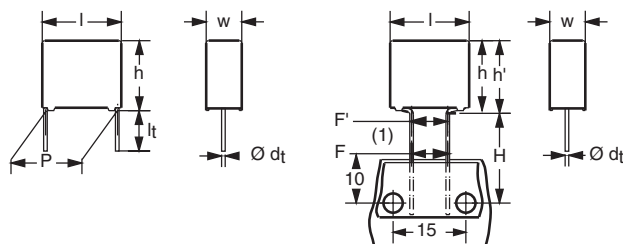


Interference Suppression Film Capacitors MKP Radial Potted Type



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 μF

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

**COMPOSITION OF CATALOG NUMBER**

TYPE AND PITCHES	
338 4 X2	7.5 mm (bent back)
	15.0 mm
	22.5 mm
	27.5 mm
	37.5 mm
55.0 mm	

CAPACITANCE (numerically)	
2222*	
338	
4.	
XX	
X	

MULTIPLIER (nF)	
1	3
10	4
100	5
1000	6

Example:
104 = 10 × 10 = 100 nF

2222*	338	4.	XX	X
BFC2	338	4.	XX	X

* Old ordering code

TYPE	PACKAGING	STANDARD DIMENSIONS		PREFERRED TYPE
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. ...	
		ALTERNATIVE PITCH SIZES		ON REQUEST
338 4 X2	loose in box	lead length 3.5 ± 0.3 mm	± 20 %	see tables for detail
		lead length 5.0 ± 1.0 mm		
		lead length 25.0 ± 2.0 mm		
		ALTERNATIVE TAPED VERSION		ON REQUEST
338 4 X2	taped	H = 18.5 mm; for P ₀ = 12.7 mm	± 20 %	see tables for detail
		ALTERNATIVE C-TOL		ON REQUEST
338 4 X2	loose in box	lead length 3.5 ± 0.3 mm	± 10 %	see tables for detail
		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 ₀ = 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 ⁻⁴	≤ 20 × 10 ⁻⁴	≤ 100 × 10 ⁻⁴
pitch = 7.5 mm (bent back); 15 mm; 22.5 mm and 27.5 mm for 470 nF < C ≤ 1 µF	≤ 20 × 10 ⁻⁴	≤ 70 × 10 ⁻⁴	-
pitch = 7.5 mm (bent back); 15 mm; 22.5 mm and 27.5 mm for 1 µF < C ≤ 3.3 µF	≤ 30 × 10 ⁻⁴	-	-
pitch = 37.5 mm and 55 mm for 2.2 µF < C ≤ 4.7 µF	≤ 50 × 10 ⁻⁴	-	-
pitch = 37.5 mm and 55 mm for 4.7 µF < C ≤ 10 µF	≤ 100 × 10 ⁻⁴	-	-
Rated voltage pulse slope (dU/dt) _R 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 (μF)	DIMENSIONS w × H (h') × L (mm)	MASS (g)	CATALOG NUMBER BFC2 338 AND PACKAGING						
			LOOSE IN BOX					REEL	
			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 = 15.0 ± 0.4 mm; d _t = 0.60 ± 0.06 mm								reel: Ø = 500 mm H = 18.5 mm; P ₀ = 12.7 mm	
0.01 0.015 0.022 0.033 0.047 0.068	5.0 × 11.0 × 17.5	1.0	44103 44153 44223 44333 44473 44683	40103 40153 40223 40333 40473 40683	1000	41103 41153 41223 41333 41473 41683	1000	48127 48128 48129 48131 48132 48133	1000
0.1	6.0 × 12.0 × 17.5	1.4	44104	40104	1000	41104	1000	48134	1000
Original pitch = 15.0 mm; bent back pitch = 7.5 ± 0.4 mm; d _t = 0.60 ± 0.06 mm								reel: Ø = 500 mm ⁽¹⁾ H = 16.0 mm; P ₀ = 15.0 mm	
0.01 0.015 0.022 0.033 0.047 0.068	5.0 × 11.0 (13.0) × 17.5	1.1						48001 48002 48003 48004 48005 48006	950
0.1	6.0 × 12.0 (14.0) × 17.5	1.4						48007	800
Pitch = 15.0 ± 0.4 mm; d _t = 0.80 ± 0.08 mm								reel: Ø = 500 mm H = 18.5 mm; P ₀ = 12.7 mm	
0.15 0.22 0.33	7.0 × 13.5 × 17.5 8.5 × 15.0 × 17.5 10.0 × 16.5 × 17.5	1.8 2.4 3.0	44154 44224 44334	40154 40224 40334	750 750 500	41154 41224 41334	500 500 450	48135 48136 48137	500 500 600
Original pitch = 15.0 mm; bent back pitch = 7.5 ± 0.4 mm; d _t = 0.80 ± 0.08 mm								reel: Ø = 500 mm ⁽¹⁾ H = 16.0 mm; P ₀ = 15.0 mm	
0.15 0.22 0.33	7.0 × 13.5 (15.5) × 17.5 8.5 × 15.0 (17.0) × 17.5 10.0 × 16.5 (18.5) × 17.5	1.8 2.4 3.0						48008 48009 48011	700 550 500
Pitch = 22.5 ± 0.4 mm; d _t = 0.80 ± 0.08 mm								reel: Ø = 500 mm H = 18.5 mm; P ₀ = 12.7 mm	
0.22 0.33 0.47 0.68 1.0	7.0 × 16.5 × 26.0 8.5 × 18.0 × 26.0 10.0 × 19.5 × 26.0 12.0 × 22.0 × 26.0	2.9 3.8 6.8 7.8	48101 48103 44474 44684 44105	48109 48112 40474 40684 40105	200 200 200 150	48118 48121 41474 41684 41105	250 250 200 200		
Pitch = 27.5 ± 0.4 mm; d _t = 0.80 ± 0.08 mm								reel: Ø = 500 mm H = 18.5 mm; P ₀ = 12.7 mm	
0.47 0.68 1.0 1.5 2.2 3.3	9.0 × 19.0 × 31.0 11.0 × 21.0 × 31.0 15.0 × 25.0 × 31.0 18.0 × 28.0 × 31.0 21.0 × 31.0 × 31.0	5.5 7.4 12.3 16.1 20.3	48104 48106 48108 44155 44225 44335	48113 48115 48117 40155 40225 40335	100 100 100 100 50	48122 48124 48126 41155 41225 41335	150 150 125 100 75		

Notes

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

**U_{Rac} = 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			
			$l_t = 3.5 \pm 0.3 \text{ mm}$	$l_t = 5.0 \pm 1.0 \text{ mm}$	SPQ	$l_t = 25.0 \pm 2.0 \text{ mm}$	SPQ		SPQ
Pitch = 37.5 ± 0.7 mm; d _t = 1.0 ± 0.1 mm									
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		
Pitch = 55.0 ± 1.0 mm; d _t = 1.0 ± 0.1 mm									
10	21.5 × 38.5 × 61.0	50.0		40106	65	41106	65	not available	

U_{Rac} = 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			
			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 = 15.0 ± 0.4 mm; d _t = 0.60 ± 0.06 mm								reel: Ø = 500 mm H = 18.5 mm; P ₀ = 12.7 mm	
0.01 0.015 0.022 0.033 0.047 0.068	5.0 × 11.0 × 17.5	1.0	45103 45153 45223 45333 45473 45683	42103 42153 42223 42333 42473 42683	1000	43103 43153 43223 43333 43473 43683	1000	48138 48141 48143 48145 48147 48149	1000
0.1	6.0 × 12.0 × 17.5	1.4	45104	42104	1000	43104	1000	48153	1000
Original pitch = 15.0 mm; bent back pitch = 7.5 ± 0.4 mm; d _t = 0.60 ± 0.06 mm								reel: Ø = 500 mm ⁽¹⁾ H = 16.0 mm; P ₀ = 15.0 mm	
0.01 0.015 0.022 0.033 0.047 0.068	5.0 × 11.0 (13.0) × 17.5	1.0						48012 48014 48016 48018 48021 48023	950
0.1	6.0 × 12.0 (14.0) × 17.5	1.4						48025	800
Pitch = 15.0 ± 0.4 mm; d _t = 0.80 ± 0.08 mm								reel: Ø = 500 mm H = 18.5 mm; P ₀ = 12.7 mm	
0.12 0.15	7.0 × 13.5 × 17.5	1.8	45124 45154	42124 42154	750	43124 43154	500	48154 48155	500
0.18 0.22	8.5 × 15.0 × 17.5	2.4	45184 45224	42184 42224	750	43184 43224	500	48156 48157	500
0.27	10.0 × 16.5 × 17.5	3.0	45274	42274	500	43274	450	48158	600
Original pitch = 15.0 mm; bent back pitch = 7.5 ± 0.4 mm; d _t = 0.80 ± 0.08 mm								reel: Ø = 500 mm ⁽¹⁾ H = 16.0 mm; P ₀ = 15.0 mm	
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 (μF)	DIMENSIONS w × H (h') × L (mm)	MASS (g)	CATALOG NUMBER BFC2 338 AND PACKAGING						
			LOOSE IN BOX					REEL	
			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 ± 0.08 mm							reel: Ø = 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 ± 0.08 mm							reel: Ø = 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 (μF)	DIMENSIONS w × H (h') × L (mm)	MASS (g)	CATALOG NUMBER BFC2 338 AND PACKAGING						
			LOOSE IN BOX					REEL	
			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 ± 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	65.0		48164		48167			
Pitch = 55.0 ± 1.0 mm; d _t = 1.0 ± 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			

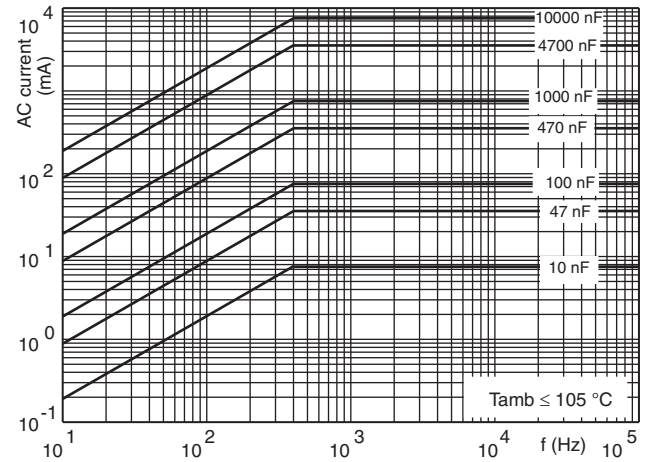
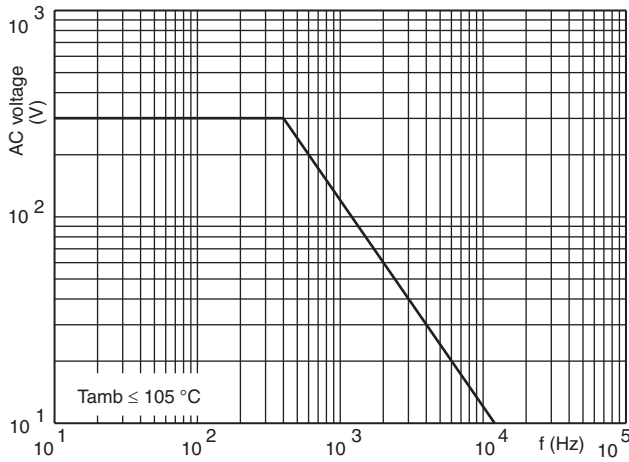


Interference Suppression Film Capacitors MKP Radial Potted Type

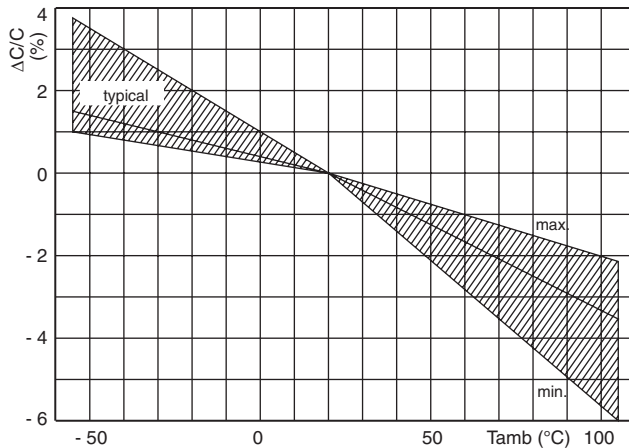
MKP 338 4 X2

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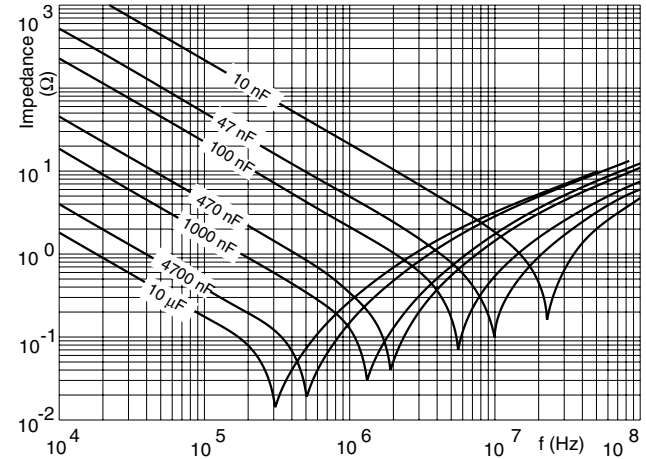
MAXIMUM RMS VOLTAGE AND AC CURRENT (SINEWAVE) AS A FUNCTION OF FREQUENCY



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 nd edition	10 nF to 3.3 μF	14222	
Europe (for AC 305 V)	EN132400 IEC 60384-14 2 nd 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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