Miniature ceramic plate capacitors — General data

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 100×10^{-6}/°C and N750 indicates a negative temperature coefficient of 750×10^{-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 384-9”* 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 384-9”* 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 384-8”*.

Table 1 Temperature characteristic of capacitance in accordance with *"IEC 384-9"*

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	–

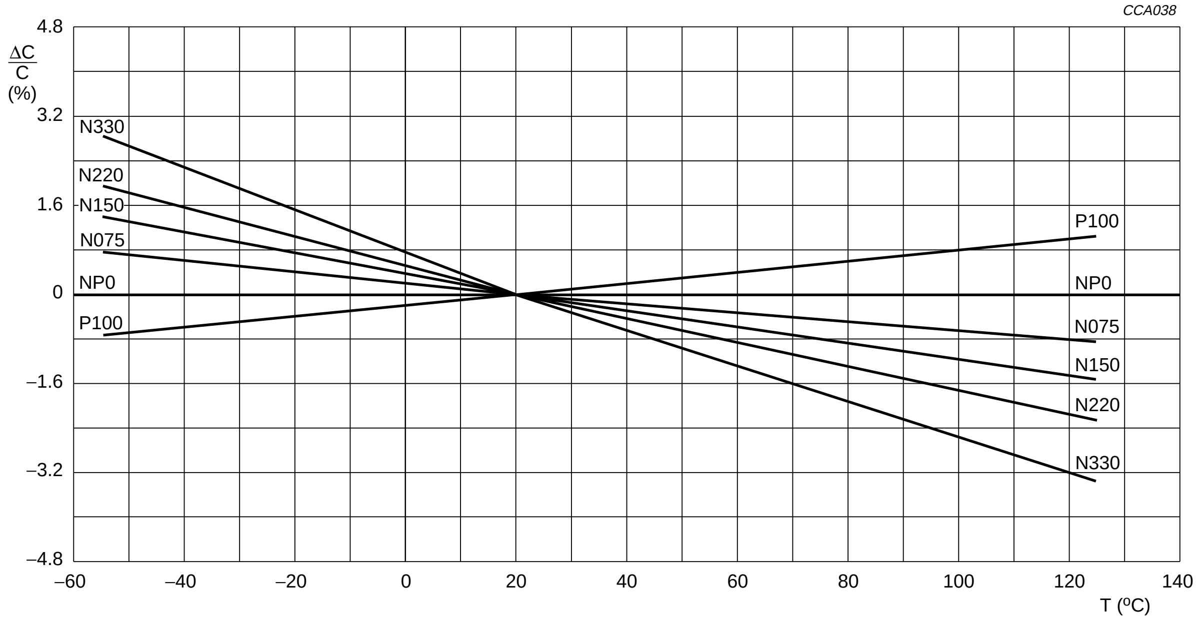


Fig.1 Capacitance change as a function of temperature.

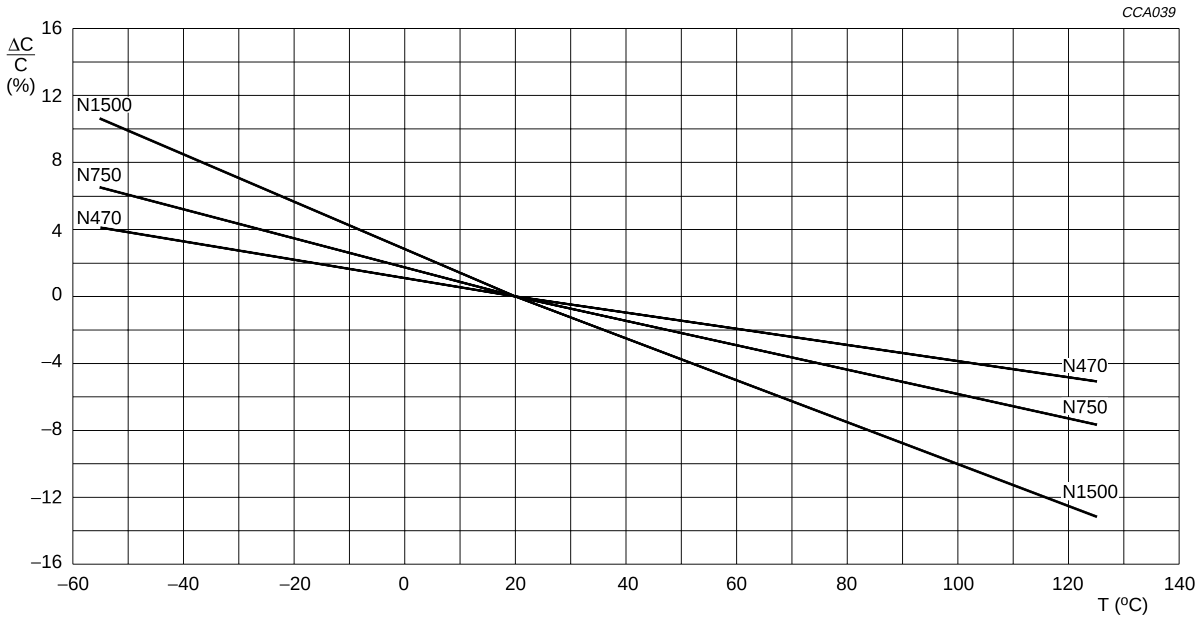


Fig.2 Capacitance change as a function of temperature.

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: ε_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: ε_r > 250; high-K types

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

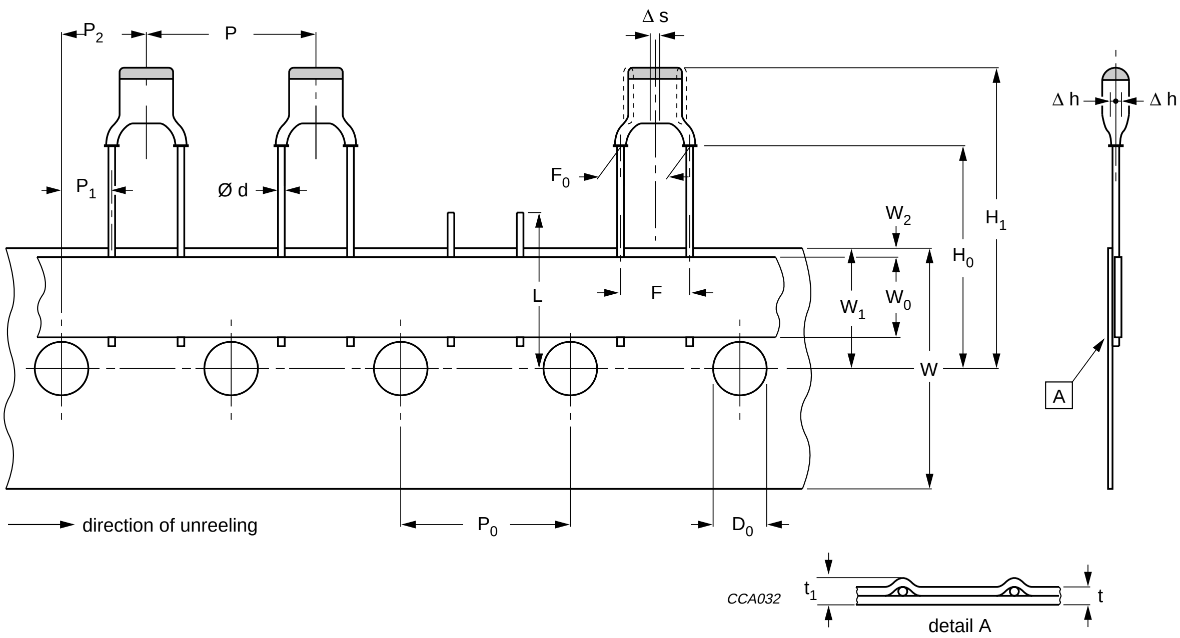
PACKAGING

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.

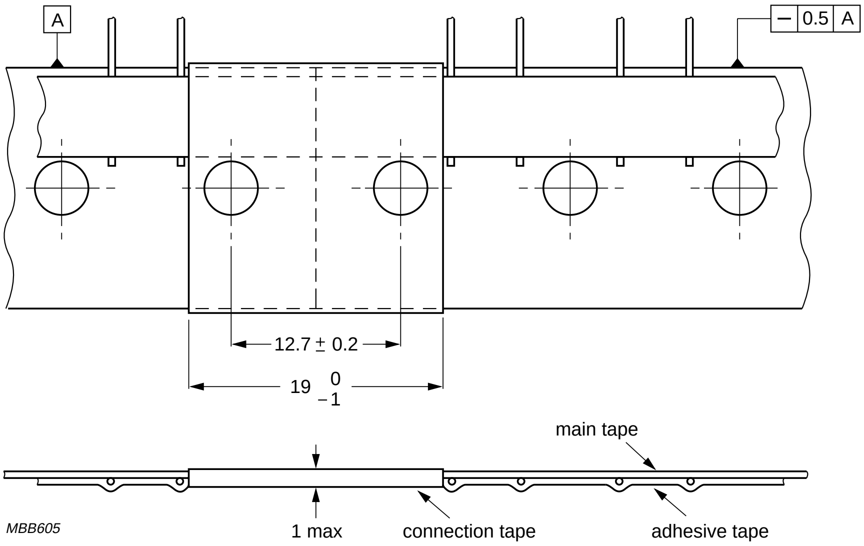
Fig.3 Capacitors, lead pitch 5.08 mm, on tape.

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.



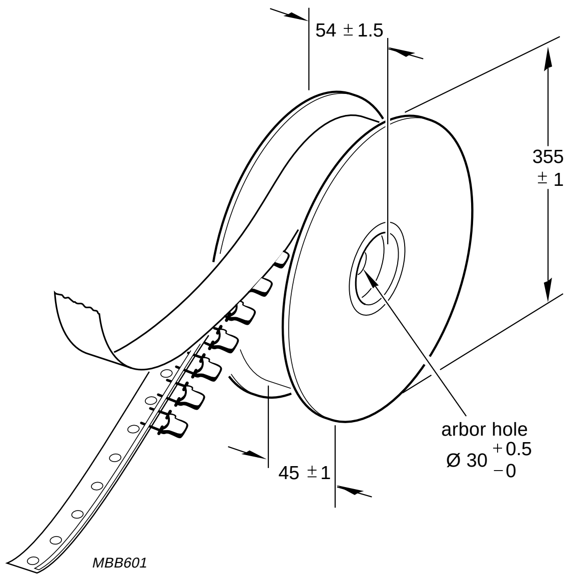
Dimensions in mm.

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.

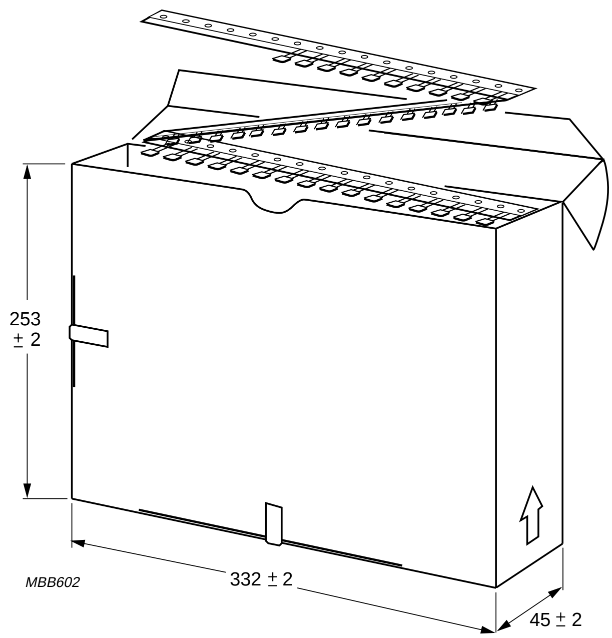
Table 8 Properties of the tape

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.

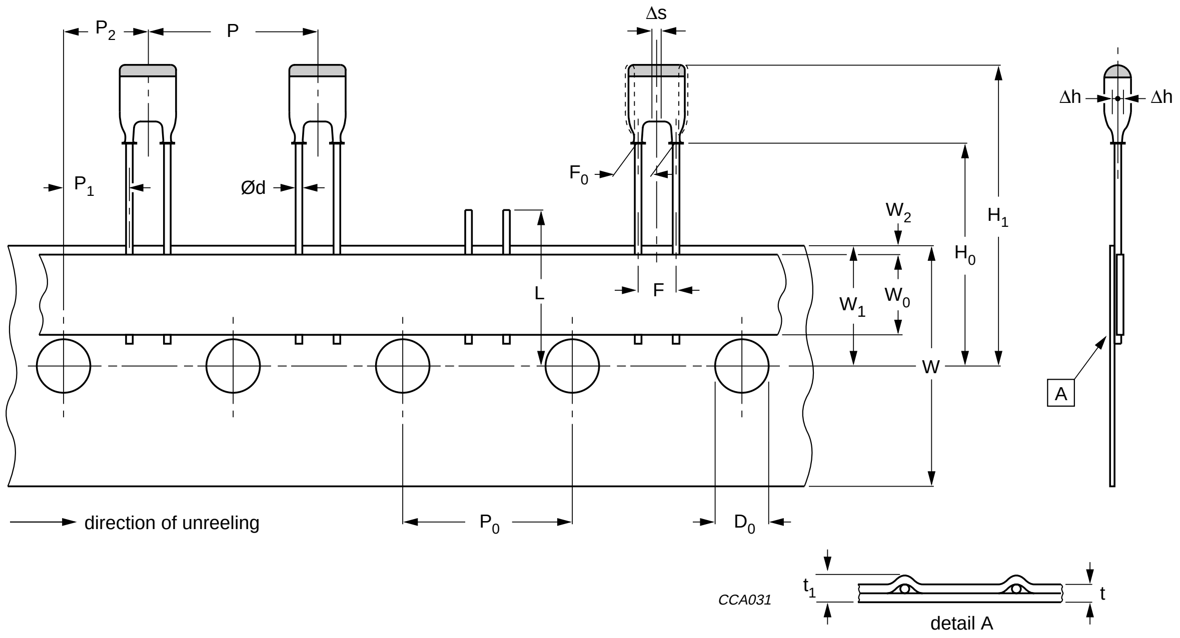
Fig.5 Reel with capacitors on tape.



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.

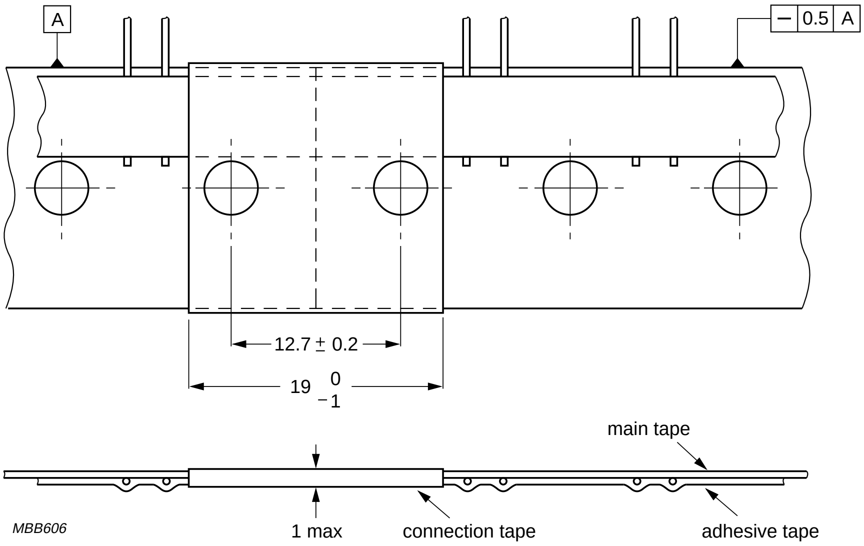
Fig.7 Capacitors, lead pitch 2.54 mm, on tape.

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.



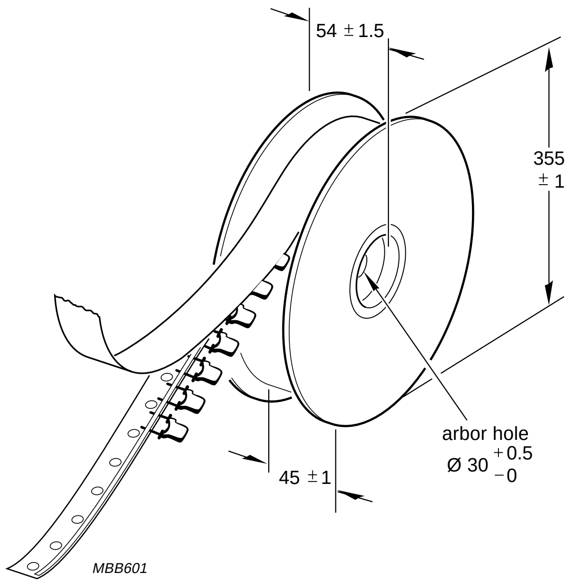
Dimensions in mm.

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.

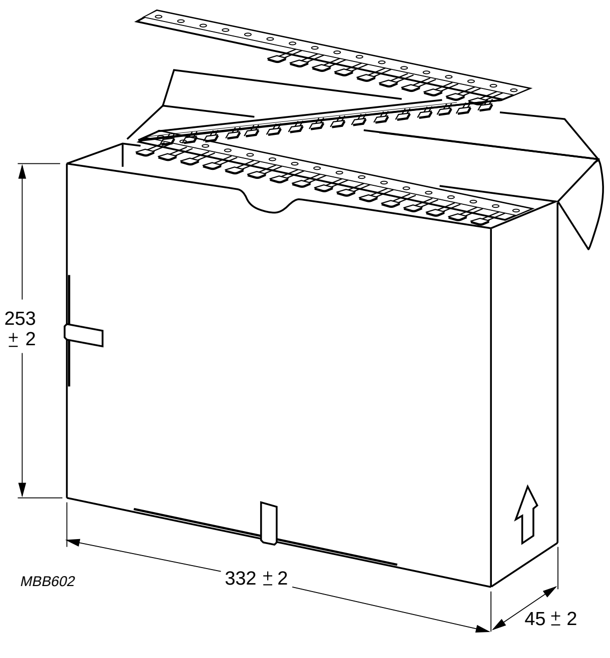
Table 10 Properties of the tape

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.

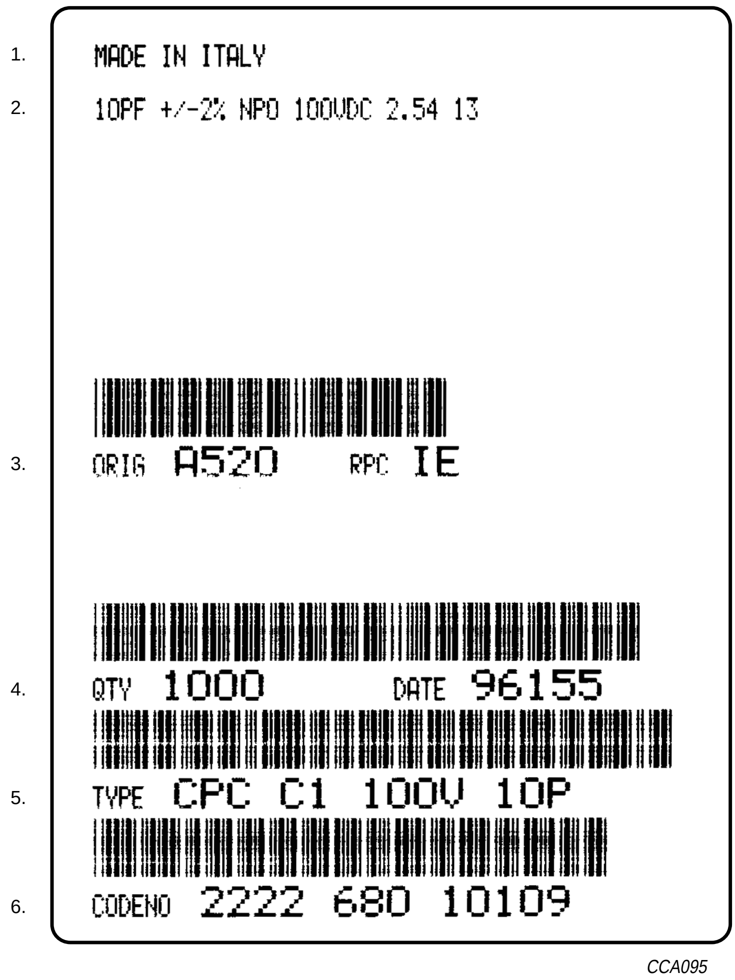


Dimensions in mm.

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 384-8"*, category as specified for each product family are carried out in accordance with *"IEC publication 68"*.

Table 11 Test procedures and requirements

IEC 384-8 CLAUSE	IEC 68-2 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 384-8 CLAUSE	IEC 68-2 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	ΔC/C: ±≤1% or ±1 pF tan δ: ≤2 × 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	ΔC/C: ±≤1% or ±1 pF tan δ: ≤2 × 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)	ΔC/C: ±≤1% or ±1 pF tan δ: ≤1.5 × 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 384-8”*, category 55/125/56 (temperature range –55/+125 °C; damp heat, long term, 56 days) are carried out in accordance with *“IEC publication 68”*.

Table 12 Test procedures and requirements

IEC 384-8 CLAUSE	IEC 68-2 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 384-8 CLAUSE	IEC 68-2 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	$\Delta C/C$: ±≤1% or ±1 pF whichever is greater tan δ: ≤2 × 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	$\Delta C/C$: ±≤1% or ±1 pF whichever is greater tan δ: ≤2 × specified tan δ R_{ins} after 1 to 2 hours: >1000 MΩ
4.13		endurance	1000 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)	$\Delta C/C$: ±≤1% or ±1 pF whichever is greater tan δ: ≤1.5 × 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 384-9”*, category as specified for each product family, are carried out in accordance with *“IEC publication 68”*.

Table 13 Test procedures and requirements

IEC 384-9 CLAUSE	IEC 68-2 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 384-9 CLAUSE	IEC 68-2 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	$\Delta C/C$ 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 $\Delta C/C$ 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)	$\Delta C/C$ 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")

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

CCA945