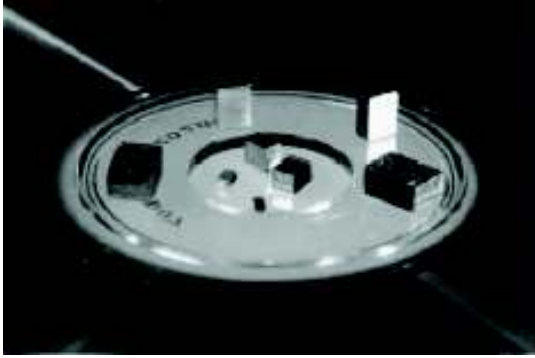


# Type FCP Surface Mount Film Capacitors

## Stable Stacked Metallized Film (PPS) Chips for Reflow Soldering



Type FCP stacked metallized polyphenylene sulfide (PPS) film capacitors offer high capacitance per unit volume, stable capacitance and DF over a wide temperature range, and excellent high frequency performance. Type FCP capacitors conform to standard EIA 0603, 0805, 1206, 1210, 1913 & 2416 surface mount case sizes and are packaged on tape and reel.

The Type FCP's combination of high capacitance density and excellent high frequency response makes it a great choice for wireless and instrumentation applications.

### Highlights

- ◆ Stacked metallized polyphenylene sulfide (PPS) film.
- ◆ High operating temperature to +125 °C
- ◆ High capacitance per unit volume
- ◆ Excellent high frequency performance
- ◆ Capacitance change from -55 °C to 105 °C  $\leq \pm 1.5\%$
- ◆ Stable cap and DF over wide temperature range

### Specifications

<b>Nominal Capacitance Range:</b>	100 pF to 0.22 $\mu$ F (1kHz at $\leq 5$ Vrms)
<b>Capacitance Tolerance:</b>	$\pm 5\%$ (J) Standard, $\pm 2\%$ (G) Optional
<b>Rated Voltage:</b>	16 Vdc and 50 Vdc
<b>Dissipation Factor (Tan d):</b>	0.6% Max. (1 kHz at $\leq 5$ Vrms)
<b>Operating Temperature Range:</b>	-55 °C to +125 °C (See Voltage derating chart for 0.12 - 0.22 $\mu$ F above 105 °C)
<b>Dielectric Strength:</b>	175% of rated Vdc for 5 seconds
<b>Insulation Resistance:</b>	3000 M $\Omega$ Min. at 20 °C, after 60 seconds (16 Vdc rated, test 10 Vdc; 50 Vdc rated, test 50 Vdc)
<b>Construction:</b>	Stacked metallized polyphenylene sulfide (PPS) film
<b>Life Test:</b>	Capacitors subjected to 1000 hours of maximum rated temperature and 125% of the rated voltage will not have any significant visual damage, the capacitance will be within $\pm 2\%$ of the initial measured value, DF will be a maximum of 0.66%, and IR will be a minimum of 1000 Megohms.
<b>Resistance to Soldering Heat:</b>	Capacitors subjected to a 260 °C reflow soldering for 5 seconds will not have any significant visual damage, dielectric strength will be as specified, the capacitance will be within $\pm 3\%$ of the initial measured value, DF will be a maximum of .66%, and IR will be a minimum of 1000 Megohms.
<b>Moisture Resistance:</b>	Capacitors subjected to 1000 hours at 40 °C and 90% to 95% RH and rated voltage will not have any significant visual damage, will withstand 1.3 times the rated voltage for one minute, the capacitance will be within $\pm 2\%$ of the initial measured value, DF will be a maximum of 0.9%, and IR will be a minimum of 1000 Megohms.



Complies with the EU Directive 2002/95/EC requirement restricting the use of Lead (Pb), Mercury (Hg), Cadmium (Cd), Hexavalent chromium (Cr(VI)), PolyBrominated Biphenyls (PBB) and PolyBrominated Diphenyl Ethers (PBDE).

# Type FCP Surface Mount Film Capacitors

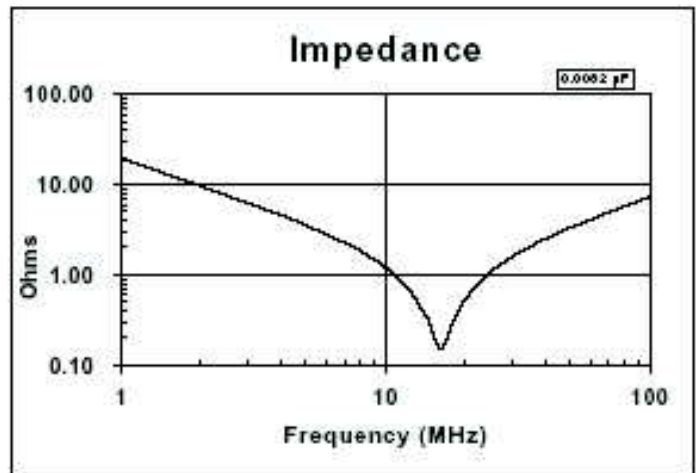
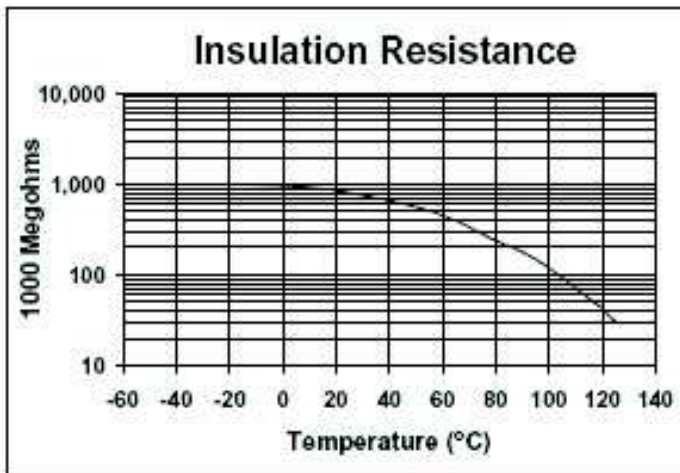
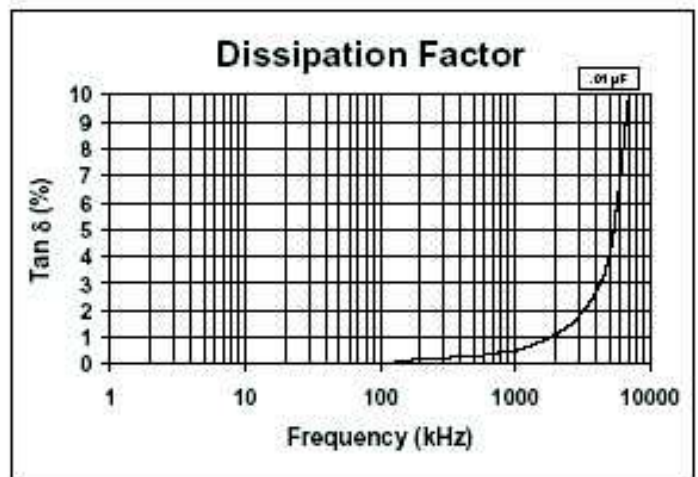
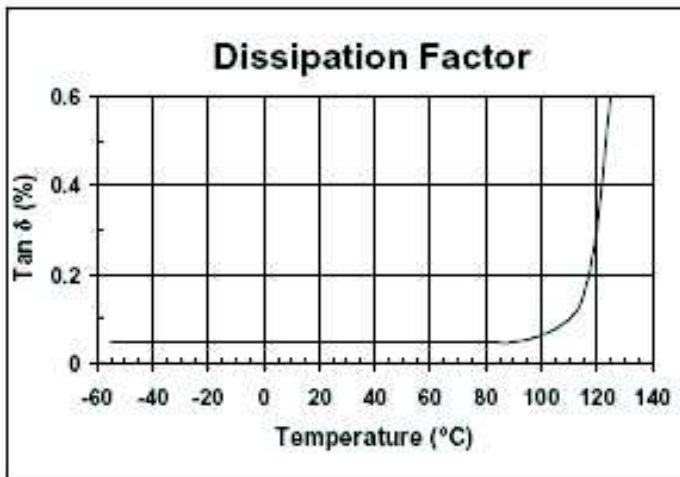
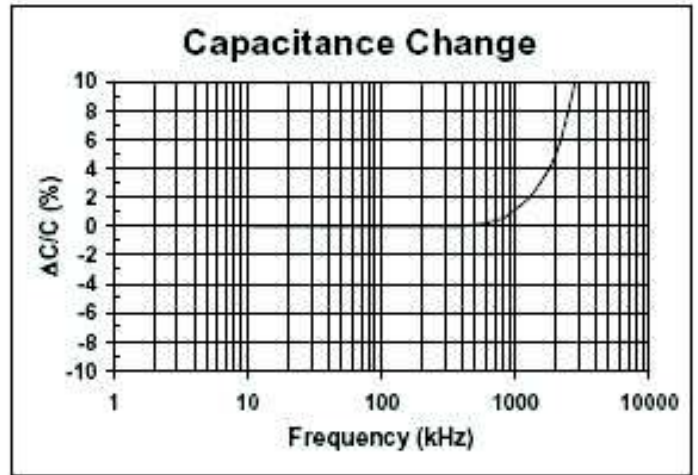
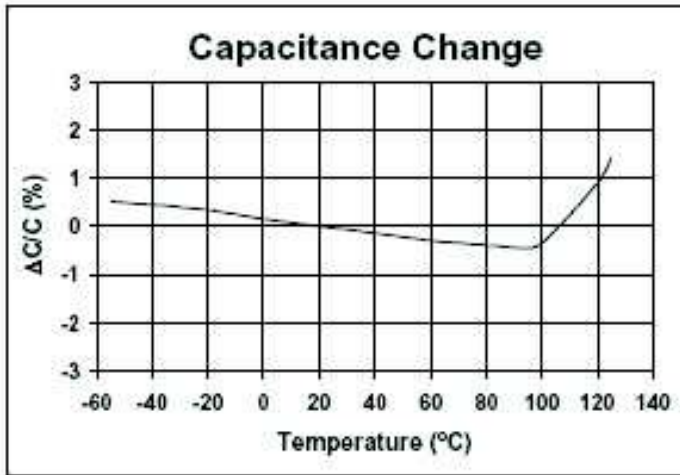
## Ratings

Capacitance			16 Vdc		50 Vdc	
( $\mu$ F)	(nF)	(pF)	Catalog Part Number	Case Code	Catalog Part Number	Case Code
.00010	.010	100	FCP0603C101J-K1	0603	FCP0805H101J-J1	0805
.00012	.012	120	FCP0603C121J-K1		FCP0805H121J-J1	
.00015	.015	150	FCP0603C151J-K1		FCP0805H151J-J1	
.00018	.018	180	FCP0603C181J-K1		FCP0805H181J-J1	
.00022	.022	220	FCP0603C221J-K1		FCP0805H221J-J1	
.00027	.027	270	FCP0603C271J-K1		FCP0805H271J-J1	
.00033	.033	330	FCP0603C331J-K1		FCP0805H331J-J1	
.00039	.039	390	FCP0603C391J-K1		FCP0805H391J-J1	
.00047	.047	470	FCP0603C471J-K1		FCP0805H471J-J1	
.00056	.056	560	FCP0603C561J-K1		FCP0805H561J-J1	
.00068	.068	680	FCP0603C681J-K1		FCP0805H681J-J1	
.00082	.082	820	FCP0603C821J-K1		FCP0805H821J-J1	
.0010	1.00	1000	FCP0603C102J-K1		FCP0805H102J-J1	
.0012	1.20	1200	FCP0603C122J-K1		FCP0805H122J-J1	
.0015	1.50	1500	FCP0603C152J-K1		FCP0805H152J-J1	
.0018	1.80	1800	FCP0603C182J-K1	FCP0805H182J-J1		
.0022	2.20	2200	FCP0603C222J-K1	FCP0805H222J-J1		
.0027	2.70	2700	FCP0603C272J-K1	FCP0805H272J-J1		
.0033	3.30	3300	FCP0805C332J-J1	805	FCP1206H332J-H1	1206
.0039	3.90	3900	FCP0805C392J-J1		FCP1206H392J-H1	
.0047	4.70	4700	FCP0805C472J-J1		FCP1206H472J-H1	
.0056	5.60	5600	FCP0805C562J-J1		FCP1206H562J-H1	
.0068	6.80	6800	FCP0805C682J-J1		FCP1206H682J-H1	
.0082	8.20	8200	FCP0805C822J-J2		FCP1206H822J-H2	
.010	10	10000	FCP0805C103J-J2		FCP1206H103J-H2	
.012	12	12000	FCP1206C123J-H1	1206	FCP1210H123J-G1	1210
.015	15	15000	FCP1206C153J-H1		FCP1210H153J-G1	
.018	18	18000	FCP1206C183J-H1		FCP1210H183J-G2	
.022	22	22000	FCP1206C223J-H1		FCP1210H223J-G2	
.027	27	27000	FCP1206C273J-H2		FCP1210H273J-G2	
.033	33	33000	FCP1206C333J-H2		FCP1210H333J-G3	
.039	39	39000	FCP1206C393J-H3		FCP1210H393J-G3	
.047	47	47000	FCP1206C473J-H3		FCP1913H473J-E1	1913
.056	56	56000	FCP1210C563J-G2	1210	FCP1913H563J-E1	
.068	68	68000	FCP1210C683J-G2		FCP1913H683J-E1	
.082	82	82000	FCP1210C823J-G3		FCP1913H823J-E2	
.100	100	100000	FCP1210C104J-G3		FCP1913H104J-E2	
.12	120	120000			FCP2416H124J-D1	2416
.15	150	150000			FCP2416H154J-D1	
.18	180	180000			FCP2416H184J-D3	
.22	220	220000			FCP2416H224J-D4	

# Type FCP Surface Mount Film Capacitors

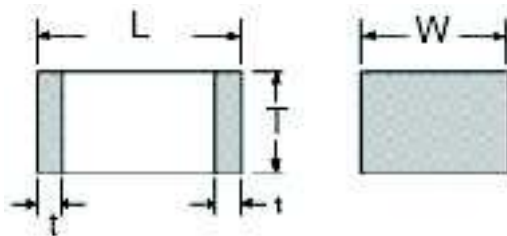
## Typical Temperature Characteristics

## Typical Frequency Characteristics



# Type FCP Surface Mount Film Capacitors

## Outline Dimensions

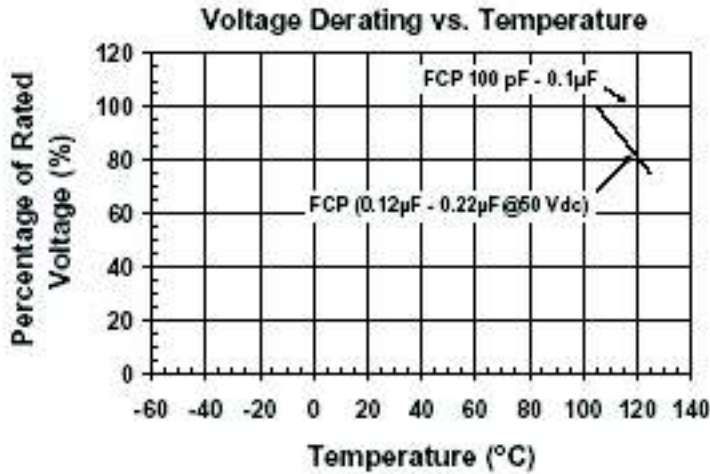


Case Code	Outline Dimensions (in.)				Case Code (metric)	Outline Dimensions (imm)				Packaging Code
	L ±0.008	W	T±0.008	t		L ±0.2	W	T±0.2	t	
0603	0.063	0.032±0.006	0.028±0.006	0.014±0.008	1608	1.6	0.80±0.15	0.70±0.15	0.35±0.2	K1
0805	0.079	0.049±0.008	0.035 0.043	0.018±0.010	2012	2.0	1.25±0.2	0.9 1.1	0.45±0.25	J1 J2
1206	0.126	0.063±0.008	0.035 0.043 0.059	0.026±0.012	3216	3.2	1.6±0.2	0.9 1.1 1.5	0.65±0.3	H1 H2 H3
1210	0.126	0.098±0.008	0.043 0.059 0.083	0.026±0.012	3225	3.2	2.5±0.2	1.1 1.5 2.1	0.65±0.3	G1 G2 G3
1913	0.189	0.130±0.012	0.059 0.083	0.031±0.012	4833	4.8	3.3±0.3	1.5 2.1	0.80±0.3	E1 E2
2416	0.236	0.161±0.012	0.075 0.098 0.110	0.031±0.012	6041	6.0	4.1±0.3	1.9 2.5 2.8	0.80±0.3	D1 D3 D4

## Pulse Handling Capability

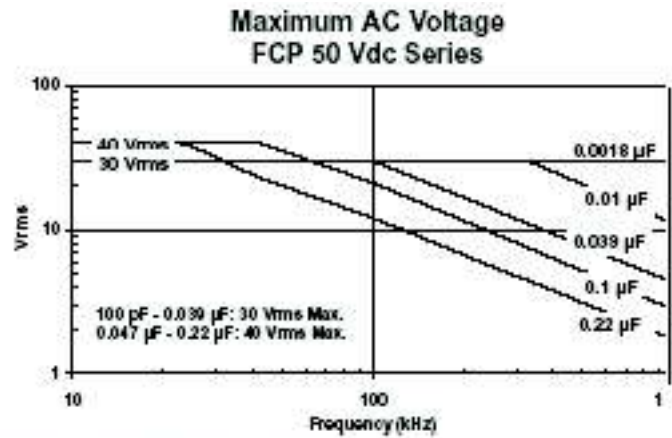
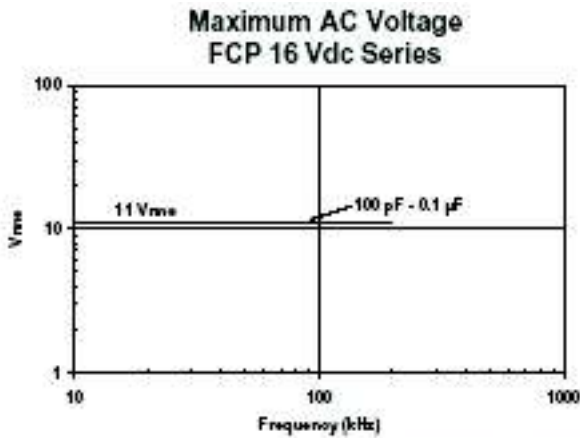
Cap (µF)	Voltage (Vdc)	dV/dt (V/µs)	Cap (µF)	Voltage (Vdc)	dV/dt (V/µs)	Cap (µF)	Voltage (Vdc)	dV/dt (V/µs)
.00010	16	420	.010	16	52	.00082	50	440
.00012	16	390	.012	16	48	.0010	50	400
.00015	16	350	.015	16	43	.0012	50	370
.00018	16	325	.018	16	40	.0015	50	340
.00022	16	295	.022	16	37	.0018	50	310
.00027	16	270	.027	16	33	.0022	50	270
.00033	16	245	.033	16	31	.0027	50	260
.00039	16	225	.039	16	28	.0033	50	240
.00047	16	205	.047	16	26	.0039	50	220
.00056	16	193	.056	16	24	.0047	50	200
.00068	16	175	.068	16	22	.0056	50	190
.00082	16	160	.082	16	20	.0068	50	170
.0010	16	150	.100	16	19	.0082	50	160
.0012	16	135	.00010	50	1100	.010	50	145
.0015	16	123	.00012	50	1050	.012	50	135
.0018	16	115	.00015	50	940	.015	50	120
.0022	16	105	.00018	50	890	.018	50	110
.0027	16	95	.00022	50	800	.022	50	100
.0033	16	86	.00027	50	730	.027	50	94
.0039	16	80	.00033	50	690	.033	50	86
.0047	16	74	.00039	50	610	.039	50	78
.0056	16	68	.00047	50	580	.047 - .10	50	180
.0068	16	62	.00056	50	520	.12 - .22	50	130
.0082	16	58	.00068	50	480			

# Type FCP Surface Mount Film Capacitors



If the temperature on the surface of the capacitor is above 105°C, then the maximum voltage for FCP 50 Vdc ratings from .12 μF to .22 μF must be derated linearly from full rated voltage at 105°C to 75% of the rated voltage at 125°C.

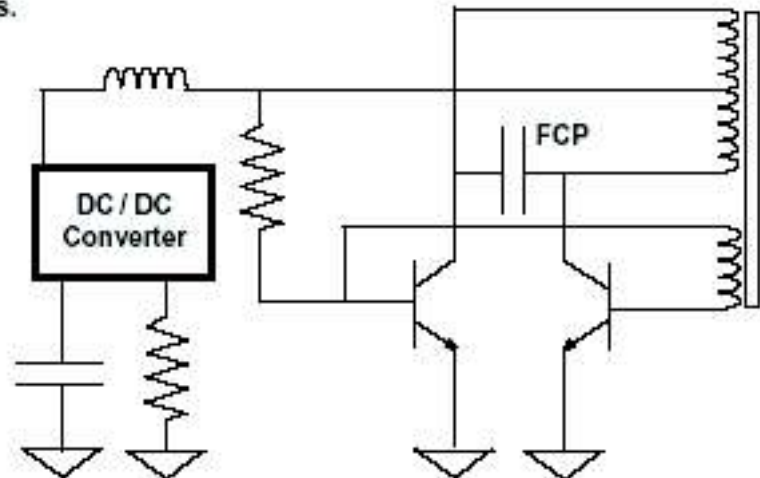
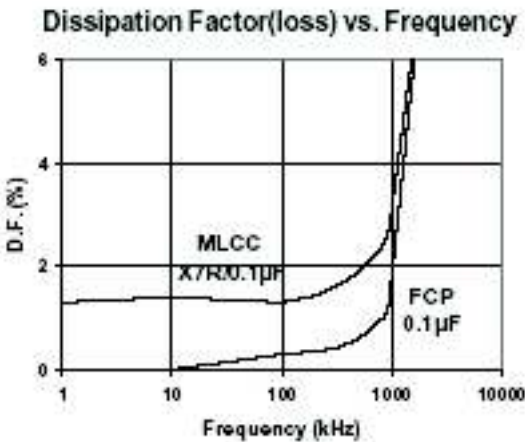
## Vrms vs. Frequency



The capacitor surface temperature should not exceed 125°C.

## Typical Applications

Higher efficiency in battery operated devices.

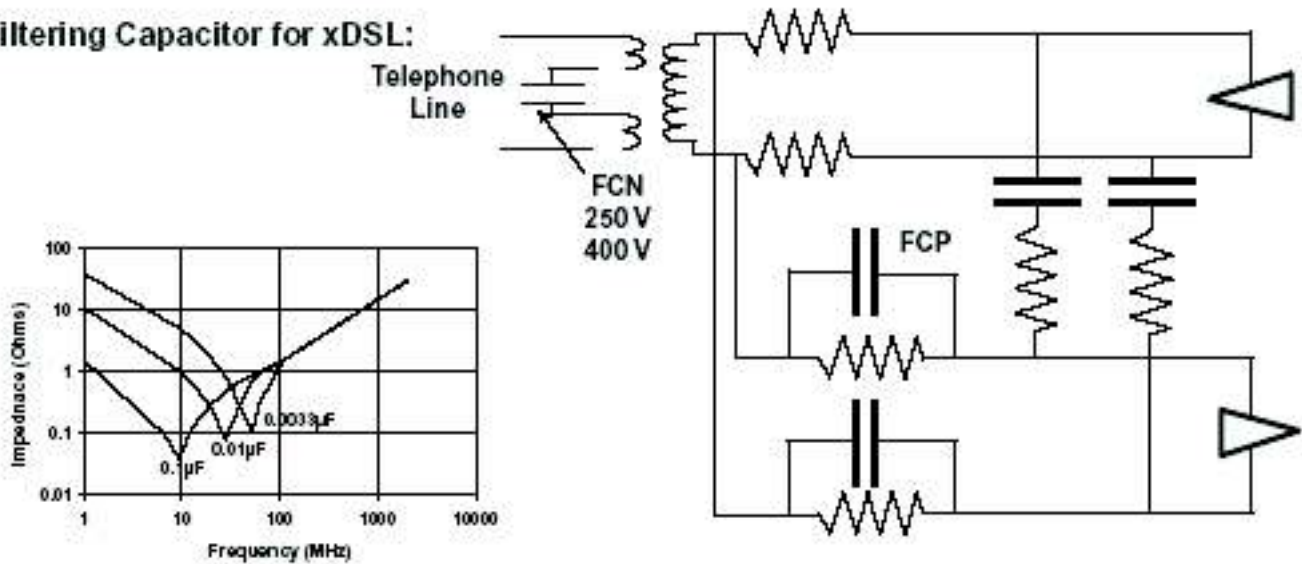


Very low losses and stable temperature characteristics make film chip capacitors the best choice for resonant circuit applications.

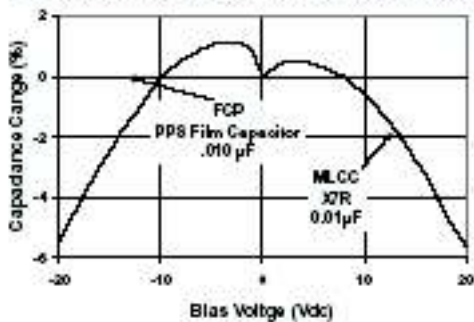
# Type FCP Surface Mount Film Capacitors

## Typical Applications

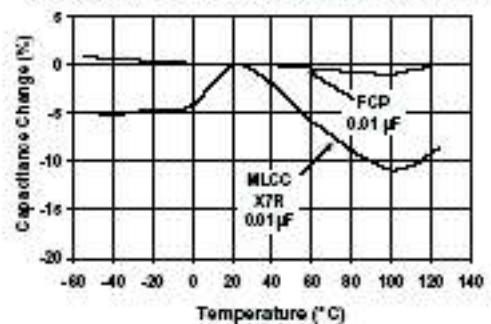
### Filtering Capacitor for xDSL:



### Capacitance Change vs. Bias Voltage

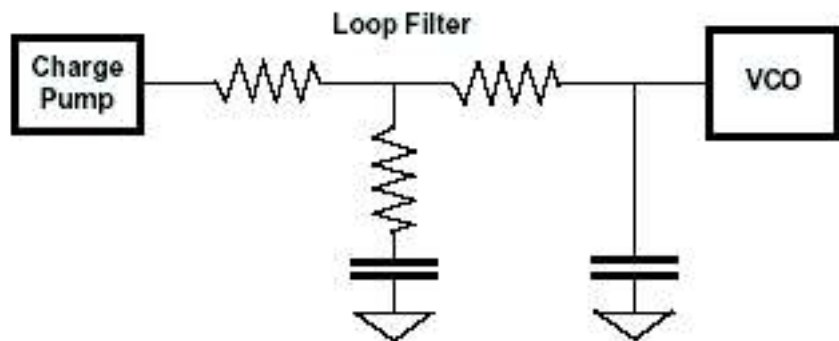
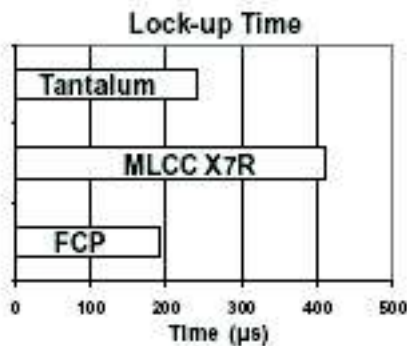


### Capacitance Change vs. Temperature



The capacitance of SMT film chips is much more stable with applied voltage and with changes in temperature than multilayer ceramic capacitors. Add in the low ESR characteristics of film chips and the final result is improved performance in filter circuit applications.

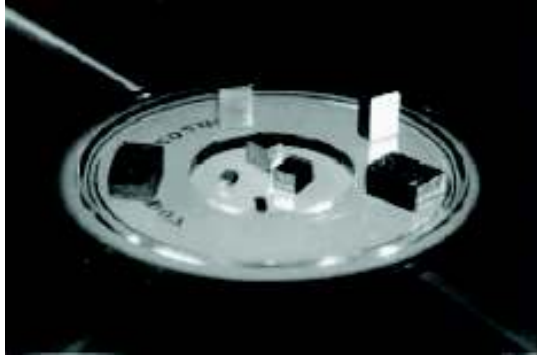
### PLL Circuit: Cellular phone, Blue Tooth, Data Communication Cards



In PLL circuit applications, FCP SMT film capacitor advantages are tight tolerance on the capacitance value, stable capacitance with temperature, faster lock-up times, and no noise due to piezoelectric effects.

# Type FCP Surface Mount Film Capacitors

## Stable Stacked Metallized Film (PPS) Chips for Reflow Soldering



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### Highlights

- ◆ Stacked metallized polyphenylene sulfide (PPS) film.
- ◆ High operating temperature to +125 °C
- ◆ High capacitance per unit volume
- ◆ Excellent high frequency performance
- ◆ Capacitance change from -55 °C to 105 °C  $\leq \pm 1.5\%$
- ◆ Stable cap and DF over wide temperature range

### Specifications

<b>Nominal Capacitance Range:</b>	100 pF to 0.22 $\mu$ F (1kHz at $\leq 5$ Vrms)
<b>Capacitance Tolerance:</b>	$\pm 5\%$ (J) Standard, $\pm 2\%$ (G) Optional
<b>Rated Voltage:</b>	16 Vdc and 50 Vdc
<b>Dissipation Factor (Tan d):</b>	0.6% Max. (1 kHz at $\leq 5$ Vrms)
<b>Operating Temperature Range:</b>	-55 °C to +125 °C (See Voltage derating chart for 0.12 - 0.22 $\mu$ F above 105 °C)
<b>Dielectric Strength:</b>	175% of rated Vdc for 5 seconds
<b>Insulation Resistance:</b>	3000 M $\Omega$ Min. at 20 °C, after 60 seconds (16 Vdc rated, test 10 Vdc; 50 Vdc rated, test 50 Vdc)
<b>Construction:</b>	Stacked metallized polyphenylene sulfide (PPS) film
<b>Life Test:</b>	Capacitors subjected to 1000 hours of maximum rated temperature and 125% of the rated voltage will not have any significant visual damage, the capacitance will be within $\pm 2\%$ of the initial measured value, DF will be a maximum of 0.66%, and IR will be a minimum of 1000 Megohms.
<b>Resistance to Soldering Heat:</b>	Capacitors subjected to a 260 °C reflow soldering for 5 seconds will not have any significant visual damage, dielectric strength will be as specified, the capacitance will be within $\pm 3\%$ of the initial measured value, DF will be a maximum of .66%, and IR will be a minimum of 1000 Megohms.
<b>Moisture Resistance:</b>	Capacitors subjected to 1000 hours at 40 °C and 90% to 95% RH and rated voltage will not have any significant visual damage, will withstand 1.3 times the rated voltage for one minute, the capacitance will be within $\pm 2\%$ of the initial measured value, DF will be a maximum of 0.9%, and IR will be a minimum of 1000 Megohms.



Complies with the EU Directive 2002/95/EC requirement restricting the use of Lead (Pb), Mercury (Hg), Cadmium (Cd), Hexavalent chromium (Cr(VI)), PolyBrominated Biphenyls (PBB) and PolyBrominated Diphenyl Ethers (PBDE).

# Type FCP Surface Mount Film Capacitors

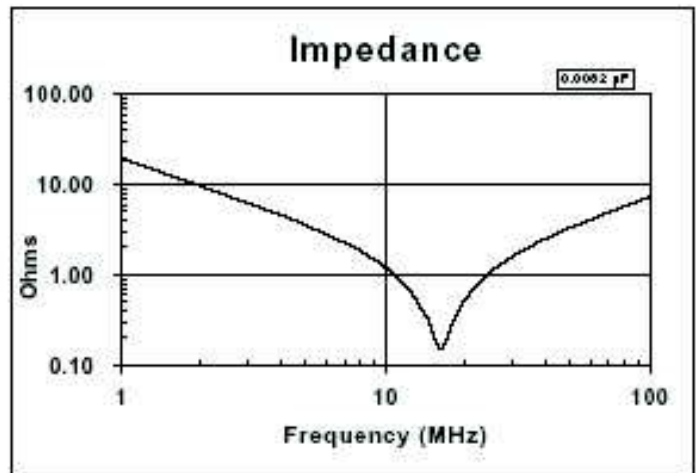
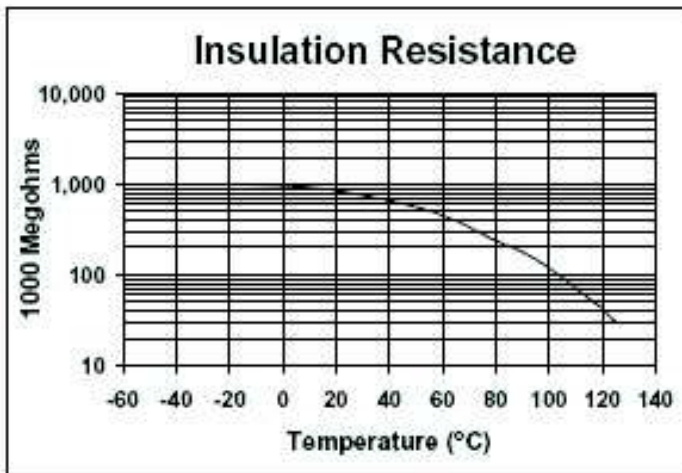
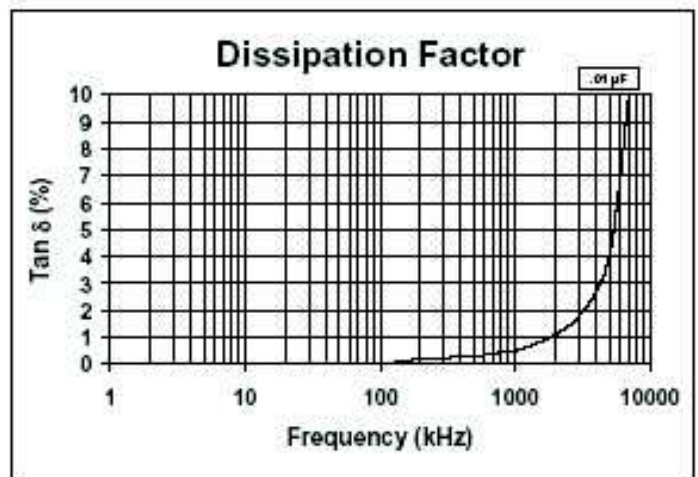
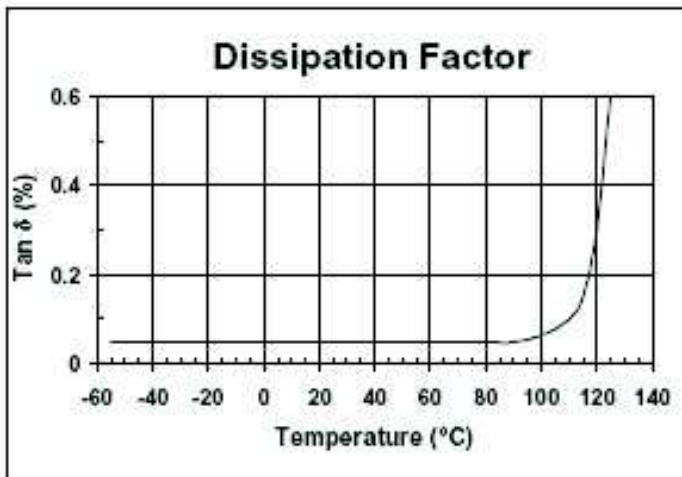
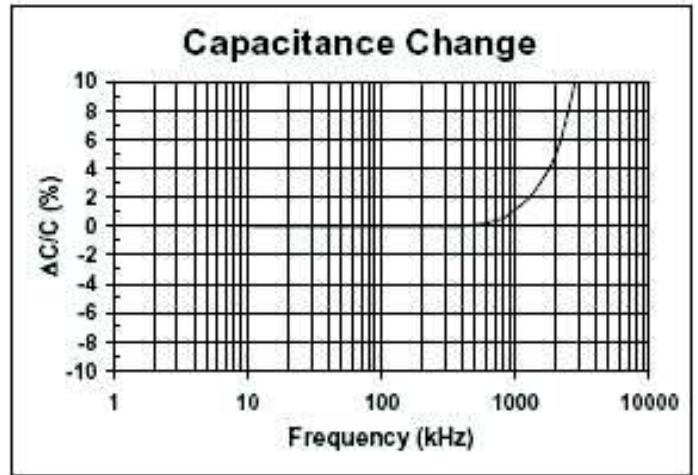
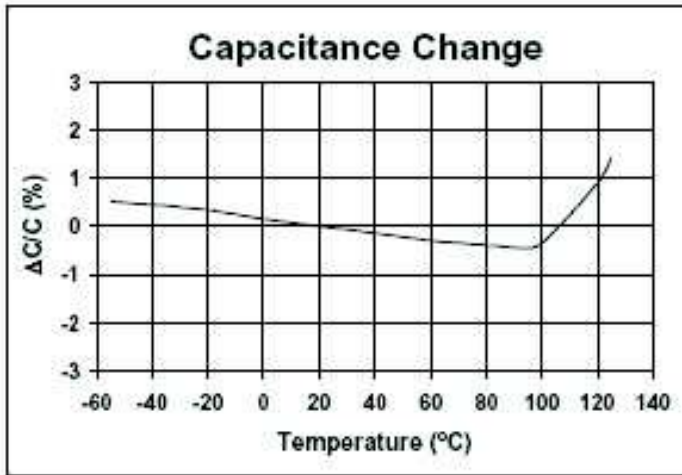
## Ratings

Capacitance			16 Vdc		50 Vdc	
( $\mu$ F)	(nF)	(pF)	Catalog Part Number	Case Code	Catalog Part Number	Case Code
.00010	.010	100	FCP0603C101J-K1	0603	FCP0805H101J-J1	0805
.00012	.012	120	FCP0603C121J-K1		FCP0805H121J-J1	
.00015	.015	150	FCP0603C151J-K1		FCP0805H151J-J1	
.00018	.018	180	FCP0603C181J-K1		FCP0805H181J-J1	
.00022	.022	220	FCP0603C221J-K1		FCP0805H221J-J1	
.00027	.027	270	FCP0603C271J-K1		FCP0805H271J-J1	
.00033	.033	330	FCP0603C331J-K1		FCP0805H331J-J1	
.00039	.039	390	FCP0603C391J-K1		FCP0805H391J-J1	
.00047	.047	470	FCP0603C471J-K1		FCP0805H471J-J1	
.00056	.056	560	FCP0603C561J-K1		FCP0805H561J-J1	
.00068	.068	680	FCP0603C681J-K1		FCP0805H681J-J1	
.00082	.082	820	FCP0603C821J-K1		FCP0805H821J-J1	
.0010	1.00	1000	FCP0603C102J-K1		FCP0805H102J-J1	
.0012	1.20	1200	FCP0603C122J-K1		FCP0805H122J-J1	
.0015	1.50	1500	FCP0603C152J-K1		FCP0805H152J-J1	
.0018	1.80	1800	FCP0603C182J-K1	FCP0805H182J-J1		
.0022	2.20	2200	FCP0603C222J-K1	FCP0805H222J-J1		
.0027	2.70	2700	FCP0603C272J-K1	FCP0805H272J-J1		
.0033	3.30	3300	FCP0805C332J-J1	805	FCP1206H332J-H1	1206
.0039	3.90	3900	FCP0805C392J-J1		FCP1206H392J-H1	
.0047	4.70	4700	FCP0805C472J-J1		FCP1206H472J-H1	
.0056	5.60	5600	FCP0805C562J-J1		FCP1206H562J-H1	
.0068	6.80	6800	FCP0805C682J-J1		FCP1206H682J-H1	
.0082	8.20	8200	FCP0805C822J-J2		FCP1206H822J-H2	
.010	10	10000	FCP0805C103J-J2		FCP1206H103J-H2	
.012	12	12000	FCP1206C123J-H1	1206	FCP1210H123J-G1	1210
.015	15	15000	FCP1206C153J-H1		FCP1210H153J-G1	
.018	18	18000	FCP1206C183J-H1		FCP1210H183J-G2	
.022	22	22000	FCP1206C223J-H1		FCP1210H223J-G2	
.027	27	27000	FCP1206C273J-H2		FCP1210H273J-G2	
.033	33	33000	FCP1206C333J-H2		FCP1210H333J-G3	
.039	39	39000	FCP1206C393J-H3		FCP1210H393J-G3	
.047	47	47000	FCP1206C473J-H3		FCP1913H473J-E1	1913
.056	56	56000	FCP1210C563J-G2	1210	FCP1913H563J-E1	
.068	68	68000	FCP1210C683J-G2		FCP1913H683J-E1	
.082	82	82000	FCP1210C823J-G3		FCP1913H823J-E2	
.100	100	100000	FCP1210C104J-G3		FCP1913H104J-E2	
.12	120	120000			FCP2416H124J-D1	2416
.15	150	150000			FCP2416H154J-D1	
.18	180	180000			FCP2416H184J-D3	
.22	220	220000			FCP2416H224J-D4	

# Type FCP Surface Mount Film Capacitors

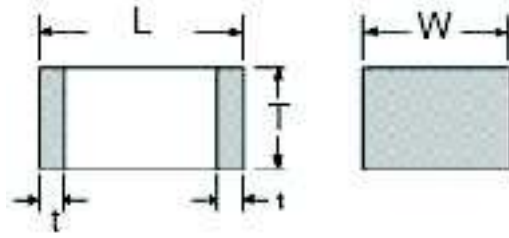
## Typical Temperature Characteristics

## Typical Frequency Characteristics



# Type FCP Surface Mount Film Capacitors

## Outline Dimensions

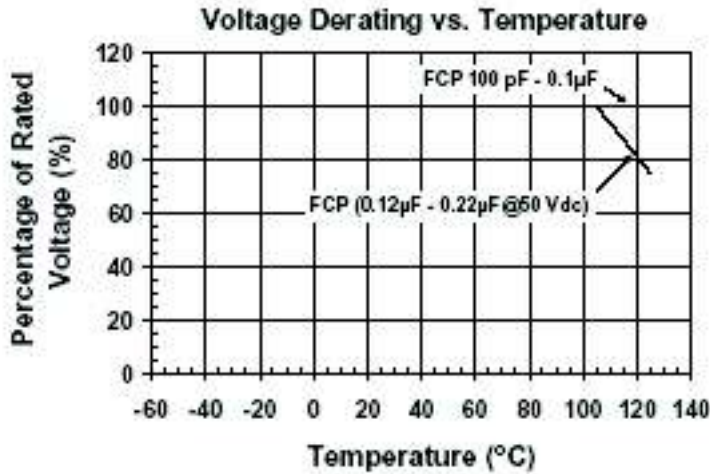


Case Code	Outline Dimensions (in.)				Case Code (metric)	Outline Dimensions (imm)				Packaging Code
	L ±0.008	W	T±0.008	t		L ±0.2	W	T±0.2	t	
0603	0.063	0.032±0.006	0.028±0.006	0.014±0.008	1608	1.6	0.80±0.15	0.70±0.15	0.35±0.2	K1
0805	0.079	0.049±0.008	0.035 0.043	0.018±0.010	2012	2.0	1.25±0.2	0.9 1.1	0.45±0.25	J1 J2
1206	0.126	0.063±0.008	0.035 0.043 0.059	0.026±0.012	3216	3.2	1.6±0.2	0.9 1.1 1.5	0.65±0.3	H1 H2 H3
1210	0.126	0.098±0.008	0.043 0.059 0.083	0.026±0.012	3225	3.2	2.5±0.2	1.1 1.5 2.1	0.65±0.3	G1 G2 G3
1913	0.189	0.130±0.012	0.059 0.083	0.031±0.012	4833	4.8	3.3±0.3	1.5 2.1	0.80±0.3	E1 E2
2416	0.236	0.161±0.012	0.075 0.098 0.110	0.031±0.012	6041	6.0	4.1±0.3	1.9 2.5 2.8	0.80±0.3	D1 D3 D4

## Pulse Handling Capability

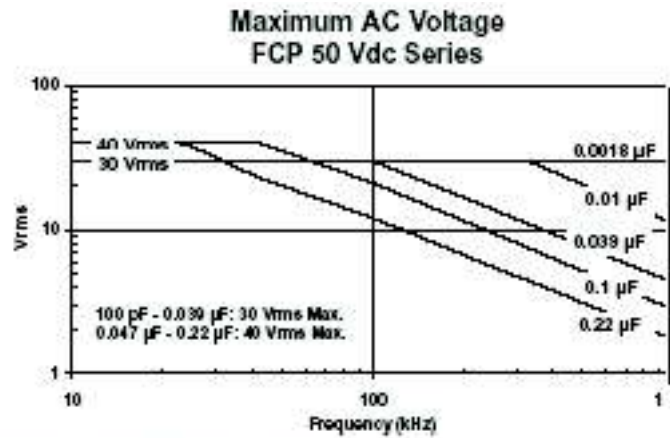
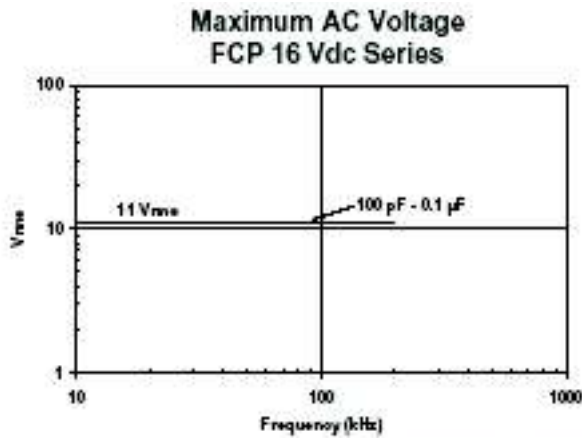
Cap (µF)	Voltage (Vdc)	dV/dt (V/µs)	Cap (µF)	Voltage (Vdc)	dV/dt (V/µs)	Cap (µF)	Voltage (Vdc)	dV/dt (V/µs)
.00010	16	420	.010	16	52	.00082	50	440
.00012	16	390	.012	16	48	.0010	50	400
.00015	16	350	.015	16	43	.0012	50	370
.00018	16	325	.018	16	40	.0015	50	340
.00022	16	295	.022	16	37	.0018	50	310
.00027	16	270	.027	16	33	.0022	50	270
.00033	16	245	.033	16	31	.0027	50	260
.00039	16	225	.039	16	28	.0033	50	240
.00047	16	205	.047	16	26	.0039	50	220
.00056	16	193	.056	16	24	.0047	50	200
.00068	16	175	.068	16	22	.0056	50	190
.00082	16	160	.082	16	20	.0068	50	170
.0010	16	150	.100	16	19	.0082	50	160
.0012	16	135	.00010	50	1100	.010	50	145
.0015	16	123	.00012	50	1050	.012	50	135
.0018	16	115	.00015	50	940	.015	50	120
.0022	16	105	.00018	50	890	.018	50	110
.0027	16	95	.00022	50	800	.022	50	100
.0033	16	86	.00027	50	730	.027	50	94
.0039	16	80	.00033	50	690	.033	50	86
.0047	16	74	.00039	50	610	.039	50	78
.0056	16	68	.00047	50	580	.047 - .10	50	180
.0068	16	62	.00056	50	520	.12 - .22	50	130
.0082	16	58	.00068	50	480			

# Type FCP Surface Mount Film Capacitors



If the temperature on the surface of the capacitor is above 105°C, then the maximum voltage for FCP 50 Vdc ratings from .12 μF to .22 μF must be derated linearly from full rated voltage at 105°C to 75% of the rated voltage at 125°C.

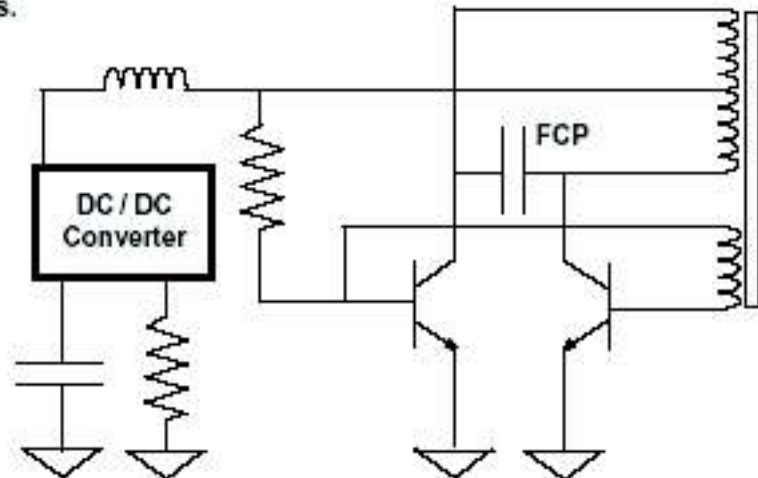
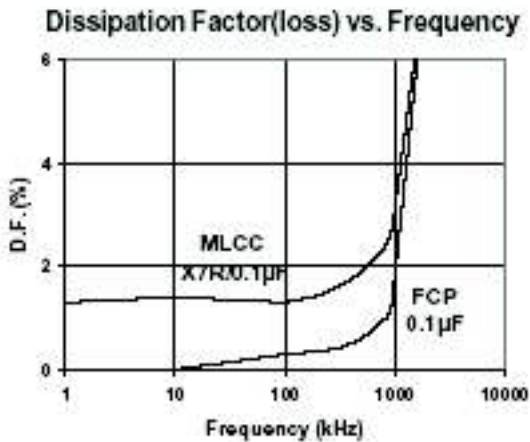
## Vrms vs. Frequency



The capacitor surface temperature should not exceed 125°C.

## Typical Applications

Higher efficiency in battery operated devices.

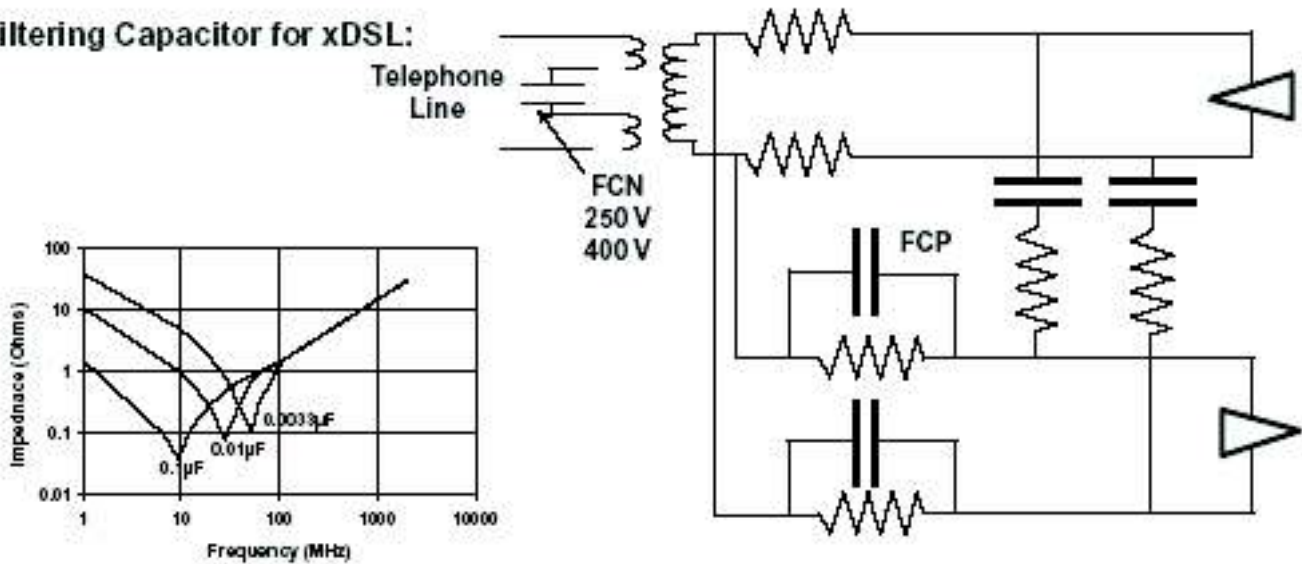


Very low losses and stable temperature characteristics make film chip capacitors the best choice for resonant circuit applications.

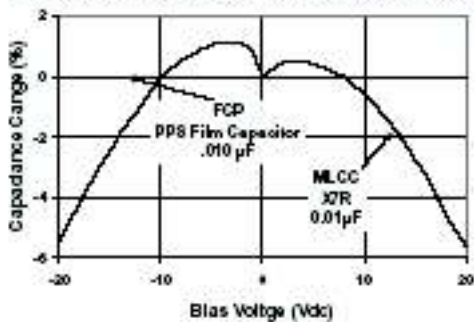
# Type FCP Surface Mount Film Capacitors

## Typical Applications

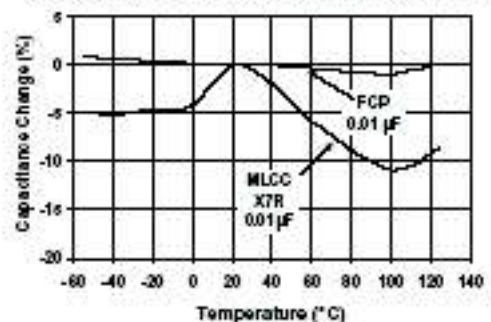
### Filtering Capacitor for xDSL:



### Capacitance Change vs. Bias Voltage

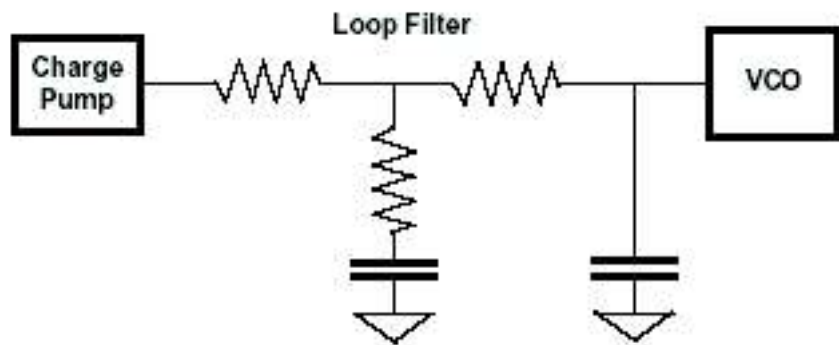
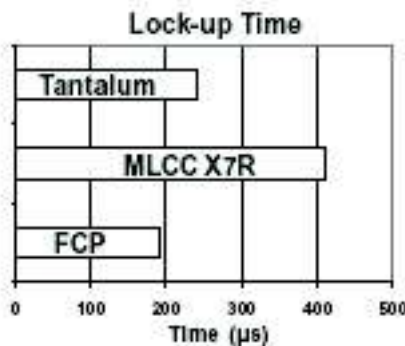


### Capacitance Change vs. Temperature



The capacitance of SMT film chips is much more stable with applied voltage and with changes in temperature than multilayer ceramic capacitors. Add in the low ESR characteristics of film chips and the final result is improved performance in filter circuit applications.

### PLL Circuit: Cellular phone, Blue Tooth, Data Communication Cards



In PLL circuit applications, FCP SMT film capacitor advantages are tight tolerance on the capacitance value, stable capacitance with temperature, faster lock-up times, and no noise due to piezoelectric effects.