

High Voltage MLC Chips

For 600V to 5000V Applications

NP0 (C0G) Dielectric Performance Characteristics

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

NP0 (C0G) CAPACITANCE RANGE – PREFERRED SIZES ARE SHADED

Case Size	0805	1206	1210	1808	1812
Soldering	Reflow/Wave	Reflow/Wave	Reflow Only	Reflow Only	Reflow Only
(L) Length mm (in.)	2.10 ± 0.20 (0.085 ± 0.008)	3.30 ± 0.30 (0.130 ± 0.012)	3.30 ± 0.40 (0.130 ± 0.016)	4.60 ± 0.50 (0.181 ± 0.020)	4.60 ± 0.50 (0.177 ± 0.012)
(W) Width mm (in.)	1.25 ± 0.20 (0.049 ± 0.008)	1.60 ± 0.30/-0.10 (0.063 ± 0.012/-0.004)	2.50 ± 0.30 (0.098 ± 0.012)	2.00 ± 0.20 (0.079 ± 0.008)	3.20 ± 0.30 (0.126 ± 0.008)
(T) Thickness mm (in.)	1.35 (0.053)	1.80 (0.071)	2.80 (0.110)	2.20 (0.087)	2.80 (0.100)
(t) Terminal min max	0.50 ± 0.20 (0.020 ± 0.008)	0.60 ± 0.20 (0.024 ± 0.008)	0.75 ± 0.35 (0.030 ± 0.014)	0.75 ± 0.35 (0.030 ± 0.014)	0.75 ± 0.35 (0.030 ± 0.014)
Voltage (V)	600 630 1000	600 630 1000 1500 2000	600 630 1000 1500 2000	600 630 1000 1500 2000 2500 3000 4000	600 630 1000 1500 2000 2500 3000 4000
Cap (pF)	1.5 1R5 A A X X X X X X	1.8 1R8 A A X X X X X X	2.2 2R2 A A X X X X X X	2.7 2R7 A A X X X X X X	3.3 3R3 A A X X X X X X
	3.9 3R9 A A X X X X X X	4.7 4R7 A A X X X X X X	5.6 5R6 A A X X X X X X	6.8 6R8 A A X X X X X X	8.2 8R2 A A X X X X X X
	10 100 A A A X X X X X X X	12 120 A A A X X X X X X X	15 150 A A A X X X X X X X	18 180 A A A X X X X X X X	22 220 A A A X X X X X X X
	27 270 A A A X X X X X X X	33 330 A A A X X X X X X X	39 390 A A A X X X X X X X	47 470 A A A X X X X X X X	56 560 A A A X X X X X X X
	68 680 A A A X X X X X X X	82 820 X X X X X X X X X X	100 101 X X X X X X X X X X	120 121 C C C X X X X X X X	150 151 C C C X X X X X X X
	180 181 C C C X X X X X X X	220 221 C C C X X X X X X X	270 271 C C C X X X X X X X	330 331 C C C X X X X X X X	390 391 C C C X X X X X X X
	470 471 C C C X X X X X X X	560 561 C C C X X X X X X X	680 681 C C C X X X X X X X	750 751 C C C X X X X X X X	820 821 C C C X X X X X X X
	1000 102 E E E E E E E E E E	1200 122 E E E E E E E E E E	1500 152 E E E E E E E E E E	1800 182 E E E E E E E E E E	2200 222 E E E E E E E E E E
	2700 272 E E E E E E E E E E	3300 332 E E E E E E E E E E	3900 392 E E E E E E E E E E	4700 472 E E E E E E E E E E	5600 562 E E E E E E E E E E
	6800 682 E E E E E E E E E E	8200 822 E E E E E E E E E E	0.010 103 E E E E E E E E E E	0.012 123 F F F F F F F F F F	0.015 153 G G G G G G G G G G
	0.018 183 G G G G G G G G G G	0.022 223 G G G G G G G G G G	0.033 333 G G G G G G G G G G	0.047 473 G G G G G G G G G G	0.056 563 G G G G G G G G G G
	0.068 683 G G G G G G G G G G	0.100 104 G G G G G G G G G G	Voltage (V)	600 630 1000 1500 2000 2500 3000 4000	600 630 1000 1500 2000 2500 3000 4000
Case Size	0805	1206	1210	1808	1812

Letter	A	C	E	F	G	X	7
Max. Thickness	0.813 (0.032)	1.448 (0.057)	1.8034 (0.071)	2.2098 (0.087)	2.794 (0.110)	0.940 (0.037)	3.30 (0.130)

NOTE: Contact factory for non-specified capacitance values

For 600V to 5000V Applications

Case Size	1825								2220								2225								3640										
Soldering	Reflow Only								Reflow Only								Reflow Only								Reflow Only										
(L) Length	4.80 ± 0.50 (0.181 ± 0.020)								5.70 ± 0.50 (0.224 ± 0.020)								5.70 ± 0.50 (0.225 ± 0.010)								9.14 ± 0.25 (0.360 ± 0.010)										
(W) Width	6.30 ± 0.40 (0.248 ± 0.016)								5.00 ± 0.40 (0.197 ± 0.016)								6.30 ± 0.40 (0.250 ± 0.010)								10.2 ± 0.25 (0.400 ± 0.010)										
(T) Thickness	3.40 (0.134)								3.40 (0.134)								3.40 (0.100)								2.54 (0.100)										
(t) Terminal	0.75 ± 0.35 (0.030 ± 0.014)								0.85 ± 0.35 (0.033 ± 0.014)								0.85 ± 0.35 (0.033 ± 0.014)								0.76 (0.030) 1.52 (0.060)										
Voltage (V)	600	630	1000	1500	2000	2500	3000	4000	600	630	1000	1500	2000	2500	3000	4000	5000	600	630	1000	1500	2000	2500	3000	4000	5000	600	630	1000	1500	2000	2500	3000	4000	5000
Cap (pF)	1.5 1R5																																		
	1.8 1R8																																		
	2.2 2R2																																		
	2.7 2R7																																		
	3.3 3R3																																		
	3.9 3R9																																		
	4.7 4R7																																		
	5.6 5R6																																		
	6.8 6R8																																		
	8.2 8R2																																		
	10 100	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	F	F								
	12 120	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	F	F								
	15 150	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	F	F	F								
	18 180	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	F	F	F								
	22 220	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	F	F	F								
	27 270	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	F	F	F								
	33 330	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	F	F	F								
	39 390	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	F	F	F								
	47 470	E	E	E	E	E	E	F	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	F	G									

Letter	A	C	E	F	G	X	7
Max. Thickness	0.813 (0.032)	1.448 (0.057)	1.8034 (0.071)	2.2098 (0.087)	2.794 (0.110)	0.940 (0.037)	3.30 (0.130)

NOTE: Contact factory for non-specified capacitance values

High Voltage MLC Chips

For 600V to 5000V Applications

X7R Dielectric

Performance Characteristics

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

X7R CAPACITANCE RANGE – PREFERRED SIZES ARE SHADED

Case Size		0805			1206					1210					1808							1812								
Soldering		Reflow/Wave			Reflow/Wave					Reflow Only					Reflow Only							Reflow Only								
(L) Length	mm (in.)	2.10 ± 0.20 (0.085 ± 0.008)			3.30 ± 0.30 (0.130 ± 0.012)					3.30 ± 0.40 (0.130 ± 0.016)					4.60 ± 0.50 (0.181 ± 0.020)							4.60 ± 0.50 (0.177 ± 0.012)								
(W) Width	mm (in.)	1.25 ± 0.20 (0.049 ± 0.008)			1.60 +0.30/-0.10 (0.063 +0.012/-0.004)					2.50 ± 0.30 (0.098 ± 0.012)					2.00 ± 0.20 (0.079 ± 0.008)							3.20 ± 0.30 (0.126 ± 0.008)								
(T) Thickness	mm (in.)	1.35 (0.053)			1.80 (0.071)					2.80 (0.110)					2.20 (0.087)							2.80 (0.100)								
(t) Terminal	min max	0.50 ± 0.20 (0.020 ± 0.008)			0.60 ± 0.20 (0.024 ± 0.008)					0.75 ± 0.35 (0.030 ± 0.014)					0.75 ± 0.35 (0.030 ± 0.014)							0.75 ± 0.35 (0.030 ± 0.014)								
Voltage (V)		600	630	1000	600	630	1000	1500	2000	600	630	1000	1500	2000	600	630	1000	1500	2000	2500	3000	4000	600	630	1000	1500	2000	2500	3000	4000
Cap (pF)	100	101	X	X	C	C	C	E	E	E	E	E	E	E																
	120	121	X	X	C	C	C	E	E	E	E	E	E	E																
	150	151	X	X	C	C	C	E	E	E	E	E	E	E																
	180	181	X	X	C	C	C	E	E	E	E	E	E	E																
	220	221	X	X	C	C	C	E	E	E	E	E	E	E																
	270	271	X	X	C	C	C	E	E	E	E	E	E	E									E	E	E	E	E			
	330	331	X	X	C	C	C	E	E	E	E	E	E	E	E	E	E	E	E	E	E	F		E	E	E	E	E		
	390	391	X	X	C	C	C	E	E	E	E	E	E	E	E	E	E	E	E	F			E	E	E	E	E			
	470	471	X	X	C	C	C	E	E	E	E	E	E	E	E	E	E	E	E	F			E	E	E	E	E	E	E	
	560	561	X	X	C	C	C	E	E	E	E	E	E	E	E	E	E	E	E	F	F		E	E	E	E	E	E	E	
	680	681	X	X	C	C	C	E	E	E	E	E	E	E	E	E	E	E	E	F	F		E	E	E	E	E	F	F	
	750	751	X	X	C	C	C	E	E	E	E	E	E	E	E	E	E	E	E	F	F		E	E	E	E	E	F	F	
	820	821	X	X	C	C	C	E	E	E	E	E	E	E	E	E	E	E	E	F	F		E	E	E	E	E	F	F	
	1000	102	X	X	X	C	C	E	E	E	E	E	E	E	E	E	E	E	E	F	F		E	E	E	E	E	F	F	
	1200	122	X	X	X	C	C	E	E	E	E	E	E	E	E	E	E	E	E	F	F		E	E	E	E	E	F	F	
	1500	152	X	X	X	C	C	E	E	E	E	E	E	E	E	E	E	E	E	F	F		E	E	E	E	E	G	G	
	1800	182	X	X	X	C	C	E	E	E	E	E	E	E	E	E	E	E	E	F	F		E	E	E	E	E	G	G	
	2200	222	X	X	X	C	C	E	E	E	E	E	E	F	E	E	E	E	F	F	F		E	E	E	E	E	G	G	
	2700	272	C	C		C	C	E	E		E	E	E	F	E	E	E	E	F	F			E	E	E	E	E	G	G	
	3300	332	C	C		C	C	E			E	E	E	F	E	E	E	E	F	F			E	E	E	F	F	G	G	
	3900	392	C	C		C	C	E			E	E	E	F		E	E	E	F				E	E	E	F	F	G	G	
	4700	472	C	C		C	C	E			E	E	E	F		E	E	E	F				E	E	E	F	F	G	G	
	5600	562	C	C		C	C	E			E	E	E	F		E	E	E	F				E	E	E	G	G	G		
	6800	682	C	C		C	C	E			E	E	E			E	E	E	F				E	E	E	G	G			
	8200	822	C	C		C	C	E			E	E	E			E	E	E					E	E	E	G	G			
Cap (µF)	0.010	103	C	C		C	C	E			E	E	E			E	E	E					E	E	F	G	G			
	0.015	153	C	C		E	E	E			E	E	E			F	F	F					E	E	F	G				
	0.018	183	C	C		E	E				E	E	E			F	F	F					E	E	G					
	0.022	223	C	C		E	E				E	E	F			F	F						E	E	G					
	0.027	273				E	E				E	E				F	F						E	E	G					
	0.033	333				E	E				E	E				F	F						E	E	G					
	0.039	393									E	E				F	F						E	E	G					
	0.047	473									E	E				F	F						E	E	G					
	0.056	563									F	F				F	F						F	F						
	0.068	683									F	F				F	F						F	F						
	0.082	823									F	F											F	F						
	0.100	104									F	F											F	F						
	0.150	154																					G	G						
	0.220	224																					G	G						
	0.270	274																												
	0.330	334																												
	0.390	394																												
	0.470	474																												
	0.560	564																												
	0.680	684																												
	0.820	824																												
	1.000	105																												
Voltage (V)		600	630	1000	600	630	1000	1500	2000	600	630	1000	1500	2000	600	630	1000	1500	2000	2500	3000	4000	600	630	1000	1500	2000	2500	3000	4000
Case Size		0805			1206					1210					1808							1812								

Letter	A	C	E	F	G	X	7
Max. Thickness	0.813 (0.032)	1.448 (0.057)	1.8034 (0.071)	2.2098 (0.087)	2.794 (0.110)	0.940 (0.037)	3.30 (0.130)

NOTE: Contact factory for non-specified capacitance values

High Voltage MLC Chips

For 600V to 5000V Applications

X7R CAPACITANCE RANGE PREFERRED SIZES ARE SHADED

Case Size		1825								2220								2225								3640										
Soldering		Reflow Only								Reflow Only								Reflow Only								Reflow Only										
(L) Length	mm (in.)	4.60 ± 0.50 (0.181 ± 0.020)								5.70 ± 0.50 (0.224 ± 0.020)								5.70 ± 0.50 (0.225 ± 0.010)								9.14 ± 0.25 (0.360 ± 0.010)										
(W) Width	mm (in.)	6.30 ± 0.40 (0.248 ± 0.016)								5.00 ± 0.40 (0.197 ± 0.016)								6.30 ± 0.40 (0.250 ± 0.010)								10.2 ± 0.25 (0.400 ± 0.010)										
(T) Thickness	mm (in.)	3.40 (0.134)								3.40 (0.134)								3.40 (0.100)								2.54 (0.100)										
(t) Terminal	min max	0.75 ± 0.35 (0.030 ± 0.014)								0.85 ± 0.35 (0.033 ± 0.014)								0.85 ± 0.35 (0.033 ± 0.014)								0.76 (0.030) 1.52 (0.060)										
Voltage (V)		600	630	1000	1500	2000	2500	3000	4000	600	630	1000	1500	2000	2500	3000	4000	5000	600	630	1000	1500	2000	2500	3000	4000	5000	600	630	1000	1500	2000	2500	3000	4000	5000
Cap (pF)		100	101																																	
		120	121																																	
		150	151																																	
		180	181																																	
		220	221																																	
		270	271																																	
		330	331																																	
		390	391																																	
		470	471																																	
		560	561																																	
		680	681																																	
		750	751																																	
		820	821																																	
		1000	102	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	G	G	G	G	G	G	G	G		
		1200	122	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	G	G	G	G	G	G	G	G		
		1500	152	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	G	G	G	G	G	G	G	G		
		1800	182	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	G	G	G	G	G	G	G	G		
		2200	222	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	G	G	G	G	G	G	G	G		
		2700	272	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	G	G	G	G	G	G	G	G		
		3300	332	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	G	G	G	G	G	G	G	G		
		3900	392	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	G	G	G	G	G	G	G	G		
		4700	472	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	G	G	G	G	G	G	G	G		
		5600	562	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	G	G	G	G	G	G	G	G		
		6800	682	F	F	F	G	G	G	G	G	G	G	G	G	G	G	G	F	F	F	F	F	F	F	G	G	G	G	G	G	G	G	G		
		8200	822	F	F	F	G	G	G	G	G	G	G	G	G	G	G	G	F	F	F	F	F	F	F	G	G	G	G	G	G	G	G	G		
Cap (µF)		0.010	103	F	F	F	G	G	G	G	G	G	G	G	G	G	G	F	F	F	F	F	F	F	G	G	G	G	G	G	G	G	G	G		
		0.015	153	F	F	F	G	G	G	G	G	G	G	G	G	G	G	F	F	F	F	F	F	F	G	G	G	G	G	G	G	G	G	G		
		0.018	183	F	F	F	G	G	G	G	G	G	G	G	G	G	G	F	F	F	F	F	F	F	G	G	G	G	G	G	G	G	G	G		
		0.022	223	F	F	F	G	G	G	G	G	G	G	G	G	G	G	F	F	F	F	F	F	F	G	G	G	G	G	G	G	G	G	G		
		0.027	273	F	F	F	G	G	G	G	G	G	G	G	G	G	G	F	F	F	F	F	F	F	G	G	G	G	G	G	G	G	G	G		
		0.033	333	F	F	F	G	G	G	G	G	G	G	G	G	G	G	F	F	F	F	F	F	F	G	G	G	G	G	G	G	G	G	G		
		0.039	393	F	F	F	G	G	G	G	G	G	G	G	G	G	G	F	F	F	F	F	F	F	G	G	G	G	G	G	G	G	G	G		
		0.047	473	F	F	F	P	G	G	G	G	G	G	G	G	G	G	F	F	F	F	F	F	F	G	G	G	G	G	G	G	G	G	G		
		0.056	563	F	F	F	G	G	G	G	G	G	G	G	G	G	G	F	F	F	F	F	F	F	G	G	G	G	G	G	G	G	G	G		
		0.068	683	F	F	G	G	G	G	G	G	G	G	G	G	G	G	F	F	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G		
		0.082	823	F	F	G	G	G	G	G	G	G	G	G	G	G	G	F	F	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G		
		0.100	104	F	F	G	G	G	G	G	G	G	G	G	G	G	G	F	F	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G		
		0.150	154	F	F	G	G	G	G	G	G	G	G	G	G	G	G	F	F	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G		
		0.220	224	F	F	G	G	G	G	G	G	G	G	G	G	G	G	F	F	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G		
		0.270	274	F	F	G	G	G	G	G	G	G	G	G	G	G	G	F	F	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G		
		0.330	334	F	F	G	G	G	G	G	G	G	G	G	G	G	G	F	F	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G		
		0.390	394	F	F	G	G	G	G	G	G	G	G	G	G	G	G	F	F	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G		
		0.470	474	F	F	G	G	G	G	G	G	G	G	G	G	G	G	F	F	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G		
		0.560	564	G	G	G	G	G	G	G	G	G	G	G	G	G	G	F	F	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G		
		0.680	684															G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G		
		0.820	824															G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G		
		1.000	105															G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G		
Voltage (V)		600	630	1000	1500	2000	2500	3000	4000	600	630	1000	1500	2000	2500	3000	4000	5000	600	630	1000	1500	2000	2500	3000	4000	5000	600	630	1000	1500	2000	2500	3000	4000	5000
Case Size		1825								2220								2225								3640										

Letter	A	C	E	F	G	X	7
Max. Thickness	0.813 (0.032)	1.448 (0.057)	1.8034 (0.071)	2.2098 (0.087)	2.794 (0.110)	0.940 (0.037)	3.30 (0.130)

NOTE: Contact factory for non-specified capacitance values