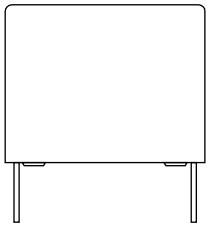
DC Film Capacitors
MKT Radial Potted Type



FEATURES

- 10 mm to 27.5 mm lead pitch
- Supplied loose in box taped on ammopack or reel
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free
RoHS COMPLIANT
HALOGEN FREE

APPLICATIONS

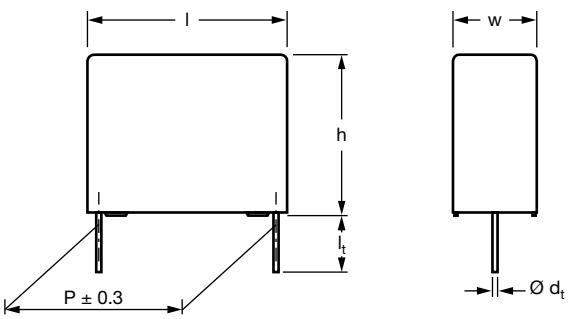
Blocking, coupling, and decoupling, bypass and energy reservoir, industrial, consumer, lighting.

QUICK REFERENCE DATA	
Capacitance range (E12 series)	0.01 µF to 10 µF
Capacitance tolerance	± 10 %, ± 5 %
Climatic testing class according to IEC 60068-1	55/105/56
Maximum application temperature	105 °C
Reference standards	IEC 60384-2
Dielectric	Polyester film
Electrodes	Metallized
Construction	Mono construction
Encapsulation	Flame retardant plastic case and epoxy resin UL-class 94 V-0
Leads	Tinned wire
Marking	C-value; tolerance; rated voltage; manufacturer's symbol; year and week of manufacture; manufacturer's type designation
Rated (DC) voltage	250 V, 400 V, 630 V
Rated (AC) voltage	63 V, 100 V, 160 V
Rated temperature	85 °C
Performance grade	Grade 1 (long life)

Note

- For more detailed data and test requirements, contact dc-film@vishay.com

DIMENSIONS



COMPOSITION OF CATALOG NUMBER

TYPE AND PITCHES	
373 M	10.0 mm
	15.0 mm
	22.5 mm
	27.5 mm

CAPACITANCE (numerically)

Example:
104 = 10 x 10 = 100 nF

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

BFC2	373	XX	YY	Y	M	Z
2222 (*)	373	XX	YY	Y	M	Z

(*) Old ordering number

PITCH (mm)	CODE
10	D
15	F
22.5	I
27.5	K

TYPE	PACKAGING	LEAD CONFIGURATION	PREFERRED TYPES			
			C-TOL.	250 V	400 V	630 V
373 M	Loose in box	Lead length 4.0 + 1.0/- 0.5 mm	± 10 %	EE	FE	GE
			± 5 %	EF	FF	GF
	Taped on reel (1)	H = 18.5 mm; P_0 = 12.7 mm; Reel diameter = 356 mm	± 10 %	EL	FL	GL
			± 5 %	EM	FM	GM
	Ammopack (1)	H = 18.5 mm; P_0 = 12.7 mm	± 10 %	EB	FB	GB
			± 5 %	EC	FC	GC

Note

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

SPECIFIC REFERENCE DATA

DESCRIPTION	VALUE		
Tangent of loss angle:	at 1 kHz	at 10 kHz	at 100 kHz
C ≤ 0.1 µF	≤ 75 x 10^{-4}	≤ 130 x 10^{-4}	≤ 250 x 10^{-4}
0.1 µF < C ≤ 0.47 µF	≤ 75 x 10^{-4}	≤ 130 x 10^{-4}	≤ 300 x 10^{-4}
0.47 µF < C ≤ 1.0 µF	≤ 75 x 10^{-4}	≤ 130 x 10^{-4}	-
1.0 µF < C ≤ 10 µF	≤ 75 x 10^{-4}	≤ 150 x 10^{-4}	-
C > 10 µF	≤ 75 x 10^{-4}	-	-
Rated voltage pulse slope $(dU/dt)_R$ at	250 V_{DC}	400 V_{DC}	630 V_{DC}
$L_{max.}$ = 12.5 mm	20 V/µs	45 V/µs	137 V/µs
$L_{max.}$ = 17.5 mm	11 V/µs	20 V/µs	44 V/µs
$L_{max.}$ = 26.0 mm	7 V/µs	10 V/µs	17 V/µs
$L_{max.}$ = 30.0 mm	5 V/µs	8 V/µs	12 V/µs
R between leads, for C ≤ 0.33 µF at 100 V; 1 min	> 30 000 MΩ	> 30 000 MΩ	-
R between leads, for C ≤ 0.33 µF at 500 V; 1 min	-	-	> 30 000 MΩ
RC between leads, for C > 0.33 µF at 100 V; 1 min	> 10 000 s	> 10 000 s	-
RC between leads, for C > 0.33 µF at 500 V; 1 min	-	-	> 10 000 s
R between interconnecting leads and casing, 100 V; 1 min	> 30 000 MΩ		
Withstanding (DC) voltage (cut off current 10 mA) (1); rise time ≤ 1000 V/s:	250 V_{DC}	400 V_{DC}	630 V_{DC}
	400 V; 1 min	640 V; 1 min	1008 V; 1 min
Withstanding (DC) voltage between leads and case for	250 V_{DC}	400 V_{DC}	630 V_{DC}
	500 V; 1 min	800 V; 1 min	1260 V; 1 min
Maximum application temperature	105 °C		

Note

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

ELECTRICAL DATA AND ORDERING INFORMATION

U_{RDC} (V)	CAP. (µF)	DIMENSIONS w x h x l (mm)	MASS (g) [3]	CATALOG NUMBER BFC2 373 XXYYYMZ AND PACKAGING						C-VALUE ..YYY	PITCH mm CODE MZ
				LOOSE IN BOX		REEL [1][2]		AMMOPACK [2]			
				l_t = 4.0 mm + 1.0 mm/ - 0.5 mm		H = 18.5 mm; P_0 = 12.7 mm		H = 18.5 mm; P_0 = 12.7 mm			
				C-TOL. = ± 10 %	C-TOL. = ± 5 %	C-TOL. = ± 10 %	C-TOL. = ± 5 %	C-TOL. = ± 10 %	C-TOL. = ± 5 %		
				XX (SPQ)	XX (SPQ)	XX (SPQ)	XX (SPQ)	XX (SPQ)	XX (SPQ)		
250	**PITCH = 10.0 mm ± 0.40 mm; d_t = 0.60 mm ± 0.06 mm (U_{RAC} = 63 V)**										
	0.10	4.0 x 10.0 x 12.5	0.65	EE... (1000)	EF... (1000)	EL... (1400)	EM... (1400)	EB... (750)	EC... (750)	104	MD
	0.12									124	MD
	0.15									154	MD
	0.18									184	MD
	0.22									224	MD
	0.27									274	MD
	0.33	5.0 x 11.0 x 12.5	0.87	EE... (1000)	EF... (1000)	EL... (1100)	EM... (1100)	EB... (600)	EC... (600)	334	MD
	0.39									394	MD
	0.47	6.0 x 12.0 x 12.5	1.15	EE... (750)	EF... (750)	EL... (900)	EM... (900)	EB... (500)	EC... (500)	474	MD
	0.56									564	MD
	PITCH = 15.0 mm ± 0.40 mm; d_t = 0.60 mm ± 0.06 mm (U_{RAC} = 63 V)										
	0.56	5.0 x 11.0 x 17.5	1.1	EE... (1000)	EF... (1000)	EL... (1100)	EM... (1100)	Not available		564	MF
	0.68	6.0 x 12.0 x 17.5	1.5	EE... (1000)	EF... (1000)	EL... (900)	EM... (900)			684	MF
	0.82									824	MF
	PITCH = 15.0 mm ± 0.40 mm; d_t = 0.80 mm ± 0.08 mm (U_{RAC} = 63 V)										
	1.0	7.0 x 13.5 x 17.5	2.0	EE... (1000)	EF... (1000)	EL... (800)	EM... (800)	Not available		105	MF
	1.2	8.5 x 15.0 x 17.5	2.7	EE... (1000)	EF... (1000)	EL... (650)	EM... (650)			125	MF
	1.5									155	MF
	1.8	10.0 x 16.5 x 17.5	3.5	EE... (500)	EF... (500)	EL... (600)	EM... (600)			185	MF
	PITCH = 22.5 mm ± 0.40 mm; d_t = 0.80 mm ± 0.08 mm (U_{RAC} = 63 V)										
	2.2	8.5 x 18.0 x 26.0	4.5	EE... (200)	EF... (200)	EL... (450)	EM... (450)	Not available		225	MI
	2.7									275	MI
	3.3									335	MI
	3.9	10.0 x 19.5 x 26.0	5.7	EE... (200)	EF... (200)	EL... (350)	EM... (350)			395	MI
	4.7									475	MI
	5.6									565	MI
	6.8	12.0 x 22.0 x 26.0	7.8	EE... (150)	EF... (150)	EL... (300)	EM... (300)			685	MI
	8.2									825	MI
	PITCH = 27.5 mm ± 0.40 mm; d_t = 0.80 mm ± 0.08 mm (U_{RAC} = 63 V)										
	6.8	13.0 x 23.0 x 31.0	10.4	EE... (100)	EF... (100)	Not available		Not available		685	MK
	8.2	15.0 x 25.0 x 31.5	12.8	EE... (100)	EF... (100)					825	MK
	10.0									106	MK
	15.0	18.0 x 28.0 x 31.5	18.4	EE... (100)	EF... (100)					156	MK

ELECTRICAL DATA AND ORDERING INFORMATION

U_{RDC} (V)	CAP. (µF)	DIMENSIONS w x h x l (mm)	MASS (g) [3]	CATALOG NUMBER BFC2 373 XXYYYMZ AND PACKAGING						C-VALUE ..YYY	PITCH mm CODE MZ
				LOOSE IN BOX		REEL [1][2]		AMMOPACK [2]			
				l_t = 4.0 mm + 1.0 mm/ - 0.5 mm		H = 18.5 mm; P_0 = 12.7 mm		H = 18.5 mm; P_0 = 12.7 mm			
				C-TOL. = ± 10 %	C-TOL. = ± 5 %	C-TOL. = ± 10 %	C-TOL. = ± 5 %	C-TOL. = ± 10 %	C-TOL. = ± 5 %		
				XX (SPQ)	XX (SPQ)	XX (SPQ)	XX (SPQ)	XX (SPQ)	XX (SPQ)		
400	**PITCH = 10.0 mm ± 0.40 mm; d_t = 0.60 mm ± 0.06 mm (U_{RAC} = 100 V)**										
	0.082	4.0 x 10.0 x 12.5	0.65	FE... (1000)	FF... (1000)	FL... (1400)	FM... (1400)	FB... (750)	FC... (750)	823	MD
	0.10									104	MD
	0.12									124	MD
	0.15									154	MD
	0.18	5.0 x 11.0 x 12.5	0.87	FE... (1000)	FF... (1000)	FL... (1100)	FM... (1100)	FB... (600)	FC... (600)	184	MD
	0.22									224	MD
	0.27									274	MD
	0.33	6.0 x 12.0 x 12.5	1.15	FE... (750)	FF... (750)	FL... (900)	FM... (900)	FB... (500)	FC... (500)	334	MD
	PITCH = 15.0 mm ± 0.40 mm; d_t = 0.60 mm ± 0.06 mm (U_{RAC} = 100 V)										
	0.27	5.0 x 11.0 x 17.5	1.1	FE... (1000)	FF... (1000)	FL... (1100)	FM... (1100)	Not available		274	MF
	0.33									334	MF
	0.39									394	MF
	0.47	6.0 x 12.0 x 17.5	1.5	FE... (1000)	FF... (1000)	FL... (900)	FM... (900)			474	MF
	0.56									564	MF
	PITCH = 15.0 mm ± 0.40 mm; d_t = 0.80 mm ± 0.08 mm (U_{RAC} = 100 V)										
	0.68	7.0 x 13.5 x 17.5	2.0	FE... (1000)	FF... (1000)	FL... (800)	FM... (800)	Not available		684	MF
	0.82	8.5 x 15.0 x 17.5	2.7	FE... (1000)	FF... (1000)	FL... (650)	FM... (650)			824	MF
	1.0									105	MF
	1.2									125	MF
	1.5	10.0 x 16.5 x 17.5	3.5	FE... (500)	FF... (500)	FL... (600)	FM... (600)			155	MF
	PITCH = 22.5 mm ± 0.40 mm; d_t = 0.80 mm ± 0.08 mm (U_{RAC} = 100 V)										
	1.0	7.0 x 16.5 x 26.0	3.3	FE... (200)	FF... (200)	FL... (450)	FM... (450)	Not available		105	MI
	1.2									125	MI
	1.5									155	MI
	1.8	8.5 x 18.0 x 26.0	4.5	FE... (200)	FF... (200)	FL... (450)	FM... (450)			185	MI
	2.2									225	MI
	2.7	10.0 x 19.5 x 26.0	5.7	FE... (200)	FF... (200)	FL... (350)	FM... (350)			275	MI
	3.3									335	MI
	3.9	12.0 x 22.0 x 26.0	7.8	FE... (150)	FF... (150)	FL... (300)	FM... (300)			395	MI
	PITCH = 27.5 mm ± 0.40 mm; d_t = 0.80 mm ± 0.08 mm (U_{RAC} = 100 V)										
	2.7	9.0 x 19.0 x 31.5	5.5	FE... (100)	FF... (100)	Not available		Not available		275	MK
	3.3	11.0 x 21.0 x 31.0	7.8	FE... (100)	FF... (100)					335	MK
	3.9	13.0 x 23.0 x 31.0	10.4	FE... (100)	FF... (100)					395	MK

ELECTRICAL DATA AND ORDERING INFORMATION

U_{RDC} (V)	CAP. (µF)	DIMENSIONS w x h x l (mm)	MASS (g) [3]	CATALOG NUMBER BFC2 373 XXYYYMZ AND PACKAGING						C-VALUE ..YYY	PITCH mm CODE MZ
				LOOSE IN BOX		REEL [1][2]		AMMOPACK [2]			
				l_t = 4.0 mm + 1.0 mm/ - 0.5 mm		H = 18.5 mm; P_0 = 12.7 mm		H = 18.5 mm; P_0 = 12.7 mm			
				C-TOL. = ± 10 %	C-TOL. = ± 5 %	C-TOL. = ± 10 %	C-TOL. = ± 5 %	C-TOL. = ± 10 %	C-TOL. = ± 5 %		
				XX (SPQ)	XX (SPQ)	XX (SPQ)	XX (SPQ)	XX (SPQ)	XX (SPQ)		
630	PITCH = 10.0 mm ± 0.40 mm; d_t = 0.60 mm ± 0.06 mm (U_{RAC} = 160 V)										
	0.010	4.0 x 10.0 x 12.5	0.65	GE... (1000)	GF... (1000)	GL... (1400)	GM... (1400)	GB... (750)	GC... (750)	103	MD
	0.012									123	MD
	0.015									153	MD
	0.018									183	MD
	0.022									223	MD
	0.027									273	MD
	0.033									333	MD
	0.039									393	MD
	0.047									473	MD
	0.056									563	MD
	0.068	5.0 x 11.0 x 12.5	0.87	GE... (1000)	GF... (1000)	GL... (1100)	GM... (1100)	GB... (600)	GC... (600)	683	MD
	0.082									823	MD
	0.100	6.0 x 12.0 x 12.5	1.15	GE... (750)	GF... (750)	GL... (900)	GM... (900)	GB... (500)	GC... (500)	104	MD
	PITCH = 15.0 mm ± 0.40 mm; d_t = 0.60 mm ± 0.06 mm (U_{RAC} = 160 V)										
	0.082	5.0 x 11.0 x 17.5	1.1	GE... (1000)	GF... (1000)	GL... (1100)	GM... (1100)	Not available		823	MF
	0.100									104	MF
	0.120									124	MF
	0.150	6.0 x 12.0 x 17.5	1.5	GE... (1000)	GF... (1000)	GL... (900)	GM... (900)			154	MF
	0.180									184	MF
	PITCH = 15.0 mm ± 0.40 mm; d_t = 0.80 mm ± 0.08 mm (U_{RAC} = 160 V)										
	0.22	7.0 x 13.5 x 17.5	2.0	GE... (1000)	GF... (1000)	GL... (800)	GM... (800)	Not available		224	MF
	0.27	8.5 x 15.0 x 17.5	2.7	GE... (1000)	GF... (1000)	GL... (650)	GM... (650)			274	MF
	0.33									334	MF
	0.39									394	MF
	0.47	10.0 x 16.5 x 17.5	3.5	GE... (500)	GF... (500)	GL... (600)	GM... (600)			474	MF
	PITCH = 22.5 mm ± 0.40 mm; d_t = 0.80 mm ± 0.08 mm (U_{RAC} = 160 V)										
	0.33	8.5 x 18.0 x 26.0	4.5	GE... (200)	GF... (200)	GL... (450)	GM... (450)	Not available		334	MI
	0.39									394	MI
	0.47									474	MI
	0.56									564	MI
	0.68									684	MI
	0.82									824	MI
	1.00	10.0 x 19.5 x 26.0	5.7	GE... (200)	GF... (200)	GL... (350)	GM... (350)			105	MI
	1.20	12.0 x 22.0 x 26.0	7.8	GE... (150)	GF... (150)	GL... (300)	GM... (300)			125	MI
	PITCH = 27.5 mm ± 0.40 mm; d_t = 0.80 mm ± 0.08 mm (U_{RAC} = 160 V)										
	0.82	9.0 x 19.0 x 31.5	5.5	GE... (100)	GF... (100)	Not available		Not available		824	MK
	1.00	11.0 x 21.0 x 31.0	7.8	GE... (100)	GF... (100)					105	MK
	1.20									125	MK

Notes

- SPQ = Standard Packing Quantity

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

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

(3) Weight for short lead product only

MOUNTING

Normal Use

The capacitors are designed for mounting on printed-circuit boards. The capacitors packed in bandoliers are designed for mounting in printed-circuit boards by means of automatic insertion machines.

For detailed tape specifications refer to type detail 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 underside of this product is 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

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 %.

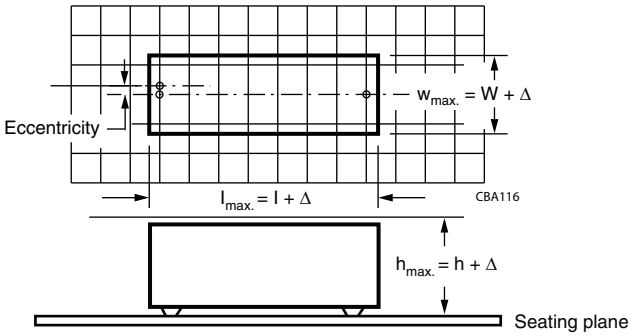
For reference testing, a conditioning period shall be applied over 96 h ± 4 h by heating the products in a circulating air oven at the rated temperature and a relative humidity not exceeding 20 %.

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 and $\Delta h = 0.1$ mm
- For products with 15 mm < pitch ≤ 27.5 mm, $\Delta w = \Delta l = 0.5$ mm and $\Delta h = 0.1$ mm

Eccentricity defined as in drawing. The maximum eccentricity is smaller than or equal to the lead diameter of the product concerned.



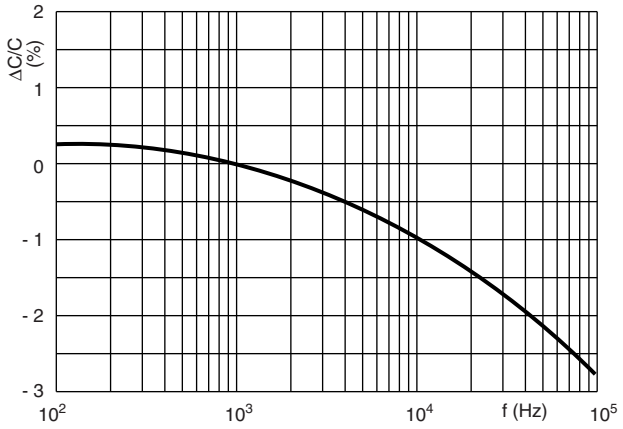
SOLDERING CONDITIONS

For general soldering conditions and wave soldering profile, we refer to the application note:
"Soldering Guidelines for Film Capacitors": www.vishay.com/doc?28171

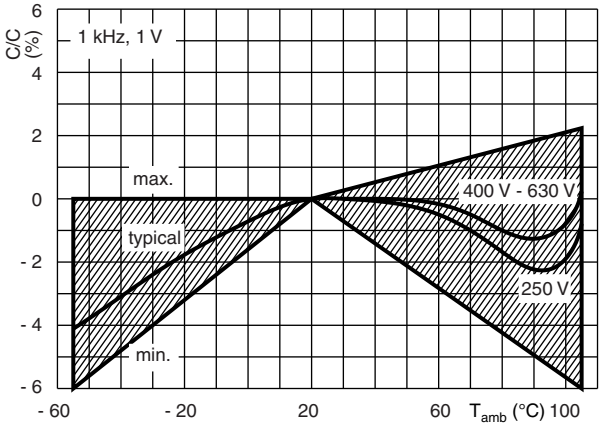
Storage Temperature

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

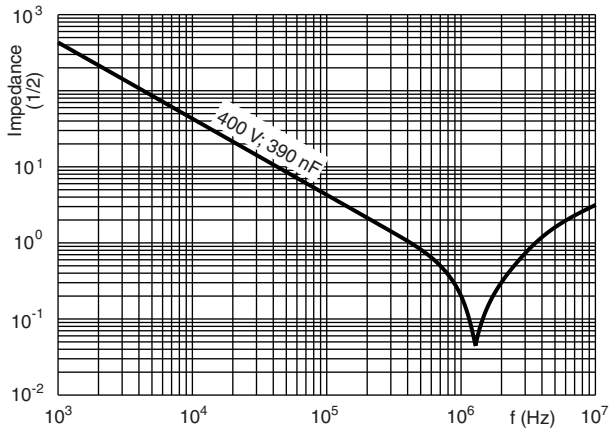
CHARACTERISTICS



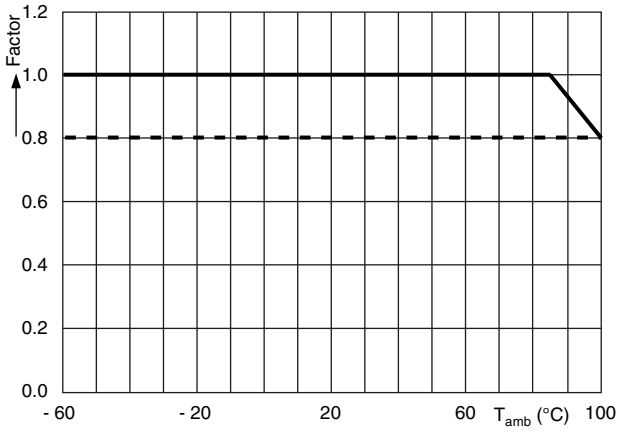
Capacitance as a function of frequency



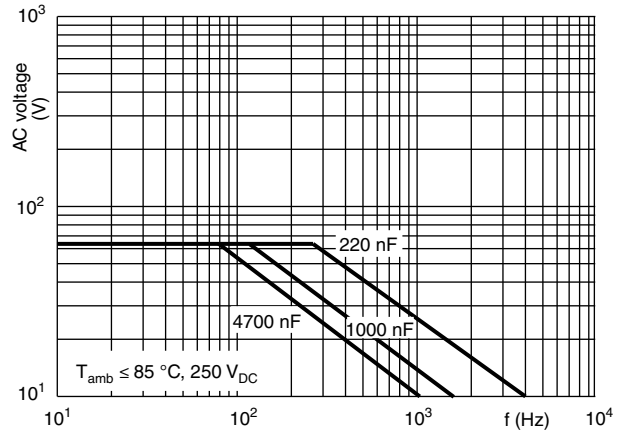
Capacitance as a function of ambient temperature



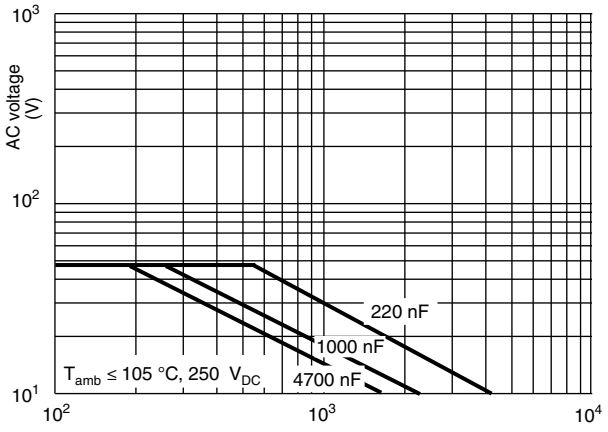
Impedance as a function of frequency



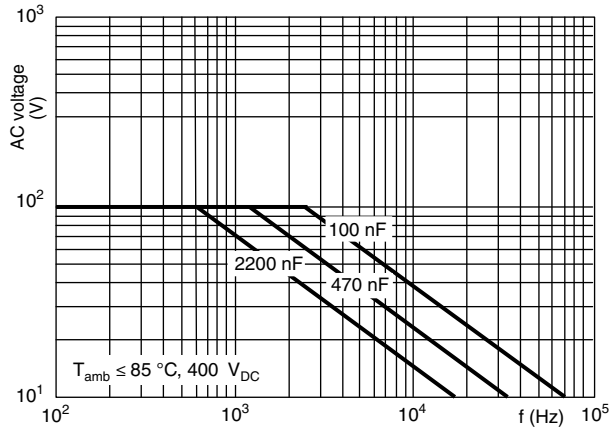
Max. DC and AC voltage as a function of temperature



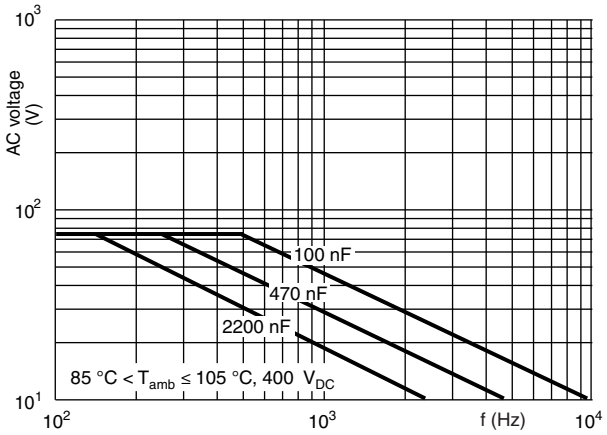
Max. RMS voltage and AC current (sinewave)



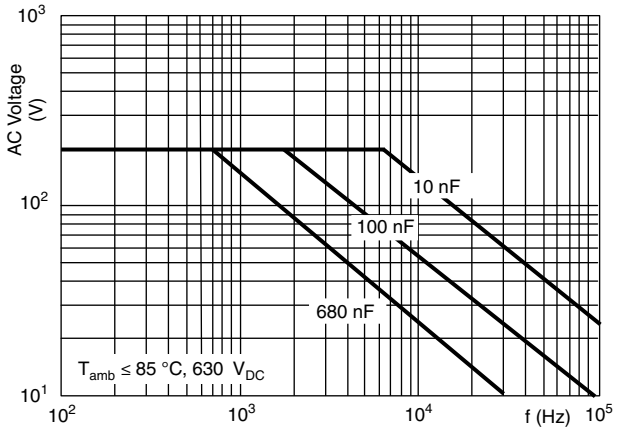
Max. RMS voltage and AC current (sinewave)



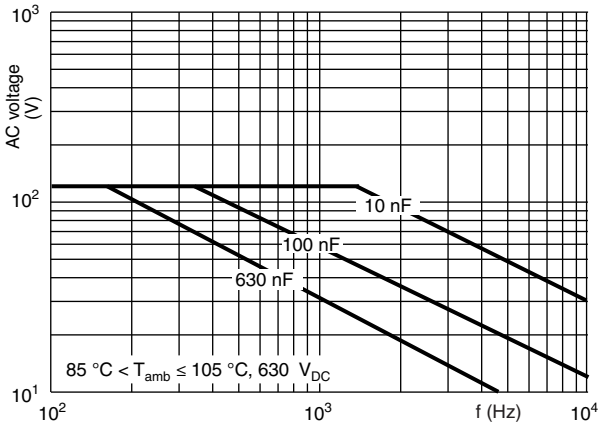
Max. RMS voltage and AC current (sinewave)



Max. RMS voltage and AC current (sinewave)



Max. RMS voltage and AC current (sinewave)

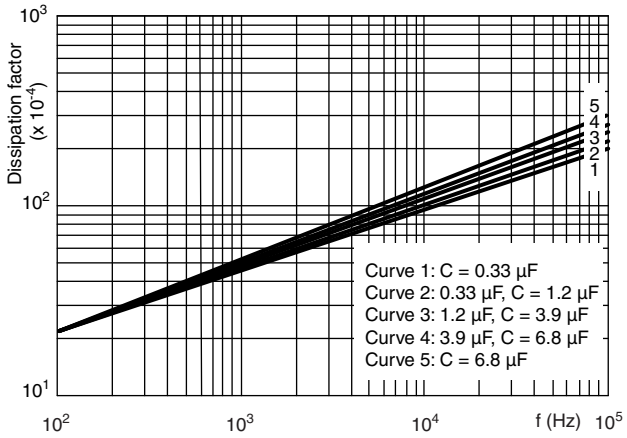


Max. RMS voltage and AC current (sinewave)

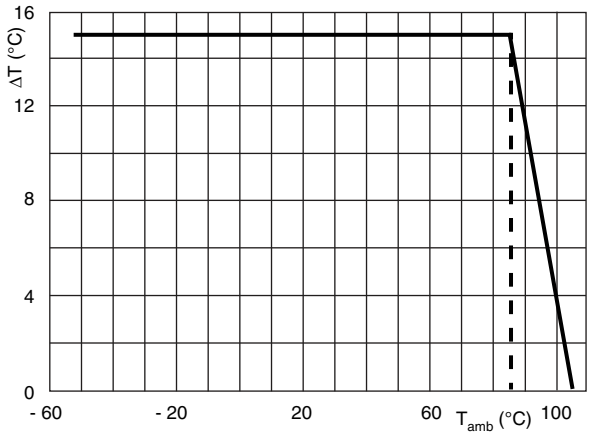
Maximum RMS Current (Sinewave) as a Function of Frequency

The maximum RMS current is defined by $I_{AC} = \omega \times C \times U_{AC}$.

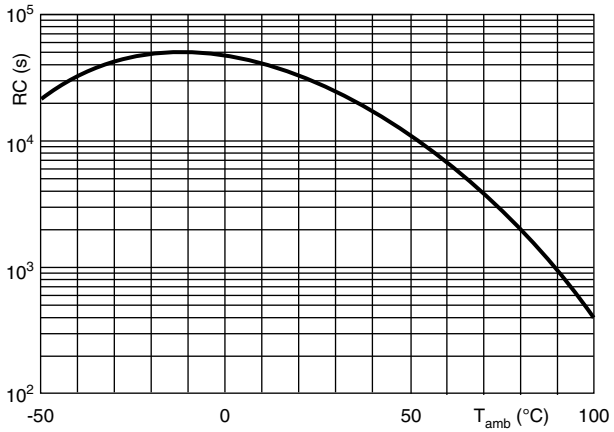
U_{AC} is the maximum AC voltage depending on the ambient temperature in the curves “Max. RMS voltage and AC current as a function of frequency”.



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



Maximum allowed component temperature rise (ΔT) as a function of the ambient temperature (T_{amb})



Insulation resistance as a function of the ambient temperature (typical curve)

HEAT CONDUCTIVITY (G) AS A FUNCTION OF (ORIGINAL) PITCH AND CAPACITOR BODY THICKNESS IN mW/°C

$W_{max.}$ (mm)	HEAT CONDUCTIVITY (mW/°C)			
	PITCH 10 mm	PITCH 15 mm	PITCH 22.5 mm	PITCH 27.5 mm
4.0	6.0	-	-	-
4.5	-	-	-	-
5.0	7.5	10	-	-
6.0	9.0	11	19	-
7.0	-	12	21	-
8.5	-	16	25	-
10.0	-	18	28	-
11.0	-	-	-	36
12.0	-	-	34	-
13.0	-	-	-	42
15.0	-	-	-	48
18.0	-	-	-	57

POWER DISSIPATION AND MAXIMUM COMPONENT TEMPERATURE RISE

The power dissipation must be limited in order not to exceed the maximum allowed component temperature rise as a function of the free ambient temperature.

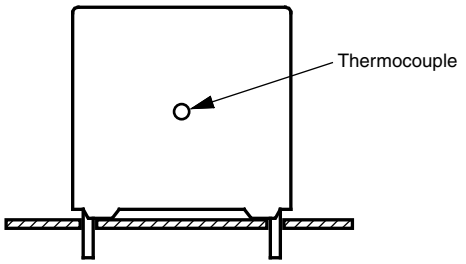
The power dissipation can be calculated according type detail specification “HQN-384-01/101: Technical Information Film Capacitors”, www.vishay.com/doc?28147.

The component temperature rise (ΔT) can be measured (see section “Measuring the component temperature” for more details) or calculated by ΔT = P/G:

- ΔT = component temperature rise (°C)
- P = power dissipation of the component (mW)
- G = heat conductivity of the component (mW/°C)

MEASURING THE COMPONENT TEMPERATURE

A thermocouple must be attached to the capacitor body as in:



The temperature is measured in unloaded (T_{amb}) and maximum loaded condition (T_C).

The temperature rise is given by $\Delta T = T_C - T_{amb}$.

To avoid radiation or convection, the capacitor should be tested in a wind-free box.

APPLICATION NOTE AND LIMITING CONDITIONS

These capacitors are not suitable for mains applications as across-the-line capacitors.

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: dc-film@vishay.com

To select the capacitor for a certain application, the following conditions must be checked:

1. The peak voltage (U_P) shall not be greater than the rated DC voltage (U_{RDC})
2. The peak-to-peak voltage (U_{P-P}) shall not be greater than $2\sqrt{2} \times U_{RAC}$ to avoid the ionization inception level
3. The voltage peak slope (dU/dt) shall not exceed the rated voltage pulse slope in an RC-circuit at rated voltage and without ringing. If the pulse voltage is lower than the rated DC voltage, the rated voltage pulse slope may be multiplied by U_{RDC} and divided by the applied voltage.
   For all other pulses following equation must be fulfilled:
   $$2 \times \int_0^T \left(\frac{dU}{dt}\right)^2 \times dt < U_{RDC} \times \left(\frac{dU}{dt}\right)_{rated}$$
   T is the pulse duration.
   The rated voltage pulse slope is valid for ambient temperatures up to 85 °C. For higher temperatures a derating factor of 3 % per K shall be applied.
4. The maximum component surface temperature rise must be lower than the limits (see figure Max. Allowed Component Temperature Rise).
5. Since in circuits used at voltages over 280 V peak-to-peak the risk for an intrinsically active flammability after a capacitor breakdown (short circuit) increases, it is recommended that the power to the component is limited to 100 times the values mentioned in the table: “Heat Conductivity”
6. When using these capacitors as across-the-line capacitor in the input filter for mains applications the applicant must guarantee that the following conditions are fulfilled in any case (spikes and surge voltages from the mains included).
7. For continuous use as series connection with an impedance to the mains, please refer to application note www.vishay.com/doc?28153.

VOLTAGE CONDITIONS FOR 6 ABOVE		
ALLOWED VOLTAGES	**$T_{amb} \leq 85$ °C**	**85 °C < $T_{amb} \leq 105$ °C**
Maximum continuous RMS voltage	U_{RAC}	0.8 x U_{RAC}
Maximum temperature RMS-overvoltage (< 24 h)	1.25 x U_{RAC}	1.0 x U_{RAC}
Maximum peak voltage (V_{O-P}) (< 2 s)	1.6 x U_{RDC}	1.3 x U_{RDC}

INSPECTION REQUIREMENTS

General Notes

Sub-clause numbers of tests and performance requirements refer to the “Sectional Specification, Publication IEC 60384-2 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 chapter “General Data” of this specification
4.3.1 Initial measurements	Capacitance at 1 kHz Tangent of loss angle: for C ≤ 470 nF at 100 kHz or for C > 470 nF at 10 kHz	
4.3 Robustness of terminations	Tensile and bending	No visible damage
4.4 Resistance to soldering heat	Method: 1A Solder bath: 280 °C ± 5 °C Duration: 10 s	
4.14 Component solvent resistance	Isopropylalcohol at room temperature Method: 2 Immersion time: 5 min ± 0.5 min Recovery time: min. 1 h, max. 2 h	
4.4.2 Final measurements	Visual examination	No visible damage Legible marking
	Capacitance	$\lvert\Delta C/C\rvert \leq 2$ % of the value measured initially
	Tangent of loss angle	Increase of tan δ: ≤ 0.005 for: C ≤ 100 nF or ≤ 0.010 for: 100 nF < C ≤ 220 nF or ≤ 0.015 for: 220 nF < C ≤ 470 nF and ≤ 0.003 for: C > 470 nF Compared to values measured in 4.3.1
SUB-GROUP C1B PART OF SAMPLE OF SUB-GROUP C1		
4.6.1 Initial measurements	Capacitance at 1 kHz Tangent of loss angle: for C ≤ 470 nF at 100 kHz or for C > 470 nF at 10 kHz	
4.6 Rapid change of temperature	θA = lower category temperature θB = upper category temperature 5 cycles Duration t = 30 min	
	Visual examination	No visible damage

GROUP C INSPECTION REQUIREMENTS		
SUB-CLAUSE NUMBER AND TEST	**CONDITIONS**	**PERFORMANCE REQUIREMENTS**
SUB-GROUP C1B PART OF SAMPLE OF SUB-GROUP C1		
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” of this specification Pulse shape: half sine Acceleration: 490 m/s² Duration of pulse: 11 ms	
4.9.3 Final measurements	Visual examination	No visible damage
	Capacitance	$\lvert\Delta C/C\rvert \leq 5$ % of the value measured in 4.6.1
	Tangent of loss angle	Increase of tan δ: ≤ 0.005 for: C ≤ 100 nF or ≤ 0.010 for: 100 nF < C ≤ 220 nF or ≤ 0.015 for: 220 nF < C ≤ 470 nF and ≤ 0.003 for: C > 470 nF Compared to values measured in 4.6.1
	Insulation resistance	As specified in section “Specific Reference Data” of this specification
SUB-GROUP C1 COMBINED SAMPLE OF SPECIMENS OF SUB-GROUPS C1A AND C1B		
4.10 Climatic sequence		
4.10.2 Dry heat	Temperature: upper category temperature Duration: 16 h	
4.10.3 Damp heat cyclic Test Db, first cycle		
4.10.4 Cold	Temperature: lower category temperature Duration: 2 h	
4.10.6 Damp heat cyclic Test Db, remaining cycles		
4.10.6.2 Final measurements	Visual examination	No visible damage Legible marking
	Capacitance	$\lvert\Delta C/C\rvert \leq 5$ % of the value measured in 4.4.2 or 4.9.3
	Tangent of loss angle	Increase of tan δ: ≤ 0.007 for: C ≤ 100 nF or ≤ 0.010 for: 100 nF < C ≤ 220 nF or ≤ 0.015 for: 220 nF < C ≤ 470 nF and ≤ 0.005 for: C > 470 nF Compared to values measured in 4.3.1 or 4.6.1
	Insulation resistance	≥ 50 % of values specified in section “Specific Reference Data” of this specification

GROUP C INSPECTION REQUIREMENTS		
SUB-CLAUSE NUMBER AND TEST	**CONDITIONS**	**PERFORMANCE REQUIREMENTS**
SUB-GROUP C2		
4.11 Damp heat steady state	56 days, 40 °C, 90 % to 95 % RH	
4.11.1 Initial measurements	Capacitance at 1 kHz Tangent of loss angle at 1 kHz	
4.11.3 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 $\delta \leq 0.005$ Compared to values measured in 4.11.1
	Insulation resistance	≥ 50 % of values specified in section “Specific Reference Data” of this specification
SUB-GROUP C3		
4.12 Endurance	Duration: 2000 h 1.25 x U_{RDC} at 85 °C 1.0 x U_{RDC} at 105 °C	
4.12.1 Initial measurements	Capacitance at 1 kHz Tangent of loss angle: for C ≤ 470 nF at 100 kHz or for C > 470 nF at 10 kHz	
4.12.5 Final measurements	Visual examination	No visible damage Legible marking
	Capacitance	$\lvert\Delta C/C\rvert \leq 5$ % compared to values measured in 4.12.1
	Tangent of loss angle	Increase of tan δ: ≤ 0.005 for: C ≤ 100 nF or ≤ 0.010 for: 100 nF < C ≤ 220 nF or ≤ 0.015 for: 220 nF < C ≤ 470 nF and ≤ 0.003 for: C > 470 nF Compared to values measured in 4.12.1
	Insulation resistance	≥ 50 % of values specified in section “Specific Reference Data” of this specification
SUB-GROUP C4		
4.13 Charge and discharge	10 000 cycles Charged to U_{RDC} Discharge resistance: $R = \frac{U_R}{C \times 2.5 \times (dU/dt)_R}$	
4.13.1 Initial measurements	Capacitance at 1 kHz Tangent of loss angle: for C ≤ 470 nF at 100 kHz or for C > 470 nF at 10 kHz	
4.13.3 Final measurements	Capacitance	$\lvert\Delta C/C\rvert \leq 3$ % compared to values measured in 4.13.1
	Tangent of loss angle	Increase of tan δ: ≤ 0.005 for: C ≤ 100 nF or ≤ 0.010 for: 100 nF < C ≤ 220 nF or ≤ 0.015 for: 220 nF < C ≤ 470 nF and ≤ 0.003 for: C > 470 nF Compared to values measured in 4.13.1
	Insulation resistance	≥ 50 % of values specified in section “Specific Reference Data” of this specification

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