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DATA SHEET

SURFACE-MOUNT CERAMIC MULTILAYER CAPACITORS

Class 2, X7R

16 V TO 500 V



Phycomp

Product Specification – Aug 17, 2005 V.9



Surface-mount ceramic multilayer capacitors

Class 2, X7R 16 V to 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

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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, 250 V and 500 V (IEC)
Capacitance range (E12 series):	
16 V	4.7 nF to 1 μF
25 V	3.3 nF to 1 μF
50 V	100 pF to 1 μF
100 V	220 pF to 560 nF
200 V	220 pF to 150 nF
250 V	220 pF to 33 nF
500 V	470 pF to 15 nF
Tolerance on capacitance	±10%; ±5%
Test voltage (DC) for 1 minute:	$2.5 \times U_r$
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 60 068)	55/125/56

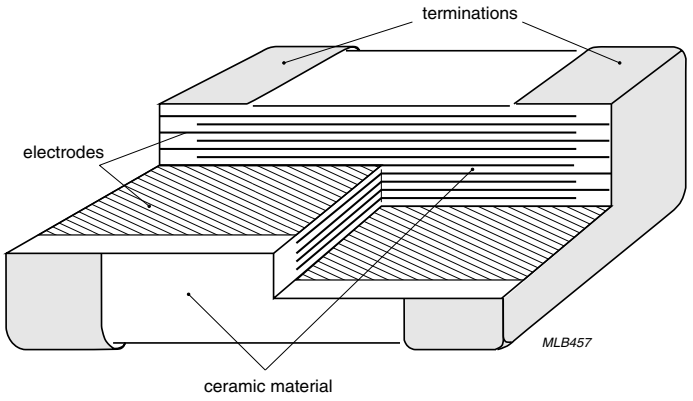
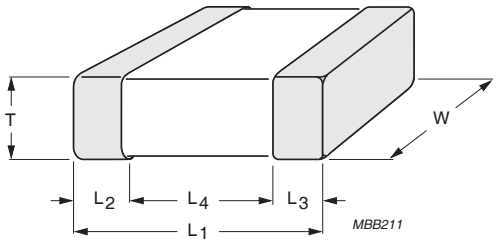


Fig.1 Construction of a ceramic multilayer capacitor.

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MECHANICAL DATA



For dimensions see Table 1.

Fig.2. Component outline.

Physical dimensions

Table 1 Capacitor dimensions

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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	1.25	0.25	0.75	1.40
1210	3.2 ±0.20	2.5 ±0.20	0.50	2.10	0.25	0.75	1.40
1812	4.5 ±0.20	3.2 ±0.20	0.90	1.75	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	0.049	0.010	0.030	0.056
1210	0.126 ±0.008	0.098 ±0.008	0.020	0.083	0.010	0.030	0.056
1812	0.177 ±0.008	0.126 ±0.008	0.035	0.069	0.010	0.030	0.088

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SELECTION CHART FOR 16 V

C (nF)	LAST TWO DIGITS OF 12NC	16 V			
		0402	0603	0805	1206
4.7	32	0.5 ±0.05			
5.6	33				
6.8	34				
8.2	35				
10	36				
12	37				
15	38				
18	39				
22	41		0.8 ±0.07		
27	42				
33	43				
39	44				
47	45			0.6 ±0.1	
56	46				
68	47				
82	48			0.85 ±0.1	
100	49				
120	51				
150	52				
180	53				
220	54				0.85 ±0.1
270	55				
330	56			1.25 ±0.1	
390	57				
470	58				
560	59				1.15 ±0.1
680	61				
820	62				
1 000	63				

Note

1. Values in shaded cells indicate thickness class in mm.
2. Thickness classification and packing quantities refer to table 2.

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SELECTION CHART FOR 25 V

C (nF)	LAST TWO DIGITS OF 12NC	25 V				
		0402	0603	0805	1206	1210
3.3	29	0.5 ±0.05				
3.9	31					
4.7	32					
5.6	33					
6.8	34					
8.2	35					
10	36		0.8 ±0.07	0.6 ±0.1		
12	37					
15	38					
18	39					
22	41					
27	42					
33	43					
39	44			0.85 ±0.1		
47	45					
56	46					
68	47					
82	48					
100	49				0.85 ±0.1	
120	51					
150	52					
180	53					
220	54					
270	55				1.15 ±0.1	
330	56					
390	57					
470	58					1.15 ±0.1
560	59					
680	61					
820	62					1.6 ±0.2
1 000	63					

Note

1. Values in shaded cells indicate thickness class in mm.
2. Thickness classification and packing quantities refer to table 2.

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Thickness classification and packing quantities for 16 V to 500 V

Table 2 Quantities for all sizes and thickness

SIZE CODE	THICKNESS CLASSIFICATION (mm)	8 mm TAPE WIDTH QUANTITY PER REEL				12 mm TAPE WIDTH QUANTITY PER REEL	QUANTITY PER BULK CASE
		∅180 mm; 7"		∅330 mm; 13"		∅180 mm; 7"	
		Paper	Blister	Paper	Blister	Blister	
0402	0.5 ±0.05	10,000	–	50,000	–	–	50,000
0603	0.8 ±0.07	4,000	–	15,000		–	15,000
0805	0.6 ±0.1	4,000	–	20,000	–	–	10,000
	0.85 ±0.1	4,000	–	15,000	–	–	8,000
	1.25 ±0.1	–	3,000	–	10,000	–	5,000
1206	0.85 ±0.1	4,000	–	15,000	–	–	–
	1.15 ±0.1	–	3,000	–	10,000	–	–
1210	0.85 ±0.1	–	4,000	–	10,000	–	–
	1.15 ±0.1	–	3,000	–	10,000	–	–
	1.6 ±0.2	–	2,000	–	–	–	–
1812	1.15 ±0.1	–	–	–	–	1,500	–
	1.6 ±0.2	–	–	–	–	1,000	–

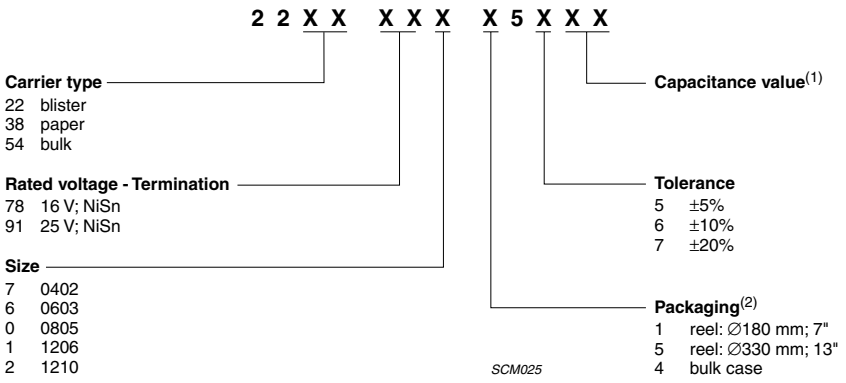
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ORDERING INFORMATION FOR 16 V AND 25 V

Components may be ordered by using either a Phycomp's unique 12NC or simple 15-digit clear text code.

Ordering code 12NC (preferred)



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

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

Clear text code

EXAMPLE: 08052R104K8BB0D

Size Code	Temp. Char.	Capacitance	Tol.	Vol.	Termination	Packing	Marking	Series
0402 0603 0805 1206 1210	2R = X7R	104 = 100000 pF; the third digit signifies the multiplying factor: 2 = × 100 3 = × 1000 4 = × 10 000 5 = × 100 000	J = ±5% K = ±10% M = ±20%	7 = 16 V 8 = 25 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

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SELECTION CHART FOR 50 V

C (pF)	LAST TWO DIGITS OF 12NC	50 V					
		0402	0603	0805	1206	1210	1812
100	09	0.5 ±0.05	0.8 ±0.07	0.6 ±0.1	0.85 ±0.1	0.85 ±0.1	
120	11						
150	12						
180	13						
220	14						
270	15						
330	16						
390	17						
470	18						
560	19						
680	21						
820	22						
1,000	23						
1,200	24						
1,500	25						
1,800	26						
2,200	27						
2,700	28						
3,300	29						
3,900	31						
4,700	32						
5,600	33						
6,800	34						
8,200	35						
10,000	36						
12,000	37						
15,000	38						
18,000	39						
22,000	41						

Note

1. Values in shaded cells indicate thickness class in mm.
2. Thickness classification and packing quantities refer to table 2.

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SELECTION CHART FOR 50 V CONTINUED

C (pF)	LAST TWO DIGITS OF 12NC	50 V					
		0402	0603	0805	1206	1210	1812
27,000	42			0.85 ±0.1	0.85 ±0.1	0.85 ±0.1	
33,000	43						
39,000	44						
47,000	45						
56,000	46						
68,000	47						
82,000	48						
100,000	49		0.8 ±0.07				1.15 ±0.1
120,000	51					1.15 ±0.1	
150,000	52				1.15 ±0.1		
180,000	53						
220,000	54						
270,000	55						
330,000	56						
390,000	57					1.6 ±0.2	
470,000	58						
560,000	59						
680,000	61						1.6 ±0.2
820,000	62						
1,000,000	63						

Note

1. Values in shaded cells indicate thickness class in mm.
2. Thickness classification and packing quantities refer to table 2.

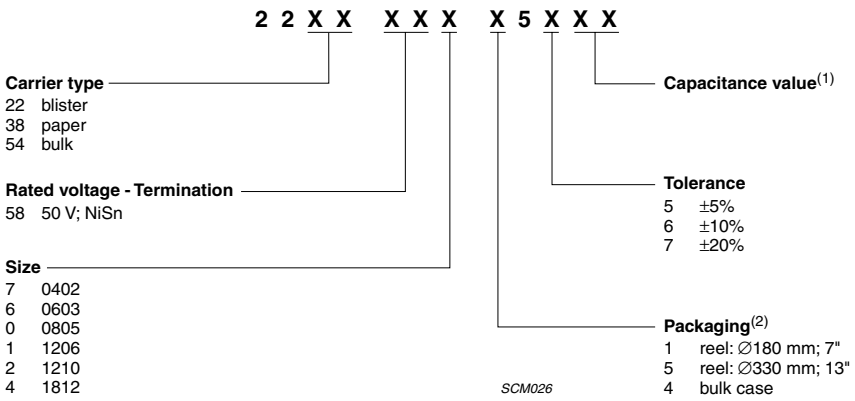
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ORDERING INFORMATION FOR 50 V

Components may be ordered by using either a Phycomp's unique 12NC or simple 15-digit clear text code.

Ordering code 12NC (preferred)



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

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

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Clear text code

EXAMPLE: 08052R104K9BB0D

Size Code	Temp. Char.	Capacitance	Tol.	Vol.	Termination	Packing	Marking	Series
0402 0603 0805 1206 1210 1812	2R = X7R	104 = 100000 pF; the third digit signifies the multiplying factor: 1 = × 10 2 = × 100 3 = × 1000 4 = × 10 000 5 = × 100 000	J = ±5% K = ±10% M = ±20%	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

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SELECTION CHART FOR 100 V

C (pF)	LAST TWO DIGITS OF 12NC	100 V			
		0805	1206	1210	1812
220	14	0.6 ±0.1	0.85 ±0.1		
270	15				
330	16				
390	17				
470	18				
560	19				
680	21				
820	22				
1,000	23				
1,200	24				
1,500	25				
1,800	26				
2,200	27				
2,700	28				
3,300	29				
3,900	31				
4,700	32				
5,600	33				
6,800	34				
8,200	35				
10,000	36				

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Note

1. Values in shaded cells indicate thickness class in mm.
2. Thickness classification and packing quantities refer to table 2.

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SELECTION CHART FOR 100 V CONTINUED

C (pF)	LAST TWO DIGITS OF 12NC	100 V			
		0805	1206	1210	1812
12,000	37	0.85 ±0.1	0.85 ±0.1		
15,000	38				
18,000	39				
22,000	41				
27,000	42				
33,000	43				
39,000	44				
47,000	45			0.85 ±0.1	
56,000	46				
68,000	47		1.15 ±0.1		
82,000	48				
100,000	49				1.15 ±0.1
120,000	51			1.15 ±0.1	
150,000	52				
180,000	53				
220,000	54				
270,000	55				
330,000	56				
390,000	57				1.6 ±0.2
470,000	58				
560,000	59				

Note

1. Values in shaded cells indicate thickness class in mm.
2. Thickness classification and packing quantities refer to table 2.

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SELECTION CHART FOR 200 V AND 250 V

C (pF)	LAST TWO DIGITS OF 12NC	200 V				250 V	
		0805	1206	1210	1812	0805	1206
220	14	0.85 ±0.1				0.85 ±0.1	
270	15						
330	16						
390	17						
470	18		0.85 ±0.1				0.85 ±0.1
560	19						
680	21						
820	22						
1,000	23						
1,200	24						
1,500	25						
1,800	26						
2,200	27						
2,700	28						
3,300	29						
3,900	31						
4,700	32						
5,600	33						
6,800	34	1.25 ±0.1				1.25 ±0.1	
8,200	35						

Note

1. Values in shaded cells indicate thickness class in mm.
2. Thickness classification and packing quantities refer to table 2.

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SELECTION CHART FOR 200 V AND 250 V CONTINUED

C (pF)	LAST TWO DIGITS OF 12NC	200 V				250 V	
		0805	1206	1210	1812	0805	1206
10,000	36	1.25 ±0.1	0.85 ±0.1	0.85 ±0.1		1.25 ±0.1	0.85 ±0.1
12,000	37						
15,000	38						
18,000	39		1.15 ±0.1				1.15 ±0.1
22,000	41			1.15 ±0.1			
27,000	42						
33,000	43						
39,000	44						
47,000	45				1.15 ±0.1		
56,000	46						
68,000	47						
82,000	48						
100,000	49						
120,000	51						
150,000	52						

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Note

1. Values in shaded cells indicate thickness class in mm.
2. Thickness classification and packing quantities refer to table 2.

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SELECTION CHART FOR 500 V

C (pF)	LAST TWO DIGITS OF 12NC	500 V		
		1206	1210	1812
470	18	1.15 ±0.1		
560	19			
680	21			
820	22			
1,000	23			
1,200	24			
1,500	25			
1,800	26			
2,200	27			
2,700	28			
3,300	29		1.15 ±0.1	0.85 ±0.1
3,900	31			
4,700	32			
5,600	33			
6,800	34			
8,200	35			
10,000	36			1.15 ±0.1
12,000	37			
15,000	38			

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Note

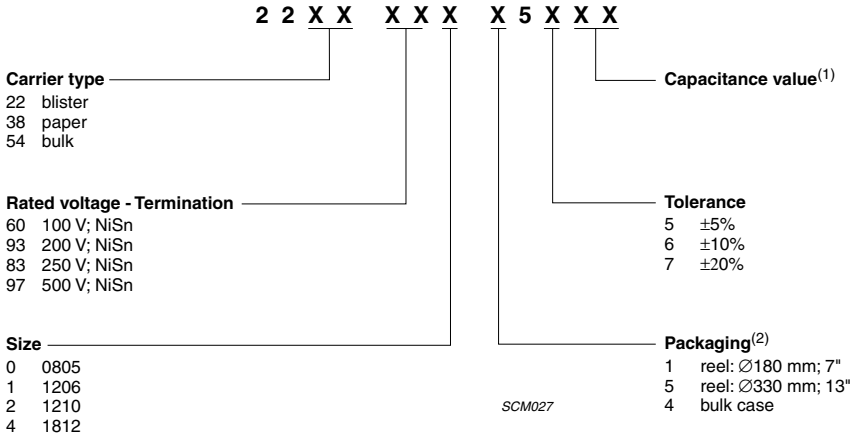
1. Values in shaded cells indicate thickness class in mm.
2. Thickness classification and packing quantities refer to table 2.

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ORDERING INFORMATION FOR 100 V, 200 V, 250 V AND 500 V

Components may be ordered by using either a Phycomp's unique 12NC or simple 15-digit clear text code.

Ordering code 12NC (preferred)



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

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

Clear text code

EXAMPLE: 18122R104KBBB0D

Size Code	Temp. Char.	Capacitance	Tol.	Vol.	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 = × 10 000	J = ±5% K = ±10% M = ±20%	0 = 100 V B = 200 V C = 250 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

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ELECTRICAL CHARACTERISTICS

Class 2 capacitors; X7R dielectric; NiSn terminations

Unless otherwise stated all electrical values apply at an ambient temperature of 25 ±1 °C, an atmospheric pressure of 86 to 105 kPa, and a relative humidity of 63 to 67%.

DESCRIPTION	VALUE
Capacitance range; note 1	100 pF to 1μF
Capacitance tolerance	±20%, ±10%, ±5%
Dissipation factor (D.F.); note 1	≤2.5%; 16 V range ≤3.5%
Insulation resistance after 1 minute at U_r (DC)	$R_{ins} \geq 10$ GΩ or $R_{ins} \times C \geq 500$ seconds whichever is less
Maximum capacitance change as a function of temperature (Temperature characteristic/coefficient; for typical values see Fig.3)	±15%
Operation temperature range	−55 °C to +125 °C

Note

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

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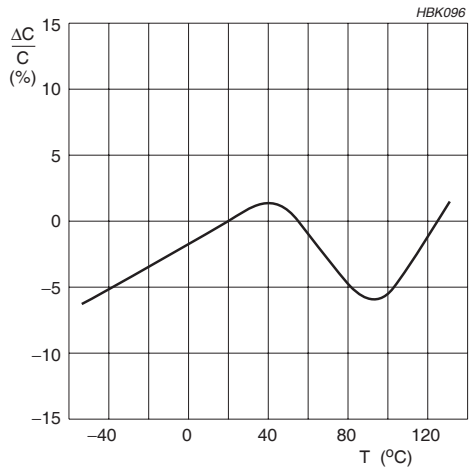
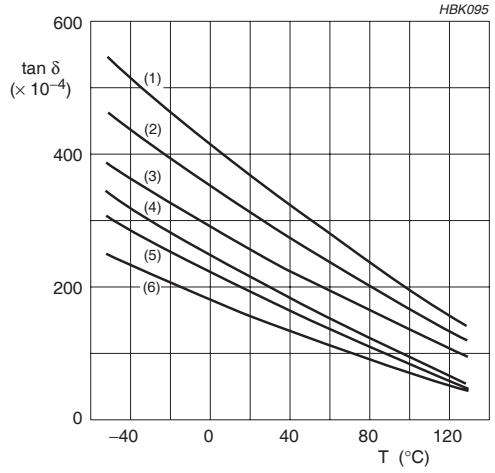


Fig.3 Typical capacitance change as a function of temperature.



Curve 1 = 16 V product.
Curve 2 = 25 V product.
Curve 3 = 50 V product.
Curve 4 = 100 V product.
Curve 5 = 200 V product.
Curve 6 = 500 V product.

Fig.4 Typical tan δ as a function of temperature.

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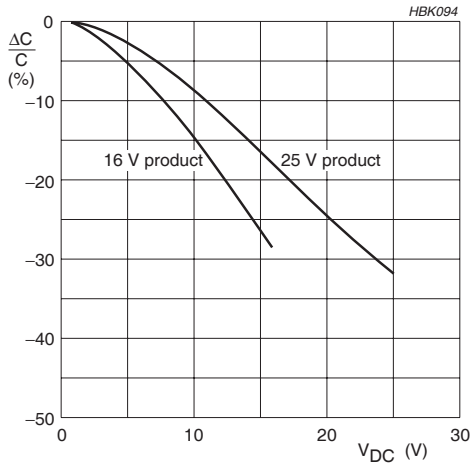


Fig.5 Typical capacitance change with respect to the capacitance at 1 V as a function of DC voltage at 20 °C.

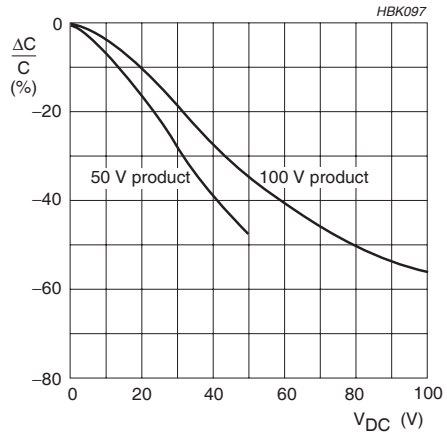


Fig.6 Typical capacitance change with respect to the capacitance at 1 V as a function of DC voltage at 20 °C.

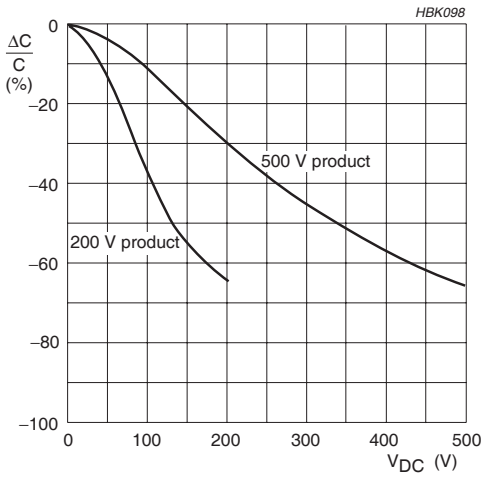


Fig.7 Typical capacitance change with respect to the capacitance at 1 V as a function of DC voltage at 20 °C.

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REVISION HISTORY

Revision	Date	Change Notification	Description
Rev.9	2005 Aug 17	-	- 0603 50V capacitance range extended to 100 nF
Rev.8	2004 Jul 30	-	- 0402 16V capacitance range extended to 47 nF
Rev.7	2004 Jan 09	-	- Revise for thickness and product range
Rev.6	2002 Aug 28	-	- Capacitance range changed from 2.2 nF
Rev.5	2002 Jul 15 2003 Jun 26	-	- Capacitance range changed from E6 into E12 - Capacitance range expanded to 4.7 μF - Figures 3 through 7 corrected - Updated company logo

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