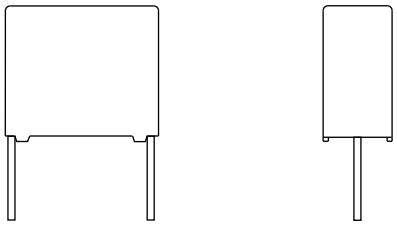
Interference Suppression Film Capacitors
MKP Radial Potted Type



FEATURES

- Compliant with IEC 60384-14: AMD1 grade IA
  - THB: 40 °C / 93 % RH, 21 days at U_{RAC}
- Supplied loose in box, taped on reel
- 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

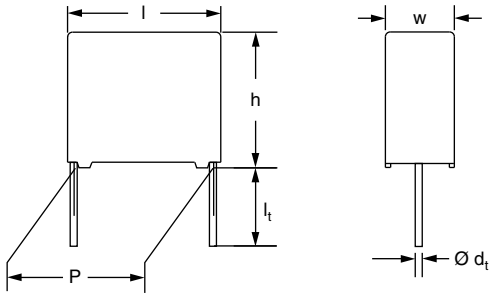
See also application note: www.vishay.com/doc?28153

QUICK REFERENCE DATA	
Capacitance range (E12 series)	0.001 µF to 3.3 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 requires pass. flamm. class B UL 60384-14; CSA-E384-14, CQC
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



For technical questions, contact: rfi@vishay.com

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COMPOSITION OF CATALOG NUMBER

TYPE AND PITCHES	
338 2 X2	7.5 mm
	10.0 mm
	15.0 mm
	22.5 mm
	27.5 mm

CAPACITANCE (numerically)

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

Example:

104 = 10 x 10 = 100 nF

BFC2	338	2X	XX	X
2222(*)	338	2X	XX	X

(*) Old ordering code

TYPE	PACKAGING	STANDARD DIMENSIONS	C-TOL.	PREFERRED TYPES
MKP338 2 X2	Loose in box	Lead length 3.5 mm + 1 mm/- 0.5 mm; pitch ≤ 10.0 mm	± 20 %	BFC2 338 20
		Lead length 3.5 mm ± 0.3 mm; pitch ≥ 15.0 mm		BFC2 338 20
		Lead length 5.0 mm ± 1 mm		BFC2 338 22
		Lead length 25.0 mm ± 2 mm		BFC2 338 24
	Taped ammo (1)	Pitch ≤ 15.0 mm; H = 18.5 mm; P_0 = 12.7 mm	± 20 % ± 10 % ± 5 %	See tables for details
	Taped reel (1)	Pitch 22.5 mm; H = 18.5 mm; P_0 = 12.7 mm		
TYPE	**PACKAGING**	**ALTERNATIVE PITCH SIZES AND TOLERANCES**	**C-TOL.**	**PREFERRED TYPES**
MKP338 2 X2	Loose in box	Packaging like 20 % and alternative pitch sizes	± 5 % ± 10 % ± 20 %	See tables for details

Notes

(1) Taped on reel and taped on ammo pitch = 27.5 mm is not available

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

SPECIFIC REFERENCE DATA

DESCRIPTION	VALUE	
Rated AC voltage (U_{RAC})	310 V	
Permisssible 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 = 7.5 mm	600 V/µs	
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

For technical questions, contact: rfi@vishay.com

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ELECTRICAL DATA AND ORDERING CODE - PITCH 7.5 mm

U_{RAC} (V)	CAP. (µF)	DIMENSIONS w x h x l (mm)	MASS (g) [2]	CATALOG NUMBER BFC2 338 ..... AND PACKAGING						
				LOOSE IN BOX					AMMOPACK [1]	
				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 = 7.5 mm ± 0.4 mm; d_t = 0.50 mm ± 0.05 mm; C-TOL. = ± 20 %									
	0.0010	4.0 x 9.0 x 10.0	0.4	20102	22102	1500	24102	1000	26102	1250
	0.0012			20122	22122		24122		26122	
	0.0015			20152	22152		24152		26152	
	0.0018			20182	22182		24182		26182	
	0.0022			20222	22222		24222		26222	
	0.0027			20272	22272		24272		26272	
	0.0033			20332	22332		24332		26332	
	0.0039			20392	22392		24392		26392	
	0.0047			20472	22472		24472		26472	
	0.0056			20562	22562		24562		26562	
	0.0068			20682	22682		24682		26682	
	0.0082			20822	22822		24822		26822	
	0.010			20103	22103		24103		26103	
	0.012			20123	22123		24123		26123	
	0.015			20153	22153		24153		26153	
	0.018			20183	22183		24183		26183	
	0.022			20223	22223		24223		26223	
	0.027			20273	22273	1000	24273	1250	26273	1000
	0.033			20333	22333		24333		26333	
	0.039	5.0 x 10.5 x 10.0	0.6	20393	22393	750	24393	1000	26393	750
	0.047			20473	22473		24473		26473	
	PITCH = 7.5 mm ± 0.4 mm; d_t = 0.50 mm ± 0.05 mm; C-TOL. = ± 10 %									
	0.0010	4.0 x 9.0 x 10.0	0.4	28101	28301	1500	28501	1000	28701	1250
	0.0012			28102	28302		28502		28702	
	0.0015			28103	28303		28503		28703	
	0.0018			28104	28304		28504		28704	
	0.0022			28105	28305		28505		28705	
	0.0027			28106	28306		28506		28706	
	0.0033			28107	28307		28507		28707	
	0.0039			28108	28308		28508		28708	
	0.0047			28109	28309		28509		28709	
	0.0056			28111	28311		28511		28711	
	0.0068			28112	28312		28512		28712	
	0.0082			28113	28313		28513		28713	
	0.010			28114	28314		28514		28714	
	0.012			28115	28315		28515		28715	
	0.015			28116	28316		28516		28716	
	0.018			28117	28317		28517		28717	
	0.022			28118	28318		28518		28718	
	0.027			28119	28319	1000	28519	1250	28719	1000
	0.033	5.0 x 10.5 x 10.0	0.6	28121	28321		28521		28721	
	0.039			28122	28332	750	28522	1000	28722	750
	0.047	6.0 x 11.5 x 10.0	0.8	28123	28323		28523		28723	

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ELECTRICAL DATA AND ORDERING CODE - PITCH 7.5 mm

U_{RAC} (V)	CAP. (µF)	DIMENSIONS w x h x l (mm)	MASS (g) (2)	CATALOG NUMBER BFC2 338 ..... AND PACKAGING						
				LOOSE IN BOX					AMMOPACK (1)	
				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 = 7.5 mm ± 0.4 mm; d_t = 0.50 mm ± 0.05 mm; C-TOL. = ± 5 %									
	0.0010	4.0 x 9.0 x 10.0	0.4	28201	28401	1500	28601	1000	28801	1250
	0.0012			28202	28402		28602		28802	
	0.0015			28203	28403		28603		28803	
	0.0018			28204	28404		28604		28804	
	0.0022			28205	28405		28605		28805	
	0.0027			28206	28406		28606		28806	
	0.0033			28207	28407		28607		28807	
	0.0039			28208	28408		28608		28808	
	0.0047			28209	28409		28609		28809	
	0.0056			28211	28411		28611		28811	
	0.0068			28212	28412		28612		28812	
	0.0082			28213	28413		28613		28813	
	0.010			28214	28414		28614		28814	
	0.012			28215	28415		28615		28815	
	0.015			28216	28416		28616		28816	
	0.018			28217	28417		28617		28817	
	0.022			28218	28418		28618		28818	
	0.027			28219	28419	1000	28619	1250	28819	1000
	0.033	5.0 x 10.5 x 10.0	0.6	28221	28421	1000	28621	1250	28821	1000
	0.039			28222	28422	750	28622	1000	28822	750
	0.047	6.0 x 11.5 x 10.0	0.8	28223	28423	750	28623	1000	28823	750

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) Weight for short lead product only

ELECTRICAL DATA AND ORDERING CODE - PITCH 10 mm

U_{RAC} (V)	CAP. (µF)	DIMENSIONS w x h x l (mm)	MASS (g) (2)	CATALOG NUMBER BFC2 338 ..... AND PACKAGING						
				LOOSE IN BOX					AMMOPACK (1)	
				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 = 0.60 mm ± 0.06 mm; C-TOL. = ± 20 %									
	0.0010	4.0 x 10.0 x 12.5	0.6	21102	23102	1000	25102	1250	Not available	
	0.0012			21122	23122		25122			
	0.0015			21152	23152		25152			
	0.0018			21182	23182		25182			
	0.0022			21222	23222		25222			
	0.0027			21272	23272		25272	1000		
	0.0033			21332	23332		25332			
	0.0039			21392	23392		25392			
	0.0047			21472	23472		25472			
	0.0056			21562	23562		25562			

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ELECTRICAL DATA AND ORDERING CODE - PITCH 10 mm

U_{RAC} (V)	CAP. (µF)	DIMENSIONS w x h x l (mm)	MASS (g) [2]	CATALOG NUMBER BFC2 338 ..... AND PACKAGING						
				LOOSE IN BOX					AMMOPACK [1]	
				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
	PITCH = 10.0 mm ± 0.4 mm; d_t = 0.60 mm ± 0.06 mm; C-TOL. = ± 20 %									
	0.0068	4.0 x 10.0 x 12.5	0.6	21682	23682	1000	25682	1000	Not available	
	0.0082			21822	23822		25822			
	0.010			21103	23103		25103			
	0.012			21123	23123		25123			
	0.015			21153	23153		25153			
	0.018			21183	23183		25183			
	0.022			21223	23223		25223			
	0.027			21273	23273		25273			
	0.033			21333	23333		25333			
	0.039			21393	23393		25393			
	0.047			21473	23473		25473			
	0.056	5.0 x 11.0 x 12.5	0.82	20563	22563	750	24563	750	27563	500
	0.068			20683	22683		24683		27683	
	0.082	6.0 x 12.0 x 12.5	1.1	20823	22823	750	24823	750	27823	500
	0.10			20104	22104		24104		27104	
	PITCH = 10.0 mm ± 0.4 mm; d_t = 0.60 mm ± 0.06 mm; C-TOL. = ± 10 %									
	0.0010	4.0 x 10.0 x 12.5	0.6	29194	29217	1000	29241	1250	Not available	500
	0.0012			29195	29218		29242			
	0.0015			29196	29219		29243			
	0.0018			29197	29221		29244			
	0.0022			29198	29222		29245			
310	0.0027			29199	29223		29246	1000		
	0.0033			29201	29224		29247			
	0.0039			29202	29225		29248			
	0.0047			29203	29226		29249			
	0.0056			29204	29227		29251			
	0.0068			29205	29228		29252			
	0.0082			29206	29229		29253			
	0.010			29207	29231		29254			
	0.012			29208	29232		29255			
	0.015			29209	29233		29256			
	0.018			29211	29234		29257			
	0.022			29212	29235		29258			
	0.027			29213	29236		29259			
	0.033			29214	29237		29261			
	0.039			29215	29238		29262			
	0.047			29216	29239		29263			
	0.056	5.0 x 11.0 x 12.5	0.82	28124	28324	750	28524	750	28924	
	0.068			28125	28325		28525		28925	
	0.082	6.0 x 12.0 x 12.5	1.1	28126	28326	750	28526	750	28926	
	PITCH = 10.0 mm ± 0.4 mm; d_t = 0.60 mm ± 0.06 mm; C-TOL. = ± 5 %									
	0.056	5.0 x 11.0 x 12.5	0.82	28224	28424	750	28624	750	28944	500
	0.068	6.0 x 12.0 x 12.5	1.1	28225	28425	750	28625	750	28945	500
	0.082			28226	28426		28626		28946	

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] Weight for short lead product only

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ELECTRICAL DATA AND ORDERING CODE - PITCH 15 mm

U_{RAC} (V)	CAP. (µF)	DIMENSIONS w x h x l (mm)	MASS (g) [2]	CATALOG NUMBER BFC2 338 ..... AND PACKAGING						
				LOOSE IN BOX					AMMOPACK [1]	
				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 = 15.0 mm ± 0.4 mm; d_t = 0.60 mm ± 0.06 mm; C-TOL. = ± 20 %									
	0.010	5.0 x 11.0 x 17.5	1.0	29076	29096	1000	29116	1000	29141	1100
	0.012			29077	29097		29117		29143	
	0.015			29078	29098		29118		29145	
	0.018			29079	29099		29119		29147	
	0.022			29081	29101		29121		29149	
	0.027			29082	29102		29122		29152	
	0.033			29083	29103		29123		29154	
	0.039			29084	29104		29124		29156	
	0.047			29085	29105		29125		29158	
	0.056			21563	23563		25563		29161	
	0.068			21683	23683		25683		29163	
	0.082			21823	23823		25823		29165	
	0.10			21104	23104		25104		29166	
	0.12			20124	22124		24124		27124	900
	0.15	6.0 x 12.0 x 17.5	1.4	20154	22154	750	24154	500	27154	800
	0.18			20184	22184		24184		27184	
	PITCH = 15.0 mm ± 0.4 mm; d_t = 0.80 mm ± 0.08 mm; C-TOL. = ± 20 %									
	0.22	7.0 x 13.5 x 17.5	1.8	20224	22224	750	24224	500	27224	650
	0.27	8.5 x 15.0 x 17.5	2.4	20274	22274	750	24274	500	27274	650
	0.33			20334	22334	500	24334	450	27334	600
	PITCH = 15.0 mm ± 0.4 mm; d_t = 0.60 mm ± 0.06 mm; C-TOL. = ± 10 %									
	0.010	5.0 x 11.0 x 17.5	1.0	29066	29086	1000	29106	1000	29139	1100
	0.012			29067	29087		29107		29142	
	0.015			29068	29088		29108		29144	
	0.018			29069	29089		29109		29146	
	0.022			29071	29091		29111		29148	
	0.027			29072	29092		29112		29151	
	0.033			29073	29093		29113		29153	
	0.039			29074	29094		29114		29155	
	0.047			29075	29095		29115		29157	
	0.056			29126	29131		29135		29159	
	0.068			29127	29132		29136		29162	
	0.082			29128	29133		29137		29164	
	0.10			28127	28327	1000	28527	1000	28927	900
	0.12	6.0 x 12.0 x 17.5	1.4	28128	28328	750	28528	500	28928	800
	0.15			28129	28329		28529		28929	
	PITCH = 15.0 mm ± 0.4 mm; d_t = 0.80 mm ± 0.08 mm; C-TOL. = ± 10 %									
	0.18	7.0 x 13.5 x 17.5	1.8	28131	28331	750	28531	500	28931	650
	0.22			28132	28332		28532		28932	
	0.27	8.5 x 15.0 x 17.5	2.4	28133	28333	500	28533	450	28933	600
	0.33			29129	29134		29138		29167	
	PITCH = 15.0 mm ± 0.4 mm; d_t = 0.60 mm ± 0.06 mm; C-TOL. = ± 5 %									
	0.10	5.0 x 11.0 x 17.5	1.0	28227	28427	1000	28627	1000	28947	900
	0.12	6.0 x 12.0 x 17.5	1.4	28228	28428	750	28628	500	28948	800
	0.15			28229	28429		28629		28949	
	PITCH = 15.0 mm ± 0.4 mm; d_t = 0.80 mm ± 0.08 mm; C-TOL. = ± 5 %									
	0.18	7.0 x 13.5 x 17.5	1.8	28231	28431	750	28631	500	28951	650
	0.22	8.5 x 15.0 x 17.5	2.4	28232	28432	750	28632	500	28952	650
	0.27			28233	28433	500	28633	450	28953	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) Weight for short lead product only

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ELECTRICAL DATA AND ORDERING CODE - PITCH 22.5 mm

U_{RAC} (V)	CAP. (µF)	DIMENSIONS w x h x l (mm)	MASS (g) [2]	CATALOG NUMBER BFC2 338 ..... AND PACKAGING						
				LOOSE IN BOX					REEL (500 mm) [1]	
				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 %									
	0.12	6.0 x 15.5 x 26.0	2.4	21124	23124	300	25124	250	29264	600
	0.15			21154	23154		25154		29265	
	0.18			21184	23184	200	25184	250	29266	500
	0.22			21224	23224		25224		29267	
	0.27			21274	23274		25274		29268	
	0.33			21334	23334		25334		29269	
	0.39	7.0 x 16.5 x 26.0	2.9	20394	22394	200	24394	250	27394	450
	0.47			20474	22474		24474		27474	
	0.56	8.5 x 18.0 x 26.0	3.8	20564	22564	200	24564	200	27564	350
	0.68			20684	22684		24684		27684	
	0.82	10.0 x 19.5 x 26.0	6.8	20824	22824	150	24824	200	27824	300
	1.0			20105	22105		24105		27105	
	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	29169	29175	300	29181	250	29271	600
	0.15			29171	29176		29182		29272	
	0.18			29172	29177	200	29183	250	29273	500
	0.22			29173	29178		29184		29274	
	0.27			29174	29179		29185		29275	
	0.33			28134	28334		28534		28934	450
	0.39	7.0 x 16.5 x 26.0	2.9	28135	28335	200	28535	250	28935	450
	0.47			28136	28336		28536	200	28936	350
	0.56	8.5 x 18.0 x 26.0	3.8	28137	28337		28537		28937	
	0.68	10.0 x 19.5 x 26.0	6.8	28138	28338	150	28538		28938	300
	0.82			28139	28339		28539		28939	
	PITCH = 22.5 mm ± 0.4 mm; d_t = 0.80 mm ± 0.08 mm; C-TOL. = ± 5 %									
	0.33	7.0 x 16.5 x 26.0	2.9	28234	28434	200	28634	250	28954	450
	0.39			28235	28435		28635		28955	
	0.47	8.5 x 18.0 x 26.0	3.8	28236	28436	200	28636	200	28956	350
	0.56			28237	28437		28637		28957	
	0.68	10.0 x 19.5 x 26.0	6.8	28238	28438	150	28638	200	28958	300
	0.82	12.0 x 22.0 x 26.0	7.8	28239	28439	150	28639	200	28959	300

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) Weight for short lead product only

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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 338 ..... 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 %							
	0.39	9.0 x 19.0 x 31.5	5.5	21394	23394	100	25394	150
	0.47			21474	23474		25474	
	0.56			21564	23564		25564	125
	0.68			21684	23684		25684	
	0.82			21824	23824		25824	
	1.0	11.0 x 21.0 x 31.0	7.4	21105	23105		25105	
	1.2			20125	22125		24125	
	1.5	13.0 x 23.0 x 31.0	9.2	20155	22155		24155	
	1.8			20185	22185		24185	100
	2.2	15.0 x 25.0 x 31.5	12.3	20225	22225		24225	
	2.7	18.0 x 28.0 x 31.5	16.1	20275	22275	50	24275	75
	3.3			20335	22335		24335	
	PITCH = 27.5 mm ± 0.4 mm; d_t = 0.80 mm ± 0.08 mm; C-TOL. = ± 10 %							
	1.0	11.0 x 21.0 x 31.0	7.4	28141	28341	100	28541	125
	1.2			28142	28342		28542	
	1.5	13.0 x 23.0 x 31.0	9.2	28143	28343		28543	
	1.8	15.0 x 25.0 x 31.5	12.3	28144	28344		28544	100
	2.2			28145	28345	50	28545	75
	2.7	18.0 x 28.0 x 31.5	16.1	28146	28346		28546	
	PITCH = 27.5 mm ± 0.4 mm; d_t = 0.80 mm ± 0.08 mm; C-TOL. = ± 5 %							
	1.0	11.0 x 21.0 x 31.0	7.4	28241	28441	100	28641	125
	1.2	13.0 x 23.0 x 31.0	9.2	28242	28442	100	28642	125
	1.5			28243	28443		28643	
	1.8	15.0 x 25.0 x 31.5	12.3	28244	28444	100	28644	100
	2.2	18.0 x 28.0 x 31.5	16.1	28245	28445	50	28645	75
	2.7			28246	28446		28646	

Notes
- SPQ = Standard Packing Quantity

(1) Weight for short lead product only

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APPROVALS				
SAFETY APPROVALS X2	**VOLTAGE**	**VALUE**	**FILE NUMBERS**	**LINKS**
EN 60384-14 (ENEC) (= IEC 60384-14 ed-4 (2013))	310 V_{AC}	1 nF to 3.3 µF	ENEC16/FI/21/01054/A2	www.vishay.com/doc?28179
UL 60384-14	310 V_{AC}	1 nF to 3.3 µF	E354331	www.vishay.com/doc?28184
CSA-E384-14	310 V_{AC}	1 nF to 3.3 µF	E354331	
CQC	310 V_{AC}	1 nF to 3.3 µF	CQC07001018685 (F)	www.vishay.com/doc?28227
			CQC07001021279 (L)	www.vishay.com/doc?28228
CB-test certificate	310 V_{AC}	1 nF to 3.3 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 ensured that the stand-off pips are in good contact with the printed-circuit board:

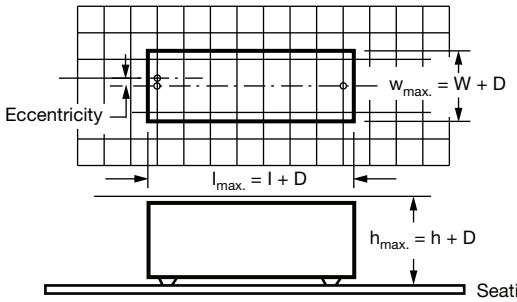
- For pitches ≤ 15 mm capacitors shall be mechanically fixed by the leads
- For longer pitches the capacitors shall be mounted in the same way and the body clamped

Space Requirements on Printed Circuit Board

The maximum space for length ($l_{max.}$), width ($w_{max.}$) and 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

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

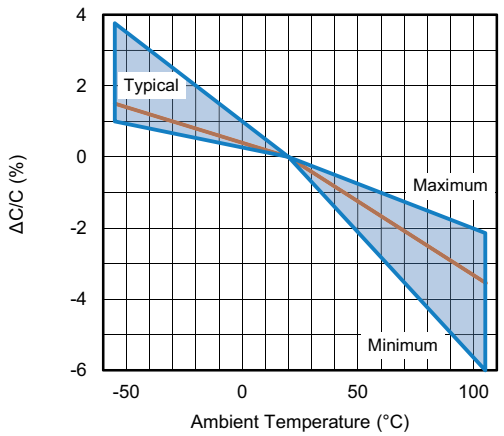
Unless otherwise specified, all electrical values apply to an ambient temperature of 23 °C ± 1 °C, an atmospheric pressure of 86 kPa to 106 kPa and a relative humidity of 50 % ± 2 %.

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 %.

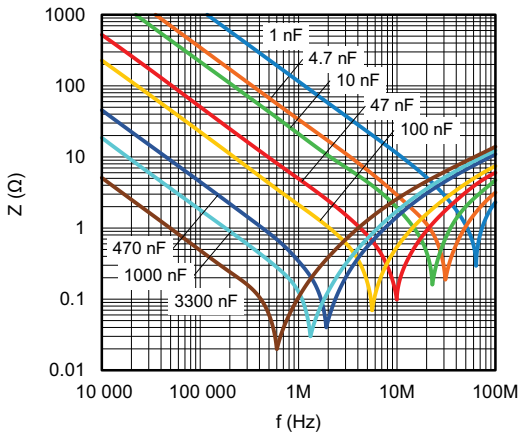
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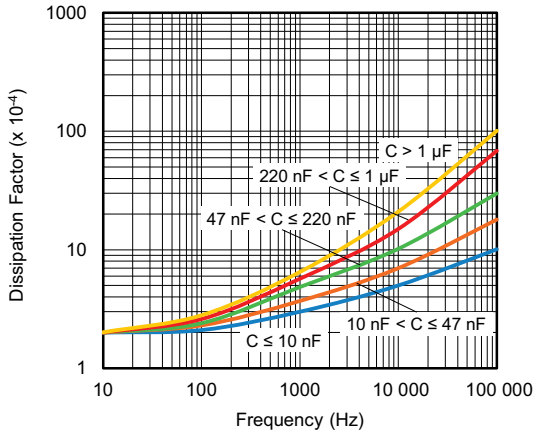
CHARACTERISTICS



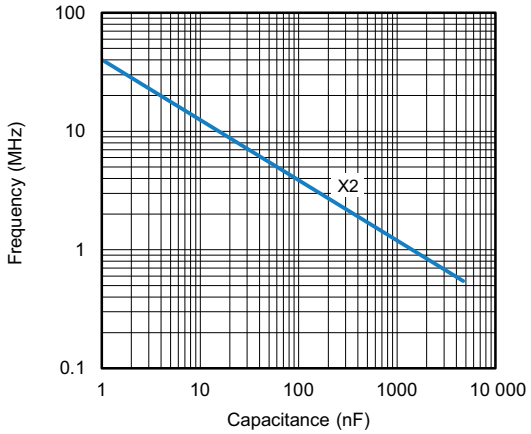
Capacitance as a function of ambient temperature
(typical curve)



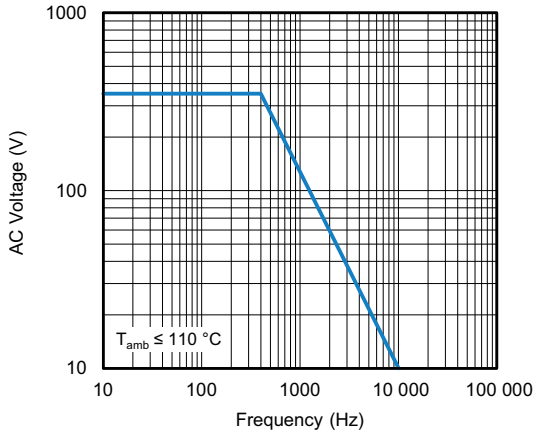
Impedance as a function of frequency
(typical curve)



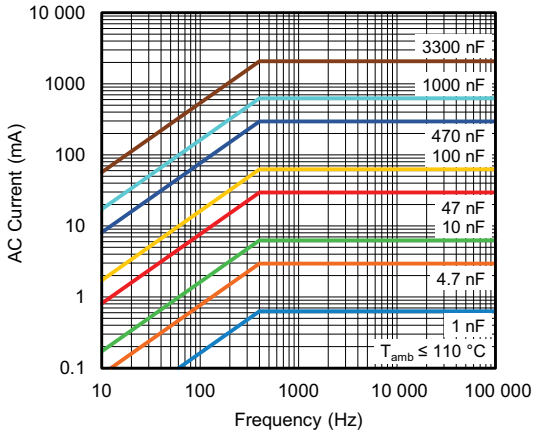
Tangent of loss angle as a function of frequency
(typical curve)



Resonant frequency as a function of capacitance
(typical curve)



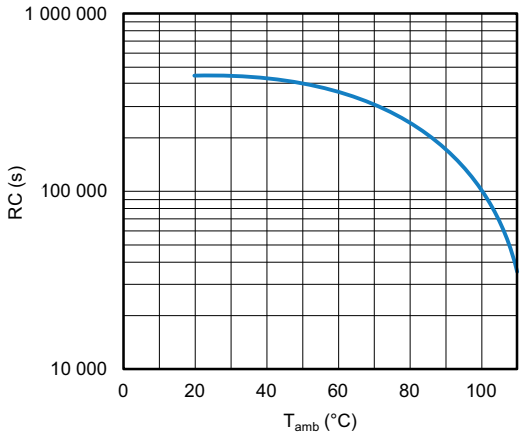
Max. RMS voltage as a function of frequency
(typical curve)



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

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Insulation resistance as a function of ambient temperature

APPLICATION NOTES

- For X2 electromagnetics 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 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 105 °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	

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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: $C \leq 1$ 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 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	
4.20 Solvent resistance of the marking	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 (see note 3.1)	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 (see note 3)	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	$\|\Delta C/C\| \leq 5$ % 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

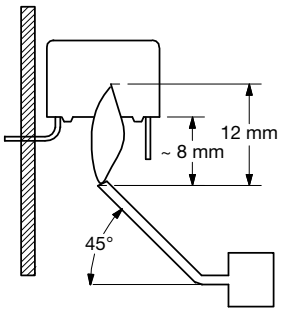
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GROUP C INSPECTION REQUIREMENTS		
SUB-CLAUSE NUMBER AND TEST	**CONDITIONS**	**PERFORMANCE REQUIREMENTS**
SUB-GROUP C1 COMBINED SAMPLE OF SPECIMENS OF SUB-GROUPS C1A AND C1B		
4.11 Climatic sequence		
4.11.1 Initial measurements	Capacitance Measured 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	$\lvert\Delta C/C\rvert \leq 5$ % of the value measured in 4.11.1.
	Tangent of loss angle	Increase of tan δ: ≤ 0.008 for: $C \leq 1$ 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	
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: $C \leq 1$ µF or ≤ 0.005 for: $C > 1$ µF Compared to values measured in 4.12.1.
	Voltage proof 1350 V_{DC}; 1 min between term.	No permanent breakdown or flash-over
	Insulation resistance	≥ 50 % of values specified in section “Insulation Resistance” of this specification

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GROUP C INSPECTION REQUIREMENTS		
SUB-CLAUSE NUMBER AND TEST	**CONDITIONS**	**PERFORMANCE REQUIREMENTS**
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/√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	|ΔC/C| ≤ 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 Charge to 435 V_{DC} Discharge resistance: $R = \frac{435\ V_{DC}}{1.25 \times C\ (dU/dt)}$	
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	|ΔC/C| ≤ 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

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GROUP C INSPECTION REQUIREMENTS		
SUB-CLAUSE NUMBER AND TEST	**CONDITIONS**	**PERFORMANCE REQUIREMENTS**
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: 310 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	$\|\Delta C/C\|$ ≤ 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

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