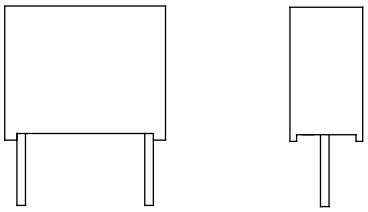
AC and Pulse Film/Foil Capacitors
Radial Potted Type



FEATURES

- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free
RoHS COMPLIANT
HALOGEN FREE
GREEN (5-2008)

APPLICATIONS

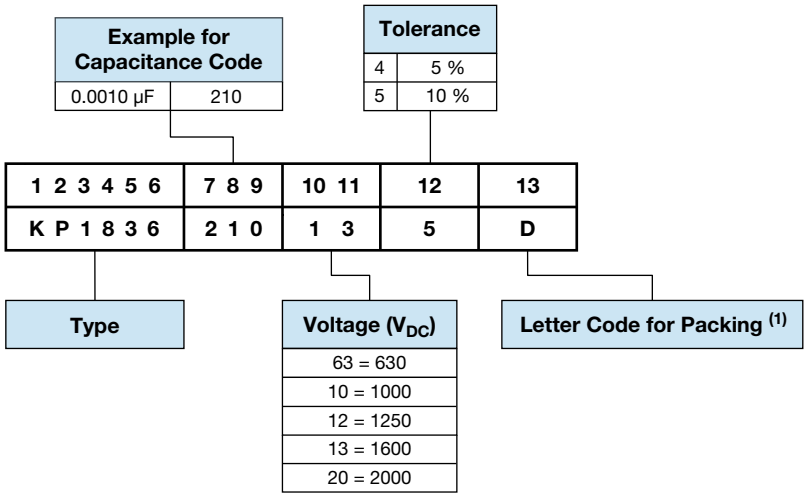
- High voltage, very high current and high pulse operations, deflection circuits in TV sets (fly-back tuning)
- Electronic ballasts, protection circuits in SMPS's
- Snubber and SCR commutating circuits

QUICK REFERENCE DATA	
Capacitance range	100 pF to 0.22 µF
Capacitance tolerances	± 10 %, ± 5 %
Climatic testing class according to IEC 60068	55/100/56
Dielectric	Polypropylene film
Electrodes	Aluminum foil
Construction	Extended aluminum foil, internal series connection, double-sided metallized, polyester carrier film
Leads	Tinned wire
Marking	Manufacturer's logo, type, C-value, rated voltage, tolerance, data of manufacture
Coating	Flame retardant plastic case (UL-class 94 V-0), epoxy resin sealed
Insulation resistance	Measured at 500 V_{DC} after one minute 100 000 MΩ minimum value (1000 GΩ typical value)
Operating temperature range	-55 °C to +100 °C
Rated DC voltages	630 V_{DC}, 1000 V_{DC}, 1250 V_{DC}, 1600 V_{DC}, 2000 V_{DC}
Permissible AC voltages (RMS) up to 60 Hz	300 V_{AC}, 350 V_{AC}, 400 V_{AC}, 500 V_{AC}, 600 V_{AC}
Test voltages (electrode/electrode)	2 x U_R for 2 s
Temperature coefficient	-250 x 10^{-6}/°C (typical value)
Capacitance drift	Up to +40 °C, ± 0.5 % for a period of two years
Derating for DC and AC category voltage U_C	At +85 °C: U_C = 1.0 U_R At +100 °C: U_C = 0.7 U_R
Self inductance	~ 6 nH measured with 2 mm long leads
Pull test on leads	≥ 30 N in direction of leads according to IEC 60068-2-21
Reliability	Operational life > 300 000 h Failure rate < 1 FIT (0.5 x U_R and 40 °C)

Note

- For further details, please refer to the general information available at www.vishay.com/doc?26033

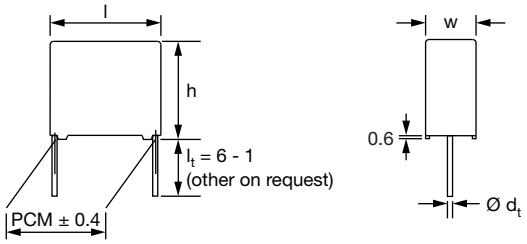
COMPOSITION OF CATALOG NUMBER



Note

(1) Letter code for packing please see table “Recommended Packaging”

DIMENSIONS in millimeters



W	Ø d
≥ 16	1.0
< 16	0.8

MAXIMUM PULSE RISE TIME

PCM (mm)	MAXIMUM PULSE RISE TIME dV/dt [V/µs]				
	630 V_{DC}	1000 V_{DC}	1250 V_{DC}	1600 V_{DC}	2000 V_{DC}
15	6500	8200	11 100	13 900	13 900
22.5	2600	3200	4600	6000	9800
27.5	1800	2300	3100	4000	6000
37.5	1200	1500	1900	2400	3500

Note

- If the maximum pulse voltage is less than the rated voltage higher dV/dt values can be permitted

DISSIPATION FACTOR tan δ

MEASURED AT	C ≤ 0.1 µF	C > 1.0 µF
1 kHz	0.3×10^{-3}	0.3×10^{-3}
10 kHz	0.4×10^{-3}	0.4×10^{-3}
100 kHz	1×10^{-3}	-
	Maximum values	

ELECTRICAL DATA

U_{RDC} (V)	CAP. (µF)	CAPACITANCE CODE	VOLTAGE CODE	V_{AC}	DIMENSIONS [1] (w x h x l) (mm)	PCM
630	0.0027	-227	63	300	5.5 x 10.5 x 18.0	15
	0.0033	-233			5.5 x 10.5 x 18.0	15
	0.0039	-239			6.5 x 12.5 x 18.0	15
	0.0047	-247			6.5 x 12.5 x 18.0	15
	0.0056	-256			7.5 x 13.5 x 18.0	15
	0.0068	-268			7.5 x 13.5 x 18.0	15
	0.0082	-282			8.5 x 14.5 x 18.0	15
	0.010	-310			8.5 x 14.5 x 18.0	15
	0.012	-312			8.5 x 17.5 x 18.0	15
	0.015	-315			10.5 x 17.5 x 18.0	15
	0.018	-318			7.5 x 15.5 x 26.5	22.5
	0.022	-322			7.5 x 15.5 x 26.5	22.5
	0.027	-327			8.5 x 16.5 x 26.5	22.5
	0.033	-333			10.5 x 18.5 x 26.5	22.5
	0.039	-339			10.5 x 18.5 x 26.5	22.5
	0.047	-347			10.5 x 18.5 x 26.5	22.5
	0.056	-356			11.5 x 20.5 x 31.5	27.5
	0.068	-368			11.5 x 20.5 x 31.5	27.5
	0.082	-382			11.5 x 20.5 x 31.5	27.5
	0.10	-410			13.5 x 23.5 x 31.5	27.5
	0.12	-412			12.5 x 22.5 x 41.5	37.5
	0.15	-415			12.5 x 22.5 x 41.5	37.5
	0.18	-418			14.5 x 24.5 x 41.5	37.5
	0.22	-422			14.5 x 24.5 x 41.5	37.5
1000	0.0018	-218	10	350	5.5 x 10.5 x 18.0	15
	0.0022	-222			5.5 x 10.5 x 18.0	15
	0.0027	-227			6.5 x 12.5 x 18.0	15
	0.0033	-233			6.5 x 12.5 x 18.0	15
	0.0039	-239			7.5 x 13.5 x 18.0	15
	0.0047	-247			7.5 x 13.5 x 18.0	15
	0.0056	-256			8.5 x 14.5 x 18.0	15
	0.0068	-268			8.5 x 14.5 x 18.0	15
	0.0082	-282			6.5 x 14.5 x 26.5	22.5
	0.010	-310			6.5 x 14.5 x 26.5	22.5
	0.012	-312			7.5 x 15.5 x 26.5	22.5
	0.015	-315			7.5 x 15.5 x 26.5	22.5
	0.018	-318			8.5 x 16.5 x 26.5	22.5
	0.022	-322			8.5 x 16.5 x 26.5	22.5
	0.027	-327			10.5 x 18.5 x 26.5	22.5
	0.033	-333			11.5 x 20.5 x 31.5	27.5
	0.039	-339			11.5 x 20.5 x 31.5	27.5
	0.047	-347			11.5 x 20.5 x 31.5	27.5
	0.056	-356			12.5 x 22.5 x 41.5	37.5
	0.068	-368			12.5 x 22.5 x 41.5	37.5
	0.082	-382			12.5 x 22.5 x 41.5	37.5
	0.10	-410			14.5 x 24.5 x 41.5	37.5
	0.12	-412			14.5 x 24.5 x 41.5	37.5
	0.15	-415			16.0 x 28.5 x 41.5	37.5
	0.18	-418			16.0 x 28.5 x 41.5	37.5
	0.22	-422			18.0 x 32.5 x 41.5	37.5

ELECTRICAL DATA

U_{RDC} (V)	CAP. (µF)	CAPACITANCE CODE	VOLTAGE CODE	V_{AC}	DIMENSIONS [1] (w x h x l) (mm)	PCM
1250	0.0012	-212	12	400	5.5 x 10.5 x 18.0	15
	0.0015	-215			5.5 x 10.5 x 18.0	15
	0.0018	-218			6.5 x 12.5 x 18.0	15
	0.0022	-222			6.5 x 12.5 x 18.0	15
	0.0027	-227			7.5 x 13.5 x 18.0	15
	0.0033	-233			7.5 x 13.5 x 18.0	15
	0.0039	-239			6.5 x 14.5 x 26.5	22.5
	0.0047	-247			6.5 x 14.5 x 26.5	22.5
	0.0056	-256			6.5 x 14.5 x 26.5	22.5
	0.0068	-268			6.5 x 14.5 x 26.5	22.5
	0.0082	-282			57.5 x 15.5 x 26.5	22.5
	0.010	-310			7.5 x 15.5 x 26.5	22.5
	0.012	-312			10.5 x 18.5 x 26.5	22.5
	0.015	-315			10.5 x 18.5 x 26.5	22.5
	0.018	-318			11.0 x 21.0 x 26.5	22.5
	0.022	-322			11.0 x 21.0 x 26.5	22.5
	0.027	-327			11.0 x 21.0 x 31.0	27.5
	0.033	-333			11.0 x 21.0 x 31.0	27.5
	0.039	-339			13.5 x 23.5 x 31.5	27.5
	0.047	-347			13.5 x 23.5 x 31.5	27.5
	0.056	-356			12.5 x 23.5 x 41.5	37.5
	0.068	-368			12.5 x 22.5 x 41.5	37.5
	0.082	-382			14.5 x 24.5 x 41.5	37.5
	0.10	-410			14.5 x 24.5 x 41.5	37.5
	0.12	-412			16.0 x 28.5 x 41.5	37.5
	0.15	-415			16.0 x 28.5 x 41.5	37.5
	0.18	-418			20.0 x 40.0 x 42.5	37.5
	0.22	-422			20.0 x 40.0 x 42.5	37.5
1600	0.00068	-168	13	500	5.5 x 10.5 x 18.0	15
	0.0010	-210			5.5 x 10.5 x 18.0	15
	0.0012	-212			6.5 x 12.5 x 18.0	15
	0.0015	-215			6.5 x 12.5 x 18.0	15
	0.0018	-218			6.5 x 14.5 x 26.5	22.5
	0.0022	-222			6.5 x 14.5 x 26.5	22.5
	0.0027	-227			6.5 x 14.5 x 26.5	22.5
	0.0033	-233			6.5 x 14.5 x 26.5	22.5
	0.0039	-239			7.5 x 15.5 x 26.5	22.5
	0.0047	-247			7.5 x 15.5 x 26.5	22.5
	0.0056	-256			8.5 x 16.5 x 26.5	22.5
	0.0068	-268			8.5 x 16.5 x 26.5	22.5
	0.0082	-282			10.5 x 18.5 x 26.5	22.5
	0.010	-310			10.5 x 18.5 x 26.5	22.5
	0.012	-312			11.5 x 20.5 x 31.5	27.5
	0.015	-315			11.5 x 20.5 x 31.5	27.5
	0.018	-318			11.5 x 20.5 x 31.5	27.5
	0.022	-322			11.5 x 20.5 x 31.5	27.5
	0.027	-327			13.5 x 23.5 x 31.5	27.5
	0.033	-333			13.5 x 23.5 x 31.5	27.5
	0.039	-339			12.5 x 22.5 x 41.5	37.5
	0.047	-347			12.5 x 22.5 x 41.5	37.5
	0.056	-356			14.5 x 24.5 x 41.5	37.5
	0.068	-368			14.5 x 24.5 x 41.5	37.5
	0.082	-382			16.0 x 28.5 x 41.5	37.5
	0.10	-410			16.0 x 28.5 x 41.5	37.5

ELECTRICAL DATA

U_{RDC} (V)	CAP. (µF)	CAPACITANCE CODE	VOLTAGE CODE	V_{AC}	DIMENSIONS [1] (w x h x l) (mm)	PCM
2000	0.00010	-110	20	600	5.5 x 10.5 x 18.0	15
	0.00015	-115			5.5 x 10.5 x 18.0	15
	0.00022	-122			5.5 x 10.5 x 18.0	15
	0.00033	-133			5.5 x 10.5 x 18.0	15
	0.00047	-147			5.5 x 10.5 x 18.0	15
	0.00068	-168			5.5 x 10.5 x 18.0	15
	0.0010	-210			6.5 x 14.5 x 26.5	22.5
	0.0012	-212			6.5 x 14.5 x 26.5	22.5
	0.0015	-215			6.5 x 14.5 x 26.5	22.5
	0.0018	-218			6.5 x 14.5 x 26.5	22.5
	0.0022	-222			6.5 x 14.5 x 26.5	22.5
	0.0027	-227			7.5 x 15.5 x 26.5	22.5
	0.0033	-233			7.5 x 15.5 x 26.5	22.5
	0.0039	-239			10.5 x 18.5 x 26.5	22.5
	0.0047	-247			10.5 x 18.5 x 26.5	22.5
	0.0056	-256			10.5 x 18.5 x 26.5	22.5
	0.0068	-268			11.5 x 20.5 x 31.5	27.5
	0.0082	-282			11.5 x 20.5 x 31.5	27.5
	0.010	-310			11.5 x 20.5 x 31.5	27.5
	0.012	-312			13.5 x 23.5 x 31.5	27.5
	0.015	-315			13.5 x 23.5 x 31.5	27.5
	0.018	-318			15.0 x 24.5 x 31.5	27.5
	0.022	-322			15.0 x 24.5 x 31.5	27.5
	0.027	-327			14.5 x 24.5 x 41.5	37.5
	0.033	-333			14.5 x 24.5 x 41.5	37.5
	0.039	-339			16.0 x 28.5 x 41.5	37.5
	0.047	-347			16.0 x 28.5 x 41.5	37.5

Notes

- Further C-values upon request

[1] For tolerances see chapter “Space Requirements for Printed-Circuit Board Applications and Dimension Tolerances”

RECOMMENDED PACKAGING

LETTER CODE	TYPE OF PACKAGING	HEIGHT (H) (mm)	REEL DIAMETER (mm)	ORDERING CODE EXAMPLES	PCM 15	PCM 22.5 TO 27.5	PCM 37.5
D	Ammo	16.5	S [1]	KP1836-168/205-D	x	-	-
G	Ammo	18.5	S [1]	KP1836-168/205-G	x	-	-
F	Reel	16.5	350	KP1836-168/205-F	x	-	-
W	Reel	18.5	350	KP1836-168/205-W	x	-	-
V	Reel	18.5	500	KP1836-310/134-V	x	x	-
G	Ammo	18.5	L [2]	KP1836-310/134-G	-	x	-
-	Bulk	-	-	KP1836-310/134	x	x	x

Notes

[1] S = Box size 55 mm x 210 mm x 340 mm (W x H x L)

[2] L = Box size 60 mm x 360 mm x 510 mm (W x H x L)

MOUNTING

Normal Use

The capacitors are designed for mounting on printed-circuit boards. The capacitors packed in bandoleers 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

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 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:

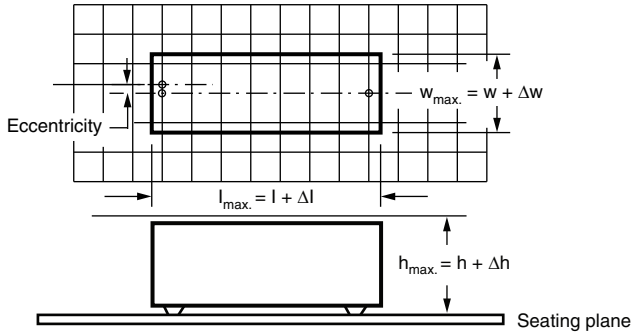
For products with pitch ≤ 15 mm, $\Delta w = \Delta l = 0.3$ mm and $\Delta h = 0.1$ mm

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

For products with pitch = 52.5 mm, $\Delta w = \Delta l = 1.0$ 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

For products with pitch = 52.5 mm, $\Delta l = 1.5$ 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

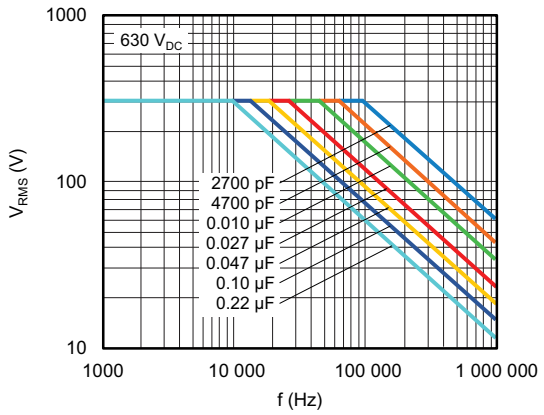
T_{stg} = -25 °C to +35 °C with RH maximum 75 % without condensation.

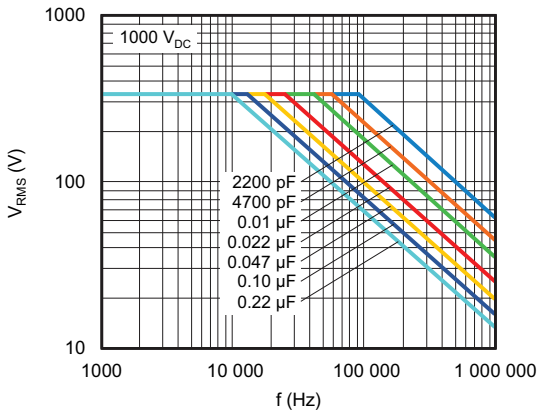
RATINGS AND CHARACTERISTICS REFERENCE CONDITIONS

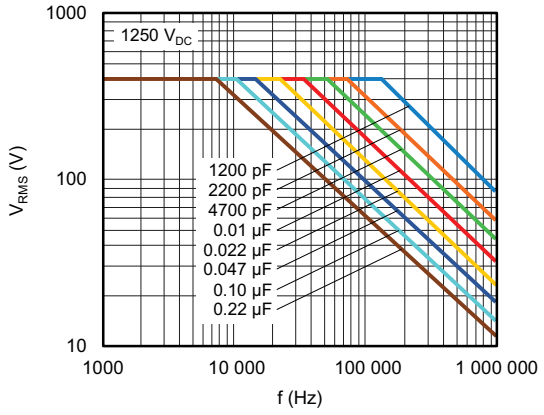
Unless otherwise specified, all electrical values apply to an ambient free temperature of 23 °C ± 1 °C, an atmospheric pressure of 86 kPa to 106 kPa, and a relative humidity of 50 % ± 2 %.

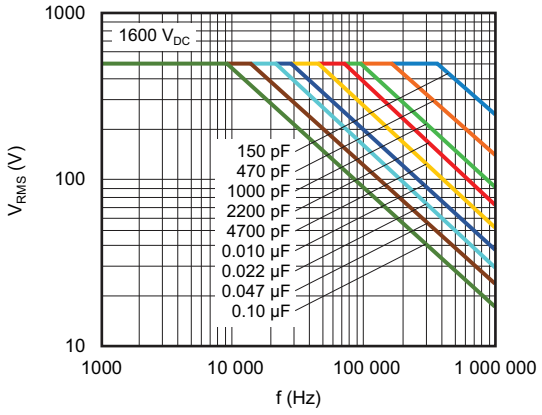
For reference testing, a conditioning period shall be applied over 96 h ± 4 h by heating the products in a circulating air oven at the rated temperature and a relative humidity not exceeding 20 %.

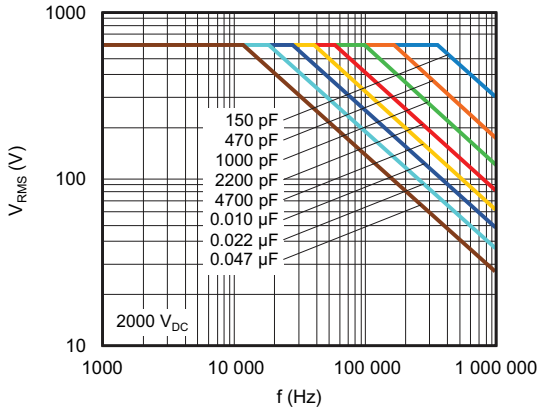
PERMISSIBLE AC VOLTAGE VS. FREQUENCY











HEAT CONDUCTIVITY (G) AS A FUNCTION OF CAPACITOR BODY THICKNESS IN mW/°C					
$w_{max.}$ (mm)	HEAT CONDUCTIVITY (mW/°C)				
	PITCH 15 mm	PITCH 22.5 mm	PITCH 27.5 mm	PITCH 37.5 mm	PITCH 52.5 mm
5.5	10.0	-	-	-	-
6.5	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

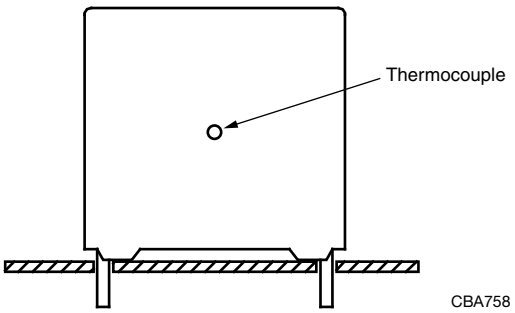
The power dissipation must be limited in order not to exceed the maximum allowed component temperature rise as a function of the free air ambient temperature.

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 should 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 ($U_{p\text{-}p}$) shall not be greater than the maximum ($U_{p\text{-}p}$) 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:

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

   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	**$T_{amb} \leq 85$ °C**	**85 °C < $T_{amb} \leq 100$ °C**
Maximum continuous RMS voltage	U_{RAC}	U_{RAC}
Maximum temporary RMS-over voltage (< 24 h)	1.25 x U_{RAC}	0.875 x U_{RAC}
Maximum peak voltage ($V_{o\text{-}p}$) (< 2 s)	1.6 x U_{RDC}	1.1 x U_{RDC}

INSPECTION REQUIREMENTS

General Notes

Sub-clause numbers of tests and performance requirements refer to the “Sectional Specification, Publication IEC 60384-14 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 Tangent of loss angle at 100 kHz	
4.3 Robustness of terminations	Tensile and bending	No visible damage
4.4 Resistance to soldering heat	Method: 1A Solder bath: 280 °C ± 5 °C Duration: 10 s	
4.14 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	$\lvert\Delta C/C\rvert \leq 2$ % of the value measured initially
	Tangent of loss angle	Increase of tan δ: ≤ 0.002 Compared to values measured initially
SUB-GROUP C1B OTHER PART OF SAMPLE OF SUB-GROUP C1		
4.6.1 Initial measurements	Capacitance Tangent of loss angle at 100 kHz	
4.15 Solvent resistance of the marking	Isopropyl alcohol 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 = lower category temperature θB = upper category temperature 5 cycles Duration t = 30 min	
4.7 Vibration	Visual examination Mounting: see section “Mounting” for more information 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

GROUP C INSPECTION REQUIREMENTS			
SUB-CLAUSE NUMBER AND TEST		**CONDITIONS**	**PERFORMANCE REQUIREMENTS**
SUB-GROUP C1B OTHER PART OF SAMPLE OF SUB-GROUP C1			
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	
4.9.3	Final measurements	Visual examination	No visible damage
		Capacitance	$\lvert\Delta C/C\rvert \leq 2$ % of the value measured in 4.6.1
		Tangent of loss angle	Increase of tan δ: ≤ 0.002 Compared to values measured in 4.6.1
		Insulation resistance	≥ 50 % of values 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	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	Voltage proof = U_{RDC} for 1 minute within 15 minutes after removal from test chamber	
4.10.6.2	Final measurements	Visual examination	No breakdown or flashover
		Capacitance	No visible damage Legible marking $\lvert\Delta C/C\rvert \leq 3$ % of the value measured initially.
		Tangent of loss angle	Increase of tan δ: ≤ 0.003 Compared to values measured in 4.3.1 or 4.6.1
		Insulation resistance	≥ 50 % of values specified in section “Insulation Resistance” of this specification
SUB-GROUP C2			
4.11	Damp heat steady state	56 days, 40 °C, 90 % to 95 % RH, no load	
4.11.1	Initial measurements	Capacitance Tangent of loss angle at 1 kHz	
4.11.3	Final measurements	Voltage proof = U_{RDC} for 1 minute within 15 minutes after removal from test chamber	No permanent breakdown or flash-over
		Visual examination	No visible damage Legible marking
		Capacitance	$\lvert\Delta C/C\rvert \leq 3$ % of the value measured initially.
		Tangent of loss angle	Increase of tan δ: ≤ 0.001 Compared to values measured in 4.3.1 or 4.6.1
		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 C3A			
4.12.1	Endurance test at 50 Hz alternating voltage	Duration: 2000 h Voltage: 1.0 x U_{RAC} at 100 °C	
4.12.1.1	Initial measurements	Capacitance Tangent of loss angle: at 10 kHz	
4.12.1.3	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: ≤ 0.004 Compared to values measured in 4.12.1
		Insulation resistance	≥ 50 % of values specified in section "Insulation Resistance" of this specification
SUB-GROUP C4			
4.2.6	Temperature characteristics Initial measurements Intermediate measurements	Capacitance Capacitance at: -55 °C Capacitance at: 20 °C Capacitance at: 100 °C	For -55 °C to +20 °C: $+1\ \% \leq \lvert\Delta C/C\rvert \leq 3.75\ \%$ or for 20 °C to 105 °C: $-6\ \% \leq \lvert\Delta C/C\rvert \leq 0\ \%$
	Final measurements	Capacitance	As specified in section "Capacitance" of this specification
		Insulation resistance	As specified in section "Insulation Resistance" of this specification
4.13	Charge and discharge	10 000 cycles Charged to U_{RDC} Discharge resistance: $R = \frac{U_{RDC}}{2.5 \times C\ (dU/dt)}$	
4.13.1	Initial measurements	Capacitance Tangent of loss angle at 100 kHz	
4.13.3	Final measurements	Capacitance	$\lvert\Delta C/C\rvert \leq 3$ % compared to values measured in 4.13.1.
		Tangent of loss angle	Increase of tan δ: ≤ 0.005 Compared to values measured in 4.13.1
		Insulation resistance	≥ 50 % of values specified in section "Insulation Resistance" of this specification

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