

Overview

KEMET's ESY Series of single-ended aluminum electrolytic capacitors are designed for very low impedance and high ripple current applications.

Applications

Typical applications include high frequency switch mode circuits.

Benefits

- Very low impedance
- High ripple current
- Operating temperature of up to +105°C
- 1,000 – 5,000 hour operating life
- Case with $\varnothing D \geq 6.3$ mm
- Safety vent on the capacitor base



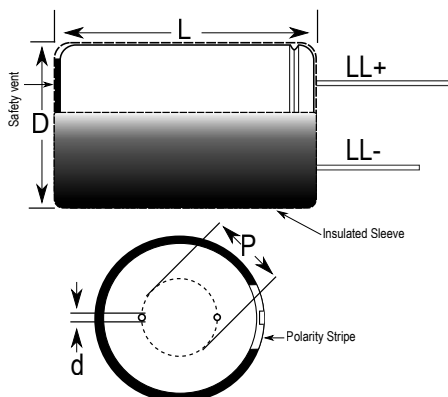
Part Number System

ESY	396	M	6R3	A	B2	AA
Series	Capacitance Code (pF)	Tolerance	Rated Voltage (VDC)	Electrical Parameters	Size Code	Packaging
Single-Ended Aluminum Electrolytic	Digits 4 – 5 represent the first two digits of the capacitance value. The final digit indicates the number of zeros to be added.	M = $\pm 20\%$	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	Packaging Type	Lead Type	Lead Length (mm)	Lead and Packaging Code
Standard Bulk Packaging Options				
4 – 22	Bulk (bag)	Straight	20/15 Minimum	AA
Standard Auto-Insertion Packaging Options				
4 – 5	Tape & Reel	Formed to 2.5 mm	$H_0 = 16.5 \pm 0.75$	LA
6.3	Tape & Reel	2.5 mm Lead Spacing	$H_0 = 18.5 \pm 0.75$	KA
8	Tape & Reel	Formed to 5 mm	$H_0 = 16.5 \pm 0.75$	JA
10 – 13	Ammo	5 mm Lead Spacing	$H_0 = 18.5 \pm 0.75$	EA
16	Ammo	7.5 mm Lead Spacing	$H_0 = 18.5 \pm 0.75$	EA
Other Packaging Options				
4 – 8	Ammo	Formed to 5 mm	$H_0 = 16.5 \pm 0.75$	DA
4 – 8	Ammo	Straight	$H_0 = 18.5 \pm 0.75$	EA
4 – 5	Ammo	Formed to 2.5 mm	$H_0 = 16.5 \pm 0.75$	FA
4 – 6.3	Tape & Reel	Formed to 5 mm	$H_0 = 16.5 \pm 0.75$	JA
4 – 5, 8 – 16	Tape & Reel	Straight	$H_0 = 18.5 \pm 0.75$	KA
Contact KEMET for other Lead and Packaging options				

Dimensions – Millimeters



Size Code	D		L		p		d		LL+/LL-	
	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
B2	4	±0.5	7	+1.5/-0	1.5	±0.5	0.45	Nominal	20/15	Minimum
C2	5	±0.5	7	+1.5/-0	2	±0.5	0.5	Nominal	20/15	Minimum
C3	5	±0.5	11	+1.5/-0	2	±0.5	0.5	Nominal	20/15	Minimum
E2	6.3	±0.5	7	+1.5/-0	2.5	±0.5	0.5	Nominal	20/15	Minimum
E3	6.3	±0.5	11	+1.5/-0	2.5	±0.5	0.5	Nominal	20/15	Minimum
G1	8	±0.5	7	+1.5/-0	3.5	±0.5	0.6	Nominal	20/15	Minimum
G2	8	±0.5	9	+1.5/-0	3.5	±0.5	0.6	Nominal	20/15	Minimum
G3	8	±0.5	11	+1.5/-0	3.5	±0.5	0.6	Nominal	20/15	Minimum
G7	8	±0.5	14	+2.0/-0	3.5	±0.5	0.6	Nominal	20/15	Minimum
G8	8	±0.5	16	+2.0/-0	3.5	±0.5	0.6	Nominal	20/15	Minimum
G6	8	±0.5	20	+2.0/-0	3.5	±0.5	0.6	Nominal	20/15	Minimum
H1	10	±0.5	12	+1.5/-0	5	±0.5	0.6	Nominal	20/15	Minimum
H2	10	±0.5	15	+2.0/-0	5	±0.5	0.6	Nominal	20/15	Minimum
H4	10	±0.5	20	+2.0/-0	5	±0.5	0.6	Nominal	20/15	Minimum
H5	10	±0.5	25	+2.0/-0	5	±0.5	0.6	Nominal	20/15	Minimum
L2	13	±0.5	16	+2.0/-0	5	±0.5	0.6	Nominal	20/15	Minimum
L3	13	±0.5	20	+2.0/-0	5	±0.5	0.6	Nominal	20/15	Minimum
L4	13	±0.5	25	+2.0/-0	5	±0.5	0.6	Nominal	20/15	Minimum
L8	13	±0.5	30	+2.0/-0	5	±0.5	0.6	Nominal	20/15	Minimum
L6	13	±0.5	36	+2.0/-0	5	±0.5	0.6	Nominal	20/15	Minimum
L7	13	±0.5	40	+2.0/-0	5	±0.5	0.6	Nominal	20/15	Minimum
M5	16	±0.5	20	+2.0/-0	7.5	±0.5	0.8	Nominal	20/15	Minimum
M7	16	±0.5	25	+2.0/-0	7.5	±0.5	0.8	Nominal	20/15	Minimum
M2	16	±0.5	32	+2.0/-0	7.5	±0.5	0.8	Nominal	20/15	Minimum
M3	16	±0.5	36	+2.0/-0	7.5	±0.5	0.8	Nominal	20/15	Minimum
M4	16	±0.5	40	+2.0/-0	7.5	±0.5	0.8	Nominal	20/15	Minimum
N4	18	±0.5	20	+2.0/-0	7.5	±0.5	0.8	Nominal	20/15	Minimum
N5	18	±0.5	25	+2.0/-0	7.5	±0.5	0.8	Nominal	20/15	Minimum
N1	18	±0.5	32	+2.0/-0	7.5	±0.5	0.8	Nominal	20/15	Minimum
N2	18	±0.5	36	+2.0/-0	7.5	±0.5	0.8	Nominal	20/15	Minimum
N3	18	±0.5	40	+2.0/-0	7.5	±0.5	0.8	Nominal	20/15	Minimum

Performance Characteristics

Item	Performance Characteristics
Capacitance Range	5.6 – 6800 μ F
Capacitance Tolerance	\pm 20% at 120 Hz / 20°C
Rated Voltage	6.3 – 100 VDC
Life Test	1,000 – 5,000 hours (see conditions in Test Method & Performance)
Operating Temperature	-40°C to +105°C
Leakage Current	$I \leq 0.01 CV$ or 3 μ A, whichever is greater C = rated capacitance (μ F), V = rated voltage (VDC). Voltage applied for 2 minutes at 20°C.

Impedance Z Characteristics at 120 Hz

Rated Voltage (VDC)	6.3	10	16	25	35	50	63	100
Z (-25°C) / Z (20°C)	2	2	2	2	2	2	2	2
Z (-40°C) / Z (20°C)	3	3	3	3	3	3	3	3

Compensation Factor of Ripple Current (RC) vs. Frequency

Capacitance Range (μ F)	50 Hz	120 Hz	1 kHz	10 kHz	100 kHz
5.6 – 390	0.60	0.70	0.85	0.95	1.00
470 – 1,000	0.65	0.75	0.90	0.98	1.00
1,200 – 6,800	0.75	0.80	0.95	1.00	1.00

Compensation Factor of Ripple Current (RC) vs. Temperature

Temperature	65°C	85°C	105°C
Coefficient	2.00	1.50	1.00

Test Method & Performance

Conditions	Load Life Test			Shelf Life Test
Temperature	105°C			105°C
Test Duration	Can Ø ≤ 8.0 mm	L = 7	1,000 hours	1,000 hours
	Can Ø ≤ 6.3 mm	L ≥ 11	2,000 hours	
	Can Ø = 8.0 mm	L ≥ 11	3,000 hours	
	Can Ø = 10.0 mm	L ≥ 11	4,000 hours	
	Can Ø ≥ 13.0 mm	L ≥ 11	5,000 hours	
Ripple Current	Maximum ripple current specified at 100 kHz 105°C			No ripple current applied
Voltage	The sum of DC voltage and the peak AC voltage must not exceed the rated voltage of the capacitor			No voltage applied
Performance	The following specifications will be satisfied when the capacitor is restored to 20°C:			
Capacitance Change	Within ±25% of the initial value			
Dissipation Factor	Does not exceed 200% of the specified value			
Leakage Current	Does not exceed specified value			

Environmental Compliance

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

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

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



RoHS Compliant

Table 1 – Ratings & Part Number Reference

VDC	VDC Surge Voltage	Rated Capacitance 120 Hz 20°C (µF)	Case Size D x L (mm)	DF 120 Hz 20°C (tan δ %)*	Z 100 kHz 20°C (Ω)	RC 100 kHz 105°C (mA)	LC 20°C 2 Minutes (µA)	Part Number
6.3	8	39	4 x 7	22	0.85	130	3	ESY396M6R3AB2
6.3	8	47	5 x 7	22	0.7	175	3	ESY476M6R3AC2
6.3	8	56	5 x 7	22	0.56	190	3	ESY566M6R3AC2
6.3	8	68	5 x 7	22	0.43	210	4	ESY686M6R3AC2
6.3	8	100	5 x 11	22	0.43	200	6	ESY107M6R3AC3
6.3	8	100	6.3 x 7	22	0.35	240	6	ESY107M6R3AE2
6.3	8	120	5 x 11	22	0.38	220	7	ESY127M6R3AC3
6.3	8	120	6.3 x 7	22	0.29	270	7	ESY127M6R3AE2
6.3	8	150	5 x 11	22	0.3	250	9	ESY157M6R3AC3
6.3	8	150	6.3 x 7	22	0.23	300	9	ESY157M6R3AE2
6.3	8	180	8 x 7	22	0.18	340	11	ESY187M6R3AG1
6.3	8	220	8 x 7	22	0.15	380	14	ESY227M6R3AG1
6.3	8	270	6.3 x 11	22	0.16	370	17	ESY277M6R3AE3
6.3	8	330	6.3 x 11	22	0.13	410	21	ESY337M6R3AE3
6.3	8	470	8 x 11	22	0.086	680	30	ESY477M6R3AG3
6.3	8	560	8 x 11	22	0.072	760	35	ESY567M6R3AG3
6.3	8	680	8 x 14	22	0.062	900	43	ESY687M6R3AG7
6.3	8	820	8 x 16	22	0.056	1000	52	ESY827M6R3AG8
6.3	8	1000	10 x 12	22	0.053	1030	63	ESY108M6R3AH1
6.3	8	1200	8 x 20	22	0.041	1250	76	ESY128M6R3AG6
6.3	8	1200	10 x 15	22	0.038	1430	76	ESY128M6R3AH2
6.3	8	1500	10 x 20	22	0.026	1820	94	ESY158M6R3AH4
6.3	8	1800	10 x 25	22	0.025	1940	113	ESY188M6R3AH5
6.3	8	2200	10 x 25	22	0.023	2150	139	ESY228M6R3AH5
6.3	8	2700	13 x 20	22	0.022	2230	170	ESY278M6R3AL3
6.3	8	3300	13 x 20	22	0.021	2360	208	ESY338M6R3AL3
6.3	8	3900	13 x 25	22	0.018	2770	246	ESY398M6R3AL4
6.3	8	4700	13 x 30	22	0.016	3290	296	ESY478M6R3AL8
6.3	8	5600	13 x 36	22	0.015	3400	353	ESY568M6R3AL6
6.3	8	5600	16 x 20	22	0.018	3140	353	ESY568M6R3AM5
6.3	8	6800	16 x 25	22	0.016	3460	428	ESY688M6R3AM7
10	13	27	4 x 7	19	0.89	130	3	ESY276M010AB2
10	13	33	5 x 7	19	0.75	160	3	ESY336M010AC2
10	13	39	5 x 7	19	0.64	175	4	ESY396M010AC2
10	13	47	5 x 7	19	0.53	190	5	ESY476M010AC2
10	13	56	5 x 7	19	0.44	210	6	ESY566M010AC2
10	13	68	5 x 11	19	0.44	210	7	ESY686M010AC3
10	13	100	5 x 11	19	0.3	250	10	ESY107M010AC3
10	13	120	6.3 x 7	19	0.23	300	12	ESY127M010AE2
10	13	150	8 x 9	19	0.18	345	15	ESY157M010AG2
10	13	180	8 x 9	19	0.15	380	18	ESY187M010AG2
10	13	220	6.3 x 11	19	0.13	410	22	ESY227M010AE3
10	13	270	8 x 11	19	0.12	580	27	ESY277M010AG3
10	13	330	8 x 11	19	0.1	640	33	ESY337M010AG3
10	13	470	8 x 11	19	0.072	760	47	ESY477M010AG3
10	13	560	8 x 16	19	0.068	910	56	ESY567M010AG8
10	13	560	10 x 12	19	0.064	940	56	ESY567M010AH1
10	13	680	8 x 16	19	0.056	1000	68	ESY687M010AG8
10	13	680	10 x 12	19	0.053	1030	68	ESY687M010AH1
10	13	820	8 x 20	19	0.05	1130	82	ESY827M010AG6
10	13	820	10 x 15	19	0.046	1300	82	ESY827M010AH2
10	13	1000	8 x 20	19	0.041	1250	100	ESY108M010AG6
10	13	1000	10 x 15	19	0.038	1430	100	ESY108M010AH2
10	13	1200	10 x 20	19	0.026	1820	120	ESY128M010AH4
10	13	1500	10 x 25	19	0.023	2150	150	ESY158M010AH5
10	13	1800	13 x 20	19	0.022	2230	180	ESY188M010AL3
10	13	2200	13 x 20	19	0.021	2360	220	ESY228M010AL3
VDC	VDC Surge	Rated Capacitance	Case Size	DF	Z	RC	LC	Part Number

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

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

Table 1 – Ratings & Part Number Reference cont'd

VDC	VDC Surge Voltage	Rated Capacitance 120 Hz 20°C (µF)	Case Size D x L (mm)	DF 120 Hz 20°C (tan δ %)*	Z 100 kHz 20°C (Ω)	RC 100 kHz 105°C (mA)	LC 20°C 2 Minutes (µA)	Part Number
10	13	2700	13 x 25	19	0.02	2510	270	ESY278M010AL4
10	13	3300	13 x 25	19	0.018	2770	330	ESY338M010AL4
10	13	3900	13 x 30	19	0.016	3290	390	ESY398M010AL8
10	13	3900	16 x 20	19	0.018	3140	390	ESY398M010AM5
10	13	4700	13 x 36	19	0.015	3400	470	ESY478M010AL6
10	13	5600	16 x 25	19	0.016	3460	560	ESY568M010AM7
16	20	18	4 x 7	16	0.92	130	3	ESY186M016AB2
16	20	27	5 x 7	16	0.61	190	4	ESY276M016AC2
16	20	33	5 x 7	16	0.45	210	5	ESY336M016AC2
16	20	39	5 x 11	16	0.43	205	6	ESY396M016AC3
16	20	47	5 x 11	16	0.36	230	7	ESY476M016AC3
16	20	56	5 x 11	16	0.34	250	9	ESY566M016AC3
16	20	68	6.3 x 7	16	0.24	300	11	ESY686M016AE2
16	20	100	6.3 x 11	16	0.16	370	16	ESY107M016AE3
16	20	100	8 x 7	16	0.18	350	16	ESY107M016AG1
16	20	120	6.3 x 11	16	0.13	410	19	ESY127M016AE3
16	20	120	8 x 7	16	0.15	380	19	ESY127M016AG1
16	20	150	8 x 11	16	0.12	510	24	ESY157M016AG3
16	20	180	8 x 11	16	0.11	560	29	ESY187M016AG3
16	20	220	8 x 11	16	0.1	620	35	ESY227M016AG3
16	20	270	8 x 11	16	0.088	690	43	ESY277M016AG3
16	20	330	8 x 11	16	0.072	760	53	ESY337M016AG3
16	20	470	8 x 16	16	0.056	1000	75	ESY477M016AG8
16	20	470	10 x 12	16	0.053	1030	75	ESY477M016AH1
16	20	560	8 x 20	16	0.049	1140	90	ESY567M016AG6
16	20	560	10 x 15	16	0.046	1300	90	ESY567M016AH2
16	20	680	8 x 20	16	0.041	1250	109	ESY687M016AG6
16	20	680	10 x 15	16	0.038	1430	109	ESY687M016AH2
16	20	820	10 x 20	16	0.032	1650	131	ESY827M016AH4
16	20	1000	10 x 20	16	0.026	1820	160	ESY108M016AH4
16	20	1200	10 x 25	16	0.023	2150	192	ESY128M016AH5
16	20	1500	13 x 20	16	0.021	2360	240	ESY158M016AL3
16	20	1800	13 x 25	16	0.02	2510	288	ESY188M016AL4
16	20	2200	13 x 25	16	0.018	2770	352	ESY228M016AL4
16	20	2700	13 x 30	16	0.016	3290	432	ESY278M016AL8
16	20	2700	16 x 20	16	0.018	3140	432	ESY278M016AM5
16	20	3300	13 x 36	16	0.015	3400	528	ESY338M016AL6
16	20	3900	16 x 25	16	0.016	3460	624	ESY398M016AM7
25	32	15	4 x 7	14	0.94	130	4	ESY156M025AB2
25	32	18	5 x 7	14	0.69	170	4	ESY186M025AC2
25	32	27	5 x 7	14	0.46	210	7	ESY276M025AC2
25	32	33	5 x 11	14	0.42	220	8	ESY336M025AC3
25	32	39	5 x 11	14	0.36	230	10	ESY396M025AC3
25	32	47	5 x 11	14	0.3	250	12	ESY476M025AC3
25	32	56	6.3 x 7	14	0.24	300	14	ESY566M025AE2
25	32	68	6.3 x 11	14	0.19	340	17	ESY686M025AE3
25	32	68	8 x 7	14	0.22	310	17	ESY686M025AG1
25	32	100	6.3 x 11	14	0.13	410	25	ESY107M025AE3
25	32	100	8 x 7	14	0.15	380	25	ESY107M025AG1
25	32	120	8 x 11	14	0.12	560	30	ESY127M025AG3
25	32	150	8 x 11	14	0.105	630	37	ESY157M025AG3
25	32	180	8 x 11	14	0.088	690	45	ESY187M025AG3
25	32	220	8 x 11	14	0.072	760	55	ESY227M025AG3
25	32	270	8 x 16	14	0.068	900	67	ESY277M025AG8
25	32	270	10 x 12	14	0.065	930	67	ESY277M025AH1
25	32	330	8 x 16	14	0.056	1000	82	ESY337M025AG8
25	32	330	10 x 12	14	0.053	1030	82	ESY337M025AH1
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Table 1 – Ratings & Part Number Reference cont'd

VDC	VDC Surge Voltage	Rated Capacitance 120 Hz 20°C (µF)	Case Size D x L (mm)	DF 120 Hz 20°C (tan δ %)*	Z 100 kHz 20°C (Ω)	RC 100 kHz 105°C (mA)	LC 20°C 2 Minutes (µA)	Part Number
25	32	470	8 x 20	14	0.041	1250	117	ESY477M025AG6
25	32	470	10 x 15	14	0.038	1430	117	ESY477M025AH2
25	32	560	10 x 20	14	0.032	1650	140	ESY567M025AH4
25	32	680	10 x 20	14	0.026	1820	170	ESY687M025AH4
25	32	820	10 x 25	14	0.023	2150	205	ESY827M025AH5
25	32	1000	13 x 20	14	0.021	2360	250	ESY108M025AL3
25	32	1200	13 x 25	14	0.02	2510	300	ESY128M025AL4
25	32	1500	13 x 25	14	0.018	2770	375	ESY158M025AL4
25	32	1800	13 x 30	14	0.016	3290	450	ESY188M025AL8
25	32	1800	16 x 20	14	0.018	3140	450	ESY188M025AM5
25	32	2200	13 x 36	14	0.015	3400	550	ESY228M025AL6
25	32	2700	16 x 25	14	0.016	3460	675	ESY278M025AM7
35	44	10	4 x 7	12	0.96	130	3	ESY106M035AB2
35	44	15	5 x 7	12	0.57	190	5	ESY156M035AC2
35	44	18	5 x 7	12	0.47	210	6	ESY186M035AC2
35	44	27	5 x 11	12	0.37	230	9	ESY276M035AC3
35	44	33	5 x 11	12	0.32	250	11	ESY336M035AC3
35	44	39	6.3 x 7	12	0.25	300	14	ESY396M035AE2
35	44	47	6.3 x 11	12	0.15	380	16	ESY476M035AE3
35	44	47	8 x 7	12	0.19	350	16	ESY476M035AG1
35	44	56	6.3 x 11	12	0.13	410	20	ESY566M035AE3
35	44	56	8 x 7	12	0.16	380	20	ESY566M035AG1
35	44	68	8 x 11	12	0.12	510	24	ESY686M035AG3
35	44	100	8 x 11	12	0.105	620	35	ESY107M035AG3
35	44	120	8 x 11	12	0.088	680	42	ESY127M035AG3
35	44	150	8 x 11	12	0.072	760	52	ESY157M035AG3
35	44	180	8 x 16	12	0.068	910	63	ESY187M035AG8
35	44	180	10 x 12	12	0.065	930	63	ESY187M035AH1
35	44	220	8 x 16	12	0.056	1000	77	ESY227M035AG8
35	44	220	10 x 12	12	0.053	1030	77	ESY227M035AH1
35	44	270	8 x 20	12	0.041	1250	94	ESY277M035AG6
35	44	330	10 x 15	12	0.038	1430	115	ESY337M035AH2
35	44	470	10 x 20	12	0.026	1820	164	ESY477M035AH4
35	44	560	10 x 25	12	0.023	2150	196	ESY567M035AH5
35	44	680	13 x 20	12	0.021	2360	238	ESY687M035AL3
35	44	820	13 x 25	12	0.02	2510	287	ESY827M035AL4
35	44	1000	13 x 25	12	0.018	2770	350	ESY108M035AL4
35	44	1200	13 x 30	12	0.016	3290	420	ESY128M035AL8
35	44	1200	16 x 20	12	0.018	3140	420	ESY128M035AM5
35	44	1500	13 x 36	12	0.015	3400	525	ESY158M035AL6
35	44	1800	16 x 25	12	0.016	3460	630	ESY188M035AM7
50	63	5.6	4 x 7	10	1	130	3	ESY565M050AB2
50	63	6.8	5 x 7	10	0.74	170	3	ESY685M050AC2
50	63	10	5 x 7	10	0.5	210	5	ESY106M050AC2
50	63	15	5 x 11	10	0.48	215	7	ESY156M050AC3
50	63	15	6.3 x 7	10	0.38	220	7	ESY156M050AE2
50	63	22	5 x 11	10	0.34	240	11	ESY226M050AC3
50	63	22	6.3 x 7	10	0.26	300	11	ESY226M050AE2
50	63	27	8 x 7	10	0.21	340	13	ESY276M050AG1
50	63	33	8 x 7	10	0.17	380	16	ESY336M050AG1
50	63	39	6.3 x 11	10	0.16	330	19	ESY396M050AE3
50	63	47	6.3 x 11	10	0.15	360	23	ESY476M050AE3
50	63	56	6.3 x 11	10	0.14	390	28	ESY566M050AE3
50	63	68	8 x 11	10	0.11	600	34	ESY686M050AG3
50	63	82	8 x 11	10	0.09	660	41	ESY826M050AG3
50	63	100	8 x 11	10	0.074	730	50	ESY107M050AG3
50	63	120	8 x 16	10	0.065	950	60	ESY127M050AG8
VDC	VDC Surge	Rated Capacitance	Case Size	DF	Z	RC	LC	Part Number

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

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

Table 1 – Ratings & Part Number Reference cont'd

VDC	VDC Surge Voltage	Rated Capacitance 120 Hz 20°C (µF)	Case Size D x L (mm)	DF 120 Hz 20°C (tan δ %)*	Z 100 kHz 20°C (Ω)	RC 100 kHz 105°C (mA)	LC 20°C 2 Minutes (µA)	Part Number
50	63	150	10 x 12	10	0.061	980	75	ESY157M050AH1
50	63	180	8 x 20	10	0.046	1190	90	ESY187M050AG6
50	63	220	10 x 15	10	0.042	1370	110	ESY227M050AH2
50	63	270	10 x 20	10	0.03	1580	135	ESY277M050AH4
50	63	330	10 x 25	10	0.028	1870	165	ESY337M050AH5
50	63	390	13 x 20	10	0.028	1870	195	ESY397M050AL3
50	63	470	13 x 20	10	0.027	2050	235	ESY477M050AL3
50	63	560	13 x 25	10	0.023	2410	280	ESY567M050AL4
50	63	680	13 x 30	10	0.021	2860	340	ESY687M050AL8
50	63	820	13 x 36	10	0.019	2960	410	ESY827M050AL6
50	63	820	16 x 20	10	0.023	2730	410	ESY827M050AM5
50	63	1000	16 x 32	10	0.021	3350	500	ESY108M050AM2
63	79	15	5 x 11	9	0.88	170	9	ESY156M063AC3
63	79	22	6.3 x 11	9	0.65	220	14	ESY226M063AE3
63	79	27	6.3 x 11	9	0.43	240	17	ESY276M063AE3
63	79	33	6.3 x 11	9	0.35	270	21	ESY336M063AE3
63	79	39	8 x 11	9	0.31	385	24	ESY396M063AG3
63	79	47	8 x 11	9	0.26	420	30	ESY476M063AG3
63	79	56	8 x 11	9	0.22	500	35	ESY566M063AG3
63	79	68	8 x 16	9	0.19	610	43	ESY686M063AG8
63	79	68	10 x 12	9	0.18	625	43	ESY686M063AH1
63	79	82	8 x 16	9	0.16	670	52	ESY826M063AG8
63	79	82	10 x 12	9	0.15	690	52	ESY826M063AH1
63	79	100	10 x 15	9	0.12	800	63	ESY107M063AH2
63	79	120	8 x 20	9	0.12	820	75	ESY127M063AG6
63	79	120	10 x 15	9	0.11	950	75	ESY127M063AH2
63	79	150	10 x 20	9	0.096	1010	94	ESY157M063AH4
63	79	150	13 x 16	9	0.098	1040	94	ESY157M063AL2
63	79	180	10 x 20	9	0.08	1100	113	ESY187M063AH4
63	79	180	13 x 16	9	0.082	1140	113	ESY187M063AL2
63	79	220	10 x 25	9	0.073	1300	139	ESY227M063AH5
63	79	270	13 x 20	9	0.06	1500	170	ESY277M063AL3
63	79	330	13 x 25	9	0.043	1850	208	ESY337M063AL4
63	79	390	13 x 30	9	0.047	2050	245	ESY397M063AL8
63	79	390	16 x 20	9	0.054	1810	245	ESY397M063AM5
63	79	470	13 x 30	9	0.039	2250	296	ESY477M063AL8
63	79	470	16 x 20	9	0.045	1990	296	ESY477M063AM5
63	79	560	13 x 36	9	0.035	2450	353	ESY567M063AL6
63	79	560	16 x 25	9	0.032	2550	353	ESY567M063AM7
63	79	680	13 x 40	9	0.029	2780	428	ESY687M063AL7
63	79	680	18 x 20	9	0.038	2450	428	ESY687M063AN4
63	79	820	16 x 32	9	0.026	2810	517	ESY827M063AM2
63	79	820	18 x 25	9	0.031	2780	517	ESY827M063AN5
63	79	1000	16 x 36	9	0.021	2840	630	ESY108M063AM3
63	79	1000	18 x 32	9	0.025	3270	630	ESY108M063AN1
63	79	1200	16 x 40	9	0.019	3340	756	ESY128M063AM4
63	79	1200	18 x 36	9	0.02	3310	756	ESY128M063AN2
63	79	1500	18 x 40	9	0.018	3420	945	ESY158M063AN3
100	125	6.8	5 x 11	8	1.4	125	7	ESY685M100AC3
100	125	10	6.3 x 11	8	0.95	170	10	ESY106M100AE3
100	125	15	6.3 x 11	8	0.57	210	15	ESY156M100AE3
100	125	22	8 x 11	8	0.44	330	22	ESY226M100AG3
100	125	27	8 x 11	8	0.36	360	27	ESY276M100AG3
100	125	33	8 x 14	8	0.3	375	33	ESY336M100AG7
100	125	39	8 x 16	8	0.25	450	39	ESY396M100AG8
100	125	47	10 x 12	8	0.24	450	47	ESY476M100AH1
100	125	56	8 x 20	8	0.19	570	56	ESY566M100AG6
VDC	VDC Surge	Rated Capacitance	Case Size	DF	Z	RC	LC	Part Number

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

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

Table 1 – Ratings & Part Number Reference cont'd

VDC	VDC Surge Voltage	Rated Capacitance 120 Hz 20°C (μ F)	Case Size D x L (mm)	DF 120 Hz 20°C ($\tan \delta$ %)*	Z 100 kHz 20°C (Ω)	RC 100 kHz 105°C (mA)	LC 20°C 2 Minutes (μ A)	Part Number
100	125	68	10 x 15	8	0.18	580	68	ESY686M100AH2
100	125	82	10 x 20	8	0.13	750	82	ESY686M100AH4
100	125	82	13 x 16	8	0.13	740	82	ESY826M100AL2
100	125	100	10 x 25	8	0.12	880	100	ESY107M100AH5
100	125	120	13 x 20	8	0.094	1050	120	ESY127M100AL3
100	125	150	13 x 25	8	0.085	1100	150	ESY157M100AL4
100	125	180	13 x 25	8	0.071	1200	180	ESY187M100AL4
100	125	220	13 x 30	8	0.063	1410	220	ESY227M100AL8
100	125	220	16 x 20	8	0.071	1300	220	ESY227M100AM5
100	125	270	13 x 36	8	0.052	1560	270	ESY277M100AL6
100	125	270	16 x 25	8	0.053	1600	270	ESY277M100AM7
100	125	270	18 x 20	8	0.069	1470	270	ESY277M100AN4
100	125	330	13 x 40	8	0.046	1700	330	ESY337M100AL7
100	125	390	16 x 32	8	0.041	1750	390	ESY397M100AM2
100	125	390	18 x 25	8	0.049	1620	390	ESY397M100AN5
100	125	470	16 x 36	8	0.033	1890	470	ESY477M100AM3
100	125	470	18 x 32	8	0.039	1780	470	ESY477M100AN1
100	125	560	16 x 40	8	0.03	2080	560	ESY567M100AM4
100	125	560	18 x 36	8	0.031	2060	560	ESY567M100AN2
100	125	680	18 x 40	8	0.028	2570	680	ESY687M100AN3
VDC	VDC Surge	Rated Capacitance	Case Size	DF	Z	RC	LC	Part Number

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

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

Mounting Positions (Safety Vent)

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

Installing

- A general principle is that lower-use temperatures result in a longer, useful life of the capacitor. For this reason, it should be ensured that electrolytic capacitors are placed away from heat-emitting components. Adequate space should be allowed between components for cooling air to circulate, particularly when high ripple current loads are applied. In any case, the maximum category temperature must not be exceeded.
- Do not deform the case of capacitors or use capacitors with a deformed case.
- Verify that the connections of the capacitors are able to insert on the board without excessive mechanical force.
- 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 mm to ≤ 40 mm	> 3 mm
> 40 mm	> 5 mm

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

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

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

Application and Operation Guidelines

Electrical Ratings: Capacitance (ESC)

Capacitance is measured by applying an alternate voltage of ≤ 0.5 V at a frequency of 120 or 100 Hz and 20°C.

Temperature Dependence of the Capacitance

Capacitance of an electrolytic capacitor depends upon temperature: with decreasing temperature the viscosity of the electrolyte increases, thereby reducing its conductivity.

Capacitance will decrease if temperature decreases. Furthermore, temperature drifts cause armature dilatation and, therefore, capacitance changes (up to 20% depending on the series considered, from 0 to 80°C). This phenomenon is more evident for electrolytic capacitors than for other types.

Frequency Dependence of the Capacitance

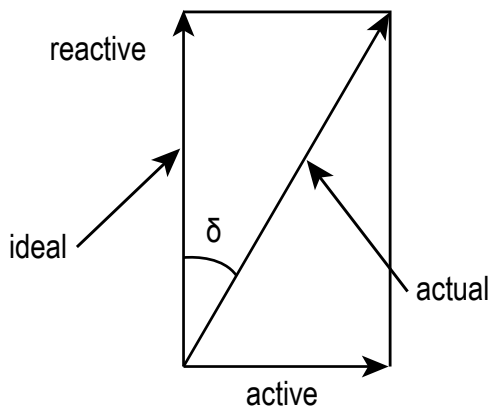
Effective capacitance value is derived from the impedance curve, as long as impedance is still in the range where the capacitance component is dominant.

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

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

Dissipation Factor $\tan \delta$ (DF)

Dissipation Factor $\tan \delta$ 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.



$\tan \delta$ is measured with the same set-up used for the series capacitance ESC.

$\tan \delta = \omega \times \text{ESC} \times \text{ESR}$ where:

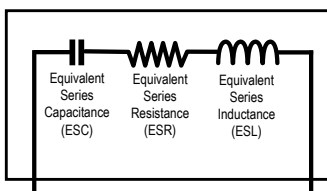
ESC = Equivalent Series Capacitance

ESR = Equivalent Series Resistance

Equivalent Series Inductance (ESL)

Self inductance or Equivalent Series 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 $\tan \delta$ by the following equation:

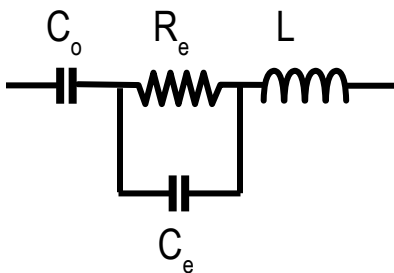
$$ESR = \frac{\tan \delta}{2\pi f ESC}$$

ESR = Equivalent Series Resistance (Ω)
 $\tan \delta$ = 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)

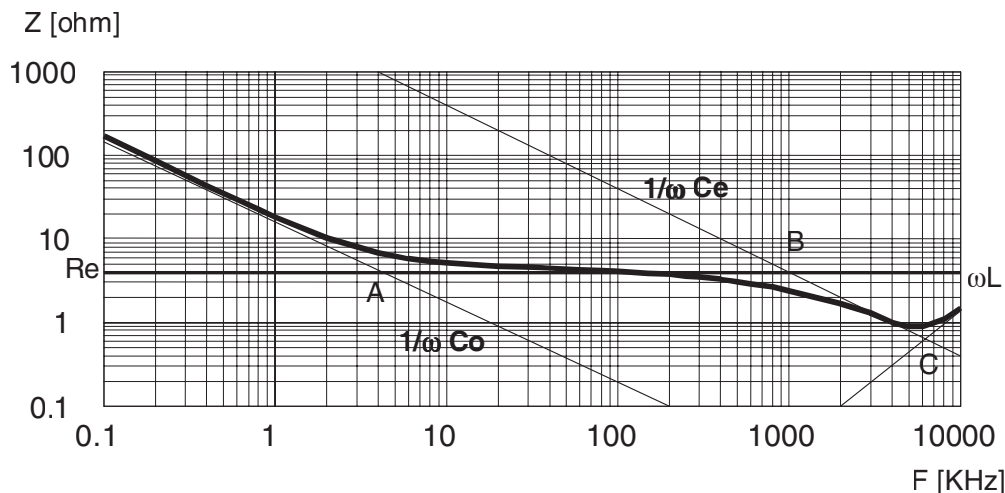
R_e = Resistance of electrolyte and paper mixture (other resistances not depending on the frequency are not considered: tabs, plates, etc.)

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.

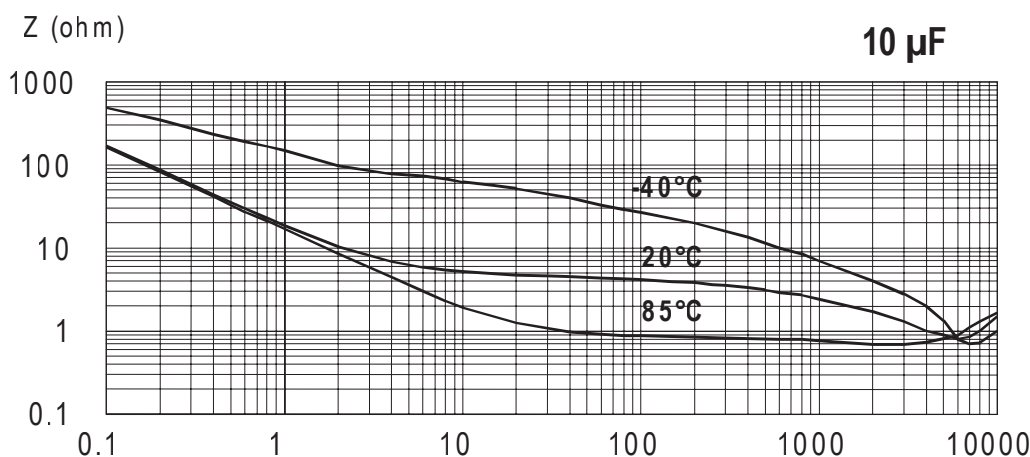
Impedance as a function of frequency (sinusoidal waveform) for a certain temperature can be represented as follows:



- Capacitive reactance predominates at low frequencies
- With increasing frequency, capacitive reactance $X_c = 1/\omega C_0$ decreases until it reaches the order of magnitude of electrolyte resistance $R_e(A)$
- At even higher frequencies, resistance of the electrolyte predominates: $Z = R_e (A - B)$
- When the capacitor's resonance frequency is reached (ω_0), capacitive and inductive reactance mutually cancel each other $1/\omega C_e = \omega L$, $\omega_0 = C\sqrt{1/LC_e}$
- Above this frequency, inductive reactance of the winding and its terminals ($X_L = Z = \omega L$) becomes effective and leads to an increase in impedance

Generally speaking, it can be estimated that $C_e \approx 0.01 C_0$.

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



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

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

Leakage Current (LC)

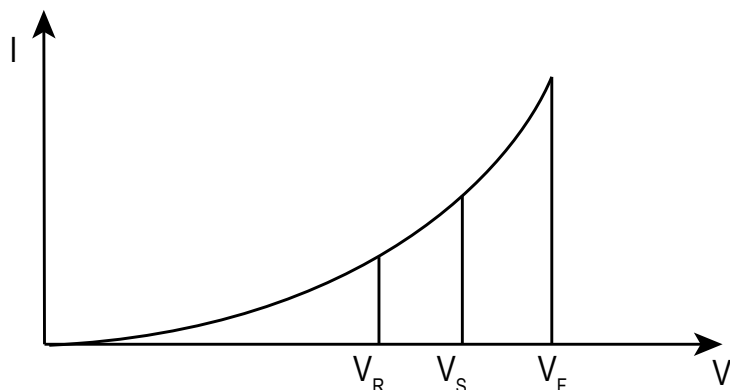
Due to the aluminum oxide layer that serves as a dielectric, a small current will continue to flow even after a DC voltage has been applied for long periods. This current is called leakage current.

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

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

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

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



Where:

V_F = **Forming voltage**

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

V_R = **Rated voltage**

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

V_S = **Surge voltage**

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

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

Ripple Current (RC)

The maximum ripple current value depends on:

- Ambient temperature
- Surface area of the capacitor (heat dissipation area)
- tan δ or ESR
- Frequency

The capacitor's life depends on the thermal stress.

Frequency Dependence of the Ripple Current

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

Temperature Dependence of the Ripple Current

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

Expected Life Calculation

Expected life depends on operating temperature according to the following formula: $L = L_o \times 2^{(T_o - T)/10}$

Where:

- L: Expected life
- L_o: Load life at maximum permissible operating temperature
- T: Actual operating temperature
- T_o: Maximum permissible operating temperature

This formula is applicable between 40°C and T_o.

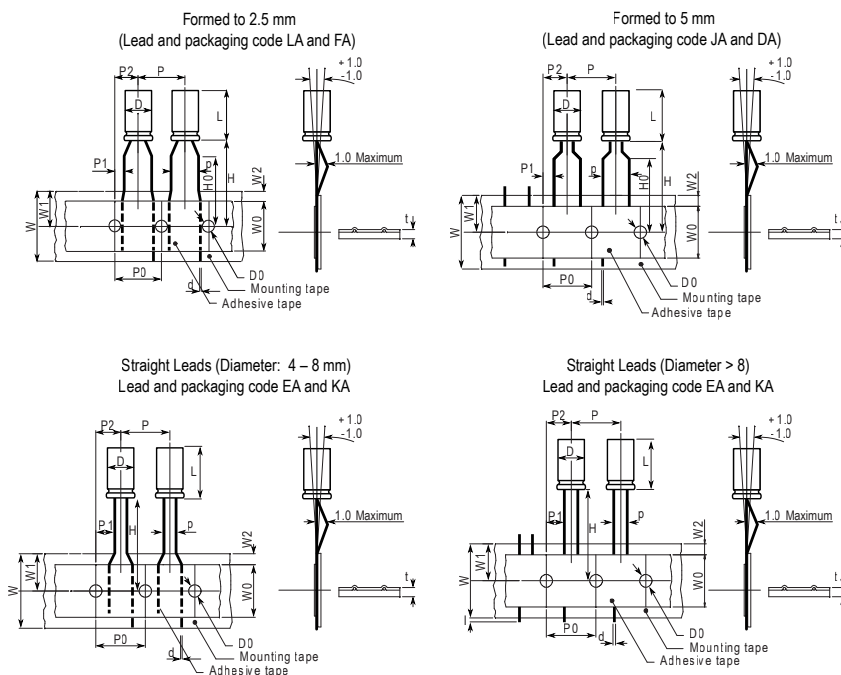
Packaging Quantities

Size Code	Diameter (mm)	Length (mm)	Bulk Standard Leads	Cut Leads	Auto-insertion	
					Ammo	Tape & Reel
B2	4	7	10000	15000	2500	1500
C3	5	11	10000	15000	2000	1300
C2	5	7	10000	15000	2000	1300
E3	6.3	11	10000	15000	2000	1100
E2	6.3	7	10000	15000	2000	1100
G3	8	11	6000	8000	1000	750
G7	8	14	5000	5000	1000	750
G8	8	16	5000	5000	1000	750
G6	8	20	4000	4000	1000	750
G1	8	7	6000	8000	1000	750
H1	10	12	4000	4000	700	600
H2	10	15	3000	4000	700	600
H4	10	20	2400	3000	700	600
H5	10	25	2400	2400	500	
L2	13	16	2400	2400	500	
L3	13	20	2000	2000	500	
L4	13	25	1600	1600	500	
L8	13	30	1200	2400		
L6	13	36	1000	1200	400	
L7	13	40	1000	500	500	
M5	16	20	1000	500	300	
M7	16	25	1000	500	300	
M2	16	32	800	500		
M3	16	36	600	500		
M4	16	40	600	500		
N4	18	20	800	1000		
N5	18	25	800	500		
N1	18	32	500	500		
N2	18	36	500	500		
N3	18	40	500	500		

Standard Marking for Radial Types

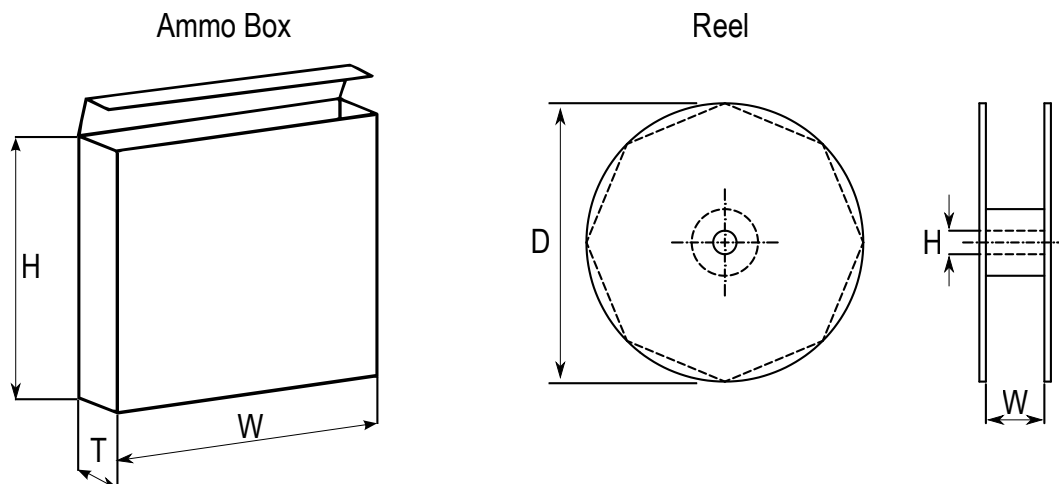
- KEMET logo
- Series
- Operating temperature (°C)
- Rated capacitance (µF)
- Rated voltage (VDC)
- Negative polarity: gold line
- Date code

Taping for Automatic Insertion Machines



Dimensions (mm)	D	L	p	d	P	P0	P1	P2	W	W0	W1	W2	H0	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
Formed to 2.5 mm	4	5-7	2.5	0.45	12.7	12.7	5.1	6.35	18	12	11	3	16	18.5		4	0.7
	5	≤7	2.5	0.45	12.7	12.7	5.1	6.35	18	12	11	3	16	18.5		4	0.7
		>7	2.5	0.5	12.7	12.7	5.1	6.35	18	12	11	3	16	18.5		4	0.7
Formed to 5 mm	4	5-7	5	0.45	12.7	12.7	3.85	6.35	18	12	11	3	16	18.5		4	0.7
	5	≤7	5	0.45	12.7	12.7	3.85	6.35	18	12	11	3	16	18.5		4	0.7
		>7	5	0.5	12.7	12.7	3.85	6.35	18	12	11	3	16	18.5		4	0.7
	6	≤7	5	0.5	12.7	12.7	3.85	6.35	18	12	11	3	16	18.5		4	0.7
		>7	5	0.5	12.7	12.7	3.85	6.35	18	12	11	3	16	18.5		4	0.7
	8	≤7	5	0.5	12.7	12.7	3.85	6.35	18	12	11	3	16	18.5		4	0.7
>7	5	0.5	12.7	12.7	3.85	6.35	18	12	11	3	16	18.5		4	0.7		
Straight leads	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	0.45	12.7	12.7	5.35	6.35	18	12	11	3	18.5			4	0.7
		>7	2	0.5	12.7	12.7	5.35	6.35	18	12	11	3	18.5			4	0.7
	6	≤7	2.5	0.5	12.7	12.7	5.1	6.35	18	12	11	3	18.5			4	0.7
		>7	2.5	0.5	12.7	12.7	5.1	6.35	18	12	11	3	18.5			4	0.7
	8	≤7	3.5	0.5	12.7	12.7	4.6	6.35	18	12	11	3	18.5			4	0.7
		>7	3.5	0.5	12.7	12.7	4.6	6.35	18	12	11	3	18.5			4	0.7
	10	12-25	5	0.6	12.7	12.7	3.85	6.35	18	12	11	3	18.5		1	4	1
	12	15-25	5	0.6	15	15	3.85	7.5	18	12	11	3	18.5		1	4	1
13	5		0.6	15	15	3.85	7.5	18	12	11	3	18.5		1	4	1	
	5		0.6	15	15	3.85	7.5	18	12	11	3	18.5		1	4	1	
16	7.5		0.8	30	30	3.75	7.5	18	12	11	3	18.5		1	4	1	
18	7.5		0.8	30	30	3.75	7.5	18	12	11	3	18.5		1	4	1	

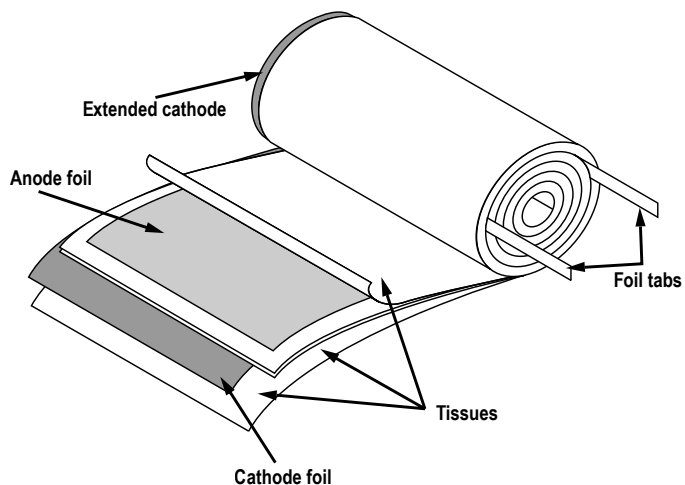
Lead Taping & Packaging



Case Size (mm)	Ammo			Reel		
	H	W	T	D	H	W
		Maximum	Maximum	±2	±0.5	+1/-0.1
4	230	340	42	350	30	50
5 x 5 – 7	230	340	42			
6.3 x 5 – 7	275	340	42			
8 x 5 – 9	235	340	45			
5 x 11	230	340	48			
6.3 x 11	270	340	48			
8 x 11	235	340	48			
8 x 14 – 20	240	340	57			
10 x 12	250	340	52			
10 x 15 – 19	256	340	57			
10 x 22 – 25	250	340	60			
12	270	340	57			
13	285	340	62			
16	265	340	62			

Construction

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.

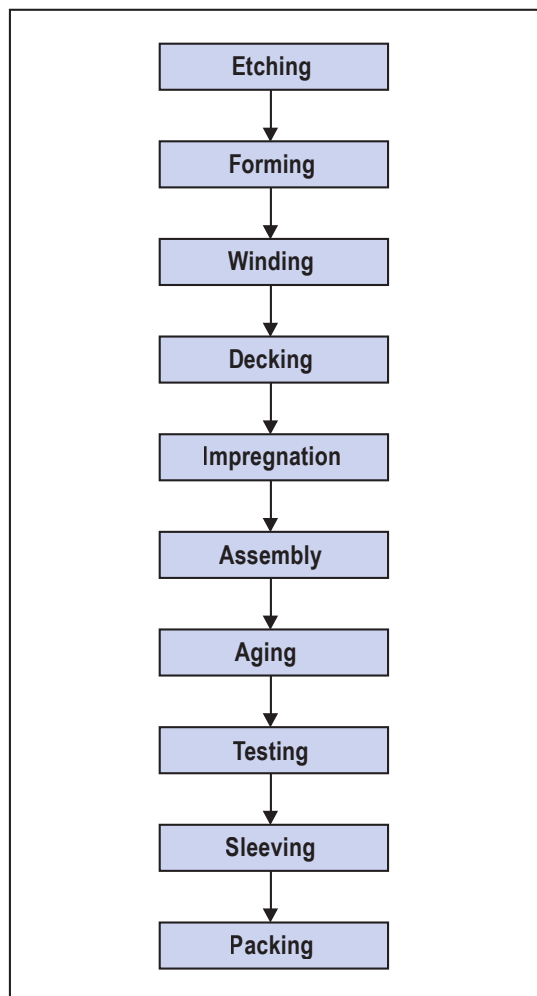
The following tests are applied and may be varied at the request of the customer. In this case the batch, or special procedure, will determine the course of action.

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 indicated or that other measures may not be required.