Snap-In and Screw Terminal Aluminum Electrolytic Capacitors

For Demanding Power Electronics and Vehicular Applications

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Electronic Components
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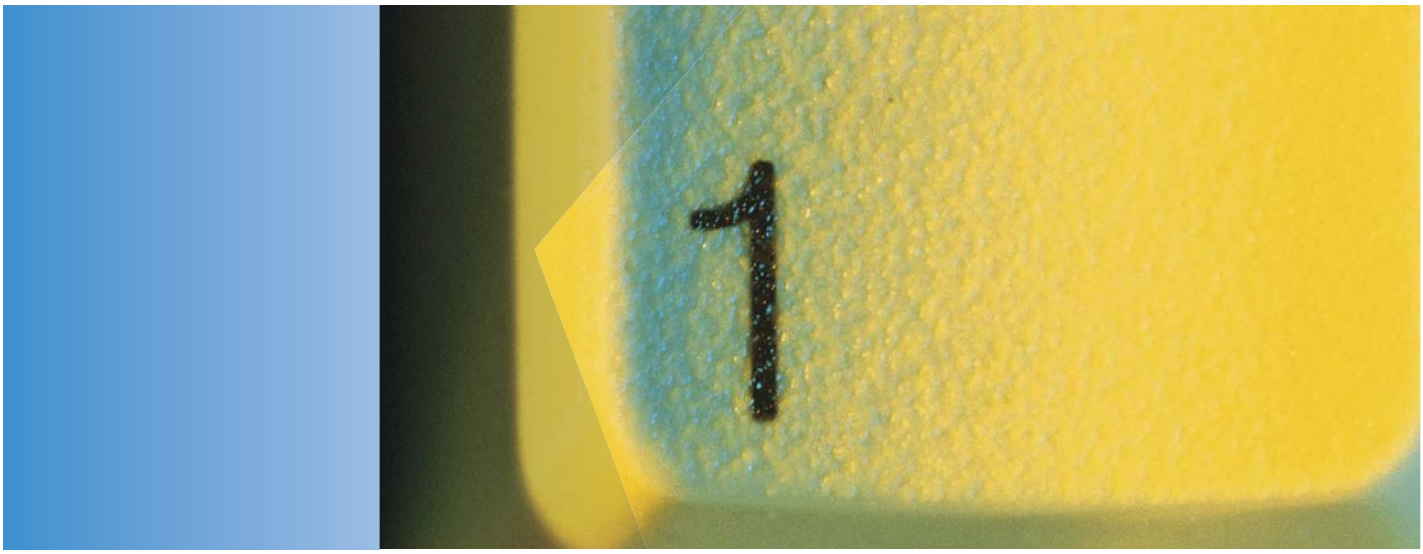


One world. One source. One KEMET.

When you partner with KEMET, our entire global organization provides you with the coordinated service you need. No bouncing from supplier to supplier. No endless phone calls and web browsing. We're your single, integrated source for electronic component solutions worldwide.

Less hassles. More solutions.

Our commitment to product quality and on-time delivery has helped customers succeed for over 90 years. There's a reason KEMET components can be found in defense and aerospace equipment. Our reputation is built on a history of consistency, reliability and service.

The "Easy-to-Buy-From" company.

KEMET offers a level of responsiveness that far surpasses any other supplier. Our passion for customer service is evident throughout our global sales organization, which offers localized support bolstered by our worldwide logistics capabilities. Whether you need rush samples, technical assistance, in-person consultation, accelerated custom design, design collaboration or prototype services, we have a solution.

Made for you.

When you need custom products delivered on a tight schedule, you can trust KEMET. Get direct design consultation from global experts, who help you get the job done on time and within budget.

Working for a better world.

KEMET is dedicated to economically, environmentally and socially sustainable development. We've adopted the Electronic Industry Code of Conduct (EICC) to address all aspects of corporate responsibility. Our manufacturing facilities have won numerous environmental excellence awards and recognitions, and our supply chain is certified. We believe doing the right thing is in everyone's interest.

About KEMET.

KEMET Corporation is a leading global supplier of electronic components. We offer our customers the broadest selection of capacitor technologies in the industry across multiple dielectrics, along with an expanding range of electromechanical devices, and electromagnetic compatibility solutions. Our vision is to be the preferred supplier of electronic component solutions for customers demanding the highest standards of quality, delivery and service.

PEH506 Series, +85ºC

Overview

KEMET's PEH506 is a long-life electrolytic capacitor designed to offer high ripple current capability and low mounting cost. Low ESR is the result of a very low resistive paper/electrolyte system. Low ESR, together with the TDC thermal concept, gives the PEH506 a high ripple current capability.

Applications

Typical applications for KEMET's PEH506 capacitor include switch mode power supplies (SMPS), drives, welding equipment, uninterruptible power supplies (UPS), and other power electronic applications where high current ratings and compact size are important.

Benefits

- Snap-In
- Long life, 3,000 hours at +85°C (V_R, I_R applied)
- PCB mounting
- Low ESR and ESL
- High ripple current

Part Number System

PEH506	J	AC	433	0	M	2
Series	Rated Voltage (VDC)	Size Code	Capacitance Code (µF)	Version	Capacitance Tolerance	Termination
Snap-In type Aluminum Electrolytic	J = 35 M = 63 P = 100 R = 200 S = 250 U = 350 V = 400 Y = 450	See Dimension Table	The last two digits represent significant figures. The first digit indicates the total number digits.	0 = Standard	M = ±20%	See Termination Table

Performance Characteristics

Item	Performance Characteristics		
Capacitance Range	68 – 27,000 µF		
Rated Voltage	35 – 450 VDC		
Operating Temperature	-40 to +85°C		
Capacitance Tolerance	±20% at 100 Hz / +20°C		
Operational Lifetime	D (mm)	Rated Voltage and Ripple Current at +85°C (hours)	Rated Voltage at +85°C (hours)
	22–35	3,000	6,000
Shelf Life	4 years at +40°C 0 VDC		
Leakage Current	I = 0.003 CV (µA)		
	C = rated capacitance (µF), V = rated voltage (VDC). Voltage applied for 5 minutes at +20°C.		
Vibration Test Specifications	Procedure	Requirements	
	0.75 mm displacement amplitude or 10 g maximum acceleration. Vibration applied for three 2-hour sessions at 10 – 500 Hz (Capacitor clamped by body).	No leakage of electrolyte or other visible damage. Deviations in capacitance and tanδ from initial measurements must not exceed: Δ C/C < 5%	
Standards	IEC 60384-4 long life grade 40/85/56, in accordance with CECC 30 301–809		

Test Method & Performance

Endurance Life Test		
Conditions	Performance	
Temperature	+85°C	
Test Duration	2,000 hours	
Ripple Current	Maximum ripple current specified in table	
Voltage	The sum of DC voltage and the peak AC voltage must not exceed the rated voltage of the capacitor	
Performance	**The following specifications will be satisfied when the capacitor is tested at +20°C:**	
Capacitance Change	≤ 160 V	Within 15% of the initial value
	> 160 V	Within 10% of the initial value
Equivalent Series Resistance	Does not exceed 200% of the initial value	
Leakage Current	Does not exceed leakage current limit	

Dimensions – Millimeters

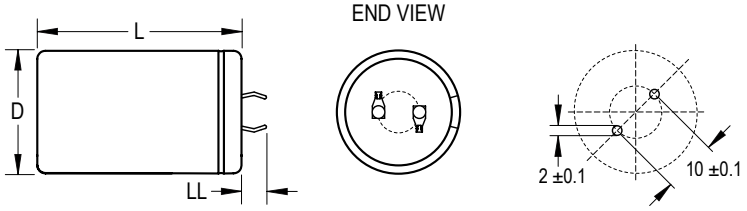
D X L	Size Code	Dimensions in mm		Approximate Weight Grams
		D1	L1	
		±0.5	±1.0	
22 x 25	AB	22.5	26	13
22 x 30	AC	22.5	31	14
22 x 35	AD	22.5	36	15
22 x 40	AE	22.5	41	17
22 x 45	AF	22.5	46	19
22 x 50	AG	22.5	51	21
25 x 25	BB	25.5	26	19
25 x 30	BC	25.5	31	21
25 x 35	BD	25.5	36	24
25 x 40	BE	25.5	41	27
25 x 45	BF	25.5	46	30
25 x 50	BG	25.5	51	33
30 x 25	CB	30.5	26	24
30 x 30	CC	30.5	31	29
30 x 35	CD	30.5	36	34
30 x 40	CE	30.5	41	39
30 x 45	CF	30.5	46	45
30 x 50	CG	30.5	51	51
35 x 25	DB	35.5	26	32
35 x 30	DC	35.5	31	40
35 x 35	DD	35.5	36	48
35 x 40	DE	35.5	41	56
35 x 45	DF	35.5	46	64
35 x 50	DG	35.5	51	72
35 x 55	DH	35.5	56	85
Note: Add 0.5 mm to D and 1 mm to L for Sleeving				

Termination Tables

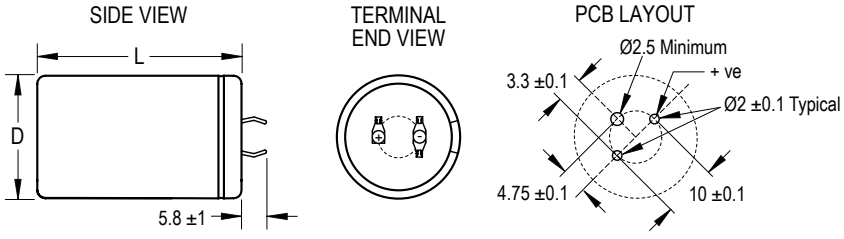
Termination Code / Diameter (mm)	2	2S	3	4	4S
22	•	•	•		
25	•	•	•		
30	•	•	•		
35	•	•	•	•	•
Mounting: These capacitors are designed to be mounted by their terminations alone and may be used in any position. Dummy pins on 4-pin decks must be isolated.					

Termination Code	Termination Style	LL ±1
Standard Termination Option		
2	2 Pin	6.3
Other Termination Options		
2S	2 Pin	4
3	3 Pin	4
4	4 Pin	6.3
4S	4 Pin	4
Dimensions in mm		

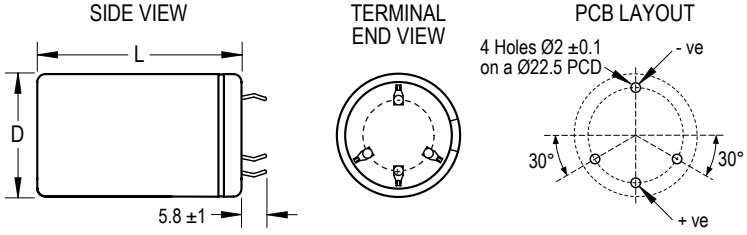
Style 2/2S



Style 3



Style 4/4S



Shelf Life

The capacitance, ESR and impedance of a capacitor will not change significantly after extended storage periods, however the leakage current will very slowly increase. KEMET products are particularly stable and allow a shelf life in excess of three years at 40°C. See sectional specification under each product series for specific data.

Re-age (Reforming) Procedure

Apply the rated voltage to the capacitor at room temperature for a period of one hour, or until the leakage current has fallen to a steady value below the specified limit. During re-aging a maximum charging current of twice the specified leakage current or 5 mA (whichever is greater) is suggested.

Reliability

The reliability of a component can be defined as the probability that it will perform satisfactorily under a given set of conditions for a given length of time.

In practice, it is impossible to predict with absolute certainty how any individual component will perform; thus, we must utilize probability theory. It is also necessary to clearly define the level of stress involved (e.g. operating voltage, ripple current, temperature and time). Finally, the meaning of satisfactory performance must be defined by specifying a set of conditions which determine the end of life of the component.

Reliability as a function of time, R(t), is normally expressed as: $R(t)=e^{-\lambda t}$
where R(t) is the probability that the component will perform satisfactorily for time t, and λ is the failure rate.

Failure Rate

The failure rate is the number of components failing per unit time. The failure rate of most electronic components follows the characteristic pattern:

- Early failures are removed during the manufacturing process.
- The operational life is characterized by a constant failure rate.
- The wear out period is characterized by a rapidly increasing failure rate.

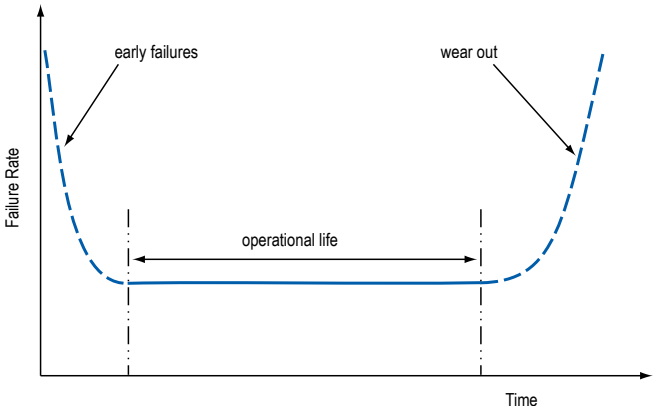
The failures in time (FIT) are given with a 60% confidence level for the various type codes. By convention, FIT is expressed as 1×10^{-9} failures per hour. Failure rate is also expressed as a percentage of failures per 1,000 hours.
e.g., 100 FIT = 1×10^{-7} failures per hour = 0.01%/1,000 hours

End of Life Definition
Catastrophic Failure: short circuit, open circuit or safety vent operation
Parametric Failure:

- Change in capacitance > ±10%
- Leakage current > specified limit
- ESR > 2 x initial ESR value

MTBF

The mean time between failures (MTBF) is simply the inverse of the failure rate.
MTBF= 1/λ



The failure rate is derived from our periodic test results. The failure rate (λ_R) is, therefore, only given at test temperature for life tests. An estimation is also given at 40°C. The expected failure rate for this capacitor range is based on our periodic test results for capacitors with structural similarity. Failure rate is frequently quoted in FIT (Failures In Time) where 1 FIT = 1 x 10^{-9} failures per hour. Failure rate per hour includes both catastrophic and parametric failures.

Environmental Compliance

As an environmentally conscious company, KEMET is working continuously with improvements concerning the environmental effects of both our capacitors and their production. 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, such as lead (Pb), in electronic equipment. All products in this catalog are produced to help our customers' obligations to guarantee their products and 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 such as 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 such as LF = Lead Free or LFW = Lead Free Wires on the label.

Table 1 – Ratings & Part Number Reference

VDC	Rated Capacitance	Size Code	Case Size	Ripple Current Maximum		ESR Maximum		Part Number
	100 Hz 20°C (µF)		D x L (mm)	100 Hz 85°C (A)	20 kHz 40°C (A)	100 Hz 20°C (mΩ)	100 kHz 20°C (mΩ)	
35	3300	AC	22 x 30	2.9	6.4	110	92	PEH506JAC4330M(1)
35	3900	AC	22 x 30	3.1	6.6	96	82	PEH506JAC4390M(1)
35	4700	AD	22 x 35	3.5	7.7	79	67	PEH506JAD4470M(1)
35	4700	BC	25 x 30	3.3	7.0	85	72	PEH506JBC4470M(1)
35	5600	AE	22 x 40	4.0	8.6	67	56	PEH506JAE4560M(1)
35	5600	BC	25 x 30	3.4	7.0	76	66	PEH506JBC4560M(1)
35	6800	AE	22 x 40	4.2	8.9	58	50	PEH506JAE4680M(1)
35	6800	BD	25 x 35	4.0	8.2	62	53	PEH506JBD4680M(1)
35	6800	CC	30 x 30	3.6	7.2	70	62	PEH506JCC4680M(1)
35	8200	AG	22 x 50	5.0	10.6	47	40	PEH506JAG4820M(1)
35	8200	BE	25 x 40	4.5	9.4	52	45	PEH506JBE4820M(1)
35	8200	CC	30 x 30	3.6	6.9	66	59	PEH506JCC4820M(1)
35	10000	BF	25 x 45	5.0	10.4	43	38	PEH506JBF5100M(1)
35	10000	CD	30 x 35	4.2	8.3	53	47	PEH506JCD5100M(1)
35	10000	DC	35 x 30	3.7	7.0	66	61	PEH506JDC5100M(1)
35	12000	BG	25 x 50	5.5	11.3	37	32	PEH506JBG5120M(1)
35	12000	CE	30 x 40	4.8	9.4	44	39	PEH506JCE5120M(1)
35	12000	DC	35 x 30	3.5	6.5	69	65	PEH506JDC5120M(1)
35	15000	CF	30 x 45	5.3	10.4	37	33	PEH506JCF5150M(1)
35	15000	DD	35 x 35	4.1	7.8	55	51	PEH506JDD5150M(1)
35	18000	DE	35 x 40	4.7	8.9	45	42	PEH506JDE5180M(1)
35	22000	DF	35 x 45	5.2	9.8	39	37	PEH506JDF5220M(1)
35	27000	DG	35 x 50	5.7	10.6	35	33	PEH506JDG5270M(1)
63	1200	AB	22 x 25	2.1	5.3	160	110	PEH506MAB4120M(1)
63	1500	AC	22 x 30	2.5	6.4	120	89	PEH506MAC4150M(1)
63	1800	AC	22 x 30	2.6	6.6	110	78	PEH506MAC4180M(1)
63	2200	AD	22 x 35	3.1	7.7	87	63	PEH506MAD4220M(1)
63	2200	BC	25 x 30	2.9	7.0	93	69	PEH506MBC4220M(1)
63	2700	AE	22 x 40	3.5	8.8	72	52	PEH506MAE4270M(1)
63	2700	BD	25 x 35	3.4	8.3	75	56	PEH506MBD4270M(1)
63	3300	AG	22 x 50	4.1	10.4	58	42	PEH506MAG4330M(1)
63	3300	BE	25 x 40	3.9	9.4	62	46	PEH506MBE4330M(1)
63	3300	CC	30 x 30	3.3	7.0	76	60	PEH506MCC4330M(1)
63	3900	BF	25 x 45	4.4	10.4	53	40	PEH506MBF4390M(1)
63	3900	CD	30 x 35	3.8	8.4	62	48	PEH506MCD4390M(1)
63	4700	BG	25 x 50	4.8	11.3	45	34	PEH506MBG4470M(1)
63	4700	CE	30 x 40	4.4	9.6	51	40	PEH506MCE4470M(1)
63	4700	DC	35 x 30	3.4	6.7	74	63	PEH506MDC4470M(1)
63	5600	CE	30 x 40	4.4	9.2	48	39	PEH506MCE4560M(1)
63	5600	DD	35 x 35	4.0	8.1	58	49	PEH506MDD4560M(1)
63	6800	CF	30 x 45	4.9	10.2	41	33	PEH506MCF4680M(1)
63	6800	DE	35 x 40	4.6	9.3	48	40	PEH506MDE4680M(1)
63	8200	DF	35 x 45	5.1	10.3	41	35	PEH506MDF4820M(1)
63	10000	DG	35 x 50	5.5	11.0	37	31	PEH506MDG5100M(1)
100	560	AB	22 x 25	1.5	3.6	370	290	PEH506PAB3560M(1)
100	680	AC	22 x 30	1.7	4.3	300	230	PEH506PAC3680M(1)
100	680	BB	25 x 25	1.7	4.1	310	240	PEH506PBB3680M(1)
100	820	AD	22 x 35	2.0	5.0	250	190	PEH506PAD3820M(1)
100	820	BC	25 x 30	2.0	4.8	260	200	PEH506PBC3820M(1)
100	1000	AE	22 x 40	2.3	5.7	210	160	PEH506PAE4100M(1)
100	1000	BC	25 x 30	2.1	5.1	210	170	PEH506PBC4100M(1)
100	1200	AE	22 x 40	2.5	6.1	170	140	PEH506PAE4120M(1)
100	1200	BD	25 x 35	2.5	6.0	180	140	PEH506PBD4120M(1)
100	1500	AF	22 x 45	2.8	6.9	140	110	PEH506PAF4150M(1)
100	1500	BE	25 x 40	2.9	6.8	140	110	PEH506PBE4150M(1)
100	1800	BF	25 x 45	3.2	7.6	120	95	PEH506PBF4180M(1)
100	1800	CD	30 x 35	3.1	7.0	130	100	PEH506PCD4180M(1)
100	2200	BG	25 x 50	3.6	8.5	100	78	PEH506PBG4220M(1)
100	2200	CE	30 x 40	3.5	8.0	110	84	PEH506PCE4220M(1)
100	2200	DC	35 x 30	2.9	6.2	120	100	PEH506PDC4220M(1)
VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR		Part Number

(1) Termination code: See Termination Tables for available options.

Table 1 – Ratings & Part Number Reference cont'd

VDC	Rated Capacitance	Size Code	Case Size	Ripple Current Maximum		ESR Maximum		Part Number
	100 Hz 20°C (µF)		D x L (mm)	100 Hz 85°C (A)	20 kHz 40°C (A)	100 Hz 20°C (mΩ)	100 kHz 20°C (mΩ)	
100	2700	CF	30 x 45	4.0	8.9	88	70	PEH506PCF4270M(1)
100	2700	DD	35 x 35	3.5	7.3	100	82	PEH506PDD4270M(1)
100	3300	CG	30 x 50	4.4	9.8	73	59	PEH506PCG4330M(1)
100	3300	DE	35 x 40	3.9	8.4	82	68	PEH506PDE4330M(1)
100	3900	DF	35 x 45	4.4	9.3	70	58	PEH506PDF4390M(1)
100	4700	DG	35 x 50	4.9	10.1	60	50	PEH506PDG4470M(1)
200	270	AC	22 x 30	1.2	5.4	510	270	PEH506RAC3270M(1)
200	270	BB	25 x 25	1.2	4.8	520	290	PEH506RBB3270M(1)
200	330	AD	22 x 35	1.4	6.2	420	220	PEH506RAD3330M(1)
200	330	BC	25 x 30	1.4	5.9	420	230	PEH506RBC3330M(1)
200	390	AD	22 x 35	1.5	6.5	360	190	PEH506RAD3390M(1)
200	390	BC	25 x 30	1.5	6.0	360	200	PEH506RBC3390M(1)
200	470	AE	22 x 40	1.7	7.4	300	160	PEH506RAE3470M(1)
200	470	BD	25 x 35	1.7	7.0	300	160	PEH506RBD3470M(1)
200	470	CC	30 x 30	1.7	6.4	310	170	PEH506RCC3470M(1)
200	560	AF	22 x 45	1.9	8.2	250	140	PEH506RAF3560M(1)
200	560	BE	25 x 40	1,9	8.0	250	140	PEH506RBE3560M(1)
200	680	AG	22 x 50	2.1	9.1	210	110	PEH506RAG3680M(1)
200	680	BF	25 x 45	2.2	8.9	210	110	PEH506RBF3680M(1)
200	680	CD	30 x 35	2.1	7.4	220	130	PEH506RCD3680M(1)
200	820	BG	25 x 50	2.5	9.7	170	96	PEH506RBG3820M(1)
200	820	CD	30 x 35	2.3	7.1	190	110	PEH506RCD3820M(1)
200	1000	CE	30 x 40	2.6	8.1	160	92	PEH506RCE4100M(1)
200	1000	DD	35 x 35	2.5	7.2	170	100	PEH506RDD4100M(1)
200	1200	CF	30 x 45	2.9	9.0	130	78	PEH506RCF4120M(1)
200	1200	DE	35 x 40	2.9	8.2	140	85	PEH506RDE4120M(1)
200	1500	DF	35 x 45	3.3	9.0	110	71	PEH506RDF4150M(1)
200	1800	DG	35 x 50	3.6	9.8	97	61	PEH506RDG4180M(1)
200	2200	DH	35 x 55	4.0	10.4	82	53	PEH506RDH4220M(1)
250	220	AC	22 x 30	1.1	5.5	520	260	PEH506SAC3220M(1)
250	220	BB	25 x 25	1.1	4.8	530	270	PEH506SBB3220M(1)
250	270	AD	22 x 35	1.3	6.4	420	210	PEH506SAD3270M(1)
250	270	BC	25 x 30	1.3	5.9	430	210	PEH506SBC3270M(1)
250	330	AE	22 x 40	1.5	7.2	350	170	PEH506SAE3330M(1)
250	330	BC	25 x 30	1.4	6.0	360	180	PEH506SBC3330M(1)
250	330	CB	30 x 25	1.4	4.9	380	200	PEH506SCB3330M(1)
250	390	AF	22 x 45	1.7	8.1	290	140	PEH506SAF3390M(1)
250	390	BD	25 x 35	1.6	7.1	300	150	PEH506SBD3390M(1)
250	470	AG	22 x 50	1.9	8.9	250	120	PEH506SAG3470M(1)
250	470	BE	25 x 40	1.9	8.0	250	130	PEH506SBE3470M(1)
250	470	CC	30 x 30	1.8	6.1	270	140	PEH506SCC3470M(1)
250	560	AG	22 x 50	2.1	9.2	210	110	PEH506SAG3560M(1)
250	560	BF	25 x 45	2.1	8.9	210	110	PEH506SBF3560M(1)
250	680	BG	25 x 50	2.4	9.8	180	90	PEH506SBG3680M(1)
250	680	CE	30 x 40	2.3	8.3	180	98	PEH506SCE3680M(1)
250	680	DC	35 x 30	2.1	5.8	210	120	PEH506SDC3680M(1)
250	820	CF	30 x 45	2.6	9.2	150	83	PEH506SCF3820M(1)
250	820	DD	35 x 35	2.4	7.0	170	99	PEH506SDD3820M(1)
250	1000	CG	30 x 50	3.0	10.0	130	70	PEH506SCG4100M(1)
250	1000	DE	35 x 40	2.8	8.0	140	82	PEH506SDE4100M(1)
250	1200	DF	35 x 45	3.1	8.9	120	70	PEH506SDF4120M(1)
250	1500	DG	35 x 50	3.5	9.5	98	59	PEH506SDG4150M(1)
350	82	AB	22 x 25	0.7	3.0	1600	970	PEH506UAB2820M(1)
350	100	AC	22 x 30	0.8	3.5	1300	800	PEH506UAC3100M(1)
350	150	AD	22 x 35	1.1	4.4	860	540	PEH506UAD3150M(1)
350	150	BC	25 x 30	1.1	4.3	870	550	PEH506UBC3150M(1)
350	180	AE	22 x 40	1.2	4.9	720	450	PEH506UAE3180M(1)
350	220	AF	22 x 45	1.4	5.6	590	370	PEH506UAF3220M(1)
350	220	BD	25 x 35	1.3	5.3	600	380	PEH506UBD3220M(1)
350	220	CC	30 x 30	1.4	5.1	610	390	PEH506UCC3220M(1)
VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR		Part Number

(1) Termination code: See Termination Tables for available options.

Table 1 – Ratings & Part Number Reference cont'd

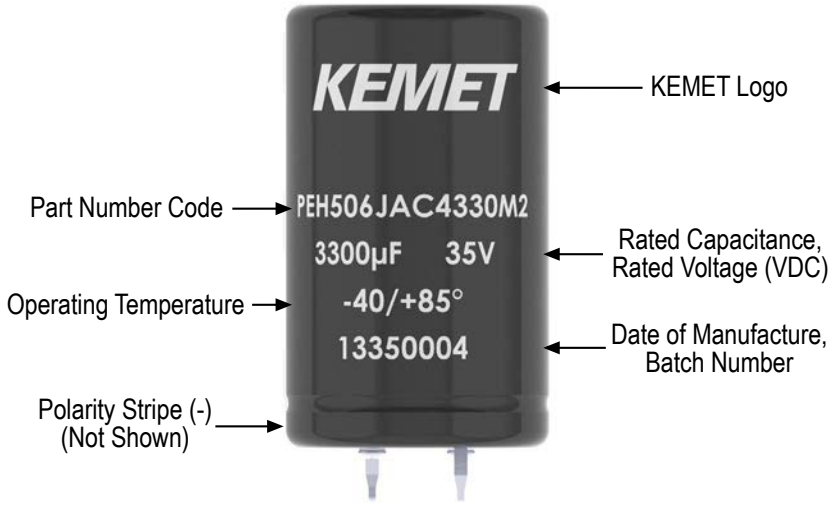
VDC	Rated Capacitance	Size Code	Case Size	Ripple Current Maximum		ESR Maximum		Part Number
	100 Hz 20°C (µF)		D x L (mm)	100 Hz 85°C (A)	20 kHz 40°C (A)	100 Hz 20°C (mΩ)	100 kHz 20°C (mΩ)	
350	270	AG	22 x 50	1.5	6.3	480	310	PEH506UAG3270M(1)
350	270	BE	25 x 40	1.5	6.0	490	310	PEH506UBE3270M(1)
350	330	BG	25 x 50	1.8	7.1	400	250	PEH506UBG3330M(1)
350	330	CE	30 x 40	1.8	6.8	400	260	PEH506UCE3330M(1)
350	330	DC	35 x 30	1.7	5.6	420	280	PEH506UDC3330M(1)
350	390	BG	25 x 50	2.0	7.5	340	220	PEH506UBG3390M(1)
350	390	CE	30 x 40	2.0	7.0	350	220	PEH506UCE3390M(1)
350	470	CF	30 x 45	2.2	7.9	290	190	PEH506UCF3470M(1)
350	470	DD	35 x 35	2.1	6.6	300	200	PEH506UDD3470M(1)
350	560	CG	30 x 50	2.5	8.7	240	160	PEH506UCG3560M(1)
350	560	DE	35 x 40	2.4	7.5	250	170	PEH506UDE3560M(1)
350	680	DF	35 x 45	2.7	8.4	210	140	PEH506UDF3680M(1)
400	82	AC	22 x 30	0.8	3.4	1300	810	PEH506VAC2820M(1)
400	100	AC	22 x 30	0.9	3.7	1100	670	PEH506VAC3100M(1)
400	100	BB	25 x 25	0.9	3.6	1100	680	PEH506VBB3100M(1)
400	120	AD	22 x 35	1.0	4.3	920	560	PEH506VAD3120M(1)
400	120	BC	25 x 30	1.0	4.2	930	570	PEH506VBC3120M(1)
400	120	CB	30 x 25	1.0	4.0	940	580	PEH506VCB3120M(1)
400	150	AE	22 x 40	1.2	4.9	740	450	PEH506VAE3150M(1)
400	150	BD	25 x 35	1.2	4.9	740	450	PEH506VBD3150M(1)
400	150	CB	30 x 25	1.1	4.2	770	480	PEH506VCB3150M(1)
400	180	AF	22 x 45	1.3	5.5	620	380	PEH506VAF3180M(1)
400	180	CC	30 x 30	1.3	5.1	630	390	PEH506VCC3180M(1)
400	220	AG	22 x 50	1.5	6.2	510	310	PEH506VAG3220M(1)
400	220	BE	25 x 40	1.5	6.0	510	320	PEH506VBE3220M(1)
400	220	CD	30 x 35	1.5	5.9	520	320	PEH506VCD3220M(1)
400	220	DB	35 x 25	1.4	4.5	550	350	PEH506VDB3220M(1)
400	270	BF	25 x 45	1.7	6.7	420	260	PEH506VBF3270M(1)
400	270	CD	30 x 35	1.7	6.2	430	270	PEH506VCD3270M(1)
400	330	CE	30 x 40	1.9	7.0	350	220	PEH506VCE3330M(1)
400	330	DD	35 x 35	1.9	6.7	360	230	PEH506VDD3330M(1)
400	390	CG	30 x 50	2.2	8.4	290	180	PEH506VCG3390M(1)
400	390	DE	35 x 40	2.2	7.6	300	190	PEH506VDE3390M(1)
400	470	DF	35 x 45	2.5	8.5	250	160	PEH506VDF3470M(1)
400	560	DG	35 x 50	2.8	9.3	210	140	PEH506VDG3560M(1)
450	68	AC	22 x 30	0.8	3.5	1300	780	PEH506YAC2680M(1)
450	68	BB	25 x 25	0.8	3.4	1300	790	PEH506YBB2680M(1)
450	82	AC	22 x 30	0.9	3.7	1100	670	PEH506YAC2820M(1)
450	82	BB	25 x 25	0.9	3.6	1100	680	PEH506YBB2820M(1)
450	100	AD	22 x 35	1.0	4.4	910	540	PEH506YAD3100M(1)
450	100	BC	25 x 30	1.0	4.3	920	540	PEH506YBC3100M(1)
450	120	AE	22 x 40	1.1	5.0	760	450	PEH506YAE3120M(1)
450	120	BC	25 x 30	1.1	4.5	780	470	PEH506YBC3120M(1)
450	120	CB	30 x 25	1.1	4.2	800	480	PEH506YCB3120M(1)
450	150	AF	22 x 45	1.3	5.6	620	370	PEH506YAF3150M(1)
450	150	BD	25 x 35	1.3	5.3	620	370	PEH506YBD3150M(1)
450	150	CC	30 x 30	1.3	5.1	630	380	PEH506YCC3150M(1)
450	180	AG	22 x 50	1.4	6.2	520	310	PEH506YAG3180M(1)
450	180	BE	25 x 40	1.4	6.0	520	310	PEH506YBE3180M(1)
450	180	CC	30 x 30	1.4	5.3	540	330	PEH506YCC3180M(1)
450	220	BF	25 x 45	1.6	6.8	430	260	PEH506YBF3220M(1)
450	220	CD	30 x 35	1.6	6.2	440	270	PEH506YCD3220M(1)
450	220	DC	35 x 30	1.6	5.6	450	280	PEH506YDC3220M(1)
450	270	CE	30 x 40	1.9	7.1	360	220	PEH506YCE3270M(1)
450	270	DD	35 x 35	1.9	6.7	360	230	PEH506YDD3270M(1)
450	330	CG	30 x 50	2.2	8.5	290	170	PEH506YCG3330M(1)
450	330	DE	35 x 40	2.2	7.6	300	180	PEH506YDE3330M(1)
450	390	DE	35 x 40	2.3	7.4	260	160	PEH506YDE3390M(1)
450	470	DG	35 x 50	2.7	9.3	210	130	PEH506YDG3470M(1)
VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR		Part Number

(1) Termination code: See Termination Tables for available options.

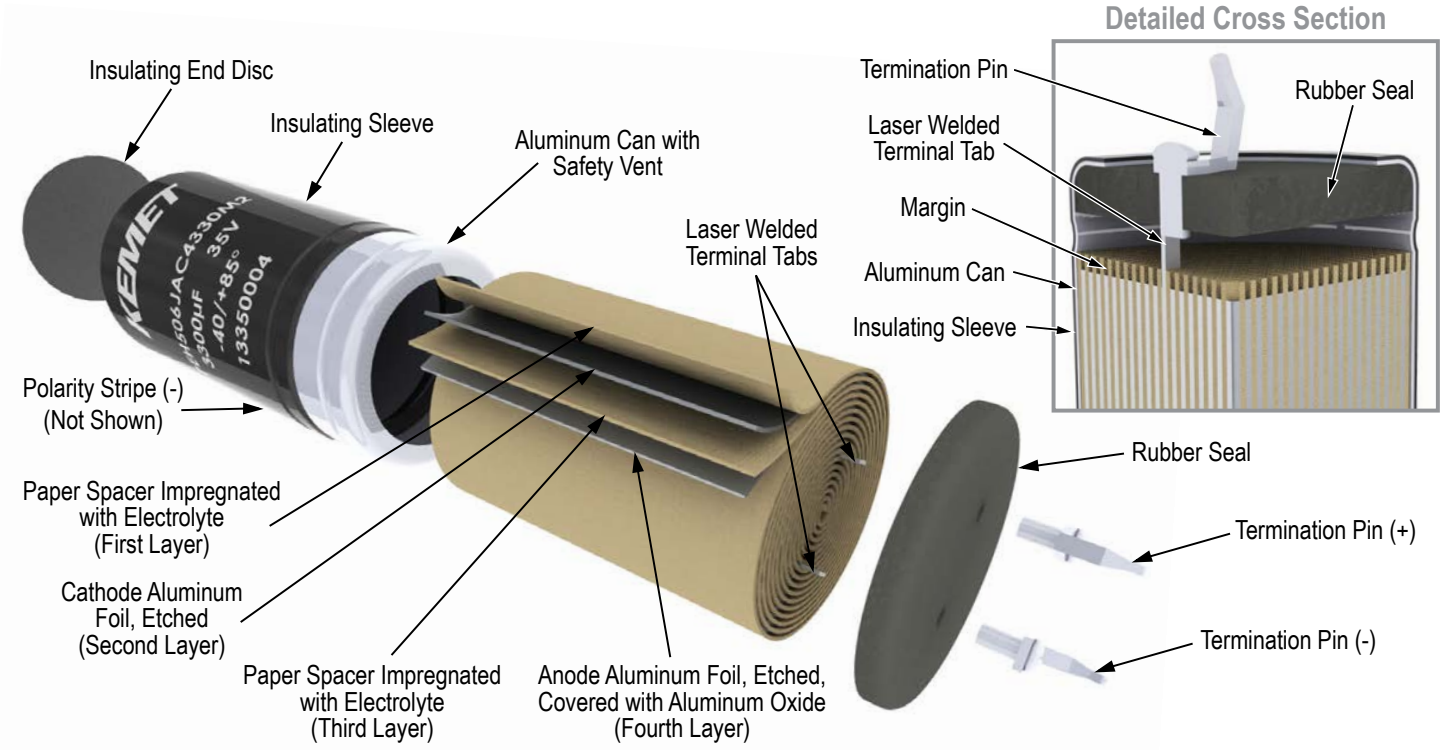
Mechanical Data

The capacitor may be mounted in any position. PEH506 is supplied with an insulation sleeve. Voltage proof of the insulation sleeve = 2.5 kVDC (1 minute). The minus pole is marked on the case surface. UL recognized sleeving is available for custom parts in this range, upon request. (UL No. E358957)

Marking



Construction



ALC10 Series, +85ºC

Overview

KEMET's ALC10 Series of snap-in capacitors covers a wide range of case sizes and voltage ratings. The ALC10 Series is designed for high voltage, up to 550 VDC, high ripple current applications and features surge voltage capability and very long-life performance.

Applications

KEMET's ALC10 Series of capacitors is ideally suited for industrial and commercial applications demanding high reliability and long life expectancy. Typical applications include frequency converters, uninterruptible power supply (UPS) systems and switch mode power supplies (SMPS).

Benefits

- Compact size
- Long life, up to 18,000 hours at +85°C (V_R, I_R applied)
- High ripple current
- High voltage
- Excellent surge voltage capability
- Optimized designs available upon request

Part Number System

ALC10	A	392	BB	040	
Series	Termination	Capacitance Code (µF)	Size Code	Rated Voltage (VDC)	
Snap-In type Aluminum Electrolytic	See Termination Table	First two digits represent significant figures. Third digit specifies number of zeros.	See Dimension Table	035 = 35 040 = 40 063 = 63 100 = 100 200 = 200 250 = 250	350 = 350 400 = 400 450 = 450 500 = 500 550 = 550

Performance Characteristics

Item	Performance Characteristics		
Capacitance Range	56 – 82,000 µF		
Rated Voltage	35 – 550 VDC		
Operating Temperature	-40 to +85°C		
Capacitance Tolerance	±20% at 100 Hz / +20°C		
Operational Lifetime	D (mm)	Rated Voltage and Ripple Current at +85°C (hours)	Rated Voltage at +85°C (hours)
	25	10,000	16,000
	30	13,000	21,000
	35	15,000	24,000
	40 – 50	18,000	29,000
End of Life Requirement	Δ C/C < ±10%, ESR < 2 x initial ESR value, IL < initial specified limit		
Shelf Life	2,000 hours at +85°C or 30,000 hours at +40°C 0 VDC		
Leakage Current	I = 0.006 CV or 6,000 (µA, whichever is smaller)		
	C = rated capacitance (µF), V = rated voltage (VDC). Voltage applied for 5 minutes at +20°C.		
Vibration Test Specifications		Procedure	Requirements
	D ≤ 40 mm	0.75 mm displacement amplitude or 10 g maximum acceleration. Vibration applied for three 2-hour sessions at 10 – 500 Hz (Capacitor clamped by body).	No leakage of electrolyte or other visible damage. Deviations in capacitance and tanδ from initial measurements must not exceed: Δ C/C < 5%
	D > 40 mm	0.35 mm displacement amplitude or 5 g maximum acceleration. Vibration applied for three 0.5-hour sessions at 10 – 55 Hz (Capacitor clamped by body).	
Standards	IEC 60384–4 long life grade 40/85/56		

Surge Voltage

Condition	Voltage (VDC)										
	35	40	63	100	200	250	350	400	450	500	550
≤ 30s Surge followed by a no load period of 330s, 1,000 cycles at +85°C	40.25	46	72.5	115	230	288	385	440	495	550	605
≤ 500 ms surge, 100 cycles at 20°C, occurring randomly throughout the life of the capacitor					350	400	500	520	550	600	620

Test Method & Performance

Endurance Life Test		
Conditions	Performance	
Temperature	+85°C	
Test Duration	2,000 hours	
Ripple Current	Rated ripple current in specified table	
Voltage	The sum of DC voltage and the peak AC voltage must not exceed the rated voltage of the capacitor	
Performance	**The following specifications will be satisfied when the capacitor is tested at +20°C:**	
Capacitance Change	≤ 160 V	Within 15% of the initial value
	≥ 160 V	Within 10% of the initial value
Equivalent Series Resistance	Does not exceed 200% of the initial value	
Leakage Current	Does not exceed leakage current limit	

Dimensions – Millimeters

Size Code	Dimensions in mm		Approximate Weight Grams
	D	L	
	-0/+1	±2	
BB	25	30	28
BC	25	35	30
BD	25	40	35
CB	30	30	35
CC	30	35	40
CD	30	40	45
CE	30	45	50
CF	30	50	55
DB	35	30	42
DC	35	35	50
DD	35	40	55
DE	35	45	65
DF	35	50	70
DG	35	55	75
DH	35	60	80
DL	35	80	105
EB	40	30	49
EC	40	35	57
ED	40	40	65
EE	40	45	80
EF	40	50	82
EG	40	55	95
Note: Dimensions include sleeving			

Size Code	Dimensions in mm		Approximate Weight Grams
	D	L	
	-0/+1	±2	
EH	40	60	98
EJ	40	70	113
EL	40	80	131
EP	40	105	170
FB	45	30	62
FC	45	35	72
FD	45	40	82
FE	45	45	92
FF	45	50	103
FG	45	55	113
FH	45	60	123
FL	45	80	164
FP	45	105	215
KB	50	30	75
KC	50	35	88
KD	50	40	100
KE	50	45	113
KF	50	50	126
KG	50	55	138
KH	50	60	151
KL	50	80	201
KP	50	105	264
Note: Dimensions include sleeving			

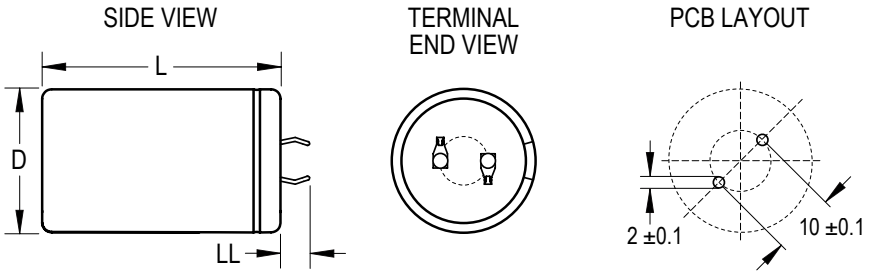
Termination Tables

Termination Code / Diameter (mm)	A	D	F	C	E	G	H
25	•	•	•				
30	•	•	•				
35	•	•	•	•	•		
40	•	•	•	•	•	•	•
45				•	•	•	•
50				•	•	•	•
Mounting: These capacitors are designed to be mounted by their terminations alone and may be used in any position. Dummy pins must be isolated on 4 and 5 pin styles.							

Termination Code	Termination Style	LL ±1
Standard Termination Option		
A	2 Pin	6.3
G (D ≥ 45)	5 Pin	6.3
Other Termination Options		
D	2 Pin	4
F	3 Pin	4
C	4 Pin	6.3
E	4 Pin	4
H	5 Pin	4
Dimensions in mm		

Termination Tables cont'd

Style A/D



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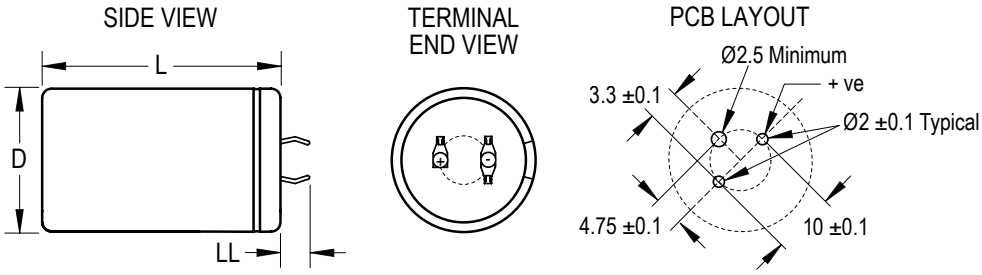

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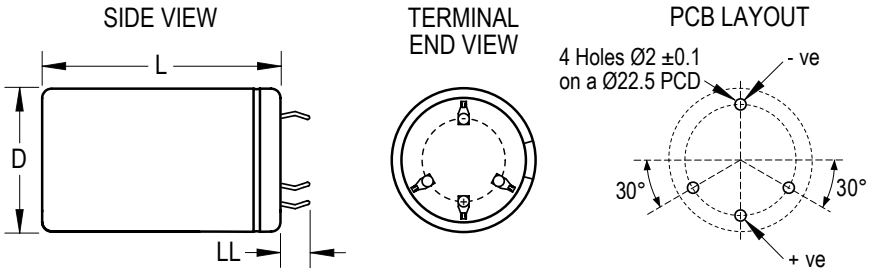
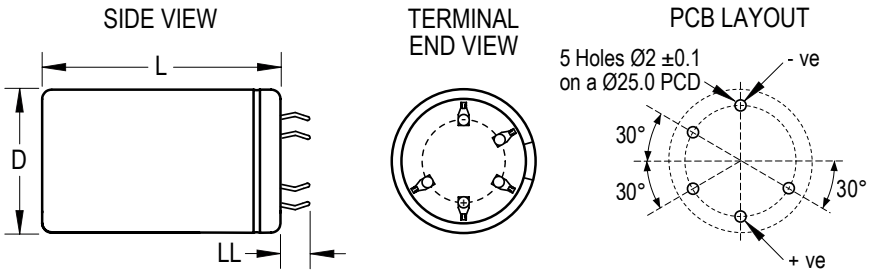


Style G/H



Shelf Life

The capacitance, ESR and impedance of a capacitor will not change significantly after extended storage periods, however the leakage current will very slowly increase. KEMET products are particularly stable and allow a shelf life in excess of three years at 40°C. See sectional specification under each product series for specific data.

Re-age (Reforming) Procedure

Apply the rated voltage to the capacitor at room temperature for a period of one hour, or until the leakage current has fallen to a steady value below the specified limit. During re-aging a maximum charging current of twice the specified leakage current or 5 mA (whichever is greater) is suggested.

Reliability

The reliability of a component can be defined as the probability that it will perform satisfactorily under a given set of conditions for a given length of time.

In practice, it is impossible to predict with absolute certainty how any individual component will perform; thus, we must utilize probability theory. It is also necessary to clearly define the level of stress involved (e.g. operating voltage, ripple current, temperature and time). Finally, the meaning of satisfactory performance must be defined by specifying a set of conditions which determine the end of life of the component.

Reliability as a function of time, R(t), is normally expressed as: $R(t)=e^{-\lambda t}$
where R(t) is the probability that the component will perform satisfactorily for time t, and λ is the failure rate.

Failure Rate

The failure rate is the number of components failing per unit time. The failure rate of most electronic components follows the characteristic pattern:

- Early failures are removed during the manufacturing process.
- The operational life is characterized by a constant failure rate.
- The wear out period is characterized by a rapidly increasing failure rate.

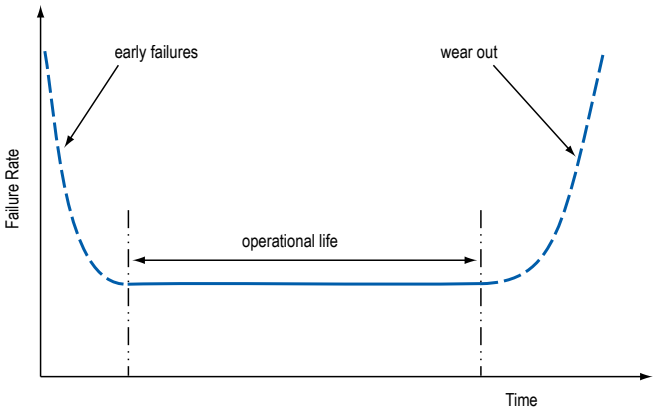
The failures in time (FIT) are given with a 60% confidence level for the various type codes. By convention, FIT is expressed as 1×10^{-9} failures per hour. Failure rate is also expressed as a percentage of failures per 1,000 hours.
e.g., 100 FIT = 1×10^{-7} failures per hour = 0.01%/1,000 hours

End of Life Definition
Catastrophic Failure: short circuit, open circuit or safety vent operation
Parametric Failure:

- Change in capacitance > ±10%
- Leakage current > specified limit
- ESR > 2 x initial ESR value

MTBF

The mean time between failures (MTBF) is simply the inverse of the failure rate.
MTBF= 1/λ



The failure rate is derived from our periodic test results. The failure rate (λ_R) is, therefore, only given at test temperature for life tests. An estimation is also given at 40°C. The expected failure rate for this capacitor range is based on our periodic test results for capacitors with structural similarity. Failure rate is frequently quoted in FIT (Failures In Time) where 1 FIT = 1 x 10^{-9} failures per hour. Failure rate per hour includes both catastrophic and parametric failures.

T_a	**Failure Rate per Hour**
85°C	250 FIT
40°C	12 FIT

Environmental Compliance

As an environmentally conscious company, KEMET is working continuously with improvements concerning the environmental effects of both our capacitors and their production. 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, such as lead (Pb), in electronic equipment. All products in this catalog are produced to help our customers' obligations to guarantee their products and 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 such as 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 such as LF = Lead Free or LFW = Lead Free Wires on the label.

Table 1 – Ratings & Part Number Reference

VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR Maximum	Impedance Maximum	Part Number
	100 Hz 20°C (µF)		D x L (mm)	100 Hz 85°C (A)	10 kHz 85°C (A)	100 Hz 20°C (mΩ)	10 kHz 20°C (mΩ)	
35	33000	EF	40 x 50	7.16	10.03	42	38	ALC10(1)333EF035
35	56000	EL	40 x 80	11.68	12.92	23	21	ALC10(1)563EL035
40	3900	BB	25 x 30	2.33	2.53	125	103	ALC10(1)392BB040
40	4700	BC	25 x 35	2.77	3.01	99	81	ALC10(1)472BC040
40	5600	CB	30 x 30	2.74	2.98	115	94	ALC10(1)562CB040
40	5600	BD	25 x 40	3.14	3.42	85	70	ALC10(1)562BD040
40	6800	CC	30 x 35	3.26	3.55	90	74	ALC10(1)682CC040
40	8200	CD	30 x 40	3.70	4.03	77	63	ALC10(1)822CD040
40	10000	DC	35 x 35	3.69	4.01	86	71	ALC10(1)103DC040
40	12000	CF	30 x 50	4.59	4.99	59	48	ALC10(1)123CF040
40	12000	DD	35 x 40	4.14	4.50	75	62	ALC10(1)123DD040
40	15000	EB	40 x 30	4.42	4.51	89	79	ALC10(1)153EB040
40	18000	DF	35 x 50	5.23	5.69	55	45	ALC10(1)183DF040
40	18000	EC	40 x 35	4.88	4.97	78	70	ALC10(1)183EC040
40	22000	ED	40 x 40	5.81	5.92	62	56	ALC10(1)223ED040
40	27000	EF	40 x 50	7.23	7.36	43	38	ALC10(1)273EF040
40	33000	EH	40 x 60	8.74	8.91	33	30	ALC10(1)333EH040
40	47000	EL	40 x 80	10.96	11.17	23	21	ALC10(1)473EL040
40	82000	EP	40 x 105	12.63	13.44	18	17	ALC10(1)823EP040
63	2200	BB	25 x 30	2.13	2.37	149	118	ALC10(1)222BB063
63	2700	BC	25 x 35	2.43	2.70	128	101	ALC10(1)272BC063
63	3300	CB	30 x 30	2.77	3.08	112	88	ALC10(1)332CB063
63	3300	BD	25 x 40	2.73	3.04	112	88	ALC10(1)332BD063
63	4700	CC	30 x 35	3.24	3.61	91	72	ALC10(1)472CC063
63	5600	CD	30 x 40	3.56	3.96	83	66	ALC10(1)562CD063
63	6800	DC	35 x 35	3.95	4.40	75	59	ALC10(1)682DC063
63	6800	CF	30 x 50	4.07	4.53	75	59	ALC10(1)682CF063
63	8200	DD	35 x 40	4.31	4.80	69	55	ALC10(1)822DD063
63	8200	EB	40 x 30	3.95	4.03	82	72	ALC10(1)822EB063
63	10000	DF	35 x 50	4.85	5.40	64	51	ALC10(1)103DF063
63	10000	EC	40 x 35	4.58	4.67	80	72	ALC10(1)103EC063
63	12000	ED	40 x 40	5.42	5.55	64	57	ALC10(1)123ED063
63	15000	EF	40 x 50	7.02	7.18	44	39	ALC10(1)153EF063
63	18000	EH	40 x 60	8.54	8.75	35	31	ALC10(1)183EH063
63	27000	EL	40 x 80	10.53	10.78	24	21	ALC10(1)273EL063
63	39000	EP	40 x 105	12.23	13.51	19	17	ALC10(1)393EP063
100	1000	BB	25 x 30	1.67	2.04	243	182	ALC10(1)102BB100
100	1200	BC	25 x 35	1.93	2.36	203	152	ALC10(1)122BC100
100	1500	CB	30 x 30	2.30	2.81	163	122	ALC10(1)152CB100
100	1500	BD	25 x 40	2.27	2.78	163	122	ALC10(1)152BD100
100	1800	CC	30 x 35	2.64	3.23	137	103	ALC10(1)182CC100
100	2200	CD	30 x 40	3.05	3.73	113	85	ALC10(1)222CD100
100	2700	DC	35 x 35	3.57	4.37	92	69	ALC10(1)272DC100
100	2700	EB	40 x 30	3.72	3.88	121	104	ALC10(1)272EB100
100	3300	CF	30 x 50	4.05	4.95	76	57	ALC10(1)332CF100
100	3300	DD	35 x 40	4.11	5.03	76	57	ALC10(1)332DD100
100	3300	EC	40 x 35	4.09	4.24	106	92	ALC10(1)332EC100
100	3900	ED	40 x 40	4.88	5.08	85	74	ALC10(1)392ED100
100	4700	DF	35 x 50	5.23	6.40	55	41	ALC10(1)472DF100
100	4700	EE	40 x 45	5.60	5.83	70	61	ALC10(1)472EE100
100	5600	EF	40 x 50	6.41	6.68	59	51	ALC10(1)562EF100
100	6800	EG	40 x 55	6.61	6.84	53	46	ALC10(1)682EG100
100	8200	EH	40 x 60	7.36	7.61	44	39	ALC10(1)822EH100
100	12000	EL	40 x 80	9.14	9.45	31	27	ALC10(1)123EL100
100	18000	EP	40 x 105	11.34	12.61	19	17	ALC10(1)183EP100
200	330	BB	25 x 30	1.18	1.63	486	340	ALC10(1)331BB200
200	390	BC	25 x 35	1.36	1.87	412	288	ALC10(1)391BC200
200	470	CB	30 x 30	1.58	2.18	343	240	ALC10(1)471CB200
200	470	BD	25 x 40	1.56	2.15	343	240	ALC10(1)471BD200
200	560	CC	30 x 35	1.82	2.51	288	202	ALC10(1)561CC200
VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR	Impedance	Part Number

(1) Termination code: See Termination Tables for available options.

Table 1 – Ratings & Part Number Reference cont'd

VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR Maximum	Impedance Maximum	Part Number
	100 Hz 20°C (µF)		D x L (mm)	100 Hz 85°C (A)	10 kHz 85°C (A)	100 Hz 20°C (mΩ)	10 kHz 20°C (mΩ)	
200	680	CD	30 x 40	2.10	2.89	238	167	ALC10(1)681CD200
200	820	DC	35 x 35	2.43	3.35	198	139	ALC10(1)821DC200
200	820	EB	40 x 30	3.06	3.63	178	142	ALC10(1)821EB200
200	1000	CF	30 x 50	2.76	3.80	163	114	ALC10(1)102CF200
200	1000	DD	35 x 40	2.81	3.87	163	114	ALC10(1)102DD200
200	1000	EC	40 x 35	3.43	3.99	153	124	ALC10(1)102EC200
200	1200	DF	35 x 50	3.06	4.01	135	82	ALC10(1)122DF200
200	1200	ED	40 x 40	4.02	4.69	124	99	ALC10(1)122ED200
200	1500	DF	35 x 50	3.70	5.10	110	77	ALC10(1)152DF200
200	1500	EE	40 x 45	4.61	5.38	101	81	ALC10(1)152EE200
200	1800	EF	40 x 50	5.27	6.15	84	68	ALC10(1)182EF200
200	2200	EH	40 x 60	6.29	7.43	67	53	ALC10(1)222EH200
200	3300	EL	40 x 80	7.83	9.17	46	37	ALC10(1)332EL200
200	4700	EP	40 x 105	8.08	11.73	45	32	ALC10(1)472EP200
200	5600	FP	45 x 105	8.51	12.16	42	29	ALC10(1)562FP200
200	8200	KP	50 x 105	9.17	11.76	33	25	ALC10(1)822KP200
250	220	BB	25 x 30	0.97	1.41	727	473	ALC10(1)221BB250
250	270	BC	25 x 35	1.13	1.65	593	385	ALC10(1)271BC250
250	330	CB	30 x 30	1.33	1.94	486	316	ALC10(1)331CB250
250	330	BC	25 x 35	1.34	1.95	490	320	ALC10(1)331BC250
250	330	BD	25 x 40	1.31	1.91	486	316	ALC10(1)331BD250
250	470	CC	30 x 35	1.67	2.43	343	223	ALC10(1)471CC250
250	560	CD	30 x 40	1.91	2.78	288	187	ALC10(1)561CD250
250	680	DC	35 x 35	2.22	3.23	238	155	ALC10(1)681DC250
250	680	CF	30 x 50	2.29	3.34	238	155	ALC10(1)681CF250
250	680	EB	40 x 30	2.79	3.56	187	144	ALC10(1)681EB250
250	820	DD	35 x 40	2.55	3.72	198	129	ALC10(1)821DD250
250	820	ED	40 x 40	3.80	4.91	153	116	ALC10(1)821ED250
250	1000	DF	35 x 50	3.26	4.75	163	106	ALC10(1)102DF250
250	1000	EE	40 x 45	4.33	5.58	126	96	ALC10(1)102EE250
250	1200	DH	35 x 60	3.76	5.48	140	100	ALC10(1)122DH250
250	1200	EF	40 x 50	4.94	6.37	104	80	ALC10(1)122EF250
250	1500	EG	40 x 55	5.29	6.58	89	69	ALC10(1)152EG250
250	1800	DL	35 x 80	4.60	6.69	100	82	ALC10(1)182DL250
250	1800	EH	40 x 60	5.92	7.34	74	58	ALC10(1)182EH250
250	2200	EL	40 x 80	7.33	9.49	57	43	ALC10(1)222EL250
250	3900	EP	40 x 105	7.78	11.71	46	32	ALC10(1)392EP250
250	4700	FP	45 x 105	8.22	12.11	42	29	ALC10(1)472FP250
250	5600	KP	50 x 105	8.63	12.03	38	27	ALC10(1)562KP250
350	120	BB	25 x 30	0.83	1.75	1139	736	ALC10(1)121BB350
350	150	BC	25 x 35	0.99	2.07	912	589	ALC10(1)151BC350
350	180	BD	25 x 40	1.13	2.37	761	492	ALC10(1)181BD350
350	180	CB	30 x 30	1.11	2.19	776	506	ALC10(1)181CB350
350	270	CC	30 x 35	1.41	2.65	527	346	ALC10(1)271CC350
350	330	CD	30 x 40	1.65	3.07	432	284	ALC10(1)331CD350
350	330	EB	40 x 30	2.02	3.97	424	277	ALC10(1)331EB350
350	390	CF	30 x 50	1.92	3.65	364	238	ALC10(1)391CF350
350	390	DC	35 x 35	1.82	3.07	386	259	ALC10(1)391DC350
350	390	EC	40 x 35	2.33	4.50	361	236	ALC10(1)391EC350
350	470	DD	35 x 40	2.07	3.47	321	216	ALC10(1)471DD350
350	470	ED	40 x 40	2.69	5.22	299	195	ALC10(1)471ED350
350	560	DF	35 x 50	2.80	4.80	268	180	ALC10(1)561DF350
350	560	EE	40 x 45	3.04	5.88	251	164	ALC10(1)561EE350
350	680	EF	40 x 50	3.46	6.65	207	136	ALC10(1)681EF350
350	820	DH	35 x 60	3.40	5.50	190	130	ALC10(1)821DH350
350	820	EG	40 x 55	3.84	7.16	174	114	ALC10(1)821EG350
350	820	EH	40 x 60	3.99	7.67	172	112	ALC10(1)821EH350
350	1000	DL	35 x 80	3.90	6.40	154	104	ALC10(1)102DL350
350	1200	EL	40 x 80	4.95	9.20	119	78	ALC10(1)122EL350
350	1800	EP	40 x 105	6.14	10.73	81	54	ALC10(1)182EP350
VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR	Impedance	Part Number

(1) Termination code: See Termination Tables for available options.

Table 1 – Ratings & Part Number Reference cont'd

VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR Maximum	Impedance Maximum	Part Number
	100 Hz 20°C (µF)		D x L (mm)	100 Hz 85°C (A)	10 kHz 85°C (A)	100 Hz 20°C (mΩ)	10 kHz 20°C (mΩ)	
350	2700	FP	45 x 105	7.00	11.44	63	42	ALC10(1)272FP350
350	3300	KP	50 x 105	7.54	11.57	54	36	ALC10(1)332KP350
400	100	BB	25 x 30	0.77	1.60	1400	943	ALC10(1)101BB400
400	120	BC	25 x 35	0.90	1.87	1166	785	ALC10(1)121BC400
400	150	CB	30 x 30	1.04	2.03	950	645	ALC10(1)151CB400
400	150	BD	25 x 40	1.06	2.18	935	630	ALC10(1)151BD400
400	180	CC	30 x 35	1.20	2.36	791	536	ALC10(1)181CC400
400	220	CC	30 x 35	1.31	2.47	650	400	ALC10(1)221CC400
400	220	CD	30 x 40	1.41	2.74	648	440	ALC10(1)221CD400
400	270	DC	35 x 35	1.61	2.88	547	376	ALC10(1)271DC400
400	270	EB	40 x 30	1.85	3.67	441	284	ALC10(1)271EB400
400	330	DC	35 x 35	1.73	2.92	461	320	ALC10(1)331DC400
400	330	CF	30 x 50	1.82	3.42	438	299	ALC10(1)331CF400
400	330	DD	35 x 40	1.84	3.27	449	309	ALC10(1)331DD400
400	330	EC	40 x 35	2.29	4.21	378	252	ALC10(1)331EC400
400	390	DF	35 x 50	2.19	3.96	377	226	ALC10(1)391DF400
400	390	ED	40 x 40	2.62	4.86	312	203	ALC10(1)391ED400
400	470	DE	35 x 45	2.40	4.10	360	246	ALC10(1)471DE400
400	470	DF	35 x 50	2.62	4.41	321	223	ALC10(1)471DF400
400	470	ED	40 x 40	2.74	5.21	230	156	ALC10(1)471ED400
400	470	EE	40 x 45	3.00	5.49	258	168	ALC10(1)471EE400
400	560	DF	35 x 50	2.57	4.04	278	180	ALC10(1)561DF400
400	560	DH	35 x 60	3.01	5.11	264	184	ALC10(1)561DH400
400	560	EF	40 x 50	3.41	6.19	216	141	ALC10(1)561EF400
400	680	DH	35 x 60	2.90	4.73	232	142	ALC10(1)681DH400
400	680	EH	40 x 60	3.99	7.14	177	114	ALC10(1)681EH400
400	820	DL	35 x 80	3.70	6.09	181	127	ALC10(1)821DL400
400	1000	DL	35 x 80	3.98	6.32	112	77	ALC10(1)102DL400
400	1000	EL	40 x 80	5.00	8.82	120	78	ALC10(1)102EL400
400	1500	EP	40 x 105	5.79	10.16	99	68	ALC10(1)152EP400
400	2200	FP	45 x 105	6.56	10.90	77	53	ALC10(1)222FP400
400	2700	KP	50 x 105	7.11	11.13	66	45	ALC10(1)272KP400
450	68	BB	25 x 30	0.69	1.50	1708	1135	ALC10(1)680BB450
450	100	BC	25 x 35	0.88	1.90	1167	777	ALC10(1)101BC450
450	120	CB	30 x 30	1.00	2.03	989	663	ALC10(1)121CB450
450	120	BD	25 x 40	1.01	2.18	973	648	ALC10(1)121BD450
450	150	BD	25 x 40	1.12	2.35	785	524	ALC10(1)151BD450
450	150	CB	30 x 30	1.10	2.12	805	543	ALC10(1)151CB450
450	150	CC	30 x 35	1.17	2.38	792	531	ALC10(1)151CC450
450	180	CD	30 x 40	1.36	2.76	661	443	ALC10(1)181CD450
450	220	DC	35 x 35	1.56	2.89	559	379	ALC10(1)221DC450
450	220	CF	30 x 50	1.61	3.27	540	362	ALC10(1)221CF450
450	220	EB	40 x 30	1.77	3.68	517	311	ALC10(1)221EB450
450	270	CF	30 x 50	1.76	3.43	446	301	ALC10(1)271CF450
450	270	DC	35 x 35	1.68	2.91	470	322	ALC10(1)271DC450
450	270	DD	35 x 40	1.78	3.27	458	311	ALC10(1)271DD450
450	270	EC	40 x 35	2.07	4.22	427	259	ALC10(1)271EC450
450	330	CF	30 x 50	1.91	3.54	373	253	ALC10(1)331CF450
450	330	DD	35 x 40	2.20	3.68	364	242	ALC10(1)331DD450
450	330	DF	35 x 50	2.41	4.38	373	253	ALC10(1)331DF450
450	330	ED	40 x 40	2.47	4.91	348	210	ALC10(1)331ED450
450	390	DF	35 x 50	2.60	4.41	240	166	ALC10(1)391DF450
450	390	EE	40 x 45	2.70	5.53	293	177	ALC10(1)391EE450
450	470	DF	35 x 50	2.43	4.03	252	155	ALC10(1)471DF450
450	470	DH	35 x 60	2.95	5.12	270	185	ALC10(1)471DH450
450	470	EF	40 x 50	3.08	6.25	243	147	ALC10(1)471EF450
450	560	DF	35 x 50	2.70	4.74	266	172	ALC10(1)561DF450
450	560	EH	40 x 60	3.56	7.04	202	121	ALC10(1)561EH450
450	680	DL	35 x 80	3.61	6.09	190	131	ALC10(1)681DL450
450	820	EL	40 x 80	4.47	8.78	138	83	ALC10(1)821EL450
VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR	Impedance	Part Number

(1) Termination code: See Termination Tables for available options.

Table 1 – Ratings & Part Number Reference cont'd

VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR Maximum	Impedance Maximum	Part Number
	100 Hz 20°C (µF)		D x L (mm)	100 Hz 85°C (A)	10 kHz 85°C (A)	100 Hz 20°C (mΩ)	10 kHz 20°C (mΩ)	
450	1000	EL	40 x 80	4.95	9.32	114	75	ALC10(1)102EL450
450	1000	EJ	40 X 70	4.42	8.42	142	93	ALC10(1)102EJ450
450	1200	EP	40 x 105	5.57	10.15	103	70	ALC10(1)122EP450
450	1800	FP	45 x 105	6.27	10.87	82	55	ALC10(1)182FP450
450	2200	KP	50 x 105	6.81	11.12	70	47	ALC10(1)222KP450
500	56	BB	25 x 30	0.74	1.44	2365	1642	ALC10(1)560BB500
500	68	BC	25 x 35	0.87	1.70	1816	1351	ALC10(1)680BC500
500	82	BD	25 x 40	1.00	1.95	1507	1120	ALC10(1)820BD500
500	82	CB	30 x 30	0.99	1.84	1527	1140	ALC10(1)820CB500
500	100	CB	30 x 30	1.08	1.94	1000	765	ALC10(1)101CB500
500	100	CC	30 x 35	1.15	2.16	1220	840	ALC10(1)101CC500
500	120	CC	30 x 35	1.25	2.28	1052	786	ALC10(1)121CC500
500	150	CD	30 x 40	1.48	2.67	895	631	ALC10(1)151CD500
500	180	CF	30 x 50	1.78	3.27	699	522	ALC10(1)181CF500
500	180	DC	35 x 35	1.70	2.84	728	549	ALC10(1)181DC500
500	180	EB	40 x 30	1.76	3.22	699	522	ALC10(1)181EB500
500	220	DD	35 x 40	1.96	3.26	622	450	ALC10(1)221DD500
500	220	EC	40 x 35	2.07	3.82	571	426	ALC10(1)221EC500
500	270	DF	35 x 50	2.34	3.97	505	362	ALC10(1)271DF500
500	270	ED	40 x 40	2.41	4.42	466	348	ALC10(1)271ED500
500	330	DF	35 x 50	2.14	3.75	492	366	ALC10(1)331DF500
500	330	EE	40 x 45	2.74	5.00	405	286	ALC10(1)331EE500
500	390	DH	35 x 60	2.87	4.67	355	258	ALC10(1)391DH500
500	390	EF	40 x 50	3.09	5.59	345	242	ALC10(1)391EF500
500	470	EH	40 x 60	3.56	6.43	285	201	ALC10(1)471EH500
500	560	DL	35 x 80	3.50	5.57	250	182	ALC10(1)561DL500
500	680	DL	35 x 80	3.65	6.45	244	178	ALC10(1)681DL500
500	680	EL	40 x 80	4.40	7.77	200	140	ALC10(1)681EL500
500	1000	EP	40 x 105	5.43	9.18	140	98	ALC10(1)102EP500
500	1500	FP	45 x 105	5.97	9.76	110	82	ALC10(1)152FP500
500	1800	KP	50 x 105	6.45	10.09	94	70	ALC10(1)182KP500
550	56	BB	25 X 30	0.68	1.13	6118	5330	ALC10(1)560BB550
550	68	BC	25 X 35	0.77	1.29	5038	4388	ALC10(1)680BC550
550	82	BD	25 X 40	0.87	1.46	4178	3640	ALC10(1)820BD550
550	82	CB	30 X 30	0.91	1.49	4196	3656	ALC10(1)820CB550
550	120	CC	30 X 35	1.14	1.86	2874	2506	ALC10(1)121CC550
550	150	CD	30 X 40	1.32	2.14	2302	2008	ALC10(1)151CD550
550	180	CF	30 X 50	1.52	2.47	1914	1670	ALC10(1)181CF550
550	180	DC	35 X 35	1.50	2.34	1940	1694	ALC10(1)181DC550
550	220	DD	35 X 40	1.72	2.67	1588	1388	ALC10(1)221DD550
550	270	DF	35 X 50	2.01	3.15	1290	1126	ALC10(1)271DF550
550	330	DH	35 X 60	2.30	3.60	1058	924	ALC10(1)331DH550
550	470	DL	35 X 80	2.87	4.43	746	650	ALC10(1)471DL550
550	180	EB	40 X 30	1.60	2.62	1936	1688	ALC10(1)181EB550
550	220	EC	40 X 35	1.84	3.01	1584	1380	ALC10(1)221EC550
550	270	ED	40 X 40	2.11	3.44	1290	1124	ALC10(1)271ED550
550	330	EE	40 X 45	2.40	3.90	1056	920	ALC10(1)331EE550
550	390	EF	40 X 50	2.67	4.33	894	780	ALC10(1)391EF550
550	470	EH	40 X 60	3.05	4.93	742	648	ALC10(1)471EH550
550	680	EL	40 X 80	3.87	6.18	514	450	ALC10(1)681EL550
550	1000	EP	40 X 105	4.86	7.59	352	308	ALC10(1)102EP550
550	1200	FP	45 X 105	5.60	8.59	296	258	ALC10(1)122FP550
550	1500	KP	50 X 105	6.50	9.63	242	212	ALC10(1)152KP550
550	1500	KP	50 X 105	6.50	9.63	242	212	ALC10(1)152KP550
VDC	**Rated Capacitance**	**Size Code**	**Case Size**	**Ripple Current**		**ESR**	**Impedance**	**Part Number**

(1) Termination code: See Termination Tables for available options.

Mechanical Data

Polarity and Reversed Voltage
Aluminium Electrolytic capacitors manufactured for use in DC applications contain an anode foil and a cathode foil. As such, they are polarized devices and must be connected with the +ve to the anode foil and the -ve to the cathode foil. If this were to be reversed then the electrolytic process that took place in forming the oxide layer on the anode would be recreated in trying to form an oxide layer on the cathode. In forming the cathode foil in this way, heat would be generated and gas given off within the capacitor, usually leading to catastrophic failure.

The cathode foil already possesses a thin stabilized oxide layer. This thin oxide layer is equivalent to a forming voltage of approximately 2 V. As a result, the capacitor can withstand a voltage reversal of up to 2 V for short periods. Above this voltage, the formation process will commence. Aluminium Electrolytic capacitors can also be manufactured for use in intermittent AC applications by using two anode foils in place of one anode and one cathode.

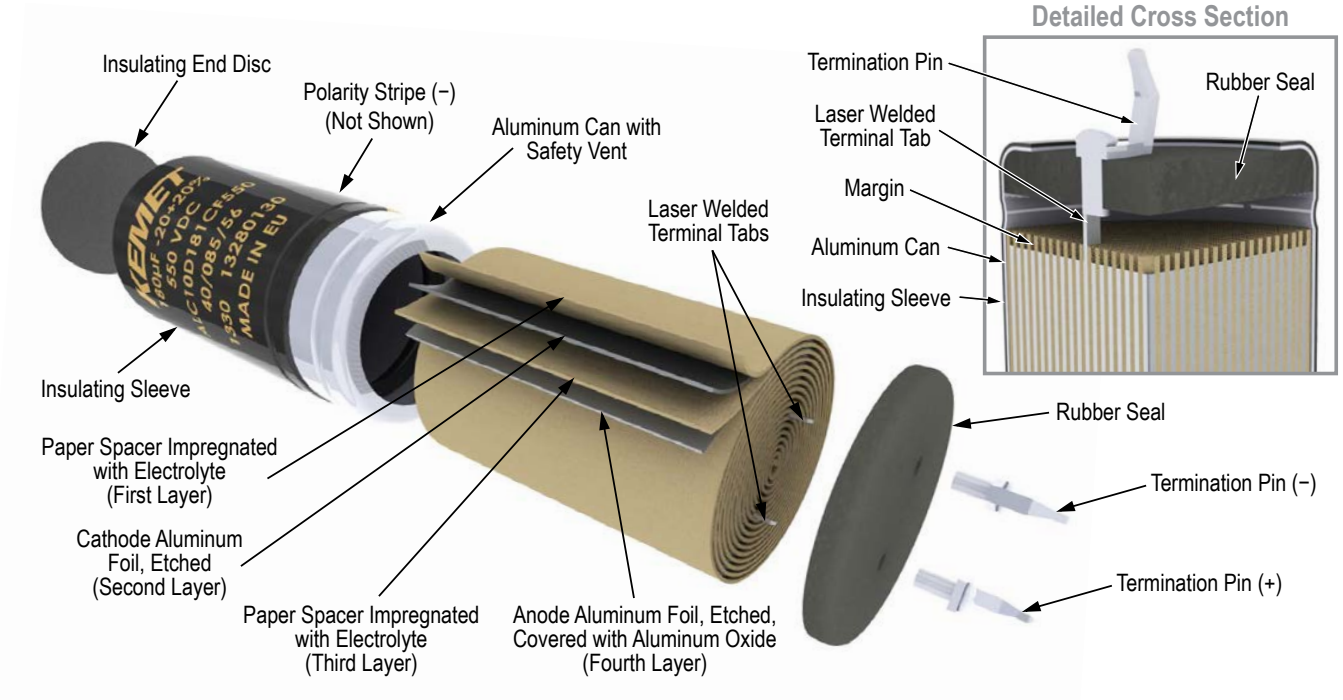
Mounting Position
The capacitor can be mounted upright or inclined to a horizontal position.

Insulating Resistance
≥ 100 MΩ at 100 VDC across insulating sleeve. UL recognized sleeving is available for custom parts in this range, upon request. (UL No. E358957)

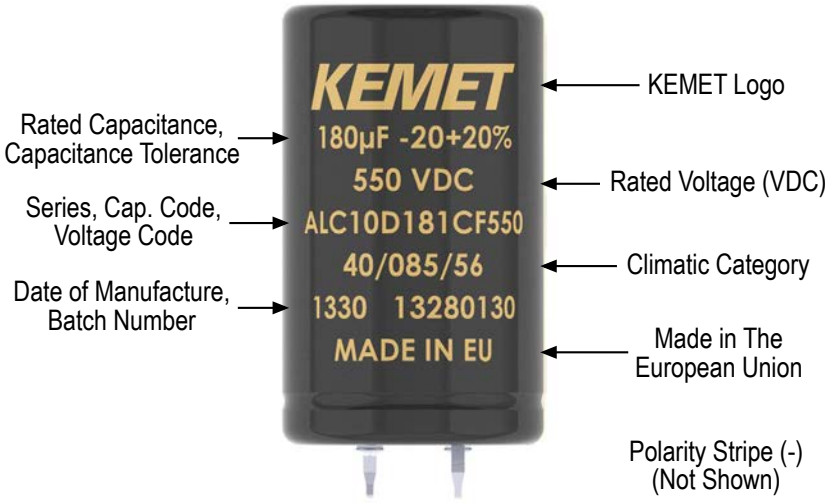
Voltage Proof
≥ 2,500 VDC across insulating sleeve.

Safety Vent
A safety vent for overpressure is featured on either the base (opposing end to the terminals) or the side of the can. This appears in the form of a grooved section on the surface of the can, which is a weakened area and designed to relieve build-up of internal pressure due to overstress or catastrophic failure.

Construction



Marking



ELH Series, +85ºC

Overview

KEMET's ELH Series of aluminum electrolytic snap-in capacitors are designed with snap-lock terminals for printed circuit board mounting. The case is aluminum with an insulated sleeve and safety vent at the bottom.

Applications

Typical applications include general purpose power electronics, UPS, SMPS and battery chargers.

Benefits

- Suited for high quality, high reliability applications
- Low impedance
- Operating temperature of up to 85°C
- 2,000 hour operating life
- RoHS Compliant and lead-free

Part Number System

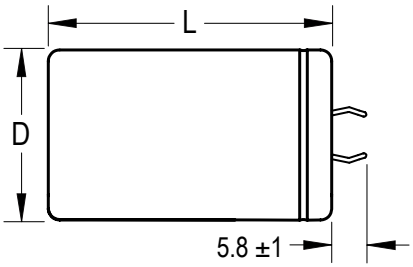
ELH	159	M	6R3		A	Q1	AA
Series	Capacitance Code (pF)	Tolerance	Rated Voltage (VDC)		Electrical Parameters	Size Code	Packaging
Snap-In Aluminum Electrolytic	First two digits represent significant figures for capacitance values. Last digit specifies the number of zeros to be added.	M = ±20%	6R3 = 6.3 010 = 10 016 = 16 025 = 25 035 = 35 050 = 50 063 = 63 080 = 80 100 = 100	160 = 160 180 = 180 200 = 200 250 = 250 350 = 350 400 = 400 420 = 420 450 = 450 500 = 500	A = Standard	See Dimension Table	See Ordering Options Table

Ordering Options Table

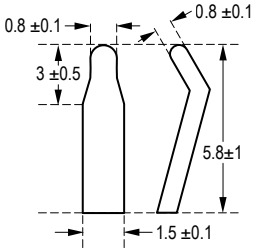
Packaging Type	Lead Length (mm)	Lead and Packaging Code
Standard Bulk Packaging Options		
Bulk (box)	5.8 ± 1.0	AA
Bulk (box)	4.0 ± 0.2	AV

Dimensions – Millimeters

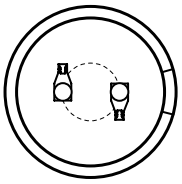
SIDE VIEW



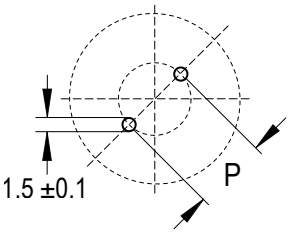
TERMINAL DETAIL



TERMINAL END VIEW



PCB LAYOUT



Size Code	D		L		p	
	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
Q7	22	+1.0/-0	20	+2.0/-0	10.0	±0.5
Q1	22	+1.0/-0	25	+2.0/-0	10.0	±0.5
Q2	22	+1.0/-0	30	+2.0/-0	10.0	±0.5
Q3	22	+1.0/-0	35	+2.0/-0	10.0	±0.5
Q4	22	+1.0/-0	40	+2.0/-0	10.0	±0.5
Q5	22	+1.0/-0	45	+2.0/-0	10.0	±0.5
Q6	22	+1.0/-0	50	+2.0/-0	10.0	±0.5
R7	25	+1.0/-0	20	+2.0/-0	10.0	±0.5
R1	25	+1.0/-0	25	+2.0/-0	10.0	±0.5
R2	25	+1.0/-0	30	+2.0/-0	10.0	±0.5
R3	25	+1.0/-0	35	+2.0/-0	10.0	±0.5
R4	25	+1.0/-0	40	+2.0/-0	10.0	±0.5
R5	25	+1.0/-0	45	+2.0/-0	10.0	±0.5
R6	25	+1.0/-0	50	+2.0/-0	10.0	±0.5
S1	30	+1.0/-0	25	+2.0/-0	10.0	±0.5
S2	30	+1.0/-0	30	+2.0/-0	10.0	±0.5
S3	30	+1.0/-0	35	+2.0/-0	10.0	±0.5
S4	30	+1.0/-0	40	+2.0/-0	10.0	±0.5
S5	30	+1.0/-0	45	+2.0/-0	10.0	±0.5
S6	30	+1.0/-0	50	+2.0/-0	10.0	±0.5
S8	30	+1.0/-0	60	+2.0/-0	10.0	±0.5
T1	35	+1.0/-0	25	+2.0/-0	10.0	±0.5
T2	35	+1.0/-0	30	+2.0/-0	10.0	±0.5
T3	35	+1.0/-0	35	+2.0/-0	10.0	±0.5
T4	35	+1.0/-0	40	+2.0/-0	10.0	±0.5
T5	35	+1.0/-0	45	+2.0/-0	10.0	±0.5
T6	35	+1.0/-0	50	+2.0/-0	10.0	±0.5
T8	35	+1.0/-0	60	+2.0/-0	10.0	±0.5

Environmental Compliance

As an environmentally conscious company, KEMET is working continuously with improvements concerning the environmental effects of both our capacitors and their production. 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, such as lead (Pb), in electronic equipment. All products in this catalog are produced to help our customers' obligations to guarantee their products and 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 such as 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 such as LF = Lead Free or LFW = Lead Free Wires on the label.

Performance Characteristics

Item	Performance Characteristics	
Capacitance Range	820 – 120000 µF	47 – 2,200 µF
Capacitance Tolerance	±20% at 120 Hz / 20°C	
Rated Voltage	6.3 – 100 VDC	160 – 500 VDC
Life Test	2,000 hours (see conditions in Test Methods & Performance)	
Operating Temperature	-40°C to +85°C	-25°C to +85°C
Leakage Current	I = 0.02 CV (mA) or 3 mA, whichever is smaller	
	C = rated capacitance (µF), V = rated voltage (VDC). Voltage applied for 5 minutes at 20°C.	

Impedance Z Characteristics at 120 Hz

Rated Voltage (VDC)	6.3 – 16	25	35	50 – 63	80 – 100	160 – 400	420 – 500
Z (-25°C) / Z (20°C)	3	3	3	2	2	4	8
Z (-40°C) / Z (20°C)	12	10	8	6	5		

Compensation Factor of Ripple Current (RC) vs. Frequency

Rated Voltage (VDC)	50 Hz	60 Hz	120 Hz	1 kHz	10 kHz
6.3 – 100	0.88	0.90	1.00	1.15	1.16
160 – 250	0.75	0.78	1.00	1.30	1.50
350 – 450	0.74	0.76	1.00	1.35	1.45
500	0.72	0.74	1.00	1.20	1.30

Test Method & Performance

Conditions	Load Life Test	Shelf Life Test
Temperature	85°C	85°C
Test Duration	2,000 hours	1,000 hours
Ripple Current	Maximum ripple current specified at 120 kHz 85°C specified in table	No ripple current applied
Voltage	The sum of DC voltage and the peak AC voltage must not exceed the rated voltage of the capacitor	No voltage applied
Performance	**The following specifications will be satisfied when the capacitor is restored to 20°C:**	
Capacitance Change	Within ±20% of the initial value	
Dissipation Factor	Does not exceed 200% of the specified value	Does not exceed 200% of the specified value
Leakage Current	Does not exceed specified value	

Shelf Life

The capacitance, ESR and impedance of a capacitor will not change significantly after extended storage periods, however the leakage current will very slowly increase.

KEMET's E-series aluminum electrolytic capacitors should not be stored in high temperatures or where there is a high level of humidity. The suitable storage condition for KEMET's E-series aluminum electrolytic capacitors is +5 to +35ºC and less than 75% in relative humidity.
KEMET's E-series aluminum electrolytic capacitors should not be stored in damp conditions such as water, saltwater spray or oil spray.
KEMET's E-series aluminum electrolytic capacitors should not be stored in an environment full of hazardous gas (hydrogen sulphide , sulphurous acid gas, nitrous acid, chlorine gas, ammonium, etc.)
KEMET's E-series aluminum electrolytic capacitors should not be stored under exposure to ozone, ultraviolet rays or radiation.
If a capacitor has been stored for more than 18 months under these conditions and it shows increased leakage current, then a treatment by voltage application is recommended.

Re-age (Reforming) Procedure

Apply the rated voltage to the capacitor at room temperature for a period of one hour, or until the leakage current has fallen to a steady value below the specified limit. During re-aging a maximum charging current of twice the specified leakage current or 5 mA (whichever is greater) is suggested.

Table 1 – Ratings & Part Number Reference

VDC	VDC Surge Voltage	Rated Capacitance 120 Hz 20°C (µF)	Case Size D x L (mm)	DF 120 Hz 20°C (tan δ %)*	RC 120 Hz 85°C (A)	LC 20°C 5 Minutes (mA)	Part Number
6.3	8	15000	22 x 25	60	2.44	1.9	ELH159M6R3AQ1(1)
6.3	8	18000	22 x 30	60	2.60	2.3	ELH189M6R3AQ2(1)
6.3	8	18000	25 x 25	60	2.62	2.3	ELH189M6R3AR1(1)
6.3	8	22000	22 x 30	60	3.06	2.8	ELH229M6R3AQ2(1)
6.3	8	22000	25 x 25	60	3.07	2.8	ELH229M6R3AR1(1)
6.3	8	27000	22 x 35	60	3.49	3.0	ELH279M6R3AQ3(1)
6.3	8	27000	25 x 30	60	3.52	3.0	ELH279M6R3AR2(1)
6.3	8	27000	30 x 25	60	3.57	3.0	ELH279M6R3AS1(1)
6.3	8	33000	22 x 40	60	3.97	3.0	ELH339M6R3AQ4(1)
6.3	8	33000	25 x 35	60	4.02	3.0	ELH339M6R3AR3(1)
6.3	8	33000	30 x 30	60	4.05	3.0	ELH339M6R3AS2(1)
6.3	8	33000	35 x 25	60	4.10	3.0	ELH339M6R3AT1(1)
6.3	8	39000	22 x 50	60	4.56	3.0	ELH399M6R3AQ6(1)
6.3	8	39000	25 x 40	60	4.50	3.0	ELH399M6R3AR4(1)
6.3	8	39000	30 x 30	60	4.46	3.0	ELH399M6R3AS2(1)
6.3	8	39000	35 x 25	60	4.51	3.0	ELH399M6R3AT1(1)
6.3	8	47000	25 x 45	60	5.09	3.0	ELH479M6R3AR5(1)
6.3	8	47000	30 x 35	60	5.06	3.0	ELH479M6R3AS3(1)
6.3	8	47000	35 x 30	60	5.03	3.0	ELH479M6R3AT2(1)
6.3	8	56000	25 x 50	60	5.71	3.0	ELH569M6R3AR6(1)
6.3	8	56000	30 x 40	60	5.70	3.0	ELH569M6R3AS4(1)
6.3	8	56000	35 x 30	60	5.75	3.0	ELH569M6R3AT2(1)
6.3	8	68000	30 x 45	60	6.48	3.0	ELH689M6R3AS5(1)
6.3	8	68000	35 x 35	60	6.42	3.0	ELH689M6R3AT3(1)
6.3	8	82000	30 x 50	60	7.32	3.0	ELH829M6R3AS6(1)
6.3	8	82000	35 x 40	60	7.29	3.0	ELH829M6R3AT4(1)
6.3	8	100000	35 x 45	60	8.31	3.0	ELH10KM6R3AT5(1)
6.3	8	120000	35 x 50	60	8.60	3.0	ELH12KM6R3AT6(1)
10	13	12000	22 x 25	55	2.40	2.4	ELH129M010AQ1(1)
10	13	15000	22 x 30	55	2.75	3.0	ELH159M010AQ2(1)
10	13	15000	25 x 25	55	2.75	3.0	ELH159M010AR1(1)
10	13	18000	22 x 35	55	3.15	3.0	ELH189M010AQ3(1)
10	13	18000	25 x 25	55	3.05	3.0	ELH189M010AR1(1)
10	13	22000	22 x 40	55	3.55	3.0	ELH229M010AQ4(1)
10	13	22000	25 x 30	55	3.50	3.0	ELH229M010AR2(1)
10	13	22000	30 x 25	55	3.55	3.0	ELH229M010AS1(1)
10	13	27000	22 x 45	55	4.05	3.0	ELH279M010AQ5(1)
10	13	27000	25 x 35	55	4.00	3.0	ELH279M010AR3(1)
10	13	27000	30 x 30	55	4.05	3.0	ELH279M010AS2(1)
10	13	33000	22 x 50	55	4.60	3.0	ELH339M010AQ6(1)
10	13	33000	25 x 40	55	4.55	3.0	ELH339M010AR4(1)
10	13	33000	30 x 30	55	4.50	3.0	ELH339M010AS2(1)
10	13	33000	35 x 25	55	4.50	3.0	ELH339M010AT1(1)
10	13	39000	25 x 45	55	5.10	3.0	ELH399M010AR5(1)
10	13	39000	30 x 35	55	5.05	3.0	ELH399M010AS3(1)
10	13	39000	35 x 30	55	5.05	3.0	ELH399M010AT2(1)
10	13	47000	25 x 50	55	5.75	3.0	ELH479M010AR6(1)
10	13	47000	30 x 40	55	5.70	3.0	ELH479M010AS4(1)
10	13	47000	35 x 30	55	5.65	3.0	ELH479M010AT2(1)
10	13	56000	30 x 45	55	6.45	3.0	ELH569M010AS5(1)
10	13	56000	35 x 35	55	6.40	3.0	ELH569M010AT3(1)
10	13	68000	30 x 50	55	7.05	3.0	ELH689M010AS6(1)
10	13	68000	35 x 40	55	7.10	3.0	ELH689M010AT4(1)
10	13	82000	35 x 50	55	7.50	3.0	ELH829M010AT6(1)
16	20	8200	22 x 25	55	2.60	2.6	ELH828M016AQ1(1)
16	20	10000	22 x 30	55	2.70	3.0	ELH109M016AQ2(1)
16	20	10000	25 x 25	55	2.75	3.0	ELH109M016AR1(1)
VDC	**VDC Surge**	**Rated Capacitance**	**Case Size**	**DF**	**RC**	**LC**	**Part Number**

(1) Insert packaging code. See Ordering Options Table for available options.

** When capacitance exceeds 1,000 µF, the DF value (%) is increased by 2% for every additional 1,000 µF.*

Table 1 – Ratings & Part Number Reference cont'd

VDC	VDC Surge Voltage	Rated Capacitance 120 Hz 20°C (µF)	Case Size D x L (mm)	DF 120 Hz 20°C (tan δ %)*	RC 120 Hz 85°C (A)	LC 20°C 5 Minutes (mA)	Part Number
16	20	12000	22 x 30	55	2.90	3.0	ELH129M016AQ2(1)
16	20	12000	25 x 25	55	2.95	3.0	ELH129M016AR1(1)
16	20	15000	22 x 35	55	3.30	3.0	ELH159M016AQ3(1)
16	20	15000	25 x 30	55	3.45	3.0	ELH159M016AR2(1)
16	20	15000	30 x 25	55	3.50	3.0	ELH159M016AS1(1)
16	20	18000	22 x 40	55	3.70	3.0	ELH189M016AQ4(1)
16	20	18000	25 x 35	55	3.75	3.0	ELH189M016AR3(1)
16	20	18000	30 x 30	55	3.80	3.0	ELH189M016AS2(1)
16	20	22000	22 x 50	55	4.35	3.0	ELH229M016AQ6(1)
16	20	22000	25 x 40	55	4.30	3.0	ELH229M016AR4(1)
16	20	22000	30 x 30	55	4.25	3.0	ELH229M016AS2(1)
16	20	22000	35 x 25	55	4.20	3.0	ELH229M016AT1(1)
16	20	27000	25 x 45	55	4.70	3.0	ELH279M016AR5(1)
16	20	27000	30 x 35	55	4.65	3.0	ELH279M016AS3(1)
16	20	27000	35 x 30	55	4.65	3.0	ELH279M016AT2(1)
16	20	33000	30 x 40	55	5.35	3.0	ELH339M016AS4(1)
16	20	33000	35 x 30	55	5.40	3.0	ELH339M016AT2(1)
16	20	39000	30 x 45	55	6.00	3.0	ELH399M016AS5(1)
16	20	39000	35 x 35	55	5.95	3.0	ELH399M016AT3(1)
16	20	47000	30 x 50	55	6.80	3.0	ELH479M016AS6(1)
16	20	47000	35 x 40	55	6.75	3.0	ELH479M016AT4(1)
16	20	56000	35 x 45	55	7.60	3.0	ELH569M016AT5(1)
16	20	68000	35 x 50	55	8.00	3.0	ELH689M016AT6(1)
16	20	82000	35 x 60	55	8.50	3.0	ELH829M016AT8(1)
25	32	5600	22 x 25	45	2.20	2.8	ELH568M025AQ1(1)
25	32	6800	22 x 30	45	2.40	3.0	ELH688M025AQ2(1)
25	32	6800	25 x 25	45	2.45	3.0	ELH688M025AR1(1)
25	32	8200	22 x 35	45	2.70	3.0	ELH828M025AQ3(1)
25	32	8200	25 x 25	45	2.75	3.0	ELH828M025AR1(1)
25	32	10000	22 x 40	45	3.10	3.0	ELH109M025AQ4(1)
25	32	10000	25 x 30	45	3.15	3.0	ELH109M025AR2(1)
25	32	10000	30 x 25	45	3.20	3.0	ELH109M025AS1(1)
25	32	12000	22 x 45	45	3.50	3.0	ELH129M025AQ5(1)
25	32	12000	25 x 35	45	3.45	3.0	ELH129M025AR3(1)
25	32	12000	30 x 30	45	3.50	3.0	ELH129M025AS2(1)
25	32	12000	35 x 25	45	3.55	3.0	ELH129M025AT1(1)
25	32	15000	22 x 50	45	4.00	3.0	ELH159M025AQ6(1)
25	32	15000	25 x 40	45	3.95	3.0	ELH159M025AR4(1)
25	32	15000	30 x 35	45	4.00	3.0	ELH159M025AS3(1)
25	32	15000	35 x 30	45	4.05	3.0	ELH159M025AT2(1)
25	32	18000	25 x 45	45	4.45	3.0	ELH189M025AR5(1)
25	32	18000	30 x 35	45	4.45	3.0	ELH189M025AS3(1)
25	32	18000	35 x 30	45	4.60	3.0	ELH189M025AT2(1)
25	32	22000	30 x 40	45	5.20	3.0	ELH229M025AS4(1)
25	32	22000	35 x 35	45	5.15	3.0	ELH229M025AT3(1)
25	32	22000	35 x 40	45	5.95	3.0	ELH229M025AS5(1)
25	32	22000	35 x 40	45	5.90	3.0	ELH229M025AT4(1)
25	32	27000	30 x 50	45	6.70	3.0	ELH279M025AS6(1)
25	32	27000	35 x 45	45	6.75	3.0	ELH279M025AT5(1)
25	32	33000	35 x 50	45	7.55	3.0	ELH339M025AT6(1)
25	32	39000	35 x 45	45	7.56	3.0	ELH399M025AT5(1)
25	32	47000	35 x 50	45	8.30	3.0	ELH479M025AT6(1)
35	63	3900	22 x 25	35	2.20	2.7	ELH398M035AQ1(1)
35	63	4700	22 x 30	35	2.40	3.0	ELH478M035AQ2(1)
35	63	4700	25 x 25	35	2.40	3.0	ELH478M035AR1(1)
35	63	5600	22 x 35	35	2.75	3.0	ELH568M035AQ3(1)
35	63	5600	25 x 25	35	2.75	3.0	ELH568M035AR1(1)
VDC	**VDC Surge**	**Rated Capacitance**	**Case Size**	**DF**	**RC**	**LC**	**Part Number**

(1) Insert packaging code. See Ordering Options Table for available options.

** When capacitance exceeds 1,000 µF, the DF value (%) is increased by 2% for every additional 1,000 µF.*

Table 1 – Ratings & Part Number Reference cont'd

VDC	VDC Surge Voltage	Rated Capacitance 120 Hz 20°C (µF)	Case Size D x L (mm)	DF 120 Hz 20°C (tan δ %)*	RC 120 Hz 85°C (A)	LC 20°C 5 Minutes (mA)	Part Number
35	63	6800	22 x 40	35	2.85	3.0	ELH688M035AQ4(1)
35	63	6800	25 x 30	35	2.85	3.0	ELH688M035AR2(1)
35	63	6800	30 x 25	35	2.90	3.0	ELH688M035AS1(1)
35	63	8200	22 x 45	35	3.15	3.0	ELH828M035AQ5(1)
35	63	8200	25 x 35	35	3.10	3.0	ELH828M035AR3(1)
35	63	8200	30 x 30	35	3.15	3.0	ELH828M035AS2(1)
35	63	10000	22 x 50	35	3.55	3.0	ELH109M035AQ6(1)
35	63	10000	25 x 40	35	3.50	3.0	ELH109M035AR4(1)
35	63	10000	30 x 30	35	3.45	3.0	ELH109M035AS2(1)
35	63	10000	35 x 25	35	3.40	3.0	ELH109M035AT1(1)
35	63	12000	25 x 45	35	3.95	3.0	ELH129M035AR5(1)
35	63	12000	30 x 35	35	4.00	3.0	ELH129M035AS3(1)
35	63	12000	35 x 30	35	4.05	3.0	ELH129M035AT2(1)
35	63	15000	25 x 50	35	4.95	3.0	ELH159M035AR6(1)
35	63	15000	30 x 40	35	4.95	3.0	ELH159M035AS4(1)
35	63	15000	35 x 35	35	5.00	3.0	ELH159M035AT3(1)
35	63	18000	30 x 45	35	5.50	3.0	ELH189M035AS5(1)
35	63	18000	35 x 40	35	5.55	3.0	ELH189M035AT4(1)
35	63	22000	30 x 50	35	6.00	3.0	ELH229M035AS6(1)
35	63	22000	35 x 45	35	6.05	3.0	ELH229M035AT5(1)
35	63	27000	35 x 50	35	6.90	3.0	ELH279M035AT6(1)
50	63	2200	22 x 25	30	1.90	2.2	ELH228M050AQ1(1)
50	63	2700	22 x 30	30	2.10	2.7	ELH278M050AQ2(1)
50	63	2700	25 x 25	30	2.20	2.7	ELH278M050AR1(1)
50	63	3300	22 x 30	30	2.35	3.0	ELH338M050AQ2(1)
50	63	3300	25 x 25	30	2.35	3.0	ELH338M050AR1(1)
50	63	3900	22 x 35	30	2.65	3.0	ELH398M050AQ3(1)
50	63	3900	25 x 30	30	2.65	3.0	ELH398M050AR2(1)
50	63	3900	30 x 25	30	2.65	3.0	ELH398M050AS1(1)
50	63	4700	22 x 40	30	3.00	3.0	ELH478M050AQ4(1)
50	63	4700	25 x 35	30	3.00	3.0	ELH478M050AR3(1)
50	63	4700	30 x 25	30	2.95	3.0	ELH478M050AS1(1)
50	63	5600	22 x 45	30	3.35	3.0	ELH568M050AQ5(1)
50	63	5600	25 x 40	30	3.35	3.0	ELH568M050AR4(1)
50	63	5600	30 x 30	30	3.35	3.0	ELH568M050AS2(1)
50	63	5600	35 x 25	30	3.40	3.0	ELH568M050AT1(1)
50	63	6800	22 x 50	30	3.80	3.0	ELH688M050AQ6(1)
50	63	6800	25 x 40	30	3.80	3.0	ELH688M050AR4(1)
50	63	6800	30 x 30	30	3.80	3.0	ELH688M050AS2(1)
50	63	6800	30 x 35	30	3.85	3.0	ELH688M050AS3(1)
50	63	6800	35 x 30	30	3.85	3.0	ELH688M050AT2(1)
50	63	8200	25 x 50	30	4.35	3.0	ELH828M050AR6(1)
50	63	8200	30 x 40	30	4.35	3.0	ELH828M050AS4(1)
50	63	8200	35 x 30	30	4.40	3.0	ELH828M050AT2(1)
50	63	10000	30 x 45	30	5.00	3.0	ELH109M050AS5(1)
50	63	10000	35 x 35	30	4.95	3.0	ELH109M050AT3(1)
50	63	12000	30 x 50	30	5.60	3.0	ELH129M050AS6(1)
50	63	12000	35 x 40	30	5.55	3.0	ELH129M050AT4(1)
50	63	15000	35 x 45	30	6.45	3.0	ELH159M050AT5(1)
50	63	18000	35 x 50	30	6.70	3.0	ELH189M050AT6(1)
63	79	1800	22 x 25	25	1.85	2.3	ELH188M063AQ1(1)
63	79	2200	22 x 30	25	2.30	2.8	ELH228M063AQ2(1)
63	79	2200	25 x 25	25	2.30	2.8	ELH228M063AR1(1)
63	79	2700	22 x 35	25	2.45	3.0	ELH278M063AQ3(1)
63	79	2700	25 x 30	25	2.45	3.0	ELH278M063AR2(1)
63	79	2700	30 x 25	25	2.50	3.0	ELH278M063AS1(1)
63	79	3300	22 x 40	25	2.60	3.0	ELH338M063AQ4(1)
VDC	**VDC Surge**	**Rated Capacitance**	**Case Size**	**DF**	**RC**	**LC**	**Part Number**

(1) Insert packaging code. See Ordering Options Table for available options.

** When capacitance exceeds 1,000 µF, the DF value (%) is increased by 2% for every additional 1,000 µF.*

Table 1 – Ratings & Part Number Reference cont'd

VDC	VDC Surge Voltage	Rated Capacitance 120 Hz 20°C (µF)	Case Size D x L (mm)	DF 120 Hz 20°C (tan δ %)*	RC 120 Hz 85°C (A)	LC 20°C 5 Minutes (mA)	Part Number
63	79	3300	25 x 30	25	2.65	3.0	ELH338M063AR2(1)
63	79	3300	30 x 25	25	2.70	3.0	ELH338M063AS1(1)
63	79	3900	22 x 45	25	2.95	3.0	ELH398M063AQ5(1)
63	79	3900	25 x 35	25	2.95	3.0	ELH398M063AR3(1)
63	79	3900	30 x 30	25	3.00	3.0	ELH398M063AS2(1)
63	79	4700	22 x 50	25	3.40	3.0	ELH478M063AQ6(1)
63	79	4700	25 x 40	25	3.35	3.0	ELH478M063AR4(1)
63	79	4700	30 x 30	25	3.35	3.0	ELH478M063AS2(1)
63	79	4700	35 x 25	25	3.40	3.0	ELH478M063AT1(1)
63	79	5600	25 x 45	25	3.70	3.0	ELH568M063AR5(1)
63	79	5600	30 x 35	25	3.75	3.0	ELH568M063AS3(1)
63	79	5600	35 x 30	25	3.75	3.0	ELH568M063AT2(1)
63	79	6800	30 x 40	25	4.25	3.0	ELH688M063AS4(1)
63	79	6800	35 x 30	25	4.20	3.0	ELH688M063AT2(1)
63	79	8200	30 x 45	25	4.80	3.0	ELH828M063AS5(1)
63	79	8200	35 x 35	25	4.80	3.0	ELH828M063AT3(1)
63	79	10000	30 x 50	25	5.50	3.0	ELH109M063AS6(1)
63	79	10000	35 x 40	25	5.45	3.0	ELH109M063AT4(1)
63	79	12000	35 x 45	25	6.20	3.0	ELH129M063AT5(1)
80	100	1200	22 x 25	25	1.65	1.9	ELH128M080AQ1(1)
80	100	1500	22 x 30	25	1.90	2.4	ELH158M080AQ2(1)
80	100	1500	25 x 25	25	1.90	2.4	ELH158M080AR1(1)
80	100	1800	22 x 35	25	2.20	2.9	ELH188M080AQ3(1)
80	100	1800	25 x 30	25	2.20	2.9	ELH188M080AR2(1)
80	100	1800	30 x 25	25	2.20	2.9	ELH188M080AS1(1)
80	100	2200	22 x 40	25	2.45	3.0	ELH228M080AQ4(1)
80	100	2200	25 x 30	25	2.45	3.0	ELH228M080AR2(1)
80	100	2200	30 x 25	25	2.50	3.0	ELH228M080AS1(1)
80	100	2700	22 x 45	25	2.80	3.0	ELH278M080AQ5(1)
80	100	2700	25 x 35	25	2.80	3.0	ELH278M080AR3(1)
80	100	2700	30 x 30	25	2.85	3.0	ELH278M080AS2(1)
80	100	2700	35 x 25	25	2.85	3.0	ELH278M080AT1(1)
80	100	3300	22 x 50	25	3.15	3.0	ELH338M080AQ6(1)
80	100	3300	25 x 40	25	3.20	3.0	ELH338M080AR4(1)
80	100	3300	30 x 30	25	3.20	3.0	ELH338M080AS2(1)
80	100	3300	35 x 25	25	3.20	3.0	ELH338M080AT1(1)
80	100	3900	25 x 45	25	3.60	3.0	ELH398M080AR5(1)
80	100	3900	30 x 35	25	3.60	3.0	ELH398M080AS3(1)
80	100	3900	35 x 30	25	3.60	3.0	ELH398M080AT2(1)
80	100	4700	25 x 50	25	4.05	3.0	ELH478M080AR6(1)
80	100	4700	30 x 40	25	4.05	3.0	ELH478M080AS4(1)
80	100	4700	35 x 35	25	4.10	3.0	ELH478M080AT3(1)
80	100	5600	30 x 45	25	4.55	3.0	ELH568M080AS5(1)
80	100	5600	35 x 35	25	4.50	3.0	ELH568M080AT3(1)
80	100	6800	30 x 50	25	5.15	3.0	ELH688M080AS6(1)
80	100	6800	35 x 40	25	5.15	3.0	ELH688M080AT4(1)
80	100	8200	35 x 45	25	5.85	3.0	ELH828M080AT5(1)
80	100	10000	35 x 50	25	6.60	3.0	ELH109M080AT6(1)
100	125	820	22 x 25	25	1.85	1.6	ELH827M100AQ1(1)
100	125	1000	22 x 30	25	2.10	2.0	ELH108M100AQ2(1)
100	125	1000	25 x 25	25	2.10	2.0	ELH108M100AR1(1)
100	125	1200	22 x 35	25	2.40	2.4	ELH128M100AQ3(1)
100	125	1200	25 x 30	25	2.45	2.4	ELH128M100AR2(1)
100	125	1500	22 x 40	25	2.70	3.0	ELH158M100AQ4(1)
100	125	1500	25 x 30	25	2.75	3.0	ELH158M100AR2(1)
100	125	1500	30 x 25	25	2.75	3.0	ELH158M100AS1(1)
100	125	1800	22 x 45	25	3.10	3.0	ELH188M100AQ5(1)
VDC	**VDC Surge**	**Rated Capacitance**	**Case Size**	**DF**	**RC**	**LC**	**Part Number**

(1) Insert packaging code. See Ordering Options Table for available options.

** When capacitance exceeds 1,000 µF, the DF value (%) is increased by 2% for every additional 1,000 µF.*

Table 1 – Ratings & Part Number Reference cont'd

VDC	VDC Surge Voltage	Rated Capacitance 120 Hz 20°C (µF)	Case Size D x L (mm)	DF 120 Hz 20°C (tan δ %)*	RC 120 Hz 85°C (A)	LC 20°C 5 Minutes (mA)	Part Number
100	125	1800	25 x 35	25	3.15	3.0	ELH188M100AR3(1)
100	125	1800	30 x 30	25	3.15	3.0	ELH188M100AS2(1)
100	125	1800	35 x 25	25	3.15	3.0	ELH188M100AT1(1)
100	125	2200	22 x 50	25	3.50	3.0	ELH228M100AQ6(1)
100	125	2200	25 x 40	25	3.55	3.0	ELH228M100AR4(1)
100	125	2200	30 x 30	25	3.55	3.0	ELH228M100AS2(1)
100	125	2200	35 x 25	25	3.60	3.0	ELH228M100AT1(1)
100	125	2700	25 x 45	25	4.10	3.0	ELH278M100AR5(1)
100	125	2700	30 x 35	25	4.05	3.0	ELH278M100AS3(1)
100	125	2700	35 x 30	25	4.05	3.0	ELH278M100AT2(1)
100	125	3300	25 x 50	25	4.50	3.0	ELH338M100AR6(1)
100	125	3300	30 x 40	25	4.55	3.0	ELH338M100AS4(1)
100	125	3300	35 x 30	25	4.50	3.0	ELH338M100AT2(1)
100	125	3900	30 x 45	25	5.15	3.0	ELH398M100AS5(1)
100	125	3900	35 x 35	25	5.10	3.0	ELH398M100AT3(1)
100	125	4700	35 x 40	25	5.75	3.0	ELH478M100AT4(1)
100	125	5600	35 x 50	25	6.20	3.0	ELH568M100AT6(1)
160	200	270	22 x 25	15	1.15	0.9	ELH277M160AQ1(1)
160	200	330	22 x 25	15	1.40	1.0	ELH337M160AQ1(1)
160	200	330	25 x 20	15	1.35	1.0	ELH337M160AR7(1)
160	200	390	22 x 30	15	1.55	1.2	ELH397M160AQ2(1)
160	200	390	25 x 25	15	1.55	1.2	ELH397M160AR1(1)
160	200	390	30 x 25	15	1.50	1.2	ELH397M160AS1(1)
160	200	470	22 x 30	15	1.75	1.5	ELH477M160AQ2(1)
160	200	470	25 x 25	15	1.75	1.5	ELH477M160AR1(1)
160	200	470	30 x 25	15	1.70	1.5	ELH477M160AS1(1)
160	200	560	22 x 30	15	1.95	1.8	ELH567M160AQ2(1)
160	200	560	25 x 30	15	1.95	1.8	ELH567M160AR2(1)
160	200	560	30 x 25	15	1.90	1.8	ELH567M160AS1(1)
160	200	680	22 x 40	15	2.20	2.2	ELH687M160AQ4(1)
160	200	680	25 x 30	15	2.20	2.2	ELH687M160AR2(1)
160	200	680	30 x 25	15	2.15	2.2	ELH687M160AS1(1)
160	200	820	22 x 45	15	2.50	2.6	ELH827M160AQ5(1)
160	200	820	25 x 35	15	2.55	2.6	ELH827M160AR3(1)
160	200	820	30 x 30	15	2.50	2.6	ELH827M160AS2(1)
160	200	820	35 x 25	15	2.50	2.6	ELH827M160AT1(1)
160	200	1000	22 x 50	15	2.85	3.0	ELH108M160AQ6(1)
160	200	1000	25 x 40	15	2.80	3.0	ELH108M160AR4(1)
160	200	1000	30 x 30	15	2.80	3.0	ELH108M160AS2(1)
160	200	1000	30 x 35	15	2.80	3.0	ELH108M160AS3(1)
160	200	1000	35 x 25	15	2.80	3.0	ELH108M160AT1(1)
160	200	1200	25 x 45	15	3.15	3.0	ELH128M160AR5(1)
160	200	1200	30 x 35	15	3.15	3.0	ELH128M160AS3(1)
160	200	1200	35 x 30	15	3.20	3.0	ELH128M160AT2(1)
160	200	1500	30 x 45	15	3.75	3.0	ELH158M160AS5(1)
160	200	1500	35 x 30	15	3.70	3.0	ELH158M160AT2(1)
160	200	1500	35 x 35	15	3.70	3.0	ELH158M160AT3(1)
160	200	1800	30 x 50	15	4.20	3.0	ELH188M160AS6(1)
160	200	1800	35 x 40	15	4.20	3.0	ELH188M160AT4(1)
160	200	2200	35 x 40	15	4.60	3.0	ELH228M160AT4(1)
160	200	2200	35 x 45	15	4.80	3.0	ELH228M160AT5(1)
160	200	2700	35 x 50	15	5.45	3.0	ELH278M160AT6(1)
180	225	180	22 x 20	15	1.00	0.6	ELH187M180AQ7(1)
180	225	220	22 x 25	15	1.10	0.8	ELH227M180AQ1(1)
180	225	270	22 x 25	15	1.25	1.0	ELH277M180AQ1(1)
180	225	270	25 x 20	15	1.25	1.0	ELH277M180AR7(1)
180	225	330	22 x 25	15	1.40	1.2	ELH337M180AQ1(1)
VDC	**VDC Surge**	**Rated Capacitance**	**Case Size**	**DF**	**RC**	**LC**	**Part Number**

(1) Insert packaging code. See Ordering Options Table for available options.

** When capacitance exceeds 1,000 µF, the DF value (%) is increased by 2% for every additional 1,000 µF.*

Table 1 – Ratings & Part Number Reference cont'd

VDC	VDC Surge Voltage	Rated Capacitance 120 Hz 20°C (µF)	Case Size D x L (mm)	DF 120 Hz 20°C (tan δ %)*	RC 120 Hz 85°C (A)	LC 20°C 5 Minutes (mA)	Part Number
180	225	330	22 x 30	15	1.40	1.2	ELH337M180AQ2(1)
180	225	330	25 x 25	15	1.40	1.2	ELH337M180AR1(1)
180	225	390	22 x 30	15	1.60	1.4	ELH397M180AQ2(1)
180	225	390	25 x 25	15	1.60	1.4	ELH397M180AR1(1)
180	225	470	22 x 35	15	1.80	1.7	ELH477M180AQ3(1)
180	225	470	25 x 30	15	1.80	1.7	ELH477M180AR2(1)
180	225	470	30 x 25	15	1.80	1.7	ELH477M180AS1(1)
180	225	560	22 x 35	15	2.00	2.0	ELH567M180AQ3(1)
180	225	560	22 x 40	15	2.00	2.0	ELH567M180AQ4(1)
180	225	560	25 x 30	15	1.95	2.0	ELH567M180AR2(1)
180	225	560	30 x 25	15	2.00	2.0	ELH567M180AS1(1)
180	225	680	22 x 45	15	2.25	2.4	ELH687M180AQ5(1)
180	225	680	25 x 35	15	2.20	2.4	ELH687M180AR3(1)
180	225	680	30 x 30	15	2.20	2.4	ELH687M180AS2(1)
180	225	680	35 x 25	15	2.20	2.4	ELH687M180AT1(1)
180	225	820	22 x 50	15	2.55	2.9	ELH827M180AQ6(1)
180	225	820	25 x 40	15	2.55	2.9	ELH827M180AR4(1)
180	225	820	30 x 30	15	2.60	2.9	ELH827M180AS2(1)
180	225	820	30 x 35	15	2.60	2.9	ELH827M180AS3(1)
180	225	820	35 x 25	15	2.60	2.9	ELH827M180AT1(1)
180	225	1000	25 x 45	15	2.85	3.0	ELH108M180AR5(1)
180	225	1000	30 x 35	15	2.85	3.0	ELH108M180AS3(1)
180	225	1000	35 x 30	15	2.90	3.0	ELH108M180AT2(1)
180	225	1200	30 x 40	15	3.25	3.0	ELH128M180AS4(1)
180	225	1200	35 x 30	15	3.30	3.0	ELH128M180AT2(1)
180	225	1200	35 x 35	15	3.30	3.0	ELH128M180AT3(1)
180	225	1500	30 x 45	15	3.85	3.0	ELH158M180AS5(1)
180	225	1500	35 x 35	15	3.80	3.0	ELH158M180AT3(1)
180	225	1500	35 x 40	15	3.80	3.0	ELH158M180AT4(1)
180	225	1800	35 x 40	15	4.30	3.0	ELH188M180AT4(1)
180	225	1800	35 x 45	15	4.30	3.0	ELH188M180AT5(1)
180	225	2200	35 x 45	15	4.90	3.0	ELH228M180AT5(1)
180	225	2200	35 x 50	15	4.90	3.0	ELH228M180AT6(1)
200	250	180	22 x 25	15	0.95	0.7	ELH187M200AQ1(1)
200	250	220	22 x 25	15	1.10	0.9	ELH227M200AQ1(1)
200	250	270	22 x 25	15	1.25	1.1	ELH277M200AQ1(1)
200	250	270	22 x 30	15	1.25	1.1	ELH277M200AQ2(1)
200	250	270	25 x 25	15	1.25	1.1	ELH277M200AR1(1)
200	250	330	22 x 25	15	1.45	1.3	ELH337M200AQ1(1)
200	250	330	22 x 30	15	1.45	1.3	ELH337M200AQ2(1)
200	250	330	25 x 25	15	1.45	1.3	ELH337M200AR1(1)
200	250	390	22 x 30	15	1.60	1.6	ELH397M200AQ2(1)
200	250	390	25 x 25	15	1.55	1.6	ELH397M200AR1(1)
200	250	470	22 x 35	15	1.80	1.9	ELH477M200AQ3(1)
200	250	470	25 x 30	15	1.80	1.9	ELH477M200AR2(1)
200	250	470	30 x 25	15	1.80	1.9	ELH477M200AS1(1)
200	250	560	22 x 40	15	2.00	2.2	ELH567M200AQ4(1)
200	250	560	25 x 35	15	2.00	2.2	ELH567M200AR3(1)
200	250	560	30 x 25	15	2.00	2.2	ELH567M200AS1(1)
200	250	680	22 x 45	15	2.35	2.7	ELH687M200AQ5(1)
200	250	680	25 x 35	15	2.30	2.7	ELH687M200AR3(1)
200	250	680	30 x 30	15	2.30	2.7	ELH687M200AS2(1)
200	250	680	35 x 25	15	2.30	2.7	ELH687M200AT1(1)
200	250	820	25 x 40	15	2.60	3.0	ELH827M200AR4(1)
200	250	820	25 x 45	15	2.60	3.0	ELH827M200AR5(1)
200	250	820	30 x 30	15	2.60	3.0	ELH827M200AS2(1)
200	250	820	30 x 35	15	2.60	3.0	ELH827M200AS3(1)
VDC	**VDC Surge**	**Rated Capacitance**	**Case Size**	**DF**	**RC**	**LC**	**Part Number**

(1) Insert packaging code. See Ordering Options Table for available options.

** When capacitance exceeds 1,000 µF, the DF value (%) is increased by 2% for every additional 1,000 µF.*

Table 1 – Ratings & Part Number Reference cont'd

VDC	VDC Surge Voltage	Rated Capacitance 120 Hz 20°C (µF)	Case Size D x L (mm)	DF 120 Hz 20°C (tan δ %)*	RC 120 Hz 85°C (A)	LC 20°C 5 Minutes (mA)	Part Number
200	250	820	35 x 30	15	2.60	3.0	ELH827M200AT2(1)
200	250	1000	25 x 45	15	3.00	3.0	ELH108M200AR5(1)
200	250	1000	25 x 50	15	3.00	3.0	ELH108M200AR6(1)
200	250	1000	30 x 35	15	3.05	3.0	ELH108M200AS3(1)
200	250	1000	30 x 40	15	3.05	3.0	ELH108M200AS4(1)
200	250	1000	35 x 30	15	3.00	3.0	ELH108M200AT2(1)
200	250	1200	25 x 50	15	3.30	3.0	ELH128M200AR6(1)
200	250	1200	30 x 40	15	3.30	3.0	ELH128M200AS4(1)
200	250	1200	30 x 45	15	3.30	3.0	ELH128M200AS5(1)
200	250	1200	35 x 30	15	3.30	3.0	ELH128M200AT2(1)
200	250	1200	35 x 35	15	3.30	3.0	ELH128M200AT3(1)
200	250	1500	30 x 45	15	3.80	3.0	ELH158M200AS5(1)
200	250	1500	30 x 50	15	3.80	3.0	ELH158M200AS6(1)
200	250	1500	35 x 35	15	3.80	3.0	ELH158M200AT3(1)
200	250	1500	35 x 40	15	3.80	3.0	ELH158M200AT4(1)
200	250	1800	35 x 40	15	4.35	3.0	ELH188M200AT4(1)
200	250	1800	35 x 45	15	4.35	3.0	ELH188M200AT5(1)
200	250	2200	35 x 45	15	4.95	3.0	ELH228M200AT5(1)
200	250	2200	35 x 50	15	4.95	3.0	ELH228M200AT6(1)
250	300	120	22 x 20	15	0.78	0.6	ELH127M250AQ7(1)
250	300	150	22 x 25	15	0.90	0.7	ELH157M250AQ1(1)
250	300	180	22 x 25	15	1.05	0.9	ELH187M250AQ1(1)
250	300	180	25 x 20	15	1.00	0.9	ELH187M250AR7(1)
250	300	220	22 x 30	15	1.15	1.1	ELH227M250AQ2(1)
250	300	220	22 x 35	15	1.15	1.1	ELH227M250AQ3(1)
250	300	220	25 x 25	15	1.15	1.1	ELH227M250AR1(1)
250	300	270	22 x 30	15	1.30	1.3	ELH277M250AQ2(1)
250	300	270	25 x 25	15	1.30	1.3	ELH277M250AR1(1)
250	300	330	22 x 30	15	1.50	1.6	ELH337M250AQ2(1)
250	300	330	25 x 25	15	1.50	1.6	ELH337M250AR1(1)
250	300	330	30 x 25	15	1.50	1.6	ELH337M250AS1(1)
250	300	390	22 x 35	15	1.65	1.9	ELH397M250AQ3(1)
250	300	390	25 x 35	15	1.65	1.9	ELH397M250AR3(1)
250	300	390	30 x 25	15	1.65	1.9	ELH397M250AS1(1)
250	300	470	22 x 40	15	1.85	2.3	ELH477M250AQ4(1)
250	300	470	25 x 35	15	1.85	2.3	ELH477M250AR3(1)
250	300	470	30 x 30	15	1.90	2.3	ELH477M250AS2(1)
250	300	470	35 x 25	15	1.90	2.3	ELH477M250AT1(1)
250	300	560	22 x 45	15	2.10	2.8	ELH567M250AQ5(1)
250	300	560	25 x 40	15	2.10	2.8	ELH567M250AR4(1)
250	300	560	30 x 30	15	2.10	2.8	ELH567M250AS2(1)
250	300	560	35 x 25	15	2.10	2.8	ELH567M250AT1(1)
250	300	680	25 x 45	15	2.45	3.0	ELH687M250AR5(1)
250	300	680	30 x 35	15	2.45	3.0	ELH687M250AS3(1)
250	300	680	35 x 25	15	2.45	3.0	ELH687M250AT1(1)
250	300	820	30 x 45	15	2.75	3.0	ELH827M250AS5(1)
250	300	820	35 x 30	15	2.75	3.0	ELH827M250AT2(1)
250	300	820	35 x 35	15	2.75	3.0	ELH827M250AT3(1)
250	300	1000	30 x 45	15	3.30	3.0	ELH108M250AS5(1)
250	300	1000	35 x 35	15	3.30	3.0	ELH108M250AT3(1)
250	300	1200	35 x 40	15	3.55	3.0	ELH128M250AT4(1)
250	300	1500	35 x 45	15	4.05	3.0	ELH158M250AT5(1)
350	400	68	22 x 20	15	0.55	0.5	ELH686M350AQ7(1)
350	400	82	22 x 25	15	0.65	0.6	ELH826M350AQ1(1)
350	400	82	25 x 20	15	0.65	0.6	ELH826M350AR7(1)
350	400	100	22 x 30	15	0.90	0.7	ELH107M350AQ2(1)
350	400	100	25 x 20	15	0.90	0.7	ELH107M350AR7(1)
VDC	**VDC Surge**	**Rated Capacitance**	**Case Size**	**DF**	**RC**	**LC**	**Part Number**

(1) Insert packaging code. See Ordering Options Table for available options.

** When capacitance exceeds 1,000 µF, the DF value (%) is increased by 2% for every additional 1,000 µF.*

Table 1 – Ratings & Part Number Reference cont'd

VDC	VDC Surge Voltage	Rated Capacitance 120 Hz 20°C (µF)	Case Size D x L (mm)	DF 120 Hz 20°C (tan δ %)*	RC 120 Hz 85°C (A)	LC 20°C 5 Minutes (mA)	Part Number
350	400	120	22 x 30	15	1.00	0.8	ELH127M350AQ2(1)
350	400	120	25 x 25	15	1.00	0.8	ELH127M350AR1(1)
350	400	150	22 x 35	15	1.15	1.0	ELH157M350AQ3(1)
350	400	150	25 x 30	15	1.15	1.0	ELH157M350AR2(1)
350	400	150	30 x 25	15	1.15	1.0	ELH157M350AS1(1)
350	400	180	22 x 40	15	1.30	1.3	ELH187M350AQ4(1)
350	400	180	25 x 30	15	1.25	1.3	ELH187M350AR2(1)
350	400	180	30 x 25	15	1.25	1.3	ELH187M350AS1(1)
350	400	220	22 x 45	15	1.45	1.5	ELH227M350AQ5(1)
350	400	220	25 x 35	15	1.45	1.5	ELH227M350AR3(1)
350	400	220	30 x 30	15	1.45	1.5	ELH227M350AS2(1)
350	400	220	35 x 25	15	1.45	1.5	ELH227M350AT1(1)
350	400	270	25 x 40	15	1.65	1.9	ELH277M350AR4(1)
350	400	270	30 x 35	15	1.65	1.9	ELH277M350AS3(1)
350	400	270	35 x 25	15	1.65	1.9	ELH277M350AT1(1)
350	400	330	25 x 50	15	1.80	2.3	ELH337M350AR6(1)
350	400	330	30 x 40	15	1.80	2.3	ELH337M350AS4(1)
350	400	330	35 x 30	15	1.80	2.3	ELH337M350AT2(1)
350	400	390	30 x 40	15	2.00	2.7	ELH397M350AS4(1)
350	400	390	35 x 30	15	2.00	2.7	ELH397M350AT2(1)
350	400	470	30 x 45	15	2.25	3.0	ELH477M350AS5(1)
350	400	470	35 x 35	15	2.25	3.0	ELH477M350AT3(1)
350	400	560	35 x 40	15	2.50	3.0	ELH567M350AT4(1)
350	400	680	35 x 45	15	2.90	3.0	ELH687M350AT5(1)
400	450	56	22 x 20	15	0.55	0.4	ELH556M400AQ7(1)
400	450	68	22 x 25	15	0.60	0.5	ELH686M400AQ1(1)
400	450	68	25 x 20	15	0.60	0.5	ELH686M400AR7(1)
400	450	82	22 x 25	15	0.80	0.6	ELH826M400AQ1(1)
400	450	82	25 x 20	15	0.80	0.6	ELH826M400AR7(1)
400	450	100	22 x 25	15	0.85	0.8	ELH107M400AQ1(1)
400	450	100	22 x 30	15	0.90	0.8	ELH107M400AQ2(1)
400	450	100	25 x 25	15	0.90	0.8	ELH107M400AR1(1)
400	450	120	22 x 30	15	0.95	1.0	ELH127M400AQ2(1)
400	450	120	22 x 35	15	1.05	1.0	ELH127M400AQ3(1)
400	450	120	25 x 25	15	1.05	1.0	ELH127M400AR1(1)
400	450	150	25 x 30	15	1.15	1.2	ELH157M400AR2(1)
400	450	150	30 x 25	15	1.15	1.2	ELH157M400AS1(1)
400	450	180	22 x 40	15	1.20	1.4	ELH187M400AQ4(1)
400	450	180	22 x 45	15	1.30	1.4	ELH187M400AQ5(1)
400	450	180	25 x 35	15	1.30	1.4	ELH187M400AR3(1)
400	450	180	30 x 30	15	1.35	1.4	ELH187M400AS2(1)
400	450	220	22 x 50	15	1.50	1.8	ELH227M400AQ6(1)
400	450	220	25 x 40	15	1.50	1.8	ELH227M400AR4(1)
400	450	220	30 x 30	15	1.50	1.8	ELH227M400AS2(1)
400	450	220	35 x 25	15	1.50	1.8	ELH227M400AT1(1)
400	450	270	22 x 50	15	1.60	2.2	ELH277M400AQ6(1)
400	450	270	25 x 40	15	1.65	2.2	ELH277M400AR4(1)
400	450	270	30 x 35	15	1.65	2.2	ELH277M400AS3(1)
400	450	270	35 x 30	15	1.65	2.2	ELH277M400AT2(1)
400	450	330	25 x 45	15	1.75	2.6	ELH337M400AR5(1)
400	450	330	25 x 50	15	1.90	2.6	ELH337M400AR6(1)
400	450	330	30 x 40	15	1.90	2.6	ELH337M400AS4(1)
400	450	330	35 x 30	15	1.85	2.6	ELH337M400AT2(1)
400	450	390	30 x 40	15	1.95	3.0	ELH397M400AS4(1)
400	450	390	30 x 45	15	2.15	3.0	ELH397M400AS5(1)
400	450	390	35 x 35	15	2.10	3.0	ELH397M400AT3(1)
400	450	470	30 x 45	15	2.20	3.0	ELH477M400AS5(1)
VDC	**VDC Surge**	**Rated Capacitance**	**Case Size**	**DF**	**RC**	**LC**	**Part Number**

(1) Insert packaging code. See Ordering Options Table for available options.

** When capacitance exceeds 1,000 µF, the DF value (%) is increased by 2% for every additional 1,000 µF.*

Table 1 – Ratings & Part Number Reference cont'd

VDC	VDC Surge Voltage	Rated Capacitance 120 Hz 20°C (µF)	Case Size D x L (mm)	DF 120 Hz 20°C (tan δ %)*	RC 120 Hz 85°C (A)	LC 20°C 5 Minutes (mA)	Part Number
400	450	470	30 x 50	15	2.40	3.0	ELH477M400AS6(1)
400	450	470	35 x 40	15	2.40	3.0	ELH477M400AT4(1)
400	450	560	30 x 50	15	2.45	3.0	ELH567M400AS6(1)
400	450	560	35 x 45	15	2.70	3.0	ELH567M400AT5(1)
400	450	680	35 x 50	15	2.90	3.0	ELH687M400AT6(1)
420	470	120	22 x 30	20	0.95	1.0	ELH127M420AQ2(1)
420	470	150	22 x 35	20	1.05	1.3	ELH157M420AQ3(1)
420	470	150	25 x 30	20	1.05	1.3	ELH157M420AR2(1)
420	470	150	30 x 25	20	1.05	1.3	ELH157M420AS1(1)
420	470	180	22 x 40	20	1.35	1.6	ELH187M420AQ4(1)
420	470	220	22 x 45	20	1.40	1.9	ELH227M420AQ5(1)
420	470	220	22 x 50	20	1.55	1.9	ELH227M420AQ6(1)
420	470	220	25 x 40	20	1.50	1.9	ELH227M420AR4(1)
420	470	220	25 x 45	20	1.60	1.9	ELH227M420AR5(1)
420	470	270	25 x 40	20	1.50	2.3	ELH277M420AR4(1)
420	470	270	30 x 40	20	1.60	2.3	ELH277M420AS4(1)
420	470	330	25 x 45	20	1.75	2.8	ELH337M420AR5(1)
420	470	330	25 x 50	20	1.85	2.8	ELH337M420AR6(1)
420	470	330	30 x 40	20	1.75	2.8	ELH337M420AS4(1)
420	470	330	30 x 45	20	1.90	2.8	ELH337M420AS5(1)
420	470	390	30 x 45	20	1.90	3.0	ELH397M420AS5(1)
420	470	470	30 x 45	20	2.10	3.0	ELH477M420AS5(1)
420	470	470	30 x 50	20	2.20	3.0	ELH477M420AS6(1)
420	470	560	30 x 50	20	2.30	3.0	ELH567M420AS6(1)
420	470	560	35 x 45	20	2.30	3.0	ELH567M420AT5(1)
450	500	47	22 x 25	20	0.50	0.4	ELH476M450AQ1(1)
450	500	56	22 x 25	20	0.65	0.5	ELH566M450AQ1(1)
450	500	68	22 x 25	20	0.67	0.6	ELH686M450AQ1(1)
450	500	68	22 x 30	20	0.70	0.6	ELH686M450AQ2(1)
450	500	68	25 x 25	20	0.70	0.6	ELH686M450AR1(1)
450	500	82	22 x 30	20	0.80	0.7	ELH826M450AQ2(1)
450	500	82	25 x 25	20	0.80	0.7	ELH826M450AR1(1)
450	500	100	22 x 30	20	0.85	0.9	ELH107M450AQ2(1)
450	500	100	22 x 35	20	0.95	0.9	ELH107M450AQ3(1)
450	500	100	25 x 30	20	0.95	0.9	ELH107M450AR2(1)
450	500	100	30 x 25	20	0.95	0.9	ELH107M450AS1(1)
450	500	120	22 x 30	20	0.95	1.1	ELH127M450AQ2(1)
450	500	120	22 x 40	20	1.05	1.1	ELH127M450AQ4(1)
450	500	120	25 x 30	20	1.05	1.1	ELH127M450AR2(1)
450	500	120	30 x 25	20	1.05	1.1	ELH127M450AS1(1)
450	500	150	22 x 35	20	1.05	1.3	ELH157M450AQ3(1)
450	500	150	22 x 45	20	1.20	1.3	ELH157M450AQ5(1)
450	500	150	25 x 35	20	1.20	1.3	ELH157M450AR3(1)
450	500	150	30 x 30	20	1.20	1.3	ELH157M450AS2(1)
450	500	180	25 x 40	20	1.35	1.6	ELH187M450AR4(1)
450	500	180	30 x 35	20	1.35	1.6	ELH187M450AS3(1)
450	500	180	35 x 25	20	1.35	1.6	ELH187M450AT1(1)
450	500	220	22 x 45	20	1.40	2.0	ELH227M450AQ5(1)
450	500	220	25 x 50	20	1.55	2.0	ELH227M450AR6(1)
450	500	220	30 x 40	20	1.55	2.0	ELH227M450AS4(1)
450	500	220	35 x 30	20	1.55	2.0	ELH227M450AT2(1)
450	500	270	25 x 50	20	1.55	2.4	ELH277M450AR6(1)
450	500	270	30 x 45	20	1.75	2.4	ELH277M450AS5(1)
450	500	270	35 x 35	20	1.70	2.4	ELH277M450AT3(1)
450	500	330	30 x 40	20	1.75	3.0	ELH337M450AS4(1)
450	500	330	30 x 50	20	2.00	3.0	ELH337M450AS6(1)
450	500	330	35 x 40	20	2.00	3.0	ELH337M450AT4(1)
VDC	**VDC Surge**	**Rated Capacitance**	**Case Size**	**DF**	**RC**	**LC**	**Part Number**

(1) Insert packaging code. See Ordering Options Table for available options.

** When capacitance exceeds 1,000 µF, the DF value (%) is increased by 2% for every additional 1,000 µF.*

Table 1 – Ratings & Part Number Reference cont'd

VDC	VDC Surge Voltage	Rated Capacitance 120 Hz 20°C (µF)	Case Size D x L (mm)	DF 120 Hz 20°C (tan δ %)*	RC 120 Hz 85°C (A)	LC 20°C 5 Minutes (mA)	Part Number
450	500	390	30 x 45	20	2.00	3.0	ELH397M450AS5(1)
450	500	390	35 x 45	20	2.25	3.0	ELH397M450AT5(1)
450	500	470	30 x 50	20	2.30	3.0	ELH477M450AS6(1)
450	500	470	35 x 50	20	2.50	3.0	ELH477M450AT6(1)
450	500	560	35 x 50	20	2.70	3.0	ELH567M450AT6(1)
450	500	680	35 x 60	20	2.90	3.0	ELH687M450AT8(1)
500	550	47	25 x 20	20	0.50	0.5	ELH476M500AR7(1)
500	550	100	22 x 40	20	1.00	1.0	ELH107M500AQ4(1)
500	550	100	30 x 25	20	0.90	1.0	ELH107M500AS1(1)
500	550	120	30 x 30	20	1.00	1.2	ELH127M500AS2(1)
500	550	120	35 x 25	20	1.00	1.2	ELH127M500AT1(1)
500	550	150	22 x 50	20	1.40	1.5	ELH157M500AQ6(1)
500	550	150	30 x 35	20	1.20	1.5	ELH157M500AT3(1)
500	550	180	30 x 40	20	1.40	1.8	ELH187M500AS4(1)
500	550	180	35 x 30	20	1.30	1.8	ELH187M500AT2(1)
500	550	220	30 x 45	20	1.60	2.2	ELH227M500AS5(1)
500	550	220	35 x 35	20	1.50	2.2	ELH227M500AT3(1)
500	550	270	30 x 50	20	1.80	2.7	ELH277M500AS6(1)
500	550	270	35 x 40	20	1.70	2.7	ELH277M500AT4(1)
500	550	330	35 x 45	20	2.00	3.0	ELH337M500AT5(1)
500	550	390	35 x 50	20	2.30	3.0	ELH397M500AT6(1)
VDC	**VDC Surge**	**Rated Capacitance**	**Case Size**	**DF**	**RC**	**LC**	**Part Number**

(1) Insert packaging code. See Ordering Options Table for available options.

** When capacitance exceeds 1,000 µF, the DF value (%) is increased by 2% for every additional 1,000 µF.*

Mounting Positions (Safety Vent)

In operation, electrolytic capacitors will always conduct a leakage current which causes electrolysis. The oxygen produced by electrolysis will regenerate the dielectric layer but, at the same time, the hydrogen released may cause the internal pressure of the capacitor to increase. The overpressure vent (safety vent) ensures that the gas can escape when the pressure reaches a certain value. All mounting positions must allow the safety vent to work properly.

Installing

- A general principle is that lower-use temperatures result in a longer, useful life of the capacitor. For this reason, it should be ensured that electrolytic capacitors are placed away from heat-emitting components. Adequate space should be allowed between components for cooling air to circulate, particularly when high ripple current loads are applied. In any case, the maximum category temperature must not be exceeded.
- Do not deform the case of capacitors or use capacitors with a deformed case.
- Verify that the connections of the capacitors are able to insert on the board without excessive mechanical force.
- If the capacitors require mounting through additional means, the recommended mounting accessories shall be used.
- Verify the correct polarization of the capacitor on the board.
- Verify that the space around the pressure relief device is according to the following guideline:

Case Diameter	Space Around Safety Vent
≤ 16 mm	> 2 mm
> 16 to ≤ 40 mm	> 3 mm
> 40 mm	> 5 mm

It is recommended that capacitors always be mounted with the safety device uppermost or in the upper part of the capacitor.

- If the capacitors are stored for a long time, the leakage current must be verified. If the leakage current is superior to the value listed in this catalog, the capacitors must be reformed. In this case, they can be reformed by application of the rated voltage through a series resistor approximately 1 kΩ for capacitors with V_R ≤ 160 V (5 W resistor) and 10 kΩ for the other rated voltages.
- In the case of capacitors connected in series, a suitable voltage sharing must be used.
  In the case of balancing resistors, the approximate resistance value can be calculated as: R = 60/C

KEMET recommends, nevertheless, to ensure that the voltage across each capacitor does not exceed its rated voltage.

Application and Operation Guidelines

Electrical Ratings:

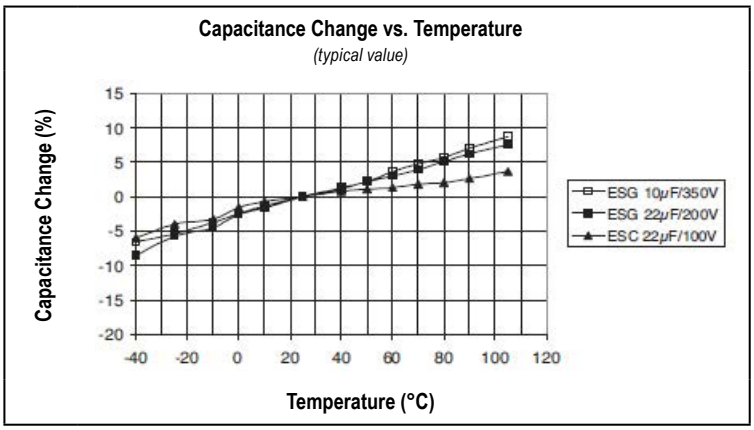
Capacitance (ESC)

Simplified equivalent circuit diagram of an electrolytic capacitor

The capacitive component of the equivalent series circuit (Equivalent Series Capacitance ESC) is determined by applying an alternate voltage of ≤ 0.5 V at a frequency of 120 or 100 Hz and 20°C (IEC 384-1, 384-4).

Temperature Dependence of the Capacitance

Capacitance of an electrolytic capacitor depends upon temperature: with decreasing temperature the viscosity of the electrolyte increases, thereby reducing its conductivity. Capacitance will decrease if temperature decreases. Furthermore, temperature drifts cause armature dilatation and, therefore, capacitance changes (up to 20% depending on the series considered, from 0 to 80°C). This phenomenon is more evident for electrolytic capacitors than for other types.

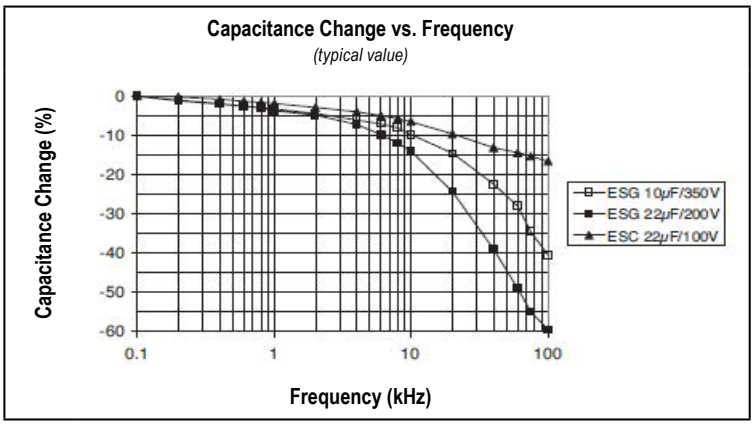


Frequency Dependence of the Capacitance

Effective capacitance value is derived from the impedance curve, as long as impedance is still in the range where the capacitance component is dominant.

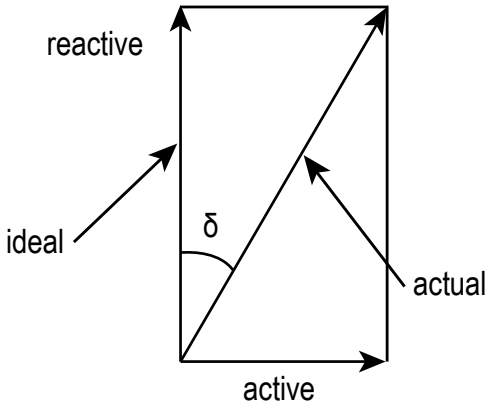
$$C = \frac{1}{2\pi fZ}$$

C = Capacitance (F)
f = Frequency (Hz)
Z = Impedance (Ω)



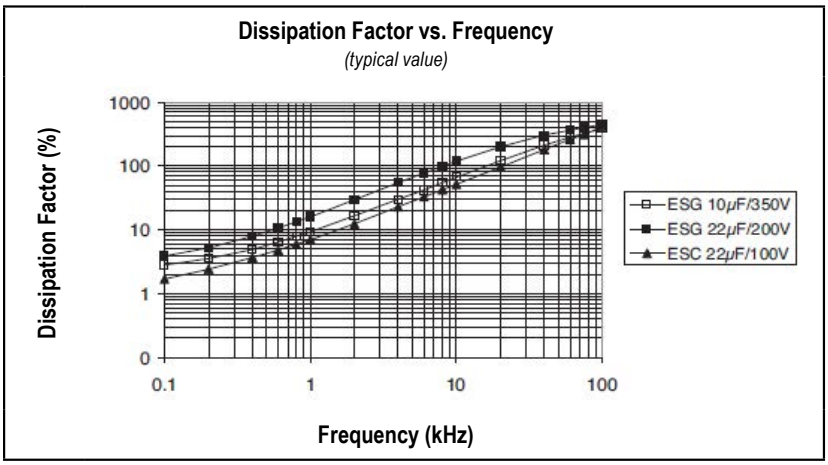
Dissipation Factor tan δ (DF)

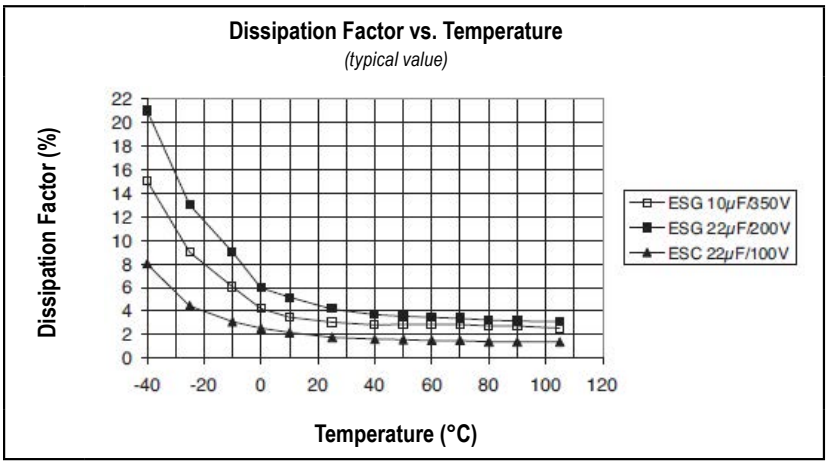
Dissipation Factor tan δ is the ratio between the active and reactive power for a sinusoidal waveform voltage. It can be thought of as a measurement of the gap between an actual and ideal capacitor.



Tan δ is measured with the same set-up used for the series capacitance ESC.
tan δ = ω x ESC x ESR where:

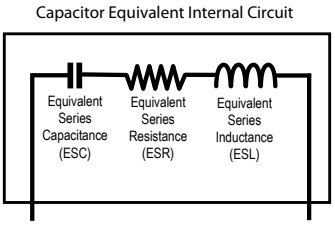
ESC = Equivalent Series Capacitance
ESR = Equivalent Series Resistance





Equivalent Series Inductance (ESL)

Equivalent Series Inductance or Self Inductance results from the terminal configuration and internal design of the capacitor.



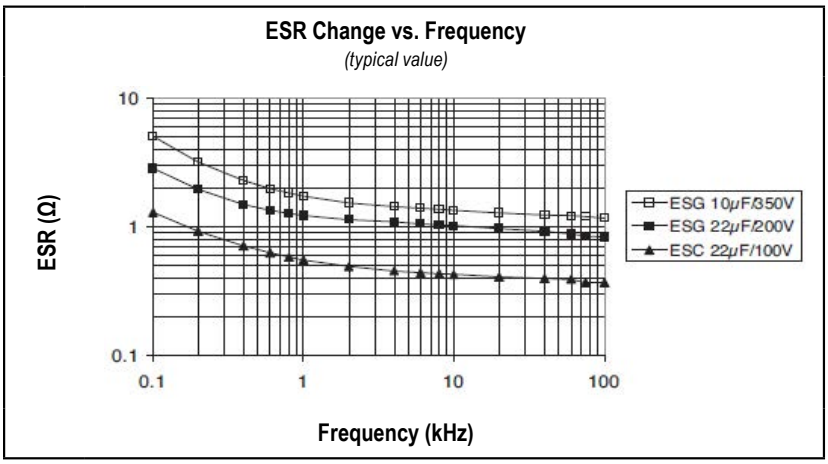
Equivalent Series Resistance (ESR)

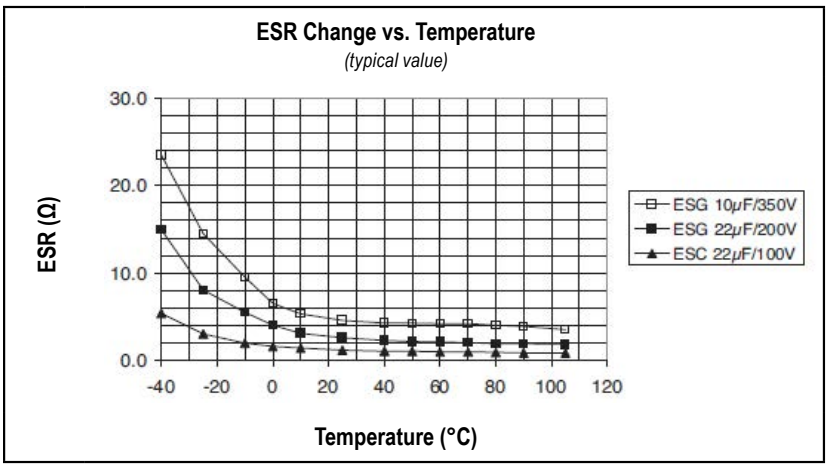
Equivalent Series Resistance is the resistive component of the equivalent series circuit. ESR value depends on frequency and temperature and is related to the tan δ by the following equation:

$$ESR = \frac{\tan \delta}{2\pi f\, ESC}$$

ESR = Equivalent Series Resistance (Ω)
tan δ = Dissipation Factor
ESC = Equivalent Series Capacitance (F)
f = Frequency (Hz)

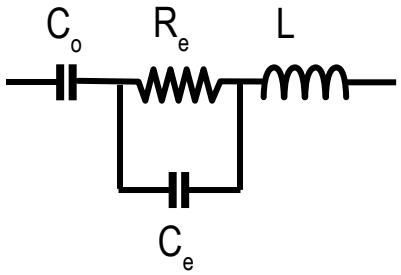
Tolerance limits of the rated capacitance must be taken into account when calculating this value.



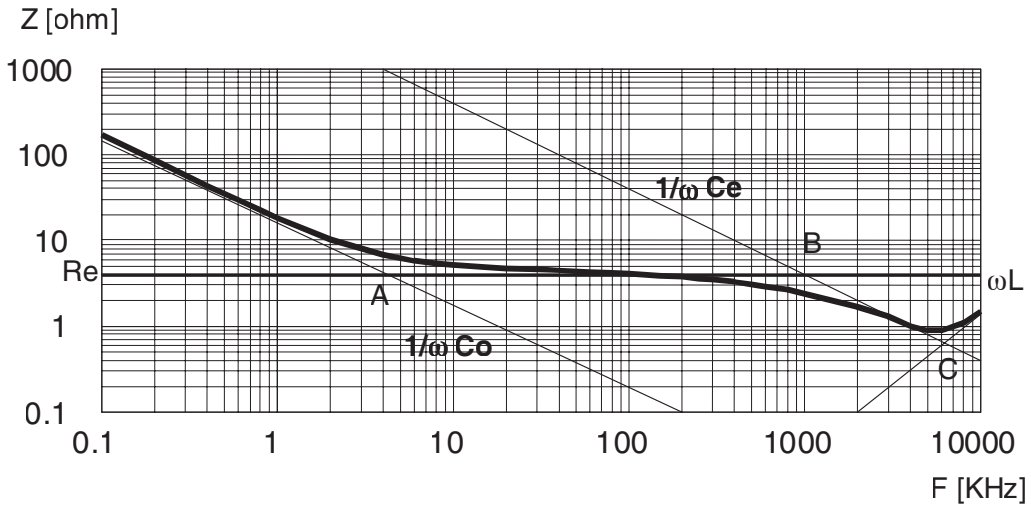


Impedance (Z)

Impedance of an electrolytic capacitor results from a circuit formed by the following individual equivalent series components:



C_o = Aluminum oxide capacitance (surface and thickness of the dielectric)
R_e = Resistance of electrolyte and paper mixture (other resistances not depending on the frequency are not considered: tabs, plates, etc.)
C_e = Electrolyte soaked paper capacitance
L = Inductive reactance of the capacitor winding and terminals
Impedance of an electrolytic capacitor is not a constant quantity that retains its value under all conditions; it changes depending on frequency and temperature.
Impedance as a function of frequency (sinusoidal waveform) for a certain temperature can be represented as follows:

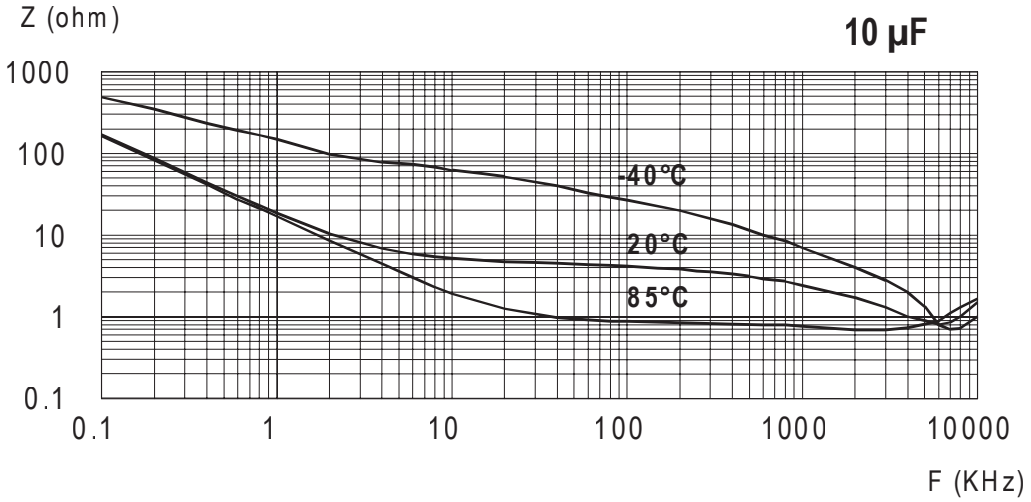


- Capacitive reactance predominates at low frequencies
- With increasing frequency, capacitive reactance Xc = $1/\omega C_o$ decreases until it reaches the order of magnitude of electrolyte resistance R_e(A)
- At even higher frequencies, resistance of the electrolyte predominates: $Z = R_e$ (A - B)
- When the capacitor's resonance frequency is reached (ω_0), capacitive and inductive reactance mutually cancel each other $1/\omega C_e = \omega L$, $\omega_0 = C\sqrt{1/LCe}$
- Above this frequency, inductive reactance of the winding and its terminals (XL = Z = ωL) becomes effective and leads to an increase in impedance

Generally speaking, it can be estimated that $C_e \approx 0.01\ C_o$.

Impedance (Z) cont'd

Impedance as a function of frequency (sinusoidal waveform) for different temperature values can be represented as follows (typical values):



R_e is the most temperature-dependent component of an electrolytic capacitor equivalent circuit. Electrolyte resistivity will decrease if temperature rises.

In order to obtain a low impedance value throughout the temperature range, R_e must be as little as possible. However, R_e values that are too low indicate a very aggressive electrolyte, resulting in a shorter life of the electrolytic capacitor at high temperatures. A compromise must be reached.

Leakage Current (LC)

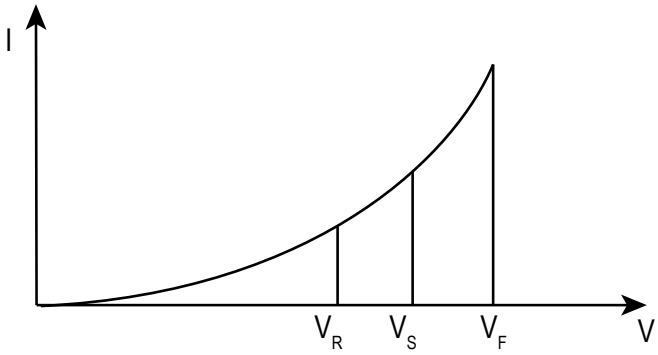
Due to the aluminum oxide layer that serves as a dielectric, a small current will continue to flow even after a DC voltage has been applied for long periods. This current is called leakage current.

A high leakage current flows after applying voltage to the capacitor then decreases in a few minutes, e.g., after prolonged storage without any applied voltage. In the course of continuous operation, the leakage current will decrease and reach an almost constant value.

After a voltage-free storage the oxide layer may deteriorate, especially at high temperature. Since there are no leakage currents to transport oxygen ions to the anode, the oxide layer is not regenerated. The result is that a higher than normal leakage current will flow when voltage is applied after prolonged storage.

Leakage Current (LC) cont'd

As the oxide layer is regenerated in use, the leakage current will gradually decrease to its normal level.
The relationship between the leakage current and voltage applied at constant temperature can be shown schematically as follows:



Where:
V_F = **Forming voltage**
If this level is exceeded, a large quantity of heat and gas will be generated and the capacitor could be damaged.
V_R = **Rated Voltage**
This level represents the top of the linear part of the curve.
V_S = **Surge voltage**
This lies between V_R and V_F. The capacitor can be subjected to V_S for short periods only.

Electrolytic capacitors are subjected to a reforming process before acceptance testing. The purpose of this preconditioning is to ensure that the same initial conditions are maintained when comparing different products.

Ripple Current (RC)

The maximum ripple current value depends on:
- Ambient temperature
- Surface area of the capacitor (heat dissipation area)

tan δ or ESR
- Frequency

The capacitor's life depends on the thermal stress.

Frequency Dependence of the Ripple Current

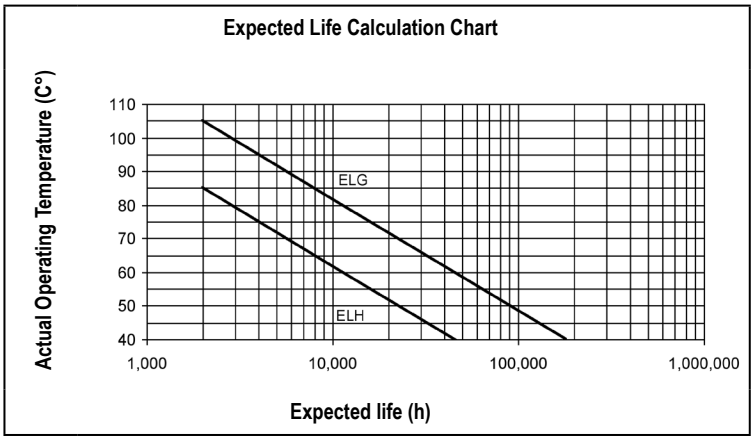
ESR and, thus, the tan δ depend on the frequency of the applied voltage. This indicates that the allowed ripple current is also a function of the frequency.

Temperature Dependence of the Ripple Current

The data sheet specifies maximum ripple current at the upper category temperature for each capacitor.

Expected Life Calculation

Expected life depends on operating temperature according to the following formula: $L = Lo \times 2^{(To-T)/10}$
Where:
L: Expected life
Lo: Load life at maximum permissible operating temperature
T: Actual operating temperature
To: Maximum permissible operating temperature
This formula is applicable between 40°C and To.

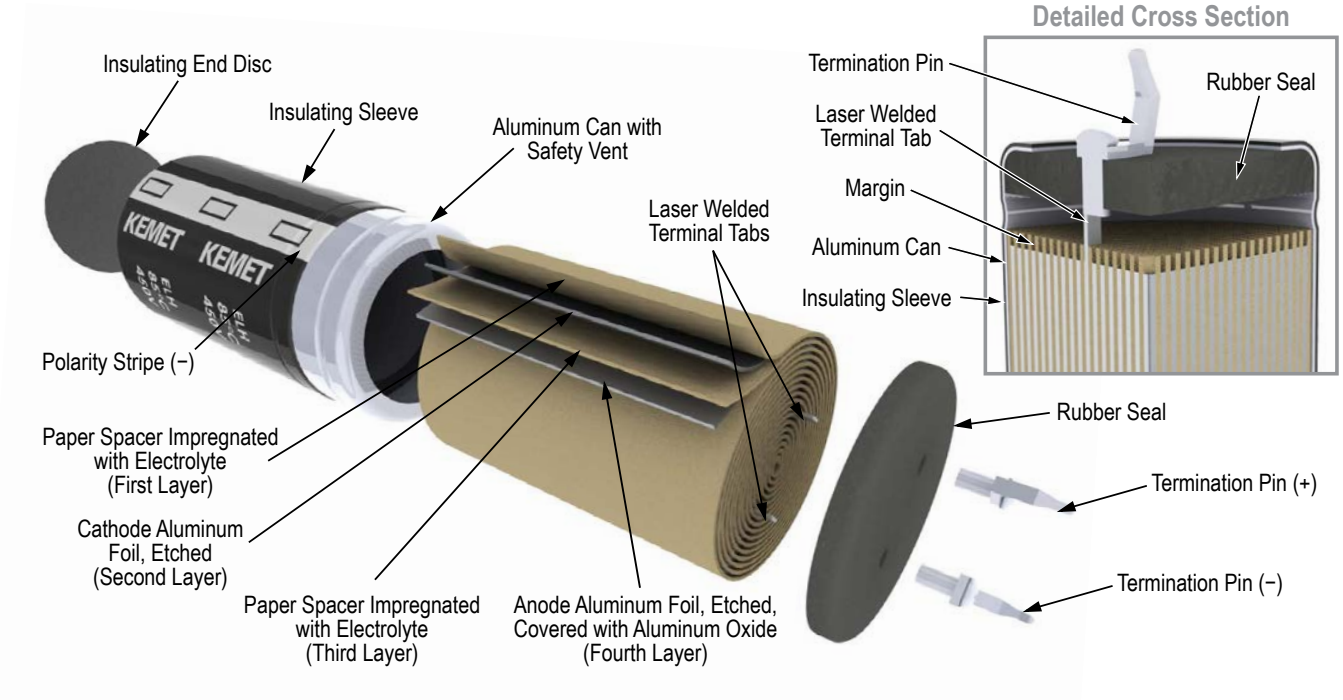


Packaging Quantities

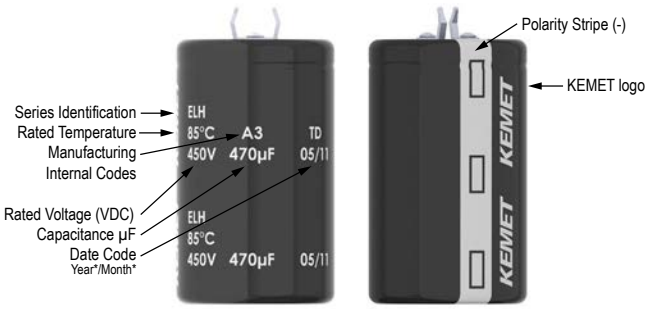
Size Code	Diameter (mm)	Length (mm)	Bulk Standard Leads
Q7	22	20	400
Q1	22	25	400
Q2	22	30	400
Q3	22	35	400
Q4	22	40	400
Q5	22	45	400
Q6	22	50	400
R7	25	20	200
R1	25	25	200
R2	25	30	200
R3	25	35	200
R4	25	40	200
R5	25	45	200
R6	25	50	200

Size Code	Diameter (mm)	Length (mm)	Bulk Standard Leads
S1	30	25	200
S2	30	30	200
S3	30	35	200
S4	30	40	200
S5	30	45	200
S6	30	50	200
S8	30	60	200
T1	35	25	200
T2	35	30	200
T3	35	35	200
T4	35	40	200
T5	35	45	200
T6	35	50	200
T8	35	60	200

Construction



Marking



*Y = Year

Code	01	02	03	04	05	06	07	08	09	9
Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2019

*M = Month

Code	01	02	03	04	05	06	07	08	09	10	11	12
Month	1	2	3	4	5	6	7	8	9	10	11	12

PEH532 Series, +105ºC

Overview

KEMET's PEH532 is a long-life electrolytic capacitor designed to offer high ripple current capability and low mounting cost. Low ESR is the result of a very low resistive paper/electrolyte system. Low ESR, together with the TDC thermal concept, gives the PEH532 a high ripple current capability.

Applications

Typical applications for KEMET's PEH532 capacitor include switch mode power supplies (SMPS), drives, welding equipment, uninterruptible power supplies (UPS), and other power electronic applications where high current ratings and compact size are important.

Benefits

- Snap-In
- 1,500 hours at +105°C (V_R, I_R applied)
- PCB mounting
- Low ESR and ESL
- High ripple current

Part Number System

PEH532	J	AC	433	0	M	2
Series	Rated Voltage (VDC)	Size Code	Capacitance Code (µF)	Version	Capacitance Tolerance	Termination
Snap-In type Aluminum Electrolytic	J = 35 M = 63 P = 100 R = 200 S = 250 U = 350 V = 400 Y = 450	See Dimension Table	The last two digits represent significant figures. The first digit indicates the total number digits.	0 = Standard	M = ±20%	See Termination Table

Performance Characteristics

Item	Performance Characteristics		
Capacitance Range	68 – 27,000 µF		
Rated Voltage	35 – 450 VDC		
Operating Temperature	-40 to +105°C		
Capacitance Tolerance	±20% at 100 Hz / +20°C		
Operational Lifetime	D (mm)	Rated Voltage and Ripple Current at +105°C (hours)	Rated Voltage at +105°C (hours)
	22 – 35	1,500	2,000
Shelf Life	4 years at +40°C 0 VDC		
Leakage Current	I = 0.003 CV (µA)		
	C = rated capacitance (µF), V = rated voltage (VDC). Voltage applied for 5 minutes at +20°C.		
Vibration Test Specifications	Procedure	Requirements	
	0.75 mm displacement amplitude or 10 g maximum acceleration. Vibration applied for three 2-hour sessions at 10 – 500 Hz (Capacitor clamped by body).	No leakage of electrolyte or other visible damage. Deviations in capacitance and tanδ from initial measurements must not exceed: Δ C/C < 5%	
Standards	IEC 60384-4 long life grade 40/85/56, in accordance with CECC 30 301–809		

Test Method & Performance

Endurance Life Test		
Conditions	Performance	
Temperature	+105°C	
Test Duration	2,000 hours	
Ripple Current	Maximum ripple current specified in table	
Voltage	The sum of DC voltage and the peak AC voltage must not exceed the rated voltage of the capacitor	
Performance	**The following specifications will be satisfied when the capacitor is tested at +20°C:**	
Capacitance Change	≤ 160 V	Within 15% of the initial value
	> 160 V	Within 10% of the initial value
Equivalent Series Resistance	Does not exceed 200% of the initial value	
Leakage Current	Does not exceed leakage current limit	

Dimensions – Millimeters

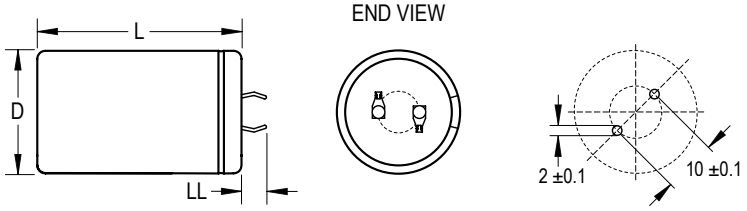
D X L	Size Code	Dimensions in mm		Approximate Weight Grams
		D1	L1	
		±0.5	±1.0	
22 x 25	AB	22.5	26	13
22 x 30	AC	22.5	31	14
22 x 35	AD	22.5	36	15
22 x 40	AE	22.5	41	17
22 x 45	AF	22.5	46	19
22 x 50	AG	22.5	51	21
25 x 25	BB	25.5	26	19
25 x 30	BC	25.5	31	21
25 x 35	BD	25.5	36	24
25 x 40	BE	25.5	41	27
25 x 45	BF	25.5	46	30
25 x 50	BG	25.5	51	33
30 x 25	CB	30.5	26	24
30 x 30	CC	30.5	31	29
30 x 35	CD	30.5	36	34
30 x 40	CE	30.5	41	39
30 x 45	CF	30.5	46	45
30 x 50	CG	30.5	51	51
35 x 25	DB	35.5	26	32
35 x 30	DC	35.5	31	40
35 x 35	DD	35.5	36	48
35 x 40	DE	35.5	41	56
35 x 45	DF	35.5	46	64
35 x 50	DG	35.5	51	72
35 x 55	DH	35.5	56	85
Note: Add 0.5 mm to D and 1 mm to L for Sleeving				

Termination Tables

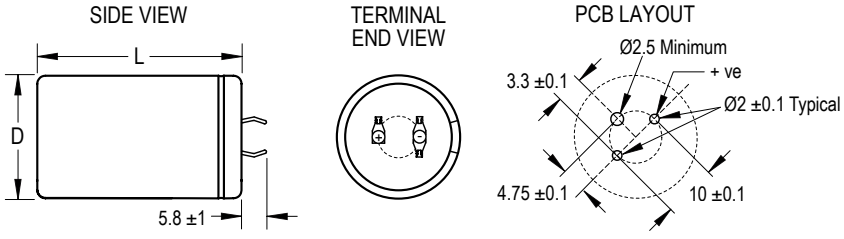
Termination Code / Diameter (mm)	2	2S	3	4	4S
22	•	•	•		
25	•	•	•		
30	•	•	•		
35	•	•	•	•	•
Mounting: These capacitors are designed to be mounted by their terminations alone and may be used in any position. Dummy pins on 4-pin decks must be isolated.					

Termination Code	Termination Style	LL ±1
Standard Termination Option		
2	2 Pin	6.3
Other Termination Options		
2S	2 Pin	4
3	3 Pin	4
4	4 Pin	6.3
4S	4 Pin	4
Dimensions in mm		

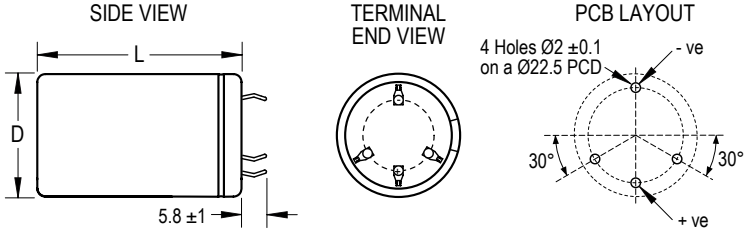
Style 2/2S



Style 3



Style 4/4S



Shelf Life

The capacitance, ESR and impedance of a capacitor will not change significantly after extended storage periods, however the leakage current will very slowly increase. KEMET products are particularly stable and allow a shelf life in excess of three years at 40°C. See sectional specification under each product series for specific data.

Re-age (Reforming) Procedure

Apply the rated voltage to the capacitor at room temperature for a period of one hour, or until the leakage current has fallen to a steady value below the specified limit. During re-aging a maximum charging current of twice the specified leakage current or 5 mA (whichever is greater) is suggested.

Reliability

The reliability of a component can be defined as the probability that it will perform satisfactorily under a given set of conditions for a given length of time.

In practice, it is impossible to predict with absolute certainty how any individual component will perform; thus, we must utilize probability theory. It is also necessary to clearly define the level of stress involved (e.g. operating voltage, ripple current, temperature and time). Finally, the meaning of satisfactory performance must be defined by specifying a set of conditions which determine the end of life of the component.

Reliability as a function of time, R(t), is normally expressed as: $R(t)=e^{-\lambda t}$
where R(t) is the probability that the component will perform satisfactorily for time t, and λ is the failure rate.

Failure Rate

The failure rate is the number of components failing per unit time. The failure rate of most electronic components follows the characteristic pattern:

- Early failures are removed during the manufacturing process.
- The operational life is characterized by a constant failure rate.
- The wear out period is characterized by a rapidly increasing failure rate.

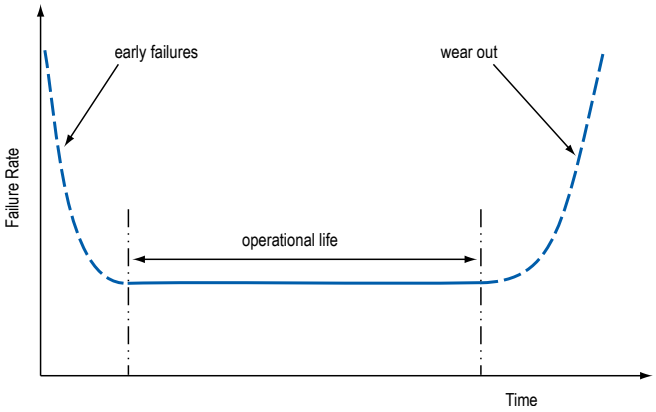
The failures in time (FIT) are given with a 60% confidence level for the various type codes. By convention, FIT is expressed as 1×10^{-9} failures per hour. Failure rate is also expressed as a percentage of failures per 1,000 hours.
e.g., 100 FIT = 1×10^{-7} failures per hour = 0.01%/1,000 hours

End of Life Definition
Catastrophic Failure: short circuit, open circuit or safety vent operation
Parametric Failure:

- Change in capacitance > ±10%
- Leakage current > specified limit
- ESR > 2 x initial ESR value

MTBF

The mean time between failures (MTBF) is simply the inverse of the failure rate.
MTBF= 1/λ



The failure rate is derived from our periodic test results. The failure rate (λ_R) is, therefore, only given at test temperature for life tests. An estimation is also given at 40°C. The expected failure rate for this capacitor range is based on our periodic test results for capacitors with structural similarity. Failure rate is frequently quoted in FIT (Failures In Time) where 1 FIT = 1 x 10^{-9} failures per hour. Failure rate per hour includes both catastrophic and parametric failures.

Environmental Compliance

As an environmentally conscious company, KEMET is working continuously with improvements concerning the environmental effects of both our capacitors and their production. 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, such as lead (Pb), in electronic equipment. All products in this catalog are produced to help our customers' obligations to guarantee their products and 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 such as 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 such as LF = Lead Free or LFW = Lead Free Wires on the label.

Table 1 – Ratings & Part Number Reference

VDC	Rated Capacitance	Size Code	Case Size	Ripple Current Maximum		ESR Maximum		Part Number
	100 Hz 20°C (µF)		D x L (mm)	100 Hz 105°C (A)	20 kHz 40°C (A)	100 Hz 20°C (mΩ)	100 kHz 20°C (mΩ)	
35	3300	AC	22 x 30	1.9	5.1	110	93	PEH532JAC4330M(1)
35	3900	AC	22 x 30	2.0	5.4	97	83	PEH532JAC4390M(1)
35	4700	AD	22 x 35	2.3	6.2	80	67	PEH532JAD4470M(1)
35	4700	BC	25 x 30	2.1	5.8	86	74	PEH532JBC4470M(1)
35	5600	AE	22 x 40	2.6	7.1	67	56	PEH532JAE4560M(1)
35	5600	BC	25 x 30	2.2	5.9	78	68	PEH532JBC4560M(1)
35	6800	AE	22 x 40	2.8	7.5	58	50	PEH532JAE4680M(1)
35	6800	BD	25 x 35	2.6	7.0	63	54	PEH532JBD4680M(1)
35	6800	CC	30 x 30	3.1	8.4	54	46	PEH532JCC4680M(1)
35	8200	AG	22 x 50	3.3	8.8	47	40	PEH532JAG4820M(1)
35	8200	BE	25 x 40	2.9	8.0	52	45	PEH532JBE4820M(1)
35	8200	CC	30 x 30	3.3	8.8	47	40	PEH532JCC4820M(1)
35	10000	BF	25 x 45	3.3	9.0	43	38	PEH532JBF5100M(1)
35	10000	CD	30 x 35	3.8	10.3	38	32	PEH532JCD5100M(1)
35	10000	DC	35 x 30	3.6	9.6	42	36	PEH532JDC5100M(1)
35	12000	BG	25 x 50	3.6	9.9	37	32	PEH532JBG5120M(1)
35	12000	CE	30 x 40	4.4	11.7	32	27	PEH532JCE5120M(1)
35	12000	DC	35 x 30	3.6	9.7	38	33	PEH532JDC5120M(1)
35	15000	CF	30 x 45	5.0	13.3	26	22	PEH532JCF5150M(1)
35	15000	DD	35 x 35	4.2	11.5	30	26	PEH532JDD5150M(1)
35	18000	DE	35 x 40	4.9	13.2	25	22	PEH532JDE5180M(1)
35	22000	DF	35 x 45	5.4	14.8	21	18	PEH532JDF5220M(1)
35	27000	DG	35 x 50	5.9	16.3	18	16	PEH532JDG5270M(1)
63	1200	AB	22 x 25	1.3	3.7	160	120	PEH532MAB4120M(1)
63	1500	AC	22 x 30	1.6	4.4	120	90	PEH532MAC4150M(1)
63	1800	AC	22 x 30	1.7	4.7	110	79	PEH532MAC4180M(1)
63	2200	AD	22 x 35	2.0	5.5	88	64	PEH532MAD4220M(1)
63	2200	BC	25 x 30	1.9	5.2	95	71	PEH532MBC4220M(1)
63	2700	AE	22 x 40	2.3	6.3	72	52	PEH532MAE4270M(1)
63	2700	BD	25 x 35	2.2	6.1	76	56	PEH532MBD4270M(1)
63	3300	AG	22 x 50	2.7	7.4	58	42	PEH532MAG4330M(1)
63	3300	BE	25 x 40	2.5	7.0	62	46	PEH532MBE4330M(1)
63	3300	CC	30 x 30	2.7	7.4	58	42	PEH532MCC4330M(1)
63	3900	BF	25 x 45	2.8	7.8	53	40	PEH532MBF4390M(1)
63	3900	CD	30 x 35	3.1	8.5	48	35	PEH532MCD4390M(1)
63	4700	BG	25 x 50	3.1	8.7	45	34	PEH532MBG4470M(1)
63	4700	CE	30 x 40	3.6	9.7	40	29	PEH532MCE4470M(1)
63	4700	DC	35 x 30	3.1	8.5	46	34	PEH532MDC4470M(1)
63	5600	CE	30 x 40	3.8	10.3	35	26	PEH532MCE4560M(1)
63	5600	DD	35 x 35	3.7	10.1	37	28	PEH532MDD4560M(1)
63	6800	CF	30 x 45	4.3	11.7	29	22	PEH532MCF4680M(1)
63	6800	DE	35 x 40	4.2	11.5	31	23	PEH532MDE4680M(1)
63	8200	DF	35 x 45	4.7	13.0	26	19	PEH532MDF4820M(1)
63	10000	DG	35 x 50	5.2	14.4	22	17	PEH532MDG5100M(1)
100	560	AB	22 x 25	1.0	2.6	380	290	PEH532PAB3560M(1)
100	680	AC	22 x 30	1.1	3.1	300	240	PEH532PAC3680M(1)
100	680	BB	25 x 25	1.1	2.9	320	250	PEH532PBB3680M(1)
100	820	AD	22 x 35	1.3	3.5	250	190	PEH532PAD3820M(1)
100	820	BC	25 x 30	1.3	3.5	260	200	PEH532PBC3820M(1)
100	1000	AE	22 x 40	1.5	4.0	210	160	PEH532PAE4100M(1)
100	1000	BC	25 x 30	1.4	3.8	220	170	PEH532PBC4100M(1)
100	1200	AE	22 x 40	1.6	4.4	170	140	PEH532PAE4120M(1)
100	1200	BD	25 x 35	1.6	4.4	180	140	PEH532PBD4120M(1)
100	1500	AF	22 x 45	1.9	5.0	140	110	PEH532PAF4150M(1)
100	1500	BE	25 x 40	1.9	5.0	140	110	PEH532PBE4150M(1)
100	1800	BF	25 x 45	2.1	5.7	120	95	PEH532PBF4180M(1)
100	1800	CD	30 x 35	2.2	6.0	120	90	PEH532PCD4180M(1)
100	2200	BG	25 x 50	2.4	6.4	99	78	PEH532PBG4220M(1)
100	2200	CE	30 x 40	2.6	6.9	95	73	PEH532PCE4220M(1)
100	2200	DC	35 x 30	2.4	6.4	100	79	PEH532PDC4220M(1)
VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR		Part Number

(1) Termination code: See Termination Tables for available options.

Table 1 – Ratings & Part Number Reference cont'd

VDC	Rated Capacitance	Size Code	Case Size	Ripple Current Maximum		ESR Maximum		Part Number
	100 Hz 20°C (µF)		D x L (mm)	100 Hz 105°C (A)	20 kHz 40°C (A)	100 Hz 20°C (mΩ)	100 kHz 20°C (mΩ)	
100	2700	CF	30 x 45	2.9	7.8	78	60	PEH532PCF4270M(1)
100	2700	DD	35 x 35	2.8	7.5	81	64	PEH532PDD4270M(1)
100	3300	CG	30 x 50	3.3	8.9	64	50	PEH532PCG4330M(1)
100	3300	DE	35 x 40	3.2	8.6	66	52	PEH532PDE4330M(1)
100	3900	DF	35 x 45	3.6	9.7	56	44	PEH532PDF4390M(1)
100	4700	DG	35 x 50	4.0	10.9	47	37	PEH532PDG4470M(1)
200	270	AC	22 x 30	0.8	2.1	510	270	PEH532RAC3270M(1)
200	270	BB	25 x 25	0.8	2.1	530	290	PEH532RBB3270M(1)
200	330	AD	22 x 35	0.9	2.5	420	220	PEH532RAD3330M(1)
200	330	BC	25 x 30	0.9	2.5	420	230	PEH532RBC3330M(1)
200	390	AD	22 x 35	1.0	2.7	360	190	PEH532RAD3390M(1)
200	390	BC	25 x 30	1.0	2.7	370	200	PEH532RBC3390M(1)
200	470	AE	22 x 40	1.1	3.1	300	160	PEH532RAE3470M(1)
200	470	BD	25 x 35	1.1	3.1	300	170	PEH532RBD3470M(1)
200	470	CC	30 x 30	1.2	3.3	290	160	PEH532RCC3470M(1)
200	560	AF	22 x 45	1.2	3.5	250	140	PEH532RAF3560M(1)
200	560	BE	25 x 40	1.2	3.5	250	140	PEH532RBE3560M(1)
200	680	AG	22 x 50	1.4	3.9	210	110	PEH532RAG3680M(1)
200	680	BF	25 x 45	1.4	4.0	210	110	PEH532RBF3680M(1)
200	680	CD	30 x 35	1.5	4.1	200	110	PEH532RCD3680M(1)
200	820	BG	25 x 50	1.6	4.5	170	96	PEH532RBG3820M(1)
200	820	CD	30 x 35	1.6	4.5	170	93	PEH532RCD3820M(1)
200	1000	CE	30 x 40	1.8	5.2	140	76	PEH532RCE4100M(1)
200	1000	DD	35 x 35	1.9	5.2	140	79	PEH532RDD4100M(1)
200	1200	CF	30 x 45	2.1	5.8	120	64	PEH532RCF4120M(1)
200	1200	DE	35 x 40	2.1	6.0	120	66	PEH532RDE4120M(1)
200	1500	DF	35 x 45	2.5	6.9	96	53	PEH532RDF4150M(1)
200	1800	DG	35 x 50	2.8	7.7	81	45	PEH532RDG4180M(1)
200	2200	DH	35 x 55	3.1	8.7	67	38	PEH532RDH4220M(1)
250	220	AC	22 x 30	0.7	2.1	520	260	PEH532SAC3220M(1)
250	220	BB	25 x 25	0.7	2.0	540	270	PEH532SBB3220M(1)
250	270	AD	22 x 35	0.9	2.4	420	210	PEH532SAD3270M(1)
250	270	BC	25 x 30	0.9	2.4	430	220	PEH532SBC3270M(1)
250	330	AE	22 x 40	1.0	2.7	350	170	PEH532SAE3330M(1)
250	330	BC	25 x 30	0.9	2.6	360	180	PEH532SBC3330M(1)
250	330	CB	30 x 25	1.0	2.7	350	170	PEH532SCB3330M(1)
250	390	AF	22 x 45	1.1	3.1	290	140	PEH532SAF3390M(1)
250	390	BD	25 x 35	1.1	3.0	300	150	PEH532SBD3390M(1)
250	470	AG	22 x 50	1.2	3.5	250	120	PEH532SAG3470M(1)
250	470	BE	25 x 40	1.2	3.4	250	130	PEH532SBE3470M(1)
250	470	CC	30 x 30	1.2	3.4	250	120	PEH532SCC3470M(1)
250	560	AG	22 x 50	1.3	3.8	210	110	PEH532SAG3560M(1)
250	560	BF	25 x 45	1.4	3.8	210	110	PEH532SBF3560M(1)
250	680	BG	25 x 50	1.5	4.3	180	90	PEH532SBG3680M(1)
250	680	CE	30 x 40	1.6	4.5	170	84	PEH532SCE3680M(1)
250	680	DC	35 x 30	1.5	4.3	180	91	PEH532SDC3680M(1)
250	820	CF	30 x 45	1.8	5.1	140	70	PEH532SCF3820M(1)
250	820	DD	35 x 35	1.8	5.0	150	75	PEH532SDD3820M(1)
250	1000	CG	30 x 50	2.1	5.8	120	58	PEH532SCG4100M(1)
250	1000	DE	35 x 40	2.1	5.8	120	61	PEH532SDE4100M(1)
250	1200	DF	35 x 45	2.3	6.5	100	51	PEH532SDF4120M(1)
250	1500	DG	35 x 50	2.7	7.5	81	42	PEH532SDG4150M(1)
350	82	AB	22 x 25	0.5	1.3	1600	980	PEH532UAB2820M(1)
350	100	AC	22 x 30	0.5	1.5	1300	800	PEH532UAC3100M(1)
350	150	AD	22 x 35	0.7	1.9	860	540	PEH532UAD3150M(1)
350	150	BC	25 x 30	0.7	1.9	870	550	PEH532UBC3150M(1)
350	180	AE	22 x 40	0.8	2.2	720	450	PEH532UAE3180M(1)
350	220	AF	22 x 45	0.9	2.5	590	370	PEH532UAF3220M(1)
350	220	BD	25 x 35	0.9	2.4	600	380	PEH532UBD3220M(1)
350	220	CC	30 x 30	0.9	2.5	590	370	PEH532UCC3220M(1)
VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR		Part Number

(1) Termination code: See Termination Tables for available options.

Table 1 – Ratings & Part Number Reference cont'd

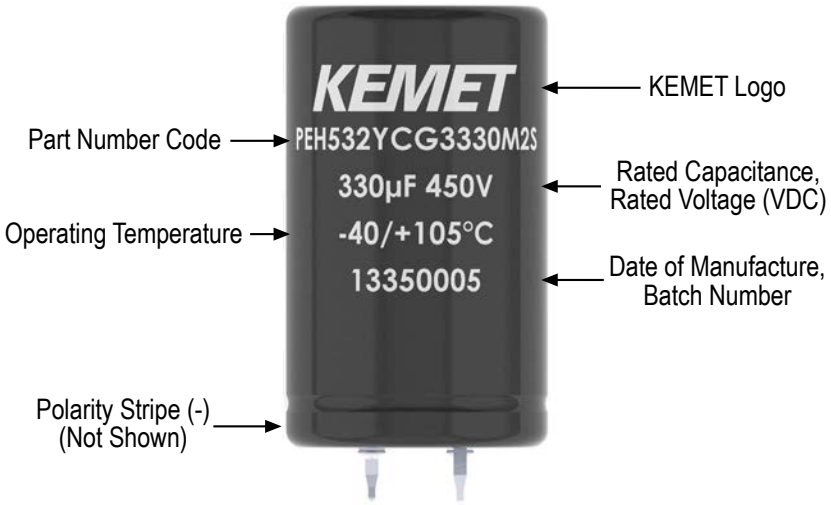
VDC	Rated Capacitance	Size Code	Case Size	Ripple Current Maximum		ESR Maximum		Part Number
	100 Hz 20°C (µF)		D x L (mm)	100 Hz 105°C (A)	20 kHz 40°C (A)	100 Hz 20°C (mΩ)	100 kHz 20°C (mΩ)	
350	270	AG	22 x 50	1.0	2.8	480	300	PEH532UAG3270M(1)
350	270	BE	25 x 40	1.0	2.8	490	310	PEH532UBE3270M(1)
350	330	BG	25 x 50	1.2	3.2	400	250	PEH532UBG3330M(1)
350	330	CE	30 x 40	1.2	3.4	390	250	PEH532UCE3330M(1)
350	330	DC	35 x 30	1.2	3.3	400	250	PEH532UDC3330M(1)
350	390	BG	25 x 50	1.3	3.5	340	220	PEH532UBG3390M(1)
350	390	CE	30 x 40	1.3	3.7	330	210	PEH532UCE3390M(1)
350	470	CF	30 x 45	1.5	4.2	280	180	PEH532UCF3470M(1)
350	470	DD	35 x 35	1.5	4.1	280	180	PEH532UDD3470M(1)
350	560	CG	30 x 50	1.7	4.7	230	150	PEH532UCG3560M(1)
350	560	DE	35 x 40	1.7	4.7	240	150	PEH532UDE3560M(1)
350	680	DF	35 x 45	1.9	5.3	190	120	PEH532UDF3680M(1)
400	82	AC	22 x 30	0.5	1.4	1300	810	PEH532VAC2820M(1)
400	100	AC	22 x 30	0.6	1.6	1100	670	PEH532VAC3100M(1)
400	100	BB	25 x 25	0.6	1.6	1100	690	PEH532VBB3100M(1)
400	120	AD	22 x 35	0.6	1.8	920	560	PEH532VAD3120M(1)
400	120	BC	25 x 30	0.7	1.8	930	570	PEH532VBC3120M(1)
400	120	CB	30 x 25	0.7	1.9	920	560	PEH532VCB3120M(1)
400	150	AE	22 x 40	0.8	2.1	740	450	PEH532VAE3150M(1)
400	150	BD	25 x 35	0.8	2.1	740	450	PEH532VBD3150M(1)
400	150	CB	30 x 25	0.8	2.1	740	460	PEH532VCB3150M(1)
400	180	AF	22 x 45	0.8	2.4	620	380	PEH532VAF3180M(1)
400	180	CC	30 x 30	0.9	2.4	620	380	PEH532VCC3180M(1)
400	220	AG	22 x 50	1.0	2.7	510	310	PEH532VAG3220M(1)
400	220	BE	25 x 40	1.0	2.7	510	320	PEH532VBE3220M(1)
400	220	CD	30 x 35	1.0	2.8	500	310	PEH532VCD3220M(1)
400	220	DB	35 x 25	1.0	2.7	510	320	PEH532VDB3220M(1)
400	270	BF	25 x 45	1.1	3.0	420	260	PEH532VBF3270M(1)
400	270	CD	30 x 35	1.1	3.1	410	250	PEH532VCD3270M(1)
400	330	CE	30 x 40	1.3	3.6	340	210	PEH532VCE3330M(1)
400	330	DD	35 x 35	1.3	3.7	340	210	PEH532VDD3330M(1)
400	390	CG	30 x 50	1.5	4.1	280	170	PEH532VCG3390M(1)
400	390	DE	35 x 40	1.5	4.1	290	180	PEH532VDE3390M(1)
400	470	DF	35 x 45	1.7	4.7	240	150	PEH532VDF3470M(1)
400	560	DG	35 x 50	1.9	5.3	200	120	PEH532VDG3560M(1)
450	68	AC	22 x 30	0.5	1.4	1300	790	PEH532YAC2680M(1)
450	68	BB	25 x 25	0.5	1.4	1400	800	PEH532YBB2680M(1)
450	82	AC	22 x 30	0.6	1.5	1100	670	PEH532YAC2820M(1)
450	82	BB	25 x 25	0.6	1.5	1100	680	PEH532YBB2820M(1)
450	100	AD	22 x 35	0.6	1.8	910	540	PEH532YAD3100M(1)
450	100	BC	25 x 30	0.6	1.8	920	540	PEH532YBC3100M(1)
450	120	AE	22 x 40	0.7	2.0	760	450	PEH532YAE3120M(1)
450	120	BC	25 x 30	0.7	1.9	780	470	PEH532YBC3120M(1)
450	120	CB	30 x 25	0.7	2.0	770	460	PEH532YCB3120M(1)
450	150	AF	22 x 45	0.8	2.3	620	370	PEH532YAF3150M(1)
450	150	BD	25 x 35	0.8	2.3	620	370	PEH532YBD3150M(1)
450	150	CC	30 x 30	0.9	2.4	620	360	PEH532YCC3150M(1)
450	180	AG	22 x 50	0.9	2.6	520	310	PEH532YAG3180M(1)
450	180	BE	25 x 40	0.9	2.6	520	310	PEH532YBE3180M(1)
450	180	CC	30 x 30	0.9	2.6	520	310	PEH532YCC3180M(1)
450	220	BF	25 x 45	1.1	3.0	430	260	PEH532YBF3220M(1)
450	220	CD	30 x 35	1.1	3.0	420	250	PEH532YCD3220M(1)
450	220	DC	35 x 30	1.1	3.1	420	250	PEH532YDC3220M(1)
450	270	CE	30 x 40	1.3	3.5	340	200	PEH532YCE3270M(1)
450	270	DD	35 x 35	1.3	3.6	350	210	PEH532YDD3270M(1)
450	330	CG	30 x 50	1.5	4.1	280	160	PEH532YCG3330M(1)
450	330	DE	35 x 40	1.5	4.1	280	170	PEH532YDE3330M(1)
450	390	DE	35 x 40	1.6	4.5	240	140	PEH532YDE3390M(1)
450	470	DG	35 x 50	1.9	5.2	200	120	PEH532YDG3470M(1)
VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR		Part Number

(1) Termination code: See Termination Tables for available options.

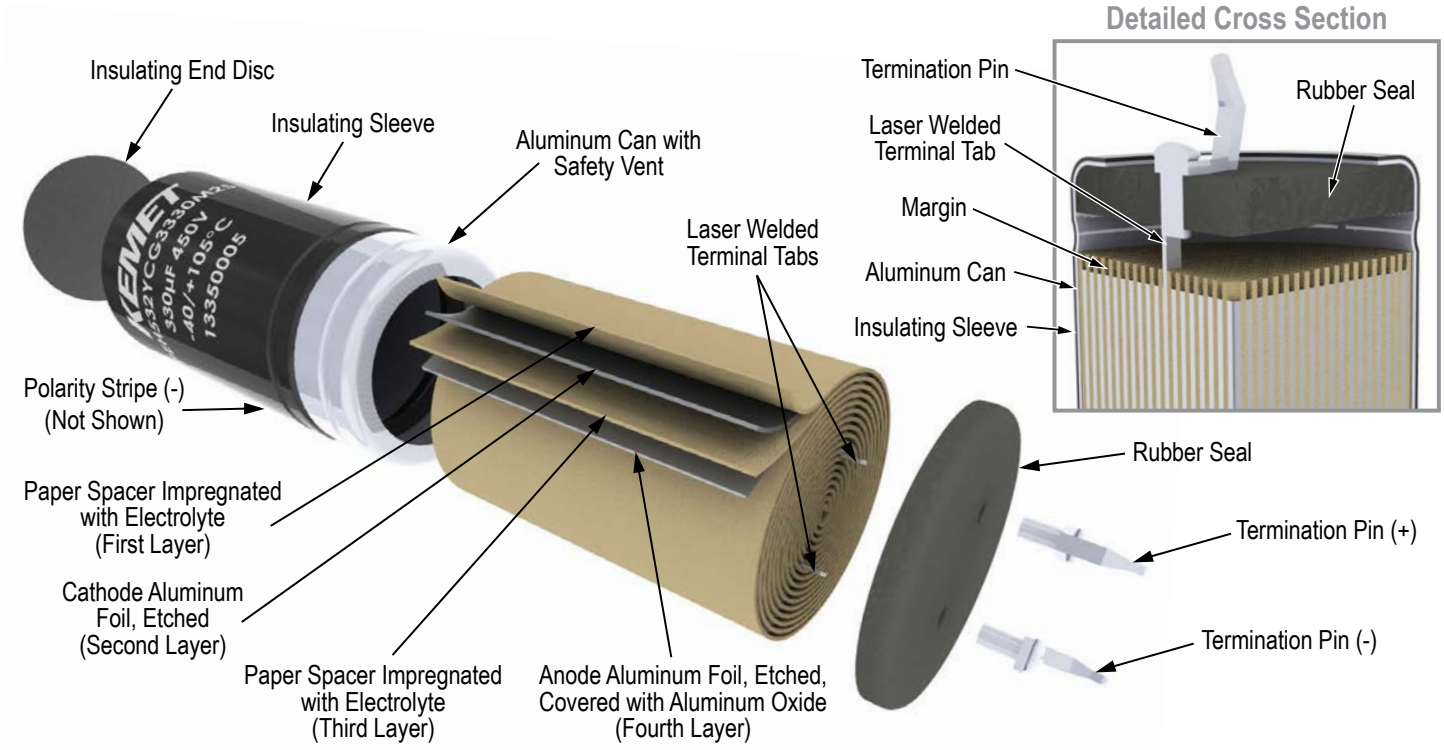
Mechanical Data

The capacitor may be mounted in any position. PEH532 is supplied with an insulation sleeve. Voltage proof of the insulation sleeve = 2.5 kVDC (1 minute). The minus pole is marked on the case surface. UL recognized sleeving is available for custom parts in this range, upon request. (UL No. E358957)

Marking



Construction



PEH534 Series, +105ºC

Overview

KEMET's PEH534 is a long-life electrolytic capacitor designed to offer high ripple current capability and low mounting cost. Low ESR is the result of a very low resistive paper/electrolyte system. Low ESR, together with the TDC thermal concept, gives the PEH534 a high ripple current capability.

Applications

Typical applications for KEMET's PEH534 capacitor include switch mode power supplies (SMPS), drives, welding equipment, uninterruptible power supplies (UPS), and other power electronic applications where high current ratings and compact size are important.

Benefits

- Snap-In
- 3,000 hours at +105°C (V_R, I_R applied)
- PCB mounting
- Low ESR and ESL
- High ripple current

Part Number System

PEH534	J	BC	456	0	M	2
Series	Rated Voltage (VDC)	Size Code	Capacitance Code (µF)	Version	Capacitance Tolerance	Termination
Snap-In type Aluminum Electrolytic	J = 35 M = 63 P = 100 R = 200 S = 250 U = 350 V = 400 Y = 450	See Dimension Table	The last two digits represent significant figures. The first digit indicates the total number digits.	0 = Standard	M = ±20%	See Termination Table

Performance Characteristics

Item	Performance Characteristics		
Capacitance Range	150 – 22,000 µF		
Rated Voltage	35 – 450 VDC		
Operating Temperature	-40 to +105°C		
Capacitance Tolerance	±20% at 100 Hz / +20°C		
Operational Lifetime	D (mm)	Rated Voltage and Ripple Current at +105°C (hours)	Rated Voltage at +105°C (hours)
	22 – 40	3,000	4,000
Shelf Life	4 years at +40°C 0 VDC		
Leakage Current	I = 0.003 CV (µA)		
	C = rated capacitance (µF), V = rated voltage (VDC). Voltage applied for 5 minutes at +20°C.		
Vibration Test Specifications	Procedure	Requirements	
	0.75 mm displacement amplitude or 10 g maximum acceleration. Vibration applied for three 2-hour sessions at 10 – 500 Hz (Capacitor clamped by body).	No leakage of electrolyte or other visible damage. Deviations in capacitance and tanδ from initial measurements must not exceed: Δ C/C < 5%	
Standards	IEC 60384-4 long life grade 40/105/56, in accordance with CECC 30 301–809		

Test Method & Performance

Endurance Life Test		
Conditions	Performance	
Temperature	+105°C	
Test Duration	2,000 hours	
Ripple Current	Maximum ripple current specified in table	
Voltage	The sum of DC voltage and the peak AC voltage must not exceed the rated voltage of the capacitor	
Performance	**The following specifications will be satisfied when the capacitor is tested at +20°C:**	
Capacitance Change	≤ 160 V	Within 15% of the initial value
	> 160 V	Within 10% of the initial value
Equivalent Series Resistance	Does not exceed 200% of the initial value	
Leakage Current	Does not exceed leakage current limit	

Dimensions – Millimeters

D X L	Size Code	Dimensions in mm		Approximate Weight Grams
		D1	L1	
		±0.5	±1.0	
25 x 30	BC	25.5	31	21
25 x 35	BD	25.5	36	24
25 x 40	BE	25.5	41	27
25 x 45	BF	25.5	46	30
25 x 50	BG	25.5	51	33
30 x 25	CB	30.5	26	24
30 x 30	CC	30.5	31	29
30 x 35	CD	30.5	36	34
30 x 40	CE	30.5	41	39
30 x 45	CF	30.5	46	45
30 x 50	CG	30.5	51	51
35 x 25	DB	35.5	26	32
35 x 30	DC	35.5	31	40
35 x 35	DD	35.5	36	48
35 x 40	DE	35.5	41	56
35 x 45	DF	35.5	46	64
35 x 50	DG	35.5	51	72
Note: Add 0.5 mm to D and 1 mm to L for Sleeving				

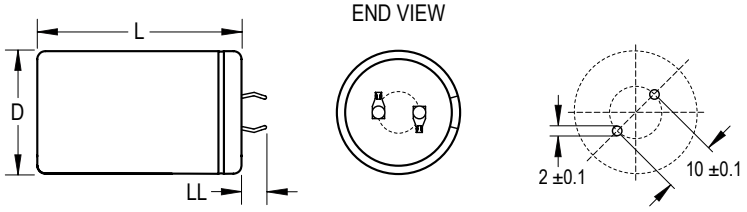
Termination Tables

Termination Code / Diameter (mm)	2	2S	3	4	4S
25	•	•	•		
30	•	•	•		
35	•	•	•	•	•

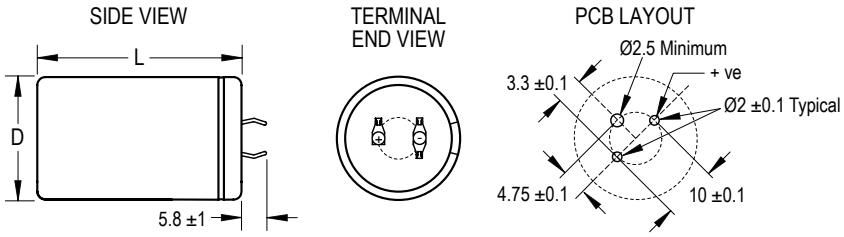
Mounting: These capacitors are designed to be mounted by their terminations alone and may be used in any position. Dummy pins on 4-pin decks must be isolated.

Termination Code	Termination Style	LL ±1
Standard Termination Option		
2	2 Pin	6.3
Other Termination Options		
2S	2 Pin	4
3	3 Pin	4
4	4 Pin	6.3
4S	4 Pin	4
Dimensions in mm		

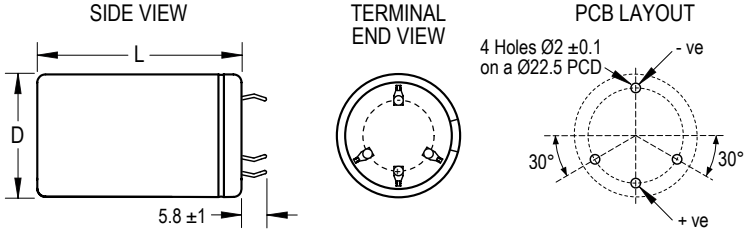
Style 2/2S



Style 3



Style 4/4S



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Shelf Life

The capacitance, ESR and impedance of a capacitor will not change significantly after extended storage periods, however the leakage current will very slowly increase. KEMET products are particularly stable and allow a shelf life in excess of three years at 40°C. See sectional specification under each product series for specific data.

Re-age (Reforming) Procedure

Apply the rated voltage to the capacitor at room temperature for a period of one hour, or until the leakage current has fallen to a steady value below the specified limit. During re-aging a maximum charging current of twice the specified leakage current or 5 mA (whichever is greater) is suggested.

Reliability

The reliability of a component can be defined as the probability that it will perform satisfactorily under a given set of conditions for a given length of time.

In practice, it is impossible to predict with absolute certainty how any individual component will perform; thus, we must utilize probability theory. It is also necessary to clearly define the level of stress involved (e.g. operating voltage, ripple current, temperature and time). Finally, the meaning of satisfactory performance must be defined by specifying a set of conditions which determine the end of life of the component.

Reliability as a function of time, R(t), is normally expressed as: $R(t)=e^{-\lambda t}$
where R(t) is the probability that the component will perform satisfactorily for time t, and λ is the failure rate.

Failure Rate

The failure rate is the number of components failing per unit time. The failure rate of most electronic components follows the characteristic pattern:

- Early failures are removed during the manufacturing process.
- The operational life is characterized by a constant failure rate.
- The wear out period is characterized by a rapidly increasing failure rate.

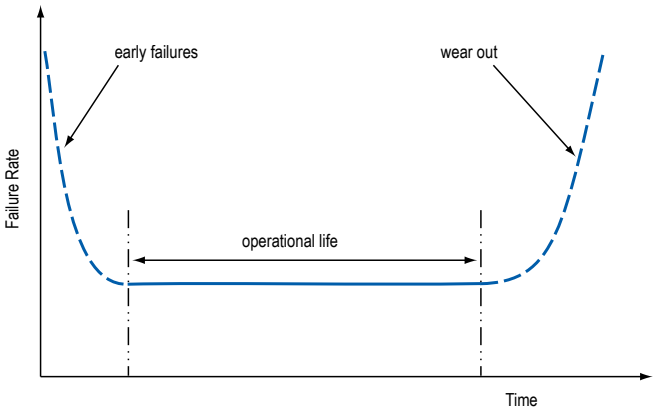
The failures in time (FIT) are given with a 60% confidence level for the various type codes. By convention, FIT is expressed as 1×10^{-9} failures per hour. Failure rate is also expressed as a percentage of failures per 1,000 hours.
e.g., 100 FIT = 1×10^{-7} failures per hour = 0.01%/1,000 hours

End of Life Definition
Catastrophic Failure: short circuit, open circuit or safety vent operation
Parametric Failure:

- Change in capacitance > ±10%
- Leakage current > specified limit
- ESR > 2 x initial ESR value

MTBF

The mean time between failures (MTBF) is simply the inverse of the failure rate.
MTBF= 1/λ



The failure rate is derived from our periodic test results. The failure rate (λ_R) is, therefore, only given at test temperature for life tests. An estimation is also given at 40°C. The expected failure rate for this capacitor range is based on our periodic test results for capacitors with structural similarity. Failure rate is frequently quoted in FIT (Failures In Time) where 1 FIT = 1 x 10^{-9} failures per hour. Failure rate per hour includes both catastrophic and parametric failures.

Environmental Compliance

As an environmentally conscious company, KEMET is working continuously with improvements concerning the environmental effects of both our capacitors and their production. 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, such as lead (Pb), in electronic equipment. All products in this catalog are produced to help our customers' obligations to guarantee their products and 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 such as 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 such as LF = Lead Free or LFW = Lead Free Wires on the label.

Table 1 – Ratings & Part Number Reference

VDC	Rated Capacitance	Size Code	Case Size	Ripple Current Maximum		ESR Maximum		Part Number
	100 Hz 20°C (µF)		D x L (mm)	100 Hz 105°C (A)	20 kHz 40°C (A)	100 Hz 20°C (mΩ)	100 kHz 20°C (mΩ)	
35	5600	BC	25 x 30	2.3	7.6	54	43	PEH534JBC4560M(1)
35	6800	BD	25 x 35	2.7	9.0	43	34	PEH534JBD4680M(1)
35	6800	CB	30 x 25	2.9	9.8	40	31	PEH534JCB4680M(1)
35	8200	BE	25 x 40	3.1	10.2	36	28	PEH534JBE4820M(1)
35	8200	CC	30 x 30	3.5	12.1	31	23	PEH534JCC4820M(1)
35	8200	DB	35 x 25	3.1	10.0	37	29	PEH534JDB4820M(1)
35	10000	BF	25 x 45	3.5	11.3	31	24	PEH534JBF5100M(1)
35	10000	CD	30 x 35	4.1	14.3	25	18	PEH534JCD5100M(1)
35	15000	CF	30 x 45	5.3	17.8	17	13	PEH534JCF5150M(1)
35	15000	DD	35 x 35	4.5	14.4	21	17	PEH534JDD5150M(1)
35	22000	DG	35 x 50	6.2	20.1	14	11	PEH534JDG5220M(1)
63	2200	BC	25 x 30	1.9	6.9	92	43	PEH534MBC4220M(1)
63	3300	BE	25 x 40	2.5	9.3	61	34	PEH534MBE4330M(1)
63	3300	CC	30 x 30	2.7	10.6	56	31	PEH534MCC4330M(1)
63	4700	CE	30 x 40	3.6	14.0	39	28	PEH534MCE4470M(1)
63	4700	DC	35 x 30	3.1	11.2	44	23	PEH534MDC4470M(1)
63	5600	CF	30 x 45	4.0	15.6	33	29	PEH534MCF4560M(1)
63	5600	DD	35 x 35	3.7	13.3	36	24	PEH534MDD4560M(1)
63	6800	CG	30 x 50	4.5	17.1	28	18	PEH534MCG4680M(1)
63	6800	DE	35 x 40	4.2	15.2	30	13	PEH534MDE4680M(1)
63	8200	DF	35 x 45	4.7	16.8	26	17	PEH534MDF4820M(1)
63	10000	DG	35 x 50	5.2	18.4	22	11	PEH534MDG5100M(1)
100	1500	BE	25 x 40	1.9	7.0	140	110	PEH534PBE4150M(1)
100	1500	CC	30 x 30	2.0	7.4	130	100	PEH534PCC4150M(1)
100	2200	CE	30 x 40	2.6	9.8	91	70	PEH534PCE4220M(1)
100	2200	DC	35 x 30	2.4	8.8	96	75	PEH534PDC4220M(1)
100	3300	CG	30 x 50	3.3	12.4	62	48	PEH534PCG4330M(1)
100	3300	DE	35 x 40	3.3	11.7	64	50	PEH534PDE4330M(1)
100	3900	DF	35 x 45	3.6	13.1	54	43	PEH534PDF4390M(1)
100	4700	DG	35 x 50	4.1	14.5	46	36	PEH534PDG4470M(1)
200	470	BD	25 x 35	1.1	7.1	290	160	PEH534RBD3470M(1)
200	560	BE	25 x 40	1.3	8.0	250	130	PEH534RBE3560M(1)
200	560	CC	30 x 30	1.3	8.9	240	130	PEH534RCC3560M(1)
200	680	BF	25 x 45	1.4	8.9	200	110	PEH534RBF3680M(1)
200	680	CD	30 x 35	1.5	10.4	200	100	PEH534RCD3680M(1)
200	680	DC	35 x 30	1.5	9.8	200	110	PEH534RDC3680M(1)
200	820	CE	30 x 40	1.7	11.8	160	87	PEH534RCE3820M(1)
200	820	DC	35 x 30	1.6	9.8	170	93	PEH534RDC3820M(1)
200	1000	CG	30 x 50	2.0	13.9	130	71	PEH534RCG4100M(1)
200	1000	DD	35 x 35	1.9	11.6	140	75	PEH534RDD4100M(1)
200	1500	DF	35 x 45	2.5	14.7	93	51	PEH534RDF4150M(1)
250	390	BE	25 x 40	1.1	7.9	290	140	PEH534SBE3390M(1)
250	390	CC	30 x 30	1.1	8.7	280	140	PEH534SCC3390M(1)
250	470	BF	25 x 45	1.3	8.8	240	120	PEH534SBF3470M(1)
250	470	CD	30 x 35	1.3	10.1	240	110	PEH534SCD3470M(1)
250	470	DC	35 x 30	1.3	9.6	240	120	PEH534SDC3470M(1)
250	560	BG	25 x 50	1.4	9.6	200	100	PEH534SBG3560M(1)
250	560	CE	30 x 40	1.5	11.4	200	95	PEH534SCE3560M(1)
250	680	CF	30 x 45	1.7	12.8	160	79	PEH534SCF3680M(1)
250	680	DD	35 x 35	1.7	11.5	170	83	PEH534SDD3680M(1)
250	820	CG	30 x 50	1.9	14.2	140	66	PEH534SCG3820M(1)
250	820	DE	35 x 40	1.9	13.1	140	69	PEH534SDE3820M(1)
250	1000	DF	35 x 45	2.2	14.6	110	57	PEH534SDF4100M(1)
350	220	BE	25 x 40	0.9	5.8	560	350	PEH534UBE3220M(1)
350	220	CC	30 x 30	0.9	6.0	550	340	PEH534UCC3220M(1)
350	220	DB	35 x 25	0.9	5.8	560	350	PEH534UDB3220M(1)
350	330	CE	30 x 40	1.2	8.0	370	230	PEH534UCE3330M(1)
350	330	DC	35 x 30	1.2	7.4	370	230	PEH534UDC3330M(1)
350	390	CF	30 x 45	1.4	9.0	310	190	PEH534UCF3390M(1)
350	390	DD	35 x 35	1.4	8.6	320	200	PEH534UDD3390M(1)
VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR		Part Number

(1) Termination code: See Termination Tables for available options.

Table 1 – Ratings & Part Number Reference cont'd

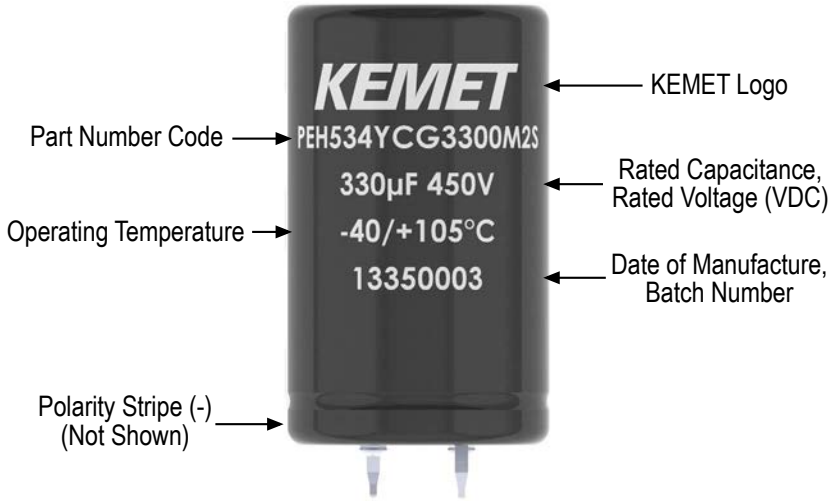
VDC	Rated Capacitance	Size Code	Case Size	Ripple Current Maximum		ESR Maximum		Part Number
	100 Hz 20°C (µF)		D x L (mm)	100 Hz 105°C (A)	20 kHz 40°C (A)	100 Hz 20°C (mΩ)	100 kHz 20°C (mΩ)	
350	470	DE	35 x 40	1.6	9.7	260	160	PEH534UDE3470M(1)
350	560	DF	35 x 45	1.8	10.9	220	140	PEH534UDF3560M(1)
400	150	BD	25 x 35	0.8	5.1	680	410	PEH534VBD3150M(1)
400	150	CB	30 x 25	0.8	5.2	680	400	PEH534VCB3150M(1)
400	220	BF	25 x 45	1.0	6.5	470	280	PEH534VBF3220M(1)
400	220	CD	30 x 35	1.0	7.1	460	270	PEH534VCD3220M(1)
400	220	DC	35 x 30	1.1	7.0	460	280	PEH534VDC3220M(1)
400	330	CF	30 x 45	1.4	9.2	310	180	PEH534VCF3330M(1)
400	330	DD	35 x 35	1.4	8.7	310	190	PEH534VDD3330M(1)
400	390	CG	30 x 50	1.5	10.2	260	160	PEH534VCG3390M(1)
400	390	DE	35 x 40	1.5	9.8	260	160	PEH534VDE3390M(1)
400	470	DF	35 x 45	1.8	11.1	220	130	PEH534VDF3470M(1)
400	560	DG	35 x 50	2.0	12.3	180	110	PEH534VDG3560M(1)
450	150	BE	25 x 40	0.9	5.8	570	330	PEH534YBE3150M(1)
450	150	CC	30 x 30	0.9	6.1	560	330	PEH534YCC3150M(1)
450	150	DB	35 x 25	0.9	5.9	570	330	PEH534YDB3150M(1)
450	220	CE	30 x 40	1.2	8.1	380	220	PEH534YCE3220M(1)
450	220	DC	35 x 30	1.2	7.5	390	230	PEH534YDC3220M(1)
450	330	CG	30 x 50	1.5	10.3	260	150	PEH534YCG3330M(1)
450	330	DE	35 x 40	1.5	9.9	260	150	PEH534YDE3330M(1)
450	390	DF	35 x 45	1.7	11.3	220	130	PEH534YDF3390M(1)
450	470	DG	35 x 50	1.9	12.4	180	110	PEH534YDG3470M(1)
VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR		Part Number

(1) Termination code: See Termination Tables for available options.

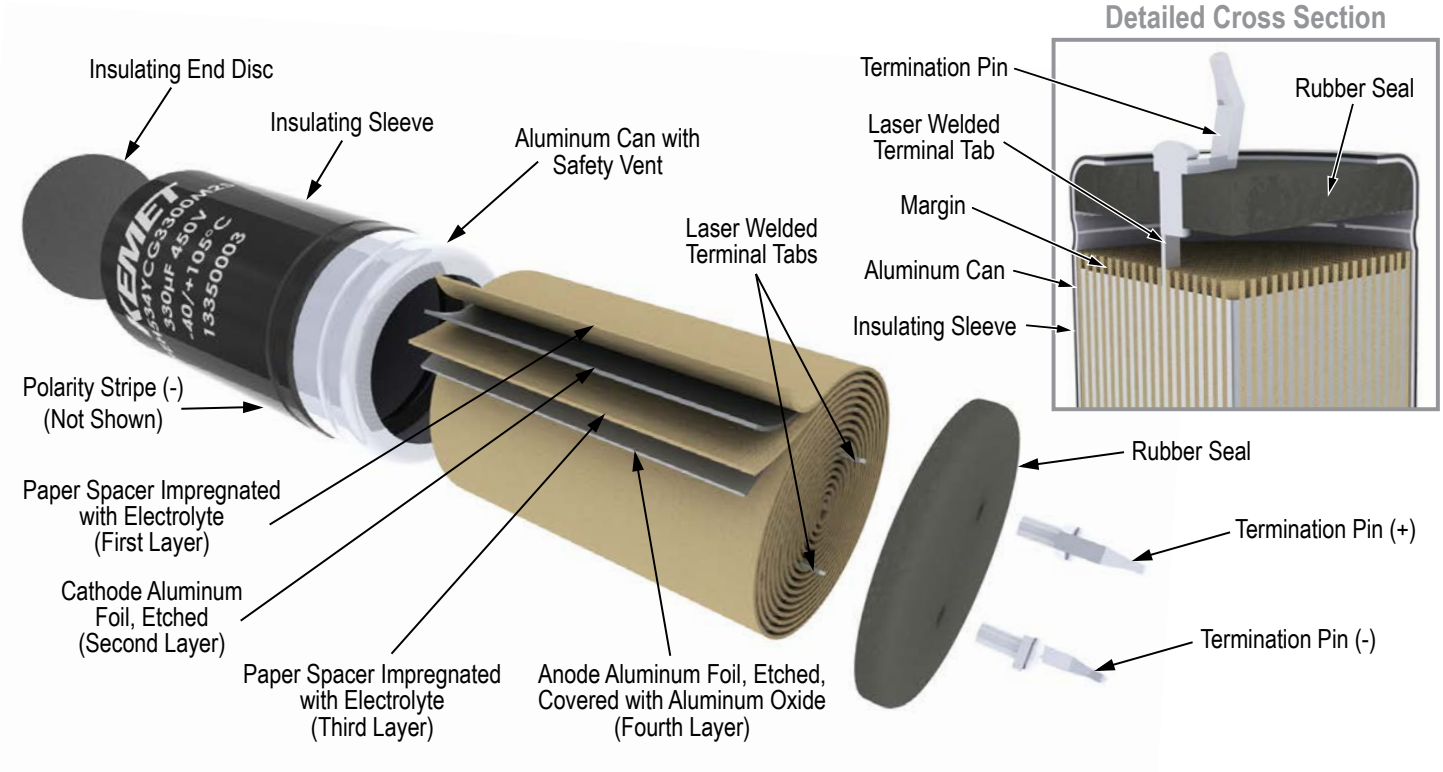
Mechanical Data

The capacitor may be mounted in any position. PEH534 is supplied with an insulation sleeve. Voltage proof of the insulation sleeve = 2.5 kVDC (1 min). The minus pole is marked on the case surface. UL recognized sleeving is available for custom parts in this range, upon request. (UL No. E358957)

Marking



Construction



PEH536 Series, +105ºC

Overview

KEMET's PEH536 is a long-life electrolytic capacitor designed to offer high ripple current capability and low mounting cost. Low ESR is the result of a very low resistive paper/electrolyte system. Low ESR, together with the TDC thermal concept, gives the PEH536 a high ripple current capability.

Applications

Typical applications for KEMET's PEH536 capacitor include switch mode power supplies (SMPS), drives, welding equipment, uninterruptible power supplies (UPS), and other power electronic applications where high current ratings and compact size are important.

Benefits

- Snap-In
- 4,600 hours at +105°C (V_R, I_R applied)
- PCB mounting
- Low ESR and ESL
- High ripple current

Part Number System

PEH536	J	AD	439	0	M	2
Series	Rated Voltage (VDC)	Size Code	Capacitance Code (µF)	Version	Capacitance Tolerance	Termination
Snap-In type Aluminum Electrolytic	J = 35 M = 63 P = 100 R = 200 S = 250 U = 350 V = 400 Y = 450	See Dimension Table	The last two digits represent significant figures. The first digit indicates the total number digits.	0 = Standard	M = ±20%	See Termination Table

Performance Characteristics

Item	Performance Characteristics		
Capacitance Range	47 – 18,000 µF		
Rated Voltage	35 – 450 VDC		
Operating Temperature	-40 to +105°C		
Capacitance Tolerance	±20% at 100 Hz / +20°C		
Operational Lifetime	D (mm)	Rated Voltage and Ripple Current at +105°C (hours)	Rated Voltage at +105°C (hours)
	22 – 40	4,600	6,000
Shelf Life	4 years at +40°C 0 VDC		
Leakage Current	I = 0.003 CV (µA)		
	C = rated capacitance (µF), V = rated voltage (VDC). Voltage applied for 5 minutes at +20°C.		
Vibration Test Specifications	Procedure	Requirements	
	0.75 mm displacement amplitude or 10 g maximum acceleration. Vibration applied for three 2-hour sessions at 10 – 500 Hz (Capacitor clamped by body).	No leakage of electrolyte or other visible damage. Deviations in capacitance and tanδ from initial measurements must not exceed: Δ C/C < 5%	
Standards	IEC 60384-4 long life grade 40/85/56, in accordance with CECC 30 301–809		

Test Method & Performance

Endurance Life Test		
Conditions	Performance	
Temperature	+105°C	
Test Duration	2,000 hours	
Ripple Current	Maximum ripple current specified in table	
Voltage	The sum of DC voltage and the peak AC voltage must not exceed the rated voltage of the capacitor	
Performance	**The following specifications will be satisfied when the capacitor is tested at +20°C:**	
Capacitance Change	≤ 160 V	Within 15% of the initial value
	> 160 V	Within 10% of the initial value
Equivalent Series Resistance	Does not exceed 200% of the initial value	
Leakage Current	Does not exceed leakage current limit	

Dimensions – Millimeters

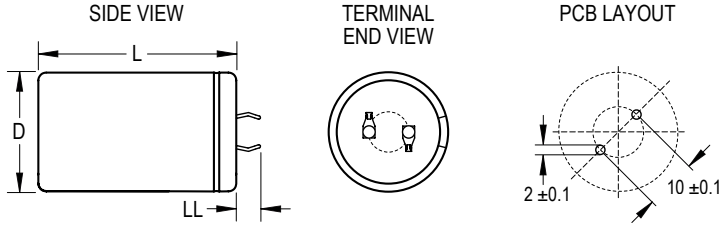
D X L	Size Code	Dimensions in mm		Approximate Weight Grams
		D1	L1	
		±0.5	±1.0	
22 x 30	AC	22.5	31	14
22 x 35	AD	22.5	36	15
22 x 40	AE	22.5	41	17
22 x 45	AF	22.5	46	19
22 x 50	AG	22.5	51	21
25 x 25	BB	25.5	26	19
25 x 30	BC	25.5	31	21
25 x 35	BD	25.5	36	24
25 x 40	BE	25.5	41	27
25 x 45	BF	25.5	46	30
25 x 50	BG	25.5	51	33
30 x 25	CB	30.5	26	24
30 x 30	CC	30.5	31	29
30 x 35	CD	30.5	36	34
30 x 40	CE	30.5	41	39
30 x 45	CF	30.5	46	45
30 x 50	CG	30.5	51	51
35 x 25	DB	35.5	26	32
35 x 30	DC	35.5	31	40
35 x 35	DD	35.5	36	48
35 x 40	DE	35.5	41	56
35 x 45	DF	35.5	46	64
35 x 50	DG	35.5	51	72
35 x 55	DH	35.5	56	85
35 x 60	DI	35.5	61	88
40 x 60	EI	40.5	61	115
40 x 70	EK	40.5	71	135
40 x 80	EM	40.5	81	155
40 x 100	EQ	40.5	101	175
Note: Add 0.5 mm to D and 1 mm to L for Sleeving				

Termination Tables

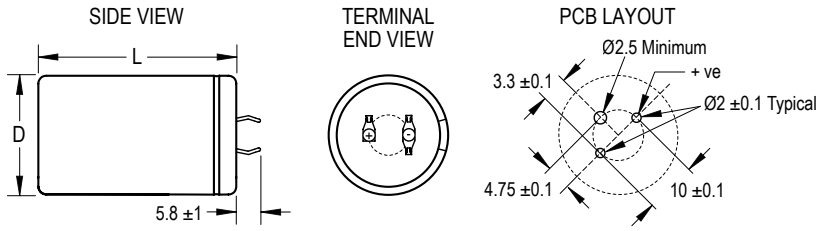
Termination Code / Diameter (mm)	2	2S	3	4	4S
22	•	•	•		
25	•	•	•		
30	•	•	•		
35	•	•	•	•	•
40	•	•	•	•	•
Mounting: These capacitors are designed to be mounted by their terminations alone and may be used in any position. Dummy pins on 4-pin decks must be isolated.					

Termination Code	Termination Style	LL ±1
Standard Termination Option		
2	2 Pin	6.3
4 (D = 40)	4 Pin	6.3
Other Termination Options		
2S	2 Pin	4
3	3 Pin	4
4S	4 Pin	4
Dimensions in mm		

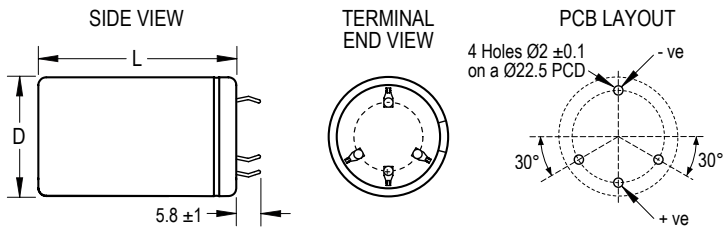
Style 2/2S



Style 3



Style 4/4S



Shelf Life

The capacitance, ESR and impedance of a capacitor will not change significantly after extended storage periods, however the leakage current will very slowly increase. KEMET products are particularly stable and allow a shelf life in excess of three years at 40°C. See sectional specification under each product series for specific data.

Re-age (Reforming) Procedure

Apply the rated voltage to the capacitor at room temperature for a period of one hour, or until the leakage current has fallen to a steady value below the specified limit. During re-aging a maximum charging current of twice the specified leakage current or 5 mA (whichever is greater) is suggested.

Reliability

The reliability of a component can be defined as the probability that it will perform satisfactorily under a given set of conditions for a given length of time.

In practice, it is impossible to predict with absolute certainty how any individual component will perform; thus, we must utilize probability theory. It is also necessary to clearly define the level of stress involved (e.g. operating voltage, ripple current, temperature and time). Finally, the meaning of satisfactory performance must be defined by specifying a set of conditions which determine the end of life of the component.

Reliability as a function of time, R(t), is normally expressed as: $R(t)=e^{-\lambda t}$
where R(t) is the probability that the component will perform satisfactorily for time t, and λ is the failure rate.

Failure Rate

The failure rate is the number of components failing per unit time. The failure rate of most electronic components follows the characteristic pattern:

- Early failures are removed during the manufacturing process.
- The operational life is characterized by a constant failure rate.
- The wear out period is characterized by a rapidly increasing failure rate.

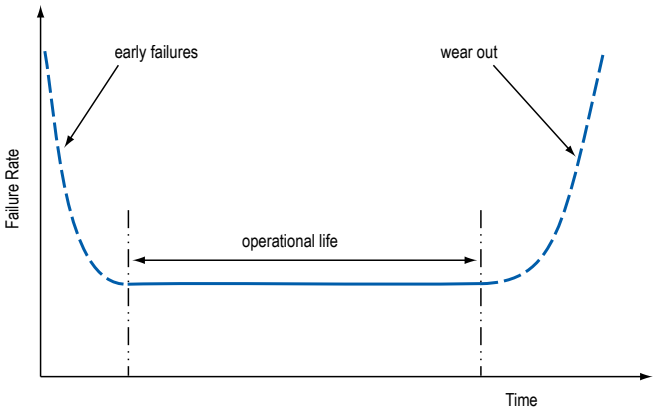
The failures in time (FIT) are given with a 60% confidence level for the various type codes. By convention, FIT is expressed as 1×10^{-9} failures per hour. Failure rate is also expressed as a percentage of failures per 1,000 hours.
e.g., 100 FIT = 1×10^{-7} failures per hour = 0.01%/1,000 hours

End of Life Definition
Catastrophic Failure: short circuit, open circuit or safety vent operation
Parametric Failure:

- Change in capacitance > ±10%
- Leakage current > specified limit
- ESR > 2 x initial ESR value

MTBF

The mean time between failures (MTBF) is simply the inverse of the failure rate.
MTBF= 1/λ



The failure rate is derived from our periodic test results. The failure rate (λ_R) is, therefore, only given at test temperature for life tests. An estimation is also given at 40°C. The expected failure rate for this capacitor range is based on our periodic test results for capacitors with structural similarity. Failure rate is frequently quoted in FIT (Failures In Time) where 1 FIT = 1 x 10^{-9} failures per hour. Failure rate per hour includes both catastrophic and parametric failures.

Environmental Compliance

As an environmentally conscious company, KEMET is working continuously with improvements concerning the environmental effects of both our capacitors and their production. 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, such as lead (Pb), in electronic equipment. All products in this catalog are produced to help our customers' obligations to guarantee their products and 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 such as 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 such as LF = Lead Free or LFW = Lead Free Wires on the label.

Table 1 – Ratings & Part Number Reference

VDC	Rated Capacitance	Size Code	Case Size	Ripple Current Maximum		ESR Maximum		Part Number
	100 Hz 20°C (µF)		D x L (mm)	100 Hz 105°C (A)	20 kHz 40°C (A)	100 Hz 20°C (mΩ)	100 kHz 20°C (mΩ)	
35	3900	AD	22 x 35	2.4	9.0	54	39	PEH536JAD4390M(1)
35	3900	BC	25 x 30	2.2	7.8	60	45	PEH536JBC4390M(1)
35	4700	AE	22 x 40	2.8	0.2	45	33	PEH536JAE4470M(1)
35	5600	BD	25 x 35	2.7	9.1	44	34	PEH536JBD4560M(1)
35	5600	CC	30 x 30	2.4	7.8	53	43	PEH536JCC4560M(1)
35	5600	DB	35 x 25	2.0	5.9	78	68	PEH536JDB4560M(1)
35	6800	BE	25 x 40	3.1	10.4	37	28	PEH536JBE4680M(1)
35	6800	CD	30 x 35	2.9	9.4	42	33	PEH536JCD4680M(1)
35	8200	BF	25 x 45	3.4	11.6	31	24	PEH536JBF4820M(1)
35	8200	CD	30 x 35	2.8	8.9	42	35	PEH536JCD4820M(1)
35	8200	DC	35 x 30	3.7	12.6	30	23	PEH536JDC4820M(1)
35	10000	BG	25 x 50	3.7	12.3	27	21	PEH536JBG5100M(1)
35	10000	CE	30 x 40	4.6	16.6	22	16	PEH536JCE5100M(1)
35	12000	CF	30 x 45	5.1	18.1	19	14	PEH536JCF5120M(1)
35	12000	DD	35 x 35	4.4	14.5	22	17	PEH536JDD5120M(1)
35	15000	DE	35 x 40	5.0	16.5	18	14	PEH536JDE5150M(1)
35	18000	DG	35 x 50	6.1	20.4	14	11	PEH536JDG5180M(1)
63	1800	AD	22 x 35	1.9	7.3	100	74	PEH536MAD4180M(1)
63	1800	BC	25 x 30	2.0	8.2	97	68	PEH536MBC4180M(1)
63	1800	CB	30 x 25	2.0	7.8	100	72	PEH536MCB4180M(1)
63	2200	BD	25 x 35	2.1	7.8	88	65	PEH536MBD4220M(1)
63	2200	CC	30 x 30	2.3	9.4	81	57	PEH536MCC4220M(1)
63	2200	DB	35 x 25	2.3	8.6	86	62	PEH536MDB4220M(1)
63	2700	AG	22 x 50	2.5	9.8	68	49	PEH536MAG4270M(1)
63	2700	BE	25 x 40	2.4	8.9	73	53	PEH536MBE4270M(1)
63	2700	CD	30 x 35	2.7	10.9	66	46	PEH536MCD4270M(1)
63	3300	BG	25 x 50	2.8	10.7	58	43	PEH536MBG4330M(1)
63	3300	CD	30 x 35	2.9	11.5	55	40	PEH536MCD4330M(1)
63	3900	CE	30 x 40	3.3	13.0	47	34	PEH536MCE4390M(1)
63	3900	DC	35 x 30	3.0	10.9	52	38	PEH536MDC4390M(1)
63	4700	CF	30 x 45	3.7	14.6	39	28	PEH536MCF4470M(1)
63	4700	DD	35 x 35	3.5	12.9	42	31	PEH536MDD4470M(1)
63	6800	DF	35 x 45	4.5	16.4	30	22	PEH536MDF4680M(1)
63	8200	DG	35 x 50	5.0	17.9	25	19	PEH536MDG4820M(1)
100	560	AC	22 x 30	1.1	4.3	320	240	PEH536PAC3560M(1)
100	560	BB	25 x 25	1.1	4.0	330	250	PEH536PBB3560M(1)
100	680	AD	22 x 35	1.2	5.0	260	190	PEH536PAD3680M(1)
100	680	BC	25 x 30	1.2	4.8	270	200	PEH536PBC3680M(1)
100	820	AE	22 x 40	1.4	5.6	220	160	PEH536PAE3820M(1)
100	820	BC	25 x 30	1.3	5.1	230	170	PEH536PBC3820M(1)
100	820	CB	30 x 25	1.4	5.6	220	160	PEH536PCB3820M(1)
100	1000	BD	25 x 35	1.6	6.0	180	140	PEH536PBD4100M(1)
100	1000	CC	30 x 30	1.7	6.6	180	130	PEH536PCC4100M(1)
100	1200	BE	25 x 40	1.8	6.8	150	120	PEH536PBE4120M(1)
100	1200	CD	30 x 35	1.9	7.7	150	110	PEH536PCD4120M(1)
100	1500	BG	25 x 50	2.1	8.1	120	92	PEH536PBG4150M(1)
100	1500	CE	30 x 40	2.2	8.9	120	88	PEH536PCE4150M(1)
100	2200	CG	30 x 50	2.8	11.2	81	61	PEH536PCG4220M(1)
100	2200	DE	35 x 40	2.8	10.9	83	62	PEH536PDE4220M(1)
100	2700	DF	35 x 45	3.2	12.3	68	51	PEH536PDF4270M(1)
100	3300	DG	35 x 50	3.6	13.8	56	43	PEH536PDG4330M(1)
100	4700	DH	35 x 55	4.3	15.8	42	32	PEH536PDH4470M(1)
200	220	AC	22 x 30	0.7	5.4	550	270	PEH536RAC3220M(1)
200	270	BC	25 x 30	0.8	5.9	460	220	PEH536RBC3270M(1)
200	330	AE	22 x 40	0.9	7.2	370	180	PEH536RAE3330M(1)
200	330	BD	25 x 35	1.0	6.9	370	190	PEH536RBD3330M(1)
200	470	AG	22 x 50	1.2	8.8	260	130	PEH536RAG3470M(1)
200	470	BE	25 x 40	1.2	8.1	270	130	PEH536RBE3470M(1)
200	560	BF	25 x 45	1.3	9.1	220	110	PEH536RBF3560M(1)
VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR		Part Number

(1) Termination code: See Termination Tables for available options.

Table 1 – Ratings & Part Number Reference cont'd

VDC	Rated Capacitance	Size Code	Case Size	Ripple Current Maximum		ESR Maximum		Part Number
	100 Hz 20°C (µF)		D x L (mm)	100 Hz 105°C (A)	20 kHz 40°C (A)	100 Hz 20°C (mΩ)	100 kHz 20°C (mΩ)	
200	560	CD	30 x 35	1.4	10.4	220	110	PEH536RCD3560M(1)
200	680	BG	25 x 50	1.5	10.0	180	93	PEH536RBG3680M(1)
200	680	CE	30 x 40	1.6	11.8	180	88	PEH536RCE3680M(1)
200	680	DD	35 x 35	1.6	11.5	180	90	PEH536RDD3680M(1)
200	820	CF	30 x 45	1.8	13.3	150	73	PEH536RCF3820M(1)
200	820	DD	35 x 35	1.8	11.8	150	77	PEH536RDD3820M(1)
200	1000	CG	30 x 50	2.0	14.8	120	61	PEH536RCG4100M(1)
200	1000	DE	35 x 40	2.0	13.5	130	63	PEH536RDE4100M(1)
200	1200	DG	35 x 50	2.3	16.2	100	52	PEH536RDG4120M(1)
250	150	AC	22 x 30	0.6	5.3	660	280	PEH536SAC3150M(1)
250	220	AE	22 x 40	0.8	7.0	450	190	PEH536SAE3220M(1)
250	220	BC	25 x 30	0.8	6.0	460	200	PEH536SBC3220M(1)
250	270	BD	25 x 35	0.9	7.1	370	160	PEH536SBD3270M(1)
250	330	BE	25 x 40	1.0	8.1	300	130	PEH536SBE3330M(1)
250	330	CC	30 x 30	1.1	8.8	300	130	PEH536SCC3330M(1)
250	390	BF	25 x 45	1.2	9.0	260	110	PEH536SBF3390M(1)
250	470	BG	25 x 50	1.3	9.9	210	96	PEH536SBG3470M(1)
250	470	CE	30 x 40	1.4	11.7	210	91	PEH536SCE3470M(1)
250	560	CF	30 x 45	1.6	13.1	180	76	PEH536SCF3560M(1)
250	680	CG	30 x 50	1.8	14.5	150	63	PEH536SCG3680M(1)
250	680	DE	35 x 40	1.8	13.4	150	66	PEH536SDE3680M(1)
250	820	DF	35 x 45	2.0	15.0	120	55	PEH536SDF3820M(1)
250	1000	DG	35 x 50	2.3	16.5	100	46	PEH536SDG4100M(1)
350	100	AC	22 x 30	0.6	3.9	1000	600	PEH536UAC3100M(1)
350	100	BB	25 x 25	0.6	3.7	1100	620	PEH536UBB3100M(1)
350	120	AD	22 x 35	0.6	4.5	870	500	PEH536UAD3120M(1)
350	150	AE	22 x 40	0.7	5.2	700	400	PEH536UAE3150M(1)
350	150	BC	25 x 30	0.7	4.7	710	410	PEH536UBC3150M(1)
350	180	AF	22 x 45	0.8	5.8	580	340	PEH536UAF3180M(1)
350	220	AG	22 x 50	1.0	6.5	480	280	PEH536UAG3220M(1)
350	220	BE	25 x 40	1.0	6.2	480	280	PEH536UBE3220M(1)
350	270	BG	25 x 50	1.1	7.4	390	230	PEH536UBG3270M(1)
350	270	CE	30 x 40	1.2	8.1	390	220	PEH536UCE3270M(1)
350	330	CF	30 x 45	1.3	9.2	320	180	PEH536UCF3330M(1)
350	330	DD	35 x 35	1.3	8.7	320	190	PEH536UDD3330M(1)
350	470	DE	35 x 40	1.6	10.5	230	130	PEH536UDE3470M(1)
350	560	DF	35 x 45	1.8	11.8	190	110	PEH536UDF3560M(1)
350	560	DG	35 x 50	1.9	12.4	190	110	PEH536UDG3560M(1)
350	680	DI	35 x 60	2.2	14.3	160	91	PEH536UDI3680M(1)
350	1000	EM	40 x 80	2.9	18.5	110	63	PEH536UEM4100M(1)
400	68	AC	22 x 30	0.5	3.6	1300	710	PEH536VAC2680M(1)
400	68	BB	25 x 25	0.5	3.5	1300	720	PEH536VBB2680M(1)
400	82	AD	22 x 35	0.6	4.2	1100	590	PEH536VAD2820M(1)
400	100	AD	22 x 35	0.6	4.6	870	480	PEH536VAD3100M(1)
400	100	BC	25 x 30	0.6	4.4	880	490	PEH536VBC3100M(1)
400	120	AE	22 x 40	0.7	5.2	720	400	PEH536VAE3120M(1)
400	150	AG	22 x 50	0.8	6.1	580	320	PEH536VAG3150M(1)
400	150	BE	25 x 40	0.8	5.9	580	330	PEH536VBE3150M(1)
400	150	CC	30 x 30	0.9	6.2	580	320	PEH536VCC3150M(1)
400	180	CD	30 x 35	1.0	7.1	480	270	PEH536VCD3180M(1)
400	180	DC	35 x 30	1.0	7.1	480	270	PEH536VDC3180M(1)
400	220	BG	25 x 50	1.1	7.4	400	220	PEH536VBG3220M(1)
400	220	CE	30 x 40	1.1	8.2	390	220	PEH536VCE3220M(1)
400	270	CF	30 x 45	1.3	9.3	320	180	PEH536VCF3270M(1)
400	330	CG	30 x 50	1.5	10.5	260	150	PEH536VCG3330M(1)
400	330	DE	35 x 40	1.5	10.1	270	150	PEH536VDE3330M(1)
400	390	DF	35 x 45	1.7	11.3	230	130	PEH536VDF3390M(1)
400	470	DG	35 x 50	1.9	12.6	190	110	PEH536VDG3470M(1)
400	560	DH	35 x 55	2.1	13.9	160	89	PEH536VDH3560M(1)
VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR		Part Number

(1) Termination code: See Termination Tables for available options.

Table 1 – Ratings & Part Number Reference cont'd

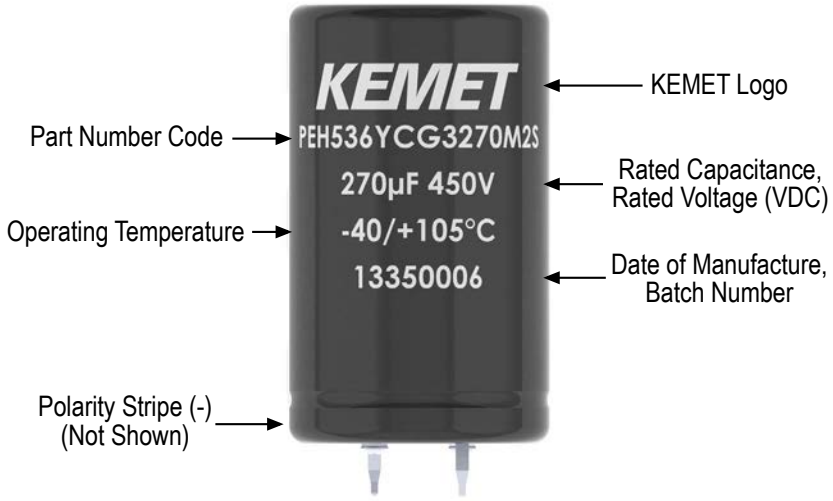
VDC	Rated Capacitance	Size Code	Case Size	Ripple Current Maximum		ESR Maximum		Part Number
	100 Hz 20°C (µF)		D x L (mm)	100 Hz 105°C (A)	20 kHz 40°C (A)	100 Hz 20°C (mΩ)	100 kHz 20°C (mΩ)	
400	680	EI	40 x 60	2.5	15.9	130	74	PEH536VEI3680M(1)
400	1000	EM	40 x 80	3.1	19.7	90	51	PEH536VEM4100M(1)
400	1500	EQ	40 x 100	3.9	22.9	61	35	PEH536VEQ4150M(1)
450	47	AC	22 x 30	0.4	3.4	1500	840	PEH536YAC2470M(1)
450	68	AE	22 x 40	0.6	4.4	1100	580	PEH536YAE2680M(1)
450	68	BC	25 x 30	0.6	4.1	1100	580	PEH536YBC2680M(1)
450	100	AF	22 x 45	0.7	5.4	720	390	PEH536YAF3100M(1)
450	100	BD	25 x 35	0.7	5.2	730	400	PEH536YBD3100M(1)
450	120	AG	22 x 50	0.8	6.0	600	330	PEH536YAG3120M(1)
450	150	BF	25 x 45	0.9	6.7	490	270	PEH536YBF3150M(1)
450	150	CD	30 x 35	1.0	7.2	480	260	PEH536YCD3150M(1)
450	180	CE	30 x 40	1.1	8.2	400	220	PEH536YCE3180M(1)
450	220	CF	30 x 45	1.3	9.3	330	180	PEH536YCF3220M(1)
450	220	DE	35 x 40	1.3	9.4	330	180	PEH536YDE3220M(1)
450	270	CG	30 x 50	1.4	10.4	270	150	PEH536YCG3270M(1)
450	270	DF	35 x 45	1.5	10.7	270	150	PEH536YDF3270M(1)
450	330	DG	35 x 50	1.7	11.9	220	120	PEH536YDG3330M(1)
450	390	DH	35 x 55	1.9	13.2	190	100	PEH536YDH3390M(1)
450	470	DI	35 x 60	2.1	14.5	160	86	PEH536YDI3470M(1)
450	560	EI	40 x 60	2.4	16.0	130	73	PEH536YEI3560M(1)
450	680	EK	40 x 70	2.7	17.9	110	61	PEH536YEK3680M(1)
450	1000	EQ	40 x 100	3.4	21.9	75	42	PEH536YEQ4100M(1)
VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR		Part Number

(1) Termination code: See Termination Tables for available options.

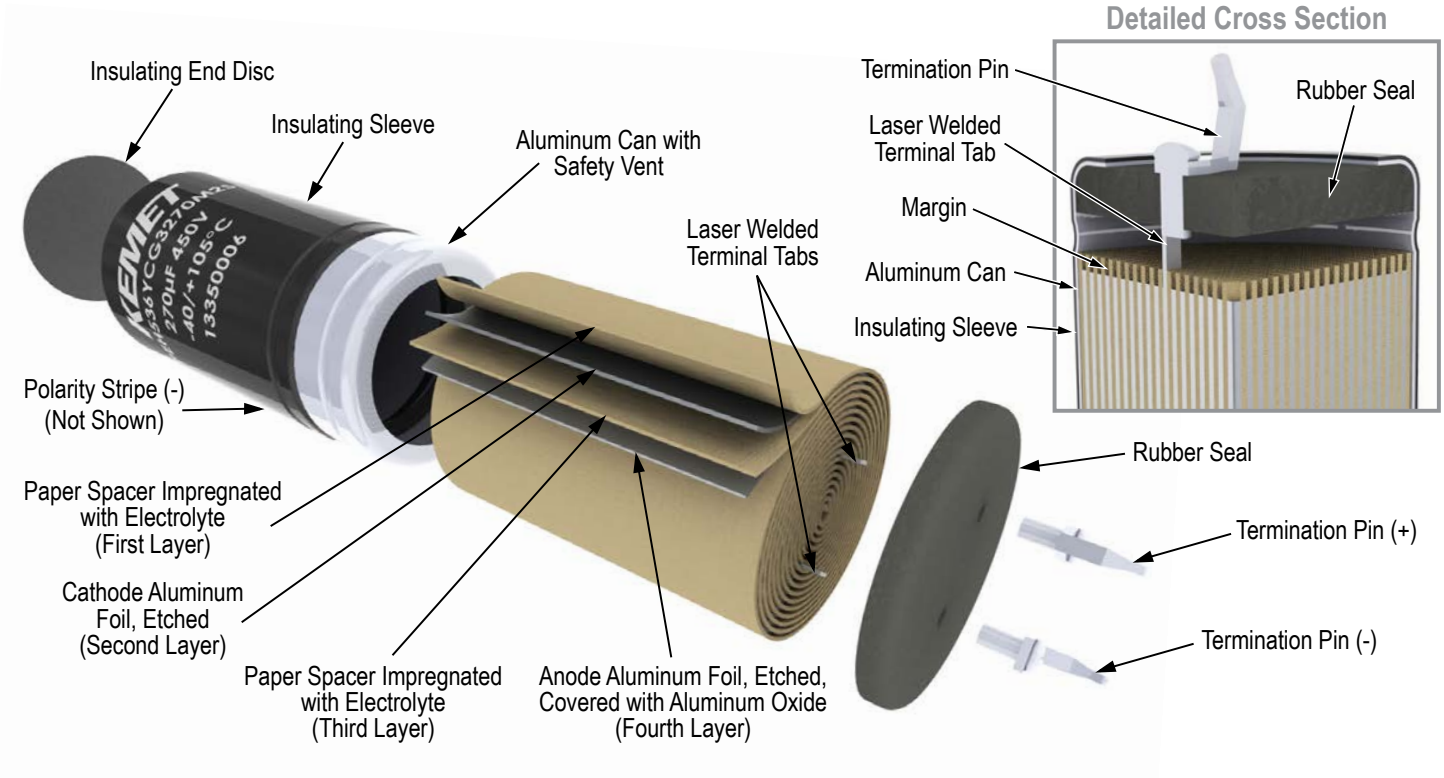
Mechanical Data

The capacitor may be mounted in any position. PEH536 is supplied with an insulation sleeve. Voltage proof of the insulation sleeve = 2.5 kVDC (1 min). The minus pole is marked on the case surface. UL recognized sleeving is available for custom parts in this range, upon request. (UL No. E358957)

Marking



Construction



ALC40 Series, +105ºC

Overview

KEMET's ALC40 Series of snap-in capacitors features the same high ripple currents and long-life characteristics as the ALC10 Series but can operate at higher temperatures.

Applications

KEMET's ALC40 Series of capacitors is suited for high reliability and long life applications such as frequency converters, uninterruptible power supply (UPS) systems and switch mode power supplies (SMPS). The extended temperature range allows increased ripple currents at lower temperatures.

Benefits

- Compact size
- Long life, up to 9,000 hours at +105°C (V_R, I_R applied)
- High ripple current
- Excellent surge voltage capability
- Optimized designs available upon request

Part Number System

ALC40	A	822	BB	025	
Series	Termination	Capacitance Code (µF)	Size Code	Rated Voltage (VDC)	
Snap-In type Aluminum Electrolytic	See Termination Table	First two digits represent significant figures. Third digit specifies number of zeros.	See Dimension Table	025 = 25 040 = 40 063 = 63 100 = 100 200 = 200	250 = 250 350 = 350 400 = 400 450 = 450 500 = 500

Performance Characteristics

Item	Performance Characteristics		
Capacitance Range	47 – 120,000 µF		
Rated Voltage	25 – 500 VDC		
Operating Temperature	-40 to +105°C		
Storage Temperature Range	-55 to +105°C		
Capacitance Tolerance	±20% at 100 Hz / +20°C		
Operational Lifetime	D (mm)	Rated Voltage and Ripple Current at +105°C (hours)	Rated Voltage at +105°C (hours)
	25	6,000	10,000
	30	7,000	11,000
	35	8,000	13,000
	40 – 50	9,000	14,000
End of Life Requirement	Δ C/C < ±10%, ESR < 2 x initial ESR value, IL < initial specified limit		
Shelf Life	2,000 hours at +85°C or 30,000 hours at +40°C 0 VDC		
Leakage Current	I = 0.003 CV or 6,000 (µA, whichever is smaller)		
	C = rated capacitance (µF), V = rated voltage (VDC). Voltage applied for 5 minutes at +20°C.		
Vibration Test Specifications		Procedure	Requirements
	D ≤ 40 mm	0.75 mm displacement amplitude or 10g maximum acceleration. Vibration applied for three 2-hour sessions at 10 – 500 Hz (Capacitor clamped by body).	No leakage of electrolyte or other visible damage. Deviations in capacitance and tanδ from initial measurements must not exceed: Δ C/C < 5%
	D > 40 mm	0.35 mm displacement amplitude or 5g maximum acceleration. Vibration applied for three 0.5-hour sessions at 10 – 55 Hz (Capacitor clamped by body).	
Standards	IEC 60384–4 long life grade 40/105/56		

Surge Voltage

Condition	Voltage (VDC)									
	25	40	63	100	200	250	350	400	450	500
≤ 30s Surge followed by a no load period of 330s, 1,000 cycles at +85°C	28.75	46	72.5	115	230	288	385	440	495	550
≤ 500 ms surge, 100 cycles at 20°C, occurring randomly throughout the life of the capacitor					350	400	500	520	550	600

Test Method & Performance

Endurance Life Test		
Conditions	Performance	
Temperature	+105°C	
Test Duration	5,000 hours	
Ripple Current	Rated ripple current in specified table	
Voltage	The sum of DC voltage and the peak AC voltage must not exceed the rated voltage of the capacitor	
Performance	**The following specifications will be satisfied when the capacitor is tested at +20°C:**	
Capacitance Change	≤ 160 V	Within 15% of the initial value
	> 160 V	Within 10% of the initial value
Equivalent Series Resistance	Does not exceed 200% of the initial value	
Leakage Current	Does not exceed leakage current limit	

Dimensions – Millimeters

Size Code	Dimensions in mm		Approximate Weight Grams
	D	L	
	-0/+1	±2	
BB	25	30	28
BC	25	35	30
BD	25	40	35
CB	30	30	35
CC	30	35	40
CD	30	40	45
CE	30	45	50
CF	30	50	55
DB	35	30	42
DC	35	35	50
DD	35	40	55
DE	35	45	65
DF	35	50	70
DG	35	55	75
DH	35	60	80
DL	35	80	105
EB	40	30	49
EC	40	35	57
ED	40	40	65
EE	40	45	80
EF	40	50	82
EG	40	55	95
Note: Dimensions include sleeving			

Size Code	Dimensions in mm		Approximate Weight Grams
	D	L	
	-0/+1	±2	
EH	40	60	98
EL	40	80	131
EP	40	105	170
FB	45	30	62
FC	45	35	72
FD	45	40	82
FE	45	45	92
FF	45	50	103
FG	45	55	113
FH	45	60	123
FL	45	80	164
FP	45	105	215
KB	50	30	75
KC	50	35	88
KD	50	40	100
KE	50	45	113
KF	50	50	126
KG	50	55	138
KH	50	60	151
KL	50	80	201
KP	50	105	264
Note: Dimensions include sleeving			

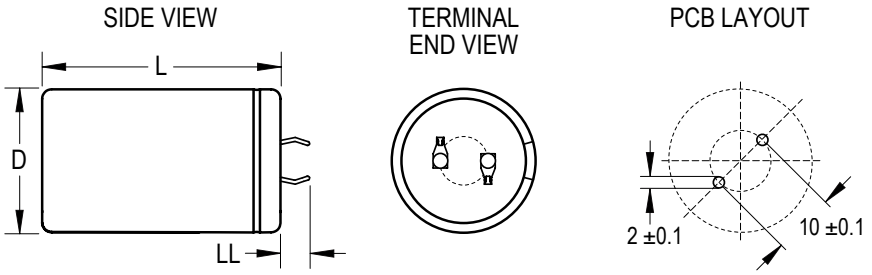
Termination Tables

Termination Code / Diameter (mm)	A	D	F	C	E	G	H
25	•	•	•				
30	•	•	•				
35	•	•	•	•	•		
40	•	•	•	•	•	•	•
45				•	•	•	•
50				•	•	•	•
Mounting: These capacitors are designed to be mounted by their terminations alone and may be used in any position. Dummy pins must be isolated on 4 and 5 pin styles.							

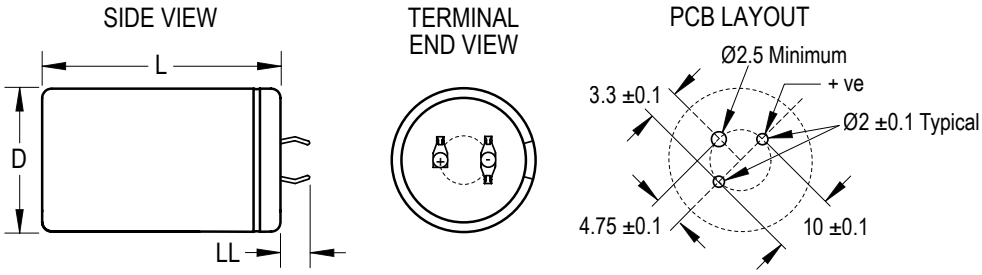
Termination Code	Termination Style	LL ±1
Standard Termination Option		
A	2 Pin	6.3
G (D ≥ 45)	5 Pin	6.3
Other Termination Options		
D	2 Pin	4
F	3 Pin	4
C	4 Pin	6.3
E	4 Pin	4
H	5 Pin	4
Dimensions in mm		

Termination Tables cont'd

Style A/D



Style F



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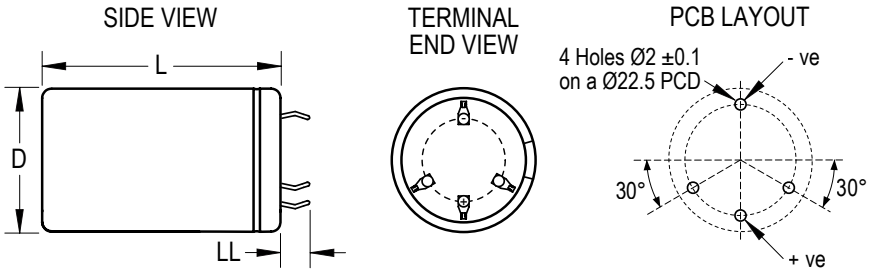
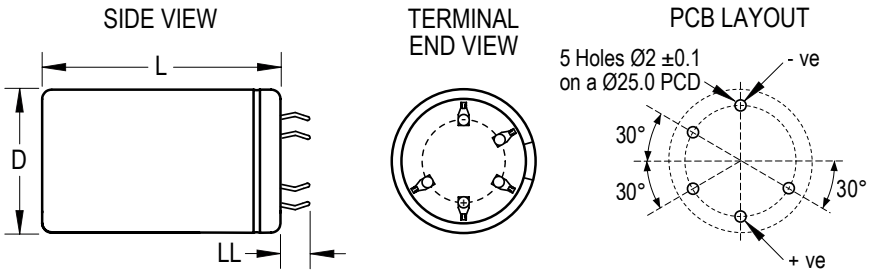


Style G/H



Shelf Life

The capacitance, ESR and impedance of a capacitor will not change significantly after extended storage periods, however the leakage current will very slowly increase. KEMET products are particularly stable and allow a shelf life in excess of three years at 40°C. See sectional specification under each product series for specific data.

Re-age (Reforming) Procedure

Apply the rated voltage to the capacitor at room temperature for a period of one hour, or until the leakage current has fallen to a steady value below the specified limit. During re-aging a maximum charging current of twice the specified leakage current or 5 mA (whichever is greater) is suggested.

Reliability

The reliability of a component can be defined as the probability that it will perform satisfactorily under a given set of conditions for a given length of time.

In practice, it is impossible to predict with absolute certainty how any individual component will perform; thus, we must utilize probability theory. It is also necessary to clearly define the level of stress involved (e.g. operating voltage, ripple current, temperature and time). Finally, the meaning of satisfactory performance must be defined by specifying a set of conditions which determine the end of life of the component.

Reliability as a function of time, R(t), is normally expressed as: $R(t)=e^{-\lambda t}$
where R(t) is the probability that the component will perform satisfactorily for time t, and λ is the failure rate.

Failure Rate

The failure rate is the number of components failing per unit time. The failure rate of most electronic components follows the characteristic pattern:

- Early failures are removed during the manufacturing process.
- The operational life is characterized by a constant failure rate.
- The wear out period is characterized by a rapidly increasing failure rate.

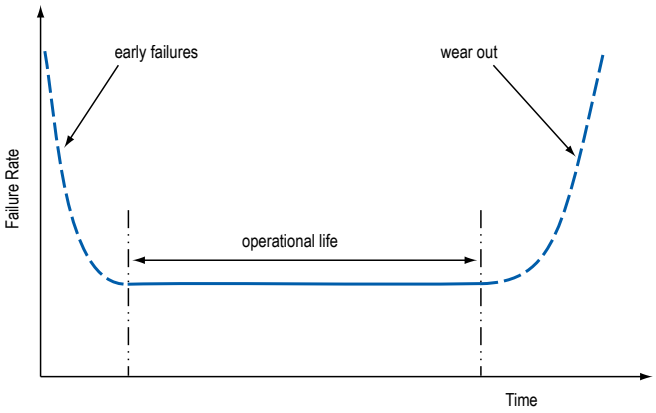
The failures in time (FIT) are given with a 60% confidence level for the various type codes. By convention, FIT is expressed as 1×10^{-9} failures per hour. Failure rate is also expressed as a percentage of failures per 1,000 hours.
e.g., 100 FIT = 1×10^{-7} failures per hour = 0.01%/1,000 hours

End of Life Definition
Catastrophic Failure: short circuit, open circuit or safety vent operation
Parametric Failure:

- Change in capacitance > ±10%
- Leakage current > specified limit
- ESR > 2 x initial ESR value

MTBF

The mean time between failures (MTBF) is simply the inverse of the failure rate.
MTBF= 1/λ



The failure rate is derived from our periodic test results. The failure rate (λ_R) is, therefore, only given at test temperature for life tests. An estimation is also given at 40°C. The expected failure rate for this capacitor range is based on our periodic test results for capacitors with structural similarity. Failure rate is frequently quoted in FIT (Failures In Time) where 1 FIT = 1 x 10^{-9} failures per hour. Failure rate per hour includes both catastrophic and parametric failures.

T_a	**Failure Rate per Hour**
85°C	250 FIT
40°C	12 FIT

Environmental Compliance

As an environmentally conscious company, KEMET is working continuously with improvements concerning the environmental effects of both our capacitors and their production. 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, such as lead (Pb), in electronic equipment. All products in this catalog are produced to help our customers' obligations to guarantee their products and 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 such as 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 such as LF = Lead Free or LFW = Lead Free Wires on the label.

Table 1 – Ratings & Part Number Reference

VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR Maximum	Impedance Maximum	Part Number
	100 Hz 20°C (µF)		D x L (mm)	100 Hz 105°C (A)	10 kHz 105°C (A)	100 Hz 20°C (mΩ)	10 kHz 20°C (mΩ)	
25	8200	BB	25 x 30	1.97	2.11	183	157	ALC40(1)822BB025
25	10000	BC	25 x 35	2.33	2.50	148	126	ALC40(1)103BC025
25	12000	BD	25 x 40	2.74	2.93	123	105	ALC40(1)123BD025
25	12000	CB	30 x 30	2.18	2.33	157	138	ALC40(1)123CB025
25	15000	CC	30 x 35	2.65	2.83	125	109	ALC40(1)153CC025
25	18000	CD	30 x 40	3.04	3.24	103	91	ALC40(1)183CD025
25	22000	DC	35 x 35	2.91	3.10	116	104	ALC40(1)223DC025
25	27000	CF	30 x 50	3.94	4.21	73	64	ALC40(1)273CF025
25	27000	DD	35 x 40	3.34	3.56	96	86	ALC40(1)273DD025
25	27000	EB	40 x 30	4.03	4.09	75	69	ALC40(1)273EB025
25	33000	DF	35 x 50	4.32	4.61	70	63	ALC40(1)333DF025
25	33000	EC	40 x 35	4.83	4.90	66	62	ALC40(1)333EC025
25	39000	DF	35 x 50	4.32	4.61	69	62	ALC40(1)393DF025
25	39000	ED	40 x 40	5.57	5.65	53	49	ALC40(1)393ED025
25	47000	EF	40 x 50	7.30	7.40	41	37	ALC40(1)473EF025
25	56000	EG	40 x 55	7.51	7.61	38	35	ALC40(1)563EG025
25	82000	EL	40 x 80	11.06	11.24	22	20	ALC40(1)823EL025
25	120000	EP	40 x 105	13.41	14.05	18	17	ALC40(1)124EP025
40	3900	BB	25 x 30	1.87	2.09	202	166	ALC40(1)392BB040
40	5600	BC	25 x 35	2.23	2.49	149	124	ALC40(1)562BC040
40	5600	CB	30 x 30	2.08	2.31	171	144	ALC40(1)562CB040
40	6800	BD	25 x 40	2.61	2.92	123	102	ALC40(1)682BD040
40	6800	CC	30 x 35	2.55	2.84	145	120	ALC40(1)682CC040
40	8200	CC	30 x 35	2.53	2.81	129	110	ALC40(1)822CC040
40	10000	CD	30 x 40	2.90	3.22	107	91	ALC40(1)103CD040
40	12000	CF	30 x 50	3.75	4.18	80	68	ALC40(1)123CF040
40	12000	DC	35 x 35	2.77	3.08	121	106	ALC40(1)123DC040
40	12000	EB	40 x 30	4.13	4.22	88	79	ALC40(1)123EB040
40	15000	DD	35 x 40	3.18	3.53	100	87	ALC40(1)153DD040
40	15000	ED	40 x 40	5.66	5.78	63	56	ALC40(1)153ED040
40	18000	DF	35 x 50	4.12	4.58	73	64	ALC40(1)183DF040
40	18000	EE	40 x 45	6.46	6.60	53	47	ALC40(1)183EE040
40	22000	EF	40 x 50	7.34	7.50	43	39	ALC40(1)223EF040
40	27000	EG	40 x 55	7.50	7.63	39	35	ALC40(1)273EG040
40	47000	EL	40 x 80	10.42	10.59	23	21	ALC40(1)473EL040
40	68000	EP	40 x 105	12.71	13.47	17	16	ALC40(1)683EP040
63	2200	BB	25 x 30	1.69	1.98	227	180	ALC40(1)222BB063
63	3300	BC	25 x 35	2.01	2.35	165	133	ALC40(1)332BC063
63	3900	BD	25 x 40	2.36	2.75	138	111	ALC40(1)392BD063
63	3900	CB	30 x 30	1.88	2.18	185	154	ALC40(1)392CB063
63	4700	CC	30 x 35	2.28	2.65	148	123	ALC40(1)472CC063
63	5600	CD	30 x 40	2.61	3.03	122	102	ALC40(1)562CD063
63	5600	EB	40 x 30	3.82	3.91	102	90	ALC40(1)562EB063
63	6800	CF	30 x 50	3.39	3.93	92	75	ALC40(1)682CF063
63	6800	DC	35 x 35	2.50	2.90	141	119	ALC40(1)682DC063
63	6800	EC	40 x 35	4.18	4.26	91	81	ALC40(1)682EC063
63	8200	CF	30 x 50	3.33	3.98	48	35	ALC40(1)822CF063
63	8200	DD	35 x 40	2.87	3.33	116	99	ALC40(1)822DD063
63	8200	ED	40 x 40	5.01	5.12	72	64	ALC40(1)822ED063
63	10000	DF	35 x 50	3.71	4.31	85	72	ALC40(1)103DF063
63	10000	EE	40 x 45	5.69	5.81	60	53	ALC40(1)103EE063
63	12000	EF	40 x 50	6.50	6.64	50	44	ALC40(1)123EF063
63	15000	EH	40 x 60	7.81	7.99	39	34	ALC40(1)153EH063
63	22000	EL	40 x 80	9.70	9.92	27	24	ALC40(1)223EL063
63	33000	EP	40 x 105	12.01	13.01	18	17	ALC40(1)333EP063
100	820	BB	25 x 30	1.39	1.82	294	220	ALC40(1)821BB100
100	1000	BC	25 x 35	1.65	2.16	238	177	ALC40(1)102BC100
100	1200	BD	25 x 40	1.93	2.53	198	147	ALC40(1)122BD100
100	1200	CB	30 x 30	1.57	2.01	245	191	ALC40(1)122CB100
VDC	**Rated Capacitance**	**Size Code**	**Case Size**	**Ripple Current**		**ESR**	**Impedance**	**Part Number**

(1) Termination code: See Termination Tables for available options.

Table 1 – Ratings & Part Number Reference cont'd

VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR Maximum	Impedance Maximum	Part Number
	100 Hz 20°C (µF)		D x L (mm)	100 Hz 105°C (A)	10 kHz 105°C (A)	100 Hz 20°C (mΩ)	10 kHz 20°C (mΩ)	
100	1500	CC	30 x 35	1.90	2.44	195	151	ALC40(1)152CC100
100	1800	CD	30 x 40	2.18	2.80	162	125	ALC40(1)182CD100
100	2200	CF	30 x 50	2.82	3.63	123	94	ALC40(1)222CF100
100	2200	DC	35 x 35	2.10	2.67	177	142	ALC40(1)222DC100
100	2200	EB	40 x 30	3.58	3.80	128	110	ALC40(1)222EB100
100	2700	DD	35 x 40	2.41	3.07	146	118	ALC40(1)272DD100
100	2700	ED	40 x 40	4.92	5.24	95	80	ALC40(1)272ED100
100	3300	DF	35 x 50	3.12	3.97	108	86	ALC40(1)332DF100
100	3300	EE	40 x 45	5.59	5.95	78	66	ALC40(1)332EE100
100	3900	EF	40 x 50	6.41	6.83	65	55	ALC40(1)392EF100
100	4700	EG	40 x 55	6.67	7.04	58	50	ALC40(1)472EG100
100	5600	EH	40 x 60	7.46	7.87	49	42	ALC40(1)562EH100
100	8200	EL	40 x 80	9.28	9.78	34	29	ALC40(1)822EL100
100	10000	EP	40 x 105	11.33	13.12	24	21	ALC40(1)103EP100
200	270	BB	25 x 30	1.01	1.56	542	377	ALC40(1)271BB200
200	390	BC	25 x 35	1.24	1.86	386	271	ALC40(1)391BC200
200	470	BD	25 x 40	1.45	2.19	320	224	ALC40(1)471BD200
200	470	CB	30 x 30	1.24	1.76	369	270	ALC40(1)471CB200
200	560	CC	30 x 35	1.50	2.13	301	219	ALC40(1)561CC200
200	680	CD	30 x 40	1.72	2.44	249	181	ALC40(1)681CD200
200	680	EB	40 x 30	2.97	3.67	202	158	ALC40(1)681EB200
200	820	CF	30 x 50	2.18	3.16	196	140	ALC40(1)821CF200
200	820	DC	35 x 35	1.70	2.34	252	191	ALC40(1)821DC200
200	820	EC	40 x 35	3.35	4.06	173	137	ALC40(1)821EC200
200	1000	DD	35 x 40	1.95	2.69	208	158	ALC40(1)102DD200
200	1000	ED	40 x 40	3.92	4.80	140	110	ALC40(1)102ED200
200	1200	DF	35 x 50	2.50	3.48	159	119	ALC40(1)122DF200
200	1200	EE	40 x 45	4.50	5.50	116	91	ALC40(1)122EE200
200	1500	EF	40 x 50	5.13	6.23	94	74	ALC40(1)152EF200
200	1800	EH	40 x 60	6.10	7.53	76	60	ALC40(1)182EH200
200	2700	EL	40 x 80	7.62	9.32	52	41	ALC40(1)272EL200
200	3900	EP	40 x 105	7.90	12.31	49	34	ALC40(1)392EP200
200	5600	FP	45 x 105	8.68	12.54	40	28	ALC40(1)562FP200
200	6800	KP	50 x 105	9.08	12.29	36	26	ALC40(1)682KP200
250	220	BB	25 x 30	0.93	1.50	592	405	ALC40(1)221BB250
250	270	BC	25 x 35	1.10	1.77	480	327	ALC40(1)271BC250
250	330	BD	25 x 40	1.29	2.08	393	268	ALC40(1)331BD250
250	330	CB	30 x 30	1.13	1.69	441	312	ALC40(1)331CB250
250	390	CC	30 x 35	1.36	2.04	364	256	ALC40(1)391CC250
250	470	CD	30 x 40	1.56	2.34	302	212	ALC40(1)471CD250
250	470	EB	40 x 30	2.59	3.49	258	193	ALC40(1)471EB250
250	560	CF	30 x 50	1.96	3.02	243	168	ALC40(1)561CF250
250	560	DC	35 x 35	1.57	2.25	297	217	ALC40(1)561DC250
250	560	EC	40 x 35	3.05	4.16	221	166	ALC40(1)561EC250
250	680	DD	35 x 40	1.80	2.59	245	179	ALC40(1)681DD250
250	680	ED	40 x 40	3.49	4.76	180	134	ALC40(1)681ED250
250	820	DF	35 x 50	3.12	4.66	190	137	ALC40(1)821DF250
250	820	EE	40 x 45	4.01	5.46	149	111	ALC40(1)821EE250
250	1000	DH	35 x 60	3.61	5.78	164	125	ALC40(1)102DH250
250	1000	EF	40 x 50	4.58	6.22	123	92	ALC40(1)102EF250
250	1200	EG	40 x 55	4.93	6.51	106	80	ALC40(1)122EG250
250	1500	DL	35 x 80	4.43	6.88	112	90	ALC40(1)152DL250
250	1800	EL	40 x 80	6.77	9.27	67	50	ALC40(1)182EL250
250	2700	EP	40 x 105	7.05	12.03	62	42	ALC40(1)272EP250
250	3900	FP	45 x 105	7.90	12.43	50	33	ALC40(1)392FP250
250	4700	KP	50 x 105	8.36	12.30	44	30	ALC40(1)472KP250
350	120	BB	25 x 30	0.88	2.07	868	562	ALC40(1)121BB350
350	150	BC	25 x 35	1.04	2.46	694	449	ALC40(1)151BC350
350	180	BD	25 x 40	1.20	2.81	578	374	ALC40(1)181BD350
VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR	Impedance	Part Number

(1) Termination code: See Termination Tables for available options.

Table 1 – Ratings & Part Number Reference cont'd

VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR Maximum	Impedance Maximum	Part Number
	100 Hz 20°C (µF)		D x L (mm)	100 Hz 105°C (A)	10 kHz 105°C (A)	100 Hz 20°C (mΩ)	10 kHz 20°C (mΩ)	
350	180	CB	30 x 30	1.17	2.46	618	410	ALC40(1)181CB350
350	220	CC	30 x 35	1.36	2.88	502	332	ALC40(1)221CC350
350	270	CD	30 x 40	1.59	3.33	410	272	ALC40(1)271CD350
350	270	EB	40 x 30	1.97	4.36	448	291	ALC40(1)271EB350
350	330	DC	35 x 35	1.79	3.24	378	260	ALC40(1)331DC350
350	390	CF	30 x 50	2.02	4.02	287	191	ALC40(1)391CF350
350	390	DD	35 x 40	2.02	3.67	317	218	ALC40(1)391DD350
350	390	ED	40 x 40	2.64	5.73	312	203	ALC40(1)391ED350
350	470	DF	35 x 50	2.72	4.90	251	170	ALC40(1)471DF350
350	470	EE	40 x 45	3.00	6.46	258	168	ALC40(1)471EE350
350	560	DF	35 x 50	2.57	4.44	224	155	ALC40(1)561DF350
350	560	DH	35 x 60	3.11	5.70	224	155	ALC40(1)561DH350
350	560	EF	40 x 50	3.41	7.27	216	141	ALC40(1)561EF350
350	680	EH	40 x 60	3.99	8.39	177	114	ALC40(1)681EH350
350	820	DL	35 x 80	3.82	6.72	150	102	ALC40(1)821DL350
350	1000	EL	40 x 80	5.00	9.98	120	78	ALC40(1)102EL350
350	1500	EP	40 x 105	6.00	11.47	99	68	ALC40(1)152EP350
350	2200	FP	45 x 105	6.79	12.06	77	53	ALC40(1)222FP350
350	2700	KP	50 x 105	7.34	12.08	66	45	ALC40(1)272KP350
400	100	BB	25 x 30	0.85	2.09	1193	788	ALC40(1)101BB400
400	120	BC	25 x 35	1.00	2.45	991	653	ALC40(1)121BC400
400	150	BD	25 x 40	1.17	2.83	794	524	ALC40(1)151BD400
400	150	CB	30 x 30	1.14	2.46	835	562	ALC40(1)151CB400
400	180	CC	30 x 35	1.31	2.88	690	463	ALC40(1)181CC400
400	220	CD	30 x 40	1.54	3.33	565	379	ALC40(1)221CD400
400	220	EB	40 x 30	1.88	4.36	521	320	ALC40(1)221EB400
400	270	DC	35 x 35	1.73	3.23	470	322	ALC40(1)271DC400
400	270	EC	40 x 35	2.21	4.95	430	266	ALC40(1)271EC400
400	330	CF	30 x 50	1.98	4.02	383	258	ALC40(1)331CF400
400	330	DD	35 x 40	1.98	3.64	386	266	ALC40(1)331DD400
400	330	ED	40 x 40	2.56	5.76	350	216	ALC40(1)331ED400
400	390	DF	35 x 50	2.64	4.66	323	221	ALC40(1)391DF400
400	390	EE	40 x 45	2.88	6.48	295	182	ALC40(1)391EE400
400	470	DE	35 x 45	2.50	4.73	300	192	ALC40(1)471DE400
400	470	DF	35 x 50	2.51	4.40	277	192	ALC40(1)471DF400
400	470	DH	35 x 60	3.04	5.78	270	185	ALC40(1)471DH400
400	470	EF	40 x 50	3.28	7.30	245	151	ALC40(1)471EF400
400	560	EG	40 x 55	3.62	7.78	209	130	ALC40(1)561EG400
400	680	DL	35 x 80	3.72	6.69	200	131	ALC40(1)681DL400
400	680	EH	40 x 60	4.08	8.58	173	107	ALC40(1)681EH400
400	1000	EL	40 x 80	4.85	10.16	118	73	ALC40(1)102EL400
400	1200	EP	40 x 105	5.76	11.46	103	70	ALC40(1)122EP400
400	1800	FP	45 x 105	6.48	12.04	82	55	ALC40(1)182FP400
400	2200	KP	50 x 105	7.02	12.08	70	47	ALC40(1)222KP400
450	47	BB	25 x 30	0.66	1.74	2011	1392	ALC40(1)470BB450
450	56	BC	25 x 35	0.76	2.03	1687	1168	ALC40(1)560BC450
450	68	BD	25 x 40	0.88	2.34	1391	963	ALC40(1)680BD450
450	68	CB	30 x 30	0.87	2.19	1403	974	ALC40(1)680CB450
450	82	CC	30 x 35	1.01	2.54	1163	807	ALC40(1)820CC450
450	100	CD	30 x 40	1.18	2.95	955	663	ALC40(1)101CD450
450	120	DC	35 x 35	1.36	3.11	810	565	ALC40(1)121DC450
450	150	CF	30 x 50	1.54	3.67	642	446	ALC40(1)151CF450
450	150	DD	35 x 40	1.57	3.53	651	454	ALC40(1)151DD450
450	150	EB	40 x 30	1.73	4.14	642	447	ALC40(1)151EB450
450	180	DF	35 x 50	1.88	4.27	541	377	ALC40(1)181DF450
450	180	EC	40 x 35	2.01	4.70	538	374	ALC40(1)181EC450
450	220	DF	35 x 50	2.28	4.71	449	315	ALC40(1)221DF450
450	220	ED	40 x 40	2.34	5.47	440	306	ALC40(1)221ED450
450	270	EF	40 x 50	2.80	6.74	356	248	ALC40(1)271EF450
VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR	Impedance	Part Number

(1) Termination code: See Termination Tables for available options.

Table 1 – Ratings & Part Number Reference cont'd

VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR Maximum	Impedance Maximum	Part Number
	100 Hz 20°C (µF)		D x L (mm)	100 Hz 105°C (A)	10 kHz 105°C (A)	100 Hz 20°C (mΩ)	10 kHz 20°C (mΩ)	
450	330	DF	35 x 50	2.53	5.14	206	140	ALC40(1)331DF450
450	330	DH	35 x 60	2.91	5.53	285	198	ALC40(1)331DH450
450	330	EG	40 x 55	3.14	7.29	293	204	ALC40(1)331EG450
450	390	EH	40 x 60	3.50	8.04	249	174	ALC40(1)391EH450
450	470	DH	35 X 60	3.00	5.82	232	148	ALC40(1)471DH450
450	470	DL	35 x 80	3.51	6.68	203	138	ALC40(1)471DL450
450	560	EL	40 x 80	4.32	9.57	175	122	ALC40(1)561EL450
450	820	EL	40 X 80	4.30	10.04	154	98	ALC40(1)821EL450
450	820	EP	40 x 105	5.34	11.05	121	85	ALC40(1)821EP450
450	1200	FP	45 x 105	5.84	11.64	105	71	ALC40(1)122FP450
450	1500	KP	50 x 105	6.44	11.85	86	59	ALC40(1)152KP450
500	56	BB	25 x 30	0.75	1.58	3930	3170	ALC40(1)560BB500
500	68	BC	25 x 35	0.85	1.81	3240	2610	ALC40(1)680BC500
500	82	BD	25 x 40	0.97	2.05	2690	2170	ALC40(1)20ABD500
500	82	CB	30 x 30	1.00	2.03	2700	2180	ALC40(1)820CB500
500	120	CC	30 x 35	1.26	2.51	1850	1500	ALC40(1)121CC500
500	150	DC	35 x 35	1.51	2.88	1500	1210	ALC40(1)151DC500
500	180	CF	30 x 50	1.67	3.34	1230	1000	ALC40(1)181CF500
500	180	DD	35 x 40	1.71	3.26	1250	1010	ALC40(1)181DD500
500	180	EB	40 x 30	1.77	3.55	1250	1010	ALC40(1)181EB500
500	220	EC	40 x 35	2.03	4.09	1020	820	ALC40(1)221EC500
500	270	DF	35 x 50	2.20	4.06	840	680	ALC40(1)271DF500
500	270	ED	40 x 40	2.32	4.66	830	670	ALC40(1)271ED500
500	330	DH	35 x 60	2.52	4.62	690	560	ALC40(1)331DH500
500	390	EF	40 x 50	2.94	5.81	580	470	ALC40(1)391EF500
500	470	DL	35 x 80	3.14	5.61	480	390	ALC40(1)471DL500
500	470	EG	40 x 55	3.30	6.42	480	390	ALC40(1)471EG500
500	680	EL	40 x 80	4.25	8.14	330	270	ALC40(1)681EL500
500	820	EP	40 x 105	4.71	8.95	280	220	ALC40(1)821EP500
500	1000	FP	45 x 105	5.52	10.08	230	190	ALC40(1)102FP500
500	1200	KP	50 x 105	6.27	11.00	190	160	ALC40(1)122KP500
VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR	Impedance	Part Number

(1) Termination code: See Termination Tables for available options.

Mechanical Data

Polarity and Reversed Voltage
Aluminium Electrolytic capacitors manufactured for use in DC applications contain an anode foil and a cathode foil. As such, they are polarized devices and must be connected with the +ve to the anode foil and the -ve to the cathode foil. If this were to be reversed then the electrolytic process that took place in forming the oxide layer on the anode would be recreated in trying to form an oxide layer on the cathode. In forming the cathode foil in this way, heat would be generated and gas given off within the capacitor, usually leading to catastrophic failure.

The cathode foil already possesses a thin stabilized oxide layer. This thin oxide layer is equivalent to a forming voltage of approximately 2 V. As a result, the capacitor can withstand a voltage reversal of up to 2 V for short periods. Above this voltage, the formation process will commence. Aluminium Electrolytic capacitors can also be manufactured for use in intermittent AC applications by using two anode foils in place of one anode and one cathode.

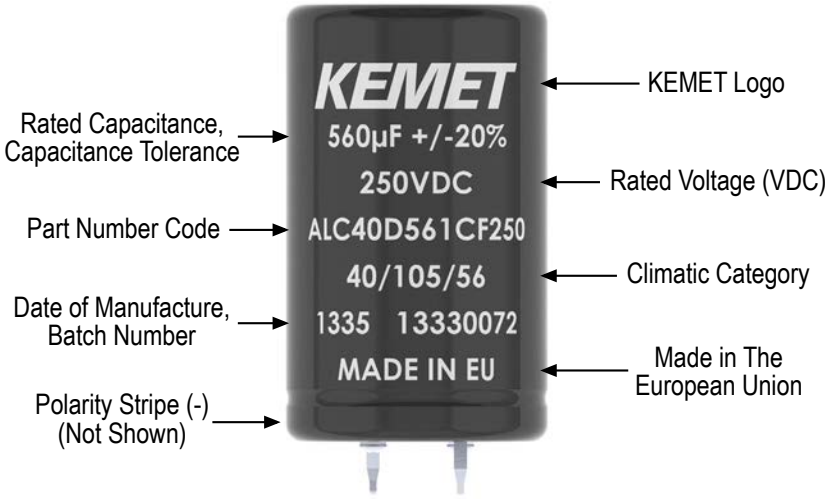
Mounting Position
The capacitor can be mounted upright or inclined to a horizontal position.

Insulating Resistance
≥ 100 MΩ at 100 VDC across insulating sleeve. UL recognized sleeving is available for custom parts in this range, upon request. (UL No. E358957)

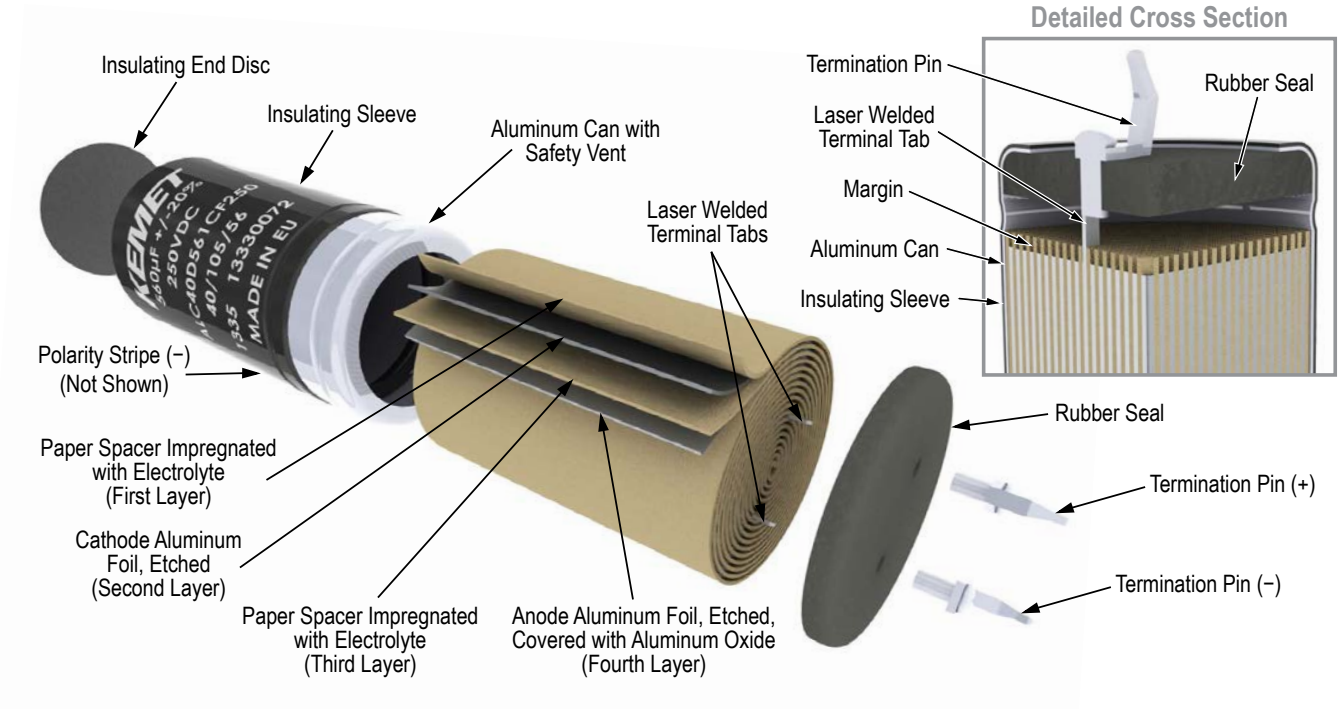
Voltage Proof
≥ 2,500 VDC across insulating sleeve.

Safety Vent
A safety vent for overpressure is featured on either the base (opposing end to the terminals) or the side of the can. This appears in the form of a grooved section on the surface of the can, which is a weakened area and designed to relieve build-up of internal pressure due to overstress or catastrophic failure.

Marking



Construction



ELG Series, +105ºC

Overview

KEMET's ELG Series of aluminum electrolytic snap-in capacitors are designed with snap-lock terminals for printed circuit board mounting. The case is aluminum with an insulated sleeve and safety vent at the bottom.

Applications

Typical applications include general purpose power electronics, UPS, SMPS and battery chargers.

Benefits

- Suited for high reliability, low ESR applications
- Operating temperature of up to 105°C
- 2,000 hour operating life
- RoHS Compliant and lead-free

Part Number System

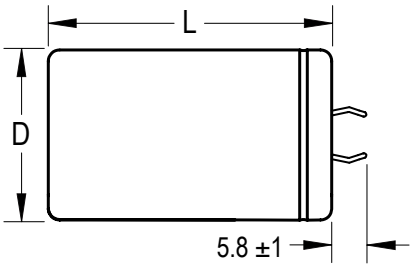
ELG	129	M	6R3		A	Q1	AA
Series	Capacitance Code (pF)	Tolerance	Rated Voltage (VDC)		Electrical Parameters	Size Code	Packaging
Snap-In Aluminum Electrolytic	First two digits represent significant figures for capacitance values. Last digit specifies the number of zeros to be added.	M = ±20%	6R3 = 6.3 010 = 10 016 = 16 025 = 25 035 = 35 050 = 50 063 = 63 080 = 80 100 = 100	160 = 160 180 = 180 200 = 200 250 = 250 350 = 350 400 = 400 420 = 420 450 = 450 500 = 500	A = Standard	See Dimension Table	See Ordering Options Table

Ordering Options Table

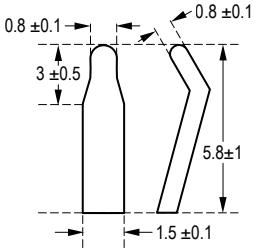
Packaging Type	Lead Length (mm)	Lead and Packaging Code
Standard Bulk Packaging Options		
Bulk (box)	5.8 ± 1.0	AA
Bulk (box)	4.0 ± 0.2	AV

Dimensions – Millimeters

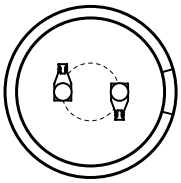
SIDE VIEW



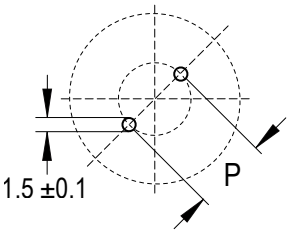
TERMINAL DETAIL



TERMINAL END VIEW



PCB LAYOUT



Size Code	D		L		p	
	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
Q7	22	+1.0/-0	20	+2.0/-0	10.0	±0.5
Q1	22	+1.0/-0	25	+2.0/-0	10.0	±0.5
Q2	22	+1.0/-0	30	+2.0/-0	10.0	±0.5
Q3	22	+1.0/-0	35	+2.0/-0	10.0	±0.5
Q4	22	+1.0/-0	40	+2.0/-0	10.0	±0.5
Q5	22	+1.0/-0	45	+2.0/-0	10.0	±0.5
Q6	22	+1.0/-0	50	+2.0/-0	10.0	±0.5
R7	25	+1.0/-0	20	+2.0/-0	10.0	±0.5
R1	25	+1.0/-0	25	+2.0/-0	10.0	±0.5
R2	25	+1.0/-0	30	+2.0/-0	10.0	±0.5
R3	25	+1.0/-0	35	+2.0/-0	10.0	±0.5
R4	25	+1.0/-0	40	+2.0/-0	10.0	±0.5
R5	25	+1.0/-0	45	+2.0/-0	10.0	±0.5
R6	25	+1.0/-0	50	+2.0/-0	10.0	±0.5
S1	30	+1.0/-0	25	+2.0/-0	10.0	±0.5
S2	30	+1.0/-0	30	+2.0/-0	10.0	±0.5
S3	30	+1.0/-0	35	+2.0/-0	10.0	±0.5
S4	30	+1.0/-0	40	+2.0/-0	10.0	±0.5
S5	30	+1.0/-0	45	+2.0/-0	10.0	±0.5
S6	30	+1.0/-0	50	+2.0/-0	10.0	±0.5
S8	30	+1.0/-0	60	+2.0/-0	10.0	±0.5
T1	35	+1.0/-0	25	+2.0/-0	10.0	±0.5
T2	35	+1.0/-0	30	+2.0/-0	10.0	±0.5
T3	35	+1.0/-0	35	+2.0/-0	10.0	±0.5
T4	35	+1.0/-0	40	+2.0/-0	10.0	±0.5
T5	35	+1.0/-0	45	+2.0/-0	10.0	±0.5
T6	35	+1.0/-0	50	+2.0/-0	10.0	±0.5
T8	35	+1.0/-0	60	+2.0/-0	10.0	±0.5

Environmental Compliance

As an environmentally conscious company, KEMET is working continuously with improvements concerning the environmental effects of both our capacitors and their production. 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, such as lead (Pb), in electronic equipment. All products in this catalog are produced to help our customers' obligations to guarantee their products and 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 such as 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 such as LF = Lead Free or LFW = Lead Free Wires on the label.

Performance Characteristics

Item	Performance Characteristics	
Capacitance Range	560 – 82,000 µF	47 – 2,200 µF
Capacitance Tolerance	±20% at 120 Hz / 20°C	
Rated Voltage	6.3 – 100 VDC	160 – 500 VDC
Life Test	2,000 hours (see conditions in Test Methods & Performance)	
Operating Temperature	-40°C to +105°C	-25°C to +105°C
Leakage Current	I = 0.02 CV (mA) or 3 mA, whichever is smaller	
	C = rated capacitance (µF), V = rated voltage (VDC). Voltage applied for 5 minutes at 20°C.	

Impedance Z Characteristics at 120 Hz

Rated Voltage (VDC)	6.3 – 16	25	35	50 – 63	80 – 100	160 – 400	420 – 450	500
Z (-25°C) / Z (20°C)	4	3	3	2	2	4	8	8
Z (-40°C) / Z (20°C)	15	10	8	6	5			

Compensation Factor of Ripple Current (RC) vs. Frequency

Rated Voltage (VDC)	50 Hz	60 Hz	120 Hz	1 kHz	10 kHz
6.3 – 100	0.88	0.90	1.00	1.15	1.16
160 – 250	0.85	0.88	1.00	1.30	1.50
350 – 450	0.88	0.90	1.00	1.35	1.45
500	0.70	0.72	1.00	1.30	1.41

Test Method & Performance

Conditions	Load Life Test	Shelf Life Test
Temperature	105°C	105°C
Test Duration	2,000 hours	1,000 hours
Ripple Current	Maximum ripple current specified at 120 kHz 105°C specified in table	No ripple current applied
Voltage	The sum of DC voltage and the peak AC voltage must not exceed the rated voltage of the capacitor	No voltage applied
Performance	**The following specifications will be satisfied when the capacitor is restored to 20°C:**	
Capacitance Change	Within ±20% of the initial value	
Dissipation Factor	Does not exceed 200% of the specified value	Does not exceed 200% of the specified value
Leakage Current	Does not exceed specified value	

Shelf Life

The capacitance, ESR and impedance of a capacitor will not change significantly after extended storage periods, however the leakage current will very slowly increase.

KEMET's E-series aluminum electrolytic capacitors should not be stored in high temperatures or where there is a high level of humidity. The suitable storage condition for KEMET's E-series aluminum electrolytic capacitors is +5 to +35ºC and less than 75% in relative humidity.
KEMET's E-series aluminum electrolytic capacitors should not be stored in damp conditions such as water, saltwater spray or oil spray.
KEMET's E-series aluminum electrolytic capacitors should not be stored in an environment full of hazardous gas (hydrogen sulphide , sulphurous acid gas, nitrous acid, chlorine gas, ammonium, etc.)
KEMET's E-series aluminum electrolytic capacitors should not be stored under exposure to ozone, ultraviolet rays or radiation.
If a capacitor has been stored for more than 18 months under these conditions and it shows increased leakage current, then a treatment by voltage application is recommended.

Re-age (Reforming) Procedure

Apply the rated voltage to the capacitor at room temperature for a period of one hour, or until the leakage current has fallen to a steady value below the specified limit. During re-aging a maximum charging current of twice the specified leakage current or 5 mA (whichever is greater) is suggested.

Table 1 – Ratings & Part Number Reference

VDC	VDC Surge Voltage	Rated Capacitance 120 Hz 20°C (µF)	Case Size D x L (mm)	DF 120 Hz 20°C (tan δ %)*	RC 120 Hz 105°C (A)	LC 20°C 5 Minutes (mA)	Part Number
6.3	8	12000	22 x 25	60	1.55	1.5	ELG129M6R3AQ1(1)
6.3	8	15000	22 x 30	60	1.70	1.9	ELG159M6R3AQ2(1)
6.3	8	15000	25 x 25	60	1.70	1.9	ELG159M6R3AR1(1)
6.3	8	18000	22 x 30	60	1.95	2.3	ELG189M6R3AQ2(1)
6.3	8	18000	25 x 25	60	1.95	2.3	ELG189M6R3AR1(1)
6.3	8	22000	22 x 35	60	2.25	2.8	ELG229M6R3AQ3(1)
6.3	8	22000	25 x 30	60	2.25	2.8	ELG229M6R3AR2(1)
6.3	8	22000	30 x 25	60	2.25	2.8	ELG229M6R3AS1(1)
6.3	8	27000	22 x 40	60	2.55	3.0	ELG279M6R3AQ4(1)
6.3	8	27000	25 x 35	60	2.55	3.0	ELG279M6R3AR3(1)
6.3	8	27000	30 x 30	60	2.55	3.0	ELG279M6R3AS2(1)
6.3	8	27000	35 x 25	60	2.55	3.0	ELG279M6R3AT1(1)
6.3	8	33000	22 x 45	60	2.90	3.0	ELG339M6R3AQ5(1)
6.3	8	33000	25 x 40	60	2.95	3.0	ELG339M6R3AR4(1)
6.3	8	33000	30 x 30	60	2.90	3.0	ELG339M6R3AS2(1)
6.3	8	33000	35 x 25	60	2.95	3.0	ELG339M6R3AT1(1)
6.3	8	39000	25 x 50	60	3.25	3.0	ELG399M6R3AR6(1)
6.3	8	39000	30 x 35	60	3.25	3.0	ELG399M6R3AS3(1)
6.3	8	39000	35 x 30	60	3.30	3.0	ELG399M6R3AT2(1)
6.3	8	47000	25 x 50	60	3.70	3.0	ELG479M6R3AR6(1)
6.3	8	47000	30 x 40	60	3.70	3.0	ELG479M6R3AS4(1)
6.3	8	56000	30 x 45	60	4.15	3.0	ELG569M6R3AS5(1)
6.3	8	56000	35 x 35	60	4.10	3.0	ELG569M6R3AT3(1)
6.3	8	68000	30 x 50	60	4.70	3.0	ELG689M6R3AS6(1)
6.3	8	68000	35 x 40	60	4.70	3.0	ELG689M6R3AT4(1)
6.3	8	82000	35 x 45	60	5.30	3.0	ELG829M6R3AT5(1)
10	13	10000	25 x 25	55	1.55	2.0	ELG109M010AR1(1)
10	13	12000	22 x 30	55	1.75	2.4	ELG129M010AQ2(1)
10	13	15000	22 x 30	55	1.90	3.0	ELG159M010AQ2(1)
10	13	15000	25 x 25	55	1.90	3.0	ELG159M010AR1(1)
10	13	18000	22 x 35	55	2.20	3.0	ELG189M010AQ3(1)
10	13	18000	25 x 30	55	2.25	3.0	ELG189M010AR2(1)
10	13	22000	22 x 40	55	2.50	3.0	ELG229M010AQ4(1)
10	13	22000	25 x 35	55	2.55	3.0	ELG229M010AR3(1)
10	13	22000	30 x 25	55	2.45	3.0	ELG229M010AS1(1)
10	13	27000	22 x 50	55	2.95	3.0	ELG279M010AQ6(1)
10	13	27000	25 x 40	55	2.90	3.0	ELG279M010AR4(1)
10	13	27000	30 x 30	55	2.85	3.0	ELG279M010AS2(1)
10	13	27000	35 x 25	55	2.80	3.0	ELG279M010AT1(1)
10	13	33000	25 x 45	55	3.30	3.0	ELG339M010AR5(1)
10	13	33000	30 x 35	55	3.30	3.0	ELG339M010AS3(1)
10	13	33000	35 x 30	55	3.30	3.0	ELG339M010AT2(1)
10	13	39000	25 x 50	55	3.70	3.0	ELG399M010AR6(1)
10	13	39000	30 x 40	55	3.70	3.0	ELG399M010AS4(1)
10	13	39000	35 x 30	55	3.65	3.0	ELG399M010AT2(1)
10	13	47000	30 x 45	55	4.20	3.0	ELG479M010AS5(1)
10	13	47000	35 x 35	55	3.80	3.0	ELG479M010AT3(1)
10	13	56000	30 x 50	55	4.65	3.0	ELG569M010AS6(1)
10	13	56000	35 x 40	55	4.65	3.0	ELG569M010AT4(1)
10	13	68000	35 x 50	55	5.50	3.0	ELG689M010AT6(1)
16	20	6800	22 x 25	55	1.55	2.2	ELG688M016AQ1(1)
16	20	8200	22 x 30	55	1.70	2.6	ELG828M016AQ2(1)
16	20	8200	25 x 25	55	1.70	2.6	ELG828M016AR1(1)
16	20	10000	22 x 30	55	1.95	3.0	ELG109M016AQ2(1)
16	20	10000	25 x 25	55	1.95	3.0	ELG109M016AR1(1)
16	20	12000	22 x 35	55	2.20	3.0	ELG129M016AQ3(1)
16	20	12000	25 x 30	55	2.25	3.0	ELG129M016AR2(1)
VDC	**VDC Surge**	**Rated Capacitance**	**Case Size**	**DF**	**RC**	**LC**	**Part Number**

(1) Insert packaging code. See Ordering Options Table for available options.

** When capacitance exceeds 1,000 µF, the DF value (%) is increased by 2% for every additional 1,000 µF.*

Table 1 – Ratings & Part Number Reference cont'd

VDC	VDC Surge Voltage	Rated Capacitance 120 Hz 20°C (µF)	Case Size D x L (mm)	DF 120 Hz 20°C (tan δ %)*	RC 120 Hz 105°C (A)	LC 20°C 5 Minutes (mA)	Part Number
16	20	12000	30 x 25	55	2.30	3.0	ELG129M016AS1(1)
16	20	15000	22 x 40	55	2.55	3.0	ELG159M016AQ4(1)
16	20	15000	25 x 35	55	2.60	3.0	ELG159M016AR3(1)
16	20	15000	30 x 30	55	2.60	3.0	ELG159M016AS2(1)
16	20	15000	35 x 25	55	2.65	3.0	ELG159M016AT1(1)
16	20	18000	22 x 45	55	2.90	3.0	ELG189M016AQ5(1)
16	20	18000	25 x 40	55	2.90	3.0	ELG189M016AR4(1)
16	20	18000	30 x 30	55	2.90	3.0	ELG189M016AS2(1)
16	20	18000	35 x 25	55	2.95	3.0	ELG189M016AT1(1)
16	20	22000	25 x 45	55	3.30	3.0	ELG229M016AR5(1)
16	20	22000	30 x 35	55	3.30	3.0	ELG229M016AS3(1)
16	20	22000	35 x 30	55	3.30	3.0	ELG229M016AT2(1)
16	20	27000	25 x 50	55	3.80	3.0	ELG279M016AR6(1)
16	20	27000	30 x 40	55	3.75	3.0	ELG279M016AS4(1)
16	20	27000	35 x 30	55	3.75	3.0	ELG279M016AT2(1)
16	20	33000	30 x 45	55	4.30	3.0	ELG339M016AS5(1)
16	20	33000	35 x 35	55	4.25	3.0	ELG339M016AT3(1)
16	20	39000	30 x 50	55	4.80	3.0	ELG399M016AS6(1)
16	20	39000	35 x 40	55	4.80	3.0	ELG399M016AT4(1)
16	20	47000	35 x 45	55	5.45	3.0	ELG479M016AT5(1)
16	20	56000	35 x 45	55	5.65	3.0	ELG569M016AT5(1)
16	20	68000	35 x 50	55	6.20	3.0	ELG689M016AT6(1)
25	32	4700	22 x 25	45	1.50	2.3	ELG478M025AQ1(1)
25	32	5600	22 x 30	45	1.65	2.8	ELG568M025AQ2(1)
25	32	5600	25 x 25	45	1.65	2.8	ELG568M025AR1(1)
25	32	6800	22 x 30	45	1.85	3.0	ELG688M025AQ2(1)
25	32	6800	25 x 25	45	1.85	3.0	ELG688M025AR1(1)
25	32	8200	22 x 35	45	2.10	3.0	ELG828M025AQ3(1)
25	32	8200	25 x 30	45	2.10	3.0	ELG828M025AR2(1)
25	32	8200	30 x 25	45	2.15	3.0	ELG828M025AS1(1)
25	32	10000	22 x 40	45	2.40	3.0	ELG109M025AQ4(1)
25	32	10000	25 x 35	45	2.40	3.0	ELG109M025AR3(1)
25	32	10000	30 x 30	45	2.40	3.0	ELG109M025AS2(1)
25	32	10000	35 x 25	45	2.40	3.0	ELG109M025AT1(1)
25	32	12000	22 x 45	45	2.70	3.0	ELG129M025AQ5(1)
25	32	12000	25 x 40	45	2.75	3.0	ELG129M025AR4(1)
25	32	12000	30 x 30	45	2.70	3.0	ELG129M025AS2(1)
25	32	12000	35 x 25	45	2.75	3.0	ELG129M025AT1(1)
25	32	15000	25 x 45	45	3.15	3.0	ELG159M025AR5(1)
25	32	15000	30 x 35	45	3.15	3.0	ELG159M025AS3(1)
25	32	15000	35 x 30	45	3.25	3.0	ELG159M025AT2(1)
25	32	18000	25 x 50	45	3.55	3.0	ELG189M025AR6(1)
25	32	18000	30 x 40	45	3.55	3.0	ELG189M025AS4(1)
25	32	18000	35 x 35	45	3.55	3.0	ELG189M025AT3(1)
25	32	22000	30 x 45	45	4.05	3.0	ELG229M025AS5(1)
25	32	22000	35 x 35	45	3.80	3.0	ELG229M025AT3(1)
25	32	27000	35 x 45	45	4.70	3.0	ELG279M025AT5(1)
25	32	33000	35 x 50	45	5.40	3.0	ELG339M025AT6(1)
25	32	39000	35 x 45	45	5.50	3.0	ELG399M025AT5(1)
25	32	47000	35 x 50	45	6.00	3.0	ELG479M025AT6(1)
35	44	3300	22 x 25	35	1.40	2.3	ELG338M035AQ1(1)
35	44	3900	22 x 30	35	1.55	2.7	ELG398M035AQ2(1)
35	44	3900	25 x 25	35	1.55	2.7	ELG398M035AR1(1)
35	44	4700	22 x 35	35	1.80	3.0	ELG478M035AQ3(1)
35	44	4700	25 x 25	35	1.80	3.0	ELG478M035AR1(1)
35	44	5600	22 x 35	35	1.95	3.0	ELG568M035AQ3(1)
35	44	5600	25 x 30	35	1.95	3.0	ELG568M035AR2(1)
VDC	**VDC Surge**	**Rated Capacitance**	**Case Size**	**DF**	**RC**	**LC**	**Part Number**

(1) Insert packaging code. See Ordering Options Table for available options.

** When capacitance exceeds 1,000 µF, the DF value (%) is increased by 2% for every additional 1,000 µF.*

Table 1 – Ratings & Part Number Reference cont'd

VDC	VDC Surge Voltage	Rated Capacitance 120 Hz 20°C (µF)	Case Size D x L (mm)	DF 120 Hz 20°C (tan δ %)*	RC 120 Hz 105°C (A)	LC 20°C 5 Minutes (mA)	Part Number
35	44	5600	30 x 25	35	2.00	3.0	ELG568M035AS1(1)
35	44	6800	22 x 40	35	2.20	3.0	ELG688M035AQ4(1)
35	44	6800	25 x 35	35	2.25	3.0	ELG688M035AR3(1)
35	44	6800	30 x 30	35	2.30	3.0	ELG688M035AS2(1)
35	44	6800	35 x 25	35	2.35	3.0	ELG688M035AT1(1)
35	44	8200	22 x 50	35	2.55	3.0	ELG828M035AQ6(1)
35	44	8200	25 x 40	35	2.50	3.0	ELG828M035AR4(1)
35	44	8200	30 x 30	35	2.75	3.0	ELG828M035AS2(1)
35	44	8200	35 x 25	35	2.75	3.0	ELG828M035AT1(1)
35	44	10000	25 x 45	35	2.85	3.0	ELG109M035AR5(1)
35	44	10000	30 x 35	35	2.90	3.0	ELG109M035AS3(1)
35	44	10000	35 x 30	35	2.95	3.0	ELG109M035AT2(1)
35	44	12000	25 x 50	35	3.25	3.0	ELG129M035AR6(1)
35	44	12000	30 x 40	35	3.25	3.0	ELG129M035AS4(1)
35	44	12000	35 x 30	35	3.15	3.0	ELG129M035AT2(1)
35	44	15000	30 x 45	35	3.70	3.0	ELG159M035AS5(1)
35	44	15000	35 x 35	35	3.65	3.0	ELG159M035AT3(1)
35	44	18000	35 x 40	35	4.35	3.0	ELG189M035AT4(1)
35	44	22000	30 x 50	35	4.90	3.0	ELG229M035AS6(1)
50	63	1800	22 x 25	30	1.30	1.8	ELG188M050AQ1(1)
50	63	2200	22 x 30	30	1.55	2.2	ELG228M050AQ2(1)
50	63	2200	25 x 25	30	1.55	2.2	ELG228M050AR1(1)
50	63	2700	22 x 30	30	1.70	2.7	ELG278M050AQ2(1)
50	63	2700	25 x 25	30	1.70	2.7	ELG278M050AR1(1)
50	63	3300	22 x 35	30	1.95	3.0	ELG338M050AQ3(1)
50	63	3300	25 x 30	30	1.85	3.0	ELG338M050AR2(1)
50	63	3900	22 x 40	30	2.15	3.0	ELG398M050AQ4(1)
50	63	3900	25 x 35	30	2.20	3.0	ELG398M050AR3(1)
50	63	3900	30 x 25	30	1.95	3.0	ELG398M050AS1(1)
50	63	4700	22 x 45	30	2.45	3.0	ELG478M050AQ5(1)
50	63	4700	25 x 40	30	2.45	3.0	ELG478M050AR4(1)
50	63	4700	30 x 30	30	2.45	3.0	ELG478M050AS2(1)
50	63	4700	35 x 25	30	2.50	3.0	ELG478M050AT1(1)
50	63	5600	22 x 50	30	2.75	3.0	ELG568M050AQ6(1)
50	63	5600	25 x 40	30	2.70	3.0	ELG568M050AR4(1)
50	63	5600	30 x 35	30	2.75	3.0	ELG568M050AS3(1)
50	63	5600	35 x 30	30	2.75	3.0	ELG568M050AT2(1)
50	63	6800	25 x 50	30	3.30	3.0	ELG688M050AR6(1)
50	63	6800	30 x 40	30	3.30	3.0	ELG688M050AS4(1)
50	63	6800	35 x 30	30	3.25	3.0	ELG688M050AT2(1)
50	63	8200	30 x 45	30	3.60	3.0	ELG828M050AS5(1)
50	63	8200	35 x 35	30	3.55	3.0	ELG828M050AT3(1)
50	63	10000	30 x 50	30	4.05	3.0	ELG109M050AS6(1)
50	63	10000	35 x 40	30	4.00	3.0	ELG109M050AT4(1)
50	63	12000	35 x 45	30	4.55	3.0	ELG129M050AT5(1)
63	79	1200	22 x 25	25	1.20	1.5	ELG128M063AQ1(1)
63	79	1500	22 x 30	25	1.30	1.9	ELG158M063AQ2(1)
63	79	1500	25 x 25	25	1.30	1.9	ELG158M063AR1(1)
63	79	1800	22 x 30	25	1.50	2.3	ELG188M063AQ2(1)
63	79	1800	25 x 25	25	1.50	2.3	ELG188M063AR1(1)
63	79	2200	22 x 35	25	1.70	2.8	ELG228M063AQ3(1)
63	79	2200	25 x 30	25	1.75	2.8	ELG228M063AR2(1)
63	79	2200	30 x 25	25	1.80	2.8	ELG228M063AS1(1)
63	79	2700	22 x 40	25	2.00	3.0	ELG278M063AQ4(1)
63	79	2700	25 x 35	25	2.00	3.0	ELG278M063AR3(1)
63	79	2700	30 x 25	25	1.95	3.0	ELG278M063AS1(1)
63	79	3300	22 x 50	25	2.30	3.0	ELG338M063AQ6(1)
VDC	**VDC Surge**	**Rated Capacitance**	**Case Size**	**DF**	**RC**	**LC**	**Part Number**

(1) Insert packaging code. See Ordering Options Table for available options.

** When capacitance exceeds 1,000 µF, the DF value (%) is increased by 2% for every additional 1,000 µF.*

Table 1 – Ratings & Part Number Reference cont'd

VDC	VDC Surge Voltage	Rated Capacitance 120 Hz 20°C (µF)	Case Size D x L (mm)	DF 120 Hz 20°C (tan δ %)*	RC 120 Hz 105°C (A)	LC 20°C 5 Minutes (mA)	Part Number
63	79	3300	25 x 40	25	2.30	3.0	ELG338M063AR4(1)
63	79	3300	30 x 30	25	2.25	3.0	ELG338M063AS2(1)
63	79	3300	35 x 25	25	2.10	3.0	ELG338M063AT1(1)
63	79	3900	25 x 45	25	2.55	3.0	ELG398M063AR5(1)
63	79	3900	30 x 35	25	2.55	3.0	ELG398M063AS3(1)
63	79	3900	35 x 30	25	2.55	3.0	ELG398M063AT2(1)
63	79	4700	25 x 50	25	2.85	3.0	ELG478M063AR6(1)
63	79	4700	30 x 40	25	2.85	3.0	ELG478M063AS4(1)
63	79	4700	35 x 30	25	2.80	3.0	ELG478M063AT2(1)
63	79	5600	30 x 45	25	3.20	3.0	ELG568M063AS5(1)
63	79	5600	35 x 35	25	3.20	3.0	ELG568M063AT3(1)
63	79	6800	30 x 50	25	3.65	3.0	ELG688M063AS6(1)
63	79	6800	35 x 40	25	3.65	3.0	ELG688M063AT4(1)
63	79	8200	35 x 45	25	3.90	3.0	ELG828M063AT5(1)
63	79	10000	35 x 50	25	4.40	3.0	ELG109M063AT6(1)
80	100	820	22 x 25	25	1.10	1.3	ELG827M080AQ1(1)
80	100	1000	22 x 30	25	1.20	1.6	ELG108M080AQ2(1)
80	100	1000	25 x 25	25	1.20	1.6	ELG108M080AR1(1)
80	100	1200	22 x 30	25	1.40	1.9	ELG128M080AQ2(1)
80	100	1200	25 x 25	25	1.40	1.9	ELG128M080AR1(1)
80	100	1500	22 x 35	25	1.60	2.4	ELG158M080AQ3(1)
80	100	1500	25 x 30	25	1.60	2.4	ELG158M080AR2(1)
80	100	1500	30 x 25	25	1.65	2.4	ELG158M080AS1(1)
80	100	1800	22 x 40	25	1.80	2.9	ELG188M080AQ4(1)
80	100	1800	25 x 35	25	1.85	2.9	ELG188M080AR3(1)
80	100	1800	30 x 25	25	1.80	2.9	ELG188M080AS1(1)
80	100	2200	22 x 45	25	2.05	3.0	ELG228M080AQ5(1)
80	100	2200	25 x 35	25	2.00	3.0	ELG228M080AR3(1)
80	100	2200	30 x 30	25	2.05	3.0	ELG228M080AS2(1)
80	100	2200	35 x 25	25	2.05	3.0	ELG228M080AT1(1)
80	100	2700	25 x 45	25	2.35	3.0	ELG278M080AR5(1)
80	100	2700	30 x 35	25	2.35	3.0	ELG278M080AS3(1)
80	100	2700	35 x 30	25	2.35	3.0	ELG278M080AT2(1)
80	100	3300	25 x 50	25	2.70	3.0	ELG338M080AR6(1)
80	100	3300	30 x 40	25	2.70	3.0	ELG338M080AS4(1)
80	100	3300	35 x 30	25	2.55	3.0	ELG338M080AT2(1)
80	100	3900	30 x 45	25	3.00	3.0	ELG398M080AS5(1)
80	100	3900	35 x 35	25	3.00	3.0	ELG398M080AT3(1)
80	100	4700	30 x 50	25	3.40	3.0	ELG478M080AS6(1)
80	100	4700	35 x 40	25	3.40	3.0	ELG478M080AT4(1)
80	100	5600	35 x 45	25	3.80	3.0	ELG568M080AT5(1)
80	100	6800	35 x 50	25	3.90	3.0	ELG688M080AT6(1)
100	125	560	22 x 25	25	1.05	1.1	ELG567M100AQ1(1)
100	125	680	22 x 25	25	1.20	1.4	ELG687M100AQ1(1)
100	125	820	22 x 30	25	1.30	1.6	ELG827M100AQ2(1)
100	125	820	25 x 25	25	1.33	1.6	ELG827M100AR1(1)
100	125	1000	22 x 35	25	1.50	2.0	ELG108M100AQ3(1)
100	125	1000	25 x 30	25	1.50	2.0	ELG108M100AR2(1)
100	125	1200	22 x 40	25	1.70	2.4	ELG128M100AQ4(1)
100	125	1200	25 x 35	25	1.70	2.4	ELG128M100AR3(1)
100	125	1200	30 x 25	25	1.70	2.4	ELG128M100AS1(1)
100	125	1500	22 x 45	25	1.95	3.0	ELG158M100AQ5(1)
100	125	1500	25 x 40	25	2.00	3.0	ELG158M100AR4(1)
100	125	1500	30 x 30	25	1.95	3.0	ELG158M100AS2(1)
100	125	1500	35 x 25	25	2.00	3.0	ELG158M100AT1(1)
100	125	1800	25 x 45	25	2.20	3.0	ELG188M100AR5(1)
100	125	1800	30 x 35	25	2.50	3.0	ELG188M100AS3(1)
VDC	**VDC Surge**	**Rated Capacitance**	**Case Size**	**DF**	**RC**	**LC**	**Part Number**

(1) Insert packaging code. See Ordering Options Table for available options.

** When capacitance exceeds 1,000 µF, the DF value (%) is increased by 2% for every additional 1,000 µF.*

Table 1 – Ratings & Part Number Reference cont'd

VDC	VDC Surge Voltage	Rated Capacitance 120 Hz 20°C (µF)	Case Size D x L (mm)	DF 120 Hz 20°C (tan δ %)*	RC 120 Hz 105°C (A)	LC 20°C 5 Minutes (mA)	Part Number
100	125	1800	35 x 30	25	2.45	3.0	ELG188M100AT2(1)
100	125	2200	25 x 50	25	2.55	3.0	ELG228M100AR6(1)
100	125	2200	30 x 40	25	2.70	3.0	ELG228M100AS4(1)
100	125	2200	35 x 30	25	2.55	3.0	ELG228M100AT2(1)
100	125	2700	30 x 45	25	2.90	3.0	ELG278M100AS5(1)
100	125	2700	35 x 35	25	2.85	3.0	ELG278M100AT3(1)
100	125	3300	30 x 50	25	3.25	3.0	ELG338M100AS6(1)
100	125	3300	35 x 40	25	3.25	3.0	ELG338M100AT4(1)
100	125	3900	30 x 50	25	3.70	3.0	ELG398M100AS6(1)
100	125	3900	35 x 45	25	3.70	3.0	ELG398M100AT5(1)
100	125	4700	35 x 50	25	3.80	3.0	ELG478M100AT6(1)
160	200	220	22 x 20	15	0.80	1.0	ELG227M160AQ7(1)
160	200	270	22 x 25	15	1.00	0.9	ELG277M160AQ1(1)
160	200	330	22 x 25	15	1.20	1.0	ELG337M160AQ1(1)
160	200	330	25 x 20	15	1.15	1.6	ELG337M160AR7(1)
160	200	390	22 x 30	15	1.30	1.2	ELG397M160AQ2(1)
160	200	390	25 x 25	15	1.30	1.2	ELG397M160AR1(1)
160	200	470	22 x 30	15	1.30	1.5	ELG477M160AQ2(1)
160	200	470	22 x 35	15	1.40	1.5	ELG477M160AQ3(1)
160	200	470	25 x 25	15	1.40	1.5	ELG477M160AR1(1)
160	200	560	22 x 40	15	1.50	1.8	ELG567M160AQ4(1)
160	200	560	25 x 30	15	1.50	1.8	ELG567M160AR2(1)
160	200	560	30 x 25	15	1.50	1.8	ELG567M160AS1(1)
160	200	680	22 x 45	15	1.70	2.2	ELG687M160AQ5(1)
160	200	680	25 x 35	15	1.70	2.2	ELG687M160AR3(1)
160	200	680	30 x 25	15	1.70	2.2	ELG687M160AS1(1)
160	200	820	22 x 50	15	1.95	2.6	ELG827M160AQ6(1)
160	200	820	25 x 40	15	2.00	2.6	ELG827M160AR4(1)
160	200	820	30 x 30	15	2.00	2.6	ELG827M160AS2(1)
160	200	820	35 x 25	15	1.90	2.6	ELG827M160AT1(1)
160	200	1000	25 x 45	15	2.20	3.0	ELG108M160AR5(1)
160	200	1000	30 x 35	15	2.20	3.0	ELG108M160AS3(1)
160	200	1000	35 x 30	15	2.20	3.0	ELG108M160AT2(1)
160	200	1200	25 x 50	15	2.45	3.0	ELG128M160AR6(1)
160	200	1200	30 x 40	15	2.45	3.0	ELG128M160AS4(1)
160	200	1200	35 x 30	15	2.45	3.0	ELG128M160AT2(1)
160	200	1500	30 x 45	15	2.80	3.0	ELG158M160AS5(1)
160	200	1500	35 x 35	15	2.80	3.0	ELG158M160AT3(1)
160	200	1800	30 x 50	15	3.30	3.0	ELG188M160AS6(1)
160	200	1800	35 x 45	15	3.30	3.0	ELG188M160AT5(1)
160	200	2200	35 x 50	15	3.75	3.0	ELG228M160AT6(1)
180	225	180	22 x 20	15	0.75	1.0	ELG187M180AQ7(1)
180	225	220	22 x 25	15	0.85	0.8	ELG227M180AQ1(1)
180	225	270	22 x 25	15	0.95	1.0	ELG277M180AQ1(1)
180	225	270	25 x 20	15	0.90	1.4	ELG277M180AR7(1)
180	225	330	22 x 25	15	1.10	1.2	ELG337M180AQ1(1)
180	225	330	22 x 30	15	1.10	1.2	ELG337M180AQ2(1)
180	225	330	25 x 25	15	1.10	1.2	ELG337M180AR1(1)
180	225	390	22 x 30	15	1.30	1.4	ELG397M180AQ2(1)
180	225	390	25 x 25	15	1.30	1.4	ELG397M180AR1(1)
180	225	470	22 x 30	15	1.30	1.7	ELG477M180AQ2(1)
180	225	470	22 x 35	15	1.35	1.7	ELG477M180AQ3(1)
180	225	470	25 x 30	15	1.40	1.7	ELG477M180AR2(1)
180	225	470	30 x 25	15	1.40	1.7	ELG477M180AS1(1)
180	225	560	22 x 40	15	1.50	2.0	ELG567M180AQ4(1)
180	225	560	25 x 35	15	1.55	2.0	ELG567M180AR3(1)
180	225	560	30 x 25	15	1.50	2.0	ELG567M180AS1(1)
VDC	**VDC Surge**	**Rated Capacitance**	**Case Size**	**DF**	**RC**	**LC**	**Part Number**

(1) Insert packaging code. See Ordering Options Table for available options.

** When capacitance exceeds 1,000 µF, the DF value (%) is increased by 2% for every additional 1,000 µF.*

Table 1 – Ratings & Part Number Reference cont'd

VDC	VDC Surge Voltage	Rated Capacitance 120 Hz 20°C (µF)	Case Size D x L (mm)	DF 120 Hz 20°C (tan δ %)*	RC 120 Hz 105°C (A)	LC 20°C 5 Minutes (mA)	Part Number
180	225	680	22 x 45	15	1.70	2.4	ELG687M180AQ5(1)
180	225	680	22 x 50	15	1.70	2.4	ELG687M180AQ6(1)
180	225	680	25 x 35	15	1.70	2.4	ELG687M180AR3(1)
180	225	680	25 x 40	15	1.75	2.4	ELG687M180AR4(1)
180	225	680	30 x 30	15	1.70	2.4	ELG687M180AS2(1)
180	225	680	35 x 25	15	1.70	2.4	ELG687M180AT1(1)
180	225	820	22 x 50	15	1.95	2.9	ELG827M180AQ6(1)
180	225	820	25 x 40	15	2.00	2.9	ELG827M180AR4(1)
180	225	820	25 x 45	15	2.00	2.9	ELG827M180AR5(1)
180	225	820	30 x 30	15	2.00	2.9	ELG827M180AS2(1)
180	225	820	30 x 35	15	2.00	2.9	ELG827M180AS3(1)
180	225	820	35 x 25	15	1.90	2.9	ELG827M180AT1(1)
180	225	1000	25 x 45	15	2.20	3.0	ELG108M180AR5(1)
180	225	1000	25 x 50	15	2.20	3.0	ELG108M180AR6(1)
180	225	1000	30 x 35	15	2.25	3.0	ELG108M180AS3(1)
180	225	1000	30 x 40	15	2.25	3.0	ELG108M180AS4(1)
180	225	1000	35 x 30	15	2.25	3.0	ELG108M180AT2(1)
180	225	1200	25 x 50	15	2.45	3.0	ELG128M180AR6(1)
180	225	1200	30 x 40	15	2.45	3.0	ELG128M180AS4(1)
180	225	1200	30 x 45	15	2.50	3.0	ELG128M180AS5(1)
180	225	1200	35 x 30	15	2.50	3.0	ELG128M180AT2(1)
180	225	1200	35 x 35	15	2.50	3.0	ELG128M180AT3(1)
180	225	1500	30 x 45	15	2.80	3.0	ELG158M180AS5(1)
180	225	1500	30 x 50	15	2.90	3.0	ELG158M180AS6(1)
180	225	1500	35 x 35	15	2.90	3.0	ELG158M180AT3(1)
180	225	1500	35 x 40	15	2.90	3.0	ELG158M180AT4(1)
180	225	1800	30 x 50	15	3.30	3.0	ELG188M180AS6(1)
180	225	1800	35 x 50	15	3.30	3.0	ELG188M180AT6(1)
180	225	2200	35 x 50	15	3.60	3.0	ELG228M180AT6(1)
200	250	150	22 x 20	15	0.65	0.9	ELG157M200AQ7(1)
200	250	180	22 x 20	15	0.70	1.0	ELG187M200AQ7(1)
200	250	220	22 x 25	15	0.80	0.9	ELG227M200AQ1(1)
200	250	220	25 x 20	15	0.80	1.3	ELG227M200AR7(1)
200	250	270	22 x 25	15	0.85	1.1	ELG277M200AQ1(1)
200	250	270	25 x 25	15	0.85	1.1	ELG277M200AR1(1)
200	250	330	22 x 30	15	1.20	1.3	ELG337M200AQ2(1)
200	250	330	25 x 25	15	1.20	1.3	ELG337M200AR1(1)
200	250	390	22 x 30	15	1.30	1.6	ELG397M200AQ2(1)
200	250	390	22 x 35	15	1.30	1.6	ELG397M200AQ3(1)
200	250	390	25 x 30	15	1.30	1.6	ELG397M200AR2(1)
200	250	390	30 x 25	15	1.30	1.6	ELG397M200AS1(1)
200	250	470	22 x 35	15	1.40	1.9	ELG477M200AQ3(1)
200	250	470	22 x 40	15	1.40	1.9	ELG477M200AQ4(1)
200	250	470	25 x 30	15	1.40	1.9	ELG477M200AR2(1)
200	250	470	30 x 25	15	1.50	1.9	ELG477M200AS1(1)
200	250	560	22 x 45	15	1.55	2.2	ELG567M200AQ5(1)
200	250	560	25 x 35	15	1.55	2.2	ELG567M200AR3(1)
200	250	560	30 x 30	15	1.55	2.2	ELG567M200AS2(1)
200	250	680	22 x 50	15	1.75	2.7	ELG687M200AQ6(1)
200	250	680	25 x 40	15	1.75	2.7	ELG687M200AR4(1)
200	250	680	30 x 30	15	1.75	2.7	ELG687M200AS2(1)
200	250	680	35 x 25	15	1.70	2.7	ELG687M200AT1(1)
200	250	820	25 x 50	15	2.05	3.0	ELG827M200AR6(1)
200	250	820	30 x 35	15	2.00	3.0	ELG827M200AS3(1)
200	250	820	35 x 30	15	2.05	3.0	ELG827M200AT2(1)
200	250	1000	30 x 40	15	2.30	3.0	ELG108M200AS4(1)
200	250	1000	30 x 45	15	2.30	3.0	ELG108M200AS5(1)
VDC	**VDC Surge**	**Rated Capacitance**	**Case Size**	**DF**	**RC**	**LC**	**Part Number**

(1) Insert packaging code. See Ordering Options Table for available options.

** When capacitance exceeds 1,000 µF, the DF value (%) is increased by 2% for every additional 1,000 µF.*

Table 1 – Ratings & Part Number Reference cont'd

VDC	VDC Surge Voltage	Rated Capacitance 120 Hz 20°C (µF)	Case Size D x L (mm)	DF 120 Hz 20°C (tan δ %)*	RC 120 Hz 105°C (A)	LC 20°C 5 Minutes (mA)	Part Number
200	250	1000	35 x 30	15	2.30	3.0	ELG108M200AT2(1)
200	250	1000	35 x 35	15	2.30	3.0	ELG108M200AT3(1)
200	250	1200	30 x 50	15	2.60	3.0	ELG128M200AS6(1)
200	250	1200	35 x 40	15	2.65	3.0	ELG128M200AT4(1)
200	250	1500	35 x 45	15	3.10	3.0	ELG158M200AT5(1)
200	250	1800	35 x 50	15	3.15	3.0	ELG188M200AT6(1)
250	300	120	22 x 20	15	0.60	0.9	ELG127M250AQ7(1)
250	300	150	22 x 25	15	0.65	0.7	ELG157M250AQ1(1)
250	300	180	22 x 25	15	0.80	0.9	ELG187M250AQ1(1)
250	300	180	25 x 20	15	0.75	1.3	ELG187M250AR7(1)
250	300	220	22 x 30	15	0.95	1.1	ELG227M250AQ2(1)
250	300	220	25 x 25	15	0.95	1.1	ELG227M250AR1(1)
250	300	270	22 x 35	15	1.15	1.3	ELG277M250AQ3(1)
250	300	270	25 x 30	15	1.15	1.3	ELG277M250AR2(1)
250	300	270	30 x 25	15	1.15	1.3	ELG277M250AS1(1)
250	300	330	22 x 40	15	1.25	1.6	ELG337M250AQ4(1)
250	300	330	25 x 30	15	1.20	1.6	ELG337M250AR2(1)
250	300	330	30 x 25	15	1.25	1.6	ELG337M250AS1(1)
250	300	390	22 x 45	15	1.50	1.9	ELG397M250AQ5(1)
250	300	390	25 x 35	15	1.50	1.9	ELG397M250AR3(1)
250	300	390	30 x 30	15	1.50	1.9	ELG397M250AS2(1)
250	300	470	22 x 50	15	1.55	2.3	ELG477M250AQ6(1)
250	300	470	25 x 40	15	1.55	2.3	ELG477M250AR4(1)
250	300	470	30 x 30	15	1.55	2.3	ELG477M250AS2(1)
250	300	470	35 x 25	15	1.55	2.3	ELG477M250AT1(1)
250	300	560	25 x 45	15	1.80	2.8	ELG567M250AR5(1)
250	300	560	30 x 35	15	1.80	2.8	ELG567M250AS3(1)
250	300	560	35 x 30	15	1.80	2.8	ELG567M250AT2(1)
250	300	680	25 x 50	15	1.95	3.0	ELG687M250AR6(1)
250	300	680	30 x 35	15	2.00	3.0	ELG687M250AS3(1)
250	300	680	30 x 40	15	2.00	3.0	ELG687M250AS4(1)
250	300	680	35 x 35	15	2.00	3.0	ELG687M250AT3(1)
250	300	820	30 x 45	15	2.15	3.0	ELG827M250AS5(1)
250	300	820	35 x 35	15	2.10	3.0	ELG827M250AT3(1)
250	300	1000	35 x 40	15	2.30	3.0	ELG108M250AT4(1)
250	300	1500	35 x 50	15	3.63	3.0	ELG158M250AT6(1)
350	400	56	22 x 20	15	0.40	0.6	ELG566M350AQ7(1)
350	400	68	22 x 25	15	0.45	0.5	ELG686M350AQ1(1)
350	400	82	22 x 25	15	0.55	0.6	ELG826M350AQ1(1)
350	400	82	25 x 20	15	0.50	0.9	ELG826M350AR7(1)
350	400	100	22 x 30	15	0.70	0.7	ELG107M350AQ2(1)
350	400	100	25 x 25	15	0.70	0.7	ELG107M350AR1(1)
350	400	120	22 x 35	15	0.75	0.8	ELG127M350AQ3(1)
350	400	120	25 x 30	15	0.75	0.8	ELG127M350AR2(1)
350	400	120	30 x 25	15	0.75	0.8	ELG127M350AS1(1)
350	400	150	22 x 40	15	0.80	1.0	ELG157M350AQ4(1)
350	400	150	25 x 30	15	0.80	1.0	ELG157M350AR2(1)
350	400	150	30 x 25	15	0.85	1.0	ELG157M350AS1(1)
350	400	180	22 x 45	15	0.90	1.3	ELG187M350AQ5(1)
350	400	180	25 x 35	15	0.90	1.3	ELG187M350AR3(1)
350	400	180	30 x 30	15	0.90	1.3	ELG187M350AS2(1)
350	400	220	22 x 50	15	1.05	1.5	ELG227M350AQ6(1)
350	400	220	25 x 40	15	1.05	1.5	ELG227M350AR4(1)
350	400	220	30 x 30	15	1.00	1.5	ELG227M350AS2(1)
350	400	220	35 x 25	15	1.05	1.5	ELG227M350AT1(1)
350	400	270	25 x 45	15	1.20	1.9	ELG277M350AR5(1)
350	400	270	30 x 35	15	1.20	1.9	ELG277M350AS3(1)
VDC	**VDC Surge**	**Rated Capacitance**	**Case Size**	**DF**	**RC**	**LC**	**Part Number**

(1) Insert packaging code. See Ordering Options Table for available options.

** When capacitance exceeds 1,000 µF, the DF value (%) is increased by 2% for every additional 1,000 µF.*

Table 1 – Ratings & Part Number Reference cont'd

VDC	VDC Surge Voltage	Rated Capacitance 120 Hz 20°C (µF)	Case Size D x L (mm)	DF 120 Hz 20°C (tan δ %)*	RC 120 Hz 105°C (A)	LC 20°C 5 Minutes (mA)	Part Number
350	400	270	35 x 30	15	1.20	1.9	ELG277M350AT2(1)
350	400	330	30 x 40	15	1.35	2.3	ELG337M350AS4(1)
350	400	330	35 x 35	15	1.35	2.3	ELG337M350AT3(1)
350	400	390	30 x 45	15	1.50	2.7	ELG397M350AS5(1)
350	400	390	35 x 35	15	1.50	2.7	ELG397M350AT3(1)
350	400	470	35 x 40	15	1.70	3.0	ELG477M350AT4(1)
350	400	560	35 x 45	15	1.90	3.0	ELG567M350AT5(1)
400	450	47	22 x 20	15	0.35	0.60	ELG476M400AQ7(1)
400	450	56	22 x 20	15	0.40	0.70	ELG566M400AQ7(1)
400	450	68	22 x 25	15	0.50	0.50	ELG686M400AQ1(1)
400	450	68	25 x 20	15	0.50	0.80	ELG686M400AR7(1)
400	450	82	22 x 25	15	0.52	0.60	ELG826M400AQ1(1)
400	450	82	22 x 30	15	0.60	0.60	ELG826M400AQ2(1)
400	450	82	25 x 25	15	0.65	0.60	ELG826M400AR1(1)
400	450	100	22 x 30	15	0.60	0.80	ELG107M400AQ2(1)
400	450	100	22 x 35	15	0.65	0.80	ELG107M400AQ3(1)
400	450	100	25 x 30	15	0.65	0.80	ELG107M400AR2(1)
400	450	120	22 x 30	15	0.62	1.00	ELG127M400AQ2(1)
400	450	120	22 x 35	15	0.70	1.00	ELG127M400AQ3(1)
400	450	120	25 x 30	15	0.70	1.00	ELG127M400AR2(1)
400	450	120	30 x 25	15	0.75	1.00	ELG127M400AS1(1)
400	450	150	22 x 35	15	0.72	1.20	ELG157M400AQ3(1)
400	450	150	22 x 40	15	0.80	1.20	ELG157M400AQ4(1)
400	450	150	25 x 30	15	0.85	1.20	ELG157M400AR2(1)
400	450	150	25 x 35	15	0.85	1.20	ELG157M400AR3(1)
400	450	150	30 x 30	15	0.85	1.20	ELG157M400AS2(1)
400	450	150	35 x 25	15	0.80	1.20	ELG157M400AT1(1)
400	450	180	22 x 40	15	0.81	1.40	ELG187M400AQ4(1)
400	450	180	22 x 50	15	0.95	1.40	ELG187M400AQ6(1)
400	450	180	25 x 40	15	0.95	1.40	ELG187M400AR4(1)
400	450	180	30 x 30	15	0.90	1.40	ELG187M400AS2(1)
400	450	220	25 x 45	15	1.05	1.80	ELG227M400AR5(1)
400	450	220	30 x 35	15	1.05	1.80	ELG227M400AS3(1)
400	450	220	35 x 30	15	1.10	1.80	ELG227M400AT2(1)
400	450	270	25 x 45	15	1.10	2.20	ELG277M400AR5(1)
400	450	270	25 x 50	15	1.20	2.20	ELG277M400AR6(1)
400	450	270	30 x 40	15	1.20	2.20	ELG277M400AS4(1)
400	450	270	35 x 35	15	1.20	2.20	ELG277M400AT3(1)
400	450	330	25 x 50	15	1.25	2.60	ELG337M400AR6(1)
400	450	330	30 x 45	15	1.40	2.60	ELG337M400AS5(1)
400	450	330	35 x 35	15	1.35	2.60	ELG337M400AT3(1)
400	450	390	30 x 45	15	1.42	3.00	ELG397M400AS5(1)
400	450	390	30 x 50	15	1.55	3.00	ELG397M400AS6(1)
400	450	390	35 x 40	15	1.55	3.00	ELG397M400AT4(1)
400	450	470	30 x 45	15	1.45	3.00	ELG477M400AS5(1)
400	450	470	30 x 50	15	1.75	3.00	ELG477M400AS6(1)
400	450	470	35 x 40	15	1.65	3.00	ELG477M400AT4(1)
400	450	470	35 x 45	15	1.75	3.00	ELG477M400AT5(1)
400	450	560	30 x 60	15	1.90	3.00	ELG567M400AS8(1)
400	450	560	35 x 45	15	1.80	3.00	ELG567M400AT5(1)
400	450	560	35 x 50	15	1.90	3.00	ELG567M400AT6(1)
400	450	680	35 x 50	15	2.10	3.00	ELG687M400AT6(1)
400	450	680	35 x 60	15	2.15	3.00	ELG687M400AT8(1)
400	450	1000	35 x 50	15	1.72	3.00	ELG108M400AT6(1)
420	470	150	22 x 35	20	0.58	1.30	ELG157M420AQ3(1)
420	470	150	22 x 40	20	0.65	1.30	ELG157M420AQ4(1)
420	470	150	25 x 30	20	0.70	1.30	ELG157M420AR2(1)
VDC	**VDC Surge**	**Rated Capacitance**	**Case Size**	**DF**	**RC**	**LC**	**Part Number**

(1) Insert packaging code. See Ordering Options Table for available options.

** When capacitance exceeds 1,000 µF, the DF value (%) is increased by 2% for every additional 1,000 µF.*

Table 1 – Ratings & Part Number Reference cont'd

VDC	VDC Surge Voltage	Rated Capacitance 120 Hz 20°C (µF)	Case Size D x L (mm)	DF 120 Hz 20°C (tan δ %)*	RC 120 Hz 105°C (A)	LC 20°C 5 Minutes (mA)	Part Number
420	470	180	22 x 40	20	0.68	1.60	ELG187M420AQ4(1)
420	470	180	25 x 35	20	0.68	1.60	ELG187M420AR3(1)
420	470	220	25 x 40	20	0.85	1.90	ELG227M420AR4(1)
420	470	220	25 x 45	20	0.95	1.90	ELG227M420AR5(1)
420	470	220	30 x 40	20	0.95	1.90	ELG227M420AS4(1)
420	470	270	25 x 45	20	1.05	2.30	ELG277M420AQ5(1)
420	470	270	30 x 40	20	1.05	2.30	ELG277M420AS4(1)
420	470	270	35 x 30	20	1.05	2.30	ELG277M420AT2(1)
420	470	330	25 x 50	20	1.15	2.80	ELG337M420AR6(1)
420	470	330	30 x 40	20	1.15	2.80	ELG337M420AS4(1)
420	470	330	35 x 35	20	1.15	2.80	ELG337M420AT3(1)
420	470	390	30 x 45	20	1.25	3.00	ELG397M420AS5(1)
420	470	470	30 x 50	20	1.40	3.00	ELG477M420AS6(1)
420	470	470	35 x 40	20	1.35	3.00	ELG477M420AT4(1)
420	470	560	35 x 45	20	1.65	3.00	ELG567M420AT5(1)
450	500	47	22 x 25	20	0.38	0.4	ELG476M450AQ1(1)
450	500	56	22 x 25	20	0.40	0.5	ELG566M450AQ1(1)
450	500	68	22 x 30	20	0.50	0.6	ELG686M450AQ2(1)
450	500	68	25 x 25	20	0.50	0.6	ELG686M450AR1(1)
450	500	82	22 x 30	20	0.52	0.7	ELG826M450AQ2(1)
450	500	82	22 x 35	20	0.55	0.7	ELG826M450AQ3(1)
450	500	82	25 x 30	20	0.55	0.7	ELG826M450AR2(1)
450	500	82	30 x 25	20	0.55	0.7	ELG826M450AS1(1)
450	500	100	22 x 30	20	0.55	0.9	ELG107M450AQ2(1)
450	500	100	22 x 40	20	0.65	0.9	ELG107M450AQ4(1)
450	500	100	25 x 30	20	0.60	0.9	ELG107M450AR2(1)
450	500	100	30 x 25	20	0.65	0.9	ELG107M450AS1(1)
450	500	120	22 x 35	20	0.60	1.1	ELG127M450AQ3(1)
450	500	120	22 x 45	20	0.70	1.1	ELG127M450AQ5(1)
450	500	120	25 x 35	20	0.70	1.1	ELG127M450AR3(1)
450	500	120	30 x 30	20	0.70	1.1	ELG127M450AS2(1)
450	500	120	35 x 25	20	0.70	1.1	ELG127M450AT1(1)
450	500	150	22 x 40	20	0.68	1.3	ELG157M450AQ4(1)
450	500	150	22 x 50	20	0.80	1.3	ELG157M450AQ6(1)
450	500	150	25 x 40	20	0.80	1.3	ELG157M450AR4(1)
450	500	150	30 x 30	20	0.75	1.3	ELG157M450AS2(1)
450	500	150	35 x 25	20	0.75	1.3	ELG157M450AT1(1)
450	500	180	22 x 45	20	0.75	1.6	ELG187M450AQ5(1)
450	500	180	25 x 45	20	0.85	1.6	ELG187M450AR5(1)
450	500	180	30 x 35	20	0.85	1.6	ELG187M450AS3(1)
450	500	180	35 x 30	20	0.85	1.6	ELG187M450AT2(1)
450	500	220	22 x 50	20	0.85	2.0	ELG227M450AQ6(1)
450	500	220	25 x 50	20	1.00	2.0	ELG227M450AR6(1)
450	500	220	30 x 40	20	1.00	2.0	ELG227M450AS4(1)
450	500	220	35 x 30	20	1.00	2.0	ELG227M450AT2(1)
450	500	270	25 x 50	20	1.05	2.4	ELG277M450AQ6(1)
450	500	270	30 x 45	20	1.15	2.4	ELG277M450AS5(1)
450	500	270	35 x 35	20	1.15	2.4	ELG277M450AT3(1)
450	500	330	30 x 45	20	1.25	3.0	ELG337M450AS5(1)
450	500	330	30 x 50	20	1.40	3.0	ELG337M450AS6(1)
450	500	330	35 x 40	20	1.40	3.0	ELG337M450AT4(1)
450	500	390	30 x 50	20	1.40	3.0	ELG397M450AS6(1)
450	500	390	35 x 45	20	1.55	3.0	ELG397M450AT5(1)
450	500	470	35 x 45	20	1.68	3.0	ELG477M450AT5(1)
450	500	470	35 x 50	20	1.70	3.0	ELG477M450AT6(1)
450	500	560	35 x 50	20	1.80	3.0	ELG567M450AT6(1)
450	500	560	35 x 60	20	2.10	3.0	ELG567M450AT8(1)
VDC	**VDC Surge**	**Rated Capacitance**	**Case Size**	**DF**	**RC**	**LC**	**Part Number**

(1) Insert packaging code. See Ordering Options Table for available options.

** When capacitance exceeds 1,000 µF, the DF value (%) is increased by 2% for every additional 1,000 µF.*

Table 1 – Ratings & Part Number Reference cont'd

VDC	VDC Surge Voltage	Rated Capacitance 120 Hz 20°C (µF)	Case Size D x L (mm)	DF 120 Hz 20°C (tan δ %)*	RC 120 Hz 105°C (A)	LC 20°C 5 Minutes (mA)	Part Number
500	550	47	22 x 25	25	0.51	0.5	ELG476M500AQ1(1)
500	550	56	22 x 30	25	0.58	0.6	ELG566M500AQ2(1)
500	550	68	25 x 25	25	0.65	0.7	ELG686M500AR1(1)
500	550	82	22 x 35	25	0.72	0.9	ELG826M500AQ3(1)
500	550	82	25 x 30	25	0.74	0.9	ELG826M500AR2(1)
500	550	100	22 x 45	25	0.83	1.0	ELG107M500AQ5(1)
500	550	100	30 x 25	25	0.82	1.0	ELG107M500AS1(1)
500	550	120	22 x 50	25	0.93	1.2	ELG127M500AQ6(1)
500	550	120	25 x 35	25	0.93	1.2	ELG127M500AR3(1)
500	550	120	30 x 30	25	0.91	1.2	ELG127M500AS2(1)
500	550	150	25 x 45	25	1.08	1.5	ELG157M500AS5(1)
500	550	150	30 x 35	25	1.04	1.5	ELG157M500AS3(1)
500	550	150	35 x 25	25	0.99	1.5	ELG157M500AT1(1)
500	550	180	25 x 50	25	1.20	1.8	ELG187M500AR6(1)
500	550	180	30 x 40	25	1.17	1.8	ELG187M500AS4(1)
500	550	180	35 x 30	25	1.10	1.8	ELG187M500AT2(1)
500	550	220	30 x 45	25	1.33	2.2	ELG227M500AS5(1)
500	550	220	35 x 35	25	1.23	2.2	ELG227M500AT3(1)
500	550	270	30 x 50	25	1.50	2.7	ELG277M500AS6(1)
500	550	270	35 x 40	25	1.42	2.7	ELG277M500AT4(1)
500	550	330	35 x 45	25	1.60	3.0	ELG337M500AT5(1)
500	550	390	35 x 50	25	1.78	3.0	ELG337M500AT6(1)
500	550	470	35 x 60	25	2.03	3.0	ELG477M500AT8(1)
VDC	**VDC Surge**	**Rated Capacitance**	**Case Size**	**DF**	**RC**	**LC**	**Part Number**

(1) Insert packaging code. See Ordering Options Table for available options.

** When capacitance exceeds 1,000 µF, the DF value (%) is increased by 2% for every additional 1,000 µF.*

Mounting Positions (Safety Vent)

In operation, electrolytic capacitors will always conduct a leakage current which causes electrolysis. The oxygen produced by electrolysis will regenerate the dielectric layer but, at the same time, the hydrogen released may cause the internal pressure of the capacitor to increase. The overpressure vent (safety vent) ensures that the gas can escape when the pressure reaches a certain value. All mounting positions must allow the safety vent to work properly.

Installing

- A general principle is that lower-use temperatures result in a longer, useful life of the capacitor. For this reason, it should be ensured that electrolytic capacitors are placed away from heat-emitting components. Adequate space should be allowed between components for cooling air to circulate, particularly when high ripple current loads are applied. In any case, the maximum category temperature must not be exceeded.
- Do not deform the case of capacitors or use capacitors with a deformed case.
- Verify that the connections of the capacitors are able to insert on the board without excessive mechanical force.
- If the capacitors require mounting through additional means, the recommended mounting accessories shall be used.
- Verify the correct polarization of the capacitor on the board.
- Verify that the space around the pressure relief device is according to the following guideline:

Case Diameter	Space Around Safety Vent
≤ 16 mm	> 2 mm
> 16 to ≤ 40 mm	> 3 mm
> 40 mm	> 5 mm

It is recommended that capacitors always be mounted with the safety device uppermost or in the upper part of the capacitor.

- If the capacitors are stored for a long time, the leakage current must be verified. If the leakage current is superior to the value listed in this catalog, the capacitors must be reformed. In this case, they can be reformed by application of the rated voltage through a series resistor approximately 1 kΩ for capacitors with V_R ≤ 160 V (5 W resistor) and 10 kΩ for the other rated voltages.
- In the case of capacitors connected in series, a suitable voltage sharing must be used.
  In the case of balancing resistors, the approximate resistance value can be calculated as: R = 60/C

KEMET recommends, nevertheless, to ensure that the voltage across each capacitor does not exceed its rated voltage.

Application and Operation Guidelines

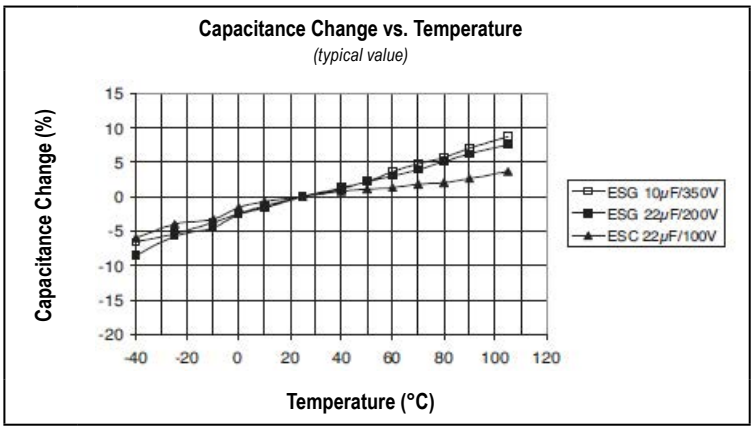
Electrical Ratings:
Capacitance (ESC)

Simplified equivalent circuit diagram of an electrolytic capacitor

The capacitive component of the equivalent series circuit (Equivalent Series Capacitance ESC) is determined by applying an alternate voltage of ≤ 0.5 V at a frequency of 120 or 100 Hz and 20°C (IEC 384-1, 384-4).

Temperature Dependence of the Capacitance

Capacitance of an electrolytic capacitor depends upon temperature: with decreasing temperature the viscosity of the electrolyte increases, thereby reducing its conductivity. Capacitance will decrease if temperature decreases. Furthermore, temperature drifts cause armature dilatation and, therefore, capacitance changes (up to 20% depending on the series considered, from 0 to 80°C). This phenomenon is more evident for electrolytic capacitors than for other types.

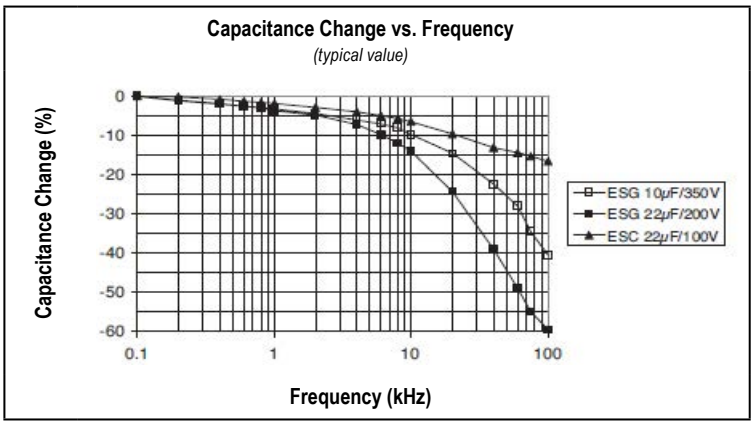


Frequency Dependence of the Capacitance

Effective capacitance value is derived from the impedance curve, as long as impedance is still in the range where the capacitance component is dominant.

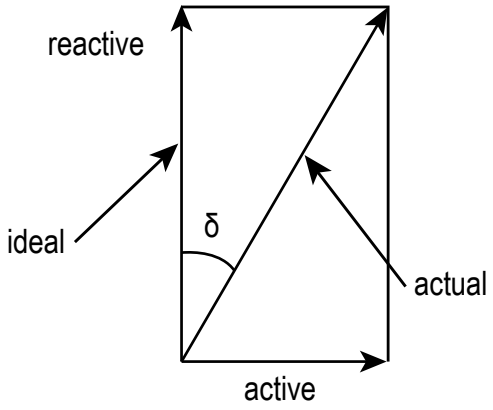
$$C = \frac{1}{2\pi fZ}$$

C = Capacitance (F)
f = Frequency (Hz)
Z = Impedance (Ω)



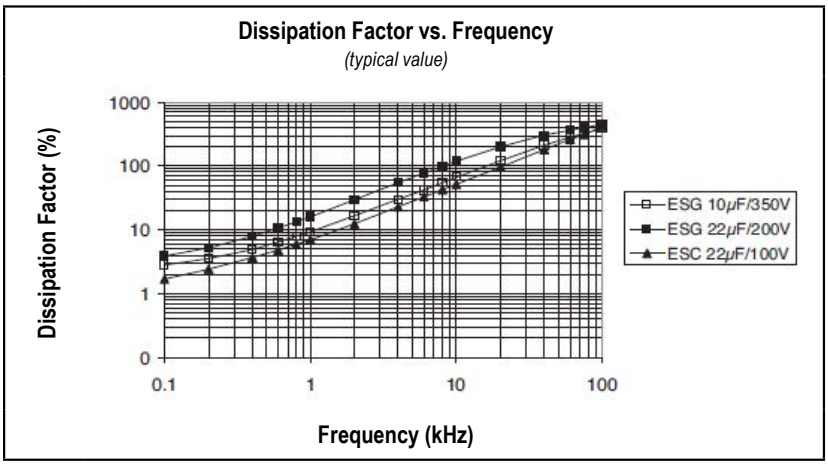
Dissipation Factor tan δ (DF)

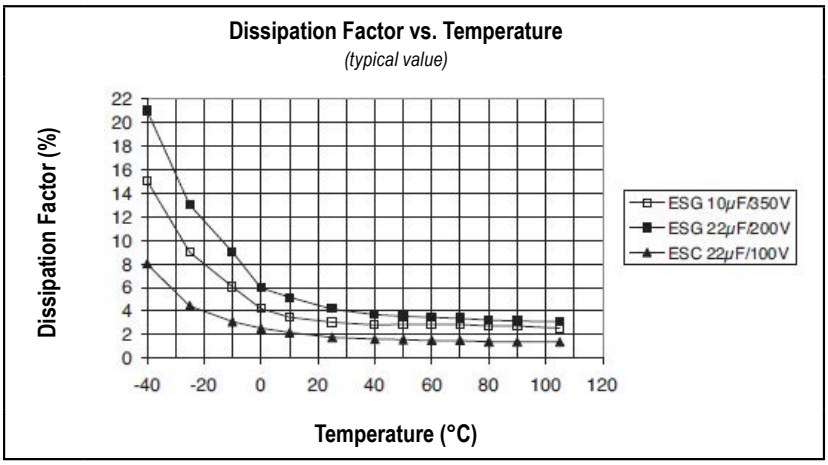
Dissipation Factor tan δ is the ratio between the active and reactive power for a sinusoidal waveform voltage. It can be thought of as a measurement of the gap between an actual and ideal capacitor.



Tan δ is measured with the same set-up used for the series capacitance ESC.
tan δ = ω x ESC x ESR where:

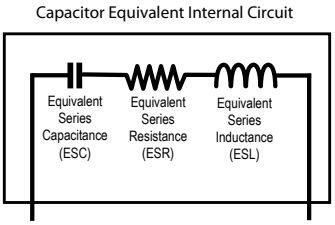
ESC = Equivalent Series Capacitance
ESR = Equivalent Series Resistance





Equivalent Series Inductance (ESL)

Equivalent Series Inductance or Self Inductance results from the terminal configuration and internal design of the capacitor.



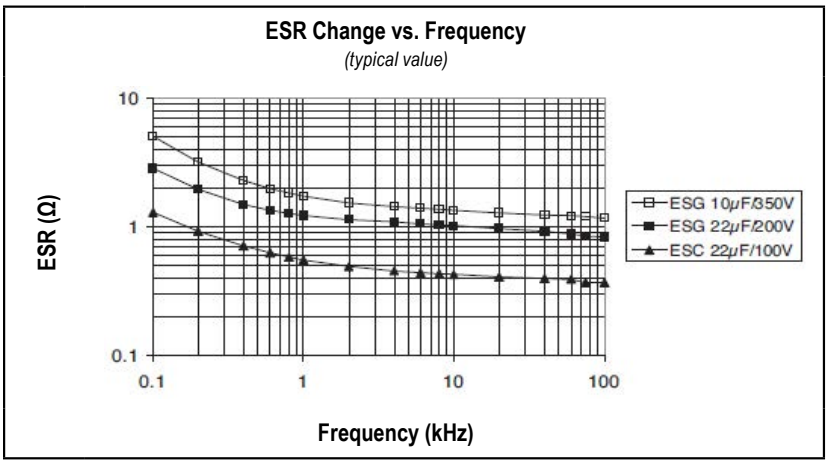
Equivalent Series Resistance (ESR)

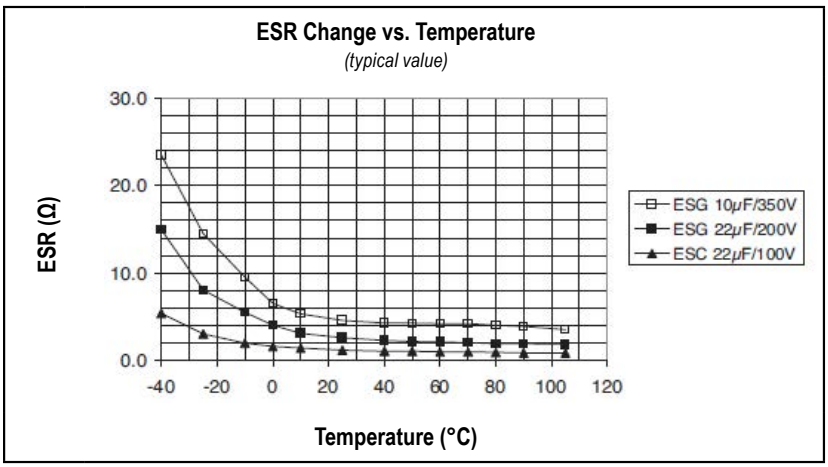
Equivalent Series Resistance is the resistive component of the equivalent series circuit. ESR value depends on frequency and temperature and is related to the tan δ by the following equation:

$$ESR = \frac{\tan \delta}{2\pi f\, ESC}$$

ESR = Equivalent Series Resistance (Ω)
tan δ = Dissipation Factor
ESC = Equivalent Series Capacitance (F)
f = Frequency (Hz)

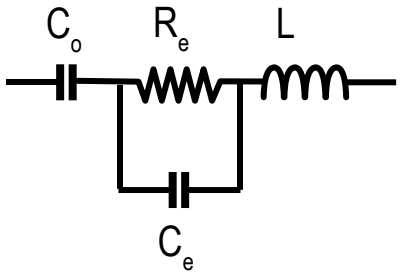
Tolerance limits of the rated capacitance must be taken into account when calculating this value.



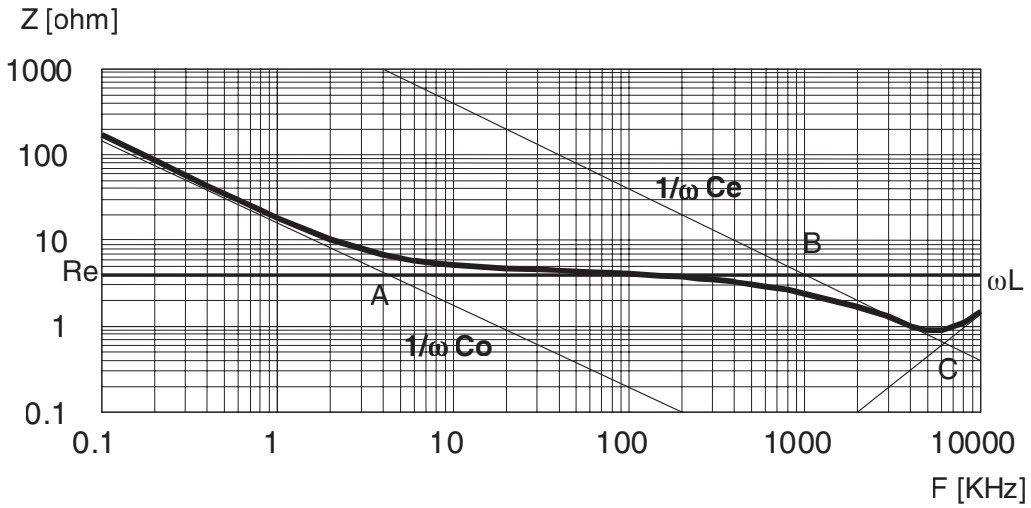


Impedance (Z)

Impedance of an electrolytic capacitor results from a circuit formed by the following individual equivalent series components:



C_o = Aluminum oxide capacitance (surface and thickness of the dielectric)
R_e = Resistance of electrolyte and paper mixture (other resistances not depending on the frequency are not considered: tabs, plates, etc.)
C_e = Electrolyte soaked paper capacitance
L = Inductive reactance of the capacitor winding and terminals
Impedance of an electrolytic capacitor is not a constant quantity that retains its value under all conditions; it changes depending on frequency and temperature.
Impedance as a function of frequency (sinusoidal waveform) for a certain temperature can be represented as follows:

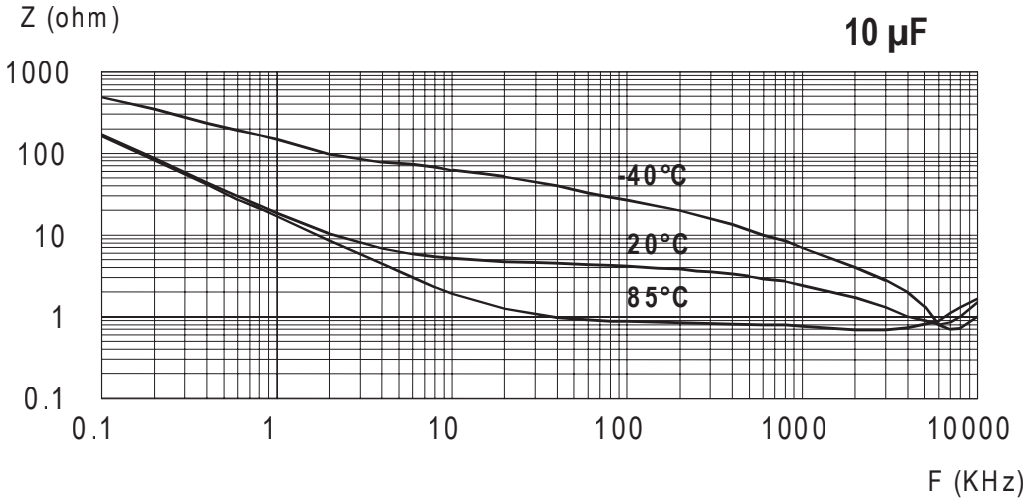


- Capacitive reactance predominates at low frequencies
- With increasing frequency, capacitive reactance Xc = $1/\omega C_o$ decreases until it reaches the order of magnitude of electrolyte resistance R_e(A)
- At even higher frequencies, resistance of the electrolyte predominates: $Z = R_e$ (A - B)
- When the capacitor's resonance frequency is reached (ω_0), capacitive and inductive reactance mutually cancel each other $1/\omega C_e = \omega L$, $\omega_0 = C\sqrt{1/LCe}$
- Above this frequency, inductive reactance of the winding and its terminals (XL = Z = ωL) becomes effective and leads to an increase in impedance

Generally speaking, it can be estimated that $C_e \approx 0.01\ C_o$.

Impedance (Z) cont'd

Impedance as a function of frequency (sinusoidal waveform) for different temperature values can be represented as follows (typical values):



R_e is the most temperature-dependent component of an electrolytic capacitor equivalent circuit. Electrolyte resistivity will decrease if temperature rises.

In order to obtain a low impedance value throughout the temperature range, R_e must be as little as possible. However, R_e values that are too low indicate a very aggressive electrolyte, resulting in a shorter life of the electrolytic capacitor at high temperatures. A compromise must be reached.

Leakage Current (LC)

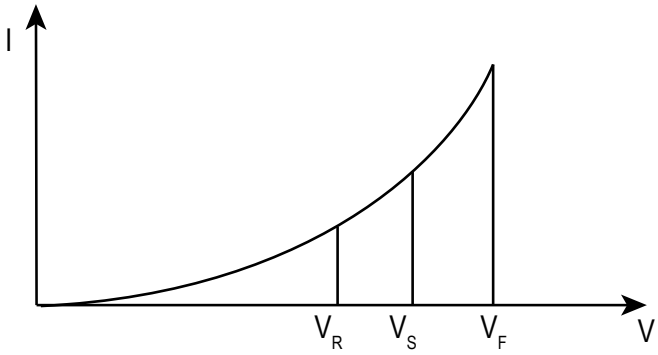
Due to the aluminum oxide layer that serves as a dielectric, a small current will continue to flow even after a DC voltage has been applied for long periods. This current is called leakage current.

A high leakage current flows after applying voltage to the capacitor then decreases in a few minutes, e.g., after prolonged storage without any applied voltage. In the course of continuous operation, the leakage current will decrease and reach an almost constant value.

After a voltage-free storage the oxide layer may deteriorate, especially at high temperature. Since there are no leakage currents to transport oxygen ions to the anode, the oxide layer is not regenerated. The result is that a higher than normal leakage current will flow when voltage is applied after prolonged storage.

Leakage Current (LC) cont'd

As the oxide layer is regenerated in use, the leakage current will gradually decrease to its normal level.
The relationship between the leakage current and voltage applied at constant temperature can be shown schematically as follows:



Where:
V_F = **Forming voltage**
If this level is exceeded, a large quantity of heat and gas will be generated and the capacitor could be damaged.
V_R = **Rated Voltage**
This level represents the top of the linear part of the curve.
V_S = **Surge voltage**
This lies between V_R and V_F. The capacitor can be subjected to V_S for short periods only.

Electrolytic capacitors are subjected to a reforming process before acceptance testing. The purpose of this preconditioning is to ensure that the same initial conditions are maintained when comparing different products.

Ripple Current (RC)

The maximum ripple current value depends on:
- Ambient temperature
- Surface area of the capacitor (heat dissipation area)

tan δ or ESR
- Frequency

The capacitor's life depends on the thermal stress.

Frequency Dependence of the Ripple Current

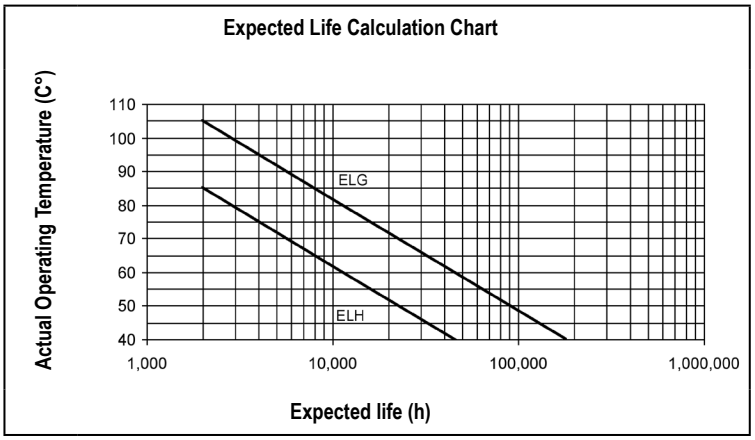
ESR and, thus, the tan δ depend on the frequency of the applied voltage. This indicates that the allowed ripple current is also a function of the frequency.

Temperature Dependence of the Ripple Current

The data sheet specifies maximum ripple current at the upper category temperature for each capacitor.

Expected Life Calculation

Expected life depends on operating temperature according to the following formula: $L = Lo \times 2^{(To-T)/10}$
Where:
L: Expected life
Lo: Load life at maximum permissible operating temperature
T: Actual operating temperature
To: Maximum permissible operating temperature
This formula is applicable between 40°C and To.

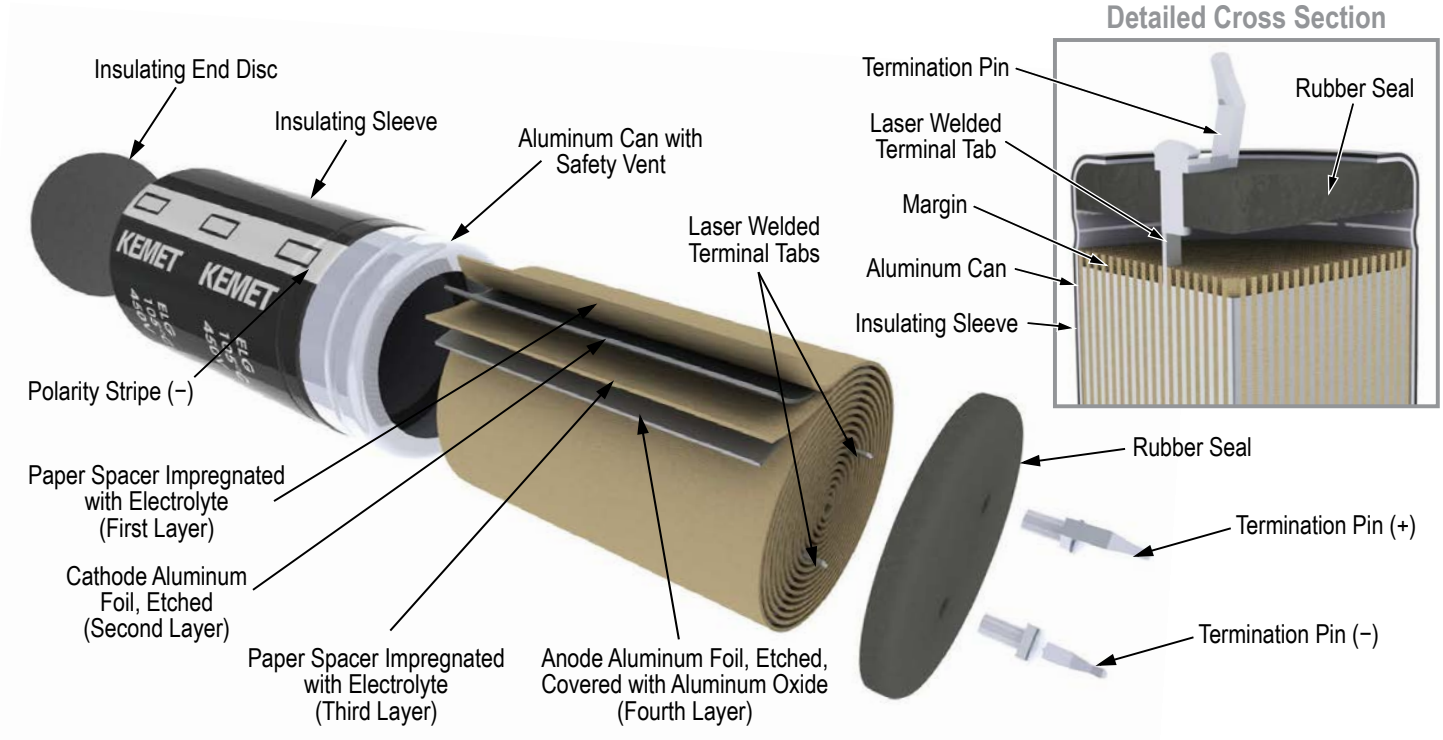


Packaging Quantities

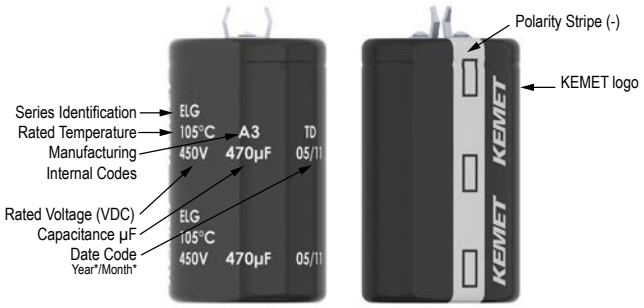
Size Code	Diameter (mm)	Length (mm)	Bulk Standard Leads
Q7	22	20	400
Q1	22	25	400
Q2	22	30	400
Q3	22	35	400
Q4	22	40	400
Q5	22	45	400
Q6	22	50	400
R7	25	20	200
R1	25	25	200
R2	25	30	200
R3	25	35	200
R4	25	40	200
R5	25	45	200
R6	25	50	200

Size Code	Diameter (mm)	Length (mm)	Bulk Standard Leads
S1	30	25	200
S2	30	30	200
S3	30	35	200
S4	30	40	200
S5	30	45	200
S6	30	50	200
S8	30	60	200
T1	35	25	200
T2	35	30	200
T3	35	35	200
T4	35	40	200
T5	35	45	200
T6	35	50	200
T8	35	60	200

Construction



Marking



*Y = Year

Code	01	02	03	04	05	06	07	08	09	9
Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2019

*M = Month

Code	01	02	03	04	05	06	07	08	09	10	11	12
Month	1	2	3	4	5	6	7	8	9	10	11	12

PEH526 Series, +125ºC

Overview

KEMET's PEH526 is an electrolytic capacitor with outstanding electrical performance. The device is polarized, has a negative pole connected to the case and a plastic cover for the outer case. Low ESR is the result of a low resistive electrolyte/paper system. Together with the TDC thermal concept, this range gives the PEH526 a very high ripple current capability. It is suitable for use in both mobile and aircraft applications with operation up to +125°C.

Applications

KEMET's PEH526 is a high performance electrolytic capacitor designed for automotive applications with high vibrations and high ambient temperatures.

Benefits

- Designed for automotive applications
- 3,000 hours at +125°C (V_R, I_R applied)
- Resistance to vibrations
- Low ESR
- High ripple current capability

Part Number System

PEH526	H	AB	427	0	M	3
Series	Rated Voltage (VDC)	Size Code	Capacitance Code (µF)	Version	Capacitance Tolerance	Termination
Snap-In type Aluminum Electrolytic	H = 25 K = 40 M = 63	See Dimension Table	The last two digits represent significant figures. The first digit specifies the total number of digits.	0 = Standard	M = ±20%	3 = 3 Pin

Performance Characteristics

Item	Performance Characteristics			
Capacitance Range	820 – 6,800 µF			
Rated Voltage	25 – 80 VDC			
Operating Temperature	-40 to +125°C			
Capacitance Tolerance	±20% at 100 Hz/+20°C			
Operational Lifetime	D (mm)	Rated Voltage and Ripple Current at +125°C (hours)	Rated Voltage at +125°C (hours)	Rated Voltage at +105°C (hours)
	22 – 30	3,000	4,000	20,000
Shelf Life	5,000 hours at 105°C or 10 years at +40°C 0 VDC			
Leakage Current	I = 0.01 CV (µA)			
	C = rated capacitance (µF), V = rated voltage (VDC). Voltage applied for 5 minutes at +20°C.			
Vibration Test Specifications	Procedure		Requirements	
	1.5 mm displacement amplitude or 20 g maximum acceleration. Vibration applied for three 2-hour sessions at 10 – 2,000 Hz (capacitor clamped by body).		No leakage of electrolyte or other visible damage. Deviations in capacitance and tan δ from initial measurements must not exceed: Δ C/C < 5%	
Standards	IEC 60384–4 long life grade 40/125/56, AEC-Q200			

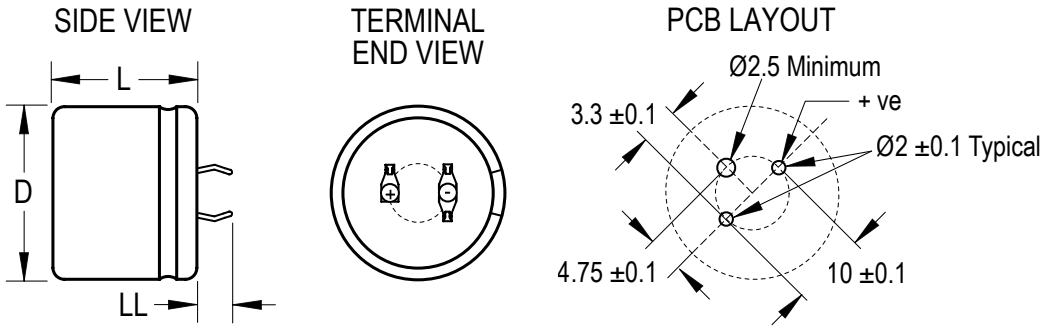
Compensation Factor of Ripple Current (RC) vs. Frequency

Frequency	300 Hz	1 kHz	5 kHz	100 kHz
Coefficient	0.70	0.89	1.00	1.03

Test Method & Performance

Endurance Life Test	
Conditions	Performance
Temperature	+125°C
Test Duration	4,000 hours
Ripple Current	Maximum ripple current specified in table
Voltage	The sum of DC voltage and the peak AC voltage must not exceed the rated voltage of the capacitor
Performance	**The following specifications will be satisfied when the capacitor is tested at +20°C:**
Capacitance Change	Within 15% of the initial value
Equivalent Series Resistance	Does not exceed 300% of the specified limit
Leakage Current	Does not exceed leakage current limit

Dimensions – Millimeters



Size Code	Dimensions in mm			Approximate Weight Grams
	D	L	LL	
	±0.5	±1	±1	
AB	22	25	4	12
AC	22	30	4	14
BB	25	25	4	19
BD	25	35	4	24
CB	30	25	4	24
CD	30	35	4	34
Note: Add 0.5 mm to D and 1 mm to L for Sleeving				

Shelf Life

The capacitance, ESR and impedance of a capacitor will not change significantly after extended storage periods, however the leakage current will very slowly increase. KEMET products are particularly stable and allow a shelf life in excess of three years at 40°C. See sectional specification under each product series for specific data.

Re-age (Reforming) Procedure

Apply the rated voltage to the capacitor at room temperature for a period of one hour, or until the leakage current has fallen to a steady value below the specified limit. During re-aging a maximum charging current of twice the specified leakage current or 5 mA (whichever is greater) is suggested.

Reliability

The reliability of a component can be defined as the probability that it will perform satisfactorily under a given set of conditions for a given length of time.

In practice, it is impossible to predict with absolute certainty how any individual component will perform; thus, we must utilize probability theory. It is also necessary to clearly define the level of stress involved (e.g. operating voltage, ripple current, temperature and time). Finally, the meaning of satisfactory performance must be defined by specifying a set of conditions which determine the end of life of the component.

Reliability as a function of time, R(t), is normally expressed as: $R(t)=e^{-\lambda t}$
where R(t) is the probability that the component will perform satisfactorily for time t, and λ is the failure rate.

Failure Rate

The failure rate is the number of components failing per unit time. The failure rate of most electronic components follows the characteristic pattern:

- Early failures are removed during the manufacturing process.
- The operational life is characterized by a constant failure rate.
- The wear out period is characterized by a rapidly increasing failure rate.

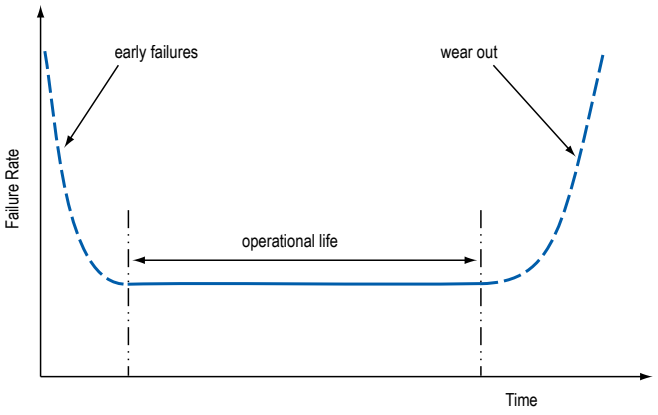
The failures in time (FIT) are given with a 60% confidence level for the various type codes. By convention, FIT is expressed as 1×10^{-9} failures per hour. Failure rate is also expressed as a percentage of failures per 1,000 hours.
e.g., 100 FIT = 1×10^{-7} failures per hour = 0.01%/1,000 hours

End of Life Definition
Catastrophic Failure: short circuit, open circuit or safety vent operation
Parametric Failure:

- Change in capacitance > ±10%
- Leakage current > specified limit
- ESR > 2 x initial ESR value

MTBF

The mean time between failures (MTBF) is simply the inverse of the failure rate.
MTBF= 1/λ



Environmental Compliance

As an environmentally conscious company, KEMET is working continuously with improvements concerning the environmental effects of both our capacitors and their production. 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, such as lead (Pb), in electronic equipment. All products in this catalog are produced to help our customers' obligations to guarantee their products and 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 such as 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 such as LF = Lead Free or LFW = Lead Free Wires on the label.

Table 1 – Ratings & Part Number Reference

VDC	Rated Capacitance	Case Size	Ripple Current Maximum				ESR Maximum			Part Number
	100 Hz 20°C (µF)	D x L (mm)	100 Hz 125°C (A)	≥ 5 kHz 85°C (A)	≥ 5 kHz 105°C (A)	≥ 5 kHz 125°C (A)	100 Hz 20°C (mΩ)	100 kHz 20°C (mΩ)	≥ 5 kHz 125°C (mΩ)	
25	2700	22 x 25	2.0	9.7	7.4	3.7	54	30	14	PEH526HAB4270M3
25	3900	22 x 30	2.5	11.9	9.1	4.5	38	22	10	PEH526HAC4390M3
25	3900	25 x 25	2.3	10.1	7.7	3.8	41	24	14	PEH526HBB4390M3
25	5600	30 x 25	2.7	10.2	7.8	3.8	33	22	17	PEH526HCB4560M3
25	6800	25 x 35	3.4	14.4	11.0	5.5	24	14	9	PEH526HBD4680M3
40	1200	22 x 25	1.5	9.4	7.2	3.6	77	28	15	PEH526KAB4120M3
40	1500	22 x 30	1.8	11.5	8.8	4.4	59	20	11	PEH526KAC4150M3
40	1500	25 x 25	1.7	9.8	7.5	3.7	62	23	16	PEH526KBB4150M3
40	1800	22 x 25	1.7	9.6	7.3	3.7	62	28	14	PEH526KAB4180M3
40	1800	25 x 35	2.5	14.1	10.7	5.3	36	14	9	PEH526KBD4180M3
40	2200	22 x 30	2.0	11.7	8.9	4.5	49	22	11	PEH526KAC4220M3
40	2200	25 x 25	1.9	10.0	7.6	3.8	52	24	15	PEH526KBB4220M3
40	2200	30 x 25	2.1	9.8	7.4	3.7	48	22	19	PEH526KCB4220M3
40	2700	25 x 35	2.5	14.1	10.7	5.3	36	14	9	PEH526KBD4270M3
40	3300	30 x 25	2.4	10.0	7.6	3.8	40	22	18	PEH526KCB4330M3
40	3900	25 x 35	2.8	14.3	10.9	5.4	30	14	9	PEH526KBD4390M3
63	820	22 x 25	1.2	5.9	4.6	2.3	150	79	36	PEH526MAB382AM3
63	1200	22 x 30	1.5	7.4	5.7	2.9	100	55	26	PEH526MAC412AM3
63	1200	25 x 25	1.5	6.8	5.3	2.6	110	59	31	PEH526MBB412AM3
63	1800	30 x 25	1.8	7.7	5.9	2.9	76	45	29	PEH526MCB418AM3
63	2200	25 x 35	2.2	10.0	7.7	3.8	59	34	18	PEH526MBD422AM3
VDC	Rated Capacitance	Case Size	Ripple Current				ESR			Part Number

80 VDC available upon request. Contact KEMET for details.

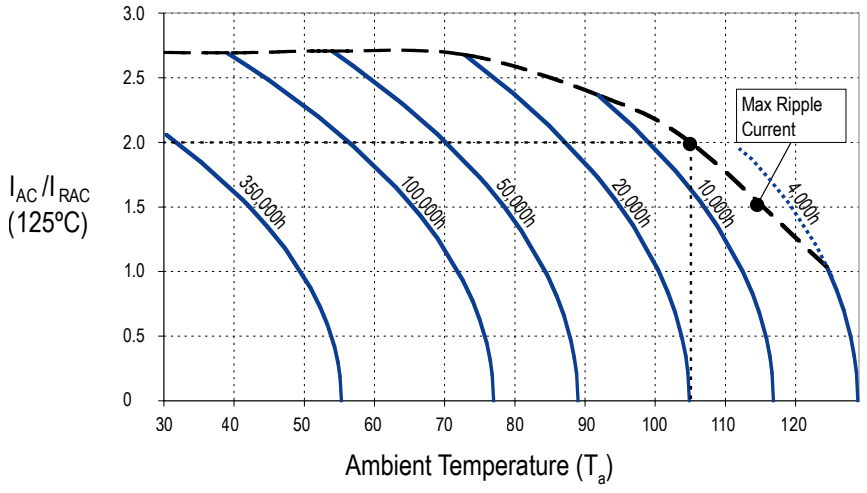
Operational Life

Operational life (L_{op}) at ambient temperature T_a and ripple current I_{AC}.

Example:
Article: PEH526KBB4220M3
Ambient temperature (T_a): +105°C
Ripple current, at 10 kHz (I_{AC}): 7.8 A

I_{RAC}(125°C, ≥ 5 kHz)= 3.9 A (from data table)
→ I_{AC}/ I_{RAC}(+125°C) = 2.0

Operational life: Interpolation between the L_{op}-curves → L_{op} ~ 8 kh (blue curves)

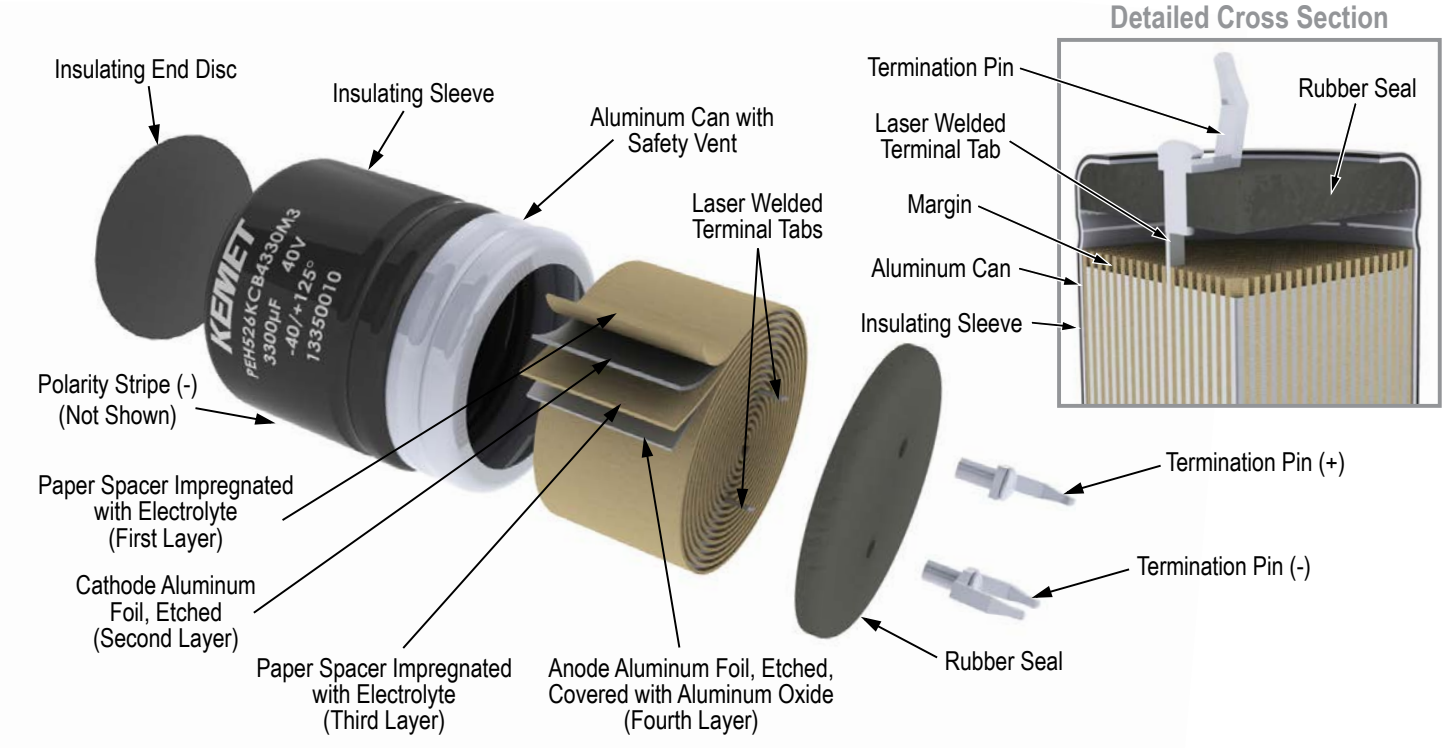


Packaging Quantities

Diameter	Length	Bulk Quantity
22-30	25	200
22-30	>25	100

Marking

Construction



ALC10S Series, +85°C

Overview

KEMET's ALC10S Series of capacitors features improvements in general construction of the capacitors to achieve better results in audio, where fidelity of the waveshape is very important. Great attention has been paid to the construction details that can affect performance such as foil type, its connections and mechanical construction. Details of capacitance and case sizes are available in KEMET's slit foil capacitor range.

Applications

Modern electrolytic capacitors are designed for use in power supplies, thus, most aspects of their design have been optimized for this application. Some advances in design may not be beneficial in audio applications where the requirements of the capacitors are very different.

KEMET has produced the ALC10S Series of slit foil capacitors specifically for audio applications. Its patented design eliminates circulating currents in the aluminium foils. This spurious current flow on the capacitor plates is known to occur but not apparent in most applications.

Benefits

- 2 pin snap-in
- Long life, up to 18,000 hours at +85°C (V_R, I_R applied)
- Slit foil technology
- Specifically designed for audio applications use only

Part Number System

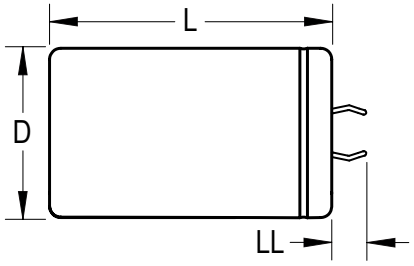
ALC10	S	110 2	DF
Series	Construction	Unique Sequential Number	Size Code
Snap-In type Aluminum Electrolytic	S = Slit foil		See Dimension Table

Performance Characteristics

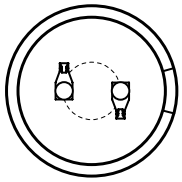
Item	Performance Characteristics		
Capacitance Range	10,000 µF		
Rated Voltage	50 – 100 VDC		
Operating Temperature	-40 to +85°C		
Storage Temperature Range	-55 to +85°C		
Capacitance Tolerance	±20%		
Operational Lifetime	D (mm)	Rated Voltage and Ripple Current at +85°C (hours)	Rated Voltage at +85°C (hours)
	35	15,000	24,000
	40	18,000	29,000
Shelf Life	2,000 hours at +85°C or 30,000 hours at +40°C 0 VDC		
Leakage Current	I = 0.006 CV or 6,000 (µA, whichever is smaller)		
	C = rated capacitance (µF), V = rated voltage (VDC). Voltage applied for 5 minutes at +20°C.		
Standards	IEC 60384–4		

Dimensions – Millimeters

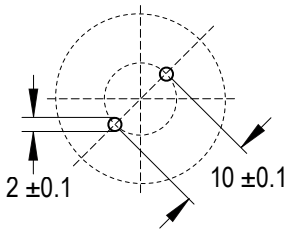
SIDE VIEW



TERMINAL END VIEW



PCB LAYOUT



Size Code	Dimensions in mm			Approximate Weight Grams
	D	L	LL	
	Nominal		±1.0	
DF	35	50	6.3	70
DH	35	60	6.3	80
DL	35	80	6.3	105
EX	40	90	6.3	147
Note: Dimensions include sleeving				

Table 1 – Ratings & Part Number Reference

VDC	Rated Capacitance (µF)	Case Size	Part Number
50	10000	35 x 50	ALC10S1102DF
63	10000	35 x 60	ALC10S1103DH
80	10000	35 x 80	ALC10S1104DL
100	10000	40 x 90	ALC10S11052EX

Shelf Life

The capacitance, ESR and impedance of a capacitor will not change significantly after extended storage periods, however the leakage current will very slowly increase. KEMET products are particularly stable and allow a shelf life in excess of three years at 40°C. See sectional specification under each product series for specific data.

Re-age (Reforming) Procedure

Apply the rated voltage to the capacitor at room temperature for a period of one hour, or until the leakage current has fallen to a steady value below the specified limit. During re-aging a maximum charging current of twice the specified leakage current or 5 mA (whichever is greater) is suggested.

Environmental Compliance

As an environmentally conscious company, KEMET is working continuously with improvements concerning the environmental effects of both our capacitors and their production. 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, such as lead (Pb), in electronic equipment. All products in this catalog are produced to help our customers' obligations to guarantee their products and 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 such as 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 such as LF = Lead Free or LFW = Lead Free Wires on the label.

Mechanical Data

Polarity and Reversed Voltage
Aluminium Electrolytic capacitors manufactured for use in DC applications contain an anode foil and a cathode foil. As such, they are polarized devices and must be connected with the +ve to the anode foil and the -ve to the cathode foil. If this were to be reversed then the electrolytic process that took place in forming the oxide layer on the anode would be recreated in trying to form an oxide layer on the cathode. In forming the cathode foil in this way, heat would be generated and gas given off within the capacitor, usually leading to catastrophic failure.

The cathode foil already possesses a thin stabilized oxide layer. This thin oxide layer is equivalent to a forming voltage of approximately 2 V. As a result, the capacitor can withstand a voltage reversal of up to 2 V for short periods. Above this voltage, the formation process will commence. Aluminium Electrolytic capacitors can also be manufactured for use in intermittent AC applications by using two anode foils in place of one anode and one cathode.

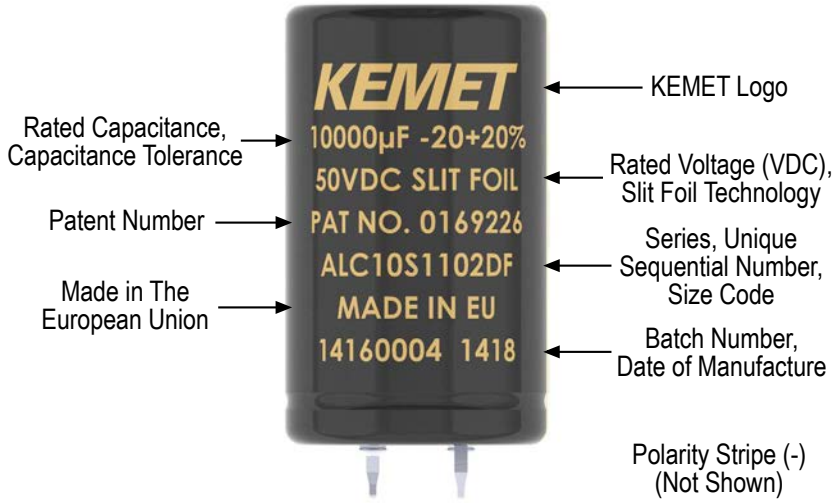
Mounting Position
The capacitor can be mounted upright or inclined to a horizontal position.

Insulating Resistance
≥ 100 MΩ at 100 VDC across insulating sleeve.

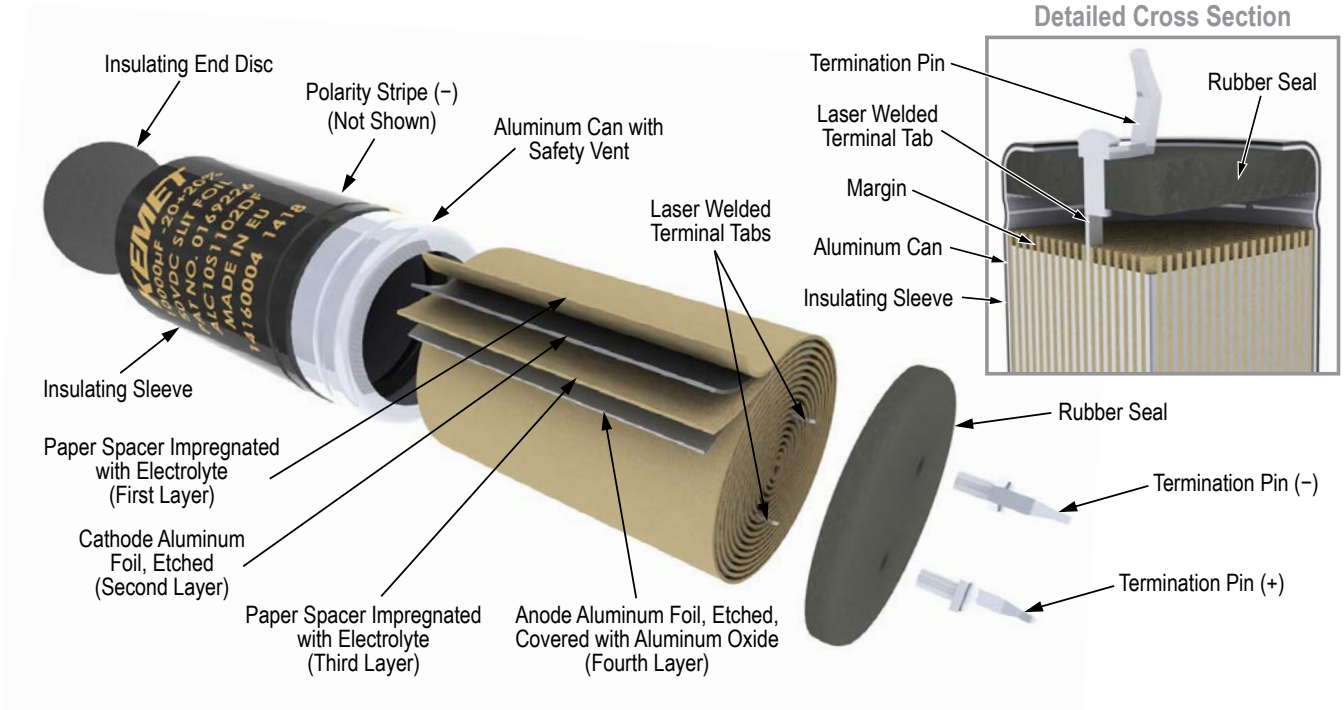
Voltage Proof
≥ 2,500 VDC across insulating sleeve.

Safety Vent
A safety vent for overpressure is featured on either the base (opposing end to the terminals) or the side of the can. This appears in the form of a grooved section on the surface of the can, which is a weakened area and designed to relieve build-up of internal pressure due to overstress or catastrophic failure.

Marking



Construction



ALS30/31 Series, +85°C

Overview

KEMET's ALS30/31 Series of screw terminal capacitors covers a wide range of case sizes and voltage ratings featuring high ripple currents and long-life performance. They are ideally suited for industrial and commercial applications demanding high reliability and long-life expectancy such as frequency converters, uninterruptible power supply (UPS) systems and switch mode power supplies (SMPS).

Applications

Typical applications for KEMET's ALS30/31 Series of capacitors include smoothing, energy storage or pulse operation in telecommunication demanding power supplies, process control, AC motor control, traction, welding, and measuring.

Benefits

- Compact size
- Long life, up to 20,000 hours at +85°C (V_R, I_R applied)
- High ripple current
- Excellent surge voltage capability
- Optimized designs available upon request

Part Number System

ALS3	0	A	153	DA	025	
Series	Stud Option	Termination	Capacitance Code (µF)	Size Code	Rated Voltage (VDC)	
Screw Terminal Aluminum Electrolytic	0 = Plain Can 1 = Threaded mounting stud	See Termination Table	First two digits represent significant figures. Third digit specifies number of zeros.	See Dimension Table	025 = 25 040 = 40 063 = 63 100 = 100 200 = 200 250 = 250	350 = 350 400 = 400 415 = 415 450 = 450 500 = 500

Performance Characteristics

Item	Performance Characteristics		
Capacitance Range	100 – 680,000 µF		
Rated Voltage	25 – 500 VDC		
Operating Temperature	-40 to +85°C		
Storage Temperature Range	-55 to +85°C		
Capacitance Tolerance	±20% at 100 Hz / +20°C		
Operational Lifetime	D (mm)	Rated Voltage and Ripple Current at +85°C (hours)	Rated Voltage at +85°C (hours)
	36	11,000	22,000
	51	18,000	36,000
	63.5, 66	19,000	38,000
	77, 90	20,000	40,000
End of Life Requirement	Δ C/C < ±10%, ESR < 2 x initial ESR value, IL < initial specified limit		
Shelf Life	2,000 hours at +85°C or 30,000 hours at +40°C 0 VDC		
Leakage Current	I = 0.003 CV or 6,000 (µA, whichever is smaller)		
	C = rated capacitance (µF), V = rated voltage (VDC). Voltage applied for 5 minutes at +20°C.		
Vibration Test Specifications		Procedure	Requirements
	Case Length < 220 mm	0.75 mm displacement amplitude or 10 g maximum acceleration. Vibration applied for three 2-hour sessions at 10 – 55 Hz (Capacitor clamped by body).	No leakage of electrolyte or other visible damage. Deviations in capacitance and tanδ from initial measurements must not exceed: Δ C/C < 5%
	Case Length ≥ 220 mm	0.35 mm displacement amplitude or 5 g maximum acceleration. Vibration applied for three 0.5 hour sessions at 10 – 55 Hz (Capacitor clamped by body).	
Standards	IEC 60384–4 long life grade 40/85/56		

Surge Voltage

Test Condition	Voltage (VDC)									
	25	40	63	100	200	250	350	400	450	500
≤ 30s Surge followed by a no load period of 330s, 1,000 cycles at +85°C	28.75	46	72.5	115	230	288	385	440	495	550
≤ 500 ms surge, 100 cycles at 20°C, occurring randomly throughout the life of the capacitor					350	400	500	520	550	600

Test Method & Performance

Endurance Life Test		
Conditions	Performance	
Temperature	+85°C	
Test Duration	5,000 hours	
Ripple Current	Rated ripple current specified in table	
Voltage	The sum of DC voltage and the peak AC voltage must not exceed the rated voltage of the capacitor	
Performance	**The following specifications will be satisfied when the capacitor is tested at +20°C:**	
Capacitance Change	≤ 160 V	Within 15% of the initial value
	> 160 V	Within 10% of the initial value
Equivalent Series Resistance	Does not exceed 200% of the initial value	
Leakage Current	Does not exceed leakage current limit	

Dimensions – Millimeters

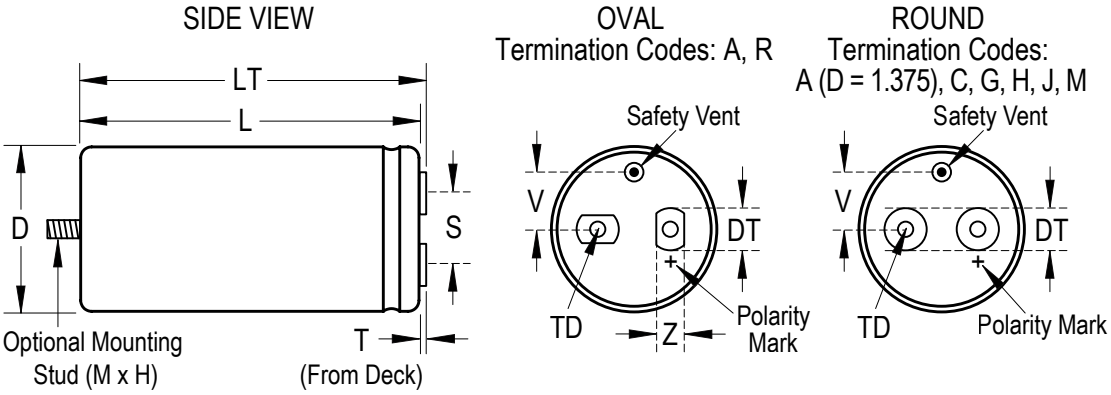
Size Code	Dimensions in mm						Mounting Clip	Approximate Weight Grams
	D	L	LT	S	V	Mounting Stud (M x H)		
	±1	±2	±1	±0.5	Nominal	±1		
DA	36	52	58.5	12.8	8	M8 x 12	V3/H2/2736	75
DB	36	62	67.5	12.8	8	M8 x 12	V3/H2/2736	90
DE	36	82	87.5	12.8	8	M8 x 12	V3/H2/2736	115
DF	36	105	111.5	12.8	8	M8 x 12	V3/H2/2736	140
KE	51	82	86.5	22.2	13.7	M12 x 16	V4/2737	220
KF	51	105	110.5	22.2	13.7	M12 x 16	V4/2737	300
LF	63.5	105	110.5	28.5	15.8	M12 x 16	V8	485
MF	66	105	110.5	28.5	15.8	M12 x 16	V10/2738	505
MJ	66	115	119	28.5	15.8	M12 x 16	V10/2738	540
ND	77	75	79.5	31.8	19	M12 x 16	V11	495
NF	77	105	110.5	31.8	19	M12 x 16	V11	690
NJ	77	115	119	31.8	19	M12 x 16	V11	766
NP	77	146	150.5	31.8	19	M12 x 16	V11	960
NT	77	220	224.5	31.8	19	M12 x 16	V11	1450
QC	90	67	71.5	31.8	25	M12 x 16	V90	615
QD	90	75	79.5	31.8	25	M12 x 16	V90	690
QH	90	98	103.5	31.8	25	M12 x 16	V90	900
QP	90	146	149.5	31.8	25	M12 x 16	V90	1345
QT	90	220	223.5	31.8	25	M12 x 16	V90	2000

Note: Dimensions include sleeving. LT listed is for A-type termination code. Information for other termination codes is available upon request.

Termination Tables

Termination Code / Diameter (mm)	A	C	G	J	M	R
36	•					
51	•					
66	•	•				
77	•	•	•	•	•	•
90	•	•		•		

Termination Code	Thread	Termination Style	T	DT	Thread Depth (TD)	Z
			± 0.5	± 0.5	Minimum	Nominal
Standard Termination Option						
A (D = 36)	M5	Round	7.14	8	10	
A (D > 36)	M5	Oval	5.5	13	10	10
Other Termination Options						
C	M6	Round	5.5	13	10	
G	M6	Round	6.35	17	11.8	
Dimensions in mm						



Case Polarity

Due to the presence of electrolyte in the capacitor, the aluminum can and stud mounting will essentially be at the same polarity as the negative terminal. We recommend that the stud and can be insulated (see accessories for insulating nuts).

Terminations

Aluminum inserts with M5 threads as standard, maximum torque 2NM. Optional M6 threaded inserts have a maximum torque 4NM. Maximum torque for stud mounting M8:4NM and M12:8NM.

Shelf Life

The capacitance, ESR and impedance of a capacitor will not change significantly after extended storage periods, however the leakage current will very slowly increase. KEMET products are particularly stable and allow a shelf life in excess of three years at 40°C. See sectional specification under each product series for specific data.

Re-age (Reforming) Procedure

Apply the rated voltage to the capacitor at room temperature for a period of one hour, or until the leakage current has fallen to a steady value below the specified limit. During re-aging a maximum charging current of twice the specified leakage current or 5 mA (whichever is greater) is suggested.

Reliability

The reliability of a component can be defined as the probability that it will perform satisfactorily under a given set of conditions for a given length of time.

In practice, it is impossible to predict with absolute certainty how any individual component will perform; thus, we must utilize probability theory. It is also necessary to clearly define the level of stress involved (e.g. operating voltage, ripple current, temperature and time). Finally, the meaning of satisfactory performance must be defined by specifying a set of conditions which determine the end of life of the component.

Reliability as a function of time, R(t), is normally expressed as: $R(t)=e^{-\lambda t}$
where R(t) is the probability that the component will perform satisfactorily for time t, and λ is the failure rate.

Failure Rate

The failure rate is the number of components failing per unit time. The failure rate of most electronic components follows the characteristic pattern:

- Early failures are removed during the manufacturing process.
- The operational life is characterized by a constant failure rate.
- The wear out period is characterized by a rapidly increasing failure rate.

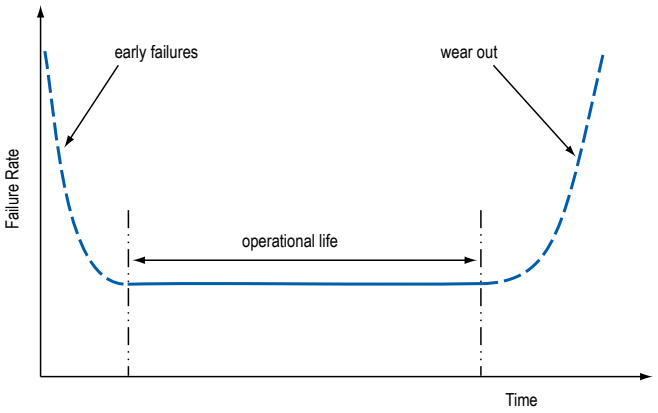
The failures in time (FIT) are given with a 60% confidence level for the various type codes. By convention, FIT is expressed as 1×10^{-9} failures per hour. Failure rate is also expressed as a percentage of failures per 1,000 hours.
e.g., 100 FIT = 1×10^{-7} failures per hour = 0.01%/1,000 hours

End of Life Definition
Catastrophic Failure: short circuit, open circuit or safety vent operation
Parametric Failure:

- Change in capacitance > ±10%
- Leakage current > specified limit
- ESR > 2 x initial ESR value

MTBF

The mean time between failures (MTBF) is simply the inverse of the failure rate.
MTBF= 1/λ



The failure rate is derived from our periodic test results. The failure rate (λ_R) is, therefore, only given at test temperature for life tests. An estimation is also given at 40°C. The expected failure rate for this capacitor range is based on our periodic test results for capacitors with structural similarity. Failure rate is frequently quoted in FIT (Failures In Time) where 1 FIT = 1 x 10^{-9} failures per hour. Failure rate per hour includes both catastrophic and parametric failures.

T_a	Failure Rate per Hour
85°C	250 FIT
40°C	12 FIT

Environmental Compliance

As an environmentally conscious company, KEMET is working continuously with improvements concerning the environmental effects of both our capacitors and their production. 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, such as lead (Pb), in electronic equipment. All products in this catalog are produced to help our customers' obligations to guarantee their products and 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 such as 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 such as LF = Lead Free or LFW = Lead Free Wires on the label.

Table 1 – Ratings & Part Number Reference

VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR Maximum	Impedance Maximum	Part Number
	100 Hz 20°C (µF)		D x L (mm)	100 Hz 85°C (A)	10 kHz 85°C (A)	100 Hz 20°C (mΩ)	10 kHz 20°C (mΩ)	
25	15000	DA	36 x 52	8.2	8.7	24	20	ALS3(1)(2)153DA025
25	22000	DB	36 x 62	9.9	10.4	17	15	ALS3(1)(2)223DB025
25	33000	DE	36 x 82	13.2	13.9	11	10	ALS3(1)(2)333DE025
25	47000	DF	36 x 105	16.6	17.4	9	7	ALS3(1)(2)473DF025
25	68000	KE	51 x 82	15.6	16.9	11	10	ALS3(1)(2)683KE025
25	100000	KF	51 x 105	19.6	20.6	9	8	ALS3(1)(2)104KF025
25	150000	ND	77 x 75	17.9	18.1	11	11	ALS3(1)(2)154ND025
25	150000	MF	66 x 105	28.4	28.9	6	6	ALS3(1)(2)154MF025
25	220000	QC	90 x 67	21.9	22.6	9	8	ALS3(1)(2)224QC025
25	220000	QD	90 x 75	18.7	18.8	12	12	ALS3(1)(2)224QD025
25	220000	NF	77 x 105	28.1	30.8	6	6	ALS3(1)(2)224NF025
25	330000	QH	90 x 98	26.4	26.5	8	8	ALS3(1)(2)334QH025
25	330000	NP	77 x 146	37.3	39.6	5	5	ALS3(1)(2)334NP025
25	470000	QP	90 x 146	43.6	43.9	4	4	ALS3(1)(2)474QP025
25	470000	NT	77 x 220	45.8	47	4	4	ALS3(1)(2)474NT025
25	680000	QT	90 x 220	55.4	56.7	4	4	ALS3(1)(2)684QT025
40	10000	DA	36 x 52	7.9	8.4	23	20	ALS3(1)(2)103DA040
40	15000	DB	36 x 62	9.5	10	17	14	ALS3(1)(2)153DB040
40	22000	DE	36 x 82	12.7	13.3	11	10	ALS3(1)(2)223DE040
40	33000	KE	51 x 82	14.2	16.7	12	11	ALS3(1)(2)333KE040
40	47000	KE	51 x 82	14.2	16.7	12	11	ALS3(1)(2)473KE040
40	68000	KF	51 x 105	18	20.6	10	9	ALS3(1)(2)683KF040
40	100000	ND	77 x 75	16.4	16.5	13	12	ALS3(1)(2)104ND040
40	100000	MF	66 x 105	26.3	26.6	7	6	ALS3(1)(2)104MF040
40	100000	QC	90 x 67	23	24.8	8	7	ALS3(1)(2)104QC040
40	100000	QD	90 x 75	20.3	20.4	10	10	ALS3(1)(2)104QD040
40	150000	NF	77 x 105	26.8	30.2	8	8	ALS3(1)(2)154NF040
40	150000	QH	90 x 98	28.6	28.9	7	7	ALS3(1)(2)154QH040
40	220000	NP	77 x 146	35.4	39.6	6	5	ALS3(1)(2)224NP040
40	220000	QP	90 x 146	46.5	47	4	4	ALS3(1)(2)224QP040
40	330000	NT	77 x 220	45	46.5	4	4	ALS3(1)(2)334NT040
40	470000	QT	90 x 220	52.3	53.4	4	4	ALS3(1)(2)474QT040
63	4700	DA	36 x 52	6.7	7.4	36	28	ALS3(1)(2)472DA063
63	6800	DB	36 x 62	8.2	9	26	20	ALS3(1)(2)682DB063
63	10000	DE	36 x 82	10.8	11.9	17	14	ALS3(1)(2)103DE063
63	15000	DF	36 x 105	10.9	14.4	15	8	ALS3(1)(2)153DF063
63	15000	KE	51 x 82	13.9	14.4	12	11	ALS3(1)(2)153KE063
63	22000	KE	51 x 82	13.9	14.4	12	11	ALS3(1)(2)223KE063
63	33000	KF	51 x 105	17.4	18	10	9	ALS3(1)(2)333KF063
63	47000	ND	77 x 75	16.6	16.8	13	13	ALS3(1)(2)473ND063
63	47000	MF	66 x 105	26.7	26.5	8	7	ALS3(1)(2)473MF063
63	47000	QD	90 x 75	20.3	20.7	11	10	ALS3(1)(2)473QD063
63	68000	QC	90 x 67	20.9	22.4	10	9	ALS3(1)(2)683QC063
63	68000	NF	77 x 105	24.7	26.4	8	8	ALS3(1)(2)683NF063
63	68000	QH	90 x 98	28.9	29.6	8	7	ALS3(1)(2)683QH063
63	100000	NP	77 x 146	34.8	35.4	6	6	ALS3(1)(2)104NP063
63	150000	QP	90 x 146	40.2	40.7	5	5	ALS3(1)(2)154QP063
63	150000	NT	77 x 220	43.3	45.1	4	4	ALS3(1)(2)154NT063
63	220000	QT	90 x 220	52.4	54.3	4	4	ALS3(1)(2)224QT063
100	2200	DA	36 x 52	4.9	5.4	69	55	ALS3(1)(2)222DA100
100	3300	DB	36 x 62	6	6.6	49	39	ALS3(1)(2)332DB100
100	4700	DE	36 x 82	7.9	8.8	33	27	ALS3(1)(2)472DE100
100	6800	DF	36 x 105	10	11.1	23	19	ALS3(1)(2)682DF100
100	10000	KE	51 x 82	10.1	10.5	28	24	ALS3(1)(2)103KE100
100	15000	KF	51 x 105	12.6	13.1	20	18	ALS3(1)(2)153KF100
100	22000	ND	77 x 75	12	12.2	25	24	ALS3(1)(2)223ND100
100	22000	MF	66 x 105	18.4	19.1	13	12	ALS3(1)(2)223MF100
100	22000	QC	90 x 67	18.9	20.9	15	13	ALS3(1)(2)223QC100
VDC	**Rated Capacitance**	**Size Code**	**Case Size**	**Ripple Current**		**ESR**	**Impedance**	**Part Number**

(1) Mounting Code: 0 = plain can, 1 = threaded mounting stud

(2) Termination Code: See Termination Tables for available options

Table 1 – Ratings & Part Number Reference cont'd

VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR Maximum	Impedance Maximum	Part Number
	100 Hz 20°C (µF)		D x L (mm)	100 Hz 85°C (A)	10 kHz 85°C (A)	100 Hz 20°C (mΩ)	10 kHz 20°C (mΩ)	
100	22000	QD	90 x 75	14.7	15	21	20	ALS3(1)(2)223QD100
100	33000	NF	77 x 105	17.6	19	15	14	ALS3(1)(2)333NF100
100	33000	QH	90 x 98	20.8	21.2	13	12	ALS3(1)(2)333QH100
100	47000	NP	77 x 146	25.2	25.7	10	9	ALS3(1)(2)473NP100
100	68000	QP	90 x 146	29.4	29.8	9	8	ALS3(1)(2)683QP100
100	68000	NT	77 x 220	40.6	41.5	7	6	ALS3(1)(2)683NT100
100	100000	QT	90 x 220	30.8	33.3	6	5	ALS3(1)(2)104QT100
200	470	DA	36 x 52	2.6	4.3	286	227	ALS3(1)(2)471DA200
200	680	DB	36 x 62	3.9	5.4	199	158	ALS3(1)(2)681DB200
200	1000	DE	36 x 82	5.1	7.1	135	107	ALS3(1)(2)102DE200
200	1500	DF	36 x 105	5.6	9.1	90	72	ALS3(1)(2)152DF200
200	2200	KE	51 x 82	8.2	9.7	73	60	ALS3(1)(2)222KE200
200	3300	KF	51 x 105	9.2	13.1	48	40	ALS3(1)(2)332KF200
200	4700	ND	77 x 75	10.6	11.5	48	42	ALS3(1)(2)472ND200
200	4700	MF	66 x 105	13	19.1	33	27	ALS3(1)(2)472MF200
200	6800	MF	66 x 105	15.7	17.7	27	23	ALS3(1)(2)682MF200
200	6800	QC	90 x 67	13.7	18.5	38	29	ALS3(1)(2)682QC200
200	6800	QD	90 x 75	13.3	14.3	35	31	ALS3(1)(2)682QD200
200	10000	NF	77 x 105	14.9	15.9	28	25	ALS3(1)(2)103NF200
200	10000	QH	90 x 98	18.8	20.3	23	20	ALS3(1)(2)103QH200
200	15000	NP	77 x 146	21.4	22.7	18	16	ALS3(1)(2)153NP200
200	22000	QP	90 x 146	26.7	28	13	12	ALS3(1)(2)223QP200
200	22000	NT	77 x 220	36.1	38.7	11	9	ALS3(1)(2)223NT200
200	33000	QT	90 x 220	42.2	44.8	10	9	ALS3(1)(2)333QT200
250	470	DA	36 x 52	3	4.5	247	187	ALS3(1)(2)471DA250
250	680	DB	36 x 62	3.8	5.6	172	131	ALS3(1)(2)681DB250
250	1000	DE	36 x 82	5	7.4	117	89	ALS3(1)(2)102DE250
250	1500	KE	51 x 82	6.2	9.8	86	67	ALS3(1)(2)152KE250
250	2200	KE	51 x 82	7.7	9.1	69	55	ALS3(1)(2)222KE250
250	3300	KF	51 x 105	10.4	12.4	45	36	ALS3(1)(2)332KF250
250	3300	ND	77 x 75	10.4	11.9	52	43	ALS3(1)(2)332ND250
250	4700	MF	66 x 105	15	18.2	31	24	ALS3(1)(2)472MF250
250	4700	QD	90 x 75	13.2	14.9	38	32	ALS3(1)(2)472QD250
250	6800	QC	90 x 67	13.5	17.7	35	27	ALS3(1)(2)682QC250
250	6800	NF	77 x 105	15	16.5	29	25	ALS3(1)(2)682NF250
250	10000	QH	90 x 98	17.1	18.4	24	21	ALS3(1)(2)103QH250
250	10000	NP	77 x 146	21.6	24	19	16	ALS3(1)(2)103NP250
250	15000	QP	90 x 146	27	29.5	14	12	ALS3(1)(2)153QP250
250	15000	NT	77 x 220	32.4	36.5	12	10	ALS3(1)(2)153NT250
250	22000	NT	77 x 220	36.3	45.8	9	7	ALS3(1)(2)223NT250
250	22000	QT	90 x 220	42.3	47.4	12	10	ALS3(1)(2)223QT250
350	330	DA	36 x 52	2.4	5	325	226	ALS3(1)(2)331DA350
350	470	DE	36 x 82	3.4	7.2	223	154	ALS3(1)(2)471DE350
350	680	DF	36 x 105	4.4	9	154	107	ALS3(1)(2)681DF350
350	1000	KE	51 x 82	6.1	10.6	116	82	ALS3(1)(2)102KE350
350	1500	KF	51 x 105	8.2	13.5	77	55	ALS3(1)(2)152KF350
350	2200	KF	51 x 105	8.7	14.1	66	48	ALS3(1)(2)222KF350
350	2200	ND	77 x 75	9.1	15.6	66	50	ALS3(1)(2)222ND350
350	2200	MF	66 x 105	11.9	19.3	52	37	ALS3(1)(2)222MF350
350	3300	MF	66 x 105	12.8	20.3	39	29	ALS3(1)(2)332MF350
350	3300	QC	90 x 67	11.8	18	49	34	ALS3(1)(2)332QC350
350	3300	QD	90 x 75	12.5	19.8	47	36	ALS3(1)(2)332QD350
350	4700	NF	77 x 105	14.7	21.7	35	27	ALS3(1)(2)472NF350
350	4700	QH	90 x 98	16.3	26.6	31	24	ALS3(1)(2)472QH350
350	6800	NP	77 x 146	19.3	26	23	18	ALS3(1)(2)682NP350
350	6800	QP	90 x 146	24.9	34.4	20	15	ALS3(1)(2)682QP350
350	10000	NT	77 x 220	31.7	39.3	15	11	ALS3(1)(2)103NT350
350	15000	QT	90 x 220	38.2	46.4	15	12	ALS3(1)(2)153QT350
VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR	Impedance	Part Number

(1) Mounting Code: 0 = plain can, 1 = threaded mounting stud

(2) Termination Code: See Termination Tables for available options

Table 1 – Ratings & Part Number Reference cont'd

VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR Maximum	Impedance Maximum	Part Number
	100 Hz 20°C (µF)		D x L (mm)	100 Hz 85°C (A)	10 kHz 85°C (A)	100 Hz 20°C (mΩ)	10 kHz 20°C (mΩ)	
400	220	DA	36 x 52	2.1	4.4	570	387	ALS3(1)(2)221DA400
400	330	DB	36 x 62	2.7	5.5	382	260	ALS3(1)(2)331DB400
400	470	DE	36 x 82	3.5	7.1	267	182	ALS3(1)(2)471DE400
400	680	DF	36 x 105	4.4	8.8	185	126	ALS3(1)(2)681DF400
400	1000	KE	51 x 82	5.8	10.3	139	98	ALS3(1)(2)102KE400
400	1500	KF	51 x 105	7.8	13.1	92	65	ALS3(1)(2)152KF400
400	1500	ND	77 x 75	8.3	14.7	97	70	ALS3(1)(2)152ND400
400	2200	KF	51 x 105	8.4	13.5	78	56	ALS3(1)(2)222KF400
400	2200	MF	66 x 105	11.2	18.8	62	44	ALS3(1)(2)222MF400
400	2200	QD	90 x 75	10.7	18.9	69	50	ALS3(1)(2)222QD400
400	3300	LF	63.5 X 105	11.81	20.54	54	36	ALS3(1)(2)332LF400
400	3300	QC	90 x 67	11.7	17.1	53	38	ALS3(1)(2)332QC400
400	3300	NF	77 x 105	13.4	21.3	49	36	ALS3(1)(2)332NF400
400	3300	QH	90 x 98	14.9	25.3	45	32	ALS3(1)(2)332QH400
400	3900	MJ	66 x 115	12.98	21.02	50	35	ALS3(1)(2)392MJ400
400	4700	NF	77 x 105	14.6	20.9	38	26	ALS3(1)(2)472NF400
400	4700	QH	90 x 98	17.1	25.4	36	26	ALS3(1)(2)472QH400
400	4700	NJ	77 X 115	15.25	23.20	38	26	ALS3(1)(2)472NJ400
400	4700	NP	77 x 146	18	26	33	24	ALS3(1)(2)472NP400
400	6800	NP	77 x 146	19.5	26.9	27	20	ALS3(1)(2)682NP400
400	6800	QP	90 x 146	23.2	32.9	24	17	ALS3(1)(2)682QP400
400	6800	NT	77 x 220	29	40.7	22	15	ALS3(1)(2)682NT400
400	10000	NT	77 X 220	31.50	42.00	19	14	ALS3(1)(2)103NT400
400	10000	QT	90 x 220	35.7	49.4	17	12	ALS3(1)(2)103QT400
415	220	DA	36 x 52	2.1	4.4	555	368	ALS3(1)(2)221DA415
415	330	DB	36 x 62	2.7	5.6	372	247	ALS3(1)(2)331DB415
415	470	DE	36 x 82	3.5	7.2	261	173	ALS3(1)(2)471DE415
415	680	DF	36 x 105	4.5	9	180	120	ALS3(1)(2)681DF415
415	1000	KE	51 x 82	5.7	10.4	136	94	ALS3(1)(2)102KE415
415	1500	KF	51 x 105	7.6	13.1	90	62	ALS3(1)(2)152KF415
415	1500	ND	77 x 75	8.1	14.7	96	68	ALS3(1)(2)152ND415
415	2200	MF	66 x 105	11	18.9	61	42	ALS3(1)(2)222MF415
415	2200	QC	90 x 67	10.5	17.5	71	49	ALS3(1)(2)222QC415
415	2200	QD	90 x 75	11.1	18.9	68	49	ALS3(1)(2)222QD415
415	3300	NF	77 x 105	13.4	21.3	48	36	ALS3(1)(2)332NF415
415	3300	QH	90 x 98	14.6	25.3	45	32	ALS3(1)(2)332QH415
415	4700	NP	77 x 146	17.6	25.9	33	24	ALS3(1)(2)472NP415
415	6800	QP	90 x 146	22.7	32.8	23	17	ALS3(1)(2)682QP415
415	6800	NT	77 x 220	28.5	40.1	21	15	ALS3(1)(2)682NT415
415	10000	QT	90 x 220	35.2	48.7	17	12	ALS3(1)(2)103QT415
450	150	DA	36 x 52	1.8	4.1	735	485	ALS3(1)(2)151DA450
450	220	DB	36 x 62	2.4	5.1	502	332	ALS3(1)(2)221DB450
450	330	DE	36 x 82	3.1	6.7	335	221	ALS3(1)(2)331DE450
450	470	DF	36 x 105	4	8.4	235	155	ALS3(1)(2)471DF450
450	680	KE	51 x 82	4.9	9.9	175	117	ALS3(1)(2)681KE450
450	1000	KF	51 x 105	6.5	12.6	118	79	ALS3(1)(2)102KF450
450	1500	ND	77 x 75	8.7	14.9	95	65	ALS3(1)(2)152ND450
450	1500	MF	66 x 105	9.5	17.4	81	52	ALS3(1)(2)152MF450
450	2200	QC	90 x 67	9.6	15.4	74	46	ALS3(1)(2)222QC450
450	2200	QD	90 x 75	11.5	19	67	47	ALS3(1)(2)222QD450
450	2200	MF	66 x 105	11.1	19.3	67	47	ALS3(1)(2)222MF450
450	2200	NF	77 x 105	12.2	21.1	59	41	ALS3(1)(2)222NF450
450	3300	QD	90 x 75	12.6	17.9	53	33	ALS3(1)(2)332QD450
450	3300	NF	77 x 105	13.8	21.2	40	30	ALS3(1)(2)332NF450
450	3300	QH	90 x 98	15.6	25.5	44	30	ALS3(1)(2)332QH450
450	4700	NJ	77 X 115	14.93	22.76	30	20	ALS3(1)(2)472NJ450
450	3300	NP	77 x 146	16.1	25.1	39	27	ALS3(1)(2)332NP450
450	4700	NP	77 x 146	17.1	25.2	36	26	ALS3(1)(2)472NP450
VDC	**Rated Capacitance**	**Size Code**	**Case Size**	**Ripple Current**		**ESR**	**Impedance**	**Part Number**

(1) Mounting Code: 0 = plain can, 1 = threaded mounting stud

(2) Termination Code: See Termination Tables for available options

Table 1 – Ratings & Part Number Reference cont'd

VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR Maximum	Impedance Maximum	Part Number
	100 Hz 20°C (µF)		D x L (mm)	100 Hz 85°C (A)	10 kHz 85°C (A)	100 Hz 20°C (mΩ)	10 kHz 20°C (mΩ)	
450	4700	QP	90 x 146	21	31.8	29	19	ALS3(1)(2)472QP450
450	6800	NT	77 x 220	27.4	38.8	21	14	ALS3(1)(2)682NT450
450	10000	QT	90 x 220	33.4	46.5	18	13	ALS3(1)(2)103QT450
500	100	DA	36 x 52	1.6	2.9	1385	847	ALS3(1)(2)101DA500
500	150	DB	36 x 62	2	3.7	930	566	ALS3(1)(2)151DB500
500	220	DE	36 x 82	2.7	4.8	635	386	ALS3(1)(2)221DE500
500	330	DE	36 x 82	3.2	5.7	450	350	ALS3(1)(2)331DE500
500	330	DF	36 x 105	3.5	6.2	420	258	ALS3(1)(2)331DF500
500	470	KE	51 x 82	4.4	7.5	365	194	ALS3(1)(2)471KE500
500	680	KF	51 x 105	5.7	9.6	255	133	ALS3(1)(2)681KF500
500	1000	ND	77 x 75	7.6	12.2	173	109	ALS3(1)(2)102ND500
500	1000	MF	66 x 105	8.1	13.8	175	96	ALS3(1)(2)102MF500
500	1500	NF	77 x 105	10.6	17	120	65	ALS3(1)(2)152NF500
500	1500	QC	90 x 67	9.5	14.3	110	87	ALS3(1)(2)152QC500
500	1500	QD	90 x 75	10.1	15.9	119	76	ALS3(1)(2)152QD500
500	2200	QH	90 x 98	13.7	21.1	80	50	ALS3(1)(2)222QH500
500	2200	NP	77 x 146	14.3	21.8	80	44	ALS3(1)(2)222NP500
500	3300	NP	77 x 146	15.3	22.6	54	39	ALS3(1)(2)332NP500
500	3300	QP	90 x 146	19	28.3	51	32	ALS3(1)(2)332QP500
500	4700	NT	77 x 220	24.3	33.3	37	24	ALS3(1)(2)472NT500
500	6800	QT	90 x 220	26.5	41.3	27	22	ALS3(1)(2)682QT500
VDC	**Rated Capacitance**	**Size Code**	**Case Size**	**Ripple Current**		**ESR**	**Impedance**	**Part Number**

(1) Mounting Code: 0 = plain can, 1 = threaded mounting stud

(2) Termination Code: See Termination Tables for available options

Mechanical Data

Polarity and Reversed Voltage
Aluminium Electrolytic capacitors manufactured for use in DC applications contain an anode foil and a cathode foil. As such, they are polarized devices and must be connected with the +ve to the anode foil and the -ve to the cathode foil. If this were to be reversed then the electrolytic process that took place in forming the oxide layer on the anode would be recreated in trying to form an oxide layer on the cathode. In forming the cathode foil in this way, heat would be generated and gas given off within the capacitor, usually leading to catastrophic failure.

The cathode foil already possesses a thin stabilized oxide layer. This thin oxide layer is equivalent to a forming voltage of approximately 2 V. As a result, the capacitor can withstand a voltage reversal of up to 2 V for short periods. Above this voltage, the formation process will commence. Aluminium Electrolytic capacitors can also be manufactured for use in intermittent AC applications by using two anode foils in place of one anode and one cathode.

Mounting Position
The capacitor can be mounted in any position as long as the safety vent can operate. It is possible for some electrolyte to be expelled. As this is a conducting liquid, suitable precautions should be initiated by the system designer to avoid secondary short circuits.
The capacitors are designed to be mounted in free air and are not suitable for submersion in liquid.

Low Inductance Version
A low inductance version of the ALS30/31 capacitors can be designed upon request, typically reducing the inductance by up to 40% of the standard capacitor's inductance. It is available in 77 & 90 mm diameters.

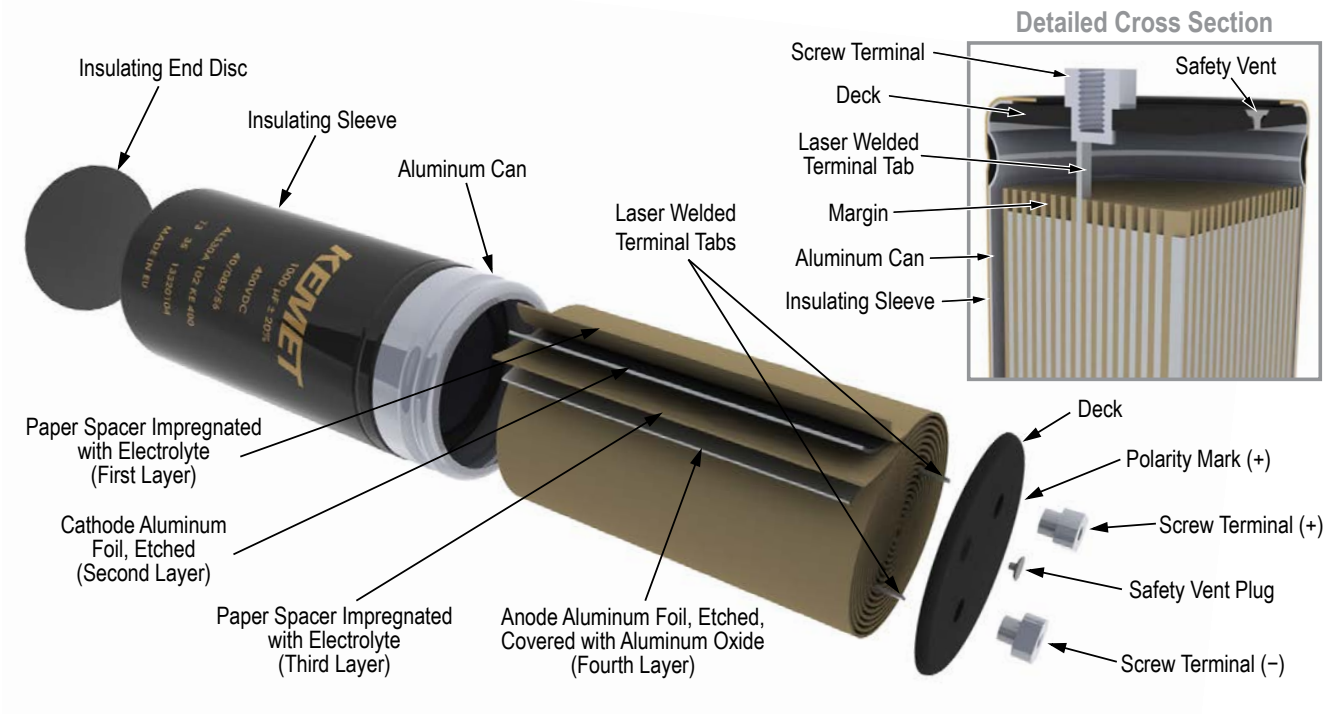
Insulating Resistance
≥ 100 MΩ at 100 VDC across insulating sleeve. UL recognized sleeving is available for custom parts in this range, upon request. (UL No. E358957)

Voltage Proof
≥ 2,500 VDC across insulating sleeve

Safety Vent
A safety vent for overpressure is featured on terminal deck. This is in the form of a rubber plug designed to relieve build-up of internal pressure due to overstress or catastrophic failure.

Marking

Construction



ALS32/33 Series, +85°C

Overview

KEMET's ALS32/33 Series of screw terminal capacitors meets the requirements of the Asian market. This range offers high CV per unit volume coupled with high ripple currents and long-life performance.

Applications

KEMET's ALS32/33 Series of capacitors is designed for industrial and commercial applications such as switch mode power supplies (SMPS), uninterruptible power supply (UPS) systems, variable speed drives, frequency inverters, welding equipment, and energy storage in pulse discharge applications.

Benefits

- Case sizes and terminals for the Asian market
- Long life, up to 20,000 hours at +85°C (V_R, I_R applied)
- High ripple current
- Excellent surge voltage capability
- Optimized designs available upon request

Part Number System

ALS3	2	A	391	D2C	350
Series	Stud Option	Termination	Capacitance Code (µF)	Size Code	Rated Voltage (VDC)
Screw Terminal Aluminum Electrolytic	2 = Plain Can 3 = Threaded mounting stud	See Termination Table	First two digits represent significant figures. Third digit specifies number of zeros.	See Dimension Table	350 = 350 400 = 400 450 = 450 500 = 500

Performance Characteristics

Item	Performance Characteristics		
Capacitance Range	220 – 18,000 µF		
Rated Voltage	350 – 500 VDC		
Operating Temperature	-40 to +85°C		
Storage Temperature Range	-55 to +85°C		
Capacitance Tolerance	±20% at 100 Hz / +20°C		
Operational Lifetime	D (mm)	Rated Voltage and Ripple Current at +85°C (hours)	Rated Voltage at +85°C (hours)
	36	11,000	22,000
	51	18,000	36,000
	63.5	19,000	38,000
	77.90	20,000	40,000
End of Life Requirement	Δ C/C < ±10%, ESR < 2 x initial ESR value, IL < initial specified limit		
Shelf Life	2,000 hours at +85°C or 30,000 hours at +40°C 0 VDC		
Leakage Current	I = 0.003 CV or 6,000 (µA, whichever is smaller)		
	C = rated capacitance (µF), V = rated voltage (VDC). Voltage applied for 5 minutes at +20°C.		
Vibration Test Specifications		Procedure	Requirements
	Case Length < 220 mm	0.75 mm displacement amplitude or 10 g maximum acceleration. Vibration applied for three 2-hour sessions at 10 – 55 Hz (Capacitor clamped by body).	No leakage of electrolyte or other visible damage. Deviations in capacitance and tanδ from initial measurements must not exceed: Δ C/C < 5%
	Case Length ≥ 220 mm	0.35 mm displacement amplitude or 5 g maximum acceleration. Vibration applied for three 0.5 hour sessions at 10 – 55 Hz (Capacitor clamped by body).	
Standards	IEC 60384–4 long life grade 40/85/56		

Surge Voltage

Condition	Voltage (VDC)			
	350	400	450	500
≤ 30s Surge followed by a no load period of 330s, 1,000 cycles at +85°C	385	440	495	550
≤ 500 ms surge, 100 cycles at 20°C, occurring randomly throughout the life of the capacitor	500	520	550	600

Test Method & Performance

Endurance Life Test		
Conditions	Performance	
Temperature	+85°C	
Test Duration	5,000 hours	
Ripple Current	Rated ripple current in specified table	
Voltage	The sum of DC voltage and the peak AC voltage must not exceed the rated voltage of the capacitor	
Performance	**The following specifications will be satisfied when the capacitor is tested at +20°C:**	
Capacitance Change	≤ 160 V	Within 15% of the initial value
	> 160 V	Within 10% of the initial value
Equivalent Series Resistance	Does not exceed 200% of the initial value	
Leakage Current	Does not exceed leakage current limit	

Termination Tables

Termination Code / Diameter (mm)	A	C
34.9	•	
50.8	•	
63.5	•	•
76.2	•	•
88.9	•	•

Termination Code	Thread	Termination Style	T ± 0.5	DT ± 0.5	Thread Depth (TD) Minimum	Z Nominal
Standard Termination Option						
A (D = 36)	M5	Round	7.14	8	10	
A (D > 36)	M5	Oval	5.5	13	10	10
Other Termination Options						
C	M6	Round	5.5	13	10	
Dimensions in mm						

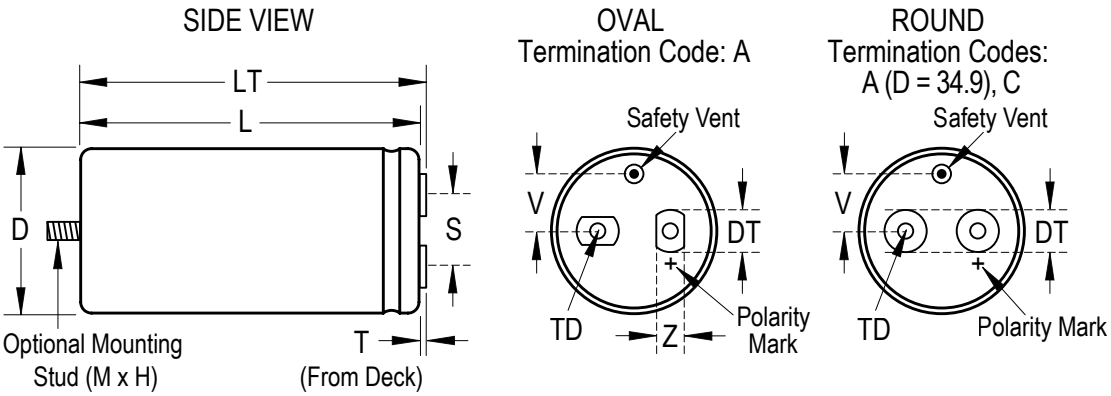
Case Polarity

Due to the presence of electrolyte in the capacitor, the aluminum can and stud mounting will essentially be at the same polarity as the negative terminal. We recommend that the stud and can be insulated (see accessories for insulating nuts).

Terminations

Aluminum inserts with M5 threads as standard, maximum torque 2NM. Optional M6 threaded inserts have a maximum torque 4NM. Maximum torque for stud mounting M8:4NM and M12:8NM.

Dimensions – Millimeters



Reference Size (mm)	Size Code	Dimensions in mm						Mounting Stud (M x H)	Mounting Clip	Approximate Weight Grams
		D	L	LT	S	T	V			
		±0.8	±1.6	±1	±0.5	±0.8	Nominal			
36 x 55	D2C	34.9	54.0	61.5	12.8	7.14	8	M8 x 12	V3/H2/2736	80
36 x 80	D3C	34.9	79.4	87.5	12.8	7.14	8	M8 x 12	V3/H2/2736	114
36 x 93	D3L	34.9	92.1	100.5	12.8	7.14	8	M8 x 12	V3/H2/2736	131
51 x 68	K2L	50.8	66.7	73.0	22.2	5.5	13.7	M12 x 16	V4/2737	165
51 x 93	K3L	50.8	92.1	98.0	22.2	5.5	13.7	M12 x 16	V4/2737	275
51 x 115	KJA	50.8	114.3	119.0	22.2	5.5	13.7	M12 x 16	V4/2737	340
51 x 131	K5C	50.8	130.2	136.0	22.2	5.5	13.7	M12 x 16	V4/2737	385
63.5 x 93	L3L	63.5	92.1	97.0	28.5	5.5	15.8	M12 x 16	V8	430
63.5 x 115	LJA	63.5	114.3	119.0	28.5	5.5	15.8	M12 x 16	V8	535
63.5 x 131	L5C	63.5	130.2	135.0	28.5	5.5	15.8	M12 x 16	V8	600
77 x 115	NJA	76.2	114.3	119.0	31.8	5.5	19	M12 x 16	V11	770
77 x 131	N5C	76.2	130.2	135.0	31.8	5.5	19	M12 x 16	V11	865
77 x 150	N5R	76.2	149.2	154.0	31.8	5.5	19	M12 x 16	V11	990
90 x 150	Q5R	88.9	149.2	154.0	31.8	5.5	25	M12 x 16	V90	1360
90 x 194	Q7L	88.9	193.7	198.0	31.8	5.5	25	M12 x 16	V90	1870
90 x 220	Q8L	88.9	219.1	224.0	31.8	5.5	25	M12 x 16	V90	2000

Note: Add 0.4 mm to D (1.1 mm when D = 88.9) and 1.1 mm to L for sleeving. LT listed is for A-type termination code. Information for other termination codes is available upon request.

Shelf Life

The capacitance, ESR and impedance of a capacitor will not change significantly after extended storage periods, however the leakage current will very slowly increase. KEMET products are particularly stable and allow a shelf life in excess of three years at 40°C. See sectional specification under each product series for specific data.

Re-age (Reforming) Procedure

Apply the rated voltage to the capacitor at room temperature for a period of one hour, or until the leakage current has fallen to a steady value below the specified limit. During re-aging a maximum charging current of twice the specified leakage current or 5 mA (whichever is greater) is suggested.

Reliability

The reliability of a component can be defined as the probability that it will perform satisfactorily under a given set of conditions for a given length of time.

In practice, it is impossible to predict with absolute certainty how any individual component will perform; thus, we must utilize probability theory. It is also necessary to clearly define the level of stress involved (e.g. operating voltage, ripple current, temperature and time). Finally, the meaning of satisfactory performance must be defined by specifying a set of conditions which determine the end of life of the component.

Reliability as a function of time, R(t), is normally expressed as: $R(t)=e^{-\lambda t}$
where R(t) is the probability that the component will perform satisfactorily for time t, and λ is the failure rate.

Failure Rate

The failure rate is the number of components failing per unit time. The failure rate of most electronic components follows the characteristic pattern:

- Early failures are removed during the manufacturing process.
- The operational life is characterized by a constant failure rate.
- The wear out period is characterized by a rapidly increasing failure rate.

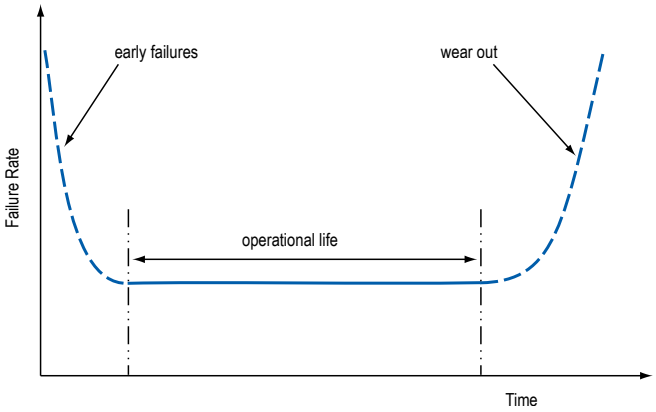
The failures in time (FIT) are given with a 60% confidence level for the various type codes. By convention, FIT is expressed as 1×10^{-9} failures per hour. Failure rate is also expressed as a percentage of failures per 1,000 hours.
e.g., 100 FIT = 1×10^{-7} failures per hour = 0.01%/1,000 hours

End of Life Definition
Catastrophic Failure: short circuit, open circuit or safety vent operation
Parametric Failure:

- Change in capacitance > ±10%
- Leakage current > specified limit
- ESR > 2 x initial ESR value

MTBF

The mean time between failures (MTBF) is simply the inverse of the failure rate.
MTBF= 1/λ



The failure rate is derived from our periodic test results. The failure rate (λ_R) is, therefore, only given at test temperature for life tests. An estimation is also given at 40°C. The expected failure rate for this capacitor range is based on our periodic test results for capacitors with structural similarity. Failure rate is frequently quoted in FIT (Failures In Time) where 1 FIT = 1 x 10^{-9} failures per hour. Failure rate per hour includes both catastrophic and parametric failures.

T_a	Failure Rate per Hour
85°C	250 FIT
40°C	12 FIT

Environmental Compliance

As an environmentally conscious company, KEMET is working continuously with improvements concerning the environmental effects of both our capacitors and their production. 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, such as lead (Pb), in electronic equipment. All products in this catalog are produced to help our customers' obligations to guarantee their products and 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 such as 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 such as LF = Lead Free or LFW = Lead Free Wires on the label.

Table 1 – Ratings & Part Number Reference

VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR Maximum	Impedance Maximum	Part Number
	120 Hz 25°C (µF)		D x L (mm)	120 Hz 85°C (A)	20 kHz 85°C (A)	120 Hz 25°C (mΩ)	20 kHz 25°C (mΩ)	
350	390	D2C	36 x 55	2.8	5.2	352	227	ALS3(1)(2)391D2C350
350	470	D3C	36 x 80	3.5	6.7	291	187	ALS3(1)(2)471D3C350
350	560	D3C	36 x 80	3.8	7.2	245	158	ALS3(1)(2)561D3C350
350	680	D3C	36 x 80	4.1	7.7	203	132	ALS3(1)(2)681D3C350
350	820	D3L	36 x 93	4.8	8.8	170	110	ALS3(1)(2)821D3L350
350	1000	D3L	36 x 93	5.2	9.3	141	92	ALS3(1)(2)102D3L350
350	1200	K2L	51 x 68	5.5	8.9	116	75	ALS3(1)(2)122K2L350
350	1500	K2L	51 x 68	5.8	8.9	99	66	ALS3(1)(2)152K2L350
350	1800	K3L	51 x 93	7.7	12.5	78	50	ALS3(1)(2)182K3L350
350	2200	K3L	51 x 93	8.2	12.5	67	44	ALS3(1)(2)222K3L350
350	2700	K5C	51 x 131	10.4	16.7	52	34	ALS3(1)(2)272K5C350
350	3300	K5C	51 x 131	11.1	16.8	45	30	ALS3(1)(2)332K5C350
350	3900	LJA	63.5 x 115	10.8	15.3	38	25	ALS3(1)(2)392LJA350
350	5600	NJA	77 x 115	16.4	22.7	30	21	ALS3(1)(2)562NJA350
350	6800	N5C	77 x 131	18.2	23.6	28	21	ALS3(1)(2)682N5C350
350	8200	N5R	77 x 150	19.9	25.5	24	18	ALS3(1)(2)822N5R350
350	10000	Q5R	90 x 150	25.5	33.5	18	13	ALS3(1)(2)103Q5R350
350	12000	Q5R	90 x 150	25.9	32.4	16	12	ALS3(1)(2)123Q5R350
350	15000	Q7L	90 x 194	32.4	41.2	13	10	ALS3(1)(2)153Q7L350
350	18000	Q8L	90 x 220	38.5	47.6	12	9	ALS3(1)(2)183Q8L350
400	330	D2C	36 x 55	2.6	5.4	351	207	ALS3(1)(2)331D2C400
400	390	D3C	36 x 80	3.3	6.9	295	174	ALS3(1)(2)391D3C400
400	470	D3C	36 x 80	3.6	7.5	246	146	ALS3(1)(2)471D3C400
400	560	D3C	36 x 80	3.9	8.0	208	123	ALS3(1)(2)561D3C400
400	680	D3L	36 x 93	4.5	8.7	182	112	ALS3(1)(2)681D3L400
400	820	D3L	36 x 93	4.9	9.2	152	94	ALS3(1)(2)821D3L400
400	1000	K2L	51 x 68	5.2	9.0	132	84	ALS3(1)(2)102K2L400
400	1200	K2L	51 x 68	5.6	9.1	113	74	ALS3(1)(2)122K2L400
400	1500	K3L	51 x 93	7.3	12.4	89	57	ALS3(1)(2)152K3L400
400	1800	K3L	51 x 93	7.8	12.5	76	50	ALS3(1)(2)182K3L400
400	2200	K5C	51 x 131	9.8	16.4	59	37	ALS3(1)(2)222K5C400
400	2700	L3L	63.5 x 93	11.3	18.3	49	31	ALS3(1)(2)272L3L400
400	3300	LJA	63.5 x 115	13.2	21.1	40	26	ALS3(1)(2)332LJA400
400	3900	L5C	63.5 x 131	14.6	22.1	37	25	ALS3(1)(2)392L5C400
400	4700	NJA	77 x 115	15.9	22.7	32	21	ALS3(1)(2)472NJA400
400	5600	N5C	77 x 131	17.6	23.7	30	21	ALS3(1)(2)562N5C400
400	6800	N5R	77 x 150	19.3	25.6	25	18	ALS3(1)(2)682N5R400
400	8200	Q5R	90 x 150	25.6	36.3	18	12	ALS3(1)(2)822Q5R400
400	10000	Q5R	90 x 150	26.5	35.6	16	11	ALS3(1)(2)103Q5R400
400	12000	Q7L	90 x 194	30.9	40.7	14	10	ALS3(1)(2)123Q7L400
400	15000	Q8L	90 x 220	37.4	47.7	12	9	ALS3(1)(2)153Q8L400
450	270	D2C	36 x 55	2.5	5.4	383	215	ALS3(1)(2)271D2C450
450	330	D3C	36 x 80	3.2	6.9	312	175	ALS3(1)(2)331D3C450
450	390	D3C	36 x 80	3.4	7.4	265	149	ALS3(1)(2)391D3C450
450	470	D3C	36 x 80	3.7	7.9	221	125	ALS3(1)(2)471D3C450
450	560	D3L	36 x 93	4.2	8.6	196	115	ALS3(1)(2)561D3L450
450	680	D3L	36 x 93	4.6	9.2	163	96	ALS3(1)(2)681D3L450
450	820	K2L	51 x 68	5.0	9.0	142	86	ALS3(1)(2)821K2L450
450	1000	K2L	51 x 68	5.3	9.1	120	75	ALS3(1)(2)102K2L450
450	1200	K3L	51 x 93	6.9	12.3	94	56	ALS3(1)(2)122K3L450
450	1500	KJA	51 x 115	8.1	14.5	75	45	ALS3(1)(2)152KJA450
450	1800	K5C	51 x 131	9.3	16.3	63	38	ALS3(1)(2)182K5C450
450	2200	L3L	63.5 x 93	10.7	18.3	53	32	ALS3(1)(2)222L3L450
450	2700	LJA	63.5 x 115	12.5	21.1	43	26	ALS3(1)(2)272LJA450
450	3300	L5C	63.5 x 131	14.6	24.1	36	22	ALS3(1)(2)332L5C450
450	3900	NJA	77 x 115	15.3	22.7	33	22	ALS3(1)(2)392NJA450
450	4700	N5C	77 x 131	18.0	26.5	28	18	ALS3(1)(2)472N5C450
450	5600	N5R	77 x 150	19.7	28.4	24	16	ALS3(1)(2)562N5R450
VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR	Impedance	Part Number

(1) Mounting Code: 0 = plain can, 1 = threaded mounting stud

(2) Termination Code: See Termination Tables for available options

Table 1 – Ratings & Part Number Reference cont'd

VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR Maximum	Impedance Maximum	Part Number
	120 Hz 25°C (µF)		D x L (mm)	120 Hz 85°C (A)	20 kHz 85°C (A)	120 Hz 25°C (mΩ)	20 kHz 25°C (mΩ)	
450	6800	Q5R	90 x 150	24.6	36.3	19	13	ALS3(1)(2)682Q5R450
450	8200	Q5R	90 x 150	25.7	35.8	17	12	ALS3(1)(2)822Q5R450
450	10000	Q7L	90 x 194	30.0	40.7	15	10	ALS3(1)(2)103Q7L450
450	12000	Q8L	90 x 220	35.7	46.9	14	10	ALS3(1)(2)123Q8L450
500	220	D2C	36 x 55	2.3	4.1	602	427	ALS3(1)(2)221D2C500
500	270	D3C	36 x 80	2.9	5.3	489	347	ALS3(1)(2)271D3C500
500	330	D3C	36 x 80	3.2	5.8	402	285	ALS3(1)(2)331D3C500
500	390	D3C	36 x 80	3.5	6.2	341	243	ALS3(1)(2)391D3C500
500	470	D3L	36 x 93	3.9	6.8	303	221	ALS3(1)(2)471D3L500
500	560	D3L	36 x 93	4.3	7.3	256	187	ALS3(1)(2)561D3L500
500	680	K2L	51 x 68	4.6	7.4	219	162	ALS3(1)(2)681K2L500
500	820	K2L	51 x 68	4.9	7.7	186	138	ALS3(1)(2)821K2L500
500	1000	K3L	51 x 93	6.4	10.3	146	107	ALS3(1)(2)102K3L500
500	1200	KJA	51 x 115	7.2	11.0	142	109	ALS3(1)(2)122KJA500
500	1500	K5C	51 x 131	8.4	12.7	114	88	ALS3(1)(2)152K5C500
500	1800	L3L	63.5 x 93	9.9	15.3	83	61	ALS3(1)(2)182L3L500
500	2200	LJA	63.5 x 115	11.6	17.8	68	51	ALS3(1)(2)222LJA500
500	2700	L5C	63.5 x 131	13.2	19.3	65	50	ALS3(1)(2)272L5C500
500	3300	NJA	77 x 115	14.2	19.7	56	44	ALS3(1)(2)332NJA500
500	3900	N5C	77 x 131	16.9	23.5	42	32	ALS3(1)(2)392N5C500
500	4700	N5R	77 x 150	18.5	25.3	35	27	ALS3(1)(2)472N5R500
500	5600	Q5R	90 x 150	23.1	32.2	29	22	ALS3(1)(2)562Q5R500
500	6800	Q5R	90 x 150	24.1	32.3	25	19	ALS3(1)(2)682Q5R500
500	8200	Q7L	90 x 194	28.6	37.8	21	16	ALS3(1)(2)822Q7L500
500	10000	Q8L	90 x 220	34.4	44.3	18	14	ALS3(1)(2)103Q8L500
VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR	Impedance	Part Number

(1) Mounting Code: 0 = plain can, 1 = threaded mounting stud

(2) Termination Code: See Termination Tables for available options

Mechanical Data

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Mounting Position
The capacitor can be mounted in any position as long as the safety vent can operate. It is possible for some electrolyte to be expelled. As this is a conducting liquid, suitable precautions should be initiated by the system designer to avoid secondary short circuits. The capacitors are designed to be mounted in free air and are not suitable for submersion in liquid.

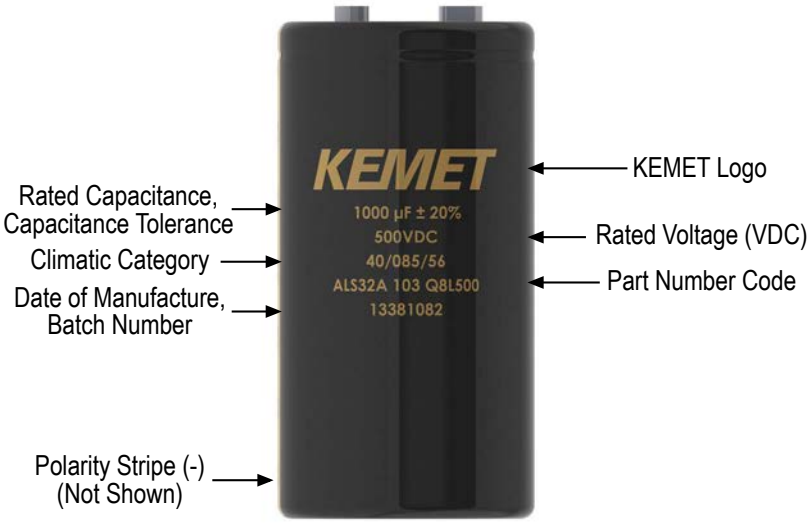
Vibration
10 – 55 Hz at 0.75 mm or 10 g for 3 x 2 hours duration, except 220 mm long cans 10 – 55 Hz at 0.35 mm or 5 g for 3 x 0.5 hours duration. Custom designs can be made in a 66 mm diameter (M6 deck), with a vibration capability of 20 g (10 – 56 Hz at 0.75 mm and 56 – 500 Hz 20 g for 3 x 0.5 hours duration)

Insulating Resistance
≥ 100 MΩ at 100 VDC across insulating sleeve. UL recognized sleeving is available for custom parts in this range, upon request. (UL No. E358957)

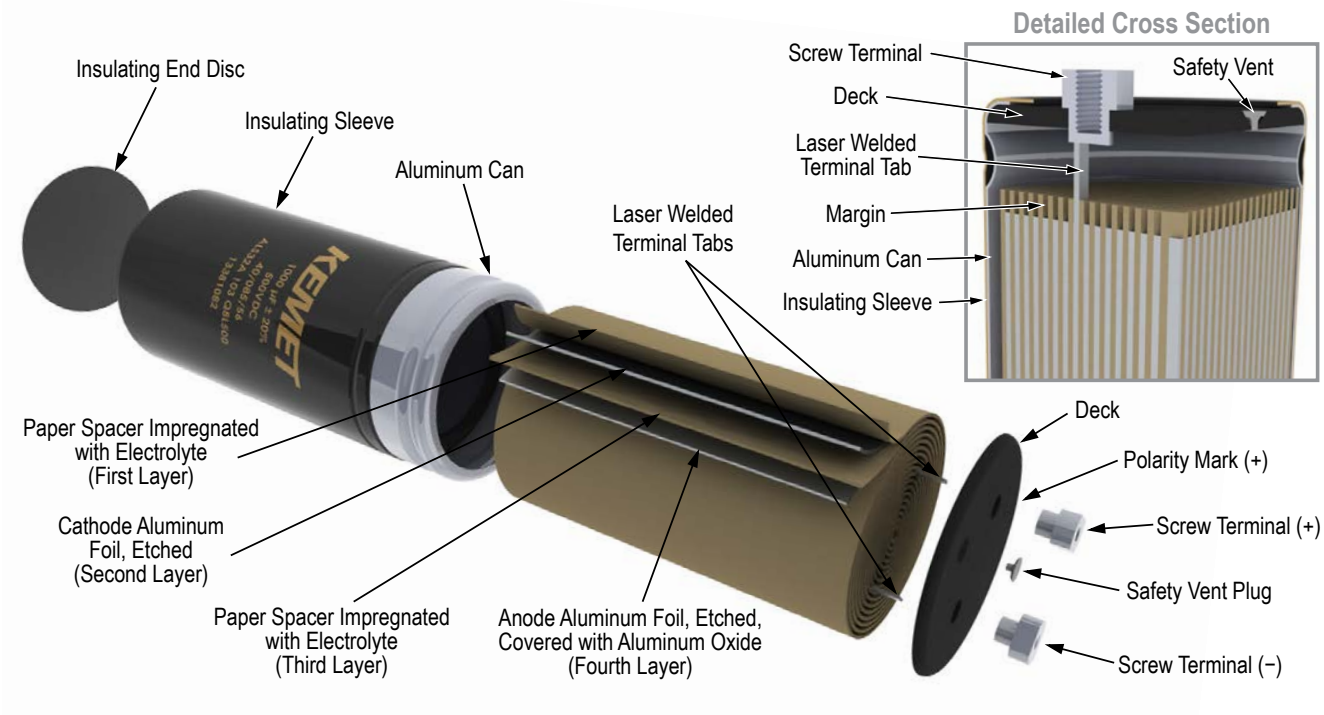
Voltage Proof
≥ 2,500 VDC across insulating sleeve

Safety Vent
A safety vent for overpressure is featured on terminal deck. This is in the form of a rubber plug designed to relieve build-up of internal pressure due to overstress or catastrophic failure.

Marking



Construction



ALS36/37 Series, +85°C

Overview

KEMET's ALS36/37 Series of screw terminal capacitors meets the requirements of the North American market. This range offers high CV per unit volume coupled with high ripple currents and long-life performance.

Applications

KEMET's ALS36/37 Series of capacitors is designed for industrial and commercial applications such as switch mode power supplies (SMPS), uninterruptible power supply (UPS) systems, variable speed drives, frequency inverters, welding equipment, and energy storage in pulse discharge applications.

Benefits

- Imperial case sizes and terminals for the North American market
- Long life, up to 20,000 hours at +85°C (V_R, I_R applied)
- High ripple current
- Excellent surge voltage capability
- Optimized designs available upon request

Part Number System

ALS3	6	A	153	D2C	025	
Series	Stud Option	Termination	Capacitance Code (µF)	Size Code	Rated Voltage (VDC)	
Screw Terminal Aluminum Electrolytic	6 = Plain Can 7 = Threaded mounting stud	See Termination Table	First two digits represent significant figures. Third digit specifies number of zeros.	See Dimension Table	025 = 25 040 = 40 050 = 50 063 = 63 075 = 75 100 = 100 160 = 160	200 = 200 250 = 250 350 = 350 400 = 400 450 = 450 500 = 500

Performance Characteristics

Item	Performance Characteristics		
Capacitance Range	150 – 470,000 µF		
Rated Voltage	25 – 500 VDC		
Operating Temperature	-40 to +85°C		
Storage Temperature Range	-55 to +85°C		
Capacitance Tolerance	-10/+30% at 120 Hz/+20°C		
Operational Lifetime	D (inch)	Rated Voltage and Ripple Current at +85°C (hours)	Rated Voltage at +85°C (hours)
	1.375	11,000	22,000
	2	18,000	36,000
	2.5	19,000	38,000
	3	20,000	40,000
End of Life Requirement	ΔC/C < ±10%, ESR < 2 x initial ESR value, IL < initial specified limit		
Shelf Life	2,000 hours at +85°C or 30,000 hours at +40°C 0 VDC		
Leakage Current	I = 0.006 CV or 6,000 (µA, whichever is smaller)		
	C = rated capacitance (µF), V = rated voltage (VDC). Voltage applied for 5 minutes at +20°C.		
Vibration Test Specifications		Procedure	Requirements
	Case Length < 220 mm	0.75 mm displacement amplitude or 10 g maximum acceleration. Vibration applied for three 2-hour sessions at 10 – 500 Hz (capacitor clamped by body).	No leakage of electrolyte or other visible damage. Deviations in capacitance and tan δ from initial measurements must not exceed: Δ C/C < 5%
	Case Length ≥ 220 mm	0.35 mm displacement amplitude or 5 g maximum acceleration. Vibration applied for three 0.5-hour sessions at 10 – 55 Hz (capacitor clamped by body).	
Standards	IEC 60384–4 long life grade 40/85/56		

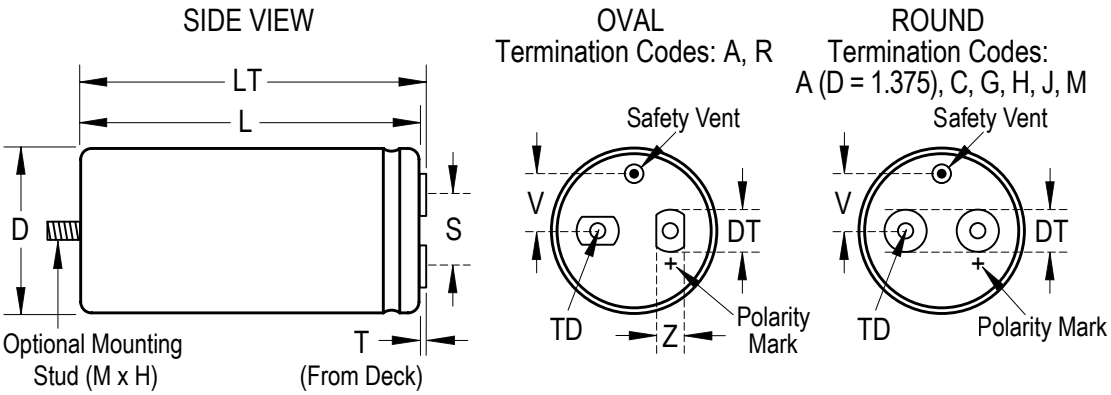
Surge Voltage

Condition	Voltage (VDC)												
	25	40	50	63	75	100	160	200	250	350	400	450	500
≤ 30 s surge, 1,000 cycles at 85°C	30	50	65	67	95	125	200	250	300	400	450	500	550
≤ 500 ms surge, 100 cycles at 20°C								350	400	500	520	550	600

Test Method & Performance

Endurance Life Test		
Conditions	Performance	
Temperature	+85°C	
Test Duration	5,000 hours	
Ripple Current	Rated ripple current in specified table	
Voltage	The sum of DC voltage and the peak AC voltage must not exceed the rated voltage of the capacitor	
Performance	**The following specifications will be satisfied when the capacitor is tested at +20°C:**	
Capacitance Change	≤ 160 V	Within 15% of the initial value
	> 160 V	Within 10% of the initial value
Equivalent Series Resistance	Does not exceed 200% of the initial value	
Leakage Current	Does not exceed leakage current limit	

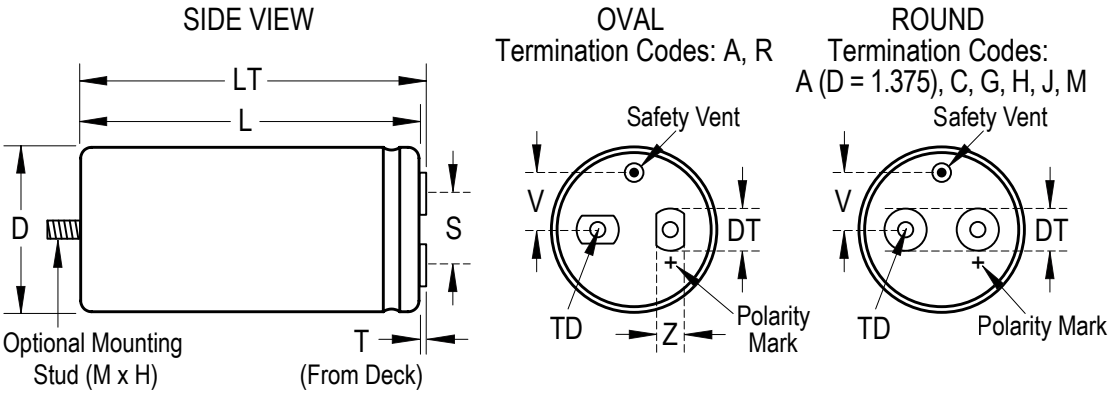
Dimensions – Inches



Size Code	Dimensions in Inches						Mounting Clip	Approximate Weight Ounces
	D	L	LT	S	V	Mounting Stud (M x H)		
	±0.031	±0.062	±0.039	±0.019	Nominal	±0.039		
D2C	1.375	2.125	2.420	0.5	0.315	M8 x 0.472	V3/H2/2736	2.8
D2L	1.375	2.625	2.930	0.5	0.315	M8 x 0.472	V3/H2/2736	3.3
D3C	1.375	3.125	3.440	0.5	0.315	M8 x 0.472	V3/H2/2736	4
D3L	1.375	3.625	3.960	0.5	0.315	M8 x 0.472	V3/H2/2736	4.6
D4C	1.375	4.125	4.430	0.5	0.315	M8 x 0.472	V3/H2/2736	5.3
D4L	1.375	4.625	4.940	0.5	0.315	M8 x 0.472	V3/H2/2736	5.8
D5C	1.375	5.125	5.450	0.5	0.315	M8 x 0.472	V3/H2/2736	6.5

Note: Add 0.015 inches to D and 0.045 inches to L for Sleeving
3.5 inch diameter cans available upon request. LT listed is for A-type termination code. Information for other termination codes is available upon request.

Dimensions – Inches cont'd



Size Code	Dimensions in Inches						Mounting Clip	Approximate Weight Ounces
	D	L	LT	S	V	Mounting Stud (M x H)		
	±0.031	±0.062	±0.039	±0.019	Nominal	±0.039		
D5L	1.375	5.625	5.960	0.5	0.315	M8 x 0.472	V3/H2/2736	7.2
K2C	2	2.125	2.420	0.875	0.539	M12 x 0.63	V4/2737	5.8
K2L	2	2.625	2.930	0.875	0.539	M12 x 0.63	V4/2737	7.1
K3C	2	3.125	3.440	0.875	0.539	M12 x 0.63	V4/2737	8.5
K3L	2	3.625	3.960	0.875	0.539	M12 x 0.63	V4/2737	9.7
K4C	2	4.125	4.430	0.875	0.539	M12 x 0.63	V4/2737	11.1
K4L	2	4.625	4.940	0.875	0.539	M12 x 0.63	V4/2737	12.3
K5C	2	5.125	5.410	0.875	0.539	M12 x 0.63	V4/2737	13.6
K5L	2	5.625	5.960	0.875	0.539	M12 x 0.63	V4/2737	15
L3C	2.5	3.125	3.370	1.125	0.622	M12 x 0.63	V8	13.1
L3L	2.5	3.625	3.880	1.125	0.622	M12 x 0.63	V8	15.2
L4C	2.5	4.125	4.390	1.125	0.622	M12 x 0.63	V8	17.1
L4L	2.5	4.625	4.900	1.125	0.622	M12 x 0.63	V8	19.2
L5L	2.5	5.625	5.890	1.125	0.622	M12 x 0.63	V8	23.3
N3L	3	3.625	3.880	1.25	0.748	M12 x 0.63	V11	21.7
N4C	3	4.125	4.390	1.25	0.748	M12 x 0.63	V11	24.7
N4L	3	4.625	4.900	1.25	0.748	M12 x 0.63	V11	27.5
N5C	3	5.125	5.370	1.25	0.748	M12 x 0.63	V11	30.5
N5L	3	5.625	5.890	1.25	0.748	M12 x 0.63	V11	33.5
N6L	3	6.625	6.870	1.25	0.748	M12 x 0.63	V11	45.2
N8L	3	8.625	8.880	1.25	0.748	M12 x 0.63	V11	51.1

Note: Add 0.015 inches to D and 0.045 inches to L for Sleeving
3.5 inch diameter cans available upon request. LT listed is for A-type termination code. Information for other termination codes is available upon request.

Termination Tables

Termination Code / Diameter (in)	A	C	E	G	H
1.375	•				•
2	•				•
2.5	•	•	•	•	•
3	•	•	•	•	•

Termination Code	Thread	Termination Style	T	DT	Thread Depth (TD)	Z
			± 0.031	± 0.019	Minimum	Nominal
Standard Termination Option						
H	10 – 32 UNF class 2B	Round	0.281	0.315	0.394	
Other Termination Options						
A (D = 1.375)	M5	Round	0.281	0.315	0.394	
A (D > 1.375)	M5	Oval	0.217	0.512	0.394	0.394
C	M6	Round	0.217	0.512	0.394	
E	1/4 – 28 UNF class 2B	Round	0.25	0.67	0.465	
G	M6	Round	0.25	0.67	0.465	
Dimensions in inches						

Case Polarity

Due to the presence of electrolyte in the capacitor, the aluminum can and stud mounting will essentially be at the same polarity as the negative terminal. We recommend that the stud and can be insulated (see accessories for insulating nuts).

Terminations

Aluminum inserts with M5 threads as standard, maximum torque 2NM. Optional M6 threaded inserts have a maximum torque 4NM. Maximum torque for stud mounting M8:4NM and M12:8NM.

Shelf Life

The capacitance, ESR and impedance of a capacitor will not change significantly after extended storage periods, however the leakage current will very slowly increase. KEMET products are particularly stable and allow a shelf life in excess of three years at 40°C. See sectional specification under each product series for specific data.

Re-age (Reforming) Procedure

Apply the rated voltage to the capacitor at room temperature for a period of one hour, or until the leakage current has fallen to a steady value below the specified limit. During re-aging a maximum charging current of twice the specified leakage current or 5 mA (whichever is greater) is suggested.

Reliability

The reliability of a component can be defined as the probability that it will perform satisfactorily under a given set of conditions for a given length of time.

In practice, it is impossible to predict with absolute certainty how any individual component will perform; thus, we must utilize probability theory. It is also necessary to clearly define the level of stress involved (e.g. operating voltage, ripple current, temperature and time). Finally, the meaning of satisfactory performance must be defined by specifying a set of conditions which determine the end of life of the component.

Reliability as a function of time, R(t), is normally expressed as: $R(t)=e^{-\lambda t}$
where R(t) is the probability that the component will perform satisfactorily for time t, and λ is the failure rate.

Failure Rate

The failure rate is the number of components failing per unit time. The failure rate of most electronic components follows the characteristic pattern:

- Early failures are removed during the manufacturing process.
- The operational life is characterized by a constant failure rate.
- The wear out period is characterized by a rapidly increasing failure rate.

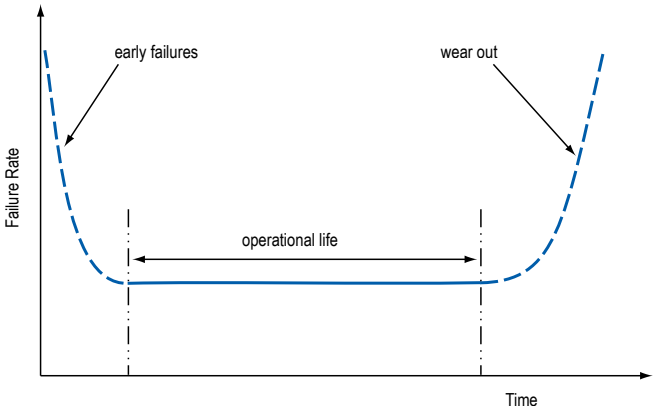
The failures in time (FIT) are given with a 60% confidence level for the various type codes. By convention, FIT is expressed as 1×10^{-9} failures per hour. Failure rate is also expressed as a percentage of failures per 1,000 hours.
e.g., 100 FIT = 1×10^{-7} failures per hour = 0.01%/1,000 hours

End of Life Definition
Catastrophic Failure: short circuit, open circuit or safety vent operation
Parametric Failure:

- Change in capacitance > ±10%
- Leakage current > specified limit
- ESR > 2 x initial ESR value

MTBF

The mean time between failures (MTBF) is simply the inverse of the failure rate.
MTBF= 1/λ



The failure rate is derived from our periodic test results. The failure rate (λ_R) is, therefore, only given at test temperature for life tests. An estimation is also given at 40°C. The expected failure rate for this capacitor range is based on our periodic test results for capacitors with structural similarity. Failure rate is frequently quoted in FIT (Failures In Time) where 1 FIT = 1 x 10^{-9} failures per hour. Failure rate per hour includes both catastrophic and parametric failures.

T_a	Failure Rate per Hour
85°C	250 FIT
40°C	12 FIT

Environmental Compliance

As an environmentally conscious company, KEMET is working continuously with improvements concerning the environmental effects of both our capacitors and their production. 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, such as lead (Pb), in electronic equipment. All products in this catalog are produced to help our customers' obligations to guarantee their products and 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 such as 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 such as LF = Lead Free or LFW = Lead Free Wires on the label.

Table 1 – Ratings & Part Number Reference

VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR Maximum		Part Number
	120 Hz 25°C (µF)		D x L (inch)	120 Hz 85°C (A)	20 kHz 85°C (A)	120 Hz 25°C (mΩ)	20 kHz 25°C (mΩ)	
25	15000	D2C	1.375 x 2.125	9.2	11.4	38	32	ALS3(1)(2)153D2C025
25	22000	D2L	1.375 x 2.625	11.4	13.7	27	23	ALS3(1)(2)223D2L025
25	33000	D3C	1.375 x 3.125	13.5	15.8	20	17	ALS3(1)(2)333D3C025
25	33000	K2C	2 x 2.125	10.6	11.5	27	24	ALS3(1)(2)333K2C025
25	47000	D4C	1.375 x 4.125	15.7	17.7	15	13	ALS3(1)(2)473D4C025
25	47000	K2L	2 x 2.625	13.2	14.4	19	17	ALS3(1)(2)473K2L025
25	68000	D5L	1.375 x 5.625	16.7	18.3	12	11	ALS3(1)(2)683D5L025
25	68000	K3C	2 x 3.125	16.3	17.6	14	12	ALS3(1)(2)683K3C025
25	100000	K4C	2 x 4.125	19.6	20.9	11	10	ALS3(1)(2)104K4C025
25	100000	L3C	2.5 x 3.125	22.5	24.1	10	9	ALS3(1)(2)104L3C025
25	150000	K5L	2 x 5.625	22.4	23.4	9	8	ALS3(1)(2)154K5L025
25	150000	L3L	2.5 x 3.625	25.4	26.7	8	7	ALS3(1)(2)154L3L025
25	220000	L5L	2.5 x 5.625	31.4	32.8	6	6	ALS3(1)(2)224L5L025
25	220000	N3L	3 x 3.625	25.6	26.3	8	8	ALS3(1)(2)224N3L025
25	330000	N5L	3 x 5.625	33.2	34.0	7	6	ALS3(1)(2)334N5L025
25	470000	N8L	3 x 8.625	45.6	46.5	6	5	ALS3(1)(2)474N8L025
40	10000	D2C	1.375 x 2.125	9.2	11.7	31	25	ALS3(1)(2)103D2C040
40	15000	D3C	1.375 x 3.125	12.5	15.7	21	17	ALS3(1)(2)153D3C040
40	22000	D4C	1.375 x 4.125	14.8	17.7	16	13	ALS3(1)(2)223D4C040
40	22000	K2C	2 x 2.125	10.0	11.2	29	25	ALS3(1)(2)223K2C040
40	33000	D5L	1.375 x 5.625	16.1	18.3	13	11	ALS3(1)(2)333D5L040
40	33000	K2L	2 x 2.625	12.4	13.9	20	17	ALS3(1)(2)333K2L040
40	47000	K3C	2 x 3.125	15.5	17.1	15	13	ALS3(1)(2)473K3C040
40	68000	K4C	2 x 4.125	18.8	20.4	11	10	ALS3(1)(2)683K4C040
40	68000	L3C	2.5 x 3.125	21.4	23.6	10	9	ALS3(1)(2)683L3C040
40	100000	K5L	2 x 5.625	21.7	23.1	9	8	ALS3(1)(2)104K5L040
40	100000	L4C	2.5 x 4.125	27.0	29.3	7	7	ALS3(1)(2)104L4C040
40	150000	N3L	3 x 3.625	24.5	25.5	9	8	ALS3(1)(2)154N3L040
40	220000	N5L	3 x 5.625	32.2	33.3	7	7	ALS3(1)(2)224N5L040
40	330000	N8L	3 x 8.625	44.4	45.6	6	6	ALS3(1)(2)334N8L040
50	6800	D2C	1.375 x 2.125	8.6	11.7	34	26	ALS3(1)(2)682D2C050
50	10000	D3C	1.375 x 3.125	11.7	15.6	24	18	ALS3(1)(2)103D3C050
50	15000	D4C	1.375 x 4.125	14.1	17.7	17	14	ALS3(1)(2)153D4C050
50	15000	K2C	2 x 2.125	9.8	11.4	31	26	ALS3(1)(2)153K2C050
50	22000	D5L	1.375 x 5.625	15.4	18.3	14	11	ALS3(1)(2)223D5L050
50	22000	K2L	2 x 2.625	12.2	14.2	21	18	ALS3(1)(2)223K2L050
50	33000	K3C	2 x 3.125	15.2	17.3	15	13	ALS3(1)(2)333K3C050
50	33000	L3C	2.5 x 3.125	21.2	24.2	11	9	ALS3(1)(2)333L3C050
50	47000	K4C	2 x 4.125	18.5	20.6	12	10	ALS3(1)(2)473K4C050
50	47000	L3L	2.5 x 3.625	24.4	27.1	9	7	ALS3(1)(2)473L3L050
50	68000	K5C	2 x 5.125	21.1	22.9	10	9	ALS3(1)(2)683K5C050
50	68000	L4C	2.5 x 4.125	26.0	28.1	7	7	ALS3(1)(2)683L4C050
50	68000	N3L	3 x 3.625	25.3	27.0	9	8	ALS3(1)(2)683N3L050
50	100000	N4L	3 x 4.625	27.8	29.1	8	7	ALS3(1)(2)104N4L050
50	150000	N6L	3 x 6.625	36.6	37.9	6	6	ALS3(1)(2)154N6L050
63	4700	D2C	1.375 x 2.125	8.1	11.7	37	27	ALS3(1)(2)472D2C063
63	6800	D2L	1.375 x 2.625	10.1	13.8	27	20	ALS3(1)(2)682D2L063
63	10000	D3L	1.375 x 3.625	12.9	17.0	20	15	ALS3(1)(2)103D3L063
63	10000	K2C	2 x 2.125	9.5	11.4	32	26	ALS3(1)(2)103K2C063
63	15000	D5C	1.375 x 5.125	14.9	18.4	15	11	ALS3(1)(2)153D5C063
63	15000	K2L	2 x 2.625	11.8	14.1	22	18	ALS3(1)(2)153K2L063
63	22000	K3C	2 x 3.125	14.7	17.2	16	13	ALS3(1)(2)223K3C063
63	22000	L3C	2.5 x 3.125	20.5	24.5	11	9	ALS3(1)(2)223L3C063
63	33000	K4C	2 x 4.125	18.0	20.4	12	10	ALS3(1)(2)333K4C063
63	33000	L3L	2.5 x 3.625	23.8	27.2	9	7	ALS3(1)(2)333L3L063
63	47000	K5C	2 x 5.125	20.6	22.7	10	9	ALS3(1)(2)473K5C063
63	47000	L4C	2.5 x 4.125	25.6	28.2	8	7	ALS3(1)(2)473L4C063
63	47000	N3L	3 x 3.625	25.0	27.1	9	8	ALS3(1)(2)473N3L063
VDC	**Rated Capacitance**	**Size Code**	**Case Size**	**Ripple Current**		**ESR**		**Part Number**

(1) Mounting Code: 6 = plain can, 7 = threaded mounting stud

(2) Termination Code: See Termination Tables for available options

Table 1 – Ratings & Part Number Reference cont'd

VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR Maximum		Part Number
	120 Hz 25°C (µF)		D x L (inch)	120 Hz 85°C (A)	20 kHz 85°C (A)	120 Hz 25°C (mΩ)	20 kHz 25°C (mΩ)	
63	68000	N4C	3 x 4.125	26.4	28.0	8	7	ALS3(1)(2)683N4C063
63	100000	N6L	3 x 6.625	36.6	38.4	6	6	ALS3(1)(2)104N6L063
75	3300	D2C	1.375 x 2.125	7.1	9.4	55	43	ALS3(1)(2)332D2C075
75	4700	D2L	1.375 x 2.625	8.8	11.3	40	32	ALS3(1)(2)472D2L075
75	4700	K2C	2 x 2.125	7.9	9.3	50	42	ALS3(1)(2)472K2C075
75	6800	D3C	1.375 x 3.125	10.6	13.2	29	24	ALS3(1)(2)682D3C075
75	6800	K2L	2 x 2.625	10.0	11.7	34	28	ALS3(1)(2)682K2L075
75	10000	D4L	1.375 x 4.625	13.2	16.0	21	17	ALS3(1)(2)103D4L075
75	10000	K3C	2 x 3.125	12.6	14.6	24	20	ALS3(1)(2)103K3C075
75	15000	K3L	2 x 3.625	13.5	14.9	21	18	ALS3(1)(2)153K3L075
75	22000	K4L	2 x 4.625	16.3	17.7	15	14	ALS3(1)(2)223K4L075
75	22000	L3C	2.5 x 3.125	16.6	18.0	16	14	ALS3(1)(2)223L3C075
75	33000	L4C	2.5 x 4.125	21.6	23.3	11	10	ALS3(1)(2)333L4C075
75	33000	N3L	3 x 3.625	20.7	21.9	13	12	ALS3(1)(2)333N3L075
75	47000	N4C	3 x 4.125	21.9	22.9	12	11	ALS3(1)(2)473N4C075
75	68000	N6L	3 x 6.625	31.7	32.9	9	8	ALS3(1)(2)683N6L075
75	100000	N8L	3 x 8.625	38.2	39.3	8	7	ALS3(1)(2)104N8L075
100	2200	D2C	1.375 x 2.125	6.6	9.3	61	46	ALS3(1)(2)222D2C100
100	3300	D2L	1.375 x 2.625	8.3	11.3	43	33	ALS3(1)(2)332D2L100
100	3300	K2C	2 x 2.125	7.7	9.3	52	42	ALS3(1)(2)332K2C100
100	4700	D3C	1.375 x 3.125	10.1	13.2	31	24	ALS3(1)(2)472D3C100
100	6800	D4C	1.375 x 4.125	12.2	15.2	23	18	ALS3(1)(2)682D4C100
100	6800	K2L	2 x 2.625	9.5	10.8	32	27	ALS3(1)(2)682K2L100
100	10000	D5L	1.375 x 5.625	13.7	16.4	18	14	ALS3(1)(2)103D5L100
100	10000	K3C	2 x 3.125	12.0	13.5	23	20	ALS3(1)(2)103K3C100
100	15000	K4C	2 x 4.125	15.0	16.5	17	15	ALS3(1)(2)153K4C100
100	15000	L3C	2.5 x 3.125	16.5	18.3	16	14	ALS3(1)(2)153L3C100
100	22000	L4C	2.5 x 4.125	21.5	23.8	11	10	ALS3(1)(2)223L4C100
100	22000	N3L	3 x 3.625	20.8	22.5	13	12	ALS3(1)(2)223N3L100
100	33000	N4C	3 x 4.125	21.9	23.1	12	11	ALS3(1)(2)333N4C100
100	47000	N6L	3 x 6.625	31.7	33.3	9	8	ALS3(1)(2)473N6L100
100	68000	N8L	3 x 8.625	38.4	39.8	8	7	ALS3(1)(2)683N8L100
160	1000	D2C	1.375 x 2.125	4.1	7.4	149	94	ALS3(1)(2)102D2C160
160	1500	D2L	1.375 x 2.625	5.3	9.2	101	65	ALS3(1)(2)152D2L160
160	1500	K2C	2 x 2.125	5.4	8.3	111	74	ALS3(1)(2)152K2C160
160	2200	D3L	1.375 x 3.625	7.0	11.9	70	45	ALS3(1)(2)222D3L160
160	2200	K2L	2 x 2.625	6.8	10.5	76	50	ALS3(1)(2)222K2L160
160	3300	D4L	1.375 x 4.625	8.7	13.8	49	32	ALS3(1)(2)332D4L160
160	3300	K3C	2 x 3.125	8.7	13.1	52	35	ALS3(1)(2)332K3C160
160	4700	K3L	2 x 3.625	10.3	14.2	40	28	ALS3(1)(2)472K3L160
160	6800	K4L	2 x 4.625	12.7	17.0	29	21	ALS3(1)(2)682K4L160
160	6800	L3C	2.5 x 3.125	13.1	17.4	29	21	ALS3(1)(2)682L3C160
160	10000	L4C	2.5 x 4.125	17.2	22.7	20	15	ALS3(1)(2)103L4C160
160	10000	N3L	3 x 3.625	17.2	21.8	22	16	ALS3(1)(2)103N3L160
160	15000	N4C	3 x 4.125	19.2	22.8	17	14	ALS3(1)(2)153N4C160
160	22000	N5L	3 x 5.625	23.3	26.4	15	12	ALS3(1)(2)223N5L160
200	680	D2C	1.375 x 2.125	3.4	5.9	241	165	ALS3(1)(2)681D2C200
200	1000	D2L	1.375 x 2.625	4.4	7.5	166	114	ALS3(1)(2)102D2L200
200	1000	K2C	2 x 2.125	4.6	7.2	175	123	ALS3(1)(2)102K2C200
200	1500	D3C	1.375 x 3.125	5.6	9.3	112	78	ALS3(1)(2)152D3C200
200	1500	K2L	2 x 2.625	5.8	9.1	117	83	ALS3(1)(2)152K2L200
200	2200	D4L	1.375 x 4.625	7.4	11.7	78	55	ALS3(1)(2)222D4L200
200	2200	K3C	2 x 3.125	7.5	11.5	81	57	ALS3(1)(2)222K3C200
200	3300	K4C	2 x 4.125	9.8	14.5	55	40	ALS3(1)(2)332K4C200
200	4700	K4L	2 x 4.625	11.3	15.7	42	31	ALS3(1)(2)472K4L200
200	4700	L3C	2.5 x 3.125	11.7	16.1	42	31	ALS3(1)(2)472L3C200
200	6800	L4C	2.5 x 4.125	15.4	21.1	29	22	ALS3(1)(2)682L4C200
200	6800	N3L	3 x 3.625	15.7	20.6	31	23	ALS3(1)(2)682N3L200
VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR		Part Number

(1) Mounting Code: 6 = plain can, 7 = threaded mounting stud

(2) Termination Code: See Termination Tables for available options

Table 1 – Ratings & Part Number Reference cont'd

VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR Maximum		Part Number
	120 Hz 25°C (µF)		D x L (inch)	120 Hz 85°C (A)	20 kHz 85°C (A)	120 Hz 25°C (mΩ)	20 kHz 25°C (mΩ)	
200	10000	N4C	3 x 4.125	17.8	22.1	24	18	ALS3(1)(2)103N4C200
200	15000	N5L	3 x 5.625	22.0	25.8	19	16	ALS3(1)(2)153N5L200
200	22000	N6L	3 x 6.625	25.9	29.2	15	13	ALS3(1)(2)223N6L200
250	680	D2C	1.375 x 2.125	3.5	6.3	206	134	ALS3(1)(2)681D2C250
250	1000	D3C	1.375 x 3.125	4.9	8.8	140	91	ALS3(1)(2)102D3C250
250	1000	K2C	2 x 2.125	4.7	7.3	154	105	ALS3(1)(2)102K2C250
250	1500	D4C	1.375 x 4.125	6.3	10.9	95	63	ALS3(1)(2)152D4C250
250	1500	K2L	2 x 2.625	5.9	9.2	103	70	ALS3(1)(2)152K2L250
250	2200	D5L	1.375 x 5.625	7.6	12.5	67	45	ALS3(1)(2)222D5L250
250	2200	K3C	2 x 3.125	7.7	11.7	71	49	ALS3(1)(2)222K3C250
250	3300	L3C	2.5 x 3.125	10.8	16.2	48	33	ALS3(1)(2)332L3C250
250	4700	K5L	2 x 5.625	12.5	17.7	36	25	ALS3(1)(2)472K5L250
250	4700	L3L	2.5 x 3.625	13.3	19.0	35	25	ALS3(1)(2)472L3L250
250	6800	L5L	2.5 x 5.625	17.7	24.7	25	18	ALS3(1)(2)682L5L250
250	6800	N3L	3 x 3.625	15.5	19.9	29	22	ALS3(1)(2)682N3L250
250	10000	N5L	3 x 5.625	21.4	26.9	20	15	ALS3(1)(2)103N5L250
250	15000	N6L	3 x 6.625	25.4	30.1	17	13	ALS3(1)(2)153N6L250
350	330	D2C	1.375 x 2.125	2.7	5.1	366	230	ALS3(1)(2)331D2C350
350	470	D2L	1.375 x 2.625	3.4	6.5	258	163	ALS3(1)(2)471D2L350
350	470	K2C	2 x 2.125	3.7	6.7	254	158	ALS3(1)(2)471K2C350
350	680	D3C	1.375 x 3.125	4.3	8.0	180	114	ALS3(1)(2)681D3C350
350	680	K2L	2 x 2.625	4.6	8.4	175	109	ALS3(1)(2)681K2L350
350	1000	D4C	1.375 x 4.125	5.5	10.0	124	79	ALS3(1)(2)102D4C350
350	1000	K3C	2 x 3.125	5.9	10.7	120	75	ALS3(1)(2)102K3C350
350	1500	D5L	1.375 x 5.625	6.8	11.7	85	55	ALS3(1)(2)152D5L350
350	1500	K3L	2 x 3.625	7.5	12.4	84	54	ALS3(1)(2)152K3L350
350	2200	K4L	2 x 4.625	9.3	15.1	58	38	ALS3(1)(2)222K4L350
350	2200	L3C	2.5 x 3.125	9.7	15.6	59	38	ALS3(1)(2)222L3C350
350	3300	L4C	2.5 x 4.125	12.9	20.3	40	26	ALS3(1)(2)332L4C350
350	4700	N3L	3 x 3.625	14.3	19.1	35	25	ALS3(1)(2)472N3L350
350	6800	N5L	3 x 5.625	19.8	26.0	25	18	ALS3(1)(2)682N5L350
350	10000	N6L	3 x 6.625	23.9	29.7	19	14	ALS3(1)(2)103N6L350
400	330	D2C	1.375 x 2.125	2.7	5.2	355	227	ALS3(1)(2)331D2C400
400	470	D3C	1.375 x 3.125	3.7	7.2	249	159	ALS3(1)(2)471D3C400
400	470	K2C	2 x 2.125	3.7	6.5	262	171	ALS3(1)(2)471K2C400
400	680	D4C	1.375 x 4.125	4.8	8.9	174	111	ALS3(1)(2)681D4C400
400	680	K2L	2 x 2.625	4.6	8.1	181	118	ALS3(1)(2)681K2L400
400	1000	D5C	1.375 x 5.125	5.8	10.5	120	78	ALS3(1)(2)102D5C400
400	1000	K3C	2 x 3.125	6.0	10.4	124	81	ALS3(1)(2)102K3C400
400	1500	K4C	2 x 4.125	7.9	13.2	84	56	ALS3(1)(2)152K4C400
400	1500	L3C	2.5 x 3.125	8.5	14.5	83	55	ALS3(1)(2)152L3C400
400	2200	K5C	2 x 5.125	10.0	15.9	60	40	ALS3(1)(2)222K5C400
400	2200	L3L	2.5 x 3.625	10.8	17.5	59	39	ALS3(1)(2)222L3L400
400	3300	L4L	2.5 x 4.625	13.4	20.4	41	28	ALS3(1)(2)332L4L400
400	3300	N3L	3 x 3.625	13.3	19.1	43	30	ALS3(1)(2)332N3L400
400	4700	N5C	3 x 5.125	17.3	23.6	32	23	ALS3(1)(2)472N5C400
400	6800	N5L	3 x 5.625	20.1	26.2	22	16	ALS3(1)(2)682N5L400
450	220	D2C	1.375 x 2.125	2.5	5.1	398	243	ALS3(1)(2)221D2C450
450	330	D3C	1.375 x 3.125	3.5	7.1	266	163	ALS3(1)(2)331D3C450
450	330	K2C	2 x 2.125	3.5	6.4	279	175	ALS3(1)(2)331K2C450
450	470	D3L	1.375 x 3.625	4.4	8.6	189	116	ALS3(1)(2)471D3L450
450	470	K2L	2 x 2.625	4.4	8.0	195	122	ALS3(1)(2)471K2L450
450	680	D5C	1.375 x 5.125	5.4	10.3	132	82	ALS3(1)(2)681D5C450
450	680	K3C	2 x 3.125	5.6	10.2	136	85	ALS3(1)(2)681K3C450
450	1000	K4C	2 x 4.125	7.4	13.0	94	59	ALS3(1)(2)102K4C450
450	1000	L3C	2.5 x 3.125	8.0	14.3	93	58	ALS3(1)(2)102L3C450
450	1500	K5C	2 x 5.125	9.5	15.8	65	42	ALS3(1)(2)152K5C450
450	1500	L3L	2.5 x 3.625	10.2	17.4	64	41	ALS3(1)(2)152L3L450
VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR		Part Number

(1) Mounting Code: 6 = plain can, 7 = threaded mounting stud

(2) Termination Code: See Termination Tables for available options

Table 1 – Ratings & Part Number Reference cont'd

VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR Maximum		Part Number
	120 Hz 25°C (µF)		D x L (inch)	120 Hz 85°C (A)	20 kHz 85°C (A)	120 Hz 25°C (mΩ)	20 kHz 25°C (mΩ)	
450	2200	N3L	3 x 3.625	12.7	19.2	47	31	ALS3(1)(2)222N3L450
450	3300	N4C	3 x 4.125	14.8	20.8	34	24	ALS3(1)(2)332N4C450
450	4700	N5L	3 x 5.625	18.8	24.8	27	20	ALS3(1)(2)472N5L450
450	6800	N6L	3 x 6.625	22.5	29.1	23	17	ALS3(1)(2)682N6L450
500	150	D2C	1.375 x 2.125	2.2	3.7	732	547	ALS3(1)(2)151D2C500
500	220	D2L	1.375 x 2.625	2.8	4.8	501	375	ALS3(1)(2)221D2L500
500	330	D3L	1.375 x 3.625	3.8	6.4	335	251	ALS3(1)(2)331D3L500
500	330	K2C	2 x 2.125	3.7	6.1	273	188	ALS3(1)(2)331K2C500
500	470	D4L	1.375 x 4.625	4.7	7.8	237	178	ALS3(1)(2)471D4L500
500	470	K2L	2 x 2.625	4.6	7.7	191	131	ALS3(1)(2)471K2L500
500	680	K4C	2 x 4.125	6.3	10.0	174	133	ALS3(1)(2)681K4C500
500	680	L3C	2.5 x 3.125	6.8	10.9	173	132	ALS3(1)(2)681L3C500
500	1000	K5C	2 x 5.125	8.6	14.4	90	62	ALS3(1)(2)102K5C500
500	1000	L3L	2.5 x 3.625	8.7	13.6	119	91	ALS3(1)(2)102L3L500
500	1500	L4C	2.5 x 4.125	10.7	15.9	82	63	ALS3(1)(2)152L4C500
500	1500	N3L	3 x 3.625	11.1	16.2	83	65	ALS3(1)(2)152N3L500
500	2200	N4L	3 x 4.625	13.7	19.1	59	46	ALS3(1)(2)222N4L500
500	3300	N6L	3 x 6.625	19.8	26.7	41	32	ALS3(1)(2)332N6L500
500	4700	N8L	3 x 8.625	26.4	34.7	24	18	ALS3(1)(2)472N8L500
VDC	**Rated Capacitance**	**Size Code**	**Case Size**	**Ripple Current**		**ESR**		**Part Number**

(1) Mounting Code: 6 = plain can, 7 = threaded mounting stud

(2) Termination Code: See Termination Tables for available options

Mechanical Data

Polarity and Reversed Voltage

Aluminium Electrolytic capacitors manufactured for use in DC applications contain an anode foil and a cathode foil. As such, they are polarized devices and must be connected with the +ve to the anode foil and the -ve to the cathode foil. If this were to be reversed then the electrolytic process that took place in forming the oxide layer on the anode would be recreated in trying to form an oxide layer on the cathode. In forming the cathode foil in this way, heat would be generated and gas given off within the capacitor, usually leading to catastrophic failure.

The cathode foil already possesses a thin stabilized oxide layer. This thin oxide layer is equivalent to a forming voltage of approximately 2 V. As a result, the capacitor can withstand a voltage reversal of up to 2 V for short periods. Above this voltage, the formation process will commence. Aluminium Electrolytic capacitors can also be manufactured for use in intermittent AC applications by using two anode foils in place of one anode and one cathode.

Mounting Position

The capacitor can be mounted in any position as long as the safety vent can operate. It is possible for some electrolyte to be expelled. As this is a conducting liquid, suitable precautions should be initiated by the system designer to avoid secondary short circuits. The capacitors are designed to be mounted in free air and are not suitable for submersion in liquid.

Insulating Resistance

≥ 100 MΩ at 100 VDC across insulating sleeve. UL recognized sleeving is available for custom parts in this range, upon request. (UL No. E358957)

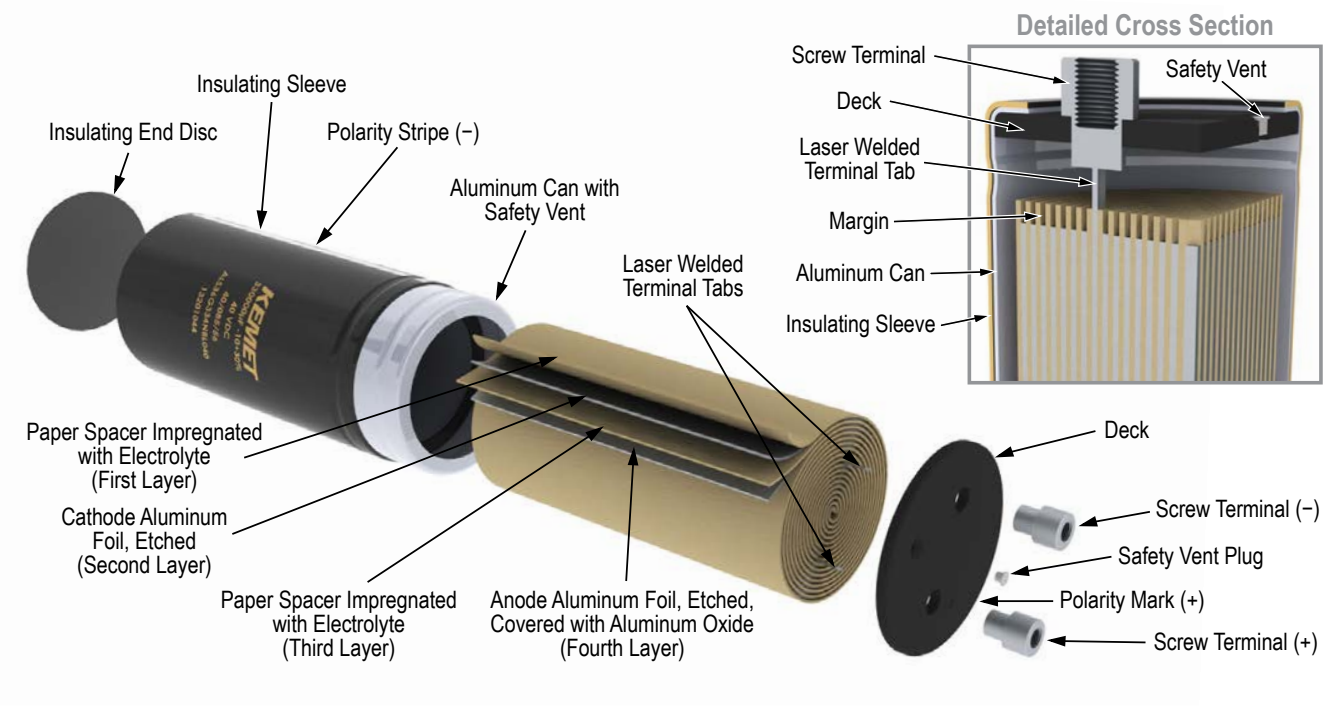
Voltage Proof

≥ 2,500 VDC across insulating sleeve

Safety Vent

A safety vent for overpressure is featured on terminal deck. This is in the form of a rubber plug designed to relieve build-up of internal pressure due to overstress or catastrophic failure.

Construction



Marking

ALS60/61 Series, +85°C

Overview

KEMET's ALS60/61 Series of screw terminal capacitors is designed for high voltage, high ripple current applications. They are ideally suited for industrial and commercial applications demanding high reliability and long-life expectancy such as frequency converters, uninterruptible power supply (UPS) systems and switch mode power supplies (SMPS).

Applications

Typical applications for KEMET's ALS60/61 Series of capacitors include smoothing, energy storage, demanding power supplies, AC motor control, traction and welding.

Benefits

- Long life, up to 20,000 hours at +85°C (V_R, I_R applied)
- High ripple current
- Excellent surge voltage capability
- Optimized designs available upon request

Part Number System

ALS6	0	A	561	KE	550
Series	Stud Option	Termination	Capacitance Code (µF)	Size Code	Rated Voltage (VDC)
Screw Terminal Aluminum Electrolytic	0 = Plain Can 1 = Threaded mounting stud	See Termination Table	First two digits represent significant figures. Third digit specifies number of zeros.	See Dimension Table	550 = 550

Performance Characteristics

Item	Performance Characteristics		
Capacitance Range	560 – 3,300 µF		
Rated Voltage	550 VDC		
Operating Temperature	-40 to +85°C		
Storage Temperature Range	-55 to +85°C		
Capacitance Tolerance	±20% at 100 Hz/+20°C		
Operational Lifetime	D (mm)	Rated Voltage and Ripple Current at +85°C (hours)	Rated Voltage at +85°C (hours)
	51	18,000	36,000
	66	19,000	38,000
	77, 90	20,000	40,000
End of Life Requirement	Δ C/C < ±15%, ESR < 3 x initial ESR limit, IL < initial specified limit		
Shelf Life	2,000 hours at +85°C or 30,000 hours at +40°C 0 VDC		
Leakage Current	I = 0.003 CV or 6,000 (µA, whichever is smaller)		
	C = rated capacitance (µF), V = rated voltage (VDC). Voltage applied for 5 minutes at +20°C.		
Vibration Test Specifications		Procedure	Requirements
	Case Length < 220 mm	0.75 mm displacement amplitude or 10 g maximum acceleration. Vibration applied for three 2-hour sessions at 10 – 55 Hz (capacitor clamped by body).	No leakage of electrolyte or other visible damage. Deviations in capacitance from initial measurements must not exceed: Δ C/C < 5%
Standards	IEC 60384–4 long life grade 40/85/56		

Surge Voltage

Condition	Voltage (VDC)
	550
≤ 30 s surge followed by a no load period of 330 s, 1,000 cycles at 85°C	605

Test Method & Performance

Endurance Life Test		
Conditions	Performance	
Temperature	+85°C	
Test Duration	2,000 hours	
Ripple Current	Rated ripple current in specified table	
Voltage	The sum of DC voltage and the peak AC voltage must not exceed the rated voltage of the capacitor	
Performance	**The following specifications will be satisfied when the capacitor is tested at +20°C:**	
Capacitance Change	> 160 V	Within 10% of the initial value
Equivalent Series Resistance	Does not exceed 1.5 x initial limit	
Leakage Current	Does not exceed leakage current limit	

Dimensions – Millimeters

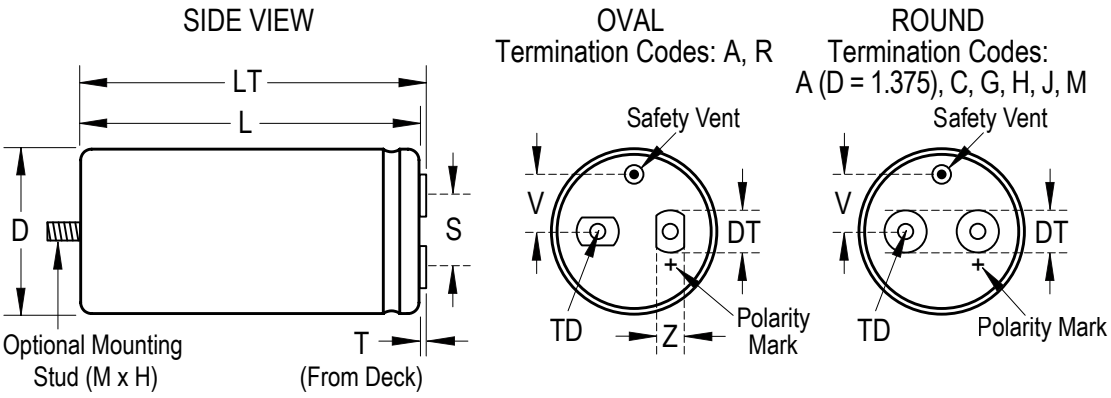
Size Code	Dimensions in mm						Approximate Weight Grams
	D	L	LT	S	V	Mounting Stud (M x H)	
	±1	±2	±1	±0.5	Nominal	±1	
KE	51	82	86.5	22.2	13.7	M12 x 16	220
KF	51	105	110.5	22.2	13.7	M12 x 16	300
KJ	51	115	119	22.2	13.7	M12 x 16	340
KM	51	131	136	22.2	13.7	M12 x 16	385
ME	66	82	86	28.5	15.8	M12 x 16	428
MF	66	105	110.5	28.5	15.8	M12 x 16	505
MJ	66	115	119	28.5	15.8	M12 x 16	540
MM	66	131	135	28.5	15.8	M12 x 16	610
MP	66	146	150	28.5	15.8	M12 x 16	675
NF	77	105	110.5	31.8	19	M12 x 16	690
NJ	77	115	119	31.8	19	M12 x 16	765
NM	77	131	135	31.8	19	M12 x 16	860
NP	77	146	150.5	31.8	19	M12 x 16	960
QH	90	98	103.5	31.8	25	M12 x 16	900

Note: Dimensions include sleeving. LT listed is for A-type termination code.
Information for other termination codes is available upon request.

Termination Tables

Termination Code Diameter (mm)	A	C
51	•	
66	•	•
77	•	•
90	•	•

Termination Code	Thread	Termination Style	T	DT	Thread Depth (TD)	Z
			± 0.5	± 0.5	Minimum	Nominal
Standard Termination Option						
A	M5	Oval	5.5	13	10	10
C	M6	Round	5.5	13	10	
Dimensions in mm						



Case Polarity

Due to the presence of electrolyte in the capacitor, the aluminum can and stud mounting will essentially be at the same polarity as the negative terminal. We recommend that the stud and can be insulated (see accessories for insulating nuts).

Terminations

Aluminum inserts with M5 threads as standard, maximum torque 2NM. Optional M6 threaded inserts have a maximum torque 4NM. Maximum torque for stud mounting M8:4NM and M12:8NM.

Shelf Life

The capacitance, ESR and impedance of a capacitor will not change significantly after extended storage periods, however the leakage current will very slowly increase. KEMET products are particularly stable and allow a shelf life in excess of three years at 40°C. See sectional specification under each product series for specific data.

Re-age (Reforming) Procedure

Apply the rated voltage to the capacitor at room temperature for a period of one hour, or until the leakage current has fallen to a steady value below the specified limit. During re-aging a maximum charging current of twice the specified leakage current or 5 mA (whichever is greater) is suggested.

Reliability

The reliability of a component can be defined as the probability that it will perform satisfactorily under a given set of conditions for a given length of time.

In practice, it is impossible to predict with absolute certainty how any individual component will perform; thus, we must utilize probability theory. It is also necessary to clearly define the level of stress involved (e.g. operating voltage, ripple current, temperature and time). Finally, the meaning of satisfactory performance must be defined by specifying a set of conditions which determine the end of life of the component.

Reliability as a function of time, R(t), is normally expressed as: $R(t)=e^{-\lambda t}$
where R(t) is the probability that the component will perform satisfactorily for time t, and λ is the failure rate.

Failure Rate

The failure rate is the number of components failing per unit time. The failure rate of most electronic components follows the characteristic pattern:

- Early failures are removed during the manufacturing process.
- The operational life is characterized by a constant failure rate.
- The wear out period is characterized by a rapidly increasing failure rate.

The failures in time (FIT) are given with a 60% confidence level for the various type codes. By convention, FIT is expressed as 1×10^{-9} failures per hour. Failure rate is also expressed as a percentage of failures per 1,000 hours.
e.g., 100FIT = 1×10^{-7} failures per hour = 0.01%/1,000 hours

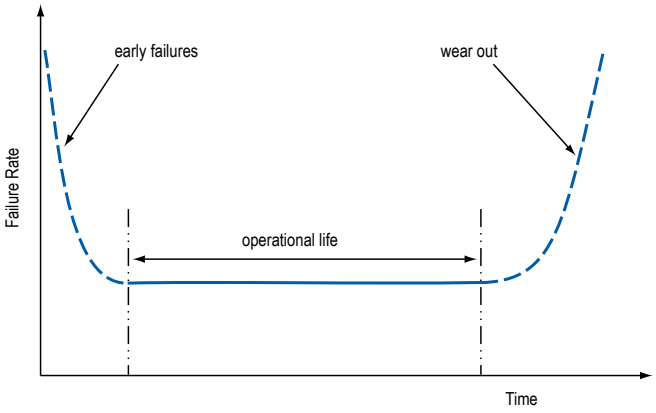
End of Life Definition
Catastrophic Fail: short circuit, open circuit or safety vent operation
Parametric Failure:

- Change in capacitance > ±15%
- Leakage current > specified limit
- ESR > 3 x initial ESR limit

Failure Rate cont'd

MTBF

The mean time between failures (MTBF) is simply the inverse of the failure rate.
MTBF= 1/λ



The failure rate is derived from our periodic test results. The failure rate (λ_R) is, therefore, only given at test temperature for life tests. An estimation is also given at 40°C. The expected failure rate for this capacitor range is based on our periodic test results for capacitors with structural similarity. Failure rate is frequently quoted in FIT (Failures In Time) where 1 FIT = 1 x 10^{-9} failures per hour. Failure rates include both catastrophic and parametric failures.

Environmental Compliance

As an environmentally conscious company, KEMET is working continuously with improvements concerning the environmental effects of both our capacitors and their production. 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, such as lead (Pb), in electronic equipment. All products in this catalog are produced to help our customers' obligations to guarantee their products and 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 such as 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 such as LF = Lead Free or LFW = Lead Free Wires on the label.

Table 1 – Ratings & Part Number Reference

VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR Maximum	Impedance Maximum	Part Number
	100 Hz 20°C (µF)		D x L (mm)	100 Hz 85°C (A)	10 kHz 85°C (A)	100 Hz 20°C (mΩ)	10 kHz 20°C (mΩ)	
550	560	KE	51 x 82	4.6	7.4	536	475	ALS6(1)(2)561KE550
550	680	KF	51 x 105	4.9	8.1	441	391	ALS6(1)(2)681KF550
550	820	KF	51 x 105	5.7	9.0	367	325	ALS6(1)(2)821KF550
550	1000	KJ	51 x 115	6.4	10.1	302	268	ALS6(1)(2)102KJ550
550	1000	ME	66 x 82	6.5	10.6	303	269	ALS6(1)(2)102ME550
550	1200	KM	51 x 131	7.1	11.0	252	224	ALS6(1)(2)122KM550
550	1200	MF	66 x 105	7.8	12.4	254	225	ALS6(1)(2)122MF550
550	1500	MJ	66 x 115	9.0	14.1	204	181	ALS6(1)(2)152MJ550
550	1800	MM	66 x 131	10.2	15.6	171	151	ALS6(1)(2)182MM550
550	1800	NF	77 x 105	10.3	16.0	167	147	ALS6(1)(2)182NF550
550	2200	MP	66 x 146	11.3	17.1	140	124	ALS6(1)(2)222MP550
550	2200	NJ	77 x 115	11.7	17.5	137	121	ALS6(1)(2)222NJ550
550	2200	QH	90 x 98	12.2	18.8	137	120	ALS6(1)(2)222QH550
550	2700	NM	77 x 131	13.2	19.1	113	100	ALS6(1)(2)272NM550
550	3300	NP	77 x 146	14.6	20.9	93	83	ALS6(1)(2)332NP550
VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR	IMP	Part Number

(1) Mounting Code: 0 = plain can, 1 = threaded mounting stud

(2) Termination Code: See Termination Tables for available options

Mechanical Data

Polarity and Reversed Voltage
Aluminium Electrolytic capacitors manufactured for use in DC applications contain an anode foil and a cathode foil. As such, they are polarized devices and must be connected with the +ve to the anode foil and the -ve to the cathode foil. If this were to be reversed then the electrolytic process that took place in forming the oxide layer on the anode would be recreated in trying to form an oxide layer on the cathode. In forming the cathode foil in this way, heat would be generated and gas given off within the capacitor, usually leading to catastrophic failure.

The cathode foil already possesses a thin stabilized oxide layer. This thin oxide layer is equivalent to a forming voltage of approximately 2 V. As a result, the capacitor can withstand a voltage reversal of up to 2 V for short periods. Above this voltage, the formation process will commence. Aluminium Electrolytic capacitors can also be manufactured for use in intermittent AC applications by using two anode foils in place of one anode and one cathode.

Mounting Position
The capacitor can be mounted in any position as long as the safety vent can operate. It is possible for some electrolyte to be expelled. As this is a conducting liquid, suitable precautions should be initiated by the system designer to avoid secondary short circuits.
The capacitors are designed to be mounted in free air and are not suitable for submersion in liquid.

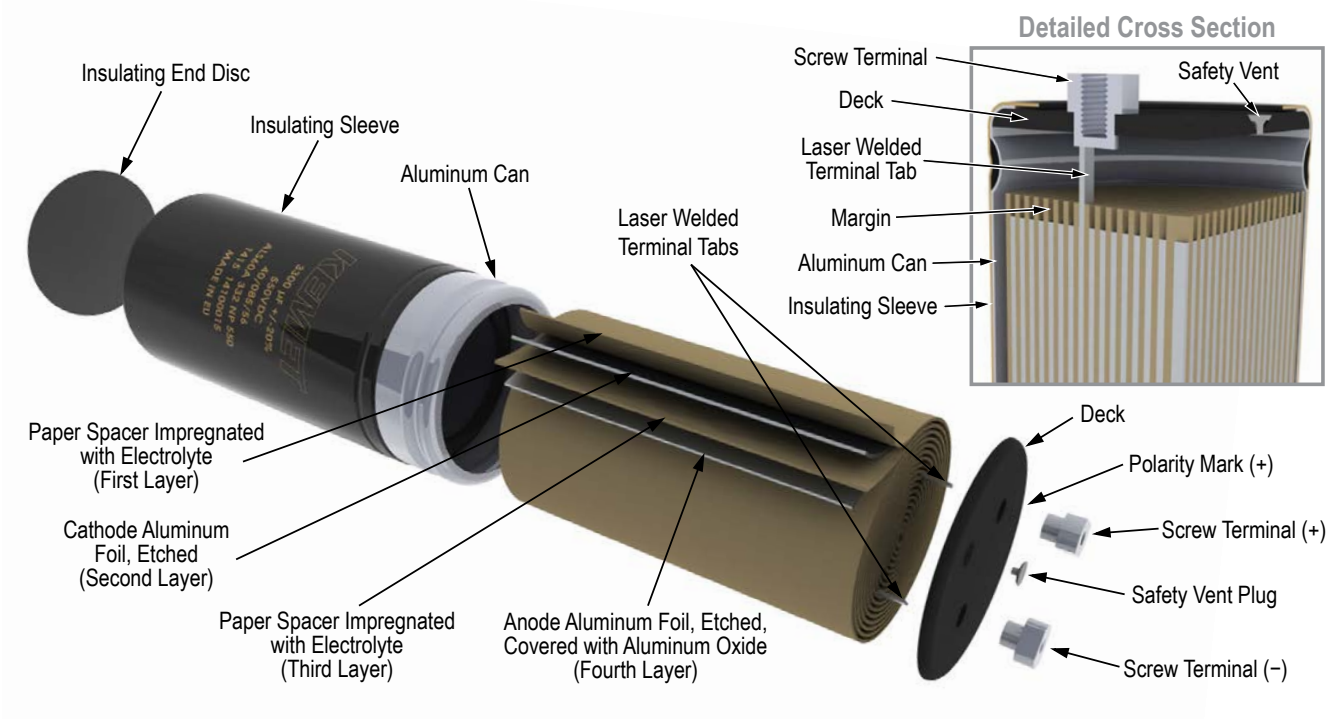
Insulating Resistance
≥ 100 MΩ at 100 VDC across insulating sleeve.

Voltage Proof
≥ 2,500 VDC across insulating sleeve.

Safety Vent
A safety vent for overpressure is featured on the terminal deck in the form of a rubber plug designed to relieve build-up of internal pressure due to overstress or catastrophic failure.

Marking

Construction



PEH200 Series, +85°C

Overview

KEMET's PEH200 Series of capacitors has a polarized all-welded design, heavy duty screw terminals, extended cathode construction, safety vent, and plastic insulation. The sealing system is designed for electrolyte leakage-free operation and a very low gas-diffusion rate of electrolyte. Mechanical contact between the winding and aluminum case allows excellent heat transfer from the winding hot-spot to the ambient, which means cooler operation and very high current ratings.

Applications

Typical applications for KEMET's PEH200 capacitor include uninterruptible power supplies (UPS), ground power units (GPU), welding equipment, and drives where high current ratings and compact size are important.

Benefits

- High CV value
- Long life, up to 29,000 hours at +85°C (V_R, I_R applied)
- Low ESR and ESL
- Compact size
- Optimized designs available upon request

Part Number System

PEH200	H		A	515	0	M	U2
Series	Rated Voltage (VDC)		Size Code	Capacitance Code (µF)	Version	Capacitance Tolerance	Stud Option
Screw Terminal Aluminum Electrolytic	H = 25 K = 40 M = 63 P = 100 S = 250 U = 350	X = 385 V = 400 O = 420 Y = 450 Z = 500	See Dimension table	The last two digits represent significant figures. The first digit specifies the total number of digits.	0 = Standard	M = ±20%	U2 = Plain Can B2 = Threaded mounting stud

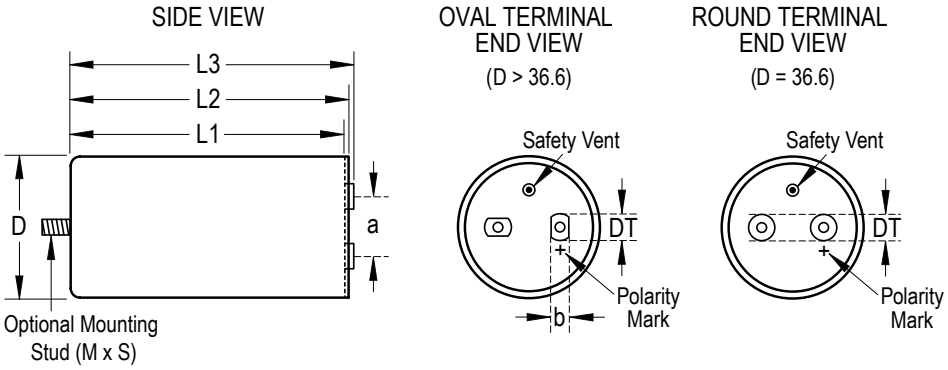
Performance Characteristics

Item	Performance Characteristics		
Capacitance Range	100 – 330,000 µF		
Rated Voltage	25 – 500 VDC		
Operating Temperature	-40 to +85°C		
Capacitance Tolerance	±20% at 100 Hz / +20°C		
Operational Lifetime	D (mm)	Rated Voltage and Ripple Current at +85°C (hours)	Rated Voltage at +85°C (hours)
	35	10,000	
	50	12,000	
	65	15,000	
	75	19,000	
	90	29,000	60,000
Shelf Life	2,000 hours at +85°C or 4 years at +40°C 0 VDC		
Leakage Current	I = 0.003 CV + 4000 (µA) (V_R < 500 VDC)		
	C = rated capacitance (µF), V = rated voltage (VDC). Voltage applied for 5 minutes at +20°C.		
Vibration Test Specifications		Procedure	Requirements
	D ≤ 50 mm	0.75 mm displacement amplitude or 10 g maximum acceleration. Vibration applied for three 2-hour sessions at 10 – 500 Hz (Capacitor clamped by body).	No leakage of electrolyte or other visible damage. Deviations in capacitance and tanδ from initial measurements must not exceed: Δ C/C < 5%
	D > 50 mm	0.75 mm displacement amplitude or 10 g maximum acceleration. Vibration applied for three 2-hour sessions at 10 – 55 Hz (Capacitor clamped by body).	
Standards	IEC 60384–4 long life grade 40/85/56		

Test Method & Performance

Endurance Life Test		
Conditions	Performance	
Temperature	+85°C	
Test Duration	2,000 hours	
Ripple Current	Maximum ripple current specified in table	
Voltage	The sum of DC voltage and the peak AC voltage must not exceed the rated voltage of the capacitor	
Performance	**The following specifications will be satisfied when the capacitor is tested at +20°C:**	
Capacitance Change	≤ 100 V	Within 15% of the initial value
	> 100 V	Within 10% of the initial value
Equivalent Series Resistance	Does not exceed 200% of the initial value	
Leakage Current	Does not exceed leakage current limit	

Dimensions – Millimeters



Reference Size (mm)	Size Code	Dimensions in mm					Mounting Stud (M x S)	Approximate Weight Grams
		D	L1	L2	L3	a		
		±1.0	±1.0	±1.0	±1.0	±0.5	Nominal	
35 x 51	A	36.6	51.5	54.5	58.9	13.0	M8 x 12	70
35 x 60	B	36.6	59.5	62.5	66.9	13.0	M8 x 12	85
35 x 75	C	36.6	73.5	76.5	80.9	13.0	M8 x 12	105
35 x 95	D	36.6	94.5	97.5	101.9	13.0	M8 x 12	130
50 x 49	G	51.6	48.5	51.5	56.4	22.0	M12 x 16	150
50 x 75	H	51.6	74.5	77.5	82.4	22.0	M12 x 16	180
50 x 95	J	51.6	95.5	98.5	103.4	22.0	M12 x 16	240
50 x 105	K	51.6	103.5	106.5	111.4	22.0	M12 x 16	265
50 x 115	I	51.6	115.5	118.5	123.4	22.0	M12 x 16	300
65 x 105	O	66.6	106.0	109.2	113.0	28.5	M12 x 16	415
65 x 115	Q	66.6	118.0	121.2	125.0	28.5	M12 x 16	460
65 x 130	S	66.6	129.0	132.2	136.0	28.5	M12 x 16	520
65 x 140	R	66.6	141.0	144.2	148.0	28.5	M12 x 16	650
75 x 78	L	76.6	77.0	80.2	84.0	32.0	M12 x 16	430
75 x 98	P	76.6	98.0	101.2	105.0	32.0	M12 x 16	530
75 x 105	T	76.6	106.0	109.2	113.0	32.0	M12 x 16	585
75 x 115	U	76.6	118.0	121.2	125.0	32.0	M12 x 16	640
75 x 145	V	76.6	146.0	149.2	153.0	32.0	M12 x 16	800
75 x 220	X	76.6	221.0	224.2	228.0	32.0	M12 x 16	1400
90 x 78	M	91.6	76.5	79.7	83.4	32.0	M12 x 16	750
90 x 98	N	91.6	97.5	100.7	104.4	32.0	M12 x 16	950
90 x 145	Y	91.6	145.5	148.7	152.4	32.0	M12 x 16	1400
90 x 220	Z	91.6	220.0	224.2	226.9	32.0	M12 x 16	1500

Note: Dimensions include sleeving. Additional case sizes available on request

Termination Table

Reference Diameter	Thread	Termination Style	Dimensions in mm	
			DT	b
35	M5	Round	8	
50	M5	Oval	15	13
65	M5	Oval	15	13
75	M5	Oval	15	13
90	M5	Oval	15	13

Note: M6 and other termination options available on request

Shelf Life

The capacitance, ESR and impedance of a capacitor will not change significantly after extended storage periods, however the leakage current will very slowly increase. KEMET products are particularly stable and allow a shelf life in excess of three years at 40°C. See sectional specification under each product series for specific data.

Re-age (Reforming) Procedure

Apply the rated voltage to the capacitor at room temperature for a period of one hour, or until the leakage current has fallen to a steady value below the specified limit. During re-aging a maximum charging current of twice the specified leakage current or 5 mA (whichever is greater) is suggested.

Reliability

The reliability of a component can be defined as the probability that it will perform satisfactorily under a given set of conditions for a given length of time.

In practice, it is impossible to predict with absolute certainty how any individual component will perform; thus, we must utilize probability theory. It is also necessary to clearly define the level of stress involved (e.g. operating voltage, ripple current, temperature and time). Finally, the meaning of satisfactory performance must be defined by specifying a set of conditions which determine the end of life of the component.

Reliability as a function of time, R(t), is normally expressed as: $R(t)=e^{-\lambda t}$
where R(t) is the probability that the component will perform satisfactorily for time t, and λ is the failure rate.

Failure Rate

The failure rate is the number of components failing per unit time. The failure rate of most electronic components follows the characteristic pattern:

- Early failures are removed during the manufacturing process.
- The operational life is characterized by a constant failure rate.
- The wear out period is characterized by a rapidly increasing failure rate.

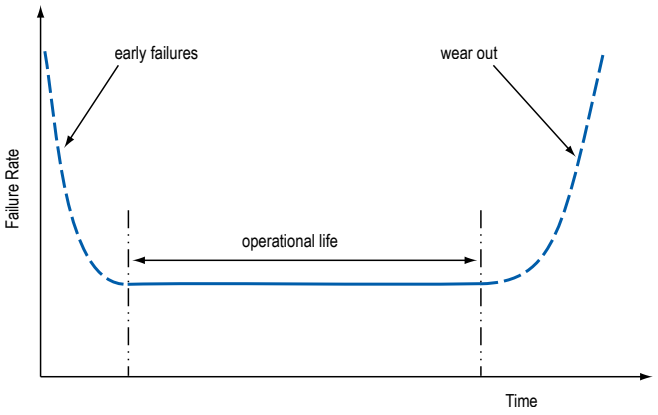
The failures in time (FIT) are given with a 60% confidence level for the various type codes. By convention, FIT is expressed as 1×10^{-9} failures per hour. Failure rate is also expressed as a percentage of failures per 1,000 hours.
e.g., 100 FIT = 1×10^{-7} failures per hour = 0.01%/1,000 hours

End of Life Definition
Catastrophic Failure: short circuit, open circuit or safety vent operation
Parametric Failure:

- Change in capacitance > ±10%
- Leakage current > specified limit
- ESR > 2 x initial ESR value

MTBF

The mean time between failures (MTBF) is simply the inverse of the failure rate.
MTBF= 1/λ



The failure rate is derived from our periodic test results. The failure rate (λ_R) is, therefore, only given at test temperature for life tests. An estimation is also given at 60°C.

The expected failure rate for this capacitor range is based on our periodic test results for capacitors with structural similarity.

T_a	Failure Rate per Hour
85°C	1,000 FIT
60°C	100 FIT

Failure rate per hour includes both catastrophic and parametric failures.

Environmental Compliance

As an environmentally conscious company, KEMET is working continuously with improvements concerning the environmental effects of both our capacitors and their production. 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, such as lead (Pb), in electronic equipment. All products in this catalog are produced to help our customers' obligations to guarantee their products and 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 such as 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 such as LF = Lead Free or LFW = Lead Free Wires on the label.

Table 1 – Ratings & Part Number Reference

VDC	Rated Capacitance	Size Code	Reference Size	Ripple Current Maximum			ESR Maximum		L_{ESL}	Part Number
	100 Hz 25°C (µF)		D x L (mm)	100 Hz 85°C (A)	10 kHz 50°C (A)[2]	10 kHz 40°C (A)	100 Hz 20°C (mΩ)	100 kHz 20°C (mΩ)	Approximate (nH)	
25	15000	A	35 x 51	11.9	28.7	19.0	25	21	12	PEH200HA5150M(1)
25	22000	C	35 x 75	15.2	34.3	24.4	17	14	12	PEH200HC5220M(1)
25	33000	D	35 x 95	17.8	38.0	28.1	12	10	12	PEH200HD5330M(1)
25	47000	H	50 x 75	20.2	43.3	30.1	11	10	16	PEH200HH5470M(1)
25	68000	J	50 x 95	23.4	47.4	34.6	8	7	16	PEH200HJ5680M(1)
25	100000	K	50 x 105	23.9	46.1	34.7	7	7	16	PEH200HK6100M(1)
25	150000	O	65 x 105	26.3	50.0	37.2	7	7	16	PEH200HO6150M(1)
25	220000	T	75 x 105	35.0	63.6	49.5	5	5	17	PEH200HT6220M(1)
25	330000	V	75 x 145	40.0	73.1	56.9	4	4	17	PEH200HV6330M(1)
40	6800	A	35 x 51	9.9	27.2	18.1	33	25	12	PEH200KA4680M(1)
40	10000	B	35 x 60	12.0	31.5	21.4	23	18	12	PEH200KB5100M(1)
40	15000	C	35 x 75	14.6	36.1	25.5	16	12	12	PEH200KC5150M(1)
40	22000	D	35 x 95	17.1	39.8	29.2	12	9	12	PEH200KD5220M(1)
40	33000	H	50 x 75	18.9	41.1	28.8	11	9	16	PEH200KH5330M(1)
40	47000	J	50 x 95	22.1	46.3	33.6	8	7	16	PEH200KJ5470M(1)
40	68000	O	65 x 105	25.2	49.9	35.6	7	7	16	PEH200KO5680M(1)
40	100000	O	65 x 105	24.9	46.3	36.9	8	8	16	PEH200KO6100M(1)
40	150000	U	75 x 115	35.7	67.7	51.2	5	4	17	PEH200KU6150M(1)
40	220000	V	75 x 145	34.4	62.3	48.9	5	5	17	PEH200KV6220M(1)
63	4700	A	35 x 51	9.0	26.8	18.0	32	21	12	PEH200MA4470M(1)
63	6800	C	35 x 75	11.5	32.7	23.5	21	14	12	PEH200MC4680M(1)
63	10000	D	35 x 95	13.6	36.0	27.0	15	10	12	PEH200MD5100M(1)
63	15000	H	50 x 75	16.1	37.3	26.5	14	11	16	PEH200MH5150M(1)
63	22000	J	50 x 95	19.0	42.0	30.9	10	8	16	PEH200MJ5220M(1)
63	33000	O	65 x 105	22.8	45.9	34.8	10	8	16	PEH200MO5330M(1)
63	47000	O	65 x 105	21.8	42.7	32.0	10	9	16	PEH200MO5470M(1)
63	68000	U	75 x 115	31.5	61.3	46.8	6	5	17	PEH200MU5680M(1)
63	100000	V	75 x 145	34.3	62.2	50.3	5	5	17	PEH200MV6100M(1)
100	1500	A	35 x 51	5.7	18.0	12.1	92	63	12	PEH200PA4150M(1)
100	2200	B	35 x 60	7.0	21.3	14.7	63	44	12	PEH200PB4220M(1)
100	3300	C	35 x 75	8.7	25.0	17.8	43	30	12	PEH200PC4330M(1)
100	4700	D	35 x 95	10.3	28.9	21.1	31	21	12	PEH200PD4470M(1)
100	6800	H	50 x 75	12.7	30.4	21.5	33	27	16	PEH200PH4680M(1)
100	10000	J	50 x 95	15.3	34.7	25.6	23	19	16	PEH200PJ5100M(1)
100	15000	K	50 x 105	17.3	37.6	27.9	17	14	16	PEH200PK5150M(1)
100	22000	O	65 x 105	19.3	38.7	30.1	15	13	16	PEH200PO5220M(1)
100	33000	T	75 x 105	26.3	53.0	39.8	10	8	17	PEH200PT5330M(1)
100	47000	V	75 x 145	30.8	60.5	47.3	7	6	17	PEH200PV5470M(1)
250	330	A	35 x 51	2.2	13.5	8.7	330	170	12	PEH200SA3330M(1)
250	470	B	35 x 60	2.7	15.9	10.6	240	120	12	PEH200SB3470M(1)
250	680	C	35 x 75	3.4	18.7	13.0	160	84	12	PEH200SC3680M(1)
250	1000	D	35 x 95	4.1	21.2	15.6	110	58	12	PEH200SD4100M(1)
250	1000	G	50 x 49	4.3	20.7	12.6	120	69	16	PEH200SG4100M(1)
250	1500	H	50 x 75	5.9	28.7	19.5	78	42	16	PEH200SH4150M(1)
250	2200	J	50 x 95	7.3	32.5	23.2	54	29	16	PEH200SJ4220M(1)
250	3300	O	65 x 105	10.0	39.8	29.4	38	22	16	PEH200SO4330M(1)
250	3300	L	75 x 78	10.5	43.8	29.6	38	22	17	PEH200SL4330M(1)
250	4700	O	65 x 105	11.3	38.2	27.2	29	18	16	PEH200SO4470M(1)
250	4700	M	90 x 78	12.7	44.2	30.4	30	18	16	PEH200SM4470M(1)
250	6800	T	75 x 105	14.7	51.5	36.5	20	12	17	PEH200ST4680M(1)
250	6800	N	90 x 98	15.8	52.1	37.3	21	13	16	PEH200SN4680M(1)
250	10000	V	75 x 145	18.0	59.0	44.0	14	9	17	PEH200SV5100M(1)
250	12000	V	75 x 145	18.8	58.6	43.6	14	9	17	PEH200SV512AM(1)
250	15000	X	75 x 220	20.6	61.6	49.2	10	6	17	PEH200SX5150M(1)
250	15000	Y	90 x 145	21.8	60.1	45.5	12	8	16	PEH200SY5150M(1)
350	220	A	35 x 51	2.0	13.7	8.8	360	170	12	PEH200UA3220M(1)
350	330	B	35 x 60	2.6	16.6	11.0	240	110	12	PEH200UB3330M(1)
350	470	C	35 x 75	3.2	19.3	13.4	170	79	12	PEH200UC3470M(1)
VDC	Rated Capacitance	Size Code	Reference Size	Ripple Current			ESR		L_{ESL}	Part Number

(1) Mounting Code: U2 = plain can, B2 = threaded mounting stud

[2] *2 m/s forced air, studmounted on 3°C/W aluminum chassis.*

Table 1 – Ratings & Part Number Reference cont'd

VDC	Rated Capacitance	Size Code	Reference Size	Ripple Current Maximum			ESR Maximum		L_{ESL}	Part Number
	100 Hz 25°C (µF)		D x L (mm)	100 Hz 85°C (A)	10 kHz 50°C (A)[2]	10 kHz 40°C (A)	100 Hz 20°C (mΩ)	100 kHz 20°C (mΩ)	Approximate (nH)	
350	680	D	35 x 95	3.8	21.9	16.0	120	55	12	PEH200UD3680M(1)
350	680	G	50 x 49	4.0	20.7	12.6	130	66	16	PEH200UG3680M(1)
350	1000	H	50 x 75	5.5	28.8	19.5	85	41	16	PEH200UH4100M(1)
350	1500	J	50 x 95	6.8	32.9	23.4	57	28	16	PEH200UJ4150M(1)
350	2200	O	65 x 105	9.4	39.8	29.2	41	21	16	PEH200UO4220M(1)
350	2200	L	75 x 78	9.8	43.5	29.4	41	21	17	PEH200UL4220M(1)
350	3300	O	65 x 105	10.9	38.6	27.5	31	17	16	PEH200UO4330M(1)
350	3300	M	90 x 78	13.1	54.0	37.0	28	15	16	PEH200UM4330M(1)
350	4700	U	75 x 115	14.5	54.7	39.5	20	11	17	PEH200UU4470M(1)
350	4700	N	90 x 98	15.0	51.3	36.7	22	13	16	PEH200UN4470M(1)
350	6800	V	75 x 145	16.8	57.0	42.3	15	8	17	PEH200UV4680M(1)
350	10000	X	75 x 220	19.4	60.8	48.5	11	7	17	PEH200UX5100M(1)
350	10000	Y	90 x 145	23.3	75.2	56.9	11	6	16	PEH200UY5100M(1)
350	15000	Z	90 x 220	27.3	79.8	64.4	8	5	16	PEH200UZ515AM(1)
385	220	A	35 x 51	2.1	14.6	9.3	330	150	12	PEH200XA3220M(1)
385	330	C	35 x 75	2.7	17.0	12.0	220	97	12	PEH200XC3330M(1)
385	470	D	35 x 95	3.3	19.1	14.2	150	69	12	PEH200XD3470M(1)
385	470	G	50 x 49	3.6	20.9	12.8	160	78	16	PEH200XG3470M(1)
385	680	H	50 x 75	4.7	26.8	18.4	110	51	16	PEH200XH3680M(1)
385	1000	J	50 x 95	5.9	31.7	22.8	76	35	16	PEH200XJ4100M(1)
385	1500	K	50 x 105	7.1	34.1	24.7	52	25	16	PEH200XK4150M(1)
385	2200	O	65 x 105	9.6	36.7	26.1	38	20	16	PEH200XO4220M(1)
385	2200	L	75 x 78	10.0	42.7	28.8	38	20	17	PEH200XL4220M(1)
385	3300	T	75 x 105	12.8	52.5	37.4	25	13	17	PEH200XT4330M(1)
385	3300	M	90 x 78	13.3	52.6	36.0	26	14	16	PEH200XM4330M(1)
385	4700	V	75 x 145	15.2	57.6	43.9	19	11	17	PEH200XV4470M(1)
385	4700	N	90 x 98	16.6	62.4	44.4	19	10	16	PEH200XN4470M(1)
385	6800	Y	90 x 145	20.9	74.8	57.2	14	8	16	PEH200XY4680M(1)
385	6800	X	75 x 220	17.4	58.9	47.0	14	8	17	PEH200XX4680M(1)
400	220	A	35 x 51	2.2	11.4	9.6	310	130	12	PEH200VA3220M(1)
400	330	C	35 x 75	2.8	14.3	12.6	210	90	12	PEH200VC3330M(1)
400	470	D	35 x 95	3.4	16.5	14.8	140	63	12	PEH200VD3470M(1)
400	470	G	50 x 49	3.7	15.0	12.7	150	73	16	PEH200VG3470M(1)
400	680	H	50 x 75	4.9	21.2	18.3	110	55	16	PEH200VH3680M(1)
400	1000	J	50 x 95	5.9	24.2	21.3	76	38	16	PEH200VJ4100M(1)
400	1500	O	65 x 105	9.1	49.1	35.1	53	27	16	PEH200VO415AQ(1)
400	1500	L	75 x 78	8.8	34.0	29.0	52	27	17	PEH200VL4150M(1)
400	2200	O	65 x 105	9.6	29.1	25.6	39	21	16	PEH200VO4220M(1)
400	2200	M	90 x 78	11.8	44.1	37.1	36	19	16	PEH200VM4220M(1)
400	3300	O	65 x 105	11.0	30.5	26.7	29	16	16	PEH200VO433AM(1)
400	3300	U	75 x 115	13.8	52.0	45.7	22	10	17	PEH200VU433AQ(1)
400	3300	N	90 x 98	14.9	52.8	45.2	25	13	16	PEH200VN4330M(1)
400	3300	T	75 x 105	13.0	41.5	36.3	26	14	17	PEH200VT4330M(1)
400	4700	V	75 x 145	15.6	57.0	42.5	18	10	17	PEH200VV447AM(1)
400	6800	X	75 x 220	17.6	51.2	47.7	13	8	17	PEH200VX4680M(1)
400	6800	Y	90 x 145	21.4	64.1	56.8	13	7	16	PEH200VY4680M(1)
400	10000	Z	90 x 220	24.7	69.2	64.0	9	5	16	PEH200VZ5100M(1)
420	150	A	35 x 51	1.8	12.1	7.8	400	170	12	PEH200OA3150M(1)
420	220	C	35 x 75	2.3	14.3	10.3	270	110	12	PEH200OC3220M(1)
420	330	D	35 x 95	2.9	16.3	12.3	180	76	12	PEH200OD3330M(1)
420	330	G	50 x 49	3.2	20.4	12.6	190	80	16	PEH200OG3330M(1)
420	470	H	50 x 75	4.2	24.8	17.0	140	62	16	PEH200OH3470M(1)
420	680	J	50 x 95	5.1	28.1	20.4	96	44	16	PEH200OJ3680M(1)
420	1000	K	50 x 105	6.3	32.0	23.2	67	31	16	PEH200OK4100M(1)
420	1500	O	65 x 105	8.8	38.9	28.4	47	23	16	PEH200OO4150M(1)
420	1500	L	75 x 78	9.1	42.3	28.5	47	23	17	PEH200OL4150M(1)
420	2200	T	75 x 105	11.5	51.6	37.0	32	16	17	PEH200OT4220M(1)
420	2200	M	90 x 78	12.2	52.7	36.0	33	17	16	PEH200OM4220M(1)
VDC	Rated Capacitance	Size Code	Reference Size	Ripple Current			ESR		L_{ESL}	Part Number

(1) Mounting Code: U2 = plain can, B2 = threaded mounting stud

[2] *2 m/s forced air, studmounted on 3°C/W aluminum chassis.*

Table 1 – Ratings & Part Number Reference cont'd

VDC	Rated Capacitance	Size Code	Reference Size	Ripple Current Maximum			ESR Maximum		L_{ESL}	Part Number
	100 Hz 25°C (µF)		D x L (mm)	100 Hz 85°C (A)	10 kHz 50°C (A)[2]	10 kHz 40°C (A)	100 Hz 20°C (mΩ)	100 kHz 20°C (mΩ)	Approximate (nH)	
420	2700	O	65 x 105	12.4	57.3	40.1	24	10	16	PEH200OO427AM(1)
420	3300	V	75 x 145	14.0	57.5	43.7	22	11	17	PEH200OV4330M(1)
420	3300	N	90 x 98	15.4	61.9	44.0	22	12	16	PEH200ON4330M(1)
420	4700	X	75 x 220	15.7	57.6	46.8	16	8	17	PEH200OX4470M(1)
420	4700	Y	90 x 145	18.2	62.2	47.5	17	9	16	PEH200OY4470M(1)
420	8200	Z	90 x 220	23.8	77.3	63.1	10	5	16	PEH200OZ4820M(1)
450	150	A	35 x 51	2.0	14.6	9.3	350	150	12	PEH200YA3150M(1)
450	220	C	35 x 75	2.5	16.8	11.9	240	99	12	PEH200YC3220M(1)
450	330	D	35 x 95	3.1	19.4	14.5	160	66	12	PEH200YD3330M(1)
450	330	G	50 x 49	3.5	20.8	12.7	170	75	16	PEH200YG3330M(1)
450	470	H	50 x 75	4.5	25.5	17.5	120	58	16	PEH200YH3470M(1)
450	680	J	50 x 95	5.5	28.8	20.8	86	41	16	PEH200YJ3680M(1)
450	1000	K	50 x 105	6.7	32.7	23.6	60	29	16	PEH200YK4100M(1)
450	1500	O	65 x 105	9.3	39.2	28.2	43	22	16	PEH200YO4150M(1)
450	1500	L	75 x 78	9.6	42.3	28.5	43	22	17	PEH200YL4150M(1)
450	1800	O	65 x 105	10.6	47.8	34.0	43	22	17	PEH200YO418AM(1)
450	2200	T	75 x 105	12.1	50.1	35.6	29	15	17	PEH200YT4220M(1)
450	2200	M	90 x 78	12.7	52.4	35.8	30	16	16	PEH200YM4220M(1)
450	3300	V	75 x 145	14.7	57.3	43.7	20	10	17	PEH200YV4330M(1)
450	3300	N	90 x 98	16.1	61.9	43.9	21	11	16	PEH200YN4330M(1)
450	4700	X	75 x 220	16.8	59.3	47.6	14	8	17	PEH200YX4470M(1)
450	4700	Y	90 x 145	18.9	61.4	46.9	16	9	16	PEH200YY4470M(1)
450	8200	Z	90 x 220	24.9	77.7	63.4	10	5	16	PEH200YZ4820M(1)
500	100	A	35 x 51	1.5	6.1	3.9	1290	760	12	PEH200ZA3100M(1)
500	150	B	35 x 60	1.9	7.5	4.9	670	390	12	PEH200ZB3150M(1)
500	220	C	35 x 75	2.3	8.4	5.8	570	345	12	PEH200ZC3220M(1)
500	220	G	50 x 49	2.5	10.1	6.1	595	365	12	PEH200ZG3220M(1)
500	330	D	35 x 95	2.9	10.7	7.7	390	234	12	PEH200ZD3330M(1)
500	470	H	50 x 75	4.2	15.8	10.5	280	165	16	PEH200ZH3470M(1)
500	680	J	50 x 95	5.1	18.4	12.8	195	115	16	PEH200ZJ3680M(1)
500	1000	O	65 x 105	6.8	21.4	15.5	130	79	16	PEH200ZO4100M(1)
500	1500	T	75 x 105	9.2	29.8	21.0	90	57	17	PEH200ZT4150M(1)
500	1800	O	65 x 105	10.6	40.9	28.2	71	45	16	PEH200ZO418HM(1)
500	2200	V	75 x 145	11.1	33.7	25.1	62	40	17	PEH200ZV4220M(1)
500	3300	X	75 x 220	12.8	36.5	29.0	43	28	17	PEH200ZX4330M(1)
500	3300	Y	90 x 145	15.7	46.9	35.4	38	24	16	PEH200ZY4330M(1)
500	5600	Z	90 x 220	19.6	53.4	42.6	31	21	16	PEH200ZZ4560M(1)
VDC	Rated Capacitance	Size Code	Reference Size	Ripple Current			ESR		L_{ESL}	Part Number

(1) Mounting Code: U2 = plain can, B2 = threaded mounting stud

[2] *2 m/s forced air, studmounted on 3°C/W aluminum chassis.*

Mechanical Data

Polarity and Reversed Voltage
Aluminium Electrolytic capacitors manufactured for use in DC applications contain an anode foil and a cathode foil. As such, they are polarized devices and must be connected with the +ve to the anode foil and the -ve to the cathode foil. If this were to be reversed then the electrolytic process that took place in forming the oxide layer on the anode would be recreated in trying to form an oxide layer on the cathode. In forming the cathode foil in this way, heat would be generated and gas given off within the capacitor, usually leading to catastrophic failure.

The cathode foil already possesses a thin stabilized oxide layer. This thin oxide layer is equivalent to a forming voltage of approximately 2 V. As a result, the capacitor can withstand a voltage reversal of up to 2 V for short periods. Above this voltage, the formation process will commence. Aluminium Electrolytic capacitors can also be manufactured for use in intermittent AC applications by using two anode foils in place of one anode and one cathode.

Mounting Position
The capacitor can be mounted upright or inclined to a horizontal position.

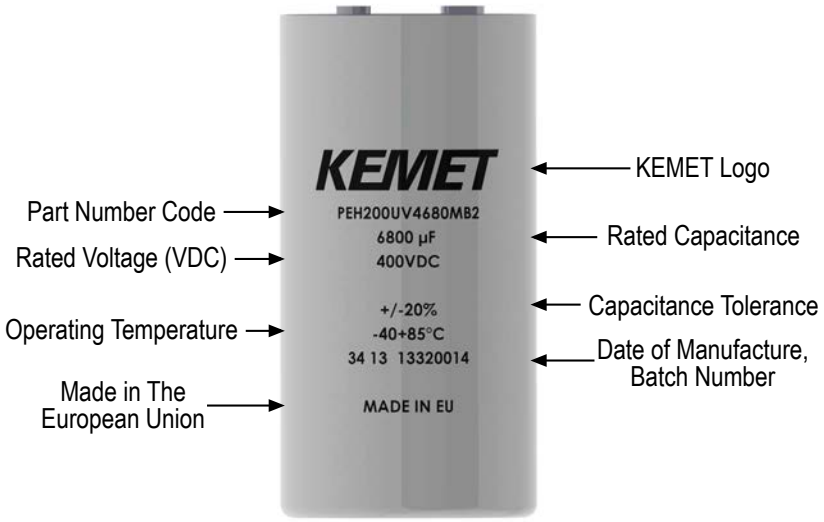
Clamp Fixing
Clips must be ordered separately.

Stud Fixing
Nylon cap nut must be ordered separately. For the stud fixing insulated version, the outer insulation serves as lock washer.
Maximum tightening torque:
M8 = 3 Nm
M12= 8 Nm
Maximum chassis thickness 5 mm.

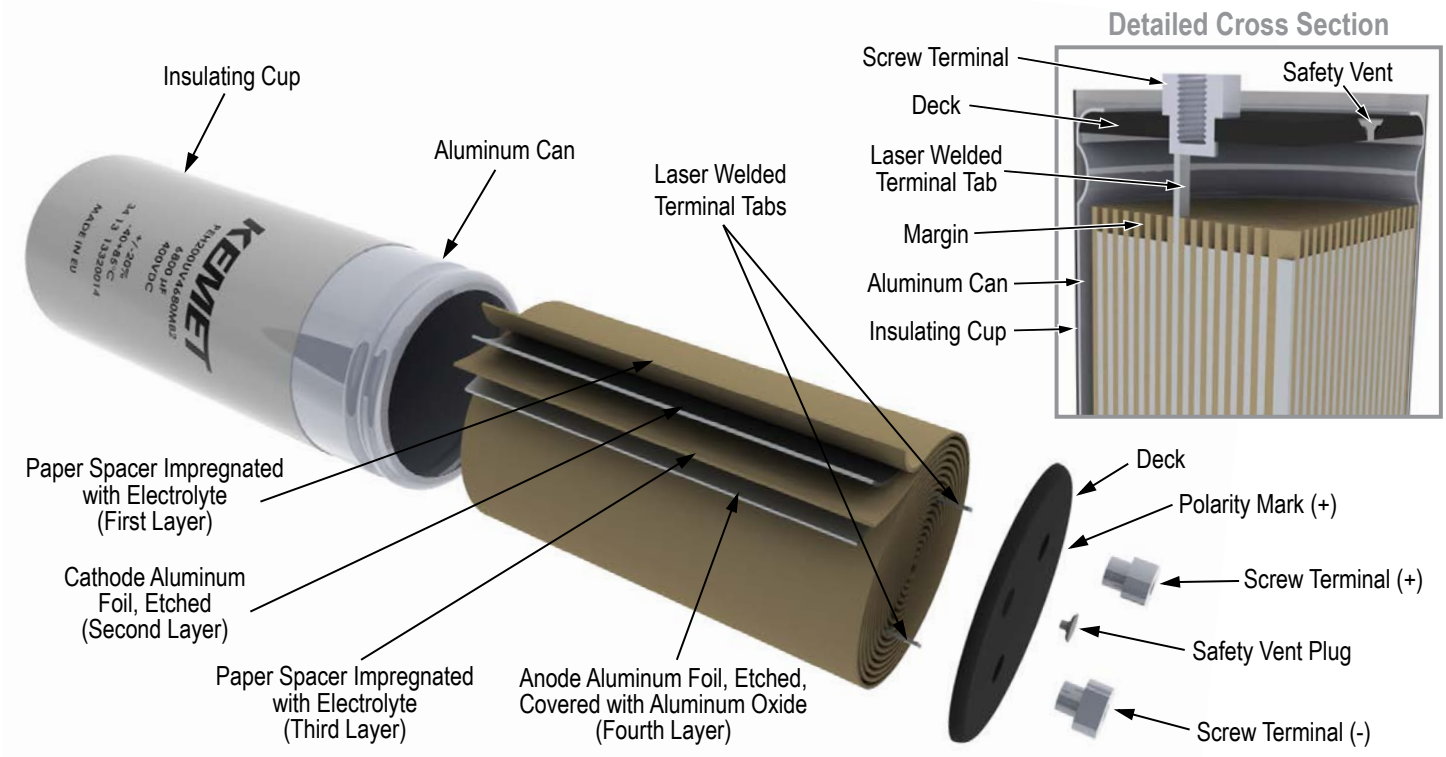
Screw Terminals
M5 x 10 according to DIN 41.248.
Maximum tightening torque = 2.5 Nm.
Must be ordered separately.
Recommended maximum connector thickness with delivered screw = 4 mm. M6 thread upon request.

Insulating Cup
PEH200 is supplied with a 0.8 mm thick polypropylene insulating cup. Voltage proof of the insulating cup: ≥ 4,000 VDC

Marking



Construction



PEH169 Series, +85°C

Overview

KEMET's PEH169 Series is a long-life electrolytic capacitor with outstanding reliability and electrical performance. The device has a polarized all-welded design, heavy duty screw terminals, extended cathode construction, safety vent, and plastic insulation. The PEH169 Series winding is housed in a cylindrical aluminum can with a reinforced molded lid incorporating a safety vent. The sealing system is designed for electrolyte leakage-free operation and a very low gas-diffusion rate of electrolyte. Mechanical contact between the winding and case allows excellent heat transfer from the winding to the ambient, which means cooler operation. Low ESR is the result of a low resistive paper/electrolyte system, at least two tabs per foil and an all-welded design.

Applications

Typical applications for KEMET's PEH169 capacitor include smoothing, energy storage or pulse operation in telecommunication demanding power supplies, process control, AC motor control, traction, welding, and measuring.

Benefits

- High CV value
- Long life, up to 38,000 hours at +85ºC (V_R, I_R applied)
- Low ESR and ESL
- High stability, 10 years shelf life
- Optimized designs available on request

Part Number System

PEH169	E		A	510	V	M	U2
Series	Rated Voltage (VDC)		Size Code	Capacitance Code (µF)	Version	Capacitance Tolerance	Stud Option
Screw Terminal Aluminum Electrolytic	E = 10 G = 16 H = 25 K = 40 M = 63 P = 100 Q = 160	R = 200 S = 250 U = 350 V = 400 O = 420 Y = 450	See Dimension Table	The last two digits represent significant figures. The first digit specifies the total number of digits.	0 = Standard	Q = -10 +30% M = ±20%	U2 = Plain Can B2 = Threaded mounting stud

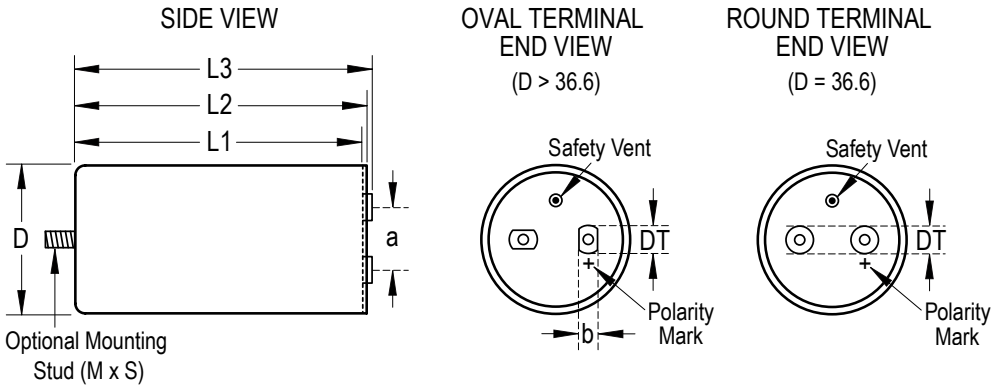
Performance Characteristics

Item	Performance Characteristics		
Capacitance Range	68 – 470,000 µF		
Rated Voltage	10 – 450 VDC		
Operating Temperature	-40 to +85°C		
Capacitance Tolerance	±20%, (-10/+30% select values) at 100 Hz / +20°C		
Operational Lifetime	D (mm)	Rated Voltage and Ripple Current at +85°C (hours)	Rated Voltage at +85°C (hours)
	35	14,000	
	50	17,000	
	65	21,000	
	75	28,000	
	90	38,000	78,000
Shelf Life	5,000 hours at +85°C or 10 years at +40°C 0 VDC		
Leakage Current	I = 0.003 CV + 4,000 (µA)		
	C = rated capacitance (µF), V = rated voltage (VDC). Voltage applied for 5 minutes at +20°C.		
Vibration Test Specifications		Procedure	Requirements
	D ≤ 50 mm	0.75 mm displacement amplitude or 10 g maximum acceleration. Vibration applied for three 2-hour sessions at 10 – 500 Hz (Capacitor clamped by body).	No leakage of electrolyte or other visible damage. Deviations in capacitance and tanδ from initial measurements must not exceed: Δ C/C < 5%
	D > 50 mm	0.75 mm displacement amplitude or 10 g maximum acceleration. Vibration applied for three 2-hour sessions at 10 – 55 Hz (Capacitor clamped by body).	
Standards	IEC 60384–4 long life grade 40/85/56, DIN 41240 type 1A CECC 30300, DIN 40040 GPF, DIN 41248		
CECC	CECC 30301-058, corresponding to CECC 30301-803		

Test Method & Performance

Endurance Life Test		
Conditions	Performance	
Temperature	+85°C	
Test Duration	5,000 hours	
Ripple Current	Maximum ripple current specified in table	
Voltage	The sum of DC voltage and the peak AC voltage must not exceed the rated voltage of the capacitor	
Performance	**The following specifications will be satisfied when the capacitor is tested at +20°C:**	
Capacitance Change	≤ 160 V	Within 15% of the initial value
	> 160 V	Within 10% of the initial value
Equivalent Series Resistance	Does not exceed 200% of the initial value	
Leakage Current	Does not exceed leakage current limit	

Dimensions – Millimeters



Reference Size (mm)	Size Code	Dimensions in mm					Mounting Stud (M x S)	Approximate Weight Grams
		D	L1	L2	L3	a		
		±1.0	±1.0	±1.0	±1.0	±0.5	Nominal	
35 x 51	A	36.6	51.5	54.5	58.9	13.0	M8 x 12	70
35 x 60	B	36.6	59.5	62.5	66.9	13.0	M8 x 12	85
35 x 75	C	36.6	73.5	76.5	80.9	13.0	M8 x 12	105
35 x 95	D	36.6	94.5	97.5	101.9	13.0	M8 x 12	130
50 x 75	H	51.6	74.5	77.5	82.4	22.0	M12 x 16	180
50 x 95	J	51.6	95.5	98.5	103.4	22.0	M12 x 16	240
50 x 105	K	51.6	103.5	106.5	111.4	22.0	M12 x 16	265
50 x 115	I*	51.6	115.5	118.5	123.4	22.0	M12 x 16	300
65 x 105	O	66.6	106.0	109.2	113.0	28.5	M12 x 16	415
65 x 115	Q*	66.6	118.0	121.2	125.0	28.5	M12 x 16	460.0
65 x 130	S*	66.6	129.0	132.2	136.0	28.5	M12 x 16	520.0
75 x 78	L	76.6	77.0	80.2	84.0	32.0	M12 x 16	430.0
75 x 98	P*	76.6	98.0	101.2	105.0	32.0	M12 x 16	530
75 x 105	T	76.6	106.0	109.2	113.0	32.0	M12 x 16	585
75 x 115	U	76.6	118.0	121.2	125.0	32.0	M12 x 16	640
75 x 145	V	76.6	146.0	149.2	153.0	32.0	M12 x 16	800
75 x 220	X	76.6	221.0	224.2	228.0	32.0	M12 x 16	1400
90 x 145	Y	91.6	145.5	148.7	152.4	32.0	M12 x 16	1400

Note: Dimensions include sleeving
Additional case sizes available on request

Termination Table

Reference Diameter	Thread	Termination Style	Dimensions in mm	
			DT	b
35	M5	Round	8	
50	M5	Oval	15	13
65	M5	Oval	15	13
75	M5	Oval	15	13
90	M5	Oval	15	13

Note: M6 and other termination options available on request

Shelf Life

The capacitance, ESR and impedance of a capacitor will not change significantly after extended storage periods, however the leakage current will very slowly increase. KEMET products are particularly stable and allow a shelf life in excess of three years at 40°C. See sectional specification under each product series for specific data.

Re-age (Reforming) Procedure

Apply the rated voltage to the capacitor at room temperature for a period of one hour, or until the leakage current has fallen to a steady value below the specified limit. During re-aging a maximum charging current of twice the specified leakage current or 5 mA (whichever is greater) is suggested.

Reliability

The reliability of a component can be defined as the probability that it will perform satisfactorily under a given set of conditions for a given length of time.

In practice, it is impossible to predict with absolute certainty how any individual component will perform; thus, we must utilize probability theory. It is also necessary to clearly define the level of stress involved (e.g. operating voltage, ripple current, temperature and time). Finally, the meaning of satisfactory performance must be defined by specifying a set of conditions which determine the end of life of the component.

Reliability as a function of time, R(t), is normally expressed as: $R(t)=e^{-\lambda t}$
where R(t) is the probability that the component will perform satisfactorily for time t, and λ is the failure rate.

Failure Rate

The failure rate is the number of components failing per unit time. The failure rate of most electronic components follows the characteristic pattern:

- Early failures are removed during the manufacturing process.
- The operational life is characterized by a constant failure rate.
- The wear out period is characterized by a rapidly increasing failure rate.

The failures in time (FIT) are given with a 60% confidence level for the various type codes. By convention, FIT is expressed as 1×10^{-9} failures per hour. Failure rate is also expressed as a percentage of failures per 1,000 hours.
e.g., 100 FIT = 1×10^{-7} failures per hour = 0.01%/1,000 hours

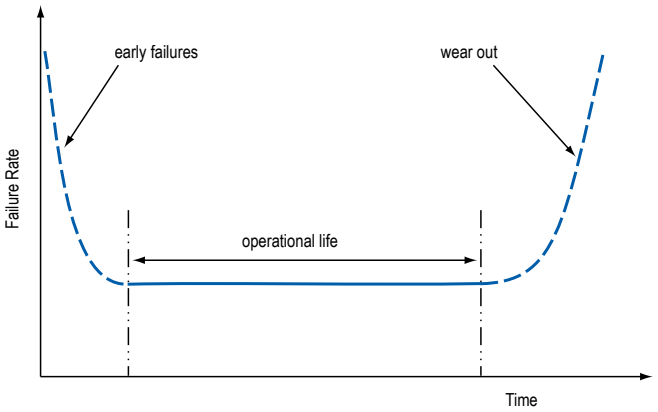
End of Life Definition
Catastrophic Failure: short circuit, open circuit or safety vent operation
Parametric Failure:

- Change in capacitance > ±10%
- Leakage current > specified limit
- ESR > 2 x initial ESR value

MTBF

The mean time between failures (MTBF) is simply the inverse of the failure rate.

MTBF= 1/λ



The failure rate is derived from our periodic test results. The failure rate (λ_R) is, therefore, only given at test temperature for life tests. An estimation is also given at 60°C.

The expected failure rate for this capacitor range is based on our periodic test results for capacitors with structural similarity.

T_a	Failure Rate per Hour
60°C	100 FIT

Failure rate per hour includes both catastrophic and parametric failures.

Environmental Compliance

As an environmentally conscious company, KEMET is working continuously with improvements concerning the environmental effects of both our capacitors and their production. 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, such as lead (Pb), in electronic equipment. All products in this catalog are produced to help our customers' obligations to guarantee their products and 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 such as 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 such as LF = Lead Free or LFW = Lead Free Wires on the label.

Table 1 – Ratings & Part Number Reference

VDC	Rated Capacitance	Size Code	Reference Size	Ripple Current Maximum			ESR Maximum		L_{ESL}	Part Number
	100 Hz 20°C (µF)		D x L (mm)	100 Hz 85°C (A)	10 kHz 50°C (A)[2]	10 kHz 40°C (A)	100 Hz 20°C (mΩ)	100 kHz 20°C (mΩ)	Approximate (nH)	
10	10000	A	35 x 51	8.6	26.0	16.8	34	28	12	PEH169EA510VM(1)
10	15000	A	35 x 51	10.0	28.3	18.9	24	20	12	PEH169EA515VM(1)
10	22000	B	35 x 60	11.9	32.3	22.1	18	15	12	PEH169EB522VM(1)
10	33000	C	35 x 75	14.6	37.6	27.2	12	10	12	PEH169EC533VM(1)
10	47000	D	35 x 95	16.1	38.9	29.0	10	9	12	PEH169ED547VM(1)
10	68000	H	50 x 75	17.4	42.3	29.8	9	8	16	PEH169EH568VM(1)
10	100000	J	50 x 95	20.1	47.1	34.3	7	6	16	PEH169EJ610VM(1)
10	150000	K	50 x 105	20.7	47.4	34.7	7	7	16	PEH169EK615VM(1)
10	220000	O	65 x 105	21.9	48.2	36.0	8	8	16	PEH169EO622VM(1)
10	330000	U	75 x 115	31.4	68.1	51.9	5	4	17	PEH169EU633VM(1)
10	470000	V	75 x 145	33.6	71.0	55.5	4	4	17	PEH169EV647VM(1)
16	10000	A	35 x 51	9.1	27.4	18.3	28	22	12	PEH169GA510VM(1)
16	15000	A	35 x 51	10.5	30.8	20.5	19	15	12	PEH169GA515VM(1)
16	22000	C	35 x 75	13.2	36.2	25.7	14	11	12	PEH169GC522VM(1)
16	33000	D	35 x 95	15.4	39.7	29.4	10	8	12	PEH169GD533VM(1)
16	47000	H	50 x 75	17.8	42.6	30.6	10	8	16	PEH169GH547VM(1)
16	68000	J	50 x 95	20.2	47.0	34.6	7	7	16	PEH169GJ568VM(1)
16	100000	O	65 x 105	23.3	52.2	39.6	8	7	16	PEH169GO610VM(1)
16	150000	T	75 x 105	31.2	68.5	53.0	5	5	17	PEH169GT615VM(1)
16	220000	U	75 x 115	31.6	69.2	52.9	5	4	17	PEH169GU622VM(1)
16	330000	V	75 x 145	33.5	69.5	55.8	4	4	17	PEH169GV633VM(1)
25	6000	A	35 X 51	8.7	8.38	6.40	37	27	12	PEH169HA460AQ(1)
25	6800	A	35 x 51	8.3	27.4	18.3	30	22	12	PEH169HA468VM(1)
25	10000	A	35 x 51	9.6	30.7	20.1	24	18	12	PEH169HA510VM(1)
25	15000	C	35 x 75	12.3	36.2	25.7	15	11	12	PEH169HC515VM(1)
25	22000	D	35 x 95	14.3	39.5	29.3	11	8	12	PEH169HD522VM(1)
25	33000	H	50 x 75	16.3	42.4	29.8	10	8	16	PEH169HH533VM(1)
25	47000	J	50 x 95	19.0	47.0	34.4	8	7	16	PEH169HJ547VM(1)
25	68000	O	65 x 105	21.6	49.6	37.3	8	7	16	PEH169HO568VM(1)
25	100000	T	75 x 105	30.1	61.2	52.2	5	5	17	PEH169HT610VM(1)
25	150000	U	75 x 115	31.1	69.8	53.1	5	4	17	PEH169HU615VM(1)
25	220000	V	75 x 145	33.1	71.0	55.9	4	4	17	PEH169HV622VM(1)
40	4700	A	35 x 51	7.7	28.3	18.9	32	20	12	PEH169KA447VM(1)
40	6800	B	35 x 60	9.0	30.4	21.1	23	15	12	PEH169KB468VM(1)
40	10000	C	35 x 75	10.9	33.7	24.5	18	13	12	PEH169KC510VM(1)
40	15000	D	35 x 95	13.0	37.5	28.6	11	8	12	PEH169KD515VM(1)
40	22000	H	50 x 75	16.3	45.3	32.0	11	8	16	PEH169KH522VM(1)
40	33000	J	50 x 95	17.8	46.3	32.9	9	8	16	PEH169KJ533VM(1)
40	47000	O	65 x 105	21.7	50.7	38.7	8	7	16	PEH169KO547VM(1)
40	68000	T	75 x 105	28.8	63.6	51.3	5	5	17	PEH169KT568VM(1)
40	100000	U	75 x 115	29.7	68.1	51.6	5	4	17	PEH169KU610VM(1)
40	150000	V	75 x 145	32.0	69.5	55.1	4	4	17	PEH169KV615VM(1)
63	2200	A	35 x 51	5.9	25.1	17.1	46	24	12	PEH169MA422VM(1)
63	3300	A	35 x 51	7.1	31.1	19.4	30	15	12	PEH169MA433VM(1)
63	4700	C	35 x 75	8.8	33.2	23.9	23	12	12	PEH169MC447VM(1)
63	6800	D	35 x 95	10.1	34.9	27.0	17	9	12	PEH169MD468VM(1)
63	10000	H	50 x 75	13.3	40.2	29.3	14	9	16	PEH169MH510VM(1)
63	15000	J	50 x 95	15.7	44.0	33.5	11	7	16	PEH169MJ515VM(1)
63	22000	K	50 x 105	17.9	48.2	35.8	9	7	16	PEH169MK522VM(1)
63	33000	T	75 x 105	27.5	71.3	54.4	6	5	17	PEH169MT533VM(1)
63	47000	U	75 x 115	29.6	73.0	55.9	5	4	17	PEH169MU547VM(1)
63	68000	V	75 x 145	30.0	68.8	54.2	5	4	17	PEH169MV568VM(1)
63	68000	V	75 x 145	29.4	65.0	52.6	6	5	17	PEH169MV568AQ(1)
63	82000	V	75 x 145	28.2	66.7	49.7	5	4	17	PEH169MV582BQ(1)
100	1000	A	35 x 51	4.1	16.4	11.1	120	75	12	PEH169PA410VM(1)
100	1500	A	35 x 51	5.0	19.5	13.1	80	51	12	PEH169PA415VM(1)
100	2200	C	35 x 75	6.1	21.5	15.5	61	41	12	PEH169PC422VM(1)
100	3300	D	35 x 95	7.4	24.3	18.3	42	29	12	PEH169PD433VM(1)
VDC	Rated Capacitance	Size Code	Reference Size	Ripple Current			ESR		L_{ESL}	Part Number

(1) Mounting Code: U2 = plain can, B2 = threaded mounting stud

[2] *2 m/s forced air, studmounted on 3°C/W aluminum chassis.*

Table 1 – Ratings & Part Number Reference cont'd

VDC	Rated Capacitance	Size Code	Reference Size	Ripple Current Maximum			ESR Maximum		L_{ESL}	Part Number
	100 Hz 20°C (µF)		D x L (mm)	100 Hz 85°C (A)	10 kHz 50°C (A)[2]	10 kHz 40°C (A)	100 Hz 20°C (mΩ)	100 kHz 20°C (mΩ)	Approximate (nH)	
100	4700	H	50 x 75	10.5	34.4	24.3	31	22	16	PEH169PH447VM(1)
100	6800	J	50 x 95	12.6	39.2	28.7	22	15	16	PEH169PJ468VM(1)
100	10000	K	50 x 105	13.9	38.6	29.1	17	13	16	PEH169PK510VM(1)
100	15000	O	65 x 105	18.4	48.5	36.3	13	10	16	PEH169PO515VM(1)
100	22000	U	75 x 115	25.4	67.3	51.3	8	6	17	PEH169PU522VM(1)
100	33000	V	75 x 145	28.5	71.0	55.2	6	5	17	PEH169PV533VM(1)
100	33000	V	75 x 145	27.3	67.3	51.5	7	6	17	PEH169PV533AQ(1)
160	470	A	35 x 51	2.5	13.6	9.0	240	110	12	PEH169QA347VM(1)
160	680	A	35 x 51	3.0	14.3	9.7	190	98	12	PEH169QA368VM(1)
160	1000	C	35 x 75	3.9	17.2	12.2	130	66	12	PEH169QC410VM(1)
160	1500	D	35 x 95	4.7	19.4	14.7	87	45	12	PEH169QD415VM(1)
160	2200	H	50 x 75	6.7	26.5	18.1	59	31	16	PEH169QH422VM(1)
160	3300	J	50 x 95	8.2	30.6	22.9	44	24	16	PEH169QJ433VM(1)
160	4700	O	65 x 105	10.9	35.8	26.8	31	17	16	PEH169QO447VM(1)
160	6800	T	75 x 105	14.6	50.2	37.2	21	12	17	PEH169QT468VM(1)
160	10000	U	75 x 115	17.0	53.6	41.7	16	10	17	PEH169QU510VM(1)
160	15000	V	75 x 145	19.6	58.2	43.4	12	7	17	PEH169QV515VM(1)
200	470	A	35 x 51	2.6	13.4	9.2	240	110	12	PEH169RA347VM(1)
200	680	B	35 x 60	3.3	15.2	11.1	170	79	12	PEH169RB368VM(1)
200	1000	D	35 x 95	4.0	18.9	13.9	110	53	12	PEH169RD410VM(1)
200	1500	H	50 x 75	5.8	24.0	18.1	79	40	16	PEH169RH415VM(1)
200	2200	J	50 x 95	7.0	28.3	21.5	55	28	16	PEH169RJ422VM(1)
200	3300	K	50 x 105	8.5	32.1	24.3	39	21	16	PEH169RK433VM(1)
200	4700	O	65 x 105	11.0	35.5	27.1	35	22	16	PEH169RO447VM(1)
200	6800	T	75 x 105	14.6	48.1	36.2	23	15	17	PEH169RT468VM(1)
200	10000	V	75 x 145	17.3	52.0	41.3	17	11	17	PEH169RV510VM(1)
250	220	A	35 x 51	1.8	8.4	6.0	500	260	12	PEH169SA322VM(1)
250	330	A	35 x 51	2.2	10.6	7.3	340	170	12	PEH169SA333VM(1)
250	470	B	35 x 60	2.7	11.9	8.7	240	130	12	PEH169SB347VM(1)
250	680	C	35 x 75	3.3	14.8	10.7	170	88	12	PEH169SC368VM(1)
250	1000	H	50 x 75	4.9	20.5	14.9	110	61	16	PEH169SH410VM(1)
250	1500	H	50 x 75	6.0	24.2	16.7	81	45	16	PEH169SH415VM(1)
250	2200	K	50 x 105	7.3	27.3	21.0	55	31	16	PEH169SK422VM(1)
250	3300	O	65 x 105	10.0	34.5	26.8	40	23	16	PEH169SO433VM(1)
250	4700	T	75 x 105	13.3	45.6	34.8	27	16	17	PEH169ST447VM(1)
250	6800	V	75 x 145	15.8	50.6	40.3	19	11	17	PEH169SV468VM(1)
250	6800	V	75 x 145	16.1	53.2	41.9	17	9	17	PEH169SV468AQ(1)
250	8800	V	75 x 145	17.3	60.6	45.9	15	9	17	PEH169SV488AM(1)
250	10000	X	75 x 220	17.3	50.7	43.2	14	9	17	PEH169SX510VM(1)
250	10000	Y	90 x 145	20.5	58.2	47.6	15	10	16	PEH169SY510VM(1)
350	150	A	35 x 51	1.6	7.6	5.0	630	340	12	PEH169UA315VM(1)
350	220	A	35 x 51	2.0	9.3	6.3	440	240	12	PEH169UA322VM(1)
350	330	C	35 x 75	2.5	10.8	7.8	290	160	12	PEH169UC333VM(1)
350	470	D	35 x 95	3.0	12.6	9.2	200	110	12	PEH169UD347VM(1)
350	680	H	50 x 75	4.4	18.2	13.4	140	80	16	PEH169UH368VM(1)
350	1000	J	50 x 95	5.3	20.8	16.1	99	55	16	PEH169UJ410VM(1)
350	1500	K	50 x 105	6.7	25.5	19.2	68	39	16	PEH169UK415VM(1)
350	2200	O	65 x 105	9.2	32.2	24.7	49	29	16	PEH169UO422VM(1)
350	3300	T	75 x 105	12.4	42.8	32.8	33	20	17	PEH169UT433VM(1)
350	4700	V	75 x 145	14.5	48.0	38.0	23	14	17	PEH169UV447VM(1)
350	6800	X	75 x 220	15.9	47.1	39.2	18	11	17	PEH169UX468VM(1)
350	6800	Y	90 x 145	18.9	53.7	43.7	19	13	16	PEH169UY468VM(1)
400	100	A	35 x 51	1.5	7.2	4.9	740	360	12	PEH169VA3100Q(1)
400	100	A	35 x 51	1.5	7.8	5.3	700	320	12	PEH169VA310VM(1)
400	150	B	35 x 60	1.8	8.7	6.3	500	240	12	PEH169VB3150Q(1)
400	150	A	35 x 51	1.8	9.4	6.3	470	220	12	PEH169VA315VM(1)
400	220	C	35 x 75	2.2	10.1	7.5	350	170	12	PEH169VC3220Q(1)
400	220	B	35 x 60	2.2	9.8	6.8	370	200	12	PEH169VB322VM(1)
VDC	Rated Capacitance	Size Code	Reference Size	Ripple Current			ESR		L_{ESL}	Part Number

(1) Mounting Code: U2 = plain can, B2 = threaded mounting stud

[2] *2 m/s forced air, studmounted on 3°C/W aluminum chassis.*

Table 1 – Ratings & Part Number Reference cont'd

VDC	Rated Capacitance	Size Code	Reference Size	Ripple Current Maximum			ESR Maximum		L_{ESL}	Part Number
	100 Hz 20°C (µF)		D x L (mm)	100 Hz 85°C (A)	10 kHz 50°C (A)[2]	10 kHz 40°C (A)	100 Hz 20°C (mΩ)	100 kHz 20°C (mΩ)	Approximate (nH)	
400	330	H	50 x 75	3.3	15.1	11.3	230	110	16	PEH169VH3330Q(1)
400	330	C	35 x 75	2.8	12.2	8.9	250	130	12	PEH169VC333VM(1)
400	470	H	50 x 75	4.0	18.9	13.5	160	78	16	PEH169VH3470Q(1)
400	470	H	50 x 75	4.1	18.7	14.0	150	73	16	PEH169VH347VM(1)
400	680	K	50 x 105	4.9	20.3	15.4	120	59	16	PEH169VK3680Q(1)
400	1000	K	50 x 105	5.8	23.0	17.6	85	47	16	PEH169VK410VM(1)
400	1000	O	65 x 105	6.8	26.9	21.2	79	41	16	PEH169VO4100Q(1)
400	1500	T	75 x 105	9.2	36.7	28.6	53	27	17	PEH169VT4150Q(1)
400	1500	O	65 x 105	8.2	30.8	23.8	58	32	16	PEH169VO415VM(1)
400	2200	P	75 x 98	11.2	48.4	36.2	35	17	17	PEH169VP422AM(1)
400	2200	V	75 x 145	11.0	41.8	34.0	36	18	17	PEH169VV4220Q(1)
400	2200	T	75 x 105	10.9	40.1	31.0	40	23	17	PEH169VT422VM(1)
400	3300	V	75 x 145	13.9	50.4	40.7	22	11	17	PEH169VV433GQ(1)
400	3300	V	75 x 145	13.3	46.0	37.3	27	15	17	PEH169VV433VM(1)
400	4700	X	75 x 220	13.8	38.5	33.8	24	16	17	PEH169VX447VM(1)
400	4700	Y	90 x 145	16.8	48.1	39.3	25	17	16	PEH169VY447VM(1)
420	68	A	35 x 51	1.0	4.5	3.2	1000	500	12	PEH169OA2680M(1)
420	100	B	35 x 60	1.2	5.5	4.0	700	340	12	PEH169OB3100M(1)
420	150	C	35 x 75	1.5	6.6	5.0	470	230	12	PEH169OC3150M(1)
420	220	D	35 x 95	1.8	7.5	5.9	320	160	12	PEH169OD3220M(1)
420	330	H	50 x 75	2.8	12.7	9.3	210	110	16	PEH169OH3330M(1)
420	470	J	50 x 95	3.4	14.4	11.0	150	75	16	PEH169OJ3470M(1)
420	680	K	50 x 105	4.1	17.5	13.3	110	53	16	PEH169OK3680M(1)
420	1000	O	65 x 105	5.8	23.3	17.9	73	38	16	PEH169OO4100M(1)
420	1500	T	75 x 105	7.9	31.6	24.1	49	25	17	PEH169OT4150M(1)
420	2200	V	75 x 145	9.3	35.2	28.1	34	18	17	PEH169OV4220M(1)
420	3300	X	75 x 220	10.0	32.9	28.3	23	12	17	PEH169OX4330M(1)
420	3300	Y	90 x 145	12.9	44.1	36.0	24	13	16	PEH169OY4330M(1)
450	68	A	35 x 51	1.0	3.7	2.9	1140	690	12	PEH169YA2680M(1)
450	100	B	35 x 60	1.3	4.4	3.6	800	490	12	PEH169YB3100M(1)
450	150	C	35 x 75	1.5	5.5	3.9	630	420	12	PEH169YC3150M(1)
450	220	D	35 x 95	1.8	5.1	4.6	440	300	12	PEH169YD3220M(1)
450	330	H	50 x 75	3.0	9.9	8.5	230	140	16	PEH169YH3330M(1)
450	470	J	50 x 95	3.8	11.8	10.1	170	100	16	PEH169YJ3470M(1)
450	680	K	50 x 105	4.2	12.2	10.5	140	96	16	PEH169YK3680M(1)
450	1000	O	65 x 105	6.4	18.5	16.0	82	52	16	PEH169YO4100M(1)
450	1500	T	75 x 105	7.8	21.7	18.7	67	47	17	PEH169YT4150M(1)
450	2200	V	75 x 145	9.4	25.4	22.7	45	31	17	PEH169YV4220M(1)
450	3300	X	75 x 220	10.2	25.0	23.8	34	24	17	PEH169YX4330M(1)
450	3300	Y	90 x 145	12.6	30.9	28.3	35	25	16	PEH169YY4330M(1)
VDC	Rated Capacitance	Size Code	Reference Size	Ripple Current			ESR		L_{ESL}	Part Number

(1) Mounting Code: U2 = plain can, B2 = threaded mounting stud

[2] *2 m/s forced air, studmounted on 3°C/W aluminum chassis.*

Mechanical Data

Polarity and Reversed Voltage
Aluminium Electrolytic capacitors manufactured for use in DC applications contain an anode foil and a cathode foil. As such, they are polarized devices and must be connected with the +ve to the anode foil and the -ve to the cathode foil. If this were to be reversed then the electrolytic process that took place in forming the oxide layer on the anode would be recreated in trying to form an oxide layer on the cathode. In forming the cathode foil in this way, heat would be generated and gas given off within the capacitor, usually leading to catastrophic failure.

The cathode foil already possesses a thin stabilized oxide layer. This thin oxide layer is equivalent to a forming voltage of approximately 2 V. As a result, the capacitor can withstand a voltage reversal of up to 2 V for short periods. Above this voltage, the formation process will commence. Aluminium Electrolytic capacitors can also be manufactured for use in intermittent AC applications by using two anode foils in place of one anode and one cathode.

Mounting Position
The capacitor can be mounted upright or inclined to a horizontal position.

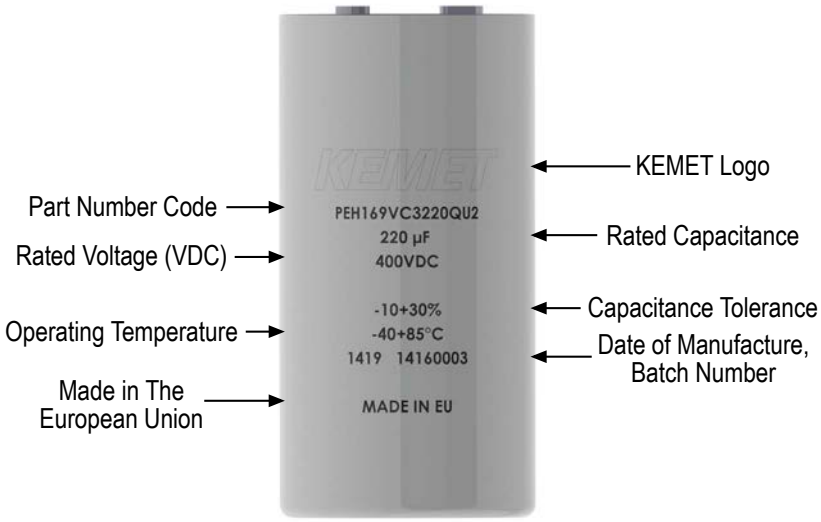
Clamp Fixing
Clips must be ordered separately.

Stud Fixing
Nylon cap nut must be ordered separately. For the stud fixing insulated version, the outer insulation serves as lock washer.
Maximum tightening torque:
M8 = 3 Nm
M12= 8 Nm
Maximum chassis thickness 5 mm.

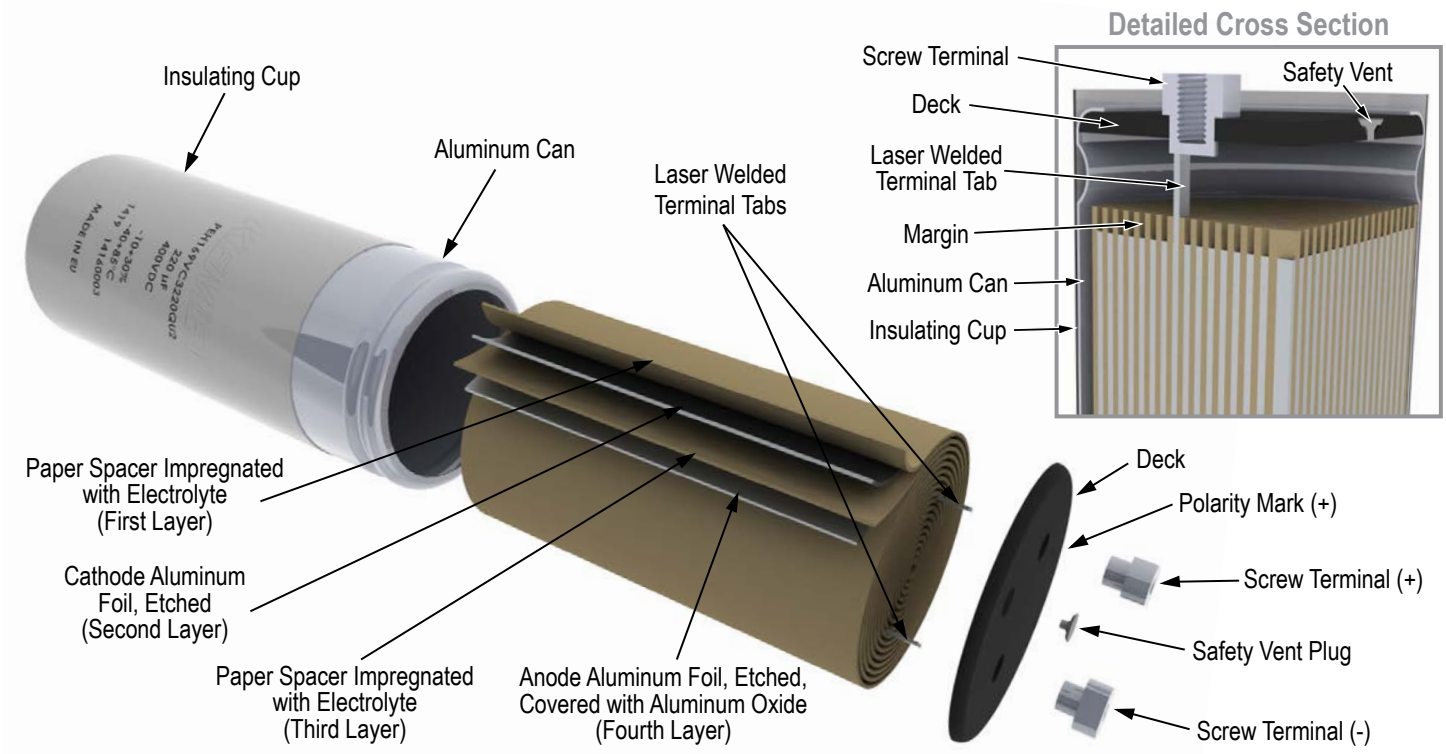
Screw Terminals
M5 x 10 according to DIN 41.248.
Maximum tightening torque = 2.5 Nm.
Must be ordered separately.
Recommended maximum connector thickness with delivered screw = 4 mm. M6 thread upon request.

Insulating Cup
PEH169 is supplied with a 0.8 mm thick polypropylene insulating cup. Voltage proof of the insulating cup: ≥ 4,000 VDC

Marking



Construction



ALS40/41 Series, +105°C

Overview

KEMET's ALS40/41 Series of screw terminal capacitors features the same high ripple currents and long-life characteristics as the ALS30/31 Series but can operate at higher temperatures. They are similarly suited for high reliability and long-life applications such as frequency converters, uninterruptible power supply (UPS) systems, and switch mode power supplies (SMPS) but the extended temperature range allows increased ripple currents at lower temperatures.

Applications

Typical applications for KEMET's ALS40/41 Series of capacitors include smoothing, energy storage or pulse operation in telecommunication demanding power supplies, process control, frequency inverters, drives, traction, welding, and measuring.

Benefits

- Compact size
- Long life, up to 9,000 hours at +105°C (V_R, I_R applied)
- High ripple current
- Excellent surge voltage capability
- Optimized designs available upon request

Part Number System

ALS4	0	A	153	DA	025	
Series	Stud Option	Termination	Capacitance Code (µF)	Size Code	Rated Voltage (VDC)	
Screw Terminal Aluminum Electrolytic	0 = Plain Can 1 = Threaded mounting stud	See Termination Table	First two digits represent significant figures. Third digit specifies number of zeros.	See Dimension Table	025 = 25 040 = 40 063 = 63 100 = 100 160 = 160 200 = 200	250 = 250 350 = 350 400 = 400 415 = 415 450 = 450 500 = 500

Performance Characteristics

Item	Performance Characteristics		
Capacitance Range	150 – 680,000 µF		
Rated Voltage	25 – 500 VDC		
Operating Temperature	-40 to +105°C		
Storage Temperature Range	-55 to +105°C		
Capacitance Tolerance	±20% at 100 Hz / +20°C		
Operational Lifetime	D (mm)	Rated Voltage and Ripple Current at +105°C (hours)	Rated Voltage at +105°C (hours)
	36	6,000	10,000
	51	7,000	11,000
	66	8,000	13,000
	77,90	9,000	15,000
End of Life Requirement	Δ C/C < ±10%, ESR < 2 x initial ESR value, IL < initial specified limit		
Shelf Life	2,000 hours at +85°C or 30,000 hours at +40°C 0 VDC		
Leakage Current	I = 0.003 CV or 6,000 (µA, whichever is smaller)		
	C = rated capacitance (µF), V = rated voltage (VDC). Voltage applied for 5 minutes at +20°C.		
Vibration Test Specifications		Procedure	Requirements
	Case Length < 220 mm	0.75 mm displacement amplitude or 10 g maximum acceleration. Vibration applied for three 2-hour sessions at 10 – 55 Hz (Capacitor clamped by body).	No leakage of electrolyte or other visible damage. Deviations in capacitance and tanδ from initial measurements must not exceed: Δ C/C < 5%
	Case Length ≥ 220 mm	0.35 mm displacement amplitude or 5 g maximum acceleration. Vibration applied for three 0.5 hour sessions at 10 – 55 Hz (Capacitor clamped by body).	
Standards	IEC 60384–4 long life grade 40/105/56		

Surge Voltage

Condition	Voltage (VDC)										
	25	40	63	100	200	250	350	400	415	450	500
≤ 30s Surge followed by a no load period of 330s, 1,000 cycles at +85°C	28.75	46	72.45	115	230	287.5	385	440	456.5	495	550
≤ 500 ms surge, 100 cycles at 20°C, occurring randomly throughout the life of the capacitor					350	400	500	520	530	550	600

Test Method & Performance

Endurance Life Test		
Conditions	Performance	
Temperature	+105°C	
Test Duration	2,000 hours	
Ripple Current	Rated ripple current in specified table	
Voltage	The sum of DC voltage and the peak AC voltage must not exceed the rated voltage of the capacitor	
Performance	**The following specifications will be satisfied when the capacitor is tested at +20°C:**	
Capacitance Change	≤ 160 V	Within 15% of the initial value
	≥ 160 V	Within 10% of the initial value
Equivalent Series Resistance	Does not exceed 200% of the initial value	
Leakage Current	Does not exceed leakage current limit	

Dimensions – Millimeters

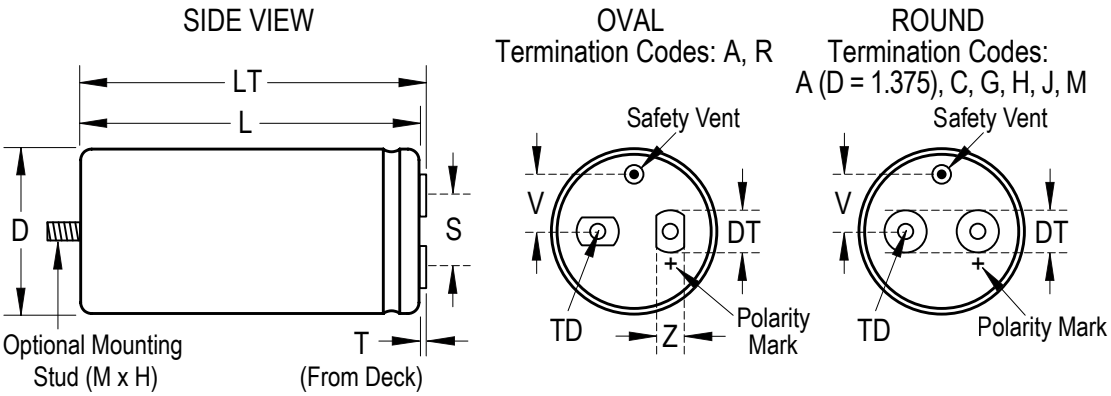
Size Code	Dimensions in mm						Mounting Clip	Approximate Weight Grams
	D	L	LT	S	V	Mounting Stud (M x H)		
	±1	±2	±1	±0.5	Nominal	±1		
DA	36	52	58.5	12.8	8	M8 x 12	V3/H2/2736	75
DB	36	62	67.5	12.8	8	M8 x 12	V3/H2/2736	90
DE	36	82	87.5	12.8	8	M8 x 12	V3/H2/2736	115
DF	36	105	111.5	12.8	8	M8 x 12	V3/H2/2736	140
KE	51	82	86.5	22.2	13.7	M12 x 16	V4/2737	220
KF	51	105	110.5	22.2	13.7	M12 x 16	V4/2737	300
MF	66	105	110.5	28.5	15.8	M12 x 16	V10/2738	505
ND	77	75	79.5	31.8	19	M12 x 16	V11	495
NF	77	105	110.5	31.8	19	M12 x 16	V11	690
NP	77	146	150.5	31.8	19	M12 x 16	V11	960
NT	77	220	224.5	31.8	19	M12 x 16	V11	1450
QC	90	67	71.5	31.8	25	M12 x 16	V90	615
QD	90	75	79.5	31.8	25	M12 x 16	V90	690
QH	90	98	103.5	31.8	25	M12 x 16	V90	900
QP	90	146	149.5	31.8	25	M12 x 16	V90	1345
QT	90	220	223.5	31.8	25	M12 x 16	V90	2000

Note: Dimensions include sleeving. LT listed is for A-type termination code. Information for other termination codes is available upon request.

Termination Tables

Termination Code / Diameter (mm)	A	C	G
36	•		
51	•		
66	•	•	
77	•	•	•
90	•	•	•

Termination Code	Thread	Termination Style	T	DT	Thread Depth (TD)	Z
			± 0.5	± 0.5	Minimum	Nominal
Standard Termination Option						
A (D = 36)	M5	Round	7.14	8	10	
A (D > 36)	M5	Oval	5.5	13	10	10
Other Termination Options						
C	M6	Round	5.5	13	10	
G	M6	Round	6.35	17	11.8	
Dimensions in mm						



Case Polarity

Due to the presence of electrolyte in the capacitor, the aluminum can and stud mounting will essentially be at the same polarity as the negative terminal. We recommend that the stud and can be insulated (see accessories for insulating nuts).

Terminations

Aluminum inserts with M5 threads as standard, maximum torque 2NM. Optional M6 threaded inserts have a maximum torque 4NM. Maximum torque for stud mounting M8:4NM and M12:8NM.

Shelf Life

The capacitance, ESR and impedance of a capacitor will not change significantly after extended storage periods, however the leakage current will very slowly increase. KEMET products are particularly stable and allow a shelf life in excess of three years at 40°C. See sectional specification under each product series for specific data.

Re-age (Reforming) Procedure

Apply the rated voltage to the capacitor at room temperature for a period of one hour, or until the leakage current has fallen to a steady value below the specified limit. During re-aging a maximum charging current of twice the specified leakage current or 5 mA (whichever is greater) is suggested.

Reliability

The reliability of a component can be defined as the probability that it will perform satisfactorily under a given set of conditions for a given length of time.

In practice, it is impossible to predict with absolute certainty how any individual component will perform; thus, we must utilize probability theory. It is also necessary to clearly define the level of stress involved (e.g. operating voltage, ripple current, temperature and time). Finally, the meaning of satisfactory performance must be defined by specifying a set of conditions which determine the end of life of the component.

Reliability as a function of time, R(t), is normally expressed as: $R(t)=e^{-\lambda t}$
where R(t) is the probability that the component will perform satisfactorily for time t, and λ is the failure rate.

Failure Rate

The failure rate is the number of components failing per unit time. The failure rate of most electronic components follows the characteristic pattern:

- Early failures are removed during the manufacturing process.
- The operational life is characterized by a constant failure rate.
- The wear out period is characterized by a rapidly increasing failure rate.

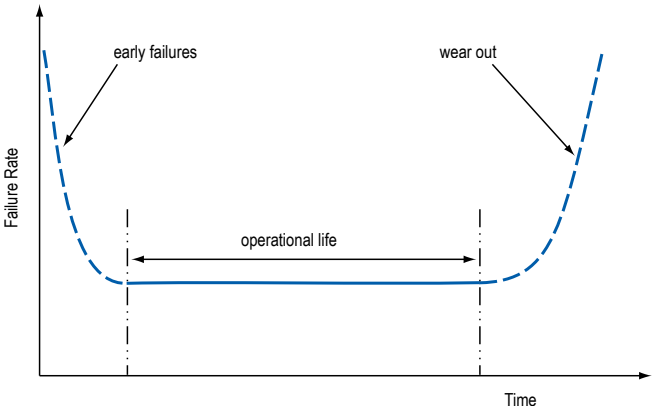
The failures in time (FIT) are given with a 60% confidence level for the various type codes. By convention, FIT is expressed as 1×10^{-9} failures per hour. Failure rate is also expressed as a percentage of failures per 1,000 hours.
e.g., 100 FIT = 1×10^{-7} failures per hour = 0.01%/1,000 hours

End of Life Definition
Catastrophic Failure: short circuit, open circuit or safety vent operation
Parametric Failure:

- Change in capacitance > ±10%
- Leakage current > specified limit
- ESR > 2 x initial ESR value

MTBF

The mean time between failures (MTBF) is simply the inverse of the failure rate.
MTBF= 1/λ



The failure rate is derived from our periodic test results. The failure rate (λ_R) is, therefore, only given at test temperature for life tests. An estimation is also given at 40°C. The expected failure rate for this capacitor range is based on our periodic test results for capacitors with structural similarity. Failure rate is frequently quoted in FIT (Failures In Time) where 1 FIT = 1 x 10^{-9} failures per hour. Failure rate per hour includes both catastrophic and parametric failures.

T_a	Failure Rate per Hour
85°C	220 FIT
40°C	10 FIT

Environmental Compliance

As an environmentally conscious company, KEMET is working continuously with improvements concerning the environmental effects of both our capacitors and their production. 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, such as lead (Pb), in electronic equipment. All products in this catalog are produced to help our customers' obligations to guarantee their products and 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 such as 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 such as LF = Lead Free or LFW = Lead Free Wires on the label.

Table 1 – Ratings & Part Number Reference

VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR Maximum	Impedance Maximum	Part Number
	100 Hz 20°C (µF)		D x L (mm)	100 Hz 105°C (A)	10 kHz 105°C (A)	100 Hz 20°C (mΩ)	10 kHz 20°C (mΩ)	
25	15000	DA	36 x 52	6.9	7.3	24	20	ALS4(1)(2)153DA025
25	22000	DB	36 x 62	8.4	8.8	17	15	ALS4(1)(2)223DB025
25	33000	DE	36 x 82	11.1	11.7	11	10	ALS4(1)(2)333DE025
25	47000	DF	36 x 105	14.0	14.7	9	8	ALS4(1)(2)473DF025
25	68000	KE	51 x 82	12.0	12.2	13	12	ALS4(1)(2)683KE025
25	100000	KF	51 x 105	16.4	16.7	9	8	ALS4(1)(2)104KF025
25	150000	ND	77 x 75	13.7	13.8	13	13	ALS4(1)(2)154ND025
25	150000	MF	66 x 105	23.8	24.1	6	6	ALS4(1)(2)154MF025
25	150000	QD	90 x 75	18.7	18.8	10	10	ALS4(1)(2)154QD025
25	220000	QC	90 x 67	18.6	19.2	9	8	ALS4(1)(2)224QC025
25	220000	NF	77 x 105	22.3	22.4	8	7	ALS4(1)(2)224NF025
25	330000	QH	90 x 98	22.3	22.4	8	8	ALS4(1)(2)334QH025
25	330000	NP	77 x 146	31.0	31.1	5	5	ALS4(1)(2)334NP025
25	470000	QP	90 x 146	36.9	37.1	4	4	ALS4(1)(2)474QP025
25	470000	NT	77 x 220	38.9	39.8	4	4	ALS4(1)(2)474NT025
25	680000	QT	90 x 220	47.0	48.1	4	3	ALS4(1)(2)684QT025
40	10000	DA	36 x 52	6.6	6.9	23	19	ALS4(1)(2)103DA040
40	10000	DB	36 x 62	8.1	8.7	19	16	ALS4(1)(2)103DB040
40	15000	DE	36 x 82	10.8	11.6	13	10	ALS4(1)(2)153DE040
40	22000	DF	36 x 105	13.6	14.5	10	8	ALS4(1)(2)223DF040
40	33000	KE	51 x 82	11.7	12.0	13	12	ALS4(1)(2)333KE040
40	47000	KF	51 x 105	16.2	16.6	9	8	ALS4(1)(2)473KF040
40	68000	ND	77 x 75	13.9	14.0	13	13	ALS4(1)(2)683ND040
40	100000	MF	66 x 105	20.6	20.8	7	7	ALS4(1)(2)104MF040
40	100000	QC	90 x 67	17.7	18.5	10	9	ALS4(1)(2)104QC040
40	100000	QD	90 x 75	16.0	16.1	12	11	ALS4(1)(2)104QD040
40	100000	NF	77 x 105	22.4	22.7	7	7	ALS4(1)(2)104NF040
40	150000	QH	90 x 98	22.6	22.8	8	8	ALS4(1)(2)154QH040
40	150000	NP	77 x 146	31.3	31.6	5	5	ALS4(1)(2)154NP040
40	220000	QP	90 x 146	36.8	37.1	4	4	ALS4(1)(2)224QP040
40	220000	NT	77 x 220	37.7	39.2	4	4	ALS4(1)(2)224NT040
40	330000	QT	90 x 220	45.6	47.0	4	4	ALS4(1)(2)334QT040
63	3300	DA	36 x 52	5.5	6.2	38	30	ALS4(1)(2)332DA063
63	4700	DB	36 x 62	6.7	7.5	27	22	ALS4(1)(2)472DB063
63	6800	DE	36 x 82	8.9	10.0	19	15	ALS4(1)(2)682DE063
63	10000	DF	36 x 105	11.2	12.6	13	10	ALS4(1)(2)103DF063
63	15000	KE	51 x 82	10.7	11.2	16	15	ALS4(1)(2)153KE063
63	22000	KF	51 x 105	14.7	15.3	11	10	ALS4(1)(2)223KF063
63	22000	ND	77 x 75	14.6	15.1	14	12	ALS4(1)(2)223ND063
63	33000	MF	66 x 105	21.3	22.2	8	7	ALS4(1)(2)333MF063
63	33000	QC	90 x 67	18.1	20.1	10	8	ALS4(1)(2)333QC063
63	33000	QD	90 x 75	17.1	17.5	11	11	ALS4(1)(2)333QD063
63	47000	NF	77 x 105	20.7	21.1	9	8	ALS4(1)(2)473NF063
63	47000	QH	90 x 98	24.4	25.1	8	7	ALS4(1)(2)473QH063
63	68000	NP	77 x 146	29.1	29.8	6	6	ALS4(1)(2)683NP063
63	100000	QP	90 x 146	34.5	35.2	5	5	ALS4(1)(2)104QP063
63	100000	NT	77 x 220	36.7	38.8	4	4	ALS4(1)(2)104NT063
63	150000	QT	90 x 220	44.4	46.5	4	4	ALS4(1)(2)154QT063
100	1500	DA	36 x 52	3.9	4.5	79	62	ALS4(1)(2)152DA100
100	2200	DB	36 x 62	4.8	5.5	56	44	ALS4(1)(2)222DB100
100	3300	DE	36 x 82	6.4	7.4	37	29	ALS4(1)(2)332DE100
100	4700	DF	36 x 105	8.1	9.3	26	21	ALS4(1)(2)472DF100
100	6800	KE	51 x 82	8.0	8.4	32	28	ALS4(1)(2)682KE100
100	10000	KF	51 x 105	10.9	11.5	21	18	ALS4(1)(2)103KF100
100	15000	ND	77 x 75	9.7	9.9	28	26	ALS4(1)(2)153ND100
100	15000	MF	66 x 105	15.8	16.7	14	12	ALS4(1)(2)153MF100
100	15000	QD	90 x 75	12.9	13.4	20	18	ALS4(1)(2)153QD100
VDC	**Rated Capacitance**	**Size Code**	**Case Size**	**Ripple Current**		**ESR**	**Impedance**	**Part Number**

(1) Mounting Code: 0 = plain can, 1 = threaded mounting stud

(2) Termination Code: See Termination Tables for available options

Table 1 – Ratings & Part Number Reference cont'd

VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR Maximum	Impedance Maximum	Part Number
	100 Hz 20°C (µF)		D x L (mm)	100 Hz 105°C (A)	10 kHz 105°C (A)	100 Hz 20°C (mΩ)	10 kHz 20°C (mΩ)	
100	22000	QC	90 x 67	14.3	15.2	17	16	ALS4(1)(2)223QC100
100	22000	NF	77 x 105	15.5	16.0	15	13	ALS4(1)(2)223NF100
100	22000	QH	90 x 98	18.4	19.0	13	11	ALS4(1)(2)223QH100
100	33000	NP	77 x 146	21.6	22.2	10	10	ALS4(1)(2)333NP100
100	47000	QP	90 x 146	25.9	26.5	9	8	ALS4(1)(2)473QP100
100	47000	NT	77 x 220	35.4	36.6	7	6	ALS4(1)(2)473NT100
100	100000	QT	90 x 220	37.2	37.9	6	6	ALS4(1)(2)104QT100
200	680	DA	36 x 52	2.9	4.0	195	154	ALS4(1)(2)681DA200
200	680	DB	36 x 62	3.3	4.6	188	147	ALS4(1)(2)681DB200
200	1000	DE	36 x 82	4.3	6.1	128	100	ALS4(1)(2)102DE200
200	1500	DF	36 x 105	5.6	7.8	86	67	ALS4(1)(2)152DF200
200	2200	KE	51 x 82	6.8	8.0	71	58	ALS4(1)(2)222KE200
200	3300	KF	51 x 105	9.1	10.9	47	38	ALS4(1)(2)332KF200
200	4700	ND	77 x 75	8.7	9.4	48	42	ALS4(1)(2)472ND200
200	6800	MF	66 x 105	12.9	14.5	27	23	ALS4(1)(2)682MF200
200	6800	QC	90 x 67	11.8	15.9	37	28	ALS4(1)(2)682QC200
200	6800	QD	90 x 75	10.9	11.7	36	32	ALS4(1)(2)682QD200
200	6800	NF	77 x 105	13.4	14.8	29	25	ALS4(1)(2)682NF200
200	10000	QH	90 x 98	15.4	16.6	23	20	ALS4(1)(2)103QH200
200	10000	NP	77 x 146	19.3	21.5	19	16	ALS4(1)(2)103NP200
200	15000	QP	90 x 146	24.2	26.5	14	12	ALS4(1)(2)153QP200
200	22000	NT	77 x 220	29.5	31.6	11	10	ALS4(1)(2)223NT200
200	33000	QT	90 x 220	34.3	36.4	10	8	ALS4(1)(2)333QT200
250	470	DA	36 x 52	2.5	3.9	235	174	ALS4(1)(2)471DA250
250	680	DB	36 x 62	3.2	4.8	164	122	ALS4(1)(2)681DB250
250	1000	DE	36 x 82	4.2	6.3	111	83	ALS4(1)(2)102DE250
250	1000	DF	36 x 105	4.7	7.5	108	79	ALS4(1)(2)102DF250
250	1500	KE	51 x 82	6.2	8.2	83	64	ALS4(1)(2)152KE250
250	2200	KF	51 x 105	8.3	11.1	56	42	ALS4(1)(2)222KF250
250	3300	ND	77 x 75	8.5	9.7	52	42	ALS4(1)(2)332ND250
250	4700	MF	66 x 105	12.3	15.0	30	24	ALS4(1)(2)472MF250
250	4700	QC	90 x 67	10.9	16.3	42	30	ALS4(1)(2)472QC250
250	4700	QD	90 x 75	10.7	12.1	38	32	ALS4(1)(2)472QD250
250	6800	NF	77 x 105	12.1	13.4	30	25	ALS4(1)(2)682NF250
250	6800	QH	90 x 98	15.1	17.3	25	20	ALS4(1)(2)682QH250
250	10000	NP	77 x 146	17.5	19.5	19	16	ALS4(1)(2)103NP250
250	15000	QP	90 x 146	21.9	23.9	14	12	ALS4(1)(2)153QP250
250	15000	NT	77 x 220	29.2	33.0	12	10	ALS4(1)(2)153NT250
250	22000	QT	90 x 220	34.1	38.2	11	9	ALS4(1)(2)223QT250
350	220	DA	36 x 52	1.8	4.5	457	303	ALS4(1)(2)221DA350
350	330	DB	36 x 62	2.4	5.7	307	204	ALS4(1)(2)331DB350
350	470	DE	36 x 82	3.0	7.2	215	143	ALS4(1)(2)471DE350
350	680	DF	36 x 105	3.9	8.9	149	99	ALS4(1)(2)681DF350
350	1000	KE	51 x 82	5.0	10.0	113	78	ALS4(1)(2)102KE350
350	1500	KF	51 x 105	6.8	12.5	75	52	ALS4(1)(2)152KF350
350	2200	ND	77 x 75	8.3	13.7	66	49	ALS4(1)(2)222ND350
350	2200	MF	66 x 105	9.8	17.9	51	35	ALS4(1)(2)222MF350
350	2200	QC	90 x 67	9.1	16.4	74	52	ALS4(1)(2)222QC350
350	2200	QD	90 x 75	9.4	17.8	56	40	ALS4(1)(2)222QD350
350	3300	NF	77 x 105	11.7	19.7	41	30	ALS4(1)(2)332NF350
350	4700	QH	90 x 98	14.6	23.2	31	23	ALS4(1)(2)472QH350
350	4700	NP	77 x 146	15.7	23.6	27	20	ALS4(1)(2)472NP350
350	6800	QP	90 x 146	20.3	29.7	19	14	ALS4(1)(2)682QP350
350	6800	NT	77 x 220	25.4	35.7	23	17	ALS4(1)(2)682NT350
350	10000	QT	90 x 220	31.0	42.7	21	16	ALS4(1)(2)103QT350
400	220	DA	36 x 52	2.0	4.9	542	349	ALS4(1)(2)221DA400
400	220	DB	36 x 62	2.1	5.4	537	344	ALS4(1)(2)221DB400
VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR	Impedance	Part Number

(1) Mounting Code: 0 = plain can, 1 = threaded mounting stud

(2) Termination Code: See Termination Tables for available options

Table 1 – Ratings & Part Number Reference cont'd

VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR Maximum	Impedance Maximum	Part Number
	100 Hz 20°C (µF)		D x L (mm)	100 Hz 105°C (A)	10 kHz 105°C (A)	100 Hz 20°C (mΩ)	10 kHz 20°C (mΩ)	
400	470	DE	36 x 82	3.2	7.8	254	164	ALS4(1)(2)471DE400
400	470	DF	36 x 105	3.5	8.5	251	161	ALS4(1)(2)471DF400
400	680	KE	51 x 82	4.2	9.8	183	121	ALS4(1)(2)681KE400
400	1000	KF	51 x 105	5.6	12.3	124	81	ALS4(1)(2)102KF400
400	1500	ND	77 x 75	7.6	13.9	93	64	ALS4(1)(2)152ND400
400	2200	MF	66 x 105	9.7	18.1	60	41	ALS4(1)(2)222MF400
400	2200	QC	90 x 67	9.4	15.9	63	44	ALS4(1)(2)222QC400
400	2200	QD	90 x 75	10.0	17.5	67	47	ALS4(1)(2)222QD400
400	2200	NF	77 x 105	10.6	19.8	62	42	ALS4(1)(2)222NF400
400	3300	QH	90 x 98	13.6	23.4	44	31	ALS4(1)(2)332QH400
400	4700	NP	77 x 146	15.4	22.6	33	23	ALS4(1)(2)472NP400
400	6800	QP	90 x 146	20.0	28.3	23	17	ALS4(1)(2)682QP400
400	6800	NT	77 x 220	23.5	33.3	21	15	ALS4(1)(2)682NT400
400	10000	QT	90 x 220	29.0	40.3	18	14	ALS4(1)(2)103QT400
415	220	DA	36 x 52	2.0	5.0	530	331	ALS4(1)(2)221DA415
415	220	DB	36 x 62	2.1	5.4	524	325	ALS4(1)(2)221DB415
415	330	DE	36 x 82	2.8	7.1	349	217	ALS4(1)(2)331DE415
415	470	DF	36 x 105	3.5	8.7	245	152	ALS4(1)(2)471DF415
415	680	KE	51 x 82	4.4	9.9	180	115	ALS4(1)(2)681KE415
415	1000	KF	51 x 105	5.8	12.3	122	77	ALS4(1)(2)102KF415
415	1500	ND	77 x 75	7.6	13.8	95	65	ALS4(1)(2)152ND415
415	2200	MF	66 x 105	9.7	18.1	60	39	ALS4(1)(2)222MF415
415	2200	QC	90 x 67	9.4	15.8	61	43	ALS4(1)(2)222QC415
415	2200	QD	90 x 75	10.0	17.3	67	47	ALS4(1)(2)222QD415
415	2200	NF	77 x 105	10.7	19.7	61	41	ALS4(1)(2)222NF415
415	3300	QH	90 x 98	13.6	23.3	44	30	ALS4(1)(2)332QH415
415	3300	NP	77 x 146	14.2	23.6	40	27	ALS4(1)(2)332NP415
415	4700	QP	90 x 146	18.5	29.8	29	19	ALS4(1)(2)472QP415
415	6800	NT	77 x 220	23.0	32.5	21	14	ALS4(1)(2)682NT415
415	10000	QT	90 x 220	28.3	39.3	18	14	ALS4(1)(2)103QT415
450	150	DA	36 x 52	1.8	4.5	721	360	ALS4(1)(2)151DA450
450	150	DB	36 x 62	1.9	4.8	715	356	ALS4(1)(2)151DB450
450	220	DE	36 x 82	2.5	6.2	487	242	ALS4(1)(2)221DE450
450	330	DF	36 x 105	3.2	7.9	325	162	ALS4(1)(2)331DF450
450	470	KE	51 x 82	4.1	9.0	239	123	ALS4(1)(2)471KE450
450	680	KF	51 x 105	5.3	11.3	164	84	ALS4(1)(2)681KF450
450	1000	ND	77 x 75	7.0	13.2	125	69	ALS4(1)(2)102ND450
450	1500	MF	66 x 105	8.9	17.1	79	42	ALS4(1)(2)152MF450
450	1500	QC	90 x 67	8.7	15.3	78	57	ALS4(1)(2)152QC450
450	1500	QD	90 x 75	9.3	16.7	87	49	ALS4(1)(2)152QD450
450	1500	NF	77 x 105	9.8	18.7	80	43	ALS4(1)(2)152NF450
450	2200	QH	90 x 98	12.5	22.5	58	32	ALS4(1)(2)222QH450
450	2200	NP	77 x 146	13.1	22.9	54	29	ALS4(1)(2)222NP450
450	3300	NP	77 x 146	14.6	22.0	38	27	ALS4(1)(2)332NP450
450	3300	QP	90 x 146	14.2	28.9	37	20	ALS4(1)(2)332QP450
450	4700	NT	77 x 220	21.9	32.0	27	15	ALS4(1)(2)472NT450
450	6800	QT	90 x 220	23.5	39.2	19	15	ALS4(1)(2)682QT450
500	220	DA	36 x 52	2.1	4.3	1000	810	ALS4(1)(2)221DA500
500	220	DB	36 x 62	2.1	4.4	1000	808	ALS4(1)(2)221DB500
500	330	DE	36 x 82	2.6	5.5	670	540	ALS4(1)(2)331DE500
500	470	DF	36 x 105	3.2	6.4	470	380	ALS4(1)(2)471DF500
500	680	KE	51 x 82	4.7	8.8	338	270	ALS4(1)(2)681KE500
500	1000	KF	51 x 105	5.7	10.6	230	187	ALS4(1)(2)102KF500
500	1500	ND	77 x 75	8.0	13.2	160	130	ALS4(1)(2)152ND500
500	2200	NF	77 x 105	10.2	17.1	110	90	ALS4(1)(2)222NF500
500	3300	NP	77 x 146	13.1	20.2	82	68	ALS4(1)(2)332NP500
500	4700	NT	77 x 220	15.3	22.9	60	48	ALS4(1)(2)472NT500
VDC	**Rated Capacitance**	**Size Code**	**Case Size**	**Ripple Current**		**ESR**	**Impedance**	**Part Number**

(1) Mounting Code: 0 = plain can, 1 = threaded mounting stud

(2) Termination Code: See Termination Tables for available options

Table 1 – Ratings & Part Number Reference cont'd

VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR Maximum	Impedance Maximum	Part Number
	100 Hz 20°C (µF)		D x L (mm)	100 Hz 105°C (A)	10 kHz 105°C (A)	100 Hz 20°C (mΩ)	10 kHz 20°C (mΩ)	
500	1500	QC	90 x 67	8.4	14.0	160	130	ALS4(1)(2)152QC500
500	2200	QD	90 x 75	10.2	16.3	112	90	ALS4(1)(2)222QD500
500	3300	QH	90 x 98	13.1	20.3	75	60	ALS4(1)(2)332QH500
500	3300	QP	90 x 146	14.1	23.4	80	66	ALS4(1)(2)332QP500
500	6800	QT	90 x 220	20.0	29.3	41	34	ALS4(1)(2)682QT500
VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR	Impedance	Part Number

(1) Mounting Code: 0 = plain can, 1 = threaded mounting stud

(2) Termination Code: See Termination Tables for available options

Mechanical Data

Polarity and Reversed Voltage
Aluminium Electrolytic capacitors manufactured for use in DC applications contain an anode foil and a cathode foil. As such, they are polarized devices and must be connected with the +ve to the anode foil and the -ve to the cathode foil. If this were to be reversed then the electrolytic process that took place in forming the oxide layer on the anode would be recreated in trying to form an oxide layer on the cathode. In forming the cathode foil in this way, heat would be generated and gas given off within the capacitor, usually leading to catastrophic failure.

The cathode foil already possesses a thin stabilized oxide layer. This thin oxide layer is equivalent to a forming voltage of approximately 2 V. As a result, the capacitor can withstand a voltage reversal of up to 2 V for short periods. Above this voltage, the formation process will commence. Aluminium Electrolytic capacitors can also be manufactured for use in intermittent AC applications by using two anode foils in place of one anode and one cathode.

Mounting Position
The capacitor can be mounted in any position as long as the safety vent can operate. It is possible for some electrolyte to be expelled. As this is a conducting liquid, suitable precautions should be initiated by the system designer to avoid secondary short circuits.
The capacitors are designed to be mounted in free air and are not suitable for submersion in liquid.

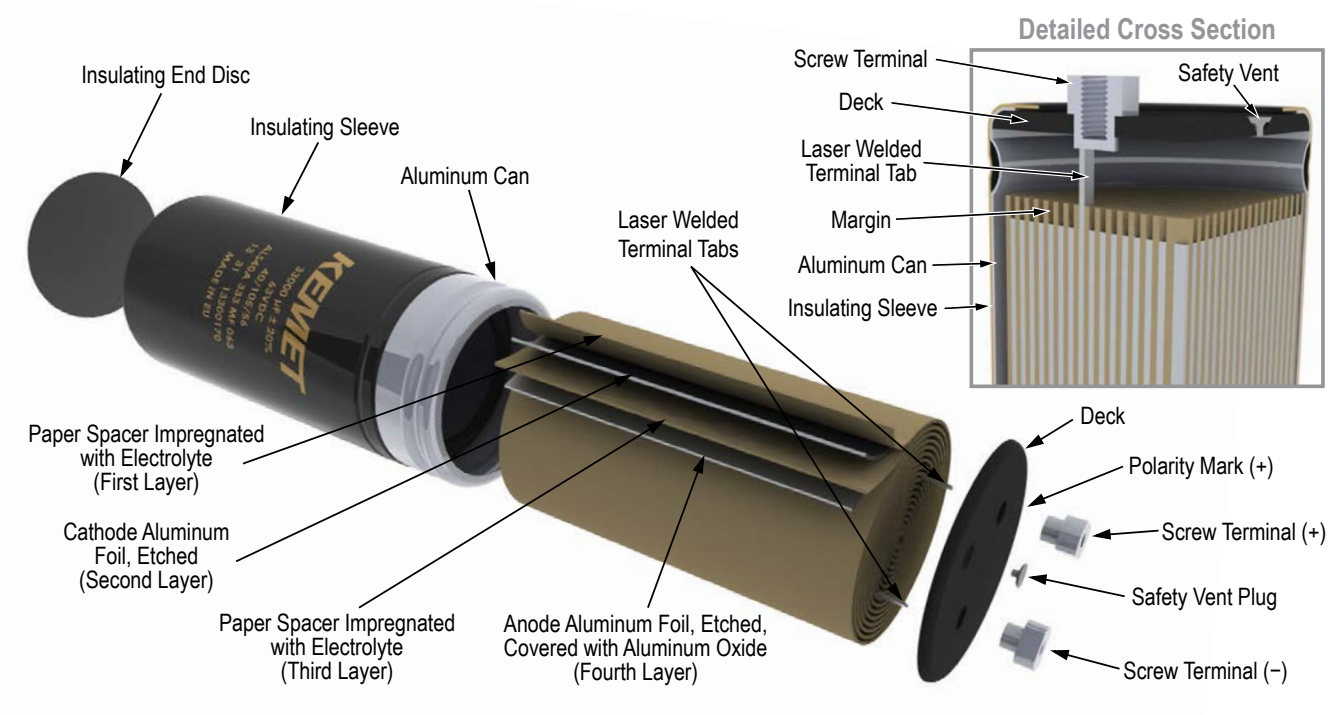
Insulating Resistance
≥ 100 MΩ at 100 VDC across insulating sleeve. UL recognized sleeving is available for custom parts in this range, upon request. (UL No. E358957)

Voltage Proof
≥ 2,500 VDC across insulating sleeve

Safety Vent
A safety vent for overpressure is featured on terminal deck. This is in the form of a rubber plug designed to relieve build-up of internal pressure due to overstress or catastrophic failure.

Marking

Construction



ALS42/43 Series, +105°C

Overview

KEMET's ALS42/43 Series of screw terminal capacitors features the same high ripple currents and long-life characteristics as the ALS32/33 Series but can operate at higher temperatures. They are similarly suited for high reliability and long-life applications such as frequency converters, uninterruptible power supply (UPS) systems, and switch mode power supplies (SMPS) but the extended temperature range allows increased ripple currents at lower temperatures.

Applications

Typical applications for KEMET's ALS 42/43 Series of capacitors include smoothing, energy storage or pulse operation in telecommunication demanding power supplies, process control, AC motor control, traction, and welding.

Benefits

- Case sizes and terminals for the Asian market
- Long life, up to 9,000 hours at +105°C (V_R, I_R applied)
- High ripple current
- Excellent surge voltage capability
- Optimized designs available upon request

Part Number System

ALS4	2	A	102	K3C	350
Series	Stud Option	Termination	Capacitance Code (µF)	Size Code	Rated Voltage (VDC)
Screw Terminal Aluminum Electrolytic	2 = Plain Can 3 = Threaded mounting stud	See Termination Table	First two digits represent significant figures. Third digit specifies number of zeros.	See Dimension Table	350 = 350 400 = 400 415 = 415 450 = 450

Performance Characteristics

Item	Performance Characteristics		
Capacitance Range	1,000 – 15,000 µF		
Rated Voltage	350 – 450 VDC		
Operating Temperature	-40 to +105°C		
Storage Temperature Range	-55 to +105°C		
Capacitance Tolerance	±20% at 120 Hz/+20°C		
Operational Lifetime	D (mm)	Rated Voltage and Ripple Current at +105°C (hours)	Rated Voltage at +105°C (hours)
	36	6,000	10,000
	51	7,000	11,000
	66	8,000	13,000
	77,90	9,000	15,000
End of Life Requirement	Δ C/C < ±10%, ESR < 2 x initial ESR value, IL < initial specified limit		
Shelf Life	2,000 hours at +85°C or 30,000 hours at +40°C 0 VDC		
Leakage Current	I = 0.003 CV or 6,000 (µA, whichever is smaller)		
	C = rated capacitance (µF), V = rated voltage (VDC). Voltage applied for 5 minutes at +20°C.		
Vibration Test Specifications		Procedure	Requirements
	Case Length < 220 mm	0.75 mm displacement amplitude or 10 g maximum acceleration. Vibration applied for three 2-hour sessions at 10 – 55 Hz (Capacitor clamped by body).	No leakage of electrolyte or other visible damage. Deviations in capacitance and tanδ from initial measurements must not exceed: Δ C/C < 5%
	Case Length ≥ 220 mm	0.35 mm displacement amplitude or 5 g maximum acceleration. Vibration applied for three 0.5 hour sessions at 10 – 55 Hz (Capacitor clamped by body).	
Standards	IEC 60384–4 long life grade 40/105/56		

Surge Voltage

Condition	Voltage (VDC)			
	350	400	415	450
≤ 30 s surge, 1,000 cycles at +85°C	400	450	456.5	500
≤ 500 ms surge, 100 cycles at +20°C	500	520	530	550

Test Method & Performance

Endurance Life Test	
Conditions	Performance
Temperature	+105°C
Test Duration	2,000 hours
Ripple Current	Maximum ripple current specified in table
Voltage	The sum of DC voltage and the peak AC voltage must not exceed the rated voltage of the capacitor
Performance	**The following specifications will be satisfied when the capacitor is tested at +20°C:**
Capacitance Change	Within 10% of the initial value
Equivalent Series Resistance	Does not exceed 200% of the initial value
Leakage Current	Does not exceed leakage current limit

Termination Table

Termination Code	Thread	Termination Style	T	DT	Thread Depth (TD)	Z
			± 0.8	± 0.5	Minimum	Nominal
Standard Termination Option						
A (D = 35)	M5	Oval	7.14	8	10	
A (D ≥ 51)	M5	Oval	5.5	13	10	10
Other Termination Options						
C (D ≥ 63.5)	M6	Round	5.5	13	10	
Dimensions in mm						

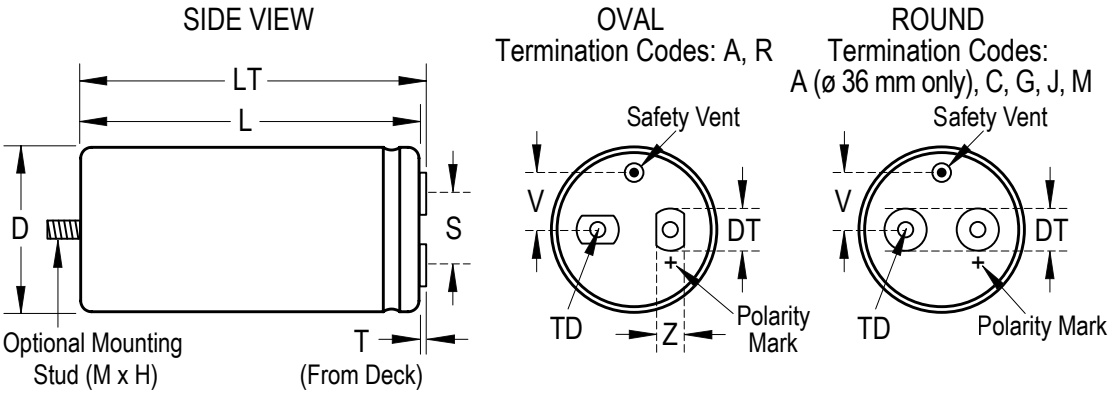
Case Polarity

Due to the presence of electrolyte in the capacitor, the aluminum can and stud mounting will essentially be at the same polarity as the negative terminal. We recommend that the stud and can be insulated (see accessories for insulating nuts).

Terminations

Aluminum inserts with M5 threads as standard, maximum torque 2NM. Optional M6 threaded inserts have a maximum torque 4NM. Maximum torque for stud mounting M8:4NM and M12:8NM.

Dimensions – Millimeters



Reference Size (mm)	Size Code	Dimensions in mm						Mounting Stud (M x H)	Mounting Clip	Approximate Weight Grams
		D	L	LT	S	T	V			
		±0.8	±1.6	±1	±0.5	±0.8	Nominal	±1		
51 x 80	K3C	50.8	79.4	86.0	22.2	5.5	13.7	M12 x 16	V4/2737	240
51 x 93	K3L	50.8	92.1	98.0	22.2	5.5	13.7	M12 x 16	V4/2737	275
51 x 115	KJA	50.8	114.3	119.0	22.2	5.5	13.7	M12 x 16	V4/2737	340
51 x 131	K5C	50.8	130.2	136.0	22.2	5.5	13.7	M12 x 16	V4/2737	385
63.5 x 93	L3L	63.5	92.1	97.0	28.5	5.5	15.8	M12 x 16	V8	430
63.5 x 115	LJA	63.5	114.3	119.0	28.5	5.5	15.8	M12 x 16	V8	535
63.5 x 131	L5C	63.5	130.2	135.0	28.5	5.5	15.8	M12 x 16	V8	600
63.5 x 150	L5R	63.5	149.2	154.0	28.5	5.5	15.8	M12 x 16	V8	690
63.5 x 194	L7L	63.5	193.7	198.0	28.5	5.5	15.8	M12 x 16	V8	890
77 x 115	NJA	76.2	114.3	119.0	31.8	5.5	19	M12 x 16	V11	770
77 x 131	N5C	76.2	130.2	135.0	31.8	5.5	19	M12 x 16	V11	865
77 x 150	N5R	76.2	149.2	154.0	31.8	5.5	19	M12 x 16	V11	990
77 x 194	N7L	76.2	193.7	198.0	31.8	5.5	19	M12 x 16	V11	1,280
90 x 150	Q5R	88.9	149.2	154.0	31.8	5.5	25	M12 x 16	V90	1,360
90 x 194	Q7L	88.9	193.7	198.0	31.8	5.5	25	M12 x 16	V90	1,870
90 x 220	Q8L	88.9	219.1	224.0	31.8	5.5	25	M12 x 16	V90	2,000

Note: Add 0.4 mm to D (1.1 mm when D = 88.9) and 1.1 mm to L for sleeving. LT listed is for A-type termination code. Information for other termination codes is available upon request.

Shelf Life

The capacitance, ESR and impedance of a capacitor will not change significantly after extended storage periods, however the leakage current will very slowly increase. KEMET products are particularly stable and allow a shelf life in excess of three years at 40°C. See sectional specification under each product series for specific data.

Re-age (Reforming) Procedure

Apply the rated voltage to the capacitor at room temperature for a period of one hour, or until the leakage current has fallen to a steady value below the specified limit. During re-aging a maximum charging current of twice the specified leakage current or 5 mA (whichever is greater) is suggested.

Reliability

The reliability of a component can be defined as the probability that it will perform satisfactorily under a given set of conditions for a given length of time.

In practice, it is impossible to predict with absolute certainty how any individual component will perform; thus, we must utilize probability theory. It is also necessary to clearly define the level of stress involved (e.g. operating voltage, ripple current, temperature and time). Finally, the meaning of satisfactory performance must be defined by specifying a set of conditions which determine the end of life of the component.

Reliability as a function of time, R(t), is normally expressed as: $R(t)=e^{-\lambda t}$
where R(t) is the probability that the component will perform satisfactorily for time t, and λ is the failure rate.

Failure Rate

The failure rate is the number of components failing per unit time. The failure rate of most electronic components follows the characteristic pattern:

- Early failures are removed during the manufacturing process.
- The operational life is characterized by a constant failure rate.
- The wear out period is characterized by a rapidly increasing failure rate.

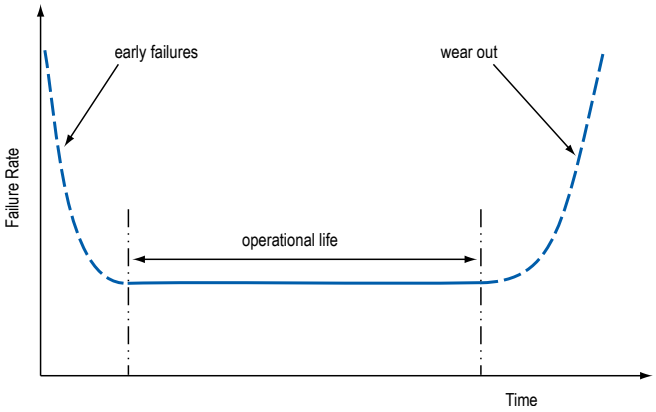
The failures in time (FIT) are given with a 60% confidence level for the various type codes. By convention, FIT is expressed as 1×10^{-9} failures per hour. Failure rate is also expressed as a percentage of failures per 1,000 hours.
e.g., 100 FIT = 1×10^{-7} failures per hour = 0.01%/1,000 hours

End of Life Definition
Catastrophic Failure: short circuit, open circuit or safety vent operation
Parametric Failure:

- Change in capacitance > ±10%
- Leakage current > specified limit
- ESR > 2 x initial ESR value

MTBF

The mean time between failures (MTBF) is simply the inverse of the failure rate.
MTBF= 1/λ



The failure rate is derived from our periodic test results. The failure rate (λ_R) is, therefore, only given at test temperature for life tests. An estimation is also given at 40°C. The expected failure rate for this capacitor range is based on our periodic test results for capacitors with structural similarity. Failure rate is frequently quoted in FIT (Failures In Time) where 1 FIT = 1 x 10^{-9} failures per hour. Failure rate per hour includes both catastrophic and parametric failures.

T_a	Failure Rate per Hour
85°C	220 FIT
40°C	10 FIT

Environmental Compliance

As an environmentally conscious company, KEMET is working continuously with improvements concerning the environmental effects of both our capacitors and their production. 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, such as lead (Pb), in electronic equipment. All products in this catalog are produced to help our customers' obligations to guarantee their products and 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 such as 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 such as LF = Lead Free or LFW = Lead Free Wires on the label.

Table 1 – Ratings & Part Number Reference

VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR Maximum		Part Number
	120 Hz 25°C (µF)		D x L (mm)	120 Hz 105°C (A)	20 kHz 105°C (A)	120 Hz 25°C (mΩ)	20 kHz 25°C (mΩ)	
350	1000	K3C	51 x 80	5.0	9.9	121	78	ALS4(1)(2)102K3C350
350	1200	K3C	51 x 80	5.3	10.1	103	67	ALS4(1)(2)122K3C350
350	1500	K3L	51 x 93	6.2	11.3	81	53	ALS4(1)(2)152K3L350
350	1800	K3L	51 x 93	6.6	11.2	70	46	ALS4(1)(2)182K3L350
350	2200	K5C	51 x 131	8.3	14.8	58	38	ALS4(1)(2)222K5C350
350	2700	L3L	63.5 x 93	9.6	16.5	48	32	ALS4(1)(2)272L3L350
350	3300	LJA	63.5 x 115	11.2	18.9	39	26	ALS4(1)(2)332LJA350
350	3900	L5C	63.5 x 131	12.5	19.7	36	25	ALS4(1)(2)392L5C350
350	4700	L5R	63.5 x 150	13.5	20.8	31	22	ALS4(1)(2)472L5R350
350	4700	NJA	77 x 115	13.5	20	30	21	ALS4(1)(2)472NJA350
350	5600	L7L	63.5 x 194	14.9	23.4	24	17	ALS4(1)(2)562L7L350
350	5600	N5C	77 x 131	15.0	20.8	28	21	ALS4(1)(2)562N5C350
350	6800	N5R	77 x 150	16.5	22.5	24	18	ALS4(1)(2)682N5R350
350	8200	Q5R	90 x 150	20.9	29.5	18	13	ALS4(1)(2)822Q5R350
350	10000	Q5R	90 x 150	21.5	28.4	16	12	ALS4(1)(2)103Q5R350
350	12000	Q7L	90 x 194	26.5	35.9	14	10	ALS4(1)(2)123Q7L350
350	15000	Q8L	90 x 220	31.8	41.3	12	9	ALS4(1)(2)153Q8L350
400	1000	K3C	51 x 80	5.2	10.1	103	65	ALS4(1)(2)102K3C400
400	1200	K3L	51 x 93	5.9	11.2	87	55	ALS4(1)(2)122K3L400
400	1500	KJA	51 x115	7.1	13.4	70	44	ALS4(1)(2)152KJA400
400	1800	K5C	51 x 131	8.0	14.8	59	37	ALS4(1)(2)182K5C400
400	2200	L3L	63.5 x 93	9.3	16.4	49	31	ALS4(1)(2)222L3L400
400	2700	LJA	63.5 x 115	10.8	18.9	40	26	ALS4(1)(2)272LJA400
400	3300	L5C	63.5 x 131	12.3	20.0	33	22	ALS4(1)(2)332L5C400
400	3900	L5R	63.5 x 150	13.1	20.7	31	21	ALS4(1)(2)392L5R400
400	3900	NJA	77 x 115	13.1	19.9	31	21	ALS4(1)(2)392NJA400
400	4700	L7L	63.5 x 194	14.4	23.1	25	17	ALS4(1)(2)472L7L400
400	4700	N5C	77 x 131	14.6	20.6	29	20	ALS4(1)(2)472N5C400
400	5600	L7L	63.5 x 194	15.2	23.0	22	15	ALS4(1)(2)562L7L400
400	5600	N5R	77 x 150	16.1	22.3	24	17	ALS4(1)(2)562N5R400
400	6800	Q5R	90 x 150	20.4	29.3	18	12	ALS4(1)(2)682Q5R400
400	8200	Q5R	90 x 150	20.9	28.1	16	12	ALS4(1)(2)822Q5R400
400	10000	Q7L	90 x 194	25.9	35.8	14	10	ALS4(1)(2)103Q7L400
400	12000	Q8L	90 x 220	30.9	41.2	12	9	ALS4(1)(2)123Q8L400
415	1000	K3C	51 x 80	5.3	10.1	98	61	ALS4(1)(2)102K3C415
415	1200	K3L	51 x 93	6.0	10.9	87	57	ALS4(1)(2)122K3L415
415	1500	KJA	51 x 115	7.2	13.5	66	42	ALS4(1)(2)152KJA415
415	1800	K5C	51 x 131	8.2	14.8	56	35	ALS4(1)(2)182K5C415
415	2200	L3L	63.5 x 93	9.4	16.1	49	32	ALS4(1)(2)222L3L415
415	2700	LJA	63.5 x 115	11.0	18.6	40	27	ALS4(1)(2)272LJA415
415	3900	L5R	63.5 x 150	13.7	22.1	29	19	ALS4(1)(2)392L5R415
415	3900	NJA	77 x 115	13.2	19.5	31	21	ALS4(1)(2)392NJA415
415	4700	N5C	77 x 131	14.6	20.6	29	20	ALS4(1)(2)472N5C415
415	4700	L7L	63.5 x 194	14.7	23.1	24	16	ALS4(1)(2)472L7L415
415	5600	L7L	63.5 x 194	15.4	22.9	21	15	ALS4(1)(2)562L7L415
415	5600	N5R	77 x 150	16.1	22.3	24	17	ALS4(1)(2)562N5R415
415	6800	Q5R	90 x 150	20.4	29.3	18	12	ALS4(1)(2)682Q5R415
415	8200	Q5R	90 x 150	20.9	28.1	16	12	ALS4(1)(2)822Q5R415
415	10000	Q7L	90 x 194	25.9	35.8	14	10	ALS4(1)(2)103Q7L415
415	12000	Q8L	90 x 220	30.9	41.2	12	9	ALS4(1)(2)123Q8L415
450	1000	K3L	51 x 93	5.8	11.2	89	54	ALS4(1)(2)102K3L450
450	1200	KJA	51 x 115	6.8	13.4	73	44	ALS4(1)(2)122KJA450
450	1500	K5C	51 x 131	7.8	14.8	60	37	ALS4(1)(2)152K5C450
450	1800	L3L	63.5 x 93	9.0	16.4	51	31	ALS4(1)(2)182L3L450
450	2200	LJA	63.5 x 115	10.5	18.9	42	26	ALS4(1)(2)222LJA450
450	2700	L5C	63.5 x 131	12.2	21.5	34	21	ALS4(1)(2)272L5C450
450	2700	NJA	77 x 115	12.3	20.3	36	23	ALS4(1)(2)272NJA450
VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR		Part Number

(1) Mounting Code: 2 = plain can, 3 = threaded mounting stud

(2) Termination Code: See Termination Tables for available options

Table 1 – Ratings & Part Number Reference cont'd

VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR Maximum		Part Number
	120 Hz 25°C (µF)		D x L (mm)	120 Hz 105°C (A)	20 kHz 105°C (A)	120 Hz 25°C (mΩ)	20 kHz 25°C (mΩ)	
450	3300	L5R	63.5 x 150	13.2	22.1	30	20	ALS4(1)(2)332L5R450
450	3300	N5C	77 x 131	14.0	21.4	31	20	ALS4(1)(2)332N5C450
450	3900	L7L	63.5 x 194	14.2	23.3	25	16	ALS4(1)(2)392L7L450
450	4700	N5R	77 x 150	15.8	22.2	25	17	ALS4(1)(2)472N5R450
450	5600	N7L	77 x 194	19.5	28.3	19	13	ALS4(1)(2)562N7L450
450	5600	Q5R	90 x 150	19.8	28.8	20	14	ALS4(1)(2)562Q5R450
450	6800	Q7L	90 x 194	24.3	36.2	16	11	ALS4(1)(2)682Q7L450
450	8200	Q7L	90 x 194	25.4	35.7	14	10	ALS4(1)(2)822Q7L450
450	10000	Q8L	90 x 220	30.4	41.2	12	9	ALS4(1)(2)103Q8L450
VDC	Rated Capacitance	Size Code	Case Size	Ripple Current		ESR		Part Number

(1) Mounting Code: 2 = plain can, 3 = threaded mounting stud

(2) Termination Code: See Termination Tables for available options

Mechanical Data

Polarity and Reversed Voltage
Aluminium Electrolytic capacitors manufactured for use in DC applications contain an anode foil and a cathode foil. As such, they are polarized devices and must be connected with the +ve to the anode foil and the -ve to the cathode foil. If this were to be reversed then the electrolytic process that took place in forming the oxide layer on the anode would be recreated in trying to form an oxide layer on the cathode. In forming the cathode foil in this way, heat would be generated and gas given off within the capacitor, usually leading to catastrophic failure.

The cathode foil already possesses a thin stabilized oxide layer. This thin oxide layer is equivalent to a forming voltage of approximately 2 V. As a result, the capacitor can withstand a voltage reversal of up to 2 V for short periods. Above this voltage, the formation process will commence. Aluminium Electrolytic capacitors can also be manufactured for use in intermittent AC applications by using two anode foils in place of one anode and one cathode.

Mounting Position
The capacitor can be mounted in any position as long as the safety vent can operate. It is possible for some electrolyte to be expelled. As this is a conducting liquid, suitable precautions should be initiated by the system designer to avoid secondary short circuits. The capacitors are designed to be mounted in free air and are not suitable for submersion in liquid.

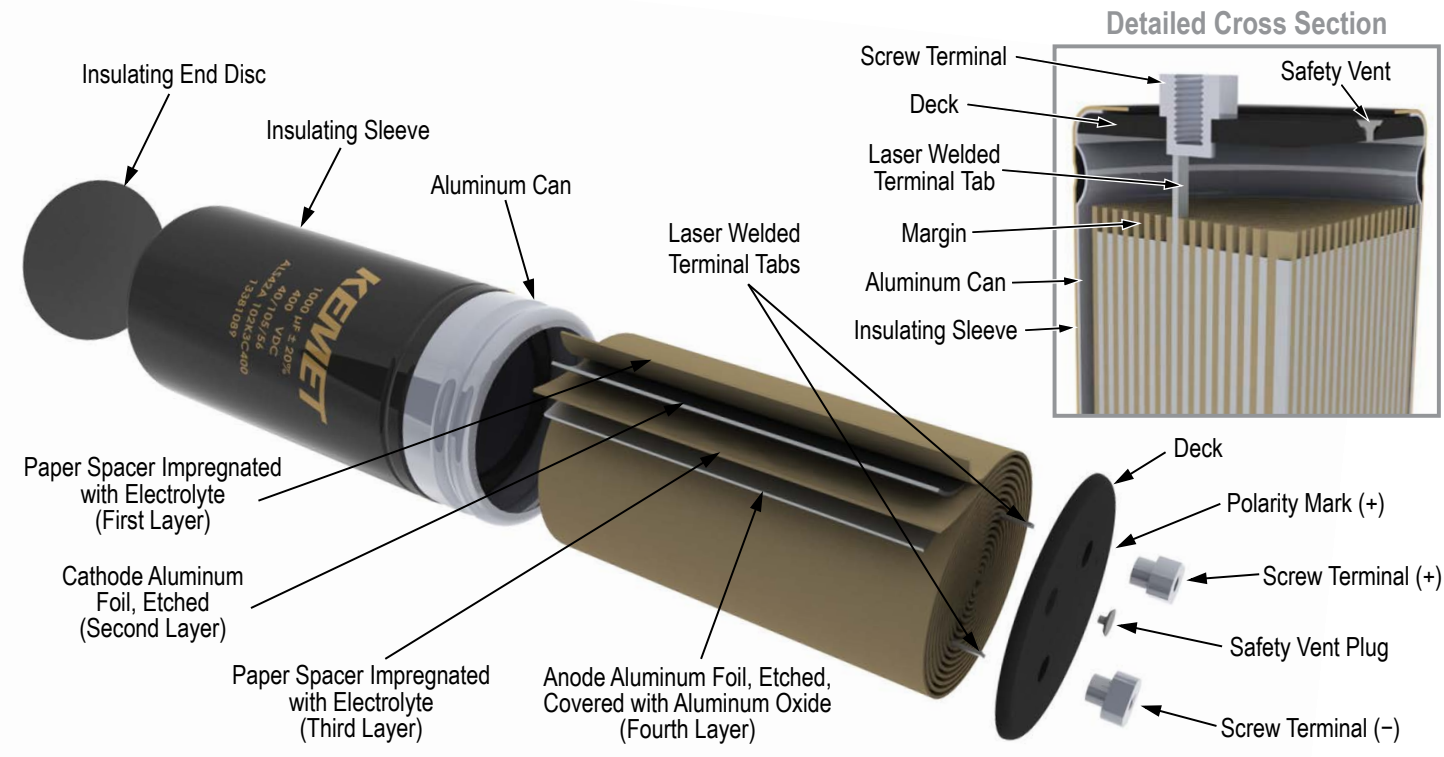
Vibration
10 – 55 Hz at 0.75 mm or 10 g for 3 x 2 hours duration, except 220 mm long cans 10 – 55 Hz at 0.35 mm or 5 g for 3 x 0.5 hours duration. Custom designs can be made in a 66 mm diameter (M6 deck), with a vibration capability of 20 g (10 – 56 Hz at 0.75 mm and 56 – 500 Hz 20 g for 3 x 0.5 hours duration).

Insulating Resistance
≥ 100 MΩ at 100 VDC across insulating sleeve. UL recognized sleeving is available for custom parts in this range, upon request. (UL No. E358957)

Voltage Proof
≥ 2,500 VDC across insulating sleeve

Safety Vent
A safety vent for overpressure is featured on terminal deck. This is in the form of a rubber plug designed to relieve build-up of internal pressure due to overstress or catastrophic failure.

Construction



Marking

PEH169 Series, +105°C

Overview

KEMET's PEH169 Series is a long-life electrolytic capacitor with outstanding reliability and electrical performance. The device has a polarized all-welded design, heavy duty screw terminals, extended cathode construction, safety vent, and plastic insulation. The PEH169 Series winding is housed in a cylindrical aluminum can with a reinforced molded lid incorporating a safety vent. The sealing system is designed for electrolyte leakage-free operation and a very low gas-diffusion rate of electrolyte. Mechanical contact between the winding and case allows excellent heat transfer from the winding to the ambient, which means cooler operation. Low ESR is the result of a low resistive paper/electrolyte system, at least two tabs per foil and all-welded design.

Applications

Typical applications for KEMET's PEH169 capacitor include smoothing, energy storage or pulse operation in telecommunication demanding power supplies, process control, AC motor control, traction, welding, and measuring.

Benefits

- High performance
- Long life, up to 18,000 hours at +105ºC (V_R, I_R applied)
- Low ESR and ESL
- High stability, 10 years shelf life
- Optimized designs available on request

Part Number System

PEH169	E		A	468	0	Q	U2
Series	Rated Voltage (VDC)		Size Code	Capacitance Code (µF)	Version	Capacitance Tolerance	Stud Option
Screw Terminal Aluminum Electrolytic	E = 10 G = 16 H = 25 K = 40 M = 63	P = 100 Q = 160 R = 200 S = 250 U = 350	See Dimension Table	The last two digits represent significant figures. The first digit specifies the total number of digits.	0 = Standard	Q = -10 +30%	U2 = Plain Can B2 = Threaded mounting stud

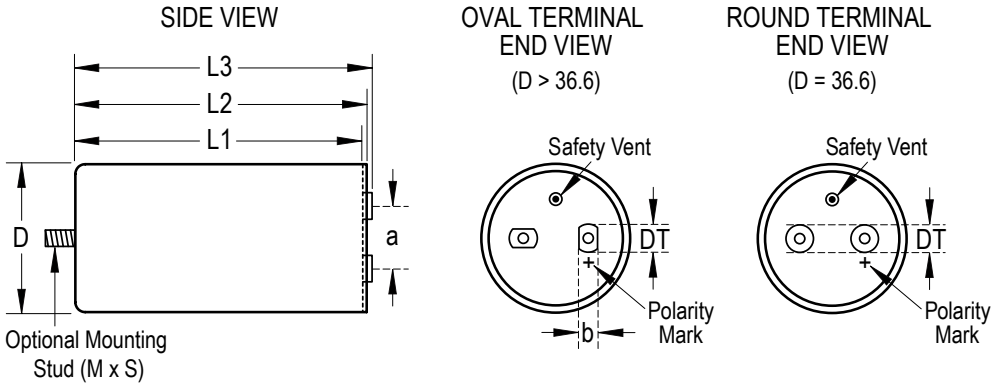
Performance Characteristics

Item	Performance Characteristics		
Capacitance Range	100 – 330,000 µF		
Rated Voltage	10 – 350 VDC		
Operating Temperature	-40 to +105°C		
Capacitance Tolerance	-10/+30% at 100 Hz / +20°C		
Operational Lifetime	D (mm)	Rated Voltage and Ripple Current at +105°C (hours)	Rated Voltage at +105°C (hours)
	35	7,000	
	50	8,000	
	65	10,000	
	75	13,000	
	90	18,000	25,000
Shelf Life	5,000 hours at +105°C or 10 years at +40°C 0 VDC		
Leakage Current	I = 0.003 CV + 4,000 (µA)		
	C = rated capacitance (µF), V = rated voltage (VDC). Voltage applied for 5 minutes at +20°C.		
Vibration Test Specifications		Procedure	Requirements
	D ≤ 50 mm	0.75 mm displacement amplitude or 10 g maximum acceleration. Vibration applied for three 2-hour sessions at 10 – 500 Hz (Capacitor clamped by body).	No leakage of electrolyte or other visible damage. Deviations in capacitance and tanδ from initial measurements must not exceed: Δ C/C < 5%
	D > 50 mm	0.75 mm displacement amplitude or 10 g maximum acceleration. Vibration applied for three 2-hour sessions at 10 – 55 Hz (Capacitor clamped by body).	
Standards	IEC 60384–4 long life grade 40/105/56, DIN 41240 type 1A CECC 30300, DIN 40040 GPF, DIN 41248		
CECC	CECC 30301-058, corresponding to CECC 30301-803		

Test Method & Performance

Endurance Life Test		
Conditions	Performance	
Temperature	+105°C	
Test Duration	2,000 hours	
Ripple Current	Maximum ripple current specified in table	
Voltage	The sum of DC voltage and the peak AC voltage must not exceed the rated voltage of the capacitor	
Performance	**The following specifications will be satisfied when the capacitor is tested at +20°C:**	
Capacitance Change	≤ 160 V	Within 15% of the initial value
	> 160 V	Within 10% of the initial value
Equivalent Series Resistance	Does not exceed 200% of the initial value	
Leakage Current	Does not exceed leakage current limit	

Dimensions – Millimeters



Reference Size (mm)	Size Code	Dimensions in mm					Mounting Stud (M x S)	Approximate Weight Grams
		D	L1	L2	L3	a		
		±1.0	±1.0	±1.0	±1.0	±0.5	Nominal	
35 x 51	A	36.6	51.5	54.5	58.9	13.0	M8 x 12	70
35 x 60	B	36.6	59.5	62.5	66.9	13.0	M8 x 12	85
35 x 75	C	36.6	73.5	76.5	80.9	13.0	M8 x 12	105
35 x 95	D	36.6	94.5	97.5	101.9	13.0	M8 x 12	130
50 x 75	H	51.6	74.5	77.5	82.4	22.0	M12 x 16	180
50 x 95	J	51.6	95.5	98.5	103.4	22.0	M12 x 16	240
50 x 105	K	51.6	103.5	106.5	111.4	22.0	M12 x 16	265
50 x 115	I*	51.6	115.5	118.5	123.4	22.0	M12 x 16	300
65 x 105	O	66.6	106.0	109.2	113.0	28.5	M12 x 16	415
65 x 115	Q*	66.6	118.0	121.2	125.0	28.5	M12 x 16	460.0
65 x 130	S*	66.6	129.0	132.2	136.0	28.5	M12 x 16	520.0
75 x 78	L	76.6	77.0	80.2	84.0	32.0	M12 x 16	430.0
75 x 98	P*	76.6	98.0	101.2	105.0	32.0	M12 x 16	530
75 x 105	T	76.6	106.0	109.2	113.0	32.0	M12 x 16	585
75 x 115	U	76.6	118.0	121.2	125.0	32.0	M12 x 16	640
75 x 145	V	76.6	146.0	149.2	153.0	32.0	M12 x 16	800
75 x 220	X	76.6	221.0	224.2	228.0	32.0	M12 x 16	1400
90 x 145	Y	91.6	145.5	148.7	152.4	32.0	M12 x 16	1400

Note: Dimensions include sleeving
Additional case sizes available on request

Termination Table

Reference Diameter	Thread	Termination Style	Dimensions in mm	
			DT	b
35	M5	Round	8	
50	M5	Oval	15	13
65	M5	Oval	15	13
75	M5	Oval	15	13
90	M5	Oval	15	13

Note: M6 and other termination options available on request

Shelf Life

The capacitance, ESR and impedance of a capacitor will not change significantly after extended storage periods, however the leakage current will very slowly increase. KEMET products are particularly stable and allow a shelf life in excess of three years at 40°C. See sectional specification under each product series for specific data.

Re-age (Reforming) Procedure

Apply the rated voltage to the capacitor at room temperature for a period of one hour, or until the leakage current has fallen to a steady value below the specified limit. During re-aging a maximum charging current of twice the specified leakage current or 5 mA (whichever is greater) is suggested.

Reliability

The reliability of a component can be defined as the probability that it will perform satisfactorily under a given set of conditions for a given length of time.

In practice, it is impossible to predict with absolute certainty how any individual component will perform; thus, we must utilize probability theory. It is also necessary to clearly define the level of stress involved (e.g. operating voltage, ripple current, temperature and time). Finally, the meaning of satisfactory performance must be defined by specifying a set of conditions which determine the end of life of the component.

Reliability as a function of time, R(t), is normally expressed as: $R(t)=e^{-\lambda t}$
where R(t) is the probability that the component will perform satisfactorily for time t, and λ is the failure rate.

Failure Rate

The failure rate is the number of components failing per unit time. The failure rate of most electronic components follows the characteristic pattern:

- Early failures are removed during the manufacturing process.
- The operational life is characterized by a constant failure rate.
- The wear out period is characterized by a rapidly increasing failure rate.

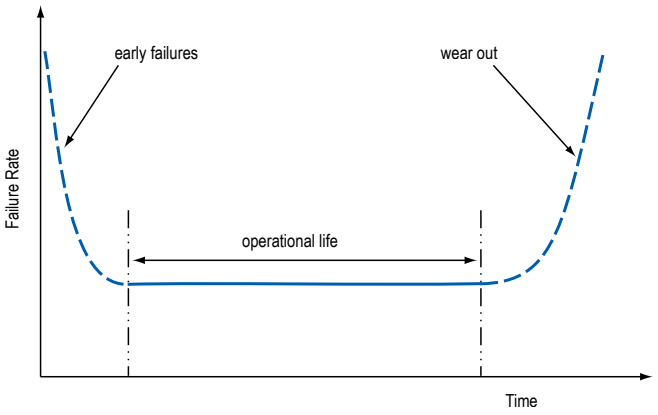
The failures in time (FIT) are given with a 60% confidence level for the various type codes. By convention, FIT is expressed as 1×10^{-9} failures per hour. Failure rate is also expressed as a percentage of failures per 1,000 hours.
e.g., 100 FIT = 1×10^{-7} failures per hour = 0.01%/1,000 hours

End of Life Definition
Catastrophic Failure: short circuit, open circuit or safety vent operation
Parametric Failure:

- Change in capacitance > ±10%
- Leakage current > specified limit
- ESR > 2 x initial ESR value

MTBF

The mean time between failures (MTBF) is simply the inverse of the failure rate.
MTBF= 1/λ



The failure rate is derived from our periodic test results. The failure rate (λ_R) is, therefore, only given at test temperature for life tests. An estimation is also given at 60°C.

The expected failure rate for this capacitor range is based on our periodic test results for capacitors with structural similarity.

T_a	Failure Rate per Hour
60°C	100 FIT

Failure rate per hour includes both catastrophic and parametric failures.

Environmental Compliance

As an environmentally conscious company, KEMET is working continuously with improvements concerning the environmental effects of both our capacitors and their production. 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, such as lead (Pb), in electronic equipment. All products in this catalog are produced to help our customers' obligations to guarantee their products and 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 such as 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 such as LF = Lead Free or LFW = Lead Free Wires on the label.

Table 1 – Ratings & Part Number Reference

VDC	Rated Capacitance	Size Code	Reference Size	Ripple Current Maximum			ESR Maximum		L_{ESL}	Part Number
	100 Hz 20°C (µF)		D x L (mm)	100 Hz 105°C (A)	10 kHz 50°C (A)[2]	10 kHz 40°C (A)	100 Hz 20°C (mΩ)	100 kHz 20°C (mΩ)	Approximate (nH)	
10	6800	A	35 x 51	5.2	21.8	15.4	46	37	12	PEH169EA4680Q(1)
10	10000	A	35 x 51	6.2	26.3	17.5	33	27	12	PEH169EA5100Q(1)
10	15000	B	35 x 60	7.4	28.9	20.5	23	19	12	PEH169EB5150Q(1)
10	22000	C	35 x 75	8.8	34.8	24.3	17	14	12	PEH169EC5220Q(1)
10	33000	D	35 x 95	10.4	38.3	28.0	12	10	12	PEH169ED5330Q(1)
10	47000	H	50 x 75	11.0	42.9	30.0	12	10	16	PEH169EH5470Q(1)
10	68000	J	50 x 95	13.5	51.8	34.1	9	8	16	PEH169EJ5680Q(1)
10	100000	K	50 x 105	14.0	48.5	35.0	8	7	16	PEH169EK6100Q(1)
10	150000	O	65 x 105	14.7	47.6	35.5	9	8	16	PEH169EO6150Q(1)
10	220000	T	75 x 105	19.4	62.8	46.7	6	5	17	PEH169ET6220Q(1)
10	330000	V	75 x 145	22.5	70.7	54.6	4	4	17	PEH169EV6330Q(1)
16	6800	A	35 x 51	5.5	25.5	16.7	36	28	12	PEH169GA4680Q(1)
16	10000	A	35 x 51	6.4	28.0	18.9	27	21	12	PEH169GA5100Q(1)
16	15000	C	35 x 75	8.3	34.3	24.6	18	14	12	PEH169GC5150Q(1)
16	22000	D	35 x 95	9.7	38.6	28.5	13	10	12	PEH169GD5220Q(1)
16	33000	H	50 x 75	11.7	43.0	31.0	12	10	16	PEH169GH5330Q(1)
16	47000	J	50 x 95	13.2	46.2	34.5	9	8	16	PEH169GJ5470Q(1)
16	68000	O	65 x 105	14.4	47.7	36.2	9	8	16	PEH169GO5680Q(1)
16	100000	T	75 x 105	21.6	70.9	54.7	6	5	17	PEH169GT6100Q(1)
16	150000	U	75 x 115	19.8	67.3	50.0	5	5	17	PEH169GU6150Q(1)
16	220000	V	75 x 145	23.6	74.7	58.0	4	4	17	PEH169GV6220Q(1)
25	4700	A	35 x 51	4.9	24.1	16.5	41	29	12	PEH169HA4470Q(1)
25	6800	A	35 x 51	5.8	27.7	18.5	30	22	12	PEH169HA4680Q(1)
25	10000	C	35 x 75	7.1	31.2	22.8	20	15	12	PEH169HC5100Q(1)
25	15000	D	35 x 95	8.7	36.8	27.2	15	11	12	PEH169HD5150Q(1)
25	22000	H	50 x 75	11.0	42.9	30.9	13	10	16	PEH169HH5220Q(1)
25	33000	J	50 x 95	12.6	46.5	34.6	10	8	16	PEH169HJ5330Q(1)
25	47000	O	65 x 105	15.8	53.7	42.1	8	7	16	PEH169HO5470Q(1)
25	68000	T	75 x 105	20.2	68.1	51.9	6	6	17	PEH169HT5680Q(1)
25	100000	U	75 x 115	21.9	70.3	55.4	5	5	17	PEH169HU6100Q(1)
25	150000	V	75 x 145	22.1	71.4	55.3	4	4	17	PEH169HV6150Q(1)
40	3300	A	35 x 51	4.6	26.3	17.6	41	25	12	PEH169KA4330Q(1)
40	4700	B	35 x 60	5.6	29.6	20.5	30	19	12	PEH169KB4470Q(1)
40	6800	C	35 x 75	6.7	32.6	23.6	22	14	12	PEH169KC4680Q(1)
40	10000	D	35 x 95	7.8	34.8	26.8	16	11	12	PEH169KD5100Q(1)
40	15000	H	50 x 75	10.2	42.9	30.5	14	10	16	PEH169KH5150Q(1)
40	22000	J	50 x 95	11.9	46.5	34.8	10	8	16	PEH169KJ5220Q(1)
40	33000	O	65 x 105	15.0	53.8	41.4	8	7	16	PEH169KO5330Q(1)
40	47000	T	75 x 105	19.9	69.5	55.0	6	5	17	PEH169KT5470Q(1)
40	68000	U	75 x 115	20.6	70.7	53.9	6	5	17	PEH169KU5680Q(1)
40	100000	V	75 x 145	23.0	71.0	59.0	4	4	17	PEH169KV6100Q(1)
63	1500	A	35 x 51	3.5	23.1	15.9	63	31	12	PEH169MA4150Q(1)
63	2200	A	35 x 51	4.1	27.0	18.1	46	23	12	PEH169MA4220Q(1)
63	3300	C	35 x 75	5.3	31.6	22.9	30	15	12	PEH169MC4330Q(1)
63	4700	D	35 x 95	6.2	34.2	25.9	22	11	12	PEH169MD4470Q(1)
63	6800	H	50 x 75	8.5	42.6	30.8	18	10	16	PEH169MH4680Q(1)
63	10000	J	50 x 95	9.9	45.3	34.2	13	8	16	PEH169MJ5100Q(1)
63	15000	O	65 x 105	13.1	53.0	41.1	10	6	16	PEH169MO5150Q(1)
63	22000	T	75 x 105	17.7	73.0	55.8	6	4	17	PEH169MT5220Q(1)
63	33000	U	75 x 115	18.9	71.0	54.3	6	5	17	PEH169MU5330Q(1)
63	47000	V	75 x 145	20.9	73.0	58.0	5	4	17	PEH169MV5470Q(1)
100	680	A	35 x 51	2.4	14.4	9.9	160	95	12	PEH169PA3680Q(1)
100	1000	A	35 x 51	2.9	17.4	11.7	110	67	12	PEH169PA4100Q(1)
100	1500	C	35 x 75	3.6	20.5	14.9	73	44	12	PEH169PC4150Q(1)
100	2200	D	35 x 95	4.3	23.2	17.6	50	31	12	PEH169PD4220Q(1)
100	3300	H	50 x 75	6.4	33.8	23.8	30	23	16	PEH169PH4330Q(1)
100	4700	J	50 x 95	7.7	37.1	27.6	26	17	16	PEH169PJ4470Q(1)
100	6800	O	65 x 105	10.4	46.4	35.5	18	12	16	PEH169PO4680Q(1)
VDC	Rated Capacitance	Size Code	Reference Size	Ripple Current			ESR		L_{ESL}	Part Number

(1) Mounting Code: U2 = plain can, B2 = threaded mounting stud

[2] *2 m/s forced air, studmounted on 3°C/W aluminum chassis.*

Table 1 – Ratings & Part Number Reference cont'd

VDC	Rated Capacitance	Size Code	Reference Size	Ripple Current Maximum			ESR Maximum		L_{ESL}	Part Number
	100 Hz 20°C (µF)		D x L (mm)	100 Hz 105°C (A)	10 kHz 50°C (A)[2]	10 kHz 40°C (A)	100 Hz 20°C (mΩ)	100 kHz 20°C (mΩ)	Approximate (nH)	
100	10000	O	65 x 105	11.7	49.1	36.6	14	10	16	PEH169PO5100Q(1)
100	15000	U	75 x 115	16.0	67.5	51.1	9	6	17	PEH169PU5150Q(1)
100	22000	V	75 x 145	18.2	70.6	55.3	7	5	17	PEH169PV5220Q(1)
160	330	A	35 x 51	1.4	9.6	6.6	400	210	12	PEH169QA3330Q(1)
160	470	A	35 x 51	1.7	11.2	7.6	290	160	12	PEH169QA3470Q(1)
160	680	C	35 x 75	2.1	13.8	10.3	190	100	12	PEH169QC3680Q(1)
160	1000	D	35 x 95	2.6	15.7	12.3	130	70	12	PEH169QD4100Q(1)
160	1500	H	50 x 75	3.8	22.1	16.2	93	51	16	PEH169QH4150Q(1)
160	2200	J	50 x 95	4.7	25.4	19.6	64	36	16	PEH169QJ4220Q(1)
160	3300	O	65 x 105	6.5	32.0	25.0	45	26	16	PEH169QO4330Q(1)
160	4700	T	75 x 105	8.7	48.1	36.9	26	13	17	PEH169QT4470Q(1)
160	6800	U	75 x 115	10.2	50.9	39.6	19	10	17	PEH169QU4680Q(1)
160	10000	V	75 x 145	11.9	55.7	43.2	14	8	17	PEH169QV5100Q(1)
200	330	A	35 x 51	1.5	8.1	5.6	480	300	12	PEH169RA3330Q(1)
200	470	B	35 x 60	1.8	9.7	6.9	340	210	12	PEH169RB3470Q(1)
200	680	D	35 x 95	2.2	10.0	7.9	250	160	12	PEH169RD3680Q(1)
200	1000	H	50 x 75	3.3	15.5	11.4	170	110	16	PEH169RH4100Q(1)
200	1500	J	50 x 95	4.0	18.0	14.0	120	76	16	PEH169RJ4150Q(1)
200	2200	K	50 x 105	4.9	23.1	17.2	76	49	16	PEH169RK4220Q(1)
200	3300	O	65 x 105	6.7	28.8	22.0	55	37	16	PEH169RO4330Q(1)
200	4700	T	75 x 105	8.6	41.6	31.1	33	20	17	PEH169RT4470Q(1)
200	6800	V	75 x 145	10.1	45.2	35.2	24	16	17	PEH169RV4680Q(1)
250	150	A	35 x 51	1.0	7.0	4.9	730	370	12	PEH169SA3150Q(1)
250	220	A	35 x 51	1.3	8.9	6.0	500	250	12	PEH169SA3220Q(1)
250	330	B	35 x 60	1.6	11.0	7.7	320	160	12	PEH169SB3330Q(1)
250	470	C	35 x 75	2.0	11.7	8.9	240	130	12	PEH169SC3470Q(1)
250	680	H	50 x 75	2.9	17.2	12.6	170	90	16	PEH169SH3680Q(1)
250	1000	H	50 x 75	3.5	21.0	15.5	110	58	16	PEH169SH4100Q(1)
250	1500	K	50 x 105	4.2	24.1	17.9	79	43	16	PEH169SK4150Q(1)
250	2200	O	65 x 105	5.8	25.8	23.6	56	32	16	PEH169SO4220Q(1)
250	3300	T	75 x 105	7.9	41.5	31.5	36	20	17	PEH169ST4330Q(1)
250	4700	V	75 x 145	9.2	46.6	37.8	26	14	17	PEH169SV4470Q(1)
250	6800	X	75 x 220	9.4	42.6	36.8	19	12	17	PEH169SX4680Q(1)
250	6800	Y	90 x 145	11.9	53.5	43.5	20	12	16	PEH169SY4680Q(1)
350	100	A	35 x 51	1.0	6.7	4.6	810	410	12	PEH169UA3100Q(1)
350	150	A	35 x 51	1.3	8.8	6.1	520	250	12	PEH169UA3150Q(1)
350	220	C	35 x 75	1.5	10.1	7.3	360	180	12	PEH169UC3220Q(1)
350	330	D	35 x 95	1.9	11.8	9.1	250	120	12	PEH169UD3330Q(1)
350	470	H	50 x 75	2.7	17.1	12.3	180	91	16	PEH169UH3470Q(1)
350	680	J	50 x 95	3.3	19.9	14.8	120	64	16	PEH169UJ3680Q(1)
350	1000	K	50 x 105	4.1	24.3	18.0	82	42	16	PEH169UK4100Q(1)
350	1500	O	65 x 105	5.5	30.6	23.5	60	33	16	PEH169UO4150Q(1)
350	2200	T	75 x 105	7.5	42.6	32.6	39	20	17	PEH169UT4220Q(1)
350	3300	V	75 x 145	9.0	44.1	38.0	26	14	17	PEH169UV4330Q(1)
350	4700	X	75 x 220	9.4	41.4	35.9	22	13	17	PEH169UX4470Q(1)
350	4700	Y	90 x 145	11.6	50.8	41.7	23	14	16	PEH169UY4470Q(1)
VDC	Rated Capacitance	Size Code	Reference Size	Ripple Current			ESR		L_{ESL}	Part Number

(1) Mounting Code: U2 = plain can, B2 = threaded mounting stud

[2] *2 m/s forced air, studmounted on 3°C/W aluminum chassis.*

Mechanical Data

Polarity and Reversed Voltage
Aluminium Electrolytic capacitors manufactured for use in DC applications contain an anode foil and a cathode foil. As such, they are polarized devices and must be connected with the +ve to the anode foil and the -ve to the cathode foil. If this were to be reversed then the electrolytic process that took place in forming the oxide layer on the anode would be recreated in trying to form an oxide layer on the cathode. In forming the cathode foil in this way, heat would be generated and gas given off within the capacitor, usually leading to catastrophic failure.

The cathode foil already possesses a thin stabilized oxide layer. This thin oxide layer is equivalent to a forming voltage of approximately 2 V. As a result, the capacitor can withstand a voltage reversal of up to 2 V for short periods. Above this voltage, the formation process will commence. Aluminium Electrolytic capacitors can also be manufactured for use in intermittent AC applications by using two anode foils in place of one anode and one cathode.

Mounting Position
The capacitor can be mounted upright or inclined to a horizontal position.

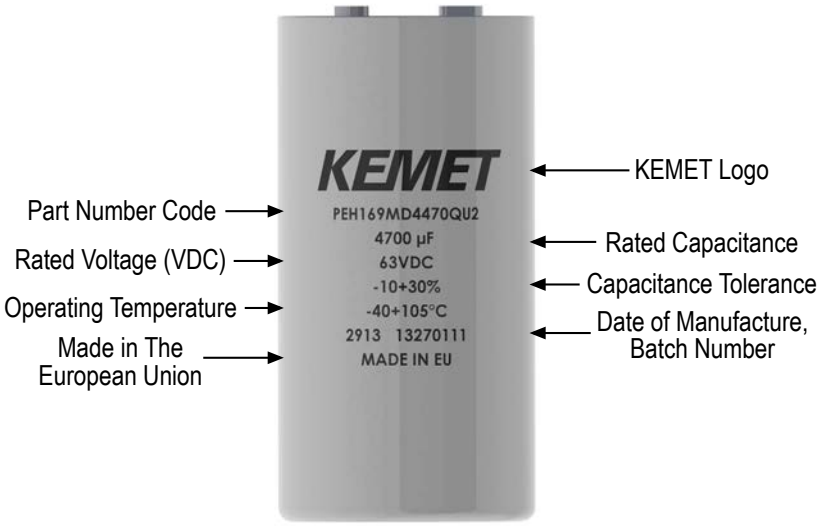
Clamp Fixing
Clips must be ordered separately.

Stud Fixing
Nylon cap nut must be ordered separately. For the stud fixing insulated version, the outer insulation serves as lock washer.
Maximum tightening torque:
M8 = 3 Nm
M12= 8 Nm
Maximum chassis thickness 5 mm.

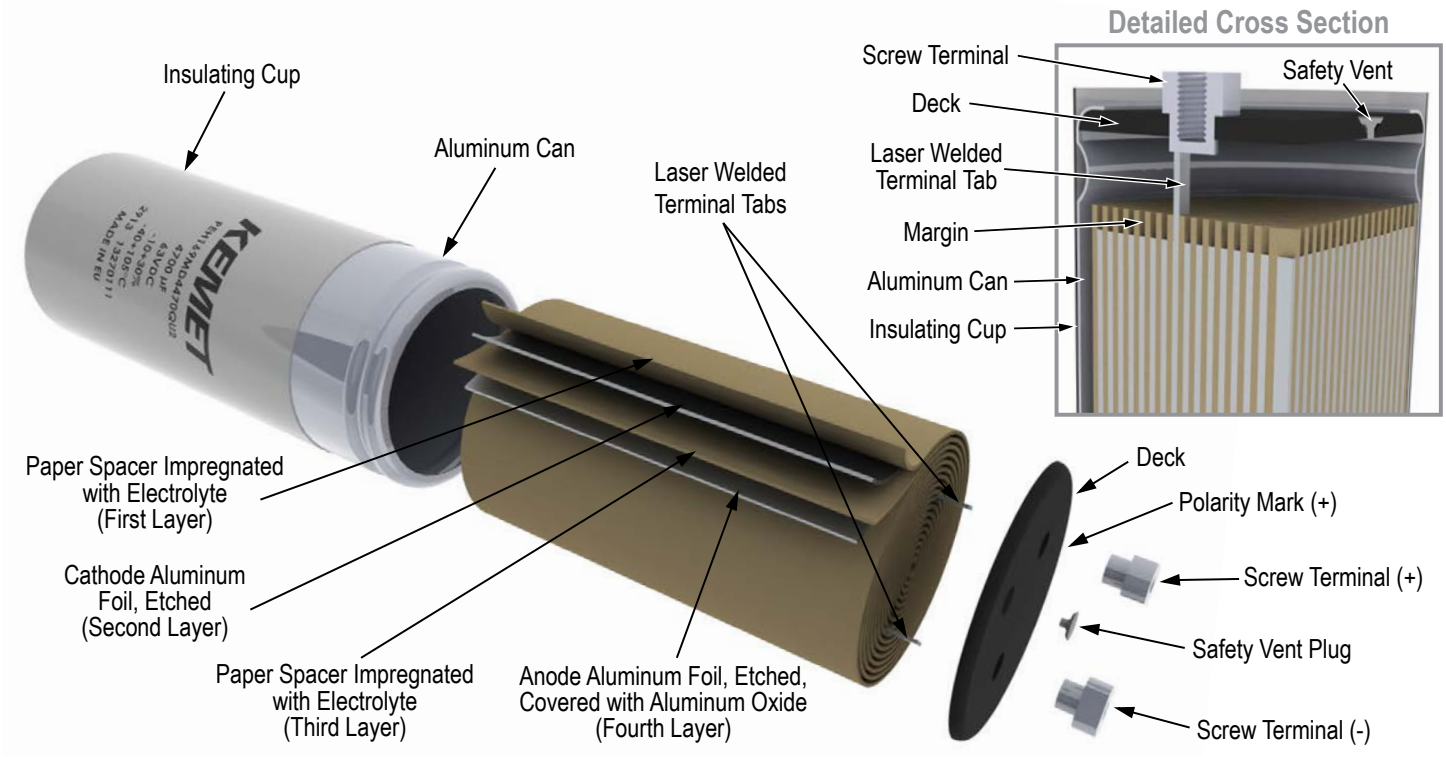
Screw Terminals
M5 x 10 according to DIN 41.248.
Maximum tightening torque = 2.5 Nm.
Must be ordered separately.
Recommended maximum connector thickness with delivered screw = 4 mm. M6 thread upon request.

Insulating Cup
PEH169 is supplied with a 0.8 mm thick polypropylene insulating cup. Voltage proof of the insulating cup: ≥ 4,000 VDC

Marking



Construction



PEH205 Series, +125°C

Overview

KEMET's PEH205 Series of capacitors has a polarized all-welded design, heavy duty screw terminals, extended cathode construction, and safety vent. The sealing system is designed for electrolyte leakage-free operation and a very low gas-diffusion rate of electrolyte. Mechanical contact between the winding and aluminium case allows excellent heat transfer from the winding hot-spot to the ambient, which means cooler operation and very high current ratings.

Please note the PEH205 is housed in a bare can and does not feature plastic insulation.

Applications

Typical applications for KEMET's PEH205 capacitor include high temperature, high ripple current applications such as welding equipment, industrial and automotive drives, and high end professional power supplies.

Benefits

- Long life, up to 8,000 hours at +125°C (V_R, I_R applied)
- High ripple current capability

Part Number System

PEH205	G	A	518	0	Q	U0
Series	Rated Voltage (VDC)	Size Code	Capacitance Code (µF)	Version	Capacitance Tolerance	Stud Option
Screw Terminal Aluminum Electrolytic	G = 16 H = 25 K = 40 L = 55 M = 63 P = 100	See Dimension Table	The last two digits represent significant figures. The first digit specifies the total number of digits.	0 = Standard	Q = -10 + 30%	U0 = Plain Can B0 = Threaded mounting stud

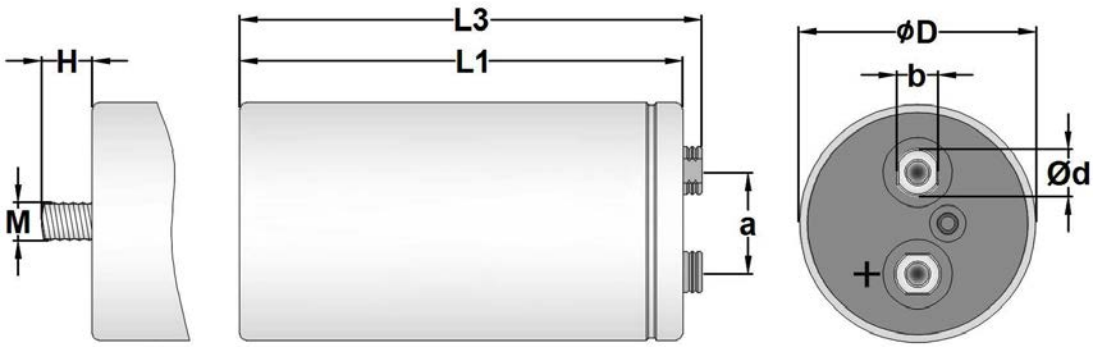
Performance Characteristics

Item	Performance Characteristics		
Capacitance Range	1,500 – 390,000 µF		
Rated Voltage	16 – 100 VDC		
Operating Temperature	-55 to +125°C		
Capacitance Tolerance	-10/+30% at 100 Hz/+20°C		
Operational Lifetime	D (mm)	Rated Voltage and Ripple Current at +125°C (hours)	
	D ≤ 50	4,000	
	D > 50	8,000	
Shelf Life	2,000 hours at +85°C or 30,000 hours at +40°C 0 VDC		
Leakage Current	I = 0.002 CV + 4 or 3,000 (µA, whichever is smaller)		
	C = rated capacitance (µF), V = rated voltage (VDC). Voltage applied for 5 minutes at +20°C.		
Vibration Test Specifications		Procedure	Requirements
	D ≤ 50 mm	0.75 mm displacement amplitude or 10 g maximum acceleration. Vibration applied for three 2-hour sessions at 10 – 500 Hz (capacitor clamped by body).	No leakage of electrolyte or other visible damage. Deviations in capacitance and tan δ from initial measurements must not exceed: Δ C/C < 5%
	D > 50 mm	0.75 mm displacement amplitude or 10 g maximum acceleration. Vibration applied for three 2-hour sessions at 10 – 55 Hz (capacitor clamped by body).	
Standards	IEC 60384–4 long life grade 55/125/56		

Test Method & Performance

Endurance Life Test	
Conditions	Performance
Temperature	+125°C
Test Duration	2,000 hours
Ripple Current	Maximum ripple current specified in table
Voltage	The sum of DC voltage and the peak AC voltage must not exceed the rated voltage of the capacitor
Performance	**The following specifications will be satisfied when the capacitor is tested at +20°C:**
Capacitance Change	Within 15% of the initial value
Equivalent Series Resistance	Does not exceed 200% of the initial value
Leakage Current	Does not exceed leakage current limit

Dimensions – Millimeters



Reference Size (mm)	Size Code	Dimensions in mm					Approximate Weight Grams
		D	L1	L3	a	Mounting Stud (M x H)	
		±0.4	±1.0	±1.0	±0.5	Nominal	
35 x 51	A	35.0	51.5	58.0	13.0	M8 x 12	70.0
35 x 75	C	35.0	73.5	80.0	13.0	M8 x 12	105.0
35 x 95	D	35.0	94.5	101.0	13.0	M8 x 12	130.0
50 x 75	H	50.0	74.5	81.0	22.0	M12 x 16	180.0
65 x 105	O	65.0	106.0	111.3	28.5	M12 x 16	415.0
75 x 105	T	75.0	106.0	111.3	32.0	M12 x 16	585.0
75 x 145	V	75.0	146.0	151.3	32.0	M12 x 16	800.0

Termination Table

Reference Diameter	Thread	Termination Style	Dimensions in mm	
			d	b
35	M5	Round	8	
50	M5	Oval	15	13
65	M5	Oval	15	13
75	M5	Oval	15	13
Note: M6 and other termination options available on request				

Shelf Life

The capacitance, ESR and impedance of a capacitor will not change significantly after extended storage periods, however the leakage current will very slowly increase. KEMET products are particularly stable and allow a shelf life in excess of three years at 40°C. See sectional specification under each product series for specific data.

Re-age (Reforming) Procedure

Apply the rated voltage to the capacitor at room temperature for a period of one hour, or until the leakage current has fallen to a steady value below the specified limit. During re-aging a maximum charging current of twice the specified leakage current or 5 mA (whichever is greater) is suggested.

Reliability

The reliability of a component can be defined as the probability that it will perform satisfactorily under a given set of conditions for a given length of time.

In practice, it is impossible to predict with absolute certainty how any individual component will perform; thus, we must utilize probability theory. It is also necessary to clearly define the level of stress involved (e.g. operating voltage, ripple current, temperature and time). Finally, the meaning of satisfactory performance must be defined by specifying a set of conditions which determine the end of life of the component.

Reliability as a function of time, R(t), is normally expressed as: $R(t)=e^{-\lambda t}$
where R(t) is the probability that the component will perform satisfactorily for time t, and λ is the failure rate.

Failure Rate

The failure rate is the number of components failing per unit time. The failure rate of most electronic components follows the characteristic pattern:

- Early failures are removed during the manufacturing process.
- The operational life is characterized by a constant failure rate.
- The wear out period is characterized by a rapidly increasing failure rate.

The failures in time (FIT) are given with a 60% confidence level for the various type codes. By convention, FIT is expressed as 1×10^{-9} failures per hour. Failure rate is also expressed as a percentage of failures per 1,000 hours.
e.g., 100 FIT = 1×10^{-7} failures per hour = 0.01%/1,000 hours

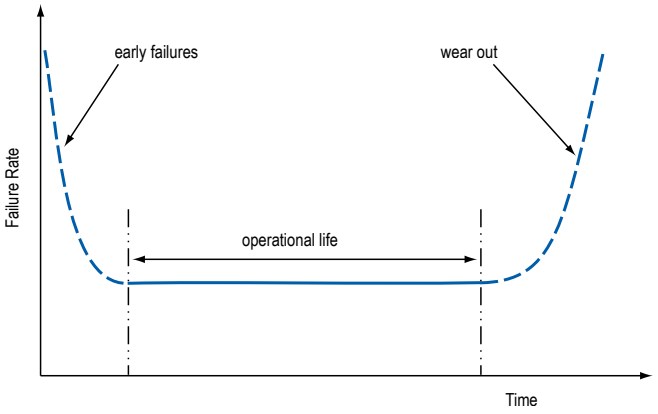
End of Life Definition
Catastrophic Failure: short circuit, open circuit or safety vent operation
Parametric Failure:

- Change in capacitance > ±10%
- Leakage current > specified limit
- ESR > 2 x initial ESR value

MTBF

The mean time between failures (MTBF) is simply the inverse of the failure rate.

MTBF= 1/λ



Environmental Compliance

As an environmentally conscious company, KEMET is working continuously with improvements concerning the environmental effects of both our capacitors and their production. 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, such as lead (Pb), in electronic equipment. All products in this catalog are produced to help our customers' obligations to guarantee their products and 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 such as 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 such as LF = Lead Free or LFW = Lead Free Wires on the label.

Table 1 – Ratings & Part Number Reference

VDC	Rated Capacitance	Size Code	Case Size	Ripple Current			ESR Maximum	Impedance Maximum	Part Number
	100 Hz 20°C (µF)		D x L (mm)	100 Hz 125°C (A)	100 Hz 85°C (A)	100 Hz 40°C (A)	100 Hz 20°C (mΩ)	10 kHz 20°C (mΩ)	
16	18000	A	35 x 51	6.2	17.2	24.2	23	16	PEH205GA5180Q(1)
16	33000	C	35 x 75	8.1	22.5	31.6	15	11	PEH205GC5330Q(1)
16	39000	D	35 x 95	8.5	23.6	33.1	13	9	PEH205GD5390Q(1)
16	68000	H	50 x 75	13.7	37.8	53.1	10	8	PEH205GH5680Q(1)
16	180000	O	65 x 105	17.4	48.1	67.5	6	7	PEH205GO6180Q(1)
16	270000	T	75 x 105	22.9	63.3	80.0	6	8	PEH205GT6270Q(1)
16	390000	V	75 x 145	24.8	68.8	80.0	6	8	PEH205GV6390Q(1)
25	10000	A	35 x 51	5.3	14.7	20.7	27	17	PEH205HA5100Q(1)
25	18000	C	35 x 75	7.0	19.4	27.2	17	11	PEH205HC5180Q(1)
25	22000	D	35 x 95	7.5	20.6	29.0	15	10	PEH205HD5220Q(1)
25	39000	H	50 x 75	12.0	33.4	46.8	11	8	PEH205HH5390Q(1)
25	120000	O	65 x 105	19.8	54.8	76.9	7	7	PEH205HO6120Q(1)
25	180000	T	75 x 105	20.8	57.7	80.0	7	8	PEH205HT6180Q(1)
25	270000	V	75 x 145	23.5	65.1	80.0	6	8	PEH205HV6270Q(1)
40	4700	A	35 x 51	4.8	13.2	18.5	32	17	PEH205KA4470Q(1)
40	10000	C	35 x 75	6.8	18.9	26.6	18	10	PEH205KC5100Q(1)
40	15000	D	35 x 95	8.1	22.4	31.5	15	9	PEH205KD5150Q(1)
40	22000	H	50 x 75	11.7	32.4	45.5	11	8	PEH205KH5220Q(1)
40	47000	O	65 x 105	18.1	50.1	70.4	7	7	PEH205KO5470Q(1)
40	68000	T	75 x 105	19.9	55.2	77.6	7	8	PEH205KT5680Q(1)
40	100000	V	75 x 145	22.2	61.5	80.0	6	8	PEH205KV6100Q(1)
55	3300	A	35 x 51	4.4	12.2	17.2	40	23	PEH205LA4330Q(1)
55	5600	C	35 x 75	5.8	16.1	22.7	25	15	PEH205LC4560Q(1)
55	8200	D	35 x 95	7.0	19.3	27.1	19	12	PEH205LD4820Q(1)
55	12000	H	50 x 75	10.3	28.4	39.9	17	9	PEH205LH5120Q(1)
55	33000	O	65 x 105	17.3	48.0	67.4	8	8	PEH205LO5330Q(1)
55	47000	T	75 x 105	19.0	52.7	74.0	8	8	PEH205LT5470Q(1)
55	68000	V	75 x 145	21.7	60.0	80.0	7	8	PEH205LV5680Q(1)
63	2200	A	35 x 51	4.1	11.4	16.1	43	24	PEH205MA4220Q(1)
63	4700	C	35 x 75	6.1	17.0	23.8	24	14	PEH205MC4470Q(1)
63	6800	D	35 x 95	7.2	19.9	28.0	19	11	PEH205MD4680Q(1)
63	10000	H	50 x 75	10.1	27.9	39.2	14	9	PEH205MH5100Q(1)
63	22000	O	65 x 105	16.3	45.2	63.4	9	8	PEH205MO5220Q(1)
63	33000	T	75 x 105	18.0	49.7	69.9	9	9	PEH205MT5330Q(1)
63	47000	V	75 x 145	20.7	57.3	80.0	7	8	PEH205MV5470Q(1)
100	1500	A	35 x 51	3.0	8.4	11.7	83	53	PEH205PA4150Q(1)
100	2200	C	35 x 75	3.7	10.3	14.4	56	36	PEH205PC4220Q(1)
100	3300	D	35 x 95	4.7	13.0	18.3	37	26	PEH205PD4330Q(1)
100	4700	H	50 x 75	6.9	19.0	26.7	29	19	PEH205PH4470Q(1)
100	15000	O	65 x 105	13.4	37.0	51.9	13	10	PEH205PO5150Q(1)
100	22000	T	75 x 105	15.2	42.0	59.0	11	10	PEH205PT5220Q(1)
100	33000	V	75 x 145	18.5	51.2	71.8	9	9	PEH205PV5330Q(1)
VDC	**Rated Capacitance**	**Size Code**	**Case Size**	**Ripple Current**			**ESR**	**Impedance**	**Part Number**

(1) Mounting Code: U0 = bare can, B0 = threaded mounting stud

Mechanical Data

Polarity and Reversed Voltage
Aluminium Electrolytic capacitors manufactured for use in DC applications contain an anode foil and a cathode foil. As such, they are polarized devices and must be connected with the +ve to the anode foil and the -ve to the cathode foil. If this were to be reversed then the electrolytic process that took place in forming the oxide layer on the anode would be recreated in trying to form an oxide layer on the cathode. In forming the cathode foil in this way, heat would be generated and gas given off within the capacitor, usually leading to catastrophic failure.

The cathode foil already possesses a thin stabilized oxide layer. This thin oxide layer is equivalent to a forming voltage of approximately 2 V. As a result, the capacitor can withstand a voltage reversal of up to 2 V for short periods. Above this voltage, the formation process will commence. Aluminium Electrolytic capacitors can also be manufactured for use in intermittent AC applications by using two anode foils in place of one anode and one cathode.

Mounting Position
The capacitor can be mounted upright or inclined to a horizontal position.

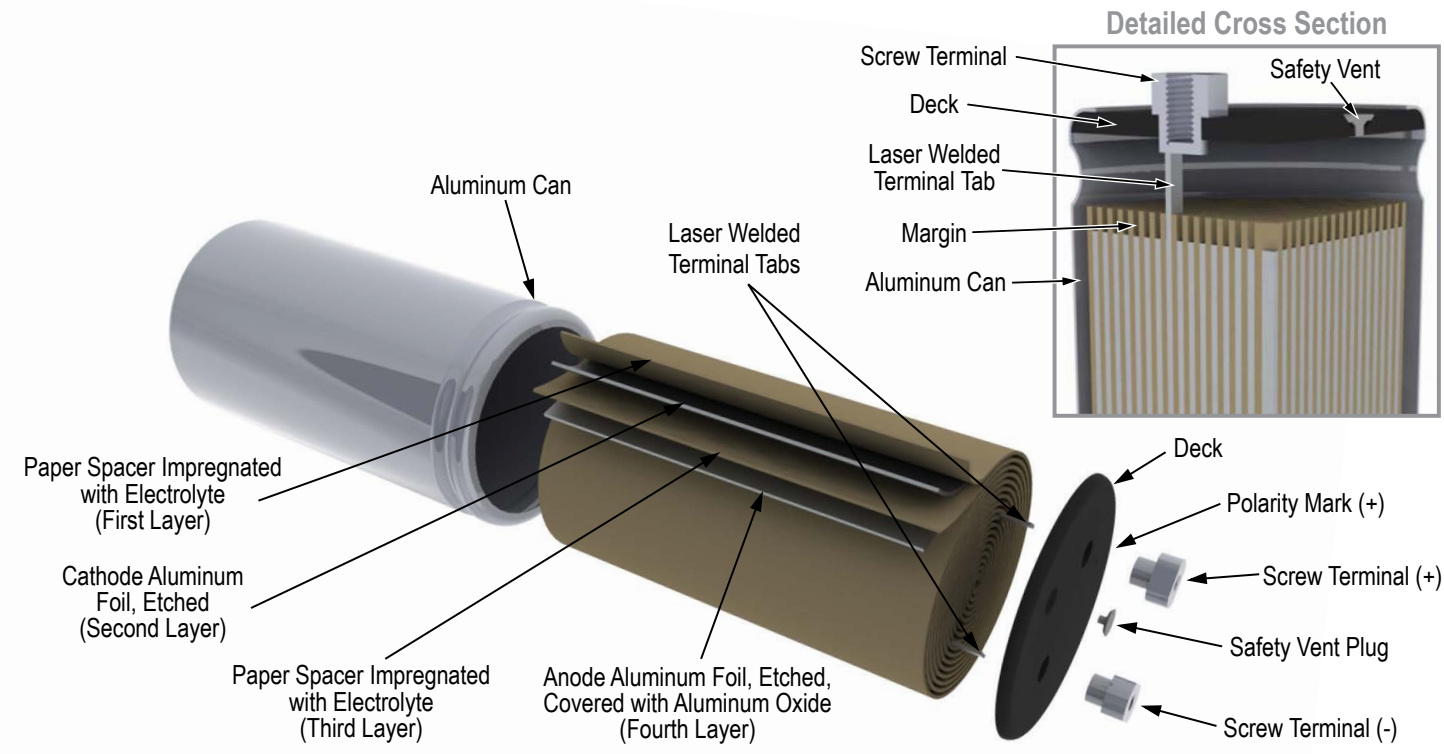
Insulating Resistance
Please note the PEH205 is housed in a bare can and does not feature plastic insulation.

Clamp Fixing
Clips must be ordered separately.

Stud Fixing
Nylon cap nut must be ordered separately.
Maximum tightening torque:
M8 = 3 Nm
M12 = 8 Nm
Maximum chassis thickness = 5 mm

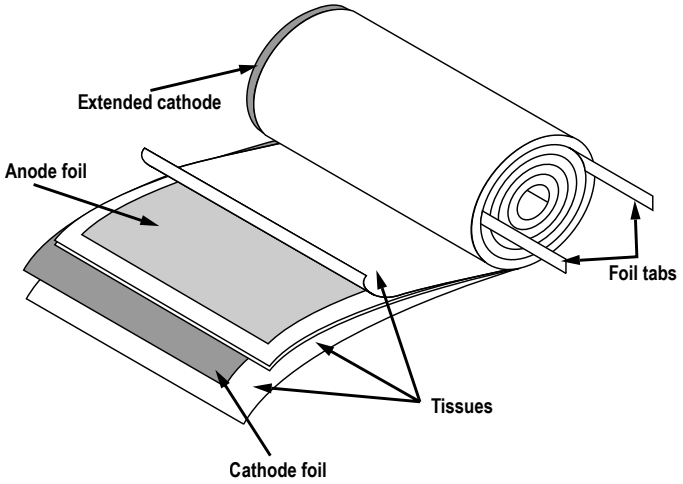
Screw Terminals
M5 x 10 according to DIN 41.248. Maximum tightening torque = 2.5 Nm. Must be ordered separately.
Recommended maximum connector thickness with delivered screw 4 mm. M6 thread upon request (65 & 75 mm diameter).

Construction



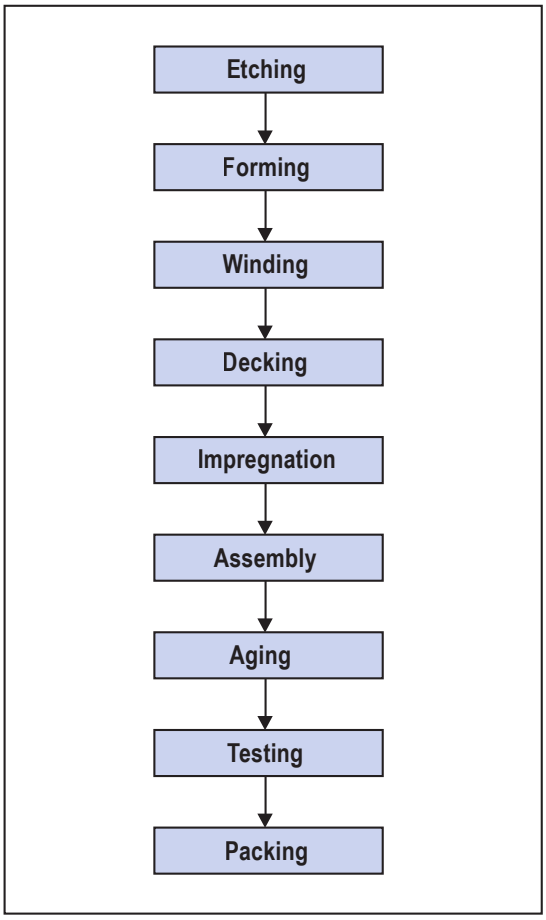
Construction Data

The manufacturing process begins with the anode foil being electrochemically etched to increase the surface area and then "formed" to produce the aluminum oxide layer. Both the anode and cathode foils are then interleaved with absorbent paper and wound into a cylinder. During the winding process, aluminum tabs are attached to each foil to provide the electrical contact.



The deck, complete with terminals, is attached to the tabs and then folded down to rest on top of the winding. The complete winding is impregnated with electrolyte before being housed in a suitable container, usually an aluminum can, and sealed. Throughout the process, all materials inside the housing must be maintained at the highest purity and be compatible with the electrolyte.

Each capacitor is aged and tested before being sleeved and packed. The purpose of aging is to repair any damage in the oxide layer and thus reduce the leakage current to a very low level. Aging is normally carried out at the rated temperature of the capacitor and is accomplished by applying voltage to the device while carefully controlling the supply current. The process may take several hours to complete.



Damage to the oxide layer can occur due to variety of reasons:

- Slitting of the anode foil after forming
- Attaching the tabs to the anode foil
- Minor mechanical damage caused during winding

A sample from each batch is taken by the quality department after completion of the production process. This sample size is controlled by the use of recognized sampling tables defined in BS 6001.

The following tests are applied and may be varied at the request of the customer. In this case the batch, or special procedure, will determine the course of action.

Electrical:

- Leakage current
- Capacitance
- ESR
- Impedance
- Tan Delta

Mechanical/Visual:

- Overall dimensions
- Torque test of mounting stud
- Print detail
- Box labels
- Packaging, including packed quantity

ALP20 and ALT20/21 Series, +85°C

Overview

KEMET's ALP20 and ALT20/21 Series of capacitors features low ESR, high ripple current ratings and outstandingly good high frequency impedance.

Applications

It should be pointed out that the ALP solder pin and ALT solder tag range details are incorporated herein, primarily, for maintenance/replacement purposes.

Benefits

- Solder tag (ALT) and DIN standard solder pin (ALP)
- Long life, up to 26,000 hours at +85°C (V_R, I_R applied)
- ALC snap-in should be considered for new designs

Part Number System

ALP	20A	682	AB	010	
Series	Version	Capacitance Code (µF)	Size Code	Rated Voltage (VDC)	
ALP = Solder pin ALT = Solder tag	20A = Standard 21A = Threaded Mounting Stud (ALT only)	First two digits represent significant figures. Third digit specifies number of zeros.	See Dimension Table	040 = 40 063 = 63 100 = 100 200 = 200	250 = 250 385 = 385 400 = 400 450 = 450

Performance Characteristics

Item	Performance Characteristics	
Capacitance Range	22 – 150,000 µF	
Rated Voltage	40 – 450 VDC	
Operating Temperature	-40 to +85°C	
Storage Temperature Range	-55 to +85°C	
Capacitance Tolerance	-10/+30%, ±20% at 100 Hz / +20°C (only at 200 V)	
Operational Lifetime	D (mm)	Rated Voltage and Ripple Current at +85°C (hours)
	25	12,000
	30	15,000
	35	18,000
	40	26,000
End of Life Requirement	Δ C/C < ±10%	
Shelf Life	2,000 hours at +85°C or 30,000 hours at +40°C 0 VDC	
Leakage Current	I = 0.006 CV or 6,000 (µA, whichever is smaller)	
	C = rated capacitance (µF), V = rated voltage (VDC). Voltage applied for 5 minutes at +20°C.	
Standards	IEC 60384–4	

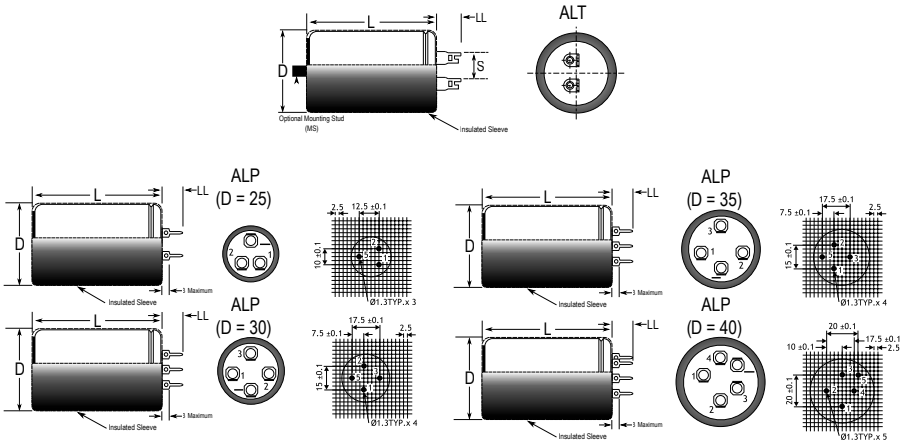
Surge Voltage

Condition	Voltage (VDC)				
	40	63	100	200	385
≤ 30 s surge, 1,000 cycles at +85°C	46	72.5	115	230	423.5

Test Method & Performance

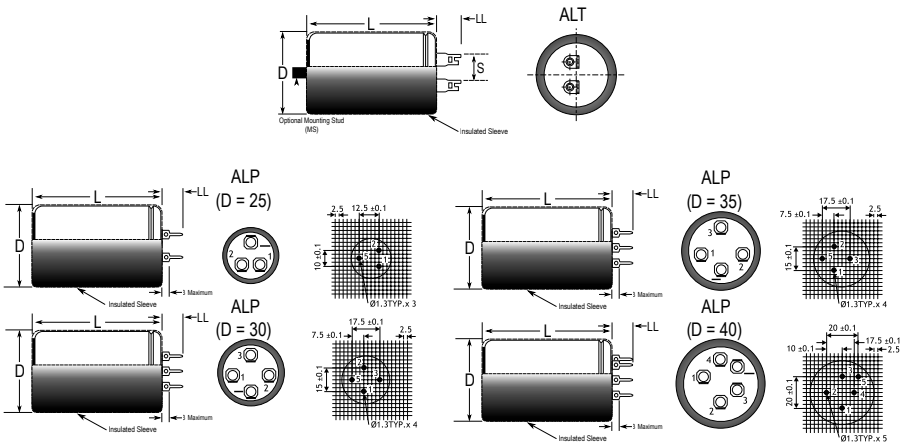
Endurance Life Test		
Conditions	Performance	
Temperature	+85°C	
Test Duration	5,000 hours	
Ripple Current	Maximum ripple current specified in table	
Voltage	The sum of DC voltage and the peak AC voltage must not exceed the rated voltage of the capacitor	
Performance	**The following specifications will be satisfied when the capacitor is tested at +20°C:**	
Capacitance Change	≤ 100 V	Within 15% of the initial value
	> 100 V	Within 10% of the initial value
Equivalent Series Resistance	Does not exceed 200% of the initial value	
Leakage Current	Does not exceed leakage current limit	

Dimensions – Millimeters (ALP)



Size Code	Dimensions in mm			Approximate Weight Grams
	D	L	LL	
	±1	±2	±0.5	
AB	25	45	7.5	30
BB	30	45	7.5	50
CB	35	45	7.5	65
CD	35	55	7.5	75
DB	40	45	7.5	80
DD	40	55	7.5	95
DE	40	75	7.5	125
DF	40	105	7.5	170
Note: Dimensions include sleeving				

Dimensions – Millimeters (ALT)



Size Code	Dimensions in mm				Mounting Stud (M x H)	Mounting Clip	Approximate Weight Grams
	D	L	S	LL			
	±1	±2	±0.5	±1	Nominal		
AA	25	35	10	10	M8 x 12	V2/H1	30
AB	25	45	10	10	M8 x 12	V2/H1	39
BB	30	45	10	10	M8 x 12		50
CB	35	45	10	10	M8 x 12	V3/H2	65
CD	35	55	10	10	M8 x 12	V3/H2	75
DB	40	45	10	10	M8 x 12	V9	80
DD	40	55	10	10	M8 x 12	V9	95
DE	40	75	10	10	M8 x 12	V9	125
DF	40	105	10	10	M8 x 12	V9	170
Note: Dimensions include sleeving							

Shelf Life

The capacitance, ESR and impedance of a capacitor will not change significantly after extended storage periods, however the leakage current will very slowly increase. KEMET products are particularly stable and allow a shelf life in excess of three years at 40°C. See sectional specification under each product series for specific data.

Re-age (Reforming) Procedure

Apply the rated voltage to the capacitor at room temperature for a period of one hour, or until the leakage current has fallen to a steady value below the specified limit. During re-aging a maximum charging current of twice the specified leakage current or 5 mA (whichever is greater) is suggested.

Reliability

The reliability of a component can be defined as the probability that it will perform satisfactorily under a given set of conditions for a given length of time.

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Reliability as a function of time, R(t), is normally expressed as: $R(t)=e^{-\lambda t}$
where R(t) is the probability that the component will perform satisfactorily for time t, and λ is the failure rate.

Failure Rate

The failure rate is the number of components failing per unit time. The failure rate of most electronic components follows the characteristic pattern:

- Early failures are removed during the manufacturing process.
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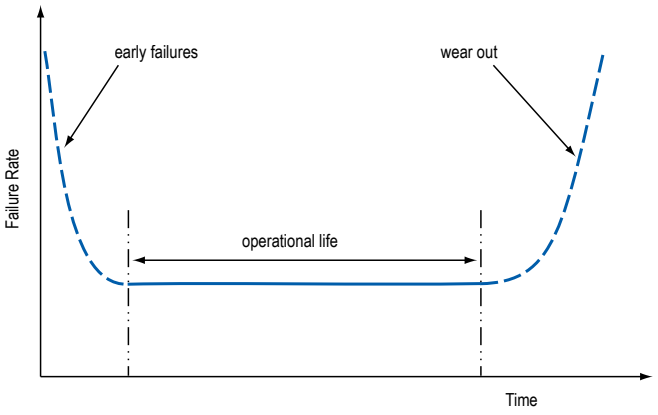
The failures in time (FIT) are given with a 60% confidence level for the various type codes. By convention, FIT is expressed as 1×10^{-9} failures per hour. Failure rate is also expressed as a percentage of failures per 1,000 hours.
e.g., 100 FIT = 1×10^{-7} failures per hour = 0.01%/1,000 hours

End of Life Definition
Catastrophic Failure: short circuit, open circuit or safety vent operation
Parametric Failure:

- Change in capacitance > ±10%
- Leakage current > specified limit
- ESR > 2 x initial ESR value

MTBF

The mean time between failures (MTBF) is simply the inverse of the failure rate.
MTBF= 1/λ



Environmental Compliance

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

Table 1A – Ratings & Part Number Reference (ALP)

VDC	Rated Capacitance (µF)	Capacitance Tolerance	Size Code	Case Size	Part Number
40	2200	-10/+30%	AB	25 x 45	ALP20A222AB040
40	4700	-10/+30%	CB	35 x 45	ALP20A472CB040
40	6800	-10/+30%	CD	35 x 55	ALP20A682CD040
40	10000	-10/+30%	DD	40 x 55	ALP20A103DD040
63	2200	-10/+30%	BB	30 x 45	ALP20A222BB063
63	3300	-10/+30%	CB	35 x 45	ALP20A332CB063
63	4700	-10/+30%	CD	35 x 55	ALP20A472CD063
63	6800	-10/+30%	DD	40 x 55	ALP20A682DD063
63	10000	-10/+30%	DE	40 x 75	ALP20A103DE063
63	15000	-10/+30%	DF	40 x 105	ALP20A153DF063
100	4700	-10/+30%	DE	40 x 75	ALP20A472DE100
250	1000	-10/+30%	DE	40 x 75	ALP20A102DE250
400	100	-10/+30%	BB	30 x 45	ALP20A101BB400
450	470	-10/+30%	DF	40 x 105	ALP20A471DF450
VDC	**Rated Capacitance (µF)**	**Capacitance Tolerance**	**Size Code**	**Case Size**	**Part Number**

Table 1B – Ratings & Part Number Reference (ALT)

VDC	Rated Capacitance (µF)	Capacitance Tolerance	Size Code	Case Size	Part Number
40	3300	-10/+30%	BB	30 x 45	ALT20A332BB040
40	4700	-10/+30%	CB	35 x 45	ALT20A472CB040
40	10000	-10/+30%	DD	40 x 55	ALT20A103DD040
63	1000	-10/+30%	AA	25 x 35	ALT20A102AA063
200	680	-10/+30%	CD	35 x 55	ALT20A681CD200
250	680	-10/+30%	DD	40 x 55	ALT20A681DD250
400	100	-10/+30%	BB	30 x 45	ALT20A101BB400
400	220	-10/+30%	CD	35 x 55	ALT20A221CD400
450	100	-10/+30%	BB	30 x 45	ALT20A101BB450
VDC	**Rated Capacitance (µF)**	**Capacitance Tolerance**	**Size Code**	**Case Size**	**Part Number**

Print Detail

- KEMET Logo
- Rated capacitance
- Capacitance tolerance
- Rated voltage
- Climatic Category
- Date of manufacture & Batch No.
- Article code

ALP22 and ALT22/23 Series, +85°C

Overview

KEMET's ALP22 and ALT22/23 Series of capacitors features low ESR, high ripple current ratings and outstandingly good high frequency impedance. KEMET's ALP/T22/23 series of capacitors has a very high CV per unit volume.

Applications

It should be pointed out that the ALP solder pin and ALT solder tag range details are incorporated herein, primarily, for maintenance/replacement purposes.

Benefits

- Solder tag (ALT) and DIN standard solder pin (ALP)
- Long life, up to 26,000 hours at +85°C (V_R, I_R applied)
- ALC snap-in should be considered for new designs

Part Number System

ALP	22A	682	AB	010	
Series	Version	Capacitance Code (µF)	Size Code	Rated Voltage (VDC)	
ALP = Solder pin ALT = Solder tag	22A = Standard 23A = Threaded Mounting Stud (ALT only)	First two digits represent significant figures. Third digit specifies number of zeros.	See Dimension Table	040 = 40 063 = 63 100 = 100 200 = 200	250 = 250 385 = 385 400 = 400 450 = 450

Performance Characteristics

Item	Performance Characteristics	
Capacitance Range	22 – 150,000 µF	
Rated Voltage	40 – 450 VDC	
Operating Temperature	-40 to +85°C	
Storage Temperature Range	-55 to +85°C	
Capacitance Tolerance	±20% at 100 Hz / +20°C	
Operational Lifetime	D (mm)	Rated Voltage and Ripple Current at +85°C (hours)
	25	12,000
	30	15,000
	35	18,000
	40	26,000
End of Life Requirement	Δ C/C < ±10%	
Shelf Life	2,000 hours at +85°C or 30,000 hours at +40°C 0 VDC	
Leakage Current	I = 0.006 CV or 6,000 (µA, whichever is smaller)	
	C = rated capacitance (µF), V = rated voltage (VDC). Voltage applied for 5 minutes at +20°C.	
Standards	IEC 60384–4	

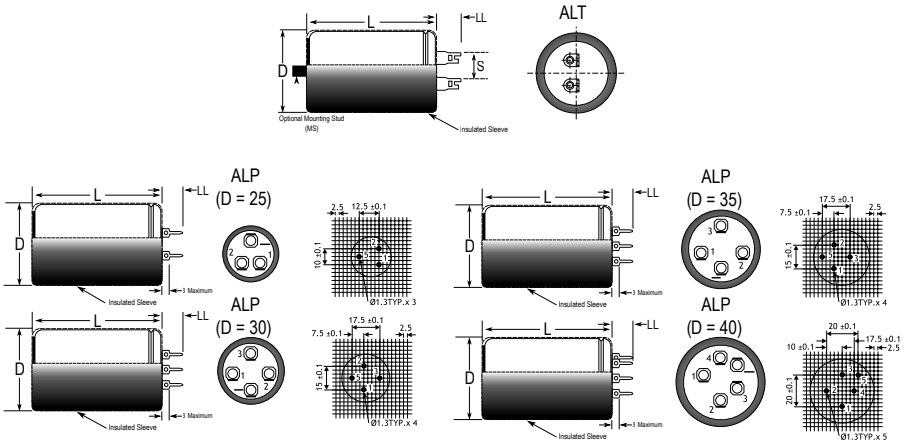
Surge Voltage

Condition	Voltage (VDC)				
	40	63	100	200	385
≤ 30 s surge, 1,000 cycles at +85°C	46	72.5	115	230	423.5

Test Method & Performance

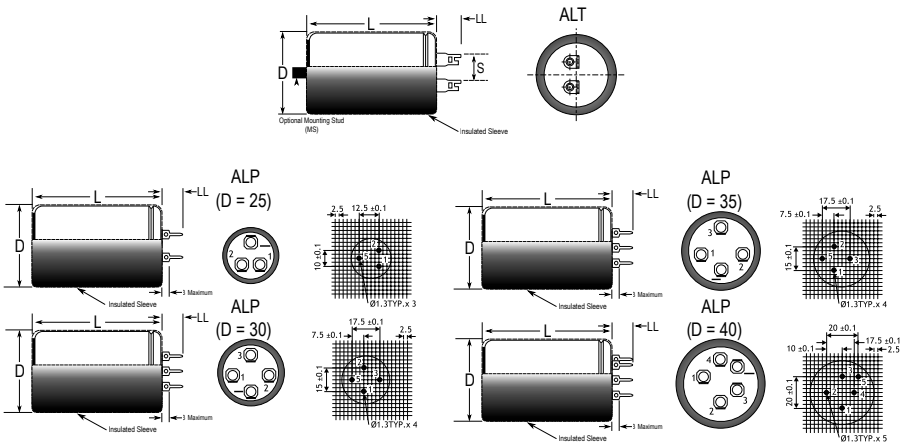
Endurance Life Test		
Conditions	Performance	
Temperature	+85°C	
Test Duration	5,000 hours	
Ripple Current	Maximum ripple current specified in table	
Voltage	The sum of DC voltage and the peak AC voltage must not exceed the rated voltage of the capacitor	
Performance	**The following specifications will be satisfied when the capacitor is tested at +20°C:**	
Capacitance Change	≤ 100 V	Within 15% of the initial value
	> 100 V	Within 10% of the initial value
Equivalent Series Resistance	Does not exceed 200% of the initial value	
Leakage Current	Does not exceed leakage current limit	

Dimensions – Millimeters (ALP)



Size Code	Dimensions in mm			Approximate Weight Grams
	D	L	LL	
	±1	±2	±0.5	
AB	25	45	7.5	30
BB	30	45	7.5	50
CB	35	45	7.5	65
CD	35	55	7.5	75
DB	40	45	7.5	80
DD	40	55	7.5	95
DE	40	75	7.5	125
DF	40	105	7.5	170
Note: Dimensions include sleeving				

Dimensions – Millimeters (ALT)



Size Code	Dimensions in mm				Mounting Stud (M x H)	Mounting Clip	Approximate Weight Grams
	D	L	S	LL			
	±1	±2	±0.5	±1	Nominal		
AA	25	35	10	10	M8 x 12	V2/H1	30
AB	25	45	10	10	M8 x 12	V2/H1	39
BB	30	45	10	10	M8 x 12		50
CB	35	45	10	10	M8 x 12	V3/H2	65
CD	35	55	10	10	M8 x 12	V3/H2	75
DB	40	45	10	10	M8 x 12	V9	80
DD	40	55	10	10	M8 x 12	V9	95
DE	40	75	10	10	M8 x 12	V9	125
DF	40	105	10	10	M8 x 12	V9	170
Note: Dimensions include sleeving							

Shelf Life

The capacitance, ESR and impedance of a capacitor will not change significantly after extended storage periods, however the leakage current will very slowly increase. KEMET products are particularly stable and allow a shelf life in excess of three years at 40°C. See sectional specification under each product series for specific data.

Re-age (Reforming) Procedure

Apply the rated voltage to the capacitor at room temperature for a period of one hour, or until the leakage current has fallen to a steady value below the specified limit. During re-aging a maximum charging current of twice the specified leakage current or 5 mA (whichever is greater) is suggested.

Reliability

The reliability of a component can be defined as the probability that it will perform satisfactorily under a given set of conditions for a given length of time.

In practice, it is impossible to predict with absolute certainty how any individual component will perform; thus, we must utilize probability theory. It is also necessary to clearly define the level of stress involved (e.g. operating voltage, ripple current, temperature and time). Finally, the meaning of satisfactory performance must be defined by specifying a set of conditions which determine the end of life of the component.

Reliability as a function of time, R(t), is normally expressed as: $R(t)=e^{-\lambda t}$
where R(t) is the probability that the component will perform satisfactorily for time t, and λ is the failure rate.

Failure Rate

The failure rate is the number of components failing per unit time. The failure rate of most electronic components follows the characteristic pattern:

- Early failures are removed during the manufacturing process.
- The operational life is characterized by a constant failure rate.
- The wear out period is characterized by a rapidly increasing failure rate.

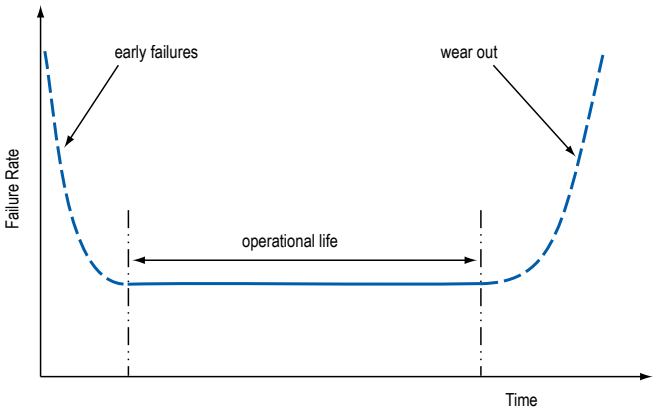
The failures in time (FIT) are given with a 60% confidence level for the various type codes. By convention, FIT is expressed as 1×10^{-9} failures per hour. Failure rate is also expressed as a percentage of failures per 1,000 hours.
e.g., 100 FIT = 1×10^{-7} failures per hour = 0.01%/1,000 hours

End of Life Definition
Catastrophic Failure: short circuit, open circuit or safety vent operation
Parametric Failure:

- Change in capacitance > ±10%
- Leakage current > specified limit
- ESR > 2 x initial ESR value

MTBF

The mean time between failures (MTBF) is simply the inverse of the failure rate.
MTBF= 1/λ



Environmental Compliance

As an environmentally conscious company, KEMET is working continuously with improvements concerning the environmental effects of both our capacitors and their production. 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, such as lead (Pb), in electronic equipment. All products in this catalog are produced to help our customers' obligations to guarantee their products and 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 such as 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 such as LF = Lead Free or LFW = Lead Free Wires on the label.

Table 1A – Ratings & Part Number Reference (ALP)

VDC	Rated Capacitance (µF)	Capacitance Tolerance	Size Code	Case Size	Part Number
40	4700	20%	AB	25 x 45	ALP22A472AB040
40	6800	20%	BB	30 x 45	ALP22A682BB040
40	10000	20%	CB	35 x 45	ALP22A103CB040
40	15000	20%	CD	35 x 55	ALP22A153CD040
40	22000	20%	DD	40 x 55	ALP22A223DD040
63	2700	20%	AB	25 x 45	ALP22A272AB063
63	4700	20%	BB	30 x 45	ALP22A472BB063
63	10000	20%	CD	35 x 55	ALP22A103CD063
63	10000	20%	DD	40 x 55	ALP22A103DD063
63	15000	20%	DE	40 x 75	ALP22A153DE063
100	1000	20%	AB	25 x 45	ALP22A102AB100
100	4700	20%	DD	40 x 55	ALP22A472DD100
100	10000	20%	DF	40 x 105	ALP22A103DF100
200	220	20%	AB	25 x 45	ALP22A221AB200
200	680	20%	CD	35 x 55	ALP22A681CD200
200	680	20%	DB	40 x 45	ALP22A681DB200
200	1000	20%	DD	40 x 55	ALP22A102DD200
200	2200	20%	DF	40 x 105	ALP22A222DF200
385	220	20%	CB	35 x 45	ALP22A221CB385
385	470	20%	DD	40 x 55	ALP22A471DD385
385	680	20%	DE	40 x 75	ALP22A681DE385
385	1000	20%	DF	40 x 105	ALP22A102DF385
450	100	20%	BB	30 x 45	ALP22A101BB450
450	220	20%	CD	35 x 55	ALP22A221CD450
450	470	20%	DE	40 x 75	ALP22A471DE450
450	680	20%	DF	40 x 105	ALP22A681DF450
450	820	20%	DF	40 x 105	ALP22A821DF450
450	1000	20%	DE	40 x 75	ALP22A102DE450
VDC	**Rated Capacitance (µF)**	**Capacitance Tolerance**	**Size Code**	**Case Size**	**Part Number**

Table 1B – Ratings & Part Number Reference (ALT)

VDC	Rated Capacitance (µF)	Capacitance Tolerance	Size Code	Case Size	Part Number
40	4700	20%	AB	25 x 45	ALT22A472AB040
40	10000	20%	CB	35 x 45	ALT22A103CB040
40	15000	20%	CD	35 x 55	ALT22A153CD040
40	22000	20%	DD	40 x 55	ALT22A223DD040
63	4700	20%	BB	30 x 45	ALT22A472BB063
63	10000	20%	CD	35 x 55	ALT22A103CD063
63	15000	20%	DE	40 x 75	ALT22A153DE063
100	1000	20%	AB	25 x 45	ALT22A102AB100
100	4700	20%	DD	40 x 55	ALT22A472DD100
100	10000	20%	DF	40 x 105	ALT22A103DF100
200	220	20%	AB	25 x 45	ALT22A221AB200
200	680	20%	DB	40 x 45	ALT22A681DB200
200	1000	20%	DD	40 x 55	ALT22A102DD200
200	2200	20%	DF	40 x 105	ALT22A222DF200
385	100	20%	AB	25 x 45	ALT22A101AB385
385	150	20%	BB	30 x 45	ALT22A151BB385
385	470	20%	DD	40 x 55	ALT22A471DD385
385	1000	20%	DF	40 x 105	ALT22A102DF385
VDC	**Rated Capacitance (µF)**	**Capacitance Tolerance**	**Size Code**	**Case Size**	**Part Number**

Print Detail

- KEMET Logo
- Rated capacitance
- Capacitance tolerance
- Rated voltage
- Climatic Category
- Date of manufacture & Batch No.
- Article code

PYR 5008 and 7511 Resistors

Overview

KEMET's PYR resistors are wire wound on a ceramic core and coated with high temperature silicone. The mounting brackets are made of stainless steel and connected by two point spotwelding. PYR resistors are for use in voltage balancing and/or discharge of electrolytic capacitors, are easy to mount and fit capacitor diameters 50 – 90 mm.

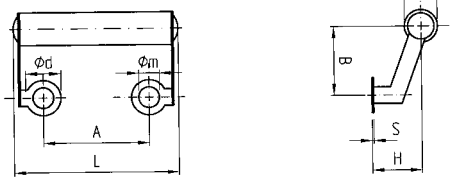
Applications

KEMET's PYR resistors can be used for voltage balancing of series connected electrolytic can-type capacitors and/or discharge purposes.

Performance Characteristics

Item	Specification
Standards	CECC 40201, MIL–R26E
Resistance Range	10 – 47 kΩ
Resistance Tolerance	+/- 5%
Rated Voltage	700 VDC acc. to CECC 40201–003
Temperature Range	-55 to +105°C

Dimensions PYR – Millimeters



Type	A	L	d	m	B	H	S	D	Weight
		±1	±2			±1	±1	Maximum	Approximate (g)
PYR 5008	22.0*	40	10.6	6.3	21	15	0.4	10	9
PYR 7511	32.0	50	10.6	6.3	21	15	0.4	10	11

** Brackets are adjustable up to A = 28.5*

Balancing and Discharge Resistor

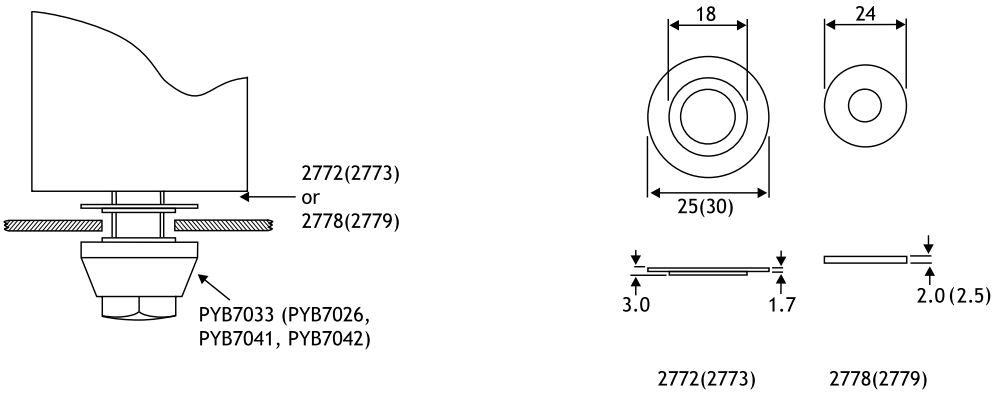
Part Number Table PYR					
Part Number Code	R (kΩ)*	P max (Ω) 40°C	P max (Ω) 85°C	P max (Ω) 105°C	Fits Capacitor Diameter
PYR 5008 / 47	47	10	8	7	50 – 65
PYR 7511 / 10	10	13	11	10	75 – 90
PYR 7511 / 18	18	13	11	10	75 – 90
PYR 7511 / 27	27	13	11	10	75 – 90
PYR 7511 / 47	47	13	11	10	75 – 90

** Other R values available upon request*

Mounting Kits

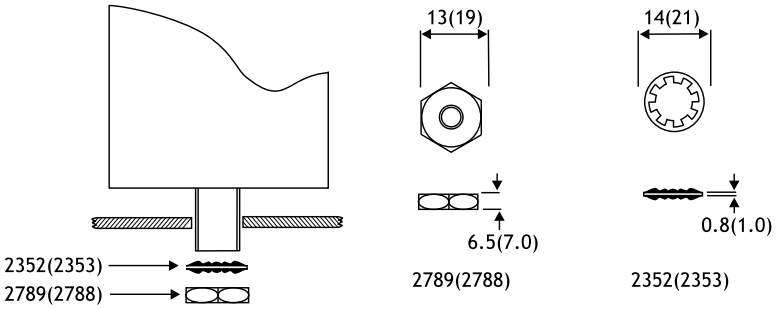
Insulated Version

M8 Stud (M12 Stud)



Non-Insulated Version

M8 Stud (M12 Stud)



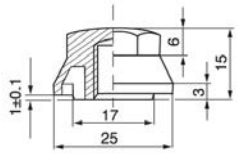
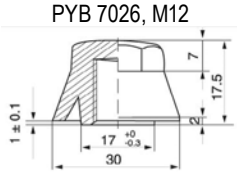
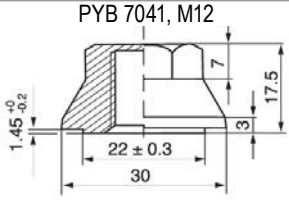
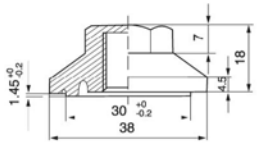
Dimensions in mm. All of the above accessories may be ordered individually using the part number shown or as kits using the kit part numbers shown in the Kit Contents and Ordering Information.

Kit Contents and Ordering Information

Standard Kits		Kit Order Number			
Part Code	Description	2740	2741	2782	2785
2352	Steel washer M8			•	
2353	Steel washer M12				•
2772	Stepped poly washer M8	•			
2773	Stepped poly washer M12		•		
2778	Plain poly washer M8	•			
2779	Plain poly washer M12		•		
2788	Steel nut M12				•
2789	Steel nut M8			•	
PYB 7033	Nylon nut M8	•			
PYB 7026	Nylon nut M12		•		
Kit Description		Insulated	Insulated	Non-Insulated	Non-Insulated
		M8	M12	M8	M12

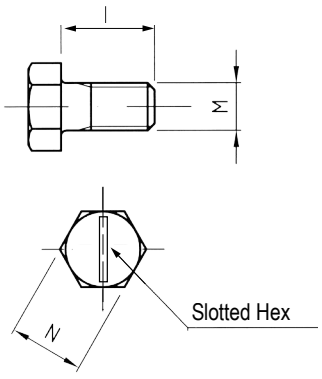
Special Kits		Kit Order Number				
Part Code	Description	2690	2691	2692	2693	2695
2352	Steel washer M8			•		
2353	Steel washer M12	•			•	
2772	Stepped poly washer M8		•	•		
2773	Stepped poly washer M12	•			•	•
2778	Plain poly washer M8		•	•		
2779	Plain poly washer M12				•	•
2788	Steel nut M12	•			•	•
2789	Steel nut M8		•	•		
PYB 7041	Nylon nut M12					
PYB 7042	Nylon nut M12					

Mounting Data for Accessories

Nylon Cap Nuts	Mounting Hole	Maximum Chassis Thickness	Width of Jaws	Creepage Distance	Test Voltage 50 – 60 Hz	Maximum Tightening Torque	Capacitor Diameter
	mm (Minimum)	(mm)	(mm)	(mm)	1 min (KVAC)	(NM)	(mm)
PYB 7033, M8 	Ø 17.5	5	17	4.5	2.5	3	Ø = 35
PYB 7026, M12 	Ø 17.5	5	19	2.5	2.5	8	Ø > 35
PYB 7041, M12 	Ø 22.5	5	19	5	2.5	8	Ø > 35
PYB 7042, M12 	Ø 30.5	5	19	9	4	8	Ø > 35

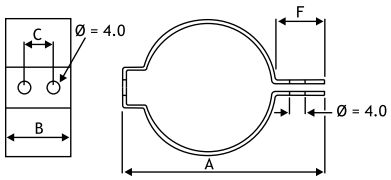
Steel Screws

Part Number	M	l (mm)	N (mm)	Maximum Tightening Torque (Nm)	Quantity per Bag
3895	M6 steel screw & shakeproof washer	10	10	4	10
3896	M5 steel screw & shakeproof washer	10	8	2	20
3897	M5 steel screw & shakeproof washer	10	8	2	50

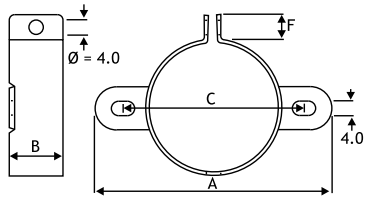


Clips – Millimeters (Material – Zinc Plated Steel)

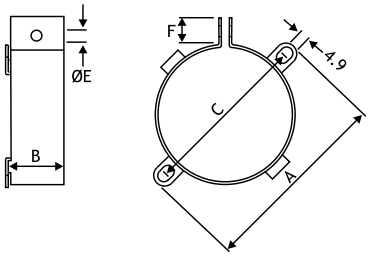
Horizontal Mounting					
Type	Can Diameter	A	B	C	F
H1	25.0	40.0	22.3	12.8	10.0
H2	35.0	52.0	22.3	12.8	10.0



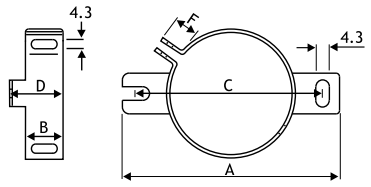
Vertical Mounting					
Type	Can Diameter	A	B	C	F
V2	25.0	49.0	19.0	37.0	10.0
V3	35.0	58.0	19.0	45.0	9.0
V9	40.0	65.0	19.0	52.4	9.5



Type	Can Diameter	A	B	C	E	F
V4	51.0	75.0	25.4	64.0	5.0	10.0
V6	45.0	69.5	17.4	58.0	4.0	10.0
V8	63.5	88.9	25.4	77.5	5.0	9.5
PYC6041	35	64	19	52	4.5	11.5



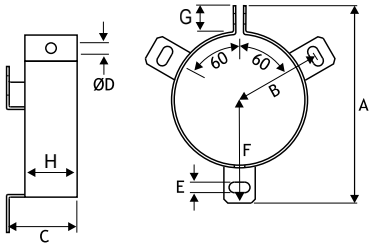
Type	Can Diameter	A	B	C	D	F
2736	35.0	63.0	12.2	54.0	17.2	9.0



When using mounting clamps, care should be taken not to obscure any safety vent in the can. Delivered without bolts and nuts for mounting. PYC clips are for PEH169 and PEH200 capacitors.

Clips – Millimeters (Material – Zinc Plated Steel) cont'd

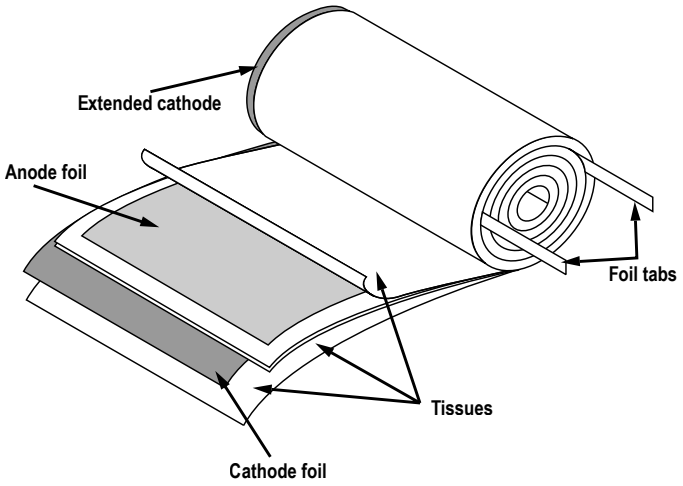
Type	Can Diameter	A	B	C	D	E	F	G	H
V10	65.0	90.0	40.0	30.0	5.0	4.5	-	10	20
V11	76.0	103.0	45.5	30.0	5.0	4.5	-	10	20
2737	50.0	75.5	33.5	27.0	4.3	4.3	39.5	10	20
2738	65.0	88.5	39.0	27.0	4.3	4.3	45.0	10	20
2739	72.0	97.0	44.0	28.0	4.3	4.3	50.0	10	20
PYC6042	50	78	32.5	30	5.5	4.5	39	12	19
PYC6043	65	90.5	38	36	5.5	4.5	44	12	25
PYC6044	75	100.5	43	36	5.5	4.5	49	12	25
PYC6045	90	115.5	50.5	36	5.5	4.5	56.5	12	25



When using mounting clamps, care should be taken not to obscure any safety vent in the can. Delivered without bolts and nuts for mounting.
PYC clips are for PEH169 and PEH200 capacitors.

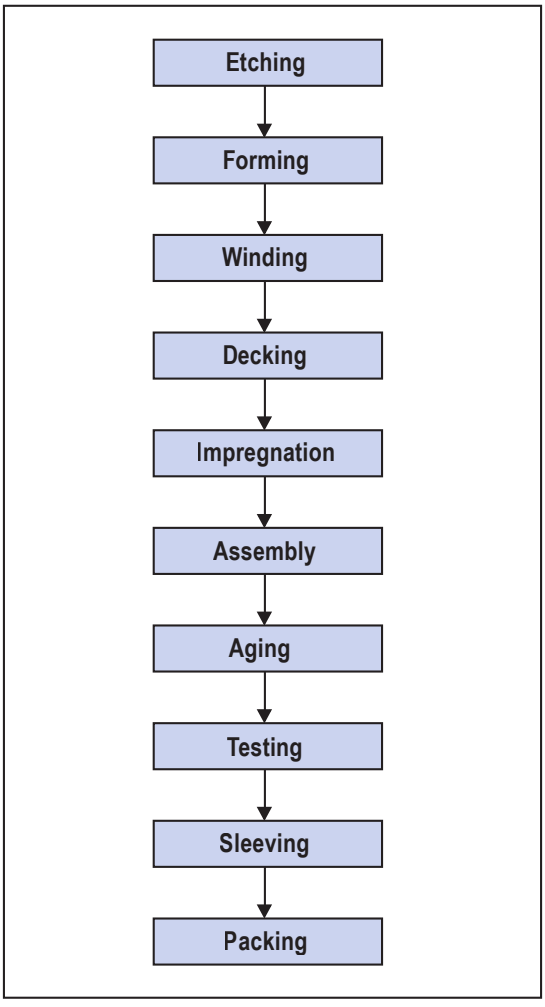
Construction Data

The manufacturing process begins with the anode foil being electrochemically etched to increase the surface area and then "formed" to produce the aluminum oxide layer. Both the anode and cathode foils are then interleaved with absorbent paper and wound into a cylinder. During the winding process, aluminum tabs are attached to each foil to provide the electrical contact.



The deck, complete with terminals, is attached to the tabs and then folded down to rest on top of the winding. The complete winding is impregnated with electrolyte before being housed in a suitable container, usually an aluminum can, and sealed. Throughout the process, all materials inside the housing must be maintained at the highest purity and be compatible with the electrolyte.

Each capacitor is aged and tested before being sleeved and packed. The purpose of aging is to repair any damage in the oxide layer and thus reduce the leakage current to a very low level. Aging is normally carried out at the rated temperature of the capacitor and is accomplished by applying voltage to the device while carefully controlling the supply current. The process may take several hours to complete.



Damage to the oxide layer can occur due to variety of reasons:

- Slitting of the anode foil after forming
- Attaching the tabs to the anode foil
- Minor mechanical damage caused during winding

A sample from each batch is taken by the quality department after completion of the production process. This sample size is controlled by the use of recognized sampling tables defined in BS 6001.

The following tests are applied and may be varied at the request of the customer. In this case the batch, or special procedure, will determine the course of action.

Electrical:

- Leakage current
- Capacitance
- ESR
- Impedance
- Tan Delta

Mechanical/Visual:

- Overall dimensions
- Torque test of mounting stud
- Print detail
- Box labels
- Packaging, including packed quantity

IEC Qualifications

This is the summary of test methods and requirements from IEC Publication 60384–4: Aluminum Electrolytic Capacitors with Non-Solid Electrolyte. Reference to relevant test methods is given below:

Test	IEC Publication	Procedure	Requirements
Mechanical Test Robustness of Terminations:	60068–2–21		No leakage of electrolyte or other visible damage. Deviations in capacitance, and tanδ from initial measurements must not exceed: Δ C/C < 5% tanδ ≤ 1.2 x initial value
Test Ua: Tensile		Loading force 10 N (0.5 < d ≤ 0.8) 20 N (0.8 < d ≤ 1.25)	
Test Ub: Bending		Loading force 5 N, two bends	
Test Uc: Torsion, Severity 2		Two successive rotations of 180° during 10 – 15 seconds, 2.0 Nm for M 5 mm thread	
Test Ud: Torque, Severity 1		2.5 Nm for M 6 mm thread	
Resistance to Soldering Heat Test T	60068–2–20	Solder bath method 260°C 10 seconds	
Solderability Test T	60068–2–20	Solder bath method 235 ±5°C/2±0.2 seconds for SnPb solder 245 ±5°C/3±0.3 seconds for SnAgCu solder 250 ±5°C/3±0.3 seconds for SnCu solder	Good tinning
Rapid Change of Temperature Test Na	60068–2–14	5 cycles Duration of exposure: 3 hours Recovery period: 16 hours	No leakage of electrolyte or other visible damage. Deviations in capacitance and tanδ from initial measurements must not exceed: Δ C/C < 5%.
Vibration Test Fc	60068–2–6	Procedure B4 **PEH169, PEH200 and PEH205:** D ≤ 50 mm Frequency range: 10 – 500 Hz Amplitude: 0.75 mm or acceleration 10 g Time: 3 x 2 hours D ≥ 50 mm Frequency range: 10 – 55 Hz Amplitude: 0.75 mm or acceleration 10 g Time: 3 x 2 hours **ALS 30/31/32/33/36/37/40/41/42/43/60/61:** Frequency range: 10 – 55 Hz Amplitude: 0.75 mm or acceleration 10 g Time: 3 x 2 hours except 220 mm long cans 10 – 55 Hz at 0.35 mm or 5 g for 3 x 0.5 hours **PEG124:** Frequency range: 10 – 500 Hz Amplitude 0.75 mm or acceleration 10 g Time 3 x 2 hours Ø 16 – 20 mm to be clamped by their body **PEG126 and PEH526:** Clamped body Frequency range: 10 – 2,000 Hz Amplitude: 1.5 mm or acceleration 20 g Time: 3 x 2 hours	No leakage of electrolyte or other visible damage. Deviations in capacitance and tanδ from initial measurements must not exceed: Δ C/C < 5%.

IEC Qualifications cont'd

Test	IEC Publication	Procedure	Requirements
Vibration Test Fc	60068–2–6	**PEG127:** Clamped body Frequency range: 10 – 2,000 Hz Amplitude: 1.5 mm or acceleration 20 g Time 3 x 22 hours **PEG130:** Clamped body Frequency range: 10 – 2,000 Hz Amplitude: 0.75 mm or acceleration 10 g Time 3 x 2 hours **PEG220, PEG225, PEG 226:** Clamped body Frequency range: 10 – 2,000 Hz Amplitude: 1.5 mm or acceleration 20 g Time 3 x 22 hours **PEH506/532/534/536** **ALC 10/12/40/42:** Clamped body Frequency range: 10 – 500 Hz Amplitude: 0.75 mm or acceleration 10 g Time: 3 x 2 hours, except ø 45, ø 50 mm: 10 – 55 Hz at 0.35 mm or 5 g for 3 x 0.5 hours	No leakage of electrolyte or other visible damage. Deviations in capacitance and tanδ from initial measurements must not exceed: Δ C/C < 5%.
Shock Test Ea	60068-2-27	Degree of severity Acceleration: 490 m/s^2 Duration of pulse: 11 ms Capacitors shall be mounted using clamps supplied by KEMET or shall be mounted by their stud, reinforced with clamps supplied by KEMET.	No leakage of electrolyte or other visible damage. Deviations in capacitance from initial measurements must not exceed: ΔC/C < 5%.
Climatic Test Climatic Sequency Test 4.21	60384–1		
1. Dry Heat Test Ba	60068–2–2	Temperature = upper category temperature Duration 16 hours	
2. Damp Heat, Cyclic Test Db	60068–2–30	Upper temperature 55°C 1 cycle of 24 hours at 55 ±2°C RH 95 to 100%, no voltage applied	
3. Cold Test Aa	60068–2–1	Temperature = lower category temperature Duration: 16 hours	
4. Low Air Pressure Test M	60068–2–13	Pressure 44 mbar (4.4 kPa) Temperature 15 – 35°C Duration: 5 minutes During the last minute the rated voltage (V_R) to be applied	
5. Damp Heat, Cyclic	60068–2–30	Remaining 5 cycles Upper temperature +55°C	No leakage of electrolyte or other damage. The marking to be legible. The difference in capacitance from the initial measurement must not exceed 10%.

IEC Qualifications cont'd

Test	IEC Publication	Procedure	Requirements
Damp Heat Steady State Test Ca	60068–2–3	Duration: 56 days	No leakage of electrolyte or other visible damage. The marking to be legible. No breakdown or flashover.
		After the test a voltage test is performed between terminations connected to case and a metal foil wrapped around the insulation, V-block as an alt. 1,000 VDC, 60 seconds. Insulation resistance measurement. 100 VDC, 60 seconds	Insulation resistance ≥100 MΩ.
Life Test Endurance Test 4.13 Long Life Types	60384–4	(1) 1,600 hours at upper category temperature The ripple current given in the part number to be superimposed. PEG127 150°C (2) 2,000 hours at upper category temperature The ripple current given in the part number to be superimposed. PEG124 125°C PEG126 150°C PEG220/22/226 150°C PEH169 105°C PEH200/PEH506 85°C PEH532/534/536 105°C PEH205/PEH526 125°C ALC12 85°C ALS40/ALS/42/ALC42 105°C (3) 5,000 hours at upper category temperature The ripple current given in the part number to be superimposed. PEH169 85°C PEG124, ALC40 105°C ALS 30/31/32/33 85°C ALS 36/37 ALC10 85°C ALP/T/N 20/22 85°C (4) 12,000 hours at upper category temperature The ripple current given in the part number to be superimposed. PEG130 105°C	No leakage of electrolyte or other visible damage. The marking to be legible. Δ C/C +15/-30% V_R ≤ 6.3 VDC Δ C/C ±15% 6.3 ≤ V_R ≤ 160 VDC Δ C/C ±10% for V_R > 160 VDC Leakage current ≤ the limit in the article list ESR ≤ 2 x initial value PEH500 range ESR ≤ 3 x initial specified limit No flashover or breakdowns in voltage proof at 1,000 VDC
Surge Voltage Test 4.14	60384–4	The capacitor to be subjected to 1,000 cycles of charge to voltage 0.5 minute load period followed by a no load period of 5 minute 30 seconds. Temperature = upper category temperature Applied voltage: 1.15 x rated voltage for V_R ≤ 315 V. 1.10 x rated voltage for V_R > 315 V. Time constant for charge 0.1 ± 0.05 seconds Duration: 30 seconds Recovery: 1–2 hours	No leakage of electrolyte or other visible damage. Δ C/C ≤ 15% Leakage current and tangent of the loss angle not to exceed the values given in the article list.

IEC Qualifications cont'd

Test	IEC Publication	Procedure	Requirements
Pressure Relief Test 4.16	60384–4	A DC voltage is applied in the reverse direction to give a current of 1 to 10A	The pressure relief is to open in such away that any danger of explosion or fire is eliminated.
Storage at High Temperature Test Ba	60068–2–2	96 ± 4 at upper category temperature. Recovery: minimum 16 hours	No leakage of electrolyte or other visible damage. Leakage current ≤ 2 x the maximum value in the part number. Δ C/C – 10%
Storage at Low Temperature Test Aa	60068–2–1	72 hours lower category temperature acc. to table below. Category Temperature °C 25/-/- –40 40/-/- –55 55/-/- –65 Recovery: minimum 16 hours	No leakage of electrolyte or other visible damage. The marking to be legible. Δ C/C ≤ 10%. The leakage current and tangent loss angle to be lower or equal to the values given in the article list.
Characteristics at High and Low Temperature Test 4.19	60068–2	Test Aa of 60068-2-1 followed by Test Ba of 60068–2–2 Temperature lower respectively upper category temperature. The impedance to be measured at lower category temperature. Leakage current, tanδ and capacitance to be measured at upper category temperature.	The ratio of the impedance measured at lower category temperature and initially must not exceed the values listed below. Rated Voltage VDC — Ratio of Impedance $V_R \leq 6.3$ — 5 $6.3 < V_R < 16$ — 4 $16 < V_R \leq 160$ — 3 $V_R > 160$ — 6
Charge and Discharge Test 4.20	60384–4	Number of cycles: 10^6 Temperature: 20°C Charge applied voltage: V_R Duration: 0.5 second Time constant: 0.1 second Discharge The discharge resistor to give a time constant = 0.1 second	No leakage of electrolyte or other visible damage. Δ C/C ≤ 10%
Fire Hazard Testing	60695–2–2	Needle-flame test. Duration of test flame: 30 seconds	Maximum burning time after removal of test flame: 30 seconds

Product Safety

THESE NOTES SHOULD BE READ IN CONJUNCTION WITH THE PRODUCT DATA SHEET. FAILURE TO OBSERVE THE RATINGS AND THE INFORMATION ON THIS SHEET MAY RESULT IN A SAFETY HAZARD.

Warning

When potentially lethal voltages e.g. 30V a.c. (r.m.s) or 60V d.c. are applied to the terminals of this product, the use of a hazard warning label is recommended. In the case of motor start capacitors they meet the requirements of British Standard Specifications BS.5267: 1976 and reference should be made to Appendix C -Guide for installation and operation.

1. Electrolyte

Aluminum electrolytic capacitors contain liquids (electrolytes) which can be hazardous. The electrolytes are conducting solutions of organic and/or boric acid, neutralized with amines or ammonia, in a variety of solvents. The major solvents are butyrolactone and ethylene glycol. Co-solvents e.g. N-methyl pyrolidone may be present. Inorganic or organo-phosphates are present in low concentration. The physical, chemical and toxicological properties of the electrolytes are largely determined by the solvents, as summarized below:

Physical Properties

1. Low viscosity–typically 5 – 50 cp at 25°C
2. Combustible–flash points 95 – 120°C
3. Low vapor pressure– < 20 mm Hg at 25°C

Chemical properties

1. Non-corrosive
2. Can be aggressive to many plastics, lacquers and resins
3. Totally soluble in hot water

Toxicology

The electrolytes are moderately toxic, with LD50 values in the range 1.5 – 2 g/Kg. Skin exposure can cause drying and defatting. Severe irritation may be caused to the mucous membranes, particularly the eyes, where conjunctivitis may result.

Safety Precautions

In the event of electrolyte escape, wash the affected area with hot water. Use rubber gloves to avoid skin contact. Any contact with the eyes should be liberally irrigated with water and medical advice sought.

Note: The electrolyte systems do not contain materials currently listed as carcinogenic, mutagenic or teratogenic, e.g., polychlorinated biphenyls (PCBs), dimethylformamide (DMF) or dimethylacetamide (DMA).

2. Intrinsic Properties

Operating

DC capacitors are polar devices and will operate safely only if correctly connected. Reversing the connections will result in high leakage currents which could subsequently cause short circuit failure, rupture of the safety vent, and possibly explosion and fire. Correctly polarized operation may result in the above failure modes if:

- The surge voltage is exceeded
- The ambient temperature is too high
- Excessive ripple currents are applied

AC types are non-polar. Catastrophic failure may be caused by:

- Abnormal duty cycles
- Voltage in excess of rated value
- Ambient temperature too high

Non-Operating

Aluminum electrolytic capacitors contain liquids which can leak out (see material content).
Damage to the encapsulation may cause leakage of the electrolyte. Excessive torque or soldering heat may affect the performance of the capacitor or damage the sealing. Electric shock may result if capacitors are not discharged.

3. Disposal

Aluminum electrolytic capacitors are consignable waste under the Special Waste Regulations 1996 (Statutory Instrument 1996 No 972), which complies with the EC Hazardous Waste Directive – Directive 91/689/EEC. The electrolyte should therefore be treated as a hazardous waste and advice should be sought from the local office of the Environmental Agency regarding its disposal.

Due to the construction of an aluminum electrolytic capacitor, high temperature incineration may cause the component to explode due to build-up of internal pressure. In addition, incineration may also cause the emission of noxious fumes. If it is decided that this is the best practicable option then it must be carried out under controlled conditions and at a minimum temperature of 1200°C. It should also be confirmed that the incinerator is authorized under parts A or B of the Environmental Protection Act.

The alternative is to dispose of them in an engineered lined landfill site that is licensed to take materials identified on the safety sheet. It should be stressed that these capacitors are not to be disposed of in a landfill site set aside for domestic waste.

KEMET strongly recommends that if there are any doubts regarding the disposal of aluminum electrolytic capacitors, that advice be sought from the local regulating authority.

In addition, KEMET would like to request that users of aluminum electrolytic capacitors respect the needs of the environment and, wherever possible, recover as much of the materials as possible, i.e. aluminum.

4. Unsafe Use

Most failures are of a passive nature and do not represent a safety hazard. A hazard may, however, arise if this failure causes a dangerous malfunction of the equipment in which the capacitor is employed. Circuits should be designed to fail safe under the normal modes of failure.

The usual failure mode is an increase in leakage current or short circuit. Other possible modes are decrease of capacitance, increase in dissipation factor (and impedance) or an open circuit.

Capacitors should be used in a well-ventilated enclosure or cabinet.

5. Mounting

Care should be taken when mounting by clamp, that any safety vent in the can is not covered.

6. Fumigation

In many countries throughout the world it is now common practice to fumigate shipments of products in order to control insect infestation, particularly when wooden packaging is used. Currently, methyl bromide is widely used as a fumigant, which can penetrate cardboard packing and polymer bags and, therefore, come into direct contact with equipment or components contained within.

If aluminum electrolytic capacitors become exposed to methyl bromide then corrosion may occur, depending upon the concentration and exposure time to the chemical.

This failure mode can affect all types of KEMET aluminum electrolytic capacitors. Methyl bromide can penetrate the seals of aluminum electrolytic capacitors and cause internal corrosion of the anode connection, resulting in the component becoming open circuit. The

rate of corrosion will depend upon the level of exposure to methyl bromide as well as the subsequent operating conditions, such as voltage and temperature. It may take months or, in some cases, several years before the component becomes open circuit.

7. Dielectric Absorption

A phenomenon known as dielectric absorption can cause aluminum electrolytic capacitors to recharge themselves. The phenomenon is well known but impossible to predict with any great accuracy, so potentially any electrolytic product could be affected. Thus, a capacitor that has been charged and then completely discharged will appear to recharge itself if left open circuit; this will manifest itself as a small voltage across the terminals of the capacitor. Generally, the voltages seen are less than 20 VDC. However, higher voltages have on occasion been reported.

In order to avoid any problems caused by this voltage, KEMET recommends that capacitors be discharged before connecting to the terminals.

8. Flammability

Most plastics and elastomers are combustible (e.g., will ignite if an ignition source is applied under suitable conditions of temperature and oxygen level). For most published data, the UL 94 Horizontal or Vertical Burning System has been applied. Although useful for comparative values, this test is not practicable, as the ignition characteristics are strongly influenced by the material dimensions and other materials with which they may be in intimate contact. KEMET has completed a series of flammability tests based on a Needle Flame Test, as specified in IEC 60695–2–2. Details of the tests undertaken on both the external components and internal wind elements can be found in a full technical article, TD005, Flammability Characteristics contained within KEMET Aluminum Electrolytic Capacitors – Application Notes.

Fire Classification of Materials

		Oxygen Index	Corresponding UL Standard
PEG124, PEG126, PEG127, PEG220-226	Tape (polyester)	20	UL 94 HB
PEH169 – PEH200 Series	Cover (phenolic - vyncolite)	35	UL 94 V-0
	Insulating cup (polypropylene)	17	UL 94 HB
ALS Series	Cover (phenolic - plenco)	30	UL 94 HB
ALS/C/P/T/N Series	Insulating sleeve (PVC)	35	UL 224 VW-1
	End disc (polypropylene)	17	UL 94 HB
ALS (on request)	Insulating sleeve (polyolefin)	34	UL94 V-2
PEH500 Series	Sleeve (PVC)	60	UL 94 V-0
ALC/P/T/N Series	Cover (phenolic - laminate)	51.3	NO DATA
MS/MD Series	Plastic case (noryl)	32	UL 94 V-1
Accessories	PYB mounting nut (polyamid)	26	UL 94 V-2

Application and Operation Guidelines

Selection of an electrolytic capacitor for reliable operation in a particular application should be based on a complete working condition specification.

An electrolytic capacitor used for smoothing, energy storage or filtering of a rectified AC voltage will be loaded with an AC ripple current causing a power loss and heating of the capacitor. The temperature in the hottest part inside the capacitor, the hot spot, is the major factor influencing operational life. The hot spot temperature is dependent upon several factors:

- Power loss caused by AC current
- Thermal resistance between the hot spot and the ambient
- Ambient temperature and capacitor cooling condition

KEMET's electrolytic can types and axial's are designed for operation under severe climatic conditions and for heavy ripple current load. This requires low internal losses and an efficient heat transfer between the capacitor hot spot and the ambient. The internal thermal design and the method of mounting the capacitor are therefore of equal importance for reliability and operational life, together with the capacitor's electrical design. Long term high parameter stability is the key to long life, as well as the ability to withstand high temperature and high ripple current. The power loss P in the capacitor can be calculated from:

$P = R_{ESR} \times I_{AC}^2$

R_{ESR} is dependent on the frequency f, and winding temperature. With complex current waveform it is therefore necessary to calculate the contribution from each harmonic frequency to the power loss.

$P = R_{ESR}(f_1) x I_{AC}^2(f_1) + R_{ESR}(f_2) x I_{AC}^2(f_2)(W)$

The thermal resistance R_{th}, (°C/W) of a capacitor is defined from the power loss P and the temperature difference, ΔT between the hot spot temperature, T_h and the ambient temperature, T_a in the thermal equilibrium.

$\Delta T = P \times R_{th}$

$Th = \Delta T + T_a$

The power P is assumed to be generated in the hot spot.

R_{th} (total thermal resistance) can be divided in two parts. R_{thhc} is the inner thermal resistance between the hot spot and the case. R_{thca} is the outer thermal resistance between the case and the ambient.

$\Delta T = P \times (R_{thhc} + R_{thca})$

R_{thhc} is dependent on the capacitor design; R_{thca} is dependent on cooling conditions. In electrolytic capacitors, heat generated in the winding is easily transferred in the axial direction. With this design a very low R_{thhc} is achieved and, thus, a very low temperature difference between the hot spot and the case. The operational life of long life electrolytic capacitors is dependent upon the evaporation of electrolyte through the seal.

At voltages up to rated voltage and at high temperatures there are practically no other factors that influence the life of the capacitors. Sealing materials are selected for minimum of diffusion losses.

Even if the Hot Spot temperature, T_h determines service life, the case temperature, T_c is better suited as a reference temperature for the calculation of service life. T_c is the temperature of a well defined surface area (the bottom of the case beneath the insulation). It is easily measured when e.g. effect of forced cooling is determined. For a certain power loss P the temperature difference between T_h and T_c is a constant.

$T_h = T_c + P \times R_{thhc}$

Parallel and Series Operation

Special considerations arise when electrolytic capacitors are used in series or parallel banks.

In series operation, matching of capacitance values may be necessary to avoid imbalance during charging and discharging mode. Steps must be taken to ensure adequate DC voltage distribution while biased, either by providing shunt resistors to compensate for inequalities in capacitor DC leakage currents, or some other means.

There are two major configurations to consider when constructing a series/parallel bank of capacitors - individual balancing resistors and common center connection. Individual balancing resistors afford greater protection for the capacitors if one becomes short circuited, but is more complex to construct and expensive. Common center connections give improved balancing during steady state and transient conditions, but offer the possibility of exposing one half of the bank to full voltage should one capacitor short circuit.

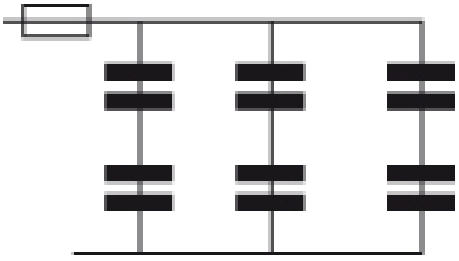
Full details on the section and use of shunt resistors can be found in the separate application notes produced by KEMET.

In parallel operation, particularly large, high voltage banks, the possibility of capacitors discharging into each other may entail special precautions in certain applications.

Series/Parallel Bank Protection

There are three major configurations to consider in protecting a series/parallel bank of capacitors. The advantages and disadvantages of each are outlined below but the final choice must be made by the equipment designer.

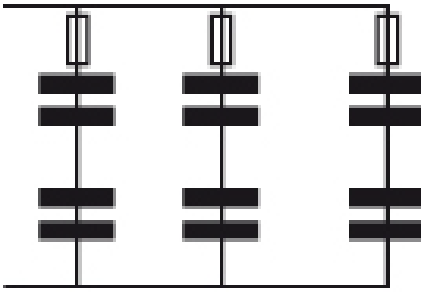
Option 1 – Fusing for Whole Bank



Advantages
- Simple construction
- Inexpensive

Disadvantages
- Only offers basic protection
- Cannot protect against internal discharges within bank

Option 2 – Individual capacitor fuses



Advantages
- Removes faulty capacitor from circuit

Disadvantages
- Expensive
- Complex assembly (busbars and fuses)

Option 3 – Electronic monitoring

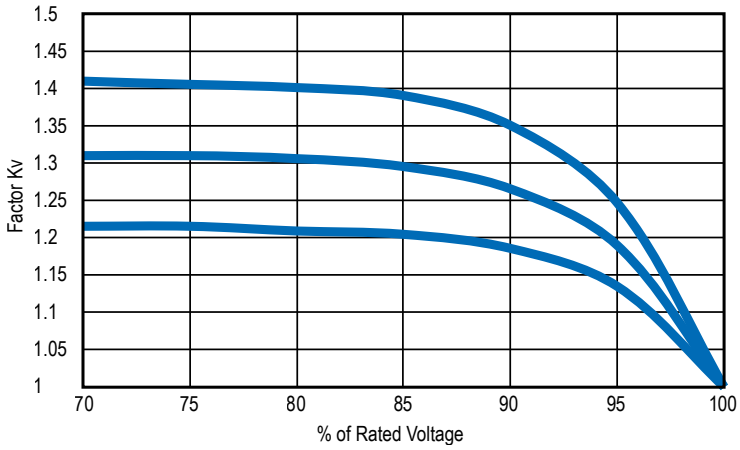
Advantages
- May prevent serious failure by early shutdown of equipment
- Optional bank discharge mechanism to prevent capacitors dumping charge into failed capacitor

Disadvantages
- Must be designed into control circuitry
- Complex and expensive

Voltage Derating

If capacitors are operated at a voltage below their rated value then the reduced stress and lower leakage current will give an improvement in the life expectancy.

Since leakage current increases with temperature, the benefit of a reduced operating voltage is more pronounced at higher temperatures. The graph below shows the voltage derating factor (Kv) for products with a rated temperature of 85°C and core temperatures (T_c) of 45°C, 65°C and 85°C.



The life expectancy of a capacitor at full rated voltage is multiplied by the voltage derating factor to obtain the new life expectancy at the lower operating voltage:

$Le(_{Vop}) = Le(V_R) \times Kv$

$Le(_{Vop})$ - Life expectancy at operating voltage

$Le(V_R)$ - Life expectancy at rated voltage

Kv - Voltage derating factor

Polarity and Reversed Voltage

Aluminum electrolytic capacitors manufactured for use in DC applications contain an anode foil and a cathode foil. As such, they are polarized devices and must be connected with the +ve to the anode foil and the -ve to the cathode foil. If this were to be reversed then the electrolytic process that took place in forming the oxide layer on the anode would be recreated in trying to form an oxide layer on the cathode. In forming the cathode foil in this way heat would be generated and gas given off within the capacitor, usually leading to catastrophic failure.

The cathode foil already possesses a thin stabilized oxide layer. This thin oxide layer is equivalent to a forming voltage of approximately 2V. As a result, the capacitor can withstand a voltage reversal of up to 2V for short periods. Above this voltage the formation process will commence.

Aluminum electrolytic capacitors can also be manufactured for use in intermittent AC applications by using two anode foils in place of one anode and one cathode.

Case Polarity

Due to the presence of electrolyte in the capacitor, the aluminum can, stud mounting and any dummy pins will essentially be at the same potential as the negative terminal. It is therefore recommended that they are either:
- Left unconnected
- Connected to the same potential as the negative terminal
- Insulated

Mounting

All aluminum electrolytic capacitors incorporate a safety vent in order to relieve build up of internal pressure due to overstress or catastrophic failure. For the smaller ranges, such as snap-in or solder pin types, this takes the form of a weakened area in the side or base of the can. For the larger screw terminal types, the vent is incorporated in the deck.

In all cases consideration must be given, when mounting the capacitor, to the operation of the vent under failure conditions. It is recommended that capacitors are always mounted with the safety vent uppermost, or in the upper part of the device. Should the vent operate, the least amount of electrolyte will then be expelled.

It is worth noting that screw terminal capacitors may be mounted in any position so long as the vent can operate safely. The operational and parametric performance is totally unaffected by the physical orientation, but should the vent operate with the capacitor mounted upside down then a few drops of electrolyte may be expelled.

Board mounting types are designed to be mounted by their terminals alone. Larger types may have dummy pins for extra rigidity. Screw terminal and tag ended types may be fixed with a base stud or suitable mounting clamp. Adequate space should be allowed between components for cooling air to circulate, particularly when high ripple currents are being applied.

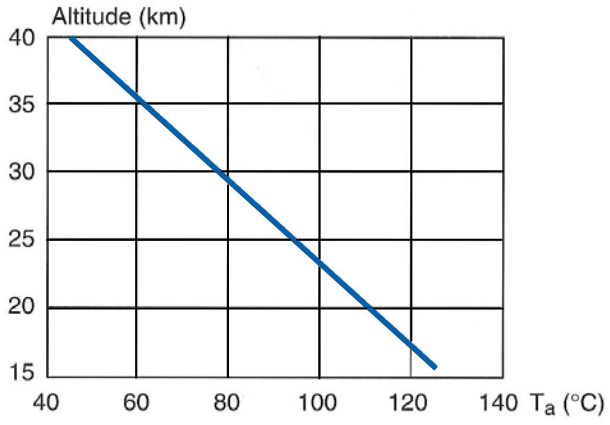
Altitude and Low Air Pressure

If a capacitor is operated at altitude, the life will be affected slightly for two reasons:

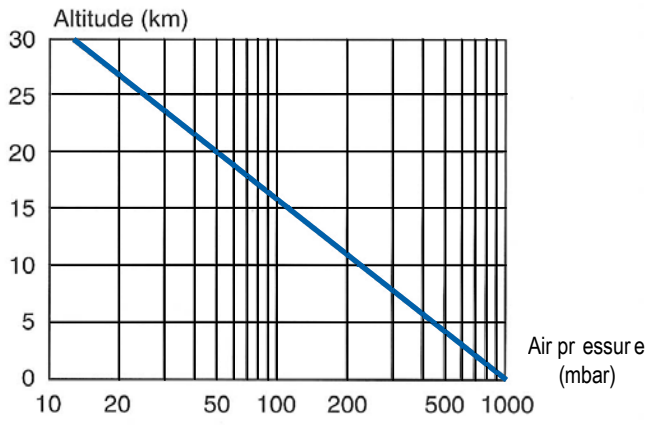
1. Convected heat loss will be reduced as the air density falls, resulting in the capacitor running hotter with a consequent reduction in life.

2. As the air pressure drops the differential between the internal case pressure and external pressure increases. A complete vacuum would cause the internal pressure to rise by approximately 15 psi. If maintained this would lead to increased electrolyte vapor loss and give a slight reduction in life expectancy.

Maximum altitude as a function of the ambient temperature (T_a)



Air pressure as a function of the altitude.



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Irving, TX
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Milpitas, CA
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Guadalajara, Jalisco
Tel: 52-33-3123-2141

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Southern Europe
Sasso Marconi, Italy
Tel: 39-051-939111

Skopje, Macedonia
Tel: 389-2-55-14-623

Central Europe
Landsberg, Germany
Tel: 49-8191-3350800

Kamen, Germany
Tel: 49-2307-438110

Northern Europe
Wyboston, United Kingdom
Tel: 44-1480-273082

Espoo, Finland
Tel: 358-9-5406-5000

Asia

Northeast Asia
Hong Kong
Tel: 852-2305-1168

Shenzhen, China
Tel: 86-755-2518-1306

Beijing, China
Tel: 86-10-5877-1075

Shanghai, China
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