Types MC and MCN Multilayer RF Capacitors

High-Frequency, High-Power, High-Voltage Chips with Nonmagnetic Option

Rugged flexibility and compatibility with FR4 boards make Type MC and MCN capacitors ideal for use where other multilayer caps aren't recommended because of cracking. The natural mica dielectric retains its high-Q to many megahertz, so higher frequency applications are limited by the circuit inductance, not the Type MC capacitor. **Nonmagnetic** Type MCN chips are available for MRI and other high frequency applications that often use more expensive porcelain ceramic chips.

Highlights

- Extremely high Q at UHF/VHF frequencies
- Free from thermal cracking, FR4 compatible
- Wave solderable
- Nonmagnetic option
- Exceed 2 mm bend test
- Better than porcelain
- High RF current — dV/dt 20,000 V/µs
- Rock stable: No change with time, V & f

Applications

- MRI Coils and Generators
- RF Instruments
- Power Amplifiers
- Tuned LCR Circuits
- CATV
- Ground and Flight Mobile Radio
- Lasers
- Software - Defined Frequency-Hopping Radio

Specifications

Voltages: 100 Vdc, 500 Vdc, and 1000 Vdc
Capacitance Range: 0.5 pF to 2,200 pF
Capacitance Tolerance: ±0.1pF to ±5%
Temperature Range: –55 ºC to +125 ºC
Case Sizes: 0805, 1210, 1812, and 2220

Ratings — RoHS Compliant

Cap (pF)	Catalog Part Number	Case Type
100 Vdc		
0.5	MC08CA0R5D-F	0805
1.0	MC08CA010D-F	0805
2.0	MC08CA020D-F	0805
3.0	MC08CA030D-F	0805
4.0	MC08CA040D-F	0805
5.0	MC08CA050D-F	0805
6.0	MC08CA060D-F	0805
7.0	MC08CA070D-F	0805
8.0	MC08CA080D-F	0805
9.0	MC08CA090D-F	0805
10.0	MC08CA100D-F	0805
12.0	MC08EA120J-F	0805
15.0	MC08EA150J-F	0805
18.0	MC08EA180J-F	0805
20.0	MC08EA200J-F	0805
22.0	MC08EA220J-F	0805
24.0	MC08EA240J-F	0805
27.0	MC08EA270J-F	0805
30.0	MC08EA300J-F	0805
33.0	MC08FA330J-F	0805
36.0	MC08FA360J-F	0805
39.0	MC08FA390J-F	0805
43.0	MC08FA430J-F	0805
47.0	MC08FA470J-F	0805
50.0	MC08FA500J-F	0805
51.0	MC08FA510J-F	0805
56.0	MC08FA560J-F	0805
62.0	MC08FA620J-F	0805

Cap (pF)	Catalog Part Number	Case Type
100 Vdc		
68	MC08FA680J-F	0805
75	MC08FA750J-F	0805
82	MC08FA820J-F	0805
91	MC08FA910J-F	0805
100	MC08FA101J-F	0805
47	MC12FA470J-F	1210
50	MC12FA500J-F	1210
51	MC12FA510J-F	1210
56	MC12FA560J-F	1210
62	MC12FA620J-F	1210
68	MC12FA680J-F	1210
75	MC12FA750J-F	1210
82	MC12FA820J-F	1210
91	MC12FA910J-F	1210
100	MC12FA101J-F	1210
110	MC12FA111J-F	1210
120	MC12FA121J-F	1210
130	MC12FA131J-F	1210
150	MC12FA151J-F	1210
160	MC12FA161J-F	1210
180	MC12FA181J-F	1210
200	MC12FA201J-F	1210
220	MC12FA221J-F	1210
240	MC12FA241J-F	1210
250	MC12FA251J-F	1210
270	MC12FA271J-F	1210
300	MC12FA301J-F	1210
330	MC12FA331J-F	1210

Cap (pF)	Catalog Part Number	Case Type
100 Vdc		
360	MC12FA361J-F	1210
390	MC12FA391J-F	1210
430	MC12FA431J-F	1210
250	MC18FA251J-F	1812
270	MC18FA271J-F	1812
300	MC18FA301J-F	1812
330	MC18FA331J-F	1812
360	MC18FA361J-F	1812
390	MC18FA391J-F	1812
430	MC18FA431J-F	1812
470	MC18FA471J-F	1812
500	MC18FA501J-F	1812
510	MC18FA511J-F	1812
560	MC18FA561J-F	1812
620	MC18FA621J-F	1812
680	MC18FA681J-F	1812
750	MC18FA751J-F	1812
820	MC18FA821J-F	1812
910	MC22FA911J-F	2220
1000	MC22FA102J-F	2220
1100	MC22FA112J-F	2220
1200	MC22FA122J-F	2220
1500	MC22FA152J-F	2220
1800	MC22FA182J-F	2220
2000	MC22FA202J-F	2220
2200	MC22FA222J-F	2220

Cap (pF)	Catalog Part Number	Case Type
500 Vdc		
0.5	MC08CD0R5D-F	0805
1	MC08CD010D-F	0805
2	MC08CD020D-F	0805
3	MC08CD030D-F	0805
4	MC08CD040D-F	0805
5	MC08CD050D-F	0805
6	MC08CD060D-F	0805
7	MC08CD070D-F	0805
8	MC08CD080D-F	0805
9	MC08CD090D-F	0805
10	MC08CD100D-F	0805
12	MC08ED120J-F	0805
15	MC08ED150J-F	0805
18	MC08ED180J-F	0805
20	MC08ED200J-F	0805
1	MC12CD010D-F	1210
2	MC12CD020D-F	1210
3	MC12CD030D-F	1210
4	MC12CD040D-F	1210
5	MC12CD050D-F	1210
6	MC12CD060D-F	1210
7	MC12CD070D-F	1210
8	MC12CD080D-F	1210
9	MC12CD090D-F	1210
10	MC12CD100D-F	1210
12	MC12ED120J-F	1210
15	MC12ED150J-F	1210

Cap (pF)	Catalog Part Number	Case Type
500 Vdc		
18	MC12ED180J-F	1210
20	MC12ED200J-F	1210
22	MC12ED220J-F	1210
24	MC12ED240J-F	1210
27	MC12ED270J-F	1210
30	MC12ED300J-F	1210
33	MC12FD330J-F	1210
36	MC12FD360J-F	1210
39	MC12FD390J-F	1210
43	MC12FD430J-F	1210
47	MC12FD470J-F	1210
50	MC12FD500J-F	1210
51	MC12FD510J-F	1210
56	MC12FD560J-F	1210
62	MC12FD620J-F	1210
68	MC12FD680J-F	1210
75	MC12FD750J-F	1210
82	MC12FD820J-F	1210
91	MC12FD910J-F	1210
100	MC12FD101J-F	1210
110	MC12FD111J-F	1210
120	MC12FD121J-F	1210
130	MC12FD131J-F	1210
150	MC12FD151J-F	1210
100	MC18FD101J-F	1812
110	MC18FD111J-F	1812
120	MC18FD121J-F	1812

Cap (pF)	Catalog Part Number	Case Type
500 Vdc		
130	MC18FD131J-F	1812
150	MC18FD151J-F	1812
160	MC18FD161J-F	1812
180	MC18FD181J-F	1812
200	MC18FD201J-F	1812
220	MC18FD221J-F	1812
240	MC18FD241J-F	1812
250	MC18FD251J-F	1812
270	MC18FD271J-F	1812
300	MC18FD301J-F	1812
330	MC18FD331J-F	1812
360	MC18FD361J-F	1812
390	MC18FD391J-F	1812
430	MC18FD431J-F	1812
470	MC18FD471J-F	1812
500	MC22FD501J-F	2220
510	MC22FD511J-F	2220
560	MC22FD561J-F	2220
620	MC22FD621J-F	2220
680	MC22FD681J-F	2220
750	MC22FD751J-F	2220
820	MC22FD821J-F	2220
910	MC22FD911J-F	2220
1000	MC22FD102J-F	2220
1100	MC22FD112J-F	2220
1200	MC22FD122J-F	2220

Cap (pF)	Catalog Part Number	Case Type
1000 Vdc		
0.5	MC12CF0R5D-F	1210
1.0	MC12CF010D-F	1210
2.0	MC12CF020D-F	1210
3.0	MC12CF030D-F	1210
4.0	MC12CF040D-F	1210
5.0	MC12CF050D-F	1210
6.0	MC12CF060D-F	1210
7.0	MC12CF070D-F	1210
8.0	MC12CF080D-F	1210
9.0	MC12CF090D-F	1210
10.0	MC12CF100D-F	1210
12.0	MC12EF120J-F	1210
15.0	MC12EF150J-F	1210
18.0	MC12EF180J-F	1210
20.0	MC12EF200J-F	1210
22.0	MC12EF220J-F	1210
24.0	MC12EF240J-F	1210
27.0	MC12EF270J-F	1210
30.0	MC12EF300J-F	1210
33.0	MC12FF330J-F	1210
36.0	MC12FF360J-F	1210

Cap (pF)	Catalog Part Number	Case Type
1000 Vdc		
39	MC12FF390J-F	1210
43	MC12FF430J-F	1210
47	MC12FF470J-F	1210
50	MC12FF500J-F	1210
51	MC22FF510J-F	2220
56	MC22FF560J-F	2220
62	MC22FF620J-F	2220
68	MC22FF680J-F	2220
75	MC22FF750J-F	2220
82	MC22FF820J-F	2220
91	MC22FF910J-F	2220
100	MC22FF101J-F	2220
110	MC22FF111J-F	2220
120	MC22FF121J-F	2220
130	MC22FF131J-F	2220
150	MC22FF151J-F	2220
160	MC22FF161J-F	2220
180	MC22FF181J-F	2220
200	MC22FF201J-F	2220
220	MC22FF221J-F	2220
240	MC22FF241J-F	2220

Cap (pF)	Catalog Part Number	Case Type
1000 Vdc		
250	MC22FF251J-F	2220
270	MC22FF271J-F	2220
300	MC22FF301J-F	2220
330	MC22FF331J-F	2220
360	MC22FF361J-F	2220
390	MC22FF391J-F	2220
430	MC22FF431J-F	2220
470	MC22FF471J-F	2220
500	MC22FF501J-F	2220
510	MC22FF511J-F	2220
560	MC22FF561J-F	2220
620	MC22FF621J-F	2220
680	MC22FF681J-F	2220
750	MC22FF751J-F	2220
820	MC22FF821J-F	2220
910	MC22FF911J-F	2220
1000	MC22FF102J-F	2220
1100	MC22FF112J-F	2220
1200	MC22FF122J-F	2220
1500	MC22FF152J-F	2220

Part Numbering System and Ordering Information

Order by complete part number, as below. For other options, write your requirement on your RFQ.

MC(N)	22	F	D	122	J	–	T	F
CDE Type	Case Code	Temperature Coefficient	Voltage	Capacitance	Capacitor Tolerance		Package	RoHS (MC only)

MC = Standard
MCN = Nonmagnetic

08 = 0805
12 = 1210
18 = 1812
22 = 2220

A = 100 Vdc
D = 500 Vdc
F = 1000 Vdc

010 = 1 pF
1R8 = 1.8 pF
(187) = 187 pF
182 = 1800 pF

Blank = Bulk
T = Tape & reel not specific

MCN complies (no F required)

TC Code	Capacitance Range (pF)	Temperature Coefficient ppm/°C	Capacitance Drift
C	0.5 to 10	100 ±100	±(0.5% +0.1 pF)
E	10.5 to 30	50 ±50	±(0.1% +0.1 pF)
F	30.5 & up	25 ±25	±(0.05% +0.1 pF)

Tol. Code	Tolerance	Capacitance Range
B	±0.1 pF	0.5 pF to 5 pF
C	±0.25 pF	0.5 pF to 100 pF
D	±0.5 pF	0.5 pF to 10 pF
D	±0.50%	50.5 pF to 100 pF
F	±1 pF	5.5 pF to 10 pF
F	±1%	25.5 pF and up
G	±2%	13.0 pF and up
J	±5%	10.5 pF and up

Available Capacitance Values

Case Code	Capacitance (pF) 100 Vdc	500 Vdc	1000 Vdc	Minimum Cap. Step, pF
08	0.5 to 100	0.5 to 20	N/A	0.5
12	43.5 to 100	0.5 to 100	N/A	0.5
12	101 to 430	101 to 150	N/A	1.0
12			0.5 to 50	1.0
18	241 to 820	91.5 to 470	N/A	1.0
22	821 to 1000	471 to 1000	N/A	1.0
22	1010 to 2200	1010 to 1200	50.5 to 1500	10.0

Standard Minimum Quanti-

Reel Packed

Case Codes 08 & 12: 3,000/reel*

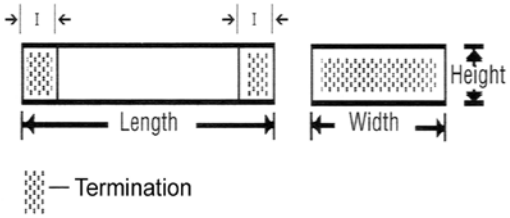
Case Codes 18 & 22: 1,000/reel**

Bulk Packed

100 per bag

*note - MC12, 100 volt units -250 pF and above, and 500 volt units -100 pF and above 2000 pc reels

**note - MC22, 1000 volt units -680 pF and above 500 pc reels



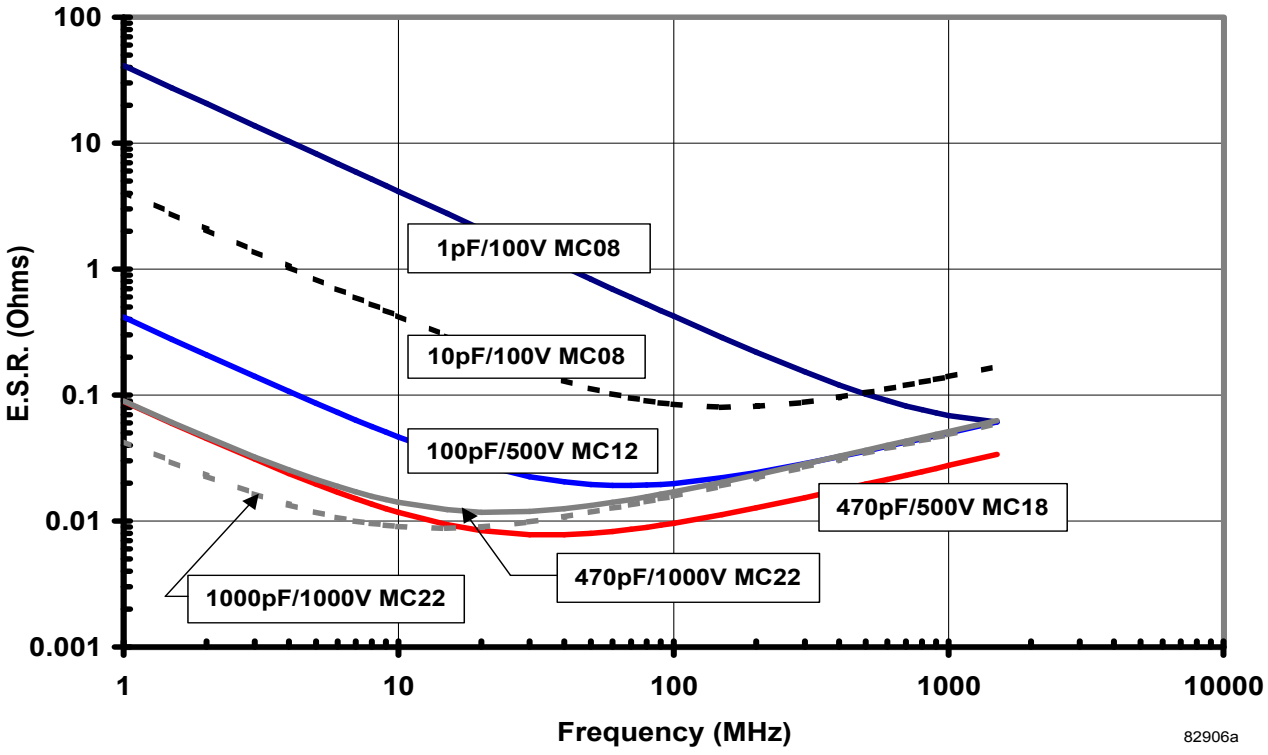
Case Sizes

Case Code	Case Type	INCHES L	W	H (Max.)	I Min./Max.	MILLIMETERS L	W	H (Max.)	I Min./Max.
08	0805	0.079 +.02 –0	0.049 +.02 –0	0.055	0.008/0.035	2.0 +0.5 –0	1.25 +0.5 –0	1.4	0.2/0.9
12	1210	0.126 +.024–.004	0.098 +.024–.004	0.079	0.012/0.043	3.2 +0.6 –0.1	2.5 +0.6 –0.1	2.0	0.3/1.1
18	1812	0.177 +.024 –.008	0.126 +.024 –.0	0.079	0.012/0.051	4.5 +0.6 –0.2	3.2 +0.6 –0	2.0	0.3/1.3
22	2220	0.224 +.016 –.012	0.197 +.016 –.012	0.079	0.012/0.051	5.7 +0.4 –0.3	5.0 +0.4 –0.3	2.0*	0.3/1.3

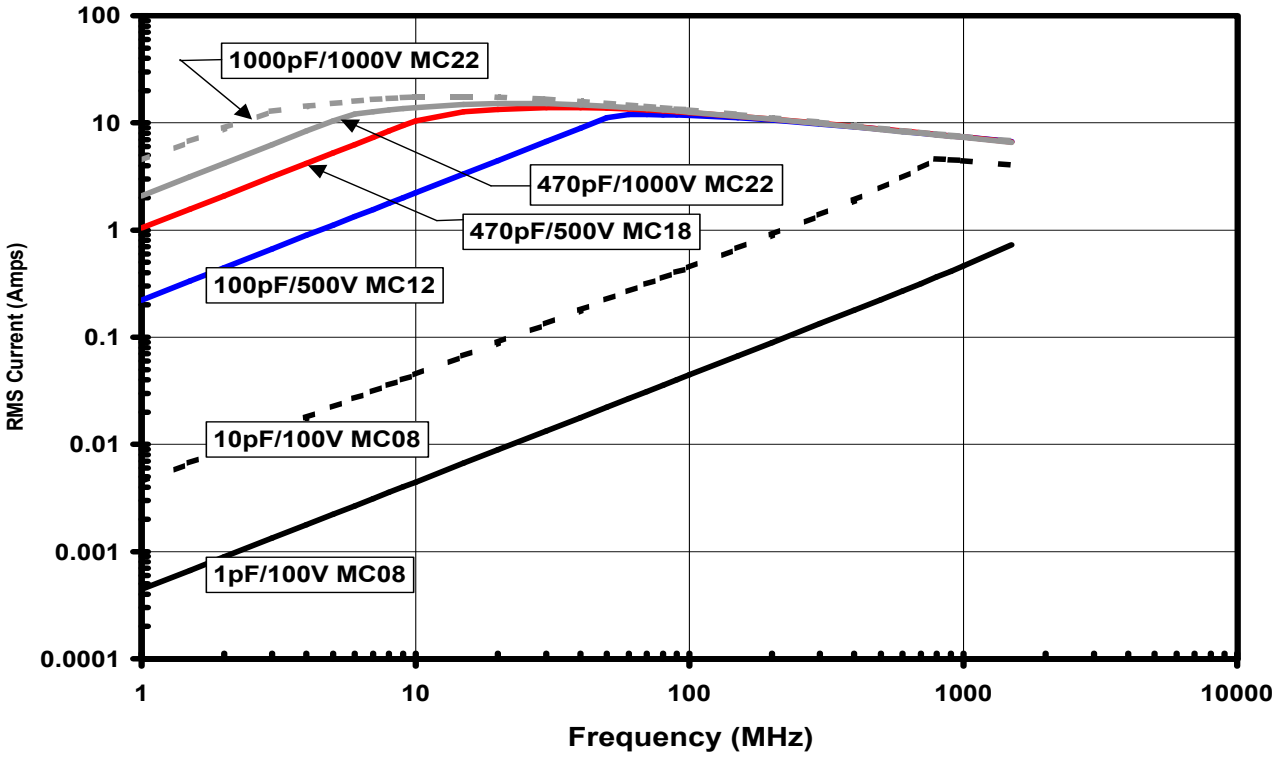
*.157 (4.0 mm) for 1000 V rating

Typical Performance Curves

Type MC Typical ESR vs. Frequency

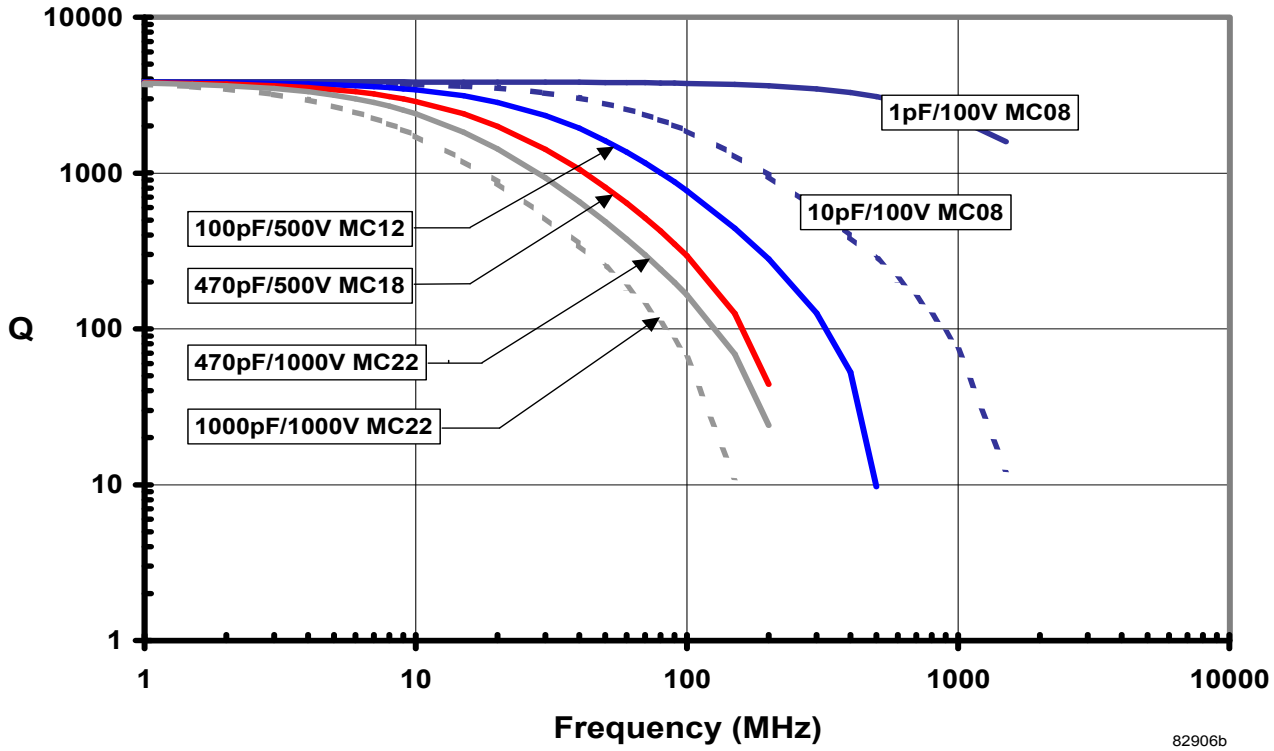


Type MC Maximum RMS Current vs. Frequency

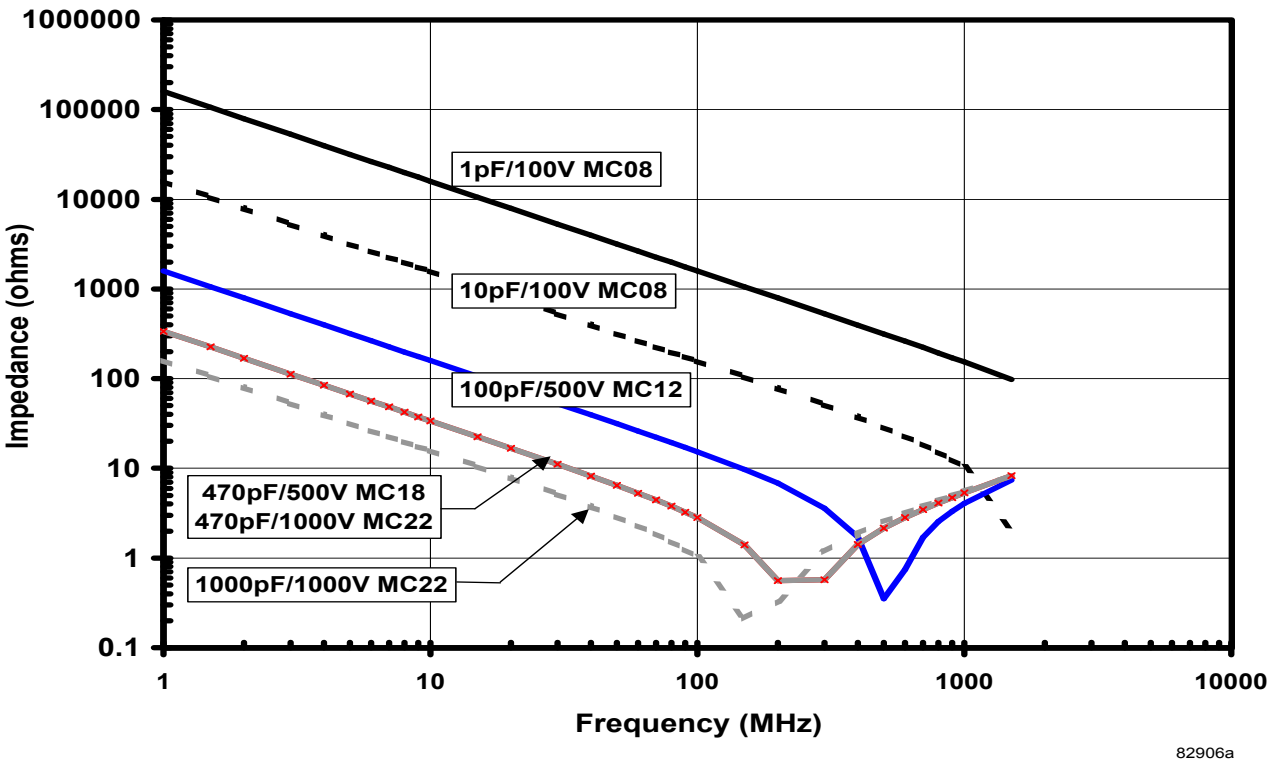


Typical Performance Curves

Type MC Typical Q vs. Frequency

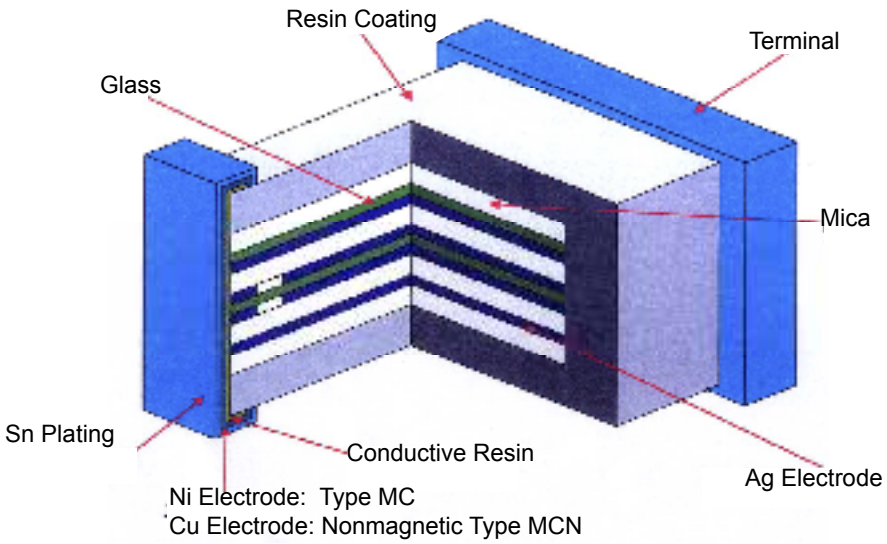


Type MC Typical Impedance vs. Frequency



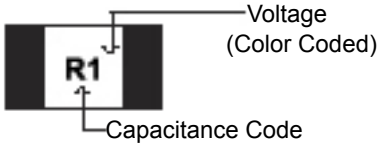
Types MC and MCN Multilayer RF Capacitors

High Q, Low ESR Construction for RF Power Applications



Specifications

Marking



Base Value	Code Ltr.	Base Value	Code Ltr.
10	A	40	d
11	B	43	R
12	C	45	e
13	D	47	S
15	E	50	f
16	F	51	T
18	G	56	U
20	H	60	m
22	J	62	V
24	K	68	W
25	a	70	n
27	L	75	X
30	M	80	t
33	N	82	Y
35	b	90	y
36	P	91	Z
39	Q		

Example:
R1 = 43 pF

Multiplier	Code No.
X 0.1	0
X 1	1
X 10	2
X 100	3
X 0.01	9

Capacitance is within tolerance when measured as follows:

1—1000 pF @ 1 MHz
>1000 pF @ 1 kHz

Dissipation Factor is no more than 0.1% when measured as above at 5 Vrms or less.

Specifications

Quality Factor (Q) is as follows when measured at 1 MHz

Capacitance Range	Min. Q
1 to 80 pF	500 to 3000
>80 pF	3000

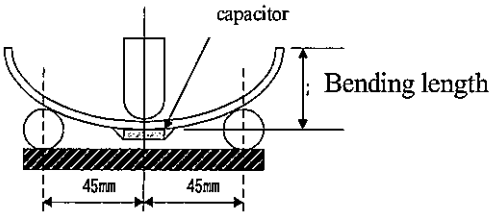
Insulation Resistance is no less than 100 GΩ when measured at 100 Vdc

Withstanding voltage is two times the rated voltage between 5 seconds and without damage: with 50 mA or less current.

Life Test: Subject capacitors to 125 ºC ±3 ºC with 1.5 times rated voltage applied for 2000 (+72, –0) hours. There will be no visual damage and the capacitors will meet the limits of the table below.

Vibration Resistance: Subject the capacitors to simple harmonic motion with an amplitude of 0.06 inches; vary the frequency uniformly from 10 to 55 Hz and return to 10 Hz, all in one minute. Repeat that cycle continuously for two hours in each of three mutually perpendicular directions. There will be no visual damage and the capacitors will meet the limits of the table below.

Bending Test: Mount the capacitor as shown below and press the ram bar until a 2.0 mm deflection is achieved. There will be no visual damage and the capacitors will meet the limits of methods JIS 5102 8.11 and AEC-Q200-005 without cracking or visual damage.



Moisture Resistance: Subject the capacitors to 40 ±2 ºC at 90 to 95% humidity for 500 (+24, –0) hours. Return to room ambient for 24 hours. There will be no visual damage and the capacitors will meet the limits of the table below.

Temperature Coefficient and Drift: Measure the capacitors' capacitance at 25 ºC, –55 ºC, 25 ºC, 125 ºC and at 25 ºC — all ±3 ºC — after stabilizing at each temperature. The capacitor will meet the limits of the Characteristic table in Ordering Information.

Heat Resistance: Subject the capacitors to 125 ±2 ºC for 2 (+1,–0) hours. Then the insulation resistance will be no less than 5GΩ.

Solderability: After 2 ±0.5 seconds in molten solder with Sn-PB between molten and solder at 235 ±5 ºC, solder coverage will be no less than 75% when examined at 10X magnification for flow soldering.

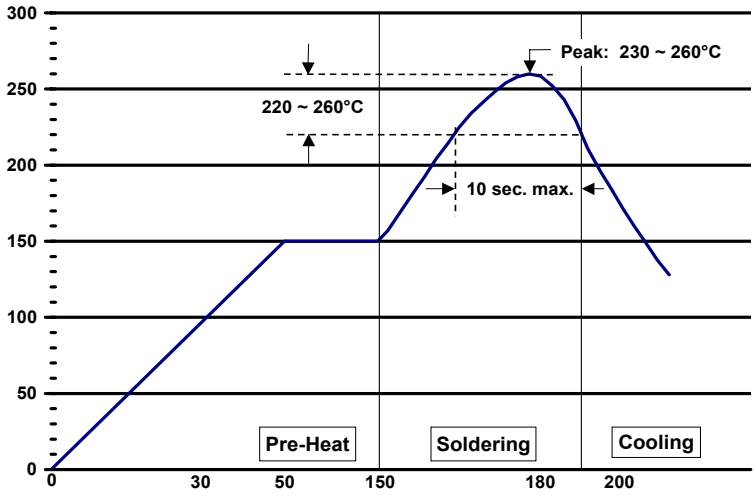
Solder Heat Resistance: Subject the capacitors to molten solder at 250±5 ºC for 5±0.5 seconds after 10 to 30 seconds pre-heating at 80 to 120 ºC. There will be no visual damage and the capacitors will meet the limits of the table below.

After-Test Limits

Test	Withstand Voltage	Insulation Resistance	Capacitance (whichever >)	DF	Q
Life Test	IL	IL	IV ±2% or ±.5 pF	150% max IL	2/3 x IL
Vibration Resistance	IL	30 GΩ	IV ±1% or ±1 pF	IL	IL
Bending Test	IL		IV ±.5% or ±1 pF	IL	
Moisture Res.	IL	30 GΩ	IV ±3% or ±.5 pF	150% max IL	2/3 x IL
Solderability	IL	IL	IL	IL	IL
Heat Resistance		5 GΩ			
Solder Heat Res.	IL	30 GΩ	IV ±.5% or ±1 pF	IL	IL

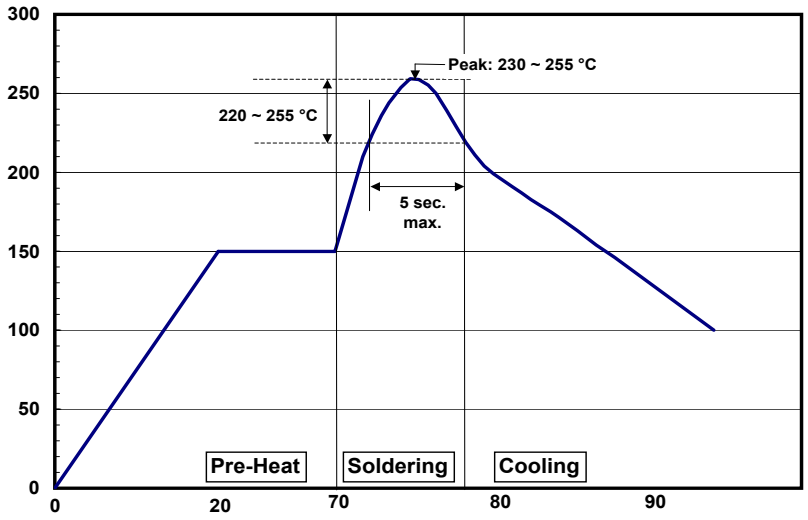
Soldering Profiles

Reflow Solder Profile



Time (sec)

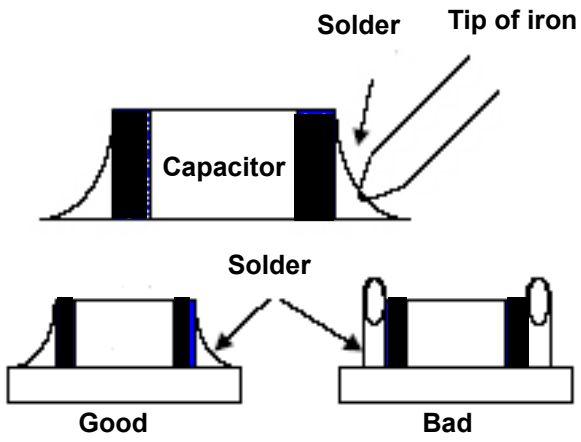
Wave Solder Profile



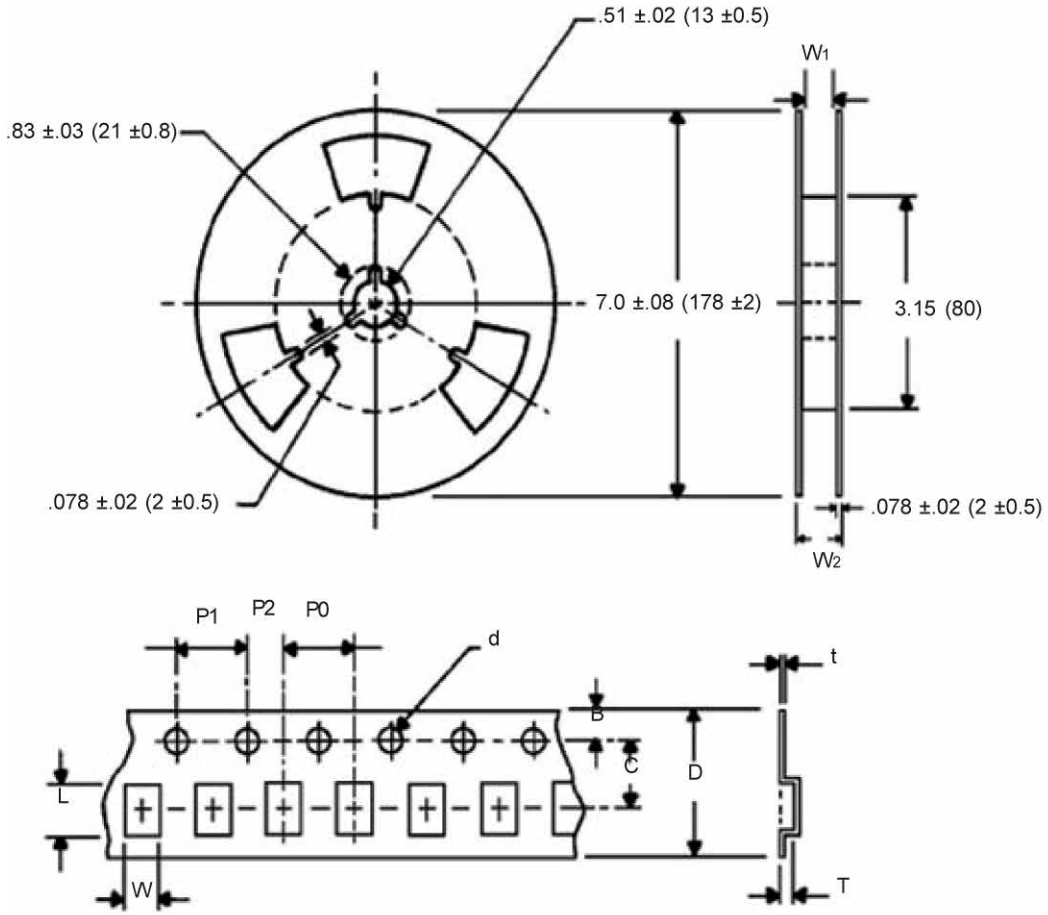
Time (sec)

Hand Soldering Method

- SnAgCu recommended solder
- Do not use strong acid type flux with RM or RMA
- Soldering iron tip temperature should be 250 ºC to 280 ºC ≤ 5 sec.
- 60 Watt iron or less



Surface-Mount Chip Mica Capacitors for Auto Insertion



Carrier Dimensions

Item	Symbol	Case Code 08	12	18	22
Sprocket hole pitch	P1	.157 ±.008 (4.0 ±0.2)			
Sprocket hole location	B	.069 ±.008 (1.75 ±0.2)			
Hole center to cavity center	C	.138 ±.002 (3.5 ±0.05)		.217±.004 (5.5 ±0.1)	
Carrier tape width	D	.315 ±.012 (8.0 ±0.3)		.472 ±.012 (12.0 ±0.3)	
Sprocket hole diameter	d	.059 (1.5)			
Cavity pitch	P_0	.157 .004 (4.0 ±0.1)		.315 ±.008 (8.0 ±0.2)	
Hole center to cavity center	P_2	.079 ±.004 (2.0 ±0.1)			
Cavity length	L	.110 (2.8)	.150 (3.8)	.205 (5.2)	.246 (6.25)
Cavity width	W	.075 ±.008 (1.9 ±0.2)	.118 ±.008 (3.0 ±0.2)	.161 ±.008 (4.1 ±0.2)	.217 ±.008 (5.5 ±0.2)
Cavity depth	T	.051 ±.004 (1.3 ±0.1)	.059 ±.004 (1.5 ±0.1)	.071 ±.004 (1.8 ±0.1)	.087 ±.004 (2.2 ±0.1)
Carrier tape thickness	t	.012 ±.002 (0.3 ±0.05)			
Holder distance	W_1	.354 (9.0)		.512 (13.0)	
Reel thickness	W_2	about .47 (12)		about .63 (16)	

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