Printed Circuit Board Mount Power Film Capacitors

C4AE Series, Radial, 2 or 4 Leads, 450 – 1,100 VDC, for DC Link

Overview

The C4AE Series is a polypropylene metallized film with rectangular plastic box type filled with resin and 2 or 4 tinned copper wires.

Applications

Typical applications include DC filtering and energy storage.

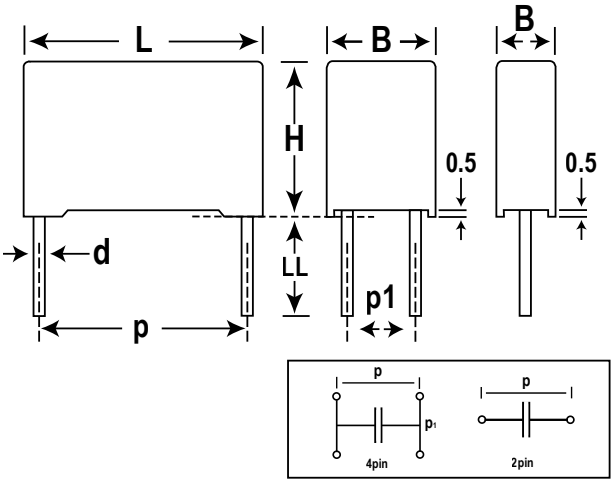
Benefits

- Self-healing
- Low losses
- High ripple current
- High capacitance density
- High contact reliability
- Suitable for high frequency applications

Part Number System

C4	AE	G	B	U	4450	A1	W	J
Series	Type	Rated Voltage (VDC)	Case	Number of Leads	Capacitance Code (pF)	Lead Diameter (mm)	Size Code	Tolerance
C4 = MKP capacitors	AE = Radial box, dc-link application	G = 450 H = 600 J = 700 O = 900 Q = 1,100	B = Plastic box with epoxy resin sealing	U = 2 lead W = 4 lead	Digits 2 – 4 indicate the first three digits of the capacitance value. First digit indicates the number of zeros to be added.	A1 = 0.8 A3 = 1.2	See Dimension Table	J = 5%

Dimensions – Millimeters



Size Code	p	p1	B	H	L	LL
	±0.4	±0.4	Maximum	Maximum	Maximum	+0/-2
W	27.5		11	20	31.5	6
X	27.5		13	25	31.5	6
Y	27.5		14	28	31.5	6
1	27.5		19	29	31.5	6
2	27.5		22	37	31.5	6
F	37.5	10.2	20	40	41.5	6
H	37.5	10.2	24	44	41.5	6
J	37.5	10.2	28	37	42.5	6
L	37.5	20.3	30	45	42	6
M	52.5	20.3	30	45	57.5	6
N	52.5	20.3	35	50	57.5	6

Qualification

Reference Standards	IEC 61071
Climatic Category	40/85/56 according to IEC 60068-1

General Technical Data

Dielectric	Polypropylene metallized film - non inductive self-healing
Application	DC filtering / DC-Link
Maximum Operating Temperature	+105°C
Upper Temperature T_{MAX}	+85°C IEC 61071, Endurance Test Temperature
Lower Temperature T_{MIN}	-40°C
Protection	"Solvent resistant plastic case UL94 V-0 Thermosetting resin sealing UL94 V-0 compliant"
Installation	Any position
Leads	Tinned copper wires
Packaging	Packed in cardboard trays with protection for the terminals
RoHS Compliant	Compliant with the restricted substance requirements of Directive 2002/95/EC

Electrical Characteristics

Capacitance tolerance	± 5% at +25°C
Dissipation factor (DF)	≤ 0.0002 at 10 kHz and +25°C (±5°C)
Surge voltage	1.5 * V_{NDC} for maximum 10 times in life time at 25°C
Overvoltage (IEC 61071)	1.15 * V_{NDC} for maximum 30 minutes - once per day
	1.3 * V_{NDC} for maximum 1 minute - once per day
Peak non Repetitive current	1.5 * I_{PKR} - maximum 1000 times in life time
Insulation Resistance	IR x C ≥ 30.000 seconds at 100 VDC 1 minute (+25°C)
Capacitance deviation in operation	±1.5% maximum on capacitance value measured at (+25°C)
Permissible relative humidity	Annual average ≤ 70%; 85% on 30 days/year randomly distributed throughout the year. Dewing not admissible

Life Expectancy

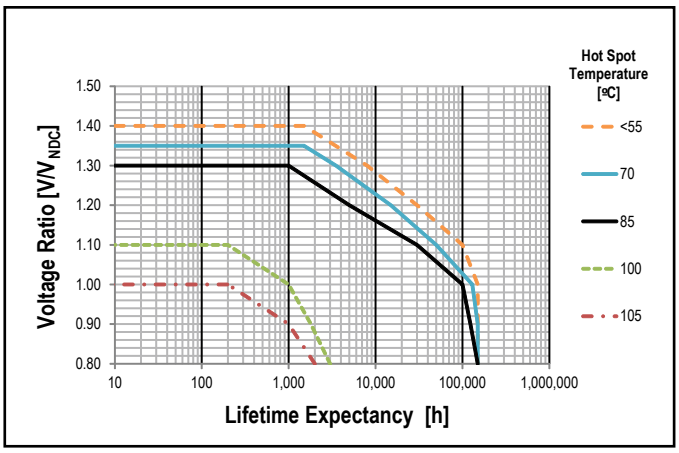
Life expectancy	100.000 hours at V_{NDC} @ Hot-Spot temperature T_{HS} = +85°C
Capacitance drop at end of life	-5% (typical)
Failure rate IEC 61709	300 FIT at V_{NDC} @ Hot-Spot temperature T_{HS} = +85°C

Test Method

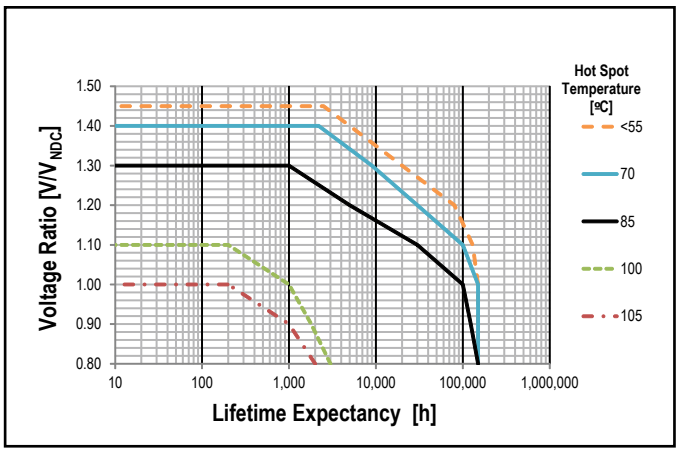
Test voltage between terminals	1.5 * V_{NDC} for 10 seconds or 1.65 V_{NDC} for 2 seconds, at +25°C
Test voltage between terminals and case	3.2 kVac 50 Hz for 2 seconds
Damp Heat	IEC 60068-2-78
Change of temperature	IEC 60068-2-14

Lifetime Expectancy/Failure Quota Graphs

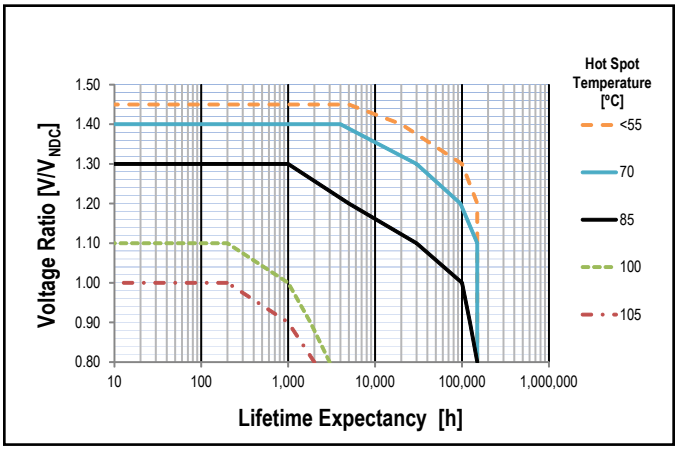
Lifetime Curve V_{NDC} = 450 V-



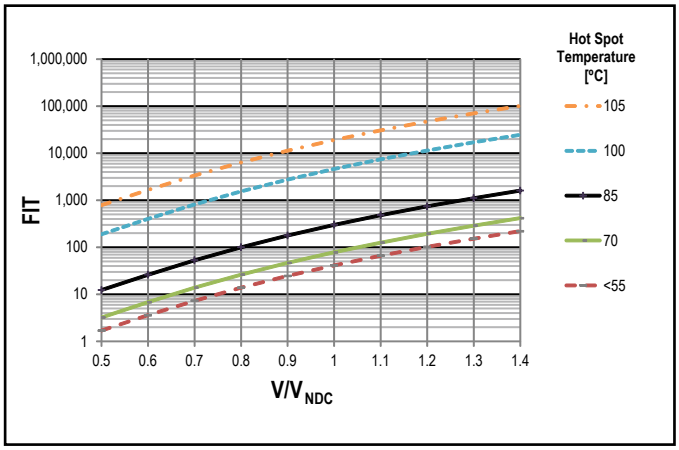
Lifetime Curve V_{NDC} = 600 V- and V_{NDC} = 700 V-



Lifetime Curve V_{NDC} = 900 V- and V_{NDC} = 1,100 V-



FIT @ Hot Spot Temperatures



Notes:
$T_{HS} = T_{AMB} + \Delta T$
$\Delta T = ESR * I_{rms}^2 * Rth$
I_{rms} *should be limited to values granting* $\Delta T \leq 30°C$

Environmental Compliance

As an environmentally conscious company, KEMET is working continuously with improvements concerning the environmental effects of both our capacitors and the production of them.

In Europe (RoHS Directive) and in some other geographical areas like China, legislation has been put in place to prevent the use of some hazardous materials, like Lead (Pb), in electronic equipment. All products in this catalog are produced to help our customers' obligations to guarantee their products to fulfill these legislative requirements. The only material of concern in our products has been Lead (Pb), which has been removed from all designs to fulfill the requirement of containing less than 0.1% of Lead in any homogeneous material.

KEMET will closely follow any changes in legislation world wide and makes any necessary changes in its products, whenever needed. Some customer segments like Medical, Military and Automotive Electronics may still require the use of Lead in electrode coatings. To clarify the situation and distinguish products from each other, a special symbol is used on the packaging labels for RoHS compatible capacitors.

Because of customer requirements there may appear additional markings like LF = Lead Free or LFW = Lead Free Wires on the label.

Materials & Environment

The selection of materials used by KEMET for the production of capacitors is the result of extensive experience and constant attention to environmental protection. KEMET selects its suppliers according to ISO 9001 standards and carries out statistical analysis on the materials purchased before acceptance. All materials are, to the company's present knowledge, non-toxic and free from Cadmium, Mercury, Chrome and compounds, PCB (Polychlorine Triphenyl), Bromide and Chlorine Dioxins Bromurate Clorurate, CFC and HCFC and Asbestos.

Green Products

All KEMET power film products are ROHS Compliant.

Insulation Resistance

When the capacitor temperature increases, the insulation resistance decreases. This is due to increased electron activity. Low insulation resistance can also be the result of moisture trapped in the windings, caused by a prolonged exposure to excessive humidity.

Dissipation Factor

Dissipation factor is a complex function involved with the inefficiency of the capacitor. The tgδ may change up and down with increased temperature. For more information, please refer to Performance Characteristics.

Sealing

Hermetically Sealed Capacitors
When the temperature increases, the pressure inside the capacitor increases. If the internal pressure is high enough, it can cause a breach in the capacitor which can result in leakage, impregnation, filling fluid or moisture susceptibility.

Resin Encased/Wrap & Fill Capacitors
The resin seals on resin encased and wrap and fill capacitors will withstand short-term exposure to high humidity environments without degradation. Resins and plastic tapes will form a pseudo-impervious barrier to humidity and chemicals. These case materials are somewhat porous and through osmosis can cause contaminants to enter the capacitor. The second area of contaminated absorption is the lead-wire/resin interface. Since resins cannot bond 100% to tinned wires, there can be a path formed up to the lead wire into the capacitor section. Aqueous cleaning of circuit boards can aggravate this condition.

Barometric Pressure
The altitude at which hermetically sealed capacitors are operated controls the voltage rating of the capacitor. As the barometric pressure decreases, the susceptibility to terminal arc-over increases. Non-hermetic capacitors can be affected by internal stresses due to pressure changes. This can be in the form of capacitance changes or dielectric arc-over as well as low insulation resistance. Heat transfer can also be affected by altitude operation. Heat generated in operation cannot be dissipated properly and can result in high RI2 losses and eventual failure.

Radiation
Radiation capabilities of capacitors must be taken into consideration. Electrical degradation in the form of dielectric embitterment can take place causing shorts or opens.

Table 1 – Ratings & Part Number Reference

Cap Value (µF)	VDC	Dimensions (mm)					dV/dt (V/µs)	Ipkr	ESL	ESR	Irms*	Rth	PART NUMBER
		B	H	L	P	P1		Apk	nH	70°C@10 kHz mΩ	70°C@10 kHz Arms	(HS/Amb) (°C/W)	
4.5	450	11	20	31.5	27.5	\	14	65	25	14.2	4.5	44	C4AEGBU4450A1WJ
6.8	450	13	25	31.5	27.5	\	15	101	25	10.0	6.0	36	C4AEGBU4680A1XJ
10	450	14	28	31.5	27.5	\	14	145	26	7.4	7.5	33	C4AEGBU5100A1YJ
12.5	450	19	29	31.5	27.5	\	15	187	26	6.2	8.5	29	C4AEGBU5125A11J
20	450	22	37	31.5	27.5	\	15	303	28	4.8	11.0	23	C4AEGBU5200A12J
30	450	20	40	41.5	37.5	10.2	10	298	30	4.1	13.0	20	C4AEGBW5300A3FJ
35	450	28	37	42.5	37.5	10.2	10	355	30	3.5	14.0	18	C4AEGBW5350A3JJ
40	450	24	44	41.5	37.5	10.2	10	406	30	3.1	16.0	17	C4AEGBW5400A3HJ
50	450	30	45	42	37.5	20.3	10	508	30	2.5	18.0	15	C4AEGBW5500A3LJ
75	450	30	45	57.5	52.5	20.3	7	503	35	3.4	18.0	12	C4AEGBW5750A3MJ
100	450	35	50	57.5	52.5	20.3	7	677	35	2.6	22.0	10	C4AEGBW6100A3NJ
3.3	600	11	20	31.5	27.5	\	17	55	25	17.0	4.0	44	C4AEHBU4330A1WJ
5.6	600	13	25	31.5	27.5	\	17	94	25	10.7	6.0	36	C4AEHBU4560A1XJ
7	600	14	28	31.5	27.5	\	17	118	26	9.0	7.0	33	C4AEHBU4700A1YJ
10	600	19	29	31.5	27.5	\	17	169	26	6.8	8.5	29	C4AEHBU5100A11J
15	600	22	37	31.5	27.5	\	17	253	28	5.3	10.5	23	C4AEHBU5150A12J
20	600	20	40	41.5	37.5	10.2	11	229	30	5.3	11.0	20	C4AEHBW5200A3FJ
30	600	28	37	42.5	37.5	10.2	11	337	30	3.6	14.0	18	C4AEHBW5300A3JJ
40	600	30	45	42	37.5	20.3	11	458	30	2.8	18.0	15	C4AEHBW5400A3LJ
55	600	30	45	57.5	52.5	20.3	8	425	35	4.1	16.5	12	C4AEHBW5550A3MJ
75	600	35	50	57.5	52.5	20.3	8	579	35	3.1	20.5	10	C4AEHBW5750A3NJ
2.7	700	11	20	31.5	27.5	\	19	51	25	18.3	4.0	44	C4AEJBU4270A1WJ
4	700	13	25	31.5	27.5	\	19	77	25	12.9	5.5	36	C4AEJBU4400A1XJ
5	700	14	28	31.5	27.5	\	19	96	26	10.7	6.0	33	C4AEJBU4500A1YJ
8	700	19	29	31.5	27.5	\	19	154	26	7.3	8.0	29	C4AEJBU4800A11J
12.5	700	22	37	31.5	27.5	\	19	241	28	5.5	10.0	23	C4AEJBU5125A12J
15	700	20	40	41.5	37.5	5.1	13	196	30	6.2	10.0	20	C4AEJBW5150A3FJ
20	700	28	37	42.5	37.5	10.2	13	262	30	4.7	12.5	18	C4AEJBW5200A3JJ
22	700	24	44	41.5	37.5	10.2	13	288	30	4.3	13.0	17	C4AEJBW5220A3HJ
30	700	30	45	42	37.5	20.3	13	389	30	3.2	16.5	15	C4AEJBW5300A3LJ
45	700	30	45	57.5	52.5	20.3	9	389	35	4.4	16.0	12	C4AEJBW5450A3MJ
55	700	35	50	57.5	52.5	20.3	9	485	35	3.6	19.0	10	C4AEJBW5550A3NJ
60	700	35	50	57.5	52.5	20.3	9	530	35	3.4	19.5	10	C4AEJBW5600A3NJ
1.5	900	11	20	31.5	27.5	\	24	36	25	26.3	3.5	44	C4AEOBU4150A1WJ
2.7	900	13	25	31.5	27.5	\	24	65	25	15.3	5.0	36	C4AEOBU4270A1XJ
3.3	900	14	28	31.5	27.5	\	24	79	26	12.9	5.5	33	C4AEOBU4330A1YJ
5	900	19	29	31.5	27.5	\	24	120	26	9.1	7.0	29	C4AEOBU4500A11J
8	900	22	37	31.5	27.5	\	24	193	28	6.6	9.5	23	C4AEOBU4800A12J
12	900	20	40	41.5	37.5	10.2	16	190	30	6.3	10.0	20	C4AEOBW5120A3FJ
14	900	28	37	42.5	37.5	10.2	16	229	30	5.4	11.5	18	C4AEOBW5140A3JJ
16	900	24	44	41.5	37.5	10.2	16	256	30	4.8	13.0	17	C4AEOBW5160A3HJ
20	900	30	45	42	37.5	20.3	16	321	30	3.9	15.0	15	C4AEOBW5200A3LJ
30	900	30	45	57.5	52.5	20.3	11	324	35	5.2	15.0	12	C4AEOBW5300A3MJ
40	900	35	50	57.5	52.5	20.3	11	428	35	4.0	18.0	10	C4AEOBW5400A3NJ
1	1100	11	20	31.5	27.5	\	28	28	25	33.1	3.0	44	C4AEQBU4100A1WJ
1.8	1100	13	25	31.5	27.5	\	29	52	25	19.1	4.5	36	C4AEQBU4180A1XJ
2.2	1100	14	28	31.5	27.5	\	29	63	26	16.0	5.0	33	C4AEQBU4220A1YJ
3.3	1100	19	29	31.5	27.5	\	29	95	26	11.2	6.5	29	C4AEQBU4330A11J
5	1100	22	37	31.5	27.5	\	29	145	28	8.2	8.5	23	C4AEQBU4500A12J
8	1100	20	40	41.5	37.5	10.2	20	157	30	7.9	9.0	20	C4AEQBW4800A3FJ
10	1100	28	37	42.5	37.5	10.2	20	196	30	6.3	11.0	18	C4AEQBW5100A3JJ
12	1100	30	45	42	37.5	20.3	20	235	30	5.3	13.0	15	C4AEQBW5120A3LJ
20	1100	30	45	57.5	52.5	20.3	13	262	35	6.5	13.0	12	C4AEQBW5200A3MJ
25	1100	35	50	57.5	52.5	20.3	13	331	35	5.2	16.0	10	C4AEQBW5250A3NJ
27	1100	35	50	57.5	52.5	20.3	13	354	35	4.9	16.5	10	C4AEQBW5270A3NJ
Cap Value (µF)	**VDC**	**B**	**H**	**L**	**P**	**P1**	**dV/dt (V/µs)**	**Ipkr**	**ESL**	**ESR**	**Irms**	**Rth**	**Part Number**

(1) Current values that lead to a ΔT of ~ 15°C in the hot spot → $T_{HS} = T_{AMB} + \Delta T = 70°C + 15°C = 85°C$
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Although all product–related warnings, cautions and notes must be observed, the customer should not assume that all safety measures are indicted or that other measures may not be required.