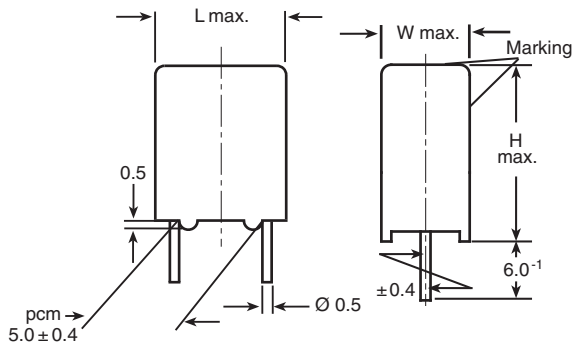


AC and Pulse Film Foil Capacitors KP Radial Potted Type



Dimensions in millimeters

MAIN APPLICATIONS

Oscillator, timing and LC/RC filter circuits, high frequency coupling of fast digital and analog IC's.

REFERENCE STANDARDS

IEC 60384-13

MARKING

C-value; tolerance; rated voltage; sub-class; manufacturer's type; code for dielectric material; manufacturer's location; manufacturer's logo; year and week

DIELECTRIC

Polypropylene film

ELECTRODES

Tin foil

CONSTRUCTION

Mono construction

RATED DC VOLTAGES

63 V, 250 V, 630 V

RATED AC VOLTAGES

40 V, 160 V, 250 V

FEATURES

- 5 mm lead pitch
- Supplied loose in box taped in ammpack or reel
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT
HALOGEN
FREE

ENCAPSULATION

Plastic case, epoxy resin sealed, flame retardant UL-class 94 V-0

CLIMATIC TESTING CLASS ACCORDING TO IEC 60068-1

55/100/56

CAPACITANCE RANGE

100 pF to 0.022 µF

CAPACITANCE TOLERANCE

± 10 % , ± 5 % , ± 2.5 % , ± 2 % , ± 1 %

LEADS

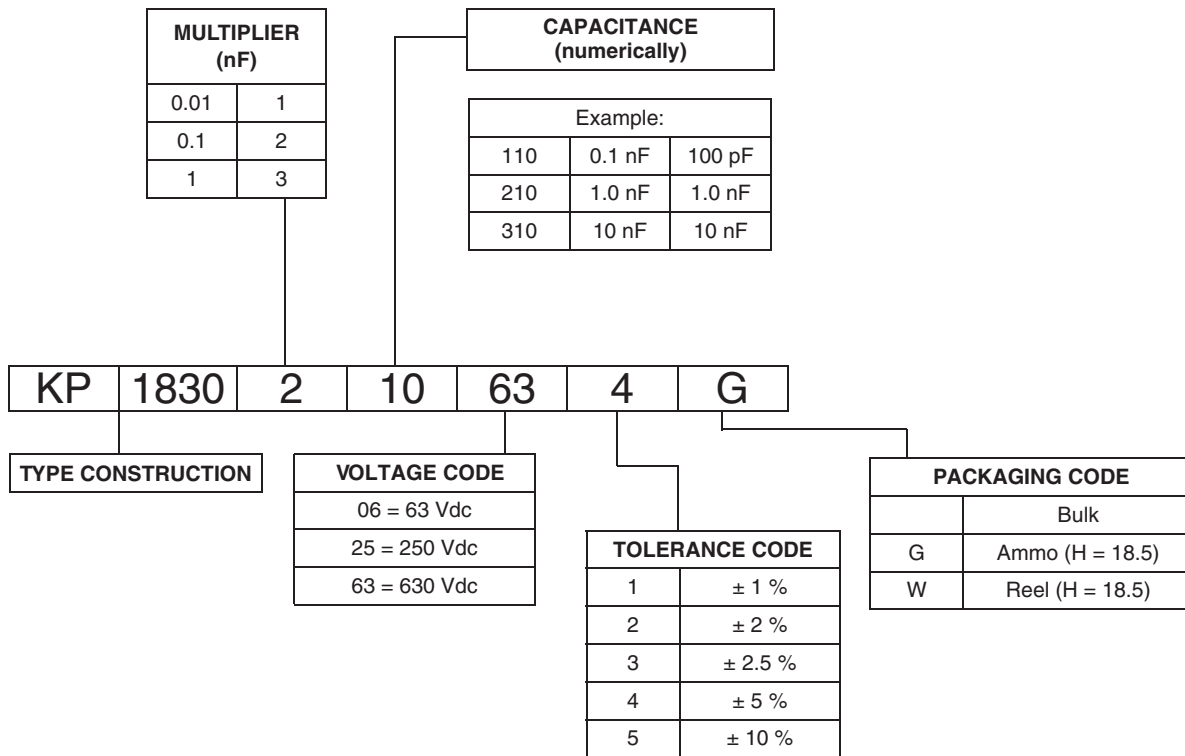
Tinned wire

MAXIMUM APPLICATION TEMPERATURE

100 °C

DETAIL SPECIFICATION

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

COMPOSITION OF CATALOG NUMBER

SPECIFIC REFERENCE DATA

| DESCRIPTION | VALUE | | | |
|--|--|---------------------|---------------------|---------------------|
| | at 1 kHz | at 10 kHz | at 100 kHz | at 1 MHz |
| Tangent of loss angle: | | | | |
| $C \leq 1000 \text{ pF}$ | - | 5×10^{-4} | - | 10×10^{-4} |
| $1000 \text{ pF} < C \leq 5000 \text{ pF}$ | - | 5×10^{-4} | 10×10^{-4} | - |
| $5000 \text{ pF} < C \leq 20\,000 \text{ pF}$ | - | 10×10^{-4} | 15×10^{-4} | - |
| $20\,000 \text{ pF} < C < 33\,000 \text{ pF}$ | - | 15×10^{-4} | 25×10^{-4} | - |
| Pitch (mm) | Maximum pulse rise time $(dU/dt)_R$ [V/ μ s] | | | |
| 5 | > 10 000 | | | |
| R between leads, for $C \leq 0.33 \text{ }\mu\text{F}$ at 100 V, 1 min | > 500 000 M Ω | | | |
| R between leads and case, 100 V, 1 min | > 30 000 M Ω | | | |
| Withstanding (DC) voltage (cut off current 10 mA), rise time 100 V/s | $1.6 \times U_{RDC}$, 1 min | | | |
| Withstanding (DC) voltage between leads and case | $2 \times U_{RDC}$, 1 min | | | |
| Maximum application temperature | 100 °C | | | |



| CAPACITANCE | CAPACITANCE CODE | VOLTAGE CODE 06 63 V _{DC} / 40 V _{AC} | | | VOLTAGE CODE 25 250 V _{DC} / 160 V _{AC} | | | VOLTAGE CODE 63 630 V _{DC} / 250 V _{AC} | | |
|-------------|------------------|--|--------|--------|--|--------|--------|--|--------|--------|
| | | W (mm) | H (mm) | L (mm) | W (mm) | H (mm) | L (mm) | W (mm) | H (mm) | L (mm) |
| 100 pF | -110 | - | - | - | - | - | - | 4.5 | 6.0 | 7.2 |
| 110 pF | -111 | - | - | - | - | - | - | 4.5 | 6.0 | 7.2 |
| 120 pF | -112 | - | - | - | - | - | - | 4.5 | 6.0 | 7.2 |
| 130 pF | -113 | - | - | - | - | - | - | 4.5 | 6.0 | 7.2 |
| 150 pF | -115 | - | - | - | - | - | - | 4.5 | 6.0 | 7.2 |
| 160 pF | -116 | - | - | - | - | - | - | 4.5 | 6.0 | 7.2 |
| 180 pF | -118 | - | - | - | - | - | - | 4.5 | 6.0 | 7.2 |
| 200 pF | -120 | - | - | - | - | - | - | 4.5 | 6.0 | 7.2 |
| 220 pF | -122 | - | - | - | - | - | - | 4.5 | 6.0 | 7.2 |
| 240 pF | -124 | - | - | - | - | - | - | 4.5 | 6.0 | 7.2 |
| 270 pF | -127 | - | - | - | - | - | - | 4.5 | 6.0 | 7.2 |
| 300 pF | -130 | - | - | - | - | - | - | 4.5 | 6.0 | 7.2 |
| 330 pF | -133 | - | - | - | - | - | - | 4.5 | 6.0 | 7.2 |
| 360 pF | -136 | - | - | - | - | - | - | 4.5 | 6.0 | 7.2 |
| 390 pF | -139 | - | - | - | - | - | - | 4.5 | 6.0 | 7.2 |
| 430 pF | -143 | - | - | - | - | - | - | 4.5 | 6.0 | 7.2 |
| 470 pF | -147 | - | - | - | - | - | - | 4.5 | 6.0 | 7.2 |
| 510 pF | -151 | - | - | - | - | - | - | 4.5 | 6.0 | 7.2 |
| 560 pF | -156 | - | - | - | - | - | - | 4.5 | 6.0 | 7.2 |
| 620 pF | -162 | - | - | - | - | - | - | 4.5 | 6.0 | 7.2 |
| 680 pF | -168 | - | - | - | - | - | - | 4.5 | 6.0 | 7.2 |
| 750 pF | -175 | - | - | - | - | - | - | 4.5 | 6.0 | 7.2 |
| 820 pF | -182 | - | - | - | - | - | - | 4.5 | 6.0 | 7.2 |
| 910 pF | -191 | - | - | - | - | - | - | 4.5 | 6.0 | 7.2 |
| 1000 pF | -210 | - | - | - | - | - | - | 4.5 | 6.0 | 7.2 |
| 1100 pF | -211 | - | - | - | - | - | - | 4.5 | 6.0 | 7.2 |
| 1200 pF | -212 | - | - | - | - | - | - | 4.5 | 6.0 | 7.2 |
| 1300 pF | -213 | - | - | - | - | - | - | 4.5 | 6.0 | 7.2 |
| 1500 pF | -215 | - | - | - | - | - | - | 4.5 | 6.0 | 7.2 |
| 1600 pF | -216 | - | - | - | - | - | - | 4.5 | 6.0 | 7.2 |
| 1800 pF | -218 | - | - | - | - | - | - | 4.5 | 6.0 | 7.2 |
| 2000 pF | -220 | - | - | - | 4.5 | 6.0 | 7.2 | 5.5 | 7.0 | 7.2 |
| 2200 pF | -222 | - | - | - | 4.5 | 6.0 | 7.2 | 5.5 | 7.0 | 7.2 |
| 2400 pF | -224 | 4.5 | 6.0 | 7.2 | 4.5 | 6.0 | 7.2 | 5.5 | 7.0 | 7.2 |
| 2700 pF | -227 | 4.5 | 6.0 | 7.2 | 4.5 | 6.0 | 7.2 | 5.5 | 7.0 | 7.2 |
| 3000 pF | -230 | 4.5 | 6.0 | 7.2 | 5.5 | 7.0 | 7.2 | 5.5 | 7.0 | 7.2 |
| 3300 pF | -233 | 4.5 | 6.0 | 7.2 | 5.5 | 7.0 | 7.2 | 5.5 | 7.0 | 7.2 |
| 3600 pF | -236 | 4.5 | 6.0 | 7.2 | 5.5 | 7.0 | 7.2 | 7.5 | 7.0 | 7.2 |
| 3900 pF | -239 | 4.5 | 6.0 | 7.2 | 5.5 | 7.0 | 7.2 | 7.5 | 9.0 | 7.2 |
| 4300 pF | -243 | 4.5 | 6.0 | 7.2 | 5.5 | 7.0 | 7.2 | 7.5 | 9.0 | 7.2 |
| 4700 pF | -247 | 4.5 | 6.0 | 7.2 | 5.5 | 7.0 | 7.2 | 7.5 | 9.0 | 7.2 |
| 5100 pF | -251 | 4.5 | 6.0 | 7.2 | 7.5 | 9.0 | 7.2 | 7.5 | 9.0 | 7.2 |
| 5600 pF | -256 | 4.5 | 6.0 | 7.2 | 7.5 | 9.0 | 7.2 | 7.5 | 9.0 | 7.2 |
| 6200 pF | -262 | 4.5 | 6.0 | 7.2 | 7.5 | 9.0 | 7.2 | 7.5 | 9.0 | 7.2 |
| 6800 pF | -268 | 4.5 | 6.0 | 7.2 | 7.5 | 9.0 | 7.2 | 7.5 | 9.0 | 7.2 |
| 7500 pF | -275 | 5.5 | 7.0 | 7.2 | 7.5 | 9.0 | 7.2 | 9.0 | 10.0 | 7.2 |
| 8200 pF | -282 | 5.5 | 7.0 | 7.2 | 7.5 | 9.0 | 7.2 | 9.0 | 10.0 | 7.2 |
| 9100 pF | -291 | 5.5 | 7.0 | 7.2 | 7.5 | 9.0 | 7.2 | 9.0 | 10.0 | 7.2 |
| 0.010 μF | -310 | 5.5 | 7.0 | 7.2 | 7.5 | 9.0 | 7.2 | 9.0 | 10.0 | 7.2 |
| 0.011 μF | -311 | 5.5 | 7.0 | 7.2 | 9.0 | 10.0 | 7.2 | - | - | - |
| 0.012 μF | -312 | 5.5 | 7.0 | 7.2 | 9.0 | 10.0 | 7.2 | - | - | - |
| 0.013 μF | -313 | 5.5 | 7.0 | 7.2 | 9.0 | 10.0 | 7.2 | - | - | - |
| 0.015 μF | -315 | 5.5 | 7.0 | 7.2 | 9.0 | 10.0 | 7.2 | - | - | - |
| 0.016 μF | -316 | 9.0 | 10.0 | 7.2 | - | - | - | - | - | - |
| 0.018 μF | -318 | 9.0 | 10.0 | 7.2 | - | - | - | - | - | - |
| 0.020 μF | -320 | 9.0 | 10.0 | 7.2 | - | - | - | - | - | - |
| 0.022 μF | -322 | 7.5 | 9.0 | 7.2 | - | - | - | - | - | - |

Note

- Further C-values upon request

RECOMMENDED PACKAGING

| LETTER CODE | TYPE OF PACKAGING | HEIGHT (H) (mm) | REEL DIAMETER (mm) | ORDERING CODE EXAMPLE | PITCH 5 |
|-------------|-------------------|-----------------|--------------------|-----------------------|---------|
| G | Ammo | 18.5 | S ⁽¹⁾ | KP1830-310-065-G | X |
| W | Reel | 18.5 | 350 | KP1830-310-065-W | X |
| - | Bulk | - | - | KP1830-310-065 | X |

Note

⁽¹⁾ S = box size 55 mm x 210 mm x 340 mm (W x H x L)

EXAMPLE OF ORDERING CODE

| TYPE | CAPACITANCE CODE | VOLTAGE CODE | TOLERANCE CODE | PACKAGING CODE |
|--------|------------------|--------------|----------------|----------------|
| KP1830 | 210 | 63 | 1 | G |

Tolerance codes: 1 = 1 % (F); 2 = 2 % (G); 3 = 2.5 % (H); 4 = 5 % (J); 5 = 10 % (K)

Note

- For detailed tape specifications refer to “Packaging Information” www.vishay.com/doc?28139 or end of catalog

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/doc?28139 or end of catalog

Specific Method of Mounting of Withstand Vibration and Shock

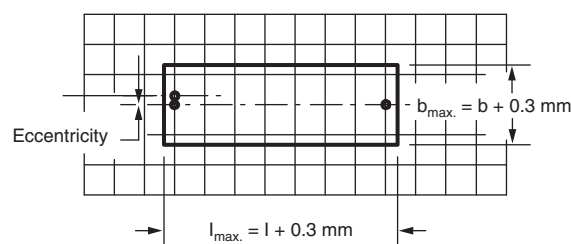
In order to withstand vibration and shock tests, it must be ensured that the stand-off pips are in good contact with the printed-circuit board.

- 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 length and width of film capacitors is shown in the drawing:

- Eccentricity as in drawing. The maximum eccentricity is smaller than or equal to the lead diameter of the product concerned
- Product height with seating plane as given by “IEC 60717” as reference: $h_{max.} \leq h + 0.4$ mm or $h_{max.} \leq h' + 0.4$ mm


Storage Temperature

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

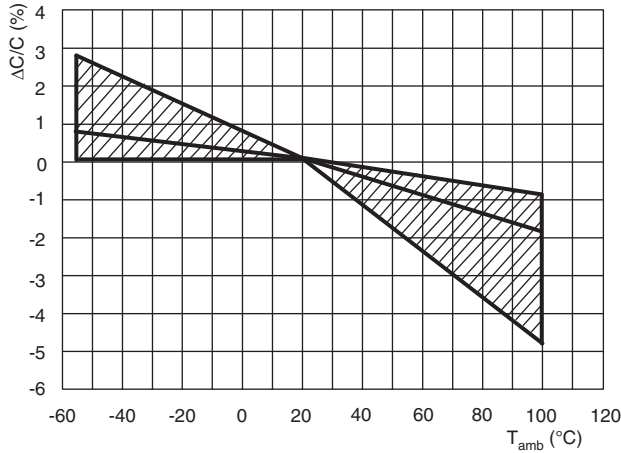
Ratings and Characteristics Reference Conditions

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 %.

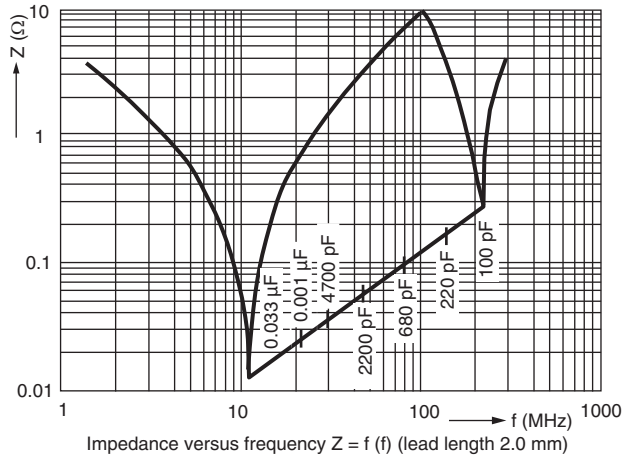
For reference testing, a conditioning period shall be applied over 96 h ± 4 h by heating the products in a circulating air oven at the rated temperature and a relative humidity not exceeding 20 %.



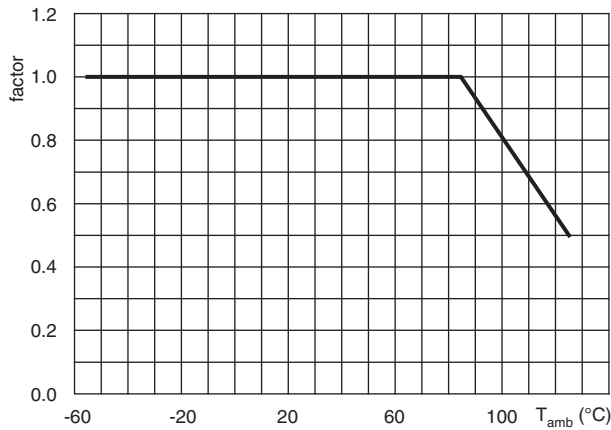
CHARACTERISTICS



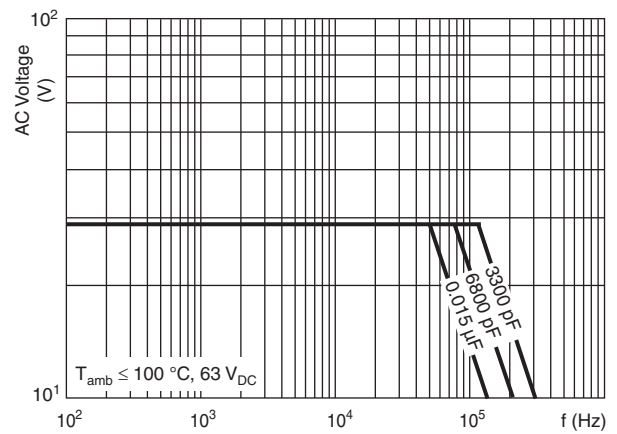
Capacitance as a function of ambient temperature (typical curve)



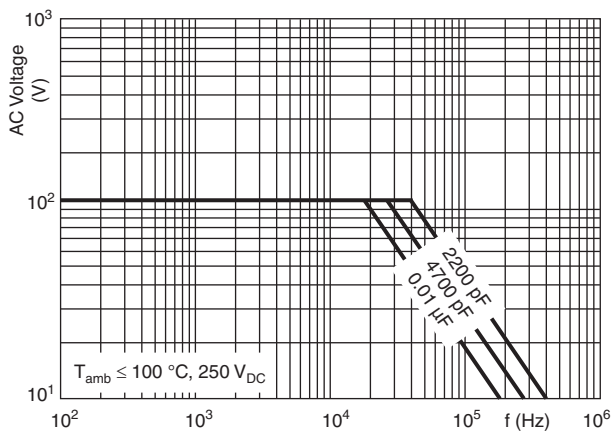
Impedance as a function of frequency (typical curve)



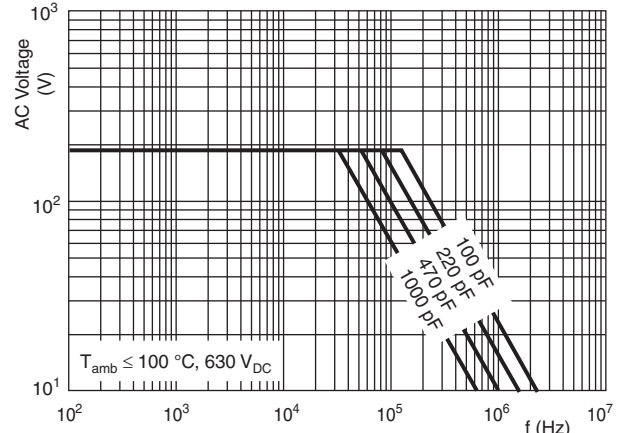
Maximum DC and AC voltage as a function of temperature



Maximum RMS voltage as a function of frequency



Maximum RMS voltage as a function of frequency



Maximum RMS voltage as a function of frequency

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

| W _{max.} (mm) | HEAT CONDUCTIVITY (mW/°C) | |
|------------------------|---------------------------|--|
| | PITCH 5 mm | |
| 4.5 | 3 | |
| 5.5 | 4 | |
| 7.5 | 6 | |
| 9.0 | 7 | |

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.

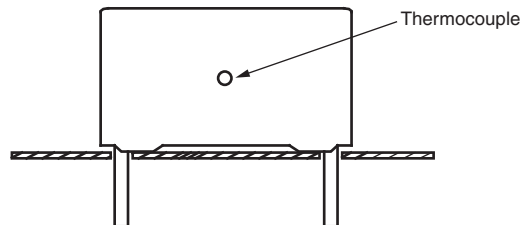
The power dissipation can be calculated according type detail specification “HQN-384-01/101: Technical Information Film Capacitors” with the typical t_{gd} of the curves.

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

- ΔT = component temperature rise (°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 radiation or convection, the capacitor should be tested in a wind-free box.

APPLICATION NOTE AND LIMITING CONDITIONS

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 maximum component surface temperature rise must be lower than the limits.
4. The maximum application temperature must be lower than 105 °C.
5. There is no limit for the voltage pulse slope in the application.

**INSPECTION REQUIREMENTS****General Notes**

Sub-clause numbers of tests and performance requirements refer to the “Sectional Specification, Publication IEC 60384-13 and Specific Reference Data”.

Group C Inspection Requirements

| SUB-CLAUSE NUMBER AND TEST | CONDITIONS | PERFORMANCE REQUIREMENTS |
|---|---|---|
| SUB-GROUP C1A PART OF SAMPLE OF SUB-GROUP C1 | | |
| 4.1 Dimensions (detail) | | As specified in chapters “General Data” of this specification |
| 4.3.1 Initial measurements | Capacitance at 1 kHz Tangent of loss angle at 100 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 predrying Method: 1A Solder bath: 280 °C ± 5 °C Duration: 5 s | |
| 4.14 Component solvent resistance | Isopropylalcohol at room temperature Method: 2 Immersion time: 5.0 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 2\%$ of the value measured in 4.3.1 |
| SUB-GROUP C1B PART OF SAMPLE OF SUB-GROUP C1 | | |
| 4.6.1 Initial measurements | Capacitance at 1 kHz Tangent of loss angle at 100 kHz | |
| 4.14 Solvent resistance of the marking | Isopropylalcohol at room temperature Method: 1 Rubbing material: cotton wool Immersion time: 5.0 min ± 0.5 min | No visible damage Legible marking |
| 4.6 Rapid change of temperature | 0A = -55 °C 0B = +105 °C 5 cycles Duration t = 30 min | |
| 4.7 Vibration | Visual examination Mounting: See section “Mounting” of this specification Procedure B4 Frequency range: 10 Hz to 55 Hz Amplitude: 0.75 mm or Acceleration 98 m/s ² (whichever is less severe) Total duration 6 h | No visible damage |
| 4.7.2 Final inspection | Visual examination | No visible damage |
| | Capacitance | $ \Delta C/C \leq 2\%$ of the value measured in 4.6.1 |
| | Tangent of loss angle | As specified in section “Tangent of loss angle” of this specification |



| SUB-CLAUSE NUMBER AND TEST | CONDITIONS | PERFORMANCE REQUIREMENTS |
|--|---|---|
| 4.9 Shock | Mounting: See section "Mounting" of this specification Pulse shape: half sine Acceleration: 490 m/s ² Duration of pulse: 11 ms | |
| 4.9.3 Final measurements | Visual examination Capacitance | No visible damage $ \Delta C/C \leq 2\%$ of the value measured in 4.6.1. |
| SUB-GROUP C1 COMBINED SAMPLE OF SPECIMENS OF SUB-GROUPS C1A AND C1B | | |
| 4.10 Climatic sequence | | |
| 4.10.2 Dry heat | Temperature: +100 °C Duration: 16 h | |
| 4.10.3 Damp heat cyclic Test Db, first cycle | | |
| 4.10.4 Cold | Temperature: -55 °C Duration: 2 h | |
| 4.10.6 Damp heat cyclic Test Db, remaining cycles | Recovery 1 h to 2 h | |
| 4.10.6.2 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 or flash-over No visible damage Legible marking $ \Delta C/C \leq 2\%$ of the value measured in 4.10.2 As specified in section "Tangent of loss angle" of this specification or ≤ 1.4 times the value measured in 4.3.1 whichever is greater $\geq 50\%$ of values specified in section "Insulation resistance" of this specification |
| SUB-GROUP C2 | | |
| 4.11 Damp heat steady state | | |
| 4.11.1 Initial measurements | Capacitance at 1 kHz Tangent of loss angle at 1 kHz Voltage proof = U_{RDC} for 1 min within 15 min after removal from testchamber | No breakdown or flash-over |
| 4.11.3 Final measurements | Visual examination Capacitance Tangent of loss angle Insulation resistance | No visible damage Legible marking $ \Delta C/C \leq 1\%$ of the value measured in 4.11.1. As specified in section "Tangent of loss angle" of this specification or ≤ 1.4 times the value measured in 4.11.1 whichever is greater $\geq 50\%$ of values specified in section "Insulation resistance" of this specification |



| SUB-CLAUSE NUMBER AND TEST | CONDITIONS | PERFORMANCE REQUIREMENTS |
|-----------------------------|--|---|
| SUB GROUP C3 | | |
| 4.12 Endurance | Duration: 2000 h 1.5 x U _{RDC} at 85 °C 1.05 x U _{RDC} at 100 °C | |
| 4.12.1 Initial measurements | Capacitance at 1 kHz Tangent of loss angle at 100 kHz | |
| 4.12.5 Final measurements | Visual examination | No visible damage Legible marking |
| | Capacitance | $ \Delta C/C \leq 2\%$ of the value measured in 4.12.1 |
| | Tangent of loss angle | As specified in section "Tangent of loss angle" of this specification or ≤ 1.4 times the value measured in 4.12.1 whichever is greater |
| | Insulation resistance | As specified in section "Insulation resistance" of this specification |



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