ESC, +105°C



Overview

The KEMET ESC radial aluminum electrolytic capacitors are designed for low impedance and high frequency applications.

Applications

Typical applications include high frequency switch mode circuits.

Benefits

- · Low impedance
- 1,000 3,000 hour operating life
- Operating temperature of up to 105°C
- Case with \emptyset D \geq 5 mm
- · Safety vent on the capacitor base



Part Number System

ESC	157	M	6R3		Α	C3	AA
Series	Capacitance Code (pF)	Tolerance	Rated Voltage (VDC)		Electrical Parameters	Size Code	Packaging
Radial Aluminum Electrolytic	First two digits represent significant figures for capacitance values. Last digit specifies the number of zeros to be added.	M = ±20%	6R3 = 6.3 010 = 10 016 = 16 025 = 25	035 = 35 050 = 50 063 = 63 100 = 100	A = Standard	See Dimension Table	See Ordering Options Table



Ordering Options Table

Diameter	Length	Packaging Type	Lead Type	Lead Length (mm)	Lead and Packaging Code				
	Standard Bulk Packaging Options								
4 - 22	All	Bulk (bag)	Straight	20/15 Minimum	AA				
	Tape & Reel								
4 - 5	All	Tape & Reel	Formed to 2.5 mm	H ₀ = 16 ±0.75	LA				
4 - 8	All	Tape & Reel	2.5 mm lead spacing	H ₀ = 18.5 ±0.75	KA				
4 - 8	All	Tape & Reel	Formed to 5 mm	$H_0 = 16 \pm 0.75$	JA				
10	≤ 20	Tape & Reel	Straight	H ₀ = 18.5 ±0.75	KA				
		Ar	nmo Pack						
4 - 8	All	Ammo	Formed to 5 mm	$H_0 = 16 \pm 0.75$	DA				
4 - 8	All	Ammo	Straight	H ₀ = 18.5 ±0.75	EA				
4 - 5	All	Ammo	Formed to 2.5 mm	$H_0 = 16 \pm 0.75$	FA				
10 - 13	All	Ammo	5 mm lead spacing	H ₀ = 18.5 ±0.75	EA				
16	All	Ammo	7.5 mm lead spacing	H ₀ = 18.5 ±0.75	EA				
18	≤ 25	Ammo	7.5 mm lead spacing	$H_0 = 18.5 \pm 0.75$	EA				
		Contact KEMET for oth	er lead and packaging op	otions					

Environmental Compliance

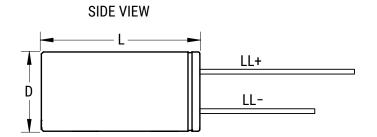
As an environmentally conscious company, KEMET is working continuously with improvements concerning the environmental effects of both our capacitors and their production. In Europe (RoHS Directive) and in some other geographical areas like China, legislation has been put in place to prevent the use of some hazardous materials, such as lead (Pb), in electronic equipment. All products in this catalog are produced to help our customers' obligations to guarantee their products and fulfill these legislative requirements. The only material of concern in our products has been lead (Pb), which has been removed from all designs to fulfill the requirement of containing less than 0.1% of lead in any homogeneous material. KEMET will closely follow any changes in legislation world wide and make any necessary changes in its products, whenever needed.

Some customer segments such as medical, military and automotive electronics may still require the use of lead in electrode coatings. To clarify the situation and distinguish products from each other, a special symbol is used on the packaging labels for RoHS compatible capacitors.

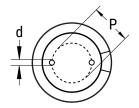
Due to customer requirements, there may appear additional markings such as lead free (LF) or lead-free wires (LFW) on the label.



Dimensions - Millimeters



TERMINAL END VIEW



0: 0 - d -	D			L		p		d	LL+/LL-	
Size Code	Nominal	Tolerance								
C3	5.0	±0.5	11.0	+1.5/-0	2.0	±0.5	0.5	Nominal	20/15	Mininimum
E3	6.3	±0.5	11.0	+1.5/-0	2.5	±0.5	0.5	Nominal	20/15	Mininimum
G3	8.0	±0.5	11.0	+1.5/-0	3.5	±0.5	0.6	Nominal	20/15	Mininimum
G4	8.0	±0.5	15.0	+2.0/-0	3.5	±0.5	0.6	Nominal	20/15	Mininimum
G6	8.0	±0.5	20.0	+2.0/-0	3.5	±0.5	0.6	Nominal	20/15	Mininimum
H9	10.0	±0.5	12.5	+1.5/-0	5.0	±0.5	0.6	Nominal	20/15	Mininimum
Н8	10.0	±0.5	16.0	+2.0/-0	5.0	±0.5	0.6	Nominal	20/15	Mininimum
H4	10.0	±0.5	20.0	+2.0/-0	5.0	±0.5	0.6	Nominal	20/15	Mininimum
H5	10.0	±0.5	25.0	+2.0/-0	5.0	±0.5	0.6	Nominal	20/15	Mininimum
H6	10.0	±0.5	30.0	+2.0/-0	5.0	±0.5	0.6	Nominal	20/15	Mininimum
L3	13.0	±0.5	20.0	+2.0/-0	5.0	±0.5	0.6	Nominal	20/15	Mininimum
L4	13.0	±0.5	25.0	+2.0/-0	5.0	±0.5	0.6	Nominal	20/15	Mininimum
L8	13.0	±0.5	30.0	+2.0/-0	5.0	±0.5	0.6	Nominal	20/15	Mininimum
L7	13.0	±0.5	40.0	+2.0/-0	5.0	±0.5	0.6	Nominal	20/15	Mininimum
M7	16.0	±0.5	25.0	+2.0/-0	7.5	±0.5	0.8	Nominal	20/15	Mininimum
M2	16.0	±0.5	32.0	+2.0/-0	7.5	±0.5	0.8	Nominal	20/15	Mininimum
M3	16.0	±0.5	36.0	+2.0/-0	7.5	±0.5	0.8	Nominal	20/15	Mininimum
N2	18.0	±0.5	36.0	+2.0/-0	7.5	±0.5	0.8	Nominal	20/15	Mininimum
N3	18.0	±0.5	40.0	+2.0/-0	7.5	±0.5	0.8	Nominal	20/15	Mininimum



Performance Characteristics

ltem	Performance Characteristics			
Capacitance Range	4.7 – 15,000 μF			
Capacitance Tolerance	±20% at 120 Hz/20°C			
Rated Voltage	6.3 – 100 VDC			
Life Test	2,000 - 3,000 hours (see conditions in Test Method & Performance)			
Operating Temperature	-40°C to +105°C			
Lookogo Current	I ≤ 0.01 CV or 3 μA, whichever is greater			
Leakage Current	C = rated capacitance (µF), V = rated voltage (VDC). Voltage applied for 2 minutes at 20°C.			

Impedance Z Characteristics at 120 Hz

Rated Voltage (VDC)	6	10	16	25	35	50	63	100
Z (-25°C)/Z (20°C)	4	3	3	3	3	2	2	2
Z (-40°C)/Z (20°C)	8	6	4	4	4	4	4	4

Compensation Factor of Ripple Current (RC) vs. Frequency

Capacitance Range (μF)	50 Hz	120 Hz	300 Hz	1 kHz	10 kHz	100 kHz
4.7	0.30	0.40	0.50	0.70	0.80	1.00
5.6 - 33	0.40	0.50	0.60	0.80	0.90	1.00
34 - 330	0.60	0.70	0.80	0.90	0.95	1.00
331 - 1,000	0.65	0.90	0.90	0.98	1.00	1.00
1,200 - 15,000	0.85	0.90	0.95	0.98	1.00	1.00



Test Method & Performance

Conditions	Load Li	fe Test	Shelf Life Test			
Temperature	105	°C	105°C			
	Can Ø ≥ 5 x 11, ≤ 10 x 12.5 mm	2,000 hours	1 000 h			
Test Duration	Can Ø ≥ 10 x 15 mm	3,000 hours	1,000 hours			
	If dimension is down size, endurance will be 1,000 hours less than standard					
Ripple Current	Maximum ripple current sp	No ripple current applied				
Voltage	The sum of DC voltage and the po the rated voltage		No voltage applied			
Performance	The following specification	ns will be satisfied when the	capacitor is restored to 20°C:			
Capacitance Change	Within ±20% of the initial value					
Dissipation Factor	Does not exceed 200% of the specified value					
Leakage Current	Does not exceed specified value					

Shelf Life

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

KEMET's E aluminum electrolytic capacitors should not be stored in high temperatures or where there is a high level of humidity. The suitable storage condition for KEMET's E aluminum electrolytic capacitors is +5 to +35°C and less than 75% in relative humidity. KEMET's E aluminum electrolytic capacitors should not be stored in damp conditions such as water, saltwater spray or oil spray. KEMET's E aluminum electrolytic capacitors should not be stored in an environment full of hazardous gas (hydrogen sulphide, sulphurous acid gas, nitrous acid, chlorine gas, ammonium, etc.) KEMET's E aluminum electrolytic capacitors should not be stored under exposure to ozone, ultraviolet rays or radiation.

If a capacitor has been stored for more than 18 months under these conditions and it shows increased leakage current, then a treatment by voltage application is recommended.

Re-Age (Reforming) Procedure

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



Table 1 - Ratings & Part Number Reference

VDC Voltage			Rated		DF	_			
Voltage		VDC		Case Size		Z	RC	LC 20°C	
Notisge	VDC	Surge				100 kHz	100 kHz	2 Minutes	Part Number
6.3 8 200 6.3 x11 22 0.200 250 13.9 ESCIFFMRBASCI) 6.6 3 8 270 6.3 x11 22 0.200 250 13.9 ESCIFFMRBASCI) 6.6 3 8 300 6.3 x11 22 0.200 250 250 28.8 ESCIFFMRBASCI) 6.6 3 8 300 6.3 x11 22 0.180 400 28.8 ESCIFFMRBASCI) 6.6 3 8 300 6.3 x11 22 0.180 400 28.8 ESCIFFMRBASCI) 6.6 3 8 470 *6.3 x11 22 0.180 400 28.8 ESCIFFMRBASCI) 6.6 3 8 470 *6.3 x11 22 0.180 400 28.8 ESCIFFMRBASCI) 6.6 3 8 600 8 \$x15 22 0.180 500 27.8 ESCIFFMRBASCI) 6.6 3 8 600 8 \$x15 22 0.180 500 27.8 ESCIFFMRBASCI) 6.6 3 8 600 8 \$x15 22 0.180 500 27.8 ESCIFFMRBASCI) 6.6 3 8 600 8 \$x15 22 0.180 500 27.8 ESCIFFMRBASCI) 6.6 3 8 600 8 \$x15 22 0.180 500 27.8 ESCIFFMRBASCI) 6.6 3 8 600 8 \$x15 22 0.085 750 42.8 ESCIFFMRBASCI) 6.6 3 8 1000 8 x15 22 0.085 750 61.0 ESCIFFMRBASCI) 6.6 3 8 1000 8 x15 22 0.085 750 61.0 ESCIFFMRBASCI) 6.6 3 8 1000 8 x20 22 0.099 800 61.0 ESCIFFMRBASCI) 6.6 3 8 1000 8 x20 22 0.099 800 61.0 ESCIFFMRBASCI) 6.6 3 8 1000 8 x20 22 0.099 800 61.0 ESCIFFMRBASCI) 6.6 3 8 1000 8 x20 22 0.099 800 61.0 ESCIFFMRBASCI) 6.6 3 8 1000 8 x20 22 0.099 800 61.0 ESCIFFMRBASCI) 6.6 3 8 1500 8 x20 22 0.099 800 61.0 ESCIFFMRBASCI) 6.6 3 8 1500 8 x20 22 0.099 800 61.0 ESCIFFMRBASCI) 6.6 3 8 1500 8 x20 22 0.099 800 61.0 ESCIFFMRBASCI) 6.6 3 8 1500 8 x20 22 0.091 800 61.0 ESCIFFMRBASCI) 6.6 3 8 1500 8 x20 22 0.091 800 61.0 ESCIFFMRBASCI) 6.6 3 8 1500 8 x20 22 0.091 800 94.5 ESCIFFMRBASCI) 6.6 3 8 1500 8 x20 22 0.091 800 94.5 ESCIFFMRBASCI] 6.6 3 8 1500 8 x20 22 0.091 800 94.5 ESCIFFMRBASCI] 6.6 3 8 1500 8 x20 22 0.091 800 94.5 ESCIFFMRBASCI] 6.6 3 8 1500 8 x20 22 0.091 800 94.5 ESCIFFMRBASCI] 6.6 3 8 1500 8 x20 22 0.091 800 94.5 ESCIFFMRBASCI] 6.6 3 8 1500 8 x20 22 0.091 800 94.5 ESCIFFMRBASCI] 6.6 3 8 1500 8 x20 22 0.091 800 94.5 ESCIFFMRBASCI] 6.6 3 8 1500 8 x20 22 0.091 800 94.5 ESCIFFMRBASCI] 6.6 3 8 1500 8 x20 22 0.091 800 94.5 ESCIFFMRBASCI] 6.6 3 8 1500 8 x20 22 0.091 800 94.5 ESCIFFMRBASCI] 6.6 3 8 1500 8 x20 22 0.091 800 94.5 ESCIFFMRBASCI] 6.6 3 8 1500 8 x20 800 94.5 ESCIFFMRBASCI] 6.6 3 8 1500 8 x20 800 94.5 ESCIFFMRBASCI] 6.6 3 8 1500 8 x20 800 94		Voltage		DXL (IIIIII)		20°C (Ω)	105°C (mA)	(μΑ)	
6.3 8 330 6.3 11 22 0.20 250 17.0 ESC2T/M893AE(1) 6.3 8 330 6.3 11 22 0.180 400 28.8 ESC33/M893AE(1) 6.3 8 470 46.3 11 22 0.180 400 28.8 ESC33/M893AE(1) 6.3 8 470 8.11 22 0.180 400 28.8 ESC33/M893AE(1) 6.3 8 630 47.11 22 0.180 400 500 256 ESC47/M893AE(1) 6.3 8 630 47.11 22 0.140 500 256 ESC47/M893AE(1) 6.3 8 630 47.11 22 0.140 500 256 ESC47/M893AE(1) 6.3 8 630 47.11 22 0.150 7780 42.3 ESC35/M893AE(1) 6.3 8 630 47.11 22 0.150 7780 42.3 ESC35/M893AE(1) 6.3 8 1000 47.11 22 0.150 7780 42.3 ESC35/M893AE(1) 6.3 8 1000 8 15 22 0.085 770 63.0 ESC10M893AE(1) 6.3 8 1000 8 15 22 0.085 770 63.0 ESC10M893AE(1) 6.3 8 1000 8 17.2 22 0.085 770 63.0 ESC10M893AE(1) 6.3 8 1000 10.12.5 22 0.086 500 63.0 ESC10M893AE(1) 6.3 8 1000 10.12.5 22 0.086 500 63.0 ESC10M893AE(1) 6.3 8 1000 10.12.5 22 0.086 500 63.0 ESC10M893AE(1) 6.3 8 1500 8 12.0 10.16 22 0.055 1000 75.6 ESC10M893AE(1) 6.3 8 1500 8 12.0 22 0.055 1000 75.6 ESC10M893AE(1) 6.3 8 1500 8 12.0 22 0.055 1000 75.6 ESC10M893AE(1) 6.3 8 1500 8 12.0 22 0.055 1000 75.6 ESC10M893AE(1) 6.3 8 1500 8 12.0 22 0.055 1000 75.6 ESC10M893AE(1) 6.3 8 1500 8 12.0 22 0.055 1000 75.6 ESC10M893AE(1) 6.3 8 1500 8 12.0 22 0.055 1000 75.6 ESC10M893AE(1) 6.3 8 1500 8 12.0 22 0.055 1000 75.6 ESC10M893AE(1) 6.3 8 1500 8 12.0 22 0.055 1000 75.6 ESC10M893AE(1) 6.3 8 1500 8 12.0 22 0.055 1000 75.6 ESC10M893AE(1) 6.3 8 1500 8 12.0 22 0.055 1000 75.6 ESC10M893AE(1) 6.3 8 1500 10.10 10.2 22 0.055 1000 75.6 ESC10M893AE(1) 6.3 8 1500 10.10 1	6.3			5 x 11	22	0.420	200		ESC157M6R3AC3(1)
6.3 8 330 6.3 x11 22 0.280 250 20.8 ESC337M638AS(1) 6.3 8 470 8 x11 22 0.180 440 26.5 ESC47M63AS(1) 6.3 8 470 8 x11 22 0.140 550 26.5 ESC47M63AS(1) 6.3 8 680 8 x15 22 0.100 700 42.8 ESC667M63AS(1) 6.3 8 680 8 x15 22 0.100 700 42.8 ESC667M63AS(1) 6.3 8 680 8 x15 22 0.100 700 42.8 ESC667M63AS(1) 6.3 8 700 8 x20 22 0.015 730 51.7 ESC327M63AS(1) 6.3 8 700 8 x20 22 0.015 730 51.7 ESC327M63AS(1) 6.3 8 1000 8 x15 22 0.025 730 51.7 ESC327M63AS(1) 6.3 8 1000 8 x15 22 0.025 730 51.7 ESC327M63AS(1) 6.3 8 1000 8 x15 22 0.025 730 51.7 ESC327M63AS(1) 6.3 8 1000 8 x15 22 0.025 730 51.7 ESC327M63AS(1) 6.3 8 1000 10 x12.5 22 0.080 690 63.0 ESC108M63AS(1) 6.3 8 1000 10 x12.5 22 0.080 690 63.0 ESC108M63AS(1) 6.3 8 1000 10 x12.5 22 0.080 690 63.0 ESC108M63AS(1) 6.3 8 1500 10 x10 12 22 0.055 10 70 94.5 ESC138M63AS(1) 6.3 8 1500 10 x10 12 22 0.055 10 70 94.5 ESC138M63AS(1) 6.3 8 1500 10 x10 12 22 0.055 10 70 94.5 ESC138M63AS(1) 6.3 8 1500 10 x20 22 0.055 10 70 94.5 ESC138M63AS(1) 6.3 8 2200 10 x20 22 0.055 10 70 94.5 ESC138M63AS(1) 6.3 8 2200 10 x20 22 0.055 10 70 94.5 ESC138M63AS(1) 6.3 8 2200 10 x20 22 0.051 120 138.6 ESC228M63AH(1) 6.3 8 2200 10 x20 22 0.051 120 138.6 ESC228M63AH(1) 6.3 8 2200 10 x20 22 0.051 120 138.6 ESC228M63AH(1) 6.3 8 2200 10 x20 22 0.051 120 138.6 ESC228M63AH(1) 6.3 8 2200 10 x20 22 0.051 120 138.6 ESC228M63AH(1) 6.3 8 2200 10 x20 22 0.044 1400 2079 ESC338M63AH(1) 6.3 8 2200 10 x20 22 0.044 1400 2079 ESC338M63AH(1) 6.3 8 2200 10 x20 22 0.044 1400 2079 ESC338M63AH(1) 6.3 8 2200 10 x20 22 0.044 1400 2079 ESC338M63AH(1) 6.3 8 200 10 x20 22 0.044 1400 2079 ESC338M63AH(1) 6.3 8 200 10 x20 22 0.044 1400 2079 ESC338M63AH(1) 6.3 8 200 10 x20 22 0.044 1400 2079 ESC338M63AH(1) 6.3 8 200 10 x20									
6.3 8 470									
6.3 8 470 *6.3 x11 22 0.180 440 29.6 ESCAT7MBRABAEI) 6.3 8 680 *8 x11 22 0.120 580 42.8 ESCAT7MBRABAEI) 6.3 8 680 8 x15 22 0.100 700 42.8 ESCASTMBRABAEI) 6.3 8 8 680 8 x15 22 0.100 700 42.8 ESCASTMBRABAEI) 6.3 8 8 1000 *8 x15 22 0.085 750 51.7 ESCAT7MBRABAEI 6.3 8 1000 8 x15 22 0.085 750 51.7 ESCAT7MBRABAEI 6.3 8 1000 8 x15 22 0.085 700 63.0 ESCI8MBRABAEI 6.3 8 1000 8 x20 22 0.099 800 63.0 ESCI8MBRABAEI 6.3 8 1000 10 x12.5 22 0.089 690 63.0 ESCI8MBRABAEI 6.3 8 1000 10 x12.5 22 0.089 690 63.0 ESCI8MBRABAEI 6.3 8 1000 10 x16 22 0.085 700 63.0 ESCI8MBRABAEI 6.3 8 1500 *8 x20 22 0.089 800 63.0 ESCI8MBRABAEI 6.3 8 1500 *8 x20 22 0.089 800 63.0 ESCI8MBRABAEI 6.3 8 1500 10 x16 22 0.085 980 94.5 ESCI8MBRABAEI 6.3 8 1500 8 x20 22 0.085 980 94.5 ESCI8MBRABAEI 6.3 8 1500 10 x20 22 0.051 800 94.5 ESCI8MBRABAEI 6.3 8 1500 10 x20 22 0.051 800 94.5 ESCI8MBRABAEI 6.3 8 1500 10 x20 22 0.051 1070 94.5 ESCI8MBRABAEI 6.3 8 200 *10 x20 22 0.051 1070 94.5 ESCI8MBRABAEI 6.3 8 200 110 x20 22 0.051 120 138.6 ESCIZEMBRABAII 6.3 8 200 110 x20 22 0.051 120 138.6 ESCIZEMBRABAII 6.3 8 200 110 x20 22 0.051 120 138.6 ESCIZEMBRABAII 6.3 8 200 110 x20 22 0.051 120 138.6 ESCIZEMBRABAII 6.3 8 200 110 x20 22 0.051 120 138.6 ESCIZEMBRABAII 6.3 8 300 13 x25 22 0.085 1700 99.5 ESCIRMBRABAEI 6.3 8 300 13 x25 22 0.085 1700 99.9 ESCIZEMBRABAII 6.3 8 300 13 x25 22 0.085 1700 99.9 ESCIZEMBRABAII 6.3 8 300 10 x20 22 0.031 1700 99.9 ESCIZEMBRABAII 6.3 8 300 10 x20 22 0.031 1700 99.9 ESCIZEMBRABAII 6.3 8 300 10 x20 22 0.032 1750 245.7 ESCIZEMBRABAII 6.3 8 300 10 x20 22 0.032 1750 245.7 ESCIZEMBRABAII 6.3 8 300 10 x20 22 0.032 1750 245.7 ESCIZEMBRABAII 6.3 8 300 10 x20 22 0.033 1770 296.1 ESCIZEMBRABAII 6.3 8 8 300 10 x25 22 0.032 1750 245.7 ESCIZEMBRABAII 6.3 8 8 300 10 x25 22 0.032 1750 245.7 ESCIZEMBRABAII 6.3 8 8 300 10 x25 22 0.032 1750 245.7 ESCIZEMBRABAII 6.3 8 8 300 10 x25 22 0.032 1750 245.7 ESCIZEMBRABAII 6.3 8 8 300 10 x25 22 0.032 1750 245.7 ESCIZEMBRABAII 6.3 8 8 300 10 x25 22 0.032 1750 245.7 ESCIZEMBRABAII 6.3 8 8 300 10 x25 22 0.032 1750 245.7									` '
6.3 8 660 *8 x 11 22 0.140 550 29.6 ESCAT7MBASAG210 6.3 8 660 *8 x 15 22 0.100 700 42.8 ESCAF7MBASAG210 6.3 8 820 8 x 20 22 0.095 750 51.7 ESCAF7MBASAG210 6.3 8 1000 8 x 15 22 0.150 580 68.0 ESC168MBASAG210 6.3 8 1000 8 x 15 22 0.055 700 68.0 ESC168MBASAG210 6.3 8 1000 8 x 15 22 0.085 700 68.0 ESC168MBASAG210 6.3 8 1000 10 x 12.5 22 0.069 800 65.0 ESC168MBASAG210 6.3 8 1000 10 x 12.5 22 0.069 800 65.0 ESC168MBASAG210 6.3 8 1000 10 x 12.5 22 0.069 800 65.0 ESC168MBASAG210 6.3 8 1000 10 x 16 22 0.064 1000 75.6 ESC128MBASAG210 6.3 8 1500 *8 x 20 22 0.055 1000 75.6 ESC128MBASAG210 6.3 8 1500 *8 x 20 22 0.051 800 94.5 ESC158MBASAG210 6.3 8 1500 *10 x 16 22 0.051 800 94.5 ESC158MBASAG210 6.3 8 1500 *10 x 16 22 0.051 800 94.5 ESC158MBASAG210 6.3 8 1500 *10 x 20 22 0.051 800 94.5 ESC158MBASAG210 6.3 8 1500 *10 x 20 22 0.051 800 94.5 ESC158MBASAG210 6.3 8 200 10 x 20 22 0.051 800 94.5 ESC158MBASAG210 6.3 8 200 *10 x 20 22 0.051 800 94.5 ESC158MBASAG210 6.3 8 200 *10 x 20 22 0.051 800 94.5 ESC158MBASAG210 6.3 8 200 *10 x 20 22 0.051 800 94.5 ESC158MBASAG210 6.3 8 200 *10 x 20 22 0.051 800 94.5 ESC158MBASAG210 6.3 8 200 *10 x 20 22 0.051 800 94.5 ESC158MBASAG210 6.3 8 200 *10 x 20 22 0.051 800 94.5 ESC158MBASAG210 6.3 8 200 *10 x 20 22 0.044 1250 94.5 ESC158MBASAG210 6.3 8 200 *10 x 20 22 0.051 800 94.5 ESC158MBASAG210 6.3 8 200 *10 x 20 22 0.044 1250 94.5 ESC158MBASAG210 6.3 8 200 *10 x 20 22 0.044 1250 94.5 ESC158MBASAG3AG210 6.3 8 200 *10 x 20 22 0.044 130 138.6 ESC228MBASAG3AG210 6.3 8 3300 *10 x 25 22 0.048 1310 138.6 ESC228MBASAG3AG210 6.3 8 3300 *10 x 25 22 0.049 130 0.000 \$20.7 9 ESC338MBASAG3AG210 \$20.7 9 ESC338MBAS		-							` '
6.3 8 660 8 x15 22 0.100 700 42.8 ESC687M6R3AG3(1) 6.3 8 660 8 x15 22 0.005 750 51.7 ESC687M6R3AG3(1) 6.3 8 1000 8 x15 22 0.085 700 63.0 ESC108M6R3AG3(1) 6.3 8 1000 8 x15 22 0.085 700 63.0 ESC108M6R3AG3(1) 6.3 8 1000 8 x15 22 0.0865 700 63.0 ESC108M6R3AG3(1) 6.3 8 1000 10 x12.5 22 0.080 690 63.0 ESC108M6R3AG3(1) 6.3 8 1000 10 x15 22 0.080 690 63.0 ESC108M6R3AG3(1) 6.3 8 1500 10 x16 22 0.066 990 94.5 ESC108M6R3AG3(1) 6.3 8 1500 10 x16 22 0.065 990 94.5 ESC108M6R3AG3(1) 6.3 8 1500 10 x16 22 0.055 1070 94.5 ESC158M6R3AG3(1) 6.3 8 1500 10 x20 22 0.051 10 x16 22 0.055 1070 94.5 ESC158M6R3AG3(1) 6.3 8 1500 10 x20 22 0.051 10 x20 12 x16 1									` '
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VDC VDC Surge Rated Capacitance Case Size DF Z RC LC Part Number	10	13	6800	16 x 36	19	0.019	2550	680.0	ESC688M010AM3(1)
	VDC	VDC Surge	Rated Capacitance	Case Size	DF	Z	RC	LC	Part Number

 $^{(1) \} Insert \ packaging \ code. \ See \ Ordering \ Options \ Table \ for \ available \ options.$

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

^{*} Dimension is down size, Endurance will be less 1,000 hours than standard.



Table 1 - Ratings & Part Number Reference cont.

10 16 16 16	VDC Surge Voltage	Rated Capacitance 120 Hz 20°C (µF) 8200 56 68 100	Case Size D x L (mm)	DF 120 Hz 20°C (tan δ %)¹	Z 100 kHz 20°C (Ω)	RC 100 kHz 105°C (mA)	LC 20°C 2 Minutes	Part Number
10 16 16 16	13 20 20 20 20 20 20	120 Hz 20°C (µF) 8200 56 68	D x L (mm)	20°C (tan δ %) ¹				Part Number
16 16 16	13 20 20 20 20 20 20	(μ F) 8200 56 68	18 x 36	(tan δ %) ¹	20°C (Ω)	105°C (mA)	(
16 16 16	13 20 20 20 20 20 20	8200 56 68		•	()	IUJ G IIIMI	(µA)	
16 16 16	20 20 20 20 20	56 68					(F-7-5)	
16 16	20 20 20 20	68	5 x 11	19	0.019	2800	820.0	ESC828M010AN2(1)
16	20 20 20			16	0.630	100	9.0	ESC566M016AC3(1)
	20 20		5 x 11 5 x 11	16 16	0.420 0.370	150 200	10.9 16.0	ESC686M016AC3(1) ESC107M016AC3(1)
16	20	120	6.3 x 11	16	0.320	250	19.2	ESC127M016AE3(1)
16		150	6.3 x 11	16	0.220	300	24.0	ESC157M016AE3(1)
16	20	220	8 x 11	16	0.140	550	35.2	ESC227M016AG3(1)
16	20	330	8 x 11	16	0.120	550	52.8	ESC337M016AG3(1)
16	20	330	8 x 15	16	0.100	750	52.8	ESC337M016AG4(1)
16	20	330	10 x 12.5	16	0.080	688	52.8	ESC337M016AH9(1)
16	20	470	8 x 15	16	0.093	730	75.2	ESC477M016AG4(1)
16	20	470 690	10 x 12.5	16 16	0.085	800	75.2 108.8	ESC477M016AH9(1)
16 16	20 20	680 820	10 x 16 10 x 20	16	0.064 0.044	1050 1100	131.2	ESC687M016AH8(1) ESC827M016AH4(1)
16	20	1000	*10 x 16	16	0.043	1140	160.0	ESC108M016AH8(1)
16	20	1000	10 x 20	16	0.039	1250	160.0	ESC108M016AH4(1)
16	20	1200	*10 x 25	16	0.042	1310	192.0	ESC128M016AH5(1)
16	20	1200	13 x 20	16	0.038	1450	192.0	ESC128M016AL3(1)
16	20	1500	*10 x 20	16	0.045	1200	240.0	ESC158M016AH4(1)
16	20	1500	13 x 20	16	0.034	1600	240.0	ESC158M016AL3(1)
16	20	2200	*10 x 30	16	0.032	1780	352.0	ESC228M016AH6(1)
16 16	20 20	2200	*13 x 20	16 16	0.033	1720	352.0 352.0	ESC228M016AL3(1) ESC228M016AL4(1)
16	20	2200 3300	13 x 25 *13 x 40	16	0.028 0.026	2000 2200	528.0	ESC338M016AL7(1)
16	20	3300	16 x 25	16	0.024	2200	528.0	ESC338M016AM7(1)
16	20	4700	16 x 36	16	0.019	2550	752.0	ESC478M016AM3(1)
16	20	6800	18 x 36	16	0.019	2800	1088.0	ESC688M016AN2(1)
25	32	10	5 x 11	14	0.550	50	3.0	ESC106M025AC3(1)
25	32	47	5 x 11	14	0.450	150	11.8	ESC476M025AC3(1)
25	32	56	5 x 11	14	0.420	150	14.0	ESC566M025AC3(1)
25 25	32 32	68	6.3 x 11	14 14	0.370	200 250	17.0 25.0	ESC686M025AE3(1)
25	32	100 120	6.3 x 11 8 x 11	14	0.220 0.200	300	30.0	ESC107M025AE3(1) ESC127M025AG3(1)
25	32	150	8 x 11	14	0.140	550	37.5	ESC157M025AG3(1)
25	32	220	8 x 11	14	0.120	550	55.0	ESC227M025AG3(1)
25	32	220	8 x 15	14	0.100	750	55.0	ESC227M025AG4(1)
25	32	330	*8 x 15	14	0.100	660	82.5	ESC337M025AG4(1)
25	32	330	8 x 20	14	0.069	800	82.5	ESC337M025AG6(1)
25	32	330	10 x 16	14	0.086	900	82.5	ESC337M025AH8(1)
25 25	32 32	470 470	8 x 20 10 x 16	14 14	0.067 0.064	800 1050	117.5 117.5	ESC477M025AG6(1)
25	32 32	470 470	10 x 16 10 x 12.5	14 14	0.086	760	117.5	ESC477M025AH8(1) ESC477M025AH9(1)
25	32	680	10 x 12.3	14	0.039	1100	170.0	ESC687M025AH4(1)
25	32	820	10 x 20	14	0.039	1250	205.0	ESC827M025AH4(1)
25	32	1000	*10 x 20	14	0.047	1160	250.0	ESC108M025AH4(1)
25	32	1000	*10 x 25	14	0.042	1310	250.0	ESC108M025AH5(1)
25	32	1000	13 x 20	14	0.038	1450	250.0	ESC108M025AL3(1)
25	32	1200	13 x 25	14	0.035	1600	300.0	ESC128M025AL4(1)
25	32	1500	*13 x 30	14	0.032	1750	375.0	ESC158M025AL8(1)
25 25	32 32	1500 2200	16 x 25 *13 x 30	14 14	0.028 0.029	2000 1810	375.0 550.0	ESC158M025AM7(1) ESC228M025AL8(1)
25	32	2200	*16 x 25	14	0.029	1660	550.0	ESC228M025AL8(1)
25	32	2200	16 x 32	14	0.024	2200	550.0	ESC228M025AM7(1)
25	32	3300	*16 x 36	14	0.019	2540	825.0	ESC338M025AM3(1)
25	32	3300	18 x 36	14	0.019	2550	825.0	ESC338M025AN2(1)
25	32	4700	18 x 36	14	0.019	2800	1175.0	ESC478M025AN2(1)
VDC	VDC Surge	Rated Capacitance	Case Size	DF	Z	RC	LC	Part Number

 $^{(1) \} Insert \ packaging \ code. \ See \ Ordering \ Options \ Table \ for \ available \ options.$

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

^{*} Dimension is down size, Endurance will be less 1,000 hours than standard.



Table 1 - Ratings & Part Number Reference cont.

VDC	VDC Surge Voltage	Rated Capacitance 120 Hz 20°C (µF)	Case Size D x L (mm)	DF 120 Hz 20°C (tan δ %)¹	Z 100 kHz 20°C (Ω)	RC 100 kHz 105°C (mA)	LC 20°C 2 Minutes (µA)	Part Number
25	32	6800	18 x 36	14	0.019	2800	1700.0	ESC688M025AN2(1)
35	44	4.7	5 x 11	12	1.200	115	3.0	ESC475M035AC3(1)
35	44	6.8	5 x 11	12	1.000	120	3.0	ESC685M035AC3(1)
35	44	10	5 x 11	12	0.900	140	3.5	ESC106M035AC3(1)
35 35	44 44	15 22	5 x 11	12 12	0.690	170 190	5.3 7.7	ESC156M035AC3(1)
35	44	33	5 x 11 5 x 11	12	0.600 0.580	200	11.6	ESC226M035AC3(1) ESC336M035AC3(1)
35	44	47	6.3 x 11	12	0.039	250	16.5	ESC476M035AE3(1)
35	44	68	6.3 x 11	12	0.220	300	23.8	ESC686M035AE3(1)
35	44	100	6.3 x 11	12	0.180	300	35.0	ESC107M035AE3(1)
35	44	100	8 x 11	12	0.140	450	35.0	ESC107M035AG3(1)
35	44	120	8 x 11	12	0.130	550	42.0	ESC127M035AG3(1)
35	44	150	8 x 15	12	0.100	650	52.5	ESC157M035AG4(1)
35	44	220	8 x 15	12	0.100	650	77.0	ESC227M035AG4(1)
35	44	220	10 x 12.5	12	0.069	800	77.0	ESC227M035AH9(1)
35	44	330	*10 x 16	12	0.052	900	115.5	ESC337M035AH8(1)
35	44	330	10 x 20	12	0.044	1050	115.5	ESC337M035AH4(1)
35	44	470	10 x 20	12	0.039	1300	164.5	ESC477M035AH4(1)
35 35	44 44	680 820	13 x 20 13 x 20	12 12	0.038 0.034	1400 1550	238.0 287.0	ESC687M035AL3(1) ESC827M035AL3(1)
35	44	1000	13 x 25	12	0.034	1700	350.0	ESC108M035AL4(1)
35	44	1200	16 x 25	12	0.028	1900	420.0	ESC128M035AM7(1)
35	44	1500	16 x 25	12	0.024	2100	525.0	ESC158M035AM7(1)
35	44	2200	*16 x 32	12	0.021	2300	770.0	ESC228M035AM2(1)
35	44	2200	16 x 36	12	0.019	2550	770.0	ESC228M035AM3(1)
35	44	3300	18 x 36	12	0.019	2800	1155.0	ESC338M035AN2(1)
50	63	4.7	5 x 11	10	2.000	115	3.0	ESC475M050AC3(1)
50	63	6.8	5 x 11	10	1.850	120	3.4	ESC685M050AC3(1)
50	63	10	5 x 11	10	1.700	140	5.0	ESC106M050AC3(1)
50	63	15	5 x 11	10	1.200	180	7.5	ESC156M050AC3(1)
50	63	22	5 x 11	10	0.700	200	11.0	ESC226M050AC3(1)
50 50	63 63	33 47	6.3 x 11 6.3 x 11	10 10	0.600 0.520	250 300	16.5 23.5	ESC336M050AE3(1) ESC476M050AE3(1)
50	63	68	8 x 11	10	0.350	450	34.0	ESC686M050AG3(1)
50	63	100	8 x 11	10	0.290	450	50.0	ESC107M050AG3(1)
50	63	100	8 x 15	10	0.250	550	50.0	ESC107M050AG4(1)
50	63	120	8 x 20	10	0.210	650	60.0	ESC127M050AG6(1)
50	63	150	10 x 12.5	10	0.160	800	75.0	ESC157M050AH9(1)
50	63	220	*10 x 16	10	0.100	1050	110.0	ESC227M050AH8(1)
50	63	220	10 x 25	10	0.068	1050	110.0	ESC227M050AH5(1)
50	63	330	10 x 20	10	0.072	1300	165.0	ESC337M050AH4(1)
50	63	470	*10 x 20	10 10	0.075	1390	235.0	ESC477M050AH4(1)
50 50	63 63	470 680	13 x 20	10 10	0.060 0.050	1400 1550	235.0 340.0	ESC477M050AL3(1) ESC687M050AL4(1)
50 50	63	820	13 x 25 16 x 25	10	0.050	1700	410.0	ESC827M050AL4(1)
50	63	1000	16 x 25	10	0.039	1900	500.0	ESC108M050AM7(1)
50	63	1200	16 x 32	10	0.025	2100	600.0	ESC128M050AM2(1)
50	63	1500	16 x 36	10	0.025	2550	750.0	ESC158M050AM3(1)
50	63	2200	18 x 40	10	0.025	2800	1100.0	ESC228M050AN3(1)
63	79	4.7	5 x 11	9	2.200	115	3.0	ESC475M063AC3(1)
63	79	6.8	5 x 11	9	2.000	120	4.3	ESC685M063AC3(1)
63	79	10	5 x 11	9	1.850	140	6.3	ESC106M063AC3(1)
63	79	15	5 x 11	9	1.700	200	9.5	ESC156M063AC3(1)
63	79	22	6.3 x 11	9	1.200	250	13.9	ESC226M063AE3(1)
63	79 70	33	6.3 x 11	9	0.900	300	20.8	ESC336M063AE3(1)
63	79	47	8 x 11	9	0.700	450	29.6	ESC476M063AG3(1)
VDC	VDC Surge	Rated Capacitance	Case Size	DF	Z	RC	LC	Part Number

 $^{(1) \} Insert \ packaging \ code. \ See \ Ordering \ Options \ Table \ for \ available \ options.$

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

^{*} Dimension is down size, Endurance will be less 1,000 hours than standard.



Table 1 - Ratings & Part Number Reference cont.

VDC	VDC Surge Voltage	Rated Capacitance 120 Hz 20°C (µF)	Case Size D x L (mm)	DF 120 Hz 20°C (tan δ %) ¹	Z 100 kHz 20°C (Ω)	RC 100 kHz 105°C (mA)	LC 20°C 2 Minutes (µA)	Part Number
63	79	68	8 x 11	9	0.520	550	42.8	ESC686M063AG3(1)
63	79	100	8 x 20	9	0.350	650	63.0	ESC107M063AG6(1)
63	79	120	10 x 16	9	0.300	800	75.6	ESC127M063AH8(1)
63	79	150	10 x 16	9	0.200	1050	94.5	ESC157M063AH8(1)
63	79	220	10 x 20	9	0.150	1300	138.6	ESC227M063AH4(1)
63	79	330	13 x 20	9	0.100	1400	207.9	ESC337M063AL3(1)
63	79	470	13 x 25	9	0.064	1550	296.1	ESC477M063AL4(1)
63	79	680	16 x 25	9	0.052	1700	428.4	ESC687M063AM7(1)
63	79	820	16 x 32	9	0.048	1900	516.6	ESC827M063AM2(1)
63	79	1000	16 x 32	9	0.042	2100	630.0	ESC108M063AM2(1)
63	79	1200	16 x 36	9	0.036	2550	756.0	ESC128M063AM3(1)
63	79	1500	18 x 36	9	0.033	2800	945.0	ESC158M063AN2(1)
100	125	4.7	5 x 11	8	2.000	120	4.7	ESC475M100AC3(1)
100	125	6.8	5 x 11	8	1.850	140	6.8	ESC685M100AC3(1)
100	125	10	6.3 x 11	8	1.500	200	10.0	ESC106M100AE3(1)
100	125	15	6.3 x 11	8	1.200	250	15.0	ESC156M100AE3(1)
100	125	22	8 x 11	8	0.790	300	22.0	ESC226M100AG3(1)
100	125	33	8 x 15	8	0.590	450	33.0	ESC336M100AG4(1)
100	125	47	10 x 16	8	0.350	550	47.0	ESC476M100AH8(1)
100	125	68	10 x 20	8	0.240	650	68.0	ESC686M100AH4(1)
100	125	100	13 x 20	8	0.180	800	100.0	ESC107M100AL3(1)
100	125	120	13 x 25	8	0.150	1050	120.0	ESC127M100AL4(1)
100	125	150	13 x 25	8	0.110	1300	150.0	ESC157M100AL4(1)
100	125	220	16 x 25	8	0.071	1400	220.0	ESC227M100AM7(1)
100	125	330	16 x 32	8	0.049	1550	330.0	ESC337M100AM2(1)
100	125	470	18 x 36	8	0.038	1700	470.0	ESC477M100AN2(1)
VDC	VDC Surge	Rated Capacitance	Case Size	DF	z	RC	LC	Part Number

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

 $^{^{1}}$ When capacitance exceeds 1,000 μ F, the DF value (%) is increased by 2% for every additional 1,000 μ F.

^{*} Dimension is down size, Endurance will be less 1,000 hours than standard.



Mounting Positions (Safety Vent)

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

Installing

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

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

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

- If the capacitors are stored for a long time, the leakage current must be verified. If the leakage current is superior to the value listed in this catalog, the capacitors must be reformed. In this case, they can be reformed by application of the rated voltage through a series resistor approximately 1 k Ω for capacitors with $V_R \le 160$ V (5 W resistor) and 10 k Ω for the other rated voltages.
- In the case of capacitors connected in a series, a suitable voltage sharing must be used.

 In the case of balancing resistors, the approximate resistance value can be calculated as: R = 60/C.

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



Electrical Ratings: Capacitance (ESC)

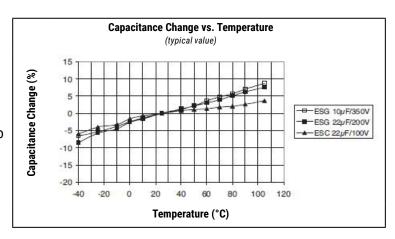


Simplified equivalent circuit diagram of an electrolytic capacitor

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

Temperature Dependence of the Capacitance

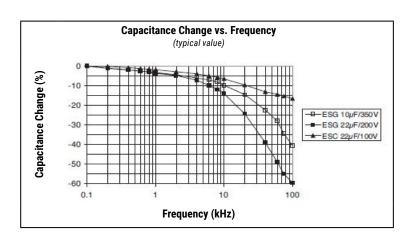
Capacitance of an electrolytic capacitor depends upon temperature: with decreasing temperature the viscosity of the electrolyte increases, thereby reducing its conductivity. Capacitance will decrease if temperature decreases. Furthermore, temperature drifts cause armature dilatation and, therefore, capacitance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



Frequency Dependence of the Capacitance

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

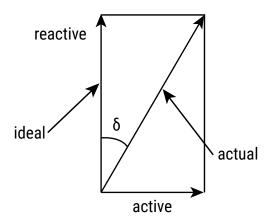
C =
$$\frac{1}{2\pi \text{ fZ}}$$
 C = capacitance (F)
f = frequency (Hz)
Z = impedance (Ω)





Dissipation Factor tan δ (DF)

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

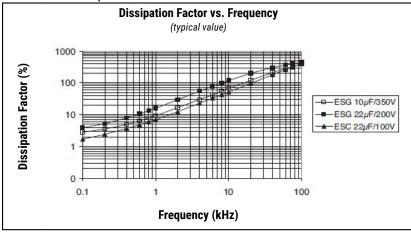


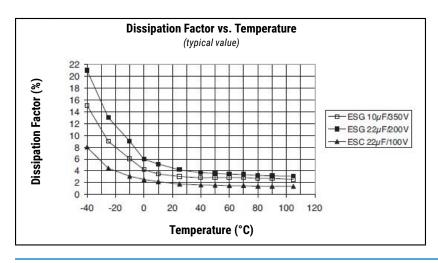
Tan δ is measured with the same set-up used for the series capacitance ESC.

Tan $\delta = \omega \times ESC \times ESR$ where:

ESC = Equivalent series capacitance

ESR = Equivalent series resistance



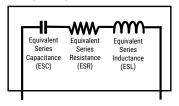




Equivalent Series Inductance (ESL)

Equivalent series inductance or self inductance results from the terminal configuration and internal design of the capacitor.

Capacitor Equivalent Internal Circuit

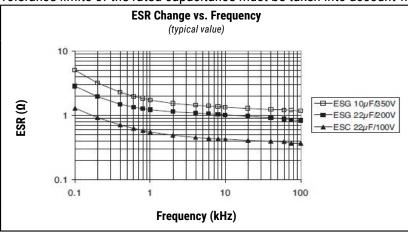


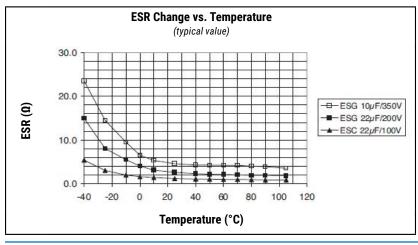
Equivalent Series Resistance (ESR)

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

$$ESR = \frac{\tan \delta}{2\pi f \ ESC} = \frac{\tan \delta}{2\pi f \ ESC} = \frac{\tan \delta}{\sin \delta} = Dissipation \ factor \\ ESC = Equivalent \ series \ capacitance \ (F) \\ f = Frequency \ (Hz)$$

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

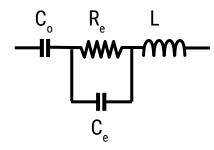






Impedance (Z)

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



C_o = Aluminum oxide capacitance (surface and thickness of the dielectric.)

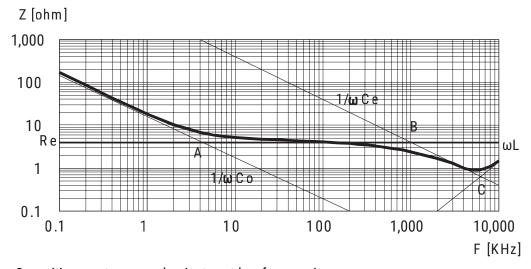
 R_e = Resistance of electrolyte and paper mixture (other resistances not depending on the frequency are not considered: tabs, plates, etc.)

C_e = Electrolyte soaked paper capacitance.

L = Inductive reactance of the capacitor winding and terminals.

Impedance of an electrolytic capacitor is not a constant quantity that retains its value under all conditions; it changes depending on frequency and temperature.

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



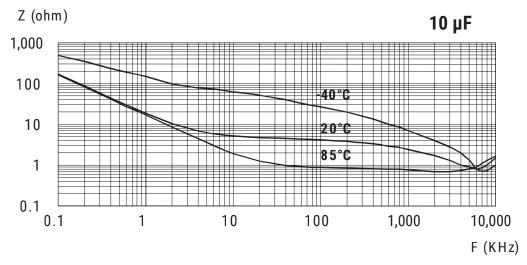
- Capacitive reactance predominates at low frequencies.
- With increasing frequency, capacitive reactance $Xc = 1/\omega C_o$ decreases until it reaches the order of magnitude of electrolyte resistance $R_o(A)$
- At even higher frequencies, resistance of the electrolyte predominates: $Z = R_e (A B)$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

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



Impedance (Z) cont.

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



 $R_{\rm e}$ is the most temperature-dependent component of an electrolytic capacitor equivalent circuit. Electrolyte resistivity will decrease if temperature rises.

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

Leakage Current (LC)

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

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

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



 $V_{\scriptscriptstyle F}$

Application & Operation Guidelines cont.

Leakage Current (LC) cont.

As the oxide layer is regenerated in use, the leakage current will gradually decrease to its normal level.

The relationship between the leakage current and voltage applied at constant temperature can be shown schematically as follows:



V_F = Forming voltage

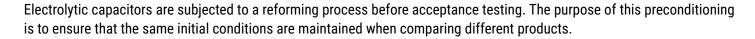
If this level is exceeded, a large quantity of heat and gas will be generated and the capacitor could be damaged.

V_D = Rated voltage

This level represents the top of the linear part of the curve.

V_s = Surge voltage

This lies between V_R and V_F . The capacitor can be subjected to V_S for short periods only.





The maximum ripple current value depends on:

- · Ambient temperature
- Surface area of the capacitor (heat dissipation area)

 $tan \; \delta \; or \; ESR$

Frequency

The capacitor's life depends on the thermal stress.

Frequency Dependence of the Ripple Current

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

Temperature Dependence of the Ripple Current

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

Expected Life Calculation

Expected life depends on operating temperature according to the following formula: L = Lo x $2^{(To-T)/10}$

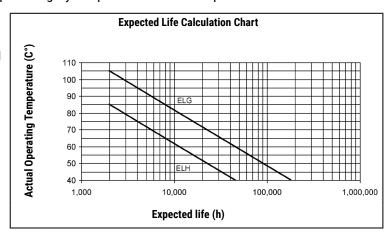
Where:

L: Expected life

Lo: Load life at a maximum permissible operating temperature

T: Actual operating temperature

To: Maximum permissible operating temperature This formula is applicable between 40°C and To.





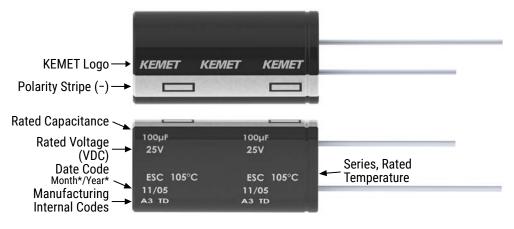


Packaging Quantities

			Ви	ılk	Auto-ir	sertion	
Size Code	Diameter (mm)	Length (mm)	Standard Leads	Cut Leads	Ammo	Tape & Reel	
C3	5.0	11.0	10,000	15,000	2,000	2,600	
E3	6.3	11.0	10,000	15,000	2,000	2,200	
G3	8.0	11.0	6,000	8,000	1,000	1,500	
G4	8.0	15.0	5,000	5,000	1,000	1,500	
G6	8.0	20.0	4,000	4,000	1,000	1,500	
Н9	10.0	12.5	4,000	4,000	700	1,200	
H8	10.0	16.0	3,000	4,000	700	1,200	
H4	10.0	20.0	2,400	3,000	700	1,200	
H5	10.0	25.0	2,400	2,400	500		
Н6	10.0	30.0	2,000	2,000	500		
L3	13.0	20.0	2,000	2,000	500		
L4	13.0	25.0	1,600	1,600	500		
L8	13.0	30.0	1,200	1,200	500		
L7	13.0	40.0	1,000	500	500		
М7	16.0	25.0	1,000	500	300		
М2	16.0	32.0	800	500	300		
М3	16.0	36.0	600	500	300		
N2	18.0	36.0	500	500			
N3	18.0	40.0	500	500			



Marking



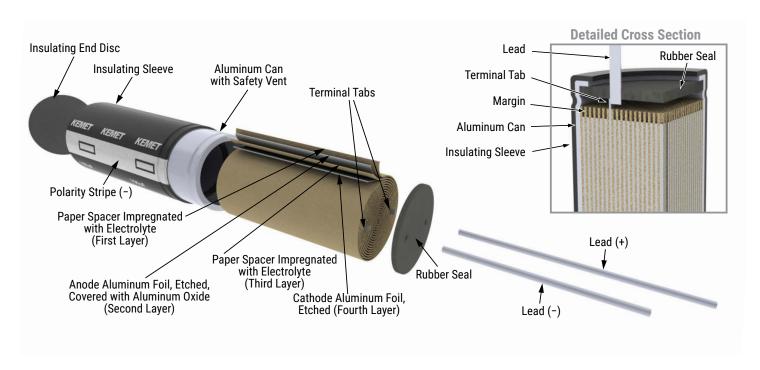
*Y = Year

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

*M = Month

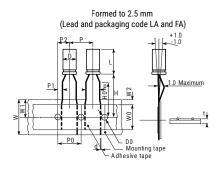
Code	01	02	03	04	05	06	07	08	09	10	11	12
Month	1	2	3	4	5	6	7	8	9	10	11	12

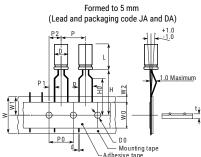
Construction



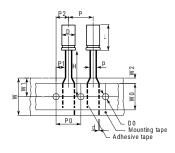


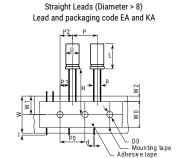
Taping for Automatic Insertion Machines





Straight Leads (Diameter: 4 - 8 mm) Lead and packaging code EA and KA



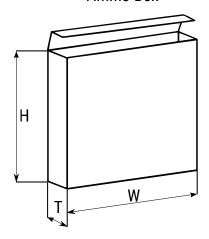


Dimensions (mm)	D	L	p	d	P	P0	P1	P2	W	W0	W 1	W2	НО	H1	I	D0	t
Tolerance	+0.5		+0.8/-0.2	±0.05	±1.0	±0.3	±0.7	±1.3	+1/-0.5	±0.5	Maximum	Maximum	±0.75	±0.5	Maximum	±0.2	±0.2
- I.	4	5 – 7	2.5	0.45	12.7	12.7	5.1	6.35	18	12	11	3	16.0	18.5		4	0.7
Formed to 2.5 mm	5	≤ 7	2.5	0.45	12.7	12.7	5.1	6.35	18	12	11	3	16.0	18.5		4	0.7
2.5 111111	3	> 7	2.5	0.50	12.7	12.7	5.1	6.35	18	12	11	3	16.0	18.5		4	0.7
	4	5 – 7	5.0	0.45	12.7	12.7	3.85	6.35	18	12	11	3	16.0	18.5		4	0.7
	5	≤ 7	5.0	0.45	12.7	12.7	3.85	6.35	18	12	11	3	16.0	18.5		4	0.7
F		>7	5.0	0.50	12.7	12.7	3.85	6.35	18	12	11	3	16.0	18.5		4	0.7
Formed to 5 mm	6	≤ 7	5.0	0.50	12.7	12.7	3.85	6.35	18	12	11	3	16.0	18.5		4	0.7
		> 7	5.0	0.50	12.7	12.7	3.85	6.35	18	12	11	3	16.0	18.5		4	0.7
	8	≤ 7	5.0	0.50	12.7	12.7	3.85	6.35	18	12	11	3	16.0	18.5		4	0.7
		> 7	5.0	0.50	12.7	12.7	3.85	6.35	18	12	11	3	16.0	18.5		4	0.7
	4	5 – 7	1.5	0.45	12.7	12.7	5.6	6.35	18	12	11	3	18.5			4	0.7
	5	≤ 7	2.0	0.45	12.7	12.7	5.35	6.35	18	12	11	3	18.5			4	0.7
		> 7	2.0	0.50	12.7	12.7	5.35	6.35	18	12	11	3	18.5			4	0.7
Straight leads	6	≤ 7	2.5	0.50	12.7	12.7	5.1	6.35	18	12	11	3	18.5			4	0.7
Straight leads	U	> 7	2.5	0.50	12.7	12.7	5.1	6.35	18	12	11	3	18.5			4	0.7
	8	≤ 7	3.5	0.50	12.7	12.7	4.6	6.35	18	12	11	3	18.5			4	0.7
	ο	> 7	3.5	0.50	12.7	12.7	4.6	6.35	18	12	11	3	18.5			4	0.7
	10	≤ 20	5.0	0.60	12.7	12.7	3.85	6.35	18	12	11	3	18.5		1	4	1.0

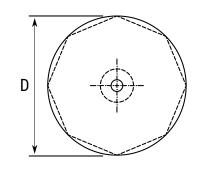


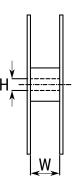
Lead Taping & Packaging











			Ammo		Reel					
Diameter	Length	Н	W	T	D	Н	W			
			Maximum	Maximum	±2	±0.5	+1/-0.1			
4	All	230	340	42						
5	≤ 7	230	340							
5	11	275	340	42		30				
6.3	≤ 7	235	340	45						
6.3	11	230	340	48						
8	≤ 7	270	340	48						
8	11	235	340	48	250		F0			
8	>11 ≤ 20	240	340	57	350		50			
10	≤ 13	250	340	52						
10	>13 ≤ 20	256	340	57						
10	>20	250	340	60						
12	All	270	340	57						
13	All	285	340	62						
16	All	265	340	62						



Construction Data

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

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

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

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

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

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

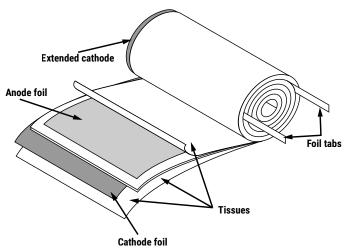
The following tests are applied and may be varied at the request of the customer. In this case the batch, or special procedure, will determine the course of action.

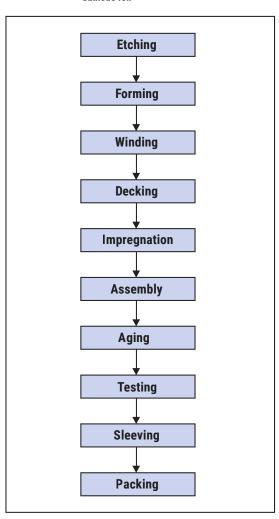
Electrical:

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

Mechanical/Visual:

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







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