FrelTec GmbH

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Multilayer Ceramic Capacitors MLCC

SMD

Capacitor SMD MLCC

SPECIFICATION

Part Number

072	05*	N*	101*	J*	500*	T10*	D*
Type	Size	Series	Capacitance in pF	Tolerance	Rated Voltage [V DC]	Packing	Thickness of chip code**
072: Multilayer Ceramic Capacitor	0A: 01005	G: C0G (NP0)	_ _ _ First two digits indicate the signify-cant digits _ _ _ The last digit is the multiplier which denotes the number of zero following If the capacitance is less than10pF, "P" is designated for a decimal point.	A : ±0,05pF	040:4V	T20: Reel 20kpcs (7" reel), paper tape Size: 01005	H: 0,20±0,02mm
	01: 0201	H: C0G HQ Higher Q and lower ESR		B : ±0,10pF	063:6,3V		6: 0,20±0,03mm
	02: 0402			C : ±0,25pF	100:10V	T15: Reel 15kpcs (7" reel), paper tape Size: 0201, 0402 (≤0,30 thickness)	A: 0,30±0,03mm
	03: 0603	F: C0G Micro-wave		D : ±0,5pF	160:16V		S: 0,30±0,05mm
	05: 0805			F : ±1%	250:25V		5: 0,30±0,09mm
	06: 1206	X: X7R		G : ±2%	350:35V	T10: Reel 10kpcs, paper tape (7" reel) Size: 0201, 0402 (>0,30 thickness)	B: 0,50±0,05mm
	08: 1808	R: X5R		J : ±5%	500:50V		R: 0,50±0,10mm
	10: 1210	S: X6S		K : ±10%	101:100V	T04: Reel 4kpcs, paper tape (7" reel) Size: 0603, 0805, 1206 (all ≤0,85 thickness)	U: 0,50±0,15mm
	12: 1812	V: X7S		M: ±20%	201:200V		T: 0,50±0,20mm
		O: X6T			631: 630V		
		T: X7T			102 : 1000V	E40: Reel 40kpcs, embossed tape (7" reel) Size: 01005	9: 0,50±0,20mm
		U: X7U			202 : 2000V	E04: Reel 4kpcs, embossed tape (7" reel) Size: 0603 (only very special item)	Q: 0,45±0,05mm
		Q: X8R			302 : 3000V	E03: Reel 3kpcs, embossed tape (7" reel) Size: 0805, 1206, 1210, 1808 (>0,85 but ≤1,25 thickness	J: 0,60±0,10mm
					402 : 4000V		C: 0,60±0,15mm
							D: 0,80±0,10mm
						E02: Reel 2kpcs, embossed tape (7" reel) Size: 0805(≥1,25 thickness), 1206, 1210 (all >1,25 but ≤2,00 thickness), 1808 (≥1,25 but ≤1,60 thickness	K: 0,80±0,15mm
							V: 0,80±0,20mm
						E01: Reel 1kpcs, embossed tape (7" reel)	1: 0,80±0,30m

												Size: 1210,1808 (all >1,60 thickness), 1812 (≤2,00 thickness		2: 0,85±0,10mm
														E: 0,85±0,15mm
												E0A: Reel 500pcs, embossed tape (7" reel) Size: 1210, 1812 (>2,00 thickness)		3: 0,85±0,20mm
														O: 0,95±0,10mm
												EY7: Reel 700pcs, embossed tape (7" reel) Size: 1812 (>2,00 thickness, ≥2,2µF, 100V)		I: 0,95±0,15mm
														F: 1,15±0,20mm
												I50**: Paper tape and reel for 50k pc (13" reel) Size: 0201, 0402 (≤0,50 thickness)		M: 1,25±0,10mm
														4: 1,25±0,15mm
												I15**: Paper tape and reel for 15k pc (13" reel) Size: 0603, 0805, 1206 (all ≤0,85 thickness)		G: 1,25±0,20mm
														W: 1,25±0,30
												L10**: Embossed tape and reel for 10k pcs (13"reel), 0805 (≥1,25 thickness), 1206 (≥1,15 thickness), 1210 (≥0,85 thickness)		L: 1,60±0,20mm
														X: 1,60±0,30mm
												* not all combination is possible		N: 2,00±0,20mm
												** check availability with sales for 13" reels		Y: 2,00±0,30mm
														Z: 2,50±0,20mm
														P: 2,50±0,30mm
														8: 2,50±0,50mm

All products according to RoHS (2015/863/EU)

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Capacitor SMD MLCC

Standard MLCC

Rated Voltage, Rated Capacitance and available Tolerances

Size Code	Rate Voltage /U_R	Rate Capacitance											
		C0G (NP0)				X7R				X5R			
		Capacitance	Tolerance	Chip Thickness	DF (max)	Capacitance	Tolerance	Chip Thickness	DF (max)	Capacitance	Tolerance	Chip Thickness	DF (max)
0201	50V	0,2pF~0,4pF	A, B, C	A	0,25%	100pF	J, K	A	3,0%	330pF	K	A	5,0%
		0,5pF~1pF	A, B, C	A	0,24%								
		1,1pF, 1,2pF	B, C	A	0,24%	120pF	K	A	3,0%				
		1,3pF~2,2pF	B, C	A	0,23%								
		2,4pF~3,0pF	B, C	A	0,22%	150pF	J, K	A	3,0%				
		3,3pF~4,3pF	B, C	A	0,21%	180pF	K	A	3,0%				
		4,7pF	B, C	A	0,20%								
		5,0pF~5,6pF	B, C, D	A	0,20%	220pF	J, K	A	3,0%	1nF	K, M	A	5,0%
		6,0pF~7,0pF	B, C, D	A	0,19%								
		7,5pF~8,2pF	B, C, D	A	0,18%								
		9pF, 9,1pF	B, C, D	A	0,17%								
		10pF	F, G, J	A	0,17%	270pF~560pF	K	A	3,0%				
		12pF	F, G, J	A	0,16%								
		15pF	F, G, J	A	0,14%								
		18pF, 20pF	F, G, J	A	0,13%	680pF	J, K	A	3,0%	$10nF^{+1}$	K	A	5,0%
		22pF	F, G, J	A	0,12%								
		24pF	J	A	0,11%								
		27pF	F, G, J	A	0,11%	820pF~2,2nF	K	A	3,0%				
		30pF, 33pF	F, G, J	A	0,10%								
		36pF	G, J	A	0,10%					$100nF^{+1}$	K	A	10,0%
		39pF	F, G, J	A	0,10%								
		43pF	G, J	A	0,10%								
		47pF	F, G, J	A	0,10%								
		51pF	G, J	A	0,10%								
		56pF	F, G, J	A	0,10%								
		62pF	G, J	A	0,10%	3,3nF, 4,7nF, 6,8nF^{+1}, 10nF^{+1}	K	A	5,0%				
		68pF	F, G, J	A	0,10%								
		75pF	G, J	A	0,10%								
		82pF, 100pF	F, G, J	A	0,10%								
		120pF	G, J	A	0,10%								
		150pF, 180pF	F, G, J	A	0,10%								
		200pF	J	A	0,10%								
		220pF	G, J	A	0,10%								
		270pF~470pF	J	A	0,10%								
	35V									$100nF^{+}$	K	A	10,0%
	25V	0,2pF~0,4pF	A, B, C	A	0,25%	100pF~180pF	K	A	3,5%	100pF~220pF	K	A	5,0%
		0,5pF~0,9pF	A, B, C	A	0,24%					1nF	K, M	A	5,0%
		1,0pF	A, B, C, D	A	0,24%								
		1,1pF, 1,2pF	B, C, D	A	0,24%	220pF	J, K	A	3,5%	2,2nF, 4,7nF, 6,8nF	K	A	5,0%
		1,3pF~2,2pF	B, C	A	0,23%								
		2,4pF~3,0pF	B, C	A	0,22%	270pF~390pF	K	A	3,5%	$10nF^{+1}$	K, M	A	5,0%
		3,3pF~4,3pF	B, C	A	0,21%	470pF	J, K	A	3,5%	$15nF^{+}$, $18nF^{+}$, $22nF^{+}$, $27nF^{+}$, $33nF^{+}$, $39nF^{+}$, $47nF^{+}$, $56nF^{+}$,	K, M	A	10,0%
		4,7pF	B, C	A	0,20%								
		5,0pF~5,6pF	B, C, D	A	0,20%	560pF, 680nF	K	A	3,5%				
		6,0pF~7,0pF	B, C, D	A	0,19%								
		7,5pF~8,2pF	B, C, D	A	0,18%	820pF, 1,0nF	J, K	A	3,5%				

Size Code	Rate Voltage /U_R	Rate Capacitance											
		C0G (NP0)				X7R				X5R			
		Capacitance	Tolerance	Chip Thickness	DF (max)	Capacitance	Tolerance	Chip Thickness	DF (max)	Capacitance	Tolerance	Chip Thickness	DF (max)
		9,0pF, 9,1pF	B, C, D	A	0,17%					68nF+, 82nF+, 100nF+			
		10pF	F, G, J	A	0,17%								
		12pF	F, G, J	A	0,16%					220nF+1	K, M	S	10,0%
		15pF, 16pF	F, G, J	A	0,14%	1,5nF~2,2nF	K	A	3,5%	330nF+1B, 470nF+1B	K, M	5	10,0%
		18pF, 20pF	F, G, J	A	0,13%								
		22pF	F, G, J	A	0,12%					***X6S***			
		24pF, 27pF	F, G, J	A	0,11%					10nF	K	A	5,0%
		30pF, 33pF, 39pF	F, G, J	A	0,10%					100nF+1	K, M	A	10,0%
		43pF	J	A	0,10%								
		47pF	F, G, J	A	0,10%	3,3nF, 4,7nF, 6,8nF	K	A	5,0%				
		51pF	J	A	0,10%								
		56pF	F, G, J	A	0,10%								
		62pF	J	A	0,10%								
		68pF	F, G, J	A	0,10%								
		75pF	J	A	0,10%								
		82pF, 100pF	F, G, J	A	0,10%								
		120pF~300pF	J	A	0,10%								
		330pF	F, G, J	A	0,10%	10nF	J, K	A	5,0%				
		360pF~430pF	J	A	0,10%								
		470pF	F, G, J	A	0,10%								
		510pF~1,0nF	J	A	0,10%								
	16V	2,7pF	B, C	A	0,22%	100pF~180pF	K	A	3,5%	1,0nF	K, M	A	5,0%
						200pF	J, K	A	3,5%	2,2nF, 3,3nF+, 4,7nF+	K	A	5,0%
						220pF, 270pF	K	A	3,5%	10nF+	K, M	A	5,0%
						330pF	J, K	A	3,5%	15nF+, 22nF+, 27nF+, 33nF+, 47nF+	K, M	A	10,0%
						470pF, 560pF	K	A	3,5%				
						680pF~1,0nF, 1,5nF	J, K	A	3,5%				
						1,8nF, 2,2nF	K	A	3,5%	68nF+A	K, M	S	10,0%
						2,7nF	J, K	A	5,0%	100nF+	K, M	A	10,0%
						3,3nF~8,2nF	K	A	5,0%	220nF+A	K, M	S	10,0%
						10nF	J, K	A	5,0%	330nF+B, 470nF+B	K, M	5	10,0%
						15nF, 22nF, 33nF, 47nF	K	A	5,0%				
		33pF	F, G, J	A	0,10%	100nF+1A	K, M	S	10,0%	1µF+12B	M	5	12,5%
						X7S				***X6S***			
		200pF, 220pF	J	A	0,10%	100nF+1A	K, M	S	10,0%	10nF	K	A	5,0%
										100nF+1A	K, M	S	10,0%
	10V	33pF	F, G, J	A	0,10%	220pF	J, K	A	5,0%	2,2nF, 3,3nF~ 10nF	K, M	A	7,5%
						1,0nF, 1,5nF~2,2nF	K	A	5,0%	15nF+, 22nF+~ 56nF+	K, M	A	10%
						2,7nF	J, K	A	5,0%	68nF+A	K, M	S	10%
						3,3nF~8,2nF	K	A	5,0%	82nF+, 100nF+	K, M	A	10%
						10nF	J, K	A	5,0%	220nF+1A	K, M	S	10%
						47nF	K	A	5,0%	330nF+1B, 470nF+1B	K, M	5	12,5%
						100nF	K, M	S	10,0%	1,0µF+1B	K, M	5	12,5%
										2,2µF+1B	K, M	5	15,0%
						X7S				***X6S***			
						100nF+A	K	S	10,0%	47nF	K, M	A	5,0%
										100nF+A	K	S	10,0%

Size Code	Rate /oltage /U_R	Rate Capacitance											
		C0G (NP0)				X7R				X5R			
		Capacitance	Tolerance	Chip Thickness	DF (max)	Capacitance	Tolerance	Chip Thick-ness	DF (max)	Capacitance	Tolerance	Chip Thick-ness	DF (max)
						220nF^{+1A}	K	S	12,5%	220nF^{+1}	K, M	A	10,0%
										1µF^{+1B}	M	5	10,0%
	6,3V					2,2nF, 3,3nF, 10nF	K	A	5,0%	100pF	K	A	5,0%
										2,2nF~ 10nF, 15nF^{+}, 22nF^{+}, 27nF^{+}, 33nF^{+}, 47nF^{+}~ 82nF^{+} 100nF^{+}, 220nF^{+1A}, 330nF^{+1A}	K, M	A	10,0%
						15nF^{+A}, 33nF^{+A}, 100nF^{+A}	K	S	10,0%	470nF^{+1B}	K, M	5	12,5%
										1µF^{+1A}	K, M	S	12,5%
						220nF^{+1A}	K	S	12,5%	2,2µF^{+12B}	M	5	20,0%
										4,7µF^{+12B}	M	S	20,0%
						X7S				***X6S***			
						100nF^{+A}	K	S	10,0%	10nF	K, M	A	5,0%
										15nF^{+A}, 22nF^{+A}	K	S	10,0%
										33nF^{+A}, 47nF^{+A}, 100nF^{+1A}	K, M	S	10,0%
						220nF^{+1A}	K	S	12,5%	220nF^{+12}	K, M	A	10,0%
										470nF^{+1B}, 1µF^{+12B}	M	5	10,0%
										2,2µF^{+12B}	M	B	15,0%
	4V									47nF^{+}	K, M	A	10,0%
										470nF^{+1B}	K, M	5	12,5%
										1,0µF^{+12A}	K, M	S	10,0%
										2,2µF^{+12B}	M	5	20,0%
										4,7µF^{+12B}	M	S	20,0%
										X6S			
										100nF^{+A}	K, M	S	10,0%
										220nF^{+2}	K, M	A	10,0%
										470nF^{+1A}	M	S	10,0%
										1µF^{+12B}, 2,2µF^{+12B}	M	5	10,0%
	2,5V									4,7µF^{+12B}	M	S	20,0%
										X6S			
										2,2µF^{+12B}, 4,72µF^{+12B}	M	5	10,0%
0402	50V	0,2pF~0,4pF	A, B, C	B	0,25%	100pF	J, K	B	3,0%	1nF, 6,8nF, 10nF, 18nF, 22nF, 33nF, 47nF	J, K, M	B	5,0%
		0,5pF~1,2pF	A, B, C	B	0,24%	120pF~180pF, 200pF, 220pF	K	B	3,0%				
		1,3pF, 1,5pF	A, B, C	B	0,23%								
		1,6pF, 1,7pF	B, C	B	0,23%	270pF	J, K	B	3,0%				
		1,8pF~2,2pF	A, B, C	B	0,23%	300pF	K	B	3,0%				
		2,4pF~3pF	A, B, C	B	0,22%	330pF, 390pF, 470pF	J, K	B	3,0%				
		3,3pF	A, B, C, D	B	0,21%	560pF	K	B	3,0%				
						680pF	J, K	B	3,0%				
		3,5pF~4,3pF	A, B, C	B	0,21%	750pF, 820pF	K	B	3,0%				
		4,5pF, 4,7pF	A, B, C	B	0,20%	1,0nF	J, K, M	B	3,0%	100nF^{+}	J, K, M	B	10,0%
		5,0pF	A, B, C, D	B	0,20%	1,2nF	J, K	B	3,0%				
						1,5nF	K	B	3,0%				
		5,1pF, 5,6pF	B, C, D	B	0,20%	1,8nF~6,8nF	J, K	B	3,0%	220nF^{+A}	K	R	10,0%
		6,0pF~7,0pF	B, C, D	B	0,19%								
		7,5pF~8,2pF	B, C, D	B	0,18%								
		9,0pF, 9,1pF	B, C, D	B	0,17%								

Size Code	Rate Voltage /U_R	Rate Capacitance											
		C0G (NP0)				X7R				X5R			
		Capacitance	Tolerance	Chip Thickness	DF (max)	Capacitance	Tolerance	Chip Thickness	DF (max)	Capacitance	Tolerance	Chip Thickness	DF (max)
		10pF	F, G, J	B	0,17%	8,2nF	K	B	3,0%	330nF^{+1A}, 470nF^{+1A}	K, M	R	10,0%
		11pF, 12pF	F, G, J	B	0,16%								
		13pF	G, J	B	0,15%								
		15pF, 16pF	F, G, J	B	0,14%								
		18pF	F, G, J, K	B	0,13%								
		20pF	F, G, J	B	0,13%	10nF	J, K, M	B	3,0%				
		22pF	F, G, J, K	B	0,12%								
		24pF, 27pF	F, G, J	B	0,11%	12nF, 15nF, 18nF	K	B	3,0%	1µF^{+1C}	K, M	T	10,0%
		30pF	F, G, J	B	0,10%	22nF	J, K	B	3,0%				
		33pF	F, G, J, K	B	0,10%	33nF	K	B	3,5%				
		36pF~43pF	F, G, J	B	0,10%								
		47pF	F, G, J, K	B	0,10%	39nF^{+}, 47nF^{+}	K	B	10,0%				
		51pF~91pF	F, G, J	B	0,10%								
		100pF, 120pF	F, G, J, K	B	0,10%	68nF^{+}	J, K	B	10,0%				
		130pF	J	B	0,10%								
		150pF~270pF	F, G, J	B	0,10%								
		300pF, 330pF	G, J	B	0,10%	100nF^{+A}	K, M	R	10,0%	***X6S***			
		390pF~680pF	F, G, J	B	0,10%								
		750pF~910pF	G, J	B	0,10%								
		1,0nF	F, G, J	B	0,10%								
		1,5nF	J	B	0,10%					220pF	K	B	3,0%
	35V					47nF^{+}	K	B	10,0%	100nF^{+},	K, M	B	10,0%
										1µF^{+1A},	K, M	R	10,0%
										2,2µF^{+1C}	K, M	T	10,0%
	25V	0,2pF,0,3pF	A, B, C	B	0,25%	100pF~820pF	K	B	3,0%	10nF	K	B	5,0%
		0,5pF	A, B, C	B	0,24%	1nF	J, K	B	3,0%	22nF	K, M	B	5,0%
		1,6pF	B	B	0,23%	1,2nF~2,7nF	K	B	3,0%	33nF, 47nF, 68nF	K	B	5,0%
		5,6pF	C, B	B	0,20%					100nF	K, M	B	5,0%
		6,8pF	B, C, D	B	0,19%	3,3nF	J, K	B	3,0%	220nF^{+}	K, M	B	10,0%
		8,0pF	C, D	B	0,18%	3,9nF	K	B	3,0%	330nF^{+}, 390nF^{+}	K, M	B	12,5%
		10pF	J	B	0,17%	4,7nF	J, K	B	3,0%	470nF^{+C}	K, M	T	12,5%
		12pF	F, G, J	B	0,16%	5,6nF~8,2nF	K	B	3,0%	560nF^{+1A}, 680nF^{+1A}, 1µF^{+1A}	K, M	R	12,5%
		16pF	J	B	0,14%	10nF~15nF	J, K	B	3,0%	2,2µF^{+1C}	K, M	T	12,5%
						18nF	K	B	3,0%	4,7µF^{+1C}	M	T	12,5%
		18pF	K	B	0,13%	22nF	J, K	B	3,0%	***X6S***			
		22pF	J	B	0,12%					33nF	K	B	3,5%
		24pF, 27pF	J	B	0,11%					100nF^{+}	K	B	10,0%
		33pF	K, J	B	0,10%	27nF	K, M	B	3,5%	220nF^{+A}	K	R	10,0%
		47pF, 56pF, 100pF, 200pF	J	B	0,10%	33nF, 39nF	K	B	3,5%	1µF^{+12A}	K, M	R	10,0%
		220pF	K, J	B	0,10%	47nF	J, K	B	3,5%	2,2µF^{+1C}	K, M	T	10,0%
		270pF	J	B	0,10%	56nF, 68nF	K	B	3,5%	***X6T***			
		330pF	F, G, J	B	0,10%	100nF^{+}	K, M	B	10,0%	1,0µF^{+1A}	K	R	10,0%
		470pF, 560pF, 910pF, 1,0nF, 1,5nF, 1,8nF, 2,2nF	J	B	0,10%	220nF^{+A}	K	R	10,0%				
						330nF^{+1B}	K	U	12,5%				

Size Code	Rate /oltage /U_R	Rate Capacitance											
		C0G (NP0)				X7R				X5R			
		Capacitance	Tolerance	Chip Thickness	DF (max)	Capacitance	Tolerance	Chip Thick-ness	DF (max)	Capacitance	Tolerance	Chip Thick-ness	DF (max)
	16V	1,0pF, 1,2pF	B	B	0,24%	100pF~180pF	K	B	5,0%	1,0nF	K	B	5,0%
		2,0pF	B	B	0,23%	220pF	J, K	B	5,0%	15nF	J, K, M	B	5,0%
						270pF~820pF	K	B	5,0%	22nF, 27nF, 33nF	K, M	B	5,0%
						1,0nF	J, K	B	5,0%	39nF	K	B	5,0%
						1,2nF	K	B	5,0%	47nF, 56nF, 68nF, 82nF, 100nF	K, M	B	5,0%
						1,5nF	J, K	B	5,0%				
						1,8nF	K	B	5,0%				
		10pF	J	B	0,17%	2,2nF	J, K	B	5,0%	120F+~ 180nF+	K, M	B	7,5%
		15pF	F, G, J	B	0,14%					220nF+	K, M	B	10,0%
		22pF	F	B	0,12%	2,7nF	K	B	5,0%	330nF+	K, M	B	12,5%
						3,3nF	J, K	B	5,0%	470nF+	K, M	R	12,5%
						3,9nF~8,2nF	K	B	5,0%	560nF+, 680nF+, 1µF+	K, M	B	12,5%
						10nF	J, K, M	B	5,0%				
		30pF	J	B	0,10%	12nF~27nF	K	B	5,0%	2,2µF+1C	K, M	R	12,5%
						33nF	J, K	B	5,0%	4,7µF+1C	M	R	12,5%
		47pF	F, G, J	B	0,10%	39nF	K	B	5,0%	***X6S***			
		100pF, 270pF	J	B	0,10%	47nF	K, M	B	5,0%	15nF	J, K	B	3,0%
						56nF~82nF	K	B	5,0%	100nF+	K	B	10,0%
		330pF	G, J	B	0,10%	100nF	J, K, M	B	5,0%	220nF+A	K	R	10,0%
						150nF+	K, M	B	10,0%	330nF+1A	K, M	R	12,5%
		470pF, 1,0nF	J	B	0,10%	220nF+A	K, M	R	10,0%	470nF+1A, 1,0µF+12A	K, M	R	12,5%
						330nF+1A	K	R	12,5%				
						470nF+1A, 1,0µF+1A	K	R	12,5%	2,2µF+C	K, M	T	10,0%
						X7S							
						1,0µF+A	K	R	10,0%				
	10V	22pF	F, G, J	B	0,12%	100pF~82nF	K	B	5,0%	1,0nF	K, M	B	5,0%
										10nF	K	B	7,5%
						100nF	J, K	B	5,0%	15nF~ 100nF, 120nF+, 150nF, 180nF, 220nF+	K, M	B	7,5%
						220nF+A, 330nF+A, 470nF+A, 680nF+1A, 1,0µF+1A	K	R	10,0%	330nF+~ 470nF+, 680nF+, 1µF+	K, M	B	10,0%
										2,2µF+1C	K, M	T	10,0%
						2,2µF+1C	K, M	T	15,0%	4,7µF+1B	K, M	U	12,5%
										10µF+12C	M	T	12,5%
										22µF+13C	M	T	20,0%
						X7S				***X6S***			
						1,0µF+1A	K	R	10,0%	1,0µF+1	K, M	B	12,5%
										2,2µF+1C	K, M	T	12,5%
						2,2µF+1C	K, M	T	10,0%	4,7µF+C	M	T	10,0%
										X6T			
										4,7µF+1C	M	T	10,0%
	6,3V					10nF, 22nF, 47nF, 68nF	K	B	5,0%	22nF, 47nF	K	B	7,5%
										100nF, 220nF+, 330nF+, 470nF+, 680nF+	K, M	B	10,0%
						100nF	J, K	B	5,0%	1µF+1	M	A*	12,5%
										1µF+2	K, M	B	10,0%
						220nF+A, 330nF+A	K	R	10,0%	2,2µF+12	M	A*	10,0%

Size Code	Rate /oltage /U_R	Rate Capacitance											
		C0G (NP0)				X7R				X5R			
		Capacitance	Tolerance	Chip Thickness	DF (max)	Capacitance	Tolerance	Chip Thick-ness	DF (max)	Capacitance	Tolerance	Chip Thick-ness	DF (max)
										$2,2\mu F^{+1C}$	K, M	T	10,0%
						$470nF^{+A}$	K, M	R	10,0%	$4,7\mu F^{+12C}$	M	A*	10,0%
										$4,7\mu F^{+12B}$	K, M	U	10,0%
						$1,0\mu F^{+1}$	K, M	B	12,5%	$10\mu F^{+2C}$	M	T	15,0%
						$2,2\mu F^{+1C}$	K	T	15,0%	$22\mu F^{+13C}$	M	T	20,0%
						X7S				***X6S***			
						$2,2\mu F^{+C}$	K	T	10,0%	$220nF^{+A}$	K	R	10,0%
										$330nF^{+1A}$	K, M	R	12,5%
										$680nF^{+1A}$	K	R	12,5%
						X7T				$1,0\mu F^{+1}$	K, M	B	12,5%
										$2,2F^{+12B}$	K, M	U	12,5%
						$470nF^{+A}$	K	R	10,0%	$4,7\mu F^{+12B}$	M	U	10,0%
										$10\mu F^{+12C}$	M	T	10,0%
										X6T			
										$4,7\mu F^{+12B}$	M	U	10,0%
	4V									$1\mu F^{+}$	K, M	B	15,0%
										$2,2\mu F^{+C}$	K, M	T	10,0%
										$2,2\mu F^{+2}$	M	A*	10,0%
										$4,7\mu F^{+2B}$	K, M	U	10,0%
										$10\mu F^{+2C}$, $22\mu F^{+13C}$	M	T	15,0%
										X6S			
										$330nF^{+A}$	K	R	10,0%
										$1,0\mu F^{+1}$	K, M	B	10,0%
										$1,5\mu F^{+1B}$, $2,2\mu F^{+12B}$	K, M	U	12,5%
										$4,7\mu F^{+12B}$	M	U	10,0%
										$10\mu F^{+12C}$	M	T	10,0%
										$22\mu F^{+13D}$	M	9	20,0%
	2,5V									***X6S***			
										$10\mu F^{+12C}$	M	T	10,0%
										$22\mu F^{+13D}$	M	9	20,0%
0603	50V	0,30pF	A, B, C	D	0,25%	100pF~390pF	K	D	2,5%	1nF, 10nF	K	D	5,0%
		0,50pF	A, B, C	D	0,24%								
		1pF, 1,2pF	B, C	D	0,24%	470pF	K, M	D	2,5%				
		1,5pF~2,2pF	B, C	D	0,23%	560pF~820pF	K	D	2,5%				
		2,4pF~3,0pF	B, C	D	0,22%	1,0nF~1,5nF	J, K	D	2,5%				
		3,3pF~4,0pF	B, C	D	0,21%	1,8nF, 2,0nF, 2,2nF, 2,7nF	K	D	2,5%				
		4,7pF	B, C	D	0,20%								
		5,0pF, 5,6pF	B, C, D	D	0,20%	3,3nF	J, K	D	2,5%	$33nF^{A}$	K	K	5,0%
		6,0pF~7,0pF	B, C, D	D	0,19%	3,9nF	K	D	2,5%				
		8,0pF, 8,2pF	B, C, D	D	0,18%	4,7nF	J, K	D	2,5%	$100nF^{+A}$, $220nF^{+A}$	K, M	K	5,0%
		9,0pF	B, C, D	D	0,17%	5,6nF	K	D	2,5%				
		10pF	F, G, J	D	0,17%	6,8nF	J, K	D	2,5%	$470nF^{+A}$, $680nF^{+A}$	K, M	K	10,0%
		11pF, 12pF	F, G, J	D	0,16%	8,2nF	K	D	2,5%				
		15pF, 16pF	F, G, J	D	0,14%	10nF	J, K, M	D	2,5%				
		18pF	F, G, J, K	D	0,13%	12nF, 15nF	K	D	2,5%				
		20pF	F, G, J	D	0,13%	18nF	J, K	D	2,5%				
		22pF	F, G, J	D	0,12%	22nF, 27nF	K	D	2,5%				
		24pF, 27pF	F, G, J	D	0,11%	$33nF^{A}$, $39nF^{A}$	K	K	2,5%				
		30pF~47pF	F, G, J	D	0,10%	$47nF^{A}$	J, K	K	3,0%				

Size Code	Rate Voltage /U_R	Rate Capacitance												
		C0G (NP0)				X7R				X5R				
		Capacitance	Tolerance	Chip Thickness	DF (max)	Capacitance	Tolerance	Chip Thickness	DF (max)	Capacitance	Tolerance	Chip Thickness	DF (max)	
						56nF[A]~82nF[A]	K	K	3,0%					
		51pF	G, J	D	0,10%	100nF[+A]	J, K, M	K	3,0%					
		56pF	F, G, J, K	D	0,10%	150nF[+A]	K	K	3,5%					
		62pF~220pF	F, G, J	D	0,10%	220nF[+A]	J, K	K	3,5%					
		270pF	G, J	D	0,10%	330nF[+A], 470nF[+A]	K	K	10,0%	1µF[+B]	K, M	V	10,0%	
		300pF	J	D	0,10%									
		330pF, 390pF	G, J	D	0,10%									
		430pF	J	D	0,10%									
		470pF	F, G, J	D	0,10%	1µF[+B]	K	V	10,0%	2,2µF[+B]	K, M	V	10,0%	
		560pF, 680pF	G, J	D	0,10%									
		750pF	J	D	0,10%									
		820pF	G, J	D	0,10%									
		1,0nF	F, G, J	D	0,10%	***X8R***								
		1,2nF[A]	J	K	0,10%									
		1,5nF[A]	G, J	K	0,10%	100nF[A]	K	K	7,5%					
		1,8nF[A]~3,9nF[A]	J	K	0,10%									
		4,7nF[A]	F, G, J	K	0,10%									
		5,6nF[A]~10nF[A]	J	K	0,10%									
	35V					470nF[+A]	K	K	10,0%	1µF[+], 2,2µF[+1]	K, M	D	10,0%	
						1µF[+B]	K	V	10,0%	4,7µF[+1B]	K, M	V	10,0%	
										10µF[+1B]	M	V	10,0%	
	25V	2,7pF, 3,0pF	C	D	0,22%	100pF~3,3nF, 3,9nF, 4,7nF~8,2nF	K	D	3,5%	100nF, 220nF	K, M	D	5,0%	
		6,0pF	D	D	0,19%	10nF	J, K	D	3,5%	330nF[A]	K	K	7,5%	
		22pF	J	D	0,12%	12nF~18nF	K	D	3,5%	470nF[+]	J, K, M	D	5,0%	
		33pF, 47pF	J	D	0,10%	22nF, 27nF	J, K	D	3,5%	680nF[+A]	K	K	7,5%	
						33nF~82nF	K	D	3,5%	1µF[+1]	K, M	R	12,5%	
		100pF, 120pF, 470pF	J, K	D	0,10%	100nF	J, K	D	3,5%	1µF[+A], 2,2µF[+A]	K, M	K	10,0%	
						120nF[A], 150nF[A], 180nF[A]	K	K	3,5%	3,3µF[+B], 4,7µF[+B]	K, M	V	10,0%	
		1,0nF	J	D	0,10%	220nF[A]	K, M	K	3,5%	10µF[+1B]	K, M	V	10,0%	
		1,5nF[B], 2,2nF[B], 6,8nF[B], 8,2nF[B], 10nF[B]	J	K	0,10%	330nF[A]	K	K	7,0%	***X6S***				
						390nF[A]	K	K	10,0%	1,0µF[+A]	K	K	10,0%	
						470nF[A]	K, M	K	10,0%					
						560nF[+A], 680nF[+A], 1,0µF[+A]	K	K	10,0%	2,2µF[+1B]	K, M	V	10,0%	
						2,2µF[+1B]	K	V	10,0%					
						X7S				4,7µF[+1B]	K, M	V	10,0%	
						2,2µF[+1B]	K	V	10,0%					
	16V	18pF	F, G, J	D	0,13%	100pF~330pF	K	D	5,0%	100nF, 220nF, 330nF	K, M	D	5,0%	
						390pF	J, K	D	5,0%					
						470pF~150nF	K	D	5,0%	470nF[+]	K, M	D	3,5%	
		30pF	J	D	0,10%	180pF[A], 220pF[A], 330nF[A], 470nF[A]	K	K	5,0%	680nF[+]	K, M	D	7,5%	
										1µF[+2]	K, M	R*	10,0%	
						680nF[A]	K	K	10,0%	1µF[+]	K, M	D	10,0%	
						1µF[+A]	J, K, M	K	10,0%	2,2µF[+A], 3,3µF[+1A], 4,7µF[+1A]	K, M	K	10,0%	
		1,2pF[B], 1,5nF[B], 2,2nF[B], 2,7nF[B],	J	K	0,10%	2,2µF[+B], 4,7µF[+B]	K, M	V	10,0%	10µF[+1B]	K, M	V	10,0%	
										22µF[+13B]	M	V	10,0%	

Size Code	Rate /oltage /U_R	Rate Capacitance											
		C0G (NP0)				X7R				X5R			
		Capacitance	Tolerance	Chip Thickness	DF (max)	Capacitance	Tolerance	Chip Thick-ness	DF (max)	Capacitance	Tolerance	Chip Thick-ness	DF (max)
		3,3nF[B], 3,9nF[B], 8,2nF[B]				***X7S***				***X6S***			
						2,2µF[+B], 4,7µF[+B]	K	V	10,0%	1µF[+A]	K	K	10,0%
										2,2µF[+1]	K, M	D	10,0%
										4,7µF[+1B]	K, M	V	10,0%
										10µF[+B]	M	V	10,0%
	10V	100pF	J, K	D	0,10%	100pF~150nF,	K	D	5,0%	100nF, 220nF, 330nF, 470nF, 680nF, 1µF[+]	K, M	D	7,5%
						220nF[A]	J, K	K	5,0%	2,2µF[+], 3,3µF[+A], 4,7µF[+A]	K, M	K	10,0%
						330nF[A], 470nF[A], 680nF[A]	K	K	10,0%	1,0µF[+], 2,2µF[+12]	K, M	R*	10,0%
										4,7µF[+B]	K, M	B*	10,0%
						1µF[+A], 2,2µF[+A]	K, M	K	10,0%	10µF[+1B]	K, M	V	10,0%
						4,7µF[+1B]	K	V	10,0%	22µF[+12B]	M	V*	15,0%
						10µF[+1B]	K, M	V	10,0%	22µF[+12B]	M	V	10,0%
						X7S				***X6S***			
						2,2µF[+B], 4,7µF[+B]	K	V	10,0%	2,2µF[+]	K	D	10,0%
						10µF[+1B]	M	V	10,0%	4,7µF[+A]	K, M	K	10,0%
						X7T				10µF[+B]	M	V	10,0%
						2,2µF[+B]	M	V	10,0%				
	6,3V					22nF, 100nF	K	D	5,0%	100nF, 1µF[+]	K, M	D	7,5%
										2,2µF[+A], 3,3µF[+A], 4,7µF[+A]	K, M	K	10,0%
						470nF[A], 1,0µF[+A], 2,2µF[+A]	K	K	10,0%	10µF[+12]	M	R*	10,0%
										10µF[+1A]	K, M	K	10,0%
						4,7µF[+B]	K, M	V	10,0%	22µF[+13B]	M	V	15,0%
						10µF[+1B]	M	V	10,0%	47µF[+13B]	M	V	12,5%
						X7S				***X6S***			
						4,7µF[+B]	K	V	10,0%	2,2µF[+1], 4,7µF[+1]	K, M	D	10,0%
						10µF[+1B]	M	V	10,0%	10µF[+B]	K, M	V	10,0%
						X7T				22µF[+13B]	M	V	10,0%
						4,7µF[+B]	K	V	10,0%				
						10µF[+1B], 22µF[+1B]	M	V	10,0%				
	4V									10µF[+]	M	D	10,0%
										22µF[+13B]	M	V	10,0%
										47µF[+13B]	M	V	12,5%
										X6S			
										4,7µF[+1]	K, M	D	10,0%
						X7T				10µF[+B], 22µF[+13B]	M	V	10,0%
						22µF[+1B]	M	V	10,0%	47µF[+13B]	M	V	15,0%
	2,5V									47µF[+13B]	M	V	15,0%
0805	50V	10pF	G, J, K	C	0,17%	100pF, 150pF~820pF	K	E	2,5%	220nF[+]	K	E	10,0%
		12pF	G, J	C	0,16%	1,0nF	J, K	E	2,5%	1µF[+], 2,2µF[+A]	K, M	E*	10,0%
		15pF	G, J	C	0,14%	1,2nF~8,2nF	K	E	2,5%				
		18pF, 20pF	G, J	C	0,13%	6,8nF	K	G*	2,5%	1µF[+], 2,2µF[+A], 4,7µF[+1A]	K, M	G	10,0%
		22pF	G, J	C	0,12%	10nF	J, K	E	2,5%				
		27pF	G, J	C	0,11%	12nF, 15nF, 18nF	K	E	2,5%				
		30pF	G, J	C	0,10%	22nF	J, K	E	2,5%				
		33pF	G, J, K	C	0,10%	27nF~150nF	K	E	2,5%	10µF[+1A]	K, M	G	10,0%
		36pF, 39pF	G, J	C	0,10%	100nF	J, K, M	D*	2,5%				
		47pF	G, J, K	C	0,10%								

Size Code	Rate /oltage /U_R	Rate Capacitance													
		C0G (NP0)				X7R				X5R			
		Capacitance	Toleranc e	Chip Thick ness	DF (max)	Capacitance	Tolera nce	Chip Thick-ness	DF (max)	Capacitance	Toler ance	Chip Thick-ness	DF (max)
		56pF	J, K	C	0,10%	180nF, 220nF	K	E*	3,0%				
		68pF	G, J, K	C	0,10%	180nF, 220nF	K	G	3,0%				
		82pF	G, J	C	0,10%								
		100pF	F, G, J	C	0,10%	330nF	K	G	3,0%				
		120pF~200pF	J	C	0,10%	470nF	K	G	3,5%				
		220pF	F, G, J	C	0,10%	680nF^{+A}	K	G	10,0%				
		270pF~1nF	J	C	0,10%	1,0µF^{+A}	K, M	G	10,0%				
		1,2nF~2,2nF	J	E	0,10%	2,2µF^{+B}	K	G	10,0%				
		2,7nF~4,7nF	J	E*	0,10%	***X7S***				***X6S***			
		2,7nF~8,2nF	J	G	0,10%	4,7µF^{+A}	K	G	10,0%	100nF	K	D	2,5%
		10nF	J	E*	0,10%								
		10nF	F, G, J	G	0,10%	***X8R***				4,7µF^{+A}	K	G	10,0%
		22nF	J	G	0,10%	100nF	K	4	5,0%				
	35V					470nF	K	G	3,5%	10µF^{+1A}	K, M	G	10,0%
										22µF^{+13A}	M	G	15,0%
										X6S			
										10,0µF^{+A}	K	G	10,0%
	25V	2,2nF	J	E	0,10%	1nF~82nF	K	E	3,5%	470nF^{A}	K, M	G	5,0%
						100nF	J, K	E	3,5%				
						120nF~180nF	K	E	3,5%				
						180nF	K	3	3,5%	1µF^{+}, 2,2µF^{+A}, 4,7µF^{+1A}	K, M	2*	10,0%
						220nF	K	E*	3,5%				
						220nF	K	G	3,5%	1µF^{A}, 2,2µF^{+A}, 4,7µF^{+A}	K, M	G	10,0%
						330nF	K	G	5,0%				
						470nF^{A}, 680nF^{A}	K	G	5,0%				
						1,0µF^{+A}	K, M	G	10%				
						2,2µF^{+A}	K	G	10%	10µF^{+1A}	K, M	2*	12,5%
						3,3µF^{+1A}, 4,7µF^{+1A}, 10µF^{+1A}	K	G	12,5%	10µF^{+1A}	K, M	G	12,5%
										22µF^{+13A}	M	G	15,0%
						X7S				***X6S***			
						2,2µF^{+}	K	4	10,0%	2,2µF^{+1A}	K	G	10,0%
						4,7µF^{+1A}	K	G	10,0%	4,7µF^{+1A}	K	G	12,5%
						10µF^{+1A}	K, M	G	10,0%	10µF^{+1A}	K, M	G	12,5%
	16V	10pF	J	C	0,17%	12nF, 47nF, 100nF	K	E	3,5%	1µF^{+}	K, M	E*	10,0%
						220nF	K	E*	3,5%	1µF, 2,2µF^{+A}, 3,3µF^{+A}	K, M	G	10,0%
						220nF	K	G	3,5%	4,7µF^{+2A}	K, M	2*	10,0%
		27pF	G, J	C	0,11%	330nF	K	G	5,0%	4,7µF^{+A}	K, M	G	10,0%
						470nF^{A}	K	G	5,0%	10µF^{+1A}	K, M	2*	10,0%
						680nF^{A}	K	G	5,0%				
						1,0µF^{A}	K, M	G	5,0%	10µF^{+12A}	K, M	G	10,0%
		3,3nF	J	G	0,10%	2,2µF^{+A}	K, M	G	10,0%	22µF^{+13A}	M	2*	10,0%
						3,3µF^{+A}	K	G	10,0%	22µF^{+13A}	K, M	G	15,0%
						4,7µF^{+A}, 10µF^{+1A}	K, M	G	10,0%	***X6S***			
						X7S				10µF^{+A}	K	G	10,0%
						10µF^{+1A}	K, M	G	10,0%	22µF^{+13A}	M	G	10,0%
	10V					1,0µF^{A}	K, M	G	5,0%	2,2µF^{+}	K, M	2*	10,0%
						2,2µF^{+A}	K, M	G	10,0%	1,0µF^{+A}, 2,2µF^{+A}, 3,3µF^{+A}, 4,7µF^{+A}, 10µF^{+A}	K, M	G	10,0%
						3,3µF^{+}, 4,7nF^{+}, 10µF^{+}	K	G	10,0%	10µF^{+2A}	K, M	2*	10,0%
										22µF^{+13A}	M	2*	10,0%

Size Code	Rate Voltage /U_R	Rate Capacitance											
		C0G (NP0)				X7R				X5R			
		Capacitance	Tolerance	Chip Thickness	DF (max)	Capacitance	Tolerance	Chip Thickness	DF (max)	Capacitance	Tolerance	Chip Thickness	DF (max)
						22µF^{+13A}	M	G	10,0%	22µF^{+13A}	M	E	15,0%
										47µF^{+13A}	M	G	10,0%
						X7S				***X6S***			
						22µF^{+13A}	M	G	10,0%	10µF^{+1A}	K	G	10,0%
						X7T				22µF^{+3A}	M	G	10,0%
						22µF^{+13A}	M	G	10,0%				
	6,3V					3,3µF^{+A}, 4,7µF^{+A}	K	G	10,0%	2,2µF^{+}	K	2*	10,0%
										2,2µF^{+A}, 3,3µF^{+A}, 4,7µF^{A}, 10µF^{+A}	K, M	G	10,0%
						10µF^{+A}	K, M	G	15,0%	10µF^{+2A}	K, M	2*	10,0%
										22µF^{+3}	K, M	4	10,0%
										22µF^{+3}	M	2*	10,0%
						22µF^{+13A}	M	G	10,0%	47µF^{+13A}	M	G	10,0%
						X7S				47µF^{+13A}	M	E*	10,0%
						22µF^{+3A}	M	G	10,0%	100µF^{+13A}	M	G	15,0%
						X7T				***X6S***			
						22µF^{+3A}	M	G	10,0%	10µF^{+1A}	K, M	G	10,0%
										22µF^{+13A}, 47µF^{+13A}	M	G	10,0%
	4V					10µF^{+A}	K, M	G	15,0%	22µF^{+3}	M	4	10,0%
										47µF^{+13A}, 100µF^{+13A}	M	G	10,0%
										X6S			
										10µF^{+A}	K, M	G	10,0%
										22µF^{+3A}, 47µF^{+13A}	M	G	10,0%
										100µF^{+13A}	M	G	15,0%
	2,5V									100µF^{+A}	M	G	20,0%
										X6S			
										100µF^{+13A}	M	G	15,0%
1206						220pF, 470pF, 1,0nF, 1,5nF, 1,8nF, 2,2nF, 4,7nF	K	2	3,5%	1,0µF^{B}	K	X	3,5%
		10pF	J	D	0,17%	5,6nF	J, K	2	3,5%				
						10nF	K, M	2	3,5%	2,2µF^{+A}	K	L	10,0%
						12nF~82nF	K	2	3,5%				
						100nF	K	2	3,5%	2,2µF^{+}, 4,7µF^{+}, 10µF^{+}	K, M	2*	10,0%
		22pF	J	D	0,12%	220nF	K	O*	3,5%				
						220nF^{A}	K	F	3,5%				
	50V					330nF	J, K	4	3,5%				
		100pF, 220pF, 1,5nF, 2,2nF	J	D	0,10%	470nF	K	4*	3,5%	4,7µF^{+A}	K, M	X	10,0%
						470nF	K	L	3,5%				
		8,2nF, 10nF	J	G	0,10%	680nF^{B}, 1,0µF^{B}	K	X	3,5%				
						1,0µF	K	4*	3,5%				
		12nF^{B}~39nF^{B}, 100nF^{B}	J	X	0,10%	2,2µF^{+A}	K	L	10,0%				
						4,7µF^{+B}	K	X	10,0%				
						10µF^{+A}	K	L	10,0%	10µF^{+A}	K, M	L	10,0%
						1,0µF^{B}	M	X	3,5%	10µF^{+}	K, M	2*	10,0%
	35V									2,2µF^{+A}, 10µF^{+A}	K, M	X	10,0%
										22µF^{+1A}	M	X	10,0%
						10µF^{+A}	K	L	10,0%	***X6S***			
										10µF^{+1B}	*K*	*X*	10,0%

Size Code	Rate /oltage /U_R	Rate Capacitance											
		C0G (NP0)				X7R				X5R			
		Capacitance	Tolerance	Chip Thickness	DF (max)	Capacitance	Tolerance	Chip Thick-ness	DF (max)	Capacitance	Tolerance	Chip Thick-ness	DF (max)
	25V	100nF[B]	J	X	0,10%	100nF	K	2	3,5%	1µF	K	2*	3,5%
						220nF	K	O	3,5%				
						330nF	K	O*	3,5%	1µF[B]	K	X	3,5%
						330nF	K	G	3,5%	2,2µF[A], 4,7µF[+A]	K, M	X	5,0%
						470nF	K	G*	3,5%	10µF[+A], 22µF[+13B]	K, M	X	10,0%
						470nF[B]	K	X	3,5%	22µF[+13A]	M	3*	10,0%
						1µF	K, M	G*	3,5%	47µF[+13B]	M	X	15,0%
						1µF[B]	K	X	3,5%	***X6S***			
						2,2µF[B]	K	X	5,0%	*10µF[+A]*	*K*	*L*	*10,0 %*
						3,3µF[+B]	K	X	10,0%				
						4,7µF[+B]	K	X	10,0%	*22µF[+3B]*	*K, M*	*X*	*10,0 %*
						10µF[+1B]	K, M	X	10,0%				
	16V	12nF[B]~39nF[B]	J	X	0,10%	100nF	K	2	3,5%	2,2µF[A], 4,7µF[+A]	K, M	X	5,0%
						470nF	K	G*	5,0%	10µF[+A], 22µF[+3A]	K, M	X	10,0%
						470nF[B], 1,0µF[B]	K	X	5,0%	47µF[+3B]	M	X	10,0%
						2,2µF[B]	K	X	10,0%	***X6S***			
						4,7µF[+B], 10µF[+1B], 22µF[+13B]	K. M	X	10,0%	*22µF[+13B]*	*K, M*	*X*	*10,0 %*
	10V					2,2µF[B]	K	X	10,0%	2,2µF[A], 4,7µF[+A]	K, M	X	7,5%
										10µF[+B], 22µF[+3B]	K, M	X	10,0%
						4,7µF[+B], 10µF[+B], 22µF[+13B]	K, M	X	10,0%	47µF[+3B]	K, M	L	10,0%
										100µF[+13B]	M	X	15,0%
						X7T				***X6S***			
						22µF[+13B]	*K, M*	*X*	*10,0%*	*22µF[+3B]*	*M*	*X*	*10,0%*
										47µF[+3B]	*M*	*X*	*10,0%*
	6,3V					10µF[+B], 22µF[+3B]	K	X	10,0%	10µF[+A]	K	X	15,0%
										22µF[+3A]	K, M	X	15,0%
										47µF[+3A]	K, M	L	10,0%
										100µF[+3B]	M	X	15,0%
						X7S				***X6S***			
						47µF[+3B]	*M*	*X*	*15,0%*	*47µF[+3B]*	*M*	*X*	*10,0%*
						X7U				***X6T***			
						47µF[+13B]	*M*	*X*	*15,0%*	*100µF[+13*	*M*	*X*	*15,0%*
	4V									22µF[+3A]	K, M	X	15,0%
										47µF[+3A], 100µF[+3B], 220µF[+3B]	M	X	15,0%
						X7U				***X6S***			
						100µF[+13B]	*M*	*X*	*15,0%*	*22µF[+3A]*	*M*	*2*	*10,0%*
										47µF[+3B]	*M*	*X*	*10,0%*
										100µF[+3A]	*M*	*L*	*10,0%*
										220µF[+13B]	*M*	*X*	*10,0%*
1210	50V					2,2µF[+]	M	Z	5,0%	4,7µF[+]	K, M	Z	10,0%
						4,7µF[+]	K	Z	10,0%				
						10µF[+A]	K, M	P	10,0%				
						10µF[+]	K	N*	15,0%	10µF[+]	K, M	Z	5,0%
						X7S							
						10µF[+]	*K, M*	*P*	*15,0%*				
	35V					10µF[+A]	K, M	P	10,0%	10µF	K, M	Z	5,0%
	25V					4,7µF	K	N*	10,0%	4,7µF, 10µF	K, M	N	10,0%
						4,7µF[B]	K	P	10,0%	22µF[+3	K, M	Z	10,0%
						10µF[+]	K	Y	10,0%	***X6S***			

Size Code	Rate /oltage /U_R	Rate Capacitance											
		C0G (NP0)				X7R				X5R			
		Capacitance	Tolerance	Chip Thickness	DF (max)	Capacitance	Tolerance	Chip Thick-ness	DF (max)	Capacitance	Tolerance	Chip Thick-ness	DF (max)
						22µF^{+3}	K, M	Z	10,0%	*10µF^{+}*	*K*	*Y*	10,0%
										22µF^{+3A}	*K*	*Z*	10,0%
	16V					4,7µF^{+}	K	Z	5,0%	4,7µF, 10µF	K, M	N	5,0%
						10µF^{+}	K	N	10,0%	22µF^{+3}	K, M	Z	10,0%
										22µF^{+3}, 47µF^{+3}	K, M	Z	15,0%
										100µF^{+3A}	M	P	10,0%
						22µF^{+3}	K, M	P	10,0%	***X6S***			
										47µF^{+13A}	*K, M*	*Z*	10,0%
	10V					22µF^{+3}	K	Z	10,0%	10µF	K	N	5,0%
										22µF^{+3}, 47µF^{+3}	K, M	Z	10,0%
						47µF^{+3}	K, M	Z	10,0%	100µF^{+3}	K, M	P	10,0%
	6,3V					47µF^{+3}	K, M	Z	10,0%	22µF^{+3}	K, M	Z	10,0%
										47µF^{+3}	K, M	Z	15,0%
										100µF^{+3A}, 220µF^{+13A}	M	P	15,0%
						X7S				***X6S***			
						100µF^{+13}	*M*	*P*	10,0%	*100µF^{+3A}*	*M*	*P*	10,0%
	2,5V									***X6S***			
										330µF^{+3A}	*M*	*P*	10,0%
1812	50V									2,2µF^{+1}	K	L	10,0%

\+ Specification II (all other according Specification I)

* Special chip thickness, higher quote

A, B, C: Special chip thickness A, B, C refer chip size table below

[1] Specification II and high temperature load life test is applicable in rated voltage 100%

Measuring condition:

C0G: ≤ 1nF: 1V, 1MHz

> 1nF 1V, 1kHz

X5R, X5S, X6S, X6T, X7R, Y5V: 1V, 1kHz

[2] for 0,5V, 1kHz

[3] for 0,5V 120Hz

C0G is below 1pF 01005 to 0402: 0,1pF, 0,2pF, 0,3pF, ... 1,0pF

after 1pF is E12 series, 20pF, 24pF, 30pF,

additionally for

0201: 50V: 1pF to 10pF is E24 series and additionally 3,5pF, 4,0pF, 4,3pF, 5,0pF, 6,0pF, 7,0pF, 8,0pF, 9,0pF, 20pF, 24pF, 30pF, 36pF, 51pF, 62pF, 75pF, 200pF

0201 25V is E24 series additionally: 1,4pF, 1,7pF, 1,9pF, 3,5pF, 4,0pF, 5,0pF, 6,0pF, 7,0pF, 8,0pF, 9,0pF but no: 11pF, no 13pF, no 36pF, no 91pF, no 110pF, no 160pF, no 560pF; no 620pF, no 750pF and no 910pF.

0402 50V: 1pF to 100pF is E24 series and additionally: no 1,1pF but 1,7pF, 1,9pF, 2,5pF, 3,5pF, 4,0pF, 4,5pF, 5,0pF, 6,0pF, 7,0pF, 8,0pF, 9,0pF, 130pF, 200pF, 300pF, 750pF but no 1,2nF

0603 50V: 1pF to 100pF is E24 series and additionally no 1,1pF but 4,0pF, no 4,3pF, 5,0pF, 6,0pF, 7,0pF, 8,0pF, 9,0pF, no 13pF, 200pF, 300pF, 430pF and 750pF

0805: additionally 20pF, no 24pF, 30pF, 36pF, 200pF

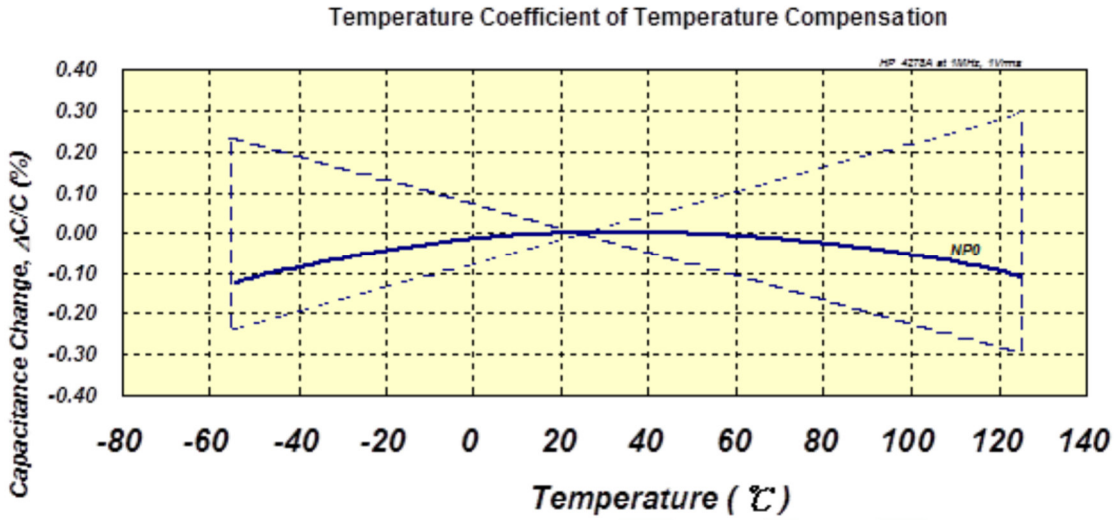
X7R all up to 0603 is E12 and above 100nF to 1µF is E6 and above 1µF is E3

X5R is below 100nF E6 series additionally 5,6nF, 8,2nF, 56nF and 82nF

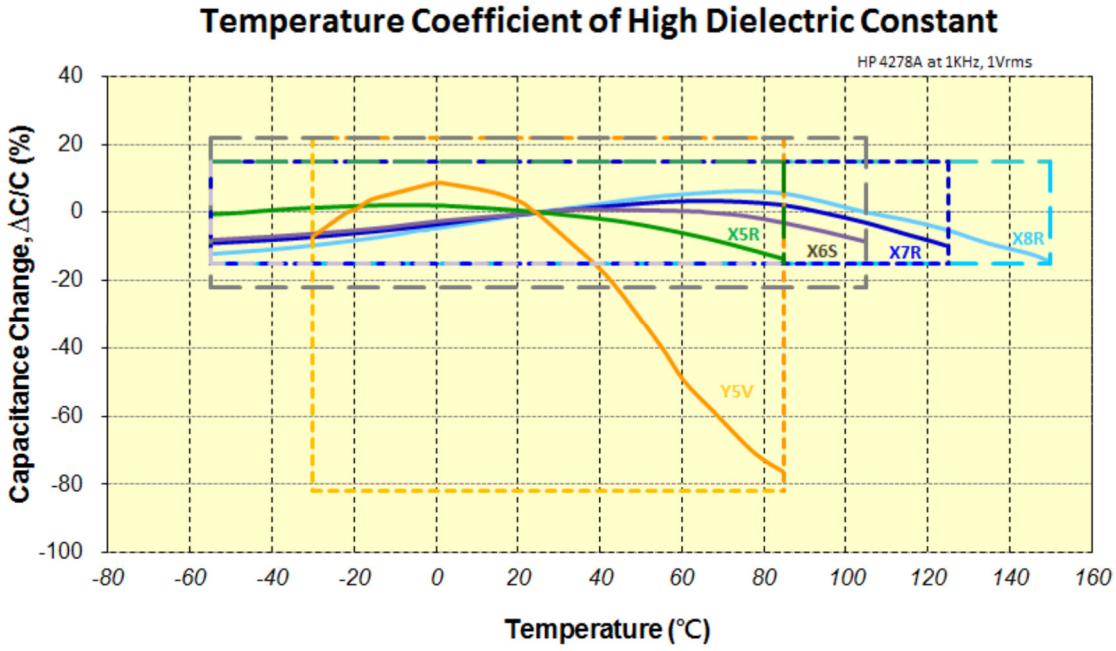
between 100nF and 1µF is E12 above 1µF is E3 series

Temperature Coefficient

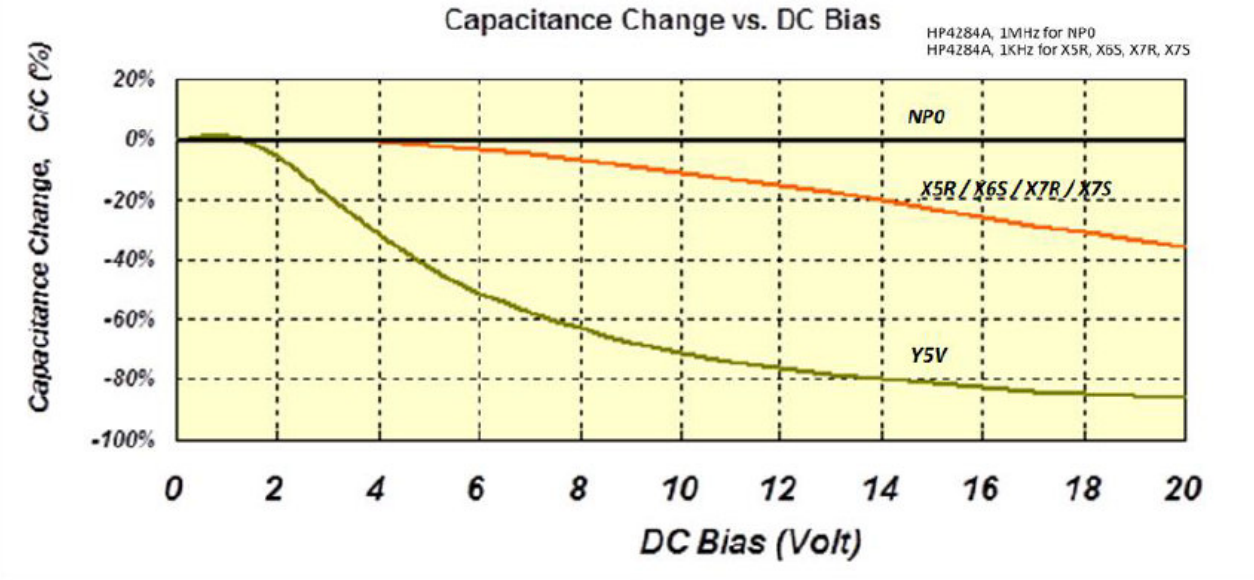
Class 1 (Temperature Compensation series)



Class 2 (High Dielectric Constant Series)

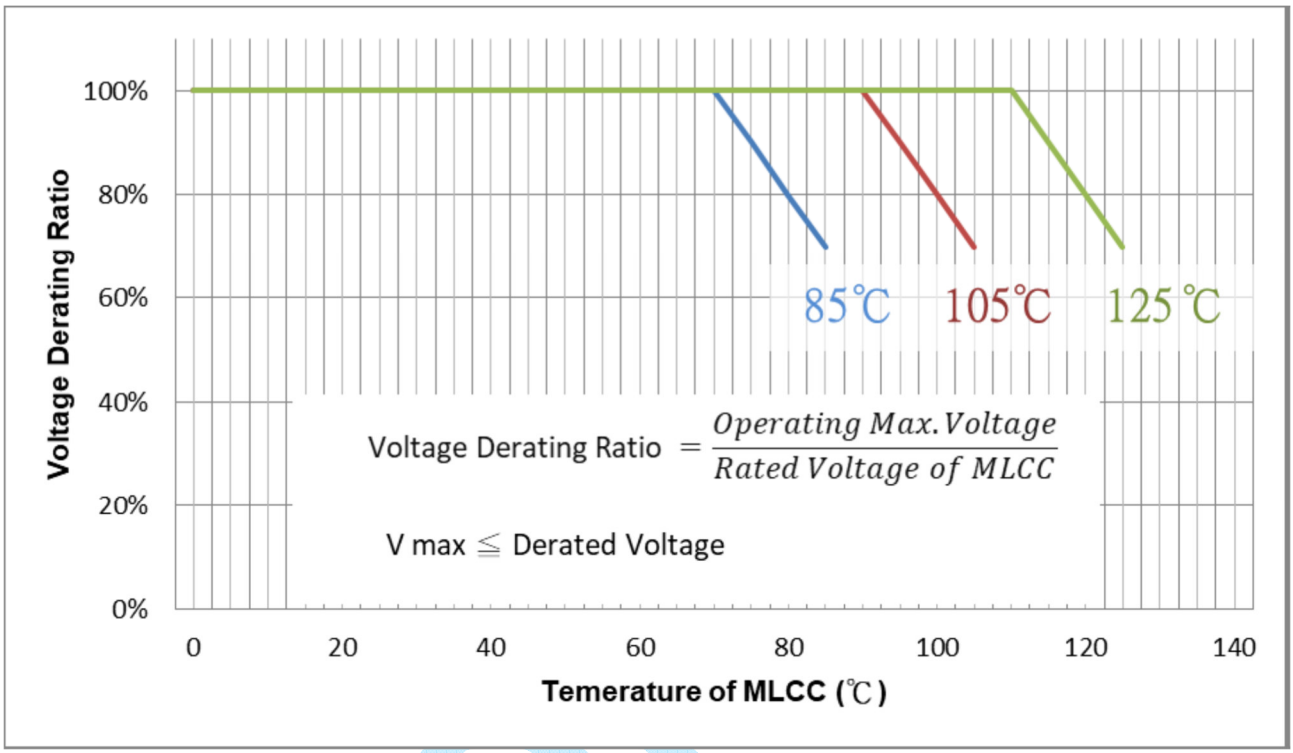


DC Voltage Coefficient

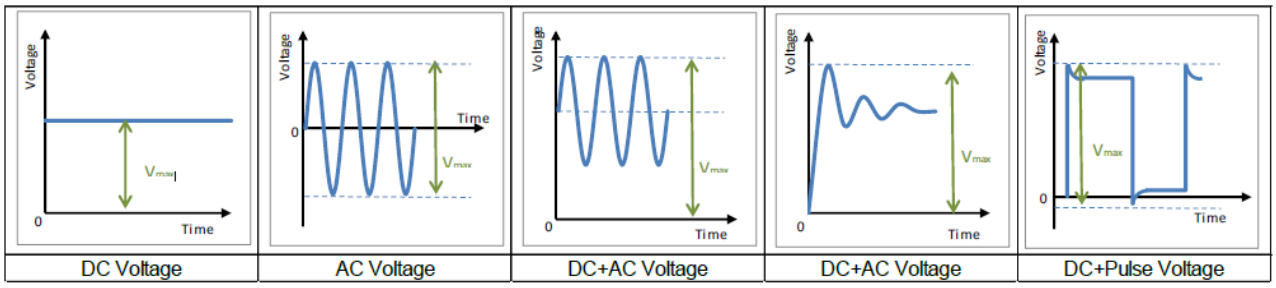


Voltage Derating and Applied Voltage

The derated MLCC should be applied with the derating voltage. The “Temperature of MLCC” is the surface temperature of MLCC including self-heating effect. The maximum operating voltage of MLCC with reference to the maximum voltage (Vmax)isas shown in the following graph.



Cautions by types of voltage applied to MLCC. For DC voltage or DC+AC voltage, DC voltage or the maximum value of DC + AC voltage should not exceed the rated voltage of MLCC. For AC voltage or pulse voltage, the peak-to-peak value of AC voltage or pulse voltage should not exceed the rated voltage of MLCC. Abnormal voltage such as surge voltage, static electricity should not exceed the rated voltage of MLCC.

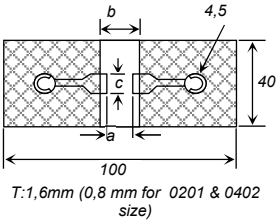


Electrical Data

Size	0201, 0402, 0603, 0805, 1206, 1210	0201, 0402, 0603, 0805, 1206, 1210			
Dielectric	**COG**	**X7R/X7S/X7T/X7U**	**X8R**	**X6S/X6T**	**X5R**
Rated voltage (VDCW)	See table above The rated voltage is defined as the maximum voltage, which may be applied continuously to the capacitor.				
Operating Temperature	-55°C to 125°C		-55°C to150°C	-55°C to105°C	-55°C to 85°C

Measured at the condition of 75% related humidity,25°C ambient temperature

Specification, General I

Item	Specification		Test Method
	Temp. compensation type	**High dielectric constant type**	
Capacitance	Within the specified tolerance X5R, X6S, X7R, X7S, X7T, X7U and X8R at 1000 h		The capacitance / D.F. shall be measured at 25°C at the frequency and voltage shown in the table above
Q/Dissipation Factor (D.F.)	C0G: If C≦30pF, DF≦1/(400+20C), C in pF If C >30pF, DF≦0,1%.	Shown in table above	
Appearance	No defects or abnormalities.		Visual inspection
Dimensions	Within the specified dimension.		Using calipers
Dielectric Strength	No defects or abnormalities.		No failure shall be observed when 250% of the rated voltage is applied between the terminations for 1 to 5 seconds. The charge and discharge current is less than 50mA.
Insulation Resistance (I.R.)	I.R. ≧10 GΩ or R_iC_R≧500Ω-F (whichever is smaller)		The insulation resistance shall be measured with a DC voltage not exceeding the rated voltage at 25°C and 75%RH max, and within 1 minute of charging.
Capacitance Temperature Characteristics	Capacitance change C0G within 0±30ppm/°C under operating temperature range.	Capacitance change X7R/X5R/X8R within ±15% X6S/X7S within ±22% X7T: -33% to + 22% X7U: -56% to + 22%	1.Temperature compensation type: The capacitance value at 25°C and 85°C shall be measured and calculated from the formula given below. T.C.=(C_{85}-C_{25})/C_{25}*ΔT*10^6(PPM/°C) 2. High dielectric constant type: The ranges of capacitance change compared with the 25°C value over the temperature ranges shall be within the specified ranges. Measurement Voltage: Less than 1,0Vrms (Refer to the electrical characteristics)
Termination Strength	No removal of the terminations or marking defect.		Apply a parallel force of 5N to a PCB mounted sample for 10±1sec. *2N for 0201.
Deflection (Bending Strength)	No cracking or marking defects shall occur at 1mm deflection. Capacitance change: C0G: within ±5% or ± 0,5pF. (whichever is larger) X8R, X7S, X7T, X7U, X7R, X6S, X5R within ±12,5%		Solder the capacitor to the test jig (glass epoxy boards) shown in Fig. a using a SAC305(Sn96,5Ag3,0Cu0,5) solder (then let sit for 24±2 hours for X5R, X6S, X7R, X7S, X7T, X7U and X8R). Then apply a force in the direction shown in Fig. b. The soldering shall be done with the reflow method and shall be conducted with care so that the soldering is uniform and free of defects such as heat shock.
	(Unit in mm)  *T:1,6mm (0,8 mm for 0201 & 0402 size)* Fig. a		

Size	a	b	C
0201	0,3	0,9	0,3
0402	0,4	1,5	0,5
0603	1,0	3,0	1,2
0805	1,2	4,0	1,65
1206	2,2	5,0	2,0
1808	3,5	7,0	2,5
1812	3,5	7,0	3,7

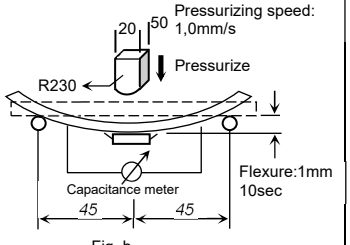
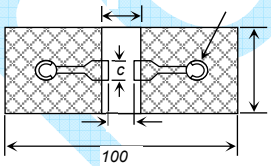
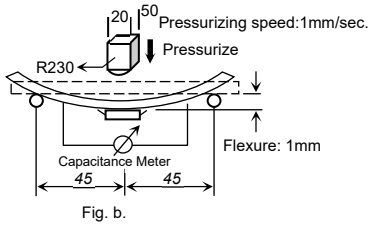


Fig. b

Solderability of Termination		90% of the terminations are to be soldered evenly and continuously.		Immerse the test capacitor into a methanol solution containing rosin for 3 to 5 seconds, preheat it 150 to 180°C for 2 to 3 minutes and immerse it into SAC305(Sn96,5Ag3,0Cu0,5) solder of 245 ± 5°C for 3±1seconds.
Resistance to Soldering Heat	**Appearance**	No marking defects		Preheat the capacitor at 120 to 150°C for 1 minute. Immerse the capacitor in a SAC305(Sn96,5Ag3,0Cu0,5) solder solution at 270±5°C for 10±1 seconds. Let sit at room temperature for 24±2 hours, then measure. Preheat 150 to 200°C for size≥1206. High dielectric constant type: Initial measurement: perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24±2 hours at room temperature. Perform the initial measurement.
	Cap. Change	C0G within ±2,5% or 0,25pF (whichever is larger)	X8R/X7S/X7T/X7U/X7R/X6S/X5R within ±7,5%	
	Q/D.F.	If C≤30pF, DF≤1/(400+20C) If C >30pF, DF≤0,1%	To satisfy the specified initial spec.	
	I.R.	I.R.≥10.000MΩ or R_iC_R≥500Ω-F. (whichever is smaller)	I.R.≥10.000MΩ or R_iC_R≥500Ω-F. (whichever is smaller)	
Temperature cycle (Thermal shock)	**Appearance**	No marking defects		Solder the capacitor to supporting jig (Glass epoxy board) and perform the five cycles according to the four heat treatments listed in the following table. Let sit for 24±2hrs at room temperature, then measure. Step 1: Minimum operating temperature: 30±3min Step 2: Room temperature: 2~3 min Step 3: Maximum operating temperature: 30±3min Step 4: Room temperature. 2~3min High dielectric constant type: Initial measurement: perform a heat treatment at 150±10°C for one hour and then let sit for 24±2 hours at room temp. Perform the initial measurement.
	Cap. Change	C0G within ±2,5% or 0,25pF (whichever is larger)	X5R/X6S/X7R/X7S/X7T/X8R within ±7,5% X7U within ±30%	
	Q/D.F.	If C≤30pF, DF≤1/(400+20C) If C >30pF, DF≤0,1%	To satisfy the specified initial spec.	
	I.R.	I.R.≥10.000MΩor R_iC_R≥500Ω-F. (whichever is smaller)	I.R≥10.000MΩ or R_iC_R≥500Ω-F. (whichever is smaller)	
Humidity load	**Appearance**	No marking defects		Apply the rated voltage at 40±2°C and 90 to 95% humidity for 500±12 hours. The charge / discharge current is less than 50mA. [Temperature compensation type] Remove and let sit for 24±2 hours at room temperature, then measure. [High dielectric constant type] Initial measurement Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24±2 hours at room temperature. Perform the initial measurement. Measurement after test Perform a heat treatment and then let sit for 24±2 hours at room temperature, then measure.
	Cap. Change	C0G within ±7,5% or 0,75pF (whichever is larger)	X5R/X6S/X7R/X7S/X7T/X7U/X8R within ±12,5%	
	Q/D.F.	If C＞30pF, DF≤0,5% If C≤30pF, D≤1/(100+10xC/3) C in pF	X5R/X6S/X7R/X7S/X7T/X7U/X8R 200% max of initial spec.	
	I.R.	I.R.≥500MΩ or R_iC_R≥25Ω-F. (whichever is smaller)	I.R.≥500MΩor R_iC_R≥25Ω-F. (whichever is smaller)	
High tempera-ture load life test	**Appearance**	No marking defects		Apply 200% of the rated voltage for 1000±12 hours at the maximum operating temperature ± 3°C. The charge / discharge current is less than 50mA. [Temperature compensation type] Remove and let sit for 24±2 hours at room temperature, then measure. [High dielectric constant type] Initial measurement Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24±2 hours at room temperature. Perform the initial measurement. Measurement after test Perform a heat treatment and then let sit for 24±2 hours at room temperature, then measure.
	Cap. Change	C0G within ±7,5% or 0,75pF (whichever is larger)	X5R/X6S/X7R/X7S/X7T/X7U/X8R within ±12,5%	
	Q/D.F.	If C>30pF, DF≤0,% If 10pF<C≤30pF, DF≤1/(275+5xC/2) If C≤10pF, DF≤1/(200+10C), C in pF	X5R/X6S/X7R/X7S/X7T/X7U/X8R 200% max of initial spec.	
	I.R.	More than 1GΩ or R_iC_r≥50 Ω-F (whichever is less.)	More than 1GΩ or R_iC_r≥50 Ω-F (whichever is less.)	

Capacitor SMD MLCC

Specification, General II (marked with "+" in table)

Item		Specification	Test Method
Capacitance		Within the specified tolerance X5R, X6S, X7R, X7S, X7T, X7U and X8R at 1000 h High cap at 24hours: X5R, X6S, X6T, X7R, X7S 0201 ≥ 4,7µF 0402 ≥ 22µF 0603 ≥ 47µF 0805 ≥ 100µF 1206 ≥ 220µF 1210 ≥ 330µF	The capacitance / D.F. shall be measured at 25°C at the frequency and voltage shown in the table above Heat treatment: Perform a heat treatment at 150+0/-10°C for 1 hour and then let sit at room temperature, then measure Measurement Frequency: 1,0+/-0,1MHz/1,0+/-0,1kHz/120+/-24Hz Measurement Voltage :1,0+/-0,2Vrms/ 0,5+/-0,1Vrms
Q/Dissipation Factor (D.F.)		Shown in table above	
Appearance		No defects or abnormalities.	Visual inspection
Dimensions		Within the specified dimension.	Using calipers
Dielectric Strength		No defects or abnormalities.	No failure shall be observed when 250% of the rated voltage is applied between the terminations for 1 to 5 seconds. The charge and discharge current is less than 50mA.
Insulation Resistance (I.R.)		$R_iC_R \geqq 50\Omega$-F High cap: X5R, X6S, X6T, X7R, X7S 0201 ≥ 2,2µF 0402 ≥ 22µF 0603 ≥ 47µF 0805 ≥ 100µF 1206 ≥ 100µF 1210 ≥ 100µF Insulation Resistance: RiCR ≥ 20Ω-F	The insulation resistance shall be measured with a DC voltage not exceeding the rated voltage at 25°C and 75%RH max, and within 1 minute of charging, provided the charge/discharge current is less than 50 mA.
Termination Strength		No removal of the terminations or marking defect.	Apply a parallel force of 5N to a PCB mounted sample for 10±1sec. 2N for 0201.
Deflection (Bending Strength)		No cracking or marking defects shall occur at 1mm deflection. Capacitance change: X7R, X6S, X5R, X6T, X7S, X7T, X7U, X8R: within ±12,5%	Solder the capacitor to the test jig (glass epoxy boards) shown in Fig. a using a SAC305(Sn96,5Ag3,0Cu0,5) solder (then let sit for 24±2 hours for X7R, X5R, X6S, X7S, X7T, X7U and X8R). Then apply a force in the direction shown in Fig. b. The soldering shall be done with the reflow method and shall be conducted with care so that the soldering is uniform and free of defects such as heat shock.
		(Unit in mm)  *T:1.6mm (0,8 mm for 0201 & 0402 size)* Fig. a Size / a / b / C 0201 / 0,3 / 0,9 / 0,3 0402 / 0,4 / 1,5 / 0,5 0603 / 1,0 / 3,0 / 1,2 0805 / 1,2 / 4,0 / 1,65 1206 / 2,2 / 5,0 / 2,0 1808 / 3,5 / 7,0 / 2,5 1812 / 3,5 / 7,0 / 3,7	 Fig. b.
Capacitance Temperature Characteristics		Capacitance change X5R/X7R/X8R within ±15%, X6S/X7S within ±22% X7U: -56% to + 22% X6T/X7T: -33% to + 22%	The ranges of capacitance change compared with the 25°C value over the temperature ranges shall be within the specified ranges. Measurement Voltage: Less than 1,0 Vrms (Refer to the electrical characteristics)
Solderability of Termination		90% of the terminations are to be soldered evenly and continuously.	Immerse the test capacitor into a methanol solution containing rosin for 3 to 5 seconds, preheat it 150 to 180°C for 2 to 3 minutes and immerse it into SAC305(Sn96.5Ag3.0Cu0.5) solder of 245 ± 5°C for 3±1seconds.
Resistance to Soldering Heat	**Appearance**	No marking defects	Preheat the capacitor at 120 to 150°C for 1 minute. Immerse the capacitor in a SAC305(Sn96.5Ag3.0Cu0.5) solder solution at 270±5°C for 10±1 seconds. Let sit at room temperature for 24±2 hours, then measure.
	Cap. Change	X7R/X5R/X6S/X6T/X7S/X7T/X7U/X8R within ±7,5%	
	D.F.	To satisfy the specified initial spec.	

	I.R.	$R_iC_R \geq 50\Omega$-F. High cap: X5R, X6S, X6T, X7R, X7S 0201 ≥ 2,2µF 0402 ≥ 22µF 0603 ≥ 47µF 0805 ≥ 100µF 1206 ≥ 100µF 1210 ≥ 100µF Insulation Resistance: RiCR ≥ 20Ω-F	Preheat 150 to 200°C for size ≧ 1206. Initial measurement: perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24±2 hours at room temperature. Perform the initial measurement.
Temperature cycle (Thermal shock)	**Appearance**	No marking defects	Solder the capacitor to supporting jig (Glass epoxy board) and perform the five cycles according to the four heat treatments listed in the following table. Let sit for 24±2hrs at room temperature, then measure. Step 1: Minimum operating temperature 30±3min Step 2: Room temperature 2~3 min Step 3: Maximum operating temperature 30±3min Step 4: Room temperature 2~3min Initial measurement: perform a heat treatment at 150±10°C for one hour and then let sit for 24±2 hours at room temp. Perform the initial measurement.
	Cap. Change	X7R/X5R/X6S/X6T/X7S/X7T/X8R within ±7,5% X7U within ±30%	
	Q/D.F.	To satisfy the specified initial spec.	
	I.R.	$R_iC_R \geq 50\Omega$-F High cap: X5R, X6S, X6T, X7R, X7S 0201 ≥ 2,2µF 0402 ≥ 22µF 0603 ≥ 47µF 0805 ≥ 100µF 1206 ≥ 100µF 1210 ≥ 100µF Insulation Resistance: RiCR ≥ 20Ω-F	
Humidity load	**Appearance**	No marking defects	Apply the rated voltage at 40±2°C and 90 to 95% humidity for 500±12 hours. The charge / discharge current is less than 50mA. Initial measurement Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24±2 hours at room temperature. Perform the initial measurement. Measurement after test Perform a heat treatment and then let sit for 24±2 hours at room temperature, then measure.
	Cap. Change	X7R/X5R/X6S/X6T/X7S/X7T/X7U/X8R within ±12,5%	
	Q/D.F.	X7R/X5R/X6S/X6T/X7S/X7T/X7U/X8R 200% max of initial spec.	
	I.R.	$R_iC_R \geq 12,5\Omega$-F. High cap: X5R: 0201 ≥ 1µF 0402 ≥ 2,2µF 0603 ≥ 4,7µF 0805 ≥ 10µF 1206 ≥ 22µF 1210 ≥ 47µF Insulation Resistance: RiCR ≥ 5Ω-F X6S, X6T, X7R, X7S: 0201 ≥ 0,1µF 0402 ≥ 0,47µF 0603 ≥ 1µF 0805 ≥ 2,2µF 1206 ≥ 4,7µF 1210 ≥ 10µF Insulation Resistance: RiCR ≥ 5Ω-F X5R, X6S, X6T, X7R, X7S 0201 ≥ 2,2µF 0402 ≥ 22µF 0603 ≥ 47µF 0805 ≥ 100µF 1206 ≥ 100µF 1210 ≥ 100µF Insulation Resistance: RiCR ≥ 1Ω-F	
High temperature load life test	**Appearance**	No markig defects	Apply 150% of the rated voltage for 1000±12 hours at the maximum operating temperature ± 3°C. The charge / discharge current is less than 50mA. Initial measurement
	Cap. Change	X7R/X5R/X6S/X6T/X7S/X7T/X7U/X8R within ±12,5%	
	D.F.	X7R/X5R/X6S/X6T/X7S/X7T/X7U/X8R 200% max of initial spec.	

	I.R.	$R_iC_r \geq$ 25 Ω-F High cap: X5R: 0201 ≥ 1µF 0402 ≥ 2,2µF 0603 ≥ 4,7µF 0805 ≥ 10µF 1206 ≥ 22µF 1210 ≥ 47µF Insulation Resistance: RiCR ≥ 10Ω-F X6S, X6T, X7R, X7S: 0201 ≥ 0,1µF 0402 ≥ 0,47µF 0603 ≥ 1µF 0805 ≥ 2,2µF 1206 ≥ 4,7µF 1210 ≥ 10µF Insulation Resistance: RiCR ≥ 10Ω-F X5R, X6S, X6T, X7R, X7S 0201 ≥ 2,2µF 0402 ≥ 22µF 0603 ≥ 47µF 0805 ≥ 100µF 1206 ≥ 100µF 1210 ≥ 100µF Insulation Resistance: RiCR ≥ 2Ω-F	Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24±2 hours at room temperature. Perform the initial measurement. Measurement after test Perform a heat treatment and then let sit for 24±2 hours at room temperature, then measure. Some of the parts are applicable in rated voltage 100%. Please refer to table above.

Capacitor SMD MLCC

Special Parts

High Voltage, Rated Voltage, Rated Capacitance and available Tolerances

Size Code	Rate Voltage /U_R	Rate Capacitance							
		C0G (NP0)				X7R			
		Capacitance	Tolerance	Chip Thick-ness	DF (max)	Capacitance	Tolerance	Chip Thick-ness	DF (max)
0201	100V	0,20pF~0,40pF	A, B, C	A	0,25%				
		0,50pF~1,0pF	A, B, C	A	0,24%				
		1,1pF, 1,2pF	B, C	A	0,24%				
		1,3pF~ 2,2pF	B, C	A	0,23%				
		2,4pF~ 3,0pF	B, C	A	0,22%				
		3,3pF~ 4,3pF	B, C	A	0,21%				
		4,7pF	B, C	A	0,20%				
		5,0pF~ 5,6pF	B, C, D	A	0,20%				
		6,0pF~ 7,0pF	B, C, D	A	0,19%				
		7,5pF~ 8,2pF	B, C, D	A	0,18%				
		9,0pF	B, C, D	A	0,17%				
		10pF	F, G, J	A	0,17%				
		12pF	G, J	A	0,16%				
		15pF	J	A	0,14%				
		18pF	J	A	0,13%				
		22pF	J	A	0,12%				
		27pF	J	A	0,11%				
		33pF, 39pF	J	A	0,10%				
		47pF	F, G, J	A	0,10%				
		56pF, 68pF, 82pF	J	A	0,10%				
		100pF	F, G, J	A	0,10%				
		120pF, 150pF, 180pF, 220pF	J	A	0,10%				
0402	100V	0,2pF~0,4pF	A, B, C	B	0,25%	100pF~10nF	K	B	3,0%
		0,5pF~1,0pF	A, B, C	B	0,24%				
		1,2pF	B, C	B	0,24%				
		1,5pF~2,2pF	B, C	B	0,23%				
		2,7pF	B, C	B	0,22%				
		3,3pF~4,0pF	B, C	B	0,21%				
		4,7pF	B, C	B	0,20%				
		5pF, 5,6pF	B, C, D	B	0,20%				
		6,8pF	B, C, D	B	0,19%				
		8,0pF, 8,2pF	B, C, D	B	0,18%				
		10pF	F, G, J	B	0,17%				
		12pF	F, G, J	B	0,16%				
		15pF, 16pF	F, G, J	B	0,14%				
		18pF	F, G, J	B	0,13%				
		22pF	F, G, J	B	0,12%				
		27pF	F, G, J	B	0,11%				
		33pF~100pF	F, G, J	B	0,10%				
		120pF~680pF, 750pF, 820pF, 1nF, 1,5nF	J	B	0,10%	***X7S***			
						2,2nF, 10nF	K	B	3,0%
0603	250V	1,0pF, 1,2pF	B, C	D	0,24%	100pF~6,8nF	K	D	2,5%
		1,5pF~2,2pF	B, C	D	0,23%				
		2,7pF	B, C	D	0,22%				
		3,3pF, 3,9pF	B, C	D	0,21%				

Size Code	Rate Voltage /U_R	Rate Capacitance							
		C0G (NP0)				X7R			
		Capacitance	Tolerance	Chip Thickness	DF (max)	Capacitance	Tolerance	Chip Thickness	DF (max)
		4,7pF	B, C	D	0,20%				
		5,6pF	B, C, D	D	0,20%				
		6,8pF	B, C, D	D	0,19%				
		8,2pF	B, C, D	D	0,18%				
		10pF	J	D	0,17%				
		12pF	J	D	0,16%				
		15pF	J	D	0,14%				
		18pF	J	D	0,13%				
		22pF	J	D	0,12%				
		27pF	J	D	0,11%	10pF[A]	K	K	2,5%
		33pF~220pF	J	D	0,10%				
		270pF[A]~1nF[A]	J	K	0,10%				
	200V	1pF	B	D	0,24%	330pF, 820pF, 3,3nF, 4,7nF	K	D	2,5%
		220pF	J	D	0,10%	10nF	K	K	2,5%
	100V	0,30pF, 0,40pF	A, B, C	D	0,25%				
		0,50pF~1,0pF	A, B, C	D	0,24%				
		1,2pF	B, C	D	0,24%				
		1,5pF~2,2pF	B, C	D	0,23%				
		2,4pF~3,0pF	B, C	D	0,22%				
		3,3pF	B, C	D	0,21%				
		3,6pF	C	D	0,21%	100pF~10nF, 15nF, 22nF	K	D	3,0%
		3,9pF~4,3pF	B, C	D	0,21%				
		4,7pF	A, B, C	D	0,20%				
		5,0pF, 5,6pF	B, C, D	D	0,20%				
		6,0pF~7,0pF	B, C, D	D	0,19%				
		8,0pF	C	D	0,18%				
		8,2pF	B, C, D	D	0,18%				
		9,0pF, 9,1pF	B, C, D	D	0,17%				
		10pF	F, G, J	D	0,17%				
		11pF, 12pF	F, G, J	D	0,16%	33nF[A], 39nF[A], 47nF[A],	K	K	3,0%
		15pF	F, G, J	D	0,14%				
		16pF	G	D	0,14%				
		18pF, 20pF	F, G, J	D	0,13%	56nF[A], 68nF[A], 82nF[A]	K	K	5,0%
		22pF	F, G, J	D	0,12%				
		24pF, 27pF	F, G, J	D	0,11%	100nF[A]	K, M	K	10,0%
		30pF~150pF	F, G, J	D	0,10%				
		180pF, 200pF	J	D	0,10%	***X5R***			
		220pF	F, G, J	D	0,10%	*10nF*	*K*	*D*	*5,0%*
		270pF~1nF	J	D	0,10%	***X7S***			
						100nF[A]	*K*	*K*	*10,0%*
0805	1000V	10pF	J	G	0,17%				
		12pF	J	G	0,16%				
		15pF	J	G	0,14%				
		18pF	J	G	0,13%	100pF	K, M	D	2,5%
		22pF	J	G	0,12%				
		27pF	J	G	0,11%				
		33pF~68pF	J	G	0,10%				
	630V	10pF	J	J*, D	0,17%	100pF, 150pF~3,3nF	K	D	2,5%
		12pF	J	J*, D	0,16%				

Size Code	Rate Voltage /U_R	Rate Capacitance							
		C0G (NP0)				X7R			
		Capacitance	Tolerance	Chip Thick-ness	DF (max)	Capacitance	Tolerance	Chip Thick-ness	DF (max)
		15pF	J	J*, D	0,14%				
		18pF	J	J*, D	0,13%				
		22pF	J	J*, D	0,12%				
		27pF	J	J*, D	0,11%				
		33pF~68pF	J	J*, D	0,10%				
		82pF~180pF	J	D	0,10%	4,7nF, 10nF, 22nF	K	G	2,5%
		220pF, 470nF, 1nF	J	G	0,10%				
	500V	10pF	J	J	0,17%				
		22pF	J	J	0,12%	100pF, 180pF~ 330pF, 470pF~ 680pF, 1,0nF, 2,2nF, 2,7nF	K	D	2,5%
		47pF	J	J	0,10%				
		100pF	J	D	0,10%				
		220pF, 470nF, 1nF	J	G	0,10%	4,7nF, 10nF, 22nF	K	G	2,5%
	250V	10pF	J	J*, D	0,17%				
		12pF	J	J*, D	0,16%	120pF, 180pF, 220pF, 330pF, 470pF, 560pF, 680pF, 1,0nF~1,5nF	K	D	2,5%
		15pF	J	J*, D	0,14%				
		18pF	J	J*, D	0,13%				
		22pF	J	J*, D	0,12%	2,2nF	J, K	D	2,5%
		27pF	J	J*, D	0,11%				
		33pF~82pF	J	J*, D	0,10%	3,3nF~ 4,7nF	K	D	2,5%
		100pF, 120pF	J	D	0,10%				
		150pF	J	V*, G	0,10%				
		180pF	J	V	0,10%				
		220pF, 270pF, 330pF	J	V*, G	0,10%	5,6nF ~ 15nF, 22nF[A], 33nF[A]	K	G	2,5%
		470pF, 560pF, 3,9nF	J	G	0,10%				
	200V	22pF	J	J	0,12%	220pF, 1,0nF	K	D	2,5%
		27pF	J	J	0,11%				
		220pF	J	D	0,10%				
		330pF	J	V	0,10%	10nF, 15nF, 22nF[A]	K	G	2,5%
		470pF, 3,9nF	J	G	0,10%				
	100V	10pF	J	J*, D	0,17%	150pF, 180pF	K	D	3,0%
		12pF	F, G, J	J	0,16%	220pF	F, K	D	3,0%
		12pF	J	D	0,16%				
		15pF	J	J*, D	0,14%	270pF ~ 820pF	K	D	3,0%
						1nF	K	D*, 2	3,0%

Size Code	Rate Voltage /U_R	Rate Capacitance							
		C0G (NP0)				X7R			
		Capacitance	Tolerance	Chip Thickness	DF (max)	Capacitance	Tolerance	Chip Thick-ness	DF (max)
		18pF, 20pF	J	J*, D	0,13%	1,2nF ~ 22nF	K	D	3,0%
		22pF	J	J*, D	0,12%	33nF	K	D*, M	2,5%
						39nF~82nF	K	M	2,5%
		24pF, 27pF	J	J*, D	0,11%	100nF[A]	K, M	G	5,0%
		30pF~120pF	J	J*, D	0,10%	150nF[A], 220nF[A]	K	G	5,0%
		130pF	J	J	0,10%	330nF[A+]	K, M	G	5,0%
		150pF~330pF	J	J*, D	0,10%	470nF[A+]	K	G	5,0%
		390pF~2,2nF	J	D	0,10%	***X7S***			
		27nF, 3,3nF	J	G	0,10%	1,0µF[A+]	K, M	G	10,0%
1206	2000V	3,3pF	C	D	0,21%	100nF[B], 150pF[B]~820pF[B]	K	G	2,5%
		10pF	J	D	0,17%				
		22pF	J	D	0,12%	1nF[B]	K, M	G	2,5%
		27pF	J	M	0,11%	1,2nF[B]~1,8nF[B]	K	G*, L	2,5%
		33pF, 47pF, 68pF, 100pF	J	M	0,10%	2,2nF[B]	K, M	G*, L	2,5%
						3,3nF[B]	K	G	2,5%
		220pF[A]	J	L	0,10%	4,7nF[B]	K, M	L	2,5%
	1000V	10pF	J	D	0,17%	100pF[B]	K, M	G	2,5%
		12pF	J	D	0,16%				
		15pF	J	D	0,14%	150pF[B]~ 820pF[B]	K	G	2,5%
		18pF	J	D	0,13%				
		22pF	J*, K	D	0,12%	1nF[B]	K, M	G	2,5%
		22pF	J	D*, M	0,12%				
		27pF	J	D*, M	0,11%				
		33pF	J	D*, M	0,10%				
		39pF	J	D	0,10%				
		47pF	J	D*, G	0,10%				
		56pF, 68pF	J	D	0,10%				
		82pF	J	D*, G	0,10%				
		100pF, 120pF, 150pF	J	G	0,10%	1,2nF[B]~ 10nF[B]	K	G	2,5%
		180pF, 220pF, 270pF[A], 330pF[A], 390pF[A], 470pf[A], 560pF[A], 1,0nF[A]	J	L	0,10%	10nF[B]	K	L*	2,5%
	630V	10pF	J	D	0,17%	100pF[+]	K	G	2,5%
		15pF	J	D	0,14%				
		22pF	J	D	0,12%	180pF[+]~ 1nF[+]	K	G	2,5%
		27pF	J	D*, M	0,11%	180pF~ 1nF	K	E*	2,5%

Size Code	Rate Voltage /U_R	Rate Capacitance							
		C0G (NP0)				X7R			
		Capacitance	Tolerance	Chip Thick-ness	DF (max)	Capacitance	Tolerance	Chip Thick-ness	DF (max)
		33pF	J	D*, M	0,10%	1,2nF^{+}1,~3,9nF^{+}	K	G	2,5%
		47pF ~ 220pF	J	D	0,10%	4,7nF^{+}	K	E*	2,5%
		270pF, 330pF, 390pF, 470pF	J	D*, O	0,10%	12nF^{+}~ 18nF^{+}	K	G	2,5%
						12nF^{B+}~ 18nF^{B+}	K	L*	2,5%
		680pF^{B}, 1,0nF^{B}, 2,2nF^{B}	J	L	0,10%	22nF^{B+}~ 33nF^{B+}, 47nF^{B+}	K	L	2,5%
	500V	10pF	J	D	0,17%	100pF	K	G	2,5%
		22pF	J	D	0,12%	180pF, 220pF, 470pF, 560pF^{+}	K	G	2,5%
		27pF	J	D	0,11%	180pF, 220pF, 470pFF	K	E*	2,5%
		47pF, 100pF, 220pF	J	D	0,10%	1,0nF	K	G, E*	2,5%
						2,2nF	K, M	G	2,5%
		470pF	J	D, O	0,10%	2,7nF~ 4,7nF, 6,8nF, 10nF	K	G	2,5%
		1,0nF^{B}, 2,2nF^{B}	J	L	0,10%	22nF^{B}, 47nF^{B}	K	L	2,5%
	250V	120pF, 150pF, 180pF, 220pF	J	D	0,10%	180pF	K	G	2,5%
						220pF, 470pF, 560nF, 1,0nF, 2,2nF, 4,7nF, 10nF	K	E*	2,5%
		270pF, 330pF, 390pF, 470pF	J	D*, O	0,10%	220pF, 470pF, 560nF, 1,0nF, 2,2nF, 4,7nF, 10nF, 15nF, 22nF	K	G	2,5%
						33nF^{B}	K	L	2,5%
		1,0nF^{B}	J	L	0,10%	47nF	K	G*	2,5%
						47nF^{A}, 100nF^{A}	K	L	2,5%
	200V	100pF, 220pF	J	D	0,10%	220pF	K	E	2,5%
						1,0nF	K	G	2,5%
		1nF	J	O*	0,10%	1,0nF	K	E*	2,5%
						2,2nF	J, K	E	2,5%
		1nF^{B}	J	L	0,10%	3,3nF	K	G, E*	2,5%
						10nF	K, M	G	2,5%
						47nF	K	G*	2,5%
						47nF^{A}, 68nF^{A}, 100nF^{A}	K	L	2,5%
	100V	10pF	J	D	0,17%	1,0nF	K	E*, G	2,5%
		12pF	J	D	0,16%	2,2nF	K	E	2,5%
		15pF	J	D	0,14%	10nF	K	D	3,5%
						12nF~18nF	K	D*, G	3,5%
		18pF	J	D	0,13%	22nF~39nF	K	D	3,5%
		22pF	J	D	0,12%	47nF	K	D*, G	3,5%
						56nF, 68nF	K	D	3,5%
						82nF, 100nF	K	D*, G	3,5%
		27pF	J	D	0,11%	150nF^{A}, 220nF^{A}	K	L	2,5%

Size Code	Rate Voltage /U_R	Rate Capacitance							
		C0G (NP0)				X7R			
		Capacitance	Tolerance	Chip Thickness	DF (max)	Capacitance	Tolerance	Chip Thick-ness	DF (max)
		33pF ~ 5,6nF	J	D	0,10%	330nF[B]	K, M	L	2,5%
		6,8nF	J	O*, G	0,10%	470nF[A]	K	L	3,0%
		8,2nF, 10nF	J	G	0,10%	1,0µF[B], 2,2µF[1B]	K	X	10,0%
		33nF	J	D	0,10%	***X7S***			
		100nF[B+]	J	X	0,10%	2,2µF[+B], 4,7µF[+B]	K	X	10,0%
1210	2000V					1,0nF[A]	K	G	2,5%
						2,2nF[A]	K	N	2,5%
						2,7nF[A]	K, M	P	2,5%
						4,7nF[A]	K, M	P	2,5%
	1000V	330pF[A]	J	L	0,10%	10nF[A]	K	L	2,5%
	630V					1,0nF, 2,2nF, 4,7nF, 10nF, 22nF	K	G	2,5%
						47nF[A], 68nF[A]	K	L	2,5%
	500V					10nF, 22nF	K	G	2,5%
						100nF[A]	K	N	2,5%
	250V	10nF[A]	J	L	0,10%	220nF[A], 270nF[A], 470nF[A]	K	P	2,5%
	100V					100nF	K	O	2,5%
						220nF	K	G	2,5%
						470nF[+]	K	I*	2,5%
						470nF, 560nF	K	P	3,0%
						820nF[A]	K	N	3,0%
						1,0µF	K	N	10,0%
						2,2µF	K	N*	10,0%
						2,2µF	K	Z	5,0%
						4,7µF[B]	K	8	10,0%
						X7S			
						4,7µF[B]	K	Y	10,0%
1808	3000V	5,0pF[A]	D	G	0,20%	1,0nF	K	G*	2,5%
		10pF[A]	J	G	0,17%				
		47pF[A]	J	G	0,10%				
		56pF[A]	G, J	G	0,10%				
		100pF[A]	J	G*	0,10%	1,0nF[B]	K	N	2,5%
		100pF[A]	J	L*	0,10%				
		100pF[A]	J, K	N*	0,10%				
	2000V	18pF[A]	J	G	0,13%	1,0nF[B], 1,5nF[B]	K	N	2,5%
		100pF[A]	J	G	0,10%				
		680pF[A]	J	N	0,10%	2,2nF	K	L	2,5%
	1000V	33pF[A]	J	G	0,10%	-	-	-	-
		680pF[A]	J	N	0,10%				
	250V	150pF[A]	J	G	0,10%	470pF[BB]	K	W	2,5%
1812	3000V					1,0nF[A]	K, M	N	2,5%
						1,5nF[A]	K	N	2,5%
						2,2nF[A], 3,3nF[A]	K	P	2,5%
	2000V	1nF[A]	K	N	0,10%	1,0nF[B]	K	M	2,5%
						2,2nF[B]	K	M*	2,5%
						2,2nF[+]	K	L	2,5%
						4,7nF[A]	K	N	2,5%
						10nF[B]	K	N*	2,5%
						10nF[A]	K	P	2,5%

Size Code	Rate Voltage /U_R	Rate Capacitance							
		C0G (NP0)				X7R			
		Capacitance	Tolerance	Chip Thick-ness	DF (max)	Capacitance	Tolerance	Chip Thick-ness	DF (max)
	1000V					4,7nF[A]	K	M	2,5%
						22nF[+A]	K	W	2,5%
	630V					68nF[+A]	K	N	2,5%
						100nF[+A]	K	N	2,5%
						150nF[+A]	K	P	2,5%
	250V					470nF[A]	K	N	2,5%
	200V					1,0µF[A]	K	P	2,5%
	100V					2,2µF[+A]	K	P	2,5%

+ Specification II (all other according Specification I)

* Special chip thickness, pls. check with sales if available.

[A, B, C]: Special chip thickness A, B, C refer chip size table below

[1] Specification II and high temperature load life test is applicable in rated voltage 100%

Measuring condition:

C0G: ≤ 1nF: 1Vrms, 1MHz
> 1nF 1Vrms, 1kHz

X7S, X7R, X5R: 1V, 1kHz

C0G is below 1pF is 0,1pF, 0,2pF, 0,3pF, ... 1,0pF
after 1pF is E12 series

additionally for 0201 is 1pF to 10pF E24 series 3,5pF but no 3,6pF and 4,0pF, 5,0pF, 6,0pF, 7,0pF, 8,0pF, 9,0pF, nut not 9,1pF

additionally for 0402 100V: 4,0pF, 5,0pF, 8,0pF, 16pF, 750pF but no 1,2nF

additionally for 0603 100V: 2,4pF, 3,0pF, 3,6pF, 4,0pF, 4,3pF, 5,0pF, 6,0pF, 6,2pF, 7,0pF, 8,0pF, 9,0pF, 9,1pF, 11pF (only 0603), 16pF (only 0603), 20pF, 24pF, 30pF, 36pF, 43pF, 62pF, 75pF, 91pF, 200pF

X7R is E12

Capacitor SMD MLCC

Specification Mid and High Voltage, Specification I

Item	Specification		Test Method
	Temp. compensation type	High dielectric constant type	
Operation Temperature Range	C0G: -55 to 125°C	Capacitance change X5R : -55 to 85°C X7R/X7S : -55 to 125°C	-
Rated Voltage	Shown in the table of "Part Number & Characteristic"		The rated voltage is defined as the maximum voltage, which may be applied continuously to the capacitor.
Appearance	No defects or abnormalities		Visual inspection
Dimensions	Within the specified dimension.		Using calipers
Dielectric Strength	No defects or abnormalities.		No failure shall be observed when 250% of the rated voltage (150% for 500V, 120% for above 1KV) is applied between the terminations for 1 to 5 seconds. The charge and discharge current is less than 50mA.
Insulation Resistance (I.R.)	Rated Voltage: <200V / To apply rated voltage. Rated Voltage: <500V / To apply rated voltage. Rated Voltage: ≧500V / To apply 500V.	I.R. ≧10G or R_iC_R≧100Ω-F (whichever is smaller)	The insulation resistance shall be measured with a DC voltage not exceeding the rated voltage at 25°C and 75%RH max, and within 1 minute of charging.
Capacitance	Within the specified tolerance. X5R/X7R/X7S at 1000 hours		The capacitance/D.F. shall be measured at 25°C at the frequency and voltage shown in the tables.
Q/Dissipation Factor (D.F.)	C0G: If C≦30pF, DF≦1/(400+20C), C in pF If C >30pF, DF≦0,1%.	Shown in the table above	
Capacitance Temperature Characteristics	Capacitance change C0G within 0±30ppm/°C under operating temperature range.	Capacitance change X5R/X7R within ±15% X7S within ±22%	1.Temperature compensation type: The capacitance value at 25°C and 85°C shall be measured and calculated from the formula given below. $T.C.=(C_{85}-C_{25})/C_{25}*\Delta T*10^6$(PPM/°C 2.High dielectric constant type: The ranges of capacitance change compared with the 25°C value over the temperature ranges shall be within the specified ranges.
Termination Strength	No removal of the terminations or marking defect.		Apply a parallel force of 5N to a PCB mounted sample for 10±1sec.
Deflection (Bending Strength)	No cracking or marking defects shall occur at 1mm deflection. Capacitance change: C0G: within ±5% or ± 0,5pF. (whichever is larger) X5R, X7R, X7S within ±12,5%		Solder the capacitor to the test jig (glass epoxy boards) shown in Fig. a using a SAC305(Sn96,5Ag3,0Cu0,5) solder (then let sit for 24±2 hours for X7R). Then apply a force in the direction shown in Fig. b. The soldering shall be done with the reflow method and shall be conducted with care so that the soldering is uniform and free of defects such as heat shock.
Solderability of Termination	90% of the terminations are to be soldered evenly and continuously.		Immerse the test capacitor into a methanol solution containing rosin for 3 to 5 seconds, preheat it 150 to 180°C for 2 to 3 minutes and immerse it into SAC305(Sn96,5Ag3,0Cu0,5) solder of 245 ± 5°C for 3±1seconds.

(Unit in mm)

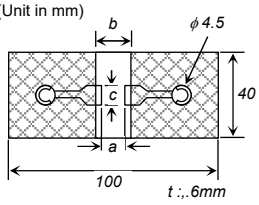


Fig. a.

T: 1,6mm (0,8mm for 0201 and 0402)

Size	a	b	C
0201	0,3	0,9	0,3
0402	0,4	1,5	0,5
0603	1,0	3,0	1,2
0805	1,2	4,0	1,65
1206	2,2	5,0	2,0
1808	3,5	7,0	2,5
1812	3,5	7,0	3,7

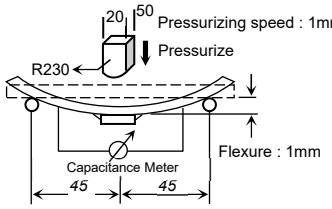


Fig. b.

Resistance to Soldering Heat	**Appearance**	No marking defects		Preheat the capacitor at 120 to 150°C for 1 minute. Immerse the capacitor in a SAC305(Sn96,5Ag3,0Cu0,5) solder solution at 270±5°C for 10±1 second. Let sit at room temperature for 24±2 hours, then measure. Preheat 150 to 200°C for size≥1206. High dielectric constant type: Initial measurement: perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24±2 hours at room temperature. Perform the initial measurement.
	Cap. Change	C0G within ±2,5% or ±0,25pF. (whichever is larger)	X5R / X7R / X7S within ±7,5%	
	Q/D.F.	If C≦30pF, DF≦1/(400+20C) If C >30pF, DF≦0,1%	To satisfy the specified initial spec.	
	I.R.	I.R.≧10.000MΩ or R_iC_R≧500Ω-F. (whichever is smaller)	I.R.≧10,000MΩ or R_iC_R≧100Ω-F. (whichever is smaller)	
Temperature Cycle (Thermal Shock)	**Appearance**	No marking defects		Solder the capacitor to supporting jig (glass epoxy board) and perform the five cycles according to the four heat treatments listed in the following table. Let sit for 24±2hrs at room temperature, then measure. Let sit for 24±2hrs at room temperature, then measure. Step 1: Minimum operating temperature 30±3min Step 2: Room temperature 2~3 min Step 3: Maximum operating temperature 30±3min Step 4: Room temperature 2~3min *High dielectric constant type: Initial measurement: Perform a heat treatment at 150±10°C for one hour and then let sit for 24±2 hours at room temp. Perform the initial measurement.
	Cap. Change	C0G within ±2,5% or 0,25pF (whichever is larger)	X5R/X7R/X7S within ±7,5%	
	Q/D.F.	If C≦30pF, DF≦1/(400+20C) If C >30pF, DF≦0,1%	To satisfy the specified initial spec.	
	I.R.	I.R.≧10.000MΩ or R_iC_R≧100Ω-F. (whichever is smaller)	I.R.≧10.000MΩ or R_iC_R≧100Ω-F. (whichever is smaller)	
Humidity load	**Appearance**	No marking defects		Apply the rated voltage (max 500V) at 40±2°C and 90 to 95% humidity for 500±12 hours. The charge / discharge current is less than 50mA. [Temperature compensation type] Remove and let sit for 24±2 hours at room temperature, then measure. [High dielectric constant type] *Initial measurement Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24±2 hours at room temperature. Perform the initial measurement. *Measurement after test Perform a heat treatment and then let sit for 24±2 hours at room temperature, then measure.
	Cap. Change	C0G within ±7,5% or ±0,75pF. (whichever is larger)	X5R / X7R / X7S within ±12,5%	
	Q/D.F.	If C>30pF, DF≦0,5% If C≦30pF, D≦1/(100+10xC/3) C in pF	X5R / X7R / X7S 200% max of initial spec.	
	I.R.	I.R.≧500MΩ or R_iC_R≧25Ω-F. (whichever is smaller)	I.R.≧500MΩ or R_iC_R≧25Ω-F. (whichever is smaller)	
High Temperature Load (Life Test)	**Appearance**	No marking defects		Apply 200% (150% for≧500V; 120% for≧1000V) of the rated voltage for 1000±12 hours at the maximum operating temperature ± 3°C. The charge / discharge current is less than 50mA. **[Temperature compensation type]** Remove and let sit for 24±2 hours at room temperature, then measure. **[High dielectric constant type]** Initial measurement Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24±2 hours at room temperature. Perform the initial measurement. Measurement after test Perform a heat treatment and then let sit for 24±2 hours at room temperature, then measure.
	Cap. Change	C0G within ±7,5% or ±0,75pF (whichever is large)	X5R / X7R / X7S within ±12,5%	
	Q/D.F.	If C>30pF, DF≦0,3% If 10pF<C≦30pF, DF≦1/(275+5xC/2) If C≦10pF, DF≦1/(200+10C), C in pF	X5R / X7R / X7S 200% max of initial spec.	
	I.R.	More than 1GΩ or R_iC_r≧50Ω-F (whichever is less.)	More than 1GΩ or R_iC_r≧50Ω-F (whichever is less.)	

Capacitor SMD MLCC

Specification Mid and High Voltage, Specification II

Item	Specification		Test Method
	Temp. compensation type	High dielectric constant type	
Operation Temperature Range	C0G: -55 to 125°C	X5R : -55 to 85°C X7R/X7S : -55 to 125°C	-
Rated Voltage	Shown in the table of "Part Number & Characteristic"		The rated voltage is defined as the maximum voltage, which may be applied continuously to the capacitor.
Appearance	No defects or abnormalities		Visual inspection
Dimensions	Within the specified dimension.		Using calipers
Dielectric Strength	No defects or abnormalities.		No failure shall be observed when 250% of the rated voltage (150% for 500V, 120% for above 1KV) is applied between the terminations for 1 to 5 seconds. The charge and discharge current is less than 50mA.
Insulation Resistance (I.R.)	C≦0,047uF: More than 10000 MΩ C> 0,047uF: More than 100Ω-F C: Nominal Capacitance		The insulation resistance shall be measured with a DC voltage not exceeding the rated voltage at 25°C and 75%RH max, and within 1 minute of charging.
Capacitance	Within the specified tolerance. X5R/X7R/X7S at 1000 hours		The capacitance/D.F. shall be measured at 25°C at the frequency and voltage shown in the tables.
Q/Dissipation Factor (D.F.)	C0G: If C≦30pF, DF≦1/(400+20C), C in pF If C >30pF, DF≦0,1%.	Shown in the table above	
Capacitance Temperature Characteristics	Capacitance change C0G within 0±30ppm/°C under operating temperature range.	Capacitance change X5R/X7R within ±15% X7S within ±22%	1.Temperature compensation type: The capacitance value at 25°C and 85°C shall be measured and calculated from the formula given below. $T.C.=(C_{85}-C_{25})/C_{25}*\Delta T*10^6$(PPM/°C 2.High dielectric constant type: The ranges of capacitance change compared with the 25°C value over the temperature ranges shall be within the specified ranges.
Termination Strength	No removal of the terminations or marking defect.		Apply a parallel force of 5N to a PCB mounted sample for 10±1sec.
Deflection (Bending Strength)	No cracking or marking defects shall occur at 1mm deflection. Capacitance change: C0G: within ±5% or ± 0,5pF. (whichever is larger) X5R, X7R, X7S within ±12,5%		Solder the capacitor to the test jig (glass epoxy boards) shown in Fig. a using a SAC305(Sn96,5Ag3,0Cu0,5) solder (then let sit for 24±2 hours for X7R). Then apply a force in the direction shown in Fig. b. The soldering shall be done with the reflow method and shall be conducted with care so that the soldering is uniform and free of defects such as heat shock.
Solderability of Termination	90% of the terminations are to be soldered evenly and continuously.		Immerse the test capacitor into a methanol solution containing rosin for 3 to 5 seconds, preheat it 150 to 180°C for 2 to 3 minutes and immerse it into SAC305(Sn96,5Ag3,0Cu0,5) solder of 245 ± 5°C for 3±1seconds.

(Unit in mm)

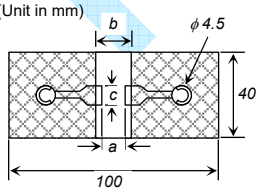


Fig. a.

T: 1,6mm (0,8mm for 0201 and 0402)

Size	a	b	C
0201	0,3	0,9	0,3
0402	0,4	1,5	0,5
0603	1,0	3,0	1,2
0805	1,2	4,0	1,65
1206	2,2	5,0	2,0
1808	3,5	7,0	2,5
1812	3,5	7,0	3,7

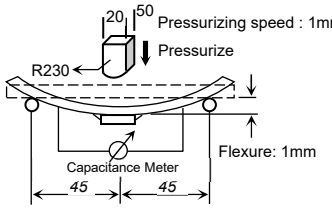


Fig. b.

Resistance to Soldering Heat	**Appearance**	No marking defects		Preheat the capacitor at 120 to 150°C for 1 minute. Immerse the capacitor in a SAC305(Sn96,5Ag3,0Cu0,5) solder solution at 270±5°C for 10±1 second. Let sit at room temperature for 24±2 hours, then measure. Preheat 150 to 200°C for size≥1206. High dielectric constant type: Initial measurement: perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24±2 hours at room temperature. Perform the initial measurement.
	Cap. Change	C0G within ±2,5% or ±0,25pF. (whichever is larger)	X5R / X7R / X7S within ±7,5%	
	Q/D.F.	If C≦30pF, DF≦1/(400+20C) If C >30pF, DF≦0,1%	To satisfy the specified initial spec.	
	I.R.	I.R.≧10.000MΩ or R_iC_R≧100Ω-F. (whichever is smaller)	I.R.≧10,000MΩ or R_iC_R≧100Ω-F. (whichever is smaller)	
Temperature Cycle (Thermal Shock)	**Appearance**	No marking defects		Solder the capacitor to supporting jig (glass epoxy board) and perform the five cycles according to the four heat treatments listed in the following table. Let sit for 24±2hrs at room temperature, then measure. Step 1: Minimum operating temperature 30±3min Step 2: Room temperature 2~3 min Step 3: Maximum operating temperature 30±3min Step 4: Room temperature 2~3min *High dielectric constant type: Initial measurement: Perform a heat treatment at 150±10°C for one hour and then let sit for 24±2 hours at room temp. Perform the initial measurement.
	Cap. Change	C0G within ±2,5% or 0,25pF (whichever is larger)	X5R / X7R / X7S within ±7,5%	
	Q/D.F.	If C≦30pF, DF≦1/(400+20C) If C >30pF, DF≦0,1%	To satisfy the specified initial spec.	
	I.R.	I.R.≧10.000MΩ or R_iC_R≧100Ω-F. (whichever is smaller)	I.R.≧10.000MΩ or R_iC_R≧100Ω-F. (whichever is smaller)	
Humidity load	**Appearance**	No marking defects		Apply the rated voltage (max 500V) at 40±2°C and 90 to 95% humidity for 500±12 hours. The charge / discharge current is less than 50mA. [Temperature compensation type] Remove and let sit for 24±2 hours at room temperature, then measure. [High dielectric constant type] *Initial measurement Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24±2 hours at room temperature. Perform the initial measurement. *Measurement after test Perform a heat treatment and then let sit for 24±2 hours at room temperature, then measure.
	Cap. Change	C0G within ±7,5% or ±0,75pF. (whichever is larger)	X5R / X7R / X7S within ±12,5%	
	Q/D.F.	If C>30pF, DF≦0,5% If C≦30pF, D≦1/(100+10xC/3) C in pF	X5R / X7R / X7S 200% max of initial spec.	
	I.R.	I.R.≧500MΩ or R_iC_R≧25Ω-F. (whichever is smaller)	I.R.≧500MΩ or R_iC_R≧25Ω-F. (whichever is smaller)	
High Temperature Load (Life Test)	**Appearance**	No marking defects		Apply 150% (120% for≧250V; 100% for≧1000V) of the rated voltage for 1000±12 hours at the maximum operating temperature ± 3°C. The charge / discharge current is less than 50mA. **[Temperature compensation type]** Remove and let sit for 24±2 hours at room temperature, then measure. **[High dielectric constant type]** Initial measurement Perform a heat treatment at 150+0/-10°C for one hour and then let sit for 24±2 hours at room temperature. Perform the initial measurement. Measurement after test Perform a heat treatment and then let sit for 24±2 hours at room temperature, then measure.
	Cap. Change	C0G within ±7,5% or ±0,75pF (whichever is large)	X5R / X7R / X7S within ±12,5%	
	Q/D.F.	If C>30pF, DF≦0,3% If 10pF<C≦30pF, DF≦1/(275+5xC/2) If C≦10pF, DF≦1/(200+10C), C in pF	X5R / X7R / X7S 200% max of initial spec.	
	I.R.	More than 1GΩ or R_iC_r≧50Ω-F (whichever is less.)	More than 1GΩ or R_iC_r≧50Ω-F (whichever is less.)	

Capacitor SMD MLCC

Special Parts

High Q and Low ESR Capacitor, C0G - Order Code "H"

Rated Voltage, Rated Capacitance and available Tolerances

Size Code	Rate Voltage /U_R	Rate Capacitance				
		C0G				
		Capacitance	Tolerance	Chip Thickness	ESR in mΩ (1GHz) (max.)	Q (1GHz) (min)
0201	50V	0,1pF	C	A	4547	350
		0,2pF	A, B, C	A	2274	350
		0,3pF	A, B, C	A	1516	350
		0,4pF	A, B, C	A	1137	350
		0,5pF	A, B, C	A	909	350
		0,6pF	A, B, C	A	758	350
		0,7pF	A, B, C	A	650	350
		0,8pF	A, B, C	A	568	350
		0,9pF	A, B, C	A	505	350
		1,0pF	A, B, C	A	455	350
		1,1pF	A, B, C	A	482	300
		1,2pF	A, B, C	A	442	300
		1,3pF	A, B, C	A	408	300
		1,4pF	A, B, C	A	379	300
		1,5pF	A, B, C	A	354	300
		1,6pF	A, B, C	A	332	300
		1,7pF	A, B, C	A	312	300
		1,8pF	A, B, C	A	295	300
		2,0pF	A, B, C	A	318	250
		2,2pF	A, B, C	A	289	250
		2,4pF	A, B, C	A	265	250
		2,5pF	A, B, C	A	255	250
		2,7pF	A, B, C	A	236	250
		3,0pF	A, B, C	A	265	200
		3,3pf	A, B, C	A	241	200
		3,6pF	A, B, C	A	221	200
		3,9pF	A, B, C	A	204	200
		4,3pF	A, B, C	A	185	200
		4,7pF	A, B, C	A	169	200
		5,0pF	B, C, D	A	177	180
		5,1pF	B, C, D	A	173	180
		5,6pF	B, C, D	A	158	180
		6,0pF	B, C, D	A	147	180
		6,2pF	B, C, D	A	143	180
		6,8pF	B, C, D	A	130	180
		7,0pF	B, C, D	A	189	120
		7,5pF	B, C, D	A	177	120
		8,2pF	B, C, D	A	162	120
		9,0pF	B, C, D	A	147	120
		9,1pF	B, C, D	A	146	120
		10pF	G, J	A	133	120
		11pF	G, J	A	138	105
		12pF	G, J	A	147	90
		13pF	G, J	A	153	80
		15pF	G, J	A	152	70
		16pF	G, J	A	166	60
		18pF	G, J	A	147	60

Size Code	Rate Voltage /U_R	Rate Capacitance				
		C0G				
		Capacitance	Tolerance	Chip Thickness	ESR in mΩ (1GHz) (max.)	Q (1GHz) (min)
		20pF	G, J	A	199	40
		22pF	F, G, J	A	207	35
	25V	0,2pF	A, B, C	A	2274	350
		0,3pF	A, B, C	A	1516	350
		0,4pF	A, B, C	A	1137	350
		0,5pF	A, B, C	A	909	350
		0,6pF	A, B, C	A	758	350
		0,7pF	A, B, C	A	650	350
		0,8pF	A, B, C	A	568	350
		0,9pF	A, B, C	A	505	350
		1,0pF	A, B, C	A	455	350
		1,1pF	A, B, C	A	482	300
		1,2pF	A, B, C	A	442	300
		1,3pF	A, B, C	A	408	300
		1,4pF	A, B, C	A	379	300
		1,5pF	A, B, C	A	354	300
		1,6pF	A, B, C	A	332	300
		1,8pF	A, B, C	A	295	300
		2,0pF	A, B, C	A	318	250
		2,2pF	A, B, C	A	289	250
		2,4pF	A, B, C	A	265	250
		2,5pF	A, B, C	A	255	250
		2,7pF	A, B, C	A	236	250
		3,0pF	A, B, C	A	265	200
		3,3pF	A, B, C	A	241	200
		3,6pF	A, B, C	A	221	200
		3,9pF	A, B, C	A	204	200
		4,3pF	A, B, C	A	185	200
		4,7pF	A, B, C	A	169	200
		5,0pF	B, C, D	A	177	180
		5,1pF	B, C, D	A	173	180
		5,6pF	B, C, D	A	158	180
		6,0pF	B, C, D	A	147	180
		6,2pF	B, C, D	A	143	180
		6,8pF	B, C, D	A	130	180
		7,0pF	B, C, D	A	189	120
		7,5pF	B, C, D	A	177	120
		8,2pF	B, C, D	A	162	120
		9,0pF	B, C, D	A	147	120
		9,1pF	B, C, D	A	146	120
		9,5pF	B, C, D	A	140	120
		10pF	G, J	A	133	120
		11pF	G, J	A	138	105
		12pF	G, J	A	147	90
		13pF	G, J	A	153	80
		15pF	G, J	A	152	70
		16pF	G, J	A	166	60
		18pF	G, J	A	147	60
		20pF	G, J	A	199	40
		22pF	F, G, J	A	207	35

Size Code	Rate Voltage /U_R	Rate Capacitance				
		C0G				
		Capacitance	Tolerance	Chip Thickness	ESR in mΩ (1GHz) (max.)	Q (1GHz) (min)
0402	100V	0,3pF	A, B, C	B	1768	300
		1,0pF	A, B, C	B	531	300
	50V	0,1pF	B	B	5305	300
		0,2pF	A, B, C	B	2653	300
		0,3pF	A, B, C	B	1768	300
		0,4pF	A, B, C	B	1326	300
		0,5pF	A, B, C	B	1061	300
		0,6pF	A, B, C	B	884	300
		0,7pF	A, B, C	B	758	300
		0,8pF	A, B, C	B	663	300
		0,9pF	A, B, C	B	589	300
		1,0pF	A, B, C	B	531	300
		1,1pF	A, B, C	B	482	300
		1,2pF	A, B, C	B	531	250
		1,3pF	A, B, C	B	490	250
		1,5pF	A, B, C	B	424	250
		1,6pF	A, B, C	B	398	250
		1,8pF	A, B, C	B	354	250
		2,0pF	A, B, C	B	398	200
		2,2pF	A, B, C	B	362	200
		2,4pF	A, B, C	B	332	200
		2,7pF	A, B, C	B	295	200
		2,9pF	A, B, C	B	274	200
		3,0pF	A, B, C	B	265	200
		3,3pf	A, B, C	B	241	200
		3,6pF	A, B, C	B	246	180
		3,9pF	A, B, C	B	227	180
		4,0pF	A, B, C	B	221	180
		4,3pF	B, C	B	206	180
		4,7pF	A, B, C	B	188	180
		5,0pF	B, C, D	B	212	150
		5,1pF	B, C, D	B	208	150
		5,6pF	B, C, D	B	189	150
		6,0pF	B, C, D	B	177	150
		6,2pF	B, C, D	B	171	150
		6,8pF	B, C, D	B	156	150
		7,0pF	B, C, D	B	227	100
		7,5pF	B, C, D	B	212	100
		8,0pF	B, C, D	B	199	100
		8,2pF	B, C, D	B	194	100
		9,0pF	B, C, D	B	177	100
		9,1pF	B, C, D	B	175	100
		9,5pF	B, C, D	B	186	90
		10pF	G, J	B	199	80
		11pF	G, J	B	207	70
		12pF	G, J	B	221	60
		15pF	F, G, J	B	265	40
		16pF	F, G, J	B	284	35
		18pF	G, J	B	295	30
		20pF	G, J	B	398	20
		22pF	G, J	B	362	20

Size Code	Rate Voltage /U_R	Rate Capacitance				
		C0G				
		Capacitance	Tolerance	Chip Thickness	ESR in mΩ (1GHz) (max.)	Q (1GHz) (min)
		35pF	B, C	B	-	180
	25V	0,5pF	B	B	1061	300
		2,0pF	B	B	398	200
		4,7pF	C	B	188	180
	16V	1,0pF	B	B	531	300
0603	250V	0,3pF	A, B, C	D	2122	250
		0,5pF	A, B, C	D	1273	250
		0,8pF	A, B, C	D	796	250
		1,0pF	A, B, C	D	637	250
		1,2pF	A, B, C	D	663	200
		1,5pF	A, B, C	D	531	200
		1,8pF	A, B, C	D	442	200
		2,0pF	A, B, C	D	531	150
		2,2pF	A, B, C	D	482	150
		2,4pF	A, B, C	D	442	150
		2,7pF	A, B, C	D	393	150
		3,0pF	A, B, C	D	531	100
		3,3pF	A, B, C	D	482	100
		3,9pF	A, B, C	D	408	100
		4,7pF	A, B, C	D	339	100
		5,1pF	A, B, C	D	347	90
		5,6pF	B, C, D	D	355	80
		6,0pF	B, C, D	D	332	80
		6,8pF	B, C, D	D	293	80
		8,2pF	B, C, D	D	277	70
		9,1pF	B, C, D	D	250	70
		10pF	J, G	D	227	70
		12pF	J	D	332	40
		15pF	J, G	D	303	35
		18pF	J, G	D	295	30
		22pF	J, G	D	289	25
	200V	1,2pF	B	D	663	200
		1,5pF	B	D	531	200
		1,8pF	B	D	442	200
		2,2pF	B	D	482	150
		2,4pF	A, B, C	D	442	150
		2,7pF	B	D	393	150
		3,0pF	B	D	531	100
		3,3pF	B	D	482	100
		3,9pF	B	D	408	100
		4,3pF	B	D	370	100
		4,7pF	A, B, C	D	339	100
		6,8pF	B	D	293	80
		8,2pF	C	D	277	70
	100V	0,3pF	A, B, C	D	2122	250
		0,5pF	A, B, C	D	1273	250
		1,0pF	A, B, C	D	637	250
		1,2pF	A, B, C	D	663	200
		1,5pF	A, B, C	D	531	200
		1,8pF	A, B, C	D	442	200
		2,0pF	A, B, C	D	531	150

Size Code	Rate Voltage /U_R	Rate Capacitance				
		C0G				
		Capacitance	Tolerance	Chip Thickness	ESR in mΩ (1GHz) (max.)	Q (1GHz) (min)
		2,2pF	A, B, C	D	482	150
		2,4pF	A, B, C	D	442	150
		2,7pF	A, B, C	D	393	150
		3,0pF	A, B, C	D	531	100
		3,3pF	A, B, C	D	482	100
		3,9pF	A, B, C	D	408	100
		4,7pF	A, B, C	D	339	100
		5,6pF	B, C, D	D	355	80
		6,0pF	B, C, D	D	332	80
		6,8pF	B, C, D	D	293	80
		8,2pF	B, C, D	D	277	70
		9,1pF	B, C, D	D	250	70
		10pF	J	D	227	70
		12pF	J	D	332	40
		15pF	J	D	303	35
		18pF	J	D	295	30
		22pF	J	D	289	25
	50V	0,2pF	A, B, C	D	3183	250
		0,3pF	A, B, C	D	2122	250
		0,5pF	A, B, C	D	1273	250
		1,0pF	A, B, C	D	637	250
		1,2pF	B, C	D	663	200
		1,5pF	B, C	D	531	200
		1,8pF	B, C	D	442	200
		2,0pF	B, C	D	531	150
		2,2pF	B, C	D	482	150
		2,4pF	B, C	D	442	150
		2,7pF	B, C	D	393	150
		3,0pF	B, C	D	531	100
		3,3pF	B, C	D	482	100
		3,9pF	B, C	D	408	100
		4,7pF	B, C	D	339	100
		5,0pF	B, C	D	354	90
		5,6pF	B, C, D	D	355	80
		6,0pF	B, C, D	D	332	80
		6,8pF	B, C, D	D	293	80
		8,2pF	B, C, D	D	277	70
		9,1pF	B, C, D	D	250	70
		10pF	J	D	227	70
		12pF	F, G, J	D	332	40
		15pF	J	D	303	35
		18pF	J	D	295	30
		22pF	J	D	289	25
0805	250V	15pF	J	4	200	53

Measuring condition:

C0G: 1Vrms, 1MHz

Comparing with popular C0G capacitor, HQ C0G capacitor take on higher Q-value and lower ESR, are ideally suited for RF and microwave application requiring high Q, low ESR, and high resonant frequency.

Capacitor SMD MLCC

Special Parts

Microwave Type, C0G - Order Code "F"

Rated Voltage, Rated Capacitance and available Tolerances

Size Code	Rate Voltage /U_R	Rate Capacitance					
		C0G					
		Capacitance	Tolerance	Chip Thickness	Testing Frequ.	ESR (1GHz) (max)	Q(1GHz) (min)
01005	25V	0,2pF	A, B, C	H	1GHz	1137	700
		0,3pF	A, B, C	H	1GHz	758	700
		0,4pF	A, B, C	H	1GHz	568	700
		0,5pF	A, B, C	H	1GHz	455	700
		0,6pF	A, B, C	H	1GHz	379	700
		0,7pF	A, B, C	H	1GHz	325	700
		0,8pF	A, B, C	H	1GHz	284	700
		0,9pF	A, B, C	H	1GHz	253	700
		1,0pF	A, B, C	H	1GHz	227	700
		1,1pF	B, C	H	1GHz	322	450
		1,2pF	B, C	H	1GHz	295	450
		1,3pF	B, C	H	1GHz	272	450
		1,5pF	B, C	H	1GHz	236	450
		1,6pF	B, C	H	1GHz	221	450
		1,8pF	B, C	H	1GHz	196	450
		2,0pF	B, C	H	1GHz	177	450
		2,2pF	B, C	H	1GHz	263	275
		2,4pF	B, C	H	1GHz	241	275
		2,5pF	B, C	H	1GHz	231	275
		2,7pF	B, C	H	1GHz	214	275
		3,0pF	B, C	H	1GHz	193	275
		3,3pF	B, C	H	1GHz	175	275
		3,6pF	B, C	H	1GHz	161	275
		3,9pF	B, C	H	1GHz	148	275
		4,3pF	B, C	H	1GHz	135	275
		4,7pF	B, C	H	1GHz	123	275
		5,6pF	B, C, D	H	1GHz	167	170
		6,0pF	B, C, D	H	1GHz	156	170
		6,2pF	B, C, D	H	1GHz	151	170
		6,8pF	B, C, D	H	1GHz	138	170
		7,0pF	B, C, D	H	1GHz	134	170
		7,5pF	B, C, D	H	1GHz	125	170
		8,2pF	B, C, D	H	1GHz	114	170
		9,1pF	B, C, D	H	1GHz	103	170
		10pF	G, J	H	1GHz	94	170
	16V	0,2pF	A, B, C	H	1GHz	1137	700
		0,3pF	A, B, C	H	1GHz	758	700
		0,4pF	A, B, C	H	1GHz	568	700
		0,5pF	A, B, C	H	1GHz	455	700
		0,6pF	A, B, C	H	1GHz	379	700
		0,7pF	A, B, C	H	1GHz	325	700
		0,8pF	A, B, C	H	1GHz	284	700
		0,9pF	A, B, C	H	1GHz	253	700
		1,0pF	A, B, C	H	1GHz	227	700
		1,1pF	B, C	H	1GHz	322	450
		1,2pF	B, C	H	1GHz	295	450
		1,3pF	B, C	H	1GHz	272	450

Size Code	Rate Voltage /U_R	Rate Capacitance					
		C0G					
		Capacitance	Tolerance	Chip Thickness	Testing Frequ.	ESR (1GHz) (max)	Q(1GHz) (min)
		1,5pF	B, C	H	1GHz	236	450
		1,6pF	B, C	H	1GHz	221	450
		1,8pF	B, C	H	1GHz	196	450
		2,0pF	B, C	H	1GHz	177	450
		2,2pF	B, C	H	1GHz	263	275
		2,4pF	B, C	H	1GHz	241	275
		2,5pF	B, C	H	1GHz	231	275
		2,7pF	B, C	H	1GHz	214	275
		3,0pF	B, C	H	1GHz	193	275
		3,3pF	B, C	H	1GHz	175	275
		3,6pF	B, C	H	1GHz	161	275
		3,9pF	B, C	H	1GHz	148	275
		4,3pF	B, C	H	1GHz	135	275
		4,7pF	B, C	H	1GHz	123	275
		5,6pF	B, C, D	H	1GHz	167	170
		6,0pF	B, C, D	H	1GHz	156	170
		6,2pF	B, C, D	H	1GHz	151	170
		6,8pF	B, C, D	H	1GHz	138	170
		7,0pF	B, C, D	H	1GHz	134	170
		7,5pF	B, C, D	H	1GHz	125	170
		8,2pF	B, C, D	H	1GHz	114	170
		9,1pF	B, C, D	H	1GHz	103	170
		10pF	G, J	H	1GHz	94	170
		12pF	G, J	H	1GHz	98	135
		15pF	G, J	H	1GHz	79	135
		18pF	G, J	H	1GHz	65	135
		20pF	G, J	H	1GHz	59	135
		22pF	G, J	H	1GHz	54	135
0201	50V	0,2pF	A, B, C	A	1GHz	1895	420
		0,3pF	A, B, C	A	1GHz	1263	420
		0,4pF	A, B, C	A	1GHz	947	420
		0,5pF	A, B, C	A	1GHz	758	420
		0,6pF	A, B, C	A	1GHz	632	420
		0,7pF	A, B, C	A	1GHz	541	420
		0,8pF	A, B, C	A	1GHz	474	420
		0,9pF	A, B, C	A	1GHz	421	420
		1,0pF	A, B, C	A	1GHz	379	420
		1,1pF	A, B, C	A	1GHz	413	350
		1,2pF	A, B, C	A	1GHz	379	350
		1,3pF	A, B, C	A	1GHz	350	350
		1,5pF	A, B, C	A	1GHz	303	350
		1,6pF	A, B, C	A	1GHz	284	350
		1,8pF	A, B, C	A	1GHz	253	350
		2,0pF	A, B, C	A	1GHz	265	300
		2,2pF	A, B, C	A	1GHz	241	300
		2,4pF	B, C	A	1GHz	221	300
		2,5pF	B, C	A	1GHz	212	300
		2,7pF	B, C	A	1GHz	196	300
		3,0pF	B, C	A	1GHz	221	240
		3,3pF	B, C	A	1GHz	201	240
		3,6pF	B, C	A	1GHz	184	240
		3,9pF	B, C	A	1GHz	170	240

Size Code	Rate Voltage /U_R	Rate Capacitance					
		C0G					
		Capacitance	Tolerance	Chip Thickness	Testing Frequ.	ESR (1GHz) (max)	Q(1GHz) (min)
		4,7pF	B, C	A	1GHz	141	240
		5,0pF	B, C, D	A	1GHz	147	216
		5,6pF	B, C, D	A	1GHz	132	216
		6,0pF	B, C, D	A	1GHz	123	216
		6,2pF	B, C, D	A	1GHz	119	216
		6,8pF	B, C, D	A	1GHz	108	216
		7,0pF	B, C, D	A	1GHz	158	144
		7,5pF	B, C, D	A	1GHz	147	144
		8,2pF	B, C, D	A	1GHz	135	144
		9,1pF	B, C, D	A	1GHz	121	144
		10pF	G, J	A	1GHz	111	144
		12pF	G, J	A	1GHz	123	108
		13pF	G, J	A	1GHz	128	96
		15pF	F, G, J	A	1GHz	126	84
		16pF	G, J	A	1GHz	138	72
		18pF	G, J	A	1GHz	123	72
		20pF	G, J	A	1GHz	159	50
		22pF	G, J	A	1GHz	181	40
		27pF	G, J	A	500MHz	196	30
		30pF	G, J	A	500MHz	212	25
		33pF	G, J	A	500MHz	241	20
	25V	0,2pF	A, B, C	A	1GHz	1895	420
		0,3pF	A, B, C	A	1GHz	1263	420
		0,4pF	A, B, C	A	1GHz	947	420
		0,5pF	A, B, C	A	1GHz	758	420
		0,6pF	A, B, C	A	1GHz	632	420
		0,7pF	A, B, C	A	1GHz	541	420
		0,8pF	A, B, C	A	1GHz	474	420
		0,9pF	A, B, C	A	1GHz	421	420
		1,0pF	A, B, C	A	1GHz	379	420
		1,1pF	A, B, C	A	1GHz	413	350
		1,2pF	A, B, C	A	1GHz	379	350
		1,3pF	A, B, C	A	1GHz	350	350
		1,4pF	A, B, C	A	1GHz	325	350
		1,5pF	A, B, C	A	1GHz	303	350
		1,6pF	A, B, C	A	1GHz	284	350
		1,8pF	A, B, C	A	1GHz	253	350
		2,0pF	A, B, C	A	1GHz	265	300
		2,2pF	A, B, C	A	1GHz	241	300
		2,4pF	B, C	A	1GHz	221	300
		2,5pF	B, C	A	1GHz	212	300
		2,7pF	B, C	A	1GHz	196	300
		3,0pF	B, C	A	1GHz	221	240
		3,3pF	B, C	A	1GHz	201	240
		3,6pF	B, C	A	1GHz	184	240
		3,9pF	B, C	A	1GHz	170	240
		4,0pF	A, B, C	A	1GHz	166	240
		4,3pF	B, C	A	1GHz	154	240
		4,7pF	B, C	A	1GHz	141	240
		5,0pF	B, C, D	A	1GHz	147	216
		5,6pF	B, C, D	A	1GHz	132	216
		6,0pF	B, C, D	A	1GHz	123	216

Size Code	Rate Voltage /U_R	Rate Capacitance					
		C0G					
		Capacitance	Tolerance	Chip Thickness	Testing Frequ.	ESR (1GHz) (max)	Q(1GHz) (min)
		6,2pF	B, C, D	A	1GHz	119	216
		6,8pF	B, C, D	A	1GHz	108	216
		7,0pF	B, C, D	A	1GHz	158	144
		7,5pF	B, C, D	A	1GHz	147	144
		8,2pF	B, C, D	A	1GHz	135	144
		9,1pF	B, C, D	A	1GHz	121	144
		10pF	G, J	A	1GHz	111	144
		12pF	G, J	A	1GHz	123	108
		13pF	G, J	A	1GHz	128	96
		15pF	G, J	A	1GHz	126	84
		16pF	G, J	A	1GHz	138	72
		18pF	G, J	A	1GHz	123	72
		20pF	G, J	A	1GHz	159	50
		22pF	G, J	A	1GHz	181	40
		24pF	G, J	A	500MHz	166	40
		27pF	G, J	A	500MHz	196	30
		33pF	G, J	A	500MHz	241	20
	6,3V	22pF	J	A	1GHz	181	40
		27pF	G, J	A	500MHz	196	30
0402	200V	0,2pF	B, C	B	1GHz	2411	330
		0,3pF	A, B, C	B	1GHz	1608	330
		0,8pF	B, C	B	1GHz	603	330
		1,0pF	A, B, C	B	1GHz	482	330
		1,2pF	A, B, C	B	1GHz	482	275
		1,5pF	B, C	B	1GHz	386	275
		1,8pF	B, C	B	1GHz	322	275
		2,2pF	B, C	B	1GHz	329	220
		2,4pF	B, C	B	1GHz	301	220
		2,7pF	A, B, C	B	1GHz	268	220
		3,3pF	A, B, C	B	1GHz	219	220
		3,9pF	A, B, C	B	1GHz	206	198
		4,3pF	A, B, C	B	1GHz	187	198
		4,7pF	A, B, C	B	1GHz	171	198
		5,1pF	B, C	B	1GHz	189	165
		5,6pF	A, B, C	B	1GHz	172	165
		6,2pF	B, C	B	1GHz	156	165
		6,8pF	A, B, C	B	1GHz	142	165
		8,2pF	A, B, C	B	1GHz	176	110
		10pF	F, G, J	B	1GHz	181	88
	100V	0,3pF	A, B, C	B	1GHz	1608	330
		0,6pF	A, B, C	B	1GHz	804	330
	50V	0,2pF	B, C	B	1GHz	2241	330
		0,3pF	A, B, C	B	1GHz	1608	330
		0,4pF	A, B, C	B	1GHz	1206	330
		0,5pF	A, B, C	B	1GHz	965	330
		0,6pF	B, C	B	1GHz	804	330
		0,7pF	A, B, C	B	1GHz	689	330
		0,8pF	A, B, C	B	1GHz	603	330
		0,9pF	B, C	B	1GHz	536	330
		1,0pF	A, B, C	B	1GHz	482	330
		1,1pF	B, C	B	1GHz	526	275

Size Code	Rate Voltage /U_R	Rate Capacitance					
		C0G					
		Capacitance	Tolerance	Chip Thickness	Testing Frequ.	ESR (1GHz) (max)	Q(1GHz) (min)
		1,2pF	B, C	B	1GHz	482	275
		1,3pF	A, B, C	B	1GHz	445	275
		1,5pF	A, B, C	B	1GHz	386	275
		1,6pF	A, B, C	B	1GHz	362	275
		1,8pF	A, B, C	B	1GHz	322	275
		2,0pF	A, B, C	B	1GHz	362	220
		2,2pF	B, C	B	1GHz	329	220
		2,4pF	A, B, C	B	1GHz	301	220
		2,7pF	A, B, C	B	1GHz	268	220
		3,0pF	B, C	B	1GHz	241	220
		3,3pF	A, B, C	B	1GHz	219	220
		3,6pF	A, B, C	B	1GHz	223	198
		3,9pF	A, B, C	B	1GHz	206	198
		4,0pF	A, B, C	B	1GHz	201	198
		4,7pF	A, B, C	B	1GHz	171	198
		5,0pF	B, C, D	B	1GHz	193	165
		5,6pF	B, C, D	B	1GHz	172	165
		6,0pF	B, C, D	B	1GHz	161	165
		6,2pF	B, C, D	B	1GHz	156	165
		6,8pF	B, C, D	B	1GHz	142	165
		7,0pF	B, C, D	B	1GHz	165	138
		7,5pF	B, C, D	B	1GHz	154	138
		8,2pF	B, C, D	B	1GHz	176	110
		9,0pF	B, C, D	B	1GHz	161	110
		9,1pF	B, C, D	B	1GHz	159	110
		10pF	F, G, J	B	1GHz	181	88
		12pF	G, J	B	1GHz	201	66
		13pF	G, J	B	1GHz	211	58
		15pF	F, G, J	B	1GHz	241	44
		16pF	G, J	B	1GHz	255	39
		18pF	G, J	B	1GHz	268	33
		20pF	F, G, J	B	1GHz	332	24
		22pF	F, G, J	B	1GHz	301	24
		24pF	G, J	B	1GHz	276	24
		27pF	G, J	B	1GHz	246	24
		30pF	F, G, J	B	1GHz	253	21
		33pF	F, G, J	B	1GHz	254	19
		39pF	G, J	B	1GHz	255	16
		47pF	F, G, J	B	1GHz	242	14
		56pF	F, G, J	B	1GHz	258	11
	25V	0,3pF	B, C	B	1GHz	1608	330
		0,5pF	B, C	B	1GHz	965	330
		1,0pF	B, C	B	1GHz	482	330
		68pF	G, J	B	1GHz	260	9
		82pF	G, J	B	1GHz	243	8
		100pF	G, J	B	1GHz	265	6
	16V	0,3pF	A, B, C	B	1GHz	1608	330
		0,8pF	A, B	B	1GHz	603	330
0603	250V	0,3pF	B, C	D	1GHz	1516	350
		0,5pF	B, C	D	1GHz	909	350
		0,8pF	B, C	D	1GHz	568	350
		0,9pF	A, B, C	D	1GHz	505	350

Size Code	Rate Voltage /U_R	Rate Capacitance					
		C0G					
		Capacitance	Tolerance	Chip Thickness	Testing Frequ.	ESR (1GHz) (max)	Q(1GHz) (min)
		1,0pF	B, C	D	1GHz	455	350
		1,2pF	B, C	D	1GHz	442	300
		1,5pF	B, C	D	1GHz	354	300
		1,8pF	B, C	D	1GHz	295	300
		2,0pF	B, C	D	1GHz	318	250
		2,2pF	B, C	D	1GHz	289	250
		2,4pF	B, C	D	1GHz	265	250
		2,7pF	B, C	D	1GHz	246	240
		3,3pF	B, C	D	1GHz	201	240
		3,9pF	B, C	D	1GHz	185	220
		4,7pF	B, C	D	1GHz	154	220
		5,1pF	B, C	D	1GHz	156	200
		5,6pF	B, C	D	1GHz	158	180
		6,0pF	B, C	D	1GHz	166	160
		6,8pF	B, C	D	1GHz	156	150
		8,2pF	B, C	D	1GHz	139	140
		9,1pF	B, C	D	1GHz	146	120
		10pF	G, J	D	1GHz	159	100
		12pF	G, J	D	1GHz	166	80
		15pF	F, G, J	D	1GHz	212	50
		18pF	F, G, J	D	1GHz	253	35
		22pF	F, G, J	D	1GHz	241	30
		82pF	G, J	D	1GHz	162	12
0805	250V	0,3pF	B, C	4	1GHz	1378	385
		0,5pF	B, C	4	1GHz	827	385
		0,6pF	B, C	4	1GHz	689	385
		0,8pF	B, C	4	1GHz	517	385
		0,9pF	B, C	4	1GHz	459	385
		1,0pF	B, C	4	1GHz	413	385
		1,2pF	A, B, C	4	1GHz	402	330
		1,5pF	A, B, C	4	1GHz	322	330
		1,8pF	B, C	4	1GHz	268	330
		2,0pF	B, C	4	1GHz	289	275
		2,2pF	A, B, C	4	1GHz	263	275
		2,4pF	B, C	4	1GHz	241	275
		2,7pF	B, C	4	1GHz	227	260
		3,3pF	B, C	4	1GHz	185	260
		3,9pF	B, C	4	1GHz	170	240
		4,7pF	B, C	4	1GHz	141	240
		5,1pF	B, C	4	1GHz	142	220
		5,6pF	B, C	4	1GHz	142	200
		6,0pF	B, C	4	1GHz	166	160
		6,8pF	B, C	4	1GHz	167	140
		8,2pF	B, C	4	1GHz	139	140
		9,1pF	B, C	4	1GHz	135	130
		10pF	F, G, J	4	1GHz	122	130
		12pF	G, J	4	1GHz	133	100
		15pF	F, G, J	4	1GHz	133	80
		18pF	F, G, J	4	1GHz	126	70
		20pF	G, J	4	1GHz	133	60
		22pF	G, J	4	1GHz	145	50
		39pF	F, G, J	4	1GHz	102	40

Capacitor SMD MLCC

Size Code	Rate Voltage /U_R	Rate Capacitance					
		C0G					
		Capacitance	Tolerance	Chip Thickness	Testing Frequ.	ESR (1GHz) (max)	Q(1GHz) (min)
		68pF	F, G, J	4	1GHz	78	30
		150pF	F, G, J	4	1GHz	59	18

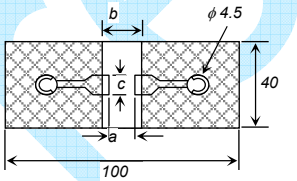
Measuring condition:

C0G: 1V, 1MHz

Capacitor SMD MLCC

Specification High Q and Low ESR Capacitor and Microwave Type

Item		Specification	Test Method
Operating Temperature Range		C0G: -55 to 125 °C	---
Rated Voltage		Shown above	The rated voltage is defined as the maximum voltage, which may be applied continuously to the capacitor.
Appearance		No defects or abnormalities.	Visual inspection
Dimensions		Within the specified dimension.	Using calipers or Microscope.
Dielectric Strength (Flash)		No defects or abnormalities.	No failure shall be observed when 250% of the rated voltage is applied between the terminations for 1 to 5 seconds. The charge and discharge current is less than 50mA.
Insulation Resistance (I.R.)		I.R.≧10GOhm	The insulation resistance shall be measured with a DC voltage not exceeding the rated voltage at 25°C and 75%RH max, and within 1 minute of charging.
Capacitance		Within the specified tolerance	The capacitance /Q shall be measured at 25°C at the frequency and voltage shown in the tables. Frequency: 1,0±0,2MHz Voltage: 1,0±0,2Vrms
Quality Factor (Q)		30pFand over: Q≧1000 30pF and below: Q≧400+20C C: Nominal Capacitance (pF)	
Capacitance Temperature Characteristics		Capacitance change within 0±30ppm/°C under operating temperature range.	The capacitance value at 25°C and 85°C shall be measured and calculated from the formula given below. T.C.=(C_{85}-C_{25})/C_{25}*ΔT*10^6(PPM/°C)
Termination Strength		No removal of the terminations or marking defect.	Apply a parallel force of 5N to a PCB mounted sample for 10±1sec. *2N for 0201.
Deflection (Bending Strength)		No cracking or marking defects shall occur at 1mm deflection. Capacitance change: COG: within ±5% or ± 0,5pF. (whichever is larger)	Solder the capacitor to the test jig (glass epoxy boards) shown in Fig. a. Using a SAC305(Sn96,5 Ag3,0 Cu0,5) solder. Then apply a force in the direction shown in Fig. b. The soldering shall be done with the reflow method and shall be conducted with care so that the soldering is uniform and free of defects such as heat shock.
Solderability of Termination		90% of the terminations are to be soldered evenly and continuously. 01005: 75% of the terminations are to be soldered evenly and continuously.	Immerse the test capacitor into a methanol solution containing rosin for 3 to 5 seconds, preheat it 150 to 180°C for 2 to 3 minutes and immerse it into SAC305 (Sn96,5 Ag3,0 Cu0,5) solder of 245 ± 5°C for 3±1seconds.
Resistance to Soldering Heat	**Appearance**	No marking defects	Immerse the capacitor in a SAC305 (Sn96,5 Ag3,0 Cu0,5) solder solution at 270±5°C for 10±1 second. Let sit at room temperature for 24±2 hours, then measure. 01005 Series not suitable for this testing
	Cap. Change	C0G within ±2,5% or ±0,25pF (whichever is larger)	
	Q	Initial spec.	
	I.R.	Initial spec.	
Temperature cycle (Thermal shock)	**Appearance**	No marking defects	Solder the capacitor to supporting jig (glass epoxy board) and perform the five cycles according to the four heat treatments listed in the following table. Let sit for 24±2hrs at room temperature, then measure.
	Cap. Change	C0G within ±2,5% or 0,25pF (whichever is larger)	
	Q	Initial spec.	



t :1,6mm (0.8mm for 01005&0201 size)
Fig. a.

Size	a	b	C
01005	0,2	0,56	0,23
0201	0,3	0,9	0,3
0402	0,4	1,5	0,5
0603	1,0	3,0	1,2

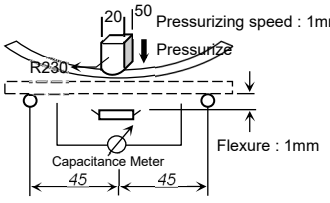


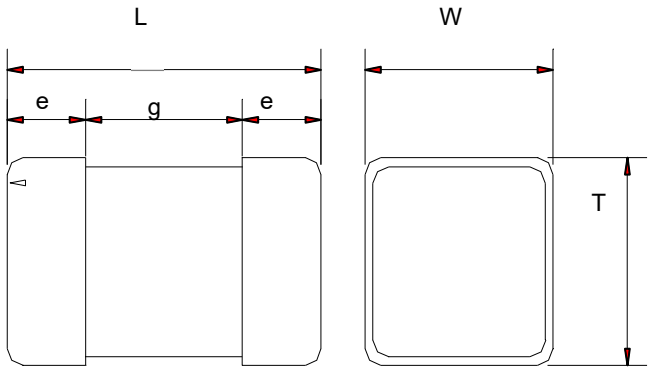
Fig. b.

	I.R.	Initial spec.	Step 1: Minimum operating temperature 30±3min Step 2: Room temperature 2~3 min Step 3: Maximum operating temperature 30±3min Step 4: Room temperature 2~3min
Humidity load	**Appearance**	No marking defects	Apply the rated voltage at 40±2°C and 90 to 95% humidity for 500±12 hours. Remove and let sit for 24±2 hours at room temperature, then measure. The charge / discharge current is less than 50mA.
	Cap. Change	C0G within ±5% or ±0,5pF (whichever is larger)	
	Q	200 min.	
	I.R.	I.R.≧500MOhm	
High temperature load life test	**Appearance**	No marking defects	Apply 200% of the rated voltage for 1000±12 hours at the maximum operating temperature ± 3°C. Let sit for 24± 2 hours at room temperature, then measure. The charge/discharge current is less than 50mA.
	Cap. Change	C0G within ±5% or ±0,5pF (whichever is larger)	
	Q	30pF and over: Q≥350 10pF and over, 30pF and below: Q≥275+5C/2 10pF and below: Q≥200+10C C: Nominal Capacitance (pF)	
	I.R.	I.R. ≥1GΩ	
ESR & Q		Shown in the table above	Testing frequency is shown in the table above

Capacitor SMD MLCC

Dimensions

Chip Size：01005, 0201, 0402,0603,0805,1206,1210,1808,1812

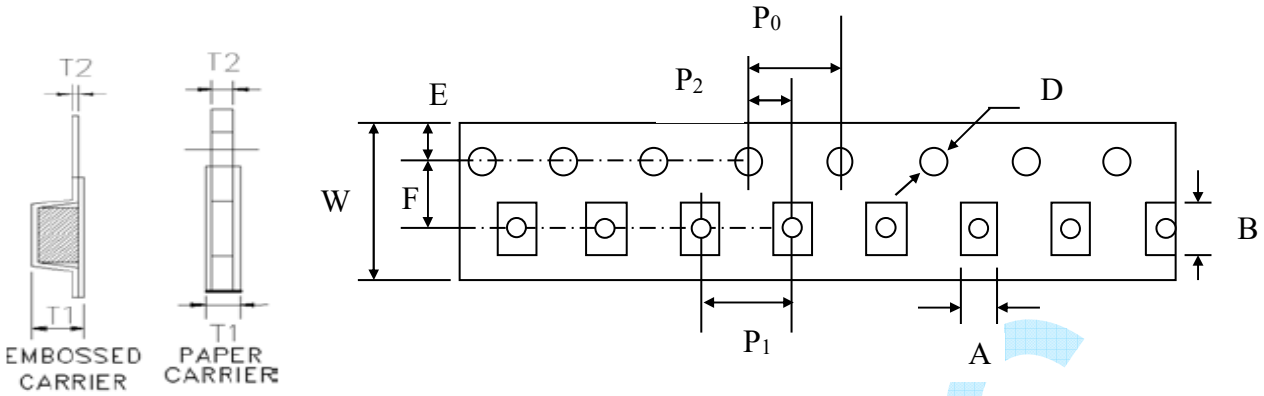


Size	L (mm)	W (mm)	e (mm)	g min (mm)	T (mm)
01005	**0,4±0,02**	**0,20±0,02**	**0,07~0,14**	**0,13**	Refer to chip thickness above
0201	**0,60±0,03**	**0,30±0,03**	**0,10~0,20**	**0,15**	
0201 Special A	0,60±0,05	0,30±0,05	0,10~0,20	0,15	
0201 Special B	0,60±0,09	0,30±0,09	0,10~0,25	0,15	
0402	**1,00±0,05**	**0,50±0,05**	**0,15~0,35**	**0,30**	
0402 Special A	1,00±0,10	0,50±0,10	0,15~0,35	0,30	
0402 Special B	1,00±0,15	0,50±0,15	0,15~0,35	0,30	
0402 Special C	1,00±0,20	0,50±0,20	0,15~0,35	0,30	
0402 Special D	1,00±0,30	0,50±0,30	0,15~0,35	0,30	
0603	**1,60±0,10**	**0,80±0,10**	**0,25~0,65**	**0,50**	
0603 Special A	1,60±0,15	0,80±0,15	0,25~0,65	0,50	
0603 Special B	1,60±0,20	0,80±0,20	0,25~0,65	0,50	
0603 Special C	1,60±0,25	0,80±0,25	0,25~0,65	0,50	
0805	**2,00±0,15**	**1,25±0,15**	**0,25~0,75**	**0,70**	
0805 (only high Voltage, C0G and >33nF)	**2,00±0,15**	**1,25±0,10**	**0,25~0,75**	**0,70**	
0805 Special A	2,00±0,20	1,25±0,20	0,25~0,75	0,70	
1206	**3,20±0,15**	**1,60±0,15**	**0,25~0,75**	**1,50**	
1206 Special A	3,20±0,20	1,60±0,20	0,25~0,75	1,50	
1206 Special B	3,20±0,30	1,60±0,30 High Voltage >1,0µF: 1,60±0,20	0,25~0,75	1,50	

1210	**3,20±0,30**	**2,50±0,20**	**0,3~0,90** High Voltage: 0,25~0,75	**1,50**	
1210 Special A	3,20±0,40	2,50±0,30	0,3~0,90	1,50	
1210 Special B	3,20±0,60	2,50±0,5	0,3~0,90	1,50	
1808	**4,60±0,30**	**2,00±0,20**	**0,25~0,75**	**1,50**	
1808 Special A	4,60+0,5 -0,3	2,00±0,30	0,25~0,75	1,50	
1808 Special B	4,60±0,40	2,00±0,30	0,25~0,75	1,50	
1812	**4,60±0,30**	**3,20±0,30**	**0,25~0,75**	**1,50**	
1812 Special A	4,60+0,5 -0,3	3,20±0,40	0,25~0,75	1,50	
1812 Special B	4,60±0,40	3,20±0,30	0,25~0,75	1,50	

Capacitor SMD MLCC

Dimensions of Carrier Tape:



Paper Carrier

Size	A	B	W	F	E	P_1	P_2	P_0	D	T1
01005	0,23±0,02	0,43±0,02	4,0±0,05	1,8±0,02	0,9±0,05	1±0,02	1±0,02	2±0,04	0,8±0,04	1,1max
0201	0,38±0,04	0,68±0,04	8,0±0,2	3,50±0,05	1,75±0,1	2,0±0,10	2,0±0,05	4,0±0,1	1,5+0,1-0,0	1,1max
0402	0,65±0,10	1,15±0,10	8,0±0,2	3,50±0,05	1,75±0,1	2,0±0,10	2,0±0,05	4,0±0,1	1,5+0,1-0,0	1,1max
0402 Special A	0,70±0,10	1,19±0,10	8,0±0,2	3,50±0,05	1,75±0,1	2,00±0,10	2,00±0,05	4,0±0,1	1,5+0,1-0,0	1,1max
0402 Special B	0,72±0,10	1,25±0,10	8,0±0,2	3,50±0,05	1,75±0,1	2,00±0,10	2,00±0,05	4,0±0,1	1,5+0,1-0,0	1,1max
0402 Special C	0,80±0,10	1,35±0,10	8,0±0,2	3,50±0,05	1,75±0,1	2,00±0,10	2,00±0,05	4,0±0,1	1,5+0,1-0,0	1,1max
0402 Special D	0,90±0,10	1,45±0,10	8,0±0,2	3,50±0,05	1,75±0,1	2,00±0,10	2,00±0,05	4,0±0,1	1,5+0,1-0,0	1,1max
0603	1,0±0,20	1,8±0,2	8,0±0,2	3,50±0,05	1,75±0,1	4,0±0,1	2,00±0,05	4,0±0,1	1,5+0,1-0,0	1,1max
0603 Special A	1,0±0,20	1,8±0,2	8,0±0,2	3,50±0,05	1,75±0,1	4,0±0,1	2,00±0,05	4,0±0,1	1,5+0,1-0,0	1,1max
0603 Special B	1,1±0,20	1,9±0,2	8,0±0,2	3,50±0,05	1,75±0,1	4,0±0,1	2,00±0,05	4,0±0,1	1,5+0,1-0,0	1,1max
0603 Special C	1,1±0,20	1,9±0,2	8,0±0,2	3,50±0,05	1,75±0,1	4,0±0,1	2,00±0,05	4,0±0,1	1,5+0,1-0,0	1,1max
0805	1,5±0,2	2,3±0,2	8,0±0,2	3,50±0,05	1,75±0,1	4,0±0,1	2,00±0,05	4,0±0,1	1,5+0,1-0,0	1,1max
1206	1,9±0,2	3,6±0,2	8,0±0,2	3,50±0,05	1,75±0,1	4,0±0,1	2,00±0,05	4,0±0,1	1,5+0,1-0,0	1,1max

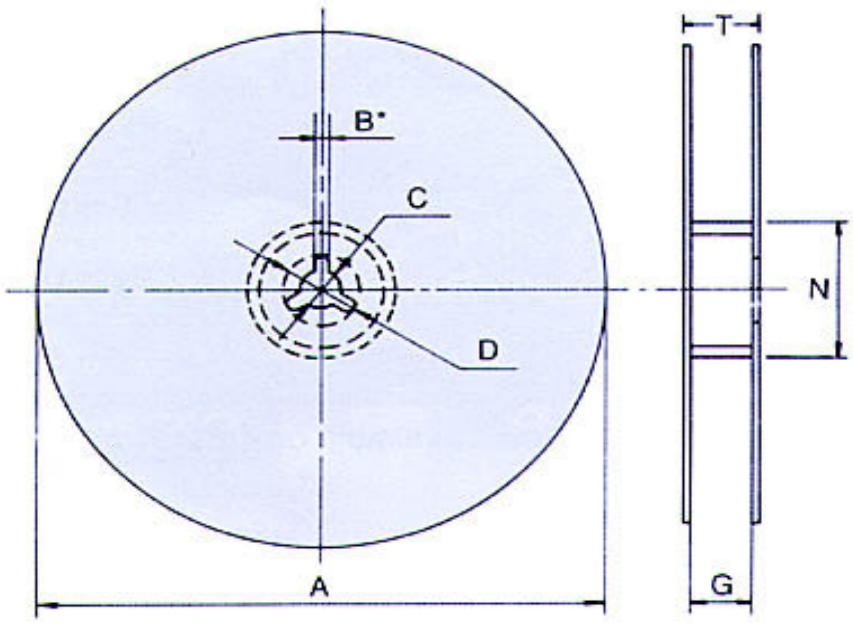
in mm

Capacitor SMD MLCC

Embossed Carrier

Size	A	B	W	F	E	P_1	P_2	P_0	D	T1	T2
01005	0,23±0,02	0,43±0,02	4±0,05	1,8±0,02	0,9±0,05	1±0,02	1±0,02	2,0±0,04	0,8±0,04	0,5max	0,15~0,40
0603	1,2±0,20	2,0±0,2	8,0±0,20	3,50±0,05	1,75±0,10	4,0±0,1	2,00±0,05	4,0±0,1	1,5+0,1-0,0	1,4max	0,25±0,1
0805	1,45±0,20	2,3±0,2	8,0±0,20	3,50±0,05	1,75±0,10	4,0±0,1	2,00±0,05	4,0±0,1	1,5+0,1-0,0	2,0max High Voltage and Microwave: 2,5max	0,30±0,1
1206	1,9±0,2	3,5±0,2	8,0±0,20	3,50±0,05	1,75±0,10	4,0±0,1	2,00±0,05	4,0±0,1	1,5+0,1-0,0	2,2max High Voltage: 2,5max	0,30±0,1
1210	2,8±0,2	3,6±0,2	8,0±0,2	3,50±0,05	1,75±0,10	4,0±0,1	2,00±0,05	4,0±0,1	1,5+0,1-0,0	3,0max High Voltage: 2,5max	0,30±0,1
1808	2,3±0,2	4,9±0,2	12,0±0,2	5,50±0,05	1,75±0,10	4,0±0,1 High Voltage: 8,0±0,1	2,00±0,05	4,0±0,1	1,5+0,1-0,0	2,5max High Voltage: 4,5max	0,30±0,1
1812	3,6±0,2	4,9±0,2	12,0±0,2	5,50±0,05	1,75±0,10	8,0±0,1	2,00±0,05	4,0±0,1	1,5+0,1-0,0	4,5max	0,30±0,1

in mm



Symbol	Reel Type / Tape	A	N	C	D	B	G	T
Dimension	7” reel for 4 mm Tape	180	50 min	13,0±0,5	21,0±0,8	2,0±0,5	5,0 ± 1,5	8,0 max
	7” reel for 8 mm Tape	180					10,0 ± 1,5	14,5 max
	10” reel for 8 mm Tape	250					10,0 ± 1,5	14,5 max
	13” reel for 8 mm Tape	330					10,0 ± 1,5	14,5 max
	7” reel for 12 mm Tape	180					14,0 ± 1,5	18,5 max

Storage:

Period of Store:

12 month and conditions for all: 5~35°C, Humidity: 45 to 70% RH, without peeling off the reel tape.

The storage atmosphere must be free of gas containing sulfur and chlorine. Also, avoid exposing the product to saline moisture. If the product is exposed to such atmospheres, the terminations will oxidize and solderability will be affected.

Circuit Design:

1. Once application and assembly environments have been checked, the capacitor may be used in conformance with the rating and performance, which are provided in both the catalog and the specifications. Exceeding the specifications listed may result in inferior performance. It may also cause a short, open, smoking, or flaming to occur, etc.

2. Please use the capacitors in conformance with the operating temperature provided in both the catalog and the specifications. Be especially cautious not to exceed the maximum temperature. In the situation the maximum temperature set forth in both the catalog and specifications is exceeded, the capacitor's insulation resistance may deteriorate, power may suddenly surge and short-circuit may occur. The loss of capacitance will occur, and may self-heat due to equivalent series resistance when alternating electric current is passed through. As this effect becomes critical in high frequency circuits, please exercise with caution. When using the capacitor in a (self-heating) circuit, please make sure the surface of the capacitor remains under the maximum temperature for usage. Also, please make certain temperature rise remain below 20℃.

3. Please keep voltage under the rated voltage, which is applied to the capacitor. Also, please make certain the peak voltage remains below the rated voltage when AC voltage is super-imposed to the DC voltage. In the situation where AC or pulse voltage is employed, ensure average peak voltage does not exceed the rated voltage. Exceeding the rated voltage provided in both catalog and specifications may lead to defective withstanding voltage or, in worse case situations, may cause the capacitor to burn out.

4. It's is a common phenomenon of high-dielectric products to have a deteriorated amount of static electricity due to the application of DC voltage.

Handling:

Chip capacitors should be handled with care to avoid contamination or damage. The use of vacuum pick-up or plastic tweezers is recommended for manual placement. Tape and reeled packages are suitable for automatic pick and placement machine.

Flux:

1. An excessive amount of flux or too rapid temperature rise can cause solvent burst, solder can generate a large quantity of gas. The gas can spread small solder particles to cause solder balling effect or bridging problem.

2. Flux containing too high of a percentage of halide may cause corrosion of termination unless sufficient cleaning is applied.

3. Use rosin-type flux. Highly acidic flux (halide content less than 0,2wt%) is not recommended.

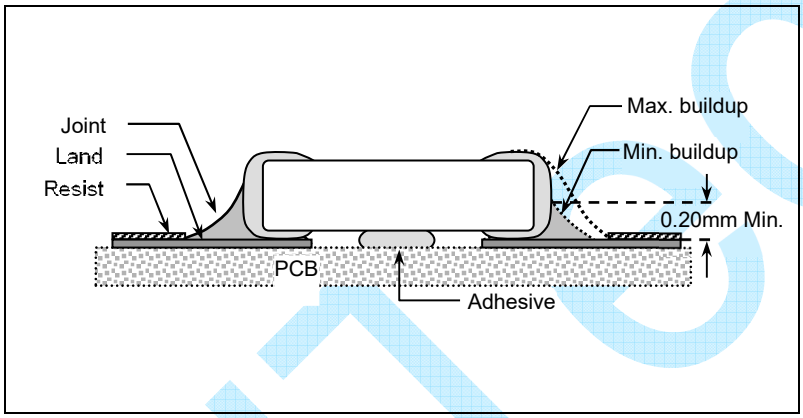
4. The water-soluble flux causes deteriorated insulation resistance between outer terminations unless sufficiently cleaned.

Component Spacing:

For wave soldering components, the spacing must be sufficient far apart to prevent bridging or shadowing. This is not so important for reflow process but enough space for rework should be considered. The suggested spacing for reflow soldering and wave soldering is 0,5mm and 1,0mm, respectively.

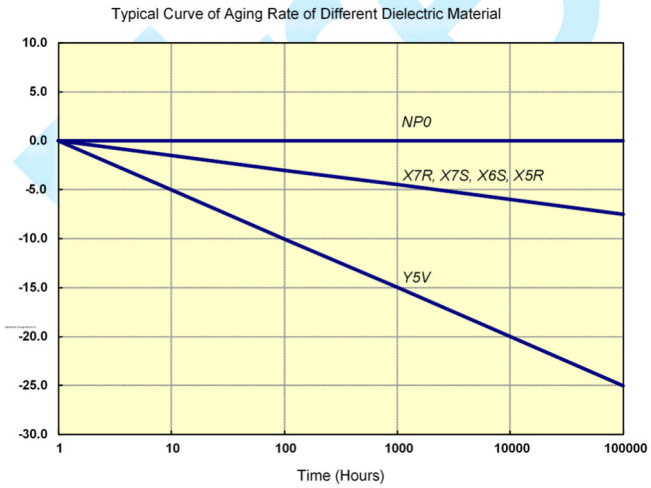
Solder Fillet:

Too much solder amount may increase solder stress and cause crack risk. Insufficient solder amount may reduce adhesive strength and cause parts falling off PCB. When soldering, confirm that the solder is placed over 0.2mm of the surface of the terminations.



Aging Rate Standard MLCC:

The capacitance and dissipation factor of class 2 capacitors decreases with time. It is known as 'aging' that follows a logarithmic low and expressed in terms of an aging constant. Aging is caused by a gradual re-alignment of the crystalline structure of the ceramic. The aging constant is defined as the percentage loss of capacitance at a 'time decade'. The law of capacitance aging is expressed as following equation:



$C_{t2} = C_{t1} \times (1 - k \times \log_{10}(t_2/t_1))$

C_{t1}: Capacitance after t1 hours of start aging.

C_{t2}: Capacitance after t2 hours of start aging.

k: aging constant (capacitance decrease per decade)

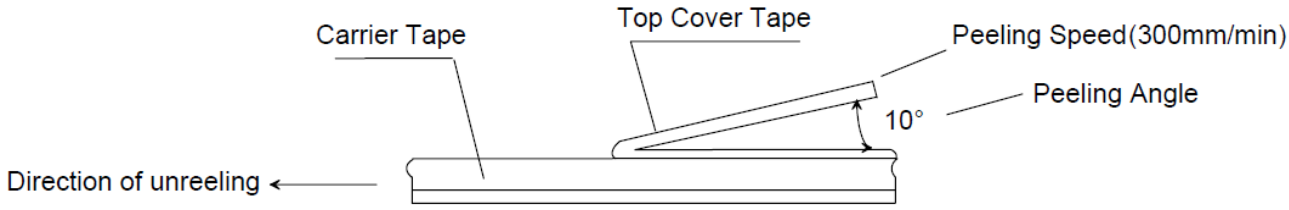
t1, t2: time in hours from start of aging.

A typical curve of aging rate is shown in following figure

When heating the capacitors above Curie temperature (130°C~150°C) the capacitance can be re-new. So capacitance of class 2 capacitors will be complete de-aged by soldering process; subsequently a new aging process begins.
Because of aging, it is specified an age for measurement to meet the prescribed tolerance for class 2 capacitors. Normally, 1000 hours (t2=1000 hrs) is defined.

Cover Tape Peel off Strength

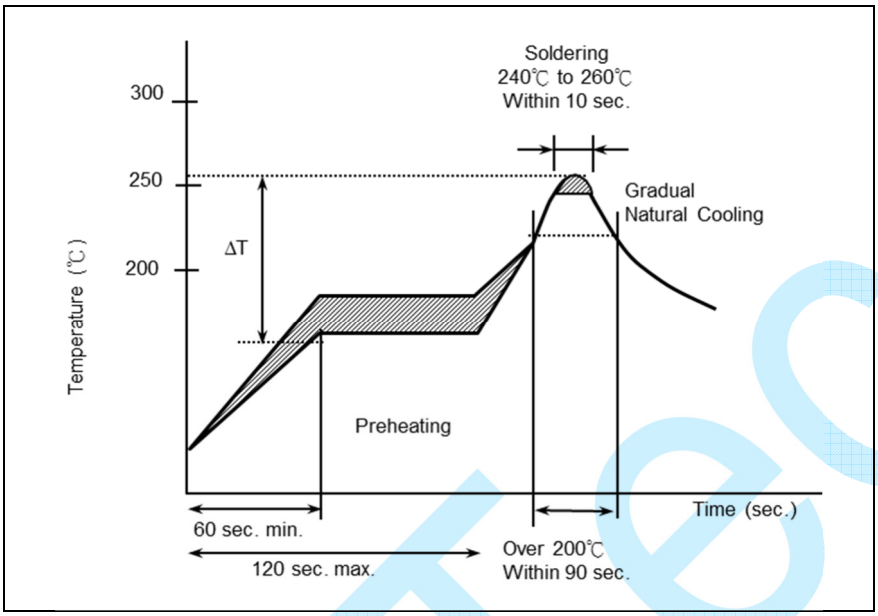
Peeling off force: 0,1N to 1,0 N
The peeling speed: 300±10 mm/min



The taped tape on reel is wound clockwise. The sprocket holes are to the right as the tape is pulled toward the user.
There are minimum 150 mm as the leader and minimum 40 mm empty tape as the tail is attached to the end of the tape.

Recommended Pb-Free soldering profile

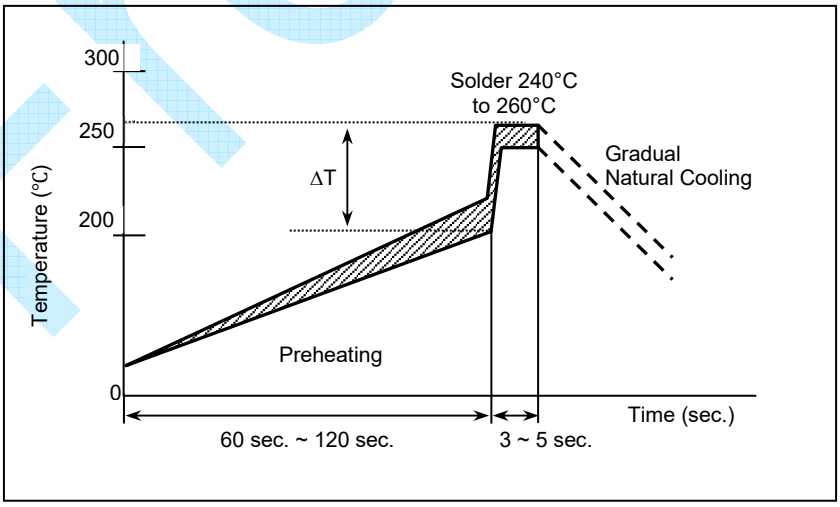
Reflow soldering



The difference between solder and chip surface should be controlled as following table. The rate of preheat should not exceed 4°C/sec and a target of 2°C/sec is preferred.

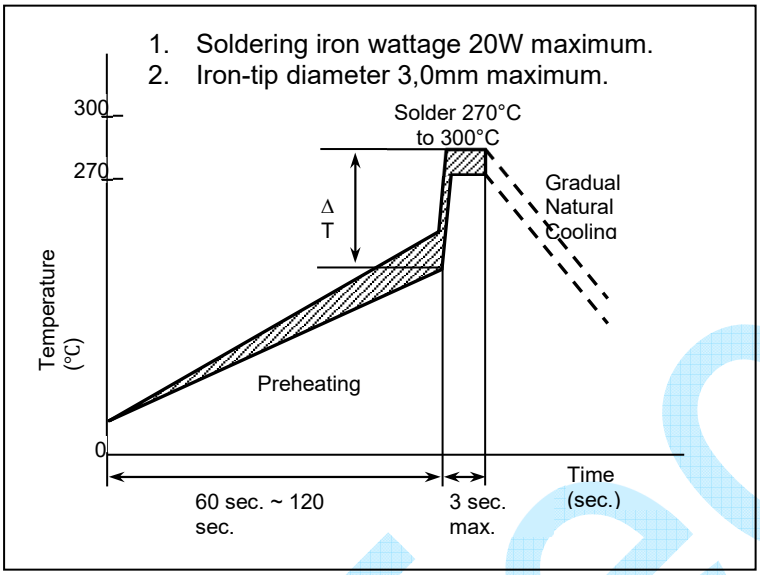
Chip Size	1206 and smaller	1210 and above
Preheating	△T ≤ 150°C	△T ≤ 130°C

Wave Soldering



Chip Size	0603 to 1206	1210 and above
Preheating	△T ≤ 150°C	-

Soldering Iron

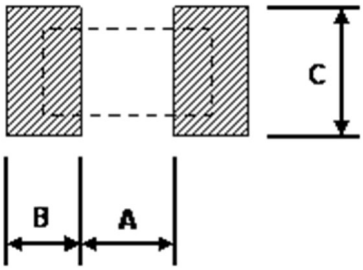


Chip Size	1206 and smaller	1210 and above
Preheating	△T ≤ 190°C	△T ≤ 130°C

Recommended Land Pattern Design:

When mounting the capacitor to substrate, it's important to consider that the amount of solder (size of fillet) used has a direct effect upon the capacitor once it's mounted.

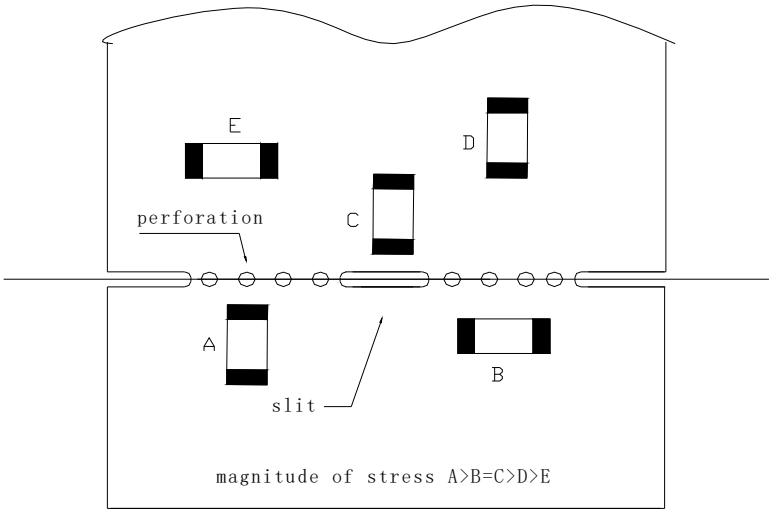
- The greater the amount of solder, the greater the stress to the elements, as this may cause the substrate to break or crack.
- In the situation where two or more devices are mounted onto a common land, separate the device into exclusive pads by using soldering resist.
- Land width equal to or less than component. It is permissible to reduce land width to 80% of component width.



Size	L x W (mm)	A (mm)	B (mm)	C (mm)
01005	0,4x0,2	0,16 to 0,20	0,12 to 0,18	0,20 to 0,23
0201	0,6x0,3 for ±0,03	0,2 to 0,35 High Q: 0,15 to 0,35	0,2 to 0,3	0,2 to 0,4 High Q: 0,25 to 0,3
	0,6x0,3 for ±0,05/±0,09	0,2 to 0,35 High Q: 0,15 to 0,35	0,2 to 0,35	0,25 to 0,4 High Q: 0,25 to 0,3
0402	1,0x0,5 for ±0,10	0,3 to 0,5	0,35 to 0,45	0,4 to 0,6 High Q: 0,4 to 0,5
	1,0x0,5 for ±0,15/±0,20	0,4 to 0,6	0,4 to 0,5	0,5 to 0,7 High Q: 0,5 to 0,6
0603	1,6x0,8 for ±0,10	0,7 to 1,0	0,6 to 0,8	0,7 to 0,8
	1,6x0,8 for ±0,15/±0,20/±0,25	0,8 to 1,1	0,7 to 0,8 High Q: 0,7 to 0,9	0,8 to 1,0 High Q: 0,8 to 0,9
0805	2,0x1,25	1,0 to 1,4	0,7 to 0,9	1,2 to 1,4
1206	3,2x1,6 for /±0,20	1,8 to 2,4	0,9 to 1,2	1,5 to 1,9
	3,2x1,6 for /±0,30	1,9 to 2,5	1,0 to 1,3	1,7 to 2,0
1210	3,2x2,5	1,8 to 2,5	1,0 to 1,2	2,0 to 2,5
1808	4,5x2,0	3,2 to 3,8	1,2 to 1,4	1,7 to 2,0
1812	4,5x3,2	3,0 to 3,5	1,4 to 1,6	2,7 to 3,5

Examples of good and bad solder application

The most preferred size is E, then D, but sizes of C, B, A are not good.



**When breaking PC boards along their perforations, the amount if mechanical stress on the capacitors can vary according to the method used. The following methods are listed in order from least stressful to most stressful: push-back, silt, -grooving, and perforation. Thus, any ideal SMD capacitor layout must also consider the PCB splitting procedure.

The good solder should be:

a) The chip should be far away from the split line edge, to minimize the mechanical stress from bending or twisting to the board;
b) The chip should be soldered parallel to the split line edge, so as to avoid the magnitude stress
c)Board splitting should not be done manually, but by using the appropriate devices.

Otherwise, chip will be easily cracked by mechanical stress and magnitude stress.

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