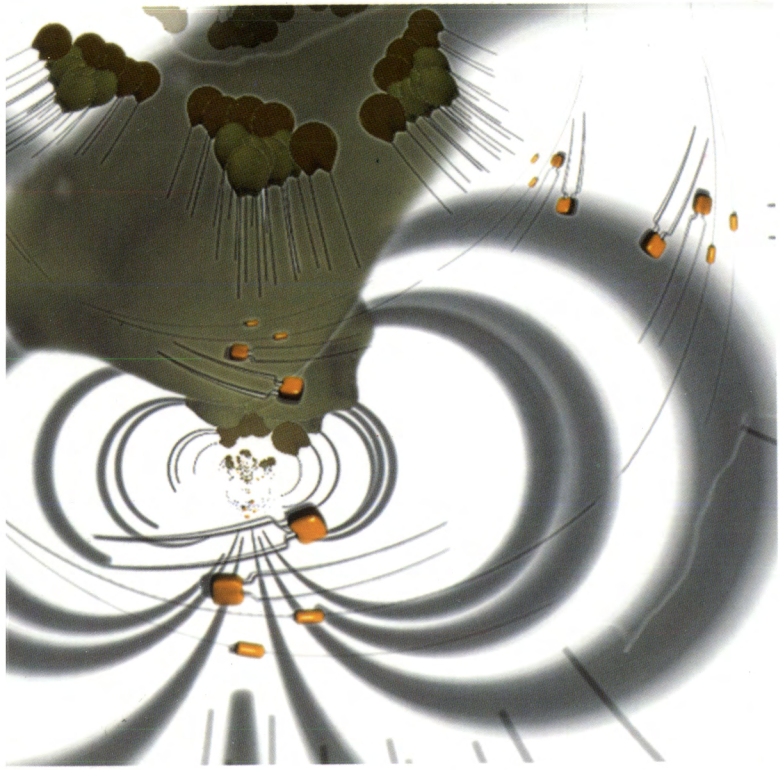

Leaded Ceramic Capacitors

Data Handbook BC06
1999

BEYSCHLAG
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COMPONENTS

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BC Components.

Leaded Ceramic Capacitors

CONTENTS

DEFINITIONS

Data sheet status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

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INTRODUCTION

GENERAL DATA

Ceramic capacitors are widely used in electronic circuitry for coupling, decoupling and in filters. These different functions require specific capacitor properties.

Ceramic capacitors can be divided into two classes:

- Class 1

  In these capacitors dielectric materials are used which have a very high specific resistance, very good Q and linear temperature dependence (ε_r from 6 up to 550). They are used in such applications as oscillators and filters where low losses, capacitance drift compensation and high stability are required.

- Class 2

  These capacitors have higher losses and have non-linear characteristics ($\varepsilon_r > 250$). They are used for coupling and decoupling.

CONSTRUCTION

The capacitance of a ceramic capacitor depends on the area of the electrodes (A), the thickness of the ceramic dielectric (t) and the dielectric constant of the ceramic material (ε_r); and on the number of dielectric layers (n) with multilayer ceramic capacitors:

$$C = \varepsilon_r \times \varepsilon_o \times \frac{A}{t} \times n$$

The rated voltage is dependent on the dielectric strength, which is mainly governed by the thickness of the dielectric layer and the ceramic structure. For this reason a reduction of the layer thickness is limited.

MANUFACTURING OF CERAMIC CAPACITORS

The raw materials are finely milled and carefully mixed. Thereafter the powders are calcined at temperatures between 1100 and 1300 °C to achieve the required chemical composition. The resultant mass is reground and dopes and/or sintering means are added.

The finely ground material is mixed with a solvent and binding matter. Thin sheets are obtained by casting or rolling.

For multilayer capacitors electrode material is printed on the sheets and after stacking and pressing of the sheets cofired with the ceramic compact at temperatures between 1000 and 1400 °C.

The totally enclosed electrodes of a multilayer capacitor guarantee good life test behaviour as well.

EQUIVALENT CIRCUIT FOR CERAMIC CAPACITORS

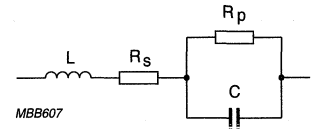


Fig.1 Equivalent circuit.

Definition of symbols; see Fig.1

SYMBOL	DESCRIPTION
C	Capacitance between the two electrodes, plus the stray capacitance at the edges and between the leads.
R_p	Resistance of insulation and dielectric. Generally R_p is very high, and of decreasing importance with increasing frequency. R_p also represents the polarization losses of the material in an alternating electric field.
R_s	Losses in the leads, the electrodes and the contacts. Up to several hundreds of MHz the current penetration depth is greater than the conductor thickness so that no skin-effect occurs. For ceramic capacitors R_s is extremely low.
L	Inductance of the leads and the internal inductance of the capacitor; the latter, however, is almost negligible. The inductance is only important in high frequency applications, since the capacitor will act as an inductance when the frequency is higher than its resonance frequency.

TANGENT OF THE LOSS ANGLE

The losses of a capacitor are expressed in terms of tan δ which is the relationship between the resistive and reactive parts of the impedance, specified as follows:

$$\tan\delta = \left|\frac{R}{X}\right| = \frac{R_p + R_s\{1 + (\omega CR_p)^2\}}{(\omega CR_p)^2 - \omega L\{1 + (\omega CR_p)^2\}}$$

From this formula, tan δ can be derived for different frequency ranges as shown in Fig.2.

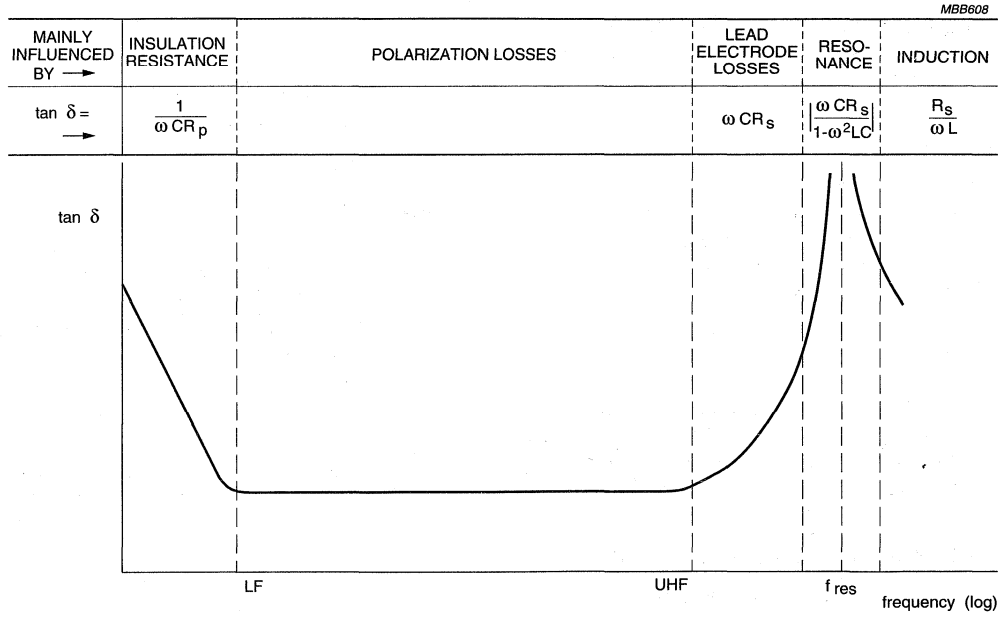
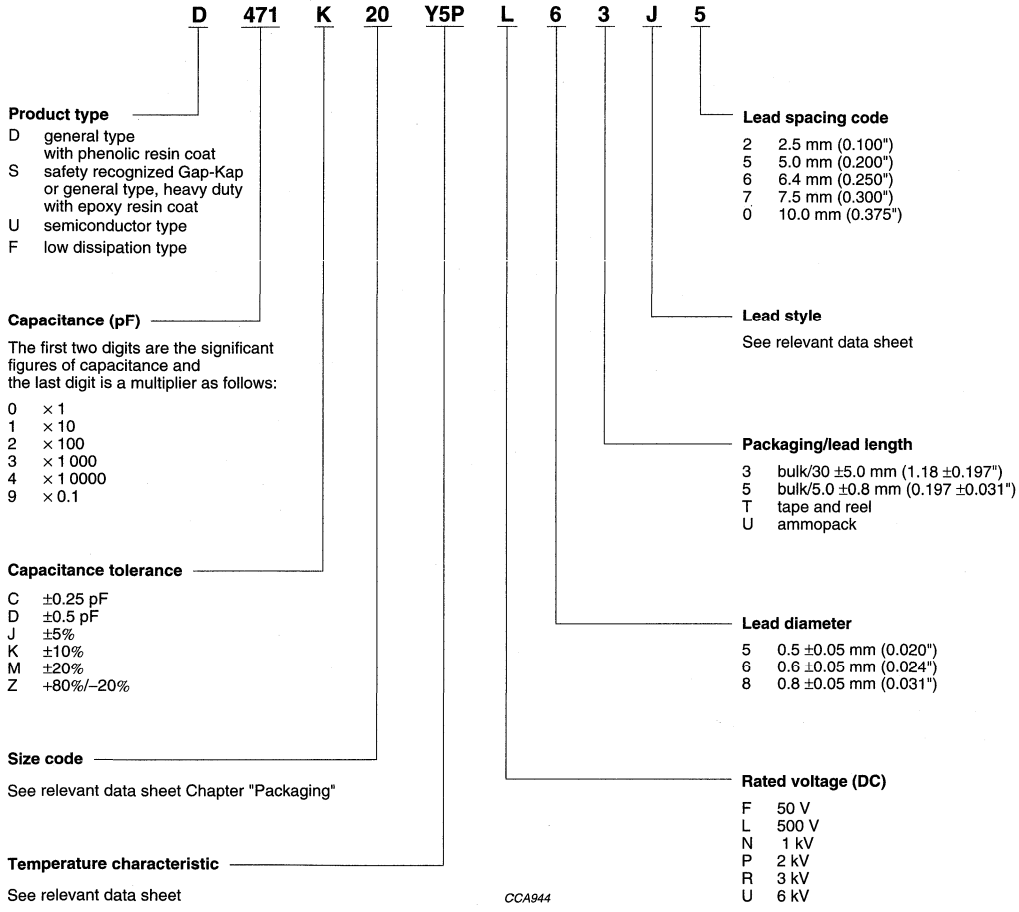


Fig.2 Tan δ as a function of frequency.

CERAMIC DISC CAPACITORS

CLEAR TEXT ORDERING CODE



SMALLEST PACKAGING QUANTITIES (SPQ)

PACKAGING	PRODUCT TYPE AND SIZE CODE		SPQ		BOX DIMENSIONS L × W × H (mm)
			2252 SERIES FE 15-digit	2222 SERIES US 15-digit	
Bulk; note 1	disc; long lead; L > 25.4 mm	20 to 25	1000		245 × 120 × 65
		29 to 39	1000		
		43 to 47	1000		
		53 to 84	500		
		96	250		
	disc; short lead; L ≤ 10 mm	20 to 25	5000		245 × 120 × 65
		29 to 39	3000		
		43 to 47	3000		
		53 to 59	2000		
		66 to 69	1000		
		75 to 84	500		
		96	500		
Tape on reel	disc	20 to 43; <500 V_{DC}	2500	2000[2]	370 × 370 × 60
		20 to 43; 500 V_{DC} ≤ WV ≤ 2 kV_{DC}	2000	2000	
Ammopack	disc	20 to 43; <500 V_{DC}	2000	2000	335 × 240 × 50
		20 to 43; 500 V_{DC} ≤ WV ≤ 2 kV_{DC}	2000	2000	335 × 290 × 50
		2 kV_{DC} only	1500	1500	

Notes

1. SPQ contains 1 or a multiple of poly-bags, 1000 units per bag, except for the following:
   a) Disc size 53 to 84, long lead and size 66 to 84, short lead: 500 units per bag.
   b) Disc size 96: 250 units per bag.
2. Non-standard SPQ for 2222 series and US 15-digit code (including FE 15-digit code with suffix XV) which will be phased out in the future.

PRODUCT DATA

Ceramic disc capacitors

Class 1 and 2, 50 V (DC) general purpose

FEATURES

- Low losses
- High stability
- High capacitance in small size
- Kinked (preferred) or straight leads.

APPLICATIONS

- Bypassing
- Coupling
- Resonant circuit.

DESCRIPTION

The capacitors consist of a ceramic disc both sides of which are silver-plated. Connection leads are made of tinned copper having a diameter of 0.6 mm.

The capacitors have inward kinked leads with a spacing of 5 mm (0.200") and a lead length from 4 to 30 mm. Encapsulation is made of phenolic resin.

QUICK REFERENCE DATA

DESCRIPTION	VALUE
Capacitance range:	
Class 1	1.0 to 100 pF
Class 2	150 to 47000 pF
Rated DC voltage	50 V
Dielectric strength	250% of rated voltage
Insulation resistance at 50 V (DC)	≥10000 MΩ
Tolerance on capacitance	±5%; ±10%; ±20%; +80%/–20%
Dissipation factor:	
Class 1, $C \leq 30$ pF	$\leq 20 \times (10/C + 0.7) \times 10^{-4}$ max.
Class 1, $C > 30$ pF	$\leq 20 \times 10^{-4}$
Class 2	≤3.0%
Temperature coefficients	NP0; SL0; Y5P; Z5U; Z5V
Sectional specifications	IEC 60384-8, IEC 60384-9, EIA 198
Climatic category:	
Class 1	55/85/21
Class 2	10/85/21

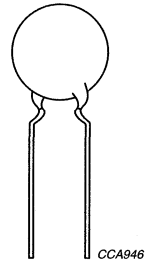
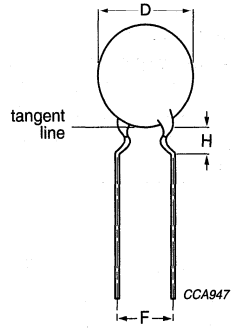


Fig.1 Simplified outline.

MECHANICAL DATA



Dimensions in mm.
For dimensions see Tables 1 and 2.

Fig.2 Capacitors with 5 mm (0.20") lead spacing.

MARKING

Marking indicates capacitance value and tolerance in accordance with *"EIA 198"*.

ORDERING INFORMATION (preferred types)

Table 1 Class 1, 50 V (DC), kinked; capacitance, mechanical dimensions and ordering information; note 1

C (pF)	TOL. (%)	D_{max} (mm)	LEAD SPACING F (mm)	SH[2] (mm)	CLEAR TEXT CODE	PACKAGING CODE 8th AND 9th DIGIT[3]			CATALOGUE NUMBER[4]
					13th DIGIT: T = REEL; U = AMMO; 3 = BULK	REEL	AMMO	BULK	
Class 1 NP0									
1.0	±25 pF	5.0	5.0	3.2	D109C20C0KF6.J5	06	08	10	2252 505 ..044
1.5	±25 pF	5.0	5.0	3.2	D159C20C0KF6.J5	06	08	10	2252 505 ..144
2.2	±25 pF	5.0	5.0	3.2	D229C20C0JF6.J5	06	08	10	2252 505 ..244
3.3	±25 pF	5.0	5.0	3.2	D339C20C0JF6.J5	06	08	10	2252 505 ..344
4.7	±25 pF	5.0	5.0	3.2	D479C20C0HF6.J5	06	08	10	2252 505 ..444
6.8	±50 pF	5.0	5.0	3.2	D689D20C0HF6.J5	06	08	10	2252 505 ..645
10	±5	5.0	5.0	3.2	D100J20C0GF6.J5	06	08	10	2252 505 ..005
12	±5	5.0	5.0	3.2	D120J20C0GF6.J5	06	08	10	2252 505 ..055
15	±5	5.0	5.0	3.2	D150J20C0GF6.J5	06	08	10	2252 505 ..105
18	±5	5.0	5.0	3.2	D180J20C0GF6.J5	06	08	10	2252 505 ..155
22	±5	5.0	5.0	3.2	D220J20C0GF6.J5	06	08	10	2252 505 ..205
27	±5	5.0	5.0	3.2	D270J20C0GF6.J5	06	08	10	2252 505 ..255
33	±5	5.0	5.0	3.2	D330J20C0GF6.J5	06	08	10	2252 505 ..305
39	±5	5.0	5.0	3.2	D390J20C0GF6.J5	06	08	10	2252 505 ..355
47	±5	6.5	5.0	3.2	D470J25C0GF6.J5	06	08	10	2252 505 ..405
Class 1 SL0									
56	±5	5.0	5.0	3.2	D560J20SL0F6.J5	06	08	10	2252 565 ..505
68	±5	5.0	5.0	3.2	D680J20SL0F6.J5	06	08	10	2252 565 ..605
82	±5	5.0	5.0	3.2	D820J20SL0F6.J5	06	08	10	2252 565 ..805
100	±5	5.0	5.0	3.2	D101J20SL0F6.J5	06	08	10	2252 565 ..015

Notes

1. Maximum thickness 4.0 mm.
2. SH = seated height.
3. Packaging codes refer to inward kinked leads. Other styles available on request.
4. 8th and 9th digit of the catalogue number to be completed with the packaging code.

Table 2 Class 2, 50 V (DC), kinked; capacitance, mechanical dimensions and ordering information; note 1

C (pF)	TOL. (%)	D_{max} (mm)	LEAD SPACING F (mm)	SH[2] (mm)	CLEAR TEXT CODE	PACKAGING CODE 8th AND 9th DIGIT[3]			CATALOGUE NUMBER[4]
					13th DIGIT: T = REEL; U = AMMO; 3 = BULK	REEL	AMMO	BULK	
Class 2 Y5P									
150	±10	5.0	5.0	3.2	D151J20Y5PF6.J5	06	08	10	2252 615 ..111
180	±10	5.0	5.0	3.2	D181J20Y5PF6.J5	06	08	10	2252 615 ..161
220	±10	5.0	5.0	3.2	D221J20Y5PF6.J5	06	08	10	2252 615 ..211
330	±10	5.0	5.0	3.2	D331K20Y5PF6.J5	06	08	10	2252 615 ..311
470	±10	5.0	5.0	3.2	D471K20Y5PF6.J5	06	08	10	2252 615 ..411
680	±10	5.0	5.0	3.2	D681K20Y5PF6.J5	06	08	10	2252 615 ..611
1000	±10	5.0	5.0	3.2	D102K20Y5PF6.J5	06	08	10	2252 615 ..021
1500	±10	5.0	5.0	3.2	D152K20Y5PF6.J5	06	08	10	2252 615 ..121
1800	±10	6.5	5.0	3.2	D182K25Y5PF6.J5	06	08	10	2252 615 ..171
2200	±10	6.5	5.0	3.2	D222K25Y5PF6.J5	06	08	10	2252 615 ..221
3300	±10	7.5	5.0	3.2	D332K29Y5PF6.J5	06	08	10	2252 615 ..321
4700	±10	8.5	5.0	3.2	D472K33Y5PF6.J5	06	08	10	2252 615 ..421
6800	±10	10.0	5.0	3.2	D682K39Y5PF6.J5	06	08	10	2252 615 ..621
10000	±10	11.0	5.0	3.2	D103K43Y5PF6.J5	06	08	10	2252 615 ..031
Class 2 Z5U									
1000	±20	5.0	5.0	3.2	D102M20Z5UF6.J5	06	08	10	2252 645 ..022
1500	±20	5.0	5.0	3.2	D152M20Z5UF6.J5	06	08	10	2252 645 ..122
2200	±20	5.0	5.0	3.2	D222M20Z5UF6.J5	06	08	10	2252 645 ..222
3300	±20	5.0	5.0	3.2	D332M20Z5UF6.J5	06	08	10	2252 645 ..322
4700	±20	5.0	5.0	3.2	D472M20Z5UF6.J5	06	08	10	2252 645 ..422
6800	±20	6.5	5.0	3.2	D682M25Z5UF6.J5	06	08	10	2252 645 ..622
10000	±20	7.5	5.0	3.2	D103M29Z5UF6.J5	06	08	10	2252 645 ..032
15000	±20	8.5	5.0	3.2	D153M33Z5UF6.J5	06	08	10	2252 645 ..132
22000	±20	10.0	5.0	3.2	D223M39Z5UF6.J5	06	08	10	2252 645 ..232
Class 2 Z5V									
4700	+80/–20	5.0	5.0	3.2	D472Z20Z5VF6.J5	06	08	10	2252 655 ..423
10000	+80/–20	6.5	5.0	3.2	D103Z25Z5VF6.J5	06	08	10	2252 655 ..033
22000	+80/–20	8.5	5.0	3.2	D223Z33Z5VF6.J5	06	08	10	2252 655 ..233
47000	+80/–20	11.0	5.0	3.2	D473Z43Z5VF6.J5	06	08	10	2252 655 ..433

Notes

1. Maximum thickness 4.0 mm.
2. SH = seated height.
3. Packaging codes refer to inward kinked leads. Other styles available on request.
4. 8th and 9th digit of the catalogue number to be completed with the packaging code.

ELECTRICAL CHARACTERISTICS

The capacitors meet the essential requirements of *"EIA 198"*. Unless stated otherwise all electrical values apply at an ambient temperature of 25 ±3 °C, at normal atmospheric conditions.

DESCRIPTION	VALUE
Capacitance range:	
Class 1, at 1 MHz, 1.2 V (RMS); note 1	1.0 to 220 pF
Class 2, at 1 kHz, 1 ±0.2 V (RMS)	330 to 47000 pF
Tolerance on capacitance	±5%; ±10%; ±20%; +80%/–20%
Dielectric strength	250% of rated voltage
Insulation resistance at 50 V (DC)	≥10000 MΩ
Temperature coefficients on capacitance:	
Class 1	NP0; SL0
Class 2	Y5P; Z5U; Z5V
Dissipation factor:	
Class 1, C ≤ 30 pF	$\leq 20 \times (10/C + 0.7) \times 10^{-4}$ max.
Class 1, C > 30 pF	$\leq 20 \times 10^{-4}$
Class 2	≤3.0%
Operating temperature range	–30 to +85 °C

Note

1. 1 kHz, 1 ±0.2 V (RMS) for capacitance values higher than 1000 pF.

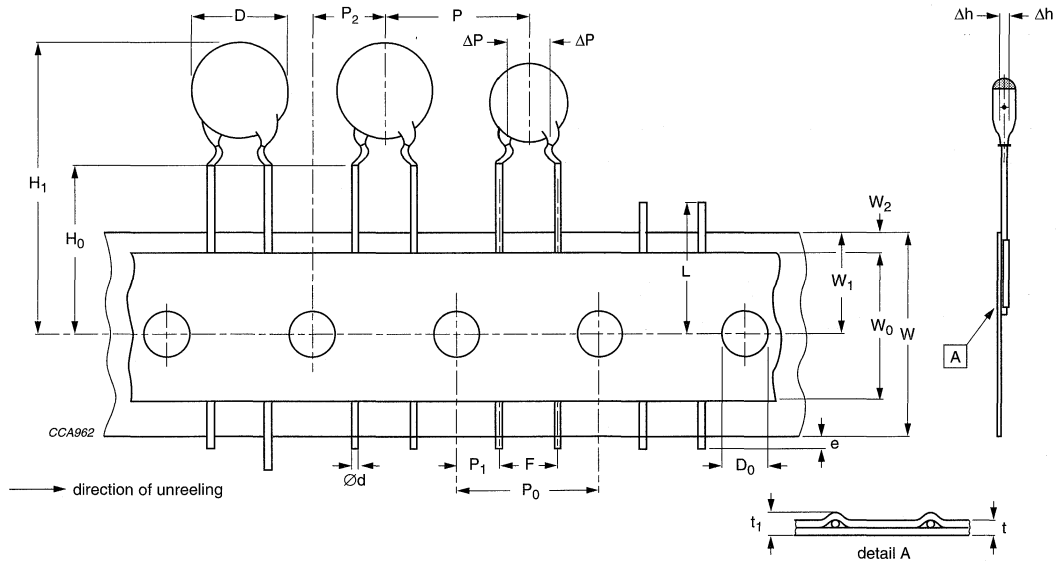
PACKAGING

The capacitors are supplied in bulk packaging (cardboard boxes), in tape on reel or in ammopack (see Table 3).

Table 3 Size codes and packaging quantities

D_{max} (mm)	SIZE CODE	PACKAGING QUANTITIES		
		BULK	REEL	AMMO
5.0 (0.20")	20	1000	2500	2000
6.5 (0.25")	25			
7.5 (0.29")	29			
8.5 (0.33")	33			
10.0 (0.39")	39			
11.0 (0.43")	43			

Kinked capacitors on tape, lead spacing 5.0 mm (0.2 inch)



For dimensions see Table 4.

Fig.3 Capacitors, lead spacing 5.0 mm, on tape.

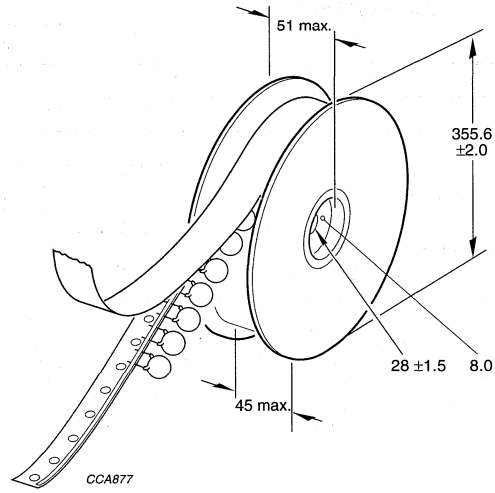
Table 4 Dimensions of tape; see Fig.3

SYMBOL	PARAMETER	DIMENSIONS (mm)	
		NOMINAL	TOLERANCE
D	body diameter	11.0 max.	–
d	lead diameter	0.6	±0.05
P	pitch between capacitors	12.7	±1.0
P_0	feed-hole pitch	12.7	±0.3; note 1
ΔP	plane deviation	1.0 max.	–
P_1	feed-hole centre to lead centre	3.85	±0.7; note 2
P_2	feed-hole centre to component centre	6.35	±1.3; note 2
F	lead spacing	5.0	+0.6 −0.4
Δh	component alignment	0	±1.0
Δs	deviation along tape, left or right	0	±1.0
W	tape width	18.0	+1.0 −0.5
W_0	hold-down tape width	5.0 min.	–
W_1	hole position	9.0	+0.75 −0.5
W_2	hold-down tape margin	3.0 max.	–
H_0	height to seating plane	16.0	±0.5
H_1	maximum component height	32.0	–
e	lead end protrusion	1.0 max.	–
L	maximum length of snipped lead	11.0	–
D_0	feed-hole diameter	4.0	±0.2
t	total tape thickness	0.9 max.	–
t_1	maximum thickness of tape and wires	1.5 max.	–

Notes

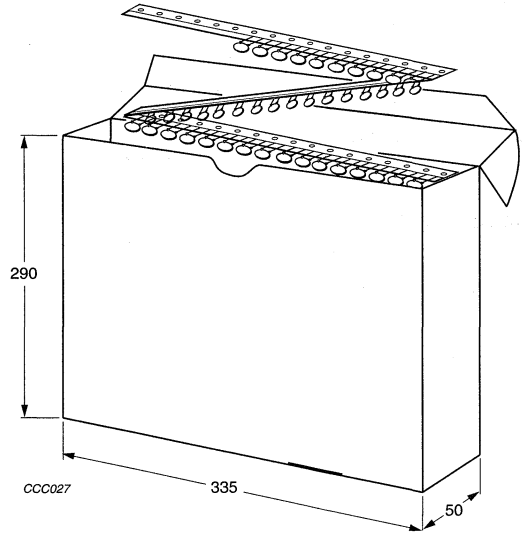
1. Cumulative pitch error: ±≤1 mm/20 pitches.
2. Obliquity maximum 3°.

REEL AND TAPE DATA



Dimensions in mm.

Fig.4 Reel with capacitors on tape.



Dimensions in mm.

Fig.5 Ammopack with capacitors on tape.

Ceramic disc capacitors

Class 1 and 2, 500 V (DC) general purpose

FEATURES

- Low losses
- High stability
- High capacitance in small size
- Kinked (preferred) or straight leads.

APPLICATIONS

- Bypassing
- Coupling
- Resonant circuit.

DESCRIPTION

The capacitors consist of a ceramic disc both sides of which are silver-plated. Connection leads are made of tinned copper having a diameter of 0.6 mm.

The capacitors have inward kinked leads with a spacing of 5 mm (0.200") or 7.5 mm (0.300") and a lead length from 4 to 30 mm. Encapsulation is made of phenolic resin.

QUICK REFERENCE DATA

DESCRIPTION	VALUE
Capacitance range:	
Class 1	10 to 82 pF
Class 2	100 to 22000 pF
Rated DC voltage	500 V
Dielectric strength	250% of rated voltage
Insulation resistance at 500 V (DC)	≥10000 MΩ
Tolerance on capacitance	±5%; ±10%; ±20%
Dissipation factor:	
Class 1, C ≤ 30 pF	$\leq 20 \times (10/C + 0.7) \times 10^{-4}$ max.
Class 1, C > 30 pF	$\leq 20 \times 10^{-4}$
Class 2	≤3.0%
Temperature coefficients	NP0; SL0; Y5P; Z5U
Sectional specifications	IEC 60384-8, IEC 60384-9, EIA 198
Climatic category:	
Class 1	55/85/21
Class 2	10/85/21

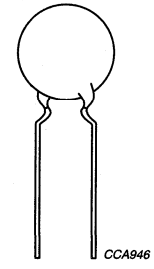
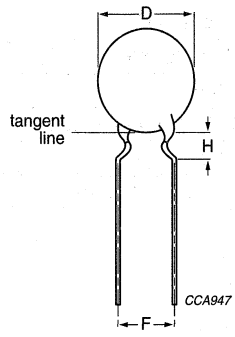


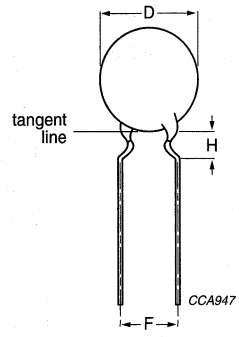
Fig.1 Simplified outline.

MECHANICAL DATA



Dimensions in mm.
For dimensions see Tables 1 and 2.

Fig.2 Capacitors with 5 mm (0.20") lead spacing.



Dimensions in mm.
For dimensions see Tables 1 and 2.

Fig.3 Capacitors with 7.5 mm (0.30") lead spacing.

MARKING

Marking indicates capacitance value and tolerance in accordance with *"EIA 198"*.

ORDERING INFORMATION (preferred types)

Table 1 Class 1, 500 V (DC), kinked; capacitance, mechanical dimensions and ordering information; note 1

C (pF)	TOL. (%)	D_{max} (mm)	LEAD SPACING F (mm)	SH[2] (mm)	CLEAR TEXT CODE	PACKAGING CODE 8th AND 9th DIGIT[3]			CATALOGUE NUMBER[4]
					13th DIGIT: T = REEL; U = AMMO; 3 = BULK	REEL	AMMO	BULK	
Class 1 NP0									
10	±5	5.0	5.0	3.2	D100J20C0GL6.J5	06	08	10	2252 508 ..005
12	±5	5.0	5.0	3.2	D120J20C0GL6.J5	06	08	10	2252 508 ..055
15	±5	5.0	5.0	3.2	D150J20C0GL6.J5	06	08	10	2252 508 ..105
18	±5	5.0	5.0	3.2	D180J20C0GL6.J5	06	08	10	2252 508 ..155
22	±5	5.0	5.0	3.2	D220J20C0GL6.J5	06	08	10	2252 508 ..205
27	±5	6.5	5.0	3.2	D270J25C0GL6.J5	06	08	10	2252 508 ..255
Class 1 SL0									
33	±5	5.0	5.0	3.2	D330J20SL0L6.J5	06	08	10	2252 568 ..305
39	±5	5.0	5.0	3.2	D390J20SL0L6.J5	06	08	10	2252 568 ..355
47	±5	5.0	5.0	3.2	D470J20SL0L6.J5	06	08	10	2252 568 ..405
56	±5	5.0	5.0	3.2	D560J20SL0L6.J5	06	08	10	2252 568 ..505
68	±5	6.5	5.0	3.2	D680J25SL0L6.J5	06	08	10	2252 568 ..605
82	±5	6.5	5.0	3.2	D820J25SL0L6.J5	06	08	10	2252 568 ..805

Notes

1. Maximum thickness 4.0 mm.
2. SH = seated height.
3. Packaging codes refer to inward kinked leads. Other styles available on request.
4. 8th and 9th digit of the catalogue number to be completed with the packaging code.

Table 2 Class 2, 500 V (DC), kinked; capacitance, mechanical dimensions and ordering information; note 1

C (pF)	TOL. (%)	D_{max} (mm)	LEAD SPACING F (mm)	SH[2] (mm)	CLEAR TEXT CODE	PACKAGING CODE 8th AND 9th DIGIT[3]			CATALOGUE NUMBER[4]
					13th DIGIT: T = REEL; U = AMMO; 3 = BULK	REEL	AMMO	BULK	
Class 2 Y5P									
100	±10	5.0	5.0	3.2	D101K20Y5PL6.J5	06	08	10	2252 618 ..011
150	±10	5.0	5.0	3.2	D151K20Y5PL6.J5	06	08	10	2252 618 ..111
220	±10	5.0	5.0	3.2	D221K20Y5PL6.J5	06	08	10	2252 618 ..211
330	±10	5.0	5.0	3.2	D331K20Y5PL6.J5	06	08	10	2252 618 ..311
470	±10	5.0	5.0	3.2	D471K20Y5PL6.J5	06	08	10	2252 618 ..411
680	±10	6.5	5.0	3.2	D681K25Y5PL6.J5	06	08	10	2252 618 ..611
1000	±10	6.5	5.0	3.2	D102K25Y5PL6.J5	06	08	10	2252 618 ..021
1500	±10	7.5	5.0	3.2	D152K29Y5PL6.J5	06	08	10	2252 618 ..121
2200	±10	8.5	5.0	3.2	D222K33Y5PL6.J5	06	08	10	2252 618 ..221
3300	±10	10.0	5.0	3.2	D332K39Y5PL6.J5	06	08	10	2252 618 ..321
4700	±10	12.0	7.5	4.0	D472K47Y5PL63J7	–	–	31	2252 618 ..421
6800	±10	13.5	7.5	4.0	D682K53Y5PL63J7	–	–	31	2252 618 ..621
10000	±10	17.5	7.5	4.0	D103K69Y5PL63J7	–	–	31	2252 618 ..031
Class 2 Z5U									
1000	±20	5.0	5.0	3.2	D102M20Z5UL6.J5	06	08	10	2252 648 ..022
1500	±20	6.5	5.0	3.2	D152M25Z5UL6.J5	06	08	10	2252 648 ..122
2200	±20	6.5	5.0	3.2	D222M25Z5UL6.J5	06	08	10	2252 648 ..222
3300	±20	7.5	5.0	3.2	D332M29Z5UL6.J5	06	08	10	2252 648 ..322
4700	±20	8.5	5.0	3.2	D472M33Z5UL6.J5	06	08	10	2252 648 ..422
6800	±20	10.0	5.0	3.2	D682M39Z5UL6.J5	06	08	10	2252 648 ..622
10000	±20	12.0	7.5	4.0	D103M47Z5UL6.J7	–	–	31	2252 648 ..032
15000	±20	13.5	7.5	4.0	D153M53Z5UL6.J7	–	–	31	2252 648 ..132
22000	±20	15.0	7.5	4.0	D223M59Z5UL6.J7	–	–	31	2252 648 ..232

Notes

1. Maximum thickness 4.0 mm.
2. SH = seated height.
3. Packaging codes refer to inward kinked leads. Other styles available on request.
4. 8th and 9th digit of the catalogue number to be completed with the packaging code.

ELECTRICAL CHARACTERISTICS

The capacitors meet the essential requirements of *"EIA 198"*. Unless stated otherwise all electrical values apply at an ambient temperature of 25 ±3 °C, at normal atmospheric conditions.

DESCRIPTION	VALUE
Capacitance range:	
Class 1, at 1 MHz, 1.2 V (RMS); note 1	10 to 82 pF
Class 2, at 1 kHz, 1 ±0.2 V (RMS)	100 to 22000 pF
Tolerance on capacitance	±5%; ±10%; ±20%
Dielectric strength	250% of rated voltage
Insulation resistance at 500 V (DC)	≥10000 MΩ
Temperature coefficients on capacitance:	
Class 1	NP0; SL0
Class 2	Y5P; Z5U
Dissipation factor:	
Class 1, C ≤ 30 pF	$\leq 20 \times (10/C + 0.7) \times 10^{-4}$ max.
Class 1, C > 30 pF	$\leq 20 \times 10^{-4}$
Class 2	≤3.0%
Operating temperature range	−30 to +85 °C

Note

1. 1 kHz, 1 ±0.2 V (RMS) for capacitance values higher than 1000 pF.

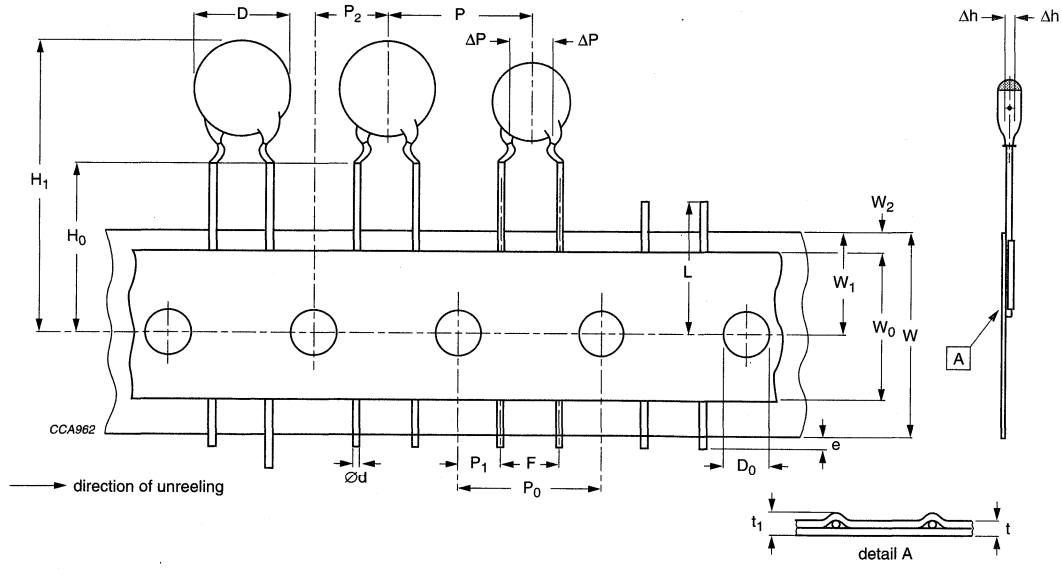
PACKAGING

The capacitors are supplied in bulk packaging (cardboard boxes), in tape on reel or in ammopack (see Table 3).

Table 3 Size codes and packaging quantities

D_{max} (mm)	SIZE CODE	PACKAGING QUANTITIES		
		BULK	REEL	AMMO
5.0 (0.20")	20	1000	2000	2000
6.5 (0.25")	25			
7.5 (0.29")	29			
8.5 (0.33")	33			
10.0 (0.39")	39			
11.0 (0.43")	43			
12.0 (0.47")	47	1000	–	–
13.5 (0.53")	53	500	–	–
15.0 (0.59")	59			
17.5 (0.69")	69			

Kinked capacitors on tape, lead spacing 5.0 mm (0.2 inch)



For dimensions see Table 4.

Fig.4 Capacitors, lead spacing 5.0 mm, on tape.

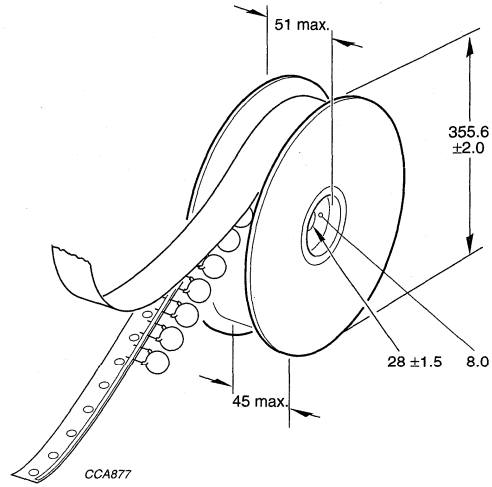
Table 4 Dimensions of tape; see Fig.4

SYMBOL	PARAMETER	DIMENSIONS (mm)	
		NOMINAL	TOLERANCE
D	body diameter	11.0 max.	–
d	lead diameter	0.6	±0.05
P	pitch between capacitors	12.7	±1.0
P_0	feed-hole pitch	12.7	±0.3; note 1
ΔP	plane deviation	1.0 max.	–
P_1	feed-hole centre to lead centre	3.85	±0.7; note 2
P_2	feed-hole centre to component centre	6.35	±1.3; note 2
F	lead spacing	5.0	+0.6 −0.4
F_0	lead-to-lead	5.08	+0.5 −0.1
Δh	component alignment	0	±1.0
Δs	deviation along tape, left or right	0	±1.0
W	tape width	18.0	+1.0 −0.5
W_0	hold-down tape width	5.0 min.	–
W_1	hole position	9.0	+0.75 −0.5
W_2	hold-down tape margin	3.0 max.	–
H_0	height to seating plane	16.0	±0.5
H_1	maximum component height	32.0	–
e	lead end protrusion	1.0 max.	–
L	maximum length of snipped lead	11.0	–
D_0	feed-hole diameter	4.0	±0.2
t	total tape thickness	0.9 max.	–
t_1	maximum thickness of tape and wires	1.5 max.	–

Notes

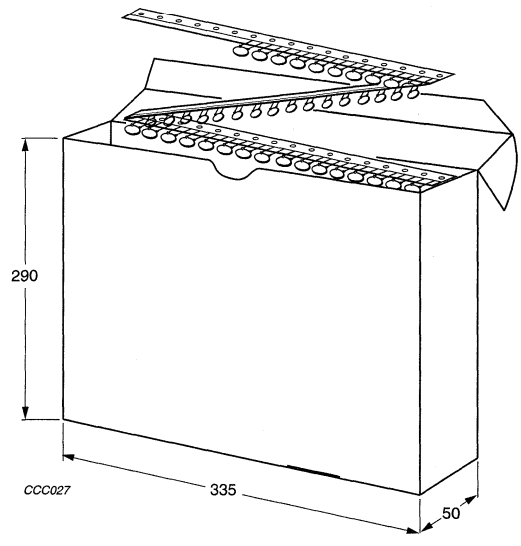
1. Cumulative pitch error: ±≤1 mm/20 pitches.
2. Obliquity maximum 3°.

REEL AND TAPE DATA



Dimensions in mm.

Fig.5 Reel with capacitors on tape.



Dimensions in mm.

Fig.6 Ammopack with capacitors on tape.

Ceramic disc capacitors

Class 1 and 2, 1/2/3/6 kV general purpose

FEATURES

- Low losses
- High stability
- High capacitance in small size
- Kinked (preferred), flanged or straight leads.

APPLICATIONS

- DC high voltage
- Pulse high voltage
- SMPS
- HV power supply
- HF ballast.

DESCRIPTION

The capacitors consist of a ceramic disc both sides of which are silver-plated. Connection leads are made of tinned copper having a diameter of 0.6 mm or 0.8 mm up to 3 kV and 0.8 mm for 6 kV.

The capacitors may be supplied with outward kinked, flanged or straight leads with a lead spacing of 5 mm (0.200"), 7.5 mm (0.300") or 10 mm (0.400") and a lead length from 4 to 30 mm. The standard tolerance on capacitance is ±5% or ±10% for class 1 capacitors and ±10% or ±20% for class 2 capacitors. Encapsulation is made of gold-coloured epoxy-resin, flammable resistant in accordance with *"UL94V-0"*.

QUICK REFERENCE DATA

DESCRIPTION	VALUE
Capacitance range:	
Class 1	10 to 270 pF
Class 2	100 to 22000 pF
Rated DC voltage	1 kV; 2 kV; 3 kV; 6 kV
Dielectric strength	200% of rated voltage
Insulation resistance at 500 V (DC)	≥10000 MΩ
Tolerance on capacitance	±5%, ±10% and ±20%; note 1
Dissipation factor:	
Class 1, C ≤ 30 pF	$\leq 20 \times (10/C + 0.7) \times 10^{-4}$ max.
Class 1, C > 30 pF	$\leq 20 \times 10^{-4}$
Class 2	≤3.0%
Temperature coefficients	SL; S3N; Y5P; Z5U
Sectional specifications	IEC 60384-8, IEC 60384-9, EIA 198
Climatic category:	
Class 1:	
flanged	30/125/21 (2 kV: 30/125/21)
kinked	55/85/21
Class 2	10/85/21

Note

1. Other tolerances available on request.

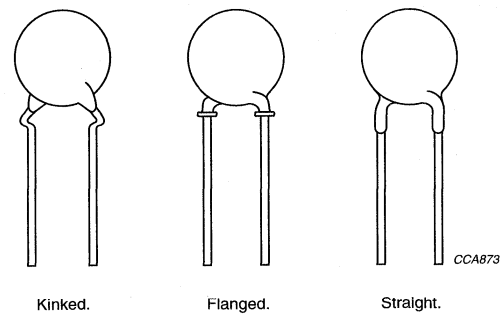
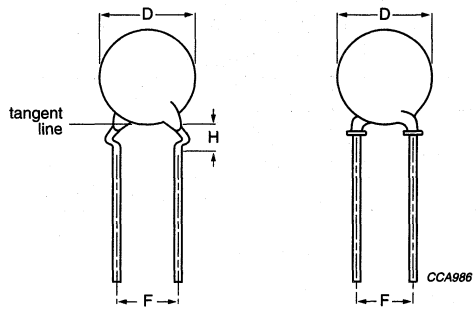


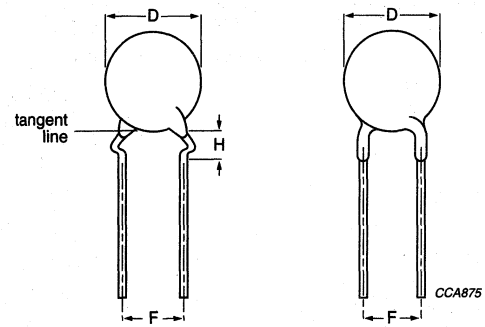
Fig.1 Simplified outlines.

MECHANICAL DATA



Dimensions in mm.
For dimensions see Tables 1 to 6.

Fig.2 Capacitors with 5 mm (0.20") lead spacing.



Dimensions in mm.
For dimensions see Tables 1 to 6.

Fig.3 Capacitors with 7.5 mm (0.30") and 10 mm (0.40") lead spacing.

MARKING

Flanged capacitors are marked as follows:

- The body of the capacitors is tan coloured; capacitance value and voltage are indicated by a marking code on the body.

Straight and kinked leaded versions are gold coloured. Marking indicates capacitance value and tolerance in accordance with *"EIA 198"*, and voltage.

ORDERING INFORMATION

Table 1 1 kV (DC), kinked; capacitance, mechanical dimensions and ordering information; note 1

C (pF)	TOL. (%)	D_{max} (mm)	LEAD SPACING F (mm)	SH[2] (mm)	CLEAR TEXT CODE	PACKAGING CODE 8th AND 9th DIGIT[3]			CATALOGUE NUMBER[4]
					13th DIGIT: T = REEL; U = AMMO; 3 = BULK				
			KINKED			REEL	AMMO	BULK	KINKED
Class 1 SL									
10	±10	6.5	5.0	3.2	S100K25SL0N6.K5	13	14	15	2252 561 ..006
15	±10	6.5	5.0	3.2	S150K25SL0N6.K5	13	14	15	2252 561 ..106
22	±10	6.5	5.0	3.2	S220K25SL0N6.K5	13	14	15	2252 561 ..206
33	±10	6.5	5.0	3.2	S330K25SL0N6.K5	13	14	15	2252 561 ..306
47	±10	6.5	5.0	3.2	S470K25SL0N6.K5	13	14	15	2252 561 ..406
68	±10	6.5	5.0	3.2	S680K25SL0N6.K5	13	14	15	2252 561 ..606
100	±10	7.5	5.0	3.2	S101K29SL0N6.K5	13	14	15	2252 561 ..016
150	±10	10.0	5.0	3.2	S151K39SL0N6.K5	13	14	15	2252 561 ..116
220	±10	10.0	5.0	3.2	S221K39SL0N6.K5	13	14	15	2252 561 ..216
Class 2 Y5P									
100	±10	6.5	5.0	3.2	S101K25Y5PN6.K5	13	14	15	2252 611 ..016
150	±10	6.5	5.0	3.2	S151K25Y5PN6.K5	13	14	15	2252 611 ..116
220	±10	6.5	5.0	3.2	S221K25Y5PN6.K5	13	14	15	2252 611 ..216
330	±10	6.5	5.0	3.2	S331K25Y5PN6.K5	13	14	15	2252 611 ..316
470	±10	6.5	5.0	3.2	S471K25Y5PN6.K5	13	14	15	2252 611 ..416
680	±10	6.5	5.0	3.2	S681K25Y5PN6.K5	13	14	15	2252 611 ..616
1000	±10	7.5	5.0	3.2	S102K29Y5PN6.K5	13	14	15	2252 611 ..026
1500	±10	8.5	5.0	3.2	S152K33Y5PN6.K5	13	14	15	2252 611 ..126
2200	±10	10.0	5.0	3.2	S222K39Y5PN6.K5	13	14	15	2252 611 ..226
3300	±10	11.0	5.0	3.2	S332K43Y5PN6.K5	13	14	15	2252 611 ..326
4700	±10	13.5	7.5	4.0	S472K53Y5PN63K7	–	–	37	2252 611 37426
6800	±10	15.0	7.5	4.0	S682K59Y5PN63K7	–	–	37	2252 611 37626
10000	±10	17.5	7.5	4.0	S103K69Y5PN63K7	–	–	37	2252 611 37036

C (pF)	TOL. (%)	D_{max} (mm)	LEAD SPACING F (mm)	SH[2] (mm)	CLEAR TEXT CODE	PACKAGING CODE 8th AND 9th DIGIT[3]			CATALOGUE NUMBER[4]
					13th DIGIT: T = REEL; U = AMMO; 3 = BULK				
			KINKED			REEL	AMMO	BULK	KINKED
Class 2 Z5U									
1000	±20	6.5	5.0	3.2	S102M25Z5UN6.K5	13	14	15	2252 641 ..027
1500	±20	6.5	5.0	3.2	S152M25Z5UN6.K5	13	14	15	2252 641 ..127
2200	±20	6.5	5.0	3.2	S222M25Z5UN6.K5	13	14	15	2252 641 ..227
3300	±20	8.5	5.0	3.2	S332M33Z5UN6.K5	13	14	15	2252 641 ..327
4700	±20	10.0	5.0	3.2	S472M39Z5UN6.K5	13	14	15	2252 641 ..427
6800	±20	11.0	5.0	3.2	S682M43Z5UN6.K5	13	14	15	2252 641 ..627
10000	±20	12.0	7.5	4.0	S103M47Z5UN63K7	–	–	37	2252 641 37037
15000	±20	15.0	7.5	4.0	S153M59Z5UN63K7	–	–	37	2252 641 37137
22000	±20	17.5	7.5	4.0	S223M69Z5UN63K7	–	–	37	2252 641 37237

Notes

1. Maximum thickness 4.5 mm.
2. SH = seated height.
3. Packaging codes refer to outward kinked leads. Other styles available on request.
4. 8th and 9th digit of the catalogue number to be completed with the packaging code.

Table 2 1 kV (DC), flanged; capacitance, mechanical dimensions and ordering information; note 1

C (pF)	TOL. (%)	D_{max} (mm)	LEAD SPACING F (mm)	SH[2] (mm)	CLEAR TEXT CODE	PACKAGING CODE 8th AND 9th DIGIT[3]			CATALOGUE NUMBER[4]
					12th AND 13th DIGIT: WG = REEL; WJ = AMMO; WF = BULK				
			FLANGED			REEL	AMMO	BULK	FLANGED
Class 1 SL									
10	±5	7	5.0	10	D100J28SL0N..AP	13	14	15	2251 561 ..005
12	±5	7	5.0	10	D120J28SL0N..AP	13	14	15	2251 561 ..055
15	±5	7	5.0	10	D150J28SL0N..AP	13	14	15	2251 561 ..105
18	±5	7	5.0	10	D180J28SL0N..AP	13	14	15	2251 561 ..155
22	±5	7	5.0	10	D220J28SL0N..AP	13	14	15	2251 561 ..205
27	±5	7	5.0	10	D270J28SL0N..AP	13	14	15	2251 561 ..255
33	±5	7	5.0	10	D330J28SL0N..AP	13	14	15	2251 561 ..305
39	±5	7	5.0	10	D390J28SL0N..AP	13	14	15	2251 561 ..355
47	±5	7	5.0	10	D470J28SL0N..AP	13	14	15	2251 561 ..405
56	±5	7	5.0	10	D560J28SL0N..AP	13	14	15	2251 561 ..505
68	±5	7	5.0	10	D680J28SL0N..AP	13	14	15	2251 561 ..605
82	±5	7	5.0	10	D820J28SL0N..AP	13	14	15	2251 561 ..805
100	±5	7	5.0	10	D101J28SL0N..AP	13	14	15	2251 561 ..015
120	±5	8	5.0	11	D121J31SL0N..AP	13	14	15	2251 561 ..065
150	±5	8	5.0	11	D151J31SL0N..AP	13	14	15	2251 561 ..115
180	±5	9	5.0	12	D181J35SL0N..AP	13	14	15	2251 561 ..165
220	±5	9	5.0	12	D221J35SL0N..AP	13	14	15	2251 561 ..215
270	±5	10	5.0	13	D271J39SL0N..AP	13	14	15	2251 561 ..265
330	±5	11	5.0	14	D331J43SL0N..AP	13	14	15	2251 561 ..315
390	±5	11	5.0	15	D391J43SL0N..AP	13	14	15	2251 561 ..365
470	±5	12	5.0	15	D331J47SL0N..AP	13	14	15	2251 561 ..415
Class 2 Y5P									
100	±10	7	5.0	10	D101K28Y5PN..SP	13	14	15	2251 611 ..016
120	±10	7	5.0	10	D121K28Y5PN..SP	13	14	15	2251 611 ..066
150	±10	7	5.0	10	D151K28Y5PN..SP	13	14	15	2251 611 ..116
180	±10	7	5.0	10	D181K28Y5PN..SP	13	14	15	2251 611 ..166
220	±10	7	5.0	10	D221K28Y5PN..SP	13	14	15	2251 611 ..216
270	±10	7	5.0	10	D271K28Y5PN..SP	13	14	15	2251 611 ..266
330	±10	7	5.0	10	D331K28Y5PN..SP	13	14	15	2251 611 ..316
390	±10	7	5.0	10	D391K28Y5PN..SP	13	14	15	2251 611 ..366
470	±10	7	5.0	10	D471K28Y5PN..SP	13	14	15	2251 611 ..416
560	±10	7	5.0	10	D561K28Y5PN..SP	13	14	15	2251 611 ..516
680	±10	7	5.0	10	D681K28Y5PN..SP	13	14	15	2251 611 ..616
820	±10	7	5.0	10	D821K28Y5PN..SP	13	14	15	2251 611 ..816

C (pF)	TOL. (%)	D_{max} (mm)	LEAD SPACING F (mm)	SH[2] (mm)	CLEAR TEXT CODE	PACKAGING CODE 8th AND 9th DIGIT[3]			CATALOGUE NUMBER[4]
					12th AND 13th DIGIT: WG = REEL; WJ = AMMO; WF = BULK				
			FLANGED			REEL	AMMO	BULK	FLANGED
1000	±10	7	5.0	10	D102K28Y5PN..SP	13	14	15	2251 611 ..026
1200	±10	8	5.0	11	D122K31Y5PN..SP	13	14	15	2251 611 ..076
1500	±10	9	5.0	12	D152K35Y5PN..SP	13	14	15	2251 611 ..126
1800	±10	9	5.0	12	D182K35Y5PN..SP	13	14	15	2251 611 ..176
2200	±10	10	5.0	13	D222K39Y5PN..SP	13	14	15	2251 611 ..226
2700	±10	11	5.0	14	D272K43Y5PN..SP	13	14	15	2251 611 ..276
3300	±10	11	5.0	14	D332K43Y5PN..SP	13	14	15	2251 611 ..326
3900	±10	11	5.0	15	D392K43Y5PN..SP	13	14	15	2251 611 ..376
4700	±10	12	5.0	15	D472K47Y5PN..SP	13	14	15	2251 611 ..426
Class 2 Z5U									
1000	±20	7	5.0	10	D102M28Z5UN..SP	13	14	15	2251 641 ..027
1200	±20	7	5.0	10	D122M28Z5UN..SP	13	14	15	2251 641 ..077
1500	±20	7	5.0	10	D152M28Z5UN..SP	13	14	15	2251 641 ..127
1800	±20	7	5.0	10	D182M31Z5UN..SP	13	14	15	2251 641 ..177
2200	±20	7	5.0	10	D222M31Z5UN..SP	13	14	15	2251 641 ..227
2700	±20	8	5.0	11	D272M31Z5UN..SP	13	14	15	2251 641 ..277
3300	±20	8	5.0	11	D332M31Z5UN..SP	13	14	15	2251 641 ..327
3900	±20	9	5.0	12	D392M35Z5UN..SP	13	14	15	2251 641 ..377
4700	±20	9	5.0	12	D472M35Z5UN..SP	13	14	15	2251 641 ..427
5600	±20	10	5.0	13	D562M39Z5UN..SP	13	14	15	2251 641 ..527
6800	±20	10	5.0	13	D682M39Z5UN..SP	13	14	15	2251 641 ..627
8200	±20	11	5.0	14	D822M43Z5UN..SP	13	14	15	2251 641 ..827
10000	±20	12	5.0	15	D103M47Z5UN..SP	13	14	15	2251 641 ..037

Notes

1. Maximum thickness 4.5 mm.
2. SH = seated height.
3. Packaging codes refer to flanged leads. Other styles available on request.
4. 8th and 9th digit of the catalogue number to be completed with the packaging code.

Table 3 2 kV (DC), kinked; capacitance, mechanical dimensions and ordering information; note 1

C (pF)	TOL. (%)	D_{max} (mm)	LEAD SPACING F (mm)	SH[2] (mm)	CLEAR TEXT CODE	PACKAGING CODE 8th AND 9th DIGIT[3]			CATALOGUE NUMBER[4]
			KINKED		13th DIGIT: T = REEL; U = AMMO; 3 = BULK	REEL	AMMO	BULK	KINKED
Class 1 SL									
10	±10	6.5	5.0	3.2	S100K25SL0P6.K5	13	14	15	2252 562 ..006
15	±10	6.5	5.0	3.2	S150K25SL0P6.K5	13	14	15	2252 562 ..106
22	±10	6.5	5.0	3.2	S220K25SL0P6.K5	13	14	15	2252 562 ..206
33	±10	6.5	5.0	3.2	S330K25SL0P6.K5	13	14	15	2252 562 ..306
47	±10	7.5	5.0	3.2	S470K29SL0P6.K5	13	14	15	2252 562 ..406
68	±10	8.5	5.0	3.2	S680K33SL0P6.K5	13	14	15	2252 562 ..606
100	±10	10.0	5.0	3.2	S101K39SL0P6.K5	13	14	15	2252 562 ..016
150	±10	11.0	5.0	3.2	S151K43SL0P6.K5	13	14	15	2252 562 ..116
Class 2 Y5P									
100	±10	6.5	5.0	3.2	S101K25Y5PP6.K5	13	14	15	2252 612 ..016
150	±10	6.5	5.0	3.2	S151K25Y5PP6.K5	13	14	15	2252 612 ..116
220	±10	6.5	5.0	3.2	S221K25Y5PP6.K5	13	14	15	2252 612 ..216
330	±10	6.5	5.0	3.2	S331K25Y5PP6.K5	13	14	15	2252 612 ..316
470	±10	6.5	5.0	3.2	S471K25Y5PP6.K5	13	14	15	2252 612 ..416
680	±10	7.5	5.0	3.2	S681K29Y5PP6.K5	13	14	15	2252 612 ..616
1000	±10	8.5	5.0	3.2	S102K33Y5PP6.K5	13	14	15	2252 612 ..026
1500	±10	10.0	5.0	3.2	S152K39Y5PP6.K5	13	14	15	2252 612 ..126
2200	±10	11.0	5.0	3.2	S222K43Y5PP6.K5	13	14	15	2252 612 ..226
3300	±10	13.5	7.5	4.0	S332K53Y5PP63K7	–	–	37	2252 612 ..326
4700	±10	17.5	7.5	4.0	S472K69Y5PP63K7	–	–	37	2252 612 ..426
Class 2 Z5U									
1000	±20	7.5	5.0	3.2	S102M29Z5UP6.K5	13	14	15	2252 642 ..027
1500	±20	7.5	5.0	3.2	S152M29Z5UP6.K5	13	14	15	2252 642 ..127
2200	±20	8.5	5.0	3.2	S222M33Z5UP6.K5	13	14	15	2252 642 ..227
3300	±20	10.0	5.0	3.2	S332M39Z5UP6.K5	13	14	15	2252 642 ..327
4700	±20	12.0	7.5	4.0	S472M47Z5UP63K7	–	–	37	2252 642 ..427
6800	±20	13.5	7.5	4.0	S682M53Z5UP63K7	–	–	37	2252 642 ..627
10000	±20	17.5	7.5	4.0	S103M69Z5UP63K7	–	–	37	2252 642 ..037

Notes

1. Maximum thickness 5.0 mm.
2. SH = seated height.
3. Packaging codes refer to outward kinked leads. Other styles available on request.
4. 8th and 9th digit of the catalogue number to be completed with the packaging code.

Table 4 2 kV (DC), flanged; capacitance, mechanical dimensions and ordering information; note 1

C (pF)	TOL. (%)	D_{max} (mm)	LEAD SPACING F (mm)	SH[2] (mm)	CLEAR TEXT CODE	PACKAGING CODE 8th AND 9th DIGIT[3]			CATALOGUE NUMBER[4]
					12th AND 13th DIGIT: WG = REEL; WJ = AMMO; WF = BULK				
			FLANGED			REEL	AMMO	BULK	FLANGED
Class 1 SL									
10	±5	7	5.0	10	D100J28SL0P..AP	13	14	15	2251 562 ..005
12	±5	7	5.0	10	D120J28SL0P..AP	13	14	15	2251 562 ..055
15	±5	7	5.0	10	D150J28SL0P..AP	13	14	15	2251 562 ..105
18	±5	7	5.0	10	D180J28SL0P..AP	13	14	15	2251 562 ..155
22	±5	7	5.0	10	D220J28SL0P..AP	13	14	15	2251 562 ..205
27	±5	7	5.0	10	D270J28SL0P..AP	13	14	15	2251 562 ..255
33	±5	7	5.0	10	D330J28SL0P..AP	13	14	15	2251 562 ..305
39	±5	7	5.0	10	D390J28SL0P..AP	13	14	15	2251 562 ..355
47	±5	7	5.0	10	D470J28SL0P..AP	13	14	15	2251 562 ..405
56	±5	7	5.0	10	D560J28SL0P..AP	13	14	15	2251 562 ..505
68	±5	8	5.0	11	D680J31SL0P..AP	13	14	15	2251 562 ..605
82	±5	8	5.0	11	D820J31SL0P..AP	13	14	15	2251 562 ..805
100	±5	9	5.0	12	D101J35SL0P..AP	13	14	15	2251 562 ..015
120	±5	10	5.0	13	D121J39SL0P..AP	13	14	15	2251 562 ..065
150	±5	10	5.0	13	D151J39SL0P..AP	13	14	15	2251 562 ..115
180	±5	11	5.0	14	D181J43SL0P..AP	13	14	15	2251 562 ..165
220	±5	12	5.0	15	D221J47SL0P..AP	13	14	15	2251 562 ..215
Class 2 Y5P									
100	±10	7	5.0	10	D101K28Y5PP..SP	13	14	15	2251 612 ..016
120	±10	7	5.0	10	D121K28Y5PP..SP	13	14	15	2251 612 ..066
150	±10	7	5.0	10	D151K28Y5PP..SP	13	14	15	2251 612 ..116
180	±10	7	5.0	10	D181K28Y5PP..SP	13	14	15	2251 612 ..166
220	±10	7	5.0	10	D221K28Y5PP..SP	13	14	15	2251 612 ..216
270	±10	7	5.0	10	D271K28Y5PP..SP	13	14	15	2251 612 ..266
330	±10	7	5.0	10	D331K28Y5PP..SP	13	14	15	2251 612 ..316
390	±10	7	5.0	10	D391K28Y5PP..SP	13	14	15	2251 612 ..366
470	±10	7	5.0	10	D471K28Y5PP..SP	13	14	15	2251 612 ..416
560	±10	8	5.0	11	D561K31Y5PP..SP	13	14	15	2251 612 ..516
680	±10	8	5.0	11	D681K31Y5PP..SP	13	14	15	2251 612 ..616
820	±10	9	5.0	12	D821K35Y5PP..SP	13	14	15	2251 612 ..816

C (pF)	TOL. (%)	D_{max} (mm)	LEAD SPACING F (mm)	SH[2] (mm)	CLEAR TEXT CODE	PACKAGING CODE 8th AND 9th DIGIT[3]			CATALOGUE NUMBER[4]
					12th AND 13th DIGIT: WG = REEL; WJ = AMMO; WF = BULK				
			FLANGED			REEL	AMMO	BULK	FLANGED
1000	±10	9	5.0	12	D102K35Y5PP..SP	13	14	15	2251 612 ..026
1200	±10	10	5.0	13	D122K39Y5PP..SP	13	14	15	2251 612 ..076
1500	±10	10	5.0	13	D152K39Y5PP..SP	13	14	15	2251 612 ..126
1800	±10	11	5.0	14	D182K43Y5PP..SP	13	14	15	2251 612 ..176
2200	±10	11	5.0	14	D222K43Y5PP..SP	13	14	15	2251 612 ..226
2700	±10	12	5.0	15	D272K47Y5PP..SP	13	14	15	2251 612 ..276
Class 2 Z5U									
1000	±20	8	5.0	11	D102M31Z5UP..SP	13	14	15	2251 642 ..027
1500	±20	8	5.0	11	D152M35Z5UP..SP	13	14	15	2251 642 ..127
2200	±20	9	5.0	12	D222M35Z5UP..SP	13	14	15	2251 642 ..227
3300	±20	10	5.0	13	D332M39Z5UP..SP	13	14	15	2251 642 ..327
4700	±20	11	5.0	14	D472M43Z5UP..SP	13	14	15	2251 642 ..427

Notes

1. Maximum thickness 4.5 mm.
2. SH = seated height.
3. Packaging codes refer to flanged leads. Other styles available on request.
4. 8th and 9th digit of the catalogue number to be completed with the packaging code.

Table 5 3 kV (DC), kinked; capacitance, mechanical dimensions and ordering information; note 1

C (pF)	TOL. (%)	D_{max} (mm)	LEAD SPACING F (mm)	SEATED HEIGHT (mm)	CLEAR TEXT CODE	CATALOGUE NUMBER[2]
			KINKED			KINKED[3]
Class 1 SL						
10	±10	8.5	7.5	4.0	S100K33SL0R63K7	2252 563 37006
15	±10	8.5	7.5	4.0	S150K33SL0R63K7	2252 563 37106
22	±10	8.5	7.5	4.0	S220K33SL0R63K7	2252 563 37206
33	±10	8.5	7.5	4.0	S330K33SL0R63K7	2252 563 37306
47	±10	8.5	7.5	4.0	S470K33SL0R63K7	2252 563 37406
68	±10	10.0	7.5	4.0	S680K39SL0R63K7	2252 563 37606
Class 2 Y5P						
100	±10	8.5	7.5	4.0	S101K33Y5PR63K7	2252 613 37016
150	±10	8.5	7.5	4.0	S150K33Y5PR63K7	2252 613 37116
220	±10	8.5	7.5	4.0	S221K33Y5PR63K7	2252 613 37216
330	±10	8.5	7.5	4.0	S331K33Y5PR63K7	2252 613 37316
470	±10	8.5	7.5	4.0	S471K33Y5PR63K7	2252 613 37416
680	±10	10.0	7.5	4.0	S681K39Y5PR63K7	2252 613 37616
1000	±10	11.0	7.5	4.0	S102K43Y5PR63K7	2252 613 37026
1500	±10	12.0	7.5	4.0	S152K47Y5PR63K7	2252 613 37126
2200	±10	15.0	7.5	4.0	S222K59Y5PR63K7	2252 613 37226
3300	±10	17.5	10.0	4.0	S332K69Y5PR83K0	2252 613 48326
Class 2 Z5U						
470	±20	8.5	7.5	4.0	S471M33Z5UR63K7	2252 643 37417
680	±20	8.5	7.5	4.0	S681K33Z5UR63K7	2252 643 37617
1000	±20	8.5	7.5	4.0	S102K33Z5UR63K7	2252 643 37027
1500	±20	10.0	7.5	4.0	S152K39Z5UR63K7	2252 643 37127
2200	±20	11.0	7.5	4.0	S222M43Z5UR63K7	2252 643 37227
3300	±20	13.5	7.5	4.0	S332M53Z5UR63K7	2252 643 37327
4700	±20	15.0	7.5	4.0	S472M59Z5UR63K7	2252 643 37427

Notes

1. Maximum thickness 6.0 mm.
2. Packaging codes refer to outward kinked leads. Other styles available on request.
3. All packaged in bulk.

Table 6 6 kV (DC), straight; capacitance, mechanical dimensions and ordering information; note 1

C (pF)	TOL. (%)	D_{max} (mm)	LEAD SPACING F (mm)	SEATED HEIGHT (mm)	CLEAR TEXT CODE	CATALOGUE NUMBER[2]
			STRAIGHT			STRAIGHT[3]
Class 1 SL						
10	±20	15.0	10	4.0	S100M59SL0U83L0	2252 564 52007
15	±20	15.0	10	4.0	S150M59SL0U83L0	2252 564 52107
22	±20	15.0	10	4.0	S220M59SL0U83L0	2252 564 52207
33	±20	15.0	10	4.0	S330M59SL0U83L0	2252 564 52307
Class 1 S3N						
47	±20	15.0	10	4.0	S470M59S3NU83L0	2252 574 52407
68	±20	15.0	10	4.0	S680M59S3NU83L0	2252 574 52607
100	±20	15.0	10	4.0	S101M59S3NU83L0	2252 574 52017
150	±20	15.0	10	4.0	S151M59S3NU83L0	2252 574 52117
Class 2 Z5U						
220	±20	15.0	10	4.0	S221M59Z5UU83L0	2252 644 52217
330	±20	15.0	10	4.0	S331M59Z5UU83L0	2252 644 52317
470	±20	15.0	10	4.0	S471M59Z5UU83L0	2252 644 52417
680	±20	15.0	10	4.0	S681M59Z5UU83L0	2252 644 52617
1000	±20	15.0	10	4.0	S102M59Z5UU83L0	2252 644 52027
1500	±20	17.5	10	4.0	S152M69Z5UU83L0	2252 644 52127
2200	±20	19.0	10	4.0	S222M75Z5UU83L0	2252 644 52227

Notes

1. Maximum thickness 8.0 mm.
2. Packaging codes refer to straight leads. Other styles available on request.
3. All packaged in bulk.

ELECTRICAL CHARACTERISTICS

The capacitors meet the essential requirements of *"IEC 60384-8"*, *"IEC 60384-9"* and *"EIA 198"*. Unless stated otherwise all electrical values apply at an ambient temperature of 25 ±3 °C, at normal atmospheric conditions.

DESCRIPTION	VALUE			
	1 kV	2 kV	3 kV	6 kV
Capacitance range:				
Class 1, at 1 MHz, 1.2 V (RMS)[1]	10 to 270 pF	10 to 180 pF	10 to 82 pF	10 to 150 pF
Class 2, at 1 kHz, 1 ±0.2 V (RMS)	100 to 22000 pF	100 to 10000 pF	100 to 4700 pF	180 to 2200 pF
Tolerance on capacitance	±5%; ±10%; ±20%	±5%; ±10%; ±20%	±10%; ±20%	±20%
Dielectric strength	200% of rated voltage			
Insulation resistance at 500 V (DC)	≥10000 MΩ			
Temperature coefficients on capacitance:				
Class 1	SL			SL; S3N
Class 2	Y5P; Z5U			Z5U
Dissipation factor:				
Class 1, at 1 MHz, 1.2 V (RMS) C ≤ 30 pF	$\leq 20 \times (10/C + 0.7) \times 10^{-4}$ max.			
Class 1, at 1 MHz, 1.2 V (RMS) C > 30 pF	$\leq 20 \times 10^{-4}$			
Class 2, at 1 kHz, 1 ±0.2 V (RMS)	≤3.0%			
Operating temperature range:				
Class 1:				
flanged	–30 to +125 °C (2 kV: –30 to +105 °C)			
kinked	–30 to +85 °C			
Class 2	–30 to +85 °C			

Note

1. 1 kHz, 1 ±0.2 V (RMS) for capacitance values higher than 1000 pF.

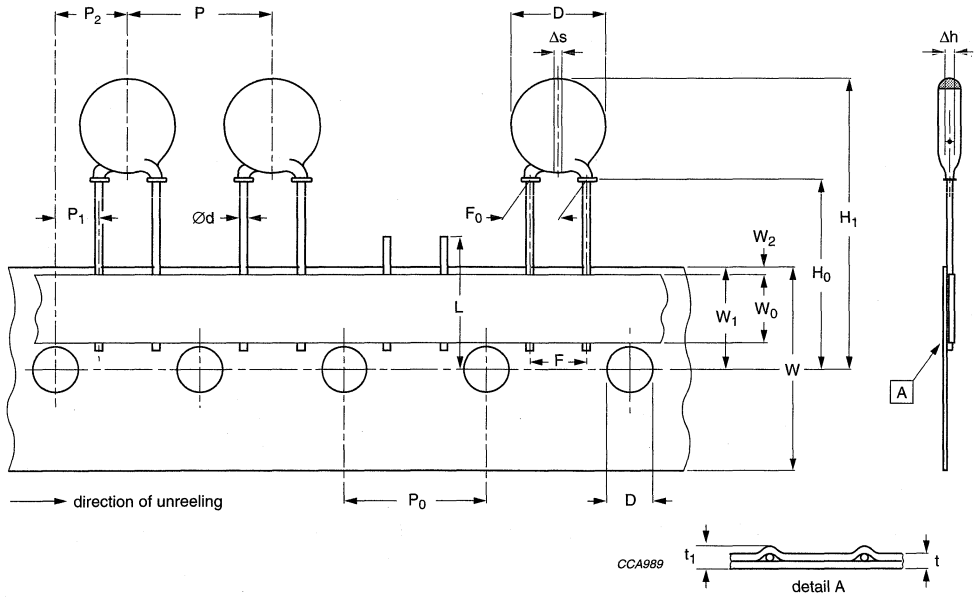
PACKAGING

The capacitors are supplied in bulk packaging (cardboard boxes), in tape on reel or in ammopack; see Tables 7 and 9.

Table 7 Packaging quantities for flanged capacitors

BULK		REEL		AMMOPACK	
1 kV	**2 kV**	**1 kV**	**2 kV**	**1 kV**	**2 kV**
500	250	2000	1500	2000	1500

Flanged capacitors on tape, lead spacing 5.0 mm (0.2 inch)



For dimensions see Table 8.

Fig.4 Capacitors, lead spacing 5.0 mm, on tape.

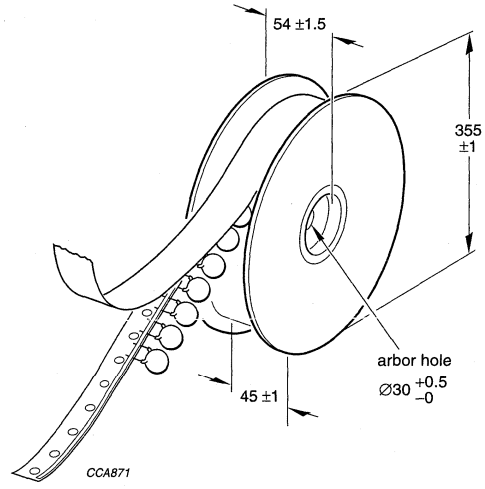
Table 8 Dimensions of tape for flanged capacitors; see Fig.4

SYMBOL	PARAMETER	DIMENSIONS (mm)	
		NOMINAL	TOLERANCE
d	lead diameter	0.6	+0.6 −0.05
P	pitch between capacitors	12.7	±1.0
P_0	feed-hole pitch	12.7	±0.2; note 1
P_1	feed-hole centre to lead centre	3.85	±0.5; note 2
P_2	feed-hole centre to component centre	6.35	±0.7; note 2
F	lead spacing	5.0	+0.6 −0.1
F_0	lead-to-lead	5.08	+0.5 −0.1
Δh	component alignment	0	±1.0
Δs	deviation along tape, left or right	0	±0.6
W	tape width	18.0	±0.5
W_0	hold-down tape width	6.0	±0.5
W_1	hole position	9.0	±0.5
W_2	hold-down tape position	0	±2
H_0	flange to tape centre	16.0	±0.5
H_1	maximum component height	28.75	–
	minimum component height	18.75	–
L	maximum length of snipped lead	11	–
D_0	feed-hole diameter	4.0	±0.2
t	total tape thickness	0.65	±0.2
t_1	maximum thickness of tape and wires	1.5	–

Notes

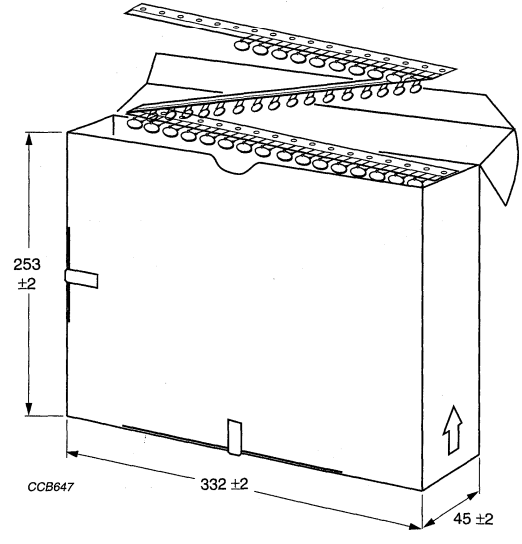
1. Cumulative pitch error: ±≤1 mm/20 pitches.
2. Obliquity maximum 3°.

REEL AND TAPE DATA



Dimensions in mm.

Fig.5 Reel with flanged capacitors on tape.



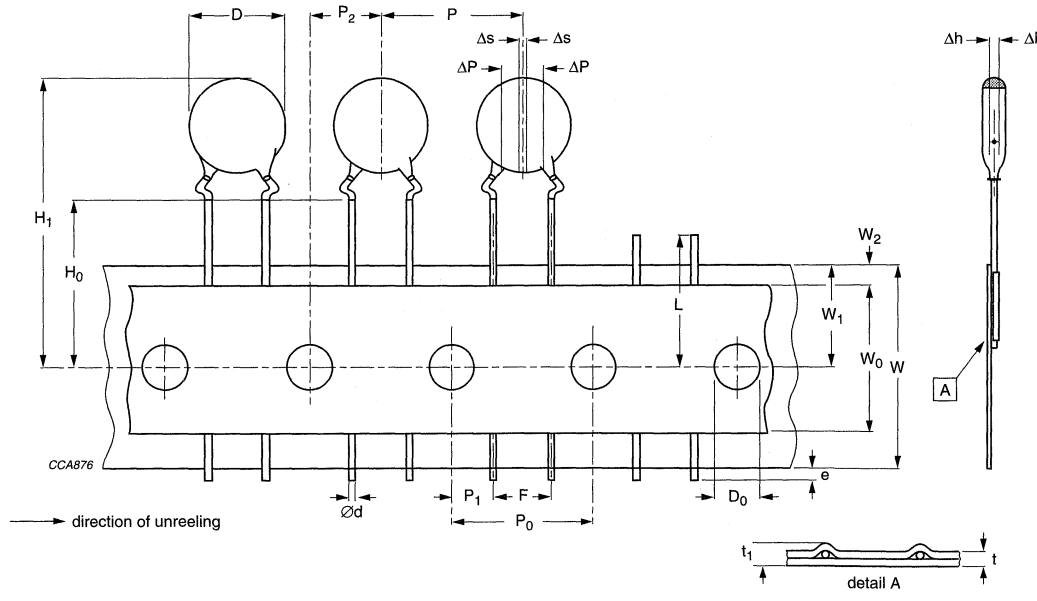
Dimensions in mm.

Fig.6 Ammopack with flanged capacitors on tape.

Table 9 Size codes and packaging quantities for kinked capacitors

D_{max} (mm)	SIZE CODE	PACKAGING QUANTITIES		
		BULK	REEL	AMMO
5.0 (0.20")	20	1000	2000	1 kV = 2000 2 kV = 1500
6.5 (0.25")	25			
7.5 (0.29")	29			
8.5 (0.33")	33			
10.0 (0.39")	39			
11.0 (0.43")	43			
12.0 (0.47")	47	1000	–	–
13.5 (0.53")	53	500	–	–
15.0 (0.59")	59			
17.5 (0.69")	69			
19.0 (0.75")	75			

Kinked capacitors on tape, lead spacing 5.0 mm (0.2 inch)



For dimensions see Table 10.

Fig.7 Capacitors, lead spacing 5.0 mm, on tape.

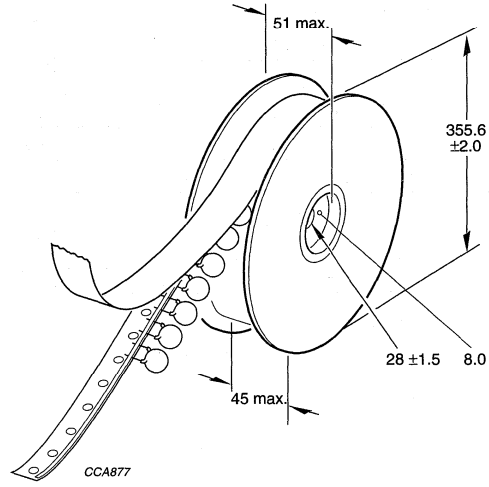
Table 10 Dimensions of tape for kinked capacitors; see Fig.7

SYMBOL	PARAMETER	DIMENSIONS (mm)	
		NOMINAL	TOLERANCE
D	body diameter	11.0 max.	–
d	lead diameter	0.6	±0.05
P	pitch between capacitors	12.7	±1.0
P_0	feed-hole pitch	12.7	±0.3; note 1
ΔP	plane deviation	1.0 max.	–
P_1	feed-hole centre to lead centre	3.85	±0.7; note 2
P_2	feed-hole centre to component centre	6.35	±1.3; note 2
F	lead spacing	5.0	+0.6 −0.4
Δh	component alignment	0	±1.0
Δs	deviation along tape, left or right	0	±0.6
W	tape width	18.0	+1.0 −0.5
W_0	hold-down tape width	5.0 min.	–
W_1	hole position	9.0	+0.75 −0.5
W_2	hold-down tape margin	3.0 max.	–
H_0	height to seating plane	16.0	±0.5
H_1	maximum component height	32.0	–
e	lead end protrusion	1.0 max.	–
L	maximum length of snipped lead	11.0	–
D_0	feed-hole diameter	4.0	±0.2
t	total tape thickness	0.9 max.	–
t_1	maximum thickness of tape and wires	1.5 max.	–

Notes

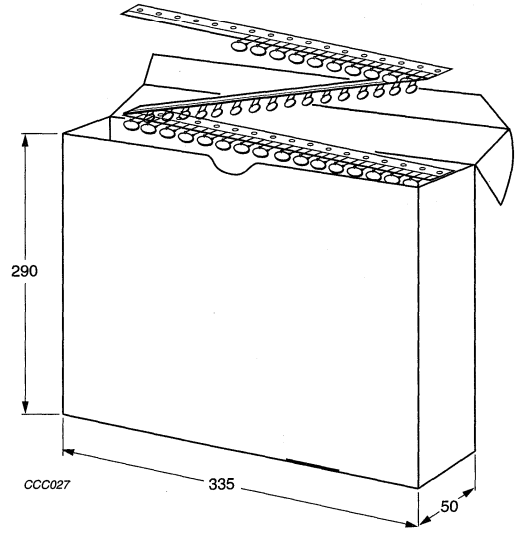
1. Cumulative pitch error: ±≤1 mm/20 pitches.
2. Obliquity maximum 3°.

REEL AND TAPE DATA



Dimensions in mm.

Fig.8 Reel with capacitors on tape.



Dimensions in mm.

Fig.9 Ammopack with capacitors on tape.

Ceramic disc capacitors

Class 2, low loss (0.5% max.) 1 kV, 2 kV and 3 kV

FEATURES

- High reliability
- Low losses
- High capacitance in small size
- Kinked (preferred) or straight leads.

APPLICATIONS

In electronic circuits where low losses and high capacitance per volume are essential, for example:

- SMPS
- HF ballast
- Snubber and high voltage circuits.

DESCRIPTION

The capacitors consist of a ceramic disc both sides of which are silver-plated. Connection leads are made of tinned copper having a diameter of 0.6 mm or 0.8 mm.

The capacitors may be supplied with outward kinked or straight leads with a lead spacing of 5 mm (0.200"), 7.5 mm (0.300") or 10 mm (0.400") and a lead length from 4 to 30 mm. The standard tolerance on capacitance is ±10%. Encapsulation is made of gold coloured epoxy-resin, flammable resistant in accordance with *"UL94V-0"*.

QUICK REFERENCE DATA

DESCRIPTION	VALUE
Capacitance range	100 to 4700 pF
Rated DC voltage	1 kV; 2 kV; 3 kV
Dielectric strength	200% of rated voltage
Insulation resistance at 500 V (DC)	≥10000 MΩ
Tolerance on capacitance	±10%; note 1
Dissipation factor	0.5% max.
Temperature coefficient	Y5P
Sectional specifications	IEC 60384-9, EIA 198
Climatic category	30/085/21

Note

1. Other tolerances available on request.

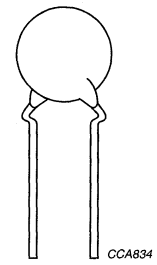
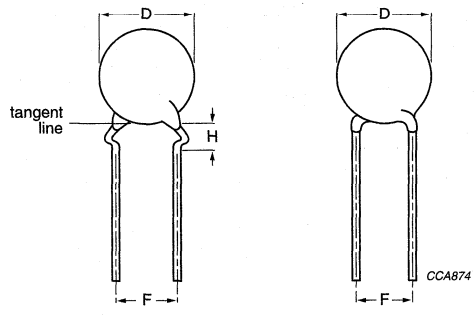


Fig.1 Simplified outline.

Ceramic disc capacitors

Class 2, low loss (0.5% max.) 1 kV, 2 kV and 3 kV

MECHANICAL DATA



Dimensions in mm.
For dimensions see Tables 1, 2 and 3.

Fig.2 Capacitors with 5 mm (0.20") lead spacing.

MARKING

Marking indicates capacitance value and tolerance in accordance with *"EIA 198"* and voltage marks.

Examples of marking code

Disc size (D_{max}) ≤6.5 mm:

R101 = low loss 100 pF
2 kV

Disc size (D_{max}) ≥7.5 mm:

R102 = low loss 1000 pF
3 kV

ORDERING INFORMATION (preferred types)

Table 1 1 kV (DC), kinked; capacitance, mechanical dimensions and ordering information; note 1

C (pF)	TOL. (%)	D_{max} (mm)	LEAD SPACING F (mm)	SH[2] (mm)	CLEAR TEXT CODE	PACKAGING CODE 8th AND 9th DIGIT[3]			CATALOGUE NUMBER[4]
					13th DIGIT: T = REEL; U = AMMO; 3 = BULK	REEL	AMMO	BULK	
Class 2 Y5P									
100	±10	6.5	5.0	3.2	F101K25Y5PN6.K5	13	14	15	2252 701 ..016
150	±10	6.5	5.0	3.2	F151K25Y5PN6.K5	13	14	15	2252 701 ..116
220	±10	6.5	5.0	3.2	F221K25Y5PN6.K5	13	14	15	2252 701 ..216
330	±10	6.5	5.0	3.2	F331K25Y5PN6.K5	13	14	15	2252 701 ..316
470	±10	6.5	5.0	3.2	F471K25Y5PN6.K5	13	14	15	2252 701 ..416
680	±10	7.5	5.0	3.2	F681K29Y5PN6.K5	13	14	15	2252 701 ..616
1000	±10	8.5	5.0	3.2	F102K33Y5PN6.K5	13	14	15	2252 701 ..026
1500	±10	10.0	5.0	3.2	F152K39Y5PN6.K5	13	14	15	2252 701 ..126
2200	±10	11.0	5.0	3.2	F222K43Y5PN6.K5	13	14	15	2252 701 ..226
3300	±10	15.0	7.5	4.0	F332K59Y5PN63K7	–	–	37	2252 701 ..326
4700	±10	17.5	7.5	4.0	F472K69Y5PN63K7	–	–	37	2252 701 ..426

Notes

1. Maximum thickness 4.5 mm.
2. SH = seated height.
3. Packaging codes refer to outward kinked leads. Other styles available on request.
4. 8th and 9th digit of the catalogue number to be completed with the packaging code.

Table 2 2 kV (DC), kinked; capacitance, mechanical dimensions and ordering information; note 1

C (pF)	TOL. (%)	D_{max} (mm)	LEAD SPACING F (mm)	SH[2] (mm)	CLEAR TEXT CODE	PACKAGING CODE 8th AND 9th DIGIT[3]			CATALOGUE NUMBER[4]
					13th DIGIT: T = REEL; U = AMMO; 3 = BULK	REEL	AMMO	BULK	
Class 2 Y5P									
100	±10	6.5	5.0	3.2	F101K25Y5PP6.K5	13	14	15	2252 702 ..016
150	±10	6.5	5.0	3.2	F151K25Y5PP6.K5	13	14	15	2252 702 ..116
220	±10	6.5	5.0	3.2	F221K25Y5PP6.K5	13	14	15	2252 702 ..216
330	±10	7.5	5.0	3.2	F331K29Y5PP6.K5	13	14	15	2252 702 ..316
470	±10	7.5	5.0	3.2	F471K29Y5PP6.K5	13	14	15	2252 702 ..416
680	±10	8.5	5.0	3.2	F681K33Y5PP6.K5	13	14	15	2252 702 ..616
1000	±10	11.0	5.0	3.2	F102K43Y5PP6.K5	13	14	15	2252 702 ..026
1500	±10	12.0	7.5	4.0	F152K47Y5PP6.K7	–	–	37	2252 702 ..126
2200	±10	15.0	7.5	4.0	F222K59Y5PP63K7	–	–	37	2252 702 ..226
3300	±10	17.5	7.5	4.0	F332K69Y5PP63K7	–	–	37	2252 702 ..326
4700	±10	19.0	10.0	4.0	F472K75Y5PP83K0	–	–	48	2252 702 ..426

Notes

1. Maximum thickness 5.0 mm.
2. SH = seated height.
3. Packaging codes refer to outward kinked leads. Other styles available on request.
4. 8th and 9th digit of the catalogue number to be completed with the packaging code.

Table 3 3 kV (DC), kinked; capacitance, mechanical dimensions and ordering information; note 1

C (pF)	TOL. (%)	D_{max} (mm)	LEAD[2] SPACING F (mm)	SH[3] (mm)	CLEAR TEXT CODE	PACKAGING CODE 8th AND 9th DIGIT[4]			CATALOGUE NUMBER[5]
					13th DIGIT: T = REEL; U = AMMO; 3 = BULK	REEL	AMMO	BULK	
Class 2 Y5P									
100	±10	8.5	7.5	4.0	F101K33Y5PR6.K7	35	36	37	2252 703 ..016
150	±10	8.5	7.5	4.0	F151K33Y5PR6.K7	35	36	37	2252 703 ..116
220	±10	8.5	7.5	4.0	F221K33Y5PR6.K7	35	36	37	2252 703 ..216
330	±10	8.5	7.5	4.0	F331K33Y5PR6.K7	35	36	37	2252 703 ..316
470	±10	8.5	7.5	4.0	F471K33Y5PR6.K7	35	36	37	2252 703 ..416
680	±10	10.0	7.5	4.0	F681K39Y5PR6.K7	35	36	37	2252 703 ..616
1000	±10	11.0	7.5	4.0	F102K43Y5PR6.K7	35	36	37	2252 703 ..026
1500	±10	13.5	7.5	4.0	F152K53Y5PR6.K7	35	36	37	2252 703 ..126
2200	±10	15.0	7.5	4.0	F222K59Y5PR63K7	–	–	37	2252 703 ..226
2700	±10	17.5	10.0	4.0	F272K69Y5PR83K0	–	–	48	2252 703 ..276

Notes

1. Maximum thickness 6.0 mm.
2. Feed-hole pitch P_0 = 15 mm.
3. SH = seated height.
4. Packaging codes refer to outward kinked leads. Other styles available on request.
5. 8th and 9th digit of the catalogue number to be completed with the packaging code.

ELECTRICAL CHARACTERISTICS

The capacitors meet the essential requirements of *"EIA 198"*. Unless stated otherwise all electrical values apply at an ambient temperature of 25 ±3 °C, at normal atmospheric conditions.

DESCRIPTION	VALUE
Capacitance range at 1 kHz, 1 ±0.2 V (RMS)	100 to 4700 pF
Tolerance on capacitance	±10%
Dielectric strength	200% of rated voltage
Insulation resistance after 2 minutes of charging at 500 V (DC)	≥10000 MΩ min.
Temperature coefficient on capacitance	Y5P
Dissipation factor at 1 kHz, 1 ±0.2 V (RMS)	0.5% max.
Operating temperature range	−30 to +85 °C
Climatic category	30/085/21

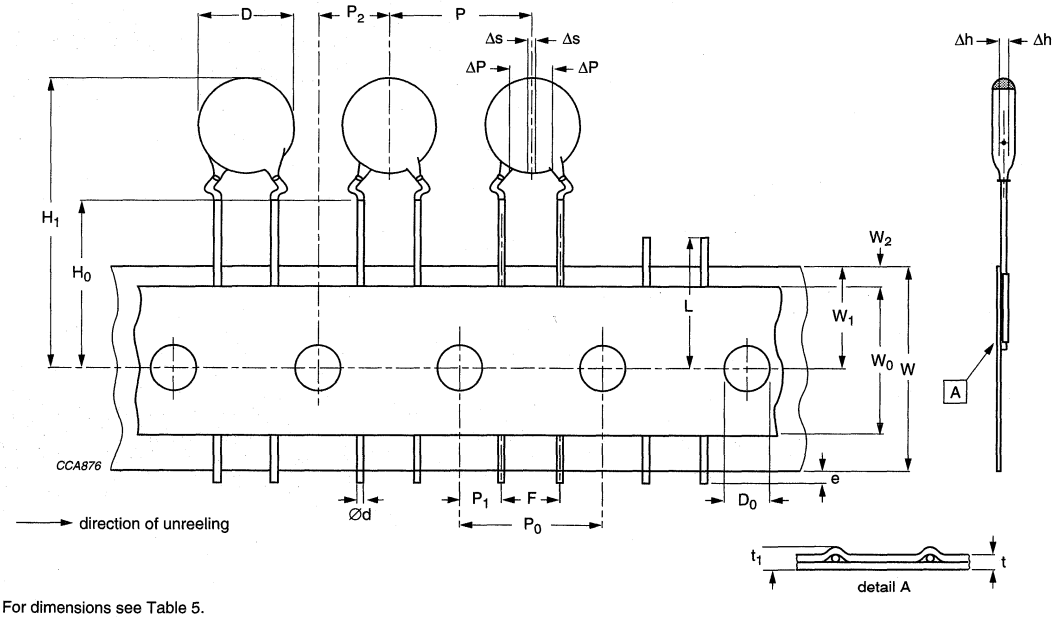
PACKAGING

The capacitors are supplied in bulk packaging (cardboard boxes), in tape on reel or in ammopack (see Table 4).

Table 4 Disc diameter and packaging quantities

PARAMETER		PACKAGING QUANTITIES		
D_{max} (mm)	VOLTAGE	BULK	REEL	AMMO
6.5 to 11.0	1 kV	1000	2000	2000
6.5 to 11.0	2 kV	1000	2000	1500
12.0	1 kV, 2 kV	1000	1500	2000
13.5	1 kV, 2 kV	500	1500	2000
13.5	3 kV	500	1000	1500
8.5 to 12.0	3 kV	1000	1000	1500
15.0 to 21.5	1 kV, 2 kV, 3 kV	500	–	–

Kinked capacitors on tape, lead spacing 5.0 mm (0.2 inch) or 7.5 mm (0.3 inch)



For dimensions see Table 5.

Fig.3 Capacitors, lead spacing 5.0 mm or 7.5 mm, on tape.

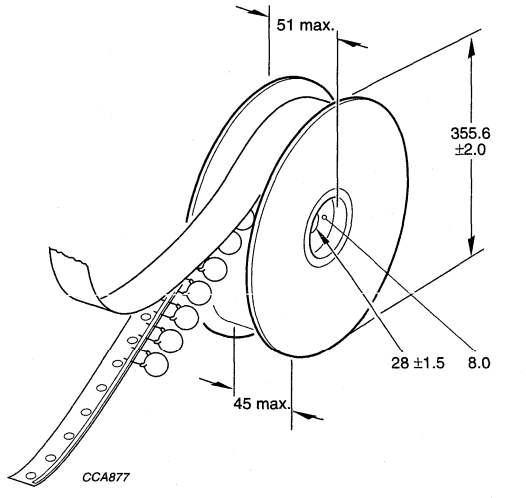
Table 5 Dimensions of tape; see Fig.3

SYMBOL	PARAMETER	DIMENSIONS (mm)	
		FEED-HOLE PITCH P_0 = 12.7	FEED-HOLE PITCH P_0 = 15.0
D	body diameter	11.0 max.	14.0 max.
d	lead diameter	0.6 ±0.05	0.6 ±0.05
P	pitch between capacitors	12.7 ±1.0	15.0 ±1.0
P_0	feed-hole pitch	12.7 ±0.3; note 1	15.0 ±0.3; note 1
ΔP	plane deviation	1.0 max.	1.0 max.
P_1	feed-hole centre to lead centre	3.85 ±0.7; note 2	3.75 ±1.0; note 2
P_2	feed-hole centre to component centre	6.35 ±1.3; note 2	7.5 ±1.5; note 2
F	lead spacing	5.0 +0.6/–0.4	7.5 ±1.0
Δh	component alignment	0 ±1.0	0 ±1.0
Δs	deviation along tape, left or right	0 ±1.0	0 ±1.0
W	tape width	18.0 +1.0/–0.5	18.0 +1.0/–0.5
W_0	hold-down tape width	5.0 min.	5.0 min.
W_1	hole position	9.0 +0.75/–0.5	9.0 +0.75/–0.5
W_2	hold-down tape margin	3.0 max.	3.0 max.
H_0	height to seating plane	16.0 ±0.5	16.0 ±0.5
H_1	maximum component height	32.0	40.0
e	lead end protrusion	1.0 max.	1.0 max.
L	maximum length of snipped lead	11.0	11.0
D_0	feed-hole diameter	4.0 ±0.2	4.0 ±0.2
t	total tape thickness	0.9 max.	0.9 max.
t_1	maximum thickness of tape and wires	1.5 max.	1.5 max.

Notes

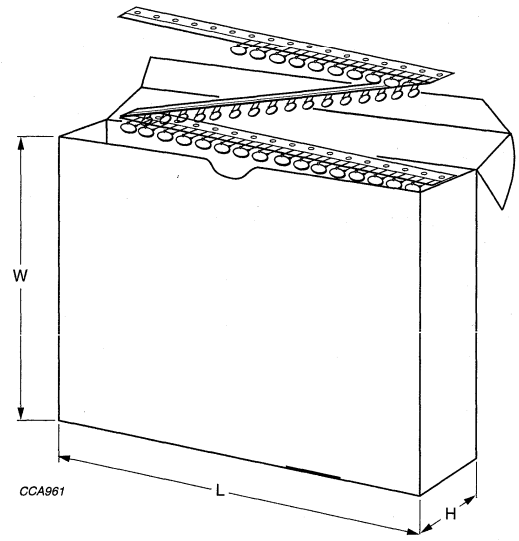
1. Cumulative pitch error: ±≤1 mm/20 pitches.
2. Obliquity maximum 3°.

REEL AND TAPE DATA



Dimensions in mm.

Fig.4 Reel with capacitors on tape.



For dimensions, see Table 6.

Fig.5 Ammopack with capacitors on tape.

Table 6 Dimensions of ammopack for relevant disc size and taping pitch; see Fig.5

PARAMETER	DISC SIZE (D_{max})		UNIT
	6.5 to 11.0 mm	12.0 to 13.5 mm	
Taping pitch	12.7	15.0	mm
L	335	350	mm
W	290	330	mm
H	50	55	mm

Ceramic disc capacitors

Class 2, low loss (0.2% max.) 1 kV and 2 kV

FEATURES

- High reliability
- Low losses
- High capacitance in small size
- Flanged leads.

APPLICATIONS

In electronic circuits where low losses and high capacitance per volume are essential, for example:

- SMPS
- HF ballast
- Snubber and high voltage circuits.

DESCRIPTION

The capacitors consist of a ceramic disc both sides of which are silver-plated. Connection leads are made of tinned copper having a diameter of 0.6 mm.

The capacitors are supplied with flanged or straight leads and lead spacings of 5 mm or 7 mm. Encapsulation is made of epoxy-resin, flammable resistant in accordance with *"UL94V-0"*.

QUICK REFERENCE DATA

DESCRIPTION	VALUE	
	1 kV	2 kV
Capacitance range	100 to 2200 pF	
Rated DC voltage	1 kV; 2 kV	
Dielectric strength	200% of rated voltage	
Insulation resistance at 500 V (DC)	≥10000 MΩ	
Tolerance on capacitance	±10%; note 1	
Dissipation factor	0.2% max.	
Temperature coefficient Y5R (2C4):		
−25 to +85 °C	±15%	
+85 to +125 °C	+15%/−30%	
Sectional specifications	IEC 60384-9, EIA 198	
Climatic category	30/125/21	30/105/21

Note

1. Other tolerances available on request.

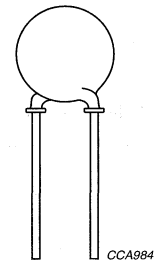
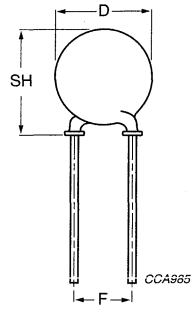


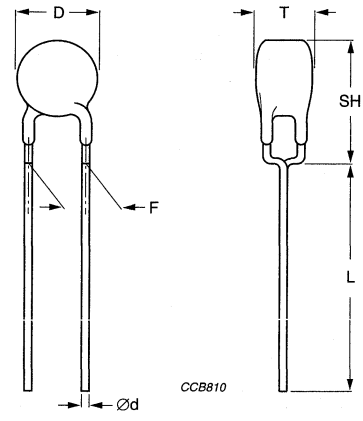
Fig.1 Simplified outline.

MECHANICAL DATA



Dimensions in mm.
For dimensions see Tables 1 and 2.

Fig.2 Capacitors with 5 mm (0.20") lead spacing.



Dimensions in mm.
For dimensions see Tables 1 and 2.

Fig.3 Capacitors with 5 mm (0.20") lead spacing.

MARKING

Flanged capacitors are marked as follows:

- The capacitors are tan coloured. The temperature dependency is indicated by a yellow coloured cap.
- The voltage is marked in clear letters, the low loss characteristics being indicated by the code 'L' marked below the capacitance value.
- Capacitance value is marked on the body in a 3-digit code: two numbers corresponding with the numerical capacitance value and one letter indicating the multiplier and the decimal point.

Example of marking code

n10 = 100 pF

1n5 = 1500 pF

ORDERING INFORMATION

Table 1 1 kV (DC), flanged; capacitance, mechanical dimensions and ordering information; note 1

C (pF)	TOL. (%)	D_{max} (mm)	LEAD SPACING F (mm)	SH[2] (mm)	CLEAR TEXT CODE	PACKAGING CODE 8th AND 9th DIGIT			CATALOGUE NUMBER[3]
					12th AND 13th DIGIT: WG = REEL; WJ = AMMO; WF = BULK	REEL	AMMO	BULK	
Class 2 Y5R									
100	±10	7	5.0	10	D101K28Y5RN..SP	13	14	15	2251 711 ..016
120	±10	7	5.0	10	D121K28Y5RN..SP	13	14	15	2251 711 ..066
150	±10	7	5.0	10	D151K28Y5RN..SP	13	14	15	2251 711 ..116
180	±10	7	5.0	10	D181K28Y5RN..SP	13	14	15	2251 711 ..166
220	±10	7	5.0	10	D221K28Y5RN..SP	13	14	15	2251 711 ..216
270	±10	7	5.0	10	D271K28Y5RN..SP	13	14	15	2251 711 ..266
330	±10	7	5.0	10	D331K28Y5RN..SP	13	14	15	2251 711 ..316
390	±10	7	5.0	10	D391K28Y5RN..SP	13	14	15	2251 711 ..366
470	±10	7	5.0	10	D471K28Y5RN..SP	13	14	15	2251 711 ..416
560	±10	7	5.0	10	D561K28Y5RN..SP	13	14	15	2251 711 ..516
680	±10	8	5.0	11	D681K31Y5RN..SP	13	14	15	2251 711 ..616
820	±10	8	5.0	11	D821K31Y5RN..SP	13	14	15	2251 711 ..816
1000	±10	9	5.0	12	D102K35Y5RN..SP	13	14	15	2251 711 ..026
1200	±10	10	5.0	12	D122K39Y5RN..SP	13	14	15	2251 711 ..076
1500	±10	11	5.0	14	D152K43Y5RN..SP	13	14	15	2251 711 ..126
1800	±10	11	5.0	14	D182K43Y5RN..SP	13	14	15	2251 711 ..176
2200	±10	12	5.0	15	D222K47Y5RN..SP	13	14	15	2251 711 ..226

Notes

1. Maximum thickness 4.5 mm.
2. SH = seated height.
3. 8th and 9th digit of the catalogue number to be completed with the packaging code.

Table 2 2 kV (DC), flanged; capacitance, mechanical dimensions and ordering information; note 1

C (pF)	TOL. (%)	D_{max} (mm)	LEAD SPACING F (mm)	SH[2] (mm)	CLEAR TEXT CODE	PACKAGING CODE 8th AND 9th DIGIT			CATALOGUE NUMBER[3]
					12th AND 13th DIGIT: WG = REEL; WJ = AMMO; WF = BULK	REEL	AMMO	BULK	
Class 2 Y5R									
100	±10	7	5.0	10	D101K28Y5RP..SP	13	14	15	2251 712 ..016
120	±10	7	5.0	10	D121K28Y5RP..SP	13	14	15	2251 712 ..066
150	±10	7	5.0	10	D151K28Y5RP..SP	13	14	15	2251 712 ..116
180	±10	7	5.0	10	D181K28Y5RP..SP	13	14	15	2251 712 ..166
220	±10	7	5.0	10	D221K28Y5RP..SP	13	14	15	2251 712 ..216
270	±10	7	5.0	10	D271K28Y5RP..SP	13	14	15	2251 712 ..266
330	±10	8	5.0	11	D331K31Y5RP..SP	13	14	15	2251 712 ..316
390	±10	8	5.0	11	D391K31Y5RP..SP	13	14	15	2251 712 ..366
470	±10	9	5.0	12	D471K35Y5RP..SP	13	14	15	2251 712 ..416
560	±10	9	5.0	12	D561K35Y5RP..SP	13	14	15	2251 712 ..516
680	±10	10	5.0	13	D681K39Y5RP..SP	13	14	15	2251 712 ..616
820	±10	11	5.0	14	D821K43Y5RP..SP	13	14	15	2251 712 ..816
1000	±10	12	5.0	15	D102K47Y5RP..SP	13	14	15	2251 712 ..026

Notes

1. Maximum thickness 4.5 mm.
2. SH = seated height.
3. 8th and 9th digit of the catalogue number to be completed with the packaging code.

Table 3 2 kV (DC), straight; capacitance, mechanical dimensions and ordering information; note 1

C (pF)	TOL. (%)	D_{max} (mm)	LEAD SPACING F (mm)	SH[2] (mm)	CLEAR TEXT CODE	PACKAGING CODE 8th AND 9th DIGIT			CATALOGUE NUMBER[3]
					12th AND 13th DIGIT: WG = REEL; WJ = AMMO; WF = BULK	REEL	AMMO	BULK	
Class 2 Y5R									
100	±10	7	7.5	10	D101K28Y5RP..SP	57	58	59	2251 712 ..016
120	±10	7	7.5	10	D121K28Y5RP..SP	57	58	59	2251 712 ..066
150	±10	7	7.5	10	D151K28Y5RP..SP	57	58	59	2251 712 ..116
180	±10	7	7.5	10	D181K28Y5RP..SP	57	58	59	2251 712 ..166
220	±10	7	7.5	10	D221K28Y5RP..SP	57	58	59	2251 712 ..216
270	±10	7	7.5	10	D271K28Y5RP..SP	57	58	59	2251 712 ..266
330	±10	8	7.5	11	D331K31Y5RP..SP	57	58	59	2251 712 ..316
390	±10	8	7.5	11	D391K31Y5RP..SP	57	58	59	2251 712 ..366
470	±10	9	7.5	12	D471K35Y5RP..SP	57	58	59	2251 712 ..416
560	±10	9	7.5	12	D561K35Y5RP..SP	57	58	59	2251 712 ..516
680	±10	10	7.5	13	D681K39Y5RP..SP	57	58	59	2251 712 ..616
820	±10	11	7.5	14	D821K43Y5RP..SP	57	58	59	2251 712 ..816
1000	±10	12	7.5	15	D102K47Y5RP..SP	57	58	59	2251 712 ..026
1200	±10	13	7.5	15	D122K51Y5RP..SP	57	58	59	2251 712 ..076
1500	±10	13	7.5	15	D152K51Y5RP..SP	57	58	59	2251 712 ..126
1800	±10	14	7.5	15	D182K55Y5RP..SP	57	58	59	2251 712 ..176
2200	±10	15	7.5	15	D222K59Y5RP..SP	57	58	59	2251 712 ..226
2700	±10	17	7.5	15	D272K67Y5RP..SP	57	58	59	2251 712 ..276
3300	±10	18	7.5	15	D322K71Y5RP..SP	57	58	59	2251 712 ..326

Notes

1. Maximum thickness 4.5 mm.
2. SH = seated height.
3. 8th and 9th digit of the catalogue number to be completed with the packaging code.

ELECTRICAL CHARACTERISTICS

The capacitors meet the essential requirements of *"IEC 60384-9 and EIA 198"*. Unless stated otherwise all electrical values apply at an ambient temperature of 25 ±3 °C, at normal atmospheric conditions.

DESCRIPTION	VALUE	
	1 kV	**2 kV**
Capacitance range at 1 kHz, 1 ±0.2 V (RMS)	100 to 2200 pF	100 to 1000 pF
Tolerance on capacitance	±10%	±10%
DC test voltage, duration 1 minute	1 kV	2 kV
Insulation resistance at 500 V (DC)	≥10000 MΩ min.	
Temperature coefficient on capacitance Y5R (2C4):		
–25 to +85 °C	±15%	
+85 to +125 °C	+15%/–30%	
Dissipation factor at 1 kHz, 1 ±0.2 V (RMS)	0.2% max.	
Operating temperature range	–30 to +125 °C	
Climatic category	30/125/21	30/105/21
Ageing	typical 0.5% per time decade	

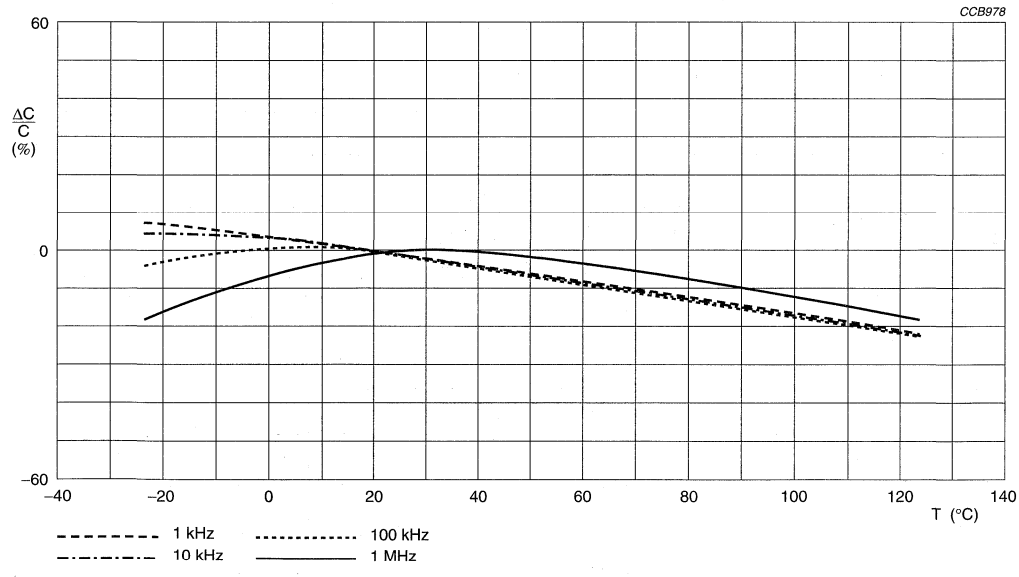


Fig.4 Typical capacitance change as a function of temperature and frequency.

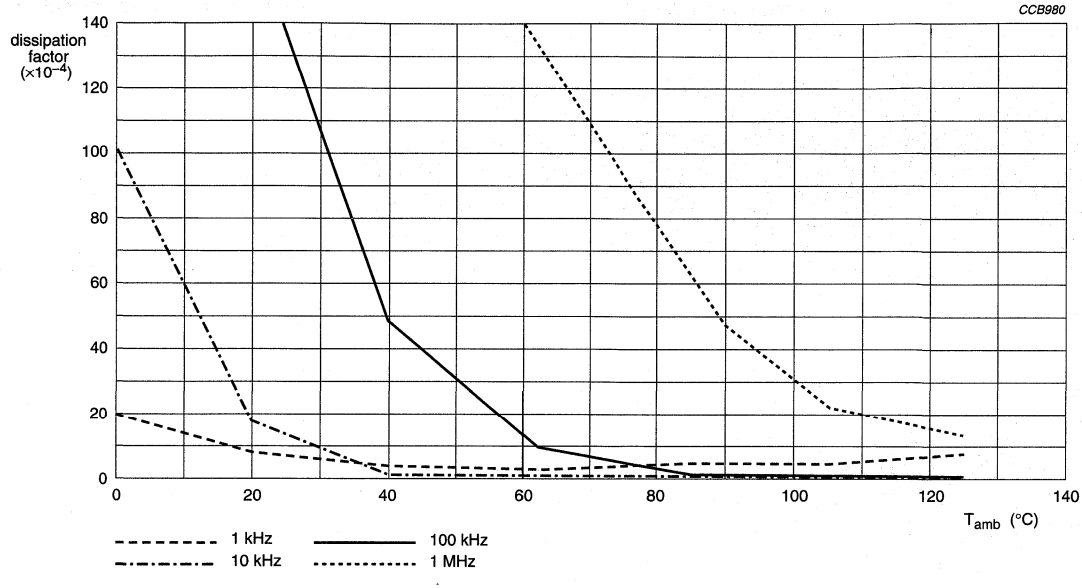


Fig.5 Typical dissipation factor as a function of temperature and frequency.

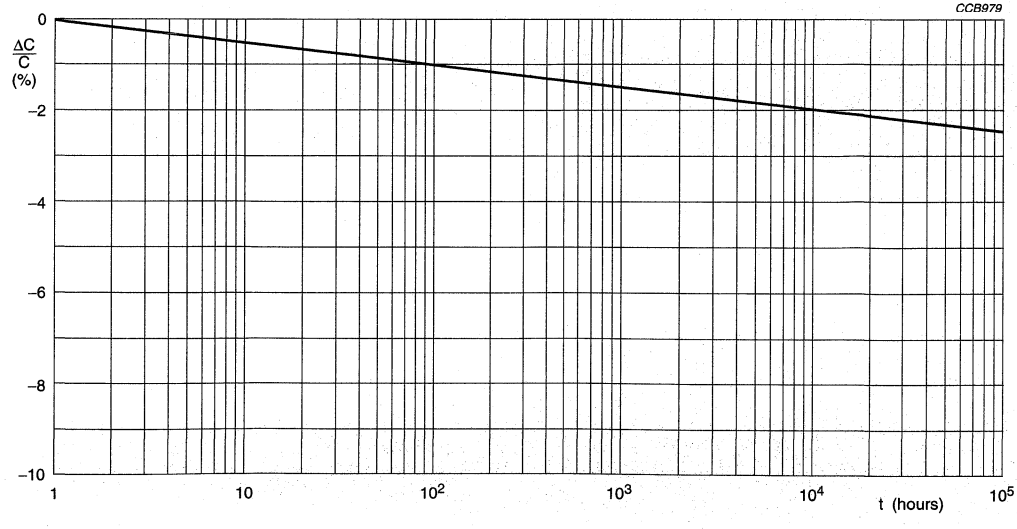


Fig.6 Ageing rate as a function of time.

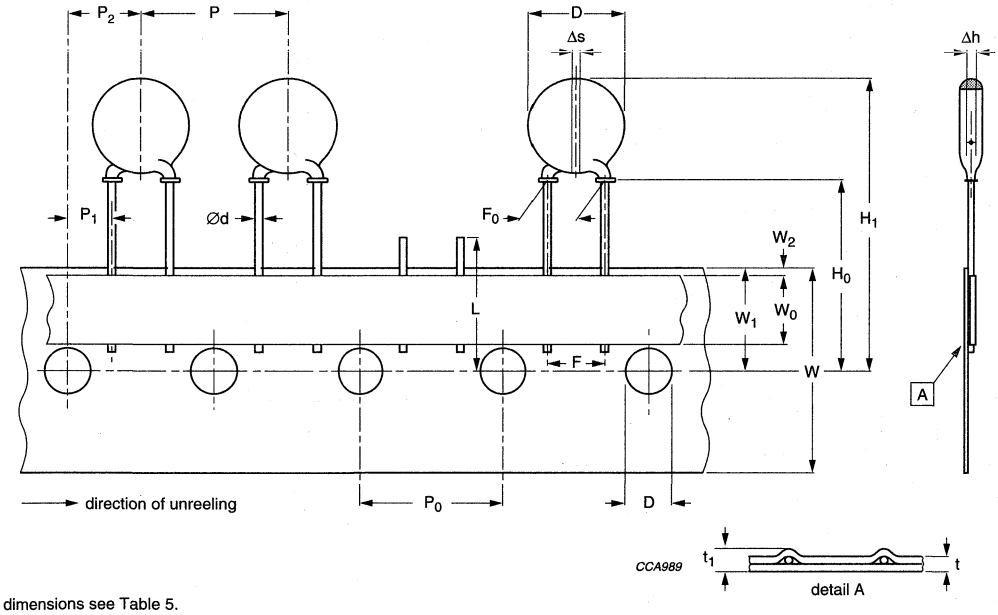
PACKAGING

The capacitors are supplied in bulk packaging (cardboard boxes), in tape on reel or in ammopack (see Table 4).

Table 4 Packaging quantities

BULK		REEL		AMMOPACK	
1 kV	**2 kV**	**1 kV**	**2 kV**	**1 kV**	**2 kV**
500	250	2000	1500	2000	1500

Flanged capacitors on tape, lead pitch 5.08 mm (0.2 inch)



For dimensions see Table 5.

Fig.7 Capacitors, lead pitch 5.08 mm, on tape.

Table 5 Dimensions of tape; see Fig.7

SYMBOL	PARAMETER	DIMENSIONS (mm)	
		NOMINAL	TOLERANCE
d	lead diameter	0.6	+0.6 −0.05
P	pitch between capacitors	12.7	±1.0
P_0	feed-hole pitch	12.7	±0.2; note 1
P_1	feed-hole centre to lead centre	3.85	±0.5; note 2
P_2	feed-hole centre to component centre	6.35	±0.7; note 2
F	lead spacing	5.0	+0.6 −0.1
F_0	lead-to-lead	5.08	+0.5 −0.1
Δh	component alignment	0	±1.0
Δs	deviation along tape, left or right	0	±0.6
W	tape width	18.0	±0.5
W_0	hold-down tape width	6.0	±0.5
W_1	hole position	9.0	±0.5
W_2	hold-down tape position	0	±2
H_0	flange to tape centre	16.0	±0.5
H_1	maximum component height	33.75	–
	minimum component height	18.75	–
L	maximum length of snipped lead	11	–
D_0	feed-hole diameter	4.0	±0.2
t	total tape thickness	0.65	±0.2
t_1	maximum thickness of tape and wires	1.5	–

Notes

1. Cumulative pitch error: ±≤1 mm/20 pitches.
2. Obliquity maximum 3°.

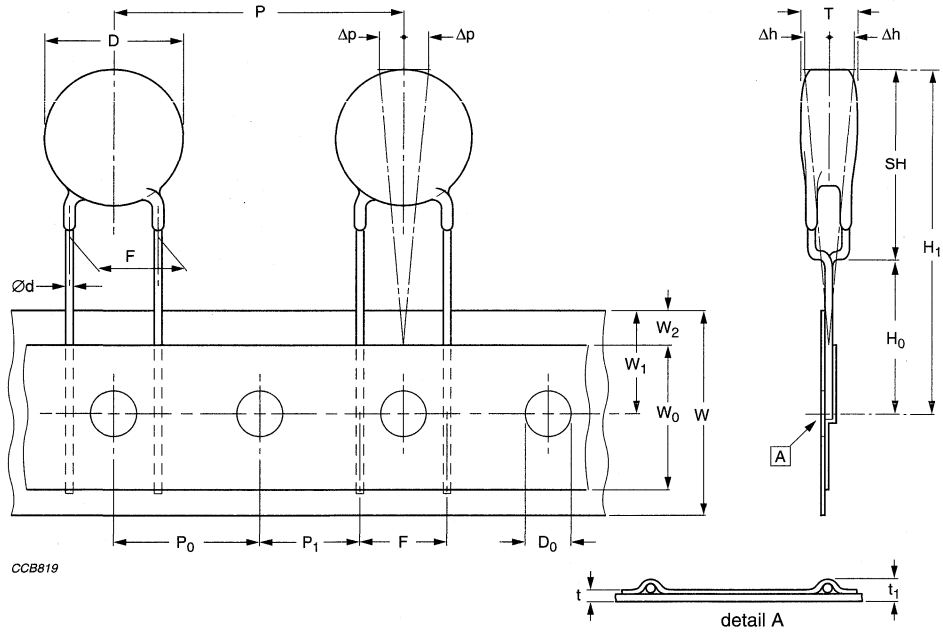
Table 6 Packaging quantities

BULK	REEL	AMMOPACK
500	1500 or 750; note 1	1500 or 750; note 1

Note

1. 750 units for products with P = 25.4 mm.

Straight leaded capacitors on tape, lead pitch 7.5 mm



P = 12.7 mm. for disc diameters up to 11 mm. P = 25.4 for disc diameters of 12 mm and higher.
For dimensions see Table 7.

Fig.8 Capacitors, lead pitch 7.5 mm, on tape.

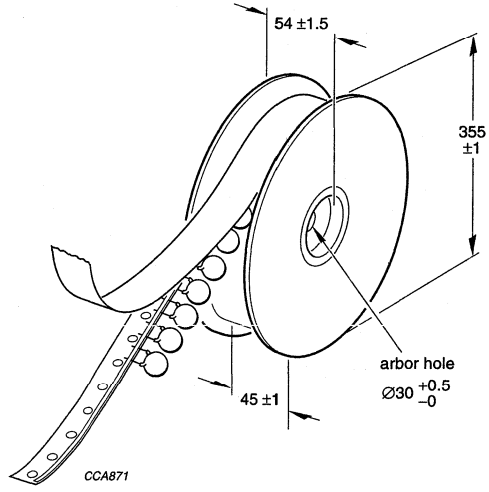
Table 7 Dimensions of tape; see Fig.7

SYMBOL	PARAMETER	DIMENSIONS (mm)	
		NOMINAL	TOLERANCE
d	lead diameter	0.6	+0.6 −0.05
P	pitch between capacitors	12.7	±1.0
P_0	feed-hole pitch	12.7	±0.2; note 1
P_1	feed-hole centre to lead centre	3.85	±0.5; note 2
P_2	feed-hole centre to component centre	6.35	±0.7; note 2
F	lead spacing	5.0	+0.6 −0.1
F_0	lead-to-lead	5.08	+0.5 −0.1
Δh	component alignment	0	±1.0
Δs	deviation along tape, left or right	0	±0.6
W	tape width	18.0	±0.5
W_0	hold-down tape width	6.0	±0.5
W_1	hole position	9.0	±0.5
W_2	hold-down tape position	0	±2
H_0	flange to tape centre	16.0	±0.5
H_1	maximum component height	33.75	–
	minimum component height	18.75	–
L	maximum length of snipped lead	11	–
D_0	feed-hole diameter	4.0	±0.2
t	total tape thickness	0.65	±0.2
t_1	maximum thickness of tape and wires	1.5	–

Notes

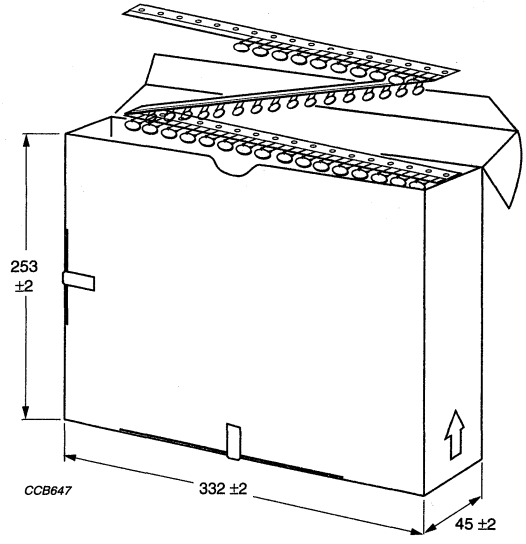
1. Cumulative pitch error: ±≤1 mm/20 pitches.
2. Obliquity maximum 3°.

REEL AND TAPE DATA



Dimensions in mm.

Fig.9 Reel with capacitors on tape.



Dimensions in mm.

Fig.10 Ammopack with capacitors on tape.

Ceramic disc capacitors

Safety, Class Y2, 250 V (AC); X1, 440 V (AC) series MY

FEATURES

- Complying with *"EN 132 400"* and *"IEC 60384-14, 2nd edition, including amendment 1.1995"*
- High capacitance in small size
- Flanged leads.

APPLICATIONS

- Across-the-line
- Line by-pass
- Antenna coupling
- Interference suppression.

DESCRIPTION

The capacitors consist of a ceramic disc both sides of which are silver-plated. Connection leads are made of tinned copper having a diameter of 0.6 mm.

The capacitors are supplied with flanged leads having a lead spacing of 5 mm (0.200") and a lead length from 4 to 13 mm. The standard tolerance on capacitance is ±20%. Encapsulation is made of flammable resistant epoxy resin.

QUICK REFERENCE DATA

DESCRIPTION	VALUE
Capacitance range at 1 kHz; 1 V (RMS)	100 to 4700 pF
Rated AC voltage: Y2 X1	 250 V; 50/60 Hz 440 V; 50/60 Hz
Dielectric strength (AC)	1500 V for 60 s
Test voltage of coating (AC)	2000 V for 60 s
Component test voltage (AC)	2500 V for 2 s
Insulation resistance at 500 V (DC)	≥10000 MΩ
Tolerance on capacitance	±20%
Dissipation factor at 1 kHz; 1 V (RMS)	2.5% max.
Temperature coefficient	Y5U or better
Operating temperature range	−30 to +125 °C
Approvals	FIMKO: FI 201989; VDE: 114133; UL: E 199698
Climatic category	25/125/21

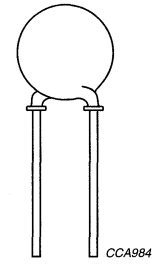
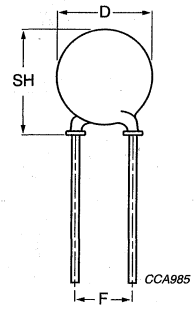


Fig.1 Simplified outline.

MECHANICAL DATA



Dimensions in mm.
For dimensions see Table 1.

Fig.2 Capacitor with 5 mm (0.20") lead spacing.

MARKING

Marking indicates the manufacturers logo (M), the capacitance value (i.e. 1n0), the series (MY), the rated voltage and subclass (250 ~ Y2, 440 ~ X1) and approval marks.

Marking example

M 1n0 MY

250 ~ Y2

440 ~ X1

ORDERING INFORMATION

Table 1 Y2, 250 V; X1, 440 V, (AC) flanged; capacitance, mechanical dimensions and ordering information; note 1

C (pF)	TOL. (%)	D_{max} (mm)	LEAD[2] SPACING F (mm)	SH[3] (mm)	CLEAR TEXT CODE	PACKAGING CODE 8th AND 9th DIGIT			CATALOGUE NUMBER[4]
					12th AND 13th DIGIT: WG = REEL; WJ = AMMO; WF = BULK	REEL	AMMO	BULK	
100	±20	8	5	11	B101M31Y5UQ..SP	13	14	15	2251 827 ..017
150	±20	8	5	11	B151M31Y5UQ..SP	13	14	15	2251 827 ..117
220	±20	8	5	11	B221M31Y5UQ..SP	13	14	15	2251 827 ..217
330	±20	8	5	11	B331M31Y5UQ..SP	13	14	15	2251 827 ..317
470	±20	8	5	11	B471M31Y5UQ..SP	13	14	15	2251 827 ..417
680	±20	8	5	11	B681M31Y5UQ..SP	13	14	15	2251 827 ..617
1000	±20	8	5	11	B102M31Y5UQ..SP	13	14	15	2251 827 ..027
1500	±20	8	5	11	B152M31Y5UQ..SP	13	14	15	2251 827 ..127
2200	±20	9	5	12	B222M35Y5UQ..SP	13	14	15	2251 827 ..227
3300	±20	10	5	13	B332M39Y5UQ..SP	13	14	15	2251 827 ..327
4700	±20	12	5	15	B472M43Y5UQ..SP	13	14	15	2251 827 ..427

Notes

1. Maximum thickness 4.5 mm.
2. Standard lead space is 5.0 mm. Other lead spacing is available on request.
3. SH = seated height.
4. 8th and 9th digit of the catalogue number to be completed with the packaging code.

ELECTRICAL CHARACTERISTICS

The capacitors meet the essential requirements of *"IEC 60384-14, 2nd edition"*. Unless stated otherwise all electrical values apply at an ambient temperature of 20 ±3 °C, at normal atmospheric conditions.

DESCRIPTION	VALUE
Capacitance range at 1 kHz, 1 V (RMS)	100 to 4700 pF
Tolerance on capacitance	±20%
Rated AC voltage:	
Y2	250 V; 50/60 Hz
X1	440 V; 50/60 Hz
AC test voltage	1500 V
Insulation resistance at 500 V (DC)	≥10000 MΩ
Temperature coefficients on capacitance	Y5U
Dissipation factor at 1 kHz, 1 V (RMS)	2.5% max.
Operating temperature range	−30 to +125 °C
Climatic category	25/125/21

PACKAGING

The capacitors are supplied in bulk packaging (cardboard boxes), in tape on reel or in ammopack; see Table 2.

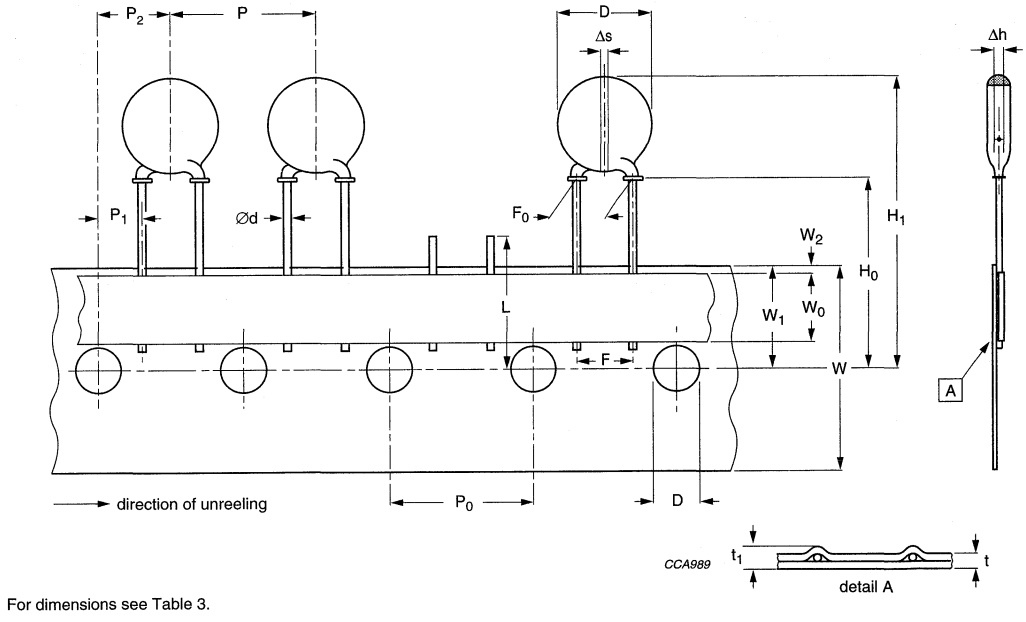
Table 2 Packaging quantities for flanged capacitors

BULK	REEL	AMMOPACK
250 or 500; note 1	1500	1500

Note

1. Quantity in box based on seated height, disc size and/or lead width.

Flanged capacitors on tape, lead pitch 5.0 mm (0.20 inch)



For dimensions see Table 3.

Fig.3 Capacitors, lead pitch 5.0 mm, on tape.

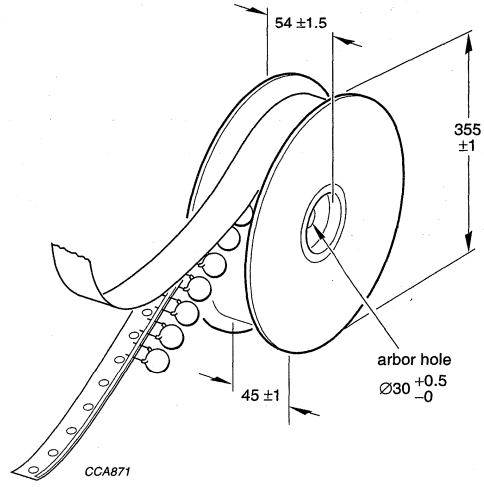
Table 3 Dimensions of tape; see Fig.3

SYMBOL	PARAMETER	DIMENSIONS (mm)	
		NOMINAL	TOLERANCE
d	lead diameter	0.6	+0.6 −0.05
P	pitch between capacitors	12.7	±1.0
P_0	feed-hole pitch	12.7	±0.2; note 1
P_1	feed-hole centre to lead centre	3.85	±0.5; note 2
P_2	feed-hole centre to component centre	6.35	±0.7; note 2
F	lead spacing	5.0	+0.6 −0.1
F_0	lead-to-lead	5.08	+0.5 −0.1
Δh	component alignment	0	±1.0
Δs	deviation along tape, left or right	0	±0.6
W	tape width	18.0	±0.5
W_0	hold-down tape width	6.0	±0.5
W_1	hole position	9.0	±0.5
W_2	hold-down tape position	0	±2
H_0	flange to tape centre	16.0	±0.5
H_1	maximum component height	33.75	–
	minimum component height	18.75	–
L	maximum length of snipped lead	11	–
D_0	feed-hole diameter	4.0	±0.2
t	total tape thickness	0.65	±0.2
t_1	maximum thickness of tape and wires	1.5	–

Notes

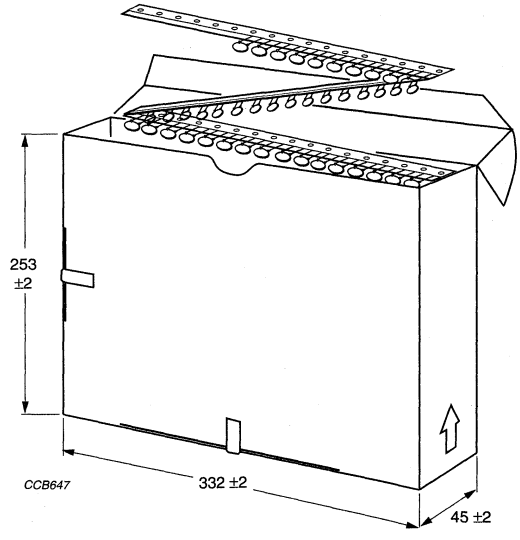
1. Cumulative pitch error: ±≤1 mm/20 pitches.
2. Obliquity maximum 3°.

REEL AND TAPE DATA



Dimensions in mm.

Fig.4 Reel with flanged capacitors on tape.



Dimensions in mm.

Fig.5 Ammopack with flanged capacitors on tape.

Ceramic disc capacitors

Safety, Class X1; Y2, 250 V (AC) series M

FEATURES

- Complying with *"EN 132 400"* and *"IEC 60384-14, 2nd edition, including amendment 1.1995"*
- High reliability
- Flanged leads.

APPLICATIONS

- Across-the-line
- Line by-pass
- Antenna coupling
- Interference suppression.

DESCRIPTION

The capacitors consist of a ceramic disc both sides of which are silver-plated. Connection leads are made of tinned copper having a diameter of 0.6 mm.

The capacitors are supplied with flanged or straight leads and lead spacings of 5 mm or 7.5 mm. The standard tolerance on capacitance is ±10% for Y5P material and ±20% for Y5U material. Encapsulation is made of flammable resistant epoxy resin in accordance with *"UL94V-0"*.

QUICK REFERENCE DATA

DESCRIPTION	VALUE
Capacitance range at 1 kHz; 1 V (RMS)	100 to 2200 pF
Rated AC voltage	250 V; 50/60 Hz
Dielectric strength	2500 V (AC) for 60 s
Insulation resistance at 500 V (DC)	≥10000 MΩ
Tolerance on capacitance	±10%; ±20%
Dissipation factor at 1 kHz; 1 V (RMS)	2.5% max.
Temperature coefficients	Y5P; Y5U
Operating temperature range	−30 to +85 °C
Approvals	FIMKO, DEMKO, NEMKO, SEMKO, VDE
Climatic category	25/85/21

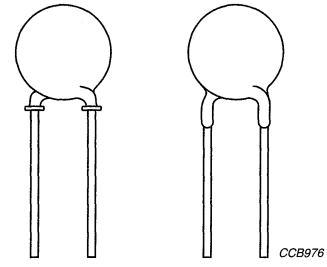
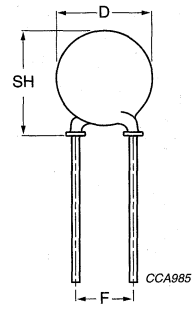


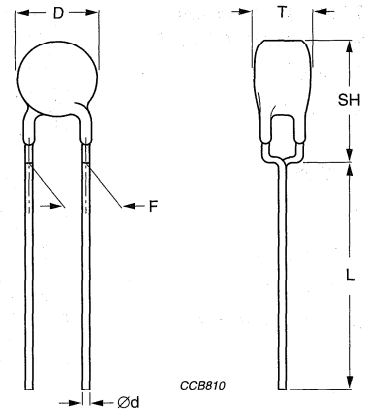
Fig.1 Simplified outline.

MECHANICAL DATA



Dimensions in mm.
For dimensions see Table 1.

Fig.2 Capacitor with 5 mm lead spacing.



Dimensions in mm.
For dimensions see Table 2.

Fig.3 Capacitor with 7.5 mm lead spacing.

MARKING

Marking indicates capacitance value, the series, subclass, voltage and approval marks.

Marking example

M-Y2

1n0

250 V (AC)

ORDERING INFORMATION

Table 1 250 V (AC), flanged; capacitance, mechanical dimensions and ordering information; note 1

C (pF)	TOL. (%)	D_{max} (mm)	LEAD SPACING F (mm)	SH[2] (mm)	CLEAR TEXT CODE	PACKAGING CODE 8th AND 9th DIGIT			CATALOGUE NUMBER[3]
					12th AND 13th DIGIT: WG = REEL; WJ = AMMO; WF = BULK	REEL	AMMO	BULK	
Class Y2 Y5P									
100	±10	8	5	11	D101K31Y5PQ..SP	13	14	15	2251 817 ..016
150	±10	8	5	11	D151K31Y5PQ..SP	13	14	15	2251 817 ..116
220	±10	8	5	11	D221K31Y5PQ..SP	13	14	15	2251 817 ..216
330	±10	8	5	11	D331K31Y5PQ..SP	13	14	15	2251 817 ..316
470	±10	8	5	11	D471K31Y5PQ..SP	13	14	15	2251 817 ..416
Class Y2 Y5U									
680	±20	9	5	12	D681M35Y5UQ..SP	13	14	15	2251 817 ..617
1000	±20	9	5	12	D102M35Y5UQ..SP	13	14	15	2251 817 ..027
1500	±20	9	5	12	D152M35Y5UQ..SP	13	14	15	2251 817 ..127
2200	±20	11	5	14	D222M43Y5UQ..SP	13	14	15	2251 817 ..227

Notes

1. Maximum thickness 4.5 mm.
2. SH = seated height.
3. 8th and 9th digit of the catalogue number to be completed with the packaging code.

Table 2 250 V (AC), straight leads; capacitance, mechanical dimensions and ordering information; note 1

C (pF)	TOL. (%)	D_{max} (mm)	LEAD SPACING F (mm)	SH[2] (mm)	CLEAR TEXT CODE	PACKAGING CODE 8th AND 9th DIGIT			CATALOGUE NUMBER[3]
					12th AND 13th DIGIT: WG = REEL; WJ = AMMO; WF = BULK	REEL	AMMO	BULK	
Class Y2 Y5P									
100	±10	8	7.5	12	D101K31Y5PQ..SP	57	58	59	2251 817 ..016
150	±10	8	7.5	12	D151K31Y5PQ..SP	57	58	59	2251 817 ..116
220	±10	8	7.5	12	D221K31Y5PQ..SP	57	58	59	2251 817 ..216
330	±10	8	7.5	12	D331K31Y5PQ..SP	57	58	59	2251 817 ..316
470	±10	8	7.5	12	D471K31Y5PQ..SP	57	58	59	2251 817 ..416
Class Y2 Y5U									
680	±20	9	7.5	13	D681M35Y5UQ..SP	57	58	59	2251 817 ..617
1000	±20	9	7.5	13	D102M35Y5UQ..SP	57	58	59	2251 817 ..027
1500	±20	9	7.5	13	D152M35Y5UQ..SP	57	58	59	2251 817 ..127
2200	±20	11	7.5	15	D222M43Y5UQ..SP	57	58	59	2251 817 ..227

Notes

1. Maximum thickness 4.5 mm.
2. SH = seated height.
3. 8th and 9th digit of the catalogue number to be completed with the packaging code.

ELECTRICAL CHARACTERISTICS

The capacitors meet the essential requirements of *"IEC 60384-14, 2nd edition"*. Unless stated otherwise all electrical values apply at an ambient temperature of 25 ±3 °C, at normal atmospheric conditions.

DESCRIPTION	VALUE
Capacitance range at 1 kHz, 1 V (RMS)	100 to 2200 pF
Tolerance on capacitance	±10%; ±20%
Rated AC voltage	250 V
AC test voltage	2500 V
Insulation resistance at 500 V (DC)	≥10000 MΩ
Temperature coefficients on capacitance	100 pF to 470 pF (Y5P); 680 pF and higher (Y5U)
Dissipation factor at 1 kHz, 1 V (RMS)	2.5% max.
Operating temperature range	−30 to +85 °C
Climatic category	25/085/21

PACKAGING

The capacitors are supplied in bulk packaging (cardboard boxes), in tape on reel or in ammopack (see Table 3).

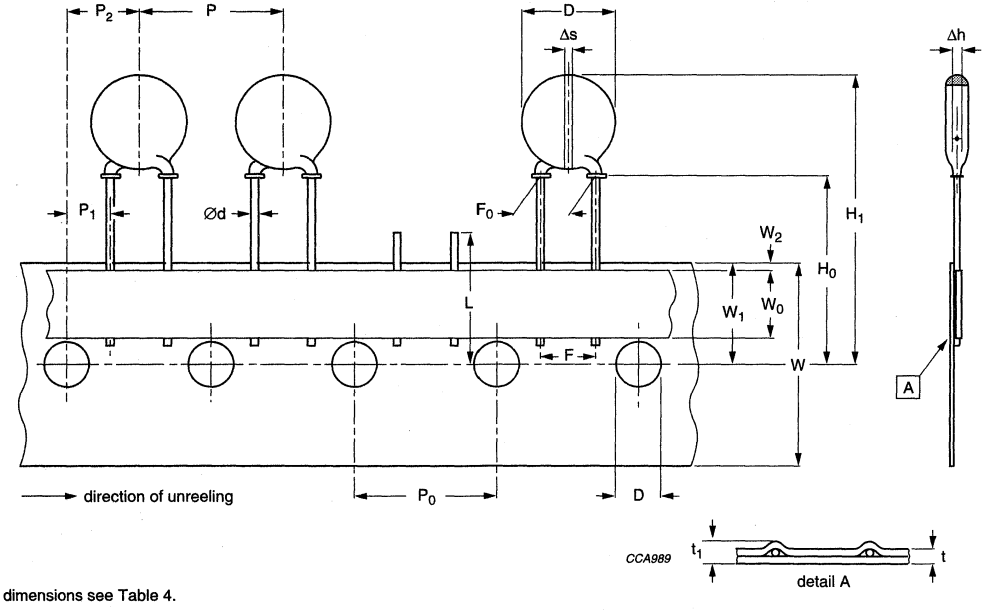
Table 3 Packaging quantities

BULK	REEL	AMMOPACK
250 or 500; note 1	1500	1500

Note

1. Quantity in box based on seated height, disc size and/or lead length.

Flanged capacitors on tape, lead pitch 5.0 mm



For dimensions see Table 4.

Fig.4 Capacitors, lead pitch 5.0 mm, on tape.

Table 4 Dimensions of tape; see Fig.4

SYMBOL	PARAMETER	DIMENSIONS (mm)	
		NOMINAL	TOLERANCE
d	lead diameter	0.6	+0.6 −0.05
P	pitch between capacitors	12.7	±1.0
P_0	feed-hole pitch	12.7	±0.2; note 1
P_1	feed-hole centre to lead centre	3.85	±0.5; note 2
P_2	feed-hole centre to component centre	6.35	±0.7; note 2
F	lead spacing	5.0	+0.6 −0.1
F_0	lead-to-lead	5.08	+0.5 −0.1
Δh	component alignment	0	±1.0
Δs	deviation along tape, left or right	0	±0.6
W	tape width	18.0	±0.5
W_0	hold-down tape width	6.0	±0.5
W_1	hole position	9.0	±0.5
W_2	hold-down tape position	0	±2
H_0	flange to tape centre	16.0	±0.5
H_1	maximum component height	33.75	–
	minimum component height	18.75	–
L	maximum length of snipped lead	11	–
D_0	feed-hole diameter	4.0	±0.2
t	total tape thickness	0.65	±0.2
t_1	maximum thickness of tape and wires	1.5	–

Notes

1. Cumulative pitch error: ±≤1 mm/20 pitches.
2. Obliquity maximum 3°.

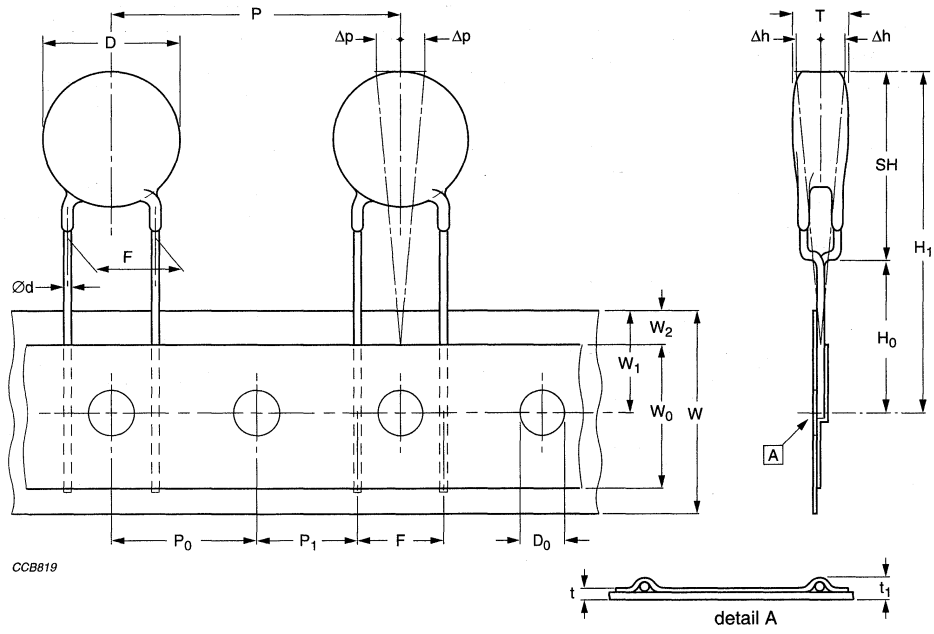
Table 5 Packaging quantities

BULK	REEL	AMMOPACK
250 or 500; note 1	1500	1500

Note

1. Quantity in box based on seated height, disc size and/or lead length.

Capacitors on tape, straight leads, lead pitch 7.5 mm



For dimensions see Table 6.

Fig.5 Taped version with straight leads.

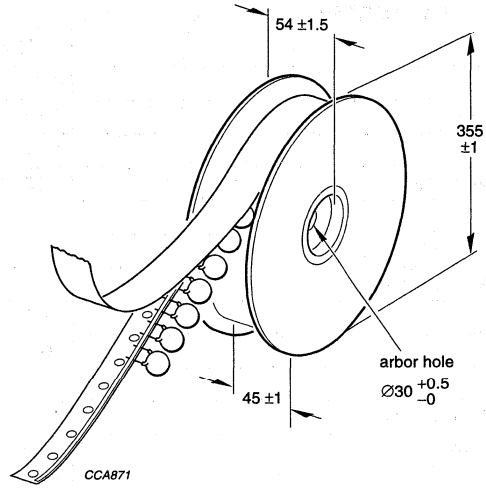
Table 6 Dimensions of tape; see Fig.5

SYMBOL	PARAMETER	DIMENSIONS (mm)	
		NOMINAL	TOLERANCE
d	lead diameter	0.6	±0.05
P	pitch between capacitors	12.7	±1.0
P_0	feed-hole pitch	12.7	±0.3; note 1
P_1	feed-hole centre to lead centre	8.95	±0.7; note 2
F	lead spacing	7.5	±0.8
Δh	component alignment	0	±3
Δp	deviation along tape, left or right	0	±1.3
W	tape width	18.0	±0.5
W_0	hold-down tape width	10	–
W_1	hole position	9.0	±0.5
W_2	maximum hold-down tape position	3	–
H_0	seated height to tape centre	16.0	±0.5
H_1	maximum component height	37	–
D_0	feed-hole diameter	4.0	±0.2
t	total tape thickness	0.65	±0.2
t_1	maximum thickness of tape and wires	1.5	–

Notes

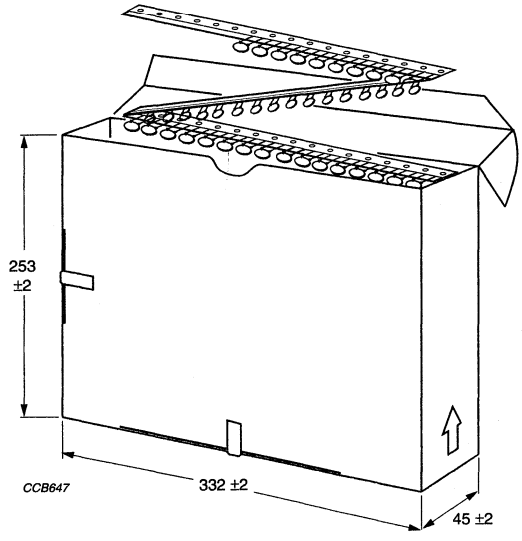
1. Cumulative pitch error: ±≤1 mm/20 pitches.
2. Obliquity maximum 3°.

REEL AND TAPE DATA



Dimensions in mm.

Fig.6 Reel with capacitors on tape.



Dimensions in mm.

Fig.7 Ammopack with capacitors on tape.

Ceramic disc capacitors

Safety, Class X1; Y2, 250 V (AC) series DN

FEATURES

- Complying with *"EN 132 400"* and *"IEC 60384-14, 2nd edition, including amendment 1.1995"*
- High reliability
- Kinked (preferred) or straight leads.

APPLICATIONS

- Across-the-line
- Line by-pass
- Antenna coupling.

DESCRIPTION

The capacitors consist of a ceramic disc both sides of which are silver-plated. Connection leads are made of tinned copper having a diameter of 0.6 mm or 0.8 mm.

The capacitors may be supplied with kinked or straight leads having a lead spacing of 7.5 mm (0.300") or 10 mm (0.400") and a lead length from 4 to 30 mm. The standard tolerance on capacitance is ±10% for Y5P material and ±20% for Z5U material. Encapsulation is made of flammable resistant epoxy resin in accordance with *"UL94V-0"*.

QUICK REFERENCE DATA

DESCRIPTION	VALUE
Capacitance range at 1 kHz; 1 V (RMS)	100 to 10000 pF
Rated AC voltage	250 V; 50/60 Hz
Dielectric strength	2500 V (AC) for 60 s
Insulation resistance at 500 V (DC)	≥10000 MΩ
Tolerance on capacitance	±10%; ±20%
Dissipation factor at 1 kHz; 1 V (RMS)	2.5% max.
Temperature coefficients	Y5P; Z5U
Operating temperature range	−30 to +125 °C; +10 to +125 °C
Approvals	FIMKO, DEMKO, SEMKO, NEMKO, SEV, VDE (UL, CSA in progress)
Climatic category	25/125/56 or 25/85/21

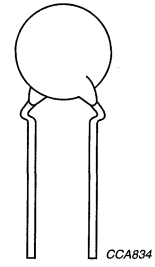
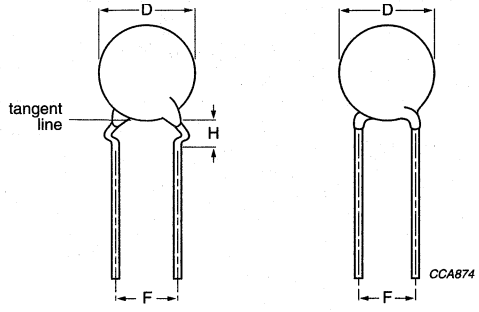


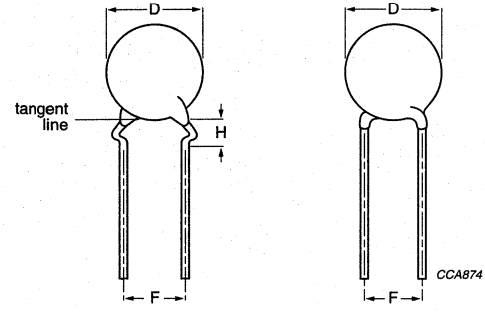
Fig.1 Simplified outline.

MECHANICAL DATA



Dimensions in mm.
For dimensions see Table 1.

Fig.2 Capacitors with 7.5 mm (0.30") lead spacing.



Dimensions in mm.
For dimensions see Table 1.

Fig.3 Capacitors with 10 mm (0.40") lead spacing.

MARKING

Marking indicates capacitance value and tolerance in accordance with *"EIA 198"*, voltage and approval marks.

ORDERING INFORMATION, TYPE DN

Table 1 250 V (AC); capacitance, mechanical dimensions and ordering information; note 1

C (pF)	TOL. (%)	D_{max} (mm)	LEAD SPACING F (mm)	SH[2] (mm)	CLEAR TEXT CODE	PACKAGING CODE 8th AND 9th DIGIT			CATALOGUE NUMBER[4]
					13th DIGIT: T = REEL; U = AMMO; 3 = BULK; note 3	REEL	AMMO	BULK	
						KINKED			
Class X1/Y2 Y5P									
100	±10	8.5	7.5	4.0	S101K33Y5PS6.K7	35	36	37	2252 812 ..016
150	±10	8.5	7.5	4.0	S151K33Y5PS6.K7	35	36	37	2252 812 ..116
220	±10	8.5	7.5	4.0	S221K33Y5PS6.K7	35	36	37	2252 812 ..216
330	±10	8.5	7.5	4.0	S331K33Y5PS6.K7	35	36	37	2252 812 ..316
470	±10	8.5	7.5	4.0	S471K33Y5PS6.K7	35	36	37	2252 812 ..416
680	±10	10.0	7.5	4.0	S681K39Y5PS6.K7	35	36	37	2252 812 ..616
Class X1/Y2 Z5U									
1000	±20	8.5	7.5	4.0	S102M33Z5US6.K7	35	36	37	2252 812 ..027
1500	±20	10.0	7.5	4.0	S152M39Z5US6.K7	35	36	37	2252 812 ..127
2200	±20	11.0	7.5	4.0	S222M43Z5US6.K7	35	36	37	2252 812 ..227
3300	±20	13.5	7.5	4.0	S332M53Z5US6.K7	35	36	37	2252 812 ..327
3900	±20	13.5	7.5	4.0	S392M53Z5US6.K7	35	36	37	2252 812 ..377
4700	±20	15.0	7.5	4.0	S472M59Z5US63K7	–	–	37	2252 812 ..427
10000	±20	21.5	10	4.0	S103M84Z5US83K0	–	–	48	2252 812 ..037

Notes

1. Maximum thickness 7.5 mm.
2. SH = seated height.
3. Straight leads are available on request.
4. 8th and 9th digit of the catalogue number to be completed with the packaging code.

ELECTRICAL CHARACTERISTICS

The capacitors meet the essential requirements of *"EIA 198"*. Unless stated otherwise all electrical values apply at an ambient temperature of 25 ±3 °C, at normal atmospheric conditions.

DESCRIPTION	VALUE
Capacitance range at 1 kHz, 1 V (RMS)	100 to 10000 pF
Tolerance on capacitance	±10%; ±20%
Rated AC voltage	250 V
AC test voltage	2500 V
Insulation resistance at 500 V (DC)	≥10000 MΩ
Temperature coefficients on capacitance	Y5P; Z5U
Dissipation factor at 1 kHz, 1 V (RMS)	2.5% max.
Operating temperature range	+10 to +85 °C (Z5U); −30 to +85 °C (Y5P)

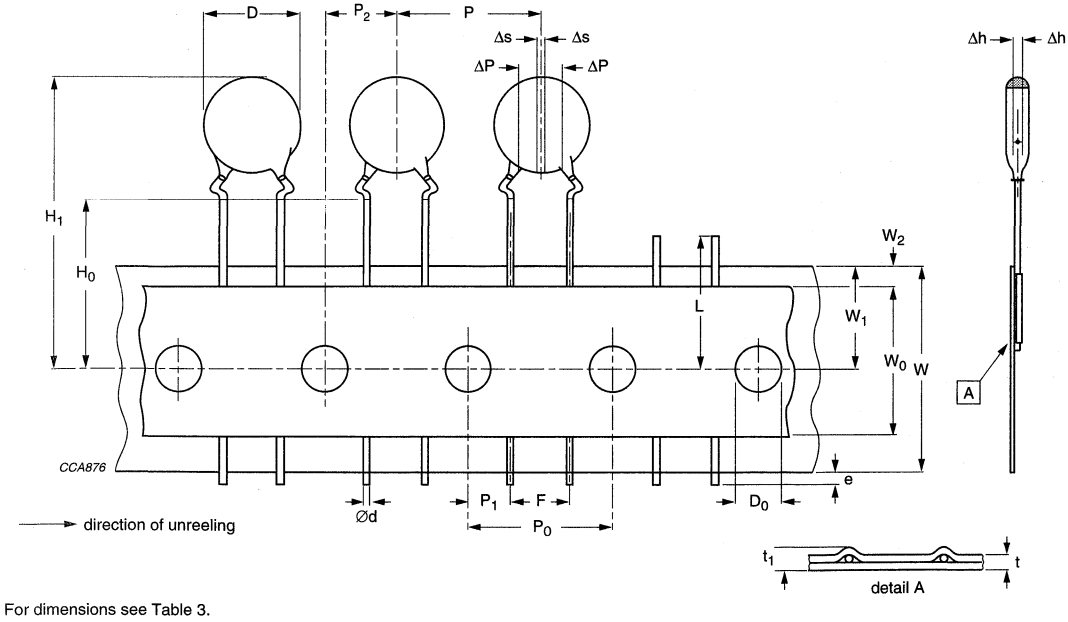
PACKAGING

The capacitors are supplied in bulk packaging (cardboard boxes), in tape on reel or in ammopack (see Table 2).

Table 2 Size codes and packaging quantities

D_{max} (mm)	SIZE CODE	PACKAGING QUANTITIES		
		BULK	REEL	AMMO
8.5 (0.33")	33	1000	1000	1500
10.0 (0.39")	39			
11.0 (0.43")	43			
12.0 (0.47")	47			
13.5 (0.53")	53	500	–	–
15.0 (0.59")	59			
17.5 (0.69")	69			
19.0 (0.75")	75			
21.5 (0.84")	84			

Kinked capacitors on tape, lead spacing 7.5 mm (0.30 inch)



For dimensions see Table 3.

Fig.4 Capacitors, lead spacing 7.5 mm, on tape.

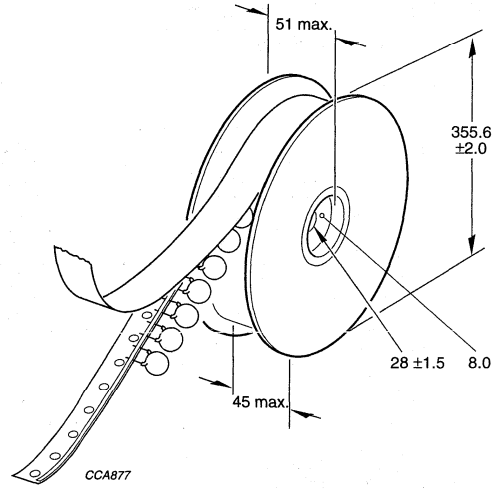
Table 3 Dimensions of tape; see Fig.4

SYMBOL	PARAMETER	DIMENSIONS (mm)	
		NOMINAL	TOLERANCE
D	body diameter	14.0 max.	–
d	lead diameter	0.6	±0.05
P	pitch between capacitors	15	±1.0
P_0	feed-hole pitch	15	±0.3; note 1
ΔP	plane deviation	1.0 max.	–
P_1	feed-hole centre to lead centre	3.75	±0.7; note 2
P_2	feed-hole centre to component centre	7.5	±1.3; note 2
F	lead spacing	7.5	±1.0
Δh	component alignment	0	±1.0
Δs	deviation along tape, left or right	0	±1.0
W	tape width	18.0	+1.0 –0.5
W_0	hold-down tape width	5.0 min.	–
W_1	hole position	9.0	+0.75 –0.5
W_2	hold-down tape margin	3.0 max.	–
H_0	height to seating plane	16.0	±0.5
H_1	maximum component height	40	–
e	lead end protrusion	1.0 max.	–
L	maximum length of snipped lead	11.0	–
D_0	feed-hole diameter	4.0	±0.2
t	total tape thickness	0.9 max.	–
t_1	maximum thickness of tape and wires	1.5 max.	–

Notes

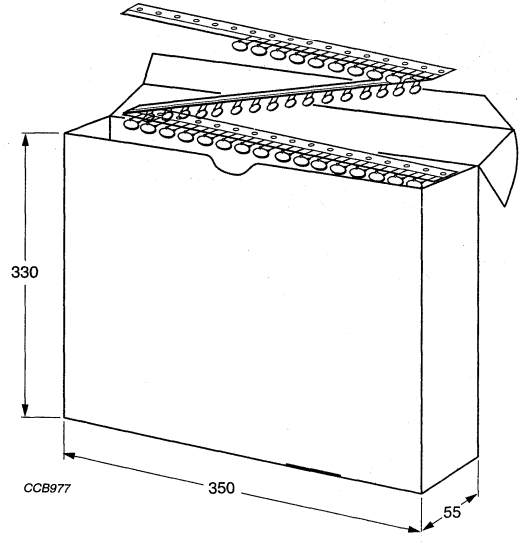
1. Cumulative pitch error: ±≤1 mm/20 pitches.
2. Obliquity maximum 3°.

REEL AND TAPE DATA



Dimensions in mm.

Fig.5 Reel with capacitors on tape.



Dimensions in mm.

Fig.6 Ammopack with capacitors on tape.

Ceramic disc capacitors

Safety, Class Y1, 250 V (AC); X1, 440 V (AC) series AY

FEATURES

- 4 kV (AC) test voltage
- High temperature operation, up to 125 °C
- Complying with *"EN 132 400"* and *"IEC 60384-14, 2nd edition, including amendment 1.1995"*.

APPLICATIONS

- Across-the-line
- Line by-pass
- Antenna coupling
- Interference suppression.

DESCRIPTION

The capacitors consist of a ceramic disc both sides of which are silver-plated. Connection leads are made of tinned copper having a diameter of 0.6 mm.

The capacitors are supplied with straight leads. The standard tolerance on capacitance is ±20%. Encapsulation is made of flammable resistant epoxy resin in accordance with *"UL94V-0"*.

QUICK REFERENCE DATA

DESCRIPTION	VALUE
Capacitance range at 1 kHz; 1 V (RMS)	100 to 4700 pF
Rated AC voltage: Y1 X1	 250 V; 50/60 Hz 440 V; 50/60 Hz
Dielectric strength (AC)	4000 V for 60 s
Test voltage of coating (AC)	4000 V for 60 s
Insulation resistance at 500 V (DC)	≥10000 MΩ
Tolerance on capacitance	±20%
Dissipation factor at 1 kHz; 1 V (RMS)	2.5% max.
Temperature coefficient	Y5U or better
Operating temperature range	−30 to +125 °C
Approvals	FIMKO, VDE, SEMKO UL (in progress)
Climatic category	25/125/21

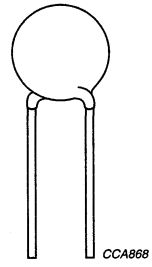
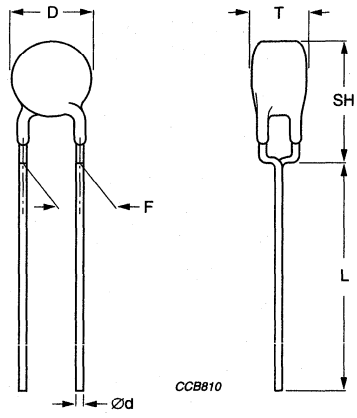


Fig.1 Simplified outline.

MECHANICAL DATA



For dimensions see Table 1.

Fig.2 Capacitor with 10 mm lead spacing.

MARKING

Marking indicates the manufacturers logo (M), the capacitance value (i.e. 1n0), the series (AY), the rated voltage and subclass (250 ~ Y1, 440 ~ X1) and approval marks.

Marking example

M 1n0 AY

250 ~ Y1

440 ~ X1

ORDERING INFORMATION

Table 1 Y1, 250 V; X1, 440 V, (AC); capacitance, mechanical dimensions and ordering information; note 1

C (pF)	TOL. (%)	D_{max} (mm)	LEAD[2] SPACING F (mm)	SH[3] (mm)	CLEAR TEXT CODE	PACKAGING CODE 8th AND 9th DIGIT			CATALOGUE NUMBER[4]
					12th AND 13th DIGIT: YG = REEL; YJ = AMMO; YF = BULK	REEL	AMMO	BULK	
100	±20	9	10 ±1	13	C101M35Y5UQ..SP	53	54	51	2251 837 ..017
150	±20	9	10 ±1	13	C151M35Y5UQ..SP	53	54	51	2251 837 ..117
220	±20	9	10 ±1	13	C221M35Y5UQ..SP	53	54	51	2251 837 ..217
330	±20	9	10 ±1	13	C331M35Y5UQ..SP	53	54	51	2251 837 ..317
470	±20	9	10 ±1	13	C471M35Y5UQ..SP	53	54	51	2251 837 ..417
560	±20	10	10 ±1	14	C561M39Y5UQ..SP	53	54	51	2251 837 ..517
680	±20	10	10 ±1	14	C681M39Y5UQ..SP	53	54	51	2251 837 ..617
1000	±20	10	10 ±1	14	C102M39Y5UQ..SP	53	54	51	2251 837 ..027
1500	±20	11	10 ±1	15	C152M43Y5UQ..SP	53	54	51	2251 837 ..127
1800	±20	12	10 ±1	16	C182M47Y5UQ..SP	53	54	51	2251 837 ..177
2200	±20	12	10 ±1	16	C222M47Y5UQ..SP	53	54	51	2251 837 ..227
2700	±20	14	10 ±1	18	C272M55Y5UQ..SP	53	54	51	2251 837 ..277
3300	±20	14	10 ±1	18	C332M55Y5UQ..SP	53	54	51	2251 837 ..327
3900	±20	15	10 ±1	20	C392M55Y5UQ..SP	53	54	51	2251 837 ..377
4700	±20	16	10 ±1	20	C472M63Y5UQ..SP	53	54	51	2251 837 ..427

Notes

1. Maximum thickness 6 mm.
2. Lead spacing of 12.5 mm is available on request.
3. SH = seated height.
4. 8th and 9th digit of the catalogue number to be completed with the packaging code.

ELECTRICAL CHARACTERISTICS

The capacitors meet the essential requirements of *"IEC 60384-14, 2nd edition"*. Unless stated otherwise all electrical values apply at an ambient temperature of 20 ±3 °C, at normal atmospheric conditions.

DESCRIPTION	VALUE
Capacitance range at 1 kHz, 1 V (RMS)	100 to 4700 pF
Tolerance on capacitance	±20%
Rated AC voltage:	
Y1	250 V; 50/60 Hz
X1	440 V; 50/60 Hz
AC test voltage	4000 V
Insulation resistance at 500 V (DC)	≥10000 MΩ
Temperature coefficients on capacitance	Y5U or better
Dissipation factor at 1 kHz, 1 V (RMS)	2.5% max.
Operating temperature range	−25 to +125 °C
Climatic category	25/125/21

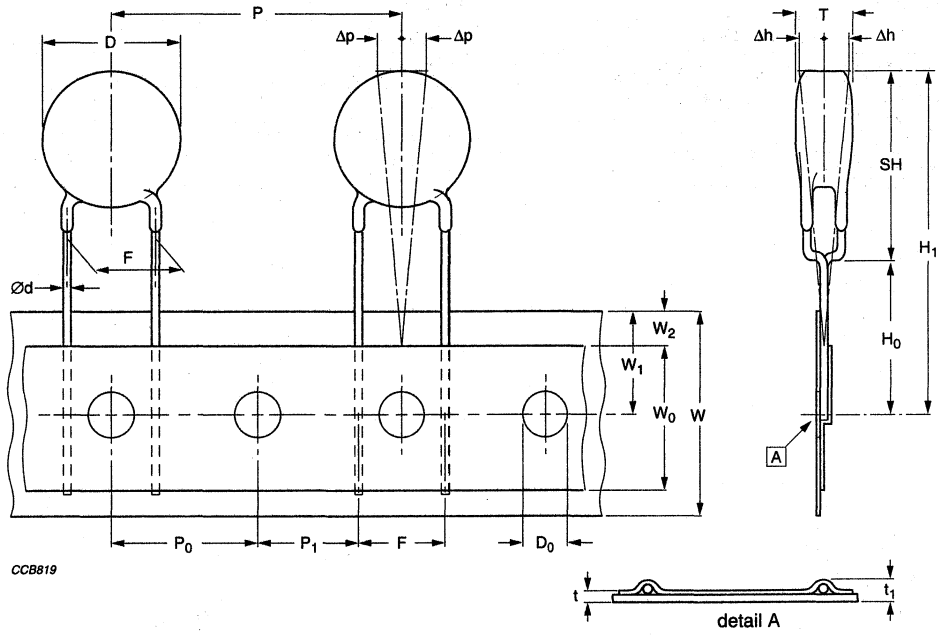
PACKAGING

The capacitors are supplied in bulk packaging (plastic bags), in tape on reel or in ammopack; see Table 2.

Table 2 Packaging quantities

BULK	REEL	AMMOPACK
500	750	750

Capacitors on tape, lead pitch 10 mm



For dimensions see Table 3.

Fig.3 Taped version with straight leads.

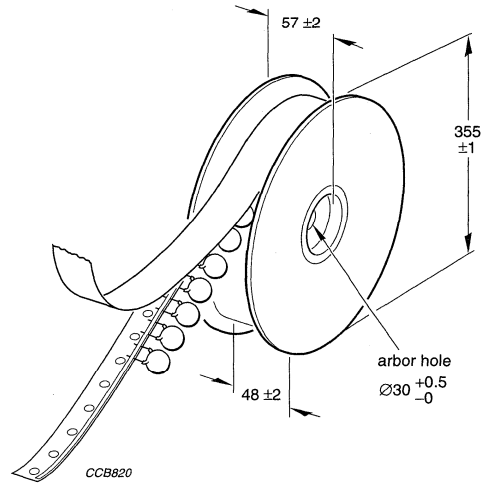
Table 3 Dimensions of tape; see Fig.3

SYMBOL	PARAMETER	DIMENSIONS (mm)	
		NOMINAL	TOLERANCE
d	lead diameter	0.6	±0.05
P	pitch between capacitors	25.4	±1.0
P_0	feed-hole pitch	12.7	±0.3; note 1
P_1	feed-hole centre to lead centre	7.62	±0.7; note 2
F	lead spacing	10.0	±0.8
Δh	component alignment	0	±3
Δp	deviation along tape, left or right	0	±1.3
W	tape width	18.0	±0.5
W_0	hold-down tape width	12	–
W_1	hole position	9.0	±0.5
W_2	maximum hold-down tape position	3	–
H_0	seated height to tape centre	16.0	±0.5
H_1	maximum component height	37	–
D_0	feed-hole diameter	4.0	±0.2
t	total tape thickness	0.65	±0.2
t_1	maximum thickness of tape and wires	1.5	–

Notes

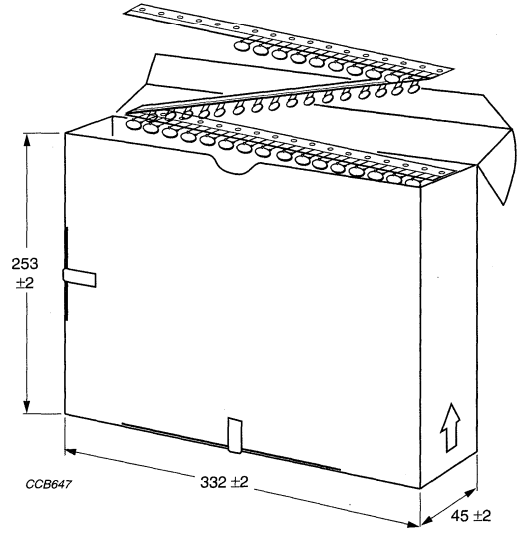
1. Cumulative pitch error: ±≤1 mm/20 pitches.
2. Obliquity maximum 3°.

REEL AND TAPE DATA



Dimensions in mm.

Fig.4 Reel with capacitors on tape.



Dimensions in mm.

Fig.5 Ammopack with capacitors on tape.

LEADED CERAMIC MULTILAYER CAPACITORS

NUMERICAL INDEX (preferred types)

Sequence of catalogue numbers in accordance with the "12-DIGIT CODE"

SELECTION GUIDE FOR LEADED CERAMIC MULTILAYER CAPACITORS

TC	$U_{R(DC)}$ (V)	CAP. RANGE	CAP. TOL.	CATALOGUE NUMBERS 2252	CLIMATIC CATEGORY	STABILITY	TYPICAL CIRCUITS	TARGET APPLICATION	PAGE
Class 1, axial Mono-axial™ series; preferred types in **bold**									
NP0 (C0G)	50	10 pF to 4700 pF	**±5%**	**205**	55/125/21	high	high frequency; tuning; temperature compensation; precision clocking	general industrial; high stress circuits; high stress automotive; professional circuits; measuring instruments	120
			±10%	215(1)					–
	100	10 pF to 3300 pF	**±5%**	**206**					120
			±10%	216(1)					–
Class 2, axial Mono-axial™ series; preferred types in **bold**									
2C1 (X7R)	25	0.039 µF to 0.22 µF	**±10%**	**222**	55/125/21	high	coupling/decoupling; filtering	high stress circuits; high stress automotive; professional circuits; measuring instruments	121
			±20%	232(1)					–
	50	100 pF to 0.22 µF	**±10%**	**225**					121
			±20%	235(1)					–
	100	100 pF to 0.10 µF	**±10%**	**226**					121
			±20%	236(1)					–
Z5U	25	0.047 µF to 0.10 µF	**±20%**	**242**	10/085/21	medium	coupling/decoupling; filtering	general industrial; consumer	122
			+80%/–20%	252(1)					–
	50	1000 pF to 0.47 µF	**±20%**	**245**					122
			+80%/–20%	255(1)					–
	100	1000 pF to 0.10 µF	**±20%**	**246**					122
			+80%/–20%	256(1)					–
Y5V	25	0.01 µF to 1.0 µF	+80%/–20%	262(1)	10/085/21	medium	coupling/decoupling; filtering	general industrial; consumer	–
	50		**+80%/–20%**	**265**					122

TC	$U_{R(DC)}$ (V)	CAP. RANGE	CAP. TOL.	CATALOGUE NUMBERS 2252	CLIMATIC CATEGORY	STABILITY	TYPICAL CIRCUITS	TARGET APPLICATION	PAGE
Class 1, radial Mono-kap™ series; preferred types in **bold**									
NP0 (C0G)	50	10 pF to 0.022 µF	**±5%**	**305**	55/125/21	high	high frequency; tuning; temperature compensation; precision clocking	general industrial; high stress circuits; high stress automotive; professional circuits; measuring instruments	128
			±10%	315(1)					–
	100	10 pF to 0.01 µF	**±5%**	**306**					128
			±10%	316(1)					–
Class 2, radial Mono-kap™ series; preferred types in **bold**									
2C1 (X7R)	25	0.039 µF to 0.22 µF	±10%	322(1)	55/125/21	high	coupling/decoupling; filtering	high stress circuits; high stress automotive; professional circuits; measuring instruments	–
			±20%	332(1)					–
	50	100 pF to 1.0 µF	**±10%**	**325**					130
			±20%	335(1)					–
	100	100 pF to 0.47 µF	**±10%**	**326**					130
			±20%	336(1)					–
Z5U	25	0.047 µF to 0.22 µF	±20%	342(1)	10/085/21	medium	coupling/decoupling; filtering	general industrial; consumer	–
			+80%/–20%	352(1)					–
	50	1000 pF to 2.2 µF	**±20%**	**345**					131
			+80%/–20%	355(1)					–
	100	1000 pF to 1 µF	**±20%**	**346**					131
			+80%/–20%	356(1)					–
Y5V	25	0.01 µF to 1.0 µF	**+80%/–20%**	**362**	10/085/21	medium	coupling/decoupling; filtering	general industrial; consumer	132
	50		**+80%/–20%**	**365**					132

Note

1. Non-preferred types available on request.

PACKAGING

The monolithic ceramic capacitors are supplied in bulk packaging, taped on reel, or in ammopack; see Tables 1 and 3.

Mono-axial™ capacitors

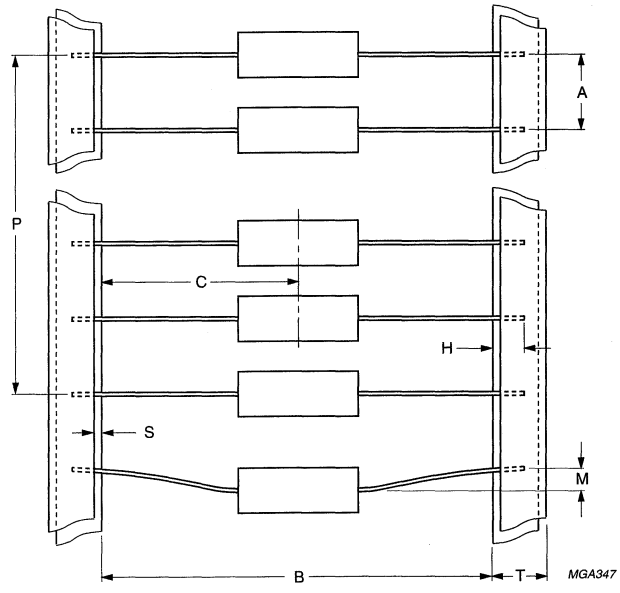
Table 1 Packaging quantities and box dimensions

PACKAGING	SIZE CODE	SMALLEST PACKAGING QUANTITY (SPQ)	BOX DIMENSIONS L × W × H (mm)
		2252 SERIES FE 15-digit(1)	
Tape on reel	15; 20	7000	370 × 370 × 90
Ammopack	15; 20	4000	265 × 85 × 95

Note

1. Non-standard SPQ for 2222 series and US 15-digit code which will be phased out in the future.

Capacitors on bandolier, Mono-axial series



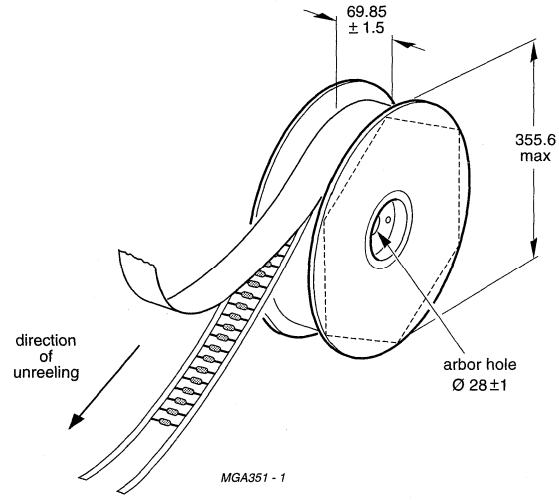
Maximum 0.1% of the total number of capacitors per reel may be missing.
A maximum of 1 consecutive vacant position is followed by 6 consecutive components.
Tape begins and ends with minimum of 60 empty positions (300 mm tape).
Maximum of 5 splices per reel.
For dimensions see Table 2.

Fig.1 Capacitors on bandolier, Mono-axial series.

Table 2 Dimensions of bandolier; see Fig.1

SYMBOL	PARAMETER	DIMENSIONS	
		mm	inch
B	inside tape spacing	52.4 ±1.5	2.062 ±0.059
C	centre-to-tape-spacing	±0.8	±0.031
P	cumulative pitch, 6 consecutive components	±1.5	±0.059
A	components pitch	5 ±0.5	0.197 ±0.015
M	lead bend	<1.2	<0.047
S	exposed adhesive	<0.8	<0.031
T	tape width	6.35	0.250
H	lead sandwich	>3.96	>0.156

REEL DATA, MONO-AXIAL SERIES



Dimensions in mm.

Maximum 0.1% of the total number of capacitors per reel may be missing.
A maximum of 1 consecutive vacant position is followed by 6 consecutive components.

Tape begins and ends with minimum of 60 empty positions (300 mm tape).

Maximum of 5 splices per reel.

For capacitor length (L) and diameter (ØD) refer to this handbook,
Chapter *"Leaded ceramic multilayer capacitors"*, Section *"Mono-axial™"*, *"Table 1"*.

Fig.2 Reel with capacitors on tape; Mono-axial series.

Mono-kap™ capacitors

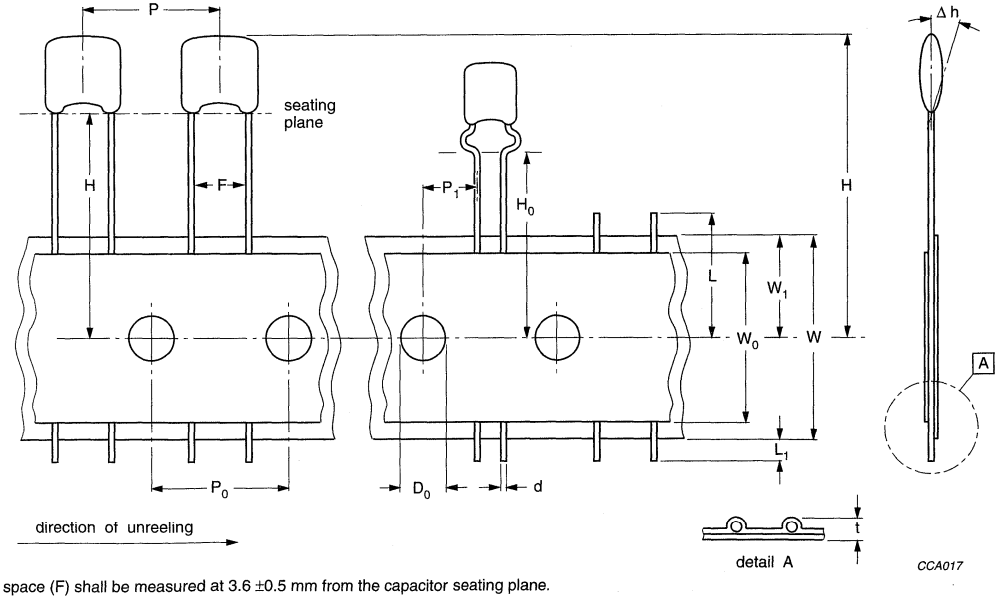
Table 3 Packaging quantities and box dimensions

PACKAGING	SIZE CODE	SMALLEST PACKAGING QUANTITY (SPQ)	BOX DIMENSIONS L × W × H (mm)
		2252 SERIES FE 15-digit[2]	
Bulk; note 1	15; 20	5000	245 × 120 × 65
	30	3000	
Tape on reel	15	4000	370 × 370 × 60
	20	3000	
	30	2500	
Ammopack	15; 20	2500	335 × 290 × 50
	30	2000	

Notes

1. SPQ contains 1 or a multiple of poly-bags, 1000 units per bag.
2. Non-standard SPQ for 2222 series and US 15-digit code which will be phased out in the future.

Capacitors on tape, lead spacing 5.0 and 2.5 mm, Mono-kap series



Lead space (F) shall be measured at 3.6 ±0.5 mm from the capacitor seating plane.
Maximum 0.5% of the total number of capacitors per reel may be missing.
A maximum of 1 consecutive vacant position is followed by 6 consecutive components.
Tape begins and ends with minimum of 24 empty positions (300 mm tape).
Maximum of 5 splices per reel.
For dimensions see Table 4.

Fig.3 Capacitors, with lead spacing 5.0 and 2.5 mm, for Mono-kap series on tape.

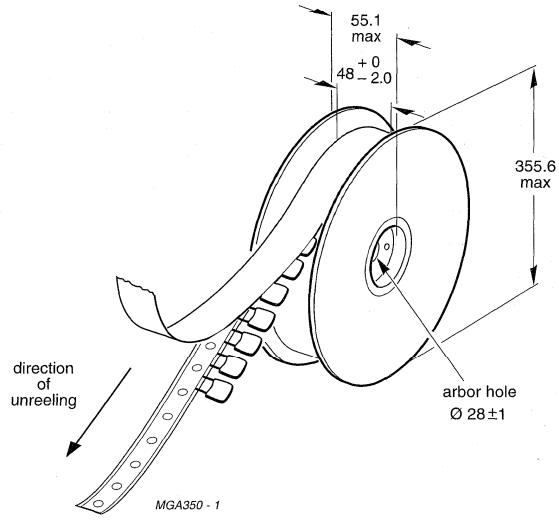
Table 4 Dimensions of tape; see Fig.3

SYMBOL	PARAMETER	DIMENSIONS	
		mm	inch
L	cut off length	<11	<0.443
L_1	lead end protrusion	<2	<0.079
H	height to seating plane	>16	>0.630
H_0	height to seating plane (formed leads)	16 ±0.5	0.630 ±0.020
H_1	top of component height	<32	<1.260
Δh	body inclination	0.0 ±<1.0	0 ±<0.039
W	carrier tape width	18 +1.0/–0.5	0.709 +0.039/–0.020
W_0	hold down tape width	15 ref.; note 1	0.591 ref.; note 1
W_1	sprocket hole position	9 +0.075/–0.5	0.354 +0.030/–0.020
F	1e lead space; note 2	2.5 +0.6/–0.4	0.100 +0.024/–0.016
	2e lead space; note 2	5.0 +0.6/–0.4	0.200 +0.024/–0.016
P_0	sprocket hole pitch	12.7 ±0.3	0.500 ±0.012
P_1	1e sprocket hole centre to lead centre; note 2	5.08 ±0.7	0.200 ±0.028
	2e sprocket hole centre to lead centre; note 2	3.85 ±0.7	0.151 ±0.028
D_0	sprocket hole diameter	4 ±0.3	0.157 ±0.012
t	overall tape thickness	<0.9	<0.035
d	wire lead diameter	0.5 ±0.05	0.02 ±0.002
P	taping pitch	12.7 ref.	0.500 ref.

Notes

1. Tape width of 6 mm (0.236 inches) permissible.
2. e = 2.54 mm.

REEL AND TAPE DATA, MONO-KAP SERIES



Dimensions in mm.

Maximum 0.5% of the total number of capacitors per reel may be missing.
A maximum of 2 consecutive vacant position is followed by 6 consecutive components.

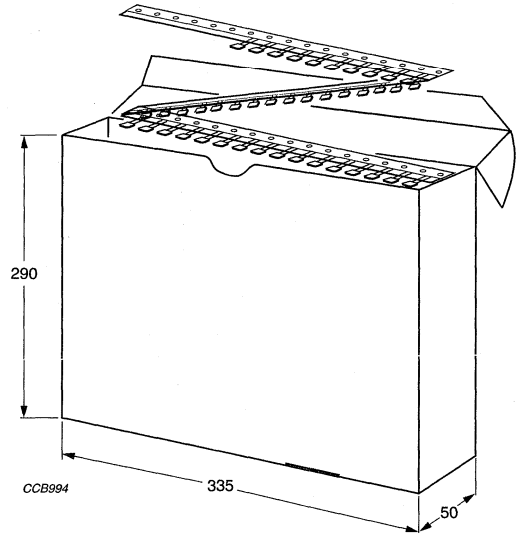
Tape begins and ends with minimum of 24 empty positions (300 mm tape).

Maximum of 5 splices per reel.

Cumulative pitch tolerance over 20 consecutive units not to exceed ⊥1.0 mm.

Lead space (F) shall be measured at 3.6 ±0.5 mm from the capacitor seating plane.

Fig.4 Reel with capacitors on tape; Mono-kap series.



Dimensions in mm.

Maximum 0.5% of the total number of capacitors per box may be missing.
A maximum of 2 consecutive vacant positions is followed by 6 consecutive components.

Tape begins and ends with minimum of 24 empty positions (300 mm tape).

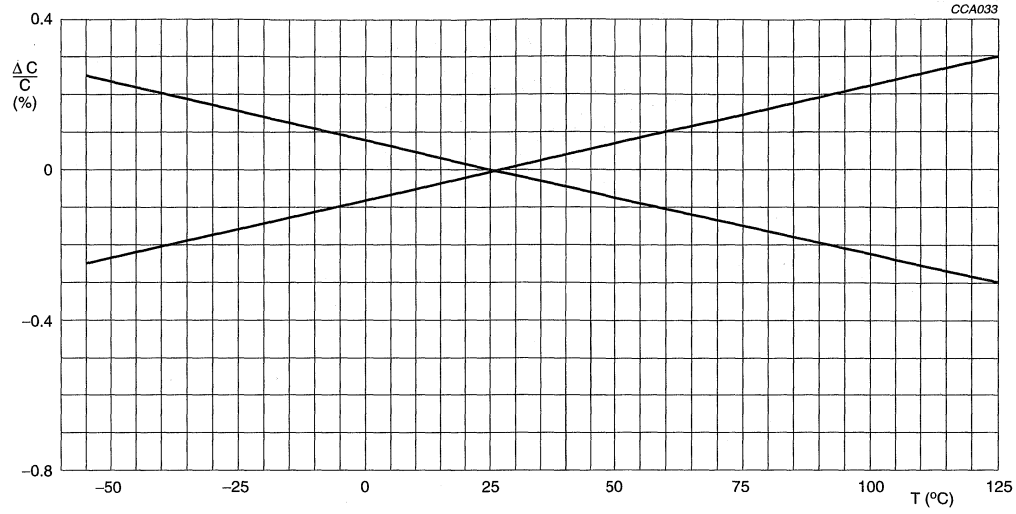
Maximum of 5 splices per box.

Cumulative pitch tolerance over 20 consecutive units not to exceed ±1.0 mm.

Lead space (F) shall be measured at 3.6 ±0.5 mm from the capacitor seating plane.

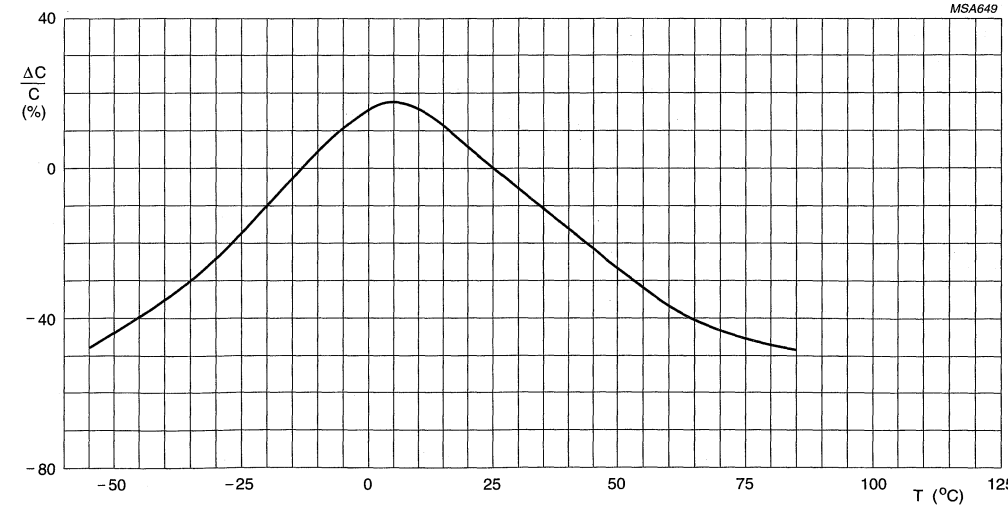
Fig.5 Ammopack with capacitors on tape; Mono-kap series.

CHARACTERISTIC CURVES



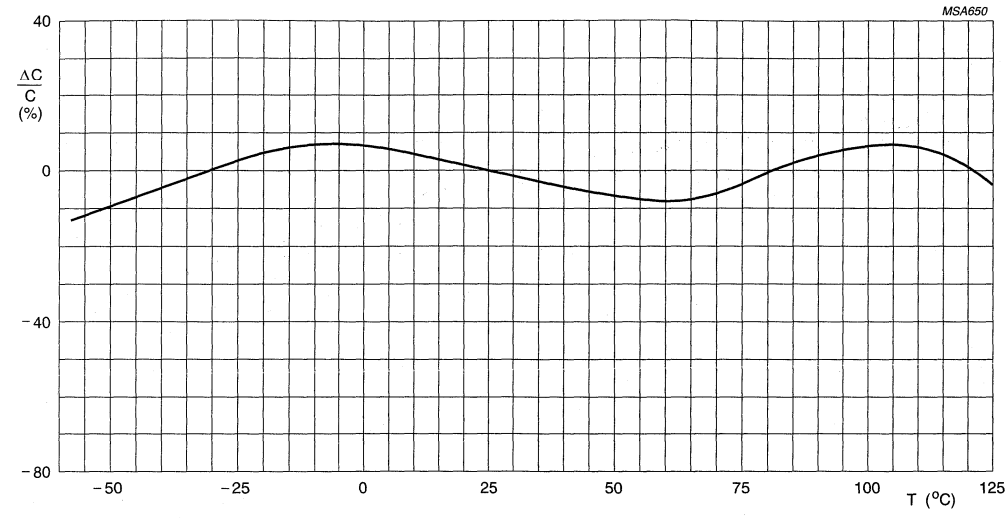
For **NP0/C0G**.

Fig.6 Typical capacitance change as a function of temperature.



For **Z5U**.

Fig.7 Typical capacitance change as a function of temperature.



For **X7R**.

Fig.8 Typical capacitance change as a function of temperature.

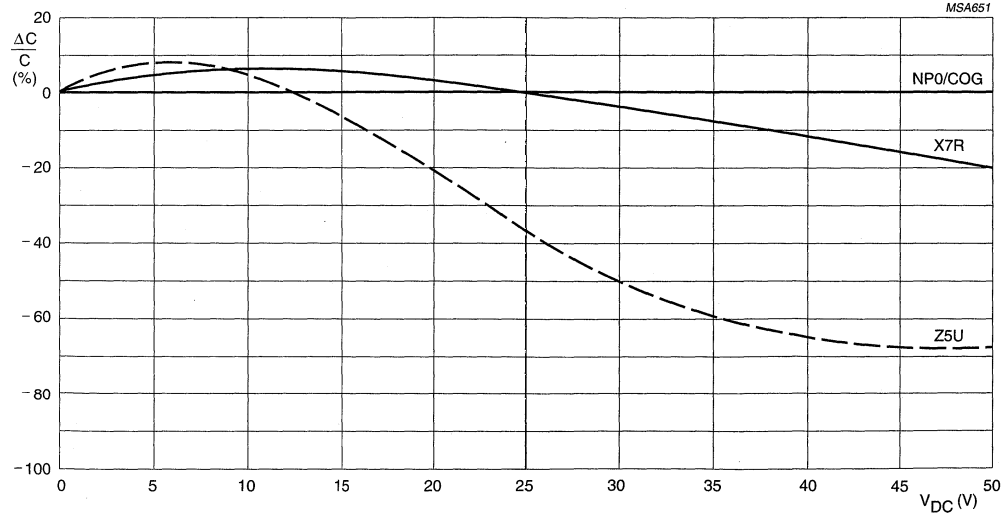


Fig.9 Typical capacitance change as a function of DC voltage.

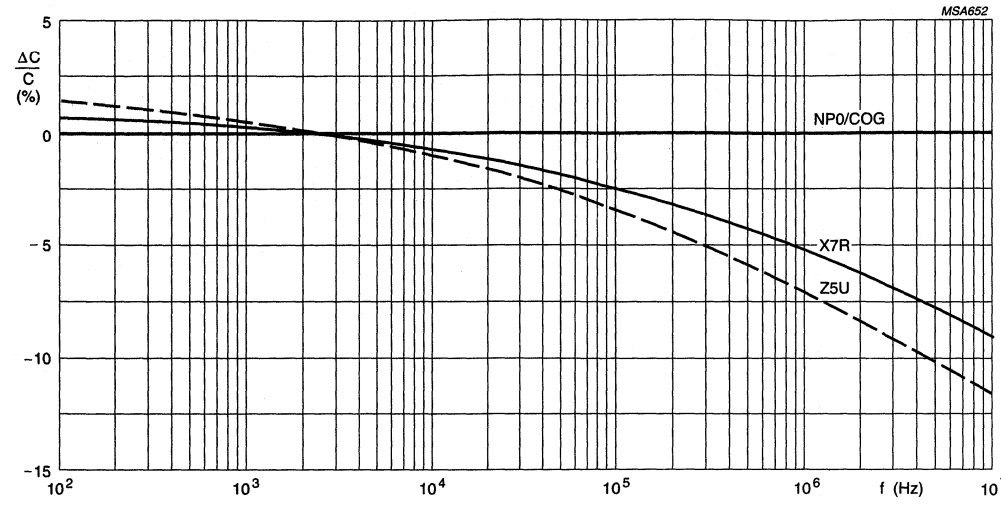


Fig.10 Typical capacitance change as a function of frequency.

TESTS AND REQUIREMENTS

Class 1 capacitors

After manufacture, each capacitor is checked on capacitance, tan δ and test voltage. Apart from this the following quality checks are carried out by frequent inspections.

Essentially all tests mentioned in the schedule of *"IEC publication 60384-8"*, category 55/125/21 (temperature range −55/+125 °C; damp heat, long term, 21 days) are carried out in accordance with *"IEC publication 60068"*.

Table 5 Test procedures and requirements

IEC 60384-8 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
4.4		robustness of terminations:		
		pull-off	pull velocity 15 cm/minute; load 5 N	no lead breakage
	Ua_1	tensile strength	axial force 10 N	no lead breakage
	Ub	bending	load 5 N; 4 × 90°	no lead breakage
4.6	Ta method 1	solderability (solder bath)	235 °C; 2 s	good tinning
4.5	Tb method 1A	resistance to soldering heat	260 °C; 10 s	no visible damage ΔC/C: ±≤0.5% or ±0.5 pF after 1 to 2 hours
4.7	Na	rapid change of temperature	30 minutes at −55 °C and 30 minutes at +125 °C; 5 cycles	no damage after 24 hours ΔC/C: ±≤0.5% or ±0.5 pF
4.8	Fc	vibration	10 to 55 to 10 Hz; 0.75 mm displacement; 3 directions; 6 hours	no visible damage
4.9	Eb	bump	4000 bumps in 2 directions; 40 g; pulse time 6 ms	no visible damage
		inflammability	15 s; 35 mm above bunsen burner with flame-height 40 to 60 mm	self-extinguishing within 15 s after removal of bunsen burner

IEC 60384-8 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
4.3		temperature coefficient	between +20 and −55 °C, and between +20 and +125 °C	within tolerance as specified for each particular material
4.11		climatic sequence:		
4.11.2	B	dry heat	16 hours; +125 °C	no visible damage
4.11.3	Db	damp heat (accelerated) 1st cycle	12 hours; +55 °C; 90 to 96% RH 12 hours; +25 °C; 95 to 100% RH	after recovery of 1 to 2 hours immediately followed by cold test
4.11.4	A	cold	2 hours; −55 °C	no visible damage
4.11.5	M	low air pressure	1 hour at 8.5 kPa, last 2 minutes rated voltage	no breakdown or flashover
4.11.6	Db	damp heat (accelerated) remaining cycle	12 hours; +55 °C; 90 to 96% RH 12 hours; +25 °C; 95 to 100% RH	$\Delta C/C$: $\pm \leq 1\%$ or ± 1 pF tan δ: $\leq 2 \times$ specified tan δ R_{ins} after 1 to 2 hours: >5000 MΩ
4.12	Ca	damp heat, steady state (half number of the lot at rated voltage, other half at zero voltage)	21 days; +40 °C; 90 to 95% RH	$\Delta C/C$: $\pm \leq 1\%$ or ± 1 pF tan δ: $\leq 2 \times$ specified tan δ R_{ins} after 1 to 2 hours: >5000 MΩ
4.13		endurance	1000 hours at maximum temperature, at $1.5 \times$ rated voltage	$\Delta C/C$: $\pm \leq 1\%$ or ± 1 pF tan δ: $\leq 1.5 \times$ specified tan δ R_{ins}: >3000 MΩ
		resistance to solvents	3 minutes ultrasonic washing in trichloroethylene; 1 minute drying; 30 °C; 10 brush strokes	marking and colour code must remain legible and not be discoloured; no mechanical or electrical damage or deterioration of the material

Class 2 capacitors

After manufacture, each capacitor is checked on capacitance, tan δ and test voltage. Apart from this the following quality checks are carried out by frequent inspections.

Essentially all tests mentioned in the schedule of *"IEC publication 60384-9"*, categories 55/125/21 and 10/85/21 respectively for X7R-2C1 and Z5U (temperature ranges –55/+125 °C and +10/+85 °C; damp heat, long term, 21 days) are carried out in accordance with *"IEC publication 60068"*.

Table 6 Test procedures and requirements

IEC 60384-9 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
4.1		pre-conditioning	1 hour; +150 °C; reference measurement after 24 hours	
4.5		robustness of terminations:		
		pull-off	pull velocity 15 cm/minute; load 5 N	no lead breakage
	Ua_1	tensile strength	axial force 10 N	no lead breakage
	Ub	bending	load 5 N; 4 × 90°	no lead breakage
4.7	Ta method 1	solderability (solder bath)	235 °C; 2 s	good tinning
4.6	Tb method 1A	resistance to soldering heat	pre-conditioning: 260 °C; 10 s	no visible damage
4.8	Na	rapid change of temperature	pre-conditioning: for X7R: –55/+125 °C; 5 cycles; for Z5U: +10/+85 °C; 5 cycles	no damage ΔC/C after 24 hours: X7R: ±≤10% Z5U: ±≤20%
4.9	Fb	vibration	10 to 55 to 10 Hz; 0.75 mm displacement; 3 directions; 6 hours	no visible damage
4.10	Eb	bump	4000 bumps in 2 directions; 40 g; pulse time 6 ms	no visible damage
		inflammability	15 s; 35 mm above bunsen burner with flame-height 40 to 60 mm	self-extinguishing within 15 s after removal of bunsen burner
		resistance to solvents	3 minutes ultrasonic washing in trichloroethylene; 1 minute drying; 30 °C; 10 brush strokes	marking and colour code must remain legible and not be discoloured; no mechanical or electrical damage or deterioration of the material

IEC 60384-9 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
4.12		climatic sequence:		
4.12.1		pre-conditioning	1 hour; +150 °C	
4.12.2	Ba	dry heat	16 hours at maximum temperature	no visible damage
4.12.3	Db	damp heat (accelerated) 1st cycle	12 hours; +55 °C; 90 to 96% RH 12 hours; +25 °C; 95 to 100% RH	no visible damage; after recovery of 1 to 2 hours immediately followed by cold test
4.12.4	Aa	cold	2 hours at minimum temperature	no visible damage
4.12.5	M	low air pressure	1 hour at 8.5 kPa, last 2 minutes rated voltage	no breakdown or flashover
4.12.6	Db	damp heat (accelerated) remaining cycle	12 hours; +55 °C; 90 to 96% RH 12 hours; +25 °C; 95 to 100% RH	after 24 hours recovery: $\Delta C/C$: X7R: ±≤15% Z5U: ±≤20% tan δ: ≤7% R_{ins}: >1000 MΩ
4.13	Ca	damp heat, steady state (half number of samples at rated voltage, other half of samples no voltage applied)	pre-conditioning: 21 days; +40 °C; 90 to 95% RH	no visible damage after 24 hours: $\Delta C/C$: X7R: ±≤15% Z5U: ±≤30% tan δ: ≤7% R_{ins}: >1000 MΩ
4.14		endurance	pre-conditioning	after 24 hours: $\Delta C/C$: X7R: ±≤20% Z5U: ±≤30% tan δ: ≤7% R_{ins}: >2000 MΩ
4.4		temperature characteristic	pre-conditioning: minimum and maximum temperature	in accordance with specification

PRODUCT DATA

Leaded ceramic multilayer capacitors Mono-axial™ series

FEATURES

- High capacitance per unit volume
- Low cost.

APPLICATIONS

These conformally coated axial leaded capacitors are designed for commercial and industrial applications in four dielectrics, NP0 (ultra-stable), X7R (stable) and Z5U, Y5V (general purpose). Applications include timing, coupling/decoupling, signal comparison and biasing. Mono-axial™ capacitors are suitable for automatic insertion equipment.

DESCRIPTION

The basic capacitor construction consists of ceramic dielectric materials processed into a tape with a typical thickness range from 0.025 to 0.076 mm. Metal electrode patterns are applied using a thick film screening process. Multiple layers are stacked and laminated in such a manner that electrodes are alternately exposed when the pattern is cut into individual chip capacitors. The capacitors are fired through a high temperature profile to mature the ceramic and metal into a homogeneous unit.

Metal end terminations are applied and fired to provide electrical connection between the individual layers. Tinned leads are attached using a solder. Encapsulation consists of a moisture resistant gold colour conformal epoxy coating that meets the flame requirements of *"UL94V-0"*.

QUICK REFERENCE DATA

DESCRIPTION	VALUE							
	2252 205	**2252 206 .....**	**2252 225 .....**	**2252 226 .....**	**2252 245 .....**	**2252 246 .....**	**2252 262 .....**	**2252 265 .....**
Capacitance range	10 to 3300 pF		220 pF to 0.22 µF		1000 pF to 0.47 µF		0.01 to 1.0 µF	
Rated DC voltage	50 V	100 V	50 V(1)	100 V(1)	50 V(1)	100 V(1)	25 V	50 V
Tolerance on capacitance	±5%		±10%		±20%		+80%/–20%	
Temperature coefficient	NP0		X7R		Z5U		Y5V	

Note

1. 7th digit of the catalogue number for $U_{R(DC)}$ 25 V is: 2.

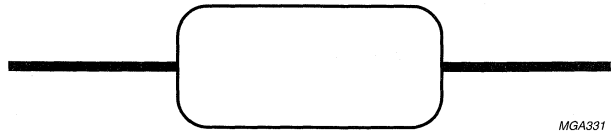
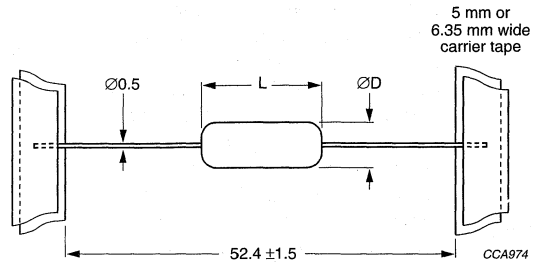


Fig.1 Simplified outline.

MECHANICAL DATA



Dimensions in mm.

Fig.2 Tape carrier.

Marking (see Fig.3)

Date code (**DDD**):

Three-digit code; first digit denotes year, last two denote week of manufacture.

941 = 1999, wk 41

Capacitance value (**CCC**):

10 pF to 99 pF; actual value in pF (2 digits only)

100 pF and above; coded capacitance value (same as used in P/N).

Capacitance tolerance (**T**):

Standard EIA tolerance (same as used in P/N).

Material code (**M**):

A = C0G

C = X7R

E = Z5U

Y = Y5V.

Voltage code (**V**):

1 = 100 V

3 = 25 V

5 = 50 V.

Physical dimensions

Table 1 Capacitor dimensions and mass

SIZE	L_{max}(1) (mm)	$ØD_{max}$(1) (mm)	MASS (g)
15	3.8 (0.150)	2.5 (0.100)	≈0.14
20	5.0 (0.200)	3.0 (0.120)	≈0.14
29	7.5 (0.290)	3.8 (0.150)	≈0.23

Note

1. Dimensions between parentheses are in inches.

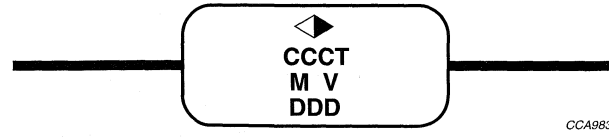


Fig.3 Markings on the body.

PACKAGING

For details refer to this data handbook, section *"Leaded ceramic multilayer capacitors"*, chapter *"Packaging"*.

ORDERING INFORMATION (preferred types)

Table 2 Capacitance, rated voltage, mechanical dimensions and ordering information

C	$U_{R(DC)}$ (V)	SIZE CODE	CLEAR TEXT CODE	CATALOGUE NUMBER
NP0 (C0G) ±5% tolerance				
10 pF	50	15	A100J15C0GF5UAA	2252 205 21109
	100	15	A100J15C0GH5UAA	2252 206 21109
12 pF	50	15	A120J15C0GF5UAA	2252 205 21129
15 pF	50	15	A150J15C0GF5UAA	2252 205 21159
18 pF	50	15	A180J15C0GF5UAA	2252 205 21189
22 pF	50	15	A220J15C0GF5UAA	2252 205 21229
	100	15	A220J15C0GH5UAA	2252 206 21229
27 pF	50	15	A270J15C0GF5UAA	2252 205 21279
33 pF	50	15	A330J15C0GF5UAA	2252 205 21339
39 pF	50	15	A390J15C0GF5UAA	2252 205 21399
47 pF	50	15	A470J15C0GF5UAA	2252 205 21479
	100	15	A470J15C0GH5UAA	2252 206 21479
56 pF	50	15	A560J15C0GF5UAA	2252 205 21569
68 pF	50	15	A680J15C0GF5UAA	2252 205 21689
82 pF	50	15	A820J15C0GF5UAA	2252 205 21829
100 pF	50	15	A101J15C0GF5UAA	2252 205 21101
	100	15	A101J15C0GH5UAA	2252 206 21101
150 pF	50	15	A151J15C0GF5UAA	2252 205 21151
220 pF	50	15	A221J15C0GF5UAA	2252 205 21221
	100	15	A221J15C0GH5UAA	2252 206 21221
330 pF	50	15	A331J15C0GF5UAA	2252 205 21331
470 pF	50	15	A471J15C0GF5UAA	2252 205 21471
	100	15	A471J15C0GH5UAA	2252 206 21471
680 pF	50	15	A681J15C0GF5UAA	2252 205 21681
1000 pF	50	15	A102J15C0GF5UAA	2252 205 21102
	100	20	A102J20C0GH5UAA	2252 206 41102
1500 pF	50	15	A152J15C0GF5UAA	2252 205 21152
2200 pF	50	15	A222J15C0GF5UAA	2252 205 21222
3300 pF	50	20	A332J20C0GF5UAA	2252 205 41332

Leaded ceramic multilayer capacitors Mono-axial™ series

C	$U_{R(DC)}$ (V)	SIZE CODE	CLEAR TEXT CODE	CATALOGUE NUMBER
X7R ±10% tolerance				
220 pF	50	15	A221K15X7RF5UAA	2252 225 21221
	100	15	A221K15X7RH5UAA	2252 226 21221
330 pF	50	15	A331K15X7RF5UAA	2252 225 21331
470 pF	50	15	A471K15X7RF5UAA	2252 225 21471
	100	15	A471K15X7RH5UAA	2252 226 21471
680 pF	50	15	A681K15X7RF5UAA	2252 225 21681
1000 pF	50	15	A102K15X7RF5UAA	2252 225 21102
	100	15	A102K15X7RH5UAA	2252 226 21102
1500 pF	50	15	A152K15X7RF5UAA	2252 225 21152
2200 pF	50	15	A222K15X7RF5UAA	2252 225 21222
	100	15	A222K15X7RH5UAA	2252 226 21222
3300 pF	50	15	A332K15X7RF5UAA	2252 225 21332
4700 pF	50	15	A472K15X7RF5UAA	2252 225 21472
	100	15	A472K15X7RH5UAA	2252 226 21472
6800 pF	50	15	A682K15X7RF5UAA	2252 225 21682
0.01 µF	50	15	A103K15X7RF5UAA	2252 225 21103
	100	15	A103K15X7RH5UAA	2252 226 21103
0.015 µF	50	15	A153K15X7RF5UAA	2252 225 21153
0.022 µF	50	15	A223K15X7RF5UAA	2252 225 21223
	100	20	A223K20X7RH5UAA	2252 226 41223
0.033 µF	50	15	A333K15X7RF5UAA	2252 225 21333
0.047 µF	50	15	A473K15X7RF5UAA	2252 225 21473
	100	20	A473K20X7RH5UAA	2252 226 41473
0.068 µF	50	15	A683K15X7RF5UAA	2252 225 21683
0.1 µF	25	15	A104K15X7RE5UAA	2252 222 21104
	50	15	A104K15X7RF5UAA	2252 225 21104
	100	20	A104K20X7RH5UAA	2252 226 41104
0.15 µF	25	20	A154K20X7RE5UAA	2252 222 41154
0.22 µF	25	20	A224K20X7RE5UAA	2252 222 41224

Leaded ceramic multilayer capacitors Mono-axial™ series

C	$U_{R(DC)}$ (V)	SIZE CODE	CLEAR TEXT CODE	CATALOGUE NUMBER
Z5U ±20% tolerance				
1000 pF	50	15	A102M15Z5UF5UAA	2252 245 21102
	100	15	A102M15Z5UH5UAA	2252 246 21102
2200 pF	50	15	A222M15Z5UF5UAA	2252 245 21222
4700 pF	50	15	A472M15Z5UF5UAA	2252 245 21472
0.01 µF	50	15	A103M15Z5UF5UAA	2252 245 21103
	100	15	A103M15Z5UH5UAA	2252 246 21103
0.022 µF	50	15	A223M15Z5UF5UAA	2252 245 21223
0.047 µF	50	15	A473M15Z5UF5UAA	2252 245 21473
0.1 µF	25	15	A104M15Z5UE5UAA	2252 242 21104
	50	15	A104M15Z5UF5UAA	2252 245 21104
	100	20	A104M20Z5UH5UAA	2252 246 41104
0.22 µF	50	20	A224M20Z5UF5UAA	2252 245 41224
0.47 µF	50	20	A474M20Z5UF5UAA	2252 245 41474
Y5V +80/–20% tolerance				
0.01 µF	50	15	A103Z15Y5VF5UAA	2252 265 21103
0.022 µF	50	15	A223Z15Y5VF5UAA	2252 265 21223
0.047 µF	50	15	A473Z15Y5VF5UAA	2252 265 21473
0.1 µF	25	15	A104Z15Y5VE5UAA	2252 262 21104
	50	15	A104Z15Y5VF5UAA	2252 265 21104
0.22 µF	25	15	A224Z15Y5VE5UAA	2252 262 21224
	50	20	A224Z20Y5VF5UAA	2252 265 41224
0.47 µF	25	20	A474Z20Y5VE5UAA	2252 262 41474
	50	20	A474Z20Y5VF5UAA	2252 265 41474
1.0 µF	25	20	A105Z20Y5VE5UAA	2252 262 41105

ELECTRICAL CHARACTERISTICS

Table 3 Electrical data for NP0, X7R, Z5U and Y5V

The capacitors meet the essential requirements of *"EIA 198"*.

Unless stated otherwise all electrical values apply at an ambient temperature of 25 ±3 °C, at barometric pressures of 650 to 800 mm of mercury, and relative humidity not to exceed 75%.

DESCRIPTION	VALUE
Capacitors with temperature coefficient NP0	
Capacitance range: at 1 MHz, 1 V; where C ≤ 1000 pF at 1 kHz, 1 V; where C > 1000 pF	 10 to 1000 pF 1200 to 3300 pF
Tolerance on the capacitance	±5%; ±10%
Rated DC voltage	50 and 100 V
Dielectric strength	250% of rated voltage
Insulation resistance at rated voltage	100000 MΩ or 1000 MΩ × μF, whichever is less at 25 °C
Temperature coefficient of the capacitance	0×10^{-6}/K
Tolerance on the temperature coefficient	$\pm 30 \times 10^{-6}$/K
Dissipation factor: at 1 MHz, 1 V; where C ≤ 30 pF at 1 kHz, 1 V; where C > 30 pF	 $< \frac{1}{(400 + 20 \times C)}$ $< 15 \times 10^{-4}$
Operating temperature range	−55 to +125 °C
Storage temperature range	−55 to +85 °C
Capacitors with temperature coefficient X7R	
Capacitance range at 1 kHz, 1 V	220 pF to 0.22 μF
Tolerance on the capacitance	±10%; ±20%
Maximum capacitance change with respect to capacitance value at 25 °C	±15%
Rated DC voltage	25 V, 50 V and 100 V
Dielectric strength	250% of rated voltage
Insulation resistance at rated voltage	100000 MΩ or 1000 MΩ × μF, whichever is less at 25 °C
Dissipation factor at 1 kHz, 1 V	≤2.5%
Operating temperature range	−55 to +125 °C
Storage temperature range	−55 to +85 °C
Ageing	typical 1% per time decade

Leaded ceramic multilayer capacitors Mono-axial™ series

DESCRIPTION	VALUE
Capacitors with temperature coefficient Z5U	
Capacitance range at 1 kHz, 0.5 V	1000 pF to 0.47 μF
Tolerance on the capacitance	±20%; +80%/–20%
Maximum capacitance change with respect to capacitance value at 25 °C	+22%/–56%
Rated DC voltage	25, 50 and 100 V
Dielectric strength	250% of rated voltage
Insulation resistance at rated voltage	10000 MΩ or 1000 MΩ × μF, whichever is less at 25 °C
Dissipation factor at 1 kHz, 0.5 V	≤4%
Operating temperature range	10 to 85 °C
Storage temperature range	–55 to +85 °C
Ageing	typical 6% per time decade
Capacitors with temperature coefficient Y5V	
Capacitance range at 1 kHz, 1 V	0.01 to 1.0 μF
Tolerance on the capacitance	+80%/–20%
Maximum capacitance change with respect to capacitance value at 25 °C	+22%/–56%
Rated DC voltage	25 V and 50 V
Dielectric strength	250% of rated voltage
Insulation resistance at rated voltage	10000 MΩ or 1000 MΩ × μF, whichever is less at 25 °C
Dissipation factor at 1 kHz, 1 V	≤5%
Operating temperature range	–30 to +85 °C
Storage temperature range	–55 to +85 °C
Ageing	typical 6% per time decade

Leaded ceramic multilayer capacitors Mono-kap™ series

FEATURES

- Very high capacitance per unit volume
- Low cost.

APPLICATIONS

These conformally coated radial leaded capacitors are designed for commercial and industrial applications in four dielectrics, NP0 (ultra-stable), X7R (stable) and Z5U, Y5V (general purpose). Applications include timing, coupling/decoupling, signal comparison and biasing. Mono-kap™ capacitors are suitable for automatic insertion equipment.

DESCRIPTION

The basic capacitor construction consists of ceramic dielectric materials processed into a tape with a typical thickness range from 0.025 to 0.076 mm. Metal electrode patterns are applied using a thick film screening process. Multiple layers are stacked and laminated in such a manner that electrodes are alternately exposed when the pattern is cut into individual chip capacitors. The capacitors are fired through a high temperature profile to mature the ceramic and metal into a homogeneous unit.

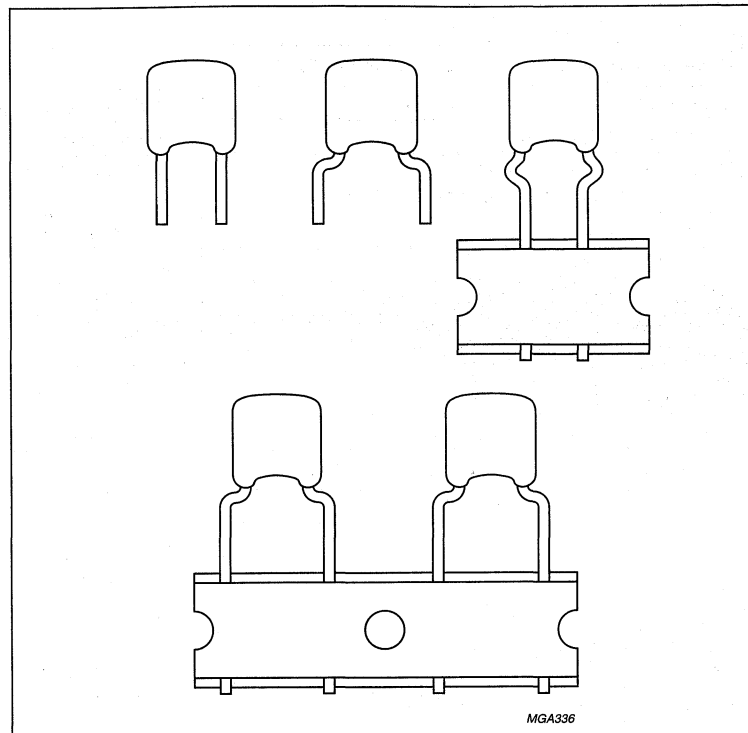


Fig.1 Component outlines.

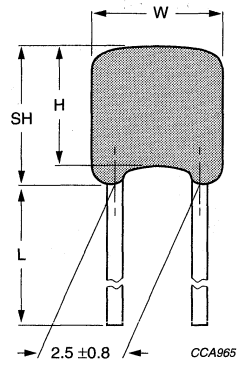
Metal end terminations are applied and fired to provide electrical connection between the individual layers. Tinned leads are attached using a solder.

Encapsulation consists of a moisture-resistant gold colour conformal epoxy coating that meets the flame requirements of *"UL94V-0"*.

QUICK REFERENCE DATA

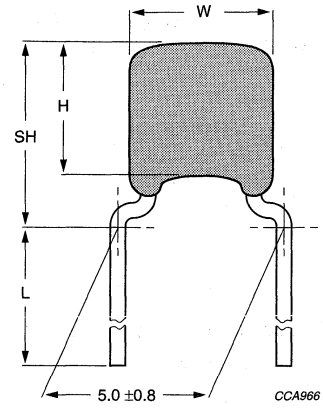
DESCRIPTION	VALUE							
	2252 305	**2252 306 .....**	**2252 325 .....**	**2252 326 .....**	**2252 345 .....**	**2252 346 .....**	**2252 362 .....**	**2252 365 .....**
Capacitance range	10 pF to 0.022 µF		100 pF to 1.0 µF		1000 pF to 2.2 µF		0.01 to 1.0 µF	
Rated DC voltage	50 V	100 V	50 V	100 V	50 V	100 V	25 V	50 V
Tolerance on capacitance	±5%		±10%		±20%; +80%/–20%		+80%/–20%	
Temperature coefficient	NP0 (C0G)		X7R		Z5U		Y5V	

MECHANICAL DATA



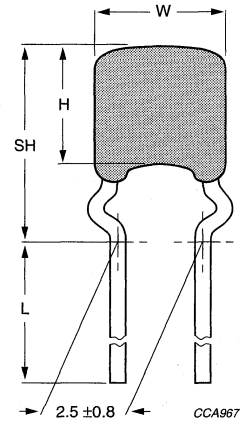
Dimensions in mm.

Fig.2 Component outline for lead spacing 2.5 ±0.8 mm (straight wires).



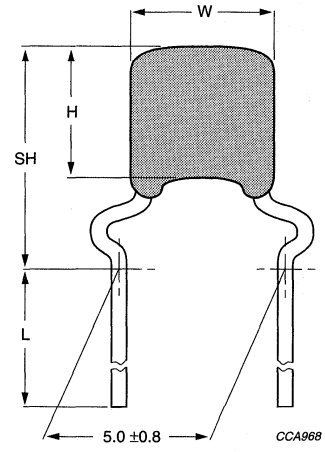
Dimensions in mm.

Fig.3 Component outline for lead spacing 5.0 ±0.8 mm (flat bent wires).



Dimensions in mm.

Fig.4 Component outline for lead spacing 2.5 ±0.8 mm (outside kink wires).



Dimensions in mm.
Lead style available on request.

Fig.5 Component outline for lead spacing 5.0 ±0.8 mm (outside kink wires).

Physical dimensions

Table 1 Capacitor dimensions and mass; notes 1 and 2

SIZE CODE	W_{max} (mm)	H_{max} (mm)	T_{max}[3] (mm)	MAX. SEATING HEIGHT (SH) (mm)				MASS (g)
				Fig.2	Fig.3	Fig.4	Fig.5	
15	4.0 (0.15)	4.0 (0.15)	2.5 (0.100)	5.58 (0.220)	6.50 (0.256)	7.50 (0.295)	7.50 (0.295)	≈0.15
20	5.0 (0.20)	5.0 (0.20)	3.2 (0.13)	6.58 (0.259)	7.50 (0.295)	8.50 (0.335)	8.50 (0.335)	≈0.16
30	7.5 (0.30)	7.5 (0.30)	3.8 (0.15)	9.08 (0.357)	10.70 (0.421)	11.00 (0.433)	11.0 (0.433)	≈0.42

Notes

1. Bulk packed products have a standard lead length L ≥ 25.4 mm.
2. Dimensions between the parentheses are in inches.
3. Thickness defined as T.

Marking[1][2] (see Fig.6)

Capacitance code (**CCC**):

10 pF to 99 pF;
actual value in pF (2 digits only)

100 pF and above;
coded capacitance value
(same as used in P/N).

Capacitance tolerance (**T**):

Standard EIA tolerance.

Material code (**M**):

A = NP0 (C0G)

C = X7R

E = Z5U

Y = Y5V.

Voltage code (**V**):

1 = 100 V

3 = 25 V

5 = 50 V.

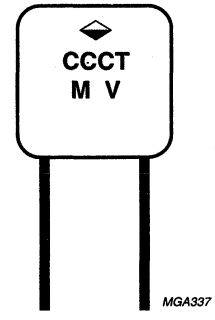


Fig.6 Markings on the body.

(1) 100 pF and above in size code 15 are marked without capacitance tolerance code (T).

(2) Only size code 30 and above are marked with the material code (M) and voltage code (V).

PACKAGING

For details refer to this data handbook, section *"Leaded ceramic multilayer capacitors"*, chapter *"Packaging"*.

ORDERING INFORMATION (preferred types)

Table 2 Capacitance, rated voltage, mechanical dimensions and ordering information; note 1

C	$U_{R(DC)}$ (V)	LEAD SPACING	SIZE CODE	CLEAR TEXT CODE	PACKAGING CODE 8th AND 9th DIGIT			CATALOGUE NUMBER (2)(3)
				13th DIGIT: T = REEL; U = AMMO; 3 = BULK	REEL	AMMO	BULK	
NP0 (C0G) ±5% tolerance								
10 pF	50	5.0	15	K100J15C0GF5.H5	10	12	08	2252 305..109
		2.5		K100J15C0GF5.L2	02	03	00	2252 305..109
	100	5.0	15	K100J15C0GH5.H5	10	12	08	2252 306..109
		2.5		K100J15C0GH5.L2	02	03	00	2252 306..109
12 pF	50	5.0	15	K120J15C0GF5.H5	10	12	08	2252 305..129
		2.5		K120J15C0GF5.L2	02	03	00	2252 305..129
15 pF	50	5.0	15	K150J15C0GF5.H5	10	12	08	2252 305..159
		2.5		K150J15C0GF5.L2	02	03	00	2252 305..159
18 pF	50	5.0	15	K180J15C0GF5.H5	10	12	08	2252 305..189
		2.5		K180J15C0GF5.L2	02	03	00	2252 305..189
22 pF	50	5.0	15	K220J15C0GF5.H5	10	12	08	2252 305..229
		2.5		K220J15C0GF5.L2	02	03	00	2252 305..229
	100	5.0	15	K220J15C0GH5.H5	10	12	08	2252 306..229
		2.5		K220J15C0GH5.L2	02	03	00	2252 306..229
27 pF	50	5.0	15	K270J15C0GF5.H5	10	12	08	2252 305..279
		2.5		K270J15C0GF5.L2	02	03	00	2252 305..279
33 pF	50	5.0	15	K330J15C0GF5.H5	10	12	08	2252 305..339
		2.5		K330J15C0GF5.L2	02	03	00	2252 305..339
39 pF	50	5.0	15	K390J15C0GF5.H5	10	12	08	2252 305..399
		2.5		K390J15C0GF5.L2	02	03	00	2252 305..399
47 pF	50	5.0	15	K470J15C0GF5.H5	10	12	08	2252 305..479
		2.5		K470J15C0GF5.L2	02	03	00	2252 305..479
	100	5.0	15	K470J15C0GH5.H5	10	12	08	2252 306..479
		2.5		K470J15C0GH5.L2	02	03	00	2252 306..479
56 pF	50	5.0	15	K560J15C0GF5.H5	10	12	08	2252 305..569
		2.5		K560J15C0GF5.L2	02	03	00	2252 305..569
68 pF	50	5.0	15	K680J15C0GF5.H5	10	12	08	2252 305..689
		2.5		K680J15C0GF5.L2	02	03	00	2252 305..689
82 pF	50	5.0	15	K820J15C0GF5.H5	10	12	08	2252 305..829
		2.5		K820J15C0GF5.L2	02	03	00	2252 305..829

Leaded ceramic multilayer capacitors Mono-kap™ series

C	$U_{R(DC)}$ (V)	LEAD SPACING	SIZE CODE	CLEAR TEXT CODE	PACKAGING CODE 8th AND 9th DIGIT			CATALOGUE NUMBER (2)(3)
				13th DIGIT: T = REEL; U = AMMO; 3 = BULK	REEL	AMMO	BULK	
100 pF	50	5.0	15	K101J15C0GF5.H5	10	12	08	2252 305..101
		2.5		K101J15C0GF5.L2	02	03	00	2252 305..101
	100	5.0	15	K101J15C0GH5.H5	10	12	08	2252 306..101
		2.5		K101J15C0GH5.L2	02	03	00	2252 306..101
150 pF	50	5.0	15	K151J15C0GF5.H5	10	12	08	2252 305..151
		2.5		K151J15C0GF5.L2	02	03	00	2252 305..151
220 pF	50	5.0	15	K221J15C0GF5.H5	10	12	08	2252 305..221
		2.5		K221J15C0GF5.L2	02	03	00	2252 305..221
	100	5.0	15	K221J15C0GH5.H5	10	12	08	2252 306..221
		2.5		K221J15C0GH5.L2	02	03	00	2252 306..221
330 pF	50	5.0	15	K331J15C0GF5.H5	10	12	08	2252 305..331
		2.5		K331J15C0GF5.L2	02	03	00	2252 305..331
470 pF	50	5.0	15	K471J15C0GF5.H5	10	12	08	2252 305..471
		2.5		K471J15C0GF5.L2	02	03	00	2252 305..471
	100	5.0	15	K471J15C0GH5.H5	10	12	08	2252 306..471
		2.5		K471J15C0GH5.L2	02	03	00	2252 306..471
680 pF	50	5.0	15	K681J15C0GF5.H5	10	12	08	2252 305..681
		2.5		K681J15C0GF5.L2	02	03	00	2252 305..681
1000 pF	50	5.0	15	K102J15C0GF5.H5	10	12	08	2252 305..102
		2.5		K102J15C0GF5.L2	02	03	00	2252 305..102
	100	5.0	20	K102J20C0GH5.H5	24	26	22	2252 306..102
		2.5		K102J20C0GH5.L2	16	17	14	2252 306..102
1500 pF	50	5.0	15	K152J15C0GF5.H5	10	12	08	2252 305..152
2200 pF	50	5.0	15	K222J15C0GF5.H5	10	12	08	2252 305..222
3300 pF	50	5.0	20	K332J20C0GF5.H5	24	26	22	2252 305..332
4700 pF	50	5.0	20	K472J20C0GF5.H5	24	26	22	2252 305..472
6800 pF	50	5.0	20	K682J20C0GF5.H5	24	26	22	2252 305..682
0.01 μF	50	5.0	20	K103J20C0GF5.H5	24	26	22	2252 305..103

Leaded ceramic multilayer capacitors Mono-kap™ series

C	$U_{R(DC)}$ (V)	LEAD SPACING	SIZE CODE	CLEAR TEXT CODE	PACKAGING CODE 8th AND 9th DIGIT			CATALOGUE NUMBER (2)(3)
				13th DIGIT: T = REEL; U = AMMO; 3 = BULK	REEL	AMMO	BULK	
X7R ±10% tolerance								
220 pF	50	5.0	15	K221K15X7RF5.H5	10	12	08	2252 325..221
		2.5		K221K15X7RF5.L2	02	03	00	2252 325..221
	100	5.0	15	K221K15X7RH5.H5	10	12	08	2252 326..221
		2.5		K221K15X7RH5.L2	02	03	00	2252 326..221
330 pF	50	5.0	15	K331K15X7RF5.H5	10	12	08	2252 325..331
		2.5		K331K15X7RF5.L2	02	03	00	2252 325..331
470 pF	50	5.0	15	K471K15X7RF5.H5	10	12	08	2252 325..471
		2.5		K471K15X7RF5.L2	02	03	00	2252 325..471
	100	5.0	15	K471K15X7RH5.H5	10	12	08	2252 326..471
		2.5		K471K15X7RH5.L2	02	03	00	2252 326..471
680 pF	50	5.0	15	K681K15X7RF5.H5	10	12	08	2252 325..681
		2.5		K681K15X7RF5.L2	02	03	00	2252 325..681
1000 pF	50	5.0	15	K102K15X7RF5.H5	10	12	08	2252 325..102
		2.5		K102K15X7RF5.L2	02	03	00	2252 325..102
	100	5.0	15	K102K15X7RH5.H5	10	12	08	2252 326..102
		2.5		K102K15X7RH5.L2	02	03	00	2252 326..102
1500 pF	50	5.0	15	K152K15X7RF5.H5	10	12	08	2252 325..152
		2.5		K152K15X7RF5.L2	02	03	00	2252 325..152
2200 pF	50	5.0	15	K222K15X7RF5.H5	10	12	08	2252 325..222
		2.5		K222K15X7RF5.L2	02	03	00	2252 325..222
	100	5.0	15	K222K15X7RH5.H5	10	12	08	2252 326..222
		2.5		K222K15X7RH5.L2	02	03	00	2252 326..222
3300 pF	50	5.0	15	K332K15X7RF5.H5	10	12	08	2252 325..332
		2.5		K332K15X7RF5.L2	02	03	00	2252 325..332
4700 pF	50	5.0	15	K472K15X7RF5.H5	10	12	08	2252 325..472
		2.5		K472K15X7RF5.L2	02	03	00	2252 325..472
	100	5.0	15	K472K15X7RH5.H5	10	12	08	2252 326..472
		2.5		K472K15X7RH5.L2	02	03	00	2252 326..472
6800 pF	50	5.0	15	K682K15X7RF5.H5	10	12	08	2252 325..682
		2.5		K682K15X7RF5.L2	02	03	00	2252 325..682
0.01 µF	50	5.0	15	K103K15X7RF5.H5	10	12	08	2252 325..103
		2.5		K103K15X7RF5.L2	02	03	00	2252 325..103
	100	5.0	15	K103K15X7RH5.H5	10	12	08	2252 326..103
		2.5		K103K15X7RH5.L2	02	03	00	2252 326..103
0.015 µF	50	5.0	15	K153K15X7RF5.H5	10	12	08	2252 325..153
		2.5		K153K15X7RF5.L2	02	03	00	2252 325..153

Leaded ceramic multilayer capacitors Mono-kap™ series

C	$U_{R(DC)}$ (V)	LEAD SPACING	SIZE CODE	CLEAR TEXT CODE	PACKAGING CODE 8th AND 9th DIGIT			CATALOGUE NUMBER (2)(3)
				13th DIGIT: T = REEL; U = AMMO; 3 = BULK	REEL	AMMO	BULK	
0.022 µF	50	5.0	15	K223K15X7RF5.H5	10	12	08	2252 325..223
		2.5		K223K15X7RF5.L2	02	03	00	2252 325..223
	100	5.0	20	K223K20X7RH5.H5	24	26	22	2252 326..223
		2.5		K223K20X7RH5.L2	16	17	14	2252 326..223
0.033 µF	50	5.0	15	K333K15X7RF5.H5	10	12	08	2252 325..333
		2.5		K333K15X7RF5.L2	02	03	00	2252 325..333
0.047 µF	50	5.0	15	K473K15X7RF5.H5	10	12	08	2252 325..473
		2.5		K473K15X7RF5.L2	02	03	00	2252 325..473
	100	5.0	20	K473K20X7RH5.H5	24	26	22	2252 326..473
		2.5		K473K20X7RH5.L2	16	17	14	2252 326..473
0.068 µF	50	5.0	15	K683K15X7RF5.H5	10	12	08	2252 325..683
		2.5		K683K15X7RF5.L2	02	03	00	2252 325..683
0.1 µF	50	5.0	15	K104K15X7RF5.H5	10	12	08	2252 325..104
		2.5		K104K15X7RF5.L2	02	03	00	2252 325..104
	100	5.0	20	K104K20X7RH5.H5	24	26	22	2252 326..104
		2.5		K104K20X7RH5.L2	16	17	14	2252 326..104
0.15 µF	50	5.0	20	K154K20X7RF5.H5	24	26	22	2252 325..154
0.22 µF	50	5.0	20	K224K20X7RF5.H5	24	26	22	2252 325..224
0.33 µF	50	5.0	30	K334K30X7RF5.H5	48	50	46	2252 325..334
0.47 µF	50	5.0	30	K474K30X7RF5.H5	48	50	46	2252 325..474
0.68 µF	50	5.0	30	K684K30X7RF5.H5	48	50	46	2252 325..684
1.0 µF	50	5.0	30	K105K30X7RF5.H5	48	50	46	2252 325..105
Z5U ±20% tolerance								
0.01 µF	50	5.0	15	K103M15Z5UF5.H5	10	12	08	2252 345..103
		2.5		K103M15Z5UF5.L2	02	03	00	2252 345..103
	100	5.0	15	K103M15Z5UH5.H5	10	12	08	2252 346..103
		2.5		K103M15Z5UH5.L2	02	03	00	2252 346..103
0.022 µF	50	5.0	15	K223M15Z5UF5.H5	10	12	08	2252 345..223
		2.5		K223M15Z5UF5.L2	02	03	00	2252 345..223
0.047 µF	50	5.0	15	K473M15Z5UF5.H5	10	12	08	2252 345..473
		2.5		K473M15Z5UF5.L2	02	03	00	2252 345..473

C	$U_{R(DC)}$ (V)	LEAD SPACING	SIZE CODE	CLEAR TEXT CODE	PACKAGING CODE 8th AND 9th DIGIT			CATALOGUE NUMBER (2)(3)
				13th DIGIT: T = REEL; U = AMMO; 3 = BULK	REEL	AMMO	BULK	
0.1 µF	50	5.0	15	K104M15Z5UF5.H5	10	12	08	2252 345..104
		2.5		K104M15Z5UF5.L2	02	03	00	2252 345..104
	100	5.0	20	K104M20Z5UH5.H5	24	26	22	2252 346..104
		2.5		K104M20Z5UH5.L2	16	17	14	2252 346..104
0.15 µF	50	5.0	15	K154M15Z5UF5.H5	10	12	08	2252 345..154
		2.5		K154M15Z5UF5.L2	02	03	00	2252 345..154
0.22 µF	50	5.0	15	K224M15Z5UF5.H5	10	12	08	2252 345..224
		2.5		K224M15Z5UF5.L2	02	03	00	2252 345..224
0.33 µF	50	5.0	20	K334M20Z5UF5.H5	24	26	22	2252 345..334
0.47 µF	50	5.0	20	K474M20Z5UF5.H5	24	26	22	2252 345..474
0.68 µF	50	5.0	20	K684M20Z5UF5.H5	24	26	22	2252 345..684
1.0 µF	50	5.0	20	K105M20Z5UF5.H5	24	26	22	2252 345..105
Y5V +80/–20% tolerance								
0.1 µF	25	5.0	15	K104Z15Y5VE5.H5	10	12	08	2252 362..104
		2.5		K104Z15Y5VE5.L2	02	03	00	2252 362..104
	50	5.0	15	K104Z15Y5VF5.H5	10	12	08	2252 365..104
		2.5		K104Z15Y5VF5.L2	02	03	00	2252 365..104
0.22 µF	25	5.0	15	K224Z15Y5VE5.H5	10	12	08	2252 362..224
		2.5		K224Z15Y5VE5.L2	02	03	00	2252 362..224
	50	5.0	15	K224Z15Y5VF5.H5	10	12	08	2252 365..224
		2.5		K224Z15Y5VF5.L2	02	03	00	2252 365..224
0.47 µF	25	5.0	20	K474Z20Y5VE5.H5	24	26	22	2252 362..474
		2.5		K474Z20Y5VE5.L2	16	17	14	2252 362..474
	50	5.0	20	K474Z20Y5VF5.H5	24	26	22	2252 365..474
		2.5		K474Z20Y5VF5.H5	16	17	14	2252 365..474
1.0 µF	25	5.0	20	K105Z20Y5VE5.H5	24	26	22	2252 362..105
		2.5		K105Z20Y5VE5.L2	16	17	14	2252 362..105
	50	5.0	20	K105Z20Y5VF5.H5	24	26	22	2252 365..105
		2.5		K105Z20Y5VF5.L2	16	17	14	2252 365..105

Notes

1. For maximum thickness refer to Table 1.
2. 8th and 9th digit of the catalogue number to be completed with the packaging code.
3. Packaging codes refer to straight leads for F = 2.5 mm and flat bent leads for F = 5.0 mm. Other styles available on request.

ELECTRICAL CHARACTERISTICS

Table 3 Electrical data for NP0, X7R, Z5U and Y5V

The capacitors meet the essential requirements of *"IEC 60384-8"*, *"IEC 60384-9"* and *"EIA 198"*.
Unless stated otherwise all electrical values apply at an ambient temperature of 25 ±3 °C, at barometric pressures of 650 to 800 mm of mercury, and relative humidity not to exceed 75%.

DESCRIPTION	VALUE
Capacitors with temperature coefficient NP0	
Capacitance range: at 1 MHz, 1 V; where C ≤ 1000 pF at 1 kHz, 1 V; where C > 1000 pF	 10 to 1000 pF 1200 pF to 0.01 μF
Tolerance on the capacitance	±5%; ±10%
Rated DC voltage	50 and 100 V
Dielectric strength	250% of rated voltage
Insulation resistance at rated voltage	100000 MΩ or 1000 MΩ × μF, whichever is less at 25 °C
Temperature coefficient of the capacitance	0×10^{-6}/K
Tolerance on the temperature coefficient	$\pm 30 \times 10^{-6}$/K
Dissipation factor: at 1 MHz, 1 V; where C ≤ 30 pF at 1 kHz, 1 V; where C > 30 pF	 $< \frac{1}{(400 + 20 \times C)}$ $< 15 \times 10^{-4}$
Operating temperature range	−55 to +125 °C
Storage temperature range	−55 to +85 °C
Capacitors with temperature coefficient X7R	
Capacitance range at 1 kHz, 1 V	100 pF to 1.0 μF
Tolerance on the capacitance	±10%; ±20%
Maximum capacitance variation with respect to capacitance value at 25 °C	±15%
Rated DC voltage	50 and 100 V
Dielectric strength	250% of rated voltage
Insulation resistance at rated voltage	100000 MΩ or 1000 MΩ × μF, whichever is less at 25 °C
Dissipation factor at 1 kHz, 1 V	≤2.5%
Operating temperature range	−55 to +125 °C
Storage temperature range	−55 to +85 °C
Ageing	typical 1% per time decade

Leaded ceramic multilayer capacitors Mono-kap™ series

DESCRIPTION	VALUE
Capacitors with temperature coefficient Z5U	
Capacitance range at 1 kHz, 0.5 V	1000 pF to 2.2 μF
Tolerance on the capacitance	±20%; +80%/–20%
Maximum capacitance variation with respect to capacitance value at 25 °C	–56%/+22%
Rated DC voltage	50 and 100 V
Dielectric strength	250% of rated voltage
Insulation resistance at rated voltage	10000 MΩ or 1000 MΩ × μF, whichever is less at 25 °C
Dissipation factor at 1 kHz, 0.5 V	≤4%
Operating temperature range	10 to 85 °C
Storage temperature range	–55 to +85 °C
Ageing	typical 6% per time decade
Capacitors with temperature coefficient Y5V	
Capacitance range at 1 kHz, 1 V	0.01 to 1.0 μF
Tolerance on the capacitance	+80%/–20%
Maximum capacitance variation with respect to capacitance value at 25 °C	–82%/+22%
Rated DC voltage	25 and 50 V
Dielectric strength	250% of rated voltage
Insulation resistance at rated voltage	10000 MΩ or 1000 MΩ × μF, whichever is less at 25 °C
Dissipation factor at 1 kHz, 1 V	≤5%
Operating temperature range	10 to 85 °C
Storage temperature range	–55 to +85 °C
Ageing	typical 6% per time decade

MINIATURE CERAMIC PLATE CAPACITORS

NUMERICAL INDEX FOR MINIATURE CERAMIC PLATE CAPACITORS

Flanged, preferred types.

12NC 2222		TC	COLOUR CODE	CLASS	CAPACITANCE RANGE (pF)	$U_{R(DC)}$ (V)	H_0 (mm)	LEAD LENGTH (mm)	PITCH	PACKAGING	PAGE
629	08...	2F6 (Y5V)	green	2	1000 to 47000	63	–	>13	1e	loose	187
	09...						–	>13	2e	loose	
	18...						–	4 ±0.5	1e	loose	
	19...						–	4 ±0.5	2e	loose	
	51...						18.25	–	1e	tape on reel	
	53...						18.25	–	2e	tape on reel	
	61...						18.25	–	1e	ammopack	
	63...						18.25	–	2e	ammopack	
630	08...	2C2-2E1 (X5S/X7T)	yellow	2	180 to 6800	100	–	>13	1e	loose	186
	09...						–	>13	2e	loose	
	18...						–	4 ±0.5	1e	loose	
	19...						–	4 ±0.5	2e	loose	
	51...						18.25	–	1e	tape on reel	
	53...						18.25	–	2e	tape on reel	
	61...						18.25	–	1e	ammopack	
	63...						18.25	–	2e	ammopack	
640	08...	2E2 (X5U)	blue	2	1000 to 15000	100	–	>13	1e	loose	187
	09...						–	>13	2e	loose	
	18...						–	4 ±0.5	1e	loose	
	19...						–	4 ±0.5	2e	loose	
	51...						18.25	–	1e	tape on reel	
	53...						18.25	–	2e	tape on reel	
	61...						18.25	–	1e	ammopack	
	63...						18.25	–	2e	ammopack	

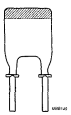
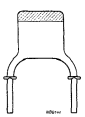
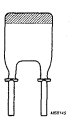
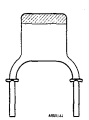
12NC 2222		TC	COLOUR CODE	CLASS	CAPACITANCE RANGE (pF)	$U_{R(DC)}$ (V)	H_0 (mm)	LEAD LENGTH (mm)	PITCH	PACKAGING	PAGE
652	**03/04...**	P100	red/violet	1	0.47 to 33	500	–	>13	2e	loose	200
	09/10...	NP0	black		0.82 to 150						
	33/34...	N150	orange		2.2 to 150						
	57/58...	N750	violet		1.8 to 150						
	69/70...	N1500	orange/orange		8.2 to 330						
653	**03/04...**	P100	red/violet	1	0.47 to 33	500	–	4 ±0.5	2e	loose	200
	09/10...	NP0	black		0.82 to 150						
	33/34...	N150	orange		2.2 to 150						
	57/58...	N750	violet		1.8 to 150						
	69/70...	N1500	orange/orange		8.2 to 330						
654	**03/04...**	P100	red/violet	1	0.47 to 33	500	18.25	–	2e	tape on reel	200
	09/10...	NP0	black		0.82 to 150						
	33/34...	N150	orange		2.2 to 150						
	57/58...	N750	violet		1.8 to 150						
	69/70...	N1500	orange/orange		8.2 to 330						
655	**09...**	2C2-2E1 (K2000)	yellow	2	100 to 4700	500	–	>13	2e	loose	217
	19...		yellow				–	4 ±0.5		loose	
	53...		yellow				18.25	–		tape on reel	
	63...		yellow				18.25	–		ammopack	
678	**03/04...**	P100	red/violet	1	0.56 to 47	100	18.25	–	1e	tape on reel	176
	09/10...	NP0	black		1.8 to 220						
	33/34...	N150	orange		3.9 to 220						
	57/58...	N750	violet		3.9 to 330						
	70...	N1500	orange/orange		18 to 560						
	90...	NP0	black		1 to 240						168

12NC 2222		TC	COLOUR CODE	CLASS	CAPACITANCE RANGE (pF)	$U_{R(DC)}$ (V)	H_0 (mm)	LEAD LENGTH (mm)	PITCH	PACKAGING	PAGE
679	**03/04...**	P100	red/violet	1	0.56 to 47	100	18.25	–	2e	tape on reel	176
	09/10...	NP0	black		1.8 to 220						
	33/34...	N150	orange		3.9 to 220						
	57/58...	N750	violet		3.9 to 330						
	70...	N1500	orange/orange		18 to 560						
	90...	NP0	black		1 to 240						168
680	**03/04...**	P100	red/violet	1	0.56 to 47	100	–	>13	1e	loose	176
	09/10...	NP0	black		1.8 to 220						
	33/34...	N150	orange		3.9 to 220						
	57/58...	N750	violet		3.9 to 330						
	70...	N1500	orange/orange		18 to 560						
	90...	NP0	black		1 to 240						168
681	**03/04...**	P100	red/violet	1	0.56 to 47	100	–	>13	2e	loose	176
	09/10...	NP0	black		1.8 to 220						
	33/34...	N150	orange		3.9 to 220						
	57/58...	N750	violet		3.9 to 330						
	70...	N1500	orange/orange		18 to 560						
	90...	NP0	black		1 to 240						168
682	**03/04...**	P100	red/violet	1	0.56 to 47	100	–	4 ±0.5	1e	loose	176
	09/10...	NP0	black		1.8 to 220						
	33/34...	N150	orange		3.9 to 220						
	57/58...	N750	violet		3.9 to 330						
	70...	N1500	orange/orange		18 to 560						
	90...	NP0	black		1 to 240						168
683	**03/04...**	P100	red/violet	1	0.56 to 47	100	–	4 ±0.5	2e	loose	176
	09/10...	NP0	black		1.8 to 220						
	33/34...	N150	orange		3.9 to 220						
	57/58...	N750	violet		3.9 to 330						
	70...	N1500	orange/orange		18 to 560						
	90...	NP0	black		1 to 240						168

12NC 2222		TC	COLOUR CODE	CLASS	CAPACITANCE RANGE (pF)	$U_{R(DC)}$ (V)	H_0 (mm)	LEAD LENGTH (mm)	PITCH	PACKAGING	PAGE
686	**03/04...**	P100	red/violet	1	0.56 to 47	100	16	–	1e	ammopack	176
	09/10...	NP0	black		1.8 to 220						
	27/28...	N075	red		3.9 to 120						
	33/34...	N150	orange		3.9 to 220						
	39/40...	N220	yellow		3.9 to 150						
	45/46...	N330	green		4.7 to 180						
	51/52...	N470	blue		6.8 to 220						
	57/58...	N750	violet		3.9 to 330						
	70...	N1500	orange/orange		18 to 560						
	90...	NP0	black		1 to 240						168
688	**03/04...**	P100	red/violet	1	0.56 to 47	100	18.25	–	1e	ammopack	176
	09/10...	NP0	black		1.8 to 220						
	33/34...	N150	orange		3.9 to 220						
	57/58...	N750	violet		3.9 to 330						
	70...	N1500	orange/orange		18 to 560						
	90...	NP0	black		1 to 240						168
689	**03/04...**	P100	red/violet	1	0.56 to 47	100	18.25	–	2e	ammopack	176
	09/10...	NP0	black		1.8 to 220						
	33/34...	N150	orange		3.9 to 220						
	57/58...	N750	violet		3.9 to 330						
	70...	N1500	orange/orange		18 to 560						
	90...	NP0	black		1 to 240						168
691	**03/04...**	P100	red/violet	1	0.47 to 33	500	18.25	–	2e	ammopack	200
	09/10...	NP0	black		0.82 to 150						
	33/34...	N150	orange		2.2 to 150						
	57/58...	N750	violet		1.8 to 150						
	69/70...	N1500	orange/orange		8.2 to 330						

12NC 2222		TC	COLOUR CODE	CLASS	CAPACITANCE RANGE (pF)	$U_{R(DC)}$ (V)	H_0 (mm)	LEAD LENGTH (mm)	PITCH	PACKAGING	PAGE
693	**09...**	2C2-2E1 (X5S/X7T)	yellow	2	100 to 1200	1000	–	>13	2e	loose	222
	19...						–	4 ±0.5		loose	
	53...						18.25	–		tape on reel	
	63...						18.25	–		ammopack	
694	**09...**	SL	–	1	0.47 to 120	1000	–	>13	2e	loose	217
	19...						–	4 ±0.5		loose	
	53...						18.25	–		tape on reel	
	63...						18.25	–		ammopack	
	64...						16	–		ammopack	
695	**09...**	2E2 (X5U)	blue	2	270 to 3300	1000	–	>13	2e	loose	227
	19...						–	4 ±0.5		loose	
	53...						18.25	–		tape on reel	
	63...						18.25	–		ammopack	

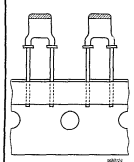
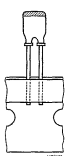
SELECTION GUIDE FOR MINIATURE CERAMIC PLATE CAPACITORS

PACKAGE OUTLINE	TC	$U_{R(DC)}$ (V)	CAP. RANGE (pF)	CAP. TOL.	CATALOGUE NUMBERS 2222	CLIMATIC CATEGORY	TYPICAL CIRCUITS	TARGET APPLICATION	PAGE
Class 1, standard types, leads with flanges									
	P100; NP0; N1500	100	0.56 to 560	±0.25 pF ±2%	678 ..... to 683 .....; 688 .....; 689	55/125/56	high frequency; tuning; temperature compensation; precision clocking; high stability	general industrial; consumer; automotive	176
	N150; N750					55/085/21			
	P100; NP0; N1500	500	0.47 to 330	±0.25 pF ±2%	652 ..... to 654 .....; 691	55/150/56	high frequency; SMPS; power supplies; temperature compensation; precision clocking; high stability	general industrial; consumer; automotive	200
	N150; N750					55/085/21			
	SL	1000	0.47 to 120	±0.25 pF ±5%	694 09...; 694 19...; 694 53...; 694 63...	55/150/56	SMPS; HV systems; HV power supplies; high stability	high stress circuits; high stress automotive; professional circuits; measuring instruments	217
Class 1, precision types, leads with flanges									
	NP0	100	0.82 to 240	±0.1 pF ±1%	678 90... to 683 90...; 688 90...; 689 90...	55/125/56	high frequency; tuning; precision clocking; high stability	high stress circuits; high stress automotive	168
	NP0	500	0.82 to 150	±0.1 pF ±1%	652 90... to 654 90...; 691 90...; note 1	55/125/56	SMPS; power supplies; high frequency; tuning; high stability	high stress circuits; high stress automotive	200

Note

1. Available on request.

SELECTION GUIDE FOR MINIATURE CERAMIC PLATE CAPACITORS (continued)

PACKAGE OUTLINE	TC	$U_{R(DC)}$ (V)	CAP. RANGE (pF)	CAP. TOL.	CATALOGUE NUMBERS 2222	CLIMATIC CATEGORY	TYPICAL CIRCUITS	TARGET APPLICATION	PAGE
Class 2, leads with flanges									
	2C2 (X5S/X7T)	100	180 to 6800	±10%	630 08...; 630 18...; 630 09...; 630 19...; 630 51...; 630 61...; 630 53...; 630 63...	55/125/56	coupling/decoupling; filtering; high stability	high stress circuits; high stress automotive; professional circuits; measuring instruments	184
	2E2 (X5U)	100	1000 to 15000	+50%/–20%	640 08...; 640 18...; 640 09...; 640 19...; 640 51...; 640 61...; 640 53...; 640 63...	55/105/21	coupling/decoupling; filtering; medium stability	high stress circuits; high stress automotive; professional circuits; measuring instruments	184
	2F6 (Y5V)	63	1000 to 47000	+80%/–20%	629 08...; 629 18...; 629 09...; 629 19...; 629 51...; 629 61...; 629 53...; 629 63...	10/085/21	general purpose; coupling/decoupling; filtering; low stability	general industrial; consumer	184
	2C2 (X5S/X7T)	500	100 to 4700	±10%	655 09...; 655 19...; 655 53...; 655 63...	55/150/56	SMPS; HV systems; HV power supplies; coupling/decoupling; filtering; high stability	high stress circuits; high stress automotive; professional circuits; measuring instruments	211

PACKAGE OUTLINE	TC	$U_{R(DC)}$ (V)	CAP. RANGE (pF)	CAP. TOL.	CATALOGUE NUMBERS 2222	CLIMATIC CATEGORY	TYPICAL CIRCUITS	TARGET APPLICATION	PAGE
	2C2 (X5S/X7T)	1000	100 to 1200	±10%	693 09...; 693 19...; 693 53...; 693 63...	55/150/56	SMPS; HV systems; HV power supplies; coupling/decoupling; filtering; high stability	high stress circuits; high stress automotive; professional circuits; measuring instruments	222
	2E2 (X5U)	1000	270 to 3300	±20%	695 09...; 695 19...; 695 53...; 695 63...	55/105/56	SMPS; HV systems; HV power supplies; coupling/decoupling; filtering; medium stability	high stress circuits; high stress automotive; professional circuits; measuring instruments	227

CURRENT AND MAINTENANCE TYPES

Current ceramic plate capacitors have leads provided with a flange. They are available in a wide variety of executions. The flange ensures excellent solderability and component height definition on the printed-circuit boards. These capacitors are suitable for both hand mounting and automatic insertion.

Ceramic plate capacitors **without flanged leads** are **not** for design-in. They are for maintenance purposes only. They are not available on tape.

The electrical properties of capacitors with flanged leads are the same as the electrical properties of capacitors with straight leads.

TC DEFINITION AND RELEVANT CODES

The variation of capacitance with temperature is determined by:

1. Temperature coefficient of capacitance.
2. Temperature characteristic of capacitance.

The temperature coefficient of capacitance is applicable to class 1 capacitors. They show a predictable and almost linear change of capacitance with temperature.
This makes them suitable for temperature compensation in resonant and tuning circuits (N150 to N1500), and in all critical applications which require a very small capacitance change with temperature (NP0).

The dielectric number indicates the nominal value of the temperature coefficient of capacitance with the letters 'P' or 'N' indicating a positive or negative capacitance change with the temperature. For example, P100 indicates a positive temperature coefficient of $100 \times 10^{-6}/°C$ and N750 indicates a negative temperature coefficient of $750 \times 10^{-6}/°C$. In accordance with *"RS198"*, the P100 is identified with the code M7G and the N750 with the code U2J.

The temperature characteristic of capacitance is specified by means of letters and numbers denoting the maximum permissible capacitance change from 20 °C over a specified temperature range. The *"EIA publication RS198"* has a similar coding system but the reference temperature is 25 °C.

Tables 1 and 2 show the temperature characteristic of capacitance in accordance with *"IEC 60384-9"* and *"RS198"* respectively.

Table 3 shows the temperature coefficient codes in accordance with *"RS198"*.

As an example, a capacitor with a capacitance change of –56 to +20% in the temperature range from –55 to +85 °C will be defined as a class 2E2 capacitor in accordance with *"IEC 60384-9"* and X5U in accordance with *"RS198"*.

Also, a capacitor with a temperature change of 0 ±30 ppm will be defined as C0G in accordance with *"RS198"* (see Table 3) and NP0 in accordance with *"IEC 60384-8"*.

Table 1 Temperature characteristic of capacitance in accordance with *"IEC 60384-9"*

SUB-CLASS LETTER CODE	ΔC/C at 20 °C (%)		PREFERRED CATEGORY TEMPERATURE RANGE (P) AND CORRESPONDING NUMBER CODE				
	WITHOUT DC VOLTAGE APPLIED	WITH RATED DC VOLTAGE APPLIED	–55/+125 °C	–55/+85 °C	–40/+85 °C	–25/+85 °C	–10/+85 °C
			1	2	3	4	6
2B	±10	+10/–15	–	P	P	P	–
2C	±20	+20/–30	P	P	P	–	–
2D	+20/–30	+20/–40	–	–	–	P	–
2E	+22/–56	+22/–70	–	P	P	P	P
2F	+30/–80	+30/–90	–	P	P	P	P
2R	±15	+15/–40	P	–	–	–	–
2X	±15	+15/–25	P	–	–	–	–

Table 2 Temperature characteristics in accordance with *"RS198"*

FIRST DIGIT IS MINIMUM TEMPERATURE CODE	SECOND DIGIT IS MAXIMUM TEMPERATURE CODE	LAST DIGIT IS RELATED TO ΔC/C at 25 °C (%)
X = –55 °C	5 = +85 °C	F = ±7.5
Y = –30 °C	6 = +105 °C	P = ±10
Z = +10 °C	7 = +125 °C	R = ±15
–	8 = +150 °C	S = ±22
–	9 = +200 °C	T = –33 to +22
–	–	U = –56 to +22
–	–	V = –82 to +22

Table 3 Temperature coefficient in accordance with *"RS198"*

SIGNIFICANT FIGURES	MULTIPLIER	TOLERANCE ppm (°C)
C = 0.0	0 = –1	G = ±30
M = 1	1 = –10	H = ±60
P = 1.5	2 = –100	J = ±120
R = 2.2	3 = –1000	K = ±250
S = 3.3	5 = +1	L = ±500
T = 4.7	6 = +10	M = ±1000
U = 7.5	7 = +100	N = ±2500
–	8 = +1000	–

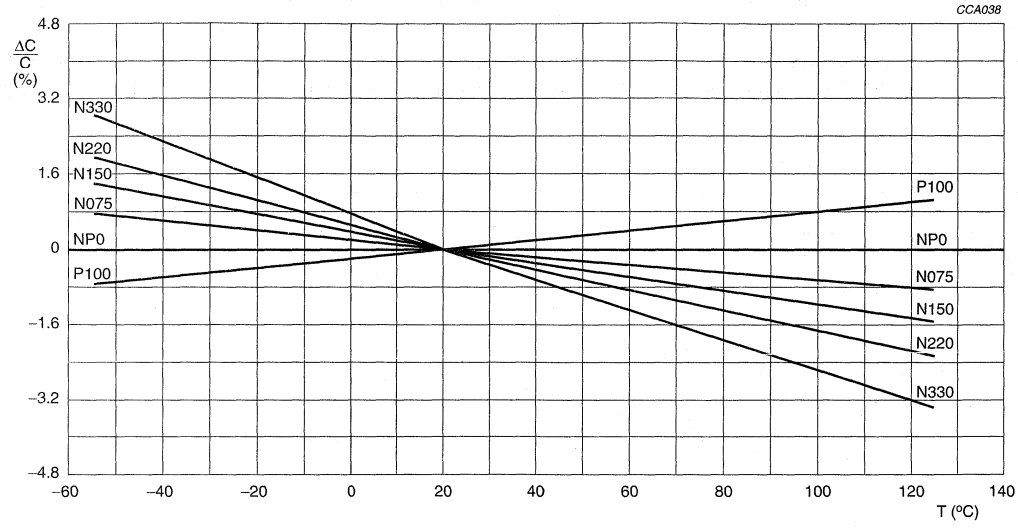


Fig.1 Capacitance change as a function of temperature.

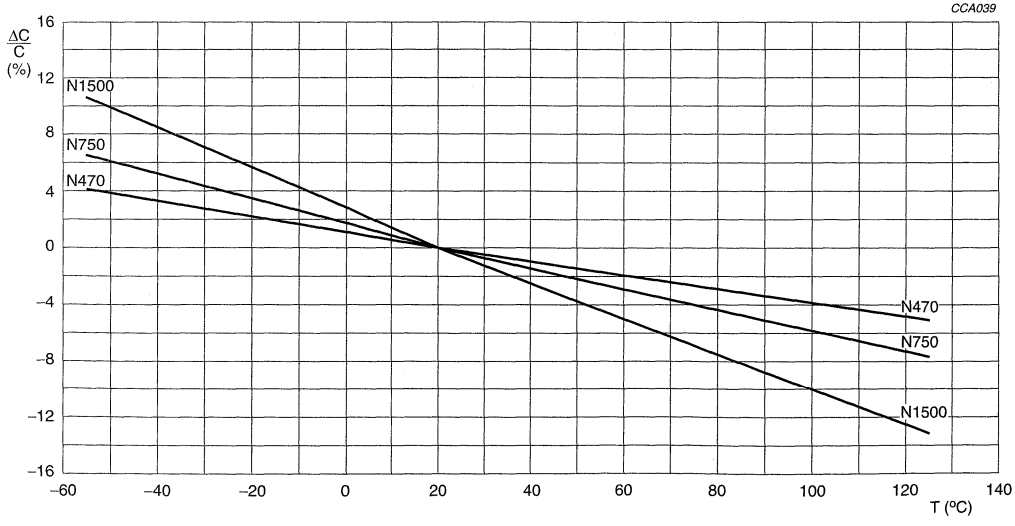


Fig.2 Capacitance change as a function of temperature.

COMPOSITION, COLOUR CODING AND MARKING

Tables 4 and 5 show the composition of the materials used in ceramic plate capacitors. Colour coding indicating the temperature coefficient or temperature dependency is given.

The capacitance is marked on the body of the plate capacitors in a 3-digit code: two numbers corresponding with the numerical capacitance value and one letter indicating the multiplier and the decimal point. For example: 1p0 = 1.0 pF, 22n = 22 nF.

Table 4 Class 1: $\varepsilon_r = 6$ up to 250; TC types

TC TYPES		MATERIAL	COLOUR CODES	
CODE	VALUE		TC	BODY
P100	$+100 \times 10^{-6}$/K	$MgTiO_3$, Mg_2SiO_4	red-violet	grey
NP0	0×10^{-6}/K	$MgTiO_3$	black	
N075	-75×10^{-6}/K	$BaNd_2(Bi_2)Ti_5O_x + TiO_2$	red	
N150	-150×10^{-6}/K	$BaNd_2(Bi_2)Ti_5O_x + TiO_2$	orange	
N220	-220×10^{-6}/K	$BaNd_2(Bi_2)Ti_5O_x + TiO_2$	yellow	
N330	-330×10^{-6}/K	$BaNd_2(Bi_2)Ti_5O_x + TiO_2$	green	
N470	-470×10^{-6}/K	$BaNd_2(Bi_2)Ti_5O_x + TiO_2$	blue	
N750	-750×10^{-6}/K	TiO_2 + additions	violet	
N1500	-1500×10^{-6}/K	$CaTiO_3$ + additions	orange/orange	

Table 5 Class 2: $\varepsilon_r > 250$; high-K types

ε_r VALUE	MATERIAL	COLOUR CODES	
		TC	BODY
$\varepsilon_r = 2000$	$Ba(Bi)TiO_3$	yellow	tan
$\varepsilon_r = 5000$	(Ba, Ca) (Ti, Zr) O_3 + additions	blue	
$\varepsilon_r = 14000$	(Ba, Ca) (Ti, Zr) O_3 + additions	green	

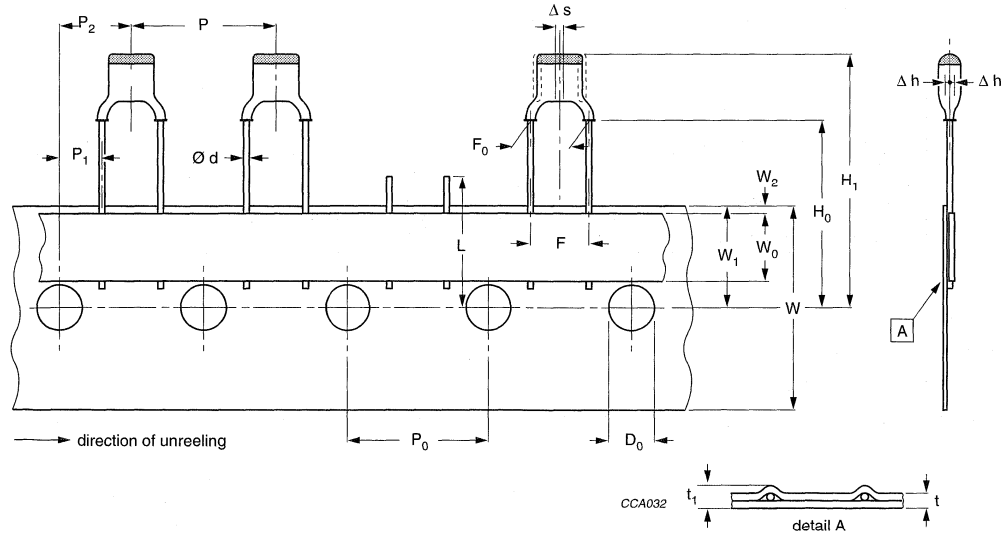
PACKAGING

The miniature ceramic plate capacitors are supplied in bulk packaging (cardboard boxes), in tape on reel or in ammopack (see Table 6).

Table 6 Packaging quantities

SIZE CODE	PACKAGING QUANTITIES		
	BOX	REEL	AMMOPACK
I, IIA, IIB (excluding 1000 V)	1000	4000	4000
III, IV, V (with lead length ≤6 mm) (excluding 1000 V)	1000	–	–
III, IV, V (with lead length >6 mm) (excluding 1000 V)	500	4000	4000
III (500 V with lead length >6 mm) (excluding 1000 V)	500	4000	4000
IV, V (500 V with lead length >6 mm) (excluding 1000 V)	500	4000	2000
I, IIA, IIB, III, IV, V (1000 V with lead length >6 mm)	500	2000	2000
I, IIA, IIB, III, IV (1000 V with lead length ≤6 mm)	1000	–	–
V (1000 V with lead length ≤6 mm)	500	–	–

CAPACITORS ON TAPE, LEAD PITCH 5.08 mm (0.2 inch)



For dimensions see Table 7.

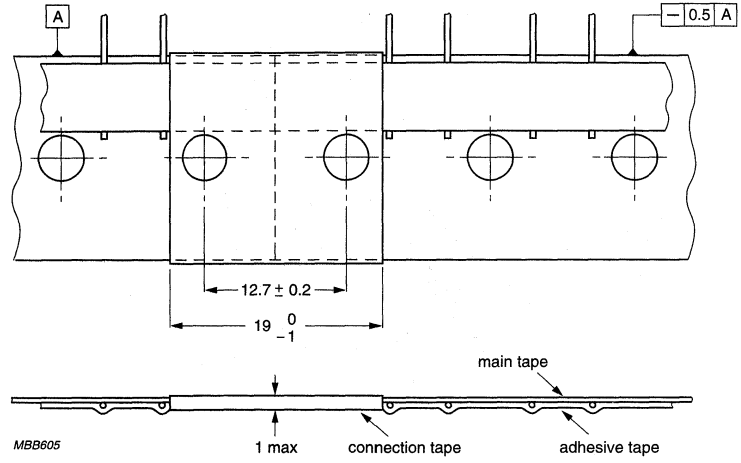
Fig.3 Capacitors, lead pitch 5.08 mm, on tape.

Table 7 Dimensions of tape; see Fig.3

SYMBOL	PARAMETER	DIMENSIONS (mm)	
		NOMINAL	TOLERANCE
d	lead diameter	0.6	+0.6 −0.05
P	pitch between capacitors	12.7	±1.0
P_0	feed-hole pitch	12.7	±0.2; note 1
P_1	feed-hole centre to lead centre	3.85	±0.5; note 2
P_2	feed-hole centre to component centre	6.35	±0.7; note 2
F	lead-to-lead	5.0	+0.6 −0.1
F_0	lead-to-lead	5.08	+0.5 −0.1
Δh	component alignment	0	±1.0
Δs	deviation along tape, left or right	0	±0.6
W	tape width	18.0	±0.5
W_0	hold-down tape width	6.0	±0.5
W_1	hole position	9.0	±0.5
W_2	hold-down tape position	0	±2
H_0	flange to tape centre	18.25 (16.0); note 3	±0.5
H_1	maximum component height	31 (28.75); note 4	–
	minimum component height	22 (18.75); note 4	–
L	maximum length of snipped lead	11	–
D_0	feed-hole diameter	4.0	±0.2
t	total tape thickness	0.65	±0.2
t_1	maximum thickness of tape and wires	1.5	–

Notes

1. Cumulative pitch error: ±≤1 mm/20 pitches.
2. Obliquity maximum 3°.
3. H_0 = 16 mm also available.
4. Values between parentheses are referred to component height when H_0 = 16 mm.



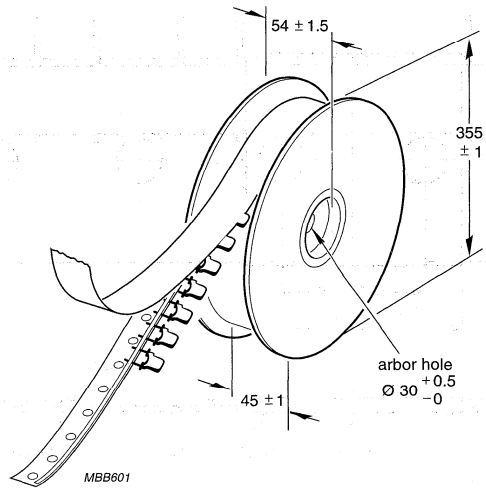
Dimensions in mm.

Maximum 0.5% of the total number of capacitors per reel may be missing. A maximum of 3 consecutive vacant positions is followed by at least 6 consecutive components. The tape begins and ends with 5 empty positions.

Fig.4 Connection of tapes, lead pitch 5.08 mm.

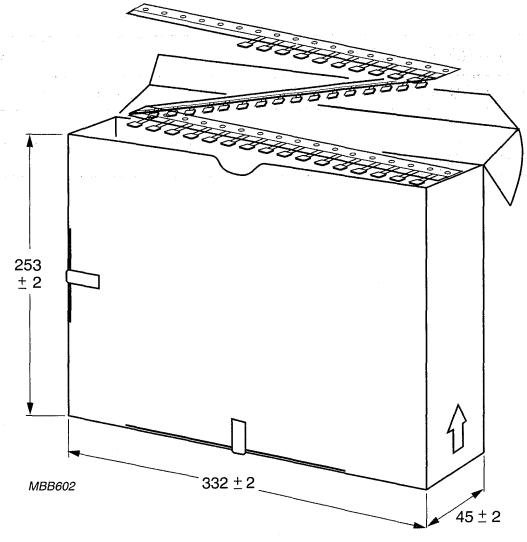
Table 8 Properties of the tape

PARAMETER	MIN.	MAX.	UNIT
Extraction force for component in the tape plane, vertically to direction of unreeling	5	–	N
Break force of tape	15	–	N
Pull-off force adhesive tape from main tape	–	2.5	N



Dimensions in mm.

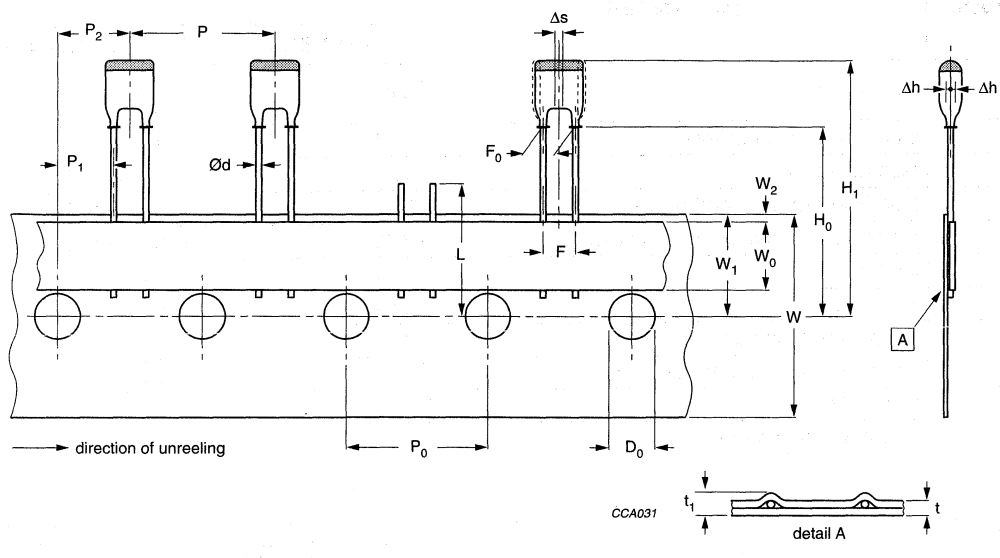
Fig.5 Reel with capacitors on tape.



Dimensions in mm.

Fig.6 Ammopack with capacitors on tape.

CAPACITORS ON TAPE, LEAD PITCH 2.54 mm (0.1 inch)



For dimensions see Table 9.

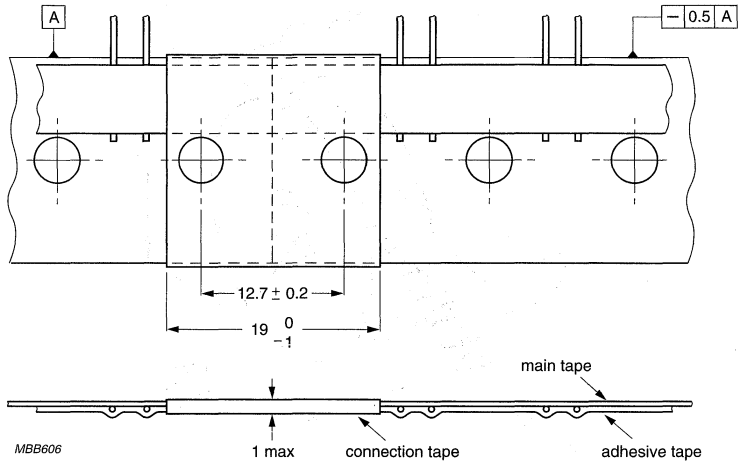
Fig.7 Capacitors, lead pitch 2.54 mm, on tape.

Table 9 Dimensions of tape; see Fig.7

SYMBOL	PARAMETER	DIMENSIONS (mm)	
		NOMINAL	TOLERANCE
d	lead diameter	0.6	+0.6 −0.05
P	pitch between capacitors	12.7	±1.0
P_0	feed-hole pitch	12.7	±0.2; note 1
P_1	feed-hole centre to lead centre	5.1	±0.5; note 2
P_2	feed-hole centre to component centre	6.35	±0.7; note 2
F	lead-to-lead	2.54	±0.3
F_0	lead-to-lead	2.54	±0.3
Δh	component alignment	0	±1.0
Δs	deviation along tape, left or right	0	±0.6
W	tape width	18.0	±0.5
W_0	hold-down tape width	6.0	±0.5
W_1	hole position	9.0	±0.5
W_2	hold-down tape position	0	±2
H_0	flange to tape centre	18.25 (16.0); note 3	±0.5
H_1	maximum component height	30 (27.75); note 4	–
	minimum component height	21 (18.75); note 4	–
L	maximum length of snipped lead	11	–
D_0	feed-hole diameter	4.0	±0.2
t	total tape thickness	0.65	±0.2
t_1	maximum thickness of tape and wires	1.5	–

Notes

1. Cumulative pitch error: ±≤1 mm/20 pitches.
2. Obliquity maximum 3°.
3. H_0 = 16 mm also available.
4. Values between parentheses are referred to component height when H_0 = 16 mm.



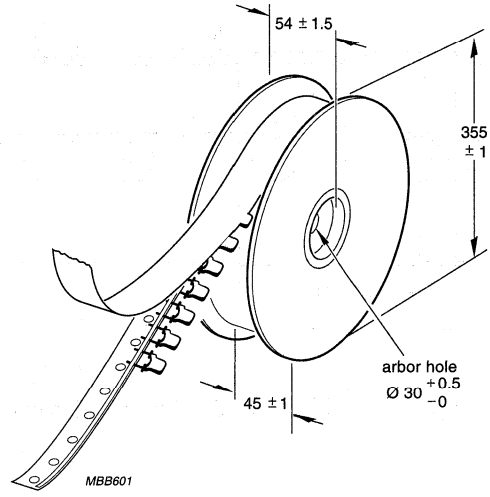
Dimensions in mm.

Maximum 0.5% of the total number of capacitors per reel may be missing. A maximum of 3 consecutive vacant positions is followed by at least 6 consecutive components. The tape begins and ends with 5 empty positions.

Fig.8 Connection of tapes, lead pitch 2.54 mm.

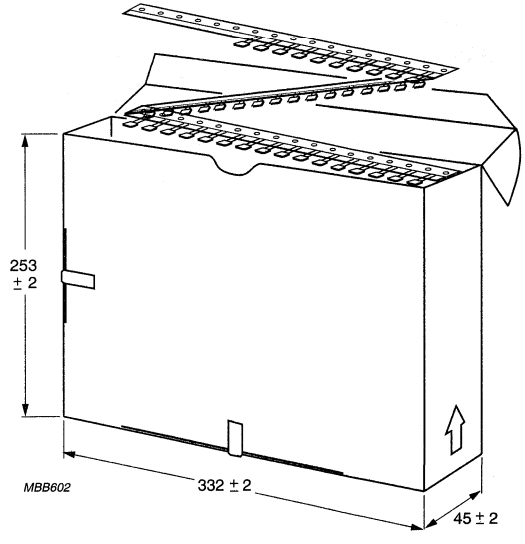
Table 10 Properties of the tape

PARAMETER	MIN.	MAX.	UNIT
Extraction force for component in the tape plane, vertically to direction of unreeling	5	–	N
Break force of tape	15	–	N
Pull-off force adhesive tape from main tape	–	2.5	N



Dimensions in mm.

Fig.9 Reel with capacitors on tape.

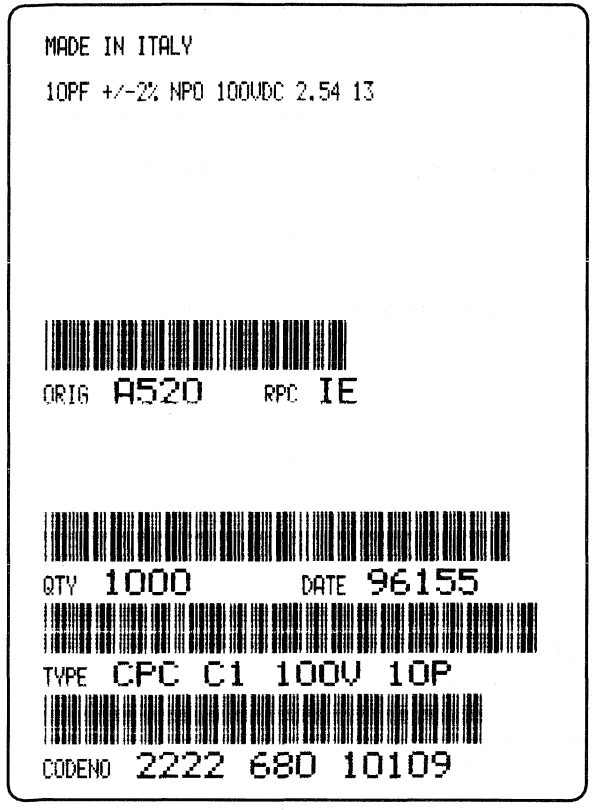


Dimensions in mm.

Fig.10 Ammopack with capacitors on tape.

LABELLING

The label on the package containing the capacitors is as shown.



LINE	MARKING EXPLANATION
1.	Country of origin
2.	Capacitance value, tolerance, dielectric class (note 1), rated voltage, lead spacing and lead length (note 2)
3.	Country of origin and responsible production centre codes; A520 is Italy
4.	Quantity and date code
5.	Commercial type number
6.	Catalogue number (12NC)

Notes

1. Temperature coefficient for Class 1 capacitors; temperature characteristics for Class 2 capacitors.
2. Lead length is not shown on taped versions.

Fig.11 Packaging label (example).

TESTS AND REQUIREMENTS

Class 1 capacitors

After manufacture, each capacitor is checked on capacitance, tan δ and test voltage. Apart from this the following quality checks are carried out by frequent inspections.

Essentially all tests mentioned in the schedule of *"IEC publication 60384-8"*, category as specified for each product family are carried out in accordance with *"IEC publication 60068"*.

Table 11 Test procedures and requirements

IEC 60384-8 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
4.4		robustness of terminations:		
		pull-off	pull velocity 15 cm/minute; load 5 N	no lead breakage
	Ua_1	tensile strength	axial force 10 N	no lead breakage
	Ub	bending	load 5 N; 4 × 90°	no lead breakage
4.6	Ta method 1	solderability (solder bath)	235 °C; 2 s	good tinning
4.5	Tb method 1A	resistance to soldering heat	260 °C; 10 s	no visible damage ΔC/C: ±≤0.5% or ±0.5 pF after 1 to 2 hours
4.7	Na	rapid change of temperature	30 minutes at –55 °C and 30 minutes at +85 °C; 5 cycles (+125 °C for P100, NP0 and N1500 with $U_{R(DC)}$ = 100 V; +150 °C for 2222 694, P100, NP0 and N1500 with $U_{R(DC)}$ = 500 V)	no damage, after 24 hours ΔC/C: ±≤0.5% or ±0.5 pF
4.8	Fc	vibration	10 to 55 to 10 Hz; 0.75 mm displacement; 3 directions; 6 hours	no visible damage
4.9	Eb	bump	4000 bumps in 2 directions; 40 g; pulse time 6 ms	no visible damage
		inflammability	15 s; 35 mm above bunsen burner with flame height 40 to 60 mm	self-extinguishing within 15 seconds after removal of bunsen burner
4.3		temperature coefficient	between +20 and –55 °C and between +20 and +85 °C	within tolerance as specified for each particular material

IEC 60384-8 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
4.11		climatic sequence:		
4.11.2	B	dry heat	16 hours; +85 °C (+125 °C for P100, NP0 and N1500 with $U_{R(DC)}$ = 100 V; +150 °C for 2222 694, P100, NP0 and N1500 with $U_{R(DC)}$ = 500 V)	no visible damage
4.11.3	Db	damp heat (accelerated) 1st cycle	12 hours; +55 °C; 90 to 96% RH 12 hours; +25 °C; 95 to 100% RH	no visible damage; after recovery of 1 to 2 hours immediately followed by cold test
4.11.4	A	cold	2 hours; –55 °C	no visible damage
4.11.5	M	low air pressure	1 hour; 8.5 kPa, last 2 minutes rated voltage	no breakdown or flashover
4.11.6	Db	damp heat (accelerated) remaining cycle	12 hours; +55 °C; 90 to 96% RH 12 hours; +25 °C; 95 to 100% RH	$\Delta C/C$: $\pm \leq 1\%$ or ± 1 pF tan δ: $\leq 2 \times$ specified tan δ R_{ins} after 1 to 2 hours: >5000 MΩ for 2222 650 to 654/691/692/694 >100 MΩ for other types
4.12	Ca	damp heat, steady state (half number of the lot at rated voltage, other half at zero voltage)	21 days; +40 °C; 90 to 95% RH	$\Delta C/C$: $\pm \leq 1\%$ or ± 1 pF tan δ: $\leq 2 \times$ specified tan δ R_{ins} after 1 to 2 hours: >5000 MΩ for 2222 650 to 654/691/692/694 >100 MΩ for other types
4.13		endurance	1000 hours at +85 °C (+125 °C for P100, NP0 and N1500 with $U_{R(DC)}$ = 100 V; +150 °C for 2222 694, P100, NP0 and N1500 with $U_{R(DC)}$ = 500 V); 2222 694: 1500 V (DC) 2222 650 to 654/691/692: 750 V (DC) other types: 150 V (DC)	$\Delta C/C$: $\pm \leq 1\%$ or ± 1 pF tan δ: $\leq 1.5 \times$ specified tan δ R_{ins} after 1 to 2 hours: >3000 MΩ for 2222 650 to 654/691/692/694 >300 MΩ for other types
		resistance to solvents	3 minutes ultrasonic washing in trichloroethylene; 1 minute drying; 30 °C; 10 brush strokes	marking and colour code must remain legible and not be discoloured; no mechanical or electrical damage or deterioration of the material

Class 1 precision capacitors NP0

After manufacture, each capacitor is checked on capacitance, tan δ and test voltage. Apart from this the following quality checks are carried out by frequent inspections.

Essentially all tests mentioned in the schedule of *"IEC publication 60384-8"*, category 55/125/56 (temperature range –55/+125 °C; damp heat, long term, 56 days) are carried out in accordance with *"IEC publication 60068"*.

Table 12 Test procedures and requirements

IEC 60384-8 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
4.4		robustness of terminations:		
		pull-off	pull velocity 15 cm/minute; load 5 N	no lead breakage
	Ua_1	tensile strength	axial force 10 N	no lead breakage
	Ub	bending	load 5 N; 4 × 90°	no lead breakage
4.6	Ta method 1	solderability (solder bath)	235 °C; 2 s	good tinning
4.5	Tb method 1A	resistance to soldering heat	260 °C; 10 s	no visible damage ΔC/C after 1 to 2 hours: ±≤0.5% or ±0.5 pF
4.7	Na	rapid change of temperature	30 minutes at –55 °C and 30 minutes at +150 °C; 5 cycles	no damage ΔC/C after 24 hours: ±≤0.5% or ±0.5 pF
4.8	Fc	vibration	10 to 55 to 10 Hz; 0.75 mm displacement; 3 directions; 6 hours	no visible damage
4.9	Eb	bump	4000 bumps in 2 directions; 40 g; pulse time 6 ms	no visible damage
		inflammability	15 s; 35 mm above bunsen burner with flame height 40 to 60 mm	self-extinguishing within 15 seconds after removal of bunsen burner
4.3		temperature coefficient	between +20 and –55 °C and between +20 and +125 °C	within tolerance as specified

IEC 60384-8 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
4.11		climatic sequence:		
4.11.2	B	dry heat	16 hours; +150 °C	no visible damage
4.11.3	Db	damp heat (accelerated) 1st cycle	12 hours; +55 °C; 90 to 96% RH 12 hours; +25 °C; 95 to 100% RH	no visible damage; after recovery of 1 to 2 hours immediately followed by cold test
4.11.4	A	cold	2 hours; –55 °C	no visible damage
4.11.5	M	low air pressure	1 hour; 8.5 kPa, last 2 minutes rated voltage	no breakdown or flashover
4.11.6	Db	damp heat (accelerated) remaining cycle	12 hours; +55 °C; 90 to 96% RH 12 hours; +25 °C; 95 to 100% RH	$\Delta C/C$: $\pm \leq 1\%$ or ± 1 pF whichever is greater tan δ: $\leq 2 \times$ specified tan δ R_{ins} after 1 to 2 hours: >1000 MΩ
4.12	Ca	damp heat, steady state (half number of the lot at rated voltage, other half at zero voltage)	56 days; +40 °C; 90 to 95% RH	$\Delta C/C$: $\pm \leq 1\%$ or ± 1 pF whichever is greater tan δ: $\leq 2 \times$ specified tan δ R_{ins} after 1 to 2 hours: >1000 MΩ
4.13		endurance	1 000 hours at +150 °C, 1.5 × rated voltage; (+125 °C for P100, NP0 and N1500 with $U_{R(DC)}$ = 100 V; +150 °C for 2222 694, P100, NP0 and N1500 with $U_{R(DC)}$ = 500 V)	$\Delta C/C$: $\pm \leq 1\%$ or ± 1 pF whichever is greater tan δ: $< 1.5 \times$ specified tan δ R_{ins}: >3000 MΩ
		resistance to solvents	3 minutes ultrasonic washing in trichloroethylene; 1 minute drying; 30 °C; 10 brush strokes	marking and colour code must remain legible and not be discoloured; no mechanical or electrical damage or deterioration of the material

Class 2 capacitors

After manufacture, each capacitor is checked on capacitance, tan δ and test voltage. Apart from this the following quality checks are carried out by frequent inspections.

Essentially all tests mentioned in the schedule of *"IEC publication 60384-9"*, category as specified for each product family, are carried out in accordance with *"IEC publication 60068"*.

Table 13 Test procedures and requirements

IEC 60384-9 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
4.1		pre-conditioning	1 hour; +150 °C; reference measurement after 24 hours	
4.5		robustness of terminations:		
		pull-off	pull velocity 15 cm/minute; load 5 N	no lead breakage
	Ua_1	tensile strength	axial force 10 N	no lead breakage
	Ub	bending	load 5 N; 4 × 90°	no lead breakage
4.7	Ta method 1	solderability (solder bath)	235 °C; 2 s	good tinning
4.6	Tb method 1A	resistance to soldering heat	pre-conditioning: 260 °C; 10 s	no visible damage ΔC/C after 24 hours: 2222 630: ±≤10% 2222 629/640/695: ±≤20% 2222 655/693: ±10%
4.8	Na	rapid change of temperature	pre-conditioning: 2222 630/655/693/695: 30 minutes at −55 °C and 30 minutes at +85 °C (+125 °C for 630; +105 °C for 640/695; +150 °C for 655/693); 2222 629: 30 minutes at −10 °C and 30 minutes at +85 °C; 5 cycles	no damage ΔC/C after 24 hours: 2222 630/655/693: ±≤10% 2222 629/640/695: ±≤20%
4.9	Fb	vibration	10 to 55 to 10 Hz; 0.75 mm displacement; 3 directions; 6 hours	no visible damage
4.10	Eb	bump	4000 bumps in 2 directions; 40 g; pulse time 6 ms	no visible damage
		inflammability	15 s; 35 mm above bunsen burner with flame height 40 to 60 mm	self-extinguishing within 15 s after removal of bunsen burner
		resistance to solvents	3 minutes ultrasonic washing in trichloroethylene; 1 minute drying, 30 °C; 10 brush strokes	marking and colour code must remain legible and not be discoloured; no mechanical or electrical damage or deterioration of the material

IEC 60384-9 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
4.12		climatic sequence:		
4.12.1		pre-conditioning	1 hour; +150 °C	
4.12.2	Ba	dry heat	16 hours at: +85 °C for 2222 629; +105 °C for 2222 640/695; +125 °C for 2222 630; +150 °C for 2222 655/693	no visible damage
4.12.3	Db	damp heat (accelerated) 1st cycle	12 hours; +55 °C; 90 to 96% RH 12 hours; +25 °C; 95 to 100% RH	no visible damage; after recovery of 1 to 2 hours immediately followed by cold test
4.12.4	Aa	cold	2222 630/640/655/693/695: 2 hours; −55 °C; 2222 629: 2 hours; −10 °C	no visible damage
4.12.5	M	low air pressure	1 hour at 8.5 kPa, last 2 minutes rated voltage	no breakdown or flashover
4.12.6	Db	damp heat (accelerated) remaining cycle	12 hours; +55 °C; 90 to 96% RH 12 hours; +25 °C; 95 to 100% RH	ΔC/C after 24 hours: 2222 630/655/693: ±≤10% 2222 629/640/695: ±≤20% tan δ: ≤7% (2222 695: <2%) R_{ins}: 2222 629/630/640: >100 MΩ 2222 655/693/695: >1000 MΩ
4.13	Ca	damp heat, steady state (half number of samples at rated voltage, other half of samples no voltage applied)	pre-conditioning: 2222 629/640: 21 days; +40 °C; 90 to 95% RH; 2222 630/655/693/695: 56 days; +40 °C; 90 to 95% RH	no visible damage ΔC/C after 24 hours: 2222 630/655/693: ±≤10% 2222 629/640/695: ±≤20% tan δ: ≤7% (2222 695: <2%) R_{ins}: 2222 629/630/640: >100 MΩ 2222 655/693/695: >1000 MΩ
4.14		endurance	pre-conditioning: 1000 hours (IEC) pre-conditioning: 2222 630: +125 °C; 150 V (DC) 2222 640: +105 °C; 150 V (DC 2222 629: +85 °C; 100 V (DC) 2222 655: +150 °C; 750 V (DC) 2222 693: +150 °C; 1500 V (DC) 2222 695: +105 °C; 1500 V (DC)	ΔC/C after 24 hours: 2222 630/655/693: ±≤10% 2222 629/640/695: ±≤20% tan δ: ≤5% (2222 629: ≤6.5%) (2222 695: <2%) R_{ins}: 2222 629/630/640: >300 MΩ 2222 655/693/695: >1000 MΩ
4.4		temperature characteristic	pre-conditioning minimum and maximum temperature	in accordance with specification

Miniature ceramic plate capacitors

Clear text code

CLEAR TEXT ORDERING CODE

R 101 G 33 C0G H WG AP

Product type

R plate capacitor

Capacitance (pF)

The first two digits are the significant figures of capacitance and the last digit is a multiplier as follows:

0	× 1
1	× 10
2	× 100
3	× 1000
9	× 0.1
8	× 0.01

Capacitance tolerance

B	±0.1 pF (NP0 precision cap. < 10 pF)
C	±0.25 pF (cap. < 10 pF)
G	±2% (class 1 for cap. ≥ 10 pF)
F	±1% (NP0 precision cap. ≥ 10 pF)
J	±5% (class 1 for cap. ≥ 10 pF)
K	±10% (class 2, Y5P)
M	±20% (class 2, X5U)
Z	+80%/–20% (class 2, Z5V)

Size code

Size	W_{max}	H_{max}
19	3.9 mm (0.152")	6.7 mm (0.254")
29	4.5 mm (0.177")	7.3 mm (0.288")
33	5.3 mm (0.208")	8.1 mm (0.319")
43	6.2 mm (0.244")	9.0 mm (0.354")
53	6.2 mm (0.244")	11.2 mm (0.441")

CCA945

Class code

AP	class 1
SP	class 2

Packaging

Code	Space	Length	Form	Packaging
WC	0.100"	0.500" min.	flange	bulk
WD	0.200"	0.167 ±0.020"	flange	bulk
WE	0.100"	0.167 ±0.020"	flange	bulk
WF	0.200"	0.500" min.	flange	bulk
WG	0.200"	H_0 = 18 mm	flange	tape on reel
WH	0.100"	H_0 = 18 mm	flange	tape on reel
WJ	0.200"	H_0 = 18 mm	flange	ammopack
WK	0.100"	H_0 = 18 mm	flange	ammopack

Rated voltage (DC)

F	50 V
H	100 V
L	500 V
N	1000 V

EIA TC codes

Code	TC		Marking
M7J	P100 ±30 ppm	class 1	red/violet
C0G	NP0 ±30 ppm	class 1	black
U1G	N075 ±30 ppm	class 1	red
P2G	N150 ±30 ppm	class 1	orange
R2G	N220 ±30 ppm	class 1	yellow
R2H	N330 ±60 ppm	class 1	green
T2H	N470 ±60 ppm	class 1	blue
U2J	N750 ±120 ppm	class 1	violet
P8K	N1500 +600/–0 ppm	class 1	orange/orange
U2M	+150 to –1500 ppm	class 1	nil
Y5P	±10%; –30 to +85 °C	class 2	yellow
X5U	+22/–58%; –55 to +85 °C	class 2	blue
Z5V	+22/–82%; –10 to +85 °C	class 2	green

PRODUCT DATA

Miniature ceramic plate capacitors Precision capacitors NP0

FEATURES

- High-frequency circuits
- High reliability
- High stability
- Space saving.

APPLICATIONS

In a great variety of electronic circuits, e.g. in filters, tuning circuits and other professional applications where high stability, precision, reliability and low losses are a requirement. Because of their small size the capacitors are suitable for use in circuitry with high component density. The high reliability even in most demanding environmental conditions make the product suitable for automotive, telecommunications and other electronic circuits used at high temperatures.

DESCRIPTION

The capacitors consist of a thin rectangular ceramic plate, both sides of which are metallized, and tinned connecting leads are secured using a high melting point solder. The capacitors are encapsulated in epoxy lacquer, which is resistant to all commonly used cleaning solvents. They have small dimensions and narrow tolerances on the lead spacing. The leads are provided with a flange, which guarantees that the leads are free of lacquer, and its shape allows soldering gasses to escape freely, ensuring excellent solderability. This makes the capacitors suitable for both hand-mounting and automatic insertion. The electrical properties are characterized by low losses, a very narrow tolerance on capacitance (±0.1 pF or 1%), high stability and, owing to the absence of silver, an extremely good DC behaviour.

QUICK REFERENCE DATA

DESCRIPTION	VALUE
Capacitance range (E24 series)	1 pF to 240 pF
Rated DC voltage	100 V; note 1
Tolerance on capacitance	C ≤ 10 pF: ±0.1 pF; C > 10 pF: ±1%
Sectional specification	IEC 60384-8
Climatic category (IEC 60068)	55/150/56

Note

1. 500 V available on request.

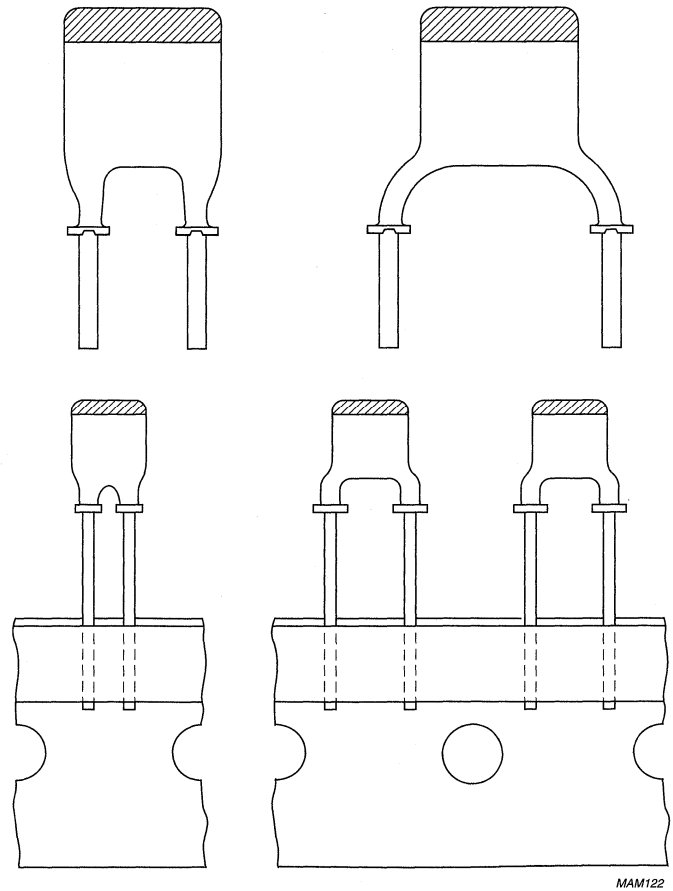
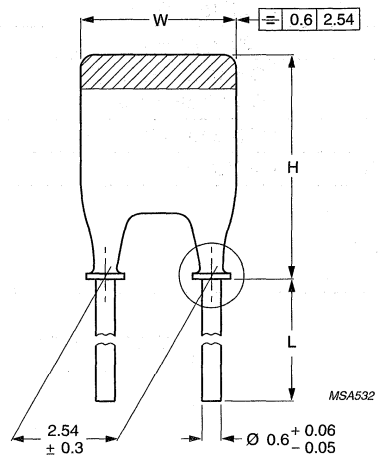


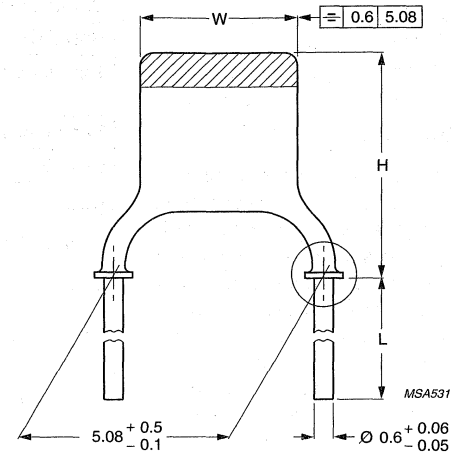
Fig.1 Outlines.

MECHANICAL DATA



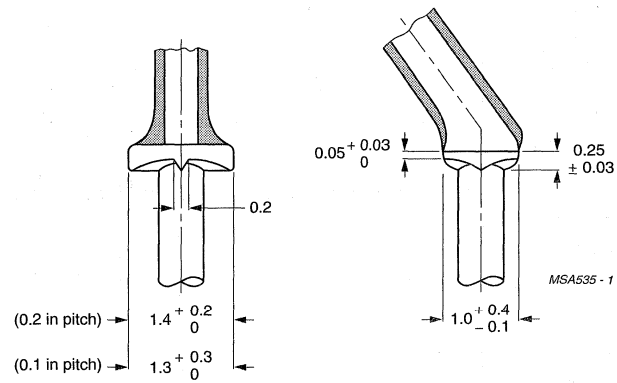
Dimensions in mm.
For dimensions H, L and W see Tables 1 and 2.

Fig.2 Component outline style 1.



Dimensions in mm.
For dimensions H, L and W see Tables 1 and 2.

Fig.3 Component outline style 2.



Dimensions in mm.

Fig.4 Detail of flange.

Marking

The temperature coefficient is indicated by a colour code in accordance with IEC and EIA recommendations. Capacitance value is indicated by a marking code in a contrasting colour on the body. Refer to Table 4, for marking codes.

Mounting

When bending, cutting or flattening, the leads should be relieved of the applied load by supporting them at the capacitor body.

Soldering conditions:

max. 265 °C, max. 10 s.

The capacitors are suitable for mounting on printed-circuit boards (hand-mounting or automatic insertion).

Physical dimensions

Table 1 Capacitor dimensions and mass

SIZE[1]	W[2] (mm)	H[2] (mm)		MASS (g)
		STYLE 1	STYLE 2	
I	3.6 (–1.1)	5.0 (–1.5)	6.3 (–1.8)	≈0.14
IIA	3.9 (–1.4)	5.3 (–1.7)	6.7 (–2.0)	≈0.15
IIB	4.5 (–1.8)	6.0 (–2.1)	7.3 (–2.4)	≈0.15
III	5.3 (–1.8)	6.8 (–2.3)	8.1 (–2.6)	≈0.17
IV	6.2 (–2.0)	7.7 (–2.4)	9.0 (–2.7)	≈0.20
V	6.2 (–2.0)	10.3 (–2.8)	11.2 (–3.1)	≈0.23

Notes

1. Unless indicated in Table 4, the thickness of the capacitors does not exceed 2.3 mm.
2. Tolerances are given between parentheses.

PACKAGING

For details refer to this handbook, chapter *"Miniature ceramic plate capacitors"*, section *"General data"*.

ORDERING INFORMATION

Table 2 Catalogue numbers

PITCH P	LEAD DIAMETER d	STYLE	CATALOGUE NUMBERS[1]			
			BULK PACKED		ON TAPE[2] (REEL)	ON TAPE[2] (AMMOPACK)
			L ≥ 13 mm	L = 4 ±0.5 mm		
2.54 mm (0.1 inch)	0.6 mm (0.024 inch)	1	2222 680	2222 682	2222 678	2222 688 .....
5.08 mm (0.2 inch)	0.6 mm (0.024 inch)	2	2222 681	2222 683	2222 679	2222 689 .....

Notes

1. Catalogue numbers to be completed by adding the last 5 digits for required capacitance value, see Table 4.
2. H_0 = 18.25 mm.

Table 3 Conditions for Table 4; precision capacitors with temperature coefficient NP0, rated voltage 100 V (DC)

DESCRIPTION	VALUE
Capacitance range	1 to 240 pF (E24 series)
Temperature coefficient of the capacitance $\left(\frac{\Delta C}{C\Delta T}\right)$	0×10^{-6}/K
Tolerance on the temperature coefficient	$\pm 30 \times 10^{-6}$/K
Marking colour of the temperature coefficient	black

Table 4 Precision capacitance range, temperature coefficient NP0

CAPACITANCE VALUE(1) (pF)	TOLERANCE(1)	SIZE (see Table 1)	MARKING	SUFFIX OF CATALOGUE NUMBER (see Table 2)
1.0	±0.1 pF	I(2)	1p0	90108
1.1	±0.1 pF	I	1p1	90118
1.2	±0.1 pF	I	1p2	90128
1.3	±0.1 pF	I	1p3	90138
1.5	±0.1 pF	I	1p5	90158
1.6	±0.1 pF	I	1p6	90168
1.8	±0.1 pF	I	1p8	90188
2.0	±0.1 pF	I	2p0	90208
2.2	±0.1 pF	I	2p2	90228
2.4	±0.1 pF	I	2p4	90248
2.7	±0.1 pF	I	2p7	90278
3.0	±0.1 pF	I	3p0	90308
3.3	±0.1 pF	I	3p3	90338
3.6	±0.1 pF	I	3p6	90368
3.9	±0.1 pF	I	3p9	90398
4.3	±0.1 pF	I	4p3	90438
4.7	±0.1 pF	I	4p7	90478
5.1	±0.1 pF	I	5p1	90518
5.6	±0.1 pF	I	5p6	90568
6.2	±0.1 pF	I	6p2	90628
6.8	±0.1 pF	I	6p8	90688
7.5	±0.1 pF	I	7p5	90758
8.2	±0.1 pF	I	8p2	90828
10	±0.1 pF	I	10p	90109
11	±1%	I	11p	90119
12	±1%	I	12p	90129
13	±1%	I	13p	90139
15	±1%	I	15p	90159
16	±1%	I	16p	90169

CAPACITANCE VALUE[1] (pF)	TOLERANCE[1]	SIZE (see Table 1)	MARKING	SUFFIX OF CATALOGUE NUMBER (see Table 2)
18	±1%	I	18p	90189
20	±1%	I	20p	90209
22	±1%	I	22p	90229
24	±1%	I	24p	90249
27	±1%	I	27p	90279
30	±1%	I	30p	90309
33	±1%	I	33p	90339
36	±1%	IIA	36p	90369
39	±1%	IIA	39p	90399
43	±1%	IIA	43p	90439
47	±1%	IIA	47p	90479
51	±1%	IIA	51p	90519
56	±1%	IIA	56p	90569
62	±1%	IIB	62p	90629
68	±1%	IIB	68p	90689
75	±1%	IIB	75p	90759
82	±1%	IIB	82p	90829
100	±1%	III	n10	90101
110	±1%	III	n11	90111
120	±1%	III	n12	90121
130	±1%	IV	n13	90131
150	±1%	IV	n15	90151
160	±1%	IV	n16	90161
180	±1%	IV	n18	90181
200	±1%	V	n20	90201
220	±1%	V	n22	90221
240	±1%	V	n24	90241

Notes

1. Other capacitance values and tolerances are available on request.
2. Maximum thickness 2.5 mm.

ELECTRICAL CHARACTERISTICS

The capacitors meet the essential requirements of *"IEC 60384-8"*. Unless stated otherwise 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 values (note 1) measured at 1 MHz, ≤5 V	see Table 4
Rated DC voltage	100 V
DC test voltage; duration 1 minute	300 V
DC test voltage of coating; duration 1 minute	300 V
Insulation resistance at 100 V (DC) after 1 minute	≥10000 MΩ
Tan δ (note 1) measured at 1 MHz, ≤5 V:	
$C \leq 50$ pF	$\leq 10\left(\frac{15}{C}+0.7\right)\times 10^{-4}$; $<20\times 10^{-4}$
$C > 50$ pF	$\leq 10\times 10^{-4}$
Category temperature range	−55 to +150 °C
Climatic category (IEC 60068)	55/150/56

Note

1. Including 2 mm per connecting lead.

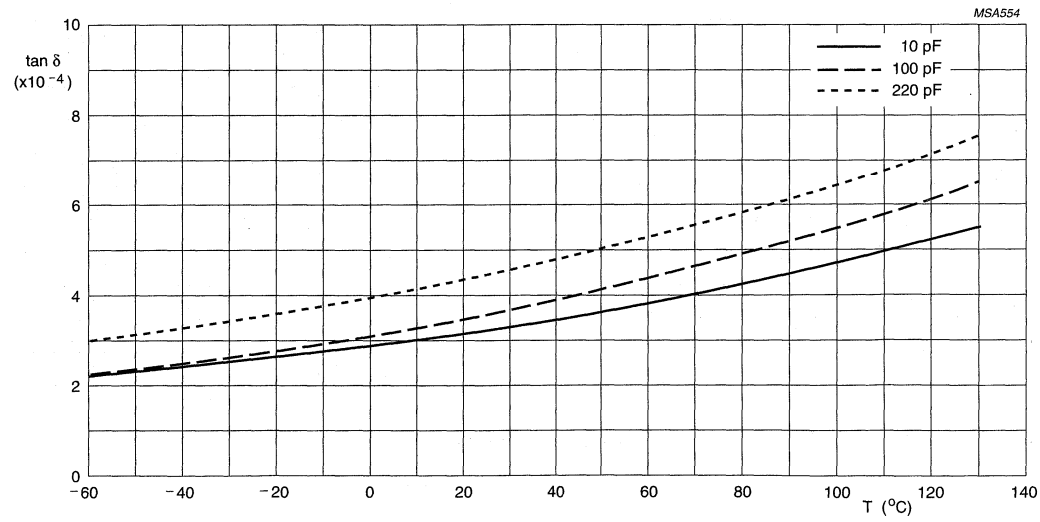
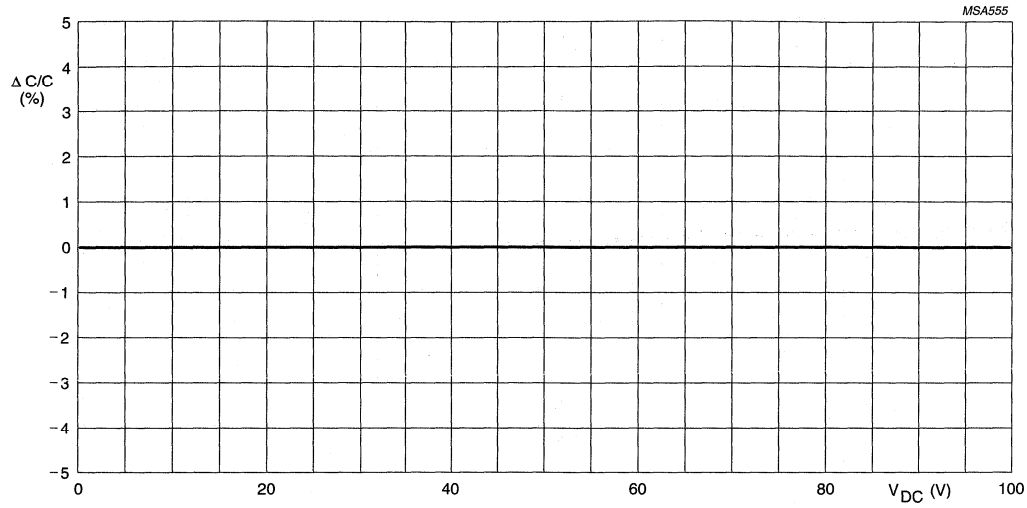


Fig.5 Typical tan δ as a function of temperature.



Reference values at 1 MHz.
Measurements made at 1 V, including 2 mm per connecting lead.

Fig.6 Typical capacitance change as function of DC voltage.

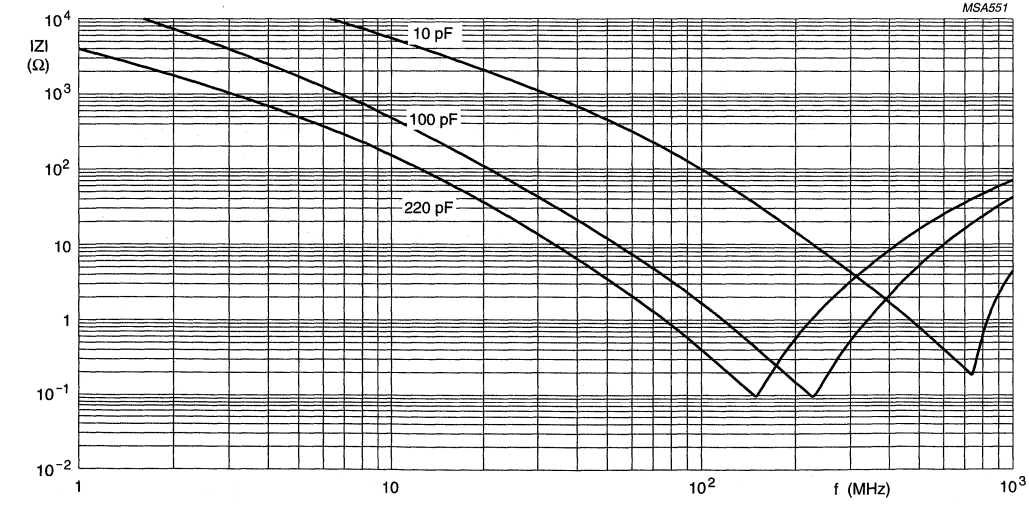
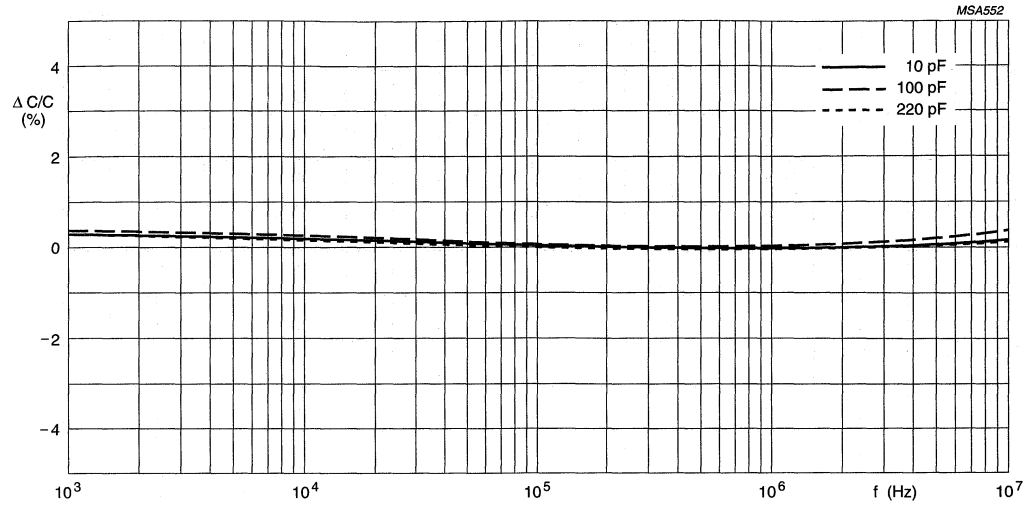


Fig.7 Typical impedance |Z| as a function of frequency.



Reference values at 1 MHz.
Measurements made at 1 V, including 2 mm per connecting lead.

Fig.8 Typical capacitance change as function of frequency.

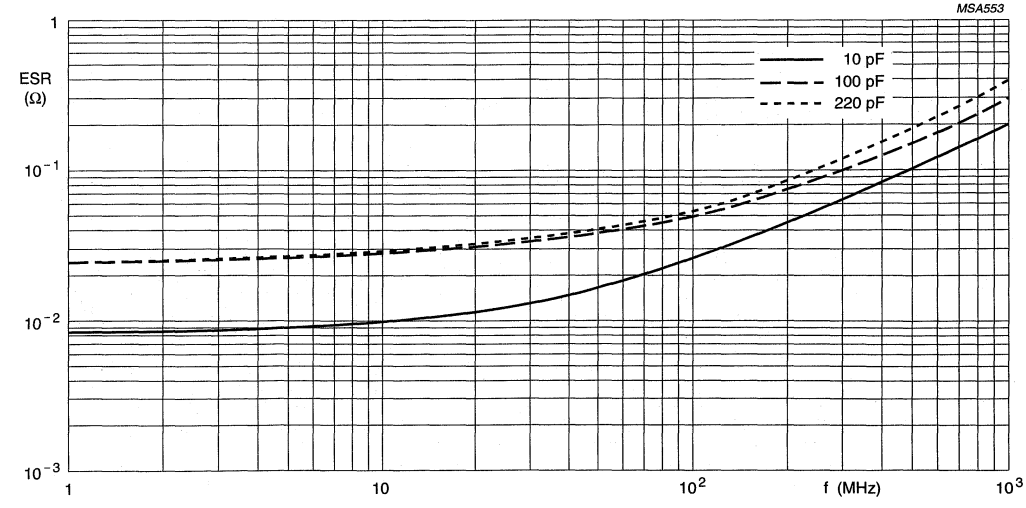


Fig.9 Equivalent series resistance (ESR) as a function of frequency.

Miniature ceramic plate capacitors

Class 1, 100 V (DC) (flanged types)

FEATURES

- High-frequency circuits
- Temperature compensating
- High stability
- Space saving.

APPLICATIONS

In a great variety of electronic circuits, e.g. in filters and tuning circuits where high stability and/or temperature compensation are a requirement. Because of their small size the capacitors are suitable for use in circuitry with high component density.

DESCRIPTION

The capacitors consist of a thin rectangular ceramic plate, both sides of which are metallized, and tinned connecting leads are secured using a high melting point solder. The capacitors are encapsulated in epoxy lacquer, which is resistant to all commonly used cleaning solvents. They have small dimensions and narrow tolerances on the lead spacing. The leads are provided with a flange, which guarantees that the leads are free of lacquer, and its shape allows soldering gasses to escape freely, ensuring excellent solderability. This makes the capacitors suitable for both hand-mounting and automatic insertion. The electrical properties are characterized by low losses, a narrow tolerance on capacitance (±0.25 pF or 2%), high stability and, owing to the absence of silver, an extremely good DC behaviour.

QUICK REFERENCE DATA

DESCRIPTION	VALUE
Capacitance range (E12 series)	0.56 to 560 pF
Rated DC voltage	100 V
Tolerance on capacitance	±2% or ±0.25 pF
Temperature coefficients	P100, NP0, N150, N750 and N1500; note 1
Sectional specification	IEC 60384-8
Climatic category (IEC 60068)	55/085/21 (N150, N750); 55/125/56 (P100, NP0, N1500)

Note

1. N075, N220, N330, N470 available on request.

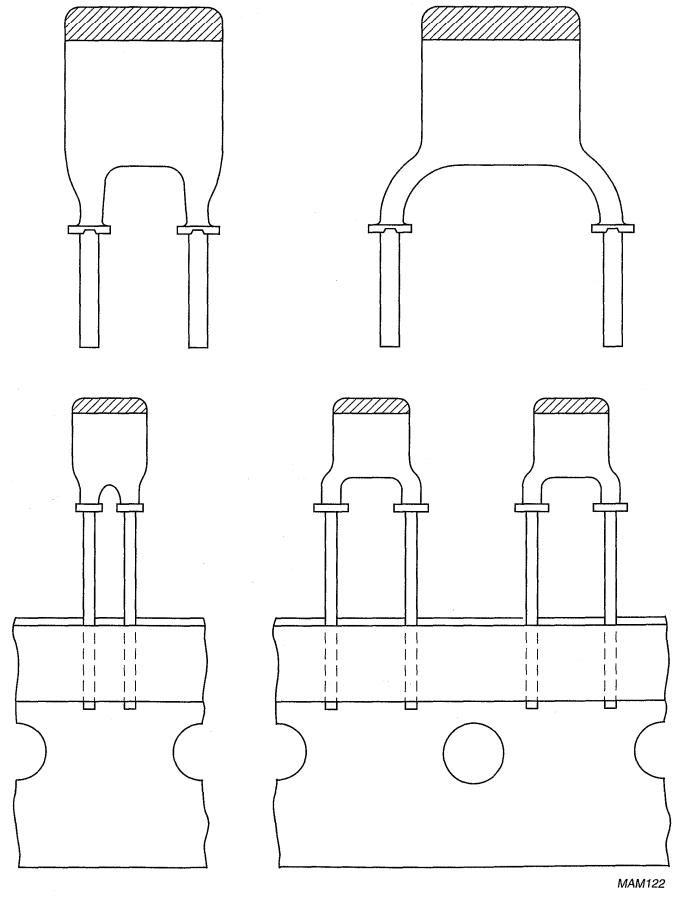
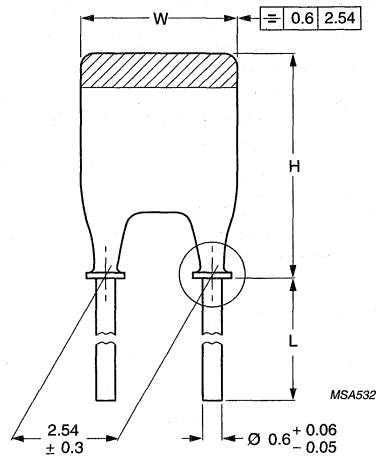


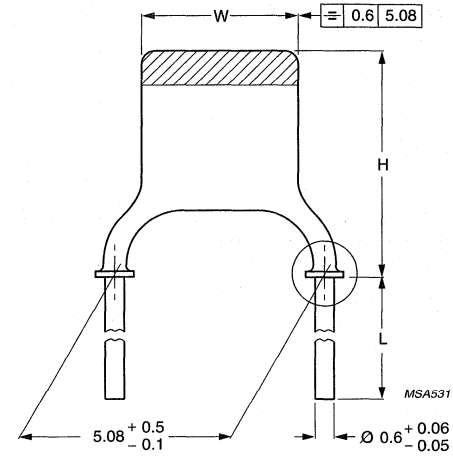
Fig.1 Outlines.

MECHANICAL DATA



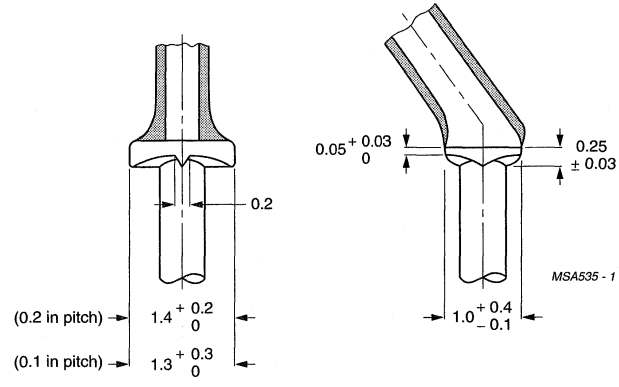
Dimensions in mm.
For dimensions H, L and W see Tables 1 and 2.

Fig.2 Component outline style 1.



Dimensions in mm.
For dimensions H, L and W see Tables 1 and 2.

Fig.3 Component outline style 2.



Dimensions in mm.

Fig.4 Detail of flange.

Marking

The temperature coefficient is indicated by a colour code in accordance with IEC and EIA recommendations. Capacitance value is indicated by a marking code in a contrasting colour on the body. Refer to Tables 3 to 12, for colour and marking codes.

Mounting

When bending, cutting or flattening, the leads should be relieved of the applied load by supporting them at the capacitor body.

Soldering conditions:

max. 265 °C, max. 10 s.

The capacitors are suitable for mounting on printed-circuit boards (hand-mounting or automatic insertion).

Physical dimensions

Table 1 Capacitor dimensions and mass

SIZE[1]	W[2] (mm)	H[2] (mm)		MASS (g)
		STYLE 1	STYLE 2	
I	3.6 (–1.1)	5.0 (–1.5)	6.3 (–1.8)	≈0.14
IIA	3.9 (–1.4)	5.3 (–1.7)	6.7 (–2.0)	≈0.15
IIB	4.5 (–1.8)	6.0 (–2.1)	7.3 (–2.4)	≈0.15
III	5.3 (–1.8)	6.8 (–2.3)	8.1 (–2.6)	≈0.17
IV	6.2 (–2.0)	7.7 (–2.4)	9.0 (–2.7)	≈0.20
V	6.2 (–2.0)	10.3 (–2.8)	11.2 (–3.1)	≈0.23

Notes

1. Unless indicated in Tables 4 to 12, the thickness of the capacitors does not exceed 2.3 mm.
2. Tolerances are given between parentheses.

PACKAGING

For details refer to this handbook, chapter *"Miniature ceramic plate capacitors"*, section *"General data"*.

ORDERING INFORMATION

Table 2 Catalogue numbers

PITCH P	LEAD DIAMETER d	STYLE	CATALOGUE NUMBERS[1]			
			BULK PACKED		ON TAPE[2] (REEL)	ON TAPE[2] (AMMOPACK)
			L ≥ 13 mm	L = 4 ±0.5 mm		
2.54 mm (0.1 inch)	0.6 mm (0.024 inch)	1	2222 680	2222 682	2222 678	2222 688 .....
5.08 mm (0.2 inch)	0.6 mm (0.024 inch)	2	2222 681	2222 683	2222 679	2222 689 .....

Notes

1. Catalogue numbers to be completed by adding the last 5-digit suffix for required capacitance value, see Tables 4 to 12.
2. H_0 = 18.25 mm.

Table 3 Conditions for Table 4; capacitors with temperature coefficient **P100 (M7G)**, rated voltage 100 V (DC)

DESCRIPTION	VALUE
Capacitance range	0.56 to 47 pF (E12 series)
Temperature coefficient of the capacitance $\left(\frac{\Delta C}{C \Delta T}\right)$	100×10^{-6}/K
Tolerance on the temperature coefficient	$\pm 30 \times 10^{-6}$/K
Marking colour of the temperature coefficient	red/violet
Climatic category (IEC 60068)	55/125/56

Table 4 **Preferred** capacitance range, temperature coefficient **P100 (M7G)**

CAPACITANCE VALUE(1) (pF)	TOLERANCE	SIZE (see Table 1)	MARKING	SUFFIX OF CATALOGUE NUMBER (see Table 2)
0.56	±0.25 pF	I(2)	p56	03567
0.68	±0.25 pF	I(2)	p68	03687
0.82	±0.25 pF	I(2)	p82	03827
1.0	±0.25 pF	I(3)	1p0	03108
1.2	±0.25 pF	I	1p2	03128
1.5	±0.25 pF	I	1p5	03158
1.8	±0.25 pF	I	1p8	03188
2.2	±0.25 pF	I	2p2	03228
2.7	±0.25 pF	I	2p7	03278
3.3	±0.25 pF	I	3p3	03338
3.9	±0.25 pF	I	3p9	03398
4.7	±0.25 pF	I	4p7	03478
5.6	±0.25 pF	I	5p6	03568
6.8	±0.25 pF	I	6p8	03688
8.2	±0.25 pF	IIA	8p2	03828
10	±2%	IIA	10p	04109
12	±2%	IIB	12p	04129
15	±2%	IIB	15p	04159
18	±2%	III	18p	04189
22	±2%	III	22p	04229
27	±2%	IV	27p	04279
33	±2%	IV	33p	04339
39	±2%	V	39p	04399
47	±2%	V	47p	04479

Notes

1. Other capacitance values and tolerances are available on request.
2. Maximum thickness 2.7 mm.
3. Maximum thickness 2.5 mm.

Table 5 Conditions for Table 6; capacitors with temperature coefficient **NP0 (C0G)**, rated voltage 100 V (DC)

DESCRIPTION	VALUE
Capacitance range	1.8 to 220 pF (E12 series)
Temperature coefficient of the capacitance $\left(\frac{\Delta C}{C\Delta T}\right)$	0×10^{-6}/K
Tolerance on the temperature coefficient	$\pm 30 \times 10^{-6}$/K
Marking colour of the temperature coefficient	black
Climatic category (IEC 60068)	55/125/56

Table 6 **Preferred** capacitance range, temperature coefficient **NP0 (C0G)**

CAPACITANCE VALUE(1) (pF)	TOLERANCE	SIZE (see Table 1)	MARKING	SUFFIX OF CATALOGUE NUMBER (see Table 2)
1.8	±0.25 pF	I(2)	1p8	09188
2.2	±0.25 pF	I	2p2	09228
2.7	±0.25 pF	I	2p7	09278
3.3	±0.25 pF	I	3p3	09338
3.9	±0.25 pF	I	3p9	09398
4.7	±0.25 pF	I	4p7	09478
5.6	±0.25 pF	I	5p6	09568
6.8	±0.25 pF	I	6p8	09688
8.2	±0.25 pF	I	8p2	09828
10	±2%	I	10p	10109
12	±2%	I	12p	10129
15	±2%	I	15p	10159
18	±2%	I	18p	10189
22	±2%	I	22p	10229
27	±2%	I	27p	10279
33	±2%	I	33p	10339
39	±2%	IIA	39p	10399
47	±2%	IIA	47p	10479
56	±2%	IIA	56p	10569
68	±2%	IIB	68p	10689
82	±2%	IIB	82p	10829
100	±2%	III	n10	10101
120	±2%	III	n12	10121
150	±2%	IV	n15	10151
180	±2%	IV	n18	10181
220	±2%	V	n22	10221

Notes

1. Other capacitance values and tolerances are available on request.
2. Maximum thickness 2.5 mm.

Table 7 Conditions for Table 8; capacitors with temperature coefficient **N150 (P2G)**, rated voltage 100 V (DC)

DESCRIPTION	VALUE
Capacitance range	3.9 to 220 pF (E12 series)
Temperature coefficient of the capacitance $\left(\frac{\Delta C}{C\Delta T}\right)$	-150×10^{-6}/K
Tolerance on the temperature coefficient	$\pm 30 \times 10^{-6}$/K
Marking colour of the temperature coefficient	orange
Climatic category (IEC 60068)	55/085/21

Table 8 **Preferred** capacitance range, temperature coefficient **N150 (P2G)**

CAPACITANCE VALUE[1] (pF)	TOLERANCE	SIZE (see Table 1)	MARKING	SUFFIX OF CATALOGUE NUMBER (see Table 2)
3.9	±0.25 pF	I[2]	3p9	33398
4.7	±0.25 pF	I	4p7	33478
5.6	±0.25 pF	I	5p6	33568
6.8	±0.25 pF	I	6p8	33688
8.2	±0.25 pF	I	8p2	33828
10	±2%	I	10p	34109
12	±2%	I	12p	34129
15	±2%	I	15p	34159
18	±2%	I	18p	34189
22	±2%	I	22p	34229
27	±2%	I	27p	34279
33	±2%	I	33p	34339
39	±2%	IIA	39p	34399
47	±2%	IIA	47p	34479
56	±2%	IIB	56p	34569
68	±2%	IIB	68p	34689
82	±2%	III	82p	34829
100	±2%	III	n10	34101
120	±2%	IV	n12	34121
150	±2%	IV	n15	34151
180	±2%	IV	n18	34181
220	±2%	V	n22	34221

Notes

1. Other capacitance values and tolerances are available on request.
2. Maximum thickness 2.5 mm.

Table 9 Conditions for Table 10; capacitors with temperature coefficient **N750 (U2J)**, rated voltage 100 V (DC)

DESCRIPTION	VALUE
Capacitance range	3.9 to 330 pF (E12 series)
Temperature coefficient of the capacitance $\left(\frac{\Delta C}{C\Delta T}\right)$	-750×10^{-6}/K
Tolerance on the temperature coefficient	$\pm 120 \times 10^{-6}$/K
Marking colour of the temperature coefficient	violet
Climatic category (IEC 60068)	55/085/21

Table 10 Preferred capacitance range, temperature coefficient **N750 (U2J)**

CAPACITANCE VALUE[1] (pF)	TOLERANCE	SIZE (see Table 1)	MARKING	SUFFIX OF CATALOGUE NUMBER (see Table 2)
3.9	±0.25 pF	I[2]	3p9	57398
4.7	±0.25 pF	I	4p7	57478
5.6	±0.25 pF	I	5p6	57568
6.8	±0.25 pF	I	6p8	57688
8.2	±0.25 pF	I	8p2	57828
10	±2%	I	10p	58109
12	±2%	I	12p	58129
15	±2%	I	15p	58159
18	±2%	I	18p	58189
22	±2%	I	22p	58229
27	±2%	I	27p	58279
33	±2%	I	33p	58339
39	±2%	I	39p	58399
47	±2%	I	47p	58479
56	±2%	IIA	56p	58569
68	±2%	IIA	68p	58689
82	±2%	IIB	82p	58829
100	±2%	IIB	n10	58101
120	±2%	III	n12	58121
150	±2%	III	n15	58151
180	±2%	IV	n18	58181
220	±2%	IV	n22	58221
270	±2%	V	n27	58271
330	±2%	V	n33	58331

Notes

1. Other capacitance values and tolerances are available on request.
2. Maximum thickness 2.5 mm.

Table 11 Conditions for Table 12; capacitors with temperature coefficient **N1500 (P3K)**, rated voltage 100 V (DC)

DESCRIPTION	VALUE
Capacitance range	18 to 560 pF (E12 series)
Temperature coefficient of the capacitance $\left(\frac{\Delta C}{C\Delta T}\right)$	-1500×10^{-6}/K
Tolerance on the temperature coefficient	$(0 \text{ to } +500) \times 10^{-6}$/K
Marking colour of the temperature coefficient	orange/orange
Climatic category (IEC 60068)	55/125/56

Table 12 Preferred capacitance range, temperature coefficient **N1500 (P3K)**

CAPACITANCE VALUE[1] (pF)	TOLERANCE	SIZE (see Table 1)	MARKING	SUFFIX OF CATALOGUE NUMBER (see Table 2)
18	±2%	I[2]	18p	70189
22	±2%	I	22p	70229
27	±2%	I	27p	70279
33	±2%	I	33p	70339
39	±2%	I	39p	70399
47	±2%	I	47p	70479
56	±2%	I	56p	70569
68	±2%	I	68p	70689
82	±2%	I	82p	70829
100	±2%	IIA	n10	70101
120	±2%	IIA	n12	70121
150	±2%	IIB	n15	70151
180	±2%	IIB	n18	70181
220	±2%	III	n22	70221
270	±2%	III	n27	70271
330	±2%	IV	n33	70331
390	±2%	IV	n39	70391
470	±2%	V	n47	70471
560	±2%	V	n56	70561

Notes

1. Other capacitance values and tolerances are available on request.
2. Maximum thickness 2.5 mm.

ELECTRICAL CHARACTERISTICS

The capacitors meet the essential requirements of *"IEC 60384-8"*. Unless stated otherwise 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 values (note 1) measured at 1 MHz, ≤5 V	see Tables 4 to 12
Rated DC voltage	100 V
DC test voltage; duration 1 minute	300 V
DC test voltage of coating; duration 1 minute	300 V
Insulation resistance at 100 V (DC) after 1 minute	≥10000 MΩ
Tan δ (note 1) measured at 1 MHz, ≤5 V:	
$C \leq 50$ pF	$\leq 15\left(\frac{15}{C}+0.7\right)\times 10^{-4}$; $<55\times 10^{-4}$
$C > 50$ pF	$\leq 15\times 10^{-4}$
Category temperature range	–55 to +85 °C (N150, N750); –55 to +125 °C (P100, NP0, N1500)
Storage temperature range	–55 to +85 °C

Note

1. Including 2 mm per connecting lead.

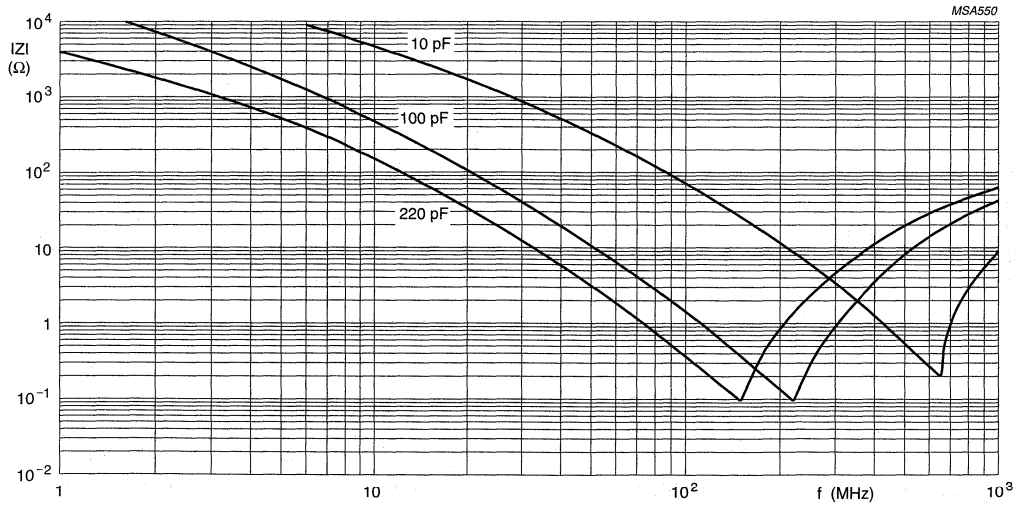


Fig.5 Typical impedance |Z| as a function of frequency.

Miniature ceramic plate capacitors

Class 2, 63 V and 100 V (DC) (flanged types)

FEATURES

- General purpose
- Coupling and decoupling
- Space saving.

APPLICATIONS

In electronic circuits where non-linear change of capacitance with temperature is permissible and low losses are not essential, i.e. coupling and decoupling. Because of their small size the capacitors are suitable for use in circuitry with high component density.

DESCRIPTION

The capacitors consist of a thin rectangular ceramic plate, both sides of which are metallized. The tinned connecting leads are secured using a high melting point solder. The capacitors are encapsulated in epoxy lacquer, which is resistant to all commonly used cleaning solvents. They have small dimensions and narrow tolerances on the lead spacing. The leads are provided with a flange, which guarantees that the leads are free of lacquer, and its shape allows soldering gasses to escape freely, ensuring excellent solderability. This makes the capacitors suitable for both hand-mounting and automatic insertion.

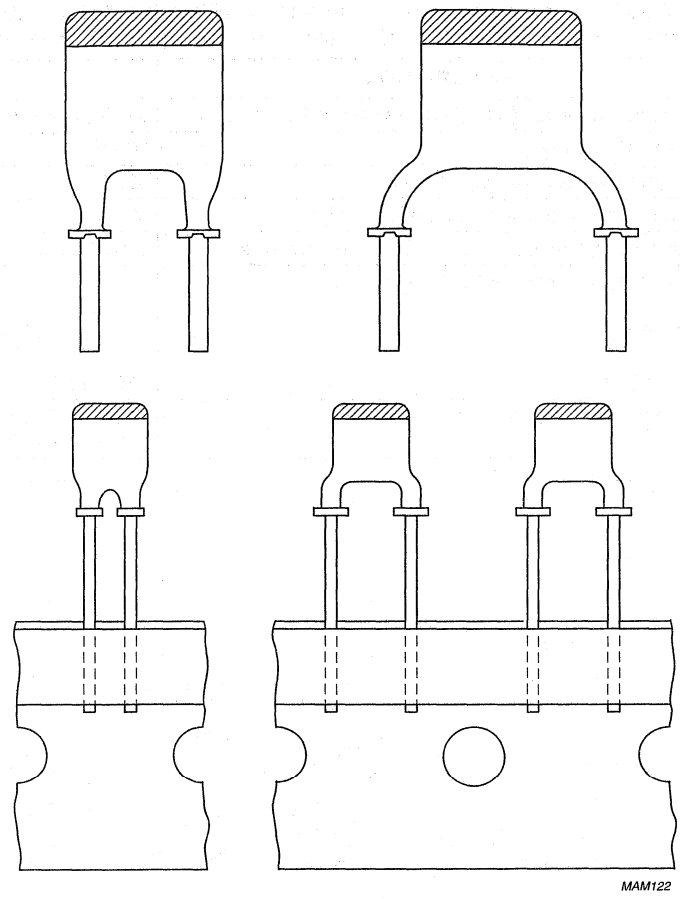
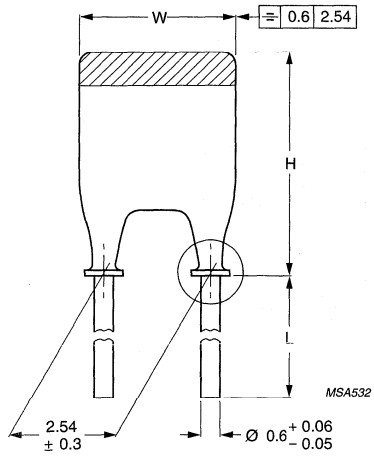


Fig.1 Outlines.

QUICK REFERENCE DATA

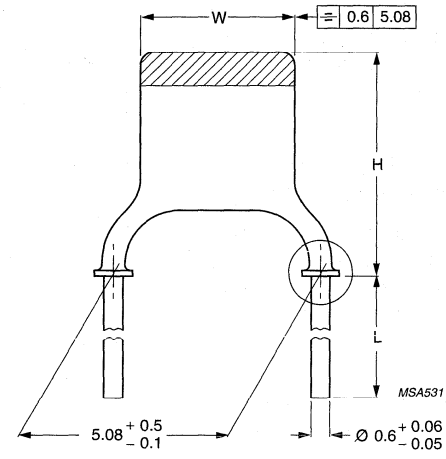
DESCRIPTION	VALUE		
	2222 630	2222 640	2222 629 .....
Capacitance range	180 to 6800 pF (E12 series)	1000 to 15000 pF (E6 series)	1000 to 47000 pF (E3 series)
Dielectric material	K2000	K5000	K14000
Rated DC voltage	100 V	100 V	63 V
Tolerance on capacitance	±10%	+50%/–20%	+80%/–20%
Sectional specification	IEC 60384-9 (2C2 and 2D1); EIA (X5S/X7T)	IEC 60384-9 (2E2); EIA (X5U)	IEC 60384-9 (2F6); EIA (Y5V)
Climatic category (IEC 60068)	55/125/56	55/105/21	10/085/21

MECHANICAL DATA



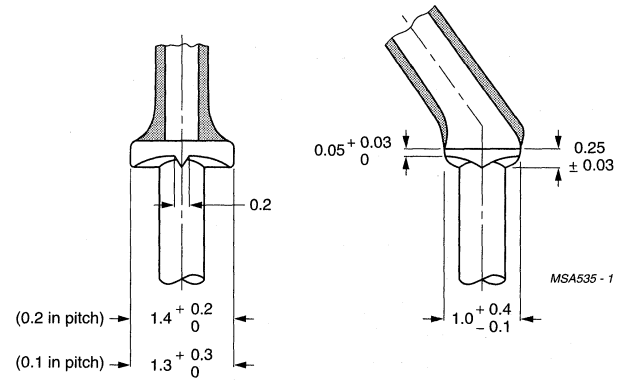
Dimensions in mm.
For dimensions H, L and W see Tables 1 and 2.

Fig.2 Component outline style 1.



Dimensions in mm.
For dimensions H, L and W see Tables 1 and 2.

Fig.3 Component outline style 2.



Dimensions in mm.

Fig.4 Detail of flange.

Miniature ceramic plate capacitors

Class 2, 63 V and 100 V (DC) (flanged types)

Marking

The body of the capacitor is tan coloured. The capacitors also have a colour mark on top indicating the temperature dependency of the capacitance:

yellow for type 2222 630 .....

blue for type 2222 640 .....

green for type 2222 629 .....

The capacitance value is indicated by a marking code in a contrasting colour on the body. Refer to Tables 3, 4 and 5 for marking codes.

Mounting

When bending, cutting or flattening, the leads should be relieved of the applied load by supporting them at the capacitor body.

Soldering conditions:

max. 265 °C, max. 10 s.

The capacitors are suitable for mounting on printed-circuit boards (hand-mounting or automatic insertion).

Physical dimensions

Table 1 Capacitor dimensions and mass

SIZE[1]	W[2] (mm)	H[2] (mm)		MASS (g)
		STYLE 1	STYLE 2	
I	3.6 (–1.1)	5.0 (–1.5)	6.3 (–1.8)	≈0.14
IIA	3.9 (–1.4)	5.3 (–1.7)	6.7 (–2.0)	≈0.15
IIB	4.5 (–1.8)	6.0 (–2.1)	7.3 (–2.4)	≈0.15
III	5.3 (–1.8)	6.8 (–2.3)	8.1 (–2.6)	≈0.17
IV	6.2 (–2.0)	7.7 (–2.4)	9.0 (–2.7)	≈0.20
V	6.2 (–2.0)	10.3 (–2.8)	11.2 (–3.1)	≈0.23

Notes

1. Unless indicated in Tables 3, 4 and 5, the thickness of the capacitors does not exceed 2.3 mm.
2. Tolerances are given between parentheses.

PACKAGING

For details refer to this handbook, chapter *"Miniature ceramic plate capacitors"*, section *"General data"*.

ORDERING INFORMATION

Table 2 Catalogue numbers

PITCH P	LEAD DIAMETER d	STYLE	CATALOGUE NUMBERS[1]			
			BULK PACKED		ON TAPE[2] (REEL)	ON TAPE[2] (AMMOPACK)
			L ≥ 13 mm	L = 4 ±0.5 mm		
2.54 mm (0.1 inch)	0.6 mm (0.024 inch)	1	2222 630 08...	2222 630 18...	2222 630 51...	2222 630 61...
			2222 640 08...	2222 640 18...	2222 640 51...	2222 640 61...
			2222 629 08...	2222 629 18...	2222 629 51...	2222 629 61...
5.08 mm (0.2 inch)	0.6 mm (0.024 inch)	2	2222 630 09...	2222 630 19...	2222 630 53...	2222 630 63...
			2222 640 09...	2222 640 19...	2222 640 53...	2222 640 63...
			2222 629 09...	2222 629 19...	2222 629 53...	2222 629 63...

Notes

1. Catalogue number to be completed by adding the 3-digit suffix for required capacitance value, see Tables 3, 4 and 5.
2. H_0 = 18.25 mm.

Table 3 **Preferred** capacitance range for **2222 630 .....**

CAPACITANCE VALUE (pF)	SIZE (see Table 1)	MARKING	SUFFIX OF CATALOGUE NUMBER (see Table 2)
180	I[1]	n18	181
220	I[1]	n22	221
270	I	n27	271
330	I	n33	331
390	I	n39	391
470	I	n47	471
560	I	n56	561
680	I	n68	681
820	I	n82	821
1000	I	1n0	102
1200	IIA	1n2	122
1500	IIA	1n5	152
1800	IIB	1n8	182
2200	IIB	2n2	222
2700	III	2n7	272
3300	III	3n3	332
3900	IV	3n9	392
4700	IV	4n7	472
5600	V	5n6	562
6800	V	6n8	682

Note

1. Maximum thickness 2.5 mm.

Table 4 **Preferred** capacitance range for **2222 640 .....**

CAPACITANCE VALUE (pF)	SIZE (see Table 1)	MARKING	SUFFIX OF CATALOGUE NUMBER (see Table 2)
1000	I	1n0	102
1500	I	1n5	152
2200	I	2n2	222
3300	IIA	3n3	332
4700	IIB	4n7	472
6800	III	6n8	682
10000	IV	10n	103
15000	V	15n	153

Table 5 **Preferred** capacitance range for **2222 629 .....**

CAPACITANCE VALUE (pF)	SIZE (see Table 1)	MARKING	SUFFIX OF CATALOGUE NUMBER (see Table 2)
1000	I	1n0	102
2200	I	2n2	222
4700	I	4n7	472
10000	IIB	10n	103
22000	IV	22n	223
47000	V	47n	473

ELECTRICAL CHARACTERISTICS

Capacitors 2222 630 (colour mark yellow)

The capacitors meet the essential requirements of *"IEC 60384-8"* (2C2 and 2D1) *"EIA"* (X5S and X7T). Unless stated otherwise 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 values measured at 1 kHz, 1 V	180 to 6800 pF; E12 series (see Table 3)
Dielectric material	K2000
Tolerance on capacitance, after 1000 hours	±10%
Maximum capacitance change with respect to capacitance value at 20 °C	+20 to −20% (see Fig.5) from −55 to +85 °C; +20 to −30% from −55 to +125 °C
Rated DC voltage	100 V
DC test voltage; duration 1 minute	300 V
DC test voltage of coating; duration 1 minute	300 V
Insulation resistance at 100 V (DC) after 1 minute	≥4 000 MΩ
Tan δ measured at 1 kHz, 1 V	≤3.5%
Maximum voltage dependency of the capacitance between 0 and 40 V	−5%
Category temperature range	−55 to +85 °C (2C2) and −55 to +125 °C (2D1)
Storage temperature range	−55 to +85 °C
Ageing	typical 1.5% per time decade
Climatic category (IEC 60068)	55/125/56

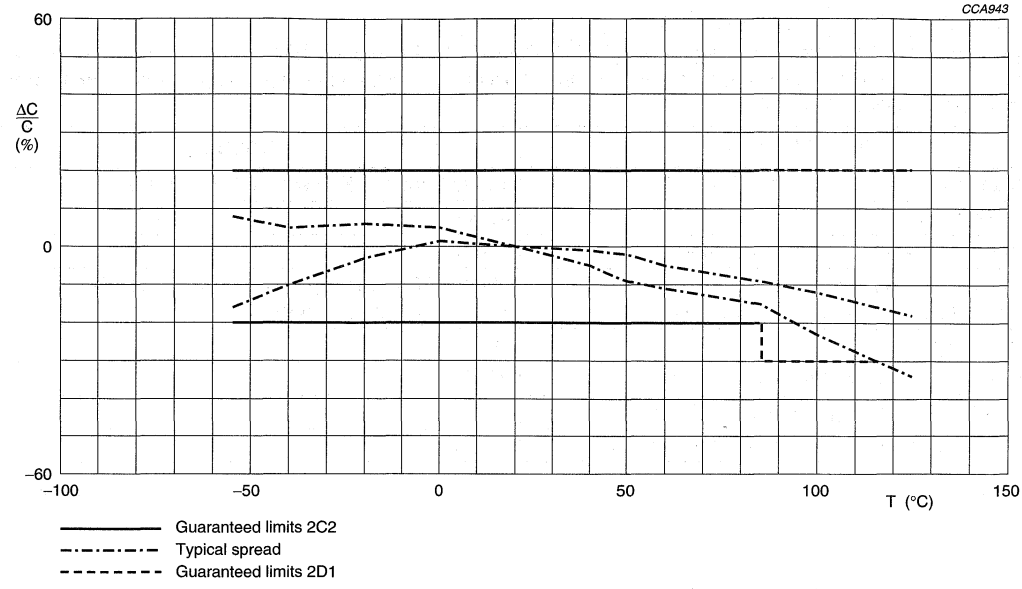
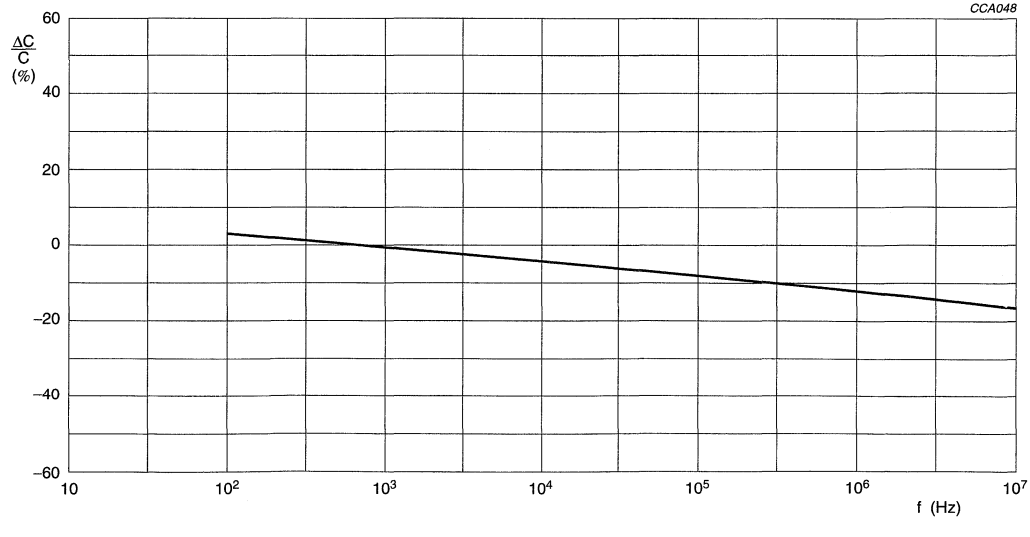
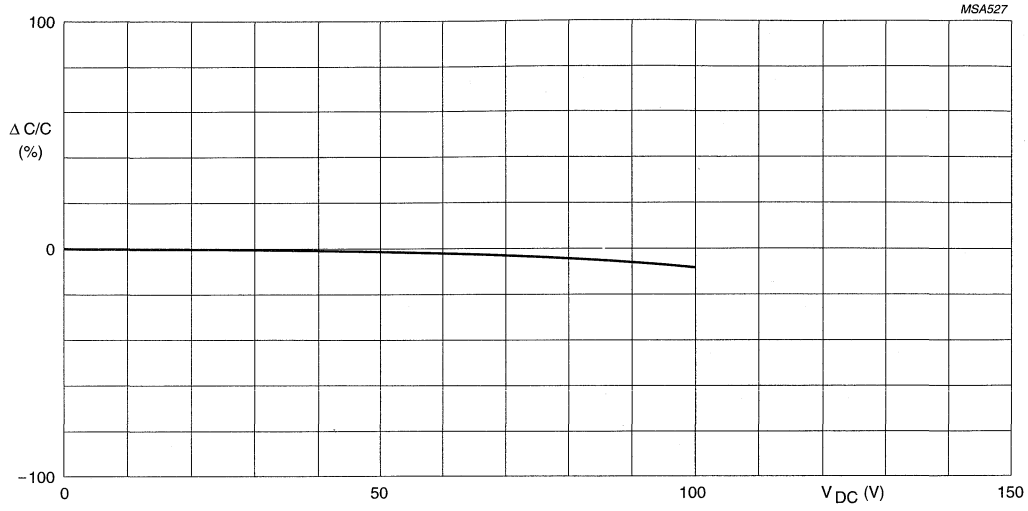


Fig.5 Typical capacitance change with respect to capacitance value at 20 °C as a function of temperature.



U = 1 V.

Fig.6 Typical capacitance change with respect to the capacitance value at 1 kHz as a function of frequency.



f = 1 kHz.
U = 1 V.
T = 20 °C.

Fig.7 Typical capacitance change with respect to the capacitance value at 0 V as a function of DC voltage.

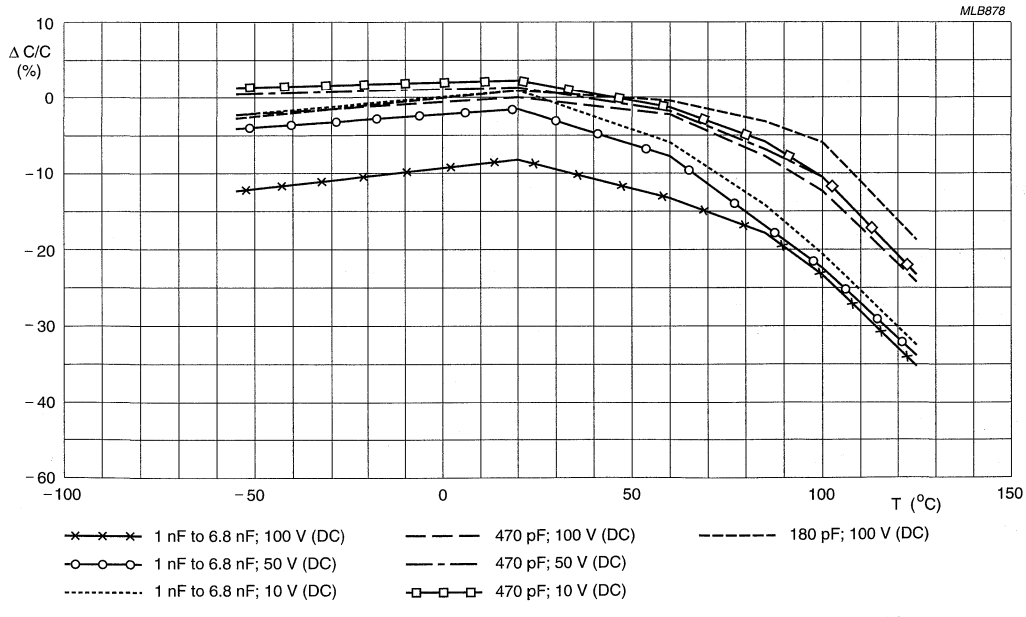
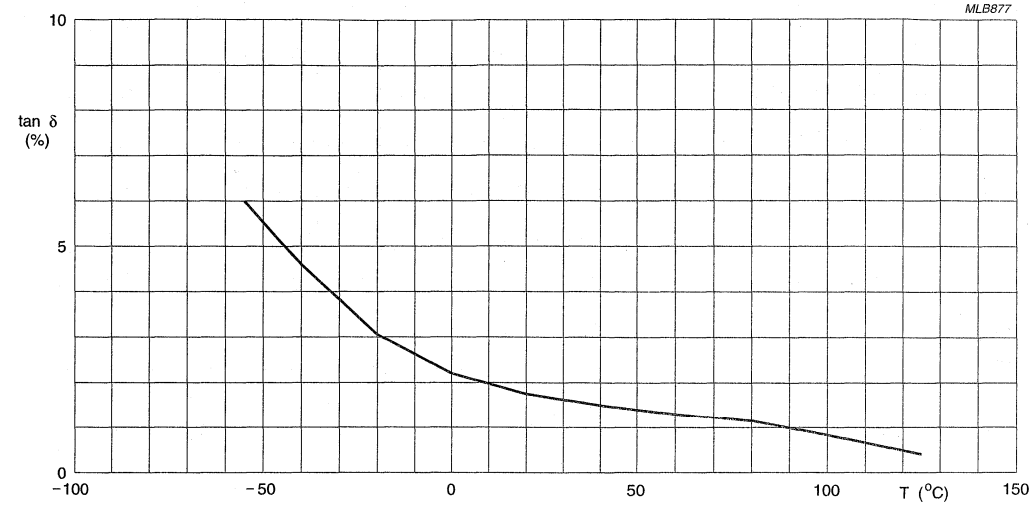


Fig.8 Typical capacitance change with respect to the capacitance value at 0 V and 20 °C as a function of temperature at different DC voltages.



f = 1 kHz.
U = 1 V.

Fig.9 Typical tan δ as a function of temperature.

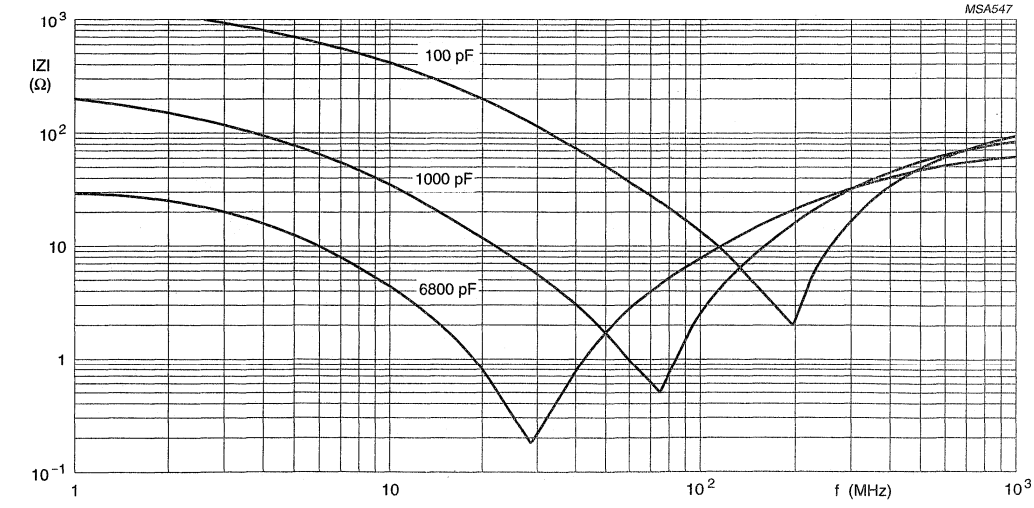
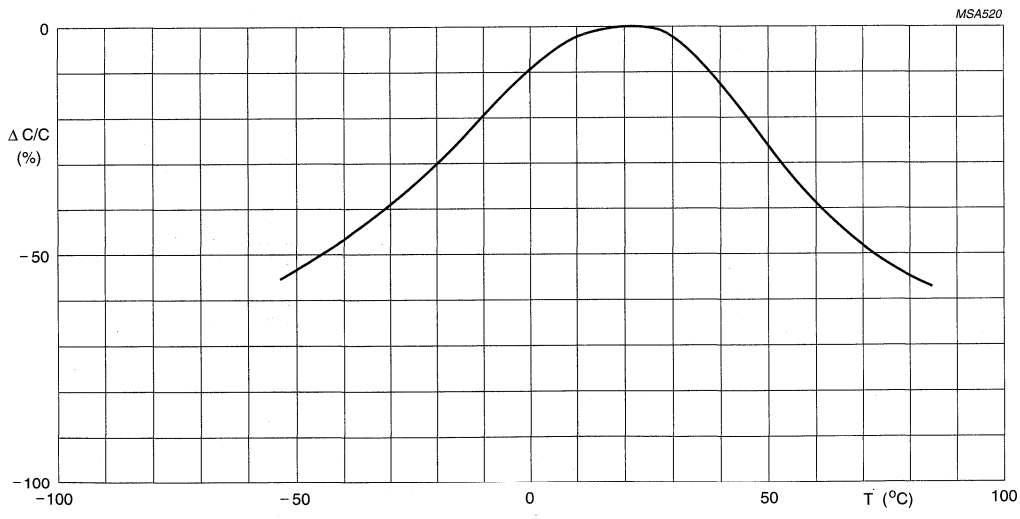


Fig.10 Typical impedance |Z| as a function of frequency.

Capacitors 2222 640 (colour mark blue)

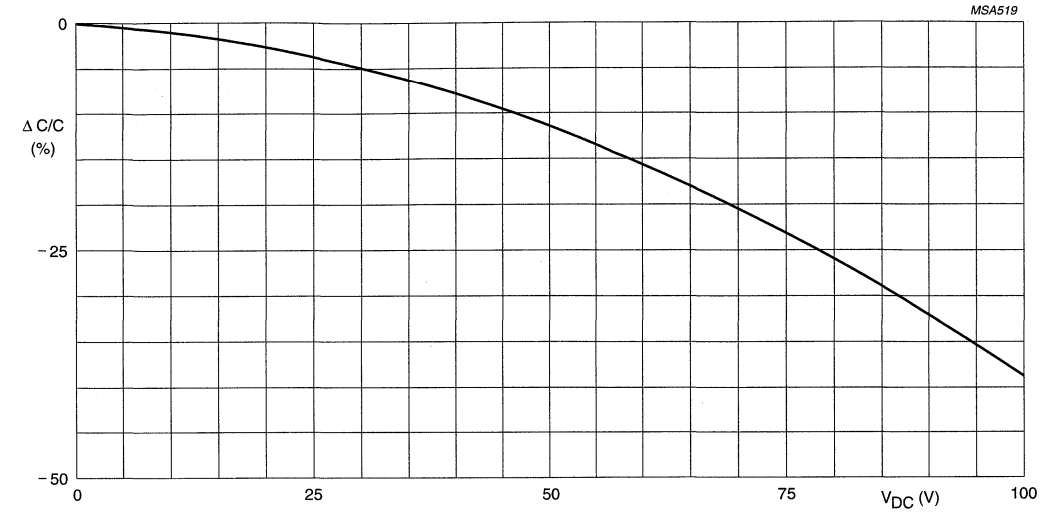
The capacitors meet the essential requirements of *"IEC 60384-9"* (2E2), *"EIA"* (X5U). Unless stated otherwise all electrical values apply at an ambient temperature of 20 ±1 °C, an atmospheric pressure of 86 to 106 kPa and a relative humidity of 63 to 67%.

DESCRIPTION	VALUE
Capacitance values measured at 1 kHz, 1 V	1000 to 15000 pF; E6 series (see Table 4)
Tolerance on capacitance, after 1000 hours	–20 to +50%
Dielectric material	K5000
Maximum capacitance change with respect to capacitance value at 20 °C	+20 to –55% (see Fig.11)
Rated DC voltage	100 V
DC test voltage; duration 1 minute	300 V
DC test voltage of coating; duration 1 minute	300 V
Insulation resistance at 100 V (DC) after 1 minute	≥4000 MΩ
Tan δ measured at 1 kHz, 1 V	≤3.5%
Category temperature range	–55 to +105 °C
Storage temperature range	–55 to +85 °C
Ageing	typical 5% per time decade
Climatic category (IEC 60068)	55/105/21



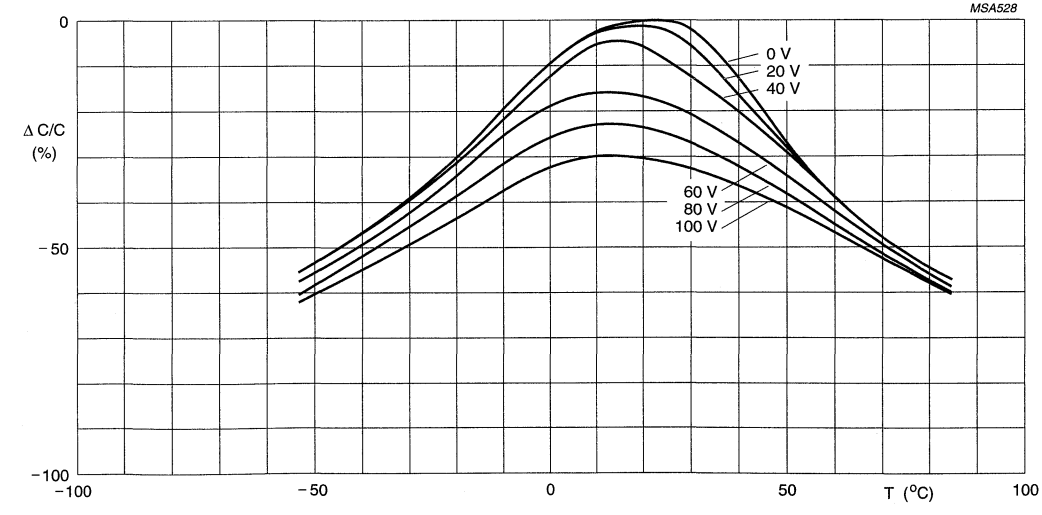
f = 1 kHz.
U = 1 V.

Fig.11 Maximum capacitance change with respect to capacitance value at 20 °C as a function of temperature.



f = 1 kHz.
U = 1 V.

Fig.12 Typical capacitance change with respect to capacitance value at 20 °C as a function of DC voltage.



f = 1 kHz.
U = 1 V.

Fig.13 Typical capacitance change with respect to the capacitance value at 0 V and 20 °C as a function of temperature at different DC voltages.

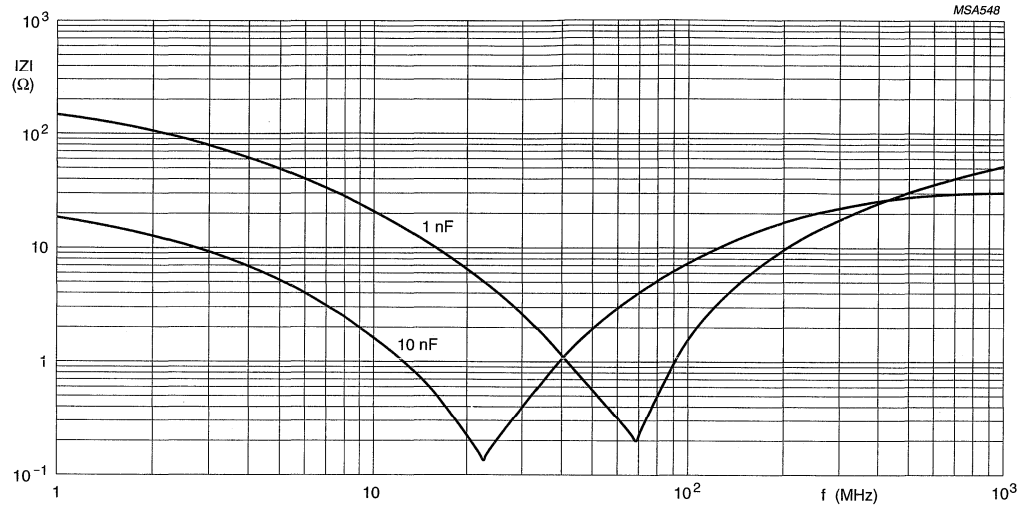
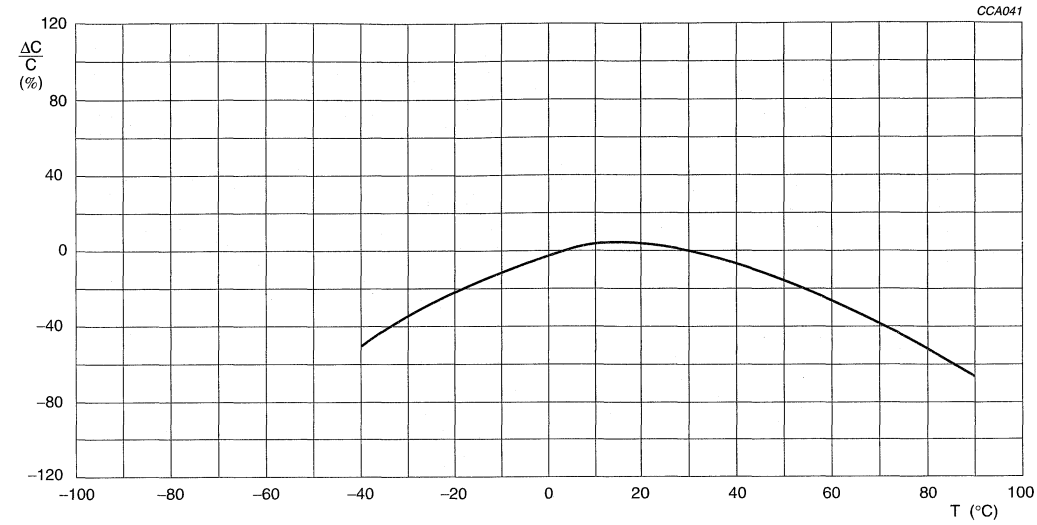


Fig.14 Typical impedance |Z| as a function of frequency.

Capacitors 2222 629 (colour mark green)

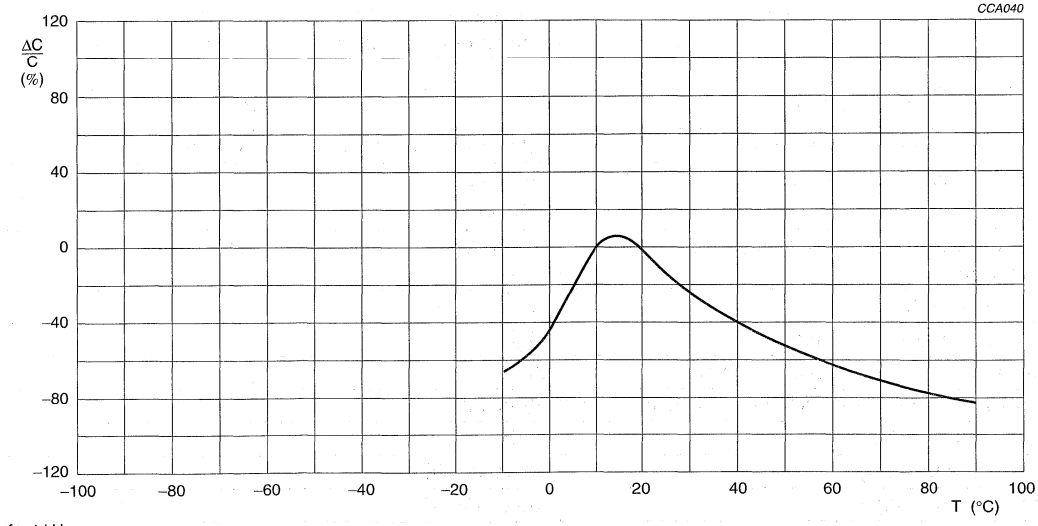
The capacitors meet the essential requirements of *"IEC 60384-9"* (2F6), *"EIA"* (Y5U). Unless stated otherwise all electrical values apply at an ambient temperature of 20 ±1 °C, an atmospheric pressure of 86 to 106 kPa and a relative humidity of 63 to 67%.

DESCRIPTION	VALUE
Capacitance values measured at 1 kHz, 1 V	1000 to 47000 pF; E3 series (see Table 5)
Tolerance on capacitance, after 1000 hours	–20 to +80%
Dielectric material	K14000
Maximum capacitance change with respect to capacitance value at 20 °C	+20 to –85% (see Figs 15 and 16)
Rated DC voltage at 85 °C	63 V
DC test voltage; duration 1 minute	200 V
DC test voltage of coating; duration 1 minute	200 V
Insulation resistance at 100 V (DC) after 1 minute	≥4000 MΩ
Tan δ measured at 1 kHz, 1 V	≤3.5%
Category temperature range	–10 to +85 °C
Storage temperature range	–55 to +85 °C
Ageing	typical 5% per time decade
Climatic category (IEC 60068)	10/085/21



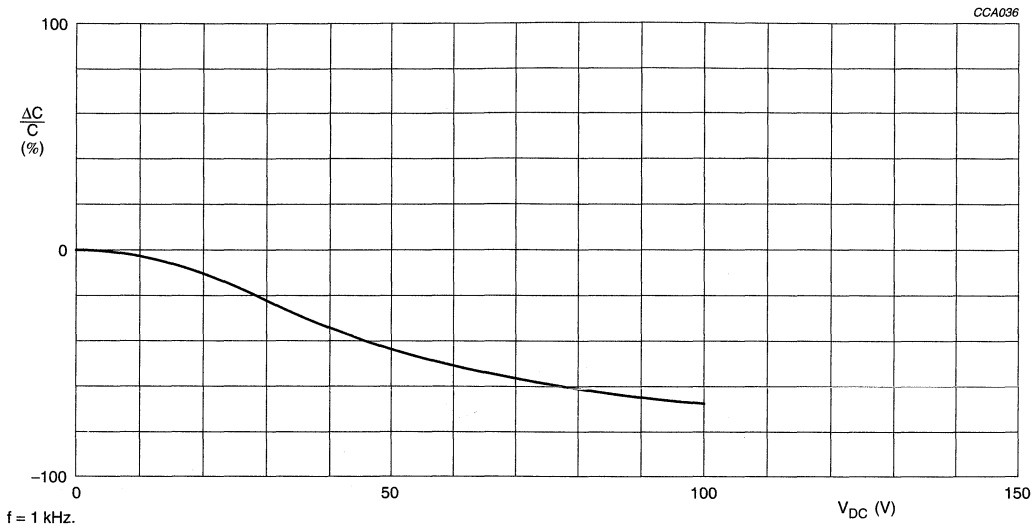
f = 1 kHz.
U = 1 V.

Fig.15 Typical capacitance change with respect to capacitance value at 20 °C as a function of temperature for capacitance value 1000 pF.



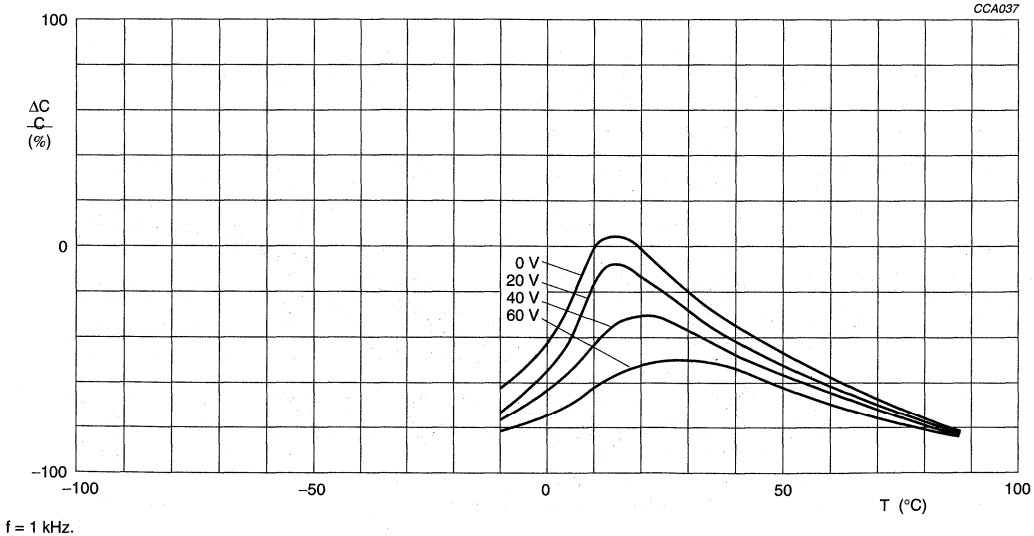
f = 1 kHz.
U = 1 V.

Fig.16 Typical capacitance change with respect to capacitance value at 20 °C as a function of temperature for capacitance values 2200 pF to 47000 pF.



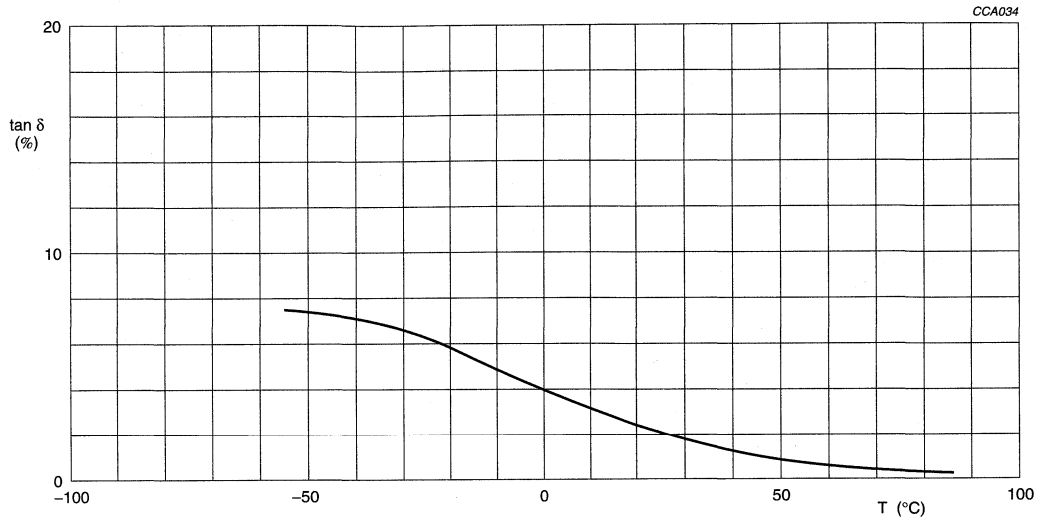
f = 1 kHz.
U = 1 V.
T = 20 °C.

Fig.17 Typical capacitance change with respect to the capacitance value at 0 V as a function of DC voltage for capacitance values 2200 to 47000 pF.



f = 1 kHz.
U = 1 V.

Fig.18 Typical capacitance change with respect to the capacitance value at 0 V and 20 °C as a function of temperature at different DC voltages for capacitance values 2200 to 47000 pF.



f = 1 kHz.
U = 1 V.

Fig.19 Typical tan δ as a function of temperature for capacitance values 2200 to 47000 pF.

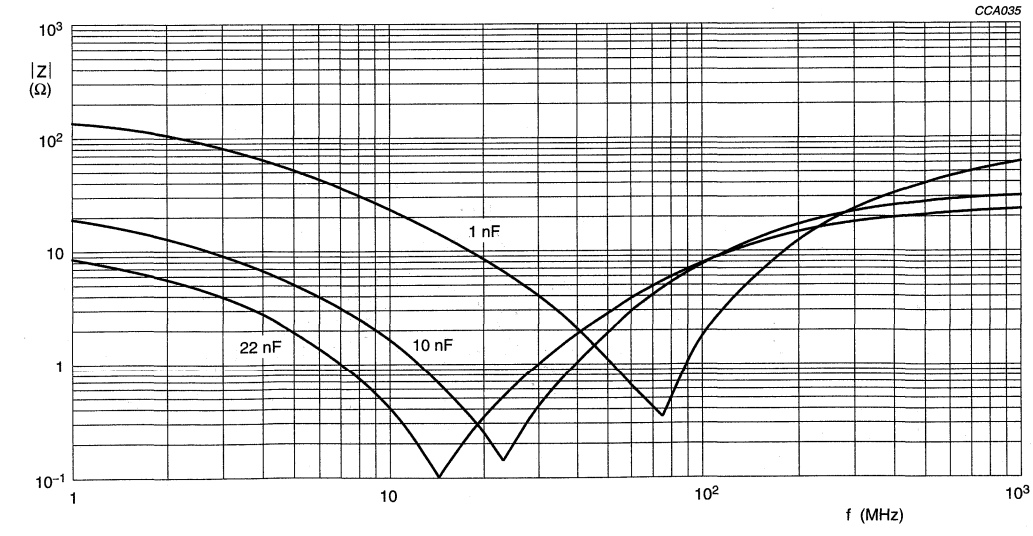


Fig.20 Typical impedance |Z| as a function of frequency.

Miniature ceramic plate capacitors

Class 1, 500 V (DC) (flanged types)

FEATURES

- Professional circuits
- High-frequency circuits
- Temperature compensating
- High stability
- Space saving
- High reliability.

APPLICATIONS

In a great variety of electronic circuits, e.g. in filters and tuning circuits where high stability and/or temperature compensation are a requirement. Because of their small size the capacitors are suitable for use in circuitry with high component density.

DESCRIPTION

The capacitors consist of a thin rectangular ceramic plate, both sides of which are metallized, and tinned connecting leads are secured using a high melting point solder. The capacitors are encapsulated in epoxy lacquer, which is resistant to all commonly used cleaning solvents. They have small dimensions and narrow tolerances on the lead spacing. The leads are provided with a flange, which guarantees that the leads are free of lacquer, and its shape allows soldering gasses to escape freely, ensuring excellent solderability. This makes the capacitors suitable for both hand-mounting and automatic insertion. The electrical properties are characterized by low losses, a narrow tolerance on capacitance (±0.25 pF or 2%), high stability and, owing to the absence of silver, an extremely good DC behaviour.

QUICK REFERENCE DATA

DESCRIPTION	VALUE
Capacitance range (E12 series)	0.47 to 330 pF
Rated DC voltage	500 V
Tolerance on capacitance	±2% or ±0.25 pF
Temperature coefficients	P100, NP0, N150, N750 and N1500
Sectional specification	IEC 60384-8
Climatic category (IEC 60068)	55/085/21 (N150, N750); 55/150/56 (P100, NP0, N1500)

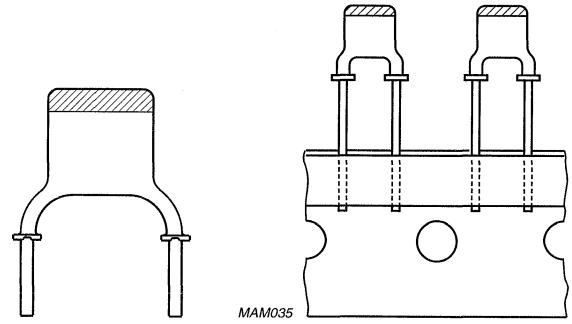
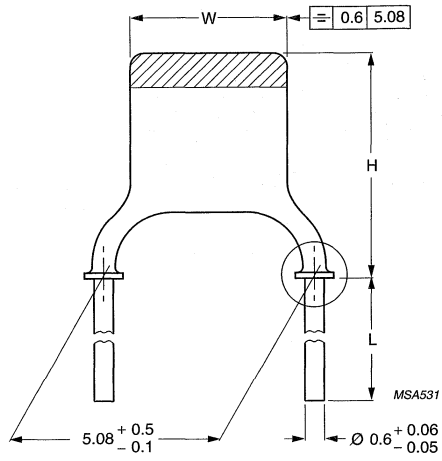


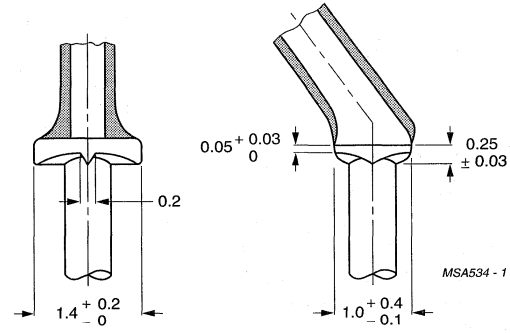
Fig.1 Outlines.

MECHANICAL DATA



Dimensions in mm.
For dimensions H, L and W see Tables 1 and 2.

Fig.2 Component outline.



Dimensions in mm.

Fig.3 Detail of flange.

Marking

The body of the capacitors is coloured grey. The temperature coefficient is indicated by a colour code in accordance with IEC and EIA recommendations. Capacitance value and voltage are indicated by a marking code in a contrasting colour on the body. Refer to Tables 3 to 12, for marking codes and colours.

Mounting

When bending, cutting or flattening, the leads should be relieved of the applied load by supporting them at the capacitor body.

Soldering conditions:

max. 265 °C, max. 10 s.

The capacitors are suitable for mounting on printed-circuit boards (hand-mounting or automatic insertion).

Physical dimensions

Table 1 Capacitor dimensions and mass

SIZE[1]	W[2] (mm)	H[2] (mm)	MASS (g)
I	3.6 (–1.1)	6.3 (–1.8)	≈0.14
IIA	3.9 (–1.4)	6.7 (–2.0)	≈0.15
IIB	4.5 (–1.8)	7.3 (–2.4)	≈0.15
III	5.3 (–1.8)	8.1 (–2.6)	≈0.17
IV	6.2 (–2.0)	9.0 (–2.7)	≈0.20
V	6.2 (–2.0)	11.2 (–3.1)	≈0.23

Notes

1. Unless indicated in Tables 4 to 12, the thickness of the capacitors does not exceed 2.3 mm.
2. Tolerances are given between parentheses.

PACKAGING

For details refer to this handbook, chapter *"Miniature ceramic plate capacitors"*, section *"General data"*.

ORDERING INFORMATION

Table 2 Catalogue numbers

PITCH P	LEAD DIAMETER d	CATALOGUE NUMBERS(1)			
		BULK PACKED		ON TAPE (REEL)	ON TAPE(2) (AMMOPACK)
		L ≥ 13 mm	L = 4 ±0.5 mm		
5.08 mm (0.2 inch)	0.6 mm (0.024 inch)	2222 652	2222 653	2222 654	2222 691 .....

Notes

1. Catalogue numbers to be completed by adding the 5-digit suffix for required capacitance value, see Tables 4 to 12.
2. H_0 = 18.25 mm.

Table 3 Conditions for Table 4; capacitors with temperature coefficient **P100 (M7G)**

DESCRIPTION	VALUE
Capacitance range	0.47 to 33 pF (E12 series)
Temperature coefficient of the capacitance $\left(\frac{\Delta C}{C \Delta T}\right)$	100×10^{-6}/K
Tolerance on the temperature coefficient	$\pm 30 \times 10^{-6}$/K
Marking colour of the temperature coefficient	red/violet
Climatic category (IEC 60068)	55/150/56

Table 4 **Preferred** capacitance range, temperature coefficient **P100 (M7G)**

CAPACITANCE VALUE[1] (pF)	TOLERANCE	SIZE (see Table 1)	MARKING CODE		SUFFIX OF CATALOGUE NUMBER (see Table 2)
			VALUE	VOLTAGE[3] (V)	
0.47	±0.25 pF	I[2]	p47	500	03477
0.56	±0.25 pF	I[2]	p56	500	03567
0.68	±0.25 pF	I[2]	p68	500	03687
0.82	±0.25 pF	I	p82	500	03827
1.0	±0.25 pF	I	1p0	500	03108
1.2	±0.25 pF	I	1p2	500	03128
1.5	±0.25 pF	I[2]	1p5	500	03158
1.8	±0.25 pF	I	1p8	500	03188
2.2	±0.25 pF	I	2p2	500	03228
2.7	±0.25 pF	I	2p7	500	03278
3.3	±0.25 pF	I	3p3	500	03338
3.9	±0.25 pF	I	3p9	500	03398
4.7	±0.25 pF	IIA	4p7	500	03478
5.6	±0.25 pF	IIA	5p6	500	03568
6.8	±0.25 pF	IIB	6p8	500	03688
8.2	±0.25 pF	IIB	8p2	500	03828
10	±2%	III	10p	500	04109
12	±2%	III	12p	500	04129
15	±2%	III	15p	500	04159
18	±2%	IV	18p	500	04189
22	±2%	IV	22p	500	04229
27	±2%	V	27p	500	04279
33	±2%	V	33p	500	04339

Notes

1. Other capacitance values and tolerances are available on request.
2. Maximum thickness 2.5 mm.
3. The voltage code may be marked on the front or rear side of the capacitor.

Table 5 Conditions for Table 6; capacitors with temperature coefficient **NP0 (C0G)**

DESCRIPTION	VALUE
Capacitance range	0.82 to 150 pF (E12 series)
Temperature coefficient of the capacitance $\left(\frac{\Delta C}{C \Delta T}\right)$	0×10^{-6}/K
Tolerance on the temperature coefficient	$\pm 30 \times 10^{-6}$/K
Marking colour of the temperature coefficient	black
Climatic category (IEC 60068)	55/150/56

Table 6 **Preferred** capacitance range, temperature coefficient **NP0 (C0G)**

CAPACITANCE VALUE[1] (pF)	TOLERANCE	SIZE (see Table 1)	MARKING CODE		SUFFIX OF CATALOGUE NUMBER (see Table 2)
			VALUE	VOLTAGE[4] (V)	
0.82	±0.25 pF	I[2]	p82	500	09827
1.0	±0.25 pF	I[3]	1p0	500	09108
1.2	±0.25 pF	I[3]	1p2	500	09128
1.5	±0.25 pF	I	1p5	500	09158
1.8	±0.25 pF	I	1p8	500	09188
2.2	±0.25 pF	I	2p2	500	09228
2.7	±0.25 pF	I	2p7	500	09278
3.3	±0.25 pF	I	3p3	500	09338
3.9	±0.25 pF	I	3p9	500	09398
4.7	±0.25 pF	I	4p7	500	09478
5.6	±0.25 pF	I	5p6	500	09568
6.8	±0.25 pF	I	6p8	500	09688
8.2	±0.25 pF	I	8p2	500	09828
10	±2%	I	10p	500	10109
12	±2%	I	12p	500	10129
15	±2%	IIA	15p	500	10159
18	±2%	IIA	18p	500	10189
22	±2%	IIA	22p	500	10229
27	±2%	IIB	27p	500	10279
33	±2%	IIB	33p	500	10339
39	±2%	IIB	39p	500	10399
47	±2%	III	47p	500	10479
56	±2%	III	56p	500	10569
68	±2%	IV	68p	500	10689
82	±2%	IV	82p	500	10829
100	±2%	IV	n10	500	10101
120	±2%	V	n12	500	10121
150	±2%	V	n15	500	10151

Notes

1. Other capacitance values and tolerances are available on request.
2. Maximum thickness 2.7 mm.
3. Maximum thickness 2.5 mm.
4. The voltage code may be marked on the front or rear side of the capacitor.

Table 7 Conditions for Table 8; capacitors with temperature coefficient **N150 (P2G)**

DESCRIPTION	VALUE
Capacitance range	2.2 to 150 pF (E12 series)
Temperature coefficient of the capacitance $\left(\frac{\Delta C}{C\Delta T}\right)$	-150×10^{-6}/K
Tolerance on the temperature coefficient	$\pm 30 \times 10^{-6}$/K
Marking colour of the temperature coefficient	orange
Climatic category (IEC 60068)	55/085/21

Table 8 **Preferred** capacitance range, temperature coefficient **N150 (P2G)**

CAPACITANCE VALUE[1] (pF)	TOLERANCE	SIZE (see Table 1)	MARKING CODE		SUFFIX OF CATALOGUE NUMBER (see Table 2)
			VALUE	VOLTAGE[3] (V)	
2.2	±0.25 pF	I[2]	2p2	500	33228
2.7	±0.25 pF	I[2]	2p7	500	33278
3.3	±0.25 pF	I	3p3	500	33338
3.9	±0.25 pF	I	3p9	500	33398
4.7	±0.25 pF	I	4p7	500	33478
5.6	±0.25 pF	I	5p6	500	33568
6.8	±0.25 pF	I	6p8	500	33688
8.2	±0.25 pF	I	8p2	500	33828
10	±2%	I	10p	500	34109
12	±2%	I	12p	500	34129
15	±2%	IIA	15p	500	34159
18	±2%	IIA	18p	500	34189
22	±2%	IIA	22p	500	34229
27	±2%	IIB	27p	500	34279
33	±2%	IIB	33p	500	34339
39	±2%	IIB	39p	500	34399
47	±2%	III	47p	500	34479
56	±2%	III	56p	500	34569
68	±2%	IV	68p	500	34689
82	±2%	IV	82p	500	34829
100	±2%	IV	n10	500	34101
120	±2%	V	n12	500	34121
150	±2%	V	n15	500	34151

Notes

1. Other capacitance values and tolerances are available on request.
2. Maximum thickness 2.5 mm.
3. The voltage code may be marked on the front or rear side of the capacitor.

Table 9 Conditions for Table 10; capacitors with temperature coefficient **N750 (U2J)**

DESCRIPTION	VALUE
Capacitance range	1.8 to 120 pF (E12 series)
Temperature coefficient of the capacitance $\left(\frac{\Delta C}{C\Delta T}\right)$	-750×10^{-6}/K
Tolerance on the temperature coefficient	$\pm 120 \times 10^{-6}$/K
Marking colour of the temperature coefficient	violet
Climatic category (IEC 60068)	55/085/21

Table 10 Preferred capacitance range, temperature coefficient **N750 (U2J)**

CAPACITANCE VALUE[1] (pF)	TOLERANCE	SIZE (see Table 1)	MARKING CODE		SUFFIX OF CATALOGUE NUMBER (see Table 2)
			VALUE	VOLTAGE[5] (V)	
1.8	±0.25 pF	I[2]	1p8	500	57188
2.2	±0.25 pF	I[3]	2p2	500	57228
2.7	±0.25 pF	I	2p7	500	57278
3.3	±0.25 pF	I	3p3	500	57338
3.9	±0.25 pF	I	3p9	500	57398
4.7	±0.25 pF	I[4]	4p7	500	57478
5.6	±0.25 pF	I	5p6	500	57568
6.8	±0.25 pF	I	6p8	500	57688
8.2	±0.25 pF	I	8p2	500	57828
10	±2%	I	10p	500	58109
12	±2%	I	12p	500	58129
15	±2%	I	15p	500	58159
18	±2%	IIA	18p	500	58189
22	±2%	IIA	22p	500	58229
27	±2%	IIB	27p	500	58279
33	±2%	IIB	33p	500	58339
39	±2%	IIB	39p	500	58399
47	±2%	III	47p	500	58479
56	±2%	III	56p	500	58569
68	±2%	IV	68p	500	58689
82	±2%	IV	82p	500	58829
100	±2%	IV	n10	500	58101
120	±2%	V	n12	500	58121
150	±2%	V	n15	500	58151

Notes

1. Other capacitance values and tolerances are available on request.
2. Maximum thickness 3.0 mm.
3. Maximum thickness 2.5 mm.
4. Maximum thickness 2.7 mm.
5. The voltage code may be marked on the front or rear side of the capacitor.

Table 11 Conditions for Table 12; capacitors with temperature coefficient **N1500 (P3K)**

DESCRIPTION	VALUE
Capacitance range	8.2 to 270 pF (E12 series)
Temperature coefficient of the capacitance $\left(\frac{\Delta C}{C\Delta T}\right)$	-1500×10^{-6}/K
Tolerance on the temperature coefficient	$(-0 + 500) \times 10^{-6}$/K
Marking colour of the temperature coefficient	orange/orange
Climatic category (IEC 60068)	55/150/56

Table 12 **Preferred** capacitance range, temperature coefficient **N1500 (P3K)**

CAPACITANCE VALUE(1) (pF)	TOLERANCE	SIZE (see Table 1)	MARKING CODE		SUFFIX OF CATALOGUE NUMBER (see Table 2)
			VALUE	VOLTAGE(4) (V)	
8.2	±0.25 pF	I(2)	8p2	500	69828
10	±2%	I(3)	10p	500	70109
12	±2%	I(3)	12p	500	70129
15	±2%	I	15p	500	70159
18	±2%	I	18p	500	70189
22	±2%	I	22p	500	70229
27	±2%	I	27p	500	70279
33	±2%	IIA	33p	500	70339
39	±2%	IIA	39p	500	70399
47	±2%	IIA	47p	500	70479
56	±2%	IIB	56p	500	70569
68	±2%	IIB	68p	500	70689
82	±2%	IIB	82p	500	70829
100	±2%	III	n10	500	70101
120	±2%	III	n12	500	70121
150	±2%	IV	n15	500	70151
180	±2%	IV	n18	500	70181
220	±2%	IV	n22	500	70221
270	±2%	V	n27	500	70271
330	±2%	V	n33	500	70331

Notes

1. Other capacitance values and tolerances are available on request.
2. Maximum thickness 3.0 mm.
3. Maximum thickness 2.5 mm.
4. The voltage code may be marked on the front or rear side of the capacitor.

ELECTRICAL CHARACTERISTICS

The capacitors meet the essential requirements of *"IEC 60384-8"*. Unless stated otherwise 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 values (note 1) measured at 1 MHz, ≤5 V	see Tables 4 to 12
Rated DC voltage	500 V
DC test voltage; duration 1 minute	1250 V
DC test voltage of coating; duration 1 minute	1250 V
Insulation resistance at 500 V (DC) after 1 minute	>10000 MΩ
Tan δ (note 1) measured at 1 MHz, ≤5 V:	
$C \leq 50$ pF	$\leq 15 \left(\frac{15}{C} + 0.7\right) \times 10^{-4}$
$C > 50$ pF	$\leq 15 \times 10^{-4}$
Category temperature range	–55 to +85 °C (N150, N750); –55 to +150 °C (P100, NP0, N1500)
Storage temperature range	–55 to +85 °C

Note

1. Including 2 mm per connecting lead.

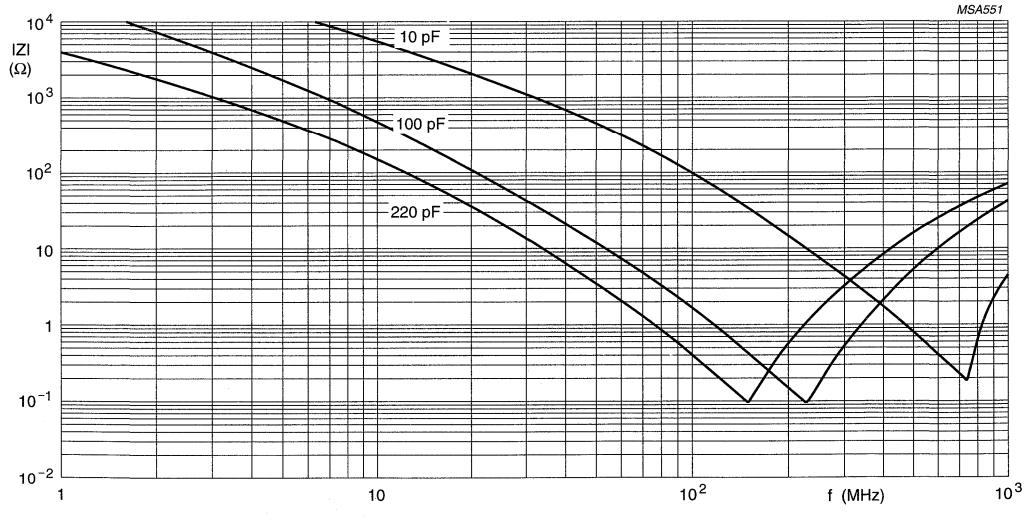


Fig.4 Typical impedance |Z| as a function of frequency.

Miniature ceramic plate capacitors

Class 2, 500 V (DC) (flanged types)

FEATURES

- Professional circuits
- Coupling and decoupling
- Space saving
- High reliability
- High temperature circuits.

APPLICATIONS

In electronic circuits where non-linear change of capacitance with temperature is permissible and low losses are not essential, e.g. coupling and decoupling. Because of their small size, the capacitors are ideal for circuitry with high component density.

DESCRIPTION

The capacitors consist of a thin rectangular ceramic plate, both sides of which are metallized. The tinned connecting leads are secured using a high melting point solder. The capacitors are encapsulated in epoxy lacquer, which is resistant to all commonly used cleaning solvents. They have small dimensions and narrow tolerances on the lead spacing. The leads are provided with a flange. The flange guarantees that the leads are free of lacquer, and its shape allows soldering gasses to escape freely, ensuring excellent solderability. This makes the capacitors suitable for both hand-mounting and automatic insertion.

QUICK REFERENCE DATA

DESCRIPTION	VALUE
Capacitance range (E12 series)	100 to 4700 pF
Dielectric material	K2000
Rated DC voltage	500 V
Tolerance on capacitance	±10%
Sectional specification	IEC 60384-9 (2C2 and 2D1) EIA (X5S/X8U)
Climatic category (IEC 60068)	55/150/56

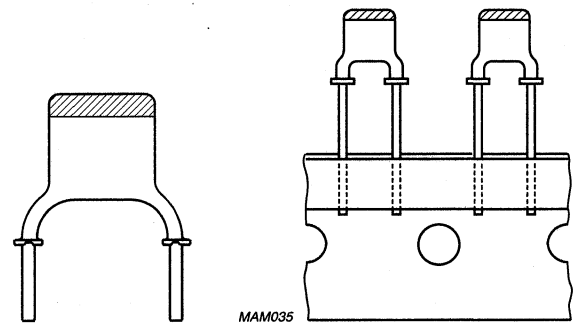
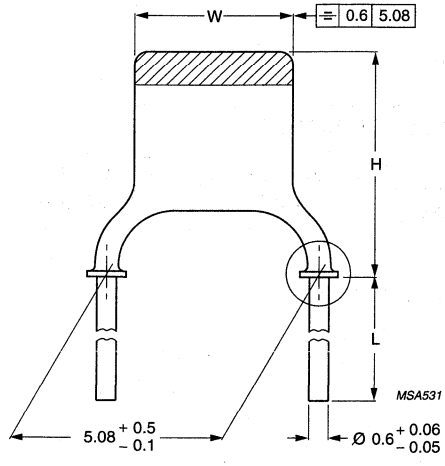


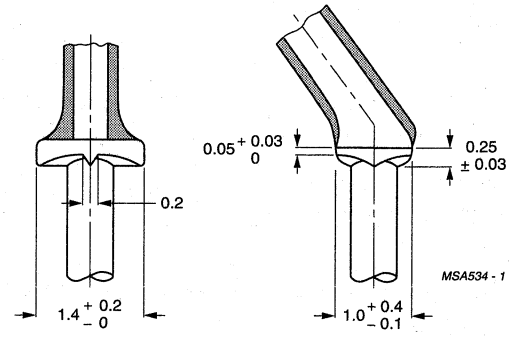
Fig.1 Outlines.

MECHANICAL DATA



Dimensions in mm.
For dimensions H, L and W see Tables 1 and 2.

Fig.2 Component outline.



Dimensions in mm.

Fig.3 Detail of flange.

Marking

The body of the capacitors is tan coloured. The temperature dependence is indicated by a yellow coloured cap. Capacitance value and voltage are indicated by a marking code in a contrasting colour on the body. Refer to Table 3 for marking codes.

Mounting

When bending, cutting or flattening, the leads should be relieved of the applied load by supporting them at the capacitor body.

Soldering conditions:

max. 265 °C, max. 10 s.

The capacitors are suitable for mounting on printed-circuit boards (hand-mounting or automatic insertion).

Physical dimensions

Table 1 Capacitor dimensions and mass

SIZE(1)	W(2) (mm)	H(2) (mm)	MASS (g)
I	3.6 (–1.1)	6.3 (–1.8)	≈0.14
IIA	3.9 (–1.4)	6.7 (–2.0)	≈0.15
IIB	4.5 (–1.8)	7.3 (–2.4)	≈0.15
III	5.3 (–1.8)	8.1 (–2.6)	≈0.17
IV	6.2 (–2.0)	9.0 (–2.7)	≈0.20
V	6.2 (–2.0)	11.2 (–3.1)	≈0.23

Notes

1. Unless indicated in Table 3 the thickness of the capacitors does not exceed 2.3 mm.
2. Tolerances are given between parentheses.

PACKAGING

For details refer to this handbook, chapter *"Miniature ceramic plate capacitors"*, section *"General data"*.

ORDERING INFORMATION

Table 2 Catalogue numbers

PITCH P	LEAD DIAMETER d	CATALOGUE NUMBERS(1)			
		BULK PACKED		ON TAPE (REEL)	ON TAPE(2) (AMMOPACK)
		L ≥ 13 mm	L = 4 ±0.5 mm		
5.08 mm (0.2 inch)	0.6 mm (0.024 inch)	2222 655 09...	2222 655 19...	2222 655 53...	2222 655 63...

Notes

1. Catalogue numbers to be completed by adding the last 3-digit suffix for required capacitance value, see Table 3.
2. H_0 = 18.25 mm.

Table 3 **Preferred** range of values

CAPACITANCE VALUE (pF)	SIZE (see Table 1)	MARKING CODE		SUFFIX OF CATALOGUE NUMBERS (see Table 2)
		VALUE	VOLTAGE[3] (V)	
100	I[1]	n10	500	101
120	I[2]	n12	500	121
150	I	n15	500	151
180	I	n18	500	181
220	I	n22	500	221
270	I	n27	500	271
330	I	n33	500	331
390	IIA	n39	500	391
470	IIA	n47	500	471
560	IIA	n56	500	561
680	IIB	n68	500	681
820	IIB	n82	500	821
1000	IIB	1n0	500	102
1200	III	1n2	500	122
1500	III	1n5	500	152
1800	III	1n8	500	182
2200	IV	2n2	500	222
2700	IV	2n7	500	272
3300	V	3n3	500	332
3900	V	3n9	500	392
4700	V	4n7	500	472

Notes

1. Maximum thickness 2.7 mm.
2. Maximum thickness 2.5 mm.
3. The voltage code may be marked on the front or rear side of the capacitor.

ELECTRICAL CHARACTERISTICS

The capacitors meet the essential requirements of *"IEC 60384-9"*. Unless stated otherwise 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 values measured at 1 kHz, 1 V	100 to 4700 pF (E12 series)
Tolerance on the capacitance, after 1000 hours	±10%
Dielectric material	K2000
Rated DC voltage	500 V
DC test voltage; duration 1 minute	1250 V
DC test voltage of coating; duration 1 minute	1250 V
Insulation resistance at 500 V (DC) after 1 minute	>4000 MΩ
Tan δ measured at 1 kHz, 1 V	<3.5%
Category temperature range	−55 to +85 °C (2C2) and −55 to +150 °C (2D1)
Storage temperature range	−55 to +85 °C
Capacitance change as a function of temperature	see Fig.4
Capacitance change as a function of frequency	see Fig.5
Climatic category (IEC 60068)	55/150/56
Ageing	typical 1.5% per time decade

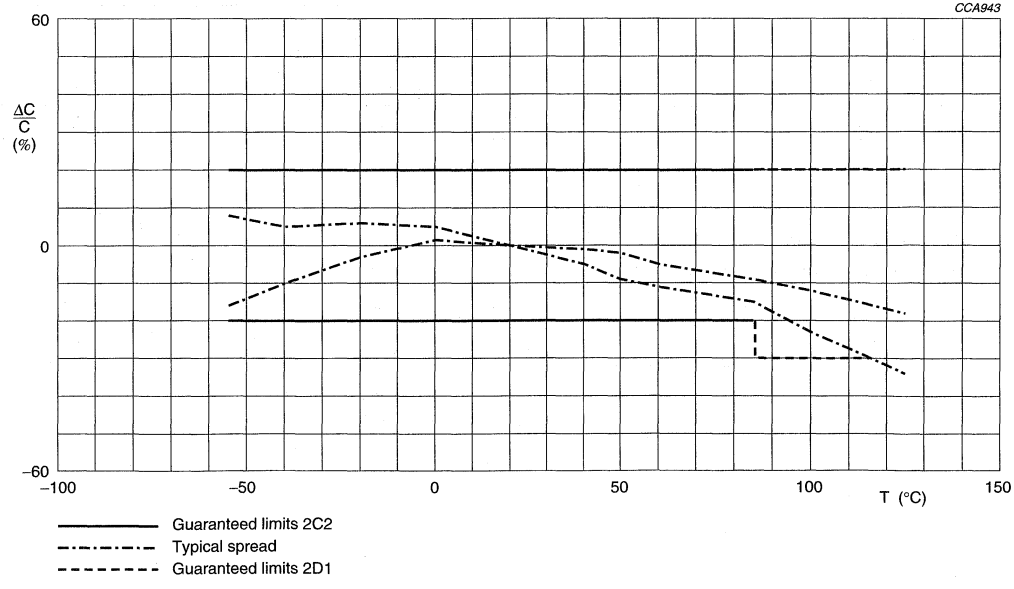
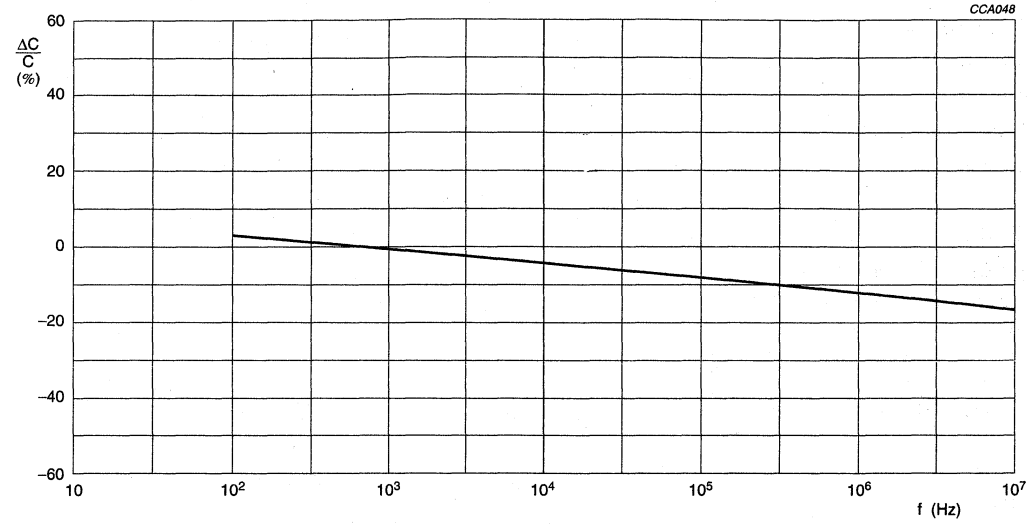


Fig.4 Typical capacitance change with respect to the capacitance at 20 °C as a function of temperature.



U = 1 V (DC).

Fig.5 Typical capacitance change with respect to the capacitance at 1 kHz as a function of frequency.

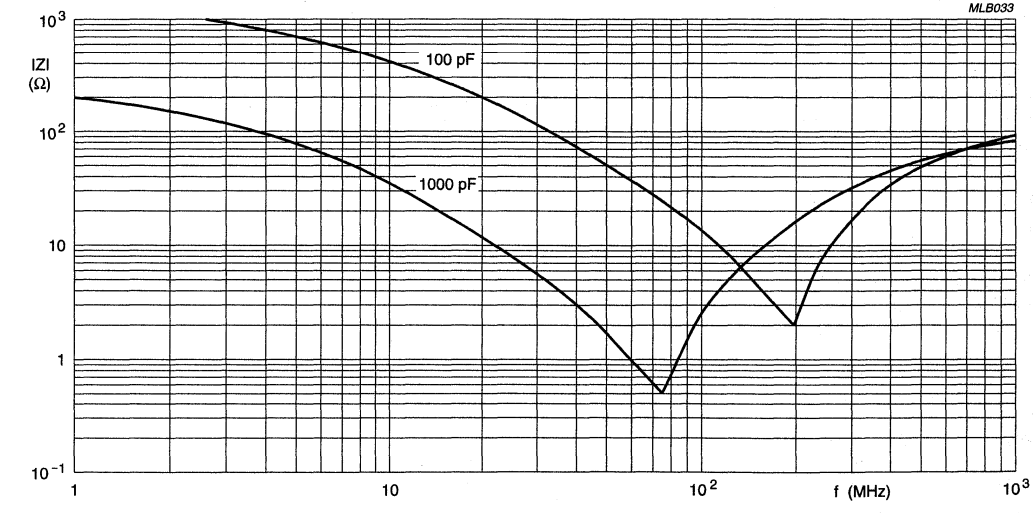


Fig.6 Typical impedance |Z| as a function of frequency.

Miniature ceramic plate capacitors

Class 1, 1000 V (DC) (flanged types)

FEATURES

- High reliability
- High-frequency circuits
- High stability
- Space saving
- High temperature circuits
- Professional circuits.

APPLICATIONS

In a great variety of electronic circuits, e.g. in filters and tuning circuits where stability and low losses are a requirement. Because of their small size the capacitors are suitable for use in circuitry with high component density such as SMPS.

DESCRIPTION

The capacitors consist of a thin rectangular ceramic plate, both sides of which are metallized, and tinned connecting leads are secured using a high melting point solder. The capacitors are encapsulated in epoxy lacquer, which is resistant to all commonly used cleaning solvents. They have small dimensions and narrow tolerances on the lead spacing. The leads are provided with a flange, which guarantees that the leads are free of lacquer, and its shape allows soldering gasses to escape freely, ensuring excellent solderability. This makes the capacitors suitable for both hand-mounting and automatic insertion. The electrical properties are characterized by low losses, a narrow tolerance on capacitance (±0.25 pF or 5%), high stability and, owing to the absence of silver, an extremely good DC behaviour.

QUICK REFERENCE DATA

DESCRIPTION	VALUE
Capacitance range (E12 series)	0.47 to 150 pF
Rated DC voltage	1000 V
Tolerance on capacitance	±5% or ±0.25 pF
Temperature coefficient	SL (+150 to -1500×10^{-6}/K)
Sectional specification	IEC 60384-8
Climatic category (IEC 60068)	55/150/56

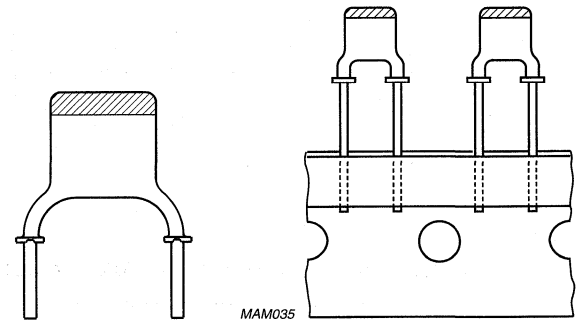
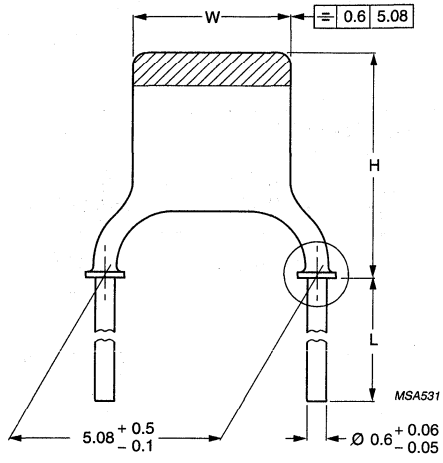


Fig.1 Outlines.

Miniature ceramic plate capacitors

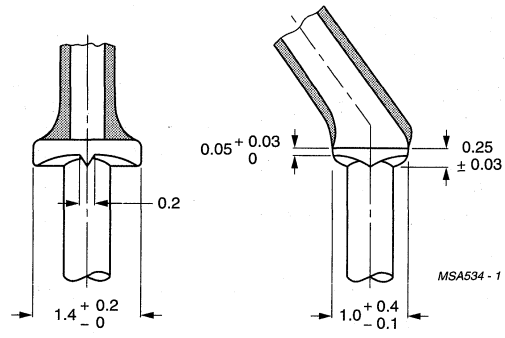
Class 1, 1000 V (DC) (flanged types)

MECHANICAL DATA



Dimensions in mm.
For dimensions H, L and W see Tables 1 and 2.

Fig.2 Component outline.



Dimensions in mm.

Fig.3 Detail of flange.

Marking

The body of the capacitors is coloured tan. Capacitance value and voltage are indicated by a marking code in a contrasting colour on the body. Refer to Tables 3 and 4 for colour and marking codes.

Mounting

When bending, cutting or flattening, the leads should be relieved of the applied load by supporting them at the capacitor body.

Soldering conditions:

max. 265 °C, max. 10 s.

The capacitors are suitable for mounting on printed-circuit boards (hand-mounting or automatic insertion).

Physical dimensions

Table 1 Capacitor dimensions and mass

SIZE(1)	W(2) (mm)	H(2) (mm)	MASS (g)
I	3.6 (–1.1)	6.3 (–1.8)	≈0.14
IIA	3.9 (–1.4)	6.7 (–2.0)	≈0.15
IIB	4.5 (–1.8)	7.3 (–2.4)	≈0.15
III	5.3 (–1.8)	8.1 (–2.6)	≈0.17
IV	6.2 (–2.0)	9.0 (–2.7)	≈0.20
V	6.2 (–2.0)	11.2 (–3.1)	≈0.23

Notes

1. Unless indicated in Table 4, the thickness of the capacitors does not exceed 3 mm.
2. Tolerances are given between parentheses.

PACKAGING

For details refer to this handbook, chapter *"Miniature ceramic plate capacitors"*, section *"General data"*.

ORDERING INFORMATION

Table 2 Catalogue numbers

PITCH P	LEAD DIAMETER d	CATALOGUE NUMBERS(1)			
		BULK PACKED		ON TAPE (REEL)	ON TAPE(2) (AMMOPACK)
		L ≥ 13 mm	L = 4 ±0.5 mm		
5.08 mm (0.2 inch)	0.6 mm (0.024 inch)	2222 694 09...	2222 694 19...	2222 694 53...	2222 694 63...

Notes

1. Catalogue numbers to be completed by adding the last 3-digit suffix for required capacitance value, see Table 4.
2. H_0 = 18.25 mm.

Table 3 Conditions for Table 4; capacitors with temperature coefficient **SL**

DESCRIPTION	VALUE
Capacitance range	0.47 to 150 pF (E12 series)
Temperature coefficient of the capacitance $\left(\frac{\Delta C}{C \Delta T}\right)$	$+150 \times 10^{-6}$/K to -1500×10^{-6}/K
Marking colour of the temperature coefficient	none

Table 4 **Preferred** capacitance range, temperature coefficient **SL**

CAPACITANCE VALUE[1] (pF)	TOLERANCE	SIZE (see Table 1)	MARKING CODE		SUFFIX OF CATALOGUE NUMBER (see Table 2)
			VALUE	VOLTAGE[2]	
0.47	±0.25 pF	I	p47	1 kV	477
0.56	±0.25 pF	I	p56	1 kV	567
0.68	±0.25 pF	I	p68	1 kV	687
0.82	±0.25 pF	I	p82	1 kV	827
1.0	±0.25 pF	I	1p0	1 kV	108
1.2	±0.25 pF	I	1p2	1 kV	128
1.5	±0.25 pF	I	1p5	1 kV	158
1.8	±0.25 pF	I	1p8	1 kV	188
2.2	±0.25 pF	I	2p2	1 kV	228
2.7	±0.25 pF	I	2p7	1 kV	278
3.3	±0.25 pF	I	3p3	1 kV	338
3.9	±0.25 pF	I	3p9	1 kV	398
4.7	±0.25 pF	I	4p7	1 kV	478
5.6	±0.25 pF	I	5p6	1 kV	568
6.8	±0.25 pF	I	6p8	1 kV	688
8.2	±0.25 pF	I	8p2	1 kV	828
10	±5%	I	10p	1 kV	109
12	±5%	I	12p	1 kV	129
15	±5%	I	15p	1 kV	159
18	±5%	IIA	18p	1 kV	189
22	±5%	IIA	22p	1 kV	229
27	±5%	IIB	27p	1 kV	279
33	±5%	IIB	33p	1 kV	339
39	±5%	IIB	39p	1 kV	399
47	±5%	III	47p	1 kV	479
56	±5%	III	56p	1 kV	569
68	±5%	III	68p	1 kV	689
82	±5%	IV	82p	1 kV	829
100	±5%	IV	n10	1 kV	101
120	±5%	V	n12	1 kV	121
150	±5%	V	n15	1 kV	151

Notes

1. Other capacitance values and tolerances are available on request.
2. The voltage code may be marked on the front or rear side of the capacitor.

ELECTRICAL CHARACTERISTICS

The capacitors meet the essential requirements of *"IEC 60384-8"*. Unless stated otherwise 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 values (note 1) measured at 1 MHz, ≤5 V	see Table 4
Rated DC voltage	1000 V
DC test voltage; duration 1 minute	2000 V
DC test voltage of coating; duration 1 minute	2000 V
Insulation resistance at 500 V (DC) after 1 minute	>10 000 MΩ
Tan δ (note 1) measured at 1 MHz, ≤5 V:	
$C \leq 50$ pF	$\leq 15 \left(\frac{15}{C} + 0.7\right) \times 10^{-4}$
$C > 50$ pF	$\leq 15 \times 10^{-4}$
Category temperature range	−55 to +150 °C
Storage temperature range	−55 to +85 °C
Climatic category (IEC 60068)	55/150/56

Note

1. Including 2 mm per connecting lead.

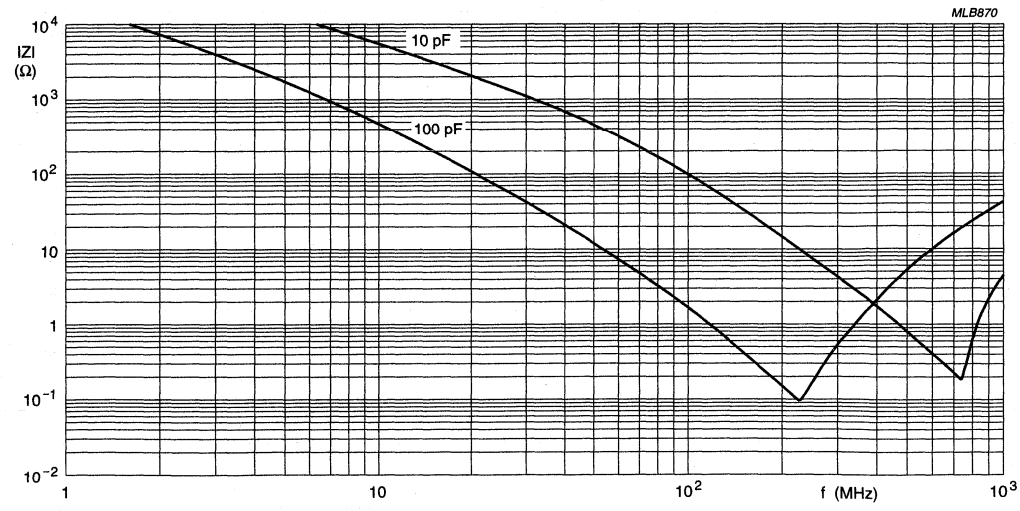


Fig.4 Typical impedance |Z| as a function of frequency.

Miniature ceramic plate capacitors

Class 2, 1000 V (DC) (2C2 and 2D1 flanged types)

FEATURES

- High reliability
- Coupling and decoupling
- Space saving
- High temperature circuits
- Professional circuits.

APPLICATIONS

In electronic circuits where non-linear change of capacitance with temperature is permissible and low losses are not essential, e.g. coupling and decoupling. Because of their small size, the capacitors are ideal for circuitry with high component density.

DESCRIPTION

The capacitors consist of a thin rectangular ceramic plate, both sides of which are metallized. The tinned connecting leads are secured using a high melting point solder. The capacitors are encapsulated in epoxy lacquer, which is resistant to all commonly used cleaning solvents. They have small dimensions and narrow tolerances on the lead spacing. The leads are provided with a flange. The flange guarantees that the leads are free of lacquer, and its shape allows soldering gasses to escape freely, ensuring excellent solderability. This makes the capacitors suitable for both hand-mounting and automatic insertion.

QUICK REFERENCE DATA

DESCRIPTION	VALUE
Capacitance range (E12 series)	100 to 1800 pF
Dielectric material	K2000
Rated DC voltage	1000 V
Tolerance on capacitance	±10%
Sectional specification	IEC 60384-9 (2C2 and 2D1); EIA (X5S/X8U)
Climatic category (IEC 60068)	55/150/56

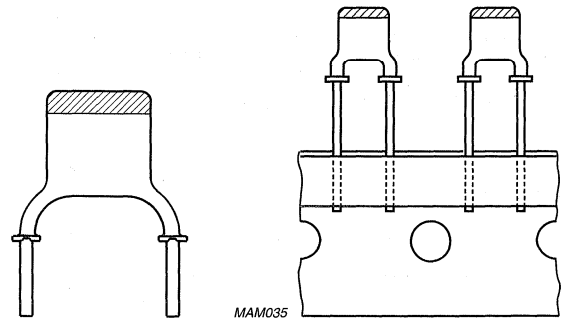
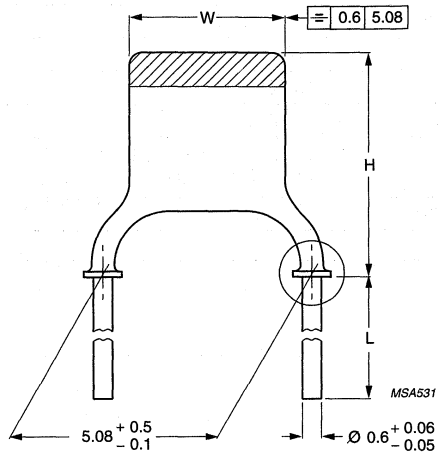


Fig.1 Outlines.

Miniature ceramic plate capacitors

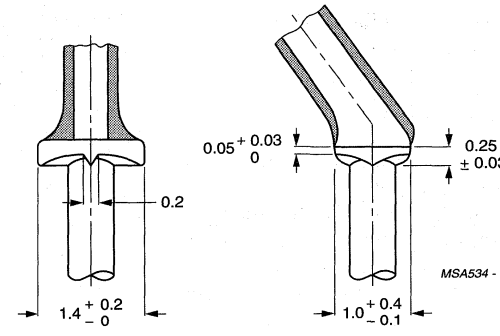
Class 2, 1000 V (DC) (2C2 and 2D1 flanged types)

MECHANICAL DATA



Dimensions in mm.
For dimensions H, L and W see Tables 1 and 2.

Fig.2 Component outline.



Dimensions in mm.

Fig.3 Detail of flange.

Marking

The body of the capacitors is tan coloured. The temperature dependency is indicated by a yellow coloured cap. Capacitance value and voltage are indicated by a marking code on the body. Refer to Table 3 for marking codes.

Mounting

When bending, cutting or flattening, the leads should be relieved of the applied load by supporting them at the capacitor body.

Soldering conditions:

max. 265 °C, max. 10 s.

The capacitors are suitable for mounting on printed-circuit boards (hand-mounting or automatic insertion).

Physical dimensions

Table 1 Capacitor dimensions and mass

SIZE(1)	W(2) (mm)	H(2) (mm)	MASS (g)
I	3.6 (–1.1)	6.3 (–1.8)	≈0.14
IIA	3.9 (–1.4)	6.7 (–2.0)	≈0.15
IIB	4.5 (–1.8)	7.3 (–2.4)	≈0.15
III	5.3 (–1.8)	8.1 (–2.6)	≈0.17
IV	6.2 (–2.0)	9.0 (–2.7)	≈0.20
V	6.2 (–2.0)	11.2 (–3.1)	≈0.23

Notes

1. Unless indicated in Table 3, the thickness of the capacitors does not exceed 3.0 mm.
2. Tolerances are given between parentheses.

PACKAGING

For details refer to this handbook, chapter *"Miniature ceramic plate capacitors"*, section *"General data"*.

ORDERING INFORMATION

Table 2 Catalogue numbers

PITCH P	LEAD DIAMETER d	CATALOGUE NUMBERS(1)			
		BULK PACKED		ON TAPE(2) (REEL)	ON TAPE(2) (AMMOPACK)
		L ≥ 13 mm	L = 4 ±0.5 mm		
5.08 mm (0.2 inch)	0.6 mm (0.024 inch)	2222 693 09...	2222 693 19...	2222 693 53...	2222 693 63...

Notes

1. Catalogue numbers to be completed by adding the 3-digit suffix for required capacitance value, see Table 3.
2. H_0 = 18.25 mm.

Table 3 **Preferred** range of values

CAPACITANCE VALUE (pF)	SIZE (see Table 1)	MARKING CODE		SUFFIX OF CATALOGUE NUMBERS (see Table 2)
		VALUE	VOLTAGE(1)	
100	I	n10	1 kV	101
120	I	n12	1 kV	121
150	I	n15	1 kV	151
180	IIA	n18	1 kV	181
220	IIA	n22	1 kV	221
270	IIA	n27	1 kV	271
330	IIB	n33	1 kV	331
390	IIB	n39	1 kV	391
470	IIB	n47	1 kV	471
560	III	n56	1 kV	561
680	III	n68	1 kV	681
820	IV	n82	1 kV	821
1000	IV	1n0	1 kV	102
1200	IV	1n2	1 kV	122
1500	V	1n5	1 kV	152
1800	V	1n8	1 kV	182

Note

1. The voltage code may be marked on the front or rear side of the capacitor.

ELECTRICAL CHARACTERISTICS

The capacitors meet the essential requirements of *"IEC 60384-9"*. Unless stated otherwise 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 values measured at 1 kHz, 1 V	see Table 3
Tolerance on the capacitance, after 1000 hours	±10%
Rated DC voltage	1000 V
DC test voltage; duration 1 minute	2000 V
DC test voltage of coating; duration 1 minute	2000 V
Insulation resistance at 500 V (DC) after 1 minute	>6000 MΩ
Tan δ measured at 1 kHz, 1 V	<3.5%
Category temperature range	−55 to +85 °C (2C2) and −55 to +150 °C (2D1)
Storage temperature range	−55 to +85 °C
Capacitance change as a function of temperature	see Fig.4
Capacitance change as a function of frequency	see Fig.5
Climatic category (IEC 60068)	55/150/56
Ageing	typical 1.5% per time decade

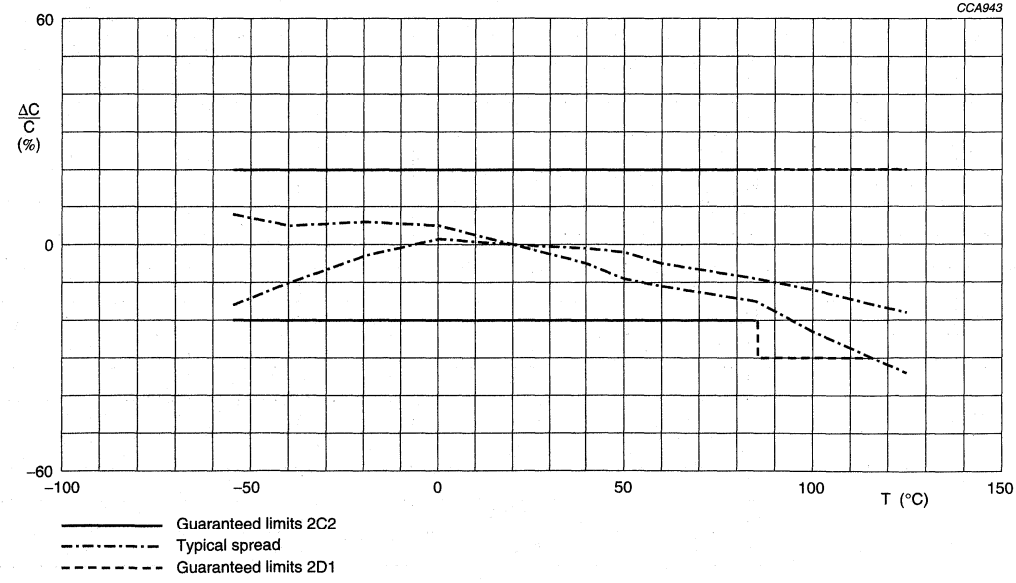
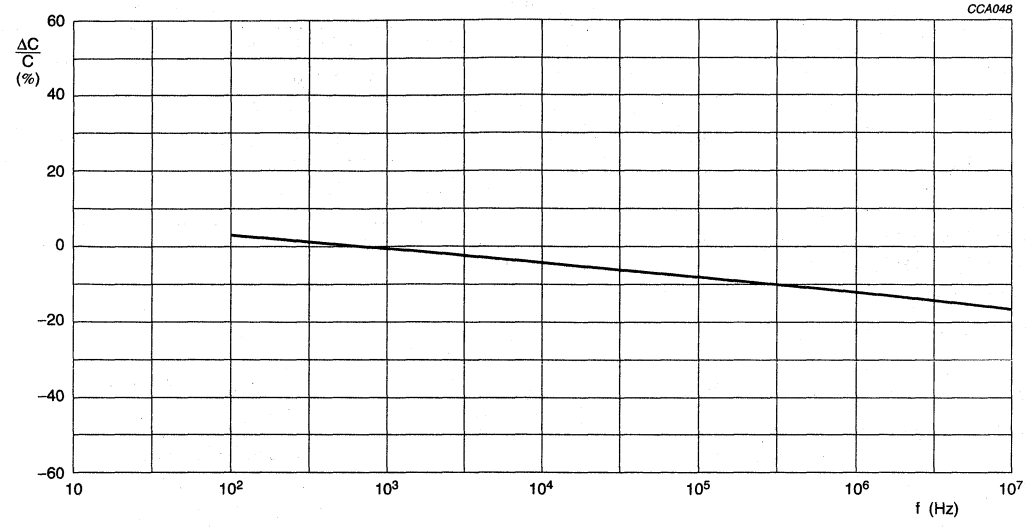


Fig.4 Typical capacitance change with respect to the capacitance at 20 °C as a function of temperature.



U = 1 V.

Fig.5 Typical capacitance change with respect to the capacitance at 1 kHz as a function of frequency.

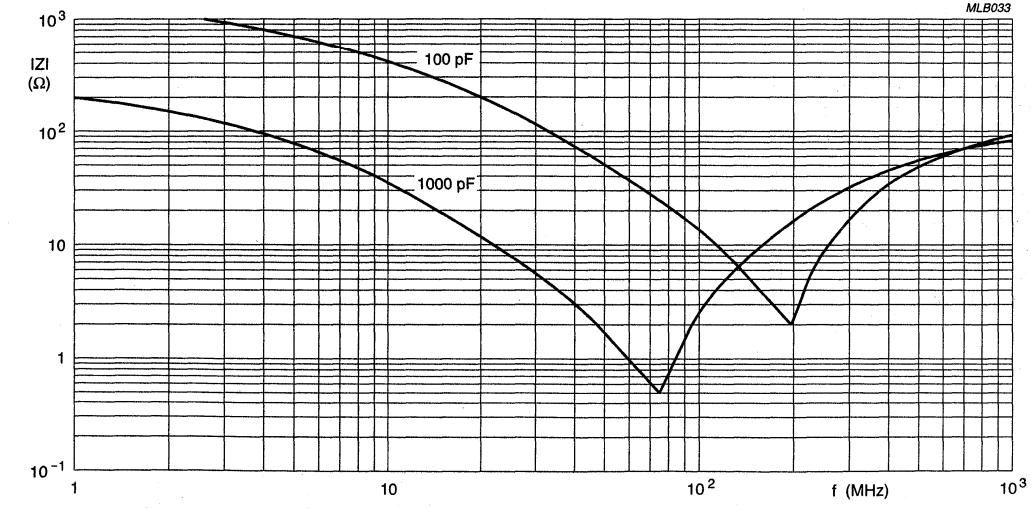


Fig.6 Typical impedance |Z| as a function of frequency.

Miniature ceramic plate capacitors

Class 2, low loss, 1000 V (DC) (2E2 flanged types)

FEATURES

- High reliability
- Coupling and decoupling
- Space saving
- High temperature circuits.

APPLICATIONS

In electronic circuits where high reliability and low losses with frequency and temperature are essential, for example:

- HF ballast
- SMPS
- Snubber and high voltage circuits.

Because of their small sizes, the capacitors are ideal for circuitry with a high component density.

DESCRIPTION

The capacitors consist of a thin rectangular ceramic plate, both sides of which are metallized. The tinned connecting leads are secured using a high melting point solder. The capacitors are encapsulated in epoxy lacquer, which is resistant to all commonly used cleaning solvents. They have small dimensions and narrow tolerances on the lead spacing. The leads are provided with a flange. The flange guarantees that the leads are free of lacquer, and its shape allows soldering gasses to escape freely, ensuring excellent solderability. This makes the capacitors suitable for both hand-mounting and automatic insertion.

QUICK REFERENCE DATA

DESCRIPTION	VALUE
Capacitance range (E12 series)	270 to 3300 pF
Rated DC voltage	1000 V
Tolerance on capacitance	±20%
Sectional specification	IEC 60384-9 (2E2)
Climatic category (IEC 60068)	55/105/56

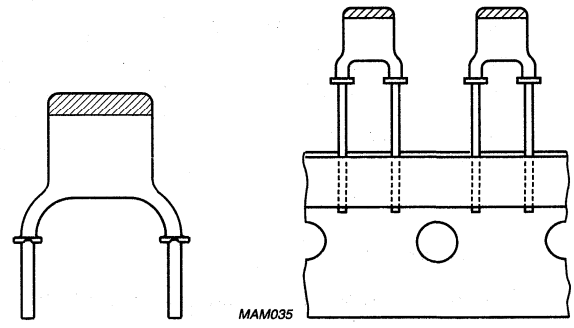
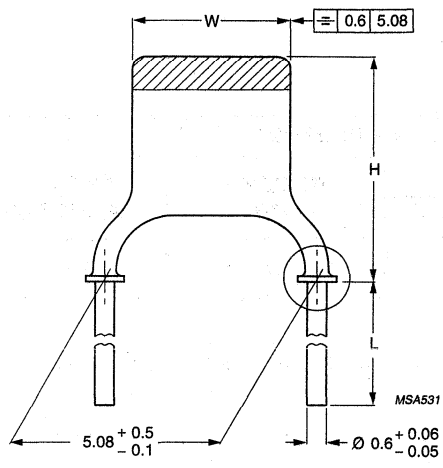


Fig.1 Outlines.

Miniature ceramic plate capacitors

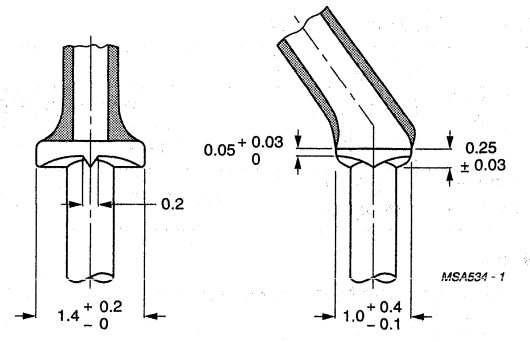
Class 2, low loss, 1000 V (DC) (2E2 flanged types)

MECHANICAL DATA



Dimensions in mm.
For dimensions H, L and W see Tables 1 and 2.

Fig.2 Component outline.



Dimensions in mm.

Fig.3 Detail of flange.

Marking

The body of the capacitors is tan coloured. The temperature dependency is indicated by a blue coloured cap. Capacitance value and voltage are indicated by a marking code on the body. Refer to Table 3 for marking codes.

Mounting

When bending, cutting or flattening, the leads should be relieved of the applied load by supporting them at the capacitor body.

Soldering conditions:

max. 265 °C, max. 10 s.

The capacitors are suitable for mounting on printed-circuit boards (hand-mounting or automatic insertion).

Physical dimensions

Table 1 Capacitor dimensions and mass

SIZE(1)	W(2) (mm)	H(2) (mm)	MASS (g)
I	3.6 (–1.1)	6.3 (–1.8)	≈0.15
IIA	3.9 (–1.4)	6.7 (–2.0)	≈0.15
IIB	4.5 (–1.8)	7.3 (–2.4)	≈0.18
III	5.3 (–1.8)	8.1 (–2.6)	≈0.22
IV	6.2 (–2.0)	9.0 (–2.7)	≈0.33
V	6.2 (–2.0)	11.2 (–3.1)	≈0.47

Notes

1. Unless indicated in Table 3, the thickness of the capacitors does not exceed 3.0 mm.
2. Tolerances are given between parentheses.

PACKAGING

For details refer to this handbook, chapter *'Miniature ceramic plate capacitors"*, section *"General data"*.

ORDERING INFORMATION

Table 2 Catalogue numbers

PITCH P	LEAD DIAMETER d	CATALOGUE NUMBERS(1)			
		BULK PACKED		ON TAPE(2) (REEL)	ON TAPE(2) (AMMOPACK)
		L ≥ 13 mm	L = 4 ±0.5 mm		
5.08 mm (0.2 inch)	0.6 mm (0.024 inch)	2222 695 09...	2222 695 19...	2222 695 53...	2222 695 63...

Notes

1. Catalogue numbers to be completed by adding the 3-digit suffix for required capacitance value, see Table 3.
2. H_0 = 18.25 mm.

Table 3 **Preferred** range of values

CAPACITANCE VALUE (pF)	SIZE (see Table 1)	MARKING CODE		SUFFIX OF CATALOGUE NUMBERS (see Table 2)
		VALUE	VOLTAGE(1)	
270	I	n27	1 kV	271
330	I	n33	1 kV	331
390	IIA	n39	1 kV	391
470	IIA	n47	1 kV	471
560	IIA	n56	1 kV	561
680	IIB	n68	1 kV	681
820	IIB	n82	1 kV	821
1000	III	1n0	1 kV	102
1200	III	1n2	1 kV	122
1500	III	1n5	1 kV	152
1800	IV	1n8	1 kV	182
2200	IV	2n2	1 kV	222
2700	V	2n7	1 kV	272
3300	V	3n3	1 kV	332

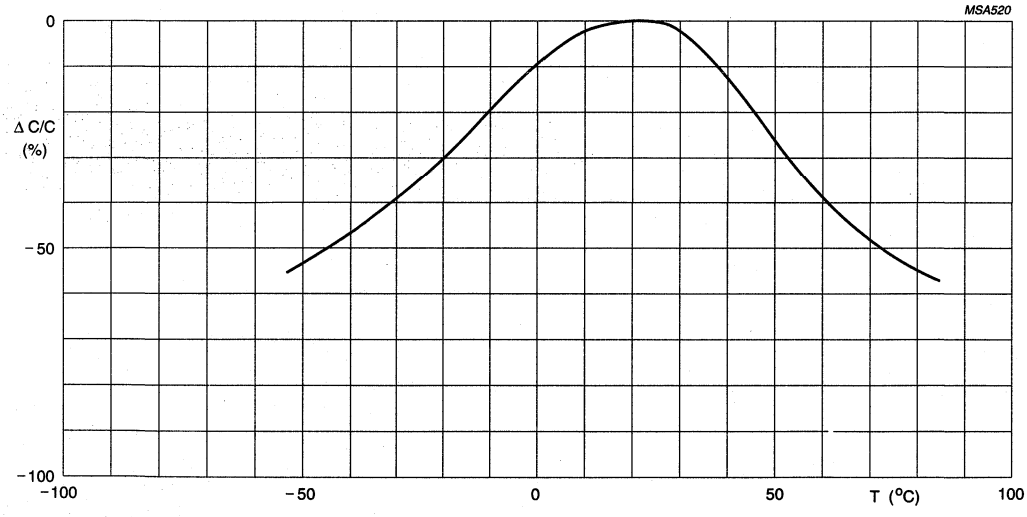
Note

1. The voltage code may be marked on the front or rear side of the capacitor.

ELECTRICAL CHARACTERISTICS

The capacitors meet the essential requirements of *"IEC 60384-9"*. Unless stated otherwise 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 values measured at 1 kHz, 1 V	see Table 3
Tolerance on the capacitance, after 1000 hours	±20%
Rated DC voltage	1000 V
DC test voltage; duration 1 minute	2000 V
DC test voltage of coating; duration 1 minute	2000 V
Insulation resistance at 500 V (DC) after 1 minute	>6000 MΩ
Tan δ measured at 1 kHz, 1 V	<1%
Category temperature range	−55 to +105 °C (2E2)
Storage temperature range	−55 to +85 °C
Typical capacitance change as a function of frequency	see Fig.5
Typical tan δ as a function of frequency	see Fig.6
Climatic category (IEC 60068)	55/105/56
Ageing	typical 5% per time decade



f = 1 kHz.
U = 1 V (DC).

Fig.4 Typical capacitance change with respect to the capacitance at 20 °C as a function of temperature.

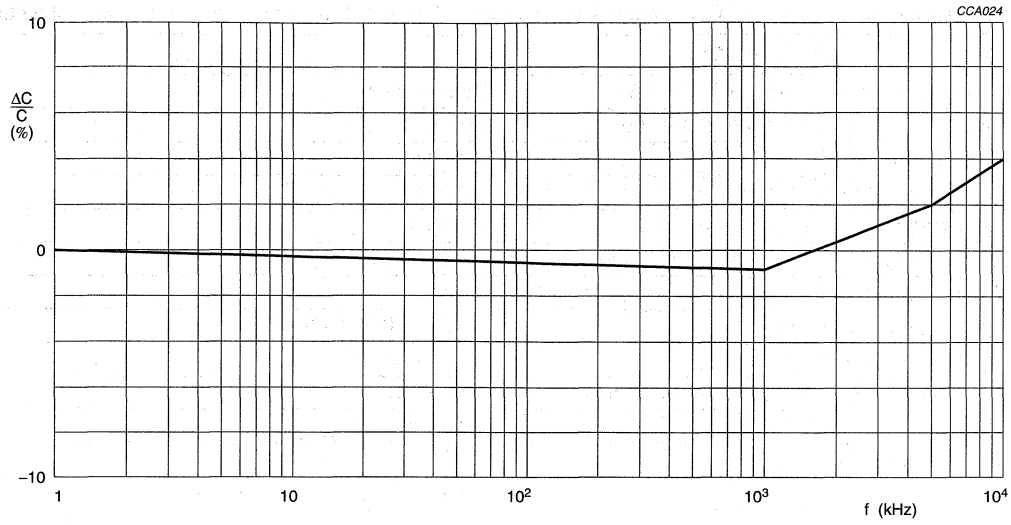


Fig.5 Typical capacitance change as a function of frequency.

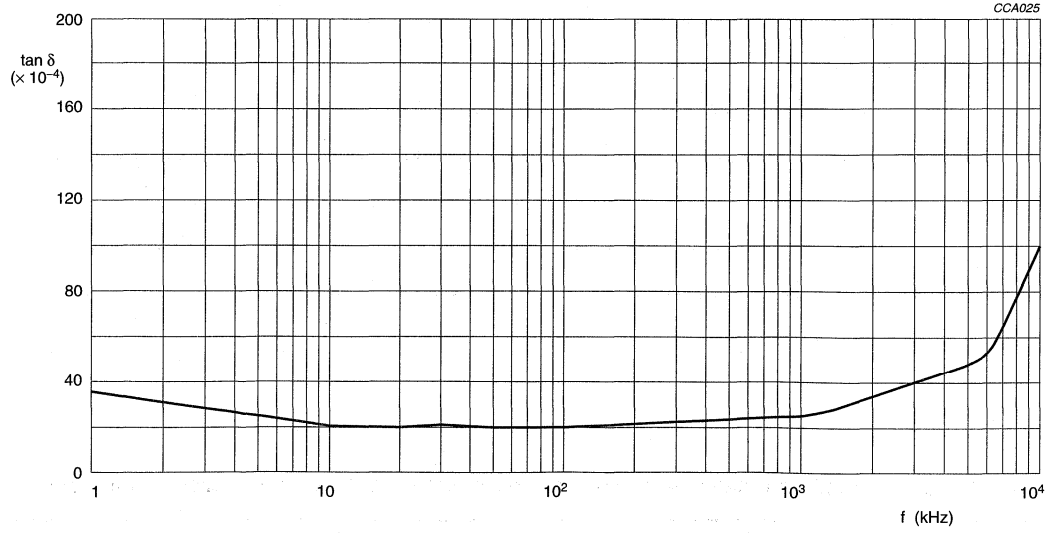


Fig.6 Typical tan δ as a function of frequency.

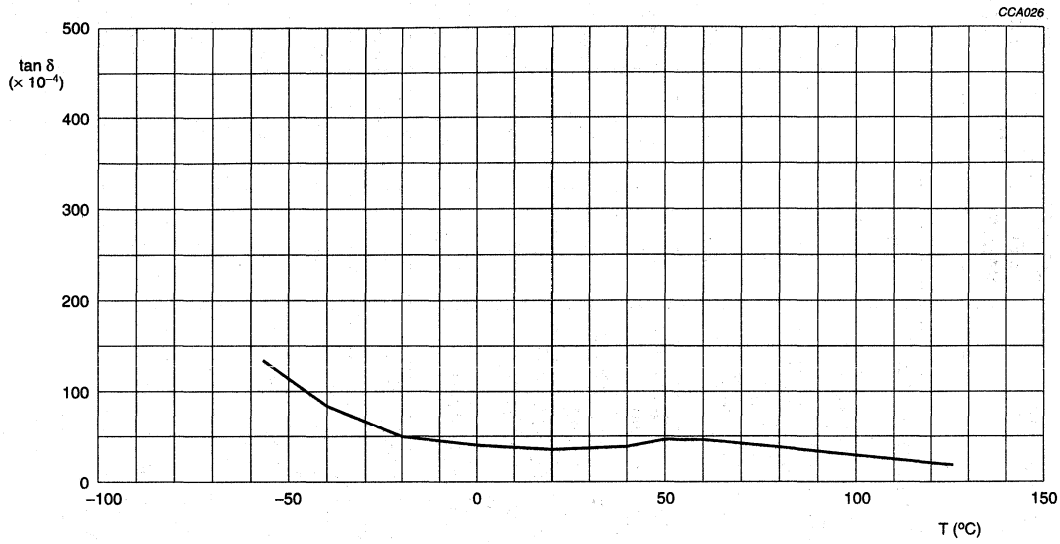


Fig.7 Typical tan δ as a function of temperature.

SAMPLE KITS: MINIATURE CERAMIC PLATE CAPACITORS

TC (TK)[1]	CAP. TOL. <10 pF (pF)	CAP. TOL. ≥10 pF (%)	$U_{R(DC)}$ (V)	LEAD SPACING (mm)	LEAD LENGTH (mm)	CAPACITANCE VALUES[2] (pF)	SAMPLES PER VALUE	SAMPLES PER KIT	ORDER NUMBER (2222)
Sample kits on plastic blisters									
NP0 precision (C0G)[3]	±0.1	±1	100	5.08	>13	1; 1.5; 2.2; 3.3; 4.7; 6.8; 10; 12; 15; 22; 33; 47; 68; 100; 120; 150; 180; 220	50	900	683 90001
P100 (M7G)	±0.25	±2		5.08	>13	0.56; 0.68; 0.82; 1; 1.2; 1.5; 2.2; 3.3; 4.7; 6.8; 10; 12; 15; 22; 27; 33; 39; 47	50	900	683 04001
NP0 (C0G)	±0.25	±2		5.08	>13	1.8; 2.2; 2.7; 3.3; 4.7; 6.8; 10; 12; 15; 22; 33; 47; 68; 100; 120; 150; 180; 220	50	900	683 10001
N150 (P2G)	±0.25	±2		5.08	>13	3.9; 4.7; 6.8; 10; 12; 15; 18; 22; 27; 33; 47; 68; 82; 100; 120; 150; 180; 220	50	900	683 34001
N750 (U2J)	±0.25	±2		5.08	>13	3.9; 4.7; 6.8; 10; 12; 15; 18; 22; 33; 47; 68; 100; 120; 150; 180; 220; 270; 330	50	900	683 58001
N1500 (P3K)	–	±2		5.08	>13	18; 22; 27; 33; 39; 47; 68; 82;100; 120; 150; 180; 220; 270; 330; 390; 470; 560	50	900	683 70001
2C2/2E1 (X5S/X7T)	–	±10		5.08	>13	180; 220; 330; 470; 560; 680; 820; 1000; 1200; 1500; 1800; 2200; 2700; 3300; 3900; 4700; 5600; 6800	50	900	630 09001
2E2 (X5U)	–	+50/–20		5.08	>13	1000; 1200; 1500; 2200; 3300; 4700; 6800; 10000; 15000	100	900	640 09001
2F6 (Y5V)	–	+80/–20	63	5.08	>13	1000; 1500; 2200; 4700; 10000; 15000; 22000; 33000; 47000	100	900	629 09001
NP0 precision (C0G)[3]	±0.1	±1	500	5.08	>13	0.82; 1; 1.2; 1.5; 2.2; 3.3; 4.7; 6.8; 10; 12; 15; 22; 33; 47; 68; 100; 120; 150	50	900	652 90001
P100 (M7G)	±0.25	±2		5.08	>13	0.47; 0.56; 0.68; 0.82; 1; 1.2; 1.5; 1.8; 2.2; 3.3; 4.7; 6.8; 10; 12; 15; 22; 27; 33	50	900	652 04001
NP0 (C0G)	±0.25	±2		5.08	>13	1; 1.5; 1.8; 2.2; 2.7; 3.3; 4.7; 6.8; 10; 12; 15; 22; 33; 47; 68; 100; 120; 150	50	900	652 10001
N150 (P2G)	±0.25	±2		5.08	>13	2.2; 3.3; 3.9; 4.7; 6.8; 10; 12; 15; 18; 22; 27; 33; 47; 68; 82; 100; 120; 150	50	900	652 34001
N750 (U2J)	±0.25	±2		5.08	>13	1.8; 2.2; 2.7; 3.3; 3.9; 4.7; 6.8; 10; 12; 15; 18; 22; 33; 47; 68; 100; 120; 150	50	900	652 58001
N1500 (P3K)	–	±2		5.08	>13	10; 12; 15; 18; 22; 27; 33; 39; 47; 68; 82; 100; 120; 150; 180; 220; 270; 330	50	900	652 70001

TC (TK)[1]	CAP. TOL.		$U_{R(DC)}$ (V)	LEAD SPACING (mm)	LEAD LENGTH (mm)	CAPACITANCE VALUES[2] (pF)	SAMPLES PER VALUE	SAMPLES PER KIT	ORDER NUMBER (2222)
	<10 pF (pF)	≥10 pF (%)							
2C2/2E1 (X5S/X7T)	–	±10	500	5.08	>13	100; 150; 180; 220; 270; 330; 470; 560; 680; 820; 1000; 1200; 1500; 1800; 2200; 2700; 3300; 3900; 4700	50	900	655 09001
SL (P100 to N1500)	±0.25	±5	1000	5.08	>13	0.47; 1; 1.5; 1.8; 2.2; 2.7; 3.3; 4.7; 6.8; 10; 12; 15; 22; 33; 47; 68; 100; 120	25	450	694 09001
2C2/2E1 (X5S/X7T)	–	±10		5.08	>13	100; 150; 180; 220; 270; 330; 470; 680; 1000; 1200	50	450	693 09001
2E2 (X5U)	–	±20		5.08	>13	270; 330; 470; 680; 1000; 1500; 2200; 2700; 3300	50	450	695 09001
Sample kits in cardboard boxes									
NP0 precision (C0G)[3]	±0.1	±1	100	5.08	>13	1; 2.2; 4.7; 10; 15; 22; 47; 100; 150; 220	500	5000	683 90002
P100 (M7G)	±0.25	±2		5.08	>13	0.56; 1; 1.5; 2.2; 4.7; 10; 15; 22; 33; 47	500	5000	683 04002
NP0 (C0G)	±0.25	±2		5.08	>13	1.5; 2.7; 4.7; 10; 15; 22; 47; 100; 150; 220	500	5000	683 10002
N150 (P2G)	±0.25	±2		5.08	>13	3.9; 4.7; 10; 15; 22; 47; 68; 100; 150; 220	500	5000	683 34002
N750 (U2J)	±0.25	±2		5.08	>13	3.9; 4.7; 10; 15; 22; 47; 100; 150; 220; 330	500	5000	683 58002
N1500 (P3K)	–	±2		5.08	>13	18; 22; 47; 68; 100; 150; 220; 330; 470; 560	500	5000	683 70002
2C2/2E1 (X5S/X7T)	–	±10		5.08	>13	180; 220; 470; 680; 1000; 1500; 2200; 3300; 4700; 5600	500	5000	630 09002
2E2 (X5U)	–	+50/–20		5.08	>13	1000; 1200; 1500; 2200; 3300; 4700; 6800; 8200; 10000; 15000	500	5000	640 09002
2F6 (Y5V)	–	+80/–20	63	5.08	>13	1000; 1500; 2200; 4700; 6800; 10000; 15000; 22000; 33000; 47000	500	5000	629 09002
NP0 precision (C0G)[3]	±0.1	±1	500	5.08	>13	0.82; 1; 2.2; 4.7; 10; 15; 22; 47; 100; 150	500	5000	652 90002
P100 (M7G)	±0.25	±2		5.08	>13	0.47; 0.68; 1; 1.5; 2.2; 4.7; 10; 15; 22; 33	500	5000	652 04002
NP0 (C0G)	±0.25	±2		5.08	>13	0.82; 1; 2.2; 4.7; 10; 15; 22; 47; 100; 150	500	5000	652 10002
N150 (P2G)	±0.25	±2		5.08	>13	2.2; 4.7; 10; 15; 22; 47; 68; 100; 120; 150	500	5000	652 34002
N750 (U2J)	±0.25	±2		5.08	>13	1.8; 2.2; 4.7; 10; 15; 22; 47; 68; 100; 150	500	5000	652 58002
N1500 (P3K)	–	±2		5.08	>13	10; 15; 22; 47; 68; 100; 150; 120; 470; 560	500	5000	652 70002
2C2/2E1 (X5S/X7T)	–	±10		5.08	>13	100; 150; 220; 470; 680; 1000; 1500; 2200; 3300; 4700	500	5000	655 09002

TC (TK)[1]	CAP. TOL.		$U_{R(DC)}$ (V)	LEAD SPACING (mm)	LEAD LENGTH (mm)	CAPACITANCE VALUES[2] (pF)	SAMPLES PER VALUE	SAMPLES PER KIT	ORDER NUMBER (2222)
	<10 pF (pF)	≥10 pF (%)							
SL (P100 to N1500)	±0.25	±5	1000	5.08	>13	0.47; 1; 2.2; 4.7; 10; 15; 22; 47; 68; 100	500	5000	694 09002
2C2/2E1 (X5S/X7T)	–	±10		5.08	>13	100; 150; 180; 220; 330; 470; 680; 820; 1000; 1200	500	5000	693 09002
2E2 (X5U)	–	±20		5.08	>13	270; 330; 470; 680; 820; 1000; 1500; 2200; 2700; 3300	500	5000	695 09002

Notes

1. Temperature coefficient code in accordance with *"RS198"* is shown between parentheses.
2. Other capacitance values and tolerances are available on request. Customized sample kits are also available on request.
3. E24 series of values are available on request.

DATA HANDBOOK SYSTEM

Data handbook system

DATA HANDBOOK SYSTEM

BC Components data handbooks are available for selected product ranges and contain all relevant data available at the time of publication and each is revised and updated regularly.

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BC02	PA02	Varistors, Thermistors and Sensors
BC03	PA03	Potentiometers
BC04	PA04	Variable Capacitors
BC05	PA05	Film Capacitors
BC06	PA06b	Ceramic Capacitors
BC08	PA08	Fixed Resistors
BC10	PA10	Quartz Crystals
BC11	PA11	Quartz Oscillators

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STANDARD SERIES OF VALUES IN A DECADE FOR RESISTANCES AND CAPACITANCES

According to *"IEC publication 60063"*.

E192	E96	E48	E192	E96	E48	E192	E96	E48	E192	E96	E48
100	100	100	178	178	178	316	316	316	562	562	562
101			180			320			569		
102	102		182	182		324	324		576	576	
104			184			328			583		
105	105	105	187	187	187	332	332	332	590	590	590
106			189			336			597		
107	107		191	191		340	340		604	604	
109			193			344			612		
110	110	110	196	196	196	348	348	348	619	619	619
111			198			352			626		
113	113		200	200		357	357		634	634	
114			203			361			642		
115	115	115	205	205	205	365	365	365	649	649	649
117			208			370			657		
118	118		210	210		374	374		665	665	
120			213			379			673		
121	121	121	215	215	215	383	383	383	681	681	681
123			218			388			690		
124	124		221	221		392	392		698	698	
126			223			397			706		
127	127	127	226	226	226	402	402	402	715	715	715
129			229			407			723		
130	130		232	232		412	412		732	732	
132			234			417			741		
133	133	133	237	237	237	422	422	422	750	750	750
135			240			427			759		
137	137		243	243		432	432		768	768	
138			246			437			777		
140	140	140	249	249	249	442	442	442	787	787	787
142			252			448			796		
143	143		255	255		453	453		806	806	
145			258			459			816		
147	147	147	261	261	261	464	464	464	825	825	825
149			264			470			835		
150	150		267	267		475	475		845	845	
152			271			481			856		
154	154	154	274	274	274	487	487	487	866	866	866
156			277			493			876		
158	158		280	280		499	499		887	887	
160			284			505			898		
162	162	162	287	287	287	511	511	511	909	909	909
164			291			517			920		
165	165		294	294		523	523		931	931	
167			298			530			942		
169	169	169	301	301	301	536	536	536	953	953	953
172			305			542			965		
174	174		309	309		549	549		976	976	
176			312			556			988		

E24	E12	E6	E3
10	10	10	10
11			
12	12		
13			
15	15	15	
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20			
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