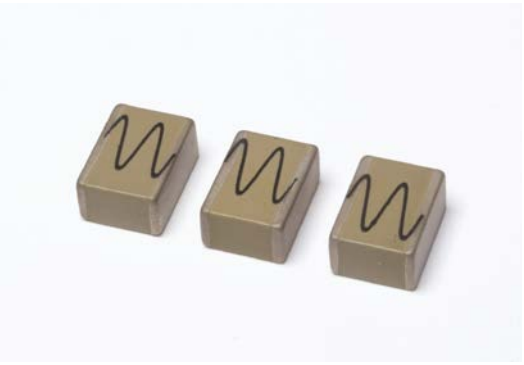
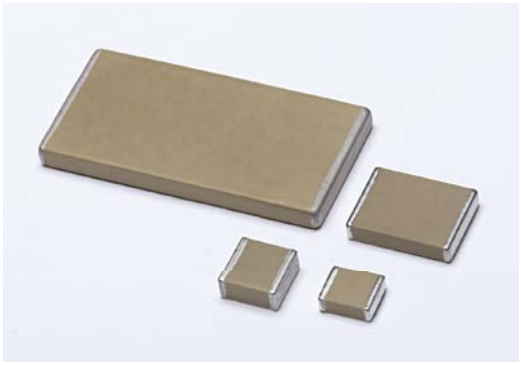
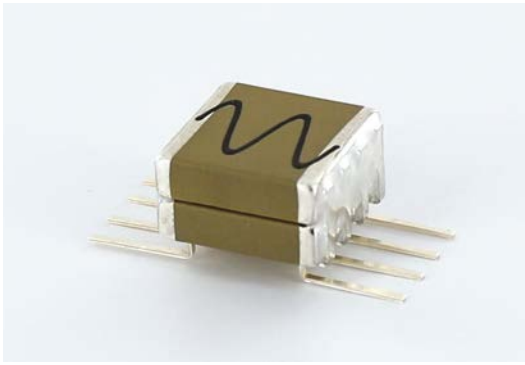
# CF/CFS Series

## Fuze Chips Capacitors







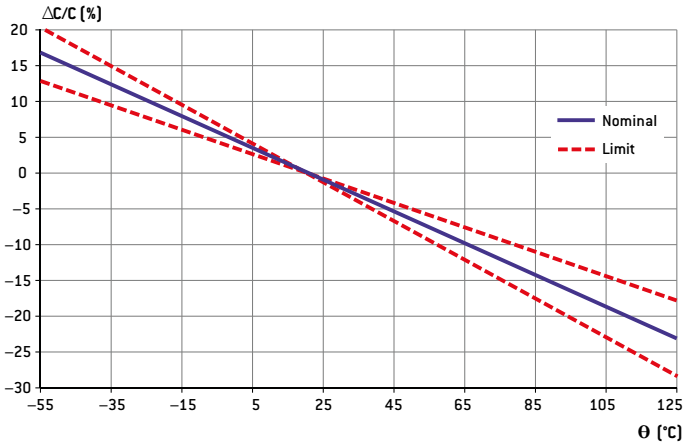
EXXELIA

# General Information

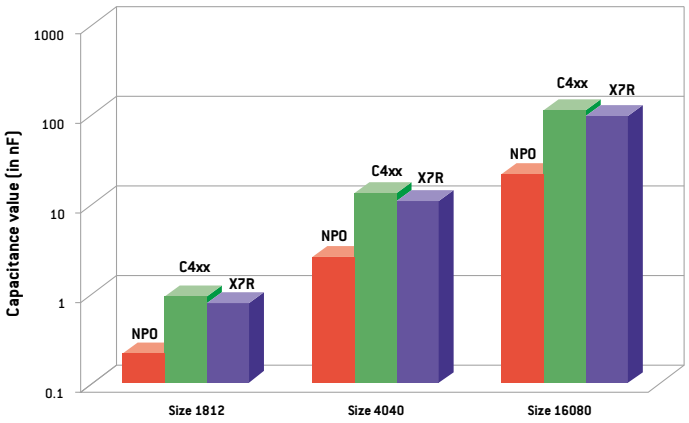
## C4xx DIELECTRIC

This ceramic is a negative temperature coefficient dielectric (–2,200 ppm/°C). Its advantage is that it combines the high dielectric constant of an X7R dielectric with the stability of an NP0 dielectric. As the C4xx ceramic features low dissipation factor it is recommended for AC line filtering for high power RF and for pulse applications.

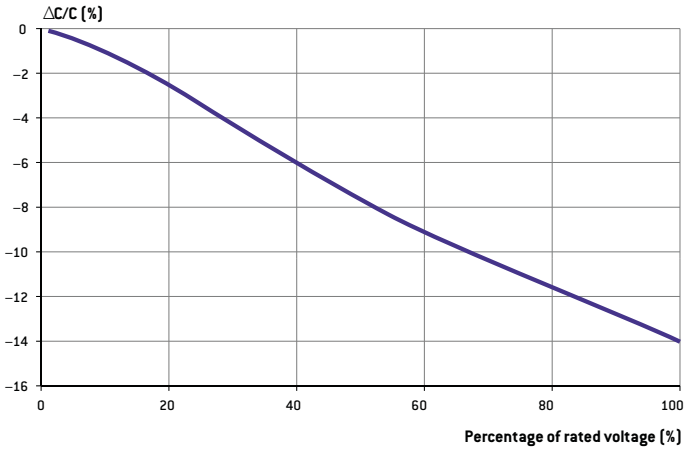
### C4xx: TEMPERATURE COEFFICIENT



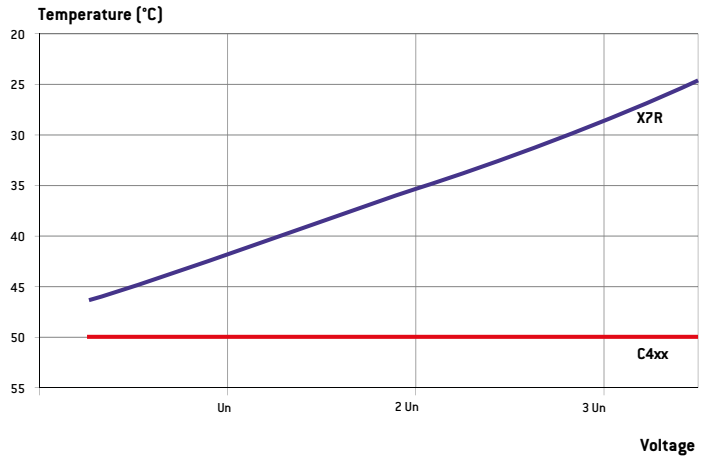

### COMPARISON OF CAPACITANCE VALUE UNDER RATED VOLTAGE AT 125°C




### C4xx: VOLTAGE COEFFICIENT

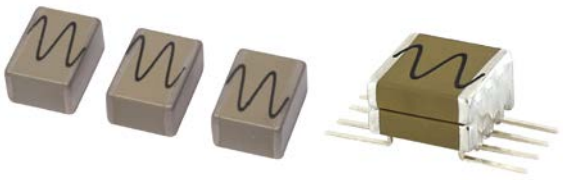



### COMPARISON OF SELF-HEATING AT 400 Hz BETWEEN C4xx AND X7R DIELECTRICS



Pulse capacitors with printed resistor option

# CF / CFS Series



## FEATURES

- Multilayer chip ceramic capacitors
- Size 1812 to 16080
- C4xx dielectric
- Capacitance range: 27pF to 15 µF
- Voltage range: 500 $V_{DC}$ to 10,000 $V_{DC}$
- Option: Printed resistor

## PHYSICAL CHARACTERISTICS

**CONSTRUCTION**

- C Series: Unleaded chip capacitors for surface mounting with optional tinning.
- P, PL, L, R, RU models: DIL or Ribbon leaded chip capacitors for surface mounting (R: varnished chips, RU: uncoated chips) recommended to eliminate thermomechanical stresses.
- N, NU models: DIL leaded chip capacitors for through-hole circuits (N: varnished chips, NU: uncoated chips).

**MARKING** (On request on unleaded chips)

Series, capacitance value, tolerance, rated voltage clear or coded, date code.

## ELECTRICAL SPECIFICATIONS

| Dielectric | C4xx |
|---|---|
| **Dielectric code** | **4** |
| **Temperature coefficient** | (−2,200 ± 500) ppm/°C |
| **Aging** | None |
| **Operating temperature** | −55°C to +125°C |
| **Rated voltage ($U_{RC}$)** | 500 $V_{DC}$ to 10,000 $V_{DC}$ |
| **Dielectric withstanding voltage** | 1.1 $U_{RC}$ |
| **Capacitance** | At 1kHz |
| **Dissipation factor** | ≤ 0.10% at 1kHz |
| **Insulation resistance at 25°C**<br>**under $U_{RC}$ for $U_{RC} \leq 500V_{DC}$**<br>**under $500V_{DC}$ for $U_{RC} > 500V_{DC}$** | ≥ 20,000 MΩ for C ≤ 25nF<br>≥ 500 MΩ. µF for C > 25nF |

## PRINTED RESISTOR OPTION

- Resistance range: from 100kΩ/sq to 1GΩ/sq

**Examples:**

500 MΩ, size 4040
100 MΩ, size 4040
7150 MΩ, size 3040

| CF | 4 | 80 | CW | - | M | F | 220nF | 10% | 500V | S12 | Rxxx |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CFS | 4 | 80 | - | P | M | F | 68nF | 10% | 1000V | - | Rxxx |

**Series**

**CF** = Pulse chips capacitor

**CFS** = Pulse stacked capacitor

**Dielectric**

**4** = C4xx

**Exxelia size code**

**79** = 1812
**90** = 1825
**80** = 2220
**91** = 2225
**81** = 2825
**82** = 3333
**83** = 4040
**84** = 5440
**89** = 5550
**85** = 6560
**87** = 11283
**88** = 16080

**Termination** (Bare chips only)

**W** = RoHS compliant

For all sizes

| | | | |
|---|---|---|---|
| - | Ag/Pd/Pt | W | Ag/Pd/Pt |
| Q | wAg | QW | Ag |

From 1812 to 3333 sizes

| | | | |
|---|---|---|---|
| - | Ag/Pd/Pt | W | Ag/Pd/Pt |
| H | Ag/Pd/Pt + dipped Sn/Pb 60/40 | HW | Ag/Pd/Pt + dipped Sn |
| E | Ni + dipped Sn/Pb 60/40 | EW | Ni + dipped Sn |
| C | Ni + electrolytic Sn/Pb 95/5 | CW | Ni + electrolytic Sn |
| D | Ag + Ni + electrolytic Sn/Pb 60/40 | - | |
| G | Ni + electrolytic Gold | - | |

From 1812 to 4040 sizes

| | | | |
|---|---|---|---|
| YC | Ag + Polymer + Ni + Sn/Pb 95/5 | YCW | Ag + Polymer + Ni + Sn |
| YD | Ag + Polymer + Ni + Sn/Pb 60/40 | - | |
| YG | Ag + Polymer + Ni + Au | YGW | Ag + Polymer + Ni + Au |

**Leads style** (Leaded chips/ Stacked capacitors)

**P**
**PW** - RoHS
**PL**
**PLW** - RoHS
**L**
**LW** - RoHS
**R**
**RW** - RoHS
**RU**
**RUW** - RoHS
**N**
**NW** - RoHS
**NU**
**NUW** - RoHS

**Marking**

For unleaded chips only with no printed resistor (Leaded chips are always marked).

**-** = no marking

**M** = Marking:

For sizes 1812 - 1825: Cap. value. For other sizes: EFD, Series, cap. value, tolerance,rated voltage, date code.

**Quality level**

**-** = standard quality level

**F** = Hi-Rel quality: screening in accordance with Exxelia specification

**Capacitance**

Capacitance value in clear

**Tolerance**

**±2%**
**±5%**
**±10%**
**±20%**

**Rated voltage**

**500V**
**1,000V**
**1,500V**
**2,000V**
**3,000V**
**4,000V**
**5,000V**
**7,500V**
**10,000V**

**Packaging**

**-** = Exxelia packaging (leaded chips : thermoformed packaging)

Only available for unleaded chips:

Sizes 1812 - 2220:
**S12** = Super 12 reel
**BA** = Tray package (non oriented chips)
**BAO** = Tray package (oriented chips)

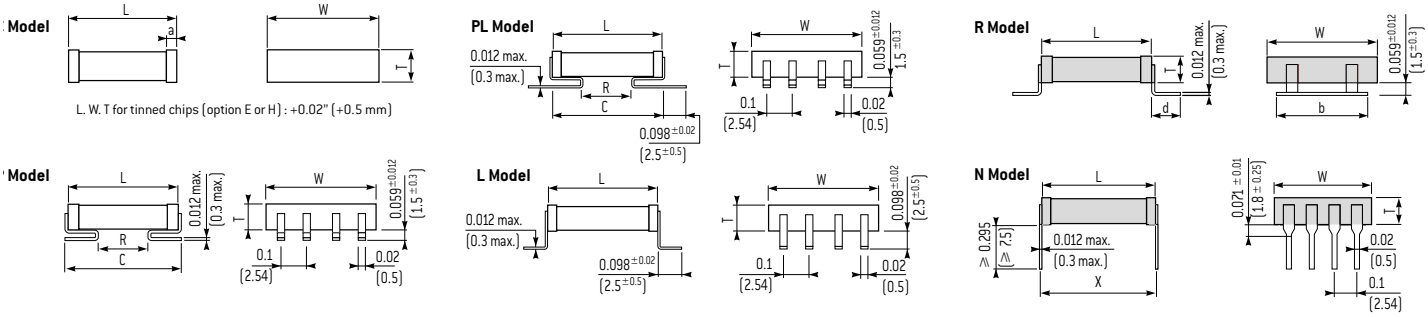
**Printed resistor**

**Rxxx** = Printed resistor option (xxx = resistor value in MΩ)

# CF Series

Pulse capacitors with printed resistor option

## DIMENSIONS in inches (mm)




## STANDARD RATINGS

| | Size | 1812 | 1825 | 2220 | 2225 | 2825 | 3333 |
|---|---|---|---|---|---|---|---|
| | Exxelia size code | 79 | 90 | 80 | 91 | 81 | 82 |
| Dimensions inches (mm) | L* | 0.177 ± 0.020 (4.5 ± 0.5) | 0.177 ± 0.020 (4.5 ± 0.5) | 0.224 ± 0.020 (5.7 ± 0.5) | 0.224 ± 0.020 (5.7 ± 0.5) | 0.276 ± 0.020 (7 ± 0.5) | 0.331 ± 0.020 (8.4 ± 0.5) |
| | W* | 0.126 ± 0.020 (3.2 ± 0.5) | 0.250 ± 0.020 (6.35 ± 0.5) | 0.197 ± 0.020 (5.0 ± 0.5) | 0.250 ± 0.020 (6.35 ± 0.5) | 0.250 ± 0.020 (6.35 ± 0.5) | 0.331 ± 0.020 (8.4 ± 0.5) |
| | a | 0.024 ± 0.020 (0.6 ± 0.5) | 0.024 ± 0.020 (0.6 ± 0.5) | 0.028 ± 0.020 (0.7 ± 0.5) | 0.028 ± 0.020 (0.7 ± 0.5) | 0.039 ± 0.020 (1 ± 0.5) | 0.039 ± 0.020 (1 ± 0.5) |
| | d | - - | 0.087 ± 0.008 (2.2 ± 0.2) | 0.087 ± 0.008 (2.2 ± 0.2) | 0.087 ± 0.008 (2.2 ± 0.2) | 0.087 ± 0.008 (2.2 ± 0.2) | 0.138 ± 0.008 (3.5 ± 0.2) |
| | b | - - | 0.197 ± 0.020 (5 ± 0.5) | 0.197 ± 0.020 (5 ± 0.5) | 0.197 ± 0.020 (5 ± 0.5) | 0.197 ± 0.020 (5 ± 0.5) | 0.315 ± 0.020 (8 ± 0.5) |
| | R min. | - - | 0.066 (1.7) | 0.098 (2.5) | 0.098 (2.5) | 0.137 (3.5) | 0.177 (4.5) |
| | C max. | - - | 0.229 (5.8) | 0.276 (7) | 0.276 (7) | 0.315 (8) | 0.355 (9) |
| | X | - - | 0.2 ± 0.020 (5.08 ± 0.5) | 0.248 ± 0.020 (6.3 ± 0.5) | 0.248 ± 0.020 (6.3 ± 0.5) | 0.300 ± 0.020 (7.62 ± 0.5) | 0.350 ± 0.020 (8.9 ± 0.5) |
| | Leads per side | | 2 | 2 | 2 | 2 | 3 |
| | T max.* | 0.138 (3.5) | 0.138 (3.5) | 0.2kV up to 3kV: 0.119 (3) 4kV-5kV: 0.150 (3.8) | 0.177 (4.5) | 0.177 (4.5) | 0.177 (4.5) |
| Min. Capacitance value | | 27pF | 33pF | 33pF | 47pF | 56pF | 82pF |
| Rated voltage ($U_{RC}$) | 0.5kV | 120nF | 330nF | 220nF | 470nF | 470nF | 820nF |
| | 1kV | 33nF | 82nF | 56nF | 120nF | 120nF | 220nF |
| | 1.5kV | 15nF | 33nF | 27nF | 47nF | 47nF | 82nF |
| | 2kV | 6.8nF | 5.6nF | 10nF | 18nF | 22nF | 39nF |
| | 3kV | 2.7nF | 2.7nF | 4.7nF | 8.2nF | 10nF | 18nF |
| | 4kV | 1.2nF | 1.5nF | 3.3nF | 4.7nF | 5.6nF | 10nF |
| | 5kV | - | - | 2.2nF | 2.7nF | 3.3nF | 5.6nF |

Pulse capacitors with printed resistor option

# CF Series

## STANDARD RATINGS

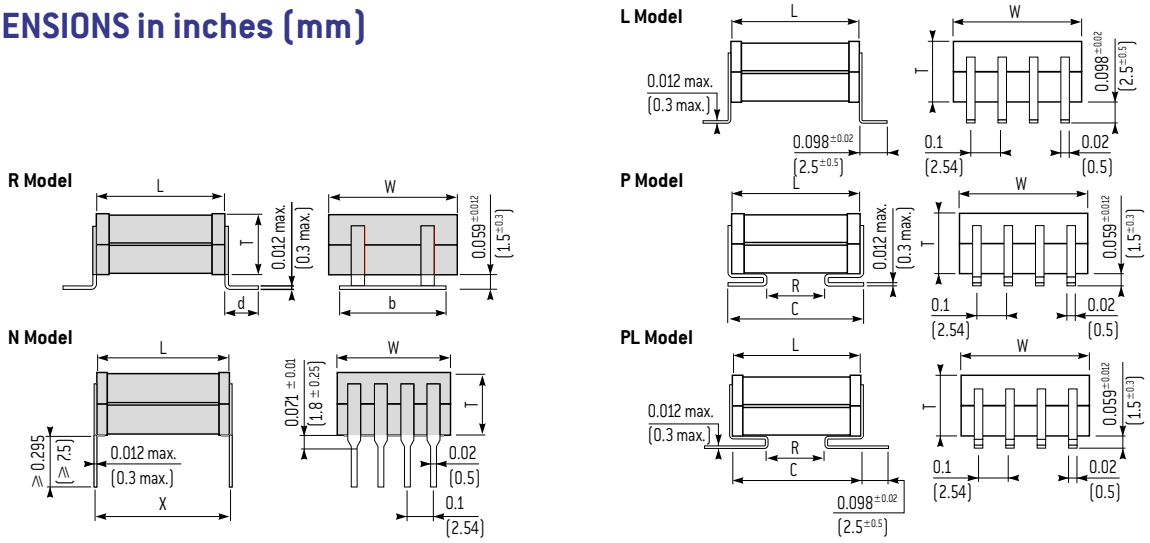
| | Size | 4040 | 5440 | 5550 | 6560 | 11283 | 16080 |
|---|---|---|---|---|---|---|---|
| | Exxelia size code | 83 | 84 | 89 | 85 | 87 | 88 |
| Dimensions inches (mm) | L* | 0.400 ± 0.039 (10.16 ± 1) | 0.539 ± 0.039 (13.7 ± 1) | 0.551 ± 0.039 (14 ± 1) | 0.650 ± 0.039 (16.5 ± 1) | 1.122 ± 0.039 (28.5 ± 1) | 1.555 ± 0.039 (39.5 ± 1) |
| | W* | 0.400 ± 0.039 (10.16 ± 1) | 0.400 ± 0.039 (10.16 ± 1) | 0.500 ± 0.039 (12.7 ± 1) | 0.598 ± 0.039 (15.2 ± 1) | 0.827 ± 0.039 (21 ± 1) | 0.756 ± 0.039 (19.2 ± 1) |
| | a | 0.059 ± 0.020 (1.5 ± 0.5) | 0.059 ± 0.020 (1.5 ± 0.5) | 0.059 ± 0.020 (1.5 ± 0.5) | 0.059 ± 0.020 (1.5 ± 0.5) | 0.059 ± 0.020 (1.5 ± 0.5) | 0.059 ± 0.020 (1.5 ± 0.5) |
| | d | 0.138 ± 0.008 (3.5 ± 0.2) | 0.138 ± 0.008 (3.5 ± 0.2) | 0.138 ± 0.008 (3.5 ± 0.2) | 0.138 ± 0.008 (3.5 ± 0.2) | 0.138 ± 0.008 (3.5 ± 0.2) | 0.138 ± 0.008 (3.5 ± 0.2) |
| | b | 0.315 ± 0.020 (8 ± 0.5) | 0.315 ± 0.020 (8 ± 0.5) | 0.315 ± 0.020 (8 ± 0.5) | 0.591 ± 0.020 (15 ± 0.5) | 0.591 ± 0.020 (15 ± 0.5) | 0.591 ± 0.020 (15 ± 0.5) |
| | R min. | 0.275 (7) | 0.393 (10) | 0.393 (10) | 0.511 (13) | 0.984 (25) | 1.377 (35) |
| | C max. | 0.473 (12) | 0.611 (15.5) | 0.63 (16) | 0.729 (18.5) | 1.26 (32) | 1.654 (42) |
| | X | 0.45 ± 0.020 (11.43 ± 0.5) | 0.551 ± 0.020 (14 ± 0.5) | 0.563 ± 0.020 (14.3 ± 0.5) | 0.7 ± 0.020 (17.78 ± 0.5) | 1.15 ± 0.020 (29.21 ± 0.5) | 1.6 ± 0.020 (40.64 ± 0.5) |
| | Leads per side | 4 | 4 | 5 | 6 | 6 | 6 |
| | T max.* | 0.177 (4.5) | 0.177 (4.5) | 0.177 (4.5) | 0.177 (4.5) | 0.177 (4.5) | 0.177 (4.5) |
| Min. Capacitance value | | 180pF | 270pF | 390pF | 470pF | 1nF | 1.8nF |
| Rated voltage ($U_{RC}$) | 0.5kV | 1.5µF | 2.2µF | 2.7µF | 3.9µF | 10µF | 12µF |
| | 1kV | 330nF | 470nF | 680nF | 1µF | 2.2µF | 2.7µF |
| | 1.5kV | 150nF | 220nF | 270nF | 390nF | 1µF | 1.2µF |
| | 2kV | 82nF | 120nF | 150nF | 220nF | 560nF | 680nF |
| | 3kV | 39nF | 56nF | 68nF | 100nF | 220nF | 330nF |
| | 4kV | 22nF | 33nF | 39nF | 56nF | 120nF | 180nF |
| | 5kV | 12nF | 18nF | 27nF | 39nF | 82nF | 100nF |
| | 7.5kV | 5.6nF | 5.6nF | 6.8nF | 12nF | 33nF | 47nF |
| | 10kV | 2.7nF | 3.3nF | 3.9nF | 6.8nF | 18nF | 22nF |

* For E, EW, H and HW: add +0.020 inch (+0.5 mm) to L, W and T dimensions.
The high voltage parts may require varnish or encapsulation to prevent surface arcing.
Available capacitance values:
C4xx dielectrics: E6, E12, E24. Specific values upon request.
The above table defines the standard products, other components may be built upon request.

# CFS Series

Pulse capacitors with printed resistor option

## DIMENSIONS in inches (mm)




## STANDARD RATINGS

| | Size | 2220 | 2825 | 3333 | 4040 | | |
|---|---|---|---|---|---|---|---|
| | Exxelia size code | 80 | 81 | 82 | 83 | | |
| Dimensions inches (mm) | L | 0.224 ± 0.020 (5.7 ± 0.5) | 0.276 ± 0.020 (7 ± 0.5) | 0.331 ± 0.020 (8.4 ± 0.5) | 0.400 ± 0.039 (10.16 ± 1) | | |
| | W | 0.197 ± 0.020 (5.0 ± 0.5) | 0.250 ± 0.020 (6.35 ± 0.5) | 0.331 ± 0.020 (8.4 ± 0.5) | 0.400 ± 0.039 (10.16 ± 1) | | |
| | d | 0.087 ± 0.008 (2.2 ± 0.2) | 0.087 ± 0.008 (2.2 ± 0.2) | 0.138 ± 0.008 (3.5 ± 0.2) | 0.138 ± 0.008 (3.5 ± 0.2) | | |
| | b | 0.197 ± 0.020 (5 ± 0.5) | 0.197 ± 0.020 (5 ± 0.5) | 0.315 ± 0.020 (8 ± 0.5) | 0.315 ± 0.020 (8 ± 0.5) | | |
| | R min. | 0.098 (2.5) | 0.137 (3.5) | 0.177 (4.5) | 0.275 (7) | | |
| | C max. | 0.276 (7) | 0.315 (8) | 0.355 (9) | 0.473 (12) | | |
| | X | 0.248 ± 0.020 (6.3 ± 0.5) | 0.300 ± 0.020 (7.62 ± 0.5) | 0.350 ± 0.020 (8.9 ± 0.5) | 0.45 ± 0.020 (11.43 ± 0.5) | | |
| | Leads per side | 2 | 2 | 3 | 4 | | |
| Min. Capacitance value | | 820pF | 1.5nF | 2.7nF | 6.8nF | T max. inches (mm) | Nb. of chips |
| Rated voltage ($U_{RC}$) | 1kV | 68nF | 180nF | 470nF | 680nF | 0.394 (10) | 2 |
| | | 100nF | 270nF | 680nF | 1µF | 0.591 (15) | 3 |
| | | 150nF | 330nF | 820nF | 1.5µF | 0.788 (20) | 4 |
| | | 180nF | 390nF | 1µF | 1.8µF | 0.985 (25) | 5 |
| | 1.5kV | 33nF | 68nF | 180nF | 330nF | 0.394 (10) | 2 |
| | | 47nF | 100nF | 270nF | 470nF | 0.591 (15) | 3 |
| | | 68nF | 150nF | 390nF | 560nF | 0.788 (20) | 4 |
| | | 82nF | 180nF | 470nF | 820nF | 0.985 (25) | 5 |
| | 2kV | 18nF | 47nF | 82nF | 150nF | 0.394 (10) | 2 |
| | | 27nF | 68nF | 120nF | 220nF | 0.591 (15) | 3 |
| | | 39nF | 82nF | 150nF | 270nF | 0.788 (20) | 4 |
| | | 47nF | 120nF | 180nF | 390nF | 0.985 (25) | 5 |
| | 3kV | Consult us | 22nF | 33nF | 68nF | 0.394 (10) | 2 |
| | | | 33nF | 56nF | 100nF | 0.591 (15) | 3 |
| | | | 39nF | 68nF | 120nF | 0.788 (20) | 4 |
| | | | 47nF | 82nF | 150nF | 0.985 (25) | 5 |
| | 4kV | | Consult us | Consult us | 39nF | 0.394 (10) | 2 |
| | | | | | 68nF | 0.591 (15) | 3 |
| | | | | | 82nF | 0.788 (20) | 4 |
| | | | | | 100nF | 0.985 (25) | 5 |
| | 5kV | | | | Consult us | 0.394 (10) | 2 |
| | | | | | | 0.591 (15) | 3 |
| | | | | | | 0.788 (20) | 4 |
| | | | | | | 0.985 (25) | 5 |
| | 7.5kV 10kV | - | - | - | | 0.394 (10) | 2 |
| | | - | - | - | | 0.591 (15) | 3 |
| | | - | - | - | | 0.788 (20) | 4 |
| | | - | - | - | | 0.985 (25) | 5 |

Pulse capacitors with printed resistor option

# CFS Series

## STANDARD RATINGS

| | Size | 5440 | 5550 | 6560 | 11283 | 16080 | | |
|---|---|---|---|---|---|---|---|---|
| | Exxelia size code | 84 | 89 | 85 | 87 | 88 | | |
| Dimensions inches (mm) | L | 0.539 ± 0.039 (13.7 ± 1) | 0.551 ± 0.039 (14 ± 1) | 0.650 ± 0.039 (16.5 ± 1) | 1.122 ± 0.039 (28.5 ± 1) | 1.555 ± 0.039 (39.5 ± 1) | | |
| | W | 0.400 ± 0.039 (10.16 ± 1) | 0.500 ± 0.039 (12.7 ± 1) | 0.598 ± 0.039 (15.2 ± 1) | 0.827 ± 0.039 (21 ± 1) | 0.756 ± 0.039 (19.2 ± 1) | | |
| | d | 0.138 ± 0.008 (3.5 ± 0.2) | 0.138 ± 0.008 (3.5 ± 0.2) | 0.138 ± 0.008 (3.5 ± 0.2) | 0.138 ± 0.008 (3.5 ± 0.2) | 0.138 ± 0.008 (3.5 ± 0.2) | | |
| | b | 0.315 ± 0.020 (8 ± 0.5) | 0.315 ± 0.020 (8 ± 0.5) | 0.591 ± 0.020 (15 ± 0.5) | 0.591 ± 0.020 (15 ± 0.5) | 0.591 ± 0.020 (15 ± 0.5) | | |
| | R min. | 0.393 (10) | 0.393 (10) | 0.511 (13) | 0.984 (25) | 1.377 (35) | | |
| | C max. | 0.611 (15.5) | 0.63 (16) | 0.729 (18.5) | 1.26 (32) | 1.654 (42) | | |
| | X | 0.552 ± 0.020 (14 ± 0.5) | 0.563 ± 0.020 (14.3 ± 0.5) | 0.7 ± 0.020 (17.78 ± 0.5) | 1.15 ± 0.020 (29.21 ± 0.5) | 1.6 ± 0.020 (40.64 ± 0.5) | | |
| | Leads per side | 4 | 5 | 6 | 6 | 6 | | |
| Min Capacitance value | | 6.8nF | 12nF | 18nF | 39nF | 47nF | T max. inches (mm) | Nb. of chips |
| Rated voltage ($U_{RC}$) | 1kV | 1µF | 1.2µF | 2.2µF | 4.7µF | 5.6µF | 0.394 (10) | 2 |
| | | 1.5µF | 1.8µF | 3.3µF | 6.8µF | 8.2µF | 0.591 (15) | 3 |
| | | 1.8µF | 2.2µF | 3.9µF | 8.2µF | 12µF | 0.788 (20) | 4 |
| | | 2.2µF | 2.7µF | 4.7µF | 12µF | 15µF | 0.985 (25) | 5 |
| | 1.5kV | 390nF | 560nF | 820nF | 2.2µF | 2.7µF | 0.394 (10) | 2 |
| | | 560nF | 820nF | 1.2µF | 3.3µF | 3.9µF | 0.591 (15) | 3 |
| | | 820nF | 1µF | 1.8µF | 3.9µF | 5.6µF | 0.788 (20) | 4 |
| | | 1µF | 1.2µF | 2.2µF | 4.7µF | 6.8µF | 0.985 (25) | 5 |
| | 2kV | 220nF | 270nF | 470nF | 1µF | 1.5µF | 0.394 (10) | 2 |
| | | 330nF | 470nF | 680nF | 1.5µF | 2.2µF | 0.591 (15) | 3 |
| | | 470nF | 560nF | 1µF | 2.2µF | 2.7µF | 0.788 (20) | 4 |
| | | 560nF | 680nF | 1.2µF | 2.7µF | 3.9µF | 0.985 (25) | 5 |
| | 3kV | 100nF | 120nF | 220nF | 470nF | 680nF | 0.394 (10) | 2 |
| | | 150nF | 180nF | 330nF | 680nF | 1µF | 0.591 (15) | 3 |
| | | 220nF | 270nF | 390nF | 1µF | 1.2µF | 0.788 (20) | 4 |
| | | 270nF | 330nF | 560nF | 1.2µF | 1.5µF | 0.985 (25) | 5 |
| | 4kV | 56nF | 68nF | 120nF | 220nF | 330nF | 0.394 (10) | 2 |
| | | 100nF | 120nF | 180nF | 330nF | 470nF | 0.591 (15) | 3 |
| | | 120nF | 150nF | 220nF | 470nF | 680nF | 0.788 (20) | 4 |
| | | 150nF | 180nF | 270nF | 560nF | 820nF | 0.985 (25) | 5 |
| | 5kV | 39nF | 47nF | 82nF | 150nF | 220nF | 0.394 (10) | 2 |
| | | 56nF | 68nF | 120nF | 220nF | 330nF | 0.591 (15) | 3 |
| | | 82nF | 100nF | 150nF | 270nF | 390nF | 0.788 (20) | 4 |
| | | 100nF | 120nF | 180nF | 390nF | 560nF | 0.985 (25) | 5 |
| | 7.5kV | 12nF | 12nF | 22nF | 68nF | 82nF | 0.394 (10) | 2 |
| | | 18nF | 18nF | 39nF | 100nF | 120nF | 0.591 (15) | 3 |
| | | 22nF | 27nF | 47nF | 120nF | 180nF | 0.788 (20) | 4 |
| | | 27nF | 33nF | 56nF | 150nF | 220nF | 0.985 (25) | 5 |
| | 10kV | 6.8nF | 6.8nF | 12nF | 33nF | 47nF | 0.394 (10) | 2 |
| | | 10nF | 12nF | 18nF | 47nF | 68nF | 0.591 (15) | 3 |
| | | 12nF | 15nF | 27nF | 68nF | 100nF | 0.788 (20) | 4 |
| | | 15nF | 18nF | 33nF | 82nF | 120nF | 0.985 (25) | 5 |

The high voltage parts may require varnish or encapsulation to prevent surface arcing.
Available capacitance values:
C4xx dielectrics: E6, E12, E24. Specific values upon request.
The above table defines the standard products, other components may be built upon request.

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