X7R Dielectric, 6.3VDC-200VDC (Automotive Grade)

Overview

KEMET's Automotive Grade Series surface mount capacitors in X7R dielectric are suited for a variety of applications requiring reliable operation. Whether under-hood or in-cabin, these devices emphasize the vital and robust nature of capacitors required for mission and safety critical automotive circuits. Stricter testing protocal and inspection criteria have been established for automotive grade products in recognition of potentially harsh environmental conditions . KEMET automotive grade series capacitors meet the demanding Automotive Electronics Council's AEC-Q200 qualification requirements and are manufactured in state of the art ISO/TS 16949:2002 certified facilities.

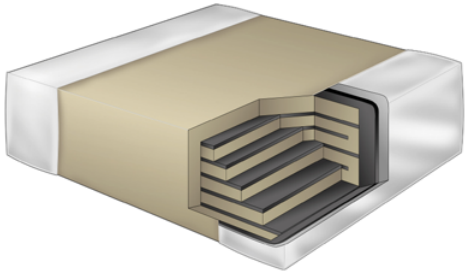
X7R dielectric features a 125°C maximum operating temperature and is considered "temperature stable," The Electronics Components, Assemblies & Materials Association (EIA) characterizes X7R dielectric as a Class II material. Components of this classification are fixed, ceramic dielectric capacitors suited for bypass and decoupling applications or for frequency discriminating circuits where Q and stability of capacitance characteristics are not critical. X7R exhibits a predictable change in capacitance with respect to time and voltage and boasts a minimal change in capacitance with reference to ambient temperature. Capacitance change is limited to ±15% from -55°C to +125°C.

Benefits

- AEC Q200 automotive qualified
- -55°C to +125°C operating temperature range
- Pb-Free and RoHS compliant
- Temperature stable dielectric
- EIA 0402, 0603, 0805, 1206, 1210, 1812, and 2220 case sizes
- DC voltage ratings of 6.3V, 10V, 16V, 25V, 50V, 100V and 200V
- Capacitance offerings ranging from 150pF to 22µF
- Available capacitance tolerances of ±5%, ±10% and ±20%
- Non-polar device, minimizing installation concerns
- 100% pure matte tin-plated termination finish allowing for excellent solderability

Applications

Typical applications include decoupling, bypass, filtering and transient voltage suppression.



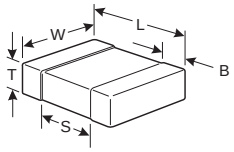
Ordering Information

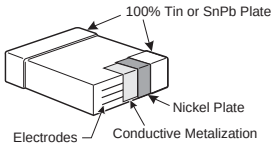
C	0805	C	225	M	4	R	A	C	AUTO
Ceramic	Case Size (L" x W")	Specification/ Series	Capacitance Code (pF)	Capacitance Tolerance	Voltage	Dielectric	Failure Rate/ Design	Termination Finish[1]	Packaging/Grade (C-Spec)[3]
	0402 0603 0805 1206 1210 1812 2220	C = Standard	2 Sig. Digits + Number of Zeros	J = ±5% K = ±10% M = ±20%	9 = 6.3V 8 = 10V 4 = 16V 3 = 25V 5 = 50V 1 = 100V 2 = 200V	R = X7R	A = N/A	C = 100% Matte Sn	AUTO = Automotive Grade 7" Reel Unmarked

[1] *Additional termination finish options may be available. Contact KEMET for details*

[2] *Additional reeling or packaging options may be available. Contact KEMET for details.*

Dimensions – Millimeters (Inches)





EIA Size Code	Metric Size Code	L Length	W Width	T Thickness	B Bandwidth	S Separation Min.	Mounting Technique
0402	1005	1.00 (.040) ± 0.05 (.002)	0.50 (.020) ± 0.05 (.002)	See Table 2 for Thickness	0.30 (.012) ± 0.10 (.004)	0.30 (.012)	Solder Reflow Only
0603	1608	1.60 (.063) ± 0.15 (.006)	0.80 (.032) ± 0.15 (.006)		0.35 (.014) ± 0.15 (.006)	0.70 (.028)	Solder Wave or Solder Reflow
0805	2012	2.00 (.079) ± 0.20 (.008)	1.25 (.049) ± 0.20 (.008)		0.50 (0.02) ± 0.25 (.010)	0.75 (.030)	
1206	3216	3.20 (.126) ± 0.20 (.008)	1.60 (.063) ± 0.20 (.008)		0.50 (0.02) ± 0.25 (.010)	N/A	
1210	3225	3.20 (.126) ± 0.20 (.008)	2.50 (.098) ± 0.20 (.008)		0.50 (0.02) ± 0.25 (.010)		Solder Reflow Only
1812	4532	4.50 (.177) ± 0.30 (.012)	3.20 (.126) ± 0.30 (.012)		0.60 (.024) ± 0.35 (.014)		
2220	5650	5.70 (.224) ± 0.40 (.016)	5.00 (.197) ± 0.40 (.016)		0.60 (.024) ± 0.35 (.014)		

Qualification/Certification

Automotive grade products meet or exceed the requirements outlined by the Automotive Electronics Council. Details regarding test methods and conditions are referenced in document AEC-Q200, Stress Test Qualification for Passive Components. For additional information regarding the Automotive Electronics Council and AEC-Q200, please visit their website @www.aecouncil.com.

Environmental Compliance

Pb-Free and RoHS compliant

Electrical Parameters/Characteristics

Item	Parameters/Characteristics
Operating Temperature Range	-55°C to +125°C
Capacitance Change with Reference to +25°C and 0 Vdc Applied (TCC)	±15%
Aging Rate (Max % Cap Loss/Decade Hour)	3.0%
Dielectric Withstanding Voltage	250% of rated voltage (5 ± 1 seconds and charge/discharge not exceeding 50mA)
Dissipation Factor (DF) Maximum Limits @ 25°C	5%(10V), 3.5%(16V & 25V) and 2.5%(50V to 250V)
Insulation Resistance (IR) Limit @ 25°C	See Insulation Resistance Limit Table (Rated voltage applied for 120 ± 5 secs @ 25°C)

Regarding Aging Rate: Capacitance measurements (including tolerance) are indexed to a referee time of 1000 Hours.
To obtain IR limit, divide MΩ-μF value by the capacitance and compare to GΩ limit. Select the lower of the two limits.
Capacitance and Dissipation Factor (DF) measured under the following conditions:

1kHz ± 50Hz and 1.0 ± 0.2 Vrms if capacitance ≤10μF

120Hz ± 10Hz and 0.5 ± 0.1 Vrms if capacitance >10μF

Note: When measuring capacitance it is important to ensure the set voltage level is held constant. The HP4284 & Agilent E4980 have a feature known as Automatic Level Control (ALC). The ALC feature should be switched to "ON".

Post Environmental Limits

High Temperature Life, Biased Humidity, Moisture Resistance					
Dielectric	Rated DC Voltage	Capacitance Value	DF (%)	Cap Shift	IR
X7R	>25	All	3.0	± 20%	10% of Initial Limit
	16 / 25		5.0		
	< 16		7.5		

Insulation Resistance Limit Table

EIA Case Size	1000 megohm microfarads **or 100GΩ**	500 megohm microfarads **or 10GΩ**
0201	N/A	ALL
0402	< .012µF	≥ .012µF
0603	< .047µF	≥ .047µF
0805	< .047µF	≥ .047µF
1206	< 0.22µF	≥ 0.22µF
1210	< 0.39µF	≥ 0.39µF
1808	ALL	N/A
1812	< 2.2µF	≥ 2.2µF
1825	ALL	N/A
2220	< 10µF	≥ 10µF
2225	ALL	N/A

Table 1A – AUTO X7R Dielectric, (0402 - 1206 Case Sizes)

Cap	Cap Code	Series			C0402					C0603							C0805							C1206						
		Voltage Code			9	8	4	3	5	9	8	4	3	5	1	2	9	8	4	3	5	1	2	9	8	4	3	5	1	2
		Voltage DC			6.3	10	16	25	50	6.3	10	16	25	50	100	200	6.3	10	16	25	50	100	200	6.3	10	16	25	50	100	200
		Cap Tolerance			**Product Availability and Chip Thickness Codes - See Table 2 for Chip Thickness Dimensions**																										
150 pF	151	J	K	M	BB	BB	BB	BB	BB																					
180 pF	181	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC							
220 pF	221	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC							
270 pF	271	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC							
330 pF	331	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC							
390 pF	391	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC							
470 pF	471	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC							
560 pF	561	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC							
680 pF	681	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC							
820 pF	821	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC							
1,000 pF	102	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
1,200 pF	122	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
1,500 pF	152	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
1,800 pF	182	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
2,200 pF	222	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
2,700 pF	272	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
3,300 pF	332	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
3,900 pF	392	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
4,700 pF	472	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
5,600 pF	562	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
6,800 pF	682	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
8,200 pF	822	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
10,000 pF	103	J	K	M	BB	BB	BB	BB	BB	CB	CB	CB	CB	CB	CB	CB	DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
12,000 pF	123	J	K	M	BB	BB	BB	BB		CB	CB	CB	CB	CB	CB		DC	DC	DC	DC	DC	DC	DC	EB	EB	EB	EB	EB	EB	EB
15,000 pF	153	J	K	M	BB	BB	BB	BB		CB	CB	CB	CB	CB	CB		DC	DC	DC	DC	DC	DD	DC	EB	EB	EB	EB	EB	EB	EB
18,000 pF	183	J	K	M	BB	BB	BB	BB		CB	CB	CB	CB	CB	CB		DC	DC	DC	DC	DC	DD	DC	EB	EB	EB	EB	EB	EB	EB
22,000 pF	223	J	K	M	BB	BB	BB	BB		CB	CB	CB	CB	CB	CB		DC	DC	DC	DC	DC	DD	DC	EB	EB	EB	EB	EB	EB	EB
27,000 pF	273	J	K	M	BB	BB	BB	BB		CB	CB	CB	CB	CB	CB		DC	DC	DC	DC	DC	DD	DE	EB	EB	EB	EB	EB	EB	EB
33,000 pF	333	J	K	M	BB	BB	BB	BB		CB	CB	CB	CB	CB	CB		DC	DC	DC	DC	DC	DD	DE	EB	EB	EB	EB	EB	EB	EB
39,000 pF	393	J	K	M	BB	BB	BB	BB		CB	CB	CB	CB	CB	CB		DC	DC	DC	DC	DC	DD	DE	EB	EB	EB	EB	EB	EC	EB
47,000 pF	473	J	K	M	BB	BB	BB	BB		CB	CB	CB	CB	CB	CB		DC	DC	DC	DC	DC	DE	DG	EB	EB	EB	EB	EB	EC	ED
56,000 pF	563	J	K	M	BB	BB	BB			CB	CB	CB	CB	CB			DD	DD	DD	DD	DD	DE	DG	EB	EB	EB	EB	EB	EB	ED
68,000 pF	683	J	K	M	BB	BB	BB			CB	CB	CB	CB	CB			DD	DD	DD	DD	DD	DE		EB	EB	EB	EB	EB	EB	ED
82,000 pF	823	J	K	M	BB	BB	BB			CB	CB	CB	CB	CB			DD	DD	DD	DD	DD	DE		EB	EB	EB	EB	EB	EB	ED
0.10 µF	104	J	K	M	BB	BB	BB			CB	CB	CB	CB	CB			DD	DD	DD	DD	DD	DE		EB	EB	EB	EB	EB	EB	EM
0.12 µF	124	J	K	M						CB	CB	CB	CB				DC	DC	DC	DC	DD	DG		EC	EC	EC	EC	EC	EC	EM
0.15 µF	154	J	K	M						CB	CB	CB	CB				DC	DC	DC	DC	DD	DG		EC	EC	EC	EC	EC	EC	EG
0.18 µF	184	J	K	M						CB	CB	CB	CB				DC	DC	DC	DC	DD	DG		EC	EC	EC	EC	EC	EC	
0.22 µF	224	J	K	M						CB	CB	CB	CD				DC	DC	DC	DC	DD	DG		EC	EC	EC	EC	EC	EC	
0.27 µF	274	J	K	M						CB	CB	CB					DD	DD	DD	DD	DD			EB	EB	EB	EB	EC	EM	
0.33 µF	334	J	K	M						CB	CB	CB					DD	DD	DD	DD	DD			EB	EB	EB	EB	EC	EG	
0.39 µF	394	J	K	M						CB	CB	CB					DG	DG	DG	DG	DE			EB	EB	EB	EB	EC	EG	
0.47 µF	474	J	K	M						CB	CB	CB					DD	DD	DD	DD	DE			EC	EC	EC	EC	EC	EG	
0.56 µF	564	J	K	M													DD	DD	DD	DG	DH			ED	ED	ED	ED	EC		
0.68 µF	684	J	K	M													DD	DD	DD	DG	DH			EE	EE	EE	EE	ED		
0.82 µF	824	J	K	M													DD	DD	DD	DG				EF	EF	EF	EF	ED		
1.0 µF	105	J	K	M													DD	DD	DD	DG				EF	EF	EF	EG	ED		
1.2 µF	125	J	K	M													DE	DE	DE					ED	ED	ED	EG	EH		
1.5 µF	155	J	K	M													DG	DG	DG					EF	EF	EF	EG	EH		
1.8 µF	185	J	K	M													DG	DG	DG					EF	EF	EF	EF	EH		
2.2 µF	225	J	K	M													DG	DG	DG					ED	ED	ED	EF	EH		
2.7 µF	275	J	K	M																				EN	EN	EN	EH			
3.3 µF	335	J	K	M																				ED	ED	ED	EH			
Cap	**Cap Code**	Voltage DC			6.3	10	16	25	50	6.3	10	16	25	50	100	200	6.3	10	16	25	50	100	200	6.3	10	16	25	50	100	200
		Voltage Code			9	8	4	3	5	9	8	4	3	5	1	2	9	8	4	3	5	1	2	9	8	4	3	5	1	2
		Series			**C0402**					**C0603**							**C0805**							**C1206**						

Table 1A – AUTO X7R Dielectric, (0402 - 1206 Case Sizes) con't

Cap	Cap Code	Series			C0402					C0603							C0805							C1206						
		Voltage Code			9	8	4	3	5	9	8	4	3	5	1	2	9	8	4	3	5	1	2	9	8	4	3	5	1	2
		Voltage DC			6.3	10	16	25	50	6.3	10	16	25	50	100	200	6.3	10	16	25	50	100	200	6.3	10	16	25	50	100	200
		Cap Tolerance			Product Availability and Chip Thickness Codes - See Table 2 for Chip Thickness Dimensions																										
3.9 µF	395	J	K	M																				EF	EF	EF	EH			
4.7 µF	475	J	K	M																				EF	EF	EF	EH			
5.6 µF	565	J	K	M																				EH	EH	EH				
6.8 µF	685	J	K	M																				EH	EH	EH				
8.2 µF	825	J	K	M																				EH	EH	EH				
10 µF	106	J	K	M																				EH	EH	EH				
12 µF	126	J	K	M																										
Cap	**Cap Code**	Voltage DC			6.3	10	16	25	50	6.3	10	16	25	50	100	200	6.3	10	16	25	50	100	200	6.3	10	16	25	50	100	200
		Voltage Code			9	8	4	3	5	9	8	4	3	5	1	2	9	8	4	3	5	1	2	9	8	4	3	5	1	2
		Series			**C0402**					**C0603**							**C0805**							**C1206**						

Table 1B – (1210 - 2220 Case Sizes)

Cap	Cap Code	Series			C1210							C1812					C2220			
		Voltage Code			9	8	4	3	5	1	2	3	5	1	2	A	3	5	1	2
		Voltage DC			6.3	10	16	25	50	100	200	25	50	100	200	250	25	50	100	200
		Cap Tolerance			Product Availability and Chip Thickness Codes - See Table 2 for Chip Thickness Dimensions															
2,200 pF	222	J	K	M	FB	FB	FB	FB	FB	FB										
2,700 pF	272	J	K	M	FB	FB	FB	FB	FB	FB										
3,300 pF	332	J	K	M	FB	FB	FB	FB	FB	FB										
3,900 pF	392	J	K	M	FB	FB	FB	FB	FB	FB										
4,700 pF	472	J	K	M	FB	FB	FB	FB	FB	FB										
5,600 pF	562	J	K	M	FB	FB	FB	FB	FB	FB										
6,800 pF	682	J	K	M	FB	FB	FB	FB	FB	FB		GB	GB	GB						
8,200 pF	822	J	K	M	FB	FB	FB	FB	FB	FB		GB	GB	GB						
10,000 pF	103	J	K	M	FB	FB	FB	FB	FB	FB		GB	GB	GB						
12,000 pF	123	J	K	M	FB	FB	FB	FB	FB	FB		GB	GB	GB						
15,000 pF	153	J	K	M	FB	FB	FB	FB	FB	FB		GB	GB	GB						
18,000 pF	183	J	K	M	FB	FB	FB	FB	FB	FB		GB	GB	GB						
22,000 pF	223	J	K	M	FB	FB	FB	FB	FB	FB		GB	GB	GB						
27,000 pF	273	J	K	M	FB	FB	FB	FB	FB	FB		GB	GB	GB						
33,000 pF	333	J	K	M	FB	FB	FB	FB	FB	FB		GB	GB	GB						
39,000 pF	393	J	K	M	FB	FB	FB	FB	FB	FB		GB	GB	GB						
47,000 pF	473	J	K	M	FB	FB	FB	FB	FB	FB		GB	GB	GB						
56,000 pF	563	J	K	M	FB	FB	FB	FB	FB	FB		GB	GB	GB						
68,000 pF	683	J	K	M	FB	FB	FB	FB	FB	FB		GB	GB	GB						
82,000 pF	823	J	K	M	FB	FB	FB	FB	FB	FC		GB	GB	GB						
0.10 µF	104	J	K	M	FB	FB	FB	FB	FB	FD		GB	GB	GB						
0.12 µF	124	J	K	M	FB	FB	FB	FB	FB	FD		GB	GB	GB						
0.15 µF	154	J	K	M	FC	FC	FC	FC	FC	FD		GB	GB	GB						
0.18 µF	184	J	K	M	FC	FC	FC	FC	FC	FD		GB	GB	GB						
0.22 µF	224	J	K	M	FC	FC	FC	FC	FC	FD		GB	GB	GB						
0.27 µF	274	J	K	M	FC	FC	FC	FC	FC	FD		GB	GB	GG		JC	JC			
0.33 µF	334	J	K	M	FD	FD	FD	FD	FD	FD		GB	GB	GG		JC	JC			
0.39 µF	394	J	K	M	FD	FD	FD	FD	FD	FD		GB	GB	GG		JC	JC			
0.47 µF	474	J	K	M	FD	FD	FD	FD	FD	FD		GB	GB	GG		JC	JC			
0.56 µF	564	J	K	M	FD	FD	FD	FD	FD	FF		GC	GC	GG		JC	JC			
Cap	**Cap Code**	Voltage DC			6.3	10	16	25	50	100	200	25	50	100	200	250	25	50	100	200
		Voltage Code			9	8	4	3	5	1	2	3	5	1	2	A	3	5	1	2
		Series			**C1210**							**C1812**					**C2220**			

Table 1B – AUTO X7R Dielectric, (1210 - 2220 Case Sizes) con't

Cap	Cap Code	Series			C1210							C1812					C2220			
		Voltage Code			9	8	4	3	5	1	2	3	5	1	2	A	3	5	1	2
		Voltage DC			6.3	10	16	25	50	100	200	25	50	100	200	250	25	50	100	200
		Cap Tolerance			**Product Availability and Chip Thickness Codes - See Table 2 for Chip Thickness Dimensions**															
0.68 µF	684	J	K	M	FD	FD	FD	FD	FD	FG		GC	GC	GG		JC	JC			
0.82 µF	824	J	K	M	FF	FF	FF	FF	FF	FL		GE	GE	GG		JC	JC			
1.0 µF	105	J	K	M	FH	FH	FH	FH	FH	FM		GE	GE	GG		JC	JC			
1.2 µF	125	J	K	M	FH	FH	FH	FH	FG							JC	JC			
1.5 µF	155	J	K	M	FH	FH	FH	FH	FG							JC	JC			
1.8 µF	185	J	K	M	FH	FH	FH	FH	FG							JD	JD			
2.2 µF	225	J	K	M	FJ	FJ	FJ	FJ	FG			GO	GO			JF	JF			
2.7 µF	275	J	K	M	FE	FE	FE	FG	FH											
3.3 µF	335	J	K	M	FF	FF	FF	FM	FM											
3.9 µF	395	J	K	M	FG	FG	FG	FG	FK											
4.7 µF	475	J	K	M	FC	FC	FC	FG	FS			GK	GK							
5.6 µF	565	J	K	M	FF	FF	FF	FH												
6.8 µF	685	J	K	M	FG	FG	FG	FM												
8.2 µF	825	J	K	M	FH	FH	FH	FK												
10 µF	106	J	K	M	FH	FH	FH	FS				GK				JF	JO			
12 µF	126	J	K	M																
15 µF	156	J	K	M																
18 µF	186	J	K	M																
22 µF	226	J	K	M	FS	FS														
47 µF	476	J	K	M																
Cap	**Cap Code**	Voltage DC			6.3	10	16	25	50	100	200	25	50	100	200	250	25	50	100	200
		Voltage Code			9	8	4	3	5	1	2	3	5	1	2	A	3	5	1	2
		Series			**C1210**							**C1812**					**C2220**			