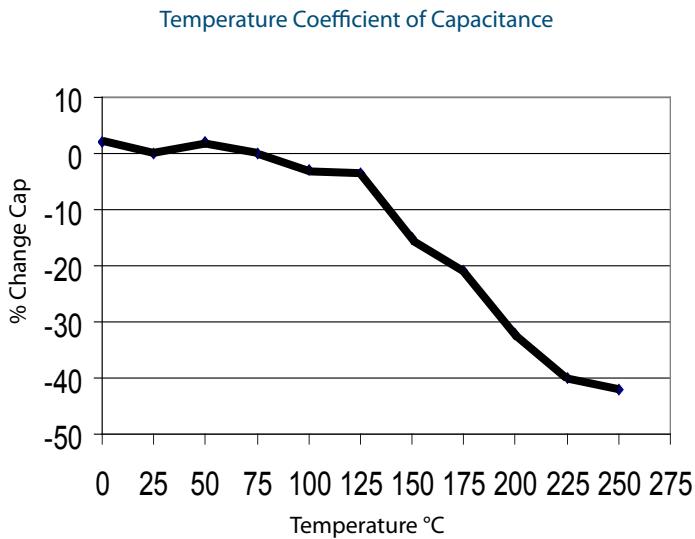
HXT

High Temperature 200°C "T" Series
Axial and Radial Leaded X7R Capacitors

Specification and Performance

Dielectric Absorption:	<2.0% -55°C to 120°C None Exhibited Above 125°C (Paraelectric)
Temperature Range:	-55°C to +200°C
Temperature Coefficient of Capacitance:	+15% , -40%
Dissipation Factor:	1.2% at 25°C<2.0% at 200°C
Insulation Resistance (IR, at Rated Voltage):	> 10 ⁴ MΩ at 25°C > 10 ³ MΩ at 200°C
Dielectric Withstand Voltage (DWV):	150% of Rated Voltage
Environmental and Mechanical:	Capable of Meeting MIL-PRF-39014 Requirements

Performance Curve



Features

- Capacitance Range: 0.1pF to 1000pF
- Operating Temperature: -55°C to +200°C
- Rated Voltage: 100V and 50V
- High Q
- Ultra-Stable Performance
- Low ESR/ESL
- High Self-Resonance



MNT11 series is high temperature RF/Microwave capacitors incorporating an ultra-stable COG (NPO) dielectric system. These capacitors are designed for continuous operating at 200°C, are low loss, high insulation resistance, and exhibit little change in capacitance over the operating temperature range. The MNT11 Series is available with 100V with a rating up to 470pF and a 50V rating up to 1000pF. This Series can be supplied compliant to the EU's **RoHS** standard.

Applications

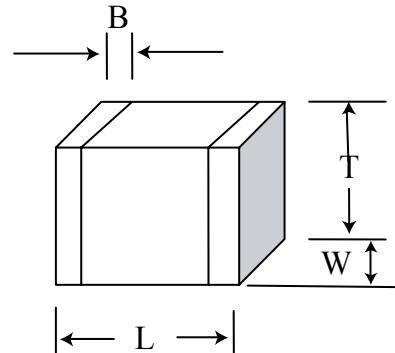
Typical Functional Applications: Bypass, Coupling, Tuning, Feedback, Impedance Matching and DC Blocking. Devices such as RF oscillators and precision timing circuits requiring a predictable temperature coefficient are examples of devices utilizing these capacitors.

AFM Part Number Code

M	N	T	11	W	101	J	D	C	B	B
Product Series: M: High Frequency		Product Type: T: 200°C		Termination Code: C: Pd/Ag Term G: Ag Term, Ni/Au Plated N: Non Magnetic Term (Ag Term, Cu/Sn Plated) W: Ag Term, Ni Barrier, 90/10 Sn/Pb Plated		Tolerance: B: ±0.1pF C: ±0.25pF D: ±0.5pF F: ±1% G: ±2% J: ±5% K: ±10% M: ±20%		Test Code: C: Commercial Test S: Special (Customer Defined) M: Hi-Rel		Packaging: B: Bulk T: Tape & Reel W: Waffle Pack
Dielectrics: N: NPO		Chip Size: 11: 0505			Capacitance Code: 1st two digits are significant: Third digit denotes number of zero(s); R=Decimal point 2R0=2.0pF 101=100pF		Voltage: B: 50Vdc D: 100 Vdc		Marking: B: Not Marked M: Marked (Cap code and tolerance) S: Special Marking	

Chip Dimensions

Length	.057in (1.5mm)
Width	.055in (1.4mm)
Thickness	.055in (1.4mm)
Band	.015in (0.38mm)



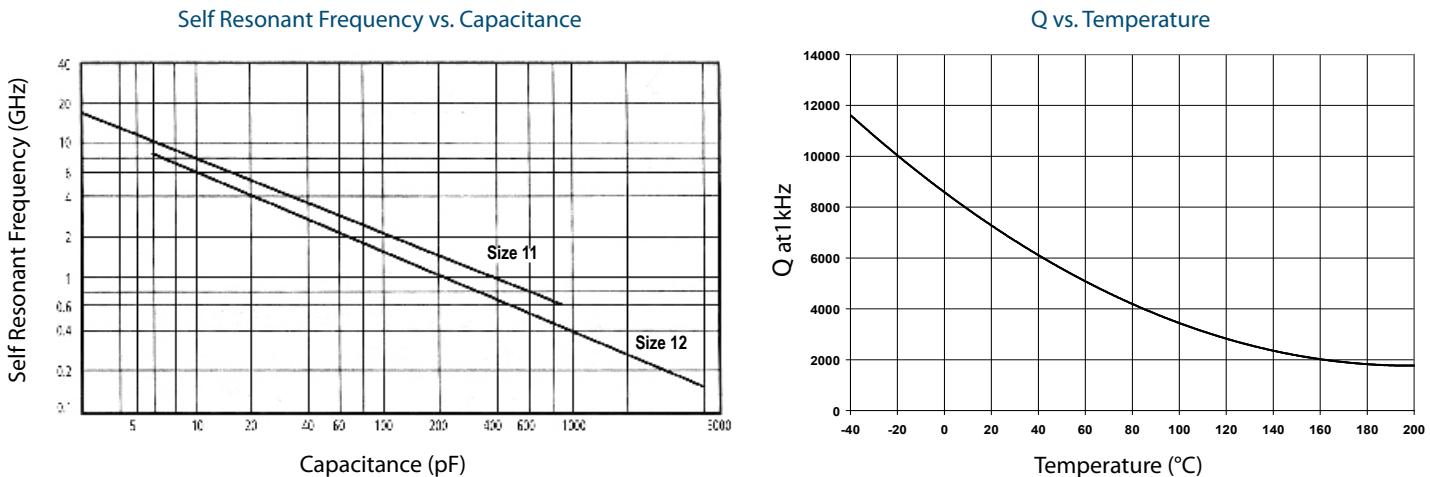
Standard Capacitance Values

CAP CODE	CAP (pF)	TOL	RATED WVdc	CAP CODE	CAP (pF)	TOL	RATED WVdc	CAP CODE	CAP (pF)	TOL	RATED WVdc	CAP CODE	CAP (pF)	TOL	RATED WVdc
0R1	0.1	B	100	2R4	2.4	B, C, D	100	200	20	F, G, J, K, M	100	151	150	100	100
0R2	0.2			2R7	2.7			220	22			161	160		
0R3	0.3			3R0	3.0			240	24			181	180		
0R4	0.4			3R3	3.3			270	27			201	200		
0R5	0.5			3R6	3.6			300	30			221	220		
0R6	0.6			3R9	3.9			330	33			241	240		
0R7	0.7			4R3	4.3			360	36			271	270		
0R8	0.8			4R7	4.7			390	39			301	300		
0R9	0.9			5R1	5.1			430	43			331	330		
1R0	1.0			5R6	5.6			470	47			361	360		
1R1	1.1	B, C, D	100	6R2	6.2	F, G, J, K, M	100	510	51			391	390	F, G, J, K, M	100
1R2	1.2			6R8	6.8			560	56			431	430		
1R3	1.3			7R5	7.5			620	62			471	470		
1R4	1.4			8R2	8.2			680	68			511	510		
1R5	1.5			9R1	9.1			750	75			561	560		
1R6	1.6			100	10			820	82			621	620		
1R7	1.7			110	11			910	91			681	680		
1R8	1.8			120	12			101	100			751	750		
1R9	1.9			130	13			111	110			821	820		
2R0	2.0			150	15			121	120			911	910		
2R1	2.1			160	16			131	130			102	1000		
2R2	2.2			180	18										

Specification and Performance

Piezoelectric and Aging Effects:	None
Temperature Range:	-55°C to +200°C
Temperature Coefficient of Capacitance:	0±30ppm/°C
Quality Factor (Q):	≤100pF at 1MHz >10k ≥100pF at 1MHz >2k
Insulation Resistance (IR, at Rated Voltage):	>10 ⁵ MΩ at 25°C >10 ⁴ MΩ at 200°C
Dielectric Withstand Voltage (DWV):	250% of Rated Voltage
Capacitance Drift:	±0.02% or 0.02 pF

Performance Curve



MNT 12

High Temperature 200°C "T" Series
COG (NPO) RF/Microwave Multilayer Capacitors

Features

- Capacitance Range: 0.1pF to 5100pF
- Operating Temperature: -55°C to 200°C
- Rated Voltage: 50V, 150V and 250V
- High Q
- Ultra-Stable Performance
- Low ESR/ESL
- High Self-Resonance
- Encapsulation Option for Leaded MNT 12 Series
- Lead Options (See Page 42)



MNT12 series is high temperature RF/Microwave capacitors incorporating an ultra-stable COG (NPO) dielectric system. These capacitors are designed for continuous operating at 200°C, are low loss, high insulation resistance, and exhibit little change in capacitance over the operating temperature range. The MNT12 Series is available in voltages from 50 to 250 volts. High-reliability and burn-in testing is available as options. This Series can be supplied compliant to the EU's **RoHS** standard.

Applications

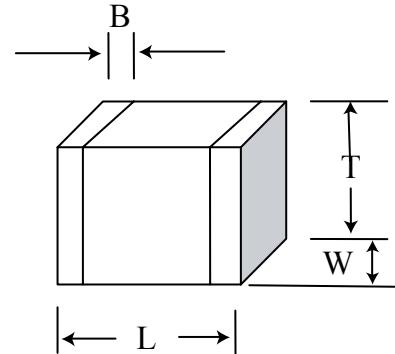
Typical Functional Applications: Bypass, Coupling, Tuning, Feedback, Impedance Matching and DC Blocking. Devices such as RF oscillators and precision timing circuits requiring a predictable temperature coefficient are examples of devices utilizing these capacitors.

AFM Part Number Code

M	N	T	11	W	101	J	D	C	B	B
Product Series: M: High Frequency		Product Type: T: 200°C		Termination Code: C: Pd/Ag Term G: Ag Term, Ni/Au Plated N: Non Magnetic Term (Ag Term, Cu/Sn Plated) W: Ag Term, Ni Barrier, 90/10 Sn/Pb Plated		Tolerance: B: $\pm 0.1\text{pF}$ C: $\pm 0.25\text{pF}$ D: $\pm 0.5\text{pF}$ F: $\pm 1\%$ G: $\pm 2\%$ J: $\pm 5\%$ K: $\pm 10\%$ M: $\pm 20\%$		Test Code: C: Commercial Test S: Special (Customer Defined) M: Hi-Rel		Packaging: B: Bulk T: Tape & Reel W: Waffle Pack
Dielectrics: N: NPO		Chip Size: 11: 0505				Capacitance Code: 1st two digits are significant: Third digit denotes number of zero(s); R=Decimal point 2R0=2.0pF 101=100pF				Marking: B: Not Marked M: Marked (Cap code and tolerance) S: Special Marking
							Voltage: B: 50Vdc D: 100 Vdc			

Chip Dimensions

Length	.110in (2.79mm)
Width	.110in (2.79mm)
Thickness	.102in (2.59mm)
Band	.015in (0.38mm)



Standard Capacitance Values

*STD.:Standard Voltage; EXT.: Extended Voltage

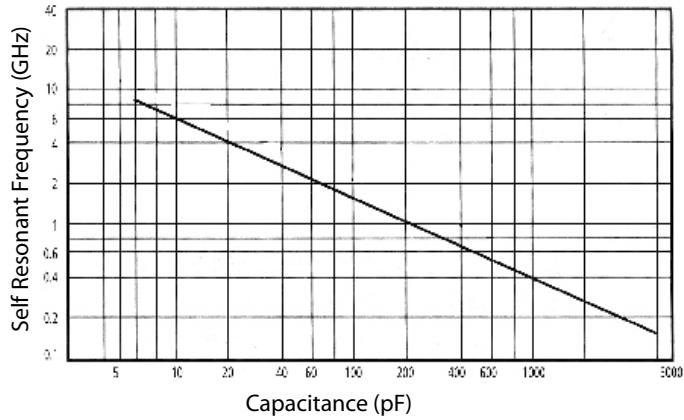
CAP CODE	CAP (pF)	TOL	RATED WVdc		CAP CODE	CAP (pF)	TOL	RATED WVdc		CAP CODE	CAP (pF)	TOL	RATED WVdc	
			STD.*	EXT.*				STD.	EXT.				STD.	EXT.
0R1	0.1	B			3R3	3.3		360	36		391	390		
0R2	0.2				3R6	3.6		390	39		431	430		200
0R3	0.3	B, C			3R9	3.9	B, C, D	430	43	1500	471	470		
0R4	0.4				4R3	4.3		470	47		511	510		
0R5	0.5	500			4R7	4.7	B, C, J, K, M	510	51	500	561	560		100
0R6	0.6				5R1	5.1		560	56		621	620		
0R7	0.7				5R6	5.6		620	62		681	680		
0R8	0.8				6R2	6.2		680	68		751	750		
0R9	0.9				6R8	6.8		750	75		821	820		
1R0	1.0				7R5	7.5		820	82		911	910		
1R1	1.1				8R2	8.2		910	91		102	1000		
1R2	1.2				9R1	9.1		101	100	F, G, J, K, M	112	1100	F, G, J, K, M	N/A
1R3	1.3	1500			100	10		111	110		122	1200		
1R4	1.4				110	11		121	120		152	1500		
1R5	1.5				120	12		131	130		182	1800		
1R6	1.6				130	13		151	150		222	2200		50
1R7	1.7				150	15		161	160		272	2700		
1R8	1.8				160	16		181	180		302	3000		
1R9	1.9				180	18		201	200		332	3300		
2R0	2.0				200	20		221	220		392	3900		
2R1	2.1				220	22		241	240		472	4700		
2R2	2.2				240	24		271	270		512	5100		
2R4	2.4				270	27		301	300					
2R7	2.7				300	30		331	330					
3R0	3.0				330	33		361	360					

Specification and Performance

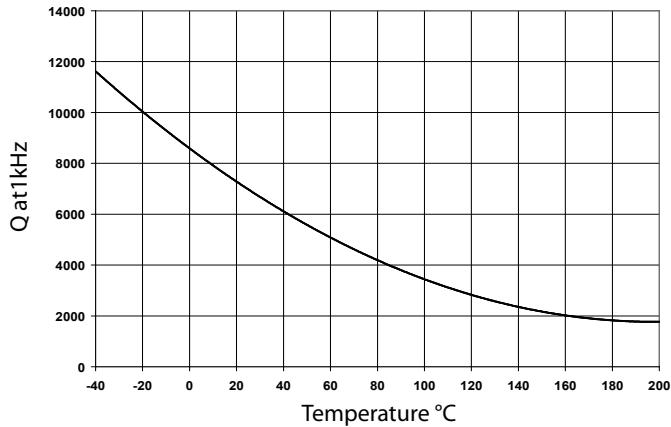
Piezoelectric and Aging Effects:	None
Temperature Range:	-55°C to +200°C
Temperature Coefficient of Capacitance:	0±30ppm/°C
Quality Factor (Q):	<200pF at 1 MHz >10k ≥200pF to 1000pF at 1 MHz >1k
Insulation Resistance (IR, at Rated Voltage):	>10 ⁵ MΩ at 25°C >10 ⁴ MΩ at 200°C
Dielectric Withstand Voltage (DWV):	200% of Rated Voltage
Capacitance Drift:	±0.02% or 0.02 pF

Performance Curve

Self Resonant Frequency vs. Capacitance



Q vs. Temperature





MPT 12

High Temperature 200°C "T" Series
Porcelain RF/Microwave Multilayer Capacitors

Features

- Capacitance Range: 0.1pF to 1000pF
- Operating Temperature: -55°C to 200°C
- Rated Voltage: 50V to 300V
- Low Noise
- Low ESR/ESL
- High Self-Resonance

The MPT series is high temperature, high frequency capacitors that is now available with an extended operating temperature up to 200°C. The MPT12 Series is available with a rated voltage from 50 volts to 300 volts based on capacitance value. Leaded capacitors are available as AFM HPT Series and are encapsulated to protect capacitors from contaminants that may be experienced due to severe environmental conditions. This Series can be supplied compliant to the EU's RoHS standard.



Applications

Typical functional applications include oil, natural gas and geothermal exploration equipment; high temperature engine controls and sensors and any other applications having severe environments.

AFM Part Number Code

M Product Series: M: High Frequency	P Product Type: T: 200°C	12 Dielectrics: P: Porcelain	W Termination Code: A: Axial Wire* C: Pd/Ag Term G: Ag Term, Ni/Au Plated S: High Temp Solder Dip T: Ag Term, Ni/100% Sn Plated (Pb Free) W: Ag Term, Ni Barrier, 90/10 Sn/Pb Plated	101 Chip Size: 12: 1111	J Tolerance: B: ± 0.1pF C: ± 0.25pF D: ± 0.5pF F: ± 1% G: ± 2% J: ± 5% K: ± 10% M: ± 20%	B Test Code: C: Commercial Test S: Special (Customer Defined) M: Hi-Rel	C Voltage: B: 50 Vdc D: 100 Vdc F: 200 Vdc H: 300Vdc	B Marking: B: Not Marked M: Marked (Cap code and tolerance) S: Special Marking	B Packaging: B: Bulk T: Tape & Reel W: Waffle Pack

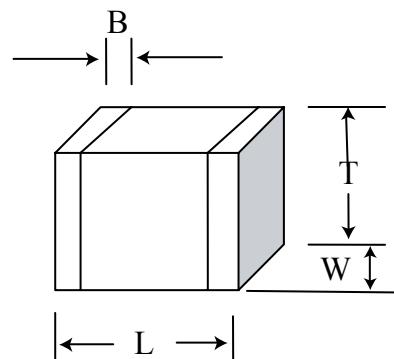
*Wire is CCS with High Temp Solder Dip

Capacitance Code:

1st two digits are significant: Third digit denotes number of zero(s); R=Decimal point
2R0=2.0pF
101=100pF

Chip Dimensions

Length	.110in (2.79mm)
Width	.110in (2.79mm)
Thickness	.102in (2.59mm)
Band	.015in (0.38mm)



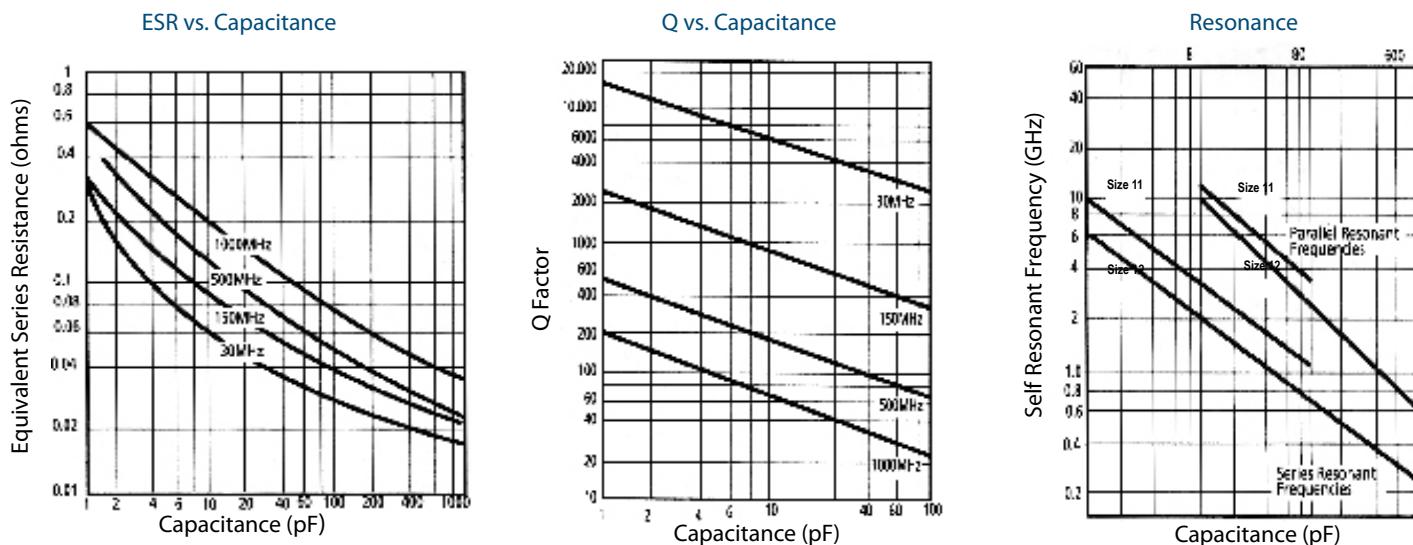
Standard Capacitance Values

CAP CODE	CAP (pF)	TOL	RATED WVdc	CAP CODE	CAP (pF)	TOL	RATED WVdc	CAP CODE	CAP (pF)	TOL	RATED WVdc	CAP CODE	CAP (pF)	TOL	RATED WVdc
0R1	0.1	B	300	2R4	2.4	F, G, J, K, M	300	180	18	F, G, J, K, M	300	131	130	100	200
0R2	0.2			2R7	2.7			200	20			151	150		
0R3	0.3			3R0	3.0			220	22			161	160		
0R4	0.4			3R3	3.3			240	24			181	180		
0R5	0.5			3R6	3.6			270	27			201	200		
0R6	0.6			3R9	3.9			300	30			221	220		
0R7	0.7			4R3	4.3			330	33			241	240		
0R8	0.8			4R7	4.7			360	36			271	270		
0R9	0.9			5R1	5.1			390	39			301	300		
1R0	1.0			5R6	5.6			430	43			331	330		
1R1	1.1			6R2	6.2			470	47			361	360		
1R2	1.2			6R8	6.8			510	51			391	390		
1R3	1.3			7R5	7.5			560	56			431	430		
1R4	1.4			8R2	8.2			620	62			471	470		
1R5	1.5			9R1	9.1			680	68			511	510		
1R6	1.6			100	10			750	75			561	560		
1R7	1.7			110	11			820	82			621	620		
1R8	1.8			120	12			910	91			681	680		
1R9	1.9			130	13			101	100			751	750		
2R0	2.0			150	15			111	110			821	820		
2R1	2.1			160	16			121	120			911	910		
2R2	2.2											102	1000		

Specification and Performance

Piezoelectric and Aging Effects:	None
Temperature Range:	-55°C to +200°C
Temperature Coefficient of Capacitance:	+90±30ppm/°C
Insulation Resistance (IR, at Rated Voltage):	>10 ⁶ MΩ at 25°C >10 ⁵ MΩ at 125°C >10 ⁴ MΩ at 200°C
Dielectric Withstand Voltage (DWV):	250% of Rated Voltage
Capacitance Drift:	±0.02% or 0.02 pF

Performance Curve



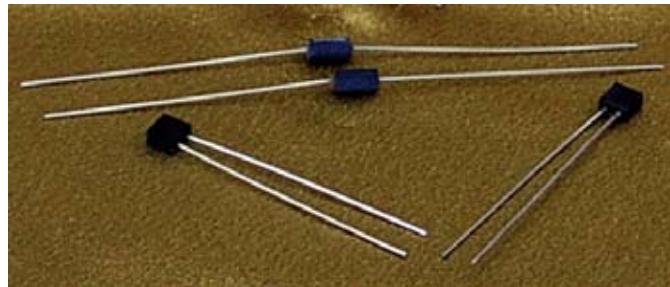


HPT 12

High Temperature 200°C "T" Series
Radial and Axial Leaded Capacitors

Features

- Capacitance Range: 0.1pF to 1000pF
- Operating Temperature: -55°C to 200°C
- Rated Voltage: 50V to 300V
- Low Noise
- Low ESR/ESL
- High Self-Resonance



HPT 12 Series is an extension of the proven MPT12 high Q, low loss microporcelain chip capacitors. The HPT12 Series is available with a rated voltage from 50 volts to 300 volts based on capacitance value. These radial or axial leaded capacitors are encapsulated with a unique high temperature polymer case and minimize partial discharges to protect capacitors from contaminants that may be experienced due to severe environmental conditions.

Applications

Typical functional applications include oil, natural gas and geothermal exploration equipment; high temperature engine controls and sensors and any other applications having severe environments.

AFM Part Number Code

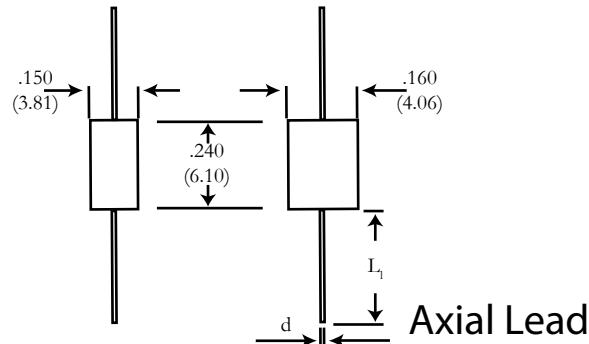
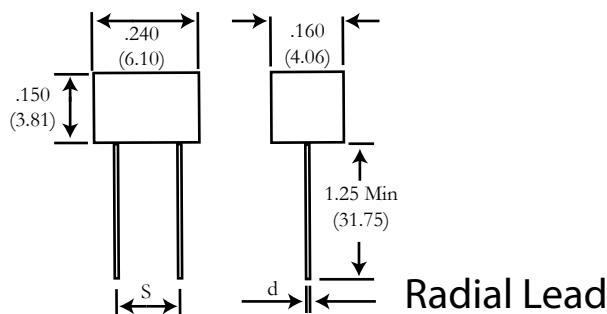
H Product Series: H: High Temperature	P Product Type: T: 200°C	12	A Termination Code: A: Axial Wire* Q: Radial Wire*	101	J Tolerance: B: $\pm 0.1\text{pF}$ C: $\pm 0.25\text{pF}$ D: $\pm 0.5\text{pF}$ F: $\pm 1\%$ G: $\pm 2\%$ J: $\pm 5\%$ K: $\pm 10\%$ M: $\pm 20\%$	B Test Code: C: Commercial Test S: Special (Customer Defined) M: Hi-Rel	C B	B Packaging: B: Bulk T: Tape & Reel W: Waffle Pack
Dielectrics: P: Porcelain	Chip Size: 12: 1111		 *Wire is CCS with High Temp Solder Dip	 Capacitance Code: 1st two digits are significant: Third digit denotes number of zero(s); R=Decimal point 2R0=2.0pF 101=100pF	 Voltage: B: 50 Vdc D: 100 Vdc F: 200 Vdc H: 300Vdc	 Marking: B: Not Marked M: Marked (Cap code and tolerance) S: Special Marking		



HPT 12

High Temperature 200°C "T" Series
Radial and Axial Leaded Capacitors

Chip Dimensions:



Standard Capacitance Values

CAP CODE	CAP (pF)	TOL	RATED WVdc	CAP CODE	CAP (pF)	TOL	RATED WVdc	CAP CODE	CAP (pF)	TOL	RATED WVdc	CAP CODE	CAP (pF)	TOL	RATED WVdc
0R1	0.1	B	300	2R4	2.4	F, G, J, K, M	300	180	18	F, G, J, K, M	300	131	130	F, G, J, K, M	200
0R2	0.2			2R7	2.7			200	20			151	150		
0R3	0.3			3R0	3.0			220	22			161	160		
0R4	0.4			3R3	3.3			240	24			181	180		
0R5	0.5			3R6	3.6			270	27			201	200		
0R6	0.6			3R9	3.9			300	30			221	220		
0R7	0.7			4R3	4.3			330	33			241	240		
0R8	0.8			4R7	4.7			360	36			271	270		
0R9	0.9			5R1	5.1			390	39			301	300		
1R0	1.0			5R6	5.6			430	43			331	330	F, G, J, K, M	100
1R1	1.1			6R2	6.2			470	47			361	360		
1R2	1.2			6R8	6.8			510	51			391	390		
1R3	1.3			7R5	7.5			560	56			431	430		
1R4	1.4			8R2	8.2			620	62			471	470		
1R5	1.5			9R1	9.1			680	68			511	510		
1R6	1.6			100	10			750	75			561	560		
1R7	1.7			110	11			820	82			621	620		
1R8	1.8			120	12			910	91			681	680		
1R9	1.9			130	13			101	100			751	750		
2R0	2.0			150	15			111	110			821	820		
2R1	2.1			160	16			121	120			200	911	910	
2R2	2.2											102	1000		

Specification and Performance

Piezoelectric and Aging Effects:	None
Temperature Range:	-55°C to +200°C
Temperature Coefficient of Capacitance:	+90±30ppm/°C
Insulation Resistance (IR, at Rated Voltage):	>10 ⁶ MΩ at 25°C; >10 ⁵ MΩ at 125°C; >10 ⁴ MΩ at 200°C
Dielectric Withstand Voltage (DWV):	250% of Rated Voltage
Capacitance Drift:	±0.02% or 0.02 pF



SNT / SXT

High Voltage, High Reliability 200°C "T" Series
DC COG (NPO)/X7R Ceramic Chip Surface Mount Capacitors



Features

- Capacitance Range: 10pF to 2.7μF
- Operating Temperature Range: -55°C to 200°C
- Voltage Range: 500V to 5kV
- COG (NPO) and X7R Dielectric

SNT/SXT series is high voltage multilayer ceramic surface mount capacitors for use in severe environment with operating temperatures up to 200°C. These ruggedized capacitors are encapsulated with unique polymer/ceramic system which enables them to operate reliably in high shock and vibrational environment and also to prevent corona (partial discharges) during operation. Each capacitor is 100% tested physically and electrically* and can be screened to Group A and B performance criteria as defined in MIL-PRF-49467. AFM has extensive electrical and environmental test capability with component burn-in and characterization up to 300°C. Custom designs, extended thickness and test protocols to customer Source Control Drawings (SCD's) are available on request.

Applications:

Typical applications include filtering of high voltage power supplies, high voltage multipliers, transient protection and noise suppression.

*See Test Options Pages at the End of the Catalog.

AFM Part Number Code

S Product Series: S: Surface Mount	N Product Type: T: 200°C	T 15	L Termination Code: J: Ag Plated Cu L: Ag Plated Cu	101	J Tolerance: J: ±5% K: ±10% M: ±20%	L	C Test Code: C: Commercial Test S: Special (Customer Defined) M: Hi-Rel	M	B Packaging: B: Bulk W: Waffle Pack
Dielectrics: N: NPO X: X7R		Size: (See Table)		Capacitance Code: 1st two digits are significant: Third digit denotes number of zero(s); R=Decimal point 2R0=2.0pF 101=100pF		Voltage: J: 500 Vdc L: 1000 Vdc O: 2000 Vdc Q: 3000 Vdc S: 4000 Vdc T: 5000 Vdc		Marking: M: Marked (per description) S: Special Marking	



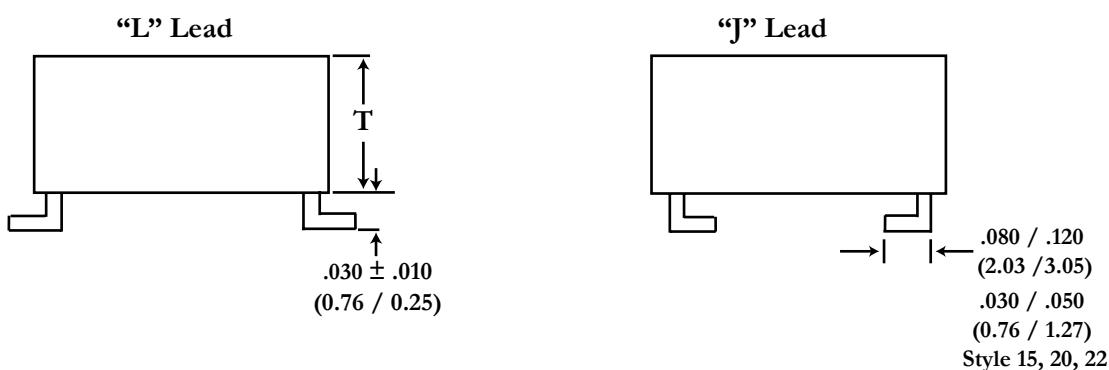
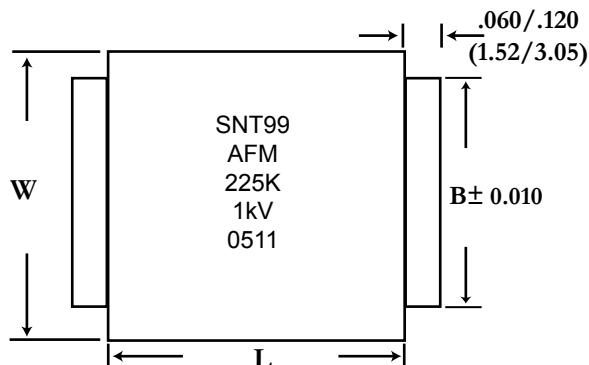
SNT / SXT

High Voltage, High Reliability 200°C "T" Series
DC COG (NPO)/X7R Ceramic Chip Surface Mount Capacitors

Capacitor Dimensions and Tolerances

Style	Length (L) Inches (mm)	Width (W) Inches (mm)	Thickness (T) Max Inches (mm)	Tab (B) Inches (mm)
15	.225 ±.015 (5.72 ±.38)	.225 ±.015 (5.72 ±.38)	.160 (4.06)	.100 (2.54)
20	.275 ±.015 (6.99 ±.38)	.275 ±.015 (6.99 ±.38)	.210 (5.33)	.100 (2.54)
25	.330 ±.015 (8.38 ±.38)	.255 ±.015 (6.48 ±.38)	.210 (5.33)	.100 (2.54)
35	.450 ±.020 (11.43 ±.51)	.370 ± .020 (9.40 ±.51)	.255 (6.48)	.200 (5.08)
40	.500 ±.020 (12.70±.51)	.500 ±.020 (12.70±.51)	.255 (6.48)	.200 (5.08)
45	.550 ±.020 (13.97±.76)	.500 ±.020 (12.70±.51)	.255 (6.48)	.300 (7.62)
55	.650 ±.030 (16.51±.76)	.600 ± .030 (15.24±.51)	.255 (6.48)	.400 (10.16)
65	.780 ±.030 (19.81±.76)	.700 ± .030 (17.78±.76)	.260 (6.60)	.500 (12.70)
70	.800 ±.030 (20.32±.76)	.400 ±.030 (10.16±.76)	.260 (6.60)	.200 (5.08)
90	1.00 ±.030 (25.40±.76)	.500 ±.020 (12.70±.51)	.260 (6.60)	.300 (7.62)
95	1.30 ±.030 (33.02±.76)	.600 ±.030 (15.24±.76)	.260 (6.60)	.400 (10.16)
99	1.50 ±.030 (38.1±.76)	.700 ± .030 (17.78±.76)	.260 (6.60)	.500 (12.70)

Outline Drawings and Lead Configurations





SNT

High Voltage, High Reliability 200°C "T" Series
DC COG (NPO) Ceramic Chip Surface Mount Capacitors

C0G (NP0) Dielectric Capacitance Ranges

Style	500 Vdc		1000 Vdc		2000 Vdc		3000 Vdc		4000 Vdc		5000 Vdc	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
15	27pF	4700pF	27pF	1500pF	12pF	680pF	10pF	150pF				
20	39pF	8200pF	39pF	3900pF	22pF	820pF	22pF	560pF	22pF	390pF		
25	47pF	.010μF	47pF	6800pF	27pF	1200pF	27pF	680pF	27pF	470pF		
35	120pF	.022μF	120pF	.018μF	47pF	3300pF	47pF	1500pF	27pF	680pF		
40	220pF	.039μF	220pF	.022μF	100pF	5600pF	100pF	2200pF	18pF	1200pF		
45	220pF	.056μF	220pF	.033μF	100pF	6800pF	100pF	3900pF	18pF	1500pF	18pF	1000pF
55	390pF	.068μF	390pF	.047μF	150pF	.010μF	150pF	6800pF	27pF	2200pF	27pF	2200pF
65	470pF	.100μF	470pF	.068μF	270pF	.022μF	220pF	8200pF	47pF	3900pF	47pF	2700pF
70	330pF	.120μF	330pF	.068μF	68pF	.010μF	68pF	4700pF	27pF	1500pF	27pF	1200pF
90	470pF	.150μF	390pF	.056μF	120pF	.015μF	100pF	5600pF	56pF	3300pF	47pF	2200pF
95	680pF	.220μF	680pF	.100μF	150pF	.022μF	150pF	.012μF	68pF	4700pF	68pF	2700pF
99	1000pF	.330μF	1000pF	.150μF	270pF	.039μF	270pF	.018μF	120pF	8200pF	120pF	5600pF

Dielectric Characteristics COG (NPO)

Capacitance Range	10pF to .330μF
Capacitance Tolerances	J \pm 5%, K \pm 10%, M \pm 20%
Dissipation Factor	0.1% Max (25°C, 1 KHz) 1Vrms \pm 0.2V
Temperature Range	-55°C to +200°C
Temperature Coefficient of Capacitance	0 \pm 30ppm/°C
Insulation Resistance 1000V or Rated V (whichever is less) at 25°C	100GΩ min or 1000MΩμF Whichever is Less
Insulation Resistance 1000V or Rated V (whichever is less) at 200°C	1GΩ min or 10MΩμF Whichever is less
Voltage Range	500V to 5kV
Dielectric Withstand	1.2 x Rated Voltage 5 Second Min
Aging	None

Marking

Styles 15 and 20 will be marked with EIA capacitance code, and tolerance (821K). Styles 25 and up will be marked with an insulating ink and will contain AFM, capacitance code, tolerance, lot code, voltage and series style.

Packaging

Bulk packaging in plastic bags is standard. Please contact factory for optional waffle packaging or tape and reel.



SXT

High Voltage, High Reliability 200°C "T" Series
DC X7R Ceramic Chip Surface Mount Capacitors

X7R Dielectric Capacitance Ranges

Style	500 Vdc		1000 Vdc		2000 Vdc		3000 Vdc		4000 Vdc		5000 Vdc	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
15	680pF	.047μF	680pF	.012μF	270pF	2700pF	100pF	1200pF				
20	1200pF	.100μF	1200pF	.039μF	560pF	6800pF	560pF	2700pF				
25	1200pF	.120μF	1200pF	.056μF	680pF	.012μF	680pF	4700pF				
35	3300pF	.390μF	3300pF	.180μF	1200pF	.027μF	1200pF	.010μF	270pF	4700pF		
40	6800pF	.470μF	6800pF	.220μF	2700pF	.033μF	2700pF	.012μF	470pF	6800pF		
45	6800pF	.680μF	6800pF	.270μF	2700pF	.047μF	2700pF	.018μF	470pF	6800pF	470pF	4700pF
55	.010μF	1.00μF	.010μF	.470μF	3900pF	.082μF	3900pF	.027μF	680pF	.010μF	680pF	6800pF
65	.015μF	1.50μF	.015μF	.560μF	6800pF	.120μF	6800pF	.047μF	1200pF	.012μF	1200pF	.010μF
70	.010μF	1.00μF	.010μF	.270μF	1800pF	.056μF	1800pF	.018μF	680pF	8200pF	680pF	4700pF
90	.012μF	1.50μF	.012μF	.470μF	3300pF	.120μF	3300pF	.033μF	1200pF	.012μF	1200pF	.012μF
95	.018μF	2.00μF	.018μF	.820μF	4700pF	.180μF	3900pF	.056μF	2200pF	.027μF	2200pF	.015μF
99	.027μF	2.70μF	.027μF	1.50μF	8200pF	.270μF	5600pF	.082μF	3300pF	.039μF	3300pF	.018μF

Dielectric Characteristics X7R

Capacitance Range	100pF to 2.7μF
Capacitance Tolerances	J±5%, K±10%, M±20%
Dissipation Factor	2.5% Max (25°C, 1 KHz) 1Vrms ±0.2V, <.20% @ 200°C
Temperature Range	-55°C to +200°C
Temperature Coefficient of Capacitance	+15%, -40% to 200°C
Insulation Resistance 1000V or Rated V (whichever is less) at 25°C	10GΩ Min or 100MΩμF Whichever is Less
Insulation Resistance 1000V or Rated V (whichever is less) at 200°C	1GΩ Min or 10MΩμF Whichever is Less
Voltage Range	500V to 5kV (See Table)
Dielectric Withstand	1.2 x rated Voltage 5 Second Min
Aging	None

Marking

Styles 15 and 20 will be marked with EIA capacitance code, and tolerance (821K). Styles 25 and up will be marked with an insulating ink and will contain AFM, Capacitance code, tolerance, lot code, voltage and series style.

Packaging

Bulk packaging in plastic bags is standard. Please contact factory for optional waffle packaging or tape and reel.

Features

- Capacitance Range: 12pF to .56μF
- Operating Temperature: -55°C to +200°C
- Rated Voltage: 500V to 4kV
- High Reliability
- Conformal Coated
- 200°C Burn-In Testing

VNT/VXT series is high voltage, high temperature capacitors which are based



on AFM's industry proven high temperature HNT/HXT Series of capacitors. These capacitors have operating voltage ratings of 500 volts up to 4000 volts. The VNT/VXT Series is designed using a high insulation resistance, high dielectric constant barium titanate dielectric system.

Applications

Typical Functional Applications: Bypass, Coupling, Tuning, Feedback, Impedance Matching and DC Blocking. Devices such as RF oscillators and precision timing circuits requiring a predictable temperature coefficient are examples of devices utilizing these capacitors.

AFM Part Number Code

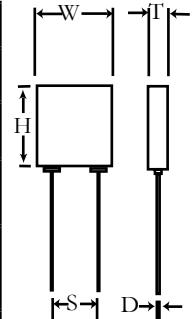
V	N	T	15	K	101	J	L	C	M	B
Product Series: V: High Voltage		Product Type: T: 200°C		Termination Code: D: Cu/Ni/Tin Plate K: Nickel Wire S: CCS - Sn/Pb Plate F: CCS - High Temp Solder Dip H: S Lead - High Temp Solder Dip		Tolerance: G: ±2% J: ±5% K: ±10% M: ±20%		Test Code: C: Commercial Test S: Special (Customer Defined) M: Hi-Rel		Packaging: B: Bulk W: Waffle Pack
Dielectrics: N: NPO X: X7R			Size: (See Table)		Capacitance Code: 1st two digits are significant: Third digit denotes number of zero(s); R=Decimal point 2R0=2.0pF 101=100pF		Voltage: J: 500 Vdc L: 1000 Vdc O: 2000 Vdc Q: 3000 Vdc S: 4000 Vdc	Marking: M: Marked S: Special Marking	Size 15 & 25	Size 35 & Up
									122k AFM Date Code	VNT55N562K 2kV AFM Date Code



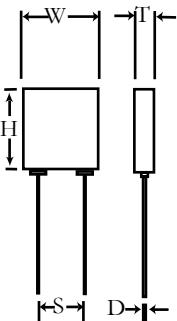
VNT

High Voltage, High Temperature 200°C "T" Series
Radial Leaded COG (NPO) Capacitors

Style	VNT 15			VNT 25				VNT 35				VNT 45				
Dimensions	W Max	.250 (6.35)		.320 (8.13)				.420 (10.67)				.520 (13.21)				
	H Max	.220 (5.59)		.300 (7.62)				.400 (10.16)				.500 (12.70)				
	T Max	.150 (3.81)		.250 (6.35)				.250 (6.35)				.300 (7.62)				
	D ± .002 (.0508)	.025 (.635)		.025 (.635)				.025 (.635)				.025 (.635)				
	S	.170 (4.32)		.200 (5.08)				.300 (7.62)				.400 (10.16)				
Capacitance Range (pF)	Vdc	500	1kV	2kV	500	1kV	2kV	3kV	500	1kV	2kV	3kV	500	1kV	2kV	3kV
	12															
	15															
	18															
	22															
	28															
	33															
	39															
	47															
	56															
	68															
	82															
	100															
	120															
	150															
	180															
	220															
	270															
	330															
	390															
	470															
	560															
	680															
	820															
	1000															
	1200															
	1500															
	1800															
	2200															
	2700															
	3300															
	3900															
	4700															
	5600															
	6800															



Style		VNT 55					VNT 65					VNT 71				
Dimensions	W Max	.620 (15.75)				.720 (18.29)				.820 (20.83)						
	H Max	.600 (15.24)				.700 (17.78)				.700 (17.78)						
	T Max	.300 (7.62)				.300 (7.62)				.350 (8.89)						
	D ± .002 (.0508)	.025 (.635)				.025 (.635)				.025 (.635)						
S		.500 (12.70)				.600 (15.24)				.700 (17.78)						
Vdc		500	1kV	2kV	3kV	4kV	500	1kV	2kV	3kV	4kV	500	1kV	2kV	3kV	4kV
Capacitance Range	1000pF															
	1200pF															
	1800pF															
	2200pF															
	2700pF															
	3300pF															
	3900pF															
	4700pF															
	5600pF															
	6800pF															
	8200pF															
	.01μF															
	.012μF															
	.015μF															
	.018μF															
	.022μF															
	.027μF															
	.033μF															



Dielectric Characteristics COG (NPO)

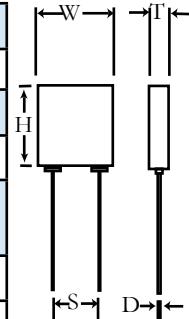
Capacitance Range	12pF to .180μF
Capacitance Tolerances	G±2%, J±5%, K±10%, M±20%
Dissipation Factor	0.1% Max (25°C, 1 KHz) 1Vrms ±0.2V
Temperature Range	-55°C to +200°C
Temperature Coefficient of Capacitance	0±30ppm/°C
Insulation Resistance 1000V or Rated V (whichever is less) at 25°C	100GΩ min or 1000MΩμF Whichever is Less
Insulation Resistance 1000V or Rated V (whichever is less) at 200°C	1GΩ min or 10MΩμF Whichever is Less
Voltage Range	500V to 4kV (See Table)
Dielectric Withstand	1.2 x Rated Voltage 5 Second Min
Aging	None

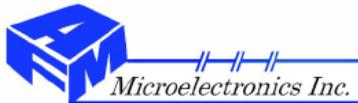


VXT

High Voltage, High Temperature 200°C "T" Series
Radial Leaded X7R Capacitors

	Style	VXT 15			VXT 25			VXT 35			VXT 45				
Dimensions	W Max	.250 (6.35)			.320 (8.13)			.420 (10.67)			.520 (13.21)				
	H Max	.220 (5.59)			.300 (7.62)			.400 (10.16)			.500 (12.70)				
	T Max	.150 (3.81)			.250 (6.35)			.250 (6.35)			.300 (7.62)				
	D ± .002 (.0508)	.025 (.635)			.025 (.635)			.025 (.635)			.025 (.635)				
	S	.170 (4.32)			.200 (5.08)			.300 (7.62)			.400 (10.16)				
Voltage dc	500	1kV	2kV	500	1kV	2kV	3kV	500	1kV	2kV	3kV	500	1kV	2kV	3kV
680pF															
820pF															
1000pF															
1200pF															
1500pF															
1800pF															
2200pF															
2700pF															
3300pF															
3900pF															
4700pF															
5600pF															
6800pF															
8200pF															
.01µF															
.012µF															
.015µF															
.018µF															
.022µF															
.027µF															
.033µF															
.039µF															
.047µF															
.056µF															
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.082µF															
.100µF															
.120µF															
.150µF															
.180µF															

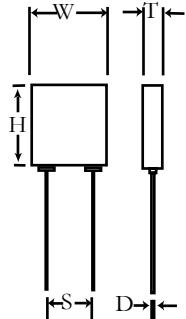




VXT

High Voltage, High Temperature 200°C "T" Series
Radial Leaded X7R Capacitors

Style		VXT 55				VXT 65				VXT 71						
Dimensions	W Max	.620 (15.75)				.720 (18.29)				.820 (20.83)						
	H Max	.600 (15.24)				.700 (17.78)				.700 (17.78)						
	T Max	.300 (7.62)				.300 (7.62)				.350 (8.89)						
	D ± .002 (.0508)	.025 (.635)				.025 (.635)				.025 (.635)						
S		.500 (12.7)				.600 (15.24)				.700 (17.78)						
Voltage dc		500	1kV	2kV	3kV	4kV	500	1kV	2kV	3kV	4kV	500	1kV	2kV	3kV	4kV
Capacitance Range (pF)	.012															
	.015															
	.018															
	.022															
	.027															
	.033															
	.039															
	.047															
	.056															
	.068															
	.082															
	.100															
	.120															
	.150															
	.180															
	.220															
	.270															
	.330															
	.390															
	.470															
	.560															
	.680															



Dielectric Characteristics X7R

Capacitance Range	680pF to .56μF
Capacitance Tolerances	J±5%, K±10%, M±20%
Dissipation Factor	2.5% Max (25°C, 1 KHz) 1Vrms ±0.2V, <20% @200°C
Temperature Range	-55°C to +200°C
Temperature Coefficient of Capacitance	+15%, -40% to 200°C
Insulation Resistance 1000V or Rated V (whichever is less) at 25°C	10GΩ min or 100MΩμF Whichever is Less
Insulation Resistance 1000V or Rated V (whichever is less) at 200°C	1GΩ min or 10MΩμF Whichever is Less
Voltage Range	500V to 5kV (See Table)
Dielectric Withstand	1.2 x Rated Voltage 5 Second Min
Aging	None

Features

- Capacitance Range: 10pF to 5.6μF
- Operating Temperature Range: -55°C to 125°C
- Voltage Range: 500 Volt to 10KV
- COG (NPO) and X7R Dielectric

SNR/SXR series is high voltage multilayer ceramic chip capacitors for use in high reliability commercial, industrial and military applications. These capacitors are designed in accordance with MIL-PRF-49467 and can be supplied to NPO and X7R voltage temperature limits. Each capacitor is 100% tested physically and electrically* and can be screened to Group A and B performance criteria as defined in MIL-PRF-49467. Custom designs, extended thickness and test protocols to customer Source Control Drawings (SCD's) are available upon request.



Applications

Typical applications include filtering of high voltage power supplies, high voltage multipliers, transient protection and noise suppression.

* See Test Option pages at the end of the catalog.

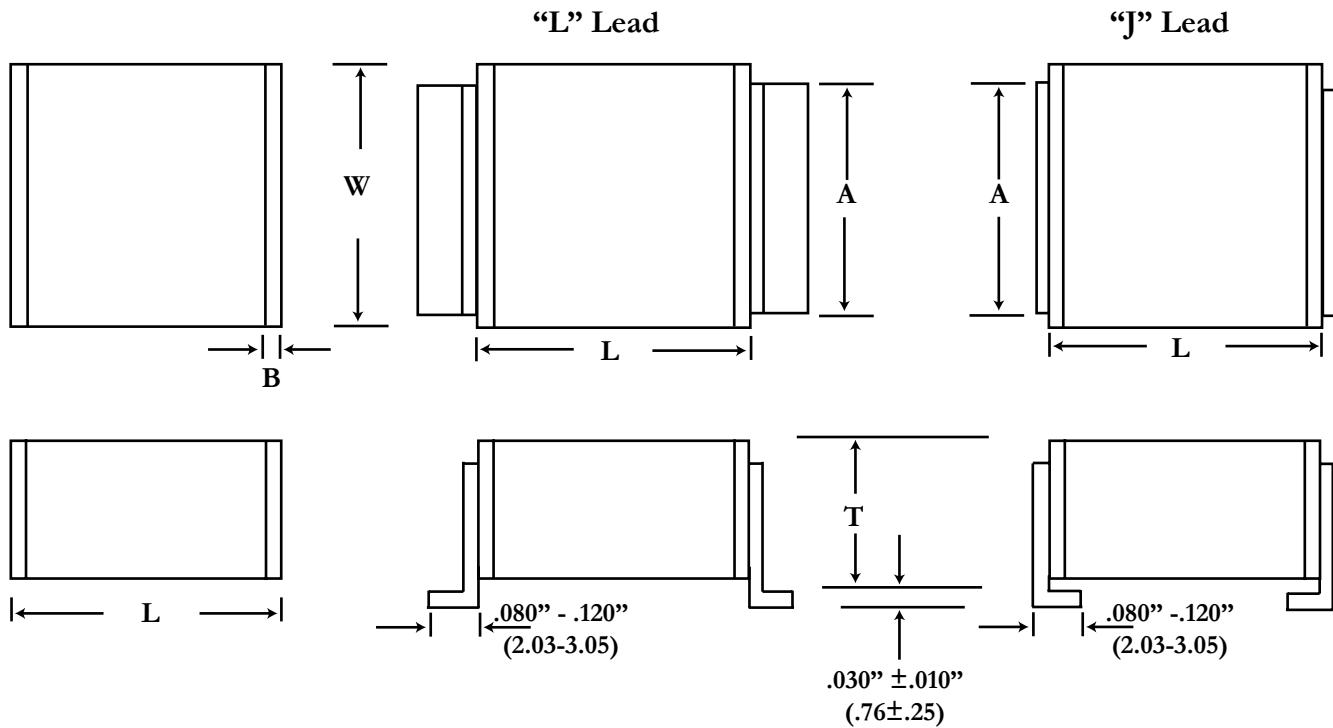
AFM Part Number Code

S	N	R	15	W	101	J	L	C	B	B
Product Series: S: Surface Mount	Product Type: R: Chip			Termination Code: C: Pd/Ag Term J: J Lead L: L Lead T: Ag Term, Ni Barrier 100 Sn plated W: Ag Term, Ni Barrier, 90/10 Sn/Pb Plated		Tolerance: J: ±5% K: ±10% M: ±20%		Test Code: C: Commercial Test S: Special (Customer Defined) M: Hi-Rel		Packaging: B: Bulk T: Tape & Reel W: Waffle Pack
Dielectrics: N: NPO X: X7R			Size: (See Table)		Capacitance Code: 1st two digits are significant: Third digit denotes number of zero(s); R=Decimal point 2R0=2.0pF 101=100pF		Voltage: J: 500 Vdc L: 1000 Vdc O: 2000 Vdc Q: 3000 Vdc S: 4000 Vdc T: 5000 Vdc W: 10000 Vdc		Marking: B: Not Marked M: Marked (per description) S: Special Marking	

Chip Capacitor Dimensions and Tolerances

Style	Length (L) Inches (mm)	Width (W) Inches (mm)	Thickness (T) (Max) Inches (mm)	Termination Band (B) Inches (mm)	Tab (A) Inches (mm)
15	.150 ±.015 (3.81 ±.38)	.150 ± .015 (3.81 ±.38)	.140 (3.56)	.020 (.508)	.100 (2.54)
20	.200 ±.020 (5.08 ±.51)	.200 ± .020 (5.08 ±.51)	.180 (4.57)	.020 (.508)	.100 (2.54)
25	.250 ±.020 (6.35 ±.51)	.200 ± .020 (5.08 ±.51)	.180 (4.57)	.020 (.508)	.100 (2.54)
35	.350 ±.030 (8.89 ±.76)	.300 ± .030 (7.62 ±.76)	.220 (5.59)	.020 (.508)	.200 (5.08)
40	.400 ±.030 (10.16±.76)	.400 ± .030 (10.16±.76)	.220 (5.59)	.020 (.508)	.200 (5.08)
45	.450 ±.030 (11.43±.76)	.400 ± .030 (10.16±.76)	.220 (5.59)	.020 (.508)	.300 (7.62)
55	.550 ±.030 (13.97±.76)	.500 ± .030 (12.70±.76)	.220 (5.59)	.020 (.508)	.400 (10.16)
65	.650 ±.030 (16.51±.76)	.600 ± .030 (15.24±.76)	.220 (5.59)	.020 (.508)	.500 (12.70)
70	.700 ±.030 (17.78±.76)	.300 ± .030 (7.62±.76)	.220 (5.59)	.020 (.508)	.200 (5.08)
90	.900 ±.030 (22.86±.76)	.400 ± .030 (10.16±.76)	.220 (5.59)	.020 (.508)	.300 (7.62)
95	1.100 ±.030 (27.94±.76)	.500 ± .030 (12.70±.76)	.220 (5.59)	.020 (.508)	.400 (10.16)
99	1.350 ±.030 (34.29±.76)	.600 ± .030 (15.24±.76)	.220 (5.59)	.020 (.508)	.500 (12.70)

Outline Drawings and Lead Configurations





SNR

High Voltage, High Reliability DC COG (NPO) Chip Capacitors

COG (NPO) Dielectric Capacitance Ranges

Style	500 Vdc		1000 Vdc		2000 Vdc		3000 Vdc		4000 Vdc		5000 Vdc		10,000 Vdc	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
15	27pF	4700pF	27pF	1500pF	12pF	680pF	10pF	150pF						
20	39pF	8200pF	39pF	3900pF	22pF	820pF	22pF	560pF	22pF	390pF				
25	47pF	.010μF	47pF	6800pF	27pF	1200pF	27pF	680pF	27pF	470pF				
35	120pF	.022μF	120pF	.018μF	47pF	3300pF	47pF	1500pF	27pF	680pF				
40	220pF	.039μF	220pF	.022μF	100pF	5600pF	100pF	2200pF	18pF	1200pF				
45	220pF	.056μF	220pF	.033μF	100pF	6800pF	100pF	3900pF	18pF	1500pF	18pF	1000pF		
55	390pF	.068μF	390pF	.047μF	150pF	.010μF	150pF	6800pF	27pF	2200pF	27pF	2200pF		
65	470pF	.100μF	470pF	.068μF	270pF	.022μF	220pF	8200pF	47pF	3900pF	47pF	2700pF		
70	330pF	.120μF	330pF	.068μF	68pF	.010μF	68pF	4700pF	27pF	1500pF	27pF	1200pF		
90	470pF	.150μF	390pF	.056μF	120pF	.015μF	100pF	5600pF	56pF	3300pF	47pF	2200pF	18pF	1200pF
95	680pF	.220μF	680pF	.100μF	150pF	.022μF	150pF	.012μF	68pF	4700pF	68pF	2700pF	27pF	1500pF
99	1000pF	.330μF	1000pF	.150μF	270pF	.039μF	270pF	.018μF	120pF	8200pF	120pF	5600pF	56pF	2200pF

Dielectric Characteristics COG (NPO)

Capacitance Range	10pF to .330μF
Capacitance Tolerances	J±5%, K±10%, M±20%
Dissipation Factor	0.15% Max (25°C, 1 KHz) 1Vrms ±0.2V
Temperature Range	-55°C to +125°C
Temperature Coefficient	0±30ppm/°C
Insulation Resistance 1000 V or Rated V (Whichever is less) at 25°C	100GΩ min or 1000MΩμF Whichever is Less
Insulation Resistance 1000 V or Rated V (Whichever is less) at 125°C	10GΩ min or 100MΩμF Whichever is Less
Voltage Range	500V to 10kV (See Table)
Dielectric Withstand	1.2 x Rated Voltage 5 Second Min
Aging	None

Optional Marking

Styles 15 and 20 will be marked with EIA capacitance code, and tolerance (821K). Styles 25 and up will be marked with an insulating ink and will contain AFM, capacitance code, tolerance, lot code, voltage and series style.

Packaging

Bulk packaging in plastic bags is standard. Please contact factory for optional waffle packaging or tape and reel.

AFM Microelectronics Inc

Phone (858)755-7688 • Fax (858)348-3217 • 3347 Industrial Court • Suite J • San Diego, CA 92121 USA

www.afmmicroelectronics.com



SXR

High Voltage, High Reliability DC X7R Chip Capacitors

X7R Dielectric Capacitance Ranges

Style	500 Vdc		1000 Vdc		2000 Vdc		3000 Vdc		4000 Vdc		5000 Vdc		10,000 Vdc	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
15	680pF	.082μF	680pF	.022μF	270pF	3900pF								
20	1200pF	.180μF	1200pF	.068μF	560pF	8200pF	560pF	3900pF						
25	1200pF	.220μF	1200pF	.082μF	680pF	.018μF	680pF	5600pF						
35	3300pF	.560μF	3300pF	.270μF	1200pF	.033μF	1200pF	.015μF	270pF	6800pF				
40	6800pF	.860μF	6800pF	.390μF	2700pF	.047μF	2700pF	.018μF	470pF	8600pF				
45	6800pF	1.20μF	6800pF	.470μF	2700pF	.068μF	2700pF	.033μF	470pF	.010μF	470pF	6800pF		
55	.010μF	1.80μF	.010μF	.820μF	3900pF	.120μF	3900pF	.039μF	680pF	.015μF	680pF	.010μF		
65	.015μF	2.50μF	.015μF	1.00μF	6800pF	.180μF	6800pF	.082μF	1200pF	.027μF	1200pF	.015μF		
70	.010μF	1.50μF	.010μF	.560μF	1800pF	.082μF	1800pF	.027μF	680pF	.012μF	680pF	6800pF		
90	.012μF	2.20μF	.012μF	.820μF	3300pF	.150μF	3300pF	.047μF	1200pF	.027μF	1200pF	.022μF	470pF	3900pF
95	.018μF	3.00μF	.018μF	1.50μF	4700pF	.270μF	3900pF	.082μF	2200pF	.039μF	2200pF	.027μF	680pF	5600pF
99	.027μF	5.60μF	.027μF	2.20μF	8200pF	.390μF	5600pF	.120μF	3300pF	.056μF	3300pF	.039μF	1200pF	.010μF

Dielectric Characteristics X7R

Capacitance Range	270pF to 5.6μF
Capacitance Tolerances	J±5%, K±10%, M±20%
Dissipation Factor	2.5% Max (25°C, 1 KHz) 1Vrms ±0.2V
Temperature Range	-55°C to +125°C
Temperature Coefficient	±15%
Insulation Resistance 1000 V or Rated V (Whichever is less) at 25°C	100GΩ min or 1000MΩμF Whichever is Less
Insulation Resistance 1000 V or Rated V (Whichever is less) at 125°C	10GΩ min or 100MΩμF Whichever is Less
Voltage Range	500V to 10kV (See Table)
Dielectric Withstand	1.2 x Rated Voltage 5 Second Min
Aging	None

Optional Marking

Styles 15 and 20 can be marked with EIA capacitance code, and tolerance (821K). Styles 25 and up will be marked with an insulating ink and will contain AFM, capacitance code, tolerance, lot code, voltage and series style.

Packaging

Bulk packaging in plastic bags is standard. Please contact factory for optional waffle packaging or tape and reel.



VNR / VXR

High Voltage, High Reliability DC COG(NPO)/X7R Ceramic Chip Capacitors

Features

- Capacitance Range: 10pF to 2.5μF
- Operating Temperature Range: -55°C to 125°C
- Voltage Range: 500 Volt to 5KV
- COG (NPO) and X7R Dielectric

VNR/VXR series is high voltage multilayer ceramic chip capacitors for use in high reliability commercial, industrial and military applications. These capacitors are designed in accordance with MIL-PRF-49467 and can be supplied to NPO and X7R voltage temperature limits. Each capacitor is 100% tested physically and electrically* and can be screened to Group A and B performance criteria as defined in MIL-PRF-49467.



Applications

Typical applications include filtering of high voltage power supplies, high voltage multipliers, transient protection and noise suppression. Custom designs, extended thickness and test protocols to customer Source Control Drawings (SCD's) are available upon request.*

* See Test Option pages at the end of the catalog.

AFM Part Number Code

V Product Series: V: High Voltage	N Product Type: R: Chip	15	W Termination Code: C: Pd/Ag Term G: Ag Term, Ni P: Solder Dipped W Term in 60/40 Sn/Pb T: Ag Term, Ni/100% Sn Plated. (Pb Free) W: Ag Term, Ni Barrier, 90/10 Sn/Pb Plated	101	J Tolerance: F: ±1%* G: ±2%* J: ±5% K: ±10% M: ±20%	L	C Test Code: C: Commercial Test S: Special (Customer Defined) M: Hi-Rel	B Packaging: B: Bulk T: Tape & Reel W: Waffle Pack
Dielectrics: N: NPO X: X7R	Chip Size: (see table)			Capacitance Code: 1st two digits are significant: Third digit denotes number of zero(s); R=Decimal point 2R0=2.0pF 101=100pF	Voltage: J: 500 Vdc L: 1000 Vdc O: 2000 Vdc Q: 3000 Vdc S: 4000 Vdc T: 5000 Vdc		Marking: B: Not Marked M: Marked (per description) S: Special Marking	

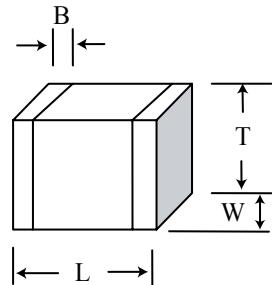
AFM Microelectronics Inc

Phone (858)755-7688 • Fax (858)348-3217 • 3347 Industrial Court • Suite J • San Diego, CA 92121 USA

www.afmmicroelectronics.com

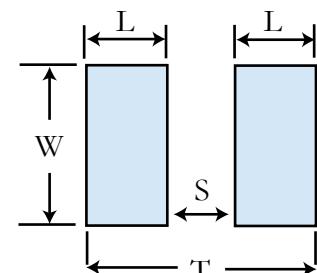
Chip Capacitor Dimensions and Tolerances

Style	EIA Size	Length (L) Inches (mm)	Width (W) Inches (mm)	Thickness (T) Inches (mm)	Bandwidth (B) Inches
12	1210	.120 ± .010 (3.05 ± .25)	.100 ± .010 (2.54 ± .25)	.100 (2.54)	.008-.025
15	1515	.150 ± .015 (3.81 ± .38)	.150 ± .015 (3.81 ± .38)	.140 (3.55)	.010-.030"
18	1812	.180 ± .020 (4.57 ± .51)	.120 ± .015 (3.05 ± .38)	.100 (2.54)	.010-.040"
19	1825	.180 ± .020 (4.57 ± .51)	.250 ± .020 (6.35 ± .51)	.160 (4.06)	.010-.040"
20	2020	.200 ± .020 (5.08 ± .51)	.200 ± .020 (5.08 ± .51)	.180 (4.57)	.010-.040"
22	2225	.220 ± .020 (5.59 ± .51)	.250 ± .020 (6.35 ± .51)	.200 (5.08)	.010-.040"
25	2520	.250 ± .020 (6.35 ± .51)	.200 ± .020 (5.08 ± .51)	.180 (4.57)	.030-.060"
33	3333	.330 ± .030 (8.38 ± .76)	.330 ± .030 (8.38 ± .76)	.220 (5.59)	.030-.060"
35	3530	.350 ± .030 (8.89 ± .76)	.300 ± .030 (7.62 ± .76)	.220 (5.59)	.030-.060"
40	4040	.400 ± .030 (10.16 ± .76)	.400 ± .030 (10.16 ± .76)	.220 (5.59)	.030-.060"
45	4540	.450 ± .030 (11.43 ± .76)	.400 ± .030 (10.16 ± .76)	.220 (5.59)	.030-.060"
54	5440	.540 ± .030 (13.72 ± .76)	.400 ± .030 (10.16 ± .76)	.220 (5.59)	.030-.060"
55	5550	.550 ± .030 (13.97 ± .76)	.500 ± .030 (12.70 ± .76)	.220 (5.59)	.030-.060"
65	6560	.650 ± .030 (16.51 ± .76)	.600 ± .030 (15.24 ± .76)	.220 (5.59)	.030-.060"



Recommended Pad Dimensions

Style	Chip Size	Total Length (T)		Separation (S)		Pad Width (W)		Pad Length (L)	
		Inches	mm	Inches	mm	Inches	mm	Inches	mm
12	1210	0.177	4.50	0.060	1.52	0.115	2.92	0.060	1.52
15	1515	0.205	5.20	0.075	1.91	0.171	4.34	0.065	1.65
18	1812	0.232	5.89	0.091	2.31	0.146	3.71	0.071	1.80
19	1825	0.232	5.89	0.091	2.31	0.272	6.91	0.071	1.80
20	2020	0.256	6.50	0.110	2.79	0.221	5.61	0.073	1.85
22	2225	0.276	7.01	0.130	3.30	0.268	6.81	0.073	1.85
25	2520	0.342	8.69	0.196	4.98	0.221	5.61	0.073	1.85
33	3333	0.430	10.92	0.280	7.11	0.365	9.27	0.075	1.91
35	3530	0.453	11.51	0.300	7.62	0.335	8.51	0.077	1.96
40	4040	0.507	12.88	0.350	8.89	0.435	11.05	0.079	2.01
45	4540	0.559	14.20	0.400	10.16	0.435	11.05	0.080	2.03
54	5440	0.650	16.51	0.410	10.41	0.435	11.05	0.120	3.05
55	5550	0.745	18.92	0.505	12.83	0.535	13.59	0.120	3.05
65	6560	0.780	19.81	0.520	13.21	0.635	16.13	0.130	3.30



Soldering Process

VNR/VXR chips should not be soldered using wave soldering process. Solder reflow hand solder methods are acceptable. Contact factory for Soldering Tech Bulletin.

C0G (NP0) Dielectric Capacitance Ranges*

Style	EIA Size	500 Vdc		1000 Vdc		2000 Vdc		3000 Vdc		4000 Vdc		5000 Vdc	
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
12	1210	10pF	2200pF	10pF	820pF	10pF	270pF						
15	1515	27pF	4700pF	27pF	1500pF	12pF	680pF	12pF	150pF	10pF	100pF		
18	1812	27pF	2700pF	27pF	1200pF	12pF	470pF	12pF	120pF	10pF	100pF		
19	1825	39pF	8200pF	39pF	3900pF	22pF	820pF	22pF	560pF	22pF	390pF		
20	2020	39pF	8200pF	39pF	3900pF	22pF	820pF	22pF	560pF	22pF	390pF		
22	2225	47pF	.012μF	47pF	8200pF	27pF	1200pF	27pF	680pF	27pF	470pF		
25	2050	47pF	.010μF	47pF	6800pF	27pF	1200pF	27pF	680pF	27pF	470pF		
33	3333	120pF	.015μF	120pF	.012μF	47pF	2700pF	47pF	1200pF	27pF	680pF		
35	3530	120pF	.022μF	120pF	.018μF	47pF	3300pF	47pF	1500pF	27pF	680pF		
40	4040	220pF	.039μF	220pF	.022μF	100pF	5600pF	100pF	2200pF	18pF	1200pF		
45	4540	220pF	.056μF	220pF	.033μF	100pF	6800pF	100pF	3900pF	18pF	1500pF	18pF	1000pF
54	5440	390pF	.082μF	390pF	.033μF	150pF	8200pF	150pF	3300pF	27pF	2200pF	22pF	1500pF
55	5550	390pF	.068μF	390pF	.047μF	150pF	.010μF	150pF	6800pF	27pF	2200pF	27pF	2200pF
65	6560	470pF	.100μF	470pF	.068μF	270pF	.022μF	270pF	6800pF	47pF	3900pF	47pF	2700pF

*For Extended Capacitance Values Please Contact Our Factory

Dielectric Characteristics COG (NPO)

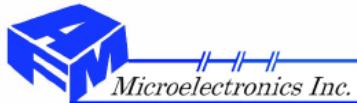
Capacitance Range	10pF to .100μF
Capacitance Tolerances	F±1%, G±2%, J±5%, K±10%, M±20%
Dissipation Factor	0.15% Max (25°C, 1 KHz) 1Vrms ±0.2V
Temperature Range	-55°C to +125°C
Temperature Coefficient	0±30ppm/°C
Insulation Resistance 1000 V or Rated V at 25°C (Whichever is less)	100GΩ min or 1000MΩμF Whichever is Less
Insulation Resistance 1000 V or Rated V at 125°C (Whichever is less)	10GΩ min or 100MΩμF Whichever is Less
Voltage Range	500V to 5kV (See Table)
Dielectric Withstand	1.2 x Rated Voltage 5 Second Min
Aging	None

Marking

Chips are supplied unmarked. Marking, if required is an additional charge. Styles 12-15 will be laser marked with EIA capacitance code, and tolerance (821K). Styles 18 and up will be marked with an insulating ink and will contain AFM, capacitance code, tolerance code and lot code.

Packaging

Bulk packaging in plastic bags is standard. Please contact factory for optional waffle packaging or tape and reel.



VXR

High Voltage, High Reliability DC X7R Ceramic Chip Capacitors

X7R Dielectric Capacitance Ranges*

Style	EIA Size	500 Vdc		1000 Vdc		2000 Vdc		3000 Vdc		4000 Vdc		5000 Vdc	
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
12	1210	270pF	.033μF										
15	1515	680pF	.068μF	680pF	.022μF								
18	1812	680pF	.056μF	680pF	.018μF	270pF	2500pF						
19	1825	1200pF	.180μF	1200pF	.047μF	560pF	8200pF	560pF	2700pF				
20	2020	1200pF	.180μF	1200pF	.068μF	560pF	8200pF	560pF	3900pF				
22	2225	1200pF	.220μF	1200pF	.082μF	680pF	.018μF	680pF	5600pF				
25	2520	1200pF	.220μF	1200pF	.068μF	680pF	.015μF	680pF	4700pF				
33	3333	3300pF	.470μF	3300pF	.250μF	1200pF	.027μF	1200pF	.012μF				
35	3530	3300pF	.560μF	3300pF	.270μF	1200pF	.033μF	1200pF	.015μF	270pF	6800pF		
40	4040	6800pF	.860μF	6800pF	.390μF	2700pF	.047μF	2700pF	.018μF	470pF	8600pF		
45	4540	6800pF	1.20μF	6800pF	.470μF	2700pF	.068μF	2700pF	.033μF	470pF	.010μF	470pF	6800pF
54	5440	.010μF	1.50μF	.010μF	.680μF	3900pF	.056μF	3900pF	.012μF	680pF	.010μF		
55	5550	.010μF	1.80μF	.010μF	.820μF	3900pF	.120μF	3900pF	.039μF	680pF	.015μF	680pF	.010μF
65	6560	.015μF	2.50μF	.015μF	1.00μF	6800pF	.180μF	6800pF	.082μF	1200pF	.027μF	1200pF	.015μF

*For Extended Capacitance Values Please Contact Our Factory

Dielectric Characteristics X7R

Capacitance Range	270pF to 2.5μF
Capacitance Tolerances	J±5%, K±10%, M±20%
Dissipation Factor	2.5% Max (25°C, 1 KHz) 1Vrms ±0.2V
Temperature Range	-55°C to +125°C
Temperature Coefficient	±15%
Insulation Resistance 1000 V or Rated V at 25°C (Whichever is less)	100GΩ min or 1000MΩμF Whichever is Less
Insulation Resistance 1000 V or Rated V at 125°C (Whichever is less)	10GΩ min or 100MΩμF Whichever is Less
Voltage Range	500V to 5kV (See Table)
Dielectric Withstand	1.2 x Rated Voltage 5 Second Min
Aging	None

Marking

Chips are supplied unmarked. Marking, if required is an additional charge. Styles 12-15 will be laser marked with EIA capacitance code, and tolerance (821K). Styles 18 and up will be marked with an insulating ink and will contain AFM, capacitance code, tolerance code and lot code.

Packaging

Bulk packaging in plastic bags is standard. Please contact factory for optional waffle packaging or tape and reel.

Features

- Capacitance Range: 10pF to .33μF
- Operating Temperature Range: -55°C to 125°C
- Voltage Range: 500V to 10kV
- Intermediate and Higher Voltages are Available
- High Reliability Long Life
- Conformal Coated

VNC series is high voltage radial lead multilayer ceramic capacitors for use in high reliability commercial and industrial applications. These capacitors are designed



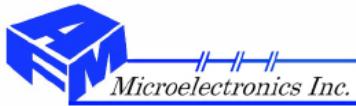
using a high density, extremely stable ceramic, having temperature coefficients meeting COG (NPO) standards. These capacitors conform to or exceed design guidelines outlined in DSCC and other MIL drawings and standards. Each capacitor is 100% tested physically and electrically. Group A and Group B Inspections, as well as partial discharge, SLAM and CSAM are available as options.

Applications

Typical applications include high voltage power supplies, voltage multipliers, surge protection and other custom applications.

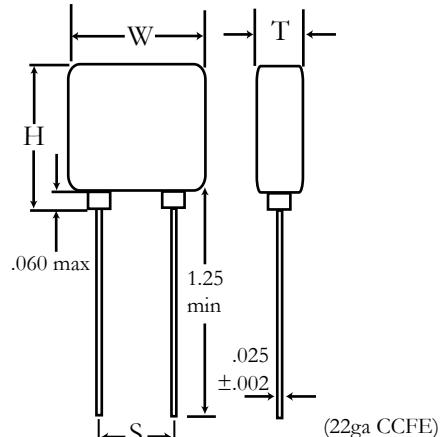
AFM Part Number Code

V	N	C	15	S	101	F	L	C	M	B
Product Series: V: High Voltage	Product Type: C: Commercial Conformal Coated			Termination Code: S: CCFE - Pb/Sn Plated		Tolerance: F: ±1% G: ±2% J: ±5% K: ±10% M: ±20%		Test Code: C: Commercial Tests S: Optional Tests M: Mil-Spec Testing		Packaging: B: Bulk W: Waffle Pack
Dielectrics: N: NPO		Size: (See Table)								
				Capacitance Code: 1st two digits are significant: Third digit denotes number of zero(s); R=Decimal point 2R0=2.0pF 101=100pF		Voltage: J: 500 Vdc L: 1000 Vdc O: 2000 Vdc Q: 3000 Vdc S: 4000 Vdc T: 5000 Vdc W: 10000Vdc		Marking: M: Marked		
										272K 5kV AFM Date Code



Size Information

Style	Sizes (Max) Inches (mm)			Lead Spacing ± 0.30 (S)
	Width (W)	Height (H)	Thickness (T)	
15	.250 (6.35)	.220 (5.59)	.200 (5.08)	.170 (4.32)
20	.320 (8.13)	.280 (7.11)	.250 (6.35)	.220 (5.59)
22	.370 (9.40)	.300 (7.62)	.250 (6.35)	.275 (6.99)
30	.450 (11.43)	.220 (5.59)	.200 (5.08)	.300 (7.62)
35	.470 (11.94)	.400 (10.16)	.270 (6.86)	.375 (9.53)
41	.550 (13.97)	.280 (7.11)	.250 (6.35)	.400 (10.16)
45	.570 (14.48)	.500 (12.70)	.270 (6.86)	.475 (12.07)
55	.670 (17.02)	.600 (15.24)	.270 (6.86)	.575 (14.61)
65	.770 (19.56)	.720 (18.29)	.270 (6.86)	.675 (17.15)
70	.850 (21.59)	.400 (10.16)	.270 (6.86)	.700 (17.78)
90	1.05 (26.67)	.500 (12.70)	.270 (6.86)	.975 (24.77)
95	1.25 (31.75)	.600 (15.24)	.270 (6.86)	1.175 (29.85)
99	1.45 (36.83)	.720 (18.29)	.270 (6.86)	1.375 (34.93)



NPO Capacitance Ranges

Style	500V		1kV		2kV		3kV		4kV		5kV		10kV	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
15	27pF	4700pF	27pF	1500pF	10pF	680pF	10pF	220pF						
20	39pF	8200pF	39pF	3900pF	22pF	820pF	22pF	560pF						
22	47pF	.012µF	47pF	6800pF	27pF	1500pF	27pF	820pF						
30	68pF	.015µF	68pF	4700pF	15pF	1000pF	15pF	390pF	10pF	220pF				
35	120pF	.022 µF	120pF	.018µF	47pF	3300pF	47pF	1500pF	27pF	680pF	15pF	470pF		
41	82pF	.027µF	82pF	.012µF	27pF	2200pF	27pF	820pF	10pF	560pF	10pF	390pF		
45	220pF	.056µF	220pF	.033µF	100pF	6800pF	100pF	3900pF	18pF	1500pF	18pF	1200pF		
55	390pF	.082µF	390pF	.047µF	150pF	.010µF	150pF	6800pF	27pF	2200pF	27pF	2200pF		
65	470pF	.100µF	470pF	.068µF	270pF	.022µF	270pF	8200pF	47pF	3900pF	47pF	2700pF		
70	330pF	.120µF	330pF	.068µF	68pF	.010µF	68pF	4700pF	27pF	1500pF	27pF	1200pF		
90	470pF	.150µF	470pF	.056µF	120pF	.015µF	120pF	5600pF	47pF	3300pF	47pF	2200pF	18pF	820pF
95	680pF	.220µF	680pF	.100µF	220pF	.022µF	220pF	.015µF	82pF	5600pF	82pF	3900pF	33pF	1200pF
99	1000pF	.330µF	1000pF	.15µF	270pF	.039µF	270pF	.018µF	120pF	8200pF	120pF	5600pF	56pF	5600pF

Specification and Performance:

Piezoelectric and Aging Effects:	None
Temperature Range:	-55°C to +200°C
Temperature Coefficient of Capacitance:	0±30ppm/°C
Insulation Resistance (IR, at Rated Voltage):	25°C > 100,000 MΩ or 1000 MΩµF; 125°C > 10,000 MΩ or 100 MΩµF Whichever is Less
Dielectric Withstand Voltage (DWV):	500V to 10kV - 1.2 x V Rated at 25°C
Dissipation Factor:	0.15 max

Features

- Capacitance Range: 100pF to 5.6μF
- Operating Temperature Range: -55°C to 125°C
- Voltage Range: 1kV to 10kV
- Intermediate and Higher Voltages are Available
- High Reliability Long Life
- Conformal Coated

VXC series is high voltage radial lead multilayer ceramic capacitors for use in high reliability commercial and industrial applications. These capacitors are designed using a high density barium titanate ceramic, having temperature coefficients meeting X7R standards. These capacitors conform to or exceed design guidelines outlined in DSCC and other MIL drawings and standards. Each capacitor is 100% tested physically and electrically. Group A and Group B Inspections, as well as partial discharge, SLAM and CSAM are available as options.



Application

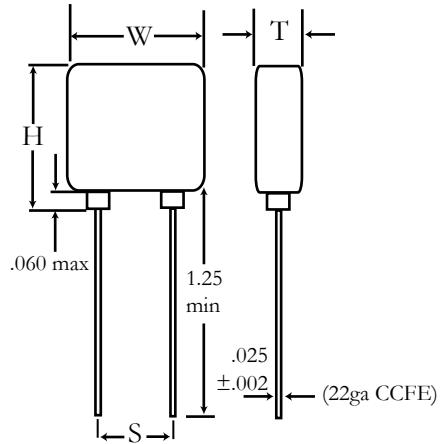
Typical applications include high voltage power supplies, voltage multipliers, surge protection and other custom applications.

AFM Part Number Code

V	X	C	15	S	101	J	L	C	M	B
Product Series: V: High Voltage		Product Type: C: Commercial Conformal Coat		Termination Code: S: CCFE - Pb/Sn Plated		Tolerance: J: ±5% K: ±10% M: ±20%		Test Code: C: Commercial Tests S: Optional Tests M: Mil-Spec Testing		Packaging: B: Bulk W: Waffle Pack
Dielectrics: X: X7R		Size: (See Table)		Capacitance Code: 1st two digits are significant; Third digit denotes number of zero(s); R=Decimal point 2R0=2.0pF 101=100pF		Voltage: L: 1000 Vdc O: 2000 Vdc Q: 3000 Vdc S: 4000 Vdc T: 5000 Vdc W: 10000Vdc		Marking: M: Marked		
										225K 1kV AFM Date Code

Size Information

Style	Sizes (Max) Inches (mm)			Lead Spacing ±0.30 (S)
	Width (W)	Height (H)	Thickness (T)	
15	.250 (6.35)	.220 (5.59)	.200 (5.08)	.170 (4.32)
20	.320 (8.13)	.280 (7.11)	.250 (6.35)	.220 (5.59)
22	.370 (9.40)	.300 (7.62)	.250 (6.35)	.275 (6.99)
30	.450 (11.43)	.220 (5.59)	.200 (5.08)	.300 (7.62)
35	.470 (11.94)	.400 (10.16)	.270 (6.86)	.375 (9.53)
41	.550 (13.97)	.280 (7.11)	.250 (6.35)	.400 (10.16)
45	.570 (14.48)	.500 (12.70)	.270 (6.86)	.475 (12.07)
55	.670 (17.02)	.600 (15.24)	.270 (6.86)	.575 (14.61)
65	.770 (19.56)	.720 (18.29)	.270 (6.86)	.675 (17.15)
70	.850 (21.59)	.400 (10.16)	.270 (6.86)	.700 (17.78)
90	1.05 (26.27)	.500 (12.70)	.270 (6.86)	.975 (24.77)
95	1.25 (31.75)	.600 (15.24)	.270 (6.86)	1.175 (29.85)
99	1.45 (36.83)	.720 (18.29)	.270 (6.86)	1.375 (34.93)



X7R Capacitance Range

Style	500V		1kV		2kV		3kV		4kV		5kV		10kV	
	Min	Max												
15	680pF	.082μF	680pF	.022μF	270pF	3900pF	100pF	1200pF						
20	1200pF	.180μF	1200pF	.068μF	560pF	.012μF	560pF	3900pF						
22	1200pF	.220μF	1200pF	.082μF	680pF	.018μF	680pF	5600pF						
30	1800pF	.220μF	1800pF	.056μF	390pF	8200pF	390pF	2200pF	150pF	1200pF				
35	3300pF	.560μF	3300pF	.270μF	1200pF	.033μF	1200pF	.015μF	270pF	6800pF				
41	2700pF	.390μF	2700pF	.150μF	680pF	.022μF	680pF	8200pF	270pF	4700pF	270pF	2700pF		
45	6800pF	1.20μF	6800pF	.470μF	2700pF	.068μF	2700pF	.033μF	470pF	.010μF	470pF	6800pF		
55	.010μF	1.80μF	.010μF	.680μF	3900pF	.100μF	3900pF	.039μF	680pF	.015μF	680pF	.010μF		
65	.015μF	2.50μF	.015μF	1.00μF	6800pF	.180μF	6800pF	.082μF	1200pF	.027μF	1000pF	.015μF	270pF	1200pF
70	.010μF	1.50μF	.010μF	.680μF	1800pF	.082μF	1800pF	.027μF	680pF	.012μF	680pF	8200pF	150pF	1000pF
90	.012μF	2.20μF	.012μF	1.00μF	3300pF	.150μF	3300pF	.056μF	1200pF	.027μF	1000pF	.022μF	470pF	3900pF
95	.018μF	3.90μF	.018μF	1.5μF	5600pF	.250μF	5600pF	.082μF	2200pF	.047μF	2000pF	.027μF	820pF	5600pF
99	.027μF	5.60μF	.027μF	2.20μF	8200pF	.390μF	8200pF	.120μF	3300pF	.068μF	3000pF	.039μF	1000pF	.010μF

Specification and Performance

Piezoelectric and Aging Effects:	None
Temperature Range:	-55°C to +200°C
Temperature Coefficient of Capacitance:	±15%
Insulation Resistance (IR, at Rated Voltage):	25°C > 100,000 MΩ or 1000 MΩμF; 125°C > 10,000 MΩ or 100 MΩμF Whichever is less
Dielectric Withstand Voltage (DWV):	500V to 10kV - 1.2 x V Rated at 25°C
Dissipation Factor:	2.5% max

Features

- Capacitance Range: 10pF to .47μF
- Operating Temperature Range: -55°C to 125°C
- Voltage Range: 600V to 5kV
- High Reliability Long Life
- Conformal Coated
- Sizes and Values Conform to MIL-PRF-49467

VNM/VRM/VZM series is high voltage radial lead multilayer ceramic capacitors

for use in high reliability commercial, industrial and military applications. These capacitors are designed in accordance with MIL-PRF-49467 and can be supplied to BP, BR, and BZ voltage temperature limits. Each capacitor is 100% tested physically and electrically to Group A Inspection, Subgroups 1, 3, 4, as defined in MIL-PRF-49467. AFM has in-house partial discharge (corona) testing capability and this test is available as an option. Group B Inspection is also available as an option.

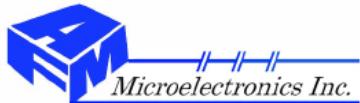


AFM Part Number Code

V	N	M	A	S	101	J	L	M	M	B
Product Series: V: High Voltage		Product Type: M: Mil Spec Applicable		Termination Code: S: CCFE - Pb/Sn Plated		Tolerance: J: ±5% K: ±10% M: ±20%		Test Code: S: Optional Tests M: Group A MIL PRF-49467		Packaging: B: Bulk W: Waffle Pack
Dielectrics: N: NPO - BP R: X7R- BR Z: X7R - BZ		Size: (See Table)		Capacitance Code: 1st two digits are significant; Third digit denotes number of zero(s); 101=100pF		Voltage: K: 600 Vdc L: 1000 Vdc O: 2000 Vdc Q: 3000 Vdc S: 4000 Vdc T: 5000 Vdc		Marking: M: Marked (per MIL-PRF-49467)*		

Specification and Performance

BP, BR and BZ Temperature Coefficient:	See "Voltage - Temperature Limits" table on next page
Insulation Resistance (IR, at Rated Voltage):	25°C > 100,000 MΩ or 1000 MΩμF 125°C > 10,000 MΩ or 100 MΩμF Whichever is Less
Dissipation Factor:	0.15% max for BP 2.5% max for BR and BZ

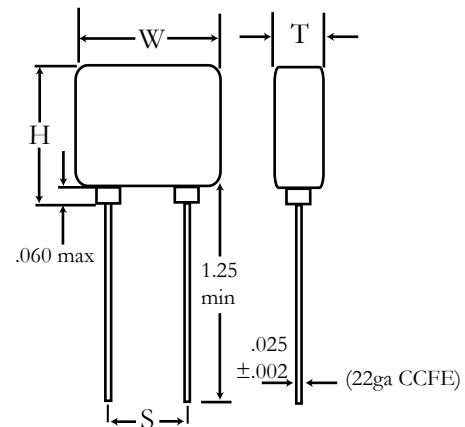


VNM

High Voltage Radial Leaded Multilayer Ceramic Capacitors MIL-PRF-49467 (Equivalent)

Size Information

Style	Sizes (Max) Inches (mm)			Lead Spacing ± 0.30 (S)
	Width (W)	Height (H)	Thickness (T)	
A	.250 (6.35)	.220 (5.59)	.200 (5.08)	.170 (4.32)
B	.320 (8.13)	.280 (7.11)	.250 (6.35)	.220 (5.59)
C	.370 (9.40)	.300 (7.62)	.250 (6.35)	.275 (6.99)
D	.470 (11.94)	.400 (10.16)	.270 (6.86)	.375 (9.53)
E	.570 (14.48)	.500 (12.70)	.270 (6.86)	.475 (12.07)
F	.670 (17.02)	.600 (15.24)	.270 (6.86)	.575 (14.61)
G	.770 (19.56)	.720 (18.29)	.270 (6.86)	.675 (17.15)
Extended Case Codes				
J	1.25 (31.75)	.600 (15.24)	.270(6.86)	1.10 (27.94)
K	1.45 (36.83)	.720 (18.29)	.270 (6.86)	1.30 (33.02)
L	.450 (11.43)	.220 (5.59)	.200 (5.08)	.300 (7.62)
M	.450 (11.43)	.220 (5.59)	.270 (6.86)	.300 (7.62)



Voltage - Temperature Limits (-55°C to +125°C)			
TC	No Load	Rated Voltage	% Change
BP	0±30ppm/°C	100%	0±30ppm/°C
BR	±15%	100%	+15, -40%
BZ	±15%	60%	+15, -45%

BP COG (NPO) Dielectric Capacitance Ranges

Style	600V		1kV		2kV		3kV		4kV		5kV	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
A	10pF	5600pF	10pF	1000pF	10pF	330pF						
B	10pF	5600pF	56pF	1800pF	22pF	820pF	10pF	560pF				
C	6800pF	.012µF	68pF	2700pF	27pF	1200pF	22pF	680pF				
D	.018µF	.039µF	120pF	4700pF	47pF	2200pF	39pF	1500pF	18pF	1000pF		
E	.047µF	.068µF	270pF	.018 µF	100pF	4700pF	100pF	3300pF	100pF	1800pF	100pF	1000pF
F			390pF	.018µF	150pF	6800pF	150pF	5600pF	150pF	3300pF	150pF	1800pF
G			470pF	.027µF	270pF	.010µF	270pF	6800pF	270pF	4700pF	270pF	3300pF
K											560pF	3900pF
L									10pF	82pF		
M									47pF	820pF		

BR (X7R) Dielectric Capacitance Ranges

Style	600V		1kV		2kV		3kV		4kV		5kV	
	Min	Max										
A	100pF	.027μF	470pF	4700pF	220pF	1500pF						
B	.033μF	.082μF	1200pF	.010μF	390pF	3900pF	270pF	1500pF				
C		.100μF	1500pF	.027μF	820pF	5600pF	560pF	2200pF				
D	.12μF	.270μF	3300pF	.068μF	1200pF	.015μF	1000pF	6800pF	100pF	4700pF		
E	.330μF	.470μF	6800pF	.150μF	2700pF	.033μF	2700pF	.012μF	470pF	6800pF	390pF	2200pF
F			.100μF	.270μF	3900pF	.047μF	3300pF	.022μF	680pF	.010μF	560pF	5600pF
G			.12μF	.470μF	6800pF	.100μF	5600pF	.039μF	1200pF	.018μF	1200pF	8200pF
J							6800pF	.047μF	1800pF	.027μF	2200pF	.015μF
K							8200pF	.082μF	2700pF	.047μF	3300pF	.022μF
M									100pF	820pF	100pF	560pF

BZ (X7R) Dielectric Capacitance Ranges

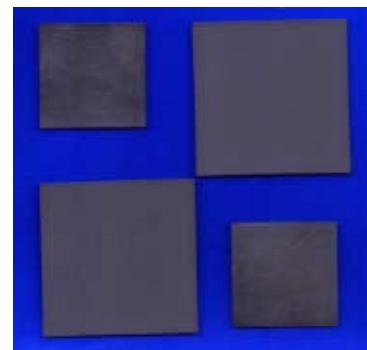
Style	1kV		2kV		3kV		4kV		5kV	
	Min	Max								
A	680pF	.010μF	220pF	2700pF						
B	1200pF	.015μF	560pF	6800pF	560pF	2200pF				
C	1500pF	.022μF	680pF	.010μF	680pF	3300pF				
D	3300pF	.056μF	1200pF	.027μF	1200pF	8200pF	120pF	6800pF		
E	6800pF	.120μF	2700pF	.056μF	2700pF	.018μF	680pF	.010μF	470pF	6800pF
F	.100μF	.180μF	3900pF	.082μF	3900pF	.027μF	820pF	.015μF	560pF	.010μF
G			5600pF	.150μF	6800pF	.047μF	1200μF	.027μF	1200pF	.015μF
J					6800pF	.047μF	2200pF	.039μF	2200pF	.022μF
K							3300pF	.056μF	3300pF	.033μF

GBBL SUBSTRATE

Substrate for Single Layer (Grain Boundary Barrier Layer) Capacitors.

Features

GBBL Substrate has 10 times and 20 times higher dielectric constant than traditional material but keeps the same property; Low-loss; Low insertion loss; Operates at very much higher frequency than traditional material and below the self-resonant frequency.



Application

DC Block, RF Bypass, Source Bypass, and Impedance Matching.

Specification

K	Size	Thickness	D.F. (%)	I.R. (25~50V)	TCC(-55°~ +125°C)
20000-22000	1.5"x1.5"	0.005"-0.020"	<1.5	>10G	X7R <+/-15%
25000=Avx MAXI + (<25mil part with border K=30000~50000)	1.5"x1.5"	0.005"-0.020"	<1.5	>10G	X7R <+/-15%
Low TC 15000-25000	1.5"x1.5"	0.005"-0.020"	<1.5	>10G	<+/-4.0%
Super High K 45000-50000 (<25mil Part With border K=90000-100000)	1.5"x1.5"	0.005"-0.020"	<1.5	>10G	X7S<+/-18~20%



Dielectric Powder

AFM supplies the Ultra Low Fired ceramic powder for Multilayer Ceramic Capacitor (MLCC) and Single Layer Capacitor (SLC). The powder system includes COG and X7R formulation. Other formulation such as Z5U and Y5V are developing. All formulations are fired at lower than 920°C. Therefore, the inner electrode can be used 95 Ag/5 Pd or 100% Silver, which will dramatically, reduces the cost of MLCC.

All formulations are Lead(Pb), Cadmium(Cd), and Bismuth(Bi) free. The COG ceramic powder is for microwave application that has high Q, low ESR, at high frequency. This feature allows the MLCC can be used in cellular phone, communication device, microwave amplifier, Blue Tooth module, computer etc.

X7R formulation has very fine grain size and density structure. This feature allows the manufacturer to make thinner ceramic sheets.



200C-ULF Powder (K20 Ultra-Low-Fire COG Dielectric)

Features

1. MgTiO₃ based ultra-low-fire COG dielectric
2. Dielectric Constant of 20-23
3. Excellent insulation resistance
4. High Q at high frequency
5. No Cd, Pb, Bi containing compounds

Typical Physical Properties

1. Particle Size (D50) 0.8-1.2um
2. Surface Area 2.0-4.0 m²/g
3. Specific Gravity 3.3-3.8g/cc
4. +325 mesh <0.5%

Typical Fired Electrical Properties

1. Dielectric Constant 20-23
2. Dissipation Factor(1MHz,1.0Vrms) 0.020%
Q(0402 14pf) @ (1 GHz) 137
3. ESR 096 Ohm
3. TCC 0± 30ppm/°C from -55-125°C
4. IR at 25°C >5,000 Ohm-F
125°C >1,000 Ohm-F
5. Dielectric Withstanding Voltage >1000V/mil
Sample size available

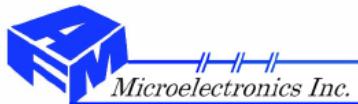
Processing Guidelines

(Detailed instructions available)

1. 200C-ULF is a fine particle size, deagglomerated powder. No further particle size reduction is required.
2. ZrO₂ media is recommended for mixing/milling operations. Contaminants such as aluminum oxides will result in degradation of electrical properties.
3. 50wt% ceramic /50% binder ratio is recommended as a starting point for casting using PVB or B7 acrylic binder systems.
4. Firing on ZrO₂ setters is recommended.
5. Firing temperature is in the 880-920°C range with a 2 hours soaking at peak temperature.

Compatible Materials systems

1. 200C-ULF is compatible with solvent base binder system.
2. 200C-ULF is compatible with commercially available 95%Ag/5%Pd or 100%Ag electrode system.



252X-ULF Powder (K2500 Ultra-Low-Fire X7R Dielectric)

Features

1. BaTiO₃ based ultra-low-fire X7R dielectric
2. Dielectric Constant of 2300-2700
3. Excellent insulation resistance
4. Resistant to physical defects
5. No Cd, Pb, Bi containing compounds

Typical Physical Properties

- | | |
|------------------------|---------------------------|
| 1. Particle Size (D50) | 0.8-1.2um |
| 2. Surface Area | 2.0-4.0 m ² /g |
| 3. Specific Gravity | 5.3-5.7g/cc |
| 4. +325 mesh | <0.5% |

Typical Fired Electrical Properties

- | | |
|-------------------------------------|--------------------|
| 1. Dielectric Constant | 2300-2700 |
| 2. Dissipation Factor(1MHz,1.0Vrms) | 1.700% |
| 3. TCC | 15% (-55-125°C) |
| 4. IR at 25°C | >20,000 Ohm-F |
| | 125°C >2,000 Ohm-F |
| 5. Dielectric Withstanding Voltage | >600V/mil |
- Sample size available

Processing Guidelines

(Detailed instructions available)

1. 252X-ULF is a fine particle size, deagglomerated powder. No further particle size reduction is required.
2. ZrO₂ media is recommended for mixing/milling operations. Contaminants such as aluminum oxides will result in degradation of electrical properties.
3. 60wt% ceramic /40% binder ratio is recommended as a starting point for casting using PVB or B7 acrylic binder systems.
4. Firing on stainless steel or superalloy boat (which reduces the recurring cost of setters) is recommended.
5. Firing temperature is in the 850-900°C range with a 2 hours soaking at peak temperature.

Compatible Materials systems

1. 252X-ULF is compatible with solvent base binder system.
2. 252X-ULF is compatible with commercially available 95%Ag/5%Pd or 100%Ag electrode system.

Cross Reference Guide to Equivalent Part Numbers

	AFM	A7C	AVX	DLI	TEMEX	MIL-C-55681
Example	MPR12T100JCMT	ATC100B100JT501XT	AQ147M100JATME	C17AH100JZNX1T	501CHB100JCLE	
	MPR11T	ATC100A...T ATC700A...T	AQ12EM...T AQ12EA...T	C11AH...Z C11CF...Z	CHA...S SHA...S	
Tin Plated Over Nickel Barrier	MNR11T	ATC100B...T ATC700B...T	AQ147M...T AQ147A...T	C17AH...Z C17CF...Z	CHB...S SHB...S	
RoHS Compliant	MPR12T	ATC100C...T ATC700C...T	HQCC...T	C22AH...Z C22CF...Z	CPX...S CLX...S	
	MNR12T	ATC100E...T ATC700E...T	HQCE...T	C40AH...Z C40CF...Z	CPE...S CLE...S	
	MPH25T	ATC100A...TN		C11AH...W	CHA...C	
	MNH25T	ATC100A...TN ATC700A...TN		C11CF...W	SHA...C	
Tin Plated Over Copper Barrier	MPR11N	ATC100B...TN ATC700B...TN		C17AH...W	CHB...C	
RoHS Compliant Non-Magnetic	MNR12N	ATC100C...TN ATC700C...TN		C17CF...W	SHB...C	
	MPH25N	ATC100E...TN ATC700E...TN		C22AH...W	CPX...C	
	MNH25N	ATC100E...TN ATC700E...TN		C22CF...W	CLX...C	
	MPH11N	ATC100A...TN		C40AH...W	CPE...C	
	MNH11N	ATC100A...TN ATC700A...TN		C40CF...W	CLX...C	
	MPR11W	ATC100A...W ATC700A...W	AQ12EM...J AQ12EA...J	C11AH...U	CDR12BG	
	MNR11W	ATC100B...W ATC700B...W	AQ147M...J AQ147A...J	C11CF...U	CDR12BP	
	MPR12W	ATC100C...W ATC700C...W	HQCC...J	C17AH...U	CDR14BG	
Tin / Pb Plated Over Nickel Barrier	MNR12W	ATC100E...W ATC700E...W	HQCE...J	C17CF...U	CDR14BP	
	MPH25W	ATC100A...P ATC700A...P	AQ12EM...J AQ12EA...J	C22AH...U		
	MNH25W	ATC100B...P ATC700B...P	AQ147M...J AQ147A...J	C22CF...U		
	MPH11P	ATC100C...P ATC700C...P	AQ147A...J	C40AH...U		
	MNR11P	ATC100E...P ATC700E...P	AQ147A...J	C40CF...U		
	MPR12P	ATC100B...P ATC700B...P	AQ147M...J AQ147A...J	C11AH...T	CDR12BG	
	MNR12P	ATC100C...P ATC700C...P	HQCC...J	C11CF...T	CDR12BP	
	MPH25P	ATC100E...P ATC700E...P	HQCE...J	C17AH...T	CDR14BG	
	MNH25P	ATC100F...P ATC700F...P	HQCE...J	C17CF...T	CDR14BP	
	MPH11P	ATC100G...P ATC700G...P	HQCE...J	C22AH...T		
	MNH11P	ATC100H...P ATC700H...P	HQCE...J	C22CF...T		
				C40AH...T		
				C40CF...T		

Cross Reference

Cross Reference Guide to Equivalent Part Numbers

	AFM	ATC	AVX	DLI	TEMEX	MIL-C-55681
Leaded with Microstrip / Non-magnetic	MPR12M / MN	ATC100B...MS/MN ATC700B...MS/MN		C17AH...A/WA C17CF...A/WA	CHB...1 SHB...1	CDR21BG CDR21BP
	MPH25M / MN	ATC100C...MS/MN ATC700C...MS/MN	HQLC	C22AH...A/WA C22CF...A/WA	CPX...1 CLX...1	
	MNH1M / MN	ATC100E...MS/MN ATC700E...MS/MN	HQLE	C40AH...A/WA C40CF...A/WA	CPE...1 CLX...1	
	MPH12B / BN	ATC100B...AR/AN ATC700B...AR/AN		C17AH...C/WC C17CF...C/WC	CHB...2 SHB...2	CDR22BG CDR22BP
	MPH25B / BN	ATC100C...AR/AN ATC700C...AR/AN	HQLC	C22AH...C/WC C22CF...C/WC	CPX...2 CLX...2	
	MNH1B / BN	ATC100E...AR/AN ATC700E...AR/AN	HQLE	C40AH...C/WC C40CF...C/WC	CPE...2 CLX...2	
Leaded with Axial Ribbon / Non-magnetic	MPH1B / BN	ATC100B...AR/AN ATC700B...AR/AN		C17AH...E/WE C17CF...E/WE	CHB...6 SHB...6	CDR25BG CDR25BP
	MNH12A / AN	ATC100B...AW/BN ATC700B...AW/BN		C22AH...E/WE C22CF...E/WE	CPX...6 CLX...6	
	MPH12A / AN	ATC100C...AW/BN ATC700C...AW/BN		C40AH...E/WE C40CF...E/WE	CPE...6 CLX...6	
	MPH25A / AN	ATC100E...AW/BN ATC700E...AW/BN		C17AH...F/WF C17CF...F/WF	CHB...7 SHB...7	CDR23BG CDR23BP
	MNH1A / AN	ATC100B...RW/RN ATC700B...RW/RN		C22AH...F/WF C22CF...F/WF	CPX...7 CLX...7	
	MPR12Q / QN	ATC100B...RW/RN ATC700B...RW/RN		C40AH...F/WF C40CF...F/WF	CPE...7 CLX...7	
Leaded with Radial Wire / Non-magnetic	MPH25Q / QN	ATC100C...RW/RN ATC700C...RW/RN		C22AH...F/WF C22CF...F/WF		
	MNH1Q / QN	ATC100E...RW/RN ATC700E...RW/RN		C40AH...F/WF C40CF...F/WF		



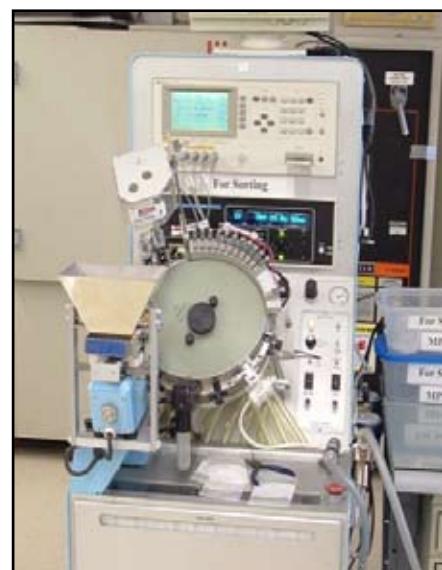
High Reliability Multilayer Ceramic Capacitor Test Protocols

AFM Microelectronics, Inc. (AFM) performs 100 percent testing of capacitors for all the dielectric systems offered. As a minimum, all capacitors are tested by AFM's Commercial Test Protocol to verify mechanical and electrical conformance to the applicable AFM or customer specifications. For high reliability applications enhanced test protocols are available options. This extended testing is outlined in the "High Reliability Test Protocol" table. These tests are in addition to the Commercial Tests and can be performed on the total lot or on a sample selected from the manufacturing lot.

For extended design verification testing (DVT), AFM offers other optional Environmental, Mechanical and Electrical Testing. These tests are performed on samples randomly selected from the production lot. These tests are used to verify that the design and manufacturing processes are well suited for the specific application and help verify reliable operation. These tests are typically destructive in nature and capacitors used for these tests are not certified for use in the production lot.

AFM follows the test methods and specifications outlined in MIL-STD-202, EIA-198 and can provide Group A, B and C testing to the MIL-PRF-49467, MIL-PRF-55681 and MIL-PRF-39014*. AFM also works with our customers to design custom test protocols that are specific to the customer's application. This can include burn-in and life testing up to at 300°C for capacitors used in oil and geothermal exploration and other high temperature applications, and high current pulse testing for detonator application.

*These capacitors are not MIL qualified





High Reliability Multilayer Ceramic Capacitor Test Protocols

Commercial Test Protocol

Test Item	Conditions	Requirements
Destructive Physical Analysis	Cross Section Representative Sample Depending on Lot Size	Microscopic Examination to AFM Internal Specification
Capacitance	Method 305 MIL-STD-202	100% at 25°C and 1Vrms Per
Dissipation Factor	Method 305 MIL-STD-202	100% at 25°C and 1Vrms $X7R \leq 2.5\%$, $NP0 \leq 0.15\%$
Dielectric Withstand Voltage (DWV)	Method 301 MIL-STD 202	250V or Less - 250% of Rated Voltage 250V to 400V - 150% of Rated Voltage $\geq 500V$ to 5kV - 120% of Rated Voltage
Insulation Resistance	Method 301 MIL-STD 202	Rated Voltage or 1kV Whichever is Less $100G\Omega$ or $1000M\Omega \cdot \mu F$ @ 25°C Whichever is Less
Visual / Mechanical Inspection	100% Per AFM Internal Specifications	Reject Visual Defects

High Reliability Test Protocol

Test Item	Conditions	Requirements
All Commercial Tests Plus:		
Voltage Conditioning:	Capacitors, $\geq 500V$ are Burned-in at Rated Voltage at 125° C for 100 Hours Capacitors, $< 500V$ are Burned at 200% Rated Voltage	PDA > 10% Lot is Rejected
Hot Insulation Resistance (IR)	Method 302 of MIL-STD-202	See Commercial Protocol $IR = 10G\Omega$ or $100M\Omega \cdot \mu F$
Percent Defective Allowed (PDA)	Cumulative Failures (PDA) After Voltage Conditioning Shall Not Exceed 10%.	Visual Defect and Out of Tolerance Pieces Not Included in PDA



High Reliability Multilayer Ceramic Capacitor Test Protocols

Optional Environmental, Mechanical and Electrical Testing

Test Item	Conditions	Requirements
Thermal Shock	Mil-STD-202, Method 107, Condition A (125°C) 20 cycles	No More Than 1 Failure Allowed in the Following Mechanical and Electrical Tests
Humidity Steady State (Low Voltage)	MIL-STD-202, Method 103, Condition A 85°C, 85% RH, DC voltage 1.3 ± 0.25 Vdc	No More Than 1 Failure Allowed
Immersion	MIL-STD-202, Method 104 Condition B	
Terminal Strength	MIL-STD-202, Method 211, Condition A	5lbs Min Force
Resistance to Soldering Heat	MIL-STD-202, Method 210, Condition B	Conformal Coated or Encapsulated Capacitors Only
Partial Discharge (Corona)	MIL-PRF-49467, Appendix B	$C \leq 5nF \leq 5$ picocoulombs $C > 5nf$ and $< .10\mu F$: < 15 picocoulombs $C \geq 1\mu F$ but $< .47\mu F$: $< 50pC$ AC Applied Voltage is 42% of Rated DC Voltage
Radiographic Inspection	MIL-STD-202, Method 209	Dielectric Voids Less Than 1/2 Dielectric Thickness
Life Test	Rated Voltage, 125°C for 1000 Hours	PDA 1 Piece or 10% Whichever is Greater
Solderability	MIL-STD-202 Method 208	> 95% Coverage
Body Insulation	1000 Volt DC Per MIL-PRF-49467 or MIL-PRF-39014 Where Applicable	No Breakdown

Test Data

Production test data is available when requested by customer. High reliability testing and data package charges will be negotiated at time of order.

Certificates of Compliance (CofC)

CofCs can be supplied with all shipments if requested by customer.



Useful Capacitor Formulas

Capacitance (Farads)	English: $C = (0.224 K A) / T_D$ Metric: $C = (0.0884 K A) / T_D$
Dissipation Factor	$D.F. = \tan \delta$ (loss angle) $= ESR/X_C$ $= (2\pi fC) (ESR)$
Equivalent Series Resistance ESR (Ohms)	$ESR = (DF) X_C = DF/2\pi fC$ $= Rsd + Rsm$ Rsd: Dielectric Loss Rsm: Metal Loss
Quality Factor	$Q = \cotan \delta = 1/DF$
Self Resonant Frequency, S.RF (Hz)	$S.R.F. = 1/(2\pi \sqrt{LC})$
Capacitive Reactance (Ohms)	$X_C = 1/(2\pi fC)$
Inductive Reactance (H)	$X_L = 2\pi fL$
Linear Charge of a Capacitor	$I = C (dV/dt)$
Total Impedance of a Capacitor (Ohms)	$Z = \sqrt{[R_s^2 + (X_C - X_L)^2]}$
Power Loss	Power Loss = $(2\pi fCV^2) (DF)$
Power Factor	$PF = \sin \delta$ (loss angle) - $\cos \Phi$ (Phase angle)
KVA (Kilowatts)	$KVA = 2\pi fCV^2 \times 10^{-3}$
Temperature Coefficient of Capacitance (TCC)	$T.C. = [(C_t - C_{25}) / C_{25} (T_t - 25)] \times 10^6$
Capacitance Drift	$CD = [(C_1 - C_2) / C_1] \times 100$
Aging Rate	$A.R. = \% \Delta C / \text{decade of time}$
Root Mean Square	$rms = 0.707 V_p$
Capacitors in Series	Any Number $1/C_T = 1/C_1 + 1/C_2 + \dots + 1/C_n$ Two Capacitors $C_T = C_1 C_2 / (C_1 + C_2)$
Capacitors in Parallel	Any Number $C_T = C_1 + C_2 + \dots + C_n$
Energy Stored in Capacitor	$E = \frac{1}{2} CV^2$
Ceramic Capacitor Reliability	$L_0 / L_t = (V_t / V_0)^x (T_t / T_0)^y$



Metric Prefixes & Symbols

Metric Prefixes

Prefix	Numveric Values
Pico	10^{-12}
Nano	10^{-9}
Micro	10^{-6}
Mili	10^{-3}
Deci	10^{-1}
Deca	10^1
Kilo	10^3
Mega	10^6
Giga	10^9
Tera	10^{12}

Symbols

A = Area
f = Frequency
K = Dielectric Constant
L = Inductance
L_0 = Operating Life
L_t = Test Life
R_s = Series Resistance
t = Time
T_0 = Operating Temperature
T_d = Dielectric Thickness
T_t = Test Temperature
V = Voltage
V_0 = Operating Temperature
V_t = Test Voltage
X, Y = Exponent Effect of Voltage and Temperature
δ = Loss angle

Equipments



Automated Printer / Stack and Laminate



ESI Auto-Termination



Isostatic Press



Auto-Test and Sort



Isostatic Press



Automated Printer / Stack and Laminate



ESI Auto-Termination



Auto-Test and Sort



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