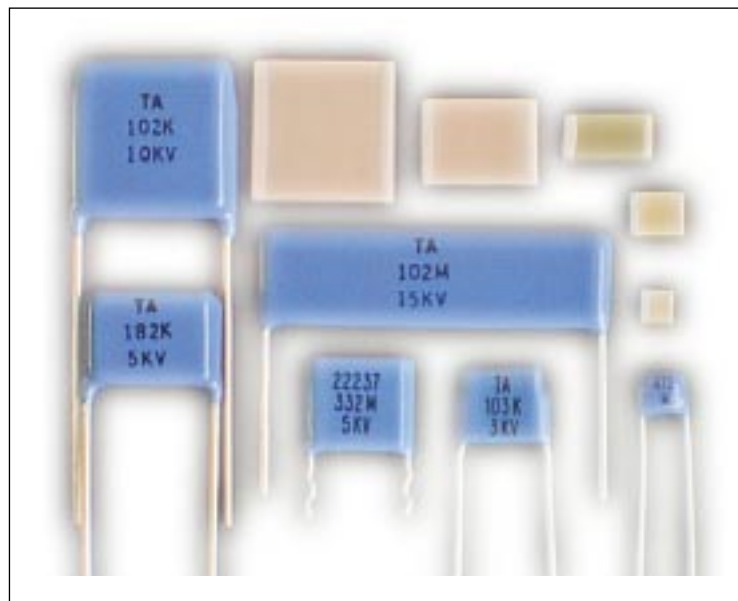




	PAGE
▶ <u>MEDIUM VOLTAGE</u>	<u>189</u>
▶ <u>HIGH VOLTAGE</u>	<u>197</u>

Description

TEMEX is proposing this range of capacitors (chips and leaded components) in order to assist the designers in their search of components for protection when environmental conditions (transient, electric electrostatic and/or electromagnetic origins) may disrupt electronic circuits.

Those capacitors are of course very well fitted to all applications requiring high voltage and / or filtering functions such as voltage multiplier, circuit protection, noise suppression, etc.

They are basically offered in:

- 3 popular IEC chip sizes 1210-1812-2220 compatible with silver-palladium terminations and radial leaded versions for standard insertion ; Both configurations in NPO and X7R dielectrics (see [tables 1 & 3](#)).
- 6 IEC chip sizes (1206,1210,1808,1812,1825,2225) with tinned nickel barrier for S.M.T applications ([see tables 2 & 4](#)).

For other sizes and capacitance-voltage combination, please consult your local sales office.

Recommendations

It is generally recommended in the industry to use reflow soldering techniques for such sizes of capacitors in order to prevent thermal shock which could crack the capacitor: this is the reason why the preferred type of terminations of the chips is an enhanced Silver-Palladium-version (A) insuring a 260° C 30 seconds soldering time free of leaching effect. Please consult us for this application.

Unless otherwise prescribed, the temperature profiles of CECC 00 802 are recommended.

Circuit applications in excess of 1000V may require adequate precaution (cleaning, surface coating, short metallized pads, slot in the P.C board...) to prevent external arcing.



MEDIUM & HIGH VOLTAGE CERAMIC CAPACITORS

Medium voltage

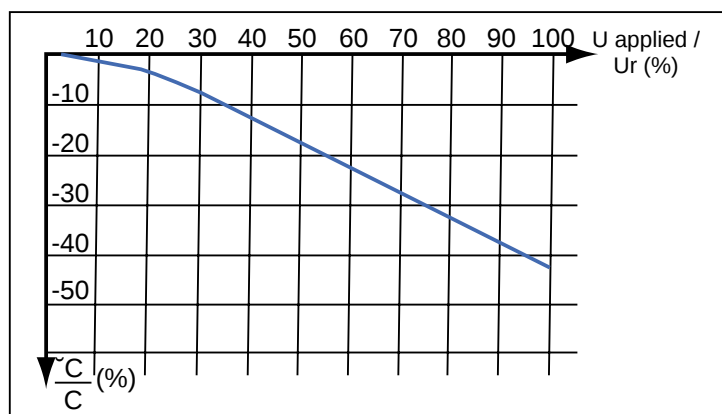
Characteristics

(Unless otherwise prescribed hereafter, the conditions of tests and measurements will be in accordance with the CECC 32101-801)

PARAMETER	NPO Dielectric	X7R Dielectric
TEMEX dielectric code	"N"	"X"
CECC Equivalence	Type 1 - 1B CG	Type 2- 2R1
Capacitance range	See tables 1 & 2	See tables 3 & 4
Voltage range (D.C)	200-500-1000-2000 V	200-500-1000-2000-3000-4000-5000 V
Tolerance on capacitance	Standard: 10 % (code K) On request: 5% (J)	Standard: 20% (code M) On request: 10% (K)
Temperature range	-55° C to +125° C	-55° C to +125° C
Temperature coefficient	0 ± 30 ppm /° C	Not applicable
Maximum variation of capacitance over temperature range	not applicable	±15 % with no voltage applied
Maximum variation of capacitance with applied voltage	not applicable	See curve of variation versus U applied / U rated
Ageing:	not applicable	2.5 % /decade hour
Tangent of the loss angle (or Dissipation Factor: D.F)	$\leq 15 \times 10^{-4}$	$\leq 25 \times 10^{-3}$
Insulation resistance: under U_r for $U_r = 200$ to 1000 V under 1000 V for $U_r > 1000$ V	@ 25° C: $R_I \geq 20 \text{ G}\Omega$ @ 125° C: $\geq 10 \text{ G}\Omega$ or $100 \text{ }\Omega\text{F}$ whichever is the less	@ 25° C $R_I \geq 20 \text{ G}\Omega$ for $C \leq 22 \text{ nF}$ $R_{I,C} \geq 500 \text{ }\Omega\text{F}$ for $C > 22 \text{ nF}$
Voltage proof	$2 \times U_r$ for $U_r \leq 500 \text{ V}$ $1.2 \times U_r$ for $U_r \geq 1000 \text{ V}$	$1.5 \times U_r$ for $U_r \leq 500 \text{ V}$ $1.2 \times U_r$ for $U_r \geq 1000 \text{ V}$
Test conditions for "C" and "D.F"		
Frequency	$C \leq 1000 \text{ pF}$ 1 MHz $C > 1000 \text{ pF}$ 1 kHz	1 kHz
Voltage	$< 5 \text{ Vrms}$	$1 \pm 0.2 \text{ Vrms}$

Note: For X7R dielectric the following curve of capacitance value versus applied voltage will apply:

Capacitance versus applied voltage (X7R dielectric) maximum deviation



MEDIUM & HIGH VOLTAGE CERAMIC CAPACITORS

Medium voltage

NPO

Table 1: NPO (Silver-Palladium terminations) - Capacitance / voltage range per case size:

Code	Cr pF/nF	0805 (R15)		1206 (R18)		1210 (S41)				1812 (S43)				2220 (S47)			
		Vdc		Vdc		Voltage (Vdc)				Voltage (Vdc)				Voltage (Vdc)			
		200V	500V	200V	500V	200V	500V	1000V	2000V	200V	500V	1000V	2000V	200V	500V	1000V	2000V
100	10																
120	12																
150	15																
180	18																
220	22																
270	27																
330	33																
390	39																
470	47																
560	56																
680	68																
820	82																
101	100																
121	120																
151	150																
181	180																
221	220																
271	270																
331	330																
391	390																
471	470																
561	560																
681	680																
821	820																
102	1000																
122	1200																
152	1500																
182	1800																
222	2200																
272	2700																
332	3300																
392	3900																
472	4700																
562	5600																
682	6800																
822	8200																
103	10																
123	12																
153	15																

Maximum allowed thickness per case size if not indicated:

0805 (R15)	1.3 mm
1206 (R18)	1.6 mm
1210 (S41) - 1812 (S43) - 2220 (S47)	1.8 mm

MEDIUM & HIGH VOLTAGE CERAMIC CAPACITORS

Medium voltage

NPO

Table 2: NPO (Tinned nickel barrier terminations) - Capacitance / Voltage range per case size:

Code	Cr pF/nF	1206 (R18)				1210 (S41)				1808 (R29)				1812 (S43)				1825 (S49)				2225 (S48)			
		200V	500V	1kV	2kV	200V	500V	1kV	2kV	200V	500V	1kV	2kV	200V	500V	1kV	2kV	200V	500V	1kV	2kV	200V	500V	1kV	2kV
100	10																								
120	12																								
150	15																								
180	18																								
220	22																								
270	27																								
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392	3900																								
472	4700																								
562	5600																								
682	6800																								
822	8200																								
103	10																								
123	12																								
153	15																								
183	18																								
223	22																								

For higher voltages, please consult us.

MEDIUM & HIGH VOLTAGE CERAMIC CAPACITORS

Medium voltage

X7R

Table 3: X7R (Silver-palladium terminations) Capacitance / Voltage range per case size:

Code	Cr pF/nF	0805 (R15)		1206 (R18)		1210 (S41)				1812 (S43)						2220 (S47)					
		Vdc		Vdc		Voltage (Vdc)				Voltage (Vdc)						Voltage (Vdc)					
		200	500	200	500	200	500	1000	2000	200	500	1000	2000	3000	4000	200	500	1000	2000	3000	4000
151	150																				
181	180																				
221	220																				
271	270																				
331	330																				
391	390																				
471	470																				
561	560																				
681	680																				
821	820																				
102	1000																				
122	1200																				
152	1500																				
182	1800																				
222	2200																				
272	2700																				
332	3300																				
392	3900																				
472	4700																				
562	5600																				
682	6800																				
822	8200																				
10000	103																				
12000	123																				
15000	153																				
18000	183																				
22000	223																				
27000	273																				
33000	333																				
39000	393																				
47000	473																				
56000	563																				
68000	683																				
82000	823																				
100000	104																				
120000	124																				
150000	154																				
180000	184																				
220000	224																				

Maximum allowed thickness per case size if not indicated:

0805 (R15)	1.3 mm
1206 (R18)	1.6 mm
1210 (S41) - 1812 (S43) - 2220 (S47)	1.8 mm

MEDIUM & HIGH VOLTAGE CERAMIC CAPACITORS

Medium voltage

X7R

Table 4: X7R (Tinned nickel barrier terminations) Capacitance / Voltage range per case size:

Cr pF/nF	Cr coding	0805 (R15)			1206 (R18)				1210 (S41)				1812 (S43)						2220 (S47)							2225 (S48)					
		200V	500V	1KV	200V	500V	1KV	2KV	200V	500V	1KV	2KV	200V	500V	1KV	2KV	3KV	4KV	200V	500V	1KV	2KV	3KV	4KV	5KV	500V	1KV	2KV	3KV	4KV	5KV
220	22																														
270	27																														
330	33																														
390	39																														
470	47																														
560	56																														
680	68																														
820	82																														
101	100																														
121	120																														
151	150																														
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681	680																														
821	820																														
102	1000																														
122	1200																														
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182	1800																														
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332	3300																														
392	3900																														
472	4700																														
562	5600																														
682	6800																														
822	8200																														
103	10																														
123	12																														
153	15																														
183	18																														
223	22																														
273	27																														
333	33																														

Maximum allowed thickness per case size if not indicated:

1206 (R18) 1.6 mm

1210 (S41) - 1812 (S43) - 2220 (S47) 1.8 mm

For 1808 & 1825 sizes, please consult your local sales office.

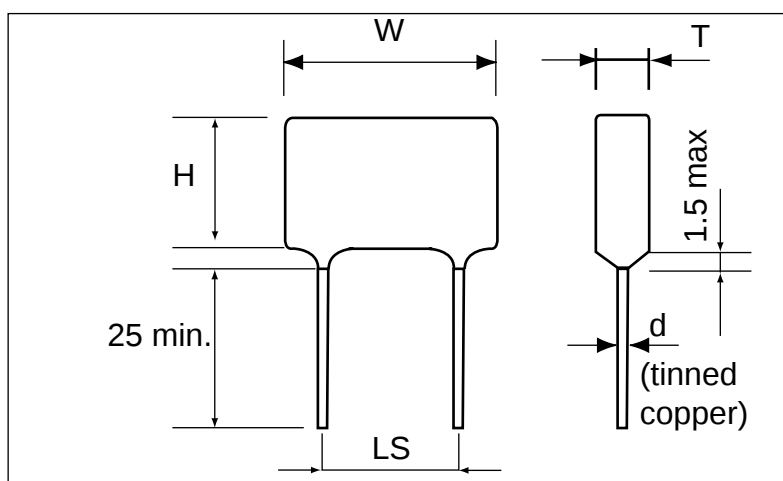
Medium voltage

(All dimensions are given in mm)

Applicable for chips described in [tables 1 & 3](#)

(*) top of the range value: 2.5 mm
For chips described in [tables 2 & 4](#), please refer to general U.S. dimension table, [page 132](#).

Only 1812 and 2220 of the [tables 1 & 3](#) are offered with radial wire terminations. Those parts are epoxy coated (dark blue) and marked with: TA logo, capacitance value (coded), tolerance (coded) and voltage (coded).



Case size	Thickness T max (*)	Width W max	Height H max	Lead spacing L.S. ± 0.5	Wire diameter d ± 10%
1812 (S43)	3.2	7.1	6.6	5.08	0.6
2220 (S47)	3.2	8.3	8.5	5.08	0.6

(*) 3.7 mm for last value of each voltage (top of the range)

MEDIUM & HIGH VOLTAGE CERAMIC CAPACITORS

Medium voltage

How to order?

(Codification of the parts)

The values indicated in tables 1 to 4 are standard values ; they can be codified as follows:

202	S43	N	101	K	V	E
↓	↓	↓	↓	↓	↓	↓
Voltage code: 201 = 200 V 501 = 500 V 102 = 1 kV 202 = 2 kV 302 = 3 kV 402 = 4 kV 502 = 5 kV	Case size: R18 = 1206 S41 = 1210 R29 = 1808 S43 = 1812 S49 = 1825 S47 = 2220 S48 = 2225	Dielectric code: N = NPO X = X7R	Capacitance value code: the first two digits are significant of C ; the last one is the number of "0" to read the capacitance in "pF": 150 = 15 pF 151 = 150 pF 103 = 10000 pF	Tolerance code: J = $\pm 5\%$ K = $\pm 10\%$ M = $\pm 20\%$	Termination code: V = Tin over nickel barrier P = Silver-Palladium A = enhanced silver-palladium (consult us) R = Radial leads (for S43 and S47 shown on tables 1 & 3 page 191 & 193)	When pieces are required taped, please specified "E" for embossed plastic tape ; (Quantity per reel is depending upon chip size)

Note:

The standard chip version ([tables 1 & 3](#)) is delivered with Silver-Palladium (P) terminations. For enhanced silver-palladium termination (A), please consult us.

Chips capacitors described in [tables 2 & 4](#) will be delivered with nickel-barrier ("V") terminations unless otherwise required.

The last digit (E) apply only for chip version (P or V) when parts are requested to be delivered on tape.

For leaded devices:

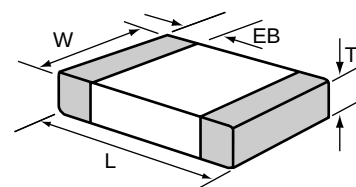
Taping may also be achieved for some sizes, please consult your local sales office.

High voltage

Description (chips)

-

Combination of standard case sizes may be obtained for special applications. They are suited for use in commercial industrial or High-Rel military circuits.



EB: min. / max. (mm) :
0.3 / 1.2 for size 1515
0.3 / 1.4 for sizes 2020 and 2520
0.5 / 2.0 for all other sizes

Dimensions (in mm)

CHIPS:

					Maximum thickness (T max) per case size/voltage									
Size (mm)	L	Tol.	W	Tol.	Voltage (kV)									
		(±)		(±)	1	2	3	4	5	6	7	8	9	10
1515	3.8	0.38	3.8	0.38	3.9	3.9	3.9	3.9						
2020	5.1	0.51	5.1	0.51	3.9	3.9	3.9	3.9						
2520	6.4	0.64	5.1	0.51	3.9	3.9	4.5	4.5	4.5					
3333	8.4	0.84	8.4	0.84	4.5	4.5	4.5	4.5	5.9	5.9				
4020	10.2	1.0	5.1	0.51	3.9	3.9	4.5	4.5	4.5	4.5	5.1	5.1	5.1	5.1
4040	10.2	1.0	10.2	1.0	3.9	4.5	5.1	5.1	5.1	5.1				
5440	13.7	1.4	10.2	1.0	4.5	5.1	5.1	5.1	6.4	6.4	6.4	6.4		
5550	14.0	1.4	12.7	1.3	4.5	5.1	6.4	6.4	6.4	6.4	6.4	6.4		
6560	16.5	1.7	15.2	1.5	4.5	5.1	5.1	5.1	6.4	6.4	6.4	6.4		
6666	16.8	1.7	16.8	1.7	3.9	4.5	4.5	5.1	6.4	6.4	6.4	6.4	6.4	6.4
7565	19.0	1.9	16.5	1.7	4.5	5.1	5.1	5.1	6.4	6.4	6.4	6.4		

 Preferred case size

MEDIUM & HIGH VOLTAGE CERAMIC CAPACITORS

High voltage

Description (leaded devices)

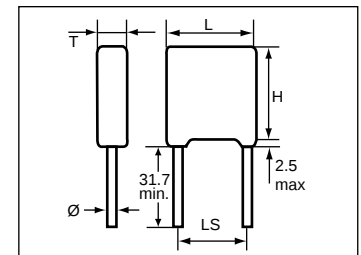
- 1 kV to 10 kV_{DC}
- NPO range 100 pF to 33 nF
- X7R range 100 pF to 470 nF

The high voltage series is intended for such typical applications as high voltage power supplies and voltage multiplier circuits.

Available as encapsulated leaded devices, they can be used in conventional circuits.

Their multilayer construction offers a significant size and space saving advantage over equivalent disc type capacitors.

They are suited for use in commercial industrial or high Rel military circuits.



Dimensions (in mm)

LEADED DEVICES:

					Maximum thickness (T max) per case size/voltage									
Size	L	L.S.	H	Ø	Voltage (kV)									
	max	±0.5	max	±10%	1	2	3	4	5	6	7	8	9	10
1515	6.3	5.08	5.8	0.6	5.2	5.2	5.2	5.2						
2020	7.6	5.08	7.1	0.6	5.2	5.2	5.2	5.2						
2520	8.9	7.62	7.1	0.6	5.2	5.2	5.8	5.8	5.8					
3333	11.4	10.16	10.4	0.9	5.8	5.8	5.8	5.8	7.2	7.2				
4020	13.2	12.70	7.1	0.9	5.2	5.2	5.8	5.8	5.8	5.8	6.4	6.4	6.4	6.4
4040	13.2	12.70	12.2	0.9	5.2	5.8	6.4	6.4	6.4	6.4				
5440	16.7	15.24	12.2	0.9	5.8	6.4	6.4	6.4	7.7	7.7	7.7	7.7		
5550	17.0	15.24	14.7	0.9	5.8	6.4	7.7	7.7	7.7	7.7	7.7	7.7		
6560	19.5	17.78	17.2	0.9	5.8	6.4	6.4	6.4	7.7	7.7	7.7	7.7		
6666	19.8	17.78	18.8	0.9	5.2	5.8	5.8	6.4	7.7	7.7	7.7	7.7	7.7	7.7

Preferred case size

MEDIUM & HIGH VOLTAGE CERAMIC CAPACITORS

High voltage - NPO

NPO

High voltage 1 kV to 4 kV Type: 1 (NPO)

NPO		1kV								2kV								3kV								4kV							
Code	Value	1515	2020	2520	3333	4040	5440	5550	6560	1515	2020	2520	3333	4040	5440	5550	6560	1515	2020	2520	3333	4040	5440	5550	6560	1515	2020	2520	3333	4040	5440	5550	6560
101	100 pF																																
121	120 pF																																
151	150 pF																																
181	180 pF																																
221	220 pF																																
271	270 pF																																
331	330 pF																																
391	390 pF																																
471	470 pF																																
561	560 pF																																
681	680 pF																																
821	820 pF																																
102	1 nF																																
122	1.2 nF																																
152	1.5 nF																																
182	1.8 nF																																
222	2.2 nF																																
272	2.7 nF																																
332	3.3 nF																																
392	3.9 nF																																
472	4.7 nF																																
562	5.6 nF																																
682	6.8 nF																																
822	8.2 nF																																
103	10 nF																																
123	12 nF																																
153	15 nF																																
183	18 nF																																
223	22 nF																																
273	27 nF																																
333	33 nF																																

High voltage - NPO

NPO

High voltage 5 kV to 10 kV Type: 1 (NPO)

[illegible]

MEDIUM & HIGH VOLTAGE CERAMIC CAPACITORS

High voltage - X7R

X7R

High voltage 1 kV to 4 kV Type: 2 (X7R)

X7R		1kV								2kV								3kV								4kV							
Code	Value	1515	2020	2520	3333	4040	5440	5550	6560	1515	2020	2520	3333	4040	5440	5550	6560	1515	2020	2520	3333	4040	5440	5550	6560	1515	2020	2520	3333	4040	5440	5550	6560
101	100 pF																																
121	120 pF																																
151	150 pF																																
181	180 pF																																
221	220 pF																																
271	270 pF																																
331	330 pF																																
391	390 pF																																
471	470 pF																																
561	560 pF																																
681	680 pF																																
821	820 pF																																
102	1 nF																																
122	1.2 nF																																
152	1.5 nF																																
182	1.8 nF																																
222	2.2 nF																																
272	2.7 nF																																
332	3.3 nF																																
392	3.9 nF																																
472	4.7 nF																																
562	5.6 nF																																
682	6.8 nF																																
822	8.2 nF																																
103	10 nF																																
123	12 nF																																
153	15 nF																																
183	18 nF																																
223	22 nF																																
273	27 nF																																
333	33 nF																																
393	39 nF																																
473	47 nF																																
563	56 nF																																
683	68 nF																																
823	82 nF																																
104	100 nF																																
124	120 nF																																
154	150 nF																																
184	180 nF																																
224	220 nF																																
274	270 nF																																
334	330 nF																																
394	390 nF																																
474	470 nF																																

MEDIUM & HIGH VOLTAGE CERAMIC CAPACITORS

High voltage - X7R

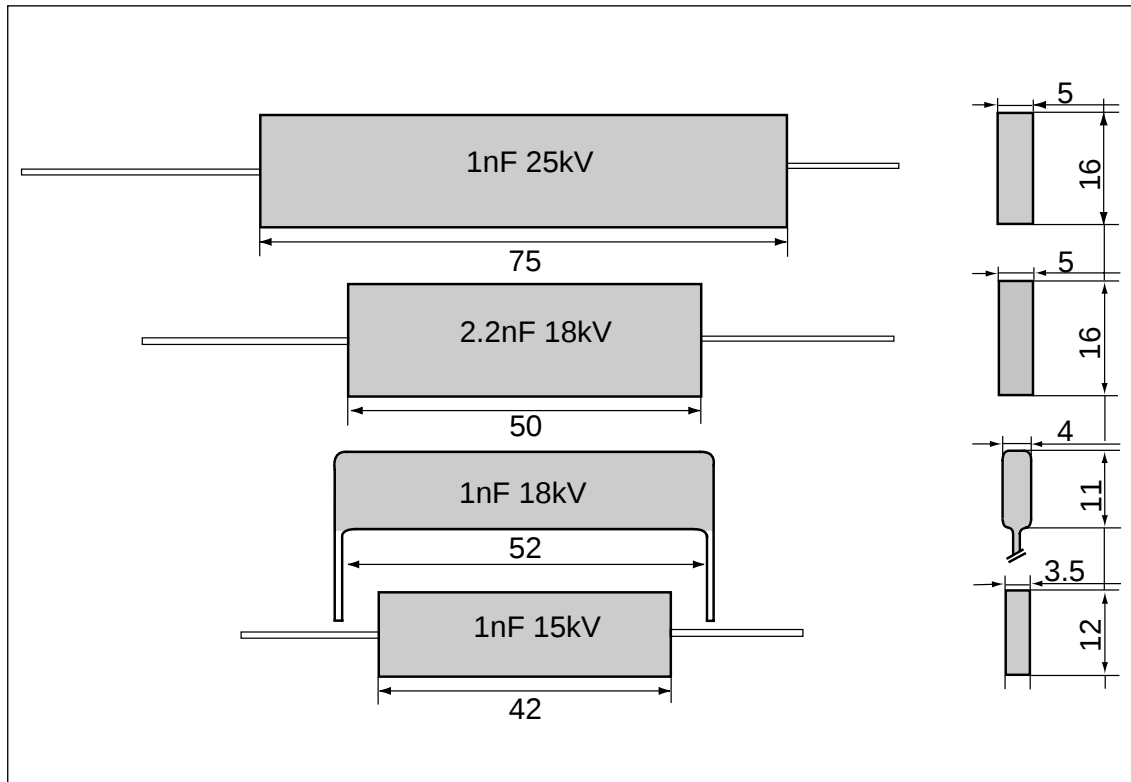
X7R

High voltage 5 kV to 10 kV Type: 2 (X7R)

X7R		5kV							6kV					7kV					8kV				9kV				10kV								
Code	Value	2520	4020	3333	4040	5440	5550	6560	4020	3333	4040	5440	5550	6560	4020	4040	5440	5550	6560	6666	4020	4040	5550	6560	6666	4020	4040	5550	6666	4020	4040	5550	6666		
101	100 pF																																		
121	120 pF																																		
151	150 pF																																		
181	180 pF																																		
221	220 pF																																		
271	270 pF																																		
331	330 pF																																		
391	390 pF																																		
471	470 pF																																		
561	560 pF																																		
681	680 pF																																		
821	820 pF																																		
102	1 nF																																		
122	1.2 nF																																		
152	1.5 nF																																		
182	1.8 nF																																		
222	2.2 nF																																		
272	2.7 nF																																		
332	3.3 nF																																		
392	3.9 nF																																		
472	4.7 nF																																		
562	5.6 nF																																		
682	6.8 nF																																		
822	8.2 nF																																		
103	10 nF																																		
123	12 nF																																		
153	15 nF																																		
183	18 nF																																		
223	22 nF																																		
273	27 nF																																		
333	33 nF																																		
393	39 nF																																		
473	47 nF																																		
563	56 nF																																		
683	68 nF																																		
823	82 nF																																		
104	100 nF																																		
124	120 nF																																		
154	150 nF																																		
184	180 nF																																		
224	220 nF																																		
274	270 nF																																		
334	330 nF																																		
394	390 nF																																		
474	470 nF																																		

SPECIAL TYPES

- You have found in the preceding pages our standard range of chips and leaded devices (epoxy coated).
- However, some special applications may require special features (higher voltage, burn-in, dimensions, coating, leading, marking, etc.) not described in the catalog.
- Based on the "State of the Art" and on their knowledge of the technology our Engineers may study, at your request, a product stemming from standard production but "Customized" to your application.
- Hereafter are some illustrations of the TEMEX special range developed with our customers.



- Please consult your local Sales Office for detailed information

MEDIUM & HIGH VOLTAGE CERAMIC CAPACITORS

High voltage

General characteristics

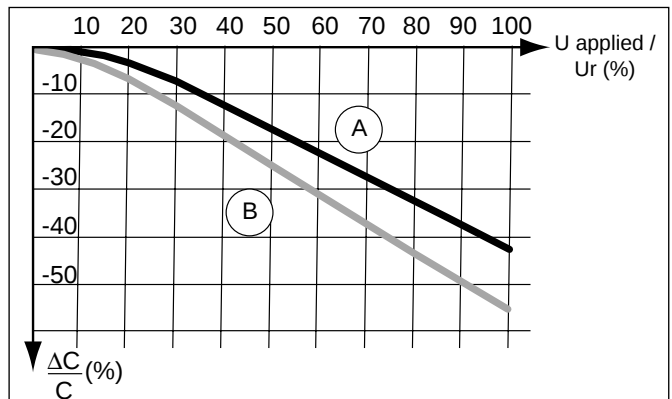
	Dielectric	
	type1 (NPO)	type 2 (X7R)
Capacitance range	100 pF - 33 nF	100 pF - 470 nF
Tolerance on capacitance	±5 ; ±10 ; ±20	±10 ; ±20
Voltage (U_R)	see table	see table
Voltage proof: (50 mA - 5 seconds)	$1.2 \times U_R$	$1.2 \times U_R$
Temperature range	-55° C / +125° C	-55° C / +125° C
Temperature coefficient or / characteristics	$0 \pm 30 \text{ ppm/}^\circ\text{C}$	± 15 %
Voltage coefficient	no effect	see curve
Ageing	no effect	2.5 % /decade hour
Dissipation factor (at 1 kHz, 25° C)	typ.: ≤0.04 % max: 0.1 %	typ.: ≤1.5 % max: 2.5 %
Insulation resistance 1000V, 25° C	100 GΩ or 1000 MΩ.μF 10 GΩ or 100 MΩ.μF (whichever is the less)	
1000V, 125° C		
Test conditions	1 kHz, 1 $V_{RMS} \pm 0.2 \text{ V}$ 20° C no bias	
Terminations	Chip: Silver palladium (P code) Leaded version: Tinned copper	
Marking: (leaded version only)	TA logo (*) C_R (coded) U_R Tolerance (coded)	

(*) Can be omitted on small sizes

How to order?

102	H4040	X	124	K	P	—
↓	↓	↓	↓	↓	↓	↓
Voltage code: 102 = 1 000V 202 = 2 000V 302 = 3 000V 502 = 5 000V 103 = 10 000V	High volt. series case size	Dielectric code: N = NPO X = X7R	Capacitance code: the first two digits are significant, third is the number of "0": ex: 124 120 000 pF	Tolerance code: J = ± 5 % (*) K = ± 10 % M = ± 20 % (*) NPO only	Termination • Radial leads : R • Silver Palladium (chip) : P	Special code for special requirement if any

Capacitance versus applied voltage
(X7R dielectric) maximum deviation



- All case sizes excepted 4020, 6666
Curve A: 1 to 3 kV
Curve B: 4 to 7 kV
- Case size 4020, 6666
Curve A: 1 to 7 kV
Curve B: 8 to 10 kV

High voltage - Surge Capacitors

NEW!

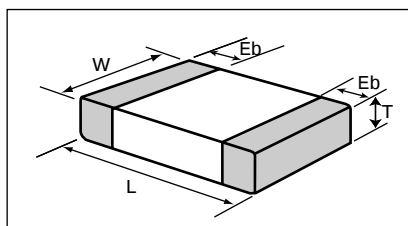
A 1 Euro coin is shown with several small, rectangular magnets placed on its surface. The magnets are arranged to form a heart shape, with some magnets at the top, bottom, and sides, and others forming the inner curve of the heart. The coin is silver-colored and has the word "EURO" and the number "1" visible.

- Developed for AC surge and lightning protection, these capacitors can be used in nearly all types of applications.

Protection for I/O electrical links in telephone and network equipment (modem, fax, telephone), protection for control/command modules in AC applications.

Ideal size for capacitance requirements with this voltage. Optimized for space and cost saving.

- IEC 60384-14 2nd Ed
- IEC 60384-1 amendment 3 cl 4.3, 4.4 & 4.14.2
- IEC 60950
- IEC 1000-4-5
- IEC 801-4-5
- EN132400:1994/A2:1998
- EN 61000-4-5
- IJ 1950



Case size	L: Length (mm)	W: Width (mm)	T: Thickness (mm)	Eb: End Band (mm)
R29/1808	4.57 ± 0025	2.03 ± 0.25	1.65 Max	0.38 ± 0.13

	NPO	Capa	Code
X7R		PF/nF	
		15	150
		18	180
		22	220
		27	270
		33	330
		39	390
		47	470
		56	560
		68	680
		82	820
		100	101
		120	121
		150	151
		180	181
		220	221
		270	271
		330	331
		390	391
		470	471
		560	561
		680	681
		820	821
		1	102
		1.2	122
		1.5	152

302	R29	X	101	K	V	E
Voltage code 302 = 3kV	Case size	Dielectric N = NPO X = X7R	Capacitance code (pF) 1st 2 digits are significant, 3rd digit = number of zeros. 101 = 100 pF	Tolerance code NPO: J = $\pm 5\%$ K = $\pm 10\%$ X7R K = $\pm 10\%$ M = $\pm 20\%$	Termination V = Nickel Barrier	E = Embossed plastic tapes