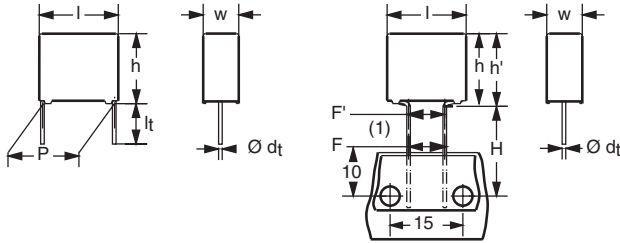


## Interference Suppression Film Capacitors MKP Radial Potted Type



Dimensions in mm

(1)  $|F - F'| < 0.3 \text{ mm}$   
 $F = 7.5 + 0.6/-0.1 \text{ mm}$

**NO FOCUS PRODUCT: USE F1778 3 X2**

**APPLICATIONS**

X2 class

For X2 electromagnetic interference suppression in across the line applications (50/60 Hz) with a maximum mains voltage of 300 V(AC) (or 305 V(AC) for pitch  $\geq 37.5 \text{ mm}$ ).

For application limitations please refer page 7.

**REFERENCE STANDARDS**

“IEC 60384-14 2nd edition and EN 132400”  
 “IEC 60065, pass. flamm. class B”  
 UL1283; ENEC; CSA-C22.2 No.8

**MARKING**

C-value; tolerance; rated voltage; sub-class; manufacturer’s type designation; code for dielectric material; manufacturer location; manufacturer’s emblem; year and week

**DIELECTRIC**

Polypropylene film

**ELECTRODES**

Metallized film

**CONSTRUCTION**

Mono construction

**RATED VOLTAGE**

AC 300 V; 50 to 60 Hz (for pitch  $< 37.5 \text{ mm}$ )

AC 305 V; 50 to 60 Hz (for pitch  $\geq 37.5 \text{ mm}$ )

**FEATURES**

15 to 55 mm lead pitch and 15 mm bent back to 7.5 mm. Supplied loose in box and taped on reel

- Lead (Pb)-free product
- RoHS-compliant product



**RoHS**  
COMPLIANT

**PERMISSIBLE DC VOLTAGE**

DC 630 V

**ENCAPSULATION**

Plastic case, epoxy resin sealed, flame retardant UL-class 94 V-0

**CLIMATIC TESTING CLASS ACC. TO EN 60068-1**

55/105/56/B

**CAPACITANCE RANGE (E12 SERIES)**

E12 series 0.01 to 10  $\mu\text{F}$   
 Preferred values acc. to E6

**CAPACITANCE TOLERANCE**

$\pm 20 \%$ ;  $\pm 10 \%$

**LEADS**

Tinned wire

**RATED TEMPERATURE**

105 °C

**MAXIMUM APPLICATION TEMPERATURE**

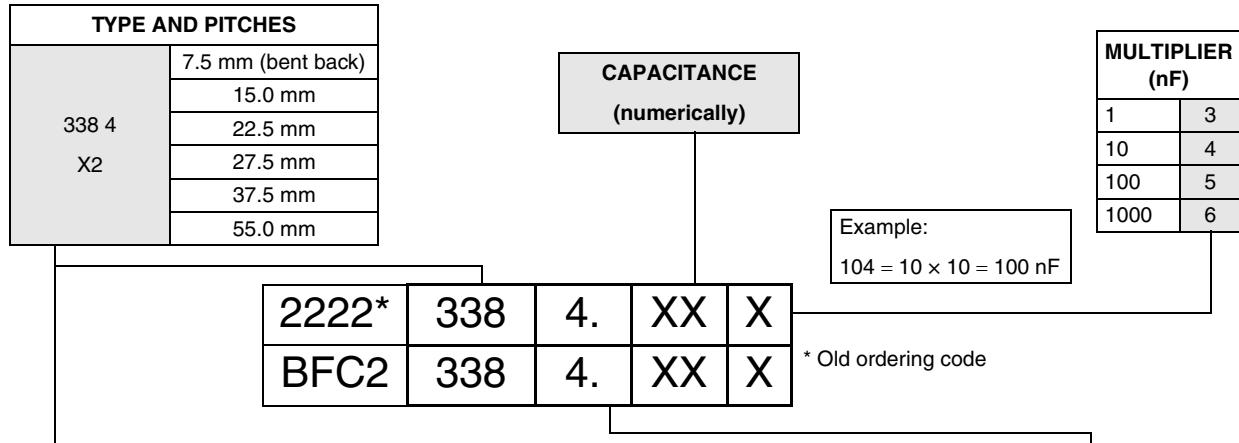
105 °C

**DETAIL SPECIFICATION**

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



COMPOSITION OF CATALOG NUMBER



TYPE	PACKAGING	STANDARD DIMENSIONS	PREFERRED TYPES	
338 4 X2	loose in box	lead length 3.5 ± 0.3 mm	± 20 %	BFC2 338 44 ...
		lead length 5.0 ± 1.0 mm		BFC2 338 40 ...
		lead length 25.0 ± 2.0 mm		BFC2 338 41 ...
	taped	15.0 mm bent back to 7.5 mm		BFC2 338 4. ...
		<b>ALTERNATIVE PITCH SIZES</b>	<b>ON REQUEST</b>	
338 4 X2	loose in box	lead length 3.5 ± 0.3 mm	± 20 %	see tables for details
		lead length 5.0 ± 1.0 mm		
		lead length 25.0 ± 2.0 mm		
		<b>ALTERNATIVE TAPED VERSION</b>	<b>ON REQUEST</b>	
338 4 X2	taped	H = 18.5 mm; for P <sub>0</sub> = 12.7 mm	± 20 %	see tables for details
		<b>ALTERNATIVE C-TOL</b>	<b>ON REQUEST</b>	
338 4 X2	loose in box	lead length 3.5 ± 0.3 mm	± 10 %	see tables for details
		lead length 5.0 ± 1.0 mm		
		lead length 25.0 ± 2.0 mm		
	taped	15.0 mm bent back to 7.5 mm		
		H = 18.5 mm; P <sub>0</sub> = 12.7 mm		

SPECIFIC REFERENCE DATA

DESCRIPTION	VALUE		
	at 1 kHz	at 10 kHz	at 100 kHz
Tangent of loss angle:			
pitch = 7.5 mm (bent back); 15 mm; 22.5 mm and 27.5 mm for C ≤ 470 nF	≤ 10 × 10 <sup>-4</sup>	≤ 20 × 10 <sup>-4</sup>	≤ 100 × 10 <sup>-4</sup>
pitch = 7.5 mm (bent back); 15 mm; 22.5 mm and 27.5 mm for 470 nF < C ≤ 1 μF	≤ 20 × 10 <sup>-4</sup>	≤ 70 × 10 <sup>-4</sup>	-
pitch = 7.5 mm (bent back); 15 mm; 22.5 mm and 27.5 mm for 1 μF < C ≤ 3.3 μF	≤ 30 × 10 <sup>-4</sup>	-	-
pitch = 37.5 mm and 55 mm for 2.2 μF < C ≤ 4.7 μF	≤ 50 × 10 <sup>-4</sup>	-	-
pitch = 37.5 mm and 55 mm for 4.7 μF < C ≤ 10 μF	≤ 100 × 10 <sup>-4</sup>	-	-
Rated voltage pulse slope (dU/dt) <sub>R</sub> at 420 V (DC)	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 minute	> 30 000 MΩ		
Withstanding (DC) voltage (cut off current 10 mA); rise time 100 V/s:			
C ≤ 1 μF	2200 V; 1 min		
1 μF < C ≤ 3.3 μF (not pitch = 37.5 mm)	1850 V; 1 min		
pitch = 37.5 mm and 55 mm	1400 V; 1 min		
Withstanding (AC) voltage between leads and case	2200 V; 1 min		

$U_{Rac} = 300\text{ V}$ ;  $C\text{-tol} = \pm 20\%$

C ( $\mu\text{F}$ )	DIMENSIONS w × H (h') × L (mm)	MASS (g)	CATALOG NUMBER BFC2 338 ..... AND PACKAGING						
			LOOSE IN BOX					REEL	
			short leads			long leads			SPQ
			$l_t =$ 3.5 ± 0.3 mm	$l_t =$ 5.0 ± 1.0 mm	SPQ	$l_t = 25.0 \pm$ 2.0 mm	SPQ		
<b>Pitch = 15.0 ± 0.4 mm; <math>d_t = 0.60 \pm 0.06</math> mm</b>							<b>reel: <math>\varnothing = 500</math> mm H = 18.5 mm; <math>P_0 = 12.7</math> mm</b>		
0.01	5.0 × 11.0 × 17.5	1.0	44103	40103	1000	41103	1000	48127	1000
0.015			44153	40153		41153		48128	
0.022			44223	40223		41223		48129	
0.033			44333	40333		41333		48131	
0.047			44473	40473		41473		48132	
0.068			44683	40683		41683		48133	
0.1	6.0 × 12.0 × 17.5	1.4	44104	40104	1000	41104	1000	48134	1000
<b>Original pitch = 15.0 mm; bent back pitch = 7.5 ± 0.4 mm; <math>d_t = 0.60 \pm 0.06</math> mm</b>							<b>reel: <math>\varnothing = 500</math> mm<sup>(1)</sup> H = 16.0 mm; <math>P_0 = 15.0</math> mm</b>		
0.01	5.0 × 11.0 (13.0) × 17.5	1.1					48001	950	
0.015							48002		
0.022							48003		
0.033							48004		
0.047							48005		
0.068							48006		
0.1	6.0 × 12.0 (14.0) × 17.5	1.4					48007	800	
<b>Pitch = 15.0 ± 0.4 mm; <math>d_t = 0.80 \pm 0.08</math> mm</b>							<b>reel: <math>\varnothing = 500</math> mm H = 18.5 mm; <math>P_0 = 12.7</math> mm</b>		
0.15	7.0 × 13.5 × 17.5	1.8	44154	40154	750	41154	500	48135	500
0.22	8.5 × 15.0 × 17.5	2.4	44224	40224	750	41224	500	48136	500
0.33	10.0 × 16.5 × 17.5	3.0	44334	40334	500	41334	450	48137	600
<b>Original pitch = 15.0 mm; bent back pitch = 7.5 ± 0.4 mm; <math>d_t = 0.80 \pm 0.08</math> mm</b>							<b>reel: <math>\varnothing = 500</math> mm<sup>(1)</sup> H = 16.0 mm; <math>P_0 = 15.0</math> mm</b>		
0.15	7.0 × 13.5 (15.5) × 17.5	1.8					48008	700	
0.22	8.5 × 15.0 (17.0) × 17.5	2.4					48009	550	
0.33	10.0 × 16.5 (18.5) × 17.5	3.0					48011	500	
<b>Pitch = 22.5 ± 0.4 mm; <math>d_t = 0.80 \pm 0.08</math> mm</b>							<b>reel: <math>\varnothing = 500</math> mm H = 18.5 mm; <math>P_0 = 12.7</math> mm</b>		
0.22	7.0 × 16.5 × 26.0	2.9	48101	48109	200	48118	250		
0.33			48103	48112		48121			
0.47	8.5 × 18.0 × 26.0	3.8	44474	40474	200	41474	250		
0.68	10.0 × 19.5 × 26.0	6.8	44684	40684	200	41684	200		
1.0	12.0 × 22.0 × 26.0	7.8	44105	40105	150	41105	200		
<b>Pitch = 27.5 ± 0.4 mm; <math>d_t = 0.80 \pm 0.08</math> mm</b>							<b>reel: <math>\varnothing = 500</math> mm H = 18.5 mm; <math>P_0 = 12.7</math> mm</b>		
0.47	9.0 × 19.0 × 31.0	5.5	48104	48113	100	48122	150		
0.68	11.0 × 21.0 × 31.0	7.4	48106	48115	100	48124	150		
1.0			48108	48117		48126			
1.5	15.0 × 25.0 × 31.0	12.3	44155	40155	100	41155	125		
2.2	18.0 × 28.0 × 31.0	16.1	44225	40225	100	41225	100		
3.3	21.0 × 31.0 × 31.0	20.3	44335	40335	50	41335	75		

**Notes**

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



**U<sub>Rac</sub> = 305 V; C-tol = ± 20 %**

C (µF)	DIMENSIONS w × H (h') × L (mm)	MASS (g)	CATALOG NUMBER BFC2 338 ..... AND PACKAGING						
			LOOSE IN BOX					REEL	
			short leads			long leads			SPQ
			$l_t =$ 3.5 ± 0.3 mm	$l_t =$ 5.0 ± 1.0 mm	SPQ	$l_t =$ 25.0 ± 2.0 mm	SPQ		
<b>Pitch = 37.5 ± 0.7 mm; d<sub>t</sub> = 1.0 ± 0.1 mm</b>									
4.7	18.5 × 35.5 × 43.0	29.0		40475	105	41475	105	not available	
6.8	21.5 × 38.5 × 43.0	35.0		40685	91	41685	91		
10	30.0 × 46.0 × 44.0	55.0		48159	63	48161	63		
<b>Pitch = 55.0 ± 1.0 mm; d<sub>t</sub> = 1.0 ± 0.1 mm</b>									
10	21.5 × 38.5 × 61.0	50.0		40106	65	41106	65	not available	

**U<sub>Rac</sub> = 300 V; C-tol = ± 10 %**

C (µF)	DIMENSIONS w × H (h') × L (mm)	MASS (g)	CATALOG NUMBER BFC2 338 ..... AND PACKAGING						
			LOOSE IN BOX					REEL	
			short leads			long leads			SPQ
			$l_t =$ 3.5 ± 0.3 mm	$l_t =$ 5.0 ± 1.0 mm	SPQ	$l_t =$ 25.0 ± 2.0 mm	SPQ		
<b>Pitch = 15.0 ± 0.4 mm; d<sub>t</sub> = 0.60 ± 0.06 mm</b>									
0.01	5.0 × 11.0 × 17.5	1.0	45103	42103	1000	43103	1000	48138	1000
0.015			45153	42153		43153		48141	
0.022			45223	42223		43223		48143	
0.033			45333	42333		43333		48145	
0.047			45473	42473		43473		48147	
0.068			45683	42683		43683		48149	
0.1	6.0 × 12.0 × 17.5	1.4	45104	42104	1000	43104	1000	48153	1000
<b>Original pitch = 15.0 mm; bent back pitch = 7.5 ± 0.4 mm; d<sub>t</sub> = 0.60 ± 0.06 mm</b>									
<b>reel: Ø = 500 mm<sup>(1)</sup> H = 18.5 mm; P<sub>0</sub> = 12.7 mm</b>									
0.01	5.0 × 11.0 (13.0) × 17.5	1.0						48012	950
0.015						48014			
0.022						48016			
0.033						48018			
0.047						48021			
0.068						48023			
0.1	6.0 × 12.0 (14.0) × 17.5	1.4						48025	800
<b>Pitch = 15.0 ± 0.4 mm; d<sub>t</sub> = 0.80 ± 0.08 mm</b>									
<b>reel: Ø = 500 mm H = 18.5 mm; P<sub>0</sub> = 12.7 mm</b>									
0.12	7.0 × 13.5 × 17.5	1.8	45124	42124	750	43124	500	48154	500
0.15			45154	42154		43154		48155	
0.18	8.5 × 15.0 × 17.5	2.4	45184	42184	750	43184	500	48156	500
0.22			45224	42224		43224		48157	
0.27	10.0 × 16.5 × 17.5	3.0	45274	42274	500	43274	450	48158	600
<b>Original pitch = 15.0 mm; bent back pitch = 7.5 ± 0.4 mm; d<sub>t</sub> = 0.80 ± 0.08 mm</b>									
<b>reel: Ø = 500 mm<sup>(1)</sup> H = 16.0 mm; P<sub>0</sub> = 15.0 mm</b>									
0.15	7.0 × 13.5 (15.5) × 17.5	1.8						48027	700
0.22	8.5 × 15.0 (17.0) × 17.5	2.4						48029	550

C ( $\mu$ F)	DIMENSIONS w × H (h') × L (mm)	MASS (g)	CATALOG NUMBER BFC2 338 ..... AND PACKAGING						REEL	
			LOOSE IN BOX							
			short leads			long leads				
			$l_t =$ 3.5 ± 0.3 mm	$l_t =$ 5.0 ± 1.0 mm	SPQ	$l_t =$ 25.0 ± 2.0 mm	SPQ		SPQ	
Pitch = 22.5 ± 0.4 mm; $d_t = 0.80 \pm 0.08$ mm							reel: $\varnothing = 500$ mm H = 18.5 mm; $P_0 = 12.7$ mm			
0.33	8.5 × 18.0 × 26.0	3.8	45334	42334	200	43334	250			
0.47	10.0 × 19.5 × 26.0	6.8	45474	42474	200	43474	200			
0.68	12.0 × 22.0 × 26.0	7.8	45684	42684	150	43684	200			
Pitch = 27.5 ± 0.4 mm; $d_t = 0.80 \pm 0.08$ mm							reel: $\varnothing = 500$ mm H = 18.5 mm; $P_0 = 12.7$ mm			
1.0	13.0 × 23.0 × 31.0	9.2	45105	42105	100	43105	125			
1.5	15.0 × 25.0 × 31.0	12.3	45155	42155	100	43155	125			
2.2	21.0 × 31.0 × 31.0	20.3	45225	42225	50	43225	75			

Notes

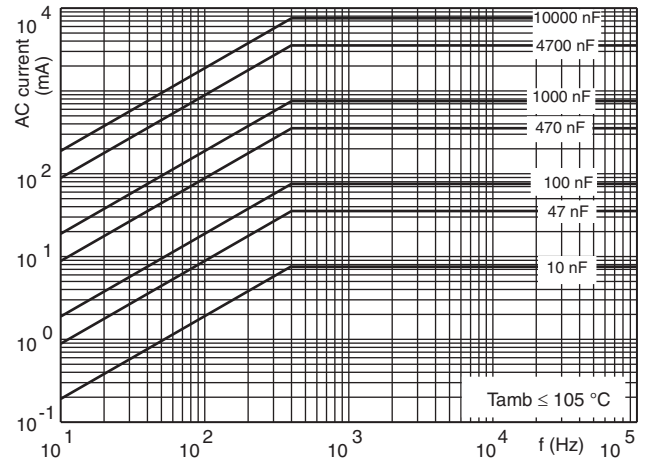
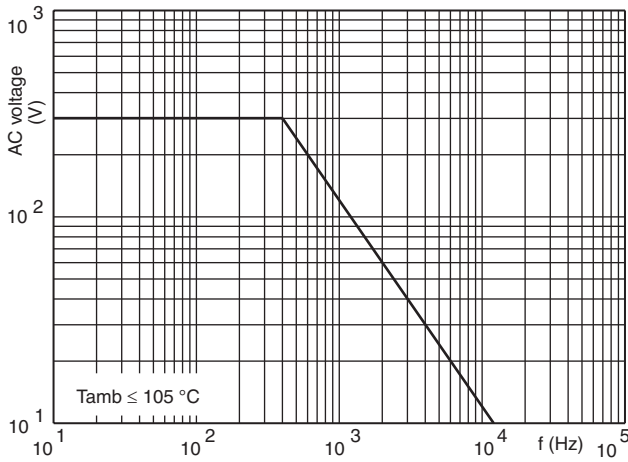
1. Reel diameter = 356 mm is available on request.

$U_{Rac} = 305$  V; C-tol = ± 10 %

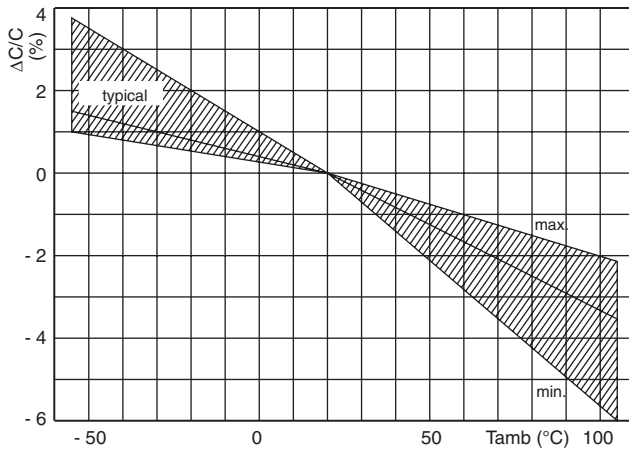
C ( $\mu$ F)	DIMENSIONS w × H (h') × L (mm)	MASS (g)	CATALOG NUMBER BFC2 338 ..... AND PACKAGING						REEL	
			LOOSE IN BOX							
			short leads			long leads				
			$l_t =$ 3.5 ± 0.3 mm	$l_t =$ 5.0 ± 1.0 mm	SPQ	$l_t =$ 25.0 ± 2.0 mm	SPQ		SPQ	
Pitch = 37.5 ± 0.7 mm; $d_t = 1.0 \pm 0.1$ mm										
3.3	18.5 × 35.5 × 43.0	32.0		42335	105	43335	105	not available		
3.9				42395					43395	
4.7	21.5 × 38.5 × 43.0	39.0		42475	91	43475	91			
5.6				42565					43565	
6.8	30.0 × 46.0 × 44.0	55.0		48162	63	48165	63			
8.2	30.0 × 46.0 × 44.0			48163					48166	
10	30.0 × 46.0 × 44.0			48164				48167		
Pitch = 55.0 ± 1.0 mm; $d_t = 1.0 \pm 0.1$ mm										
6.8	21.5 × 38.5 × 61.0	50.0		42685	65	43685	65	not available		
8.2				42825					43825	
10				42106					43106	



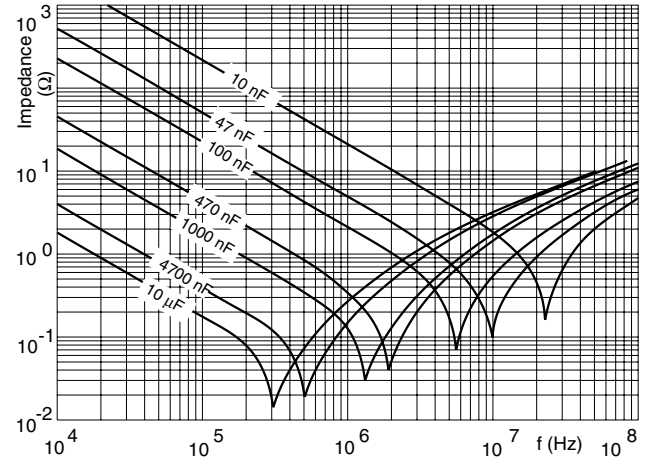
**MAXIMUM RMS VOLTAGE AND AC CURRENT (SINEWAVE) AS A FUNCTION OF FREQUENCY**



**CAPACITANCE**



**IMPEDANCE**



**APPROVALS**

COUNTRY	SPECIFICATION	ELECTRICAL VALUES	FILE NUMBERS	APPROVAL MARK
U.S.A. and Canada (for AC 300 V)	UL1283 and CSA-C22.2 No.8	10 nF to 3.3 μF	E109565	
U.S.A. (for AC 300 V)	UL1283	3.3 μF to 10 μF	E109565	
Europe (for AC 300 V)	EN132400 IEC 60384-14 2 <sup>nd</sup> edition	10 nF to 3.3 μF	14222	
Europe (for AC 305 V)	EN132400 IEC 60384-14 2 <sup>nd</sup> edition	3.3 μF to 10 μF	14223	



## APPLICATION NOTES

- For X2 electromagnetic interference suppression in **across the line applications** (50/60 Hz) with a maximum mains voltage of 300 V (AC) for pitch 7.5 to 27.5 mm and 305 V(AC) for pitch 37.5 to 55 mm  $\pm$  10 % instability.
- These capacitors are not intended for continuous pulse applications. For these situations, capacitors of the AC and pulse programs must be used.
- These capacitors are not intended for series impedance application. For these situations in case safety approvals are requested, please refer to our special capacitors of 1772 series with internal series connection.
- 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 420 V (DC) and divided by the applied voltage.



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