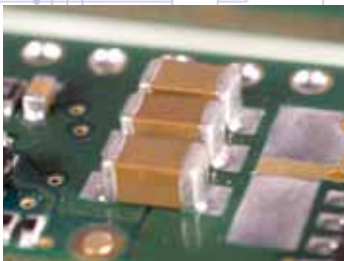


Ceramic Capacitors



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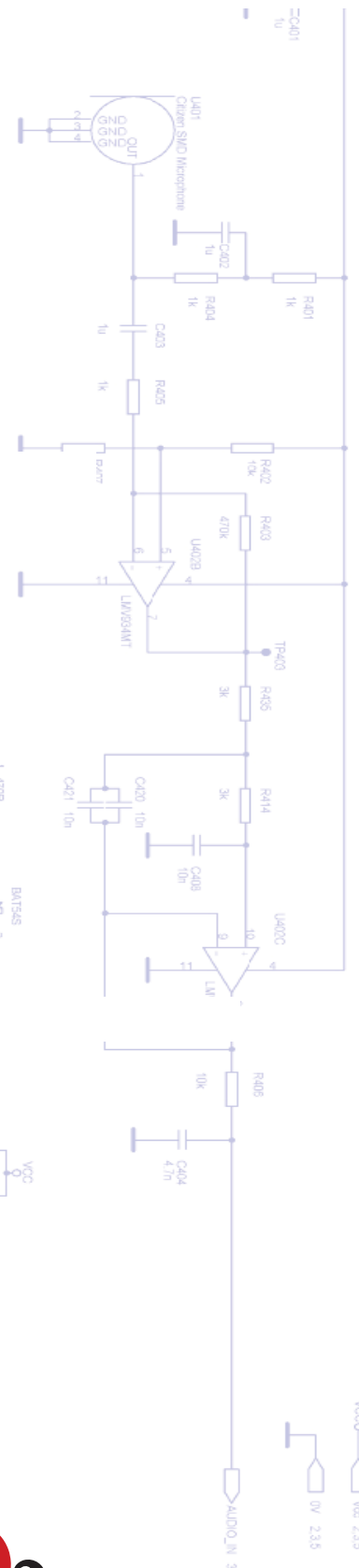
X2Y Filters

High Voltage

AC Safety

High Capacitance

Surface Mount





Your Technology Partner

The mission of the Johanson Companies is to translate our customer needs into quality electronic components, produced in factories that are models of excellence, supported by innovative service. With over 30 years of experience, Johanson Dielectrics provides both standard and custom technology solutions tailored to your specific electronic applications.

Our standard product range includes High Voltage and AC Safety Capacitors providing solutions for Lighting, IT and Business Equipment designs. Our X2Y® Capacitor line provides advanced EMI filtering and IC decoupling solutions and our High Capacitance Tanceram® products provide the highest capacitance values in the smallest cases sizes.

Customized solutions in the areas of high temperature and high AC power ceramic capacitors are available to customers who require a partnered technology solution.

Johanson Dielectrics design and manufacturing operations are located in Sylmar, California and Zhaoqing, PRC. Our quality minded management system utilizes and continuous improvement programs are focused on increased product reliability, manufacturing throughput, and product performance. Our broad experience, applications support, and responsive service enhance our ability to drive down your total cost of procurement and speed your time to market.

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Additional Products & Resources

Tin-Lead Termination Capacitors
Polyterm® Termination Capacitors
Tip & Ring 250 & 300 VDC
Low Inductance MLCCs
High Temperature MLCCs
Large Case Size MLCCs

NEW APPLICATION NOTES

- Lead-Free Reflow Processing
- High Voltage PCB Design
- X2Y Filter Evaluation & PCB Design Guide
- X2Y Filter Optimization for Inst. Amplifiers

Environmental Compliance Policy & Data

On-line sample, quote, and info request system.



CERAMIC CAPACITOR ENGINEERING DESIGN KITS

Johanson Dielectrics, Inc. has partnered with premiere on-line order provider Digi-key to offer a variety of multi-layer chip capacitor sample kits for proto-type design work. Each kit is grouped by type, size, or voltage and contains a selection of popular values and tolerances. The chips are individually packaged in labeled plastic compartments for easy access. The general range of kit contents is described below. Specific part number details may be found at Digi-key.com or JohansonDielectrics.com



0402 CERAMIC CHIP CAPACITOR KIT					P/N: S-0402	
1400 piece sample assortment of selected values from 1.0pF to 0.1µF						
Chip Size	Voltage Rating	Dielectric	Capacitanc Range	Qty / Value	Total Qty	
0402	50 VDC - 6.3 VDC	NPO, X7R,Y5V	1.0pF to 0.22µF	50 pcs	1400 pcs	

0603 CERAMIC CHIP CAPACITOR KIT					P/N: S-0603	
1400 piece sample assortment of selected values from 1.0pF to 0.1µF						
Chip Size	Voltage Rating	Dielectric	Capacitanc Range	Qty / Value	Total Qty	
0603	50 VDC - 16 VDC	NPO, X7R,Y5V	10pF to 0.22µF	50 pcs	1400 pcs	

0805 CERAMIC CHIP CAPACITOR KIT					P/N: S-0805	
1400 piece sample assortment of selected values from 1.0pF to 0.1µF						
Chip Size	Voltage Rating	Dielectric	Capacitanc Range	Qty / Value	Total Qty	
0805	100 VDC - 16 VDC	NPO, X7R	10pF to 0.47µF	50 pcs	1400 pcs	

TANCERAM® HIGH CAPACITANCE CERAMIC CHIP CAPACITOR KIT					P/N: S-TAN-X5R	
500 piece sample assortment of selected values from 1.0µF to 100µF						
Chip Size	Voltage Rating	Dielectric	Capacitanc Range	Qty / Value	Total Qty	
0402, 0603, 0805 1206, 1210	25 VDC - 6.3 VDC	X5R	1.0µF - 100µF	10 - 25 pcs	500 pcs	

500 VDC CERAMIC CHIP CAPACITOR KIT					P/N: S-500	
400 piece sample assortment of selected values from 33pF to 0.1µF						
Chip Size	Voltage Rating	Dielectric	Capacitanc Range	Qty / Value	Total Qty	
0805 - 1812	500 VDC	NPO, X7R	33pF to 0.1µF	10-20 pcs	400 pcs	

1000 VDC CERAMIC CHIP CAPACITOR KIT					P/N: S-1KV	
400 piece sample assortment of selected values from 22pF to 0.1µF						
Chip Size	Voltage Rating	Dielectric	Capacitanc Range	Qty / Value	Total Qty	
0805 - 2225	1000 VDC	NPO, X7R	22pF to 0.1µF	10-20 pcs	400 pcs	

Johanson may from time-time adjust actual kit contents based on design demand trends. Check the Johanson or Digi-key web site for design kit updates and kit content changes.



CERAMIC CAPACITOR ENGINEERING DESIGN KITS

2000 VDC CERAMIC CHIP CAPACITOR KIT					P/N: S-2KV
300 piece sample assortment of selected values from 22pF to 0.022μF					
Chip Size	Voltage Rating	Dielectric	Capacitanc Range	Qty / Value	Total Qty
1206 - 2225	2000 VDC	NPO, X7R	22pF to 0.022μF	10-20 pcs	300 pcs

X2Y/3 SAFETY CERTIFIED CERAMIC CHIP CAPACITOR KIT					P/N: S-SY3
240 piece sample assortment of selected values from 10pF to 1500 pF					
Chip Size	Voltage Rating	Dielectric	Capacitanc Range	Qty / Value	Total Qty
1808	3KV DC / 250 AC	NPO, X7R	10pF to 1500 pF	20 pcs	240 pcs

X1Y/2 SAFETY CERTIFIED CERAMIC CHIP CAPACITOR KIT					P/N: S-SY2
200 piece sample assortment of selected values from 10pF to 2200 pF					
Chip Size	Voltage Rating	Dielectric	Capacitanc Range	Qty / Value	Total Qty
1808 - 2220	5KV DC / 250 AC	NPO, X7R	10pF to 2200pF	20 pcs	200 pcs

X2Y® EMI FILTER CAPACITOR KIT - 0402 SIZE					P/N: S-X07-CBK
600 piece sample assortment of selected values from 1.0pF to 0.01μF					
Chip Size	Voltage Rating	Dielectric	Capacitanc Range	Qty / Value	Total Qty
0402	10 - 50 VDC	NPO, X7R	1.0pF to 0.01μF	50 pcs	600 pcs

X2Y® EMI FILTER CAPACITOR KIT - 0603 SIZE					P/N: S-X14-CBK
700 piece sample assortment of selected values from 1.0pF to 0.01μF					
Chip Size	Voltage Rating	Dielectric	Capacitanc Range	Qty / Value	Total Qty
0603	50 - 100 VDC	NPO, X7R	1.0pF to 0.01μF	50 pcs	700 pcs

X2Y® POWER BYPASS CAPACITOR KIT - 0603 SIZE					P/N: S-X14-PBP
300 piece sample assortment of selected values from 1.0pF to 1.0μF					
Chip Size	Voltage Rating	Dielectric	Capacitanc Range	Qty / Value	Total Qty
0603	6.3 - 100 VDC	X7R, X5R	1.0nF to 1.0μF	20 pcs	300 pcs

X2Y® EMI FILTER CAPACITOR KIT - 0805 SIZE					P/N: S-X15
300 piece sample assortment of selected values from 1.0pF to 0.01μF					
Chip Size	Voltage Rating	Dielectric	Capacitanc Range	Qty / Value	Total Qty
0805	50 - 100 VDC	NPO, X7R	1.0pF to 0.01μF	20 pcs	300 pcs

X2Y® DC MOTOR FILTER CAPACITOR KIT					P/N: S-X2Y-MTR
300 piece sample assortment of selected values from 0.10 to 0.47μF					
Chip Size	Voltage Rating	Dielectric	Capacitanc Range	Qty / Value	Total Qty
1206 - 1812	100 VDC	X7R	0.10 to 0.47μF	30 pcs	300 pcs

Johanson may from time-time adjust actual kit contents based on design demand trends. Check the Johanson or Digi-key web site for design kit updates and kit content changes.



HIGH VOLTAGE SURFACE MOUNT MLCCs 250 - 6,000 VDC



These high voltage capacitors feature a special internal electrode design which reduces voltage concentrations by distributing voltage gradients throughout the entire capacitor. This unique design also affords increased capacitance values in a given case size and voltage rating. The capacitors are designed and manufactured to the general requirement of EIA198 and are subjected to a 100% electrical testing making them well suited for a wide variety of telecommunication, commercial, and industrial applications.





APPLICATIONS

- Analog & Digital Modems
- Lighting Ballast Circuits
- DC-DC Converters
- LAN/WAN Interface
- Voltage Multipliers
- Back-lighting Inverters

NOW AVAILABLE with Polyterm® soft termination option for demanding environments & processes. Visit our website for full details.

Mechanical Characteristics

Available Capacitance

			Rated Voltage	NPO Dielectric		X7R Dielectric	
				Minimum	Maximum	Minimum	Maximum
R15/0805 		Inches (mm)	250 VDC	-	-	1000 pF	0.022 µF
	L	.080 ±.010 (2.03 ±.25)	500 VDC	10 pF	680 pF	1000 pF	0.010 µF
	W	.050 ±.010 (1.27 ±.25)	630 VDC	10 pF	560 pF	1000 pF	3900 pF
	T	.055 Max. (1.40)	1000 VDC	10 pF	390 pF	100 pF	2700 pF
	E/B	.020 ±.010 (0.51±.25)					
R18/1206 		Inches (mm)	250 VDC	-	-	1000 pF	0.068 µF
	L	.125 ±.010 (3.17 ±.25)	500 VDC	10 pF	1500 pF	1000 pF	0.027 µF
	W	.062 ±.010 (1.57 ±.25)	630 VDC	10 pF	1200 pF	1000 pF	0.010 µF
	T	.067 Max. (1.70)	1000 VDC	10 pF	1000 pF	100 pF	5600 pF
	E/B	.020 ±.010 (0.51±.25)	2000 VDC	10 pF	220 pF	100 pF	1000 pF
			3000 VDC	10 pF	82 pF	100 pF	220 pF
S41/1210 		Inches (mm)	250 VDC	-	-	1000 pF	0.120 µF
	L	.125 ±.010 (3.18 ±.25)	500 VDC	10 pF	3900 pF	1000 pF	0.047 µF
	W	.095 ±.010 (2.41 ±.25)	630 VDC	10 pF	2700 pF	1000 pF	0.027 µF
	T	.080 Max. (2.03)	1000 VDC	10 pF	1800 pF	100 pF	0.010 µF
	E/B	.020 ±.010 (0.51±.25)	2000 VDC	10 pF	560 pF	100 pF	2200 pF
			3000 VDC	10 pF	220 pF	100 pF	560 pF
R29/1808 		Inches (mm)	500 VDC	10 pF	4700 pF	1000 pF	0.056 µF
	L	.189 ±.010 (4.80 ±.25)	630 VDC	10 pF	3300 pF	1000 pF	0.039 µF
	W	.080 ±.010 (2.03 ±.25)	1000 VDC	1.0 pF	2200 pF	100 pF	0.018 µF
	T	.085 Max. (2.16)	2000 VDC	1.0 pF	820 pF	100 pF	6800 pF
	E/B	.020 ±.010 (0.51±.25)	3000 VDC	1.0 pF	470 pF	100 pF	3300 pF
			4000 VDC	1.0 pF	180 pF	100 pF	270 pF
			5000 VDC	1.0 pF	75 pF	47 pF	120 pF
			6000 VDC	1.0 pF	75 pF	47 pF	100 pF

Available capacitance values include the following significant retma values and their multiples:





1.0 1.2 1.5 1.8 2.2 2.7 3.3 3.9 4.7 5.6 6.8 8.2 (1.0 = 1.0, 10, 100, 1000, etc.)

Consult factory for non-retma values and sizes or voltages not shown.

HIGH VOLTAGE SURFACE MOUNT MLCCs 250 - 6,000 VDC

Mechanical Characteristics

Available Capacitance

	Inches	(mm)	Rated Voltage	NPO Dielectric		X7R Dielectric	
				Minimum	Maximum	Minimum	Maximum
S43 / 1812 	L	.180 ± .010	250 VDC	-	-	0.010 µF	0.220 µF
	W	.125 ± .010	500 VDC	100 pF	8200 pF	1000 pF	0.150 µF
	T	.110 Max.	630 VDC	100 pF	6800 pF	1000 pF	0.100 µF
	E/B	.025 ± .015	1000 VDC	10 pF	5600 pF	1000 pF	0.022 µF
			2000 VDC	10 pF	1800 pF	100 pF	6800 pF
			3000 VDC	10 pF	1000 pF	100 pF	4700 pF
			4000 VDC	10 pF	390 pF	100 pF	1500 pF
			5000 VDC	10 pF	150 pF	100 pF	680 pF
			6000 VDC	10 pF	150 pF	10 pF	680 pF
S49 / 1825 	L	.180 ± .010	500 VDC	100 pF	0.018 µF	0.01 µF	0.330 µF
	W	.250 ± .010	630 VDC	100 pF	0.015 µF	0.01 µF	0.220 µF
	T	.140 Max.	1000 VDC	10 pF	0.012 µF	1000 pF	0.039 µF
	E/B	.025 ± .015	2000 VDC	10 pF	5600 pF	100 pF	0.018 µF
			3000 VDC	10 pF	2200 pF	100 pF	8200 pF
			4000 VDC	10 pF	1200 pF	100 pF	2000 pF
			5000 VDC	10 pF	390 pF	100 pF	820 pF
			6000 VDC	10 pF	390 pF	100 pF	820 pF
	S47 / 2220 	L	.225 ± .015	500 VDC	1000 pF	0.018 µF	0.01 µF
W		.200 ± .015	630 VDC	1000 pF	0.018 µF	0.01 µF	0.270 µF
T		.150 Max.	1000 VDC	100 pF	0.015 µF	1000 pF	0.056 µF
E/B		.025 ± .015	2000 VDC	100 pF	5600 pF	1000 pF	0.027 µF
			3000 VDC	10 pF	2700 pF	100 pF	0.010 µF
			4000 VDC	10 pF	1500 pF	100 pF	2200 pF
			5000 VDC	10 pF	470 pF	100 pF	1500 pF
			6000 VDC	10 pF	470 pF	100 pF	1500 pF
S48 / 2225 		L	.225 ± .010	500 VDC	1000 pF	0.027 µF	0.01 µF
	W	.255 ± .015	630 VDC	1000 pF	0.022 µF	0.01 µF	0.330 µF
	T	.160 Max.	1000 VDC	100 pF	0.018 µF	1000 pF	0.120 µF
	E/B	.025 ± .015	2000 VDC	100 pF	8200 pF	1000 pF	0.039 µF
			3000 VDC	10 pF	3300 pF	100 pF	0.015 µF
			4000 VDC	10 pF	1800 pF	100 pF	5600 pF
			5000 VDC	10 pF	470 pF	100 pF	1500 pF
			6000 VDC	10 pF	470 pF	100 pF	1500 pF

Available capacitance values include the following significant retma values and their multiples: 1.0 1.2 1.5 1.8 2.2 2.7 3.3 3.9 4.7 5.6 6.8 8.2 (1.0 = 1.0, 10, 100, 1000, etc.) Consult factory for non-retma values and sizes or voltages not shown.

ELECTRICAL CHARACTERISTICS

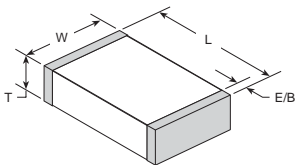
Meets the standard NPO & X7R dielectric specifications listed on page 20

Dielectric Withstanding Voltage

DWV = 1.5 X rated WVDC for ratings ≤ 500 WVDC,

DWV = 1.2 X rated WVDC for ratings ≥ 1,000 WVDC

NOTE: Capacitors may require a surface coating to prevent external arcing. Solder mask should not be used beneath capacitors. For more information see JDI Tech Note "Surface Arc Season"

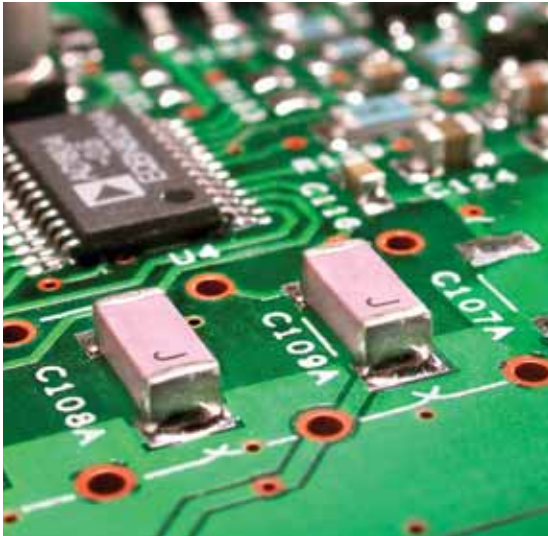


HOW TO ORDER

Part number written: 202R29N101KV4E

202	R29	N	101	K	V	4	E
VOLTAGE 501 = 500 V 631 = 630 V 102 = 1000 V 202 = 2000 V 302 = 3000 V 402 = 4000 V 502 = 5000 V 602 = 6000 V	CASE SIZE See Chart	DIELECTRIC N = NPO/COG W = X7R	CAPACITANCE 1st two digits are significant; third digit denotes number of zeros, R = decimal. 1R0 = 1.0 pF 101 = 100 pF	TOLERANCE NPO: J = ± 5% K = ± 10% X7R: K = ± 10% M = ± 20%	TERMINATION V = Ni barrier w/ 100% Sn Plating F = Polyterm flexible termination	MARKING 4 = Unmarked 6 = EIA Code*	TAPE MODIFIER Code Tape Reel E Embossed 7" U Embossed 13" T Paper 7" R Paper 13" Tape specs. per EIA RS481



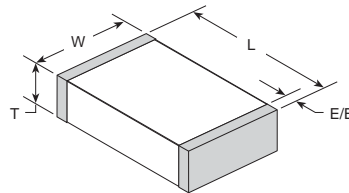


Johanson Dielectrics Type SC ceramic chip capacitors are designed for AC voltage surge and lightning protection in line-to-ground interface applications in computer networks, modem, facsimile and other equipment.

Johanson's safety capacitor offering includes four different case sizes and NPO and X7R dielectric materials.

These devices are surface mount ready with barrier terminations and tape and reel packaging.

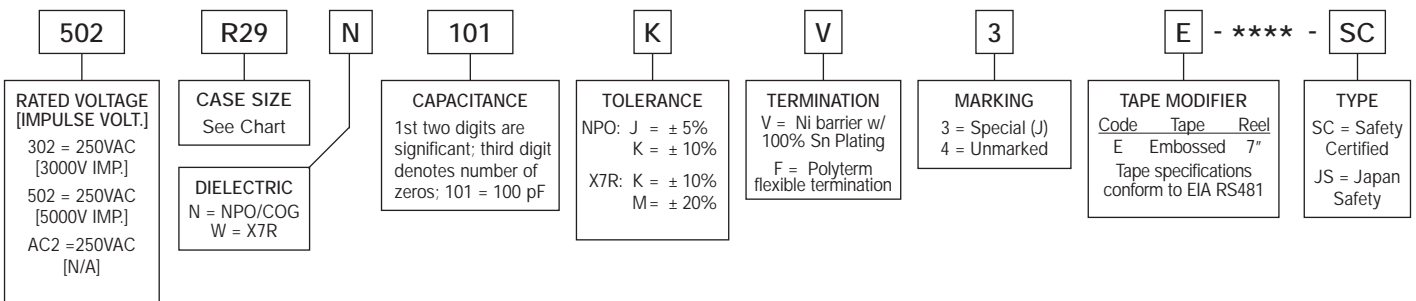
Additional information on capacitor safety ratings may be found below. Specific certification details may be found under each product listing on the facing page.








Polyterm® soft termination option available for demanding environments & processes.

SAFETY RATING	VOLTAGE RATING	WITHSTANDING VOLTAGE	IMPULSE VOLTAGE	CASE SIZE	JOHANSON ORDERING P/N
X2/Y3	250 VAC	1,500 VAC	2,500 V	1808	302R29____V3E-****-SC
STANDARDS: EN 60384-14:2005, EN 60950 2001 • UL 60950-01 CERTIFICATIONS: TUV T72090022 & T72072987 • UL File E212609 • Semko 0026092-1 & 0003222-1					
Y3	250 VAC	1,500 VAC	2,500 V	1812	302S43____V3E-****-SC
STANDARDS: EN 60384-14:2005, EN 60950:2001 CERTIFICATIONS: TUV Rheinland T72072987					
X1/Y2	250 VAC	1,500 VAC	5,000 V	1808	502R29____V3E-****-SC
STANDARDS: EN 60384-14:2005 • UL 60950-01 CERTIFICATIONS: TUV Rheinland T72090023 & T72090024 / UL File E212609-A1-UL-1					
Y2	250 VAC	1,500 VAC	5,000 V	2211	502R30____V3E-****-SC
STANDARDS: EN 60384-14:2005 • UL 60950-01 CERTIFICATIONS: TUV Rheinland T72090024 • UL File: E212609-A1-UL-1					
X1/Y2	250 VAC	1,500 VAC	5,000 V	2220	502S47____V3E-****-SC
STANDARDS: EN 60384-14:2005 • UL 60950-01 CERTIFICATIONS: TUV Rheinland R72060014 • UL File: E212609-A1-UL-1					
Japan	250 VAC	1,500 VAC	3,000 V	2220	AC2____V4E-****-JS
STANDARDS: JIS-C-5102 • JIS-C-5150 CERTIFICATIONS: N/A					
X Capacitors are defined as suitable for use in situations where failure of the capacitor would not lead to danger of electric shock. Y Capacitors are defined as suitable for use in situations where failure of the capacitor could lead to danger of electric shock.					

HOW TO ORDER SAFETY CERTIFIED P/N written: 302R29N101KV3E-****-SC



SAFETY CERTIFIED




			5 pF	10 pF	12 pF	15 pF	18 pF	22 pF	27 pF	33 pF	47 pF	56 pF	68 pF	100 pF	120 pF	150 pF	180 pF	220 pF	270 pF	330 pF	470 pF	560 pF	680 pF	1000 pF	1200 pF	1500 pF	1800 pF	2200 pF	2700 pF	3300 pF	4700 pF						
R29 / 1808  X2/Y3	INCHES	(mm)																																			
	L	.189 ±.010	(4.80 ±.25)																																		
	W	.080 ±.010	(2.03 ±.25)																																		
	T	.085 Max.	(2.16)																																		
	E/B	.020 ±.010	(0.51±.25)																																		
S43 / 1812  Y3	INCHES	(mm)																																			
	L	.175 ±.010	(4.45 ±.25)																																		
	W	.125 ±.010	(3.17 ±.25)																																		
	T	.115 Max.	(2.92)																																		
	E/B	.025 ±.015	(0.64±.38)																																		
R29 / 1808  X1/Y2	INCHES	(mm)																																			
	L	.189 ±.010	(4.80 ±.25)																																		
	W	.080 ±.010	(2.03 ±.25)																																		
	T	.085 Max.	(2.16)																																		
	E/B	.012 ±.005	(0.30±.13)																																		
R30 / 2211  Y2	INCHES	(mm)																																			
	L	.225 ±.016	(5.72 ±.40)																																		
	W	.110 ±.010	(2.80 ±.25)																																		
	T	.115 Max.	(2.92)																																		
	E/B	.020 ±.010	(0.51±.25)																																		
S47 / 2220  X1/Y2	INCHES	(mm)																																			
	L	.225 ±.015	(5.72 ±.38)																																		
	W	.200 ±.015	(5.08 ±.38)																																		
	T	.150 Max.	(3.81)																																		
	E/B	.025 ±.015	(0.64±.38)																																		

DIELECTRIC

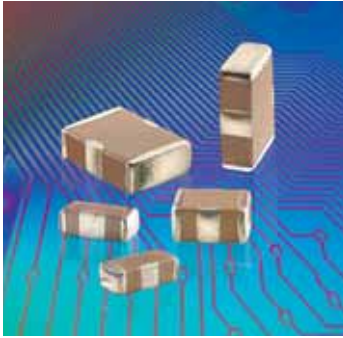
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X7R

JAPAN STANDARD

			470pF	1000pF	2200pF	3300pF	4700pF	0.01µF	0.022µF	0.047µF	0.10µF	
J29 / 1808  Japan Safety	INCHES	(mm)										
	L	.189 ±.010	(4.80 ±.25)									
	W	.080 ±.010	(2.03 ±.25)									
	T	.085 Max.	(2.16)									
	E/B	.020 ±.010	(0.51±.25)									
J43 / 1812  Japan Safety	INCHES	(mm)										
	L	.175 ±.010	(4.45 ±.25)									
	W	.125 ±.010	(3.17 ±.25)									
	T	.115 Max.	(2.92)									
	E/B	.025 ±.015	(0.64±.38)									
J47 / 2220  Japan Safety	INCHES	(mm)										
	L	.225 ±.015	(5.72 ±.38)									
	W	.200 ±.015	(5.08 ±.38)									
	T	.150 Max.	(3.81)									
	E/B	.025 ±.015	(0.64±.38)									

X2Y® FILTER & DECOUPLING CAPACITORS



X2Y® filter capacitors employ a unique, patented low inductance design featuring two balanced capacitors that are immune to temperature, voltage and aging performance differences. These components offer superior decoupling and EMI filtering performance, virtually eliminate parasitics, and can replace multiple capacitors and inductors saving board space and reducing assembly costs.

ADVANTAGES

- One device for EMI suppression or decoupling
- Replace up to 7 components with one X2Y
- Differential and common mode attenuation
- Matched capacitance line to ground, both lines
- Low inductance due to cancellation effect

APPLICATIONS

- Amplifier Filter & Decoupling
- High Speed Data Filtering
- EMC I/O Filtering
- FPGA / ASIC / μ -P Decoupling
- DDR Memory Decoupling

Circuit 1 (1 Y-Cap.)		<10pF	10pF	22pF	27pF	33pF	47pF	100pF	220pF	470pF	1000pF	1500pF	2200pF	4700pF	.010 μ F	.015 μ F	.022 μ F	.039 μ F	.047 μ F	0.10 μ F	0.18 μ F	0.22 μ F	0.33 μ F	0.40 μ F	0.47 μ F	1.0 μ F	
Circuit 2 (2 Y-Caps.)		<20pF	20pF	44pF	54pF	66pF	94pF	200pF	440pF	940pF	2000pF	3000pF	4400pF	9400pF	.020 μ F	.030 μ F	.044 μ F	.078 μ F	.094 μ F	0.20 μ F	0.36 μ F	0.44 μ F	0.68 μ F	0.80 μ F	0.94 μ F	2.0 μ F	
SIZE	CAP. CODE	XRX	100	220	270	330	470	101	221	471	102	152	222	472	103	153	223	393	473	104	184	224	334	404	474	105	
0402 (X07)	NPO	50	50	50	50	50	50	50																			
	X7R								50	50	50	50	50	50	16												
0603 (X14)	NPO	100	100	100	100	100	50	50	50																		
	X7R						100	100	100	100	100	100	100	100	50	25	25		16	10		6.3					
	X5R																					16	10		10	10	
0805 (X15)	NPO		100	100	100	100	100	100	50																		
	X7R							100	100	100	100	100	100	100	100	50	50		50	25	10						
1206 (X18)	NPO										100																
	X7R														100	100	100		100	100		16	16		10		
1210 (X41)	X7R														500				100		100	100		25	16		
1410 (X44)	X7R															500								100			
1812 (X43)	X7R																	500							100		

SEE PART NUMBER LISTING TABLE ON PAGES 7 & 8 Contact factory for part combinations not shown.
 Circuit 1 capacitance measured Line-to-Ground (A or B to G) Circuit 2 capacitance measured Power-to-Ground (A + B to G)
 Rated voltage is from line to ground in Circuit 1, power to ground in Circuit 2 .

HOW TO ORDER X2Y® FILTER & DECOUPLING CAPACITORS

P/N written: 100X14W104MV4T

100	X14	W	104	M	V	4	T									
VOLTAGE 6R3 = 6.3 V 100 = 10 V 160 = 16 V 250 = 25 V 500 = 50 V 101 = 100 V 501 = 500 V	CASE SIZE X07 = 0402 X14 = 0603 X15 = 0805 X18 = 1206 X41 = 1210 X43 = 1812 X44 = 1410	DIELECTRIC N = NPO W = X7R X = X5R	CAPACITANCE (Circuit 1) 1st two digits are significant; third digit denotes number of zeros. 102 = 1000 pF = 1 nF 103 = 0.01 μ F = 10 nF 104 = 0.10 μ F = 100 nF 5R6 = 5.6pF	TOLERANCE M = \pm 20% D = \pm 0.5pF (Values < 10pF)	TERMINATION V = Ni barrier w/ 100% Sn Plating Available on select parts: F = Polyterm® soft polymer termination T = SnPb	MARKING 4 = Unmarked	TAPE MODIFIER <table border="1"> <tr> <th>Code</th> <th>Tape</th> <th>Reel</th> </tr> <tr> <td>E</td> <td>Embossed</td> <td>7"</td> </tr> <tr> <td>T</td> <td>Paper</td> <td>7"</td> </tr> </table> Tape specs. per EIA RS481	Code	Tape	Reel	E	Embossed	7"	T	Paper	7"
Code	Tape	Reel														
E	Embossed	7"														
T	Paper	7"														

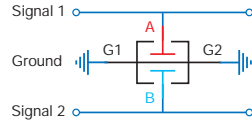
X2Y® technology patents and registered trademark under license from X2Y ATTENUATORS, LLC



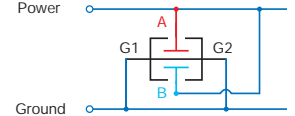
X2Y® FILTER & DECOUPLING CAPACITORS



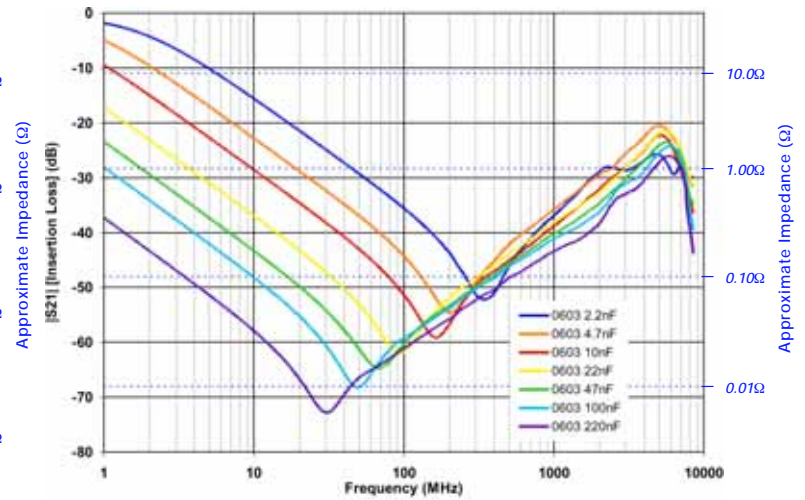
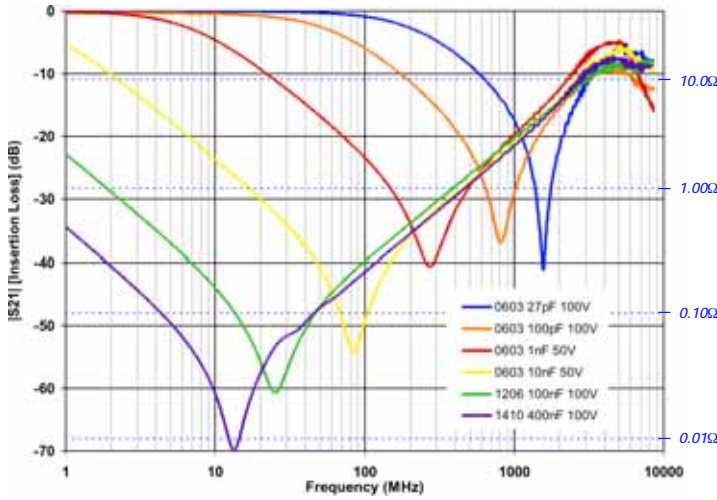
Filtering Circuit 1 S21 Signal-to-Ground



Decoupling Circuit 2 S21 Power-to-Ground

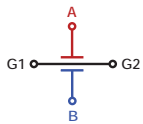


Labeled capacitance values below follow the P/N order code or Y cap value (Circuit 1.)
Effective capacitance measured in Circuit 2 is 200% of the labeled Circuit 1 Y cap value.

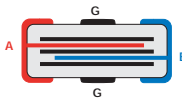


ELECTRICAL CHARACTERISTICS	NPO	X7R	X5R
Temperature Coefficient:	±15% (-55 to +125°C)	±15% (-55 to +125°C)	±15% (-55 to +85°C)
Dielectric Strength:	Rated ≤100VDC: DWV = 2.5 X WVDC, 25°C, 50mA max.		Rated = 500VDC: DWV = 1.5 X WVDC, 25°C, 50mA max.
Dissipation Factor:	0.1% max.	WVDC ≥ 50 VDC: 2.5% max. WVDC = 25 VDC: 3.5% max. WVDC = 10-16 VDC: 5.0% max. WVDC = 6.3 VDC: 10% max.	WVDC ≥ 50 VDC: 5% max. WVDC ≤ 25 VDC: 10% max.
Insulation Resistance (Min. @ 25°C, WVDC)	C ≤ 0.047μF: 1000 ΩF or 100 GΩ, whichever is less C > 0.047μF: 500 ΩF or 10 GΩ, whichever is less		
Test Conditions:	C > 100 pF; 1kHz ±50Hz; 1.0±0.2 VRMS C ≤ 100 pF; 1Mhz ±50kHz; 1.0±0.2 VRMS	1.0kHz±50Hz @ 1.0±0.2 Vrms	
Other:	See main catalog page 18 for additional dielectric specifications.		

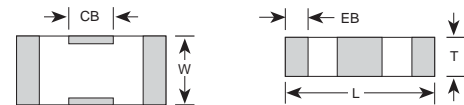
Equivalent Circuits



Cross-sectional View



Dimensional View



MECHANICAL CHARACTERISTICS

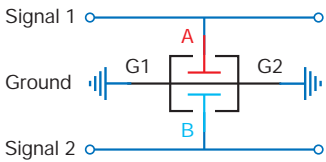
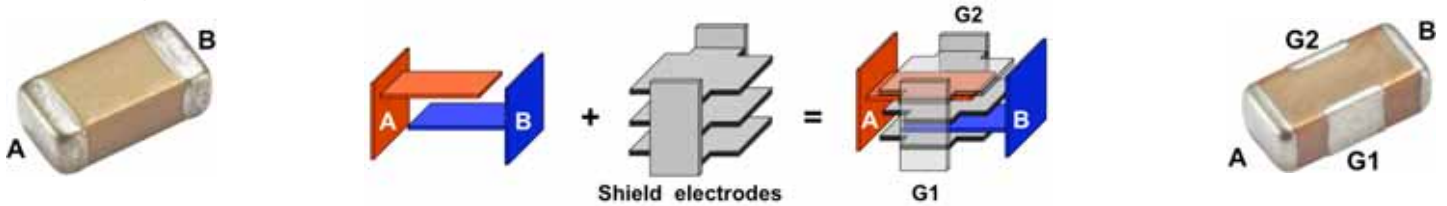
	0402 (X07)		0603 (X14)		0805 (X15)		1206 (X18)		1210 (X41)		1410 (X44)		1812 (X43)	
	IN	mm	IN	mm	IN	mm	IN	mm	IN	mm	IN	mm	IN	mm
L	0.045 ± 0.003	1.143 ± 0.076	0.064 ± 0.005	1.626 ± 0.127	0.080 ± 0.008	2.032 ± 0.203	0.124 ± 0.010	3.150 ± 0.254	0.125 ± 0.010	3.175 ± 0.254	0.140 ± 0.010	3.556 ± 0.254	0.174 ± 0.010	4.420 ± 0.254
W	0.025 ± 0.003	0.635 ± 0.076	0.035 ± 0.005	0.889 ± 0.127	0.050 ± 0.008	1.270 ± 0.203	0.063 ± 0.010	1.600 ± 0.254	0.098 ± 0.010	2.489 ± 0.254	0.098 ± 0.010	2.490 ± 0.254	0.125 ± 0.010	3.175 ± 0.254
T	0.020 max	0.508 max	0.026 max	0.660 max	0.040 max	1.016 max	0.050 max	1.270 max	0.070 max	1.778 max	0.070 max	1.778 max	0.090 max	2.286 max
EB	0.008 ± 0.003	0.203 ± 0.076	0.010 ± 0.006	0.254 ± 0.152	0.012 ± 0.008	0.305 ± 0.203	0.016 ± 0.010	0.406 ± 0.254	0.018 ± 0.010	0.457 ± 0.254	0.018 ± 0.010	0.457 ± 0.254	0.022 ± 0.012	0.559 ± 0.305
CB	0.012 ± 0.003	0.305 ± 0.076	0.018 ± 0.004	0.457 ± 0.102	0.022 ± 0.005	0.559 ± 0.127	0.040 ± 0.005	1.016 ± 0.127	0.045 ± 0.005	1.143 ± 0.127	0.045 ± 0.005	1.143 ± 0.127	0.045 ± 0.005	1.143 ± 0.127



X2Y® FILTER & DECOUPLING CAPACITORS

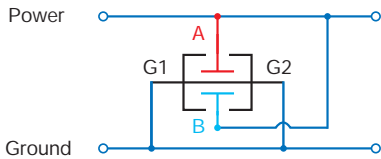
The X2Y® Design - A Balanced, Low ESL, "Capacitor Circuit"

The X2Y® capacitor design starts with standard 2 terminal MLC capacitor's opposing electrode sets, A & B, and adds a third electrode set (G) which surround each A & B electrode. The result is a highly versatile three node capacitive circuit containing two tightly matched, low inductance capacitors in a compact, four-terminal SMT chip.



X2Y® Circuit 1: Filtering

Circuit 1 connects the X2Y® filter capacitor across two signal lines. Common-mode noise is filtered to ground (or reference) by the two Y-capacitors, A & B. Because X2Y® is a balanced circuit that is tightly matched in both phase and magnitude with respect to ground, common-to-differential mode noise conversion is minimized and any differential-mode noise is cancelled within the device. The low inductance of the capacitors extends their high frequency attenuation considerably over discrete MLCs.



X2Y® Circuit 2: Power Bypass / Decoupling

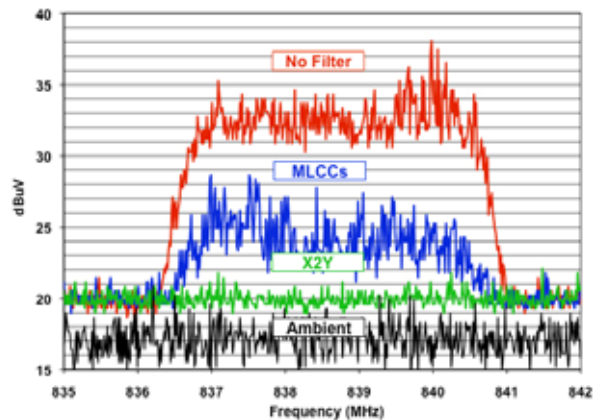
Circuit 2 connects the A & B capacitors in parallel doubling the total capacitance while reducing the inductance. X2Y capacitors exhibit up to 1/10th the device inductance and 1/5th the mounted inductance of similar sized MLC capacitors enabling high-performance bypass networks with far fewer components and vias. Low ESL delivers improved High Frequency performance into the GHz range.

GSM RFI Attenuation in Audio & Analog

GSM handsets transmit in the 850 and 1850 MHz bands using a TDMA pulse rate of 217Hz. These signals cause the GSM buzz heard in a wide range of audio products from headphones to concert hall PA systems or "silent" signal errors created in medical, industrial process control, and security applications. Testing was conducted where an 840MHz GSM handset signal was delivered to the inputs of three different amplifier test circuit configurations shown below whose outputs were measured on a HF spectrum analyzer.

- 1) No input filter, 2 discrete MLC 100nF power bypass caps.
- 2) 2 discrete MLC 1nF input filter, 2 discrete MLC 100nF power bypass caps.
- 3) A single X2Y 1nF input filter, a single X2Y 100nF power bypass cap.

X2Y configuration provided a nearly flat response above the ambient and up to 10 dB improved rejection than the conventional MLCC configuration.

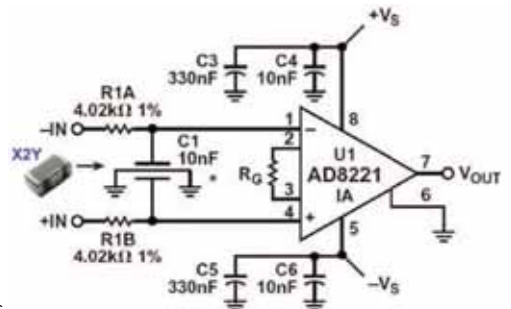


Amplifier Input Filter Example

In this example, a single Johanson X2Y® component was used to filter noise at the input of a DC instrumentation amplifier. This reduced component count by 3-to-1 and costs by over 70% vs. conventional filter components that included 1% film Y-capacitors.

Parameter	X2Y® 10nF	Discrete 10nF, 2 @ 220 pF	Comments
DC offset shift	< 0.1 μ V	< 0.1 μ V	Referred to input
Common mode rejection	91 dB	92 dB	

Source: Analog Devices, "A Designer's Guide to Instrumentation Amplifiers (2nd Edition)" by Charles Kitchin and Lew Counts

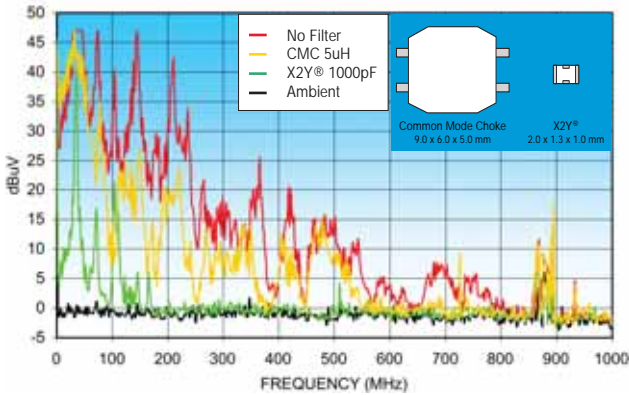


X2Y® FILTER & DECOUPLING CAPACITORS



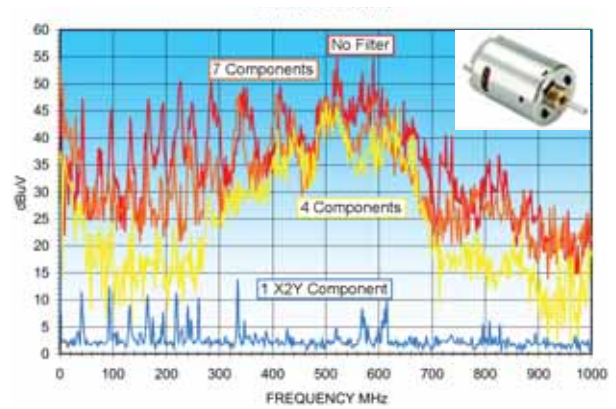
Common Mode Choke Replacement

In this example, a 5 μ H common mode choke is replaced by an 0805, 1000pF X2Y® component achieving superior EMI filtering by a component a fraction of the size and cost.



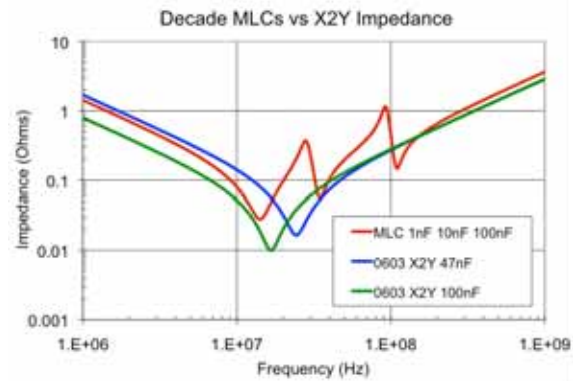
DC Motor EMI Reduction: A Superior Solution

One X2Y® component has successfully replaced 7 discrete filter components while achieving superior EMI filtering.



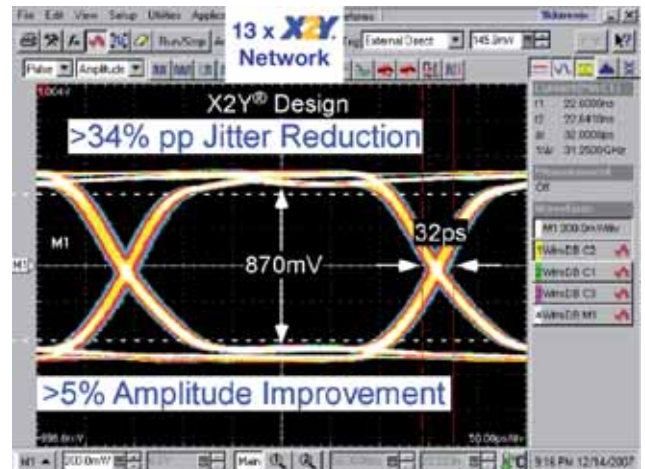
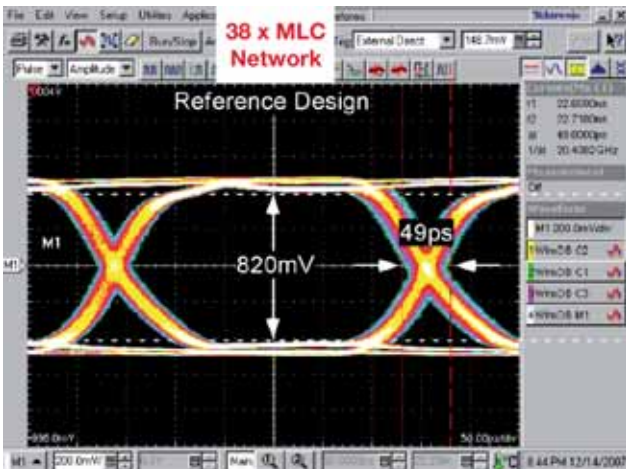
Eliminating Capacitor Anti-Resonance Issue

A common design practice is to parallel decade capacitance values to extend the high frequency performance of the filter network. This causes an unintended and often over-looked effect of anti-resonant peaks in the filter networks combined impedance. X2Y's very low mounted inductance allows designers to use a single, higher value part and completely avoid the anti-resonance problem. The impedance graph on right shows the combined impedance of a 1nF, 10nF & 100nF 0402 MLC in parallel in RED. The MLC networks anti-resonance peaks are nearly 10 times the desired impedance. A 100nF and 47nF X2Y are plotted in BLUE and GREEN. (The total capacitance of X2Y (Circuit 2) is twice the value, or 200nF and 98nF in this example.) The single X2Y is clearly superior to the three paralleled MLCs.



X2Y High Performance Power Bypass - Improve Performance, Reduce Space & Vias

Actual measured performance of two high performance SerDes FPGA designs demonstrate how a 13 component X2Y bypass network significantly outperforms a 38 component MLC network. For more information see http://johanson-dielectrics.com/pdfs/JDI_X2Y_STXII.pdf





TANCERAM® chip capacitors can replace tantalum capacitors in many applications and offer several key advantages over traditional tantalums. Because Tanceram® capacitors exhibit extremely low ESR, equivalent circuit performance can often be achieved using considerably lower capacitance values. Low DC leakage reduces current drain, extending the battery life of portable products. Tancerams® high DC breakdown voltage ratings offer improved reliability and eliminate large voltage de-rating common when designing with tantalums.

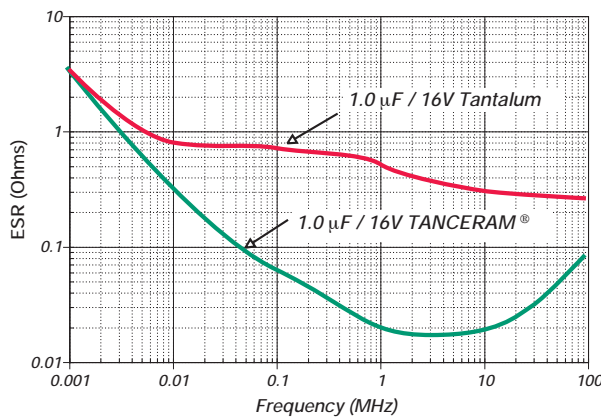
ADVANTAGES

- Low ESR
- Higher Surge Voltage
- Reduced CHIP Size
- Higher Insulation Resistance
- Low DC Leakage
- Non-polarized Devices
- Improved Reliability
- Higher Ripple Current

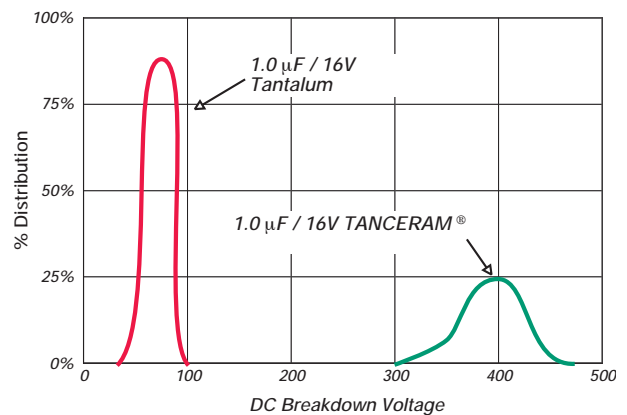
APPLICATIONS

- Switching Power Supply Smoothing (Input/Output)
- DC/DC Converter Smoothing (Input/Output)
- Backlighting Inverters
- General Digital Circuits

Typical ESR Comparison



Typical Breakdown Voltage Comparison



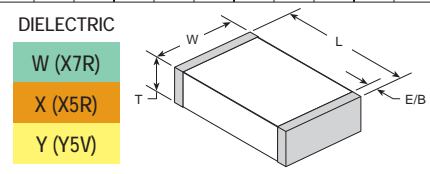
HOW TO ORDER TANCERAM®

250	R18	Y	105	Z	V	4	E
VOLTAGE 500 = 50 V 250 = 25 V 160 = 16 V 100 = 10 V 6R3 = 6.3 V	CASE SIZE See Chart	DIELECTRIC W = X7R X = X5R Y = Y5V	CAPACITANCE 1st two digits are significant; third digit denotes number of zeros. 474 = 0.47 µF 105 = 1.00 µF	TOLERANCE Y5V Z = +80% -20% X7R/X5R K = ±10% M = ±20%	TERMINATION V = Ni barrier w/ 100% Sn Plating	MARKING 4 = Unmarked	TAPE MODIFIER Code Type Reel E Plastic 7" T Paper 7" Tape specifications conform to EIA RS481

P/N written: 250R18Y105ZV4E

CAPACITANCE SELECTION

CASE SIZE			VDC	1.0 μ F	2.2 μ F	4.7 μ F	10 μ F	22 μ F	47 μ F	100 μ F
0402 R07	L W T E/B	Inches (mm) .040 ±.004 (1.02 ±.10) .020 ±.004 (0.51 ±.10) .025 Max. (0.64) .008 ±.004 (0.20±.10)	10	*						
			6.3	*	*					
			25		*					
			16		*	*				
0603 R14	L W T E/B	Inches (mm) .063 ±.008 (1.60 ±.20) .032 ±.008 (0.81 ±.20) .035 Max. (0.89) .010±.005 (.25±.13)	10	*	*	*				
			6.3	*	*	*				
			25	*	*	*				
			16	*	*	*				
0805 R15	L W T E/B	Inches (mm) .080 ±.010 (2.03 ±.25) .050 ±.010 (1.27 ±.25) .060 Max. (1.52) .020±.010 (0.51±.25)	10	*	*	*	*	*		
			6.3	*	*	*	*	*	*	
			25	*	*	*	*	*	*	
			16	*	*	*	*	*	*	
1206 R18	L W T E/B	Inches (mm) .125 ±.010 (3.17 ±.25) .062 ±.010 (1.57 ±.25) .070 Max. (1.78) .020 +.015-.010 (0.51+.38-.25)	10	*	*	*	*	*	*	*
			6.3	*	*	*	*	*	*	
			25	*	*	*	*	*	*	
			16	*	*	*	*	*	*	
1210 S41	L W T E/B	Inches (mm) .125 ±.010 (3.18 ±.25) .095 ±.010 (2.41 ±.25) .110 Max. (2.8) .020 +.015-.010 (0.51+.38-.25)	50	*	*	*	*	*	*	*
			25	*	*	*	*	*	*	
			16	*	*	*	*	*	*	
			10	*	*	*	*	*	*	
			DIELECTRIC CODE	W X Y	W X Y	W X Y	W X Y	W X Y	W X Y	W X Y



* = NEW PART • = HIGH VOLUME

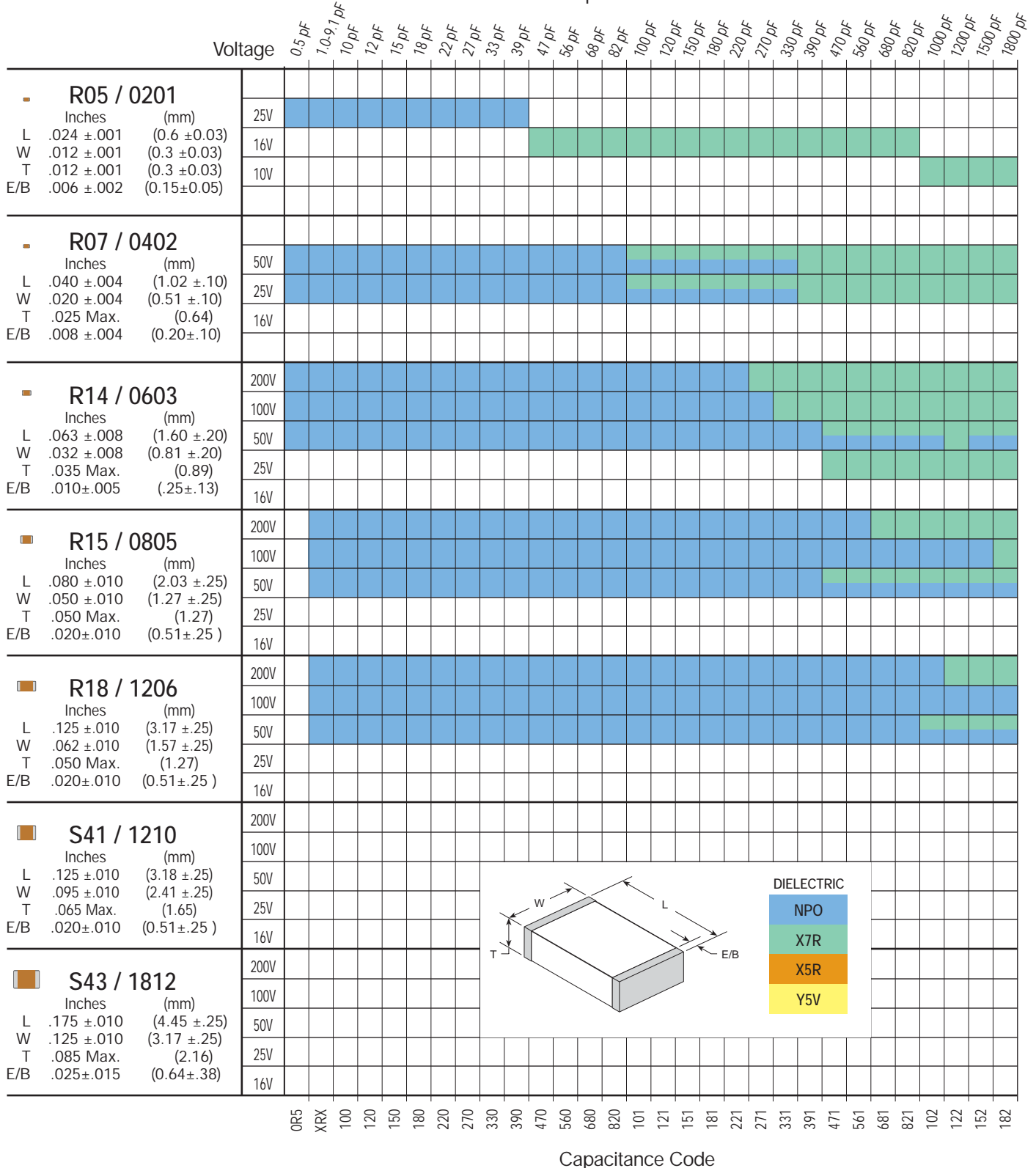
ELECTRICAL

CHARACTERISTICS

	X7R	X5R	Y5V
Temperature Coefficient:	±15% (-55 to +125°C)	±15% (-55 to +85°C)	+22%, -82% (-30 to +85°C)
Dissipation Factor:	For ≥ 50 VDC: 5% max. For ≤ 25 VDC: 10% max.	For ≥ 50 VDC: 5% max. For ≤ 25 VDC: 10% max.	For ≥ 10 VDC: 16% max. For 6.3 VDC: 20% max.
Insulation Resistance (Min. @ 25°C, WVDC)	100 Ω F or 10 G Ω , whichever is less		
Dielectric Strength:	2.5 X WVDC, 25°C, 50mA max.		
Test Conditions:	Capacitance values ≤ 22 μ F: 1.0kHz±50Hz @ 1.0±0.2 Vrms Capacitance values > 22 μ F: 120Hz±10Hz @ 0.5V±0.1 Vrms		
Other:	See page 18 for additional dielectric specifications.		

SURFACE MOUNT MLCCs 10 - 200 VDC

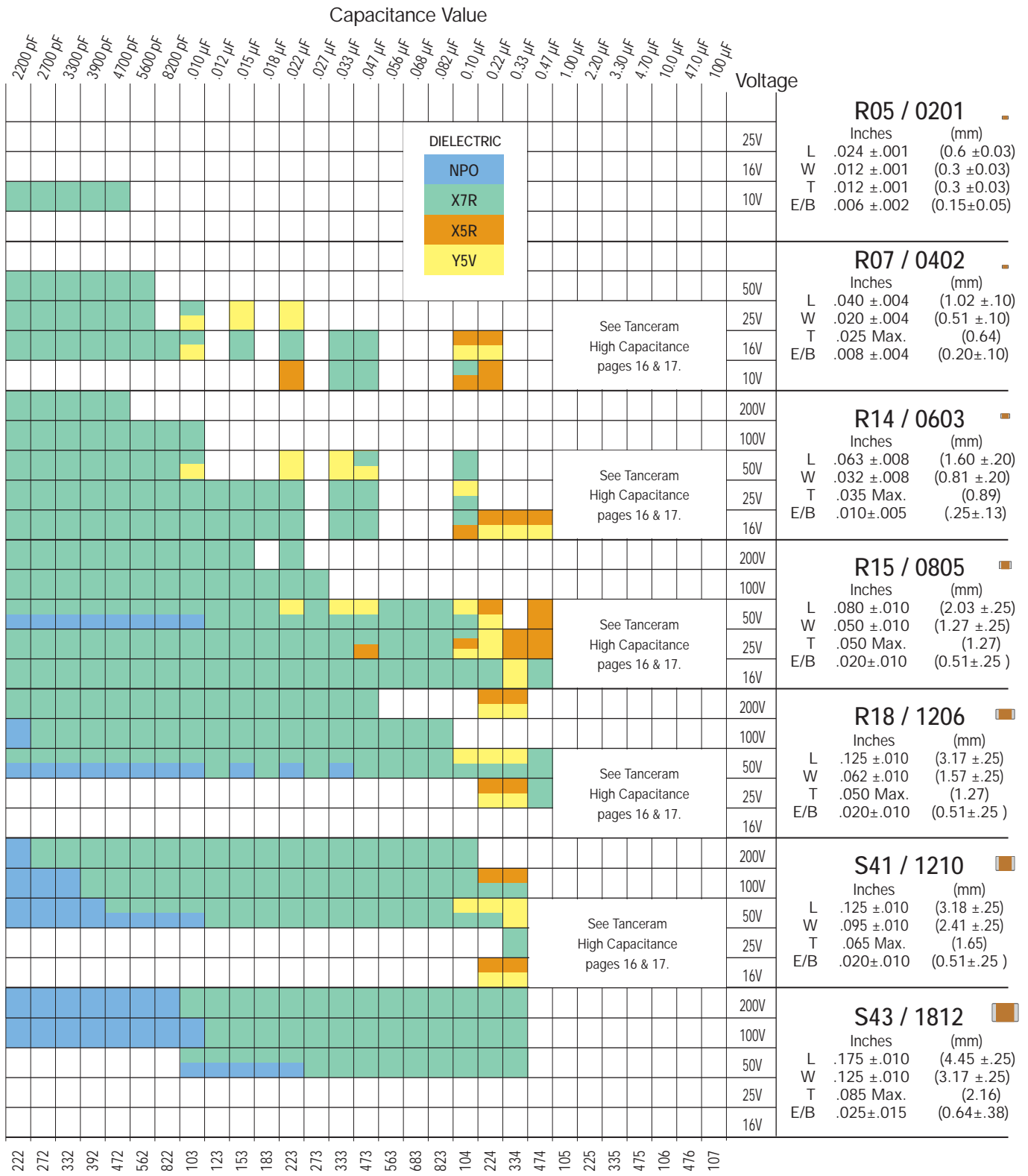
Capacitance Value



Dielectric specifications and part number breakdown may be found on page 18.



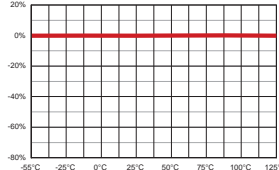
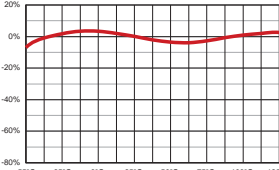
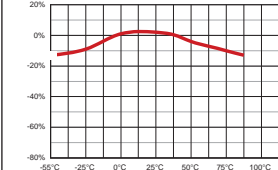
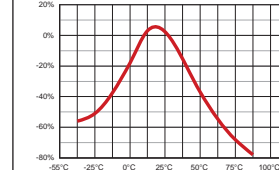
SURFACE MOUNT MLCCs 10 - 200 VDC



Dielectric specifications and part number breakdown may be found on page 18.



ELECTRICAL CHARACTERISTICS

PARAMETER	NPO	X7R	X5R	Y5V
TEMPERATURE COEFFICIENT:	0 ± 30 ppm/°C -55 to +125°C 	± 15% -55 to +125°C 	± 15% -55 to +85°C 	+22% -82% -30 to +85°C 
DISSIPATION FACTOR:	.001 (0.1%) max	WVDC ≥ 50 VDC, DF = 2.5% max WVDC = 25 VDC, DF = 3.0% max WVDC = 16 VDC, DF = 3.5% max	For Vrated ≥ 50 VDC, DF = 5% max For Vrated ≤ 25 VDC: DF = 10% max	For Vrated ≥ 10 VDC, DF = 16% max For Vrated = 6.3 VDC: DF = 20% max
AGING:	None	2.5% / decade hour	2.5% / decade hour	7.0% / decade hour
INSULATION RESISTANCE:	1000ΩF or 100GΩ whichever is less @ 25°C, WVDC	500ΩF or 500GΩ whichever is less @ 25°C, WVDC	100ΩF or 10GΩ whichever is less @ 25°C, WVDC	100ΩF or 10GΩ whichever is less @ 25°C, WVDC
DIELECTRIC STRENGTH:	For Vrated = 6 - 200 VDC, DWV = 2.5 X WVDC, 25°C, 50mA max. For Vrated = 201 - 499 VDC, DWV = 2.0 X WVDC, 25°C, 50mA max. For Vrated = 500 - 999 VDC, DWV = 1.5 X WVDC, 25°C, 50mA max. For Vrated = 1000+ VDC, DWV = 1.2 X WVDC, 25°C, 50mA max.		DWV = 2.5 X WVDC, 25°C, 50mA max.	DWV = 2.5 X WVDC, 25°C, 50mA max.
TEST PARAMETERS:	C > 100 pF; 1kHz ±50Hz; 1.0±0.2 VRMS C ≤ 100 pF 1MHz ±50kHz; 1.0±0.2 VRMS	1kHz ±50Hz; 1.0±0.2 VRMS	1kHz ±50Hz; 0.5±0.2 VRMS	1kHz ±50Hz; 1.0±0.2 VRMS
NOTES:		Tanceram IR = 500 ΩF or 10 GΩ Tanceram DF for Vrated ≥ 50 VDC = 5% max. Tanceram DF for Vrated ≤ 25 VDC, DF = 10% max	Tanceram IR = 100 ΩF or 10 GΩ	

PART NUMBER BREAKDOWN

Part number written: 500R15N101JV4T

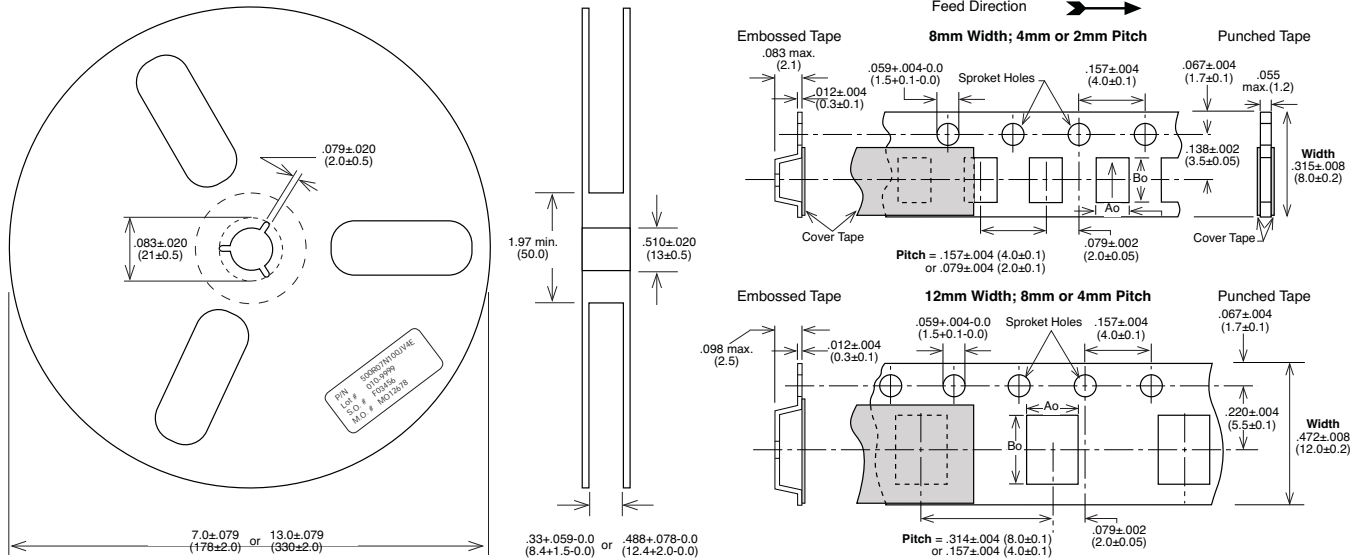
500	R15	N	101	J	V	4	T
VOLTAGE	CASE SIZE	DIELECTRIC	CAPACITANCE	TOLERANCE	TERMINATION	MARKING	PACKAGING
6R3 = 6.3 V 100 = 10 V 160 = 16 V 250 = 25 V 500 = 50 V 101 = 100 V 201 = 200 V 251 = 250 V 301 = 300 V 501 = 500 V 631 = 630 V 102 = 1000 V 202 = 2000 V 302 = 3000 V 402 = 4000 V 502 = 5000 V ACJ = 250 VAC	R05=0201 R07=0402 A11=0405 R14=0603 R15=0805 A18=0612 R18=1206 S41=1210 R29=1808 S43=1812 S47=2220 S49=1825 S48=2225 X07=0402 X2Y X14=0603 X2Y X15=0805 X2Y X18=1206 X2Y X41=1210 X2Y X44=1410 X2Y X43=1812 X2Y	N = NPO W = X7R X = X5R Y = Y5V	1st two digits are significant; third digit denotes number of zeros, R = decimal. 1R0 = 1.0 pF 100 = 10 pF S41 = 1,000 pF 474 = 0.47 μF	* B = ± 0.10 pF * C = ± 0.25 pF * D = ± 0.50 pF F = ± 1 % G = ± 2% J = ± 5% K = ± 10% M = ± 20% Z = +80 -20% *Values < 10 pF only	V = Nickel Barrier with 100% Tin Plating (Matte) F = Polyterm flexible termination T = SnPb P = PdAg	3 = Special (J) 4 = Unmarked 6 = EIA Code* *Not available on sizes ≥ 0402	Tape Tape Reel Code Type Size U Embossed 13" R Punched 13" E Embossed 7" T Punched 7" No code = bulk pack Tape specifications conform to EIA RS481

PLEASE NOTE: Not all combinations of JDI P/Ns are valid. Please refer to the appropriate "How to Order" section for a particular product or contact your Sales Representative if you need assistance.



CAPACITOR PACKAGING & MARKING

Johanson capacitors are available taped per EIA standard 481. Tape options include 7" and 13" diameter reels. Johanson uses high quality, dust free, punched 8mm paper tape and plastic embossed 8mm tape for thicker MLCCs. Quantity per reel ranges are listed in the tables below and are dependent on chip thickness.



COMPONENT	7" DIAMETER REEL				13" DIAMETER REEL			
	REEL QTY	TAPE TYPE	WIDTH / PITCH	CODE	REEL QTY	TAPE TYPE	WIDTH / PITCH	CODE
R05 / 0201 MLCC	15000	Paper	8mm/2mm	T	N/A	N/A		N/A
R07 / 0402 MLCC	10000	Paper	8mm/2mm	T	N/A	N/A		N/A
R14 / 0603 MLCC	4000	Paper	8mm/4mm	T	10000	Paper	8mm/4mm	R
R15 / 0805 MLCC	4000 / 3000	Paper / Embossed	8mm/4mm	T / E	10000	Paper / Embossed	8mm/4mm	R / U
R18 / 1206 MLCC	4000 / 3000	Paper / Embossed	8mm/4mm	T / E	10000	Paper / Embossed	8mm/4mm	R / U
S41 / 1210 MLCC	2000 - 4000	Embossed	8mm/4mm	E	5000-10000	Embossed	8mm/4mm	U
R29 / 1808 MLCC	2000	Embossed	12mm/4mm	E	5000 - 8000	Embossed	12mm/4mm	U
R30 / 2211 MLCC	1000 - 2000	Embossed	12mm/4mm	E	2000 - 5000	Embossed	12mm/4mm	U
S43 / 1812 MLCC	500 - 1000	Embossed	12mm/8mm	E	3000 - 5000	Embossed	12mm/8mm	U
S47 / 2220 MLCC	250 - 1000	Embossed	12mm/8mm	E	2000 - 5000	Embossed	12mm/8mm	U
S49 / 1825 MLCC	250 - 1000	Embossed	12mm/8mm	E	2000 - 4000	Embossed	12mm/8mm	U
S48 / 2225 MLCC	250 - 1000	Embossed	12mm/8mm	E	2000 - 4000	Embossed	12mm/8mm	U
X07 / 0402 X2Y	4000	Paper	8mm/2mm	T	10000	Paper	8mm/2mm	R
X14 / 0603 X2Y	4000	Paper	8mm/4mm	T	10000	Paper	8mm/4mm	R
X15 / 0805 X2Y	4000	Embossed	8mm/4mm	E	10000	Embossed	8mm/4mm	U
X18 / 1206 X2Y	3000 - 4000	Embossed	8mm/4mm	E	10000	Embossed	8mm/4mm	U
X41 / 1210 X2Y	2000 - 3000	Embossed	8mm/4mm	E				
X44 / 1410 X2Y	1000 - 2000	Embossed	8mm/4mm	E				
X43 / 1812 X2Y	1000	Embossed	12mm/8mm	E				

Actual reel quantities based on part thickness and tape type. Contact sales for reel quantities of specific part numbers.



Your Technology Partner



High Voltage

AC Safety



X2Y

Tanceram



Low Voltage

Tin-Lead

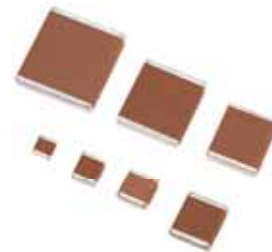


Custom Solutions

High Temperature



AC Power



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