



FEATURES

- Planar capacitor arrays
- X7R dielectrics (NPO available on request)
- Capacitance range: 330pF - 68nF
- Voltage range: 25V_{DC} to 200V_{DC}
- Specific configurations available on request

PHYSICAL CHARACTERISTICS

CONSTRUCTION

Circular or rectangular multilayer capacitor arrays with Silver / Palladium / Platinum terminations. Other shapes available on request.

MARKING (on packaging)

Series, capacitance value, tolerance, rated voltage, batch number.

ELECTRICAL SPECIFICATIONS

| Description | X7R |
|--|---|
| Operating temperature | -55°C to +125°C |
| Maximum $\Delta C/C$ over temperature range without DC voltage applied | ± 15% |
| Climatic category | 55 / 125 / 56 |
| Rated voltage (U _{RC}) | 25V _{DC} to 200V _{DC} |
| Dielectric withstanding voltage at 25°C between holes and outside | 2.5 U _{RC} |
| Capacitance | at 1kHz |
| Dissipation factor at 25°C | ≤ 2.5% at 1kHz |
| Insulation resistance at 25°C under U _{RC} | ≥ 20,000MΩ |
| Aging | ≤ 2.5% per decade hour |

NPO, BX and BR dielectrics available on request.

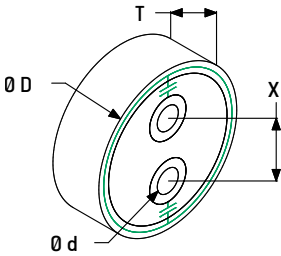
HOW TO ORDER

| BPM | 22 | W | 470nF | 10% | 200 V |
|---------------------|--|-----------------------------------|----------------------------|----------------|--------------------------------|
| Series | Design code | RoHS compliant | Capacitance | Tolerance | Rated voltage |
| BPM = Planar arrays | 22 = 2 capacitors - discoidal shape 224 = 4 capacitors - discoidal shape 24 = 4 capacitors - rectangular shape | - = No RoHS W = RoHS compliant | Capacitance value in clear | ± 10% ± 20% | 25 V 50 V 100 V 200 V |

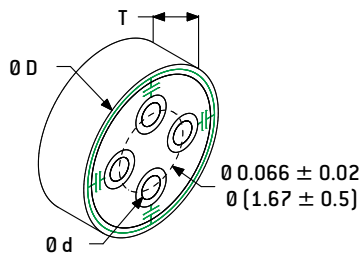
BPM Series

DIMENSIONS

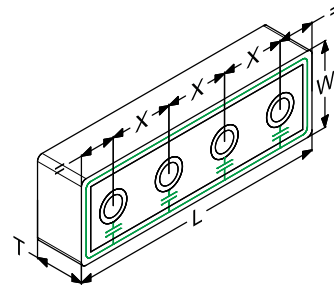
Design code 22



Design code 224



Design code 24



Black lines: mechanical

Green lines: electrical (external termination is connected to the ground)

STANDARD RATINGS

| Size | BPM22 | BPM224 | BPM24 | |
|-----------------------------------|-----------------------|-----------------|-----------------|----------------|
| Dimensions Inches [mm] | L ± 0.008 [± 0.2] | - | 0.248 [6.3] | |
| | W ± 0.008 [± 0.2] | - | 0.081 [2.05] | |
| | D ± 0.004 [± 0.1] | 0.142 [3.6] | 0.12 [3.05] | - |
| | d ± 0.002 [± 0.05] | 0.022 [0.55] | 0.019 [0.49] | - |
| | T max. | 0.048 [1.2] | 0.05 [1.25] | 0.048 [1.2] |
| | X ± 0.002 [± 0.05] | 0.056 [1.42] | - | 0.06 [1.52] |
| Min. Capacitance value | 330pF | 330pF | 330pF | |
| Rated voltage (U _{r,c}) | 25V | 68nF | 12nF | 56nF |
| | 50V | 39nF | 4.7nF | 27nF |
| | 100V | 18nF | 2.7nF | 12nF |
| | 200V | 8.2nF | - | 5.6nF |

Available capacitance values:

E6, E12 (see page 14). Specific values upon request.

For standard products capacitance value is the same for each hole, it can be different on request.

The above table defines the standard products, other components may be built upon request (NP0, BX, BR, shapes, number of holes, combination of capacitance values, etc.)

FEED-THRU

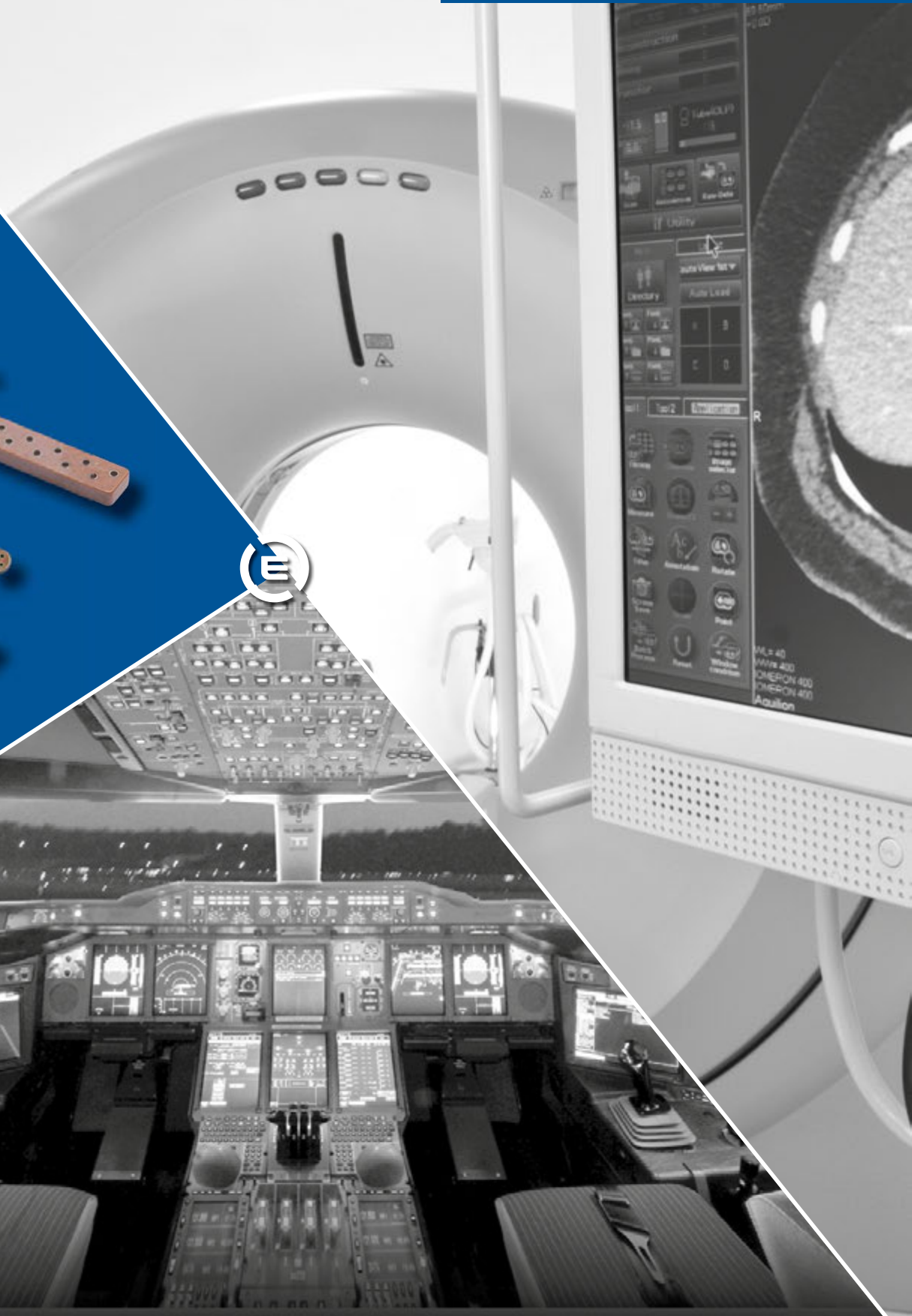
GENERAL INFORMATION 114

TBC SERIES

Discoidal Capacitors 115

BPM SERIES

Planar Arrays 117



General Information

Discoidal capacitors with NPO, X7R ceramics (BX and BR available on request) feature unique frequency performance due to very low inductance inherent to the configuration.

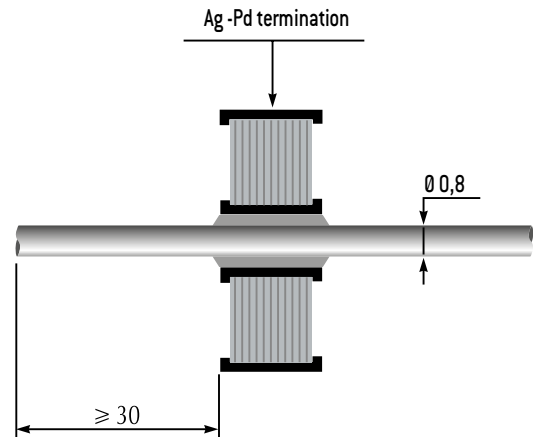
They are ideally suited to interconnect power amplifier stages through a shielding wall (high impedance electronic circuits).

Silver-palladium terminations can be directly mounted on the metal surface of the shielding wall.

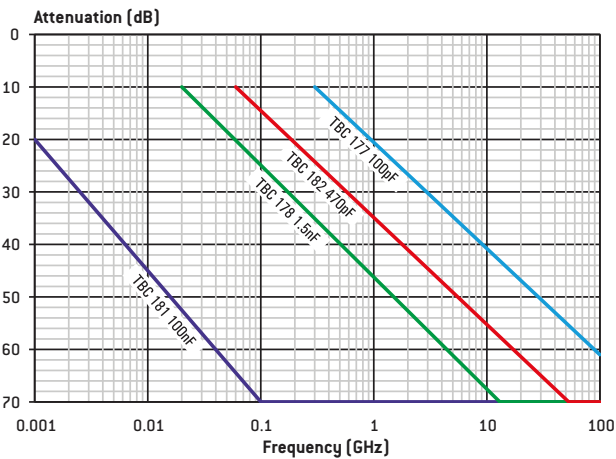
Multiple lines can be filtered simultaneously using the BPM Series which consist of multiple capacitors in the same component. These capacitors can have the same or different values. EXXELIA expertise and flexible manufacturing processes enable a wide range of arrays: custom configuration or geometry. Consult our Engineering team to support your design requirements.

Another version (option T) featuring central conductor configuration (illustrated below) enables to get rid of thermal and mechanical shocks inherent to lead soldering. This also eliminates the risks of plating deterioration during the soldering process.

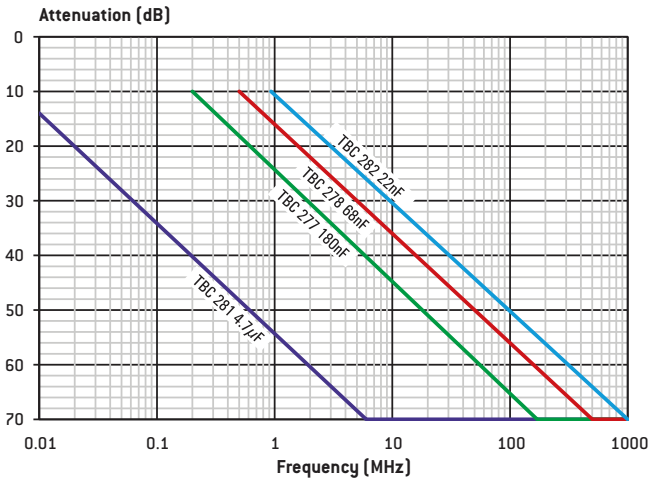
At last 2 lines can be filtered simultaneously using the BPM 12 or BPM 22 which consists of two capacitors in the same component (4 lines with the BPM24 or BPM224). These capacitors can have the same or different values (consult us).



NPO: TYPICAL ATTENUATION CURVE VERSUS FREQUENCY (50Ω IMPEDANCE)



X7R: TYPICAL ATTENUATION CURVE VERSUS FREQUENCY (50Ω IMPEDANCE)



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

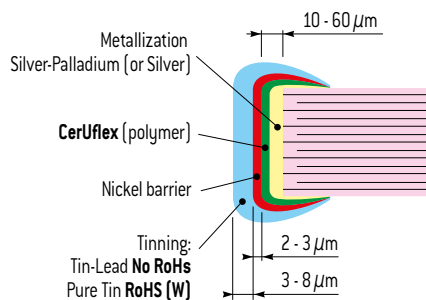
EXXELIA is committed to applying a robust environmental policy, from product design through to shipment. To control its environmental footprint and reconcile this with the company' functional imperatives, our environmental policy provides for the reduction or elimination of hazardous substances. We also 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 | | | • | | | | | | | | | Power supply, voltage multiplier, radars. • aerospace • space • defence • railways | 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 | | | | | | | | | | | | 65 |















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 | • | | | | | | | | | • | | Very low ESL 115 | |
| | BPM SERIES Planar Array  | - | X7R | 25V to 200V | 330pF to 68nF | -55°C to +125°C | • | | | | | | | | | • | | Very low ESL, miniaturisation 117 | |

Selection Guide

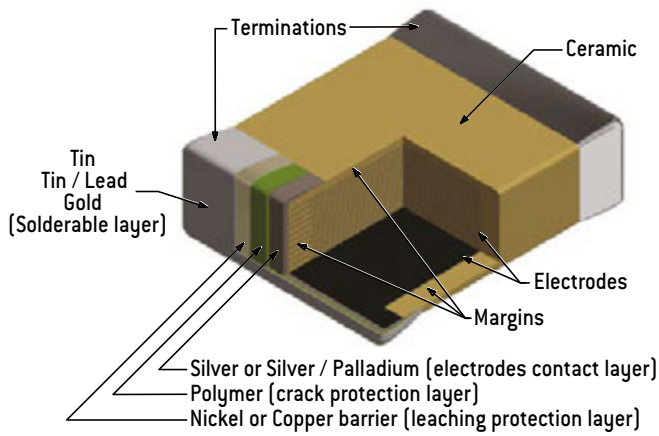
| Main Characteristic | Model | Size range | Dielectric | Voltage range | Capacitance range | Temperature range | Coating | | | | | Leads | | | | Mounting | | Main Applications | Page |
|---------------------|---|--------------------|------------|--------------------|----------------------|-----------------------|----------|-----------|------------------|--------|----------------|-------|--------|-------|--------|----------|--|-------------------|------|
| | | | | | | | Uncoated | Varnished | Conformal coated | Molded | Self protected | DIL | Ribbon | Axial | Radial | SMD | Through hole | | |
| | | | | | | | | | | | | | | | | | | | |
| HIGH Q | 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. | 129 | |
| | 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 Broadband Point to point/ multi-point radios RF generators | 132 | |
| | SHD / SHR SERIES Reverse Geometry  | 0709 0711 | NPO | 500V | 0.5pF to 100pF | -55°C to +175°C | • | | | | | | | | • | | | 135 | |
| | NHB SERIES High Self Resonant Frequency  | 1111 | NPO | 500V | 0.3pF to 100pF | -55°C to +175°C | • | | | | | | | | • | | 137 | | |
| | 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 | 139 | |
| | 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 | 143 | |

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 | | • | | | | | • | • | | | - |
| | LAG Series  | - | 2C1 | 25V to 63V | 100pF to 1µF | -55°C to +125°C | | • | | | | | • | • | | | - |
| HIGH VOLTAGE | 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, 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



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 Ω.F or MΩ.μF.

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:

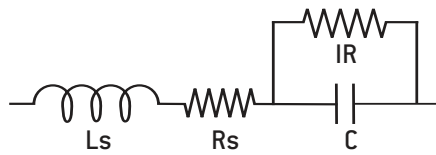
$$DF = 2\pi f C ESR$$

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

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

EQUIVALENT CIRCUIT

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



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

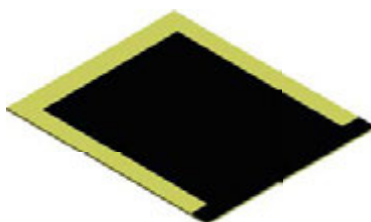
MANUFACTURING STEPS

SLIP CASTING



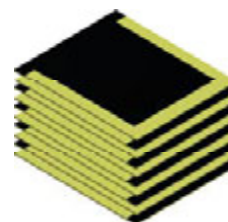
A slurry, a mix of ceramic powder, binder and solvents, is poured onto conveyor belt inside a drying oven, resulting in a dry ceramic sheet.

ELECTRODE SCREEN PRINTING



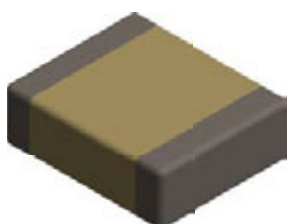
The electrode ink, made from a metal powder mixed with solvents, is printed onto the ceramic sheets using a screen printing process.

STACKING



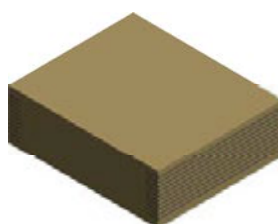
The sheets with electrode printed are stacked to create a multilayer structure.

TERMINATIONS



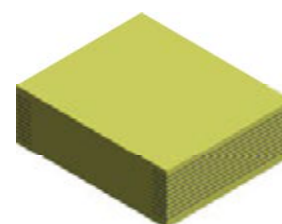
Each terminal of the capacitor is dipped in the termination ink, mix of metal powder, solvents and glass frit and the parts are fired in an oven.

SINTERING



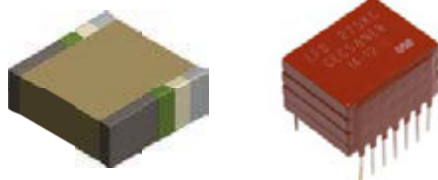
The parts are sintered in an oven with a precise temperature profile which is very important to the characteristics of the capacitors.

PRESSING



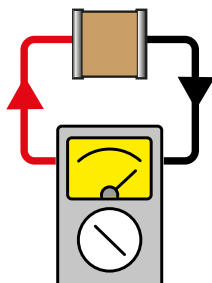
Pressure is applied to the stack to fuse all the separate layers, this created a monolithic structure.

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

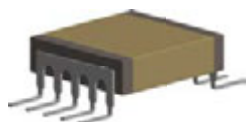
P style



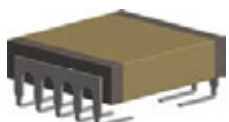
PL style



L style

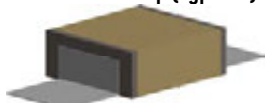


J style

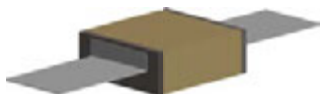


RIBBON LEADS

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



Axial (Type 2)



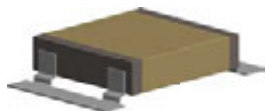
Radial (Type 3)



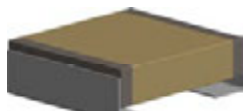
R style



RX style



RJ style



Please contact Exxelia sales for any lead configuration not shown.

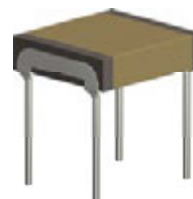
TROUGH-HOLE MOUNTING

AXIAL AND RADIAL

Radial leads (Type 6)



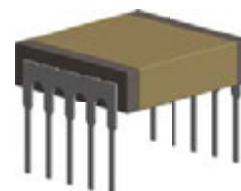
Radial leads (4 leads)



Axial leads (Type 7)



DIL leads: N style

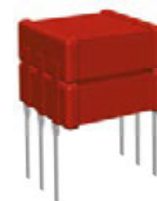


ENCAPSULATION STYLES

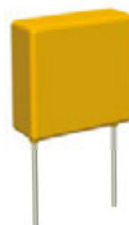
Ceramic encapsulation
(selfprotected)



Varnish



Conformal coating

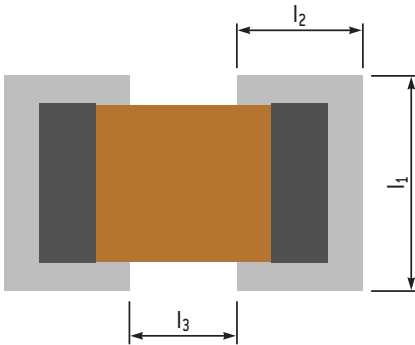


Molding



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

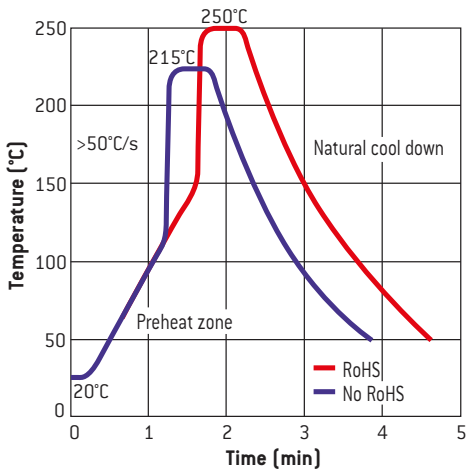
Ceramic is by nature a material which is sensitive both thermally and mechanically. Stresses caused by the physical and thermal properties of the capacitors, substrates and solders are attenuated by the leads.

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).

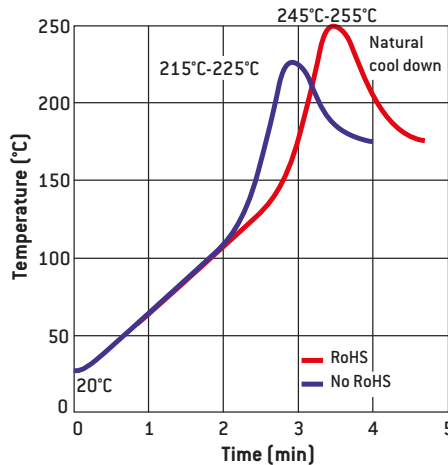
Infrared and vapor phase reflow, are preferred for high reliability applications as inherent thermo-mechanical strains are lower than those inherent to wave soldering.

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

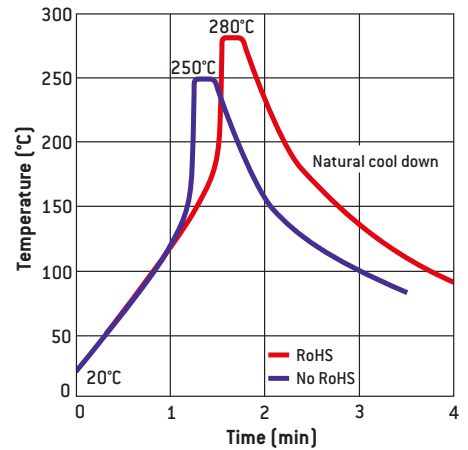
RECOMMENDED VAPOR PHASE REFLOW PROFILE



RECOMMENDED IR REFLOW PROFILE



RECOMMENDED WAVE SOLDERING PROFILE



User Guide

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,

- 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.

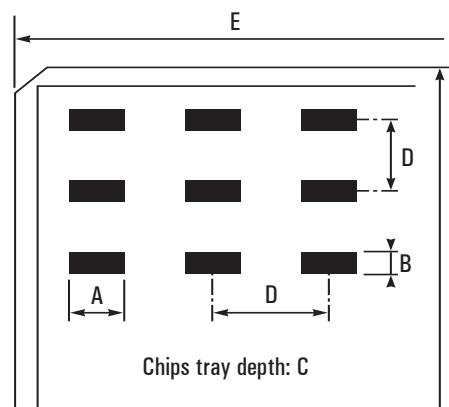
Maximum quantities per reel are as follows:

- 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) |

User Guide

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 | 27 | 43 |
| | | 47 |
| | | 51 |
| 82 | 33 | 56 |
| | | 62 |
| | | 68 |
| 91 | 39 | 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.

