

# X7R Dielectric, KGM Series

## General Specifications



The X7R dielectric is the most popular of the intermediate EIA class II materials due to its relative temperature stability. While the capacitance change is non-linear, temperature variation is within  $\pm 15\%$  from  $-55^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$ .

Capacitance for X7R varies under the influence of electrical operating conditions such as voltage and frequency. X7R dielectric chip usage covers a broad spectrum of industrial applications where known changes in capacitance due to applied voltages are acceptable.

SpicAT is an additional online resource that KYOCERA AVX offers to help create engineering simulations. Please visit [spicat.kyocera-avx.com](http://spicat.kyocera-avx.com) for more information.

### HOW TO ORDER

#### KGM

**Series**  
General Purpose  
Tin/Nickel Finish

#### 03

**Size**  
02= 01005 32= 1210  
03= 0201 43= 1812  
05= 0402 44= 1825  
15= 0603 55= 2220  
21= 0805 56= 2225  
31= 1206

#### A

**Thickness**  
See Cap Chart

#### R7

**Dielectric**  
R7 = X7R

#### 1E

**Voltage**  
0G = 4.0V 1H = 50V  
0J = 6.3V 2A = 100V  
1A = 10V 2D = 200V  
1C = 16V 2E = 250V  
1E = 25V 2H = 500V

#### 101

**Capacitance Code**  
2 Significant Digits +  
Number of zeros  
eg. 106 =  $10\mu\text{F}$   
103 =  $10\text{nF}$

#### M

**Tolerance**  
J\* =  $\pm 5\%$   
K =  $\pm 10\%$   
M =  $\pm 20\%$   
  
\* $\leq 1\mu\text{F}$  only, contact  
factory for additional  
values

#### N

**Packaging**  
See Table Below



### PACKAGING CODES

Code	EIA (inch)	IEC(mm)	7" Paper	7" Embossed	13" Paper	13" Embossed
02	01005	0402	H			
03	0201	0603	H		N	
05	0402	1005	H		N	
15	0603	1608	T		M	
21	0805	2012	T	U	M	L
31	1206	3216	T	U	M	L
32	1210	3225		U		L
43	1812	4532		V		S
44	1825	4564		V		S
55	2220	5750		V		S
56	2225	5763		V		S

\*Note: The thickness determines if packaging is paper or embossed.



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## Specifications and Test Methods



Parameter/Test		X7R Specification Limits	Measuring Conditions (Complies with JIS C5101 / IEC60384)
Operating Temperature Range		-55°C to +125°C	Temperature Cycle Chamber
Capacitance		Within specified tolerance	Measure after heat treatment Capacitance Frequency Volt C≤10μF Frequency : 1kHz±10% Volt : 1.0±0.2Vrms *0.5±0.2Vrms
Dissipation Factor / Tanδ		Refer to <a href="https://spicat.kyocera-avx.com">https://spicat.kyocera-avx.com</a> for individual part number specification	C>10μF Frequency : 120Hz±10% Volt : 0.5±0.2Vrms The charge and discharge current of the capacitor must not exceed 50mA.
Insulation Resistance		Refer to <a href="https://spicat.kyocera-avx.com">https://spicat.kyocera-avx.com</a> for individual part number specification	Apply the rated voltage for 1 minute, and measure it in normal temperature and humidity. The charge and discharge current of the capacitor must not exceed 50mA.
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.
Bending Strength		No significant damage with 1mm bending	Glass epoxy PCB: Fulcrum spacing: 90mm, duration time 10 seconds.
Solderability		Solder coverage : 95% min.	Soaking condition Sn-3Ag-0.5Cu 245±5°C 3±0.5 sec.
Resistance to Solder Heat	Appearance	No problem observed	Take the initial value after heat treatment. Soak the sample in 260°C±5°C solder for 10±0.5 seconds and place in normal temperature and humidity, and measure after heat treatment. (Pre-heating conditions) Order      Temperature      Time 1            80 to 100°C            2 minutes 2            150 to 200°C            2 minutes The charge and discharge current of the capacitor must not exceed 50mA for IR and withstanding voltage measurement.
	Capacitance Variation	≤ ±7.5%	
	Dissipation Factor / Tanδ	Within specification	
	Insulation Resistance	Within specification	
Withstanding Voltage / Dielectric Strength		Resist without problem	
Thermal Shock	Appearance	No visual defects	Take the initial value after heat treatment. (Cycle) Room temperature (3 min.)→ Lowest operation temperature (30 min.)→ Room temperature (3 min.)→ Highest operation temperature(30 min.) After 5 cycles, measure after heat treatment. The charge and discharge current of the capacitor must not exceed 50mA for IR and withstanding voltage measurement.
	Capacitance Variation	≤ ±7.5%	
	Dissipation Factor	Within specification	
	Insulation Resistance	Within specification	
Withstanding Voltage / Dielectric Strength		Resist without problem	
Load Life	Appearance	No visual defects	Take the initial value after heat treatment. After applying *1.5 the rated voltage at the highest operation temperature for 1000+12/ -0 hours, and measure the sample after heat treatment in normal temperature and humidity. The charge and discharge current of the capacitor must not exceed 50mA for IR measurement. *Apply 1.0 times when the rated voltage is 4V or less. Applied voltages for respective products are indicated in the chart below.
	Capacitance Variation	≤ ±12.5%	
	Dissipation Factor / Tanδ	≤ Initial Value x 2.0 (See Above)	
	Insulation Resistance	Over 1000MΩ or 50MΩ · μF, whichever is less. *Exceptions Listed Below	
Load Humidity	Appearance	No visual defects	Take the initial value after heat treatment. After applying rated voltage for 500+12/ -0 hours in the condition of 40°C ± 2°C and 90 to 95%RH, and place in normal temperature and humidity, then measure the sample after heat treatment. The charge and discharge current of the capacitor must not exceed 50mA for IR measurement.
	Capacitance Variation	≤ ±12.5%	
	Dissipation Factor / Tanδ	Within specification	
	Insulation Resistance	Over 1000MΩ or 50MΩ · μF, whichever is less. *Exceptions Listed Below	
Appearance		No problem observed	Microscope
Termination Strength		No problem observed	Apply a sideward force of 500g (5N) to a PCB-mounted sample. note : 2N for 0201 size, and 1N for 01005 size.
Vibration	Appearance	No problem observed	Take the initial value after heat treatment. Vibration frequency: 10 to 55 (Hz) Amplitude: 1.5mm Sweeping condition: 10 → 55 → 10Hz/ 1 minute in X, Y and Z directions: 2 hours each, 6 hours in total, and place in normal temperature and humidity, then measure the sample after heat treatment.
	Capacitance	Within tolerance	
	Tanδ	Within tolerance	
Heat Treatment		Expose sample in the temperature of 150+0/ -10°C for 1 hour and leave the sample in normal temperature and humidity for 24±2 hours.	

Voltage to be applied in the High Temperature Load (Applied voltage is the multiple of the rated voltage)

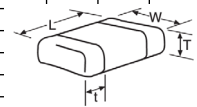


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## Capacitance Range



SIZE	1210								1812					1825				2220					2225							
Soldering	Reflow Only								Reflow Only					Reflow Only				Reflow Only					Reflow Only							
Packaging	Paper/Embossed								All Embossed					All Embossed				All Embossed					All Embossed							
(L) Length mm (in.)	3.30±0.4 (0.130±0.016)								4.50±0.40 (0.177±0.016)					4.50±0.40 (0.177±0.016)				5.70±0.50 (0.224±0.020)					5.70±0.40 (0.224±0.016)							
(W) Width mm (in.)	2.50±0.30 (0.098±0.012)								3.20±0.40 (0.126±0.016)					6.40±0.40 (0.252±0.016)				5.00±0.40 (0.197±0.016)					6.30±0.40 (0.248±0.016)							
(t) Terminal mm (in.)	0.50±0.25 (0.020±0.010)								0.61±0.36 (0.024±0.014)					0.61±0.36 (0.024±0.014)				0.64±0.39 (0.025±0.015)					0.64±0.39 (0.025±0.015)							
WVDC	10	16	25	50	100	200	500	16	25	50	100	200	500	50	100	200	500	25	50	100	200	500	50	100	200	500				
Cap 100 (pF)	101																													
220	221	R	R	R	R	R	R	D																						
330	331	R	R	R	R	R	R	D	A	A	A	A	A	A																
470	471	R	R	R	R	R	R	D	A	A	A	A	A	A																
680	681	R	R	R	R	R	R	D	A	A	A	A	A	A																
1000	102	R	R	R	R	R	R	D	A	A	A	A	A	B	C	C	C	C	Z	Z	Z	Z	Z	Z	Z	D	D	D	D	
1500	152	R	R	R	R	R	R	D	A	A	A	A	A	B	C	C	C	C	Z	Z	Z	Z	Z	Z	Z	D	D	D	D	
2200	222	R	R	R	R	R	R	D	A	A	A	A	A	B	C	C	C	C	Z	Z	Z	Z	Z	Z	Z	D	D	D	D	
3300	332	R	R	R	R	R	R	E	A	A	A	A	A	B	C	C	C	C	Z	Z	Z	Z	Z	Z	Z	D	D	D	D	
3900	392	R	R	R	R	R	R	E	A	A	A	A	A	B	C	C	C	C	Z	Z	Z	Z	Z	Z	Z	D	D	D	D	
4700	472	R	R	R	R	R	R	E	A	A	A	A	A	B	C	C	C	C	Z	Z	Z	Z	Z	Z	Z	D	D	D	D	
5600	562	R	R	R	R	R	R	E	A	A	A	A	A	B	C	C	C	C	Z	Z	Z	Z	Z	Z	Z	D	D	D	D	
6800	682	R	R	R	R	R	R	E	A	A	A	A	A	B	C	C	C	C	Z	Z	Z	Z	Z	Z	Z	D	D	D	D	
Cap 0.010 (µF)	103	R	R	R	R	R	R	E	A	A	A	A	A	B	C	C	C	C	Z	Z	Z	Z	Z	Z	Z	D	D	D	D	
0.015	123	R	R	R	R	R	R	E	A	A	A	A	A	B	C	C	C	C	Z	Z	Z	Z	Z	Z	Z	D	D	D	D	
0.018	183	R	R	R	R	R	R	E	A	A	A	A	A	B	C	C	C	C	Z	Z	Z	Z	Z	Z	Z	D	D	D	D	
0.022	223	R	R	R	R	R	R	E	A	A	A	A	A	B	C	C	C	C	Z	Z	Z	Z	Z	Z	Z	D	D	D	D	
0.027	273	R	R	R	R	R	R	E	H	A	A	A	A	B	C	C	C	C	Z	Z	Z	Z	Z	Z	Z	D	D	D	D	
0.033	333	R	R	R	R	R	R	E	H	A	A	A	A	B	C	C	C	C	Z	Z	Z	Z	Z	Z	Z	D	D	D	D	
0.039	393	R	R	R	R	R	R	E	H	A	A	A	A	B	C	C	C	C	Z	Z	Z	Z	Z	Z	Z	D	D	D	D	
0.047	473	R	R	R	R	R	R	E	H	A	A	A	A	B	C	C	C	C	Z	Z	Z	Z	Z	Z	Z	D	D	D	D	
0.068	683	R	R	R	R	R	R	H	P	A	A	A	A	B	F	C	C	C	C	Z	Z	Z	Z	Z	Z	Z	D	D	D	D
0.082	823	R	R	R	R	R	R	H	P	A	A	A	A	B	F	C	C	C	C	Z	Z	Z	Z	Z	Z	Z	D	D	D	D
0.100	104	R	R	R	R	R	R	H	P	A	A	A	B	F	C	C	C	C	Z	Z	Z	Z	Z	Z	Z	D	D	D	D	
0.120	124	R	R	R	R	R	R	H		A	A	A	B	B	J	C	C	C	C	Z	Z	Z	Z	Z	Z	Z	D	D	D	D
0.150	154	E	E	E	E	E	E	L		A	A	A	B	F	J	C	C	C	C	Z	Z	Z	Z	Z	Z	Z	D	D	D	D
0.220	224	E	E	E	E	E	E	L		A	A	A	B	F	J	C	C	C	C	Z	Z	Z	Z	Z	Z	Z	D	D	D	D
0.330	334	E	E	E	E	E	H	L		A	A	A	B	F	J	C	C	C	C	Z	Z	Z	Z	Z	Z	Z	D	D	D	D
0.470	474	E	E	E	E	E	H	L		A	A	A	F	F	J	C	C	C	C	Z	Z	Z	Z	Z	Z	Z	D	D	D	D
0.680	684	E	E	E	E	K	L	L		F	F	F	F	J		C	C	C		Z	Z	Z	Z	C	D	D	D	D	G	
1.000	105	E	E	E	E	G	L			F	F	F	F	J		C	C	C		Z	Z	Z	Z	C	D	D	D	D		
2.200	225	L	L	L	L	L				F	F	F	J			C	C	F		Z	Z	Z	C		D	D	G			
4.700	475	L	L	L	L	L				J	J	J	J			C	F			Z	C	C			D	G				
10	106	L	L	L	L	A				J	J	J				F	F			C	C	D			G	G				
22	226	L	A	L																D	D	H								
47	476	L																												
100	107																													
WVDC		10	16	25	50	100	200	500	16	25	50	100	200	500	50	100	200	500	25	50	100	200	500	50	100	200	500			
SIZE		1210								1812					1825				2220					2225						



\*Dimension exception for KGM32AR71H106:  
 (L) 3.2 ± 0.3 mm  
 (W) 2.5 ± 0.2mm

Case Size	1210 (KGM 32)								1812 (KGM 43)				1825 (KGM 44)				2220 (KGM 55)				2225 (KGM56)	
Thickness Letter	R	D	E	G	H	P	A	L	A	B	F	J	C	F	Z	C	D	H	D	G		
Max Thickness (mm)	1.05	1.4	1.45	1.78	1.8	2.2	2.70	2.80	1.4	1.45	2.21	2.80	2.21	2.80	2.21	2.80	3.3	3.4	2.21	2.80		
Carrier Tape	EMB	EMB	EMB	EMB	EMB	EMB	EMB	EMB	EMB	EMB	EMB	EMB	EMB	EMB	EMB	EMB	EMB	EMB	EMB	EMB		
Packaging Code 7"reel	U	U	U	U	U	U	U	U	V	V	V	V	V	V	V	V	V	V	V	V		
Packaging Code 13"reel	L	L	L	L	L	L	L	L	S	S	S	S	S	S	S	S	S	S	S	S		

EMBOSS (EMB)