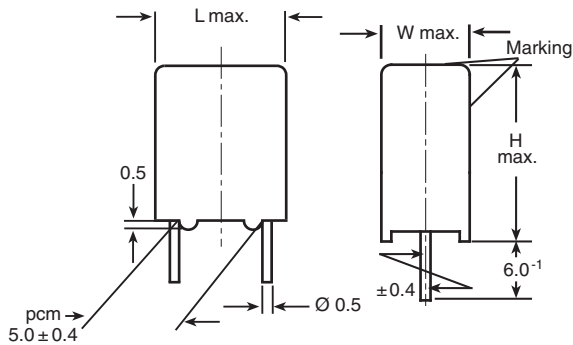


## AC and Pulse Film Foil Capacitors KP Radial Potted Type



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](http://www.vishay.com/doc?99912)

### 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  $\mu$ F

### CAPACITANCE TOLERANCE

$\pm 10\%$ ,  $\pm 5\%$ ,  $\pm 2.5\%$ ,  $\pm 2\%$ ,  $\pm 1\%$

### LEADS

Tinned wire

### MAXIMUM APPLICATION TEMPERATURE

100 °C

### DETAIL SPECIFICATION

For more detailed data and test requirements contact: [dc-film@vishay.com](mailto: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:				
$C \leq 1000 \text{ pF}$	-	$5 \times 10^{-4}$	-	$10 \times 10^{-4}$
$1000 \text{ pF} < C \leq 5000 \text{ pF}$	-	$5 \times 10^{-4}$	$10 \times 10^{-4}$	-
$5000 \text{ pF} < C \leq 20\,000 \text{ pF}$	-	$10 \times 10^{-4}$	$15 \times 10^{-4}$	-
$20\,000 \text{ pF} < C < 33\,000 \text{ pF}$	-	$15 \times 10^{-4}$	$25 \times 10^{-4}$	-
Pitch (mm)	Maximum pulse rise time $(dU/dt)_R$ [V/ $\mu$ s]			
5	> 10 000			
R between leads, for $C \leq 0.33 \text{ }\mu\text{F}$ at 100 V, 1 min	> 500 000 M $\Omega$			
R between leads and case, 100 V, 1 min	> 30 000 M $\Omega$			
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 <sub>DC</sub> / 40 V <sub>AC</sub>			VOLTAGE CODE 25 250 V <sub>DC</sub> / 160 V <sub>AC</sub>			VOLTAGE CODE 63 630 V <sub>DC</sub> / 250 V <sub>AC</sub>		
		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 <sup>(1)</sup>	KP1830-310-065-G	X
W	Reel	18.5	350	KP1830-310-065-W	X
-	Bulk	-	-	KP1830-310-065	X

**Note**

<sup>(1)</sup> 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](http://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](http://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  $\leq 15$  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**

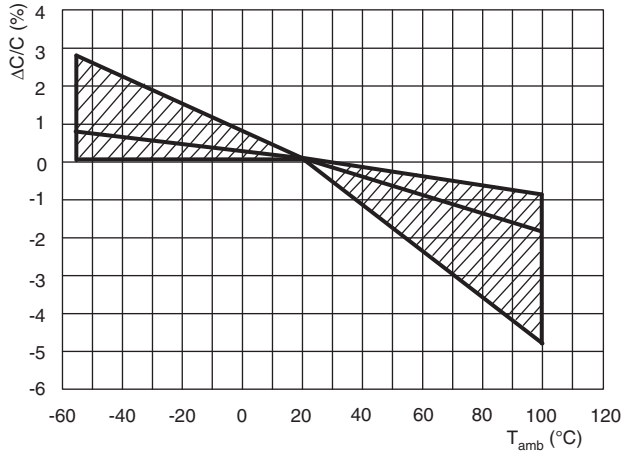
$T_{\text{stg}} = -25$  °C to  $+35$  °C with RH maximum 75 % without condensation

**Ratings and Characteristics Reference Conditions**

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

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

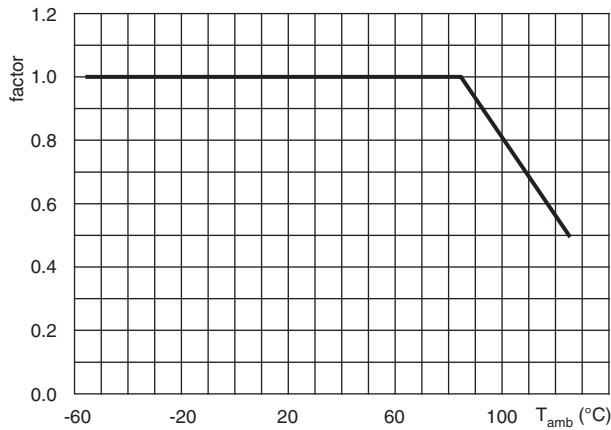
**CHARACTERISTICS**



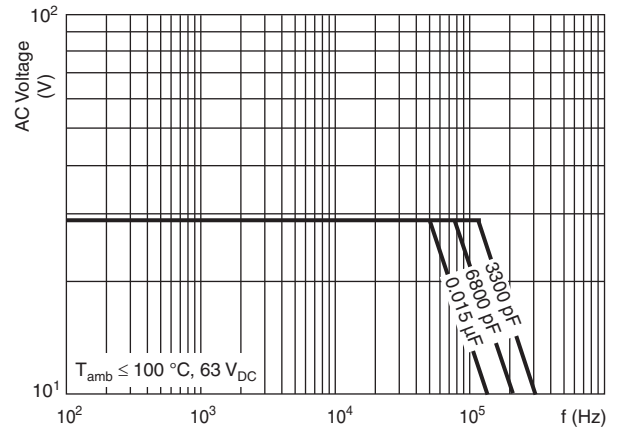
Capacitance as a function of ambient temperature (typical curve)



Impedance as a function of frequency (typical curve)



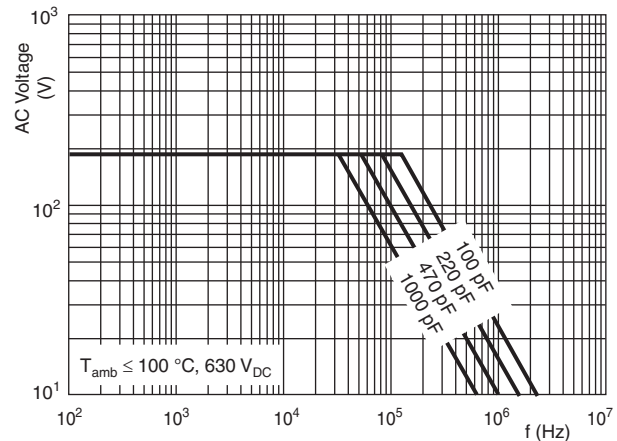
Maximum DC and AC voltage as a function of temperature



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

- $\Delta T$  = component temperature rise (°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
<b>SUB-GROUP C1A PART OF SAMPLE OF SUB-GROUP C1</b>		
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
<b>SUB-GROUP C1B PART OF SAMPLE OF SUB-GROUP C1</b>		
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 <sup>2</sup> (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  4.9.3 Final measurements	Mounting: See section "Mounting" of this specification Pulse shape: half sine Acceleration: 490 m/s <sup>2</sup> Duration of pulse: 11 ms  Visual examination  Capacitance	No visible damage  $ \Delta C/C  \leq 2\%$ of the value measured in 4.6.1.
<b>SUB-GROUP C1 COMBINED SAMPLE OF SPECIMENS OF SUB-GROUPS C1A AND C1B</b>		
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: +100 °C Duration: 16 h  Temperature: -55 °C Duration: 2 h  Recovery 1 h to 2 h  Voltage proof = U <sub>RDC</sub> 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 $\leq 1.4$ times the value measured in 4.3.1 whichever is greater  $\geq 50\%$ of values specified in section "Insulation resistance" of this specification
<b>SUB-GROUP C2</b>		
4.11 Damp heat steady state  4.11.1 Initial measurements  4.11.3 Final measurements	Capacitance at 1 kHz Tangent of loss angle at 1 kHz  Voltage proof = U <sub>RDC</sub> 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 1\%$ of the value measured in 4.11.1.  As specified in section "Tangent of loss angle" of this specification or $\leq 1.4$ 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
<b>SUB GROUP C3</b>		
4.12 Endurance	Duration: 2000 h 1.5 x U <sub>RDC</sub> at 85 °C 1.05 x U <sub>RDC</sub> 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 $\leq 1.4$ 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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