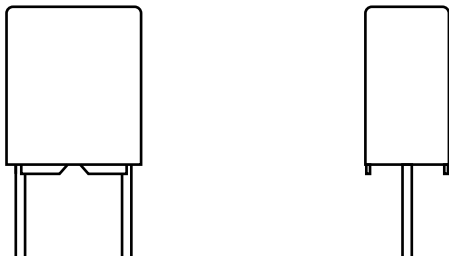




Interference Suppression Film Capacitors MKT Radial Potted Type



FEATURES

- 15 mm to 37.5 mm lead pitch
- Supplied loose in box, taped on reel
- Material categorization:
for definitions of compliance please see
www.vishay.com/doc?99912




RoHS
COMPLIANT
HALOGEN
FREE

APPLICATIONS

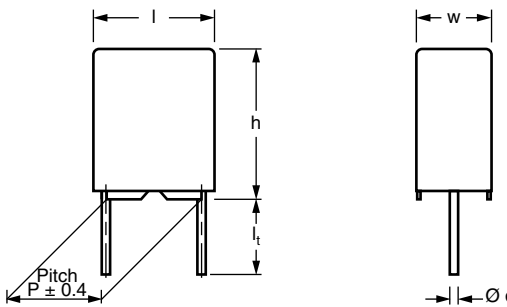
High stability grade for continuous across the line X2 applications.

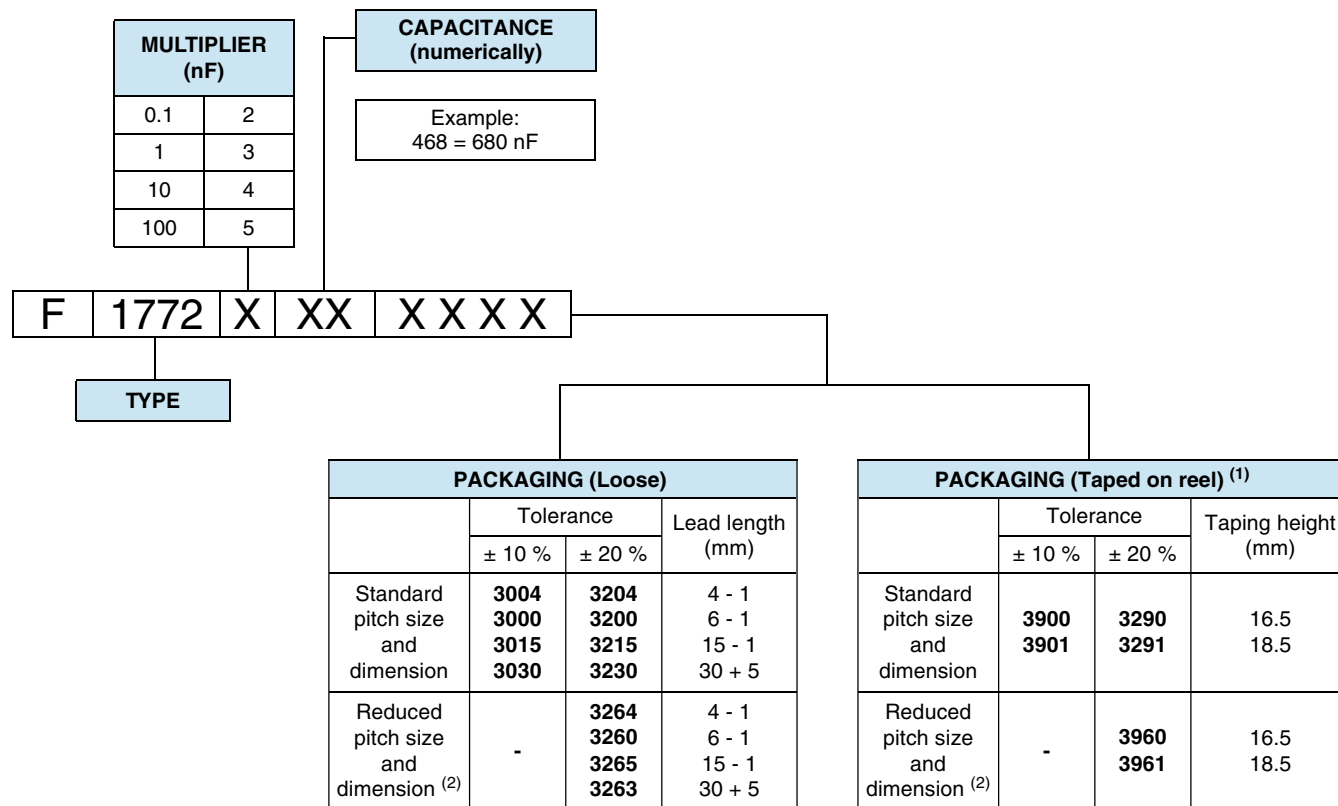
See also application note: www.vishay.com/doc?28153

QUICK REFERENCE DATA	
Capacitance range (E12 series)	E12 series 0.01 μ F to 2.2 μ F preferred values acc. to E6
Capacitance tolerance	$\pm 10\%$, $\pm 20\%$
Rated AC voltage	300 V _{AC} ; 50 Hz to 60 Hz
Permissible DC voltage	800 V _{DC} at 85 °C 630 V _{DC} at 110 °C
Climatic testing class acc. to IEC 60068-1	40/100/56/C
Maximum application temperature	100 °C
Reference standards	IEC 60384-14 ed-3 and EN 60384-14 IEC 60065 pass. flamm. class C CSA-E384-14 UL 60384-14
Dielectric	Polyester film
Electrodes	Metallized
Construction	Series construction 
Encapsulation	Plastic case, epoxy resin sealed, flame retardant UL-class 94 V-0
Leads	Tinned wire
Marking	C-value; tolerance; rated voltage; sub-class; manufacturer's type; code for dielectric material; manufacturer location; manufacturer's logo; year and week; safety approvals

Note

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

DIMENSIONS in millimeters


**COMPOSITION OF CATALOG NUMBER**

Example: F17724153215 means 0.15 μ F, \pm 20 %; standard pitch 22.5 mm; lead length 15 mm - 1 mm;
 F17724153265 means 0.15 μ F, \pm 20 %; reduced pitch 15.0 mm; lead length 15 mm - 1 mm

Notes

- For detailed tape specifications refer to packaging information www.vishay.com/doc?28139
- ⁽¹⁾ Taped on reel pitch \geq 27.5 mm is not available
- ⁽²⁾ Same capacitance values \geq 0.15 μ F at 20 % are available in two different pitch sizes and dimensions

SPECIFIC REFERENCE DATA	
DESCRIPTION	VALUE
Rated AC voltage (U_{RAC})	300 V
Permissible DC voltage (U_{RDC})	630 V
Tangent of loss angle	$\leq 100 \times 10^{-4}$ at 1 kHz
Rated voltage pulse slope at $(dU/dt)_R$ 435 V _{DC}	100 V/ μ s
R between leads, for $C \leq 0.33 \mu$ F at 100 V; 1 min	$> 15\,000 \text{ M}\Omega$
RC between leads, $C > 0.33 \mu$ F at 100 V; 1 min	$> 5000 \text{ s}$
R between leads and case; 100 V; 1 min	$> 30\,000 \text{ M}\Omega$
Withstanding (DC) voltage (cut off current 10 mA) ⁽¹⁾ ; rise time $\leq 1000 \text{ V/s}$	2150 V; for 1 min
Withstanding (AC) voltage between leads and case	2500 V; for 2 s at 25 °C
Maximum application temperature	100 °C

Note

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



ELECTRICAL DATA AND ORDERING INFORMATION						
U_{RAC} (V)	CAP. (μ F)	PITCH (mm)	DIMENSIONS w x h x l MAX. (mm)	MASS ⁽³⁾ (g)	SPQ (pieces) SHORT LEAD	ORDERING CODE BULK LEAD LENGTH 6 mm - 1 mm ⁽¹⁾⁽²⁾
300	$d_t = 0.60 \text{ mm} \pm 0.06 \text{ mm}$; C-TOL. = $\pm 10 \%$					
	0.010	15	5.0 x 11.0 x 17.5	1.4	750	F17723103000
	0.012	15	5.0 x 11.0 x 17.5	1.4	750	F17723123000
	0.015	15	5.0 x 11.0 x 17.5	1.4	750	F17723153000
	0.018	15	5.0 x 11.0 x 17.5	1.4	750	F17723183000
	0.022	15	5.0 x 11.0 x 17.5	1.4	750	F17723223000
	0.027	15	5.0 x 11.0 x 17.5	1.4	750	F17723273000
	0.033	15	5.0 x 11.0 x 17.5	1.4	750	F17723333000
	0.039	15	6.0 x 12.0 x 17.5	2.0	500	F17723393000
	0.047	15	6.0 x 12.0 x 17.5	2.0	500	F17723473000
	0.056	15	6.0 x 12.0 x 17.5	2.0	500	F17723563000
	$d_t = 0.80 \text{ mm} \pm 0.08 \text{ mm}$; C-TOL. = $\pm 10 \%$					
	0.068	15	7.0 x 13.5 x 17.5	2.4	450	F17723683000
	0.082	15	8.5 x 15.0 x 17.5	2.7	300	F17723823000
	0.10	15	8.5 x 15.0 x 17.5	2.7	325	F17724103000
	0.12	15	8.5 x 15.0 x 17.5	2.7	300	F17724123000
	0.15	22.5	7.0 x 16.5 x 26.0	4.1	235	F17724153000
	0.18	22.5	7.0 x 16.5 x 26.0	4.1	235	F17724183000
	0.22	22.5	8.5 x 18.0 x 26.0	4.6	200	F17724223000
	0.33	27.5	11.0 x 20.3 x 31.3	6.7	170	F17724333000
	0.39	27.5	11.0 x 21.0 x 31.0	9.1	125	F17724393000
	0.47	27.5	11.0 x 21.0 x 31.0	9.1	125	F17724473000
	0.56	27.5	11.0 x 21.0 x 31.0	9.1	125	F17724563000
	0.68	27.5	13.0 x 23.0 x 31.0	12.9	110	F17724683000
	0.82	27.5	13.0 x 23.0 x 31.0	12.9	110	F17724823000
	1.0	27.5	15.0 x 25.0 x 31.5	15.0	100	F17725103000
	1.5	37.5	15.5 x 28.5 x 41.5	24.0	70	F17725153000
	1.8	37.5	15.5 x 28.5 x 41.5	24.0	70	F17725183000
	2.2	37.5	18.0 x 32.5 x 41.5	31.6	60	F17725223000
	$d_t = 0.60 \text{ mm} \pm 0.06 \text{ mm}$; C-TOL. = $\pm 20 \%$					
	0.010	15	5.0 x 11.0 x 17.5	1.4	750	F17723103200
	0.015	15	5.0 x 11.0 x 17.5	1.4	750	F17723153200
	0.022	15	5.0 x 11.0 x 17.5	1.4	750	F17723223200
0.033	15	5.0 x 11.0 x 17.5	1.4	750	F17723333200	
0.047	15	5.0 x 11.0 x 17.5	1.4	750	F17723473200	
0.068	15	6.0 x 12.0 x 17.5	2.0	600	F17723683200	
0.10	15	6.0 x 12.0 x 17.5	2.0	600	F17724103200	



ELECTRICAL DATA AND ORDERING INFORMATION						
U_{RAC} (V)	CAP. (μF)	PITCH (mm)	DIMENSIONS w x h x l MAX. (mm)	MASS ⁽³⁾ (g)	SPQ (pieces) SHORT LEAD	ORDERING CODE BULK LEAD LENGTH 6 mm - 1 mm ⁽¹⁾⁽²⁾
d_t = 0.80 mm ± 0.08 mm; C-TOL. = ± 20 %						
300	0.15	15	8.5 x 15.0 x 17.5	2.7	325	F17724153260
	0.15	22.5	6.0 x 15.5 x 26.0	3.3	260	F17724153200
	0.22	15	10.0 x 16.5 x 17.5	4.5	300	F17724223260
	0.22	22.5	7.0 x 16.5 x 26.0	4.1	235	F17724223200
	0.33	22.5	8.5 x 18.0 x 26.0	5.3	190	F1772433200
	0.47	22.5	10.0 x 19.5 x 26.0	6.7	170	F17724473260
	0.47	27.5	9.0 x 19.0 x 31.5	6.8	160	F17724473200
	0.68	22.5	12.0 x 22.0 x 26.0	13.4	110	F17724683260
	0.68	27.5	11.0 x 21.0 x 31.0	12.9	125	F17724683200
	1.0	22.5	15.5 x 26.5 x 26.5	13.5	110	F17725103260
	1.0	27.5	15.0 x 25.0 x 31.5	15.0	100	F17725103200
	1.5	27.5	18.0 x 28.0 x 31.5	19.0	85	F17725153260
	1.5	37.5	14.5 x 24.5 x 41.5	18.9	80	F17725153200
2.2	37.5	15.5 x 28.5 x 41.5	24.0	70	F17725223200	

Notes

- SPQ = Standard Packing Quantity
- For detailed tape specifications refer to packaging information: www.vishay.com/doc?28139
- (1) For further packaging see table "Composition of Catalog Number"
- (2) Further information about packaging quantities with different lead length and/or taped versions, see document "Packing Quantities" www.vishay.com/doc?27608
- (3) Weight for short lead product only

APPROVALS			
SAFETY APPROVALS X2	VOLTAGE	VALUE	FILE NUMBERS
EN 60384-14 (ENEC) (= IEC 60384-14 ed 3)	310 V _{AC}	0.01 μF to 2.2 μF X2	40005079
UL 60384-14	310 V _{AC}	0.01 μF to 2.2 μF X2	E354331
CSA-E 384-14	310 V _{AC}	0.01 μF to 2.2 μF X2	E354331
CB test-certificate	310 V _{AC}	0.01 μF to 2.2 μF X2	DE 1-40110/A1
The ENEC-approval together with the CB-certificate replace all national marks of the following countries (they have already signed the ENEC-agreement): Austria; Belgium; Czech. Republic; Denmark; Finland; France; Germany; Greece; Hungary; Ireland; Italy; Luxembourg; Netherlands; Norway; Portugal; Slovenian; Spain; Sweden; Switzerland and United Kingdom.			

**MOUNTING****Normal Use**

The capacitors are designed for mounting on printed-circuit boards. The capacitors packed in 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 stand-off pips are in good contact with the printed-circuit board:

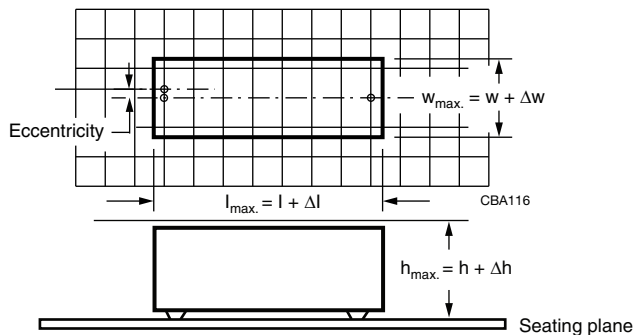
- For pitches ≤ 15 mm capacitors shall be mechanically fixed by the leads
- For larger pitches the capacitors shall be mounted in the same way and the body clamped

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 pitch = 37.5 mm, $\Delta w = \Delta l = 0.7$ 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

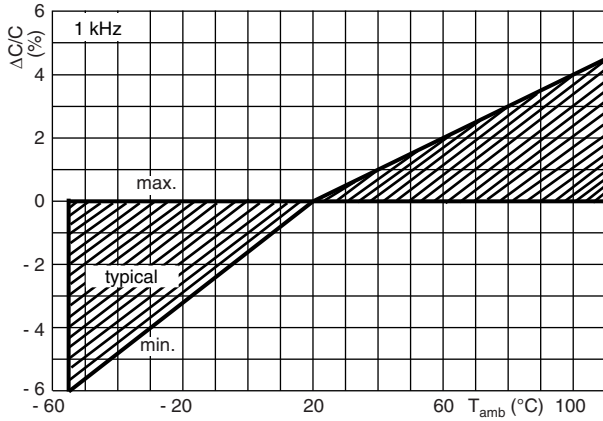
Ratings and Characteristics Reference Conditions

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

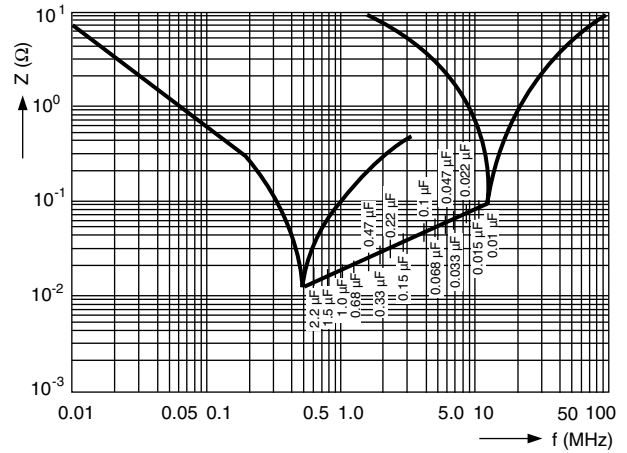
For reference testing, a conditioning period shall be applied over 96 h ± 4 h by heating the products in a circulating air oven at the rated temperature and a relative humidity not exceeding 20 %.



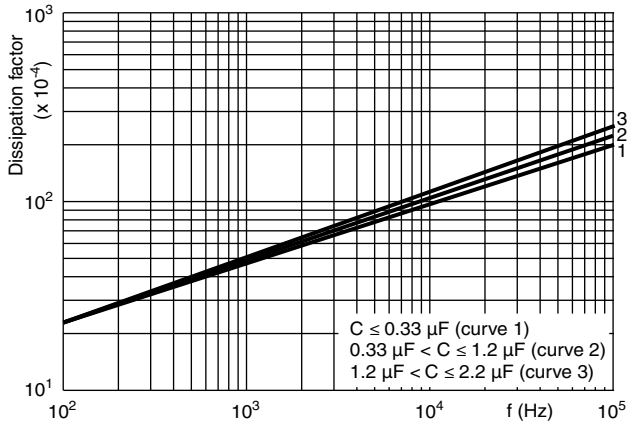
CHARACTERISTICS



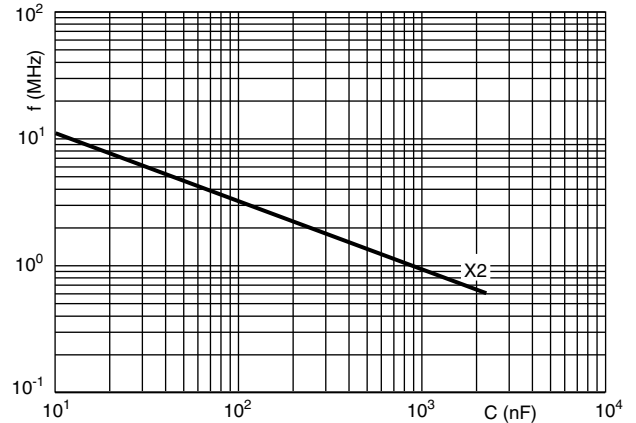
Capacitance as a function of ambient temperature (typical curve)



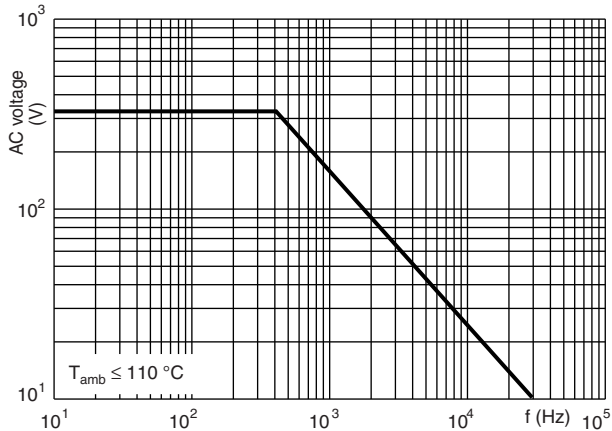
Impedance as a function of frequency (typical curve)



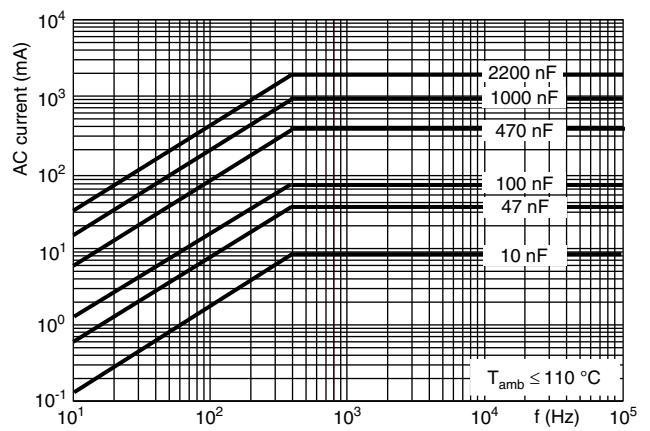
Tangent of loss angle as a function of frequency (typical curve)



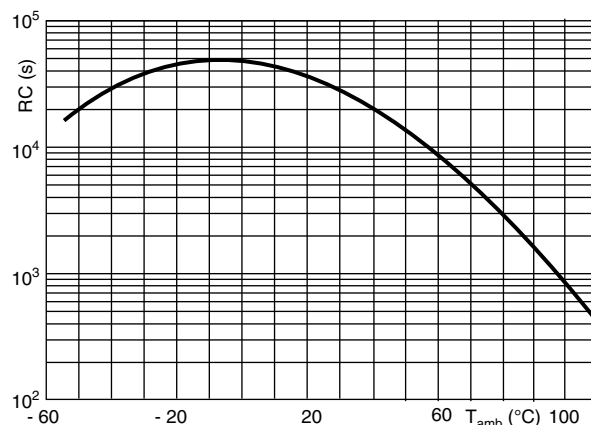
Resonant frequency as a function of capacitance (typical curve)



Max. RMS voltage as a function of frequency



Max. RMS current as a function of frequency



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

APPLICATION NOTES AND LIMITING CONDITIONS

- For X2 electromagnetic interference suppression where a higher stability grade is needed for **continuous across the line applications** (50 Hz/60 Hz) with a maximum mains voltage of 300 V_{AC}.
- These capacitors are not intended for continuous pulse application. For these situations capacitors of the AC and pulse programs must be used.
- For series impedance applications we refer to application note: www.vishay.com/doc?28153
- The maximum ambient temperature must not exceed 100 °C.
- Rated voltage pulse slope:
If the pulse voltage is lower than the rated voltage, the values of the specific reference data can be multiplied by 435 V_{DC} and divided by the applied voltage.

INSPECTION REQUIREMENTS

General Notes

Sub-clause numbers of tests and performance requirements refer to the “Sectional Specification, Publication IEC 60384-14 ed 3 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
Initial measurements	Capacitance Tangent of loss angle: For C ≤ 1 μF at 10 kHz For C > 1 μF at 1 kHz	
4.3 Robustness of terminations	Tensile: Load 10 N; 10 s Bending: Load 5 N; 4 x 90°	No visible damage
4.4 Resistance to soldering heat	No pre-drying Method: 1A Solder bath: 280 °C ± 5 °C Duration: 10 s	



GROUP C INSPECTION REQUIREMENTS		
SUB-CLAUSE NUMBER AND TEST	CONDITIONS	PERFORMANCE REQUIREMENTS
SUB-GROUP C1A PART OF SAMPLE OF SUB-GROUP C1		
4.19 Component solvent resistance	Isopropylalcohol at room temperature Method: 2 Immersion time: 5 min ± 0.5 min Recovery time: Min. 1 h, max. 2 h	
4.4.2 Final measurements	Visual examination Capacitance Tangent of loss angle Insulation resistance	No visible damage Legible marking $ \Delta C/C \leq 5\%$ of the value measured initially Increase of $\tan \delta$ ≤ 0.008 for: $C \leq 1 \mu\text{F}$ or ≤ 0.005 for: $C > 1 \mu\text{F}$ Compared to values measured initially As specified in section "Insulation Resistance" of this specification
SUB-GROUP C1B PART OF SAMPLE OF SUB-GROUP C1		
Initial measurements	Capacitance Tangent of loss angle: For $C \leq 1 \mu\text{F}$ at 10 kHz For $C > 1 \mu\text{F}$ at 1 kHz	
4.20 Solvent resistance of the marking	Isopropylalcohol at room temperature Method: 1 Rubbing material: Cotton wool Immersion time: 5 min ± 0.5 min	No visible damage Legible marking
4.6 Rapid change of temperature	$\theta A = -40\text{ }^\circ\text{C}$ $\theta B = +100\text{ }^\circ\text{C}$ 5 cycles Duration $t = 30$ min	
4.6.1 Inspection	Visual examination	No visible damage
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	
4.9.2 Final measurements	Visual examination Capacitance Tangent of loss angle Insulation resistance	No visible damage $ \Delta C/C \leq 5\%$ of the value measured initially Increase of $\tan \delta$ ≤ 0.008 for: $C \leq 1 \mu\text{F}$ or ≤ 0.005 for: $C > 1 \mu\text{F}$ Compared to values measured initially As specified in section "Specific Reference" of this specification

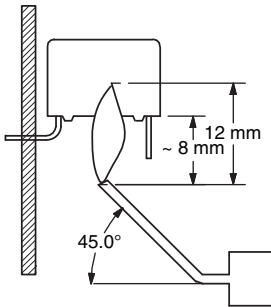


GROUP C INSPECTION REQUIREMENTS		
SUB-CLAUSE NUMBER AND TEST	CONDITIONS	PERFORMANCE REQUIREMENTS
SUB-GROUP C1 COMBINED SAMPLE OF SPECIMENS OF SUB-GROUPS C1A AND C1B		
4.11 Climatic sequence	Capacitance	
4.11.1 Initial measurements	Measured in 4.4.2 and 4.9.2 Tangent of loss angle Measured initially in C1A and C1B	
4.11.2 Dry heat	Temperature: 100 °C Duration: 16 h	
4.11.3 Damp heat cyclic Test Db, first cycle		
4.11.4 Cold	Temperature: - 40 °C Duration: 2 h	
4.11.5 Damp heat cyclic Test Db, remaining cycles		
4.11.6 Final measurements	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 $\tan \delta$ ≤ 0.008 for: $C \leq 1 \mu\text{F}$ or ≤ 0.005 for: $C > 1 \mu\text{F}$ Compared to values measured in 4.11.1
	Voltage proof 1350 V _{DC} 1 min between terminations	No permanent breakdown or flash-over
	Insulation resistance	$\geq 50\%$ of values specified in section "Insulation Resistance" of this specification
SUB-GROUP C2		
4.12 Damp heat steady state	56 days, 40 °C, 90 % to 95 % RH No load	
4.12.1 Initial measurements	Capacitance Tangent of loss angle: 1 kHz	
4.12.3 Final measurements	Visual examination	No visible damage Legible marking
	Capacitance	$ \Delta C/C \leq 5\%$ of the value measured in 4.12.1
	Tangent of loss angle	Increase of $\tan \delta$ ≤ 0.008 for: $C \leq 1 \mu\text{F}$ or ≤ 0.005 for: $C > 1 \mu\text{F}$ Compared to values measured in 4.12.1
	Voltage proof 1350 V _{DC} ; 1 min between terminations	No permanent breakdown or flash-over
	Insulation resistance	$\geq 50\%$ of values specified in section "Insulation Resistance" of this specification



GROUP C INSPECTION REQUIREMENTS		
SUB-CLAUSE NUMBER AND TEST	CONDITIONS	PERFORMANCE REQUIREMENTS
SUB-GROUP C3		
4.13.1 Initial measurements	Capacitance Tangent of loss angle: For C ≤ 1 μF at 10 kHz For C > 1 μF at 1 kHz	
4.13 Impulse voltage	3 successive impulses, full wave, peak voltage: X2: 2.5 kV for C ≤ 1 μF X2: 2.5 kV/√C for C > 1 μF Max. 24 pulses	No self healing breakdowns or flash-over
4.14 Endurance	Duration: 1000 h 1.25 x U _{RAC} at 100 °C Once in every hour the voltage is increased to 1000 V (RMS) for 0.1 s via resistor of 47 Ω ± 5 %	
4.14.7 Final measurements	Visual examination Capacitance Tangent of loss angle Voltage proof 1350 V _{DC} ; 1 min between terminations 2500 V _{AC} ; 2 s at 25 °C between terminations and case Insulation resistance	No visible damage Legible marking ΔC/C ≤ 5 % compared to values measured in 4.13.1 Increase of tan δ ≤ 0.008 for: C ≤ 1 μF or ≤ 0.005 for: C > 1 μF Compared to values measured in 4.13.1 No permanent breakdown or flash-over ≥ 50 % of values specified in section "Insulation Resistance" of this specification
SUB-GROUP C4		
4.15 Charge and discharge	10 000 cycles Charged to 435 V _{DC} Discharge resistance: $R = \frac{435 V_{DC}}{1.5 \times C(dU/dt)}$	
4.15.1 Initial measurements	Capacitance Tangent of loss angle: For C ≤ 1 μF at 10 kHz For C > 1 μF at 1 kHz	
4.13.3 Final measurements	Capacitance Tangent of loss angle Insulation resistance	ΔC/C ≤ 10 % compared to values measured in 4.15.1 Increase of tan δ ≤ 0.008 for: C ≤ 1 μF or ≤ 0.005 for: C > 1 μF Compared to values measured in 4.15.1 ≥ 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 C5		
4.16 Radio frequency characteristic	Resonance frequency	≥ 0.9 times the value as specified in section "Resonant Frequency" of this specification.
SUB-GROUP C6		
4.17 Passive flammability Class C	Bore of gas jet: $\varnothing 0.5$ mm Fuel: Butane Test duration for actual volume V in mm^3 : $V \leq 250$: 5 s $250 < V \leq 500$: 10 s $500 < V \leq 1750$: 20 s $V > 1750$: 30 s One flame application 	After removing test flame from capacitor, the capacitor must not continue to burn for more than 30 s. No burning particle must drop from the sample.
SUB-GROUP C7		
4.18 Active flammability	20 cycles of 2.5 kV discharges on the test capacitor connected to U_{RAC} .	The cheese cloth around the capacitors shall not burn with a flame. No electrical measurements are required.



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[46KF310000M1M](#) [46KI22205001M](#) [46KI24705201K](#) [46KI2470CK01M](#) [46KI2470ND01K](#) [46KI2680JH01M](#) [46KI315000M2K](#)
[46KI315000M2M](#) [46KI3150CKM2K](#) [46KI3150CKM2M](#) [46KI3150NDM2M](#) [46KI3220CKP0M](#) [46KI3220JLM1M](#) [46KN3150JH01K](#)
[46KN34705001K](#) [46KN347050N0K](#) [46KN3470JHP0M](#) [46KN410040H1M](#) [46KW510050M1K](#) [474I24700003K](#) [PHE840MD6220MD13R30](#)
[PHE840MY6470MD14R06](#) [PHE845VD5470MR06](#) [YV500103Z060B20X5P](#) [MKPX2R-1/400/10P27](#) [YP102271K050B20C6P](#)
[YP102391K050BAND5P](#) [YP501101K040BAND5P](#) [YP102681K060B20C6P](#) [YP501121K040B20C6P](#)