

DATA SHEET

MKP 338 1

Metallized polyester film capacitors

Product specification

2000 Aug 28

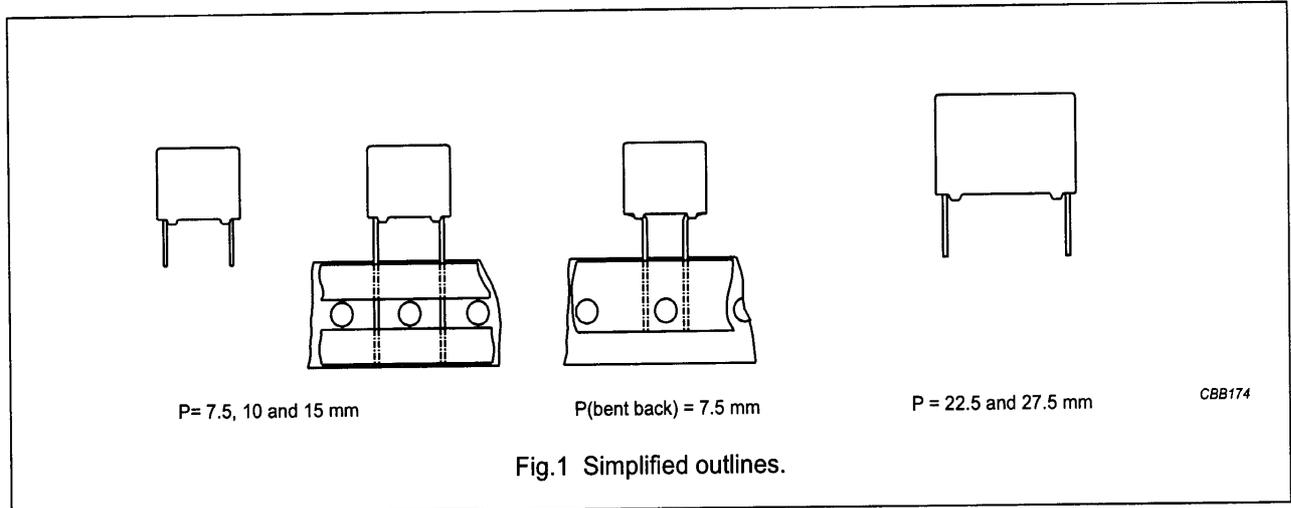
NEW

File under BCcomponents, BC05

Metallized polyester film capacitors

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MKP RADIAL POTTED TYPE

PITCH 15/22.5/27.5 mm
PITCH 7.5 mm (bent back leads)

FEATURES

- 7.5 to 27.5 mm lead pitch
- Supplied loose in box, taped on ammpack or reel
- Consists of a low-inductive wound cell of metallized polypropylene film, potted in a flame-retardant case.

APPLICATIONS

- For X1 electromagnetic interference suppression
- Specially designed to meet the **NEW REQUIREMENTS** of the new "IEC 60384-14 2nd edition and EN 132400", requiring a 4 kV peak pulse voltage test UL1414 and CSA-C22.2 No. 1 specifications.

QUICK REFERENCE DATA

DESCRIPTION	VALUE
Capacitance range (E12 series)	10 nF to 1 μ F
Capacitance tolerance	$\pm 20\%$; $\pm 10\%$; $\pm 5\%$
Rated (AC) voltage, 50 to 60 Hz	440 V
Rated (DC) voltage	1000 V
Climatic category	55/105/56/B
Rated temperature	105 °C
Maximum application temperature	105 °C
Reference specifications	IEC 60384-14 2 nd edition and EN 132400
Safety approvals:	
250 V	UL1414; note 1
440 V	UL1283; note 2
440 V	FI; note 1
Materials	qualified in accordance with UL94V-O
Safety class	X1

Notes

1. Approved
2. Pending.

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SAFETY APPROVALS

SAFETY APPROVALS (X1)		VOLTAGE	VALUE	FILE NUMBERS
	UL1414	250 V (AC)	10 nF to 1 μ F	E112471
	UL1283	440 V (AC)	10 nF to 1 μ F	pending
	FI (EN132400)	440 V (AC)	10 nF to 1 μ F	FI 15350

SAFETY TEST REPORT

SAFETY TEST REPORT		VOLTAGE	VALUE	FILE NUMBERS
CB TEST CERTIFICATE		440 V (AC)	10 nF to 1.0 μ F: 55/105/56/B	FI 1653
This approval together with the CB-Certificate replace all national approval marks of the following countries (they have already signed the CB-Agreement):				
Austria	Belgium	Denmark	Finland	Sweden
France	Germany	Ireland	Italy	Switzerland
Netherlands	Israel	Portugal	Spain	Great Britain
Japan	Norway	China	Poland	Czech. Republic
Singapore	Rep. of Korea	Hungary	Iceland	Slovenian

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COMPOSITION OF CATALOGUE NUMBER

TYPE AND PITCHES	
338 1 X1	7.5 mm (bent back)
	15.0 mm
	22.5 mm
	27.5 mm

CAPACITANCE
(numerically)

MULTIPLIER (nF)	
0.1	2
1	3
10	4
100	5

Example:
104 = 10 x 10 = 100 nF

2222 338 1X XX X

TYPE	PACKAGING	STANDARD DIMENSIONS		PREFERRED TYPES	
338 1 X1	loose in box	lead length 3.5 mm	±20%	2222 338 10...	see Handbook
		lead length 5.0 mm		2222 338 12...	
		lead length 25.0 mm		2222 338 14...	
	taped	pitch = 7.5 mm or bent back to 7.5 mm		2222 338 16...	
		ALTERNATIVE C-TOL		ON REQUEST	
338 1 X1	loose in box	lead length 3.5 mm	±10%	2222 338 1....	see Type detail specification
			±5%	2222 338 1....	
		lead length 5.0 mm	±10%	2222 338 1....	
		±5%	2222 338 1....		
	lead length 25.0 mm	±10%	2222 338 1....		
		±5%	2222 338 1....		
taped	pitch = bent back to 7.5 mm	±10%	2222 338 1....	2222 338 1....	
	H = 18.5 mm; for P ₀ = 12.7 mm; note 2	±10%	2222 338 1....	2222 338 1....	
			±5%	2222 338 1....	

Notes

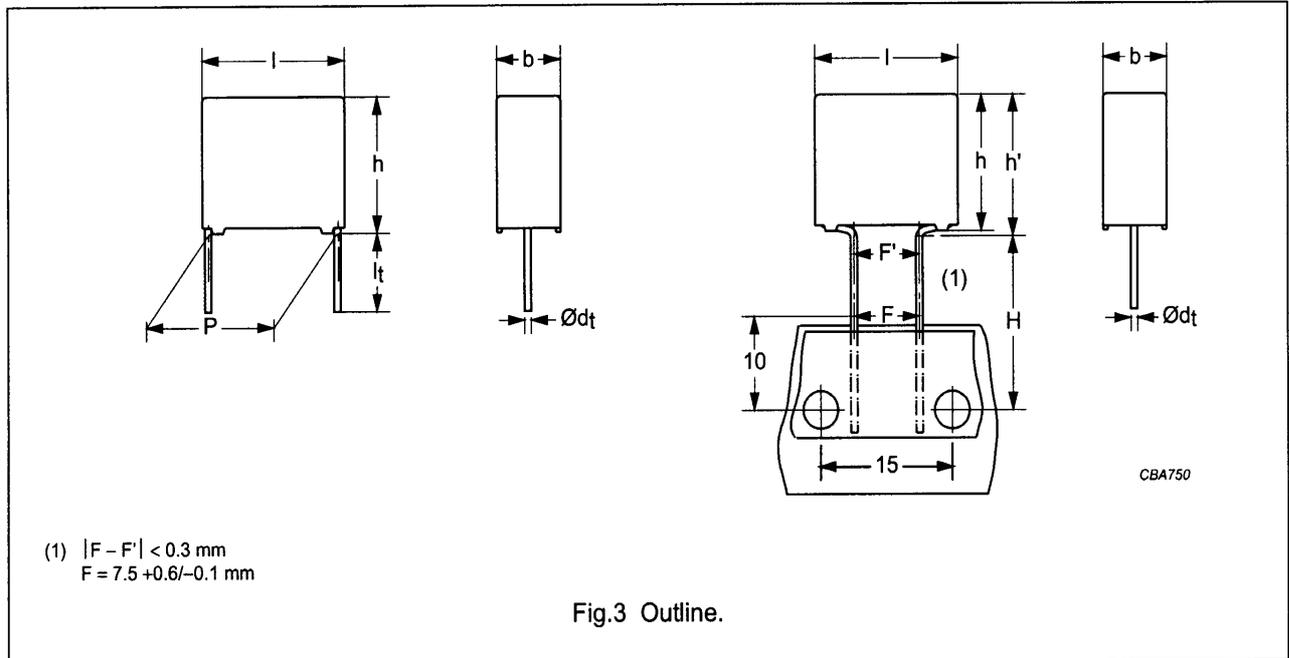
- 1) For SPQ refer to this handbook, chapter "Packaging information"; taped on reel pitch = 27.5 mm is not available.
- 2) H = in-tape height; for detailed specifications refer to this handbook, chapter "Packaging information".

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MKP 338 1 GENERAL DATA

PITCH 15/22.5/27.5 mm
 PITCH 7.5 mm (bent back leads)



Specific reference data for the 440 V AC (X1) capacitors

DESCRIPTION	VALUE		
	at 1 kHz	at 10 kHz	at 100 kHz
Tangent of loss angle: $C \leq 470 \text{ nF}$ $C > 470 \text{ nF}$	$\leq 10 \times 10^{-4}$ $\leq 20 \times 10^{-4}$	$\leq 20 \times 10^{-4}$ $\leq 70 \times 10^{-4}$	$\leq 100 \times 10^{-4}$ -
Rated voltage pulse slope (dU/dt)R at 615 V: $P = 15.0 \text{ mm}$ $P = 22.5 \text{ mm}$ $P = 27.5 \text{ mm}$	250 V/ μs 150 V/ μs 100 V/ μs		
R between leads, for $C \leq 0.33 \mu\text{F}$ at 100 V; 1 minute	>15000 M Ω		
RC between leads, for $C > 0.33 \mu\text{F}$ at 100 V; 1 minute	>5000 s		
R between leads and case; 100 V; 1 minute	>30000 M Ω		
Withstanding (DC) voltage (cut off current 10 mA); rise time 100 V/s:	3400 V; 1 minute		
Withstanding (AC) voltage between leads and case	2380 V; 1 minute		

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 $U_{Rac} = 440 \text{ V (X1)}$; $U_{Rdc} = 1000 \text{ V}$

C (μF)	DIMENSIONS $b \times h \times l$ (mm)	MASS (g)	CATALOGUE NUMBER			
			LOOSE IN BOX			TAPED LARGE REEL (500 mm) ⁽¹⁾⁽²⁾
			short leads		long leads	
			$l_t =$ $3.5 \pm 0.3 \text{ mm}$	$l_t =$ $5.0 \pm 1.0 \text{ mm}$	$l_t =$ $25.0 \pm 2.0 \text{ mm}$	
			C-tol = $\pm 20\%$			C-tol = $\pm 20\%$
			catalogue number ⁽³⁾	last 5 digits ⁽³⁾		last 5 digits ⁽³⁾
Pitch = $15.0 \pm 0.4 \text{ mm}$; $d_t = 0.60 \pm 0.06 \text{ mm}$					reel; pitch = 7.5 mm ; $d_t = 0.60 \text{ mm}$	
0.01	5.0 × 11.0 × 17.5	1.2	2222 338 10103	.. 12103	.. 14103	.. 16103
0.015			2222 338 10153	.. 12153	.. 14153	.. 16153
0.022			2222 338 10223	.. 12223	.. 14223	.. 16223
0.033	6.0 × 12.0 × 17.5	1.4	2222 338 10333	.. 12333	.. 14333	.. 16333
Pitch = $15.0 \pm 0.4 \text{ mm}$; $d_t = 0.80 \pm 0.08 \text{ mm}$					reel; pitch = 7.5 mm ; $d_t = 0.80 \text{ mm}$	
0.047	7.0 × 13.5 × 17.5	1.9	2222 338 10473	.. 12473	.. 14473	.. 16473
0.068	8.5 × 15.0 × 17.5	2.6	2222 338 10683	.. 12683	.. 14683	.. 16683
0.1	10.0 × 16.5 × 17.5	3.1	2222 338 10104	.. 12104	.. 14104	.. 16104
Pitch = $22.5 \pm 0.4 \text{ mm}$; $d_t = 0.80 \pm 0.08 \text{ mm}$						
0.15	8.5 × 18.0 × 26.0	4.4	2222 338 10154	.. 12154	.. 14154	not available
0.22	10.0 × 19.5 × 26.0	5.5	2222 338 10224	.. 12224	.. 14224	
Pitch = $27.5 \pm 0.4 \text{ mm}$; $d_t = 0.80 \pm 0.08 \text{ mm}$						
0.33	13.0 × 23.0 × 31.0	10.4	2222 338 10334	.. 12334	.. 14334	not available
0.47	15.0 × 25.0 × 31.0	12.8	2222 338 10474	.. 12474	.. 14474	
0.68	18.0 × 28.0 × 31.0	17.2	2222 338 10684	.. 12684	.. 14684	
1	21.0 × 31.0 × 31.0	20.4	2222 338 10105	.. 12105	.. 14105	

Notes

1. H = in-tape height; P_0 = sprocket hole distance; for detailed specifications refer to this handbook, chapter "Packaging information".
2. For pitch = 7.5 mm (bent back): H = 16.0 mm and $P_0 = 15.0 \text{ mm}$.
The reel diameter = 500 mm; reel diameter = 356 mm is available on request.
3. The shading indicates preferred types.

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CONSTRUCTION

Description

- Low-inductive wound cell of metallized polypropylene (PP) film, potted with epoxy resin in a flame-retardant polypropylene case
- Radial leads, solder-coated:
 - Copper clad steel wire for original pitch = 15 mm ($b \leq 6$ mm)
 - Copper wire for original pitch = 15 ($b \geq 7$ mm), 22.5 and 27.5 mm
- Small stand-off pips allow removal of solder flux etc. during cleaning of the printed-circuit board.

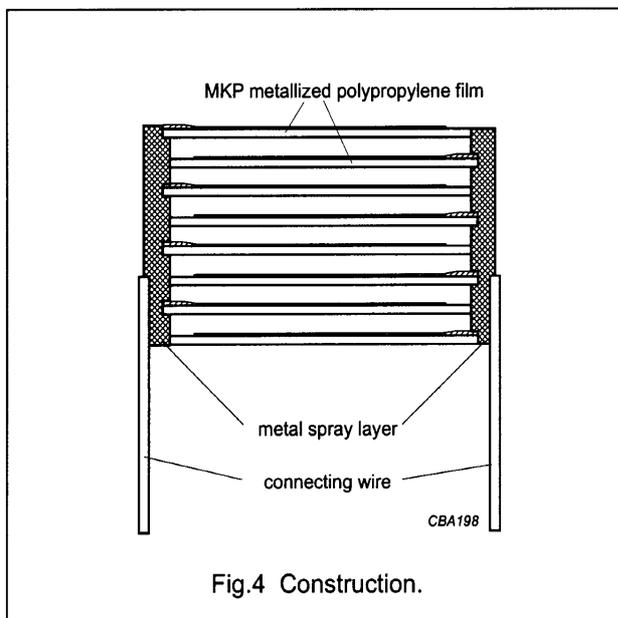


Fig.4 Construction.

Mounting

NORMAL USE

The capacitors are designed for mounting on printed-circuit boards. The capacitors packed in bandoliers are designed for mounting on printed-circuit boards by means of automatic insertion machines.

For detailed tape specifications refer to Type detail specification "HQN-384-01/102, Packaging information"

SPECIFIC METHOD OF MOUNTING TO WITHSTAND VIBRATION AND SHOCK

In order to withstand vibration and shock tests, it must be ensured that the stand-off pips are in good contact with the printed-circuit board:

- For pitches ≤ 15 mm capacitors shall be mechanically fixed by the leads.
- For larger pitches the capacitors shall be mounted in the same way and the body clamped.

SPACE REQUIREMENTS ON PRINTED-CIRCUIT BOARD

The maximum length and width of film capacitors is shown in Fig.5:

- Eccentricity as in Fig.5. The maximum eccentricity is smaller than or equal to the lead diameter of the product concerned.
- Product height with seating plane as given by "IEC 60717" as reference: $h_{\max} \leq h + 0.3$ mm.

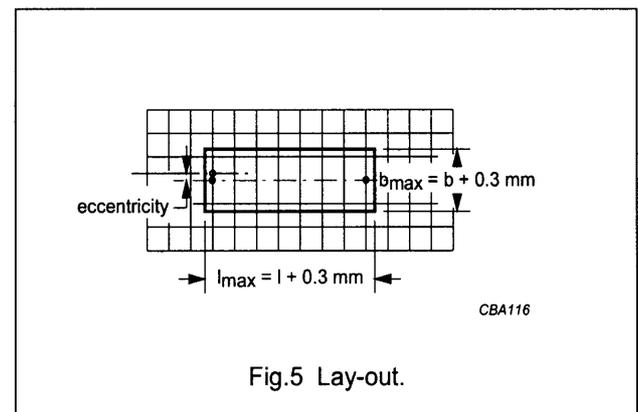


Fig.5 Lay-out.

Storage temperature

- Storage temperature: $T_{\text{stg}} = -25$ to $+40$ °C with RH maximum 80% without condensation.

RATINGS AND CHARACTERISTICS REFERENCE CONDITIONS

Unless otherwise specified, all electrical values apply to an ambient temperature of 23 ± 1 °C, an atmospheric pressure of 86 to 106 kPa and a relative humidity of $50 \pm 2\%$.

For reference testing, a conditioning period shall be applied over 96 ± 4 hours by heating the products in a circulating air oven at the rated temperature and a relative humidity not exceeding 20%.

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CHARACTERISTICS

Capacitance

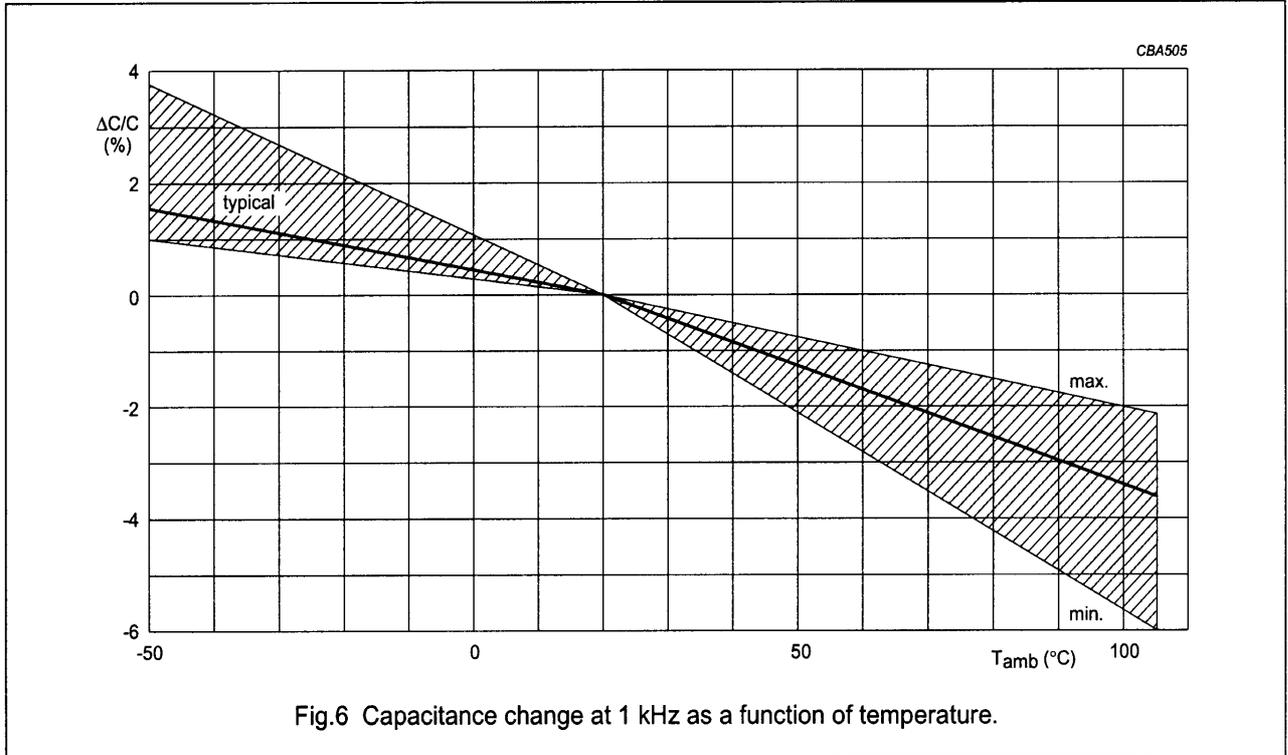


Fig.6 Capacitance change at 1 kHz as a function of temperature.

Tangent of loss angle

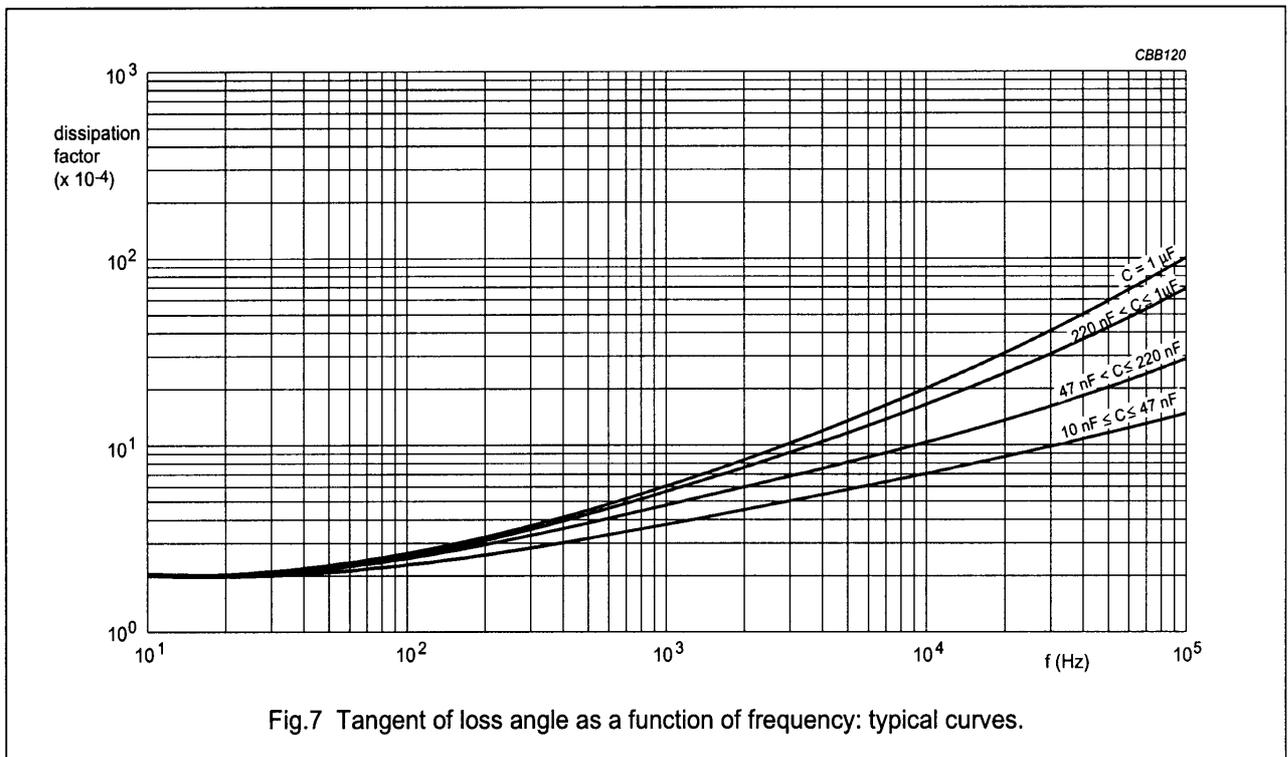
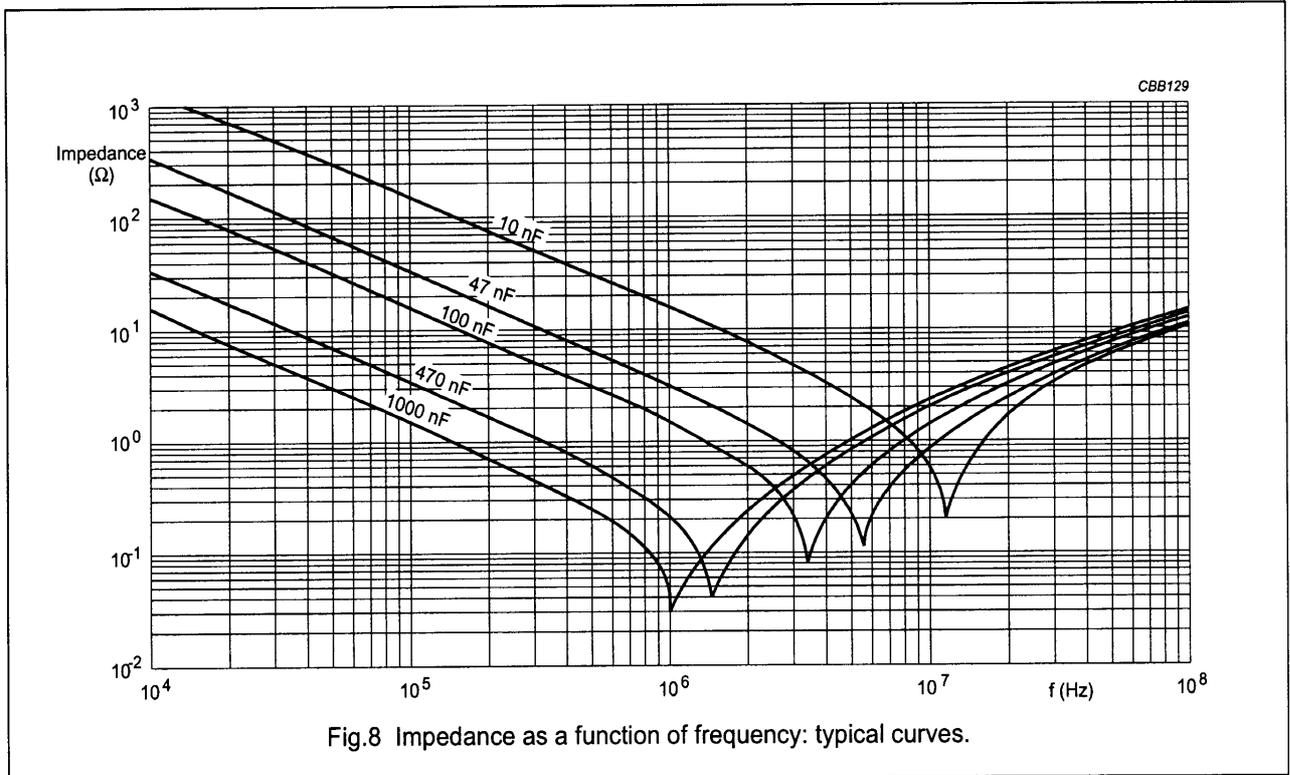


Fig.7 Tangent of loss angle as a function of frequency: typical curves.

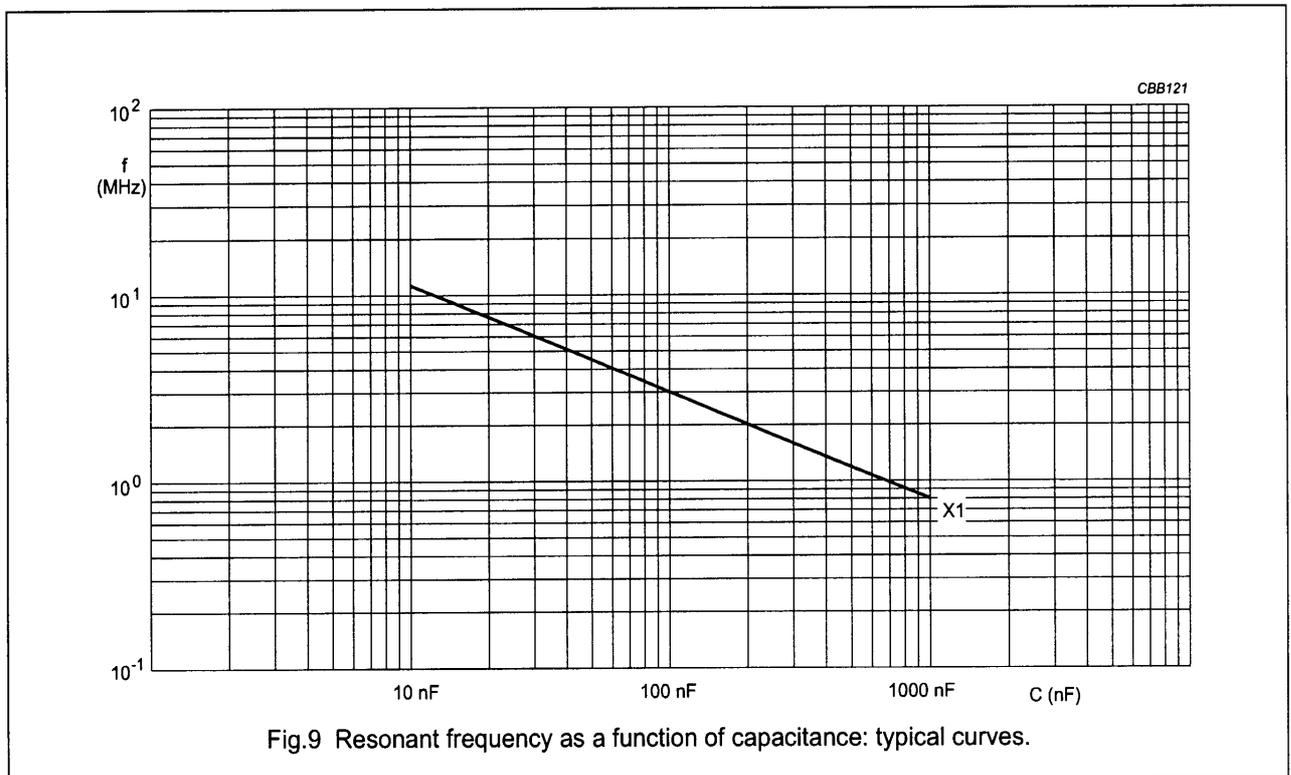
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Impedance



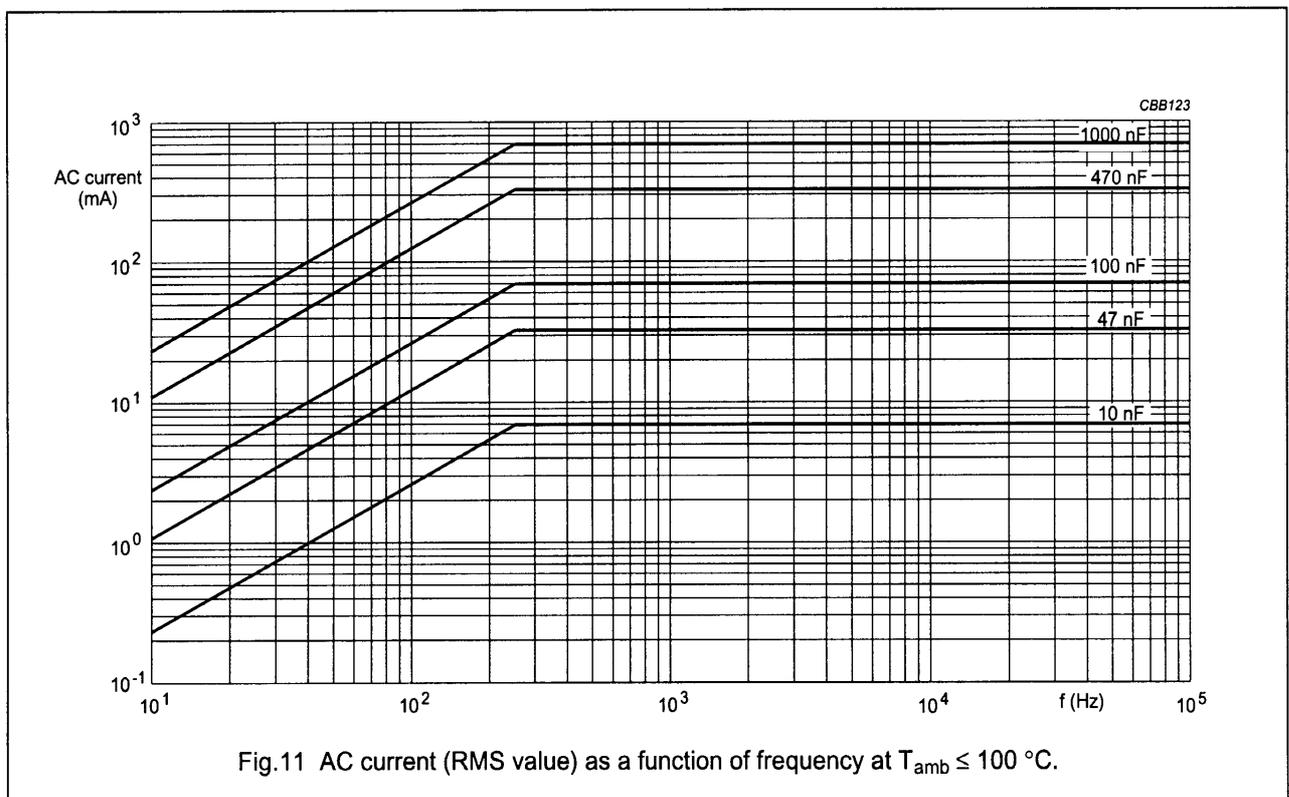
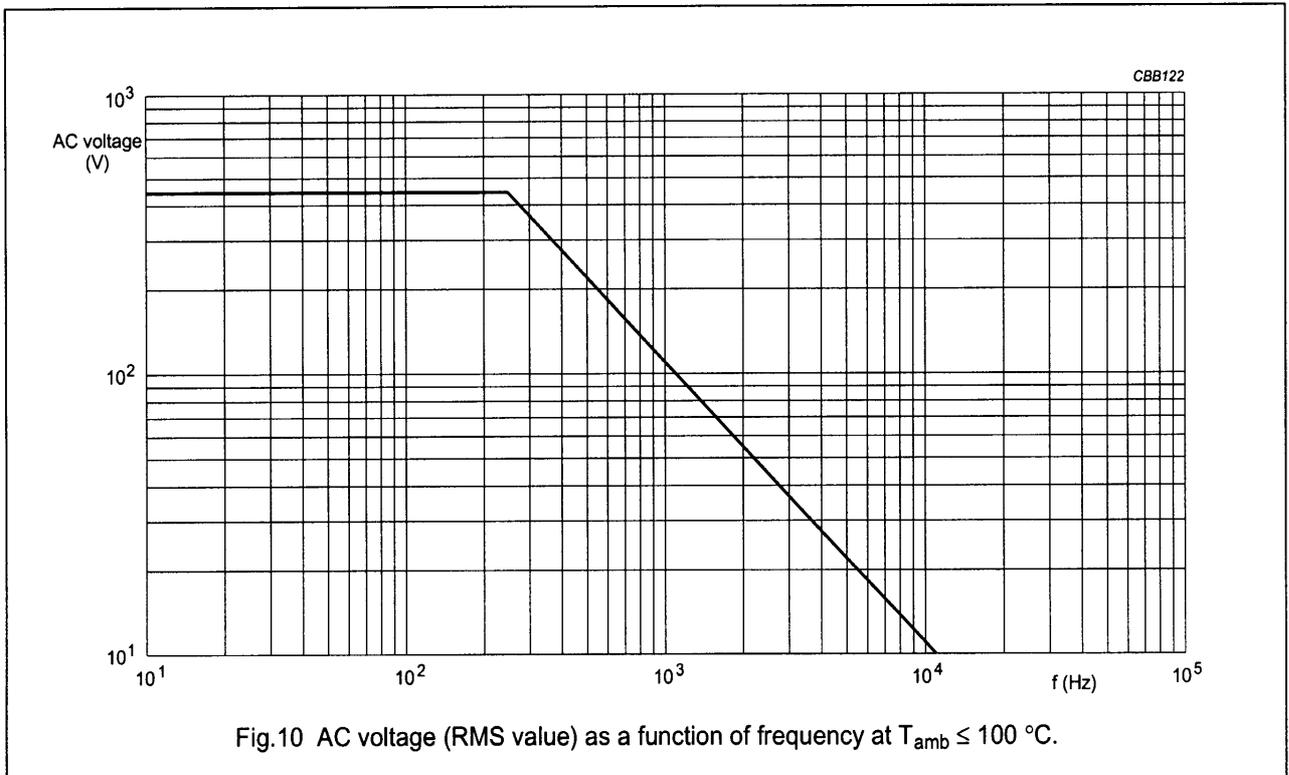
Resonant frequency



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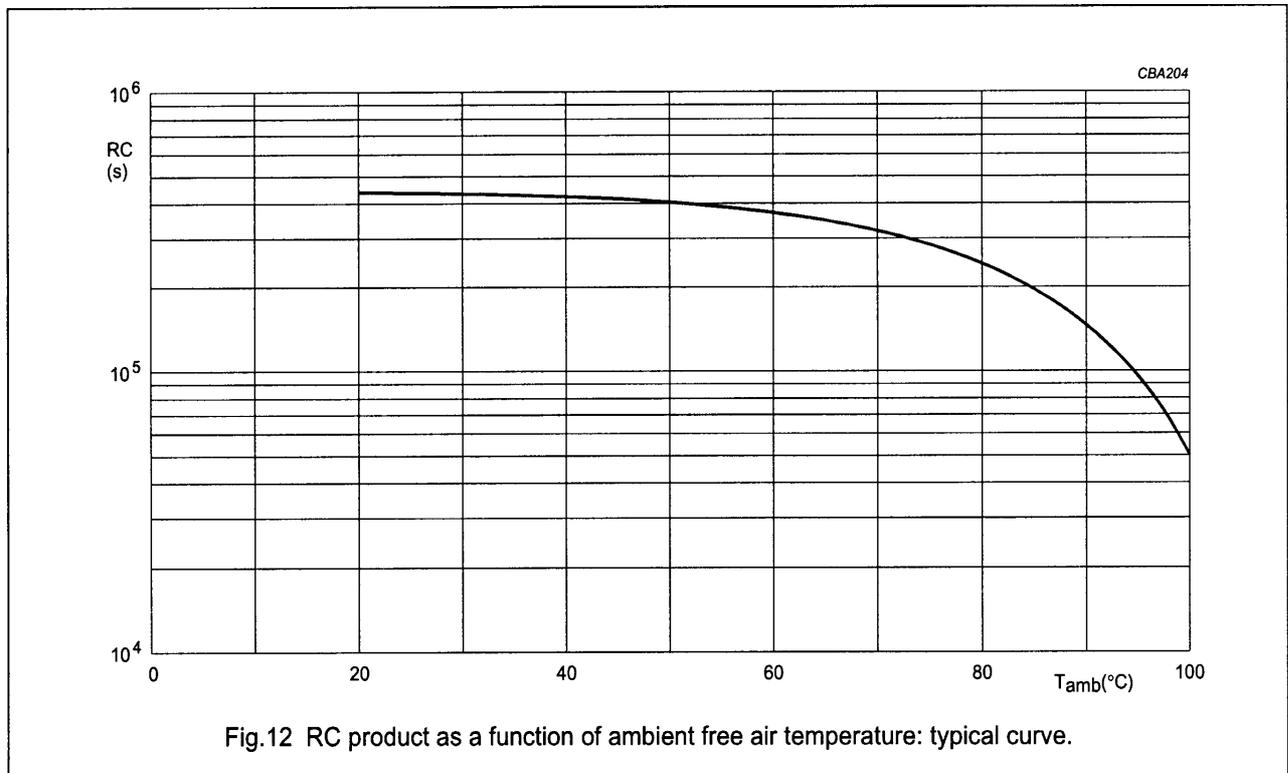
Maximum RMS voltage and AC current (sinewave) as a function of frequency for $T_{amb} \leq 100\text{ }^{\circ}\text{C}$



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Insulation resistance



APPLICATION NOTES

- For X1 electromagnetic interference suppression in across the line applications (50/60 Hz) with a maximum mains voltage of 440 V (AC).
- These capacitors are not intended for continuous pulse applications. For these situations, capacitors of the AC and pulse program must be used, such as: 2222 375; 2222 383 or 2222 479
- The maximum ambient temperature must not exceed 105 °C.
- Rated voltage pulse slope:
 - If the pulse voltage is lower than the rated voltage, the values of the specific reference data can be multiplied by 615 V (DC) and divided by the applied voltage.

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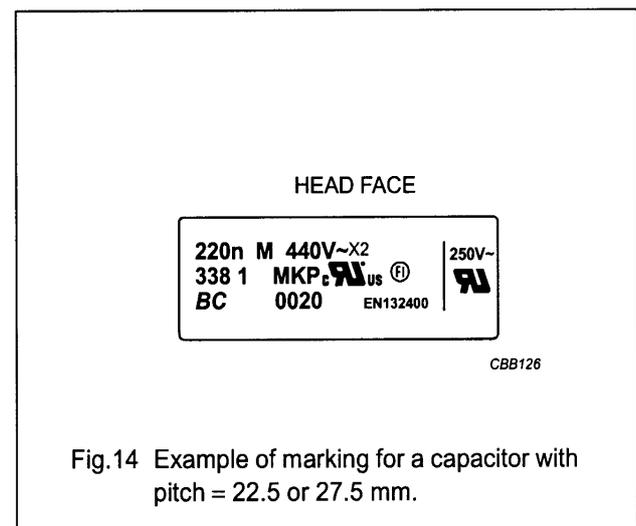
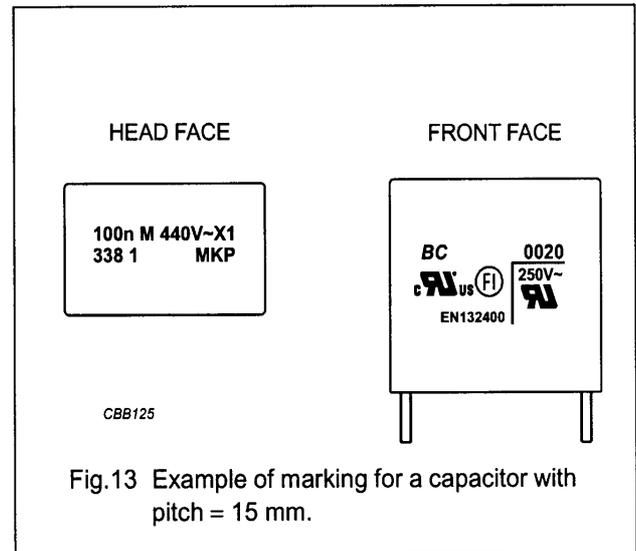
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MARKING

Product marking

The capacitors are marked by laser print; on the top for pitch ≥ 22.5 mm (see Fig.14), or on the top and one side for pitch = 15 mm (see Fig.13) with the following information:

1. Rated capacitance code in accordance with "IEC 60062"
2. Tolerance on rated capacitance; M = $\pm 20\%$; K = $\pm 10\%$; J = $\pm 5\%$
3. Rated (AC) voltage (440 V)
4. Sub-class (e.g. X1)
5. Manufacturer's type designation (e.g. 338 1)
6. Code for dielectric material (MKP)
7. Manufacturer
8. Year and week of manufacture (e.g. 0020)
9. Safety approvals: products will be marked with approvals depending on the available marking space per product. Although all approvals remain valid as indicated in the reference data.



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Package marking

The package containing the capacitors is marked as shown Fig.15.

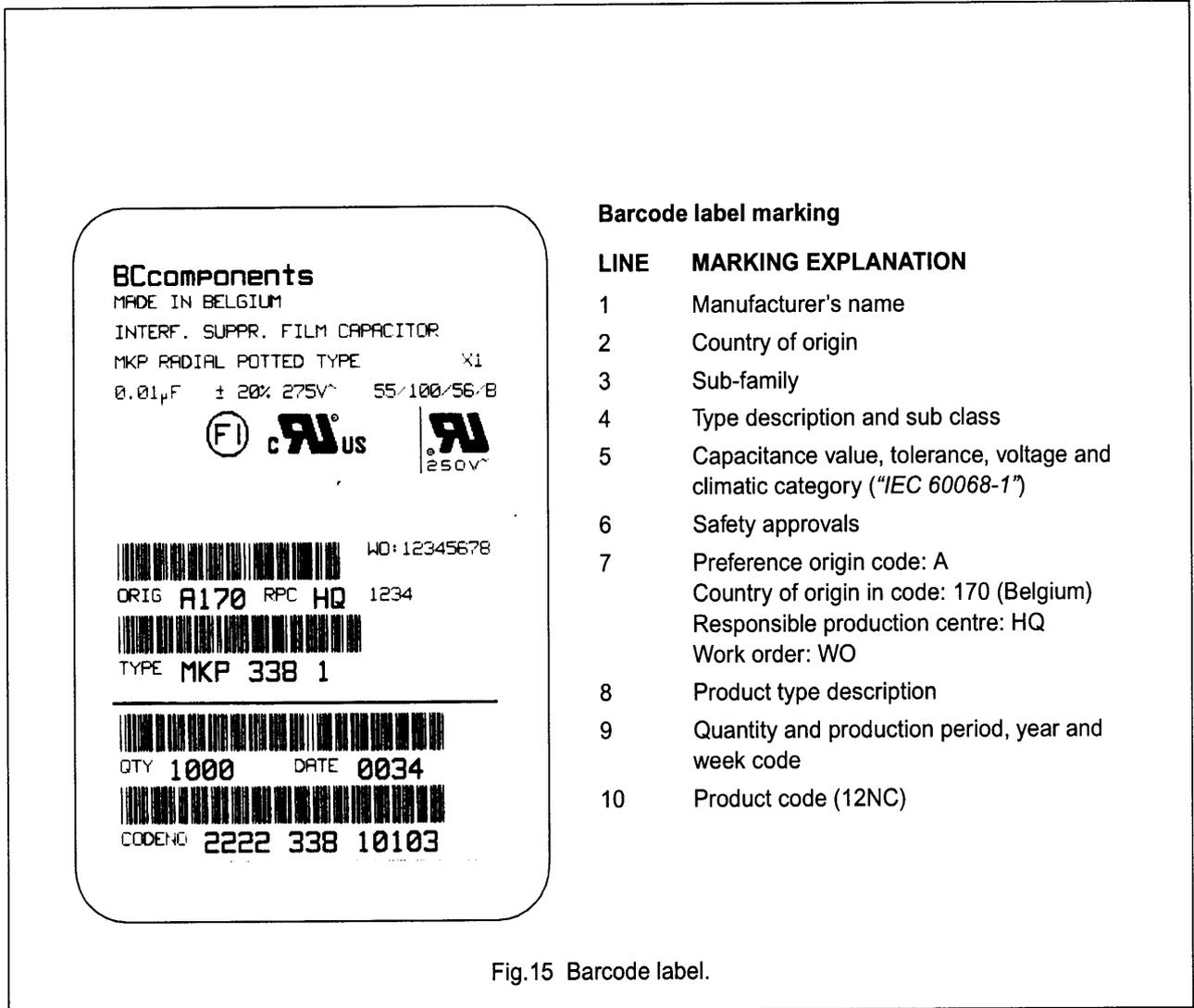


Fig.15 Barcode label.

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QUICK REFERENCE TEST REQUIREMENTS

TEST	PROCEDURE (quick reference)	REQUIREMENTS
Robustness of leads		
Tensile strength: "IEC 60068-2-21"	load 10 N; 10 s	no visible damage legible marking $ \Delta C/C \leq 5\%$ $\Delta \tan \delta \leq 80 \times 10^{-4}$ at 10 kHz
Bending: "IEC 60068-2-21"	load 5 N; $4 \times 90^\circ$	
Resistance to soldering heat: "IEC 60068-2-20"	solder bath: 260 °C; 10 s solder bath: 350 °C; 3.5 s	
Component solvent resistance	isopropyl alcohol; 23 °C; 5 minutes	
Robustness of component		
Rapid change of temperature: "IEC 60068-2-14"	5 cycles 1 cycle = 30 minutes at -55 °C and 30 minutes at 100 °C	$ \Delta C/C \leq 5\%$ $\Delta \tan \delta \leq 80 \times 10^{-4}$ at 10 kHz
Vibration: "IEC 60068-2-6"	10 to 55 Hz; amplitude 0.75 mm; 6 hours	
Shock: "IEC 60068-2-27"	half sinewave; 490 m/s ² ; 11 ms	
Climatic sequence		
Dry heat: "IEC 60068-2-2"	16 hours; 100 °C	$ \Delta C/C \leq 5\%$ $\Delta \tan \delta \leq 80 \times 10^{-4}$ at 10 kHz $R_{ins} \geq 50\%$ of specified value
Damp heat, cyclic, test Db, first cycle: "IEC 60068-2-30"		
Cold: "IEC 60068-2-1"	2 hours; -55 °C	
Damp heat, cyclic, test Db, remaining cycles: "IEC 60068-2-30"		
Voltage proof: "IEC 60384-14"	$V_p = 1200$ V (DC); 1 minute	
Other applicable tests		
Damp heat, steady state: "IEC 60068-2-3"	21 days; 40 °C; 90 to 95% RH no load $V_p = 1200$ V (DC); 1 minute	$ \Delta C/C \leq 5\%$ $\Delta \tan \delta \leq 70 \times 10^{-4}$ $R_{ins} \geq 50\%$ of specified value
Endurance (AC): "IEC 60384-14"	3×4.0 kV pulse voltage 1000 hours; $1.25 \times U_{Rac}$ at 100 °C; once per hour; 0.1 s; 1000 V (RMS) via resistor of 47 Ω ; $V_p = 1200$ V (DC); 1 minute	$ \Delta C/C \leq 10\%$ $\Delta \tan \delta \leq 80 \times 10^{-4}$ at 10 kHz $R_{ins} \geq 50\%$ of specified value

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TEST	PROCEDURE (quick reference)	REQUIREMENTS
Charge and discharge: "IEC 60384-14"	10000 cycles; 5 ms; 1.5 × dV/dt	$ \Delta C/C \leq 10\%$ $\Delta \tan \delta \leq 80 \times 10^{-4}$ at 10 kHz $R_{ins} \geq 50\%$ of specified value
Passive flammability: "IEC 60384-14"	class B	no burning
Active flammability: "IEC 60384-14"	20 × 4 kV discharge	no burning
Heat storage: "IEC 60384-14"	1000 hours; 100 °C	$ \Delta C/C \leq 5\%$ $\Delta \tan \delta \leq 80 \times 10^{-4}$ at 10 kHz
Resistance to soldering heat with preheating: "IEC 60384-14"	preheating: 100 °C; solder bath: 260 °C; 10 s	$ \Delta C/C \leq 5\%$ $\Delta \tan \delta \leq 80 \times 10^{-4}$ at 10 kHz
Active flammability test	Voltage proof up to 2 × peak impulse voltage of 4.13 or until breakdown (100 V/sec, current limited 2mA) Failed capacitors connected to a 250 V (AC) power supply during 5 minutes	no burning