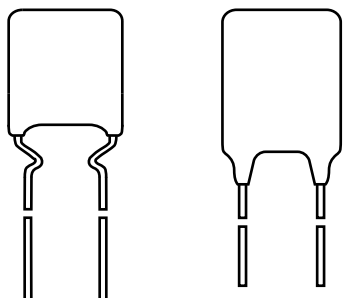


DC Film Capacitor MKT Radial Lacquered Type



FEATURES

- Available taped and loose in box
- Material categorization:
for definitions of compliance please see
www.vishay.com/doc?99912


RoHS
COMPLIANT

APPLICATIONS

Blocking and coupling, bypass and energy reservoir.

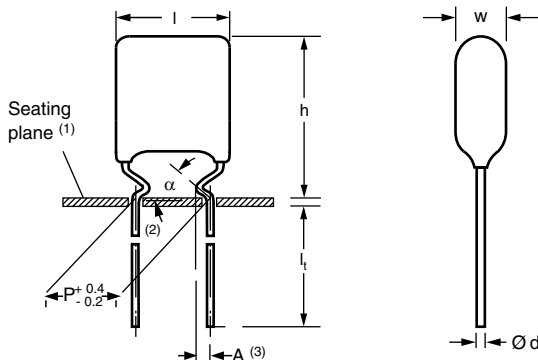
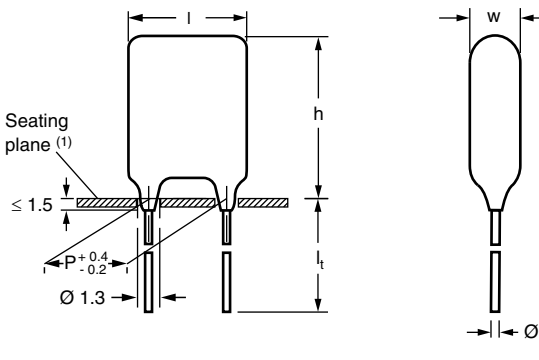
QUICK REFERENCE DATA

Capacitance range (E12 series)	366: 0.0033 μ F to 1.0 μ F 367: 0.0033 μ F to 1.0 μ F
Capacitance tolerance	$\pm 10\%$, $\pm 5\%$
Climatic testing class according to IEC 60068-1	55/105/56
Maximum application temperature	105 °C
Reference specifications	IEC 60384-2
Dielectric	Polyester film
Electrodes	Metallized
Construction	Mono construction
Encapsulation	Flame retardant epoxy material UL-class 94 V-0
Leads	Tinned wire
Marking	C-value; rated voltage; tolerance
Rated temperature	85 °C
Rated (DC) voltage	63 V _{DC} , 100 V _{DC} , 250 V _{DC} , 400 V _{DC}
Rated (AC) voltage	40 V _{AC} , 63 V _{AC} , 160 V _{AC} , 220 V _{AC}

Note

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

DIMENSIONS in millimeters

MKT366 KINKED LEADS	MKT367 STRAIGHT LEADS
	

Notes

- (1) Hole $\varnothing 1.0$ for $d_t = 0.5$ mm
- (2) $0 \leq \alpha < 50^\circ$
- (3) $A = 1.7 \text{ mm} \pm 0.3 \text{ mm}$

**COMPOSITION OF CATALOG NUMBER: MKT366**

TYPE AND PITCHES		CAPACITANCE (numerically)			MULTIPLIER (nF)	
366	7.5 mm				0.1	2
					1	3
					10	4
					100	5
		Example: 104 = 10 x 10 = 100 nF				
		BFC2	366	XX	YY	Y
		2222 (*)	366	XX	YY	Y
		(*) Old ordering number				

TYPE	PACKAGING	LEAD CONFIGURATION	PREFERRED TYPES				
			C-TOL.	63 V	100 V	250 V	400 V
Pitch = 7.5 mm							
366	Loose in box	Kinked; Lead length 4.0 mm + 1.0 mm /- 0.5 mm	± 10 %	15	25	45	55
			± 5 %	16	26	46	56
		Kinked; Lead length 17.0 mm ± 4.0 mm	± 10 %	11	21	41	51
			± 5 %	12	22	42	52
	Ammopack ⁽¹⁾	Kinked; H = 16.0 mm; P ₀ = 12.7 mm	± 10 %	13	23	43	53
			± 5 %	17	27	47	57

Note

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

SPECIFIC REFERENCE DATA: MKT366				
DESCRIPTION	VALUE			
Tangent of loss angle:	at 1 kHz	at 10 kHz	at 100 kHz	
C ≤ 0.47 μF	≤ 75 x 10 ⁻⁴	≤ 130 x 10 ⁻⁴	≤ 225 x 10 ⁻⁴	
C > 0.47 μF	≤ 75 x 10 ⁻⁴	≤ 130 x 10 ⁻⁴	-	
Rated voltage pulse slope (dU/dt) _R at	63 V _{DC}	100 V _{DC}	250 V _{DC}	400 V _{DC}
	110 V/μs	110 V/μs	130 V/μs	170 V/μs
R between leads, for C ≤ 0.33 μF at 10 V; 1 min at 100 V; 1 min	> 15 000 MΩ	> 15 000 MΩ	> 30 000 MΩ	> 30 000 MΩ
RC between leads, for C > 0.33 μF at 10 V; 1 min	> 5000 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	100 V; 1 min	160 V; 1 min	400 V; 1 min	640 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: MKT366**

U _{RDC} (V)	CAP. (μF)	DIMENSIONS w _{max.} x h _{max.} x l _{max.} (mm)	MASS (g) ⁽¹⁾	CATALOG NUMBER BFC2 366 XXYYY AND PACKAGING							C-VALUE	
				LOOSE IN BOX				AMMOPACK				
				l _t = 4.0 mm + 1.0 mm / - 0.5 mm		l _t = 17.0 mm ± 4.0 mm		H = 16.0 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)	..YYY		
63	PITCH = 7.5 mm + 0.4 mm / - 0.2 mm; d _t = 0.60 mm ± 0.06 mm (U _{RAC} = 40 V)											
	0.12 0.15 0.18 0.22	4.0 x 12.0 x 10.0	0.30								124 154 184 224	
	0.27			15... (1000)	16... (1000)	11... (1000)	12... (1000)	13... (1250)	17... (1250)	274		
	0.33 0.39			5.0 x 13.5 x 10.5	0.43	15... (1000)	16... (1000)	11... (1000)	12... (1000)	13... (1000)	17... (1000)	334 394
	0.47			5.5 x 14.0 x 10.5	0.53	15... (1000)	16... (1000)	11... (1000)	12... (1000)	13... (1000)	17... (1000)	474
	0.56 0.68 0.82 1.0	5.5 x 14.5 x 10.5	0.54								564 684 824 105	
				15... (1000)	16... (1000)	11... (1000)	12... (1000)	13... (1000)	17... (1000)			
	100	PITCH = 7.5 mm + 0.4 mm / - 0.2 mm; d _t = 0.60 mm ± 0.06 mm (U _{RAC} = 63 V)										
		0.039 0.047 0.056 0.068 0.082	4.0 x 12.0 x 10.0	0.30								393 473 563 683 823
		0.10			4.0 x 13.0 x 10.0	0.26	25... (1000)	26... (1000)	21... (1000)	22... (1000)	23... (1500)	27... (1500)
0.12		4.5 x 13.0 x 10.5			0.38	25... (1000)	26... (1000)	21... (1000)	22... (1000)	23... (1250)	27... (1250)	124
0.15		5.0 x 13.0 x 15.0			0.40	25... (1000)	26... (1000)	21... (1000)	22... (1000)	23... (1000)	27... (1000)	154
0.18		5.0 x 13.5 x 10.5			0.43	25... (1000)	26... (1000)	21... (1000)	22... (1000)	23... (1000)	27... (1000)	184
0.22		5.5 x 13.5 x 10.5	0.50	25... (1000)	26... (1000)	21... (1000)	22... (1000)	23... (1000)	27... (1000)	224		
0.27		6.0 x 14.5 x 10.5	0.55	25... (1000)	26... (1000)	21... (1000)	22... (1000)	23... (1000)	27... (1000)	274		
0.33 0.39 0.47		6.0 x 15.0 x 10.5	0.58								334 394 474	
				25... (1000)	26... (1000)	21... (1000)	22... (1000)	23... (1000)	27... (1000)			

Notes

- SPQ = Standard Packing Quantity

⁽¹⁾ Net weight for short lead products only



ELECTRICAL DATA AND ORDERING INFORMATION: MKT366																		
U _{RDC} (V)	CAP. (μF)	DIMENSIONS w _{max.} x h _{max.} x l _{max.} (mm)	MASS (g) ⁽¹⁾	CATALOG NUMBER BFC2 366 XXYYY AND PACKAGING														
				LOOSE IN BOX				AMMOPACK		C-VALUE								
				l _t = 4.0 mm + 1.0 mm / - 0.5 mm		l _t = 17.0 mm ± 4.0 mm		H = 16.0 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)	..YYY								
250	PITCH = 7.5 mm + 0.4 mm / - 0.2 mm; d _t = 0.60 mm ± 0.06 mm (U _{RAC} = 160 V)																	
	0.018 0.022 0.027 0.033 0.039 0.047	4.0 x 13.0 x 10.0	0.26	45... (1000)	46... (1000)	41... (1000)	42... (1000)	43... (1500)	47... (1500)	183 223 273 333 393 473								
	0.056									4.0 x 14.0 x 10.0	0.35	45... (1000)	46... (1000)	41... (1000)	42... (1000)	43... (1500)	47... (1500)	563
	0.068									4.5 x 14.0 x 10.0	0.39	45... (1000)	46... (1000)	41... (1000)	42... (1000)	43... (1250)	47... (1250)	683
	0.082									4.5 x 13.0 x 10.0	0.38	45... (1000)	46... (1000)	41... (1000)	42... (1000)	43... (1250)	47... (1250)	823
	0.10									5.0 x 13.5 x 10.0	0.40	45... (1000)	46... (1000)	41... (1000)	42... (1000)	43... (1000)	47... (1000)	104
	0.12									5.5 x 14.0 x 10.0	0.50	45... (1000)	46... (1000)	41... (1000)	42... (1000)	43... (1000)	47... (1000)	124
0.15	5.5 x 15.5 x 10.0	0.58	45... (1000)	46... (1000)	41... (1000)	42... (1000)	43... (1000)	47... (1000)	154									
400	PITCH = 7.5 mm + 0.4 mm / - 0.2 mm; d _t = 0.60 mm ± 0.06 mm (U _{RAC} = 220 V)																	
	0.0033 0.0039 0.0047	4.0 x 12.0 x 10.0	0.30	55... (1000)	56... (1000)	51... (1000)	52... (1000)	53... (1500)	57... (1500)	332 392 472								
	0.0056 0.0068									4.0 x 13.0 x 10.0	0.26	55... (1000)	56... (1000)	51... (1000)	52... (1000)	53... (1500)	57... (1500)	562 682 822 103 123 153
	0.0082 0.010 0.012 0.015																	
	0.018	4.0 x 13.5 x 10.0	0.35	55... (1000)	56... (1000)	51... (1000)	52... (1000)	53... (1250)	57... (1250)									183
	0.022	5.0 x 14.0 x 10.0	0.45	55... (1000)	56... (1000)	51... (1000)	52... (1000)	53... (1000)	57... (1000)									223
	0.027	4.0 x 12.5 x 10.0	0.35	55... (1000)	56... (1000)	51... (1000)	52... (1000)	53... (1500)	57... (1500)									273
	0.033	4.5 x 13.0 x 10.0	0.38	55... (1000)	56... (1000)	51... (1000)	52... (1000)	53... (1250)	57... (1250)	333								
	0.039 0.047	5.0 x 13.5 x 10.0	0.40	55... (1000)	56... (1000)	51... (1000)	52... (1000)	53... (1000)	57... (1000)	393 473								
	0.056	5.5 x 14.0 x 10.0	0.50	55... (1000)	56... (1000)	51... (1000)	52... (1000)	53... (1000)	57... (1000)	563								

Notes

- SPQ = Standard Packing Quantity
- ⁽¹⁾ Net weight for short lead products only

**COMPOSITION OF CATALOG NUMBER: MKT367**

TYPE AND PITCHES		CAPACITANCE (numerically)		MULTIPLIER (nF)			
367	7.5 mm						
				0.1	2		
				1	3		
				10	4		
				100	5		
				Example: 104 = 10 x 10 = 100 nF			
		BFC2	367	XX	YY	Y	
		2222 (*)	367	XX	YY	Y	
		(*) Old ordering number					
TYPE	PACKAGING	LEAD CONFIGURATION	PREFERRED TYPES				
			C-TOL.	63 V	100 V	250 V	400 V
Pitch = 7.5 mm							
367	Loose in box	Straight; Lead length 4.0 mm + 1.0 mm /- 0.5 mm	± 10 %	15	25	45	55
			± 5 %	16	26	46	56
		Straight; Lead length 22.0 mm ± 4.0 mm	± 10 %	11	21	41	51
			± 5 %	12	22	42	52
	Ammopack ⁽¹⁾	Straight; H = 18.5 mm; P ₀ = 12.7 mm	± 10 %	13	23	43	53
			± 5 %	17	27	47	57

Note

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

SPECIFIC REFERENCE DATA: MKT367				
DESCRIPTION	VALUE			
Tangent of loss angle:	at 1 kHz	at 10 kHz	at 100 kHz	
C ≤ 0.47 μF	≤ 75 x 10 ⁻⁴	≤ 130 x 10 ⁻⁴	≤ 225 x 10 ⁻⁴	
C > 0.47 μF	≤ 75 x 10 ⁻⁴	≤ 130 x 10 ⁻⁴	-	
Rated voltage pulse slope (dU/dt) _R at	63 V _{DC}	100 V _{DC}	250 V _{DC}	400 V _{DC}
	110 V/μs	110 V/μs	130 V/μs	170 V/μs
R between leads, for C ≤ 0.33 μF at 10 V; 1 min at 100 V; 1 min	> 15 000 MΩ	> 15 000 MΩ	> 30 000 MΩ	> 30 000 MΩ
RC between leads, for C > 0.33 μF at 10 V; 1 min	> 5000 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	100 V; 1 min	160 V; 1 min	400 V; 1 min	640 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: MKT367										
U _{RDC} (V)	CAP. (μF)	DIMENSIONS w _{max.} x h _{max.} x l _{max.} (mm)	MASS (g) ⁽¹⁾	CATALOG NUMBER BFC2 367 XYYYY AND PACKAGING						
				LOOSE IN BOX				AMMOPACK		C-VALUE
				l _t = 4.0 mm + 1.0 mm / - 0.5 mm		l _t = 22.0 mm ± 4.0 mm		H = 18.5 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)	
63	PITCH = 7.5 mm + 0.4 mm / - 0.2 mm; d _t = 0.60 mm ± 0.06 mm (U _{RAC} = 40 V)									
	0.12 0.15 0.18 0.22	4.0 x 9.5 x 10.0	0.23	15... (1000)	16... (1000)	11... (1000)	12... (1000)	13... (1500)	17... (1500)	124 154 184 224
	0.27	4.5 x 10.0 x 10.5	0.37	15... (1000)	16... (1000)	11... (1000)	12... (1000)	13... (1000)	17... (1000)	274
	0.33 0.39	5.0 x 10.5 x 10.5	0.39	15... (1000)	16... (1000)	11... (1000)	12... (1000)	13... (1000)	17... (1000)	334 394
	0.47	5.5 x 11.0 x 10.5	0.44	15... (1000)	16... (1000)	11... (1000)	12... (1000)	13... (1000)	17... (1000)	474
	0.56 0.68 0.82 1.0	5.5 x 12.0 x 10.5	0.46	15... (1000)	16... (1000)	11... (1000)	12... (1000)	13... (1000)	17... (1000)	564 684 824 105
100	PITCH = 7.5 mm + 0.4 mm / - 0.2 mm; d _t = 0.60 mm ± 0.06 mm (U _{RAC} = 63 V)									
	0.039 0.047 0.056 0.068 0.082 0.10	4.0 x 9.5 x 10.0	0.23	25... (1000)	26... (1000)	21... (1000)	22... (1000)	23... (1500)	27... (1500)	393 473 563 683 823 104
	0.12	4.5 x 10.0 x 10.5	0.37	25... (1000)	26... (1000)	21... (1000)	22... (1000)	23... (1000)	27... (1000)	124
	0.15 0.18	5.0 x 10.5 x 10.5	0.39	25... (1000)	26... (1000)	21... (1000)	22... (1000)	23... (1000)	27... (1000)	154 184
	0.22	5.5 x 11.5 x 10.5	0.44	25... (1000)	26... (1000)	21... (1000)	22... (1000)	23... (1000)	27... (1000)	224
	0.27 0.33 0.39 0.47	6.0 x 12.5 x 10.5	0.55	25... (1000)	26... (1000)	21... (1000)	22... (1000)	23... (1000)	27... (1000)	274 334 394 474

Notes

- SPQ = Standard Packing Quantity

⁽¹⁾ Net weight for short lead products only

**ELECTRICAL DATA AND ORDERING INFORMATION: MKT367**

U _{RDC} (V)	CAP. (μF)	DIMENSIONS w _{max.} x h _{max.} x l _{max.} (mm)	MASS (g) ⁽¹⁾	CATALOG NUMBER BFC2 367 XYYYY AND PACKAGING						C-VALUE																
				LOOSE IN BOX				AMMOPACK																		
				l _t = 4.0 mm + 1.0 mm / - 0.5 mm		l _t = 22.0 mm ± 4.0 mm		H = 18.5 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)		..YYY															
250	PITCH = 7.5 mm + 0.4 mm / - 0.2 mm; d _t = 0.60 mm ± 0.06 mm (U _{RAC} = 160 V)																									
	0.018 0.022 0.027 0.033 0.039 0.047 0.056	4.0 x 9.5 x 10.0	0.23	45... (1000)	46... (1000)	41... (1000)	42... (1000)	43... (1500)	47... (1500)	183 223 273 333 393 473 563																
	0.068 0.082									4.5 x 10.0 x 10.0	0.37	45... (1000)	46... (1000)	41... (1000)	42... (1000)	43... (1000)	47... (1000)	683 823								
	0.10 0.12 0.15																	5.0 x 10.5 x 10.0 5.5 x 11.0 x 10.0 5.5 x 12.5 x 10.0	0.39 0.42 0.48	45... (1000) 45... (1000) 45... (1000)	46... (1000) 46... (1000) 46... (1000)	41... (1000) 41... (1000) 41... (1000)	42... (1000) 42... (1000) 42... (1000)	43... (1000) 43... (1000) 43... (1000)	47... (1000) 47... (1000) 47... (1000)	104 124 154
	400									PITCH = 7.5 mm + 0.4 mm / - 0.2 mm; d _t = 0.60 mm ± 0.06 mm (U _{RAC} = 220 V)																
										0.0033 0.0039 0.0047 0.0056 0.0068 0.0082 0.010 0.012 0.015	4.0 x 9.5 x 10.0	0.23	55... (1000)	56... (1000)	51... (1000)	52... (1000)	53... (1500)	57... (1500)	332 392 472 562 682 822 103 123 153							
		0.018	4.5 x 10.0 x 10.0	0.37	55... (1000)	56... (1000)	51... (1000)	52... (1000)	53... (1000)	57... (1000)									183							
		0.022																	5.0 x 10.5 x 10.0	0.39	55... (1000)	56... (1000)	51... (1000)	52... (1000)	53... (1000)	57... (1000)
0.027		4.0 x 9.5 x 10.0	0.23	55... (1000)	56... (1000)	51... (1000)	52... (1000)	53... (1500)	57... (1500)	273																
0.033										4.5 x 10.0 x 10.0																
0.039 0.047																			5.0 x 10.5 x 10.0	0.39	55... (1000)	56... (1000)	51... (1000)	52... (1000)	53... (1000)	57... (1000)
0.056										5.5 x 11.0 x 10.0																

Notes

- SPQ = Standard Packing Quantity
- ⁽¹⁾ Net weight for short lead products 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 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 underside and the kinks are in good contact with the printed-circuit board.

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

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

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

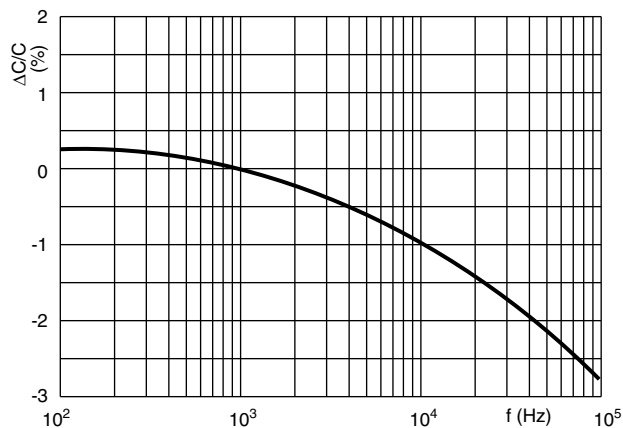
Ratings and Characteristics Reference Conditions

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

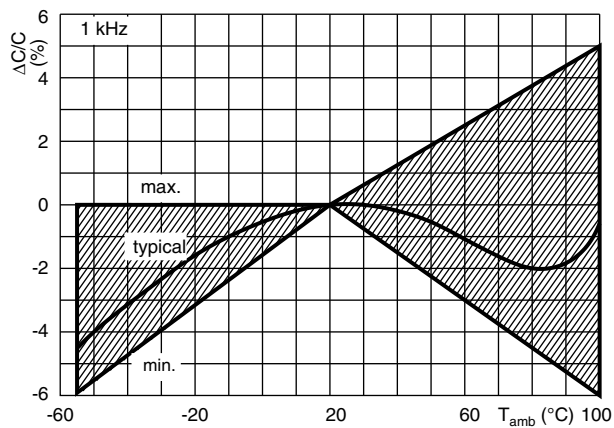
For reference testing, a conditioning period shall be applied over $96\text{ h} \pm 4\text{ h}$ by heating the products in a circulating air oven at the rated temperature and a relative humidity not exceeding 20 %.



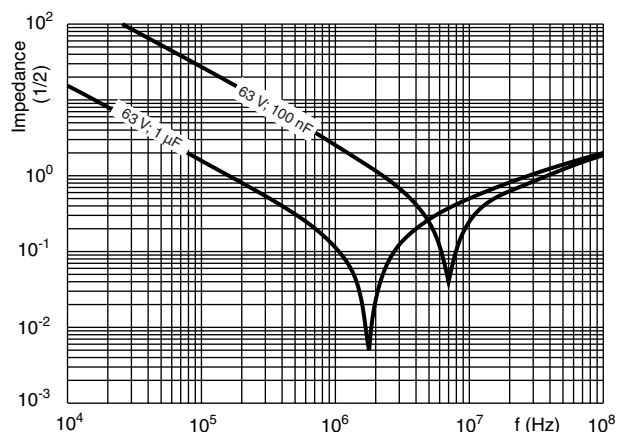
CHARACTERISTICS



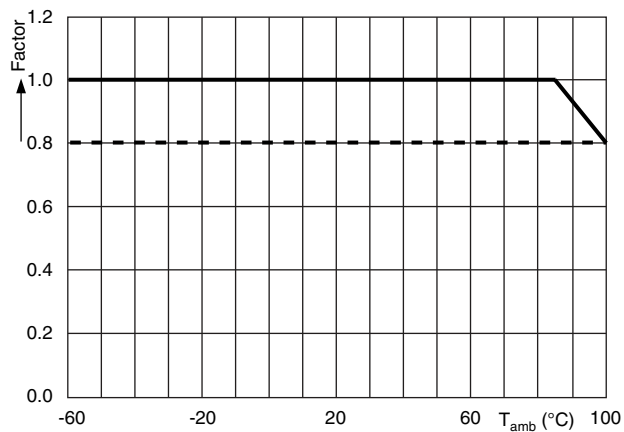
Capacitance as a function of frequency
(typical curve)



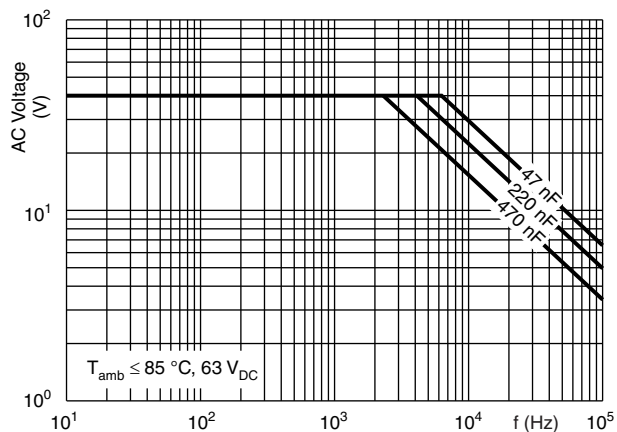
Capacitance as a function of ambient temperature
(typical curve)



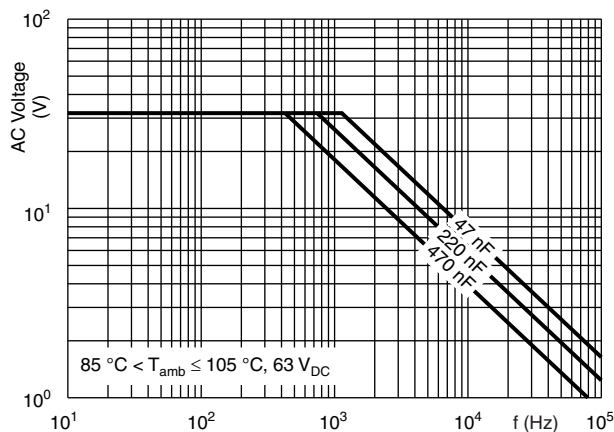
Impedance as a function of frequency
(typical curve)



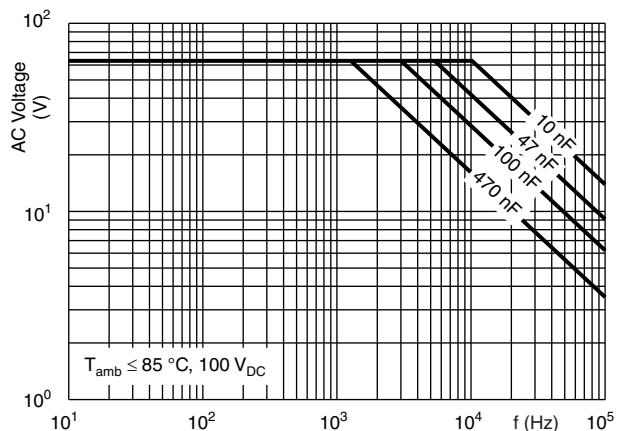
Max. DC and AC voltage as a function of temperature



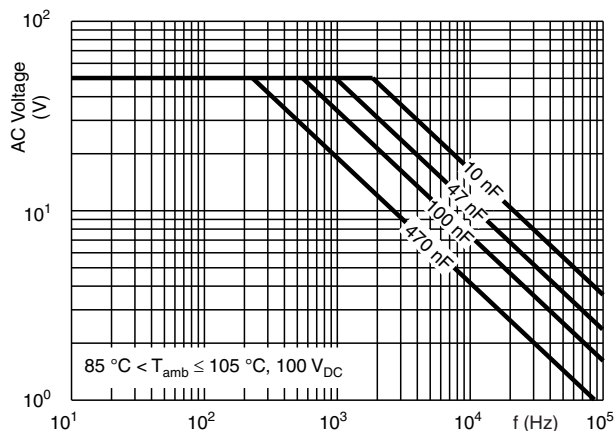
Max. RMS voltage as a function of frequency



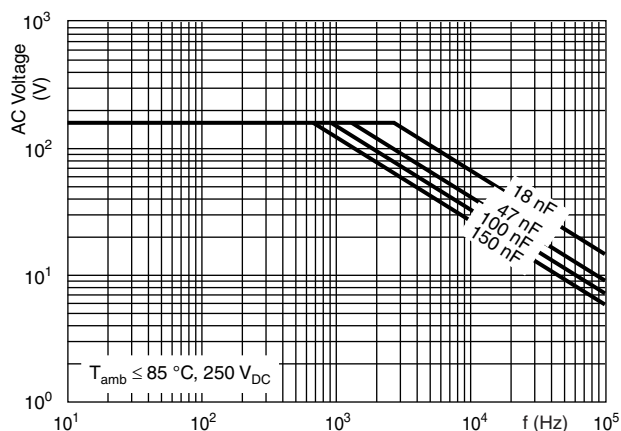
Max. RMS voltage as a function of frequency



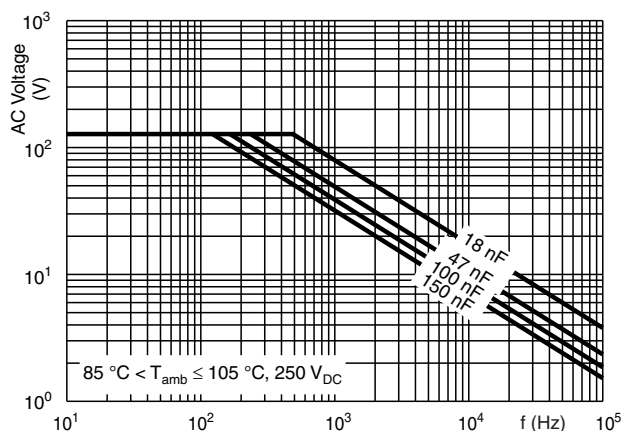
Max. RMS voltage as a function of frequency



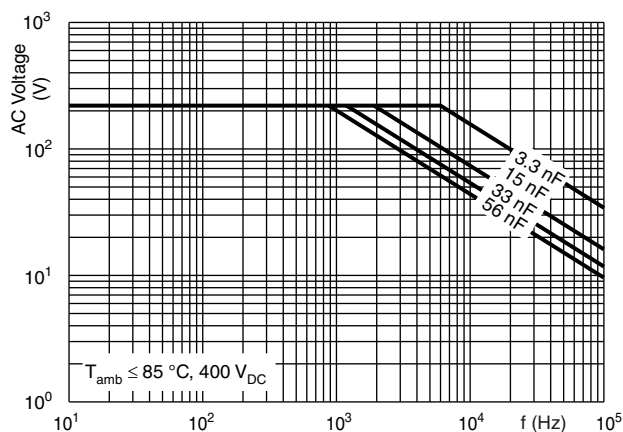
Max. RMS voltage as a function of frequency



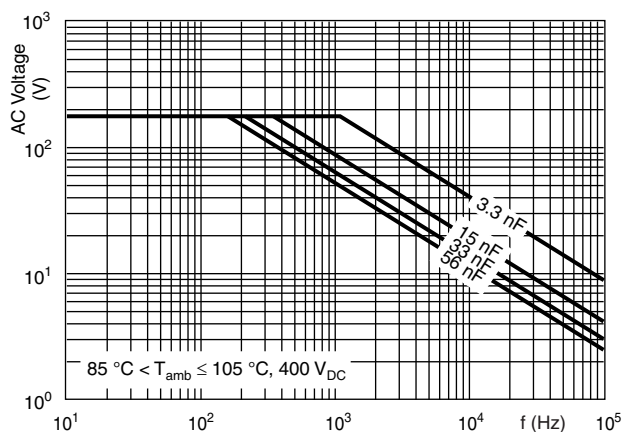
Max. RMS voltage as a function of frequency



Max. RMS voltage as a function of frequency



Max. RMS voltage as a function of frequency

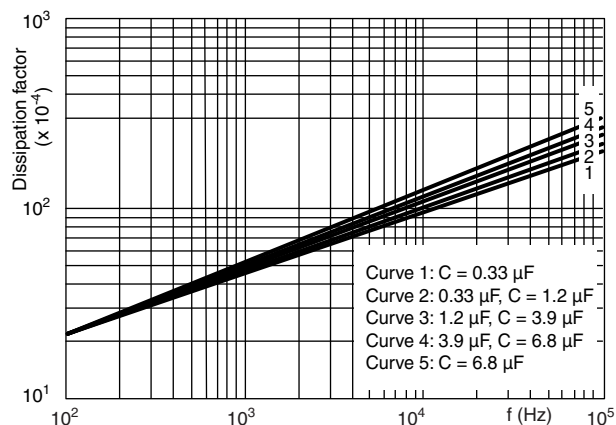


Max. RMS voltage as a function of frequency

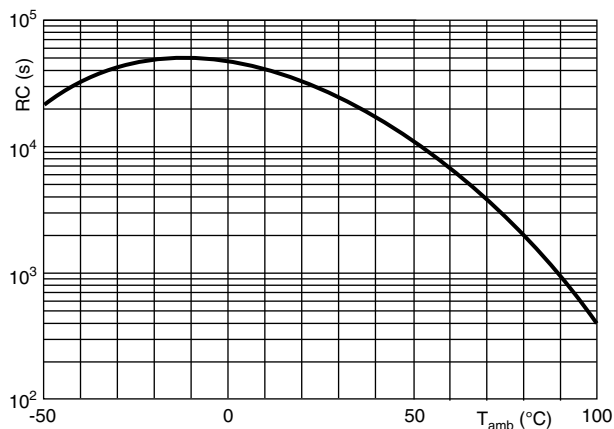
MAXIMUM RMS CURRENT (SINEWAVE) AS A FUNCTION OF FREQUENCY

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

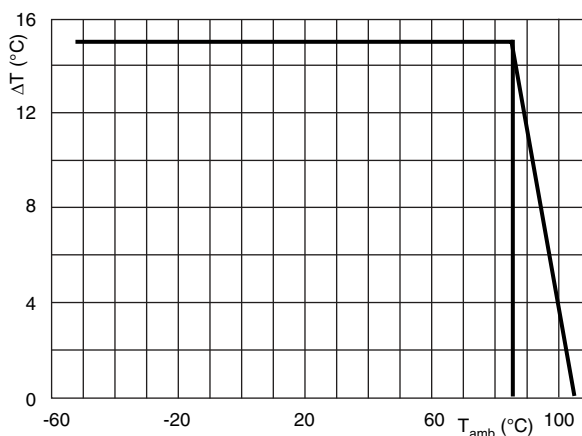
U_{AC} is the maximum AC voltage depending on the ambient temperature in the curves “Max. RMS voltage and AC current as a function of frequency”.



Tangent of loss angle as a function of frequency



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



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

HEAT CONDUCTIVITY (G) AS A FUNCTION OF (ORIGINAL) PITCH AND CAPACITOR BODY THICKNESS IN $mW/^{\circ}C$

$W_{max.}$ (mm)	HEAT CONDUCTIVITY ($mW/^{\circ}C$)
3.5	3.0
4.0	3.5
4.5	3.5
5.0	4.0
5.5	4.0
6.0	4.5
6.5	5.0

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.

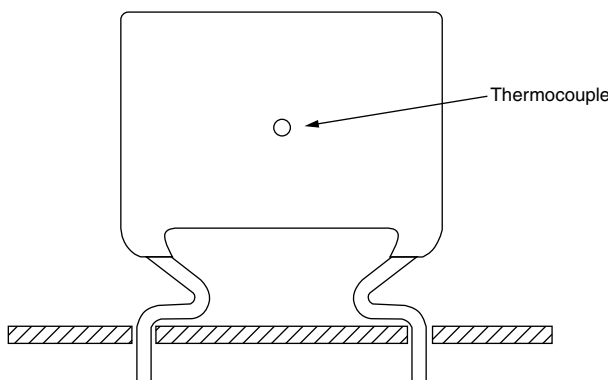
The power dissipation can be calculated according type detail specification "HQN-384-01/101: Technical Information Film Capacitors".

The component temperature rise (ΔT) can be measured (see section "Measuring the Component Temperature" for more details) or calculated by $\Delta T = P/G$:

- ΔT = component temperature rise ($^{\circ}\text{C}$)
- P = power dissipation of the component (mW)
- G = heat conductivity of the component ($\text{mW}/^{\circ}\text{C}$)

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 $\Delta T = T_C - T_{\text{amb}}$.

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 without additional protection, as described hereunder. These mains applications are strictly regulated in safety standards and therefore electromagnetic interference suppression capacitors conforming the standards must be used.

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

1. 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
2. The peak voltage (U_P) shall not be greater than the rated DC voltage (U_{RDC})
3. The peak-to-peak voltage ($U_{\text{P-P}}$) shall not be greater than $2\sqrt{2} \times U_{\text{RAC}}$ to avoid the ionization inception level
4. The voltage pulse 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:

$$2 \times \int_0^T \left(\frac{dU}{dt} \right)^2 \times dt < U_{\text{RDC}} \times \left(\frac{dU}{dt} \right)_{\text{rated}}$$

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.

5. The maximum component surface temperature rise must be lower than the limits (see graph “Max. allowed component temperature rise”).
6. 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”
7. When using these capacitors as across-the-line capacitor in the input filter for mains applications or as series connected with an impedance to the mains the applicant must guarantee that the following conditions are fulfilled in any case (spikes and surge voltages from the mains included).

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

Example

$C = 330 \text{ nF}$ - 63 V used for the voltage signal shown in next drawing.

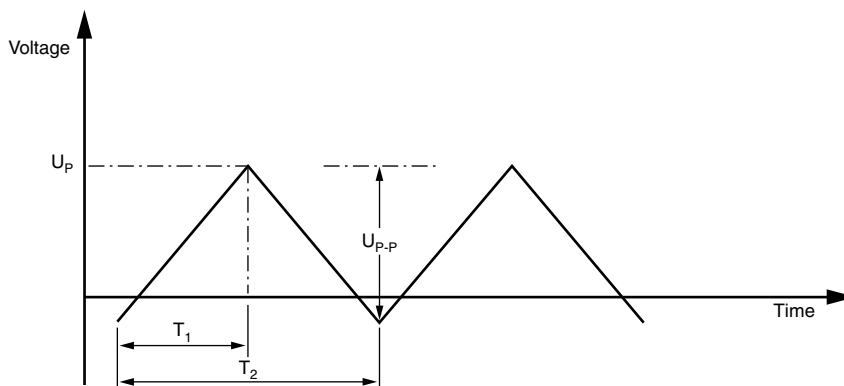
$U_{P-P} = 40 \text{ V}$; $U_P = 35 \text{ V}$; $T_1 = 100 \mu\text{s}$; $T_2 = 200 \mu\text{s}$

The ambient temperature is 35°C

Checking conditions:

1. The peak voltage $U_P = 35 \text{ V}$ is lower than 63 V_{DC}
2. The peak-to-peak voltage 40 V is lower than $2\sqrt{2} \times 40 \text{ V}_{AC} = 113 \text{ V}_{P-P}$
3. The voltage pulse slope $(dU/dt) = 40 \text{ V}/100 \mu\text{s} = 0.4 \text{ V}/\mu\text{s}$
This is lower than $110 \text{ V}/\mu\text{s}$ (see specific reference data for each version)
4. The dissipated power is 16.2 mW as calculated with fourier terms
The temperature rise for $W_{max.} = 4.5 \text{ mm}$ and pitch = 5 mm will be $16.2 \text{ mW}/2.5 \text{ mW}/^{\circ}\text{C} = 6.5^{\circ}\text{C}$
This is lower than 15°C temperature rise at 35°C , according figure “Max. allowed component temperature rise”
5. Not applicable
6. Not applicable

Voltage Signal



**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 chapters “General Data” of this specification
4.3.1 Initial measurements	Capacitance Tangent of loss angle: for $C \leq 470 \text{ nF}$ at 100 kHz or for $C > 470 \text{ nF}$ at 10 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	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 Capacitance Tangent of loss angle	No visible damage Legible marking $ \Delta C/C \leq 2 \%$ of the value measured initially Increase of $\tan \delta$ ≤ 0.005 for: $C \leq 100 \text{ nF}$ or ≤ 0.010 for: $100 \text{ nF} < C \leq 220 \text{ nF}$ or ≤ 0.015 for: $220 \text{ nF} < C \leq 470 \text{ nF}$ and ≤ 0.003 for: $C > 470 \text{ nF}$ Compared to values measured in 4.3.1
SUB-GROUP C1B PART OF SAMPLE OF SUB-GROUP C1		
4.6.1 Initial measurements	Capacitance Tangent of loss angle: for $C \leq 470 \text{ nF}$ at 100 kHz or for $C > 470 \text{ nF}$ at 10 kHz	No visible damage
4.6 Rapid change of temperature	$\theta A = -55 \text{ °C}$ $\theta B = +105 \text{ °C}$ 5 cycles Duration $t = 30 \text{ min}$	
4.7 Vibration	Visual examination Mounting: See section “Mounting” of this specification Procedure B4 Frequency range: 10 Hz to 55 Hz Amplitude: 0.75 mm or Acceleration 98 m/s ² (whichever is less severe) Total duration 6 h	No visible damage
4.7.2 Final inspection	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		
4.9 Shock	Mounting: See section "Mounting" of this specification Pulse shape: half sine Acceleration: 490 m/s ² Duration of pulse: 11 ms	
4.9.3 Final measurements	Visual examination Capacitance Tangent of loss angle Insulation resistance	No visible damage $ \Delta C/C \leq 3\%$ of the value measured in 4.6.1 Increase of $\tan \delta$ ≤ 0.005 for: $C \leq 100$ nF or ≤ 0.010 for: 100 nF $< C \leq 220$ nF or ≤ 0.015 for: 220 nF $< C \leq 470$ nF and ≤ 0.003 for: $C > 470$ nF Compared to values measured in 4.6.1 As specified in section "Insulation Resistance" 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: +105 °C Duration: 16 h	
4.10.3 Damp heat cyclic Test Db, first cycle		
4.10.4 Cold	Temperature: -55 °C Duration: 2 h	
4.10.6 Damp heat cyclic Test Db, remaining cycles		
4.10.6.2 Final measurements	Voltage proof = U_{RDC} for 1 min within 15 min after removal from test chamber Visual examination Capacitance Tangent of loss angle Insulation resistance	No breakdown of flash-over No visible damage Legible marking $ \Delta C/C \leq 5\%$ of the value measured in 4.4.2 or 4.9.3 Increase of $\tan \delta$ ≤ 0.007 for: $C \leq 100$ nF or ≤ 0.010 for: 100 nF $< C \leq 220$ nF or ≤ 0.015 for: 220 nF $< C \leq 470$ nF and ≤ 0.005 for: $C > 470$ nF Compared to values measured in 4.3.1 or 4.6.1 $\geq 50\%$ of values specified in section "Insulation Resistance" 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 Tangent of loss angle at 1 kHz	
4.11.3 Final measurements	Voltage proof = U_{RDC} for 1 min within 15 min after removal from test chamber	No breakdown of flash-over
	Visual examination	No visible damage Legible marking
	Capacitance	$ \Delta C/C \leq 5\%$ of the value measured in 4.11.1.
	Tangent of loss angle	Increase of $\tan \delta \leq 0.005$ Compared to values measured in 4.11.1
	Insulation resistance	$\geq 50\%$ of values specified in section "Insulation Resistance" of this specification
SUB-GROUP C3		
4.12 Endurance	Duration: 2000 h $1.25 \times U_{RDC}$ at 85 °C $1.0 \times U_{RDC}$ at 105 °C	
4.12.1 Initial measurements	Capacitance Tangent of loss angle: for $C \leq 470$ 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	$ \Delta C/C \leq 5\%$ compared to values measured in 4.12.1
	Tangent of loss angle	Increase of $\tan \delta$ ≤ 0.005 for: $C \leq 100$ nF or ≤ 0.010 for: 100 nF $< C \leq 220$ nF or ≤ 0.015 for: 220 nF $< C \leq 470$ nF and ≤ 0.003 for: $C > 470$ nF Compared to values measured in 4.12.1
	Insulation resistance	$\geq 50\%$ of values specified in section "Insulation Resistance" of this specification
SUB-GROUP C4		
4.13 Charge and discharge	10 000 cycles Charged to $U_R V_{DC}$ Discharge resistance: $R = \frac{U_R}{C \times 2.5 \times (dU/dt)_R}$	
4.13.1 Initial measurements	Capacitance Tangent of loss angle: for $C \leq 470$ nF at 100 kHz or for $C > 470$ nF at 10 kHz	
4.13.3 Final measurements	Capacitance	$ \Delta C/C \leq 3\%$ compared to values measured in 4.13.1
	Tangent of loss angle	Increase of $\tan \delta$ ≤ 0.005 for: $C \leq 100$ nF or ≤ 0.010 for: 100 nF $< C \leq 220$ nF or ≤ 0.015 for: 220 nF $< C \leq 470$ nF and ≤ 0.003 for: $C > 470$ nF Compared to values measured in 4.13.1
	Insulation resistance	$\geq 50\%$ of values specified in section "Insulation Resistance" of this specification



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