

Surface Mount Ceramic Capacitor Products





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	Capacitance Range		
	Supuriturior runge		



How to Order

Part Number Explanation



Commercial Surface Mount Chips EXAMPLE: 08055A101JAT2A

0805	5	Α	101	J*	Α	T	2	A**
Size (L" x W") 0101* 0201 0402 0603 0805 1206 1210 1812 1825 2220 2225	Voltage 4 = 4V 6 = 6.3V Z = 10V Y = 16V 3 = 25V D = 35V 5 = 50V 1 = 100V 2 = 200V 7 = 500V	Dielectric A = NP0(C0G) C = X7R D = X5R F = X8R G = Y5V U = U Series W = X6S Z = X7S	101 Capacitance 2 Sig. Fig + No. of Zeros Examples: 100 = 10 pF 101 = 100 pF 102 = 1000 pF 223 = 22000 pF 224 = 220000 pF 105 = 1μF 106 = 10μF 107 = 100μF For values below	Tolerance B = ±.10 pF C = ±.25 pF	-)	Terminations T = Plated Ni and Sn 7 = Gold Plated U = Conductive Expoxy for Hybrid Applications Z = FLEXITERM® *X = FLEXITERM® with 5% min lead (X7R & X8R only)	Packaging Available 2 = 7" Reel 4 = 13" Reel U = 4mm TR (01005) Contact Factory For Multiples	Special Code A = Std K = 30K (0603 2mm pitch) 22K (0805/1206 <0.030"/ 0.76mm) H = 18K (0603/0805/1206 <0.037" / 0.94mm) J = 15K (0805/1206 <0.050" / 1.27mm) 1 = 12K (0805/1206 <0.055 / 1.4mm) **Non std options upon
*EIA 01005		Factory for Voltages 9 = 300V 8 = 400V	10 pF, use "R" in place of Decimal point, e.g., 9.1 pF = 9R1.					approval from the factory

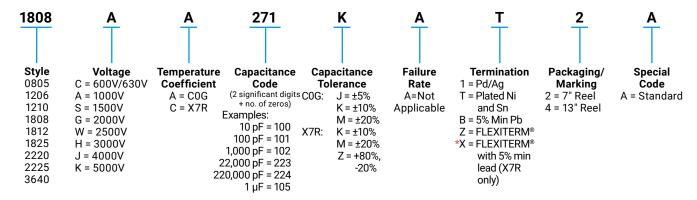
^{*} B, C & D tolerance for ≤10 pF values.

Standard Tape and Reel material (Paper/Embossed) depends upon chip size and thickness. See individual part tables for tape material type for each capacitance value.

NOTE: Contact factory for availability of Termination and Tolerance Options for Specific Part Numbers. For Tin/Lead Terminations, please refer to LD Series

High Voltage MLC Chips

EXAMPLE: 1808AA271KAT2A



NOTE: Contact factory for availability of Termination and Tolerance Options for Specific Part Numbers. For Tin/Lead Terminations, please refer to LD Series

Not RoHS Compliant



For RoHS compliant products, please select correct termination style.

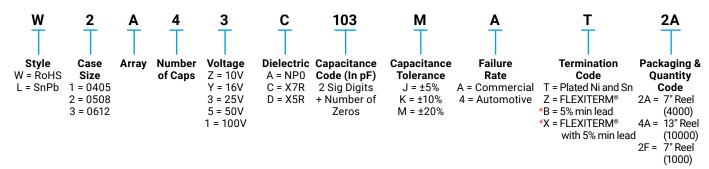
How to Order

Part Number Explanation



Capacitor Array

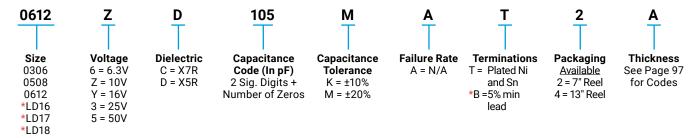
EXAMPLE: W2A43C103MAT2A



NOTE: Contact factory for availability of Termination and Tolerance Options for Specific Part Numbers.

Low Inductance Capacitors (LICC®)

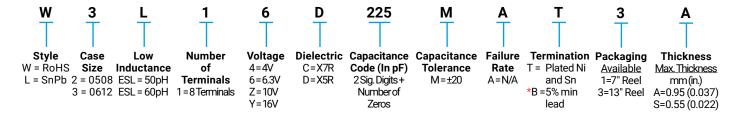
EXAMPLE: 0612ZD105MAT2A



NOTE: Contact factory for availability of Termination and Tolerance Options for Specific Part Numbers.

Interdigitated Capacitors (IDC)

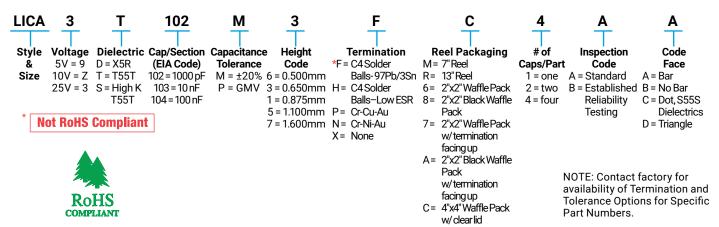
EXAMPLE: W3L16D225MAT3A



NOTE: Contact factory for availability of Termination and Tolerance Options for Specific Part Numbers.

Low Inductance Decoupling Capacitor Arrays (LICA)

EXAMPLE: LICA3T183M3FC4AA



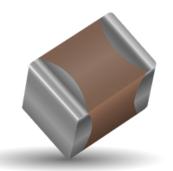


2

COG (NPO) Dielectric

General Specifications



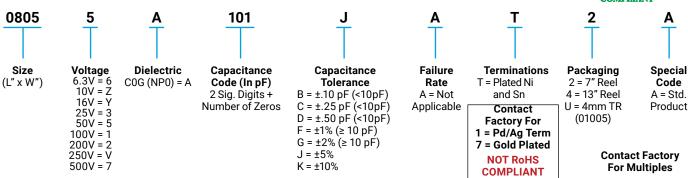


COG (NPO) is the most popular formulation of the "temperature-compensating," EIA Class I ceramic materials. Modern COG (NPO) formulations contain neodymium, samarium and other rare earth oxides.

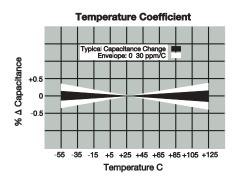
COG (NP0) ceramics offer one of the most stable capacitor dielectrics available. Capacitance change with temperature is 0 ±30ppm/°C which is less than ±0.3% C from -55°C to +125°C. Capacitance drift or hysteresis for COG (NPO) ceramics is negligible at less than ±0.05% versus up to ±2% for films. Typical capacitance change with life is less than ±0.1% for COG (NPO), one-fifth that shown by most other dielectrics. COG (NPO) formulations show no aging characteristics.

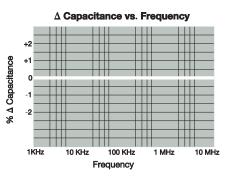
PART NUMBER (SEE PAGE 4 FOR COMPLETE PART NUMBER EXPLANATION)



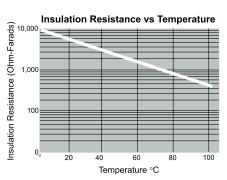


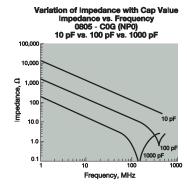
NOTE: Contact factory for availability of Termination and Tolerance Options for Specific Part Numbers. Contact factory for non-specified capacitance values.

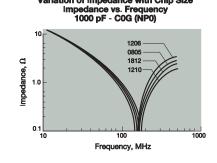


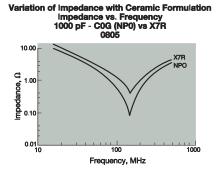


Variation of Impedance with Chip Size









COG (NP0) Dielectric





Parame	ter/Test	NP0 Specification Limits	Measuring (Conditions
	perature Range	-55°C to +125°C	Temperature C	
-	itance Q	Within specified tolerance <30 pF: Q≥ 400+20 x Cap Value ≥30 pF: Q≥ 1000	Freq.: 1.0 MHz ± 10% 1.0 kHz ± 10% fo Voltage: 1.0	r cap > 1000 pF
Insulation	Resistance	10,000MΩ or 500MΩ - μ F, whichever is less	Charge device with rated @ room tem	
Dielectric	: Strength	No breakdown or visual defects	Charge device with 250% seconds, w/charge and d to 50 mA Note: Charge device with for 500V	ischarge current limited A (max) n 150% of rated voltage
	Appearance	No defects	_	
Resistance to	Capacitance Variation	±5% or ±.5 pF, whichever is greater	Deflectio Test Time: 3	
Flexure	Q	Meets Initial Values (As Above)	V	
Stresses	Insulation Resistance	≥ Initial Value x 0.3	90 n	nm
Solder	rability	≥ 95% of each terminal should be covered with fresh solder	Dip device in eutectic sold 0.5 sec	
	Appearance	No defects, <25% leaching of either end terminal		
	Capacitance Variation	≤ ±2.5% or ±.25 pF, whichever is greater	Dip device in eutectic	c solder at 260°C for
Resistance to	Q	Meets Initial Values (As Above)	60sec- onds. Store at	
Solder Heat	Insulation Resistance	Meets Initial Values (As Above)	properties.	re measuring electrical
	Dielectric Strength	Meets Initial Values (As Above)		
	Appearance	No visual defects	Step 1: -55°C ± 2°	30 ± 3 minutes
	Capacitance Variation	≤ ±2.5% or ±.25 pF, whichever is greater	Step 1: $-55^{\circ}C \pm 2^{\circ}$ 30 ± 3 minutesStep 2: Room Temp ≤ 3 minutes	
Thermal Shock	Q	Meets Initial Values (As Above)	Step 3: +125°C ± 2°	30 ± 3 minutes
	Insulation Resistance	Meets Initial Values (As Above)	Step 4: Room Temp	≤ 3 minutes
	Dielectric Strength	Meets Initial Values (As Above)	Repeat for 5 cycles 24 hours at roor	
	Appearance	No visual defects	_	
	Capacitance Variation	≤ ±3.0% or ± .3 pF, whichever is greater	Charge device with twic chamber set at	
Load Life	Q (C=Nominal Cap)	≥ 30 pF: Q≥ 350 ≥10 pF, <30 pF: Q≥ 275 +5C/2 <10 pF: Q≥ 200 +10C	for 1000 hou Remove from test cha	rs (+48, -0).
	Insulation Resistance	≥ Initial Value x 0.3 (See Above)	room temperatu before me	re for 24 hours
	Dielectric Strength	Meets Initial Values (As Above)		
	Appearance	No visual defects		
	Capacitance Variation	≤ ±5.0% or ± .5 pF, whichever is greater	Store in a test chamber s	et at 85°C + 2°C/ 85% +
Load Humidity	Q	≥ 30 pF: Q≥ 350 ≥10 pF, <30 pF: Q≥ 275 +5C/2 <10 pF: Q≥ 200 +10C	5% relative humidi (+48, -0) with rated	ty for 1000 hours I voltage applied.
	Insulation Resistance	≥ Initial Value x 0.3 (See Above)	Remove from chamber temperature for 24 ± 2 ho	
	Dielectric Strength	Meets Initial Values (As Above)		

COG (NP0) Dielectric





PREFERRED SIZES ARE SHADED

SIZE		0101*	02	:01		0402				0603						0805						1206			
Solderin		Reflow Only		w Only		flow/W				eflow/W						ow/Wave			Reflow/Wave						
Packagir (L) Length	mm	All Paper 0.40 ± 0.02	0.60	aper ± 0.03	1.	All Pape 00 ± 0.	10		1	All Pape 1.60 ± 0.	15				2.0	/Emboss 01 ± 0.20						per/Embe 3.20 ± 0.	20		
(L) Length	(in.)	(0.016 ± 0.0008)	(0.024 :		<u> </u>	40 ± 0.				063 ± 0.						79 ± 0.00	B)					.126 ± 0.			
W) Width	mm (in.)	0.20 ± 0.02 (0.008 ± 0.0008)	0.30 :			50 ± 0. 20 ± 0.).81 ± 0. 032 ± 0.						25 ± 0.20 19 ± 0.00	8)					1.60 ± 0. .063 ± 0.			
(t) Terminal	mm	0.10 ± 0.04	0.15			25 ± 0.				0.35 ± 0.						50 ± 0.25						0.50 ± 0.			
(0) 1011111101	(in.) WVDC	(0.004 ± 0.0016) 16	(0.006 :	± 0.002)	(0.0	10 ± 0.0	006) 50	16	(0. 25	014 ± 0. 50	006) 100	200	16	25	(0.02	20 ± 0.010 100	0) 200	250	16	25	50	.020 ± 0.	010) 200	250	500
Сар	0.5	10	A A	A	C	C	C	G	G	G	G	200	J	J	J	J	J	J	J	J	J	J	J	J	J
(pF)	1.0	В	Α	A	С	С	С	G	G	G	G		J	J	J	J	J	J	J	J	J	J	J	J	J
	1.2 1.5	B B	A A	A	C	C	C	G	G G	G G	G G		J	J	J	J	J	J	J	J	J	J	J	J	J
	1.8	В	Α	Α	С	С	С	G	G	G	G		J	J	J	J	J	J	J	J	J	J	J	J	J
	2.2 2.7	B B	A	A	C	C	C	G	G	G	G		J	J	J	J	J	J	J	J	J	J	J	J	J
	3.3	В	A	A	C	C	C	G	G	G	G		J	J	J	J	J	J	J	J	J	J	J	J	J
	3.9	В	A	A	С	C	C	G	G	G	G		J	J	J	J	J	J	J	J	J	J	J	J	J
	4.7 5.6	B B	A	A	C	C	C	G	G	G	G		J	J	J	J	J	J	J	J	J	J	J	J	J
	6.8	В	Α	A	С	С	С	G	G	G	G		J	J	J	J	J	J	J	J	J	J	J	J	J
	8.2 10	B B	A	A	C	C	C	G	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J	J
	12	В	Α	Α	С	С	С	G	G	G	G	G	Ĵ	J	J	J	J	Ĵ	J	J	J	J	J	Ĵ	J
	15 18	B B	A	A	C	C	C	G	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J	J
	22	В	Α	A	С	С	С	G	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J	J
	27 33	B B	A	A	C	C	C	G	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J	J
	39	В	A	A	C	C	c	G	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J	J
	47 56	B B	A	A	C	С	C	G	G G	G G	G	G G	J	J	J	J	J	J	J	J	J	J	J	J	J
	68	В	A	A	C	C	C	G	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J	J
	82	В	Α	A	С	С	С	G	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J	J
	100 120	В	Α	Α	C	C	C	G	G G	G	G	G G	J	J	J	J	J	J	J	J	J	J	J	J	J
	150				С	С	С	G	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J	J
	180 220				C	C	C	G G	G G	G G	G G	G G	J	J	J	J	J N	N N	J	J	J	J	J	J	J
	270				С	С	С	G	G	G	G		J	J	J	J	N	N	J	J	J	Ĵ	Ĵ	J	J
	330 390				C	C	C	G	G G	G G	G G		J	J	J	J	N N	N N	J	J	J	J	J	J	J
	470				С	С	С	G	G	G	G		J	J	J	J	N	N	J	J	J	J	J	J	J
	560 680				C	C	C	G	G G	G G	G G		J	J	J	J	N N	N N	J	J	J	J	J	J	J
	750				C	c	c	G	G	G	G		Ĵ	Ĵ	Ĵ	J	N	N	J	J	Ĵ	Ĵ	Ĵ	J	J
	820 1000				C	C	C	G	G	G	G		J	J	J	J	N N	N N	J	J	J	J	J	J	J
	1200				C			G	G	G	G		J	J	J	J	P	P	J	J	J	J	J	J	J
	1500 1800							G	G	G			J	J	J	J	P P	P P	J	J	J M	M P	Q	P P	P P
	2200							G	G G	G G			J P	J P	J P	J P	P	P	J	J	M	P	Q Q	P	P
	2700							G	G	G			Р	Р	P	P	P	P	J	J	M	P	Q	P	P
	3300 3900							G	G G	G			P P	P P	P P	P P	P P	P P	J	J	M M	P P	Q X	X	P X
	4700							G	G	G			Р	Р	Р	P	P	P	J	J	М	Р	Х	Х	Х
	5600 6800												P P	P P	P P				J M	J M	M M	P P	X	X	X
	8200												P	P	P				P	P	P	P	X	X	.,
Cap (μF)	0.010 0.012												P P	P P	P P				P X	P X	P X	P X	X	Х	
(P1)	0.015			1		l							, i		L'				Х	Х	Х	Х			
	0.018 0.022	_1_	-	\sim	₩.	>													X	X	X	X			
	0.027	_	\leq))) ÎT													Х	Х	X				
	0.033 0.039) _	سلر	-	_												X	X	X	Х			
	0.039		<u>_</u>	1															X	X	X				
	0.068		4	•															Х	Х	Х				
	0.082 0.1		1 1	ĺ		l	l												Х	X	X				
WVDC		16	25	50	16	25	50	16	25	50	100	200	16	25	50	100	200	250	16	25	50	100	200	250	500
SIZE		0101*	02	:01		0402				0603						0805						1206			

Letter	Α	В	С	Е	G	J	K	М	N	Р	Q	Х	Υ	Z
Max. Thickness	0.33 (0.013)	0.22 (0.009)	0.56 (0.022)	0.71 (0.028)	0.90 (0.035)	0.94 (0.037)	1.02 (0.040)	1.27 (0.050)	1.40 (0.05 5)	1.52 (0.060)	1.78 (0.070)	2.29 (0.090)	2.54 (0.100)	2.79 (0.110)
			P/	APER						EMB	OSSED			

COG (NP0) Dielectric





PREFERRED SIZES ARE SHADED

SIZE				1210					1812				1825			2220			2225	
Soldering				Reflow Only					Reflow Only				Reflow Onl			Reflow Onl			eflow Only	
Packaging				per/Embos					II Embosse				All Embosse			II Embosse			Embossed	
(L) Length	mm (in.)			3.20 ± 0.20 0.126 ± 0.00					4.50 ± 0.30 1.177 ± 0.01				4.50 ± 0.30 0.177 ± 0.01			5.70 ± 0.40 .225 ± 0.01			5.72 ± 0.25 225 ± 0.010	
W) Width	mm			2.50 ± 0.20)				3.20 ± 0.20				6.40 ± 0.40)	Ì	5.00 ± 0.40)	6	.35 ± 0.25	
vv) vvidin	(in.)			0.098 ± 0.00					.126 ± 0.00				0.252 ± 0.01			.197 ± 0.01			250 ± 0.010	
(t) Terminal	mm (in.)			0.50 ± 0.25 0.020 ± 0.01					0.61 ± 0.36 0.024 ± 0.01				0.61 ± 0.36 0.024 ± 0.01			0.64 ± 0.39 .025 ± 0.01			0.64 ± 0.39 025 ± 0.01	
	WVDC	25	50	100	200	500	25	50	100	200	500	50	100	200	50	100	200	50	100	200
Сар	3.9																			
(pF)	4.7 5.6																			
	6.8																			
	8.2																			
	10	М	М	М	М	М	P	P	P	P	P						~	~	N	
	12 15	M M	M M	M M	M M	M M	P P	P P	P P	P P	P P					~L		$\overline{}$	5	
	18	M	M	M	M	M	P	P	P	P	P					+ (-	\ \ \	JJT-	\vdash
	22	М	М	М	М	М	Р	Р	Р	Р	Р					_	$\overline{}$			
	27	М	М	М	М	М	Р	Р	Р	Р	Р					1	1	-	_	igsquare
	33 39	M	M M	M M	M M	M M	P P	P P	P P	P P	P P						t	1	ı	
	47	M P	P	P IVI	P IVI	P	P	P	P	P	P									
	56	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р									
	68	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р									
	82	P	P	P	P	P	P	P	P	P	P									\vdash
	100 120	P P	P P	P P	P P	P P	P P	P P	P P	P P	P P									
	150	P	P	P	P	P	P	P	P	P	P									
	180	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р									
	220	P	P	P	P	P	P	P	P	P	P									
	270 330	P P	P P	P P	P P	P P	P P	P P	P P	P P	P P				-					\vdash
	390	P	P	P	P	P	P	P	P	P	P									
	470	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р									
	560	P	P	P	P	P	P	P	P	P	P									
	680 820	P P	P P	P P	P P	P P	P P	P P	P P	P P	P P									
	1000	P	P	P	P	P	P	P	P	P	P	М	М	М				М	М	Р
	1200	Р	Р	Р	Р	Р	Р	Р	Р	Р	Р	М	М	М				М	М	Р
	1500	P	P	P	P	Р	Р	P	P	Р	Р	М	М	М				М	М	P
	1800 2200	P P	P P	P P	P P	P P	P P	P P	P P	P P	P P	M X	M X	M M				M M	M M	P P
	2700	P	P	P	P	P	P	P	P	P	Q	x	x	M				M	M	P
	3300	Р	Р	P	P	P	P	Р	Р	P	Q	X	X	X			Х	М	М	Р
	3900	Р	P	P	P	P	P	P	P	P	Q	X	X	X			X	М	М	P
	4700 5600	P P	P P	P P	P P	P P	P P	P P	P P	P P	Y	X	X	X	X	X	X	M M	M M	P P
	6800	P	P	P	X	X	P	P	Q	Q	Ϋ́	x	x	x	x	x	x	M	M	P
	8200	Р	Р	Р	Х	Х	Р	Р	Q	Q	Υ	Х	Х	Х	Х	Х	Х	М	М	Р
Cap	0.010	P	P	X	X	X	Р	Р	Q	Q	Y	X	X	Х	X	X	X	М	М	Р
(μF)	0.012 0.015	X X	X	X X	X Z	X Z	P P	P P	Q	X X	Y	X	X X	X X	X	X	X	M M	M M	P Y
	0.013	X	X	Z	Z		P	P	X	X	Y	X	X	X	X	X	X	M	M	Y
	0.022	Χ	X	Z	Z		Р	Р	Х	х		Х	Х	х	Х	X		М	Y	Y
	0.027	X	Z	Z	Z		Q	X	X	Z		X	X	Y	X	X	$\vdash \vdash \vdash$	P	Y	Y
	0.033	X Z	Z Z	Z Z	Z		Q X	X X	X Z	Z Z		X X	X		X Y	Х		X X	Y Y	Y
	0.039	Z	Z	Z			x	×	Z	Z		X			Y			X	Z	
	0.068				İ		Z	Z	Z				İ		Z			Х	Z	\Box
	0.082						Z	Z	Z						Z			X	Z	
	0.1 WVDC	25	50	100	200	500	Z 25	50	Z 100	200	500	50	100	200	50	100	200	50	Z 100	200
	SIZE	23	1 30	1210	200	300	23	30	1812	200	300	30	1825	200	30	2220	200	30	2225	200

Letter	Α	В	С	E	G	J	K	М	N	Р	Q	Х	Υ	Z
Max. Thickness	0.33 (0.013)	0.22 (0.009)	0.56 (0.022)	0.71 (0.028)	0.90 (0.035)	0.94 (0.037)	1.02 (0.040)	1.27 (0.050)	1.40 (0.055)	1.52 (0.060)	1.78 (0.070)	2.29 (0.090)	2.54 (0.100)	2.79 (0.110)
			PAF	PER						EMBO	SSED			



U Dielectric

RF/Microwave C0G (NP0) Capacitors (RoHS)

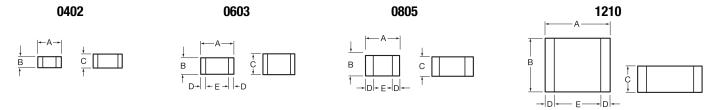
Ultra Low ESR, "U" Series, COG (NP0) Chip Capacitors



GENERAL INFORMATION

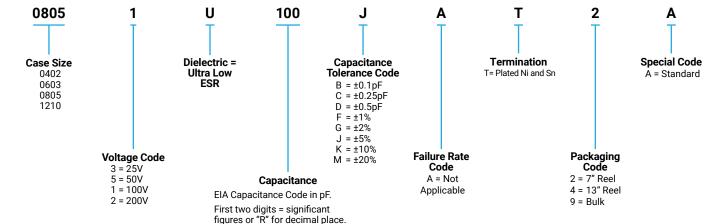
"U" Series capacitors are C0G (NP0) chip capacitors specially designed for "Ultra" low ESR for applications in the communications market. Max ESR and effective capacitance are met on each value producing lot to lot uniformity. Sizes available are EIA chip sizes 0603, 0805, and 1210.

DIMENSIONS: inches (millimeters)



Size	A	В	С	D	E
0402	0.039±0.004 (1.00±0.1)	0.020±0.004 (0.50±0.1)	0.024 (0.6) max	0.010 ± 0.006 (0.25 ± 0.15)	0.014 (0.36) min
0603	0.060±0.010 (1.52±0.25)	0.030±0.010 (0.76±0.25)	0.036 (0.91) max	0.010 ± 0.005 (0.25 ± 0.13)	0.030 (0.76) min
0805	0.079±0.008 (2.01±0.2)	0.049±0.008 (1.25±0.2)	0.045 (1.15mm) max	0.020 ± 0.010 (0.51 ± 0.254)	0.020 (0.51) min
1210	0.126±0.008 (3.2±0.2)	0.098±0.008 (2.49±0.2)	0.055 (1.40mm) max	0.025 ± 0.015 (0.635 ± 0.381)	0.040 (1.02) min

HOW TO ORDER



Third digit = number of zeros or after "R" significant figures.

ELECTRICAL CHARACTERISTICS

Capacitance Values and Tolerances:

Size 0402 - 0.2 pF to 22 pF @ 1 MHz Size 0603 - 1.0 pF to 100 pF @ 1 MHz Size 0805 - 1.6 pF to 160 pF @ 1 MHz Size 1210 - 2.4 pF to 1000 pF @ 1 MHz

Temperature Coefficient of Capacitance (TC):

0±30 ppm/°C (-55° to +125°C)

Insulation Resistance (IR):

 $10^{12}\,\Omega$ min. @ $25^{\circ}C$ and rated WVDC $10^{11} \Omega$ min. @ 125° C and rated WVDC

Working Voltage (WVDC):

Size Working Voltage 0402 50, 25 WVDC 0603 200, 100, 50 WVDC 0805 200, 100 WVDC 1210 200, 100 WVDC

Dielectric Working Voltage (DWV):

250% of rated WVDC

Equivalent Series Resistance Typical (ESR):

0402 - See Performance Curve, page 300 0603 - See Performance Curve, page 300 0805 - See Performance Curve, page 300 1210 - See Performance Curve, page 300

Marking

Laser marking EIA J marking standard (except 0603) (capacitance code and tolerance upon request).

LEAD-FREE

LEAD-FREE COMPATIBLE COMPONENT

RoHS

COMPLIANT

MILITARY SPECIFICATIONS

Meets or exceeds the requirements of MIL-C-55681



U Dielectric

RF/Microwave C0G (NP0) Capacitors (RoHS)



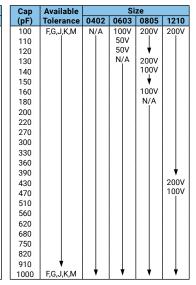


CAPACITANCE RANGE

Cap	Available		Si	ze	
(pF)	Tolerance	0402	0603	0805	1210
0.2	B,C	50V	N/A	N/A	N/A
0.3					
0.4	♦				
0.5	B,C				
0.6	B,Ç,D				
0.7					
0.8	▼				
0.9	B,C,D	🗡	*	♦	🕈

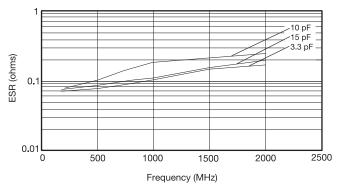
Cap	Available		Si	ze	
(pF)	Tolerance	0402	0603	0805	1210
1.0	B,C,D	50V	200V	200V	200V
1.1					
1.2					
1.3					
1.4					
1.5					
1.6					
1.7					
1.8					
1.9					
2.0					
2.1					
2.2					
2.4					
2.7					
3.0					
3.3					
3.6					
3.9					
4.3 4.7					
5.1					
5.6	↓				
6.2	B,C,D				
6.8	B,C,J,K,M	♦	♦	♦	♦
0.8	ט,ט,ט,ועו				

Cap	Available						
(pF)	Tolerance	0402	0603	0805	1210		
7.5	B,C,J,K,M	50V	200V	200V	200V		
8.2	♦						
9.1	B,C,J,K,M						
10	F,G,J,K,M						
11							
12							
13							
15			♦				
18			200V				
20			100V				
22							
24							
27		♦					
30		50V					
33		N/A					
36							
39							
43							
47							
51							
56							
68							
75				1			
82	1 1	1 1		1	1		
91	▼	_ ▼	_ ▼	₹	- ₹		

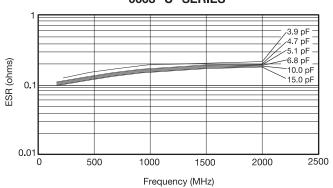


ULTRA LOW ESR, "U" SERIES

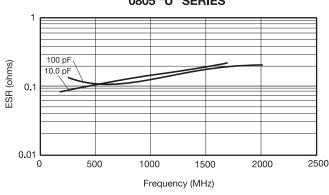
TYPICAL ESR vs. FREQUENCY 0402 "U" SERIES



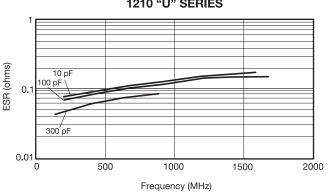
TYPICAL ESR vs. FREQUENCY 0603 "U" SERIES



TYPICAL ESR vs. FREQUENCY 0805 "U" SERIES



TYPICAL ESR vs. FREQUENCY 1210 "U" SERIES

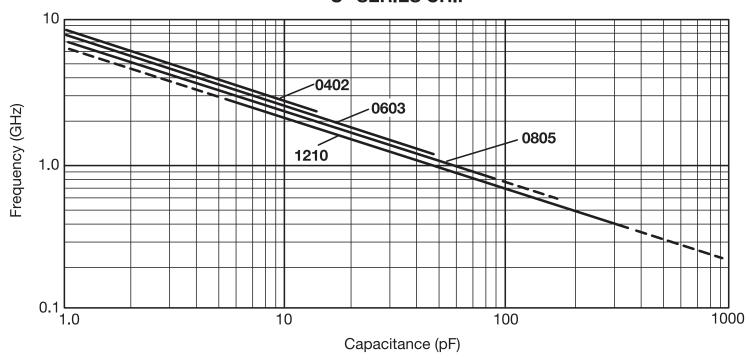


ESR Measured on the Boonton 34A



Ultra Low ESR, "U" Series, COG (NP0) Chip Capacitors

TYPICAL SERIES RESONANT FREQUENCY "U" SERIES CHIP



U Dielectric

RF/Microwave C0G (NP0) Capacitors (Sn/Pb)

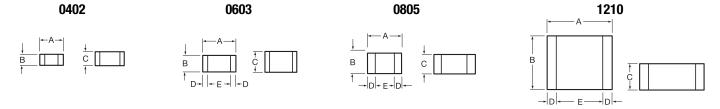
Ultra Low ESR, "U" Series, COG (NP0) Chip Capacitors



GENERAL INFORMATION

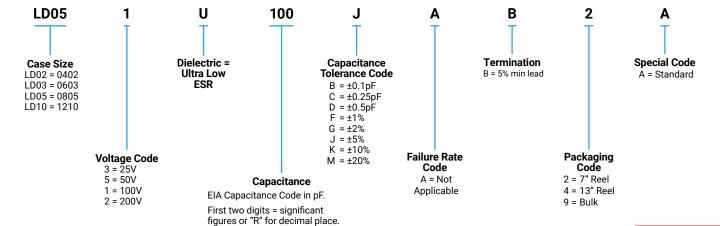
"U" Series capacitors are C0G (NP0) chip capacitors specially designed for "Ultra" low ESR for applications in the communications market. Max ESR and effective capacitance are met on each value producing lot to lot uniformity. Sizes available are EIA chip sizes 0603, 0805, and 1210.

DIMENSIONS: inches (millimeters)



Size	Α	В	С	D	E
0402	0.039±0.004 (1.00±0.1)	0.020±0.004 (0.50±0.1)	0.024 (0.6) max	0.010 ± 0.006 (0.25 ± 0.15)	0.014 (0.36) min
0603	0.060±0.010 (1.52±0.25)	0.030±0.010 (0.76±0.25)	0.036 (0.91) max	0.010±0.005 (0.25±0.13)	0.030 (0.76) min
0805	0.079±0.008 (2.01±0.2)	0.049±0.008 (1.25±0.2)	0.045 (1.15mm) max	0.020±0.010 (0.51±0.254)	0.020 (0.51) min
1210	0.126±0.008 (3.2±0.2)	0.098±0.008 (2.49±0.2)	0.055 (1.40mm) max	0.025±0.015 (0.635±0.381)	0.040 (1.02) min

HOW TO ORDER



Third digit = number of zeros or after "R" significant figures.

Not RoHS Compliant

ELECTRICAL CHARACTERISTICS

Capacitance Values and Tolerances:

Size 0402 - 0.2 pF to 22 pF @ 1 MHz Size 0603 - 1.0 pF to 100 pF @ 1 MHz

Size 0805 - 1.6 pF to 160 pF @ 1 MHz

Size 1210 - 2.4 pF to 1000 pF @ 1 MHz

Temperature Coefficient of Capacitance (TC):

0±30 ppm/°C (-55° to +125°C)

Insulation Resistance (IR):

 $10^{12}\,\Omega$ min. @ 25° C and rated WVDC $10^{11} \Omega$ min. @ 125° C and rated WVDC

Working Voltage (WVDC):

Size Working Voltage 0402 - 50, 25 WVDC 0603 - 200, 100, 50 WVDC 0805 - 200, 100 WVDC 1210 - 200, 100 WVDC

Dielectric Working Voltage (DWV):

250% of rated WVDC

Equivalent Series Resistance Typical (ESR):

040 - See Performance Curve, page 306

0603 - See Performance Curve, page 306

0805 - See Performance Curve, page 306

1210 - See Performance Curve, page 306

Laser marking EIA J marking standard (except 0603) (capacitance code and tolerance upon request).

Military Specifications

Meets or exceeds the requirements of MIL-C-55681



U Dielectric

RF/Microwave C0G (NP0) Capacitors (Sn/Pb)

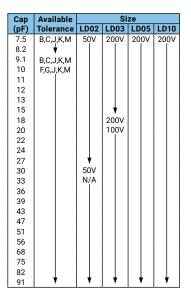


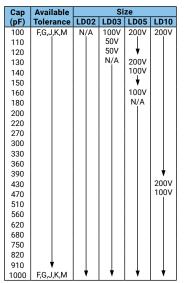


CAPACITANCE RANGE

Available	Size					
Tolerance	LD02	LD03	LD05	LD10		
B,C	50V	N/A	N/A	N/A		
♦						
B,C						
B,Ç,D						
▼						
B,C,D	♦	♦	♦	♦		
	B,C B,C B,C B,C,D	B,C SOV B,C,D	Tolerance	Tolerance		

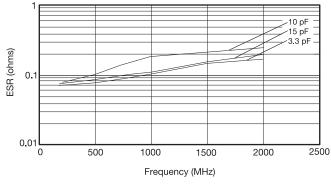
Сар	Available	Size				
(pF)	Tolerance	LD02	02 LD03 LD05		LD10	
1.0	B,C,D	50V	200V	200V	200V	
1.1						
1.2						
1.3						
1.4						
1.5						
1.6						
1.7						
1.8						
1.9						
2.0						
2.1						
2.2						
2.4						
2.7						
3.0						
3.3						
3.6						
3.9						
4.3						
4.7						
5.1						
5.6	▼					
6.2	B,C,D	↓	↓	↓	↓	
6.8	B,C,J,K,M	*		■	"	



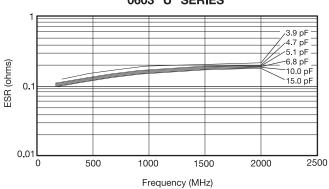


ULTRA LOW ESR, "U" SERIES

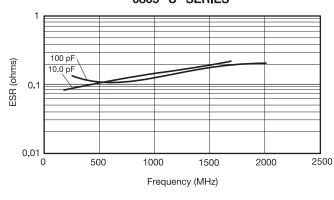
TYPICAL ESR vs. FREQUENCY 0402 "U" SERIES



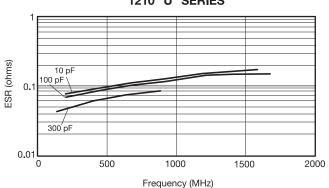
TYPICAL ESR vs. FREQUENCY 0603 "U" SERIES



TYPICAL ESR vs. FREQUENCY 0805 "U" SERIES



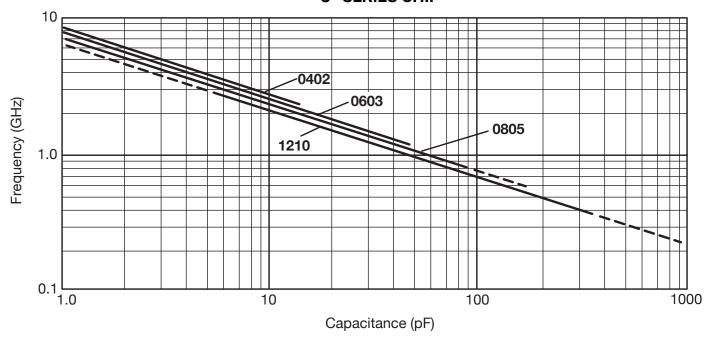
TYPICAL ESR vs. FREQUENCY 1210 "U" SERIES



ESR Measured on the Boonton 34A



TYPICAL SERIES RESONANT FREQUENCY "U" SERIES CHIP



U Dielectric

RF/Microwave Automotive C0G (NP0) Capacitors (RoHS)



AEC Q200 Qualified Ultra Low ESR, "U" Series, C0G (NP0) Chip Capacitors

GENERAL INFORMATION

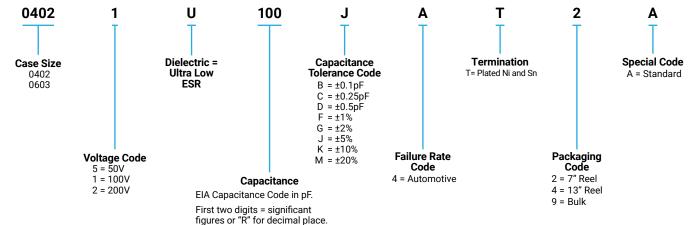
Automotive "U" Series capacitors are COG (NPO) chip capacitors specially designed for "Ultra" low ESR for applications in the automotive market. Max ESR and effective capacitance are met on each value producing lot to lot uniformity. Sizes available are EIA chip sizes 0402 and 0603.

DIMENSIONS: inches (millimeters)

inches (mm)

Size	Α	В	С	D	E
0402	0.039±0.004 (1.00±0.1)	0.020±0.004 (0.50±0.1)	0.024 max (0.6)	N/A	N/A
0603	0.060±0.010 (1.52±0.25)	0.030±0.010 (0.76±0.25)	0.036 max (0.91)	0.010±0.005 (0.25±0.13)	0.030 min (0.76)

HOW TO ORDER



LEAD-FREE LEAD-FREE COMPATIBLE COMPONENT

ELECTRICAL CHARACTERISTICS Capacitance Values and Tolerances:

Size 0402 - 0.2 pF to 22 pF @ 1 MHz Size 0603 - 1.0 pF to 100 pF @ 1 MHz

Temperature Coefficient of Capacitance (TC):

0±30 ppm/°C (-55° to +125°C)

Insulation Resistance (IR):

 $10^{12} \Omega$ min. @ 25°C and rated WVDC $10^{11} \Omega$ min. @ 125° C and rated WVDC

Working Voltage (WVDC):

Working Voltage 0402 - 100, 50, 25 WVDC 0603 - 200, 100, 50 WVDC

Dielectric Working Voltage (DWV):

250% of rated WVDC

Third digit = number of zeros or after "R" significant figures.

Equivalent Series Resistance Typical (ESR):

See Performance Curve, page 303 0603 See Performance Curve, page 303

Automotive Specifications

Meets or exceeds the requirements of AEC Q200

120216

U Dielectric

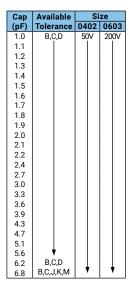
RF/Microwave Automotive C0G (NP0) Capacitors (RoHS)



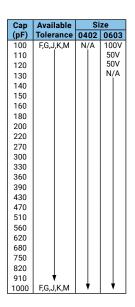
AEC Q200 Qualified, Ultra Low ESR, "U" Series, C0G (NP0) Chip Capacitors

CAPACITANCE RANGE

Cap	Available	Size		
(pF)	Tolerance	0402	0603	
0.2	B,C	50V	N/A	
0.3				
0.4	♦			
0.5	B,C			
0.6	B,C,D			
0.7				
0.8	▼			
0.9	B,C,D	♦	🗡	

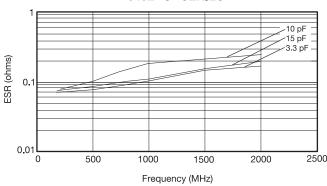


Сар	Available	Si	ze
(pF)	Tolerance	0402	0603
7.5	B,C,J,K,M	50V	200V
8.2	♦		
9.1	B,C,J,K,M		
10	F,G,J,K,M		
11			
12			
13			
15			🔻
18			200V
20			100V
22			
24			
27		♦	
30		50V	
33		N/A	
36			
39			
43			
47			
51			
56			
68			
75			
82			
91	▼	▼	▼

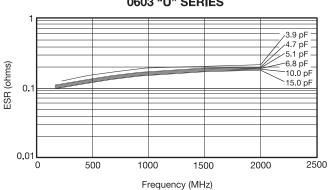


ULTRA LOW ESR, "U" SERIES

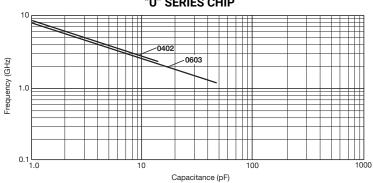
TYPICAL ESR vs. FREQUENCY 0402 "U" SERIES



TYPICAL ESR vs. FREQUENCY 0603 "U" SERIES



TYPICAL SERIES RESONANT FREQUENCY "U" SERIES CHIP





0402

	Kit 5000 UZ						
Cap. Value PF	/alue Tolerance Value		Tolerance				
0.5		4.7					
1.0		5.6	B (± 0.1pF)				
1.5		6.8					
1.8	B (±0.1pF)	8.2					
2.2	в (±0.1µг)	10.0					
2.4		12.0	J (±5%)				
3.0		15.0	J (±3%)				
3.6							

^{***25} each of 15 values

0805

Kit 3000 UZ						
Cap. Value PF	Tolerance	Cap. Value pF	Tolerance			
1.0		15.0				
1.5		18.0				
2.2		22.0				
2.4		24.0				
2.7]	27.0				
3.0	B (±0.1pF)	33.0				
3.3	D (±0.1pi)	36.0	J (±5%)			
3.9		39.0	3 (±3%)			
4.7		47.0				
5.6		56.0				
7.5		68.0				
8.2		82.0				
10.0	J (±5 %)	100.0				
12.0	3 (±3 %)	130.0				

^{***25} each of 30 values

0603

Kit 4000 UZ						
Cap. Value PF	Tolerance	Cap. Value pF	Tolerance			
1.0		6.8				
1.2		7.5	B (±0.1pF)			
1.5		8.2				
1.8		10.0				
2.0		12.0				
2.4	B (±0.1pF)	15.0				
2.7	Б (±0.1рі)	18.0				
3.0		22.0	J (±5%)			
3.3		27.0				
3.9		33.0				
4.7		39.0				
5.6		47.0				

^{***25} each of 24 values

1210

	Kit 3500 UZ						
Cap. Value PF	Tolerance	Cap. Value pF	Tolerance				
2.2		36.0					
2.7		39.0					
4.7		47.0					
5.1	B (±0.1pF)	51.0					
6.8		56.0					
8.2		68.0					
9.1		82.0					
10.0		100.0	J (±5%)				
13.0		120.0					
15.0		130.0					
18.0	1/+ 5 %)	240.0					
20.0	J (± 5 %)	300.0					
24.0		390.0					
27.0		470.0					
30.0		680.0					

^{***25} each of 30 values

X8R/X8L Dielectric

General Specifications





KYOCERA AVX has developed a range of multilayer ceramic capacitors designed for use in applications up to 150°C. These capacitors are manufactured with an X8R and an X8L dielectric material. X8R material has capacitance variation of ± 15% between -55°C and +150°C. The X8L material has capacitance variation of ±15% between -55°C to 125°C to 125°C and +15/40% from +125°C to +150°C.

The need for X8R and X8L performance has been driven by customer requirements for parts that operate at elevated temperatures. They provide a highly reliable capacitor with low loss and stable capacitance over temperature.

They are ideal for automotive under the hood sensors, and various industrial applications. Typical industrial application would be drilling monitoring system. They can also be used as bulk capacitors for high temperature camera modules.



Both X8R and X8L dielectric capacitors are automotive AEC-Q200 qualified. Optional termination systems, tin, FLEXITERM® and conductive epoxy for hybrid applications are available. Providing this series with our FLEXITERM® termination system provides further advantage to customers by way of enhanced resistance to both, temperature cycling and mechanical

0805	5	Α	104	K	4	<u>T</u>	2	Α
\Box	T	T	T	T	T	T	T	T
Size	Voltage	Dielectric	Capacitance	Capacitance	Failure	Terminations	Packaging	Special Code
0402	10V = Z	X8R = F	Code (in pF)	Tolerance	Rate	T = Plated Ni and Sn	2 = 7" Reel	A = Std. Product
0603	16V = Y	X8L = L	2 Sig. Digits +	$J = \pm 5\%$	4=Automotive	Z = FLEXITERM®**	4 = 13" Reel	
0805	25V = 3		Number of Zeros	K = ±10%	A = Not			
1206	50V = 5		e.g. 10 F = 106	$M = \pm 20\%$	Applicable			
	100V = 1		3		Applicable			

NOTE: Contact factory for availability of Termination and Tolerance Options for Specific Part Numbers.

	Style 0603 0805				1206				
S	oldering	Ref	flow/W	ave	Ref	flow/W	ave	Reflow/Wave	
	WVDC	25V	50V	100V	25V	50V	100V	25V	50V
221	220				J	J	J		
271	270	G	G		J	J	J		
331	pF 330	G	G		J	J	J		
471	470	G	G	G	J	J	J		
681	680	G	G	G	J	J	J		
102	1000	G	G	G	J	J	J	J	J
152	1500	G	G	G	J	J	J	J	J
222	2200	G	G	G	J	J	J	J	J
332	3300	G	G	G	J	J	J	J	J
472	4700	G	G	G	J	J	J	J	J
682	6800	G	G	G	J	J	J	J	J
103	uF 0.01	G	G	G	J	J	J	J	J
153	0.015	G	G		J	J	N	J	J
223	0.022	G	G		J	J	N	J	J
333	0.033	G	G		J	J		J	J
473	0.047	G	G		J	J		J	J
683	0.068	G			N	N		М	М
104	0.1				N	N		М	М
154	0.15				N	N		М	М
224	0.22				N			М	М
334	0.33							М	M
474	0.47							М	Q
684	0.68							Q	Q
105	uF 1							Q	Q
	WVDC	25V	50V	100V	25V	50V	100V	25V	50V
	Style		0603			0805		12	06

Size		0603	0805	1206	1210
Solderin	ıg	Reflow/Wave	Reflow/Wave	Reflow/Wave	Reflow/Wave
Packagii	ng	All Paper	Paper/Embossed	Paper/Embossed	Paper/Embossed
(L) Length	mm	1.60 ± 0.15	2.01 ± 0.20	3.20 ± 0.20	3.30 ± 0.4
	(in)	(0.063 ± 0.006)	(0.079 ± 0.008)	(0.126 ± 0.008)	(0.130 ± 0.016)
(W) Width	mm	0.81 ± 0.15	1.25 ± 0.20	1.60 ± 0.20	2.50 ± 0.20
	(in)	(0.032 ± 0.006)	(0.049 ± 0.008)	(0.063 ± 0.008)	(0.098 ± 0.008)
(t) Terminal	mm	0.35 ± 0.15	0.50 ± 0.25	0.50 ± 0.25	0.50 ± 0.25
	(in)	(0.014 ± 0.006)	(0.020 ± 0.010)	(0.020 ± 0.010)	(0.020 ± 0.010)

X₈L

	Size		0603			0805	, AO		12	06			1210	
<u> </u>	Solderina	D.	flow/W		D - 4					/Wave		D - 4	low/W	
`	WVDC	25V	50V	ave 100V	25V	flow/W 50V	ave 100V	16V	25V	50V	100V	10V	50V	ave 100V
271	Cap 270	G	G	1007	25V	50 V	1000	100	25V	50 V	1007	100	507	1000
331	(pF) 330	G	G	G	J	J	J							
471	(pr) 330 470	G	G	G	J	J	J		_					
681	680	G	G	G	_	_								
102	1000	G	G	G	J	J	J			J				
152	1500	G	G	G	J	J	J		J	J	J			
182	1800	G	G	G	_	_			_	_	_			
222	2200	G	G	G	J	J	J		J	J	J			
							J		J	J				
272	2700	G	G	G	J	J	J		J	_	J			
332 392	3300 3900	G	G	G	J	J	J		J	J	J			
					_	_	_		J	_	_			
472	4700	G G	G G	G G	J	J	J		J	J	J			
562 682	5600 6800	G	G	G	J	J			J	J	J			
						_	J							
822 103	8200 Cap 0.01	G G	G G	G	J-	J	J		J	J	J			
				G	J	J	J		J	J	J			
123	(μF) 0.012	G	G		J	J	J		J	J	J			
153	0.015	G G	G		J	J	J		J	J	J			
183	0.018		G		J	J	J		J	J	J			
223	0.022	G G	G		J	J	J		J	J	J			
273	0.027		G G		J	J	J		J	J	J			
333	0.033	G G	G		J	J	N		J	J	J			
393	0.039				J	J	N		J	J	J			
473	0.047	G	G		J	J	N		J	J	J			
563	0.056	G	G		J	J	N		J	J	J			
683	0.068	G	G		J	J	N		J	J	J			
823	0.082	G			J	J	N		J	J	J			
104	0.1	G	G		J	J	N		J	J	М			
124	0.12 0.15				J	N N			J	J	M			
154					J			J	J	J	Q			
184	0.18		-		N	N	_	J	J	J	Q			
224	0.22	_	-		N	N		J	J	J	Q			
274	0.27		-		N		_	J	M	М	Q			
334	0.33		-		N N		<u> </u>	J	M	M P	Q			
394	0.39	_					_	М	M		Q			
474	0.47		-		N		-	M	M	P	Q			
684	0.68		-		N		_	M	M	P	Q			
824	0.82				N			М	M	Р	Q			
105	1		-		N		_	М	M	Р	Q			
155	1.5							М	M				-	-
225	2.2							М	М				Z	Z
475												-	Z	
106	140/5-5	05)	50) <i>(</i>	400)	05)/	E0) /	400);	4616	05)	50) <i>(</i>	400);	Z	F0) /	400)
	WVDC	25V	50V	100V	25V	50V	100V	16V	25V	50V	100V	10V	50V	100V
	SIZE		0603			0805			12	06			1210	

Letter	Α	С	E	G	J	K	М	N	Р	Q	X	Υ	Z
Max. Thickness	0.33 (-0.013)	0.56 (-0.022)	0.71 (-0.028)	0.9 (-0.035)	0.94 (-0.037)	1.02 (-0.04)	1.27 (-0.05)	1.4 (-0.055)	1.52 (-0.06)	1.78 (-0.07)	2.29 (-0.09)	2.54 (-0.1)	2.79 (-0.11)
			PAPER						FMB0:	SSFD			



KYDCER3 The Important Information/Disclaimer is incorporated in the catalog where these specifications came from or available online at www.kyocera-avx.com/disclaimer/ by reference and should be reviewed in full before placing any order.

X8R/X8L Dielectric

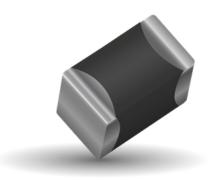
General Specifications



APPLICATIONS FOR X8R AND X8L CAPACITORS

- All market sectors with a 150°C requirement
- Automotive on engine applications
- Oil exploration applications
- · Hybrid automotive applications
 - Battery control
 - Inverter / converter circuits
 - Motor control applications
- Water pump
- Hybrid commercial applications
 - Emergency circuits
 - Sensors
 - Temperature regulation





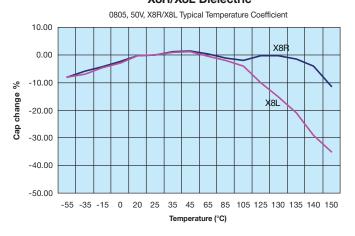
ADVANTAGES OF X8R AND X8L MLC CAPACI-TORS

- Both ranges are qualified to the highest automotive AEC-Q200 standards
- Excellent reliability compared to other capacitor technologies
- RoHS compliant
- Low ESR / ESL compared to other technologies
- Tin solder finish
- FLEXITERM® available
- Epoxy termination for hybrid available
- 100V range available

ENGINEERING TOOLS FOR HIGH VOLTAGE MLC CAPACITORS

- Samples
- **Technical Articles**
- **Application Engineering**
- **Application Support**

X8R/X8L Dielectric



X8R/X8L Dielectric

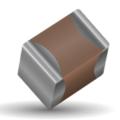




Parame	ter/Test	X8R/X8L Specification Limits	Measuring (Conditions
Operating Tem	perature Range	-55°C to +150°C	Temperature C	ycle Chamber
Capac	itance	Within specified tolerance	Freg.: 1.0 k	Hz + 10%
Dissipati	on Factor	≤ 2.5% for ≥ 50V DC rating ≤ 3.5% for 25V DC and 16V DC rating	Voltage: 1.0	
Insulation	Resistance	100,000ΜΩ or 1000ΜΩ - μF, whichever is less	Charge device with rated @ room tem	
Dielectric	: Strength	No breakdown or visual defects	Charge device with 250 1-5 seconds, w/charge limited to 50 Note: Charge device with for 500V	and discharge current mA (max) n 150% of rated voltage
	Appearance	No defects	Deflection	n: 2mm
Resistance to	Capacitance Variation	≤ ±12%	Test Time: 3	
Flexure Stresses	Dissipation Factor	Meets Initial Values (As Above)	V	
	Insulation Resistance	≥ Initial Value x 0.3	90 n	nm ————————————————————————————————————
Solder	rability	≥ 95% of each terminal should be covered with fresh solder	Dip device in eutectic sold 0.5 sec	
	Appearance	No defects, <25% leaching of either end terminal		
	Capacitance Variation	≤ ±7.5%	Die deute in cut cat	d + 0 < 0 0 0 f
Resistance to Solder Heat	Dissipation Factor	Meets Initial Values (As Above)	Dip device in eutection 60 seconds. Store at 24 ± 2 hours before n	room temperature for
	Insulation Resistance	Meets Initial Values (As Above)	properties.	g
	Dielectric Strength	Meets Initial Values (As Above)		
	Appearance	No visual defects	Step 1: -55°C ± 2°	30 ± 3 minutes
	Capacitance Variation	≤ ±7.5%	Step 2: Room Temp	≤ 3 minutes
Thermal Shock	Dissipation Factor	Meets Initial Values (As Above)	Step 3: +125°C ± 2°	30 ± 3 minutes
	Insulation Resistance	Meets Initial Values (As Above)	Step 4: Room Temp	≤ 3 minutes
	Dielectric Strength	Meets Initial Values (As Above)	Repeat for 5 cycles 24 ± 2 hours at ro	
	Appearance	No visual defects	-	
	Capacitance Variation	≤ ±12.5%	Charge device with 1.5 r	
Load Life	Dissipation Factor	≤ Initial Value x 2.0 (See Above)	for 1000 hou	
	Insulation Resistance	≥ Initial Value x 0.3 (See Above)	Remove from test chamb temperature for 24 ± 2 ho	
	Dielectric Strength	Meets Initial Values (As Above)		
	Appearance	No visual defects	_	
	Capacitance Variation	≤ ±12.5%	Store in a test chamber s 5% relative humidi	
Load Humidity	Dissipation Factor	≤ Initial Value x 2.0 (See Above)	(+48, -0) with rated	voltage applied.
riamuity	Insulation Resistance	≥ Initial Value x 0.3 (See Above)	Remove from chamber temperature and humidity measu	for 24 ± 2 hours before
	Dielectric Strength	Meets Initial Values (As Above)	measu	inig

General Specifications





X7R formulations are called "temperature stable" ceramics and fall into EIA Class II materials. X7R is the most popular of these intermediate dielectric constant materials. Its temperature variation of capacitance is within ±15% from -55°C to +125°C. This capacitance change is non-linear.

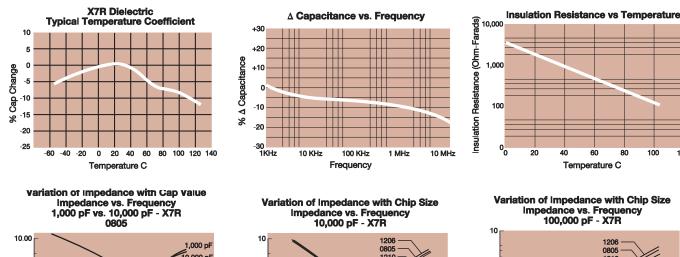
Capacitance for X7R varies under the influence of electrical operating con-ditions such as voltage and frequency.

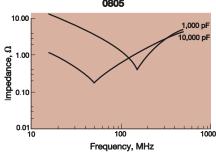
X7R dielectric chip usage covers the broad spectrum of industrial applications where known changes in capacitance due to applied voltages are acceptable.

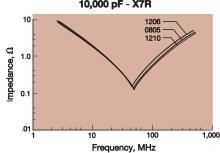
PART NUMBER (SEE PAGE 4 FOR COMPLETE PART NUMBER EXPLANATION)

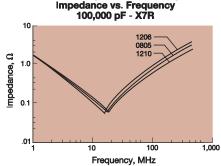
0805	<u>5</u>	<u>C</u>	103	M T	<u>A</u>	T T	<u>2</u>	<u>A</u>
Size (L" x W")	Voltage 4V = 4 6.3V = 6 10V = Z	Dielectric X7R = C	Capacitance Code (In pF) 2 Sig. Digits + Number of Zeros	Capacitance Tolerance J = ± 5%* K = ±10%	Failure Rate A = Not Applicable	Terminations T = Plated Ni and Sn Z= FLEXITERM®**	Packaging 2 = 7" Reel 4 = 13" Reel	Special Code A = Std. Product
	16V = Y 16V = Y 25V = 3 50V = 5		Number of Zeros	$M = \pm 20\%$	Арріісавіе	*Optional termination **See FLEXITERM® X7R section	Contact Factory For Multiples	rioduct
	100V = 1 200V = 2 500V = 7			*≤1µF only, contact factory fo additional values		XXXX		

Contact factory for availability of Termination and Tolerance Options for Specific Part Numbers. Contact factory for non-specified capacitance values.









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Paramete	er/Test	X7R Specification Limits	M	easuring Conditions
Operating Tempo		-55°C to +125°C	Tem	perature Cycle Chamber
Capacit Dissipation		Within specified tolerance ≤ 10% for ≥ 50V DC rating≤ 12.5% for 25V DC rating ≤ 12.5% for 25V and 16V DC rating ≤ 12.5% for ≤ 10V DC rating Contact Factory for DF by PN	Vo	Freq.: 1.0 kHz ± 10% oltage: 1.0Vrms ± .2V o > 10μF, 0.5Vrm @ 120Hz
Insulation R	esistance	10,000MΩ or 500MΩ - μF, whichever is less		levice with rated voltage for ecs @ room temp/humidity
Dielectric S	Strength	No breakdown or visual defects	charge and disch	50% of rated voltage for 1-5 seconds, w/ arge current limited to 50 mA (max) th 150% of rated voltage for 500V devices.
	Appearance	No defects		
Resistance to	Capacitance Variation	≤ ±12%		Deflection: 2mm
Flexure Stresses	Dissipation Factor	Meets Initial Values (As Above)	T€	est Time: 30 seconds
	Insulation Resistance	≥ Initial Value x 0.3		
Soldera	bility	≥ 95% of each terminal should be covered with fresh solder		in eutectic solder at 230 ± 5°C or 5.0 ± 0.5 seconds
	Appearance	No defects, <25% leaching of either end terminal		
	Capacitance Variation	≤ ±7.5%	_	
Resistance to Solder Heat	Dissipation Factor	Meets Initial Values (As Above)	Dip device in eutectic room temperature for	solder at 260°C for 60 seconds. Store at 24 ± 2hours before measuring electrical
Solder Heat	Insulation Resistance	Meets Initial Values (As Above)		properties.
	Dielectric Strength	Meets Initial Values (As Above)		
	Appearance	No visual defects	Step 1: -55°C ± 2°	30 ± 3 minutes
	Capacitance Variation	≤ ±7.5%	Step 2: Room Temp	≤ 3 minutes
Thermal Shock	Dissipation Factor	Meets Initial Values (As Above)	Step 3: +125°C ± 2°	30 ± 3 minutes
	Insulation Resistance	Meets Initial Values (As Above)	Step 4: Room Temp	≤ 3 minutes
	Dielectric Strength	Meets Initial Values (As Above)	,	and measure after 24 ± 2 hours at room temperature
	Appearance Capacitance Variation	No visual defects ≤ ±12.5%	Pre-treatment: After m 10C for 2 hour, then	ounting, perform heat treatment 150+0/- stabilise for 24+/-2 hour at room temp, then measure.
	Dissipation Factor	≤ Initial Value x 2.0 (See Above)		≥ rated voltage in test chamber set at
Load Life	Insulation Resistance	≥ Initial Value x 0.3 (See Above)		2°C for 1000 hours (+48, -0).
	Dielectric Strength	Meets Initial Values (As Above)	treatment 150+0/-100 at roo	emove from test chamber, perform heat of or 2 hour, then stabilise for 24+/-2 hour om temp, then measure. A AVX for datasheet of specific parts.
	Appearance	No visual defects	Pre-treatment: After m	ounting, perform heat treatment 150+0/-
	Capacitance Variation	≤ ±12.5%	10C for 2 hour, then	stabilise for 24+/-2 hour at room temp, then measure.
Load Humidity	Dissipation Factor	≤ Initial Value x 2.0 (See Above)		per set at 85°C ± 2°C/ 85% ± 5% relative
Haimaity	Insulation Resistance	≥ Initial Value x 0.3 (See Above)		emove from test chamber, perform heat
	Dielectric Strength	Meets Initial Values (As Above)	treatment 150+0/-100	or 2 hour, then stabilise for 24+/-2 hour or temp, then measure.





PREFERRED SIZES ARE SHADED

SIZE		0101*			0201					-0/	02						06	02							- 00	05								1206				
	_		_											\vdash								-								_								_
Solderin		Reflow Only Paper/			flow (eflov		/e				- 1	eflow		е							//Wav								low/V				\dashv
Packagin	ng	Embossed			II Pap						aper						All P	aper								mbos						- 1		/Emb		d		
(L) Length	mm (in.)	0.40 ± 0.02 (0.016 ± 0.0008)			50 ± 0 24 ± 0					1.00							1.60 ± .063									± 0.20								20 ± 0 26 ± 0				
	mm	0.20 ± 0.02			30 ± 0				<u> </u>	0.50							0.81 :									± 0.20								50 ± 0				
W) Width	(in.)	(0.008 ± 0.0008)			11 ± 0				(0	.020	± 0.00	04)					.032 :									± 0.00								53 ± 0				
(t) Terminal	mm	0.10± 0.04			15 ± 0					0.25	± 0.1	5					0.35	± 0.15	5						0.50	± 0.25	5						0.5	50 ± 0	.25			
	(in.)	(0.004 ± 0.0016)			06 ± 0					.010							.014									± 0.01								20 ± 0				
WVDC		16	6.3	_	_	25	50	6.3	10	16	25	50	100	6.3	10	16	_	50	_	_	_	6.3	10	16	25	50	100	200	250	6.3	10	16	25	_	_	_	250	-
Cap 100		В	Α	Α	Α	Α	Α	С	С	С	С	С	С	G	G	G	G	G	G	J	J													G	G	N	N	N
(pF) 150		В	Α	Α	Α	Α	Α	С	С	С	С	С	С	G	G	G	G	G	G	J	J									G	G	G	G	G	G	N	N	N
220		В	Α	Α	Α	Α	Α	С	С	С	С	С	С	G	G	G	G	G	G	J	J	Е	E	Е	Е	Е	Е	E	J	J	J	J	J	J	J	N	N	Р
330		В	Α	Α	Α	Α	Α	С	С	С	С	С	С	G	G	G	G	G	G	J	J		J	J	J	J	J	J	J	J	J	J	J	J	J	N	N	Р
470		В	A	A	A	Α	A	C	С	С	С	С	С	G	G	G	G	G	G	J	J	<u> </u>	J	J	J	J	J	J	J	J	J	J	J	J	J	N	N	Р
680		В	A	A	A	Α	A	С	С	С	С	С	С	G	G	G	G	G	G	J	J	-	J	J	J	J	J	J	J	J	J	J	J	J	J	N	N	Р
1000		В	A	A	A	A	Α	С	С	С	С	С	С	G	G	G	G	G	G	J	J	_	J	J	J	J	J	J	J	7	J	J	J	J	J	N	N	Р
1500 2200	152 222		A	A	A	A	-	C	С	C	С	С	С	G	G	G	G	G	G	J	J	-	J	J	J	J	J	J	J	J	J	J	J	J	J	N	N N	P P
3300			A	A	A	A	_	С	C	С	C	C	C	G	G	G	G	G	G	J	J	-	J	J	J	J	J	J	J	J	J	J	J	J	J	N	N	P
3900			A	A	-	A	-	C	L	C	L	L	U	G	G	G	G	G	G	J	J		J	J	J	J	J	J	J	J	J	J	J	J	J	IN	IN	Р
4700			A	A	A	A		С	С	С	С	С	С	G	G	G	G	G	G	J	J		J	J	J	J	J	J	J	J	J	J	J	J	J	N	N	Р
5600	-		A	A	A	A		C	U	C	C	C	U	G	G	G	G	G	G	J	J		J	J	J	J	J	J	J	J	J	J	J	J	J	IN	IN	Р
6800			A	A	A	A		С	С	С	С	С	С	G	G	G	G	G	G	J	J		J	J	J	J	J	Р	Р	J	J	J	J	J	J	N	N	Р
Cap 0.01	103		A	A	A	A		С	С	С	С	C	С	G	G	G	G	G	G	J	J		J	J	J	J	J	Р	P	J	J	J	J	J	J	N	N	Р
(μF) 0.012				_	_								U	0	0	0	G	0	-	3	3		3	3	3	3	3		•	3	<u> </u>	3	3	3	3	IN.	14	_
0.015								С	С	С	С	Е		G	G	G	G	G	J	J	J		J	J	J	J	J	Р	Р	J	J	J	J	J	J	N	N	Q
0.018												_											ļ -						•			-		-				
0.022			Α	Α	Α			С	С	С	С	Е		G	G	G	G	G	J	J	J		J	J	J	J	J	Р	Р	J	J	J	J	J	J	Р	Р	Q
0.027				-					1	_	Ť	_		_	-	_	-	_	_	_	-			_	-	_	_			_	_	_	_		_	Ė		$\overline{}$
0.033								С	С	С	С	Е		G	G	G	G	J	J				J	J	J	J	Р	Р	Р	J	J	J	J	J	J	Q	Q	Q
0.039																																				Ť		$\overline{}$
0.047	473							С	С	С	С	Е		G	G	G	G	J	J				J	J	J	J	Р	Р	Р	J	J	J	J	J	J	Q	Q	Q
0.068	683							С	С	С	С	Е		G	G	G	G	J	J				J	J	J	J	Р	Р		J	J	J	J	J	Р	Q	Q	\Box
0.082	823																																					П
0.1	104		Α					С	С	С	С	Е		G	G	G	G	J	J				J	J	J	J	Р	Р		J	J	J	J	J	Р	Q	Q	
0.12	124																																					
0.15														G	G	G	J	J					N	N	N	N	Р			K	K	K	K	K	Q	Q	Q	
0.22								С	С	С	С			G	G	J	J	J					N	N	N	N	Р			K	K	K	K	K	Q	Q	Q	
0.33														J	J	J	J	J					Р	Р	Р	Р	Р	Ш		K	K	K	K	N	Q			Ш
0.47								С	С					J	J	J	J	J					Р	Р	Р	Р	Р	Ш		М	М	М	М	Х	Х			Ш
0.68			_	_	<u> </u>	<u> </u>	_		_	_	_	_		J	J	J			_			_	Р	P	Р	_		Ш		М	М	М	М	Х	Х	_		Ш
1.0			_	-	<u> </u>	├	\vdash	С	-			-		J	J	J	J	K	_				Р	Р	Р	Р	_	$\vdash \vdash$		М	М	М	М	X	X	-		-
2.2				-	—	—	—	-	₩			-		J	J	K							Р	Р	Р	Р		\vdash		М	М	М	X	X	Х	-		-
	475			-	-	1	-	-	-	-	-	-	_	K	<u> </u>	_		<u> </u>			_		Р	Р	Р		_	Ш		X	X	X	X	Z		-		\vdash
10				-	-	-	-	-	-	-		-	-	_		_		_	_		-	Р	Р	Р			_	\vdash		X	X	Х	Х	-	-	-		\vdash
22 47				-	\vdash	\vdash	\vdash	-	\vdash			-	<u> </u>	_	<u> </u>	<u> </u>	\vdash	\vdash			<u> </u>	-	\vdash	<u> </u>		-	-	$\vdash\vdash$		Х	Х			\vdash	-	-	\vdash	\vdash
100			<u> </u>	-	\vdash	\vdash	-	-	\vdash		-	-	\vdash	-	-		\vdash	-	<u> </u>		\vdash	-	-		-	-		\vdash		-	-			\vdash	-	-	\vdash	\vdash
WVDC	107	16	63	10	16	25	50	6.3	10	16	25	50	100	63	10	16	25	50	100	200	250	63	10	16	25	50	100	200	250	63	10	16	25	50	100	200	250	500
SIZE		0101*	0.5		0201		1 30	0.3	10		02	1 00	100	0.3	10	1.0	06		100	200	200	0.3	10	10		05	100	200	200	0.0		10		1206		1200	200	500
JIZE		0101			J201					- 0-								-															_	.200				

ı	Letter	Α	В	С	E	G	J	K	М	N	Р	Q	X	Υ	Z
Ī	Max.	0.33	0.22	0.56	0.71	0.90	0.94	1.02	1.27	1.40	1.52	1.78	2.29	2.54	2.79
-	Thickness	(0.013)	(0.009)	(0.022)	(0.028)	(0.035)	(0.037)	(0.040)	(0.050)	(0.055)	(0.060)	(0.070)	(0.090)	(0.100)	(0.110)
				PAF	PER						EMBO	SSED			

NOTE: Contact factory for non-specified capacitance values

^{**}Contact Factory for Specifications

Capacitance Range



PREFERRED SIZES ARE SHADED

	SIZE					1210						18	12				1825				2220				2225	
	Soldering				R	eflow Or	nly					Reflo	w Only			R	eflow Or	nly		R	eflow Or	nly		R	eflow On	ıly
F	ackaging				Pape	er/Embo	ssed					All Em	bossed			All	l Emboss	sed			Emboss			All	Emboss	sed
(L) Len	ngth	mm (in.)				3.30 ± 0. 130± 0.0							± 0.40 ± 0.016)				l.50 ± 0.4 177 ± 0.0				.70 ± 0.5 224 ± 0.0				.70 ± 0.4 224 ± 0.0	
W) Wid	dth	mm (in.)			(0.0	.50 ± 0.3 098 ± 0.0)12)						± 0.40 ± 0.016)				5.40 ± 0.4 252 ± 0.0			(0.	.00 ± 0.4 197 ± 0.0	016)			.30 ± 0.4 248 ± 0.0	
(t) Terr		mm (in.)			(0.0	.50 ± 0.2 020 ± 0.0	010)					(0.024	± 0.36 ± 0.014)			(0.0	0.61 ± 0.3 024 ± 0.0	014)		(0.	0.64 ± 0.3 025 ± 0.0	015)		(0.0	0.64 ± 0.3 025 ± 0.0)15)
		VVDC	10	16	25	50	100	200	500	16	25	50	100	200	500	50	100	200	25	50	100	200	500	50	100	200
Cap	100	101																						>	~W	-
(pF)	150	151																					1		7	15-
	220	221				K	K	K	М														(7	1 1) 正]
	330	331				K	K	K	М			N	N	N	N								_	Ļ		
	470	471				K	K	K	М			N	N	N	N								ļ	1	1	ل_
	680	681				K	K	K	М			N	N	N	N											
	1000	102	K	K	K	K	K	K	М	N	N	N	N	N	N	X	Х	Х		Х	Х	Х	X	X	X	Х
	1500	152	K	K	K	K	K	K	М	N	N	N	N	N	N	X	X	X		X	X	X	X	X	X	X
	2200	222	K	K	K	K	K	K	М	N	N	N	N	N	N	X	X	X		X	X	X	X	X	X	X
	3300	332	K	K	K	K	K	K	P	N	N	N	N	N	N	Х	Х	X		Х	Х	Х	X	X	X	Х
	4700	472	K	K	K	K	K	K	P	N	N	N	N	N	P	Х	Х	X		Х	X	X	X	Х	X	Х
_	6800	682	K	K	K	K	K	K	P	N	N	N	N	N	P	Х	X	X		Х	Х	Х	X	Х	X	Х
Cap	0.01	103	K	K	K	K	K	K	P	N	N	N	N	N	P	Х	X	X		Х	X	X	Х	Х	X	Х
(µF)	0.015	153	K	K	K	K	K	K	P	N	N	N	N	N	P	X	X	X		X	X	X	X	X	X	X
	0.022	223	K	K	K	K	K	P	Q	N	N	N	N	N	P	X	X	X		X	X	X	X	X	X	X
	0.033	333	K	K	K	K	K	P	X	N	N	N	N	N	X	X	X	X		X	X	X	X	X	X	X
	0.047	473	K	K	K	K	K	P	X	N	N	N	N	P	X	X	X	X		X	X	X	X	X	X	X
	0.068	683	K	K	K	K	K	P	X	N	N	N	N	P	X	X	X	X		X	X	X	X	X	X	X
	0.1	104	K	K	K	K	K	P	X	N	N	N	P P	P P	X	X	X	X		X	X	X	X	X	X	X
	0.15	154	K	K	K	M		Z	Z	N	N	N			Z	X	X	X	<u> </u>	X	X	X	X	X	X	X
	0.22	224	K	K	K	M	P	Z		N	N	N	P P	Q	Z	X	X	X	-	X	X	X	X	X	X	X
_	0.33	334 474	K M	K M	K M	M P	Q	Z		N N	N N	N N	0	X	Z	X	X	X		X	X	X	X	X	X	X
-	0.47	684		M	P	X	X	Z		0	Q	_	Q	Z		X	X	X		X	X	X	Z	X	X	X
	1.0	105	M P	P	P	X	Z	<u> </u>		0		Q	X	Z		X	X	X		X	X	X	7	X	X	X
	1.5	155	N	N	Z	Z	Z			Ų	Q Z	Z	Z			X	X	Z		X	X	Z	/	X	X	Z
	2.2	225	X	X	Z	Z	Z				Z	Z	Z			X	X	Z		X	X	Z		X	X	Z
	3.3	335	X	X	Z	Z	Z				Z	Z	Z			X	X			X	Z			X	X	
-	4.7	475	Z	Z	Z	Z	Z				Z	Z	Z		-	X	X	-	-	Z	Z	_		X	X	\vdash
-	10	106	Z	Z	Z	Z				Z	Z	Z			-	Z	Z	-		Z	Z	-		Z	Z	\vdash
	22	226	Z	Z	Z			-											Z			_				$\vdash \vdash \vdash$
	47	476	Z				_					_					-	-			_	_			 	$\vdash \vdash \vdash$
	100	107				 	_					_					_	-	-	-	_				 	$\vdash \vdash \vdash$
	WVDC	10/	10	16	25	50	100	200	500	16	25	50	100	200	500	50	100	200	25	50	100	200	500	50	100	200
	SIZE		10	10		1210	100	200	300	10			12	200	300	30	1825	200	23	_ 30	2220	200	300	30	2225	200
	SIZE					1210						10	114				1023				2220				2223	

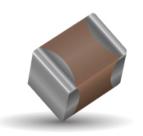
Letter	Α	В	С	Е	G	J	K	М	N	Р	Q	Х	Υ	Z	7
Max.	0.33	0.22	0.56	0.71	0.90	0.94	1.02	1.27	1.40	1.52	1.78	2.29	2.54	2.79	3.30
Thickness	(0.013)	(0.009)	(0.022)	(0.028)	(0.035)	(0.037)	(0.040)	(0.050)	(0.055)	(0.060)	(0.070)	(0.090)	(0.100)	(0.110)	(0.130)
			PAI	PER							MBOSSEI)			

NOTE: Contact factory for non-specified capacitance values

080221

General Specifications





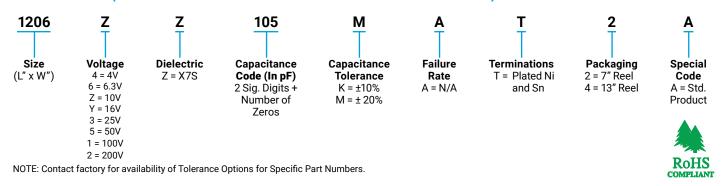
GENERAL DESCRIPTION

X7S formulations are called "temperature stable" ceramics and fall into EIA Class II materials. Its temperature variation of capacitances within ±22% from -55°C to +125°C. This capacitance change is non-linear.

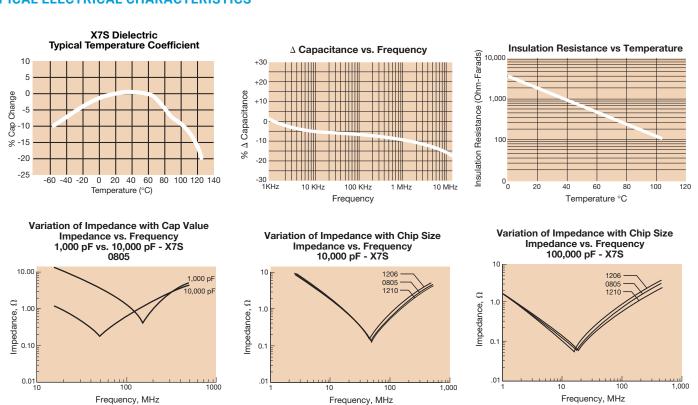
Capacitance for X7S varies under the influence of electrical operating conditions such as voltage and frequency.

X7S dielectric chip usage covers the broad spectrum of industrial applications where known changes in capacitance due to applied voltages are acceptable.

PART NUMBER (SEE PAGE 4 FOR COMPLETE PART NUMBER EXPLANATION)



TYPICAL ELECTRICAL CHARACTERISTICS







Parame	ter/Test	X7S Specification Limits	Measuring	Conditions
	perature Range	-55°C to +125°C	Temperature C	ycle Chamber
•	on Factor	Within specified tolerance ≤ 5.0% for ≥ 100V DC rating ≤ 5.0% for ≥ 25V DC rating ≤ 10.0% for ≥ 10V DC rating ≤ 10.0% for ≤ 10V DC rating Contact Factory for DF by PN	Freq.: 1.0 k Voltage: 1.0 For Cap > 10 μF, 0	Vrms ± .2V
Insulation	Resistance	100,000MΩ or 1000MΩ - μF, whichever is less	Charge device with 120 ± 5 secs @ roo	
Dielectric	: Strength	No breakdown or visual defects	Charge device with 250 1-5 seconds, w/charge limited to 50	and discharge current
	Appearance	No defects	Deflection	
Resistance to	Capacitance Variation	≤ ±12%	Test Time: 3	30 seconds 7 1mm/sec
Flexure Stresses	Dissipation Factor	Meets Initial Values (As Above)		
	Insulation Resistance	≥ Initial Value x 0.3	90 1	mm —
Solder	rability	≥ 95% of each terminal should be covered with fresh solder	Dip device in eutection for 5.0 ± 0.	
	Appearance	No defects, <25% leaching of either end terminal		
	Capacitance Variation	≤ ±7.5%		
Resistance to Solder Heat	Dissipation Factor	Meets Initial Values (As Above)	Dip device in eutectic s seconds. Store at room	temperature for 24 ± 2
	Insulation Resistance	Meets Initial Values (As Above)	hours before measurin	g electrical properties.
	Dielectric Strength	Meets Initial Values (As Above)		
	Appearance	No visual defects	Step 1: -55°C ± 2°	30 ± 3 minutes
	Capacitance Variation	≤ ±7.5%	Step 2: Room Temp	≤ 3 minutes
Thermal Shock	Dissipation Factor	Meets Initial Values (As Above)	Step 3: +125°C ± 2°	30 ± 3 minutes
	Insulation Resistance	Meets Initial Values (As Above)	Step 4: Room Temp	≤ 3 minutes
	Dielectric Strength	Meets Initial Values (As Above)	Repeat for 5 cycles 24 ± 2 hours at ro	and measure after oom temperature
	Appearance	No visual defects		
	Capacitance Variation	≤ ±12.5%	Charge device with 1.5 test chamber set	
Load Life	Dissipation Factor	≤ Initial Value x 2.0 (See Above)	for 1000 hou	
	Insulation Resistance	≥ Initial Value x 0.3 (See Above)	Remove from test chamb temperature for 24 ± 2 h	
	Dielectric Strength	Meets Initial Values (As Above)	,	
	Appearance	No visual defects		
	Capacitance Variation	≤ ±12.5%	Store in a test chamber s 5% relative humid	
Load	Dissipation Factor	≤ Initial Value x 2.0 (See Above)	(+48, -0) with rate	d voltage applied.
Humidity	Insulation Resistance	≥ Initial Value x 0.3 (See Above)	Remove from chamber temperature ar	nd humidity for
	Dielectric Strength	Meets Initial Values (As Above)	24 ± 2 hours bef	ore measuring.





PREFERRED SIZES ARE SHADED

				6		[
SIZ	E I	0	402	0603	0805		1206		1210
Solder	rina	Reflo	w/Wave	Reflow/Wave	Reflow/Wave	Re	flow/W	ave	Reflow Only
Packa			Paper	All Paper	Paper/Embossed		r/Embo		Paper/Embossed
	mm		± 0.10	1.60 ± 0.15	2.01 ± 0.20		20 ± 0.		3.20 ± 0.20
(L) Length	(in.)	(0.040	± 0.004)	(0.063 ± 0.006)	(0.079 ± 0.008)	(0.1	26 ± 0.	(800	(0.126 ± 0.008)
14/\ 14/: -l4l-	mm	0.50	± 0.10	0.81 ± 0.15	1.25 ± 0.20	1.	60 ± 0.:	20	2.50 ± 0.20
W) Width	(in.)	(0.020	± 0.004)	(0.032 ± 0.006)	(0.049 ± 0.008)	(0.0	63 ± 0.	(800	(0.098 ± 0.008)
(t)	mm	0.25	± 0.15	0.35 ± 0.15	0.50 ± 0.25	0.	50 ± 0.:	25	0.50 ± 0.25
Terminal	(in.)	(0.010	± 0.006)	(0.014 ± 0.006)	(0.020 ± 0.010)	(0.0	20 ± 0.	010)	(0.020 ± 0.010)
	WVDC	4	6.3	6.3	4	10	50	100	6.3
Сар	100								
(pF)	150								
	220					l	'	1	
	330						-1-	'	W_
	470					*			775
	680						_		IJ. J T
	1000							11.	
	1500							+	
	2200					ļ		4	
	3300							111	
	4700								
	6800								
Сар	0.010								
(μF)	0.015								
	0.022								
	0.033		С						
	0.047		С						
	0.068		С						
	0.10		С						
	0.15								
	0.22								
	0.33			G					
	0.47			G					
	0.68			G					
	1.0	E		G					
	1.5				N				
	2.2	Е			N			Q	
	3.3				N				
	4.7				N	Q			
	10								
	22								Z
	47								
	100								
	WVDC	4	6.3	6.3	4	10	50	100	6.3
	SIZE	0	402	0603	0805		1206		1210

Letter	Α	С	Е	G	J	K	М	N	Р	Q	Х	Υ	Z
Max.	0.33	0.56	0.71	0.90	0.94	1.02	1.27	1.40	1.52	1.78	2.29	2.54	2.79
Thickness	(0.013)	(0.022)	(0.028)	(0.035)	(0.037)	(0.040)	(0.050)	(0.055)	(0.060)	(0.070)	(0.090)	(0.100)	(0.110)
			PAPER						EMBO	SSED			

^{*}Contact Factory for Specifications

General Specifications





GENERAL DESCRIPTION

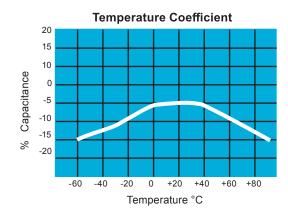
- · General Purpose Dielectric for Ceramic Capacitors
- EIA Class II Dielectric
- Temperature variation of capacitance is within ±15% from -55°C to +85°C
- Well suited for decoupling and filtering applications
- Available in High Capacitance values (up to 100µF)

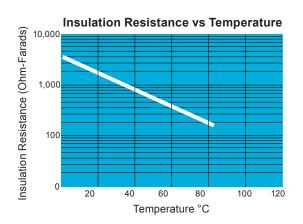
PART NUMBER (SEE PAGE 4 FOR COMPLETE PART NUMBER EXPLANATION)

1210	4	D	107	M	Α	T	2	Α
	T	T	T	T	T	T	T	T
Size	Voltage	Dielectric	Capacitance	Capacitance	Failure	Terminations	Packaging	Special
(L" x W")	4 = 4V	D = X5R	Code (In pF)	Tolerance	Rate	T = Plated Ni	2 = 7" Reel	Code
0101**	6 = 6.3V		2 Sig. Digits +	$K = \pm 10\%$	A = N/A	and Sn	4 = 13" Reel	A = Std.
0201	Z = 10V		Number of	$M = \pm 20\%$				
0402	Y = 16V		Zeros					
0603	3 = 25V							
0805	D = 35V							A •
1206	5 = 50V							
1210	1 = 100V							The same of the sa
1812								
**EIA 010	005							RoHS COMPLIANT

NOTE: Contact factory for availability of Tolerance Options for Specific Part Numbers. Contact factory for non-specified capacitance values.

TYPICAL ELECTRICAL CHARACTERISTICS









Paramet	ter/Test	X5R Specification Limits	Measuring C	conditions
Operating Temp	perature Range	-55°C to +85°C	Temperature Cy	cle Chamber
Capac	itance	Within specified tolerance		
Dissipatio	on Factor	≤ 2.5% for ≥ 50V DC rating ≤ 12.5% for 25V, 35V DC rating ≤ 12.5% Max. for 16V DC rating and lower Contact Factory for DF by PN	Freq.: 1.0 kl Voltage: 1.0\ For Cap > 10 μF, 0.	/rms ± .2V
Insulation I	Resistance	10,000MΩ or 500MΩ - μ F, whichever is less	Charge device with rate secs @ room te	
Dielectric	Strength	No breakdown or visual defects	Charge device with 250% seconds, w/charge and di to 50 mA	scharge current limited
	Appearance	No defects	Deflection	n: 2mm
Resistance to	Capacitance Variation	≤ ±12%	Test Time: 3	
Flexure Stresses	Dissipation Factor	Meets Initial Values (As Above)	V	
	Insulation Resistance	≥ Initial Value x 0.3	90 m	ım ———
Solder	ability	≥ 95% of each terminal should be covered with fresh solder	Dip device in eutectic solo ± 0.5 sec	
	Appearance	No defects, <25% leaching of either end terminal		
	Capacitance Variation	≤ ±7.5%		
Resistance to Solder Heat	Dissipation Factor	Meets Initial Values (As Above)	Dip device in eutectic 60seconds. Store at roor	n temperature for 24 ±
ooluel Heut	Insulation Resistance	Meets Initial Values (As Above)	2hours before measuring	g electrical properties.
	Dielectric Strength	Meets Initial Values (As Above)		
	Appearance	No visual defects	Step 1: -55°C ± 2°	30 ± 3 minutes
	Capacitance Variation	≤ ±7.5%	Step 2: Room Temp	≤ 3 minutes
Thermal Shock	Dissipation Factor	Meets Initial Values (As Above)	Step 3: +85°C ± 2°	30 ± 3 minutes
	Insulation Resistance	Meets Initial Values (As Above)	Step 4: Room Temp	≤ 3 minutes
	Dielectric Strength	Meets Initial Values (As Above)	Repeat for 5 cycles and hours at room	
	Appearance	No visual defects	Charge device with 1.5>	rated voltage in test
	Capacitance Variation	≤ ±12.5%	chamber set at 85°C ± (+48,	2°C for 1000 hours
Load Life	Dissipation Factor	≤ Initial Value x 2.0 (See Above)	Note: Contact factory for	
			part numbers that are t	esteu at < 1.58 fälleu
	Insulation Resistance	≥ Initial Value x 0.3 (See Above)	volta	ge.
		≥ Initial Value x 0.3 (See Above) Meets Initial Values (As Above)	Remove from test chambe temperature for	er and stabilize at room
	Resistance Dielectric	· · · · · · · · · · · · · · · · · · ·	Remove from test chambe	er and stabilize at room
	Resistance Dielectric Strength	Meets Initial Values (As Above)	Remove from test chamber temperature for Store in a test chamber se	er and stabilize at room 24 ± 2 hours et at 85°C ± 2°C/ 85% ±
Load Humidity	Resistance Dielectric Strength Appearance Capacitance	Meets Initial Values (As Above) No visual defects	Remove from test chamber temperature for	er and stabilize at room 24 ± 2 hours et at 85°C ± 2°C/ 85% ± 200 hours (+48, -0) with
Load Humidity	Resistance Dielectric Strength Appearance Capacitance Variation Dissipation	Meets Initial Values (As Above) No visual defects ≤ ±12.5%	Remove from test chamber temperature for Store in a test chamber se	er and stabilize at room 24 ± 2 hours et at 85°C ± 2°C/ 85% ± 2000 hours (+48, -0) with e applied. and stabilize at room d humidity for





PREFERRED SIZES ARE SHADED

Case Size		01	01*						04	02						0603							0805					
Soldering			w Only		Re	flow 0	nlv				Reflow		e				Refl	ow/W						Ref	low/W			
Packaging		Paper/Er				II Pap						aper						II Pap								ossed		
(L) Length	mm (in.)	0.40			0.0	60 ± 0. 24 ± 0.	.09			((± 0.20					1.0	50 ± 0 53 ± 0	.20					2.0	01 ± 0 79 ± 0	.20		
W) Width	mm (in.)	0.20 : (0.008 ±	± 0.02 : 0.0008)			30 ± 0. 11 ± 0.				((0.50 : 0.020 :	± 0.20 ± 0.00						30 ± 0 31 ± 0							25 ± 0 49 ± 0			
(t) Terminal	mm (in.)	0.10 : (0.004 ±				15 ± 0. 06 ± 0.				((0.25 :	± 0.10 ± 0.00						35 ± 0 14 ± 0							50 ± 0 20 ± 0			
Voltage:		6.3	10	4	6.3	10	16	25	4	6.3	10	16	25	50	4	6.3	10	16	25	35	50	4	6.3	10	16	25	35	50
Cap (pF) 100	101		В					Α																				
150	151		В					Α																				
220	221		В					Α						С														
330	331		В					Α						С														
470	471		В					Α						С														
680	681		В					Α						С														
1000	102		В				Α	Α						С														
1500	152	В	В				Α	Α						С														
2200	222	В	В			Α	Α	Α						С														
3300	332	В	В			Α	Α	Α						С														<u> </u>
4700	472	В	В			Α	Α	Α					С								G							
6800	682	В	В			Α	Α	Α					С								G							<u> </u>
Cap (µF) 0.01	103	В	В			Α	Α	Α					С						G	G	G							
0.015	150	В											С	_			_		G	G	G				_			
0.022	223	В			Α	Α	Α	Α				С	С						G	G	G							N
0.033	333	В										С					ļ		G	G	G	_			-			N
0.047	473	В			Α	Α	Α	Α				С	С				-		G	G	G				-			N
0.068	689	В		_							_	С					_		G		G	_			-			N
0.1	104	В			Α	Α	Α	Α			С	С	С	С					G	G	G					N	N	N
0.15	154 224	В						-	_		_	_	_				<u> </u>	_	G						-	N	N	
0.22	334	В		Α	Α	Α				С	С	С	С	С				G	G						1	N N	N	N
0.33	474	В		Α	Α	-		-	С	С	С	С	С	E	\vdash		-	G	J	_			-	-	+	N	P	P
0.47	684	D		А	A			 	U	U	U	U	U			<u> </u>	-	G	J	_	-		\vdash	_	1	N	P	P
1.0	105			Α	Α	С	С		С	С	С	С	С		G	G	G	G	J	G	G		-		N	N	Р	Р
1.5	155			A	_ A										G	G	G	G	J	G	G				IN	IN		F
2.2	225			С	С	С		 	С	С	С	С	С		G	G	J	J	J	К	K		 	N	N	Р	Р	Р
3.3	335			U					U						J	J	J	J	3	IX	IX		N	N	IN			
4.7	475			С	С			 	Е	Е	Е	Е		\vdash	J	J	J	G	К		\vdash	N	P	J	N	N	Р	Р
10	106			U				<u> </u>	E	E	E	_		<u> </u>	K	J	K	K	K		\vdash	P	P	P	P	P		
22	226							<u> </u>	E	G					K	K	K	- 1	- 1			P	P	P	P	P		\vdash
47	476								_						K	K	- 1					P	P	P	<u> </u>			\vdash
100	107				\vdash								\vdash	<u> </u>	- 1	- 1							<u> </u>			<u> </u>		\vdash
Voltage:	107	6.3	10	4	6.3	10	16	25	4	6.3	10	16	25	50	4	6.3	10	16	25	35	50	4	6.3	10	16	25	35	50
Case Size									02						0603							0805						

Letter	Α	В	С	E	G	J	K	М	N	Р	Q	Х	Y	Z
Max. Thickness	0.33 (0.013)	0.22 (0.009)	0.56 (0.022)	0.71 (0.028)	0.90 (0.035)	0.94 (0.037)	1.02 (0.040)	1.27 (0.050)	1.40 (0.055)	1.52 (0.060)	1.78 (0.070)	2.29 (0.090)	2.54 (0.100)	2.79 (0.110)
			PAI	PER				,		EMBO	SSED			

PAPER and EMBOSSED available for 01005 NOTE: Contact factory for non-specified capacitance values *EIA 01005





PREFERRED SIZES ARE SHADED

Case Size					1206							1210							1812			
Soldering				Refl	ow/W	/ave					Re	flow C	nly					Re	flow 0	nly		
Packaging				Paper	/Emb	ossec	t				Paper	r/Emb	ossed					All	Embos	ssed		
(L) Length	mm (in.)				20 ± 0. 26 ± 0.							20 ± 0. 26 ± 0.							50 ± 0. 77 ± 0.			
W) Width	mm (in.)			1.6	0 ± 0. 3 ± 0.	.30					2.5	50 ± 0. 98 ± 0.	30					3.:	20 ± 0. 26 ± 0.	.20		
(t) Terminal	mm (in.)			0.5	50 ± 0. 20 ± 0.	.25					0.5	50 ± 0. 20 ± 0.	25					0.0	61 ± 0. 24 ± 0.	.36		
Voltage:		4	6.3	10	16	25	35	50	4	6.3	10	16	25	35	50	4	6.3	10	16	25	35	50
Cap (pF) 100	101																					
150	151																					
220	221																					
330	331																					
470	471																					
680	681																					
1000	102																					
1500	152																					
2200	222																					
3300	332																					
4700	472																					
6800	682																					
Cap (µF) 0.01	103																					
0.015	150																					
0.022	223																					
0.033	333																					
0.047	473																					
0.068	689																					
0.1	104																					
0.15	154																					
0.22	224																					
0.33	334																					
0.47	474					Q	Q							Х	Х							
0.68	684																					
1.0	105					Q	Q	Q					Χ	Χ	Х							
1.5	155																					
2.2	225			Q	Q	Q	Q	Q					Х	Z	Z							
3.3	335		Q	Q																		
4.7	475	Χ	Х	Х	Х	Х	Х	Χ			Z	Z	Z	Z	Z							
10	106	Х	Х	Х	Х	Х	Х	Χ		Х	Х	Z	Z	Z	Z					Z		
22	226	Χ	Χ	Х	Х	Х			Z	Z	Z	Z	Z			Z	Z	Z	Z			
47	476	Χ					Z	Z	Z	Z	Z											
100	107	Χ	Χ						Z	Z												
Voltage:		4	6.3	10	16	25	35	50	4	6.3	10	16	25	35	50	4	6.3	10	16	25	35	50
Case Size					1206							1210							1812			

Letter	Α	В	С	E	G	J	K	М	N	P	Q	X	Υ	Z
Max.	0.33	0.22	0.56	0.71	0.90	0.94	1.02	1.27	1.40	1.52	1.78	2.29	2.54	2.79
Thickness	(0.013)	(0.009)	(0.022)	(0.028)	(0.035)	(0.037)	(0.040)	(0.050)	(0.055)	(0.060)	(0.070)	(0.090)	(0.100)	(0.110)
			PA	PER						ЕМВО	SSED			

PAPER and EMBOSSED available for 01005

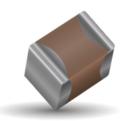
NOTE: Contact factory for non-specified capacitance values *EIA 01005



TDS-SMDMLCC-0014 | Rev 1

General Specifications





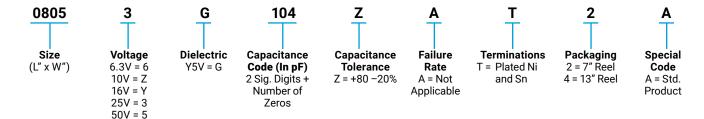
GENERAL DESCRIPTION

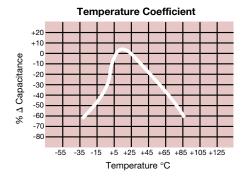
Y5V formulations are for general-purpose use in a limited temperature range. They have a wide temperature characteristic of +22% -82% capacitance change over the operating temperature range of -30°C to +85°C.

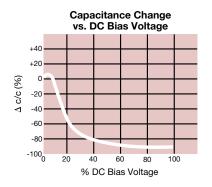
These characteristics make Y5V ideal for decoupling applications within limited temperature range.

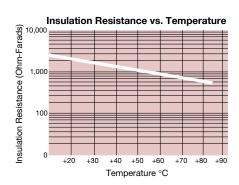


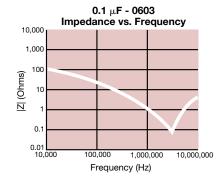
PART NUMBER (SEE PAGE 4 FOR COMPLETE PART NUMBER EXPLANATION)

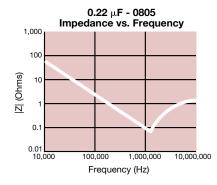


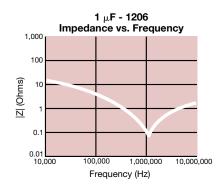












Y5V Dielectric





Parame	ter/Test	Y5V Specification Limits	Measuring (Conditions
Operating Tem	perature Range	-30°C to +85°C	Temperature Cy	ycle Chamber
Capac	itance	Within specified tolerance		
Dissipati	on Factor	\leq 5.0% for \geq 50V DC rating \leq 7.0% for 25V DC rating \leq 9.0% for 16V DC rating \leq 12.5% for \leq 10V DC rating	Freq.: 1.0 k Voltage: 1.0\ For Cap > 10 μF, 0.	Vrms ± .2V
Insulation	Resistance	10,000MΩ or 500MΩ - μF, whichever is less	Charge device with rated @ room tem	
Dielectric	Strength	No breakdown or visual defects	Charge device with 250 1-5 seconds, w/charge limited to 50	and discharge current
	Appearance	No defects	Deflection	n: 2mm
Resistance to	Capacitance Variation	≤ ±30%	Test Time: 3	
Flexure Stresses	Dissipation Factor	Meets Initial Values (As Above)	· ·	
	Insulation Resistance	≥ Initial Value x 0.1	90 n	nm —
Solde	rability	≥ 95% of each terminal should be covered with fresh solder	Dip device in eutectic for 5.0 ± 0.5	
	Appearance	No defects, <25% leaching of either end terminal		
	Capacitance Variation	≤ ±20%		
Resistance to Solder Heat	Dissipation Factor	Meets Initial Values (As Above)	Dip device in eutectic s seconds. Store at room	temperature for 24 ± 2
	Insulation Resistance	Meets Initial Values (As Above)	hours before measuring	g electrical properties.
	Dielectric Strength	Meets Initial Values (As Above)		
	Appearance	No visual defects	Step 1: -30°C ± 2°	30 ± 3 minutes
	Capacitance Variation	≤ ±20%	Step 2: Room Temp	≤ 3 minutes
Thermal Shock	Dissipation Factor	Meets Initial Values (As Above)	Step 3: +85°C ± 2°	30 ± 3 minutes
	Insulation Resistance	Meets Initial Values (As Above)	Step 4: Room Temp	≤ 3 minutes
	Dielectric Strength	Meets Initial Values (As Above)	Repeat for 5 cycles 24 ±2 hours at roo	
	Appearance	No visual defects		
	Capacitance Variation	≤ ±30%	Charge device with twic	
Load Life	Dissipation Factor	≤ Initial Value x 1.5 (See Above)	for 1000 hou	
	Insulation Resistance	≥ Initial Value x 0.1 (See Above)	Remove from test chamb temperature for 24 ± 2 ho	
	Dielectric Strength	Meets Initial Values (As Above)		
	Appearance	No visual defects		
	Capacitance Variation	≤ ±30%	Store in a test chamber s 5% relative humidit	ty for 1000 hours
Load Humidity	Dissipation Factor	≤ Initial Value x 1.5 (See above)	(+48, -0) with rated	voltage applied.
	Insulation Resistance	≥ Initial Value x 0.1 (See Above)	Remove from chamber temperature and 24 ± 2 hours befo	d humidity for
	Dielectric Strength	Meets Initial Values (As Above)	24 ± 2 Hours ben	ore measuring.

Y5V Dielectric





PREFERRED SIZES ARE SHADED

SIZE		02	01			0402				06	03			08	05			12	06			12	10	
Solderi	ng	Reflow	Only		Ref	low/W	ave		F	Reflow	//Wav	9	F	Reflow	//Wav	e		Reflow	Mfeve	•	F	Reflow	/Wav	e
Packag	ing	All Pa	aper		Α	II Pape	er			All P	aper		Pa	per/Ei	mbos	sed	Pa	per/Er	nboss	ed	Pa	per/Er	nboss	sed
(L) Length	mm	0.60 ±	0.09		1.0	00 ± 0.	10			1.60 :	± 0.15			2.01 :	± 0.20			3.20 :	0.20			3.20 :	± 0.20	
(L) Length	(in.)	(0.024 ±	0.004)		(0.04	40 ± 0.	004)		(0	0.063	± 0.00	6)	(0	0.079 :	± 0.00	8)	(0).126 :	0.008	8)	(0	.126 :	± 0.00	8)
W) Width	mm	0.30 ±	0.09		0.5	50 ± 0.	10			.81 ±	0.15			1.25 :	± 0.20			1.60 :	0.20			2.50 :	± 0.20	
W) Width	(in.)	(0.011 ±	0.004)		(0.02	20 ± 0.	004)		(0	0.032 :	± 0.00	6)	(0	.049 :	± 0.00	8)	(0	0.063 :	0.008	B)	(0	.098 :	± 0.00	8)
(t) Terminal	mm	0.15 ±	0.05		0.2	25 ± 0.	15			0.35	± 0.15			0.50 :	± 0.25			0.50 :	0.25			.50 ±	0.25	
(t) Terrilliai	(in.)	(0.006 ±	0.002)		(0.0	10 ± 0.			(0		± 0.00		(0	.020 :	± 0.01	. /	(0	0.020 :			(0		± 0.01	
	WVDC	6.3	10	6	10	16	25	50	10	16	25	50	10	16	25	50	10	16	25	50	10	16	25	50
Сар	820																				~	-<	W-W	
(pF)	1000		Α																-	× 1	<		7	4
	2200		Α																_	(7		لله	Ŧ
	4700		Α																		<u> </u>	4		
Сар	0.010	Α	Α																		ŀ	1		
(μF)	0.022	Α																		<u> </u>	<u> </u>	_	<u> </u>	${oldsymbol{\sqcup}}$
	0.047	Α				С																		
	0.10				С	С					G	G				K								
	0.22									G	_													ш
	0.33									G														
	0.47			_	_	С				G	G													
	1.0			С	С			1	G	G	J		-	N	N	N		М	М	М				N
	2.2				С				J					N	N			_	K	Q				
	4.7												N	N	N			Р	Q			N	N	_
	10.0							1					N	Р			Q	Q	Х		Х	Q	Q	Z
	22.0																Q				Х	Z		1
	47.0		10	-	40	4.0	0.5	50	40	4.0	0.5		10	4.0	0.5		40	1.0	0.5		40	1.0	0.5	
SIZE	WVDC	6.3 02 0	10	6	10	16 0402	25	50	10	16	25 03	50	10	16	25 05	50	10	16 12	25	50	10	16	25 10	50
SIZE		020	JI			0402				- 06	03			U8	ເບວ			12	00			12	10	
Letter	Α	С	Е		G	J		K		М	N		Р		Q	Х		Υ		Z				
Max.	0.33	0.56	0.71	0	.90	0.94	4	1.02	1	.27	1.4)	1.52		.78	2.2	9	2.54	2.	79				
Thickness	(0.013)	(0.022)	(0.028)	(0.	035)	(0.03	7)	(0.040)	(0.	050)	(0.05	5) ((0.060)	(0.	070)	(0.09	0) (0.100)	(0.1	110)				
			DADED			, (, , , , , , , , , , , , , , , , , ,																		

PAPER

EMBOSSED

MLCC Gold Termination — AU Series







KYOCERA AVX will support those customers for commercial and military Multilayer Ceramic Capacitors with a termination consisting of Gold. This termination is indicated by the use of a "7" or "G" in the 12th position of the KYOCERA AVX Catalog Part Number. This fulfills KYOCERA AVX's commitment to providing a full range of products to our customers. Please contact the factory if you require additional information on our MLCC Gold Termination.

PART NUMBER

AU03	Y	G	104	<u>K</u>	<u>A</u>	7	<u>2</u>	<u>A</u>
Size AU02 - 0402 AU03 - 0603 AU05 - 0805 AU06 - 1206 AU10 - 1210 AU12 - 1812 AU13 - 1825 AU14 - 2225 AU16 - 0306 AU17 - 0508	Voltage 6.3V = 6 10V = Z 16V = Y 25V = 3 35V = D 50V = 5 100V = 1 200V = 2 500V = 7	Dielectric COG (NPO) = A X7R = C X5R = D	Capacitance Code (In pF) 2 Sig. Digits + Number of Zeros	Capacitance Tolerance B = \pm .10 pF (<10pF) C = \pm .25 pF (<10pF) D = \pm .50 pF (<10pF) F = \pm 1% (\geq 10 pF) G = \pm 2% (\geq 10 pF) J = \pm 5% K = \pm 10% M = \pm 20%	Failure Rate A = Not Applicable	Terminations G*=1.9 μ" to 7.87 μ" 7 = 100 μ" minimum	Packaging 2 = 7" Reel 4 = 13" Reel U = 4mm TR (01005) Contact Factory For Multiples*	Special Code A = Std. Product

^{*} Contact factory for availability.

AU18 - 0612





PREFERRED SIZES ARE SHADED

SIZE		Б.	AU02	/		AU					AU05	201/					J06		
Solderi	ng		flow/Epo Vire Bond			Reflow, Wire I					flow/Epo Vire Bond						/Epoxy/ Bond*		
Packagi	na		All Pape			All P					er/Embo					Paper/E		d	
) Length	mm		.00 ± 0.1				£ 0.15				2.01 ± 0.2						± 0.20		
) Length	(in.)		040 ± 0.0			(0.063 :					079 ± 0.0						± 0.008)		
) Width	mm		0.50 ± 0.1			0.81 :					.25 ± 0.2						± 0.20		
<u>, </u>	(in.) mm		020 ± 0.0			0.032 :					049 ± 0.0 0.50 ± 0.2						± 0.008) ± 0.25		
) Terminal	(in.)		010 ± 0.0			(0.014 :					020 ± 0.2						± 0.23 ± 0.010)		
	WVDC	16	25	50	16	25	50	100	16	25	50	100	200	16	25	50	100	200	500
Сар	0.5	С	С	С	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
(pF)	1.0	С	С	С	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	1.2 1.5	C C	C	C	G G	G G	G G	G G	J	J	J	J	J	J	J	J	J	J	J
	1.8	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	2.2	C	C	C	G	G	Ğ	G	J	Ĵ	J	Ĵ	Ĵ	J	J	J	J	J	J
	2.7	C	C	C	G	G	G	G	Ĵ	J	Ĵ	Ĵ	Ĵ	J	Ĵ	Ĵ	J	Ĵ	J
	3.3	С	С	С	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	3.9	С	С	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	4.7	С	С	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	5.6 6.8	C C	C	C	G G	G G	G G	G G	J	J	J	J	J	J	J	J	J	J	J
	8.2	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
4	10	С	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	12	С	С	С	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	15	С	С	С	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	18	С	С	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	22 27	C C	C	C	G G	G G	G G	G G	J	J	J	J	J	J	J	J	J	J	J
	33	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	39	C	c	c	Ğ	G	Ğ	Ğ	Ĵ	Ĵ	Ĵ	Ĵ	Ĵ	Ĵ	Ĵ	Ĵ	Ĵ	Ĵ	Ĵ
	47	C	С	С	G	G	G	G	Ĵ	J	Ĵ	J	Ĵ	J	J	Ĵ	Ĵ	Ĵ	J
	56	С	С	С	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	68	С	С	С	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	82 100	C	C	C	G G	G G	G G	G	J	J	J	J	J	J	J	J	J	J	J
	120	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	150	C	c	c	Ğ	G	Ğ	Ğ	Ĵ	Ĵ	Ĵ	Ĵ	Ĵ	Ĵ	Ĵ	Ĵ	J	Ĵ	J
	180	С	С	С	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	220	С	С	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	M
	270	С	С	C	G	G	G	G	J	J	J	J	М	J	J	J	J	J	M
	330	С	C	С	G G	G G	G G	G	J	J	J	J	M M	J	J	J	J	J	M M
	390 470	C	C	C	G	G	G		J	J	J	J	M	J	J	J J	J	J	M
	560	U			G	G	G		J	J	J	J	M	J	J	J	J	J	M
	680				G	G	G		J	J	J	J	М	J	J	J	J	J	Р
	820				G	G	G		J	J	J	J	М	J	J	J	J	М	
	1000				G	G	G		J	J	J	J	М	J	J	J	J	Q	
	1200 1500								J	J	J			J	J	J	J	Q Q	
	1800			<u> </u>					J	J	J			J	J	J M	M	Ų	-
	2200								J	J	N			J	J	M	P		
	2700							L	Ĵ	Ĵ	N			J	7	М	Р		
	3300								J	J				J	J	М	Р		
	3900								J	J				J	J	M	P		
	4700 5600			-				-	J	J				J	J	M M	Р		-
	6800													M	M	IVI			
	8200													M	M				
,	0.010		ĺ		ĺ			1						М	М				
	0.012			>		1	-\//												
	0.015	- 50			\sim	_	~\`\`\`\	_											-
	0.018 0.022		-	\sim			1	ÎT.											
	0.022		(1		レー	† '											
	0.033				1 1											<u> </u>	t		t
	0.039					500													
	0.047				4.0														
	0.068				11														
	0.082		1	1				I											
	0.11		I .							0.5									
	WVDC	16	25	50	16	25	50	100	16	25	50	100	200	16	25	50	100	200	500

^{*} Contact Factory

Letter	Α	С	Е	G	J	К	М	N	Р	Q	Х	Υ	Z
Max.	0.33	0.56	0.71	0.90	0.94	1.02	1.27	1.40	1.52	1.78	2.29	2.54	2.79
Thickness	(0.013)	(0.022)	(0.028)	(0.035)	(0.037)	(0.040)	(0.050)	(0.055)	(0.060)	(0.070)	(0.090)	(0.100)	(0.110)
			PAPER						EMB	OSSED			



Capacitance Range (NPO Dielectric)

PREFERRED SIZES ARE SHADED

SIZE				AU10					AU12				AU13			AU14	
Solderin	a			low/Epo					flow/Epo				Reflow/Epoxy	/		Reflow/Epoxy	1/
				/ire Bond					Vire Bon				Wire Bond*			Wire Bond*	
Packagir	_			er/Embo .20 ± 0.2					Emboss .50 ± 0.3				All Embossed 4.50 ± 0.30			All Embossed 5.72 ± 0.25	1
(L) Length	mm (in.)													۸	,		n)
	(in.) mm			26 ± 0.0					177 ± 0.0	_			(0.177 ± 0.012 6.40 ± 0.40	.)	(0.225 ± 0.010 6.35 ± 0.25	J)
W) Width	(in.)			.30 ± 0.2)98 ± 0.0					126 ± 0.0				(0.252 ± 0.016	١		0.250 ± 0.25	1)
	mm			.50 ± 0.0					.61 ± 0.3				0.61 ± 0.36	<u>'</u>	'	0.64 ± 0.39	2)
(t) Terminal	(in.)			020 ± 0.0					024 ± 0.0				(0.024 ± 0.014	.)	(0.025 ± 0.015	5)
	WVDC	25	50	100	200	500	25	50	100	200	500	50	100	200	50	100	200
Cap (pF)	0.5 1.0																
(p.)	1.2								İ								
	1.5																
	1.8 2.2																-W-
	2.7														<		J =
	3.3																$\bigcap \mathcal{T}_{\mathbf{I}}$
	3.9 4.7														_		
	5.6															4.0	
	6.8															1	
	8.2 10				<u> </u>	J		-									
	10					J											
	15					J											
	18 22					J											
	27					J											
	33					J			İ								
	39					J											
	47 56					J											
	68					J											
	82					J											
	100 120					J											
	150					J											
	180					J											
	220 270					J J											
	330					J											
	390					М											
	470 560	J	J	J	J	M											
	680	J	J	J	J	M											
	820	J	J	J	J	М											
	1000	J	J	J	J M	M M	K	K	K	K	M	M M	M M	M M	M M	M M	P P
	1200 1500	J	J	J	M	M	K K	K	K	K K	M M	M	M M	M M	M M	M M	P
,	1800	J	J	J	М		K	K	K	К	М	М	М	М	М	М	Р
	2200 2700	J J	J	J	Q		K K	K K	K	K	P	M M	M M	M M	M M	M M	P P
	3300	J	J	J	Q		K	K	K	P	Q Q	M	M	M	M	M	P
	3900	J	J	М			K	K	K	Р	Q	М	М	М	М	М	Р
	4700 5600	J J	J	М	<u> </u>		K	K	K	P P	Q X	M M	M M	M M	M M	M M	P P
	6800	J	J				K	K	M	X	^	M	M M	M	M	M	Р
	8200	J	J				K	М	М			М	М		M	М	Р
	0.010 0.012	J J	J				K K	M M	М			M M	M		M M	M M	P P
	0.012	J	J				M	M				M	M M		M M	M	Y
	0.018						М	М				Р	M		М	М	Y
	0.022 0.027						M	M				P P			M	Y	Y
	0.027				 		M M	M				P P			P P	Y	Y
	0.039						M	M				P			P		
	0.047						М	М				Р			P		
	0.068 0.082						M M	M M							P Q		
	0.082							IVI							Q		
	WVDC	25	50	100 AU10	200	500	25	50	100 AU12	200	500	50	100 AU13	200	50	100	200
	SIZE															AU14	

* Contact Factory

			PAPER						FMB	DSSED			
Thickness	(0.013)	(0.022)	(0.028)	(0.035)	(0.037)	(0.040)	(0.050)	(0.055)	(0.060)	(0.070)	(0.090)	(0.100)	(0.110)
Max.	0.33	0.56	0.71	0.90	0.94	1.02	1.27	1.40	1.52	1.78	2.29	2.54	2.79
Letter	Α	С	E	G	J	K	М	N	Р	Q	Х	Υ	Z
,													





Capacitance Range (X7R Dielectric)

PREFERRED SIZES ARE SHADED

SIZE			AU	02					AU03	3						AU0	5						Αl	J06			
Solderin	a	R		′Ероху	1/				ow/Ep		'						роху	/					eflow				
			Wire E						ire Bo							ire Bo							Wire				
Packagin	nm mm		All P						II Pap 60 ± 0							r/Em 01 ±	boss	ea					per/E 3.20				
(L) Length	(in.)	((£ 0.10 £ 0.004	1)				63 ± 0		١						0.20 0.008	3)					.126				
	mm		0.50 ±		')				81 ± 0		<u>' </u>					25 ±		<i>-</i>)					1.60				
W) Width	(in.)	((£ 0.004	4)				32 ± 0)						0.008	3)					.063				
() T	mm		0.25 ±		·/				35 ± 0		<u>′ </u>					50 ±		-/					0.50				
(t) Terminal	(in.)	(0	0.010 ±	0.006	5)				14 ± 0)				(0.0	20 ±	0.010	0)				(0	.020	± 0.01	10)		
WVDC		10	16	25	50	6.3	10	16	25	50	100	200	63	10	16	25	50	100	200	6.3	10	16	25	50	100	200	500
Сар	100																										
(pF)	150																										
(1-7	220				С				G		_	_															
	330				С					G	G	G		J	J	J	J	J	J								K
	470 680				C					G	G G	G		J	J	J	J	J	J								K
	1000				C					G	G	G		J	J	J	J	J	J								K
	1500				C					G	G	G		J	J	J	J	J	J		J	J	J	J	J	J	M
	2200				C					G	G			J	J	J	J	J	J		J	J	J	J	J	J	M
	3300			С	C					G	G			J	J	J	J	J	J		J	J	J	J	J	J	M
	4700			C	C					G	G			J	J	J	J	J	Ĵ		J	Ĵ	J	J	J	J	М
	6800		С	С						G	G			J	J	J	J	J	J		J	J	J	J	J	J	Р
0	0.010		С					G		G	G			J	J	J	J	J	J		J	J	J	J	J	J	Р
Cap (μF)	0.015		С						G	G				J	J	J	J	J	J		J	J	J	J	J	М	
(μι)	0.022	С	С						G	G				J	J	J	J	J	N		J	J	J	J	J	М	
	0.033	С							G	G				J	J	J	J	N			J	J	J	J	J	М	
	0.047							G	G	G				J	J	J	J	N			J	J	J	J	J	M	
	0.068							G	G	G				J	J	J	J	N			J	J	J	J	J	Р	
	0.10						G	G	G	G				J	J	J	J	N.			J	J	J	J	M	Р	
	0.15 0.22					G	G							J J	J	J	N	N N			J	J J	J	J	Q		
	0.22					G	G							N	N	N	N	N			J	J	M	P	Q		
	0.33													N	N	N	N	N			М	M	M	P	Q		
	0.68													N	N	N		.,			M	M	Q	Q	Q		
	1.0													N	N	N					М	М	Ì	Q	Q		
	1.5																				Р	Q	Q				
	2.2															P*					Q	Q	Q				
	3.3																										
	4.7													P*							Q	Q					
	10																				Q*				<u> </u>		
	22																			Q*							
	47																										
	100 WVDC	10	16	25	50	63	10	16	25	50	100	200	63	10	16	25	50	100	200	63	10	16	25	50	100	200	500
	SIZE	IU	10	AU02		0.3	IU	l lo	AU03		100	200	ರಿವ	IU	10	AU0		100	ZW	0.3	l IO	סו		106	100	200	500
	SIZE			AUUZ					AUUS	,						AUU	J						AL	000			

^{*} Contact Factory

Letter	Α	С	Е	G	J	K	М	N	Р	Q	Х	Υ	Z
Max.	0.33	0.56	0.71	0.90	0.94	1.02	1.27	1.40	1.52	1.78	2.29	2.54	2.79
Thickness	(0.013)	(0.022)	(0.028)	(0.035)	(0.037)	(0.040)	(0.050)	(0.055)	(0.060)	(0.070)	(0.090)	(0.100)	(0.110)
			PAPER						FMRC	SSED			



Capacitance Range (X7R Dielectric)

PREFERRED SIZES ARE SHADED

SIZE					AU10						112			J13		J14
Solderin	a				flow/Epo						/Epoxy/			/Epoxy/		/Epoxy/
	_				Vire Bond						Bond*			Bond*		Bond*
Packagii					er/Embos 3.20 ± 0.2						bossed ± 0.30		All Em	± 0.30		bossed ± 0.25
(L) Length	mm (in.)				126 ± 0.2						± 0.30 ± 0.012)			± 0.30 ± 0.012)		± 0.25 ± 0.010)
	mm				2.50 ± 0.0						± 0.012)			± 0.40		± 0.010)
W) Width	(in.)				098 ± 0.0						± 0.200			± 0.40 ± 0.016)		± 0.23
() T	mm				0.50 ± 0.2						± 0.36			± 0.36		± 0.39
(t) Terminal	(in.)			(0.	020 ± 0.0	10)				(0.024 :	± 0.014)		(0.024 :	± 0.014)	(0.025	± 0.015)
WVDC		10	16	25	50	100	200	500	50	100	200	500	50	100	50	100
Con	100															
Cap (pF)	150															
(pi)	220												A Company			
	330												1	~	-W_	
	470											[_			S	
	680		*)]	↑	
	1000												١	レ-	* '	
	1500	J	J J J J M													
	2200	J	J J J J M										ĺ			
	3300	J	J J J J M M													
	4700	J										١,٠	i	ı	ı	
	6800	J	J J J J M													
Сар	0.010	J	J	J	J	J	J	М	K	K	K	K	М	М	М	Р
(μF)	0.015	J	J	J	J	J	J	Р	K	K	K	Р	М	М	М	Р
(F-)	0.022	J	J	J	J	J	J	Q	K	K	K	Р	М	М	М	Р
	0.033	J	J	J	J	J	J	Q	K	K	K	Х	М	М	М	Р
	0.047	J	J	J	J	J	J		K	K	K	Z	М	М	М	P
	0.068	J	J	J	J	J	M		K	K	K	Z	M	M	M	P
	0.10	J	J	J	J	J	M		K	K	K P	Z	M	M	М	P P
	0.15	J	J J	J	J	M P	Z Z		K K	K K	l P		M M	M M	M M	P
	0.22	J	J	J	J	Q			K	M	X		M	M	M	P
	0.47	M	M	M	M	Q			K	P	^		M	M	M	P
	0.68	М	М	P	X	X			M	Q			М	P	М	P
	1.0	N											М	P	М	P
	1.5	N	N	Z	Z	Z			Z	Z			М		М	X
	2.2	Χ	Х	Z	Z	Z			Z	Z					М	
	3.3	Х	Х	Z	Z				Z							
	4.7	X	X	Z	Z				Z							
	10	Z	Z	Z												
	22															
	47 100															
	WVDC	10	16	25	50	100	200	500	50	100	200	500	50	100	50	100
	SIZE	10	10		AU10	100	200	300	30	AU		300	AU			J14

^{*} Contact Factory

Letter	Α	С	Е	G	J	K	М	N	Р	Q	Х	Υ	Z
Max.	0.33	0.56	0.71	0.90	0.94	1.02	1.27	1.40	1.52	1.78	2.29	2.54	2.79
Thickness	(0.013)	(0.022)	(0.028)	(0.035)	(0.037)	(0.040)	(0.050)	(0.055)	(0.060)	(0.070)	(0.090)	(0.100)	(0.110)
			PAPER						EMBO	DSSED			



Capacitance Range (X5R Dielectric)

PREFERRED SIZES ARE SHADED

SIZE				AU	102					-	AU03	3					ΑL	105						J06					-	AU1	0				4	U12	
Solderii	ng			flow /ire l					ſ		ow/E e Bo		y			Re V	flow /ire	/Epc Bonc	oxy ł*			Re V	eflow Vire	/Epo	oxy ł*			ı		ow/E e Bo		у				w/Ep e Bor	ooxy/ nd*
Packagi	ing			All P	ape	r				Al	l Pap	er				Pape	er/Ei	mbo	ssec	i		Pap	er/E	mbo	ssec	1		Pa	per/	/Eml	ooss	ed		Α	All Er	nbos	ssed
(L) Length	mm (in.)			1.00 : 040 :						(0.06	0 ± 0 3 ± 0	.006))					± 0.20 ± 0.00						± 0.20					(0.12	0 ± 0 6 ± 0	.008)		(0 ± 0. 7 ± 0.	
(W) Width	mm (in.)		(0.	0.50 : 020 :	± 0.0	04)				(0.03	11 ± 0 12 ± 0	.006))			(0.	049 :	± 0.20	08)			(0.	.063	± 0.20	08)				(0.09	0 ± 0 8 ± 0	.008)		((0.12	0 ± 0. 6 ± 0.	(800
(t) Terminal	mm (in.)			0.25 : 010 :							5 ± 0 4 ± 0)					± 0.25 ± 0.01						± 0.2						0 ± 0 0 ± 0)				1 ± 0. 4 ± 0.	
WVDC	;	4		10			50	4	6.3	10		25		50	6.3	10		25		50	6.3	10	16	25	35	50	4	6.3		16			50	6.3		25	50
Сар	100																																				
(pF)	150																																				
	220																					İ		İ													
	330						С																														
	470						С																														
	680						С																														
	1000						С																														
	1500						С																														
	2200						С																	-							-						
	3300 4700					С	С							G																							
	6800					C								G																							
Сар	0.010					С								G																							
(μF)	0.015					C						G	G	G																							
()	0.022				С	С						G	G	G						N																	
	0.033				С							G	G	G						N																	
	0.047				С	С						G	G	G						N																	
	0.068				С							G		G						N																	
	0.10		С		С	С						G		G				N		N																	
	0.15											G						N	N																		
	0.22		C*								G	G						N	N																		
	0.33										G	G						N								Q											
	0.47	C*									G							N						Q	Q								,,,				
	0.68					_			G	G	G	J*			N		N	N N		P*				0	Q						Х	Х	X				
	1.0								G	G	G	J^			N		IN	IN		Ρ"				Q	Ų						٨	^	^				
	2.2	C*						G*	G*	J*	J*				N	N	N	N					Q	Q							Z	Х					
	3.3							J*	J*	J*	J*				N	N	14	14			Q	Q	ď	Ų							_						
	4.7							J*	J*	J*						N	N*	N*			Q	Q	Q	Q						Q	Z						
	10							K*							P*	P*	P*				Q	Q	Q	Q*					Х	z	Z					Z	
	22														P*						Q*	Q*	Q*	Ė				Z	Z	Z	Z						
	47			ĺ																	Q*							Z*									
	100																										Z*	Z*									
	WVDC	4	6.3	10	16	25	50	4	6.3	10	16	25	35	50	6.3	10	16	25	35	50	6.3	10	16	25	35	50	4	6.3	10	16	25	35	50	6.3	10	25	50
	SIZE			AU	102				AU03			ΑU	105					Αl	J06						AU1 (0				4	U12						

^{*} Contact Factory

Letter	Α	С	E	G	J	K	М	Ν	Р	Q	Х	Υ	Z
Max.	0.33	0.56	0.71	0.90	0.94	1.02	1.27	1.40	1.52	1.78	2.29	2.54	2.79
Thickness	(0.013)	(0.022)	(0.028)	(0.035)	(0.037)	(0.040)	(0.050)	(0.055)	(0.060)	(0.070)	(0.090)	(0.100)	(0.110)
			PAPER						EMBC	SSED			

= *Optional Specifications - Contact Factory

NOTE: Contact factory for non-specified capacitance values

AU16/AU17/AU18



	IZE		(AU1 030	5)			(0	U17	3)			(AU1 061:	2)	
Pack	kaging			nbos					boss					nboss		
Length	mm (in.)		(0.03	31 ± 0 32 ± 0	.006)	(0.05	7 ± 0. 0 ± 0.	010)			(0.06	0 ± 0 3 ± 0	.010)	,
Width	mm (in.)			0 ± 0 3 ± 0)	(0 ± 0. 0 ± 0.					20 ± 0 26 ± 0		
Cap Code	WVDC	4	6.3	10	16	25	6.3	10	16	25	50	6.3	10	16	25	50
102	Cap 0.001		Α	Α	Α	Α	S	S	S	S	٧	S	S	S	S	V
222	(μF) .0022		Α	Α	Α	Α	S	S	S	S	٧	S	S	S	S	٧
332	0.0033		Α	Α	Α	Α	S	S	S	S	٧	S	S	S	S	٧
472	0.0047		Α	Α	Α	Α	S	S	S	S	٧	S	S	S	S	٧
682	0.0068		Α	Α	Α	Α	S	S	S	S	٧	S	S	S	S	٧
103	0.01		Α	Α	Α	Α	S	S	S	S	٧	S	S	S	S	٧
153	0.015		Α	Α	Α	Α	S	S	S	S	٧	S	S	S	S	W
223	0.022		Α	Α	Α	Α	S	S	S	S	٧	S	S	S	S	W
333	0.033		Α	Α	Α		S	S	S	٧	٧	S	S	S	S	W
473	0.047		Α	Α	Α		S	S	S	٧	Α	S	S	S	S	W
683	0.068		Α	Α	Α		S	S	S	Α	Α	S	S	S	٧	W
104	0.1		Α	Α	/		S	S	٧	Α	Α	S	S	S	٧	W
154	0.15		Α	Α			S	S	٧			S	S	S	W	W
224	0.22		Α	Α			S	S	Α			S	S	٧	W	
334	0.33						٧	٧	Α			S	S	٧		
474	0.47						٧	٧	///			S	S	٧		
684	0.68						Α	Α				٧	٧	W		
105	1	A					Α	Α				٧	٧	Α		
155	1.5						//					W	W			
225	2.2											Α	Α			
335	3.3											/				
475	4.7															
685	6.8															
106	10															

Solid = X7R





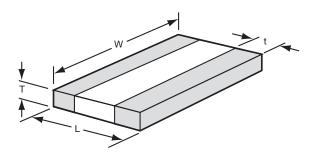
mm (in.) AU16 (0306)Code Thickness

0.56 (0.022)

	mm (in.)
	AU16 (0508)
Code	Thickness
S	0.56 (0.022)
V	0.76 (0.030)
Α	1.02 (0.040)

	mm (in.)										
	AU16 (0612)										
Code	Thickness										
S	0.56 (0.022)										
V	0.76 (0.030)										
W	1.02 (0.040)										
Α	1.27 (0.050)										

PHYSICAL DIMENSIONS AND **PAD LAYOUT**



PHYSICAL DIMENSIONS

MM (IN.)

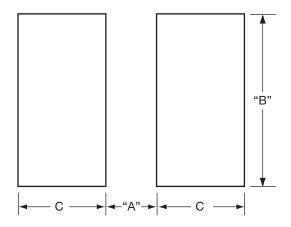
	L	W	t
AU16	0.81 ± 0.15	1.60 ± 0.15	0.13 min.
(0306)	(0.032 ± 0.006)	(0.063 ± 0.006)	(0.005 min.)
AU17	1.27 ± 0.25	2.00 ± 0.25	0.13 min.
(0508)	(0.050 ± 0.010)	(0.080 ± 0.010)	(0.005 min.)
AU18	1.60 ± 0.25	3.20 ± 0.25	0.13 min.
(0612)	(0.063 ± 0.010)	(0.126 ± 0.010)	(0.005 min.)

T - See Range Chart for Thickness and Codes

PAD LAYOUT DIMENSIONS

MM (IN.)

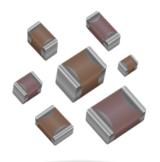
	Α	В	С
AU16 (0306)	0.31 (0.012)	1.52 (0.060)	0.51 (0.020)
AU17 (0508)	0.51 (0.020)	2.03 (0.080)	0.51 (0.020)
AU18 (0612)	0.76 (0.030)	3.05 (0.120)	0.635 (0.025)



MLCC Tin/Lead Termination "B" (LD Series)







KYOCERA AVX will support those customers for commercial and military Multilayer Ceramic Capacitors with a termination consisting of 5% minimum lead. This termination is indicated by the use of a "B" in the 12th position of the KYOCERA AVX Catalog Part Number. This fulfills KYOCERA AVX's commitment to providing a full range of products to our customers. KYOCERA AVX has provided in the following pages a full range of values that we are currently offering in this special "B" termination. Please contact the factory if you require additional information on our MLCC Tin/Lead Termination "B" products.

PART NUMBER (SEE PAGE 4 FOR COMPLETE PART NUMBER EXPLANATION)

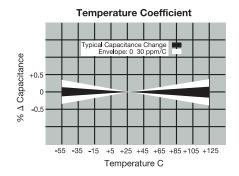
Not RoHS Compliant

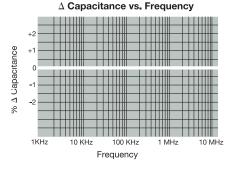
LD05	5	A	101	<u>J</u>	<u>A</u>	<u>B</u>	2	Α
Size LD02 - 0402 LD03 - 0603 LD04 - 0504* LD05 - 0805 LD06 - 1206 LD10 - 1210 LD12 - 1812 LD13 - 1825 LD14 - 2225	Voltage 6.3V = 6 10V = Z 16V = Y 25V = 3 35V = D 50V = 5 100V = 1 200V = 2	Dielectric COG (NPO) = A X7R = C X5R = D X8R = F	Capacitance Code (In pF) 2 Sig. Digits + Number of Zeros	Capacitance Tolerance B = ±.10 pF (<10pF) C = ±.25 pF (<10pF) D = ±.50 pF (<10pF) F = ±1% (≥ 10 pF) G = ±2% (≥ 10 pF) J = ±5% K = ±10%	Failure Rate A = Not Applicable 4 = Automotive	Terminations B = 5% min lead X = FLEXITERM® with 5% min lead** **X7R only	Packaging 2 = 7" Reel 4 = 13" Reel Contact Factory For Multiples*	Special Code A = Std. Product
LD20 - 2220	500V = 7			$M = \pm 20\%$				

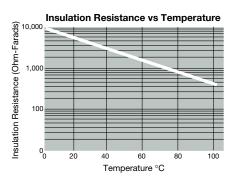
*LD04 has the same CV ranges as LD03.

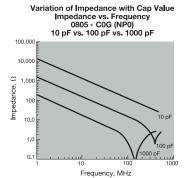
See FLEXITERM® section for CV options

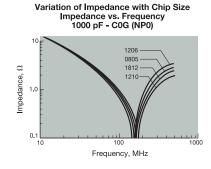
NOTE: Contact factory for availability of Tolerance Options for Specific Part Numbers. Contact factory for non-specified capacitance values.

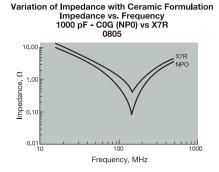












KYDCER3 | The Important Information/Disclaimer is incorporated in the catalog where these specifications came from or available online at www.kyocera-avx.com/disclaimer/ by reference and should be reviewed in full before placing any order.





COG (NP0) - Specifications and Test Methods

Parame	ter/Test	NP0 Specification Limits	Measuring (Conditions			
Operating Tem	perature Range	-55°C to +125°C	Temperature C	ycle Chamber			
Capac	itance	Within specified tolerance	Freq.: 1.0 MHz ± 109				
C)	<30 pF: Q≥ 400+20 x Cap Value ≥30 pF: Q≥ 1000	1.0 kHz ± 10% fo Voltage: 1.0	r cap > 1000 pF Vrms ± .2V			
Insulation	Resistance	100,000MΩ or 1000MΩ - μF, whichever is less	Charge device with rated voltage for 60 ± 5 secs @ room temp/humidity				
Dielectric	: Strength	No breakdown or visual defects	Charge device with 250% of rated voltage f 1-5 seconds, w/charge and discharge curre limited to 50 mA (max) Note: Charge device with 150% of rated volta for 500V devices.				
	Appearance	No defects	Deflectio				
Resistance to Flexure	Capacitance Variation	±5% or ±.5 pF, whichever is greater	Test Time: 3	30 seconds 7 1mm/sec			
Stresses	Q	Meets Initial Values (As Above)					
Insulation Resistance		≥ Initial Value x 0.3	90 r				
Solder	ability	≥ 95% of each terminal should be covered with fresh solder	Dip device in eutection for 5.0 ± 0.				
	Appearance	No defects, <25% leaching of either end terminal					
	Capacitance Variation	≤ ±2.5% or ±.25 pF, whichever is greater					
Resistance to Solder Heat	Q	Meets Initial Values (As Above)	Dip device in eutectic solder at 260°C for 60 seconds. Store at room temperature for 24 ± 2				
Soluel Heat	Insulation Resistance	Meets Initial Values (As Above)	hours before measuring	g electrical properties.			
	Dielectric Strength	Meets Initial Values (As Above)					
	Appearance	No visual defects	Step 1: -55°C ± 2°	30 ± 3 minutes			
	Capacitance Variation	≤ ±2.5% or ±.25 pF, whichever is greater	Step 2: Room Temp	≤ 3 minutes			
Thermal Shock	Q	Meets Initial Values (As Above)	Step 3: +125°C ± 2°	30 ± 3 minutes			
	Insulation Resistance	Meets Initial Values (As Above)	Step 4: Room Temp	≤ 3 minutes			
	Dielectric Strength	Meets Initial Values (As Above)	Repeat for 5 cycles 24 hours at roo				
	Appearance	No visual defects					
	Capacitance Variation	≤ ±3.0% or ± .3 pF, whichever is greater	Charge device with twic				
Load Life	Q	≥ 30 pF: Q≥ 350 ≥10 pF, <30 pF: Q≥ 275 +5C/2 <10 pF: Q≥ 200 +10C	for 1000 hou Remove from test chamb	rs (+48, -0).			
	Insulation Resistance	≥ Initial Value x 0.3 (See Above)	temperature before me	for 24 hours			
	Dielectric Strength	Meets Initial Values (As Above)					
	Appearance	No visual defects					
	Capacitance Variation	≤ ±5.0% or ± .5 pF, whichever is greater	Store in a test chamber s	et at 85°C ± 2°C/ 85% ±			
Load Humidity	Q	≥ 30 pF: Q≥ 350 ≥10 pF, <30 pF: Q≥ 275 +5C/2 <10 pF: Q≥ 200 +10C	5% relative humidi (+48, -0) with rated	d voltage applied.			
	Insulation Resistance	≥ Initial Value x 0.3 (See Above)	Remove from chamber and stabilize at room temperature for 24 ± 2 hours before measuring.				
	Dielectric Strength	Meets Initial Values (As Above)					





PREFERRED SIZES ARE SHADED

			-																
SIZE			LD02				003				LD05					LD0			
Solderi			eflow/Wa				v/Wave				flow/Wa					Reflow/			
Packag	mm		.00 ± 0.1				aper ± 0.15		Paper/Embossed 2.01 ± 0.20					Paper/Embossed 3.20 ± 0.20					
(L) Length	(in.)		040 ± 0.0				± 0.006)		(0.079 ± 0.008)					(0.126 ± 0.008)					
W) Width	mm		.50 ± 0.1				± 0.15		1.25 ± 0.20					1.60 ± 0.20					
	(in.) mm		020 ± 0.0				± 0.006) ± 0.15		(0.049 ± 0.008) 0.50 ± 0.25				(0.063 ± 0.008)						
(t) Terminal	(in.)		0.10 ± 0.0			(0.014 ± 0.006)				(0.020 ± 0.010)					0.50 ± 0.25 (0.020 ± 0.010)				
	WVDC	16	25	50	16	25	50	100	16	25	50	100	200	16	25	50	100	200	500
Cap	0.5 1.0	C	C	C	G G	G G	G G	G G	J	J	J	J	J	J	J	J	J	J	J
(pF)	1.0	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	1.5	С	С	С	G	G	G	G	Ĵ	Ĵ	Ĵ	Ĵ	Ĵ	Ĵ	J	J	J	J	J
	1.8	С	С	С	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	2.2 2.7	C C	C	C	G G	G G	G G	G G	J	J	J	J	J	J	J	J J	J	J	J
	3.3	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	3.9	С	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	4.7 5.6	C	C	C	G G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	6.8	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	8.2	С	С	С	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	10 12	C	C	C	G G	G G	G G	G G	J	J	J	J	J	J	J	J	J	J	J
	12	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	18	С	С	С	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	22 27	C C	C	C	G G	G	G G	G G	J	J	J	J	J	J	J	J	J	J	J
	33	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	39	C	c	c	Ğ	Ğ	Ğ	Ğ	Ĵ	Ĵ	Ĵ	Ĵ	Ĵ	Ĵ	Ĵ	Ĵ	Ĵ	Ĵ	Ĵ
	47	С	С	С	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	56 68	C C	C	C	G G	G	G G	G G	J	J	J	J	J	J	J	J	J	J	J
	82	C	Č	č	G	G	Ğ	Ğ	Ĵ	J	Ĵ	Ĵ	Ĵ	Ĵ	J	J	Ĵ	J	J
	100	С	С	С	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	120 150	C C	C	C	G G	G	G G	G G	J	J J	J	J J	J	J	J J	J J	J	J	J
-	180	C	C	C	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J
	220	С	С	С	G	G	G	G	J	J	Ĵ	J	J	J	J	J	J	J	М
	270 330	C	C	C	G	G	G G	G G	J	J	J	J	M M	J	J	J	J	J	M M
	390	C	C	C	G G	G	G	G	J	J	J	J	M	J	J	J	J	J	M
	470	Ċ	C	c	G	G	G		J	J	Ĵ	J	М	J	J	J	J	J	М
	560				G	G	G		J	J	J	J	М	J	J	J	J	J	M
	680 820				G G	G	G G		J	J	J	J		J	J J	J	J	J M	Р
	1000				G	G	G		J	Ĵ	J	J		J	J	J	J	Q	
	1200					G			J	J	J			J	J	J	J	Q	
	1500 1800					-	-		J	J	J			J	J	J M	M M	Q	
	2200								J	J	N			J	J	M	P		
	2700								J	J	N			J	J	M	Р		\square
	3300 3900								J	J				J	J	M M	P P		
	4700								J	J				J	J	M	P		
	5600													J	J	М			
	6800 8200													M M	M M				
Сар	0.010						 							M	M				\vdash
(pF)	0.012																		
	0.015		1	1	~	W-	_												
	0.018 0.022		×			7	1												
	0.027			-		.لا	Ţ T _												
	0.033		,		سلرا														
	0.039 0.047				4.0														
	0.047		t		T.I		. –												\vdash
	0.082																		
	0.1 WVDC	16	25	50	16	25	50	100	16	25	50	100	200	16	25	50	100	200	500
	SIZE	10	LD02	30	10)03	100	10		LD05	100		10		LD0		200	300
	GIZL		LD02				-55									LDU	~		

Letter	Α	С	E	G	J	K	М	N	Р	Q	Х	Υ	Z
Max.	0.33	0.56	0.71	0.90	0.94	1.02	1.27	1.40	1.52	1.78	2.29	2.54	2.79
Thickness	(0.013)	(0.022)	(0.028)	(0.035)	(0.037)	(0.040)	(0.050)	(0.055)	(0.060)	(0.070)	(0.090)	(0.100)	(0.110)
PAPER								EMB	OSSED				





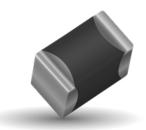
PREFERRED SIZES ARE SHADED

SIZE	=			LD10					LD12				LD1				LD14	
Solder			D	Reflow Or	Ny.				Reflow On	dv		Reflow Only				Reflow Only		
Packag				er/Embo					I Emboss			All Embossed			All Embossed			
(L) Length	mm		3	3.20 + 0.2	20			-	4.50 ± 0.3	0		4.50 ± 0.30			5.72 ± 0.25			
	(in.) mm			126 ± 0.0 2.50 ± 0.2					177 ± 0.0 3.20 ± 0.2				(0.177 ± 6.40 ±			(0.225 ± 0.010) 6.35 ± 0.25		
W) Width	(in.)		(0.	098 ± 0.0	008)			(0.	126 ± 0.0	(80			(0.252 ±	0.016)		((0.250 ± 0.010))
(t) Terminal	mm (in.)			0.50 ± 0.2 020 ± 0.0					0.61 ± 0.3 024 ± 0.0				0.61 ± (0.024 ±			(0.64 ± 0.39 (0.025 ± 0.015	5)
	WVDC	25	50	100	200	500	25	50	100	200	500	50	10		200	50	100	200
Cap (pF)	0.5 1.0																	
(P.)	1.2																	
	1.5																	
	1.8 2.2																7	W
	2.7															_ </td <td></td> <td></td>		
	3.3 3.9															() I
	4.7															_	1	
	5.6 6.8																4	
	8.2																1	
	10 12					J												
	15					J												
	18 22					J												
	27					J												
	33 39					J												
	47					J												
	56					J												
	68 82					J												
	100					J												
	120 150					J												
	180					J												
	220 270					J												
	330					J												
	390 470					M M												
	560	J	J	J	J	М												
	680 820	J	J	J J	J	M M												
	1000	J	J	J	J	M	К	K	K	K	М	М	М		М	М	М	Р
	1200 1500	J	J	J J	M M	M M	K K	K K	K K	K K	M M	M M	M		M M	M M	M M	P P
	1800	J	J	J	M	IVI	K	K	K	K	М	M	M		M	M	M	Р
	2200 2700	J	J J	J J	QQ		K K	K K	K K	K P	P Q	M M	M		M M	M M	M M	P P
	3300	J	J	J	ų į		P	P	P	P	Q	M	M		M	M	M	P
	3900 4700	J J	J J	M M			P P	P P	P P	P P	Q Y	M M	M		M M	M M	M M	P P
	5600	J	J	IVI			Р	Р	Р	Р	Y	M	M		М	М	М	Р
	6800 8200	J	J				P P	P P	Q Q	Q Q	Y	M M	M		М	M M	M M	P P
Сар	0.010	J	J				Р	Р	Q	Q	Y	М	M			М	М	Р
(pF)	0.012 0.015	J	J				P P	P P	Q Q	X X	Y	M M	M			M M	M M	P Y
	0.018						Р	Р	Х	Х	Y	Р	M			М	М	Y
	0.022 0.027						P Q	P X	X X	X Z		P P				M P	Y Y	Y
	0.033						Q	Х	Х	Z		Р				Р		
	0.039 0.047						X	X	Z Z	Z Z		P P				P P		
	0.068						Z	Z	Z	_						Р		
	0.082						Z Z	Z Z	Z Z							Q Q		
	WVDC	25	50	100	200	500	25	50	100	200	500	50	10		200	50	100	200
SIZI	E			LD10					LD12				LD1	3			LD14	
Lotton	Λ	С		Е	G			K	М		N	Р	Q	Х	Y	Z	1	
Letter Max.	0.33	0.56		0.71	0.90	0.9		1.02	1.27	-	.40	1.52	1.78	2.29	2.54	2.79	+	
Thickness	(0.013)	(0.022		0.028)	(0.035)	(0.0)		(0.040)	(0.050	1	055)	(0.060)	(0.070)	(0.090)	- 1			
· mokileaa	(0.0.0)																	









KYOCERA AVX will support those customers for commercial and military Multilayer Ceramic Capacitors with a termination consisting of 5% minimum lead. This termination is indicated by the use of a "B" in the 12th position of the KYOCERA AVX Catalog Part Number. This fulfills KYOCERA AVX's commitment to providing a full range of products to our customers. KYOCERA AVX has provided in the following pages a full range of values that we are currently offering in this special "B" termination. Please contact the factory if you require additional information on our MLCC Tin/Lead Termination "B" products.

Not RoHS Compliant

PART NUMBER (SEE PAGE 4 FOR COMPLETE PART NUMBER EXPLANATION)

LD05	<u>5</u>	F T	101		<u>A</u>	<u>B</u>	2	<u>A</u>
Size LD02 - 0402 LD03 - 0603 LD04 - 0504* LD05 - 0805 LD06 - 1206 LD10 - 1210 LD12 - 1812 LD13 - 1825 LD14 - 2225 LD20 - 2220	Voltage 6.3V = 6 10V = Z 16V = Y 25V = 3 35V = D 50V = 5 100V = 1 200V = 2 500V = 7	Dielectric X8R = F	Capacitance Code (In pF) 2 Sig. Digits + Number of Zeros	Capacitance Tolerance B = ±.10 pF (<10pF) C = ±.25 pF (<10pF) D = ±.50 pF (<10pF) F = ±1% (≥ 10 pF) G = ±2% (≥ 10 pF) J = ±5% K = ±10% M = ±20%	Failure Rate A = Not Applicable	Terminations B = 5% min lead X = FLEXITERM® with 5% min lead** **X7R only	Packaging 2 = 7" Reel 4 = 13" Reel Contact Factory For Multiples*	Special Code A = Std. Product

LD04 has the same CV ranges as LD03.

See FLEXITERM® section for CV options

NOTE: Contact factory for availability of Tolerance Options for Specific Part Numbers. Contact factory for non-specified capacitance values.





Parame	ter/Test	X8R Specification Limits	Measuring	Conditions			
Operating Tem	perature Range	-55°C to +150°C	Temperature C	ycle Chamber			
Capac	itance	Within specified tolerance	Frog : 1 0 k	√U¬ ± 100/			
Dissipati	on Factor	≤ 2.5% for ≥ 50V DC rating ≤ 3.5% for 25V DC and 16V DC rating	Freq.: 1.0 k Voltage: 1.0				
Insulation	Resistance	100,000ΜΩ or 1000ΜΩ - μF, whichever is less	Charge device with rated voltage for 120 ± 5 secs @ room temp/humidity				
Dielectric	: Strength	No breakdown or visual defects	Charge device with 250% of rated voltage for 1-5 seconds, w/charge and discharge current limited to 50 mA (max) Note: Charge device with 150% of rated voltage for 500V devices.				
	Appearance	No defects	Deflection: 2mm				
Resistance to	Capacitance Variation	≤ ±12%	Test Time: 3				
Flexure Stresses	Dissipation Factor	Meets Initial Values (As Above)					
	Insulation Resistance	≥ Initial Value x 0.3	90 r	mm			
Solder	rability	≥ 95% of each terminal should be covered with fresh solder	Dip device in eutection for 5.0 ± 0.				
	Appearance	No defects, <25% leaching of either end terminal					
	Capacitance Variation	≤ ±7.5%					
Resistance to Solder Heat	Dissipation Factor	Meets Initial Values (As Above)	Dip device in eutectic s seconds. Store at room	temperature for 24 ± 2			
	Insulation Resistance	Meets Initial Values (As Above)	hours before measuring	g electrical properties.			
	Dielectric Strength	Meets Initial Values (As Above)					
	Appearance	No visual defects	Step 1: -55°C ± 2°	30 ± 3 minutes			
	Capacitance Variation	≤ ±7.5%	Step 2: Room Temp	≤ 3 minutes			
Thermal Shock	Dissipation Factor	Meets Initial Values (As Above)	Step 3: +125°C ± 2°	30 ± 3 minutes			
	Insulation Resistance	Meets Initial Values (As Above)	Step 4: Room Temp	≤ 3 minutes			
	Dielectric Strength	Meets Initial Values (As Above)	Repeat for 5 cycles 24 ± 2 hours at ro	and measure after oom temperature			
	Appearance	No visual defects					
	Capacitance Variation	≤ ±12.5%	Charge device with 1.5 r				
Load Life	Dissipation Factor	≤ Initial Value x 2.0 (See Above)	for 1000 hou				
	Insulation Resistance	≥ Initial Value x 0.3 (See Above)	Remove from test chamb temperature for 24 ± 2 h				
	Dielectric Strength	Meets Initial Values (As Above)					
	Appearance	No visual defects					
	Capacitance Variation	≤ ±12.5%	Store in a test chamber s 5% relative humidi				
Load Humidity	Dissipation Factor	≤ Initial Value x 2.0 (See Above)	(+48, -0) with rated	d voltage applied.			
	Insulation Resistance	≥ Initial Value x 0.3 (See Above)	Remove from chamber temperature an	d humidity for			
	Dielectric Strength	Meets Initial Values (As Above)	24 ± 2 hours before measuring.				



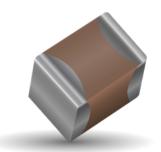
X8R - Capacitance Range

	SIZE	LD	03	LD	05	LD06		
	WVDC	25V	50V	25V	50V	25V	50V	
271	Cap 270	G	G					
331	(pF) 330	G	G	J	J			
471	470	G	G	J	J			
681	680	G	G	J	J			
102	1000	G	G	J	J	J	J	
152	1500	G	G	J	J	J	J	
182	1800	G	G	J	J	J	J	
222	2200	G	G	J	J	J	J	
272	2700	G	G	J	J	J	J	
332	3300	G	G	J	J	J	J	
392	3900	G	G	J	J	J	J	
472	4700	G	G	J	J	J	J	
562	5600	G	G	J	J	J	J	
682	6800	G	G	J	J	J	J	
822	Cap 8200	G	G	J	J	J	J	
103	(μF) 0.01	G	G	J	J	J	J	
123	0.012	G	G	J	J	J	J	
153	0.015	G	G	J	J	J	J	
183	0.018	G	G	J	J	J	J	
223	0.022	G	G	J	J	J	J	
273	0.027	G	G	J	J	J	J	
333	0.033	G	G	J	J	J	J	
393	0.039	G	G	J	J	J	J	
473		G	G	J	J	J	J	
563	0.056	G		N	N	M	М	
683	0.068	G		N	N	M	М	
823	0.082			N	N	M	М	
104	0.1			N	N	М	М	
124	0.12			N	N	М	М	
154	0.15			N	N	М	М	
184	0.18			N		М	М	
224	0.22			N		М	М	
274	0.27					М	М	
334	0.33					М	М	
394	0.39					М		
474	0.47					М		
684	0.68							
824	0.82							
105	1							
	WVDC	25V	50V	25V	50V	25V	50V	
	SIZE	LD	03	LD	05	LD	06	

Letter	Α	С	Е	G	J	K	М	N	Р	Q	Χ	Υ	Z
Max.	0.33	0.56	0.71	0.90	0.94	1.02	1.27	1.40	1.52	1.78	2.29	2.54	2.79
Thickness	(0.013)	(0.022)	(0.028)	(0.035)	(0.037)	(0.040)	(0.050)	(0.055)	(0.060)	(0.070)	(0.090)	(0.100)	(0.110)
	PAPER								FMBC	SSFD			

X7R - General Specifications





KYOCERA AVX will support those customers for commercial and military Multilayer Ceramic Capacitors with a termination consisting of 5% minimum lead. This termination is indicated by the use of a "B" in the 12th position of the KYOCERA AVX Catalog Part Number. This fulfills KYOCERA AVX's commitment to providing a full range of products to our customers. KYOCERA AVX has provided in the following pages a full range of values that we are currently offering in this special "B" termination. Please contact the factory if you require additional information on our MLCC Tin/Lead Termination "B" products.

Not RoHS Compliant

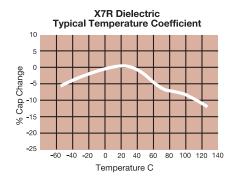
PART NUMBER (SEE PAGE 4 FOR COMPLETE PART NUMBER EXPLANATION)

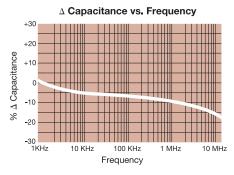
LD05	5	<u>c</u>	101	J	<u>A</u>	<u>B</u>	2	<u>A</u>
Size LD03 - 0603 LD04 - 0504* LD05 - 0805 LD06 - 1206 LD10 - 1210 LD12 - 1812 LD13 - 1825 LD14 - 2225 LD20 - 2220	Voltage 6.3V = 6 10V = Z 16V = Y 25V = 3 35V = D 50V = 5 100V = 1 200V = 2 500V = 7	Dielectric X7R = C	Capacitance Code (In pF) 2 Sig. Digits + Number of Zeros	Capacitance Tolerance B = \pm .10 pF (<10pF) C = \pm .25 pF (<10pF) D = \pm .50 pF (<10pF) F = \pm 1% (\geq 10 pF) G = \pm 2% (\geq 10 pF) J = \pm 5% K = \pm 10% M = \pm 20%	Failure Rate A = Not Applicable	Terminations B = 5% min lead X = FLEXITERM® with 5% min lead** **X7R only	Packaging 2 = 7" Reel 4 = 13" Reel Contact Factory For Multiples*	Special Code A = Std. Product

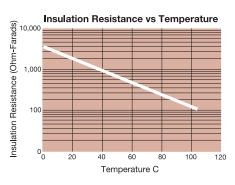
^{*}LD04 has the same CV ranges as LD03.

See FLEXITERM® section for CV options

NOTE: Contact factory for availability of Tolerance Options for Specific Part Numbers. Contact factory for non-specified capacitance values.





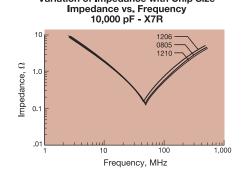


0805 10.00 1 000 pF Impedance, Ω 0.01 100 1000

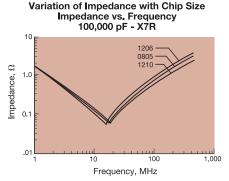
Frequency, MHz

Variation of Impedance with Cap Value

Impedance vs. Frequency 1,000 pF vs. 10,000 pF - X7R



Variation of Impedance with Chip Size







Parame	ter/Test	X7R Specification Limits	Measuring (Conditions
Operating Tem	perature Range	-55°C to +125°C	Temperature C	ycle Chamber
Capac	itance	Within specified tolerance		
Dissipati	on Factor	≤ 10% for ≥ 50V DC rating ≤ 12.5% for 25V DC rating ≤ 12.5% for 25V and 16V DC rating ≤ 12.5% for ≤ 10V DC rating	Freq.: 1.0 k Voltage: 1.0'	
Insulation	Resistance	100,000ΜΩ or 1000ΜΩ - μF, whichever is less	Charge device with 120 ± 5 secs @ roo	
Dielectric	: Strength	No breakdown or visual defects	Charge device with 250 1-5 seconds, w/charge limited to 50 Note: Charge device with for 500V	and discharge current mA (max) n 150% of rated voltage
	Appearance	No defects	Deflectio	n: 2mm
Resistance to	Capacitance Variation	≤ ±12%	Test Time: 3	
Flexure Stresses	Dissipation Factor	Meets Initial Values (As Above)	To the second	
	Insulation Resistance	≥ Initial Value x 0.3	90 r	nm —
Solder	rability	≥ 95% of each terminal should be covered with fresh solder	Dip device in eutectic for 5.0 ± 0.5	
	Appearance	No defects, <25% leaching of either end terminal		
	Capacitance Variation	≤ ±7.5%		
Resistance to Solder Heat	Dissipation Factor	Meets Initial Values (As Above)	Dip device in eutectic s seconds. Store at room	temperature for 24 ± 2
	Insulation Resistance	Meets Initial Values (As Above)	hours before measuring	g electrical properties.
	Dielectric Strength	Meets Initial Values (As Above)		
	Appearance	No visual defects	Step 1: -55°C ± 2°	30 ± 3 minutes
	Capacitance Variation	≤ ±7.5%	Step 2: Room Temp	≤ 3 minutes
Thermal Shock	Dissipation Factor	Meets Initial Values (As Above)	Step 3: +125°C ± 2°	30 ± 3 minutes
	Insulation Resistance	Meets Initial Values (As Above)	Step 4: Room Temp	≤ 3 minutes
	Dielectric Strength	Meets Initial Values (As Above)	Repeat for 5 cycles 24 ± 2 hours at ro	
	Appearance	No visual defects		
	Capacitance Variation	≤ ±12.5%	Charge device with 1.5 r test chamber set	
Load Life	Dissipation Factor	≤ Initial Value x 2.0 (See Above)	for 1000 hou	
	Insulation Resistance	≥ Initial Value x 0.3 (See Above)	Remove from test chamb temperature for 24 ± 2 h	
	Dielectric Strength	Meets Initial Values (As Above)		
	Appearance	No visual defects		
	Capacitance Variation	≤ ±12.5%	Store in a test chamber s 5% relative humidi	
Load Humidity	Dissipation Factor	≤ Initial Value x 2.0 (See Above)	(+48, -0) with rated	l voltage applied.
Hammunty	Insulation Resistance	≥ Initial Value x 0.3 (See Above)	Remove from chamber temperature an 24 ± 2 hours bef	d humidity for
	Dielectric Strength	Meets Initial Values (As Above)	Z4 I Z Hours ber	ore measuring.

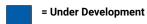




PREFERRED SIZES ARE SHADED

			-																							
SIZE		·	LD02					LD03							LD05							LD				
Solderi Packagi			low/V				Ref	low/V	vave						low/W	<u>rave</u> ossed						Reflow aper/Er				
	mm		00 ± 0					60 ± 0							01 ± 0						ГС	3.20 ±		eu		
(L) Length	(in.)		40 ± 0					63 ± 0							79 ± 0.						((0.126 ±		8)		
W) Width	mm		50 ± 0					81 ± 0							25 ± 0							1.60 ±		٥١		
<u> </u>	(in.) mm		20 ± 0 25 ± 0					32 ± 0 35 ± 0							49 ± 0. 50 ± 0.						(0.063 ± 0.50 ±		8)		
(t) Terminal	(in.)		23 ± 0 10 ± 0					33 ± 0 14 ± 0							30 ± 0. 20 ± 0.						(0.30 ±		0)		
WVDO		16	25	50	6.3	10	16	25	50	100	200	6.3	10	16	25	50	100	200	6.3	10	16	25	50	100	200	500
Сар	100											0.0							0.0							
(pF)	150																									
()	220			С																						
	330			С					G	G	G		J	J	J	J	J	J								K
	470			С					G	G	G		J	J	J	J	J	J								K
	680			С					G	G	G		J	J	J	J	J	J								K
	1000			С					G	G	G		J	J	J	J	J	J								K
	1500			С					G	G			J	J	J	J	J	J		J	J	J	J	J	J	М
	2200			С					G	G			J	J	J	J	J	J		J	J	J	J	J	J	М
	3300		С	С					G	G			J	J	J	J	J	J		J	J	J	J	J	J	М
	4700		C	C					G	G			J	J	J	J	J	J		J	J	J	J	J	J	M
	6800	С	С						G	G			J	J	J	J	J	J		J	J	J	J	J	J	Р
Cap	0.010	С	С						G	G			J	J	J	J	J	J		J	J	J	J	J	J	Р
(μF)	0.015	С						G	G				J	J	J	J	J	J		J	J	J	J	J	M	
	0.022	С						G	G				J	J	J	J	J	N		J	J	J	J	J	М	
	0.033	С						G	G				J	J	J	J	N			J	J	J	J	J	М	
	0.047						G	G	G				J	J	J	J	N			J	J	J	J	J	М	
	0.068					_	G	G	G				J	J	J	J	N			J	J	J	J	J	Р	
	0.10		C*			G	G	G	G				J	J	J	J	N			J	J	J	J	P	Р	
	0.15				G	G							J	J	J	N	N			J	J	J	J	Q		
	0.22				G	G							J	J	N	N	N			J	J	J	J	Q		
	0.33												N	N	N	N	N			J	J	М	Р	Q		
	0.47 0.68							J*					N	N	N	N	N			M	M	M	P	Q		
						J*	1+						N N	N N	N N*					M	M	Q	Q	Q		
	1.0 1.5					J	J*						IN	IN	IN"					P M	Q	Q Q	Ų	Ų		
	2.2				J*										P*					0	0	Q				
	3.3				J										Г					Ų	Ų	Ų				\vdash
	4.7												P*	P*						0*	Q*	0*				
	10											P*	' Р							0*	0*	Q				
	22											'							0*	٧	٧	٧				\vdash
	47																		~							
	100																									
	WVDC	16	25	50	6.3	10	16	25	50	100	200	6.3	10	16	25	50	100	200	6.3	10	16	25	50	100	200	500
	SIZE		LD02																			LD				
						LD03 LD05																				

Letter	Α	С	Е	G	J	K	М	N	Р	Q	Х	Υ	Z
Max.	0.33	0.56	0.71	0.90	0.94	1.02	1.27	1.40	1.52	1.78	2.29	2.54	2.79
Thickness	(0.013)	(0.013) (0.022) (0.028) (0.035) (0.03					(0.050)	(0.055)	(0.060)	(0.070)	(0.090)	(0.100)	(0.110)
			PAPER						EMBC	SSED			









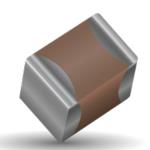
PREFERRED SIZES ARE SHADED

SIZE					LD10					LD	12		LD	13		LD	20		LD	14
Solderin	ng			R	eflow On	ly				Reflov				w Only		Reflo				w Only
Packagii	ng				er/Embo					All Emb				bossed		All Em				bossed
(L) Length	mm				.20 + 0.2					4.50 ±				± 0.30			± 0.50			± 0.25
(L) Length	(in.)				26 ± 0.0					(0.177 ±			_	± 0.012)		(0.224 :				± 0.010)
W) Width	mm				.50 ± 0.2					3.20 ±				± 0.40			± 0.40			± 0.25
	(in.)				98 ± 0.0					(0.126 ±				± 0.016)		(0.197 :			(0.250	
(t) Terminal	mm				.50 ± 0.2					0.61 ±				± 0.36			± 0.39			± 0.39
WVDC	(in.)	10	16	25	20 ± 0.0 50	10)	200	500	50	(0.024 ±	200	500	50	± 0.014)	25	50	± 0.015) 100	200	(0.025 :	100
	100	10	16	25	50	100	200	500	50	100	200	500	50	100	25	50	100	200	50	100
Cap (pF)	150																			
(pr)	220																	ا	<u> </u>	
	330															†	-[\sim	W	
	470)) [
	680																$\overline{}$	1)	~
	1000															Ī		1		
	1500	J	J	J	J	J	J	М										₹		
	2200	J	J	J	J	J	J	М												
	3300	J	J	J	J	J	J	М												
	4700	J	J	J	J	J	J	М												
	6800	J	J	J	J	J	J	М												_
	0.010	J	J	J	J	J	J	M	K	K	K	K	М	М		X	X	Х	M	P
(I:)	0.015	J	J	J	J	J	J	Р	K	K	K	Р	М	М		X	X	X	M	P
	0.022	J J	J	J	J	J	J	Q O	K	K	K	P X	M	M M		X	X	X	M M	P
	0.033		J	-	-	-	J	Ų	K	K		Z	M M	M M		X	X	X		P
	0.047	J J	J	J	J J	J	J M		K K	K	K K	Z	M	M		X	X	X	M M	P
	0.10		J	J	J	J	M		K	K	K	Z	M	M		X	X	X	M	P
	0.15	J	J	J	J	M	Z		K	K	P		M	M		X	l x	x	M	P
	0.22	J	Ĵ	Ĵ	Ĵ	P	Z		ĸ	K	Р		M	М		X	x	x	M	Р
	0.33	J	J	J	J	Q			K	М	X		М	М		X	X	X	М	P
	0.47	М	М	М	М	Q			К	Р			М	М		Х	Х	х	М	Р
	0.68	М	М	Р	Х	X			М	Q			М	Р		Х	X		М	Р
	1.0	N	N	Р	Х	Z			М	Х			М	Р		Х	Х		М	Р
	1.5	N	N	Z	Z	Z			Z	Z			М			Х	X		М	X
	2.2	Χ	Х	Z	Z	Z			Z	Z						Х	Х		М	
	3.3	Х	Х	Z	Z				Z	_						X	Z			
	4.7	X	X	Z	Z				Z	Z						X	Z			
	10	<u>Z</u>	Z	Z	Z										7	Z	Z		-	\vdash
	22 47	Z Z	Z												Z					
	100	2																		
	WVDC	10	0 16 25 50 100 200 5					500	50	100	200	500	50	100	25	50	100	200	50	100
SIZE	11100	10	10			100	200	300	30	LD		300		13		LD				014
J.ZL		LD10																	• •	

Letter	Α	С	E	G	J	K	М	N	Р	Q	Χ	Υ	Z
Max.	0.33	0.56	0.71	0.90	0.94	1.02	1.27	1.40	1.52	1.78	2.29	2.54	2.79
Thickness	(0.013)	(0.022)	(0.028)	(0.035)	(0.037)	(0.040)	(0.050)	(0.055)	(0.060)	(0.070)	(0.090)	(0.100)	(0.110)
			PAPER						EMBC	SSED			

X5R - General Specifications





KYOCERA AVX will support those customers for commercial and military Multilayer Ceramic Capacitors with a termination consisting of 5% minimum lead. This termination is indicated by the use of a "B" in the 12th position of the KYOCERA AVX Catalog Part Number. This fulfills KYOCERA AVX's commitment to providing a full range of products to our customers. KYOCERA AVX has provided in the following pages a full range of values that we are currently offering in this special "B" termination. Please contact the factory if you require additional information on our MLCC Tin/Lead Termination "B" products.

Not RoHS Compliant

PART NUMBER (SEE PAGE 4 FOR COMPLETE PART NUMBER EXPLANATION)

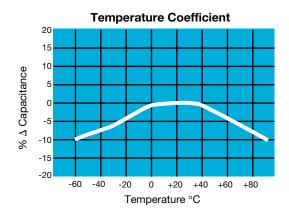
LD05	5	D	101	Ţ	A	В	2	A
Size LD02 - 0402 LD03 - 0603 LD04 - 0504* LD05 - 0805 LD06 - 1206 LD10 - 1210 LD12 - 1812 LD13 - 1825 LD14 - 2225 LD20 - 2220	Voltage 6.3V = 6 10V = Z 16V = Y 25V = 3 35V = D 50V = 5 100V = 1 200V = 2 500V = 7	Dielectric X5R = D	Capacitance Code (In pF) 2 Sig. Digits + Number of Zeros	Capacitance Tolerance B = ±.10 pF (<10pF) C = ±.25 pF (<10pF) D = ±.50 pF (<10pF) F = ±1% (≥ 10 pF) G = ±2% (≥ 10 pF) J = ±5% K = ±10% M = ±20%	Failure Rate A = Not Applicable	Terminations B = 5% min lead X = FLEXITERM® with 5% min lead** **X7R only	Packaging 2 = 7" Reel 4 = 13" Reel Contact Factory For Multiples*	Special Code A = Std. Product

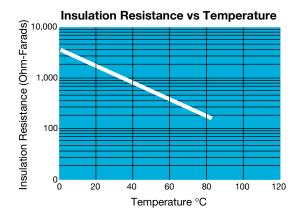
^{*}LD04 has the same CV ranges as LD03.

NOTE: Contact factory for availability of Tolerance Options for Specific Part Numbers. Contact factory for non-specified capacitance values.

See FLEXITERM® section for CV options

TYPICAL ELECTRICAL CHARACTERISTICS









Parame	ter/Test	X5R Specification Limits	Measuring (Conditions
Operating Tem	perature Range	-55°C to +85°C	Temperature C	ycle Chamber
Capac	itance	Within specified tolerance		
Dissipati	on Factor	≤ 2.5% for ≥ 50V DC rating ≤ 3.0% for 25V, 35V DC rating ≤ 12.5% Max. for 16V DC rating and lower Contact Factory for DF by PN	Freq.: 1.0 k Voltage: 1.0' For Cap > 10 μF, 0.	Vrms ± .2V
Insulation	Resistance	10,000MΩ or 500MΩ - μF, whichever is less	Charge device with 120 ± 5 secs @ roo	
Dielectric	Strength	No breakdown or visual defects	Charge device with 250 1-5 seconds, w/charge limited to 50	and discharge current
	Appearance	No defects	Deflectio	n: 2mm
Resistance to	Capacitance Variation	≤ ±12%	Test Time: 3	0 seconds 7 1mm/sec
Flexure Stresses	Dissipation Factor	Meets Initial Values (As Above)	\ \tag{\frac{1}{2}}	
	Insulation Resistance	≥ Initial Value x 0.3	90 n	mm ————
Solder	rability	≥ 95% of each terminal should be covered with fresh solder	Dip device in eutectic for 5.0 ± 0.5	
	Appearance	No defects, <25% leaching of either end terminal		
	Capacitance Variation	≤ ±7.5%		
Resistance to Solder Heat	Dissipation Factor	Meets Initial Values (As Above)	Dip device in eutectic s seconds. Store at room	temperature for 24 ± 2
	Insulation Resistance	Meets Initial Values (As Above)	hours before measuring	g electrical properties.
	Dielectric Strength	Meets Initial Values (As Above)		
	Appearance	No visual defects	Step 1: -55°C ± 2°	30 ± 3 minutes
	Capacitance Variation	≤ ±7.5%	Step 2: Room Temp	≤ 3 minutes
Thermal Shock	Dissipation Factor	Meets Initial Values (As Above)	Step 3: +85°C ± 2°	30 ± 3 minutes
	Insulation Resistance	Meets Initial Values (As Above)	Step 4: Room Temp	≤ 3 minutes
	Dielectric Strength	Meets Initial Values (As Above)	Repeat for 5 cycles 24 ± 2 hours at ro	
	Appearance	No visual defects	01	V
	Capacitance Variation	≤ ±12.5%	Charge device with 1.52 chamber set at 85°C ± (+48, -0). Note: Contact	£ 2°C for 1000 hours
Load Life	Dissipation Factor	≤ Initial Value x 2.0 (See Above)	specification part numb	pers that are tested at
	Insulation Resistance	≥ Initial Value x 0.3 (See Above)	Remove from test chamb	
	Dielectric Strength	Meets Initial Values (As Above)	temperature for 24 ± 2 ho	ours before measuring.
	Appearance	No visual defects		
	Capacitance Variation	≤ ±12.5%	Store in a test chamber s 5% relative humidi	ty for 1000 hours
Load Humidity	Dissipation Factor	≤ Initial Value x 2.0 (See Above)	(+48, -0) with rated	
,	Insulation Resistance	≥ Initial Value x 0.3 (See Above)	Remove from chamber temperature an 24 ± 2 hours bef	d humidity for
	Dielectric Strength	Meets Initial Values (As Above)	24 ± 2 Hours ben	ore measuring.





PREFERRED SIZES ARE SHADED

											=						п	1																			
SIZE				L	D02						.D0	3					LD	05					LD	06						.D10)				LD	12	
Solderi	ng		R	eflo	w/W	ave			ı	Reflo	ow/V	Vave	9			Re	flow	/Wa	/e			Re	eflow	/Wa	ve				Reflo	w/W	/ave						
Packagi	ing				Pap						Pa				P	ape				d	Р		r/Er			d		Pa		Emb		ed					
(L) Length	mm				± 0.					1.60							.01 ±						.20 ±							0 ± 0							
	(in.) mm				± 0.	004)		-		0.8		0.00	5)				.25 ±						126 ±					(6 ± 0 0 ± 0)					_
W) Width	(in.)					004)						0.00	6)				.23 <u>1</u>)49 <u>+</u>						.00 <u>1</u> 1 063					(1		8 ± 0)					
(t) Terminal	mm				± 0.					0.3							.50 ±						.50 ±							0 ± 0							
WVDC	(in.)	1	(0.	.010	± 0.	006)	150	1	(C 6.3	1014	4 ± (125	6) 35	50	6.3	(0.0)20 ±	0.0	10) 135	150	63	(0.I	020 ±	25	10) 135	150	1	ار الا عا	0.02	0 ± 0	.010) 25	150	6.3	10	25	50
Cap	100	4	0.3	10	10	23	30	4	0.3	10	10	23	33	30	0.3	10	10	23	33	30	0.3	10	10	23	33	30	4	0.3	10	10	23	33	30	0.3	10	23	30
(pF)	150																																	l			
(1-1)	220						С																											İ			
	330						С																					Н				1		1_	H	H	_
	470						С																							-1-	~	~	\leq	₹ _V	٧-	_	
	680		L				С						L						L						L		L	_	<		<	_		$\bigcap_{i=1}^{\infty}$)_	Ť	
	1000						С																						(_ `	\supset)		┸	ノ_	<u>* '</u>	
	1500						С																								<u> </u>	4					
	2200						С	L																							4	7					
	3300					_	С																								- 1						
	4700					С								G																							
	6800				_	С		-			-	-		G						_								Н				\vdash		-			_
Cap (µF)	0.010 0.015					C						G	_	G																							
(με)	0.015				С	C						G	G	G						N																	
	0.022				С		-	-				G	G	G					<u> </u>	N								Н						-	Н		_
	0.033				C	С						G	G	G						N																	
	0.068				C							G		G						N																	
	0.10			С	C	С					T	G		G				N		N								П							П		_
	0.15											G			i			N	N															İ			
	0.22		C*	ĺ							G	G						N	N							Q						İ					
	0.33										G	G						N										П							П		
	0.47	C*	C*								G							N						Q	Q								Х				
	0.68										G							N									$oxed{oxed}$	Ш							Ш		_
	1.0	C*	C*	C*					G	G	G	J*					N	N		P*				Q	Q						Х	X	Х				
	1.5																														_						
	2.2	C*	<u> </u>	\vdash	\vdash	_	-	G*	G*	J*	J*	H	<u> </u>	_		N	N	N	\vdash	<u> </u>			Q	Q	\vdash		<u> </u>	Н			Z	Х	_	<u> </u>	Н		_
	3.3							J*	J*	J*	J*				N	N	NI4	NI4			X	X	\ \	. V						0	7	1					
	4.7 10							J* K*	J*	J*					N P	N P	N* P	N*			X	X	X	X					Х	Q Z	Z					Z	
	22		\vdash	\vdash	\vdash	\vdash	\vdash	Κ^			\vdash	\vdash	\vdash		P*	P	Р		\vdash		X	X	X	X			\vdash	Z	Z	<u></u> 	Z	\vdash		-	Н		_
	47																				x	^	^	^				Z*		_		1					
	100																										Z*	Z									
	WVDC	4	6.3	10	16	25	50	4	6.3	10	16	25	35	50	6.3	10	16	25	35	50	6.3	10	16	25	35	50	4	6.3	10	16	25	35	50	6.3	10	25	50
	SIZE			LI	D02					L	DO	3					LD	05	•				LD	06					L	.D10)				LD	12	

Letter	Α	С	Е	G	J	K	М	N	Р	Q	Х	Υ	Z
Max.	0.33	0.56	0.71	0.90	0.94	1.02	1.27	1.40	1.52	1.78	2.29	2.54	2.79
Thickness	(0.013)	(0.022)	(0.028)	(0.035)	(0.037)	(0.040)	(0.050)	(0.055)	(0.060)	(0.070)	(0.090)	(0.100)	(0.110)
			PAPER						EMBC	SSED			

^{*}Optional Specifications - Contact factory

NOTE: Contact factory for non-specified capacitance values

Automotive MLCC

General Specifications



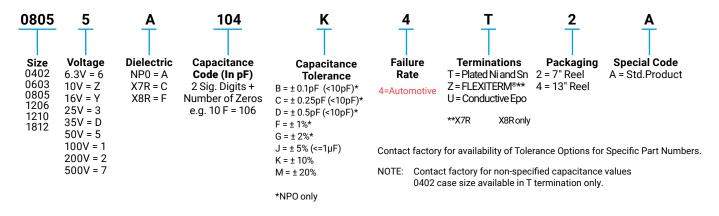


GENERAL DESCRIPTION

KYOCERA AVX has supported the Automotive Industry requirements for Multilayer Ceramic Capacitors consistently for more than 25 years. Products have been developed and tested specifically for automotive applications and all manufacturing facilities are QS9000 and VDA 6.4 approved.

KYOCERA AVX is using AECQ200 as the qualification vehicle for this transition. A detailed qualification package is available on request and contains results on a range of part numbers.

HOW TO ORDER



COMMERCIAL VS AUTOMOTIVE MLCC PROCESS COMPARISON

		Commercial	Automotive
	Administrative	Standard Part Numbers. No restriction on who purchases these parts.	Specific Automotive Part Number. sed to control supply of product to Automotive customers.
	Lot Qualification (Destructive Physical Analysis - DPA)	As per EIA RS469	Increased sample plan stricter criteria.
Ì	Visual/Cosmetic Quality	Standard process and inspection	100% inspection
	Application Robustness	Standard sampling for accelerated wave solder on X7R dielectrics	Increased sampling for accelerated wave solder on X7R and NP0 followed by lot by lot reliability testing.

All Tests have Accept/Reject Criteria 0/1

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Automotive MLCC

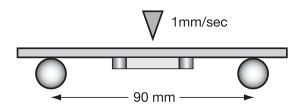
NP0/X7R Dielectric



FLEXITERM FEATURES

a) Bend Test

The capacitor is soldered to the PC Board as shown:



Typical bend test results are shown below:

Style	Conventional	Soft Term
0603	>2mm	>5
0805	>2mm	>5
1206	>2mm	>5

a) Temperature Cycle testing FLEXITERM® has the ability to withstand at least 1000 cycles between -55°C and +125°C

Automotive MLCC-NP0



Capacitance Range

Case	Size		0402				0603						0805							12	206							1210			
Length (L)	mm (in.)		1.00 ± 0.1 040 ± 0.0				1.60 ± 0.1 .063 ± 0.0						2.01 ± 0.2 079 ± 0.0							3.20 (0.126	± 0.20 ± 0.008)							3.20 ± 0.20 126 ± 0.00			
Width (W)	mm (in.)		0.50 ± 0.1 020 ± 0.0				0.81 ± 0.1 .032 ± 0.0						1.25 ± 0.2 049 ± 0.0							1.60 (0.063	± 0.20 ± 0.008)						(0.	2.50 ± 0.20 .098 ± 0.00	0 08)		
Terminal (t)	mm (in.)	(0.	0.25 ± 0.1 010 ± 0.0	5 06)		(0.	0.35 ± 0.1 .014 ± 0.0	5 06)				(0.	0.50 ± 0.2 020 ± 0.0	5 10)						0.50 (0.020	± 0.25 ± 0.010)						(0.	0.50 ± 0.25 020 ± 0.0	5 10)		
CAP	CAP Code	25	50	100	25	50	100	200	250	25	50	100	200	250	500	630	25	50	100	200	250	500	630	1000	50	100	200	250	500	630	1000
0.5	0R5	С	С	С	G	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J	J	Q	Q	J	J	J	J	J	J	J
5	1R0 5R0	С	С	С	G	G	G	G G	G	J	J	J	J	J	J	J	J	J	J	J	J	J	Q Q	Q	J	J	J	J	J	J	J
10	100	С	С	С	G	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J	J	Q	Q	J	J	J	J	J	J	J
12	120	С	С	С	G	G	G	G	G	J	J	J	J	J			J	J	J	J	J	J	Q	Q	J	J	J	J	J	J	J
15	150	С	С	С	G	G	G	G	G	J	J	J	J	J			J	J	J	J	J	J	Q	Q	J	J	J	J	J	J	J
18 22	180 220	С	C	C	G	G	G	G	G	J	J	J	J	J			J	J	J	J	J	J	Q Q	Q	J	J	J J	J	J	J	J
27	270	С	С	С	G	G	G	G	G	J	J	J	J	J			J	J	J	J	J	J	Q	Q	J	J	J	J	J	J	J
33	330	С	С	С	G	G	G	G	G	J	J	J	J	J			J	J	J	J	J	J	Q	Q	J	J	J	J	J	J	J
39	390	С	С	С	G	G	G	G	G	J	J	J	J	J			J	J	J	J	J	J	Q	Q	J	J	J	J	J	J	J
47 56	470 560	C	С	_	G	G	G	G	G	J	J	J	J	J			J	J	J	J	J	J	Q Q	Q	J	J	J	J	J	J	J
68	680	C	C		G	G	G	G		J	J	J	J	N N			J	J	J	J	J	J	Q	Q	J	J	J	J	J	J	J
82	820	С	С		G	G	G	G		J	J	J	J	N			J	J	J	J	J	J	Q	Q	N	N	N	N	N	N	N
100	101	С	С		G	G	G	G		J	J	J	J	N			J	J	J	J	J	J	Q	Q	N	N	N	N	N	N	N
120	121				G	G	G			J	J	J	J	N			J	J	J	J	J	J	Q	Q	N	N	N	P	P	P	X
150 180	151 181				G	G	G		-	J	J	J	J	N N			J	J	J	J	J	J	Q Q	Q Q	N N	N N	N N	P P	P P	P P	X
220	221				G	G	G			J	J	J	J	N			J	J	J	J	J	J	Q	Q	N	N	N	P	P	P	X
270	271				G	G	G			J	J	J	J	N			J	J	J	J	J	J	Q		N	N	N	Р	Р	Р	Х
330	331				G	G	G			J	J	J	J	N			J	J	J	J	J	J	Q		N	N	N	P	P	P	X
390 430	391 431				G	G	G			J	J	J	J				J	J	J	J	J	J	Q Q		N N	N N	N N	P P	P P	P	X
470	471				G	G				J	J	J	J				J	J	J	J	J	J	Q		N	N	N	P	P	P	X
560	561				G	G				J	J	J					J	J	J	J	М	Q	Q		N	N	N	Р	Р	Р	
680	681				G	G				J	J	J					J	J	J	J	M	Q	Q		N	N	N	P	P	Р	
1,000	102				G	G				J	J	J					J	J N	J N	J N	М	Q	Q		N N	N N	N N	P P	P P	Х	\vdash
1,500	152				G	G				J	J						N	N	N	N					N	N	N	P	P		\vdash
2,200	222				G					J	J						М	М	М	М	М	М	М		N	N	N	Р	К	K	
2,700 3,300	272 332				G												M M	М	M	М	M	М	M M			ļ			K	K	
3,300	392				G		-		-								M	M	M M	M M	M M	M M	M	_					K M	K M	\vdash
4,700	472				G												P	P	P	P	P	P	P						M	М	
5,600	562				G																								М	М	
6,800	682				G																								N	N	ш
8,200 10,000	822 103				G		-		\vdash	-								<u> </u>		-	<u> </u>							Х	P X	P X	$\vdash\vdash$
12,000	123																											X			\vdash
15,000	153																											х			
18,000	183																									_		Х		<u> </u>	\sqcup
22,000 27,000	223 273																											X		-	\vdash
33,000	333																											X		$\overline{}$	\vdash
39,000	393																														
47,000	473																													\vdash	\Box
56,000 68,000	563 683			_	_	-	-	_	<u> </u>	-								<u> </u>			<u> </u>			<u> </u>	_	-					$\vdash\vdash$
82,000	823		<u> </u>				<u> </u>		 	<u> </u>		 						<u> </u>		 			-		-	1					\vdash
100,000	104																														
CAP	CAP Code	25	50	100	25	50	100	200	250	25	50	100	200	250	500	630	25	50	100	200	250	500	630	1000	50	100	200	250	500	630	1000
Case	Size		0402				0603						0805							12	06							1210			

Letter	Α	С	E	G	J	K	М	N	Р	Q	Х	Υ	Z
Max.	0.33	0.56	0.71	0.90	0.94	1.02	1.27	1.40	1.52	1.78	2.29	2.54	2.79
Thickness	(0.013)	(0.022)	(0.028)	(0.035)	(0.037)	(0.040)	(0.050)	(0.055)	(0.060)	(0.070)	(0.090)	(0.100)	(0.110)
			PAPER						EMBC	SSED			

Automotive MLCC - X7R



Capacitance Range

	Size	1	04	02					0603				r			01	305							1206				ſ		- 1	210			10	312			22	220		
	Idering	+	Reflow					F	Reflow/W	ave			<u> </u>				v/Wave						Re	eflow/Wa	ave						w Only			_	w Only				w Only	_	
(L) Length	mm (in.)		1 ± (0.04 ±	0.1					1.6 ± 0.1 0.063 ± 0.0	15						2.01	± 0.2 ± 0.008)							3.2 ± 0.2 126 ± 0.0	2					3.2	± 0.2 ± 0.008)			4.5 (0.1 0.0	± 0.3 77 ± 112)			5.7	± 0.5 ± 0.02)		
(W) Width	mm (in.)		0.5 ± (0.02 ±	0.1 0.004)				(0	0.81 ± 0. 0.032 ± 0.	15 006)						1.25	± 0.2 ± 0.008)						(0.	1.6 ± 0.2 063 ± 0.0	2008)					2.5 (0.098	± 0.2 ± 0.008)			(0.1 0.0	(80			5 ± (0.197	0.4 ± 0.016)		
(t) Terminal	mm (in.)		0.25 ± (0.01 ±	0.15 0.006)				(0	0.35 ± 0. 0.014 ± 0.0	15 006)						0.5 (0.02	± 0.25 ± 0.01)						(0	0.5 ± 0.2 0.02 ± 0.0	5)1)					0.5 : (0.02	± 0.25 ± 0.01)			(0.0	± 0.36 124 ± 114)			0.64	± 0.39 ± 0.015)		
W	VVDC	6.3V	16V	25V	50V	10V	16V	25V	50V	100V	/ 200V	250V	6.3V	10V	16V	25V	50V	100V	200V	250V	16V	25V	50V	100V	200V	250V	500V	16V	25V	50V	100V	200V	250V	50V	100V	25V	50V	100V	200V	250V	500V
101	100																															М	Q						<u> </u>	<u> </u>	
221	220		С	С	С	G	G	G	G	G	G	_	_				_					_								_	_	М	Q						└	└	ш
271	270		С	С	С	G	G	G	G	G	G	_	_	_			_	_				_			_	_		_	_			М	Q					_	 -	<u> </u>	\vdash
331	330		С	С	С	G	G	G	G	G	G	_	-									_									_	М	Q						₩	 -	\vdash
391 471	390	_	С	С	С	G	G	G	G	G	G	-	-		-		-					-		-		-					-	M	Q		-			-	₩	₩	\vdash
561	470 560	-	C	С	С	G	G	G	G	G	G	_	-	_	-		<u> </u>	_				-		-	_	-			_		-	M	Q		-			_	\vdash	┢	\vdash
681	680		С	C	С	G	G	G	G	G	G	\vdash	\vdash	\vdash	\vdash	\vdash	\vdash	\vdash	\vdash	\vdash	\vdash	\vdash		\vdash	\vdash	\vdash	\vdash	\vdash	\vdash	\vdash	\vdash	M	Q	\vdash	\vdash	\vdash	\vdash	\vdash	\vdash	₩	\vdash
821	820		С	С	С	G	G	G	G	G	G		\vdash				\vdash		\vdash	<u> </u>		 		\vdash		\vdash		\vdash		\vdash	 	м	Q							Н	\vdash
102	1000		С	С	С	G	G	G	G	G	G	G			J	J	J	J	J	J	J	J	J	J	J	J	J	К	К	К	К	M	Q	К	К				М	т	\vdash
122	1220		С	С	С	G	G	G	G	G	G	G			J	J	J	J	J	J	J	J	J	J	J	J	J	К	К	К	К	М	Q	К	К				H	H	
152	1500		С	С	С	G	G	G	G	G	G	G			J	J	J	J	J	J	J	J	J	J	J	J	J	К	К	К	К	М	Q	К	К					т	М
182	1800		С	С	С	G	G	G	G	G	G	G			J	J	J	J	J	J	J	J	J	J	J	J	J	К	К	К	К	М	Q	К	К					Г	
222	2200		С	С	С	G	G	G	G	G	G	G			J	J	J	J	J	J	J	J	J	J	J	J	J	К	К	К	К	М	Q	К	К						
272	2700		С	С	С	G	G	G	G	G	G	G			J	J	J	J	J	J	J	J	J	J	J	J	J	К	К	К	К	М	Q	К	К						
332	3300		С	С	С	G	G	G	G	G	G	G			J	J	J	J	J	J	J	J	J	J	J	J	J	К	К	К	К	М	Q	К	К						
392	3900		С	С	С	G	G	G	G	G	G	G			J	J	J	J	J	J	J	J	J	J	J	J	J	К	К	K	K	М	Q	К	K						
472	4700		С	С	С	G	G	G	G	G	G	G			J	J	J	J	J	J	J	J	J	J	J	J	J	К	К	K	K	М	Q	К	K						
562	5600		С	С	С	G	G	G	G	G	G	G			J	J	J	J	J	J	J	J	J	J	J	J	J	K	К	K	K	М	Q	К	K				<u> </u>		Ш
682	6800		С	С	С	G	G	G	G	G	G	G			J	J	J	J	J	J	J	J	J	J	J	J	J	К	К	K	K	М	Q	К	K				<u> </u>	<u> </u>	
822	8200		С	С	С	G	G	G	G	G	G	G			J	J	J	J	J	J	J	J	J	J	J	J	J	К	К	К	К	М	Q	К	К				<u> </u>	<u> </u>	\sqcup
103	Cap 0.01		С	С	С	G	G	G	G	G	G	G	_	_	J	J	J	J	J	J	J	J	J	J	J	J	J	К	K	К	К	М	Q	К	K	_		<u> </u>	 -	 -'	\sqcup
123	(uF) 0.012		С			G	G	G	G	G		_	-	_	J	J	J	N	N	N	J	J	J	J	J	J		K	K	K	K	М	Q	K	K				—	 -'	\vdash
153	0.015		С			G	G	G	G	G		-	-	_	J	J	J	N	N	N	J	J	J	J	J	J		K	K	K	K	М	Q	K	K	-	-		₩	₩	\vdash
183 223	0.018		C			G G	G	G	G	G			-		J	J	J	N N	N N	N N	J	J	J	J	J	J Q		K	K	K	K	M	Q	K	K			-	₩	₩	\vdash
273	0.022	-	С			G	G	G	G	J		-	-		J	J	J	N	N	N	J	J	J	J	Q	Q		K	K	K	K	M	Q	K	K				₩	₩	\vdash
333	0.027		С			G	G	G	G	J			-		J	J	J	N	N	N	J	J	J	J	Q	Q		K	K	K	K	м	Q	K	K				\vdash	\vdash	\vdash
393	0.039				-	G	G	G	G	J			<u> </u>	-	J	J	J	N	N	N	J	J	J	J	Q	Q		K	K	K	К	м	Q	К	К				H	H	\vdash
473	0.047					G	G	G	G	J					J	J	J	N	N	N	J	J	J	М	Q	Q		К	К	К	К	М	Q	К	К				H		
563	0.056					G	G	G	G	J					J	J	J	N			J	J	J	М	Q	Q		К	К	К	М	М	Q	К	К	İ					
683	0.068		П			G	G	G	G	J					J	J	J	N			J	J	J	М	Q	Q		К	К	К	М	М	Q	К	К					г	
823	0.082		П			G	G	G	G	J					J	J	J	N			J	J	J	М	Q	Q		К	К	К	М	Q	Q	К	К						
104	0.1					G	G	G	G	J					J	J	J	N			J	J	J	М	Q	Q		К	К	К	М	Q	Q	К	К			İ			Х
124	0.12					G	J	J							J	J	N	N			J	J	М	М	Q	Q		К	К	K	Р	Q	Q	К	К						
154	0.15					G	J	J							М	N	N	N			J	J	М	М	Q	Q		К	К	К	Р	Q	Q	К	K						
224	0.22					G	J	J							М	N	N	N			J	М	М	Q	Q	Q		М	М	М	Р	Q	Q	М	М						
334	0.33														N	N	N	N			J	М	Р	Q				Р	Р	Р	Q	Z	Z	Х	Х						
474	0.47		ш						_			\perp			N	N	N	N	\vdash		М	М	Р	Q				Р	Р	Р	Q			Х	Х				igsquare	igsqcurve	\Box
684	0.68	_	Щ					┞	_		_	Ь	\vdash		N	N	N	N	<u> </u>		М	Q	Q	Q		$oxed{igspace}$		Р	Р	Q	х		<u> </u>	Х	Х		Ь.		<u> </u>	<u> </u>	\Box
105	1		Щ		_	_	_	1	1	1	1	L	—	_	N	N	N	N	<u> </u>		М	Q	Q	Q		<u> </u>		Р	Q	Q	Z		<u> </u>	Х	Х	_	Z	Z	Х	Х	\sqcup
155	1.5	_	Ш		<u> </u>	<u> </u>	-	₩	+-	₩	+	-	├	<u> </u>	N	N	N	<u> </u>	<u> </u>		Q	Q	Q	Q	<u> </u>	-	_	P	Q	Z	Z	<u> </u>	-	X	X	_	Z	Z	Z	Z	\vdash
225	2.2	_	Ш		<u> </u>	<u> </u>	-	₩	+	1	+-	-	\vdash	<u> </u>	N	N	N	_	<u> </u>	<u> </u>	Q	Q	Q	Q	_	-		Z	Z	Z	Z	<u> </u>	-	Z	Z	-	Z	Z	—	₩-	\vdash
335	3.3	_	\vdash		\vdash	-	-	₩	+-	-	+	-	\vdash	<u> </u>	-	-	\vdash		<u> </u>	_	Q	Q	Q	\vdash	-	-		X	Z	Z	Z	-	-	Z	-	-	Z	Z			\vdash
475 106	4.7	_	H		-	-	-	1	+	1	1	-	P	P	-	-	\vdash		\vdash	-	Q	Q	Q	-		-		X Z	Z	Z	Z		-	Z	-	Z	Z	Z	\vdash	⊢	\vdash
226	22		H		\vdash	\vdash	\vdash	\vdash	+	+	+	\vdash	-	P	\vdash	\vdash	\vdash	\vdash	\vdash			\vdash		\vdash	\vdash	\vdash	\vdash				-	\vdash	\vdash			Z			\vdash	\vdash	\vdash
220	22	1	ш		Ц																						_														ш

Letter	A	С	E	G	J	K	М	N	Р	0	Х	Υ	Z
Max.	0.33	0.56	0.71	0.90	0.94	1.02	1.27	1.40	1.52	1.78	2.29	2.54	2.79
Thickness	(0.013)	(0.022)	(0.028)	(0.035)	(0.037)	(0.04)	(0.05)	(0.055)	(0.060)	(0.07)	(0.09)	(0.1)	(0.11)
	(3 2 2)		PAPER		()	(, , ,	()	(FMR	OSSED	()	(- /	(-)

Automotive MLCC - X8R



Capacitance Range

	SIZE			0603			0805		12	06	
	Soldering	J		Reflow/Wave			Reflow/Wave		Reflow	/Wave	
WVDC	W	VDC	25V	50V	100V	25V	50V	100V	25V	50V	
472	pF	4700	G	G	G	J	J	J	J	J	
562		5600	G	G	G	J	J	J	J	J	
682		6800	G	G	G	J	J	J	J	J	
822		8200	G	G	G	J	J	J	٦	J	
103	uF	0.01	G	G	G	J	J	J	J	J	
123		0.012	G	G		J	J	N	J	J	
153		0.015	G	G		J	J	N	J	J	
183		0.018	G	G		J	J	N	J	J	
223		0.022	G	G		J	J	N	J	J	
273		0.027	G	G		J	J		J	J	
333		0.033	G	G		J	J		J		
393		0.039	G	G		J	J		J		
473		0.047	G	G		J	J		J	J	
563		0.056	G			N	N		М	М	
683		0.068	G			N	N		М	М	
823		0.082				N	N		М	М	
104		0.1				N	N		М	М	
124		0.12				N	N		М	М	
154		0.15				N	N		М	М	
184		0.18				N			М	М	
224		0.22				N			М	М	
274		0.27							М	М	
334		0.33							М	М	
394		0.39							М	М	
474		0.47							М	Q	
684		0.68							Q	Q	
824		0.82							Q	Q	
105		1							Q	Q	
WVDC		/DC	25V	50V	100V	25V	50V	100V	25V	50V	
	SIZE			0603			0805		12	06	

Letter	Α	С	Е	G	J	K	М	N	Р	Q	Х	Υ	Z
Max.	0.33	0.56	0.71	0.90	0.94	1.02	1.27	1.40	1.52	1.78	2.29	2.54	2.79
Thickness	(0.013)	(0.022)	(0.028)	(0.035)	(0.037)	(0.040)	(0.050)	(0.055)	(0.060)	(0.070)	(0.090)	(0.100)	(0.110)
			PAPER						EMBC	SSED			

APS for COTS+ High Reliability Applications



General Specifications Surface Mount NPO, X7R and X8R/L MLCCs



KYOCERA AVX's APS COTS+ series of multilayer ceramic capacitors offers the customer a high reliability solution with an ultralow failure rate, <1ppb, in a variety of case sizes and voltages. The APS range encompasses a wide range of dielectric types to meet the customer's requirements from low temperature/voltage capacitance change dielectric, NPO, to high preforming capacitance voltage X7R to high temperature reliability dielectrics, X8R/L.

APS capacitors have a wider capacitance range than MIL spec parts that satisfies the need for higher CV demands and board space saving requirements. Each production lot is extensively tested and removes the requirement for customer specific drawings. The testing regime uses many of the MIL-STD test methods as per MIL-PRF-55681 and has a field failure rate of less than 1 ppb. The APS testing series uses KYOCERA AVX's unique in-house maverick testing detection system that eliminates infant mortality failures.

Applications suitable for APS include Industrial, Telecommunications, Aviation, and Military. The APS is available with a range of different termination finishes, Flexiterm®, Nickel / Tin and Tin with Pb1. Flexiterm® technology delivers improved thermo-mechanical stress resistance.

APS RELIABILITY TEST SUMMARY

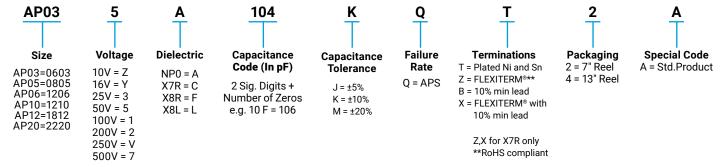
- 100% Visual Inspection
- DPA
- IR, DF, Cap, DWV
- Maverick Lot Review
- Thermal Shocl
- 85/85 Testina
- Additional Life Testing
- C of C with every Order
- Quarterly Data Package

FEATURES

- · The APS range has been extensively reliability tested as standard resulting in an ultralow failure rate, ≤1ppb
- The APS range is available with Flexiterm® that deliver's high thermo-mechanical stress resistance.
- High CV range enabling board space saving requirements.

Dielectric	Temperature/Percentage Cap Change
NP0	-30ppm +30ppm from -55°C + 125°C
X7R	-15% +15% from -55°C to + 125°C
X8R	-15% +15% from -55°C to + 150°C
X8L	-15% +40% from -55°C to + 150°C

HOW TO ORDER



NOTE: Contact factory for availability of Termination and Tolerance Options for Specific Part Number.

APS COTS+ NP0 Series



Capacitance Range

Size	AP	03 = 060	03	AP	05 = 08	05		AF	P06 = 12	06			AP10 :	= 1210	
WVDC	25V	50V	100V	25V	50V	100V	25V	50V	100V	200V	500V	25V	50V	100V	200V
100 10pF	G	G	G	J	J	J	J	J	J	J	J				
120 12	G	G	G	J	J	J	J	J	J	J	J				
150 15	G	G	G	J	J	J	J	J	J	J	J				
180 18	G	G	G	J	J	J	J	J	J	J					
220 22	G	G	G	J	J	J	J	J	J	J					
270 27	G	G	G	J	J	J	J	J	J	J					
330 33	G	G	G	J	J	J	J	J	J	J					
390 39	G	G	G	J	J	J	J	J	J	J					
470 47	G	G	G	J	J	J	J	J	J	J					
510 51	G	G	G	J	J	J	J	J	J	J					
560 56	G	G	G	J	J	J	J	J	J	J					
680 68	G	G	G	J	J	J	J	J	J	J					
820 82	G	G	G	J	J	J	J	J	J	J					
101 100	G	G	G	J	J	J	J	J	J	J					
121 120	G	G	G	J	J	J	J	J	J	J					
151 150	G	G	G	J	J	J	J	J	J	J					
181 180	G	G	G	J	J	J	J	J	J	J					
221 220	G	G	G	J	J	J	J	J	J	J					
271 270	G	G	G	J	J	J	J	J	J	J					
331 330	G	G	G	J	J	J	J	J	J	J					
391 390	G	G		J	J	J	J	J	J	J					
471 470	G	G		J	J	J	J	J	J	J					
561 560				J	J	J	J	J	J	J					
681 680				J	J	J	J	J	J	J					
821 820				J	J	J	J	J	J	J					
102 1000				J	J	J	J	J	J	J		J	J	J	J
122 1200												J	J	М	М
152 1500												J	J	М	М
182 1800												J	J	М	М
222 2200												J	J	М	М
272 2700															
332 3300															
392 3900															
472 4700															
103 10nF															
WVDC	25V	50V	100V	25V	50V	100V	25V	50V	100V	200V	500V	25V	50V	100V	200V
Size	AP	03 = 060	03	AP	05 = 08	05		AF	P06 = 12	06			AP10 :	= 1210	



Letter	Α	С	Е	G	J	K	М	N	Р	Q	X	Υ	Z
Max.	0.33	0.56	0.71	0.90	0.94	1.02	1.27	1.40	1.52	1.78	2.29	2.54	2.79
Thickness	(0.013)	(0.022)	(0.028)	(0.035)	(0.037)	(0.040)	(0.050)	(0.055)	(0.060)	(0.070)	(0.090)	(0.100)	(0.110)
			PAPER						EMBO	SSED			

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APS COTS+ X7R Series



Capacitance Range

	Size		AP	03 = 06	603			AP	05 = 0	805				AP06 =	1206				AP10	= 1210)	AP12	= 1812	AP2	20 = 22	220
	WVDC	16V	25V	50V	100V	200V	16V	25V	50V	100V	200V	16V	25V	50V	100V	200V	500V	16V	25V	50V	100V	50V	100V	25V	50V	100V
102	Cap 1000	G	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J	K	K	K	К	К	K			
182	(pF) 1800	G	G	G	G		J	J	J	J	J	J	J	J	J	J	J	K	K	K	К	К	K			
222	2200	G	G	G	G		J	J	J	J	J	J	J	J	J	J	J	K	K	K	K	K	K			
332	3300	G	G	G	G		J	J	J	J	J	J	J	J	J	J	J	K	K	K	K	K	K			
472	4700	G	G	G	G		J	J	J	J	J	J	J	J	J	J	J	K	K	K	K	K	K			
103	0.01	G	G	G	G		J	J	J	J	J	J	J	J	J	J	J	K	K	K	K	K	K			
123	0.012	G	G	G			J	J	J	М		J	J	J	J	J		K	K	K	K	K	K			
153	0.015	G	G	G			J	J	J	М		J	J	J	J	J		K	K	K	K	K	K			
183	0.018	G	G	G			J	J	J	М		J	J	J	J	J		K	K	K	K	K	K			
223	0.022	G	G	G			J	J	J	М		J	J	J	J	J		K	K	K	K	K	K			
273	0.027	G	G	G			J	J	J	М		J	J	J	J	J		K	K	K	K	K	K			
333	0.033	G	G	G			J	J	J	М		J	J	J	J	J		K	K	K	K	K	K			
473	0.047	G	G	G			J	J	J	М		J	J	J	М	J		K	K	K	K	K	K			
563	0.056	G	G	G			J	J	J	М		J	J	J	М	J		K	K	K	М	K	K			
683	0.068	G	G	G			J	J	J	М		J	J	J	М	J		K	K	K	М	K	K			
823	0.082	G	G	G			J	J	J	М		J	J	J	М	J		K	K	K	М	K	K			
104	0.1	G	G	G			J	J	М	М		J	J	J	М	J		K	K	K	М	K	K			
124	0.12						J	J	М	N		J	J	М	М			K	K	K	Р	K	K			
154	0.15						М	N	М	N		J	J	М	М			K	K	K	Р	K	K			
224	0.22						М	N	М	N		J	М	М	Q			М	М	М	Р	М	М		ļ	
334	0.33						N	N	М	N		J	М	Р	Q			Р	Р	Р	Q	Х	Х		<u> </u>	
474	0.47						N	N	М	N		М	М	Р	Q			Р	Р	Р	Q	Х	Х		ļ'	
684	0.68						N	N	N			М	Q	Q	Q			Р	Р	Q	Х	Х	Х		<u></u>	
105	Cap 1.0						N	N	N*			М	Q	Q	Q*			P	Q	Q	Z*	Х	Х		<u></u>	
155	(μF) 1.5											Q	Q	Q				P	Q	Z	Z	X	X		<u> </u>	
225	2.2											Q	Q	Q				Z	Z	Z	Z*	Z	Z		<u> </u>	
335	3.3											Q						Х	Z	Z	Z	Z			<u></u>	
475	4.7											Q						X	Z	Z		Z*				
106	10																	Z	Z*						Z	Z*
226	22	4616	05)/	50)/	400);	000)	46)/	05)/	E0) (400);	000)	45)/	05)/	E01/	400)	000)	E00) (45)/	05)	50)/	400);	F0) (400);	Z	E0) (400)
	WVDC	16V	25V	50V	100V	200V	16V	25V	50V		200V	16V	25V	50V	100V	200V	500V	16V	25V	50V	100V	50V	100V	25V		100V
	Size		AP	03 = 06	03			AP	05 = 0	805				AP06 =	1206				AP10	= 1210)	AP12	= 1812	AP2	20 = 22	220

^{*}Not currently available with lead plating finish, contact plant for further information.

Letter	Α	С	E	G	J	K	М	N	Р	Q	Х	Υ	Z
Max.	0.33	0.56	0.71	0.90	0.94	1.02	1.27	1.40	1.52	1.78	2.29	2.54	2.79
Thickness	(0.013)	(0.022)	(0.028)	(0.035)	(0.037)	(0.040)	(0.050)	(0.055)	(0.060)	(0.070)	(0.090)	(0.100)	(0.110)
			PAPER						EMBO	SSED			

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APS COTS+ X8R/L Series



Capacitance Range

X8R

	SIZE	AP03 =	: 0603	AP05	= 0805	AP06 =	1206
1	WVDC	25V	50V	25V	50V	25V	50V
331	Cap 330	G	G	J	J		
471	(pF) 470	G	G	J	J		
681	680	G	G	J	J		
102	1000	G	G	J	J	J	J
152	1500	G	G	J	J	J	J
222	2200	G	G	J	J	J	J
332	3300	G	G	J	J	J	J
472	4700	G	G	J	J	J	J
682	6800	G	G	J	J	J	J
103	Cap 0.01	G	G	J	J	J	J
153	(μF) 0.015	G	G	J	J	J	J
223	0.022	G	G	J	J	J	J
333	0.033	G	G	J	J	J	J
473	0.047	G	G	J	J	J	J
683	0.068	G		N	N	M	М
104	0.1			N	N	M	М
154	0.15			N	N	M	М
224	0.22			N		М	М
334	0.33					M	М
474	0.47					М	
684	0.68						
105	1						<u> </u>
	WVDC	25V	50V	25V	50V	25V	50V
	SIZE	060	03	30	305	120	6

X8L

	SIZE	J	AP03 = 0603	3	,	AP05 = 080	5		AP06 :	= 1206	
	WVDC	25V	50V	100V	25V	50V	100V	16V	25V	50V	100V
331	Cap 330		G	G		J	J				
471	(pF) 470		G	G		J	J				
681	680		G	G		J	J				
102	1000		G	G		J	J				
152	1500		G	G		J	J			J	J
222	2200		G	G		J	J			J	J
332	3300		G	G		J	J			J	J
472	4700		G	G		J	J			J	J
682	6800		G	G		J	J			J	J
103	Cap 0.01		G	G		J	J			J	J
153	(μF) 0.015	G	G		J	J	J			J	J
223	0.022	G	G		J	J	J			J	J
333	0.033	G	G		J	J	N			J	J
473	0.047	G	G		J	J	N			J	J
683	0.068	G	G		J	J				J	J
104	0.1	G	G		J	J				J	М
154	0.15				J	N		J	J	J	Q
224	0.22				N	N		J	J	J	Q
334	0.33				N			J	М	Р	Q
474	0.47				N			М	М	Р	
684	0.68							М			
105	1							М			
	WVDC	25V	50V	100V	25V	50V	100V	V 16V 25V 50V 1			100V
	SIZE		0603			0805	0805 1206				



Letter	Α	С	Е	G	J	K	М	N	Р	Q	Х	Υ	Z
Max.	0.33	0.56	0.71	0.90	0.94	1.02	1.27	1.40	1.52	1.78	2.29	2.54	2.79
Thickness	(0.013)	(0.022)	(0.028)	(0.035)	(0.037)	(0.040)	(0.050)	(0.055)	(0.060)	(0.070)	(0.090)	(0.100)	(0.110)
			PAPER						EMBO	SSED			

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General Specifications





GENERAL DESCRIPTION

With increased requirements from the automotive industry for additional component robustness, KYOCERA AVX recognized the need to produce a MLCC with enhanced mechanical strength. It was noted that many components may be subject to severe flexing and vibration when used in various under the hood automotive and other harsh environment applications.

To satisfy the requirement for enhanced mechanical strength, KYOCERA AVX had to find a way of ensuring electrical integrity is maintained whilst external forces are being applied to the component. It was found that the structure of the termination needed to be flexible and after much research and development, KYOCERA AVX launched FLEXITERM®. FLEXITERM® is designed to enhance the mechanical flexure and temperature cycling performance of a standard ceramic capacitor with an X7R dielectric. The industry standard for flexure is 2mm minimum. Using FLEXITERM®, KYOCERA AVX provides up to 5mm of flexure without internal cracks. Beyond 5mm, the capacitor will generally fail "open".

As well as for automotive applications FLEXITERM® will provide Design Engineers with a satisfactory solution when designing PCB's which may be subject to high levels of board flexure.

PRODUCT ADVANTAGES

- High mechanical performance able to withstand, 5mm bend test guaranteed
- Increased temperature cycling performance, 3000 cycles and beyond
- Flexible termination system
- Reduction in circuit board flex failures
- Base metal electrode system
- Automotive or commercial grade products available
- AECQ200 Qualified
- Approved to VW 80808 Specification

APPLICATIONS

High Flexure Stress Circuit Boards

· e.g. Depanelization: Components near edges of board.

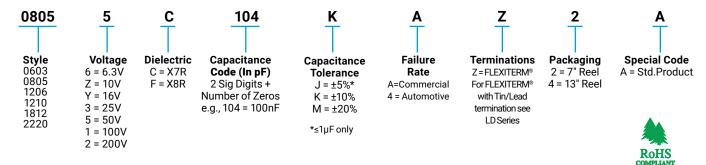
Variable Temperature Applications

- · Soft termination offers improved reliability performance in applications where there is temperature variation.
- · e.g. All kind of engine sensors: Direct connection to battery rail.

Automotive Applications

- Improved reliability.
- Excellent mechanical performance and thermo mechanical performance.

HOW TO ORDER



NOTE: Contact factory for availability of Tolerance Options for Specific Part Numbers.



Specifications and Test Methods

KYOCERa

PERFORMANCE TESTING

AEC-0200 Qualification:

Created by the Automotive Electronics

Specification defining stress test qualification for passive components

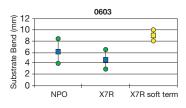
Testing:

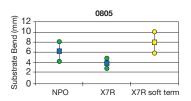
Key tests used to compare soft termination to AEC-Q200 qualification:

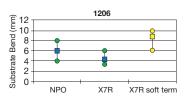
- **Bend Test**
- Temperature Cycle Test

BOARD BEND TEST RESULTS

AEC-Q200 Vrs FLEXITERM® Bend Test







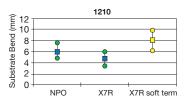


TABLE SUMMARY

Typical bend test results are shown below:

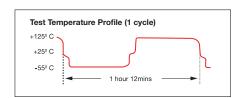
Style	Conventional Termination	FLEXITERM®
0603	>2mm	>5mm
0805	>2mm	>5mm
1206	>2mm	>5mm

TEMPERATURE CYCLE TEST PROCEDURE

Test Procedure as per AEC-0200:

The test is conducted to determine the resistance of the component when it is exposed to extremes of alternating high and low temperatures.

- Sample lot size quantity 77 pieces
- TC chamber cycle from -55°C to +125°C for 1000 cycles
- Interim electrical measurements at 250, 500, 1000 cycles
- Measure parameter capacitance dissipation factor, insulation resistance



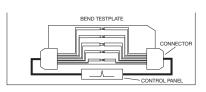
BOARD BEND TEST PROCEDURE

According to AEC-Q200

Test Procedure as per AEC-Q200: Sample size: 20 components

Span: 90mm Minimum deflection spec: 2 mm

- Components soldered onto FR4 PCB (Figure 1)
- Board connected electrically to the test equipment



MOUNTING 41110

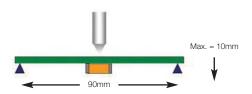
Fig 1 - PCB layout with electrical connections

Fig 2 - Board Bend test equipment

ENHANCED SOFT TERMINATION BEND TEST PROCEDURE

Bend Test

The capacitor is soldered to the printed circuit board as shown and is bent up to 10mm at 1mm per second:



- · The board is placed on 2 supports 90mm apart (capacitor side down)
- The row of capacitors is aligned with the load stressing knife



- · The load is applied and the deflection where the part starts to crack is recorded (Note: Equipment detects the start of the crack using a highly sensitive current detection circuit)
- The maximum deflection capability is 10mm

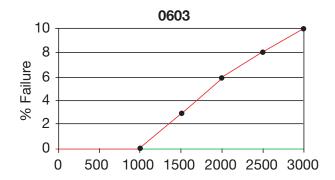


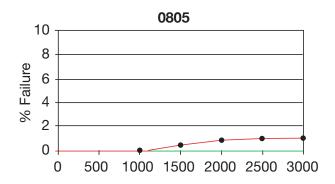
KYDCER3 The Important Information/Disclaimer is incorporated in the catalog where these specifications came from or available online at www.kyocera-avx.com/disclaimer/ by reference and should be reviewed in full before placing any order.

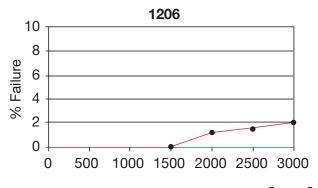
Specifications and Test Methods

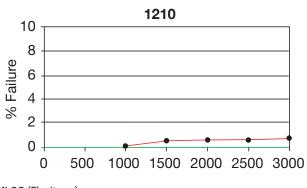


BEYOND 1000 CYCLES: TEMPERATURE CYCLE TEST RESULTS









Green = Soft Term MLCC (Flexiterm) Red = Standard MLCC

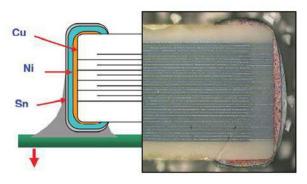
Soft Term - No Defects up to 3000 cycles

AEC-Q200 specification states 1000 cycles compared to 3000 temperature cycles.

FLEXITERM® TEST SUMMARY

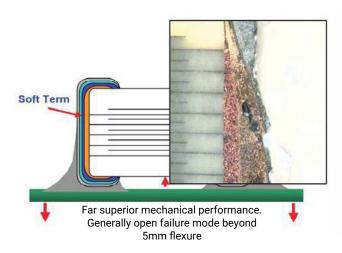
- · Qualified to AEC-Q200 test/specification with the exception of using 3000 temperature cycles (up to +150°C bend test guaranteed greater than 5mm).
- · FLEXITERM® provides improved performance compared to standard termination systems.
- Board bend test improvement by a factor of 2 to 4 times.
- **Temperature Cycling:**
- 0% Failure up to 3000 cycles
- No ESR change up to 3000 cycle

WITHOUT SOFT TERMINATION



Major fear is of latent board flex failures.

WITH SOFT TERMINATION



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Capacitance Range X8R Dielectric

	SIZE	06	03	0:	805	1206 Reflow/Wave		
S	oldering	Reflow	//Wave	Reflo	w/Wave	Reflow	/Wave	
	WVDC	25V	50V	25V	50V	25V	50V	
271	Cap 270	G	G					
331	(pF) 330	G	G	J	J			
471	470	G	G	J	J			
681	680	G	G	J	J			
102	1000	G	G	J	J	J	J	
152	1500	G	G	J	J	J	J	
182	1800	G	G	J	J	J	J	
222	2200	G	G	J	J	J	J	
272	2700	G	G	J	J	J	J	
332	3300	G	G	J	J	J	J	
392 472	3900 4700	G G	G	J	J	J	J	
562	5600	G	G G	J	J	J	J	
682	6800	G	G	J	J	J	J	
822	8200	G	G	J	J	J	J	
103	Cap 0.01	G	G	J	J	J	J	
123	(μF) 0.012	G	G	J	J	J	J	
153	0.015	G	G	J	J	J	J	
183	0.013	G	G	J	J	J	.]	
223	0.022	G	G	J	J	J	J	
273	0.027	G	G	J	J	J	J	
333	0.033	G	G	J	J	J	J	
393	0.039	G	G	J	J	J	J	
473	0.047	G	G	J	J	J	J	
563	0.056	G		N	N	М	М	
683	0.068	G		N	N	М	М	
823	0.082			N	N	М	М	
104	0.1			N	N	M	M	
124	0.12			N	N	M	М	
154	0.15			N	N	M	М	
184	0.18			N		M	М	
224	0.22			N		M	M	
274	0.27					M	M	
334	0.33				1	M	М	
394	0.39				-	M		
474	0.47				1	М		
684 824	0.68 0.82				1	1		
105	0.82				+	-		
105	WVDC	25V	50V	25V	50V	25V	50V	
	SIZE		03	25V 50V 0805		12		
	SIZE	Ub	03	l O	000	12	00	

Letter	Α	С	Е	G	J	K	М	N	Р	Q	Χ	Υ	Z
Max. Thickness	0.33 (0.013)	0.56 (0.022)	0.71 (0.028)	0.90 (0.035)	0.94 (0.037)	1.02 (0.040)	1.27 (0.050)	1.40 (0.055)	1.52 (0.060)	1.78 (0.070)	2.29 (0.090)	2.54 (0.100)	2.79 (0.110)
			PAPER					` ′	EMBO	SSED		· ·	

TS 16949, ISO 9001Certified

020117



Capacitance Range X7R Dielectric

	Size			0402	2				06	03						805						120	6				12	10		18	312		2220	
	Solderi	ng	Ref	low/\	Vave			R	eflow	/Wave					Reflo	w/Wa	ve				Re	eflow/	Wave				Reflov	v Only	/	Reflo	w Only	Re	eflow C	nly
	WVD0	0	16V	25V	150V	10V	16V	25V	50V	100 V	200V	250V	16V	25V	50V	100 V	200V	250V	16V	25V	50V	100 V	/200V	1250V	500V	16V	25V	150V	100V	50V	100 V	25V	50V	1100 V
221	Сар	220		С	С											С																		
271	(pF)	270	С	С	C																										İ			
331		330	С	С	С																													
391		390	С	С	С																													
471		470	С	С	С																													
561		560	С	С	С																													
681		680	С	С	С																													
821		820	С	С	С																													
102		1000	С	С	С		G	G	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J	J	K	K	K	K	N	N			
182		1800	С	С	С		G	G	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J	J	K	K	K	K	N	N			
222		2200	С	С	С		G	G	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J	J	K	K	K	K	N	N			
332		3300	С	С	С		G	G	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J	J	K	K	K	K	N	N			
472		4700	С	С	C		G	G	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J	J	K	K	K	K	N	N			
103	Cap	0.01	С				G	G	G	G	G	G	J	J	J	J	J	J	J	J	J	J	J	J	J	K	K	K	K	N	N			
123	(μF)	0.012	С				G	G	G				J	J	J	N	N	N	J	J	J	J	J	J		K	K	K	K	N	N			
153		0.015	С				G	G	G				J	J	J	N	N	N	J	J	J	J	J	J		K	K	K	K	N	N			
183		0.018	С				G	G	G				J	J	J	N	N	N	J	J	J	J	J	J		K	K	K	K	N	N			
223		0.022	С				G	G	G				J	J	J	N	N	N	J	J	J	J	J	J		K	K	K	K	N	N			
273		0.027	С				G	G	G				J	J	J	N	N	N	J	J	J	J	J	J		K	K	K	K	N	N			
333		0.033	С				G	G	G				J	J	J	N	N	N	J	J	J	J	J	J		K	K	K	K	N	N			
473		0.047					G	G	G				J	J	J	N	N	N	J	J	J	М	J	J		K	K	K	K	N	N			
563		0.056					G	G	G				J	J	J	N			J	J	J	М	J	J		K	K	K	М	N	N			
683		0.068		<u> </u>	_	_	G	G	G				J	J	J	N			J	J	J	М	J	J		K	K	K	М	N	N			
823		0.082					G	G	G				J	J	J	N			J	J	J	М	J	J		K	K	K	М	N	N			
104		0.1	С	_	_		G	G	G				J	J	J	N			J	J	J	М	J	J		K	K	K	M	N	N			
124		0.12		_	_	_	<u> </u>						J	J	N	N			J	J	М	М		_		K	K	K	P	N	N			
154		0.15		<u> </u>	-								М	N	N	N			J	J	М	М	<u> </u>	<u> </u>		K	K	K	Р	N	N			
224		0.22		₩	-	G	J	J	J	_			М	N	N	N		_	J	М	M	Q	-	<u> </u>		М	M	M	P	N	N			
334		0.33	_	1	1		L .		_	-			N	N	N	N	-	_	J	M	Р	Q	-	1	-	Р	P	P	Q	X	X		-	_
474		0.47		-	-	J	J	J	_				N	N	N	N	-		M	M	P	Q	_	-		Р	Р	P	Q	X	X	-		
684 105		0.68		\vdash	+	\vdash	\vdash	_	-	_			N	N	N	N	-	_	M	Q	Q	Q	_	-	_	P	P	Q	X	X	X			_
155		1.5		1	1	-	\vdash						N	N	N	N			M 0	Q	Q	Q		-		P	Q	Q Z	Z	X	X			
225		2.2		+	+	₩	\vdash		-					N		-	-			Q	Q	<u> </u>	+	1			Q			Z				
335		3.3	_	-	+-	-	\vdash	_	_				N	N	-		-		Q	Q	Q		-	-		X	Z	Z	Z	Z	Z	_		
475		4.7		1	1	1	\vdash		-					-	-		-		Q	Q	_	_	1	1		X	Z	Z	Z	Z		-		Z
106		10	-	1	1	1	\vdash	_	-	-			_	-	\vdash	-	-	_	Ų	Ų	<u> </u>	-	-	1	-	Z	Z	Z				-	Z	Z
226		22	-	-	+	\vdash	\vdash	\vdash	-	-			\vdash	-	\vdash	-	-	\vdash	-	-	\vdash	\vdash	\vdash	-	-						-	Z		
220	WVD0		161/	251/	501/	101/	161/	251/	501/	100 \/	200V	2501/	161/	251/	501/	100 \	2001/	2501/	16\/	251/	501/	100 \	/2001	2501	5001/	16\/	25V	501/	100 V	50V	100 V		50\/	100 V
	Size		100	0402		100	100	123V	06		2000	2301	100	Z3V		805	1 Z U U V	1230V	100	123V	JUV	120		1230 V	1000	100	23V 12		1100 V		100 v	230	2220	
	0126			3702					- 00	-					_							120	_				- 12			- 10			2220	

Letter	Α	С	E	G	J	K	M	N	Р	Q	Х	Υ	Z
Max.	0.33	0.56	0.71	0.90	0.94	1.02	1.27	1.40	1.52	1.78	2.29	2.54	2.79
Thickness	(0.013)	(0.022)	(0.028)	(0.035)	(0.037)	(0.040)	(0.050)	(0.055)	(0.060)	(0.070)	(0.090)	(0.100)	(0.110)
			PAPER						EMBC	SSED			

FLEXISAFE MLC Chips

General Specifications and Capacitance Range For Ultra Safety Critical Applications





KYOCERA AVX have developed a range of components specifically for safety critical applications.

Utilizing the award-winning FLEXITERM™ layer in conjunction with the cascade design previously used for high voltage MLCCs, a range of ceramic capacitors is now available for customers who require components designed with an industry leading set of safety features.

The FLEXITERM™ layer protects the component from any damage to the ceramic resulting from mechanical stress during PCB assembly or use with end customers. Board flexure type mechanical damage accounts for the majority of MLCC failures. The addition of the cascade structure protects the component from low insulation resistance failure resulting from other common causes for failure; thermal stress damage, repetitive strike ESD damage and placement damage. With the inclusion of the cascade design structure to complement the FLEXITERM™ layer, the FLEXISAFE range of capacitors has unbeatable safety features. Flexisafe capacitors are qualified in accordance with AEC-Q200 standard. AEC-Q200 detailed qualification data is available on request

HOW TO ORDER

FS05	<u>5</u>	<u>c</u>	<u>104</u>	K ⊤	Q 	z 	2	<u>A</u>
Size FS03 = 0603 FS05 = 0805 FS06 = 1206 FS10 = 1210	Voltage 16V = Y 25V = 3 50V = 5 100V = 1	Dielectric X7R = C	Capacitance Code (In pF) 2 Sig. Digits + Number of Zeros e.g. 10µF =106	Capacitance Tolerance J = ±5% K = ±10% M = ±20%	Failure Rate A = Commercial 4 = Automotive Q = APS	Terminations Z = FLEXITERM™ *X = FLEXITERM™ with 5% min lead *Not RoHS Compliant	Packaging 2 = 7" Reel 4 = 13" Reel	Special Code A = Std.Product

CAPACITANCE RANGE FLEXISAFE X7R

SI	SIZE FS03 = 0603						FS05 :	= 0805		FS	306 = 120	6	FS	10 = 121	0
W	/DC	16	25	50	100	16	25	50	100	16	25	50	16	25	50
102	1000	G	G	G	G	J	J	J	J	J	J	J			
182	1800	G	G	G	G	J	J	J	J	J	J	J			
222	2200	G	G	G	G	J	J	J	J	J	J	J			
332	3300	G	G	G	G	J	J	J	J	J	J	J			
472	4700	G	G	G	G	J	J	J	J	J	J	J			
682	6800	G	G	G	G	J	J	J	J	J	J	J			
103	0.01	G	G	G	G	J	J	J	J	J	J	J			
123	0.012	G	G	G		J	J	J	J	J	J	J			
153	0.015	G	G	G		J	J	J	J	J	J	J			
183	0.018	G	G	G		J	J	J	J	J	J	J			
223	0.022	G	G	G		N	N	N	N	J	J	J			
273	0.027					N	N	N	N	J	J	J			
333	0.033					N	N	N	N	J	J	J			
473	0.047					N	N	N	N	М	М	М			
563	0.056					N	N	N	N	М	М	М			
683	0.068					N	N	N	N	М	М	М			
823	0.082					N	N	N	N	М	М	М			
104	0.1					N	N	N	N	М	М	М			
124	0.12									М	М	М			
154	0.15									М	М	М	Q	Q	Q
224	0.22												Q	Q	Q
334	0.33												Q	Q	Q
474	0.47												Q	Q	Q

Letter	G	J	М	N	Q
Max. Thickness	0.90 (0.035)	0.94 (0.037)	1.27 (0.050)	1.40 (0.055)	1.78 (0.070)
	PAF	PFR		FMBOSSFD	





Capacitor Array

Capacitor Array (IPC)



BENEFITS OF USING CAPACITOR ARRAYS

KYOCERA AVX capacitor arrays offer designers the opportunity to lower placement costs, increase assembly line output through lower component count per board and to reduce real estate requirements.

Reduced Costs

Placement costs are greatly reduced by effectively placing one device instead of four or two. This results in increased throughput and translates into savings on machine time. Inventory levels are lowered and further savings are made on solder materials, etc.

Space Saving

Space savings can be quite dramatic when compared to the use of discrete chip capacitors. As an example, the 0508 4-element array offers a space reduction of >40% vs. 4 x 0402 discrete capacitors and of >70% vs. 4 x 0603 discrete capacitors. (This calculation is dependent on the spacing of the discrete components.)

Increased Throughput

Assuming that there are 220 passive components placed in a mobile

A reduction in the passive count to 200 (by replacing discrete components with arrays) results in an increase in throughput of approximately 9%.

A reduction of 40 placements increases throughput by 18%.

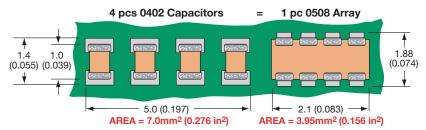
For high volume users of cap arrays using the very latest placement equipment capable of placing 10 components per second, the increase in throughput can be very significant and can have the overall effect of reducing the number of placement machines required to mount components:

If 120 million 2-element arrays or 40 million 4-element arrays were placed in a year, the requirement for placement equipment would be reduced by one machine.

During a 20Hr operational day a machine places 720K components. Over a working year of 167 days the machine can place approximately 120 million. If 2-element arrays are mounted instead of discrete components, then the number of placements is reduced by a factor of two and in the scenario where 120 million 2-element arrays are placed there is a saving of one pick and place machine.

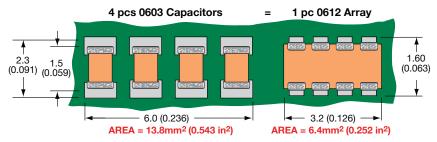
Smaller volume users can also benefit from replacing discrete components with arrays. The total number of placements is reduced thus creating spare capacity on placement machines. This in turn generates the opportunity to increase overall production output without further investment in new equipment.

W2A (0508) Capacitor Arrays



The 0508 4-element capacitor array gives a PCB space saving of over 40% vs four 0402 discretes and over 70% vs four 0603 discrete capacitors.

W3A (0612) Capacitor Arrays



The 0612 4-element capacitor array gives a PCB space saving of over 50% vs four 0603 discretes and over 70% vs four 0805 discrete capacitors.



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Capacitor Array (IPC)







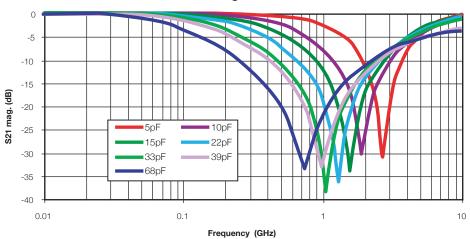
GENERAL DESCRIPTION

KYOCERA AVX is the market leader in the development and manufacture of capacitor arrays. The array family of products also includes the 0612 4-element device as well as 0508 2-element and 4-element series, all of which have received widespread acceptance in the marketplace.

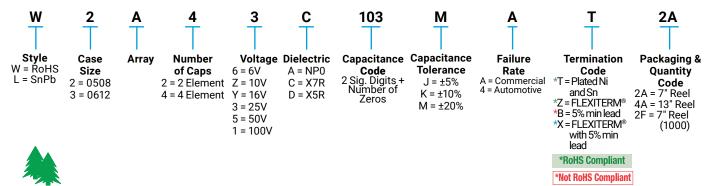
KYOCERA AVX capacitor arrays are available in X5R, X7R and NP0 (C0G) ceramic dielectrics to cover a broad range of capacitance values. Voltage ratings from 6.3 Volts up to 100 Volts are offered. KYOCERA AVX also now offers a range of automotive capacitor arrays qualified to AEC-Q200 (see separate table).

Key markets for capacitor arrays are Mobile and Cordless Phones, Digital Set Top Boxes, Computer Motherboards and Peripherals as well as Automotive applications, RF Modems, Networking Products, etc.

AVX Capacitor Array - W2A41A***K S21 Magnitude



HOW TO ORDER



NOTE: Contact factory for availability of Termination and Tolerance Options for Specific Part Numbers.



RoHS COMPLIANT





SIZE		W	2 = 050	08	W	3 = 061	2	
# Elemen	ts		4			4		
Soldering		Re	flow/Wa	ave	Re	flow/Wa	ve	
Packaging			er/Embos			er/Embos		
	mm		1.30 ± 0.1			.60 ± 0.15		
Length	(in.)	(0.	051 ± 0.0	06)	(0.063 ± 0.006)			
Width	mm		2.10 ± 0.1			3.20 ± 0.20		
Max.	(in.) mm	(0.	083 ± 0.0 0.94	06)	(0.	126 ± 0.00 1.35	J8)	
Thickness	(in.)		(0.037)			(0.053)		
WVDC		16	25	50	16	25	50	
1R0 Cap	1.0							
1R2 (pF)	1.2							
1R5	1.5							
1R8	1.8							
2R2	2.2							
2R7	2.7							
3R3	3.3							
3R9	3.9							
4R7	4.7							
5R6 6R8	5.6 6.9							
8R2	6.8 8.2							
100	10							
120	12							
150	15							
180	18							
220	22							
270	27							
330	33							
390	39							
470	47							
560	56							
680	68							
820 101	82 100							
121	120							
151	150							
181	180							
221	220							
271	270							
331	330							
391	390							
471	470							
561	560							
681	680							
821	820							
102	1000							
122 152	1200 1500							
182	1800							
222	2200							
272	2700							
332	3300							
392	3900							
472	4700							
562	5600							
682	6800							
822	8200							

= Supported Values





	SIZE			W2 = 0508			٧	/2 =	050	8			V	V3 =	061	2				
#	Elemen	ts				2						4						1		
	Soldering				Reflov	v/Wav	e					//Wav					Reflow			
	Packaqinq					aper				Pa		mboss					per/E			
Lengt	th	mm (in.)		(1.30 0.051	± 0.15				(0		± 0.15 ± 0.00					1.60 ±			
		mm		('		± 0.00						± 0.00			(0.063 ± 0.006) 3.20 ± 0.20					
Width	1	(in.)		(0.083							± 0.00				(0	0.26 :		8)	
Max.		mm			0.	.94					0.	94					1.	35		
Thick	ness	(in.)				037)					(0.0	37)					(0.0			100
101	WVDC Cap	100	6	10	16	25	50	100	6	10	16	25	50	100	6	10	16	25	50	100
121	(PF)	120																		
151	(11)	150																		
181		180																		
221		220																		
271		270																		
331		330 390																		
471		470																		
561		560																		
681		680																		
821		820																		
102		1000																		
122		1200																		
152 182		1500 1800																		
222		2200																		
272		2700																		
332		3300																		
392		3900																		
472		4700																		
562 682		5600 6800																		
822		8200																		
103		0.010																		
123	(μF)	0.012																		
153		0.015																		
183		0.018																		
223 273		0.022 0.027																		
333		0.027																		\vdash
393		0.039																		
473		0.047																		Ш
563		0.056																		
683		0.068																		
823 104		0.082																		\vdash
124		0.10																		
154		0.15			L		L	L	L	L		L	L	L		L	L	L		<u>∟</u> ∣
184		0.18																		
224		0.22																		
274 334		0.27		<u> </u>	<u> </u>	-	<u> </u>		-							_	<u> </u>			$\vdash\vdash$
474		0.33																		
564		0.56																		
684		0.68																		
824		0.82																		
105		1.0		_	_		_										_			Ш
125 155		1.2 1.5																		
185		1.5																		
225		2.2																		\Box
335		3.3																		
475		4.7																		Ш
106		10]
226		22																		
476		47																		
107		100																		ш

Automotive Capacitor Array (IPC)





As the market leader in the development and manufacture of capacitor arrays KYOCERA AVX is pleased to offer a range of AEC-Q200 qualified arrays to compliment our product offering to the Automotive industry. Both the KYOCERA AVX 0612 and 0508 4-element capacitor array styles are qualified to the AEC-Q200 automotive specifications.

AEC-Q200 is the Automotive Industry qualification standard and a detailed qualification package is available on request.

All KYOCERA AVX automotive capacitor array production facilities are certified to ISO/TS 16949:2002.

HOW TO ORDER

$\frac{w}{T}$	<u>3</u>	<u>A</u>	4	Y	C	<u>104</u>	<u>K</u>	4	<u>T</u>	2A
Style W = RoHS L = SnPb	Case Size 2 = 0508 3 = 0612	Array	Number of Caps	Voltage Z = 10V Y = 16V 3 = 25V 5 = 50V 1 = 100V	Dielectric A = NP0 C = X7R F = X8R	Capacitance Code (In pF) Significant Digits + Number of Zeros e.g. 10µF=106	Capacitance Tolerance *J = $\pm 5\%$ *K = $\pm 10\%$ *M = $\pm 20\%$	Failure Rate 4 = Automotive	Terminations *T = Plated Ni and Sn *Z = FLEXITERM® B = 5% min lead X = FLEXITERM® with 5% min lead *RoHS Compliant	Packaging & Quantity Code 2A = 7" Reel 4A = 13" Reel 2F = 7" Reel (1000)

^{*}Contact factory for availability by part number for $K = \pm 10\%$ and $J = \pm 5\%$ tolerance.

NPO/COG

SIZI	Ε	W3 = 0612						
No. of Eler	nents	Re	flow/Wa	ive				
WVD	2	16	25	50				
1R0 Ca	p 1.0							
1R2 (pl	1.2			i i				
1R5	1.5		İ	i i				
1R8	1.8							
2R2	2.2							
2R7	2.7							
3R3	3.3							
3R9	3.9							
4R7	4.7							
5R6	5.6							
6R8	6.8							
8R2	8.2							
100	10							
120	12							
150 180	15 18							
220 270	22 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							
152 182	1500 1800			\vdash				
222	2200							
272	2700							
332	3300		 	\vdash				
392	3900							
472	4700							
562	5600			\vdash				
682	6800		l					
822	8200		l					

	SIZE		W2 =	0508	}		W2 =	0508			W	3 = 06	12	
No.	of Elements			2			-	4				4		
	WVDC	16	25	50	100	16	25	50	100	10	16	25	50	100
101	Cap 100													
121	(pF) 120		ĺ	İ		İ			İ	İ	İ		i I	
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													
222 272	2200 2700													
332	3300													
392	3900													
472	4700													
562	5600													
682	6800													
822	8200													
103	Cap 0 010													
123	(μF) 0.012													
153	0.015													
153	0.018													
223	0.022				i				i					
273	0.027													
333	0.033													
393	0.039				l		l	l	l					
473	0.047													
563	0.056													
683	0.068						l							
823	0.082													
104	0.10													
124	0.12													
154	0.15													
224	0.22													

*Not RoHS Compliant



LEAD-FREE COMPATIBLE COMPONENT

For RoHS compliant products,



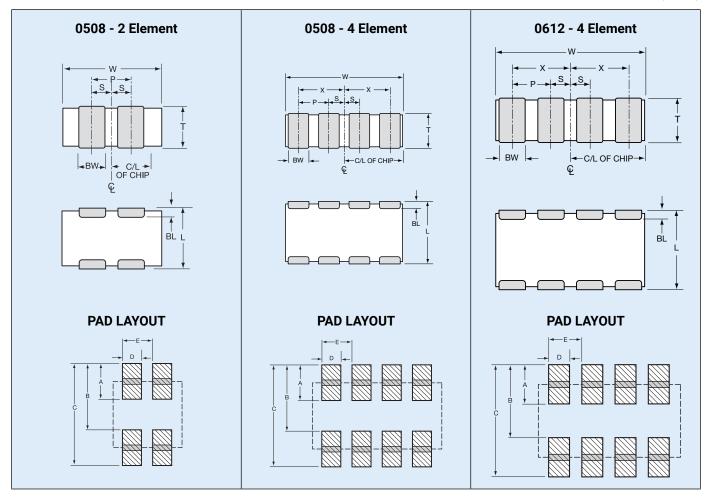
= X7R

= NPO/COG



PART & PAD LAYOUT DIMENSIONS

millimeters (inches)



PART DIMENSIONS

0508 - 2 Element

L	W	Т	BW	BL	Р	S
1.30 ± 0.15	2.10 ± 0.15	0.94 MAX	0.43 ± 0.10	0.33 ± 0.08	1.00 REF	0.50 ± 0.10
(0.051 ± 0.006)	(0.083 ± 0.006)	(0.037 MAX)	(0.017 ± 0.004)	(0.013 ± 0.003)	(0.039 REF)	(0.020 ± 0.004)

0508 - 4 Element

L	W	Т	BW	BL	Р	X	S
1.30 ± 0.15	2.10 ± 0.15	0.94 MAX	0.25 ± 0.06	0.20 ± 0.08	0.50 REF	0.75 ± 0.10	0.25 ± 0.10
(0.051 ± 0.006)	(0.083 ± 0.006)	(0.037 MAX)	(0.010 ± 0.003)	(0.008 ± 0.003)	(0.020 REF)	(0.030 ± 0.004)	(0.010 ± 0.004)

0612 - 4 Element

L	W	Т	BW	BL	Р	X	S
1.60 ± 0.20	3.20 ± 0.20	1.35 MAX	0.41 ± 0.10	0.18 - 0.25	0.76 REF	1.14 ± 0.10	0.38 ± 0.10
(0.063 ± 0.008)	(0.126 ± 0.008)	(0.053 MAX)	(0.016 ± 0.004)	(0.007 + 0.010) -0.003	(0.030 REF)	(0.045 ± 0.004)	(0.015 ± 0.004)

PAD LAYOUT DIMENSIONS

0508 - 2 Element

Α	В	С	D	E
0.68	1.32	2.00	0.46	1.00
(0.027)	(0.052)	(0.079)	(0.018)	(0.039)

0508 - 4 Element

Α	В	С	D	Е
0.56	1.32	1.88	0.30	0.50
(0.022)	(0.052)	(0.074)	(0.012)	(0.020)

0612 - 4 Element

Α	В	С	D	E
0.89	1.65	2.54	0.46	0.76
(0.035)	(0.065)	(0.100)	(0.018)	(0.030)

Low Inductance Capacitors

Introduction



The signal integrity characteristics of a Power Delivery Network (PDN) are becoming critical aspects of board level and semiconductor package designs due to higher operating frequencies, larger power demands, and the ever shrinking lower and upper voltage limits around low operating voltages. These power system challenges are coming from mainstream designs with operating frequencies of 300MHz or greater, modest ICs with power demand of 15 watts or more, and operating voltages below 3 volts.

The classic PDN topology is comprised of a series of capacitor stages. Figure 1 is an example of this architecture with multiple capacitor stages.

An ideal capacitor can transfer all its stored energy to a load instantly. A real capacitor has parasitics that prevent instantaneous transfer of a capacitor's stored energy. The true nature of a capacitor can be modeled as an RLC equivalent circuit. For most simulation purposes, it is possible to model the characteristics of a real capacitor with one capacitor, one resistor, and one inductor. The RLC values in this model are commonly referred to as equivalent series capacitance (ESC), equivalent series resistance (ESR), and equivalent series inductance (ESL).

The ESL of a capacitor determines the speed of energy transfer to a load. The lower the ESL of a capacitor, the faster that energy can be transferred to a load. Historically, there has been a tradeoff between energy storage (capacitance) and inductance (speed of energy delivery). Low ESL devices typically have low capacitance. Likewise, higher capacitance devices typically have higher ESLs. This tradeoff between ESL (speed of energy delivery) and capacitance (energy storage) drives the PDN design topology that places the fastest low ESL capacitors as close to the load as possible. Low Inductance MLCCs are found on semiconductor packages and on boards as close as possible to the load.

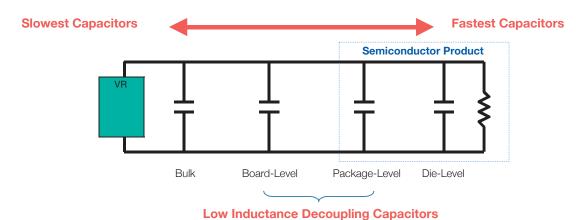


Figure 1 Classic Power Delivery Network (PDN) Architecture

LOW INDUCTANCE CHIP CAPACITORS

The key physical characteristic determining equivalent series inductance (ESL) of a capacitor is the size of the current loop it creates. The smaller the current loop, the lower the ESL. A standard surface mount MLCC is rectangular in shape with electrical terminations on its shorter sides. A Low Inductance Chip Capacitor (LICC®) sometimes referred to as Reverse Geometry Capacitor (RGC) has its terminations on the longer side of its rectangular shape.

When the distance between terminations is reduced, the size of the current loop is reduced. Since the size of the current loop is the primary driver of inductance, an 0306 with a smaller current loop has significantly lower ESL then an 0603. The reduction in ESL varies by EIA size, however, ESL is typically reduced 60% or more with an LICC® versus a standard MLCC.

INTERDIGITATED CAPACITORS

The size of a current loop has the greatest impact on the ESL characteristics of a surface mount capacitor. There is a secondary method for decreasing the ESL of a capacitor. This secondary method uses adjacent opposing current loops to reduce ESL. The InterDigitated Capacitor (IDC) utilizes both primary and secondary methods of reducing inductance. The IDC architecture shrinks the distance between terminations to minimize the current loop size, then further reduces inductance by creating adjacent opposing current loops.

An IDC is one single capacitor with an internal structure that has been optimized for low ESL. Similar to standard MLCC versus LICC®s, the reduction in ESL varies by EIA case size. Typically, for the same EIA size, an IDC delivers an ESL that is at least 80% lower than an MLCC.

Low Inductance Capacitors

Introduction



LAND GRID ARRAY (LGA) CAPACITORS

Land Grid Array (LGA) capacitors are based on the first Low ESL MLCC technology created to specifically address the design needs of current day Power Delivery Networks (PDNs). This is the 3rd low inductance capacitor technology developed by KYOCERA AVX. LGA technology provides engineers with new options. The LGA internal structure and manufacturing technology eliminates the historic need for a device to be physically small to create small current loops to minimize inductance.

The first family of LGA products are 2 terminal devices. A 2 terminal 0306 LGA delivers ESL performance that is equal to or better than an 0306 8 terminal IDC. The 2 terminal 0805 LGA delivers ESL performance that approaches the 0508 8 terminal IDC. New designs that would have used 8 terminal IDCs are moving to 2 terminal LGAs because the layout is easier for a 2 terminal device and manufacturing yield is better for a 2 terminal LGA versus an 8 terminal IDC.

LGA technology is also used in a 4 terminal family of products that KYOCERA AVX is sampling and will formerly introduce in 2008. Beyond 2008, there are new multi-terminal LGA product families that will provide even more attractive options for PDN designers.

LOW INDUCTANCE CHIP ARRAYS (LICA®)

The LICA® product family is the result of a joint development effort between KYOCERA AVX and IBM to develop a high performance MLCC family of decoupling capacitors. LICA was introduced in the 1980s and remains the leading choice of designers in high performance semiconductor packages and high reliability board level decoupling applications.

LICA® products are used in 99.999% uptime semiconductor package applications on both ceramic and organic substrates. The C4 solder ball termination option is the perfect compliment to flip-chip packaging technology. Mainframe class CPUs, ultimate performance multi-chip modules, and communications systems that must have the reliability of 5 9's use LICA®.

LICA® products with either Sn/Pb or Pb-free solder balls are used for decoupling in high reliability military and aerospace applications. These LICA® devices are used for decoupling of large pin count FPGAs, ASICs, CPUs, and other high power ICs with low operating voltages.

When high reliability decoupling applications require the very lowest ESL capacitors, LICA® products are the best option.

470 nF 0306 Impedance Comparison

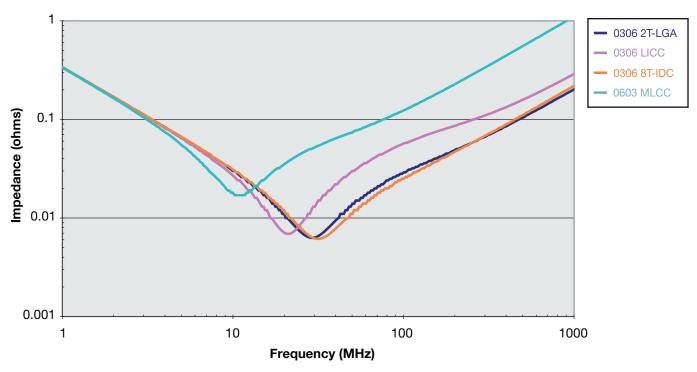


Figure 2 MLCC, LICC®, IDC, and LGA technologies deliver different levels of equivalent series inductance (ESL).

Low Inductance Ceramic Capacitors



LICC® (Low Inductance Chip Capacitors)

0204/0306/0508/0612 RoHS Compliant

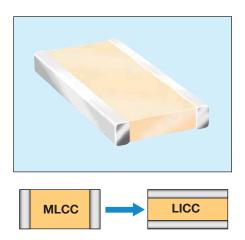
GENERAL DESCRIPTION

The key physical characteristic determining equivalent series inductance (ESL) of a capacitor is the size of the current loop it creates. The smaller the current loop, the lower the ESL.

A standard surface mount MLCC is rectangular in shape with electrical terminations on its shorter sides. A Low Inductance Chip Capacitor (LICC®) sometimes referred to as Reverse Geometry Capacitor (RGC) has its terminations on the longer sides of its rectangular shape. The image on the right shows the termination differences between an MLCC and an LICC®.

When the distance between terminations is reduced, the size of the current loop is reduced. Since the size of the current loop is the primary driver of inductance, an 0306 with a smaller current loop has significantly lower ESL then an 0603. The reduction in ESL varies by EIA size, however, ESL is typically reduced 60% or more with an LICC® versus a standard MLCC.

KYOCERA AVX LICC® products are available with a lead-free finish of plated Nickel/Tin.



PERFORMANCE CHARACTERISTICS

Capacitance Tolerances	K = ±10%; M = ±20%
Operation Temperature Range	X7R = -55°C to +125°C X5R = -55°C to +85°C X7S = -55°C to +125°C
Temperature Coefficient	X7R, X5R = ±15%; X7S = ±22%
Voltage Ratings	4, 6.3, 10, 16, 25 VDC
Dissipation Factor	4V, 6.3V = 6.5% max; 10V = 5.0% max; 16V = 3.5% max; 25V = 3.0% max
Insulation Resistance (@+25°C, RVDC)	100,000MΩ min, or 1,000MΩ per μF min.,whichever is less



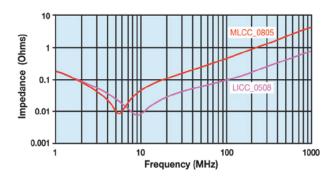
HOW TO ORDER

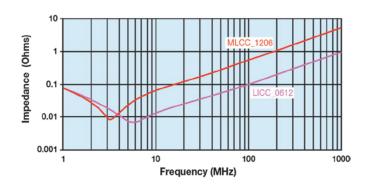
0612	Z	D	105	M	Α	<u>T</u>	2	A *
Size 0204 0306 0508 0612	Voltage 4 = 4V 6 = 6.3V Z = 10V Y = 16V 3 = 25V 5 = 50V	Dielectric C = X7R D = X5R W = X6S Z = X7S	Capacitance Code (In pF) 2 Sig. Digits + Number of Zeros	Capacitance Tolerance K = ±10% M = ±20%	Failure Rate A = N/A 4 = Automotive**	Terminations T = Plated Ni and Sn	Packaging Available 2 = 7" Reel 4 = 13" Reel	Thickness Thickness mm (in) 0.56 (0.022) 0.76 (0.030) 1.02 (0.040) 1.27 (0.050)

^{*}See the thickness tables on the next page.

NOTE: Contact factory for availability of Termination and Tolerance Options for Specific Part Numbers.

TYPICAL IMPEDANCE CHARACTERISTICS





^{**}Select voltages for Automotive version, contact factory

Low Inductance Ceramic Capacitors



LICC® (Low Inductance Chip Capacitors)

0204/0306/0508/0612 RoHS Compliant

SIZE				04		0306				0508				0612						
Pa	ckaging			per				Paper			Paper/Embossed			ł				ossec	İ	
Length	mm	0.50 ± 0.05							1.27 + 0.25				1.60 + 0.25							
	(in.) mm		1.020 ±		2)	(0.032 ± 0.006) 1.60 + 0.15				(0.050 ± 0.010) 2.00 + 0.25				(0.063 ± 0.010) 3.20 + 0.25						
Width	(in.)		1.00 ±		2)			53 ± 0					30 ± 0					26 ± 0		
Cap Code	WVDC	4	6.3	10	16	4	6.3	10	16	25	6.3	10	16	25	50	6.3	10	16	25	50
102	Cap 0.001						Α	Α	Α	Α	V	V	٧	٧	V	S	S	S	S	V
222	(μF) .0022						Α	Α	Α	Α	S	S	S	S	٧	S	S	S	S	٧
332	0.0033						Α	Α	Α	Α	S	S	S	S	٧	S	S	S	S	٧
472	0.0047						Α	Α	Α	Α	S	S	S	S	٧	S	S	S	S	٧
682	0.0068						Α	Α	Α	Α	S	S	S	S	٧	S	S	S	S	٧
103	0.01						Α	Α	Α	Α	S	S	S	S	٧	S	S	S	S	٧
153	0.015						Α	Α	Α	Α	S	S	S	S	٧	S	S	S	S	W
223	0.022						Α	Α	Α	Α	S	S	S	S	٧	S	S	S	S	W
333	0.033						Α	Α	Α		S	S	S	٧	٧	S	S	S	S	W
473	0.047						Α	Α	Α		S	S	S	٧	Α	S	S	S	S	W
683	0.068						Α	Α	Α		S	S	S	Α	Α	S	S	S	٧	W
104	0.1	c					Α	Α	/N/		S	S	٧	Α	Α	S	S	S	٧	W
154	0.15						Α	Α			S	S	٧			S	S	S	W	W
224	0.22						Α	Α			S	S	Α			S	S	٧	W	
334	0.33										٧	٧	Α			S	S	٧		
474	0.47										٧	٧	/#//			S	S	٧		
684	0.68										Α	Α				٧	٧	W		
105	1					A					Α	Α				٧	٧	Α		
155	1.5										/K/					W	W			
225	2.2															Α	Α			
335	3.3															//				
475	4.7															,,,,				
685	6.8																			
106	10																			

Solid = X7R







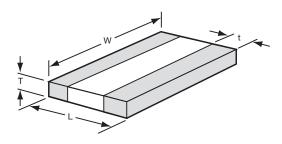
	mm (in.)								
0204									
Code	Thickness								
С	0.35 (0.014)								

	mm (in.)
	0306
Code	Thickness
Α	0.56 (0.022)

	mm (in.)
	0508
Code	Thickness
S	0.56 (0.022)
V	0.76 (0.030)
Α	1.02 (0.040)

	mm (in.)
	0612
Code	Thickness
S	0.56 (0.022)
٧	0.76 (0.030)
W	1.02 (0.040)
Α	1.27 (0.050)

PHYSICAL DIMENSIONS AND PAD LAYOUT



PHYSICAL DIMENSIONS

MM (IN.)

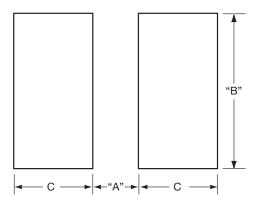
S	ize	L	W	t				
0	204	0.50 ± 0.05	1.00 ± 0.05	0.18 ± 0.08				
02	204	(0.020 ± 0.002)	(0.040 ± 0.002)	(0.007 ± 0.003)				
0.	306	0.81 ± 0.15	1.60 ± 0.15	0.13 min.				
U	000	(0.032 ± 0.006)	(0.063 ± 0.006)	(0.005 min.)				
	508	1.27 ± 0.25	2.00 ± 0.25	0.13 min.				
U	000	(0.050 ± 0.010)	(0.080 ± 0.010)	(0.005 min.)				
04	512	1.60 ± 0.25	3.20 ± 0.25	0.13 min.				
00	J12	(0.063 ± 0.010)	(0.126 ± 0.010)	(0.005 min.)				

T - See Range Chart for Thickness and Codes

PAD LAYOUT DIMENSIONS

MM (IN.)

Size	Α	В	С
0306	0.31 (0.012)	1.52 (0.060)	0.51 (0.020)
0508	0.51 (0.020)	2.03 (0.080)	0.76 (0.030)
0612	0.76 (0.030)	3.05 (0.120)	0.635 (0.025)
0204			



Low Inductance Capacitors with SnPb Terminations





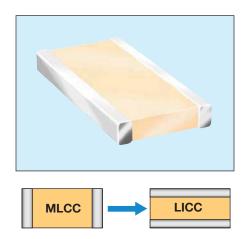
GENERAL DESCRIPTION

The key physical characteristic determining equivalent series inductance (ESL) of a capacitor is the size of the current loop it creates. The smaller the current loop, the lower the ESL.

A standard surface mount MLCC is rectangular in shape with electrical terminations on its shorter sides. A Low Inductance Chip Capacitor (LICC®) sometimes referred to as Reverse Geometry Capacitor (RGC) has its terminations on the longer sides of its rectangular shape. The image on the right shows the termination differences between an MLCC and an LICC®.

When the distance between terminations is reduced, the size of the current loop is reduced. Since the size of the current loop is the primary driver of inductance, an 0306 with a smaller current loop has significantly lower ESL then an 0603. The reduction in ESL varies by EIA size, however, ESL is typically reduced 60% or more with an LICC® versus a standard MLCC.

AVX LICC® products are available with a lead termination for high reliability military and aerospace applications that must avoid tin whisker reliability issues.



PERFORMANCE CHARACTERISTICS

Capacitance Tolerances	K = ±10%; M = ±20%
Operation Temperature Range	X7R = -55°C to +125°C X5R = -55°C to +85°C X7S = -55°C to +125°C
Temperature Coefficient	X7R, X5R = ±15%; X7S = ±22%
Voltage Ratings	4, 6.3, 10, 16, 25 VDC
Dissipation Factor	4V, 6.3V = 6.5% max; 10V = 5.0% max; 16V = 3.5% max; 25V = 3.0% max
Insulation Resistance (@+25°C, RVDC)	100,000MΩ min, or 1,000MΩ per μF min.,whichever is less

*Not RoHS Compliant

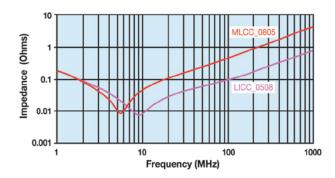
HOW TO ORDER

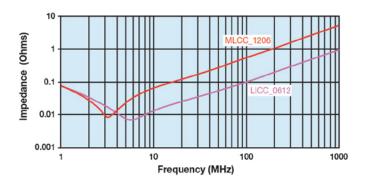


*See the thickness tables on the next page.

NOTE: Contact factory for availability of Termination and Tolerance Options for Specific Part Numbers.

TYPICAL IMPEDANCE CHARACTERISTICS







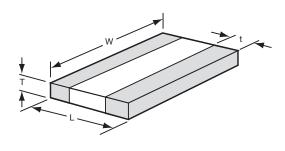
Low Inductance Capacitors with SnPb Terminations



LD15/LD16/LD17/LD18 Tin-Lead Termination "B"

	SIZE			15 04)		LD16 (0306)				LD17 (0508)				LD18 (0612)						
Pa	Packaging Paper				Paper				Paper/Embossed				Paper/Embossed							
	mm (in.)	(0	.020 :	£ 0.05 £ 0.00			(0.0	31 ± 0. 32 ± 0.	006)			(0.05	27 ± 0 50 ± 0	010)		1.60 ± 0.25 (0.063 ± 0.010)				
Width	mm (in.)		1.00 : :040 :	£ 0.05 £ 0.00	2)		1.60 ± 0.15 (0.063 ± 0.006)					00 ± 0 80 ± 0			3.20 ± 0.25 (0.126 ± 0.010)					
Cap Code	WVDC	4	6.3	10	16	4	6.3	10	16	25	6.3	10	16	25	50	6.3	10	16	25	50
102	Cap 0.001						Α	Α	Α	Α	S	S	S	S	V	S	S	S	S	>
222	(μF) .0022						Α	Α	Α	Α	S	S	S	S	٧	S	S	S	S	٧
332	0.0033						Α	Α	Α	Α	S	S	S	S	٧	S	S	S	S	>
472	0.0047						Α	Α	Α	Α	S	S	S	S	٧	S	S	S	S	٧
682	0.0068						Α	Α	Α	Α	S	S	S	S	٧	S	S	S	S	>
103	0.01						Α	Α	Α	Α	S	S	S	S	٧	S	S	S	S	٧
153	0.015						Α	Α	Α	Α	S	S	S	S	٧	S	S	S	S	W
223	0.022						Α	Α	Α	Α	S	S	S	S	٧	S	S	S	S	W
333	0.033						Α	Α	Α		S	S	S	٧	٧	S	S	S	S	W
473	0.047						Α	Α	Α		S	S	S	٧	Α	S	S	S	S	W
683	0.068						Α	Α	Α		S	S	S	Α	Α	S	S	S	٧	W
104	0.1	С					Α	Α			S	S	٧	Α	Α	S	S	S	٧	W
154	0.15						Α	Α			S	S	٧			S	S	S	W	W
224	0.22						Α	Α			S	S	Α			S	S	٧	W	
334	0.33										٧	٧	Α			S	S	٧		
474	0.47										٧		Α			S	S	٧		
684	0.68										Α	Α				٧	٧	W		
105	1					А					Α	Α				٧	٧	Α		
155	1.5															W	W			
225	2.2															Α	Α			
335	3.3															//				
475	4.7																			
685	6.8																			
106	10																			

PHYSICAL DIMENSIONS AND **PAD LAYOUT**



PHYSI	CAL DIMENS	SIONS	MM (IN.)
Size	L	W	t
LD15	0.50 ± 0.05	1.00 ± 0.05	0.18 ± 0.08
(0204)	(0.020 ± 0.002)	(0.040 ± 0.002)	(0.007 ± 0.003)
LD16	0.81 ± 0.15	1.60 ± 0.15	0.13 min.
(0306)	(0.032 ± 0.006)	(0.063 ± 0.006)	(0.005 min.)
LD17	1.27 ± 0.25	2.00 ± 0.25	0.13 min.
(0508)	(0.050 ± 0.010)	(0.080 ± 0.010)	(0.005 min.)
LD18	1.60 ± 0.25	3.20 ± 0.25	0.13 min.
(0612)	(0.063 ± 0.010)	(0.126 ± 0.010)	(0.005 min.)

T - See Range Chart for Thickness and Codes

Solid = X7R







mm (in.)	
LD15	

LD15								
(0204)								
Code	Thickness							
C 0.35 (0.014								

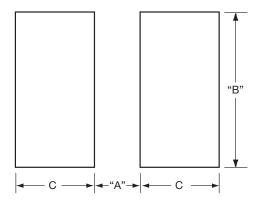
	mm (in.)					
LD16						
(0306)						
Code	Thickness					
Α	0.56 (0.022)					

	mm (in.)					
LD17						
(0508)						
Code	Thickness					
S	0.56 (0.022)					
٧	0.76 (0.030)					
Α	1.02 (0.040)					

	mm (in.)								
LD18									
(0612)									
Code	Thickness								
S	0.56 (0.022)								
٧	0.76 (0.030)								
W	1.02 (0.040)								
Α	1.27 (0.050)								

PAD LAYOUT DIMENSIONS MM (IN.)

Size	Α	В	С
LD15			
(0204)			
LD16	0.31 (0.012)	1.52 (0.060)	0.51 (0.020)
(0306)	0.31 (0.012)	1.32 (0.000)	0.51 (0.020)
LD17	0.51 (0.020)	2.03 (0.080)	0.76 (0.030)
(0508)	0.31 (0.020)	2.03 (0.000)	0.70 (0.030)
LD18	0.76 (0.030)	3.05 (0.120)	0.635 (0.025)
(0612)	3.7 3 (3.000)	0.00 (0.120)	0.000 (0.020)



IDC Low Inductance Capacitors (RoHS)

IDC (InterDigitated Capacitors) 0306/0612/0508



GENERAL DESCRIPTION

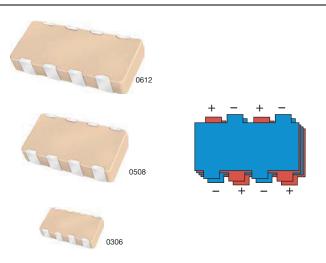
Inter-Digitated Capacitors (IDCs) are used for both semiconductor package and board level decoupling. The equivalent series inductance (ESL) of a single capacitor or an array of capacitors in parallel determines the response time of a Power Delivery Network (PDN). The lower the ESL of a PDN, the faster the response time. A designer can use many standard MLCCs in parallel to reduce ESL or a low ESL Inter-Digitated Capacitor (IDC) device. These IDC devices are available in versions with a maximum height of 0.95mm or 0.55mm.

IDCs are typically used on packages of semiconductor products with power levels of 15 watts or greater. Inter-Digitated Capacitors are used on CPU, GPU, ASIC, and ASSP devices produced on 0.13µ, 90nm, 65nm, and 45nm processes. IDC devices are used on both ceramic and organic package substrates. These low ESL surface mount capacitors can be placed on the bottom side or the top side of a package substrate. The low profile 0.55mm maximum height IDCs can easily be used on the bottom side of BGA packages or on the die side of packages under a heat spreader.

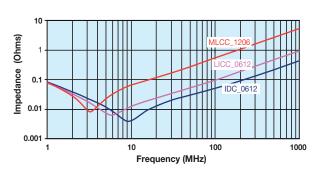
IDCs are used for board level decoupling of systems with speeds of 300MHz or greater. Low ESL IDCs free up valuable board space by reducing the number of capacitors required versus standard MLCCs. There are additional benefits to reducing the number of capacitors beyond saving board space including higher reliability from a reduction in the number of components and lower placement costs based on the need for fewer capacitors.

The Inter-Digitated Capacitor (IDC) technology was developed by KYOCERA AVX. This is the second family of Low Inductance MLCC products created by KYOCERA AVX. IDCs are a cost effective alternative to KYOCERA AVX's first generation low ESL family for high-reliability applications known as LICA (Low Inductance Chip Array).

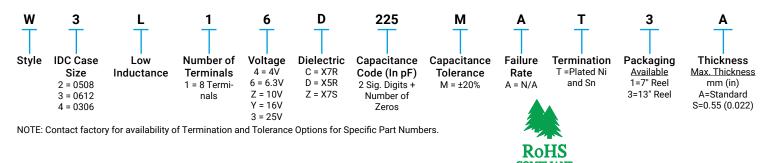
KYOCERA AVX IDC products are available with a lead-free finish of plated Nickel/ Tin.



TYPICAL IMPEDANCE



HOW TO ORDER



PERFORMANCE CHARACTERISTICS

Capacitance Tolerance	±20% Preferred							
Operation Temperature Range	X7R = -55°C to +125°C X5R = -55°C to +85°C X7S = -55°C to +125°C							
Temperature Coefficient	±15% (0VDC), ±22% (X7S)							
Voltage Ratings	4, 6.3, 10, 16, 25 VDC							
Dissipation Factor	≤ 6.3V = 6.5% max; 10V = 5.0% max; ≥ 16V = 3.5% max							
Insulation Resistance (@+25°C, RVDC)	100,000MΩ min, or 1,000MΩ per μ F min.,whichever is less							

Dissipation Factor	No problems observed after 2.5 x RVDC for 5 seconds at 50mA max current
CTE (ppm/C)	12.0
Thermal Conductivity	4-5W/M K
Terminations Available	Plated Nickel and Solder

072522

072522

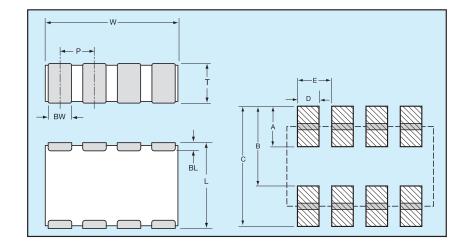
IDC Low Inductance Capacitors (RoHS)



IDC (InterDigitated Capacitors) 0306/0612/0508

SIZE	W4 =	0306		W2 =	Thin	0508	3		W2	2 = 05	80		W	3= Tl	nin 06	12		W3	3 = 06	512		W3	= TH	ICK 0	612
Max. mm	0.	55			0.55			0.95				0.55				0.95					1.22				
Thickness (in.)	(0.0)22)		(0.022	2)			((0.037)				(0.	022)		(0.037)					(0.048)			
WVDC	4	6.3	4	6.3	10	16	25	4	6.3	10	16	25	4	6.3	10	16	4	6.3	10	16	25	4	6.3	10	16
Cap (µF) 0.010																									
0.022																									
0.033																									
0.047																									
0.068																									
0.10																									
0.22																									
0.33																									
0.47																									
0.68																									
1.0																									
1.5																									
2.2																									
3.3																									

PHYSICAL DIMENSIONS AND PAD LAYOUT



Consult factory for additional requirements



PHYSICAL CHIP DIMENSIONS

MILLIMETERS (INCHES)

SIZE	W	L	BW	BL	Р
0206	1.60 ± 0.20	0.82 ± 0.10	0.25 ± 0.10	0.20 ± 0.10	0.40 ± 0.05
0306	(0.063 ± 0.008)	(0.032 ± 0.006)	(0.010 ± 0.004)	(0.008± 0.004)	(0.015 ± 0.002)
0508	2.03 ± 0.20	1.27 ± 0.20	0.30 ± 0.10	0.25 ± 0.15	0.50 ± 0.05
0508	(0.080 ± 0.008)	(0.050 ± 0.008)	(0.012 ± 0.004)	(0.010± 0.006)	(0.020 ± 0.002)
0612	3.20 ± 0.20	1.60 ± 0.20	0.50 ± 0.10	0.25 ± 0.15	0.80 ± 0.10
0012	(0.126 ± 0.008)	(0.063 ± 0.008)	(0.020 ± 0.004)	(0.010 ± 0.006)	(0.031 ± 0.004)

PAD LAYOUT DI-MENSIONS

SIZE	Α	В	С	D	E
0306 0.38 (0.015		0.89 (0.035)	1.27 (0.050)	0.20 (0.008)	0.40 (0.015)
0508	0.64 (0.025)	1.27 (0.050)	1.91 (0.075)	0.28 (0.011)	0.50 (0.020)
0612	0.89 (0.035)	1.65 (0.065)	2.54 (0.010)	0.45 (0.018)	0.80 (0.031)



IDC Low Inductance Capacitors (SnPb)

IDC (InterDigitated Capacitors) 0306/0612/0508



GENERAL DESCRIPTION

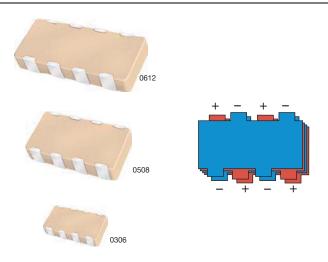
Inter-Digitated Capacitors (IDCs) are used for both semiconductor package and board level decoupling. The equivalent series inductance (ESL) of a single capacitor or an array of capacitors in parallel determines the response time of a Power Delivery Network (PDN). The lower the ESL of a PDN, the faster the response time. A designer can use many standard MLCCs in parallel to reduce ESL or a low ESL Inter-Digitated Capacitor (IDC) device. These IDC devices are available in versions with a maximum height of 0.95mm or 0.55mm.

IDCs are typically used on packages of semiconductor products with power levels of 15 watts or greater. Inter-Digitated Capacitors are used on CPU, GPU, ASIC, and ASSP devices produced on 0.13µ, 90nm, 65nm, and 45nm processes. IDC devices are used on both ceramic and organic package substrates. These low ESL surface mount capacitors can be placed on the bottom side or the top side of a package substrate. The low profile 0.55mm maximum height IDCs can easily be used on the bottom side of BGA packages or on the die side of packages under a heat spreader.

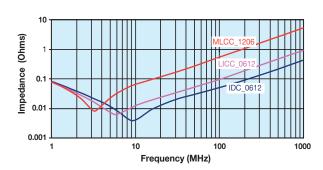
IDCs are used for board level decoupling of systems with speeds of 300MHz or greater. Low ESL IDCs free up valuable board space by reducing the number of capacitors required versus standard MLCCs. There are additional benefits to reducing the number of capacitors beyond saving board space including higher reliability from a reduction in the number of components and lower placement costs based on the need for fewer capacitors.

The Inter-Digitated Capacitor (IDC) technology was developed by KYOCERA AVX. This is the second family of Low Inductance MLCC products created by KYOCERA AVX. IDCs are a cost effective alternative to KYOCERA AVX's first generation low ESL family for high-reliability applications known as LICA (Low Inductance Chip Array).

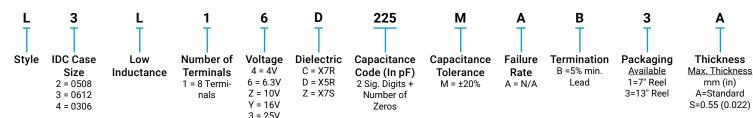
KYOCERA AVX IDC products are available with a lead termination for high reliability military and aerospace applications that must avoid tin whisker reliability issues.



TYPICAL IMPEDANCE



HOW TO ORDER



NOTE: Contact factory for availability of Termination and Tolerance Options for Specific Part Numbers.

Not RoHS Compliant

PERFORMANCE CHARACTERISTICS

Capacitance Tolerance	±20% Preferred
Operation Temperature Range	X7R = -55°C to +125°C X5R = -55°C to +85°C X7S = -55°C to +125°C
Temperature Coefficient	±15% (0VDC), ±22% (X7S)
Voltage Ratings	4, 6.3, 10, 16, 25 VDC
Dissipation Factor	≤ 6.3V = 6.5% max; 10V = 5.0% max; ≥ 16V = 3.5% max
Insulation Resistance (@+25°C, RVDC)	100,000MΩ min, or 1,000MΩ per μF min.,whichever is less

Dissipation Factor	No problems observed after 2.5 x RVDC for 5 seconds at 50mA max current
CTE (ppm/C)	12.0
Thermal Conductivity	4-5W/M K
Terminations Available	Plated Nickel and Solder

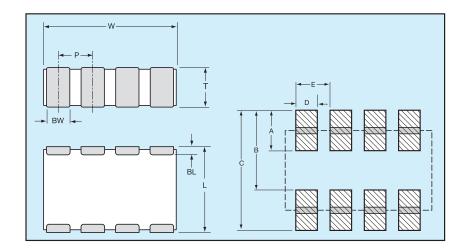
IDC Low Inductance Capacitors (SnPb)



IDC (InterDigitated Capacitors) with Sn/Pb Termination 0306/0612/0508

SIZE	W4 =	0306		W2 =	Thin	0508	В		W2	2 = 05	508		W	3= Th	nin 06	12		W3	3 = 06	512		W3	= THI	ICK 0	612
Max. mm					0.55.					0.95					.55				0.95					22	
Thickness (in.)	(0.0)			(0.022)		(0.037)			(0.022)			(0.037)					(0.048)								
WVDC	4	6.3	4	6.3	10	16	25	4	6.3	10	16	25	4	6.3	10	16	4	6.3	10	16	25	4	6.3	10	16
Cap (μF) 0.010																									
0.022																									
0.033																									
0.047																									
0.068																									
0.10																									
0.22																									
0.33																									
0.47																									
0.68																									
1.0																									
1.5																									
2.2																									
3.3																									

PHYSICAL DIMENSIONS AND PAD LAYOUT



Consult factory for additional requirements



PHYSICAL CHIP DIMENSIONS

MILLIMETERS (INCHES)

SIZE	W	L	BW	BL	P
0206	1.60 ± 0.20	0.82 ± 0.10	0.25 ± 0.10	0.20 ± 0.10	0.40 ± 0.05
0306	(0.063 ± 0.008)	(0.032 ± 0.006)	(0.010 ± 0.004)	(0.008± 0.004)	(0.015 ± 0.002)
0508	2.03 ± 0.20	1.27 ± 0.20	0.30 ± 0.10	0.25 ± 0.15	0.50 ± 0.05
0306	(0.080 ± 0.008)	(0.050 ± 0.008)	(0.012 ± 0.004)	(0.010± 0.006)	(0.020 ± 0.002)
0612	3.20 ± 0.20	1.60 ± 0.20	0.50 ± 0.10	0.25 ± 0.15	0.80 ± 0.10
0012	(0.126 ± 0.008)	(0.063 ± 0.008)	(0.020 ± 0.004)	(0.010 ± 0.006)	(0.031 ± 0.004)

PAD LAYOUT DI-MENSIONS

SIZE	Α	В	С	D	Е
0306	0.38	0.89	1.27	0.20	0.40
	(0.015)	(0.035)	(0.050)	(0.008)	(0.015)
0508	0.64	1.27	1.91	0.28	0.50
	(0.025)	(0.050)	(0.075)	(0.011)	(0.020)
0612	0.89	1.65	2.54 (0.010)	0.45	0.80

LGA Low Inductance Capacitors

0204/0306 Land Grid Array





Land Grid Array (LGA) capacitors are the latest family of low inductance MLCCs from KYOCERA AVX. These new LGA products are the third low inductance family developed by KYOCERA AVX. The innovative LGA technology sets a new standard for low inductance MLCC performance.

Our initial 2 terminal versions of LGA technology deliver the performance of an 8 terminal IDC low inductance MLCC with a number of advantages including:

- Simplified layout of 2 large solder pads compared to 8 small pads for IDCs
- Opportunity to reduce PCB or substrate contribution to system ESL by using multiple parallel vias in solder pads
- Advanced FCT manufacturing process used to create uniformly flat terminations on the capacitor that resist "tombstoning"
- Better solder joint reliability

APPLICATIONS

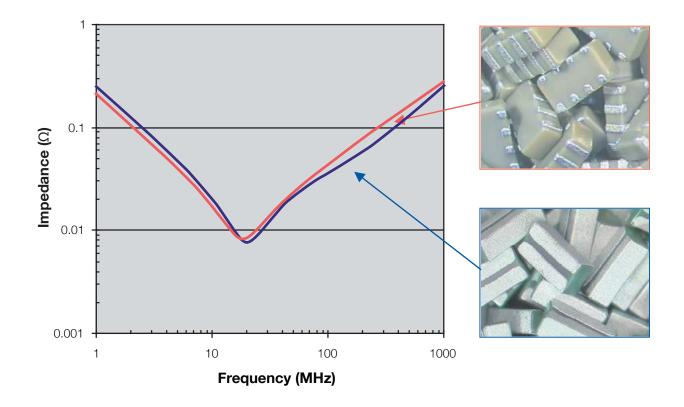
Semiconductor Packages

- · Microprocessors/CPUs
- Graphics Processors/GPUs
- Chipsets
- **FPGAs**
- **ASICs**

Board Level Device Decoupling

- · Frequencies of 300 MHz or more
- · ICs drawing 15W or more
- · Low voltages
- · High speed buses

0306 2 TERMINAL LGA COMPARISON WITH 0306 8 TERMINAL IDC





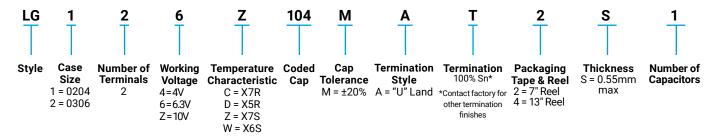
LGA Low Inductance Capacitors

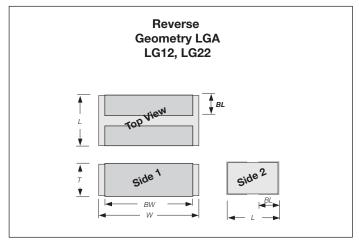




SIZE		L	G12 (0204	!)			LG22 (0306)								
Length mm (in.)		0.50 (0.020)							0.76 (0.030)							
Width mm (in.)		1.00 (0.039)								1.6	0.0)	63)				
Temp. Char.	X5R	(D)	X7S	(Z)	X6S	(W)	Х	7R (C	:)	X5R	(D)	X7S	(Z)	X6S (W)		
Working Voltage	6.3	4	6.3	4	6.3	4	10	6.3	4	6.3	4	6.3	4	6.3	4	
	(6)	(4)	(6)	(4)	(6)	(4)	(Z)	(6)	(4)	(6)	(4)	(6)	(4)	(6)	(4)	
Cap (µF) 0.010 (103)																
0.022 (223)																
0.047 (473)																
0.100 (104)																
0.220 (224)																
0.330 (334)																
0.470 (474)																
1.000 (105)																
2.200 (225)																
		= X7	R		= X5	R		= X7	S		= X6	S				

HOW TO ORDER





PART DIMENSIONS

MM (INCHES)

Series	L	w	Т	BW	BL
LG12 (0204)	0.5 ± 0.05	1.00 ± 0.10	0.50 ± 0.05	0.8 ± 0.10	0.13 ± 0.08
	(0.020±0.002)	(0.039 ± 0.004)	(0.020 ± 0.002)	(0.031 ± 0.004)	(0.005 ± 0.003)
LG22 (0306)	0.76 ± 0.10	1.60 ± 0.10	0.50 ± 0.05	1.50 ±0.10	0.28 ± 0.08
	(0.030 ± 0.004)	(0.063 ± 0.004)	(0.020 ± 0.002)	(0.059 ± 0.004)	(0.011 ± 0.003)



RECOMMENDED SOLDER PAD DIMENSIONS

ENSIONS	MM (INCHES)



Series	PL	PW1	G
LG12 (0204)	0.50 (0.020)	1.00 (0.039)	0.20 (0.008)
LG22 (0306)	0.65 (0.026)	1.50 (0.059)	0.20 (0.008)



Downloaded from Arrow.com.

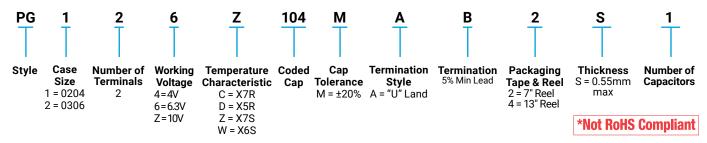
LGA Low Inductance Capacitors

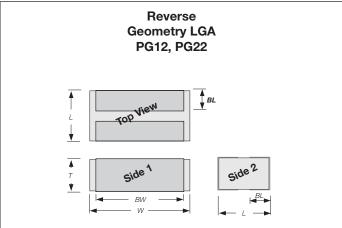


0204/0306 Land Grid Array - Tin/Lead Termination "B"

SIZE		Р	G12	(0204	l)			PG22 (0306)								
Length mm (in.)			0.50 (0.020)				0.76 (0.030)								
Width mm (in.)		1.00 (0.039)								1.6	0.0)	63)				
Temp. Char.	X5F	(D)	X78	(Z)	X6S	(W)	Х	7R (C)	X5R	(D)	X7S	(Z)	X6S	(W)	
Working Voltage	6.3	4	6.3	4	6.3	4	10	6.3	4	6.3	4	6.3	4	6.3	4	
	(6)	(4)	(6)	(4)	(6)	(4)	(Z)	(6)	(4)	(6)	(4)	(6)	(4)	(6)	(4)	
Cap (µF) 0.010 (103)																
0.022 (223)																
0.047 (473)																
0.100 (104)																
0.220 (224)																
0.330 (334)																
0.470 (474)																
1.000 (105)																
2.200 (225)																
		= X7	R		= X5	R		= X7S = X6S								

HOW TO ORDER





PART DIMENSIONS

MM (INCHES)

Series	L	W	Т	BW	BL
PG12 (0204)	0.5 ± 0.05	1.00 ± 0.10	0.50 ± 0.05	0.8 ± 0.10	0.13 ± 0.08
	(0.020±0.002)	(0.039 ± 0.004)	(0.020 ± 0.002)	(0.031 ± 0.004)	(0.005 ± 0.003)
PG22 (0306)	0.76 ± 0.10	1.60 ± 0.10	0.50 ± 0.05	1.50 ±0.10	0.28 ± 0.08
	(0.030 ± 0.004)	(0.063 ± 0.004)	(0.020 ± 0.002)	(0.059 ± 0.004)	(0.011 ± 0.003)

RECOMMENDED SOLDER PAD DIMENSIONS

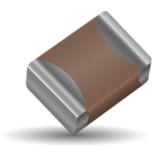
MM (INCHES)



Series	PL	PW1	G
PG12 (0204)	0.50 (0.020)	1.00 (0.039)	0.20 (0.008)
PG22 (0306)	0.65 (0.026)	1.50 (0.059)	0.20 (0.008)

AT Series - 200°C & 250°C Rated





Present military specifications, as well as a majority of commercial applications, require a maximum operating temperature of 125°C. However, the emerging market for high temperature electronics demands capacitors operating reliably at temperatures beyond 125°C. KYOCERA AVX's high temperature chip capacitor product line, has been extended with the BME COG chip. All AT chips have verified capabilities of long term operation up to 250°C for applications in both military and commercial businesses. These capacitors demonstrate high volumetric efficiency, high insulation resistance and low ESR/ESL for the most demanding applications, such as "down-hole" oil exploration and aerospace programs.

HOW TO ORDER

AT10	3	Т	104	K	Α	Т	2	Α
	T	T		Т	T	Τ	Т	Т
Style	Voltage	Temperature	Capacitance Code	Capacitance	Test Level	Termination	Packaging	Special
AT03 = 0603	Code	Coefficient	(2 significant digits	Tolerance	A = Standard	1 = Pd/Ag	2 = 7" Reel	Code
AT05 = 0805	16V = Y	PME	+ no. of zeros)	$J = \pm 5\%$		T = 100% Sn Plated	4 = 13" Reel	A = Standard
AT06 = 1206	25V = 3	C0G 250°C = A	101 = 100pF	$K = \pm 10\%$		(RoHS Compliant)	9 = Bulk	
AT10 = 1210	50V = 5	COG 200°C = 2	102 = 1nF	$M = \pm 20\%$		7 = Ni/Au Plated		
AT12 = 1812		VHT 250°C = T	103 = 10nF			(For 250°C BME		
AT14 = 2225		VHT 200°C = 4	104 = 100nF			COG Only)		
		BME	105 = 1μF			• •		
		C0G 250°C = 5	·					
		COG 200°C = 3						

ELECTRICAL SPECIFICATIONS

Temperature Coefficient

PME COG 0±30ppm/°C, -55C to 250°C BME COG 0±30ppm/°C, -55C to 200°C

See TCC Plot for +250°C

VHT: T ±15%, -55°C to +150°C

See TCC Plot for +250°C

Capacitance Test (MIL-STD-202, Method 305) 25°C, 1.0 ± 0.2 Vrms (open circuit voltage) @ 1kHz

Dissipation factor 25°C

COG: 0.15% Max at 1.0 ± 0.2 Vrms (open circuit voltage) @ 1kHz VHT: 2.5% Max at 1.0 ± 0.2 Vrms (open circuit voltage) @ 1kHz

Insulation Resistance 25°C (MIL-STD-202, Method 302)

100GΩ or 1000MΩ- μ F (whichever is less)

Insulation Resistance 125°C (MIL-STD-202, Method 302)

 $10G\Omega$ or $100M\Omega$ -μF (whichever is less)

Insulation Resistance 200°C (MIL-STD-202, Method 302)

1GΩ or 10MΩ- μ F (whichever is less)

Insulation Resistance 250°C (MIL-STD-202, Method 302)

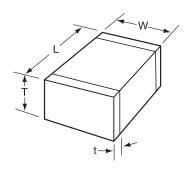
100M Ω or 1M Ω -uF (whichever is less)

Direct Withstanding Voltage 25°C (Flash Test)

250% rated voltage for 5 seconds with 50mA max charging current

DIMENSIONS:

MILLIMETERS (INCHES)



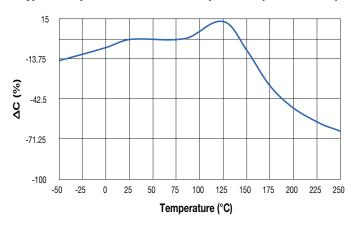
Size	AT03 = 0603	AT05= 0805	AT06=1206	AT10=1210	AT12=1812	AT14=2225
(I) Longth	1.60 ± 0.15	2.01 ± 0.20	3.20 ± 0.20	3.20 ± 0.20	4.50 ± 0.30	5.72 ± 0.25
(L) Length	(0.063 ± 0.006)	(0.079 ± 0.008)	(0.126 ± 0.008)	(0.126 ± 0.008)	(0.177 ± 0.012)	(0.225 ± 0.010)
(W) Width	0.81 ± 0.15	1.25 ± 0.20	1.60 ± 0.20	2.50 ± 0.20	3.20 ± 0.20	6.35 ± 0.25
(vv) vvidu i	(0.032 ± 0.006)	(0.049 ± 0.008)	(0.063 ± 0.008)	(0.098 ± 0.008)	(0.126 ± 0.008)	(0.250 ± 0.010)
(T) Thickness Max.	1.02	1.30	1.52	1.70	2.54	2.54
(1) THICKHESS Max.	(0.040)	(0.051)	(0.060)	(0.067)	(0.100)	(0.100)
(t) min.	0.25 (0.010)	0.25 (0.010)	0.25 (0.010)	0.25 (0.010)	0.25 (0.010)	0.25 (0.010)
terminal max.	0.75 (0.030)	0.75 (0.030)	0.75 (0.030)	0.75 (0.030)	1.02 (0.040)	1.02 (0.040)

AT Series - 200°C & 250°C Rated

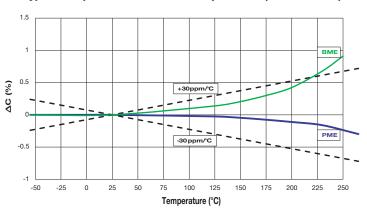


PERFORMANCE CHARACTERISTICS

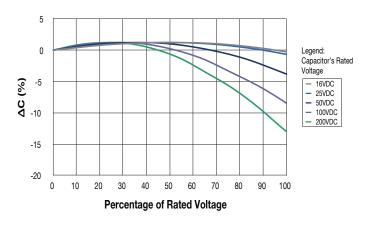
Typical Temperature Coefficient of Capacitance (VHT Dielectric)



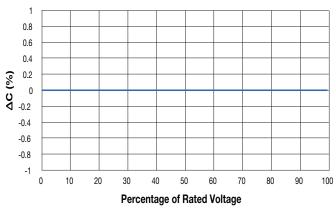
Typical Temperature Coefficient of Capacitance (COG Dielectric)



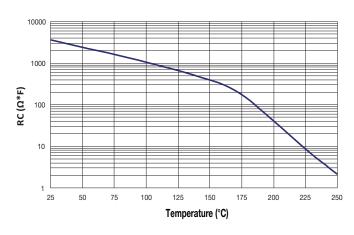
Typical Voltage Coefficient of Capacitance (VHT Dielectric)



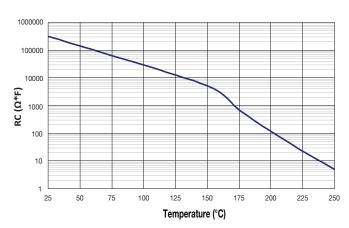
Typical Voltage Coefficient of Capacitance (COG Dielectric)



Typical RC vs Temperature (VHT Dielectric)



Typical RC vs Temperature (COG Dielectric)

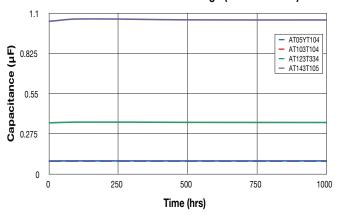


AT Series - 200°C & 250°C Rated



RELIABILITY

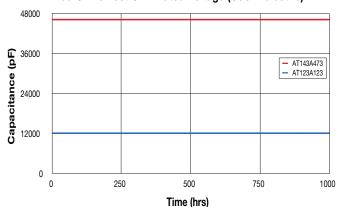
250°C Life Test @ 2x Rated Voltage (VHT Dielectric)



VHT - Failure Rate @ 90% Confidence Level (%/1000 hours)									
Temperature (°C)	50% Rated Voltage	100% Rated Voltage							
200	0.002	0.017							
250	0.026	0.210							

^{*}Typical 1210, 1812, 2225 Failure Rate Analysis based on 250°C testing and voltage ratings specified on the following page.

250°C Life Test @ 2x Rated Voltage (C0G Dielectric)

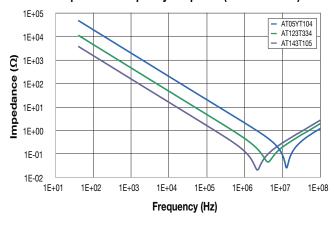


COG - Failure Rate @ 90% Confidence Level (%/1000 hours)								
Temperature (°C)	50% Rated Voltage	100% Rated Voltage						
200	0.006	0.047						
250	0.074	0.590						

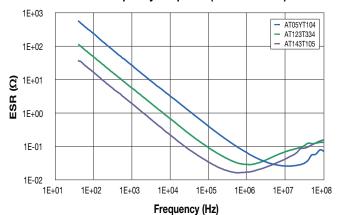
^{*}Typical 1812 and 2225 Failure Rate Analysis based on 250°C testing and voltage ratings specified on the following page.

FREQUENCY RESPONSE

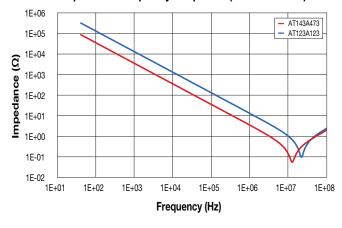
Impedance Frequency Response (VHT Dielectric)



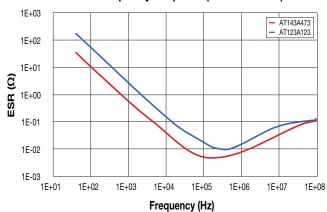
ESR Frequency Response (VHT Dielectric)



Impedance Frequency Response (COG Dielectric)



ESR Frequency Response (C0G Dielectric)



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CAPACITANCE RANGE PREFERRED SIZES ARE SHADED

_	HT		emp. Coeffi				Rate		•	ATGO	ATC C
(Case S	ize	AT03 =	ATO			06 =	AT1		AT12 =	AT14 =
			0603	08			06	12		1812	2225
_;	<u>Solderi</u>	ng Imm	Reflow/Wave 1.60±0.15	2.01 :			//Wave ±0.20	Refloy 3.20:		Reflow Only 4.50 ± 0.30	Reflow Only 5.72 ± 0.25
(L) I	Length	(in.)	(0.063±0.006)	(0.079			± 0.008)		0.008)	(0.177±0.012)	(0.225±0.010)
(14/)	Width	mm	0.81 ± 0.15	1.25:	±0.20	1.60	±0.20	2.50±0.20		3.20±0.20	6.35±0.25
(vv)	wiatn	(in.)	(0.032±0.006)	(0.049±0.008)		_	±0.008)	_	± 0.008)	(0.126±0.008)	(0.250 ± 0.010)
(T) T	hickness	mm	1.02	1.		1.52		1.		2.54	2.54
` '		(in.) min	(0.040) 0.25(0.010)	(0.051) 0.25(0.010)			060) 0.010)	(0.067) 0.25(0.010)		(0.100) 0.25(0.010)	(0.100) 0.25(0.010)
(t) Terminal max			0.75 (0.030)	0.75(0.030)	0.75(0		1.02 (0.040)	1.02 (0.040)
Rat	ted Tem		200	200			00	20		200	200
	np. Coef		4	4			4			4	4
١	/oltage	(V)	25	25	50	25	50	25	50	50	50
	1000	102									
	1200	122									
	1500	152									
	1800	182									
	2200	222									
Сар	2700	272									
(pF)	3300	332									
	3900	392									
	4700	472									
	5600	562									
	6800	682									
	8200	822									
┪	0.010	103									
	0.012	123									
	0.012	153									
	0.013	183									
	0.018	223									
		_									
	0.027	273									
	0.033	333									
	0.039	393									
	0.047	473									
	0.056	563									
	0.068	683									
Сар	0.082	823									
(μF)	0.100	104									
	0.120	124									
	0.150	154									
	0.180	184									
	0.220	224									
	0.270	274									
	0.330	334									
	0.390	394									
	0.470	474									
	0.560	564									
	0.680	684									
	0.820	824									
	1.000	105									
٦	/oltage	(V)	25	25	50	25	50	25	50	50	50
Ra	Rated Temp. (°C)		200	20	00	2	00	20	00	200	200
			AT03 =)5 =		06 =	AT1		AT12 =	AT14 =
(Case S	ize	0603	08	05	12	.06	12	10	1812	2225

	A		AT03 =	A 1 1)5 =	ΔΙΙ	06 =	AI	10 =	AT12 =	AT14 =
	Case :	Size	0603		05		206	12		1812	2225
	Solde	ring	Reflow/Wave		/Wave		v/Wave	Reflo		Reflow Only	Reflow Only
		mm	1.60±0.15		±0.20	3.20±0.20		3.20:		4.50±0.30	5.72±0.25
L) L	ength.	(in.)	(0.063±0.006)	(0.079±0.008)		(0.126±0.008)			±0.008)	(0.177±0.012)	(0.225±0.010
W) Width		mm	0.81±0.15	1.25±0.20		1.60±0.20		2.50±0.20		3.20±0.20	6.35±0.25
(vv	wiatn	(in.)	(0.032±0.006)	(0.049±0.008)			±0.008)		±0.008)	(0.126±0.008)	(0.250±0.010
T) T	hickness	mm	1.02		30		52		70	2.54	2.54
.,,	THOM ICOO	(in.)	(0.040)	(0.0			060)	(0.0		(0.100)	(0.100)
t) T	erminal	min	0.25(0.010)	0.25(0.010)	0.25(0.25 (0.010)	0.25(0.010)
_		max	0.75(0.030)	0.75((0.030)	0.75(1.02 (0.040)	1.02 (0.040)
	ated Ter		250 T	250		2	50	2	50	250 T	250 T
_!	emp. Co Voltag		16	16 25		16	25	16	25	25	25
_			10	10	23	10	23	10	23	23	23
-	1000	102									
ļ	1200	122									
	1500	152									
	1800	182									
	2200	222									
Сар	2700	272									
pF)	3300	332									
l	3900	392									
	4700	472									
ſ	5600	562									
İ	6800	682									
ŀ	8200	822									
┪	0.010	103									
ŀ	0.012	123									
ŀ											
ŀ	0.015	153						_			
ļ	0.018	183									
ļ	0.022	223									
Į	0.027	273									
	0.033	333									
ſ	0.039	393									
Ī	0.047	473									
ŀ	0.056	563									
ŀ	0.068	683									
ŀ	0.082	823									
Сар	0.002										
μF)		104	 								
-	0.120	124									
ļ	0.150	154									
ļ	0.180	184	ļ				<u> </u>				
l	0.220	224									
	0.270	274									
ſ	0.330	334									
İ	0.390	394									
ı	0.470	474									
ŀ	0.560	564									
ŀ	0.680	684					<u> </u>	\vdash			
-		824					-	\vdash	\vdash		
-	0.820						-	<u> </u>	<u> </u>		
┙	1.000	105						<u> </u>			
	Voltag		16	16	25	16	25	16	25	25	25
R	ated Ter	np. (°C)	250		50		50		50	250	250
_	Case Size		AT03 =	AT)5 =	AT	06 =	AT1		AT12 =	AT14 =

Voltage rating per table. Capacitance values specified at 25°C, derate capacitance value based on TCC and VCC Plots on page 107. NOTE: Contact factory for non-specified capacitance values.

AT Series - 200°C & 250°C Rated



CAPACITANCE RANGE PREFERRED SIZES ARE SHADED

BME COG	Temp. Coefficient: 4	200°C Rated
DIVIL 000	. cp. cccc.c	200°C Rateu

BME COG Temp. Coefficie						nt: 4	200	O°C Rated				
(Case Siz	ze	A.	T03:	=0603		AT05	=0805	AT06	=1206		
9	Solderin	ng	Re	eflow	//Wave		Reflov	v/Wave	Reflow	//Wave		
(L)	Length	mm		1.60±	±0.15		2.01	±0.20	3.20:	±0.20		
		(in.)			±0.006)			±0.008)		±0.008)		
(W)	Width	mm (:)			±0.15			±0.20		±0.20		
m	hickness	(in.) mm	(U	.032 <u>1</u> 1.0	±0.006)			±0.008) 30	(0.063±0.008) 1.52			
(1)	TIICKIICOO	(in.)		(0.0)				051)	(0.060)			
(t) 1	erminal	min	(0.010)			0.010)	0.25 (0.010)			
		max						0.030)	0.75(
Rat	Rated Temp. (°C)			20	00		2	00	20	00		
	Temp. Coefficeint		3				:	3	;	3		
	Voltage (25		50	2	5	50	25	50		
Сар	39	390	25		30		<u> </u>	30	2.5	30		
(pF)	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										
	680 820	681 821										
	1000	102										
	1200	122										
	1500	152										
	1800	182										
	2200	222										
	2700	272										
	3300	332										
	3900	392										
	4700	472										
	5600	562										
	6800	682				-						
Cap	8200 0.010	822 103										
(μF)	0.010	123				 						
	0.012											
	0.013											
	0.022	223										
	0.027	273										
	0.033	333										
	0.039	393										
	0.047	473										
	0.056	563										
	0.068	683										
		823										
L.	0.100	_			F0		-	F0	0.5	F0		
	oltage (25		50		5	50	25	50		
	ed Temp		200	T00	200		00	200	200	200		
	Case Siz	ze	A	103:	=0603		A105	=0805	AT06:	AT06=1206		

Case	Size	AT03=0603	AT05=0805	AT06 = 1206		
Solde	rina	Reflow/Wave	Reflow/Wave	Reflow/Wave		
L) Lengtl		1.60±0.15	2.01 ± 0.20	3.20±0.20		
_, _cg	(in.)	(0.063±0.006)	(0.079±0.008)	(0.126±0.008)		
W) Width		0.81±0.15	1.25±0.20	1.60±0.20		
,	(in.)	(0.032±0.006)	(0.049±0.008)	(0.063±0.008)		
T)	mm	1.02	1.30	1.52		
hickness	(in.)	(0.040)	(0.051)	(0.060)		
t)	min	0.25 (0.010)	0.25(0.010)	0.25 (0.010)		
erminal	max	0.75 (0.030)	0.75(0.030)	0.75 (0.030)		
Rated Te	mp. (°C)	250	250	250		
Ten	1р.	5	5	5		
Coeff		J	-	J		
Voltag	je (V)	25	25	25		
ap 39	390					
^{oF)} 47	470					
56	560					
68	680					
82	820					
100	101					
120	121					
	1					
150	151					
180	181					
220	221					
270	271					
330	331					
390	391					
470	471					
560	561					
680	681					
820	1 1					
1000	1 1					
1200	1 1					
	1 1					
1500	1 1					
1800	1 1					
2200	1					
2700	1 1					
3300	1 1					
3900	392					
4700	472					
5600	562					
6800	682					
8200	822					
ap 0.010	103	ĺ				
0.012	123					
0.01						
0.018	1 1					
0.01	1 1					
	1 1					
0.02	\rightarrow					
0.033	1 1					
0.039	1 1					
0.04	1 1					
0.056	563					
0.068	683					
0.082	823					
0.100	104					
Voltag	e (V)	25	25	25		
	mp. (°C)	250	250	250		
		AT03=0603	AT05=0805	AT06=1206		

Voltage rating per table. Capacitance values specified at 25°C, derate capacitance value based on TCC and VCC Plots on page 107. NOTE: Contact factory for non-specified capacitance values.



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CAPACITANCE RANGE PREFERRED SIZES ARE SHADED

P	ME	CO	G Temp. (Coefficient: 2	200°C Rate	ed		P	ME	CO(G Temp. C	Coefficient: A	250°C Rate	ed	
	Case S	ize	AT05 = 0805	AT06 = 1206	AT10 = 1210	AT12 = 1812	AT14 = 2225		Case S	Size	AT05 = 0805	AT06 = 1206	AT10 = 1210	AT12 = 1812	AT14 = 2225
	Solder	ina	Reflow/Wave	Reflow/Wave	Reflow Only	Reflow Only	Reflow Only		Solder	ina	Reflow/Wave	Reflow/Wave	Reflow Only	Reflow Only	Reflow Only
		mm	2.01 ± 0.20	3.20 ± 0.20	3.20 ± 0.20	4.50 ± 0.30	2.75 ± 0.25			mm	2.01 ± 0.20	3.20 ± 0.20	3.20 ± 0.20	4.50 ± 0.30	2.75 ± 0.25
(L)	ength	(in.)	(0.079 ± 0.008)		(0.126 ± 0.008)	(0.177 ± 0.012)	(0.225 ± 0.010)	(L) L	ength	(in.)	(0.079 ± 0.008)	(0.126 ± 0.008)	(0.126 ± 0.008)	(0.177 ± 0.012)	(0.225 ± 0.010)
210	Mr. Ivi	mm	1.25 ± 0.20	1.60 ± 0.20	2.50 ± 0.20	3.20 ± 0.20	6.35 ± 0.25	440	Mr. Id	mm	1.25 ± 0.20	1.60 ± 0.20	2.50 ± 0.20	3.20 ± 0.20	6.35 ± 0.25
(W)	Width	(in.)	(0.049 ± 0.008)	(0.063 ± 0.008)	(0.098 ± 0.008)	(0.126 ± 0.008)	(0.250 ± 0.010)	(w)	Width	(in.)	(0.049 ± 0.008)	(0.063 ± 0.008)	(0.098 ± 0.008)	(0.126 ± 0.008)	(0.250 ± 0.010)
(T)	This law are	mm	1.30	1.52	1.70	2.54	2.54	(T) 7	ri.:	mm	1.30	1.52	1.70	2.54	2.54
(1)	Thickness	(in.)	(0.051)	(0.060)	(0.067)	(0.100)	(0.100)	(1)	Thickness	(in.)	(0.051)	(0.060)	(0.067)	(0.100)	(0.100)
(±) 7	arminal	min	0.25 (0.010)	0.25 (0.010)	0.25 (0.010)	0.25 (0.010)	0.25 (0.010)	(+) T	arminal	min	0.25 (0.010)	0.25 (0.010)	0.25 (0.010)	0.25 (0.010)	0.25 (0.010)
(1)	erminal	max	0.75 (0.030)	0.75 (0.030)	0.75 (0.030)	1.02 (0.040)	1.02 (0.040)	(ι) 1	erminal	max	0.75 (0.030)	0.75 (0.030)	0.75 (0.030)	1.02 (0.040)	1.02 (0.040)
R	ated Tem	p. (°C)	200	200	200	200	200	Ra	ated Tem	p. (°C)	250	250	250	250	250
Te	mp. Coe	fficeint	2	2	2	2	2	Te	mp. Coe	fficeint	Α	Α	Α	Α	A
	Voltage	(V)	50	50	50	50	50		Voltage	(V)	25	25	25	25	25
	100	101							100	101					
	120	121							120	121					
	150	151							150	151					
	180	181							180	181					
	220	221							220	221					
	270	271							270	271					
	330	331							330	331					
	390	391							390	391					
	470	471							470	471					
	560	561							560	561					
	680	681							680	681					
Cap (pF)	820	821						(pF)	820	821					
(pr)	1000	102						(pr)	1000	102					
	1200	122							1200	122					
	1500	152							1500	152					
	1800	182							1800	182					
	2200	222							2200	222					
	2700	272							2700	272					
	3300	332							3300	332 392					
	4700								4700	472					
	5600	_							5600	562					
	6800	682							6800	682					
	8200	_							8200	822					
\vdash	0.010	_							0.010	_					
	0.012	_							0.012	123					
	0.015								0.015						
	0.018	_							0.018	_					
	0.022	223						İ	0.022	223					
١.	0.027	273							0.027	273					
Cap (µF)	0.033	333						Cap (µF)	0.033	333					
(Pr)	0.039	393						(hr.)	0.039	393					
	0.047	_							0.047	473					
	0.056	_							0.056	_					
	0.068	_							0.068	_					
	0.082								0.082						
	0.100								0.100						
	Voltage	<u> </u>	50	50	50	50	50		Voltage	<u> </u>	25	25	25	25	25
Ra	ted Tem	p. (°C)	200	200	200	200	200	Rat	ted Tem	ıр. (°С)	250	250	250	250	250
	Case S	ize	AT05 = 0805	AT06 = 1206	AT10 = 1210	AT12 = 1812	AT14 = 2225		Case S	Size	AT05 = 0805	AT06 = 1206	AT10 = 1210	AT12 = 1812	AT14 = 2225

Voltage rating per table. Capacitance values specified at 25°C, derate capacitance value based on TCC and VCC Plots on page 107. NOTE: Contact factory for non-specified capacitance values.

For 600V to 5000V Applications





High value, low leakage and small size are difficult parameters to obtain in capacitors for high voltage systems. KYOCERA AVX special high voltage MLC chip capacitors meet these performance characteristics and are designed for applications such as snubbers in high frequency power converters, resonators in SMPS, and high voltage coupling/dc blocking. These high voltage chip designs exhibit low ESRs at high frequencies.

Larger physical sizes than normally encountered chips are used to make high voltage MLC chip products. Special precautions must be taken in applying these chips in surface mount assemblies. The temperature gradient during heating or cooling cycles should not exceed 4°C per second. The preheat temperature must be within 50°C of the peak temperature reached by the ceramic bodies through the soldering process. Chip sizes 1210 and larger should be reflow soldered only. Capacitors may require protective surface coating to prevent external arcing.

For 1825, 2225 and 3640 sizes, KYOCERA AVX offers leaded version in either thru-hole or SMT configurations (for details see section on high voltage leaded MLC chips)

NEW 630V RANGE

HOW TO ORDER

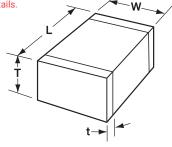
1808	Α	Α	271	М	Α	Т	2	Α
\top	T	T	T	T	T	T	T	T
Style	Voltage	Temperature	Capacitance	Capacitance	Test Level	Termination*	Packaging	Special
0805	C = 600V/630V	Coefficient	Code	Tolerance	A = Standard	T = Plated Ni and Sn	2 = 7" Reel**	Code
1206	A = 1000V	A = NPO(COG)	(2 significant digits	C0G: $J = \pm 5\%$		(RoHS Compliant)	4 = 13" Reel**	A = Standard
1210	S = 1500V	C = X7R ` ´	+ no. of zeros)	K = ±10%			6 = Tray (3640 Style)	
1808	G = 2000V		Examples:	$M = \pm 20\%$				
1812	W = 2500V		10 pF = 100	X7R: K = ±10%				
1825	H = 3000V		100 pF = 101	$M = \pm 20\%$				
2220	J = 4000V		1,000 pF = 102	Z = +80%,				
2225	K = 5000V		22,000 pF = 223	-20%				
3640			220,000 pF = 224					
***			1 μF = 105					

Notes:

- 1. Capacitors with X7R dielectrics are not intended for applications across AC supply mains or AC line filtering with polarity reversal. Contact plant for recommendations. Contact factory for availability of Termination and Tolerance options for Specific Part Numbers.
- *Terminations with 5% minimum lead (Pb) is available, see pages 100 and 101 for LD style. Leaded terminations are available, see pages 102-106.

**The 3640 Style is not available on Reels.

^{***} KYOCERA AVX offers nonstandard chip sizes. Contact factory for details





DIMENSIONS: millimeters (inches)

SIZE	0805	1206	1210*	1808*	1812*	1825*	2220*	2225*	3640*
(L) Length	2.10 ± 0.20	3.30 ± 0.30	3.30 ± 0.40	4.60 ± 0.50	4.60 ± 0.50	4.60 ± 0.50	5.70 ± 0.50	5.70 ± 0.50	9.14 ± 0.25
	(0.083 ± 0.008)	(0.130 ± 0.012)	(0.130 ± 0.016)	(0.181 ± 0.020)	(0.181 ± 0.020)	(0.181 ± 0.020)	(0.224 ± 0.020)	(0.224 ± 0.020)	(0.360 ± 0.010)
(W) Width	1.25 ± 0.20	1.60 ± 0.20	2.50 ± 0.30	2.00 ± 0.20	3.20 ± 0.30	6.30 ± 0.40	5.00 ± 0.40	6.30 ± 0.40	10.2 ± 0.25
	(0.049 ±0.008)	(0.063 ± 0.008)	(0.098 ± 0.012)	(0.079 ± 0.008)	(0.126 ± 0.012)	(0.248 ± 0.016)	(0.197 ± 0.016)	(0.248 ± 0.016)	(0.400 ± 0.010)
(t) terminal min. max.	0.50 ± 0.20	0.60 ± 0.20	0.75 ± 0.35	0.75 ± 0.35	0.75 ± 0.35	0.75 ± 0.35	0.85 ± 0.35	0.85 ± 0.35	0.76 (0.030)
	(0.020 ± 0.008)	(0.024 ± 0.008)	(0.030 ± 0.014)	(0.030 ± 0.014)	(0.030 ± 0.014)	(0.030 ± 0.014)	(0.033 ± 0.014)	(0.033 ± 0.014)	1.52 (0.060)

^{*}Reflow Soldering Only

For 600V to 5000V Applications



NPO (COG) DIELECTRIC - PERFORMANCE CHARACTERISTICS

Capacitance Range	10 pF to 0.100 μF (25°C, 1.0 ±0.2 Vrms at 1kHz, for ≤ 1000 pF use 1 MHz)					
Capacitance Tolerances	±5%, ±10%, ±20%					
Dissipation Factor	0.1% max. (+25°C, 1.0 ±0.2 Vrms, 1kHz, for ≤ 1000 pF use 1 MHz)					
Operating Temperature Range	-55°C to +125°C					
Temperature Characteristic	0 ±30 ppm/°C (0 VDC)					
Voltage Ratings	600, 630, 1000, 1500, 2000, 2500, 3000, 4000 & 5000 VDC (+125°C)					
Insulation Resistance (+25°C, at 500 VDC)	100K MΩ min. or 1000 MΩ - μF min., whichever is less					
Insulation Resistance (+125°C, at 500 VDC)	10K MΩ min. or 100 MΩ - μF min., whichever is less					
Dielectric Strength	Minimum 120% rated voltage for 5 seconds at 50 mA max. current					

NPO (COG) CAPACITANCE RANGE - PREFERRED SIZES ARE SHADED

Case			0805				1206						10							808							18				
Solde			low/V				ow/W					Reflo							Reflo		/						Reflov				
(L) Length	mm (:)		10 ± 0				0 + 0.				//	3.30						//	4.60 -		٥)					(4.60		۸		
W) Width	(in.) mm		85 ± 0 25 ± 0			1.60 -	$\frac{10 + 0}{10}$				(2.50	+ 0.01 + 0.30					((0.181 - 2.00 -							(3.20+	0.020)		
W) Width	(in.)		49 ± 0		(0	.063 +			14)		((2.30 0.098 ·						((2.00).079 ·							((· 0.30)		
(t) Terminal	mm		50 + 0		1		0 + 0.		, .,			0.75							0.75								0.75 -		,		
()	(in.)	(0.02	20 + 0	(800.0		(0.0)	4 + 0.0	(800			(.030 +	0.014	4)				(.030 +	0.014	4)					(.030 +	0.014)		
Voltag		600	630	1000	600	630	1000	1500	2000	600	630	1000	1500	2000	3000	600	630	1000	1500	2000	2500	3000	4000	600	630	1000	1500	2000	2500	3000	4000
Cap (pF)	.5 OR5		A	C																											
-	1.0 1R0 1.2 1R2		A	C																		_					-		\vdash		
	1.5 1R5	Α	A	C	Y	Y	Υ	Y	Y																						
	1.8 1R8	A	Â	Č	X	X	X	X	X																		<u> </u>				
	2.2 2R2	A	A	C	X	X	X	X	X								С	С		С		С	С								
	2.7 2R7	Α	Α	С	Х	Х	Х	Х	Х								С	C	С	С	С	С	С								
	3.3 3R3	Α	Α	С	Х	Χ	Χ	Χ	Χ								С	С	С	С	С	С	С								
	3.9 3R9	Α	Α	С	Х	Х	Χ	Х	Х								С	С	С	С	С	С	С								
	4.7 4R7	Α	Α	С	Х	Х	Х	Х	Х								С	C	С	С	С	С	С								
	5.6 5R6	A	A	C	X	X	X	X	X								С	C	C	C	C	С	С								
	6.8 6R8	A	A	C	X	X	X	X	X							_	C	C	С	C	C	СС	C						\vdash		
—	8.2 8R2 10 100	A	A	C	C	C	C	C	C						E		C	C	C	C	C	C	C					_			F
	12 120	A	A	C	C	C	C	C	C	C	C	C	C	Č	F	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	E
	15 150	A	A	C	C	C	C	C	C	C	C	C	C	C	F	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	Ē
	18 180	A	A	Č	Č	Č	Č	Č	Č	C	Č	Č	Č	č	F	C	C	Č	Č	C	Č	C	Č	C	C	č	Č	Č	C	Č	Ē
	22 220	Α	Α	С	С	С	С	С	С	С	С	С	С	С	F	С	С	С	С	С	С	С	Е	С	С	С	С	С	С	С	Е
	27 270	Α	Α	С	С	С	С	С	С	С	С	С	С	С	F	С	С	С	С	С	С	С	Е	С	С	С	С	F	С	С	E
	33 330	Α	Α	С	С	С	С	С	С	С	С	С	С	С	F	С	С	С	С	С	С	С	F	С	С	С	С	F	С	С	E
	39 390	Α	Α	С	С	С	C	С	С	С	С	С	С	С	F	С	С	С	С	С	С	С	F	С	С	С	С	F	С	С	Е
	47 470	A	A	C	C	С	С	C	C	C	C	С	C	C	F	С	C	C	C	C	C	С	F	С	C	C	C	F	C	C	E
	56 560	A	A	С	C	С	С	С	С	С	С	С	C	C	F	С	С	C	С	C	С	C		С	C	C	C	F -	С	С	-
	68 680 82 820	A X	X	C X	C	C	O _O	C	C	C	C	C	C	C	E	C	C	C	C	C	C	С		C	C	C	C	F	C	C	
	100 101	X	X	X	C	C	C	C	C	C	C	C	C	C	F	C	C	C	C	C	F	F		C	C	C	C	F	C	C	F
	120 121	Ĉ	Ĉ	Ĉ	č	Č	Č	Ĕ	Ĕ	Č	Č	Č	Č	č	Ė	C	Č	č	Č	C	Ė	Ė		C	C	č	č	Ė	C	č	Ġ
	150 151	C	C	C	Č	C	Č	Ē	Ē	C	C	C	Ē	Ē	F	C	C	C	F	F	F	F		C	C	C	C	F	C	C	G
	180 181	С	С	С	C	С	Ē	Е	Е	С	С	E	Е	Е	F	С	С	С	F	F	F	F		С	С	С	С	F	F	F	
	220 221	С	С	С	С	С	Е	Е	Е	С	С	Е	Е	Е	F	С	С	С	F	F	F	F		С	С	С	С	F	F	F	
	270 271	С	С	С	С	С	Е	Е	Е	С	С	Е	Е	Е	G	С	F	С	F	F	F	F		С	С	С	С	F	F	F	
	330 331	С	С	С	С	С	E	E	E	C	С	E	E	E		С	F	F	F	F	F	F		С	С	C	F	F	F	F	
	390 391	C C	C	С	C	C	E	E	E	C C	C	E	E	E		C	F	F	F	F	F	F		C C	C	C	F	F	F	F	
	470 471 560 561	U C	C	_	C	C	E		Е	C	C	E	E	E	_	C	F	F	F	F	F	F		C	C	F	F	F	F	F	
	680 681	C	C		C	C	Ē			С	C	Ė	È	È		C	F	F	F	F				C	C	F	F	F	G	G	
	750 751	C	č		Ē	Ē	Ē			C	Č	È	È	È		Č	F	F	F	F				C	C	F	F	F	G	G	
	820 821	C	C		Ē	E	E			C	C	Ē	Ē	Ē		C	F	F	E	F				C	C	F	F	F	G	G	
	1000 102		C		Е	Е	Е			С	С	Е	F	F		С	F	F	Е	F				С	С	F	F	F	G	G	
	1200 122		С		Е	Е	Е			С	С	Е	F	F		С	F	F	Е	F				С	С	F	Е	Е			
	1500 152		С		Е	Е				С	С	F	G	G		Е	F	F		F				С	С	F	F	F			
	1800 182		C		Ē	E		<u> </u>		C	C	G	G	G	_	Ē	F	F		F	_			C	C	F	G	F	\vdash		
	2200 222 2700 272		С		E	E				C	С	G		-	-	E	F	F						С	C	E	G	G			
—	2700 272 3300 332		\vdash	+	E	E		\vdash		C C	C	G		\vdash	 	E	F	F				_		C	C	F	G	G	\vdash		
	3900 392			 	E	E				C	C	G				E	F					_		O	C	F		-			
	4700 472				Ē	Ē				C	C					Ē	F							C	C	G				\vdash	
	5600 562									Ē	E					E	F							C	C	Ğ					
	6800 682									Е	Е					F	F							С	С						
	8200 822									F	F						F							Е	С						
Cap (µF)	0.010 103			1						F	F						F							F	F						
<u> </u>	0.012 123		-	_	-	\vdash		<u> </u>	\vdash	F	F	_	_	-	-	\vdash	_	-	_	_	_	_		F	F	_	-	-	\vdash	\vdash	
	0.015 153 0.018 183		-	-	-			<u> </u>		G	G			-	-	<u> </u>	<u> </u>	-						G G	G	_	-	-			
	0.018 183		\vdash	+	\vdash	\vdash		\vdash				 		_	_	\vdash	\vdash	\vdash				_		U	F			_	\vdash	\vdash	
	0.022 223		 	 										1	 										G			 			
	0.033 333																								G						
	0.047 473			i –																											
	0.056 563																														
	0.068 683																														
	0.100 104	45-		10-		45.	40						-			46.				-				46-				-			
Voltag		600			600	630		1500	2000	600	630		<u>1500</u> 10	2000	3000	600	630	1000			2500	3000	4000	600	630	1000			2500	3000	4000
Case	SIZE		0805				1206					12	10						18	808							18	12			

Letter	Α	С	Е	F	G	Х	7
Max.	0.81	1.45	1.80	2.20	2.80	0.94	3.30
Thickness	(0.032)	(0.057)	(0.071)	(0.087)	(0.110)	(0.037)	(0.130)







NPO (COG) CAPACITANCE RANGE - PREFERRED SIZES ARE SHADED

Case Size				18	25								2220									2225	,								3640				
Soldering				Reflo		у							flow C									flow (flow C				
(L) Length mm			,	4.60		٥)							70 ± 0.									70 ± 0.									14 ± 0.				
(in.)			. (0.181 : 6.30 :		U)							24 ± 0. 00 ± 0.									24 ± 0. 30 ± 0.									60 ± 0. 0.2 ± 0.			_	
W) Width (in.)			(0.248		6)							97 ± 0.									48 ± 0.									00 ± 0.				
mm					± 0.35								85 ± 0									85 ± 0.								0.7	76 (0.0	30)			
(t) Terminal max				0.030									33 ± 0.									33 ± 0.									2 (0.0				
Voltage (V)	600	630	1000	1500	2000	2500	3000	4000	600	630	1000	1500	2000	2500	3000	4000	5000	600	630	1000	1500	2000	2500	3000	4000	5000	600	630	1000	1500	2000	2500	3000	4000	5000
Cap (pF) 1.5 1R5 1.8 1R8						<u> </u>																	1											\vdash	\vdash
2.2 2R2																																		\Box	
2.7 2R7																																			
3.3 3R3																																			\Box
3.9 3R9								-															-											$\vdash \vdash$	\vdash
4.7 4R7 5.6 5R6																																		\vdash	
6.8 6R8																																		\Box	
8.2 8R2																																			
10 100	Е	Е	G	Е	F	Е	F	F	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	F	F									
12 120	E	E	G	E	F	E	F	F	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	F	F		-		_	_			ightharpoonup	Ш
15 150 18 180	E	E	G	E	F	E	F	F	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	F	F		-	\vdash		\vdash	-	\vdash	\vdash	\vdash
22 220	E	E	G	E	F	E	F	F	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	F	F		\vdash		\vdash			\vdash	\vdash	Н
27 270	E	E	G	E	F	E	F	F	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	F	F									П
33 330	Е	Е	G	Е	F	Е	F	F	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	F	F									
39 390	Е	Е	G	Е	F	Е	F	F	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	F	F								لــــا	
47 470	E	E	G	E	F	E	F	F	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	F	G G	_	-	_	-	_	_		\vdash	G
56 560 68 680	E	E	G	E	F	E	F	F	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	F	G								\vdash	G
82 820	E	E	G	E	F	E	F	F	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	F	G									G
100 101	Е	Е	G	Е	F	Е	F	F	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	G	G				G	G	G	G	G	G
120 121	Е	Е	G	Е	F	Е	F	F	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	G	G				G	G	G	G	G	G
150 151	E	E	G	E	F	E	F	F	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	G	G				G	G	G	G	G	G
180 181 220 221	E	E	G	E	F	E	F	F	E	E	E	E	E	E	E	F	F	E	E	E	E	E	E	E	G	G G				G	G	G	G G	G G	G
270 271	E	E	G	E	F	E	F	F	E	E	E	E	E	E	E	-	_	E	E	E	E	E	E	E	G	G				G	G	G	G	G	G
330 331	Е	Е	G	Е	F	Е	F	F	Е	Е	Е	Е	Е	Е	Е			Е	Е	Е	Е	Е	Е	Е	G					G	G	G	G	G	G
390 391	Е	Е	G	Е	F	Е	F		Е	Е	Е	Е	Е	Е	Е			Е	Е	Е	Е	Е	Е	Е	G					G	G	G	G	G	G
470 471	E	E	G	E	F	E	F		E	E	E	E	E	E	E			E	E	E	E	E	E	E	G					G	G	G	G	G	G
560 561 680 681	E	E	G	E	F	E F	G		E	E	E	E	E	E F	E F		-	E E	E	E	E	E	E	E	G					G	G G	G	G G	G G	G
750 751	E	E	G	E	F	F	G		E	E	E	E	E	F	F			E	E	E	E	E	E	E						G	G	G	G	G	G
820 821	Е	Е	G	Е	F	F	G		Е	Е	Е	Е	Е	F	F			Е	Е	Е	Е	Е	F	Е						G	G	G	G	G	G
1000 102	Е	Е	G	Е	F	F	G		Е	Е	Е	Е	Е	F	F			Е	Е	Е	Е	Е	Е	Е			G	G	G	G	G	G	G	G	
1200 122	E	E	G	E	F	G	G		E	E	E	E	E	G	G			Е	E	Е	E	E	F	F			G	G	G	G	G	G	G	G	\sqcup
1500 152 1800 182	E	E	G	F	G	G	G		E	E	E	F	F	G	G			E	E	E	E	E	F G	F G			G G	G	G G	G	G	G	G	$\vdash\vdash$	\vdash
2200 222	E	E	G	G	G	-	G		E	E	E	G	G	-				E	E	E	E	E	-	G			G	G	G	G	G	G	G	\vdash	\vdash
2700 272	E	E	G	G	G		G		E	E	E	G	G					E	E	E	F	F					G	G	G	G	G	G	G	\Box	М
3300 332	Е	Е	G	G	G				Е	Е	Е	G	G					Е	Е	Е	F	F					G	G	G	G	G	G			
3900 392	E	E	G	G	G				E	E	Е	G	G					E	E	Е	G	G					G	G	G	G	G	G		لـــــا	
4700 472 5600 562	E F	E F	G	G	G		1	1	E F	E F	E F	G	G			-		F	F	F	G	G			-		G G	G	G	G	G			\vdash	\vdash
6800 682	F	F	G	3	G			 	F	F	F		9					F	F	F	G	G		\vdash	\vdash		G	G	G	G	G		\vdash	\vdash	Н
8200 822	F	F	G		G				G	G	G							G	G	G							G	G	G	G				\Box	М
Cap (µF) 0.010 103	F	F	G						7	7	7							G	G	G							G	G	G	G					
0.012 123	F	F	G															G	G								G	G	G					لب	Ш
0.015 153	_	F			_	<u> </u>		-				-		-		-		G G	G G				-	_	-		G	G	G		<u> </u>			$\vdash \vdash$	\vdash
0.018 183 0.022 223	F	F																G	G				1				G G	G	G G					\vdash	\vdash
0.022 223		F				<u> </u>	 	t															t										H	\vdash	\Box
0.033 333		F																G	G								G	G							
0.039 393		G																																	
0.047 473	_	G	<u> </u>			<u> </u>	_	-			<u> </u>					<u> </u>		G	G	\vdash			ļ		<u> </u>		G	G		<u> </u>				\vdash	\vdash
0.056 563 0.068 683	G G	G			_	1	1	-						\vdash		-	_	G G	G G				-				\vdash		\vdash		\vdash			\vdash	\vdash
0.100 104		9		-		 		1								<u> </u>		3	9				1											\vdash	\vdash
Voltage (V)		630	1000	1500	2000	2500	3000	4000	600	630	1000	1500	2000	2500	3000	4000	5000	600	630	1000	1500	2000	2500	3000	4000	5000	600	630	1000	1500	2000	2500	3000	4000	5000
Case Size					25								2220									2225									3640				

Letter	Α	С	Е	F	G	Х	7
Max.	0.81	1.45	1.80	2.20	2.80	0.94	3.30
Thickness	(0.032)	(0.057)	(0.071)	(0.087)	(0.110)	(0.037)	(0.130)



For 600V to 5000V Applications



X7R Dielectric

Performance Characteristics

Capacitance Range	10 pF to 0.82 μF (25°C, 1.0 ±0.2 Vrms at 1kHz)
Capacitance Tolerances	±10%; ±20%; +80%, -20%
Dissipation Factor	2.5% max. (+25°C, 1.0 ±0.2 Vrms, 1kHz)
Operating Temperature Range	-55°C to +125°C
Temperature Characteristic	±15% (0 VDC)
Voltage Ratings	600, 630, 1000, 1500, 2000, 2500, 3000, 4000 & 5000 VDC (+125°C)
Insulation Resistance (+25°C, at 500 VDC)	100K MΩ min. or 1000 MΩ - μF min., whichever is less
Insulation Resistance (+125°C, at 500 VDC)	10K MΩ min. or 100 MΩ - μF min., whichever is less
Dielectric Strength	Minimum 120% rated voltage for 5 seconds at 50 mA max. current

X7R CAPACITANCE RANGE - PREFERRED SIZES ARE SHADED

Case Siz	ze		0805				1206					1210						18	808							18	12			
Solderin	ng		low/W				low/W					flow O						Reflov								Reflov				
(L) Length	mm		10 ± 0. 85 ± 0.				30 ± 0. 30 ± 0.					30 ± 0.4 30 ± 0.0					,		± 0.50 ± 0.020	`						4.60 : 0.181 :	± 0.50	`		
	(in.) mm		85 ± 0. 25 ± 0.				+0.30/				2.	50 ± 0.3	30				(± 0.020 ± 0.20)						3.20)		-
W) Width	(in.)		49 ± 0.			0.063 -	+0.012	/-0.004	.)		(0.0	98 ± 0.0	012)				(± 0.008)					(0.126	± 0.012)		
(t) Terminal	mm max		50 ± 0. 20 ± 0.				60 ± 0. 24 ± 0.					75 ± 0.0 30 ± 0.0					(± 0.35 ± 0.014)						0.75 0.030)		
Voltage (630		600			1500	2000	600	630			2000	600	630			2000		3000	4000	600	630					3000	4000
Cap (pF) 100	101	Х	Х	С	С	С	Е	Е	Е	Е	ш	Е	Е	Е																
120	121	Х	Х	С	С	С	Е	Е	Е	Е	Е	Е	Е	Е																
150	151	Х	Х	С	С	С	Е	Е	Е	Е	Е	Е	Е	Е																
180	181	Х	Х	С	С	С	Е	Е	Е	Е	Е	Е	Е	Е																
220	221	Х	Х	С	С	С	Е	Е	Е	Е	Е	Е	Е	Е																
270	271	Х	Х	С	С	С	Е	Е	Е	Е	Е	Е	Е	Е									Е	Е	Е	Е	Е			
330		Х	Х	С	С	С	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	F		Е	Е	Е	Е	Е			
390		Х	Х	С	С	С	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	F		Е	Е	Е	Е	Е			
470		Х	Х	С	С	С	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	F		Е	Е	Е	Е	Е	Е	Е	
560	561	Х	Х	С	С	С	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	F	F		Е	Е	Е	Е	Е	Е	Е	
680		Х	Х	С	С	С	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	F	F		Е	Е	Е	Е	Е	F	F	
750		Х	Х	С	С	С	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	F	F		Е	Е	Е	Е	Е	F	F	
820		Х	Х	С	С	С	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	F	F	<u> </u>	Е	Е	Е	Е	Е	F	F	
1000			Х	Х	С	С	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	F	F	<u> </u>	Е	Е	Е	Е	Е	F	F	
1200		Х	Х	Х	С	С	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	F	F		F	F	F	F	F	F	F	
1500		Х	Х	Х	С	С	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	F	F		F	F	F	F	F	G	G	
1800		Х	Х	С	С	С	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	F	F		F	F	F	F	F	G	G	
2200		Х	Х	Х	С	С	Е	Е	Е	Е	Е	Е	F	Е	Е	Е	Е	F	F	F			F	F	F	F	F	G	G	
2700		С	С		С	С	Е	Е		Е	Е	Е	F	Е	Е	Е	Е	F	F				F	F	F	F	F	G	G	
3300		С	С		С	С	Е			Е	Е	Е	F	Е	Е	Е	Е	F	F				F	F	F	F	F	G	G	
3900		С	С		С	С	Е			Е	Е	Е	F		Е	Е	Е	F					F	F	F	F	F	G	G	
4700		С	С		С	С	Е			Е	Е	Е	F		Е	Е	Е	F					F	F	F	F	F	G	G	
5600		С	С		С	С	Е			Е	Е	Е	F		Е	Е	Е	F					F	F	F	G	G	G		
6800		С	С		С	С	Е			Е	Е	Е			Е	Е	Е	F					F	F	F	G	G			
8200		С	С		С	С	Е			Е	Е	Е			Е	Е	Е						F	F	F	G	G			
Cap (µF) 0.010		С	С		С	С	Е			Е	Е	Е			Е	Е	Е						F	F	F	G	G			
0.015		С	С		Е	Е	Е			Е	Е	Е			F	F	F				_		F	F	F	G				_
0.018		С	С		E	E				Е	E	E			F	F	F						F	F	G					
0.022		С	С		Е	Е				Е	Е	F			F	F	F						F	F	G					—
0.027		-	-		E	E				E	E				F	F					_		F	F	G					\vdash
0.033		-	-	-	Е	Е				E	E	-			F	F							F	F	G		-			-
0.039		-	-							E	E				F	F							F	F	G					-
0.047		-	-	-		<u> </u>	_	<u> </u>		E	E	<u> </u>	_		F	F			_	-	_		F	F	G		-			\vdash
0.056		-	-			<u> </u>		<u> </u>		F	F				F	F			<u> </u>		<u> </u>		F	F	<u> </u>					₩
0.068		-	-	-		<u> </u>	_	<u> </u>		F	F	<u> </u>	_		F	F	_		_	_	<u> </u>		F	F		_	-			\vdash
0.082		-	-	-		_		_			F	-									-		F				-			├
0.100		-	-	-		-	<u> </u>	-	-	F	F		-			_	-	-	<u> </u>		-	-		F	-	-	-		_	-
0.150		1	-	-																			G	G			-			-
0.220		1	-	-		_		_	_				_				_		_		_		G	G			-			\vdash
0.270		1	-	-		<u> </u>		<u> </u>		-	-								<u> </u>		<u> </u>				-	-	-			├
0.330		1	-	-		_		_	_				_				_		_		_				-		-			\vdash
0.390		-	-		-		<u> </u>									-			-			-		<u> </u>	-				-	-
0.470		1	-	-		_		_	_				_				_		_		_				-		-			\vdash
0.560		1	\vdash			-		-				-								-			_		-				-	-
0.680		1	-	-		<u> </u>	-	-	_	_	\vdash	-	_				_		-	-	-		-	-	-	_	-		_	₩
1.000		1	\vdash			-		-			-	_							-	_	-				-					-
		600	620	1000	600	620	1000	1500	2000	600	630	1000	1500	2000	600	620	1000	1500	2000	2500	3000	4000	600	620	1000	1500	2000	2500	3000	4000
Voltage (600	630 0805	1000	000	030	1206		2000	000	030	1210	1500	2000	000	030	1000	18		2500	3000	4000	000	030	1000	18		2500	3000	14000
Case Siz	.6		0605				1200					1210						18	00							18	14			

Letter	Α	С	E	F	G	Х	7
Max.	0.81	1.45	1.80	2.20	2.80	0.94	3.30
Thickness	(0.032)	(0.057)	(0.071)	(0.087)	(0.110)	(0.037)	(0.130)







X7R CAPACITANCE RANGE PREFERRED SIZES ARE SHADED

Case Size					18	325								2220	1								222	5								3640)			
Soldering	\Box					w Only								low 0									flow (eflow (
(L) Length	- 1					± 0.50								70 ± 0.									70 ± 0									.14 ± 0				
(in.)	\rightarrow					± 0.02								24 ± 0.									24 ± 0									60 ± 0		_	_	
W) Width (in.)						± 0.40 ± 0.01								00 ± 0. 97 ± 0.									30 ± 0 48 ± 0									0.2 ± 0 100 ± 0				
mn						± 0.35								35 ± 0.									85 ± 0									76 (0.0				
(t) Terminal ma		1		((0.030	± 0.01	4)	1	1				(0.03	3 ± 0.	014)						1	(0.0	33 ± 0	.014)							1.	52 (0.0	060)			1
Voltage (V) Cap (pF) 100 1	101	600	630	1000	1500	2000	2500	3000	4000	600	630	1000	1500	2000	2500	3000	4000	5000	600	630	1000	1500	2000	2500	3000	4000	5000	600	630	1000	1500	2000	2500	3000	4000	5000
	121	-			-	<u> </u>	-	┢	-								\vdash				-		-			-					-		-	\vdash	Н	\vdash
	151				-	-	-	-	-												-		-			-					-		-	\vdash	H	
	181	-			\vdash	 	\vdash	┢	\vdash								\vdash				\vdash		 			\vdash					\vdash		\vdash	\vdash	Н	\vdash
	221					1											\vdash																	\vdash	\vdash	
	271																																	\vdash	$\vdash\vdash$	\vdash
	331																																	\vdash	$\vdash\vdash$	\vdash
	391					1											\vdash						\vdash			1					1		1	\vdash	\vdash	\vdash
	471																																	\vdash	\vdash	
	561					1		\vdash									\vdash						\vdash	t										\vdash	Г	
	581	\dashv				 		t									\vdash																	\vdash	\sqcap	
	751					1		\vdash															\vdash											\vdash	\Box	
	321																																		\Box	
	102	F	F	F	F	F	F	F		F	F	F	F	F	F	G			F	F	F	F	F	F	F			G	G	G	G	G	G	G	G	G
	122	F	F	F	F	F	F	F		F	F	F	F	F	F	G			F	F	F	F	F	F	F			G	G	G	G	G	G	G	G	G
	152	F	F	F	F	F	F	F		F	F	F	F	F	F	G			F	F	F	F	F	F	F			G	G	G	G	G	G	G	G	G
	182	F	F	F	F	F	F	F		F	F	F	F	F	F	G			F	F	F	F	F	F	F			G	G	G	G	G	G	G	G	G
2200 2	222	F	F	F	F	F	F	F		F	F	F	F	F	F	G			F	F	F	F	F	F	F			G	G	G	G	G	G	G	G	G
2700 2	272	F	F	F	F	F	F	F		F	F	F	F	F	F	G			F	F	F	F	F	F	F			G	G	G	G	G	G	G	G	G
3300 3	332	F	F	F	F	F	F	F		F	F	F	F	F	F	G			F	F	F	F	F	F	F			G	G	G	G	G	G	G	G	G
3900 3	392	F	F	F	F	F	F	F		F	F	F	F	F	F	G			F	F	F	F	F	F	F			G	G	G	G	G	G	G	G	
4700 4	172	F	F	F	F	F	F	F		F	F	F	F	F	F	G			F	F	F	F	F	F	F			G	G	G	G	G	G	G	G	
5600 5	562	F	F	F	F	F	F	F		F	F	F	F	F	F	G			F	F	F	F	F	F	F			G	G	G	G	G	G	G	G	
6800 6	582	F	F	F	G	G	G	G		F	F	F	F	F	G	G			F	F	F	F	F	G	G			G	G	G	G	G	G	G	G	
8200 8	322	F	F	I.	G	G	G	G		F	F	F	G	G	G	G			F	F	F	F	F	G	G			G	G	G	G	G	G	G		
	103	F	F	F	G	G	G	G		F	F	F	G	G	G	G			F	F	F	F	F	G	G			G	G	G	G	G	G	G	ш	igsquare
0.015 1	153	F	F	F	G	G	G			F	F	F	G	G	G				F	F	F	G	G	G	G			G	G	G	G	G	G	G	ш	igsquare
0.018 1	183	F	F	F	G	G			<u> </u>	F	F	F	G	G	G				F	F	F	G	G	G		ļ		G	G	G	G	G	G	G	ш	
0.022 2	223	F	F	F	G	G				F	F	F	G	G					F	F	F	G	G	G				G	G	G	G	G	G			
0.027 2	273	F	F	F	G					F	F	F	G	G					F	F	F	G	G					G	G	G	G	G			ш	
	333	F	F	F	G					F	F	F	G						F	F	F	G	G					G	G	G	G			\square	ш	\Box
	393	F	F	F	G		<u> </u>	<u> </u>	<u> </u>	F	F	F	G			_	ш		F	F	F	G		<u> </u>	\vdash	_	_	G	G	G	G		_	\sqcup	oxdot	\square
	473	F	F	F	Р		_	_	_	F	F	F	G				Ш		F	F	F	G		_			_	G	G	G	G	_		\sqcup	لــــــا	\square
	563	F	F	F	G					F	F	F	G						F	F	F	G						G	G	G	G			\square	\square	\sqcup
	583	F	F	G		<u> </u>		-		F	F	G					ш		F	F	F	G						G	G	G	G			\square	\square	\vdash
	323	F	F	G		-		-		F	F	G		_			\Box		F	F	G		-	_				G	G	_				\vdash	$oldsymbol{\sqcup}$	\vdash
	104	F	F	G		-	-	-	-	F	F	G							F	F	G		-		-	-		G	G	-	-		-	\vdash	$\vdash\vdash$	\vdash
	154	F	F		-	├	-	-	-	F	F	G		_			\vdash		F	F	G		-	-	-			G	G	-				\vdash	ш	\vdash
	224	F	F		-	╁	-	\vdash	-	F	F	G		_	-		\vdash		F	F			-			-		G	G	-	-		-	$\vdash\vdash$	$\vdash\vdash$	$\vdash\vdash$
	274	F			-	 	-	\vdash	-		-	_		_	-		\vdash		+	_			-			-		G	G	-	-		-	$\vdash\vdash$	$\vdash\vdash$	$\vdash\vdash$
	334	F F	F		\vdash	+-	\vdash	\vdash	\vdash	F	F	-	-	\vdash		\vdash	Н		F	F		-	\vdash	-	\vdash	 		G	G		 	-	 	$\vdash\vdash$	Н	\vdash
	394 174	F	F		\vdash	+	\vdash	\vdash	\vdash	F	F	-		\vdash		\vdash	$\vdash\vdash$		F	F		-	\vdash	-	\vdash	\vdash		G G	G G		\vdash	-	\vdash	$\vdash\vdash$	Н	\vdash
	564	G	G		\vdash	1	\vdash	\vdash	\vdash	G	G	 		\vdash		\vdash	Н		F	F		-	\vdash	<u> </u>	\vdash	\vdash		G	G		\vdash	-	\vdash	$\vdash\vdash$	\vdash	\vdash
	584	U	U		\vdash	+-	\vdash	\vdash	\vdash	G	G	-	 		-	\vdash	Н		G	G		-	\vdash	-	\vdash	 		U	9		 	-	 	$\vdash\vdash$	Н	\vdash
	324				\vdash	1	\vdash	1	\vdash	G	G			\vdash			\vdash		G	G			\vdash	-		\vdash					\vdash		\vdash	$\vdash\vdash$	Н	\vdash
	105	\dashv			\vdash	+	\vdash	1	\vdash					\vdash			H		G	9				-		\vdash					\vdash		\vdash	\vdash	Н	\vdash
Voltage (V)		600	630	1000	1500	2000	2500	3000	4000	600	630	1000	1500	2000	2500	3000	4000	5000	600	630	1000	1500	2000	2500	3000	4000	5000	600	630	1000	1500	2000	2500	3000	4000	5000
Case Size	\dashv		-50	. 200		325		, 2 3 0 0	. 500	1.00		. 500		2220		,							222		12300	.500	,	-50			. 300	3640				
Ouse Size					- 10					_				0			_							-								0070				

Letter	A	С	Е	F	G	X	7
Max.	0.81	1.45	1.80	2.20	2.80	0.94	3.30
Thickness	(0.032)	(0.057)	(0.071)	(0.087)	(0.110)	(0.037)	(0.130)









NEW 630V RANGE

KYOCERA AVX will support those customers for commercial and military Multilayer Ceramic Capacitors with a termination consisting of 5% minimum lead. This termination is indicated by the use of a "B" in the 12th position of the KYOCERA AVX Catalog Part Number. This fulfills KYOCERA AVX's commitment to providing a full range of products to our customers. KYOCERA AVX has provided in the following pages, a full range of values that we are offering in this "B" termination.

Larger physical sizes than normally encountered chips are used to make high voltage MLC chip product. Special precautions must be taken in applying these chips in surface mount assemblies. The temperature gradient during heating or cooling cycles should not exceed 4°C per second.

The preheat temperature must be within 50°C of the peak temperature reached by the ceramic bodies through the soldering process. Chip sizes 1210 and larger should be reflow soldered only. Capacitors may require protective surface coating to prevent external arcing.

For 1825, 2225 and 3640 sizes, KYOCERA AVX offers leaded version in either thru-hole or SMT configurations (for details see section on high voltage leaded MLC chips).

HOW TO ORDER

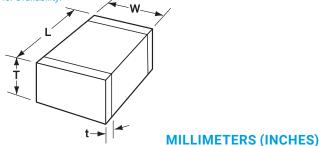
LD08	Α	Α	271	K	Α	В	2	Α
	Ţ	Ţ	T	T	T	Ţ	Ţ	T
Style	Voltage	Temperature	Capacitance	Capacitance	Test Level	Termination*	Packaging	Special
LD05 - 0805	600V/630V = C	Coefficient	Code	Tolerance	A = Standard	B = 5% Min Pb	2 = 7" Reel**	Code
LD06 - 1206	1000V = A	COG = A	(2 significant digits	COG: $J = \pm 5\%$	4 = Automotive*	X = FLEXITERM®	4 = 13" Reel**	A = Standard
LD10 - 1210	1500V = S	X7R = C	+ no. of zeros)	$K = \pm 10\%$		5% min. Pb*	6 = Tray (3640 Style)	
LD08 - 1808	2000V = G		Examples:	$M = \pm 20\%$				
LD12 - 1812	2500V = W		10 pF = 100	$X7R: K = \pm 10\%$				
LD13 - 1825	3000V = H		100 pF = 101	$M = \pm 20\%$				
LD20 - 2220	4000V = J		1.000 pF = 102	Z = +80%, -20%				
LD14 - 2225	5000V = K		22,000 pF = 223					
LD40 - 3640			220,000 pF = 224					
***			1 μF =105					

Notes: Capacitors with X7R dielectrics are not intended for applications across AC supply mains or AC line filtering with polarity reversal. Contact plant for recommendations. Contact factory for availability of Termination and Tolerance options for Specific Part Numbers.

- * FLEXITERM is not available in the LD40 Style
- ** The LD40 Style is not available on Reels.
- *** KYOCERA AVX offers nonstandard chip sizes. Contact factory for details.

* Not all values are supported in Automotive grade. Please contact factory for availability





DIMENSIONS

SIZE		LD05 (0805)	LD06 (1206)	LD10* (1210)	LD08* (1808)	LD12* (1812)	LD13* (1825)	LD20* (2220)	LD14* (2225)	LD40* (3640)
(L) Length		2.10 ± 0.20	3.30 ± 0.30	3.30 ± 0.40	4.60 ± 0.50	4.60 ± 0.50	4.60 ± 0.50	5.70 ± 0.50	5.70 ± 0.50	9.14 ± 0.25
(L) Lengui		(0.083 ± 0.008)	(0.130 ± 0.012)	(0.130 ± 0.016)	(0.181 ± 0.020)	(0.181 ± 0.020)	(0.181 ± 0.020)	(0.224 ± 0.020)	(0.224 ± 0.020)	(0.360 ± 0.010)
(\A(\) \A(i)d+b		1.25 ± 0.20	1.60 ± 0.20	2.50 ± 0.30	2.00 ± 0.20	3.20 ± 0.30	6.30 ± 0.40	5.00 ± 0.40	6.30 ± 0.40	10.2 ± 0.25
(W) Width		(0.049 ± 0.008)	(0.063 ± 0.008)	(0.098 ± 0.012)	(0.079 ± 0.008)	(0.126 ± 0.012)	(0.248 ± 0.016)	(0.197 ± 0.016)	(0.248 ± 0.016)	(0.400 ± 0.010)
(t) m	nin.	0.50 ± 0.20	0.60 ± 0.20	0.75 ± 0.35	0.75 ± 0.35	0.75 ± 0.35	0.75 ± 0.35	0.85 ± 0.35	0.85 ± 0.35	0.76 (0.030)
terminal m	ax.	(0.020 ± 0.008)	(0.024 ± 0.008)	(0.030 ± 0.014)	(0.030 ± 0.014)	(0.030 ± 0.014)	(0.030 ± 0.014)	(0.033 ± 0.014)	(0.033 ± 0.014)	1.52 (0.060)

^{*}Reflow Soldering Only

Performance of ceramic capacitors can be simulated by using the online SpiMLCC software program - http://spicat.avx.com/mlcc Custom values, ratings and configurations are also available



TDS-SMDMLCC-0020 | Rev 1



Tin/Lead Termination "B" - 600V to 5000V Applications

NP0 (C0G) Dielectric

Performance Characteristics

Capacitance Range	10 pF to 0.047 μF (25°C, 1.0 ± 0.2 Vrms at 1kHz, for \leq 1000 pF use 1 MHz)
Capacitance Tolerances	±5%, ±10%, ±20%
Dissipation Factor	0.1% max. (+25°C, 1.0 ±0.2 Vrms, 1kHz, for ≤ 1000 pF use 1 MHz)
Operating Temperature Range	-55°C to +125°C
Temperature Characteristic	0 ±30 ppm/°C (0 VDC)
Voltage Ratings	600, 630, 1000, 1500, 2000, 2500, 3000, 4000 & 5000 VDC (+125°C)
Insulation Resistance (+25°C, at 500 VDC)	100K MΩ min. or 1000 MΩ - μF min., whichever is less
Insulation Resistance (+125°C, at 500 VDC)	10K MΩ min. or 100 MΩ - μF min., whichever is less
Dielectric Strength	Minimum 120% rated voltage for 5 seconds at 50 mA max. current

HIGH VOLTAGE COG CAPACITANCE VALUES

VOLTA	GE	LD05 (0805)	LD06 (1206)	LD10 (1210)	LD08 (1808)	LD12 (1812)	LD13 (1825)	LD20 (2220)	LD14 (2225)	LD40 (3640)
600/630	min.	10 pF	10 pF	100 pF	100 pF	100 pF	1000 pF	1000 pF	1000 pF	1000 pF
000/030	max.	330 pF	1200 pF	2700 pF	3300 pF	5600 pF	0.012 μF	0.012 pF	0.018 μF	0.047 µF
1000	min.	10 pF	10 pF	10 pF	100 pF	100 pF	100 pF	1000 pF	1000 pF	1000 pF
1000	max.	180 pF	560 pF	1500 pF	2200 pF	3300 pF	8200 pF	0.010 pF	0.010 μF	0.022 μF
1500	min.	_	10 pF	10 pF	10 pF	10 pF	100 pF	100 pF	100 pF	100 pF
1300	max.	_	270 pF	680 pF	820 pF	1800 pF	4700 pF	4700 pF	5600 pF	0.010 μF
2000	min.	_	10 pF	10 pF	10 pF	10 pF	100 pF	100 pF	100 pF	100 pF
2000	max.	-	120 pF	270 pF	330 pF	1000 pF	1800 pF	2200 pF	2700 pF	6800 pF
2500	min.	-	-	-	10 pF	10 pF	10 pF	100 pF	100 pF	100 pF
2300	max.	-	-	_	180 pF	470 pF	1200 pF	1500 pF	1800 pF	3900 pF
3000	min.	-	-	_	10 pF	10 pF	10 pF	10 pF	10 pF	100 pF
3000	max.	-	-	-	120 pF	330 pF	820 pF	1000 pF	1200 pF	2700 pF
4000	min.	_	-	_	10 pF	10 pF	10 pF	10 pF	10 pF	100 pF
4000	max.	-	-	_	47 pF	150 pF	330 pF	470 pF	560 pF	1200 pF
5000	min.	_	_	-	_	_	_	10 pF	10 pF	10 pF
3000	max.	_	_	_	_	_	_	220 pF	270 pF	820 pF

X7R Dielectric

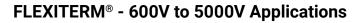
Performance Characteristics

Capacitance Range	10 pF to 0.56 μF (25°C, 1.0 ±0.2 Vrms at 1kHz)
Capacitance Tolerances	±10%; ±20%; +80%, -20%
Dissipation Factor	2.5% max. (+25°C, 1.0 ±0.2 Vrms, 1kHz)
Operating Temperature Range	-55°C to +125°C
Temperature Characteristic	±15% (0 VDC)
Voltage Ratings	600, 630, 1000, 1500, 2000, 2500, 3000, 4000 & 5000 VDC (+125°C)
Insulation Resistance (+25°C, at 500 VDC)	100K MΩ min. or 1000 MΩ - μF min., whichever is less
Insulation Resistance (+125°C, at 500 VDC)	10K MΩ min. or 100 MΩ - μF min., whichever is less
Dielectric Strength	Minimum 120% rated voltage for 5 seconds at 50 mA max. current

HIGH VOLTAGE X7R MAXIMUM CAPACITANCE VALUES

VOLTA	\GE	0805	1206	1210	1808	1812	1825	2220	2225	3640
600/630	min.	100 pF	1000 pF	1000 pF	1000 pF	1000 pF	0.010 μF	0.010 μF	0.010 μF	0.010 μF
000/030	max.	6800 pF	0.022 μF	0.056 μF	0.068 μF	0.120 μF	0.390 μF	0.270 µF	0.330 μF	0.560 μF
1000	min.	100 pF	100 pF	1000 pF	1000 pF	1000 pF	1000 pF	1000 pF	1000 pF	0.010 μF
1000	max.	1500 pF	6800 pF	0.015 μF	0.018 μF	0.039 µF	0.100 μF	0.120 µF	0.150 μF	0.220 μF
1500	min.	-	100 pF	100 pF	100 pF	100 pF	1000 pF	1000 pF	1000 pF	1000 pF
1300	max.	-	2700 pF	5600 pF	6800 pF	0.015 μF	0.056 μF	0.056 μF	0.068 μF	0.100 μF
2000	min.	_	10 pF	100 pF	100 pF	100 pF	100 pF	1000 pF	1000 pF	1000 pF
2000	max.	-	1500 pF	3300 pF	3300 pF	8200 pF	0.022 µF	0.027 µF	0.033 µF	0.027 µF
2500	min.	-	-	-	10 pF	10 pF	100 pF	100 pF	100 pF	1000 pF
2300	max.	-	-	_	2200 pF	5600 pF	0.015 μF	0.018 µF	0.022 μF	0.022 μF
3000	min.	-	-	-	10 pF	10 pF	100 pF	100 pF	100 pF	1000 pF
3000	max.	-	-	_	1800 pF	3900 pF	0.010 μF	0.012 µF	0.015 μF	0.018 μF
4000	min.	-	-	-	-	-	-	_	-	100 pF
4000	max.	_	_	_	_	-	_	_	_	6800 pF
5000	min.	_	_	-	_	_	_	_	_	100 pF
3000	max.	-	_	_	_	_	_	_	_	3300 pF









High value, low leakage and small size are difficult parameters to obtain in capacitors for high voltage systems. KYOCERA AVX special high voltage MLC chips capacitors meet these performance characteristics and are designed for applications such as snubbers in high frequency power converters, resonators in SMPS, and high voltage coupling/DC blocking. These high voltage chip designs exhibit low ESRs at high frequencies.

To make high voltage chips, larger physical sizes than are normally encountered are necessary. These larger sizes require that special precautions be taken in applying these chips in surface mount assemblies. In response to this, and to follow from the success of the FLEXITERM® range of low voltage parts, KYOCERA AVX is delighted to offer a FLEXITERM® high voltage range of capacitors, FLEXITERM®.

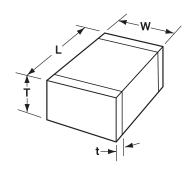
The FLEXITERM® layer is designed to enhance the mechanical flexure and temperature cycling performance of a standard ceramic capacitor, giving customers a solution where board flexure or temperature cycle damage are concerns.

HOW TO ORDER

1808	A T	c ⊤	<u>272</u>	<u>K</u>	<u>A</u>	z T	2 T	<u>A</u>
Style 0805 1206 1210 1808 1812 1825 2220 2225 ****	Voltage 600V/630V = C 1000V = A 1500V = S 2000V = G 2500V = W 3000V = H 4000V = J 5000V = K	Temperature Coefficient COG = A X7R = C	Capacitance Code (2 significant digits + no. of zeros) Examples: 10 pF = 100 100 pF = 101 1,000 pF = 102 22,000 pF = 223 220,000 pF = 224 1 µF =105	Capacitance Tolerance COG: J = ±5% K = ±10% M = ±20% X7R: K = ±10% M = ±20% Z = +80%, -20%	Test Level	Termination* Z=FLEXITERM® 100% Tin (RoHS Compliant)	Packaging 2 = 7" Reel 4 = 13" Reel	Special Code A = Standard

Notes: Capacitors with X7R dielectrics are not intended for applications across AC supply mains or AC line filtering with polarity reversal. Contact plant for recommendations. Contact factory for availability of Termination and Tolerance options for Specific Part Numbers.

^{***} KYOCERA AVX offers nonstandard chip sizes. Contact factory for details.





DIMENSIONS millimeters (inches)

SIZE		0805	1206	1210*	1808*	1812*	1825*	2220*	2225*
(L) Length		2.10 ± 0.20 (0.083 ± 0.008)	3.30 ± 0.30 (0.130 ± 0.012)	3.30 ± 0.40 (0.130 ± 0.016)	4.60 ± 0.50 (0.181 ± 0.020)	4.60 ± 0.50 (0.181 ± 0.020)	4.60 ± 0.50 (0.181 ± 0.020)	5.70 ± 0.50 (0.224 ± 0.020)	5.70 ± 0.50 (0.224 ± 0.020)
(W) Width		1.25 ± 0.20 (0.049 ±0.008)	$1.60^{+0.30}_{-0.10} \ (0.063^{+0.012}_{-0.004})$	2.50 ± 0.30 (0.098 ± 0.012)	2.00 ± 0.20 (0.079 ± 0.008)	3.20 ± 0.30 (0.126 ± 0.012)	6.30 ± 0.40 (0.248 ± 0.016)	5.00 ± 0.40 (0.197 ± 0.016)	6.30 ± 0.40 (0.248 ± 0.016)
(t) terminal	min. max.	0.50 ± 0.20 (0.020 ± 0.008)	0.60 ± 0.20 (0.024 ± 0.008)	0.75 ± 0.35 (0.030 ± 0.014)	0.75 ± 0.35 (0.030 ± 0.014)	0.75 ± 0.35 (0.030 ± 0.014)	0.75 ± 0.35 (0.030 ± 0.014)	0.85 ± 0.35 (0.033 ± 0.014)	0.85 ± 0.35 (0.033 ± 0.014)

^{*}Reflow Soldering Only



Performance of SMPS capacitors can be simulated by downloading SpiCalci software program - http://www.avx.com/SpiApps/default.asp#spicalci Custom values, ratings and configurations are also available.



FLEXITERM® - 600V to 5000V Applications



NP0 (COG) Dielectric Performance Characteristics

Capacitance Range	10 pF to 0.100 μF (+25°C, 1.0 ±0.2 Vrms, 1kHz)
Capacitance Tolerances	±5%, ±10%, ±20%
Dissipation Factor	0.1% max. (+25°C, 1.0 ±0.2 Vrms, 1kHz)
Operating Temperature Range	-55°C to +125°C
Temperature Characteristic	0 ±30 ppm/°C (0 VDC)
Voltage Ratings	600, 630, 1000, 1500, 2000, 2500, 3000, 4000 & 5000 VDC (+125°C)
Insulation Resistance (+25°C, at 500 VDC)	100K MΩ min. or 1000 MΩ - μF min., whichever is less
Insulation Resistance (+125°C, at 500 VDC)	10K MΩ min. or 100 MΩ - μF min., whichever is less
Dielectric Strength	Minimum 120% rated voltage for 5 seconds at 50 mA max. current

NPO (COG) CAPACITANCE RANGE PREFERRED SIZES ARE SHADED

Case Size	Т		0805				1206			l		1210						18	808							18	12			
Soldering		Reflo	ow/W				low/V	/ave			Re	flow 0	nly					Reflo	w Only	,						Reflo	v Only			
(L) Length mm (in.)	丄	(0.08)	0 ± 0.2 3 ± 0.0	008)		(0.1	30 ± 0. 30 ± 0.	.012)			(0.1	30 ± 0. 30 ± 0.	016)				((0.181:	± 0.50 ± 0.020	0)						4.60 (0.181	± 0.020)		
W) Width mm (in.)			5 ± 0.2 9 ± 0.0		١.,	1.60 : 0.063)	± 0.30. + 0.012		1)			50 ± 0.: 98 ± 0.:					(± 0.20 ± 0.008	3)						: 3.20 : 0.126)	± 0.30 + 0.012)		
(t) Terminal mm		0.5	0 ± 0.2	20		0.	.60 ± 0.	.20	-,		0.	75 ± 0.	35					0.75	± 0.35							0.75	± 0.35			
Voltage (V)			0 ± 0.0	1000	600		24 ± 0.	1500	2000	600		30 ± 0.	1500	2000	600	630			± 0.014		3000	4000	600	630		(0.030			3000	4000
Cap (pF) 1.5 1F	₹5	Α	Α		X	Х	Х	Х	Χ																				-	
1.8 1F 2.2 2F		A A	Α		X	X	X	X	X	_										1	1									
2.2 2F 2.7 2F		A	A		X	X	X	X	X	-							С	С	С	С	С									
3.3 3F	₹3	Α	Α		Х	Х	Х	Х	Х								С	С	С	С	С									
3.9 3F 4.7 4F		A A	A		X	X	X	X	X	-					_		C	C	C	C	C									
5.6 5F		A	A		X	X	X	X	X	 					┢		C	C	C	C	C		 							<u> </u>
6.8 6F	₹8	Α	Α		Х	Х	Х	Х	Х								С	С	С	С	С									
8.2 8F		Α	Α		X	X	X	X	X		_	0	_	0		_	C	C	С	C	C		_	0	0		_		_	_
10 10		A A	A	A	X	X	X	X	X	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	E
15 15	50	A	Α	A	X	X	X	X	X	С	C	С	С	С	C	С	С	С	C	С	С	С	С	С	С	C	С	С	С	E
18 18		Α	Α	A	X	X	X	X	X	С	С	С	С	С	С	С	С	С	С	С	С	С	С	С	С	С	С	С	С	E
22 22		A A	A	A	X	X	X	X	X	C	C	C	C	C	C C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	E
33 33		A	A	A	X	X	X	D	D	C	C	C	C	C	C	С	C	C	С	C	C	C	C	C	C	C	C	C	C	E
39 39	90	Α	Α	Α	Х	Х	Х	D	D	С	С	С	С	С	С	С	С	С	С	С	С	С	С	С	С	С	С	С	С	Е
47 47 56 56		A A	A	A	X	X	M	D C	D C	C	C	C	C	C	C	C	C	C	C	C	C	С	C	C	C	C	C	C	C	E
68 68		A	A	A	X	X	M	C	C	C	С	С	C	C	C	C	C	C	C	C	C		C	C	C	C	C	C	С	F
82 82		Х	Χ	Х	Х	Х	С	С	С	С	С	С	С	С	С	С	С	С	С	С	С		С	С	С	С	С	С	С	F
100 10 120 12		X	X C	X C	X	X	C	C E	C E	С	C	C	С	C	С	C	С	C	C	F	F		C	С	С	C	C	С	С	F G
150 15		C C	C	C	X	X	C	E	E	C	C	C	C F	E	C	C	C	F	F	F	F		C	C	C	C	C	C	C	G
180 18	81	C	C	C	Х	Х	E	Е	E	C	C	E	E	E	C	C	C	F	F	F	F		C	С	C	C	C	F	F	
220 22		C	С		Х	X	E	E	E	С	С	E	E	E	С	С	С	F	F	F	F		С	С	С	C	С	F	F	
270 27 330 33		C C	C C		C	C	E	E	E	C	C	E	E	E	C	C	C F	F	F	F	F		C	C	C	C F	C F	F	F	
390 39	91	С	С		С	С	Е	Е	Е	С	С	Е	Е	Е	С	С	F	F	F	F	F		С	С	С	F	F	F	F	
470 47		C C	С		С	C	E	Е	Е	С	С	E	E	E	С	С	F	F	F	F	F		С	С	F	F	F	F	F	
560 56 680 68		C	C C		C	C	E			C	C	E	E	E	C	C	F	F	F		1		C	C	F	F	F	G	G	
750 75		C	C		E	E	Ē			C	C	E	Ē	Ē	C	C	F	F	F				C	C	F	F	F	G	G	
820 82		С	С		Е	Е	Е			С	С	Е	E	Е	С	С	F	Е	Е		ļ		С	С	F	F	F	G	G	
1000 10 1200 12					E	E	E			C	C	E	F	F	C E	C E	F	E	E		<u> </u>		C	C	F	F E	F E	G	G	
1500 15					E	E				C	C	F	G	G	E	E	F						C	C	F	F	F			
1800 18		\Box			E	Е				С	С	G	G	G	E	Е	F						С	С	F	F	F			
2200 22 2700 27					E F	E				C	C	G G		-	E F	E	_	-	-	-	\vdash		C	C	E	G	G		-	<u> </u>
3300 33	32				E	E				С	С	G			E	E							С	С	F					
3900 39		П								С	С	G			E	E							С	С	F					
4700 47 5600 56		\dashv			\vdash	1	-	-		C F	C		-	-	E	E		-	-	1	\vdash	-	C	C	G		-	-		
6800 68										E	E				F	F							C	C						
8200 82		\Box								F	F												Е	Е						
Cap (µF) 0.010 10		_			<u> </u>	1	<u> </u>			F	F								-	1	┞		Е	Е						
0.012 12	_	_			⊢	├	-	-		F	F				<u> </u>			-	-	├			F	F		-		-		<u> </u>
0.015 15	_	_			!	-	<u> </u>	-		G	G	-	-	-	├	-		<u> </u>	-	-	\vdash	-	G	G		-	-	-	_	-
0.018 18	_	-			\vdash	\vdash	-	-		\vdash			-	-	\vdash	<u> </u>		-	-	\vdash	\vdash	<u> </u>	G	G		-	-	-		<u> </u>
0.022 22	_	-			\vdash	\vdash	-	-	_	 			-	-	├	-	_	-	-	\vdash	\vdash	-	 	-	-		-			\vdash
0.033 33	_	-			\vdash	\vdash	<u> </u>	-		\vdash	-	-		-	\vdash			<u> </u>	-	\vdash	\vdash		┢	-	1				-	\vdash
0.056 56	_	\dashv			\vdash	1		_		 				-	\vdash	-				1	\vdash	-	 	-						\vdash
0.056 56	_	\dashv	-		\vdash	1		1		\vdash	 	-		-	\vdash	<u> </u>			 	1	\vdash	<u> </u>	 	-	 	 		 	-	
0.100 10	_	\dashv				\vdash				\vdash					\vdash					\vdash	\vdash									
Voltage (V)		500	630	1000	600	630	1000	1500	2000	600	630	1000	1500	2000	600	630	1000	1500	2000	2500	3000	4000	600	630	1000	1500	2000	2500	3000	4000
Case Size			0805	1000 600 630 1000 1500 2000 1206								1210							808								12			



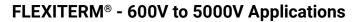


NPO (COG) CAPACITANCE RANGE PREFERRED SIZES ARE SHADED

Case Size					1	825								2220)								2225	5			
Soldering					Refle	ow Only	у						R	eflow (Only								eflow (
I (I) I engin	nm					± 0.50								.70 ± 0									.70 ± 0				
(11	n.)					± 0.02				-				224 ± 0									224 ± 0				
(W) Width	nm) ± 0.40								.00 ± 0					ł				.30 ± 0				
	n.) nm					± 0.01				-				.85 ± 0									248 ± 0				
I (T) Terminai	nax					± 0.01								033 ± 0								0	.85 ± C).35			
Voltage (V)		600	630	1000			2500	3000	4000	600	630	1000				3000	4000	5000	600	630	1000	1500	2000	2500	3000	4000	5000
	1R5																										
	1R8																						-	ļ		igwdown	
	2R2 2R7									<u> </u>																$\vdash \vdash \vdash$	
	3R3									┢																$\vdash \vdash$	
	3R9																										
	4R7																										
	5R6																						-	ļ		igwdown	
	6R8 8R2																		-							$\vdash\vdash$	
	100	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	F	F
	120	Ē	ш	Ē	E	Ē	E	E	E	E	E	Ē	Ē	Ē	E	E	E	E	E	E	Ē	E	Ē	E	E	F	F
	150	Е	Ε	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	F	F
	180	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	F	F
	220 270	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	F	F
	330	E	E	E	E	E	E	E	E	E	E	Ē	E	E	E	E	E	E	E	E	E	E	E	E	E	F	F
	390	E	E	E	E	E	E	E	Е	E	E	E	Е	Е	E	E	E	Е	E	E	E	E	E	E	E	F	F
	470	Е	Е	Е	Е	Е	Е	Е	F	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	F	G
	560	E	E	E	E	E	E	E	F	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	F	G
	680 820	E	E	E	E	E	E	E	F	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	F	G G
	101	E	E	E	E	E	E	E	F	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	G	G
	121	Ē	Ė	Ē	Ē	Ē	Ē	Ē	F	Ē	Ē	Ē	E	Ē	Ē	Ē	Ē	Ē	Ē	E	Ē	Ē	Ē	Ē	Ē	G	G
150	151	Е	Е	Е	Е	Е	Е	Е	F	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	G	G
	181	Е	Е	Е	Е	Е	Е	Е	F	Е	Е	Е	Е	Е	Е	Е	F	F	Е	Е	Е	Е	Е	Е	Е	G	G
	221 271	E	E	E	E	E	E	E	F	E	E	E	E	E	E	E	F	F	E	E	E	E	E	E	E	G	G G
	331	E	E	E	E	E	E	E	F	E	E	Ė	E	E	E	E			E	E	E	E	E	E	E	G	G
	391	Ē	Ė	Ē	Ē	Ē	Ē	Ē		Ē	Ē	Ē	E	Ē	Ē	Ē			Ē	E	Ē	Ē	Ē	Ē	Ē	G	
	471	Е	Е	Е	Е	Е	Е	Е		Е	Е	Е	Е	Е	Е	Е			Е	Е	Е	Е	Е	Е	Е	G	
	561	E	E	E	E	E	E	E		E	E	E	E	E	E	E			E	E	E	E	E	E	E	G	
	681 751	E	E	E	E	E	F	F		E	E	E	E	E	F	F			E	E	E	E	E	E	E	$\vdash\vdash$	
	821	E	E	E	E	E	F	F		E	E	E	E	E	F	F			E	E	E	E	E	F	E	\vdash	
	102	Ē	Ē	Ē	Ē	Ē	F	F		E	E	Ē	E	E	F	F			E	E	Ē	Ē	Ē	E	Ē		
	122	Е	Е	Е	Е	Е	G	G		Е	Е	Е	Е	Е	G	G			Е	Е	Е	Е	Е	F	F		
	152	E	Е	E	F	F	G	G		E	E	E	F	F	G	G	<u> </u>		E	E	E	E	E	F	F	$\vdash \vdash$	
	182 222	E	E	E	F G	F G	G	G		E	E	E	F G	F G	G	G			E	E	E	E	E	G	G	$\vdash \vdash \vdash$	
	272	E	E	E	G	G				E	E	E	G	G					E	E	E	F	F			М	
3300	332	Е	Е	E	G	G				Е	Е	Е	G	G					Е	Е	Е	F	F				
	392	Е	Е	Е	G	G				Е	Е	Е	G	G					Е	Е	Е	G	G				
	472	E	Е	E	G	G				E	E F	E	G	G					F	F	F	G	G			$\vdash \vdash$	
	562 682	F	F	F	G	G		-		F	F	F							F	F	F	G	G			$\vdash \vdash \vdash$	
	822	G	G	G						G	G	G							G	G	G					М	
Cap (μF) 0.010	103																		G	G	G						
	123																		G	G	G					\Box	
0.015	$\overline{}$							_		-						-	_		G	G	G		-	-	_	$\vdash \vdash$	\vdash
0.018 0.022	183 223									-						-			G	G G	G G		-	-		$\vdash\vdash$	
0.022										╁						 			G	G	G			\vdash		H	
0.047										l									G	G	G					М	
0.056	$\overline{}$																		G	G	G						
0.068																			G	G	G					igsqcut	
0.100 Voltage (V)	104	6በበ	630	1000	1500	2000	2500	3000	4000	600	630	1000	1500	2000	2500	3000	4000	5000	G 600	G 630	1000	1500	2000	2500	3000	4000	5000
Case Size		000	000	1000		825		10000	7000	000		1000	1300	2220		1 3000		3000	000		1000	1300	2225		3000	-+000	3000

Letter	Α	С	E	F	G	X
Max.	0.81	1.45	1.80	2.20	2.80	0.94
Thickness	(0.032)	(0.057)	(0.071)	(0.087)	(0.110)	(0.037)







X7R Dielectric

Performance Characteristics

Capacitance Range	10 pF to 0.82 μF (25°C, 1.0 ±0.2 Vrms at 1kHz)
Capacitance Tolerances	±10%; ±20%; +80%, -20%
Dissipation Factor	2.5% max. (+25°C, 1.0 ±0.2 Vrms, 1kHz)
Operating Temperature Range	-55°C to +125°C
Temperature Characteristic	±15% (0 VDC)
Voltage Ratings	600, 630, 1000, 1500, 2000, 2500, 3000, 4000 & 5000 VDC (+125°C)
Insulation Resistance (+25°C, at 500 VDC)	100K MΩ min. or 1000 MΩ - μF min., whichever is less
Insulation Resistance (+125°C, at 500 VDC)	10K MΩ min. or 100 MΩ - μF min., whichever is less
Dielectric Strength	Minimum 120% rated voltage for 5 seconds at 50 mA max. current

X7R CAPACITANCE RANGE PREFERRED SIZES ARE SHADED

Case Size Soldering (L) Length mm (n) (W) Width mmx Voltage (V) Cap (pF) 100 101 150 151 180 181 220 221 270 271 330 331 390 391 470 471 560 561 680 681 750 751 820 821 1000 102 1200 122 11500 152	Ref (0.0 1. (0.0 0. (0.0	0805 flow/Withdress f	20 (08) (0 (08) (0 (08)	600 C C C C C	Refi 3.: (0.1: 1.60 0.063 + 0.: (0.0: 630 C C C C C	60 ± 0. 24 ± 0. 1000 E E E E	/ave 30 012) -0.10 /-0.004 20		600 E E	Ref (0.1) (0.0) (0.0) (0.0)	1210 flow O 30 ± 0.4 30 ± 0.6 50 ± 0.3 98 ± 0.6 75 ± 0.3 30 ± 0.6 1000	10 016) 30 012) 35 014) 1500	2000 E	600		(2.00 : 0.079 : 0.75 :	v Only ± 0.50 ± 0.020 ± 0.20 ± 0.008 ± 0.35)					(Reflow 4.60 ± 0.181 ± 3.20 ± 0.126 ± 0.75 ±	v Only : 0.50 : 0.020) : 0.30 : 0.012) : 0.35)		
(L) Length (in.) W) Width mm (in.) (t) Terminal max Voltage (V) Cap (pF) 100 101 120 121 150 151 180 181 220 221 270 271 330 331 390 391 470 471 560 561 680 681 750 751 820 821 1000 102 1200 122 1500 152	(0.0 1. (0.0 0.0 (0.0 0.0 0.0 0.0 0.0 0.0 X X X X X X X X	83 ± 0.C .25 ± 0.2 .25 ± 0.2 .49 ± 0.C .50 ± 0.2 .20 ± 0.C .630 X X X X X X X X X X X	008) 008) 008) 008) 1000 C C C C C C	600 C C C C C	(0.1; 1.60 0.063 + 0.0 (0.0; 630 C C C C C	30 ± 0. +0.30/ +0.012/ 60 ± 0. 24 ± 0. 1000 E E E	012) -0.10 -0.004 20 008) 1500 E E E	2000 E E	E E E	(0.1: 2.: (0.0: 0.: (0.0: 630 E	30 ± 0.0 50 ± 0.3 98 ± 0.0 75 ± 0.3 30 ± 0.0	016) 30 012) 35 014) 1500		600		(0.181 ± 2.00 ± 0.079 ± 0.75 ±	± 0.020 ± 0.20 ± 0.008 ± 0.35)					(0.181 ± 3.20 ± 0.126 ± 0.75 ±	0.020) 0.30 0.012))		
W) Width mm (n) (n) (t) Terminal mm (nx) mm (nx) Voltage (V) 100 101 120 121 150 151 180 181 220 221 270 271 330 331 390 391 470 471 560 561 680 681 750 751 820 821 1000 102 122 1500 152 150 1500 152 1800 182	(0.0 (0.0 (0.0 X X X X X X X X X X X X X	149 ± 0.C 50 ± 0.2 120 ± 0.C 1630 X X X X X X X X X X X	008) 20 008) 1000 C C C C C C	600 C C C C C	1.60 0.063 + 0.1 (0.0) 630 C C C C C	+0.30/ +0.012 60 ± 0. 24 ± 0. 1000 E E E E	7-0.10 /-0.004 20 008) 1500 E E E	2000 E E	E E E	(0.0° (0.0° (0.0° 630 E	98 ± 0.0 75 ± 0.3 30 ± 0.0 1000	012) 35 014) 1500		600		,	0.079 : 0.75 :	± 0.008 ± 0.35							0.126 ± 0.75 ±	0.012			
(t) Terminal max Voltage (V) Cap (pF) 100 101 120 121 150 151 180 181 220 221 270 271 330 331 390 391 470 471 560 561 680 681 750 751 820 821 1000 102 1200 122 1500 152	0. (0.0 600 x x x x x x x x x x x x x x x	.50 ± 0.2 .20 ± 0.0 .630	20 008) 10000 C C C C C C	600 C C C C C	0.0 (0.0) 630 C C C C C	60 ± 0. 24 ± 0. 1000 E E E E	20 008) 1500 E E E	2000 E E	E E E	0. (0.0: 630 E	75 ± 0.3 30 ± 0.0 1000 E	35 014) 1500 E		600	600	,	0.75	± 0.35							0.75 ±	0.35			
Voltage (V) Cap (pF) 100 101 120 121 150 151 180 181 220 221 270 271 330 331 390 391 470 471 560 561 680 681 750 751 820 821 1000 102 1200 122 1500 152	x x x x x x x x x x x x x x x	630 X X X X X X X X X	1000 C C C C C C C	0 0 0 0 0	630 C C C C C	1000 E E E E E	1500 E E E	E E	E E E	630 E E	1000 E	1500 E		600	600	()		
Cap (pF) 100 101 120 121 150 151 180 181 220 221 270 271 330 331 390 391 470 471 560 561 680 681 750 751 820 821 1000 102 122 1500 152 1800 182	x x x x x x x x x x x x	X X X X X X X X X X X X X X X X X X X	C C C C C C	0 0 0 0 0	C C C C	E E E E	E E E	E E	E E E	E E	Е	Е				1000		± 0.014		3000	4000	600	630		0.030 ±			3000	4000
150 151 180 181 220 221 270 271 330 331 390 391 470 471 560 561 680 681 750 751 820 821 1000 102 1200 122 1500 152	X X X X X X X X X	X X X X X X X X X X X X X X X X X X X	C C C C C	C C C C	C C C	E E E	E E	Е	Е		Е									-									
180 181 220 221 270 271 330 331 390 391 470 471 560 561 680 681 750 751 820 821 1000 102 1200 122 1500 152	X X X X X X X X	X X X X X X X	C C C C	C C C	C C C	E E E	Е	-	_	Е		Е	Е																
220 221 270 271 330 331 330 391 470 471 560 561 680 681 750 751 820 821 1000 102 1200 122 1500 152	X X X X X X X	X X X X X X	C C C	C C C	C C	E E		Е		_ C	Е	Е	Е																
270 271 330 331 390 391 470 471 560 561 680 681 750 751 820 821 1000 102 1200 122 1500 152	X X X X X X	X X X X X	C C C	C C	C C	Е	Е		Е	Е	Е	Е	Е																
330 331 390 391 470 471 560 561 680 681 750 751 820 821 1000 102 1200 122 1500 152 1800 182	X X X X X	X X X X	C C	C C	С			Е	Е	Е	Е	Е	Е																
390 391 470 471 560 561 680 681 750 751 820 821 1000 102 1200 122 1500 152 1800 182	X X X X X	X X X	C C	С			Е	Е	Е	Е	Е	Е	Е									Е	Е	Е	Е	Е			
470 471 560 561 680 681 750 751 820 821 1000 102 1200 122 1500 152 1800 182	X X X X	X X X	С	_		Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	F		Е	Е	Е	Е	Е			
560 561 680 681 750 751 820 821 1000 102 1200 122 1500 152 1800 182	X X X	X	_	_	С	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	F		Е	Е	Е	Е	Е			
680 681 750 751 820 821 1000 102 1200 122 1500 152 1800 182	X X X	Х	С	С	С	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	F		Е	Е	Е	Е	Е	Е	Е	
750 751 820 821 1000 102 1200 122 1500 152 1800 182	X		$\overline{}$	С	С	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	F	F		Е	Е	Е	Е	Е	Е	Е	
820 821 1000 102 1200 122 1500 152 1800 182	Х	1 V	С	С	С	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	F	F		Е	Е	Е	Е	Е	F	F	
1000 102 1200 122 1500 152 1800 182	_		С	С	С	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	F	F		Е	Е	Е	Е	Е	F	F	
1200 122 1500 152 1800 182	Х	Х	С	С	С	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	F	F		Е	Е	Е	Е	Е	F	F	
1500 152 1800 182		Х	С	С	С	E	E	E	E	E	E	E	E	E	Е	E	E	Е	F	F		E	E	E	E	E	F	F	
1800 182	Х	Х	С	С	С	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	Е	F	F		F	F	F	F	F	F	F	
	Х	Х	С	С	С	E	E	E	E	E	E	E	E	E	Е	E	E	E	F	F		F	F	F	F	F	G	G	_
	Х	X		С	С	E	E	E	E	E	E	E	E	E	Е	E	E	Е	F	F		F	F	F	F	F	G	G	_
2200 222	Х	X		С	С	E	E	Е	E	E	E	F	E	E	E	E	F	F	F			F	F	F	F	F	G	G	_
2700 272	Х	X		C C	С	E	Е		E	E	E	F	E	E	E	E	F	F				F	F	F	F	F F	G	G	_
3300 332	X	X		C	С	E		_	E	E	E	F	Е	E	E	E	F	F				F	F	F	F	F	G	G	_
3900 392	X	X	_	_	С	E			E E	E	E	G		E	E	E	F					F	_	F	F		G	G	_
4700 472 5600 562	X	X	_	C C	C	E			E	E	E	G G		E E	E	E	F					F	F	F	G	F G	G	G	├
6800 682	X	X	-	С	С	E			E	E	E	G		E	E	E	F					F	F	F	G	G			├
8200 822	X	X	-	С	0	E			E	E	E		\vdash	E	E	E	-					F	F	E	G	G			\vdash
Cap (µF) 0.010 103	C	C		С	С	E			E	E	E			E	E	E						F	F	F	G	G			\vdash
0.015 153	C	С	-	E	E	E			E	E	E			F	F	F						F	F	F	G	0			
0.018 183	С	С		Ē	E	_			E	E	E			F	F	F						F	F	G					
0.022 223	С	С		E	E				E	E	E			F	F	F						F	F	G					
0.027 273				Е	Е				Е	Е				F	F							F	F	G					
0.033 333				Е	Е				Е	Е				F	F							F	F	G					
0.039 393									Е	Е				F	F							F	F	G					
0.047 473									Е	Е				F	F							F	F	G					
0.056 563									F	F				F	F							F	F						
0.068 683									F	F				F	F							F	F						
0.082 823									F	F												F	F						
0.100 104]						F	F												F	F						
0.150 154		oxdot																				G	G						<u> </u>
0.220 224		\sqcup							<u> </u>													G	G						<u> </u>
0.270 274		\sqcup																											<u> </u>
0.330 334		\sqcup							<u> </u>				Ш																Ь—
0.390 394		\sqcup							<u> </u>																				₩
0.470 474		\vdash						\vdash	├—				\vdash																—
0.560 564		\vdash							<u> </u>				\vdash															$\overline{}$	—
0.680 684	<u> </u>	\vdash						\vdash	├				$\vdash\vdash$				—						_				$\vdash \vdash$		₩
0.820 824 1.000 105		\vdash							<u> </u>				\vdash										_						—
1.000 105 Voltage (V)	600	630	1000	600	630	1000	1500	2000	600	630	1000	1500	2000	600	620	1000	1500	2000	2500	3000	4000	600	630	1000	1500	2000	2500	3000	4000
Case Size		0805	.000	000		1206		2000	000		1210	1000																	





X7R CAPACITANCE RANGE PREFERRED SIZES ARE SHADED

Case Size					325								2220									2225									3640				
Soldering	_				w Only								low 0									flow C									eflow C				
(L) Length mm (in.)					± 0.50 0.020								70 0.5 24 0.0									70 ± 0 24 ± 0									.14 ± 0 360 ± 0				
W) Width mm				6.30 :	± 0.40)						5.	00 0.4	0							6.3	30 ± 0	.40							5	.72 ± 0	.25			
· (In.)	_		(± 0.01								97 0.0									18 ± 0									225 ± 0				
(t) Terminal mm max			((± 0.35 ± 0.01								85 0.3 3 ± 0.									35 ± 0 33 ± 0									.76 (0.0 .52 (0.0				
Voltage (V)	600	630					3000	4000	600	630	1000				3000	4000	5000	600	630	1000				3000	4000	5000	600	630	1000			2500	3000	4000	5000
Cap (pF) 100 101																																			
120 121																																			
150 151	ㄴ		_	_	<u> </u>	<u> </u>	_	\perp																											Щ
180 181	<u> </u>	-			<u> </u>	<u> </u>		\perp																			_								
220 221 270 271	⊢	-	-	-	₩	-	-	\vdash					_				_				_			_	_	_	_		-	-	-				\vdash
330 331	┢	1	-	-	-	1	+	+																			-		-	-					
390 391	┢	1				1		+																											$\vdash\vdash\vdash$
470 471	┢	\vdash			\vdash	+		+					\vdash							\vdash	_					_	_								\vdash
560 561	Н	t	t		l –	1	t	\vdash													\vdash						t		t	t	t		t		$\vdash \vdash$
680 681	T	1			1	1		+																											М
750 751	Г		1		t	t	t	\Box																											\vdash
820 821					i –	1										Ì								İ											М
1000 102	F	F	F	F	F	F	F		F	F	F	F	F	F	G			F	F	F	F	F	F	F			G	G	G	G	G	G	G	G	G
1200 122	F	F	F	F	F	F	F		F	F	F	F	F	F	G			F	F	F	F	F	F	F			G	G	G	G	G	G	G	G	G
1500 152	F	F	F	F	F	F	F		F	F	F	F	F	F	G			F	F	F	F	F	F	F			G	G	G	G	G	G	G	G	G
1800 182	F	F	F	F	F	F	F		F	F	F	F	F	F	G			F	F	F	F	F	F	F			G	G	G	G	G	G	G	G	G
2200 222	F	F	F	F	F	F	F		F	F	F	F	F	F	G			F	F	F	F	F	F	F			G	G	G	G	G	G	G	G	G
2700 272	F	F	F	F	F	F	F		F	F	F	F	F	F	G			F	F	F	F	F	F	F			G	G	G	G	G	G	G	G	G
3300 332	F	F	F	F	F	F	F		F	F	F	F	F	F	G			F	F	F	F	F	F	F			G	G	G	G	G	G	G	G	G
3900 392	F	F	F	F	F	F	F		F	F	F	F	F	F	G			F	F	F	F	F	F	F			G	G	G	G	G	G	G	G	
4700 472	F	F	F	F	F	F	F		F	F	F	F	F	F	G			F	F	F	F	F	F	F			G	G	G	G	G	G	G	G	
5600 562	F	F	F	F	F	F	F		F	F	F	F	F	F	G			F	F	F	F	F	F	F			G	G	G	G	G	G	G	G	
6800 682	F	F	F	G	G	G	G		F	F	F	F	F	G	G			F	F	F	F	F	G	G			G	G	G	G	G	G	G	G	
8200 822	F	F	F	G	G	G	G		F	F	F	G	G	G	G			F	F	F	F	F	G	G			G	G	G	G	G	G	G		
Cap (µF) 0.010 103	F	F	F	G	G	G	G		F	F	F	G	G	G	G			F	F	F	F	F	G	G			G	G	G	G	G	G	G		
0.015 153	F	F	F	G	G	G			F	F	F	G	G	G	_			F	F	F	G	G	G	G			G	G	G	G	G	G	G		Ш
0.018 183	F	F	F	G	G	_	_		F	F	F	G	G	G	_			F	F	F	G	G	G				G	G	G	G	G	G	G		Ш
0.022 223	F	F	F	G	G	_			F	F	F	G	G					F	F	F	G	G	G				G	G	G	G	G	G			Ш
0.027 273	F	F	F	G			_		F	F	F	G	G					F	F	F	G	G					G	G	G	G	G				Щ
0.033 333	F	F	F	G		1	_		F	F	F	G				_		F	F	F	G	G					G	G	G	G					\sqcup
0.039 393	F	F	F	G		1	_		F	F	F	G				_		F	F	F	G						G	G	G	G					\sqcup
0.047 473	F	F	F	Р	_	1	1	\vdash	F	F	F	G			_	_		F	F	F	G			_	_		G	G	G	G					\sqcup
0.056 563	F	F	F	G	-	1	1	\vdash	F	F	F	G		_			<u> </u>	F	F	F	G	_	<u> </u>		<u> </u>		G	G	G	G	_		-	_	\sqcup
0.068 683	F	F	G	_	1	1	1	\vdash	F	F	G			_			<u> </u>	F	F	F	G		-		<u> </u>		G	G	G	G	_		-	_	\sqcup
0.082 823	F	F	G		1	1	_		F	F	G							F	F	G				_			G	G							\sqcup
0.100 104	F	F	G		<u> </u>	1	_		F	F	G							F	F	G				_			G	G							\sqcup
0.150 154	F	F		<u> </u>	1	1	1		F	F	G			_	-			F	F	G	-	_		_	_	_	G	G	_	-	-		-		$\vdash \vdash \vdash$
0.220 224	F	F		\vdash	₩	₩	+		F	F	G		-		-	<u> </u>	<u> </u>	F	F	<u> </u>	-		-	-	<u> </u>	-	G	G	-	\vdash	\vdash		-	-	$\vdash \vdash \vdash$
0.270 274 0.330 334	F	F		\vdash	1	1	1	\vdash	F	F				-			<u> </u>	F	F		-	-	-		<u> </u>	-	G G	G G		-	-		-		$\vdash\vdash\vdash$
0.390 394	F	F		\vdash	+	+	+		F	F			\vdash	\vdash	\vdash			F	F	\vdash	_	\vdash		\vdash		_	G	G		\vdash	\vdash		\vdash		$\vdash\vdash\vdash$
0.470 474	F	F		\vdash	1	1	+		F	F					<u> </u>			F	F		\vdash				\vdash	\vdash	G	G		\vdash	\vdash			<u> </u>	$\vdash \vdash$
0.560 564	G	G			1	1		\vdash	G	G								F	F								G	G							$\vdash \vdash \vdash$
0.680 684					t	 			G	G								G	G																\vdash
0.820 824	Г		1		l	l	1		G	G								G	G								i –								
1.000 105	Г	1			1	1			G	G						Ì		G	G					İ											Π
Voltage (V)	600	630	1000			2500	3000	4000	600	630	1000			2500	3000	4000	5000	600	630	1000				3000	4000	5000	600	630	1000	1500		2500	3000	4000	5000
Case Size				18	325								2220									2225)								3640				

Letter	Α	С	Е	F	G	Р	Х
Max.	0.81	1.45	1.80	2.20	2.80	3.10	0.94
Thickness	(0.032)	(0.057)	(0.071)	(0.087)	(0.110)	(0.120)	(0.037)

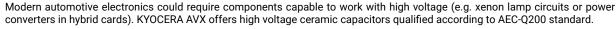


High Voltage MLC Chip Capacitors

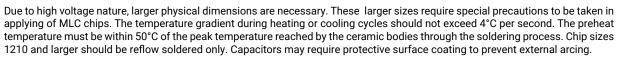


For 600V to 3000V Automotive Applications - AEC-Q200





High value, low leakage and small size are diffocult parameters to obtain in cpacitors for high voltage systems. KYOCERA AVX special hgih voltage MLC chip capacitors meet these performance characteristics and are designed for applications such as snubbers in high frequency power converters, resonators in SMPS, and high voltage coupling/dc blocking. These high voltage chip designs exhibit low ESRs at high frequencies.



To improve mechanical and thermal resistance, KYOCERA AVX recommend to use flexible terminations system - FLEXITERM®.

HOW TO ORDER

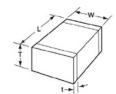
1210	С	С	223	K	4	Т	2	Α
$\overline{}$	T	T	T	T	\top	T	T	T
Size	Voltage	Dielectric	Capacitance	Capacitance	Failure Rate	Terminations	Packaging	Special Code
1206	C = 630V	X7R = C	Code	Tolerance	4 = Automotive	T = Plated Ni and Sn	2 = 7" Reel	A = Std. Product
1210	A = 1000V		2 Sig. Digits +	K = ±10%		Z = FLEXITERM®	4 = 13" Reel	
1808	S = 1500V		Number of Zeros	M = ±20%				
1812	G = 2000V		e.g. 103 = 10nF					
2220	W = 2500V		(223 = 22nF)					
	H = 3000V		(- ==)					

^{*}KYOCERA AVX offers nonstandard case size. Contact factory for details.

Notes: Capacitors with X7R dielectrics are not indeded for applications across AC supply mains or AC line filtering with polarity reversal. Please contact KYOCERA AVX for recommendations

CHIP DIMENSIONS DESCRIPTION

(SEE CAPACITANCE RANGE CHART ON PAGE 128)



L = Length W = Width T = Thickness t = Terminal

X7R DIELECTRIC PERFORMANCE CHARACTERISTICS

Parameter/Test	Specification Limits	Measuring Conditions		
Operating Temperature Range	-55°C to +125°C	Temperature Cycle Chamber		
Capacitance	within specified tolerance	Freq.: 1kHz ±10%		
Dissipation Factor	2.5% max.	Voltage: 1.0Vrm s ±0.2Vrms		
Capacitance Tolerance	±5% (J), ±10% (K), ±20% (M)	T = +25°C, V = 0Vdc		
Temperature Characteristics	X7R = ±15%	Vdc = 0V, T = (-55°C to +125°C)		
	100GΩ min. or 1000MΩ • μF min. (whichever is less)	T = +25°C, V = 500Vdc		
Insulation Resistance	10GΩ min. or 1000MΩ • μ F min. (whichever is less)	T = +125°C, V = 500Vdc		
	TOOL TIME OF TOOMILE AT TIME (WINGHEVER TO 1600)	(t ≥ 120 sec, l ≤ 50mA)		
Dielectric Strength	No breakdown or visual defect	120% of rated voltage		
Dielectric otrength	No breakdown or visual defect	t ≤ 5 sec, l ≤ 50mA		

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High Voltage MLC Chips FLEXITERM®



For 600V to 3000V Automotive Applications - AEC-Q200

X7R CAPACITANCE RANGE PREFERRED SIZES ARE SHADED

Case Siz	ze			1206				12	10				18	808					18	12					2220		
Solderin	g			low/W				Reflow		e				v Only						v Only					flow 0		
(L) Length	mm			.2 ± 0				3.2 ±			4.57 ± 0.25						± 0.3					.7 ± 0.					
(L) Length	(in.)			26 ± 0			(().126 :		8)				± 0.01))			((± 0.012	2)				24 ± 0		
W) Width	mm			.6 ± 0				2.5 :					2.03 :							± 0.2			l		5 ± 0.4		
,	(in.)			53 ± 0			(0	0.098 ±		8)			<u> </u>	± 0.01))			((± 0.008	3)				97 ± 0.		
(t) Terminal	mm			5 ± 0.				0.5 ±					0.61 :		•			,,		± 0.36			0.64 ± 0.39				
• •	max			02 ± 0				(0.02 ±						± 0.01						± 0.014					25 ± 0.		
Voltage (,	630		_	2000		630	1000	1500	2000	630	1000	1500	2000	2500	3000	630	1000	1500	2000	2500	3000	630	1000	1500	2000	3000
Cap (pF) 101	100	С	E	E	E	E																					
121	120	С	E	E	E	E																					
151	150	С	E	E	E	E																				-	
181	180	С	E	E	E	E					_															_	
221	220 270	С	E	E	E	E	_	Г	Г		E	E	E	E	E	E											
271 331	330	C	E	E	E	E	E	E	E	E	E	E	E	E	E	E											
331	390	С	E	E	E	E	E	E	E	E	E	E	E	E	E	F	E										
471	470	C	E	E	E	E	E	E	E	E	E	E	E	E	F	F	E	Е	Е	Е	Е	Е			_	\vdash	_
561	560	С	E	E	E	E	E	E	E	E	E	E	E	E	F	F	E	E	E	E	E	E	l —		-	\vdash	-
681	680	С	E	E	E	E	E	E	E	E	E	E	F	F	F	F	E	E	E	E	F	F	 			\vdash	
821	820	С	E	E	E	E	E	E	E	E	E	E	F	F	F	F	E	E	E	E	F	F	-			\vdash	
102	1000	С	E	E	E	E	E	E	E	E	E	E	F	F	F	F	E	E	E	E	F	F	F	F	F	F	G
122	1220	С	E	E	E	-	Ē	E	E	E		_	•	•	•	•	F	F	F	F	G	•	F	F	F	F	G
152	1500	C	E	E	E		E	E	E	E							F	F	F	F	G		F	F	F	F	G
182	1800	C	E	E			E	E	Е	E							F	F	F	F	G		F	F	F	F	G
222	2200	С	Е	Е			Е	Е	Е	Е							F	F	F	F	G		F	F	F	F	G
272	2700	С	Е	Е			Е	Е	Е	Е							F	F	F	F			F	F	F	F	
332	3300	С	Е				Е	Е	Е	Е							F	F	F	F			F	F	F	F	
392	3900	С	Е				Е	Е	Е								F	F	F	F			F	F	F	F	
472	4700	С	Е				Е	Е	Е								F	F	G	G			F	F	F	F	
562	5600	С	Е				Е	Е	Е								F	F	G	G			F	F	F	F	
682	6800	Е	Е				Е	Е									F	F	G	G			F	F	F	F	
822	8200	Е					Е	Е									F	F	G	G			F	F	G	G	
103	0.01	Е					Е	Е									F	F	G				G	G	G	G	
123							Е	Е									F	F	G				G	G	G	G	
153						-	E	E									F	F	G				G	G	G	G	
183							E	Е									F	F					G	G	G	G	
223							E										F	F					G	G	G	G	
273 333						-	Q										F						G G	G			
393																	F						G	G G		 	
473											1						F						G	G			
563										<u> </u>	\vdash												G	G			<u> </u>
683											 						 	<u> </u>					G	G			
823											†												G	G			
104	0.1				i i									İ	İ								G	G			
124	0.12																						G				
154	0.15																						G				
224	0.22																										
334																											
474																											
684																	<u> </u>						l			<u> </u>	
105	1				<u> </u>												<u> </u>						<u> </u>			L	
155					-	<u> </u>					ļ						<u> </u>	<u> </u>					ļ			<u> </u>	
225	2.2				-	-											<u> </u>						<u> </u>			<u> </u>	ļ
335					-	-											<u> </u>						ļ			 	
475											-						 						 				
106 226											-												<u> </u>			 	
WVDC		630	1000	1500	2000	2500	630	1000	1500	2000	630	1000	1500	2000	2500	3000	630	1000	1500	2000	2500	3000	630	1000	1500	2000	3000
Size		030	1000	1206		12300	030		10	12000	030	1000		08	12300	13000	030	1000		12000	2300	13000	030	1000	2220		13000
3126				1200				12					10	JU					10	14					2220		

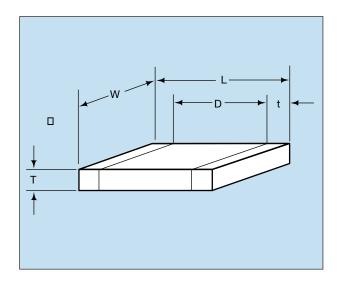
NOTE: Contact factory for non-specified capacitance values

Letter	Α	С	E	F	G	Q
Max	0.81	1.45	1.80	2.20	2.80	1.78
Thickness	(0.032)	(0.057)	(0.071)	(0.087)	(0.110)	(0.070)



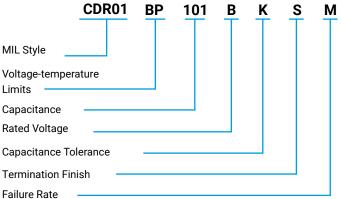
Part Number Example CDR01 thru CDR06





MILITARY DESIGNATION PER MIL-PRF-55681

Part Number Example



NOTE: Contact factory for availability of Termination and Tolerance Options for Specific Part Numbers.

MIL Style: CDR01, CDR02, CDR03, CDR04, CDR05,

CDR06

Voltage Temperature Limits:

BP = 0 ± 30 ppm/°C without voltage; 0 ± 30 ppm/°C with rated voltage from -55°C to +125°C

BX = $\pm 15\%$ without voltage; $\pm 15 - 25\%$ with rated voltage from -55°C to +125°C

Capacitance: Two digit figures followed by multiplier (number of zeros to be added) e.g., 101 = 100 pF

Rated Voltage: A = 50V, B = 100V

Capacitance Tolerance: J ± 5%, K ± 10%, M ± 20%

Termination Finish:

M = Palladium silver

N = Silver-nickel-gold

S = Solder coated final with a minimum of 4 percent lead

T = Silver

Base metallization-barrier metal-solder coated (tin/lead alloy, with a minimum of 4 percent lead)

W = Base metallization-barrier metal-tinned (tin or tin/lead alloy)

Base metallization-barrier metal-tin (100 percent)

Z = Base metallization-barrier metal-tinned (tin/lead alloy, with a minimum of 4 percent lead)

*See MIL-PRF-55681 Specification for more details

M = 1.0%, P = .1%, R = .01%, Failure Rate Level:

S = .001%

Packaging: Bulk is standard packaging. Tape and reel

per RS481 is available upon request.

*Not RoHS Compliant

CROSS REFERENCE: MIL-PRF-55681/CDR01 THRU CDR06*

Per	Cardo	Length (L)	Width (W)	Thickr	ness (T)		D	Termination Band (t)	
MIL-PRF-55681	Style			Min.	Max.	Min.	Max.	Min.	Max.
CDR01	0805	.080 ± .015	.050 ± .015	.022	.055	.030	_	.010	_
CDR02	1805	.180 ± .015	.050 ± .015	.022	.055	_	_	.010	.030
CDR03	1808	.180 ± .015	.080 ± .018	.022	.080	_	_	.010	.030
CDR04	1812	.180 ± .015	.125 ± .015	.022	.080	_	_	.010	.030
CDR05	1825	.180 + .020 015	+.020 .250 ₀₁₅	.020	.080	_	_	.010	.030
CDR06	2225	225 + 020	250 + 020	020	080	_	_	010	.030

*For CDR11, 12, 13, and 14 see KYOCERA AVX Microwave Chip Capacitor Catalog

Military Part Number Identification CDR01 thru CDR06



CDR01 thru CDR06 to MIL-PRF-55681

Military Type Designation	Capacitance in pF	Capacitance tolerance	Rated temperature and voltage- temperature limits	WVDC
Style 0805/CDR	01	<u> </u>	, ,	
CDR01BP100B	10	J,K	BP	100
CDR01BP120B	12	j	BP	100
CDR01BP150B	15	J,K	BP	100
CDR01BP180B	18	J	BP	100
CDR01BP220B	22	J,K	BP	100
CDR01BP270B	27	J	BP	100
CDR01BP330B	33	J,K	BP	100
CDR01BP390B	39	J	BP	100
CDR01BP470B	47	J,K	BP	100
CDR01BP560B	56	l '	BP BP	
CDR01BP580B	68	J J,K	BP BP	100 100
CDR01BP820B	82	J,K	BP BP	100
CDR01BP101B	100	J,K	BP	100
CDR01B-121B	120	J,K	BP,BX	100
CDR01B151B	150	J,K	BP,BX	100
CDR01B181B	180	J,K	BP,BX	100
CDR01BX221B	220	K,M	BX	100
CDR01BX271B	270	K	BX	100
CDR01BX331B	330	K,M	BX	100
CDR01BX391B	390	K	BX	100
CDR01BX471B	470	K,M	BX	100
CDR01BX561B	560	K	BX	100
CDR01BX681B	680	K,M	BX	100
CDR01BX821B	820	K	BX	100
CDR01BX102B	1000	K,M	BX	100
CDR01BX122B	1200	K	BX	100
CDR01BX152B	1500	K,M	BX	100
CDR01BX182B	1800	K	BX	100
CDR01BX222B	2200	K,M	BX	100
CDR01BX272B	2700	K	BX	100
CDR01BX332B	3300	K,M	BX	100
CDR01BX392A	3900	K	BX	50
CDR01BX472A	4700	K,M	BX	50
tyle 1805/CDR	02			
CDR02BP221B	220	J,K	BP	100
CDR02BP271B	270	J	BP	100
CDR02BX392B	3900	K	BX	100
CDR02BX472B	4700	K,M	BX	100
CDR02BX562B	5600	K	BX	100
CDR02BX682B	6800	K,M	BX	100
CDR02BX822B	8200	K	BX	100
CDR02BX103B	10,000	K,M	BX	100
CDR02BX123A	12,000	K	BX	50
CDR02BX153A	15,000	K,M	BX	50
CDR02BX183A	18,000	Ŕ	BX	50
CDR02BX223A	22,000	K,M	BX	50
CDRUZBX223A	22,000 Add appropriat Add appropriat	e failure rate		<u> 50 </u>

Military Type Designation/	Capacitance in pF	Capacitance tolerance	Rated temperature and voltage-	WVDC
Style 1808/CDR			temperature limits	
CDR03BP331B	330	J,K	BP	100
CDR03BP391B	390	J	BP	100
CDR03BP471B	470	J,K	BP	100
CDR03BP561B	560	J	BP	100
CDR03BP681B	680	J,K	BP BP	100
CDR03BP821B	820	J	BP	100
CDR03BP102B	1000	J,K	BP	100
CDR03BX123B	12,000	K	BX	100
CDR03BX153B	15.000	K,M	BX	100
CDR03BX183B	18.000	K	BX	100
CDR03BX223B	22,000	K,M	BX	100
CDR03BX273B	27.000	K	BX	100
CDR03BX333B	33.000	K,M	BX	100
CDR03BX393A	39.000	K	BX	50
CDR03BX473A	47.000	K,M	BX	50
CDR03BX563A	56.000	K	BX	50
CDR03BX683A	68.000	K,M	BX	50
Style 1812/CDR	04			
CDR04BP122B	1200	J	BP	100
CDR04BP152B	1500	J,K	BP	100
CDR04BP182B	1800	J	BP	100
CDR04BP222B	2200	J,K	BP	100
CDR04BP272B	2700	J	BP	100
CDR04BP332B	3300	J,K	BP	100
CDR04BX393B	39.000	K	BX	100
CDR04BX473B	47.000	K,M	BX	100
CDR04BX563B	56.000	K	BX	100
CDR04BX823A	82.000	K	BX	50
CDR04BX104A	100,000	K,M	BX	50
CDR04BX124A	120,000	K	BX	50
CDR04BX154A	150.000	K,M	BX	50
CDR04BX184A	180.000	K	BX	50
Style 1825/CDR				
CDR05BP392B	3900	J,K	BP	100
CDR05BP472B	4700	J,K	BP	100
CDR05BP562B	5600	J,K	BP BY	100
CDR05BX683B	68,000	K,M K	BX BX	100
CDR05BX823B	82,000	K,M	BX BX	100 100
CDR05BX104B CDR05BX124B	100,000 120,000	K,IVI	BX BX	100
CDR05BX124B CDR05BX154B	150.000	K,M	BX BX	100
CDR05BX224A	220.000	K,M	BX	50
CDR05BX274A	270,000	K,IVI	BX	50
CDR05BX334A	330,000	K,M	BX	50
Style 2225/CDR		1 15111		
CDR06BP682B	6800	J,K	BP	100
CDR06BP822B	8200	J,K	BP BP	100
CDR06BP103B	10,000	J,K	BP BP	100
CDR06BX394A	390.000	K K	BX	50
CDR06BX474A	470.000	K,M	BX	50

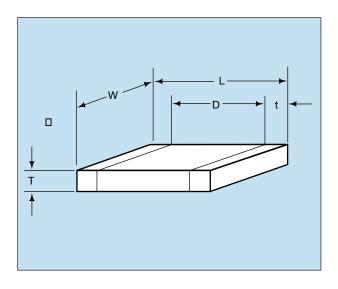
Add appropriate failure rate

Add appropriate termination finish

Capacitance Tolerance

Part Number Example CDR31 thru CDR35





MILITARY DESIGNATION PER MIL-PRF-55681

Part Number Example (example) CDR31 BP 101 В Κ S M MIL Style Voltage-Temperature Limits Capacitance Rated Voltage Capacitance Tolerance **Termination Finish** Failure Rate

NOTE: Contact factory for availability of Termination and Tolerance Options for Specific Part Numbers.

MIL Style: CDR31, CDR32, CDR33, CDR34, CDR35

Voltage-Temperature Limits:

BP = 0 ± 30 ppm/°C without voltage; 0 ± 30 ppm/°C with rated voltage from -55°C to +125°C

BX = $\pm 15\%$ without voltage; $\pm 15 - 25\%$ with rated voltage from -55°C to +125°C

Capacitance: Two digit figures followed by multiplier (number of zeros to be added) e.g., 101 = 100 pF

Rated Voltage: A = 50V. B = 100V

Capacitance Tolerance: B \pm .10 pF, C \pm .25 pF, D \pm .5

pF, F ± 1%, J ± 5%, K ± 10%,

M ± 20%

Termination Finish:

M = Palladium silver

N = Silver-nickel-gold

Solder coated final with a minimum of 4 percent lead S =

U = Base metallization-barrier metal-solder coated (tin/lead alloy, with a minimum of 4 percent lead)

W = Base metallization-barrier metal-tinned (tin or tin/lead alloy)

Y = Base metallization-barrier metal-tin (100 percent)

Z = Base metallization-barrier metal-tinned (tin/lead alloy, with a minimum of 4 percent lead)

*See MIL-PRF-55681 Specification for more details

Failure Rate Level: M = 1.0%, P = .1%, R = .01%,

S = .001%

Packaging: Bulk is standard packaging. Tape and reel per RS481 is available upon request.

*Not RoHS Compliant

CROSS REFERENCE: MIL-PRF-55681/CDR31 THRU CDR35

Per MIL-PRF-55681	Style	Length (L)	Width (W)	Thickness (T)	D	Termination Band (t)		
Per MIL-PRP-33001		(mm)	(mm)	Max. (mm)	Max. (mm)	Min. (mm)	Max. (mm)	
CDR31	0805	2.00	1.25	1.3	.50	.70	.30	
CDR32	1206	3.20	1.60	1.3	_	.70	.30	
CDR33	1210	3.20	2.50	1.5	_	.70	.30	
CDR34	1812	4.50	3.20	1.5	_	.70	.30	
CDR35	1825	4.50	6.40	1.5	_	.70	.30	





CDR31 to MIL-PRF-55681/7

Military Type Designation <u>1</u> /	Capacitance in pF	Capacitance tolerance	Rated temperature and voltage- temperature limits	WVDC
Style 0805/0	DR31 (BP)			
CDR31BP1R0B	1.0	B,C	BP	100
CDR31BP1R1B	1.1	B,C	BP	100
CDR31BP1R2B	1.2	B,C	BP	100
CDR31BP1R3B	1.3	B,C	BP	100
CDR31BP1R5B	1.5	B,C	BP	100
CDR31BP1R6B	1.6	B,C	BP	100
CDR31BP1R8B	1.8	B,C	BP	100
CDR31BP2R0B	2.0	B,C	BP	100
CDR31BP2R2B	2.2	B,C	BP	100
CDR31BP2R4B	2.4	B,C	BP	100
CDR31BP2R7B	2.7	B,C,D	BP	100
CDR31BP3R0B	3.0	B,C,D	BP	100
CDR31BP3R3B	3.3	B,C,D	BP	100
CDR31BP3R6B	3.6	B,C,D	BP	100
CDR31BP3R9B	3.9	B,C,D	BP	100
CDR31BP4R3B	4.3	B,C,D	BP	100
CDR31BP4R7B	4.7	B,C,D	BP	100
CDR31BP5R1B	5.1	B,C,D	BP	100
CDR31BP5R6B	5.6	B,C,D	BP	100
CDR31BP6R2B	6.2	B,C,D	BP	100
CDR31BP6R8B	6.8	B,C,D	BP	100
CDR31BP7R5B	7.5	B,C,D	BP	100
CDR31BP8R2B	8.2	B,C,D	BP	100
CDR31BP9R1B	9.1	B,C,D	BP	100
CDR31BP100B	10	FJ,K	BP	100
CDR31BP110B	11	FJ,K	BP	100
CDR31BP120B	12	FJ,K	BP	100
CDR31BP130B	13	FJ,K	BP	100
CDR31BP150B	15	FJ,K	BP	100
CDR31BP160B	16	FJ,K	BP	100
CDR31BP180B	18	FJ,K	BP	100
CDR31BP200B	20	F,J,K	BP	100
CDR31BP220B	22	FJ,K	BP	100
CDR31BP240B	24	F,J,K	BP	100
CDR31BP270B	27	FJ,K	BP	100
CDR31BP300B	30	FJ,K	BP	100
CDR31BP330B	33	F,J,K	BP	100
CDR31BP360B	36	FJ,K	BP	100
CDR31BP390B	39	F,J,K	BP	100
CDR31BP430B	43	FJ,K	BP	100
CDR31BP470B	47	FJ,K	BP	100
CDR31BP510B	51	F,J,K	BP	100
CDR31BP560B	56	FJ,K	BP	100
CDR31BP620B	62	F,J,K	BP BP	100
CDR31BP680B	68	FJ,K		100
CDR31BP750B	75	FJ,K	BP	100
CDR31BP820B	82	F,J,K	BP	100
CDR31BP910B	91	FJ,K	BP	100

L	Add appropriate failure rate
_	Add appropriate termination finish
	Capacitance Tolerance

Γ	г	г	Г	<u>'</u>
Military Type Designation 1 /	Capacitance in pF	Capacitance tolerance	Rated temperature and voltage-	WVDC
Deorgination 17	۲۰	toleranoe	temperature limits	
Style 0805/0	DR31 (BP)	cont'd		
CDR31BP101B	100	F,J,K	BP	100
CDR31BP111B	110	F,J,K	BP	100
CDR31BP121B	120	F,J,K	BP	100
CDR31BP131B	130	F,J,K	BP	100
CDR31BP151B	150	F,J,K	BP	100
CDR31BP161B	160	F,J,K	BP	100
CDR31BP181B	180	F,J,K	BP	100
CDR31BP201B	200	F,J,K	BP	100
CDR31BP221B	220	F,J,K	BP	100
CDR31BP241B	240	F,J,K	BP	100
CDR31BP271B	270	F,J,K	BP	100
CDR31BP301B	300	F,J,K	BP	100
CDR31BP331B	330	F,J,K	BP	100
CDR31BP361B	360	F,J,K	BP	100
CDR31BP391B	390	F,J,K	BP	100
CDR31BP431B	430	F,J,K	BP	100
CDR31BP471B	470	F,J,K	BP	100
CDR31BP511A	510	F,J,K	BP	50
CDR31BP561A	560	F,J,K	BP	50
CDR31BP621A	620	F,J,K	BP	50
CDR31BP681A	680	F,J,K	BP	50
Style 0805/0	DR31 (BX)			
CDR31BX471B	470	K,M	BX	100
CDR31BX561B	560	K,M	BX	100
CDR31BX681B	680	K,M	BX	100
CDR31BX821B	820	K.M	BX	100
CDR31BX102B	1,000	K,M	BX	100
CDR31BX122B	1,200	K,M	BX	100
CDR31BX152B	1,500	K,M	BX	100
CDR31BX182B	1,800	K,M	BX	100
CDR31BX222B	2,200	K,M	BX	100
CDR31BX272B	2,700	K,M	BX	100
CDR31BX332B	3,300	K,M	BX	100
CDR31BX392B	3,900	K,M	BX	100
CDR31BX472B	4.700	K,M	BX	100
CDR31BX562A	5,600	K,M	BX	50
CDR31BX682A	6,800	K,M	BX	50
CDR31BX822A	8,200	K,M	BX	50
CDR31BX103A	10,000	K.M	BX	50
CDR31BX123A	12,000	K,M	BX	50
CDR31BX153A	15.000	K,M	BX	50
CDR31BX183A	18.000	K,M	BX	50

Add appropriate failure rate Add appropriate termination finish Capacitance Tolerance

^{1/} The complete part number will include additional symbols to indicate capacitance tolerance, termination and failure rate level.





CDR32 to MIL-PRF-55681/8

Military Type Designation <u>1</u> /	Capacitance in pF	Capacitance Tolerance	Rated temperature and Voltage- Temperature Limits	WVDC
Style 1206/0	DR32 (BP)			
CDR32BP1R0B	1.0	B,C	BP	100
CDR32BP1R1B	1.1	B,C	BP	100
CDR32BP1R2B	1.2	B,C	BP	100
CDR32BP1R3B	1.3	B,C	BP	100
CDR32BP1R5B	1.5	B,C	BP	100
CDR32BP1R6B	1.6		BP BP	
	1	B,C		100
CDR32BP1R8B	1.8	B,C	BP	100
CDR32BP2R0B	2.0	B,C	BP	100
CDR32BP2R2B	2.2	B,C	BP	100
CDR32BP2R4B	2.4	B,C	BP	100
CDR32BP2R7B	2.7	B,C,D	BP	100
CDR32BP3R0B	3.0	B,C,D	BP	100
CDR32BP3R3B	3.3	B,C,D	BP	100
CDR32BP3R6B	3.6	B,C,D	BP	100
CDR32BP3R9B	3.9	B,C,D	BP	100
CDR32BP4R3B	4.3	B,C,D	BP	100
CDR32BP4R7B	4.7	B,C,D	BP	100
CDR32BP5R1B	5.1	B,C,D	BP	100
CDR32BP5R6B	5.6	B,C,D	BP	100
CDR32BP6R2B	6.2	B,C,D	BP	100
CDR32BP6R8B	6.8	B,C,D	BP	100
CDR32BP7R5B	7.5	B,C,D	BP	100
CDR32BP8R2B	8.2	B,C,D	BP	100
CDR32BP9R1B	9.1	B,C,D	BP	100
CDR32BP100B	10	FJ,K	BP	100
CDR32BP110B	11	F,J,K	BP	100
CDR32BP120B	12	FJ,K	BP	100
CDR32BP130B	13	FJ,K	BP	100
CDR32BP150B	15	FJ,K	BP	100
CDR32BP160B	16	FJ,K	BP	100
CDR32BP180B	18	FJ.K	BP	100
CDR32BP200B	20	F,J,K	BP	100
CDR32BP220B	22	FJ,K	BP	100
CDR32BP240B	24	F,J,K	BP	100
CDR32BP270B	27	FJ,K	BP	100
CDR32BP300B	30	FJ.K	BP	100
CDR32BP330B	33	F.J.K	BP BP	100
CDR32BP360B	36		BP BP	100
CDR32BP360B	39	FJ,K	BP BP	100
CDR32BP390B CDR32BP430B	43	F,J,K	BP BP	
		FJ,K		100
CDR32BP470B	47	FJ,K	BP	100
CDR32BP510B	51	F,J,K	BP	100
CDR32BP560B	56	FJ,K	BP	100
CDR32BP620B	62	F,J,K	BP	100
CDR32BP680B	68	FJ,K	BP	100
CDR32BP750B	75	FJ,K	BP	100
CDR32BP820B	82	F,J,K	BP	100
CDR32BP910B	91	FJ,K	BP	100

91	FJ,K	BP	10
 Add appropriat 	e failure rate		
- Add appropriat		inish	
- Capacitance To	olerance		

Military Type Designation 1 /	Capacitance in pF	Capacitance Tolerance	Rated Temperature and Voltage-	WVDC
	•		Temperature Limits	
Style 1206/0	DR32 (BP)	cont'd		
CDR32BP101B	100	FJ,K	BP	100
CDR32BP111B	110	FJ,K	BP	100
CDR32BP121B	120	FJ,K	BP	100
CDR32BP131B	130	FJ,K	BP	100
CDR32BP151B	150	FJ,K	BP	100
CDR32BP161B	160	FJ,K	BP	100
CDR32BP181B	180	F,J,K	BP	100
CDR32BP201B	200	FJ,K	BP	100
CDR32BP221B	220	F,J,K	BP	100
CDR32BP241B	240	FJ,K	BP	100
CDR32BP271B	270	FJ,K	BP	100
CDR32BP301B	300	F,J,K	BP	100
CDR32BP331B	330	FJ,K	BP	100
CDR32BP361B	360	F,J,K	BP	100
CDR32BP391B	390	FJ,K	BP	100
CDR32BP431B	430	FJ.K	BP	100
CDR32BP471B	470	F,J,K	BP	100
CDR32BP511B	510	FJ,K	BP	100
CDR32BP561B	560	F,J,K	BP	100
CDR32BP621B	620	FJ,K	BP	100
CDR32BP681B	680	FJ.K	BP	100
CDR32BP751B	750	F,J,K	BP	100
CDR32BP821B	820	FJ,K	BP	100
CDR32BP911B	910	F,J,K	BP	100
CDR32BP102B	1,000	FJ,K	BP	100
CDR32BP112A	1,100	FJ.K	BP	50
CDR32BP122A	1,200	F,J,K	BP	50
CDR32BP132A	1,300	FJ,K	BP	50
CDR32BP152A	1,500	F,J,K	BP	50
CDR32BP162A	1,600	FJ,K	BP	50
CDR32BP182A	1,800	FJ.K	BP	50
CDR32BP202A	2,000	F,J,K	BP BP	50
CDR32BP222A	2,200	FJ,K	BP	50
Style 1206/0	DR32 (BX)			
CDR32BX472B	4,700	K,M	BX	100
CDR32BX562B	5,600	K,M	BX	100
CDR32BX682B	6,800	K,M	BX	100
CDR32BX822B	8,200	K,M	BX	100
CDR32BX103B	10,000	K,M	BX	100
CDR32BX103B	12,000	K,M	BX	100
CDR32BX123B CDR32BX153B	15.000	K,M	BX BX	100
CDR32BX183B	18.000	K,M	BX BX	50
CDR32BX183A	22,000	K,M	BX BX	50 50
CDR32BX2Z3A CDR32BX273A	27,000	K,M	BX	50
CDR32BX333A	33.000	K,M	BX	50
CDR32BX393A	39.000	K,M	BX	50

Add appropriate failure rate Add appropriate termination finish Capacitance Tolerance

040121

^{1/} The complete part number will include additional symbols to indicate capacitance tolerance, termination and failure rate level.





CDR33/34/35 to MIL-PRF-55681/9/10/11

Military Type Designation <u>1</u> /	Capacitance in pF	Capacitance tolerance	Rated temperature and voltage- temperature limits	WVDC
Style 1210/0	DR33 (BP)			
CDR33BP102B CDR33BP112B CDR33BP122B CDR33BP132B CDR33BP152B CDR33BP162B CDR33BP182B CDR33BP202B	1,000 1,100 1,200 1,300 1,500 1,600 1,800 2,000	FJ,K FJ,K FJ,K FJ,K FJ,K FJ,K FJ,K	BP BP BP BP BP BP BP	100 100 100 100 100 100 100 100
CDR33BP222B CDR33BP242A CDR33BP272A CDR33BP302A CDR33BP332A	2,200 2,400 2,700 3,000 3,300	F,J,K FJ,K FJ,K F,J,K FJ,K	BP BP BP BP BP	100 50 50 50 50 50
Style 1210/0	DR33 (BX)			
CDR33BX153B CDR33BX183B CDR33BX223B CDR33BX273B CDR33BX393A CDR33BX473A CDR33BX563A CDR33BX823A CDR33BX823A CDR33BX8104A	15.000 18.000 22,000 27.000 39.000 47.000 56.000 68.000 82,000 100,000	K,M K,M K,M K,M K,M K,M K,M K,M	BX BX BX BX BX BX BX BX BX	100 100 100 100 50 50 50 50 50
Style 1812/0	DR34 (BP)			
CDR34BP222B— CDR34BP242B— CDR34BP272B— CDR34BP302B— CDR34BP332B— CDR34BP362B— CDR34BP392B— CDR34BP432B— CDR34BP472B— CDR34BP512A— CDR34BP562A—	2,200 2,400 2,700 3,000 3,300 3,600 3,900 4,300 4,700 5,100 5,600	EJ,K EJ,K EJ,K EJ,K EJ,K EJ,K EJ,K	BP BP BP BP BP BP BP BP BP	100 100 100 100 100 100 100 100 50
CDR34BP622A CDR34BP682A CDR34BP752A CDR34BP822A CDR34BP912A CDR34BP103A	6,200 6,800 7,500 8,200 9,100 10,000	F,J,K FJ,K FJ,K FJ,K FJ,K FJ,K	BP BP BP BP BP BP	50 50 50 50 50 50

Add appropriate failure rate Add appropriate termination finish Capacitance Tolerance

Military Type Designation <u>1</u> /	Capacitance in pF	Capacitance tolerance	Rated temperature and voltage- temperature limits	WVDC
Style 1812/0	DR34 (BX)			
CDR34BX273B— CDR34BX333B— CDR34BX393B— CDR34BX473B— CDR34BX563B— CDR34BX104A— CDR34BX124A— CDR34BX154A— CDR34BX154A— CDR34BX184A—	27.000 33.000 39.000 47.000 56.000 100,000 120,000 150.000 180.000	K,M K,M K,M K,M K,M K,M K,M	BX BX BX BX BX BX BX BX BX	100 100 100 100 100 50 50 50
Style 1825/0	DR35 (BP)			
CDR35BP472B— CDR35BP512B— CDR35BP562B— CDR35BP622B— CDR35BP62B— CDR35BP752B— CDR35BP822B— CDR35BP912B— CDR35BP113A— CDR35BP13A— CDR35BP133A— CDR35BP153A— CDR35BP153A— CDR35BP153A— CDR35BP15A— CDR35BP15A— CDR35BP15A— CDR35BP15A— CDR35BP15A— CDR35BP15A— CDR35BP15A— CDR35BP15A— CDR35BP15A— CDR35BP15A— CDR35BP15A— CDR35BP15A— CDR35BP15A— CDR35BP15A—	4,700 5,100 5,600 6,200 6,800 7,500 8,200 9,100 10,000 11,000 12,000 13.000 15.000 16.000 18,000 20,000 22,000	£3'K £3'K £3'K £3'K £3'K £3'K £3'K £3'K	BP BP BP BP BP BP BP BP BP BP BP BP BP B	100 100 100 100 100 100 100 100 50 50 50 50 50 50 50
Style 1825/0	DR35 (BX)			
CDR35BX563B— CDR35BX683B— CDR35BX823B— CDR35BX104B— CDR35BX124B— CDR35BX154B— CDR35BX154B— CDR35BX224A— CDR35BX274A— CDR35BX334A— CDR35BX394A— CDR35BX394A— CDR35BX394A— CDR35BX394A—	56.000 68.000 82,000 100,000 120,000 150.000 180.000 220,000 270.000 330.000 390.000 470.000	K,M K,M K,M K,M K,M K,M K,M K,M K,M K,M	BX BX BX BX BX BX BX BX BX BX BX BX	100 100 100 100 100 100 50 50 50 50 50

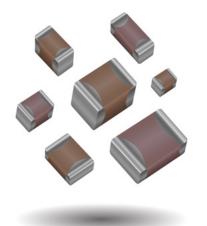
Add appropriate failure rate Add appropriate termination finish Capacitance Tolerance

^{1/} The complete part number will include additional symbols to indicate capacitance tolerance, termination and failure rate level.

MLCC Medical Applications – MM Series







The MM series is a multi-layer ceramic capacitor designed for use in medical applications other than implantable/life support. These components have the design & change control expected for medical devices and also offer enhanced LAT including reliability testing and 100% inspection.

APPLICATIONS

Implantable, Non-Life Supporting Medical Devices

· e.g. implanted temporary cardiac monitor, insulin pumps

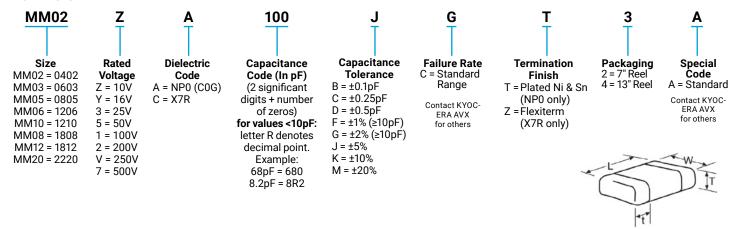
External, Life Supporting Medical Devices

· e.g. heart pump external controller

External Devices

· e.g. patient monitoring, diagnostic equipment

HOW TO ORDER



COMMERCIAL VS MM SERIES PROCESS COMPARISON

	Commercial	MM Series
Administrative	Standard part numbers; no restriction on who purchases these parts	Specific series part number, used to control supply of product
Lot Qualification Destructive Physical Analysis (DPA)	As per EIA RS469	Increased sample plan – stricter criteria
Visual/Cosmetic Quality	Standard process and inspection	100% inspection
Application Robustness	Standard sampling for accelerated wave solder on X7R dielectrics	Increased sampling for accelerated wave solder on X7R and NP0 followed by lot by lot reliability testing
Design/Change Control	Required to inform customer of changes in: form fit function	KYOCERA AVX will qualify and notify customers before making any change to the following materials or processes: Dielectric formulation, type, or supplier Metal formulation, type, or supplier Termination material formulation, type, or supplier Manufacturing equipment type Quality testing regime including sample size and accept/reject criteria



NP0 (C0G) - Specifications & Test Methods

Parame	ter/Test	NP0 Specification Limits	Measuring Conditions					
	perature Range	-55°C to +125°C	Temperature Cycle Chamber					
Capac	itance Q	Within specified tolerance <30 pF: Q≥ 400+20 x Cap Value ≥30 pF: Q≥ 1000	Freq.: 1.0 MHz ± 10% for cap ≤ 1000 pF 1.0 kHz ± 10% for cap > 1000 pF Voltage: 1.0Vrms ± .2V					
Insulation	Resistance	100,000MΩ or 1000MΩ - μF, whichever is less	Charge device with rated voltage for 60 ± 5 secs @ room temp/humidity					
Dielectric	: Strength	No breakdown or visual defects	Charge device with 300% of rated voltage for 1-5 seconds, w/charge and discharge current limited to 50 mA (max) Note: Charge device with 150% of rated voltage for 500V devices.					
	Appearance	No defects	Deflection: 2mm					
Resistance to	Capacitance Variation	±5% or ±.5 pF, whichever is greater	Test Time: 30 seconds 1mm/sec					
Flexure Stresses	Q	Meets Initial Values (As Above)						
	Insulation Resistance	≥ Initial Value x 0.3	90 mm					
Solder	rability	≥ 95% of each terminal should be covered with fresh solder	Dip device in eutectic solder at 230 ± 5°C for 5.0 ± 0.5 seconds					
	Appearance	No defects, <25% leaching of either end terminal						
	Capacitance Variation	≤ ±2.5% or ±.25 pF, whichever is greater						
Resistance to Solder Heat	Q	Meets Initial Values (As Above)	Dip device in eutectic solder at 260°C for 60 seconds. Store at room temperature for 24 ± 2					
Coluct Fleut	Insulation Resistance	Meets Initial Values (As Above)	hours before measuring electrical properties.					
	Dielectric Strength	Meets Initial Values (As Above)						
	Appearance	No visual defects	Step 1: -55°C ± 2° 30 ± 3 minutes					
	Capacitance Variation	≤ ±2.5% or ±.25 pF, whichever is greater	Step 2: Room Temp ≤ 3 minutes					
Thermal Shock	Q	Meets Initial Values (As Above)	Step 3: +125°C ± 2° 30 ± 3 minutes					
Siloux	Insulation Resistance	Meets Initial Values (As Above)	Step 4: Room Temp ≤ 3 minutes					
	Dielectric Strength	Meets Initial Values (As Above)	Repeat for 5 cycles and measure after 24 hours at room temperature					
	Appearance	No visual defects						
	Capacitance Variation	≤ ±3.0% or ± .3 pF, whichever is greater	Charge device with twice rated voltage in test chamber set at 125°C ± 2°C					
Load Life	Q	≥ 30 pF: Q≥ 350 ≥10 pF, <30 pF: Q≥ 275 +5C/2 <10 pF: Q≥ 200 +10C	for 1000 hours (+48, -0).					
	Insulation Resistance	≥ Initial Value x 0.3 (See Above)	room temperature for 24 hours before measuring.					
	Dielectric Strength	Meets Initial Values (As Above)	before medodring.					
	Appearance	No visual defects						
	Capacitance Variation	≤ ±5.0% or ± .5 pF, whichever is greater	Store in a test chamber set at 85°C ± 2°C/ 85%					
Load Humidity	Q	≥ 30 pF: Q≥ 350 ≥10 pF, <30 pF: Q≥ 275 +5C/2 <10 pF: Q≥ 200 +10C	± 5% relative humidity for 1000 hours (+48, -0) with rated voltage applied.					
	Insulation Resistance	≥ Initial Value x 0.3 (See Above)	Remove from chamber and stabilize at room temperature for 24 ± 2 hours before measuring.					
	Dielectric Strength	Meets Initial Values (As Above)						



NP0/C0G Capacitance Range

PREFERRED SIZES ARE SHADED

S	IZE			06	03				0805				1206	
	1	WVDC	16	25	50	100	16	25	50	100	16	25	50	100
Сар	0.5	0R5												
	1.0	1R0												
	1.2	1R2												
	1.5	1R5												
,	1.8	1R8												
	2.2	2R2												
	2.7	2R7												
	3.3	3R3												
	3.9	3R9												
	4.7	4R7												
	5.6	5R6												
	6.8	6R8												
	8.2	8R2												
	10	100												
	12	120												
	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												
	320	821												
	000	102												
	200	122												
	500	152												
W	/VDC		16	25	50	100	16	25	50	100	16	25	50	100
S	IZE		0603			0805					1206			



X7R Specifications and Test Methods

	ter/Test	X7R Specification Limits	Measuring Conditions						
	perature Range	-55°C to +125°C	Temperature C	ycle Chamber					
Capac Dissipati	itance on Factor	Within specified tolerance ≤ 10% for ≥ 50V DC rating ≤ 12.5% for 25V DC rating ≤ 12.5% for 25V and 16V DC rating ≤ 12.5% for ≤ 10V DC rating	Freq.: 1.0 kHz ± 10% Voltage: 1.0Vrms ± .2V						
Insulation	Resistance	100,000MΩ or 1000MΩ - μF, whichever is less	Charge device with rated voltage for 120 ± 5 secs @ room temp/humidity						
Dielectric	: Strength	No breakdown or visual defects	Charge device with 250 1-5 seconds, w/charge limited to 50 Note: Charge device with for 500V	% of rated voltage for and discharge current mA (max) n 150% of rated voltage					
	Appearance	No defects	Deflectio						
Resistance to	Capacitance Variation	≤ ±12%	Test Time: 3	0 seconds 7 _{1mm/sec}					
Flexure Stresses	Dissipation Factor	Meets Initial Values (As Above)	V						
	Insulation Resistance	≥ Initial Value x 0.3	90 n						
Solder	rability	≥ 95% of each terminal should be covered with fresh solder	Dip device in eutectic for 5.0 ± 0.5						
	Appearance	No defects, <25% leaching of either end terminal							
	Capacitance Variation	≤ ±7.5%							
Resistance to Solder Heat	Dissipation Factor	Meets Initial Values (As Above)	Dip device in eutectic solder at 260°C for 60 seconds. Store at room temperature for 24 ±						
oolder Heat	Insulation Resistance	Meets Initial Values (As Above)	hours before measuring	g electrical properties.					
	Dielectric Strength	Meets Initial Values (As Above)							
	Appearance	No visual defects	Step 1: -55°C ± 2°	30 ± 3 minutes					
	Capacitance Variation	≤ ±7.5%	Step 2: Room Temp	≤ 3 minutes					
Thermal Shock	Dissipation Factor	Meets Initial Values (As Above)	Step 3: +125°C ± 2°	30 ± 3 minutes					
	Insulation Resistance	Meets Initial Values (As Above)	Step 4: Room Temp	≤ 3 minutes					
	Dielectric Strength	Meets Initial Values (As Above)	Repeat for 5 cycles 24 ± 2 hours at ro	and measure after om temperature					
	Appearance	No visual defects	Chargo dovice with 1.5 =	otod voltage (+ 10\/) :					
	Capacitance Variation	≤ ±12.5%	Charge device with 1.5 r test chamber set for 1000 hou	at 125°C ± 2°C					
Load Life	Dissipation Factor	≤ Initial Value x 2.0 (See Above)	Remove from test cha	,					
	Insulation Resistance	≥ Initial Value x 0.3 (See Above)	room temperature for measu	24 ± 2 hours before					
	Dielectric Strength	Meets Initial Values (As Above)	measc	y. 					
	Appearance	No visual defects	Store in a test shame	not at 0E00 + 000 / 0E0/					
	Capacitance Variation	≤ ±12.5%	Store in a test chamber s ± 5% relative humid						
Load Humidity	Dissipation Factor	≤ Initial Value x 2.0 (See Above)	± 5% relative humidity for 1000 hours (+48, -0) with rated voltage applied.						
Humidity	Insulation Resistance	≥ Initial Value x 0.3 (See Above)	Remove from chamber temperature an	d humidity for					
	Dielectric Strength	Meets Initial Values (As Above)	24 ± 2 hours before measuring.						



X7R Capacitance Range

PREFERRED SIZES ARE SHADED

	SIZE	E		040)2			(06	03					(080	5						12	206							12	10				1	80	8		18	12		:	222	0
		WVDC	16	25	50	10	1	6 2	25	50	100	200	10	16	25	50	100	200	250	10	16	25	50	100	200	250	500	10	16	25	50	100	200	250	500	50	100	200	50	100	200	250	25	50	100
Сар	220	221																																											
(pF)	270	271		T			T	T	ヿ																																				\neg
(F-)	330	331		T		T	T	T	T															1								T												П	\neg
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	560	561		T			Т	T	寸															†	T																		Г		\neg
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	1500	152		T		T	T	T	寸																															İ			г		_
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	SIZE	E		040)2			(06	03					(080	5						12	206							12	10				1	80	8		18	12		1	222	0
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Packaging of Chip Components



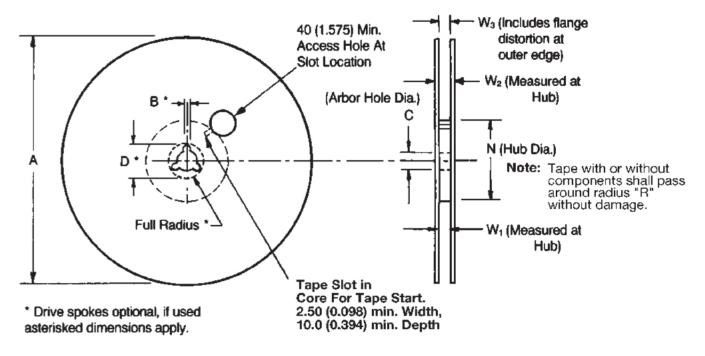


TAPE & REEL QUANTITIES

All tape and reel specifications are in compliance with RS481.

	4mm	8mm	12mm	
Paper or Embossed Carrier		0612, 0508, 0805, 1206, 1210		
Embossed Only	0101		1808	1812, 1825 2220, 2225
Paper Only		0101, 0201, 0306, 0402, 0603		
Qty. per Reel/7" Reel	4,000	1,000, 2,000, 3,000 or 4,000, 10,000, 15,000, 20,000 Contact factory for exact quantity	3,000	500, 1,000 Contact factory for exact quantity
Qty. per Reel/13" Reel		5,000, 10,000, 50,000 Contact factory for exact quantity	10,000	4,000

REEL DIMENSIONS



Tape Size ⁽¹⁾	A Max.	B* Min.	С	D* Min.	N Min.	W ₁	W ₂ Max.	W ₃
4mm	1.80 (7.087)	1.5 (0.059)	13.0±0.5 (0.522±0.020)	20.2 (0.795)	60.0 (2.362)	4.35±0.3 (0.171±0.011)	7.95 (0.312)	
8mm	330	1.5	13.0 ^{+0.50}	20.2	50.0	8.40 ^{+1.5} (0.331 ^{+0.059})	14.4 (0.567)	7.90 Min. (0.311) 10.9 Max. (0.429)
12mm	(12.992)	(0.059)	(0.512 ^{+0.020} _{-0.008})	(0.795)	(1.969)	12.4 ^{+2.0} (0.488 ^{+0.079})	18.4 (0.724)	11.9 Min. (0.469) 15.4 Max. (0.607)

Metric dimensions will govern.

English measurements rounded and for reference only.

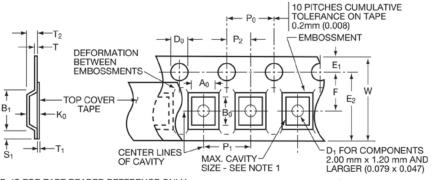
⁽¹⁾ For tape sizes 16mm and 24mm (used with chip size 3640) consult EIA RS-481 latest revision.

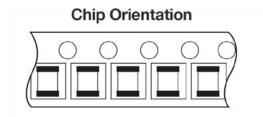


Embossed Carrier Configuration

4, 8 & 12mm Tape Only







B₁ IS FOR TAPE READER REFERENCE ONLY INCLUDING DRAFT CONCENTRIC AROUND B0

User Direction of Feed

4, 8 & 12mm Embossed Tape **Metric Dimensions Will Govern**

CONSTANT DIMENSIONS

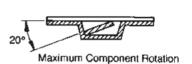
Tape Size	D _o	E ₁	P ₀	P ₂	S ₁ Min.	T Max.	T₁ Max.
4mm	0.80±0.04	0.90±0.05	2.0±0.04	1.00±0.02	1.075	0.26	0.06
	(0.031±0.001)	(0.035±0.001)	(0.078±0.001)	(0.039±0.0007)	(0.042)	(0.010)	(0.002)
8mm	$1.50_{ -0.0}^{ +0.10} \\ (0.059_{ -0.0}^{ +0.004})$	1.75 ± 0.10	4.0 ± 0.10	2.0 ± 0.05	0.60	0.60	0.10
& 12mm		(0.069 ± 0.004)	(0.157 ± 0.004)	(0.079 ± 0.002)	(0.024)	(0.024)	(0.004)

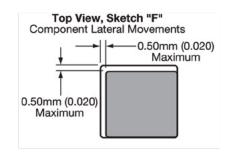
VARIABLE DIMENSIONS

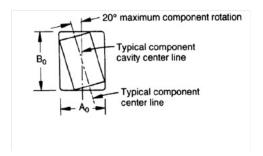
Tape Size	B ₁ Max.	D ₁ Min.	E ₂ Min.	F	P ₁ See Note 5	R Min. See Note 2	T ₂	W Max.	A ₀ B ₀ K ₀
8mm	4.35 (0.171)	1.00 (0.039)	6.25 (0.246)	3.50 ± 0.05 (0.138 ± 0.002)	4.00 ± 0.10 (0.157 ± 0.004)	25.0 (0.984)	2.50 Max. (0.098)	8.30 (0.327)	See Note 1
12mm	8.20 (0.323)	1.50 (0.059)	10.25 (0.404)	5.50 ± 0.05 (0.217 ± 0.002)	4.00 ± 0.10 (0.157 ± 0.004)	30.0 (1.181)	6.50 Max. (0.256)	12.3 (0.484)	See Note 1
8mm 1/2 Pitch	4.35 (0.171)	1.00 (0.039)	6.25 (0.246)	3.50 ± 0.05 (0.138 ± 0.002)	2.00 ± 0.10 (0.079 ± 0.004)	25.0 (0.984)	2.50 Max. (0.098)	8.30 (0.327)	See Note 1
12mm Double Pitch	8.20 (0.323)	1.50 (0.059)	10.25 (0.404)	5.50 ± 0.05 (0.217 ± 0.002)	8.00 ± 0.10 (0.315 ± 0.004)	30.0 (1.181)	6.50 Max. (0.256)	12.3 (0.484)	See Note 1

NOTES:

- 1. The cavity defined by A0, B0, and K0 shall be configured to provide the following: Surround the component with sufficient clearance such that:
 - b) the component does not protrude beyond the sealing plane of the cover tape.
 - c) the component can be removed from the cavity in a vertical direction without mechanical restriction, after the cover tape has been removed.
 - d) rotation of the component is limited to 20° maximum (see Sketches D & E).
 - e) lateral movement of the component is restricted to 0.5mm maximum (see Sketch F).
- 2. Tape with or without components shall pass around radius "R" without damage.
- 3. Bar code labeling (if required) shall be on the side of the reel opposite the round sprocket holes. Refer to EIA-556.
- 4. B₁ dimension is a reference dimension for tape feeder clearance only. 5. If P_1 = 2.0mm, the tape may not properly index in all tape feeders.







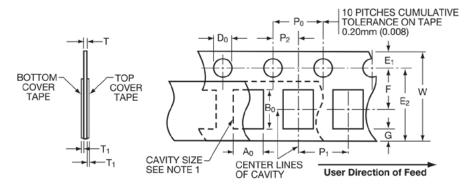


KYDCER3 | The Important Information/Disclaimer is incorporated in the catalog where these specifications came from or available online at www.kyocera-avx.com/disclaimer/ by reference and should be reviewed in full before placing any order.

Paper Carrier Configuration

8 & 12mm Tape Only





4, 8 & 12mm Embossed Tape **Metric Dimensions Will Govern**

CONSTANT DIMENSIONS

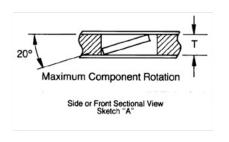
Tape Size	D _o	E	P ₀	P ₂	T ₁	G. Min.	R Min.
8mm and 12mm	1.50 ^{+0.10} (0.059 ^{+0.004})	1.75 ± 0.10 (0.069 ± 0.004)	4.00 ± 0.10 (0.157 ± 0.004)	2.00 ± 0.05 (0.079 ± 0.002)	0.10 (0.004) Max.	0.75 (0.030) Min.	25.0 (0.984) See Note 2 Min.

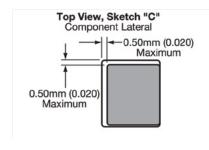
VARIABLE DIMENSIONS

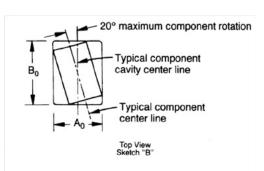
Tape Size	P ₁ See Note 4	E ₂ Min.	F	w	A ₀ B ₀	Т
8mm	4.00 ± 0.10 (0.157 ± 0.004)	6.25 (0.246)	3.50 ± 0.05 (0.138 ± 0.002)	8.00 ^{+0.30} (0.315 ^{+0.012} (0.315 ^{+0.004})	See Note 1	1.10mm (0.043) Max.
12mm	4.00 ± 0.10 (0.157 ± 0.004)	10.25 (0.404)	5.50 ± 0.05 (0.217 ± 0.002)	12.0 ± 0.30 (0.472 ± 0.012)		for Paper Base Tape and
8mm 1/2 Pitch	2.00 ± 0.05 (0.079 ± 0.002)	6.25 (0.246)	3.50 ± 0.05 (0.138 ± 0.002)	8.00 ^{+0.30} (0.315 ^{+0.012} (0.315 -0.004)		1.60mm
12mm Double Pitch	8.00 ± 0.10 (0.315 ± 0.004)	10.25 (0.404)	5.50 ± 0.05 (0.217 ± 0.002)	12.0 ± 0.30 (0.472 ± 0.012)		(0.063) Max. for Non-Paper Base Compositions

NOTES:

- 1. The cavity defined by A0, B0, and T shall be configured to provide sufficient clearance surrounding the component so that:
 - a) the component does not protrude beyond either surface of the carrier tape;
 - b)) the component can be removed from the cavity in a vertical direction without mechanical restriction after the top cover tape has been removed;
- c) rotation of the component is limited to 20° maximum (see Sketches A & B);
- d) lateral movement of the component is restricted to 0.5mm maximum (see Sketch C).
- 2. Tape with or without components shall pass around radius "R" without damage.
- 3. Bar code labeling (if required) shall be on the side of the reel opposite the sprocket holes. Refer to EIA-556.
- 4. If P₁ = 2.0mm, the tape may not properly index in all tape feeders.







Bar Code Labeling Standard

KYOCERA AVX bar code labeling is available and follows latest version of EIA-556





Basic Capacitor Formulas

I. Capacitance (farads)

English:
$$C = \frac{.224 \text{ K A}}{T_D}$$

Metric: $C = \frac{.0884 \text{ K A}}{T_D}$

II. Energy stored in capacitors (Joules, watt - sec)

III. Linear charge of a capacitor (Amperes)

$$I = C \frac{dV}{dt}$$

IV. Total Impedance of a capacitor (ohms)

$$Z = \sqrt{R_S^2 + (X_C - X_L)^2}$$

V. Capacitive Reactance (ohms)

$$x_C = \frac{1}{2 \pi fC}$$

VI. Inductive Reactance (ohms)

$$x_1 = 2 \pi fL$$

VII. Phase Angles:

Ideal Capacitors: Current leads voltage 90° Ideal Inductors: Current lags voltage 90° Ideal Resistors: Current in phase with voltage

VIII. Dissipation Factor (%)

D.F.=
$$\tan \delta$$
 (loss angle) = $\frac{\text{E.S.R.}}{\text{X}_{\text{C}}}$ = (2 π fC) (E.S.R.)

IX. Power Factor (%)

P.F. = Sine (loss angle) = $\cos \varphi$ (phase angle)

P.F. = (when less than 10%) = DF

X. Quality Factor (dimensionless)

Q = Cotan
$$\delta$$
 (loss angle) = $\frac{1}{D.E}$

XI. Equivalent Series Resistance (ohms)

E.S.R. = (D.F.) (Xc) = (D.F.) / (2
$$\pi$$
 fC)

XII. Power Loss (watts)

Power Loss = $(2 \pi fCV^2)$ (D.F.)

XIII. KVA (Kilowatts)

 $KVA = 2 \pi fCV^2 \times 10^{-3}$

XIV. Temperature Characteristic (ppm/°C)

T.C. =
$$\frac{Ct - C_{25}}{C_{25} (T_t - 25)} \times 10^6$$

XV. Cap Drift (%)

C.D. =
$$\frac{C_1 - C_2}{C_1}$$
 x 100

XVI. Reliability of Ceramic Capacitors

$$\begin{array}{c} L_{o} = \left(\frac{V_{t}}{V_{o}} \right) X & \left(\frac{T_{t}}{T_{o}} \right) \end{array} \label{eq:loss_problem}$$

XVII. Capacitors in Series (current the same)

Any Number:
$$\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} - \cdots \frac{1}{C_N}$$
 Two: $C_T = \frac{C_1 C_2}{C_1 + C_2}$

XVIII. Capacitors in Parallel (voltage the same)

$$C_T = C_1 + C_2 - - + C_N$$

XIX. Aging Rate

A.R. = $\%\Delta$ C/decade of time

XX. Decibels

$$db = 20 \log \frac{V_1}{V_2}$$

METRIC PREFIXES

Pico	X 10 ⁻¹²
FICO	
Nano	X 10 ⁻⁹
Micro	X 10 ⁻⁶
Milli	X 10 ⁻³
Deci	X 10 ⁻¹
Deca	X 10 ⁺¹
Kilo	X 10 ⁺³
Mega	X 10 ⁺⁶
Giga	X 10 ⁺⁹
Tera	X 10 ⁺¹²

SYMBOLS

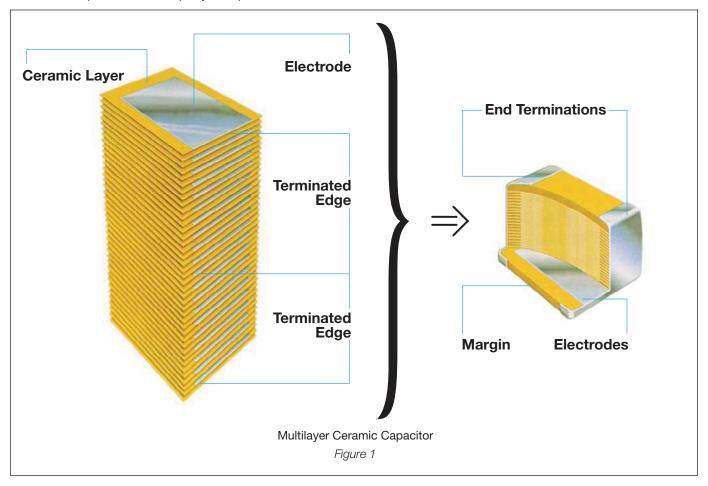
K = Dielectric Constant	f = frequency	L _t = Test life
A = Area	L = Inductance	V _t = Test voltage
T _D = Dielectric thickness	δ = Loss angle	V _o = Operating voltage
V = Voltage	φ = Phase angle	T _t = Test temperature
t = time	X & Y = exponent effect of voltage and temp.	T _o = Operating temperature
R _s = Series Resistance	L _o = Operating life	



General Description

Basic Construction - A multilayer ceramic (MLC) capacitor is a monolithic block of ceramic containing two sets of offset, interleaved planar electrodes that extend to two opposite surfaces of the ceramic dielectric. This simple structure requires a considerable amount of sophistication, both in material and manufacture, to produce it in the quality and quantities needed in

today's electronic equipment.



Formulations - Multilayer ceramic capacitors are available in both Class 1 and Class 2 formulations. Temperature compensating formulation are Class 1 and temperature stable and general application formulations are classified as Class 2.

Class 1 - Class 1 capacitors or temperature compensating capacitors are usually made from mixtures of titanates where barium titanate is normally not a major part of the mix. They have predictable temperature coefficients and in general, do not have an aging characteristic. Thus they are the most stable capacitor available. The most popular Class 1 multilayer ceramic capacitors are COG (NPO) temperature compensating capacitors (negativepositive 0 ppm/°C).

Class 2 - EIA Class 2 capacitors typically are based on the chemistry of barium titanate and provide a wide range of capacitance values and temperature stability. The most commonly used Class 2 dielectrics are X7R and Y5V. The X7R provides intermediate capacitance values which vary only ±15% over the temperature range of -55°C to 125°C. It finds applications where stability over a wide temperature range is required.

The Y5V provides the highest capacitance values and is used in applications where limited temperature changes are expected. The capacitance value for Y5V can vary from 22% to -82% over the -30°C to 85°C temperature range.

All Class 2 capacitors vary in capacitance value under the influence of temperature, operating voltage (both AC and DC), and frequency. For additional information on performance changes with operating conditions, consult KYOCERA AVX's software, SpiCap.



General Description

Table 1: EIA and MIL Temperature Stable and General **Application Codes**

EIA CODE Percent Capacity Change Over Temperature Range						
RS198	Temperature Range					
X7	-55°C to +125°C					
X6	-55°C to +105°C					
X5	-55°C to +85°C					
Y5	-30°C to +85°C					
Z5	+10°C to +85°C					
Code	Percent Capacity Change					
D	±3.3%					
E	±4.7%					
F	±7.5%					
Р	±10%					
R	±15%					
S	±22%					
Т Т	+22%, -33%					
U	+22%, - 56%					
V	+22%, -82%					

EXAMPLE - A capacitor is desired with the capacitance value at 25°C to increase no more than 7.5% or decrease no more than 7.5% from -30°C to +85°C. EIA Code will be Y5F.

MIL CODE								
Symbol	Tempera	Temperature Range						
Α	-55°C t	to +85°C						
В	-55°C to +125°C							
С	-55°C to +150°C							
Oh al	Cap. Change	Cap. Change						
Symbol	Zero Volts	Rated Volts						
R	+15%, -15%	+15%, -40%						
S	+22%, -22%	+22%, -56%						
W	+22%, -56%	+22%, -66%						
X	+15%, -15%	+15%, -25%						
Υ	+30%, -70%	+30%, -80%						
7	+20%, -20%	+20%30%						

Temperature characteristic is specified by combining range and change symbols, for example BR or AW. Specification slash sheets indicate the characteristic applicable to a given style of capacitor.

In specifying capacitance change with temperature for Class 2 materials, EIA expresses the capacitance change over an operating temperature range by a 3 symbol code. The first symbol represents the cold temperature end of the temperature range, the second represents the upper limit of the operating temperature range and the third symbol represents the capacitance change allowed over the operating temperature range. Table 1 provides a detailed explanation of the EIA system.

Effects of Voltage - Variations in voltage have little effect on Class 1 dielectric but does affect the capacitance and dissipation factor of Class 2 dielectrics. The application of DC voltage reduces both the capacitance and dissipation factor while the application of an AC voltage within a reasonable range tends to increase both capacitance and dissipation factor readings. If a high enough AC voltage is applied, eventually it will reduce capacitance just as a DC voltage will. Figure 2 shows the effects of AC voltage.

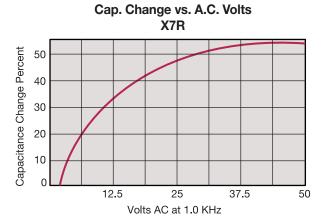


Figure 2

Capacitor specifications specify the AC voltage at which to measure (normally 0.5 or 1 VAC) and application of the wrong voltage can cause spurious readings. Figure 3 gives the voltage coefficient of dissipation factor for various AC voltages at 1 kilohertz. Applications of different frequencies will affect the percentage changes versus voltages.

D.F. vs. A.C. Measurement Volts X7R

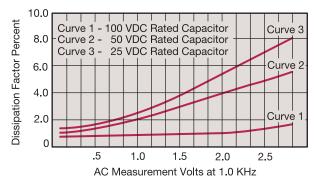


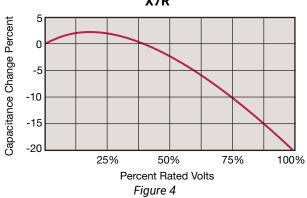
Figure 3

Typical effect of the application of DC voltage is shown in Figure 4. The voltage coefficient is more pronounced for higher K dielectrics. These figures are shown for room temperature conditions. The combination characteristic known as voltage temperature limits which shows the effects of rated voltage over the operating temperature range is shown in Figure 5 for the military BX characteristic.





Example Change vs. D.C. Volts X7R



Example Cap. Change vs. Temperature X7R

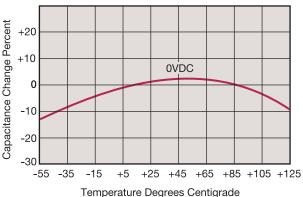
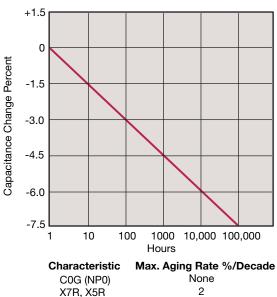


Figure 5

Effects of Time - Class 2 ceramic capacitors change capacitance and dissipation factor with time as well as temperature, voltage and frequency. This change with time is known as aging. Aging is caused by a gradual re-alignment of the crystalline structure of the ceramic and produces an exponential loss in capacitance and decrease in dissipation factor versus time. A typical curve of aging rate for semistable ceramics is shown in Figure 6.

If a Class 2 ceramic capacitor that has been sitting on the shelf for a period of time, is heated above its curie point, (125°C for 4 hours or 150°C for 1/2 hour will suffice) the part will de-age and return to its initial capacitance and dissi-pation factor readings. Because the capacitance changes rapidly, immediately after de-aging, the basic capacitance measurements are normally referred to a time period sometime after the de-aging process. Various manufacturers use different time bases but the most popular one is one day or twentyfour hours after "last heat." Change in the aging curve can be caused by the application of voltage and other stresses. The possible changes in capacitance due to de-aging by heating the unit explain why capacitance changes are allowed after test, such as temperature cycling, moisture resistance, etc., in MIL specs. The application of high voltages such as dielectric withstanding voltages also tends to de-age capacitors and is why re-reading of capacitance after 12 or 24 hours is allowed in military specifications after dielectric strength tests have been performed.

Example Curve of Aging Rate X7R



X7R, X5R Y5V

Figure 6

Effects of Frequency - Frequency affects capacitance and impedance characteristics of capacitors. This effect is much more pronounced in high dielectric constant ceramic formulation than in low K formulations. KYOCERA AVX's SpiCap software generates impedance, ESR, series inductance, series resonant frequency and capacitance all as functions of frequency, temperature and DC bias for standard chip sizes and styles. It is available free from KYOCERA AVX and can be downloaded for free from KYOCERA AVX website: www.kyocera-avx.com.





KYOCERa

General Description

Effects of Mechanical Stress - High "K" dielectric ceramic capacitors exhibit some low level piezoelectric reactions under mechanical stress. As a general statement, the piezoelectric output is higher, the higher the dielectric constant of the ceramic. It is desirable to investigate this effect before using high "K" dielectrics as coupling capacitors in extremely low level applications.

Reliability - Historically ceramic capacitors have been one of the most reliable types of capacitors in use today. The approximate formula for the reliability of a ceramic capacitor is:

$$\frac{L_o}{L_t} = \left(\frac{V_t}{V_o}\right) X \left(\frac{T_t}{T_o}\right) Y$$

where

L_o = operating life T_t = test temperature and L, = test life T_0 = operating temperature in °C V_t = test voltage

X,Y = see text V_0 = operating voltage

Historically for ceramic capacitors exponent X has been considered as 3. The exponent Y for temperature effects typically tends to run about 8.

A capacitor is a component which is capable of storing electrical energy. It consists of two conductive plates (electrodes) separated by insulating material which is called the dielectric. A typical formula for determining capacitance is:

$$C = \frac{.224 \text{ KA}}{t}$$

C = capacitance (picofarads)

K = dielectric constant (Vacuum = 1)

A = area in square inches

t = separation between the plates in inches (thickness of dielectric)

.224 = conversion constant (.0884 for metric system in cm)

Capacitance - The standard unit of capacitance is the farad. A capacitor has a capacitance of 1 farad when 1 coulomb charges it to 1 volt. One farad is a very large unit and most capacitors have values in the micro (10^{-6}), nano (10^{-9}) or pico (10^{-12}) farad level.

Dielectric Constant - In the formula for capacitance given above the dielectric constant of a vacuum is arbitrarily chosen as the number 1. Dielectric constants of other materials are then compared to the dielectric constant of a vacuum.

Dielectric Thickness - Capacitance is indirectly proportional to the separation between electrodes. Lower voltage requirements mean thinner dielectrics and greater capacitance per volume.

Area - Capacitance is directly proportional to the area of the electrodes. Since the other variables in the equation are usually set by the performance desired, area is the easiest parameter to modify to obtain a specific capacitance within a material group.

Energy Stored – The energy which can be stored in a capacitor is given by the formula:

$$E = \frac{1}{2}CV^2$$

E = energy in joules (watts-sec)

V = applied voltage

C = capacitance in farads

Potential Change - A capacitor is a reactive component which reacts against a change in potential across it. This is shown by the equation for the linear charge of a capacitor:

$$I_{ideal} = C \frac{dV}{dt}$$

where

I = Current

C = Capacitance

dV/dt = Slope of voltage transition across capacitor

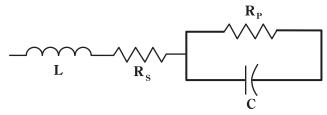
Thus an infinite current would be required to instantly change the potential across a capacitor. The amount of current a capacitor can 'sink" is determined by the above equation.

Equivalent Circuit - A capacitor, as a practical device, exhibits not only capacitance but also resistance and inductance. A simplified schematic for the equivalent circuit is:

C = Capacitance L = Inductance

R_s = Series Resistance

R_n = Parallel Resistance



Reactance - Since the insulation resistance (Rp) is normally very high, the total impedance of a capacitor is:

$$Z = \sqrt{R_S^2 + (X_C - X_L)^2}$$

where

Z = Total Impedance

R_s = Series Resistance

X_c = Capacitive Reactance 2π fC

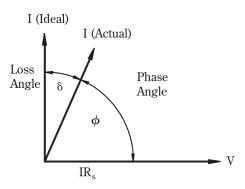
X₁ = Inductive Reactance

The variation of a capacitor's impedance with frequency determines its effectiveness in many applications.

Phase Angle - Power Factor and Dissipation Factor are often confused since they are both measures of the loss in a capacitor under AC application and are often almost identical in value. In a "perfect" capacitor the current in the capacitor will lead the voltage by 90°.

General Description





In practice the current leads the voltage by some other phase angle due to the series resistance RS. The complement of this angle is called the loss angle and:

Power Factor (P.F.) = Cos ϕ or Sine δ Dissipation Factor (D.F.) = $\tan \delta$

for small values of the tan and sine are essentially equal which has led to the common interchangeability of the two terms in the industry.

Equivalent Series Resistance – The term E.S.R. or Equivalent Series Resistance combines all losses both series and parallel in a capacitor at a given frequency so that the equivalent circuit is reduced to a simple R-C series connection.

Dissipation Factor – The DF/PF of a capacitor tells what percent of the apparent power input will turn to heat in the capacitor.

Dissipation Factor =
$$\frac{\text{E.S.R.}}{X_{\odot}}$$
 = (2 π fC) (E.S.R.)

The watts loss are:

Watts loss = $(2 \pi fCV^2)$ (D.F.)

Very low values of dissipation factor are expressed as their reciprocal for convenience. These are called the "Q" or Quality factor of capacitors.

Parasitic Inductance – The parasitic inductance of capacitors is becoming more and more important in the decoupling of today's high speed digital systems. The relationship between the inductance and the ripple voltage induced on the DC voltage line can be seen from the simple inductance equation:

$$V = L \frac{di}{dt}$$

The $\frac{cli}{cl}$ seen in current microprocessors can be as high as 0.3 A/ns, and up to 10A/ns. At 0.3 A/ns, 100pH of parasitic inductance can cause a voltage spike of 30mV. While this does not sound very drastic, with the Vcc for microprocessors decreasing at the current rate, this can be a fairly large percentage.

Another important, often overlooked, reason for knowing the parasitic inductance is the calculation of the resonant frequency. This can be important for high frequency, bypass capacitors, as the resonant point will give the most signal attenuation. The resonant frequency is calculated from the simple equation:

$$f_{\text{res}} = \frac{1}{2\pi\sqrt{\text{LC}}}$$

Insulation Resistance – Insulation Resistance is the resistance measured across the terminals of a capacitor and consists principally of the parallel resistance RP shown in the equivalent circuit. As capacitance values and hence the area of dielectric increases, the I.R. decreases and hence the product (C x IR or RC) is often specified in ohm farads or more commonly megohm-microfarads. Leakage current is determined by dividing the rated voltage by IR (Ohm's Law).

Dielectric Strength – Dielectric Strength is an expression of the ability of a material to withstand an electrical stress. Although dielectric strength is ordinarily expressed in volts, it is actually dependent on the thickness of the dielectric and thus is also more generically a function of volts/mil.

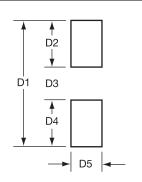
Dielectric Absorption – A capacitor does not discharge instantaneously upon application of a short circuit, but drains gradually after the capacitance proper has been discharged. It is common practice to measure the dielectric absorption by determining the "reappearing voltage" which appears across a capacitor at some point in time after it has been fully discharged under short circuit conditions.

Corona – Corona is the ionization of air or other vapors which causes them to conduct current. It is especially prevalent in high voltage units but can occur with low voltages as well where high voltage gradients occur. The energy discharged degrades the performance of the capacitor and can in time cause catastrophic failures.

MLC Chip Capacitors



REFLOW SOLDERING



Case Size	D1	D2	D3	D4	D5
0201	0.85 (0.033)	0.30 (0.012)	0.25 (0.010)	0.30 (0.012)	0.35 (0.014)
0402	1.70 (0.067)	0.60 (0.024)	0.50 (0.020)	0.60 (0.024)	0.50 (0.020)
0603	2.30 (0.091)	0.80 (0.031)	0.70 (0.028)	0.80 (0.031)	0.75 (0.030)
0805	3.00 (0.118)	1.00 (0.039)	1.00 (0.039)	1.00 (0.039)	1.25 (0.049)
1206	4.00 (0.157)	1.00 (0.039)	2.00 (0.079)	1.00 (0.039)	1.60 (0.063)
1210	4.00 (0.157)	1.00 (0.039)	2.00 (0.079)	1.00 (0.039)	2.50 (0.098)
1808	5.60 (0.220)	1.00 (0.039)	3.60 (0.142)	1.00 (0.039)	2.00 (0.079)
1812	5.60 (0.220)	1.00 (0.039)	3.60 (0.142)	1.00 (0.039)	3.00 (0.118)
1825	5.60 (0.220)	1.00 (0.039)	3.60 (0.142)	1.00 (0.039)	6.35 (0.250)
2220	6.60 (0.260)	1.00 (0.039)	4.60 (0.181)	1.00 (0.039)	5.00 (0.197)
2225	6.60 (0.260)	1.00 (0.039)	4.60 (0.181)	1.00 (0.039)	6.35 (0.250)

Dimensions in millimeters (inches)

Component Pad Design

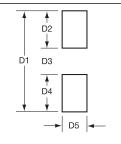
Component pads should be designed to achieve good solder filets and minimize component movement during reflow soldering. Pad designs are given below for the most common sizes of multilayer ceramic capacitors for both wave and reflow soldering. The basis of these designs is:

Pad width equal to component width. It is permissible to

decrease this to as low as 85% of component width but it is not advisable to go below this.

- · Pad overlap 0.5mm beneath component.
- · Pad extension 0.5mm beyond components for reflow and 1.0mm for wave soldering.

WAVE SOLDERING



Case Size	D1	D2	D3	D4	D5
0603	3.10 (0.12)	1.20 (0.05)	0.70 (0.03)	1.20 (0.05)	0.75 (0.03)
0805	4.00 (0.15)	1.50 (0.06)	1.00 (0.04)	1.50 (0.06)	1.25 (0.05)
1206	5.00 (0.19)	1.50 (0.06)	2.00 (0.09)	1.50 (0.06)	1.60 (0.06)

Dimensions in millimeters (inches)

Component Spacing

For wave soldering components, must be spaced sufficiently far apart to avoid bridging or shadowing (inability of solder to penetrate properly into small spaces). This is less important for reflow soldering but sufficient space must be allowed to enable rework should it be required.

Preheat & Soldering

The rate of preheat should not exceed 4°C/second to prevent thermal shock. A better maximum figure is about 2°C/second.

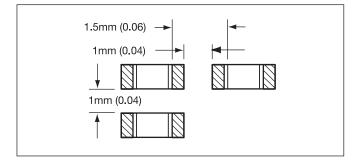
For capacitors size 1206 and below, with a maximum thickness of 1.25mm, it is generally permissible to allow a temperature differential from preheat to soldering of 150°C. In all other cases this differential should not exceed 100°C.

For further specific application or process advice, please consult KYOCERA AVX.

Cleaning

Care should be taken to ensure that the capacitors are thoroughly cleaned of flux residues especially the space beneath the capacitor. Such residues may otherwise become conductive and effectively offer a low resistance bypass to the capacitor.

Ultrasonic cleaning is permissible, the recommended conditions being 8 Watts/litre at 20-45 kHz, with a process cycle of 2 minutes vapor rinse, 2 minutes immersion in the ultrasonic solvent bath and finally 2 minutes vapor rinse.



Recommended Soldering Profiles



REFLOW SOLDER PROFILES

KYOCERA AVX RoHS compliant products utilize termination finishes (e.g.Sn or SnAg) that are compatible with all Pb-Free soldering systems and are fully reverse compatible with SnPb soldering systems. A recommended SnPb profile is shown for comparison; for Pb-Free soldering, IPC/ JEDECJ- STD-020C may be referenced. The upper line in the chart shows the maximum envelope to which products are qualified (typically 3x reflow cycles at 260°C max). The center line gives the recommended profile for optimum wettability and soldering in Pb-Free Systems.

Preheat:

The pre-heat stabilizes the part and reduces the temperature differential prior to reflow. The initial ramp to 125°C may be rapid, but from that point (2-3)°C/sec is recommended to allow ceramic parts to heat uniformly and plastic encapsulated parts to stabilize through the glass transition temperature of the body (~ 180°C).

Reflow:

In the reflow phase, the maximum recommended time > 230°C is 40secs. Time at peak reflow is 10secs max.; optimum reflow is achieved at 250°C, (see wetting balance chart opposite) but products are qualified to 260°C max. Please reference individual product datasheets for maximum limits

Cool down should not be forced and 6°C/sec is recommended. A slow cool down will result in a finer grain structure of the reflow solder in the solder fillet.

WAVE SOLDER PROFILES

For wave solder, there is no change in the recommended wave profile; all standard Pb-Free (SnCu/SnCuAg) systems operate at the same 260°C max recommended for SnPb systems.

Preheat:

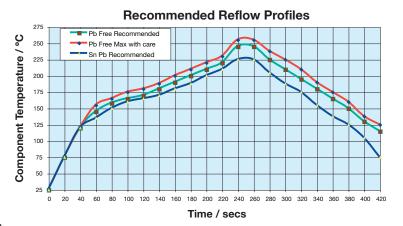
This is more important for wave solder; a higher temperature preheat will reduce the thermal shock to SMD parts that are immersed (please consult individual product data sheets for SMD parts that are suited to wave solder). SMD parts should ideally be heated from the bottom-Side prior to wave. PTH (Pin through hole) parts on the topside should not be separately heated.

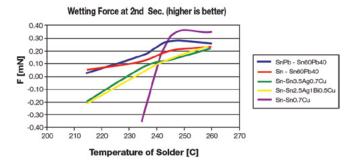
Wave:

250°C - 260°C recommended for optimum solderability.

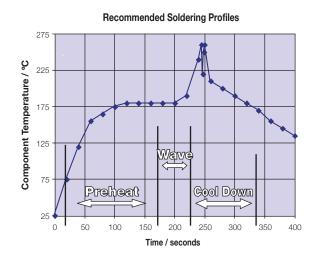
Cool Down:

As with reflow solder, cool down should not be forced and 6°C/sec is recommended. Any air knives at the end of the 2nd wave should be heated.





IMPORTANT NOTE: Typical Pb-Free reflow solders have a more dull and grainy appearance compared to traditional SnPb. Elevating the reflow temperature will not change this, but extending the cool down can help improve the visual appearance of the joint.





MLC Chip Capacitors



APPLICATION NOTES

Storage

The components should be stored in their "as received packaging" where possible. If the components are removed from their original packaging then they should be stored in an airtight container (e.g. a heat sealed plastic bag) with desiccant (e.g. silica gel). Storage area temperature should be kept between +5 degrees C and +30 degrees C with humidity < 70% RH. Storage atmosphere must be free of gas containing sulfur and chlorine. Avoid exposing the product to saline moisture or to temperature changes that might result in the formation of condensation. To assure good solderability performance we recommend that the product be used within 6 months from our shipping date, but can be used for up to 12 months. Chip capacitors may crack if exposed to hydrogen (H2) gas while sealed or if coated with silicon, which generates hydrogen gas.

Solderability

Terminations to be well soldered after immersion in a 60/40 tin/lead solder bath at 245°C +/- 5°C for 5 +0/-0.5 seconds.

Leaching

Terminations will resist leaching for at least the immersion times and conditions shown below.

Termination Type	Solder Tin/	Solder	Immersion
	Lead/Silver	Temp °C	Time Seconds
Nickel Barrier	60/40/0	260 ± 5	30 ± 1

Lead-Free Wave Soldering

The recommended peak temperature for lead-free wave soldering is 250°C-260°C for 3-5 seconds. The other parameters of the profile remains the same as above.

The following should be noted by customers changing from lead based systems to the new lead free pastes.

- A. The visual standards used for evaluation of solder joints will need to be modified as lead free joints are not as bright as with tin-lead pastes and the fillet may not be as large.
- B. Lead-free solder pastes do not allow the same self alignment as lead containing systems. Standard mounting pads are acceptable, but machine set up may need to be modified.

General

Surface mounting chip multilaver ceramic capacitors are designed for soldering to printed circuit boards or other substrates. The construction of the components is such that they will withstand the time/temperature profiles used in both wave and reflow soldering methods.

Handling

Chip multilayer ceramic capacitors should be handled with care to avoid damage or contamination from perspiration and skin oils. The use of tweezers or vacuum pick ups is strongly recommended for individual components. Bulk handling should ensure that abrasion and mechanical shock are minimized. Taped and reeled components provides the ideal medium for direct presentation to the placement machine. Any mechanical shock should be minimized during handling chip multilayer ceramic capacitors.

Preheat

It is important to avoid the possibility of thermal shock during soldering and carefully controlled preheat is therefore required. The rate of preheat should not exceed 4°C/second and a target figure 2°C/second is recommended. Although an 80°C to 120°C temperature differential is preferred, recent developments allow a temperature differential between the component surface and the soldering temperature of 150°C (Maximum) for capacitors of 1210 size and below with a maximum thickness of 1.25mm. The user is cautioned that the risk of thermal shock increases as chip size or temperature differential increases.

Soldering

Mildly activated rosin fluxes are preferred. The minimum amount of solder to give a good joint should be used. Excessive solder can lead to damage from the stresses caused by the difference in coefficients of expansion between solder, chip and substrate. KYOCERA AVX terminations are suitable for all wave and reflow soldering systems. If hand soldering cannot be avoided, the preferred technique is the utilization of hot air soldering tools.

Natural cooling in air is preferred, as this minimizes stresses within the soldered joint. When forced air cooling is used, cooling rate should not exceed 4°C/second. Quenching is not recommended but if used, maximum temperature differentials should be observed according to the preheat conditions above.

Cleaning

Flux residues may be hygroscopic or acidic and must be removed. KYOCERA AVX MLC capacitors are acceptable for use with all of the solvents described in the specifications MIL-STD-202 and EIA-RS-198. Alcohol based solvents are acceptable and properly controlled water cleaning systems are also acceptable. Many other solvents have been proven successful, and most solvents that are acceptable to other components on circuit assemblies are equally acceptable for use with ceramic capacitors.

Prevention of Metallic Migration

Note that when components with Sn plating on the end terminations are to be used in applications that are likely to experience conditions of high humidity under bias voltage, we strongly recommend that the circuit boards be conformally coated to protect the Sn from moisture that might lead to migration and eventual current leakage.

When using Capacitor Arrays we recommend that there is no differential in applied voltage between adjacent elements.

MLC Chip Capacitors



POST SOLDER HANDLING

Once SMP components are soldered to the board, any bending or flexure of the PCB applies stresses to the soldered joints of the components. For leaded devices, the stresses are absorbed by the compliancy of the metal leads and generally don't result in problems unless the stress is large enough to fracture the soldered connection.

Ceramic capacitors are more susceptible to such stress because they don't have compliant leads and are brittle in nature. The most frequent failure mode is low DC resistance or short circuit. The second failure mode is significant loss of capacitance due to severing of contact between sets of the internal electrodes.

Cracks caused by mechanical flexure are very easily identified and generally take one of the following two general forms:

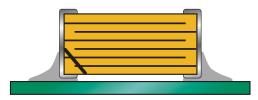
Mechanical cracks are often hidden underneath the termination and are difficult to see externally. However, if one end termination falls off during the removal process from PCB, this is one indication that the cause of failure was excessive mechanical stress due to board warping.

COMMON CAUSES OF MECHANICAL CRACKING

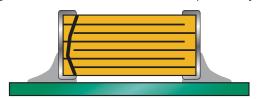
The most common source for mechanical stress is board depanelization equipment, such as manual breakapart, v-cutters and shear presses. Improperly aligned or dull cutters may cause torqueing of the PCB resulting in flex stresses being transmitted to components near the board edge. Another common source of flexural stress is contact during parametric testing when test points are probed. If the PCB is allowed to flex during the test cycle, nearby ceramic capacitors may be broken.

A third common source is board to board connections at vertical connectors where cables or other PCBs are connected to the PCB. If the board is not supported during the plug/unplug cycle, it may flex and cause damage to nearby components.

Special care should also be taken when handling large (>6" on a side) PCBs since they more easily flex or warp than smaller boards.



Type A: Angled crack between bottom of device to top of solder joint.

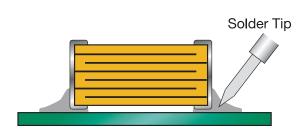


Type B: Fracture from top of device to bottom of device.

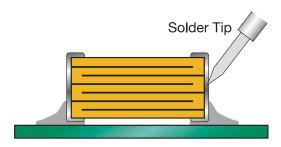
REWORKING OF MLCS

Thermal shock is common in MLCs that are manually attached or reworked with a soldering iron. KYOCERA AVX strongly recommends that any reworking of MLCs be done with hot air reflow rather than soldering irons. It is practically impossible to cause any thermal shock in ceramic capacitors when using hot air reflow.

However direct contact by the soldering iron tip often causes thermal cracks that may fail at a later date. If rework by soldering iron is absolutely necessary, it is recommended that the wattage of the iron be less than 30 watts and the tip temperature be <300°C. Rework should be performed by applying the solder iron tip to the pad and not directly contacting any part of the ceramic capacitor.



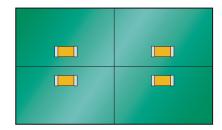
Preferred Method - No Direct Part Contact



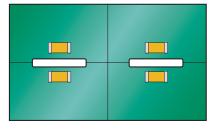
Poor Method - Direct Contact with Part

PCB BOARD DESIGN

To avoid many of the handling problems, KYOCERA AVX recommends that MLCs be located at least .2" away from nearest edge of board. However when this is not possible, KYOCERA AVX recommends that the panel be routed along the cut line, adjacent to where the MLC is located.



No Stress Relief for MLCs



Routed Cut Line Relieves Stress on MLC



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