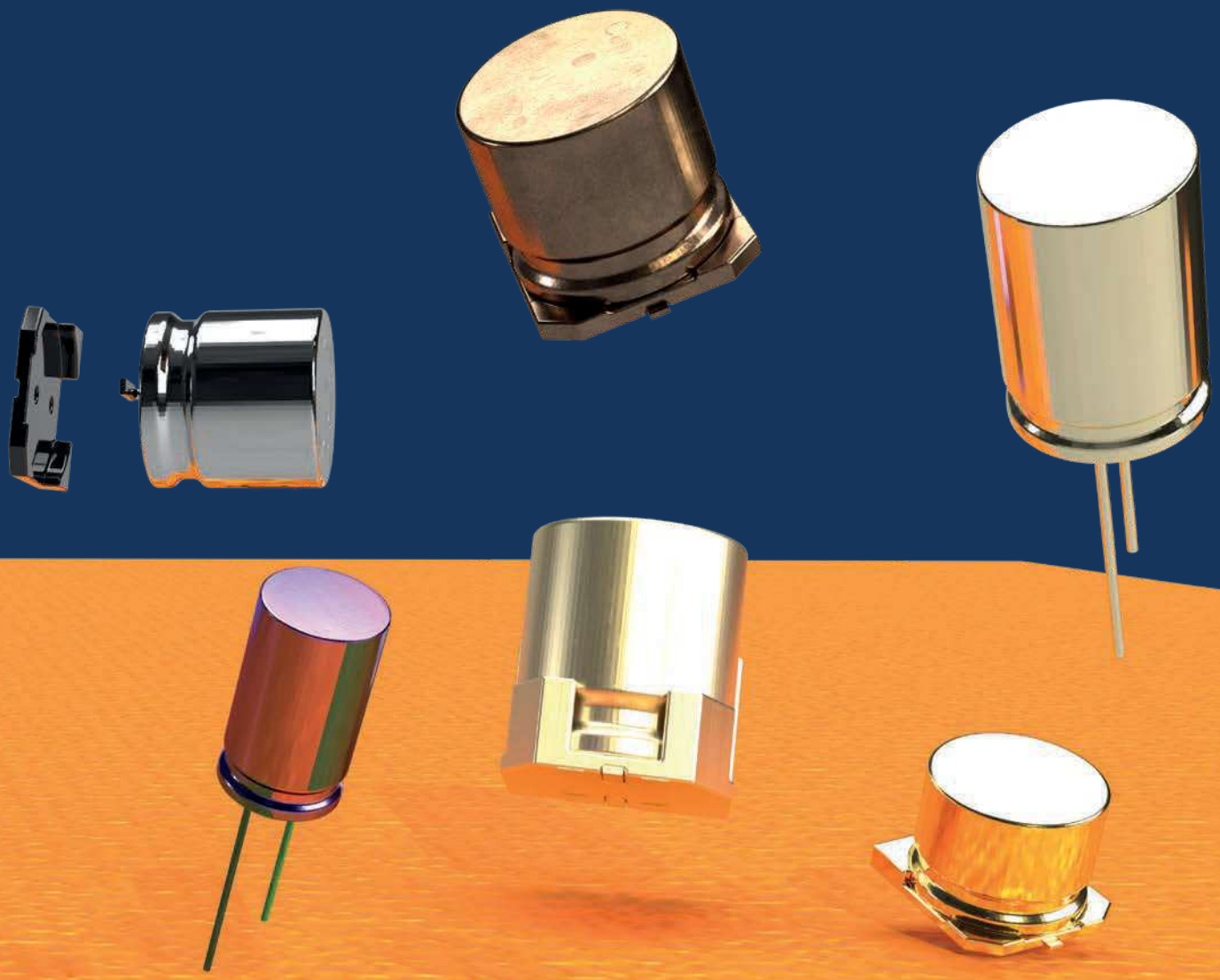
CapXon

ELECTROLYTIC CAPACITORS

HYBRID CONDUCTIVE POLYMER TYPES

Best Performance



2024

CONTENT

WORLD OF CAPXON	Page
GENERAL INFORMATION	
About us	4
Overview Capacitor Technologies	5
Technology Comparison	6
FURTHER INFORMATION	
Certification	7
Smart Production	8
Advanced Technology	9
New Research	10
Component Reliability Data	11
Quality and Environmental Management	17
AEC-Q200 and Automotive Requirements	20
Lifetime Estimation ▪ Lifetime Compendium	21
Technical Notes ▪ Technical Compendium	22
Application Examples	23
Technical Terms	26
Notes	129

HYBRID CONDUCTIVE POLYMER CAPACITORS	Page
SMD TYPE	
Overview ▪ Selection Table	27
Overview ▪ Group Chart	28
Datasheets	29
Product Code and Marking	106
Taping and Packaging	107
Dimensions and PAD Layout	110
Vibration Specifications	113
General Precautions and Guidelines	121
Soldering Specifications	127

CONTENT

HYBRID CONDUCTIVE POLYMER CAPACITORS		Page
	**RADIAL TYPE**	
	Overview ▪ Selection Table	73
	Overview ▪ Group Chart	74
	Datasheets	75
	Product Code and Marking	121
	Taping	115
	Packaging	117
	Available Lead Treatments	119
	General Precautions and Guidelines	121
	Soldering Specifications	128

10 FACTS ABOUT CAPXON

Founded 1980
by Victor Lin

Established in Taipei
Taiwan

Family owned and
independent

> 40 years experience in
electrolytic capacitors

2500 professional
employees

Fully owned factories
E-cap and foil factories

ISO9001, ISO14001
and IATF 16949 certified

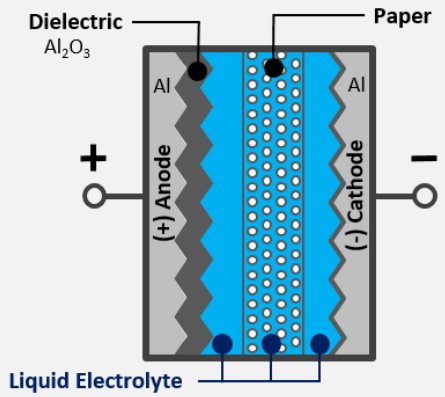
Patented production
process

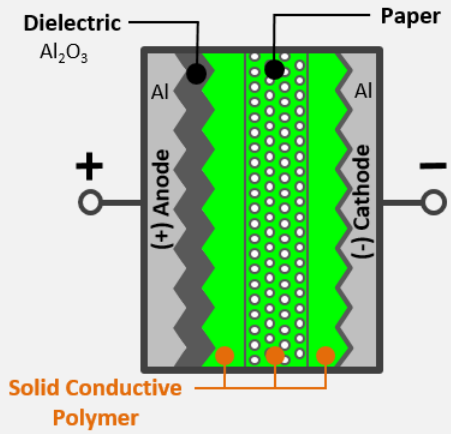
Belongs to the TOP 10
manufacturers in e-caps

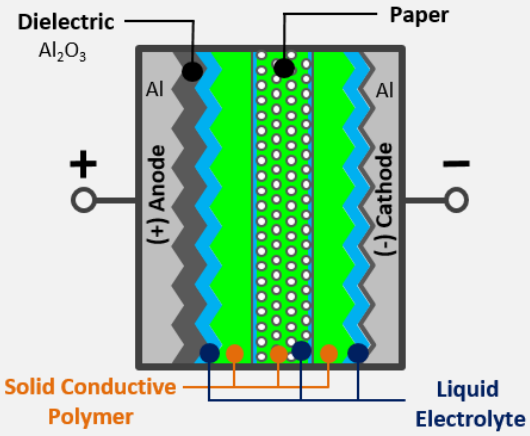
Production of more than
1 bio pcs per month

A WORLD OF ELECTROLYTIC CAPACITORS

CapXon's know-how in Electrolytic Capacitors covers technologies with aluminum foil. These are Aluminum Electrolytics, Solid Conductive Polymers and the combination known as Hybrid Conductive Polymers:

Aluminum Electrolytic	Description	Features
	Rated Voltage ▪ V_R	4 VDC to 650 VDC
	Cathode Material	Liquid Electrolyte
	Self-healing of Dielectric	Yes
	Package	Widest range in all sizes
	Stability	Reduced performance at low temperature
	Lifetime	Limited life at high temperature
	Reliability	Automotive AEC-Q200 qualified

Solid Conductive Polymer	Description	Features
	Rated Voltage ▪ V_R	2.5 VDC to 100 VDC
	Cathode Material	Solid Conductive Polymer
	Self-Healing of Dielectric	No
	ESR	Ultra-low ESR at high frequency
	Stability	Stable for low and high temperature
	Lifetime	Very stable and long life - no dry out
	Reliability	Only internal standard qualification

Hybrid Conductive Polymer	Description	Features
	Rated Voltage ▪ V_R	16 VDC to 400 VDC
	Cathode Material	Solid Conductive Polymer & Liquid Electrolyte
	Self-Healing of Dielectric	Yes
	ESR	Very low ESR at high frequency
	Stability	Even more stable than liquid type
	Leakage Current ▪ I_{LEAK}	Lower leakage current than Solid Conductive Polymer Type
	Reliability	Automotive AEC-Q200 qualified

COMPARISON OF ELECTROLYTIC CAPACITOR TECHNOLOGIES

Characteristics	Aluminum Electrolytic Capacitor	Solid Conductive Polymer Capacitor	Hybrid Conductive Polymer Capacitor
ESR at High Frequency	● (120 ~ 1 000 mΩ)	++ (7 ~ 15 mΩ)	+ (20 ~ 30 mΩ)
Leakage Current ▪ I_{LEAK}	++ ($0.01*C_R*V_R$)	● ($0.2*C_R*V_R$)	++ ($0.01*C_R*V_R$)
Ripple Current ▪ I_R	● (~ 600 mA)	++ (2 000 ~ 7 000 mA)	+ (2 000 ~ 3 000 mA)
Rated Voltage ▪ V_R	++ (~ 700 V)	● (~ 100 V)	+ (~ 400 V)
Operating Temperature Characteristics	+ (-40 ~ + 125 °C)	+ (-55 ~ + 125 °C)	++ (-55 ~ + 150 °C)
Low Temperature Characteristics	● (-40 ~ + 125 °C)	++ (-55 ~ + 125 °C)	+ (-55 ~ + 150 °C)
Lifetime	● (105 °C / 3 000h)	++ (105 °C / 5 000h)	++ (105 °C / 10 000h)
Failure Mode	+ Open	● Short	+ Open

++ ... best performance

\+ ... well performance

● ... basic performance

CERTIFICATION ACCORDING TO INTERNATIONAL STANDARDS

Quality, the environment, safety, and conservation of resources are the focus of our daily added value.

To meet the high requirements in the electronics industry, CapXon, as a global company, is certified according to the highest international standards. In this way, we ensure that all procedures and processes in our company are always structured and continuously optimized based on the valid and defined requirements.

CapXon is certified according to the following standards:

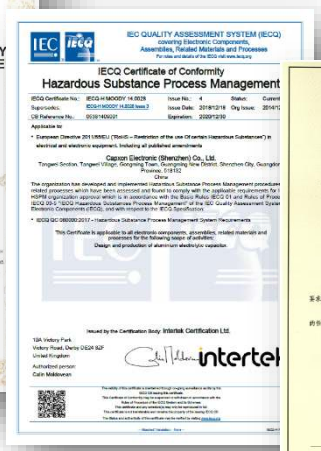
ISO 9001

ISO 14001

IATF 16949

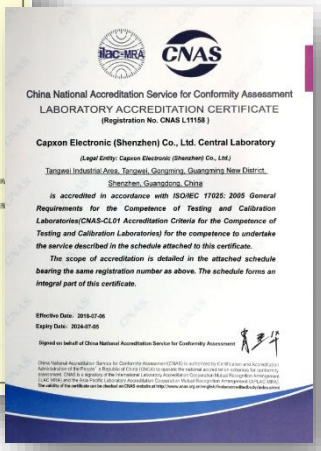
ISO 50001

OHSAS 18001



OC 080000

China RoHS

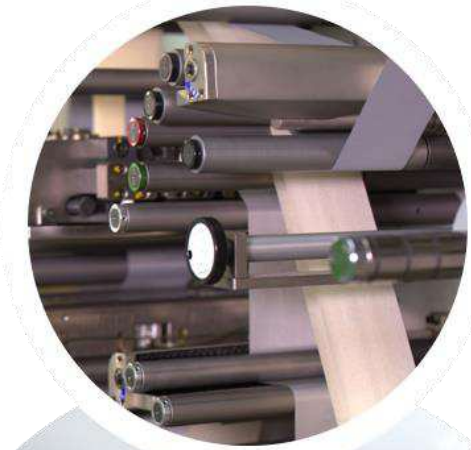


ISO/IEC 17025

SMART PRODUCTION

Since 1980 CapXon focuses on research, development and manufacturing of Aluminum Electrolytic Capacitors and is a leading brand with its own capacitor production in Shenzhen and Shanxi as well as its own foil production in Yichang, Qinghai, Baotou and Shanxi. More than 40 years of experience give us a deep understanding of foil material, high performance electrolytes, advance lead wire technology, conductive polymer and electrochemical systems.

Precision equipment ensures the quality of key components



Capacitor production for all core technologies as Aluminium Electrolytic, Solid Conductive and Hybrid Conductive Polymer capacitors with R&D and Quality headquarters in Shenzhen

Development of our own production process and machinery with the highest grade of automated production equipment and software

ADVANCED TECHNOLOGY

Only with the best production equipment and well-trained staff is it possible to maintain and expand the market position. Every year CapXon invests very large sums in machine, software and the education for our more than 2500 employees. To recognize deviation immediately during the production process, CapXon uses various precise inspection equipment.

All productions are qualified with strict specifications and every operation is monitored and measured at the machine

The products and the production meet the requirements of all industries even Medical or Automotive

Automated and full controlled manufacturing process

NEW RESEARCH

Highly roughened and formed anode foils are the heart of every Aluminum Electrolytic Capacitor. CapXon has been conducting intensive research and development for decades to bring low-voltage and high-voltage films into new spheres and at the same time to optimize processability and durability. The electrolytes and conductive polymers used on the cathode side are subject to a continuous improvement process, taking commercial and technical aspects into account.

Electrolyte and polymer development to achieve maximum product reliability and a long life

High grade etching foil, high grade forming foil through consistent further development to the limit of what is technically feasible

Well-equipped ISO/IEC 17025: 2005 accredited laboratories for research, analysis and testing

COMPONENT RELIABILITY DATA

In this section, the main parameters for predictive reliability and availability calculations are explained and in which way CapXon can provide you with such data.

FAILURE RATE λ

The failure rate λ describes the frequency which components possibly fail. The failure rate describes how many defects can be expected, if you run the application in operation for a certain time.

The failure rate can be calculated as following:

$$(1) \quad \lambda = \frac{n}{N*t}$$

n … Number of defect components

N … Number of tested components

t … Amount of operating hours

FAILURE CRITERIA

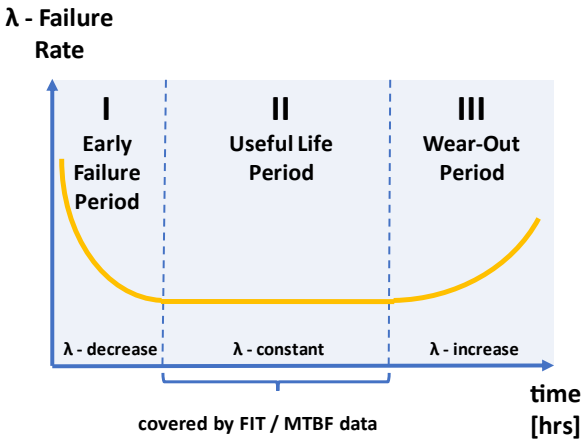
Capacitors will show certain wear-out phenomenon's by aging and so as times goes by the capacitors can possibly change their electrical performance.

As soon as the component is no longer fulfilling their electrical spec, stated features or with customer agreed parameters, the status of capacitor is seen as in failure mode or defect. This does not necessarily mean that the application will fail. An essential influence are the design and dimensioning by customer, which lead to major impact on possible failure modes and fail criteria for the application itself.

All given data by CapXon is just concerning the failure mode cases of the single component and is not representing the complexity of complete applications, assembled systems nor full electronic PCB boards.

BATHTUB CURVE

It's a widely used model within the reliability engineering to describe the expected failure rates over the whole application lifetime / product life cycle.



Bathtub curve

The Bathtub Curve states the failure rate behaviour within the three different product life cycle stages. These are the Early Failure Period, the Useful Life Period and the Wear Out Period.

With production control, monitoring and quality assurance, it is possible to reduce the early failures to a best possible minimum.

Failures within the Useful Life Period, which are described as FIT or MTBF value, are defined as events of coincidence and are not representing any systematic or epidemic failures.

FIT – FAILURES IN TIME

FIT - Failures In Time is the common way to describe the expected failure rate for electronics.

The FIT values describe certain failure rate within the useful life period and provides the basis for calculations, assumptions and extrapolation of reliability and availability to gather the understanding for expected failures / defects. These calculated figures are used to decide whether the component is a proper choice for the desired use case. Additionally, it need to be clarified whether redundancies are necessary and which redundancies are needed to fulfil the desired mission profile of an application.

The unit FIT defines the expected amount of failures per application hour.

$$(2) \quad 1\ FIT = \frac{10^{-9}}{h} = \frac{10^{-9} failures}{per\ operating\ hour}$$

So as higher the stated FIT value is, as higher the statistical chance of defect is.

Please find the following example of a failure rate test determined by a useful life test:

- Number of failures n = 2
- Number of tested components N = 10 000
- Operating hours t = 20 000 h

$$(3) \quad \lambda = \frac{n}{N*t} = \frac{2}{10\,000*20\,000h} = 10\ FIT$$

$$(4) \quad 10\ FIT = \frac{10^{-8}}{h} = \frac{0.001\%}{1\,000h}$$

MTBF ▪ MEANTIME BETWEEN FAILURES

It's the predicted elapsed time between inherent failures of an electronic system during normal operation. The MTBF can be calculated as arithmetic mean / average time between failures of a system.

Assuming a constant failure rate, the MTBF can be easily calculated by reciprocal value of the Failure Rate λ**:**

$$(5) \quad MTBF = \frac{1}{\lambda}$$

MTBF is just a different way to describe the failure rate and can be easily converted to FIT and vice versa:

$$(6) \quad MTBF = \frac{10^9 h}{FIT} = \frac{114\,000\ years}{FIT}$$

$$(7) \quad FIT = \frac{10^9 h}{MTBF} = \frac{114\,000\ years}{MTBF}$$

The **MTBF** values are just covering the useful life period (flat middle section) of the bathtub curve. Because of this, a FIT or MTBF value can't be extrapolated to estimate the service lifetime for a component. FIT or MTBF values doesn't cover the higher failure rates of the wear-out period, where the expected failure rate would be higher due to occurring wear-out phenomenon's.

LIFETIME TESTS

Due to the fact that all electrolytic capacitors show aging behaviour and a possible drift of electrical parameters over usage time, lifetime tests are performed by manufacturers to describe the related reliability and performance of a certain capacitor. Different product series as well as the single product itself can provide very different lifetime performance. So, these test results are given to select the proper product in relation to the applied stress profile of application to gain the desired application performance within the whole product life cycle.

There are various names (e.g. Endurance, Load Life, Useful Life, Operational Life, Life Expectancy, Shelf Life, …) and different lifetime tests that are existing within the industry. Please kindly check the specific test specification and given data for the capacitor before design-in.

Sadly, there is no standardized naming and test criteria existing, given by any international accepted standard committee for all the lifetime tests, which are applied to electrolytic capacitors. Customers need to compare competitor products carefully with each other to see if test specifications are similar or different.

Please see particular datasheets for the specific test results and criteria of an individual product of CapXon.

Again, please note that the criteria of failure are given by the test specification limits of the dedicated lifetime test and as soon as a component is not fulfilling these given limits, it is rated as a failure. So, failure does not necessarily mean defect or breakdown of application. It is just describing that the drift of electrical performance is bigger than the checked limits of the particular test. It doesn't matter whether the measured C value is lower as the allowed test limit or the component is in a failure mode of open circuit, both cases are treated the same as a failure. Design and dimensioning of application will arrange how much drift of electrical parameters can be accepted for the individual capacitor. For example, when the rate of capacitance change is becoming critical within the application is defined by customer design. The lifetime tests are in place to provide a common and industry-wide comparable performance index of the capacitors.

As manufacturer, we can state and check how fast a drift of capacitance and further parameters will happen. Dimensioning within application design will set how long an error-free operation is possible. A proper dimensioning can enlarge the acceptable drift and so the lifetime performance. But be aware, if it is not done properly or component is overstressed, it also can shorten the expected lifetime performance. Please be aware to check dimensioning and drift estimation to assure your product performance for the desired lifetime. For support with lifetime estimations and dimensioning, we are pleased to support you and feel free to get in touch with our technical support.

In the following section CapXon's lifetime tests, which are performed with our products, are described in detail.

ENDURANCE

The Endurance test of the product checks the performance of its electrical parameters, such as capacitance change, leakage current and dissipation factor on their behaviour over time at a predetermined test setup of electrical stress and ambient condition.

Depending on the product series, the Endurance test is performed according to one of the settings below:

Setting 1 - applying Endurance test:

- max. Temperature
- V_R - Rated Voltage

Setting 2 - applying Endurance test:

- max. Temperature
- V_R - Rated Voltage
- I_R - Rated Ripple

Setting 1 is in accordance to the IEC 60364-4 / JIS 51001-4 test criteria and Setting 2 is enlarging the electrical stress setup with additional appliance of I_R, to get a more representative result in comparison to possible real-life application stress.

The Endurance test is performed within product qualification at the stage of internal product validation and is repeated periodically for product requalification.

USEFUL LIFE

To get more representative understanding of lifetime performance for typical capacitor use, the useful life test represents such criteria.

The applied electrical stress is like the Endurance test - Setting 2. The test specification limits are wider as the endurance test specification, but as described the applied electrical stress stays similar. So, a larger acceptable drift of electrical parameters results in a larger expected lifetime. This represents the operational frame which is set by customer at dimensioning the capacitor specification for their application and the possible borders of an error-free operation.

Also, we state a FIT value related to the useful life test. These failure rate describes the deviation / possibility of occurrence of failures within the useful life period when the settings of useful life test are applied. This is related to the middle section of the bathtub curve the so-called useful life period (see above page 12 - Bathtub Curve of Product Reliability).

In the datasheet you will find the following phrase:

Failure Rate (during useful Life): 1%/1 000h with a confidence level of 60%. As a result, this is like a 10 000 FIT:

$$\lambda = \frac{1\%}{1000\ h} = 100\ FIT = 100\ failures * 10^{-9h}$$

Example:

If you have 8 000 components running in applications for 5 000 hours with the test conditions applied like the useful life test, you can estimate the number of components that show a higher drift as given by the useful life test spec borders as follows:

- Number of components N = 8 000
- Operating hours t = 5 000 h

$$\lambda = \frac{n}{N * t}$$

$$n = \lambda * N * t = \frac{0.01\%}{1\,000h} * 8\,000 * 5\,000h = 4$$

This means that when there are 8 000 pcs in operation for 5 000 hours at the maximum possible operating conditions (max. temp., V_R & I_R similar to useful life test criteria) an amount of 4 products (with a confidence level of 60%) can be expected to show a higher drift as given in the test spec.

SHELF LIFE

The shelf life test simulates the aging of the capacitor, if it is just stressed with ambient temperature without any electrical load. The shelf life is not defining the possible storage time of the capacitor but just to describe the aging situation before mounting / PCB assembly.

The Shelf Life test criteria shall be satisfied, if the capacitor was restored to 20°C and following a conditioning by voltage treatment in accordance with 4.1 of JIS 5101-4 was applied, before measuring the capacitor.

LIFETIME TEST EXAMPLES

Example 1 - Useful Life, Endurance (Setting 1) and Shelf life tests of SMD types – HV Series:

Lifetime Test		
Endurance 105°C (V_R applied)	Test	2 000 hours
	ΔC/C	≤ ±30% of initial measured value
	tanδ	≤ 300% of initial specified value
	I_{Leak}	≤ the initial specified value
Shelf Life 105°C (None)	Test	1 000 hours
	ΔC/C	≤ ±30% of initial measured value
	tanδ	≤ 300% of initial specified value
	I_{Leak}	≤ the initial specified value
Resistance to Soldering Heat	The capacitors shall be kept on a hot plate maintained at 250°C for 30 seconds. After removing from the hot plate and restored at room temperature, they meet the characteristic requirements listed below	
	ΔC/C	Within ±10% of initial value
	tanδ	Less than specified value
	I_{Leak}	Less than specified value

Example 2 - of Useful Life, Endurance (Setting 2) and Shelf life tests of Radial types – GF Series

Lifetime Test			
Endurance 105°C (V_R & I_R applied)	Test	2 000 hours	ø D 5 ~ 6.3 mm
		3 000 hours	ø D 8 mm
		5 000 hours	ø D ≥ 10 mm
	ΔC/C	≤ ±20% of initial measured value	
	tanδ	≤ 200% of initial specified value	
	I_{Leak}	≤ the initial specified value	
Shelf Life 105°C (None)	Test	1 000 hours	
	ΔC/C	≤ ±20% of initial measured value	
	tanδ	≤ 200% of initial specified value	
	I_{Leak}	≤ the initial specified value	

Example 3 - of Useful Life, Endurance (Setting 2) and Shelf life tests of Snap In types – HU Series:

Lifetime Test		$V_R \leq 100V$	$V_R > 100V$
Useful Life 105°C (V_R & I_R applied)	Test	5 000 hours	8 000 hours
	ΔC/C	≤ ±30% of initial measured value	≤ ±20% of initial measured value
	tanδ	≤ 300% of initial specified value	≤ 200% of initial specified value
	I_{Leak}	≤ the initial specified value	≤ the initial specified value
Endurance 105°C (V_R applied)	Test	3 000 hours	
	ΔC/C	≤ ±15% of initial measured value	≤ ±10% of initial measured value
	tanδ	≤ 130% of initial specified value	≤ 130% of initial specified value
	I_{Leak}	≤ the initial specified value	≤ the initial specified value
Shelf Life 105°C (None)	Test	1 000 hours	
	ΔC/C	≤ ±15% of initial measured value	≤ ±10% of initial measured value
	tanδ	≤ 130% of initial specified value	≤ 130% of initial specified value
	I_{Leak}	≤ the initial specified value	≤ the initial specified value

Example 4 - Useful Life, Endurance (Setting 2) and Shelf life tests of Screw types – RK Series:

Lifetime Test		
Useful Life 105°C (V_R & I_R applied)	Test	4 000 hours
	ΔC/C	≤ ±45% of initial measured value
	tanδ	≤ 300% of initial specified value
	I_{Leak}	≤ the initial specified value
Endurance 105°C (V_R applied)	Test	2 000 hours
	ΔC/C	≤ ±15% of initial measured value
	tanδ	≤ 130% of initial specified value
	I_{Leak}	≤ the initial specified value
Shelf Life 105°C (None)	Test	1 000 hours
	ΔC/C	≤ ±15% of initial measured value
	tanδ	≤ 130% of initial specified value
	I_{Leak}	≤ the initial specified value

TELCORDIA SR-332

This industry-wide accepted standard provides data and tools for reliability predictions of components, devices or full hardware units of electronic equipment. Telcordia (formerly Bellcore). With the given figures and data, it is possible to assure system availability and to gather the desired system reliability.

FIT & MTBF DATA OF CAPXON PRODUCTS

CapXon provides FIT & MTBF values based on Telcordia SR332 standard for all components. From our perspective, it provides more reliable prediction because it is more specific and detailed than MIL-217 or Siemens SN 29500.

Please find the FIT values for CapXon components and application-based reliability prediction calculations on the following page.

The table of SMD / RADIAL / Snap-In is covering all Electrolytic Technologies – Liquid, Solid and Hybrid Electrolytic Capacitors in SMD & Radial.

The table of Screw capacitors is just concerning Liquid Aluminum Electrolytic Capacitors.

Mounting Type	SMD / Radial / Snap-In					
Electrical Stress	100%		75%		50%	
Operating Temp. [°C]	λ [FIT]	σ [FIT]	λ [FIT]	σ [FIT]	λ [FIT]	σ [FIT]
≤ 30	1,19	0,28	0,65	0,15	0,36	0,08
35	1,52	0,35	0,84	0,19	0,46	0,11
40	1,94	0,45	1,06	0,25	0,58	0,14
45	2,45	0,57	1,34	0,31	0,74	0,17
50	3,07	0,71	1,68	0,39	0,92	0,22
55	3,82	0,89	2,10	0,49	1,15	0,27
60	4,72	1,10	2,59	0,60	1,42	0,33
65	5,80	1,35	3,19	0,74	1,75	0,41
70	7,09	1,65	3,89	0,91	2,14	0,50
75	8,61	2,01	4,73	1,10	2,59	0,60
80	10,40	2,42	5,71	1,33	3,13	0,73
85	12,50	2,91	6,86	1,60	3,76	0,88
90	14,94	3,48	8,20	1,91	4,50	1,05
95	17,78	4,14	9,76	2,27	5,35	1,25
100	21,05	4,90	11,55	2,69	6,34	1,48
105	24,82	5,78	13,62	3,17	7,47	1,74
110	29,13	6,78	15,99	3,72	8,77	2,04
115	34,05	7,93	18,69	4,35	10,26	2,39
120	39,65	9,23	21,76	5,07	11,94	2,78
125	45,99	10,71	25,24	5,88	13,85	3,23
130	53,15	12,38	29,17	6,79	16,01	3,73
135	61,20	14,25	33,59	7,82	18,43	4,29
140	70,24	16,36	38,55	8,98	21,15	4,93
145	80,34	18,71	44,09	10,27	24,20	5,64
150	91,60	21,33	50,27	11,71	27,59	6,43

Table 1: FIT values for SMD, Radial, Snap-In

Remark: Above values are only valid within the max. specified temperature range of the particular component. All given FIT data is meant for lifetime predictions only and is not representing any warranty.

For particular products (e.g. screw capacitors) within the datasheet, further FIT or MTBF data is added and in such a case, this substitutes the general information stated above.

Mounting Type	Screw terminal					
Electrical Stress	100%		75%		50%	
Operating Temp. [°C]	λ [FIT]	σ [FIT]	λ [FIT]	σ [FIT]	λ [FIT]	σ [FIT]
≤ 30	34,20	24,43	18,77	13,40	10,30	7,36
35	43,85	31,32	24,06	17,19	13,21	9,43
40	55,78	39,84	30,61	21,87	16,80	12,00
45	70,42	50,30	38,65	27,61	21,21	15,15
50	88,27	63,05	48,44	34,60	26,59	18,99
55	109,88	78,48	60,30	43,07	33,09	23,64
60	135,88	97,06	74,57	53,27	40,93	29,23
65	166,99	119,28	91,65	65,46	50,30	35,93
70	203,99	145,71	111,95	79,97	61,44	43,89
75	247,76	176,97	135,97	97,12	74,62	53,30
80	299,26	213,76	164,24	117,31	90,14	64,38
85	359,57	256,84	197,34	140,96	108,30	77,36
90	429,86	307,04	235,91	168,51	129,47	92,48
95	511,39	365,28	280,66	200,47	154,03	110,02
100	605,57	432,55	332,34	237,39	182,39	130,28
105	713,89	509,92	391,79	279,85	215,02	153,59

Table 2: FIT values for Screw types

λ - Mean Component Failure Rate

σ - Standard Deviation of Component Failure Rate

CALCULATION OF FIT VALUE FOR APPLICATION CASE

By using the given Telcordia SR-332 figures and by the assumption that the failure rate follows a gamma distribution, the FIT value can be calculated with given mean λ and standard deviation σ (see section tables in section 8.8) and desired UCL - Upper Confidence Level as follows:

$$\boldsymbol{shape\ \kappa = \left(\frac{\lambda}{\sigma}\right)^2}$$

$$\boldsymbol{scale\ \theta = \frac{\sigma^2}{\lambda}}$$

The desired FIT value for the application case is the P% quantile of the gamma distribution and it can be calculated by the inverse cumulative gamma distribution with the shape κ and scale θ parameters as follows:

$$\boldsymbol{\lambda_{P\%UCL} = G^{-1}(90/100; \kappa; \theta)}$$

If the shape κ parameter is >100 the FIT can also be calculated by using the P% quantile of the normal distribution, by inverse cumulative distribution of normal distribution with mean λ and standard deviation σ:

$$\boldsymbol{\lambda_{P\%UCL} = N^{-1}(P/100;\ \lambda; \sigma)}$$

Customer need to define which UCL is desired for the reliability prediction for their application case (typical values for UCL are e.g. 60%,90%, 95%, 99%).

CALCULATION EXAMPLE

Example 1:

GF Series – Radial type
Aluminum Electrolytic Capacitor

@ 70°C and 75% electrical stress
Upper Confidence Level (UCL) = 90%

Values according to table 1 at page 16:
λ= 3.89 FIT / σ= 0.91 FIT

$$\boldsymbol{shape\ \kappa = \left(\frac{3.89}{0.91}\right)^2 = 18.27}$$

$$\boldsymbol{scale\ \theta = \frac{0.91^2}{3.89} = 0.21}$$

$$\boldsymbol{\lambda_{90\%UCL} = G^{-1}(90/100; 18.27; 0.21) = 5.02\ FIT}$$

In Microsoft Excel you can solve this with the following formula:

International / American Excel Version:
=GAMMAINV(0.9,18.27,0.21)

European Excel Version:
=GAMMAINV(0,9;18,27;0.21)

Example 2:

RG Series - Screw type
Aluminum Electrolytic Capacitor

@ 60°C and 75% electrical stress
Upper Confidence Level (UCL) = 90%

Values according to table 2 at page 16:
λ= 74.57 FIT / σ= 53,27 FIT

$$\boldsymbol{shape\ \kappa = \left(\frac{74.57}{53.27}\right)^2 = 2.01}$$

$$\boldsymbol{scale\ \theta = \frac{0.91^2}{3.89} = 38.05\ FIT}$$

$$\boldsymbol{\lambda_{90\%UCL} = G^{-1}(90/100; 2.01; 38.05) = 148.57 FIT}$$

In Microsoft Excel you can solve this with the following formula:

International / American Excel Version:
=GAMMAINV(0.9,2.01,38.05)

European Excel Version:
=GAMMAINV(0,9;2,01;38,05)

QUALITY MANAGEMENT SYSTEM

We are committed and living the principle of **QUALITY FIRST - to offer highly satisfying products and service to the customer**. This global aim is shared by the CapXon quality and environmental management system and part of our business philosophy:

QUALITY MANAGEMENT SYSTEM CERTIFICATION

In accordance with our quality commitment, CapXon quality management is certified by **ISO 9001** and **IATF 16949**. The certification covers our production plants as well as our sales organization. This standard is applied throughout the company and is used to implement, monitor and to proceed the CapXon quality policy in all process steps.

PRODUCT AND PROCESS QUALITY

Our product and process development follows the sequence and phases of **APQP – Advance Product Quality Planning:**

5 Phases of APQP

Quality tools such quality tools, including **5S, PDCA, FMEA, (DFMEA & PFMEA), MSA, APQP, PPAP, SPC** and others, are in place to minimize risks, provide constant monitoring and ensure continuous improvements in conjunction with regular internal audits and QM reviews.

QUALITY ASSURANCE

For our sample checks, we refer to **AQL - Acceptable Quality Level** figures, which are based on a random sampling plan in accordance with **MIL-STD-1916**. Referring to instructions of this standard, a delivered lot will be accepted with a probability of 90%, if the percentage of non-conformance does not exceed the stated AQL figure. As a general internal target, the percentage of non-conformance in deliveries from CapXon is significantly below the AQL figure. The acceptance value we apply to non-conform components is c= 0.

INCOMING GOODS INSPECTION BY CUSTOMER

We recommend applying planned random sampling checks in accordance with MIL-STD-1916 , is compliant with MIL STD 105 D and IEC 60410, for incoming goods inspection. The test methods, which shall be applied, are laid down in the relevant standards.

ENVIRONMENTAL MANAGEMENT

Environmental Policy

CapXon defines internally the following environmental **protection principles**:

- **comply with the given law & regulations**
- **observe and act to reduce pollution**
- **produce cleanly**
- **reduce the consumption and save resources**
- **cut down usage of toxic substances**
- **make continuous improvements**
- **protect the environment**

ENVIRONMENTAL MANAGEMENT SYSTEM CERTIFICATION

CapXon environmental management system is certified in accordance with ISO 14001 and is applied throughout the whole company as well as CapXon's environmental policy is implemented.

ENVIRONMENTAL HAZARDOUS SUBSTANCES FREE MANAGEMENT SYSTEM

To show our commitment to protect the environment and people, CapXon drives a sustainable effort to produce environment-friendly products.

IECQ QC 080000 HSPM - Hazardous Substance Process Management, which is based on the quality management system of ISO 9001.

The CapXon QC080000 based HSF management system is company-wide applied for implementing the CapXon environmental Hazardous Substances management and that CapXon products effectively in the management of hazardous substances.

ENERGY MANAGEMENT SYSTEM

CapXon establishes comprehensive energy use management in accordance with the requirements of ISO 50001 Energy Management System in order to meet the social responsibility of low carbon environmental protection and efficiency

CERTIFICATION IN ACCORDANCE TO ISO 14001, ISO 50001, QC 080000

The CapXon Group operates an environmental management system that conforms to the requirements of **ISO 14001** and is mandatory for all plants. The CapXon Group operates an Energy management system that conforms to the requirements of **ISO 50001** and is mandatory for all plants. The CapXon Group operates an environmental **Hazardous Substances Free management system** that conforms to the requirements of QC 080000 and is mandatory for all plants. The company certificate is posted on the CapXon internet: (www.capxongroup.com).

RoHS COMPLIANCE

The abbreviation **RoHS** is usually **called Restriction of Hazardous Substances**, the full term is the short term for the **Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment** and is referring to the EU directive 2011/65/EU. The RoHS 2 – 2011/65/Eu substituted the former RoHS 1- 2002/95/EC.

The aim of RoHS is to banish Hazardous Substances of electronic waste, which can harm the environment and others. Based on this regulation, we as component manufacturer, need to design, observe and control that such hazardous materials are fully avoided and reduced to the max. Morever, it's possible to replace them by adequate non concerned materials within the given limitations .

For all by RoHS scoped materials (excluding exempt products) the maximum permitted concentrations are:

all concerned materials (except Cd)

- 0,1% / 1000ppm

Cadmium -Cd:

- 0,01% or 100ppm

These limitations for the restricted materials focus on each homogeneous material within the product. So, the limitations are concerning each individual / single substance or part, which can be separated mechanically (e.g. aluminum can, rubber sealant) and are not apply to the weight of the whole component itself.

Last update of RoHS was Directive (EU) 2015/863, which was published on 2015-03-31 and implemented by 2019-07-22. According to this directive, the following ten substances are restricted:

- **Pb** - Lead
- **Hg**- Mercury
- **Cd** - Cadmium
- **Cr^{+6}** - Hexavalent chromium
- **PBB** - Polybrominated biphenyls
- **PBDE** - Polybrominated diphenyl ether
- **DEHP** - Bis (2-ethylhexyl) phthalate
- **BBP** - Butyl benzyl phthalate
- **DBP** - Dibutyl phthalate
- **DIBP** - Diisobutyl phthalate

By the update DEHP, BBP, DBP and DIBP were added to the list of hazardous substances.

Since 2011 RoHS compliance is mandatory to be able to get CE approval.

C-RoHS / CHINA RoHS COMPLIANCE

The common speech so called China RoHS means the conformance to **SJ/T 11363-2006** for electronical components and assemblies and is fully called **Administrative Measure on the Control of Pollution Caused by Electronic Information Products**.

In China RoHS, the following substances are banned because they are considered as environmentally hazardous:

- **Pb** - Lead
- **Hg**- Mercury
- **Cd** - Cadmium
- **Cr^{+6}** - Hexavalent chromium
- **PBB** - Polybrominated biphenyls
- **PBDE** - Polybrominated diphenyl ether

Since December 2012, CapXon has provided China RoHS certification for our products and certifications.

SONY GP CERTIFICATION

Since Nov 2011, CapXon has been certified as Green Partner by SONY and we are running an environmental management system that continuously meet the requirements of the SONY Green Partner Program and we are working in

accordance with the Sony environmental quality assurance. The Certificate is listed by **SONY GP Certificate No.: FC012746**

REACH CERTIFICATION

REACH is the abbreviation for Registration, Evaluation, Authorization of Chemicals and by Regulation (EC) No 1907 /2006 it is

So each manufacturer or importer, who is shipping goods to the European Union, need to declare and be compliant according to REACH, if within the shipped goods a substance, which is listed out SVHC-List (Substances of Very High Concern) is included and overall a total mass of bigger a ton per year is imported.

CapXon is working in accordance with REACH requirements and certification is available for our products.

ROHS & REACH MARKING

Within our datasheets, we mark the RoHS and REACH compliance with our "RoHS & REACH compliant"- marking, please see marking below for reference:

HALOGEN FREE (HF)

The Halogen Free requirements are based on customer and environmental regulations on management and control requirements of halogens, such as the **European Directive 2002/95/EC**, **IEC 61249-2-21**, **Montreal Protocol on Substances that Deplete the Ozone Layer and Controls the Stockholm joint pledge about durable organic pollutant**.

Concerned by the halogen-free initiative are elements like:

- **Fluorine**
- **Chlorine**
- **Bromine**
- **Iodine**
- **Astatine**

In case of fire, these elements can release toxic fumes, which could harm humans and can also cause corrosion of metals.

CapXon is using halogen-free materials for all our electrolytic capacitors. Since 31st of Oct 2009 all products meet the halogen-free requirements.

BANNED AND ENVIRONMENTAL HAZARDOUS SUBSTANCES IN COMPONENTS

As a manufacturer of passive components, we develop our products focussing on sustainability. In order to guarantee a standardized procedure within CapXon, a mandatory avoidance list of Environmental Hazardous Substances with special interest is part of our environmental management system. The planning and development instructions include regulations and guidelines that aim to identify environmental aspects and to optimize products as well as processes with respect to material usage and environmental compliance to design them with sparing use of resources and to substitute hazardous substances as far as possible.

The environmental officer provides support in the assessment of the environmental impacts of our development projects and as part of our environmental management these aspects are checked and recorded in internal design reviews.

AEC-Q200 & AUTOMOTIVE REQUIREMENTS

To serve the high standards of automotive applications, CapXon provides AEC-Q200 versions for many of their product series.

If AEC-Q200 version is available, the product series or single component is marked with the following marking on the datasheet:

Mmarking of components with references in reliability testing to AEC-Q200

The AEC-Q200 versions are different in case of reliability testing, production monitoring and available material declaration. For details, please see the table below:

	Standard Version	AEC-Q200 Version
Reliability Testing		
Tests according to **internal specification**	✓	✓
Tests according to **AEC-Q200** applied test range related to product	✗	✓
Production Monitoring		
Production & documentation in accordance with **ISO 9001**	✓	✓
Production & documentation in accordance with **IATF 16949**	✗	✓
Compliance and Declarations		
RoHS & **REACH** compliance	✓	✓
IMDS entry available (on request)	✗	✓
PPAP (on request)	✗	✓

Table 9: Differences between standard and AEC-Q200 components

AEC-Q200

The AEC-Q200 was issued as a global reliability test standard by the AEC - Automotive Electronics Council. The overall aim of this standard is to define the minimum stress test driven qualification requirements and references of test conditions for qualification of passive components.

AEC-Q200 qualified components are highly qualified products for critical surroundings and can withstand the harsh and challenging usage conditions of an automotive environment.

For Aluminum Electrolytic Capacitors, concerning all technologies of Liquid Aluminum Electrolytic, Solid and hybrid types, the AEC-Q200 claims a test plan of 27 different reliability tests (e.g.: Temperature Cycling, Vibration, Biased Humidity, Surge Voltage, …) with a sample size of about 77 pcs. and a maximum test duration of particular test of about 1000 hours.

By AEC-Q200 at least the temperature range of -40°C to 105°C need to be tested and applicable for Aluminum Electrolytic Capacitors, if not, differently specified by datasheet.

In case of AEC-Q200 version, reliability testing is performed for the dedicated components in addition to CapXon's internal qualification setup as well as additional agreed requirements between CapXon and their customers.

PPAP

PPAP – Production Part Approval Process is a documentation to assure quality of supplier and their production process within the automotive supply chain.

The PPAP covers and ensure the following aspects:

- Manufacturability and meeting all given quality requirements
- Design records and specification requirements
- Manufacturing process can consistently meet all component requirements

For our AEC-Q200 components, we provide PPAP Level 3 on request, which is providing product samples as well as the complete supporting data.

IMDS

The IMDS – International Material Database System contains information about the used materials within the build-up of the component.

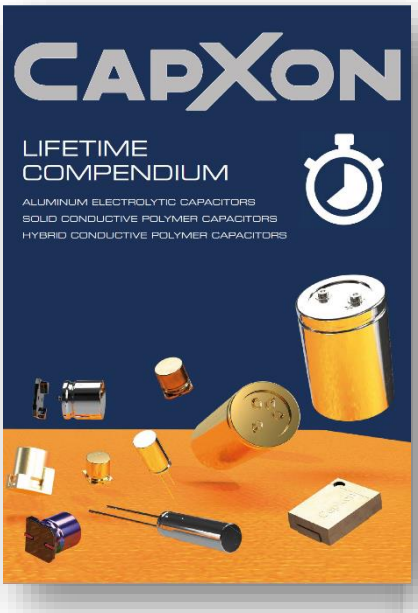
With IMDS, it is possible to monitor and control hazardous substances and prohibited substances down to the single component. IMDS is mainly used to fulfil various reporting requirements of automotive manufacturers.

For all our AEC-Q200 components and in case of an automotive use case, we provide IMDS entries on request. For further information, visit our website http://www.capxongroup.com/en/ or contact CapXon directly.

LIFETIME ESTIMATION ▪ LIFETIME COMPENDIUM

The accurate estimation of the lifetime of components is one of the elementary considerations of any electronic assembly. If electrolytic capacitors are not properly designed for the application environment and load, they will inevitably lead to a disproportionate change in their electrical performance or, in the worst case, failure of the capacitor. CapXon's lifetime compendium helps users to calculate and estimate the expected lifetime of **Aluminum Electrolytic Capacitors**.

The lifetime compendium is available to download from our website
http://www.capxongroup.com/files/Lifetime%20Compendium_EN.pdf

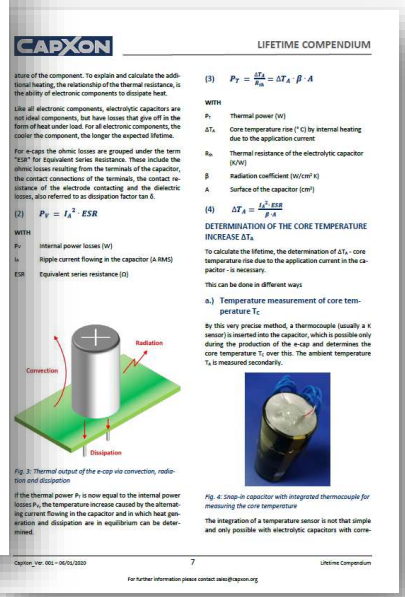


Content

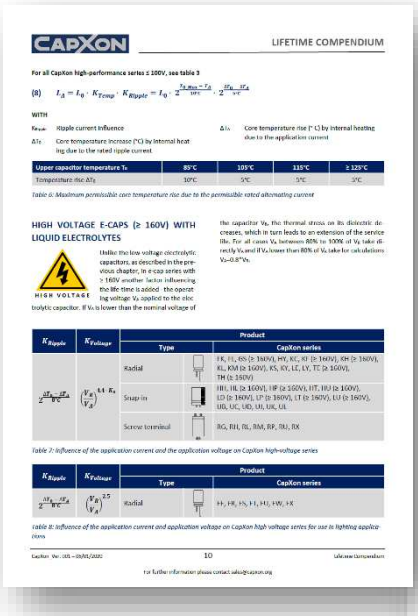

CONTENT

WORLD OF CAPXON	Page
GENERAL INFORMATION	
About us	3
Technical Terms	4
LIFETIME COMPENDIUM	**Page**
HOW CAN THE TERM 'LIFETIME' AND THE END OF IT BE SUBJECT TO AN E-CAP?	5
LOW VOLTAGE E-CAPS (≤ 100V) WITH LIQUID ELECTROLYTE	6
HIGH VOLTAGE E-CAPS (≥ 160V) WITH LIQUID ELECTROLYTES	10
TOTAL LIFETIME EXPERIENCE WITH CHANGING RIPPLE CURRENT IN THE APPLICATION	11
CALCULATION EXAMPLE - OUTPUT FILTER CAP - IN A SWITCH MODE POWER SUPPLY	13
CALCULATION STEPS	14
DETERMINATION OF USEFUL LIFE BY GRAPHIC WAY - LIFETIME NOMOGRAM -	16
APPLICATION EXAMPLES	17
SOLID CONDUCTIVE POLYMER CAPACITORS (SOLID TYPE E-CAPS)	21
HYBRID CONDUCTIVE POLYMER CAPACITORS	24
RULE OF THUMB FOR SIMPLE AND QUICK LIFETIME ESTIMATIONS	26
COMPONENT RELIABILITY DATA	27
FIT – FAILURES IN TIME	27
MTBF – MEANTIME BETWEEN FAILURES	28
LIFETIME TESTS	28
FIT & MTBF DATA OF CAPXON PRODUCTS	30
CALCULATION OF FIT VALUE FOR APPLICATION CASE	32
NOTES	33

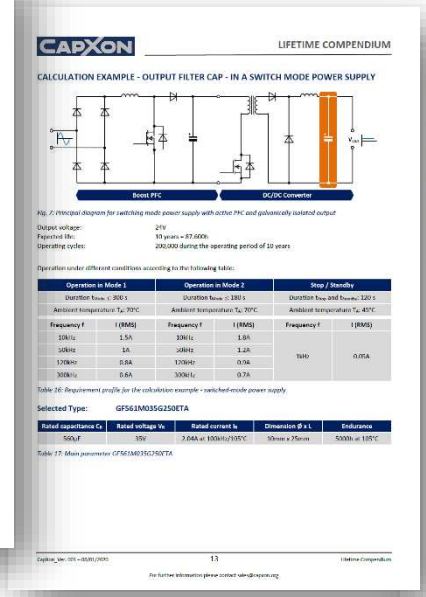
Technical Background


LIFETIME COMPENDIUM

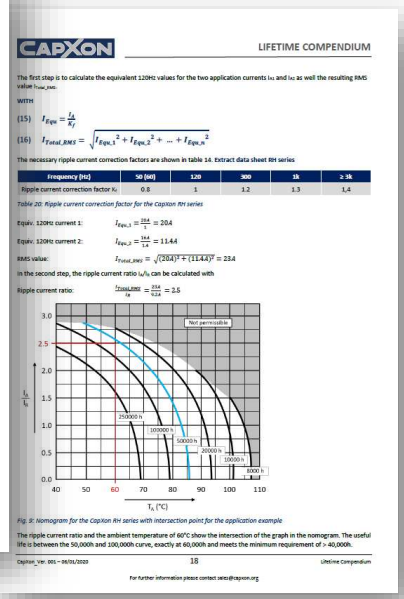
Calculation base


LIFETIME COMPENDIUM

Application example


LIFETIME COMPENDIUM
CALCULATION EXAMPLE - OUTPUT FILTER CAP - IN A SWITCH MODE POWER SUPPLY

Graphical estimation

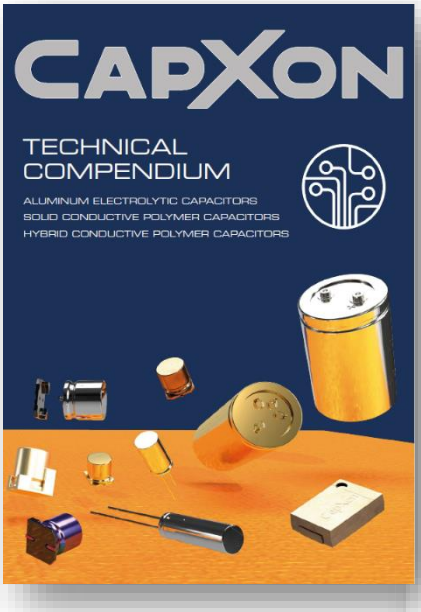

LIFETIME COMPENDIUM

TECHNICAL NOTES ▪ TECHNICAL COMPENDIUM

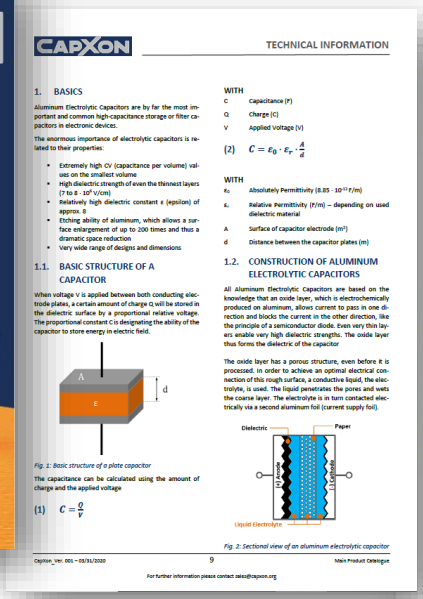
Due to their compact design, **Aluminum Electrolytic Capacitors** are the most common high-capacitance storage and filter elements in electronics. Like all electronic components, they do not have an “ideal” electrical behavior, they have losses. Their properties are very dependent on temperature and frequency. Detailed knowledge of these components is an absolute must for all electronics developers, especially for power supplies and converters.

The CapXon Technical Compendium describes the basics, electrical parameters, production steps, provides suggestions for the selection of suitable capacitors and design rules for reliable and long-lasting operation.

The technical compendium is available to download from our website
http://www.capxongroup.com/files/Technical%20Compendium_EN.pdf

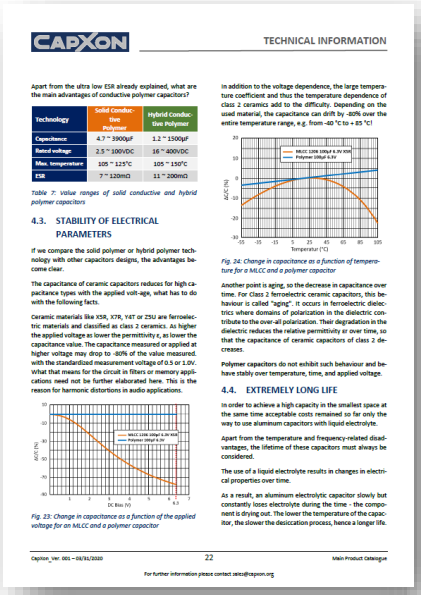


Basics

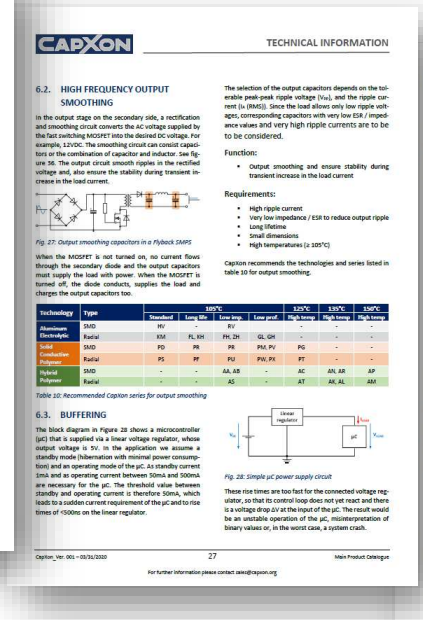


Production steps

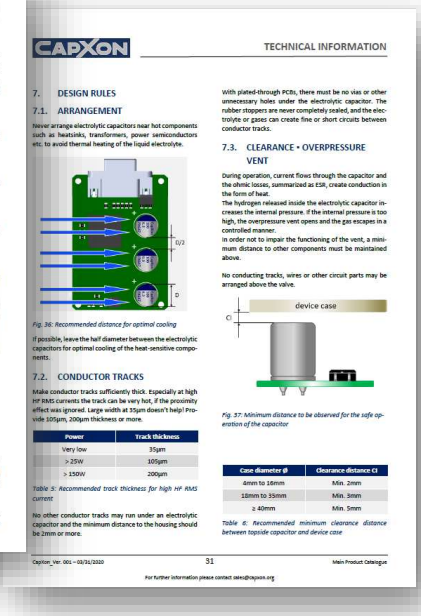
Electrical parameters



Capacitor selection

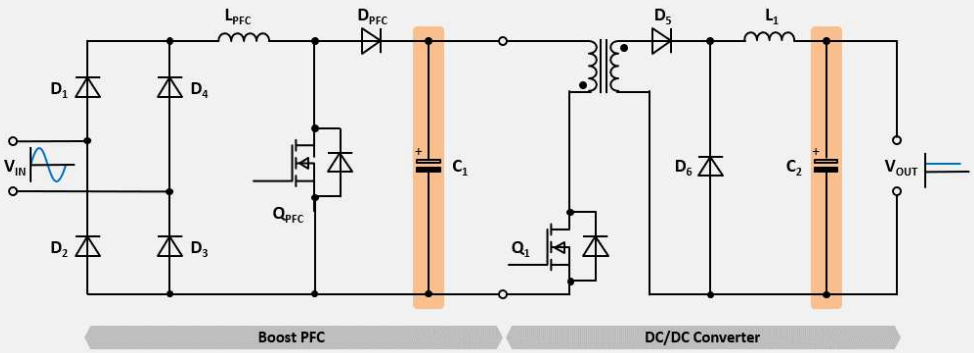


Design rules



SWITCH MODE POWER SUPPLY (SMPS)

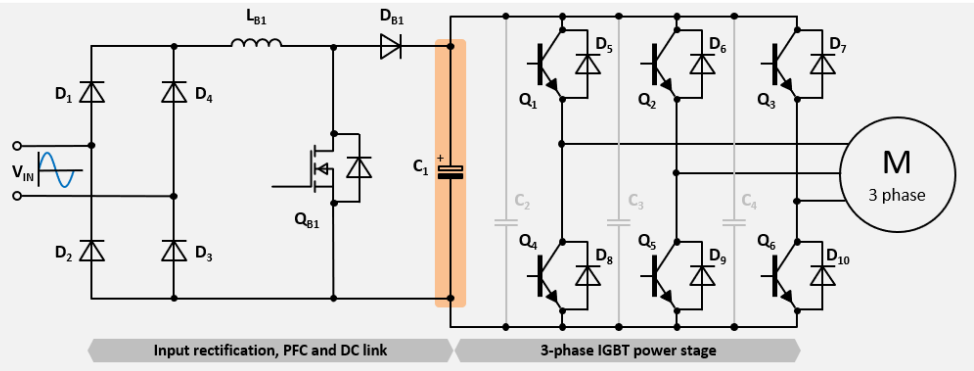
Example of a Switch Mode Power Supply with boost Power Factor Correction (PFC) and downstream DC/DC converter in Fly-back topology with recommended products.



Designation	Circuit	Purpose	Specification	Series	Part Number
C_1	Boost PFC	Inductor ripple current filtering	100µF; 400V; 105°C; Radial; 2000h D18xL31.5mm; 0.53A@120Hz	KM	KM101M400K315A
C_1	Boost PFC	Inductor ripple current filtering	470µF; 450V; 105°C; Snap-In ; 5000h D35xL45mm; 1.94A@120Hz	HP	HP471M450P450A
C_2	DC/DC Converter	Output filtering	470µF; 25V; 105°C; SMD; 2000h D10xL10.5mm; 0.65A@100kHz	DV	DV471M025G105A
C_2	DC/DC Converter	Output filtering	1000µF; 25V; 105°C; Radial; 10000h D13xL20mm; 1.91A@100kHz	FH	FH102M025I200A
C_2	DC/DC Converter	Output filtering	82µF; 25V; 105°C; Radial; 2000h D8xL11.5mm; 4.1A@100kHz	PS	PS820M025F115A

INDUSTRIAL MOTOR DRIVE

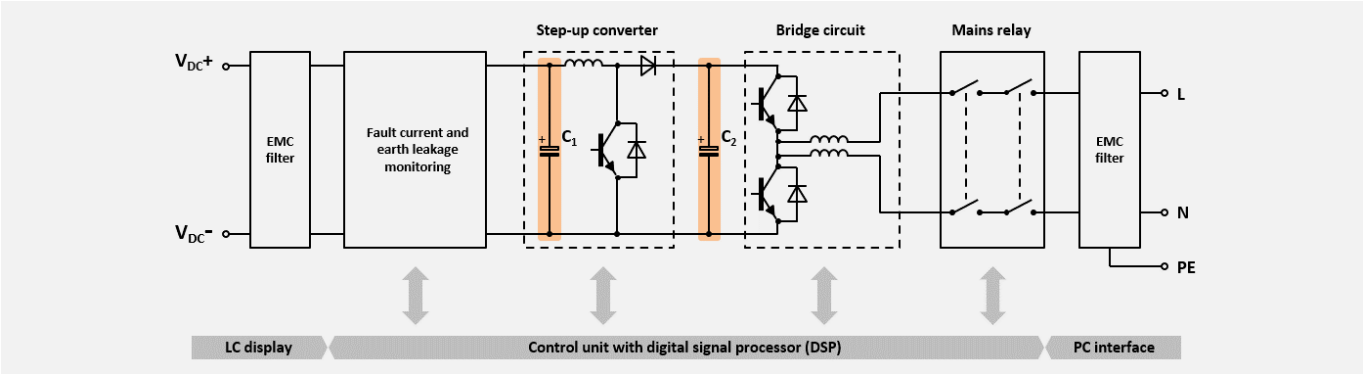
Example of a typical industrial motor drive for pumps, fans or compressors. The power circuit consist input rectifier, Power Factor Correction (PFC), DC link bank and 3-phase IGBT power stage. CapXon offers the full range of DC link solutions in electrolyte technology



Designation	Circuit	Purpose	Specification	Series	Part Number
C_1	DC link bank	Energy storage and supply	560µF; 450V; 85°C; Snap-In; 7000h D30xL50mm; 3.17A@120Hz	UC	UC561M450O500A
C_1	DC link bank	Energy storage and supply	470µF; 500V; 85°C; Snap-In; 10000h D35xL55mm; 2.99A@120Hz	UD	UD471M500P550A
C_1	DC link bank	Energy storage and supply	680µF; 450V; 105°C; Snap-In; 8000h D35xL60mm; 2.94A@120Hz	UK	UK681M450P600A
C_1	DC link bank	Energy storage and supply	680µF; 450V; 105°C; Snap-In; 10000h D35xL55mm; 3A@120Hz	UL	UL821M450Q550A

PHOTO VOLTAIC INVERTER

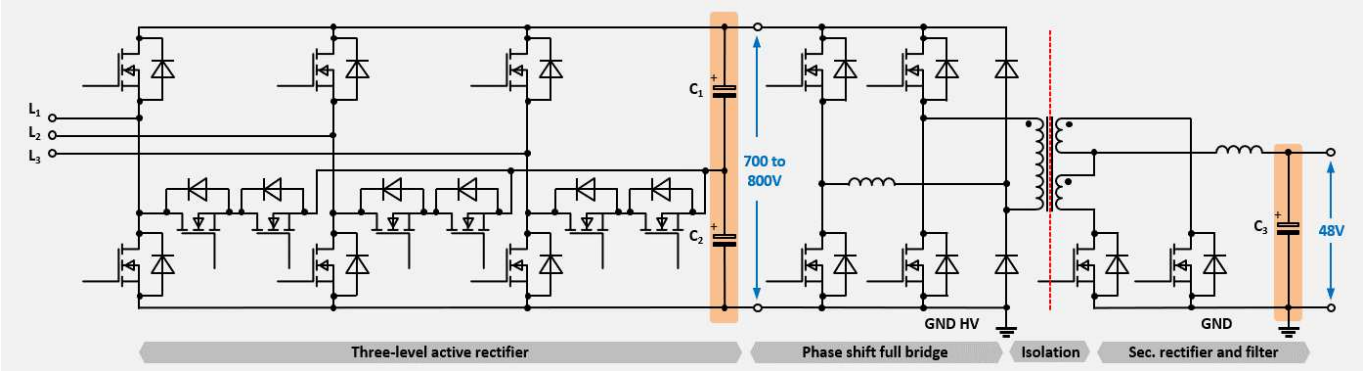
Block diagram of the power circuit of a photo voltaic inverter with EMC filter, monitoring circuit, step-up converter, bridge circuit, and mains relay with recommended products.



Designation	Circuit	Purpose	Specification	Series	Part Number
C_1, C_2	Step-up + DC link	Energy storage and supply	680µF; 500V; 105°C; Snap-In; 5000h D40xL60mm; 3A@120Hz	UJ	UJ681M500Q600A
C_1, C_2	Step-up + DC link	Energy storage and supply	5600µF; 450V; 105°C; Screw; 20000h D63.5xL165mm; 21.7@120Hz	RX	RX562M450SA65A
C_1, C_2	Step-up + DC link	Energy storage and supply	470µF; 450V; 105°C; Snap-In; 10000h D30xL50mm; 1.97A@120Hz	UL	UL471M450O500A
C_1, C_2	Step-up + DC link	Energy storage and supply	1000µF; 450V; 105°C; Screw; 8000h D51xL80mm; 4.6A@120Hz	RH	RH102M350R800A

3-PHASE HIGH VOLTAGE BATTERY CHARGER

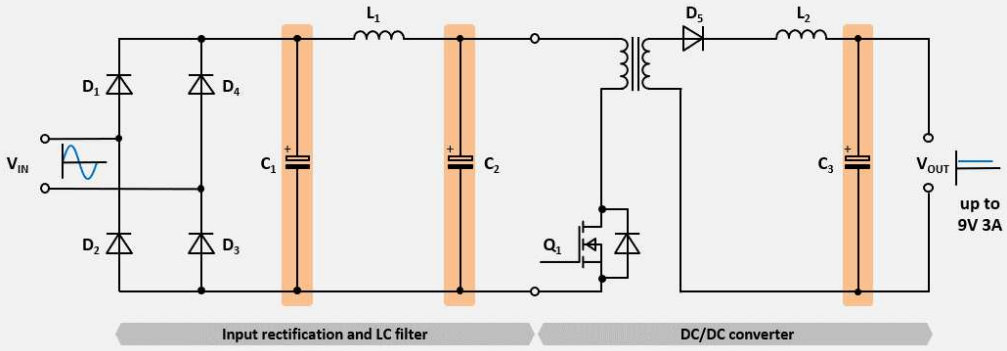
Principal circuit of a 3-phase high voltage battery charger for bidirectional applications such as electric vehicle charging (e-cars, fork-lift trucks, transport vehicles with recommend products for the active rectifier and output filter.



Designation	Circuit	Purpose	Specification	Series	Part Number
C_1 ,C_2	Three-level active rectifier	Energy storage and supply	2200µF; 450V; 85°C; Snap-In; 7000h D45xL90mm; 8.5A@120Hz	UC	UC222M450V900A
C_1 ,C_2	Three-level active rectifier	Energy storage and supply	1000µF; 500V; 105°C; Snap-In; 5000h D40xL80mm; 4.68A@120Hz	UJ	UJ102M500Q800A
C_3	Output filter	Output buffering and ensure stability	56µF; 63V; 105°C; Radial; 10000h D10xL12.5mm; 2.4A@100kHz	AS	AS560M063G125PTA
C_3	Output filter	Output buffering and ensure stability	150µF; 63V; 105°C; Radial; 2000h D10xL18mm; 3A@100kHz	PH	PH151M063G125PTA

27W PORTABLE POWER USB-C ADAPTER

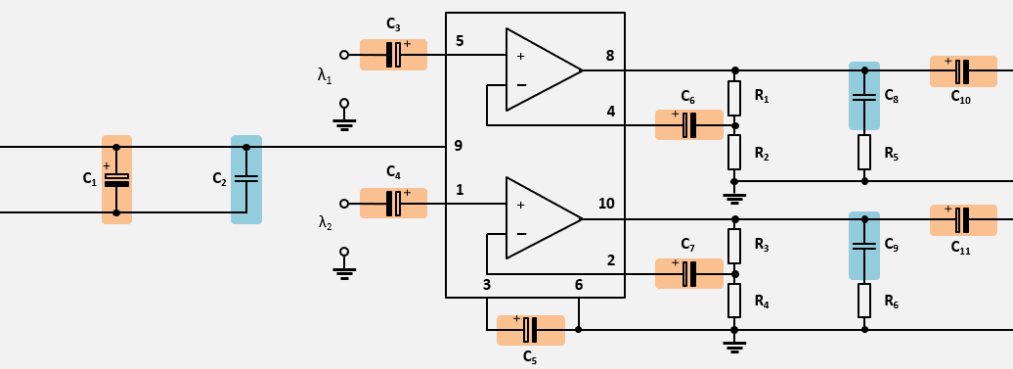
Example of a portable power adapter for USB-C laptops, smartphones and tablets with recommend products for the LC filter and to ensure stability (smoothing) during transient increase in the load voltage.



Designation	Circuit	Purpose	Specification	Series	Part Number
C_1 ,C_2	LC filter	Input filtering	22µF; 400V; 105°C; Radial; 2000h D10xL25mm; 0.125A@120Hz	KM	KM220M400G250A
C_1 ,C_2	LC filter	Input filtering	15µF; 400V; 105°C; Radial; 5000h D10xL20mm; 0.24A@120Hz	KF	KF150M400G200A
C_3	DC/DC converter	Output filtering	470µF; 16V; 105°C; Radial; 2000h D5.5xL11mm; 2.69A@100kHz	PX	PX471M016C090P
C_3	DC/DC converter	Output filtering	330µF; 12V; 105°C; Radial; 2000h D5xL9mm; 2.69A@100kHz	PX	PX331M012C090P

AUDIO SPEAKER

Example of an active audio speaker with treble and bass and the recommend products for the NF filter as well as the acoustic coupling.



Designation	Circuit	Purpose	Specification	Series	Part Number
C_1 ,C_3 ,C_4 ,C_5 C_6 ,C_7 ,C_{10} ,C_{11}	Audio speaker	NF filter	470µF; 35V; 85°C; Radial; 2000h D10xL16mm; 0.63A@120Hz	RW	RW471M035G160A
C_2 ,C_8 ,C_9	Audio speaker	Acoustic coupling	47µF; 35V; 85°C; Radial; 2000h D10xL12.5mm; 0.15A@120Hz	NR	NR470M035G125ETA

TECHNICAL TERMS

Item	Description	SI units
V_R	Rated voltage	V
V_S	Surge voltage	V
V_{Ripple_AC}	Ripple voltage	V
$V_{Reverse}$	Reverse voltage	V
V_A	Application voltage, operating voltage	A
I_R	Rated ripple current, rated alternating current	A
I_A	Application current, operating current	A
I_{A_Max}	Maximum application current, maximum operating current	A
I_{Leak}	Leakage current	A
T_{0_Max}	Upper category temperature	°C
T_{0_Min}	Lower category temperature	°C
T_A	Application temperature, operating temperature	°C
T_S	Capacitor surface temperature	°C
ΔT_0	Core temperature rise by internal heating due to rated ripple current	°C
ΔT_A	Core temperature rise by internal heating due to application ripple current	°C
C_R	Rated capacitance	F
ΔC	Capacitance tolerance	%
C/C_R	Capacitance drift	-
tan δ	Dissipation factor	-
Z	Impedance	Ω
ESR	Equivalent series resistance	Ω
ESL	Equivalent series inductance	H
X_C	Capacitive reactance	Ω
X_L	Inductive reactance	Ω
f	Frequency	Hz
ω	Angular frequency	Hz
λ	FIT = failure in time	-
K_f	Multiplier for ripple current vs. frequency	-
K_T	Multiplier for ripple current vs. temperature	-
K_0	Dielectric constant derating coefficient at high temperature	-
L_0	Specified lifetime at max. capacitor temperature, rated voltage (and rated ripple current)	h
L_A	Expected lifetime at application conditions	h

OVERVIEW ▪ SMD HYBRID CONDUCTIVE POLYMER CAPACITORS

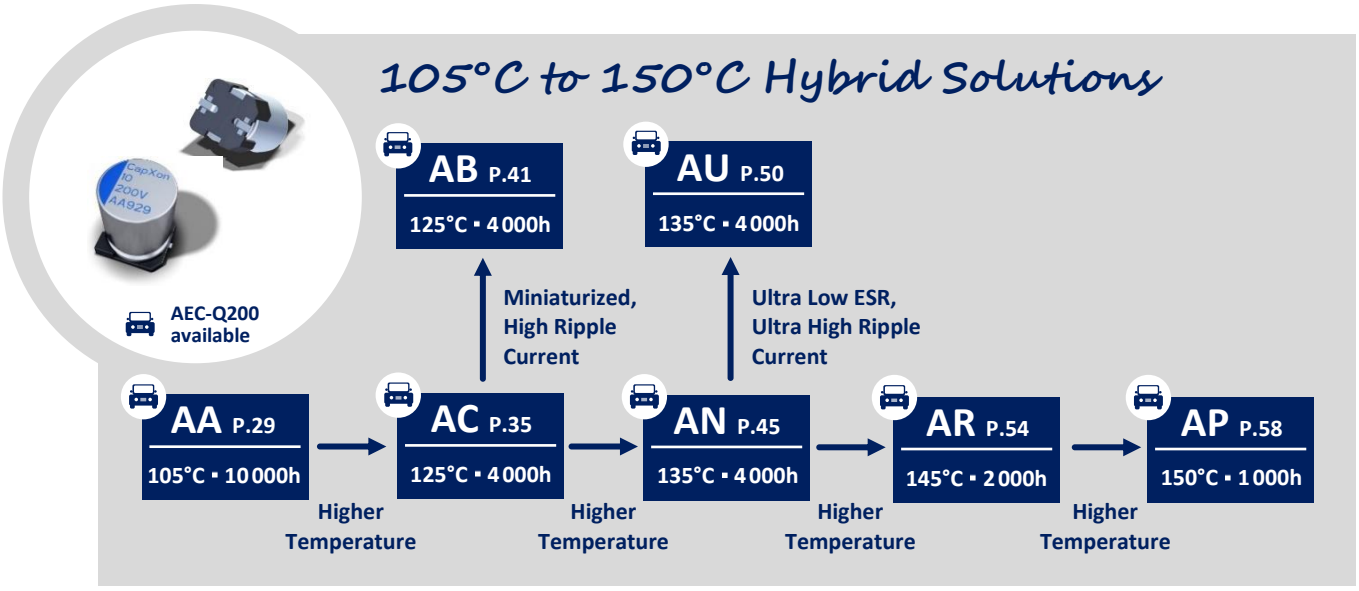
Features

Series		Page	AEC-Q200	High Temperature	Low ESR	Slim Type	Standard	Ultra Miniaturized	Ultra Low ESR	Vibration Proof	Temperature Range (°C)		Voltage Range (V)		Capacitance Range (µF)		Endurance (hours)
AA		29	●		●	●	●			●	-55	+105	16	200	10	1500	5000 to 10000
AC		35	●	●	●	●				●	-55	+125	16	100	10	1500	4000
AB		41	●	●	●			●	●	●	-55	+125	25	35	33	680	4000
AN		45	●	●	●					●	-55	+135	16	100	10	820	4000
AU		50	●	●					●	●	-55	+135	25	100	22	680	4000
AR		54	●	●	●					●	-55	+145	16	80	22	560	2000
AP		58	●	●	●					●	-55	+150	16	80	22	560	1000

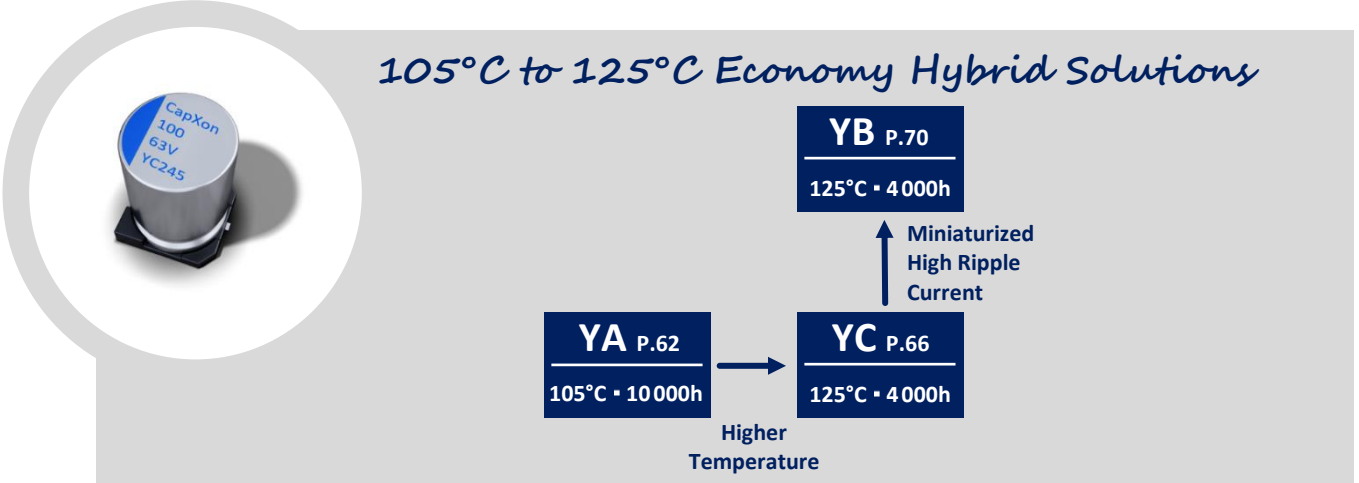
ECONOMY SERIES FOR NON-AUTOMOTIVE APPLICATIONS

Series		Page	AEC-Q200	High Temperature	Low ESR	Slim Type	Standard	Ultra Miniaturized	Ultra Low ESR	Vibration Proof	Temperature Range (°C)		Voltage Range (V)		Capacitance Range (µF)		Endurance (hours)
YA		62			●		●				-55	+105	16	100	10	1500	10000
YC		66		●	●		●				-55	+125	16	100	10	1500	4000
YB		70		●	●		●	●	●		-55	+125	25	35	33	680	4000

GROUP CHART ▪ HIGH PERFORMANCE SERIES FOR AUTOMOTIVE APPLICATIONS



GROUP CHART ▪ ECONOMY SERIES FOR NON-AUTOMOTIVE APPLICATIONS



AA SERIES ▪ LONG LIFE UP TO 10 000 HOURS

KEY FEATURES

AEC-Q 200 · HIGH VOLTAGE

- **HYBRID CONDUCTIVE POLYMER** ▪ SMD type
- Endurance: 105°C ▪ 5000 up to 10 000 hours
- Low ESR and high ripple current
- Vibration Proof (VP) version (up to 30g) available
- AEC-Q200 version available

HF Halogen Free · MSL 1 · RoHS & REACH COMPLIANT

SPECIFICATIONS

Items		Performance Characteristics
Operating Temperature Range		-55 ~ +105°C
Rated Voltage Range	V_R	16 ~ 200V DC
Surge Voltage	V_S	($V_R \le 100V$): $V_S = 1.25 \cdot V_R$ ($V_R \ge 200V$): $V_S = 1.15 \cdot V_R$
Capacitance Range	C_R	10 ~ 1500µF
Cap. Tolerance	ΔC	±20% (120Hz ▪ 20°C)
Leakage Current (20°C ▪ V_R applied)	I_{LEAK}	Not to exceed the values shown in standard ratings After 2 minutes
Dissipation Factor % (20°C ▪ 120Hz)	tanδ	Not to exceed the values shown in standard ratings
Equivalent Series Resistance (20°C ▪ 100kHz)	ESR	Not to exceed the values shown in standard ratings

Lifetime Test			
Endurance 105°C (V_R & I_R applied)	Test	**10 000 hours**	≤ 100V
		5 000 hours	> 100V
	$\triangle C/C_R$	Within ±30% of the initial value	
	tanδ	Less than 200% of the specified value	
	ESR	Less than 200% of the specified value	
	I_{Leak}	Less than the specified value	

MULTIPLIER K_f for RIPPLE CURRENT vs. FREQUENCY

Frequency (Hz)	100 ≤ Freq. < 120	120 ≤ Freq. < 200	200 ≤ Freq. < 300	300 ≤ Freq. < 500
Coefficient K_f	0.10	0.10	0.10	0.15

Frequency (Hz)	500 ≤ Freq. < 1k	1k ≤ Freq. < 2k	2k ≤ Freq. < 3k	3k ≤ Freq. < 5k
Coefficient K_f	0.20	0.30	0.40	0.45

Frequency (Hz)	5k ≤ Freq. < 10k	10k ≤ Freq. < 15k	15k ≤ Freq. < 20k	20k ≤ Freq. < 40k
Coefficient K_f	0.50	0.60	0.65	0.75

Frequency (Hz)	40k ≤ Freq. < 50k	50k ≤ Freq. < 100k	100k ≤ Freq. < 500k	500k ≤ Freq. < 1M
Coefficient K_f	0.80	0.85	1.00	1.05

STANDARD RATINGS

Part number shows blister tape on paper reel

V_R (V)	Standard	Vibration-proof	C_R (µF)	ø D (mm)	L (mm)	I_{LEAK} (µA, 2min)	tanδ +20°C ▪ 120Hz (%)	Max. ESR +20°C ▪ 100kHz (mΩ)	I_R ▪ Max. Ripple Current +105°C ▪ 100kHz (mA rms)	CapXon Part Number
16	●	●	100	6.3	5.8	16.0	16	50	1300	AA101M016E058PTR [ ] [ ]
	●	●	120	6.3	5.8	19.2	16	50	1300	AA121M016E058PTR [ ] [ ]
	●	●	150	6.3	5.8	24.0	16	50	1300	AA151M016E058PTR [ ] [ ]
	●	●	220	6.3	7.7	35.2	16	30	2000	AA221M016E077PTR [ ] [ ]
	●	●	270	6.3	7.7	43.2	16	30	2000	AA271M016E077PTR [ ] [ ]
	●	●	330	10.0	10.5	52.8	16	20	2500	AA331M016G105PTR [ ] [ ]
	●	●	470	8.0	10.5	75.2	16	27	2300	AA471M016F105PTR [ ] [ ]
	●	●	470	10.0	10.5	75.2	16	20	2500	AA471M016G105PTR [ ] [ ]
	●	●	560	8.0	11.7	89.6	16	23	2400	AA561M016F117PTR [ ] [ ]
	●	●	560	10.0	10.5	89.6	16	20	2500	AA561M016G105PTR [ ] [ ]
	●	●	820	10.0	12.4	131.2	16	16	2800	AA821M016G124PTR [ ] [ ]
	●	●	1500	10.0	16.5	240.0	16	11	5000	AA152M016G165PTR [ ] [ ]
25	●		33	5.0	5.8	8.3	14	80	900	AA330M025C058PTR [ ] [ ]
	●	●	56	6.3	5.8	14.0	14	50	1300	AA560M025E058PTR [ ] [ ]
	●	●	100	6.3	7.7	25.0	14	30	2000	AA101M025E077PTR [ ] [ ]
	●	●	220	8.0	10.5	55.0	14	27	2300	AA221M025F105PTR [ ] [ ]
	●	●	270	8.0	11.7	67.5	14	25	2400	AA271M025F117PTR [ ] [ ]
	●	●	330	10.0	10.5	82.5	14	20	2500	AA331M025G105PTR [ ] [ ]
	●	●	470	10.0	12.4	117.5	14	16	2800	AA471M025G124PTR [ ] [ ]
	●	●	560	10.0	16.5	140.0	14	11	5000	AA561M025G165PTR [ ] [ ]
35	●		22	5.0	5.8	7.7	12	100	900	AA220M035C058PTR [ ] [ ]
	●	●	27	6.3	5.8	9.5	12	60	1300	AA270M035E058PTR [ ] [ ]
	●	●	47	6.3	5.8	16.5	12	60	1300	AA470M035E058PTR [ ] [ ]
	●	●	68	6.3	7.7	23.8	12	35	2000	AA680M035E077PTR [ ] [ ]
	●	●	100	8.0	10.5	35.0	12	27	2300	AA101M035F105PTR [ ] [ ]
	●	●	150	8.0	10.5	52.5	12	27	2300	AA151M035F105PTR [ ] [ ]
	●	●	180	8.0	11.7	63.0	12	25	2400	AA181M035F117PTR [ ] [ ]
	●	●	270	10.0	10.5	94.5	12	20	2500	AA271M035G105PTR [ ] [ ]
	●	●	330	10.0	12.4	115.5	12	17	2800	AA331M035G124PTR [ ] [ ]
	●	●	470	10.0	16.5	164.5	12	11	5000	AA471M035G165PTR [ ] [ ]
50	●		10	5.0	5.8	5.0	10	120	750	AA100M050C058PTR [ ] [ ]
	●	●	22	6.3	5.8	11.0	10	80	1100	AA220M050E058PTR [ ] [ ]
	●	●	33	6.3	7.7	16.5	10	40	1600	AA330M050E077PTR [ ] [ ]
	●	●	56	10.0	10.5	28.0	10	28	2000	AA680M050F105PTR [ ] [ ]
	●	●	68	8.0	10.5	34.0	10	30	1800	AA820M050F117PTR [ ] [ ]
	●	●	82	8.0	11.7	41.0	10	28	1880	AA680M050G105PTR [ ] [ ]
	●	●	100	10.0	10.5	50.0	10	28	2000	AA101M050G105PTR [ ] [ ]
	●	●	120	10.0	12.4	60.0	10	25	2200	AA121M050G124PTR [ ] [ ]
	●	●	220	10.0	16.5	110.0	10	13	4600	AA221M050G165PTR [ ] [ ]

[ ] **see description at end of standard ratings**

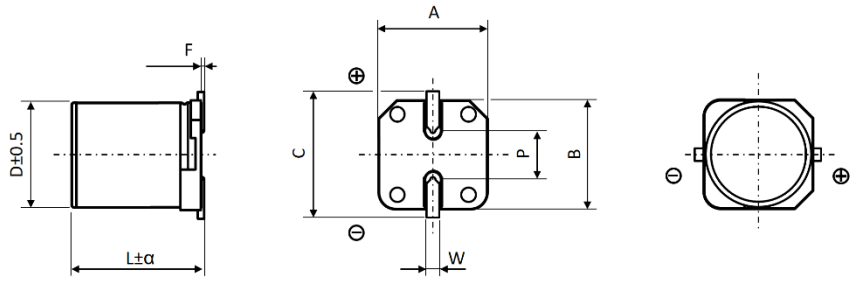
STANDARD RATINGS

Part number shows blister tape on paper reel

V_R (V)	Standard	Vibration-proof	C_R (µF)	ø D (mm)	L (mm)	I_{LEAK} (µA, 2min)	tanδ +20°C ▪ 120Hz (%)	Max. ESR +20°C ▪ 100kHz (mΩ)	I_R ▪ Max. Ripple Current +105°C ▪ 100kHz (mA rms)	CapXon Part Number
63	●	●	10	6.3	5.8	6.3	8	120	1000	AA100M063E058PTR ☐☐
	●	●	22	6.3	7.7	13.9	8	80	1500	AA220M063E077PTR ☐☐
	●	●	33	8.0	10.5	20.8	8	40	1700	AA330M063F105PTR ☐☐
	●	●	47	8.0	10.5	29.6	8	40	1700	AA470M063F105PTR ☐☐
	●	●	47	8.0	11.7	29.6	8	38	1750	AA470M063F117PTR ☐☐
	●	●	56	10.0	10.5	35.3	8	30	1800	AA560M063G105PTR ☐☐
	●	●	68	10.0	10.5	42.8	8	30	1800	AA680M063G105PTR ☐☐
	●	●	82	10.0	12.4	51.7	8	22	2100	AA820M063G124PTR ☐☐
	●	●	150	10.0	16.5	94.5	8	15	4350	AA151M063G165PTR ☐☐
80	●	●	22	8.0	10.5	17.6	8	45	1550	AA220M080F105PTR ☐☐
	●	●	27	8.0	11.7	21.6	8	43	1600	AA270M080F117PTR ☐☐
	●	●	33	10.0	10.5	26.4	8	36	1700	AA330M080G105PTR ☐☐
	●	●	47	10.0	10.5	37.6	8	36	1700	AA470M080G105PTR ☐☐
	●	●	56	10.0	12.4	44.8	8	32	1800	AA560M080G124PTR ☐☐
100	●	●	22	8.0	10.5	22.0	8	55	1400	AA220M100F105PTR ☐☐
	●	●	22	8.0	11.7	22.0	8	52	1450	AA220M100F117PTR ☐☐
	●	●	22	10.0	10.5	22.0	8	45	1500	AA220M100G105PTR ☐☐
	●	●	27	10.0	12.4	27.0	8	40	1600	AA270M100G124PTR ☐☐
	●	●	33	10.0	12.4	33.0	8	40	1600	AA330M100G124PTR ☐☐
200	●	●	10	10.0	12.4	20.0	12	100	800	AA100M200G124PTR ☐☐

☐☐: Leave **blank** for Standard package
☐☐: Enter **W** for Vibration proof version
☐☐: Enter **X** for AEC-Q200
☐☐: Enter **XW** for AEC-Q200 and Vibration Proof version

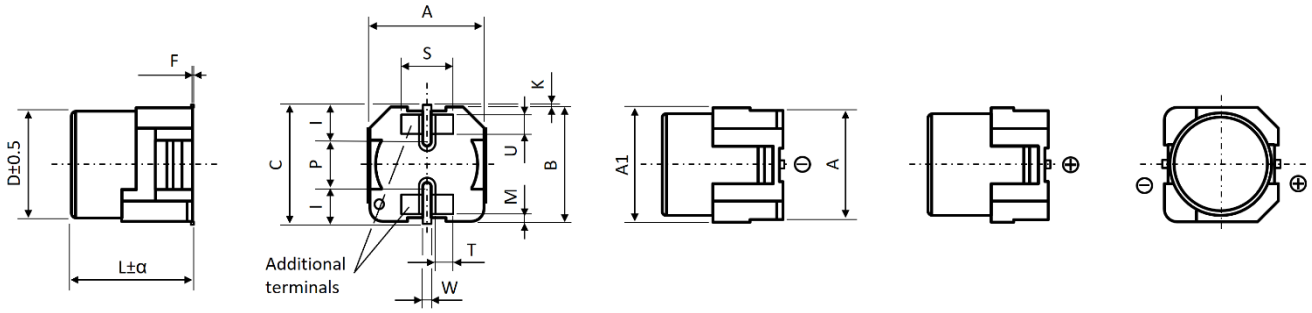
DIMENSIONS STANDARD PACKAGE ▪ All dimensions in mm



Recommended pad layout on page 110.

ø D	L	α	A ± 0.2	B ± 0.2	C ± 0.2	F	P ± 0.2	W
5.0	5.8	0.3	5.3	5.3	5.9	0.3 max.	1.4	0.5 to 0.8
6.3	5.8	0.3	6.6	6.6	7.2	0.3 max.	2.2	0.5 to 0.8
6.3	7.7	0.3	6.6	6.6	7.2	0.3 max.	2.2	0.5 to 0.8
8.0	10.5	0.3	8.3	8.3	9.0	0.3 max.	3.1	0.7 to 1.1
8.0	11.7	0.3	8.3	8.3	9.0	0.3 max.	3.1	0.7 to 1.1
10.0	10.5	0.3	10.3	10.3	11.0	0.3 max.	4.5	0.7 to 1.1
10.0	12.4	0.3	10.3	10.3	11.0	0.3 max.	4.5	1.0 to 1.4
10.0	16.5	0.3	10.3	10.3	11.0	0.3 max.	4.5	1.0 to 1.4

DIMENSIONS VP PACKAGE (VIBRATION-PROOF) Ø D6.3 ▪ All dimensions in mm



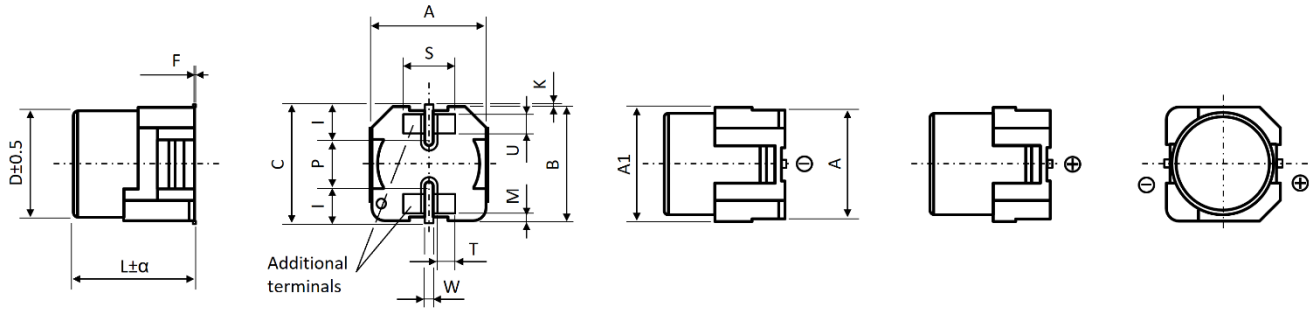
Note: Additional terminals electrical connected to anode or cathode terminal.

ø D	L	α	A ± 0.2	A1 (max.)	B ± 0.2	C (max.)	F	K
6.3	5.8	-0.3/+0.7	6.6	7.1	6.6	7.8	0 to 0.15	0.35 +0.15/-0.2
6.3	7.7	-0.3/+0.7	6.6	7.1	6.6	7.8	0 to 0.15	0.35 +0.15/-0.2

ø D	L	I ± 0.1	M ± 0.1	P ± 0.2	S ± 0.1	T ± 0.1	U ± 0.1	W ± 0.1
6.3	5.8	2.5	0.35	2.2	3.2	1.1	0.7	0.65
6.3	7.7	2.5	0.35	2.2	3.2	1.1	0.7	0.65

Recommended pad layout on page 111.

DIMENSIONS VP PACKAGE (VIBRATION-PROOF) Ø D8 and D10 ▪ All dimensions in mm



Note: Additional terminals electrical connected to anode or cathode terminal.

ø D	L	α	A ± 0.2	A1 (max.)	B ± 0.2	C (max.)	F	K ± 0.2
8.0	10.5	-0.3/+0.7	8.3	8.8	8.3	10.0	0 to 0.15	0.7
8.0	11.7	-0.3/+0.7	8.3	8.8	8.3	10.0	0 to 0.15	0.7
10.0	10.5	-0.3/+0.7	10.3	10.8	10.3	12.0	0 to 0.15	0.7
10.0	12.4	-0.3/+0.7	10.3	10.8	10.3	12.0	0 to 0.15	0.7
10.0	16.5	-0.3/+0.7	10.3	10.8	10.3	12.0	0 to 0.15	0.7

ø D	L	I ± 0.1	M ± 0.1	P ± 0.2	S ± 0.1	T ± 0.1	U ± 0.1	W ± 0.1
8.0	10.5	3.3	0.75	3.1	3.3	0.9	0.8	1.2
8.0	11.7	3.3	0.75	3.1	3.3	0.9	0.8	1.2
10.0	10.5	3.5	0.9	4.6	3.3	0.9	0.8	1.2
10.0	12.4	3.5	0.9	4.6	3.3	0.9	0.8	1.2
10.0	16.5	3.5	0.9	4.6	3.3	0.9	0.8	1.2

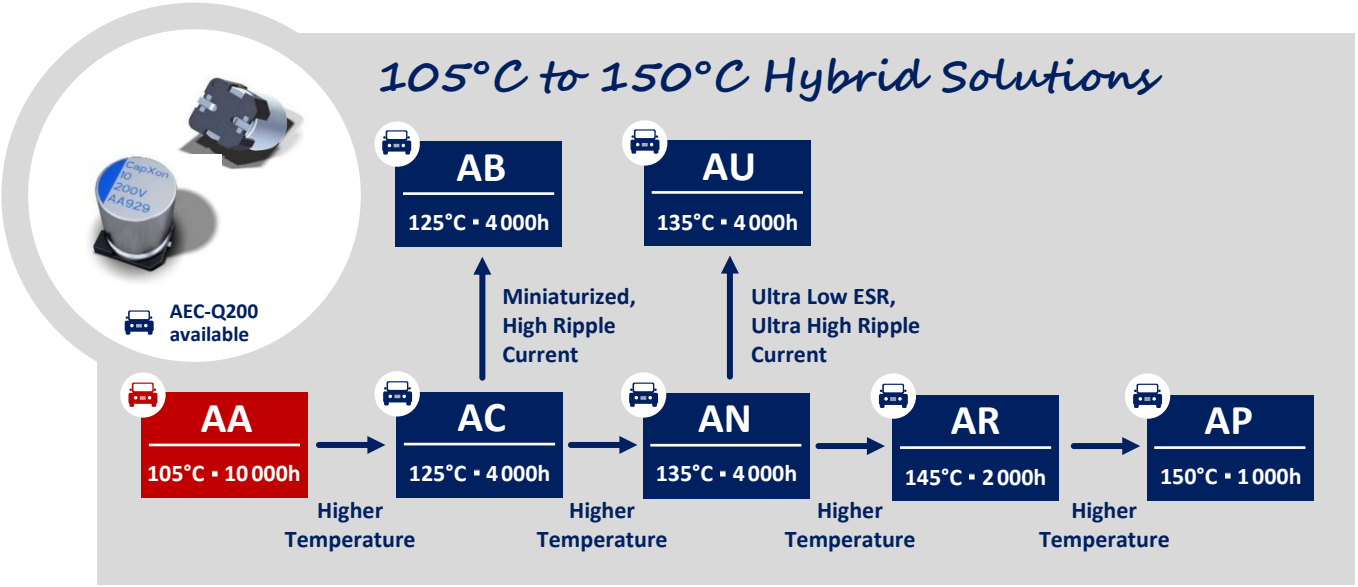
Recommended pad layout on page 112.

PRECAUTIONS, GUIDELINES AND PACKAGING INFORMATION

Unless otherwise agreed in individual specifications, all products are subject to our “General Precautions and Guidelines” as well as our “Packaging Information”. Please refer to the following links in the table.

General Precautions & Guidelines	Packaging Information	Vibration Test Profiles	3D Models	Reliability Tests

GROUP CHART



AC SERIES ▪ LONG LIFE AT 125°C

KEY FEATURES

AEC-Q 200 · HIGH TEMPERATURE

- **HYBRID CONDUCTIVE POLYMER** ▪ SMD type
- Endurance: 125°C ▪ 4000 hours
- Low ESR and high ripple current
- Vibration Proof (VP) version (up to 30g) available
- AEC-Q200 version available

HF Halogen Free · MSL 1 · RoHS & REACH COMPLIANT

SPECIFICATIONS

Items		Performance Characteristics
Operating Temperature Range		-55 ~ +125°C
Rated Voltage Range	V_R	16 ~ 100V DC
Surge Voltage	V_S	($V_R \le 100V$): $V_S = 1.25 \cdot V_R$
Capacitance Range	C_R	10 ~ 1500µF
Cap. Tolerance	ΔC	±20% (120Hz ▪ 20°C)
Leakage Current (20°C ▪ V_R applied)	I_{LEAK}	Not to exceed the values shown in standard ratings After 2 minutes
Dissipation Factor % (20°C ▪ 120Hz)	tanδ	Not to exceed the values shown in standard ratings
Equivalent Series Resistance (20°C ▪ 100kHz)	ESR	Not to exceed the values shown in standard ratings

Lifetime Test		
Endurance 125°C (V_R & I_R applied)	Test	**4000 hours**
	△C/C_R	Within ±30% of the initial value
	tanδ	Less than 200% of the specified value
	ESR	Less than 200% of the specified value
	I_{Leak}	Less than the specified value

MULTIPLIER Kf for RIPPLE CURRENT vs. FREQUENCY

Frequency (Hz)	100 ≤ Freq. < 120	120 ≤ Freq. < 200	200 ≤ Freq. < 300	300 ≤ Freq. < 500
Coefficient K_f	0.10	0.10	0.10	0.15

Frequency (Hz)	500 ≤ Freq. < 1k	1k ≤ Freq. < 2k	2k ≤ Freq. < 3k	3k ≤ Freq. < 5k
Coefficient K_f	0.20	0.30	0.40	0.45

Frequency (Hz)	5k ≤ Freq. < 10k	10k ≤ Freq. < 15k	15k ≤ Freq. < 20k	20k ≤ Freq. < 40k
Coefficient K_f	0.50	0.60	0.65	0.75

Frequency (Hz)	40k ≤ Freq. < 50k	50k ≤ Freq. < 100k	100k ≤ Freq. < 500k	500k ≤ Freq. < 1M
Coefficient K_f	0.80	0.85	1.00	1.05

STANDARD RATINGS

Part number shows blister tape on paper reel

V_R (V)	Standard	Vibration-proof	C_R (µF)	ø D (mm)	L (mm)	I_{LEAK} (µA, 2min)	tanδ +20°C ▪ 120Hz (%)	Max. ESR +20°C ▪ 100kHz (mΩ)	I_R ▪ Max. Ripple Current +125°C ▪ 100kHz (mA rms)	CapXon Part Number
16	●	●	100	6.3	5.8	16.0	16	50	900	AC101M016E058PTR [ ]
	●	●	120	6.3	5.8	19.2	16	50	900	AC121M016E058PTR [ ]
	●	●	150	6.3	5.8	24.0	16	50	900	AC151M016E058PTR [ ]
	●	●	220	6.3	7.7	35.2	16	30	1400	AC221M016E077PTR [ ]
	●	●	270	6.3	7.7	43.2	16	30	1700	AC271M016E077PTR [ ]
	●	●	330	10.0	10.5	52.8	16	20	2000	AC331M016G105PTR [ ]
	●	●	470	8.0	10.5	75.2	16	27	1600	AC471M016F105PTR [ ]
	●	●	470	10.0	10.5	75.2	16	20	2000	AC471M016G105PTR [ ]
	●	●	560	8.0	11.7	89.6	16	23	1650	AC561M016F117PTR [ ]
	●	●	560	10.0	10.5	89.6	16	20	2000	AC561M016G105PTR [ ]
	●	●	820	10.0	12.4	131.2	16	16	2260	AC821M016G124PTR [ ]
	●	●	1500	10.0	16.5	240.0	16	11	4000	AC152M016G165PTR [ ]
25	●		33	5.0	5.8	8.3	14	80	550	AC330M025C058PTR [ ]
	●	●	56	6.3	5.8	14.0	14	50	900	AC560M025E058PTR [ ]
	●	●	100	6.3	7.7	25.0	14	30	1400	AC101M025E077PTR [ ]
	●	●	220	8.0	10.5	55.0	14	27	1600	AC221M025F105PTR [ ]
	●	●	270	8.0	11.7	67.5	14	25	1650	AC271M025F117PTR [ ]
	●	●	330	10.0	10.5	82.5	14	20	2000	AC331M025G105PTR [ ]
	●	●	470	10.0	12.4	117.5	14	16	2260	AC471M025G124PTR [ ]
	●	●	560	10.0	16.5	140.0	14	11	4000	AC561M025G165PTR [ ]
35	●		22	5.0	5.8	7.7	12	100	550	AC220M035C058PTR [ ]
	●	●	47	6.3	5.8	16.5	12	60	900	AC470M035E058PTR [ ]
	●	●	68	6.3	7.7	23.8	12	35	1400	AC680M035E077PTR [ ]
	●	●	100	8.0	10.5	35.0	12	27	1600	AC101M035F105PTR [ ]
	●	●	150	8.0	10.5	52.5	12	27	1600	AC151M035F105PTR [ ]
	●	●	180	8.0	11.7	63.0	12	25	1650	AC181M035F117PTR [ ]
	●	●	270	10.0	10.5	94.5	12	20	2000	AC271M035G105PTR [ ]
	●	●	330	10.0	12.4	115.5	12	17	2260	AC331M035G124PTR [ ]
	●	●	470	10.0	16.5	164.5	12	11	4000	AC471M035G165PTR [ ]
50	●		10	5.0	5.8	5.0	10	120	500	AC100M050C058PTR [ ]
	●	●	22	6.3	5.8	11.0	10	80	750	AC220M050E058PTR [ ]
	●	●	33	6.3	7.7	16.5	10	40	1100	AC330M050E077PTR [ ]
	●	●	56	10.0	10.5	28.0	10	28	1600	AC560M050G105PTR [ ]
	●	●	68	8.0	10.5	34.0	10	30	1250	AC680M050F105PTR [ ]
	●	●	82	8.0	11.7	41.0	10	28	1300	AC820M050F117PTR [ ]
	●	●	100	10	10.5	50.0	10	28	1600	AC101M050G105PTR [ ]
	●	●	120	10	10.5	60.0	10	28	1600	AC121M050G105PTR [ ]
	●	●	120	10	12.4	60.0	10	25	1750	AC121M050G124PTR [ ]
	●	●	220	10	16.5	110.0	10	13	3700	AC221M050G165PTR [ ]

[ ] see description at end of standard ratings

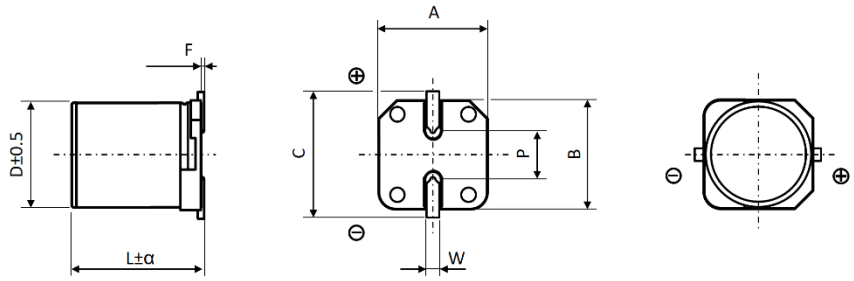
STANDARD RATINGS

Part number shows blister tape on reel version

V_R (V)	Standard	Vibration-proof	C_R (µF)	ø D (mm)	L (mm)	I_{LEAK} (µA, 2min)	tanδ +20°C ▪ 120Hz (%)	Max. ESR +20°C ▪ 100kHz (mΩ)	I_R ▪ Max. Ripple Current +125°C ▪ 100kHz (mA rms)	CapXon Part Number
63	●	●	10	6.3	5.8	6.3	8	120	700	AC100M063E058PTR ☐☐
	●	●	22	6.3	7.7	13.9	8	80	900	AC220M063E077PTR ☐☐
	●	●	33	8.0	10.5	20.8	8	40	1100	AC330M063F105PTR ☐☐
	●	●	47	8.0	10.5	29.6	8	40	1100	AC470M063F105PTR ☐☐
	●	●	47	8.0	11.7	29.6	8	38	1130	AC470M063F117PTR ☐☐
	●	●	56	10.0	10.5	35.3	8	30	1400	AC560M063G105PTR ☐☐
	●	●	68	10.0	10.5	42.8	8	30	1400	AC680M063G105PTR ☐☐
	●	●	82	10.0	12.4	51.7	8	22	1650	AC820M063G124PTR ☐☐
	●	●	150	10.0	16.5	94.5	8	15	3500	AC151M063G165PTR ☐☐
80	●	●	22	8.0	10.5	17.6	8	45	1050	AC220M080F105PTR ☐☐
	●	●	27	8.0	11.7	21.6	8	43	1080	AC270M080F117PTR ☐☐
	●	●	33	10.0	10.5	26.4	8	36	1360	AC330M080G105PTR ☐☐
	●	●	47	10.0	10.5	37.6	8	36	1360	AC470M080G105PTR ☐☐
	●	●	56	10.0	12.4	44.8	8	35	1440	AC560M080G124PTR ☐☐
	●	●	68	10.0	12.4	54.4	8	32	1540	AC680M080G124PTR ☐☐
100	●	●	22	8.0	10.5	22.0	8	55	950	AC220M100F105PTR ☐☐
	●	●	22	8.0	11.7	22.0	8	52	980	AC220M100F117PTR ☐☐
	●	●	22	10.0	10.5	22.0	8	45	1200	AC220M100G105PTR ☐☐
	●	●	27	10.0	12.4	27.0	8	40	1360	AC270M100G124PTR ☐☐
	●	●	33	10.0	12.4	33.0	8	40	1360	AC330M100G124PTR ☐☐

☐☐: Leave **blank** for Standard package
☐☐: Enter **W** for Vibration proof version
☐☐: Enter **X** for AEC-Q200
☐☐: Enter **XW** for AEC-Q200 and Vibration proof version

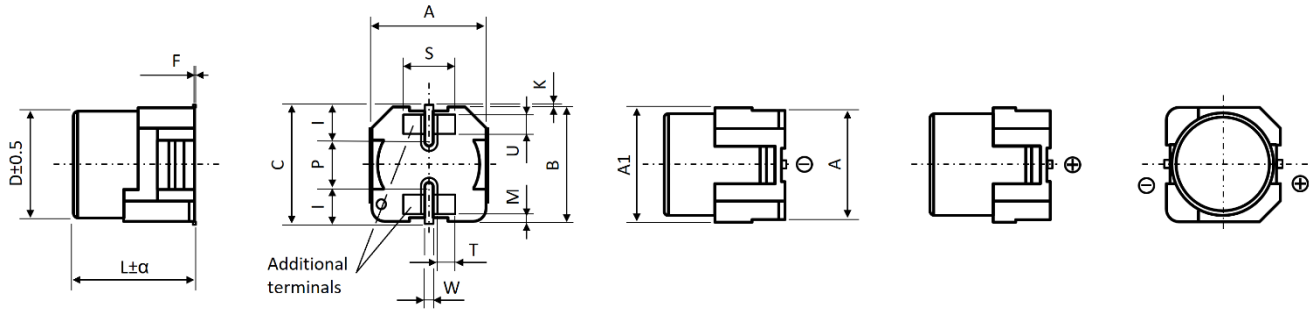
DIMENSIONS STANDARD PACKAGE ▪ All dimensions in mm



Recommended pad layout on page 110.

ø D	L	α	A ± 0.2	B ± 0.2	C ± 0.2	F	P ± 0.2	W
5.0	5.8	0.3	5.3	5.3	5.9	0.3 max.	1.4	0.5 to 0.8
6.3	5.8	0.3	6.6	6.6	7.2	0.3 max.	2.2	0.5 to 0.8
6.3	7.7	0.3	6.6	6.6	7.2	0.3 max.	2.2	0.5 to 0.8
8.0	10.5	0.3	8.3	8.3	9.0	0.3 max.	3.1	0.7 to 1.1
8.0	11.7	0.3	8.3	8.3	9.0	0.3 max.	3.1	0.7 to 1.1
10.0	10.5	0.3	10.3	10.3	11.0	0.3 max.	4.5	0.7 to 1.1
10.0	12.4	0.3	10.3	10.3	11.0	0.3 max.	4.5	1.0 to 1.4
10.0	16.5	0.3	10.3	10.3	11.0	0.3 max.	4.5	1.0 to 1.4

DIMENSIONS VP PACKAGE (VIBRATION-PROOF) Ø D6.3 ▪ All dimensions in mm



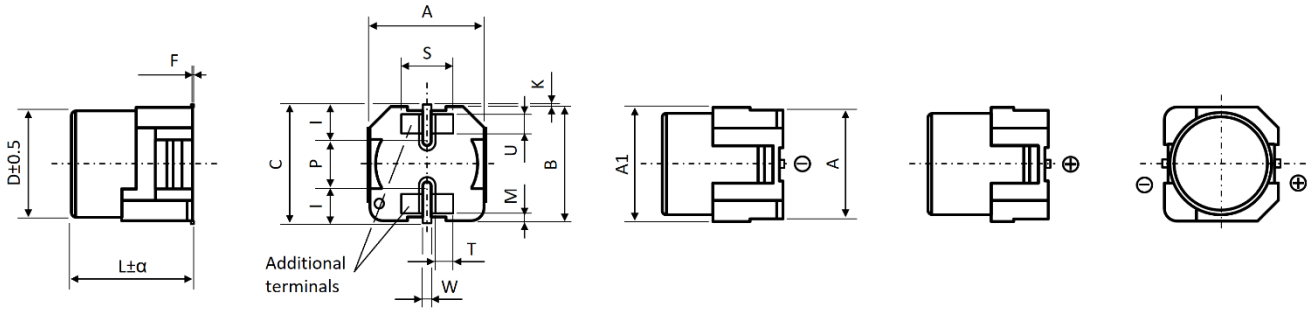
Note: Additional terminals electrical connected to anode or cathode terminal.

ø D	L	α	A ± 0.2	A1 (max.)	B ± 0.2	C (max.)	F	K
6.3	5.8	-0.3/+0.7	6.6	7.1	6.6	7.8	0 to 0.15	0.35 +0.15/-0.2
6.3	7.7	-0.3/+0.7	6.6	7.1	6.6	7.8	0 to 0.15	0.35 +0.15/-0.2

ø D	L	I ± 0.1	M ± 0.1	P ± 0.2	S ± 0.1	T ± 0.1	U ± 0.1	W ± 0.1
6.3	5.8	2.5	0.35	2.2	3.2	1.1	0.7	0.65
6.3	7.7	2.5	0.35	2.2	3.2	1.1	0.7	0.65

Recommended pad layout on page 111.

DIMENSIONS VP PACKAGE (VIBRATION-PROOF) Ø D8 and D10 ▪ All dimensions in mm



Note: Additional terminals electrical connected to anode or cathode terminal.

ø D	L	α	A ± 0.2	A1 (max.)	B ± 0.2	C (max.)	F	K ± 0.2
8.0	10.5	-0.3/+0.7	8.3	8.8	8.3	10.0	0 to 0.15	0.7
8.0	11.7	-0.3/+0.7	8.3	8.8	8.3	10.0	0 to 0.15	0.7
10.0	10.5	-0.3/+0.7	10.3	10.8	10.3	12.0	0 to 0.15	0.7
10.0	12.4	-0.3/+0.7	10.3	10.8	10.3	12.0	0 to 0.15	0.7
10.0	16.5	-0.3/+0.7	10.3	10.8	10.3	12.0	0 to 0.15	0.7

ø D	L	I ± 0.1	M ± 0.1	P ± 0.2	S ± 0.1	T ± 0.1	U ± 0.1	W ± 0.1
8.0	10.5	3.3	0.75	3.1	3.3	0.9	0.8	1.2
8.0	11.7	3.3	0.75	3.1	3.3	0.9	0.8	1.2
10.0	10.5	3.5	0.9	4.6	3.3	0.9	0.8	1.2
10.0	12.4	3.5	0.9	4.6	3.3	0.9	0.8	1.2
10.0	16.5	3.5	0.9	4.6	3.3	0.9	0.8	1.2

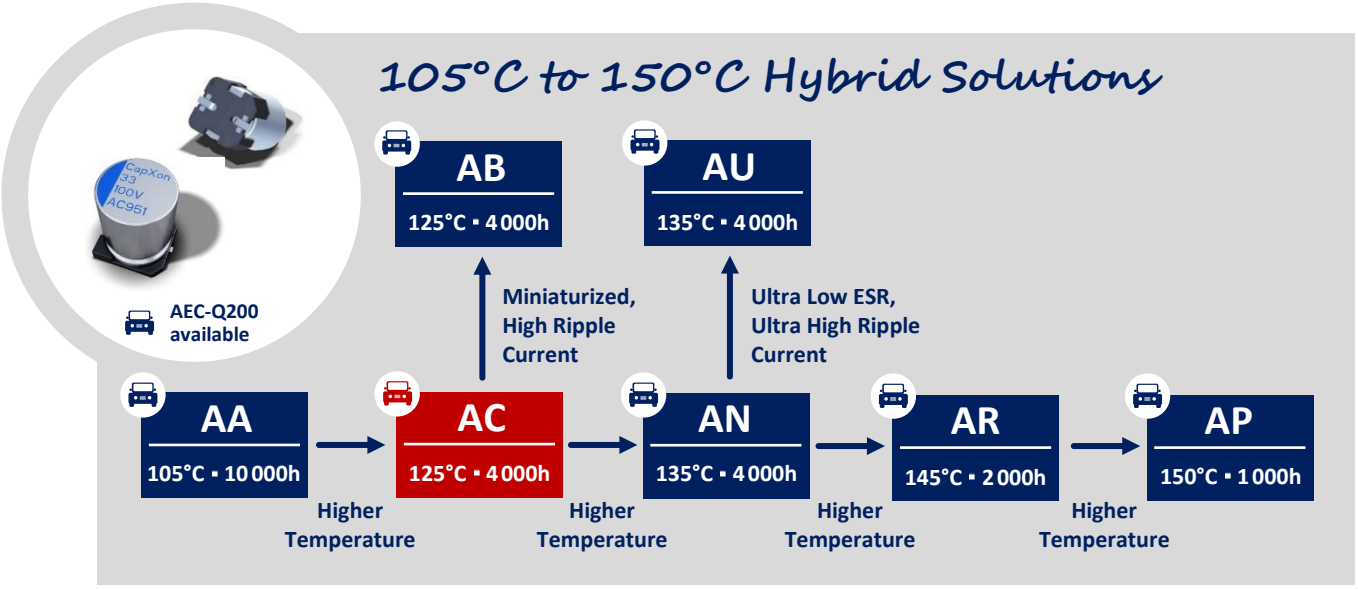
Recommended pad layout on page 112.

PRECAUTIONS, GUIDELINES AND PACKAGING INFORMATION

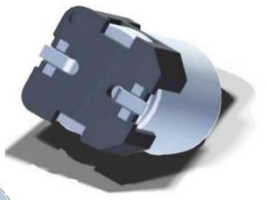
Unless otherwise agreed in individual specifications, all products are subject to our “General Precautions and Guidelines” as well as our “Packaging Information”. Please refer to the following links in the table.

General Precautions & Guidelines	Packaging Information	Vibration Test Profiles	3D Models	Reliability Tests

GROUP CHART



AB SERIES ▪ MINIATURIZED HIGH RIPPLE CURRENT TYPE



KEY FEATURES

AEC-Q 200 · HIGH TEMPERATURE · MINIATURIZED

- **HYBRID CONDUCTIVE POLYMER** ▪ SMD type
- Endurance: 125°C ▪ 4000 hours
- Low ESR and **extremely** high ripple current in small dimensions
- Vibration Proof (VP) version (up to 30g) available
- AEC-Q200 version available

HF Halogen Free · MSL 1 · RoHS & REACH COMPLIANT

SPECIFICATIONS

Items		Performance Characteristics
Operating Temperature Range		-55 ~ +125°C
Rated Voltage Range	V_R	25 ~ 35V DC
Surge Voltage	V_S	($V_R \le 100V$): $V_S = 1.25 \cdot V_R$
Capacitance Range	C_R	33 ~ 680µF
Cap. Tolerance	ΔC	±20% (120Hz ▪ 20°C)
Leakage Current (20°C ▪ V_R applied)	I_{LEAK}	Not to exceed the values shown in standard ratings After 2 minutes
Dissipation Factor % (20°C ▪ 120Hz)	tanδ	Not to exceed the values shown in standard ratings
Equivalent Series Resistance (20°C ▪ 100kHz)	ESR	Not to exceed the values shown in standard ratings

Lifetime Test		
Endurance 125°C (V_R & I_R applied)	Test	**4000 hours**
	$\triangle C/C_R$	Within ±30% of the initial value
	tanδ	Less than 200% of the specified value
	ESR	Less than 200% of the specified value
	I_{Leak}	Less than the specified value

MULTIPLIER K_f for RIPPLE CURRENT vs. FREQUENCY

Frequency (Hz)	100 ≤ Freq. < 120	120 ≤ Freq. < 200	200 ≤ Freq. < 300	300 ≤ Freq. < 500
Coefficient K_f	0.15	0.15	0.20	0.25

Frequency (Hz)	500 ≤ Freq. < 1k	1k ≤ Freq. < 2k	2k ≤ Freq. < 3k	3k ≤ Freq. < 5k
Coefficient K_f	0.35	0.45	0.55	0.60

Frequency (Hz)	5k ≤ Freq. < 10k	10k ≤ Freq. < 15k	15k ≤ Freq. < 20k	20k ≤ Freq. < 40k
Coefficient K_f	0.65	0.70	0.75	0.75

Frequency (Hz)	40k ≤ Freq. < 50k	50k ≤ Freq. < 100k	100k ≤ Freq. < 500k	500k ≤ Freq. < 1M
Coefficient K_f	0.80	0.85	1.00	1.05

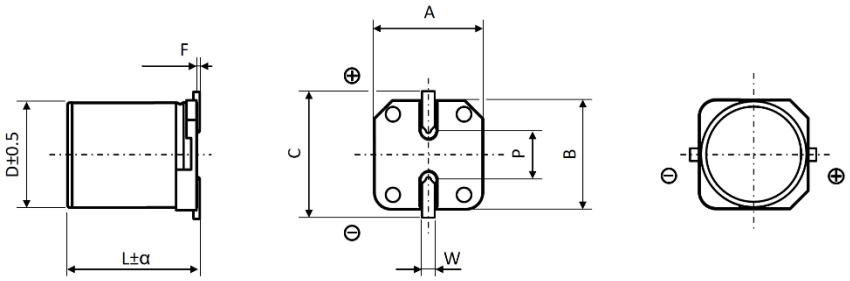
STANDARD RATINGS

Part number shows blister tape on paper reel

V_R (V)	Standard	Vibration-proof	C_R (µF)	ø D (mm)	L (mm)	I_{LEAK} (µA, 2min)	tanδ +20°C ▪ 120Hz (%)	Max. ESR +20°C ▪ 100kHz (mΩ)	I_R ▪ Max. Ripple Current +125°C ▪ 100kHz (mA rms)	CapXon Part Number
25	●		47	5.0	5.8	11.8	14	80	850	AB470M025C058PTR ☐☐☐
	●		56	5.0	5.8	14.0	14	80	850	AB560M025C058PTR ☐☐☐
	●	●	68	6.3	5.8	17.0	14	50	1300	AB680M025E058PTR ☐☐☐
	●	●	82	6.3	5.8	20.5	14	50	1300	AB820M025E058PTR ☐☐☐
	●	●	100	6.3	5.8	25.0	14	50	1300	AB101M025E058PTR ☐☐☐
	●	●	150	6.3	7.7	37.5	14	30	1800	AB151M025E077PTR ☐☐☐
	●	●	180	6.3	7.7	45.0	14	30	1800	AB181M025E077PTR ☐☐☐
	●	●	270	8.0	10.5	67.5	14	27	2000	AB271M025F105PTR ☐☐☐
	●	●	330	8.0	10.5	82.5	14	27	2000	AB331M025F105PTR ☐☐☐
	●	●	470	10.0	10.5	117.5	14	20	2800	AB471M025G105PTR ☐☐☐
	●	●	560	10.0	10.5	140.0	14	20	2800	AB561M025G105PTR ☐☐☐
	●	●	680	10.0	12.4	170.0	14	16	3160	AB681M025G124PTR ☐☐☐
35	●		33	5.0	5.8	11.5	12	100	750	AB330M035C058PTR ☐☐☐
	●		39	5.0	5.8	13.7	12	100	750	AB390M035C058PTR ☐☐☐
	●	●	56	6.3	5.8	19.6	12	60	1200	AB560M035E058PTR ☐☐☐
	●	●	68	6.3	5.8	23.8	12	60	1200	AB680M035E058PTR ☐☐☐
	●	●	100	6.3	7.7	35.0	12	35	1700	AB101M035E077PTR ☐☐☐
	●	●	120	6.3	7.7	42.0	12	35	1700	AB121M035E077PTR ☐☐☐
	●	●	180	8.0	10.5	63.0	12	27	2000	AB181M035F105PTR ☐☐☐
	●	●	220	8.0	10.5	77.0	12	27	2000	AB221M035F105PTR ☐☐☐
	●	●	330	10.0	10.5	115.5	12	20	2800	AB331M035G105PTR ☐☐☐
	●	●	390	10.0	10.5	136.5	12	20	2800	AB391M035G105PTR ☐☐☐

☐☐☐: Leave **blank** for Standard package
☐☐☐: Enter **W** for Vibration proof version
☐☐☐: Enter **X** for AEC-Q200
☐☐☐: Enter **XW** for AEC-Q200 and Vibration proof version

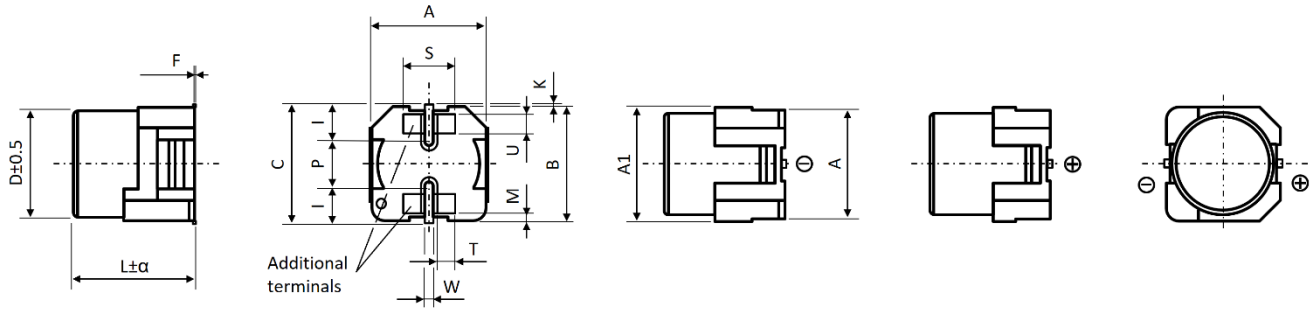
DIMENSIONS STANDARD PACKAGE ▪ All dimensions in mm



Recommended pad layout on page 110.

ø D	L	α	A ± 0.2	B ± 0.2	C ± 0.2	F	P ± 0.2	W
5.0	5.8	0.3	5.3	5.3	5.9	0.3 max.	1.4	0.5 to 0.8
6.3	5.8	0.3	6.6	6.6	7.2	0.3 max.	2.2	0.5 to 0.8
6.3	7.7	0.3	6.6	6.6	7.2	0.3 max.	2.2	0.5 to 0.8
8.0	10.5	0.3	8.3	8.3	9.0	0.3 max.	3.1	0.7 to 1.1
10.0	10.5	0.3	10.3	10.3	11.0	0.3 max.	4.5	0.7 to 1.1
10.0	12.4	0.3	10.3	10.3	11.0	0.3 max.	4.5	1.0 to 1.4

DIMENSIONS VP PACKAGE (VIBRATION-PROOF) Ø D6.3 ▪ All dimensions in mm



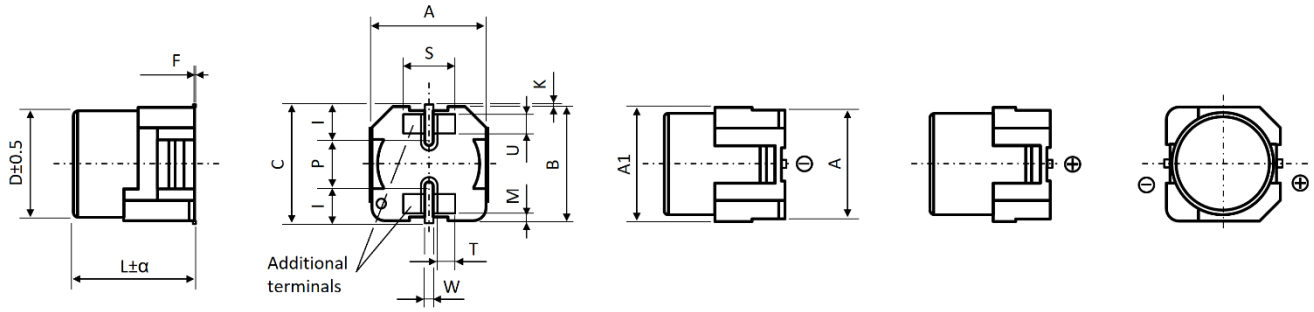
Note: Additional terminals electrical connected to anode or cathode terminal.

ø D	L	α	A ± 0.2	A1 (max.)	B ± 0.2	C (max.)	F	K
6.3	5.8	-0.3/+0.7	6.6	7.1	6.6	7.8	0 to 0.15	0.35 +0.15/-0.2
6.3	7.7	-0.3/+0.7	6.6	7.1	6.6	7.8	0 to 0.15	0.35 +0.15/-0.2

ø D	L	I ± 0.1	M ± 0.1	P ± 0.2	S ± 0.1	T ± 0.1	U ± 0.1	W ± 0.1
6.3	5.8	2.5	0.35	2.2	3.2	1.1	0.7	0.65
6.3	7.7	2.5	0.35	2.2	3.2	1.1	0.7	0.65

Recommended pad layout on page 111.

DIMENSIONS VP PACKAGE (VIBRATION-PROOF) Ø D8 and D10 ▪ All dimensions in mm



Note: Additional terminals electrical connected to anode or cathode terminal.

ø D	L	α	A ± 0.2	A1 (max.)	B ± 0.2	C (max.)	F	K ± 0.2
8.0	10.5	-0.3/+0.7	8.3	8.8	8.3	10.0	0 to 0.15	0.7
10.0	10.5	-0.3/+0.7	10.3	10.8	10.3	12.0	0 to 0.15	0.7
10.0	12.4	-0.3/+0.7	10.3	10.8	10.3	12.0	0 to 0.15	0.7

ø D	L	I ± 0.1	M ± 0.1	P ± 0.2	S ± 0.1	T ± 0.1	U ± 0.1	W ± 0.1
8.0	10.5	3.3	0.75	3.1	3.3	0.9	0.8	1.2
10.0	10.5	3.5	0.9	4.6	3.3	0.9	0.8	1.2
10.0	12.4	3.5	0.9	4.6	3.3	0.9	0.8	1.2

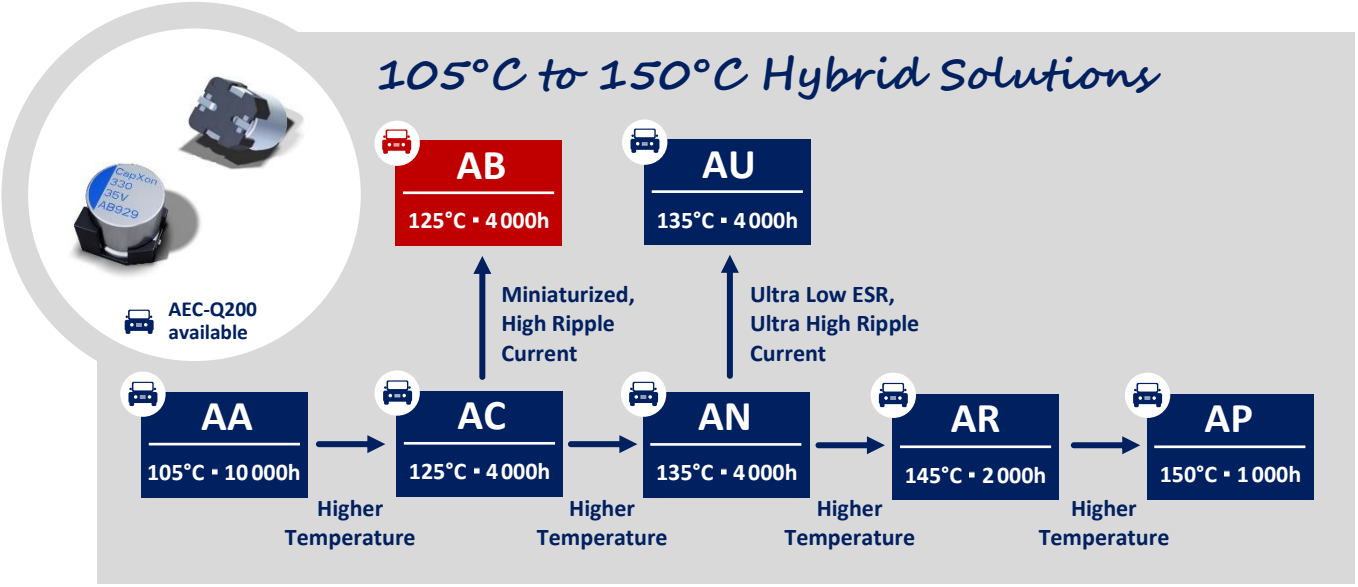
Recommended pad layout on page 112.

PRECAUTIONS, GUIDELINES AND PACKAGING INFORMATION

Unless otherwise agreed in individual specifications, all products are subject to our “General Precautions and Guidelines” as well as our “Packaging Information”. Please refer to the following links in the table.

General Precautions & Guidelines	Packaging Information	Vibration Test Profiles	3D Models	Reliability Tests

GROUP CHART



AN SERIES ▪ LONG LIFE AT 135°C

KEY FEATURES

AEC-Q 200 · HIGH TEMPERATURE

- **HYBRID CONDUCTIVE POLYMER** ▪ SMD type
- Endurance: 135°C ▪ 4000 hours
- Low ESR and high ripple current
- Vibration Proof (VP) version (up to 30g) available
- AEC-Q200 version available

HF Halogen Free · MSL 1 · RoHS & REACH COMPLIANT

SPECIFICATIONS

Items		Performance Characteristics
Operating Temperature Range		-55 ~ +135°C
Rated Voltage Range	V_R	16 ~ 100V DC
Surge Voltage	V_S	($V_R \le 100V$): $V_S = 1.25 \cdot V_R$
Capacitance Range	C_R	10 ~ 820µF
Cap. Tolerance	ΔC	±20% (120Hz ▪ 20°C)
Leakage Current (20°C ▪ V_R applied)	I_{LEAK}	Not to exceed the values shown in standard ratings After 2 minutes
Dissipation Factor % (20°C ▪ 120Hz)	tanδ	Not to exceed the values shown in standard ratings
Equivalent Series Resistance (20°C ▪ 100kHz)	ESR	Not to exceed the values shown in standard ratings

Lifetime Test		
Endurance 135°C (V_R & I_R applied)	Test	**4000 hours**
	△C/C_R	Within ±30% of the initial value
	tanδ	Less than 200% of the specified value
	ESR	Less than 200% of the specified value
	I_{Leak}	Less than the specified value

MULTIPLIER K_f for RIPPLE CURRENT vs. FREQUENCY

Frequency (Hz)	100 ≤ Freq. < 120	120 ≤ Freq. < 200	200 ≤ Freq. < 300	300 ≤ Freq. < 500
Coefficient K_f	0.15	0.15	0.20	0.25

Frequency (Hz)	500 ≤ Freq. < 1k	1k ≤ Freq. < 2k	2k ≤ Freq. < 3k	3k ≤ Freq. < 5k
Coefficient K_f	0.30	0.40	0.45	0.55

Frequency (Hz)	5k ≤ Freq. < 10k	10k ≤ Freq. < 15k	15k ≤ Freq. < 20k	20k ≤ Freq. < 40k
Coefficient K_f	0.60	0.70	0.75	0.80

Frequency (Hz)	40k ≤ Freq. < 50k	50k ≤ Freq. < 100k	100k ≤ Freq. < 500k	500k ≤ Freq. < 1M
Coefficient K_f	0.85	0.90	1.00	1.00

STANDARD RATINGS

Part number shows blister tape on paper reel

V_R (V)	Standard	Vibration-proof	C_R (µF)	ø D (mm)	L (mm)	I_{LEAK} (µA, 2min)	tanδ +20°C ▪ 120Hz (%)	Max. ESR +20°C ▪ 100kHz (mΩ)	I_R ▪ Max. Ripple Current +135°C ▪ 100kHz (mA rms)	CapXon Part Number
16	●	●	100	6.3	5.8	16.0	16	50	900	AN101M016E058PTR ⛶⛶
	●	●	120	6.3	5.8	19.2	16	50	900	AN121M016E058PTR ⛶⛶
	●	●	150	6.3	5.8	24.0	16	50	900	AN151M016E058PTR ⛶⛶
	●	●	220	6.3	7.7	35.2	16	30	1400	AN221M016E077PTR ⛶⛶
	●	●	270	6.3	7.7	43.2	16	30	1700	AN271M016E077PTR ⛶⛶
	●	●	330	10.0	10.5	52.8	16	20	2000	AN331M016G105PTR ⛶⛶
	●	●	470	8.0	10.5	75.2	16	27	1600	AN471M016F105PTR ⛶⛶
	●	●	470	10.0	10.5	75.2	16	20	2000	AN471M016G105PTR ⛶⛶
	●	●	560	8.0	11.7	89.6	16	23	1650	AN561M016F117PTR ⛶⛶
	●	●	560	10.0	10.5	89.6	16	20	2000	AN561M016G105PTR ⛶⛶
	●	●	820	10.0	12.4	131.2	16	16	2260	AN821M016G124PTR ⛶⛶
25	●		33	5.0	5.8	8.3	14	80	550	AN330M025C058PTR ⛶⛶
	●	●	56	6.3	5.8	14.0	14	50	900	AN560M025E058PTR ⛶⛶
	●	●	100	6.3	7.7	25.0	14	30	1400	AN101M025E077PTR ⛶⛶
	●	●	220	8.0	10.5	55.0	14	27	1600	AN221M025F105PTR ⛶⛶
	●	●	270	8.0	11.7	67.5	14	25	1650	AN271M025F117PTR ⛶⛶
	●	●	330	10.0	10.5	82.5	14	20	2000	AN331M025G105PTR ⛶⛶
	●	●	470	10.0	12.4	117.5	14	16	2260	AN471M025G124PTR ⛶⛶
35	●		22	5.0	5.8	7.7	12	100	550	AN220M035C058PTR ⛶⛶
	●	●	47	6.3	5.8	16.5	12	60	900	AN470M035E058PTR ⛶⛶
	●	●	68	6.3	7.7	23.8	12	35	1400	AN680M035E077PTR ⛶⛶
	●	●	100	8.0	10.5	35.0	12	27	1600	AN101M035F105PTR ⛶⛶
	●	●	150	8.0	10.5	52.5	12	27	1600	AN151M035F105PTR ⛶⛶
	●	●	180	8.0	11.7	63.0	12	25	1650	AN181M035F117PTR ⛶⛶
	●	●	270	10.0	10.5	94.5	12	20	2000	AN271M035G105PTR ⛶⛶
	●	●	330	10.0	12.4	115.5	12	17	2260	AN331M035G124PTR ⛶⛶
50	●		10	5.0	5.8	5.0	10	120	500	AN100M050C058PTR ⛶⛶
	●	●	22	6.3	5.8	11.0	10	80	750	AN220M050E058PTR ⛶⛶
	●	●	33	6.3	7.7	16.5	10	40	1100	AN330M050E077PTR ⛶⛶
	●	●	56	10.0	10.5	28.0	10	28	1600	AN560M050G105PTR ⛶⛶
	●	●	68	8.0	10.5	34.0	10	30	1250	AN680M050F105PTR ⛶⛶
	●	●	82	8.0	11.7	41.0	10	28	1300	AN820M050F117PTR ⛶⛶
	●	●	100	10.0	10.5	50.0	10	28	1600	AN101M050G105PTR ⛶⛶
	●	●	120	10.0	10.5	60.0	10	28	1600	AN121M050G105PTR ⛶⛶
	●	●	120	10.0	12.4	60.0	10	25	1750	AN121M050G124PTR ⛶⛶
63	●	●	10	6.3	5.8	6.3	8	120	700	AN100M063E058PTR ⛶⛶
	●	●	22	6.3	7.7	13.9	8	80	900	AN220M063E077PTR ⛶⛶
	●	●	33	8.0	10.5	20.8	8	40	1100	AN330M063F105PTR ⛶⛶
	●	●	47	8.0	10.5	29.6	8	40	1100	AN470M063F105PTR ⛶⛶
	●	●	47	8.0	11.7	29.6	8	38	1130	AN470M063F117PTR ⛶⛶
	●	●	56	10.0	10.5	35.3	8	30	1400	AN560M063G105PTR ⛶⛶
	●	●	68	10.0	10.5	42.8	8	30	1400	AN680M063G105PTR ⛶⛶
	●	●	82	10.0	12.4	51.7	8	22	1650	AN820M063G124PTR ⛶⛶

⛶ **see description at end of standard ratings**

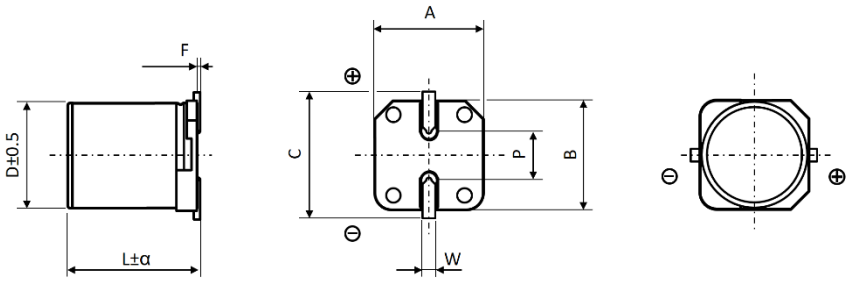
STANDARD RATINGS

Part number shows blister tape on paper reel

V_R (V)	Standard	Vibration-proof	C_R (µF)	ø D (mm)	L (mm)	I_{LEAK} (µA, 2min)	tanδ +20°C ▪ 120Hz (%)	Max. ESR +20°C ▪ 100kHz (mΩ)	I_R ▪ Max. Ripple Current +135°C ▪ 100kHz (mA rms)	CapXon Part Number
80	●	●	22	8.0	10.5	17.6	8	45	1050	AN220M080F105PTR ☐☐
	●	●	27	8.0	11.7	21.6	8	43	1080	AN270M080F117PTR ☐☐
	●	●	33	10.0	10.5	26.4	8	36	1360	AN330M080G105PTR ☐☐
	●	●	47	10.0	10.5	37.6	8	36	1360	AN470M080G105PTR ☐☐
	●	●	56	10.0	12.4	44.8	8	35	1440	AN560M080G124PTR ☐☐
	●	●	68	10.0	12.4	54.4	8	32	1540	AN680M080G124PTR ☐☐
100	●	●	22	8.0	10.5	22.0	8	55	950	AN220M100F105PTR ☐☐
	●	●	22	8.0	11.7	22.0	8	52	980	AN220M100F117PTR ☐☐
	●	●	22	10.0	10.5	22.0	8	45	1200	AN220M100G105PTR ☐☐
	●	●	27	10.0	12.4	27.0	8	40	1360	AN270M100G124PTR ☐☐
	●	●	33	10.0	12.4	33.0	8	40	1360	AN330M100G124PTR ☐☐

☐☐: Leave **blank** for Standard package
☐☐: Enter **W** for Vibration proof version
☐☐: Enter **X** for AEC-Q200
☐☐: Enter **XW** for AEC-Q200 and Vibration proof version

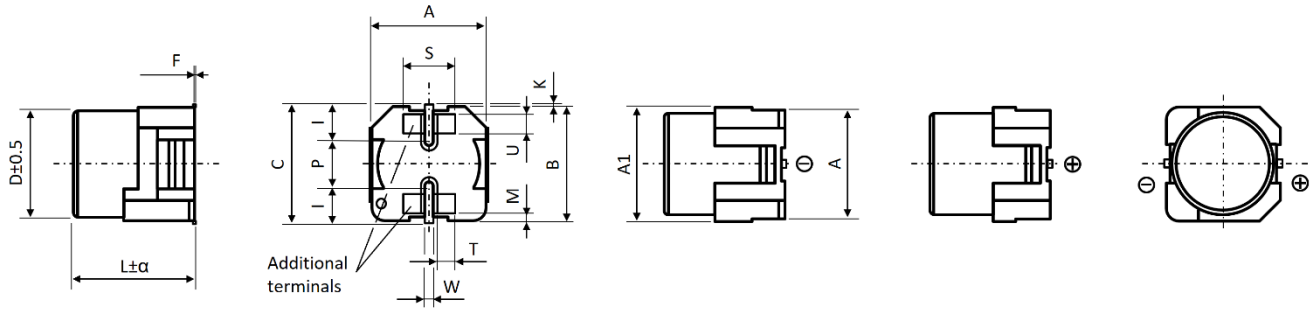
DIMENSIONS STANDARD PACKAGE ▪ All dimensions in mm



Recommended pad layout on page 111.

ø D	L	α	A ± 0.2	B ± 0.2	C ± 0.2	F	P ± 0.2	W
5.0	5.8	0.3	5.3	5.3	5.9	0.3 max.	1.4	0.5 to 0.8
6.3	5.8	0.3	6.6	6.6	7.2	0.3 max.	2.2	0.5 to 0.8
6.3	7.7	0.3	6.6	6.6	7.2	0.3 max.	2.2	0.5 to 0.8
8.0	10.5	0.3	8.3	8.3	9.0	0.3 max.	3.1	0.7 to 1.1
8.0	11.7	0.3	8.3	8.3	9.0	0.3 max.	3.1	0.7 to 1.1
10.0	10.5	0.3	10.3	10.3	11.0	0.3 max.	4.5	0.7 to 1.1
10.0	12.4	0.3	10.3	10.3	11.0	0.3 max.	4.5	1.0 to 1.4

DIMENSIONS VP PACKAGE (VIBRATION-PROOF) Ø D6.3 ▪ All dimensions in mm



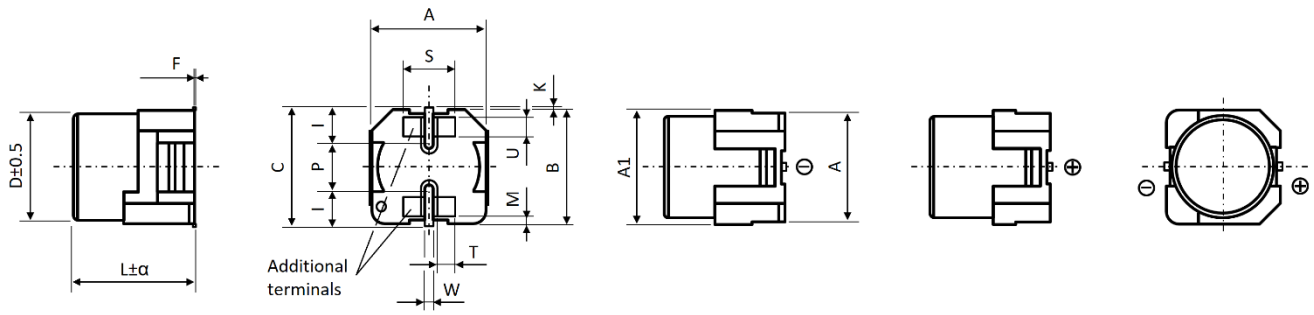
Note: Additional terminals electrical connected to anode or cathode terminal.

ø D	L	α	A ± 0.2	A1 (max.)	B ± 0.2	C (max.)	F	K
6.3	5.8	-0.3/+0.7	6.6	7.1	6.6	7.8	0 to 0.15	0.35 +0.15/-0.2
6.3	7.7	-0.3/+0.7	6.6	7.1	6.6	7.8	0 to 0.15	0.35 +0.15/-0.2

ø D	L	I ± 0.1	M ± 0.1	P ± 0.2	S ± 0.1	T ± 0.1	U ± 0.1	W ± 0.1
6.3	5.8	2.5	0.35	2.2	3.2	1.1	0.7	0.65
6.3	7.7	2.5	0.35	2.2	3.2	1.1	0.7	0.65

Recommended pad layout on page 111.

DIMENSIONS VP PACKAGE (VIBRATION-PROOF) Ø D8 and D10 ▪ All dimensions in mm



Note: Additional terminals electrical connected to anode or cathode terminal.

ø D	L	α	A ± 0.2	A1 (max.)	B ± 0.2	C (max.)	F	K ± 0.2
8.0	10.5	-0.3/+0.7	8.3	8.8	8.3	10.0	0 to 0.15	0.7
8.0	11.7	-0.3/+0.7	8.3	8.8	8.3	10.0	0 to 0.15	0.7
10.0	10.5	-0.3/+0.7	10.3	10.8	10.3	12.0	0 to 0.15	0.7
10.0	12.4	-0.3/+0.7	10.3	10.8	10.3	12.0	0 to 0.15	0.7

ø D	L	I ± 0.1	M ± 0.1	P ± 0.2	S ± 0.1	T ± 0.1	U ± 0.1	W ± 0.1
8.0	10.5	3.3	0.75	3.1	3.3	0.9	0.8	1.2
8.0	11.7	3.3	0.75	3.1	3.3	0.9	0.8	1.2
10.0	10.5	3.5	0.9	4.6	3.3	0.9	0.8	1.2
10.0	12.4	3.5	0.9	4.6	3.3	0.9	0.8	1.2

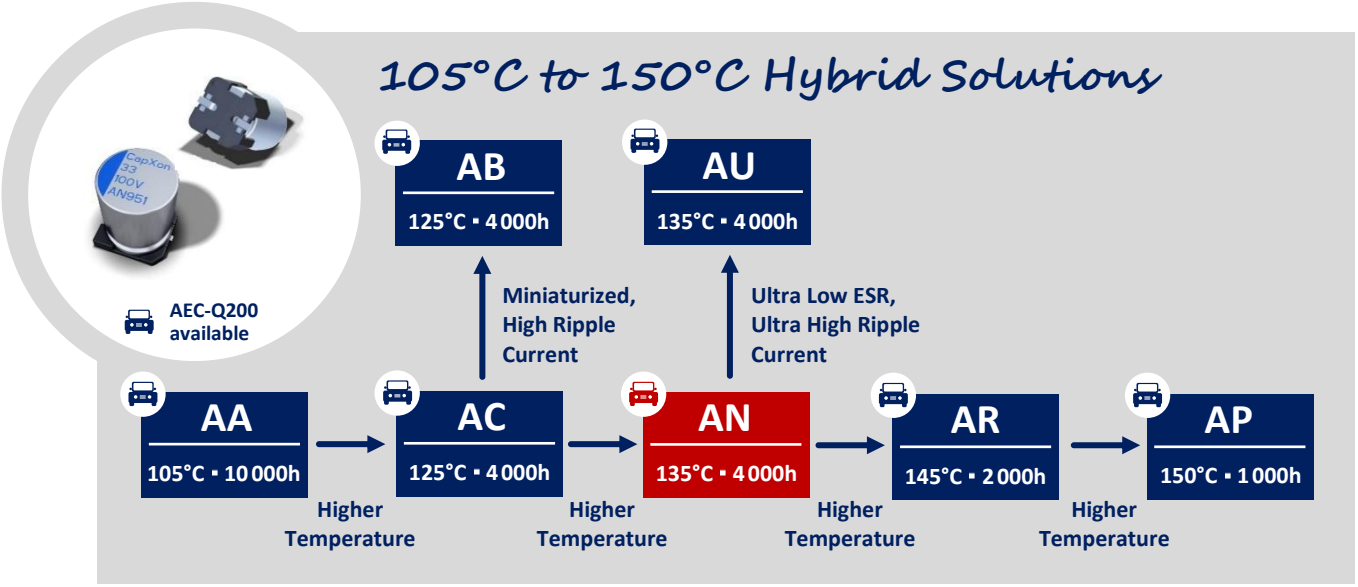
Recommended pad layout on page 112.

PRECAUTIONS, GUIDELINES AND PACKAGING INFORMATION

Unless otherwise agreed in individual specifications, all products are subject to our “General Precautions and Guidelines” as well as our “Packaging Information”. Please refer to the following links in the table.

General Precautions & Guidelines	Packaging Information	Vibration Test Profiles	3D Models	Reliability Tests

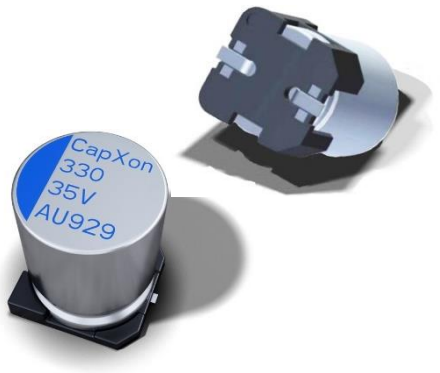
GROUP CHART



AU SERIES ▪ HIGH RIPPLE CURRENT TYPE

KEY FEATURES

AEC-Q 200 · HIGH TEMPERATURE · HIGH RIPPLE



- **HYBRID CONDUCTIVE POLYMER** ▪ SMD type
- Endurance: 135°C ▪ 4000 hours
- Ultra-low ESR and highest ripple current
- Vibration Proof (VP) version (up to 30g) available
- AEC-Q200 version available

HF Halogen Free · MSL 1 · RoHS & REACH COMPLIANT

SPECIFICATIONS

Items		Performance Characteristics
Operating Temperature Range		-55 ~ +135°C
Rated Voltage Range	V_R	25 ~ 100V DC
Surge Voltage	V_S	($V_R \le 100V$): $V_S = 1.25 \cdot V_R$
Capacitance Range	C_R	22 ~ 680µF
Cap. Tolerance	ΔC	±20% (120Hz ▪ 20°C)
Leakage Current (20°C ▪ V_R applied)	I_{LEAK}	Not to exceed the values shown in standard ratings After 2 minutes
Dissipation Factor % (20°C ▪ 120Hz)	tanδ	Not to exceed the values shown in standard ratings
Equivalent Series Resistance (20°C ▪ 100kHz)	ESR	Not to exceed the values shown in standard ratings

Lifetime Test		
Endurance 135°C (V_R & I_R applied)	Test	**4000 hours**
	△C/C_R	Within ±30% of the initial value
	tanδ	Less than 200% of the specified value
	ESR	Less than 200% of the specified value
	I_{Leak}	Less than the specified value

MULTIPLIER K_f for RIPPLE CURRENT vs. FREQUENCY

Frequency (Hz)	100 ≤ Freq. < 120	120 ≤ Freq. < 200	200 ≤ Freq. < 300	300 ≤ Freq. < 500
Coefficient K_f	0.15	0.15	0.20	0.25

Frequency (Hz)	500 ≤ Freq. < 1k	1k ≤ Freq. < 2k	2k ≤ Freq. < 3k	3k ≤ Freq. < 5k
Coefficient K_f	0.30	0.40	0.45	0.55

Frequency (Hz)	5k ≤ Freq. < 10k	10k ≤ Freq. < 15k	15k ≤ Freq. < 20k	20k ≤ Freq. < 40k
Coefficient K_f	0.60	0.70	0.75	0.80

Frequency (Hz)	40k ≤ Freq. < 50k	50k ≤ Freq. < 100k	100k ≤ Freq. < 500k	500k ≤ Freq. < 1M
Coefficient K_f	0.85	0.90	1.00	1.00

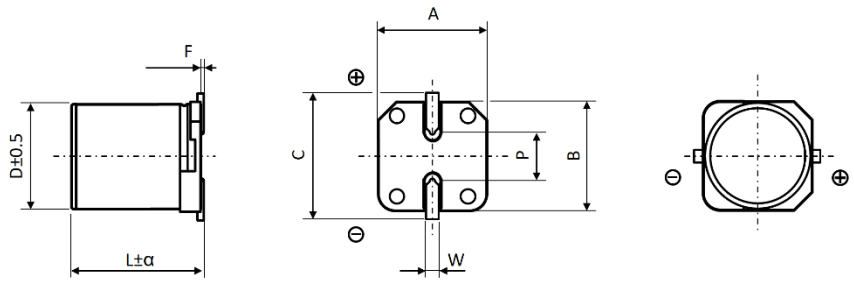
STANDARD RATINGS

Part number shows blister tape on paper reel

V_R (V)	Standard	Vibration-proof	C_R (µF)	ø D (mm)	L (mm)	I_{LEAK} (µA, 2min)	tanδ +20°C ▪ 120Hz (%)	Max. ESR +20°C ▪ 100kHz (mΩ)	I_R ▪ Max. Ripple Current ▪ 100kHz (mA rms)		CapXon Part Number
									+125°C	+135°C	
25	●	●	470	10.0	12.4	117.5	14	10	5000	3500	AU471M025G124PTR [ ][ ]
	●	●	560	10.0	16.5	140	14	8	5800	4000	AU561M025G165PTR [ ][ ]
	●	●	680	10.0	16.5	170	14	8	5800	4000	AU681M025G165PTR [ ][ ]
35	●	●	330	10.0	12.4	115.5	12	11	4800	3300	AU331M035G124PTR [ ][ ]
	●	●	470	10.0	16.5	164.5	12	9	5500	3800	AU471M035G165PTR [ ][ ]
50	●	●	68	10.0	12.4	34	10	15	4000	2800	AU680M050G124PTR [ ][ ]
	●	●	100	10.0	12.4	50	10	15	4000	2800	AU101M050G124PTR [ ][ ]
	●	●	120	10.0	12.4	60	10	12	4600	3200	AU121M050G124PTR [ ][ ]
	●	●	150	10.0	12.4	75	10	12	4600	3200	AU151M050G124PTR [ ][ ]
	●	●	180	10.0	16.5	90	10	10	5200	3600	AU181M050G165PTR [ ][ ]
	●	●	220	10.0	16.5	110	10	10	5200	3600	AU221M050G165PTR [ ][ ]
63	●	●	47	10.0	12.4	29.6	8	15	4000	2800	AU470M063G124PTR [ ][ ]
	●	●	56	10.0	12.4	35.3	8	15	4000	2800	AU560M063G124PTR [ ][ ]
	●	●	68	10.0	12.4	42.8	8	15	4000	2800	AU680M063G124PTR [ ][ ]
	●	●	100	10.0	12.4	63.0	8	12	4600	3200	AU101M063G124PTR [ ][ ]
	●	●	120	10.0	12.4	75.6	8	12	4600	3200	AU121M063G124PTR [ ][ ]
	●	●	150	10.0	16.5	94.5	8	10	5200	3600	AU151M063G165PTR [ ][ ]
80	●	●	47	10.0	12.4	37.6	8	18	3600	2500	AU470M080G124PTR [ ][ ]
	●	●	56	10.0	12.4	44.8	8	15	3600	2500	AU560M080G124PTR [ ][ ]
	●	●	68	10.0	12.4	54.5	8	15	4000	2800	AU680M080G124PTR [ ][ ]
	●	●	100	10.0	16.5	80	8	12	4700	3300	AU101M080G165PTR [ ][ ]
100	●	●	22	10.0	12.4	22	8	25	3000	2100	AU220M100G124PTR [ ][ ]
	●	●	33	10.0	12.4	33	8	20	3400	2400	AU330M100G124PTR [ ][ ]
	●	●	47	10.0	16.5	47	8	15	4100	2900	AU470M100G165PTR [ ][ ]

[ ][ ][ ]: Leave **blank** for Standard package
[ ][ ]: Enter **W** for Vibration proof version
[ ][ ][ ]: Enter **X** for AEC-Q200
[ ][ ][ ]: Enter **XW** for AEC-Q200 and Vibration proof version

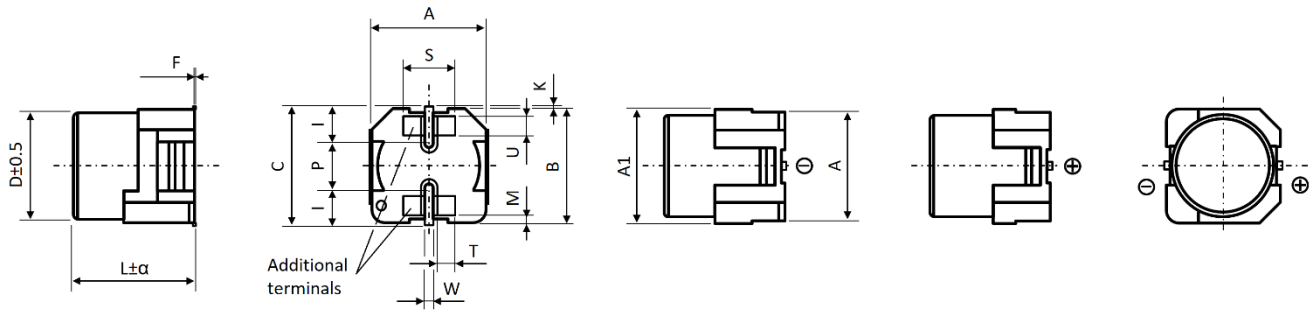
DIMENSIONS STANDARD PACKAGE ▪ All dimensions in mm



Recommended pad layout on page 110.

ø D	L	α	A ± 0.2	B ± 0.2	C ± 0.2	F	P ± 0.2	W
10.0	12.4	0.3	10.3	10.3	11.0	0.3 max.	4.5	1.0 to 1.4
10.0	16.5	0.3	10.3	10.3	11.0	0.3 max.	4.5	1.0 to 1.4

DIMENSIONS VP PACKAGE (VIBRATION-PROOF) Ø D10 ▪ All dimensions in mm



Note: Additional terminals electrical connected to anode or cathode terminal.

ø D	L	α	A ± 0.2	A1 (max.)	B ± 0.2	C (max.)	F	K ± 0.2
10.0	12.4	-0.3/+0.7	10.3	10.8	10.3	12.0	0 to 0.15	0.7
10.0	16.5	-0.3/+0.7	10.3	10.8	10.3	12.0	0 to 0.15	0.7

ø D	L	I ± 0.1	M ± 0.1	P ± 0.2	S ± 0.1	T ± 0.1	U ± 0.1	W ± 0.1
10.0	12.4	3.5	0.9	4.6	3.3	0.9	0.8	1.2
10.0	16.5	3.5	0.9	4.6	3.3	0.9	0.8	1.2

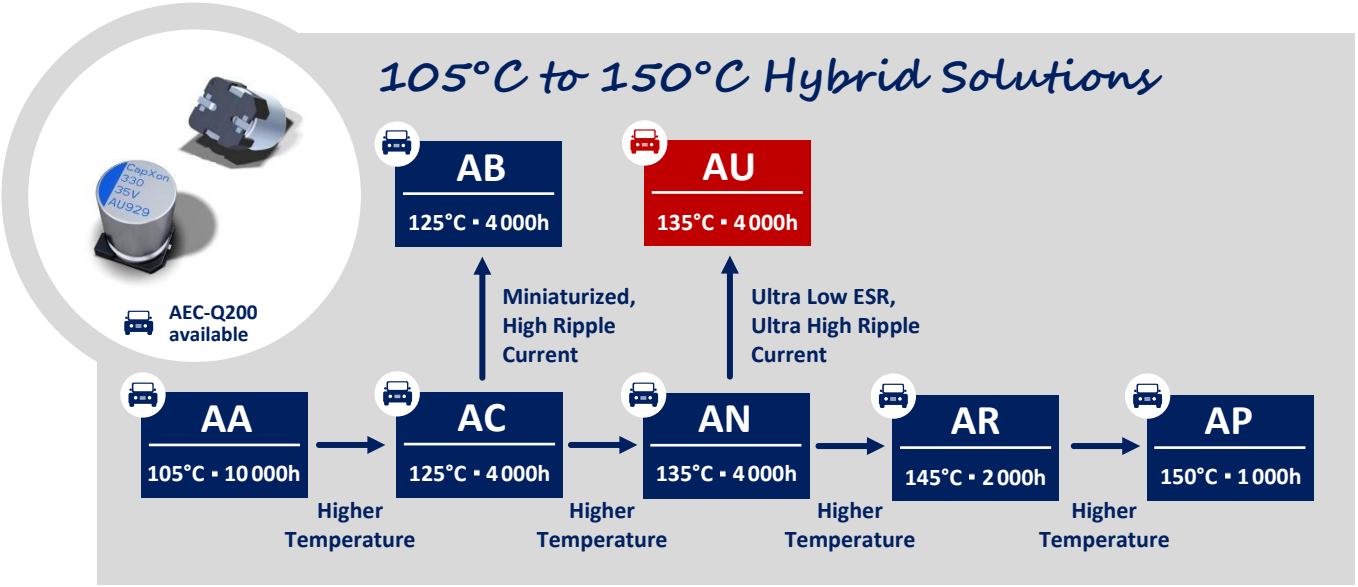
Recommended pad layout on page 112.

PRECAUTIONS, GUIDELINES AND PACKAGING INFORMATION

Unless otherwise agreed in individual specifications, all products are subject to our “General Precautions and Guidelines” as well as our “Packaging Information”. Please refer to the following links in the table.

General Precautions & Guidelines	Packaging Information	Vibration Test Profiles	3D Models	Reliability Tests

GROUP CHART



AR SERIES ▪ HIGH TEMPERATURE TYPE 145°C

KEY FEATURES

AEC-Q 200 · HIGH TEMPERATURE

- **HYBRID CONDUCTIVE POLYMER** ▪ SMD type
- Endurance: 145°C ▪ 2 000 hours
- Low ESR and high ripple current
- Vibration-proof (VP) version (up to 30g) available
- AEC-Q200 version available

HF Halogen Free · MSL 1 · RoHS & REACH COMPLIANT

SPECIFICATIONS

Items		Performance Characteristics
Operating Temperature Range		-55 ~ +145°C
Rated Voltage Range	V_R	16 ~ 80V DC
Surge Voltage	V_S	($V_R \le 100V$): $V_S = 1.25 \cdot V_R$
Capacitance Range	C_R	22 ~ 560µF
Cap. Tolerance	ΔC	±20% (120Hz ▪ 20°C)
Leakage Current (20°C ▪ V_R applied)	I_{LEAK}	Not to exceed the values shown in standard ratings After 2 minutes
Dissipation Factor % (20°C ▪ 120Hz)	tanδ	Not to exceed the values shown in standard ratings
Equivalent Series Resistance (20°C ▪ 100kHz)	ESR	Not to exceed the values shown in standard ratings

Lifetime Test		
Endurance 145°C (V_R & I_R applied)	Test	**2 000 hours**
	$\triangle C/C_R$	Within ±30% of the initial value
	tanδ	Less than 200% of the specified value
	ESR	Less than 200% of the specified value
	I_{Leak}	Less than the specified value

MULTIPLIER K_f for RIPPLE CURRENT vs. FREQUENCY

Frequency (Hz)	100 ≤ Freq. < 120	120 ≤ Freq. < 200	200 ≤ Freq. < 300	300 ≤ Freq. < 500
Coefficient K_f	0.10	0.10	0.10	0.15

Frequency (Hz)	500 ≤ Freq. < 1k	1k ≤ Freq. < 2k	2k ≤ Freq. < 3k	3k ≤ Freq. < 5k
Coefficient K_f	0.20	0.30	0.40	0.45

Frequency (Hz)	5k ≤ Freq. < 10k	10k ≤ Freq. < 15k	15k ≤ Freq. < 20k	20k ≤ Freq. < 40k
Coefficient K_f	0.50	0.60	0.65	0.75

Frequency (Hz)	40k ≤ Freq. < 50k	50k ≤ Freq. < 100k	100k ≤ Freq. < 500k	500k ≤ Freq. < 1M
Coefficient K_f	0.80	0.85	1.00	1.05

STANDARD RATINGS

Part number shows blister tape on paper reel

V_R (V)	Standard	Vibration-proof	C_R (µF)	ø D (mm)	L (mm)	I_{LEAK} (µA, 2min)	tanδ +20°C ▪ 120Hz (%)	Max. ESR +20°C ▪ 100kHz (mΩ)	I_R ▪ Max. Ripple Current +145°C ▪ 100kHz (mA rms)	CapXon Part Number
16	●	●	270	8.0	10.5	43.2	16	27	700	AR271M016F105PTR ☐☐☐
	●	●	330	8.0	10.5	52.8	16	25	770	AR331M016F105PTR ☐☐☐
	●	●	470	10.0	10.5	75.2	16	20	900	AR471M016G105PTR ☐☐☐
	●	●	560	10.0	12.4	89.6	16	16	1050	AR561M016G124PTR ☐☐☐
25	●	●	220	8.0	10.5	55.0	14	27	700	AR221M025F105PTR ☐☐☐
	●	●	270	8.0	11.7	67.5	14	25	770	AR271M025F117PTR ☐☐☐
	●	●	330	10.0	10.5	82.5	14	20	900	AR331M025G105PTR ☐☐☐
	●	●	470	10.0	12.4	117.5	14	16	1050	AR471M025G124PTR ☐☐☐
35	●	●	100	8.0	10.5	35.0	12	27	700	AR101M035F105PTR ☐☐☐
	●	●	150	8.0	10.5	52.5	12	27	700	AR151M035F105PTR ☐☐☐
	●	●	180	8.0	11.7	63.0	12	25	770	AR181M035F117PTR ☐☐☐
	●	●	270	10.0	10.5	94.5	12	20	900	AR271M035G105PTR ☐☐☐
	●	●	330	10.0	12.4	115.5	12	17	1020	AR331M035G124PTR ☐☐☐
50	●	●	68	8.0	10.5	34.0	10	30	600	AR680M050F105PTR ☐☐☐
	●	●	82	8.0	11.7	41.0	10	28	660	AR820M050F117PTR ☐☐☐
	●	●	56	10.0	10.5	28.0	10	28	800	AR560M050G105PTR ☐☐☐
	●	●	100	10.0	10.5	50.0	10	28	800	AR101M050G105PTR ☐☐☐
	●	●	120	10.0	10.5	60.0	10	28	800	AR121M050G105PTR ☐☐☐
	●	●	120	10.0	12.4	60.0	10	25	900	AR121M050G124PTR ☐☐☐
63	●	●	33	8.0	10.5	20.8	8	40	600	AR330M063F105PTR ☐☐☐
	●	●	47	8.0	10.5	29.6	8	40	600	AR470M063F105PTR ☐☐☐
	●	●	47	8.0	11.7	29.6	8	38	650	AR470M063F117PTR ☐☐☐
	●	●	56	10.0	10.5	35.3	8	30	800	AR560M063G105PTR ☐☐☐
	●	●	68	10.0	10.5	42.8	8	30	800	AR680M063G105PTR ☐☐☐
	●	●	82	10.0	12.4	51.7	8	27	900	AR820M063G124PTR ☐☐☐
80	●	●	22	8.0	10.5	17.6	8	45	560	AR220M080F105PTR ☐☐☐
	●	●	27	8.0	11.7	21.6	8	43	580	AR270M080F117PTR ☐☐☐
	●	●	33	8.0	10.5	26.4	8	36	730	AR330M080G105PTR ☐☐☐
	●	●	47	10.0	10.5	37.6	8	36	730	AR470M080G105PTR ☐☐☐
	●	●	56	10.0	12.4	44.8	8	34	800	AR560M080G124PTR ☐☐☐
	●	●	68	10.0	12.4	54.4	8	34	800	AR680M080G124PTR ☐☐☐

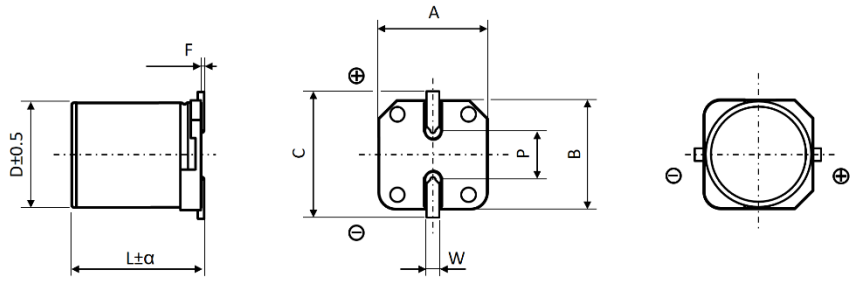
☐☐☐: Leave **blank** for Standard package

☐☐☐: Enter **W** for Vibration proof version

☐☐☐: Enter **X** for AEC-Q200

☐☐☐: Enter **XW** for AEC-Q200 and Vibration proof version

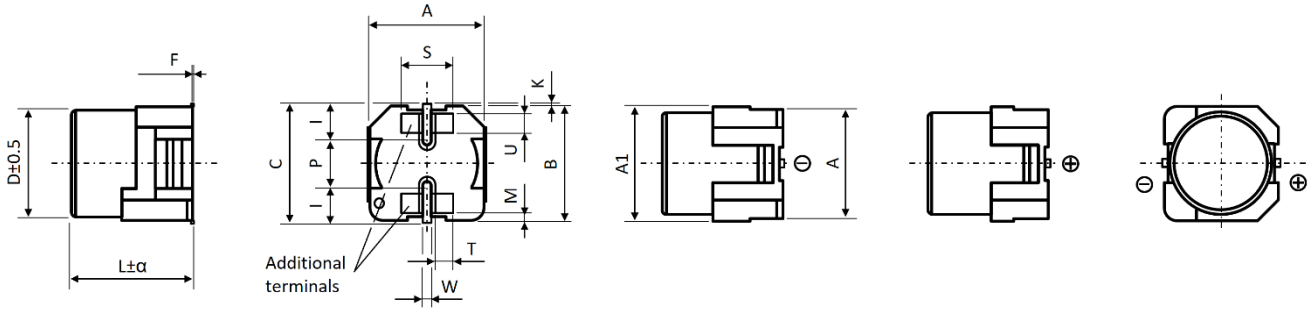
DIMENSIONS STANDARD PACKAGE ▪ All dimensions in mm



Recommended pad layout on page 110.

ø D	L	α	A ± 0.2	B ± 0.2	C ± 0.2	F	P ± 0.2	W
8.0	10.5	0.3	8.3	8.3	9.0	0.3 max.	3.1	0.7 to 1.1
8.0	11.7	0.3	8.3	8.3	9.0	0.3 max.	3.1	0.7 to 1.1
10.0	10.5	0.3	10.3	10.3	11.0	0.3 max.	4.5	0.7 to 1.1
10.0	12.4	0.3	10.3	10.3	11.0	0.3 max.	4.5	1.0 to 1.4

DIMENSIONS VP PACKAGE (VIBRATION-PROOF) Ø D8 and D10 ▪ All dimensions in mm



Note: Additional terminals electrical connected to anode or cathode terminal.

ø D	L	α	A ± 0.2	A1 (max.)	B ± 0.2	C (max.)	F	K ± 0.2
8.0	10.5	-0.3/+0.7	8.3	8.8	8.3	10.0	0 to 0.15	0.7
8.0	11.7	-0.3/+0.7	8.3	8.8	8.3	10.0	0 to 0.15	0.7
10.0	10.5	-0.3/+0.7	10.3	10.8	10.3	12.0	0 to 0.15	0.7
10.0	12.4	-0.3/+0.7	10.3	10.8	10.3	12.0	0 to 0.15	0.7

ø D	L	I ± 0.1	M ± 0.1	P ± 0.2	S ± 0.1	T ± 0.1	U ± 0.1	W ± 0.1
8.0	10.5	3.3	0.75	3.1	3.3	0.9	0.8	1.2
8.0	11.7	3.3	0.75	3.1	3.3	0.9	0.8	1.2
10.0	10.5	3.5	0.9	4.6	3.3	0.9	0.8	1.2
10.0	12.4	3.5	0.9	4.6	3.3	0.9	0.8	1.2

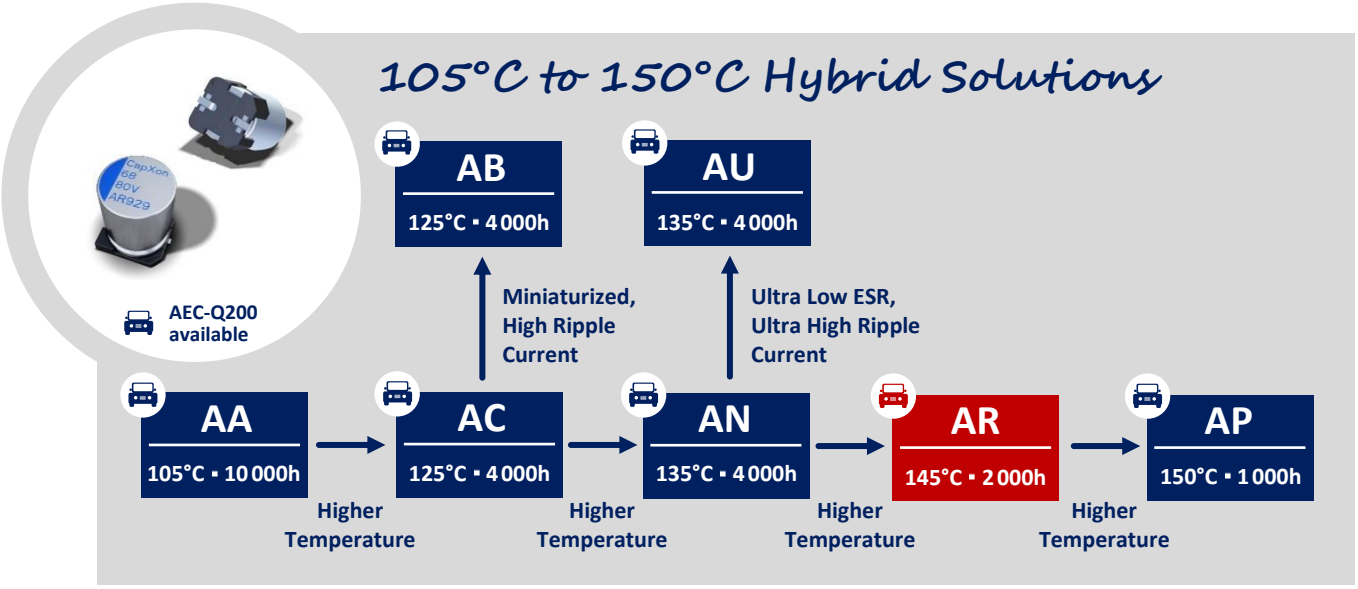
Recommended pad layout on page 112.

PRECAUTIONS, GUIDELINES AND PACKAGING INFORMATION

Unless otherwise agreed in individual specifications, all products are subject to our “General Precautions and Guidelines” as well as our “Packaging Information”. Please refer to the following links in the table.

General Precautions & Guidelines	Packaging Information	Vibration Test Profiles	3D Models	Reliability Tests

GROUP CHART



AP SERIES ▪ HIGH TEMPERATURE TYPE 150°C

KEY FEATURES

AEC-Q 200 · HIGH TEMPERATURE

- **HYBRID CONDUCTIVE POLYMER** ▪ SMD type
- Endurance: 150°C ▪ 1000 hours
- Low ESR and high ripple current
- Vibration Proof (VP) version (up to 30g) available
- AEC-Q200 version available

HF Halogen Free · MSL 1 · RoHS & REACH COMPLIANT

SPECIFICATIONS

Items		Performance Characteristics
Operating Temperature Range		-55 ~ +150°C
Rated Voltage Range	V_R	16 ~ 80V DC
Surge Voltage	V_S	($V_R \le 100V$): $V_S = 1.25 \cdot V_R$
Capacitance Range	C_R	22 ~ 560µF
Cap. Tolerance	ΔC	±20% (120Hz ▪ 20°C)
Leakage Current (20°C ▪ V_R applied)	I_{LEAK}	Not to exceed the values shown in standard ratings After 2 minutes
Dissipation Factor % (20°C ▪ 120Hz)	tanδ	Not to exceed the values shown in standard ratings
Equivalent Series Resistance (20°C ▪ 100kHz)	ESR	Not to exceed the values shown in standard ratings

Lifetime Test		
Endurance 150°C (V_R & I_R applied)	Test	**1000 hours**
	$\triangle C/C_R$	Within ±30% of the initial value
	tanδ	Less than 200% of the specified value
	ESR	Less than 200% of the specified value
	I_{Leak}	Less than the specified value

MULTIPLIER K_f for RIPPLE CURRENT vs. FREQUENCY

Frequency (Hz)	100 ≤ Freq. < 120	120 ≤ Freq. < 200	200 ≤ Freq. < 300	300 ≤ Freq. < 500
Coefficient K_f	0.10	0.10	0.10	0.15

Frequency (Hz)	500 ≤ Freq. < 1k	1k ≤ Freq. < 2k	2k ≤ Freq. < 3k	3k ≤ Freq. < 5k
Coefficient K_f	0.20	0.30	0.40	0.45

Frequency (Hz)	5k ≤ Freq. < 10k	10k ≤ Freq. < 15k	15k ≤ Freq. < 20k	20k ≤ Freq. < 40k
Coefficient K_f	0.50	0.60	0.65	0.75

Frequency (Hz)	40k ≤ Freq. < 50k	50k ≤ Freq. < 100k	100k ≤ Freq. < 500k	500k ≤ Freq. < 1M
Coefficient K_f	0.80	0.85	1.00	1.05

STANDARD RATINGS

Part number shows blister tape on paper reel

V_R (V)	Standard	Vibration-proof	C_R (µF)	ø D (mm)	L (mm)	I_{LEAK} (µA, 2min)	tanδ +20°C ▪ 120Hz (%)	Max. ESR +20°C ▪ 100kHz (mΩ)	I_R ▪ Max. Ripple Current +150°C ▪ 100kHz (mA rms)	CapXon Part Number
16	●	●	270	8.0	10.5	43.2	16	27	700	AP271M016F105PTR □□□
	●	●	330	8.0	10.5	52.8	16	25	770	AP331M016F105PTR □□□
	●	●	470	10.0	10.5	75.2	16	20	900	AP471M016G105PTR □□□
	●	●	560	10.0	12.4	89.6	16	16	1050	AP561M016G124PTR □□□
25	●	●	220	8.0	10.5	55.0	14	27	700	AP221M025F105PTR □□□
	●	●	270	8.0	11.7	67.5	14	25	770	AP271M025F117PTR □□□
	●	●	330	10.0	10.5	82.5	14	20	900	AP331M025G105PTR □□□
	●	●	470	10.0	12.4	117.5	14	16	1050	AP471M025G124PTR □□□
35	●	●	100	8.0	10.5	35.0	12	27	700	AP101M035F105PTR □□□
	●	●	150	8.0	10.5	52.5	12	27	700	AP151M035F105PTR □□□
	●	●	180	8.0	11.7	63.0	12	25	770	AP181M035F117PTR □□□
	●	●	270	10.0	10.5	94.5	12	20	900	AP271M035G105PTR □□□
	●	●	330	10.0	12.4	115.5	12	17	1020	AP331M035G124PTR □□□
50	●	●	56	10.0	10.5	28.0	10	28	800	AP560M050G105PTR □□□
	●	●	68	8.0	10.5	34.0	10	30	600	AP680M050F105PTR □□□
	●	●	82	8.0	11.7	41.0	10	28	660	AP820M050F117PTR □□□
	●	●	100	10.0	10.5	50.0	10	28	800	AP101M050G105PTR □□□
	●	●	120	10.0	10.5	60.0	10	28	800	AP121M050G105PTR □□□
	●	●	120	10.0	12.4	60.0	10	25	900	AP121M050G124PTR □□□
63	●	●	33	8.0	10.5	20.8	8	40	600	AP330M063F105PTR □□□
	●	●	47	8.0	10.5	29.6	8	40	600	AP470M063F105PTR □□□
	●	●	47	8.0	11.7	29.6	8	38	650	AP470M063F117PTR □□□
	●	●	56	10.0	10.5	35.3	8	30	800	AP560M063G105PTR □□□
	●	●	68	10.0	10.5	42.8	8	30	800	AP680M063G105PTR □□□
	●	●	82	10.0	12.4	51.7	8	27	900	AP820M063G124PTR □□□
80	●	●	22	8.0	10.5	17.6	8	45	560	AP220M080F105PTR □□□
	●	●	27	8.0	11.7	21.6	8	43	580	AP270M080F117PTR □□□
	●	●	33	8.0	10.5	26.4	8	36	730	AP330M080G105PTR □□□
	●	●	47	10.0	10.5	37.6	8	36	730	AP470M080G105PTR □□□
	●	●	56	10.0	12.4	44.8	8	34	800	AP560M080G124PTR □□□
	●	●	68	10.0	12.4	54.4	8	34	800	AP680M080G124PTR □□□

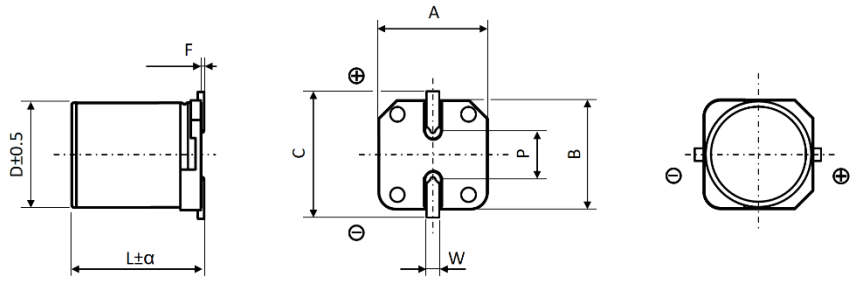
□□□: Leave **blank** for Standard package

□□□: Enter **W** for Vibration proof version

□□□: Enter **X** for AEC-Q200

□□□: Enter **XW** for AEC-Q200 and Vibration proof version

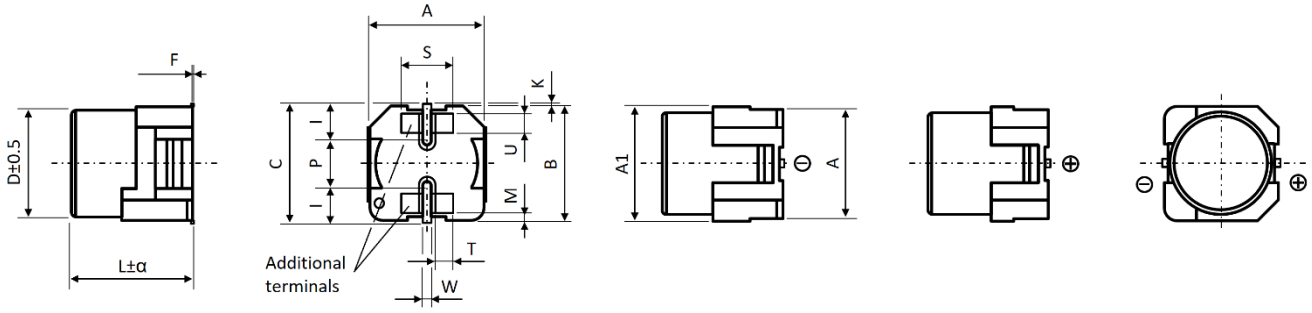
DIMENSIONS STANDARD PACKAGE ▪ All dimensions in mm



Recommended pad layout on page 110.

ø D	L	α	A ± 0.2	B ± 0.2	C ± 0.2	F	P ± 0.2	W
8.0	10.5	0.3	8.3	8.3	9.0	0.3 max.	3.1	0.7 to 1.1
8.0	11.7	0.3	8.3	8.3	9.0	0.3 max.	3.1	0.7 to 1.1
10.0	10.5	0.3	10.3	10.3	11.0	0.3 max.	4.5	0.7 to 1.1
10.0	12.4	0.3	10.3	10.3	11.0	0.3 max.	4.5	1.0 to 1.4

DIMENSIONS VP PACKAGE (VIBRATION-PROOF) Ø D8 and D10 ▪ All dimensions in mm



Note: Additional terminals electrical connected to anode or cathode terminal.

ø D	L	α	A ± 0.2	A1 (max.)	B ± 0.2	C (max.)	F	K ± 0.2
8.0	10.5	-0.3/+0.7	8.3	8.8	8.3	10.0	0 to 0.15	0.7
8.0	11.7	-0.3/+0.7	8.3	8.8	8.3	10.0	0 to 0.15	0.7
10.0	10.5	-0.3/+0.7	10.3	10.8	10.3	12.0	0 to 0.15	0.7
10.0	12.4	-0.3/+0.7	10.3	10.8	10.3	12.0	0 to 0.15	0.7

ø D	L	I ± 0.1	M ± 0.1	P ± 0.2	S ± 0.1	T ± 0.1	U ± 0.1	W ± 0.1
8.0	10.5	3.3	0.75	3.1	3.3	0.9	0.8	1.2
8.0	11.7	3.3	0.75	3.1	3.3	0.9	0.8	1.2
10.0	10.5	3.5	0.9	4.6	3.3	0.9	0.8	1.2
10.0	12.4	3.5	0.9	4.6	3.3	0.9	0.8	1.2

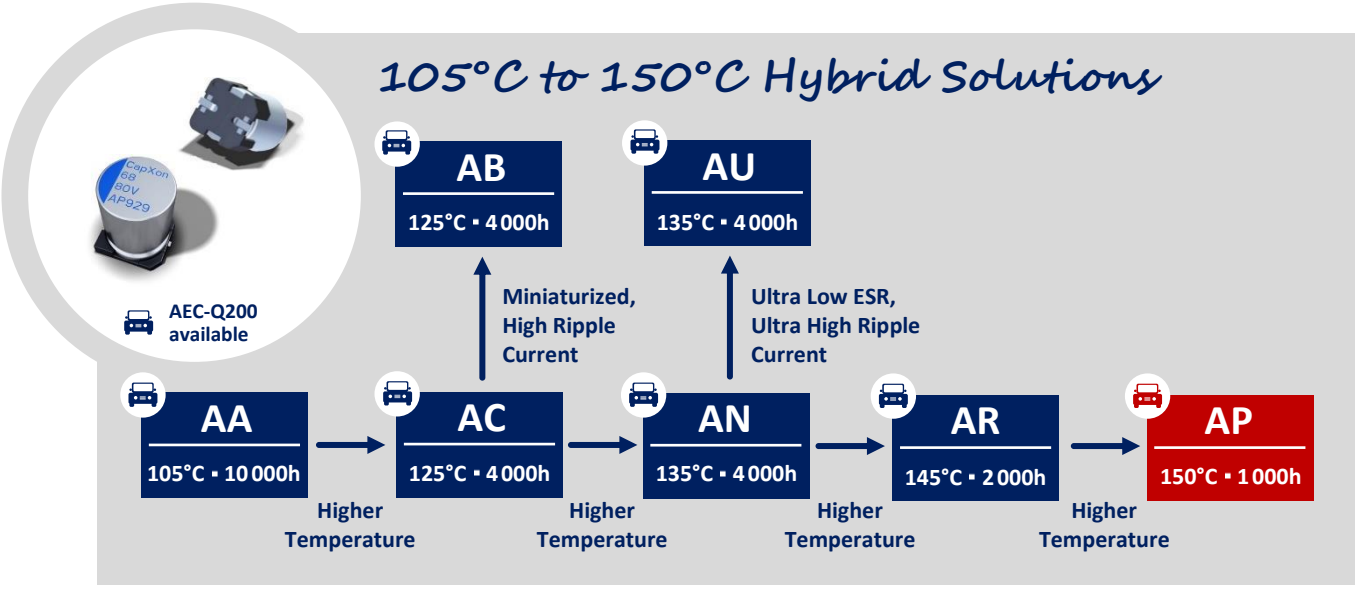
Recommended pad layout on page 112.

PRECAUTIONS, GUIDELINES AND PACKAGING INFORMATION

Unless otherwise agreed in individual specifications, all products are subject to our “General Precautions and Guidelines” as well as our “Packaging Information”. Please refer to the following links in the table.

General Precautions & Guidelines	Packaging Information	Vibration Test Profiles	3D Models	Reliability Tests

GROUP CHART



YA SERIES ▪ ECONOMY, LONG LIFE 10 000 HOURS TYPE

KEY FEATURES

ECONOMY

- **HYBRID CONDUCTIVE POLYMER** ▪ SMD type
- Endurance: 105°C ▪ 10 000 hours
- Low ESR and high ripple current
- Economy series for cost effective applications
- Lower leakage current than comparable solid polymer capacitors

HF Halogen Free · MSL 1 · RoHS & REACH COMPLIANT

SPECIFICATIONS

Items		Performance Characteristics
Operating Temperature Range		-55 ~ +105°C
Rated Voltage Range	V_R	16 ~ 100V DC
Surge Voltage	V_S	($V_R \le 100V$): $V_S = 1.25 \cdot V_R$
Capacitance Range	C_R	10 ~ 1500µF
Cap. Tolerance	ΔC	±20% (120Hz ▪ 20°C)
Leakage Current (20°C ▪ V_R applied)	I_{LEAK}	Not to exceed the values shown in standard ratings After 2 minutes
Dissipation Factor % (20°C ▪ 120Hz)	tanδ	Not to exceed the values shown in standard ratings
Equivalent Series Resistance (20°C ▪ 100kHz)	ESR	Not to exceed the values shown in standard ratings

Lifetime Test		
Endurance 105°C (V_R & I_R applied)	Test	**10 000 hours**
	$\triangle C/C_R$	Within ±30% of the initial value
	tanδ	Less than 200% of the specified value
	ESR	Less than 200% of the specified value
	I_{Leak}	Less than the specified value

MULTIPLIER K_f for RIPPLE CURRENT vs. FREQUENCY

Frequency (Hz)	100 ≤ Freq. < 120	120 ≤ Freq. < 200	200 ≤ Freq. < 300	300 ≤ Freq. < 500
Coefficient K_f	0.10	0.10	0.10	0.15

Frequency (Hz)	500 ≤ Freq. < 1k	1k ≤ Freq. < 2k	2k ≤ Freq. < 3k	3k ≤ Freq. < 5k
Coefficient K_f	0.20	0.30	0.40	0.45

Frequency (Hz)	5k ≤ Freq. < 10k	10k ≤ Freq. < 15k	15k ≤ Freq. < 20k	20k ≤ Freq. < 40k
Coefficient K_f	0.50	0.60	0.65	0.75

Frequency (Hz)	40k ≤ Freq. < 50k	50k ≤ Freq. < 100k	100k ≤ Freq. < 500k	500k ≤ Freq. < 1M
Coefficient K_f	0.80	0.85	1.00	1.05

STANDARD RATINGS

Part number shows blister tape on paper reel

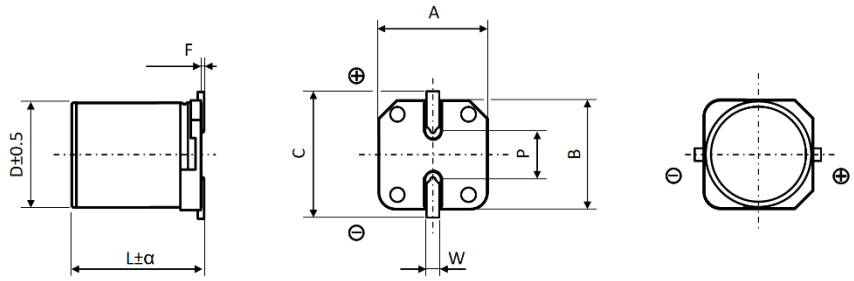
V_R (V)	C_R (µF)	ø D (mm)	L (mm)	I_{LEAK} (µA, 2min)	tanδ +20°C ▪ 120Hz (%)	Max. ESR +20°C ▪ 100kHz (mΩ)	I_R ▪ Max. Ripple Current +105°C ▪ 100kHz (mA rms)	CapXon Part Number
16	100	6.3	5.8	16.0	16	50	1300	YA101M016E058PTR
	120	6.3	5.8	19.2	16	50	1300	YA121M016E058PTR
	150	6.3	5.8	24.0	16	50	1300	YA151M016E058PTR
	220	6.3	7.7	35.2	16	30	2000	YA221M016E077PTR
	270	6.3	7.7	43.2	16	30	2000	YA271M016E077PTR
	330	10.0	10.5	52.8	16	20	2500	YA331M016G105PTR
	470	8.0	10.5	75.2	16	27	2300	YA471M016F105PTR
	470	10.0	10.5	75.2	16	20	2500	YA471M016G105PTR
	560	8.0	11.7	89.6	16	23	2400	YA561M016F117PTR
	560	10.0	10.5	89.6	16	20	2500	YA561M016G105PTR
	820	10.0	12.4	131.2	16	16	2800	YA821M016G124PTR
	1500	10.0	16.5	240.0	16	11	5000	YA152M016G165PTR
25	33	5.0	5.8	8.3	14	80	900	YA330M025C058PTR
	56	6.3	5.8	14.0	14	50	1300	YA560M025E058PTR
	100	6.3	7.7	25.0	14	30	2000	YA101M025E077PTR
	220	8.0	10.5	55.0	14	27	2300	YA221M025F105PTR
	270	8.0	11.7	67.5	14	25	2400	YA271M025F117PTR
	330	10.0	10.5	82.5	14	20	2500	YA331M025G105PTR
	470	10.0	12.4	117.5	14	16	2800	YA471M025G124PTR
	560	10.0	16.5	140.0	14	11	5000	YA561M025G165PTR
35	22	5.0	5.8	7.7	12	100	900	YA220M035C058PTR
	27	6.3	5.8	9.5	12	60	1300	YA270M035E058PTR
	47	6.3	5.8	16.5	12	60	1300	YA470M035E058PTR
	68	6.3	7.7	23.8	12	35	2000	YA680M035E077PTR
	100	8.0	10.5	35.0	12	27	2300	YA101M035F105PTR
	150	8.0	10.5	52.5	12	27	2300	YA151M035F105PTR
	180	8.0	11.7	63.0	12	25	2400	YA181M035F117PTR
	270	10.0	10.5	94.5	12	20	2500	YA271M035G105PTR
	330	10.0	12.4	115.5	12	17	2800	YA331M035G124PTR
	470	10.0	16.5	164.5	12	11	5000	YA471M035G165PTR
50	10	5.0	5.8	5.0	10	120	750	YA100M050C058PTR
	22	6.3	5.8	11.0	10	80	1100	YA220M050E058PTR
	33	6.3	7.7	16.5	10	40	1600	YA330M050E077PTR
	56	10.0	10.5	28.0	10	28	2000	YA680M050F105PTR
	68	8.0	10.5	34.0	10	30	1800	YA820M050F117PTR
	82	8.0	11.7	41.0	10	28	1880	YA680M050G105PTR
	100	10.0	10.5	50.0	10	28	2000	YA101M050G105PTR
	120	10.0	12.4	60.0	10	25	2200	YA121M050G124PTR
	220	10.0	16.5	110.0	10	13	4600	YA221M050G165PTR

STANDARD RATINGS

Part number shows blister tape on paper reel

V_R (V)	C_R (µF)	ø D (mm)	L (mm)	I_{LEAK} (µA, 2min)	tanδ +20°C ▪ 120Hz (%)	Max. ESR +20°C ▪ 100kHz (mΩ)	I_R ▪ Max. Ripple Current +105°C ▪ 100kHz (mA rms)	CapXon Part Number
63	10	6.3	5.8	6.3	8	120	1000	YA100M063E058PTR
	22	6.3	7.7	13.9	8	80	1500	YA220M063E077PTR
	33	8.0	10.5	20.8	8	40	1700	YA330M063F105PTR
	47	8.0	10.5	29.6	8	40	1700	YA470M063F105PTR
	47	8.0	11.7	29.6	8	38	1750	YA470M063F117PTR
	56	10.0	10.5	35.3	8	30	1800	YA560M063G105PTR
	68	10.0	10.5	42.8	8	30	1800	YA680M063G105PTR
	82	10.0	12.4	51.7	8	22	2100	YA820M063G124PTR
	150	10.0	16.5	94.5	8	15	4350	YA151M063G165PTR
80	22	8.0	10.5	17.6	8	45	1550	YA220M080F105PTR
	27	8.0	11.7	21.6	8	43	1600	YA270M080F117PTR
	33	10.0	10.5	26.4	8	36	1700	YA330M080G105PTR
	47	10.0	10.5	37.6	8	36	1700	YA470M080G105PTR
	56	10.0	12.4	44.8	8	32	1800	YA560M080G124PTR
100	22	8.0	10.5	22.0	8	55	1400	YA220M100F105PTR
	22	8.0	11.7	22.0	8	52	1450	YA220M100F117PTR
	22	10.0	10.5	22.0	8	45	1500	YA220M100G105PTR
	27	10.0	12.4	27.0	8	40	1600	YA270M100G124PTR
	33	10.0	12.4	33.0	8	40	1600	YA330M100G124PTR

DIMENSIONS STANDARD PACKAGE ▪ All dimensions in mm



Recommended pad layout on page 110.

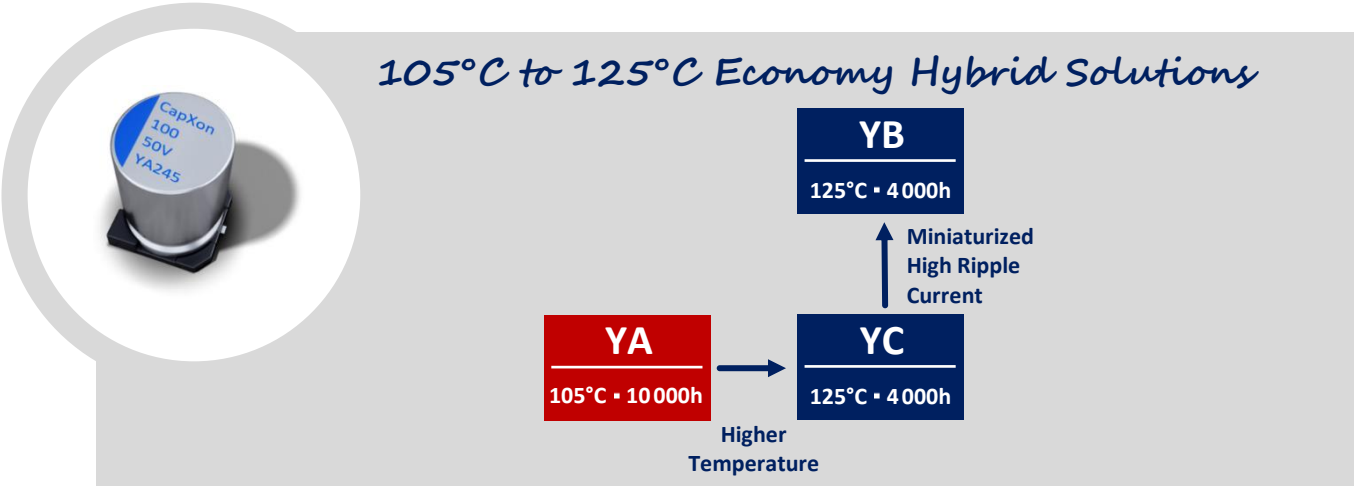
ø D	L	α	A ± 0.2	B ± 0.2	C ± 0.2	F	P ± 0.2	W
5.0	5.8	0.3	5.3	5.3	5.9	0.3 max.	1.4	0.5 to 0.8
6.3	5.8	0.3	6.6	6.6	7.2	0.3 max.	2.2	0.5 to 0.8
6.3	7.7	0.3	6.6	6.6	7.2	0.3 max.	2.2	0.5 to 0.8
8.0	10.5	0.3	8.3	8.3	9.0	0.3 max.	3.1	0.7 to 1.1
8.0	11.7	0.3	8.3	8.3	9.0	0.3 max.	3.1	0.7 to 1.1
10.0	10.5	0.3	10.3	10.3	11.0	0.3 max.	4.5	0.7 to 1.1
10.0	12.4	0.3	10.3	10.3	11.0	0.3 max.	4.5	1.0 to 1.4
10.0	16.5	0.3	10.3	10.3	11.0	0.3 max.	4.5	1.0 to 1.4

PRECAUTIONS, GUIDELINES AND PACKAGING INFORMATION

Unless otherwise agreed in individual specifications, all products are subject to our “General Precautions and Guidelines” as well as our “Packaging Information”. Please refer to the following links in the table.

General Precautions & Guidelines	Packaging Information	Vibration Test Profiles	3D Models	Reliability Tests

GROUP CHART



YC SERIES ▪ ECONOMY, LONG LIFE AT 125°C TYPE

KEY FEATURES

ECONOMY

HIGH TEMPERATURE

- **HYBRID CONDUCTIVE POLYMER** ▪ SMD type
- Endurance: 125°C ▪ 4000 hours
- Low ESR and high ripple current
- Economy series for cost effective applications
- Lower leakage current than comparable solid polymer capacitors

HF Halogen Free

MSL 1

RoHS & REACH COMPLIANT

SPECIFICATIONS

Items		Performance Characteristics
Operating Temperature Range		-55 ~ +125°C
Rated Voltage Range	V_R	16 ~ 100V DC
Surge Voltage	V_S	($V_R \le 100V$): $V_S = 1.25 \cdot V_R$
Capacitance Range	C_R	10 ~ 1500µF
Cap. Tolerance	ΔC	±20% (120Hz ▪ 20°C)
Leakage Current (20°C ▪ V_R applied)	I_{LEAK}	Not to exceed the values shown in standard ratings After 2 minutes
Dissipation Factor % (20°C ▪ 120Hz)	tanδ	Not to exceed the values shown in standard ratings
Equivalent Series Resistance (20°C ▪ 100kHz)	ESR	Not to exceed the values shown in standard ratings

Lifetime Test		
Endurance 125°C (V_R & I_R applied)	Test	**4000 hours**
	$\triangle C/C_R$	Within ±30% of the initial value
	tanδ	Less than 200% of the specified value
	ESR	Less than 200% of the specified value
	I_{Leak}	Less than the specified value

MULTIPLIER K_f for RIPPLE CURRENT vs. FREQUENCY

Frequency (Hz)	100 ≤ Freq. < 120	120 ≤ Freq. < 200	200 ≤ Freq. < 300	300 ≤ Freq. < 500
Coefficient K_f	0.10	0.10	0.10	0.15

Frequency (Hz)	500 ≤ Freq. < 1k	1k ≤ Freq. < 2k	2k ≤ Freq. < 3k	3k ≤ Freq. < 5k
Coefficient K_f	0.20	0.30	0.40	0.45

Frequency (Hz)	5k ≤ Freq. < 10k	10k ≤ Freq. < 15k	15k ≤ Freq. < 20k	20k ≤ Freq. < 40k
Coefficient K_f	0.50	0.60	0.65	0.75

Frequency (Hz)	40k ≤ Freq. < 50k	50k ≤ Freq. < 100k	100k ≤ Freq. < 500k	500k ≤ Freq. < 1M
Coefficient K_f	0.80	0.85	1.00	1.05

STANDARD RATINGS

Part number shows blister tape on paper reel

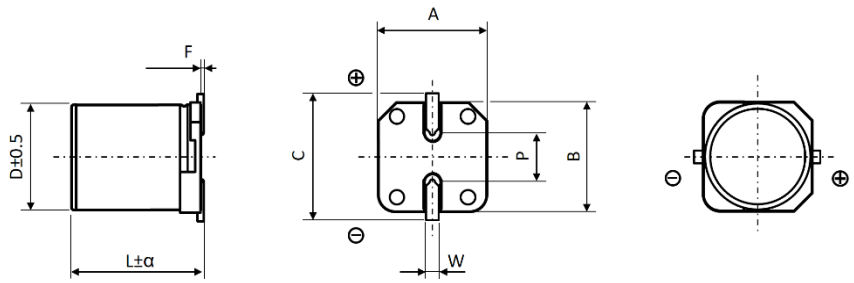
V_R (V)	C_R (µF)	ø D (mm)	L (mm)	I_{LEAK} (µA, 2min)	tanδ +20°C ▪ 120Hz (%)	Max. ESR +20°C ▪ 100kHz (mΩ)	I_R ▪ Max. Ripple Current +125°C ▪ 100kHz (mA rms)	CapXon Part Number
16	100	6.3	5.8	16.0	16	50	900	YC101M016E058PTR
	120	6.3	5.8	19.2	16	50	900	YC121M016E058PTR
	150	6.3	5.8	24.0	16	50	900	YC151M016E058PTR
	220	6.3	7.7	35.2	16	30	1400	YC221M016E077PTR
	270	6.3	7.7	43.2	16	30	1700	YC271M016E077PTR
	330	10.0	10.5	52.8	16	20	2000	YC331M016G105PTR
	470	8.0	10.5	75.2	16	27	1600	YC471M016F105PTR
	470	10.0	10.5	75.2	16	20	2000	YC471M016G105PTR
	560	8.0	11.7	89.6	16	23	1650	YC561M016F117PTR
	560	10.0	10.5	89.6	16	20	2000	YC561M016G105PTR
	820	10.0	12.4	131.2	16	16	2260	YC821M016G124PTR
	1500	10.0	16.5	240.0	16	11	4000	YC152M016G165PTR
25	33	5.0	5.8	8.3	14	80	550	YC330M025C058PTR
	56	6.3	5.8	14.0	14	50	900	YC560M025E058PTR
	100	6.3	7.7	25.0	14	30	1400	YC101M025E077PTR
	220	8.0	10.5	55.0	14	27	1600	YC221M025F105PTR
	270	8.0	11.7	67.5	14	25	1650	YC271M025F117PTR
	330	10.0	10.5	82.5	14	20	2000	YC331M025G105PTR
	470	10.0	12.4	117.5	14	16	2260	YC471M025G124PTR
	560	10.0	16.5	140.0	14	11	4000	YC561M025G165PTR
35	22	5.0	5.8	7.7	12	100	550	YC220M035C058PTR
	47	6.3	5.8	16.5	12	60	900	YC470M035E058PTR
	68	6.3	7.7	23.8	12	35	1400	YC680M035E077PTR
	100	8.0	10.5	35.0	12	27	1600	YC101M035F105PTR
	150	8.0	10.5	52.5	12	27	1600	YC151M035F105PTR
	180	8.0	11.7	63.0	12	25	1650	YC181M035F117PTR
	270	10.0	10.5	94.5	12	20	2000	YC271M035G105PTR
	330	10.0	12.4	115.5	12	17	2260	YC331M035G124PTR
	470	10.0	16.5	164.5	12	11	4000	YC471M035G165PTR
50	10	5.0	5.8	5.0	10	120	500	YC100M050C058PTR
	22	6.3	5.8	11.0	10	80	750	YC220M050E058PTR
	33	6.3	7.7	16.5	10	40	1100	YC330M050E077PTR
	56	10.0	10.5	28.0	10	28	1600	YC560M050G105PTR
	68	8.0	10.5	34.0	10	30	1250	YC680M050F105PTR
	82	8.0	11.7	41.0	10	28	1300	YC820M050F117PTR
	100	10.0	10.5	50.0	10	28	1600	YC101M050G105PTR
	120	10.0	10.5	60.0	10	28	1600	YC121M050G105PTR
	120	10.0	12.4	60.0	10	25	1750	YC121M050G124PTR
	220	10.0	16.5	110.0	10	13	3700	YC221M050G165PTR

STANDARD RATINGS

Part number shows blister tape on reel version

V_R (V)	C_R (µF)	ø D (mm)	L (mm)	I_{LEAK} (µA, 2min)	tanδ +20°C ▪ 120Hz (%)	Max. ESR +20°C ▪ 100kHz (mΩ)	I_R ▪ Max. Ripple Current +125°C ▪ 100kHz (mA rms)	CapXon Part Number
63	10	6.3	5.8	6.3	8	120	700	YC100M063E058PTR
	22	6.3	7.7	13.9	8	80	900	YC220M063E077PTR
	33	8.0	10.5	20.8	8	40	1100	YC330M063F105PTR
	47	8.0	10.5	29.6	8	40	1100	YC470M063F105PTR
	47	8.0	11.7	29.6	8	38	1130	YC470M063F117PTR
	56	10.0	10.5	35.3	8	30	1400	YC560M063G105PTR
	68	10.0	10.5	42.8	8	30	1400	YC680M063G105PTR
	82	10.0	12.4	51.7	8	22	1650	YC820M063G124PTR
	150	10.0	16.5	94.5	8	15	3500	YC151M063G165PTR
80	22	8.0	10.5	17.6	8	45	1050	YC220M080F105PTR
	27	8.0	11.7	21.6	8	43	1080	YC270M080F117PTR
	33	10.0	10.5	26.4	8	36	1360	YC330M080G105PTR
	47	10.0	10.5	37.6	8	36	1360	YC470M080G105PTR
	56	10.0	12.4	44.8	8	35	1440	YC560M080G124PTR
	68	10.0	12.4	54.4	8	32	1540	YC680M080G124PTR
100	22	8.0	10.5	22.0	8	55	950	YC220M100F105PTR
	22	8.0	11.7	22.0	8	52	980	YC220M100F117PTR
	22	10.0	10.5	22.0	8	45	1200	YC220M100G105PTR
	27	10.0	12.4	27.0	8	40	1360	YC270M100G124PTR
	33	10.0	12.4	33.0	8	40	1360	YC330M100G124PTR

DIMENSIONS STANDARD PACKAGE ▪ All dimensions in mm



Recommended pad layout on page 110.

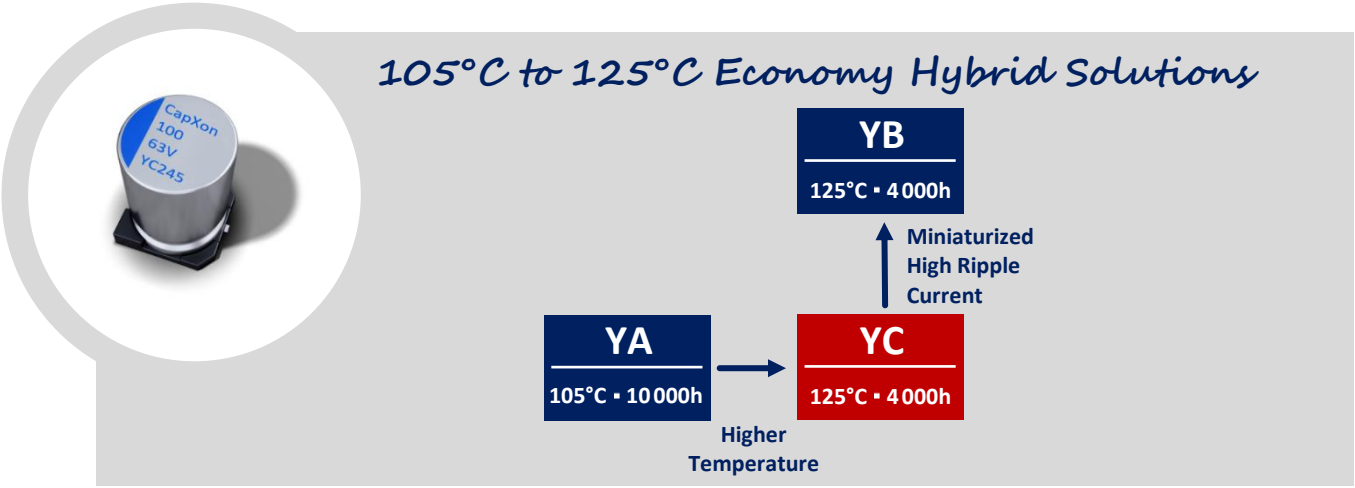
ø D	L	α	A ± 0.2	B ± 0.2	C ± 0.2	F	P ± 0.2	W
5.0	5.8	0.3	5.3	5.3	5.9	0.3 max.	1.4	0.5 to 0.8
6.3	5.8	0.3	6.6	6.6	7.2	0.3 max.	2.2	0.5 to 0.8
6.3	7.7	0.3	6.6	6.6	7.2	0.3 max.	2.2	0.5 to 0.8
8.0	10.5	0.3	8.3	8.3	9.0	0.3 max.	3.1	0.7 to 1.1
8.0	11.7	0.3	8.3	8.3	9.0	0.3 max.	3.1	0.7 to 1.1
10.0	10.5	0.3	10.3	10.3	11.0	0.3 max.	4.5	0.7 to 1.1
10.0	12.4	0.3	10.3	10.3	11.0	0.3 max.	4.5	1.0 to 1.4
10.0	16.5	0.3	10.3	10.3	11.0	0.3 max.	4.5	1.0 to 1.4

PRECAUTIONS, GUIDELINES AND PACKAGING INFORMATION

Unless otherwise agreed in individual specifications, all products are subject to our “General Precautions and Guidelines” as well as our “Packaging Information”. Please refer to the following links in the table.

General Precautions & Guidelines	Packaging Information	Vibration Test Profiles	3D Models	Reliability Tests

GROUP CHART



YB SERIES ▪ ECONOMY, MINIATURIZED HIGH RIPPLE CURRENT TYPE

KEY FEATURES

ECONOMY · HIGH TEMPERATURE · MINIATURIZED SIZE

- **HYBRID CONDUCTIVE POLYMER** ▪ SMD type
- Endurance: 125°C ▪ 4000 hours
- Low ESR and **extremely** high ripple current in small dimensions
- Economy series for cost effective applications
- Lower leakage current than comparable solid polymer capacitors

HF Halogen Free · MSL 1 · RoHS & REACH COMPLIANT

SPECIFICATIONS

Items		Performance Characteristics
Operating Temperature Range		-55 ~ +125°C
Rated Voltage Range	V_R	25 ~ 35V DC
Surge Voltage	V_S	($V_R \le 100V$): $V_S = 1.25 \cdot V_R$
Capacitance Range	C_R	33 ~ 680µF
Cap. Tolerance	ΔC	±20% (120Hz ▪ 20°C)
Leakage Current (20°C ▪ V_R applied)	I_{LEAK}	Not to exceed the values shown in standard ratings After 2 minutes
Dissipation Factor % (20°C ▪ 120Hz)	tanδ	Not to exceed the values shown in standard ratings
Equivalent Series Resistance (20°C ▪ 100kHz)	ESR	Not to exceed the values shown in standard ratings

Lifetime Test		
Endurance 125°C (V_R & I_R applied)	Test	**4000 hours**
	$\triangle C/C_R$	Within ±30% of the initial value
	tanδ	Less than 200% of the specified value
	ESR	Less than 200% of the specified value
	I_{Leak}	Less than the specified value

MULTIPLIER K_f for RIPPLE CURRENT vs. FREQUENCY

Frequency (Hz)	100 ≤ Freq. < 120	120 ≤ Freq. < 200	200 ≤ Freq. < 300	300 ≤ Freq. < 500
Coefficient K_f	0.15	0.15	0.20	0.25

Frequency (Hz)	500 ≤ Freq. < 1k	1k ≤ Freq. < 2k	2k ≤ Freq. < 3k	3k ≤ Freq. < 5k
Coefficient K_f	0.35	0.45	0.55	0.60

Frequency (Hz)	5k ≤ Freq. < 10k	10k ≤ Freq. < 15k	15k ≤ Freq. < 20k	20k ≤ Freq. < 40k
Coefficient K_f	0.65	0.70	0.75	0.75

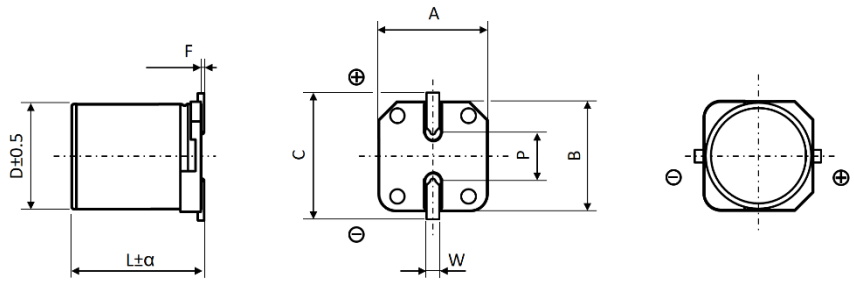
Frequency (Hz)	40k ≤ Freq. < 50k	50k ≤ Freq. < 100k	100k ≤ Freq. < 500k	500k ≤ Freq. < 1M
Coefficient K_f	0.80	0.85	1.00	1.05

STANDARD RATINGS

Part number shows blister tape on paper reel

V_R (V)	C_R (µF)	ø D (mm)	L (mm)	I_{LEAK} (µA, 2min)	tanδ +20°C ▪ 120Hz (%)	Max. ESR +20°C ▪ 100kHz (mΩ)	I_R ▪ Max. Ripple Current +125°C ▪ 100kHz (mA rms)	CapXon Part Number
25	47	5.0	5.8	11.8	14	80	850	YB470M025C058PTR
	56	5.0	5.8	14.0	14	80	850	YB560M025C058PTR
	68	6.3	5.8	17.0	14	50	1300	YB680M025E058PTR
	82	6.3	5.8	20.5	14	50	1300	YB820M025E058PTR
	100	6.3	5.8	25.0	14	50	1300	YB101M025E058PTR
	150	6.3	7.7	37.5	14	30	1800	YB151M025E077PTR
	180	6.3	7.7	45.0	14	30	1800	YB181M025E077PTR
	270	8.0	10.5	67.5	14	27	2000	YB271M025F105PTR
	330	8.0	10.5	82.5	14	27	2000	YB331M025F105PTR
	470	10.0	10.5	117.5	14	20	2800	YB471M025G105PTR
	560	10.0	10.5	140.0	14	20	2800	YB561M025G105PTR
	680	10.0	12.4	170.0	14	16	3160	YB681M025G124PTR
35	33	5.0	5.8	11.5	12	100	750	YB330M035C058PTR
	39	5.0	5.8	13.7	12	100	750	YB390M035C058PTR
	56	6.3	5.8	19.6	12	60	1200	YB560M035E058PTR
	68	6.3	5.8	23.8	12	60	1200	YB680M035E058PTR
	100	6.3	7.7	35.0	12	35	1700	YB101M035E077PTR
	120	6.3	7.7	42.0	12	35	1700	YB121M035E077PTR
	180	8.0	10.5	63.0	12	27	2000	YB181M035F105PTR
	220	8.0	10.5	77.0	12	27	2000	YB221M035F105PTR
	330	10.0	10.5	115.5	12	20	2800	YB331M035G105PTR
	390	10.0	10.5	136.5	12	20	2800	YB391M035G105PTR

DIMENSIONS STANDARD PACKAGE ▪ All dimensions in mm



Recommended pad layout on page 110.

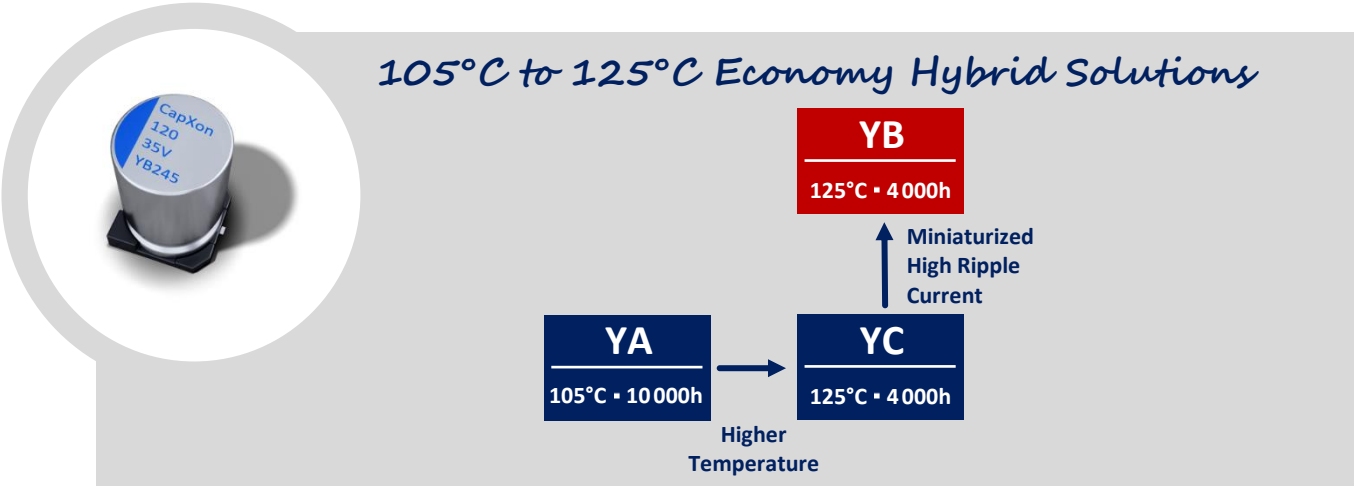
ø D	L	α	A ± 0.2	B ± 0.2	C ± 0.2	F	P ± 0.2	W
5.0	5.8	0.3	5.3	5.3	5.9	0.3 max.	1.4	0.5 to 0.8
6.3	5.8	0.3	6.6	6.6	7.2	0.3 max.	2.2	0.5 to 0.8
6.3	7.7	0.3	6.6	6.6	7.2	0.3 max.	2.2	0.5 to 0.8
8.0	10.5	0.3	8.3	8.3	9.0	0.3 max.	3.1	0.7 to 1.1
10.0	10.5	0.3	10.3	10.3	11.0	0.3 max.	4.5	0.7 to 1.1
10.0	12.4	0.3	10.3	10.3	11.0	0.3 max.	4.5	1.0 to 1.4

PRECAUTIONS, GUIDELINES AND PACKAGING INFORMATION

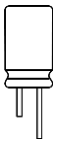
Unless otherwise agreed in individual specifications, all products are subject to our “General Precautions and Guidelines” as well as our “Packaging Information”. Please refer to the following links in the table.

General Precautions & Guidelines	Packaging Information	Vibration Test Profiles	3D Models	Reliability Tests

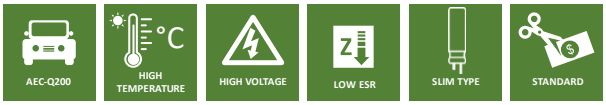
GROUP CHART



OVERVIEW ▪ RADIAL HYBRID POLYMER CONDUCTIVE CAPACITORS



Features

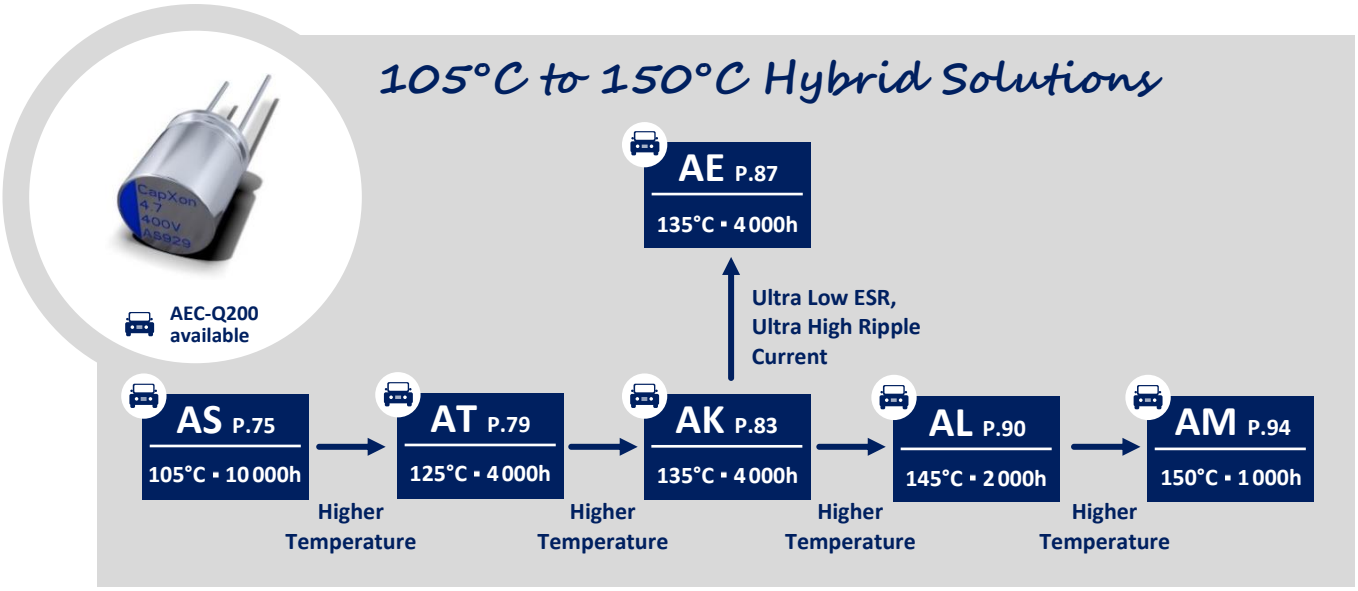


Series	Page	AEC-Q200	High Temperature	High Voltage	Low ESR	Slim Type	Standard	Ultra Low ESR	Temperature Range (°C)		Voltage Range (V)		Capacitance Range (µF)		Endurance (hours)
AS	75	●		●	●	●	●		-55	+105	16	400	1.2	1500	2000 to 10000
AT	79	●	●		●	●			-55	+125	16	100	8.2	1500	2000 to 4000
AK	83	●	●		●				-55	+135	16	100	8.2	560	2000 to 3000
AE	87	●	●					●	-55	+135	25	100	22	680	4000
AL	90	●	●		●				-55	+145	16	80	8.2	560	2000
AM	94	●	●		●				-55	+150	16	80	8.2	560	1000

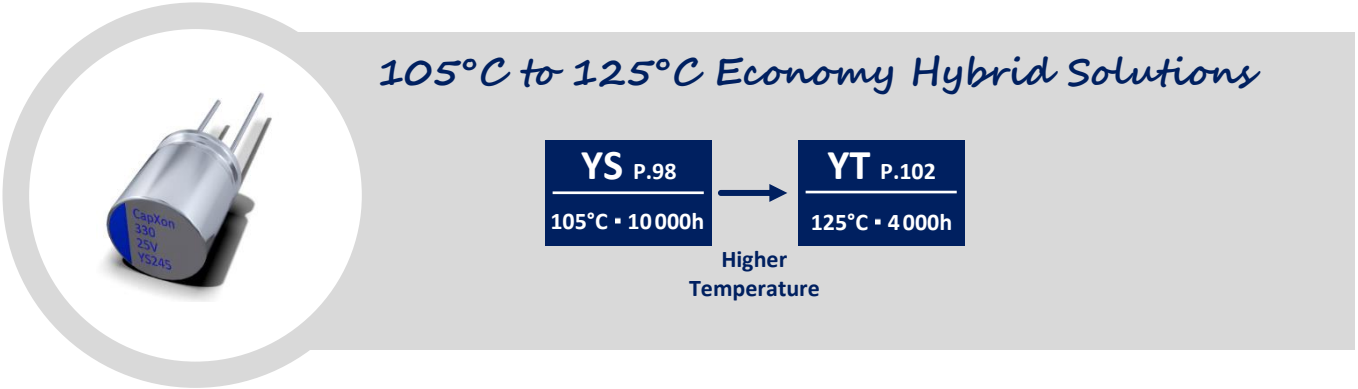
ECONOMY SERIES FOR NON-AUTOMOTIVE APPLICATIONS

Series	Page	AEC-Q200	High Temperature	Low ESR	Slim Type	Standard	Ultra Miniaturized	Ultra Low ESR	Vibration Proof	Temperature Range (°C)		Voltage Range (V)		Capacitance Range (µF)		Endurance (hours)
YS	98			●		●				-55	+105	16	100	10	1500	5000 to 10000
YT	105		●	●		●				-55	+125	16	100	10	1500	2000 to 4000

GROUP CHART ▪ HIGH PERFORMANCE SERIES FOR AUTOMOTIVE APPLICATIONS



GROUP CHART ▪ ECONOMY SERIES FOR NON-AUTOMOTIVE APPLICATIONS



AS SERIES ▪ LONG LIFE UP TO 10 000 HOURS

KEY FEATURES

AEC-Q 200 HIGH VOLTAGE

- **HYBRID CONDUCTIVE POLYMER** ▪ THT type
- Endurance: 105°C ▪ 2 000 up to 10 000 hours
- Low ESR and high ripple current
- Superior electrical stability over application lifetime
- AEC-Q200 version available

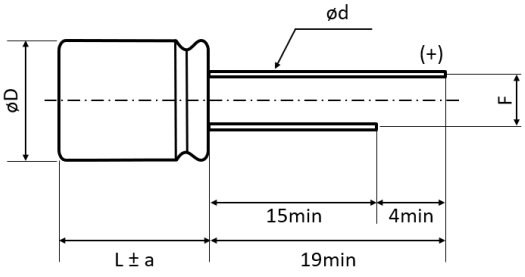
HF Halogen Free RoHS & REACH COMPLIANT

SPECIFICATIONS

Items		Performance Characteristics
Operating Temperature Range		-55 ~ +105°C
Rated Voltage Range	V_R	16 ~ 400V DC
Surge Voltage	V_S	($V_R \le 100V$): $V_S = 1.25 \cdot V_R$ ($V_R \ge 200V$): $V_S = 1.15 \cdot V_R$
Capacitance Range	C_R	1.2 ~ 1500µF
Cap. Tolerance	ΔC	±20% (120Hz ▪ 20°C)
Leakage Current (20°C ▪ V_R applied)	I_{LEAK}	Not to exceed the values shown in standard ratings After 2 minutes
Dissipation Factor % (20°C ▪ 120Hz)	tanδ	Not to exceed the values shown in standard ratings
Equivalent Series Resistance (20°C ▪ 100kHz)	ESR	Not to exceed the values shown in standard ratings

Lifetime Test			
Endurance 105°C (V_R & I_R applied)	Test	**10 000 hours**	≥ ø D 8 ▪ < 250V
		5 000 hours	≤ ø D 6.3 ▪ < 250V DC
		5 000 hours	250V
		2 000 hours	400V
	△C/C_R	Within ±30% of the initial value	
	tanδ	Less than 200% of the specified value	
	ESR	Less than 200% of the specified value	
	I_{Leak}	Less than the specified value	

DIMENSIONS ▪ All dimensions in mm



ø D	L	ØD±0.5	a	F±0.5	Ød±0.05
6.3	8	6.3	1	2.5	0.6
8	9	8	1.5	3.5	0.6
8	11.5	8	1.5	3.5	0.6
10	10	10	1.5	5	0.6
10	12.5	10	1.5	5	0.8
10	18	10	2	5	0.8

STANDARD RATINGS

V_R (V)	C_R (µF)	ø D (mm)	L (mm)	I_{LEAK} (µA, 2min)	tanδ +20°C ▪ 120Hz (%)	Max. ESR +20°C ▪ 100kHz (mΩ)	I_R ▪ Max. Ripple Current +105°C ▪ 100kHz (mA rms)	CapXon Part Number
16	120	6.3	8	19.2	16	40	1500	AS121M016E080PTC [ ]
	270	8	9	43.2	16	26	2000	AS271M016F090PTD [ ]
	330	8	11.5	52.8	16	23	2350	AS331M016F115PTD [ ]
	470	10	10	75.2	16	21	2600	AS471M016G100PTA [ ]
	560	10	12.5	89.6	16	15	3000	AS561M016G125PTA [ ]
	1500	10	18	240.0	16	12	5000	AS152M016G180PTA [ ]
25	68	6.3	8	17.0	16	45	1400	AS680M025E080PTC [ ]
	150	8	9	37.5	16	27	1900	AS151M025F090PTD [ ]
	220	8	11.5	55.0	16	24	2250	AS221M025F115PTD [ ]
	270	10	10	67.5	16	22	2530	AS271M025G100PTA [ ]
	330	10	12.5	82.5	16	16	2900	AS331M025G125PTA [ ]
	1000	10	18	250,0	16	12	5000	AS102M025G180PTA [ ]
35	47	6.3	8	16.5	16	60	1300	AS470M035E080PTC [ ]
	100	8	9	35.0	16	30	1800	AS101M035F090PTD [ ]
	150	8	11.5	52.5	16	25	2100	AS151M035F115PTD [ ]
	150	10	10	52.5	16	23	2470	AS151M035G100PTA [ ]
	220	10	12.5	77.0	16	17	2830	AS221M035G125PTA [ ]
	680	10	18	238.0	16	14	4600	AS681M035G180PTA [ ]
40	27	6.3	8	10.8	16	70	1250	AS270M040E080PTC [ ]
	56	8	9	22.4	16	32	1750	AS560M040F090PTD [ ]
	82	8	11.5	32.8	16	27	2000	AS820M040F115PTD [ ]
	100	10	10	40.0	16	24	2400	AS101M040G100PTA [ ]
	120	10	10	48.0	16	18	2750	AS121M040G100PTA [ ]
	180	10	12.5	72.0	16	18	3000	AS181M040G125PTA [ ]
50	15	6.3	8	7.5	16	80	1200	AS150M050E080PTC [ ]
	33	8	9	16.5	16	35	1670	AS330M050F090PTD [ ]
	47	8	11.5	23.5	16	30	1900	AS470M050F115PTD [ ]
	56	10	10	28.0	16	25	2320	AS560M050G100PTA [ ]
	82	10	12.5	41.0	16	19	2650	AS820M050G125PTA [ ]
	220	10	18	110.0	16	15	4350	AS221M050G180PTA [ ]
63	10	6.3	8	6.3	16	100	1060	AS100M063E080PTC [ ]
	22	8	9	13.9	16	40	1560	AS220M063F090PTD [ ]
	27	8	11.5	17.0	16	35	1750	AS270M063F115PTD [ ]
	33	10	10	20.8	16	30	2100	AS330M063G100PTA [ ]
	47	10	10	29.6	16	30	2100	AS470M063G100PTA [ ]
	56	10	12.5	35.3	16	22	2400	AS560M063G125PTA [ ]
	150	10	18	94.5	16	18	4000	AS151M063G180PTA [ ]
80	8.2	8	9	6.6	16	90	1050	AS8R2M080F115PTD [ ]
	15	8	11.5	12.0	16	70	1400	AS150M080F115PTD [ ]
	12	10	10	9.6	16	70	1600	AS120M080G100PTA [ ]
	15	10	10	12.0	16	70	1600	AS150M080G100PTA [ ]
	18	10	12.5	14.4	16	50	1830	AS180M080G125PTA [ ]

[ ] see description at end of standard ratings

Part number shows taped version with straight leads and Ammo Pack packaging.

See "ADDITIONAL INFORMATION" for further lead treatment options.

STANDARD RATINGS

V_R (V)	C_R (µF)	ø D (mm)	L (mm)	I_{LEAK} (µA, 2min)	tanδ +20°C ▪ 120Hz (%)	Max. ESR +20°C ▪ 100kHz (mΩ)	I_R ▪ Max. Ripple Current +105°C ▪ 100kHz (mA rms)	CapXon Part Number
100	8.2	8	9	8.2	16	100	1000	AS8R2M100F090PTD ⬚
	10	8	11.5	10.0	16	80	1300	AS100M100F115PTD ⬚
	10	10	10	10.0	16	80	1450	AS100M100G100PTA ⬚
	12	10	10	12.0	16	80	1450	AS120M100G100PTA ⬚
	15	10	12.5	15.0	16	60	1660	AS150M100G125PTA ⬚
	47	10	12.5	47.0	16	60	1660	AS470M100G125PTA ⬚
250	8.2	10	12.5	20.5	16	120	740	AS8R2M250G125PTA ⬚
400	1.2	8	9	4.8	16	200	430	AS1R2M400F090PTD ⬚
	2.2	8	11.5	8.8	16	170	510	AS2R2M400F115PTD ⬚
	4.7	10	12.5	18.8	16	150	650	AS4R7M400G125PTA ⬚

⬚: Leave **blank** for Standard type ⬚: Enter **X** for AEC-Q200 type

Part number shows taped version with straight leads and Ammo Pack packaging.

See "PACKAGING INFORMATION" for further lead treatment options.

MULTIPLIER K_f for RIPPLE CURRENT vs. FREQUENCY

Frequency (Hz)	100 ≤ Freq. < 120	120 ≤ Freq. < 200	200 ≤ Freq. < 300	300 ≤ Freq. < 500
Coefficient K_f	0.10	0.10	0.10	0.15

Frequency (Hz)	500 ≤ Freq. < 1k	1k ≤ Freq. < 2k	2k ≤ Freq. < 3k	3k ≤ Freq. < 5k
Coefficient K_f	0.20	0.30	0.40	0.45

Frequency (Hz)	5k ≤ Freq. < 10k	10k ≤ Freq. < 15k	15k ≤ Freq. < 20k	20k ≤ Freq. < 40k
Coefficient K_f	0.50	0.60	0.65	0.70

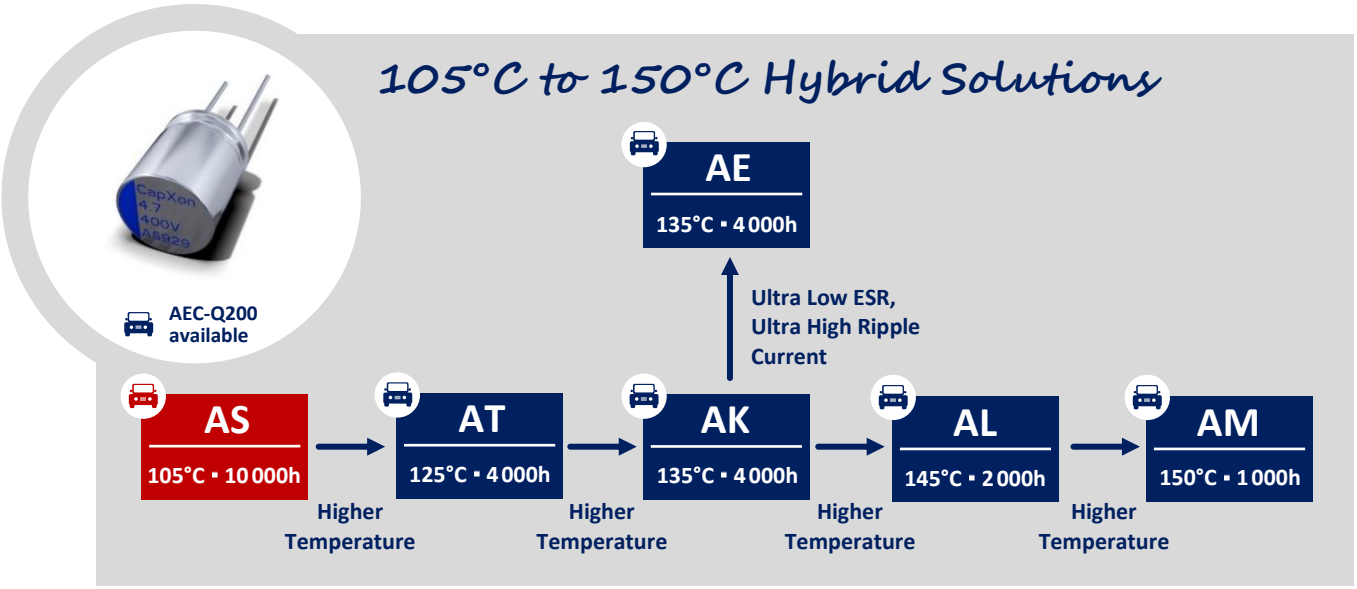
Frequency (Hz)	40k ≤ Freq. < 50k	50k ≤ Freq. < 100k	100k ≤ Freq. < 500k	500k ≤ Freq. < 1M
Coefficient K_f	0.80	0.85	1.00	1.05

PRECAUTIONS, GUIDELINES AND PACKAGING INFORMATION

Unless otherwise agreed in individual specifications, all products are subject to our "General Precautions and Guidelines" as well as our "Packaging Information". Please refer to the following links in the table.

General Precautions & Guidelines	Packaging Information	3D Models	Reliability Tests

GROUP CHART



AT SERIES ▪ LONG LIFE AT 125°C UP TO 4 000 hours

KEY FEATURES

AEC-Q 200 · °C HIGH TEMPERATURE

- **HYBRID CONDUCTIVE POLYMER** ▪ THT type
- Endurance: 125°C ▪ 2 000 up to 4 000 hours
- Low ESR and high ripple current
- Superior electrical stability over application lifetime
- AEC-Q200 version available

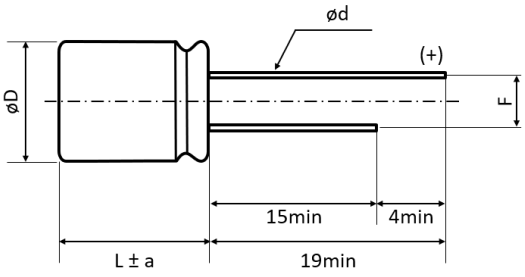
HF Halogen Free · RoHS & REACH COMPLIANT

SPECIFICATIONS

Items		Performance Characteristics
Operating Temperature Range		-55 ~ +125°C
Rated Voltage Range	V_R	16 ~ 100V DC
Surge Voltage	V_S	($V_R \le 100V$): $V_S = 1.25 \cdot V_R$
Capacitance Range	C_R	8.2 ~ 1500µF
Cap. Tolerance	ΔC	±20% (120Hz ▪ 20°C)
Leakage Current (20°C ▪ V_R applied)	I_{LEAK}	Not to exceed the values shown in standard ratings After 2 minutes
Dissipation Factor % (20°C ▪ 120Hz)	tanδ	Not to exceed the values shown in standard ratings
Equivalent Series Resistance (20°C ▪ 100kHz)	ESR	Not to exceed the values shown in standard ratings

Lifetime Test			
Endurance 125°C (V_R & I_R applied)	Test	**4 000 hours**	≥ ø D 8
		2 000 hours	≤ ø D 6.3
	$\triangle C/C_R$	Within ±30% of the initial value	
	tanδ	Less than 200% of the specified value	
	ESR	Less than 200% of the specified value	
	I_{Leak}	Less than the specified value	

DIMENSIONS ▪ All dimensions in mm



ø D	L	ØD±0.5	a	F±0.5	Ød±0.05
6.3	8	6.3	1	2.5	0.6
8	9	8	1.5	3.5	0.6
8	11.5	8	1.5	3.5	0.6
10	10	10	1.5	5	0.6
10	12.5	10	1.5	5	0.8
10	18	10	2	5	0.8

STANDARD RATINGS

V_R (V)	C_R (µF)	ø D (mm)	L (mm)	I_{LEAK} (µA, 2min)	tanδ +20°C ▪ 120Hz (%)	Max. ESR +20°C ▪ 100kHz (mΩ)	I_R ▪ Max. Ripple Current +125°C ▪ 100kHz (mA rms)	CapXon Part Number
16	120	6.3	8	19.2	16	32	1440	AT121M016E080PTC [ ]
	270	8	9	43.2	16	23	1970	AT271M016F090PTD [ ]
	330	8	11.5	52.8	16	20	2340	AT331M016F115PTD [ ]
	470	10	10	75.2	16	18	2620	AT471M016G100PTA [ ]
	560	10	12.5	89.6	16	14	3030	AT561M016G125PTA [ ]
	1500	10	18	240.0	16	12	4000	AT152M016G180PTA [ ]
25	68	6.3	8	17.0	16	35	1380	AT680M025E080PTC [ ]
	150	8	9	37.5	16	25	1880	AT151M025F090PTD [ ]
	220	8	11.5	55.0	16	22	2230	AT221M025F115PTD [ ]
	270	10	10	67.5	16	19	2500	AT271M025G100PTA [ ]
	330	10	12.5	82.5	16	14	2890	AT331M025G125PTA [ ]
	1000	10	18	250.0	16	12	4000	AT102M025G180PTA [ ]
35	47	6.3	8	16.5	16	45	1280	AT470M035E080PTC [ ]
	100	8	9	35.0	16	28	1780	AT101M035F090PTD [ ]
	150	8	11.5	52.5	16	25	2100	AT151M035F115PTD [ ]
	150	10	10	52.5	16	20	2440	AT151M035G100PTA [ ]
	220	10	12.5	77.0	16	15	2800	AT221M035G125PTA [ ]
	680	10	18	238.0	16	14	3700	AT681M035G180PTA [ ]
40	27	6.3	8	10.8	16	48	1230	AT270M040E080PTC [ ]
	56	8	9	22.4	16	30	1710	AT560M040F090PTD [ ]
	82	8	11.5	32.8	16	27	2000	AT820M040F115PTD [ ]
	100	10	10	40.0	16	21	2360	AT101M040G100PTA [ ]
	120	10	10	48.0	16	20	2400	AT121M040G100PTA [ ]
	180	10	12.5	72.0	16	18	2550	AT181M040G125PTA [ ]
50	15	6.3	8	7.5	16	80	960	AT150M050E080PTC [ ]
	33	8	9	16.5	16	35	1330	AT330M050F090PTD [ ]
	47	8	11.5	23.5	16	30	1520	AT470M050F115PTD [ ]
	56	10	10	28.0	16	30	1850	AT560M050G100PTA [ ]
	82	10	12.5	41.0	16	25	2120	AT820M050G125PTA [ ]
	220	10	18	110.0	16	15	3500	AT221M050G180PTA [ ]
63	10	6.3	8	6.3	16	100	840	AT100M063E080PTC [ ]
	22	8	9	13.9	16	40	1240	AT220M063F090PTD [ ]
	27	8	11.5	17	16	35	1400	AT270M063F115PTD [ ]
	33	10	10	20.8	16	35	1680	AT330M063G100PTA [ ]
	47	10	10	29.6	16	35	1680	AT470M063G100PTA [ ]
	56	10	12.5	35.3	16	30	1920	AT560M063G125PTA [ ]
	150	10	18	94.5	16	18	3200	AT151M063G180PTA [ ]
80	8.2	8	9	6.6	16	90	840	AT8R2M080F090PTD [ ]
	15	8	11.5	12	16	70	1120	AT150M080F115PTD [ ]
	12	10	10	9.6	16	70	1280	AT120M080G100PTA [ ]
	15	10	10	12	16	70	1280	AT150M080G100PTA [ ]
	18	10	12.5	14.4	16	60	1460	AT180M080G125PTA [ ]

[ ] see description at end of standard ratings

Part number shows taped version with straight leads and Ammo Pack packaging.

See "PACKAGING INFORMATION" for further lead treatment options.

STANDARD RATINGS

V_R (V)	C_R (µF)	ø D (mm)	L (mm)	I_{LEAK} (µA, 2min)	tanδ +20°C ▪ 120Hz (%)	Max. ESR +20°C ▪ 100kHz (mΩ)	I_R ▪ Max. Ripple Current +125°C ▪ 100kHz (mA rms)	CapXon Part Number
100	8.2	8	9	8.2	16	100	800	AT8R2M100F090PTD ⬚
	10	8	11.5	10	16	80	1040	AT100M100F115PTD ⬚
	10	10	10	10	16	80	1160	AT100M100G100PTA ⬚
	12	10	10	12	16	80	1160	AT120M100G100PTA ⬚
	15	10	12.5	15	16	70	1320	AT150M100G125PTA ⬚
	47	10	12.5	15	16	70	1320	AT470M100G125PTA ⬚

⬚: Leave **blank** for Standard type ⬚: Enter **X** for AEC-Q200 type

Part number shows taped version with straight leads and Ammo Pack packaging.

See "PACKAGING INFORMATION" for further lead treatment options.

MULTIPLIER K_f for RIPPLE CURRENT vs. FREQUENCY

Frequency (Hz)	100 ≤ Freq. < 120	120 ≤ Freq. < 200	200 ≤ Freq. < 300	300 ≤ Freq. < 500
Coefficient K_f	0.10	0.10	0.10	0.15

Frequency (Hz)	500 ≤ Freq. < 1k	1k ≤ Freq. < 2k	2k ≤ Freq. < 3k	3k ≤ Freq. < 5k
Coefficient K_f	0.20	0.30	0.40	0.45

Frequency (Hz)	5k ≤ Freq. < 10k	10k ≤ Freq. < 15k	15k ≤ Freq. < 20k	20k ≤ Freq. < 40k
Coefficient K_f	0.50	0.60	0.65	0.70

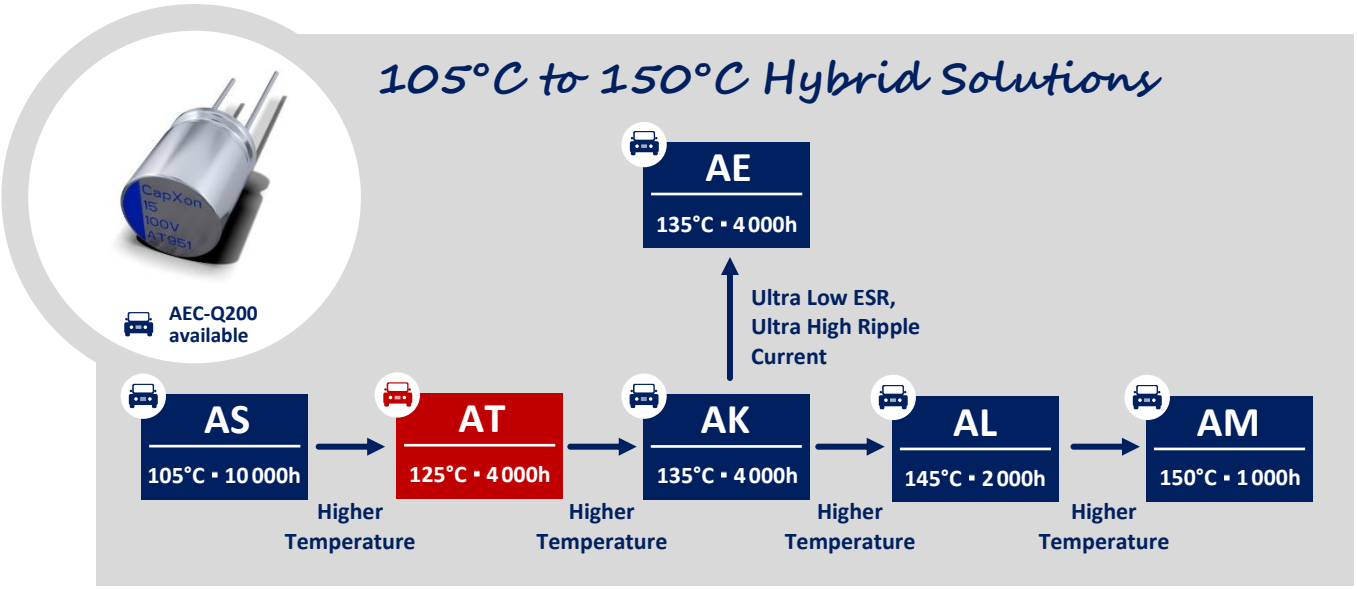
Frequency (Hz)	40k ≤ Freq. < 50k	50k ≤ Freq. < 100k	100k ≤ Freq. < 500k	500k ≤ Freq. < 1M
Coefficient K_f	0.80	0.85	1.00	1.05

PRECAUTIONS, GUIDELINES AND PACKAGING INFORMATION

Unless otherwise agreed in individual specifications, all products are subject to our "General Precautions and Guidelines" as well as our "Packaging Information". Please refer to the following links in the table.

General Precautions & Guidelines	Packaging Information	3D Models	Reliability Tests

GROUP CHART



AK SERIES ▪ LONG LIFE AT 135°C UP TO 3 000 hours

KEY FEATURES

AEC-Q 200 · °C HIGH TEMPERATURE

- **HYBRID CONDUCTIVE POLYMER** ▪ THT type
- Endurance: 135°C ▪ 2 000 to 3 000 hours
- Low ESR and high ripple current
- Superior electrical stability over application lifetime
- AEC-Q200 version available

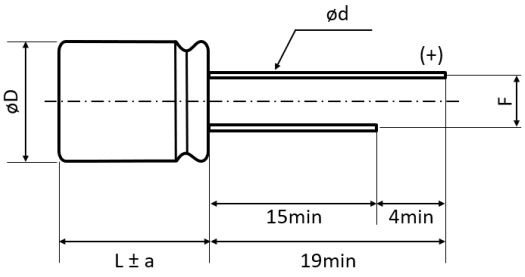
HF Halogen Free · RoHS & REACH COMPLIANT

SPECIFICATIONS

Items		Performance Characteristics
Operating Temperature Range		-55 ~ +135°C
Rated Voltage Range	V_R	16 ~ 100V DC
Surge Voltage	V_S	($V_R \leq 100V$): $V_S = 1.25 \cdot V_R$
Capacitance Range	C_R	8.2 ~ 560µF
Cap. Tolerance	ΔC	±20% (120Hz ▪ 20°C)
Leakage Current (20°C ▪ V_R applied)	I_{LEAK}	Not to exceed the values shown in standard ratings After 2 minutes
Dissipation Factor % (20°C ▪ 120Hz)	tanδ	Not to exceed the values shown in standard ratings
Equivalent Series Resistance (20°C ▪ 100kHz)	ESR	Not to exceed the values shown in standard ratings

Lifetime Test			
Endurance 135°C (V_R & I_R applied)	Test	**3 000 hours**	≥ Ø 8
		2 000 hours	≤ Ø 6.3
	$\triangle C/C_R$	Within ±30% of the initial value	
	tanδ	Less than 200% of the specified value	
	ESR	Less than 200% of the specified value	
	I_{Leak}	Less than the specified value	

DIMENSIONS ▪ All dimensions in mm



ø D	L	ØD±0.5	a	F±0.5	Ød±0.05
6.3	8	6.3	1	2.5	0.6
8	9	8	1.5	3.5	0.6
8	11.5	8	1.5	3.5	0.6
10	10	10	1.5	5	0.6
10	12.5	10	1.5	5	0.8

STANDARD RATINGS

V_R (V)	C_R (µF)	ø D (mm)	L (mm)	I_{LEAK} (µA, 2min)	tanδ +20°C ▪ 120Hz (%)	Max. ESR +20°C ▪ 100kHz (mΩ)	I_R ▪ Max. Ripple Current +135°C ▪ 100kHz (mA rms)	CapXon Part Number
16	120	6.3	8	19.2	16	32	1440	AK121M016E080PTC [ ]
	270	8	9	43.2	16	23	1970	AK271M016F090PTD [ ]
	330	8	11.5	52.8	16	20	2340	AK331M016F115PTD [ ]
	470	10	10	75.2	16	18	2620	AK471M016G100PTA [ ]
	560	10	12.5	89.6	16	14	3030	AK561M016G125PTA [ ]
25	68	6.3	8	17.0	16	35	1380	AK680M025E080PTC [ ]
	150	8	9	37.5	16	25	1880	AK151M025F090PTD [ ]
	220	8	11.5	55.0	16	22	2230	AK221M025F115PTD [ ]
	270	10	10	67.5	16	19	2500	AK271M025G100PTA [ ]
	330	10	12.5	82.5	16	14	2890	AK331M025G125PTA [ ]
35	47	6.3	8	16.5	16	45	1280	AK470M035E080PTC [ ]
	100	8	9	35.0	16	28	1780	AK101M035F090PTD [ ]
	150	8	11.5	52.5	16	25	2100	AK151M035F115PTD [ ]
	150	10	10	52.5	16	20	2440	AK151M035G100PTA [ ]
	220	10	12.5	77.0	16	15	2800	AK221M035G125PTA [ ]
40	27	6.3	8	10.8	16	48	1230	AK270M040E080PTC [ ]
	56	8	9	22.4	16	30	1710	AK560M040F090PTD [ ]
	82	8	11.5	32.8	16	27	2000	AK820M040F115PTD [ ]
	100	10	10	40.0	16	21	2360	AK101M040G100PTA [ ]
	120	10	10	48.0	16	20	2400	AK121M040G100PTA [ ]
	180	10	12.5	72.0	16	18	2550	AK181M040G125PTA [ ]
50	15	6.3	8	7.5	16	80	960	AK150M050E080PTC [ ]
	33	8	9	16.5	16	35	1330	AK330M050F090PTD [ ]
	47	8	11.5	23.5	16	30	1520	AK470M050F115PTD [ ]
	56	10	10	28.0	16	30	1850	AK560M050G100PTA [ ]
	82	10	12.5	41.0	16	25	2120	AK820M050G125PTA [ ]
63	10	6.3	8	6.3	16	100	840	AK100M063E080PTC [ ]
	22	8	9	13.9	16	40	1240	AK220M063F090PTD [ ]
	27	8	11.5	17.0	16	35	1400	AK270M063F115PTD [ ]
	33	10	10	20.8	16	35	1680	AK330M063G100PTA [ ]
	47	10	10	29.6	16	35	1680	AK470M063G100PTA [ ]
	56	10	12.5	35.3	16	30	1920	AK560M063G125PTA [ ]
80	8.2	8	9	6.6	16	90	840	AK8R2M080F090PTD [ ]
	15	8	11.5	12.0	16	70	1120	AK150M080F115PTD [ ]
	12	10	10	9.6	16	70	1280	AK120M080G100PTA [ ]
	15	10	10	12.0	16	70	1280	AK150M080G100PTA [ ]
	18	10	12.5	14.4	16	60	1460	AK180M080G125PTA [ ]
100	8.2	8	9	8.2	16	100	800	AK8R2M100F090PTD [ ]
	10	8	11.5	10.0	16	80	1040	AK100M100F115PTD [ ]
	10	10	10	10.0	16	80	1160	AK100M100G100PTA [ ]
	12	10	10	12.0	16	80	1160	AK120M100G100PTA [ ]
	15	10	12.5	15.0	16	70	1320	AK150M100G125PTA [ ]

[ ]: Leave **blank** for Standard type [ ]: Enter **X** for AEC-Q200 type

Part number shows taped version with straight leads and Ammo Pack packaging.

See "PACKAGING INFORMATION" for further lead treatment options.

MULTIPLIER K_f for RIPPLE CURRENT vs. FREQUENCY

Frequency (Hz)	100 ≤ Freq. < 120	120 ≤ Freq. < 200	200 ≤ Freq. < 300	300 ≤ Freq. < 500
Coefficient K_f	0.15	0.15	0.20	0.25

Frequency (Hz)	500 ≤ Freq. < 1k	1k ≤ Freq. < 2k	2k ≤ Freq. < 3k	3k ≤ Freq. < 5k
Coefficient K_f	0.30	0.40	0.45	0.55

Frequency (Hz)	5k ≤ Freq. < 10k	10k ≤ Freq. < 15k	15k ≤ Freq. < 20k	20k ≤ Freq. < 40k
Coefficient K_f	0.60	0.70	0.75	0.80

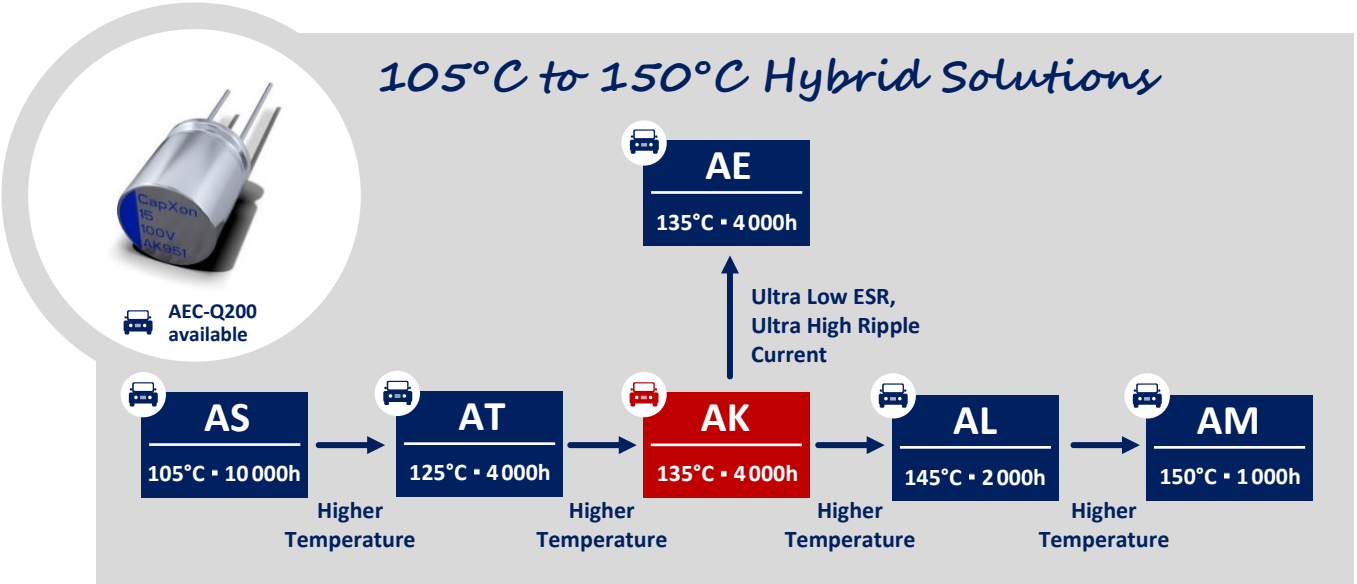
Frequency (Hz)	40k ≤ Freq. < 50k	50k ≤ Freq. < 100k	100k ≤ Freq. < 500k	500k ≤ Freq. < 1M
Coefficient K_f	0.85	0.90	1.00	1.00

PRECAUTIONS, GUIDELINES AND PACKAGING INFORMATION

Unless otherwise agreed in individual specifications, all products are subject to our “General Precautions and Guidelines” as well as our “Packaging Information”. Please refer to the following links in the table.

General Precautions & Guidelines	Packaging Information	3D Models	Reliability Tests

GROUP CHART



DISCLAIMER

All product related data (e.g. specification, statements and general information) are subject to change without any notice. It is necessary that the customer observes all product related technical / application information and handling instructions.

CapXon products are designed and manufactured according to severe quality and safety standards. Under no circumstance, CapXon warrants that any CapXon product is suitable for the purposes intended for your application, even CapXon knows the application. It is customer's duty and obligation to check and make sure that CapXon products are suitable for the purposes intended and select the correct and proper CapXon product. Customers are requested to perform a sufficient validation and reliability evaluation to assure needed safety level and reliability performance by suitable designs and to apply proper safeguards (e.g. redundancies, protective circuits).

Particular operating conditions (ambient temperature, ripple current, voltage, thermal resistance, etc.) as well as storage, production or assembly may affect the performance and the lifetime of the capacitor. Please consult CapXon for lifetime estimation, failure mode considerations or worst-case scenarios according to the product technology, product tolerances / deviations or change of the characteristics of the capacitor due to shipment, storage, handling, production and usage.

For aerospace or military application, life-saving, life-sustaining, safety critical applications or any application where failure may cause severe personal injury or death, please consult us before design-in the capacitor in your application.

Except for the written expressed warranties, CapXon does not impliedly, by assumption or whatever else, warrant, undertake, promise any other warranty or guaranty for any CapXon product.

For further information, please visit our website www.capxongroup.com or contact CapXon directly.

AE SERIES ▪ HIGH RIPPLE CURRENT TYPE

KEY FEATURES

AEC-Q 200 · HIGH TEMPERATURE · HIGH RIPPLE

- **HYBRID CONDUCTIVE POLYMER** ▪ THT type
- Endurance: 135°C ▪ 4000 hours
- Ultra-low ESR and highest ripple current
- Superior electrical stability over application lifetime
- AEC-Q200 version available

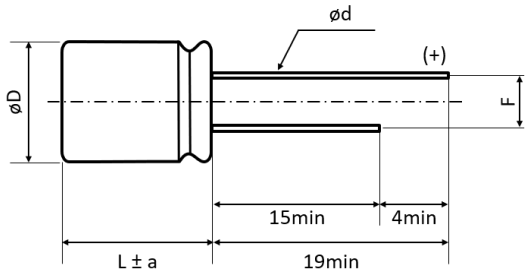
HF Halogen Free · RoHS & REACH COMPLIANT

SPECIFICATIONS

Items		Performance Characteristics
Operating Temperature Range		-55 ~ +135°C
Rated Voltage Range	V_R	25 ~ 100V DC
Surge Voltage	V_S	($V_R \le 100V$): $V_S = 1.25 \cdot V_R$
Capacitance Range	C_R	22 ~ 680µF
Cap. Tolerance	ΔC	±20% (120Hz ▪ 20°C)
Leakage Current (20°C ▪ V_R applied)	I_{LEAK}	Not to exceed the values shown in standard ratings After 2 minutes
Dissipation Factor % (20°C ▪ 120Hz)	tanδ	Not to exceed the values shown in standard ratings
Equivalent Series Resistance (20°C ▪ 100kHz)	ESR	Not to exceed the values shown in standard ratings

Lifetime Test		
Endurance 135°C (V_R & I_R applied)	Test	**4000 hours**
	△C/C_R	Within ±30% of the initial value
	tanδ	Less than 200% of the specified value
	ESR	Less than 200% of the specified value
	I_{Leak}	Less than the specified value

DIMENSIONS ▪ All dimensions in mm



ø D	L	ØD±0.5	a	F±0.5	Ød±0.05
10.0	12.5	10	1.5	5	0.8
10.0	16.0	10	2.0	5	0.8

STANDARD RATINGS

V_R (V)	C_R (µF)	ø D (mm)	L (mm)	I_{LEAK} (µA, 2min)	tanδ +20°C ▪ 120Hz (%)	Max. ESR +20°C ▪ 100kHz (mΩ)	I_R ▪ Max. Ripple Current ▪ 100kHz (mA rms)		CapXon Part Number
							+125°C	+135°C	
25	470	10	12.5	117.5	16	10	5000	3500	AE471M025G125PTA ☐
	560	10	16	140	16	8	5800	4000	AE561M025G160PTA ☐
	680	10	16	170	16	8	5800	4000	AE681M025G160PTA ☐
35	330	10	12.5	115.5	16	11	4800	3300	AE331M035G125PTA ☐
	470	10	16	164.5	16	9	5500	3800	AE471M035G160PTA ☐
50	68	10	12.5	34	16	15	4000	2800	AE680M050G125PTA ☐
	100	10	12.5	50	16	15	4000	2800	AE101M050G125PTA ☐
	120	10	12.5	60	16	12	4600	3200	AE121M050G125PTA ☐
	150	10	12.5	75	16	12	4600	3200	AE151M050G125PTA ☐
	180	10	16	90	16	10	5200	3600	AE181M050G160PTA ☐
	220	10	16	110	16	10	5200	3600	AE221M050G160PTA ☐
63	47	10	12.5	29.6	16	15	4000	2800	AE470M063G125PTA ☐
	56	10	12.5	35.3	16	15	4000	2800	AE560M063G125PTA ☐
	68	10	12.5	42.8	16	15	4000	2800	AE680M063G125PTA ☐
	100	10	12.5	63.0	16	12	4600	3200	AE101M063G125PTA ☐
	120	10	12.5	75.6	16	12	4600	3200	AE121M063G125PTA ☐
	150	10	16	94.5	16	10	5200	3600	AE151M063G160PTA ☐
80	47	10	12.5	37.6	16	18	3600	2500	AE470M080G125PTA ☐
	56	10	12.5	44.8	16	18	3600	2500	AE560M080G125PTA ☐
	68	10	12.5	54.4	16	15	4000	2800	AE680M080G125PTA ☐
	100	10	16	80	16	12	4700	3300	AE101M080G160PTA ☐
100	22	10	12.5	22	16	25	3000	2100	AE220M100G125PTA ☐
	33	10	12.5	33	16	20	3400	2400	AE330M100G125PTA ☐
	47	10	16	47	16	15	4100	2900	AE470M100G160PTA ☐

☐: Leave **blank** for Standard type ☐: Enter **X** for AEC-Q200 type

Part number shows taped version with straight leads and Ammo Pack packaging.

See "PACKAGING INFORMATION" for further lead treatment options.

MULTIPLIER K_f for RIPPLE CURRENT vs. FREQUENCY

Frequency (Hz)	100 ≤ Freq. < 120	120 ≤ Freq. < 200	200 ≤ Freq. < 300	300 ≤ Freq. < 500
Coefficient K_f	0.15	0.15	0.20	0.25

Frequency (Hz)	500 ≤ Freq. < 1k	1k ≤ Freq. < 2k	2k ≤ Freq. < 3k	3k ≤ Freq. < 5k
Coefficient K_f	0.30	0.40	0.45	0.55

Frequency (Hz)	5k ≤ Freq. < 10k	10k ≤ Freq. < 15k	15k ≤ Freq. < 20k	20k ≤ Freq. < 40k
Coefficient K_f	0.60	0.70	0.75	0.80

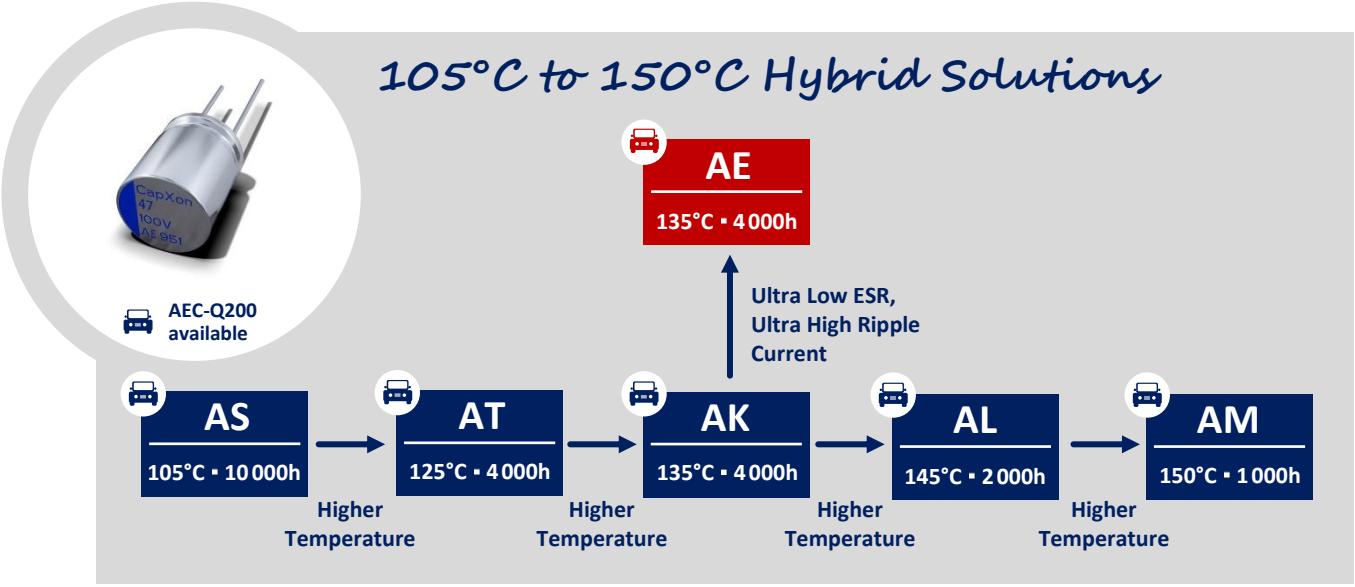
Frequency (Hz)	40k ≤ Freq. < 50k	50k ≤ Freq. < 100k	100k ≤ Freq. < 500k	500k ≤ Freq. < 1M
Coefficient K_f	0.85	0.90	1.00	1.00

PRECAUTIONS, GUIDELINES AND PACKAGING INFORMATION

Unless otherwise agreed in individual specifications, all products are subject to our “General Precautions and Guidelines” as well as our “Packaging Information”. Please refer to the following links in the table.

General Precautions & Guidelines	Packaging Information	3D Models	Reliability Tests

GROUP CHART



AL SERIES ▪ HIGH TEMPERATURE TYPE 145°C

KEY FEATURES

AEC-Q 200 · HIGH TEMPERATURE

- **HYBRID CONDUCTIVE POLYMER** ▪ THT type
- Endurance: 145°C ▪ 2 000 hours
- Low ESR and high ripple current
  Superior electrical stability over application lifetime
- AEC-Q200 version available

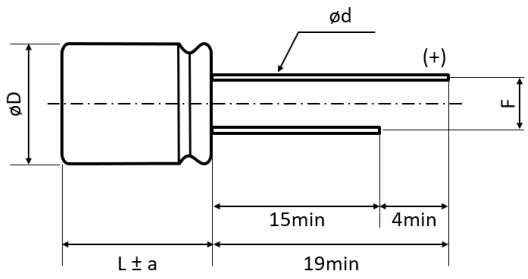
HF Halogen Free · RoHS & REACH COMPLIANT

SPECIFICATIONS

Items		Performance Characteristics
Operating Temperature Range		-55 ~ +145°C
Rated Voltage Range	V_R	16 ~ 80V DC
Surge Voltage	V_S	($V_R \leq 100V$): $V_S = 1.25 \cdot V_R$
Capacitance Range	C_R	8.2 ~ 560µF
Cap. Tolerance	ΔC	±20% (120Hz ▪ 20°C)
Leakage Current (20°C ▪ V_R applied)	I_{LEAK}	Not to exceed the values shown in standard ratings After 2 minutes
Dissipation Factor % (20°C ▪ 120Hz)	tanδ	Not to exceed the values shown in standard ratings
Equivalent Series Resistance (20°C ▪ 100kHz)	ESR	Not to exceed the values shown in standard ratings

Lifetime Test		
Endurance 145°C (V_R & I_R applied)	Test	**2 000 hours**
	△C/C_R	Within ±30% of the initial value
	tanδ	Less than 200% of the specified value
	ESR	Less than 200% of the specified value
	I_{Leak}	Less than the specified value

DIMENSIONS ▪ All dimensions in mm



ø D	L	ØD±0.5	a	F±0.5	Ød±0.05
8	9	8	1.5	3.5	0.6
8	11.5	8	1.5	3.5	0.6
10	10	10	1.5	5	0.6
10	12.5	10	1.5	5	0.8

STANDARD RATINGS

V_R (V)	C_R (µF)	ø D (mm)	L (mm)	I_{LEAK} (µA, 2min)	tanδ +20°C ▪ 120Hz (%)	Max. ESR +20°C ▪ 100kHz (mΩ)	I_R ▪ Max. Ripple Current +145°C ▪ 100kHz (mA rms)	CapXon Part Number
16	270	8	9	43.2	16	25	780	AL271M016F090PTD ☐
	330	8	11.5	52.8	16	23	950	AL331M016F115PTD ☐
	470	10	10	75.2	16	20	1050	AL471M016G100PTA ☐
	560	10	12.5	89.6	16	16	1220	AL561M016G125PTA ☐
25	150	8	9	37.5	16	27	750	AL151M025F090PTD ☐
	220	8	11.5	55	16	25	900	AL221M025F115PTD ☐
	270	10	10	67.5	16	22	1000	AL271M025G100PTA ☐
	330	10	12.5	82.5	16	16	1150	AL331M025G125PTA ☐
35	100	8	9	16.5	16	30	700	AL101M035F090PTD ☐
	150	8	11.5	35	16	27	850	AL151M035F115PTD ☐
	150	10	10	52.5	16	23	950	AL151M035G100PTA ☐
	220	10	12.5	77	16	18	1100	AL221M035G125PTA ☐
40	56	8	9	22.4	16	30	660	AL560M040F090PTD ☐
	82	8	11.5	32.8	16	27	800	AL820M040F115PTD ☐
	100	10	10	40	16	25	920	AL101M040G100PTA ☐
	120	10	10	48	16	23	920	AL121M040G100PTA ☐
	180	10	12.5	48	16	20	1040	AL181M040G125PTA ☐
50	33	8	9	16.5	16	35	620	AL330M050F090PTD ☐
	47	8	11.5	23.5	16	28	730	AL570M050F115PTD ☐
	56	10	10	28	16	28	880	AL560M050G100PTA ☐
	82	10	12.5	41	16	25	1040	AL820M050G125PTA ☐
63	22	8	9	13.9	16	40	600	AL220M063F090PTD ☐
	27	8	11.5	17	16	35	700	AL270M063F115PTD ☐
	33	10	10	20.8	16	30	850	AL330M063G100PTA ☐
	47	10	10	29.6	16	30	850	AL470M063G100PTA ☐
	56	10	12.5	35.3	16	25	950	AL560M063G125PTA ☐
80	8.2	8	9	6.6	16	90	450	AL8R2M080F090PTD ☐
	12	10	10	9.6	16	70	650	AL120M080G100PTA ☐
	15	8	11.5	12	16	70	550	AL150M080F115PTD ☐
	15	10	10	12	16	70	650	AL150M080G100PTA ☐
	18	10	12.5	14.4	16	50	750	AL180M080G125PTA ☐

☐: Leave **blank** for Standard type ☐: Enter **X** for AEC-Q200 type

Part number shows taped version with straight leads and Ammo Pack packaging.

See "PACKAGING INFORMATION" for further lead treatment options.

MULTIPLIER K_f for RIPPLE CURRENT vs. FREQUENCY

Frequency (Hz)	100 ≤ Freq. < 120	120 ≤ Freq. < 200	200 ≤ Freq. < 300	300 ≤ Freq. < 500
Coefficient K_f	0.10	0.10	0.10	0.15

Frequency (Hz)	500 ≤ Freq. < 1k	1k ≤ Freq. < 2k	2k ≤ Freq. < 3k	3k ≤ Freq. < 5k
Coefficient K_f	0.20	0.30	0.40	0.45

Frequency (Hz)	5k ≤ Freq. < 10k	10k ≤ Freq. < 15k	15k ≤ Freq. < 20k	20k ≤ Freq. < 40k
Coefficient K_f	0.50	0.60	0.65	0.70

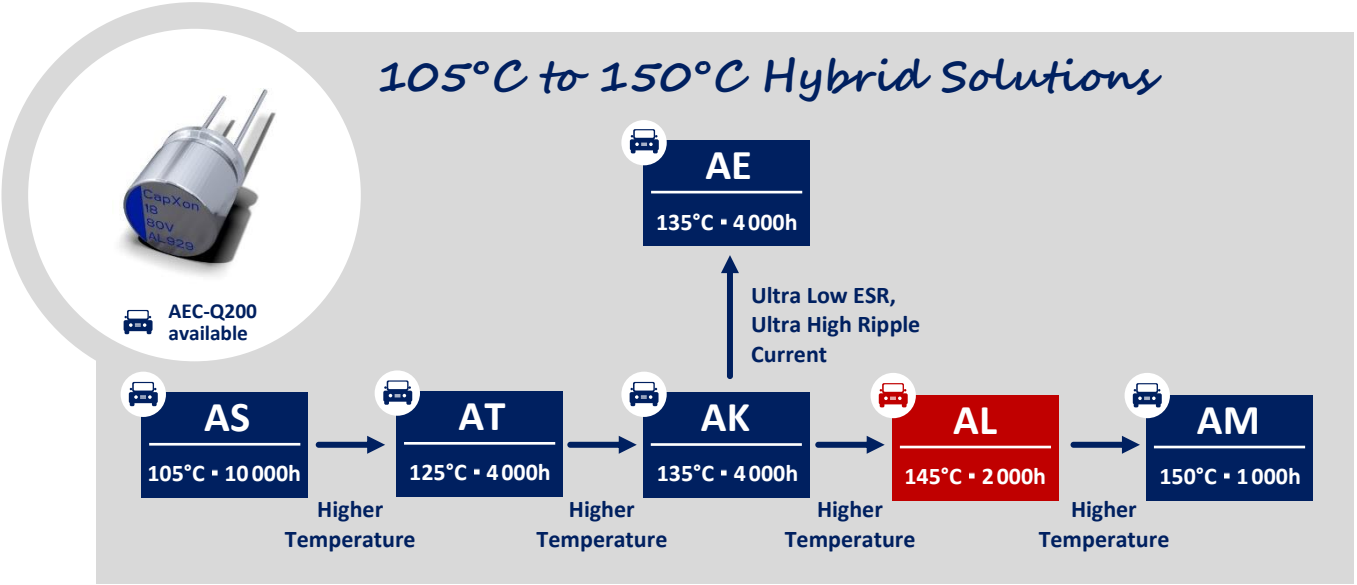
Frequency (Hz)	40k ≤ Freq. < 50k	50k ≤ Freq. < 100k	100k ≤ Freq. < 500k	500k ≤ Freq. < 1M
Coefficient K_f	0.80	0.85	1.00	1.05

PRECAUTIONS, GUIDELINES AND PACKAGING INFORMATION

Unless otherwise agreed in individual specifications, all products are subject to our “General Precautions and Guidelines” as well as our “Packaging Information”. Please refer to the following links in the table.

General Precautions & Guidelines	Packaging Information	3D Models	Reliability Tests

GROUP CHART



DISCLAIMER

All product related data (e.g. specification, statements and general information) are subject to change without any notice. It is necessary that the customer observes all product related technical / application information and handling instructions.

CapXon products are designed and manufactured according to severe quality and safety standards. Under no circumstance, CapXon warrants that any CapXon product is suitable for the purposes intended for your application, even CapXon knows the application. It is customer's duty and obligation to check and make sure that CapXon products are suitable for the purposes intended and select the correct and proper CapXon product. Customers are requested to perform a sufficient validation and reliability evaluation to assure needed safety level and reliability performance by suitable designs and to apply proper safeguards (e.g. redundancies, protective circuits).

Particular operating conditions (ambient temperature, ripple current, voltage, thermal resistance, etc.) as well as storage, production or assembly may affect the performance and the lifetime of the capacitor. Please consult CapXon for lifetime estimation, failure mode considerations or worst-case scenarios according to the product technology, product tolerances / deviations or change of the characteristics of the capacitor due to shipment, storage, handling, production and usage.

For aerospace or military application, life-saving, life-sustaining, safety critical applications or any application where failure may cause severe personal injury or death, please consult us before design-in the capacitor in your application.

Except for the written expressed warranties, CapXon does not impliedly, by assumption or whatever else, warrant, undertake, promise any other warranty or guaranty for any CapXon product.

For further information, please visit our website www.capxongroup.com or contact CapXon directly.

AM SERIES ▪ HIGH TEMPERATURE TYPE 150°C

KEY FEATURES

AEC-Q 200 · °C HIGH TEMPERATURE

- **HYBRID CONDUCTIVE POLYMER** ▪ THT type
- Endurance: 150°C ▪ 1 000 hours
- Low ESR and high ripple current
- Superior electrical stability over application lifetime
- AEC-Q200 version available

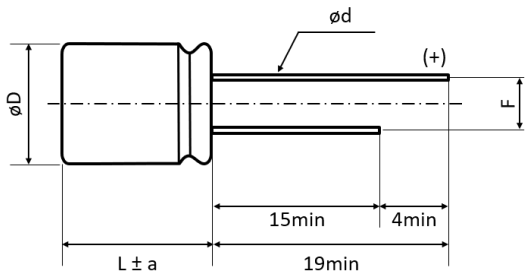
HF Halogen Free · RoHS & REACH COMPLIANT

SPECIFICATIONS

Items		Performance Characteristics
Operating Temperature Range		-55 ~ +150°C
Rated Voltage Range	V_R	16 ~ 80V DC
Surge Voltage	V_S	($V_R \leq 100V$): $V_S = 1.25 \cdot V_R$
Capacitance Range	C_R	8.2 ~ 560µF
Cap. Tolerance	ΔC	±20% (120Hz ▪ 20°C)
Leakage Current (20°C ▪ V_R applied)	I_{LEAK}	Not to exceed the values shown in standard ratings After 2 minutes
Dissipation Factor % (20°C ▪ 120Hz)	tanδ	Not to exceed the values shown in standard ratings
Equivalent Series Resistance (20°C ▪ 100kHz)	ESR	Not to exceed the values shown in standard ratings

Lifetime Test		
Endurance 150°C (V_R & I_R applied)	Test	**1 000 hours**
	$\triangle C/C_R$	Within ±30% of the initial value
	tanδ	Less than 200% of the specified value
	ESR	Less than 200% of the specified value
	I_{Leak}	Less than the specified value

DIMENSIONS ▪ All dimensions in mm



ø D	L	ØD±0.5	a	F±0.5	Ød±0.05
8	9	8	1.5	3.5	0.6
8	11.5	8	1.5	3.5	0.6
10	10	10	1.5	5	0.6
10	12.5	10	1.5	5	0.8

STANDARD RATINGS

V_R (V)	C_R (µF)	ø D (mm)	L (mm)	I_{LEAK} (µA, 2min)	tanδ +20°C ▪ 120Hz (%)	Max. ESR +20°C ▪ 100kHz (mΩ)	I_R ▪ Max. Ripple Current +150°C ▪ 100kHz (mA rms)	CapXon Part Number
16	270	8	9	43.2	16	25	770	AM271M016F090PTD ☐
	330	8	11.5	52.8	16	23	800	AM331M016F115PTD ☐
	470	10	10	75.2	16	20	880	AM471M016G100PTA ☐
	560	10	12.5	89.6	16	16	1010	AM561M016G125PTA ☐
25	150	8	9	37.5	16	27	750	AM151M025F090PTD ☐
	220	8	11.5	55.0	16	25	770	AM221M025F115PTD ☐
	270	10	10	67.5	16	22	850	AM271M025G100PTA ☐
	330	10	12.5	82.5	16	16	970	AM331M025G125PTA ☐
35	100	8	9	16.5	16	30	710	AM101M035F090PTD ☐
	150	8	11.5	35.0	16	27	730	AM151M035F115PTD ☐
	150	10	10	52.5	16	23	830	AM151M035G100PTA ☐
	220	10	12.5	77.0	16	18	950	AM221M035G125PTA ☐
40	56	8	9	22.4	16	30	650	AM560M040F090PTD ☐
	82	8	11.5	32.8	16	27	660	AM820M040F115PTD ☐
	100	10	10	40.0	16	25	720	AM101M040G100PTA ☐
	120	10	10	48.0	16	23	740	AM121M040G100PTA ☐
	180	10	12.5	48.0	16	20	850	AM181M040G125PTA ☐
50	33	8	9	16.5	16	35	550	AM330M050F090PTD ☐
	47	8	11.5	23.5	16	28	620	AM470M050F115PTD ☐
	56	10	10	28.0	16	28	660	AM560M050G100PTA ☐
	82	10	12.5	41.0	16	25	720	AM820M050G125PTA ☐
63	22	8	9	13.9	16	40	520	AM220M063F090PTD ☐
	27	8	11.5	17.0	16	35	540	AM270M063F115PTD ☐
	33	10	10	20.8	16	30	570	AM330M063G100PTA ☐
	47	10	10	29.6	16	30	570	AM470M063G100PTA ☐
	56	10	12.5	35.3	16	25	620	AM560M063G125PTA ☐
80	8.2	8	9	6.6	16	90	320	AM8R2M080F090PTD ☐
	12	10	10	9.6	16	70	440	AM120M080G100PTA ☐
	15	8	11.5	12.0	16	70	410	AM150M080F115PTD ☐
	15	10	10	12.0	16	70	440	AM150M080G100PTA ☐
	18	10	12.5	14.4	16	50	480	AM180M080G125PTA ☐

☐: Leave **blank** for Standard type ☐: Enter **X** for AEC-Q200 type

Part number shows taped version with straight leads and Ammo Pack packaging.

See "PACKAGING INFORMATION" for further lead treatment options.

MULTIPLIER K_f for RIPPLE CURRENT vs. FREQUENCY

Frequency (Hz)	100 ≤ Freq. < 120	120 ≤ Freq. < 200	200 ≤ Freq. < 300	300 ≤ Freq. < 500
Coefficient K_f	0.10	0.10	0.10	0.15

Frequency (Hz)	500 ≤ Freq. < 1k	1k ≤ Freq. < 2k	2k ≤ Freq. < 3k	3k ≤ Freq. < 5k
Coefficient K_f	0.20	0.30	0.40	0.45

Frequency (Hz)	5k ≤ Freq. < 10k	10k ≤ Freq. < 15k	15k ≤ Freq. < 20k	20k ≤ Freq. < 40k
Coefficient K_f	0.50	0.60	0.65	0.70

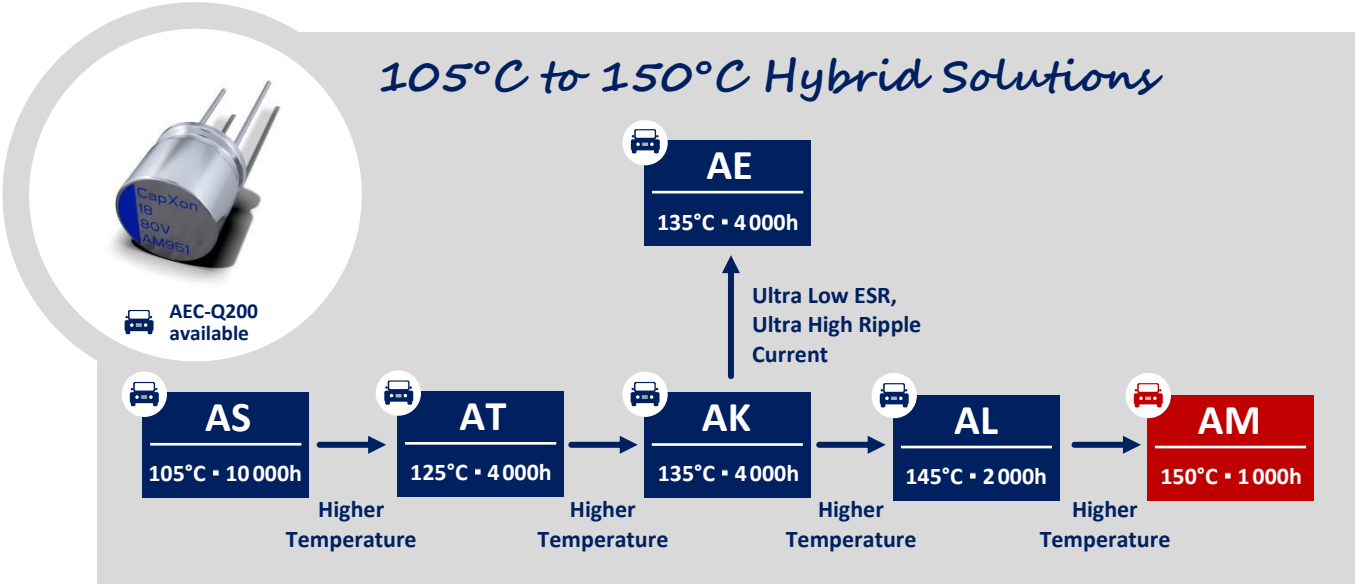
Frequency (Hz)	40k ≤ Freq. < 50k	50k ≤ Freq. < 100k	100k ≤ Freq. < 500k	500k ≤ Freq. < 1M
Coefficient K_f	0.80	0.85	1.00	1.05

PRECAUTIONS, GUIDELINES AND PACKAGING INFORMATION

Unless otherwise agreed in individual specifications, all products are subject to our “General Precautions and Guidelines” as well as our “Packaging Information”. Please refer to the following links in the table.

General Precautions & Guidelines	Packaging Information	3D Models	Reliability Tests

GROUP CHART



DISCLAIMER

All product related data (e.g. specification, statements and general information) are subject to change without any notice. It is necessary that the customer observes all product related technical / application information and handling instructions.

CapXon products are designed and manufactured according to severe quality and safety standards. Under no circumstance, CapXon warrants that any CapXon product is suitable for the purposes intended for your application, even CapXon knows the application. It is customer's duty and obligation to check and make sure that CapXon products are suitable for the purposes intended and select the correct and proper CapXon product. Customers are requested to perform a sufficient validation and reliability evaluation to assure needed safety level and reliability performance by suitable designs and to apply proper safeguards (e.g. redundancies, protective circuits).

Particular operating conditions (ambient temperature, ripple current, voltage, thermal resistance, etc.) as well as storage, production or assembly may affect the performance and the lifetime of the capacitor. Please consult CapXon for lifetime estimation, failure mode considerations or worst-case scenarios according to the product technology, product tolerances / deviations or change of the characteristics of the capacitor due to shipment, storage, handling, production and usage.

For aerospace or military application, life-saving, life-sustaining, safety critical applications or any application where failure may cause severe personal injury or death, please consult us before design-in the capacitor in your application.

Except for the written expressed warranties, CapXon does not impliedly, by assumption or whatever else, warrant, undertake, promise any other warranty or guaranty for any CapXon product.

For further information, please visit our website www.capxongroup.com or contact CapXon directly.

YS SERIES ▪ ECONOMY, LONG LIFE UP TO 10 000 HOURS TYPE

KEY FEATURES

ECONOMY

- **HYBRID CONDUCTIVE POLYMER** ▪ THT type
- Endurance: 105°C ▪ 5 000 up to 10 000 hours
- Low ESR and high ripple current
- Economy series for cost effective applications
- Lower leakage current than comparable solid polymer capacitors

HF Halogen Free

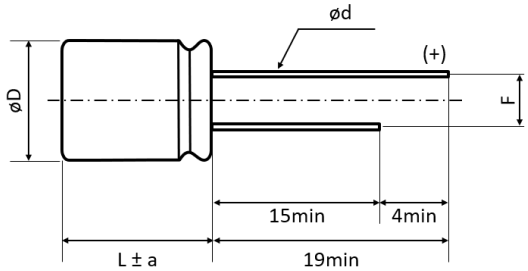
RoHS & REACH COMPLIANT

SPECIFICATIONS

Items		Performance Characteristics
Operating Temperature Range		-55 ~ +105°C
Rated Voltage Range	V_R	16 ~ 100V DC
Surge Voltage	V_S	($V_R \le 100V$): $V_S = 1.25 \cdot V_R$
Capacitance Range	C_R	8.2 ~ 1500µF
Cap. Tolerance	ΔC	±20% (120Hz ▪ 20°C)
Leakage Current (20°C ▪ V_R applied)	I_{LEAK}	Not to exceed the values shown in standard ratings After 2 minutes
Dissipation Factor % (20°C ▪ 120Hz)	tanδ	Not to exceed the values shown in standard ratings
Equivalent Series Resistance (20°C ▪ 100kHz)	ESR	Not to exceed the values shown in standard ratings

Lifetime Test			
Endurance 105°C (V_R & I_R applied)	Test	**10 000 hours**	≥ ø D 8 ▪ ≤ 100V
		5 000 hours	≤ ø D 6.3 ▪ ≤ 100V DC
	$\triangle C/C_R$	Within ±30% of the initial value	
	tanδ	Less than 200% of the specified value	
	ESR	Less than 200% of the specified value	
	I_{Leak}	Less than the specified value	

DIMENSIONS ▪ All dimensions in mm



ø D	L	ØD±0.5	a	F±0.5	Ød±0.05
6.3	8	6.3	1	2.5	0.6
8	9	8	1.5	3.5	0.6
8	11.5	8	1.5	3.5	0.6
10	10	10	1.5	5	0.6
10	12.5	10	1.5	5	0.8
10	18	10	2	5	0.8

STANDARD RATINGS

V_R (V)	C_R (µF)	ø D (mm)	L (mm)	I_{LEAK} (µA, 2min)	tanδ +20°C ▪ 120Hz (%)	Max. ESR +20°C ▪ 100kHz (mΩ)	I_R ▪ Max. Ripple Current +105°C ▪ 100kHz (mA rms)	CapXon Part Number
16	120	6.3	8	19.2	16	40	1500	YS121M016E080PTC
	270	8	9	43.2	16	26	2000	YS271M016F090PTD
	330	8	11.5	52.8	16	23	2350	YS331M016F115PTD
	470	10	10	75.2	16	21	2600	YS471M016G100PTA
	560	10	12.5	89.6	16	15	3000	YS561M016G125PTA
	1500	10	18	240.0	16	12	5000	YS152M016G180PTA
25	68	6.3	8	17.0	16	45	1400	YS680M025E080PTC
	150	8	9	37.5	16	27	1900	YS151M025F090PTD
	220	8	11.5	55.0	16	24	2250	YS221M025F115PTD
	270	10	10	67.5	16	22	2530	YS271M025G100PTA
	330	10	12.5	82.5	16	16	2900	YS331M025G125PTA
	1000	10	18	250,0	16	12	5000	YS102M025G180PTA
35	47	6.3	8	16.5	16	60	1300	YS470M035E080PTC
	100	8	9	35.0	16	30	1800	YS101M035F090PTD
	150	8	11.5	52.5	16	25	2100	YS151M035F115PTD
	150	10	10	52.5	16	23	2470	YS151M035G100PTA
	220	10	12.5	77.0	16	17	2830	YS221M035G125PTA
	680	10	18	238.0	16	14	4600	YS681M035G180PTA
40	27	6.3	8	10.8	16	70	1250	YS270M040E080PTC
	56	8	9	22.4	16	32	1750	YS560M040F090PTD
	82	8	11.5	32.8	16	27	2000	YS820M040F115PTD
	100	10	10	40.0	16	24	2400	YS101M040G100PTA
	120	10	10	48.0	16	18	2750	YS121M040G100PTA
	180	10	12.5	72.0	16	18	3000	YS181M040G125PTA
50	15	6.3	8	7.5	16	80	1200	YS150M050E080PTC
	33	8	9	16.5	16	35	1670	YS330M050F090PTD
	47	8	11.5	23.5	16	30	1900	YS470M050F115PTD
	56	10	10	28.0	16	25	2320	YS560M050G100PTA
	82	10	12.5	41.0	16	19	2650	YS820M050G125PTA
	220	10	18	110.0	16	15	4350	YS221M050G180PTA
63	10	6.3	8	6.3	16	100	1060	YS100M063E080PTC
	22	8	9	13.9	16	40	1560	YS220M063F090PTD
	27	8	11.5	17.0	16	35	1750	YS270M063F115PTD
	33	10	10	20.8	16	30	2100	YS330M063G100PTA
	47	10	10	29.6	16	30	2100	YS470M063G100PTA
	56	10	12.5	35.3	16	22	2400	YS560M063G125PTA
	150	10	18	94.5	16	18	4000	YS151M063G180PTA
80	8.2	8	9	6.6	16	90	1050	YS8R2M080F115PTD
	15	8	11.5	12.0	16	70	1400	YS150M080F115PTD
	12	10	10	9.6	16	70	1600	YS120M080G100PTA
	15	10	10	12.0	16	70	1600	YS150M080G100PTA
	18	10	12.5	14.4	16	50	1830	YS180M080G125PTA

Part number shows taped version with straight leads and Ammo Pack packaging.
See "PACKAGING INFORMATION" for further lead treatment options.

STANDARD RATINGS

V_R (V)	C_R (µF)	ø D (mm)	L (mm)	I_{LEAK} (µA, 2min)	tanδ +20°C ▪ 120Hz (%)	Max. ESR +20°C ▪ 100kHz (mΩ)	I_R ▪ Max. Ripple Current +105°C ▪ 100kHz (mA rms)	CapXon Part Number
100	8.2	8	9	8.2	16	100	1000	YS8R2M100F090PTD
	10	8	11.5	10.0	16	80	1300	YS100M100F115PTD
	10	10	10	10.0	16	80	1450	YS100M100G100PTA
	12	10	10	12.0	16	80	1450	YS120M100G100PTA
	15	10	12.5	15.0	16	60	1660	YS150M100G125PTA
	47	10	12.5	47.0	16	60	1660	YS470M100G125PTA

Part number shows taped version with straight leads and Ammo Pack packaging.
See "PACKAGING INFORMATION" for further lead treatment options.

MULTIPLIER K_f for RIPPLE CURRENT vs. FREQUENCY

Frequency (Hz)	100 ≤ Freq. < 120	120 ≤ Freq. < 200	200 ≤ Freq. < 300	300 ≤ Freq. < 500
Coefficient K_f	0.10	0.10	0.10	0.15

Frequency (Hz)	500 ≤ Freq. < 1k	1k ≤ Freq. < 2k	2k ≤ Freq. < 3k	3k ≤ Freq. < 5k
Coefficient K_f	0.20	0.30	0.40	0.45

Frequency (Hz)	5k ≤ Freq. < 10k	10k ≤ Freq. < 15k	15k ≤ Freq. < 20k	20k ≤ Freq. < 40k
Coefficient K_f	0.50	0.60	0.65	0.70

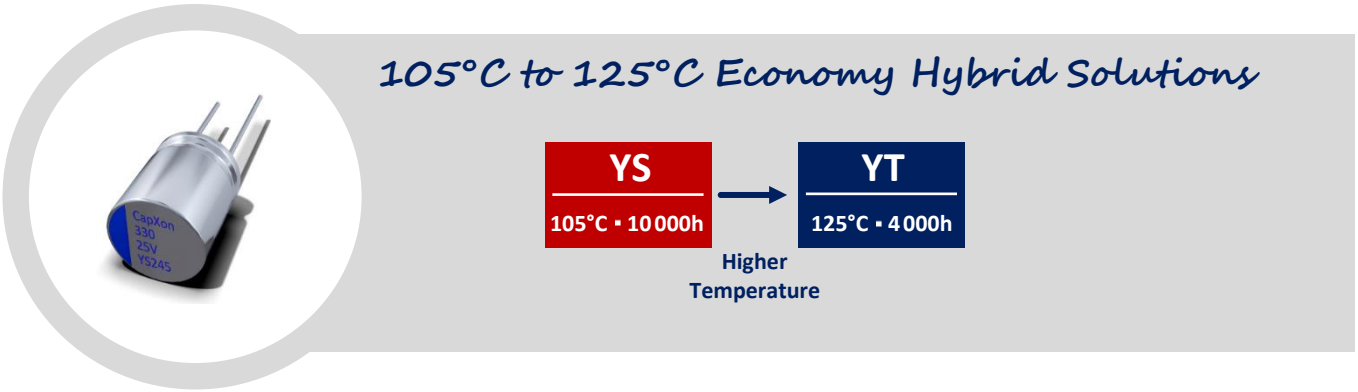
Frequency (Hz)	40k ≤ Freq. < 50k	50k ≤ Freq. < 100k	100k ≤ Freq. < 500k	500k ≤ Freq. < 1M
Coefficient K_f	0.80	0.85	1.00	1.05

PRECAUTIONS, GUIDELINES AND PACKAGING INFORMATION

Unless otherwise agreed in individual specifications, all products are subject to our "General Precautions and Guidelines" as well as our "Packaging Information". Please refer to the following links in the table.

General Precautions & Guidelines	Packaging Information	3D Models	Reliability Tests

GROUP CHART



DISCLAIMER

All product related data (e.g. specification, statements and general information) are subject to change without any notice. It is necessary that the customer observes all product related technical / application information and handling instructions.

CapXon products are designed and manufactured according to severe quality and safety standards. Under no circumstance, CapXon warrants that any CapXon product is suitable for the purposes intended for your application, even CapXon knows the application. It is customer's duty and obligation to check and make sure that CapXon products are suitable for the purposes intended and select the correct and proper CapXon product. Customers are requested to perform a sufficient validation and reliability evaluation to assure needed safety level and reliability performance by suitable designs and to apply proper safeguards (e.g. redundancies, protective circuits).

Particular operating conditions (ambient temperature, ripple current, voltage, thermal resistance, etc.) as well as storage, production or assembly may affect the performance and the lifetime of the capacitor. Please consult CapXon for lifetime estimation, failure mode considerations or worst-case scenarios according to the product technology, product tolerances / deviations or change of the characteristics of the capacitor due to shipment, storage, handling, production and usage.

For aerospace or military application, life-saving, life-sustaining, safety critical applications or any application where failure may cause severe personal injury or death, please consult us before design-in the capacitor in your application.

Except for the written expressed warranties, CapXon does not impliedly, by assumption or whatever else, warrant, undertake, promise any other warranty or guaranty for any CapXon product.

For further information, please visit our website www.capxongroup.com or contact CapXon directly.

YT SERIES ▪ ECONOMY, LONG LIFE AT 125°C TYPE

KEY FEATURES

ECONOMY

HIGH TEMPERATURE

- **HYBRID CONDUCTIVE POLYMER** ▪ THT type
- Endurance: 125°C ▪ 2 000 up to 4 000 hours
- Low ESR and high ripple current
- Economy series for cost effective applications
- Lower leakage current than comparable solid polymer capacitors

HF Halogen Free

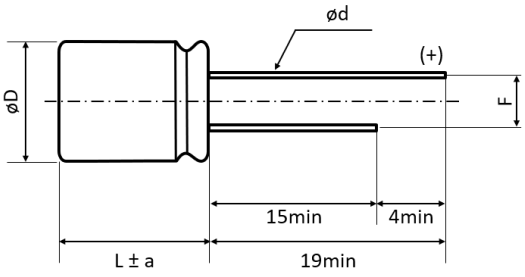
RoHS & REACH COMPLIANT

SPECIFICATIONS

Items		Performance Characteristics
Operating Temperature Range		-55 ~ +125°C
Rated Voltage Range	V_R	16 ~ 100V DC
Surge Voltage	V_S	($V_R \leq 100V$): $V_S = 1.25 \cdot V_R$
Capacitance Range	C_R	8.2 ~ 1500µF
Cap. Tolerance	ΔC	±20% (120Hz ▪ 20°C)
Leakage Current (20°C ▪ V_R applied)	I_{LEAK}	Not to exceed the values shown in standard ratings After 2 minutes
Dissipation Factor % (20°C ▪ 120Hz)	tanδ	Not to exceed the values shown in standard ratings
Equivalent Series Resistance (20°C ▪ 100kHz)	ESR	Not to exceed the values shown in standard ratings

Lifetime Test			
Endurance 125°C (V_R & I_R applied)	Test	**4 000 hours**	≥ ø D 8
		2 000 hours	≤ ø D 6.3
	$\triangle C/C_R$	Within ±30% of the initial value	
	tanδ	Less than 200% of the specified value	
	ESR	Less than 200% of the specified value	
	I_{Leak}	Less than the specified value	

DIMENSIONS ▪ All dimensions in mm



ø D	L	ØD±0.5	a	F±0.5	Ød±0.05
6.3	8	6.3	1	2.5	0.6
8	9	8	1.5	3.5	0.6
8	11.5	8	1.5	3.5	0.6
10	10	10	1.5	5	0.6
10	12.5	10	1.5	5	0.8
10	18	10	2	5	0.8

STANDARD RATINGS

V_R (V)	C_R (µF)	ø D (mm)	L (mm)	I_{LEAK} (µA, 2min)	tanδ +20°C ▪ 120Hz (%)	Max. ESR +20°C ▪ 100kHz (mΩ)	I_R ▪ Max. Ripple Current +125°C ▪ 100kHz (mA rms)	CapXon Part Number
16	120	6.3	8	19.2	16	32	1440	YT121M016E080PTC
	270	8	9	43.2	16	23	1970	YT271M016F090PTD
	330	8	11.5	52.8	16	20	2340	YT331M016F115PTD
	470	10	10	75.2	16	18	2620	YT471M016G100PTA
	560	10	12.5	89.6	16	14	3030	YT561M016G125PTA
	1500	10	18	240.0	16	12	4000	YT152M016G180PTA
25	68	6.3	8	17.0	16	35	1380	YT680M025E080PTC
	150	8	9	37.5	16	25	1880	YT151M025F090PTD
	220	8	11.5	55.0	16	22	2230	YT221M025F115PTD
	270	10	10	67.5	16	19	2500	YT271M025G100PTA
	330	10	12.5	82.5	16	14	2890	YT331M025G125PTA
	1000	10	18	250.0	16	12	4000	YT102M025G180PTA
35	47	6.3	8	16.5	16	45	1280	YT470M035E080PTC
	100	8	9	35.0	16	28	1780	YT101M035F090PTD
	150	8	11.5	52.5	16	25	2100	YT151M035F115PTD
	150	10	10	52.5	16	20	2440	YT151M035G100PTA
	220	10	12.5	77.0	16	15	2800	YT221M035G125PTA
	680	10	18	238.0	16	14	3700	YT681M035G180PTA
40	27	6.3	8	10.8	16	48	1230	YT270M040E080PTC
	56	8	9	22.4	16	30	1710	YT560M040F090PTD
	82	8	11.5	32.8	16	27	2000	YT820M040F115PTD
	100	10	10	40.0	16	21	2360	YT101M040G100PTA
	120	10	10	48.0	16	20	2400	YT121M040G100PTA
	180	10	12.5	72.0	16	18	2550	YT181M040G125PTA
50	15	6.3	8	7.5	16	80	960	YT150M050E080PTC
	33	8	9	16.5	16	35	1330	YT330M050F090PTD
	47	8	11.5	23.5	16	30	1520	YT470M050F115PTD
	56	10	10	28.0	16	30	1850	YT560M050G100PTA
	82	10	12.5	41.0	16	25	2120	YT820M050G125PTA
	220	10	18	110.0	16	15	3500	YT221M050G180PTA
63	10	6.3	8	6.3	16	100	840	YT100M063E080PTC
	22	8	9	13.9	16	40	1240	YT220M063F090PTD
	27	8	11.5	17	16	35	1400	YT270M063F115PTD
	33	10	10	20.8	16	35	1680	YT330M063G100PTA
	47	10	10	29.6	16	35	1680	YT470M063G100PTA
	56	10	12.5	35.3	16	30	1920	YT560M063G125PTA
	150	10	18	94.5	16	18	3200	YT151M063G180PTA
80	8.2	8	9	6.6	16	90	840	YT8R2M080F090PTD
	15	8	11.5	12	16	70	1120	YT150M080F115PTD
	12	10	10	9.6	16	70	1280	YT120M080G100PTA
	15	10	10	12	16	70	1280	YT150M080G100PTA
	18	10	12.5	14.4	16	60	1460	YT180M080G125PTA

Part number shows taped version with straight leads and Ammo Pack packaging.
See "PACKAGING INFORMATION" for further lead treatment options.

STANDARD RATINGS

V_R (V)	C_R (µF)	ø D (mm)	L (mm)	I_{LEAK} (µA, 2min)	tanδ +20°C ▪ 120Hz (%)	Max. ESR +20°C ▪ 100kHz (mΩ)	I_R ▪ Max. Ripple Current +125°C ▪ 100kHz (mA rms)	CapXon Part Number
100	8.2	8	9	8.2	16	100	800	YT8R2M100F090PTD
	10	8	11.5	10	16	80	1040	YT100M100F115PTD
	10	10	10	10	16	80	1160	YT100M100G100PTA
	12	10	10	12	16	80	1160	YT120M100G100PTA
	15	10	12.5	15	16	70	1320	YT150M100G125PTA
	47	10	12.5	15	16	70	1320	YT470M100G125PTA

Part number shows taped version with straight leads and Ammo Pack packaging.
See "PACKAGING INFORMATION" for further lead treatment options.

MULTIPLIER K_f for RIPPLE CURRENT vs. FREQUENCY

Frequency (Hz)	100 ≤ Freq. < 120	120 ≤ Freq. < 200	200 ≤ Freq. < 300	300 ≤ Freq. < 500
Coefficient K_f	0.10	0.10	0.10	0.15

Frequency (Hz)	500 ≤ Freq. < 1k	1k ≤ Freq. < 2k	2k ≤ Freq. < 3k	3k ≤ Freq. < 5k
Coefficient K_f	0.20	0.30	0.40	0.45

Frequency (Hz)	5k ≤ Freq. < 10k	10k ≤ Freq. < 15k	15k ≤ Freq. < 20k	20k ≤ Freq. < 40k
Coefficient K_f	0.50	0.60	0.65	0.70

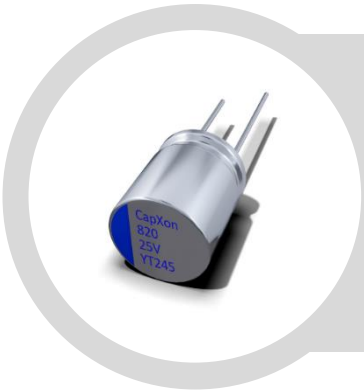
Frequency (Hz)	40k ≤ Freq. < 50k	50k ≤ Freq. < 100k	100k ≤ Freq. < 500k	500k ≤ Freq. < 1M
Coefficient K_f	0.80	0.85	1.00	1.05

PRECAUTIONS, GUIDELINES AND PACKAGING INFORMATION

Unless otherwise agreed in individual specifications, all products are subject to our "General Precautions and Guidelines" as well as our "Packaging Information". Please refer to the following links in the table.

General Precautions & Guidelines	Packaging Information	3D Models	Reliability Tests

GROUP CHART



105°C to 125°C Economy Hybrid Solutions

YS — 105°C ▪ 10 000h → **YT** — 125°C ▪ 4 000h

Higher Temperature

DISCLAIMER

All product related data (e.g. specification, statements and general information) are subject to change without any notice. It is necessary that the customer observes all product related technical / application information and handling instructions.

CapXon products are designed and manufactured according to severe quality and safety standards. Under no circumstance, CapXon warrants that any CapXon product is suitable for the purposes intended for your application, even CapXon knows the application. It is customer's duty and obligation to check and make sure that CapXon products are suitable for the purposes intended and select the correct and proper CapXon product. Customers are requested to perform a sufficient validation and reliability evaluation to assure needed safety level and reliability performance by suitable designs and to apply proper safeguards (e.g. redundancies, protective circuits).

Particular operating conditions (ambient temperature, ripple current, voltage, thermal resistance, etc.) as well as storage, production or assembly may affect the performance and the lifetime of the capacitor. Please consult CapXon for lifetime estimation, failure mode considerations or worst-case scenarios according to the product technology, product tolerances / deviations or change of the characteristics of the capacitor due to shipment, storage, handling, production and usage.

For aerospace or military application, life-saving, life-sustaining, safety critical applications or any application where failure may cause severe personal injury or death, please consult us before design-in the capacitor in your application.

Except for the written expressed warranties, CapXon does not impliedly, by assumption or whatever else, warrant, undertake, promise any other warranty or guaranty for any CapXon product.

For further information, please visit our website www.capxongroup.com or contact CapXon directly.

PRODUCT CODE ▪ SMD HYBRID CONDUCTIVE POLYMER CAPACITORS

SMD type example:
AA series ▪ 220µF ▪ 25V ▪ ±20% ▪ Ø 8mm ▪ L 10.5mm ▪ Tape & Reel ▪ AEC-Q200 ▪ Vibration proof package

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	A	2	2	1	M	0	2	5	F	1	0	5	P	T	R	X	W	-	-

Series

Capacitance

Code	µF
010	1
4R7	4.7
100	10
101	100
102	1000
152	1500

Capacitance tolerance

Code	%
M	±20

Voltage

Code	Volt
016	16
025	25
035	35
050	50
063	63
080	80
100	100
200	200

Case Ø (mm)

Code	ØD
C	5
E	6.3
F	8
G	10

Height (mm)

Code	H
058	5.8
077	7.7
105	10.5
117	11.7
124	12.4
165	16.5

Type code

Code	Type
P	Polymer

Taping

Code	
TR	Tape on reel

Special requirement

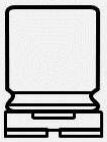
Code	Special
U	Plastic reel
W	Vibration proof
X	AEC-Q200

See datasheet for reference

Please consult CapXon for further assistance

MARKING ▪ SMD HYBRID CONDUCTIVE POLYMER CAPACITORS

Hybrid Polymer Capacitor ▪ SMD type



CapXon:	Manufacturer trademark
220:	Nominal capacitance (µF)
25V:	Rated voltage (V) ▪ Standard type
25X:	Rated voltage (V) ▪ AEC-Q200 type
	(-) polarity (Cathode indicate)
AA:	AA Series
003:	Production datacode year/week (ex. 2020/3rd week)

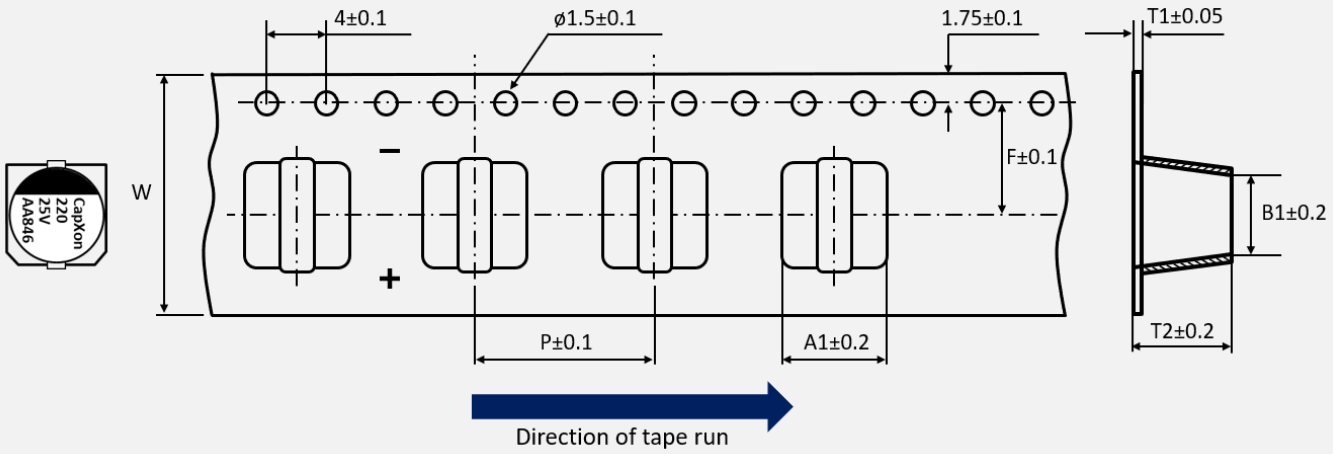
Top view Standard type

Top view AEC-Q200 type

0 03
Production week
Last digit of the year

TAPING ▪ SMD HYBRID CONDUCTIVE POLYMER CAPACITORS ▪ REEL PACK

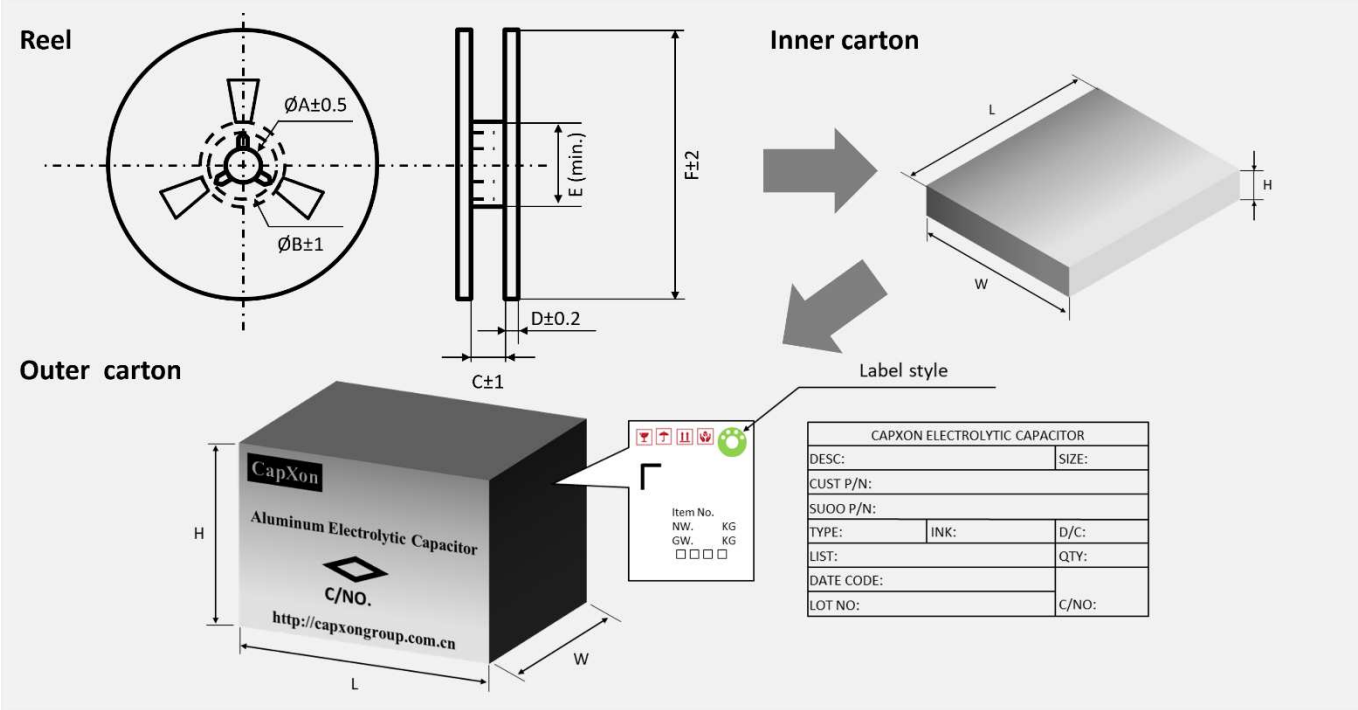
SMD taping ▪ ØD 5mm to 10mm



All dimensions in mm

Ø D	5 x 5.8	6.3 x 5.8	6.3 x 7.7	8 x 10.5	8 x 11.7	10 x 10.5	10 x 12.4	10 x 16.5
W	12	16	16	24	24	24	24	24
P	12	12	12	16	16	16	16	16
F	5.5	7.5	7.5	11.5	11.5	11.5	11.5	11.5
A1	5.7	7	7	8.7	8.7	10.7	10.7	10.7
B1	5.7	7	7	8.7	8.7	10.7	10.7	10.7
T1	0.4	0.4	0.4	0.4	0.5	0.4	0.5	0.5
T2	6.1	6.2	8	11	13	11	12.9	17.5

TAPING ▪ SMD HYBRID CONDUCTIVE POLYMER CAPACITORS ▪ REEL PACK ▪ PAPER REEL



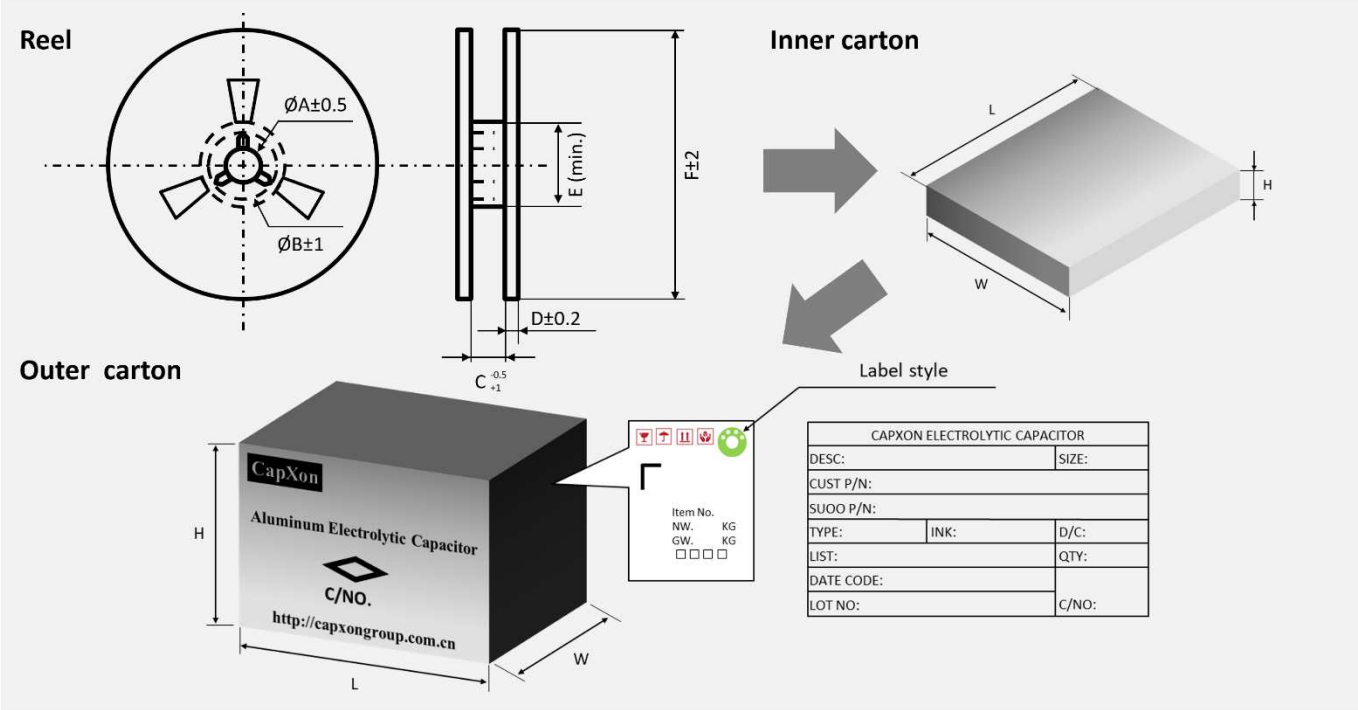
Ø D (mm)	L (mm)	Reel quantity (pcs)	Inner box quantity (pcs)	Inner box size L x W x H (mm)	Outer box quantity (pcs)	Outer box size L x W x H (mm)	Country of origin	Tariff number
5	5.8	1000	5000	400 x 390 x 106	15000	425 x 412 x 340	China	85322200
6.3	5.8	1000	4000	400 x 390 x 106	12000	425 x 412 x 340	China	85322200
	7.7	900	3600	400 x 390 x 106	10800	425 x 412 x 340	China	85322200
8	10.5	500	1500	400 x 390 x 106	4500	425 x 412 x 340	China	85322200
	11.7	400	1200	400 x 390 x 106	3600	425 x 412 x 340	China	85322200
10	10.5	500	1500	400 x 390 x 106	4500	425 x 412 x 340	China	85322200
	12.4	400	1200	400 x 390 x 106	3600	425 x 412 x 340	China	85322200
	16.5	250	750	400 x 390 x 106	2250	425 x 412 x 340	China	85322200

All reel dimensions in mm

Ø D	5	6.3	6.3	8	8	10	10	10
L	5.8	5.8	7.7	10.5	11.7	10.5	12.4	16.5
A	15	15	15	15	15	15	15	15
B	21	21	21	21	21	21	21	21
C	14	18	18	26	26	26	26	26
D	3	3	3	3	3	3	3	3
E	80	80	80	80	80	80	80	80
F	380	380	380	380	380	380	380	380

Remark: Standard = Paper reel

TAPING ▪ SMD HYBRID CONDUCTIVE POLYMER CAPACITORS ▪ REEL PACK ▪ PLASTIC REEL



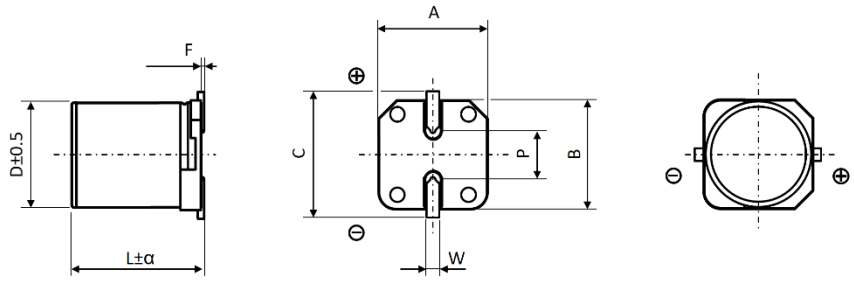
Ø D (mm)	L (mm)	Reel quantity (pcs)	Inner box quantity (pcs)	Inner box size L x W x H (mm)	Outer box quantity (pcs)	Outer box size L x W x H (mm)	Country of origin	Tariff number
5	5.8	1000	5000	400 x 390 x 106	15000	425 x 412 x 340	China	85322200
6.3	5.8	1000	4000	400 x 390 x 106	12000	425 x 412 x 340	China	85322200
	7.7	900	3600	400 x 390 x 106	10800	425 x 412 x 340	China	85322200
8	10.5	500	1500	400 x 390 x 106	4500	425 x 412 x 340	China	85322200
	11.7	400	1200	400 x 390 x 106	3600	425 x 412 x 340	China	85322200
10	10.5	500	1500	400 x 390 x 106	4500	425 x 412 x 340	China	85322200
	12.4	400	1200	400 x 390 x 106	3600	425 x 412 x 340	China	85322200
	16.5	250	750	400 x 390 x 106	2250	425 x 412 x 340	China	85322200

All reel dimensions in mm

Ø D	5	6.3	6.3	8	8	10	10	10
L	5.8	5.8	7.7	10.5	11.7	10.5	12.4	16.5
A	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2
B	21.5	21.5	21.5	21.5	21.5	21.5	21.5	21.5
C	13	17	17	25	25	25	25	25
D	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
E	100	100	100	100	100	100	100	100
F	380	380	380	380	380	380	380	380

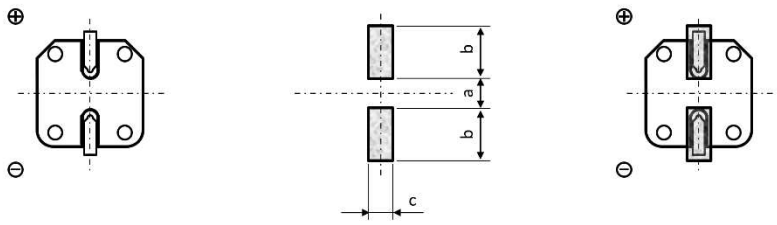
Remark: Plastic reel = Add code "U" at the end of the part number

DIMENSIONS STANDARD PACKAGE ▪ All dimensions in mm



ø D	L	α	A ± 0.2	B ± 0.2	C ± 0.2	F	P ± 0.2	W
5.0	5.8	0.3	5.3	5.3	5.9	0 to 0.3	1.4	0.5 to 0.8
6.3	5.8	0.3	6.6	6.6	7.2	0 to 0.3	2.2	0.5 to 0.8
6.3	7.7	0.3	6.6	6.6	7.2	0 to 0.3	2.2	0.5 to 0.8
8.0	10.5	0.3	8.3	8.3	9.0	0 to 0.3	3.1	0.7 to 1.1
8.0	11.7	0.3	8.3	8.3	9.0	0 to 0.3	3.1	0.7 to 1.1
10.0	10.5	0.3	10.3	10.3	11.0	0 to 0.3	4.5	0.7 to 1.1
10.0	12.4	0.3	10.3	10.3	11.0	0 to 0.3	4.5	1.0 to 1.4
10.0	16.5	0.3	10.3	10.3	11.0	0 to 0.3	4.5	1.0 to 1.4

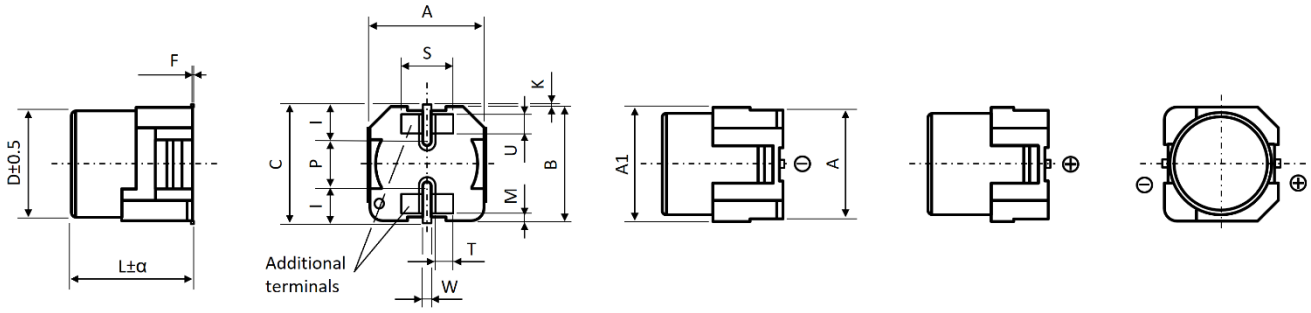
PAD LAYOUT STANDARD PACKAGE ▪ All dimensions in mm



Bottom view **Recommended land patterns** **Capacitor mounted on pads**

ø D	L	a	b	c
5.0	5.8	1.4	3.0	1.6
6.3	5.8	2.1	3.5	1.6
6.3	7.7	2.1	3.5	1.6
8.0	10.5	2.8	4.2	1.9
8.0	11.7	2.8	4.2	1.9
10.0	10.5	4.3	4.4	1.9
10.0	12.4	4.3	4.4	2.2
10.0	16.5	4.3	4.4	2.2

DIMENSIONS VP PACKAGE (VIBRATION-PROOF) Ø D6.3 ▪ All dimensions in mm

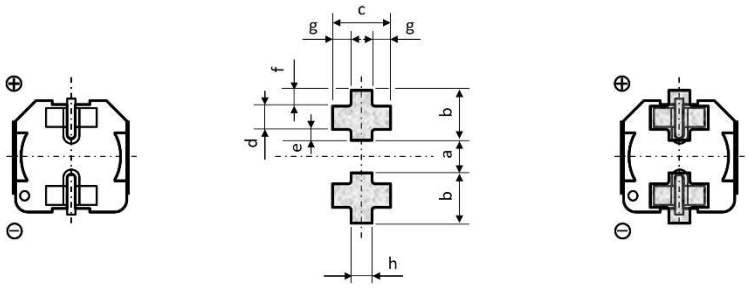


Note: Additional terminals electrical connected to anode or cathode terminal.

ø D	L	α	A ± 0.2	A1 (max.)	B ± 0.2	C (max.)	F	K
6.3	5.8	-0.3/+0.7	6.6	7.1	6.6	7.8	0 to 0.15	0.35 +0.15/-0.2
6.3	7.7	-0.3/+0.7	6.6	7.1	6.6	7.8	0 to 0.15	0.35 +0.15/-0.2

ø D	L	I ± 0.1	M ± 0.1	P ± 0.2	S ± 0.1	T ± 0.1	U ± 0.1	W ± 0.1
6.3	5.8	2.5	0.35	2.2	3.2	1.1	0.7	0.65
6.3	7.7	2.5	0.35	2.2	3.2	1.1	0.7	0.65

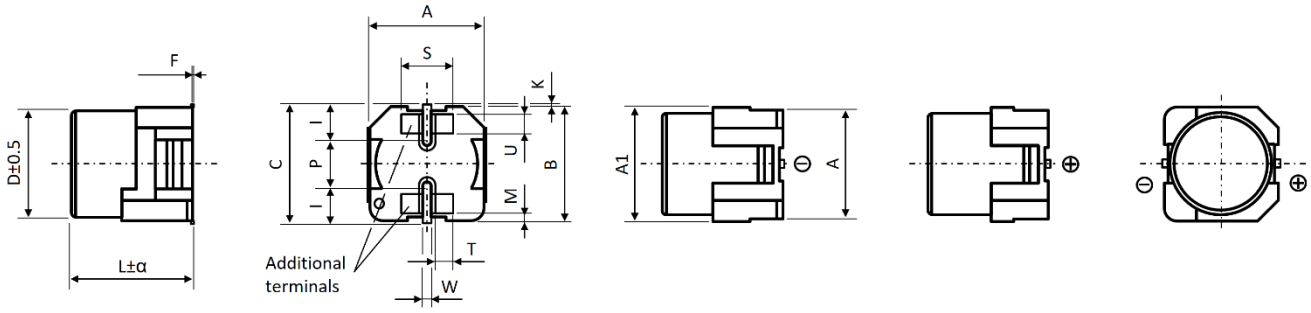
PAD LAYOUT VP PACKAGE (VIBRATION-PROOF) Ø D6.3 ▪ All dimensions in mm



Bottom view **Recommended land patterns** **Capacitor mounted on pads**

ø D	L	a	b	c	d	e	f	g	h
6.3	5.8	1.2	3.6	3.2	2.0	0.95	0.65	1.0	1.2
6.3	7.7	1.2	3.6	3.2	2.0	0.95	0.65	1.0	1.2

DIMENSIONS VP PACKAGE (VIBRATION-PROOF) Ø D8 and D10 ▪ All dimensions in mm

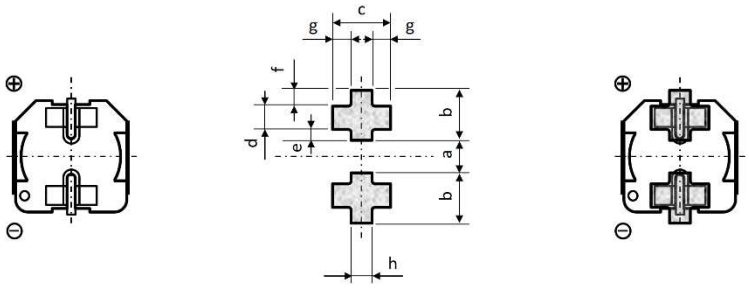


Note: Additional terminals electrical connected to anode or cathode terminal.

ø D	L	α	A ± 0.2	A1 (max.)	B ± 0.2	C (max.)	F	K ± 0.2
8.0	10.5	-0.3/+0.7	8.3	8.8	8.3	10.0	0 to 0.15	0.7
8.0	11.7	-0.3/+0.7	8.3	8.8	8.3	10.0	0 to 0.15	0.7
10.0	10.5	-0.3/+0.7	10.3	10.8	10.3	12.0	0 to 0.15	0.7
10.0	12.4	-0.3/+0.7	10.3	10.8	10.3	12.0	0 to 0.15	0.7
10.0	16.5	-0.3/+0.7	10.3	10.8	10.3	12.0	0 to 0.15	0.7

ø D	L	I ± 0.1	M ± 0.1	P ± 0.2	S ± 0.1	T ± 0.1	U ± 0.1	W ± 0.1
8.0	10.5	3.3	0.75	3.1	3.3	0.9	0.7	1.2
8.0	11.7	3.3	0.75	3.1	3.3	0.9	0.7	1.2
10.0	10.5	3.5	0.9	4.6	3.3	0.9	0.8	1.2
10.0	12.4	3.5	0.9	4.6	3.3	0.9	0.8	1.2
10.0	16.5	3.5	0.9	4.6	3.3	0.9	0.8	1.2

PAD LAYOUT VP PACKAGE (VIBRATION-PROOF) Ø D8 and D10 ▪ All dimensions in mm



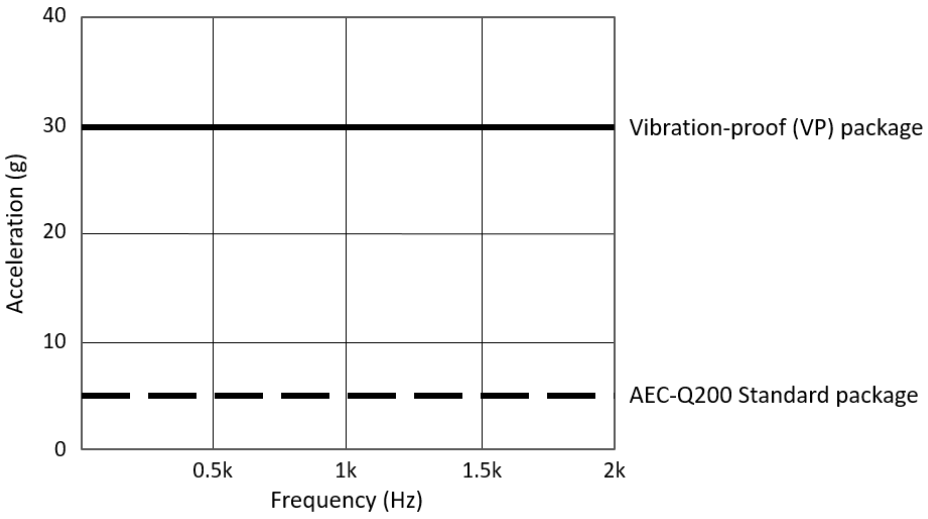
Bottom view **Recommended land patterns** **Capacitor mounted on pads**

ø D	L	a	b	c	d	e	f	g	h
8.0	10.5	2.7	4.0	4.7	1.3	1.0	1.7	1.1	2.5
8.0	11.7	2.7	4.0	4.7	1.3	1.0	1.7	1.1	2.5
10.0	10.5	3.9	4.4	4.7	1.3	1.2	1.9	1.1	2.5
10.0	12.4	3.9	4.4	4.7	1.3	1.2	1.9	1.1	2.5
10.0	16.5	3.9	4.4	4.7	1.3	1.2	1.9	1.1	2.5

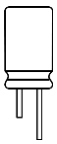
VIBRATION SPECIFICATION ▪ STANDARD AND VIBRATION PROOF PACKAGE

Reference JIS C 60068-2 / IEC 60068-2-6

Package	Condition	Determinant Standard
Standard	1. 10Hz ~ 2kHz ~ 10Hz (20 minutes) 2. Amplitude (single peak): 0.35 mm (at 10 ~ 55Hz) 3. Acceleration: 49m/s^2 (5g at 55 ~ 2kHz) 4. X, Y, Z directions, 4 hours per direction, total 12 hours	1. ΔC/C ≤ ±5% of initial value 2. DF ≤ stated limit 3. LC ≤ stated limit 4. No visible damage 5. No leakage of electrolyte
Vibration-proof	1. 10Hz ~ 2kHz ~ 10Hz (10 minutes) 2. Amplitude (single peak): 2 mm (at 10 ~ 55Hz) 3. Acceleration: 294m/s^2 (30g at 55 ~ 2kHz) 4. X, Y, Z directions, 4 hours per direction, total 12 hours	1. ΔC/C ≤ ±5% of initial value 2. DF ≤ stated limit 3. LC ≤ stated limit 4. No visible damage 5. No leakage of electrolyte



PRODUCT CODE ▪ RADIAL HYBRID CONDUCTIVE POLYMER CAPACITORS



THT type example:
AT series ▪ 47µF ▪ 50V ▪ ±20% ▪ Ø 8mm ▪ L 11.5mm ▪ P 3.5mm ▪ Tape Ammo ▪ AEC-Q200

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	T	4	7	0	M	0	5	0	F	1	1	5	P	T	D	X	-	-	-
Series		Capacitance			Capacitance tolerance	Voltage			Case Ø (mm)	Height (mm)			Type code	Taping / lead treatment *		Special requirement			

Code	µF
010	1
4R7	4.7
100	10
101	100
102	1000
152	1500

Code	%
M	±20

Code	Volt
016	16
025	25
035	35
040	40
050	50
063	63
080	80
100	100
250	250
400	400

Code	ØD
E	6.3
F	8
G	10

Code	H
080	8
090	9
100	10
115	11.5
125	12.5
160	16
180	18

Code	Type
P	Polymer

Code	Pitch (mm)
TC	2.5
TD	3.5
TA	5

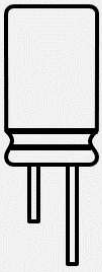
Code	Special
X	AEC-Q200

See datasheet for reference

* See chapter taping or lead treatment for further information
Please consult CapXon for further assistance

MARKING ▪ RADIAL HYBRID POLYMER CAPACITORS

Hybrid Polymer Capacitor ▪ Radial type



CapXon:	Manufacturer trademark
47:	Nominal capacitance (µF)
50V:	Rated voltage (V) ▪ Standard type
50X:	Rated voltage (V) ▪ AEC-Q200 type
	(-) polarity (Cathode indicate)
AT:	AT Series
003:	Production datacode year/week (ex. 2020/3rd week)

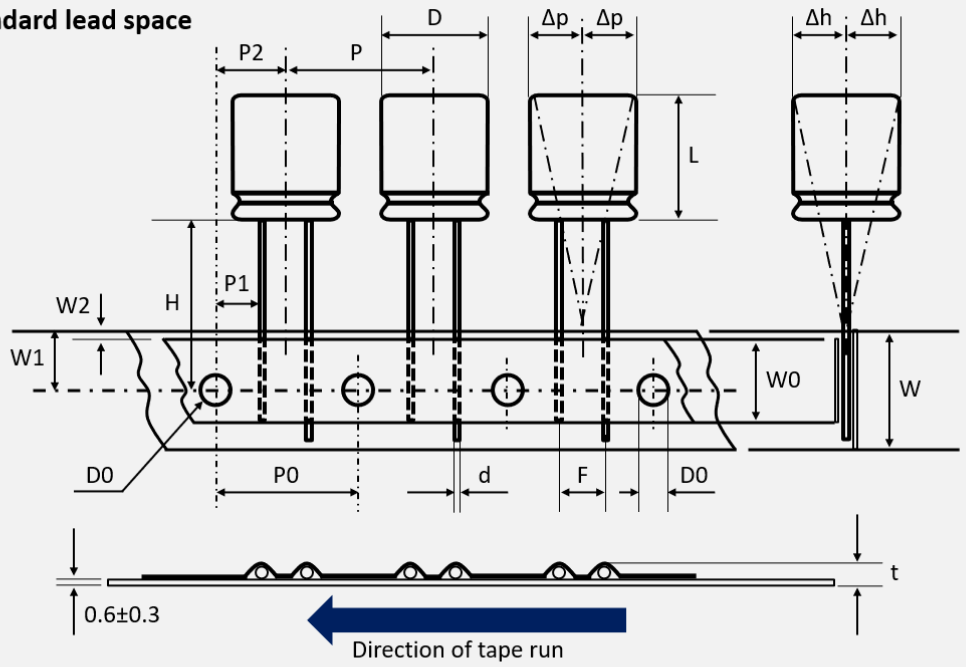
Top view Standard type

Top view AEC-Q200 type

0 03
Production week
Last digit of the year

TAPING ▪ RADIAL HYBRID POLYMER CAPACITORS ▪ AMMO PACK

Taping ▪ ØD ≥6.3mm ▪ standard lead space



Example

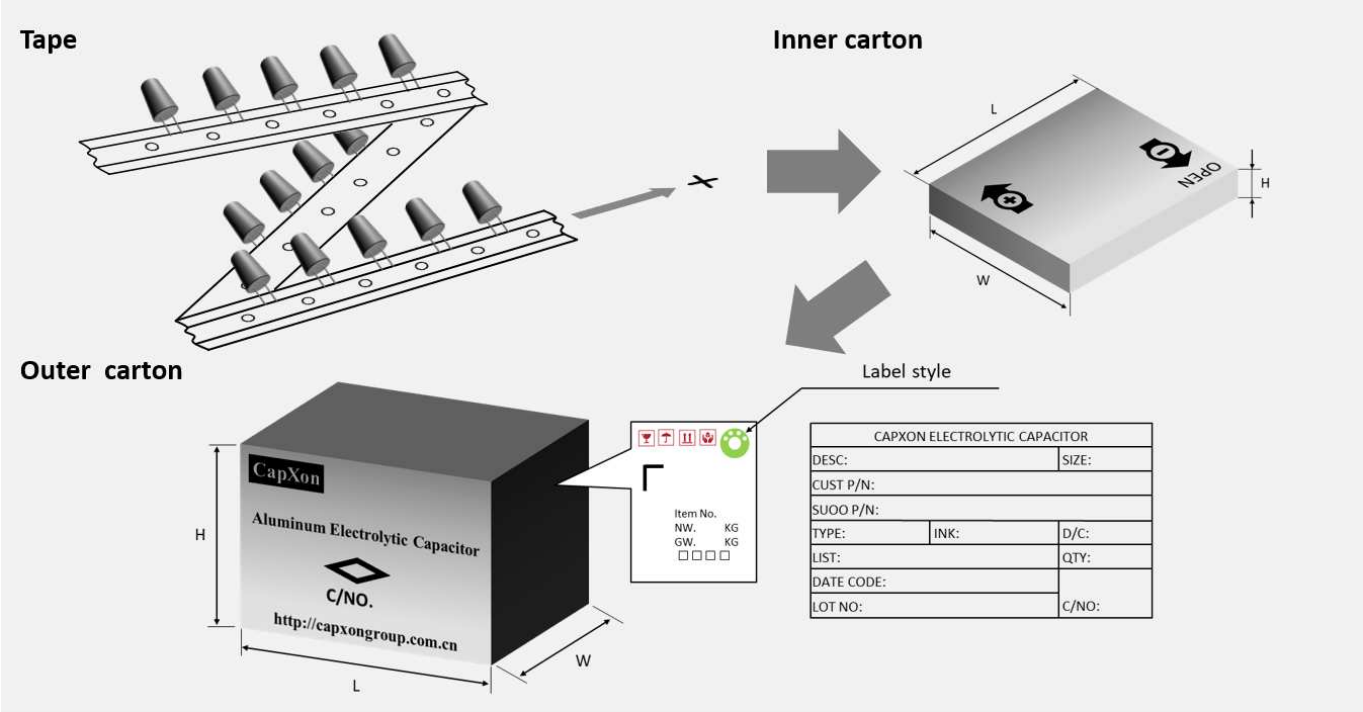
A S	2 2 1	M	0 2 5	F	1 1 5	P	T D	- - - -
Series	Capacitance	Tolerance	Voltage	ØD (mm)	Height (mm)	Type code	Lead treatment	Special requirement

All dimensions in mm

	D	L	d	P	P0	P1	P2	F	W	W0	W1	W2	H	D0	Δh	Δp	t	Code
Tol	±0.5	-	±0.02	±1.0	±0.2	±0.7	±1.3	+0.4 -0.2	±0.5	±0.5	±0.5	Max	+0.75 -0.5	±0.2	Max	Max	Max	
Item	6.3	8 (±1)	0.6	12.7	12.7	5.1	6.35	**2.5**	18	11	9	2	18.5	4	1	1	1.5	TC
	8	9 (±1.5)	0.6	12.7	12.7	4.6	6.35	**3.5**	18	11	9	2	18.5	4	1	1	1.5	TD
		11.5 (±1.5)																
	10	10 (±1.5)	0.6	12.7	12.7	3.85	6.35	**5**	18	11	9	2	18.5	4	1	1	1.5	TA
		12.5 (±1.5)	0.8															
		16 (±2)																
		18 (±2)																

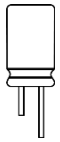
The negative lead (cathode) is in the front, i.e. in the direction of tape run.

TAPING ▪ RADIAL HYBRID POLYMER CAPACITORS ▪ AMMO PACK



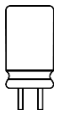
Ø D (mm)	Length L (mm)	Inner box quantity (pcs)	Inner box size L x W x H (mm)	Outer box quantity (pcs)	Outer box size L x W x H (mm)	Country of origin	Tariff number
6.3	8	1500	331 x 227 x 51	15000	474 x 343 x 285	China	85322200
8	9 to 11.5	800	331 x 227 x 51	8000	474 x 343 x 285	China	85322200
10	10 to 12.5	600	331 x 227 x 51	6000	474 x 343 x 285	China	85322200
	16	600	331 x 227 x 51	6000	474 x 343 x 285	China	85322200
	18	600	331 x 227 x 51	6000	474 x 343 x 285	China	85322200

PACKAGING ▪ RADIAL HYBRID POLYMER CAPACITORS
STRAIGHT LEADS ▪ BULK PACK



Ø D (mm)	Length L (mm)	Inner bag / Inner row (pcs)	Inner box quantity (pcs)	Inner box size L x W x H (mm)	Outer box quantity (pcs)	Outer box size L x W x H (mm)	Country of origin	Tariff number
6.3	8	600/bag	7200	295 x 181 x 222	7200	295 x 181 x 222	China	85322200
8	9	450/bag	5400	295 x 181 x 222	5400	295 x 181 x 222	China	85322200
	11.5	300/bag	3600	295 x 181 x 222	3600	295 x 181 x 222	China	85322200
10	10	300/bag	3600	295 x 181 x 222	3600	295 x 181 x 222	China	85322200
	12.5	200/bag	2400	295 x 181 x 222	2400	295 x 181 x 222	China	85322200
	16	200/bag	2400	295 x 181 x 222	2400	295 x 181 x 222	China	85322200
	18	150/bag	1800	295 x 181 x 222	1800	295 x 181 x 222	China	85322200

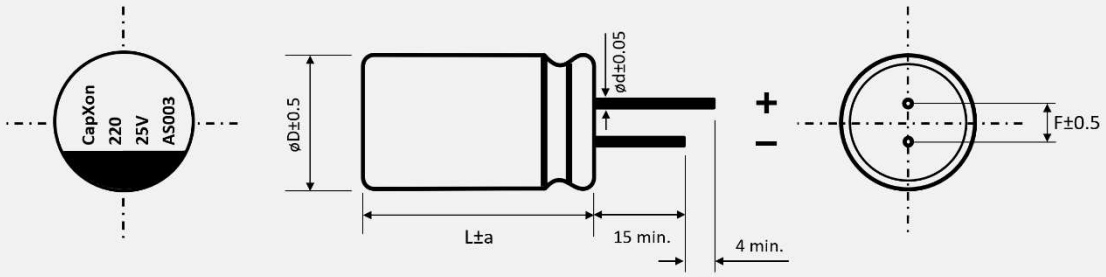
PACKAGING ▪ RADIAL HYBRID POLYMER CAPACITORS
CUTTED LEADS ▪ BULK PACK



Ø D (mm)	Length L (mm)	Inner bag / Inner row (pcs)	Inner box quantity (pcs)	Cutting height (mm)	Outer box quantity (pcs)	Outer carton quantity (pcs)	Country of origin	Tariff number
6.3	8	800/bag	800/box	≤ 7	9600	9600	China	85322200
8	9	600/bag	600/box	≤ 7	7200	7200	China	85322200
	11.5	500/bag	500/box	≤ 7	6000	6000	China	85322200
10	10	400/bag	400/box	≤ 7	4800	4800	China	85322200
	12.5	300/bag	300/box	≤ 7	3600	3600	China	85322200
	16	250/bag	250/box	≤ 7	3000	3000	China	85322200
	18	200/bag	200/box	≤ 7	2400	2400	China	85322200

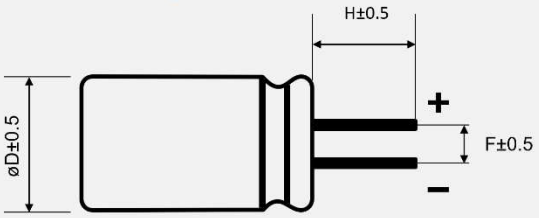
AVAILABLE LEAD TREATMENTS ▪ RADIAL HYBRID POLYMER CAPACITORS

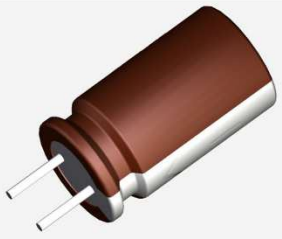
Radial type ▪ standard lead spacing (all dimensions in mm)



Ø D (mm)	L (mm)	a (mm)	F (mm)	Ø d (mm)
6.3	8	1	2.5	0.6
8	9	1.5	3.5	0.6
8	11.5	1.5	3.5	0.6
10	10	1.5	5	0.6
10	12.5	1.5	5	0.8
10	16	2	5	0.8
10	18	2	5	0.8

Radial type ▪ CA version ▪ cutted leads ▪ standard lead spacing





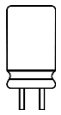
Example

Length „H" customized. See product code table customized lead length for further reference.

Ø D (mm)	6.3	8	10
F (mm)	2.5	3.5	5

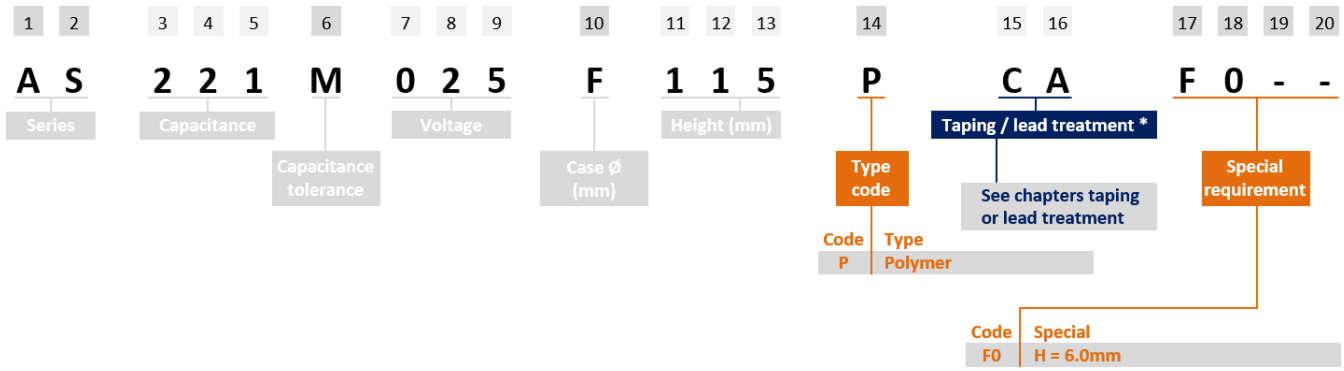
A S	2 2 1	M	0 2 5	F	1 1 5	P	C A	- - - -
Series	Capacitance	Tolerance	Voltage	ØD (mm)	Height (mm)	Type code	Lead treatment	Special requirement

PRODUCT CODE TABLE ▪ CUSTOMIZED LEAD LENGTH



THT type example:

AS series ▪ 220µF ▪ 25V ▪ ±20% ▪ Ø 8mm ▪ L 11.5mm ▪ CA version, cutted leads ▪ P 3.5mm ▪ H 6.0mm ▪ Non-Automotive



Product code 17th digit	H (mm)
A	1
B	2
C	3
D	4
E	5
F	6
G	7

Product code 18st digit	H (mm)
0	0.0
1	0.1
2	0.2
3	0.3
4	0.4
5	0.5
6	0.6
7	0.7
8	0.8
9	0.9

Example H (mm)	Product code Non-Automotive
4.0	**D0**
4.5	**D5**
5.2	**E2**
6.0	**F0**

Example H (mm)	Product code Automotive
4.0	**XD0**
4.5	**XD5**
5.2	**XE2**
6.0	**XF0**

The 17th digit is according basic ordering of the Latin alphabet and shows the measure "H" in front of the decimal separator. The 18th digit follows the numbering from 0 to 9 and shows the measure "H" after the decimal separator.

Remark for Automotive version: In the case of an AEC-Q200 qualified component, the measure "H" in front of the decimal separator moves to the 18th digit and the measure "H" after the decimal separator to the 19th digit.

GENERAL PRECAUTIONS & GUIDELINES

1. GENERAL PRECAUTIONS & GUIDELINES 122

1.1. GENERAL - ALL TYPES -.....122

1.1.1. POLARITY 122

1.1.2. OVERVOLTAGE.....122

1.1.3. OPERATING TEMPERATURE.....122

1.1.4. RIPPLE CURRENT.....122

1.1.5. CHARGE AND DISCHARGING 122

1.1.6. SOLDERING CONDITIONS.....122

1.1.7. MSL – MOISTURE SENSITIVE LEVEL (ONLY FOR SMD TYPES).....122

1.1.8. RESISTANCE TO CHEMICALS AND SOLVENTS FOR WASHING, GLUING, FILLING AND COATING.....122

1.1.9. CLEANING AND WASHING.....123

1.1.10. GLUING, FILLING OR COATING.....123

1.1.11. OPERATION AND ENVIRONMENT 123

1.1.12. MECHANICAL STRESS 124

1.1.13. STORAGE 124

1.1.14. DISPOSAL.....124

1.2. ALUMINUM ELECTROLYTIC & HYBRID CONDUCTIVE POLYMER CAPACITORS - ALL MOUNTING STYLES -.....124

1.2.1. VENT & VENT OPERATION AT EMERGENCY.....124

1.2.2. SLEEVE MATERIAL (NOT FOR SMD) 125

1.3. ALUMINUM ELECTROLYTIC - RADIAL TYPE - 125

1.3.1. PIN CUTTING & BENDING 125

1.3.2. SOLDERING 125

1.4. ALUMINUM ELECTROLYTIC CAPACITORS - SCREW TYPE -.....125

1.4.1. MAINTENANCE 125

1.4.2. MOUNTING & INSTALLATION.....125

1.4.3. MOUNTING DIRECTION OF SCREW TYPE CAPACITORS.....125

1.4.4. HORIZONTAL MOUNTING.....126

1.5. SOLID CONDUCTIVE POLYMER CAPACITORS.....126

1.5.1. APPLICATION RESTRICTIONS.....126

1.5.2. SUDDEN CHARGE AND DISCHARGE 126

2. SOLDERING INSTRUCTIONS 127

2.1. REFLOW SOLDERING ▪ SMD – HYBRID CONDUCTIVE POLYMER CAPACITORS.....127

2.2. WAVE SOLDERING ▪ ALL RADIAL & SNAP-IN CAPACITORS.....128

1. GENERAL PRECAUTIONS & GUIDELINES

In the following Precautions and Guidelines, CapXon provides instructions and requirements to assure a proper handling and desired performance of capacitors. Firstly, all general information is given, which applies to all technologies. The following chapters provides additional instructions specifically about technology and mounting style, which completes the full set of instructions.

1.1. GENERAL - ALL TYPES -

1.1.1. POLARITY

All conventional Electrolytic Capacitors have a polarity due to the internal construction. This polarity is marked on the component by printing on the top of component or on the sleeve of Aluminum Electrolytic Capacitors, including Radial, Snap-In and Screw types.

Any reverse voltage can cause short circuit breakdown of capacitor or leakage of electrolyte. Electrolytic Capacitors isn't designed for AC-voltage supply and only meant for DC-voltage applications.

For an application where polarity in circuit can be reversed or unknown, specific bi-polar aluminium electrolytic capacitors shall be used. We offer such components within our product range.

1.1.2. OVERVOLTAGE

Overvoltage can damage the capacitor and can cause a drastic increase in leakage current, which possibly shortens the lifetime of the capacitor. In a worst case, short circuit failure mode can happen. As a result, do not apply any continuous or temporary overvoltage.

The applied operating voltage, which is applied to the capacitor, should not exceed the rated voltage of the capacitor.

1.1.3. OPERATING TEMPERATURE

Only operate the capacitor within the limits of allowed temperature range, which is specified by datasheet. Be aware that the sum of thermal stress by ambient condition plus electrical stress is the main driving factor for aging. As the thermal stress level gets higher, the expected capacitor lifetime would be lower.

A drop in applied temperature, ambient condition or cooling within application can enlarge the expected lifetime of the capacitor. For details, please see further documentation of lifetime estimation.

1.1.4. RIPPLE CURRENT

The applied ripple current shall not exceed the stated max. ripple current I_R on the datasheet at the specific frequency.

When capacitors are overstressed by ripple, it can generate massive heat inside the capacitor, which can result in deterioration, vent operation or capacitor breakage.

1.1.5. CHARGE AND DISCHARGING

Frequent and quick charge / discharge generates heat inside the capacitor and can cause possible increase of leakage current, reduction of the expected lifetime, decrease of capacitance, vent operation or breakage.

For such applications please see design rules or consult our technical support for assistance.

1.1.6. SOLDERING CONDITIONS

For recommended reflow solder profile, please see additional information at Section 2. Soldering Instructions.

Soldering by vapor phase for SMD types or any hand soldering are not recommended. No permission is released by CapXon side either. In case of such a usage, customer need to validate solder result and applied component stress within their own manufacturing process.

1.1.7. MSL – MOISTURE SENSITIVE LEVEL (ONLY FOR SMD TYPES)

Our standard SMD components are rated according to JEDEC J-STD020 with MSL1. Construction of this part does not include hygroscopic critical materials and are not prone to delamination or popcorn effects. Only SMD MLPC types of the Solid Conductive Polymer components have MSL3. Moreover, only this type requires additional actions or specific handling in factory floor by customer such as handling or storing the goods after opening the package in accordance to JEDEC J-STD020.

1.1.8. RESISTANCE TO CHEMICALS AND SOLVENTS FOR WASHING, GLUING, FILLING AND COATING

Due to the wide variety of suppliers and different chemical formulas of washing, gluing, filling and coating materials, the individually used material and appliance process need to be validated by customer itself. It is not possible to provide any global material usage approval from our side.

CapXon can provide additional information, including combination of chemicals which could be critical to the component behavior and can support measurements of component performance after appliance of washing, gluing, filling or coating martials. For specific support, please kindly contact our technical support for further advices.

1.1.9. CLEANING AND WASHING

Do not wash the assembled capacitors with the following cleaning agents:

- **Xylene**
  - can cause deterioration of the rubber seal material
- **Halogenated solvents**
  - can cause corrosion and electrical failure modes
- **Petroleum based solvents**
  - can cause degeneration of the rubber seal material
- **Alkali based solvents**
  - can cause corrosion and dissolving of aluminum can
- **Acetone**
  - component marking possibly dissolve

After finishing cleaning and washing, the below points need to be verified by customer:

Dry all solvents properly from PCB as well as capacitor surface sufficiently and apply air blower or air knife, with temperatures within the temperature range of the product specification, if needed.

Monitor pH value, conductivity, specific gravity and water content of cleaning solvents to be sure of possible contaminations and pollution. Contaminations can negatively affect the performance of the capacitor.

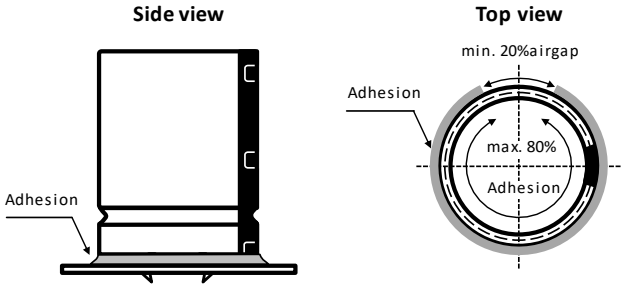
1.1.10. GLUING, FILLING OR COATING

It is not allowed to use any gluing (adhesives), filling or coating materials, which contains halogenated solvents. Halogen ions are critical, because they can diffuse or creep in the capacitor through rubber sealing and can possibly damage the internal capacitor element /structure result in serious failure modes for the capacitor.

Additionally, please pay attention to the following points:

- Make sure that the surface of capacitor and the area between component bottom / rubber sealant is dry and clean before appliance of gluing, filling or coating material. It is important to avoid any contamination with chemical residues (e.g. flux residues, cleaning).
- Please follow and meet the stated gluing, coating, filling, heating and curing instructions from manufacturer or supplier of such materials. Be aware of possible shrinkage of such materials. Verify that the hardening was properly done and that no solvents / agents do remain.
- There should be no excessive heat nor mechanical pressure /stress at any stages from the production on customer side. Be aware of the possible material shrinkage of used material. High material shrinkage which leads to damage on capacitor is not CapXon's responsibility.
- The used materials of gluing, coating or filling can possibly react with the marking of component and this can change optical appearance such as the appearance and legibility.
- If the rubber seal surface is fully covered by gluing, filling or coating material, it is no longer possible to have a natural diffusion of gas between the inside of the capacitor and the ambient. So, to avoid such situation, it's strongly recommended to block maximum 80% of the sealed section on the bottom side of the capacitor.

Please find the example below of how gluing could be applied on Radial and Snap-In types.



Gluing reference example of a Snap-In capacitor

1.1.11. OPERATION AND ENVIRONMENT

As long as the application is powered, in operation and cap is not discharged, the user is never permitted to touch the electric terminals of the capacitor directly or to bridge the terminals by hand or any other conductive liquid or solid material. Otherwise, a short circuit of terminals can happen and a hard discharge can damage capacitor / application as well as it can harm the operator.

Within operation, please avoid the following environmental conditions to assure proper capacitor operation:

- high vibration, shocks or mechanical stress. For tested and allowed conditions, please see available references or contact us for details
- avoid direct sunlight, ozone and any kind of radiation or ultraviolet rays
- corrosive or toxic gases (e.g. ammonium, chlorine

and compounds, bromine and compounds, hydrogen sulfide, sulfuric acid)
- ambient with high amount of damp condensation, water or types of oil

1.1.12. MECHANICAL STRESS

Best possible, avoid mechanical stress for the capacitor and do not apply any excessive mechanical stress to the lead wire pins or terminal.

After mounting, do not lift nor carry the PCB assembly by just grabbing the capacitor to pick up the board.

1.1.13. STORAGE

In case of long-term storage without applying voltage to the capacitor, leakage current tends to increase.

By applying the rated voltage before usage, the dielectric layer of aluminium oxide and leakage current can be stabilized.

If the capacitor is for more than 12 months, it is recommended to apply the DC rated voltage V_R for 30 minutes through 1kΩ protective series resistor.

The storage conditions for storage on customer side should be monitored and controlled to a temperature of 5°C up to 35°C and less than 75% rel. humidity.

1.1.14. DISPOSAL

Please follow your local governmental and organizational restrictions for disposal and if needed, contact your local responsible for correct handling.

In case of incineration, punch holes in the aluminum can in advanced to avoid explosion of capacitor and then burn with at least 800°C, otherwise it can result toxic gas.

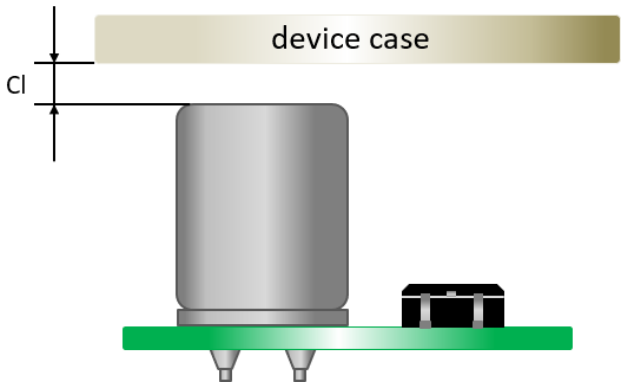
1.2. ALUMINUM ELECTROLYTIC & HYBRID CONDUCTIVE POLYMER CAPACITORS - ALL MOUNTING STYLES -

1.2.1. VENT & VENT OPERATION AT EMERGENCY

As a safety feature, most our regular electrolytic capacitors have a so-called vent, which is a pre-determined breaking point. In case of overstressed component, it can lead to internal gassing and due to this an internal overpressure will result in vent operation. So, the vent will open to release such pressure and gas can become visible. If user detects vent operation or gassing out of the capacitor when operating, disconnect the application immediately from power supply to turn it off directly. If it can't be turned off, the capacitor or the conductive liquid / gas of electrolyte can result in short-circuits, which can dramatically damage the application.

Please notice to avoid being near with body or face above or in direction of capacitors vent when powered. When the running application is overstressed, gas leakage by vent is possible. By this gas with temperatures higher than 100°C can occur and can hurt human body and face. In such an event, if contact with skin, wash it immediately with plenty of water and soap. If contact with eyes, rinse immediately (e.g. eye shower) with plenty of water. If gas is inhaled, gargle right away with plenty of water. For all three cases, please consult a doctor for medical advices.

For proper operation of vent, consider space between the vent and covering surfaces (e.g. housing) as stated at the table below, it is strongly recommended for your mechanical construction / build-up of your product:



Minimum distance to be observed for the safe operation of the capacitor

Case diameter Ø	Clearance distance Cl
6.3mm to 16mm	Min. 2mm
18mm to 35mm	Min. 3mm
≥ 40mm	Min. 5mm

Recommended minimum clearance distance between topside capacitor and device case

If such a space is not provided, the vent will not operate completely or even cannot open in case of overpressure.

Case sizes which are smaller than 6.3mm in diameter have no vent on top, for these no space need to be considered.

1.2.2. SLEEVE MATERIAL (NOT FOR SMD)

The standard sleeve material for the majority of our Radial, Snap-In and Screw mounting capacitors is PET and for some series PVC is used as sleeve material. When sleeve is exposed to xylene, toluene or similar and afterwards exposed to high heat, the sleeve may be cracked or damaged.

The sleeve is not used as insulating material or layer and does not insulate capacitor to surroundings. For needed insulation, further actions need to be considered by customer and please follow our recommended design rules.

Sleeves are applied for all Aluminum Electrolytic Capacitors with Radial, Snap-In or Screw mounting and if desired for further customized solutions.

1.3. ALUMINUM ELECTROLYTIC - RADIAL TYPE -

1.3.1. PIN CUTTING & BENDING

Please take absolute care when cutting or bending pins, that the pin is fixed mechanically in direction of rubber sealant. It is necessary that the mechanical force while cutting and bending, which results in pulling or pressing force on pin, does not stress the inner construction of capacitor element or to damage the rubber sealant. Excessive pulling or pressing force on the pin with missing fixation can result in damage of internal pin to capacitor element connection and also the sealing can be weakened. So, please take care to assure appropriate cutting and bending. Do not predamage the capacitors and shorten their lifetime performance by incorrect handling.

1.3.2. SOLDERING

For recommended wave solder profile, please see additional solder instruction at section 2.5.

Improper soldering conditions may shrink or break the sleeve. Additionally, excessive heat can damage the internal capacitor element as terminals and lead wires conduct heat into the capacitor.

1.4. ALUMINUM ELECTROLYTIC CAPACITORS - SCREW TYPE -

1.4.1. MAINTENANCE

A regular inspection is recommended when screw capacitors are used at industrial applications. Before inspection, make sure to turn off the power, discharge screw capacitors carefully and do not apply mechanical force or pressure to the terminal to avoid damage. Inspection items are as stated below:

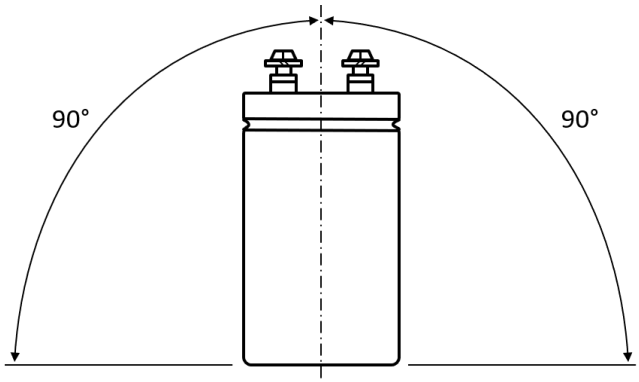
- Check on outer damage, deformation and electrolyte leakage
- Check electrical performance: leakage current, capacitance, DF value and other product specifications. If there is any abnormality detected, make sure a capacitor replacement will be done and handled properly

1.4.2. MOUNTING & INSTALLATION

Make sure capacitors rated capacitance, rated voltage and polarity is according to spec before installation. Please confirm that capacitors and circuit board terminal pitch is consistent to each other before installation. It may cause stress to internal capacitor element through the terminal. if the pitch is different, mounting was done nevertheless and strong mechanical stress was applied. In such case, this can cause short-circuit and other failure modes. Machine automated force and lead torque strength must be controlled properly when mounting happens with automated machine.

1.4.3. MOUNTING DIRECTION OF SCREW TYPE CAPACITORS

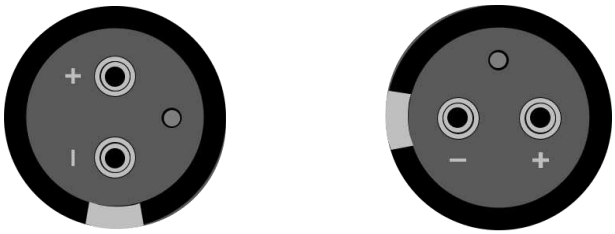
To avoid screw capacitor breakage / explosion, it is not allowed to be mounted with the safety vent downwards to ground, because vent can’t function properly when mounted with vent to bottom side and existing gas pressure cannot release properly. Recommended mounting method is shown as figure below, to avoid any safety vent downwards installation. So, capacitor should be mounted with screw terminals up as shown below:



Recommended mounting direction

1.4.4. HORIZONTAL MOUNTING

For horizontal mounting following mounting is strongly recommended. Anode terminal in upper position with safety vent in horizontal position as figure below on left side or safety vent in upper position with anode and cathode terminal in horizontal as figure below on right side.



Recommended mounting position, also in accordance to EIAJ RCR-2367C

It may not damage capacitors directly, but an electrolyte leakage may happen, if installed by other mounting method in horizontal direction.

1.5. SOLID CONDUCTIVE POLYMER CAPACITORS

1.5.1. APPLICATION RESTRICTIONS

The leakage current of Solid Conductive Polymer Capacitors may vary which depends on thermal stress.

Please don't use Solid Conductive Polymer Capacitors in the following types of applications / circuits:

- High-impedance circuits - which are meant to sustain voltages
- Coupling circuits
- Time constant circuits - in addition to the leakage current fluctuation, capacitance may also fluctuate, which depends on operational temperature and humidity. The fluctuation of the capacitance may cause problems, if it is used as a time constant capacitor, which is extremely sensitive to the fluctuation of the capacitance. So, do not use it as a time constant capacitor.
- Other circuits - which are significantly affected by leakage current. If you want to use 2 or more capacitors in a series connection, please contact us before usage.

1.5.2. SUDDEN CHARGE AND DISCHARGE

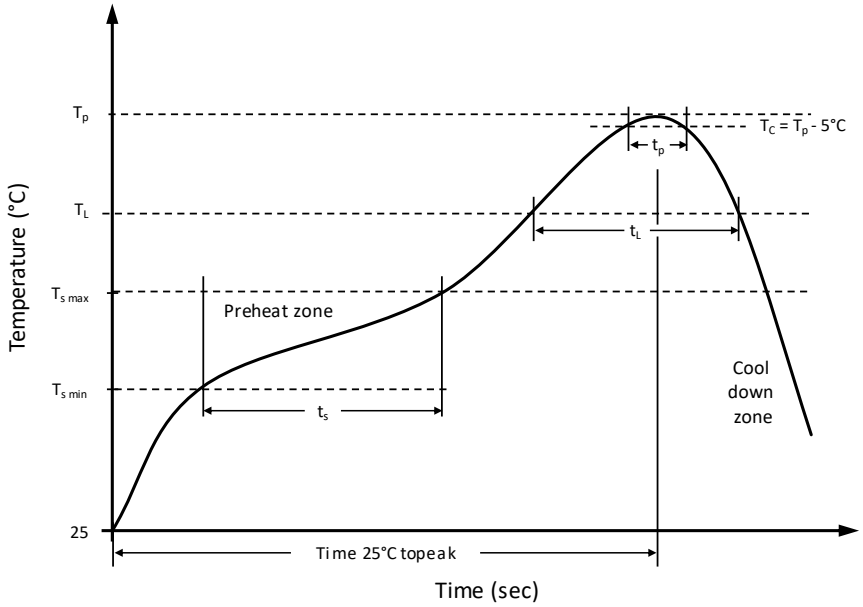
Do not use the capacitor in circuits when capacitor is repetitively charged and discharged rapidly. If repetitively and rapid charging and discharging stresses the capacitor, it can result in reduction of capacitance or may cause further damage due to internal heating. The usage of a protective circuit is recommended to ensure reliability, when rush currents exceeds 10 times of capacitors allowed max. ripple current I_R, but never more than max. 10A. When measuring the leakage current, a protective resistor (1 kΩ) must be inserted to the circuit during the charge and discharge.

2. SOLDERING INSTRUCTIONS

In the following sections CapXon's leadfree solder profiles are stated in detail.

2.1. REFLOW SOLDERING ▪ SMD – HYBRID CONDUCTIVE POLYMER CAPACITORS

Recommended reflow soldering conditions



Classification of reflow soldering profile

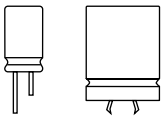
Profile Features		Value
Preheat temperature min.	$T_{s\,min}$	160 °C
Preheat temperature max.	$T_{s\,max}$	200 °C
Preheat time t_s from $T_{s\,min}$ to $T_{s\,max}$	t_s	120 seconds
Ramp-up rate (T_L to T_p)		max. 3 °C/second
Liquidous temperature	T_L	217 °C
Time t_L maintained above T_L	t_L	See reference table below for proper Ø Diameter
Peak package body temperature	T_p	See reference table below for proper Ø Diameter
Timeframe of within 5°C below and up to max actual peak body temperature	t_p	See reference table below for proper Ø Diameter
Ramp-down rate (T_L to T_p)		max. 6 °C/second
Time 25°C to peak temperature		max. 8 minutes

*** Limitations of ramp rates to JEDEC-J-STD020E**

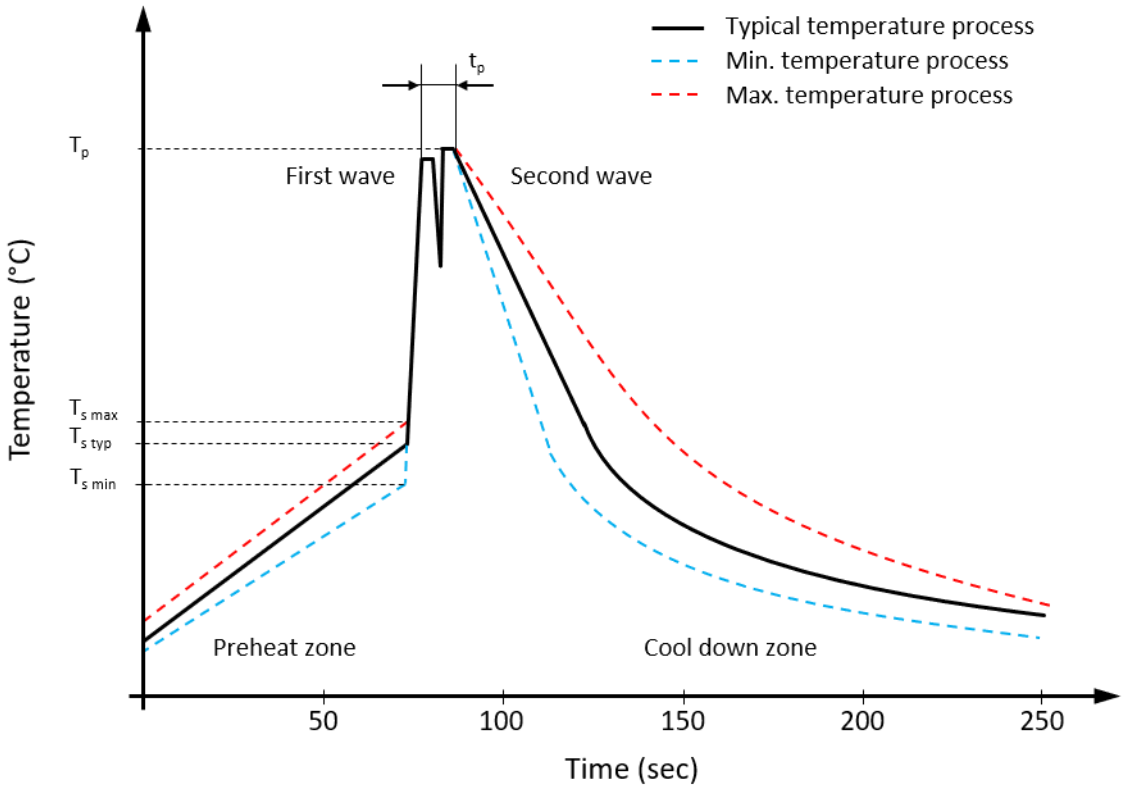
Package classification reflow temperature for SMD – Hybrid Conductive Polymer Capacitors

Ø Diameter (mm)	Time above 200°C	t_L Time above 217°C	Time above 230°C	T_P Peak Temperature (°C)	t_p Timing (seconds)	Allowed Reflow Runs
≤ 6.3	70 sec. max	40 sec. max.	30 sec. max.	260	5	max. twice
≥ 8	70 sec. max	40 sec. max.	30 sec. max.	245	10	max. twice
	70 sec. max	40 sec. max.	30 sec. max.	260	5	only once

2.2. WAVE SOLDERING ▪ ALL RADIAL & SNAP-IN CAPACITORS



Recommended wave soldering conditions



Classification wave soldering profile ▪ Refer to EN 61760-1: 2006

Profile Features		Value ▪ Pb-free Assembly	Value ▪ Sn-Pb Assembly
Preheat temperature min.	$T_{s\,min}$	100 °C	100 °C
Preheat temperature typical	$T_{s\,typ}$	120 °C	120 °C
Preheat temperature max.	$T_{s\,max}$	130 °C	130 °C
Preheat time t_s from $T_{s\,min}$ to $T_{s\,max}$	t_s	70 seconds	70 seconds
Peak temperature	T_p	245 °C ~ 260 °C	235 °C ~ 260 °C
Time of actual peak temperature	t_p	Max. 10 seconds Max. 5 second each wave	Max. 10 seconds Max. 5 second each wave
Ramp-down date min.		~ 2 °C/second	~ 2 °C/second
Ramp-down rate typical		~ 3.5 °C/second	~ 3.5 °C/second
Ramp-down rate max.		~ 5 °C/second	~ 5 °C/second
Time 25°C to 25°C		4 minutes	4 minutes

VIMOS
TECHNOLOGIES

Europe

ViMOS Technologies GmbH
Mehlbeerenstraße 2
82024 Taufkirchen
Germany

Contact us:

+49 89 5419 200 60

info@vimos-technologies.com