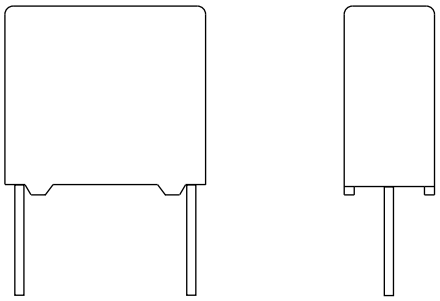
Interference Suppression Film Capacitors - Class X2
Radial MKP 310 V_{AC} - Standard Across the Line



FEATURES

- Compliant with IEC 60381-14: AMD1 THB grade IA
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

RoHS COMPLIANT

APPLICATIONS

For standard across the line X2 applications

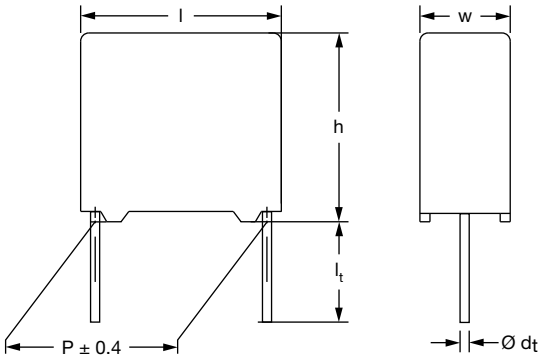
See also application note: www.vishay.com/doc?28153

QUICK REFERENCE DATA	
Capacitance range (E12 series)	0.001 µF to 2.2 µF (preferred values acc. to E6)
Capacitance tolerance	± 20 %; ± 10 %; ± 5 %
Climatic testing class according to IEC 60068-1	55/110/56/B
Rated AC voltage	310 V_{AC}; 50 Hz to 60 Hz
Permissible DC voltage	800 V_{DC} at 85 °C, 630 V_{DC} at 110 °C
Maximum application temperature	C ≤ 470 nF: 110 °C (125 °C for less than 1000 h), C > 470 nF: 110 °C
Reference standards	IEC 60384-14:2013 IEC 60384-14:2013 / AMD1:2016 EN 60384-14:2013 + AMD1:2016 IEC 60065, pass. flamm. class B for volumes > 1750 mm^3 CQC GB/T6346.14-2015 UL 60384-14; CSA E384-14
Dielectric	Polypropylene film
Electrodes	Metallized film
Construction	Mono 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 designation; 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

DIMENSIONS in millimeters



COMPOSITION OF CATALOG NUMBER

TYPE AND PITCHES	
336 2 X2	10.0 mm
	15.0 mm
	22.5 mm
	27.5 mm

CAPACITANCE (numerically)

Example:
104 = 10 x 10 = 100 nF

MULTIPLIER (nF)	
0.1	2
1	3
10	4
100	5

BFC2	336	2X	XX	X
2222(*)	336	2X	XX	X

(*) old ordering code

TYPE	PACKAGING	STANDARD DIMENSIONS	C-TOL.	CODE NUMBER
336 2 X2	Loose in box	Lead length 3.5 mm + 1 mm/- 0.5 mm or 3.5 mm ± 0.3 mm	± 20 %	BFC2 336 20…
		Lead length 5.0 mm ± 1.0 mm		See tables
		Lead length 25.0 mm ± 2.0 mm		BFC2 336 26…
	Taped on reel (1)	H = 18.5 mm; P_0 = 12.7 mm		BFC2 336 23…
	Loose in box	Lead length 3.5 mm + 1 mm/- 0.5 mm or 3.5 mm ± 0.3 mm	± 10 %	BFC2 336 21…
		Lead length 5.0 mm ± 1.0 mm		See tables
		Lead length 25.0 mm ± 2.0 mm		BFC2 336 27…
	Taped on reel (1)	H = 18.5 mm; P_0 = 12.7 mm		BFC2 336 24…
	Loose in box	Lead length 3.5 mm + 1 mm/- 0.5 mm or 3.5 mm ± 0.3 mm	± 5 %	BFC2 336 22…
		Lead length 5.0 mm ± 1.0 mm		See tables
		Lead length 25.0 mm ± 2.0 mm		BFC2 336 28…
	Taped on reel (1)	H = 18.5 mm; P_0 = 12.7 mm		BFC2 336 25…
	PACKAGING	**ALTERNATIVE LARGER PITCH SIZES**	**C-TOL.**	**CODE NUMBER**
	Loose in box	Lead length 3.5 mm + 1 mm/- 0.5 mm or 3.5 mm ± 0.3 mm	± 20 %	See tables for details
		Lead length 5.0 mm ± 1.0 mm		
		Lead length 25.0 mm ± 2.0 mm		
	Taped on reel (1)	H = 18.5 mm; P_0 = 12.7 mm		
	Loose in box	Lead length 3.5 mm + 1 mm/- 0.5 mm or 3.5 mm ± 0.3 mm	± 10 %	
		Lead length 5.0 mm ± 1.0 mm		
		Lead length 25.0 mm ± 2.0 mm		
	Taped on reel (1)(2)	H = 18.5 mm P_0 = 12.7 mm		

Notes

(1) For detailed tape specifications refer to packaging information: www.vishay.com/doc?28139

(2) Taped on reel pitch = 27.5 mm is not available

SPECIFIC REFERENCE DATA		
DESCRIPTION	**VALUE**	
Rated AC voltage U_{RAC}	310 V	
Permissible DC voltage U_{RDC}	630 V	
Tangent of loss angle:	at 1 kHz	at 10 kHz
C < 470 nF	≤ 10 x 10^{-4}	≤ 20 x 10^{-4}
470 nF ≤ C ≤ 1 µF	≤ 20 x 10^{-4}	≤ 70 x 10^{-4}
C > 1 µF	≤ 30 x 10^{-4}	-
Rated voltage pulse slope $(dU/dt)_R$ at 435 V_{DC}	-	
Pitch = 10 mm	600 V/µs	
Pitch = 15 mm and 7.5 mm (bent back)	400 V/µs	
Pitch = 22.5 mm	150 V/µs	
Pitch = 27.5 mm	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) (1); rise time ≤ 1000 V/s:		
C ≤ 1 µF	2200 V; 1 min	
C > 1 µF	1800 V; 1 min	
Withstanding (AC) voltage between leads and case	2120 V; 1 min	
Max. application temperature for 0.001 µF ≤ C ≤ 0.47 µF	110 °C (125 °C for less than 1000 h)	
Max. application temperature for C > 0.47 µF	110 °C	

Note

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

ELECTRICAL DATA AND ORDERING CODE - PITCH 10 mm

U_{RAC} (V)	CAP. (µF)	DIMENSIONS w x h x l (mm)	MASS (g) (3)	CATALOG NUMBER BFC2 336 ..... AND PACKAGING						
				LOOSE IN BOX					REEL (500 mm) (1)(2)	
				SHORT LEADS			LONG LEADS		H = 18.5 mm P_0 = 12.7 mm	
				l_t = 3.5 mm + 1 mm/- 0.5 mm	l_t = 5.0 mm ± 1.0 mm	SPQ	l_t = 25.0 mm ± 2.0 mm	SPQ		SPQ
310	PITCH = 10.0 mm ± 0.4 mm; d_t = 0.6 mm ± 0.06 mm; C-TOL. = ± 20 %									
	0.0010	4.0 x 10.0 x 12.5	0.6	20102	29131	1000	26102	1250	23102	1400
	0.0015			20152	29132		26152		23152	
	0.0022			20222	29133		26222		23222	
	0.0033			20332	29134		26332	1000	23332	1100
	0.0047			20472	29135		26472		23472	
	0.0068			20682	29136		26682		23682	
	0.010			20103	29137		26103		23103	
	0.015			20153	29138		26153		23153	
	0.022			20223	29139		26223		23223	
	0.033			20333	29141	750	26333	750	23333	900
	PITCH = 10.0 mm ± 0.4 mm; d_t = 0.6 mm ± 0.06 mm; C-TOL. = ± 10 %									
	0.0010	4.0 x 10.0 x 12.5	0.6	21102	29154	1000	27102	1250	24102	1400
	0.0012			21122	-		27122		24122	
	0.0015			21152	29155		27152		24152	
	0.0018			21182	-		27182		24182	
	0.0022			21222	29156		27222		24222	

ELECTRICAL DATA AND ORDERING CODE - PITCH 10 mm

U_{RAC} (V)	CAP. (µF)	DIMENSIONS w x h x l (mm)	MASS (g) (3)	CATALOG NUMBER BFC2 336 ..... AND PACKAGING						
				LOOSE IN BOX					REEL (500 mm) (1)(2)	
				SHORT LEADS			LONG LEADS		H = 18.5 mm P_0 = 12.7 mm	
				l_t = 3.5 mm + 1 mm/- 0.5 mm	l_t = 5.0 mm ± 1.0 mm	SPQ	l_t = 25.0 mm ± 2.0 mm	SPQ		SPQ
310	PITCH = 10.0 mm ± 0.4 mm; d_t = 0.6 mm ± 0.06 mm; C-TOL. = ± 10 %									
	0.0027	4.0 x 10.0 x 12.5	0.6	21272	-	1000	27272	1000	24272	1100
	0.0033			21332	29157		27332		24332	
	0.0039			21392	-		27392		24392	
	0.0047			21472	29158		27472		24472	
	0.0056			21562	-		27562		24562	
	0.0068			21682	29159		27682		24682	
	0.0082			21822	-		27822		24822	
	0.010			21103	29161		27103		24103	
	0.012			21123	-		27123		24123	
	0.015			21153	29162		27153		24153	
	0.018			21183	-		27183		24183	
	0.022			21223	29163		27223		24223	
	0.027			21273	-	750	27273	750	24273	900
	0.033			21333	29164		27333		24333	
	PITCH = 10.0 mm ± 0.4 mm; d_t = 0.6 mm ± 0.06 mm; C-TOL. = ± 5 %									
	0.0010	4.0 x 10.0 x 12.5	0.6	22102	-	1000	28102	1250	25102	1400
	0.0012			22122	-		28122		25122	
	0.0015			22152	-		28152		25152	
	0.0018			22182	-		28182		25182	
	0.0022			22222	-		28222		25222	
	0.0027			22272	-		28272	1000	25272	1100
	0.0033			22332	-		28332		25332	
	0.0039			22392	-		28392		25392	
	0.0047			22472	-		28472		25472	
	0.0056			22562	-		28562		25562	
	0.0068			22682	-		28682		25682	
	0.0082			22822	-		28822		25822	
	0.010			22103	-		28103		25103	
	0.012			22123	-		28123		25123	
	0.015			22153	-		28153		25153	
	0.018			22183	-		28183		25183	
	0.022			22223	-		28223		25223	
	0.027			22273	-	750	28273	750	25273	900
	0.033			22333	-		28333		25333	

Notes

- SPQ = Standard Packing Quantity

(1) H = In-tape height; P_0 = sprocket hole distance; for detailed specifications refer to packaging information: www.vishay.com/doc?28139

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

(3) Weight for short lead product only

ELECTRICAL DATA AND ORDERING CODE - PITCH 15 mm

U_{RAC} (V)	CAP. (µF)	DIMENSIONS w x h x l (mm)	MASS (g) [3]	CATALOG NUMBER BFC2 336 ..... AND PACKAGING						
				LOOSE IN BOX					REEL (500 mm) [1][2]	
				SHORT LEADS			LONG LEADS		H = 18.5 mm P_0 = 12.7 mm	
				l_t = 3.5 mm ± 0.3 mm	l_t = 5.0 mm ± 1.0 mm	SPQ	l_t = 25.0 mm ± 2.0 mm	SPQ		SPQ
310	PITCH = 15 mm ± 0.4 mm; d_t = 0.60 ± 0.06 mm; C-TOL. = ± 20 %									
	0.010	5.0 x 11.0 x 17.5	0.98	29001	29273	1000	29097	1000	29004	1100
	0.015			29011	29274		29071		29014	
	0.022			29021	29275		29076		29024	
	0.033			29031	29276		29082		29034	
	0.047			20473	29142		26473		23473	
	0.068			20683	29143		26683		23683	
	0.10			20104	29144		26104		23104	900
	0.15	6.0 x 12.0 x 17.5	1.4	20154	29145		26154	500	23154	650
	PITCH = 15 mm ± 0.4 mm; d_t = 0.80 ± 0.08 mm; C-TOL. = ± 20 %									
	0.22	7.0 x 13.5 x 17.5	1.8	20224	29146	500	26224	500	23224	600
	PITCH = 15 mm ± 0.4 mm; d_t = 0.60 ± 0.06 mm; C-TOL. = ± 10 %									
	0.010	5.0 x 11.0 x 17.5	0.98	29002	29281	1000	29066	1000	29005	1100
	0.012			29007	-		29068		29009	
	0.015			29012	29282		29072		29015	
	0.018			29017	-		29074		29019	
	0.022			29022	29283		29077		29025	
	0.027			29027	-		29079		29029	
	0.033			29032	29284		29083		29035	
	0.039			21393	-		27393		24393	
	0.047			21473	29165		27473		24473	
	0.056			21563	-		27563		24563	
	0.068			21683	29166		27683		24683	900
	0.082			21823	-		27823		24823	
	0.10			21104	29167		27104	500	24104	800
	0.12	6.0 x 12.0 x 17.5	1.4	21124	-		27124		24124	650
	0.15			21154	29168		27154		24154	
	PITCH = 15 mm ± 0.4 mm; d_t = 0.80 ± 0.08 mm; C-TOL. = ± 10 %									
	0.18	7.0 x 13.5 x 17.5	1.8	21184	-	500	27184	500	24184	600
	0.22			21224	29169		27224		24224	
	PITCH = 15 mm ± 0.4 mm; d_t = 0.60 ± 0.06 mm; C-TOL. = ± 5 %									
	0.010	5.0 x 11.0 x 17.5	0.98	29003	-	1000	29067	1000	29006	1100
	0.012			29008	-		29069		29061	
	0.015			29013	-		29073		29016	
	0.018			29018	-		29075		29062	
	0.022			29023	-		29078		29026	
	0.027			29028	-		29081		29063	
	0.033			29033	-		29084		29036	
	0.039			22393	-		28393		25393	
	0.047			22473	-		28473		25473	
	0.056			22563	-		28563		25563	
	0.068			22683	-		28683		25683	900
	0.082			22823	-		28823		25823	
	0.10			22104	-		28104	500	25104	800
	0.12	6.0 x 12.0 x 17.5	1.4	22124	-		28124		25124	650
	0.15			22154	-		28154		25154	
	PITCH = 15 mm ± 0.4 mm; d_t = 0.80 ± 0.08 mm; C-TOL. = ± 5 %									
	0.18	7.0 x 13.5 x 17.5	1.8	22184	-	500	28184	500	25184	600

Notes

- SPQ = Standard Packing Quantity

(1) H = In-tape height; P_0 = sprocket hole distance; for detailed specifications refer to packaging information: www.vishay.com/doc?28139

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

(3) Weight for short lead product only

ELECTRICAL DATA AND ORDERING CODE - PITCH 22.5 mm

U_{RAC} (V)	CAP. (µF)	DIMENSIONS w x h x l (mm)	MASS (g) [3]	CATALOG NUMBER BFC2 336 ..... AND PACKAGING						
				LOOSE IN BOX					REEL (500 mm) [1][2]	
				SHORT LEADS			LONG LEADS		H = 18.5 mm P_0 = 12.7 mm	
				l_t = 3.5 mm ± 0.3 mm	l_t = 5.0 mm ± 1.0 mm	SPQ	l_t = 25.0 mm ± 2.0 mm	SPQ		SPQ
310	PITCH = 22.5 mm ± 0.4 mm; d_t = 0.80 mm ± 0.08 mm; C-TOL. = ± 20 %									
	0.15	6.0 x 15.5 x 26.0	2.4	29041	29277	300	29087	500	29044	600
	0.22			29051	29278		29093		29053	550
	0.33			20334	29147		26334		23334	450
	0.47	7.0 x 16.5 x 26.0	2.9	20474	29148	200	26474	500	23474	400
	PITCH = 22.5 mm ± 0.4 mm; d_t = 0.80 mm ± 0.08 mm; C-TOL. = ± 10 %									
	0.12	6.0 x 15.5 x 26.0	2.4	29037	-	300	29085	500	29039	600
	0.15			29042	29285		29088		29045	
	0.18			29047	-		29091		29049	550
	0.22			29052	29286		29094		29054	
	0.27			21274	-		27274		24274	450
	0.33			21334	29171		27334		24334	
	0.39	7.0 x 16.5 x 26.0	2.9	21394	-	200	27394		24394	400
	0.47			21474	29172		27474		24474	
	PITCH = 22.5 mm ± 0.4 mm; d_t = 0.80 mm ± 0.08 mm; C-TOL. = ± 5 %									
	0.12	6.0 x 15.5 x 26.0	2.4	29038	-	300	29086	500	29064	600
	0.15			29043	-		29089		29046	
	0.18			29048	-		29092		29065	550
	0.22			22224	-		28224		25224	
	0.27			22274	-		28274		25274	450
	0.33	7.0 x 16.5 x 26.0	2.9	22334	-	200	28334		25334	
	0.39			22394	-		28394		25394	400

Notes

- SPQ = Standard Packing Quantity

(1) H = In-tape height; P_0 = sprocket hole distance; for detailed specifications refer to packaging information: www.vishay.com/doc?28139

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

(3) Weight for short lead product only

ELECTRICAL DATA AND ORDERING CODE - PITCH 27.5 mm

U_{RAC} (V)	CAP. (µF)	DIMENSIONS w x h x l (mm)	MASS (g) (1)	CATALOG NUMBER BFC2 336 ..... AND PACKAGING				
				LOOSE IN BOX				
				SHORT LEADS			LONG LEADS	
				l_t = 3.5 mm ± 0.3 mm	l_t = 5.0 mm ± 1.0 mm	SPQ	l_t = 25.0 mm ± 2.0 mm	SPQ
310	PITCH = 27.5 mm ± 0.4 mm; d_t = 0.80 mm ± 0.08 mm; C-TOL. = ± 20 %							
	0.47	9.0 x 19.0 x 31.5	5.5	29055	29279	100	29095	150
	0.68			20684	29149		26684	125
	1.0	11.0 x 21.0 x 31.0	7.4	20105	29151		26105	
	1.5	13.0 x 23.0 x 31.0	9.2	20155	29152		26155	
	2.2	15.0 x 25.0 x 31.5	12.3	20225	29153		26225	75
	PITCH = 27.5 mm ± 0.4 mm; d_t = 0.80 mm ± 0.08 mm; C-TOL. = ± 10 %							
	0.47	9.0 x 19.0 x 31.5	5.5	29056	29287	100	29096	150
	0.56			21564	-		27564	125
	0.68			21684	29173		27684	
	0.82	11.0 x 21.0 x 31.0	7.4	21824	-		27824	
	1.0			21105	29174		27105	
	1.2	13.0 x 23.0 x 31.0	9.2	21125	-		27125	
	1.5			21155	29175		27155	
	1.8	15.0 x 25.0 x 31.5	12.3	21185	-		27185	75
	2.2			21225	29176		27225	
	PITCH = 27.5 mm ± 0.4 mm; d_t = 0.80 mm ± 0.08 mm; C-TOL. = ± 5 %							
	0.47	9.0 x 19.0 x 31.5	5.5	22474	-	100	28474	125
	0.56			22564	-		28564	
	0.68			22684	-		28684	
	0.82	11.0 x 21.0 x 31.0	7.4	22824	-		28824	
	1.0			22105	-		28105	
	1.2	13.0 x 23.0 x 31.0	9.2	22125	-		28125	
	1.5			22155	-		28155	
	1.8	15.0 x 25.0 x 31.5	12.3	22185	-		28185	75
	2.2			22225	-		28225	

Notes
- SPQ = Standard Packing Quantity

(1) Weight for short lead product only

APPROVALS				
SAFETY APPROVALS X2	**VOLTAGE**	**VALUE**	**FILE NUMBERS**	**LINK**
EN 60384-14 (ENEC) (= IEC 60384-14 ed-4 (2013))	310 V_{AC}	1 nF to 2.2 µF	ENEC16/FI/21/01054/A2	www.vishay.com/doc?28179
UL 60384-14	310 V_{AC}	1 nF to 2.2 µF	E354331	www.vishay.com/doc?28184
CSA-E 384-14	310 V_{AC}	1 nF to 2.2 µF	E354331	
CQC GB/T6346.14-2015	310 V_{AC}	1 nF to 2.2 µF	CQC07001021280 (L)	www.vishay.com/doc?28199
			CQC04001009262 (F)	www.vishay.com/doc?28200
CB test certificate	310 V_{AC}	1 nF to 2.2 µF	FI-39827/A1	www.vishay.com/doc?28175
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 bandoleers 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 insured that the stand-off pips are in good contact with the printed circuit board:

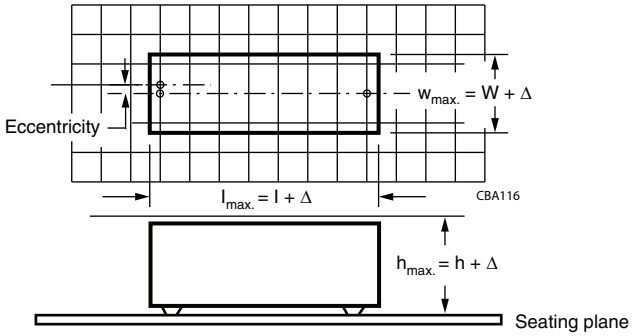
- For pitches ≤ 15 mm capacitors shall be mechanically fixed by the leads
- For larger pitches the capacitors shall be mounted in the same way and the body clamped.

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 ≤ 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

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

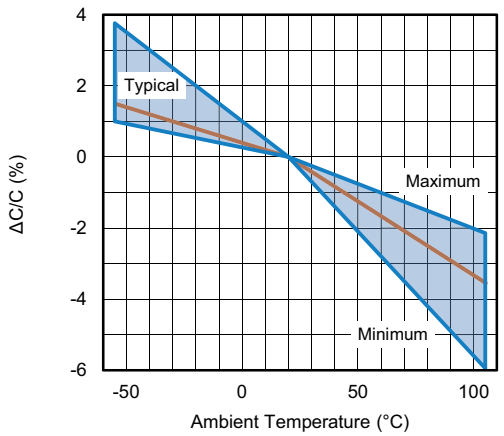
T_{stg} = -25 °C to +35 °C with RH maximum 75 % without condensation

Ratings and Characteristics Reference Conditions

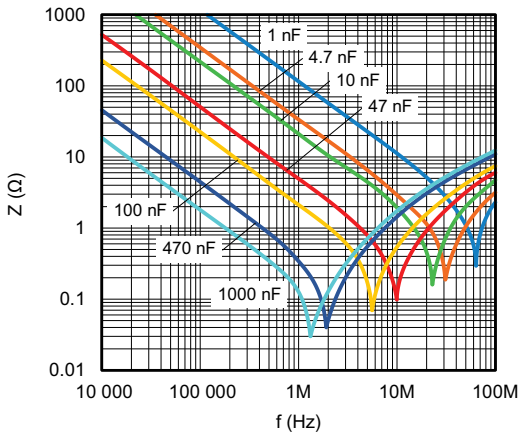
Unless otherwise specified, all electrical values apply to an ambient temperature of 23 °C ± 1 °C, an atmospheric pressure of 86 kPa to 106 kPa and a relative humidity of 50 % ± 2 %.

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 %.

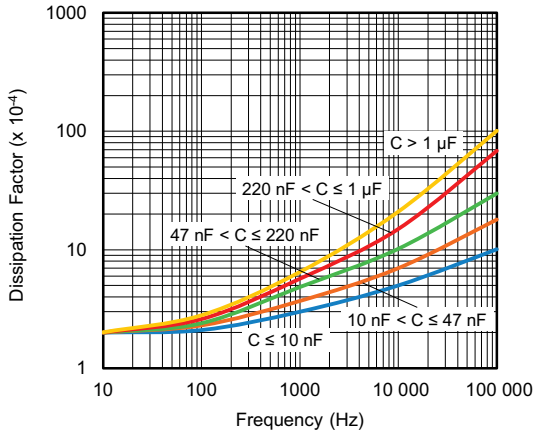
CHARACTERISTICS



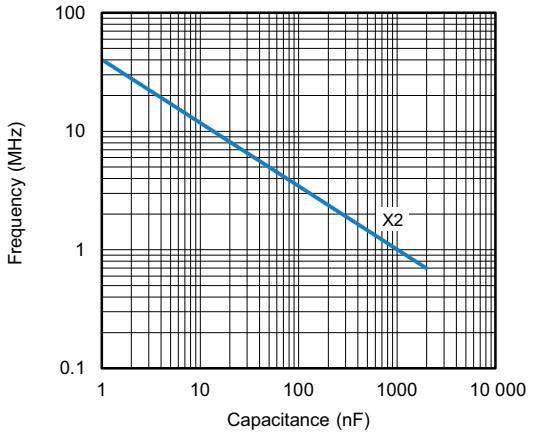
Capacitance as a function of ambient temperature
(typical curve)



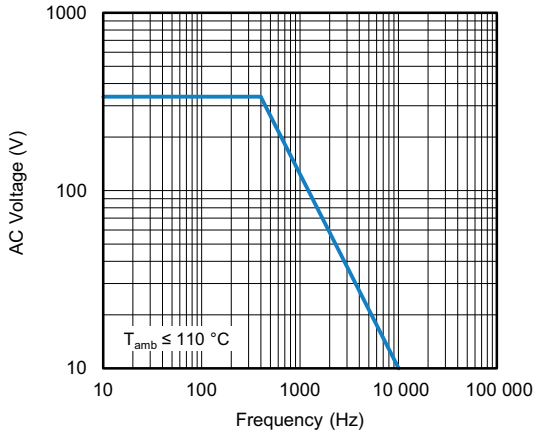
Impedance as a function of frequency
(typical curve)



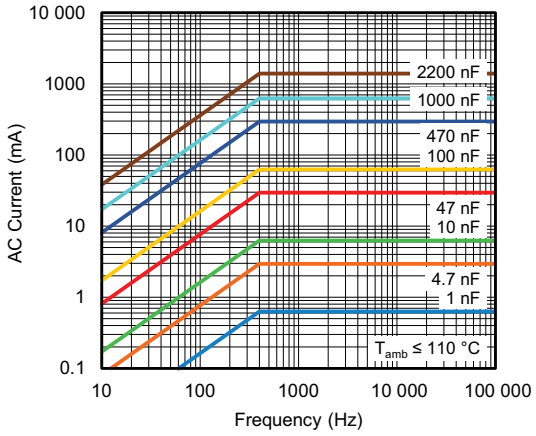
Tangent of loss angle as a function of frequency
(typical curve)



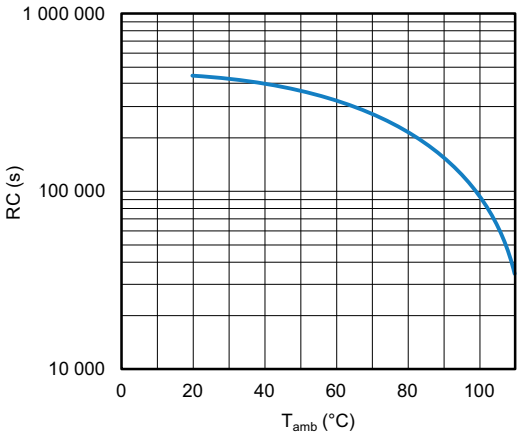
Resonant frequency as a function of capacitance
(typical curve)



Max. RMS voltage as a function of frequency
(typical curve)



Max. RMS current as a function of frequency
(typical curve)



Insulation resistance as a function of ambient temperature

APPLICATION NOTES

- For X2 electromagnetic interference suppression in **standard across the line applications** (50 Hz / 60 Hz) with a maximum mains voltage of 310 V_{AC}
- For series impedance applications we refer to the application note www.vishay.com/doc?28153
- For capacitors connected in parallel, normally the proof voltage and possibly the rated voltage must be reduced. For information depending of the capacitance value and the number of parallel connections contact: rfi@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 110 °C (125 °C for less than 1000 h) for C ≤ 470 nF and 110 °C for C > 470 nF
- 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

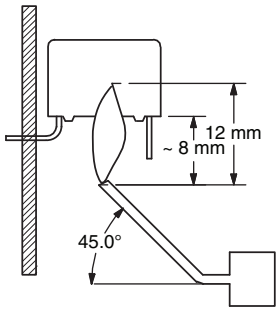
Sub-clause numbers of tests and performance requirements refer to the “Sectional Specification, IEC Publication IEC 60384-14 ed-4 (2013) and Specific Reference Data”.

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: For C ≤ 1 µF at 10 kHz For C > 1 µF at 1 kHz	
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	

GROUP C INSPECTION REQUIREMENTS		
SUB-CLAUSE NUMBER AND TEST	**CONDITIONS**	**PERFORMANCE REQUIREMENTS**
SUB-GROUP C1A PART OF SAMPLE OF SUB-GROUP C1		
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	$\|\Delta C/C\| \leq 5$ % of the value measured initially
	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 initially
	Insulation resistance	As specified in section “Insulation resistance” of this specification
SUB-GROUP C1B PART OF SAMPLE OF SUB-GROUP C1		
Initial measurements	Capacitance Tangent of loss angle: For C ≤ 1 µF at 10 kHz For C > 1 µF at 1 kHz	
4.20 Solvent resistance of the marking: see section “General notes”; item 5	Isopropylalcohol at room temperature Method: 1 Rubbing material: Cotton wool Immersion time: 5 min ± 0.5 min	No visible damage Legible marking
4.6 Rapid change of temperature	θA = - 55 °C θB = + 110 °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/s² (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/s² Duration of pulse: 11 ms	

GROUP C INSPECTION REQUIREMENTS		
SUB-CLAUSE NUMBER AND TEST	**CONDITIONS**	**PERFORMANCE REQUIREMENTS**
SUB-GROUP C1B PART OF SAMPLE OF SUB-GROUP C1		
4.9.2 Final measurements	Visual examination	No visible damage
	Capacitance	$\|\Delta C/C\| \leq 5$ % 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 section "Insulation resistance" 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: 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	No visible damage Legible marking
	Capacitance	$\|\Delta C/C\| \leq 5$ % of the value measured in 4.11.1.
	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 in 4.11.1.
	Voltage proof 1350 V_{DC}; 1 min between terminations	No permanent breakdown or flash-over
	Insulation resistance	≥ 50 % of values specified in section "Insulation resistance" of this specification
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	

GROUP C INSPECTION REQUIREMENTS		
SUB-CLAUSE NUMBER AND TEST	**CONDITIONS**	**PERFORMANCE REQUIREMENTS**
SUB-GROUP C2		
4.12.3 Final measurements	Visual examination	No visible damage Legible marking
	Capacitance	$\|\Delta C/C\| \leq 5$ % 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 1350 V_{DC}; 1 min between terminations	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: 2.5 kV for C ≤ 1 µF 2.5 kV/√C for C > 1 µF Max. 24 pulses	No selfhealing breakdowns or flashover
4.14 Endurance	Duration: 1000 h 1.25 x U_{RAC} at 110 °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	$\|\Delta C/C\| \leq 10$ % 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 1350 V_{DC}; 1 min between terminations 2120 V_{AC}; 1 min between terminations and case	No permanent breakdown or flash-over
	Insulation resistance	≥ 50 % of values specified in section “Insulation resistance” of this specification
SUB-GROUP C4		
4.15 Charge and discharge	10 000 cycles Charged to 435 V_{DC} Discharge resistance: $R = \frac{435\ V_{DC}}{1.25 \times C\ (dU/dt)}$	

GROUP C INSPECTION REQUIREMENTS		
SUB-CLAUSE NUMBER AND TEST	**CONDITIONS**	**PERFORMANCE REQUIREMENTS**
SUB-GROUP C4		
4.15.1 Initial measurements	Capacitance Tangent of loss angle: For C ≤ 1 µF at 10 kHz For C > 1 µF at 1 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 the 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 2.5 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.
SUB-GROUP ADD1		
A.1 Damp heat steady state with voltage	RH: 40 %; temp.: 93 °C, voltage: 300 V_{AC} Duration: 21 days	
A.1.1 Initial measurements	Capacitance Tangent of loss angle: at 10 kHz	
A.1.2 Final measurements	Visual examination	No visible damage Legible marking
	Capacitance	$\lvert\Delta C/C\rvert \leq 10$ % of the value with initial measurement A.1.1
	Tangent of loss angle	Increase of tan δ ≤ 0.024 Compared to values with initial measurement A.1.1
	Insulation resistance	≥ 50 % of values specified in section “Insulation Resistance” of this specification

Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, “Vishay”), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and / or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Hyperlinks included in this datasheet may direct users to third-party websites. These links are provided as a convenience and for informational purposes only. Inclusion of these hyperlinks does not constitute an endorsement or an approval by Vishay of any of the products, services or opinions of the corporation, organization or individual associated with the third-party website. Vishay disclaims any and all liability and bears no responsibility for the accuracy, legality or content of the third-party website or for that of subsequent links.

Vishay products are not designed for use in life-saving or life-sustaining applications or any application in which the failure of the Vishay product could result in personal injury or death unless specifically qualified in writing by Vishay. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.