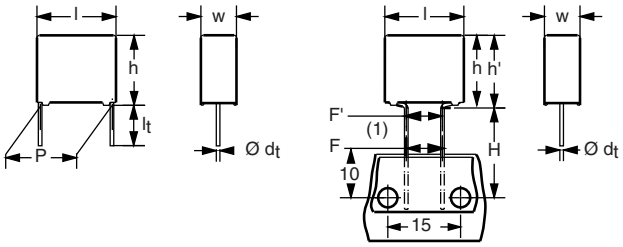
Interference Suppression Film Capacitors
MKP Radial Potted Type



Dimensions in mm
(1) $|F - F'| < 0.3$ mm
$F = 7.5 + 0.6/- 0.1$ mm

NO FOCUS PRODUCT: USE F1778 3 X2

APPLICATIONS

X2 class

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

AC 305 V; 50 to 60 Hz (for pitch ≥ 37.5 mm)

FEATURES

- 15 mm to 55 mm lead pitch and 15 mm bent back to 7.5 mm. Supplied loose in box, taped on reel
- Compliant to RoHS Directive 2002/95/EC

Pb-free
e3
RoHS COMPLIANT

PERMISSIBLE DC VOLTAGE

800 V_{DC} at 85 °C
630 V_{DC} at 110 °C

ENCAPSULATION

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

CLIMATIC TESTING CLASS ACC. TO IEC 60068-1

55/105/56/B

CAPACITANCE RANGE (E12 SERIES)

E12 series 0.01 µF to 10 µF
Preferred values acc. to E6

CAPACITANCE TOLERANCE

± 20 %; ± 10 %

LEADS

Tinned wire

RATED TEMPERATURE

105 °C

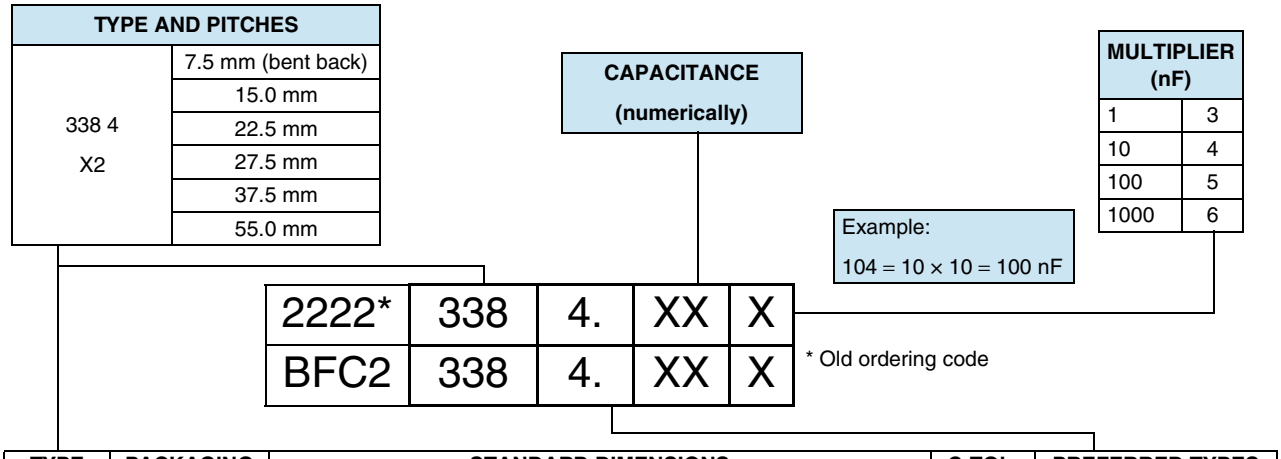
MAXIMUM APPLICATION TEMPERATURE

105 °C

DETAIL SPECIFICATION

For more detailed data and test requirements contact:
rfi@vishay.com

COMPOSITION OF CATALOG NUMBER



TYPE	PACKAGING	STANDARD DIMENSIONS	C-TOL.	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 [1][2]	15.0 mm bent back to 7.5 mm		BFC2 338 4. ...
		ALTERNATIVE PITCH SIZES	**C-TOL.**	**ON REQUEST**
	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		
		ALTERNATIVE TAPED VERSION	**C-TOL.**	**ON REQUEST**
	taped [1][2]	H = 18.5 mm; for P_0 = 12.7 mm	± 20 %	see tables for details
		ALTERNATIVE C-TOL	**C-TOL.**	**ON REQUEST**
	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 [1][2]	15.0 mm bent back to 7.5 mm		
		H = 18.5 mm; P_0 = 12.7 mm		

Notes

[1] For detailed tape specification refer to “Packaging Information”: www.vishay.com/doc?28139

[2] Tape on reel pitch = 27.5 mm is not available

SPECIFIC REFERENCE DATA

DESCRIPTION	VALUE		
Tangent of loss angle:	at 1 kHz	at 10 kHz	at 100 kHz
pitch = 7.5 mm (bent back); 15 mm; 22.5 mm and 27.5 mm for C ≤ 470 nF	≤ 10 x 10^{-4}	≤ 20 x 10^{-4}	≤ 100 x 10^{-4}
pitch = 7.5 mm (bent back); 15 mm; 22.5 mm and 27.5 mm for 470 nF < C ≤ 1 µF	≤ 20 x 10^{-4}	≤ 70 x 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 x 10^{-4}	-	-
pitch = 37.5 mm and 55 mm for 2.2 µF < C ≤ 4.7 µF	≤ 50 x 10^{-4}	-	-
pitch = 37.5 mm and 55 mm for 4.7 µF < C ≤ 10 µF	≤ 100 x 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) [1]; rise time ≤ 1000 V/s:			
C ≤ 1µF	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		

Note

[1] See “Voltage Proof Test for Metalized Film Capacitors”: www.vishay.com/doc?28169

U_{RAC} = 300 V; C-tol = ± 20 %

C (µF)	DIMENSIONS w x h x 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 x 11.0 x 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 x 12.0 x 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 x 11.0 (13.0) x 17.5	1.1						48001 48002 48003 48004 48005 48006	950
0.1	6.0 x 12.0 (14.0) x 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	7.0 x 13.5 x 17.5	1.8	44154	40154	750	41154	500	48135	500
0.22	8.5 x 15.0 x 17.5	2.4	44224	40224	750	41224	500	48136	500
0.33	10.0 x 16.5 x 17.5	3.0	44334	40334	500	41334	450	48137	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 x 13.5 (15.5) x 17.5	1.8						48008	700
0.22	8.5 x 15.0 (17.0) x 17.5	2.4						48009	550
0.33	10.0 x 16.5 (18.5) x 17.5	3.0						48011	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	7.0 x 16.5 x 26.0	2.9	48101 48103	48109 48112	200	48118 48121	250		
0.47	8.5 x 18.0 x 26.0	3.8	44474	40474	200	41474	250		
0.68	10.0 x 19.5 x 26.0	6.8	44684	40684	200	41684	200		
1.0	12.0 x 22.0 x 26.0	7.8	44105	40105	150	41105	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	9.0 x 19.0 x 31.0	5.5	48104	48113	100	48122	150		
0.68 1.0	11.0 x 21.0 x 31.0	7.4	48106 48108	48115 48117	100	48124 48126	150		
1.5	15.0 x 25.0 x 31.0	12.3	44155	40155	100	41155	125		
2.2	18.0 x 28.0 x 31.0	16.1	44225	40225	100	41225	100		
3.3	21.0 x 31.0 x 31.0	20.3	44335	40335	50	41335	75		

Notes

- SPQ = Standard Packing Quantity

[1] H = in-tape height; P_0 = sprocket hole distance; for detailed specifications refer to “Packaging Information”

[2] Reel diameter = 356 mm is available on request

[3] Weight for short lead product only

U_{RAC} = 305 V; C-tol = ± 20 %

C (µF)	DIMENSIONS w x h x l (mm)	Mass (g) (1)	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; dt = 1.0 ± 0.1 mm								
4.7	18.5 x 35.5 x 43.0	29.0		40475	105	41475	105	not available
6.8	21.5 x 38.5 x 43.0	35.0		40685	91	41685	91	
10	30.0 x 46.0 x 44.0	55.0		48159	63	48161	63	
Pitch = 55.0 ± 1.0 mm; dt = 1.0 ± 0.1 mm								
10	21.5 x 38.5 x 61.0	50.0		40106	65	41106	65	not available

Notes

- SPQ = Standard Packing Quantity

(1) Weight for short lead product only

U_{RAC} = 300 V; C-tol = ± 10 %

C (µF)	DIMENSIONS w x h x l (mm)	MASS (g) (3)	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	5.0 x 11.0 x 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 x 12.0 x 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	5.0 x 11.0 (13.0) x 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 x 12.0 (14.0) x 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	7.0 x 13.5 x 17.5	1.8	45124	42124	750	43124	500	48154	500
0.15			45154	42154		43154		48155	
0.18	8.5 x 15.0 x 17.5	2.4	45184	42184	750	43184	500	48156	500
0.22			45224	42224		43224		48157	
0.27	10.0 x 16.5 x 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 x 13.5 (15.5) x 17.5	1.8						48027	700
0.22	8.5 x 15.0 (17.0) x 17.5	2.4						48029	550

C (µF)	DIMENSIONS w x h x l (mm)	MASS (g) (3)	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 x 18.0 x 26.0	3.8	45334	42334	200	43334	250		
0.47	10.0 x 19.5 x 26.0	6.8	45474	42474	200	43474	200		
0.68	12.0 x 22.0 x 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 x 23.0 x 31.0	9.2	45105	42105	100	43105	125		
1.5	15.0 x 25.0 x 31.0	12.3	45155	42155	100	43155	125		
2.2	21.0 x 31.0 x 31.0	20.3	45225	42225	50	43225	75		

Notes

- SPQ = Standard Packing Quantity

(1) H = in-tape height; P_0 = sprocket hole distance; for detailed specifications refer to “Packaging Information”

(2) Reel diameter = 356 mm is available on request

(3) Weight for short lead product only

U_{RAC} = 305 V; C-tol = ± 10 %

C (µF)	DIMENSIONS w x h x l (mm)	MASS (g) (1)	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 x 35.5 x 43.0	32.0		42335	105	43335	105	not available	
3.9				42395		43395			
4.7	21.5 x 38.5 x 43.0	39.0		42475	91	43475	91		
5.6				42565		43565			
6.8	30.0 x 46.0 x 44.0	55.0		48162	63	48165	63		
8.2	30.0 x 46.0 x 44.0			48163		48166			
10	30.0 x 46.0 x 44.0	65.0		48164		48167			
Pitch = 55.0 ± 1.0 mm; d_t = 1.0 ± 0.1 mm									
6.8	21.5 x 38.5 x 61.0	50.0		42685	65	43685	65	not available	
8.2				42825		43825			
10				42106		43106			

Note

- SPQ = Standard Packing Quantity

(1) Weight for short lead product only

APPROVALS

SAFETY APPROVALS X2	VOLTAGE	VALUE	FILE NUMBERS
EN 60384-14 (ENEC) (= IEC 60384-14 ed 3)	300 V_{AC}	10 nF to 10 µF	FI 2008038 A1
UL1283; CSA-C22.2 No.8	300 V_{AC}	10 nF to 10 µF	E109565
UL 1283	300 V_{AC}	3.3 nF to 10 µF	E109565
CB-test certificate	300 V_{AC}	10 nF to 10 µF	FI 5257 A1
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 in printed-circuit boards by means of automatic insertion machines.
For detailed tape specifications refer to: “Packaging Information”: www.vishay.com/doc?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:

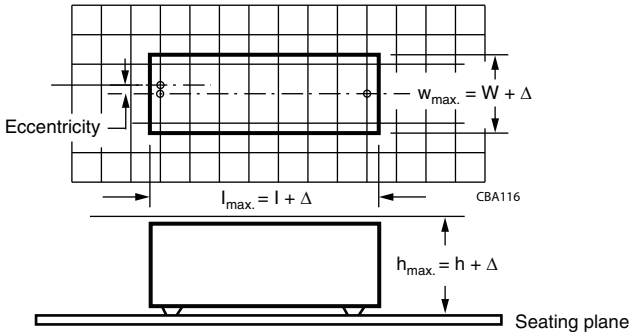
- For pitches ≤ 15 mm capacitors shall be mechanically fixed by the leads
- For longer pitches the capacitors shall be mounted in the same way and the body clamped

Space Requirements on Printed Circuit Board

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

- For products with pitch ≤ 15 mm, $\Delta w = \Delta l = 0.3$ mm; $\Delta h = 0.1$ mm
- For products with 15 mm < pitch ≤ 27.5 mm, $\Delta w = \Delta l = 0.5$ mm; $\Delta h = 0.1$ mm
- For products with 15 mm < pitch ≤ 37.5 mm, $\Delta w = \Delta l = 0.7$ mm; $\Delta h = 0.5$ mm
- For products with 15 mm < pitch ≤ 52.5 mm, $\Delta w = \Delta l = 1.0$ mm; $\Delta h = 0.5$ 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 application note:
“**Soldering Guidelines for Film Capacitors**”: www.vishay.com/doc?28171

Storage Temperature

• Storage temperature: T_{stg} = - 25 °C to + 40 °C with RH maximum 80 % without condensation

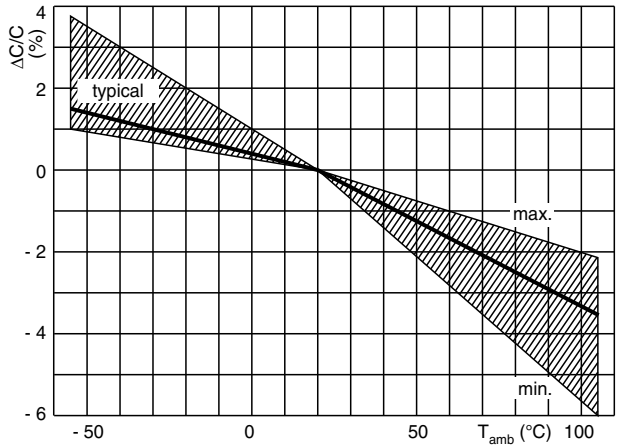
Ratings and Characteristics Reference Conditions

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

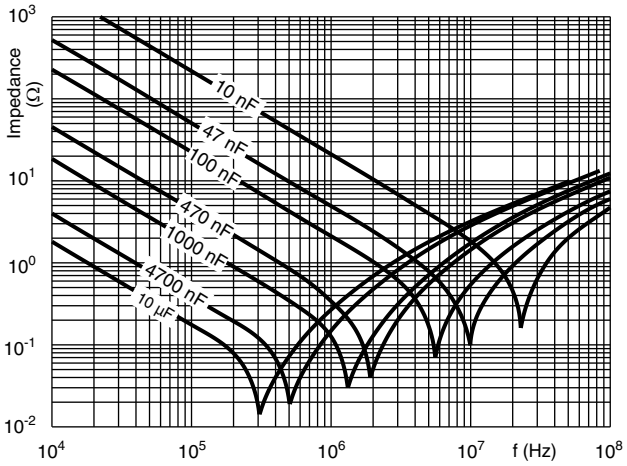
For reference testing, a conditioning period shall be applied over 96 h ± 4 h by heating the products in a circulating air oven at the rated temperature and a relative humidity not exceeding 20 %.

CHARACTERISTICS

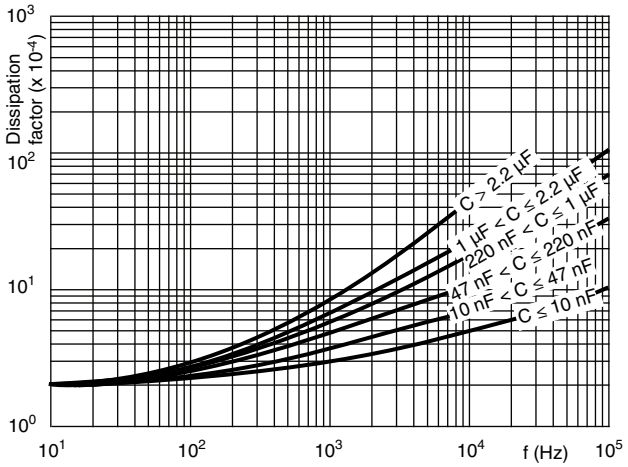
Capacitance as a function of ambient temperature (typical curve)



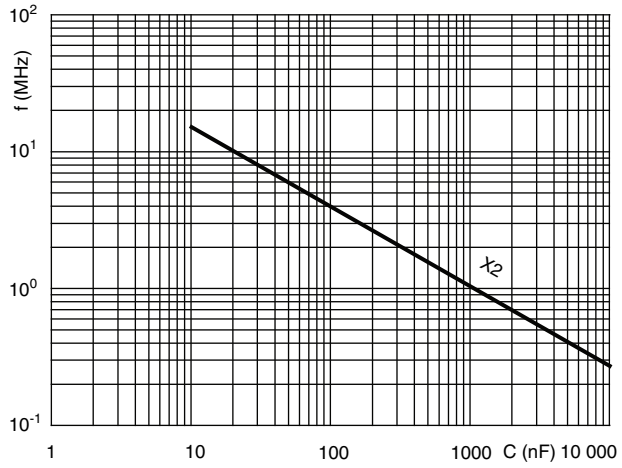
Impedance as a function of frequency (typical curve)



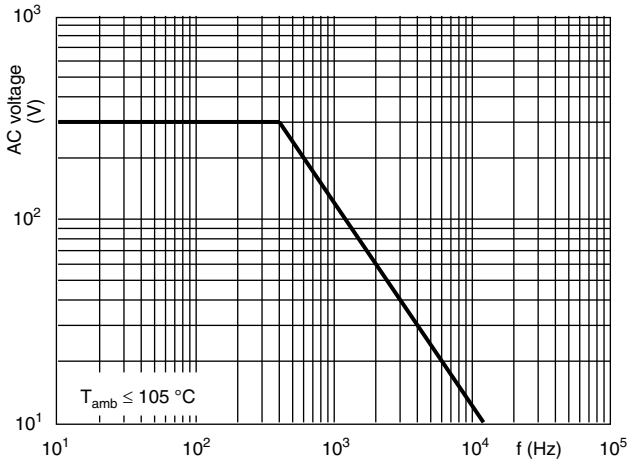
Tangent of loss angle as a function of frequency (typical curve)



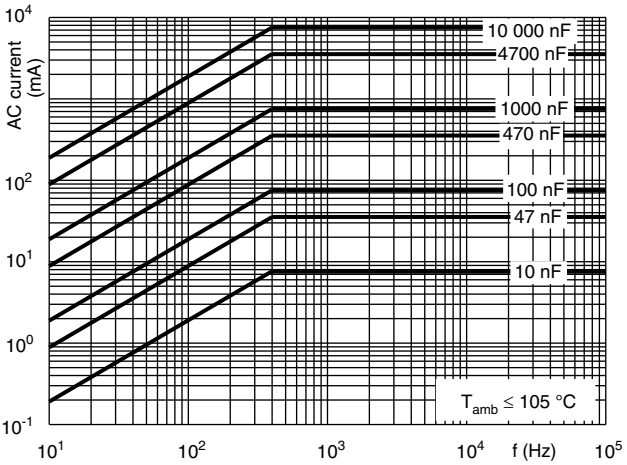
Resonant frequency as a function of capacitance (typical curve)

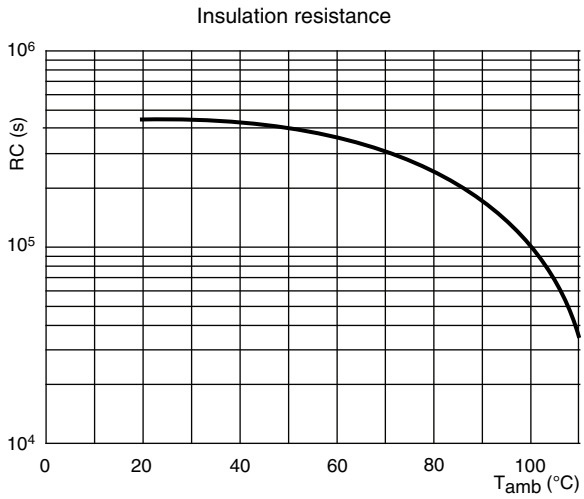


Max. RMS as a function of frequency



Max. RMS current as a function of frequency





APPLICATION NOTES

- For X2 electromagnetics interference suppression in **standard across the line applications** (50 Hz/60 Hz) with a maximum mains voltage of 300 V_{AC} for pitch 7.5 mm to 2.5 mm and 305 V_{AC} for pitch 37.5 mm to 55 mm.
- For series impedance applications we refer to Application Note www.vishay.com/doc?28153
- For capacitors connected in parallel, normally the proof voltage and possibly te rated voltage must be reduced. For information depending of the capacitance value and the number of parallel connections contact: dc-film@vishay.com
- 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 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 435 V_{DC} and divided by the applied voltage.

INSPECTION REQUIREMENTS

General Notes:

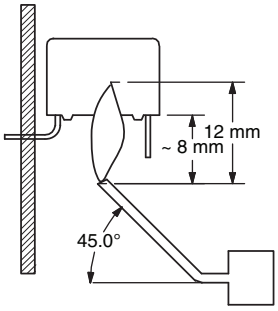
1. Sub-clause numbers of tests and performance requirements refer to the “Sectional Specification, Publication IEC 60384-14 ed-3 and Specific Reference Data.”

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	
4.3 Robustness o terminations	Tensile: For wire diameter = 0.6 mm and 0.8 mm: load 10 N; 10 s For wire diameter = 1 mm: load 20 N; 10 s Bending: For wire diameter = 0.6 mm and 0.8 mm: load 5 N; 4 x 90° For wire diameter = 1 mm: load 10 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	
4.19 Component solvent resistance	Isopropylalcohol at room temperature Method: 2 Immersion time: 5 min ± 0.5 min Recovery time: Min. 1 h, max 2 h	
4.4.2 Final measurements	Visual examination	No visible damage Legible marking
	Capacitance	$\lvert\Delta C/C\rvert \leq 5$ % of the value measured initially
	Tangent of loss angle	Increase of tan δ: ≤ 0.008 for : $C \leq 1$ µF or ≤ 0.005 for : $C > 1$ µF Compared to values measured initially
	Insulation resistance	As specified in chapters “General data” of this specification
SUB-GROUP C1B PART OF SAMPLE OF SUB-GROUP C1		
Initial measurements	Capacitance Tangent of loss angle: For $C \leq 1$ µF at 10 kHz For $C > 1$ µF at 1 kHz	No visible damage Legible marking
4.20 Solvent resistance of the marking	Isopropylalcohol at room temperature Method: 1 Rubbing material: cotton wool Immersion time: 5 min. ± 0.5 min	
4.6 Rapid change of temperature	θA = - 55 °C θB = + 105 °C 5 cycles Duration t = 30 min	

SUB-CLAUSE NUMBER AND TEST	CONDITIONS	PERFORMANCE REQUIREMENTS
4.6.1 Inspection 4.7 Vibration	Visual examination Mounting: See section “Mounting” of this specification Procedure B4 Frequency range: 10 Hz to 55 Hz Amplitude: 0.75 mm or Acceleration 98 m/s² (whichever is less severe) Total duration 6 h	No visible damage
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/s² Duration of pulse: 11 ms	
4.9.2 Final measurements	Visual examination	No visible damage
	Capacitance	$\lvert\Delta C/C\rvert \leq 5$ % of the value measured initially
		Increase of tan δ: ≤ 0.008 for : C ≤ 1 µF or ≤ 0.005 for : C > 1 µF Compared to values measured initially
	Tangent of loss angle	Increase of tan δ ≤ 0.008 Compared to values measured initially
	Insulation resistance	As specified in chapters “General data” of this specification
SUB-GROUP C1 COMBINED SAMPLE OF SPECIMENS OF SUB-GROUPS C1A AND C1B		
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: 105 °C Duration: 16 h	
4.11.3 Damp heat cyclic Test Db First cycle		
4.11.4 Cold	Temperature: - 55 °C Duration: 2 h	
4.11.5 Damp heat cyclic Test Db Remaining cycles		
4.11.6 Final measurements	Visual examination	No visible damage Legible marking
	Capacitance	$\lvert\Delta C/C\rvert \leq 5$ % of the value measured in 4.11.1.
	Tangent of loss angle	Increase of tan δ: ≤ 0.008 for : C ≤ 1 µF or ≤ 0.005 for : C > 1 µF Compared to values measured in 4.11.1
	Voltage proof 1290 V_{DC}; pitch ≤ 27.5 mm 1320 V_{DC}; pitch > 27.5 mm 1 min between terminals	No permanent breakdown or flash-over
	Insulation resistance	≥ 50 % of values specified in chapters “General data” of this specification

SUB-CLAUSE NUMBER AND TEST	CONDITIONS	PERFORMANCE REQUIREMENTS
SUB-GROUP C2		
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	No visible damage Legible marking
	Capacitance	$\lvert\Delta C/C\rvert \leq 5$ % of the value measured in 4.12.1.
	Tangent of loss angle	Increase of tan δ: ≤ 0.008 for : C ≤ 1 µF or ≤ 0.005 for : C > 1 µF Compared to values measured in 4.12.1
	Voltage proof 1290 V_{DC}; pitch ≤ 27.5 mm 1320 V_{DC}; pitch > 27.5 mm 1 min between terminals	No permanent breakdown or flash-over
	Insulation resistance	≥ 50 % of values specified in section "Insulation resistance" of this specification
SUB-GROUP C3		
4.13.1 Initial measurements	Capacitance Tangent of loss angle: For C ≤ 1 µF at 10 kHz For C > 1 µF at 1 kHz	
4.13 Impulse voltage	3 successive impulses, full wave, peak voltage: X2: 2.5 kV for C ≤ 1 µF X2: 2.5 kV for C >1 µF Max. 24 pulses	No self healing breakdowns or flash-over
4.14 Endurance	Duration: 1000 h 1.25 x U_{RAC} at 105 °C Once in every hour the voltage is increased to 1000 V_{RMS} for 0.1 s via resistor of 47 Ω ± 5 %	
4.14.7 Final measurements	Visual examination	No visible damage Legible marking
	Capacitance	$\lvert\Delta C/C\rvert \leq 10$ % compared to values measured in 4.13.1.
	Tangent of loss angle	Increase of tan δ: ≤ 0.008 for : C ≤ 1 µF or ≤ 0.005 for : C > 1 µF Compared to values measured in 4.13.1
	Voltage proof 1290 V_{DC}; pitch ≤ 27.5 mm 1320 V_{DC}; pitch > 27.5 mm 1 min between terminals 2200 $V_{AC;}$ 1 min between terminals and case	No permanent breakdown or flash-over
	Insulation resistance	≥ 50 % of values specified in chapters "General data" of this specification

SUB-CLAUSE NUMBER AND TEST	CONDITIONS	PERFORMANCE REQUIREMENTS
SUB-GROUP C4		
4.15 Charge and discharge	10 000 cycles Charged to 420 V_{DC} Discharge resistance: $R = \frac{420\ V_{DC}}{1.5 \times C\ (dU/dt)}$	
4.15.1 Initial measurements	Capacitance Tangent of loss angle at 10 kHz	
4.15.3 Final measurements	Capacitance	$\lvert\Delta C/C\rvert \leq 10$ % compared to values measured in 4.15.1.
	Tangent of loss angle	Increase of tan δ: ≤ 0.008 for : C ≤ 1 µF or ≤ 0.005 for : C > 1 µF Compared to values measured in 4.15.1
	Insulation resistance	≥ 50 % of values specified in section “Insulation resistance” of this specification
SUB-GROUP C5		
4.16 Radio frequency characteristic	Resonance frequency	≥ 0.9 times value as specified in section “Resonant frequency” of this specification
SUB-GROUP C6		
4.17 Passive flammability Class B	Bore of gas jet: Ø 0.5 mm Fuel: Butane Test duration for actual volume V in mm³: V ≤ 250: 10 s 250 < V ≤ 500: 20 s 500 < V ≤ 1750: 30 s V > 1750: 60 s One flame application 	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.
SUB-GROUP C7		
4.18 Active flammability	20 cycles of 4 kV discharges on the test capacitor connected to U_{RAC}	The cheese cloth around the capacitors shall not burn with a flame. No electrical measurements are required.

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