

DC Film Capacitors MKT Radial Potted Type



FEATURES

- AEC-Q200 qualified (rev. D) for PCM 10.0 mm up to and including 22.5 mm (further customized components on request)
- High temperature capabilities, up to 150 °C
- Capacitance up to 560 µF
- 4-pin version available under request for pitch ≥ 37.5 mm, under request
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

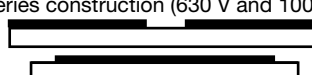
APPLICATIONS

- Automotive
- DC filtering
- Low voltage DC link (48 V bus)
- General purpose


RoHS
COMPLIANT

HALOGEN
FREE
GREEN
(5-2008)

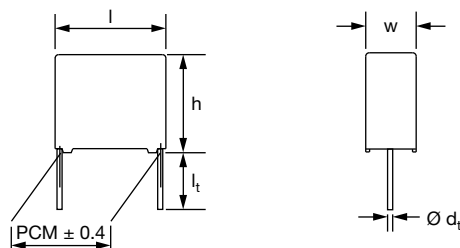
QUICK REFERENCE DATA

Capacitance range	1000 pF to 560 µF
Capacitance tolerance	$\pm 20\%$, $\pm 10\%$, $\pm 5\%$
Climatic testing class according to IEC 60068-1	55/125/56
Maximum application temperature	125 °C
Reference standards	IEC 60384-2
Dielectric	Polyester film
Electrodes	Metallized
Construction	Mono construction  Series construction (630 V and 1000 V) 
Encapsulation	Plastic case, epoxy resin sealed, flame retardant UL-class 94 V-0
Leads	Tinned wire
Marking	C-value; tolerance; rated voltage; code for dielectric material; code for manufacturing origin; manufacturer's type designation; manufacturer's logo or name; year and week of manufacture
Rated (DC) voltage	63 V _{DC} , 100 V _{DC} , 160 V _{DC} , 250 V _{DC} , 400 V _{DC} , 630 V _{DC} , 1000 V _{DC}
Rated (AC) voltage	40 V _{AC} , 63 V _{AC} , 160 V _{AC} , 200 V _{AC} , 220 V _{AC}
Maximum operating temperature for limited time	150 °C at 0.3 U _R for maximum 200 h (not applicable for pitch ≥ 37.5 mm)

Note

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

DIMENSIONS in millimeters



COMPOSITION OF CATALOG NUMBER

Notes

- For detailed tape specifications refer to packaging information www.vishay.com/docs?28139 or end of catalog
- For PCM ≥ 37.5 mm, 4 pin versions are available under customer request

SPECIFIC REFERENCE DATA							
DESCRIPTION				VALUE			
Tangent of loss angle:				at 100 Hz	at 1 kHz	at 10 kHz	at 100 kHz
$C \leq 0.1 \mu\text{F}$				-	$\leq 80 \times 10^{-4}$	$\leq 150 \times 10^{-4}$	$\leq 250 \times 10^{-4}$
$0.1 \mu\text{F} < C \leq 1.0 \mu\text{F}$				-	$\leq 80 \times 10^{-4}$	$\leq 150 \times 10^{-4}$	-
$1.0 \mu\text{F} < C \leq 10.0 \mu\text{F}$				$\leq 35 \times 10^{-4}$	$\leq 150 \times 10^{-4}$	-	-
$10.0 \mu\text{F} < C \leq 100 \mu\text{F}$				$\leq 50 \times 10^{-4}$	$\leq 300 \times 10^{-4}$	-	-
$C > 100 \mu\text{F}$				$\leq 70 \times 10^{-4}$	-	-	-
PITCH (mm)	MAXIMUM PULSE RISE TIME (dU/dt) _R [V/ μ s]						
	63 V _{DC}	100 V _{DC}	160 V _{DC}	250 V _{DC}	400 V _{DC}	630 V _{DC}	1000 V _{DC}
10	12	18	-	36	52	70	260
15	8	10	-	20	32	66	130
22.5	5	6	-	12	18	38	68
27.5	3	5	6	8	14	28	50
37.5	0.8	1	2	3	-	-	-
52.5	0.2	0.3	0.4	1	-	-	-
If the maximum pulse voltage is less than the rated voltage higher dU/dt values can be permitted.							
R between leads, for $C \leq 0.33 \mu\text{F}$ and $U_R \leq 100 \text{ V}$				> 15 000 M Ω			
R between leads, for $C \leq 0.33 \mu\text{F}$ and $U_R > 100 \text{ V}$				> 30 000 M Ω			
RC between leads, for $C > 0.33 \mu\text{F}$ and $U_R \leq 100 \text{ V}$				> 5000 s			
RC between leads, for $C > 0.33 \mu\text{F}$ and $U_R > 100 \text{ V}$				> 10 000 s			
R between leads and case, 100 V; (foil method)				> 30 000 M Ω			
Withstanding (DC) voltage (cut off current 10 mA) ⁽¹⁾ ; rise time < 1000 V/s				1.6 x U _{RDC} , 1 min			
Withstanding (DC) leads and case				2 x U _{RDC} , 1 min			
Maximum application temperature				125 °C			

Note

- ⁽¹⁾ See "Voltage Proof Test for Metalized Film Capacitors": www.vishay.com/doc?28169



ELECTRICAL DATA								
U _{RDC} (V)	CAP. (μF)	CAPACITANCE CODE	VOLTAGE CODE	V _{AC}	DIMENSIONS w x h x l (mm)	PCM (mm)	d _t ± 0.08 mm (mm)	ORDERING CODE FOR 10 % TOL./BULK PACKING ⁽¹⁾
63	0.22	422	06	40	3.5 x 8.0 x 13.0	10.0	0.80	MKT1820422065
	0.33	433			3.5 x 8.0 x 13.0	10.0		MKT1820433065
	0.47	447			3.5 x 8.0 x 13.0	10.0		MKT1820447065
	0.68	468			4.0 x 9.0 x 13.0	10.0		MKT1820468065
	1.0	510			4.5 x 9.5 x 13.0	10.0		MKT1820510065
	1.5	515			5.5 x 10.5 x 13.0	10.0		MKT1820515065
	2.2	522			6.5 x 11.5 x 13.0	10.0		MKT1820522065
	3.3	533			9.0 x 15.5 x 13.0	10.0		MKT1820533065M
	3.3	533			6.5 x 12.5 x 18.0	15.0		MKT1820533065
	4.7	547			9.0 x 15.5 x 13.0	10.0		MKT1820547065M
	4.7	547			7.5 x 13.5 x 18.0	15.0		MKT1820547065
	6.8	568			8.5 x 14.5 x 18.0	15.0		MKT1820568065
	10.0	610			8.5 x 17.5 x 18.0	15.0		MKT1820610065
	15.0	615			8.5 x 16.5 x 26.5	22.5		MKT1820615065
	22.0	622			10.5 x 18.5 x 26.5	22.5		MKT1820622065M
	18.0	618			9.0 x 19.0 x 32.0	27.5		MKT1820618065
	22.0	622			11.0 x 21.0 x 32.0	27.5		MKT1820622065
	27.0	627			11.0 x 21.0 x 32.0	27.5		MKT1820627065
	33.0	633			13.0 x 23.0 x 32.0	27.5		MKT1820633065
	39.0	639			13.0 x 23.0 x 32.0	27.5		MKT1820639065
	47.0	647			15.0 x 25.0 x 32.0	27.5		MKT1820647065
	56.0	656			18.0 x 28.0 x 32.0	27.5		MKT1820656065
	68.0	668			18.0 x 28.0 x 32.0	27.5		MKT1820668065
	82.0	682			21.0 x 31.0 x 32.0	27.5		MKT1820682065
	100.0	710			21.0 x 31.0 x 32.0	27.5		MKT1820710065M
	100.0	710			18.5 x 35.5 x 43.0	37.5	1.0	MKT1820710065
	120.0	712			18.5 x 35.5 x 43.0	37.5		MKT1820712065
	150.0	715			18.5 x 35.5 x 43.0	37.5		MKT1820715065
	180.0	718			21.5 x 38.5 x 43.0	37.5		MKT1820718065
	220.0	722			24.0 x 44.0 x 42.0	37.5		MKT1820722065M
	270.0	727			30.0 x 45.0 x 42.0	37.5		MKT1820727065M
	330.0	733			30.0 x 45.0 x 42.0	37.5		MKT1820733065M
	220.0	722			25.0 x 45.0 x 57.5	52.5	1.2	MKT1820722065
	270.0	727			25.0 x 45.0 x 57.5	52.5		MKT1820727065
	330.0	733			25.0 x 45.0 x 57.5	52.5		MKT1820733065
	390.0	739			30.0 x 45.0 x 57.5	52.5		MKT1820739065
	470.0	747			35.0 x 50.0 x 57.5	52.5		MKT1820747065
	560.0	756			35.0 x 50.0 x 57.5	52.5		MKT1820756065

Note

⁽¹⁾ Please replace "5" by: "4" for 5 % tolerance or "6" for 20 % tolerance



ELECTRICAL DATA								
U _{RDC} (V)	CAP. (μF)	CAPACITANCE CODE	VOLTAGE CODE	V _{AC}	DIMENSIONS w x h x l (mm)	PCM (mm)	d _t ± 0.08 mm (mm)	ORDERING CODE FOR 10 % TOL./BULK PACKING ⁽¹⁾
100	0.068	368	01	63	3.5 x 8.0 x 13.0	10.0	0.8	MKT1820368015
	0.10	410			3.5 x 8.0 x 13.0	10.0		MKT1820410015
	0.15	415			3.5 x 8.0 x 13.0	10.0		MKT1820415015
	0.22	422			3.5 x 8.0 x 13.0	10.0		MKT1820422015
	0.33	433			4.0 x 9.0 x 13.0	10.0		MKT1820433015
	0.47	447			4.5 x 9.5 x 13.0	10.0		MKT1820447015
	0.68	468			5.5 x 10.5 x 13.0	10.0		MKT1820468015
	1.0	510			5.5 x 10.5 x 13.0	10.0		MKT1820510015M
	1.0	510			5.5 x 10.5 x 18.0	15.0		MKT1820510015
	1.5	515			6.5 x 12.5 x 18.0	15.0		MKT1820515015
	2.2	522			6.5 x 12.5 x 18.0	15.0		MKT1820522015
	3.3	533			8.5 x 14.5 x 18.0	15.0		MKT1820533015
	4.7	547			8.5 x 14.5 x 18.0	15.0		MKT1820547015M
	4.7	547			7.5 x 15.5 x 26.5	22.5		MKT1820547015
	6.8	568			8.5 x 16.5 x 26.5	22.5		MKT1820568015
	10.0	610			10.5 x 18.5 x 26.5	22.5		MKT1820610015
	15.0	615			10.5 x 18.5 x 26.5	22.5		MKT1820615015M
	15.0	615			11.0 x 21.0 x 32.0	27.5		MKT1820615015
	18.0	618			13.0 x 23.0 x 32.0	27.5		MKT1820618015
	22.0	622			13.0 x 23.0 x 32.0	27.5		MKT1820622015
	27.0	627			15.0 x 25.0 x 32.0	27.5		MKT1820627015
	33.0	633			18.0 x 28.0 x 32.0	27.5		MKT1820633015
	39.0	639			18.0 x 28.0 x 32.0	27.5		MKT1820639015
	47.0	647			21.0 x 31.0 x 32.0	27.5		MKT1820647015
	56.0	656			21.0 x 31.0 x 32.0	27.5		MKT1820656015M
	56.0	656			18.5 x 35.5 x 43.0	37.5	1.0	MKT1820656015
	68.0	668			18.5 x 35.5 x 43.0	37.5		MKT1820668015
	82.0	682			18.5 x 35.5 x 43.0	37.5		MKT1820682015
	100.0	710			21.5 x 38.5 x 43.0	37.5		MKT1820710015
	120.0	712			24.0 x 44.0 x 42.0	37.5		MKT1820712015M
	150.0	715			30.0 x 45.0 x 42.0	37.5		MKT1820715015M
	180.0	718			30.0 x 45.0 x 42.0	37.5		MKT1820718015M
	120.0	712			25.0 x 45.0 x 57.5	52.5	1.2	MKT1820712015
	150.0	715			25.0 x 45.0 x 57.5	52.5		MKT1820715015
	180.0	718			25.0 x 45.0 x 57.5	52.5		MKT1820718015
	220.0	722			30.0 x 45.0 x 57.5	52.5		MKT1820722015
	270.0	727			35.0 x 50.0 x 57.5	52.5		MKT1820727015
	330.0	733			35.0 x 50.0 x 57.5	52.5		MKT1820733015

Note

⁽¹⁾ Please replace "5" by: "4" for 5 % tolerance or "6" for 20 % tolerance



ELECTRICAL DATA								
U _{RDC} (V)	CAP. (μF)	CAPACITANCE CODE	VOLTAGE CODE	V _{AC}	DIMENSIONS w x h x l (mm)	PCM (mm)	d _t ± 0.08 mm (mm)	ORDERING CODE FOR 10 % TOL./BULK PACKING ⁽¹⁾
160	4.7	547	16	63	9.0 x 19.0 x 32.0	27.5	0.8	MKT1820547165
	6.8	568			11.0 x 21.0 x 32.0	27.5		MKT1820568165
	10.0	610			11.0 x 21.0 x 32.0	27.5		MKT1820610165
	15.0	615			13.0 x 23.0 x 32.0	27.5		MKT1820615165
	18.0	618			15.0 x 25.0 x 32.0	27.5		MKT1820618165
	22.0	622			18.0 x 28.0 x 32.0	27.5		MKT1820622165
	27.0	627			18.0 x 28.0 x 32.0	27.5		MKT1820627165
	33.0	633			31.0 x 31.0 x 32.0	27.5		MKT1820633165M
	33.0	633			18.5 x 35.5 x 43.0	37.5	1.0	MKT1820633165
	39.0	639			18.5 x 35.5 x 43.0	37.5		MKT1820639165
	47.0	647			18.5 x 35.5 x 43.0	37.5		MKT1820647165
	56.0	656			21.5 x 38.5 x 43.0	37.5		MKT1820656165
	68.0	668			21.5 x 38.5 x 43.0	37.5		MKT1820668165
	82.0	682			24.0 x 44.0 x 42.0	37.5		MKT1820682165M
	100.0	710			30.0 x 45.0 x 42.0	37.5		MKT1820710165M
	120.0	712			30.0 x 45.0 x 42.0	37.5		MKT1820712165M
	82.0	682			25.0 x 45.0 x 57.5	52.5	1.2	MKT1820682165
	100.0	710			25.0 x 45.0 x 57.5	52.5		MKT1820710165
	120.0	712			25.0 x 45.0 x 57.5	52.5		MKT1820712165
	150.0	715			30.0 x 45.0 x 57.5	52.5		MKT1820715165
	180.0	718			35.0 x 50.0 x 57.5	52.5		MKT1820718165
	220.0	722			35.0 x 50.0 x 57.5	52.5		MKT1820722165
250	0.022	322	25	160	3.5 x 8.0 x 13.0	10.0	0.8	MKT1820322255
	0.033	333			3.5 x 8.0 x 13.0	10.0		MKT1820333255
	0.047	347			3.5 x 8.0 x 13.0	10.0		MKT1820347255
	0.068	368			3.5 x 8.0 x 13.0	10.0		MKT1820368255
	0.10	410			4.5 x 9.5 x 13.0	10.0		MKT1820410255
	0.15	415			5.5 x 10.5 x 13.0	10.0		MKT1820415255
	0.22	422			6.5 x 11.5 x 13.0	10.0		MKT1820422255
	0.33	433			6.5 x 11.5 x 13.0	10.0		MKT1820433255M
	0.33	433			5.5 x 10.5 x 18.0	15.0		MKT1820433255
	0.47	447			9.0 x 15.5 x 13.0	10.0		MKT1820447255M
	0.47	447			6.5 x 12.5 x 18.0	15.0		MKT1820447255
	0.68	468			7.5 x 13.5 x 18.0	15.0		MKT1820468255
	1.0	510			8.5 x 14.5 x 18.0	15.0		MKT1820510255
	1.5	515			10.5 x 17.5 x 18.0	15.0		MKT1820515255M
	1.5	515			8.5 x 16.5 x 26.5	22.5		MKT1820515255
	2.2	522			10.5 x 18.5 x 26.5	22.5		MKT1820522255
	3.3	533			12.5 x 20.0 x 26.5	22.5		MKT1820533255

Note

⁽¹⁾ Please replace "5" by: "4" for 5 % tolerance or "6" for 20 % tolerance



ELECTRICAL DATA								
U _{RDC} (V)	CAP. (μF)	CAPACITANCE CODE	VOLTAGE CODE	V _{AC}	DIMENSIONS w x h x l (mm)	PCM (mm)	d _t ± 0.08 mm (mm)	ORDERING CODE FOR 10 % TOL./BULK PACKING ⁽¹⁾
250	4.7	547	25	100	11.0 x 21.0 x 32.0	27.5	0.8	MKT1820547255
	6.8	568			13.0 x 23.0 x 32.0	27.5		MKT1820568255
	10.0	610			15.0 x 25.0 x 32.0	27.5		MKT1820610255
	15.0	615			18.0 x 28.0 x 32.0	27.5		MKT1820615255
	18.0	618			21.0 x 31.0 x 32.0	27.5		MKT1820618255M
	18.0	618			18.5 x 35.5 x 43.0	37.5	1.0	MKT1820618255
	22.0	622			18.5 x 35.5 x 43.0	37.5		MKT1820622255
	27.0	627			18.5 x 35.5 x 43.0	37.5		MKT1820627255
	33.0	633			21.5 x 38.5 x 43.0	37.5		MKT1820633255
	39.0	639			21.5 x 38.5 x 43.0	37.5		MKT1820639255
	47.0	647			24.0 x 44.0 x 42.0	37.5		MKT1820647255
	56.0	656			30.0 x 45.0 x 42.0	37.5		MKT1820656255
	68.0	668			30.0 x 45.0 x 42.0	37.5		MKT1820668255
	56.0	656			25.0 x 45.0 x 57.5	52.5	1.2	MKT1820656255M
	68.0	668			25.0 x 45.0 x 57.5	52.5		MKT1820668255M
	82.0	682			25.0 x 45.0 x 57.5	52.5		MKT1820682255
	100.0	710			30.0 x 45.0 x 57.5	52.5		MKT1820710255
	120.0	712			35.0 x 50.0 x 57.5	52.5		MKT1820712255
400	0.010	310	40	200	3.5 x 8.0 x 13.0	10.0	0.8	MKT1820310405
	0.015	315			3.5 x 8.0 x 13.0	10.0		MKT1820315405
	0.022	322			3.5 x 8.0 x 13.0	10.0		MKT1820322405
	0.033	333			4.0 x 9.0 x 13.0	10.0		MKT1820333405
	0.047	347			4.5 x 9.5 x 13.0	10.0		MKT1820347405
	0.068	368			5.5 x 10.5 x 13.0	10.0		MKT1820368405
	0.10	410			6.5 x 11.5 x 13.0	10.0		MKT1820410405
	0.15	415			9.0 x 15.5 x 13.0	10.0		MKT1820415405M
	0.15	415			6.5 x 12.5 x 18.0	15.0		MKT1820415405
	0.22	422			9.0 x 15.5 x 13.0	10.0		MKT1820422405M
	0.22	422			6.5 x 12.5 x 18.0	15.0		MKT1820422405
	0.33	433			7.5 x 13.5 x 18.0	15.0		MKT1820433405
	0.47	447			8.5 x 17.5 x 18.0	15.0		MKT1820447405
	0.68	468			8.5 x 16.5 x 26.5	22.5		MKT1820468405
	1.0	510			10.5 x 18.5 x 26.5	22.5		MKT1820510405
	1.5	515			11.0 x 21.0 x 26.5	22.5		MKT1820515405M
	1.5	515			11.0 x 21.0 x 31.0	27.5		MKT1820515405
	2.2	522			13.5 x 23.5 x 31.5	27.5		MKT1820522405
	3.3	533			15 x 24.5 x 31.5	27.5		MKT1820533405
	4.7	547			18.0 x 28.0 x 31.5	27.5		MKT1820547405

Note

(1) Please replace "5" by: "4" for 5 % tolerance or "6" for 20 % tolerance



ELECTRICAL DATA								
U _{RDC} (V)	CAP. (μF)	CAPACITANCE CODE	VOLTAGE CODE	V _{AC}	DIMENSIONS w x h x l (mm)	PCM (mm)	d _t ± 0.08 mm (mm)	ORDERING CODE FOR 10 % TOL./BULK PACKING ⁽¹⁾
630	0.0010	210	63	220	3.5 x 8.0 x 13.0	10.0	0.80	MKT1820210635
	0.0015	215			3.5 x 8.0 x 13.0	10.0		MKT1820215635
	0.0022	222			3.5 x 8.0 x 13.0	10.0		MKT1820222635
	0.0033	233			3.5 x 8.0 x 13.0	10.0		MKT1820233635
	0.0047	247			3.5 x 8.0 x 13.0	10.0		MKT1820247635
	0.0068	268			3.5 x 8.0 x 13.0	10.0		MKT1820268635
	0.010	310			4.0 x 9.0 x 13.0	10.0		MKT1820310635
	0.015	315			4.5 x 9.5 x 13.0	10.0		MKT1820315635
	0.022	322			5.5 x 10.5 x 13.0	10.0		MKT1820322635
	0.033	333			6.5 x 11.5 x 13.0	10.0		MKT1820333635M
	0.033	333			5.5 x 10.5 x 18.0	15.0		MKT1820333635
	0.047	347			6.5 x 11.5 x 13.0	10.0		MKT1820347635M
	0.047	347			6.5 x 12.5 x 18.0	15.0		MKT1820347635
	0.068	368			7.5 x 13.5 x 18.0	15.0		MKT1820368635
	0.10	410			7.5 x 13.5 x 18.0	15.0		MKT1820410635M
	0.10	410			6.5 x 14.5 x 26.5	22.5		MKT1820410635
	0.15	415			7.5 x 15.5 x 26.5	22.5		MKT1820415635
	0.22	422			8.5 x 16.5 x 26.5	22.5		MKT1820422635
	0.33	433			11.0 x 21.0 x 31.0	27.5		MKT1820433635
	0.47	447			11.0 x 21.0 x 31.0	27.5		MKT1820447635
	0.68	468			13.5 x 23.5 x 31.5	27.5		MKT1820468635
	1.0	510			15.0 x 24.5 x 31.5	27.5		MKT1820510635
	1.5	515			18.0 x 28.0 x 31.5	27.5		MKT1820515635
1000	0.0010	210	10	220	4.0 x 9.0 x 13.0	10.0	0.80	MKT1820210105
	0.0015	215			4.0 x 9.0 x 13.0	10.0		MKT1820215105
	0.0022	222			4.0 x 9.0 x 13.0	10.0		MKT1820222105
	0.0033	233			4.0 x 9.0 x 13.0	10.0		MKT1820233105
	0.0047	247			5.5 x 10.5 x 13.0	10.0		MKT1820247105
	0.0068	268			6.5 x 11.5 x 13.0	10.0		MKT1820268105
	0.010	310			5.5 x 10.5 x 18.0	15.0		MKT1820310105
	0.015	315			6.5 x 12.5 x 18.0	15.0		MKT1820315105
	0.022	322			7.5 x 13.5 x 18.0	15.0		MKT1820322105
	0.033	333			8.5 x 14.5 x 18.0	15.0		MKT1820333105M
	0.033	333			6.5 x 14.5 x 26.5	22.5		MKT1820333105
	0.047	347			7.5 x 15.5 x 26.5	22.5		MKT1820347105
	0.068	368			8.5 x 16.5 x 26.5	22.5		MKT1820368105
	0.10	410			10.5 x 18.5 x 26.5	22.5		MKT1820410105
	0.15	415			11.0 x 21.0 x 31.0	27.5		MKT1820415105
	0.22	422			13.5 x 23.5 x 31.5	27.5		MKT1820422105
	0.33	433			16.5 x 29.5 x 31.5	27.5		MKT1820433105
	0.47	447			20.0 x 35.0 x 31.5	27.5		MKT1820447105

Note

⁽¹⁾ Please replace "5" by: "4" for 5 % tolerance or "6" for 20 % tolerance

RECOMMENDED PACKAGING								
PACKAGING CODE	TYPE OF PACKAGING	HEIGHT (H) (mm)	REEL DIAMETER/ BOX SIZE (mm)	ORDERING CODE EXAMPLES	PITCH 10	PITCH 15	PITCH 22.5 TO 27.5	PITCH 37.5 TO 52.5
G	Ammo	18.5	55 x 210 x 340	MKT1820410405G	x	x	-	-
W	Reel	18.5	350	MKT1820410405W	x	x	-	-
V	Reel	18.5	500	MKT1820422635V	-	x	x	-
G	Ammo	18.5	60 x 360 x 510	MKT1820422635G	-	-	x	-
-	Bulk	-	-	MKT1820515405	x	x	x	x

EXAMPLE OF ORDERING CODE				
TYPE	CAPACITANCE CODE	VOLTAGE CODE	TOLERANCE CODE ⁽¹⁾	PACKAGING CODE
MKT1820	410	06	5	G

MOUNTING

Normal Use

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

For detailed tape specifications refer to packaging information www.vishay.com/docs?28139

Specific Method of Mounting to Withstand Vibration and Shock

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

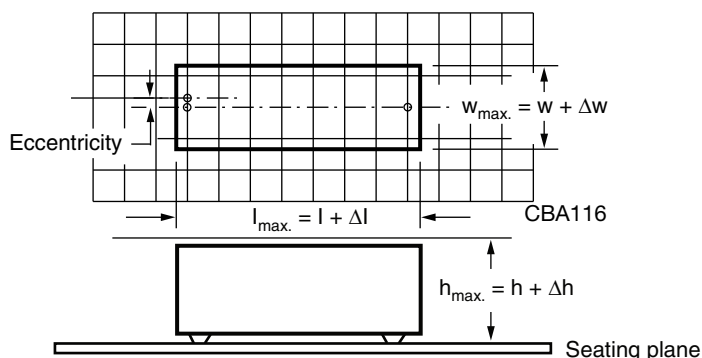
- For pitches ≤ 15 mm the capacitors shall be mechanically fixed by the leads
- For larger pitches the capacitors shall be mounted in the same way and the body clamped

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 ≤ 15 mm, $\Delta w = \Delta l = 0.3$ mm; $\Delta h = 0.1$ mm
- For products with 15 mm $<$ pitch ≤ 27.5 mm, $\Delta w = \Delta l = 0.5$ mm; $\Delta h = 0.1$ mm
- For products with 27.5 mm $<$ pitch ≤ 52.5 mm, $\Delta w = \Delta l = 0.5$ mm; $\Delta h = 0.5$ 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

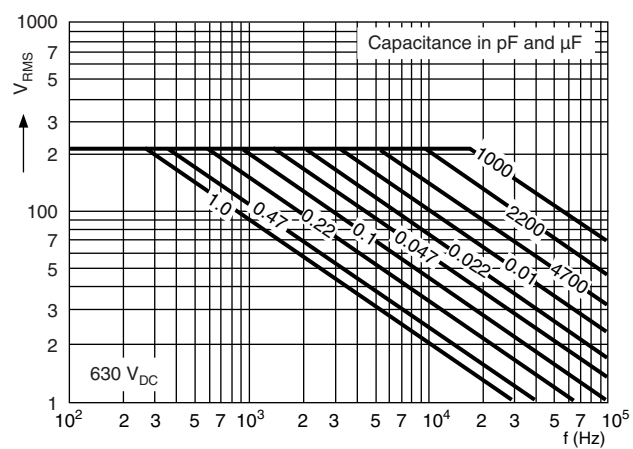
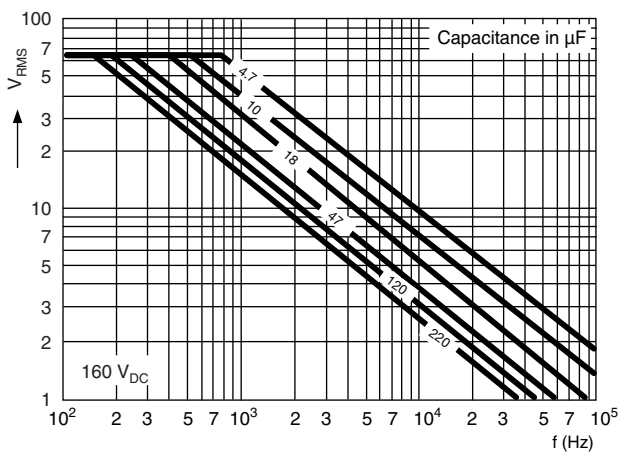
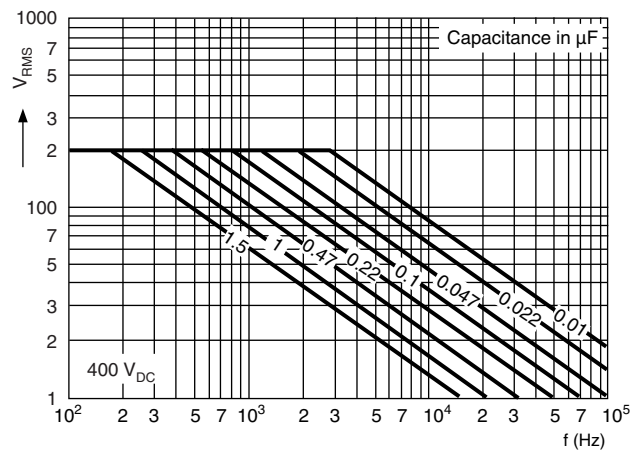
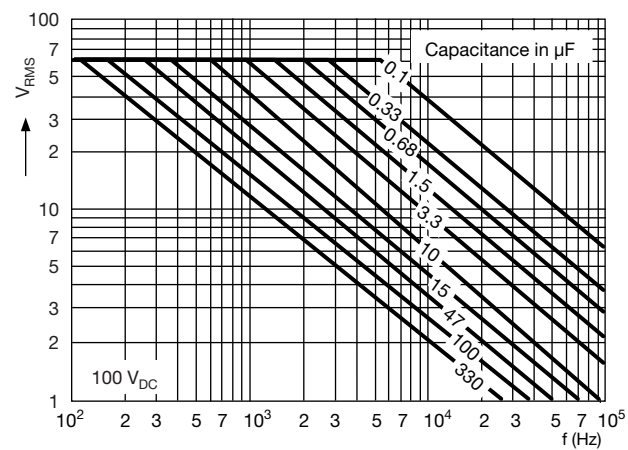
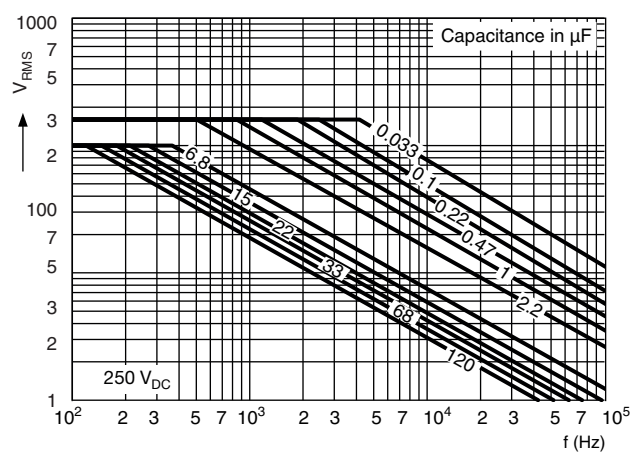
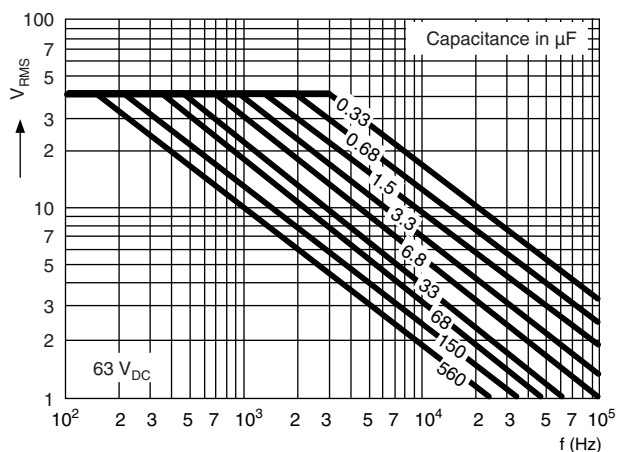
Ratings and Characteristics Reference Conditions

Unless otherwise specified, all electrical values apply to an ambient free 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 %.

CHARACTERISTICS

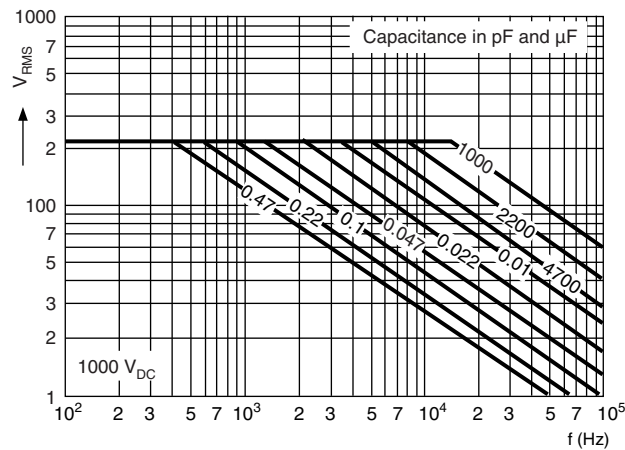
PERMISSIBLE AC VOLTAGE VS. FREQUENCY AT $T_{amb} \leq 85^{\circ}C$



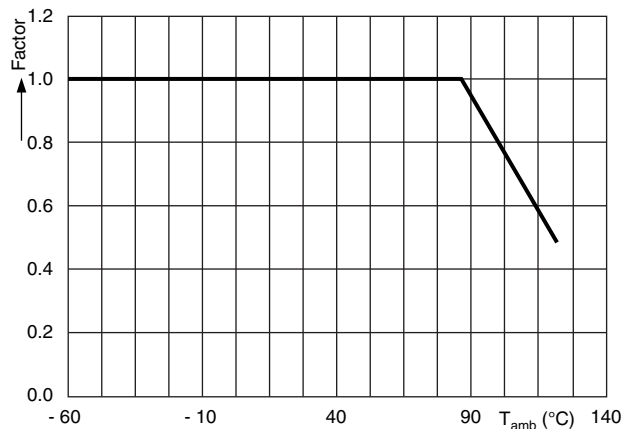


CHARACTERISTICS

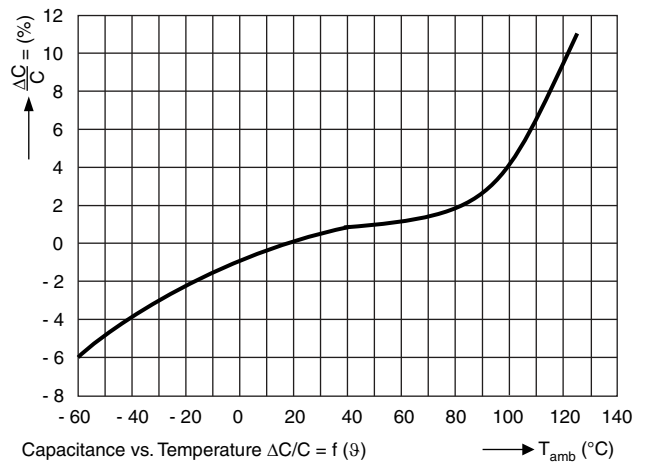
PERMISSIBLE AC VOLTAGE VS. FREQUENCY AT $T_{amb} \leq 85^\circ\text{C}$



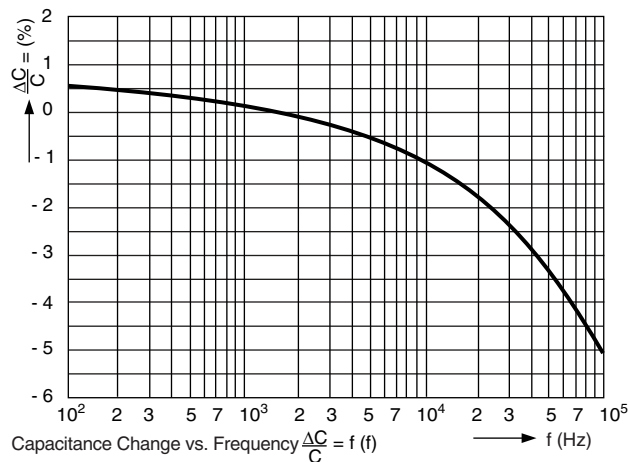
CHARACTERISTICS



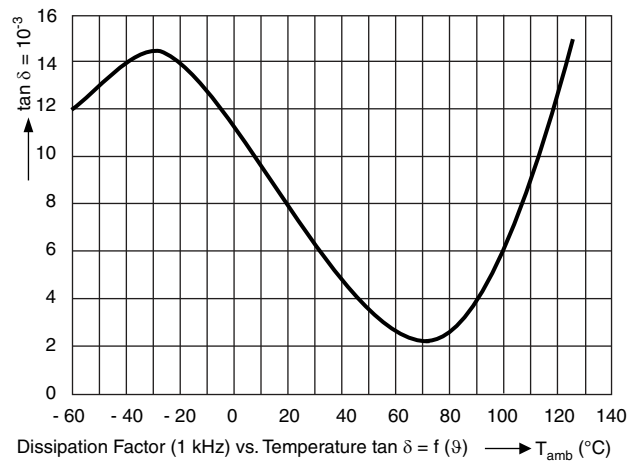
Nominal voltage (AC and DC) as a function of temperature



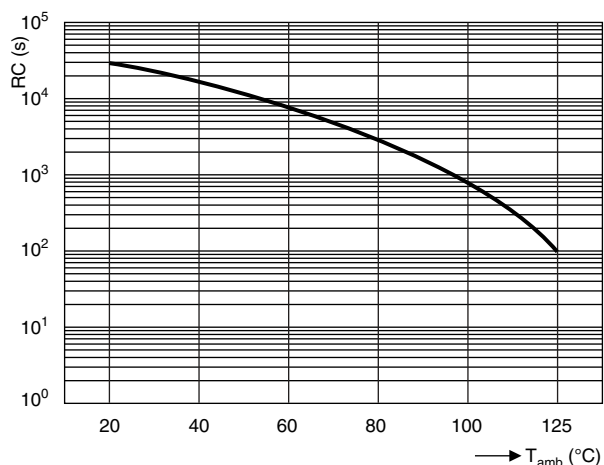
Capacitance vs. Temperature $\Delta C/C = f(T)$
Capacitance as a function of temperature (typical curve)



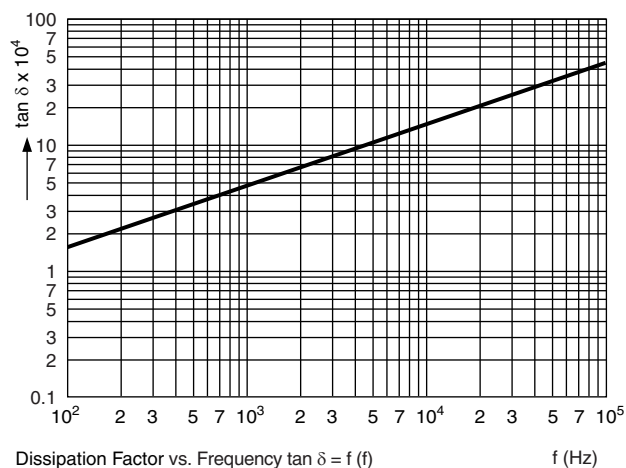
Capacitance Change vs. Frequency $\Delta C/C = f(f)$
Capacitance as a function of frequency (typical curve)



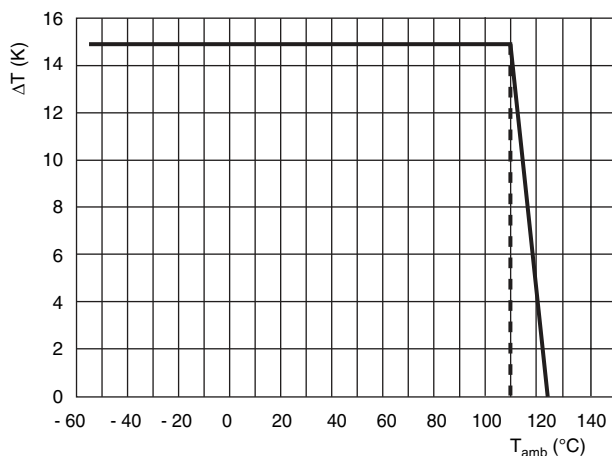
Dissipation Factor (1 kHz) vs. Temperature $\tan \delta = f(T)$
Dissipation factor as a function of temperature (typical curve)



Insulation resistance as a function of temperature
(typical curve)



Dissipation Factor vs. Frequency $\tan \delta = f(f)$
Dissipation factor as a function of frequency
(typical curve)



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

HEAT CONDUCTIVITY (G) AS A FUNCTION OF CAPACITOR BODY THICKNESS IN mW/°C						
W_{max.} (mm)	HEAT CONDUCTIVITY (mW/°C)					
	PITCH 10.0 mm	PITCH 15.0 mm	PITCH 22.5 mm	PITCH 27.5 mm	PITCH 37.5 mm	PITCH 52.5 mm
3.5	5.0	-	-	-	-	-
4.0	6.0	-	-	-	-	-
4.5	7.0	-	-	-	-	-
5.5	8.0	10.0	-	-	-	-
6.5	10.0	13.0	20.0	-	-	-
7.5	-	15.0	22.0	-	-	-
8.5	-	16.0	24.0	-	-	-
9.0	-	-	-	32.0	-	-
10.5	-	-	30.0	-	-	-
11.0	-	-	-	38.0	-	-
11.5	-	-	-	38.0	-	-
12.5	-	-	34.0	-	-	-
13.0	-	-	-	45.0	-	-
13.5	-	-	-	45.0	-	-
15.0	-	-	-	50.0	-	-
16.5	-	-	-	58.0	-	-
18.0	-	-	-	60.0	-	-
18.5	-	-	-	-	90.0	-
20.0	-	-	-	73.0	-	-
21.0	-	-	-	70.0	-	-
21.5	-	-	-	-	102.0	-
24.0	-	-	-	-	118.0	-
25.0	-	-	-	-	-	155.0
30.0	-	-	-	-	135.0	170.0
35.0	-	-	-	-	-	200.0

POWER DISSIPATION AND MAXIMUM COMPONENT TEMPERATURE RISE

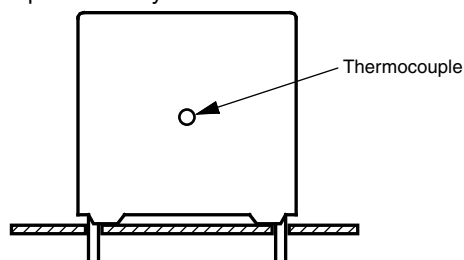
The power dissipation must be limited in order not to exceed the maximum allowed component temperature rise as a function of the free air ambient temperature.

The component temperature rise (ΔT) can be measured or calculated by $\Delta T = P/G$:

- ΔT = component temperature rise (°C) with a maximum of 15 °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 thermal radiation or convection, the capacitor must be tested in a closed area from air circulation.

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. 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 the maximum (U_{P-P}) 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:

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

T is the pulse duration.

4. The maximum component surface temperature rise must be lower than the limits (see graph "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 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).
7. 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.

VOLTAGE CONDITIONS FOR 6 ABOVE			
ALLOWED VOLTAGES	$T_{amb} \leq 85\text{ °C}$	$85\text{ °C} < T_{amb} \leq 100\text{ °C}$	$100\text{ °C} < T_{amb} \leq 125\text{ °C}$
Maximum continuous RMS voltage	U_{RAC}	$0.8 \times U_{RAC}$	$0.5 \times U_{RAC}$
Maximum temperature RMS-overvoltage (< 24 h)	$1.25 \times U_{RAC}$	U_{RAC}	$0.6 \times U_{RAC}$
Maximum peak voltage (V_{O-P}) (< 2 s)	$1.6 \times U_{RDC}$	$1.3 \times U_{RDC}$	$0.5 \times U_{RDC}$

**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 Tangent of loss angle: for $C \leq 1 \mu\text{F}$ at 10 kHz for $1 \mu\text{F} < C < 100 \mu\text{F}$ at 1 kHz for $C \geq 100 \mu\text{F}$ at 100 Hz	
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 min $\pm$ 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 $\tan \delta$: ≤ 0.003 for $C \leq 1 \mu\text{F}$ or ≤ 0.002 for $C > 1 \mu\text{F}$ ≤ 0.004 for $C \geq 100 \mu\text{F}$ 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 $C \leq 1 \mu\text{F}$ at 10 kHz for $1 \mu\text{F} < C < 100 \mu\text{F}$ at 1 kHz for $C \geq 100 \mu\text{F}$ at 100 Hz	
4.6 Rapid change of temperature	$\theta A = -55 \text{ }^{\circ}\text{C}$ $\theta B = +125 \text{ }^{\circ}\text{C}$ 5 cycles Duration $t = 30 \text{ min}$ Visual examination	No visible damage Legible marking
4.7 Vibration	Mounting: see section “Mounting” of this specification Procedure B4 Frequency range: 10 Hz to 55 Hz Amplitude: 0.75 mm or Acceleration 98 m/s^2 (whichever is less severe) Total duration 6 h	
4.7.2 Final inspection	Visual examination	No visible damage
4.9 Shock	Mounting: see section “Mounting” for more information Pulse shape: half sine Acceleration: 490 m/s^2 Duration of pulse: 11 ms	



GROUP C INSPECTION REQUIREMENTS		
SUB-CLAUSE NUMBER AND TEST	CONDITIONS	PERFORMANCE REQUIREMENTS
SUB-GROUP C1B PART OF SAMPLE OF SUB-GROUP C1		
4.9.3 Final measurements	Visual examination Capacitance Tangent of loss angle For $C \leq 1 \mu\text{F}$ at 10 kHz For $1 \mu\text{F} < C < 100 \mu\text{F}$ at 1 kHz For $C \geq 100 \mu\text{F}$ at 100 Hz Insulation resistance	No visible damage $ \Delta C/C \leq 5 \%$ of the value measured in 4.6.1 Increase of $\tan \delta$: ≤ 0.003 for $C \leq 1 \mu\text{F}$ or ≤ 0.002 for $C > 1 \mu\text{F}$ ≤ 0.004 for $C \geq 100 \mu\text{F}$ 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 4.10.3 Damp heat cyclic Test Db, first cycle 4.10.4 Cold 4.10.6 Damp heat cyclic Test Db, remaining cycles 4.10.6.2 Final measurements	Temperature: +125 °C Duration: 16 h Temperature: -55 °C Duration: 2 h Voltage proof = U_{RDC} for 1 min within 15 min after removal from testchamber Visual examination Capacitance Tangent of loss angle For $C \leq 1 \mu\text{F}$ at 10 kHz For $1 \mu\text{F} < C < 100 \mu\text{F}$ at 1 kHz For $C \geq 100 \mu\text{F}$ at 100 Hz Insulation resistance	No breakdown or flashover No visible damage Legible marking $ \Delta C/C \leq 5 \%$ of the value measured in 4.4.2 or 4.9.3 Increase of $\tan \delta$: ≤ 0.005 for $C \leq 1 \mu\text{F}$ or ≤ 0.003 for $C > 1 \mu\text{F}$ ≤ 0.004 for $C \geq 100 \mu\text{F}$ Compared to values measured in 4.3.1 or 4.6.1 $\geq 50 \%$ of values specified in section "Insulation Resistance" of this specification
SUB-GROUP C2		
4.11 Damp heat steady state 4.11.1 Initial measurements 4.11.3 Final measurements	56 days; 40 °C; 90 % to 95 % RH Capacitance Tangent of loss angle For $C \leq 1 \mu\text{F}$ at 10 kHz For $1 \mu\text{F} < C < 100 \mu\text{F}$ at 1 kHz For $C \geq 100 \mu\text{F}$ at 100 Hz Voltage proof = U_{RDC} for 1 min within 15 min after removal from testchamber Visual examination	No breakdown or flashover No visible damage Legible marking



GROUP C INSPECTION REQUIREMENTS		
SUB-CLAUSE NUMBER AND TEST	CONDITIONS	PERFORMANCE REQUIREMENTS
SUB-GROUP C2		
4.11.3 Final measurements	Capacitance Tangent of loss angle For $C \leq 1 \mu\text{F}$ at 10 kHz For $1 \mu\text{F} < C < 100 \mu\text{F}$ at 1 kHz For $C \geq 100 \mu\text{F}$ at 100 Hz Insulation resistance	$ \Delta C/C \leq 5\%$ of the value measured in 4.11.1. Increase of $\tan \delta$ ≤ 0.005 for $C \leq 1 \mu\text{F}$ or ≤ 0.003 for $C > 1 \mu\text{F}$ ≤ 0.004 for $C \geq 100 \mu\text{F}$ Compared to values measured in 4.11.1 $\geq 50\%$ of values specified in section "Insulation Resistance" 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 100 °C 0.6 x U_{RDC} at 125 °C Duration: 200 h 0.3 x U_{RDC} at 150 °C (not applicable for pitch ≥ 37.5 mm)	
4.12.1 Initial measurements	Capacitance Tangent of loss angle: for $C \leq 1 \mu\text{F}$ at 10 kHz for $1 \mu\text{F} < C < 100 \mu\text{F}$ at 1 kHz for $C \geq 100 \mu\text{F}$ at 100 Hz	
4.12.5 Final measurements	Visual examination Capacitance Tangent of loss angle For $C \leq 1 \mu\text{F}$ at 10 kHz For $1 \mu\text{F} < C < 100 \mu\text{F}$ at 1 kHz For $C \geq 100 \mu\text{F}$ at 100 Hz Insulation resistance	No visible damage Legible marking $ \Delta C/C \leq 5\%$ compared to values measured in 4.12.1 Increase of $\tan \delta$: ≤ 0.003 for $C \leq 1 \mu\text{F}$ or ≤ 0.002 for $1 \mu\text{F} < C < 100 \mu\text{F}$ ≤ 0.004 for $C \geq 100 \mu\text{F}$ Compared to values measured in 4.12.1 $\geq 50\%$ of values specified in section "Insulation Resistance" of this specification
SUB-GROUP C4		
4.13 Charge and discharge	10 000 cycles Charged to U_{RDC} Discharge resistance: $R = \frac{U_R}{C \times K \times (dU/dt)_R}$ K = 5 for pitch ≤ 27.5 mm K = 1.5 for pitch 37.5 mm/52.5 mm	
4.13.1 Initial measurements	Capacitance Tangent of loss angle: for $C \leq 1 \mu\text{F}$ at 10 kHz for $1 \mu\text{F} < C < 100 \mu\text{F}$ at 1 kHz for $C \geq 100 \mu\text{F}$ at 100 Hz	
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 $\tan \delta$: ≤ 0.003 for $C \leq 1 \mu\text{F}$ or ≤ 0.002 for $C > 1 \mu\text{F}$ ≤ 0.004 for $C \geq 100 \mu\text{F}$ Compared to values measured in 4.13.1 $\geq 50\%$ of values specified in section "Insulation Resistance" of this specification



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