

# Large Size Multilayer Ceramic Chip Capacitors [Large Stacked Capacitors]

## FSC Series

### MLCC Design, Suitable for Switchmode Power Supply Filters

#### ◆ Features

- High CV MLCC design, effectively can replace Tantalum and Aluminum electrolytics
- Inherently low ESR.
- N leads for through hole applications and J or L lead configuration for surface mount with stress relief against board flexure and thermal excursions.
- High reliability testing available including space level screening.
- BME designs for extended cap ranges are also available--contact factory for details.
- Custom sizes and values available--contact factory for details or to define your needs.

#### ◆ Application

- Power supplies
- DC-DC converters
- Surge protection
- Industrial control circuits
- Snubbers
- Filtering, smoothing, and decoupling application
- HIREL applications
- Custom applications

#### ◆ Summary of Specification

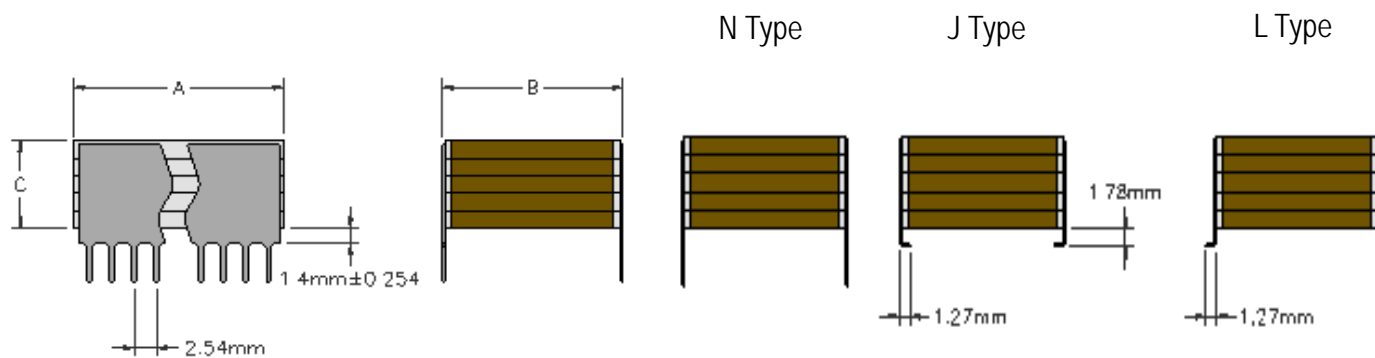
Operating Temperature	-55 to +125 °C
Rated Voltage	50Vdc to 500Vdc
Temperature Coefficient of Capacitance	NPO : $\leq \pm 30\text{ppm}/^\circ\text{C}$ , -55 to +125 °C (EIA Class I )
	X7R : $\leq \pm 15\%$ , -55 to +125 °C (EIA Class II )
Capacitance Range	NPO: 70nF to 9.0uF
	X7R : 620nF to 600uF
Dissipation Factor :	NPO : $Q \geq 1000$ at 1KHz
	X7R : 2.5%max. at 1KHz
Insulation Resistance	10GΩ or 500/C Ω whichever is smaller
Aging	NPO : 0% , X7R : 2.5% per decade of time
Dielectric Withstanding Voltage	$V \leq 50V$ ; 250% Rated Voltage
	$100V \leq V < 500V$ ; 200% Rated Voltage
	$500V \leq V < 1KV$ ; 150% Rated Voltage
Tolerance	$\pm 1\%$ & $\pm 2\%$ tolerances are only available in NPO

#### ◆ How To Order

FSC	3A	J	X	224	K	501	W	H	01
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Product Code	Stack and Size	Lead Configuration	Material	Capacitance (pF)	Tolerance	Rated Voltage	Packaging	Special Test Requirement	Special Requirement
FSC: Large Size Multilayer Ceramic Chip Capacitor	The first digit: # of chips in stack  Second Digit: Chip Size A B C D	Ex.: J :J Lead L :L Lead N: Straight Lead	Ex.: N: NPO X: X7R M: BX/BR/BQ	Ex.: 103:10x10 <sup>3</sup> 224:22x10 <sup>4</sup> 475:47x10 <sup>5</sup>	Ex.: F: +/-1.0% G: +/-2.0% J: +/-5.0% K: +/- 10% M: +/- 20%	Ex.: 050:50Vdc 101:100Vdc 201:200Vdc 501:500Vdc	B: Bulkl W: Waffle pack	Blank: Standard electrical test H: Hi-Rel Testing	Blank: No special requirement 01~99: Customer special requirement

## ◆ Dimensions



Size Code	A (Max) mm	B (Max) mm	C (Max) mm	Leads per side	Size Code	A (Max) mm	B (Max) mm	C (Max) mm	Leads per side	Size Code	A (Max) mm	B (Max) mm	C (Max) mm	Leads per side
1A	8.7	9.2	3.1	3	1J	15.5	16.8	3.1	6	1S	28.6	32.5	3.1	11
2A	8.7	9.2	6.2	3	2J	15.5	16.8	6.2	6	2S	28.6	32.5	6.2	11
3A	8.7	9.2	9.3	3	3J	15.5	16.8	9.3	6	3S	28.6	32.5	9.3	11
4A	8.7	9.2	12.4	3	4J	15.5	16.8	12.4	6	4S	28.6	32.5	12.4	11
5A	8.7	9.2	15.5	3	5J	15.5	16.8	15.5	6	5S	28.6	32.5	15.5	11
1B	10.7	10.7	3.1	4	1K	16.8	15.5	3.1	6	1T	11.8	11.2	3.1	4
2B	10.7	10.7	6.2	4	2K	16.8	15.5	6.2	6	2T	11.8	11.2	6.2	4
3B	10.7	10.7	9.3	4	3K	16.8	15.5	9.3	6	3T	11.8	11.2	9.3	4
4B	10.7	10.7	12.4	4	4K	16.8	15.5	12.4	6	4T	11.8	11.2	12.4	4
5B	10.7	10.7	15.5	4	5K	16.8	15.5	15.5	6	5T	11.8	11.2	15.5	4
1C	13.6	14.9	3.1	5	1L	8.0	9.9	3.1	3	1U	13.1	15.0	3.1	5
2C	13.6	14.9	6.2	5	2L	8.0	9.9	6.2	3	2U	13.1	15.0	6.2	5
3C	13.6	14.9	9.3	5	3L	8.0	9.9	9.3	3	3U	13.1	15.0	9.3	5
4C	13.6	14.9	12.4	5	4L	8.0	9.9	12.4	3	4U	13.1	15.0	12.4	5
5C	13.6	14.9	15.5	5	5L	8.0	9.9	15.5	3	5U	13.1	15.0	15.5	5
1D	21.6	16.8	3.1	7	1M	9.3	8.6	3.1	3	1V	14.4	13.7	3.1	5
2D	21.6	16.8	6.2	7	2M	9.3	8.6	6.2	3	2V	14.4	13.7	6.2	5
3D	21.6	16.8	9.3	7	3M	9.3	8.6	9.3	3	3V	14.4	13.7	9.3	5
4D	21.6	16.8	12.4	7	4M	9.3	8.6	12.4	3	4V	14.4	13.7	12.4	5
5D	21.6	16.8	15.5	7	5M	9.3	8.6	15.5	3	5V	14.4	13.7	15.5	5
1E	16.6	21.6	3.1	6	1N	10.6	10.2	3.1	4	1W	16.9	20.1	3.1	6
2E	16.6	21.6	6.2	6	2N	10.6	10.2	6.2	4	2W	16.9	20.1	6.2	6
3E	16.6	21.6	9.3	6	3N	10.6	10.2	9.3	4	3W	16.9	20.1	9.3	6
4E	16.6	21.6	12.4	6	4N	10.6	10.2	12.4	4	4W	16.9	20.1	12.4	6
5E	16.6	21.6	15.5	6	5N	10.6	10.2	15.5	4	5W	16.9	20.1	15.5	6
1F	38.2	12.0	3.1	14	1P	9.6	11.2	3.1	4	1X	19.5	17.5	3.1	7
2F	38.2	12.0	6.2	14	2P	9.6	11.2	6.2	4	2X	19.5	17.5	6.2	7
3F	38.2	12.0	9.3	14	3P	9.6	11.2	9.3	4	3X	19.5	17.5	9.3	7
4F	38.2	12.0	12.4	14	4P	9.6	11.2	12.4	4	4X	19.5	17.5	12.4	7
5F	38.2	12.0	15.5	14	5P	9.6	11.2	15.5	4	5X	19.5	17.5	15.5	7
1G	38.2	18.9	3.1	14	1Q	10.6	12.4	3.1	4					
2G	38.2	18.9	6.2	14	2Q	10.6	12.4	6.2	4					
3G	38.2	18.9	9.3	14	3Q	10.6	12.4	9.3	4					
4G	38.2	18.9	12.4	14	4Q	10.6	12.4	12.4	4					
5G	38.2	18.9	15.5	14	5Q	10.6	12.4	15.5	4					
1H	40.6	24.0	3.1	14	1R	25.5	27.3	3.1	10					
2H	40.6	24.0	6.2	14	2R	25.5	27.3	6.2	10					
3H	40.6	24.0	9.3	14	3R	25.5	27.3	9.3	10					
4H	40.6	24.0	12.4	14	4R	25.5	27.3	12.4	10					
5H	40.6	24.0	15.5	14	5R	25.5	27.3	15.5	10					

◆ Capacitance Range

Size Code	NPO Maximum Capacitance				BX Maximum Capacitance				X7R Maximum Capacitance			
	50V	100V	200V	500V	50V	100V	200V	500V	50V	100V	200V	500V
1A	124	114	983	843	195	125	724	284	815	495	365	744
2A	244	224	194	164	395	245	145	564	166	985	725	145
3A	364	334	294	254	575	365	215	844	246	146	106	225
4A	484	444	394	334	765	485	285	115	326	196	146	295
5A	604	554	494	424	955	605	365	145	406	246	186	375
1B	184	174	154	134	305	205	115	444	136	795	585	125
2B	364	344	304	264	305	405	225	884	266	156	116	245
3B	544	514	454	394	905	605	335	135	396	236	176	365
4B	724	684	604	524	126	805	445	175	526	316	236	485
5B	904	854	754	654	156	106	555	225	656	396	296	605
1C	354	324	304	244	565	375	215	844	246	146	106	225
2C	704	644	604	484	116	745	425	165	486	286	206	445
3C	105	964	904	724	166	116	635	255	726	426	306	665
4C	145	125	125	964	226	146	845	335	966	566	406	885
5C	175	165	155	125	286	186	106	425	127	706	506	116
1D	654	604	554	454	985	665	385	155	446	266	196	405
2D	135	125	115	904	196	136	765	305	886	526	386	805
3D	195	185	165	135	296	196	116	455	137	786	576	126
4D	265	245	225	185	396	266	156	605	177	107	766	166
5D	325	305	275	225	496	336	196	755	227	137	956	206
1E	654	604	554	454	985	665	385	155	446	266	196	405
2E	135	125	115	904	196	136	765	305	886	526	386	805
3E	195	185	165	135	296	196	116	455	137	786	576	126
4E	265	245	225	185	396	266	156	605	177	107	766	166
5E	325	305	275	225	496	336	196	755	227	137	956	206
1F	774	714	654	564	126	845	455	195	556	336	246	505
2F	155	145	135	115	246	166	905	385	117	666	486	106
3F	235	215	195	165	366	256	136	575	167	996	726	156
4F	305	285	265	225	486	336	186	765	227	137	966	206
5F	385	355	325	285	606	426	226	955	277	167	127	256
1G	145	135	125	984	226	156	855	335	986	596	436	865
2G	285	265	245	195	446	306	176	665	197	117	866	176
3G	425	395	365	295	666	456	256	995	297	177	127	256
4G	566	435	485	395	886	606	346	136	397	237	177	346
5G	705	655	605	495	117	756	426	166	497	297	217	436
1H	185	165	155	125	286	196	106	425	127	766	566	116
2H	365	325	305	245	566	386	206	845	247	157	117	226
3H	545	485	455	365	846	576	306	126	367	227	167	336
4H	725	645	605	485	117	766	406	166	487	307	227	446
5H	905	805	755	605	147	956	506	216	607	387	287	556
1J	454	424	394	324	705	485	275	105	316	186	136	285
2J	904	844	784	644	146	965	545	205	626	366	266	565
3J	135	125	115	964	216	146	815	305	936	546	396	845
4J	185	165	155	125	286	196	106	405	127	726	536	116
5J	225	215	195	165	356	246	136	505	137	906	656	146
1K	454	424	394	324	705	485	275	105	316	186	136	285
2K	904	844	784	644	146	965	545	205	626	366	266	565
3K	135	125	115	964	216	146	815	305	936	546	396	845
4K	185	165	155	125	286	196	106	405	127	726	536	116
5K	225	215	195	165	356	246	136	505	137	906	656	146
1L	104	923	853	703	165	105	584	254	715	435	315	624
2L	204	184	174	144	325	205	115	504	146	865	625	125
3L	304	274	254	214	485	305	175	754	216	126	935	185
4L	404	364	344	284	645	405	234	105	286	176	126	245
5L	504	464	424	354	805	505	295	125	356	216	156	315

◆ Capacitance Range

Size Code	NPO Maximum Capacitance				BX Maximum Capacitance				X7R Maximum Capacitance			
	50V	100V	200V	500V	50V	100V	200V	500V	50V	100V	200V	500V
1M	104	923	853	703	165	105	584	254	715	435	315	624
2M	204	184	174	144	325	205	115	504	146	865	625	125
3M	304	274	254	214	485	305	175	754	216	126	935	185
4M	404	364	344	284	645	405	234	105	286	176	126	245
5M	504	464	424	354	805	505	295	125	356	216	156	315
1N	154	134	124	104	245	165	904	364	106	635	465	944
2N	304	264	244	204	485	325	185	724	206	126	925	185
3N	454	394	364	304	725	485	275	105	306	186	136	285
4N	604	524	484	404	965	645	365	145	406	256	186	375
5N	754	654	604	504	126	805	455	185	506	316	236	475
1P	154	134	124	104	245	165	904	364	106	635	465	944
2P	304	264	244	204	485	325	185	724	206	126	925	185
3P	454	394	364	304	725	485	275	105	306	186	136	285
4P	604	524	484	404	965	645	365	145	406	256	186	375
5P	754	654	604	504	126	805	455	185	506	316	236	475
1Q	204	184	174	144	325	215	125	474	146	855	635	125
2Q	404	364	344	284	645	425	245	945	286	176	126	245
3Q	604	544	514	424	965	635	365	145	426	256	186	365
4Q	804	724	684	564	126	845	485	185	566	346	256	485
5Q	105	904	854	704	166	106	605	235	706	426	316	605
1R	125	115	105	914	206	136	765	255	896	546	396	785
2R	243	225	205	185	406	266	156	505	177	107	786	156
3R	365	335	305	275	606	396	226	755	267	167	117	236
4R	485	445	405	365	806	526	306	106	357	217	157	216
5R	605	555	505	455	107	656	386	126	447	277	197	396
1S	185	165	155	125	286	196	106	385	127	766	566	116
2S	365	325	305	245	566	386	206	765	247	157	117	226
3S	545	485	455	365	846	576	306	116	367	227	167	336
4S	725	645	605	485	117	766	406	156	487	307	227	446
5S	905	805	755	605	147	956	506	196	607	387	287	556
1T	204	184	174	144	325	215	125	474	146	855	635	125
2T	404	364	344	284	645	425	245	945	286	176	126	245
3T	604	544	514	424	965	635	365	145	426	256	186	365
4T	804	724	684	564	126	845	485	185	566	346	256	485
5T	105	904	854	704	166	106	605	235	706	426	316	605
1U	304	274	254	214	475	315	175	704	206	116	905	185
2U	604	544	505	424	945	625	345	145	406	226	186	365
3U	904	814	754	634	146	935	515	215	606	336	276	545
4U	125	105	105	844	186	126	685	285	806	446	366	725
5U	155	135	125	105	236	156	855	355	127	556	456	905
1V	304	274	254	214	475	315	175	704	206	116	905	185
2V	604	544	505	424	945	625	345	145	406	226	186	365
3V	904	814	754	634	146	935	515	215	606	336	276	545
4V	125	105	105	844	186	126	685	285	806	446	366	725
5V	155	135	125	105	236	156	855	355	127	556	456	905
1W	564	504	464	394	845	605	335	135	386	226	176	345
2W	115	105	924	784	166	126	665	265	766	446	346	685
3W	165	155	135	115	256	186	995	395	117	666	516	106
4W	225	205	185	155	226	246	135	525	157	886	686	136
5W	285	255	235	195	426	306	165	655	197	117	856	176
1X	564	504	464	394	845	605	335	135	386	226	176	345
2X	115	105	924	784	166	126	665	265	766	446	346	685
3X	165	155	135	115	256	186	995	395	117	666	516	106
4X	225	205	185	155	226	246	135	525	157	886	686	136
5X	285	255	235	195	426	306	165	655	197	117	856	176

■ Other Stacked configuration on other sizes, capacitance values and voltages rating are available. Please contact HEC.

\*Soldering And Handling Precautions:

The recommended method for soldering large SMC capacitor, is reflow soldering. Wave soldering and manual soldering with Iron is not recommended. Ceramic capacitors must be preheated with less than 2°C/sec rate to about 50°C below the reflow temperature. Sudden increase, or decrease in temperature more than the recommended rate, during soldering, may cause internal thermal cracks.

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