

DATA SHEET

Class 2, X7R
16/25/50/100/200/500 V
Surface-mount ceramic
multilayer capacitors

Product specification
Supersedes data of 30th November 2000
File under Discrete Ceramics, ACM2

2001 Mar 08 Rev.4

Surface-mount ceramic
multilayer capacitors

Class 2, X7R 16/25/50/100/200/500 V

FEATURES

- Six standard sizes
- High capacitance per unit volume
- Supplied in tape on reel or in bulk case
- NiSn terminations.

APPLICATIONS

- Consumer electronics, for example:
 - Tuners
 - Television receivers
 - Video recorders
 - All types of cameras
- Telecommunications
- Automotive
- Data processing.

DESCRIPTION

The capacitor consists of a rectangular block of ceramic dielectric in which a number of interleaved nickel electrodes are contained. This structure gives rise to a high capacitance per unit volume.

The inner electrodes are connected to the two copper terminations, coated with a barrier layer of plated nickel and finally covered with a layer of plated tin (NiSn). A cross section of the structure is shown in Fig.1.

QUICK REFERENCE DATA

DESCRIPTION	VALUE
Rated voltage U_R (DC)	16 V, 25 V, 50 V, 100 V, 200 V and 500 V (IEC)
Capacitance range (E6 series):	
16 V	6.8 nF to 1000 nF
25 V	3.3 nF to 470 nF
50 V	100 pF to 1000 nF
100 V	220 pF to 470 nF
200 V	220 pF to 100 nF
500 V	470 pF to 15 nF
Tolerance on capacitance	$\pm 10\%$; $\pm 5\%$
Test voltage (DC) for 1 minute:	
16 V, 25 V, 50 V and 100 V	$2.5 \times U_R$
200 V	$3 \times U_R$
500 V	$2 \times U_R$
Sectional specifications	IEC 60384-10, second edition 1989-04; also based on CECC 32 100
Detailed specification	based on CECC 32 101-801
Climatic category (IEC 60068)	55/125/56

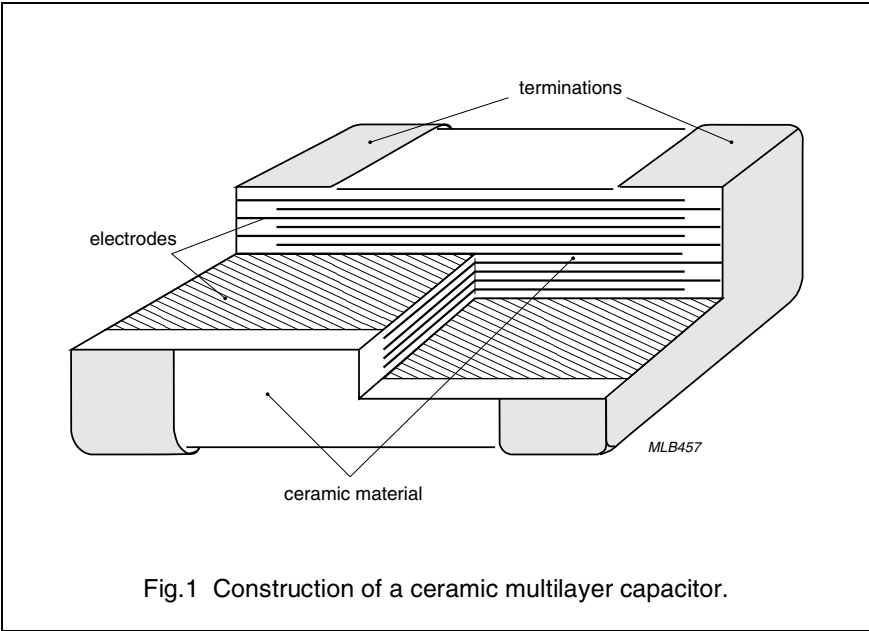
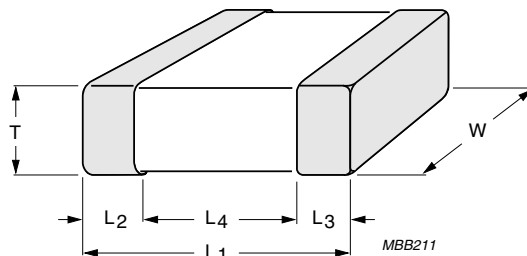


Fig.1 Construction of a ceramic multilayer capacitor.

Surface-mount ceramic multilayer capacitors

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MECHANICAL DATA



For dimensions see Table 1.

Fig.2 Component outline.

Physical dimensions

Table 1 Capacitor dimensions

CASE SIZE	L ₁	W	T		L ₂ and L ₃		L ₄ MIN.
			MIN.	MAX.	MIN.	MAX.	
Dimensions in millimetres							
0402	1.0 ±0.05	0.5 ±0.05	0.45	0.55	0.20	0.30	0.40
0603	1.6 ±0.10	0.8 ±0.07	0.73	0.87	0.25	0.65	0.40
0805	2.0 ±0.10	1.25 ±0.10	0.50	1.35	0.25	0.75	0.55
1206	3.2 ±0.15	1.6 ±0.15	0.50	1.75	0.25	0.75	1.40
1210	3.2 ±0.20	2.5 ±0.20	0.50	1.80	0.25	0.75	1.40
1812	4.5 ±0.20	3.2 ±0.20	0.50	1.80	0.25	0.75	2.20
Dimensions in inches							
0402	0.040 ±0.002	0.020 ±0.002	0.018	0.022	0.008	0.012	0.016
0603	0.063 ±0.004	0.032 ±0.003	0.029	0.035	0.010	0.026	0.016
0805	0.079 ±0.004	0.049 ±0.004	0.020	0.053	0.010	0.030	0.022
1206	0.126 ±0.006	0.063 ±0.006	0.020	0.069	0.010	0.030	0.056
1210	0.126 ±0.008	0.098 ±0.008	0.020	0.072	0.010	0.030	0.056
1812	0.177 ±0.008	0.126 ±0.008	0.020	0.072	0.010	0.030	0.088

Surface-mount ceramic multilayer capacitors

Class 2, X7R 16 V and 25 V

SELECTION CHART FOR 16 V AND 25 V

C (nF)	LAST TWO DIGITS OF 12NC	16 V				25 V				
		0402	0603	0805	1206	0402	0603	0805	1206	1210
3.3	29					0.5 ±0.05				
4.7	32									
6.8	34									
10	36	0.5 ±0.05								
15	38						0.8 ±0.07	0.6 ±0.1		
22	41									
33	43									
47	45		0.8 ±0.07	0.6 ±0.1						
68	47							0.85 ±0.1		
100	49									
150	52			0.85 ±0.1					0.85 ±0.1	
220	54									0.5 to 1.0
330	56			1.25 ±0.1	0.85 ±0.1				1.15 ±0.1	
470	58									0.9 to 1.3
680	61				1.15 ±0.1					
1000	63									

Note

- Values in shaded cells indicate thickness class.

Thickness classification and packing quantities

THICKNESS CLASSIFICATION (mm)	8 mm TAPE WIDTH QUANTITY PER REEL				QUANTITY PER BULK CASE		
	Ø180 mm; 7"		Ø330 mm; 13"				
	PAPER	BLISTER	PAPER	BLISTER	0402	0603	0805
0.5 ±0.05	10000	–	50000	–	50000	–	–
0.6 ±0.1	4000	–	20000	–	–	–	10000
0.85 ±0.1	4000	–	15000	–	–	–	8000
0.5 to 1.0	–	4000	–	10000	–	–	–
0.8 ±0.07	4000	–	15000	–	–	15000	–
0.9 to 1.3	–	3000	–	10000	–	–	–
1.15 ±0.1	–	3000	–	10000	–	–	–
1.25 ±0.1	–	3000	–	10000	–	–	5000

Surface-mount ceramic
multilayer capacitors

Class 2, X7R 16 V and 25 V

ORDERING INFORMATION FOR 16 V AND 25 V

Clear text code (preferred)

Example: 08052R104K8BB0D

SIZE CODE	TEMP. CHAR.	CAPACITANCE	TOL.	VOLTAGE	TERMINATION	PACKING	MARKING	SERIES
0402	2R = X7R	104 = 100000 pF;	J = ±5%	7 = 16 V	B = NiSn	2 = 180 mm; 7" paper	0 = no marking	D = BME
0603		the third digit	K = ±10%	8 = 25 V		3 = 330 mm; 13" paper		
0805		signifies the				B = 180 mm; 7" blister		
1206		multiplying factor:				F = 330 mm; 13" blister		
1210		2 = × 100				P = bulk case		
		3 = × 1000						
		4 = × 10000						
		5 = × 100000						

Ordering code 12NC

2 2 X X X X X X 5 X X X

Carrier type

22 blister

38 paper

54 bulk

Rated voltage - Termination

78 16 V; NiSn

91 25 V; NiSn

Size

7 0402

6 0603

0 0805

1 1206

2 1210

Capacitance value⁽¹⁾

Tolerance

5 ±5%

6 ±10%

Packaging⁽²⁾

1 reel: Ø180 mm; 7"

5 reel: Ø330 mm; 13"

4 bulk case

CCA611

(1) Refer to chapter "Selection chart for 16 V and 25 V".

(2) quantity on reel depends on thickness classification, see section "Thickness classification and packing quantities".

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Class 2, X7R 50 V

SELECTION CHART FOR 50 V

C (pF)	LAST TWO DIGITS OF 12NC	50 V					
		0402	0603	0805	1206	1210	1812
100	09						
150	12						
220	14						
330	16						
470	18	0.5 ±0.05					
680	21						
1000	23		0.8 ±0.07				
1500	25			0.6 ±0.1			
2200	27						
3300	29				0.85 ±0.1		
4700	32						
6800	34						
10000	36						
15000	38						
22000	41						
33000	43			0.85 ±0.1		0.5 to 1.0	
47000	45						
68000	47			1.25 ±0.1			
100000	49						
150000	52				1.15 ±0.1		
220000	54					0.9 to 1.3	0.9 to 1.3
330000	56						
470000	58						
680000	61						
1000000	63						1.2 to 1.75

Note

1. Values in shaded cells indicate thickness class.

Thickness classification and packing quantities

THICKNESS CLASSIFICATION (mm)	8 mm TAPE WIDTH QUANTITY PER REEL				12 mm TAPE WIDTH QUANTITY PER REEL	QUANTITY PER BULK CASE		
	Ø180 mm; 7"		Ø330 mm; 13"		Ø180 mm; 7" BLISTER			
	PAPER	BLISTER	PAPER	BLISTER	1812	0402	0603	0805
0.5 ±0.05	10000	–	50000	–	–	50000	–	–
0.6 ±0.1	4000	–	20000	–	–	–	–	10000
0.85 ±0.1	4000	–	15000	–	–	–	–	8000
0.5 to 1.0	–	4000	–	10000	–	–	–	–
0.8 ±0.07	4000	–	15000	–	–	–	15000	–
0.9 to 1.3	–	3000	–	10000	1500	–	–	–
1.15 ±0.1	–	3000	–	10000	–	–	–	–
1.25 ±0.1	–	3000	–	10000	–	–	–	5000
1.2 to 1.75	–	–	–	–	1000	–	–	–

Surface-mount ceramic
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Class 2, X7R 50 V

ORDERING INFORMATION FOR 50 V

Clear text code (preferred)

EXAMPLE: 08052R104K9BB0D

SIZE CODE	TEMP. CHAR.	CAPACITANCE	TOL.	VOLTAGE	TERMINATION	PACKING	MARKING	SERIES
0402 0603 0805 1206 1210 1812	2R = X7R	104 = 100 000 pF; the third digit signifies the multiplying factor: 1 = × 10 2 = × 100 3 = × 1000 4 = × 10 000 5 = × 100 000	J = ±5% K = ±10%	9 = 50 V	B = NiSn	2 = 180 mm; 7" paper 3 = 330 mm; 13" paper B = 180 mm; 7" blister F = 330 mm; 13" blister P = bulk case	0 = no marking	D = BME

Ordering code 12NC

2 2 X X X X X X 5 X X X

Carrier type

22 blister
38 paper
54 bulk

Rated voltage - Termination

58 50 V; NiSn

Size

7 0402
6 0603
0 0805
1 1206
2 1210
4 1812

Capacitance value⁽¹⁾

Tolerance

5 ±5%
6 ±10%

Packaging⁽²⁾

1 reel: Ø180 mm; 7"
5 reel: Ø330 mm; 13"
4 bulk case

CCA612

(1) Refer to chapter "Selection chart for 50 V".

(2) quantity on reel depends on thickness classification, see section "Thickness classification and packing quantities".

Surface-mount ceramic multilayer capacitors

Class 2, X7R 100 V, 200 V and 500 V

SELECTION CHART FOR 100 V, 200 V AND 500 V

C (pF)	LAST TWO DIGITS OF 12NC	100 V				200 V				500 V		
		0805	1206	1210	1812	0805	1206	1210	1812	1206	1210	1812
220	14											
330	16											
470	18											
680	21											
1000	23					0.85 ±0.1				1.15 ±0.1		
1500	25	0.6 ±0.1										
2200	27											
3300	29		0.85 ±0.1				0.85 ±0.1				0.9 to 1.3	
4700	32											
6800	34					1.25 ±0.1					1.2 to 1.75	
10000	36											0.9 to 1.3
15000	38	0.85 ±0.1										
22000	41						1.15 ±0.1					
33000	43							0.9 to 1.3				
47000	45											
68000	47		1.15 ±0.1	0.5 to 1.0					0.9 to 1.3			
100000	49											
150000	52			0.9 to 1.3								
220000	54				0.9 to 1.3							
330000	56											
470000	58											

Note

1. Values in shaded cells indicate thickness class.

Thickness classification and packing quantities

THICKNESS CLASSIFICATION (mm)	8 mm TAPE WIDTH QUANTITY PER REEL				12 mm TAPE WIDTH QUANTITY PER REEL	QUANTITY PER BULK CASE
	Ø180 mm; 7"		Ø330 mm; 13"		Ø180 mm; 7" BLISTER	
	PAPER	BLISTER	PAPER	BLISTER	1812	
0.6 ±0.1	4000	–	20000	–	–	10000
0.85 ±0.1	4000	–	15000	–	–	8000
0.8 to 1.0	–	4000	–	10000	–	–
0.5 to 1.0	–	4000	–	10000	2000	–
0.9 to 1.3	–	3000	–	10000	1500	–
1.15 ±0.1	–	3000	–	10000	–	–
1.25 ±0.1	–	3000	–	10000	–	5000
1.2 to 1.75	–	2500	–	10000	–	–

Surface-mount ceramic
multilayer capacitors

Class 2, X7R 100 V, 200 V and 500 V

ORDERING INFORMATION FOR 100 V, 200 V AND 500 V

Clear text code (preferred)

Example: 18122R104KBBB0D

SIZE CODE	TEMP. CHAR.	CAPACITANCE	TOL.	VOLTAGE	TERMINATION	PACKING	MARKING	SERIES
0805 1206 1210 1812	2R = X7R	104 = 100000 pF; the third digit signifies the multiplying factor: 1 = × 10 2 = × 100 3 = × 1000 4 = × 10000	J = ±5% K = ±10%	0 = 100 V B = 200 V D = 500 V	B = NiSn	2 = 180 mm; 7" paper 3 = 330 mm; 13" paper B = 180 mm; 7" blister F = 330 mm; 13" blister P = bulk case	0 = no marking	D = BME

Ordering code 12NC

2 2 X X X X X X 5 X X X

Carrier type

Rated voltage - Termination

Size

Capacitance value⁽¹⁾

Tolerance

Packaging⁽²⁾

22 blister
38 paper
54 bulk

60 100 V; NiSn
93 200 V; NiSn
97 500 V; NiSn

0 0805
1 1206
2 1210
4 1812

5 ±5%
6 ±10%

1 reel: Ø180 mm; 7"
5 reel: Ø330 mm; 13"
4 bulk case

CCA613

(1) Refer to chapter "Selection chart for 100 V, 200 V and 500 V".

(2) quantity on reel depends on thickness classification, see section "Thickness classification and packing quantities".

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Surface-mount ceramic
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Class 2, X7R 16/25/50/100/200/500 V

ELECTRICAL CHARACTERISTICS

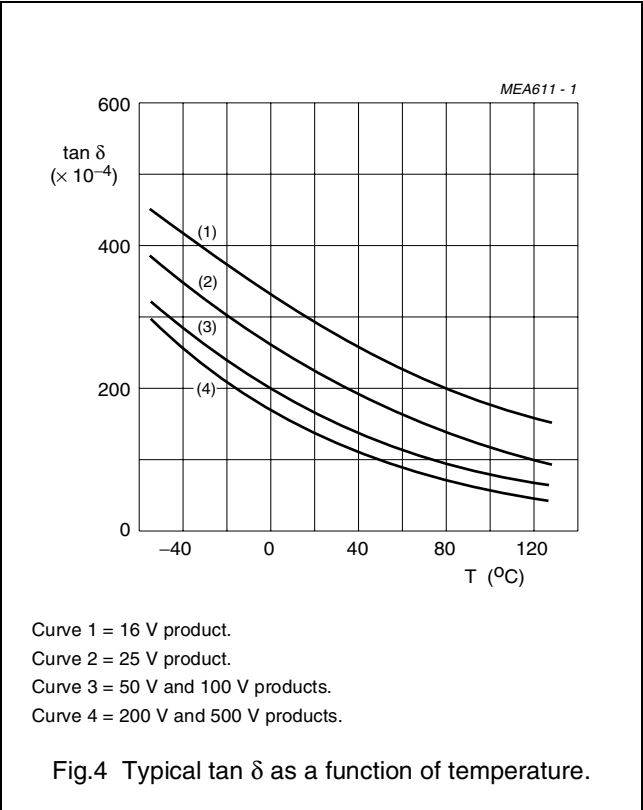
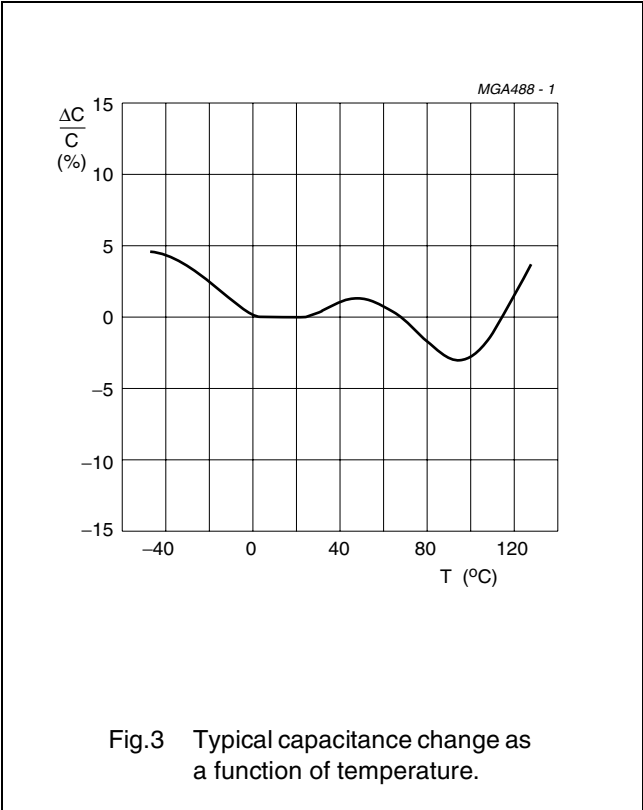
Class 2 capacitors; X7R dielectric; NiSn terminations

Unless otherwise stated all electrical values apply at an ambient temperature of 20 ±1 °C, an atmospheric pressure of 86 to 106 kPa, and a relative humidity of 63 to 67%.

DESCRIPTION	VALUE
Capacitance range (E6 series); note 1	100 pF to 1000 nF
Tolerance on capacitance after 1000 hours	±10%; ±5%
Tan δ; note 1	≤2.5%; 16 V range ≤3.5%
Insulation resistance after 1 minute at U _R (DC): C ≤ 10 nF C > 10 nF	R _{ins} > 100 GΩ R _{ins} × C > 1000 seconds
Maximum capacitance change as a function of temperature (for typical values see Fig.3)	±15%
Ageing	typical 1% per time decade

Note

1. Measured at 1 V, 1 kHz, using a four-gauge method.



Surface-mount ceramic multilayer capacitors

Class 2, X7R 16/25/50/100/200/500 V

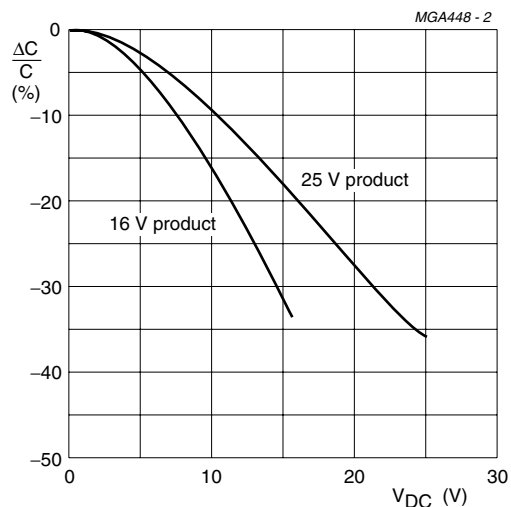


Fig.5 Typical capacitance change with respect to the capacitance at 1 V as a function of DC voltage at 20 °C.

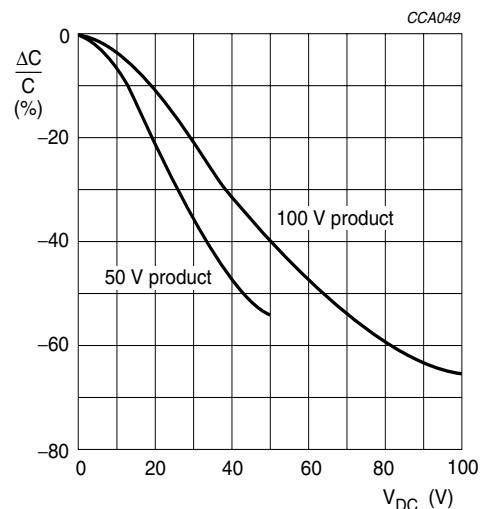


Fig.6 Typical capacitance change with respect to the capacitance at 1 V as a function of DC voltage at 20 °C.

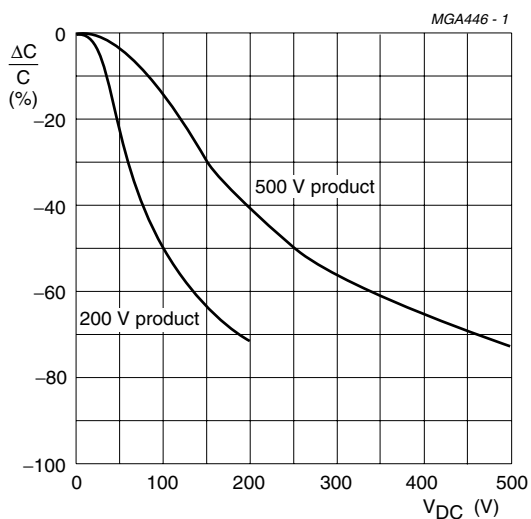


Fig.7 Typical capacitance change with respect to the capacitance at 1 V as a function of DC voltage at 20 °C.