Interference Suppression Film Capacitor - Class X2
Radial MKT 310 V_{AC} - High Stability Grade

FEATURES

- AEC-Q200 qualified (rev. D) up to 110 °C for ≤ 470 nF
- Compliant with IEC 60384-14: AMD1 grade IB
  - THB: 85 °C / 85 % RH, 168 h at U_{RAC}
- THB: 40 °C / 90 % RH for 1000 h at rated voltage, in compliance with AEC-Q200
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

AUTOMOTIVE GRADE Available

Pb-free

RoHS COMPLIANT

APPLICATIONS

High stability grade for continuous across the line X2 applications.

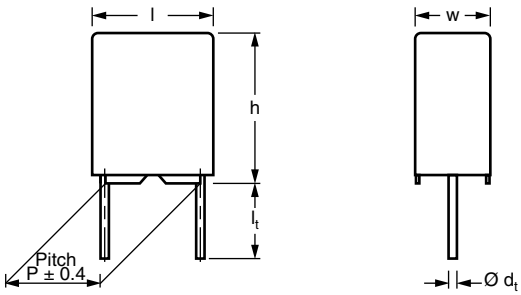
See also application note: www.vishay.com/doc?28153

QUICK REFERENCE DATA	
Capacitance range (E12 series)	0.01 µF to 2.2 µF (preferred values acc. to E6)
Capacitance tolerance	± 10 %, ± 20 % (± 5 % on request)
Rated AC voltage	310 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 according to IEC 60068-1	40/110/56/C for the product volume ≤ 1750 mm^3 40/110/56/B for the product volume ≥ 1750 mm^3
Maximum application temperature	110 °C
Reference standards	IEC 60384-14 ed-4 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, year and week; manufacturer's logo or name; safety approvals

Note

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

DIMENSIONS in millimeters



COMPOSITION OF CATALOG NUMBER

MULTIPLIER (nF)	
0.1	2
1	3
10	4
100	5

CAPACITANCE (numerically)

Example:
468 = 680 nF

F	1772	X	XX	X X X X

TYPE

PACKAGING (Loose)			
	Tolerance		Lead length (mm)
	± 10 %	± 20 %	
Standard pitch size and dimension	**2004** **2000** **2015** **2030**	**2204** **2200** **2215** **2230**	4 - 1 6 - 1 15 - 1 30 + 5
Reduced pitch size and dimension (2)	**2164** **2160** **2165** **2163**	**2264** **2260** **2265** **2263**	4 - 1 6 - 1 15 - 1 30 + 5

PACKAGING (Taped on reel) (1)			
	Tolerance		Taping height (mm)
	± 10 %	± 20 %	
Standard pitch size and dimension	**2900** **2901**	**2290** **2291**	16.5 18.5
Reduced pitch size and dimension (2)	**2970** **2971**	**2960** **2961**	16.5 18.5

Example: F1772415**2215** means 0.15 µF, ± 20 %; standard pitch 22.5 mm; lead length 15 mm - 1 mm;
F1772415**2265** means 0.15 µF, ± 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 ≥ 27.5 mm is not available

(2) Same capacitance values ≥ 0.15 µF are available in two different pitch sizes and dimensions

SPECIFIC REFERENCE DATA	
DESCRIPTION	**VALUE**
Rated AC voltage (U_{RAC})	310 V
Permissible DC voltage (U_{RDC})	630 V
Tangent of loss angle	≤ 100 x 10^{-4} at 1 kHz
Rated voltage pulse slope at $(dU/dt)_R$ 435 V_{DC}	100 V/µs
R between leads, for C ≤ 0.33 µF at 100 V; 1 min	> 15 000 MΩ
RC between leads, C > 0.33 µF at 100 V; 1 min	> 5000 s
R between leads and case; 100 V; 1 min	> 30 000 MΩ
Withstanding (DC) voltage (cut off current 10 mA) (1); rise time ≤ 1000 V/s C ≤ 0.47 µF C > 0.47 µF	 2200 V; for 1 min 2150 V; for 1 min
Withstanding (AC) voltage between leads and case	2120 V; 1 min
Maximum application temperature	110 °C

Note

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

ELECTRICAL DATA AND ORDERING INFORMATION

U_{RAC} (V)	CAP. (µF)	PITCH (mm)	DIMENSIONS [4] 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 = 0.60 mm ± 0.06 mm; C-TOL. = ± 10 %					
	0.010	15	5.0 x 11.0 x 17.5	1.4	750	F17723102000
	0.012	15	5.0 x 11.0 x 17.5	1.4	750	F17723122000
	0.015	15	5.0 x 11.0 x 17.5	1.4	750	F17723152000
	0.018	15	5.0 x 11.0 x 17.5	1.4	750	F17723182000
	0.022	15	5.0 x 11.0 x 17.5	1.4	750	F17723222000
	0.027	15	5.0 x 11.0 x 17.5	1.4	750	F17723272000
	0.033	15	5.0 x 11.0 x 17.5	1.4	750	F17723332000
	0.039	15	6.0 x 12.0 x 17.5	2.0	500	F17723392000
	0.047	15	6.0 x 12.0 x 17.5	2.0	500	F17723472000
	0.056	15	6.0 x 12.0 x 17.5	2.0	500	F17723562000
	d_t = 0.80 mm ± 0.08 mm; C-TOL. = ± 10 %					
	0.068	15	7.0 x 13.5 x 17.5	2.4	450	F17723682000
	0.082	15	8.5 x 15.0 x 17.5	2.7	300	F17723822000
	0.10	15	8.5 x 15.0 x 17.5	2.7	325	F17724102000
	0.12	15	8.5 x 15.0 x 17.5	2.7	300	F17724122000
	0.15	15	8.5 x 15.0 x 17.5	2.7	300	F17724152160
	0.15	22.5	7.0 x 16.5 x 26.0	4.1	235	F17724152000
	0.18	22.5	7.0 x 16.5 x 26.0	4.1	235	F17724182000
	0.22	15	10.0 x 16.5 x 17.5	3.0	235	F17724222160
	0.22	22.5	8.5 x 16.5 x 26.5	4.6	200	F17724222000
	0.27	22.5	10.0 x 19.5 x 26.0	6.7	170	F17724272000
	0.33	15	13.5 x 22.5 x 18.0	5.5	185	F17724332160
310	0.33	22.5	10.0 x 19.5 x 26.0	6.7	170	F17724332000
	0.39	27.5	11.0 x 21.0 x 31.0	9.1	125	F17724392000
	0.47	22.5	12.0 x 22.0 x 26.0	13.0	110	F17724472160
	0.47	27.5	11.0 x 21.0 x 31.0	9.1	125	F17724472000
	0.56	27.5	11.0 x 21.0 x 31.0	9.1	125	F17724562000
	0.68	22.5	15.5 x 26.5 x 26.5	13.5	110	F17724682160
	0.68	27.5	13.0 x 23.0 x 31.0	12.9	110	F17724682000
	0.82	27.5	13.0 x 23.0 x 31.0	12.9	110	F17724822000
	1.0	22.5	15.5 x 26.5 x 26.5	13.5	110	F17725102160
	1.0	27.5	15.0 x 25.0 x 31.5	15.0	100	F17725102000
	1.2	37.5	14.5 x 24.5 x 41.5	18.9	80	F17725122000
	1.5	27.5	18.0 x 28.0 x 31.0	19.0	85	F17725152160
	1.5	37.5	15.5 x 28.5 x 41.5	24.0	70	F17725152000
	1.8	37.5	15.5 x 28.5 x 41.5	24.0	70	F17725182000
	2.2	27.5	21.0 x 31.0 x 31.0	28.0	70	F17725222160
	2.2	37.5	18.0 x 32.5 x 41.5	31.6	60	F17725222000
	d_t = 0.60 mm ± 0.06 mm; C-TOL. = ± 20 %					
	0.010	15	5.0 x 11.0 x 17.5	1.4	750	F17723102200
	0.015	15	5.0 x 11.0 x 17.5	1.4	750	F17723152200
	0.022	15	5.0 x 11.0 x 17.5	1.4	750	F17723222200
	0.033	15	5.0 x 11.0 x 17.5	1.4	750	F17723332200
	0.047	15	5.0 x 11.0 x 17.5	1.4	750	F17723472200
	0.068	15	6.0 x 12.0 x 17.5	2.0	600	F17723682200
	0.10	15	6.0 x 12.0 x 17.5	2.0	600	F17724102200

ELECTRICAL DATA AND ORDERING INFORMATION

U_{RAC} (V)	CAP. (µF)	PITCH (mm)	DIMENSIONS [4] 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 %					
310	0.15	15	8.5 x 15.0 x 17.5	2.7	325	F17724152260
	0.15	22.5	6.0 x 15.5 x 26.0	3.3	260	F17724152200
	0.22	15	10.0 x 16.5 x 17.5	4.5	300	F17724222260
	0.22	22.5	7.0 x 16.5 x 26.0	4.1	235	F17724222200
	0.33	15	13.5 x 22.5 x 18.0	5.5	185	F17724332260
	0.33	22.5	8.5 x 18.0 x 26.0	5.3	190	F17724332200
	0.47	22.5	10.0 x 19.5 x 26.0	6.7	170	F17724472260
	0.47	27.5	9.0 x 19.0 x 31.5	6.8	160	F17724472200
	0.68	22.5	12.0 x 22.0 x 26.0	13.4	110	F17724682260
	0.68	27.5	11.0 x 21.0 x 31.0	12.9	125	F17724682200
	1.0	22.5	15.5 x 26.5 x 26.5	13.5	110	F17725102260
	1.0	27.5	15.0 x 25.0 x 31.5	15.0	100	F17725102200
	1.5	27.5	18.0 x 28.0 x 31.5	19.0	85	F17725152260
	1.5	37.5	14.5 x 24.5 x 41.5	18.9	80	F17725152200
	2.2	27.5	21.0 x 31.0 x 31.0	28.0	70	F17725222260
	2.2	37.5	15.5 x 28.5 x 41.5	24.0	70	F17725222200

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

(4) For tolerances see chapter “Space Requirements for Printed-Circuit Board Applications and Dimension Tolerances”

APPROVALS

SAFETY APPROVALS X2	VOLTAGE	VALUE	FILE NUMBERS	LINK
EN 60384-14 (ENEC) (= IEC 60384-14 ed-4)	310 V_{AC}	0.01 µF to 2.2 µF X2	40005079	www.vishay.com/doc?28196
UL 60384-14	310 V_{AC}	0.01 µF to 2.2 µF X2	E354331	www.vishay.com/doc?28191
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	DE1-58410	www.vishay.com/doc?28226

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:

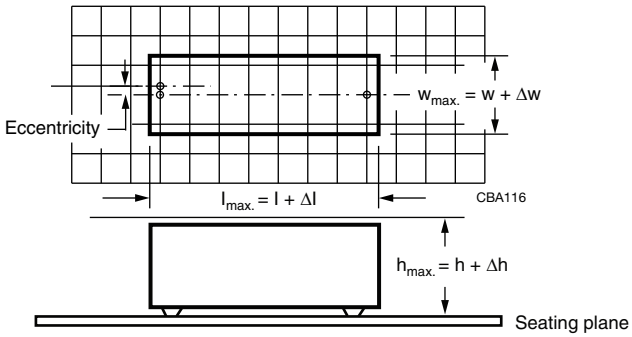
- For pitches ≤ 15 mm capacitors shall be mechanically fixed by the leads
- For larger pitches the capacitors shall be mounted in the same way and the body clamped

SPACE REQUIREMENTS FOR PRINTED-CIRCUIT BOARD APPLICATIONS AND DIMENSION TOLERANCES

For the maximum product dimensions and maximum space requirements for length ($l_{max.}$), width ($w_{max.}$) and height ($h_{max.}$) following tolerances must be taken in account in the envelopment of the components as shown in the drawings below.

- For products with pitch ≤ 15 mm, $\Delta w = \Delta l = 0.3$ mm, and $\Delta h = 0.1$ mm
- For products with 15 mm < pitch ≤ 27.5 mm, $\Delta w = \Delta l = 0.5$ mm, and $\Delta h = 0.1$ mm
- For products with pitch = 37.5 mm, $\Delta w = \Delta l = 0.7$ mm, and $\Delta h = 0.5$ mm

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



For the minimum product dimensions for length ($l_{min.}$), width ($w_{min.}$) and height ($h_{min.}$) following tolerances of the components are valid:

$l_{min.} = l - \Delta l$, $w_{min.} = w - \Delta w$, and $h_{min.} = h - \Delta h$ following

- For products with pitch ≤ 10 mm, $\Delta l = 0.3$ mm, and $\Delta w = \Delta h = 0.3$ mm
- For products with pitch = 15 mm, $\Delta l = 0.5$ mm, and $\Delta w = \Delta h = 0.5$ mm
- For products with 15 mm < pitch ≤ 27.5 mm, $\Delta l = 1.0$ mm and $\Delta w = \Delta h = 0.5$ mm
- For products with pitch = 37.5 mm, $\Delta l = 1.0$ mm and $\Delta w = \Delta h = 1.0$ mm

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

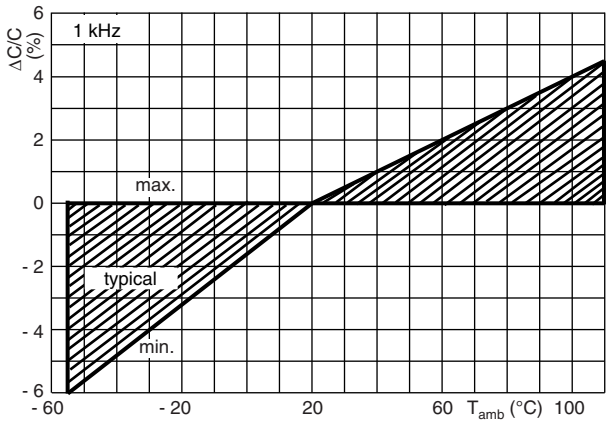
T_{stg} = -25 °C to +35 °C with RH maximum 75 % without condensation

Ratings and Characteristics Reference Conditions

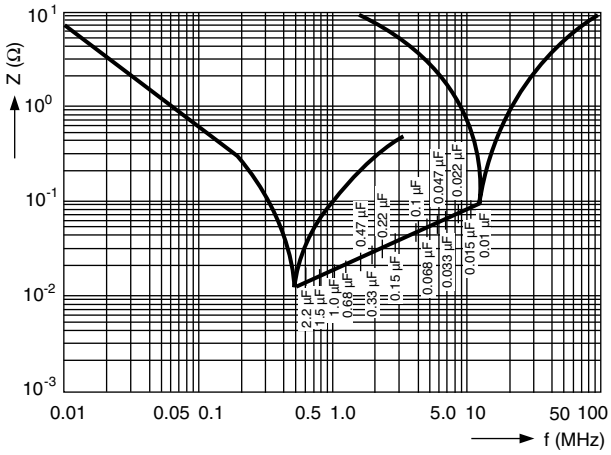
Unless otherwise specified, all electrical values apply to an ambient temperature of 23 °C ± 1 °C, an atmospheric pressure of 86 kPa to 106 kPa and a relative humidity of 50 % ± 2 %.

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 %.

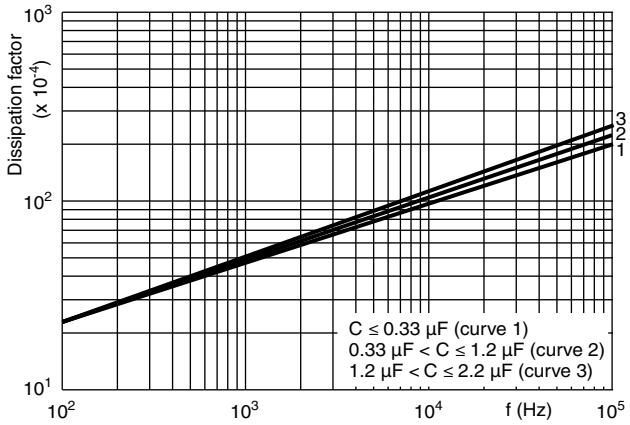
CHARACTERISTICS



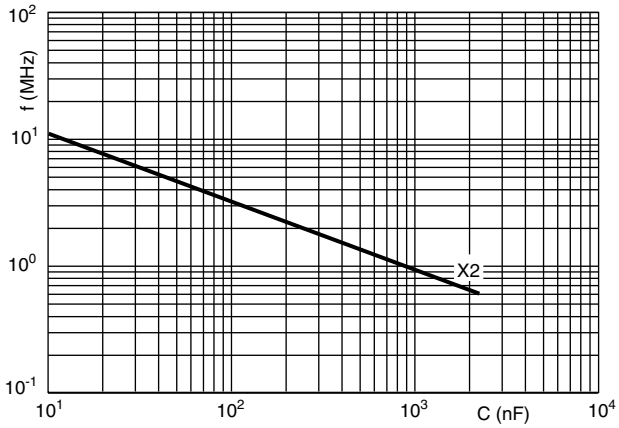
Capacitance as a function of ambient temperature
(typical curve)



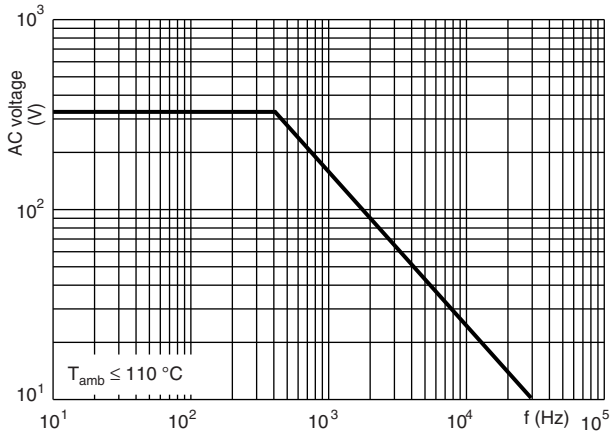
Impedance as a function of frequency
(typical curve)



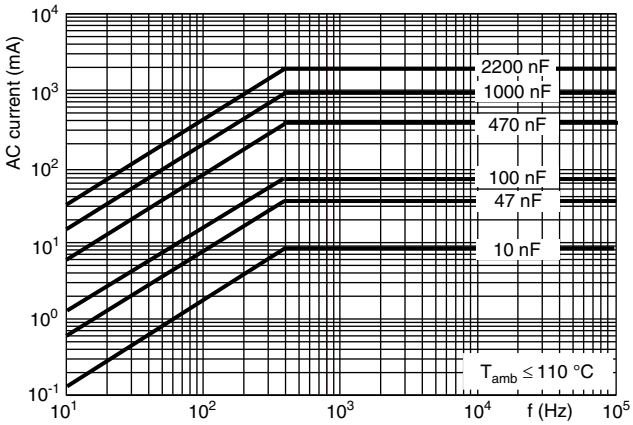
Tangent of loss angle as a function of frequency
(typical curve)



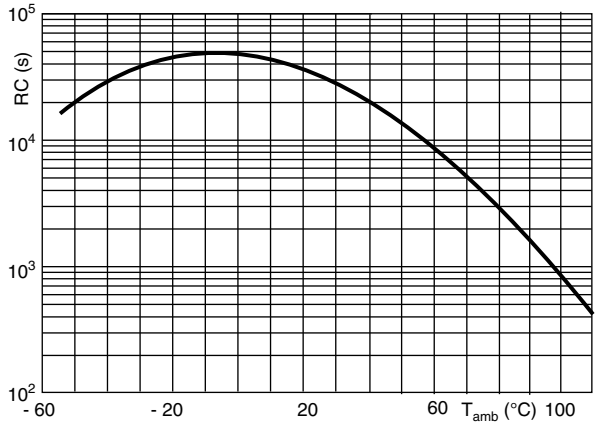
Resonant frequency as a function of capacitance
(typical curve)



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 stabililty grade is needed for **continuous across the line applications** (50 Hz/60 Hz) with a maximum mains voltage of 310 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 110 °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

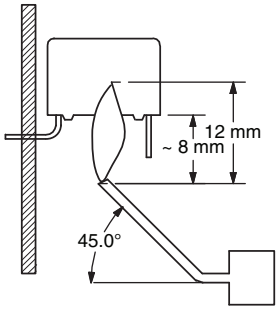
Sub-clause numbers of tests and performance requirements refer to the “Sectional Specification, Publication IEC 60384-14 ed 3 and Specific Reference Data”.

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	No visible damage Legible marking
	Capacitance	$\|\Delta C/C\| \leq 5$ % of the value measured initially
	Tangent of loss angle	Increase of tan δ ≤ 0.008 for: $C \leq 1$ µF or ≤ 0.005 for: $C > 1$ µF Compared to values measured initially
	Insulation resistance	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 $C \leq 1$ µF at 10 kHz for $C > 1$ µF 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	θA = -40 °C θB = +110 °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/s² (whichever is less severe) Total duration 6 h	
4.7.2 Final inspection	Visual examination	No visible damage
4.9 Shock	Mounting: See section “Mounting” for more information Pulse shape: half sine Acceleration: 490 m/s² Duration of pulse: 11 ms	
4.9.2 Final measurements	Visual examination	No visible damage
	Capacitance	$\|\Delta C/C\| \leq 5$ % of the value measured initally
	Tangent of loss angle	Increase of tan δ ≤ 0.008 for: $C \leq 1$ µF or ≤ 0.005 for: $C > 1$ µF Compared to values measured initially
	Insulation resistance	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 initally in C1A and C1B	
4.11.2 Dry heat	Temperature: 110 °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	$\lvert\Delta C/C\rvert \leq 5$ % of the value measured in 4.11.1
	Tangent of loss angle	Increase of tan δ ≤ 0.008 for: $C \leq 1$ µF or ≤ 0.005 for: $C > 1$ µF 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	≥ 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	$\lvert\Delta C/C\rvert \leq 5$ % of the value measured in 4.12.1
	Tangent of loss angle	Increase of tan δ ≤ 0.008 for: $C \leq 1$ µF or ≤ 0.005 for: $C > 1$ µF 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	≥ 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 C2A		
4.12A Damp heat steady state with load	RH: 85 %; temp.: 85 °C, load: 310 V_{AC} Duration: 168 h	
4.12.1A Initial measurements	Capacitance Tangent of loss angle: 1 kHz	
4.12.3A Final measurements	Visual examination	No visible damage Legible marking
	Capacitance	$\lvert\Delta C/C\rvert \leq 10$ % of the value measured in 4.12.1
	Tangent of loss angle	Increase of tan δ ≤ 0.024 for: $C \leq 1$ µF or ≤ 0.015 for: $C > 1$ µF Compared to values measured in 4.12.1
	Insulation resistance	≥ 50 % of values specified in section "Insulation Resistance" of this specification or minimum 200 MΩ, whichever is higher
SUB-GROUP C3		
4.13.1 Initial measurements	Capacitance Tangent of loss angle: for $C \leq 1$ 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 $C \leq 1$ 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 110 °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	No visible damage Legible marking
	Capacitance	$\lvert\Delta C/C\rvert \leq 5$ % compared to values measured in 4.13.1
	Tangent of loss angle	Increase of tan δ ≤ 0.008 for: $C \leq 1$ µF or ≤ 0.005 for: $C > 1$ µF Compared to values measured in 4.13.1
	Voltage proof 1350 V_{DC}; 1 min between terminations 2120 V_{AC}; 1 min between terminations and case	No permanent breakdown or flash-over
	Insulation resistance	≥ 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 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	$\lvert\Delta C/C\rvert \leq 10$ % compared to values measured in 4.15.1
	Tangent of loss angle	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
	Insulation resistance	≥ 50 % of values specified in section "Insulation Resistance" of this specification
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: Ø 0.5 mm Fuel: butane Test duration for actual volume V in mm³: V ≤ 250: 5 s 250 < V ≤ 500: 10 s 500 < V ≤ 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.

TEST CONDITIONS AND REQUIREMENTS ACCORDING AEC-Q200 REVISION D				
NO.	**TEST NAME**	**REFERENCE**	**TEST CONDITIONS**	**PERFORMANCE REQUIREMENTS**
1	Pre- and post-stress electrical test	Spec.	-	-
3	High temperature exposure (storage)	MIL-STD 202 method 108	110 °C; unpowered 250 h / 500 h / 1000 h	$\|\Delta C/C\| \leq 5$ % Increase of tan δ ≤ 0.008 for C $\leq$ 1 µF at 10 kHz or ≤ 0.005 for C > 1 µF at 1 kHz IR > 50 % of initial specified value
4	Temperature cycling	JESD22 method JA-104	1000 cycles: -40 °C / +110 °C 30 min. dwell time at each temperature extreme Transition time < 1 min.	$\|\Delta C/C\| \leq 5$ % Increase of tan δ ≤ 0.008 for C $\leq$ 1 µF at 10 kHz or ≤ 0.005 for C > 1 µF at 1 kHz IR > 50 % of initial specified value
6	Moisture resistance	MIL-STD 202 method 106	10 cycles at 24 h/cycle unpowered	$\|\Delta C/C\| \leq 5$ % Increase of tan δ ≤ 0.008 for C $\leq$ 1 µF at 10 kHz or ≤ 0.005 for C > 1 µF at 1 kHz IR > 50 % of initial specified value
7	Biased humidity	MIL-STD 202 method 103	40 °C; 93 % RH; U_{RAC} (310 V_{AC}) 250 h / 500 h / 1000 h	$\|\Delta C/C\| \leq 10$ % Increase of tan δ ≤ 0.008 for C $\leq$ 1 µF at 10 kHz or ≤ 0.005 for C > 1 µF at 1 kHz IR > 50 % of initial specified value
8	Operational life	MIL-STD 202 method 108	T_{amb} = 110 °C; (310 V_{AC}) 250 h / 500 h / 1000 h	$\|\Delta C/C\| \leq 10$ % Increase of tan δ ≤ 0.008 for C $\leq$ 1 µF at 10 kHz or ≤ 0.005 for C > 1 µF at 1 kHz IR > 50 % of initial specified value
9	External visual	MIL-STD 883 method 2009	Device construction, marking, and workmanship	Device construction and workmanship; legible marking
10	Physical dimension	JESD22 method JB-100	Spec.	Datasheet
11	Terminal strength (leaded)	MIL-STD 202 method 211	Test leaded device lead integrity only. - A (pull-test): 2.27 kg (10 s) - C (wire-lead bend test): 227 g (3 x 3 s)	No visual damage
12	Resistance to solvents	MIL-STD 202 method 215	- Also aqueous chemical - OKEM clean or equivalent. Do not use banned solvents.	No visual damage Legible marking
13	Mechanical shock	MIL-STD 202 method 213	100 *g*'s; 6 ms half-sine; 3.75 m/s	No visual damage
14	Vibration	MIL-STD 202 method 204	5 *g*'s for 20 min; 12 cycles x 3 directions 10 Hz to 2000 Hz	No visual damage
15	Resistance to soldering heat	MIL-STD 202 method 210	280 °C; 10 s solder within 1.5 mm of device body	$\|\Delta C/C\| \leq 5$ % Increase of tan δ ≤ 0.008 for C $\leq$ 1 µF at 10 kHz or ≤ 0.005 for C > 1 µF at 1 kHz IR > 50 % of initial specified value
17	ESD	-	-	-
18	Solderability	J-STD-002	Leaded: method A, category 3 (245 °C / 3 s)	Good tinning as evidence by free flowing of the solder with wetting of terminations > 95 %
19	Electrical characterization	-	-	-
20	Flammability	UL 94 IEC 60384-1	One flame application Class B	V-0 or V-1 are acceptable. Class B or C acc. IEC is also acceptable

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