

TKD Series

High Voltage Conformal Coated Leded Capacitors



According to
Available space ranges:
consult our detail
specifications

ELECTRICAL SPECIFICATIONS

| DIELECTRIC | NPO | C4xx | X7R |
|---|--|--|--|
| Dielectric code | 1 | 4 | 2 |
| Maximum $\Delta C/^\circ C$ over temperature range without voltage | NA | NA | $\pm 15\%$ |
| Temperature coefficient | (0 ± 30) ppm/ $^\circ C$ | $(-2,200 \pm 500)$ ppm/ $^\circ C$ | NA |
| Aging | None | None | $\leq 2.5\%$ per decade hour |
| Operating temperature | $-55^\circ C$ to $+125^\circ C$ | | |
| Rated voltage (U_{RC}) | 250 V_{DC} to 10,000 V_{DC} | 250 V_{DC} to 5,000 V_{DC} | 250 V_{DC} to 10,000 V_{DC} |
| Dielectric withstanding voltage | 2.5 U_{RC} for $U_{RC} \leq 500 V_{DC}$ 1.6 U_{RC} for $U_{RC} \geq 1,000 V_{DC}$ Extended range: 2 U_{RC} for $U_{RC} \leq 500 V_{DC}$ 1.3 U_{RC} for $U_{RC} \geq 1,000 V_{DC}$ | 2.5 U_{RC} for $U_{RC} = 250 V_{DC}$ 2 U_{RC} for $U_{RC} = 500 V_{DC}$ 1.5 U_{RC} for $U_{RC} = 1,000 V_{DC}$ 1.4 U_{RC} for $U_{RC} > 1,000 V_{DC}$ Extended range: 1.5 U_{RC} for $U_{RC} \leq 500 V_{DC}$ 1.2 U_{RC} for $U_{RC} \geq 1,000 V_{DC}$ | 2.5 U_{RC} for $U_{RC} = 250 V_{DC}$ 2 U_{RC} for $U_{RC} = 500 V_{DC}$ 1.5 U_{RC} for $U_{RC} = 1,000 V_{DC}$ 1.2 U_{RC} for $U_{RC} > 1,000 V_{DC}$ Extended range: 1.5 U_{RC} for $U_{RC} \leq 500 V_{DC}$ 1.2 U_{RC} for $U_{RC} \geq 1,000 V_{DC}$ |
| Capacitance | at 1MHz for $C \leq 1,000$ pf at 1kHz for $C > 1,000$ pf | at 1kHz | at 1kHz |
| Dissipation factor | $\leq 0.015 (150/C + 7)\%$ at 1MHz for $C \leq 50$ pf $\leq 0.15\%$ at 1MHz for 50 pf $< C \leq 1,000$ pf $\leq 0.15\%$ at 1kHz for $C > 1,000$ pf | $\leq 0.1\%$ at 1kHz | $\leq 2.5\%$ at 1kHz |
| Insulation resistance at 25$^\circ C$ under U_{RC} for $U_{RC} \leq 500 V$ under 500 V_{DC} for $U_{RC} > 500 V$ | $\geq 100,000 M\Omega$ for $C \leq 10$ nf $\geq 1,000 M\Omega \mu F$ for $C > 10$ nf | $\geq 20,000 M\Omega$ for $C \leq 25$ nf $\geq 500 M\Omega \mu F$ for $C > 25$ nf | |
| Voltage proof body insulation | under U_{RC} for $U_{RC} \leq 1,250 V_{DC}$ under 1,300 V_{DC} for $U_{RC} > 1,250 V_{DC}$ | | |

FEATURES

- Multilayer chip ceramic capacitors
- NPO, C4xx and X7R dielectrics
- Capacitance range: 10pf to 39 μF
- Voltage range: 250 V_{DC} to 10,000 V_{DC}

PHYSICAL CHARACTERISTICS

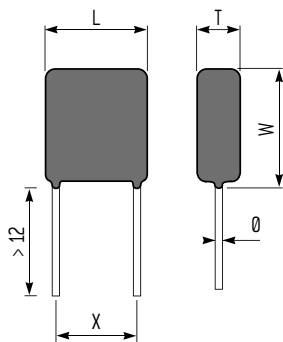
CONSTRUCTION

Epoxy conformal coated radial leaded capacitors suited to through-hole circuits.

MARKING

Series, capacitance value, tolerance, rated voltage, date code.

DIMENSIONS in inches (mm)



HOW TO ORDER

| TKD | 1 | 82 | W | F | 680pF | 10% | 4,000 V | B |
|--|--------------------------------|--|-----------------------------------|--|----------------------------|--|---|---|
| Series | Dielectric code | Exxelia size code | RoHS compliant | Quality level | Capacitance | Tolerance | Rated voltage | Reliability level |
| TKD = Conformal coated radial leaded capacitor | 1 = NPO 2 = X7R 4 = C4xx | 79 90 80 91 81 82 83 84 89 85 87 88 | - = No RoHS W = RoHS compliant | - = standard quality level F = Hi-Rel quality: screening in accordance with Exxelia specification | Capacitance value in clear | <u>NPO dielectric:</u> $\pm 1\%$ $\pm 2\%$ $\pm 5\%$ $\pm 10\%$ $\pm 20\%$ <u>C4xx dielectric:</u> $\pm 2\%$ $\pm 5\%$ $\pm 10\%$ $\pm 20\%$ <u>X7R dielectric:</u> $\pm 10\%$ $\pm 20\%$ | 200 V 500 V 1,000 V 1,500 V 2,000 V 3,000 V 4,000 V 5,000 V 7,500 V 10,000 V Intermediary and higher voltages available: contact your sales representative. | For F parts only. Acc. to Exxelia spec. - T5 T6 See page 15 |

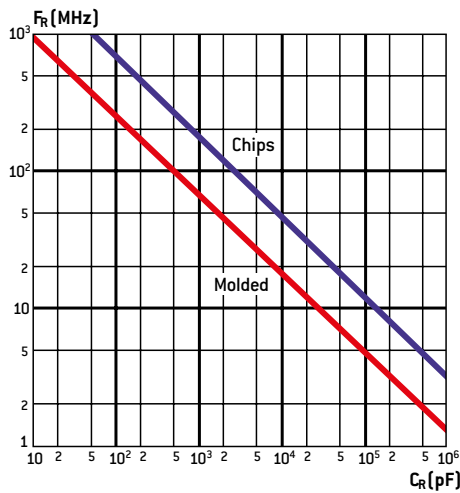
General Information

High voltage multilayer ceramic capacitors designed by EXXELIA are adapted to applications in electronics such as high voltage power supplies and high voltage multiplier circuits. Their multilayer construction offers significant size and space saving advantages. They are available in class 1 (NPO), class 2 (X7R) and C4xx (-2,200 ppm/°C) dielectrics versions complying with the main requirements of applicable standards. They are suited for use in commercial, industrial and High-Rel military and space circuits.

As standard products can't meet all the specificities of all applications, special applications may require specific features (higher voltage, burn-in, dimensions, coating, leading, marking...) not described in this catalogue. Based on our state-of-the-art technologies and our expertise, our Engineers may study at your request all special components to meet your application.

Please, consult us for more information.

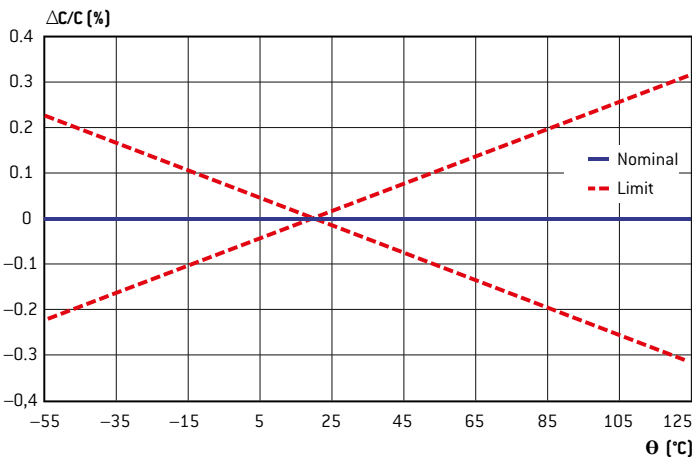
NPO, X7R, C4xx: SELF-RESONANCE FREQUENCY VS CAPACITANCE



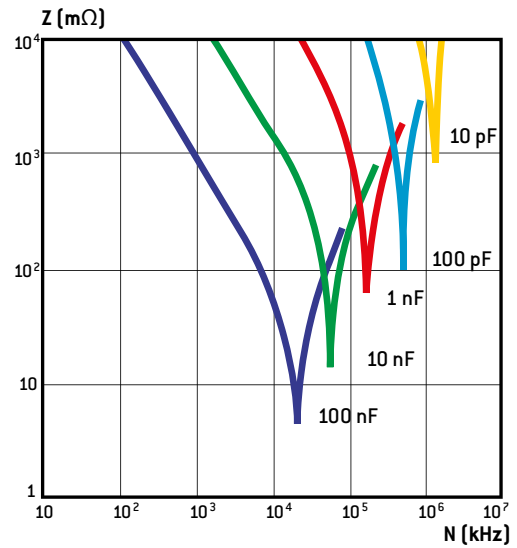
NPO/COG DIELECTRICS (CLASS 1)

Made of titanium oxide and other various selected oxides, they feature unique stability of all parameters under such constraints as operating time, temperature, voltage applied. For example, the quality factor remains very high over an extremely wide frequency range. As example, loss angle tangent value at 1MHz is typically in the order of $3 \cdot 10^{-4}$. These characteristics make them compatible with steep-edge impulse mode without noticeable temperature rise. The different parameters and related variations are illustrated in figures below:

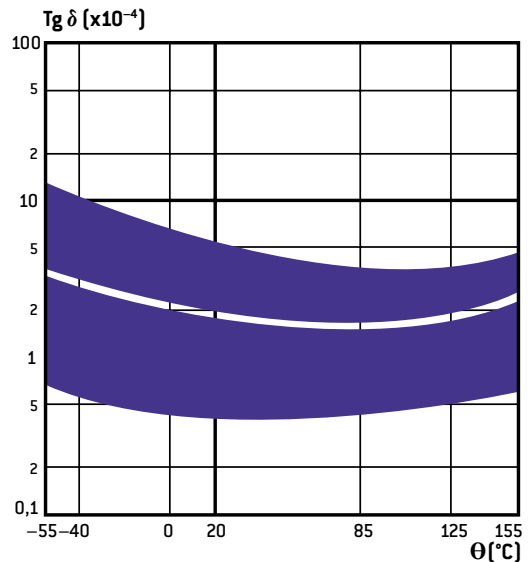
NPO: RELATIVE CAPACITANCE CHANGE VS TEMPERATURE



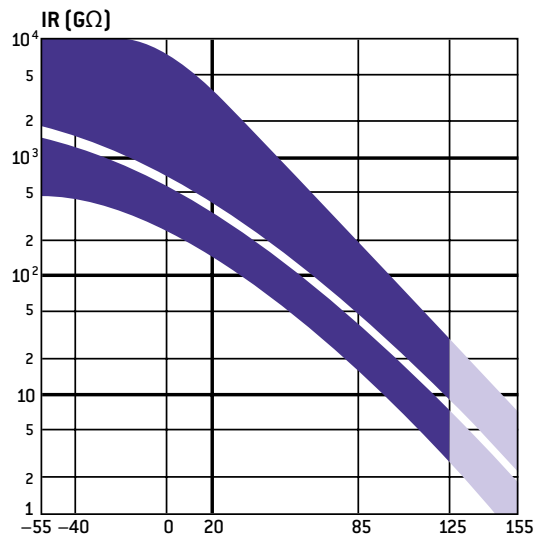
NPO: IMPEDANCE VS FREQUENCY



NPO: LOSS TANGENT VS TEMPERATURE



NPO: INSULATION RESISTANCE VS TEMPERATURE



General Information

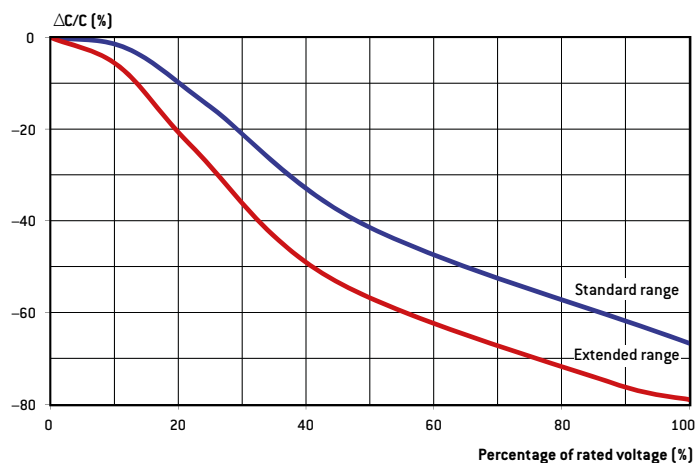
X7R DIELECTRICS (CLASS 2)

They are mainly made of barium titanate modified by various oxides to achieve the electrical properties required. A specific ceramic dielectric is used to achieve an excellent dielectric strength. High dielectric constant enables to achieve high capacitance values.

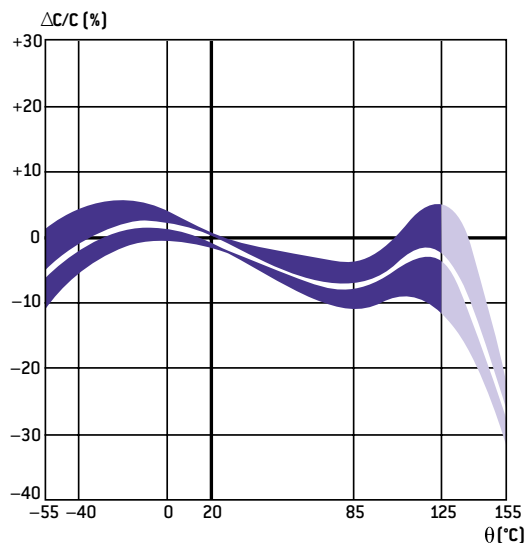
For optimum use, the specific properties of barium titanate in function of the different parameters must be taken into account.

See the variations illustrated in figures below:

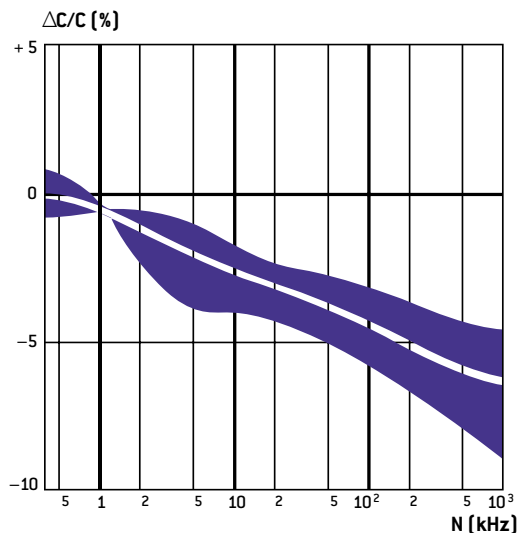
CHANGE VS PERCENTAGE OF RATED VOLTAGE APPLIED



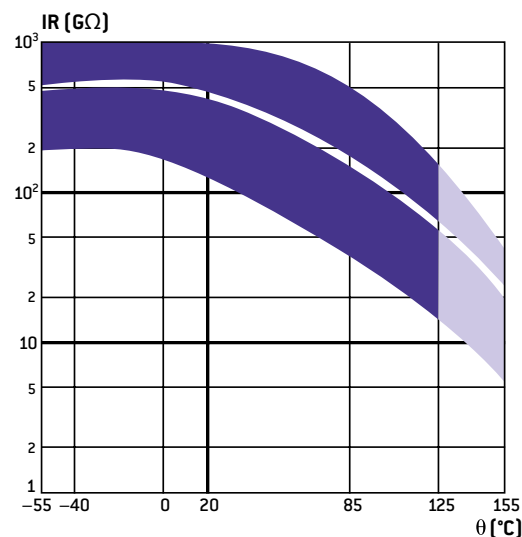
X7R: CAPACITANCE CHANGE VS TEMPERATURE



X7R: CAPACITANCE CHANGE VS FREQUENCY



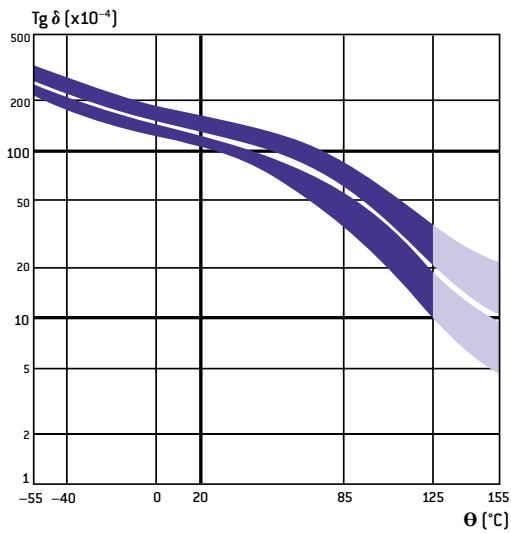
X7R: INSULATION RESISTANCE VS TEMPERATURE



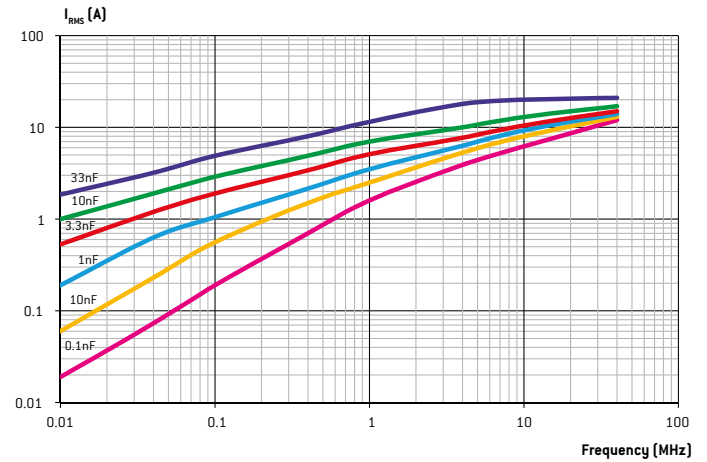
HIGH VOLTAGE

General Information

X7R: LOSS TANGENT CHANGE VS TEMPERATURE



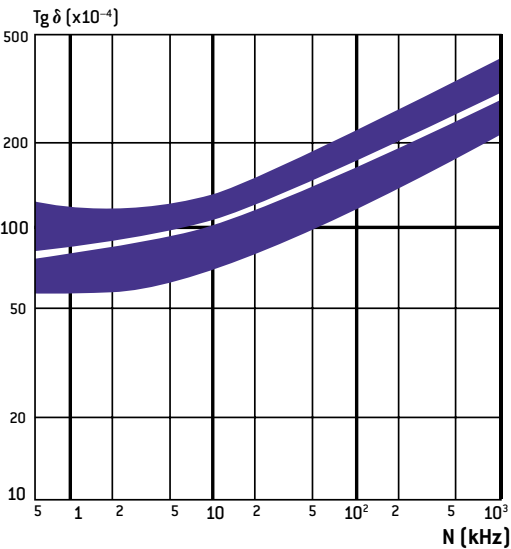
X7R: MAXIMUM ADMISSIBLE CURRENT VS FREQUENCY



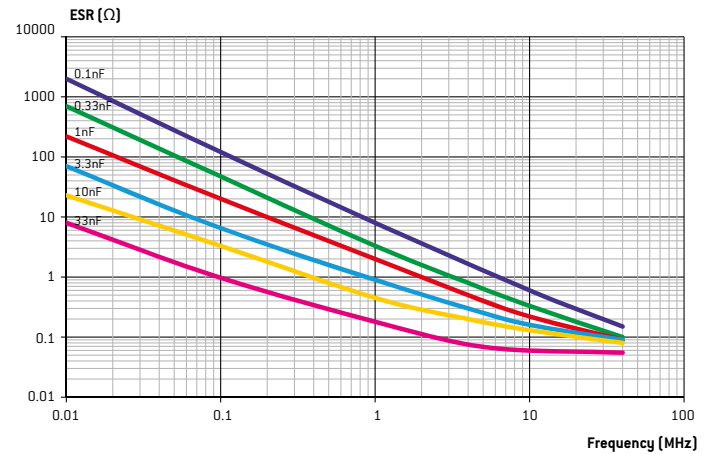
These typical curves are examples of admissible currents for one family of chip capacitors (size 3333). For other curves and products or for further information, please contact us.

Note: for the calculations, we have considered that the terminations are directly connected to an infinite heat sink. In other words, the thermal resistance of the circuit itself which depends on its type and design has not been taken into account. Moreover, the ambient temperature taken is 25°C.

X7R: LOSS TANGENT CHANGE VS FREQUENCY



X7R: ESR VS FREQUENCY



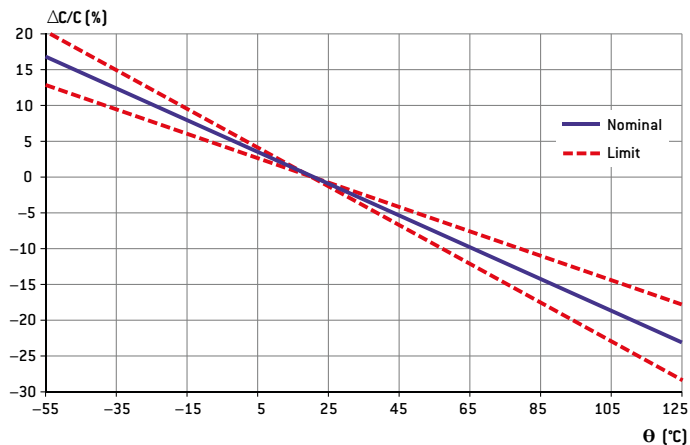
The ESR (Equivalent Serial Resistance) typical curves are given, here for SMD (chip) capacitors. Regarding the curves for the leaded capacitors, they are rather the same. Indeed, due to the resistivity of the raw material used and the wire diameters, the resistance of the wires is much lower than the ESR of the chips. So, in a first approach, their influence can be considered as negligible.

General Information

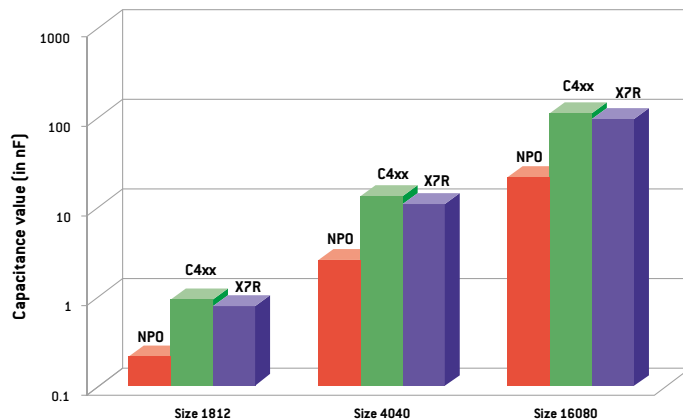
C4xx DIELECTRIC

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 NPO dielectric. As the C4xx ceramic features low dissipation factor it is recommended for AC line filtering from 110 Vrms to 230 Vrms, 20 to 400 Hz, for high power RF at high voltage up to 5,000 V and for pulse applications.

C4xx: TEMPERATURE COEFFICIENT

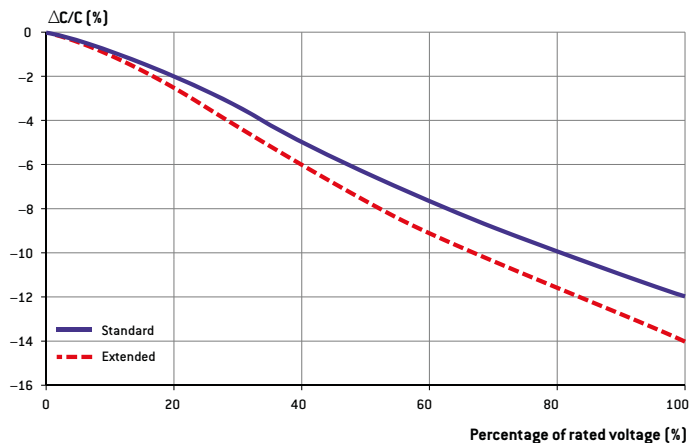


COMPARISON OF CAPACITANCE VALUE UNDER RATED VOLTAGE AT 125°C

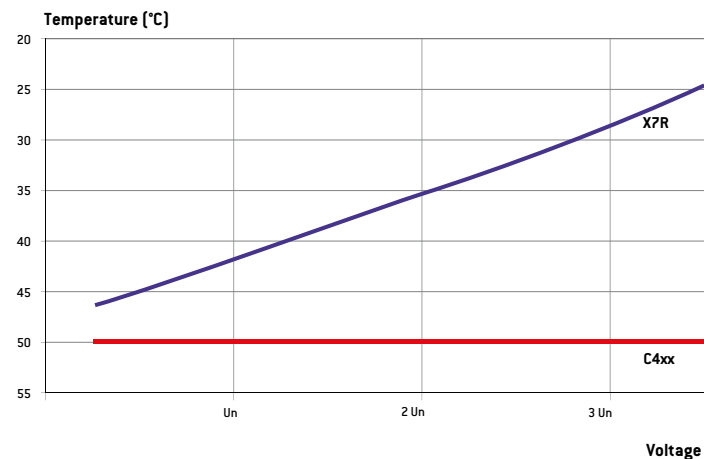


HIGH VOLTAGE

C4xx: VOLTAGE COEFFICIENT



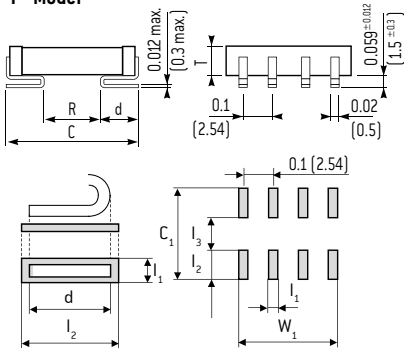
COMPARISON OF SELF-HEATING AT 400 Hz BETWEEN C4xx AND X7R DIELECTRICS



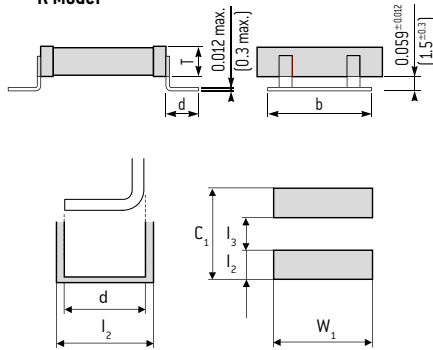
General Information

RECOMMENDED FOOTPRINTS

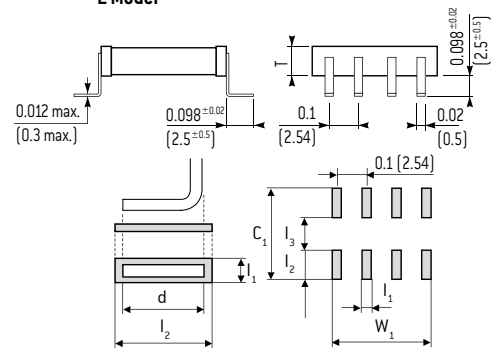
P* Model



R Model



L Model



DIMENSIONS in inches (mm)

| Exxelia size code | Lead shape | C max inches (mm) | Leads per side | d inches (mm) | b inches (mm) | C ₁ inches (mm) | W ₁ inches (mm) | I ₁ inches (mm) | I ₂ inches (mm) | I ₃ inches (mm) |
|-------------------|------------|-------------------|----------------|---------------------------|-------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 90 | P* | 0.228 (5.8) | 2 | 0.06 ± 0.012 (1.5 ± 0.3) | - | 0.268 (6.8) | 0.147 (3.74) | 0.047 (1.2) | 0.108 (2.75) | 0.098 (2.5) |
| | L | 0.394 (10) | 2 | 0.098 ± 0.02 (2.5 ± 0.5) | - | 0.433 (11) | 0.147 (3.74) | 0.047 (1.2) | 0.152 (3.85) | 0.130 (3.3) |
| | R | 0.386 (9.8) | 1 | 0.087 ± 0.008 (2.2 ± 0.2) | 0.197 ± 0.02 (5 ± 0.5) | 0.425 (10.8) | 0.244 (6.2) | - | 0.148 (3.75) | 0.130 (3.3) |
| 80 | P* | 0.276 (7) | 2 | 0.06 ± 0.012 (1.5 ± 0.3) | - | 0.315 (8) | 0.147 (3.74) | 0.047 (1.2) | 0.108 (2.75) | 0.098 (2.5) |
| | L | 0.480 (12.2) | 2 | 0.098 ± 0.02 (2.5 ± 0.5) | - | 0.520 (13.2) | 0.147 (3.74) | 0.047 (1.2) | 0.171 (4.35) | 0.177 (4.5) |
| | R | 0.433 (11) | 1 | 0.087 ± 0.008 (2.2 ± 0.2) | 0.197 ± 0.02 (5 ± 0.5) | 0.472 (12) | 0.244 (6.2) | - | 0.148 (3.75) | 0.177 (4.5) |
| 91 | P* | 0.276 (7) | 2 | 0.06 ± 0.012 (1.5 ± 0.3) | - | 0.315 (8) | 0.147 (3.74) | 0.047 (1.2) | 0.108 (2.75) | 0.098 (2.5) |
| | L | 0.480 (12.2) | 2 | 0.098 ± 0.02 (2.5 ± 0.5) | - | 0.520 (13.2) | 0.147 (3.74) | 0.047 (1.2) | 0.171 (4.35) | 0.177 (4.5) |
| | R | 0.433 (11) | 1 | 0.087 ± 0.008 (2.2 ± 0.2) | 0.197 ± 0.02 (5 ± 0.5) | 0.472 (12) | 0.244 (6.2) | - | 0.148 (3.75) | 0.177 (4.5) |
| 81 | P* | 0.315 (8) | 2 | 0.087 ± 0.012 (2.2 ± 0.3) | - | 0.354 (9) | 0.147 (3.74) | 0.047 (1.2) | 0.108 (2.75) | 0.138 (3.5) |
| | L | 0.531 (13.5) | 2 | 0.098 ± 0.02 (2.5 ± 0.5) | - | 0.571 (14.5) | 0.147 (3.74) | 0.047 (1.2) | 0.171 (4.35) | 0.228 (5.8) |
| | R | 0.484 (12.3) | 1 | 0.087 ± 0.008 (2.2 ± 0.2) | 0.197 ± 0.02 (5 ± 0.5) | 0.524 (13.3) | 0.244 (6.2) | - | 0.148 (3.75) | 0.228 (5.8) |
| 82 | P* | 0.354 (9) | 3 | 0.087 ± 0.012 (2.2 ± 0.3) | - | 0.394 (10) | 0.247 (6.28) | 0.047 (1.2) | 0.108 (2.75) | 0.177 (4.5) |
| | L | 0.587 (14.9) | 3 | 0.098 ± 0.02 (2.5 ± 0.5) | - | 0.626 (15.9) | 0.247 (6.28) | 0.047 (1.2) | 0.171 (4.35) | 0.283 (7.2) |
| | R | 0.642 (16.3) | 1 | 0.138 ± 0.008 (3.5 ± 0.2) | 0.315 ± 0.02 (8 ± 0.5) | 0.681 (17.3) | 0.362 (9.2) | - | 0.199 (5.05) | 0.283 (7.2) |
| 83 | P* | 0.472 (12) | 4 | 0.087 ± 0.012 (2.2 ± 0.3) | - | 0.512 (13) | 0.347 (8.82) | 0.047 (1.2) | 0.118 (3) | 0.276 (7) |
| | L | 0.676 (17.16) | 4 | 0.098 ± 0.02 (2.5 ± 0.5) | - | 0.715 (18.16) | 0.347 (8.82) | 0.047 (1.2) | 0.191 (4.85) | 0.333 (8.46) |
| | R | 0.731 (18.56) | 1 | 0.138 ± 0.008 (3.5 ± 0.2) | 0.315 ± 0.02 (8 ± 0.5) | 0.770 (19.56) | 0.362 (9.2) | - | 0.219 (5.55) | 0.333 (8.46) |
| 84 | P* | 0.610 (15.5) | 4 | 0.087 ± 0.012 (2.2 ± 0.3) | - | 0.650 (16.5) | 0.347 (8.82) | 0.047 (1.2) | 0.128 (3.25) | 0.394 (10) |
| | L | 0.815 (20.7) | 4 | 0.098 ± 0.02 (2.5 ± 0.5) | - | 0.854 (21.7) | 0.347 (8.82) | 0.047 (1.2) | 0.191 (4.85) | 0.472 (12) |
| | R | 0.870 (22.1) | 1 | 0.138 ± 0.008 (3.5 ± 0.2) | 0.315 ± 0.02 (8 ± 0.5) | 0.909 (23.1) | 0.362 (9.2) | - | 0.219 (5.55) | 0.472 (12) |
| 89 | P* | 0.630 (16) | 5 | 0.087 ± 0.012 (2.2 ± 0.3) | - | 0.669 (17) | 0.347 (8.82) | 0.047 (1.2) | 0.128 (3.25) | 0.413 (10.5) |
| | L | 0.827 (21) | 5 | 0.098 ± 0.02 (2.5 ± 0.5) | - | 0.866 (22) | 0.347 (8.82) | 0.047 (1.2) | 0.191 (4.85) | 0.484 (12.3) |
| | R | 0.882 (22.4) | 1 | 0.138 ± 0.008 (3.5 ± 0.2) | 0.315 ± 0.02 (8 ± 0.5) | 0.921 (23.4) | 0.362 (9.2) | - | 0.219 (5.55) | 0.484 (12.3) |
| 85 | P* | 0.728 (18.5) | 6 | 0.087 ± 0.012 (2.2 ± 0.3) | - | 0.768 (19.5) | 0.547 (13.9) | 0.047 (1.2) | 0.128 (3.25) | 0.512 (13) |
| | L | 0.925 (23.5) | 6 | 0.098 ± 0.02 (2.5 ± 0.5) | - | 0.965 (24.5) | 0.547 (13.9) | 0.047 (1.2) | 0.191 (4.85) | 0.583 (14.8) |
| | R | 0.980 (24.9) | 1 | 0.138 ± 0.008 (3.5 ± 0.2) | 0.591 ± 0.02 (15 ± 0.5) | 1.020 (25.9) | 0.638 (16.2) | - | 0.219 (5.55) | 0.583 (14.8) |
| 87 | P* | 1.260 (32) | 6 | 0.087 ± 0.012 (2.2 ± 0.3) | - | 1.299 (33) | 0.547 (13.9) | 0.047 (1.2) | 0.128 (3.25) | 0.945 (24) |
| | L | 1.398 (35.5) | 6 | 0.098 ± 0.02 (2.5 ± 0.5) | - | 1.437 (36.5) | 0.547 (13.9) | 0.047 (1.2) | 0.191 (4.85) | 1.055 (26.8) |
| | R | 1.453 (36.9) | 1 | 0.138 ± 0.008 (3.5 ± 0.2) | 0.591 ± 0.02 (15 ± 0.5) | 1.492 (37.9) | 0.638 (16.2) | - | 0.219 (5.55) | 1.055 (26.8) |
| 88 | P* | 1.654 (42) | 6 | 0.087 ± 0.012 (2.2 ± 0.3) | - | 1.693 (43) | 0.547 (13.9) | 0.047 (1.2) | 0.128 (3.25) | 1.378 (35) |
| | L | 1.831 (46.5) | 6 | 0.098 ± 0.02 (2.5 ± 0.5) | - | 1.870 (47.5) | 0.547 (13.9) | 0.047 (1.2) | 0.191 (4.85) | 1.488 (37.8) |
| | R | 1.886 (47.9) | 1 | 0.138 ± 0.008 (3.5 ± 0.2) | 0.591 ± 0.02 (15 ± 0.5) | 1.925 (48.9) | 0.638 (16.2) | - | 0.219 (5.55) | 1.488 (37.8) |

* For PL and PLS, add 0.098 in (2.5 mm) to d and I2 and 0.197 in (5 mm) to C1.

General Information

MATERIALS EXPERT

For 50 years and as a market leader, EXXELIA's comprehensive knowledge of the materials properties and performances have enabled us to design capacitors in Porcelain, NPO, BX, 2C1, BP, X7R and –2200ppm/°C ceramics.

CUSTOM DESIGNS

Our catalog products don't meet your application?

Based on the valuable experience accumulated over the design of 2,000+ specific ceramic capacitors, you can trust EXXELIA to define a qualitative custom solution in a time effective manner.

NO OBSOLESCENCE

Choosing a standard or custom EXXELIA product means you won't have to worry about obsolescence.

TYPICAL APPLICATIONS

- Aerospace & Defense: cockpit panels, flight control, radio systems, missile guidance systems...
- Space: military and commercial satellites, launcher...
- Medical: MRI, external defibrillators, implantable devices...
- Telecommunications: base stations...
- Oil and gas: drilling tools, MWD, LWD, wellheads...

ISO 9001 AND AS9100C

Quality is at the core of Exxelia's corporate culture. Each sites has its own certifications.

CERTIFICATIONS

Capacitors manufactured by EXXELIA comply with American and European standards and meet the requirements of many international standards.

For Space qualified parts (ESA QPL), please refer to our catalog «Ceramic capacitors for Space applications».

QUALITY & RELIABILITY

EXXELIA is committed to design and manufacture high quality and reliability products. The test cycles reproducing the most adverse operating conditions over extended periods (up to 10 000 hours) have logged to date well over 5.10⁹ hours/Component.

Failure rate data can be provided upon request.

CONFLICT MINERALS

EXXELIA is committed to an approach based on «Conflict Minerals Compliance». This US SEC rule demands complete traceability and a control mechanism for the mineral procurement chain, encouraging importers to buy only «certified» ore.

We have discontinued relations with suppliers that procure from the Democratic Republic of the Congo or an adjoining country.

ENVIRONMENT

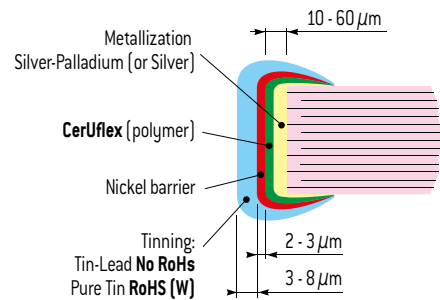
EXXELIA is committed to applying a robust environmental policy, from product design through to shipment. To control its environmental footprint and reconcile this with the company' functional imperatives, our environmental policy provides for the reduction or elimination of hazardous substances. We also focus on compliance with European Union directives and regulations, notably REACH and RoHS.

RoHS COMPLIANCY

SMD CAPACITORS

The capacitor terminations are generally protected by a nickel barrier formed by electrolytic deposit. This barrier gives chip capacitors leaching performance far exceeding the requirements of all applicable standards. The nickel barrier guarantees a minimum resistance to soldering heat for a period of 1 minute at 260°C in a tin-lead (60/40) or tin-lead-silver (62/36/2) bath without noticeable alteration to the solderability. It also allows repeated soldering-unsoldering and the longer soldering times required by reflow techniques.

However nickel barrier amplifies thermal shock and is not recommended for chip sizes equal or greater than CNC Y (30 30) - (C 282 to C 288 - CNC 80 to CNC 94).


















LEADED COMPONENTS

As well as for SMD products, leaded capacitors ranges can also be RoHS. These products, which are characterized by the suffix «W» added to the commercial type, are naturally compatible with the soldering alloys used in RoHS mounting technology. The connections coating is generally an alloy SnAg (with a maximum of 4% Ag). However, on a few products that EXXELIA will precise on request, the coating is pure silver.

Selection Guide

| Main Characteristic | Model | Size | Dielectric | Voltage | Capacitance | Temperature | Coating | | | | | Leads | | | | Mounting | | Main Applications | Page |
|---------------------|--|---------------|-------------------|---------------|----------------|-----------------|-----------------|-----------|------------------|--------|----------------|-------|--------|-------|--------|----------|--------------|--|------|
| | | | | | | | Uncoated | Varnished | Conformal coated | Molded | Self-protected | DIL | Ribbon | Axial | Radial | SMD | Through hole | | |
| | | | | | | | | | | | | | | | | | | | |
| STANDARD | CEC / CNC SERIES Low and Medium Voltage Chips Capacitors | 0402 to 3040 | NPO BX to 2C1 X7R | 10V to 1,000V | 1pF to 12μF | -55°C to +125°C | • | | | | | | | | | | | Precision, stability, decoupling | 22 |
| | NON MAGNETIC CHIPS SERIES Low and Medium Voltage Chips Capacitors | 0603 to 2220 | NPO X7R | 63V to 500V | 10pF to 1μF | -55°C to +125°C | • | | | | | | | | | | | Precision, stability, decoupling | 26 |
| | OP SERIES Open Mode Chips Capacitors | 0805 to 2220 | NPO X7R | 10V to 100V | 1pF to 4.7μF | -55°C to +125°C | • | | | | | | | | | | | Precision, stability, decoupling, Significantly reduce risk of short circuit | 28 |
| | CER / CNR SERIES Low Inductance Chips Capacitors | 0306 to 0612 | NPO X7R | 16V to 100V | 1pF to 270nF | -55°C to +125°C | • | | | | | | | | | | | Decoupling, low ESL, medical embedded | 30 |
| | C3N / C4N / C3E / C4E SERIES Capacitors Arrays | - | NPO X7R | 25V to 200V | 4.7pF to 33nF | -55°C to +125°C | • | | | | | | | | | | | Medical embedded, miniaturisation | 32 |
| | 30 S4 SERIES Safety Capacitors | - | NPO X7R | 40V to 100V | 470pF to 820nF | -55°C to +125°C | • | | | | • | | | | • | | | Railway | 33 |
| | TCE / TCX / TCN / TXR MOLDED SERIES Radial Molded Capacitors | - | NPO BX to 2C1 X7R | 25V to 500V | 1pF to 4.7μF | -55°C to +125°C | | | • | | | | | | • | | | Precision, stability, decoupling | 34 |
| | LA SERIES Radial Molded Capacitors | - | NPO Temp. coeff. | 25V to 63V | 1pF to 680nF | -55°C to +125°C | | | | • | | | | | | • | | Decoupling | 36 |
| | TCE / TCX / TCN / TXR AXIAL SERIES Axial Molded Capacitors | - | NPO BX - 2C1 X7R | 25V to 500V | 1pF to 3.9μF | -55°C to +125°C | | | | • | | | | | | | • | Precision, stability, decoupling | 38 |
| | TCE / TCX / TCN / TXR CONFORMAL COATED SERIES Radial Dipped Capacitors | - | NPO BX - 2C1 X7R | 25V to 500V | 1pF to 6.8μF | -55°C to +125°C | | | • | | | | | | | | • | Precision, stability, decoupling | 40 |
| | NON MAGNETIC CONFORMAL COATED SERIES Radial Dipped Capacitors | - | NPO X7R | 63V to 500V | 180pF to 1μF | -55°C to +125°C | | | • | | | | | | | | • | Precision, stability, decoupling | 42 |
| | CK SERIES Radial Molded Capacitors | - | BX | 25V to 250V | 10pF to 1μF | -55°C to +125°C | | | | • | | | | | | | • | Decoupling | 44 |
| HIGH VOLTAGE | C Series High voltage chips Capacitors | 1812 to 16080 | NPO C4xx X7R | 200V to 10kV | 10pF to 39μF | -55°C to +125°C | • | | | | | | | | | | | | 51 |
| | TCL / TCK Series High voltage Molded & Varnished leaded Capacitors | - | NPO C4xx X7R | 200V to 10kV | 10pF to 39μF | -55°C to +125°C | | • | | • | | | | | | | • | | 54 |
| | TCF Series High voltage Conformal coated leaded Capacitors | - | NPO C4xx X7R | 200V to 10kV | 10pF to 39μF | -55°C to +125°C | | | • | | | | | | | | • | | 57 |
| | TKD Series High voltage Conformal coated leaded Capacitors | - | NPO C4xx X7R | 200V to 10kV | 10pF to 39μF | -55°C to +125°C | | | • | | | | | | | | • | | 60 |
| | CS Series High voltage Stacked Capacitors | 2220 to 16080 | NPO C4xx X7R | 1kV to 10kV | 220pF to 15μF | -55°C to +125°C | • | • | | | • | • | | | | | • | • | 62 |
| | VM Series Voltage Multipliers | - | - | - | - | - | -55°C to +125°C | | | | • | | | | | | | • | |
| | | | | | | | | | | | | | | | | | | Power supply, voltage multiplier, radars. • aerospace • space • defence • railways | |

Selection Guide

| Main Characteristic | Model | Size range | Dielectric | Voltage range | Capacitance range | Temperature range | Coating | | | | | Leads | | | | Mounting | | Main Applications | Page |
|--|---|----------------|-------------|-----------------|-------------------|-------------------|----------|-----------|------------------|--------|----------------|-------|--------|-------|--------|----------|--------------|-------------------|------|
| | | | | | | | Uncoated | Varnished | Conformal coated | Molded | Self protected | DIL | Ribbon | Axial | Radial | SMD | Through hole | | |
| HIGH CAPACITANCE | R SERIES (CHIPS) High Capacitance Chips Capacitors  | 2225 to 45107 | X7R | 50V to 500V | 47nF to 27µF | -55°C to +125°C | • | | | | | | | | | | • | | 73 |
| | R SERIES (LEADED) Radial Leaded Conformal Coated Capacitors  | - | X7R | 50V to 500V | 47nF to 27µF | -55°C to +125°C | | | • | | | | | | | | • | | 77 |
| | TEF SERIES Radial Leaded Conformal Coated Capacitors  | - | NPO | 63V to 500V | 10nF to 680nF | -55°C to +125°C | | | • | | | | | | | | • | | 80 |
| | SV / SC SERIES High Capacitance Stacked Capacitors  | 2225 to 125205 | X7R | 50V to 500V | 47nF to 390µF | -55°C to +125°C | • | • | | | | • | • | | | | • | • | 81 |
| | CNC3X SERIES High Capacitance Stacked Capacitors  | 2220 to 4040 | X7R | 16V to 25V | 1.2µF to 68µF | -55°C to +125°C | • | • | | | | • | | | | | • | • | 88 |
| | CEC5X SERIES High Capacitance Stacked Capacitors  | 3033 to 80150 | NPO | 63V to 500V | 10nF to 6.8µF | -55°C to +125°C | • | • | | | | • | | | | | • | • | 90 |
| | TEP / TEV SERIES High Capacitance Stacked Capacitors  | - | NPO | 63V to 500V | 10nF to 6.8µF | -55°C to +125°C | | • | | | | | | | | | • | • | 93 |
| TCN8X SERIES High Capacitance Molded Stacked Capacitors  | - | X7R | 63V to 500V | 0.47µF to 120µF | -55°C to +125°C | | | | • | | | | | | | • | • | 95 | |
| HIGH TEMPERATURE | CE / CN SERIES High Temperature Chips Capacitors  | 0402 to 3040 | NPO to X7R | 16V to 100V | 1pF to 8.2µF | -55°C to +250°C | • | | | | | | | | | | • | | 100 |
| | SCT SERIES High Temperature Stacked Capacitors  | 2225 to 125205 | X7R | 50V to 500V | 47nF to 390µF | -55°C to +215°C | • | • | | | | • | | | | | • | • | 102 |
| | TCE / TCN MOLDED SERIES HT High Temperature Molded Capacitors  | - | NPO to X7R | 16V to 100V | 1pF to 10µF | -55°C to +220°C | | | | • | | | | | | | • | • | 107 |
| | TCE / TCN SELF-PROTECTED SERIES High Temperature Self-Protected Capacitors  | - | NPO to X7R | 25V to 500V | 10pF to 3.9µF | -55°C to +250°C | | | | | • | | | | | | • | • | 109 |
| | TCH SERIES High Temperature High Voltage Capacitors  | - | NPO to X7R | 200V to 10kV | 10pF to 15µF | -55°C to +250°C | | • | | | | | | | | | • | • | 111 |
| FEED-THRU | TBC SERIES Discoidal Capacitors  | - | NPO to X7R | 25V to 1kV | 10pF to 12µF | -55°C to +125°C | • | | | | | | | | | | • | | 115 |
| | BPM SERIES Planar Array  | - | X7R | 25V to 200V | 330pF to 68nF | -55°C to +125°C | • | | | | | | | | | | • | | 117 |

Switch Mode Power Supply, filtering, smoothing, decoupling.

- aerospace
- space
- defence

Oil drilling, motor control, braking systems.

Very low ESL

Very low ESL, miniaturisation

Selection Guide

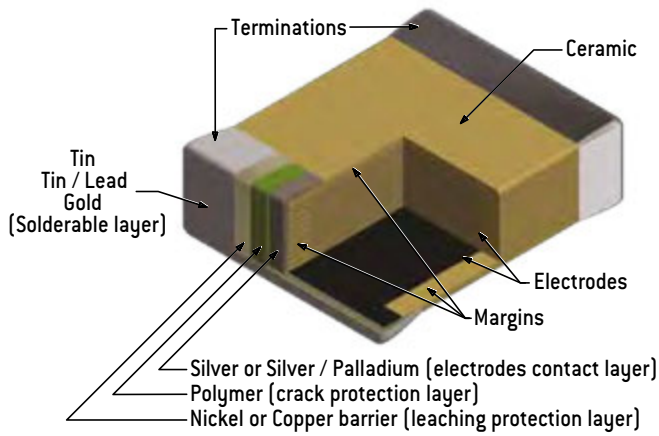
| Main Characteristic | Model | Size range | Dielectric | Voltage range | Capacitance range | Temperature range | Coating | | | | | Leads | | | | Mounting | | Main Applications | Page |
|---------------------|---|--------------|------------|---------------|-------------------|-------------------|----------|-----------|------------------|--------|----------------|-------|--------|-------|--------|--|---|----------------------------------|------|
| | | | | | | | Uncoated | Varnished | Conformal coated | Molded | Self protected | DIL | Ribbon | Axial | Radial | SMD | Through hole | | |
| | | | | | | | | | | | | | | | | | | | |
| HIGH Q | XBL SERIES Broadband | 0402 | X7R | 16V | 100nF | -55°C to +125°C | • | | | | | | | | | | | DC Blocking, Coupling, Bypassing | 138 |
| | UBL SERIES Broadband | 0402 | X7R | 16V | 100nF | -55°C to +125°C | • | | | | | | | | | | 140 | | |
| | UBZ SERIES Broadband | 0201 | X5R X6T | 10V | 100nF | -55°C to +105°C | • | | | | | | | | | | | | |
| | CH SERIES Classic HiQ | 0505 1111 | P100 | 50V to 1.5kV | 0.1pF to 1nF | -55°C to +175°C | • | | | | • | | • | • | | | Cellular base station amplifier, MRI. | 144 | |
| | SH SERIES Super HiQ | 0402 to 1210 | NPO | 25V to 1.5kV | 0.2pF to 1nF | -55°C to +150°C | • | | | | • | | • | • | | | Cellular base station equipment | 147 | |
| | SHD / SHR SERIES Reverse Geometry | 0709 0711 | NPO | 500V | 0.5pF to 100pF | -55°C to +175°C | • | | | | | | | • | | Broadband Point to point/ multi-point radios RF generators | 150 | | |
| | NHB SERIES High Self Resonant Frequency | 1111 | NPO | 500V | 0.3pF to 100pF | -55°C to +175°C | • | | | | | | | | • | | | 152 | |
| | CP SERIES High Power | 2225 4040 | P100 | 200V to 7kV | 1pF to 10nF | -55°C to +125°C | • | • | | | • | • | • | • | • | | RF power amplifier Plasma chamber MRI coils | 154 | |
| | CL SERIES High Power | 2225 to 7065 | NPO | 200V to 7kV | 1pF to 10nF | -55°C to +125°C | • | • | | | • | • | • | • | • | | RF power amplifier Plasma chamber MRI coils | | 158 |

ADDITIONAL AVAILABLE RANGES (consult our website)

| | | | | | | | | | | | | | | | | | | | |
|------------------|--------------------------------|---------------|------------|--------------|----------------|-----------------|---|---|---|---|---|--|---|---|--|--|--|--|---|
| STANDARD | TCE1X Series | - | NPO | 63V to 100V | 0.5pF to 10nF | -55°C to +125°C | | | | • | | | | | | | | Precision, stability, decoupling | - |
| | TCN19 Series | - | 2C1 | 63V to 250V | 10pF to 1µF | -55°C to +125°C | | | | | • | | | | | | | Decoupling | - |
| | TCN3X Series | - | 2C1 | 50V to 100V | 100pF to 1,8µF | -55°C to +125°C | | | | | • | | | | | | | | - |
| | LA6 Series | - | 2C1 | 25V to 63V | 100pF to 1µF | -55°C to +125°C | | | | | • | | | | | | | | - |
| HIGH VOLT. | H Series | 0805 to 6560 | NPO X7R | 1kV to 10kV | 2pF to 390nF | -55°C to +125°C | • | • | | | | | | | | | | Power supply, voltage multiplier, radars. | - |
| HIGH CAPACITANCE | CNC5X Series | 3033 to 80150 | X7R | 63V to 500V | 0.1µF to 180µF | -55°C to +125°C | • | • | | | • | | | | | | | Switch Mode Power Supply, filtering, smoothing, decoupling. • aerospace • space • defence | - |
| | CNC8X Series (chips) | 3033 to 33110 | X7R | 63V to 400V | 47nF to 27µF | -55°C to +125°C | • | | | | | | | | | | | | - |
| | CNC8X Series (DIL) | 3333 to 80150 | X7R | 63V to 400V | 47nF to 180µF | -55°C to +125°C | • | • | | | • | | | | | | | | - |
| | TCP / TCV8X Series | 3333 to 80150 | X7R | 63V to 400V | 47nF to 180µF | -55°C to +125°C | | • | | | | | | | | | | | - |
| | TCP / TCV5X Series | 3033 to 80150 | X7R | 63V to 500V | 0.1µF to 180µF | -55°C to +125°C | | • | | | | | | | | | | | - |
| | TCF Series | - | X7R | 63V to 500V | 0.1µF to 18µF | -55°C to +125°C | | | • | | | | | | | | | | - |
| HIGH TEMP. | CNC25X Series | 3033 to 5550 | X7R | 50V | 1µF to 33µF | -55°C to +200°C | • | • | | | • | | | | | | | Oil drilling, motor control, braking systems. | - |
| HIGH Q | CNW Series | - | X7R | 100V to 300V | 10nF to 1µF | -55°C to +125°C | • | | | | | | • | • | | | | Power amplifier | - |
| | SPT519 / CAW CEW Series | - | NPO | 100V to 300V | 10nF to 1µF | -55°C to +125°C | • | • | | | | | | | | | | | - |

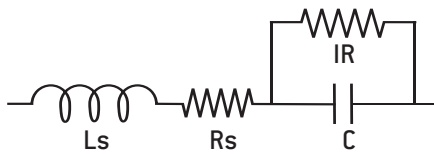
Ceramic Capacitors Technology

MLCC STRUCTURE



EQUIVALENT CIRCUIT

Capacitor is a complex component combining resistive, inductive and capacitive phenomena. A simplified schematic for the equivalent circuit is:



DIELECTRIC CHARACTERISTICS

Insulation Resistance (IR) is the resistance measured under DC voltage across the terminals of the capacitor and consists principally of the parallel resistance shown in the equivalent circuit. As capacitance values and hence the area of dielectric increases, the IR decreases and hence the product (C x IR) is often specified in $\Omega \cdot F$ or $M\Omega \cdot \mu F$.

The Equivalent Series Resistance (ESR) is the sum of the resistive terms which generate heating when capacitor is used under AC voltage at a given frequency (f).

Dissipation factor (DF) is the ration of the apparent power input will turn to heat in the capacitor:

$$DF = 2\pi f C ESR$$

When a capacitor works under AC voltage, **heat power loss (P)**, expressed in Watt, is equal to:

$$P = 2\pi f C V_{rms}^2 DF$$

The series inductance (Ls) is due to the currents running through the electrodes. It can distort the operation of the capacitor at high frequency where the **impedance (Z)** is given as:

$$Z = R_s + j (L_s \cdot \omega - 1 / (C \cdot \omega)) \text{ with } \omega = 2\pi f$$

When frequency rises, the capacitive component of capacitors is gradually canceled up to the resonance frequency, where :

$$Z = R_s \text{ and } L_s C \cdot \omega^2 = 1$$

Above this frequency the capacitor behaves like an inductor.

| | P100 | NPO | N2200 (C4xx) | BX | 2C1 | X7R |
|---|--|---|---------------------------|---------------------------------------|----------|----------------|
| Dielectric material | Porcelain | Magnesium titanate or Neodymium baryum titanate | Barium zirconate titanate | Baryum titanate (BaTiO ₃) | | |
| Dielectric constant | 15 – 18 | 20 – 85 | 450 | 2,000 – 5,000 | | |
| Electrode technology | PME (Precious Metal Electrodes): Ag/Pd | | | | | |
| Capacitance variation between –55°C and +125°C without DC voltage | (100 ± 30)ppm/°C | (0 ± 30)ppm/°C | (–2,200 ± 500) ppm/°C | ± 15% | ± 20% | ± 15% |
| Capacitance variation between –55°C and +125°C with DC rated voltage | | | 0 -15% | 15% –25% | 20% –30% | Not applicable |
| Piezo-electric effect | None | | None | Yes | | |
| Dielectric absorption | None | | Few % | Few % | | |
| Thermal shock sensitive | + | | + | ++ | | |

Ceramic Capacitors Technology

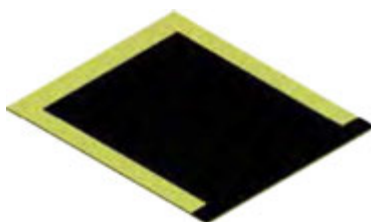
MANUFACTURING STEPS

SLIP CASTING



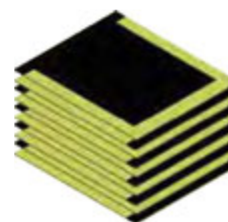
A slurry, a mix of ceramic powder, binder and solvents, is poured onto conveyor belt inside a drying oven, resulting in a dry ceramic sheet.

ELECTRODE SCREEN PRINTING



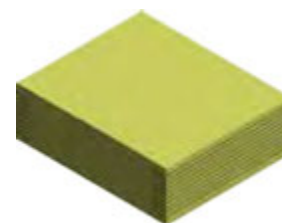
The electrode ink, made from a metal powder mixed with solvents, is printed onto the ceramic sheets using a screen printing process.

STACKING



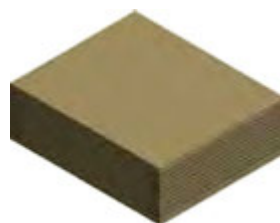
The sheets with electrode printed are stacked to create a multilayer structure.

PRESSING



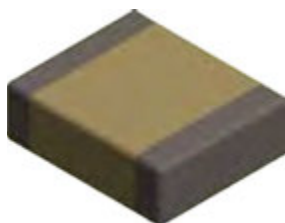
Pressure is applied to the stack to fuse all the separate layers, this created a monolithic structure.

SINTERING



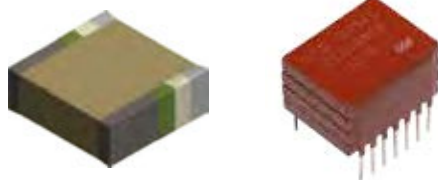
The parts are sintered in an oven with a precise temperature profile which is very important to the characteristics of the capacitors.

TERMINATIONS



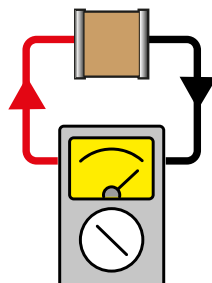
Each terminal of the capacitor is dipped in the termination ink, mix of metal powder, solvents and glass frit and the parts are fired in an oven.

TERMINATIONS PLATING



Stacking + leads soldering + encapsulation
[see pages 10-11]

FINAL TESTING



PACKAGING



User Guide

SMD TERMINATIONS

| NON RoHS COMPLIANT | Code | RoHS COMPLIANT | Code | Recommended mounting process | | | | | | | Storage [months]* | |
|------------------------------------|------------|---------------------------|---------------|------------------------------|---------------|----------------|----------------|-----------------------|--------------------|--------------|-------------------|----|
| | | | | Magnetic | Epoxy bonding | Iron soldering | Wave soldering | Vapor phase soldering | Infrared soldering | Wire bonding | | |
| Ag | Q | Ag | QW / P | No | • | • | • | • | | | | 18 |
| Ag/Pd/Pt | - | Ag/Pd/Pt | W / A | No | • | • | • | | | | | 24 |
| Ag + Ni + dipped Sn/Pb 60/40 | T** | - | - | No | | • | • | • | • | | | 24 |
| Ag/Pd/Pt + dipped Sn/Pb 60/40 | H | Ag/Pd/Pt + dipped Sn | HW | No | | • | | | | | | 24 |
| Ag + Ni + electrolytic Sn/Pb 95/5 | C | Ag + Ni + electrolytic Sn | CW / S | Yes | | • | • | • | • | | | 18 |
| Ag + Ni + electrolytic Sn/Pb 60/40 | D | - | - | Yes | | • | • | • | • | | | 18 |
| - | - | Ag + Cu + electrolytic Sn | C*** | No | | • | • | • | • | | | 18 |
| Ag + Ni + dipped Sn/Pb 60/40 | E | Ag + Ni + electrolytic Sn | EW | Yes | | • | • | | | | | 24 |
| Ag + Ni + Au | G | Ag + Ni + Au | GW | Yes | • | • | • | • | • | • | | 36 |
| Ag + Polymer + Ni + Sn/Pb 95/5 | YC | Ag + Polymer + Ni + Sn | YCW | Yes | | • | • | • | • | | | 18 |
| Ag + Polymer + Ni + Sn/Pb 60/40 | YD | - | - | Yes | | • | • | • | • | | | 18 |
| Ag + Polymer + Ni + Au | YG | Ag + Polymer + Ni + Au | YGW | Yes | • | • | • | • | • | • | | 36 |

Nickel (Ni) or Copper (Cu) barriers amplify thermal shock and are not recommended for chip sizes larger than 3030.

* Storage must be in a dry environment at a temperature of 20°C with a relative humidity below 50%, or preferably in a package enclosing a desiccant.

** Maintenance only.

*** Non magnetic chips series only.

SMD ENVIRONMENTAL TESTS

Ceramic chip capacitors for SMD are designed to meet test requirements of **CECC 32100** and **NF C 93133** standards as specified below in compliance with **NF C 20700** and **IEC 68** standards:

- Solderability: **NF C 20758**, 260°C, bath 62/36/2.
- Adherence: 5N force.
- Vibration fatigue test: **NF C 20706**, 20 g, 10 Hz to 2,000 Hz, 12 cycles of 20 minutes each.
- Rapid temperature change: **NF C 20714**, -55°C to + 125°C, 5 cycles.
- Combined climatic test: **IEC 68-2-38**.
- Damp heat: **NF C 20703**, 93 %, H.R., 40°C.
- Endurance test: 1,000 hours, 1.5 U_{RC}, 125°C.

STORAGE OF CHIP CAPACITORS

TINNED OR NON TINNED CHIP CAPACITORS

Storage must be in a dry environment at a temperature of 20°C with a relative humidity below 50 %, or preferably in a packaging enclosing a desiccant.

STORAGE IN INDUSTRIAL ENVIRONMENT:

- 2 years for tin dipped chip capacitors,
- 18 months for tin electroplated chip capacitors,
- 2 years for non tinned chip capacitors,
- 3 years for gold plated chip capacitors.

STORAGE IN CONTROLLED NEUTRAL NITROGEN ENVIRONMENT:

- 4 years for tin dipped or electroplated chip capacitors,
- 4 years for non tinned chip capacitors,
- 5 years for gold plated chip capacitors.

Storage duration should be considered from delivery date and not from batch manufacture date. The tests carried out at final acceptance stage [solderability, susceptibility to solder heat] enable to assess the compatibility to surface mounting of the chips.

User Guide

LEAD STYLES

SURFACE MOUNTING

DIL LEADS

P style



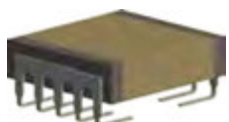
PL style



L style

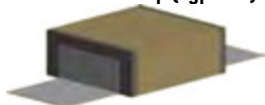


J style



RIBBON LEADS

Micro-strip (type 1)
Short Micro-strip (type 1S)



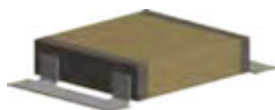
Axial (Type 2)



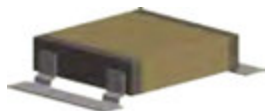
Radial (Type 3)



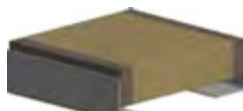
R style



RX style



RJ style



Please contact Exxelia sales for any lead configuration not shown.

TROUGH-HOLE MOUNTING

AXIAL AND RADIAL

Radial leads (Type 6)



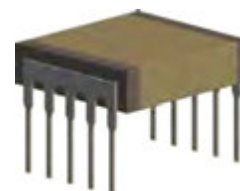
Radial leads (4 leads)



Axial leads (Type 7)



DIL leads: N style

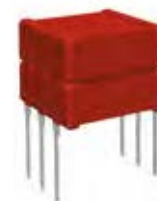


ENCAPSULATION STYLES

Ceramic encapsulation
(selfprotected)



Varnish



Conformal coating

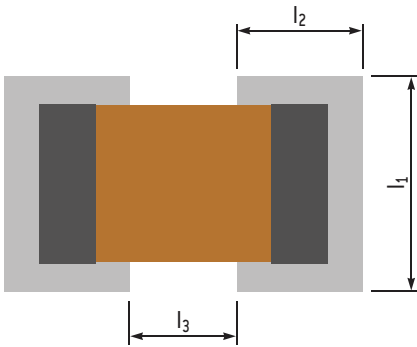


Molding



User Guide

SOLDERING ADVICES FOR REFLOW SOLDERING



Large chips above size 2225 are not recommended to be mounted on epoxy board due to thermal expansion coefficient mismatch between ceramic capacitor and epoxy. Where larger sizes are required, it is recommended to use components with ribbon or other adapted leads so as to absorb thermo-mechanical strains.

| Dimensions in inches (in mm) | Reflow soldering | | | | | | Wave soldering | | | | | |
|------------------------------|------------------|--------|----------------|--------|----------------|-------|----------------|--------|----------------|--------|----------------|-------|
| | l ₁ | | l ₂ | | l ₃ | | l ₁ | | l ₂ | | l ₃ | |
| 0402 | 0.043 | (1.1) | 0.035 | (0.9) | 0.012 | (0.3) | 0.043 | (1.1) | 0.047 | (1.2) | 0.012 | (0.3) |
| 0403 | 0.055 | (1.4) | 0.035 | (0.9) | 0.012 | (0.3) | 0.055 | (1.4) | 0.047 | (1.2) | 0.012 | (0.3) |
| 0504 | 0.063 | (1.6) | 0.051 | (1.3) | 0.016 | (0.4) | 0.063 | (1.6) | 0.063 | (1.6) | 0.016 | (0.4) |
| 0603 | 0.055 | (1.4) | 0.059 | (1.5) | 0.02 | (0.5) | 0.055 | (1.4) | 0.071 | (1.8) | 0.02 | (0.5) |
| 0805 | 0.073 | (1.85) | 0.065 | (1.65) | 0.024 | (0.6) | 0.073 | (1.85) | 0.077 | (1.95) | 0.024 | (0.6) |
| 0907 | 0.094 | (2.4) | 0.065 | (1.65) | 0.035 | (0.9) | 0.094 | (2.4) | 0.077 | (1.95) | 0.035 | (0.9) |
| 1005 | 0.073 | (1.85) | 0.067 | (1.7) | 0.039 | (1) | 0.073 | (1.85) | 0.079 | (2) | 0.039 | (1) |
| 1206 | 0.083 | (2.1) | 0.067 | (1.7) | 0.059 | (1.5) | 0.083 | (2.1) | 0.079 | (2) | 0.059 | (1.5) |
| 1210 | 0.118 | (3) | 0.069 | (1.75) | 0.059 | (1.5) | 0.118 | (3) | 0.081 | (2.05) | 0.059 | (1.5) |
| 1605 | 0.073 | (1.85) | 0.071 | (1.8) | 0.087 | (2.2) | 0.073 | (1.85) | 0.083 | (2.1) | 0.087 | (2.2) |
| 1806 | 0.087 | (2.2) | 0.073 | (1.85) | 0.102 | (2.6) | 0.087 | (2.2) | 0.085 | (2.15) | 0.102 | (2.6) |
| 1812 | 0.152 | (3.85) | 0.073 | (1.85) | 0.102 | (2.6) | 0.152 | (3.85) | 0.085 | (2.15) | 0.102 | (2.6) |
| 1825 | 0.281 | (7.15) | 0.073 | (1.85) | 0.102 | (2.6) | 0.281 | (7.15) | 0.085 | (2.15) | 0.102 | (2.6) |
| 2210 | 0.13 | (3.3) | 0.079 | (2) | 0.146 | (3.7) | 0.13 | (3.3) | 0.091 | (2.3) | 0.146 | (3.7) |
| 2220 | 0.228 | (5.8) | 0.079 | (2) | 0.146 | (3.7) | 0.228 | (5.8) | 0.091 | (2.3) | 0.146 | (3.7) |
| 2225 | 0.281 | (7.15) | 0.079 | (2) | 0.146 | (3.7) | 0.281 | (7.15) | 0.091 | (2.3) | 0.146 | (3.7) |

RECOMMENDED FOOTPRINT FOR SMD CAPACITORS

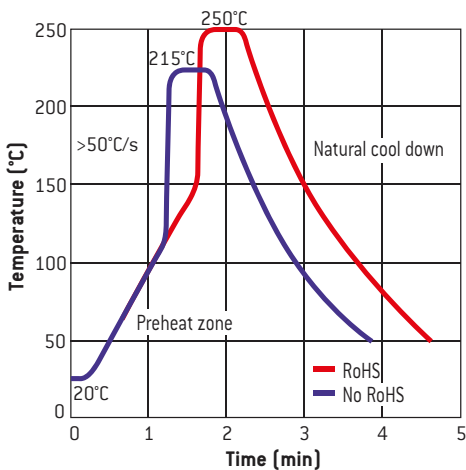
Ceramic is by nature a material which is sensitive both thermally and mechanically. Stresses caused by the physical and thermal properties of the capacitors, substrates and solders are attenuated by the leads.

Wave soldering is unsuitable for sizes larger than 2220 and for the higher ends of capacitance ranges due to possible thermal shock (capacitance values given upon request).

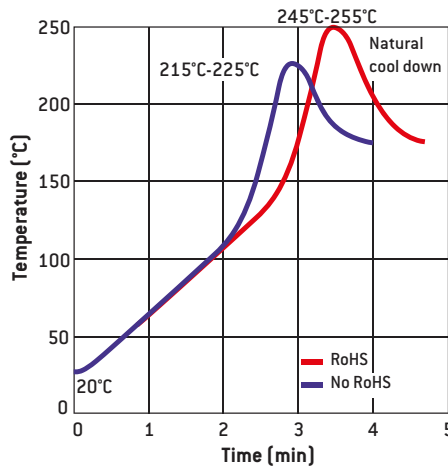
Infrared and vapor phase reflow, are preferred for high reliability applications as inherent thermo-mechanical strains are lower than those inherent to wave soldering.

Whatever the soldering process is, it is highly recommended to apply a thermal cycle, see hereafter our recommended soldering profile:

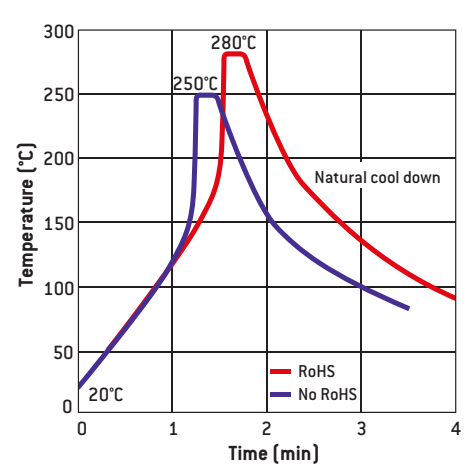
RECOMMENDED VAPOR PHASE REFLOW PROFILE



RECOMMENDED IR REFLOW PROFIL



RECOMMENDED WAVE SOLDERING PROFILE



SOLDERING ADVICES FOR IRON SOLDERING

Attachment with a soldering iron is discouraged due to ceramic brittleness and the process control limitations. In the event that a soldering iron must be used, the following precautions should be observed:

- Use a substrate with chip footprints big enough to allow putting side by side one end of the capacitor and the iron tip without any contact between this tip and the component,
- place the capacitor on this footprint,

- heat the substrate until the capacitor's temperature reaches 150°C minimum (preheating step, maximum 1°C per second),
- place the hot iron tip (a flat tip is preferred) on the footprint **without touching the capacitor**. Use a regulated iron with a 30 watts maximum power. The recommended temperature of the iron is 270 ± 10°C. The temperature gap between the capacitor and the iron tip must not exceed 120°C,

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- leave the tip on the footprint for a few seconds in order to increase locally the footprint's temperature,
- use a cored wire solder and put it down on the iron tip. In a preferred way use Sn/Pb/Ag 62/36/2 alloy,
- wait until the solder fillet is formed on the capacitor's termination,
- take away iron and wire solder,

- wait a few minutes so that the substrate and capacitor come back down to the preheating temperature,
- solder the second termination using the same procedure as the first,
- let the soldered component cool down slowly to avoid any thermal shock.

PACKAGING

TAPE AND REEL

The films used on the reels correspond to standard IEC 60286-3. Films are delivered on reels in compliance with document IEC 286-3 dated 1991.

Minimum quantity is 250 chips.

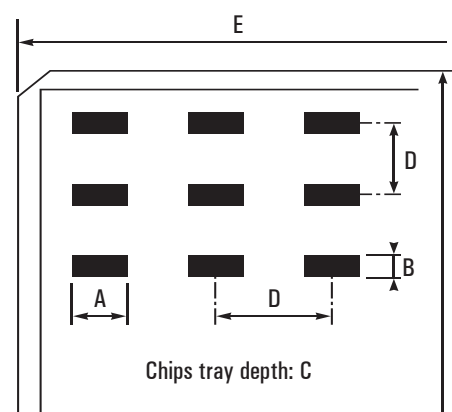
Maximum quantities per reel are as follows:

- Super 8 reel - Ø 180: 2,500 chips.
- Super 8 reel - Ø 330: 10,000 chips.
- Super 12 reel - Ø 180: 1,000 chips.

Reel marking complies with CECC 32100 standard:

- Model.
- Rated capacitance.
- Capacitance tolerance.
- Rated voltage.
- Batch number.

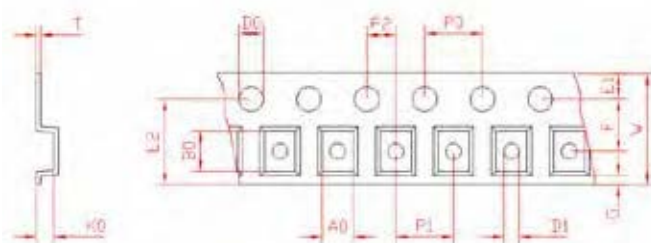
TRAY PACKAGES



DIMENSIONAL CHARACTERISTICS OF CHIPS TRAY PACKAGES

| Sizes | Nr. of chips/ package | Oriented chips | Dimensions in inches (in mm) | | | | |
|-------|--------------------------|----------------|------------------------------|--------------|--------------|--------------|-----------|
| | | | A | B | C | D | E |
| 0402 | 100 | No | 0 0.112 [0 3.02] | | 0.065 [1.65] | 0.167 [4.24] | 2 [50.8] |
| 0403 | 100 | No | 0 0.112 [0 3.02] | | 0.065 [1.65] | 0.167 [4.24] | 2 [50.8] |
| 0504 | 100 | Yes | 0.059 [1.5] | 0.045 [1.14] | 0.035 [0.89] | 0.167 [4.24] | 2 [50.8] |
| 0603 | 340 | Yes | 0.1 [2.54] | 0.06 [1.52] | 0.045 [1.14] | 0.167 [4.24] | 2 [50.8] |
| 0805 | 100 | Yes | 0.1 [2.54] | 0.06 [1.52] | 0.045 [1.14] | 0.167 [4.24] | 2 [50.8] |
| 1206 | 100 | No | 0.14 [3.56] | 0.14 [3.56] | 0.06 [1.52] | 0.167 [4.24] | 2 [50.8] |
| 1210 | 100 | Yes | 0.14 [3.56] | 0.14 [3.56] | 0.06 [1.52] | 0.167 [4.24] | 2 [50.8] |
| 1812 | 100 | No | 0.25 [6.35] | 0.25 [6.35] | 0.13 [3.3] | 0.345 [8.76] | 4 [101.6] |
| | 25 | Yes | 0.24 [6.1] | 0.265 [6.73] | 0.07 [1.78] | 0.345 [8.76] | 2 [50.8] |
| 2220 | 100 | Yes | 0.25 [6.35] | 0.25 [6.35] | 0.13 [3.3] | 0.345 [8.76] | 4 [101.6] |
| | 25 | Yes | 0.24 [6.1] | 0.265 [6.73] | 0.07 [1.78] | 0.345 [8.76] | 2 [50.8] |

HIGH Q CAPACITORS TAPE AND REEL PACKAGING SPECIFICATIONS



| Sizes | Type [1] | W±0.3 inches (mm) | F ±0.05 inches (mm) | P1 ±0.1 inches (mm) | T max. inches (mm) | Reel Size inches (mm) | Quantity per Reel |
|----------|----------|----------------------|------------------------|------------------------|-----------------------|--------------------------|-------------------|
| A [0505] | H | 0,315 [8] | 0,138 [3.5] | 0,157 [4] | 0,010 [0,25] | 7,087 [180] | 3'000 |
| A [0505] | V | 0,315 [8] | 0,138 [3.5] | 0,157 [4] | 0,010 [0,25] | 7,087 [180] | 3'000 |
| S [0603] | H | 0,315 [8] | 0,138 [3.5] | 0,157 [4] | 0,016 [0,4] | 7,087 [180] | 4'000 |
| F [0805] | H | 0,315 [8] | 0,138 [3.5] | 0,157 [4] | 0,016 [0,4] | 7,087 [180] | 4'000 |
| B [1111] | H | 0,315 [8] | 0,138 [3.5] | 0,157 [4] | 0,012 [0,3] | 7,087 [180] | 1'000 |
| B [1111] | V | 0,315 [8] | 0,138 [3.5] | 0,157 [4] | 0,010 [0,25] | 7,087 [180] | 1'000 |
| X [2225] | H | 0,472 [12] | 0,138 [5.5] | 0,472 [12] | 0,018 [0,45] | 12,992 [330] | 500 |
| E [4040] | H | 0,945 [24] | 0,453±0,004 [11,5±0,1] | 0,630 [16] | 0,018 [0,45] | 12,992 [330] | 700 |
| E [4040] | V | 1,260 [32] | 0,559±0,004 [14,2±0,1] | 0,945 [24] | 0,022 [0,55] | 15 [381] | 350 |

[1]: Horizontal (H) or Vertical (V) orientation in cavities.

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EIA STANDARD CAPACITANCE VALUES

Following EIA standard, the values and multiples that are indicated in the chart below can be ordered. E48, E96 series and intermediary values are available upon request.

| E6 (± 20%) | E12 (± 10%) | E24 (± 5%) |
|---------------|----------------|---------------|
| 10 | 10 | 10 |
| | | 11 |
| | | 12 |
| 15 | 12 | 13 |
| | | 15 |
| | | 16 |
| 22 | 15 | 18 |
| | | 20 |
| | | 22 |
| 33 | 18 | 24 |
| | | 27 |
| | | 30 |
| 47 | 22 | 33 |
| | | 36 |
| | | 39 |
| 68 | 33 | 43 |
| | | 47 |
| | | 51 |
| 82 | 39 | 56 |
| | | 62 |
| | | 68 |
| 100 | 47 | 75 |
| | | 82 |
| | | 91 |

EIA CAPACITANCE CODE

The capacitance is expressed in three digit codes and in units of pico Farads (pF). The first and second digits are significant figures of the capacitance value and the third digit identifies the multiplier.

For capacitance value < 10pF, R designates a decimal point.
See examples below:

| EIA code | Capacitance value | | |
|----------|-------------------|---------|------------|
| | in pF | in nF | in μ F |
| 2R2 | 2.2 | 0.0022 | 0.0000022 |
| 6R8 | 6.8 | 0.0068 | 0.0000068 |
| 220 | 22 | 0.022 | 0.000022 |
| 470 | 47 | 0.047 | 0.000047 |
| 181 | 180 | 0.18 | 0.00018 |
| 221 | 220 | 0.22 | 0.00022 |
| 102 | 1,000 | 1 | 0.001 |
| 272 | 2,700 | 2.7 | 0.0027 |
| 123 | 12,000 | 12 | 0.012 |
| 683 | 68,000 | 68 | 0.068 |
| 124 | 120,000 | 120 | 0.12 |
| 564 | 560,000 | 560 | 0.56 |
| 335 | 3,300,000 | 3,300 | 3.3 |
| 825 | 8,200,000 | 8,200 | 8.2 |
| 156 | 15,000,000 | 15,000 | 15 |
| 686 | 68,000,000 | 68,000 | 68 |
| 107 | 100,000,000 | 100,000 | 100 |
| 227 | 220,000,000 | 220,000 | 220 |

PART MARKING VOLTAGE CODES

Use the following voltage code chart for part markings:

| Voltage (V) | Code | Letter code |
|-------------|------|-------------|
| 25 | 250 | A |
| 40 | 400 | B |
| 50 | 500 | C |
| 63 | 630 | D |
| 100 | 101 | E |
| 200 | 201 | G |
| 250 | 251 | H |
| 400 | 401 | K |
| 500 | 501 | L |
| 1,000 | 102 | M |
| 2,000 | 202 | P |
| 3,000 | 302 | R |
| 4,000 | 402 | S |
| 5,000 | 502 | T |
| 7,500 | 752 | U |
| 10,000 | 103 | W |

PART MARKING TOLERANCE CODES

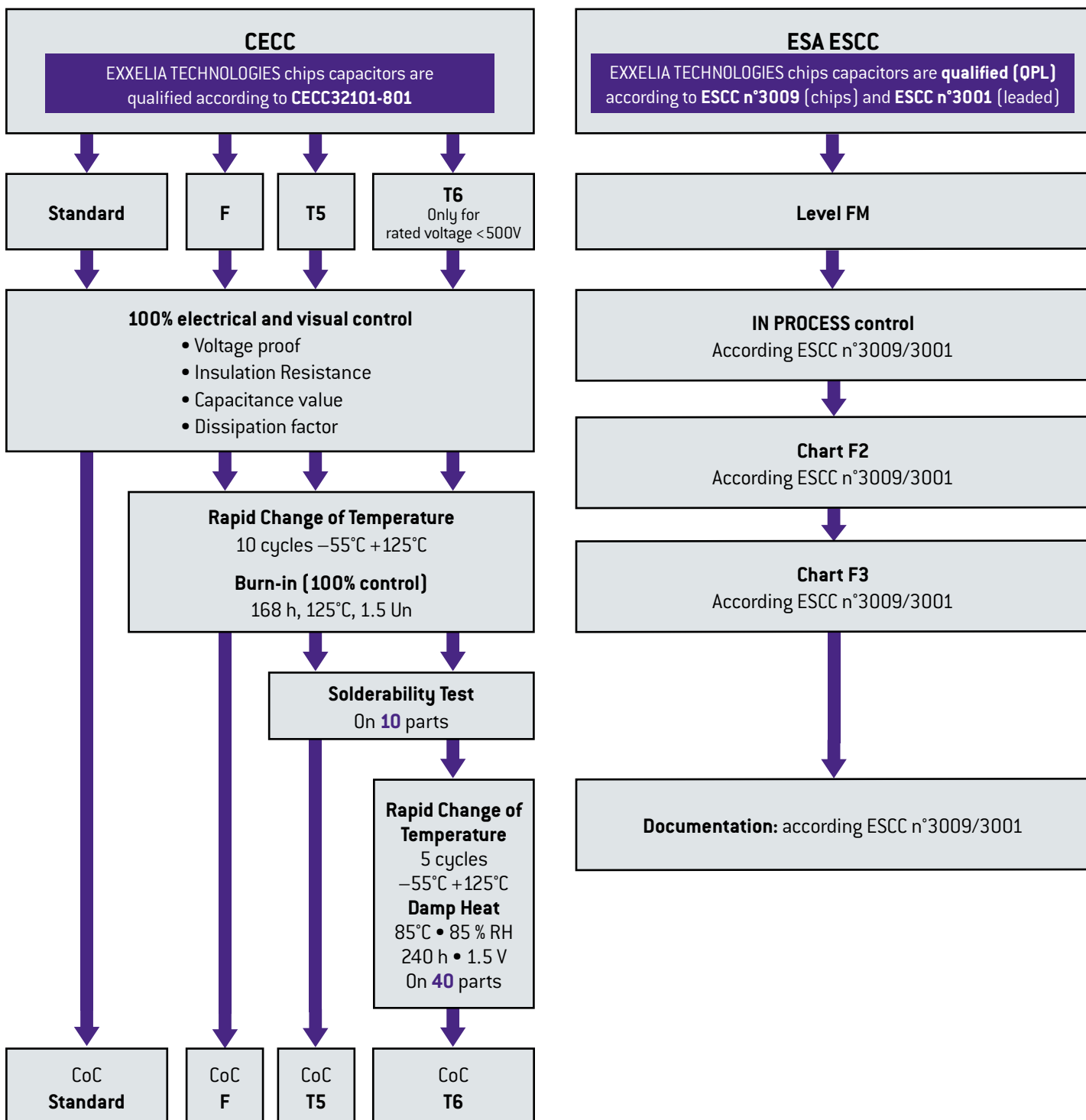
Use the following tolerance code chart for part markings:

| Tolerance | Letter code |
|-----------|-------------|
| ± 0.25pF | CU |
| ± 0.5pF | DU |
| ± 1pF | FU |
| ± 1% | F |
| ± 2% | G |
| ± 5% | J |
| ± 10% | K |
| ± 20% | M |

User Guide

RELIABILITY LEVELS

Exxelia proposes different reliability levels for the ceramic capacitors for both NPO and X7R ceramics.



As the world's leading manufacturer of specific passive components, we stand apart through our ability to quickly evaluate the application specific engineering challenges and provide a cost-effective and efficient solutions.

For requirements that cannot be met by catalog products, we offer leading edge solutions in custom configuration: custom geometries, packaging, characteristics, all is possible thanks to our extensive experience and robust development process, while maintaining the highest level of reliability.

Where necessary, special testing is done to verify requirements, such as low dielectric absorption, ultra-high insulation resistance, low dissipation factor, stability under temperature cycling or under specified environmental conditions, etc.

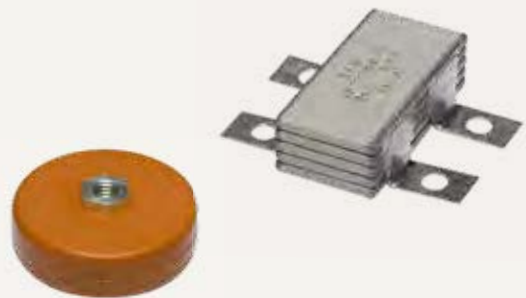
HIGH CAPACITANCE

- High energy density
- Specific case sizes
- Specific shape of connections (high resistance to vibrations)



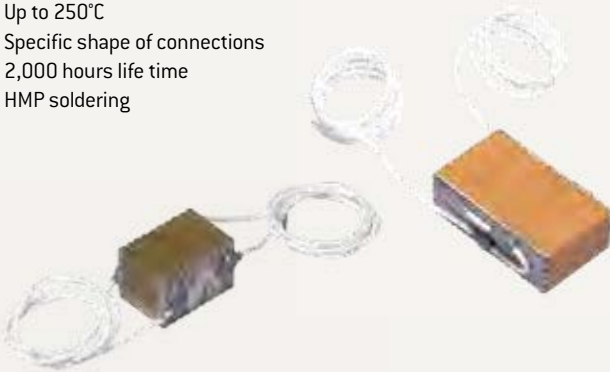
HIGH VOLTAGE

- Up to 50 kV
- Specific circular shape



HIGH TEMPERATURE

- Up to 250°C
- Specific shape of connections
- 2,000 hours life time
- HMP soldering



OTHERS

- Screen printed resistors
- Complex components
- Full functions available

