DATA SHEET

Class 2, Y5V 16 V, 25 V and 50 V
Surface mount ceramic multilayer capacitors

Product specification
Supersedes data of 6th December 1999
File under Discrete Ceramics, ACM2

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Philips Components

PHILIPS

Surface mount ceramic multilayer capacitors

Class 2, Y5V 16 V, 25 V and 50 V

FEATURES

- Five standard sizes
- High capacitance per unit volume
- Supplied in tape on reel
- Nickel-barrier end terminations.

APPLICATIONS

Consumer electronics, for example:

- Tuners
- Television receivers
- Video recorders
- All types of cameras
- Mobile telephones.

DESCRIPTION

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

The inner electrodes are connected to the two terminations 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
Capacitance range (E6 series)	1 nF to 4.7 μF; note 1
Tolerance on capacitance after 1000 hours	±20% (M); –20% to +80% (Z)
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
End terminations	NiSn
Climatic category (IEC 60068)	25/85/21

Note

1. Measured at 25 °C, 1 V and 1 kHz, using a four-gauge method.

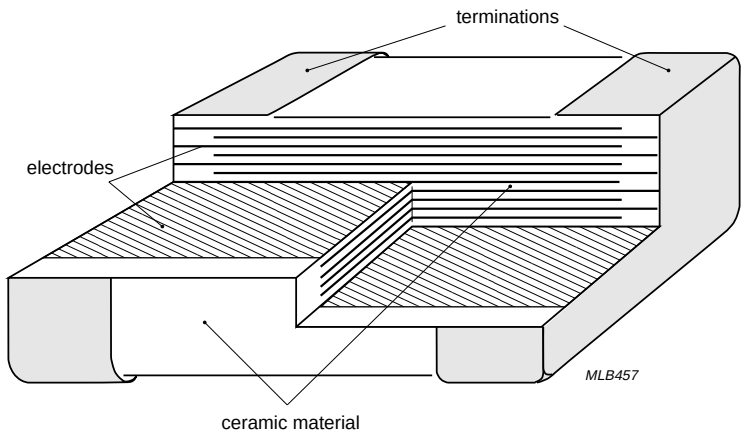
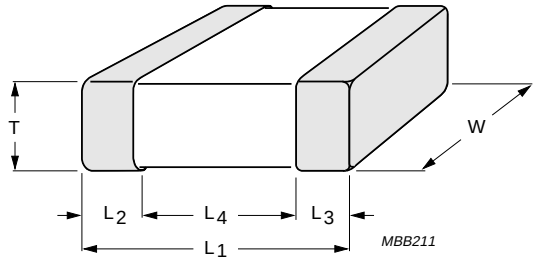


Fig.1 Construction of a ceramic multilayer capacitor.

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							
0201	0.6 ±0.03	0.3 ±0.03	0.027	0.033	0.10	0.20	0.20
0402	1.0 ±0.05	0.50 ±0.05	0.45	0.55	0.15	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
Dimensions in inches							
0201	0.024 ±0.001	0.012 ±0.001	0.011	0.013	0.004	0.008	0.008
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

Surface mount ceramic multilayer capacitors — Class 2, Y5V 16 V, 25 V and 50 V

SELECTION CHART FOR 16 V AND 25 V

C (nF)	LAST TWO DIGITS OF 12NC	16 V					25 V		
		0201	0402	0603	0805	1206	0603	0805	1206
1	23								
1.5	25								
2.2	27								
3.3	29	0.3 ±0.03							
4.7	32								
6.8	34								
10	36								
15	38								
22	41								
33	43		0.5 ±0.05				0.8 ±0.07		
47	45								
68	47								
100	49							0.6 ±0.1	
150	52				Values in shaded cells indicate thickness classification.			0.85 ±0.1	0.6 ±0.1
220	54			0.8 ±0.07					
330	56							1.25 ±0.1	
470	58				0.85 ±0.1				0.85 ±0.1
680	61								
1000	63					0.85 ±0.1			1.15 ±0.1
1500	65				1.25 ±0.1				
2200	67								
2700	68								
3300	69					1.15 ±0.1			
3900	71								
4700	72								

SELECTION CHART FOR 50 V

C (nF)	LAST TWO DIGITS OF 12NC	50 V		
		0603	0805	1206
10	05			
15	06			
22	07			
33	08	0.8 ±0.07	0.6 ±0.1	
47	09			
68	11			
100	12			
150	13		0.85 ±0.1	0.6 ±0.1
220	14			
330	15		1.25 ±0.1	
470	16			0.85 ±0.1
680	17	Values in shaded cells indicate thickness classification.		
1000	18			1.15 ±0.1

Thickness classification and packaging quantities

THICKNESS CLASSIFICATION (mm)	8 mm TAPE WIDTH AMOUNT PER REEL				AMOUNT PER BULK CASE			
	∅180 mm; 7"		∅330 mm; 13"		0201	0402	0603	0805
	PAPER	BLISTER	PAPER	BLISTER				
0.3 ±0.03	10000	–	50000	–	50000	–	–	–
0.5 ±0.05	10000	–	50000	–	–	50000	–	10000
0.6 ±0.1	4000	–	10000	–	–	–	–	10000
0.85 ±0.1	4000	–	10000	–	–	–	–	8000
0.8 ±0.07	4000	4000	15000	15000	–	–	15000	–
1.25 ±0.1	–	3000	–	10000	–	–	–	5000
1.15 ±0.1	–	3000	–	10000	–	–	–	–

ORDERING INFORMATION

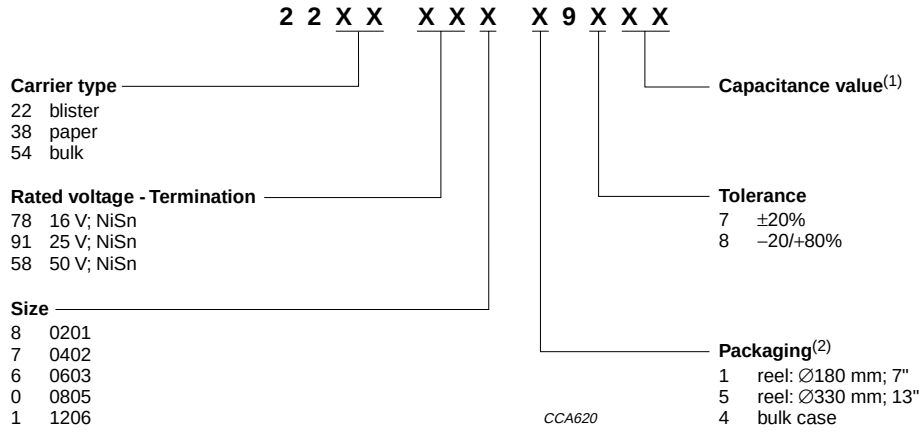
Components may be ordered by using either a simple 15-digit clear text code or Philips unique 12NC.

Clear text code

Example: 12062F105M8BB0D

SIZE CODE	TEMP. CHAR.	CAPACITANCE	TOL.	VOLTAGE	TERMINATION	PACKAGING	MARKING	SERIES
0201 0402 0603 0805 1206	2F = Y5V	105 = 1000000 pF; the third digit signifies the multiplying factor: 2 = × 100 3 = × 1000 4 = × 10000 5 = × 100000	M = ±20% Z = –20%/+80%	7 = 16 V 8 = 25 V 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 2 = 2-character marking in North America only	D = BME

Ordering code 12NC



(1) Refer to chapters “Selection chart for 16 V and 25 V” and “Selection chart for 50 V”.

(2) Amount on reel depends on thickness classification, see section “Thickness classification and packaging quantities”.

ELECTRICAL CHARACTERISTICS

Class 2 capacitors; Y5V base metal electrode 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 (E6 series); note 1	1 nF to 4.7 μF
Tolerance on capacitance after 1000 hours	±20% (M); –20% to +80% (Z)
Tan δ; note 1:	
all 25 V and 50 V (except 1206 and 1 μF; 0603 and 100 nF; 0805 and 330 nF)	≤5%
sizes 1206 and 1 μF; 0603 and 100 nF; 0805 and 330 nF	≤7%
all 16 V (except 0402; 0603 and 330 nF, 470 nF; 0805 and 2.2 μF; 1206 and 3.3 μF, 4.7 μF)	≤9%
sizes 0201; 0402; 0603 and 330 nF, 470 nF; 0805 and 2.2 μF; 1206 and 3.3 μF, 4.7 μF	≤12.5%
Insulation resistance after 1 minute at U_R (DC)	$I_R \times C > 500$ seconds
Maximum capacitance change with respect to capacitance at 25 °C (for typical values see Fig.5)	+22% to –82%
Ageing	typical 7% per time decade
Resistance to soldering heat	260 °C; 10 seconds

Note

1. Measured at 25 °C, 1 V and 1 kHz, using a four-gauge method.

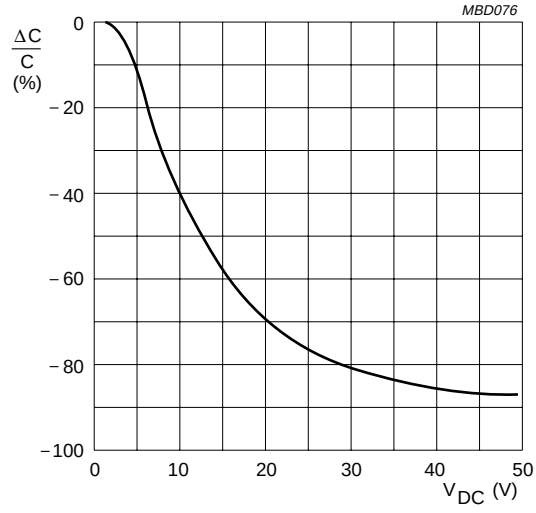


Fig.3 Typical capacitance change with respect to the capacitance at 1 V as a function of DC voltage at 25 °C.

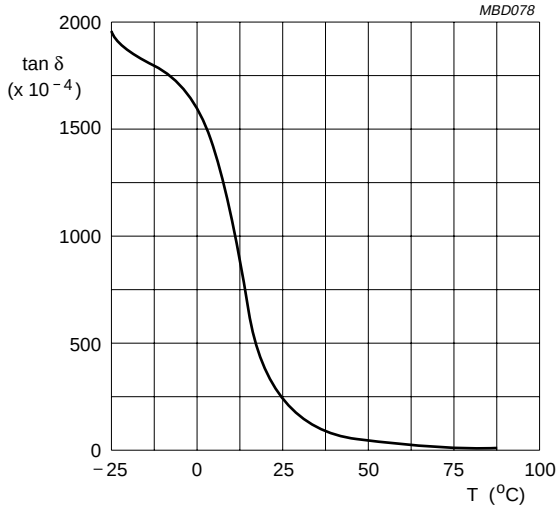


Fig.4 Typical tan δ as a function of temperature.

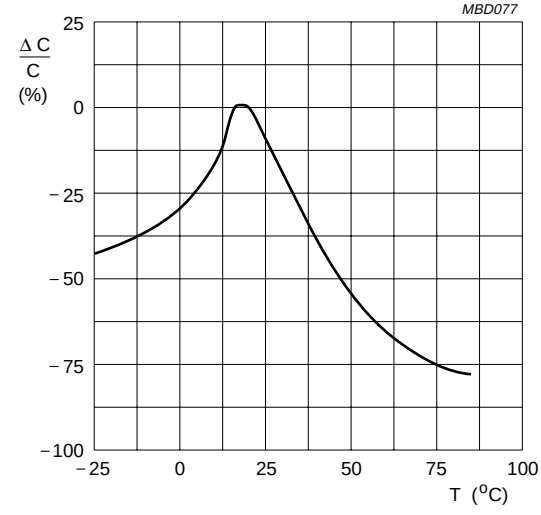


Fig.5 Typical capacitance change as a function of temperature.

TESTS AND REQUIREMENTS

Table 2 Test procedures and requirements

IEC 60384-10/ CECC 32 100 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
4.4		mounting	the capacitors may be mounted on printed-circuit boards or ceramic substrates by applying wave soldering, reflow soldering (including vapour phase soldering) or conductive adhesive	no visible damage
4.5		visual inspection and dimension check	any applicable method using ×10 magnification	in accordance with specification
4.6.1		capacitance	f = 1 kHz; measuring voltage 1 V_{rms} at 25 °C	within specified tolerance
4.6.2		tan δ	f = 1 kHz; measuring voltage 1 V_{rms} at 25 °C	in accordance with specification
4.6.3		insulation resistance	at U_R (DC) for 1 minute	$R_i C_R \geq 500$ s
4.6.4		voltage proof	$2.5 \times U_R$ for 1 minutes	no breakdown or flashover
4.7.1		temperature characteristic	between minimum and maximum temperature	in accordance with specification
4.8		adhesion	a force of 5 N applied for 10 s to the line joining the terminations and in a plane parallel to the substrate	no visible damage
4.9		bond strength of plating on end face	mounted in accordance with CECC 32 100, paragraph 4.4	no visible damage
			conditions: bending 1 mm at a rate of 1 mm/s, radius jig 340 mm	ΔC/C: ±30%
4.10	Tb	resistance to soldering heat	preconditioning: 120 to 150 °C during 1 minute; 260 ±5 °C for 10 ±0.5 s in a static solder bath	the terminations shall be well tinned after recovery ΔC/C: ±20% tan δ: original specification R_{ins}: original specification
		resistance to leaching	260 ±5 °C for 30 ±1 s in a static solder bath	using visual enlargement of ×10, dissolution of the terminations shall not exceed 10%
4.11	Ta	solderability	zero hour test, and test after storage (20 to 24 months) in original packing in normal atmosphere; unmounted chips completely immersed for 2 ±0.5 s in a solder bath at 235 ±5 °C	the terminations shall be well tinned

IEC 60384-10/ CECC 32 100 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
4.12	Na	rapid change of temperature	preconditioning: between minimum and maximum temperature, 5 cycles	no visual damage after 48 hours recovery: $\Delta C/C$: ±20%
4.14	Ca	damp heat, steady state	initialization: 48 ±4 hours after U_R at 40 °C for 1 hour (for initial value measurement); 500 ±12 hours at 40 °C; 90 to 95% RH; U_R applied	no visual damage after 48 hours recovery: $\Delta C/C$: +30%/–40% tan δ: ≤15% R_{ins}: 500 MΩ or $R_i C_R \geq 100$ s, whichever is less
		damp heat, with U_R load	initialization: 48 hours after U_R at 40 °C for 1 hour (for initial value measurement); 500 ±12 hours at 40 °C; 90 to 95% RH; U_R applied	preconditioning: U_R at 40 °C for 1 hour after 48 hours recovery: $\Delta C/C$: +30%/–40% tan δ: ≤15% R_{ins}: 500 MΩ or $R_i C_R \geq 25$ s, whichever is less
4.15		endurance	initialization: $2 \times U_R$ at 85 °C for 1 hour (initial value is measured after 48 ±4 hours); $2 \times U_R$ at 85 °C for 1000 hours, recovery 48 ±4 hours at room temperature	after 48 hours recovery: $\Delta C/C$: +30%/–40% tan δ: ≤15% R_{ins}: 1000 MΩ or $R_i C_R \geq 50$ s, whichever is less