

# DATA SHEET

## **MKP 336 1**

**Interference suppression film  
capacitors**

Product specification  
Supersedes data of April 1999  
File under BCcomponents, BC05

2000 Feb 08

## Interference suppression film capacitors

## MKP 336 1

## MKP RADIAL POTTED TYPE

PITCH 10/15/22.5/27.5 mm

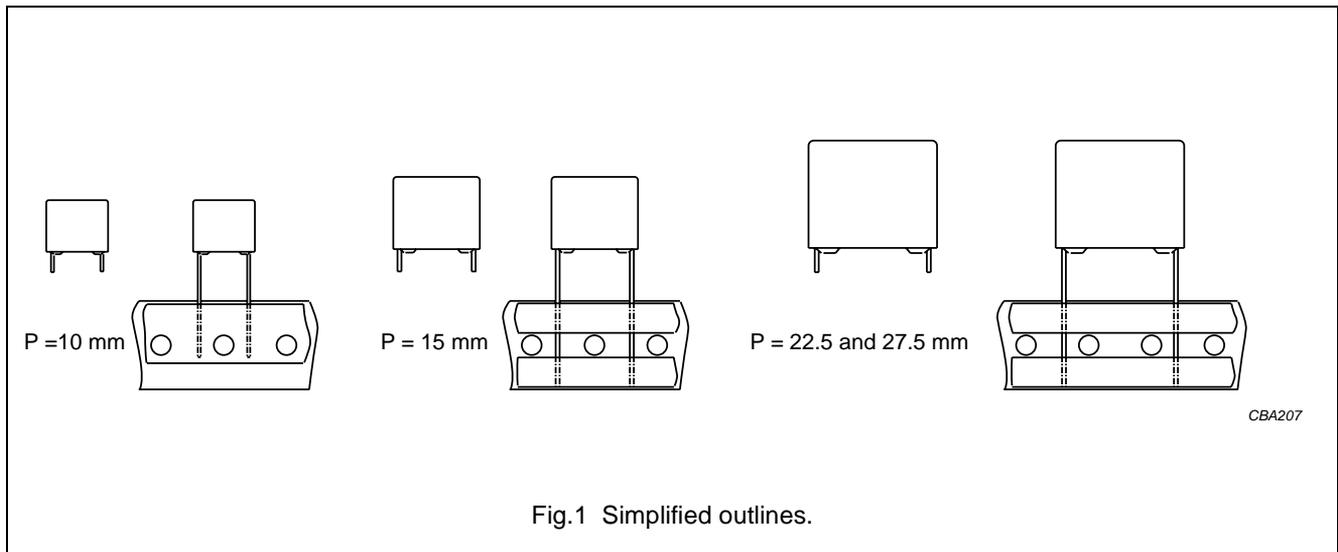


Fig.1 Simplified outlines.

## FEATURES

- 10 to 27.5 mm lead pitch
- Supplied loose in box and taped on 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 2<sup>nd</sup> edition and EN 132400", requiring a 4 kV peak pulse voltage test UL1414 and CSA-C22.2 No. 1 specifications.

## DETAIL SPECIFICATION

For more detailed data and test requirements see "Type detail specification HQN-384-14/108".

## QUICK REFERENCE DATA

DESCRIPTION	VALUE
Capacitance range (E12 series)	1 nF to 1 $\mu$ F
Capacitance tolerance	$\pm 20\%$ ; $\pm 10\%$ ; $\pm 5\%$
Rated (AC) voltage, 50 to 60 Hz	275 V
Rated (DC) voltage	630 V
Climatic category	55/100/21/B
Rated temperature	100 °C
Maximum application temperature	100 °C
Reference specifications	IEC 60384-14 2 <sup>nd</sup> edition and EN 132400
Safety approvals: 250 V 275 V	UL1414; CSA-C22.2 No 1; note 2 UL1283; SEV; VDE; FI; N; D; S; IMQ; ÖVE; note 2 CCEE; note 1
Materials	qualified in accordance with UL94V-O
Safety class	X1

## Notes

1. Pending.
2. Approved.

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## SAFETY APPROVALS

SAFETY APPROVALS (X1)		VOLTAGE	VALUE	FILE NUMBERS
	UL1414	250 V (AC)	1 nF to 1 µF	E 112471
	UL1283	275 V (AC)	1 nF to 1 µF	E 109565
	CSA-C22.2 No.1	250 V (AC)	1 nF to 1 µF	LR 94054
	SEV (EN132400)	275 V (AC)	1 nF to 1 µF	99,6 60107,01
	VDE (EN132400)	275 V (AC)	1 nF to 1 µF	83619
	FI (EN132400)	275 V (AC)	1 nF to 1 µF	178882
	NEMKO (EN132400)	275 V (AC)	1 nF to 1 µF	P99102660
	DEMKO (EN132400)	275 V (AC)	1 nF to 1 µF	99-06011
	SEMKO (EN132400)	275 V (AC)	1 nF to 1 µF	9447024
	IMQ (EN132400)	275 V (AC)	1 nF to 1 µF	V 3731
	ÖVE (EN132400)	275 V (AC)	1 nF to 1 µF	E 260-001

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COMPOSITION OF CATALOGUE NUMBER

TYPE AND PITCHES	
336 1	10.0 mm
X1	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 336 1X XX X

TYPE	PACKAGING <sup>(1)</sup>	LEAD CONFIGURATION	C-TOL	PREFERRED TYPES
336 1 X1	loose in box	lead length 3.5 mm	±20%	2222 336 10...
		lead length 25.0 mm		2222 336 16...
				<b>ON REQUEST</b>
336 1 X1	loose in box	lead length 3.5 mm	±10%	2222 336 11...
		lead length 25.0 mm		2222 336 17...
	taped on reel	H = 18.5 mm; note 2	±20%	2222 336 13...
			±10%	2222 336 14...

Notes

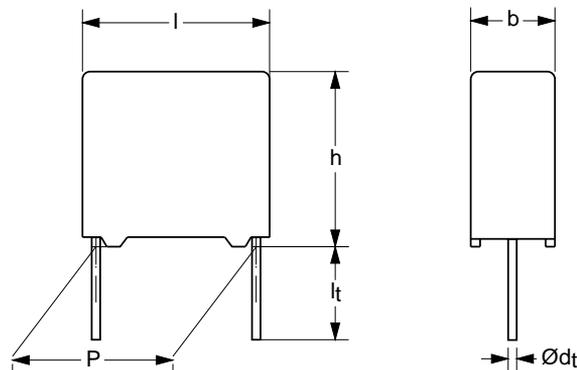
- 1) For SPQ refer to this handbook, chapter "Packaging information"; taped on reel pitch = 27.5 mm is not available.
- 2) H = in-tape height; for detailed specifications refer to this handbook, chapter "Packaging information".

## Interference suppression film capacitors

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## MKP 336 1 GENERAL DATA

PITCH 10/15 mm



CBA196

Fig.3 Outline.

## Specific reference data for the 275 V AC (X1) capacitors

DESCRIPTION	VALUE	
	at 10 kHz	at 100 kHz
Tangent of loss angle: $C \leq 100 \text{ nF}$	$\leq 10 \times 10^{-4}$	$\leq 50 \times 10^{-4}$
Rated voltage pulse slope $(dU/dt)_R$ at 385 V (DC) $P = 10 \text{ mm}$ $P = 15 \text{ mm}$	200 V/ $\mu\text{s}$ 500 V/ $\mu\text{s}$	
R between leads, for $C \leq 0.33 \mu\text{F}$ at 100 V; 1 minute	>15000 M $\Omega$	
R between leads and case; 100 V; 1 minute	>30000 M $\Omega$	
Withstanding (DC) voltage (cut off current 10 mA); rise time 100 V/s	3400 V; 1 minute	
Withstanding (AC) voltage between leads and case	2050 V; 1 minute	

## Interference suppression film capacitors

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 $U_{Rac} = 275 \text{ V (X1)}$ ;  $U_{Rdc} = 630 \text{ V}$ 

C ( $\mu\text{F}$ )	DIMENSIONS $b \times h \times l$ (mm)	MASS (g)	CATALOGUE NUMBER	
			LOOSE IN BOX	
			$l_t = 3.5 +1/-0.5\text{mm}^{(1)}$	$l_t = 25.0 \pm 2.0 \text{ mm}$
			C-tol = $\pm 20\%$	
			catalogue number <sup>(2)</sup>	last 5 digits <sup>(2)</sup>
<b>Pitch = <math>10.0 \pm 0.4 \text{ mm}</math>; <math>d_t = 0.60 \pm 0.06 \text{ mm}</math></b>				
0.001	4.0 × 10.0 × 12.5	0.6	2222 336 10 <b>102</b>	.. 16 <b>102</b>
0.0015			2222 336 10 <b>152</b>	.. 16 <b>152</b>
0.0022			2222 336 10 <b>222</b>	.. 16 <b>222</b>
0.0033	5.0 × 11.0 × 12.5	0.9	2222 336 10 <b>332</b>	.. 16 <b>332</b>
0.0047			2222 336 10 <b>472</b>	.. 16 <b>472</b>
0.0068			2222 336 10 <b>682</b>	.. 16 <b>682</b>
0.01	6.0 × 12.0 × 12.5	1.0	2222 336 10 <b>103</b>	.. 16 <b>103</b>
<b>Pitch = <math>15.0 \pm 0.4 \text{ mm}</math>; <math>d_t = 0.80 \pm 0.08 \text{ mm}</math></b>				
0.01	5.0 × 11.0 × 17.5	1.2	2222 336 19 <b>001</b>	.. 19 <b>007</b>
0.015			2222 336 10 <b>153</b>	.. 16 <b>153</b>
0.022			2222 336 10 <b>223</b>	.. 16 <b>223</b>
0.033	6.0 × 12.0 × 17.5	1.4	2222 336 10 <b>333</b>	.. 16 <b>333</b>
0.047	7.0 × 13.5 × 17.5	1.9	2222 336 10 <b>473</b>	.. 16 <b>473</b>
0.068	8.5 × 15.0 × 17.5	2.6	2222 336 10 <b>683</b>	.. 16 <b>683</b>
0.1	10.0 × 16.5 × 17.5	3.1	2222 336 10 <b>104</b>	.. 16 <b>104</b>

**Notes**

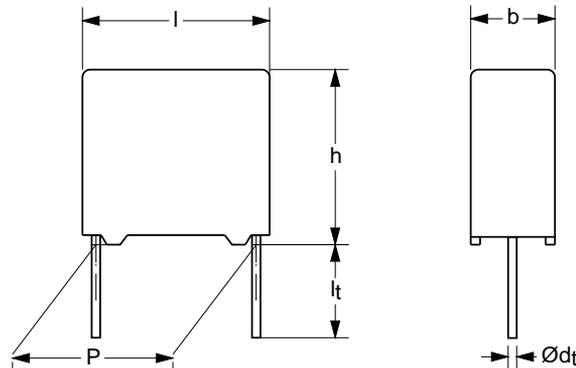
1.  $l_t = 3.5 \pm 0.3 \text{ mm}$  for pitch = 15 mm.
2. The shading indicates preferred types.

## Interference suppression film capacitors

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## MKP 336 1 GENERAL DATA

PITCH 22.5/27.5 mm



CBA196

Fig.4 Outline.

## Specific reference data for the 275 V AC (X1) capacitors

DESCRIPTION	VALUE	
	at 10 kHz	at 100 kHz
Tangent of loss angle: 100 nF < C ≤ 470 nF C > 470 nF	≤ 20 × 10 <sup>-4</sup> ≤ 70 × 10 <sup>-4</sup>	≤ 100 × 10 <sup>-4</sup> -
Rated voltage pulse slope (dU/dt) <sub>R</sub> at 385 V (DC) P = 22.5 mm P = 27.5 mm	300 V/μs 200 V/μs	
R between leads, for C ≤ 0.33 μF at 100 V; 1 minute	> 15000 MΩ	
RC between leads, for C > 0.33 μF at 100 V; 1 minute	> 5000 s	
R between leads and case; 100 V; 1 minute	> 30000 MΩ	
Withstanding (DC) voltage (cut off current 10 mA); rise time 100 V/s	3400 V; 1 minute	
Withstanding (AC) voltage between leads and case	2050 V; 1 minute	

## Interference suppression film capacitors

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 $U_{Rac} = 275 \text{ V (X1)}$ ;  $U_{Rdc} = 630 \text{ V}$ 

C ( $\mu\text{F}$ )	DIMENSIONS $b \times h \times l$ (mm)	MASS (g)	CATALOGUE NUMBER	
			LOOSE IN BOX	
			$l_t = 3.5 \pm 0.3 \text{ mm}$	$l_t = 25.0 \pm 2.0 \text{ mm}$
			C-tol = $\pm 20\%$	
			catalogue number <sup>(1)</sup>	last 5 digits <sup>(1)</sup>
<b>Pitch = <math>22.5 \pm 0.4 \text{ mm}</math>; <math>d_t = 0.80 \pm 0.08 \text{ mm}</math></b>				
0.1	$7.0 \times 16.5 \times 26.0$	3.2	2222 336 19003	.. 19008
0.15	$8.5 \times 18.0 \times 26.0$	4.4	2222 336 10154	.. 16154
0.22	$10.0 \times 19.5 \times 26.0$	5.5	2222 336 10224	.. 16224
<b>Pitch = <math>27.5 \pm 0.4 \text{ mm}</math>; <math>d_t = 0.80 \pm 0.08 \text{ mm}</math></b>				
0.22	$11.0 \times 21.0 \times 31.0$	7.8	2222 336 19005	.. 19009
0.33	$13.0 \times 23.0 \times 31.0$	10.4	2222 336 10334	.. 16334
0.47	$15.0 \times 25.0 \times 31.0$	12.8	2222 336 10474	.. 16474
0.68	$18.0 \times 28.0 \times 31.0$	17.2	2222 336 10684	.. 16684
1	$21.0 \times 31.0 \times 31.0$	20.4	2222 336 10105	.. 16105

**Note**

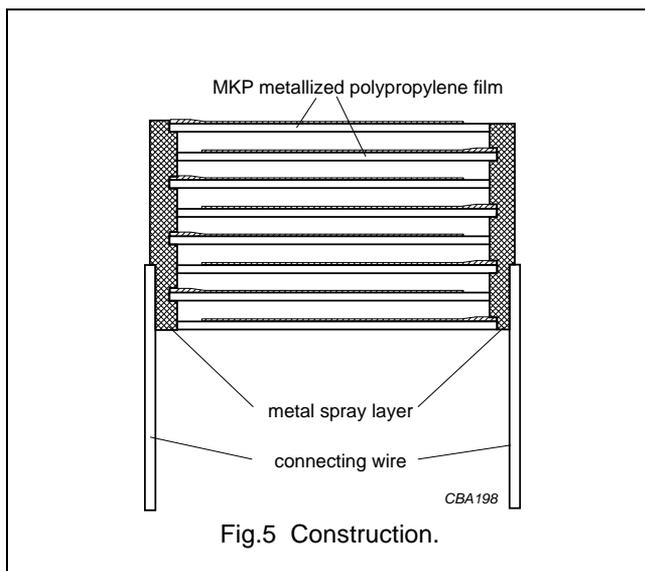
1. The shading indicates preferred types.

## Interference suppression film capacitors

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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 = 7.5, 10 and 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.

**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 this handbook, chapter "Packaging information".

**SPECIFIC METHOD OF MOUNTING TO WITHSTAND VIBRATION AND SHOCK**

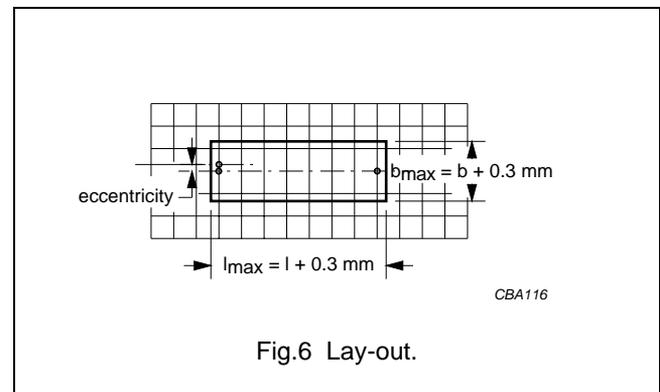
In order to withstand vibration and shock tests, it must be ensured that the stand-off pips are in good contact with the printed-circuit board:

- For pitches  $\leq 15$  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.6:

- Eccentricity as in Fig.6. 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.

**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  $23 \pm 1$  °C, an atmospheric pressure of 86 to 106 kPa and a relative humidity of  $50 \pm 2\%$ .

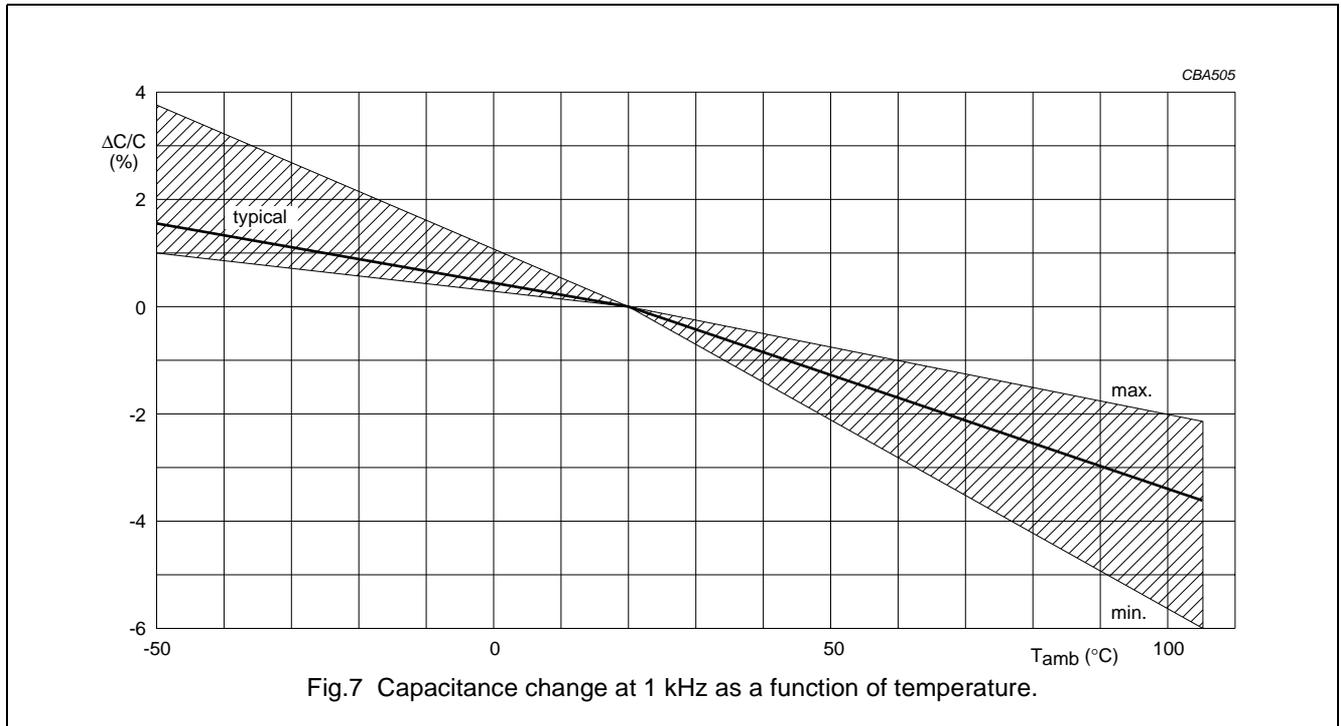
For reference testing, a conditioning period shall be applied over  $96 \pm 4$  hours by heating the products in a circulating air oven at the rated temperature and a relative humidity not exceeding 20%.

# Interference suppression film capacitors

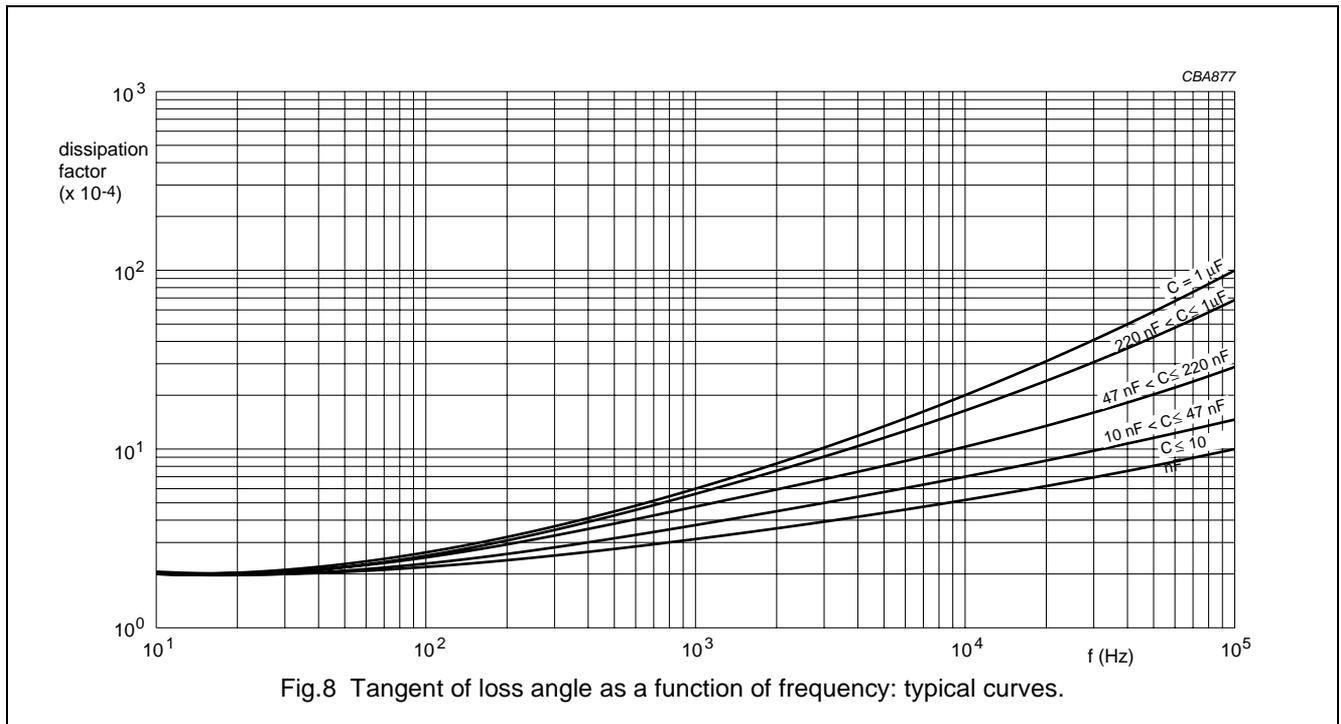
# MKP 336 1

## CHARACTERISTICS

### Capacitance



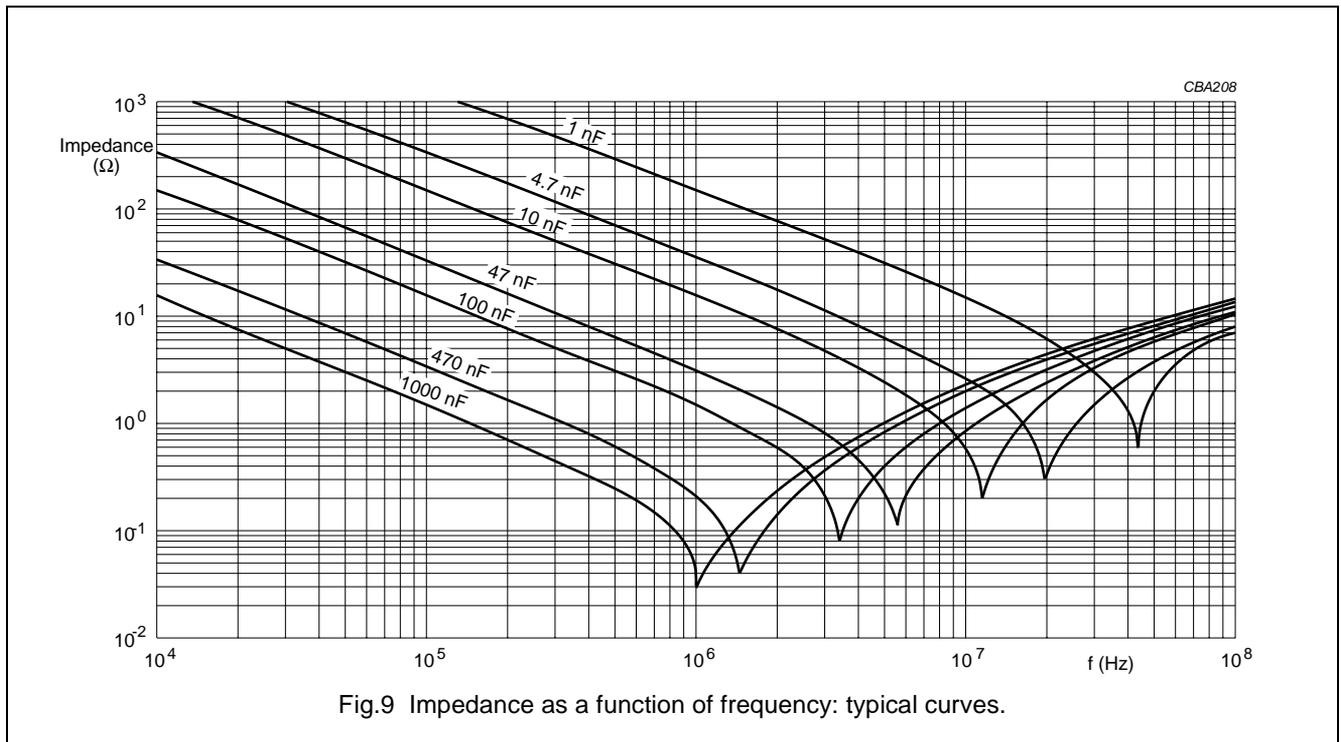
### Tangent of loss angle



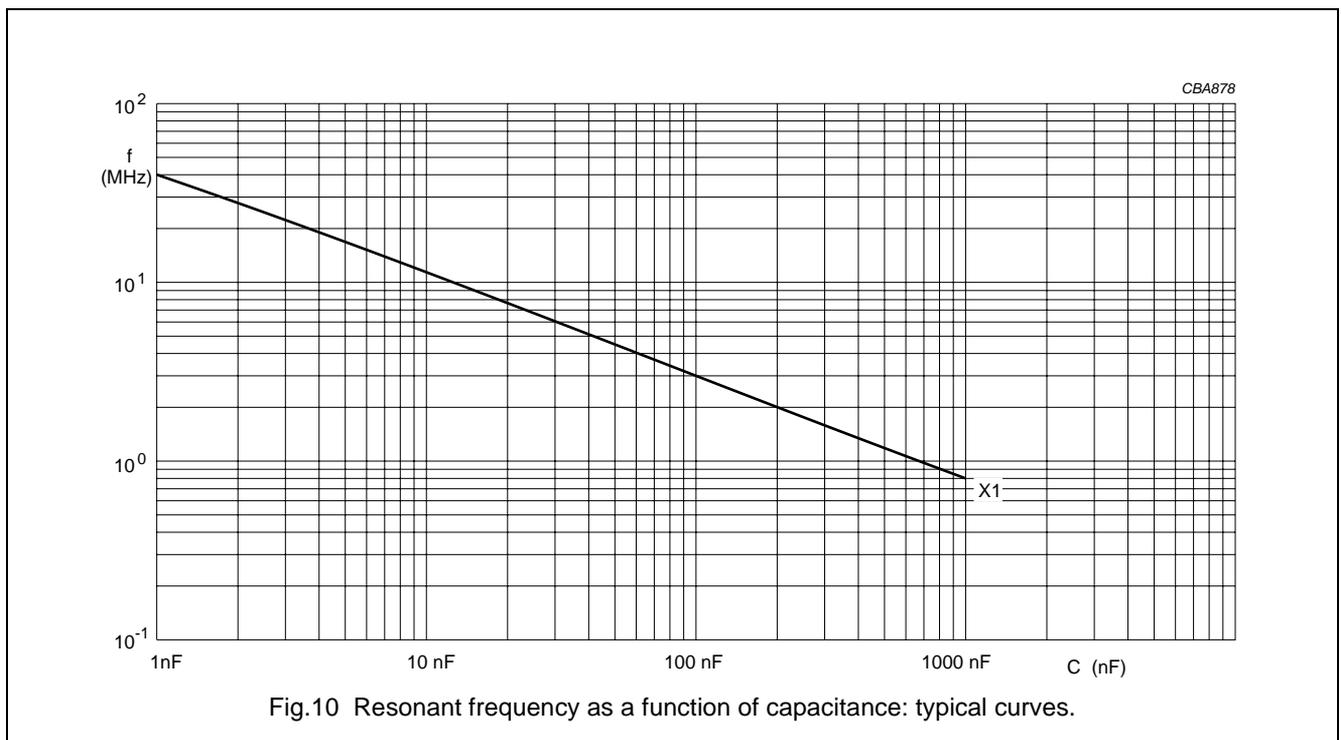
# Interference suppression film capacitors

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## Impedance



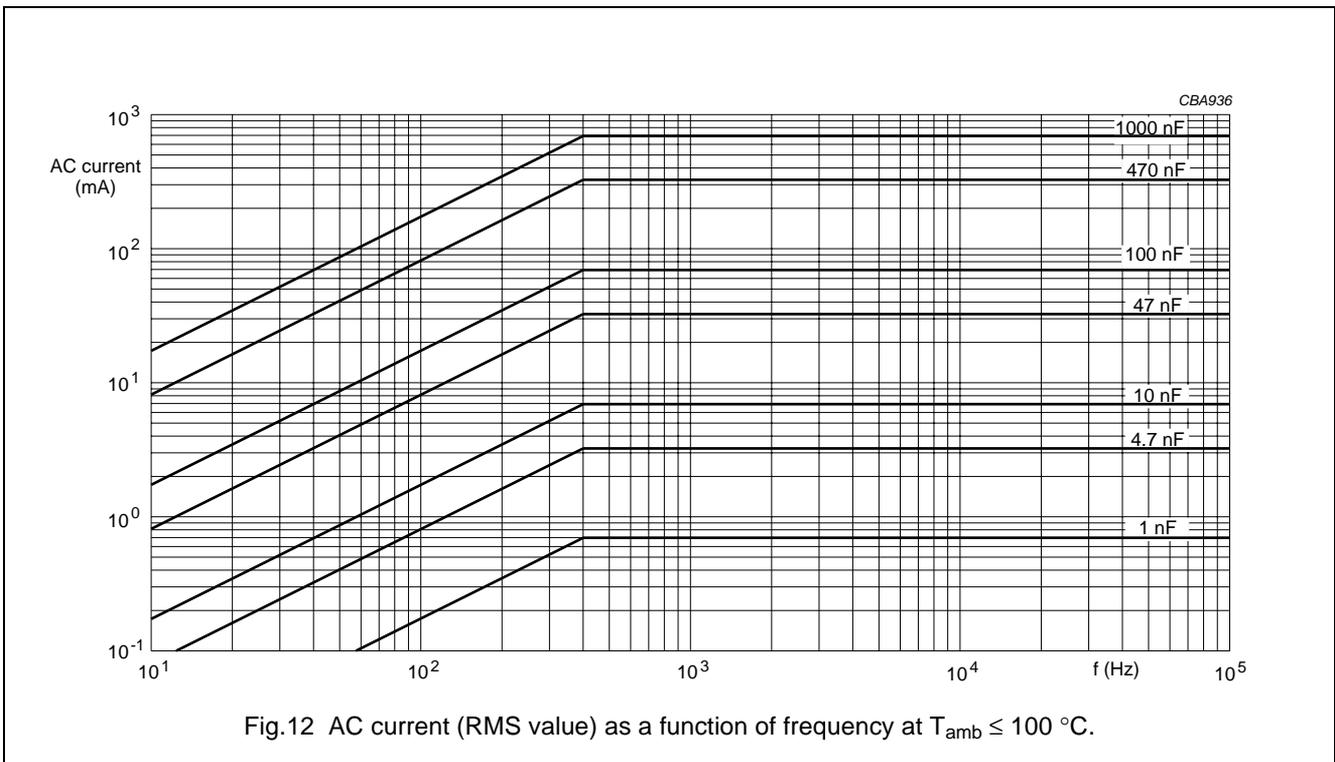
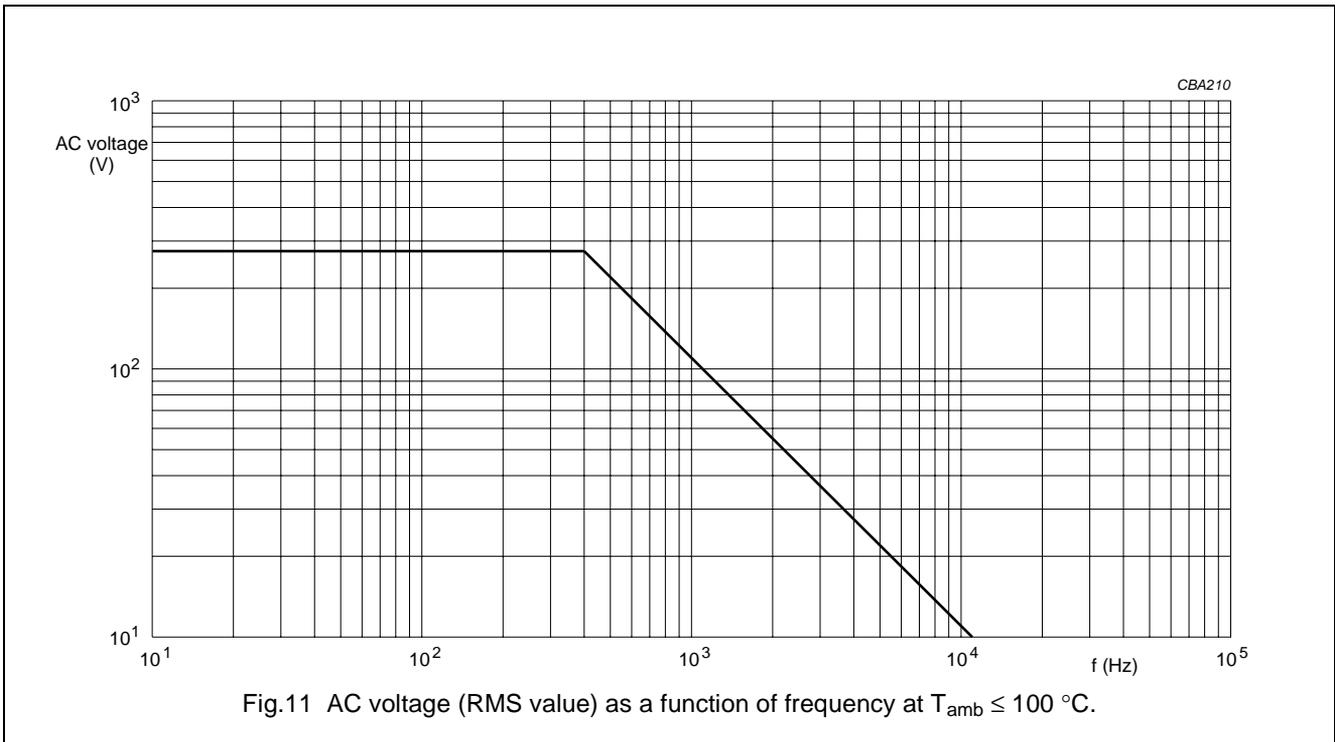
## Resonant frequency



Interference suppression film capacitors

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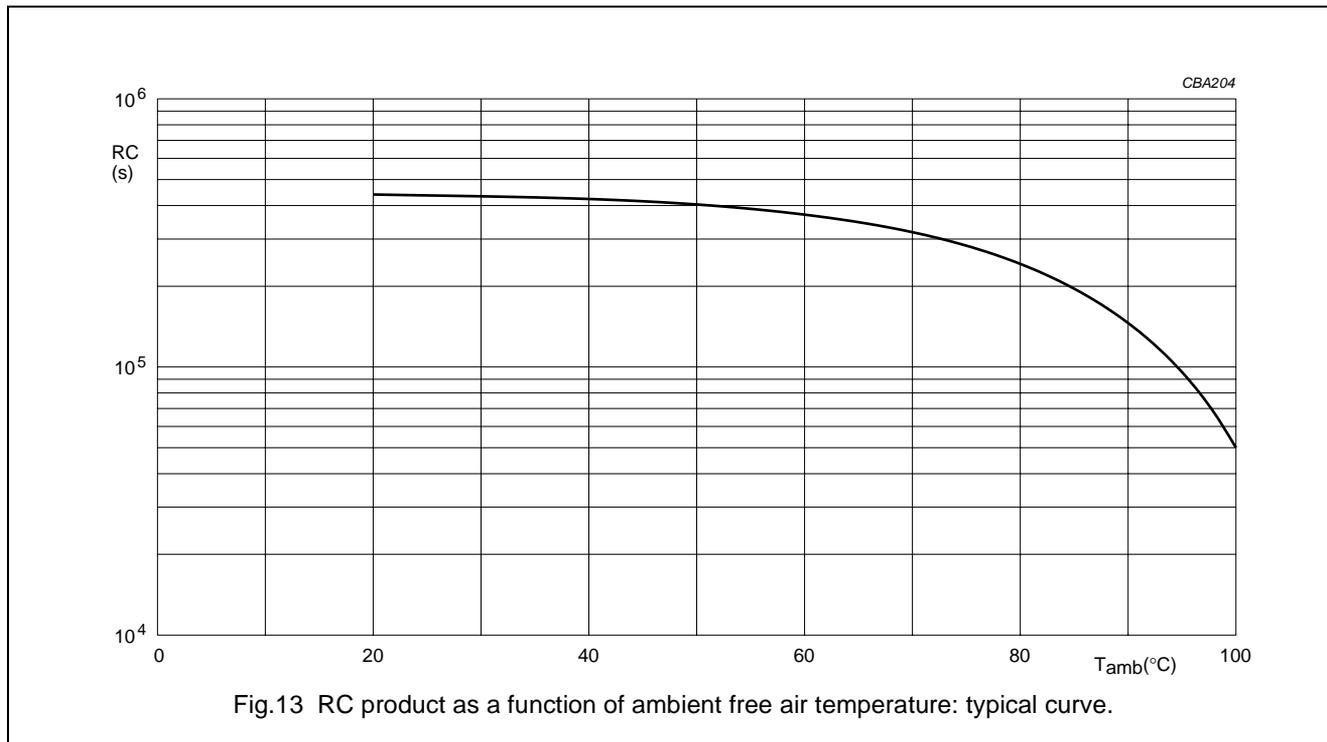
Maximum RMS voltage and AC current (sinewave) as a function of frequency for  $T_{amb} \leq 100\text{ }^{\circ}\text{C}$



## Interference suppression film capacitors

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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 275 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 100 °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 385 V (DC) and divided by the applied voltage.

# Interference suppression film capacitors

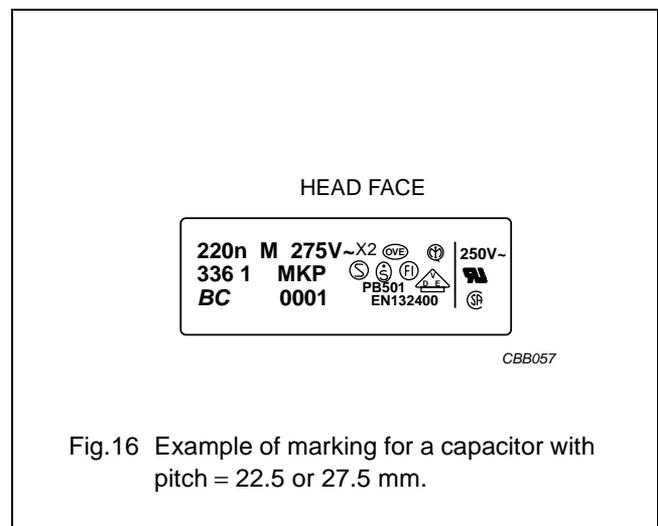
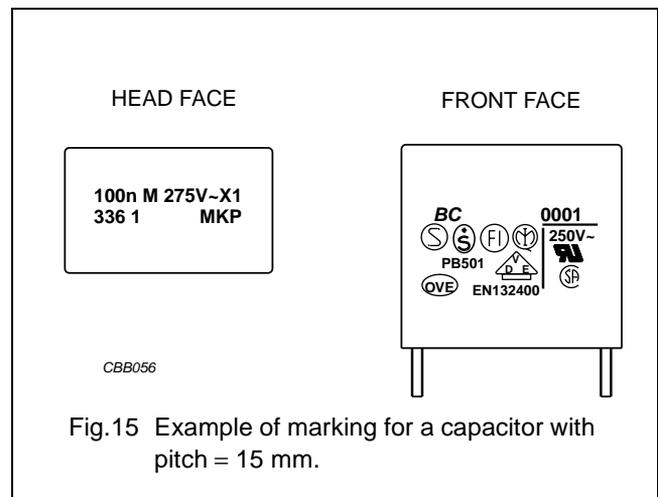
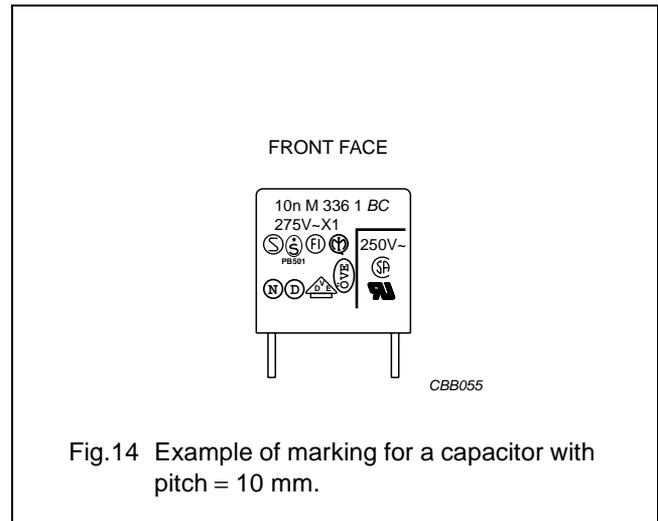
# MKP 336 1

## MARKING

### Product marking

The capacitors are marked by laser print; on the top for pitch  $\geq 22.5$  mm (see Fig.16), on the top and one side for pitch = 15 mm (see Fig.15) or on one side for pitch = 10 mm (see Fig.14) 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 (275 V)
4. Sub-class (e.g. X1)
5. Manufacturer's type designation (e.g. 336 1)
6. Code for dielectric material (MKP) for pitch  $\geq 15$  mm
7. Manufacturer
8. Year and week of manufacture (e.g. 0001) for pitch  $\geq 15$  mm
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.



Interference suppression film capacitors

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Package marking

The package containing the capacitors is marked as shown Fig.17.

**BCcomponents**  
 MADE IN BELGIUM  
 INTERF. SUPPR. FILM CAPACITOR  
 MKP RADIAL POTTED TYPE X1  
 0.01 $\mu$ F  $\pm$ 20% 275V $\sim$  55/100/21/B



WD: 12345678  
 250V $\sim$

ORIG **A170** RPC **HQ** 1234

TYPE **MKP 336 1**

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QTY **750** DATE **0003**

CODENO **2222 336 10103**

**Barcode label marking**

LINE	MARKING EXPLANATION
1	Manufacturer's name
2	Country of origin
3	Sub-family
4	Type description and sub class
5	Capacitance value, tolerance, voltage and climatic category ("IEC 60068-1")
6	Safety approvals
7	Preference origin code: A Country of origin in code: 170 (Belgium) Responsible production centre: HQ Work order: WO Wage number of final inspection (only for capacitors with pitch = 10 mm)
8	Product type description
9	Quantity and production period, year and week code
10	Product code (12NC)

Fig.17 Barcode label.

## Interference suppression film capacitors

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## QUICK REFERENCE TEST REQUIREMENTS (see note 1)

TEST	PROCEDURE (quick reference)	REQUIREMENTS
<b>Robustness of leads</b>		
Tensile strength: "IEC 60068-2-21"	load 10 N; 10 s	no visible damage legible marking $ \Delta C/C  \leq 5\%$ $\Delta \tan \delta \leq 100 \times 10^{-4}$ ( $C \leq 100$ nF); note 2 $\Delta \tan \delta \leq 200 \times 10^{-4}$ ( $100$ nF < $C \leq 470$ nF); note 2 $\Delta \tan \delta \leq 70 \times 10^{-4}$ ( $C > 470$ nF); note 2
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	
Component solvent resistance	isopropyl alcohol; 23 °C; 5 minutes	
<b>Robustness of component</b>		
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\%$ $\Delta \tan \delta \leq 100 \times 10^{-4}$ ( $C \leq 100$ nF); note 2 $\Delta \tan \delta \leq 200 \times 10^{-4}$ ( $100$ nF < $C \leq 470$ nF); note 2 $\Delta \tan \delta \leq 70 \times 10^{-4}$ ( $C > 470$ nF); note 2
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 <sup>2</sup> ; 11 ms	
<b>Climatic sequence</b>		
Dry heat: "IEC 60068-2-2"	16 hours; 100 °C	$ \Delta C/C  \leq 5\%$ $\Delta \tan \delta \leq 100 \times 10^{-4}$ ( $C \leq 100$ nF); note 2 $\Delta \tan \delta \leq 200 \times 10^{-4}$ ( $100$ nF < $C \leq 470$ nF); note 2 $\Delta \tan \delta \leq 70 \times 10^{-4}$ ( $C > 470$ nF); note 2 $R_{ins} \geq 50\%$ 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	
<b>Other applicable tests</b>		
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"	$3 \times 4.0$ 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 $\Omega$ ; $V_p = 1200$ V (DC); 1 minute	$ \Delta C/C  \leq 10\%$ $\Delta \tan \delta \leq 100 \times 10^{-4}$ ( $C \leq 100$ nF); note 2 $\Delta \tan \delta \leq 200 \times 10^{-4}$ ( $100$ nF < $C \leq 470$ nF); note 2 $\Delta \tan \delta \leq 70 \times 10^{-4}$ ( $C > 470$ nF); note 2 $R_{ins} \geq 50\%$ of specified value

## Interference suppression film capacitors

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TEST	PROCEDURE (quick reference)	REQUIREMENTS
Charge and discharge: "IEC 60384-14"	10000 cycles; 5 ms; $1.5 \times dV/dt$	$ \Delta C/C  \leq 10\%$ $\Delta \tan \delta \leq 100 \times 10^{-4}$ ( $C \leq 100$ nF); note 2 $\Delta \tan \delta \leq 200 \times 10^{-4}$ ( $100$ nF < $C \leq 470$ nF); note 2 $\Delta \tan \delta \leq 70 \times 10^{-4}$ ( $C > 470$ nF); note 2 $R_{ins} \geq 50\%$ of specified value
Passive flammability: "IEC 60384-14"	class B	no burning
Active flammability: "IEC 60384-14"	$20 \times 4$ kV discharge	no burning
Heat storage: "IEC 60384-14"	1000 hours; 100 °C	$ \Delta C/C  \leq 5\%$ $\Delta \tan \delta \leq 100 \times 10^{-4}$ ( $C \leq 100$ nF); note 2 $\Delta \tan \delta \leq 200 \times 10^{-4}$ ( $100$ nF < $C \leq 470$ nF); note 2 $\Delta \tan \delta \leq 70 \times 10^{-4}$ ( $C > 470$ nF); note 2
Resistance to soldering heat with preheating: "IEC 60384-14"	preheating: 100 °C; solder bath: 260 °C; 10 s	$ \Delta C/C  \leq 5\%$ $\Delta \tan \delta \leq 100 \times 10^{-4}$ ( $C \leq 100$ nF); note 2 $\Delta \tan \delta \leq 200 \times 10^{-4}$ ( $100$ nF < $C \leq 470$ nF); note 2 $\Delta \tan \delta \leq 70 \times 10^{-4}$ ( $C > 470$ nF); note 2
Active flammability test	Voltage proof up to $2 \times$ 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

**Notes**

1. For detailed information: see "Type detail specification HQN-384-14/108".
2. Measuring frequency 100 kHz for  $C \leq 470$  nF and 10 kHz for  $C > 470$  nF.