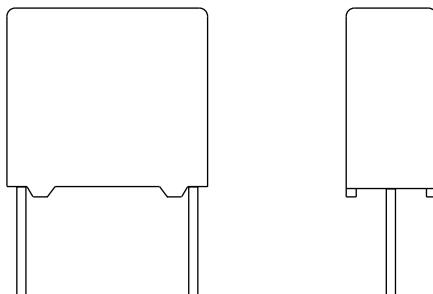


## Interference Suppression Film Capacitors - Class X2

### Radial MKP 310 V<sub>AC</sub> - Standard Across the Line



#### FEATURES

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



#### APPLICATIONS

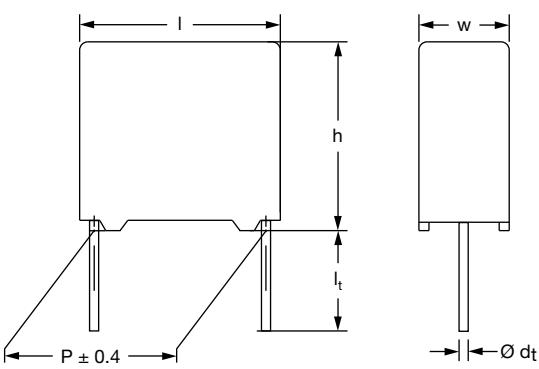
For standard across the line X2 applications

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

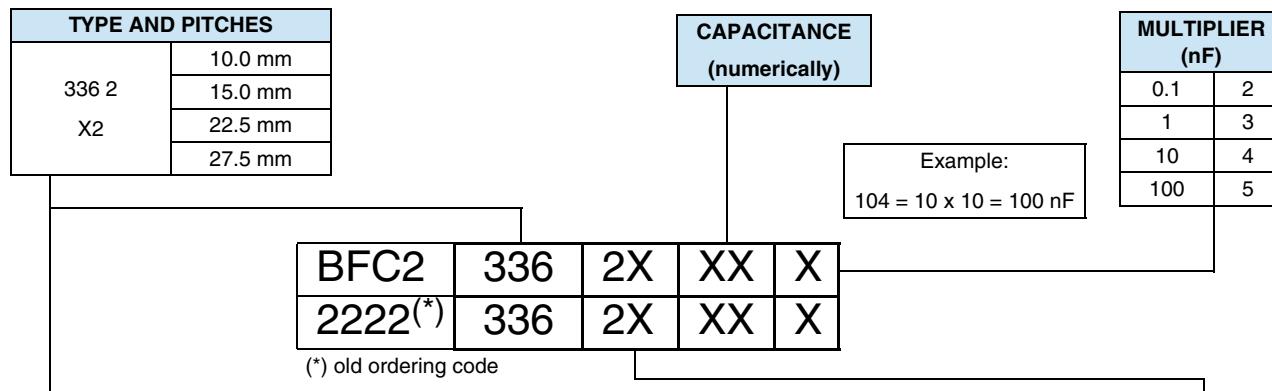
QUICK REFERENCE DATA	
Capacitance range (E12 series)	0.001 $\mu$ F to 2.2 $\mu$ F (preferred values acc. to E6)
Capacitance tolerance	$\pm 20\%$ ; $\pm 10\%$ ; $\pm 5\%$
Climatic testing class according to IEC 60068-1	55/110/56/B
Rated AC voltage	310 V <sub>AC</sub> ; 50 Hz to 60 Hz
Permissible DC voltage	800 V <sub>DC</sub> at 85 °C, 630 V <sub>DC</sub> at 110 °C
Maximum application temperature	C $\leq$ 470 nF: 110 °C (125 °C for less than 1000 h), C > 470 nF: 110 °C
Reference standards	IEC 60384-14 ed-4 (2013) and EN 60384-14 IEC 60065, pass. flamm. class B for volumes > 1750 mm <sup>3</sup> 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](mailto:rfi@vishay.com)

DIMENSIONS in millimeters	
	

## COMPOSITION OF CATALOG NUMBER



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 <sup>(1)</sup>	H = 18.5 mm; P <sub>0</sub> = 12.7 mm		BFC2 336 23...			
		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			
	Loose in box	Lead length 25.0 mm ± 2.0 mm		BFC2 336 27...			
		H = 18.5 mm; P <sub>0</sub> = 12.7 mm		BFC2 336 24...			
		Lead length 3.5 mm + 1 mm/- 0.5 mm or 3.5 mm ± 0.3 mm	± 5 %	BFC2 336 22...			
	Loose in box	Lead length 5.0 mm ± 1.0 mm		See tables			
		Lead length 25.0 mm ± 2.0 mm		BFC2 336 28...			
	Taped on reel <sup>(1)</sup>	H = 18.5 mm; P <sub>0</sub> = 12.7 mm		BFC2 336 25...			
PACKAGING	ALTERNATIVE LARGER PITCH SIZES	C-TOL.	CODE NUMBER	See tables for details			
Loose in box	Lead length 3.5 mm + 1 mm/- 0.5 mm or 3.5 mm ± 0.3 mm	± 20 %					
	Lead length 5.0 mm ± 1.0 mm						
	Lead length 25.0 mm ± 2.0 mm						
Taped on reel <sup>(1)</sup>	H = 18.5 mm; P <sub>0</sub> = 12.7 mm	± 10 %					
	Lead length 3.5 mm + 1 mm/- 0.5 mm or 3.5 mm ± 0.3 mm						
	Lead length 5.0 mm ± 1.0 mm						
	Lead length 25.0 mm ± 2.0 mm						
Taped on reel <sup>(1)(2)</sup>	H = 18.5 mm P <sub>0</sub> = 12.7 mm						

## Notes

(1) For detailed tape specifications refer to packaging information: [www.vishay.com/doc?28139](http://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: $C < 470 \text{ nF}$	at 1 kHz	at 10 kHz
$470 \text{ nF} \leq C \leq 1 \mu\text{F}$	$\leq 10 \times 10^{-4}$	$\leq 20 \times 10^{-4}$
$C > 1 \mu\text{F}$	$\leq 20 \times 10^{-4}$	$\leq 70 \times 10^{-4}$
$\leq 30 \times 10^{-4}$		-
Rated voltage pulse slope ( $dU/dt$ ) at 435 V <sub>DC</sub>	-	
Pitch = 10 mm	600 V/ $\mu\text{s}$	
Pitch = 15 mm and 7.5 mm (bent back)	400 V/ $\mu\text{s}$	
Pitch = 22.5 mm	150 V/ $\mu\text{s}$	
Pitch = 27.5 mm	100 V/ $\mu\text{s}$	
R between leads, for $C \leq 0.33 \mu\text{F}$ at 100 V; 1 min	> 15 000 M $\Omega$	
RC between leads, for $C > 0.33 \mu\text{F}$ at 100 V; 1 min	> 5000 s	
R between leads and case; 100 V; 1 min	> 30 000 M $\Omega$	
Withstanding (DC) voltage (cut off current 10 mA) <sup>(1)</sup> ; rise time $\leq 1000 \text{ V/s}$ :		
$C \leq 1 \mu\text{F}$	2200 V; 1 min	
$C > 1 \mu\text{F}$	1800 V; 1 min	
Withstanding (AC) voltage between leads and case	2120 V; 1 min	
Max. application temperature for $0.001 \mu\text{F} \leq C \leq 0.47 \mu\text{F}$	110 °C (125 °C for less than 1000 h)	
Max. application temperature for $C > 0.47 \mu\text{F}$	110 °C	

**Note**

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

ELECTRICAL DATA AND ORDERING CODE - PITCH 10 mm									
U <sub>RAC</sub> (V)	CAP. ( $\mu\text{F}$ )	DIMENSIONS w x h x l (mm)	MASS (g) <sup>(3)</sup>	CATALOG NUMBER BFC2 336 ..... AND PACKAGING					
				LOOSE IN BOX				REEL (500 mm) <sup>(1)(2)</sup>	
				SHORT LEADS		LONG LEADS		H = 18.5 mm $P_0 = 12.7 \text{ mm}$	
				$l_t = 3.5 \text{ mm}$ $+ 1 \text{ mm}/- 0.5 \text{ mm}$	$l_t = 5.0 \text{ mm}$ $\pm 1.0 \text{ mm}$	SPQ	$l_t = 25.0 \text{ mm}$ $\pm 2.0 \text{ mm}$	SPQ	SPQ
310	PITCH = 10.0 mm $\pm 0.4 \text{ mm}$ ; $d_t = 0.6 \text{ mm} \pm 0.06 \text{ mm}$ ; C-TOL. = $\pm 20 \%$								
	0.0010	4.0 x 10.0 x 12.5	0.6	20102	29131	1000	26102	23102	1400
	0.0015			20152	29132		26152	23152	
	0.0022			20222	29133		26222	23222	
	0.0033			20332	29134		26332	23332	
	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	23333	900
PITCH = 10.0 mm $\pm 0.4 \text{ mm}$ ; $d_t = 0.6 \text{ mm} \pm 0.06 \text{ mm}$ ; C-TOL. = $\pm 10 \%$									
24102	0.0010	4.0 x 10.0 x 12.5	0.6	21102	29154	1000	27102	24102	
	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 <sub>RAC</sub> (V)	CAP. ( $\mu$ F)	DIMENSIONS w x h x l (mm)	MASS (g) <sup>(3)</sup>	CATALOG NUMBER BFC2 336 ..... AND PACKAGING				
				LOOSE IN BOX			REEL (500 mm) <sup>(1)(2)</sup>	
				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
PITCH = 10.0 mm ± 0.4 mm; $d_t$ = 0.6 mm ± 0.06 mm; C-TOL. = ± 10 %								
0.0027 0.0033 0.0039 0.0047 0.0056 0.0068 0.0082 0.010 0.012 0.015 0.018 0.022 0.027 0.033	4.0 x 10.0 x 12.5	0.6		21272	-		27272	24272
				21332	29157		27332	24332
				21392	-		27392	24392
				21472	29158		27472	24472
				21562	-		27562	24562
				21682	29159	1000	27682	24682
				21822	-		27822	24822
				21103	29161		27103	24103
				21123	-		27123	24123
				21153	29162		27153	24153
				21183	-		27183	24183
				21223	29163		27223	24223
				21273	-	750	27273	24273
				21333	29164		27333	24333
PITCH = 10.0 mm ± 0.4 mm; $d_t$ = 0.6 mm ± 0.06 mm; C-TOL. = ± 5 %								
310 0.0010 0.0012 0.0015 0.0018 0.0022 0.0027 0.0033 0.0039 0.0047 0.0056 0.0068 0.0082 0.010 0.012 0.015 0.018 0.022 0.027 0.033	4.0 x 10.0 x 12.5	0.6		22102	-		28102	25102
				22122	-		28122	25122
				22152	-		28152	25152
				22182	-		28182	25182
				22222	-		28222	25222
				22272	-		28272	25272
				22332	-		28332	25332
				22392	-		28392	25392
				22472	-	1000	28472	25472
				22562	-		28562	25562
				22682	-		28682	25682
				22822	-		28822	25822
				22103	-		28103	25103
				22123	-		28123	25123
				22153	-		28153	25153
				22183	-		28183	25183
				22223	-		28223	25223
				22273	-	750	28273	25273
				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](http://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 <sub>RAC</sub> (V)	CAP. ( $\mu$ F)	DIMENSIONS w x h x l (mm)	MASS (g) <sup>(3)</sup>	CATALOG NUMBER BFC2 336 ..... AND PACKAGING					
				LOOSE IN BOX				REEL (500 mm) <sup>(1)(2)</sup>	
				SHORT LEADS			LONG LEADS		H = 18.5 mm P <sub>0</sub> = 12.7 mm
				I <sub>t</sub> = 3.5 mm ± 0.3 mm	I <sub>t</sub> = 5.0 mm ± 1.0 mm	SPQ	I <sub>t</sub> = 25.0 mm ± 2.0 mm	SPQ	SPQ
310	PITCH = 15 mm ± 0.4 mm; d <sub>t</sub> = 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
	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		6.0 x 12.0 x 17.5	20104	29144		26104	500	23104
	0.15			20154	29145		26154		900
	PITCH = 15 mm ± 0.4 mm; d <sub>t</sub> = 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
	PITCH = 15 mm ± 0.4 mm; d <sub>t</sub> = 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
	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
	0.082			21823	-		27823		24823
	0.10			21104	29167		27104	500	24104
	0.12	6.0 x 12.0 x 17.5	1.4	21124	-		27124		800
	0.15	21154	29168	27154	650				
	PITCH = 15 mm ± 0.4 mm; d <sub>t</sub> = 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
	0.22	21224	29169	27224	24224				
	PITCH = 15 mm ± 0.4 mm; d <sub>t</sub> = 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
	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
	0.082			22823	-		28823		25823
	0.10			22104	-		28104	500	25104
	0.12	6.0 x 12.0 x 17.5	1.4	22124	-		28124		800
	0.15	22154	-	28154	650				
	PITCH = 15 mm ± 0.4 mm; d <sub>t</sub> = 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

## Notes

- SPQ = Standard Packing Quantity
- (1) H = In-tape height; P<sub>0</sub> = sprocket hole distance; for detailed specifications refer to packaging information: [www.vishay.com/doc?28139](http://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 <sub>RAC</sub> (V)	CAP. ( $\mu$ F)	DIMENSIONS w x h x l (mm)	MASS (g) <sup>(3)</sup>	CATALOG NUMBER BFC2 336 ..... AND PACKAGING						
				LOOSE IN BOX				REEL (500 mm) <sup>(1)(2)</sup>		
				SHORT LEADS			LONG LEADS		H = 18.5 mm $P_0$ = 12.7 mm	
				$I_t$ = 3.5 mm $\pm$ 0.3 mm	$I_t$ = 5.0 mm $\pm$ 1.0 mm	SPQ	$I_t$ = 25.0 mm $\pm$ 2.0 mm	SPQ		
310	PITCH = 22.5 mm $\pm$ 0.4 mm; $d_t$ = 0.80 mm $\pm$ 0.08 mm; C-TOL. = $\pm$ 20 %									
	0.15	6.0 x 15.5 x 26.0	2.4	29041	29277		29087	500	29044	600
	0.22			29051	29278	300	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 $\pm$ 0.4 mm; $d_t$ = 0.80 mm $\pm$ 0.08 mm; C-TOL. = $\pm$ 10 %									
	0.12	6.0 x 15.5 x 26.0	2.4	29037	-		29085	500	29039	600
	0.15			29042	29285		29088		29045	
	0.18			29047	-	300	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 $\pm$ 0.4 mm; $d_t$ = 0.80 mm $\pm$ 0.08 mm; C-TOL. = $\pm$ 5 %									
	0.12	6.0 x 15.5 x 26.0	2.4	29038	-		29086	500	29064	600
	0.15			29043	-		29089		29046	
	0.18			29048	-	300	29092		29065	550
	0.22			22224	-		28224		25224	
	0.27			22274	-		28274		25274	450
	0.33			22334	-	200	28334		25334	
	0.39			22394	-		28394		25394	400

**Notes**

- SPQ = Standard Packing Quantity

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

<sup>(2)</sup> Reel diameter = 356 mm is available on request

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

ELECTRICAL DATA AND ORDERING CODE - PITCH 27.5 mm								
U <sub>RAC</sub> (V)	CAP. ( $\mu$ F)	DIMENSIONS w x h x l (mm)	MASS (g) <sup>(1)</sup>	CATALOG NUMBER BFC2 336 ..... AND PACKAGING				
				LOOSE IN BOX				
				SHORT LEADS		LONG LEADS		
				$l_t = 3.5 \text{ mm}$ $\pm 0.3 \text{ mm}$	$l_t = 5.0 \text{ mm}$ $\pm 1.0 \text{ mm}$	SPQ	$l_t = 25.0 \text{ mm}$ $\pm 2.0 \text{ mm}$	
PITCH = 27.5 mm $\pm$ 0.4 mm; $d_t$ = 0.80 mm $\pm$ 0.08 mm; C-TOL. = $\pm$ 20 %								
310	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 $\pm$ 0.4 mm; $d_t$ = 0.80 mm $\pm$ 0.08 mm; C-TOL. = $\pm$ 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 $\pm$ 0.4 mm; $d_t$ = 0.80 mm $\pm$ 0.08 mm; C-TOL. = $\pm$ 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	125
	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

<b>APPROVALS</b>				
<b>SAFETY APPROVALS X2</b>	<b>VOLTAGE</b>	<b>VALUE</b>	<b>FILE NUMBERS</b>	<b>LINK</b>
EN 60384-14 (ENEC) (= IEC 60384-14 ed-4 (2013))	310 V <sub>AC</sub>	1 nF to 2.2 $\mu$ F	ENEC16/FI/19/10001	<a href="http://www.vishay.com/doc?28179">www.vishay.com/doc?28179</a>
UL 60384-14	310 V <sub>AC</sub>	1 nF to 2.2 $\mu$ F	E354331	<a href="http://www.vishay.com/doc?28184">www.vishay.com/doc?28184</a>
CSA-E 384-14	310 V <sub>AC</sub>	1 nF to 2.2 $\mu$ F	E354331	<a href="http://www.vishay.com/doc?28184">www.vishay.com/doc?28184</a>
CQC GB/T6346.14-2015	310 V <sub>AC</sub>	1 nF to 2.2 $\mu$ F	CQC07001021280 (L) CQC04001009262 (F)	<a href="http://www.vishay.com/doc?28199">www.vishay.com/doc?28199</a> <a href="http://www.vishay.com/doc?28200">www.vishay.com/doc?28200</a>
CB test certificate	310 V <sub>AC</sub>	1 nF to 2.2 $\mu$ F	FI-39827	<a href="http://www.vishay.com/doc?28175">www.vishay.com/doc?28175</a>
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](http://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:

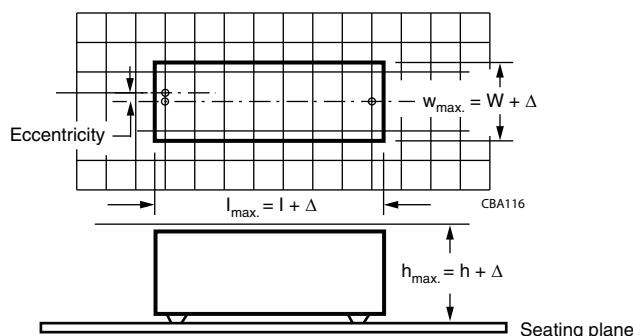
- For pitches  $\leq$  15 mm capacitors shall be mechanically fixed by the leads
- For larger pitches the capacitors shall be mounted in the same way and the body clamped.

### 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  $\leq$  15 mm,  $\Delta w = \Delta l = 0.3$  mm;  $\Delta h = 0.1$  mm
- For products with 15 mm  $<$  pitch  $\leq$  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](http://www.vishay.com/doc?28171)

### Storage Temperature

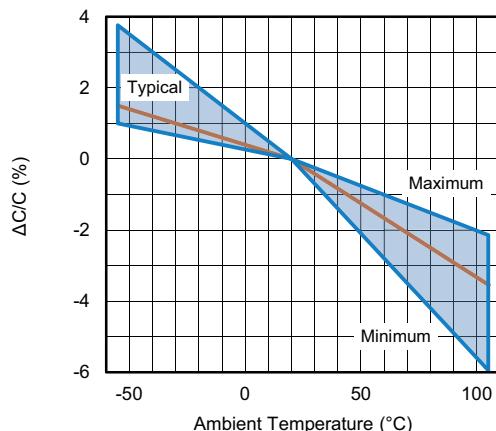
$T_{stg} = -25$  °C to  $+35$  °C with RH maximum 75 % without condensation

### Ratings and Characteristics Reference Conditions

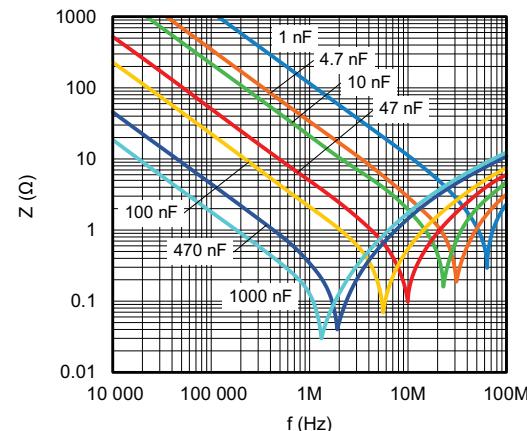
Unless otherwise specified, all electrical values apply to an ambient temperature of  $23$  °C  $\pm 1$  °C, an atmospheric pressure of 86 kPa to 106 kPa and a relative humidity of 50 %  $\pm 2$  %.

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 %.

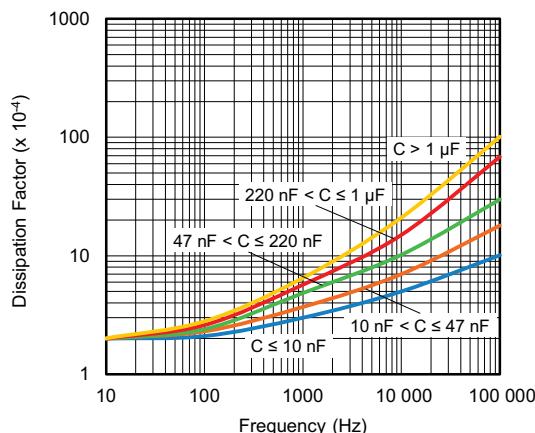
## CHARACTERISTICS



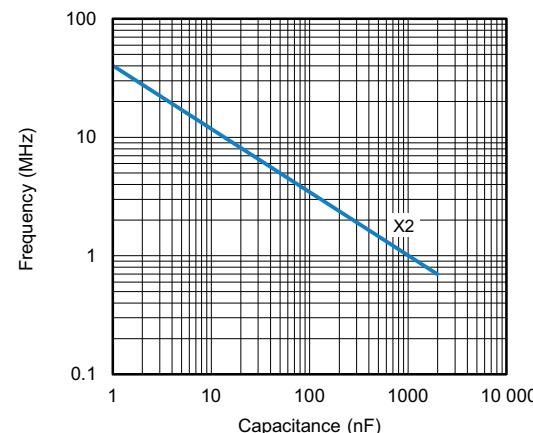
Capacitance as a function of ambient temperature  
(typical curve)



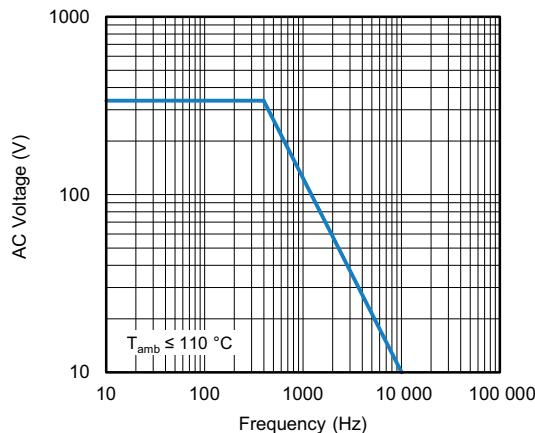
Impedance as a function of frequency  
(typical curve)



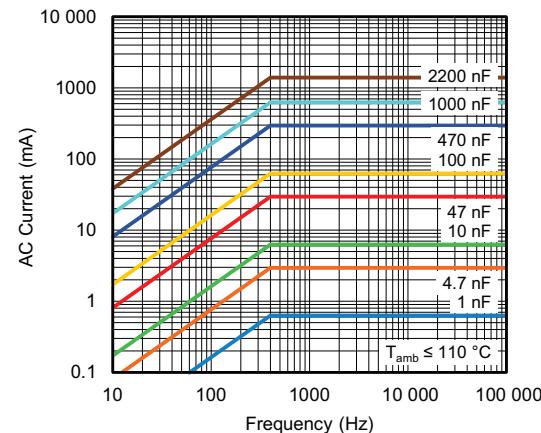
Tangent of loss angle as a function of frequency  
(typical curve)



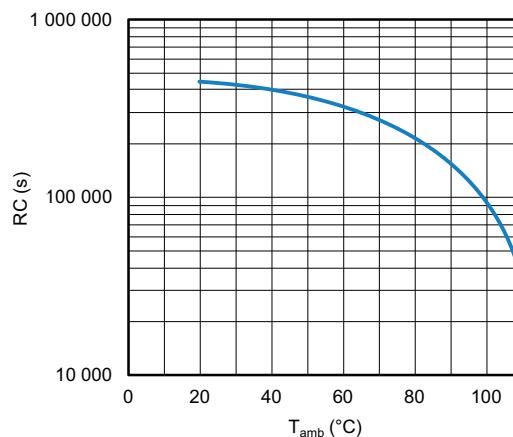
Resonant frequency as a function of capacitance  
(typical curve)



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<sub>AC</sub>
- For series impedance applications we refer to the application note [www.vishay.com/doc?28153](http://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](mailto: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<sub>DC</sub> and divided by the applied voltage

## INSPECTION REQUIREMENTS

### General Notes

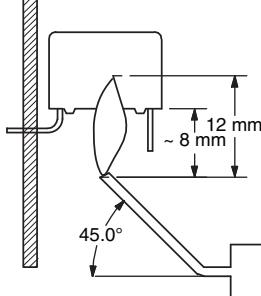
Sub-clause numbers of tests and performance requirements refer to the "Sectional Specification, IEC Publication IEC 60384-14 ed-4 (2013) and Specific Reference Data".

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
<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 ± 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: $C \leq 1 \mu\text{F}$ or $\leq 0.005$ for: $C > 1 \mu\text{F}$ Compared to values measured initially  As specified in section "Insulation resistance" of this specification
<b>SUB-GROUP C1B PART OF SAMPLE OF SUB-GROUP C1</b>		
Initial measurements	Capacitance Tangent of loss angle: For $C \leq 1 \mu\text{F}$ at 10 kHz For $C > 1 \mu\text{F}$ 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	0A = - 55 °C 0B = + 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/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	

GROUP C INSPECTION REQUIREMENTS		
SUB-CLAUSE NUMBER AND TEST	CONDITIONS	PERFORMANCE REQUIREMENTS
<b>SUB-GROUP C1B PART OF SAMPLE OF SUB-GROUP C1</b>		
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: $C \leq 1 \mu\text{F}$ or $\leq 0.005$ for: $C > 1 \mu\text{F}$ Compared to values measured initially  As specified in section "Insulation resistance" of this specification
<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 1350 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: $C \leq 1 \mu\text{F}$ or $\leq 0.005$ 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	

GROUP C INSPECTION REQUIREMENTS		
SUB-CLAUSE NUMBER AND TEST	CONDITIONS	PERFORMANCE REQUIREMENTS
<b>SUB GROUP C2</b>		
4.12.3 Final measurements	Visual examination Capacitance Tangent of loss angle Voltage proof 1350 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 $\tan \delta$ : $\leq 0.008$ for: $C \leq 1 \mu\text{F}$ or $\leq 0.005$ for: $C > 1 \mu\text{F}$ 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>SUB-GROUP C3</b>		
4.13.1 Initial measurements	Capacitance Tangent of loss angle: For $C \leq 1 \mu\text{F}$ at 10 kHz For $C > 1 \mu\text{F}$ at 1 kHz	
4.13 Impulse voltage	3 successive impulses, full wave, peak voltage: 2.5 kV for $C \leq 1 \mu\text{F}$ 2.5 kV/ $\sqrt{C}$ for $C > 1 \mu\text{F}$ Max. 24 pulses	No selfhealing breakdowns or flashover
4.14 Endurance	Duration: 1000 h 1.25 $\times U_{RAC}$ at 110 °C Once in every hour the voltage is increased to 1000 V <sub>RMS</sub> for 0.1 s via resistor of $47 \Omega \pm 5\%$	
4.14.7 Final measurements	Visual examination Capacitance Tangent of loss angle Voltage proof 1350 V <sub>DC</sub> ; 1 min between terminations 2120 V <sub>AC</sub> ; 1 min between terminations and case Insulation resistance	No visible damage Legible marking $ \Delta C/C  \leq 10\%$ compared to values measured in 4.13.1. Increase of $\tan \delta$ : $\leq 0.008$ for: $C \leq 1 \mu\text{F}$ or $\leq 0.005$ for: $C > 1 \mu\text{F}$ Compared to values measured in 4.13.1. No permanent breakdown or flash-over $\geq 50\%$ 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 435 V <sub>DC</sub> Discharge resistance: $R = \frac{435 \text{ V}_{DC}}{1.25 \times C \text{ (dU/dt)}}$	

GROUP C INSPECTION REQUIREMENTS		
SUB-CLAUSE NUMBER AND TEST	CONDITIONS	PERFORMANCE REQUIREMENTS
<b>SUB-GROUP C4</b>		
4.15.1 Initial measurements	Capacitance Tangent of loss angle: For $C \leq 1 \mu\text{F}$ at 10 kHz For $C > 1 \mu\text{F}$ at 1 kHz	
4.15.3 Final measurements	Capacitance  Tangent of loss angle  Insulation resistance	$ \Delta C/C  \leq 10\%$ compared to values measured in 4.15.1.  Increase of $\tan \delta$ : $\leq 0.008$ for: $C \leq 1 \mu\text{F}$ or $\leq 0.005$ for: $C > 1 \mu\text{F}$ Compared to values measured in 4.15.1.  $\geq 50\%$ of values specified in section "Insulation resistance" of this specification
<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	Bore of gas jet: $\varnothing 0.5$ mm Fuel: Butane Test duration for actual volume $V$ in $\text{mm}^3$ : $V \leq 250$ : 10 s $250 < V \leq 500$ : 20 s $500 < V \leq 1750$ : 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.
		
<b>SUB-GROUP C7</b>		
4.18 Active flammability	20 cycles of 2.5 kV discharges on the test capacitor connected to URAC.	The cheese cloth around the capacitors shall not burn with a flame. No electrical measurements are required.

## **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.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. 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.

# Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[Vishay](#):

[BFC233624224](#) [BFC233624474](#) [BFC233624683](#) [BFC233627155](#)