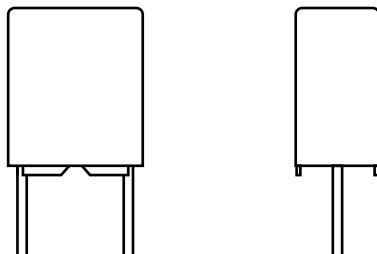


## DC Film Capacitors

### MKT Radial Potted Type



#### FEATURES

- 5.08 mm lead pitch
- Supplied loose in box, taped on ammopack or reel
- AEC-Q200 qualified (rev. D)
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
COMPLIANT

#### APPLICATIONS

Blocking and coupling, bypass and energy reservoir, telecom, industrial, consumer.

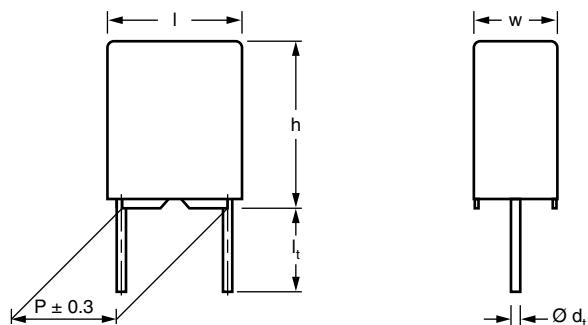
#### QUICK REFERENCE DATA

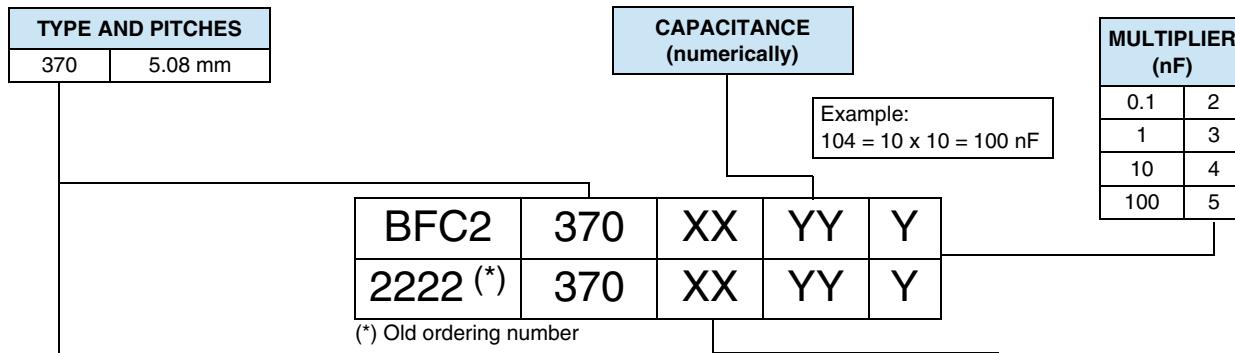
Capacitance range (E12 series)	0.001 $\mu$ F to 1.5 $\mu$ F
Capacitance tolerance	$\pm 10\%$ , $\pm 5\%$
Rated DC voltage	50 V, 63 V, 250 V, 400 V, 630 V
Rated AC voltage	32 V, 40 V, 63 V, 160 V, 220 V
Climatic testing class acc. to IEC 60068-1	55/100/56 for rated voltage 50 V and 63 V 55/105/56 for rated voltage > 63 V
Maximum application temperature	100 °C for rated voltage 50 V and 63 V 105 °C for rated voltage > 63 V
Rated temperature	85 °C
Reference standards	IEC 60384-2
Dielectric	Polyester film
Electrodes	Metallized
	Mono construction
Construction	Triple construction for 630 V, 0.00068 $\mu$ F to 0.0018 $\mu$ F
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
Performance grade	Grade 1 (long life)

#### Note

- For more detailed data and test requirements, contact [dc-film@vishay.com](mailto:dc-film@vishay.com)

#### DIMENSIONS in millimeters



**COMPOSITION OF CATALOG NUMBER**


TYPE	PACKAGING	LEAD CONFIGURATION	PREFERRED TYPES				
			C-TOL.	63 V	100 V	250 V	400 V
370 (standard size)	Loose in box	Lead length 4.0 mm + 1.0 mm/- 0.5 mm	± 10 %	11	21	41	51
			± 5 %	12	22	42	52
	Taped on reel <sup>(1)</sup>	Lead length 26.0 mm ± 2.0 mm	± 10 %	15	25	45	55
			± 5 %	16	26	46	56
	Ammopack <sup>(2)</sup>	H = 18.5 mm; P <sub>0</sub> = 12.7 mm; Reel diameter = 356 mm	± 10 %	18	28	48	58
			± 5 %	19	29	49	59
370 (compact size)	Loose in box	H = 18.5 mm; P <sub>0</sub> = 12.7 mm	± 10 %	75	85	35	65
			± 5 %	76	86	36	66
	Taped on reel <sup>(1)</sup>		CE	EE	FE	GE	
			CF	EF	FF	GF	
	Ammopack <sup>(2)</sup>	Lead length 26.0 mm ± 2.0 mm	CH	EH	FH	GH	
			CI	EI	FI	GI	
370 (compact size)	Taped on reel <sup>(1)</sup>	H = 18.5 mm; P <sub>0</sub> = 12.7 mm; Reel diameter = 356 mm	CL	EL	FL	GL	
			CM	EM	FM	GM	
	Ammopack <sup>(2)</sup>	H = 18.5 mm; P <sub>0</sub> = 12.7 mm	CB	EB	FB	GB	
			CC	EC	FC	GC	

**Notes**

- For detailed tape specifications refer to packaging information: [www.vishay.com/doc?28139](http://www.vishay.com/doc?28139) or end of catalog

<sup>(1)</sup> Reel diameter = 356 mm is available on request

<sup>(2)</sup> H = in-tape height; P<sub>0</sub> = sprocket hole distance; for detailed specifications refer to packaging information

<b>SPECIFIC REFERENCE DATA</b> (Standard Size)			
<b>DESCRIPTION</b>	<b>VALUE</b>		
Tangent of loss angle: $C \leq 0.1 \mu F$ $0.1 \mu F < C \leq 0.47 \mu F$ $0.47 \mu F < C \leq 1.5 \mu F$	at 1 kHz	at 10 kHz	at 100 kHz
	$\leq 75 \times 10^{-4}$	$\leq 130 \times 10^{-4}$	$\leq 220 \times 10^{-4}$
	$\leq 75 \times 10^{-4}$	$\leq 130 \times 10^{-4}$	$\leq 300 \times 10^{-4}$
Rated voltage pulse slope $(dU/dt)_R$ at	$50 V_{DC}/63 V_{DC}$	$100 V_{DC}$	$250 V_{DC}$
	$60 V/\mu s$	$110 V/\mu s$	$330 V/\mu s$
R between leads, for $C \leq 0.33 \mu F$ at 10 V; 1 min at 100 V; 1 min	$> 15\,000 M\Omega$	$> 15\,000 M\Omega$	$> 30\,000 M\Omega$
	$> 15\,000 M\Omega$	$> 30\,000 M\Omega$	$> 30\,000 M\Omega$
	$> 15\,000 M\Omega$	$> 30\,000 M\Omega$	$> 30\,000 M\Omega$
RC between leads $0.33 \mu F < C \leq 1.0 \mu F$ at 10 V; 1 min $C > 1.0 \mu F$ at 10 V; 1 min $C > 0.33 \mu F$ at 100 V; 1 min	$> 5000 s$	$> 5000 s$	$> 5000 s$
	$> 1000 s$		
R between interconnecting leads and case (foil method)	$> 30\,000 M\Omega$	$> 30\,000 M\Omega$	$> 30\,000 M\Omega$
Withstanding (DC) voltage (cut off current 10 mA) <sup>(1)</sup> ; rise time $\leq 1000 V/s$ rise time 100 V/s	100 V; 1 min	160 V; 1 min	400 V; 1 min
Withstanding (DC) voltage between leads and case	200 V; 1 min	200 V; 1 min	500 V; 1 min
Maximum application temperature	100 °C	105 °C	

**Note**

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

<b>SPECIFIC REFERENCE DATA</b> (Compact Size)			
<b>DESCRIPTION</b>	<b>VALUE</b>		
Tangent of loss angle: $C \leq 0.1 \mu F$ $0.1 \mu F < C \leq 0.47 \mu F$ $C > 0.47 \mu F$	at 1 kHz	at 10 kHz	at 100 kHz
	$\leq 75 \times 10^{-4}$	$\leq 130 \times 10^{-4}$	$\leq 220 \times 10^{-4}$
	$\leq 75 \times 10^{-4}$	$\leq 130 \times 10^{-4}$	$\leq 300 \times 10^{-4}$
Rated voltage pulse slope $(dU/dt)_R$ at	$100 V_{DC}$	$250 V_{DC}$	$400 V_{DC}$
	$37 V/\mu s$	$44 V/\mu s$	$200 V/\mu s$
R between leads, for $C \leq 0.33 \mu F$ at 100 V; 1 min	$> 15\,000 M\Omega$	$> 30\,000 M\Omega$	$> 30\,000 M\Omega$
	$> 15\,000 M\Omega$	$> 30\,000 M\Omega$	$> 30\,000 M\Omega$
RC between leads $C > 0.33 \mu F$ at 100 V; 1 min	$> 5000 s$		
R between interconnecting leads and case (foil method)	$> 30\,000 M\Omega$	$> 30\,000 M\Omega$	$> 30\,000 M\Omega$
Withstanding (DC) voltage (cut off current 10 mA) <sup>(1)</sup> ; rise time $\leq 1000 V/s$ rise time 100 V/s	160 V; 1 min	400 V; 1 min	640 V; 1 min
Withstanding (DC) voltage between leads and case	200 V; 1 min	500 V; 1 min	800 V; 1 min
Maximum application temperature	100 °C	105 °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 INFORMATION (Standard Size)													
U <sub>RDC</sub> (V)	CAP. ( $\mu$ F)	DIMENSIONS w x h x l (mm)	MASS (g) <sup>(1)</sup>	CATALOG NUMBER BFC2 370 XXXXX AND PACKAGING								C-VALUE	
				AMMOPACK		LOOSE IN BOX				REEL			
				H = 18.5 mm; P <sub>0</sub> = 12.7 mm		SHORT LEADS		LONG LEADS					
				C-TOL. = $\pm 10\%$	C-TOL. = $\pm 5\%$	C-TOL. = $\pm 10\%$	C-TOL. = $\pm 5\%$	C-TOL. = $\pm 10\%$	C-TOL. = $\pm 5\%$	C-TOL. = $\pm 10\%$	C-TOL. = $\pm 5\%$		
				XX (SPQ)	XX (SPQ)	XX (SPQ)	XX (SPQ)	XX (SPQ)	XX (SPQ)	XX (SPQ)	XX (SPQ)	..YYY	
<b>U<sub>RAC</sub> = 32 V; PITCH = 5.08 mm <math>\pm</math> 0.30 mm; d<sub>t</sub> = 0.50 mm <math>\pm</math> 0.05 mm</b>													
50	1.2	6.0 x 11.0 x 7.2	0.64	75... (750)	76... (750)	11... (2000)	12... (2000)	15... (1000)	16... (1000)	18... (1000)	19... (1000)	125	
	1.5											155	
<b>U<sub>RAC</sub> = 40 V; PITCH = 5.08 mm <math>\pm</math> 0.30 mm; d<sub>t</sub> = 0.50 mm <math>\pm</math> 0.05 mm</b>													
63	0.056	2.5 x 6.5 x 7.2	0.18	75... (2000)	76... (2000)	11... (2000)	12... (2000)	15... (1000)	16... (1000)	18... (2000)	19... (2000)	563	
	0.068											683	
	0.082											823	
	0.10											104	
	0.12											124	
	0.15											154	
63	0.18											184	
	0.22	3.5 x 8.0 x 7.2	0.3	75... (1500)	76... (1500)	11... (2000)	12... (2000)	15... (1000)	16... (1000)	18... (1500)	19... (1500)	224	
	0.27											274	
	0.33											334	
	0.39											394	
	0.47											474	
100	0.56	4.5 x 9.0 x 7.2	0.42	75... (1000)	76... (1000)	11... (2000)	12... (2000)	15... (1000)	16... (1000)	18... (1000)	19... (1000)	564	
	0.68											684	
	0.82											824	
	1.0											105	
	0.0010	2.5 x 6.5 x 7.2	0.18	85... (2000)	86... (2000)	21... (2000)	22... (2000)	25... (1000)	26... (1000)	28... (2000)	29... (2000)	102	
	0.0012											122	
100	0.0015											152	
	0.0018											182	
	0.0022											222	
	0.0027											272	
	0.0033											332	
	0.0039											392	
100	0.0047	3.5 x 8.0 x 7.2	0.3	75... (1500)	76... (1500)	11... (2000)	12... (2000)	15... (1000)	16... (1000)	18... (1500)	19... (1500)	472	
	0.0056											562	
	0.0068											682	
	0.0082											822	
	0.010											103	
	0.012											123	
100	0.015	4.5 x 9.0 x 7.2	0.42	85... (1000)	86... (1000)	21... (2000)	22... (2000)	25... (1000)	26... (1000)	28... (2000)	29... (2000)	153	
	0.018											183	
	0.022											223	
	0.027											273	
	0.033											333	
	0.039											393	
100	0.047	6.0 x 11.0 x 7.2	0.64	85... (750)	86... (750)	21... (2000)	22... (2000)	25... (1000)	26... (1000)	28... (1000)	29... (1000)	473	
	0.056											563	
	0.068											683	
	0.082											823	
	0.10											104	
	0.12											124	
100	0.15	3.5 x 8.0 x 7.2	0.30	85... (1500)	86... (1500)	21... (2000)	22... (2000)	25... (1000)	26... (1000)	28... (1500)	29... (1500)	154	
	0.18											184	
	0.22											224	
	0.27											274	
	0.33											334	
	0.39											394	
100	0.47											474	

ELECTRICAL DATA AND ORDERING INFORMATION (Standard Size)													
U <sub>RDC</sub> (V)	CAP. ( $\mu$ F)	DIMENSIONS w x h x l (mm)	MASS (g) <sup>(1)</sup>	CATALOG NUMBER BFC2 370 XXXXX AND PACKAGING								C-VALUE	
				AMMOPACK		LOOSE IN BOX				REEL			
				H = 18.5 mm; P <sub>0</sub> = 12.7 mm		SHORT LEADS		LONG LEADS					
				C-TOL. = $\pm 10\%$	C-TOL. = $\pm 5\%$	C-TOL. = $\pm 10\%$	C-TOL. = $\pm 5\%$	C-TOL. = $\pm 10\%$	C-TOL. = $\pm 5\%$	C-TOL. = $\pm 10\%$	C-TOL. = $\pm 5\%$		
				XX (SPQ)	XX (SPQ)	XX (SPQ)	XX (SPQ)	XX (SPQ)	XX (SPQ)	XX (SPQ)	XX (SPQ)	..YYY	
<b>U<sub>RAC</sub> = 160 V; PITCH = 5.08 mm <math>\pm</math> 0.30 mm; d<sub>t</sub> = 0.50 mm <math>\pm</math> 0.05 mm</b>													
250	0.0010	2.5 x 6.5 x 7.2	0.18									102	
	0.0012											122	
	0.0015											152	
	0.0018											182	
	0.0022											222	
	0.0027											272	
	0.0033											332	
	0.0039											392	
	0.0047											472	
	0.0056											562	
	0.0068											682	
	0.0082											822	
	0.010											103	
	0.012											123	
	0.015											153	
	0.018											183	
400	0.022	3.5 x 8.0 x 7.2	0.30	35... (2000)	36... (2000)	41... (2000)	42... (2000)	45... (1000)	46... (1000)	48... (2000)	49... (2000)	223	
	0.027											273	
	0.033											333	
	0.039											393	
	0.047											473	
	0.056											563	
	0.068											683	
	0.082											823	
	0.10											104	
	<b>U<sub>RAC</sub> = 220 V; PITCH = 5.08 mm <math>\pm</math> 0.30 mm; d<sub>t</sub> = 0.50 mm <math>\pm</math> 0.05 mm</b>												
	0.0010	2.5 x 6.5 x 7.2	0.18	65... (2000)	66... (2000)	51... (2000)	52... (2000)	55... (1000)	56... (1000)	58... (2000)	59... (2000)	102	
	0.0012											122	
	0.0015											152	
	0.0018											182	
	0.0022											222	
	0.0027											272	
	0.0033											332	
	0.0039											392	
	0.0047											472	
	0.0056											562	
	0.0068											682	
	0.0082											822	
	0.010											103	
	0.012											123	
	0.015											153	
	0.018											183	
	0.022											223	
	0.027											273	
	0.027											273	
	0.033											333	
	0.039											393	
	0.047											473	

**Notes**

- SPQ = Standard Packing Quantity

<sup>(1)</sup> Weight for short lead product only

ELECTRICAL DATA AND ORDERING INFORMATION (Compact Size)														
U <sub>RDC</sub> (V)	CAP. ( $\mu$ F)	DIMENSIONS w x h x l (mm)	MASS (g) <sup>(1)</sup>	CATALOG NUMBER BFC2 370 XXXXX AND PACKAGING								C-VALUE		
				AMMOPACK		LOOSE IN BOX				REEL				
				H = 18.5 mm; P <sub>0</sub> = 12.7 mm		SHORT LEADS		LONG LEADS						
				C-TOL. = $\pm 10\%$	C-TOL. = $\pm 5\%$	C-TOL. = $\pm 10\%$	C-TOL. = $\pm 5\%$	C-TOL. = $\pm 10\%$	C-TOL. = $\pm 5\%$	C-TOL. = $\pm 10\%$	C-TOL. = $\pm 5\%$			
		XX (SPQ)		XX (SPQ)	XX (SPQ)	XX (SPQ)	XX (SPQ)	XX (SPQ)	XX (SPQ)	XX (SPQ)	XX (SPQ)	..YYY		
<b>U<sub>RAC</sub> = 40 V; PITCH = 5.08 mm <math>\pm</math> 0.30 mm; d<sub>t</sub> = 0.50 mm <math>\pm</math> 0.05 mm</b>														
100	0.12	3.5 x 8.0 x 7.2	0.30	CB...	CC...	CE...	CF...	CH...	CI...	CL...	CM...	124		
	0.15			(1500)	(1500)	(2000)	(2000)	(1000)	(1000)	(1500)	(1500)	154		
	0.18											184		
	0.22	4.5 x 9.0 x 7.2	0.42	CB...	CC...	CE...	CF...	CH...	CI...	CL...	CM...	224		
	0.27			(1000)	(1000)	(2000)	(2000)	(1000)	(1000)	(1000)	(1000)	274		
	0.33											334		
250	0.39	2.5 x 6.5 x 7.2	0.18	EB...	EC...	EE...	EF...	EH...	EI...	EL...	EM...	394		
	0.47			(2000)	(2000)	(2000)	(2000)	(1000)	(1000)	(1000)	(1000)	474		
	0.56											564		
	<b>U<sub>RAC</sub> = 63 V; PITCH = 5.08 mm <math>\pm</math> 0.30 mm; d<sub>t</sub> = 0.50 mm <math>\pm</math> 0.05 mm</b>													
	0.022	3.5 x 8.0 x 7.2	0.30	EB...	EC...	EE...	EF...	EH...	EI...	EL...	EM...	223		
	0.027			(1500)	(1500)	(2000)	(2000)	(1000)	(1000)	(1000)	(1000)	273		
	0.033											333		
400	0.039	4.5 x 9.0 x 7.2	0.42	EB...	EC...	EE...	EF...	EH...	EI...	EL...	EM...	393		
	0.047			(1000)	(1000)	(2000)	(2000)	(1000)	(1000)	(1000)	(1000)	473		
	0.056											563		
	0.068	6.0 x 11.0 x 7.2	0.64	EB...	EC...	EE...	EF...	EH...	EI...	EL...	EM...	683		
	0.082			(750)	(750)	(2000)	(2000)	(1000)	(1000)	(1000)	(1000)	823		
	0.10											104		
400	0.12	2.5 x 6.5 x 7.2	0.18	EB...	EC...	EE...	EF...	EH...	EI...	EL...	EM...	124		
	0.15			(2000)	(2000)	(2000)	(2000)	(1000)	(1000)	(1000)	(1000)	154		
	0.18											184		
	0.22											224		
	<b>U<sub>RAC</sub> = 160 V; PITCH = 5.08 mm <math>\pm</math> 0.30 mm; d<sub>t</sub> = 0.50 mm <math>\pm</math> 0.05 mm</b>													
	0.010	3.5 x 8.0 x 7.2	0.30	FB...	FC...	FE...	FF...	FH...	FI...	FL...	FM...	103		
	0.012			(1500)	(1500)	(2000)	(2000)	(1000)	(1000)	(1000)	(1000)	123		
	0.015											153		
	0.018											183		
400	0.022	4.5 x 9.0 x 7.2	0.42	FB...	FC...	FE...	FF...	FH...	FI...	FL...	FM...	223		
	0.027			(1000)	(1000)	(2000)	(2000)	(1000)	(1000)	(1000)	(1000)	273		
	0.033											333		
	0.039											393		
	0.047	6.0 x 11.0 x 7.2	0.64	FB...	FC...	FE...	FF...	FH...	FI...	FL...	FM...	473		
	0.056			(750)	(750)	(2000)	(2000)	(1000)	(1000)	(1000)	(1000)	563		
	0.068											683		
400	0.082	2.5 x 6.5 x 7.2	0.18	FB...	FC...	FE...	FF...	FH...	FI...	FL...	FM...	823		
	0.10			(2000)	(2000)	(2000)	(2000)	(1000)	(1000)	(1000)	(1000)	104		
	0.12											123		
	0.15											153		
	0.18											183		
	0.22											223		

ELECTRICAL DATA AND ORDERING INFORMATION (Compact Size)												
U <sub>RDC</sub> (V)	CAP. ( $\mu$ F)	DIMENSIONS w x h x l (mm)	MASS (g) <sup>(1)</sup>	CATALOG NUMBER BFC2 370 XXXXX AND PACKAGING							C-VALUE	
				AMMOPACK		LOOSE IN BOX			REEL			
				H = 18.5 mm; P <sub>0</sub> = 12.7 mm		SHORT LEADS		LONG LEADS				
				C-TOL. = $\pm 10\%$	C-TOL. = $\pm 5\%$	C-TOL. = $\pm 10\%$	C-TOL. = $\pm 5\%$	C-TOL. = $\pm 10\%$	C-TOL. = $\pm 5\%$	C-TOL. = $\pm 10\%$		
				XX (SPQ)	XX (SPQ)	XX (SPQ)	XX (SPQ)	XX (SPQ)	XX (SPQ)	XX (SPQ)		
$U_{RAC} = 220\text{ V}; \text{PITCH} = 5.08\text{ mm} \pm 0.30\text{ mm}; d_t = 0.50\text{ mm} \pm 0.05\text{ mm}$												
630	0.0010	3.5 x 8.0 x 7.2	0.35	GB... (1500)	GC... (1500)	GE... (2000)	GF... (2000)	GH... (1000)	GI... (1000)	GL... (1500)	GM... (1500)	102
	0.0012											122
	0.0015											152
	0.0018											182
	0.0020											202
	0.0022											222
	0.0024											242
	0.0027											272
	0.0033											332
	0.0039											392
	0.0047											472
	0.0056											562
	0.0068											682
	0.0082											822
	0.010											103
	0.012	4.5 x 9.0 x 7.2	0.45	GB... (1000)	GC... (1000)	GE... (2000)	GF... (2000)	GH... (1000)	GI... (1000)	GL... (1000)	GM... (1000)	123
	0.015											153
	0.018											183
	0.022											223
	0.027	6.0 x 11.0 x 7.2	0.65	GB... (750)	GC... (750)	GE... (2000)	GF... (2000)	GH... (1000)	GI... (1000)	GL... (1000)	GM... (1000)	273
	0.033											333

**Notes**

- SPQ = Standard Packing Quantity

<sup>(1)</sup> 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 packaging information: [www.vishay.com/doc?28139](http://www.vishay.com/doc?28139) or end of catalog.

### Specific Method of Mounting to Withstand Vibration and Shock

In order to withstand vibration and shock tests, it must be ensured that stand-off pips are in good contact with the printed-circuit board:

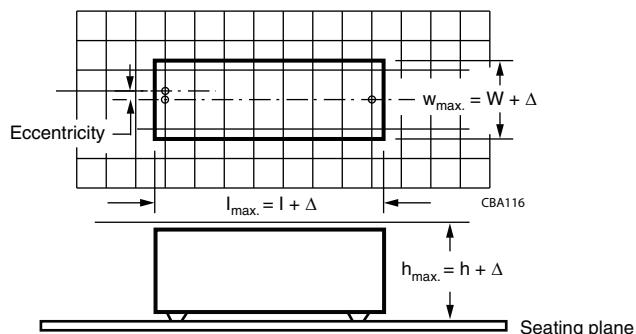
- For pitches  $\leq 15$  mm capacitors shall be mechanically fixed by the leads
- For larger pitches the capacitors shall be mounted in the same way and the body clamped

### 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

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)

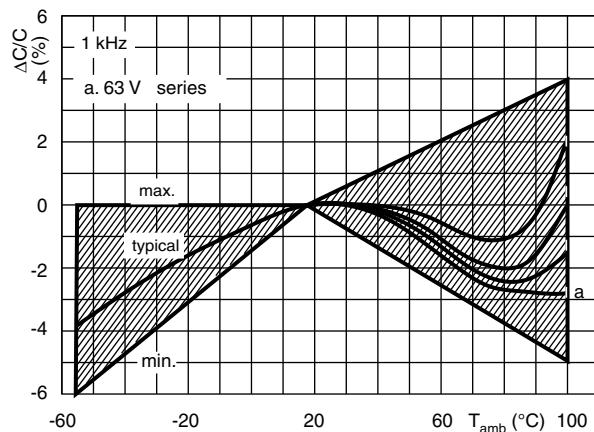
### Storage Temperature

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

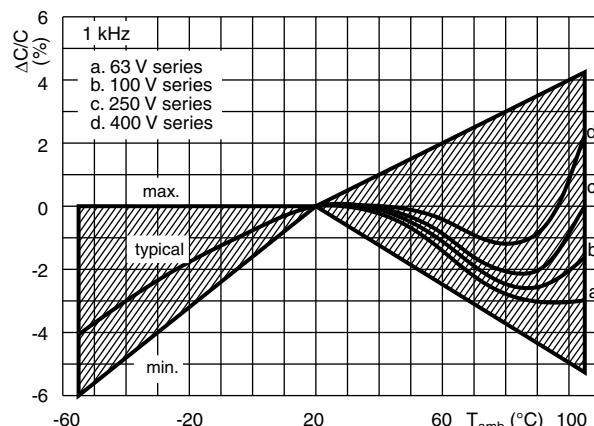
### Ratings and Characteristics Reference Conditions

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 %  $\pm 2$  %.

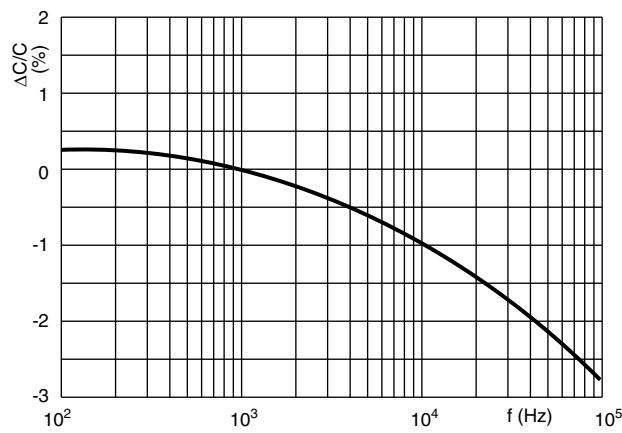
For reference testing, a conditioning period shall be applied over 96 h  $\pm 4$  h by heating the products in a circulating air oven at the rated temperature and a relative humidity not exceeding 20 %.

**CHARACTERISTICS**


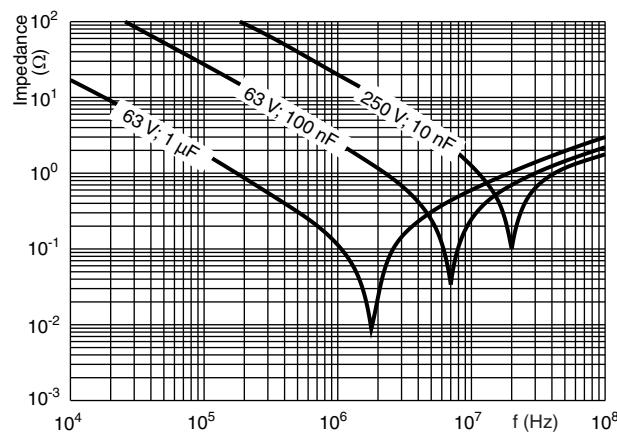
Capacitance as a function of ambient temperature  
(typical curve) for voltage 63 V



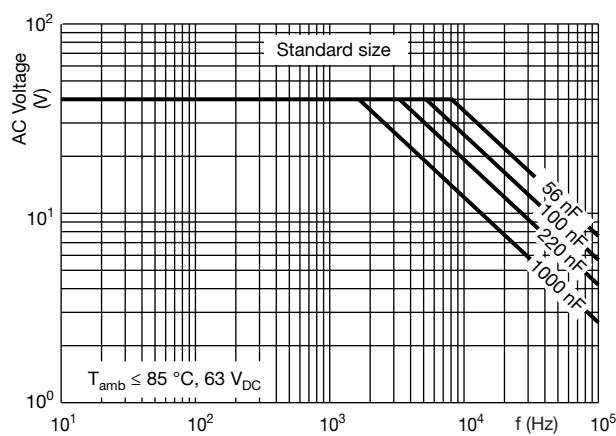
Capacitance as a function of ambient temperature  
(typical curve) for voltages > 63 V



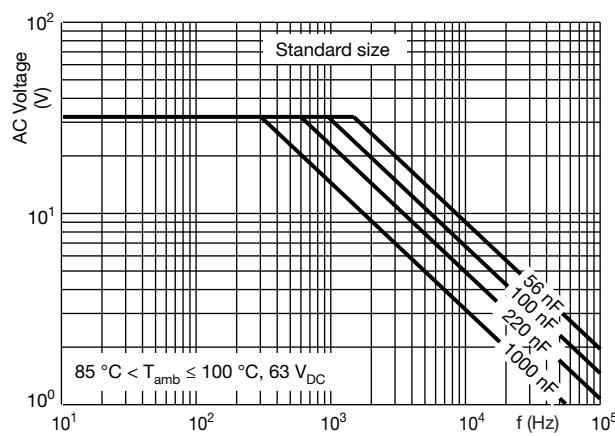
Capacitance as a function of frequency  
(typical curve)



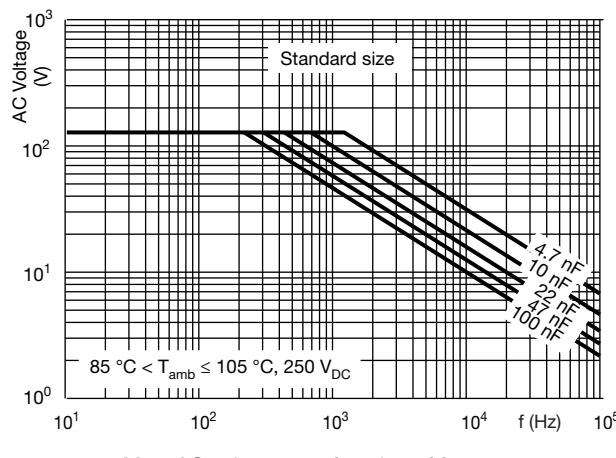
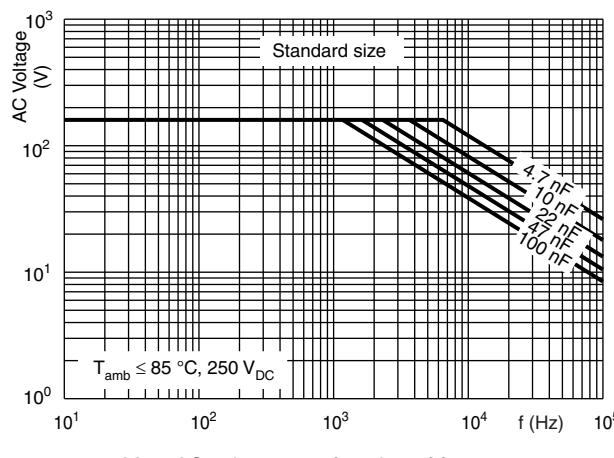
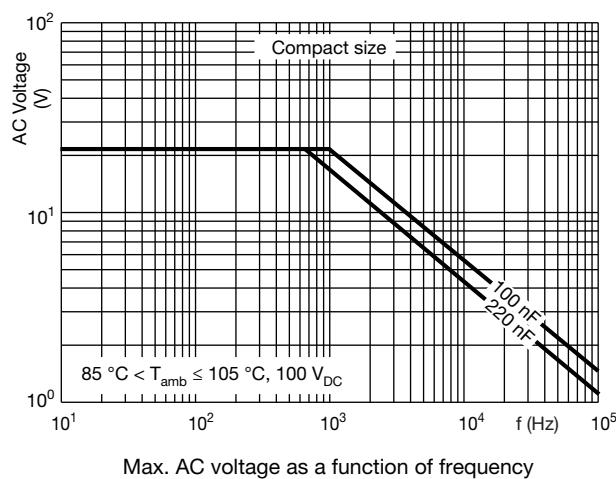
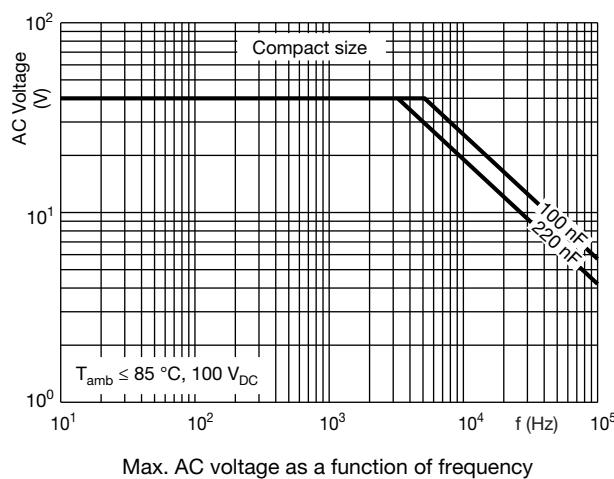
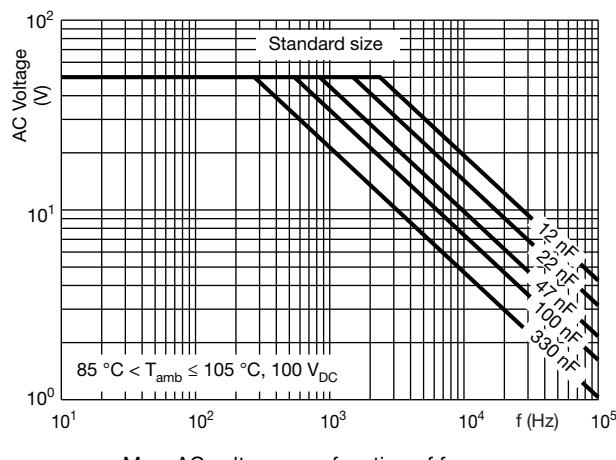
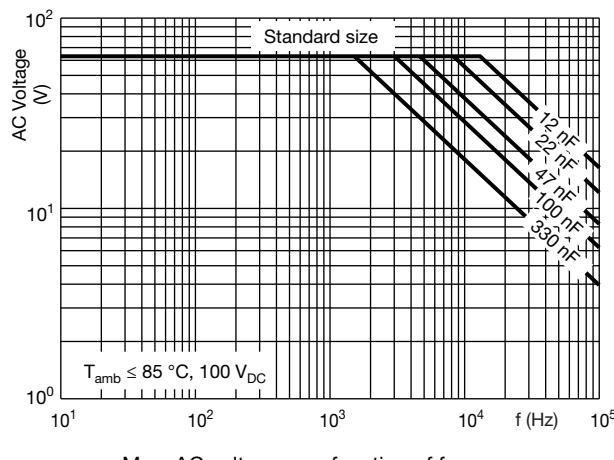
Impedance as a function of frequency

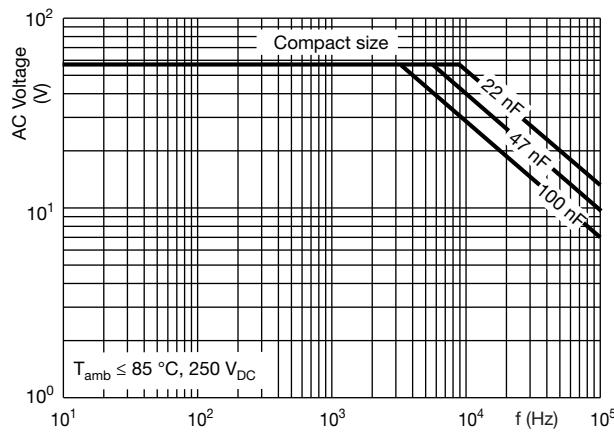


Max. AC voltage as a function of frequency

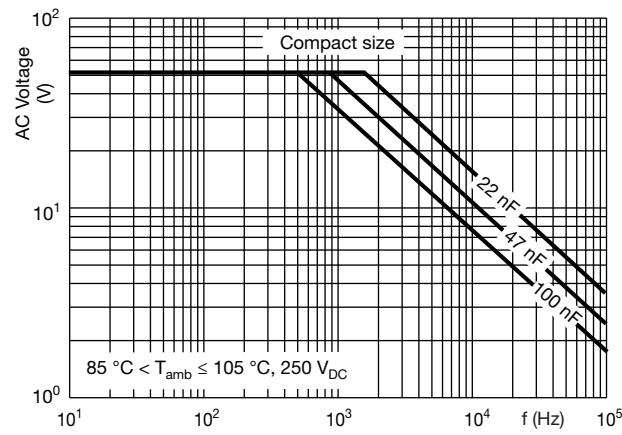


Max. AC voltage as a function of frequency

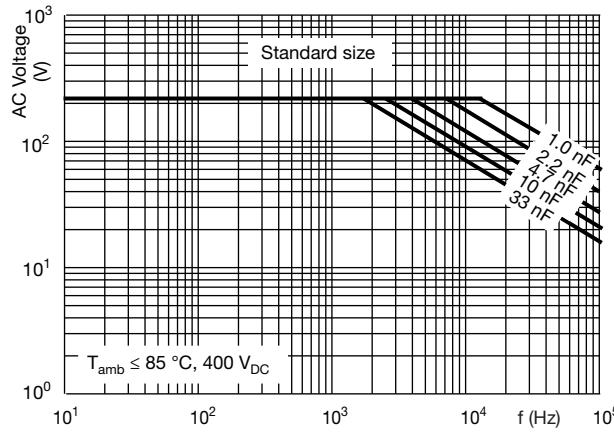
**CHARACTERISTICS**


**CHARACTERISTICS**


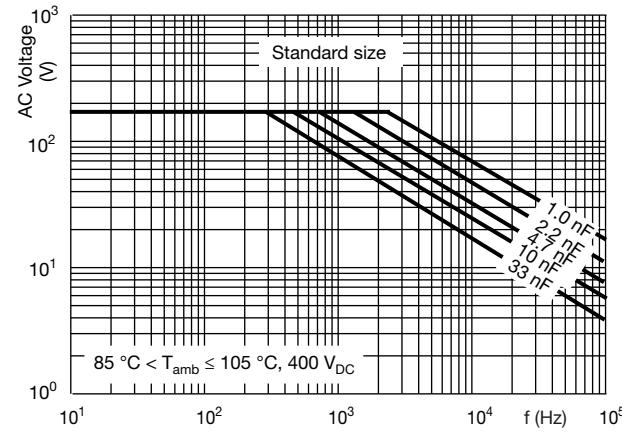
Max. AC voltage as a function of frequency



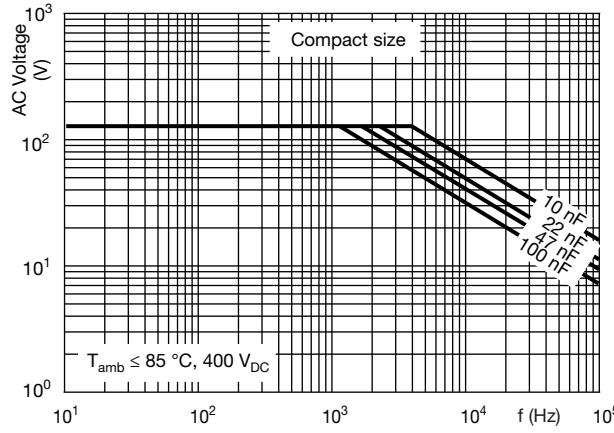
Max. AC voltage as a function of frequency



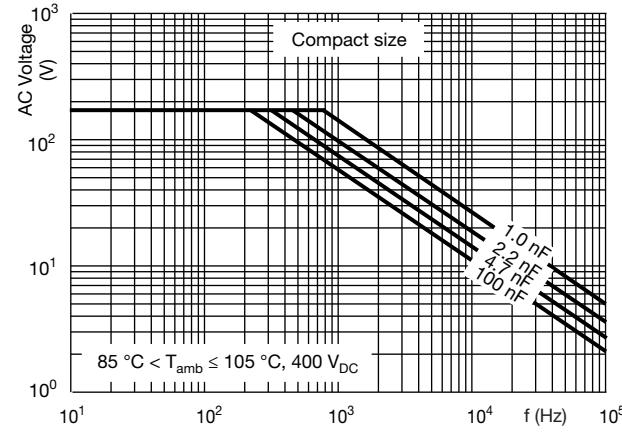
Max. AC voltage as a function of frequency



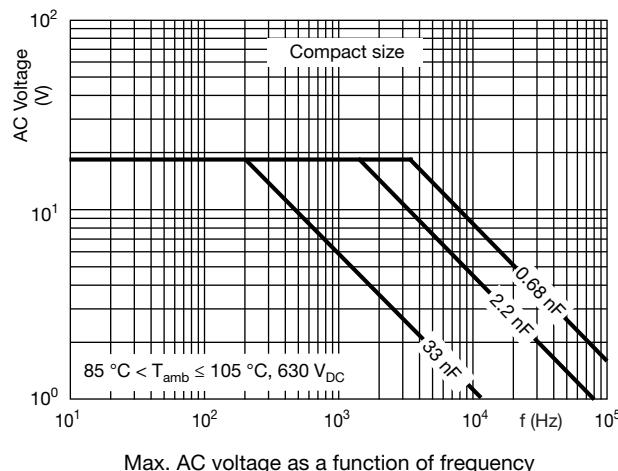
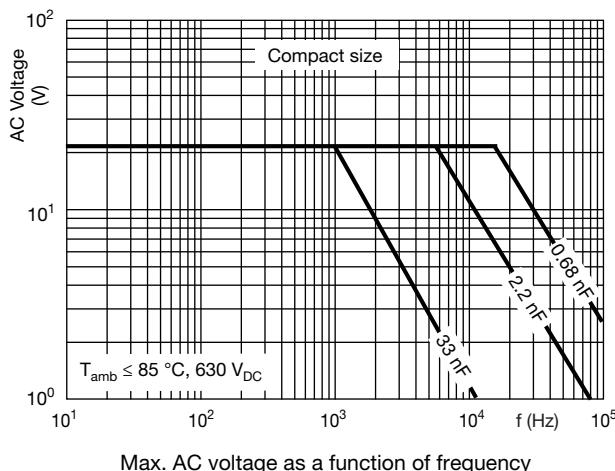
Max. AC voltage as a function of frequency



Max. AC voltage as a function of frequency

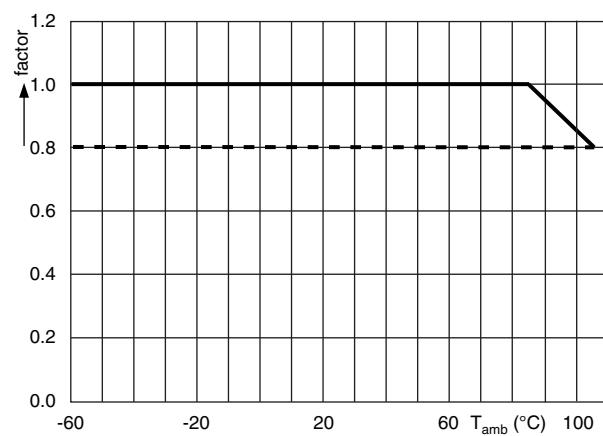
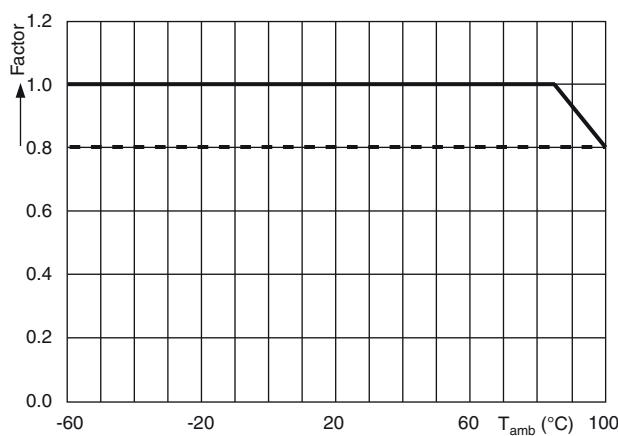
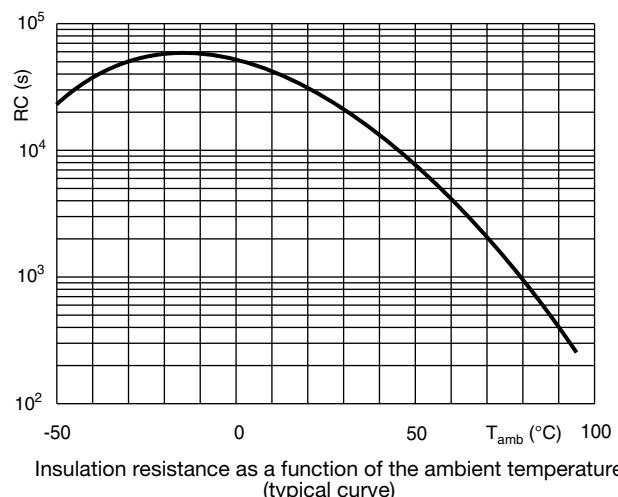
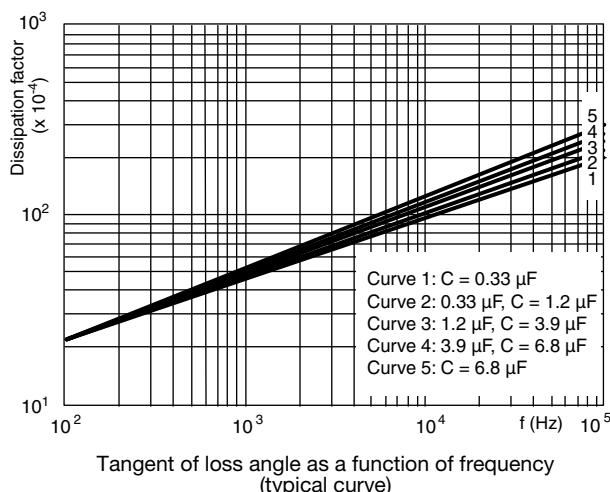


Max. AC voltage as a function of frequency

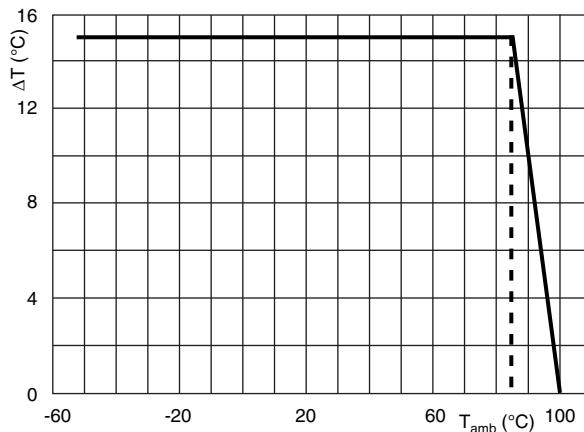
**CHARACTERISTICS**

**Maximum RMS current (sinewave) as a function of frequency**

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

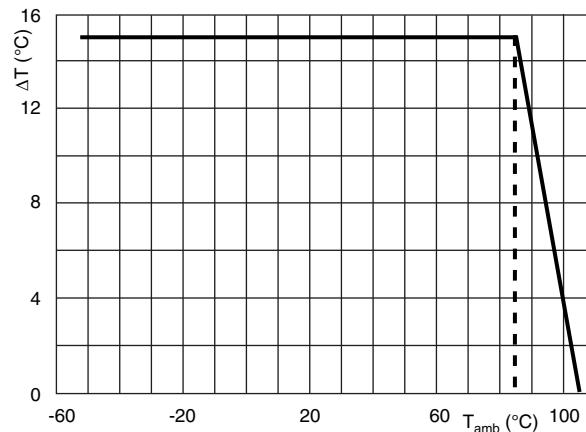
$U_{AC}$  is the maximum AC voltage depending on the ambient temperature in the curves "Max. RMS voltage and AC current as a function of frequency".



## CHARACTERISTICS



Maximum allowed component temperature rise ( $\Delta T$ ) as a function of the ambient temperature ( $T_{amb}$ ) for voltage 63 V



Maximum allowed component temperature rise ( $\Delta T$ ) as a function of the ambient temperature ( $T_{amb}$ ) for voltages > 63 V

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

W <sub>max.</sub> (mm)	HEAT CONDUCTIVITY (mW/°C)	
	PITCH 5 mm	PITCH 10 mm
2.5	2.5	3.0
3.5	3.0	3.5
4.5	4.0	4.5
6.0	5.5	6.0

## 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.

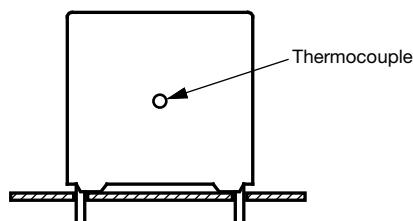
The power dissipation can be calculated according type detail specification "HQN-384-01/101: Technical Information Film Capacitors", [www.vishay.com/doc?28147](http://www.vishay.com/doc?28147).

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

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

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.

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](mailto: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:

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

$T$  is the pulse duration.

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](http://www.vishay.com/doc?28153).

VOLTAGE CONDITIONS FOR 6 ABOVE		
ALLOWED VOLTAGES	$T_{\text{amb}} \leq 85^{\circ}\text{C}$	$85^{\circ}\text{C} < T_{\text{amb}} \leq 100^{\circ}\text{C}$ FOR 63 V
		$85^{\circ}\text{C} < T_{\text{amb}} \leq 105^{\circ}\text{C}$ FOR > 63 V
Maximum continuous RMS voltage	$U_{RAC}$	See "Max. AC voltage as function of temperature CBB952" per characteristics
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

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

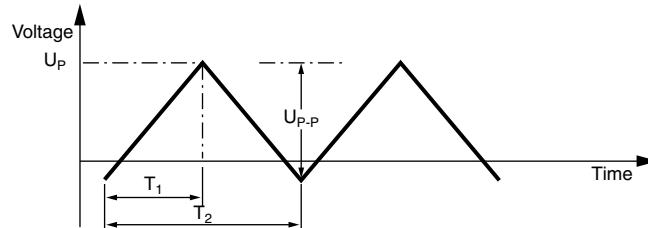
$U_{P-P} = 40 \text{ V}$ ;  $U_P = 35 \text{ V}$ ;  $T_1 = 100 \mu\text{s}$ ;  $T_2 = 200 \mu\text{s}$

The ambient temperature is  $35^{\circ}\text{C}$

Checking conditions:

1. The peak voltage  $U_P = 35 \text{ V}$  is lower than  $63 \text{ V}_{DC}$
2. The peak-to-peak voltage  $40 \text{ V}$  is lower than  $2\sqrt{2} \times 40 \text{ V}_{AC} = 113 \text{ U}_{P-P}$
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  $60 \text{ V}/\mu\text{s}$  (see specific reference data for each version)
4. The dissipated power is  $16.2 \text{ mW}$  as calculated with fourier terms  
The temperature rise for  $W_{\text{max.}} = 3.5 \text{ mm}$  and pitch =  $5 \text{ mm}$  will be  $16.2 \text{ mW}/3.0 \text{ mW}/^{\circ}\text{C} = 5.4^{\circ}\text{C}$   
This is lower than  $15^{\circ}\text{C}$  temperature rise at  $35^{\circ}\text{C}$ , according figure max. allowed component temperature rise
5. Not applicable
6. Not applicable
7. 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
<b>SUB-GROUP C1A PART OF SAMPLE OF SUB-GROUP C1</b>		
4.1 Dimensions (detail)		As specified in chapters “MKT 370 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 and bending	No visible damage
4.4 Resistance to soldering heat	Method: 1A Solder bath: $280 \text{ }^{\circ}\text{C} \pm 5 \text{ }^{\circ}\text{C}$ Duration: 10 s	
4.14 Component solvent resistance	Isopropylalcohol at room temperature Method: 2 Immersion time: $5 \text{ min} \pm 0.5 \text{ min}$ 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 \text{ \%}$ of the value measured initially  Increase of $\tan \delta$ $\leq 0.005$ for: $C \leq 100 \text{ nF}$ or $\leq 0.010$ for: $100 \text{ nF} < C \leq 220 \text{ nF}$ or $\leq 0.015$ for: $220 \text{ nF} < C \leq 470 \text{ nF}$ and $\leq 0.003$ for: $C > 470 \text{ nF}$ Compared to values measured in 4.3.1
<b>SUB-GROUP C1B OTHER PART OF SAMPLE OF SUB-GROUP C1</b>		
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	
4.6 Rapid change of temperature	$\theta A = -55 \text{ }^{\circ}\text{C}$ $\theta B = +100 \text{ }^{\circ}\text{C}$ for rated voltage 63 V $+105 \text{ }^{\circ}\text{C}$ for rated voltage $> 63 \text{ V}$ 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 <sup>2</sup> (whichever is less severe) Total duration 6 h	No visible damage
4.7.2 Final inspection	Visual examination	No visible damage

<b>GROUP C INSPECTION REQUIREMENTS</b>		
<b>SUB-CLAUSE NUMBER AND TEST</b>	<b>CONDITIONS</b>	<b>PERFORMANCE REQUIREMENTS</b>
<b>SUB-GROUP C1B OTHER PART OF SAMPLE OF SUB-GROUP C1</b>		
4.9 Shock	Mounting: see section "Mounting" of this specification Pulse shape: half sine Acceleration: 490 m/s <sup>2</sup> Duration of pulse: 11 ms	
4.9.3 Final measurements	Visual examination  Capacitance  Tangent of loss angle  Insulation resistance	No visible damage   ΔC/C  ≤ 3 % of the value measured in 4.6.1  Increase of tan δ ≤ 0.010 for: 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  As specified in section "Specific Reference Data 370" of this specification
<b>SUB-GROUP C1 COMBINED SAMPLE OF SPECIMENS OF SUB-GROUPS C1A AND C1B</b>		
4.10 Climatic sequence		
4.10.2 Dry heat	Temperature: +100 °C for rated voltage 63 V +105 °C for rated voltage > 63 V 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	Voltage proof = U <sub>RDC</sub> for 1 min within 15 min after removal from testchamber	No breakdown of flash-over
4.10.6.2 Final measurements	Visual examination  Capacitance  Tangent of loss angle  Insulation resistance	No visible damage Legible marking   ΔC/C  ≤ 5 % of the value measured in 4.4.2 or 4.9.3  Increase of tan δ ≤ 0.010 for: 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  ≥ 50 % of values specified in section "Specific Reference Data 370" of this specification
<b>SUB-GROUP C2</b>		
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	

<b>GROUP C INSPECTION REQUIREMENTS</b>		
<b>SUB-CLAUSE NUMBER AND TEST</b>	<b>CONDITIONS</b>	<b>PERFORMANCE REQUIREMENTS</b>
<b>SUB-GROUP C2</b>		
4.11.3 Final measurements	Voltage proof = $U_{RDC}$ for 1 min within 15 min after removal from testchamber 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 4.11.1. Increase of $\tan \delta \leq 0.005$ Compared to values measured in 4.11.1 $\geq 50\%$ of values specified in section "Specific Reference Data 370" of this specification
<b>SUB-GROUP C3</b>		
4.12 Endurance	Duration: 2000 h $1.25 \times U_{RDC}$ at $85^\circ C$ $0.8 \times 1.25 U_{RDC}$ at $+100^\circ C$ for rated voltage 63 V $0.8 \times 1.25 U_{RDC}$ at $+105^\circ C$ for rated voltage $> 63 V$	
4.12.1 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	
4.12.5 Final measurements	Visual examination Capacitance Tangent of loss angle Insulation resistance	No visible damage Legible marking $ \Delta C/C  \leq 5\%$ compared to values measured in 4.12.1 Increase of $\tan \delta$ $\leq 0.005$ for at $85^\circ C$ $\leq 0.010$ for at $100^\circ C$ for: $C \leq 220 \text{ nF}$ or $\leq 0.015$ for: $220 \text{ nF} < C \leq 470 \text{ nF}$ and $\leq 0.003$ for: $C > 470 \text{ nF}$ Compared to values measured in 4.12.1 $\geq 50\%$ of values specified in section "Specific Reference Data 370" of this specification
<b>SUB-GROUP C4</b>		
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 Tangent of loss angle: For $C \leq 470 \text{ nF}$ at 100 kHz or for $C > 470 \text{ nF}$ at 10 kHz	
4.13.3 Final measurements	Capacitance Tangent of loss angle Insulation resistance	$ \Delta C/C  \leq 3\%$ compared to values measured in 4.13.1 Increase of $\tan \delta$ $\leq 0.005$ for: $C \leq 100 \text{ nF}$ or $\leq 0.010$ for: $100 \text{ nF} < C \leq 220 \text{ nF}$ or $\leq 0.015$ for: $220 \text{ nF} < C \leq 470 \text{ nF}$ and $\leq 0.003$ for: $C > 470 \text{ nF}$ Compared to values measured in 4.13.1 $\geq 50\%$ of values specified in section "Specific Reference Data 370" of this specification

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