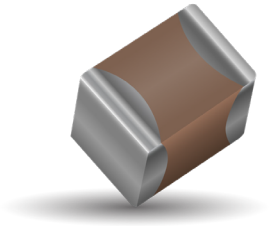
Automotive MLCC, KAM Series

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.

The KAM series are plated with a Nickel/Tin finish. For FLEXITERM® please refer to the KAF series datasheet.

HOW TO ORDER

KAM

Series
AEC-Q200
Tin Nickel
Finish

31

Size
03 = 0201
05 = 0402
15 = 0603
21 = 0805
31 = 1206
32 = 1210
42 = 1808
43 = 1812
55 = 2220

G

Thickness
See Cap Chart

R7

Dielectric
CG = COG
R7 = X7R
S7 = X7S
T7 = X7T
R8 = X8R
L8 = X8L
G8 = X8G

1H

Voltage
0E = 2.5V
0G = 4V
0J = 6.3V
1A = 10V
1C = 16V
1E = 25V
1H = 50V
2A = 100V
2D = 200V
2E = 250V
2H = 500V
2J = 630V
3A = 1000V
3N = 1500V
3D =2000V
3E = 2500V
3U = 3000V

475

Capacitance Code Code (in pF)
2 Significant Digits
+Number of zeros
eg 10uF = 106
10nF = 103
47pF = 470

K

Capacitance Tolerance
B = ± 0.1pF (<10pF)*
C = ± 0.25pF (<10pF)*
D = ± 0.5pF (<10pF)*
F = ± 1%*
G = ± 2%*
J = ± 5%
K = ± 10%
M = ± 20%

*C0G only

U

Packaging
See Table Below

PACKAGING CODES

Packaging Code	Size Code	EIA (inch)	IEC (mm)	Width	Pitch	Material	Reel Size
H	03 &05	0201 & 0402	0603 & 1005	8mm	2mm	Paper	7" Reel
T	15-32	0603-1210	1608-3225	8mm	4mm	Paper	
U	15-32	0603-1210	1608-3225	8mm	4mm	Embossed	
Y	42	1808	4520	12mm	4mm	Embossed	
V	43 & 55	1812 & 2220	4532 & 5750	12mm	8mm	Embossed	
N	03 &05	0201 & 0402	0603 & 1005	8mm	2mm	Paper	13" Reel
M	15-32	0603-1210	1608-3225	8mm	4mm	Paper	
L	15-32	0603-1210	1608-3225	8mm	4mm	Embossed	
K	42	1808	4520	12mm	4mm	Embossed	
S	43 & 55	1812 & 2220	4532 & 5750	12mm	8mm	Embossed	
A	15-31	0603-1206	1608-3216	8mm	4mm	Paper	Maxi Reel*
D	21 & 31	0805 & 1206	2012 & 3216	8mm	4mm	Embossed	

Note: thickness determines paper or plastic embossed packaging
*please consult factory for maxi reel availability

DIELECTRIC

Dielectric	Operating Temperature (°C)	Capacitance Change Rate
X7R	-55~+125	±15%
X7T	-55~+125	±22/-33%
X8R	-55~+150	±15%
X8L	-55~+125	±15%
X8L	+125~+150	+15/-40%
X8G	-55~+150	0±30ppm/°C
NP0	-55~+125	0±30ppm/°C

TYPICAL APPLICATIONS

X7R KAM

- High capacitance values
- Broadest voltage and cap offering
- Cameras
- Body control modules
- Infotainment
- ECU
- Climate control

X7T KAM

- Motor drive
- Door lock

NP0 KAM

- Extreme capacitance stability
- Automotive LED Lighting System
- Key fob
- Audio
- Touchscreen
- GPS
- Safety

X8G KAM

- Extreme capacitance stability
- High temperature
- Battery Management Systems
- Powertrain Sensors & Actuators
- Engine management
- Transmission control
- Safety

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.
Visual/Cosmetic Quality	Standard process and inspection	100% inspection
Application Robustness	Standard sampling for accelerated wave solder	Increased sampling for accelerated wave solder followed by lot by lot reliability testing.

All Tests have Accept/Reject Criteria 0/1

Automotive MLCC - C0G

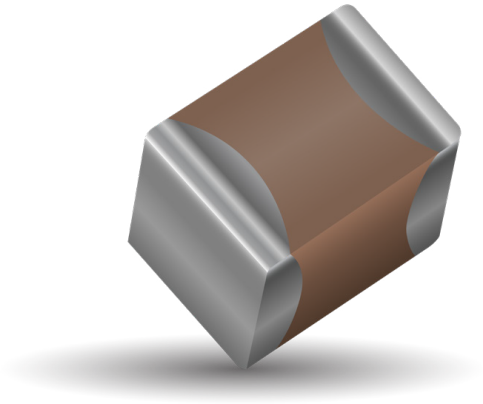
General Specifications

TYPICAL APPLICATIONS

- Extreme capacitance stability
- Automotive LED Lighting System
- Key fob
- Audio
- Touchscreen
- GPS
- Safety

ENGINEERING TOOLS

- Samples
- Technical Articles
- Application Engineering
- Application Support



Automotive MLCC - C0G

Capacitance Range

Case Size		0402			0603					0805							1206								1210							1812		
Length (L)	mm (in.)	1.00 ± 0.10 (0.040 ± 0.004)			1.60 ± 0.15 (0.063 ± 0.006)					2.01 ± 0.20 0.079 ± 0.008							3.20 ± 0.20 (0.126 ± 0.008)								3.20 ± 0.20 (0.126 ± 0.008)							4.5 ± 0.3 (0.177 ± 0.012)		
Width (W)	mm (in.)	0.50 ± 0.10 (0.020 ± 0.004)			0.81 ± 0.15 (0.032 ± 0.006)					1.25 ± 0.20 (0.049 ± 0.008)							1.60 ± 0.20 (0.063 ± 0.008)								2.50 ± 0.20 (0.098 ± 0.008)							3.2 ± 0.2 (0.126 ± 0.008)		
Terminal (t)	mm (in.)	0.25 ± 0.15 (0.010 ± 0.006)			0.35 ± 0.15 (0.014 ± 0.006)					0.50 ± 0.25 (0.020 ± 0.010)							0.50 ± 0.25 (0.020 ± 0.010)								0.50 ± 0.25 (0.020 ± 0.010)							0.61 ± 0.36 (0.024 ± 0.014)		
WVDC		25V	50V	100V	25V	50V	100V	200V	250V	25V	50V	100V	200V	250V	500V	630V	25V	50V	100V	200V	250V	500V	630V	1000V	50V	100V	200V	250V	500V	630V	1000V	50V	100V	200V
Cap (pF) 0R5	0.5	A	A	A	A	A	A	A	A	B	B	B	B	B	B	B		B	B	B	B	B	B	G	Q	Q	Q	Q	Q	Q	Q	Y	Y	Y
1R0	1.0	A	A	A	A	A	A	A	A	B	B	B	B	B	B	B		B	B	B	B	B	B	G	Q	Q	Q	Q	Q	Q	Q	Y	Y	Y
100	10	A	A	A	A	A	A	A	A	B	B	B	B	B	B	B		B	B	B	B	B	G	G	Q	Q	Q	Q	Q	Q	Q	Y	Y	Y
120	12	A	A	A	A	A	A	A	A	B	B	B	B	B				B	B	B	B	B	G	G	Q	Q	Q	Q	Q	Q	Q	Y	Y	Y
150	15	A	A	A	A	A	A	A	A	B	B	B	B	B				B	B	B	B	B	G	G	Q	Q	Q	Q	Q	Q	Q	Y	Y	Y
180	18	A	A	A	A	A	A	A	A	B	B	B	B	B				B	B	B	B	B	G	G	Q	Q	Q	Q	Q	Q	Q	Y	Y	Y
220	22	A	A	A	A	A	A	A	A	B	B	B	B	B				B	B	B	B	B	G	G	Q	Q	Q	Q	Q	Q	Q	Y	Y	Y
270	27	A	A	A	A	A	A	A	A	B	B	B	B	B				B	B	B	B	B	G	G	Q	Q	Q	Q	Q	Q	Q	Y	Y	Y
330	33	A	A	A	A	A	A	A	A	B	B	B	B	B				B	B	B	B	B	G	G	Q	Q	Q	Q	Q	Q	Q	Y	Y	Y
390	39	A	A	A	A	A	A	A	A	B	B	B	B	B				B	B	B	B	B	G	G	Q	Q	Q	Q	Q	Q	Q	Y	Y	Y
470	47	A	A		A	A	A	A	A	B	B	B	B	B				B	B	B	B	B	G	G	Q	Q	Q	Q	Q	Q	Q	Y	Y	Y
560	56	A	A		A	A	A	A	A	B	B	B	B	A				B	B	B	B	B	G	G	Q	Q	Q	Q	Q	Q	Q	Y	Y	Y
680	68	A	A		A	A	A	A	A	B	B	B	B	A				B	B	B	B	B	G	G	Q	Q	Q	Q	Q	Q	Q	Y	Y	Y
820	82	A	A		A	A	A	A	A	B	B	B	B	A				B	B	B	B	B	G	G	D	D	D	D	D	D	D	Y	Y	Y
101	100	A	A		A	A	A	A	A	B	B	B	B	A				B	B	B	B	B	G	G	D	D	D	D	D	D	D	Y	Y	Y
121	120				A	A	A		A	B	B	B	B	A				B	B	B	B	B	G	G	D	D	D	F	F	F	K	Y	Y	Y
151	150				A	A	A		A	B	B	B	B	A				B	B	B	B	N	G	G	D	D	D	F	F	F	K	Y	Y	Y
181	180				A	A	A		A	B	B	B	B	A				B	B	B	B	N	G	G	D	D	D	F	F	F	K	Y	Y	Y
221	220				A	A	A		A	B	B	B	B	A				B	B	B	B	N	G	G	D	D	D	F	F	F	K	Y	Y	Y
271	270				A	A	A		A	B	B	B	B	A				B	B	B	B	N	G		D	D	D	F	F	F	K	Y	Y	Y
331	330				A	A	A		A	B	B	B	B	A				B	B	B	B	N	G		D	D	D	F	F	F	K	Y	Y	Y
391	390				A	A	A		A	B	B	B	B	A				B	B	B	B	N	G		D	D	D	F	F	F	K	Y	Y	Y
471	470				A	A	A*		A	B	B	B	B	A				B	B	B	N	N	G		D	D	D	F	F	F	K	Y	Y	Y
561	560				A	A	A*		A	B	B	B	B	A				B	B	B	N	G	G		D	D	D	F	F	F	K	Y	Y	Y
681	680				A	A	A*		A	B	B	B	B	A				B	B	B	N	G	G		D	D	D	F	F	F	K	Y	Y	Y
821	820				A*	A*	A*		A	B	B	B	B	A				B	B	N	N	G	G		D	D	D	F	F	F	K	Y	Y	Y
102	1000				A*	A*	A*		A	B	B	B	B	A				B	B	N	N	G	G		D	D	D	F	F	K	K	Y	Y	Y
122	1200				A*	A*	A*		A	B	B	B	B	A				D	N	N	B	B	B		D	D	D	F	F	F	K	Y	Y	Y
152	1500				A*	A*	A*		A	B	B	B	B	A				D	N	N	B	B	B		D	D	D	F	F	G	G	Y	Y	Y
222	2200				A*	A*	A*			B	A	B		B				B	B	B	B	B	B		D	D	D	F	G	G	G			
272	2700				A*	A*					K	K		K				B	B	B	B	B	B		G	G	G	G	G	G	G			
332	3300				A*	A*					K	K		K				G	G	G	G	G	G		G	G	G	G	G	G	G			
392	3900				A*	A*					K	K		K				G	G	G	G	G	G		G	G	G	G	G	G	G			
472	4700				A*	A*					K	K		K				G	G	G	G	G	G		G	G	G	G	G	G	G			
562	5600				A*	A*					K	K						G	G	G	G	G	G		G	G	G	G	G	G	G			
682	6800				A*	A*					K	K						G	G	G	G	G	G		K	K	K	K	K	K	K			
822	8200				A*						K	K						G	G	G	G	G	G		K	K	K	K	K	K	K			
103	10000				A*						K	A						G	G	G	G	G	G		K	K	K	K	K	K	L			
123	12000																G	G	G	G	G				K	K	K	K	K	K				
153	15000																G	G	G	G	G				L	L	L	L	L	L				
183	18000																G	G	G	G	G				L	L	L	L	L	L				
223	22000																G	G	G						L	L	L	L	L	L				
273	27000																G	G	G						L	L	L	L	L	L				
333	33000																G	G	G						L	L	L	L	L	L				
393	39000																G	G																
473	47000																G	G																
563	56000																																	
683	68000																																	
823	82000																																	
104	100000																																	
WVDC		25V	50V	100V	25V	50V	100V	200V	250V	25V	50V	100V	200V	250V	500V	630V	25V	50V	100V	200V	250V	500V	630V	1000V	50V	100V	200V	250V	500V	630V	1000V	50V	100V	250V
Case Size		0402			0603					0805							1206								1210							1812		

* These dimensions differ from the standard in table above and are:
0603 L= 1.6 ± 0.2 mm , W = 0.8 ± 0.2 mm
1210 L= 3.2 ± 0.4 mm , W = 2.5 ± 0.3 mm

Case Size	0402 (KAM05)	0603 (KAM15)	0805 (KAM21)			1206 (KAM31)				1210 (KAM32)						1812 (KAM43)
Thickness Letter	A	A	B	K	A	B	N	D	G	Q	D	F	G	K	L	Y
Max Thickness (mm)	0.55	0.90	0.94	1.4	1.45	0.94	1.27	1.45	1.78	0.94	1.45	1.52	1.78	2.29	2.80	1.02
Carrier Tape	PAPER	PAPER	PAPER	EMB	EMB	PAPER	EMB	EMB	EMB	PAPER	EMB	EMB	EMB	EMB	EMB	EMB
Packaging Code 7" reel	H	T	T	U	U	T	U	U	U	T	U	U	U	U	U	V
Packaging Code 13" reel	N	M	M	L	L	M	L	L	L	M	L	L	L	L	L	S
	PAPER					EMBOSSED (EMB)										

Automotive MLCC - X7R / X7T

General Specifications

TYPICAL APPLICATIONS

X7R KAM

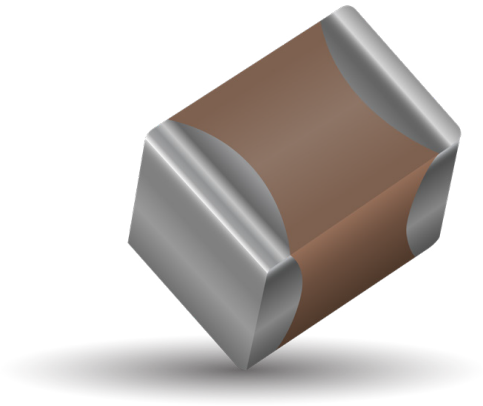
- High capacitance values
- Broadest voltage and cap offering
- Cameras
- Body control modules
- Infotainment
- ECU
- Climate control

X7T KAM

- Motor drive
- Door lock

ENGINEERING TOOLS

- Samples
- Technical Articles
- Application Engineering
- Application Support



Automotive MLCC - X7R, 4V to 500V

Capacitance Range

SIZE		0201				0402							0603									0805									1206							1210						1812		2220					
Soldering		Reflow/Wave				Reflow/Wave							Reflow/Wave									Reflow/Wave									Reflow/Wave							Reflow Only						Reflow Only		Reflow Only					
(L) Length	mm	0.6 ± 0.09				1 ± 0.1							1.6 ± 0.15									2.01 ± 0.2									3.2 ± 0.2							3.2 ± 0.2						4.5 ± 0.3		5.7 ± 0.5					
	(in.)	(0.024 ± 0.004)				(0.04 ± 0.004)							(0.063 ± 0.006)									(0.079 ± 0.008)									(0.126 ± 0.008)							(0.126 ± 0.008)						(0.177 ± 0.012)		(0.224 ± 0.02)					
(W) Width	mm	0.3 ± 0.09				0.5 ± 0.1							0.81 ± 0.15									1.25 ± 0.2									1.6 ± 0.2							2.5 ± 0.2						3.2 ± 0.2		5 ± 0.4					
	(in.)	(0.011 ± 0.004)				(0.02 ± 0.004)							(0.032 ± 0.006)									(0.049 ± 0.008)									(0.063 ± 0.008)							(0.098 ± 0.008)						(0.126 ± 0.008)		(0.197 ± 0.016)					
(t) Terminal	mm	0.18 ± 0.09				0.25 ± 0.15							0.35 ± 0.15									0.5 ± 0.25									0.5 ± 0.25							0.5 ± 0.25						0.61 ± 0.36		0.64 ± 0.39					
	(in.)	(0.007 ± 0.004)				(0.01 ± 0.006)							(0.014 ± 0.006)									(0.02 ± 0.01)									(0.02 ± 0.01)							(0.02 ± 0.01)						(0.024 ± 0.014)		(0.025 ± 0.015)					
WVDC		2.5V	4V	6.3V	10V	2.5V	4V	6.3V	10V	16V	25V	50V	2.5V	4V	6.3V	10V	16V	25V	50V	100V	200V	250V	2.5V	4V	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	Cap 100																																																		
221	(pF) 220									A	A	A					A	A	A	A	A	A																			Q	Q										
271	270									A	A	A					A	A	A	A	A	A																			Q	Q										
331	330									A	A	A					A	A	A	A	A	A																			Q	Q										
391	390									A	A	A					A	A	A	A	A	A																			Q	Q										
471	470									A	A	A					A	A	A	A	A	A																			Q	Q										
561	560									A	A	A					A	A	A	A	A	A																			Q	Q										
681	680									A	A	A					A	A	A	A	A	A																			Q	Q										
821	820									A	A	A					A	A	A	A	A	A																			Q	Q										
102	1000									A	A	A					A	A	A	A	A	A	A					B	B	B	B	B	B	B	B	B	B	B	B	B	Q	Q	Q	Q	Q	Q	Y	Y						
122	1220									A	A	A					A	A	A	A	A	A	A					B	B	B	B	B	B	B	B	B	B	B	B	B	Q	Q	Q	Q	Q	Q	Y	Y						
152	1500									A	A	A					A	A	A	A	A	A	A					B	B	B	B	B	B	B	B	B	B	B	B	B	Q	Q	Q	Q	Q	Q	Y	Y						
182	1800									A	A	A					A	A	A	A	A	A	A					B	B	B	B	B	B	B	B	B	B	B	B	B	Q	Q	Q	Q	Q	Q	Y	Y						
222	2200									A	A	A					A	A	A	A	A	A	A					B	B	B	B	B	B	B	B	B	B	B	B	B	Q	Q	Q	Q	Q	Q	Y	Y						
272	2700									A	A	A					A	A	A	A	A	A	A					B	B	B	B	B	B	B	B	B	B	B	B	B	Q	Q	Q	Q	Q	Q	Y	Y						
332	3300									A	A	A					A	A	A	A	A	A	A					B	B	B	B	B	B	B	B	B	B	B	B	B	Q	Q	Q	Q	Q	Q	Y	Y						
392	3900									A	A	A					A	A	A	A	A	A	A					B	B	B	B	B	B	B	B	B	B	B	B	B	Q	Q	Q	Q	Q	Q	Y	Y						
472	4700									A	A	A					A	A	A	A	A	A	A					B	B	B	B	B	B	B	B	B	B	B	B	B	Q	Q	Q	Q	Q	Q	Y	Y						
562	5600									A	A	A					A	A	A	A	A	A	A					B	B	B	B	B	B	B	B	B	B	B	B	B	Q	Q	Q	Q	Q	Q	Y	Y						
682	6800									A	A	A					A	A	A	A	A	A	A					B	B	B	B	B	B	B	B	B	B	B	B	B	Q	Q	Q	Q	Q	Q	Y	Y						
822	8200									A	A	A					A	A	A	A	A	A	A					B	B	B	B	B	B	B	B	B	B	B	B	B	Q	Q	Q	Q	Q	Q	Y	Y						
103	Cap 0.01									A	A	A					A	A	A	A	A	A	A					B	B	B	B	B	B	B	B	B	B	B	B	G	Q	Q	Q	Q	Q	Q	Y	Y						
123	(µF) 0.012									A	F	F					A	A	A	A	A							B	B	B	B	B	B	K	B	B	B	B	B	N		Q	Q	Q	Q	Q	G	Y	Y						
153	0.015									A	F	F					A	A	A	A	A							B	B	B	B	B	B	K	B	B	B	B	B	N		Q	Q	Q	Q	Q	G	Y	Y						
183	0.018									A	F	F					A	A	A	A	A							B	B	B	B	K	K		B	B	B	B	B	N		Q	Q	Q	Q	Q	G	Y	Y						
223	0.022									A	F	F					A	A	A	A	A							B	B	B	B	K	K		B	B	B	B	G	G		Q	Q	Q	Q	Q	G	Y	Y						
273	0.027									A	F	F					A	A	A	A	B							B	B	B	B	K	K		B	B	B	B	G	G		Q	Q	Q	Q	Q	G	Y	Y						
333	0.033									A	F	F					A	A	A	A	B							B	B	B	K	K	K		B	B	B	B	G	G		Q	Q	Q	Q	Q	G	Y	Y						
393	0.039										F	F					A	A	A	A	B							B	B	B	K	K	K		B	B	B	B	G	G		Q	Q	Q	Q	Q	G	Y	Y						
473	0.047								F	F	F	F					A	A	A	A	B							B	B	B	K	K	K		B	B	B	N	G	G		Q	Q	Q	Q	Q	G	Y	Y						
563	0.056								F	F	F	F					A	A	A	A	B							B	B	B	K				B	B	B	N	G	G		Q	Q	Q	Q	C	G	Y	Y						
683	0.068								F	F	F	F					A	A	A	A	B							B	B	B	K				B	B	B	N	G	G		Q	Q	Q	Q	C	G	Y	Y						
823	0.082								F	F	F	F					A	A	A	A	B							B	B	B	K				B	B	B	N	G	G		Q	Q	Q	Q	G	G	Y	Y						
104	0.10	A	A	A					F	F	F	F					A	A	A	A	B							B	B	B	K				B	B	B	N	G	G		Q	Q	Q	Q	G	G	Y	Y						A
124	0.12								F	F	F						A	B	B	B								B	B	B	K	K			B	B	B	N	G	G		Q	Q	Q	F	G	G	Y	Y						
154	0.15								F	F	F						A	B	B	B								B	B	B	N	G	G		B	B	B	N	G	G		Q	Q	Q	F	K	G	Y	Y						
224	0.22	A(X7T)	A(X7T)	A(X7T)					F	F	F						A	B	B	B								J	K	K	K				B	B	B	G	G	G		Q	Q	Q	F	G	G	Z	Z						
334	0.33																B	B	B									K	K	K	K				B	N	E	G	G	G		Q	Q	Q	G	L	L	G	G						
474	0.47	C(X7T)	C(X7T)	C(X7T)	C (X7T)	A	A	A	A								B	B	B									K	K	K	K				N	N	E	G				F	F	F	G			G	G						
684	0.68					A	A																					K	K	K	K				N	G	G	G				F	F	G	K			G	G						
105	1.0	C(X7T)	C(X7T)	C(X7T)				A	C				A	A	A	A	A												K	K	K	K				N	G	G	G				F	G	G	L			G	G		C	C	A	A	
155	1.5																												K	K	K					G	G	G	G				F	G	L	L			G	G		C	C	C	C	
225	2.2					C(X7T)	C(X7T)	C(X7T)	C(X7T)				A	A	A	A													K	K	K					G	G	G	G				L	L	L	L			J	J		C	C	C	C	
335	3.3																																			G	G	G					K	L	L	L			J			C	C			
475	4.7					C(X7T)	C(X7T)	C(X7T)					A	A	C																						G	G	G					K	L	L	L			J			C	C			
106	10					C(X7T)	C(X7T)						C(X7T)	C(X7T)	C(X7T)												A	A								H*	H*					L	L	L				J		C	C	C			
226	22												C(X7T)	C(X7T)	C(X7T)								A(X7T)	A(X7T)	A(X7T)																							C							
WVDC		2.5V	4V	6.3V	10V	2.5V	4V	6.3V	10V	16V	25V	50V	2.5V	4V	6.3V	10V	16V	25V	50V	100V	200V	250V	2.5V	4V	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
Size		0201				0402							0603									0805									1206							1210						1812		2220					

*These dimensions differ from the standard in table above and are:
Length (mm) 3.2 ± 0.4
Width (mm) 1.6 ± 0.3

Case Size	0201(KAM03)		0402(KAM05)			0603(KAM15)			0805(KAM21)				1206(KAM31)					1210(KAM32)						1812(KAM43)				2220(KAM55)	
Thickness Letter	A	C	A	**F**	C	A	B	C	B	J	K	A	B	N	E	G	**H**	Q	C	F	G	K	L	Y	Z	G	J	A	C
Max Thickness(mm)	0.33	0.39	0.56	**0.6**	0.70	0.90	0.95	1.00	0.94	1.27	1.40	1.45	0.94	1.27	1.52	1.78	**1.9**	0.94	1.27	1.52	1.78	2.29	2.80	1.02	1.27	2.29	2.80	2.29	2.80
Carrier Tape	PAPER	PAPER	PAPER	**PAPER**	PAPER	PAPER	PAPER	PAPER	PAPER	EMB	EMB	EMB	PAPER	EMB	EMB	EMB	**EMB**	PAPER	EMB	EMB	EMB	EMB	EMB	EMB	EMB	EMB	EMB	EMB	EMB
Packaging Code 7"reel	H	H	H	**H**	H	T	T	T	T	U	U	U	T	U	U	U	**U**	T	U	U	U	U	U	V	V	V	V	V	V
Packaging Code 13"reel	N	N	N	**N**	N	M	M	M	M	L	L	L	M	L	L	L	**L**	M	L	L	L	L	L	S	S	S	S	S	S
	PAPER																	EMBOSSED (EMB)												

Automotive MLCC - X7R, 630V to 3000V

Capacitance Range

PREFERRED SIZES ARE SHADED

Case Size		1206					1210				1808						1812						2220				
Soldering		Reflow/Wave					Reflow/Wave				Reflow Only						Reflow Only						Reflow Only				
(L) Length	mm (in.)	3.2 ± 0.2 (0.126 ± 0.008)					3.2 ± 0.2 (0.126 ± 0.008)				4.57 ± 0.25 (0.18 ± 0.01)						4.5 ± 0.3 (0.177 ± 0.012)						5.7 ± 0.5 (0.224 ± 0.02)				
W) Width	mm (in.)	1.6 ± 0.2 (0.063 ± 0.008)					2.5 ± 0.2 (0.098 ± 0.008)				2.03 ± 0.25 (0.08 ± 0.01)						3.2 ± 0.2 (0.126 ± 0.008)						5 ± 0.4 (0.197 ± 0.016)				
(t) Terminal	mm max	0.5 ± 0.25 (0.02 ± 0.01)					0.5 ± 0.25 (0.02 ± 0.01)				0.61 ± 0.36 (0.024 ± 0.014)						0.61 ± 0.36 (0.024 ± 0.014)						0.64 ± 0.39 (0.025 ± 0.015)				
Voltage (V)		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
101	Cap 100	B	B	B	B	B																					
121	(pF) 120	B	B	B	B	B																					
151	150	B	B	B	B	B																					
181	180	B	B	B	B	B																					
221	220	B	B	B	B	B					B	B	B	B	B	B											
271	270	B	B	B	B	B	H	H	H	H	B	B	B	B	B	B											
331	330	B	B	B	B	B	H	H	H	H	B	B	B	B	B	B	E										
391	390	B	B	B	B	B	H	H	H	H	B	B	B	B	B	B	E										
471	470	B	B	B	B	B	H	H	H	H	B	B	B	B	B	B	E	E	E	E	E	E					
561	560	B	B	B	B	B	H	H	H	H	B	B	B	B	B	B	E	E	E	E	E	E					
681	680	B	B	B	B	B	H	H	H	H	B	B	B	B	B	B	E	E	E	E	E	E					
821	820	B	B	B	B	B	H	H	H	H	B	B	C	C	C	C	E	E	E	E	E	E					
102	1000	B	B	B	B	B	H	H	H	H	B	B	C	C	C	C	E	E	E	E	E	E	Z	Z	Z	Z	C
122	1220	D	A	A	A		H	H	H	H							F	F	F	F	F		Z	Z	Z	Z	C
152	1500	D	A	A	A		H	H	H	H							F	F	F	F	F		Z	Z	Z	Z	C
182	1800	D	A	A			H	H	H	H							F	F	F	F	F		Z	Z	Z	Z	C
222	2200	D	A	A			H	H	H	H							F	F	F	F	F		Z	Z	Z	Z	C
272	2700	D	A	A			H	H	H	H							F	F	F	F			Z	Z	Z	Z	
332	3300	D	A				H	H	H	H							F	F	F	F			Z	Z	Z	Z	
392	3900	D	A				H	H	H								F	F	F	F			Z	Z	Z	Z	
472	4700	D	A				H	H	H								F	F	J	J			Z	Z	Z	Z	
562	5600	D	A				H	H	H								F	F	J	J			Z	Z	Z	Z	
682	6800	A	A				H	H									F	F	J	J			Z	Z	Z	Z	
822	8200	A					H	H									F	F	J	J			Z	Z	C	C	
103	Cap 0.01	A					H	H									F	F	J				C	C	C	C	
123	(µF) 0.012						H	H									F	F	J				C	C	C	C	
153	0.015						H	H									F	F	J				C	C	C	C	
183	0.018						H										F	F					C	C	C	C	
223	0.022						H										F	F					C	C	C	C	
273	0.027						H										F	F					C	C	C		
333	0.033																F						C	C			
393	0.039																F						C	C			
473	0.047																F						C	C			
563	0.056																						C	C			
683	0.068																						C	C			
823	0.082																						C	C			
104	0.1																						C	C			
124	0.12																						C				
154	0.15																						C				
224	0.22																										
334	0.33																										
474	0.47																										
684	0.68																										
105	1																										
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		1206					1210				1808						1812						2220				

NOTE: Contact factory for non-specified capacitance values

Case Size	1206(KAM31)			1210(KAM32)	1808(KAM42)		1812(KAM43)			2220(KAM55)	
Thickness Letter	B	D	A	H	B	C	E	F	J	Z	C
Max Thickness	0.94	1.45	1.80	1.80	1.80	2.21	1.80	2.21	2.80	2.21	2.80
Carrier Tape	PAPER	EMB	EMB	EMB	EMB	EMB	EMB	EMB	EMB	EMB	EMB
Packaging Code 7"reel	T	U	U	U	Y	Y	V	V	V	V	V
Packaging Code 13"reel	M	L	L	L	K	K	S	S	S	S	S
	PAPER						EMBOSSED (EMB)				

Automotive MLCC - X8R / X8L

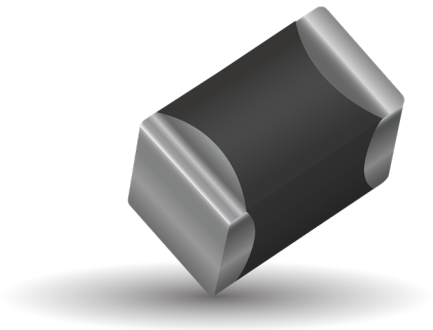
General Specifications

TYPICAL APPLICATIONS

- 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

ENGINEERING TOOLS

- Samples
- Technical Articles
- Application Engineering
- Application Support

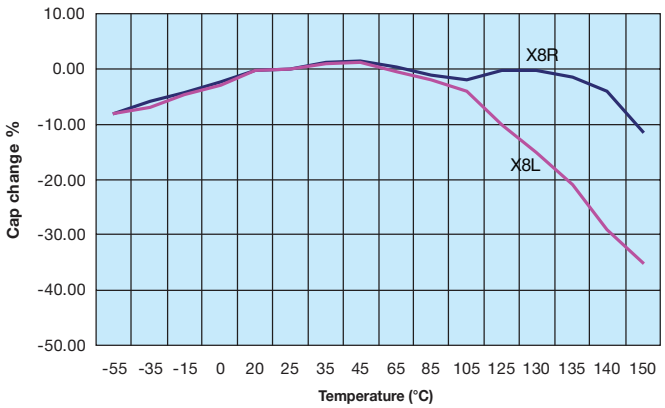


ADVANTAGES OF X8R AND X8L MLC CAPACITORS

- 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
- 100V range available

X8R/X8L Dielectric

0805, 50V, X8R/X8L Typical Temperature Coefficient



Automotive MLCC - X8R / X8L

Capacitance Range

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.

X8R

SIZE		0402	0603			0805			1206		
Soldering		Reflow/Wave	Reflow/Wave			Reflow/Wave			Reflow/Wave		
(L) Length	mm	1.0 ± 0.2	1.6 ± 0.15			2.01 ± 0.2			3.2 ± 0.2		
	(in.)	(0.04 ± 0.008)	(0.063 ± 0.006)			(0.079 ± 0.008)			(0.126 ± 0.008)		
(W) Width	mm	0.5 ± 0.2	0.81 ± 0.15			1.25 ± 0.2			1.6 ± 0.2		
	(in.)	(0.02 ± 0.008)	(0.032 ± 0.006)			(0.049 ± 0.008)			(0.063 ± 0.008)		
(t) Terminal	mm	0.25 ± 0.15	0.35 ± 0.15			0.5 ± 0.25			0.5 ± 0.25		
	(in.)	(0.01 ± 0.006)	(0.014 ± 0.006)			(0.02 ± 0.01)			(0.02 ± 0.01)		
WVDC		50V	25V	50V	100V	25V	50V	100V	25V	50V	100V
271	Cap 270	A	A	A	A						
331	(pF) 330	A	A	A	A	B	B	B			
471	470	A	A	A	A	B	B	B			
681	680	A	A	A	A	B	B	B			
102	1000	A	A	A	A	B	B	B	B	B	
152	1500	A	A	A	A	B	B	B	B	B	
182	1800	A	A	A	A	B	B	B	B	B	
222	2200	A	A	A	A	B	B	B	B	B	
272	2700	A	A	A	A	B	B	B	B	B	
332	3300	A	A	A	A	B	B	B	B	B	
392	3900	A	A	A	A	B	B	B	B	B	
472	4700	A	A	A	A	B	B	B	B	B	
562	5600		A	A	A	B	B	B	B	B	
682	6800		A	A	A	B	B	B	B	B	
822	8200		A	A	A	B	B	B	B	B	
103	Cap 0.01		A	A	A	B	B	B	B	B	
123	(uF) 0.012		A	A		B	B	B	B	B	
153	0.015		A	A		B	B	A	B	B	
183	0.018		A	A		B	B	A	B	B	
223	0.022		A	A		B	B	A	B	B	
273	0.027		A	A		B	B		B	B	
333	0.033		A	A		B	B		B	B	
393	0.039		A	A		B	B		B	B	
473	0.047		A	A		B	B		B	B	
563	0.056		A			A	A		N	N	
683	0.068		A			A	A		N	N	
823	0.082					A	A		N	N	
104	0.1					A	A		N	N	
124	0.12					A	A		N	N	
154	0.15					A	A		N	N	
184	0.18					A			N	N	
224	0.22					A			N	N	
274	0.27								N	N	
334	0.33								N	N	
394	0.39								E	G	
474	0.47								E	G	
684	0.68								G	G	
824	0.82								G	G	
105	1								G	G	
WVDC		50V	25V	50V	100V	25V	50V	100V	25V	50V	100V
SIZE		0402	0603			0805			1206		

Case Size	0402(KAM05)	0603(KAM15)		0805(KAM21)		1206(KAM31)				1210(KAM32)	2220(KAM55)
Thickness Letter	A	A	B	B	A	B	N	E	G	L	C
Max Thickness	0.56	0.90	0.95	0.94	1.45	0.94	1.27	1.52	1.78	2.79	2.80
Carrier Tape	PAPER	PAPER	PAPER	PAPER	EMB	PAPER	EMB	EMB	EMB	EMB	EMB
Packaging Code 7"reel	H	T	T	T	U	T	U	U	U	U	V
Packaging Code 13"reel	N	M	M	M	L	M	L	L	L	L	S
	PAPER					EMBOSSED (EMB)					

X8L

SIZE		0603			0805			1206				1210				2220	
Soldering		Reflow/Wave			Reflow/Wave			Reflow/Wave				Reflow/Wave				Reflow Only	
(L) Length	mm	1.6 ± 0.15			2.01 ± 0.2			3.2 ± 0.2				3.2 ± 0.2				5.7 ± 0.5	
	(in.)	(0.063 ± 0.006)			(0.079 ± 0.008)			(0.126 ± 0.008)				(0.126 ± 0.008)				(0.224 ± 0.02)	
(W) Width	mm	0.81 ± 0.15			1.25 ± 0.2			1.6 ± 0.2				2.5 ± 0.2				5 ± 0.4	
	(in.)	(0.032 ± 0.006)			(0.049 ± 0.008)			(0.063 ± 0.008)				(0.098 ± 0.008)				(0.197 ± 0.016)	
(t) Terminal	mm	0.35 ± 0.15			0.5 ± 0.25			0.5 ± 0.25				0.5 ± 0.25				0.64 ± 0.39	
	(in.)	(0.014 ± 0.006)			(0.02 ± 0.01)			(0.02 ± 0.01)				(0.02 ± 0.01)				(0.025 ± 0.015)	
WVDC		25V	50V	100V	25V	50V	100V	16V	25V	50V	100V	10V	25V	50V	100V	200V	250V
271	Cap 270	A	A														
331	(pF) 330	A	A	A	B	B	B										
471	470	A	A	A	B	B	B										
681	680	A	A	A	B	B	B										
102	1000	A	A	A	B	B	B		B	B	B						
152	1500	A	A	A	B	B	B		B	B	B						
182	1800	A	A	A	B	B	B		B	B	B						
222	2200	A	A	A	B	B	B		B	B	B						
272	2700	A	A	A	B	B	B		B	B	B						
332	3300	A	A	A	B	B	B		B	B	B						
392	3900	A	A	A	B	B	B		B	B	B						
472	4700	A	A	A	B	B	B		B	B	B						
562	5600	A	A	A	B	B	B		B	B	B						
682	6800	A	A	A	B	B	B		B	B	B						
822	8200	A	A	A	B	B	B		B	B	B						
103	Cap 0.01	A	A	A	B	B	B		B	B	B						
123	(uF) 0.012	A	A		B	B	B		B	B	B						
153	0.015	A	A		B	B	B		B	B	B						
183	0.018	A	A		B	B	B		B	B	B						
223	0.022	A	A		B	B	B		B	B	B						
273	0.027	A	A		B	B	B		B	B	B						
333	0.033	A	A		B	B	A		B	B	B						
393	0.039	A	A		B	B	A		B	B	B						
473	0.047	A	A		B	B	A		B	B	B						
563	0.056	A	A		B	B	A		B	B	B						
683	0.068	A	A		B	B	A		B	B	B						
823	0.082	A	A		B	B	A		B	B	N						
104	0.1	A	A		B	B	A		B	B	N						
124	0.12				B	A			B	B	N						
154	0.15				B	A		B	B	B	N						
184	0.18				A	A		B	B	B	G						
224	0.22				A	A		B	B	B	G						
274	0.27				A	A		B	N	N							
334	0.33				A	A		B	N	E							
394	0.39				A	A		N	N	E							
474	0.47				A	A		N	N	E							
684	0.68				A	A		N	G	G							
824	0.82				A	A		N	G	G							
105	1				A	A		N	G	G							
155	1.5				A			G	G	G							
225	2.2				A			G	G	G				L	L	C	C
475	4.7							G	G					L			
106	10											L	L	L			
WVDC		25V	50V	100V	25V	50V	100V	16V	25V	50V	100V	10V	25V	50V	100V	200V	250V
SIZE		0603			0805			1206				1210				2220	

Automotive MLCC - X8G

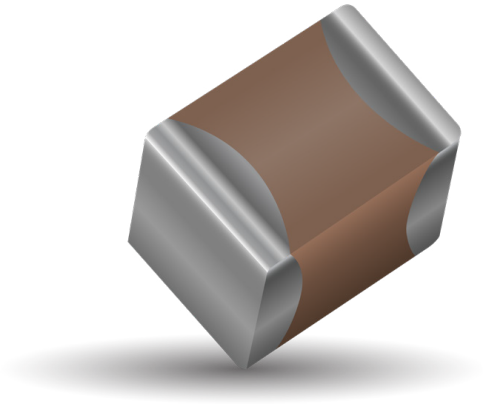
General Specifications

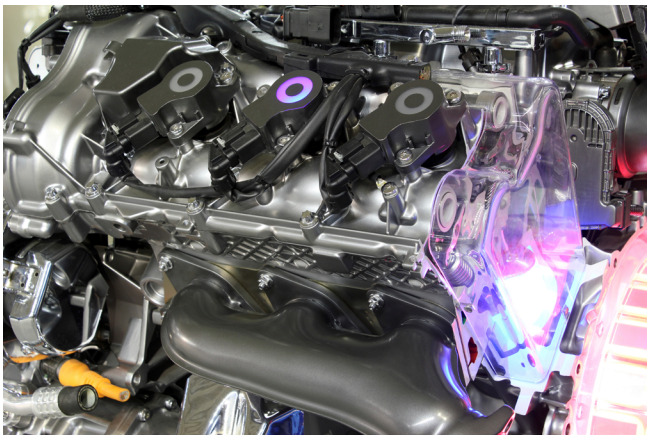
TYPICAL APPLICATIONS

- Extreme capacitance stability
- High temperature
- Battery Management Systems
- Powertrain Sensors & Actuators
- Engine management
- Transmission control
- Safety

ENGINEERING TOOLS

- Samples
- Technical Articles
- Application Engineering
- Application Support





Automotive X8G (-55°C to 150°C , ±30ppm/°C)

Capacitance Range

SIZE		0402		0603		0805			
Soldering		Reflow/Wave		Reflow/Wave		Reflow/Wave			
(L) Length	mm (in.)	1 ± 0.1 (0.04 ± 0.004)		1.6 ± 0.15 (0.063 ± 0.006)		2.01 ± 0.2 (0.079 ± 0.008)			
(W) Width	mm (in.)	0.5 ± 0.1 (0.02 ± 0.004)		0.81 ± 0.15 (0.032 ± 0.006)		1.25 ± 0.2 (0.049 ± 0.008)			
(t) Terminal	mm (in.)	0.25 ± 0.15 (0.01 ± 0.006)		0.35 ± 0.15 (0.014 ± 0.006)		0.5 ± 0.25 (0.02 ± 0.01)			
WVDC		25V	50V	25V	50V	50V	100V	200V	250V
0R5	0.5			A	A	B	B	B	B
1R0	1.0			A	A	B	B	B	B
1R2	1.2			A	A	B	B	B	B
1R5	1.5			A	A	B	B	B	B
1R8	1.8			A	A	B	B	B	B
2R2	2.2			A	A	B	B	B	B
2R7	2.7			A	A	B	B	B	B
3R3	3.3			A	A	B	B	B	B
3R9	3.9			A	A	B	B	B	B
4R7	4.7			A	A	B	B	B	B
5R0	5			A	A	B	B	B	B
5R6	5.6			A	A	B	B	B	B
6R8	6.8			A	A	B	B	B	B
8R2	8.2			A	A	B	B	B	B
100	10			A	A	B	B	B	B
120	12			A	A	B	B	B	B
150	15			A	A	B	B	B	B
180	18			A	A	B	B	B	B
220	22			A	A	B	B	B	B
270	27			A	A	B	B	B	B
330	33			A	A	B	B	B	B
390	39			A	A	B	B	B	B
470	47	A	A	A	A	B	B	B	B
510	51	A	A	A	A	B	B	B	B
560	56	A	A	A	A	B	B	B	B
680	68	A	A	A	A	B	B	B	J
820	82	A	A	A	A	B	B	B	J
101	100	A	A	A	A	B	B	B	J
121	120			A	A	B	B	B	J
151	150			A	A	B	B	B	J
181	180			A	A	B	B	B	J
221	220			A	A	B	B	B	J
271	270			A	A	B	B	B	J
331	330			A	A	B	B	B	J
391	390			A	A	B	B	B	J
471	470			A	A	B	B	B	J
561	560			A	A	B	B	J	J
681	680			A	A	B	B	J	J
821	820					B	B	J	J
102	1000					B	B	J	J
122	1200					B	B	J	J
152	1500					B	B	J	J
182	1800								
222	2200								
272	2700								
332	3300								
392	3900								
472	4700								
562	5600								
682	6800								
103	10nF								
WVDC		25V	50V	25V	50V	50V	100V	200V	250V
Size		0402		0603		0805			

Case Size	0402(KAM05)	0603(KAM15)	0805(KAM21)	
Letter	A	A	B	J
Max Thickness mm	0.56	0.90	0.94	1.27
Carrier Tape	Paper	Paper	Paper	Emb
Packaging Code 7"reel	H	T	T	U
Packaging Code 13"reel	N	M	M	L
	PAPER			EMBOSSED