

# DATA SHEET

## **MKP 338 2 X2** **Interference suppression film** **capacitors**

Product specification  
Supersedes data of 2001-09-13  
File under BCcomponents, BC05

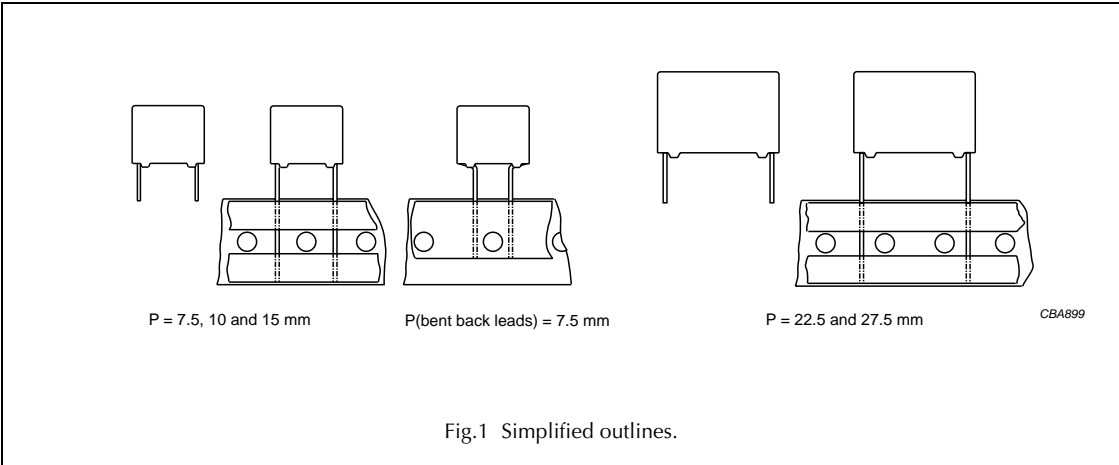
2002 Oct 07

Interference suppression film capacitors

MKP 338 2 X2

MKP RADIAL POTTED TYPE

PITCH 7.5/10/15/22.5/27.5 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 X2 electromagnetic interference suppression
- Specially designed to meet the requirements of the “IEC 60384-14 2<sup>nd</sup> edition and EN 132400”, requiring for X2 a 2.5 kV peak pulse voltage test and both UL1414 and CSA-C22.2 No 1 specifications.
- Meet the requirements of “IEC 60065, pass. flamm. class B”







QUICK REFERENCE DATA

DESCRIPTION	VALUE
Capacitance range (E12 series)	0.001 to 3.3 µF
Capacitance tolerance	±20%; ±10%; ±5%
Rated (AC) voltage, 50 to 60 Hz	275 V
Rated (DC) voltage for reference	630 V
Climatic category	55/105/56/B
Rated temperature	105 °C
Maximum application temperature	105 °C
Reference specifications	IEC 60384-14 2 <sup>nd</sup> edition and EN 132400
Safety approvals:	
250 V	CSA-C22.2 No 1; UL1414
275 V	CSA-C22.2 No 8; CCEE
275 V	ENEC
305 V	UL1283
Materials	qualified in accordance with UL94V-O
Safety class	X2; across the line

DETAIL SPECIFICATION

For more detailed data and test requirements see “Type detail specification HQN-384-14/111”.

**Interference suppression film capacitors****MKP 338 2 X2****SAFETY APPROVALS AND SAFETY TEST REPORT****Approvals**

SAFETY APPROVALS (X2)		VOLTAGE	VALUE	FILE NUMBERS
	EN132400	275 V (AC)	1 nF to 3.3 $\mu$ F	ENEC/B05/2001
	UL1414	250 V (AC)	1 nF to 1 $\mu$ F	E112471
	UL1283	305 V (AC)	1 nF to 3.3 $\mu$ F	E109565
	CSA-C22.2 No.1	250 V (AC)	1 nF to 1 $\mu$ F	1087424 (LR94054-15)
	CSA-C22.2 No.8	275 V (AC)	1 nF to 3.3 $\mu$ F	1078568
	CCEE	275 V (AC)	1 nF to 3.3 $\mu$ F	CH0038043-99 (Roeselare factory) CH0066809-2001 (Shanghai factory)

**Safety test report**

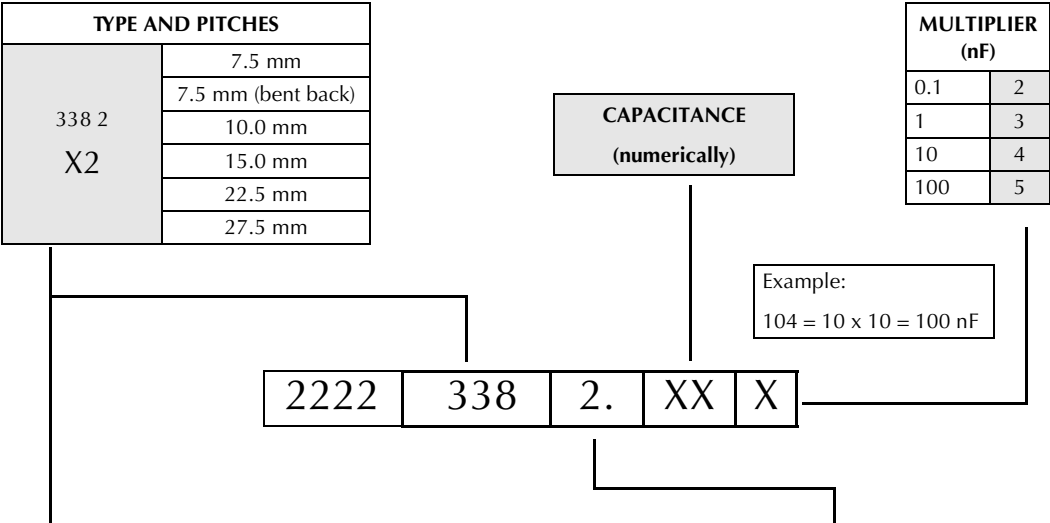
SAFETY TEST REPORT	VOLTAGE	VALUE	FILE NUMBERS
CB TEST CERTIFICATE	275 V (AC)	1 nF to 3.3 $\mu$ F: 55/100/56/B	FI 1095A2 and FI 1709

The Enec-approval together with the CB-Certificate replace all national approval marks of the following countries (they have already signed the ENEC-Agreement): Austria; Belgium; Czech. Republic; Denmark; Finland; France; Germany; Greece; Hungary; Ireland; Italy; Luxembourg; Netherlands; Norway, Portugal; Slovenian; Spain; Sweden; Switzerland and United Kingdom.

Interference suppression film capacitors

MKP 338 2 X2

COMPOSITION OF CATALOGUE NUMBER



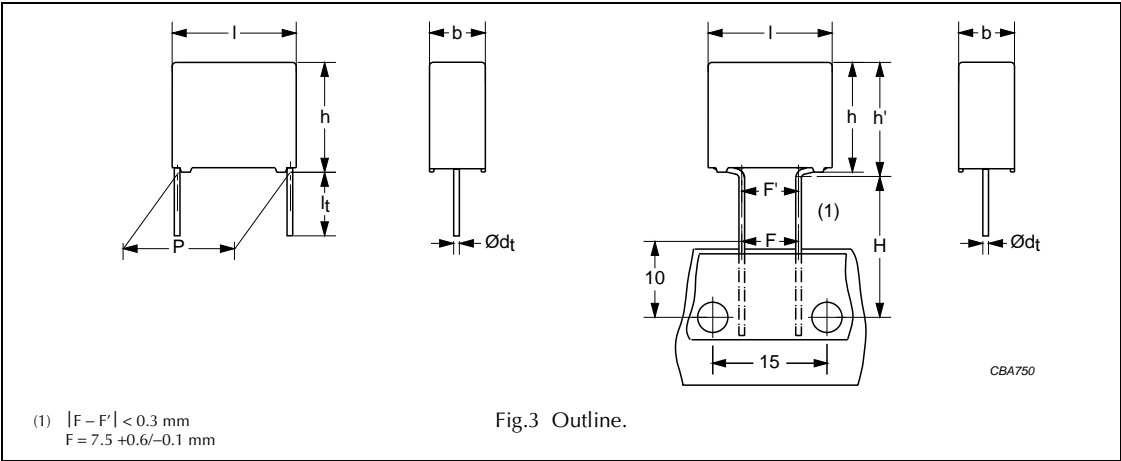
TYPE	PACKAGING	STANDARD DIMENSIONS	C-TOL	PREFERRED TYPES
338 2 X2	loose in box	lead length 3.5 mm	±20%	20
		lead length 5.0 mm		22
		lead length 25.0 mm		24
	taped	pitch 7.5 mm or bent back to 7.5 mm		26
		ALTERNATIVE LARGER PITCH SIZES		ON REQUEST
338 2 X2	loose in box	lead length 3.5 mm	±20%	see tables for details
		lead length 5.0 mm		
		lead length 25.0 mm		
		ALTERNATIVE TAPED VERSION		ON REQUEST
338 2 X2	taped	H = 18.5 mm; for P <sub>0</sub> = 12.7 mm	±20%	see tables for details
		ALTERNATIVE C-TOL		ON REQUEST
338 2 X2	loose in box	lead length 3.5 mm	±10%	see tables for details
		lead length 5.0 mm	±10%	
		lead length 25.0 mm	±10%	
	taped	pitch 7.5 mm or bent back to 7.5 mm	±10%	
		H = 18.5 mm; for P <sub>0</sub> = 12.7 mm	±10%	
	loose in box	lead length 3.5 mm	±5%	see HQN-384-14/111
		lead length 5.0 mm	±5%	
		lead length 25.0 mm	±5%	
	taped	pitch 7.5 mm or bent back to 7.5 mm	±5%	
		H = 18.5 mm; for P <sub>0</sub> = 12.7 mm	±5%	

Interference suppression film capacitors

MKP 338 2 X2

MKP 338 2 GENERAL DATA

PITCH 7.5 mm  
PITCH 7.5 mm (bent back leads)



Specific reference data for the 275 V AC (X2) capacitors

DESCRIPTION	VALUE		
	at 1 kHz	at 10 kHz	at 100 kHz
Tangent of loss angle	$\leq 10 \times 10^{-4}$	$\leq 20 \times 10^{-4}$	$\leq 100 \times 10^{-4}$
Rated voltage pulse slope $(dU/dt)_R$ at 385 V (DC)	100 V/ $\mu$ s		
R between leads, for $C \leq 0.33 \mu\text{F}$ at 100 V; 1 minute	$> 15\,000 \text{ M}\Omega$		
R between leads and case; 100 V; 1 minute	$> 30\,000 \text{ M}\Omega$		
Withstanding (DC)voltage (cut off current 10 mA); rise time 100 V/s	2200 V; 1 minute		
Withstanding (AC) voltage between leads and case	2050 V; 1 minute		

Available 275 V AC (X2) versions

PACKAGING	DIMENSIONS	C-tol <sup>(1)</sup>	ORDERING	CATALOGUE NUMBER
Loose in box	$l_t = 3.5 +1/-0.5 \text{ mm}$	$\pm 20\%$	preferred	see tables for details
		$\pm 10\%$	on request	
	$l_t = 5.0 \pm 1.0 \text{ mm}$	$\pm 20\%$	preferred	
		$\pm 10\%$	on request	
	$l_t = 25.0 \pm 2.0 \text{ mm}$	$\pm 20\%$	preferred	
		$\pm 10\%$	on request	
Ammopack	H = 18.5 mm; for $P_0 = 12.7 \text{ mm}$ ; reel diameter = 500 mm	$\pm 20\%$	preferred	see tables for details
		$\pm 10\%$	on request	
Taped on reel; bent back	H = 16.0 mm; for $P_0 = 15.0 \text{ mm}$ ; reel diameter = 500 mm	$\pm 20\%$	preferred	
		$\pm 10\%$	on request	

Note

1.  $\pm 5\%$  tolerance values and other values are available on special request.

**Interference suppression film capacitors****MKP 338 2 X2****Pitch: 7.5 mm; C-tol =  $\pm 20\%$**  **$U_{Rac} = 275\text{ V}$** (for reference:  $U_{Rdc} = 630\text{ V}$ )

C (μF)	DIMENSIONS b × h × l (mm)	MASS (g)	CATALOGUE NUMBER 2222 338 ..... AND PACKAGING						
			LOOSE IN BOX					AMMOPACK	
			short leads			long leads		H = 18.5 mm P <sub>0</sub> = 12.7 mm	
			l <sub>t</sub> = 3.5 +1/−0.5 mm	l <sub>t</sub> = 5.0 ±1.0 mm	SPQ	l <sub>t</sub> = 25.0 ±2.0 mm	SPQ		SPQ
Pitch = 7.5 ±0.4 mm; d <sub>t</sub> = 0.50 ±0.05 mm									
0.001	4.0 × 9.0 × 10.0	0.5	20102	22102	1500	24102	1000	26102	1250
0.0015			20152	22152		24152		26152	
0.0022			20222	22222		24222		26222	
0.0033			20332	22332		24332		26332	
0.0047			20472	22472		24472		26472	
0.0068			20682	22682		24682		26682	
0.01			20103	22103		24103		26103	
0.015			20153	22153		24153		26153	
0.022			20223	22223		24223		26223	
0.033	5.0 × 10.5 × 10.0	0.9	20333	22333	1000	24333	1250	26333	1000
0.047	6.0 × 11.5 × 10.0	1.0	20473	22473	750	24473	1000	26473	750

**Pitch: 7.5 mm; C-tol =  $\pm 10\%$**  **$U_{Rac} = 275\text{ V}$** (for reference:  $U_{Rdc} = 630\text{ V}$ )

C (μF)	DIMENSIONS b × h × l (mm)	MASS (g)	CATALOGUE NUMBER 2222 338 ..... AND PACKAGING							
			LOOSE IN BOX					AMMOPACK		
			short leads			long leads		H = 18.5 mm P <sub>0</sub> = 12.7 mm		
			l <sub>t</sub> = 3.5 +1/−0.5 mm	l <sub>t</sub> = 5.0 ±1.0 mm	SPQ	l <sub>t</sub> = 25.0 ±2.0 mm	SPQ		SPQ	
Pitch = 7.5 ±0.4 mm; d <sub>t</sub> = 0.50 ±0.05 mm										
0.001	4.0 × 9.0 × 10.0	0.5	28101	28301	1 500	28501	1 000	28701	1 250	
0.0015			28103	28303		28503		28703		
0.0022			28105	28305		28505		28705		
0.0033			28107	28307		28507		28707		
0.0047			28109	28309		28509		28709		
0.0068			28112	28312		28512		28712		
0.01			28114	28314		28514		28714		
0.015			28116	28316		28516		28716		
0.022			28118	28318		28518		28718		
0.033	5.0 × 10.5 × 10.0	0.9	28121	28321	1 000	28521	1 250	28721	1 000	
0.047	6.0 × 11.5 × 10.0	1.0	28123	28323	750	28523	1 000	28723	750	

## Interference suppression film capacitors

## MKP 338 2 X2

Bent back pitch: 7.5 mm (only taped) ; C-tol =  $\pm 20\%$  $U_{Rac} = 275 \text{ V}$ (for reference:  $U_{Rdc} = 630 \text{ V}$ )

C (μF)	DIMENSIONS b × h × l (mm)	MASS (g)	CATALOGUE NUMBER 2222 338 ..... AND PACKAGING	
			REEL <sup>(1)</sup>	
			H = 16.0 mm; P <sub>0</sub> = 15.0 mm	SPQ
Bent back pitch = 7.5 ±0.4 mm; d <sub>l</sub> = 0.60 ±0.06 mm				
0.068 0.1	6.0 × 14.0 × 12.5	1.0	26683 26104	1 500
Bent back pitch = 7.5 ±0.4 mm; d <sub>l</sub> = 0.80 ±0.08 mm				
0.15	7.0 × 15.5 × 17.5	1.9	26154	700
0.22	8.5 × 17.0 × 17.5	2.6	26224	550
0.33	10.0 × 18.5 × 17.5	3.1	26334	500

## Note

1. Reel diameter = 356 mm is available on request.

Bent back pitch: 7.5 mm (only taped) ; C-tol =  $\pm 10\%$  $U_{Rac} = 275 \text{ V}$ (for reference:  $U_{Rdc} = 630 \text{ V}$ )

C (μF)	DIMENSIONS b × h × l (mm)	MASS (g)	CATALOGUE NUMBER 2222 338 ..... AND PACKAGING	
			REEL <sup>(1)</sup>	
			H = 16.0 mm; P <sub>0</sub> = 15.0 mm	SPQ
Bent back pitch = 7.5 ±0.4 mm; d <sub>t</sub> = 0.60 ±0.06 mm				
0.068	6.0 × 14.0 × 12.5	1.0	28725	1 500
Bent back pitch = 7.5 ±0.4 mm; d <sub>t</sub> = 0.60 ±0.06 mm				
0.1	6.0 × 14.0 × 17.5	1.4	28727	800
Bent back pitch = 7.5 ±0.4 mm; d <sub>t</sub> = 0.80 ±0.08 mm				
0.15	7.0 × 15.5 × 17.5	1.9	28729	700
0.22	8.5 × 17.0 × 17.5	2.6	28732	550
0.33	10.0 × 18.5 × 17.5	3.1	29168	500

## Note

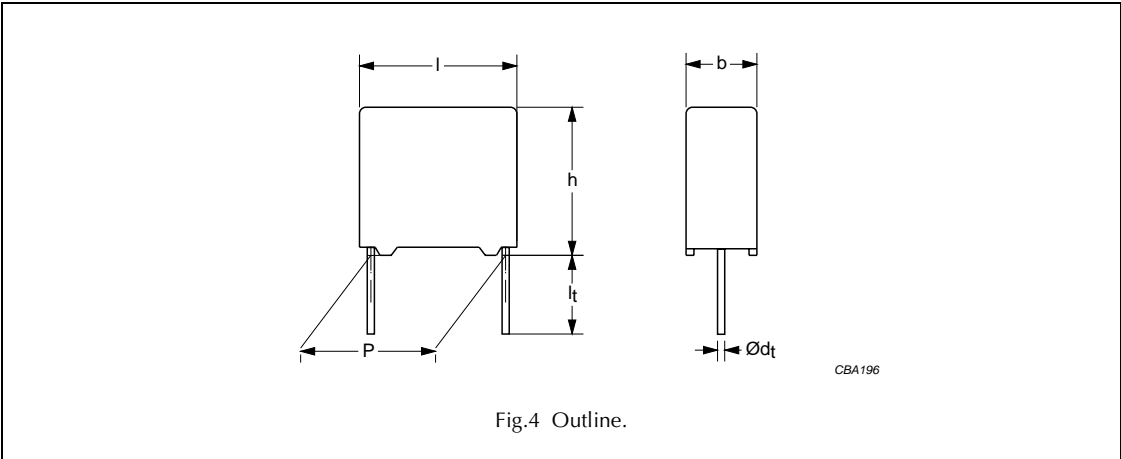
1. Reel diameter = 356 mm is available on request.

Interference suppression film capacitors

MKP 338 2 X2

MKP 338 2 GENERAL DATA

PITCH 10 mm



Specific reference data for the 275 V AC (X2) capacitors

DESCRIPTION	VALUE		
	at 1 kHz	at 10 kHz	at 100 kHz
Tangent of loss angle	$\leq 10 \times 10^{-4}$	$\leq 20 \times 10^{-4}$	$\leq 100 \times 10^{-4}$
Rated voltage pulse slope $(dU/dt)_R$ at 385 V (DC)	100 V/ $\mu$ s		
R between leads, for $C \leq 0.33 \mu$ F at 100 V; 1 minute	$> 15\,000 \text{ M}\Omega$		
RC between leads, for $C > 0.33 \mu$ F at 100 V; 1 minute	$> 5\,000 \text{ s}$		
R between leads and case; 100 V; 1 minute	$> 30\,000 \text{ M}\Omega$		
Withstanding (DC) voltage (cut off current 10 mA); rise time 100 V/s	2200 V; 1 minute		
Withstanding (AC) voltage between leads and case	2050 V; 1 minute		

Available 275 V AC (X2) versions

PACKAGING	DIMENSIONS	C-tol <sup>(1)</sup>	ORDERING	CATALOGUE NUMBER
Loose in box	$l_t = 3.5 +1/-0.5 \text{ mm}$	$\pm 20\%$	preferred	see tables for details
		$\pm 10\%$	on request	
	$l_t = 5.0 \pm 1.0 \text{ mm}$	$\pm 20\%$	preferred	
		$\pm 10\%$	on request	
	$l_t = 25.0 \pm 2.0 \text{ mm}$	$\pm 20\%$	preferred	
		$\pm 10\%$	on request	
Ammopack	$H = 18.5 \text{ mm}$ ; for $P_0 = 12.7 \text{ mm}$ ;	$\pm 20\%$	on request	
		$\pm 10\%$	on request	

Note

1.  $\pm 5\%$  tolerance values and other values are available on special request.



## Interference suppression film capacitors

## MKP 338 2 X2

Pitch: 10.0 mm; C-tol =  $\pm 20\%$  $U_{Rac} = 275\text{ V}$ (for reference:  $U_{Rdc} = 630\text{ V}$ )

C (μF)	DIMENSIONS b × h × l (mm)	MASS (g)	CATALOGUE NUMBER 2222 338 ..... AND PACKAGING							
			LOOSE IN BOX						AMMOPACK	
			short leads			long leads			H = 18.5 mm P <sub>0</sub> = 12.7 mm	
			l <sub>t</sub> = 3.5 +1/−0.5 mm	l <sub>t</sub> = 5.0 ±1.0 mm	SPQ	l <sub>t</sub> = 25.0 ±2.0 mm	SPQ		SPQ	
Pitch = 10.0 ±0.4 mm; d <sub>t</sub> = 0.60 ±0.06 mm										
0.001	4.0 × 10.0 × 12.5	0.6	21102	23102	1 000	25102	1 250			
0.0015			21152	23152		25152				
0.0022			21222	23222		25222				
0.0033	5.0 × 11.0 × 12.5	0.9	21332	23332	1 000	25332	1 000			
0.0047			21472	23472		25472				
0.0068			21682	23682		25682				
0.01			21103	23103		25103				
0.015			21153	23153		25153				
0.022			21223	23223		25223				
0.033			21333	23333		25333				
0.047			21473	23473		25473				
0.068	6.0 × 12.0 × 12.5	1.0	20683	22683	750	24683	750	27683	500	
0.1			20104	22104		24104		27104		

Pitch: 10.0 mm; C-tol =  $\pm 10\%$  $U_{Rac} = 275\text{ V}$ (for reference:  $U_{Rdc} = 630\text{ V}$ )

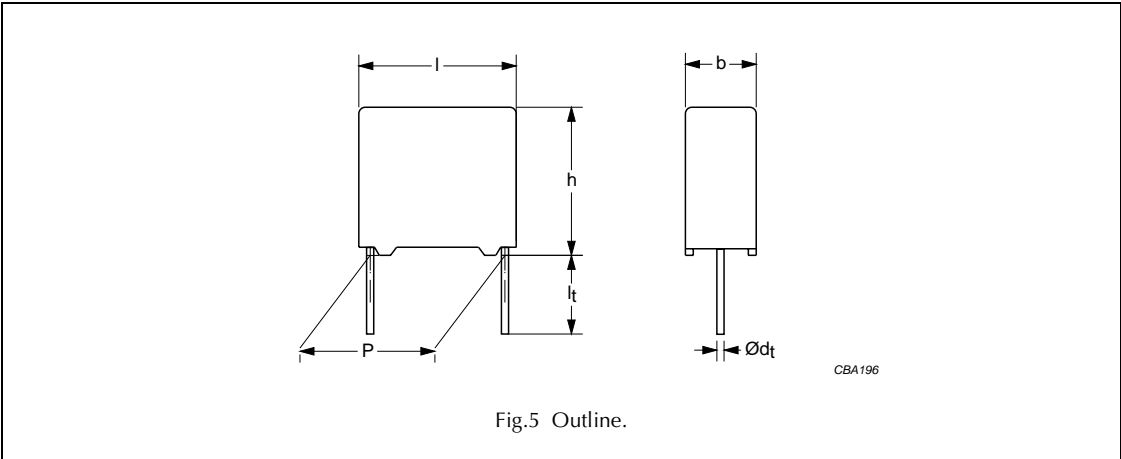
C (μF)	DIMENSIONS b × h × l (mm)	MASS (g)	CATALOGUE NUMBER 2222 338 ..... AND PACKAGING							
			LOOSE IN BOX						AMMOPACK	
			short leads			long leads			H = 18.5 mm P <sub>0</sub> = 12.7 mm	
			l <sub>t</sub> = 3.5 +1/−0.5 mm	l <sub>t</sub> = 5.0 ±1.0 mm	SPQ	l <sub>t</sub> = 25.0 ±2.0 mm	SPQ		SPQ	
Pitch = 10.0 ±0.4 mm; d <sub>t</sub> = 0.60 ±0.06 mm										
0.001	4.0 × 10.0 × 12.5	0.6	29194	29217	1 000	29241	1 250			
0.0015			29196	29219		29243				
0.0022			29198	29222		29245				
0.0033	5.0 × 11.0 × 12.5	0.9	29201	29224	1 000	29247	1 000			
0.0047			29203	29226		29249				
0.0068			29205	29228		29252				
0.01			29207	29231		29254				
0.015			29209	29233		29256				
0.022			29212	29235		29258				
0.033			29214	29237		29261				
0.047			29216	29239		29263				
0.068	6.0 × 12.0 × 12.5	1.0	28125	28325	750	28525	750	28925	500	

Interference suppression film capacitors

MKP 338 2 X2

MKP 338 2 GENERAL DATA

PITCH 15 mm



Specific reference data for the 275 V AC (X2) capacitors

DESCRIPTION	VALUE		
	at 1 kHz	at 10 kHz	at 100 kHz
Tangent of loss angle: C ≤ 470 nF 470 nF < C ≤ 1 µF	≤10 × 10 <sup>-4</sup>	≤20 × 10 <sup>-4</sup>	≤100 × 10 <sup>-4</sup>
	≤20 × 10 <sup>-4</sup>	≤70 × 10 <sup>-4</sup>	–
Rated voltage pulse slope (dU/dt) <sub>R</sub> at 385 V (DC)	100 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	2200 V; 1 minute		
Withstanding (AC) voltage between leads and case	2050 V; 1 minute		

Available 275 V AC (X2) versions

PACKAGING	DIMENSIONS	C-tol <sup>(1)</sup>	ORDERING	CATALOGUE NUMBER
Loose in box	l <sub>t</sub> = 3.5 ±0.3 mm	±20%	preferred	see tables for details
		±10%	on request	
	l <sub>t</sub> = 5.0 ±1.0 mm	±20%	preferred	
		±10%	on request	
	l <sub>t</sub> = 25.0 ±2.0 mm	±20%	preferred	
		±10%	on request	
Taped on reel	H = 18.5 mm; for P <sub>0</sub> = 12.7 mm; reel diameter = 500 mm	±20%	on request	
		±10%	on request	

Note

1. ±5% tolerance values and other values are available on special request.

**Interference suppression film capacitors****MKP 338 2 X2****Pitch: 15.0 mm; C-tol =  $\pm 20\%$**  **$U_{Rac} = 275\text{ V}$** (for reference:  $U_{Rdc} = 630\text{ V}$ )

C (μF)	DIMENSIONS b × h × l (mm)	MASS (g)	CATALOGUE NUMBER 2222 338 ..... AND PACKAGING							
			LOOSE IN BOX						REEL	
			short leads			long leads			H = 18.5 mm P <sub>0</sub> = 12.7 mm	
			l <sub>t</sub> = 3.5 ±0.3 mm	l <sub>t</sub> = 5.0 ±1.0 mm	SPQ	l <sub>t</sub> = 25.0 ±2.0 mm	SPQ		SPQ	
Pitch = 15.0 ±0.4 mm; d <sub>t</sub> = 0.60 ±0.06 mm										
0.01	5.0 × 11.0 × 17.5	1.2	29076	29096	1 000	29116	1 000	29141	1 100	
0.015			29078	29098		29118		29145		
0.022			29081	29101		29121		29149		
0.033			29083	29103		29123		29154		
0.047			29085	29105		29125		29158		
0.068			21683	23683		25683		29163		
0.1			21104	23104		25104		29166		
Pitch = 15.0 ±0.4 mm; d <sub>t</sub> = 0.80 ±0.08 mm										
0.15	7.0 × 13.5 × 17.5	1.9	20154	22154	750	24154	500	27154	800	
0.22	8.5 × 15.0 × 17.5	2.6	20224	22224	750	24224	500	27224	650	
0.33	10.0 × 16.5 × 17.5	3.1	20334	22334	500	24334	450	27334	600	

**Pitch: 15.0 mm; C-tol =  $\pm 10\%$**  **$U_{Rac} = 275\text{ V}$** (for reference:  $U_{Rdc} = 630\text{ V}$ )

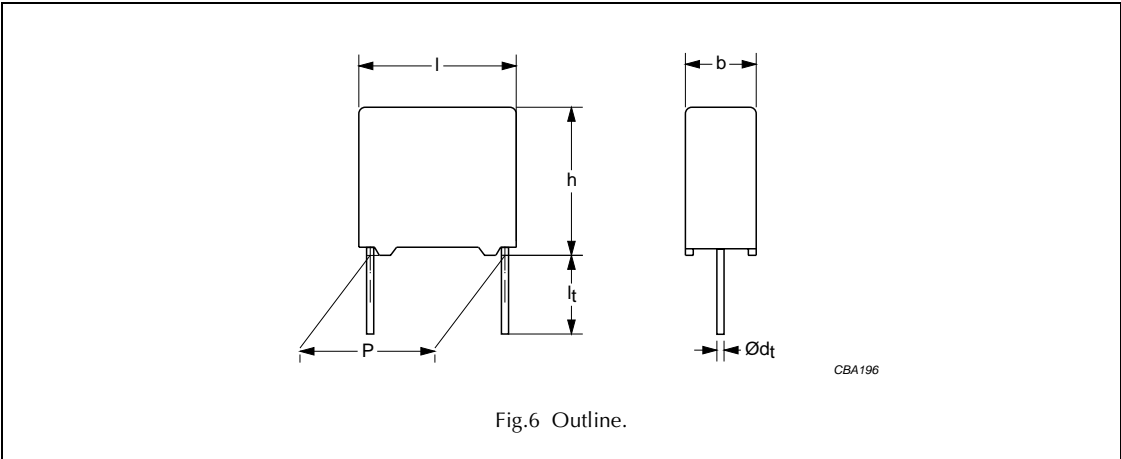
C (μF)	DIMENSIONS b × h × l (mm)	MASS (g)	CATALOGUE NUMBER 2222 338 ..... AND PACKAGING							
			LOOSE IN BOX						REEL	
			short leads			long leads			H = 18.5 mm P <sub>0</sub> = 12.7 mm	
			l <sub>t</sub> = 3.5 ±0.3 mm	l <sub>t</sub> = 5.0 ±1.0 mm	SPQ	l <sub>t</sub> = 25.0 ±2.0 mm	SPQ		SPQ	
Pitch = 15.0 ±0.4 mm; d <sub>t</sub> = 0.60 ±0.06 mm										
0.01	5.0 × 11.0 × 17.5	1.2	29066	29086	1000	29106	1000	29139	1100	
0.015			29068	29088		29108		29144		
0.022			29071	29091		29111		29148		
0.033			29073	29093		29113		29153		
0.047			29075	29095		29115		29157		
0.068			29127	29132		29136		29162		
0.1	6.0 × 12.0 × 17.5	1.4	28127	28327	1000	28527	1000	28927	900	
Pitch = 15.0 ±0.4 mm; d <sub>t</sub> = 0.80 ±0.08 mm										
0.15	7.0 × 13.5 × 17.5	1.9	28129	28329	750	28529	500	28929	800	
0.18			28131	28331		28531		28931		
0.22	8.5 × 15.0 × 17.5	2.6	28132	28332	750	28532	500	28932	650	
0.33	10.0 × 16.5 × 17.5	3.1	29129	29134	500	29138	450	29167	600	

Interference suppression film capacitors

MKP 338 2 X2

MKP 338 2 GENERAL DATA

PITCH 22.5 mm



Specific reference data for the 275 V AC (X2) capacitors

DESCRIPTION	VALUE		
	at 1 kHz	at 10 kHz	at 100 kHz
Tangent of loss angle: C ≤ 470 nF 470 nF < C ≤ 1 µF	≤10 × 10 <sup>-4</sup>	≤20 × 10 <sup>-4</sup>	≤100 × 10 <sup>-4</sup>
	≤20 × 10 <sup>-4</sup>	≤70 × 10 <sup>-4</sup>	–
Rated voltage pulse slope (dU/dt) <sub>R</sub> at 385 V (DC)	100 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	2200 V; 1 minute		
Withstanding (AC) voltage between leads and case	2050 V; 1 minute		

Available 275 V AC (X2) versions

PACKAGING	DIMENSIONS	C-tol <sup>(1)</sup>	ORDERING	CATALOGUE NUMBER
Loose in box	l <sub>t</sub> = 3.5 ±0.3 mm	±20%	preferred	see tables for details
		±10%	on request	
	l <sub>t</sub> = 5.0 ±1.0 mm	±20%	preferred	
		±10%	on request	
	l <sub>t</sub> = 25.0 ±2.0 mm	±20%	preferred	
		±10%	on request	
Taped on reel	H = 18.5 mm; for P <sub>0</sub> = 12.7 mm; reel diameter = 500 mm	±20%	on request	
		±10%	on request	

Note

1. ±5% tolerance values and other values are available on special request.

## Interference suppression film capacitors

## MKP 338 2 X2

Pitch: 22.5 mm; C-tol =  $\pm 20\%$  $U_{Rac} = 275\text{ V}$ (for reference:  $U_{Rdc} = 630\text{ V}$ )

C (μF)	DIMENSIONS b × h × l (mm)	MASS (g)	CATALOGUE NUMBER 2222 338 ..... AND PACKAGING						
			LOOSE IN BOX					REEL	
			short leads			long leads		H = 18.5 mm P <sub>0</sub> = 12.7 mm	
			l <sub>t</sub> = 3.5 ±0.3 mm	l <sub>t</sub> = 5.0 ±1.0 mm	SPQ	l <sub>t</sub> = 25.0 ±2.0 mm	SPQ		SPQ
Pitch = 22.5 ±0.4 mm; d <sub>t</sub> = 0.80 ±0.08 mm									
0.15	6.0 × 15.5 × 26.0	2.9	21154	23154	200	25154	250	29265	600
0.22	7.0 × 16.5 × 26.0	3.2	21224	23224	200	25224	250	29267	500
0.33			21334	23334		25334		29269	
0.47	8.5 × 18.0 × 26.0	4.4	20474	22474	200	24474	250	27474	450
0.56			20564	22564		24564		27564	
0.68	10.0 × 19.5 × 26.0	5.5	20684	22684	200	24684	200	27684	350
1	12.0 × 22.0 × 26.0	7.8	20105	22105	100	24105	200	27105	300

Pitch: 22.5 mm; C-tol =  $\pm 10\%$  $U_{Rac} = 275\text{ V}$ (for reference:  $U_{Rdc} = 630\text{ V}$ )

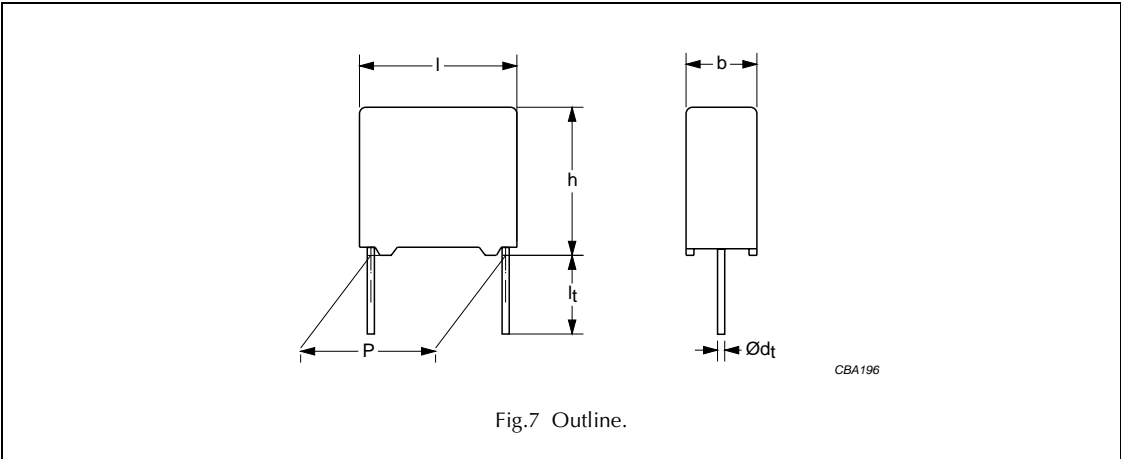
C (μF)	DIMENSIONS b × h × l (mm)	MASS (g)	CATALOGUE NUMBER 2222 338 ..... AND PACKAGING						
			LOOSE IN BOX					REEL	
			short leads			long leads		H = 18.5 mm P <sub>0</sub> = 12.7 mm	
			l <sub>t</sub> = 3.5 ±0.3 mm	l <sub>t</sub> = 5.0 ±1.0 mm	SPQ	l <sub>t</sub> = 25.0 ±2.0 mm	SPQ		SPQ
Pitch = 22.5 ±0.4 mm; d <sub>t</sub> = 0.80 ±0.08 mm									
0.15	6.0 × 15.5 × 26.0	2.9	29171	29176	200	29182	250	29272	600
0.22	7.0 × 16.5 × 26.0	3.2	29173	29178	200	29184	250	29274	500
0.33	8.5 × 18.0 × 26.0	4.4	28134	28334	200	28534	250	28934	450
0.47	10.0 × 19.5 × 26.0	5.5	28136	28336	200	28536	200	28936	350
0.68	12.0 × 22.0 × 26.0	7.8	28138	28338	100	28538	200	28938	300

Interference suppression film capacitors

MKP 338 2 X2

MKP 338 2 GENERAL DATA

PITCH 27.5 mm



Specific reference data for the 275 V AC (X2) capacitors

DESCRIPTION	VALUE		
	at 1 kHz	at 10 kHz	at 100 kHz
Tangent of loss angle: C ≤ 470 nF 470 nF < C ≤ 1 µF C > 1 µF	≤10 × 10 <sup>-4</sup>	≤20 × 10 <sup>-4</sup>	≤100 × 10 <sup>-4</sup>
	≤20 × 10 <sup>-4</sup>	≤70 × 10 <sup>-4</sup>	–
	≤30 × 10 <sup>-4</sup>	–	–
Rated voltage pulse slope (dU/dt) <sub>R</sub> at 385 V (DC)	100 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: C ≤ 1µF C > 1µF	2200 V; 1 minute		
	1800 V; 1 minute		
	2050 V; 1 minute		
Withstanding (AC) voltage between leads and case	2050 V; 1 minute		

Available 275 V AC (X2) versions

PACKAGING	DIMENSIONS	C-tol <sup>(1)</sup>	ORDERING	CATALOGUE NUMBER
Loose in box	l <sub>t</sub> = 3.5 ±0.3 mm	±20%	preferred	see tables for details
		±10%	on request	
	l <sub>t</sub> = 5.0 ±1.0 mm	±20%	preferred	
		±10%	on request	
	l <sub>t</sub> = 25.0 ±2.0 mm	±20%	preferred	
		±10%	on request	

Note

1. ±5% tolerance values and other values are available on special request.

## Interference suppression film capacitors

## MKP 338 2 X2

Pitch: 27.5 mm; C-tol =  $\pm 20\%$  $U_{Rac} = 275\text{ V}$ (for reference:  $U_{Rdc} = 630\text{ V}$ )

C (μF)	DIMENSIONS b × h × l (mm)	MASS (g)	CATALOGUE NUMBER 2222 338 ..... AND PACKAGING				
			LOOSE IN BOX				
			short leads			long leads	
			l <sub>t</sub> = 3.5 ±0.3 mm	l <sub>t</sub> = 5.0 ±1.0 mm	SPQ	l <sub>t</sub> = 25.0 ±2.0 mm	SPQ
Pitch = 27.5 ±0.4 mm; d <sub>t</sub> = 0.80 ±0.08 mm							
0.47	9.0 × 19.0 × 31.0	5.5	21474	23474	100	25474	150
0.68	11.0 × 21.0 × 31.0	7.8	21684	23684	100	25684	125
1.0			21105	23105		25105	
1.5	15.0 × 25.0 × 31.0	12.8	20155	22155	100	24155	125
2.2	18.0 × 28.0 × 31.0	17.2	20225	22225	100	24225	100
3.3	21.0 × 31.0 × 31.0	20.4	20335	22335	50	24335	75

Pitch: 27.5 mm; C-tol =  $\pm 10\%$  $U_{Rac} = 275\text{ V}$ (for reference:  $U_{Rdc} = 630\text{ V}$ )

C ( $\mu\text{F}$ )	DIMENSIONS $b \times h \times l$ (mm)	MASS (g)	CATALOGUE NUMBER 2222 338 ..... AND PACKAGING				
			LOOSE IN BOX				
			short leads			long leads	
			$l_t =$ 3.5 $\pm 0.3$ mm	$l_t =$ 5.0 $\pm 1.0$ mm	SPQ	$l_t =$ 25.0 $\pm 2.0$ mm	SPQ
Pitch = 27.5 $\pm 0.4$ mm; $d_t = 0.80 \pm 0.08$ mm							
1	13.0 $\times$ 23.0 $\times$ 31.0	10.4	28141	28341	100	28541	125
1.5	15.0 $\times$ 25.0 $\times$ 31.0	12.8	28143	28343	100	28543	125
2.2	21.0 $\times$ 31.0 $\times$ 31.0	20.4	28145	28345	50	28545	75

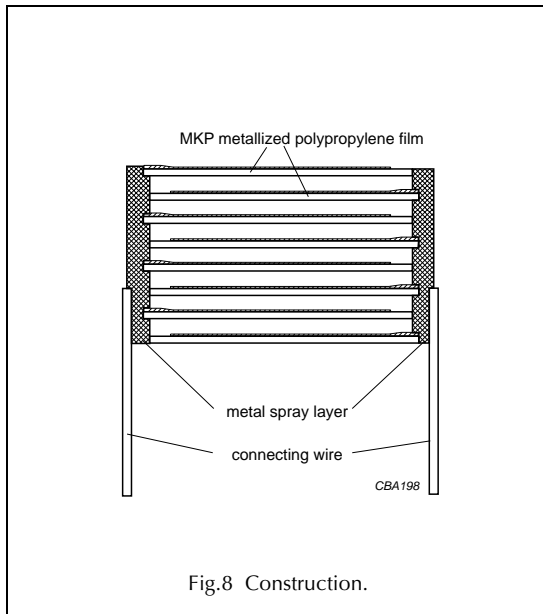
# Interference suppression film capacitors

## MKP 338 2 X2

### CONSTRUCTION

#### Description

- Low-inductive wound cell of metallized polypropylene (PP) film, potted with epoxy resin in a flame-retardant case
- Radial leads, solder-coated
- 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

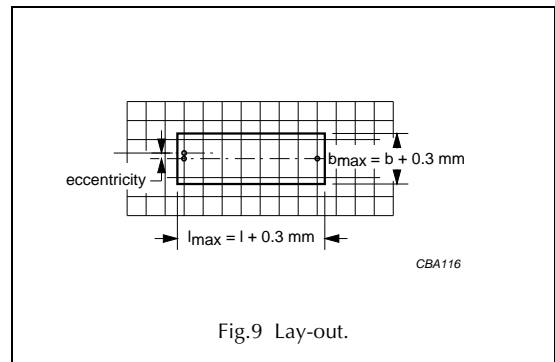
In order to withstand vibration and shock tests, it must be ensured that the stand-off pips are in good contact with the printed-circuit board:

- 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.9:

- Eccentricity as in Fig.9. 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 or  $h_{\max} \leq h' + 0.3$  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%.

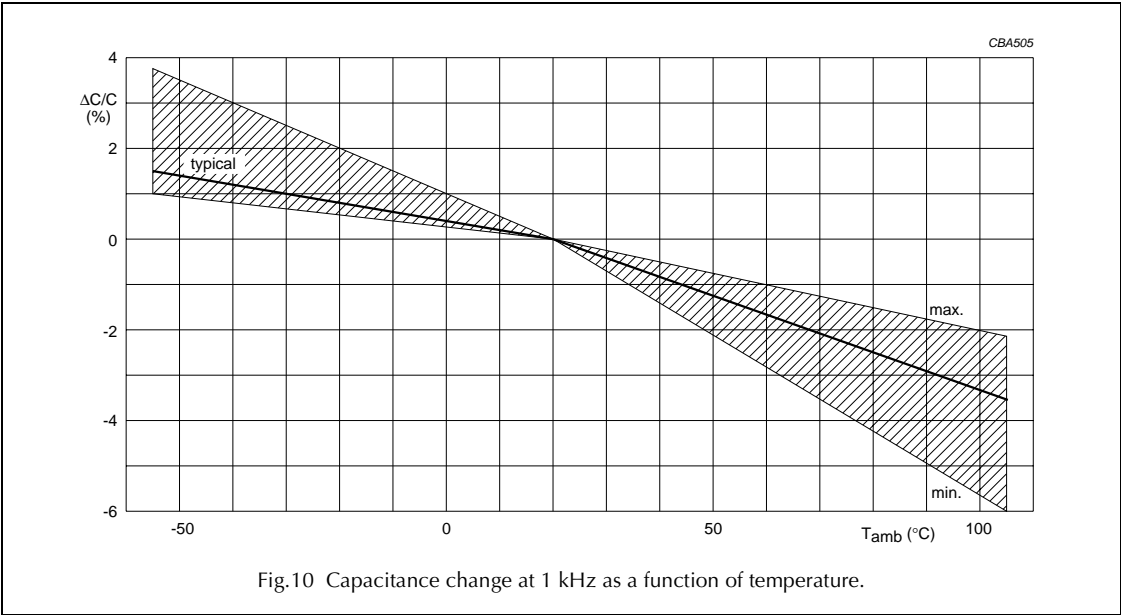


Interference suppression film capacitors

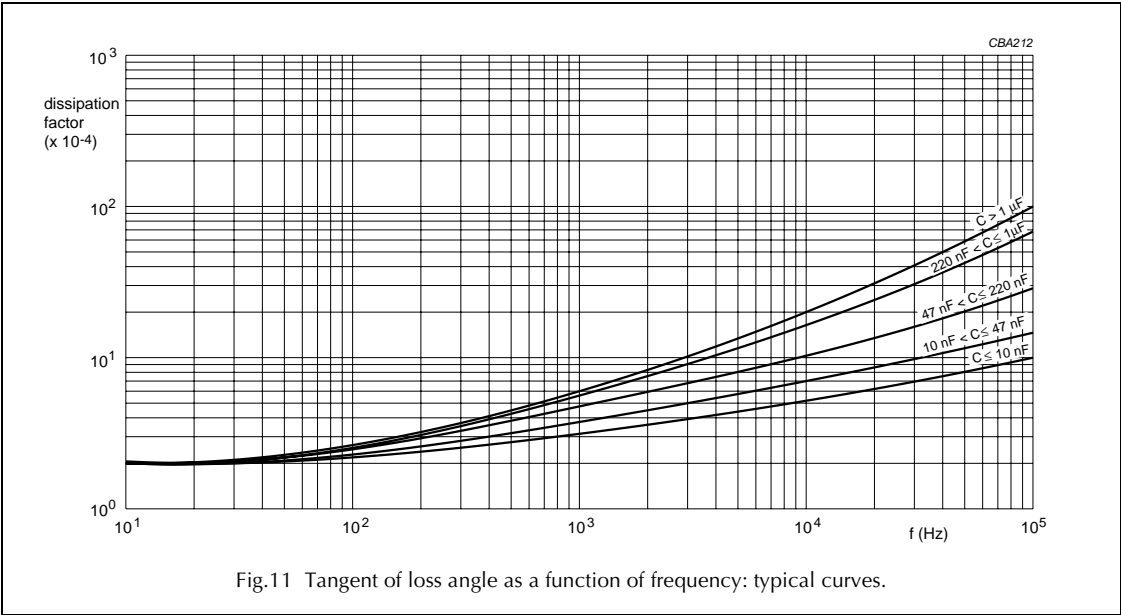
MKP 338 2 X2

CHARACTERISTICS

Capacitance



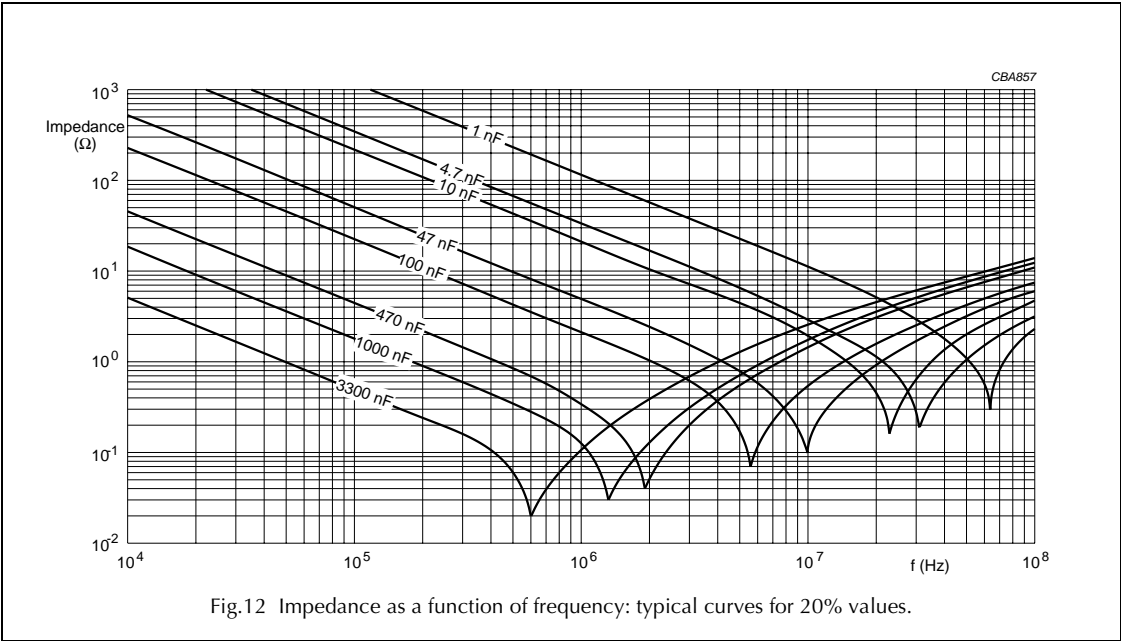
Tangent of loss angle



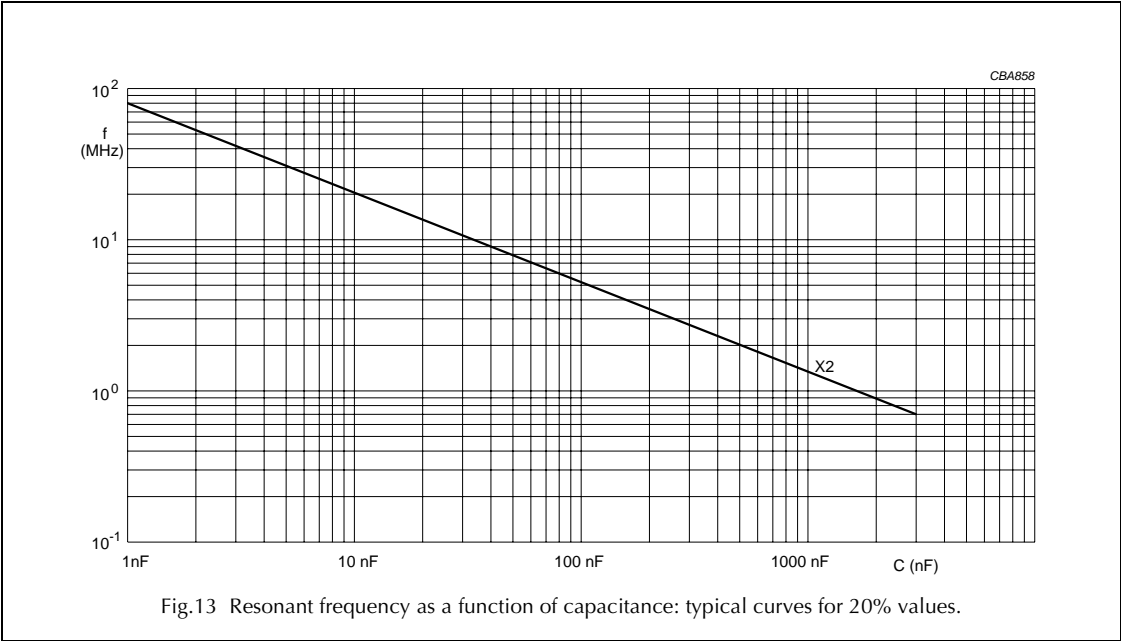
Interference suppression film capacitors

MKP 338 2 X2

Impedance



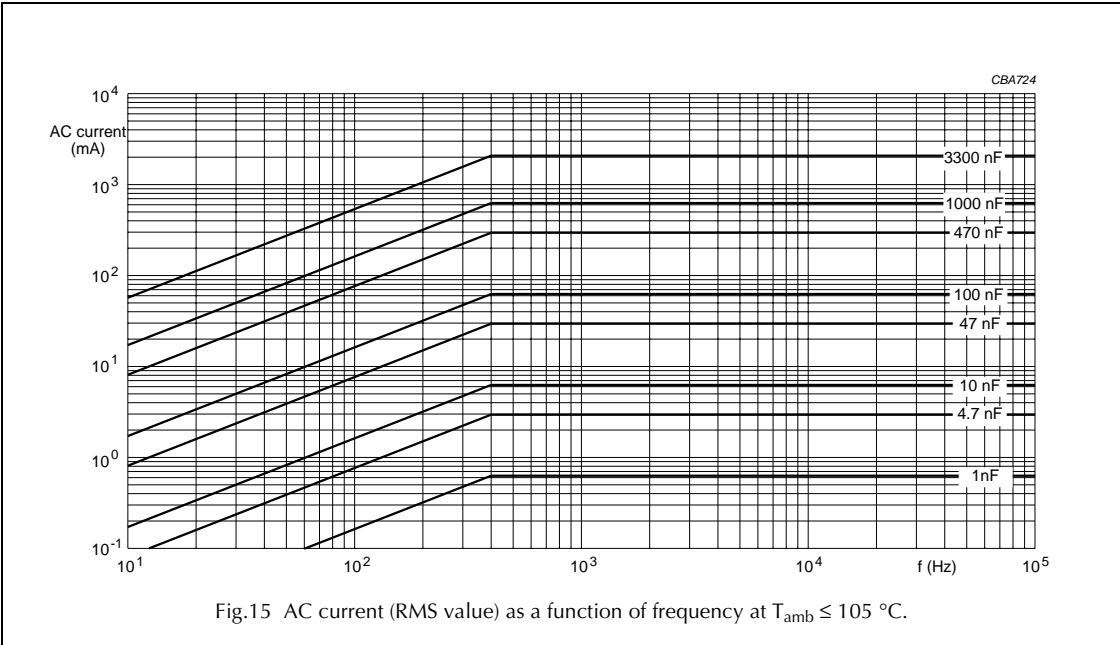
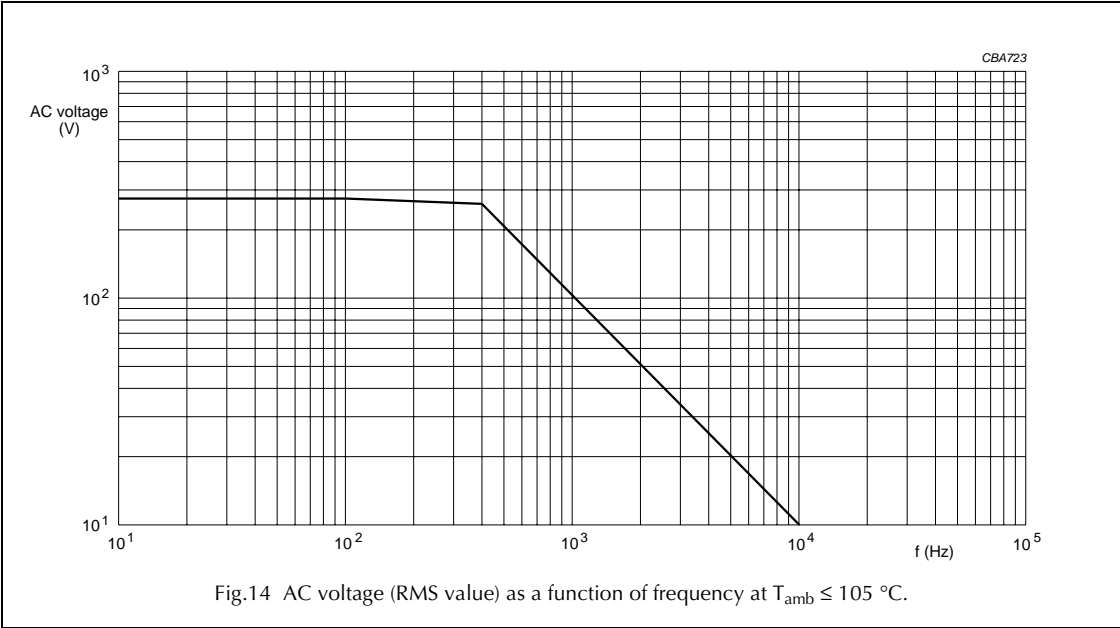
Resonant frequency



Interference suppression film capacitors

MKP 338 2 X2

Maximum RMS voltage and AC current (sinewave) as a function of frequency for  $T_{amb} \leq 105\text{ }^{\circ}\text{C}$



# Interference suppression film capacitors

# MKP 338 2 X2

## Insulation resistance

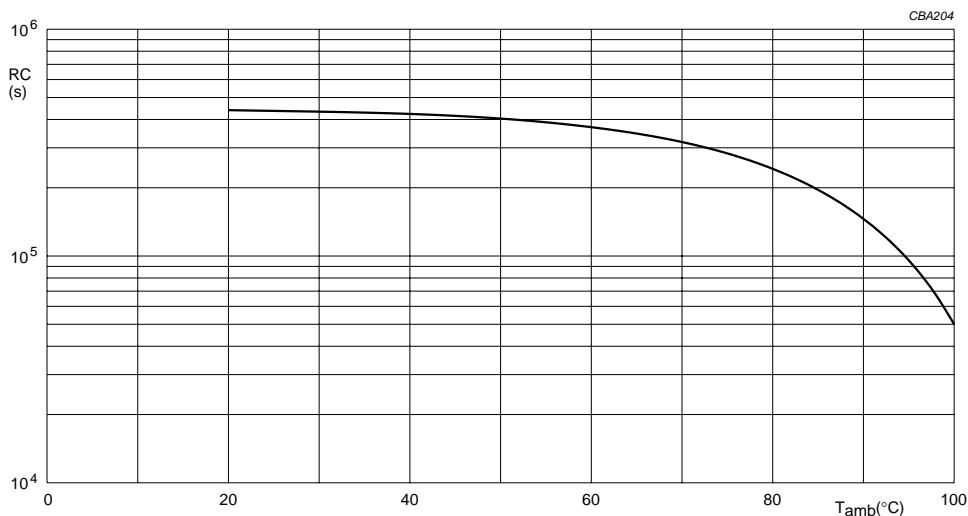


Fig.16 RC product as a function of ambient free air temperature: typical curve.

## APPLICATION NOTES

- For X2 electromagnetic interference suppression in across the line applications (50/60 Hz) with a maximum mains voltage of 275 V (AC)  $\pm 10\%$  instability.
- 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 385 V (DC) and divided by the applied voltage.

Interference suppression film capacitors

MKP 338 2 X2

MARKING

Product marking

The capacitors are marked by laser print (see Figs 17 to 21) with the following information:

- 1. Rated capacitance code in accordance with "IEC 60062"
- 2. Tolerance on rated capacitance; M = ±20%; K = ±10%; J = ±5%
- 3. Rated (AC) voltage (e.g. 275 V)
- 4. Sub-class (e.g. X2)
- 5. Manufacturer's type designation (e.g. 338 2)
- 6. Code for dielectric material (MKP) for capacitors with original pitch = 15, 22.5 and 27.5 mm
- 7. Manufacturer location:
  - a) " " : Roeselare
  - b) "07" : Shanghai
- 8. Manufacturer (BC)
- 9. Year and week of manufacture (e.g. 0133) for capacitors with original pitch = 15, 22.5 and 27.5 mm

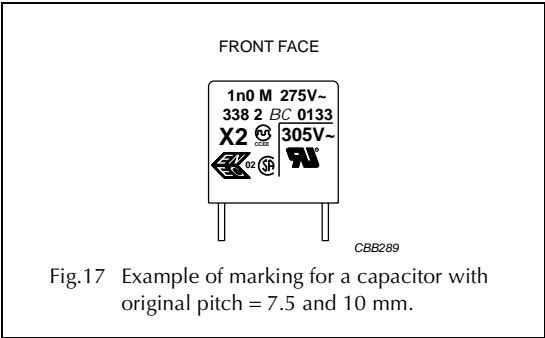


Fig.17 Example of marking for a capacitor with original pitch = 7.5 and 10 mm.

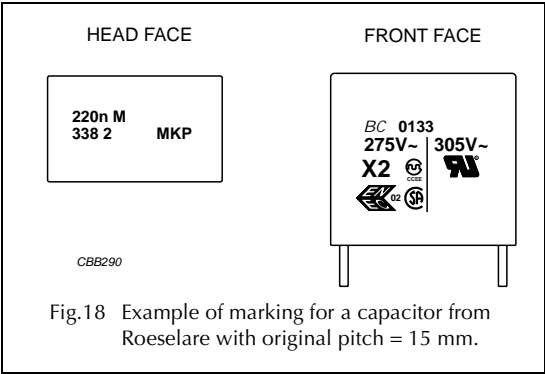


Fig.18 Example of marking for a capacitor from Roeselare with original pitch = 15 mm.

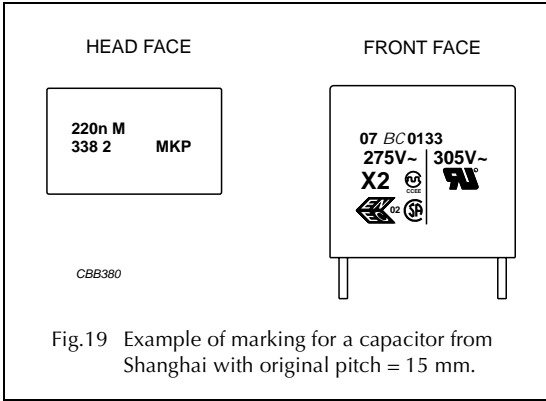


Fig.19 Example of marking for a capacitor from Shanghai with original pitch = 15 mm.

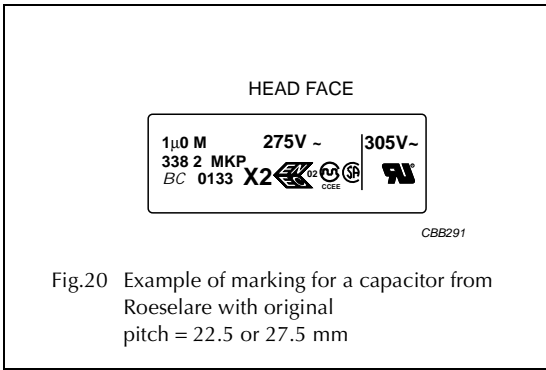


Fig.20 Example of marking for a capacitor from Roeselare with original pitch = 22.5 or 27.5 mm

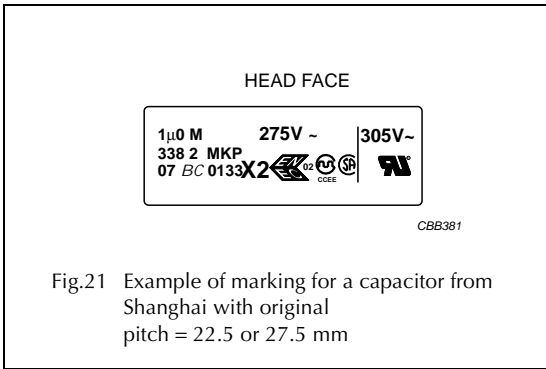


Fig.21 Example of marking for a capacitor from Shanghai with original pitch = 22.5 or 27.5 mm





## Interference suppression film capacitors

## MKP 338 2 X2

## Package marking

COUNTRY OF ORIGIN: BELGIUM

The package containing the capacitors is marked as shown Fig.22.

BCcomponents  
MADE IN BELGIUM  
INTERF. SUPPR. FILM CAPACITOR  
MKP RADIAL POTTED TYPE  
0.047µF ±20% 275V~ 55/105/56/8  
X2  02     
275 V~ 305 V~  
WQ: 12345678  
ORIG A170 RPC HQ 1234  
TYPE MKP 338 2  
QTY 750 DATE 0105  
CODEND 2222 338 20473

## 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 original pitch = 7.5 and 10 mm)
8	Product type description
9	Quantity and production period, year and week code
10	Product code (12NC)

Fig.22 Barcode label.

## Interference suppression film capacitors

MKP 338 2 X2

COUNTRY OF ORIGIN: CHINA

The package containing the capacitors is marked as shown Fig.23.

BCcomponents

INTERF. SUPPR. FILM CAPACITOR - MADE IN CHINA

MKP RADIAL POTTED TYPE

0.047uF +/-20% 275V~ = 55/105/56/B

X2

 02



CCEE





275V~

305V~

BATCHNO IF01051-49413

ORIG N260 RPC 07

TYPE MKP 338 2

QTY 750 DATE 0116

CODENO 2222 338 20473

### Barcode label marking

LINE	MARKING EXPLANATION
1	Manufacturer's name
2	Sub-family - Country of origin
3	Type description and sub class
4	Capacitance value, tolerance, voltage and climatic category ( <i>"IEC 60068-1"</i> )
5	Approvals
6	Batch number
7	Preference origin code: N Country of origin in code: 260 (China) Responsible production centre: 07
8	Product type description
9	Quantity and production period, year and week code
10	Product code (12NC)

Fig.23 Barcode label.

## Interference suppression film capacitors

## MKP 338 2 X2

## 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\%$ $\Delta \tan \delta \leq 80 \times 10^{-4}$ (C $\leq$ 1 $\mu$ F); note 1 $\Delta \tan \delta \leq 50 \times 10^{-4}$ (C $>$ 1 $\mu$ F); note 1
Bending: "IEC 60068-2-21"	load 5 N; 4 $\times$ 90 °	
Resistance to soldering heat: "IEC 60068-2-20"	solder bath: 260 °C; 10 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 105 °C	$ \Delta C/C  \leq 5\%$ $\Delta \tan \delta \leq 80 \times 10^{-4}$ (C $\leq$ 1 $\mu$ F); note 1 $\Delta \tan \delta \leq 50 \times 10^{-4}$ (C $>$ 1 $\mu$ F); note 1
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	
Climatic sequence		
Dry heat: "IEC 60068-2-2"	16 hours; 105 °C	$ \Delta C/C  \leq 5\%$ $\Delta \tan \delta \leq 80 \times 10^{-4}$ (C $\leq$ 1 $\mu$ F); note 1 $\Delta \tan \delta \leq 50 \times 10^{-4}$ (C $>$ 1 $\mu$ F); note 1 $R_{\text{ins}} \geq 50\%$ 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"	$V_p = 1\,200$ V (DC); 1 minute	
Other applicable tests		
Damp heat, steady state: "IEC 60068-2-3"	56 days; 40 °C; 90 to 95% RH no load $V_p = 1\,200$ V (DC); 1 minute	$ \Delta C/C  \leq 5\%$ $\Delta \tan \delta \leq 80 \times 10^{-4}$ (C $\leq$ 1 $\mu$ F); note 1 $\Delta \tan \delta \leq 50 \times 10^{-4}$ (C $>$ 1 $\mu$ F); note 1 $R_{\text{ins}} \geq 50\%$ of specified value
Endurance (AC): "IEC 60384-14"	3 $\times$ 2.5 kV pulse voltage for X2; 1 000 hours; 1.25 $\times$ $U_{\text{Rac}}$ at 105 °C; once per hour; 0.1 s; 1 000 V (RMS) via resistor of 47 $\Omega$ ; $V_p = 1\,200$ V (DC); 1 minute	



**Interference suppression film capacitors****MKP 338 2 X2**

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\%$ $\Delta \tan \delta \leq 80 \times 10^{-4}$ ( $C \leq 1 \mu F$ ); note 1 $\Delta \tan \delta \leq 50 \times 10^{-4}$ ( $C > 1 \mu F$ ); note 1 $R_{ins} \geq 50\%$ of specified value
Passive flammability: "IEC 60384-14"	class B	no burning
Active flammability: "IEC 60384-14"	$20 \times 2.5$ kV discharge	no burning
Heat storage: "IEC 60384-14"	1 000 hours; 105 °C	$ \Delta C/C  \leq 5\%$ $\Delta \tan \delta \leq 80 \times 10^{-4}$ ( $C \leq 1 \mu F$ ); note 1 $\Delta \tan \delta \leq 50 \times 10^{-4}$ ( $C > 1 \mu F$ ); note 1
Resistance to soldering heat with preheating: "IEC 60384-14"	preheating: 105 °C; solder bath: 260 °C; 10 s	$ \Delta C/C  \leq 5\%$ $\Delta \tan \delta \leq 80 \times 10^{-4}$ ( $C \leq 1 \mu F$ ); note 1 $\Delta \tan \delta \leq 50 \times 10^{-4}$ ( $C > 1 \mu F$ ); note 1
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

**Note**

1. Measuring frequency 10 kHz for  $C \leq 1 \mu F$  and 1 kHz for  $C > 1 \mu F$ .