



# X7R - HIGH RELIABILITY - 16Vdc to 10KVdc



NOVACAP manufactures and tests X7R chips in accordance with MIL-PRF-55681, MIL-PRF-123, MIL-PRF-49467, or customer SCD. Product is designed for optimum reliability, burned in at elevated voltage and temperature, and 100% physically and electrically inspected to ascertain conformance to strict performance criteria. Voltage ratings from 16 VDC to 10,000 VDC are available on standard EIA case sizes. Applications for High Reliability products include medical implanted devices, aerospace, airborne and various military applications, and consumer uses requiring safety margins not attainable with conventional product.

## CAPACITANCE & VOLTAGE SELECTION FOR POPULAR CHIP SIZES

3 digit code: two significant digits, followed by number of zeros eg: 183 = 18,000 pF. R denotes decimal, eg. 2R7 = 2.7 pF

MAX CAP & VOLTAGE

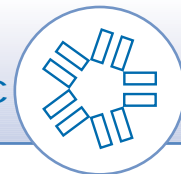
SIZE	0402	0504	0603	0805	1005	1206	1210	1515	1808	1812	1825	1825	1825	
Min Cap	121	121	121	121	121	121	121	151	151	151	151	151	471	471
Tmax	.024	.044	.035	.054	.054	.064	.065	.130	.065	.080 <sup>x</sup>	.065	.100 <sup>x</sup>	.080	.140 <sup>x</sup>
16V	472	333	223	104	124	274	474	105	394	684	824	824	155	225
25V	472	333	223	104	124	274	474	824	394	564	824	824	155	225
50V	472	333	223	823	104	224	394	824	334	474	684	684	125	185
100V	392	273	183	563	683	154	274	684	224	334	474	474	105	185
200V	182	123	822	223	333	823	124	394	124	154	224	394	564	105
250V	102	822	562	183	273	393	823	224	683	104	124	124	394	684
300V	•	•	•	103	123	273	563	184	563	683	104	154	274	474
400V	•	•	•	682	682	183	333	104	333	393	563	124	184	334
500V	•	•	•	472	472	123	273	823	273	333	473	683	124	274
600V	•	•	•	332	272	682	153	563	183	223	273	473	823	184
800V*	•	•	•	222	182	472	103	333	103	123	183	273	563	104
1000V*	•	•	•	122	821	222	562	183	562	822	103	183	333	563
1500V*	•	•	•	•	•	102	222	822	272	332	392	822	123	273
2000V*	•	•	•	•	•	471	102	392	122	152	182	332	682	123
3000V*	•	•	•	•	•	•	•	152	391	471	821	152	222	392
4000V*	•	•	•	•	•	•	•	•	181	271	391	681	821	182
5000V*	•	•	•	•	•	•	•	•	•	•	•	•	561	102
6000V*	•	•	•	•	•	•	•	•	•	•	•	•	•	•
7000V*	•	•	•	•	•	•	•	•	•	•	•	•	•	•
8000V*	•	•	•	•	•	•	•	•	•	•	•	•	•	•
9000V*	•	•	•	•	•	•	•	•	•	•	•	•	•	•
10000V*	•	•	•	•	•	•	•	•	•	•	•	•	•	•

Note: " x " denotes a special thickness (see Tmax row above). An X is required in the part number. Please refer to page 10 for how to order.

\* Units rated above 800V may require conformal coating in use to preclude arcing over the chip surface

**NOTE: REFER TO PAGES 10 & 11 FOR ORDERING INFORMATION**

# X7R - HIGH RELIABILITY - 16Vdc to 10KVdc



Stable EIA Class II dielectric, with +/-15% temperature coefficient and predictable variation of electrical properties with time, temperature and voltage. These chips are designed for surface mount application with nickel barrier terminations suitable for solder wave, vapor phase or reflow solder board attachment. Also available in silver-palladium terminations for hybrid use with conductive epoxy. Class II X7R chips are used as decoupling, by-pass, filtering and transient voltage suppression elements.

## CAPACITANCE & VOLTAGE SELECTION FOR POPULAR CHIP SIZES

3 digit code: two significant digits, followed by number of zeros eg: 183 = 18,000 pF. R denotes decimal, eg. 2R7 = 2.7 pF

SIZE	2020	2221	2225		2520	3333	3530	4040	4540	5440	5550	6560	7565			
Min Cap	102	471	471	471	102	102	102	102	102	102	102	222	222			
Tmax	.180	.080	.080	.150 <sup>x</sup>	.180	.250	.250	.300	.300	.300	.300	.300	.300			
16V	185	125	185	275	Note: " x " denotes a special thickness (see Tmax row above). An X is required in the part number. Please refer to page 10 for how to order.											
25V	155	125	185	225												
50V	155	125	155	225												
100V	1125	824	125	185												
200V	105	474	564	125	.	.	.	.	.	.	.	.	.			
250V	684	394	394	684	.	.	.	.	.	.	.	.	.			
300V	564	224	334	684	.	.	.	.	.	.	.	.	.			
400V	334	154	184	394	.	.	.	.	.	.	.	.	.			
500V	224	154	154	334	274	684	684	155	155	155	185	275	395			
600V	154	823	104	224	184	474	474	824	824	105	155	225	275			
800V*	104	563	683	124	124	334	334	564	684	824	125	185	225			
1000V*	563	273	393	823	683	184	184	394	474	474	684	105	125			
1500V*	123	123	153	333	333	823	823	184	184	224	274	474	564			
2000V*	123	562	822	153	153	473	473	104	104	124	184	224	334			
3000V*	472	182	222	562	562	223	223	393	473	473	683	104	154			
4000V*	182	821	102	222	272	123	123	183	223	273	393	563	823			
5000V*	102	561	561	122	182	682	822	103	153	183	273	393	473			
6000V*	.	.	.	.	.	472	562	682	103	123	183	273	333			
7000V*	.	.	.	.	.	.	392	472	682	822	123	183	273			
8000V*	.	.	.	.	.	.	272	392	562	682	103	153	183			
9000V*	.	.	.	.	.	.	222	272	392	472	682	123	153			
10000V*	.	.	.	.	.	.	152	222	332	392	562	822	123			

\* Units rated above 800V may require conformal coating in use to preclude arcing over the chip surface

NOTE: REFER TO PAGES 10 & 11 FOR ORDERING INFORMATION



# STANDARD SMT CHIP P/N BREAKDOWN

1206 N 472 J 101 N X050 H T M

Case Size

Dielectric Code

Code	EIA	Class
N	COG/NP0	Ultra Stable
B	X7R	Stable
X	BX	MIL
Y	Y5V	General Purpose
Z	Z5U	General Purpose
S	X8R	High Temp up to 150°C
D	COG/NPO	High Temp up to 200°C
E	Class II (Stable)	High Temp up to 200°C

Capacitance

1st two digits are significant, third digit denotes number of zeros, R= decimal

Examples:

- 1R0 = 1.0 pF
- 120 = 12 pF
- 471 = 470 pF
- 102 = 1,000 pF
- 273 = .027 μF
- 474 = 0.47 μF
- 105 = 1.0 μF

Capacitance Tolerance

Code		COG NPO	X7R	BX	Z5U Y5V	X8R 150°C	D 200°C	E 200°C
Cap Value < 10pF	B ±0.10pF	█						
	C ±0.25pF	█						
	D ±0.50pF	█						
	F ± 1%pF		█	█			█	
	G ± 2%pF		█	█			█	█
	J ± 5%pF		█	█		█	█	█
	K ±10%pF		█	█		█	█	█
	M ±20%pF		█	█	█	█	█	█
	Z +80% -20%		█	█	█	█	█	█
	P +100%/-0%		█	█	█	█	█	█

Marking

- M = Marked
- None = Unmarked
- Marking not available on sizes 0603 and below

Packaging

- T = Tape and Reel
- W = Waffle Pack
- None = Bulk

High Reliability Testing

- H = High Reliability Testing Required
- None = Standard SMT, no High-Rel
- Consult catalog to determine MIL SPEC required.

Special Thickness

- X in the part number denotes a special thickness other than standard. Specify in mils if required. (As shown above X=.050")
- If no X in the part number then thickness is standard per Novacap catalog specifications.

Termination

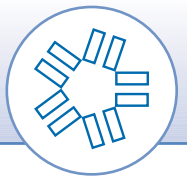
- N = Nickel Barrier (100% Tin)
- P = Palladium Silver
- Y = Nickel Barrier (90%Tin/10%Lead)
- S = Silver
- C = Polymer with Nickel Barrier (100% Tin)
- D = Polymer with Nickel Barrier (90%Tin/10%Lead)
- V = Non-Solderable Silver

Voltage

Examples:

- 160 = 16 Volts      202 = 2000 Volts
- 250 = 25 Volts      302 = 3000 Volts
- 500 = 50 Volts      402 = 4000 Volts
- 101 = 100 Volts      502 = 5000 Volts
- 251 = 250 Volts      602 = 6000 Volts
- 501 = 500 Volts      802 = 8000 Volts
- 102 = 1000 Volts      103 = 10,000 Volts

*This ordering information relates to NOVACAP's standard surface mount capacitors. Please refer to the specific catalog pages for ordering information for our application specific products; ie: Stacked, Leaded, Capacitor Arrays, Pulsed Power capacitors and other specialty products.*

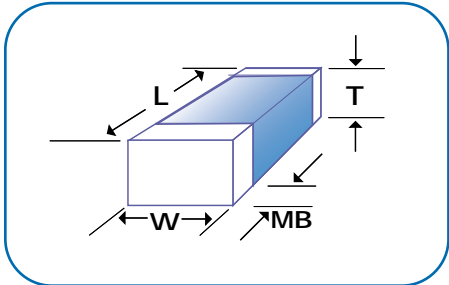


## PART NUMBER PREFIX DEFINITIONS

<b>LS</b> = Y3 Certified Safety Capacitor	pg. 36
<b>ES</b> = Y2 Certified Safety Capacitor	pg. 37
<b>AP</b> = Arc Prevention Capacitor	pg. 50
<b>CR</b> = Cap-Rack Capacitor Array	pg. 40 - 41
<b>RD</b> = Ring Detect Capacitor	pg. 38
<b>ST</b> = Stacked Capacitor Assembly	pg. 48 - 49
<b>SM</b> = Hi-Rel Stacked Capacitor Assembly	pg. 48 - 49

## CODE COMBINATIONS

Dielectric Code	Max. Temp. Rated	Terminations (allowed)
<b>N</b> (COG/NPO)	125°	N, P, Y, S, V
<b>B</b> (X7R)	125°	N, P, Y, C, D, S, V
<b>X</b> (BX)	125°	N, P, Y, C, D, S, V
<b>Y</b> (Y5V)	125°	N, Y, C, D
<b>Z</b> (Z5U)	125°	N, Y, C, D
<b>D</b> (NPO-HIGH TEMP)	200°	P, S, V
<b>E</b> (CLASS 11-HIGH TEMP)	200°	P, S, V
<b>F</b> (NPO-HIGH TEMP)	160°	N, P, Y, S, V
<b>G</b> (CLASS 11-HIGH TEMP)	160°	N, P, Y, S, V
<b>S</b> (X8R)	150°	N, P, Y, S, V
<b>P</b> (PULSE POWER)	125°	P
<b>R</b> (R2D)	200°	P



DIMENSIONS  
TOLERANCE +/-  
INCHES (MM)

SIZE	0402	0504	0603	0805	0907	1005	1206	1210	1515	1808	1812	1825
LENGTH L	.040 (1.02)	.050 (1.27)	.060 (1.52)	.080 (2.03)	.090 (2.29)	.100 (2.54)	.125 (3.18)	.125 (3.18)	.150 (3.81)	.180 (4.57)	.180 (4.57)	.180 (4.57)
WIDTH W	.020 (.508)	.040 (1.02)	.030 (.762)	.050 (1.27)	.070 (1.78)	.050 (1.27)	.060 (1.52)	.100 (2.54)	.150 (3.81)	.080 (2.03)	.125 (3.18)	.250 (6.35)
T MAX.	.024 (.610)	.044 (1.12)	.035 (.889)	.054 (1.37)	.054 (1.37)	.054 (1.37)	.064 (1.63)	.065 (1.65)	.130 (3.30)	.065 (1.65)	.065 (1.65)	.080 (2.03)
MB	.010 (.254)	.014 (.356)	.014 (.356)	.020 (.508)	.020 (.508)	.020 (.508)	.020 (.508)	.020 (.508)	.040 (1.02)	.024 (.610)	.024 (.610)	.024 (.610)
LENGTH	.004 (.102)	.006 (.152)	.006 (.152)	.008 (.203)	.008 (.203)	.008 (.203)	.008 (.203)	.008 (.203)	.015 (.381)	.012 (.305)	.012 (.305)	.012 (.305)
WIDTH	.004 (.102)	.006 (.152)	.006 (.152)	.008 (.203)	.008 (.203)	.008 (.203)	.008 (.203)	.008 (.203)	.015 (.381)	.008 (.203)	.008 (.203)	.015 (.381)
MB	.006 (.152)	.006 (.152)	.006 (.152)	.010 (.254)	.010 (.254)	.010 (.254)	.010 (.254)	.010 (.254)	.015 (.381)	.014 (.356)	.014 (.356)	.014 (.356)

DIMENSIONS  
TOLERANCE +/-  
INCHES (MM)

SIZE	2020	2221	2225	2520	3333	3530	4040	4540	5440	5550	6560	7565
LENGTH L	.200 (5.08)	.220 (5.59)	.220 (5.59)	.250 (6.35)	.330 (8.38)	.350 (8.89)	.400 (10.2)	.450 (11.4)	.540 (13.7)	.550 (14.0)	.650 (16.5)	.750 (19.1)
WIDTH W	.200 (5.08)	.210 (5.33)	.250 (6.35)	.200 (5.08)	.330 (8.38)	.300 (7.62)	.400 (10.2)	.400 (10.2)	.400 (10.2)	.500 (12.7)	.600 (15.2)	.650 (16.5)
T MAX.	.180 (4.57)	.080 (2.03)	.080 (2.03)	.180 (4.57)	.250 (6.35)	.250 (6.35)	.300 (7.62)	.300 (7.62)	.300 (7.62)	.300 (7.62)	.300 (7.62)	.300 (7.62)
MB	.024 (.610)	.030 (.762)	.030 (.762)	.030 (.762)	.030 (.762)	.030 (.762)	.040 (1.02)	.040 (1.02)	.040 (1.02)	.040 (1.02)	.040 (1.02)	.040 (1.02)
LENGTH	.015 (.381)	.015 (.381)	.015 (.381)	.015 (.381)	.017 (.432)	.018 (.457)	.020 (.508)	.023 (.584)	.027 (.686)	.028 (.711)	.033 (.838)	.038 (.965)
WIDTH	.015 (.381)	.015 (.381)	.015 (.381)	.015 (.381)	.017 (.432)	.015 (.381)	.020 (.508)	.020 (.508)	.020 (.508)	.025 (.635)	.030 (.762)	.033 (.838)
MB	.014 (.356)	.015 (.381)	.015 (.381)	.015 (.381)	.015 (.381)	.015 (.381)	.020 (.508)	.020 (.508)	.020 (.508)	.020 (.508)	.020 (.508)	.020 (.508)