DISCRETE CERAMICS

DATA SHEET

Class 1, NP0
50 V to 500 V
Surface-mount ceramic multilayer capacitors

2003 Mar 21 Rev.7

Phycomp

Surface-mount ceramic multilayer capacitors

Class 1, NP0 50 V to 500V

FEATURES

- Six standard sizes
- High capacitance per unit volume
- Supplied in tape on reel or in bulk case (case sizes 0402, 0603 and 0805 only)
- For high frequency applications
- NiSn terminations.

APPLICATIONS

- Consumer electronics
- Telecommunications
- Automotive
- Data processing.

DESCRIPTION

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

The inner electrodes are connected to the two terminations, either by silver palladium (AgPd) alloy, or silver dipped 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)	50 V, 100 V, 200 V and 500 V (IEC)
Capacitance range (E12 series); note 1:	
50 V; note 2	0.47 pF to 22 nF
100 V	10 pF to 22 nF
200 V	10 pF to 5.6 nF
500 V	10 pF to 3.3 nF
Tolerance on capacitance:	
$C \geq 10$ pF	±5%; ±2%; ±1%
$C < 10$ pF	±0.5 pF; ±0.25 pF; ±0.1 pF
Test voltage (DC) for 1 minute:	
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

Notes

1. Other values below 10 pF and non E12 series are available on request.
2. Also applicable for applications up to 63 V.

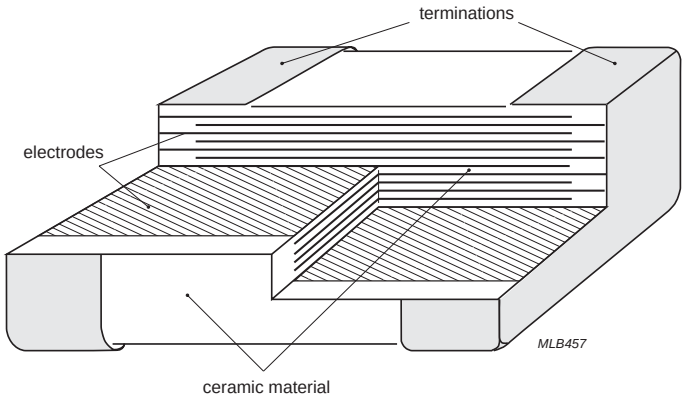
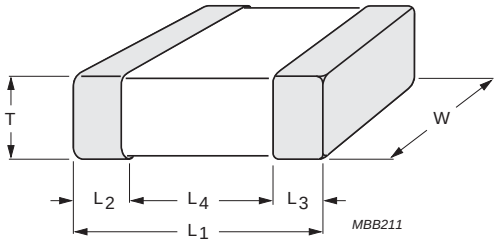


Fig.1 Construction of a ceramic multilayer capacitor.

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	1.25	0.25	0.75	1.40
1210	3.2 ±0.20	2.5 ±0.20	0.50	1.75	0.25	0.75	1.40
1812	4.5 ±0.20	3.2 ±0.20	0.50	1.30	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	0.069	0.010	0.030	0.056
1812	0.177 ±0.008	0.126 ±0.008	0.020	0.051	0.010	0.030	0.088

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SELECTION CHART FOR 50 V

C (pF)	LAST THREE DIGITS OF 12NC	50 V					
		0402	0603	0805	1206	1210	1812
0.47	477						
0.56	567						
0.68	687					Values in shaded cells indicate thickness class.	
0.82	827						
1.0	108						
1.2	128						
1.5	158						
1.8	188						
2.2	228						
2.7	278						
3.3	338						
3.9	398						
4.7	478						
5.6	568						
6.8	688	0.5 ±0.05	0.8 ±0.07	0.6 ±0.1	0.6 ±0.1		
8.2	828						
10	109						
12	129						
15	159						
18	189						
22	229						
27	279					0.5 to 1.0	
33	339						
39	399						
47	479						
56	569						
68	689						
82	829						

SELECTION CHART FOR 50 V (CONTINUED)

C (pF)	LAST THREE DIGITS OF 12NC	50 V					
		0402	0603	0805	1206	1210	1812
100	101						
120	121						
150	151	0.5 ±0.05					
180	181						
220	221						
270	271		0.8 ±0.07				
330	331			0.6 ±0.1			
390	391						
470	471				0.6 ±0.1		
560	561						
680	681						
820	821						
1000	102					0.5 to 1.0	
1200	122						
1500	152			0.85 ±0.1			
1800	182						
2200	222			1.25 ±0.1			0.5 to 1.0
2700	272						
3300	332						
3900	392				0.85 ±0.1		
4700	472						
5600	562				1.15 ±0.1		
6800	682						
8200	822						
10000	103						
12000	123						
15000	153						
18000	183	Values in shaded cells indicate thickness class.					0.9 to 1.3
22000	223						

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		
	∅180 mm; 7"		∅330 mm; 13"		∅180 mm; 7" BLISTER			
	PAPER	BLISTER	PAPER	BLISTER	1812	0402	0603	0805
0.5 ±0.05	10 000	–	50 000	–	–	50 000	–	–
0.6 ±0.1	4 000	–	20 000	–	–	–	–	10 000
0.8 ±0.07	4 000	–	15 000	–	–	–	15 000	–
0.85 ±0.1	4 000	–	15 000	–	–	–	–	8 000
0.5 to 1.0	–	4 000	–	10 000	2 000	–	–	–
0.9 to 1.3	–	3 000	–	10 000	1 500	–	–	–
1.15 ±0.1	–	3 000	–	10 000	–	–	–	–
1.25 ±0.1	–	3 000	–	10 000	–	–	–	5 000

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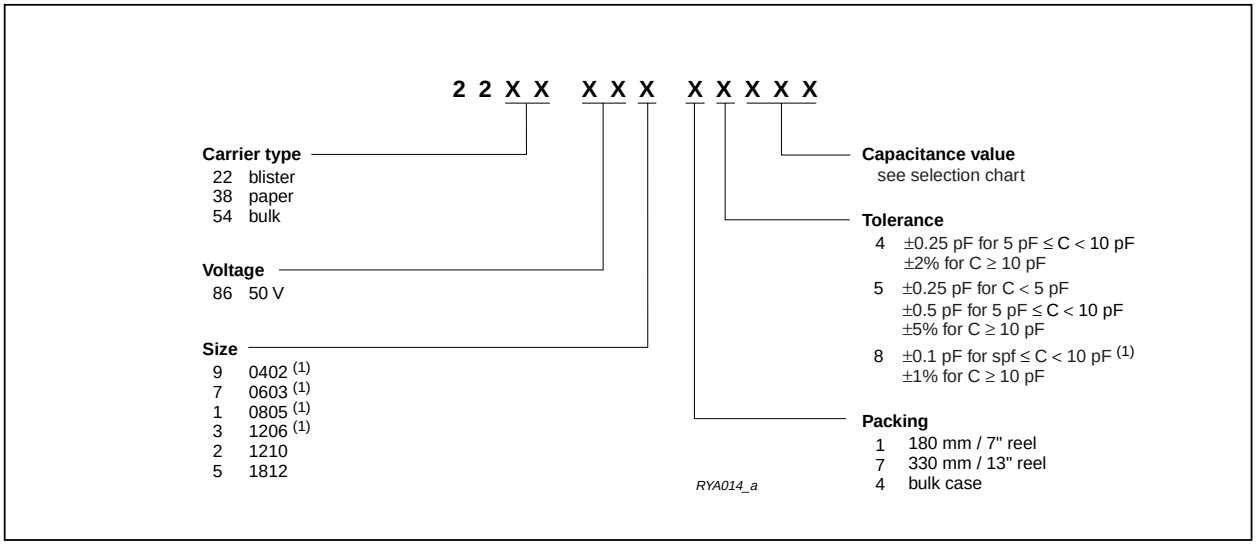
ORDERING INFORMATION FOR 50 V

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

Ordering code 12NC (preferred)



Note

1. ±1 % only available in 0402, 0603, 0805, and 1206.

Clear text code

Example: 0805CG102J9B200

Size Code	Temp. Char.	Capacitance	Tol.	Vol.	Termination	Packing	Marking	Series
0402 (1) 0603 (1) 0805 (1) 1206 (1) 1210 1812	CG = NP0	102 = 1000 pF; the third digit signifies the multiplying factor: 8 = × 0.01 9 = × 0.1 0 = × 1 1 = × 10 2 = × 100 3 = × 1000	B = ±0.1 pF C = ±0.25 pF D = ±0.5 pF F = ±1 % G = ±2% J = ±5%	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	0 = conv. ceramic

Note

1. ±1 % only available in 0402, 0603, 0805, and 1206.

SELECTION CHART FOR 100 V

C (pF)	LAST TWO DIGITS OF 12NC	100 V				
		0603	0805	1206	1210	1812
10	23					
12	24					
15	25					
18	26					
22	27					
27	28					
33	29					
39	31					
47	32					
56	33					
68	34					
82	35	0.8 ±0.07	0.6 ±0.1	0.6 ±0.1		
100	36					
120	37					
150	38					
180	39					
220	41					
270	42					
330	43					
390	44					
470	45					
560	46					
680	47					
820	48					

Note

1. Values in shaded cells indicate thickness class.

SELECTION CHART FOR 100 V (CONTINUED)

C (pF)	LAST TWO DIGITS OF 12NC	100 V				
		0603	0805	1206	1210	1812
1000	49		0.6 ±0.1			
1200	51					
1500	52		0.85 ±0.1	0.6 ±0.1		
1800	53					
2200	54		1.25 ±0.1			
2700	55					
3300	56					
3900	57			0.85 ±0.1		
4700	58					
5600	59			1.15 ±0.1		
6800	61					
8200	62				0.5 to 1.0	
10000	63					
12000	64					0.5 to 1.0
15000	65	Values in shaded cells indicate thickness class.				
18000	66					0.9 to 1.3
22000	67					

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	1210	1812
10	23								
12	24								
15	25								
18	26								
22	27								
27	28								
33	29								
39	31								
47	32	0.6 ±0.1	0.6 ±0.1			0.6 ±0.1	0.6 ±0.1		
56	33								
68	34								
82	35								
100	36								
120	37								
150	38								
180	39								
220	41								
270	42								
330	43	0.85 ±0.1				0.85 ±0.1			
390	44								
470	45		0.85 ±0.1				0.85 ±0.1		
560	46	1.25 ±0.1				1.25 ±0.1			
680	47								
820	48								
1 000	49								
1 200	51								
1 500	52		1.15 ±0.1				1.15 ±0.1		
1 800	53			0.8 to 1.0				0.8 to 1.0	
2 200	54								
2 700	55			0.9 to 1.3				0.9 to 1.3	
3 300	56								
3 900	57				0.8 to 1.0				0.8 to 1.0
4 700	58	Values in shaded cells indicate thickness class.			0.9 to 1.3				0.9 to 1.3
5 600	59								

SELECTION CHART FOR 500 V

C (pF)	LAST TWO DIGITS OF 12NC	500 V		
		1206	1210	1812
10	23			
12	24			
15	25			
18	26			
22	27			
27	28			
33	29			
39	31			
47	32	0.6 ±0.1		
56	33			
68	34			
82	35			
100	36			
120	37			
150	38			
180	39			
220	41		0.8 to 1.0	
270	42			
330	43	0.85 ±0.1		
390	44			
470	45			
560	46			
680	47	1.15 ±0.1		
820	48			
1000	49			
1 200	51		0.9 to 1.3	
1 500	52			
1 800	53		1.2 to 1.75	
2 200	54			
2 700	55			0.9 to 1.3
3 300	56			
3 900	57			
4 700	58	Values in shaded cells indicate thickness class.		
5 600	59			

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	
	∅180 mm; 7"		∅330 mm; 13"		∅180 mm; 7" BLISTER		
	PAPER	BLISTER	PAPER	BLISTER	1812	0603	0805
0.6 ±0.1	4 000	–	20 000	–	–	–	10 000
0.8 ±0.07	4 000	–	15 000	–	–	15 000	–
0.85 ±0.1	4 000	–	15 000	–	–	–	8 000
0.8 to 1.0	–	4 000	–	10 000	2 000	–	–
0.9 to 1.3	–	3 000	–	10 000	1 500	–	–
1.15 ±0.1	–	3 000	–	10 000	–	–	–
1.25 ±0.1	–	3 000	–	10 000	–	–	5 000
1.2 to 1.75	–	2 500	–	10 000	1 200	–	–

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ORDERING INFORMATION FOR 100 V TO 500 V

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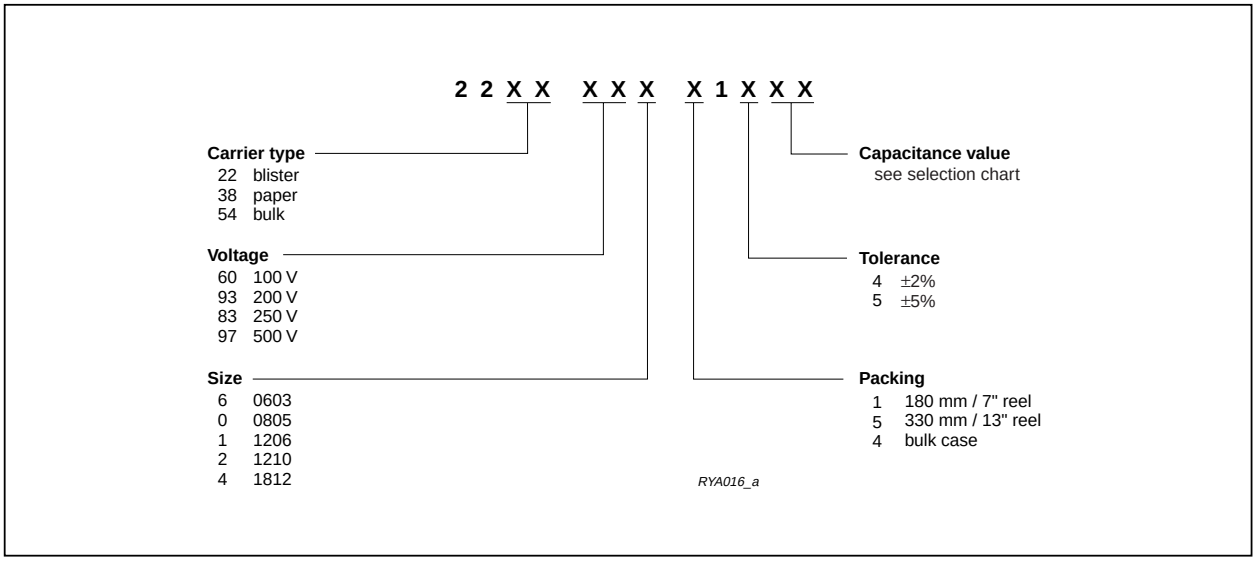
Ordering code 12NC (preferred)



Clear text code

Example: 1206CG102GBB200

Size Code	Temp. Char.	Capacitance	Tol.	Vol.	Termination	Packing	Marking	Series
0805 1206 1210 1812	CG = NP0	102 = 1000 pF; the third digit signifies the multiplying factor: 0 = × 1 1 = × 10 2 = × 100 3 = × 1000	G = ±2% J = ±5%	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	0 = conv. ceramic

ELECTRICAL CHARACTERISTICS

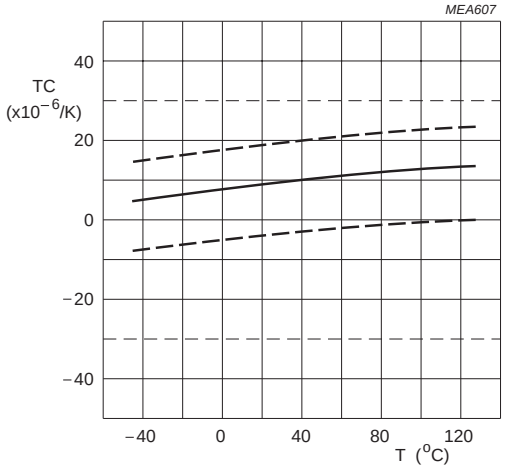
Class 1 capacitors; NP0 dielectric; NiSn terminations

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 (E12 series); note 1	
50 V	0.47 pF to 22 nF
100 V	10 pF to 22 nF
200 V	10 pF to 5.6 nF
500 V	10 pF to 3.3 nF
Tolerance on capacitance after 1000 hours	
$C \geq 10$ pF	±5%; ±2%
5 pF ≤ C < 10 pF	±0.5 pF, ±0.25 pF
C < 5 pF	±0.25 pF
Tan δ; note 1	
C < 10pF	$\leq 10\left(\frac{3}{C} + 0.7\right) \times 10^{-4}$ or 30×10^{-4}, whichever is smallest
C ≥ 10 pF	$\leq 10 \times 10^{-4}$
Insulation resistance after 1 minute at U_R (DC)	$R_{ins} > 10$ GΩ
Temperature coefficient:	
C < 10 pF	$(0 \pm 150) \times 10^{-6}$/K; note 2
C ≥ 10 pF	$(0 \pm 30) \times 10^{-6}$/K; note 2
Ageing	not applicable

Notes

1. Measured at 1 V, 1 MHz for C ≤ 1000 pF and 1 V, 1 kHz for C > 1000 pF, using a four-gauge method.
2. For sizes 0402 and 0603 all capacitance values from 0.47 pF to 150 pF have a temperature coefficient of $(0 \pm 30) \times 10^{-6}$/K.



Sample limits (broken lines).
Requirement levels (dotted lines).

Fig.3 Typical temperature coefficient as a function of temperature.

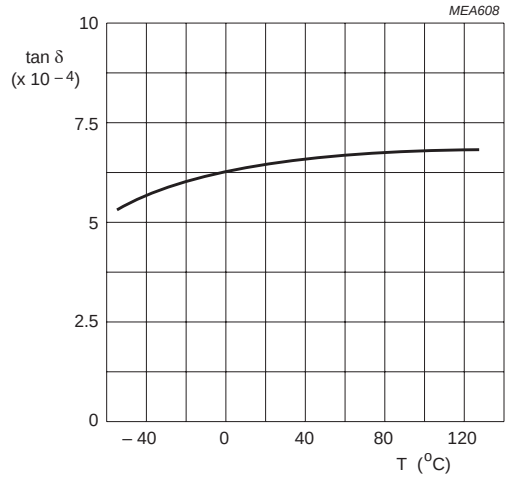


Fig.4 Typical tan δ as a function of temperature.

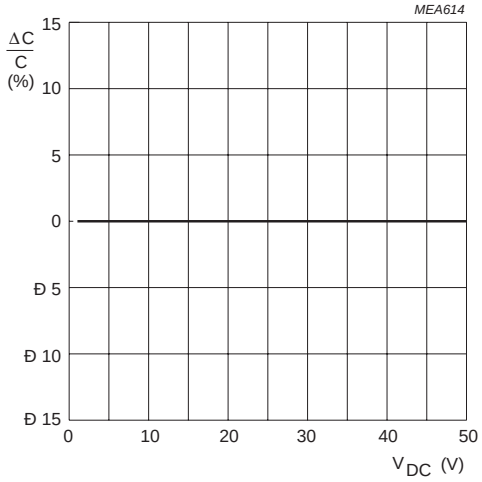
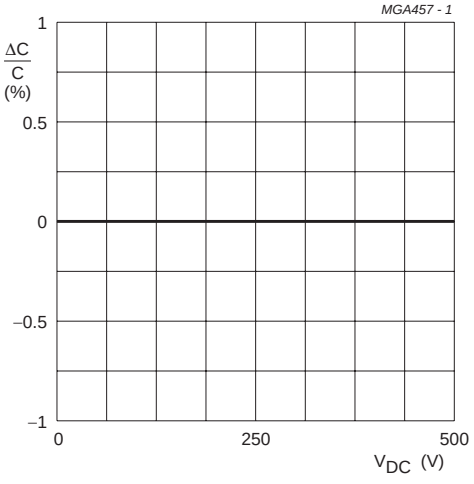


Fig.5 Typical capacitance change with respect to the capacitance at 1 V as a function of DC voltage.



High voltage series.

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

REVISION HISTORY

Revision	Date	Change Notification	Description
Rev.6	2001 Jul 16	–	- Converted to Phycomp brand - Highest value in 50 V range reduced from 47 nF to 33 nF - Various thickness classes corrected - Products in 2020 case size removed - AgPd finishing for terminations no longer supported
Rev.7	2003 Mar 21	-	- Update company logo