



Overview

The KEMET APL90 is an AEC-Q200 qualified aluminum polymer rectangular capacitor, designed to fulfill 48V automotive applications and related platforms requiring compactness under low profile or low footprint application needs. It offers high capacitance, high ripple current performance and robust vibration resistance. Rated at 125°C, the APL90 offers excellent volumetric efficiency in a shape that lends itself to stacking into modules. Its shape, allows for easy use with a heat sink from the large surface area of the aluminum case or along its thickness, as like offers a solution for applications requiring very low profiles. These capacitors can then be mounted in horizontal or vertical position both allowing heat-sink to benefit space usage. Also, systems needing high energy efficient 48V power supplies, like the ones required for high end data centers, can also benefit with the usage of this product.

Applications

Typical applications are mainly in the field of automotive, such as DC-link on 48V inverters for MHEV, DC-Link on 48V systems motor drives as water pumps, power steering or cooling fans. Also, input capacitors for 48V systems data centers power supplies.

Benefits

- Rectangular shape for good volumetric efficiency and modular stacking options
- Easy use of multiple heat sink options - allowing I_{AC} optimization
- Height restriction solution / Compactness
- Life of 2,000 hours at +125°C [(V_R) and (I_R) applied]
- AEC-Q200 qualified for automotive applications
- High vibration up to 20 g
- Excellent ripple current capability
- Excellent surge voltage capability
- Optimized designs available on request

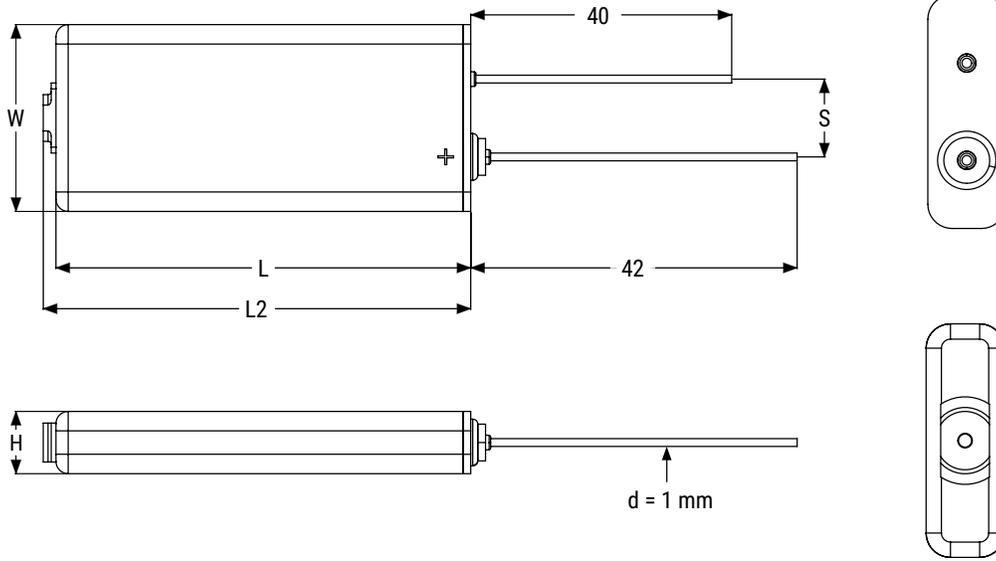


Part Number System

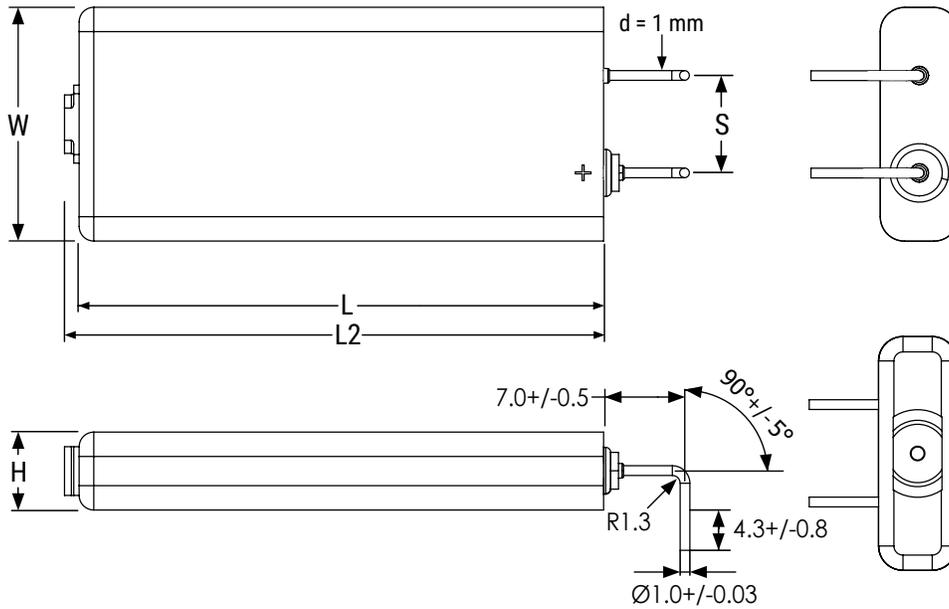
APL90	A	112	LH	063
Series	Termination	Capacitance Code (μF)	Size Code	Rated Voltage (VDC)
Aluminum Polymer Rectangular	A, B	First two digits represent significant figures. Third digit specifies number of zeros.	See Dimension Table	063 = 63 035 = 35 025 = 25

Termination Style and Dimensions – Millimeters

Termination A



Termination B



Size Code	Dimensions* in mm					Approximate Weight (Grams)
	H	W	L	L2	S	
	±0.5	±0.5	±0.5	± 2	± 1	
LH	8.0	24.0	53.8	54.9	10.0	14
LF	8.0	24.0	36.4	38.0	10.0	9.5

Case - Aluminum

Leads - Copper wire with tin electroplate

Performance Characteristics

Item	Performance Characteristics	
Capacitance Range	660 – 5,600 μ F	
Rated Voltage	25 – 63 VDC	
Operating Temperature	–55 to +125°C	
Storage Temperature Range	–55 to +125°C	
Capacitance Tolerance	\pm 20% select values at 100 Hz/+20°C	
Operational Lifetime	Rated voltage, +125°C, Rated ripple current	
	2,000 hours	
Leakage Current	I < 0.01 CV (μ A)	
	Leakage current performance is in line with wet and hybrid polymer electrolytic capacitor's behaviour. Leakage current limit is calculated under same principle being 1/20 x lower than conventional solid polymer capacitors. C = rated capacitance (μ F), V = rated voltage (VDC). Voltage applied for 5 minutes at +20°C	
Typical ESL	The series inductance (ESL) depends on wire length and mounting conditions. ESL of 4 nH at 1 MHz for approx. 5mm wire terminals.	
Vibration Test Specifications	Procedure	Requirements
	1.5 mm displacement amplitude or 20 g maximum acceleration. Vibration applied for three directions of 4-hour sessions at 10 – 2,000 Hz. (Capacitor clamped by body.)	No visible capacitor body damage. Deviations in capacitance from initial measurements must not exceed Δ C/C \pm 5%

Surge Voltage

Test Condition	Voltage (VDC)		
	25	35	63
\leq 30 second surge followed by a no load period of 330 seconds, 1,000 cycles at +125°C	28.75	40.25	72.45

Compensation Factor of Ripple Current (RC) vs. Frequency

Frequency	100 Hz	1 kHz	4 kHz	10 kHz	40 kHz	100 kHz
Coefficient Vr \leq 35 V	0.56	0.96	1.11	1.11	1.07	1.00
Coefficient Vr = 63 V	0.32	0.60	0.86	0.95	1.03	1.00

Test Method & Performance

Endurance Life Test	
Conditions	Performance
Temperature	+125°C
Test Duration	2,000 hours
Ripple Current	No ripple current applied
Voltage	The sum of DC voltage and the peak AC voltage must not exceed the rated voltage of the capacitor
Shelf Life Test	
Temperature	+125°C
Test Duration	1,000 hours
Ripple Current	No ripple current applied
Voltage	No voltage applied
The following specifications will be satisfied when the capacitor is tested at +20°C (±5°C)	
Capacitance Change	Within 15% of the initial value
Equivalent Series Resistance	Does not exceed 2x initial measured value
Leakage Current	Does not exceed leakage current limit

Shelf Life and Re-Ageing

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

After long periods of storage, it could be a benefit to re-age the capacitors as common practice for Aluminum capacitors. Leakage current performance is in line with wet and hybrid electrolytic capacitor's behaviour. Leakage current limit is calculated under same principle.

Reliability

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. Therefore, 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.

End of Life Definition

Catastrophic failure: short circuit, open circuit or safety vent operation

Parametric failure:

- Change in capacitance > $\pm 15\%$
- Leakage current > initial specified limit
- ESR > 2x ESR Limit

Mechanical Data

Polarity & 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 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 1.5 V for short periods. Above this voltage, the formation process will commence.

Mounting Position

The capacitor can be mounted upright or inclined to a horizontal position. For the vibration specifications to be valid, the capacitor must always be clamped by the body. The leads and connection tabs cannot provide the support necessary to stabilize the capacitor.

Installing

As general principle, KEMET recommends:

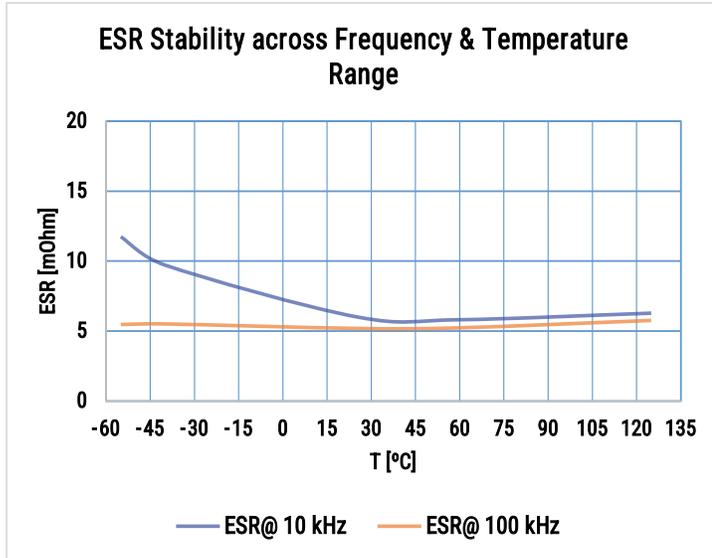
- The maximum rated temperature of the capacitor must not be exceeded.
- Ensure that the voltage across each capacitor does not exceed its rated voltage.
- Ensure electrical insulation between the capacitor case, negative terminal, positive terminal and PCB.
- Verify the correct polarization of the capacitor on the board.
- Do not cover the safety vent.
- Due to its rectangular shape, our APL90 product families offer the ability of stack capacitors, getting a modular arrangement. Also, easy use of heat sink condition is allowed to improve ripple current capability. More technical information related with this benefit can be checked under our specific Application Notes for Rectangular Aluminum Products.

Electrical Performance

Temperature stability characteristics

Due to a solid polymer technology, Solid Polymer Aluminum Capacitors feature higher conductivity. This results in a lower ESR which, coupled with high capacitance allows an aluminum polymer capacitor to replace several standard electrolytic capacitors, reducing the number of components and maximizing board space.

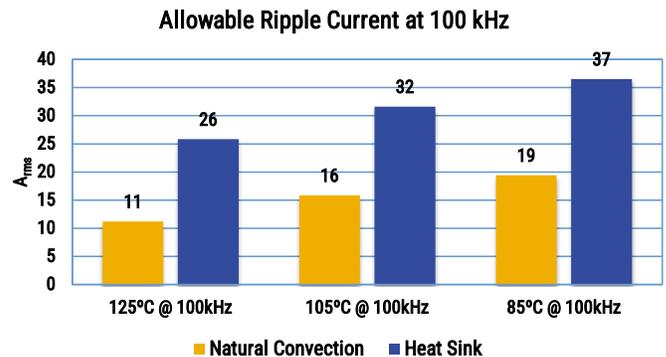
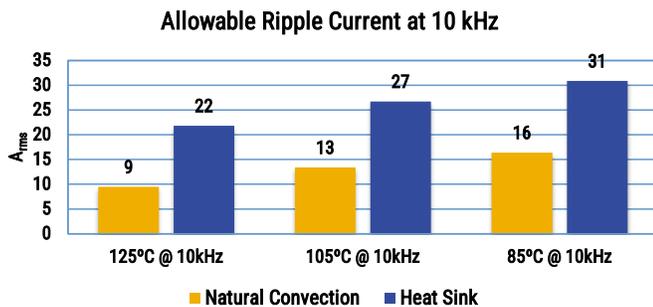
The ESR at high frequency (from 10kHz to 100kHz) of polymer capacitors is nearly constant within its operating temperature range, while the ESR of a standard electrolytic capacitor noticeably changes with temperature.



Ripple Current and Heat sink condition

As a result of a lower ESR, solid polymer aluminum capacitors are able to withstand higher ripple currents during normal operation. Specially, the rectangular shape allows for a very efficient usage of a heat sink condition, promoting a very easy way to double the ripple current capability under compact application conditions.

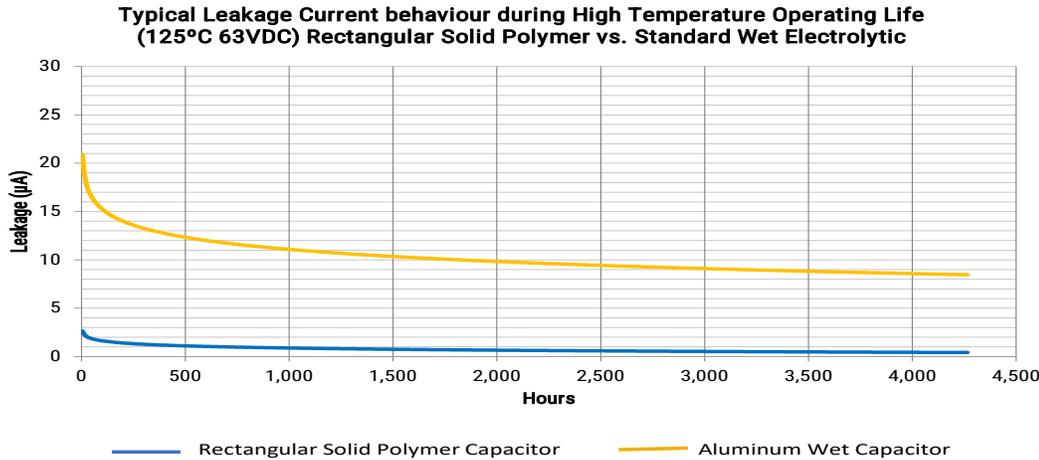
1100uF 63V – LH size



Electrical Performance cont.

Leakage current behavior in time

When during application, this KEMET polymer technology capacitor shows very low leakage current values, as the results of KEMET material process development designed for Thermal and Electrical efficiency without compromising leakage current behaviour.



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.

Due to customer requirements, there may appear additional markings such as lead-free (LF) or lead-free wires (LFW) on the label.

Table 1 – Ratings & Part Number Reference

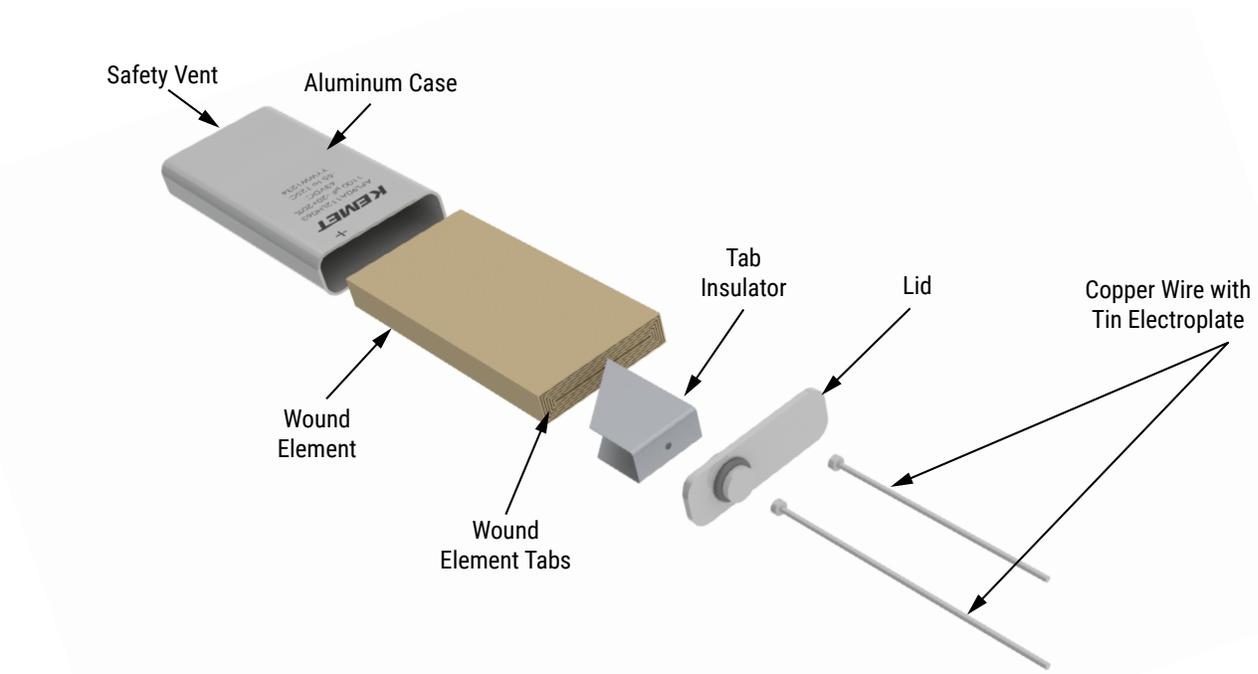
Rated Voltage (VDC)	Rated Capacitance 100 Hz, 20°C (µF)	Size Code	Case Size W x L (mm)	Ripple Current						ESR Maximum		Part Number
				100 kHz 85°C (A) ¹	100 kHz 105°C (A) ¹	100 kHz 125°C (A) ¹	100 kHz 85°C (A) ²	100 kHz 105°C (A) ²	100 kHz 125°C (A) ²	10 kHz, 20°C (mOhms)	100 kHz, 20°C (mOhms)	
25	5600	LH	24 x 53.8	28.3	23.1	16.3	55.3	45.2	31.9	5.0	5.0	APL90(1)562LH025
35	3300	LH	24 x 53.8	28.3	23.1	16.3	55.3	45.2	31.9	5.0	5.0	APL90(1)332LH035
63	1100	LH	24 x 53.8	19.4	15.9	11.2	36.5	31.6	25.8	10.5	7.5	APL90(1)112LH063
63	660	LF	24 x 36.4	12.4	10.1	7.1	26.1	22.6	18.4	16.0	12.0	APL90(1)661LF063

(A)¹ Natural convection

(A)² Heat sink

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

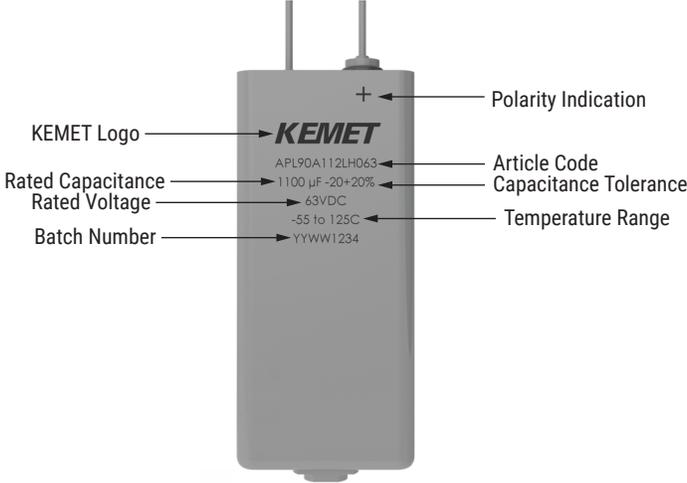
Construction



Rectangular Aluminum Polymer Capacitors

APL90, +125C, Polymer, AEC-Q200

Marking



**Print shown is representative*

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Although KEMET designs and manufactures its products to the most stringent quality and safety standards, given the current state of the art, isolated component failures may still occur. Accordingly, customer applications which require a high degree of reliability or safety should employ suitable designs or other safeguards (such as installation of protective circuitry or redundancies) in order to ensure that the failure of an electrical component does not result in a risk of personal injury or property damage.

Although all product-related warnings, cautions and notes must be observed, the customer should not assume that all safety measures are indicated or that other measures may not be required.

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