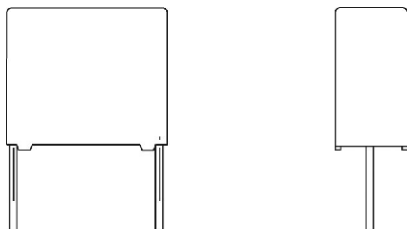


## Interference Suppression Film Capacitors MKP Radial Potted Type

Under development;  
samples available



### FEATURES

- 10 mm to 27.5 mm lead pitch
- Supplied loose in box or taped on reel
- Material categorization:  
For definitions of compliance please see  
[www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



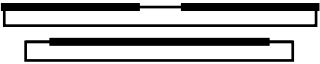
**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

### APPLICATIONS

For standard across the line X1 applications

See also application note: [www.vishay.com/doc?28153](http://www.vishay.com/doc?28153)

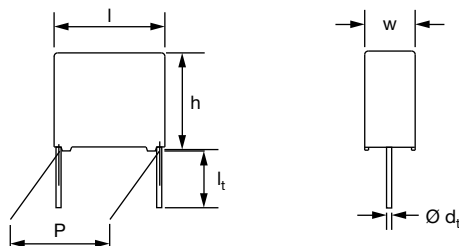
### QUICK REFERENCE DATA

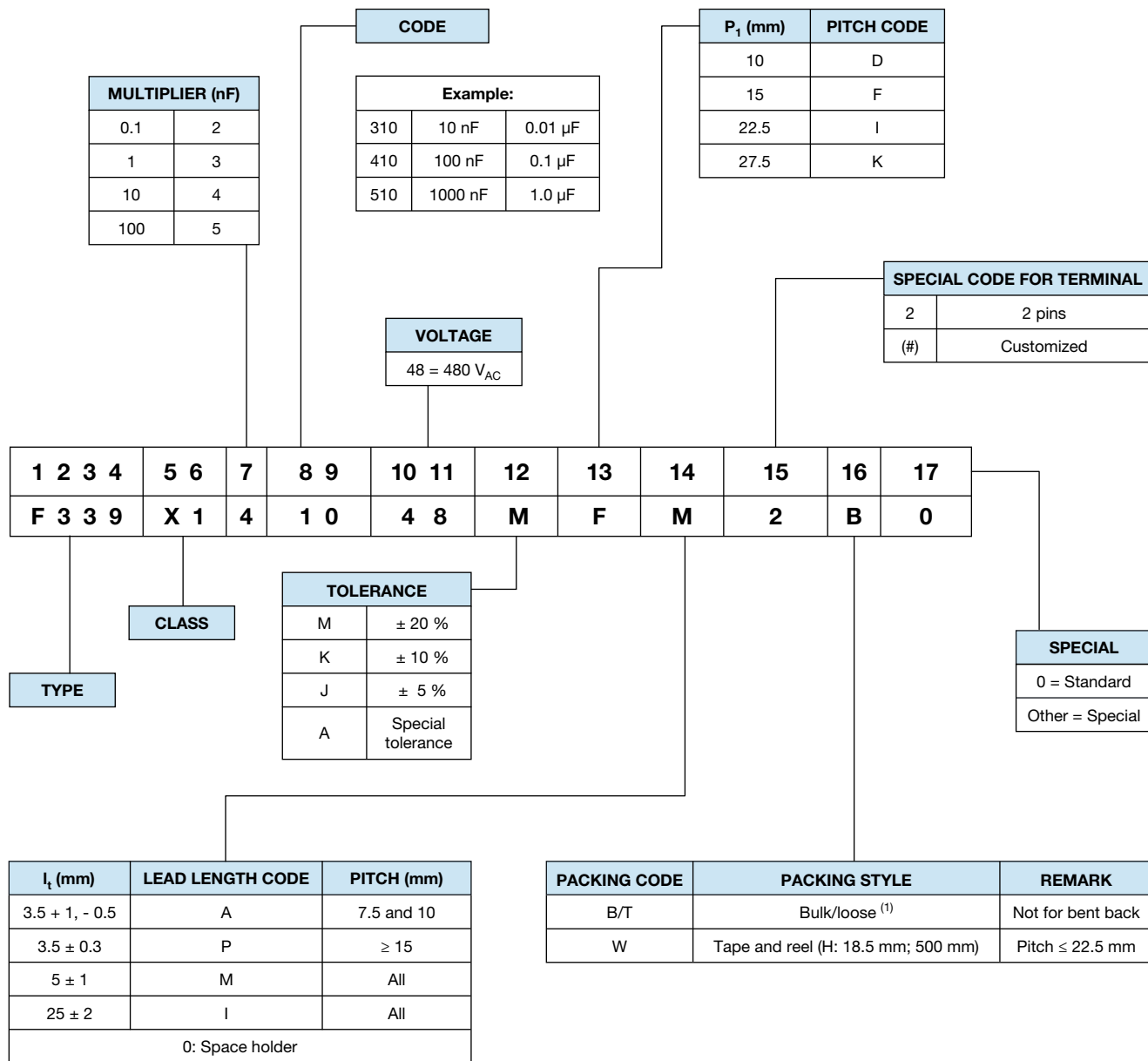
Capacitance range (E12 series)	0.001 $\mu$ F to 1.2 $\mu$ F (preferred values according to E6)
Capacitance tolerance	$\pm 20\%$ ; $\pm 10\%$ ; $\pm 5\%$
Climatic testing class according to IEC 60068-1	55/110/56/B
Rated AC voltage	480 V <sub>AC</sub> ; 50 Hz to 60 Hz
Permissible DC voltage	1000 V <sub>DC</sub>
Maximum application temperature	110 °C
Reference standards	IEC 60384-14 ed-3 and EN 60384-14 IEC 60065 requires pass. flamm. class B CSA-E384-14; UL 60384-14 CQC
Dielectric	Polypropylene film
Electrodes	Metallized
Construction	Series construction 
Encapsulation	Plastic case, epoxy resin sealed, flame retardant UL-class 94 V-0
Leads	Tinned wire
Marking	C-value; tolerance; rated voltage; sub-class; manufacturer's type; code for dielectric material; manufacturer location; manufacturer's logo; year and week, safety approvals

#### Note

- For more detailed data and test requirements, contact [rfi@vishay.com](mailto:rfi@vishay.com)

### DIMENSIONS in millimeters



**COMPOSITION OF CATALOG NUMBER**

**Notes**

- For detailed tape specifications refer to packaging information [www.vishay.com/doc?28139](http://www.vishay.com/doc?28139)
- <sup>(1)</sup> Packaging will be bulk for all capacitors with pitch  $\leq 15$  mm and such with long leads ( $> 5$  mm). Capacitors with short leads up to 5 mm and pitch  $> 15$  mm will be in tray and asking code will be "T".



## SPECIFIC REFERENCE DATA

DESCRIPTION	VALUE	
Rated AC voltage (U <sub>RAC</sub> )	480 V	
Permissible DC voltage (U <sub>RDC</sub> )	1000 V	
Tangent of loss angle	At 1 kHz	At 10 kHz
C < 470 nF	≤ 10 x 10 <sup>-4</sup>	≤ 20 x 10 <sup>-4</sup>
470 nF ≤ C ≤ 1 μF	≤ 20 x 10 <sup>-4</sup>	≤ 70 x 10 <sup>-4</sup>
C > 1 μF	≤ 30 x 10 <sup>-4</sup>	-
Rated voltage pulse slope (dU/dt) <sub>R</sub> at 670 V	100 V/μs	
R between leads, for C ≤ 0.33 μF at 100 V; 1 min	> 15 000 MΩ	
RC between leads, for C > 0.33 μF at 100 V; 1 min	> 5000 s	
R between leads and case; 100 V; 1 min	> 30 000 MΩ	
Withstanding (DC) voltage (cut off current 10 mA) <sup>(1)</sup> ; rise time ≤ 1000 V/s: C ≤ 1.2 μF	3400 V; 1 min	
Withstanding (AC) voltage between leads and case	2380 V; 1 min	
Maximum application temperature	110 °C	

## Note

<sup>(1)</sup> See "Voltage Proof Test for Metalized Film Capacitors": [www.vishay.com/doc?28169](http://www.vishay.com/doc?28169)

## ELECTRICAL DATA AND ORDERING INFORMATION

U <sub>RAC</sub> (V)	CAP. (μF)	DIMENSIONS w x h x l (mm)	MASS (g) <sup>(3)</sup>	CATALOG NUMBER F339X1... AND PACKAGING							
				LOOSE IN BOX						TAPED REEL	
				SHORT LEADS			LONG LEADS				
				l <sub>t</sub> = 3.5 mm + 1 mm/- 0.5 mm (PITCH ≤ 10 mm) or 3.5 mm ± 0.3 mm (PITCH ≥ 15 mm)	l <sub>t</sub> = 5.0 mm ± 1.0 mm	SPQ	l <sub>t</sub> = 25.0 mm ± 2.0 mm	SPQ	Ø = 500 mm <sup>(1)(2)</sup> H = 18.5 mm; P <sub>0</sub> = 12.7 mm	SPQ	
480	PITCH = 10 mm ± 0.4 mm; d <sub>t</sub> = 0.60 mm ± 0.06 mm; C-TOL. = ± 20 %										
	0.0010	4.0 x 10.0 x 12.5	0.6	21048MDA2B0	21048MDM2B0	1000	21048MDI2B0	1250	21048MD02W0	1400	
	0.0015			21548MDA2B0	21548MDM2B0		21548MDI2B0		21548MD02W0		
	0.0022			22248MDA2B0	22248MDM2B0		22248MDI2B0		22248MD02W0		
	0.0033			23348MDA2B0	23348MDM2B0		23348MDI2B0		23348MD02W0		
	0.0047	5.0 x 11.0 x 12.5	0.82	24748MDA2B0	24748MDM2B0	1000	24748MDI2B0	1000	24748MD02W0	1100	
	0.0068	6.0 x 12.0 x 12.5	1.1	26848MDA2B0	26848MDM2B0	750	26848MDI2B0	750	26848MD02W0	900	
	0.010			31048MDA2B0	31048MDM2B0		31048MDI2B0		31048MD02W0		
	PITCH = 15 mm ± 0.4 mm; d <sub>t</sub> = 0.60 mm ± 0.06 mm; C-TOL. = ± 20 %										
	0.010	5.0 x 11.0 x 17.5	1.0	31048MFP2B0	31048MFM2B0	1250	31048MFI2B0	1000	31048MF02W0	1100	
	0.015			31548MFP2B0	31548MFM2B0		31548MFI2B0		31548MF02W0		
	0.022			32248MFP2B0	32248MFM2B0		32248MFI2B0		32248MF02W0		
	0.033			33348MFP2B0	33348MFM2B0		33348MFI2B0		33348MF02W0		
	0.047	6.0 x 12.0 x 17.5	1.4	34748MFP2B0	34748MFM2B0	1000	34748MFI2B0	1000	34748MF02W0	900	
	PITCH = 15 mm ± 0.4 mm; d <sub>t</sub> = 0.80 mm ± 0.08 mm; C-TOL. = ± 20 %										
	0.068	8.5 x 15.0 x 17.5	2.4	36848MFP2B0	36848MFM2B0	750	36848MFI2B0	500	36848MF02W0	650	
	0.100	10 x 16.5 x 17.5	3.0	41048MFP2B0	41048MFM2B0	500	41048MFI2B0	450	41048MF02W0	600	
	PITCH = 22.5 mm ± 0.4 mm; d <sub>t</sub> = 0.80 mm ± 0.08 mm; C-TOL. = ± 20 %										
	0.047	6.0 x 15.5 x 26.0	2.4	34748MIP2B0	34748MIM2B0	300	34748MII2B0	250	34748MI02W0	600	
	0.068			36848MIP2B0	36848MIM2B0		36848MII2B0		36848MI02W0		
	0.10			41048MIP2B0	41048MIM2B0		41048MII2B0		41048MI02W0		
	0.15	7.0 x 16.5 x 26.0	2.9	41548MIP2B0	41548MIM2B0	200	41548MII2B0	250	41548MI02W0	500	
	0.22	8.5 x 18.0 x 26.0	3.8	42248MIP2B0	42248MIM2B0	200	42248MII2B0	250	42248MI02W0	450	
0.33	12 x 22.0 x 26.0	7.8	43348MIP2B0	43348MIM2B0	150	43348MII2B0	200	43348MI02W0	300		



## ELECTRICAL DATA AND ORDERING INFORMATION

U <sub>RAC</sub> (V)	CAP. (μF)	DIMENSIONS w x h x l (mm)	MASS (g) <sup>(3)</sup>	CATALOG NUMBER F339X1... AND PACKAGING							
				LOOSE IN BOX					TAPED REEL		
				SHORT LEADS			LONG LEADS				
				$l_t = 3.5\text{ mm} + 1\text{ mm/- }0.5\text{ mm}$ (PITCH ≤ 10 mm) or $3.5\text{ mm} \pm 0.3\text{ mm}$ (PITCH ≥ 15 mm)	$l_t = 5.0\text{ mm} \pm 1.0\text{ mm}$	SPQ	$l_t = 25.0\text{ mm} \pm 2.0\text{ mm}$	SPQ	Ø = 500 mm <sup>(1)(2)</sup> H = 18.5 mm; P <sub>0</sub> = 12.7 mm	SPQ	
480	PITCH = 27.5 mm ± 0.4 mm; d <sub>t</sub> = 0.80 mm ± 0.08 mm; C-TOL. = ± 20 %										
	0.15	9.0 x 19.0 x 31.5	5.5	41548MKP2B0	41548MKM2B0	100	41548MKI2B0	150	-		
	0.22			42248MKP2B0	42248MKM2B0		42248MKI2B0				
	0.33	11.0 x 21.0 x 31.0	7.4	43348MKP2B0	43348MKM2B0	100	43348MKI2B0	125			
	0.47	13.0 x 23.0 x 31.0	9.2	48748MKP2B0	48748MKM2B0	100	48748MKI2B0	125			
	0.68	15.0 x 25.0 x 31.5	12.3	46848MKP2B0	46848MKM2B0	100	46848MKI2B0	125			
	1.0	18.0 x 28.0 x 31.5	16.1	51048MKP2B0	51048MKM2B0	100	51048MKI2B0	100			
	1.2	21.0 x 31.0 x 31.0	20.3	51248MKP2B0	51248MKM2B0	50	51248MKI2B0	75			
480	PITCH = 10.0 mm ± 0.4 mm; d <sub>t</sub> = 0.60 mm ± 0.06 mm; C-TOL. = ± 10 %										
	0.0010	4.0 x 10.0 x 12.5	0.6	21048KDA2B0	21048KDM2B0	1000	21048KDI2B0	1250	21048KD02W0	1400	
	0.0012			21248KDA2B0	21248KDM2B0		21248KDI2B0		21248KD02W0		
	0.0015			21548KDA2B0	21548KDM2B0		21548KDI2B0		21548KD02W0		
	0.0018			21848KDA2B0	21848KDM2B0		21848KDI2B0		21848KD02W0		
	0.0022			22248KDA2B0	22248KDM2B0		22248KDI2B0		22248KD02W0		
	0.0027			22748KDA2B0	22748KDM2B0		22748KDI2B0		22748KD02W0		
	0.0033			23348KDA2B0	23348KDM2B0		23348KDI2B0		23348KD02W0		
	0.0039			23948KDA2B0	23948KDM2B0		23948KDI2B0		23948KD02W0		
	0.0047	5.0 x 11.0 x 12.5	0.82	24748KDA2B0	24748KDM2B0	1000	24748KDI2B0	1000	24748KD02W0	1100	
	0.0056			25648KDA2B0	25648KDM2B0		25648KDI2B0		25648KD02W0		
	0.0068	6.0 x 12.0 x 12.5	1.1	26848KDA2B0	26848KDM2B0	750	26848KDI2B0	750	26848KD02W0	900	
	0.0082			28248KDA2B0	28248KDM2B0		28248KDI2B0		28248KD02W0		
	PITCH = 15.0 mm ± 0.4 mm; d <sub>t</sub> = 0.60 mm ± 0.06 mm; C-TOL. = ± 10 %										
	0.010	5.0 x 11.0 x 17.5	1.0	31048KFP2B0	31048KFM2B0	1250	31048KFI2B0	1000	31048KF02W0	1100	
	0.012			31248KFP2B0	31248KFM2B0		31248KFI2B0		31248KF02W0		
	0.015			31548KFP2B0	31548KFM2B0		31548KFI2B0		31548KF02W0		
	0.018			31848KFP2B0	31848KFM2B0		31848KFI2B0		31848KF02W0		
	0.022			32248KFP2B0	32248KFM2B0		32248KFI2B0		32248KF02W0		
	0.027			32748KFP2B0	32748KFM2B0		32748KFI2B0		32748KF02W0		
	0.033	6.0 x 12.0 x 17.5	1.4	33348KFP2B0	33348KFM2B0	1000	33348KFI2B0	1000	33348KF02W0	900	
	0.039			33948KFP2B0	33948KFM2B0		33948KFI2B0		33948KF02W0		
	PITCH = 15.0 mm ± 0.4 mm; d <sub>t</sub> = 0.80 mm ± 0.08 mm; C-TOL. = ± 10 %										
	0.047	7.0 x 13.5 x 17.5	1.8	34748KFP2B0	34748KFM2B0	750	34748KFI2B0	500	34748KF02W0	800	
	0.056			35648KFP2B0	35648KFM2B0		35648KFI2B0		35648KF02W0		
	0.068	8.5 x 15.0 x 17.5	2.4	36848KFP2B0	36848KFM2B0	750	36848KFI2B0	500	36848KF02W0	650	
	0.082			38248KFP2B0	38248KFM2B0		38248KFI2B0		38248KF02W0		
	0.100	10.0 x 16.5 x 17.5	3.0	41048KFP2B0	41048KFM2B0	500	41048KFI2B0	450	41048KF02W0	600	
	PITCH = 22.5 mm ± 0.4 mm; d <sub>t</sub> = 0.80 mm ± 0.08 mm; C-TOL. = ± 10 %										
	0.047	6.0 x 15.5 x 26.0	2.4	34748KIP2B0	34748KIM2B0	300	34748KII2B0	250	34748KI02W0	600	
	0.056			35648KIP2B0	35648KIM2B0		35648KII2B0		35648KI02W0		
	0.068			36848KIP2B0	36848KIM2B0		36848KII2B0		36848KI02W0		
	0.082			38248KIP2B0	38248KIM2B0		38248KII2B0		38248KI02W0		
	0.10			41048KIP2B0	41048KIM2B0		41048KII2B0		41048KI02W0		
	0.12	7.0 x 16.5 x 26.0	2.9	41248KIP2B0	41248KIM2B0	200	41248KII2B0	250	41248KI02W0	500	
	0.15	8.5 x 18.0 x 26.0	3.8	41548KIP2B0	41548KIM2B0	200	41548KII2B0	250	41548KI02W0	450	
	0.18			41848KIP2B0	41848KIM2B0		41848KII2B0		41848KI02W0		
	0.22	10.0 x 19.5 x 26.0	6.8	42248KIP2B0	42248KIM2B0	200	42248KII2B0	200	42248KI02W0	350	
	0.27	12.0 x 22.0 x 26.0	7.8	42748KIP2B0	42748KIM2B0	150	42748KII2B0	200	42748KI02W0	300	
	0.33			43348KIP2B0	43348KIM2B0		43348KII2B0		43348KI02W0		

**ELECTRICAL DATA AND ORDERING INFORMATION**

U <sub>RAC</sub> (V)	CAP. (μF)	DIMENSIONS w x h x l (mm)	MASS (g) <sup>(3)</sup>	CATALOG NUMBER F339X1... AND PACKAGING							
				LOOSE IN BOX					TAPED REEL		
				SHORT LEADS			LONG LEADS				
				$l_t = 3.5\text{ mm} + 1\text{ mm/- }0.5\text{ mm}$ (PITCH ≤ 10 mm) or $3.5\text{ mm} \pm 0.3\text{ mm}$ (PITCH ≥ 15 mm)	$l_t = 5.0\text{ mm} \pm 1.0\text{ mm}$	SPQ	$l_t = 25.0\text{ mm} \pm 2.0\text{ mm}$	SPQ	Ø = 500 mm <sup>(1)(2)</sup> H = 18.5 mm; P <sub>0</sub> = 12.7 mm	SPQ	
480	PITCH = 27.5 mm ± 0.4 mm; d <sub>t</sub> = 0.80 mm ± 0.08 mm; C-TOL. = ± 10 %										
	0.15	9.0 x 19.0 x 31.5	5.5	41548KKP2B0	41548KKM2B0	100	41548KKI2B0	150	-		
	0.18			41848KKP2B0	41848KKM2B0		41848KKI2B0				
	0.22			42248KKP2B0	42248KKM2B0		42248KKI2B0				
	0.27	11.0 x 21.0 x 31.0	7.4	42748KKP2B0	42748KKM2B0	100	42748KKI2B0	125			
	0.33			43348KKP2B0	43348KKM2B0		43348KKI2B0				
	0.39	13.0 x 23.0 x 31.0	9.2	43948KKP2B0	43948KKM2B0	100	43948KKI2B0	125			
	0.47			48748KKP2B0	48748KKM2B0		48748KKI2B0				
	0.56			15.0 x 25.0 x 31.5	12.3		45648KKP2B0				45648KKM2B0
	0.68	18.0 x 28.0 x 31.5	16.1	46848KKP2B0	46848KKM2B0	100	46848KKI2B0	100			
	0.82			48248KKP2B0	48248KKM2B0		48248KKI2B0				
	1.0	21.0 x 31.0 x 31.0	20.3	51048KKP2B0	51048KKM2B0	50	51048KKI2B0	75			
1.2	51248KKP2B0			51248KKM2B0	51248KKI2B0						
480	PITCH = 10.0 mm ± 0.4 mm; d <sub>t</sub> = 0.60 mm ± 0.06 mm; C-TOL. = ± 5 %										
	0.0010	4.0 x 10.0 x 12.5	0.6	21048JDA2B0	21048JDM2B0	1000	21048JDI2B0	1250	21048JD02W0	1400	
	0.0012			21248JDA2B0	21248JDM2B0		21248JDI2B0		21248JD02W0		
	0.0015			21548JDA2B0	21548JDM2B0		21548JDI2B0		21548JD02W0		
	0.0018			21848JDA2B0	21848JDM2B0		21848JDI2B0		21848JD02W0		
	0.0022			22248JDA2B0	22248JDM2B0		22248JDI2B0		22248JD02W0		
	0.0027			22748JDA2B0	22748JDM2B0		22748JDI2B0		22748JD02W0		
	0.0033			23348JDA2B0	23348JDM2B0		23348JDI2B0		23348JD02W0		
	0.0039			23948JDA2B0	23948JDM2B0		23948JDI2B0		23948JD02W0		
	0.0047	5.0 x 11.0 x 12.5	0.82	24748JDA2B0	24748JDM2B0	1000	24748JDI2B0	1000	24748JD02W0	1100	
	0.0056			25648JDA2B0	25648JDM2B0		25648JDI2B0		25648JD02W0		
	0.0068	6.0 x 12.0 x 12.5	1.1	26848JDA2B0	26848JDM2B0	750	26848JDI2B0	750	26848JD02W0	900	
	0.0082			28248JDA2B0	28248JDM2B0		28248JDI2B0		28248JD02W0		
	PITCH = 15.0 mm ± 0.4 mm; d <sub>t</sub> = 0.60 mm ± 0.06 mm; C-TOL. = ± 5 %										
	0.010	5.0 x 11.0 x 17.5	1.0	31048JFP2B0	31048JFM2B0	1250	31048JFI2B0	1000	31048JF02W0	1100	
	0.012			31248JFP2B0	31248JFM2B0		31248JFI2B0		31248JF02W0		
	0.015			31548JFP2B0	31548JFM2B0		31548JFI2B0		31548JF02W0		
	0.018			31848JFP2B0	31848JFM2B0		31848JFI2B0		31848JF02W0		
	0.022			32248JFP2B0	32248JFM2B0		32248JFI2B0		32248JF02W0		
	0.027			32748JFP2B0	32748JFM2B0		32748JFI2B0		32748JF02W0		
	0.033	6.0 x 12.0 x 17.5	1.4	33348JFP2B0	33348JFM2B0	1000	33348JFI2B0	1000	33348JF02W0	900	
	0.039			33948JFP2B0	33948JFM2B0		33948JFI2B0		33948JF02W0		
	PITCH = 15.0 mm ± 0.4 mm; d <sub>t</sub> = 0.80 mm ± 0.08 mm; C-TOL. = ± 5 %										
	0.047	7.0 x 13.5 x 17.5	1.8	34748JFP2B0	34748JFM2B0	750	34748JFI2B0	500	34748JF02W0	800	
0.056	35648JFP2B0			35648JFM2B0	35648JFI2B0		35648JF02W0				
0.068	8.5 x 15.0 x 17.5	2.4	36848JFP2B0	36848JFM2B0	750	36848JFI2B0	500	36848JF02W0	650		
0.082			38248JFP2B0	38248JFM2B0		38248JFI2B0		38248JF02W0			
0.100	10.0 x 16.5 x 17.5	3.0	41048JFP2B0	41048JFM2B0	500	41048JFI2B0	450	41048JF02W0	600		



ELECTRICAL DATA AND ORDERING INFORMATION										
U <sub>RAC</sub> (V)	CAP. (μF)	DIMENSIONS w x h x l (mm)	MASS (g) <sup>(3)</sup>	CATALOG NUMBER F339X1... AND PACKAGING						
				LOOSE IN BOX					TAPED REEL	
				SHORT LEADS			LONG LEADS			
				l <sub>t</sub> = 3.5 mm + 1 mm/- 0.5 mm (PITCH ≤ 10 mm) or 3.5 mm ± 0.3 mm (PITCH ≥ 15 mm)	l <sub>t</sub> = 5.0 mm ± 1.0 mm	SPQ	l <sub>t</sub> = 25.0 mm ± 2.0 mm	SPQ	Ø = 500 mm <sup>(1)(2)</sup> H = 18.5 mm; P <sub>0</sub> = 12.7 mm	SPQ
480	PITCH = 22.5 mm ± 0.4 mm; d <sub>t</sub> = 0.80 mm ± 0.08 mm; C-TOL. = ± 5 %									
	0.047	6.0 x 15.5 x 26.0	2.4	34748JIP2B0	34748JIM2B0	300	34748JII2B0	250	34748JI02W0	600
	0.056			35648JIP2B0	35648JIM2B0		35648JII2B0		35648JI02W0	
	0.068			36848JIP2B0	36848JIM2B0		36848JII2B0		36848JI02W0	
	0.082			38248JIP2B0	38248JIM2B0		38248JII2B0		38248JI02W0	
	0.10	7.0 x 16.5 x 26.0	2.9	41048JIP2B0	41048JIM2B0	200	41048JII2B0	250	41048JI02W0	550
	0.12			41248JIP2B0	41248JIM2B0		41248JII2B0		41248JI02W0	
	0.15	8.5 x 18.0 x 26.0	3.8	41548JIP2B0	41548JIM2B0	200	41548JII2B0	250	41548JI02W0	450
	0.18			41848JIP2B0	41848JIM2B0		41848JII2B0		41848JI02W0	
	0.22	10.0 x 19.5 x 26.0	4.4	42248JIP2B0	42248JIM2B0	200	42248JII2B0	200	42248JI02W0	350
	0.27	12.0 x 22.0 x 26.0	7.8	42748JIP2B0	42748JIM2B0	150	42748JII2B0	200	42748JI02W0	300
	0.33			43348JIP2B0	43348JIM2B0		43348JII2B0		43348JI02W0	
	PITCH = 27.5 mm ± 0.4 mm; d <sub>t</sub> = 0.80 mm ± 0.08 mm; C-TOL. = ± 5 %									
	0.15	9.0 x 19.0 x 31.5	5.5	41548JKP2B0	41548JKM2B0	100	41548JKI2B0	150	-	
	0.18			41848JKP2B0	41848JKM2B0		41848JKI2B0			
	0.22			42248JKP2B0	42248JKM2B0		42248JKI2B0			
	0.27	11.0 x 21.0 x 31.0	7.4	42748JKP2B0	42748JKM2B0	100	42748JKI2B0	125		
	0.33			43348JKP2B0	43348JKM2B0		43348JKI2B0			
	0.39	13.0 x 23.0 x 31.0	9.2	43948JKP2B0	43948JKM2B0	100	43948JKI2B0	125		
	0.47			44748JKP2B0	44748JKM2B0		44748JKI2B0			
	0.56	15.0 x 25.0 x 31.5	12.3	45648JKP2B0	45648JKM2B0	100	45648JKI2B0	125		
0.68	18.0 x 28.0 x 31.5	16.1	46848JKP2B0	46848JKM2B0	100	46848JKI2B0	100			
0.82			48248JKP2B0	48248JKM2B0		48248JKI2B0				
1.0	21.0 x 31.0 x 31.0	20.3	51048JKP2B0	51048JKM2B0	50	51048JKI2B0	75			
1.2			51248JKP2B0	51248JKM2B0		51248JKI2B0				





**Notes**

- SPQ = Standard Packing Quantity

<sup>(1)</sup> Reel diameter = 356 mm is available on request

<sup>(2)</sup> H = In-tape height; P<sub>0</sub> = Sprocket hole distance; for detailed specifications refer to "Packaging Information"

<sup>(3)</sup> Weight for short lead product only

APPROVALS			
SAFETY APPROVALS X1	VOLTAGE	VALUE	FILE NUMBERS
EN 60384-14 (ENEC) (= IEC 60384-14 ed-3)	480 V <sub>AC</sub>	1 nF to 1.0 µF	40033060
UL 60384-14	480 V <sub>AC</sub>	1 nF to 1.0 µF	Pending
CSA-E384-14	480 V <sub>AC</sub>	1 nF to 1.0 µF	Pending
CQC	480 V <sub>AC</sub>	1 nF to 1.0 µF	Pending
CB-test certificate	480 V <sub>AC</sub>	1 nF to 1.0 µF	DE1-48823
The ENEC-approval together with the CB-certificate replace all national 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.			
   			

## 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 packaging information [www.vishay.com/docs?28139](http://www.vishay.com/docs?28139)

### 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:

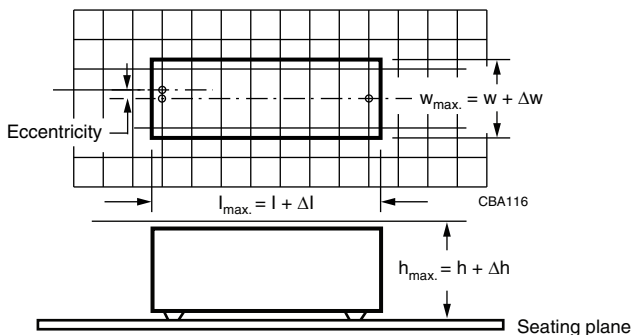
- For original pitch  $\leq 15$  mm the capacitors shall be mechanically fixed by the leads
- For larger pitches the capacitors shall be mounted in the same way and the body clamped

### Space Requirements on Printed-Circuit Board

The maximum space for length ( $l_{max.}$ ), width ( $w_{max.}$ ) and height ( $h_{max.}$ ) of film capacitors to take in account on the printed circuit board is shown in the drawings.

- For products with pitch  $\leq 15$  mm,  $\Delta w = \Delta l = 0.3$  mm and  $\Delta h = 0.1$  mm
- For products with  $15$  mm  $<$  pitch  $\leq 27.5$  mm,  $\Delta w = \Delta l = 0.5$  mm and  $\Delta h = 0.1$  mm

Eccentricity defined as in drawing. The maximum eccentricity is smaller than or equal to the lead diameter of the product concerned.



## SOLDERING CONDITIONS

For general soldering conditions and wave soldering profile we refer to the document "Soldering Guidelines for Film Capacitors": [www.vishay.com/doc?28171](http://www.vishay.com/doc?28171)

## STORAGE TEMPERATURE

T<sub>stg</sub> = - 25 °C to + 35 °C with RH maximum 75 % without condensation

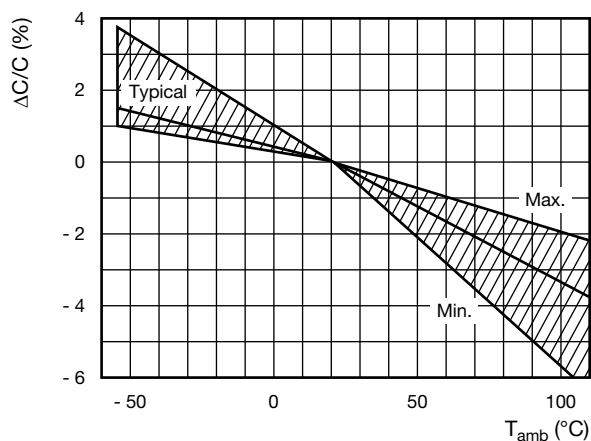
## RATINGS AND CHARACTERISTICS REFERENCE CONDITIONS

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

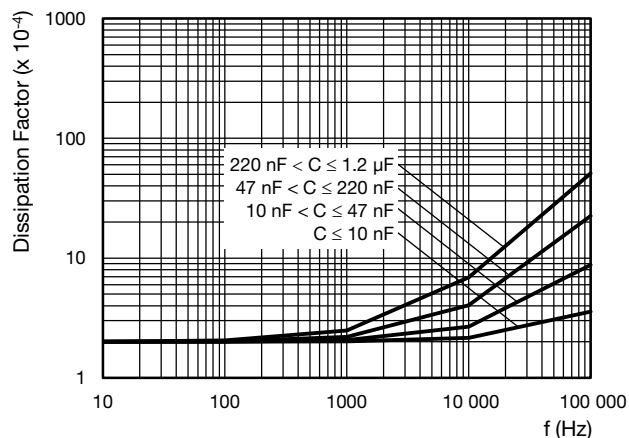
For reference testing, a conditioning period shall be applied over 96 h  $\pm$  4 h by heating the products in a circulating air oven at the rated temperature and a relative humidity not exceeding 20 %.



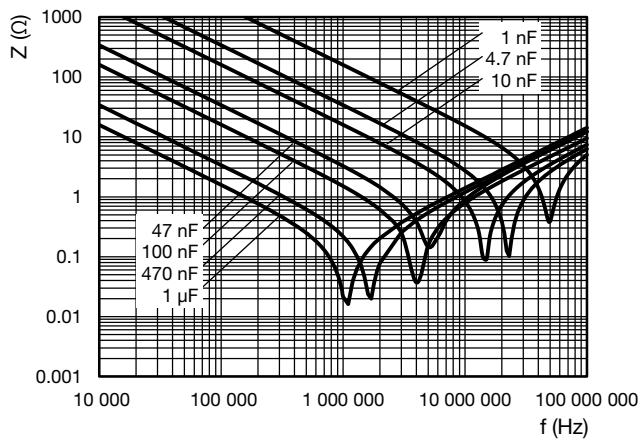
## CHARACTERISTICS



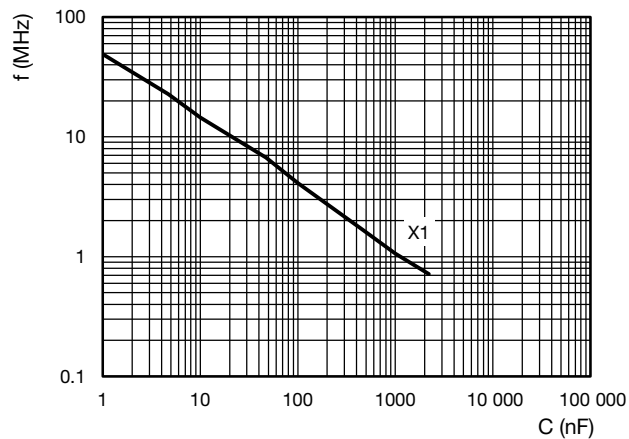
Capacitance as a function of ambient temperature (typical curve)



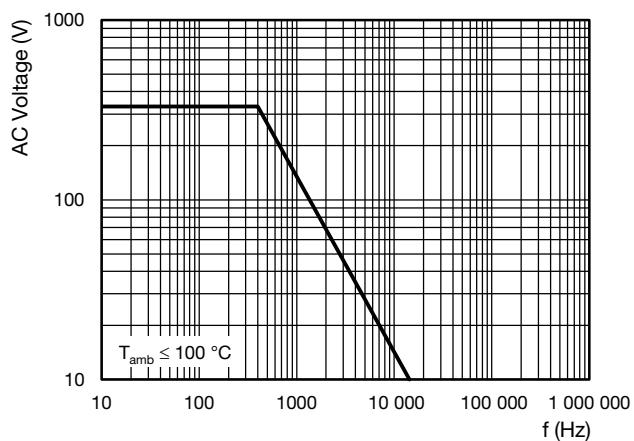
Tangent of loss angle as a function of frequency (typical curve)



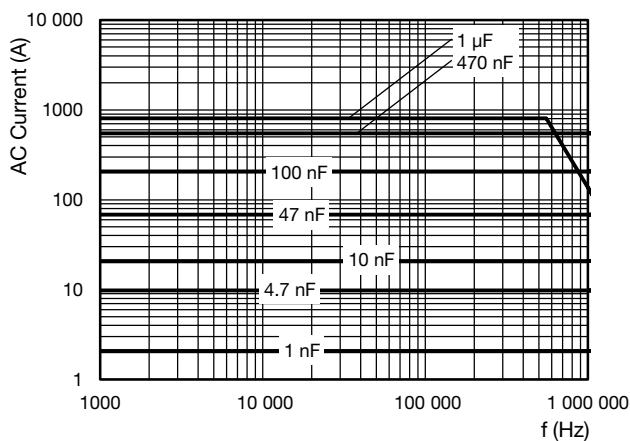
Impedance as a function of frequency (typical curve)



Resonant frequency as a function of capacitance (typical curve)

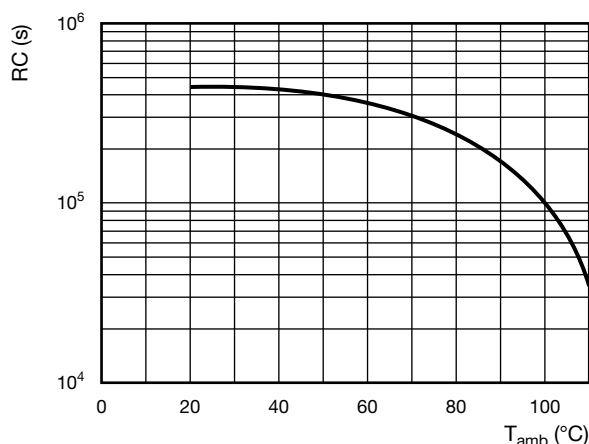


Max. RMS voltage as a function of frequency



Max. RMS current as a function of frequency





Insulation resistance as a function of ambient temperature  
(typical curve)

## APPLICATION NOTES

- For X1 electromagnetic interference suppression in **standard across the line applications** (50 Hz/60 Hz) with a maximum mains voltage of 480 V<sub>AC</sub>
- For series impedance applications we refer to the application note: [www.vishay.com/doc?28153](http://www.vishay.com/doc?28153)
- These capacitors are not intended for continuous pulse applications. For these situations, capacitors of the AC and pulse programs must be used.
- The maximum ambient temperature must not exceed 110 °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 670 V<sub>DC</sub> and divided by the applied voltage.

## INSPECTION REQUIREMENTS

### General Notes

Sub-clause numbers of tests and performance requirements refer to the "Sectional Specification, Publication IEC 60384-14 ed-3 and Specific Reference Data".

GROUP C INSPECTION REQUIREMENTS		
SUB-CLAUSE NUMBER AND TEST	CONDITIONS	PERFORMANCE REQUIREMENTS
SUB-GROUP C1A PART OF SAMPLE OF SUB-GROUP C1		
4.1 Dimensions (detail)		As specified in chapters "General Data" of this specification
Initial measurements	Capacitance Tangent of loss angle at 10 kHz for C ≤ 1 µF Tangent of loss angle at 1 kHz for C > 1 µF	
4.3 Robustness of terminations	Tensile: Load 10 N; 10 s Bending: Load 5 N; 4 x 90°	No visible damage
4.4 Resistance to soldering heat	No pre-drying Method: 1A Solder bath: 280 °C ± 5 °C Duration: 10 s	



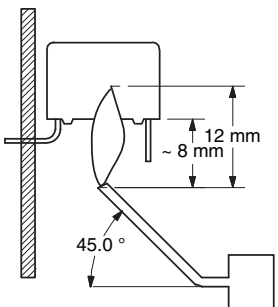
<b>GROUP C INSPECTION REQUIREMENTS</b>		
<b>SUB-CLAUSE NUMBER AND TEST</b>	<b>CONDITIONS</b>	<b>PERFORMANCE REQUIREMENTS</b>
<b>SUB-GROUP C1A PART OF SAMPLE OF SUB-GROUP C1</b>		
4.19 Component solvent resistance	Isopropylalcohol at room temperature Method: 2 Immersion time: 5 min $\pm$ 0.5 min Recovery time: Min. 1 h, max. 2 h	
4.4.2 Final measurements	Visual examination  Capacitance  Tangent of loss angle  Insulation resistance	No visible damage Legible marking  $ \Delta C/C  \leq 5\%$ of the value measured initially  Increase of $\tan \delta \leq 0.008$ for $\leq 1 \mu F$ Increase of $\tan \delta \leq 0.005$ for $C > 1 \mu F$ Compared to values measured initially  As specified in section "Insulation Resistance" of this specification
<b>SUB-GROUP C1B OTHER PART OF SAMPLE OF SUB-GROUP C1</b>		
Initial measurements	Capacitance Tangent of loss angle at 10 kHz for $C \leq 1 \mu F$ Tangent of loss angle at 1 kHz for $C > 1 \mu F$	
4.20 Solvent resistance of the marking	Isopropyl alcohol at room temperature Method: 1 Rubbing material: Cotton wool Immersion time: 5 min $\pm$ 0.5 min	No visible damage Legible marking
4.6 Rapid change of temperature	$\theta A = -55^\circ C$ $\theta B = +110^\circ C$ 5 cycles Duration $t = 30$ min	
4.6.1 Inspection	Visual examination	No visible damage
4.7 Vibration	Mounting: See section "Mounting" of this specification Procedure B4: Frequency range: 10 Hz to 55 Hz Amplitude: 0.75 mm or Acceleration 98 m/s <sup>2</sup> (whichever is less severe) Total duration 6 h	
4.7.2 Final inspection	Visual examination	No visible damage
4.9 Shock	Mounting: See section "Mounting" for more information Pulse shape: Half sine Acceleration: 490 m/s <sup>2</sup> Duration of pulse: 11 ms	
4.9.2 Final measurements	Visual examination  Capacitance  Tangent of loss angle  Insulation resistance	No visible damage  $ \Delta C/C  \leq 5\%$ of the value measured initially  Increase of $\tan \delta \leq 0.008$ for $\leq 1 \mu F$ Increase of $\tan \delta \leq 0.005$ for $C > 1 \mu F$ Compared to values measured initially  As specified in section "Insulation Resistance" of this specification



<b>GROUP C INSPECTION REQUIREMENTS</b>		
<b>SUB-CLAUSE NUMBER AND TEST</b>	<b>CONDITIONS</b>	<b>PERFORMANCE REQUIREMENTS</b>
<b>SUB-GROUP C1 COMBINED SAMPLE OF SPECIMENS OF SUB-GROUPS C1A AND C1B</b>		
4.11 Climatic sequence		
4.11.1 Initial measurements	Capacitance Measured in 4.4.2 and 4.9.2 Tangent of loss angle: Measured initially in C1A and C1B	
4.11.2 Dry heat	Temperature: 110 °C	
4.11.3 Damp heat cyclic Test Db First cycle	Duration: 16 h	
4.11.4 Cold	Temperature: - 55 °C	
4.11.5 Damp heat cyclic Test Db remaining cycles	Duration: 2 h	
4.11.6 Final measurements	Visual examination  Capacitance  Tangent of loss angle  Voltage proof 1900 V <sub>DC</sub> ; 1 min between terminations  Insulation resistance	No visible damage Legible marking  $ \Delta C/C  \leq 5\%$ of the value measured in 4.11.1.  Increase of $\tan \delta \leq 0.008$ for $\leq 1 \mu\text{F}$ Increase of $\tan \delta \leq 0.005$ for $C > 1 \mu\text{F}$ Compared to values measured in 4.11.1  No permanent breakdown or flash-over  $\geq 50\%$ of values specified in section “Insulation Resistance” of this specification
<b>SUB-GROUP C2</b>		
4.12 Damp heat steady state	56 days, 40 °C, 90 % to 95 % RH, no load	
4.12.1 Initial measurements	Capacitance Tangent of loss angle at 1 kHz	
4.12.3 Final measurements	Visual examination  Capacitance  Tangent of loss angle  Voltage proof 1900 V <sub>DC</sub> ; 1 min between terminations  Insulation resistance	No visible damage Legible marking  $ \Delta C/C  \leq 5\%$ of the value measured in 4.12.1.  Increase of $\tan \delta \leq 0.008$ Compared to values measured in 4.12.1.  No permanent breakdown or flash-over  $\geq 50\%$ of values specified in section “Insulation Resistance” of this specification



<b>GROUP C INSPECTION REQUIREMENTS</b>		
<b>SUB-CLAUSE NUMBER AND TEST</b>	<b>CONDITIONS</b>	<b>PERFORMANCE REQUIREMENTS</b>
<b>SUB-GROUP C3</b>		
4.13.1 Initial measurements	Capacitance Tangent of loss angle at 10 kHz for $C \leq 1 \mu\text{F}$ Tangent of loss angle at 1 kHz for $C > 1 \mu\text{F}$	
4.13 Impulse voltage	3 successive impulses, full wave, peak voltage: X1: 4.0 kV for $C \leq 1 \mu\text{F}$ X1: 4.0 kV/ $\sqrt{C}$ for $C > 1 \mu\text{F}$ Max. 24 pulses	No self healing breakdowns or flash-over
4.14 Endurance	Duration: 1000 h 1.25 x $U_{\text{RAC}}$ at 110 °C Once in every hour the voltage is increased to 1000 $V_{\text{RMS}}$ for 0.1 s via resistor of $47 \Omega \pm 5 \%$	
4.14.7 Final measurements	Visual examination	No visible damage Legible marking
	Capacitance	$ \Delta C/C  \leq 10 \%$ compared to values measured in 4.13.1.
	Tangent of loss angle	Increase of $\tan \delta \leq 0.008$ for $\leq 1 \mu\text{F}$ Increase of $\tan \delta \leq 0.005$ for $C > 1 \mu\text{F}$ Compared to values measured in 4.13.1
	Voltage proof 1900 $V_{\text{DC}}$ ; 1 min between terminations 2380 $V_{\text{AC}}$ ; 1 min between terminations and case	No permanent breakdown or flash-over
	Insulation resistance	$\geq 50 \%$ of values specified in section "Insulation Resistance" of this specification
<b>SUB-GROUP C4</b>		
4.15 Charge and discharge	10 000 cycles charged to 670 $V_{\text{DC}}$ Discharge resistance: $R = \frac{670 V_{\text{DC}}}{1.5 \times C (dU/dt)}$	
4.15.1 Initial measurements	Capacitance Tangent of loss angle at 10 kHz for $C \leq 1 \mu\text{F}$ Tangent of loss angle at 1 kHz for $C > 1 \mu\text{F}$	
4.15.3 Final measurements	Capacitance	$ \Delta C/C  \leq 10 \%$ compared to values measured in 4.15.1.
	Tangent of loss angle	Increase of $\tan \delta \leq 0.008$ for $\leq 1 \mu\text{F}$ Increase of $\tan \delta \leq 0.005$ for $C > 1 \mu\text{F}$ Compared to values measured in 4.15.1
	Insulation resistance	$\geq 50 \%$ of values specified in section "Insulation Resistance" of this specification

GROUP C INSPECTION REQUIREMENTS		
SUB-CLAUSE NUMBER AND TEST	CONDITIONS	PERFORMANCE REQUIREMENTS
<b>SUB-GROUP C5</b>		
4.16 Radio frequency characteristic	Resonance frequency	$\geq 0.9$ times the value as specified in section "Resonant Frequency" of this specification
<b>SUB-GROUP C6</b>		
4.17 Passive flammability Class B	<p>Bore of gas jet: <math>\varnothing 0.5</math> mm  Fuel: Butane  Test duration for actual volume V in mm<sup>3</sup>:  V <math>\leq</math> 250: 10 s  250 &lt; V <math>\leq</math> 500: 20 s  500 &lt; V <math>\leq</math> 1750: 30 s  V &gt; 1750: 60 s  One flame application</p> 	After removing test flame from capacitor, the capacitor must not continue to burn for more than 10 s. No burning particle must drop from the sample.
<b>SUB-GROUP C7</b>		
4.18 Active flammability	20 cycles of 4 kV discharges on the test capacitor connected to U <sub>RAC</sub>	<p>The cheese cloth around the capacitors shall not burn with a flame.</p> <p>No electrical measurements are required.</p>



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