

# 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.

The detailed AECQ200 qualification package is available upon request, containing 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

<b>KAM</b>	<b>31</b>	<b>G</b>	<b>R7</b>	<b>1H</b>	<b>475</b>	<b>K</b>	<b>U</b>
Series AEC-Q200 Tin Nickel Finish	Size 03 = 0201 05 = 0402 15 = 0603 21 = 0805 31 = 1206 32 = 1210 42 = 1808 43 = 1812 55 = 2220	Thickness See Cap Chart	Dielectric CG = COG R7 = X7R S7 = X7S T7 = X7T R8 = X8R L8 = X8L G8 = X8G	Voltage 0E = 2.5V 2E = 250V 0G = 4V 2H = 500V 0J = 6.3V 2J = 630V 1A = 10V 3A = 1000V 1C = 16V 3N = 1500V 1E = 25V 3D = 2000V 1H = 50V 3E = 2500V 2A = 100V 3U = 3000V 2D = 200V	Capacitance Code Code (in pF) 2 Significant Digits +Number of zeros eg 10uF = 106 10nF = 103 47pF = 470	Capacitance Tolerance B = ± 0.1pF (<10pF)* C = ± 0.25pF (<10pF)* D = ± 0.5pF (<10pF)* F = ± 1%* G = ± 2%* J = ± 5% K = ± 10% M = ± 20%	Packaging See Table Below

\*COG only

### 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

# Automotive MLCC, KAM Series

## General Specifications



### COMMERCIAL VS AUTOMOTIVE MLCC PROCESS COMPARISON

	Commercial	Automotive
<b>Administrative</b>	Standard Part Numbers. No restriction on who purchases these parts.	Specific Automotive Part Number. Used to control supply of product to Automotive customers.
<b>Lot Qualification (Destructive Physical Analysis - DPA)</b>	As per EIA RS469	Increased sample plan stricter criteria.
<b>Visual/Cosmetic Quality</b>	Standard process and inspection	100% inspection
<b>Application Robustness</b>	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 - COG

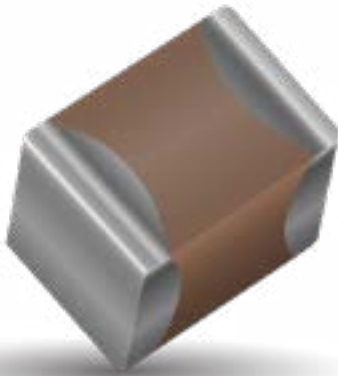
## General Specifications

### 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 - X7R / X7T

## General Specifications



### TYPICAL APPLICATIONS

#### X7R KAM

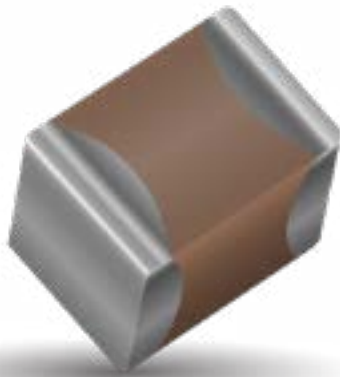
- High capacitance values
- Broadest voltage and cap offering
- Cameras
- Body control modules
- Infotainment
- ECU
- Climate control

#### X7T KAM

- Motor drive
- Door lock

### ENGINEERING TOOLS

- Samples
- Technical Articles
- Application Engineering
- Application Support





# Automotive MLCC - X7R, 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	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	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	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	2500	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	A	H	H	H	H							F	F	F	F	F	F	Z	Z	Z	Z	C
152	1500	D	A	A	A	A	H	H	H	H							F	F	F	F	F	F	Z	Z	Z	Z	C
182	1800	D	A	A	A	A	H	H	H	H							F	F	F	F	F	F	Z	Z	Z	Z	C
222	2200	D	A	A	A	A	H	H	H	H							F	F	F	F	F	F	Z	Z	Z	Z	C
272	2700	D	A	A	A	A	H	H	H	H							F	F	F	F	F	F	Z	Z	Z	Z	
332	3300	D	A	A	A	A	H	H	H	H							F	F	F	F	F	F	Z	Z	Z	Z	
392	3900	D	A	A	A	A	H	H	H	H							F	F	F	F	F	F	Z	Z	Z	Z	
472	4700	D	A	A	A	A	H	H	H	H							F	F	J	J	J	J	Z	Z	Z	Z	
562	5600	D	A	A	A	A	H	H	H	H							F	F	J	J	J	J	Z	Z	Z	Z	
682	6800	A	A	A	A	A	H	H	H	H							F	F	J	J	J	J	Z	Z	Z	Z	
822	8200	A	A	A	A	A	H	H	H	H							F	F	J	J	J	J	Z	Z	C	C	
103	Cap 0.01	A	A	A	A	A	H	H	H	H							F	F	J	J	J	J	C	C	C	C	
123	(µF) 0.012						H	H	H	H							F	F	J	J	J	J	C	C	C	C	
153	0.015						H	H	H	H							F	F	J	J	J	J	C	C	C	C	
183	0.018						H	H	H	H							F	F	J	J	J	J	C	C	C	C	
223	0.022						H	H	H	H							F	F	J	J	J	J	C	C	C	C	
273	0.027						H	H	H	H							F	F	J	J	J	J	C	C	C	C	
333	0.033																F	F	J	J	J	J	C	C	C	C	
393	0.039																F	F	J	J	J	J	C	C	C	C	
473	0.047																F	F	J	J	J	J	C	C	C	C	
563	0.056																						C	C	C	C	
683	0.068																						C	C	C	C	
823	0.082																						C	C	C	C	
104	0.1																						C	C	C	C	
124	0.12																						C	C	C	C	
154	0.15																						C	C	C	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						EMBOSSSED (EMB)						

# Automotive MLCC - X8R / X8L

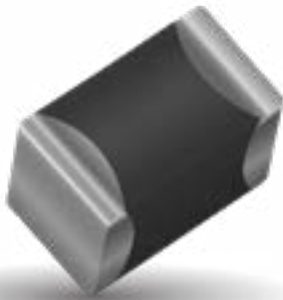
## General Specifications

### 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

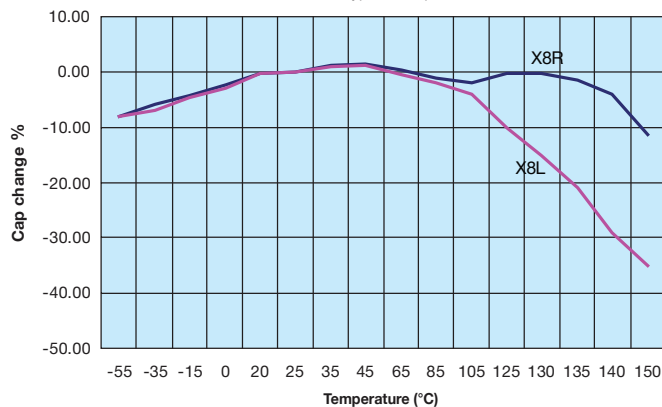


### ADVANTAGES OF X8R AND X8L MLC CAPACITORS

- 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 (0.04 ± 0.008)			1.6 ± 0.15 (0.063 ± 0.006)			2.01 ± 0.2 (0.079 ± 0.008)			3.2 ± 0.2 (0.126 ± 0.008)		
	(in.)												
(W) Width	mm	0.5 ± 0.2 (0.02 ± 0.008)			0.81 ± 0.15 (0.032 ± 0.006)			1.25 ± 0.2 (0.049 ± 0.008)			1.6 ± 0.2 (0.063 ± 0.008)		
	(in.)												
(t) Terminal	mm	0.25 ± 0.15 (0.01 ± 0.006)			0.35 ± 0.15 (0.014 ± 0.006)			0.5 ± 0.25 (0.02 ± 0.01)			0.5 ± 0.25 (0.02 ± 0.01)		
	(in.)												
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	A	B	B	B	B	B			
682	6800	A	A	A	A	B	B	B	B	B			
822	8200	A	A	A	A	B	B	B	B	B			
103	Cap 0.01	A	A	A	A	B	B	B	B	B			
123	(uF) 0.012	A	A	A	A	B	B	B	B	B			
153	0.015	A	A	A	A	B	B	A	B	B			
183	0.018	A	A	A	A	B	B	A	B	B			
223	0.022	A	A	A	A	B	B	A	B	B			
273	0.027	A	A	A	A	B	B		B	B			
333	0.033	A	A	A	A	B	B		B	B			
393	0.039	A	A	A	A	B	B		B	B			
473	0.047	A	A	A	A	B	B		B	B			
563	0.056	A	A			A	A		N	N			
683	0.068	A	A			A	A		N	N			
823	0.082	A	A			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	U	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 (0.063 ± 0.006)			2.01 ± 0.2 (0.079 ± 0.008)			3.2 ± 0.2 (0.126 ± 0.008)				3.2 ± 0.2 (0.126 ± 0.008)				5.7 ± 0.5 (0.224 ± 0.02)	
	(in.)																
(W) Width	mm	0.81 ± 0.15 (0.032 ± 0.006)			1.25 ± 0.2 (0.049 ± 0.008)			1.6 ± 0.2 (0.063 ± 0.008)				2.5 ± 0.2 (0.098 ± 0.008)				5 ± 0.4 (0.197 ± 0.016)	
	(in.)																
(t) Terminal	mm	0.35 ± 0.15 (0.014 ± 0.006)			0.5 ± 0.25 (0.02 ± 0.01)			0.5 ± 0.25 (0.02 ± 0.01)				0.5 ± 0.25 (0.02 ± 0.01)				0.64 ± 0.39 (0.025 ± 0.015)	
	(in.)																
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								
152	1500	A	A	A	B	B	B	B	B	B	B	B					
182	1800	A	A	A	B	B	B	B	B	B	B	B					
222	2200	A	A	A	B	B	B	B	B	B	B	B					
272	2700	A	A	A	B	B	B	B	B	B	B	B					
332	3300	A	A	A	B	B	B	B	B	B	B	B					
392	3900	A	A	A	B	B	B	B	B	B	B	B					
472	4700	A	A	A	B	B	B	B	B	B	B	B					
562	5600	A	A	A	B	B	B	B	B	B	B	B					
682	6800	A	A	A	B	B	B	B	B	B	B	B					
822	8200	A	A	A	B	B	B	B	B	B	B	B					
103	Cap 0.01	A	A	A	B	B	B	B	B	B	B	B					
123	(uF) 0.012	A	A	A	B	B	B	B	B	B	B	B					
153	0.015	A	A	A	B	B	B	B	B	B	B	B					
183	0.018	A	A	A	B	B	B	B	B	B	B	B					
223	0.022	A	A	A	B	B	B	B	B	B	B	B					
273	0.027	A	A	A	B	B	B	B	B	B	B	B					
333	0.033	A	A	A	B	B	A		B	B	B	B					
393	0.039	A	A	A	B	B	A		B	B	B	B					
473	0.047	A	A	A	B	B	A		B	B	B	B					
563	0.056	A	A		A	A			B	B	B	B					
683	0.068	A	A		A	A			B	B	B	B					
823	0.082	A	A		A	A			B	B	A						
104	0.1	A	A						B	B	A						
124	0.12								B	A							
154	0.15								B	A							
184	0.18								A	A							
224	0.22								A	A							
274	0.27								A	A							
334	0.33								A	A							
394	0.39								A	A							
474	0.47								A	A							
684	0.68								A	A							
824	0.82								A	A							
105	1								A	A							
155	1.5																
225	2.2																
475	4.7																
106	10																
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

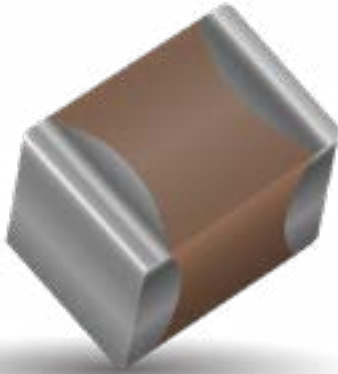
## General Specifications

### 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	Size	25V	50V	25V	50V	50V	100V	200V	250V
		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			EMBOSSSED