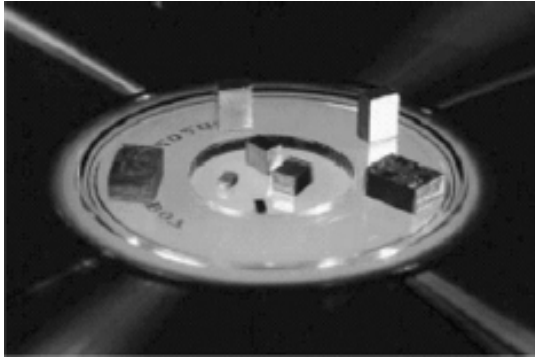


# Type FCP Surface Mount Film Capacitors

## 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  |

**Life Test:** 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.

**Resistance to Soldering Heat:** 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.



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).

**Moisture Resistance:** 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.

# Type FCP Surface Mount Film Capacitors

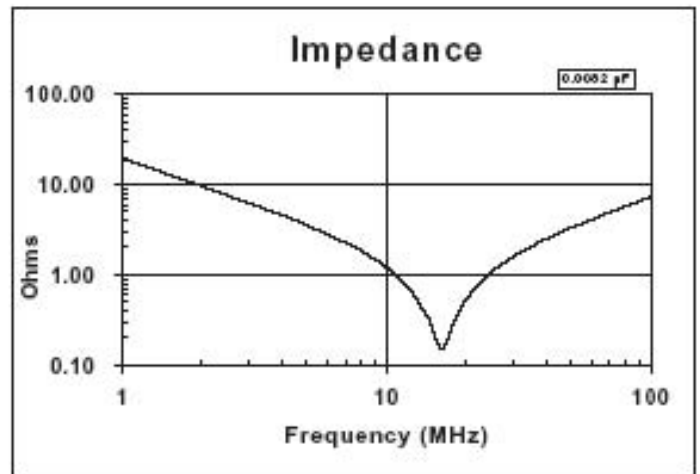
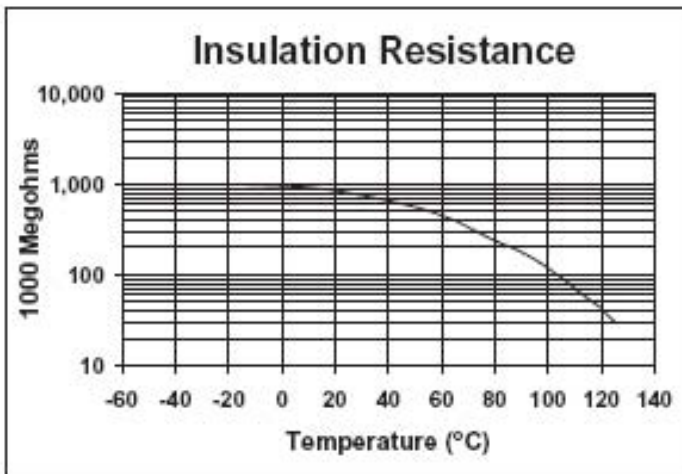
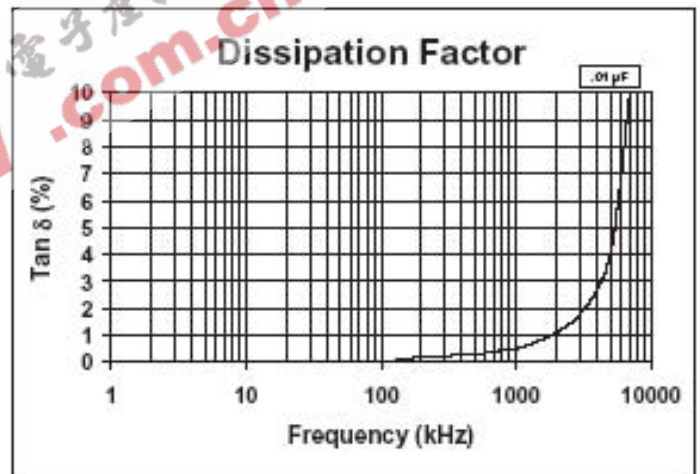
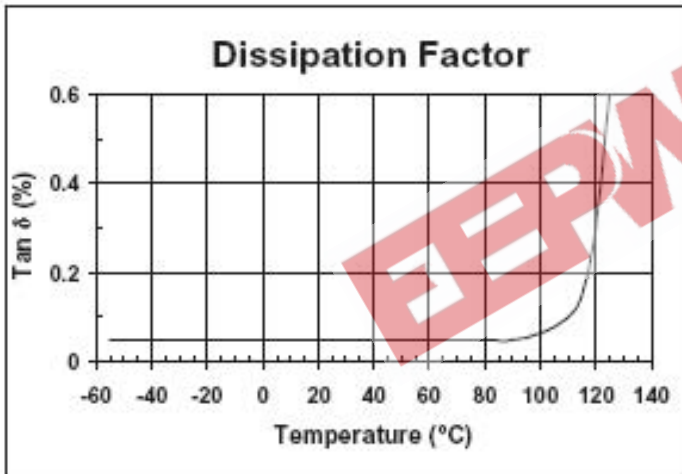
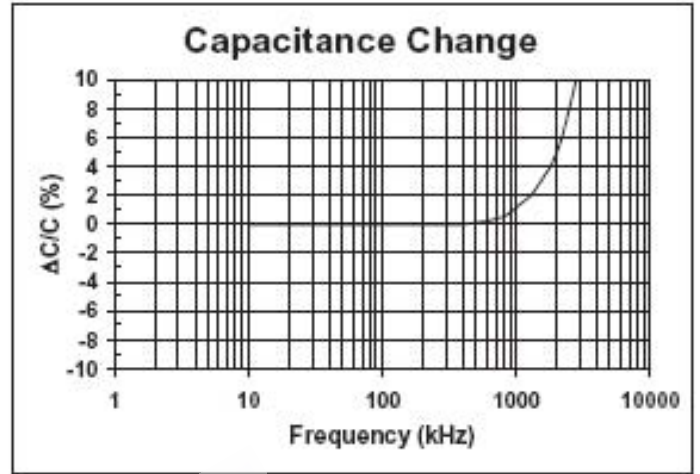
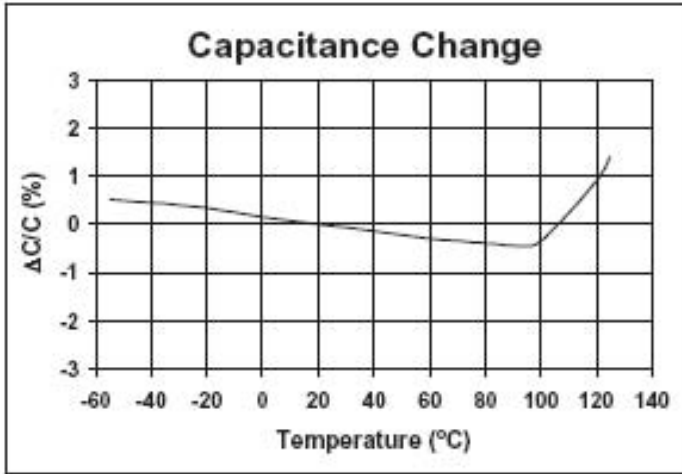
## Ratings

| 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     | FCP1913H563J-E2 |                     |           |
| .068        | 68   | 68000  | FCP1210C683J-G2     | FCP1913H683J-E2 |                     |           |
| .082        | 82   | 82000  | FCP1210C823J-G3     | FCP1913H823J-E4 |                     |           |
| .100        | 100  | 100000 | FCP1210C104J-G3     | FCP1913H104J-E3 |                     |           |
| .12         | 120  | 120000 |                     | 2416            | FCP2416H124J-D1     |           |
| .15         | 150  | 150000 |                     |                 | FCP2416H154J-D3     |           |
| .18         | 180  | 180000 |                     |                 | FCP2416H184J-D4     |           |
| .22         | 220  | 220000 |                     |                 | FCP2416H224J-D5     |           |

# Type FCP Surface Mount Film Capacitors

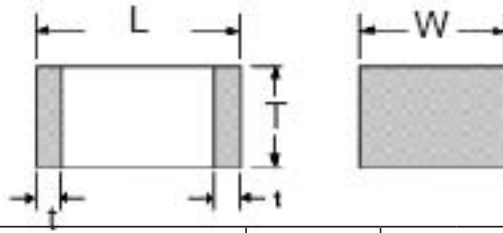
## Typical Temperature Characteristics

## Typical Frequency Characteristics



# Type FCP Surface Mount Film Capacitors

## Outline Dimensions

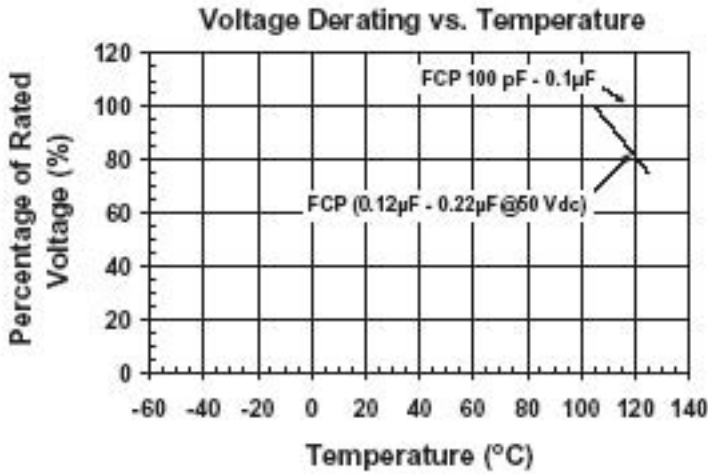


| Case Code | Outline Dimensions (in.) |              |              |              | Case Size (metric) | Outline Dimensions (mm) |            |           |            | Packaging Code |
|-----------|--------------------------|--------------|--------------|--------------|--------------------|-------------------------|------------|-----------|------------|----------------|
|           | 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 | 0.7 ±0.15 | 0.35 ±0.2  | K1             |
| 0805      | 0.079                    | 0.049 ±0.008 | 0.035        | 0.018 ±0.010 | 2012               | 2                       | 1.25 ±0.2  | 0.9       | 0.45 ±0.25 | J1             |
|           |                          |              | 0.043        |              |                    |                         |            | 1.1       |            | J2             |
| 1206      | 0.126                    | 0.063 ±0.008 | 0.035        | 0.026 ±0.012 | 3216               | 3.2                     | 1.6 ±0.2   | 0.9       | 0.65 ±0.3  | H1             |
|           |                          |              | 0.043        |              |                    |                         |            | 1.1       |            | H2             |
|           |                          |              | 0.059        |              |                    |                         |            | 1.5       |            | H3             |
| 1210      | 0.126                    | 0.098 ±0.008 | 0.043        | 0.026 ±0.012 | 3225               | 3.2                     | 2.5 ±0.2   | 1.1       | 0.65 ±0.3  | G1             |
|           |                          |              | 0.059        |              |                    |                         |            | 1.5       |            | G2             |
|           |                          |              | 0.083        |              |                    |                         |            | 2.1       |            | G3             |
| 1913      | 0.189                    | 0.130 ±0.012 | 0.055        | 0.014 ±0.008 | 4833               | 4.8                     | 3.3 ±0.3   | 1.4       | 0.35 ±0.2  | F1             |
|           |                          |              | 0.076        |              |                    |                         |            | 2.0       |            | E2             |
|           |                          |              | 0.110        |              |                    |                         |            | 2.8       |            | E3             |
|           |                          |              | 0.094        |              |                    |                         |            | 2.4       |            | E4             |
| 2416      | 0.236                    | 0.161 ±0.012 | 0.071        | 0.014 ±0.008 | 6041               | 6                       | 4.1 ±0.3   | 1.8       | 0.35 ±0.2  | D1             |
|           |                          |              | 0.094        |              |                    |                         |            | 2.4       |            | D3             |
|           |                          |              | 0.110        |              |                    |                         |            | 2.8       |            | D4             |
|           |                          |              | 0.126        |              |                    |                         |            | 3.2       |            | D5             |

## Pulse Handling Capability

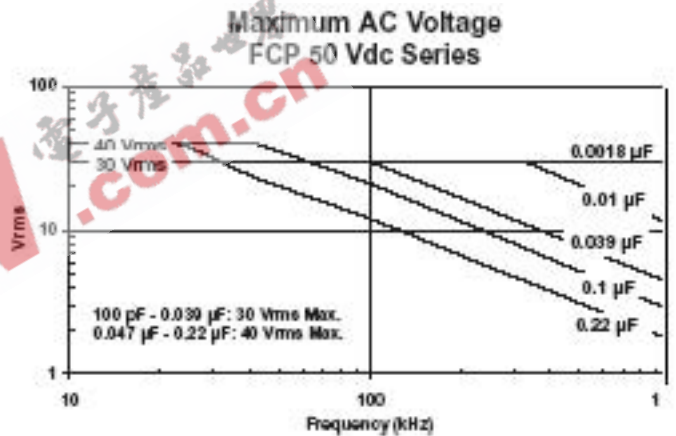
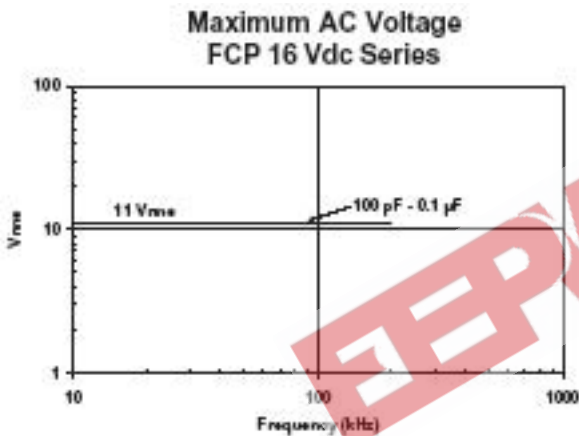
| Cap (µF) | Voltage (Vdc) | dV/dt (V/µs) | Cap (µF) | Voltage (Vdc) | dV/dt (V/µs) | Cap (µF)   | Voltage (Vdc) | dV/dt (V/µs) |
|----------|---------------|--------------|----------|---------------|--------------|------------|---------------|--------------|
| .00010   | 16            | 420          | .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 .22µF must be derated linearly from full rated voltage at 105°C to 75% of the rated voltage at 125°C.

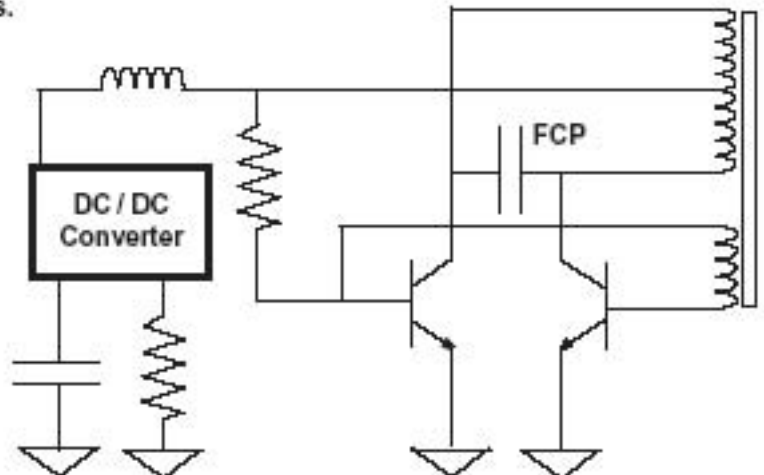
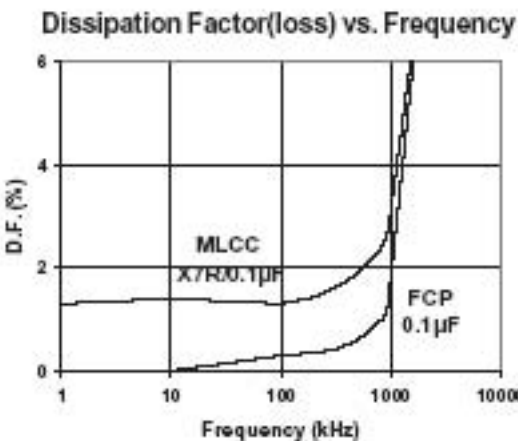
## Vrms vs. Frequency



The capacitor surface temperature should not exceed 125°C.

## Typical Applications

Higher efficiency in battery operated devices.

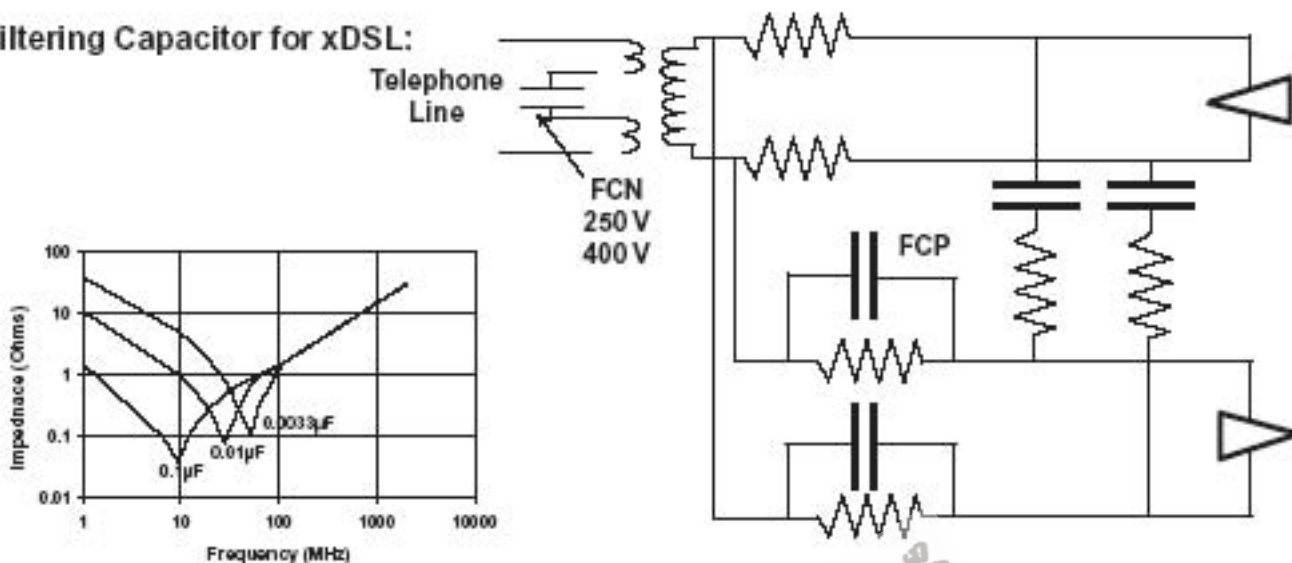


Very low losses and stable temperature characteristics make film chip capacitors the best choice for resonant circuit applications.

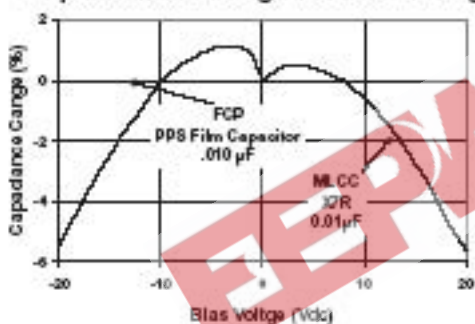
# Type FCP Surface Mount Film Capacitors

## Typical Applications

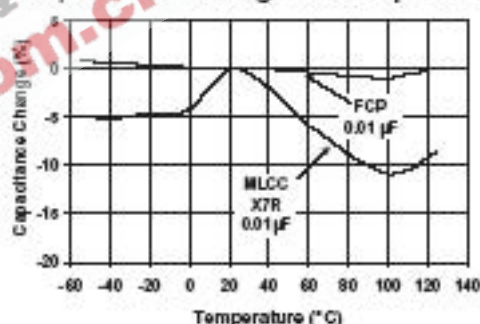
### Filtering Capacitor for xDSL:



### Capacitance Change vs. Bias Voltage

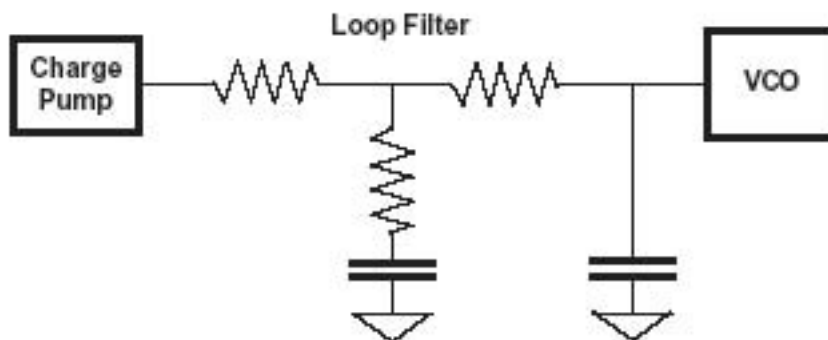
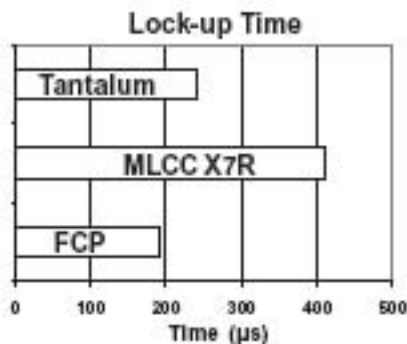


### Capacitance Change vs. Temperature



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.