



Capacitor Assemblies

FOR POWER AND RF
APPLICATIONS



Capacitor Racks | SV/ST/SM Stacks | Large Capacitor Assembly | High-Q | Custom Machining | EMI Filters

Capacitor Assemblies — "Cap-Rack" Arrays

The "Cap-Rack" (US Patent 6,058,004) is an assembly of individual chip capacitors, bonded with high temperature epoxy. A "Cap-Rack" can be made up of a pair, to as many as eight, same-size chips — 0603, 0805, 1005, 1206, 1210, 1808, 1812, 1825, 2221 and 2225 — into one single component providing extended freedom for PCB space utilization. Footprint dimensions can also vary to further optimize board space usage. The patented design allows the chips to behave as individual components, not as a single large ceramic mass, and therefore reduces harmful thermal stress during assembly. Typical applications are in Multi-line designs, Mobile phones, Automotive, Computers, Network Devices and Medical products.

Electrical advantages include reduction in "cross talk," to insignificant levels, by elimination of capacitance coupling between adjacent capacitors; the ability to combine resistors and inductors within the "Cap-Rack", as well as mixing and matching capacitance values and dielectrics.

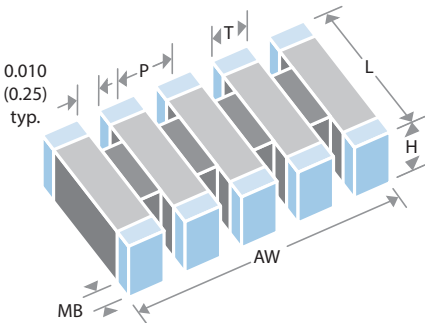
Mechanical advantages include reduced board area; easier to handle; reduced placement cost; reduced component stress and decreased cycle time. "Cap-Rack" can also be used with traditional pick and place equipment.

Consult the sales office for High Reliability versions and custom designs, particularly for high voltage applications.

- For dielectric characteristics, see our MLCC catalog.
- For dimensions of individual chips, see our MLCC catalog.
- P and AW dimensions are dependant on the chips utilized in the array.
- Cap Arrays require drawings to specify length and width of array and chip size used. Please contact the Sales Office.

DIMENSIONS — INCHES/MM

Size	0603	0805	1005	1206	1210	1808	1812	1825	2221	2225
Max number of Caps	6	6	6	6	6	6	8	8	8	8



ORDERING INFORMATION — "CAP-RACK" ARRAYS

CR	1206	N	562	K	101	N	H	T	- 4
Style	Size	Dielectric	Capacitance in picofarads (pF)	Capacitance tolerance	Voltage d.c.	Termination	Hi-Rel Option	Packing	No. of chips
Cap-Rack	Size of individual chips that make up the array	N = COG/NPO B = X7R	Value in Picofarads. Two significant figures, followed by number of zeros: 562 = 5600pF	B = 0.10pF* C = 0.25pF* D = 0.50pF* F = ± 1.0%* G = ± 2.0%* H = ± 3.0%* J = ± 5% K = ± 10% M = ± 20% Z = +80% -20% P = +100% -0% *COG/NPO only	Two significant figures, followed by number of zeros: 101 = 100V	N = Nickel Barrier (100% tin) P = Palladium Silver Y = Nickel Barrier (90% tin/10% lead)	Ref: MIL-PRF-55681 & MIL-PRF-123	T = Tape & Reel W = Waffle Pack	



Capacitor Assemblies SV2220

The SV capacitor assemblies are a vertical stacking of ceramic capacitors, offering far superior performance than either aluminum or tantalum electrolytic capacitors. They can be made with up to 10 same size chips with various lead configurations to safeguard against thermal and mechanical stresses and are 100% tested for dielectric withstanding voltage, insulation resistance, capacitance and dissipation factor.



Applications	Input and output stages of switch-mode power supplies and DC-DC converters		
Benefits	- Reduces the overall circuit board footprint - Low ESR and low ESL - High capacitance to volume ratio - Superior performance over aluminum or tantalum capacitors		

ELECTRICAL SPECIFICATIONS

DIELECTRIC WITHSTANDING VOLTAGE:	250% of rated voltage for 5 seconds
INSULATION RESISTANCE AT 25°C:	500 mega-ohm/micro-farad minimum
INSULATION RESISTANCE AT 125°C:	50 mega-ohm/micro-farad minimum
CAPACITANCE AT 25°C:	1.0±0.2 VRMS at 120 Hz
DISSIPATION FACTOR AT 25°C	5% maximum at 1.0±0.2 VRMS at 120 Hz
LIFE TEST:	150% of rated voltage at 125°C for 1000 hours
MOISTURE RESISTANCE:	10 cycles without voltage. MIL-STD-202 M106
THERMAL SHOCK:	MIL-STD-202 M107, test condition A -55°C to +125°C
IMMERSION CYCLING:	MIL-STD-20 M104, condition B
RESISTANCE TO SOLDER HEAT:	MIL-STD-202, M210, condition B 20 seconds at 260°C

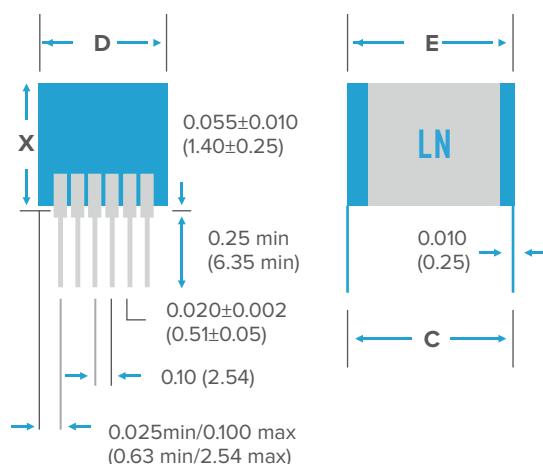
		Capacitance (μF)						
		14	22	27	47	68	100	220
Voltage	25V					-3	-5	-10
	50V			-3	-5		-10	
	100V	-3	-5		-10			

Note: Dash number denotes number of capacitors and leads per side.

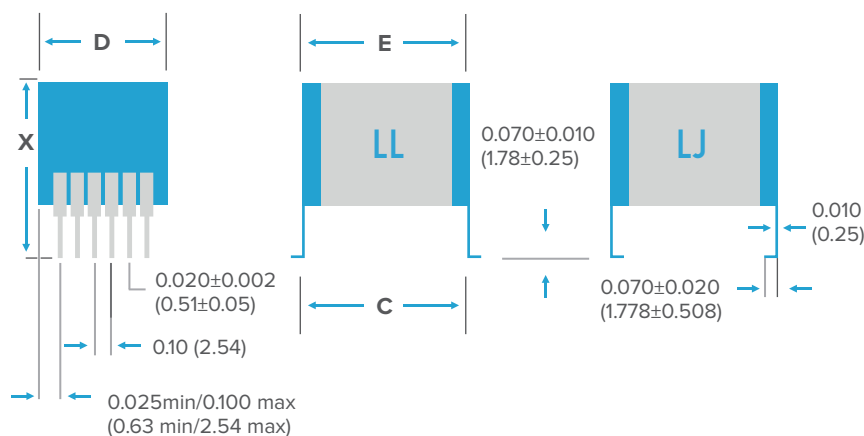
Typical ESR (Ohms)					
	22μF	27μF	47μF	100μF	220μF
ESR @ 1kHz	0.0830	0.0680	0.0400	0.0240	0.0110
ESR @ 10kHz	0.0086	0.0070	0.0040	0.0033	0.0015
ESR @ 50kHz	0.0044	0.0031	0.0020	0.0013	0.0006
ESR @ 100kHz	0.0032	0.0022	0.0015	0.0009	0.0004

Capacitor Assemblies SV2220

LN (STRAIGHT WIRE LEADS)



LJ AND LL (BENT WIRE LEADS)



NUMBER	STYLE	C $\pm$.025"	D (MAX)	E (MAX)	X (MAX)
-3	LN	.250" (6.35)	.375" (9.5)	.300" (7.62)	.285" (7.24)
-3	LJ, LL	.250" (6.35)	.375" (9.5)	.300" (7.62)	.300" (7.62)
-5	LN	.250" (6.35)	.575" (14.6)	.300" (7.62)	.285" (7.24)
-5	LJ, LL	.250" (6.35)	.575" (14.6)	.300" (7.62)	.300" (7.62)
-10	LN	.250" (6.35)	1.075" (27.3)	.300" (7.62)	.285" (7.24)
-10	LJ, LL	.250" (6.35)	1.075" (27.3)	.300" (7.62)	.300" (7.62)

SV	2220	BB	476	M	101	LJ	W	-10	R
SERIES	SIZE	DIELECTRIC	CAPACITANCE	TOLERANCE	VOLTAGE VDCW	LEAD STYLE	PACKAGING	CAPS/LEADS	RoHS
	See Chart	BB = X7R Class II BME	Value in picofarads — two significant figures, followed by number of zeros: 476 = 47,000,000pF	M = $\pm$ 20%	Two significant figures, followed by number of zeros: 250 = 25V 500 = 50V 101 = 100V	LN = Straight LL = L Lead LJ = J Lead	W = Waffle Pack	Number of caps and leads per side	R = RoHS compliant with exemption 7a R = 100% Sn finish on lead No R on P/N = 60Sn/40Pb finish on leads

Capacitor Assemblies — ST and SM — COG/NPO and X7R

Our complete testing facility is available for any additional military testing requirements. Options available include thru-hole and surface mount lead styles, to make them suitable for mounting on ceramic substrates or epoxy PCBs.

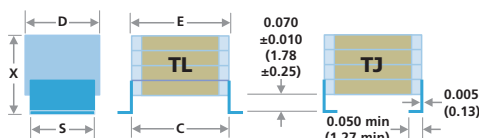
Consult the Sales Office if your specific requirements exceed our catalog maximums (size, cap. value and voltage). These ranges of both High Capacitance and High Voltage MLC assemblies are available in COG/NPO and X7R dielectrics. Low ESR and Low ESL are inherent in the design, giving the assemblies a high capability up to 1MHz, and offer far superior performance than either Aluminium or Tantalum electrolytic capacitors.

They are designed for use in high power or high frequency applications such as switched mode power supplies, DC-DC converters, high capacitance discharge circuits and high temperature filtering/decoupling. They can be made with up to five same size chips with various lead configurations to safeguard against thermal and mechanical stresses.

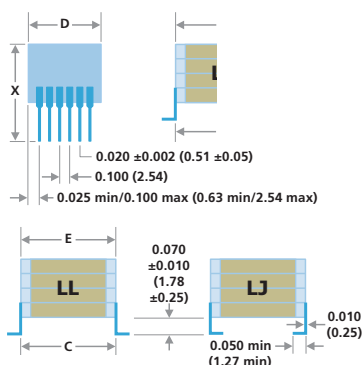
The commercial "ST" series provide the highest capacitance available and are 100% tested for Dielectric Withstanding Voltage, Insulation Resistance, Capacitance and Dissipation Factor.

In contrast, the High Reliability "SM" series is designed and tested for military and industrial applications and tested as per of MIL-PRF-49470 (DSCC 87106), Group A.

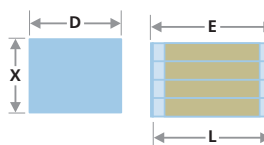
TJ & TL (tab leads)



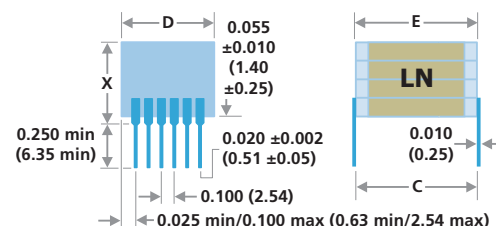
LJ & LL (bent leads)



NN or NP (no leads)



LN (straight leads)



MAXIMUM STACK HEIGHT, X DIMENSION — INCHES/MM

No. of chips	Chip size	Style NN, NP	Style TJ & TL	Style LN, LJ & LL
1	1812	0.100/2.54	0.180/4.57	N/A
	1825	0.100/2.54	0.180/4.57	0.180/4.57
	2225	0.120/3.05	0.200/5.08	0.200/5.08
	>2225	N/A	0.200/5.08	0.200/5.08
2	1812	0.200/5.08	0.280/7.11	N/A
	1825	0.200/5.08	0.280/7.11	0.280/7.11
	2225	0.240/6.10	0.320/8.13	0.320/8.13
	>2225	N/A	0.320/8.13	0.320/8.13
3	812	0.300/7.62	0.380/9.65	N/A
	1825	0.300/7.62	0.380/9.65	0.380/9.65
	2225	0.360/9.14	0.440/11.2	0.440/11.20
	>2225	N/A	0.440/11.2	0.440/11.20
4	1812	0.400/10.20	0.480/12.2	N/A
	1825	0.400/10.20	0.480/12.2	0.480/12.20
	2225	0.480/12.20	0.560/14.2	0.560/14.20
	>2225	N/A	0.560/14.2	0.560/14.20
5	1812	0.520/13.20	0.600/15.2	N/A
	1825	0.520/13.20	0.600/15.2	0.600/15.2
	2225	0.635/16.10	0.715/18.2	0.715/18.2
	>2225	N/A	0.715/18.2	0.715/18.2

DIMENSIONS — INCHES/MM

Size	1812	1825	2225	3640	4540	5550	7565
C*	0.210/ 5.33	0.210/5.33	0.250/6.35	0.400/10.20	0.480/12.20	0.580/14.70	0.780/19.80
D*	0.125/3.18	0.250/6.35	0.250/6.35	0.400/10.20	0.400/10.20	0.500/12.70	0.650**/16.50
E max	0.260/6.60	0.260/6.60	0.300/7.62	0.430/10.90	0.530/13.50	0.630/16.00	0.830/21.10
L nom	0.180/4.57	0.180/4.57	0.220/5.59	0.360/9.14	0.450/11.40	0.550/14.00	0.750/19.10
Leads per side	N/A	3	3	4	4	5	6

Notes: 1) *C & D inches ±0.025;/mm ±0.64: 2) **±0.035/0.89

ORDERING INFORMATION — ST AND SM CAPACITOR ASSEMBLIES

ST	3640	B	474	M	101	LJ	X	W	-5	R
Style	Size	Dielectric	Capacitance	Tolerance	Voltage VDCW	Lead style	Thickness option	Packing	No. Chips	RoHS
ST = Commercial SM = High Reliability	See Chart	N = COG/NPO B = X7R	Value in Picofarads. Two significant figures, followed by number of zeros: 825 = 8,200,000pF (8.2µF)	F = ±1%* B = ±2%* H = ±3%* J = ±5% K = ±10% M = ±20% Z = +80 -20% P = +100 -0% *COG/NPO only	Two significant figures, followed by number of zeros: 101 = 100V	LN = Straight* LL = L Lead* LJ = J Lead* TL = L Tab TJ = J tab NN = Nickel NP = Pd/Ag *Not 1812	Specify standoff dimension if less than max.	W = Waffle T = Tape & Reel* *Consult the sales office	1 to 5	≥250V RoHS

COG/NPO CAPACITANCE AND VOLTAGE SELECTION

Number of chips required to achieve the capacitance value

Note: Capacitance values are shown as 3-digit code:
2 significant figures followed by the no. of zeros, e.g., 183 = 18,000pF.

7

X7R CAPACITANCE AND VOLTAGE SELECTION

Number of chips required to achieve the capacitance value

Capacitor Assemblies — ST and SM — X7R

X7R CAPACITANCE AND VOLTAGE SELECTION

Note: Capacitance values are shown as 3-digit code:
2 significant figures followed by the no. of zeros, e.g., 183 = 18,000pF.

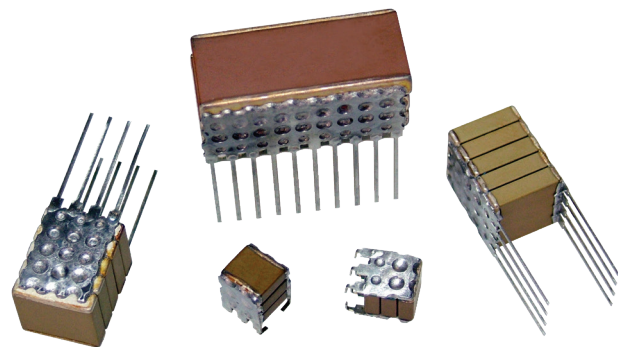
4540								5550								6560								7565								Size		
50V		100V		200V		500V		50V		100V		200V		500V		50V		100V		200V		500V		50V		100V		200V		500V		Vdc		
ST	SM	ST	SM	ST	SM	ST	SM	ST	SM	ST	SM	ST	SM	ST	SM	ST	SM	ST	SM	ST	SM	ST	SM	ST	SM	ST	SM	ST	SM	ST	SM	Cap	Code	
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DSCC Approved Capacitor Assemblies

A range of switch mode leaded capacitor assemblies in three approved DSCC 87106 case codes sizes.

The below referenced DSCC (Defense Supply Center Columbus) dash numbers show our approved range.

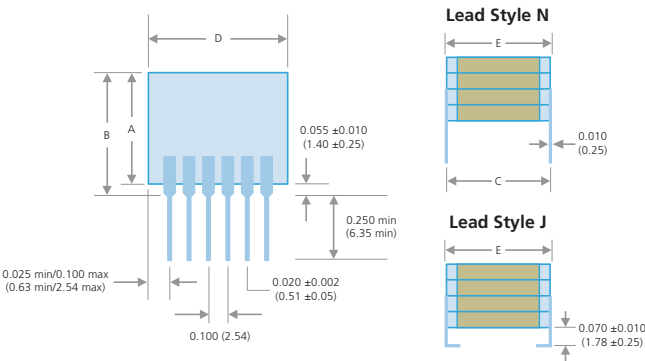
Novacap Vendor CAGE code is 65238.



DIMENSIONS — INCHES/MM

Size	5	4	3
C	0.250/6.35	0.400/10.16	0.450/11.43
D min	0.224/5.69	0.350/8.89	0.950/24.13
D max	0.275/6.99	0.425/10.80	1.075/27.30
E max	0.300/7.62	0.440/11.18	0.500/12.70
Leads per side	3	4	10

Notes: For dimensions A and B please refer to DSCC 87106



LEAD STYLE N - DSCC 87106 DASH NUMBERS

Voltage	Case code	5	4	3
50V	Dash#	001-020	021-028	029-040
	Cap value	105-565	825-156	186-476
	Dash#	•	222-223	•
	Cap value	•	685	•
100V	Dash#	055-072	073-082	083-092
	Cap value	684-335	395-825	126-276
	Dash#	•	•	229-230
	Cap value	•	•	106
200V	Dash#	113-126	127-136	137-148
	Cap value	474-155	185-395	475-126
500V	Dash#	173-190	191-198	199-208
	Cap value	154-684	105-185	275-565
	Dash#	•	231-232	233-234
	Cap value	•	824	225

LEAD STYLE N - DSCC 87106 DASH NUMBERS

Voltage	Case code	5	4	3
50V	Dash#	241-260	261-270	271-282
	Cap value	105-565	685-156	186-476

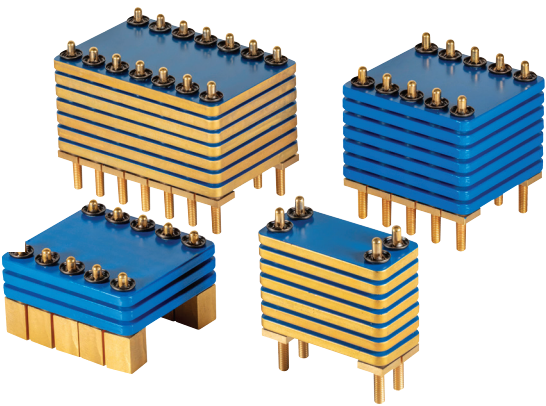
HOW TO ORDER - THE PURCHASE ORDER OR CONTRACT MUST SPECIFY THE FOLLOWING:

1	2	3
The Complete DSCC part number - Drawing Number and Dash Number Example: 87106-222	Whether you want Novacap to perform the Group B Test, or provide a certification of compliance for Group B requirement.	Specify requirements for packaging.

Large Capacitor Assembly

Achieving high capacitance means going big. But how do you do that while still minimizing footprint? Knowles Precision Devices can custom build large capacitor assemblies that utilize the vertical space above the circuit board, offering very high capacitance and very high voltage in a smaller area.

Our large diameter pins are low loss and ultra stable. They're also mechanically decoupled from ceramic elements, which allows the assembly to withstand severe shock and vibration. Talk to us today about creating a customized solution for your automotive, aerospace or military applications, or any project that requires high capacitance and proven durability in a tight space.



APPLICATIONS

- Automotive and EV
- Military
- Aerospace
- Downhole

BENEFITS

- Customizable to your specific needs
- Maximizes remaining board space by utilizing vertical space above board
- Allows very high capacitance (nF to μ F) and very high voltage (approved 500V to 5kV)
- Ultra-stable, low-loss dielectric
- Extremely resilient against vibration and temperature variation
- High ripple current
- Up to 140 μ F (Class 2) and 6.65 μ F (Class 1)
- Can be de-rated for use at elevated temperatures

LARGE CAPACITOR RANGE - CLASS 1 & CLASS 2

CLASS 1 - COG/NPO	HOLES	WIDTH	LENGTH	WORKING VOLTAGE	6KV	5KV	4KV	3KV	2KV	1KV	500V
	2 WAY	9.15	37.6	Max Capacitance/nF	1.2	1.75	2.5	4.5	10	45	125
	4 WAY	17.15	37.6	Max Capacitance/nF	2.5	3.5	5.5	10	24	100	250
	6 WAY	25.15	37.6	Max Capacitance/nF	3.75	5.5	8.5	13	35	150	400
	8 WAY	33.15	37.6	Max Capacitance/nF	5	7.5	11.5	21	49	200	550
	10 WAY	41.15	37.6	Max Capacitance/nF	6.3	9	14	26	61	250	680
	12 WAY	49.15	37.6	Max Capacitance/nF	7.5	11	17.5	32	72.5	290	800
	14 WAY	57.15	37.6	Max Capacitance/nF	9	13	20	37.5	85	350	950

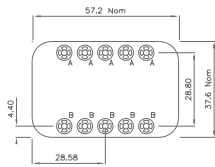
Max Capacitance is per element, assemblies may be specified with up to 7 elements e.g. 14 way 500V max capacitance is 7x 950nF

CLASS 2 - X7R	HOLES	WIDTH	LENGTH	WORKING VOLTAGE	6KV	5KV	4KV	3KV	2KV	1KV	500V
	2 WAY	9.15	37.6	Max Capacitance/nF	20	30	40	70	175	750	3000
	4 WAY	17.15	37.6	Max Capacitance/nF	40	60	80	150	350	1250	6000
	6 WAY	25.15	37.6	Max Capacitance/nF	60	100	140	230	550	2000	9000
	8 WAY	33.15	37.6	Max Capacitance/nF	80	120	175	325	750	3000	12000
	10 WAY	41.15	37.6	Max Capacitance/nF	100	150	225	400	1000	4000	15000
	12 WAY	49.15	37.6	Max Capacitance/nF	120	180	275	500	1100	4500	17500
	14 WAY	57.15	37.6	Max Capacitance/nF	140	200	300	600	1250	5000	20000

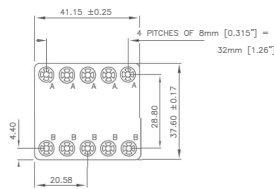
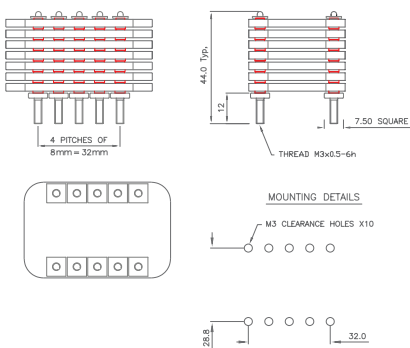
Max Capacitance is per element, assemblies may be specified with up to 7 elements e.g. 14 way 500V max capacitance is 7x 20000nF

TECHNICAL SUMMARY

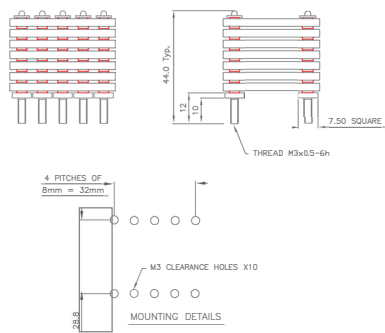
Typical layout shown — parts are designed to be totally customizable in shape and height, within limits. We encourage discussions. Examples below show typical formats.



EXAMPLE 1: 500V, 3.9 μ F



EXAMPLE 2: 5kV, 70nF



High Q (COG/NPO) High Power RF Range and Assemblies

A range of ultra-low loss high Q ceramic capacitors with COG/NPO characteristics suitable for high power applications where minimal power loss and very low self-heating is demanded.

Supplied as standard in non-magnetic format common applications include MRI body coils, Semiconductor Manufacturing Equipment, RF Power Amplifiers and Matching Networks, and Broadcast equipment.

The High Q High Power RF range is available in surface mount, ribbon leaded or as a custom assembly.



HIGH Q (COG/NPO) HIGH POWER RF RANGE – PME (SURFACE MOUNT AND RIBBON LEADED)

Chip Size	0505		1111		2225		4040	
Min Cap Tolerance								
	Min	Max	Min	Max	Min	Max	Min	Max
50V	820pF	820pF	-	-	-	-	-	-
100V	680pF	680pF	1.6nF	2.2nF	-	-	-	-
150V	470pF	560pF	1.1nF	1.5nF	-	-	-	-
200V	330pF	390pF	-	-	6.2nF	10nF	16nF	27nF
250V	240pF	270pF	750pF	1nF	6.2nF	10nF	16nF	27nF
300V	120pF	220pF	620pF	680pF	-	-	-	-
500V	0.2pF	100pF	510pF	560pF	5.1nF	5.6nF	13nF	15nF
630V	-	-	240pF	470pF	3.6nF	4.7nF	11nF	12nF
1kV	-	-	110pF	220pF	2.7nF	3.3nF	9.1nF	10nF
1.5kV	-	-	75pF	100pF	1.1nF	2.4nF	5.6nF	8.2nF
2kV	-	-	0.4pF/* 2.2pF	68pF	910pF	1.0nF	2.4nF	5.1nF
2.5kV	-	-	-	-	510pF	820pF	1.6nF	2.2nF
3kV	-	-	-	-	110pF	470pF	910pF	1.5nF
3.6kV	-	-	-	-	1pF	47pF** /100pF	-	-
4kV	-	-	-	-	-	-	620pF	820pF
5kV	-	-	-	-	-	-	360pF	560pF
6kV	-	-	-	-	-	-	160pF	330pF
7kV / 7.2kV	-	-	-	-	-	-	1pF	56pF*** /150pF

*1111 2kV: Min value is 0.4pF for surface mount part and 2.2pF for ribbon leaded part

**2225 3.6kV: Values up to 47pF max. are dual rated 3.6kVdc and 2.5kVac @ 30MHz

***4040 7kV/7.2kV: Values up to 56pF max. are dual rated 7kV/7.2kVdc and 5kVac @ 30MHz

MINIMUM/MAXIMUM CAPACITANCE VALUES (CONTINUED)

Chip Size	6040		7065		7274		7676		A3A3	
Min Cap Tolerance	±0.10pF (<10pF) and ±1% (≥10pF)									
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
1kV	11nF	15nF	16nF	22nF	27nF	33nF	27nF	33nF	75nF	120nF
2kV	6.2nF	10nF	9.1nF	15nF	16nF	24nF	16nF	24nF	36nF	68nF
3kV	2.4nF	5.6nF	3.6nF	8.2nF	5.6nF	15nF	5.6nF	15nF	13nF	33nF
5kV	510pF	2.2nF	910pF	3.3nF	1.1nF	5.1nF	1.1nF	5.1nF	3.6nF	12nF
8kV	300pF	470pF	620pF	820pF	750pF	1.0nF	1.0nF	1.0nF	3.3nF	3.3nF
10kV	100pF	270pF	100pF	560pF	100pF	680pF	680pF	680pF	200pF	2.7nF

****A3A3 only available with ribbon leads

High Q (COG/NPO) High Power RF Range and Assemblies

NON-MAGNETIC CAPACITORS – SURFACE MOUNT - HIGH Q HIGH POWER RF RANGE

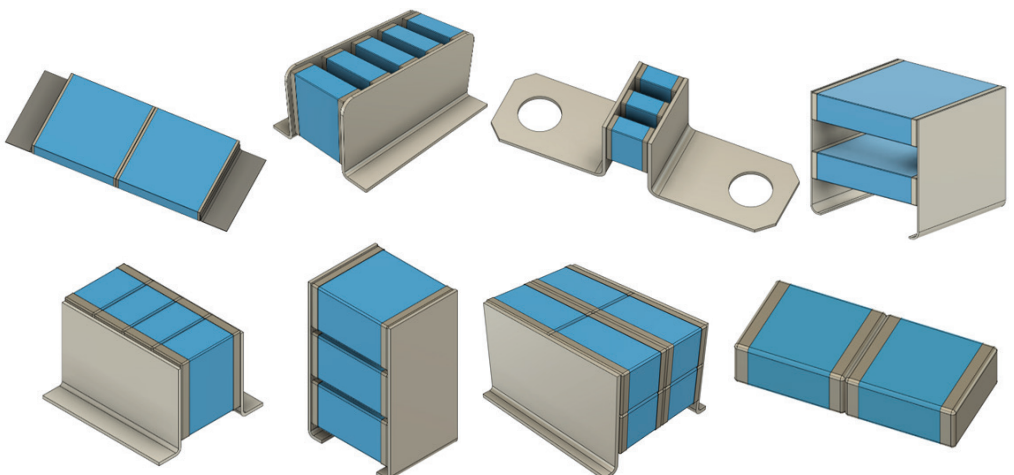
4040	2	7K0	0470	G	Q	B	AF9
Chip Size	Termination	Rated Voltage	Capacitance in Pico farads (pF)	Capacitance Tolerance	Dielectric Codes	Packaging	Suffix Code
0505 1111 2225 4040 6040 7065 7274 7676	2 = Sintered silver base with copper barrier (100% matte tin plating). RoHS compliant.	100 = 100V 150 = 150V 200 = 200V 250 = 250V 300 = 300V 500 = 500V 630 = 630V 1K0 = 1kV 1K5 = 1.5kV 2K0 = 2kV 3K0 = 3kV 3K6 = 3.6kV 4K0 = 4kV 5K0 = 5kV 6K0 = 6kV 7K0 = 7kV / 7.2kV 8K0 = 8kV 10K = 10kV	<10pF Insert a P for the decimal point as the second character. e.g., P300 = 0.3pF 8P20 = 8.2pF ≥10pF First digit is 0. Second and third digits are significant figures of capacitance code. The fourth digit is the number of zeros following. e.g., 0103 = 10000 pF Values <1pF in 0.1pF steps, above this values are E24 series	<10pF H: ± 0.05pF B: ± 0.10pF C: ± 0.25pF D: ± 0.5pF ≥10pF F: ± 1% G: ± 2% J: ± 5% K: ± 10% M: ± 20%	H = High Q (COG/NPO) – BME Q = High Q (COG/NPO) - PME	T = 178mm (7") reel - horizontal (chip sizes 1111 and 2225 only) V = 178mm (7") reel - vertical (chip size 1111 only) R = 330mm (13") reel B = Bulk pack – tubs or trays	AF9 = SM standard AF9LM = SM standard with optional marking Also used for specific customer requirements

NON-MAGNETIC CAPACITORS – RIBBON LEADED - HIGH Q HIGH POWER RF RANGE

2225	V	3K0	6P80	G	Q	B	R	-
Chip Size	Termination	Rated Voltage	Capacitance in Pico farads (pF)	Capacitance Tolerance	Dielectric Codes	Packaging	Lead Option	Suffix Code
1111 2225 4040 6040 7065 7274 7676 A3A3	B = Uncoated V = Coated with modified silicone lacquer	100 = 100V 150 = 150V 200 = 200V 250 = 250V 300 = 300V 500 = 500V 630 = 630V 1K0 = 1kV 1K5 = 1.5kV 2K0 = 2kV 3K0 = 3kV 3K6 = 3.6kV 4K0 = 4kV 5K0 = 5kV 6K0 = 6kV 7K0 = 7kV / 7.2kV 8K0 = 8kV 10K = 10kV	<10pF Insert a P for the decimal point as the second character. e.g., P300 = 0.3pF 8P20 = 8.2pF ≥10pF First digit is 0. Second and third digits are significant figures of capacitance code. The fourth digit is the number of zeros following. e.g., 0103 = 10000 pF Values <1pF in 0.1pF steps, above this values are E24 series	<10pF H: ± 0.05pF B: ± 0.10pF C: ± 0.25pF D: ± 0.5pF ≥10pF F: ± 1% G: ± 2% J: ± 5% K: ± 10% M: ± 20%	Q = High Q (COG/NPO) - PME	B = Bulk pack – tubs or trays	R = Ribbon Lead	W211 = leaded and marked W221 = leaded / not marked (standard) Also used for specific customer requirements

CUSTOM ASSEMBLIES

For higher capacitance, voltage and power requirements these capacitors can be combined in series and parallel combinations with lead and other custom metalwork. With in house machining and plating capabilities, along with a multitude of soldering and attachment technologies, we are able to consider any project. Please reach out to us to discuss your custom requirements at appengcap@knowles.com. We are also able to accommodate assemblies using other MLCC types from our standard ranges.



EMI Filters and Assemblies

Manufacturing to customer designs or working together with the customer to develop a solution to a problem, Knowles offer the ability to modify standard filter designs or develop custom designs to suit your application.

MODIFICATIONS TO STANDARD FILTERS

Special mechanical outline

Typical examples:

- Lead lengths to suit
- Special thread options – e.g. M5 x 0.5 – 6g
- Special lead forms – e.g. headed pin/threaded contact
- Larger pin diameters
- Special body or pin finishes

Special electrical testing

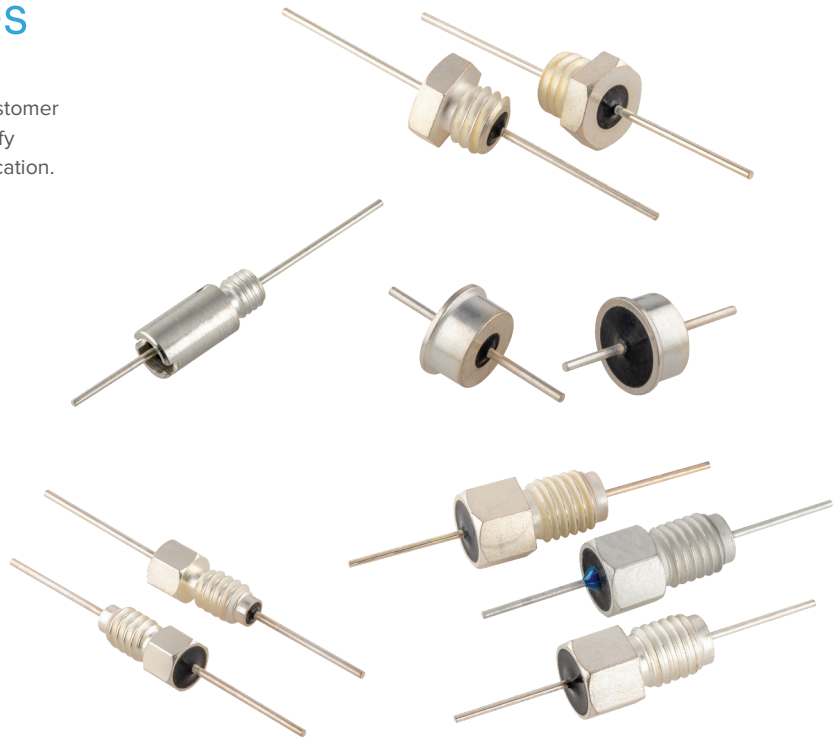
Typical examples:

- Special test voltages – e.g. 500Vac 50Hz DWV test
- Special capacitance values
- 100% burn-in
- Higher current ratings possible

Multiway filter assemblies

From a simple panel fitted with our single line discrete filters to a complex custom designed Pi filter assembly, we offer a full design and manufacture service. Assemblies can be based around discoidal capacitors for maximum flexibility or planar arrays for optimum space utilisation.

As an extension to our planar array range, we can offer soldered-in spring retaining clips for easy assembly into difficult applications such as hermetic sealed connectors and our extensive experience with filter connectors allows us to offer subcontract manufacturing to this industry sector.



Example 1 -

- 4 way 22nF C section planar based filter assembly. DWV 2500Vdc, 100% tested. Supplied to sensor manufacturer for installation into commercial aerospace application.

Example 2 -

- 85 way 1800pF L-C section planar based filter assembly, fitted into mounting plate for easy assembly. Designed to fit specific space envelope for military aerospace application.

Please contact our sales office to discuss your specific filtering requirement. We would be pleased to provide a technical and commercial proposal.

SPECIAL DISCRETE FILTERS TO MATCH YOUR SPECIFIC REQUIREMENTS

Manufactured to fit the customers specific requirements, electrical characteristics and space envelope. We can offer design solutions to meet your requirement or develop customer designs into production reality.

Example 1 -

- Battery terminal filter to meet precise environmental requirements and provide flat pin contact surface for connection to spring contacts on clip-on batteries. Designed to fit customers' space envelope and meet specific electrical parameters.

Example 2 -

- Special SFSSC disc-on-pin decoupling stub filter for military application. Contact pin terminating inside discoidal and insulated from non pin side. Assembled with high melting point solder to allow customer to solder into panel.



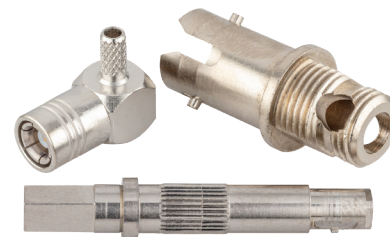
High Precision and High Reliability Machined and Plated Solutions

Experience the benefits of our all-inclusive manufacturing complex.

With no outsourcing, our seamless operational setup allows you to individualize the services you need, do a combination, or select them all!

With **“get it right the first time”** accuracy, we deliver:

- » High Quality
- » Specialized Projects – we do things no one else can!
- » Everything under one roof, giving us end-to-end control of the project
- » Engineering support throughout your entire project
- » Catered to you! Pick the services you need!
- » Production Scaling

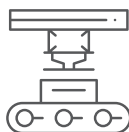


Choose the service you need - select one, multiple or all!



High Precision Tools Shop

Realize better yields and increased efficiencies with tools made to maintain tight tolerances and high quality.



Machining Center

We take on the smallest, most intricate parts with complex geometries.



Plating House

We excel at MIL-SPEC plating and handling difficult plating issues involving complex geometries. Our gold plating is known for its unparalleled strength!



Electromechanical Assembly & Design

Design, prototype and production – we do it all in-house.



Engineering Services

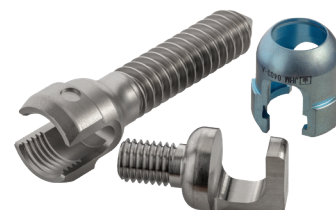
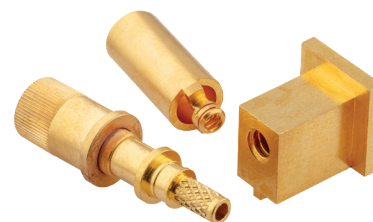
With decades of experience, our engineers will help you find the right solution, no matter how challenging the requirement!

Benefits



- » Our tools are ready for immediate use
- » Increase efficiencies and yield
- » Increase quality levels
- » Improve finished product
- » Reduce equipment jams
- » Cost effective and saves time!
- » We excel at extremely tight tolerances
- » Complex parts
- » Press-fit for dimension control
- » Variety of materials for use

Visit our website at www.knowledscapacitors.com for more information and a complete list of our products and services.





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