

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

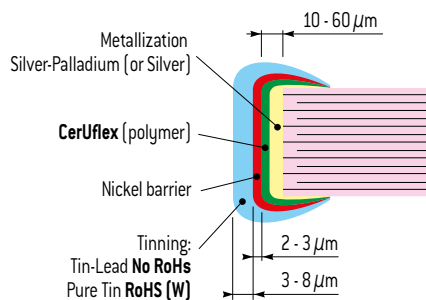
EXXELIA is committed to applying a robust environmental policy, from product design through to shipment. To control its environmental footprint and reconcile this with the company' functional imperatives, our environmental policy provides for the reduction or elimination of hazardous substances. We also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

General Information NPO/COG (Class 1)

COMPOSITION

NPO capacitors are produced by using a dielectric made of titanium dioxide (TiO_2) modified by magnesium oxide MgO (white ceramics) or a rare earth oxide, e.g. Nd_2O_3 (other NPO ceramics).

As a consequence, these ceramics are non ferro-electric materials with a low dielectric constant ($\epsilon_r \leq 110$).

Other additives are used to dope the dielectric constant up to 300. Though derogating from CG class, doped dielectric constant features a linear temperature drift and a matchless stability compared with class 2 ceramics.

The wide range of possible NPO dielectric compositions enables to use the material best suited to the application :

- standard applications,
- high voltage,
- high temperature,
- microwave,
- power capacitors.

«Temperature coefficient» compositions are particularly suitable for impedance matching. These ceramics usually enable to achieve temperature coefficients from 0 to $-1000 \text{ ppm}/^\circ\text{C}$. For specific requirements, other coefficients can be achieved (e.g. $-3300 \text{ ppm}/^\circ\text{C}$).

STABILITY

As ϵ_r is low, these dielectrics are extremely stable with only minor changes under such stresses as :

- temperature,
- voltage,
- frequency.

In addition, they are not affected by piezo-electric phenomena and their dielectric absorption coefficients are low and even non measurable for dielectrics with the lowest constants.

MECHANICAL PROPERTIES

Class 1 ceramics are the perfect match for metallic electrodes made of Pd or Ag-Pd alloy and have a high hardness and mechanical toughness making them resistant to thermal shocks (wave soldering for instance) and to thermal cycling after mounting on substrates having an expansion coefficient close to the capacitor one.

Ceramic chips meet CECC 32100 and NF C 93133 standards.

CLIMATIC CATEGORIES

Climatic categories are identified by three-digit codes as per NF C 20700 standard. Coding method is described in table 6.

e.g. : $-55^\circ\text{C} + 125^\circ\text{C} / 56$ days category is identified by code 434.

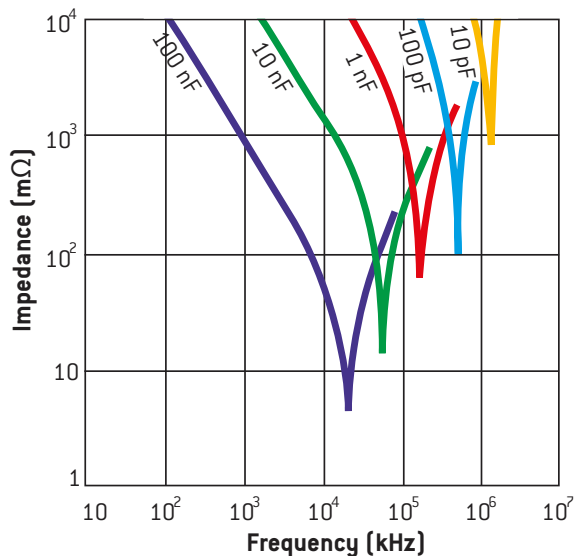
TEMPERATURE COEFFICIENT

Temperature coefficient $k\theta$ (ppm/ $^\circ\text{C}$)		
$k\theta$	Tolerances	Code letter
+ 100	± 30	AG
0	± 30	CG
- 33	± 30	HG
- 75	± 30	LG
- 150	± 30	PG
- 220	± 30	RG
- 330	± 60	SH
- 470	± 60	TH
- 750	± 120	UJ
- 1 000	± 250	QK

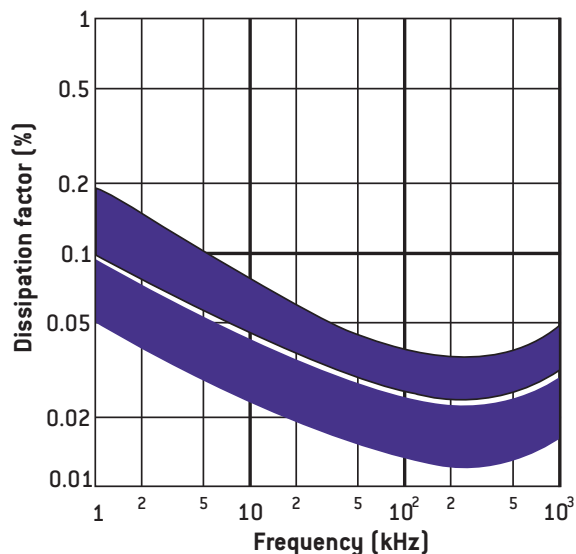
General Information NPO/COG (Class 1)

STANDARD

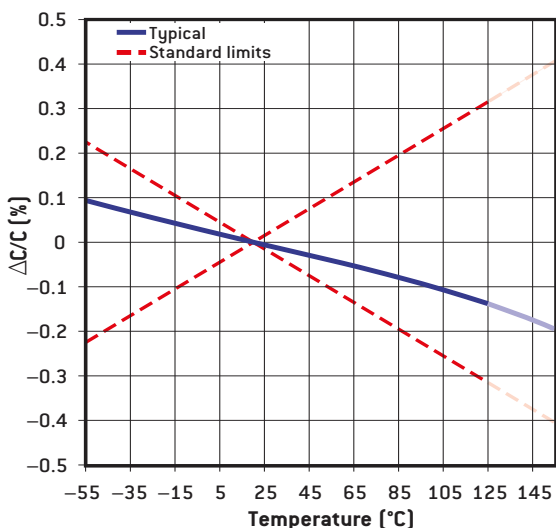
IMPEDANCE VERSUS FREQUENCY



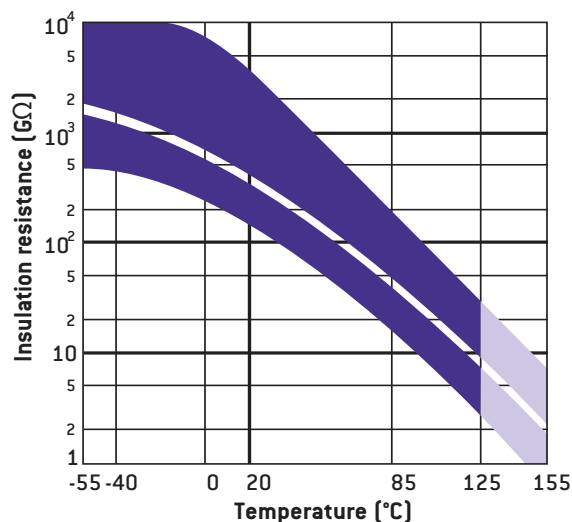
DISSIPATION FACTOR VERSUS FREQUENCY



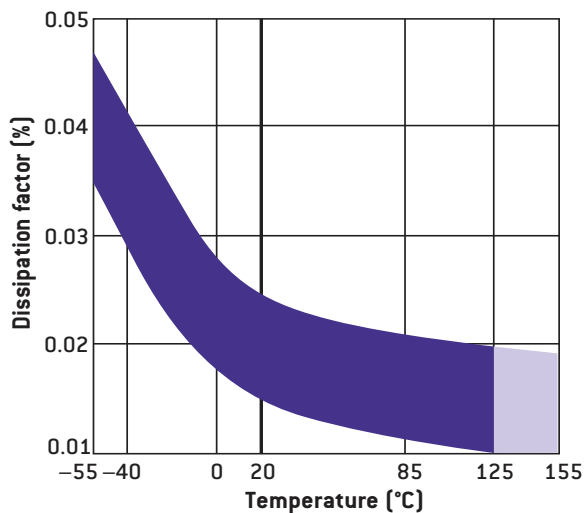
CAPACITANCE CHANGE VERSUS TEMPERATURE



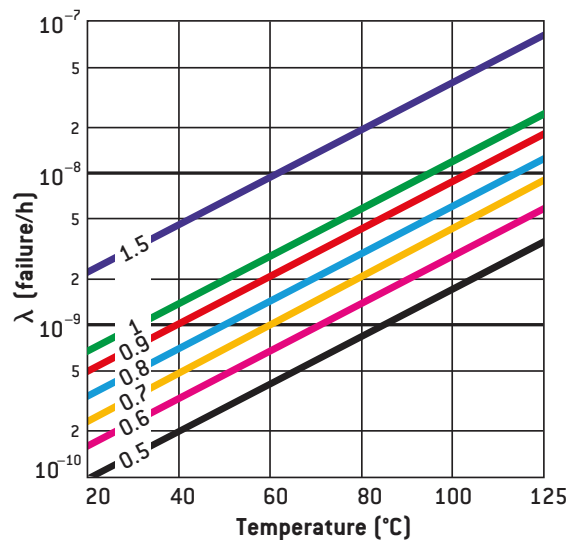
IR VERSUS TEMPERATURE



DISSIPATION FACTOR VERSUS TEMPERATURE



TYPICAL FAILURE RATE VERSUS TEMPERATURE



General Information X7R (Class 2)

COMPOSITION

Class 2 capacitors are produced by using a dielectric made of barium titanate (Ba Ti O₃). By nature, the dielectric is a ferroelectric compound with a high dielectric constant usually varying :

- from 1000 to 5000 - typical of capacitors meeting 2C1 type specifications (BX, X7R),
- from 5000 to 15000 - typical of capacitors meeting Z5U or Y5V type specifications.

Depending on whether the dielectric contains a flux additive, mainly bismuth or boron, electrodes are made of Ag-Pd alloys with high silver content or high palladium content, even pure palladium in some cases.

STABILITY

As the dielectric is a ferro-electric material, class 2 capacitors present significant variations under such stresses as :

- temperature,
- voltage,
- frequency.

In addition, the dielectric absorption coefficient can reach a few % and piezo-electric phenomena can affect the dielectric at critical frequencies (full information and specific documents available on request).

MECHANICAL PROPERTIES

Class 2 dielectrics are hard materials and are sensitive to thermo-mechanical stress. Stress should be limited when mounting and adequate substrates with an adapted expansion coefficient used.

BISMUTH OR BISMUTH FREE DIELECTRICS

Class 2 capacitors are made of ceramics capable to embed a flux element (e.g. bismuth or boron salt). Their eventual use will affect the choice of electrode alloys firing temperature used. Capacitor behavior under such constraints as temperature, voltage, frequency and even reliability, in some applications (further information available on request), is also different.

That is why French and European standard authorities have decided to differentiate bismuth from bismuth free ceramics by measuring tangent δ at -55°C . Tangent $\text{Tg } \delta (-55^{\circ}\text{C}) 350.10^{-4}$ in flux free dielectrics.

Flux free dielectrics are identified by suffix «A» after capacitor type (e.g. CNC2A).

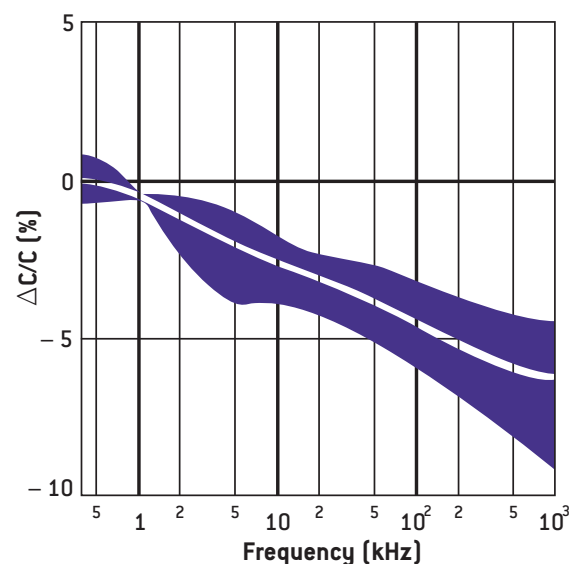
CAPACITANCE/TEMPERATURE RELATIONSHIP

Capacitance variations are defined within a specified temperature range, +20°C being the reference temperature. This characteristic is expressed by associating the temperature range and capacitance stability.

Stability category Code letter	Max. capacitance variation (%) with reference to capacitance at 20°C	
	Without voltage	At rated DC voltage (U _{DC})
B	± 10	+ 10– 15
C	± 20	+ 20– 30
D	+ 20 – 30	+ 20 – 40
E	+ 20 – 55	+ 20 – 65
R	+ 15 – 15	Not applicable
X	+ 15 – 15	+ 15 – 25

Temperature category	
Code	Temperature range
1	– 55°C + 125°C
2	– 55°C + 85°C
4	– 25°C + 85°C

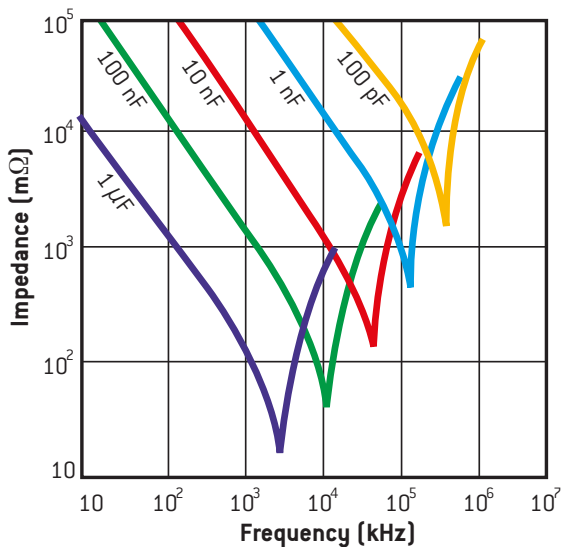
CAPACITANCE CHANGE VERSUS FREQUENCY



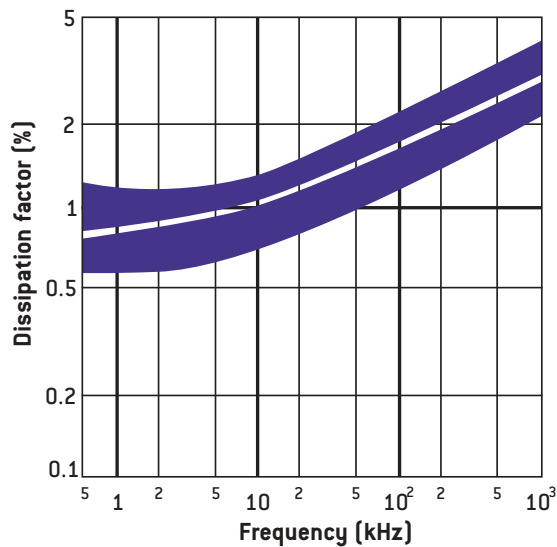
General Information X7R (Class 2)

STANDARD

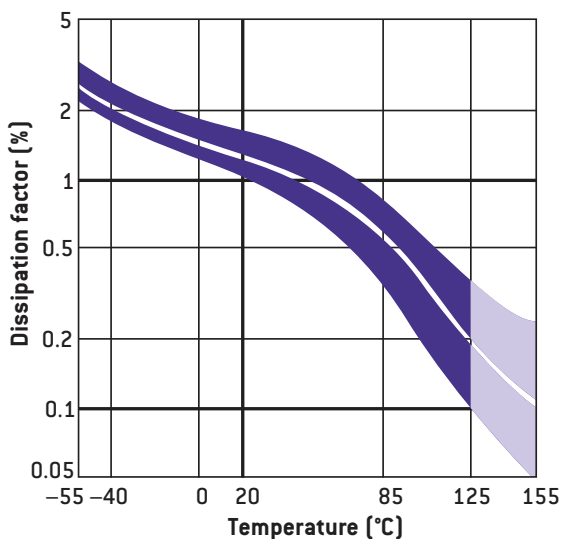
IMPEDANCE VERSUS FREQUENCY



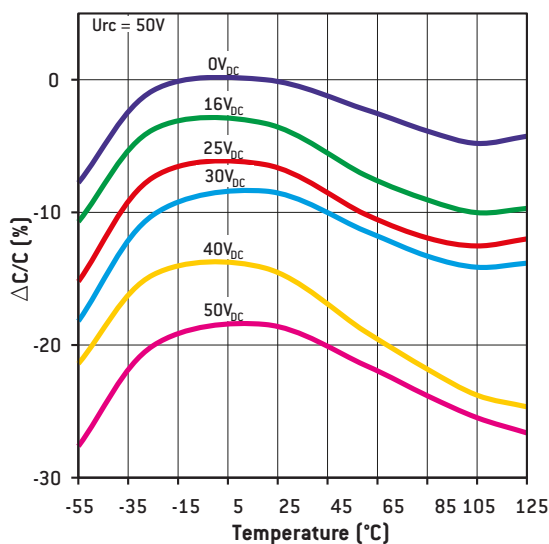
DISSIPATION FACTOR VERSUS FREQUENCY



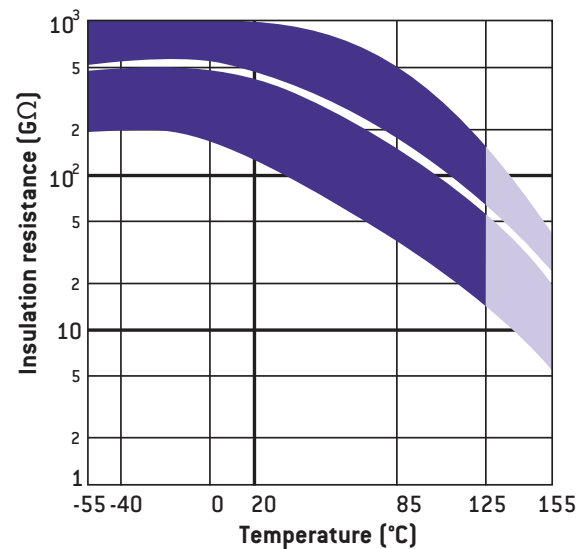
DISSIPATION FACTOR VERSUS TEMPERATURE



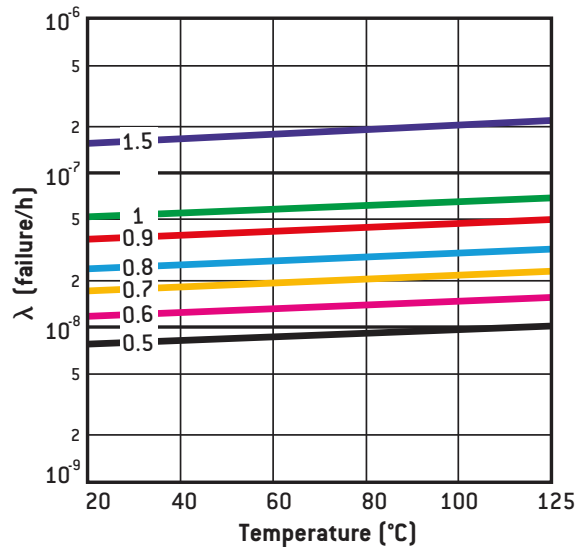
CAPACITANCE CHANGE VERSUS TEMPERATURE



IR VERSUS TEMPERATURE



TYPICAL FAILURE RATE VERSUS TEMPERATURE





FEATURES

- 4 terminals security capacitors
- Detection of the open circuits
- NPO and X7R dielectrics
- Capacitance range: 470pF to 820nF
- Ag/Pd/Pt, tinned terminations, ribbon connections available
- RoHS and Non RoHS compliant capacitors available

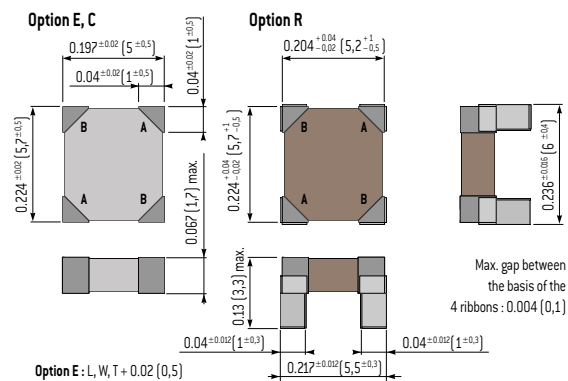
PHYSICAL CHARACTERISTICS

MLCC capacitors for surface mounting with optional Nickel barrier or ribbon connections

ELECTRICAL SPECIFICATIONS

Description	NPO	X7R
Operating temperature	-55°C to +125°C	-55°C to +125°C
Climatic category	55 / 125 / 56	55 / 125 / 56
Rated voltage (U_{RC})	40V _{DC} to 100V _{DC}	40V _{DC} to 100V _{DC}
Dielectric withstanding voltage at 25°C	2.5 U _{RC}	2.5 U _{RC}
Capacitance	at 1MHz for C ≤ 1,000pF at 1kHz for C > 1,000pF	at 1MHz for C ≤ 100pF at 1kHz for C > 100pF
Dissipation factor at 25°C	≤0.15% at 1MHz for C ≤ 1,000pF ≤0.15% at 1kHz for C > 1,000pF	≤2.5% at 1kHz
Insulation resistance at 25°C under U_{RC}	≥ 100,000MΩ	≥ 20,000MΩ for C ≤ 25nF ≥ 500MΩ.μF for C > 25nF
Aging	None	≤ 2.5% per decade hour

DIMENSIONS in inches (mm)



STANDARD RATINGS

Dielectric	NPO	X7R
Series	1 30 S4	2 30 S4
Min Capacitance value	470pF	3.3nF
Rated voltage (U_{RC})	40V	39nF
	63V	22nF
	100V	10nF
	820nF	560nF
		180nF

Available capacitance values:
 NPO: E6, E12, E24, E48, E96 (See page 14). Specific values upon request.
 X7R: E6, E12, E24 (See page 14). Specific values upon request.
 The above table defines the standard products, other components may be built upon request.

HOW TO ORDER

130S4	C	M	1.5nF	10%	63V
Series/Dielectric	Termination	Marking	Capacitance	Tolerance	Rated voltage
1 30 S4 = NPO 2 30 S4 = X7R	- Ag/Pd/Pt W Ag/Pd/Pt (RoHS) C Ag + Ni + electrolytic Sn/Pb 95/5 CW Ag + Ni + electrolytic Sn (RoHS) E Ag + Ni + dipped Sn/Pb 60/40 EW Ag + Ni + electrolytic Sn (RoHS) R Solderable ribbons RW Solderable ribbons (RoHS)	For Ag/Pd/Pt, E, C terminations: - = No marking M = Marking Systematic marking for ribbon terminations	Capacitance value in clear	NPO: ± 1% ± 2% ± 5% ± 10% ± 20% X7R: ± 10% ± 20%	40V 63V 100V Intermediary and higher voltages available on request.