



Aluminum Capacitors



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Aluminum Capacitors

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SMD Aluminum Electrolytic Capacitors

AEA Series



FEATURES

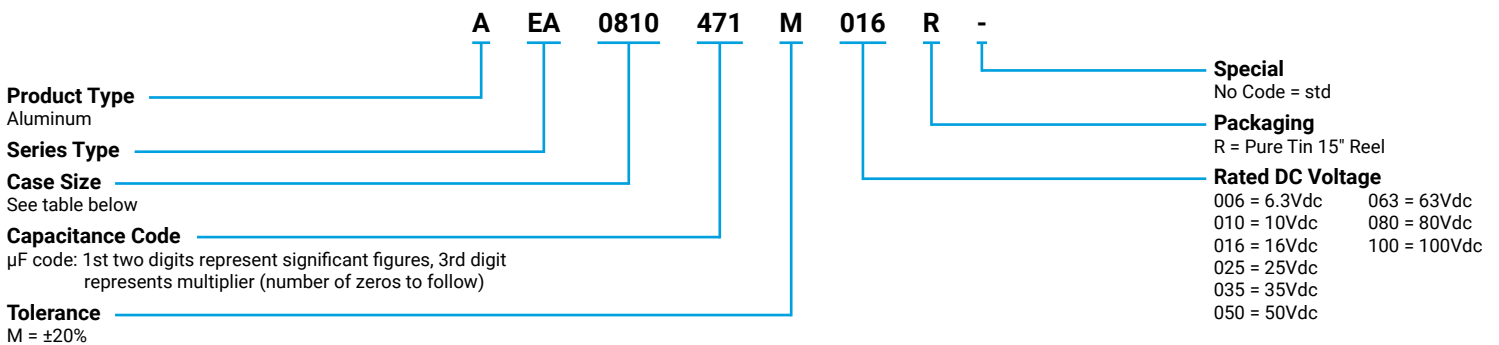
- Low Impedance, 105°C 5,000 hours
- Applicable to SMT Process
- RoHS Compliance

APPLICATIONS

- Industrial/Consumer Electronics
- Lighting
- DC/DC Converters



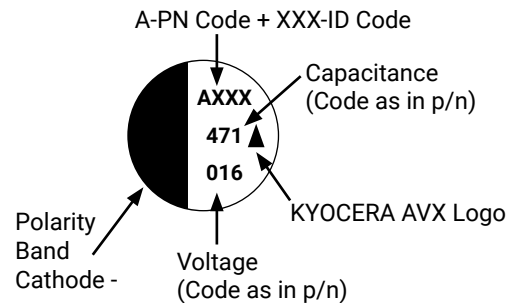
HOW TO ORDER



CASE DIMENSIONS millimeters (inches)

Code	D±0.50 (0.020)	L±0.50 (0.020)	W±0.20 (0.008)	H±0.20 (0.008)	C±0.20 (0.008)	R	P±0.30 (0.012)	V max
0810	8.00 (0.315)	10.50 (0.413)	8.30 (0.327)	8.30 (0.327)	9.00 (0.354)	0.70 - 1.10 (0.028 - 0.043)	3.20 (0.126)	0.30 (0.012)
1010	10.00 (0.394)	10.00 (0.394)	10.30 (0.406)	10.30 (0.406)	11.00 (0.433)	0.70 - 1.30 (0.028 - 0.051)	4.50 (0.177)	0.30 (0.012)
1213	12.50 (0.492)	13.50 (0.531)	13.00 (0.512)	13.00 (0.512)	13.70 (0.539)	1.10 - 1.40 (0.043 - 0.055)	4.50 (0.177)	0.40 (0.016)
1616	16.00 (0.630)	16.50 (0.650)	17.00 (0.669)	17.00 (0.669)	18.00 (0.709)	1.40 - 1.80 (0.055 - 0.071)	6.40 (0.252)	0.40 (0.016)

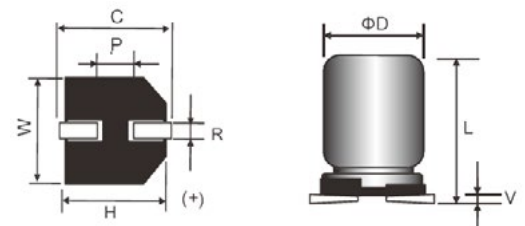
MARKING



TECHNICAL SPECIFICATIONS

Category Temperature Range:	-55°C to + 105°C	
Capacitance Range:	At 20°C, 120Hz	22µF to 6800µF
Capacitance Tolerance:	At 20°C, 120Hz	±20%
Dissipation Factor %	Measurement Frequency: 120Hz at 20°C	Please see the ratings and part number reference table below.
Leakage Current	After 2 minutes at rated working voltage at 20°C*	I ≤ 0.01CV or 3µA whichever is greater

* Note: In the case of an anomalous reading, re-measure the leakage current after following voltage treatment:
Voltage treatment: DC rated voltage to be applied to the capacitors for 120 minutes at 105°C.



SMD Aluminum Electrolytic Capacitors

AEA Series



CAPACITANCE AND RATED VOLTAGE RANGE (FIGURES DENOTES CASE SIZE)

Capacitance		Rated Voltage DC (V _R)								
μF	Code	6.3V	10V	16V	25V	35V	50V	63V	80V	100V
22	220									0810
33	330								0810	1010
47	470							0810	1010	1213
56	560						0810	1010		
68	680						0810			1213
100	101					0810	0810	1213	1213	1616
150	151				0810	0810	1010	1213	1213	1616
220	221				0810	1010	1010	1213		
330	331		0810	0810	0810		1213	1616	1616	
470	471	0810	0810	0810	1010	1213	1616	1616		
680	681	0810	1010	1010	1213	1213	1616			
1000	102	0810	1010	1010, 1213	1213	1616	1616			
1500	152	1010	1213	1213	1616	1616				
2200	222	1213	1213		1616					
3300	332			1616						
4700	472		1616							
6800	682	1616								

Released ratings

RATINGS & PART NUMBER REFERENCE

Part No.	Case Size	Capacitance (μF)	Rated Voltage (V)	DCL Max. (μA)	DF Max. (%)	100kHz RMS Current (mA)/105°C	Impedance 100kHz Max. (Ω)
6.3 Volt							
AEA0810471M006R	0810	470	6.3	30	30	600	0.17
AEA0810681M006R	0810	680	6.3	43	30	600	0.17
AEA0810102M006R	0810	1000	6.3	63	30	600	0.17
AEA1010152M006R	1010	1500	6.3	95	30	850	0.09
AEA1213222M006R	1213	2200	6.3	139	30	1100	0.06
AEA1616682M006R	1616	6800	6.3	428	30	1800	0.035
10 Volt							
AEA0810331M010R	0810	330	10	33	26	600	0.17
AEA0810471M010R	0810	470	10	47	26	600	0.17
AEA1010681M010R	1010	680	10	68	26	850	0.09
AEA1010102M010R	1010	1000	10	100	26	850	0.09
AEA1213152M010R	1213	1500	10	150	26	1100	0.06
AEA1213222M010R	1213	2200	10	220	26	1100	0.06
AEA1616472M010R	1616	4700	10	470	26	1800	0.035
16 Volt							
AEA0810331M016R	0810	330	16	53	22	600	0.17
AEA0810471M016R	0810	470	16	75	22	600	0.17
AEA1010681M016R	1010	680	16	109	22	850	0.09
AEA1010102M016R	1010	1000	16	160	22	850	0.09
AEA1213102M016R	1213	1000	16	160	22	1100	0.06
AEA1213152M016R	1213	1500	16	240	22	1100	0.06
AEA1616332M016R	1616	3300	16	528	22	1800	0.035
25 Volt							
AEA0810151M025R	0810	150	25	37.5	16	600	0.17
AEA0810221M025R	0810	220	25	55	16	600	0.17
AEA0810331M025R	0810	330	25	82.5	16	600	0.17
AEA1010471M025R	1010	470	25	117.5	16	850	0.09
AEA1213681M025R	1213	680	25	170	16	1100	0.06
AEA1213102M025R	1213	1000	25	250	16	1100	0.06
AEA1616152M025R	1616	1500	25	375	16	1800	0.035
AEA1616222M025R	1616	2200	25	550	16	1800	0.035

All technical data relates to an ambient temperature of +25°C. Capacitance and DF are measured at 120Hz, 0.5RMS with DC bias of 2.2 volts. DCL is measured at rated voltage after 5 minutes.

SMD Aluminum Electrolytic Capacitors

AEA Series



RATINGS & PART NUMBER REFERENCE

Part No.	Case Size	Capacitance (μF)	Rated Voltage (V)	DCL Max. (μA)	DF Max. (%)	100kHz RMS Current (mA)/105°C	Impedance 100kHz Max. (Ω)
35 Volt							
AEA0810101M035R	0810	100	35	35	14	600	0.17
AEA0810151M035R	0810	150	35	53	14	600	0.17
AEA1010221M035R	1010	220	35	77	14	850	0.09
AEA1213471M035R	1213	470	35	165	14	1100	0.06
AEA1213681M035R	1213	680	35	238	14	1100	0.06
AEA1616102M035R	1616	1000	35	350	14	1800	0.035
AEA1616152M035R	1616	1500	35	525	14	1800	0.035
50 Volt							
AEA0810560M050R	0810	56	50	28	14	330	0.34
AEA0810680M050R	0810	68	50	34	14	330	0.34
AEA0810101M050R	0810	100	50	50	14	330	0.34
AEA1010151M050R	1010	150	50	75	14	670	0.18
AEA1010221M050R	1010	220	50	110	14	670	0.18
AEA1213331M050R	1213	330	50	165	14	900	0.12
AEA1616471M050R	1616	470	50	235	14	1610	0.073
AEA1616681M050R	1616	680	50	340	14	1610	0.073
AEA1616102M050R	1616	1000	50	500	14	1610	0.073
63 Volt							
AEA0810470M063R	0810	47	63	30	8	200	0.7
AEA1010560M063R	1010	56	63	35	8	369	0.48
AEA1213101M063R	1213	100	63	63	8	800	0.16
AEA1213151M063R	1213	150	63	95	8	800	0.16
AEA1213221M063R	1213	220	63	139	8	800	0.16
AEA1616331M063R	1616	330	63	208	8	1410	0.082
AEA1616471M063R	1616	470	63	298	8	1410	0.082
80 Volt							
AEA0810330M080R	0810	33	80	26	8	130	1.88
AEA1010470M080R	1010	47	80	38	8	200	0.9
AEA1213101M080R	1213	100	80	80	8	500	0.32
AEA1213151M080R	1213	150	80	120	8	500	0.32
AEA1616331M080R	1616	330	80	264	8	793	0.17
100 Volt							
AEA0810220M100R	0810	22	100	22	7	130	1.88
AEA1010330M100R	1010	33	100	33	7	200	0.65
AEA1213470M100R	1213	47	100	47	7	500	0.32
AEA1213680M100R	1213	68	100	68	7	500	0.32
AEA1616101M100R	1616	100	100	100	7	793	0.17
AEA1616151M100R	1616	150	100	150	7	793	0.17

All technical data relates to an ambient temperature of +25°C. Capacitance and DF are measured at 120Hz, 0.5RMS with DC bias of 2.2 volts. DCL is measured at rated voltage after 5 minutes.

FREQUENCY COEFFICIENT OF PERMISSIBLE RIPPLE CURRENT

Capacitance Range	120 ≤ F(Hz) < 1K	1K ≤ F(Hz) < 10K	10K ≤ F(Hz) < 100K	100K(Hz) ≤ F
≤ 33	0.35	0.70	0.90	1.00
33 - 150	0.40	0.85	0.92	1.00
> 150	0.60	0.85	0.95	1.00

The endurance of capacitors is reduced with internal heating produced by ripple current at the rate of halving the lifetime with every 5°C rise. When long life performance is required in actual use, the rms ripple current has to be reduced.

SMD Aluminum Electrolytic Capacitors

AEA Series



QUALIFICATION TABLE

Test	AEA series											
	Condition	Characteristics										
Low Temperature Characteristics (Max. Impedance Ratio)	At 120Hz	Rated Voltage (V)	6.3	10	16	25	35	50	63	80	100	
		Z(-25°C)/Z(+20°C)	4	3	2	2	2	2	2	2	2	
		Z(-55°C)/Z(+20°C)	8	5	4	3	3	3	3	3	3	
Endurance	5000 hours, with application of rated voltage at 105°C	ΔC/C	Within ±30% of the initial limit									
		DF	300% or less of the initial specified limit									
		DCL	Initial specified limit or less									
Shelf Life	The following specifications shall be satisfied when the capacitors are restored to 20° after exposing them for 1000 hours 105°C without voltage applied. Before the measurement, the capacitor shall be preconditioned by applying voltage according to them 4.1 of JIS C5101-4.	ΔC/C	Within ±30% of the initial limit									
		DF	300% or less of the initial specified limit									
		DCL	Initial specified limit or less									
Resistance to Soldering Heat	The capacitors shall be kept on the hot plate maintained at 250°C for 30 seconds. After removing from the hot plate and restored at room temperature they meet the characteristics requirements listed at right.	ΔC/C	Within ±10% of the initial limit									
		DF	Initial specified limit									
		DCL	Initial specified limit or less									
Standards	JIS C 5101-4-1 (IEC 60384)											

REFLOW

Diameter (mm)	Φ4 - 6.3	Φ8 - 16
Peak Temperature	260°C, 5 sec. max.	245°C, 5 sec. max.
Preheat Temperature	150°C to 180°C, 120 sec. max.	
Duration at 217°C or Higher	90 sec. max.	90 sec. max.
Reflow Number	Once	Twice or less

STORAGE

- It is recommended to keep capacitors between the ambient temperatures of 5°C to 35°C and a relative humidity of 75% or below.
- Confirm that the environment does not have any of the following conditions:
 - Damp conditions such as water, saltwater spray, or oil spray or fumes. High humidity or humidity condensation situations.
 - In an atmosphere filled with toxic gasses (such as hydrogen sulfide, sulfurous acid, nitrous acid, chlorine, ammonia, etc.).
 - Being exposed to direct sunlight, ozone, ultraviolet ray, or radiation.
 - Being exposed to acidic or alkaline solutions.
 - Under severe conditions where vibration and / or mechanical shock exceed the applicable ranges of the specification.
-

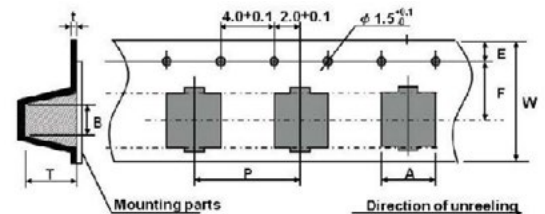
Category	Description	Storage Life
Mid-High Voltage	160V and above	2yrs, after 1yr, needs to check characteristics, if NG, needs to do aging
Low Voltage	120V and below	2yrs

Remark: Re-aging condition depends on its own spec.

PACKAGE TAPE DIMENSIONS units (mm)

Size Code	A±0.20	B±0.20	W±0.30	F±0.10	E±0.10	P±0.10	t±0.10	T±0.20
0810	8.7	8.7	24.0	11.5	1.75	16.0	0.4	11.0
1010	10.7	10.7	24.0	11.5	1.75	16.0	0.4	11.0
1213	13.4/13.7(G)	13.4/13.7(G)	32.0	14.2	1.75	24.0	0.4	14.5
1616	17.5	17.5	44.0	20.2	1.75	28.0	0.4	17.5

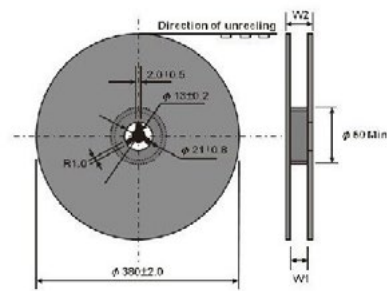
„(G)“ „Anti-vibration Structure“



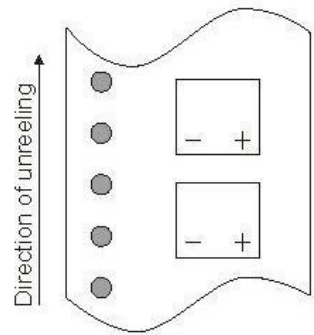
SMD Aluminum Electrolytic Capacitors

AEA Series

REEL



POLARITY



DIMENSIONS units (mm)

Size Code	W1±1.00	W2±1.00	Qty./Reel
0810	18.0	22.0	500
1010	26.0	31.0	500
1213	34.0	39.0	250
1616	46.0	51.0	200

SMD Aluminum Electrolytic Capacitors

AEF Series



FEATURES

- Endurance, 105°C, 6000 hours
- Designed for surface mounting on high density PC board
- RoHS Compliance



LEAD-FREE
LEAD-FREE COMPATIBLE
COMPONENT

APPLICATIONS

- Industrial
- Consumer electronics
- Lighting
- DC/DC converters



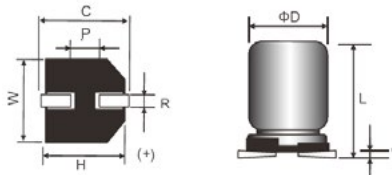
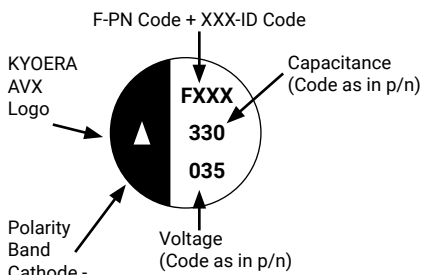
HOW TO ORDER

Product Type Aluminum	A	EF	0608	330	M	035	R	-	Special No Code = std
Series Type									Packaging R = Pure Tin 13" Reel (D ≥ 12.50mm) 15" Reel (D ≤ 10.00mm)
Case Size See table below									Rated DC Voltage 006 = 6.3Vdc 080 = 80Vdc 010 = 10Vdc 100 = 100Vdc 016 = 16Vdc 160 = 160Vdc 025 = 25Vdc 200 = 200Vdc 035 = 35Vdc 250 = 250Vdc 050 = 50Vdc 400 = 400Vdc 063 = 63Vdc
Capacitance Code µF code: 1st two digits represent significant figures, 3rd digit represents multiplier (number of zeros to follow)									
Tolerance M = ±20%									

CASE DIMENSIONS millimeters (inches)

Code	D±0.50 (0.020)	L±0.50 (0.020)	W±0.20 (0.008)	H±0.20 (0.008)	C±0.20 (0.008)	R	P±0.30 (0.012)	V max
0608	6.30 (0.248)	8.00 (0.315)	6.60 (0.260)	6.60 (0.260)	7.30 (0.287)	0.50 - 0.80 (0.020 - 0.031)	2.00 (0.080)	0.30 (0.012)
0610	6.30 (0.248)	10.50 (0.413)	6.60 (0.260)	6.60 (0.260)	7.30 (0.287)	0.50 - 0.80 (0.020 - 0.031)	2.00 (0.080)	0.30 (0.012)
0810	8.00 (0.315)	10.50 (0.413)	8.30 (0.327)	8.30 (0.327)	9.00 (0.354)	0.70 - 1.10 (0.028 - 0.043)	3.20 (0.126)	0.30 (0.012)
0812	8.00 (0.315)	12.50 (0.492)	8.30 (0.327)	8.30 (0.327)	9.00 (0.354)	0.70 - 1.10 (0.028 - 0.043)	3.20 (0.126)	0.30 (0.012)
0813	8.00 (0.315)	13.50 (0.531)	8.30 (0.327)	8.30 (0.327)	9.00 (0.354)	0.70 - 1.10 (0.028 - 0.043)	3.20 (0.126)	0.30 (0.012)
1010	10.00 (0.394)	10.50 (0.413)	10.30 (0.406)	10.30 (0.406)	11.00 (0.433)	0.70 - 1.10 (0.028 - 0.043)	4.50 (0.177)	0.30 (0.012)
1012	10.00 (0.394)	12.50 (0.492)	10.30 (0.406)	10.30 (0.406)	11.00 (0.433)	0.70 - 1.10 (0.028 - 0.043)	4.50 (0.177)	0.30 (0.012)
1013	10.00 (0.394)	13.50 (0.531)	10.30 (0.406)	10.30 (0.406)	11.00 (0.433)	0.70 - 1.10 (0.028 - 0.043)	4.50 (0.177)	0.30 (0.012)
1016	10.00 (0.394)	16.50 (0.650)	10.30 (0.406)	10.30 (0.406)	11.00 (0.433)	0.70 - 1.10 (0.028 - 0.043)	4.50 (0.177)	0.30 (0.012)
1213	12.50 (0.492)	13.50 (0.531)	13.00 (0.512)	13.00 (0.512)	13.70 (0.539)	1.10 - 1.40 (0.043 - 0.055)	4.50 (0.177)	0.40 (0.016)
1216	12.50 (0.492)	16.00 (0.630)	13.00 (0.512)	13.00 (0.512)	13.70 (0.539)	1.10 - 1.40 (0.043 - 0.055)	4.50 (0.177)	0.40 (0.016)

MARKING



SMD Aluminum Electrolytic Capacitors

AEF Series

TECHNICAL SPECIFICATIONS

Category Temperature Range:	-55°C to +105°C (6.3 - 100V), -40°C to + 105°C (160 - 400V)		
Capacitance Range:	At 20°C, 120Hz	2.2μF to 470μF	
Capacitance Tolerance:	At 20°C, 120Hz	±20%	
Dissipation Factor (%):	Measurement Frequency: 120Hz at 20°C	Please see the Ratings and Part Number Reference Table below	
Leakage Current:	Rated voltage at 20°C*	6.3 - 100V	160 - 400V
		$I \leq 0.03CV$ or 4μA, whichever is greater (2min)	$I \leq 0.04CV + 100\mu A$ (1min)

* Note: In the case of an anomalous reading, re-measure the leakage current after following voltage treatment:
Voltage treatment: DC rated voltage to be applied to the capacitors for 120 minutes at 105°C.

CAPACITANCE AND RATED VOLTAGE RANGE (FIGURES DENOTES CASE SIZE)

Capacitance		Rated Voltage DC (V _R)												
μF	Code	6.3V	10V	16V	25V	35V	50V	63V	80V	100V	160V	200V	250V	400V
2.2	2R2													0610
3.3	3R3													0810
4.7	4R7												0810	0812
5.6	5R6													0812
6.8	6R8													1013
10	100					0608			0608	0608	1010	0810	0812	1013
15	150										0812	0813		1016
22	220					0608	0608	0608	0810	0810			1016	
33	330					0608		0810	0810	1010	1013			
47	470				0608	0608	0810	0810	1010	1010	1016			
100	101	0608		0608	0608	0810	1010	1010	1012	1213				
150	151		0608											
220	221	0608	0810	0810	0810	1010	1213	1213	1216					
330	331	0810	1010	0812	1010		1216							
470	471	0810	1010	1010										

Released ratings

RATINGS & PART NUMBER REFERENCE

Part Number	Case Size	Capacitance (μF)	Rated Voltage (V)	DCL Max. (μA)	DF Max. (%)	ESR Max. @100kHz (Ω)	100kHz RMS Current (mA)
6.3 Volt							
AEF0608101M006R	0608	100	6.3	18	32	0.75	145
AEF0608221M006R	0608	220	6.3	39.6	32	0.75	180
AEF0810331M006R	0810	330	6.3	59.4	32	0.36	280
AEF0810471M006R	0810	470	6.3	84.6	32	0.36	360
10 Volt							
AEF0608151M010R	0608	150	10	45	28	0.75	105
AEF0810221M010R	0810	220	10	66	28	0.36	280
AEF1010331M010R	1010	330	10	99	28	0.23	400
AEF1010471M010R	1010	470	10	141	28	0.23	545
16 Volt							
AEF0608101M016R	0608	100	16	48	26	0.75	145
AEF0810221M016R	0810	220	16	105.6	26	0.36	475
AEF0812331M016R	0812	330	16	158.4	26	0.36	510
AEF1010471M016R	1010	470	16	225.6	26	0.23	720
25 Volt							
AEF0608470M025R	0608	47	25	35.3	16	0.75	165
AEF0608101M025R	0608	100	25	75	16	0.75	175
AEF0810221M025R	0810	220	25	165	16	0.36	535
AEF1010331M025R	1010	330	25	247.5	16	0.23	750
35 Volt							
AEF0608100M035R	0608	10	35	10.5	14	0.75	145
AEF0608220M035R	0608	22	35	23.1	14	0.75	160
AEF0608330M035R	0608	33	35	34.7	14	0.75	175
AEF0608470M035R	0608	47	35	49.4	14	0.75	190

All technical data relates to an ambient temperature of +25°C. Capacitance and DF are measured at 120Hz, 0.5RMS with DC bias of 2.2 volts. DCL is measured at rated voltage after 5 minutes.

SMD Aluminum Electrolytic Capacitors

AEF Series



RATINGS & PART NUMBER REFERENCE

Part Number	Case Size	Capacitance (μF)	Rated Voltage (V)	DCL Max. (μA)	DF Max. (%)	ESR Max. @100kHz (Ω)	100kHz RMS Current (mA)
AEF0810101M035R	0810	100	35	105	14	0.36	560
AEF1010221M035R	1010	220	35	231	14	0.23	800
50 Volt							
AEF0608220M050R	0608	22	50	33	14	1.5	145
AEF0810470M050R	0810	47	50	70.5	14	0.57	520
AEF1010101M050R	1010	100	50	150	14	0.4	680
AEF1213221M050R	1213	220	50	330	14	0.18	875
AEF1216331M050R	1216	330	50	495	14	0.17	1020
63 Volt							
AEF0608220M063R	0608	22	63	41.6	12	4.6	140
AEF0810330M063R	0810	33	63	62.4	12	1.36	320
AEF0810470M063R	0810	47	63	88.8	12	1.36	380
AEF1010101M063R	1010	100	63	189	12	0.73	530
AEF1213221M063R	1213	220	63	415.8	12	0.3	840
80 Volt							
AEF0607100M080R	0608	10	80	24	12	5.2	130
AEF0810220M080R	0810	22	80	52.8	12	2.2	360
AEF0810330M080R	0810	33	80	79.2	12	2.2	410
AEF1010470M080R	1010	47	80	112.8	12	1.4	490
AEF1012101M080R	1012	100	80	240	12	1.4	530
AEF1216221M080R	1216	220	80	528	12	0.49	1020
100 Volt							
AEF0608100M100R	0608	10	100	30	10	5.5	140
AEF0810220M100R	0810	22	100	66	10	2.7	320
AEF1010330M100R	1010	33	100	99	10	1.8	360
AEF1010470M100R	1010	47	100	141	10	1.8	540
AEF1213101M100R	1213	100	100	300	10	0.68	550
160 Volt							
AEF1010100M160R	1010	10	160	164	20	16	176
AEF0812150M160R	0812	15	160	196	20	14	204
AEF1013330M160R	1013	33	160	311.2	20	9	340
AEF1016470M160R	1016	47	160	400.8	20	8	420
200 Volt							
AEF0810100M200R	0810	10	200	180	20	16	170
AEF0813150M200R	0813	15	200	220	20	14	210
250 Volt							
AEF0810470M250R	0810	4.7	250	147	20	30	90
AEF0812100M250R	0812	10	250	200	20	16	150
AEF1016220M250R	1016	22	250	320	20	12	312
400 Volt							
AEF06102R2M400R	0610	2.2	400	135.2	24	35	48
AEF08103R3M400R	0810	3.3	400	152.8	24	32	72
AEF08124R7M400R	0812	4.7	400	175.2	24	26	100
AEF08125R6M400R	0812	5.6	400	189.6	24	24	108
AEF10136R8M400R	1013	6.8	400	208.8	24	22	140
AEF1013100M400R	1013	10	400	260	24	18	194
AEF1016150M400R	1016	15	400	340	24	16	235

All technical data relates to an ambient temperature of +25°C. Capacitance and DF are measured at 120Hz, 0.5RMS with DC bias of 2.2 volts. DCL is measured at rated voltage after 5 minutes.

SMD Aluminum Electrolytic Capacitors

AEF Series



FREQUENCY COEFFICIENT OF PERMISSIBLE RIPPLE CURRENT

Rated Voltage (Vdc)	120 - 1K(Hz)	1K - 10K(Hz)	10K - 100K(Hz)	100K(Hz)
6.3 - 400	0.50	0.80	0.90	1.00

Internal heating produced by ripple current will reduce the lifetime of capacitors, at a rate of halving the lifetime with every 5°C rise. When long life performance is required in actual use the rms ripple current should be minimized.

QUALIFICATION TABLE

Test	AEF series								
	Condition	Characteristics							
Low Temperature Characteristics (Max. Impedance Ratio)	At 120Hz	Rated Voltage (V)	6.3	10	16	25	35 - 100	160 - 250	400
		Z(-25°C)/Z(+20°C)	4	3	2	2	2	6	6
		Z(-40°C)/Z(+20°C)	10	8	6	4	3	10	18
Endurance	The specifications shall be met when the capacitors are restored to 20°C after rated voltage is applied for 6,000 hours at 105°C.	Rated Voltage (V)	6.3 - 100				160 - 400		
		ΔC/C	≤±30% of the initial limit				≤±20% of the initial limit		
		DF	≤300% of the initial specified limit				≤200% of the initial specified limit		
		DCL	≤the initial specified limit				≤the initial specified limit		
Shelf Life	The following specifications shall be satisfied when the capacitors are restored to 20°C after leaving them under no load at 105°C for 1,000 hours.	Rated Voltage (V)	6.3 - 100				160 - 400		
		ΔC/C	≤±30% of the initial limit				≤±20% of the initial limit		
		DF	≤300% of the initial specified limit				≤200% of the initial specified limit		
		DCL	≤200% of the initial specified limit				≤200% of the initial specified limit		

REFLOW

Diameter (mm)	Φ6.3	Φ8	Φ10	Φ12.5
Peak Temperature	260°C, 5 sec. max.			
Preheat Temperature	100°C to 200°C, 180 sec. max.			100°C to 180°C, 150 sec. max.
Duration at 200°C or higher	90 sec. max.	90 sec. max.	60 sec. max.	60 sec. max.
Duration at 230°C or higher	40 sec. max.	30 sec. max.	30 sec. max.	30 sec. max.
Reflow Number	Twice* or less			

*if twice then need to be at least 2hrs between reflows

STORAGE

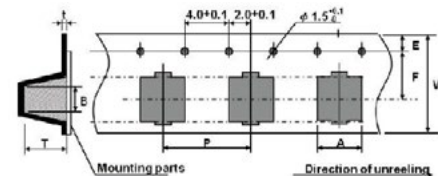
- It is recommended to keep capacitors between the ambient temperatures of 5°C to 35°C (if between 35°C to 85°C, it should be less than three months) and the relative humidity of 75% or below.
- Confirm that the environment does not have any of the following conditions:
 - Damp conditions such as water, saltwater spray, or oil spray or fumes. High humidity or humidity condensation situations.
 - In an atmosphere filled with toxic gasses (such as hydrogen sulfide, sulfurous acid, nitrous acid, chlorine, ammonia, etc.).
 - Being exposed to direct sunlight, ozone, ultraviolet ray, or radiation.
 - Being exposed to acidic or alkaline solutions.
 - Under severe conditions where vibration and / or mechanical shock exceed the applicable ranges of the specification.
- Storage time:
 - Before unseal: within 2 years after delivery

SMD Aluminum Electrolytic Capacitors

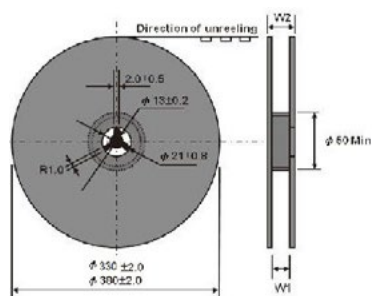
AEF Series

PACKAGE TAPE DIMENSIONS units (mm)

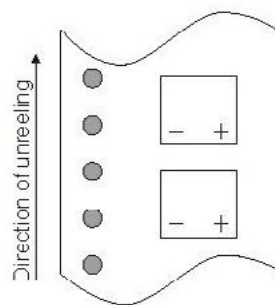
Size Code	A0±0.20	B0±0.20	W±0.30	F±0.10	E±0.10	P±0.10	t±0.10	T±0.20
0608	7.0	7.0	16.0	7.5	1.75	12.0	0.4	8.0
0610	7.0	7.0	16.0	7.5	1.75	12.0	0.4	11.0
0810	8.7	8.7	24.0	11.5	1.75	16.0	0.4	11.0
0812	8.7	8.7	24.0	11.5	1.75	16.0	0.4	13.0
0813	8.7	8.7	24.0	11.5	1.75	16.0	0.4	14.0
1010	10.7	10.7	24.0	11.5	1.75	16.0	0.4	11.0
1012	10.7	10.7	24.0	11.5	1.75	16.0	0.4	13.0 - 13.5
1013	10.7	10.7	24.0	11.5	1.75	16.0	0.4	15.0
1016	10.7	10.7	24.0	11.5	1.75	16.0	0.4	17.5
1213	13.4	13.4	32.0	14.2	1.75	24.0	0.4	14.5
1216	13.4	13.4	32.0	14.2	1.75	24.0	0.4	16.5



REEL



POLARITY



DIMENSIONS units (mm)

Size Code	W1±1.00	W2±1.00	Qty./Reel	Reel size (inch)
0608	18.0	22.0	1000	15
0610	18.0	22.0	1000	15
0810	18.0	22.0	550	15
0812	26.0	31.0	550	15
0813	26.0	31.0	550	15
1010	26.0	31.0	550	15
1012	26.0	31.0	500	15
1013	26.0	31.0	450	15
1016	26.0	31.0	350	15
1213	34.0	39.0	200	13
1216	34.0	39.0	150	13

SMD Aluminum Electrolytic Capacitors

AEH Series



FEATURES

- Endurance: 125°C, 2000 to 5000 hours
- Designed for surface mounting on high density PC board
- RoHS Compliance



LEAD-FREE
LEAD-FREE COMPATIBLE
COMPONENT

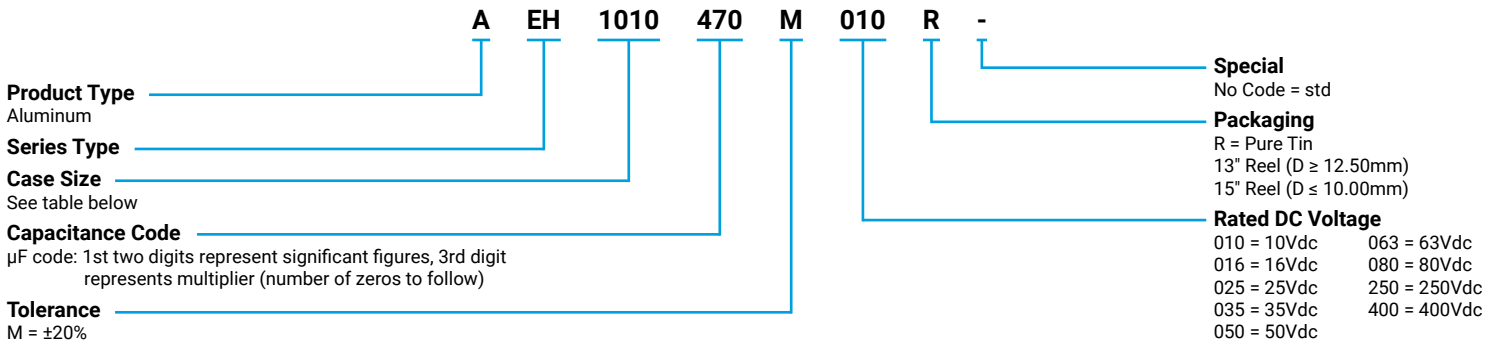


RoHS
COMPLIANT

APPLICATIONS

- DC/DC Converters, for high density SMD boards and higher operation temperature environment applications

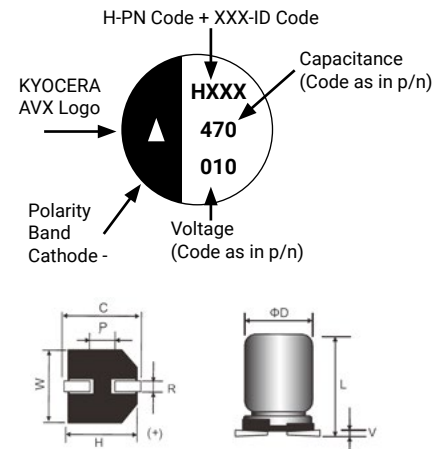
HOW TO ORDER



CASE DIMENSIONS millimeters (inches)

Code	D±0.50 (0.020)	L±0.50 (0.020)	W±0.20 (0.008)	H±0.20 (0.008)	C±0.20 (0.008)	R	P±0.30 (0.012)	V max
0608	6.30 (0.248)	8.00 (0.315)	6.60 (0.260)	6.60 (0.260)	7.30 (0.287)	0.50 - 0.80 (0.020 - 0.031)	2.00 (0.080)	0.30 (0.012)
0810	8.00 (0.315)	10.50 (0.413)	8.30 (0.327)	8.30 (0.327)	9.00 (0.354)	0.70 - 1.10 (0.028 - 0.043)	3.20 (0.126)	0.30 (0.012)
1010	10.00 (0.394)	10.50 (0.413)	10.30 (0.406)	10.30 (0.406)	11.00 (0.433)	0.70 - 1.30 (0.028 - 0.051)	4.50 (0.177)	0.30 (0.012)
1012	10.00 (0.394)	12.50 (0.492)	10.30 (0.406)	10.30 (0.406)	11.00 (0.433)	0.70 - 1.30 (0.028 - 0.051)	4.50 (0.177)	0.30 (0.012)
1013	10.00 (0.394)	13.50 (0.531)	10.30 (0.406)	10.30 (0.406)	11.00 (0.433)	0.70 - 1.30 (0.028 - 0.051)	4.50 (0.177)	0.30 (0.012)
1016	10.00 (0.394)	16.50 (0.650)	10.30 (0.406)	10.30 (0.406)	11.00 (0.433)	0.70 - 1.30 (0.028 - 0.051)	4.50 (0.177)	0.30 (0.012)
1213	12.50 (0.492)	13.50 (0.531)	13.00 (0.512)	13.00 (0.512)	13.70 (0.539)	1.10 - 1.40 (0.043 - 0.055)	4.50 (0.177)	0.40 (0.016)
1216	12.50 (0.492)	16.00 (0.630)	13.00 (0.512)	13.00 (0.512)	13.70 (0.539)	1.10 - 1.40 (0.043 - 0.055)	4.50 (0.177)	0.40 (0.016)

MARKING



TECHNICAL SPECIFICATIONS

Category Temperature Range:	-55°C to + 125°C (10 - 80V), -40°C to + 125°C (250 - 400V)			
Capacitance Range	At 20°C, 120Hz	2.2μF to 470μF		
Capacitance Tolerance:	At 20°C, 120Hz	±20%		
Dissipation Factor (%)	Measurement Frequency: 120Hz at 20°C	Please see the ratings and part number reference table below		
Leakage Current	Rated voltage at 20°C	10 - 80V		250 - 400V
		0608 - 1013 1213 - 1616		I ≤ 0.04CV + 100μA (1minute)
		I ≤ 0.01CV or 3μA, I ≤ 0.03CV or 4μA, whichever is greater whichever is greater (2min) (2min)		

SMD Aluminum Electrolytic Capacitors

AEH Series



CAPACITANCE AND RATED VOLTAGE RANGE (FIGURES DENOTES CASE SIZE)

Capacitance		Rated Voltage DC (V _R)								
μF	Code	10V	16V	25V	35V	50V	63V	80V	250V	400V
2.2	2R2									0810
4.7	4R7								1010	1010
6.8	6R8									1013
10	100					0608				1016
22	220					0608				
33	330					0608				
47	470			0608	0608	0810		1010		
100	101	0608	0608, 0810	0810	0810	1010	1012			
220	221			1010	1010	1012, 1213				
330	331			1010		1216				
470	471	1010	1012	1213	1216					

Released ratings

RATINGS & PART NUMBER REFERENCE

Part No.	Case Size	Capacitance (μF)	Rated Voltage (V)	DF Max. (%)	100kHz RMS Current (mA)
10 Volt					
AEH0608101M010R	0608	100	10	24	110
AEH1010471M010R	1010	470	10	24	296
16 Volt					
AEH0608101M016R	0608	100	16	20	110
AEH0810101M016R	0810	100	16	20	220
AEH1012471M016R	1012	470	16	20	340
25 Volt					
AEH0608470M025R	0608	47	25	16	110
AEH0810101M025R	0810	100	25	16	220
AEH1010221M025R	1010	220	25	16	296
AEH1010331M025R	1010	330	25	16	296
AEH1213471M025R	1213	470	25	16	750
35 Volt					
AEH0608470M035R	0608	47	35	14	110
AEH0810101M035R	0810	100	35	14	220
AEH1010221M035R	1010	220	35	14	296
AEH1216471M035R	1216	470	35	14	900
50 Volt					
AEH0608100M050R	0608	10	50	14	83
AEH0608220M050R	0608	22	50	14	83
AEH0608330M050R	0608	33	50	14	83
AEH0810470M050R	0810	47	50	14	160
AEH1010101M050R	1010	100	50	14	247
AEH1012221M050R	1012	220	50	14	350
AEH1213221M050R	1213	220	50	14	550
AEH1216331M050R	1216	330	50	14	700
63 Volt					
AEH1012101M063R	1012	100	63	12	270
80 Volt					
AEH1010470M080R	1010	47	80	12	245
250 Volt					
AEH10104R7M250R	1010	4.7	250	24	59
400 Volt					
AEH08102R2M400R	0810	2.2	400	30	30
AEH10104R7M400R	1010	4.7	400	30	65
AEH10136R8M400R	1013	6.8	400	30	90
AEH1016100M400R	1016	10	400	30	102

All technical data relates to an ambient temperature of +25°C. Capacitance and DF are measured at 120Hz, 0.5RMS with DC bias of 2.2 volts. DCL is measured at rated voltage after 5 minutes.

SMD Aluminum Electrolytic Capacitors

AEH Series

FREQUENCY COEFFICIENT OF PERMISSIBLE RIPPLE CURRENT

Rated Voltage (Vdc)	Capacitance (μF)	120 - 1K (Hz)	1K - 10K (Hz)	10K - 100K (Hz)	100K(Hz)
10 - 80	Cap. < 220	0.40	0.75	0.90	1.00
	220 ≤ Cap. < 470	0.50	0.85	0.94	1.00
250 - 400	Cap. ≤ 33	0.55	0.83	0.97	1.00
	Cap. > 33	0.66	0.86	0.93	1.00

Internal heating produced by ripple current will reduce the lifetime of capacitors, at a rate of halving the lifetime with every 5°C rise. When long life performance is required in actual use the rms ripple current should be minimized.

REFLOW

Diameter (mm)	Φ6.3	Φ8	Φ10	Φ12.5
Peak Temperature	260°C, 5 sec. max.			
Preheat Temperature	100°C to 200°C, 180 sec. max.			100°C to 180°C, 150 sec. max.
Duration at 200°C or higher	90 sec. max.	90 sec. max.	60 sec. max.	60 sec. max.
Duration at 230°C or higher	40 sec. max.	30 sec. max.	30 sec. max.	30 sec. max.
Reflow Number	Twice* or less			

*if twice then need to be at least 2hrs between reflows

QUALIFICATION TABLE

Test	AEH series											
	Condition	Characteristics										
Low Temperature Characteristics (Max. Impedance Ratio)	At 120Hz	Rated Voltage (V)		10	16	25	35	50	63	80	250	400
		0608-1016	Z(-25°C)/Z(+20°C)	3	2	2	2	2	2	2	6	6
			Z(-40°C)/Z(+20°C)	6	4	4	3	3	3	3	10	18
		1213-1216	Z(-25°C)/Z(+20°C)	4	3	2	2	2	2	2	6	6
			Z(-40°C)/Z(+20°C)	8	6	4	3	3	3	3	10	18
Endurance	The specifications shall be met when the capacitors are restored to 20°C after rated voltage is applied for a specified period of time at 125°C. Load life: 0608 (10-50V) 1000 hours 0810-1016 (10-80V) 2000 hours 1213-1216 (10-80V) 5000 hours 0810-1216 (250-400V) 3000 hours	ΔC/C		≤ ±30% of the initial limit								
		DF		≤ 300% of the initial specified limit								
		DCL		≤ Initial specified limit								
Shelf Life	The following specifications shall be satisfied when the capacitors are restored to 20°C after leaving them under no load at 125°C for 1,000 hours (400V: 500 hours).	ΔC/C		≤ ±30% of the initial limit								
		DF		≤ 300% of the initial specified limit								
		DCL		≤ 500% of the initial specified limit								

STORAGE

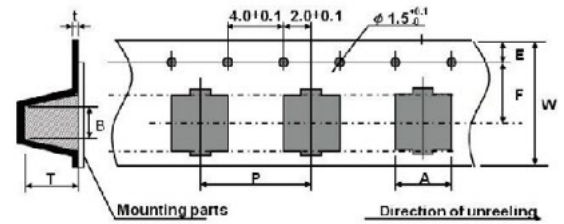
- It is recommended to keep capacitors between the ambient temperatures of 5°C to 35°C (If between 35 to 85°C, it should be less than three months), and the relative humidity of 75% or below.
- Confirm that the environment does not have any of the following conditions:
 - Damp conditions such as water, saltwater spray, or oil spray or fumes. High humidity or humidity condensation situations.
 - In an atmosphere filled with toxic gasses (such as hydrogen sulfide, sulfurous acid, nitrous acid, chlorine, ammonia, etc.).
 - Being exposed to direct sunlight, ozone, ultraviolet ray, or radiation.
 - Being exposed to acidic or alkaline solutions.
 - Under severe conditions where vibration and / or mechanical shock exceed the applicable ranges of the specification.
- Storage time:
 - Before unseal: within 2 years after delivery

SMD Aluminum Electrolytic Capacitors

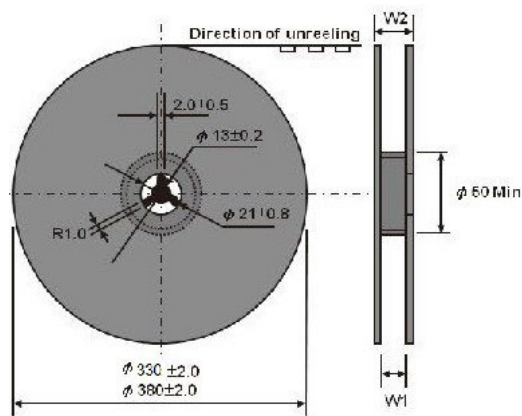
AEH Series

PACKAGE TAPE DIMENSIONS units (mm)

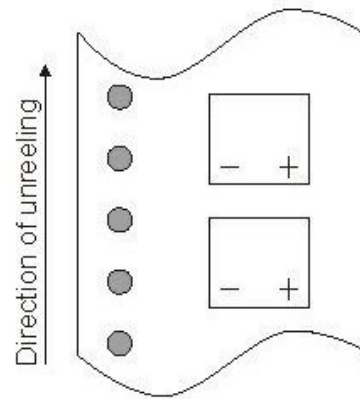
Size Code	A±0.20	B±0.20	W±0.30	F±0.10	E±0.10	P±0.10	t±0.10	T±0.20
0608	7.0	7.0	16.0	7.5	1.75	12.0	0.4	8.0
0810	8.7	8.7	24.0	11.5	1.75	16.0	0.4	11.0
1010	10.7	10.7	24.0	11.5	1.75	16.0	0.4	11.0
1012	10.7	10.7	24.0	11.5	1.75	16.0	0.4	13.0 - 13.5
1013	10.7	10.7	24.0	11.5	1.75	16.0	0.4	15.0
1016	10.7	10.7	24.0	11.5	1.75	16.0	0.4	17.5
1213	13.4	13.4	32.0	14.2	1.75	24.0	0.4	14.5
1216	13.4	13.4	32.0	14.2	1.75	24.0	0.4	16.5



REEL



POLARITY



DIMENSIONS units (mm)

Size Code	W1±1.00	W2±1.00	Qty./Reel	Reel Size (inches)
0608	18.0	22.0	1000	15
0810	18.0	22.0	550	15
1010	26.0	31.0	550	15
1012	26.0	31.0	500	15
1013	26.0	31.0	450	15
1016	26.0	31.0	350	15
1213	34.0	39.0	200	13
1216	34.0	39.0	150	13

SMD Aluminum Electrolytic Capacitors

AEK Series



FEATURES

- Endurance, 105°C, 2000 (6.3 - 100V) - 3000 hours (160 - 400V)
- Designed for surface mounting on high density PC board
- RoHS Compliance

APPLICATIONS

- Industrial
- Commercial DC/DC
- Energy Storage



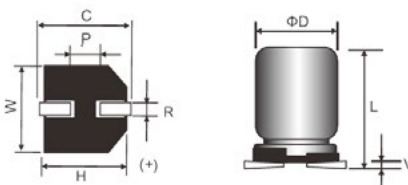
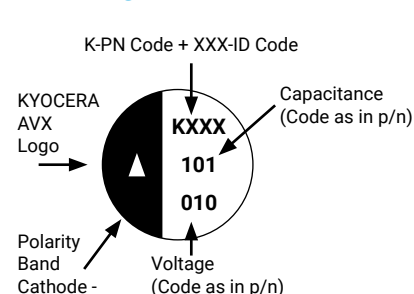
HOW TO ORDER

Product Type Aluminum	A	EK	0608	101	M	010	R	-	Special No Code = std
Series Type									Packaging R = Pure Tin 13" Reel (D ≥ 12.50mm) 15" Reel (D ≤ 10.00mm)
Case Size See table below									Rated DC Voltage 006 = 6.3Vdc 080 = 80Vdc 010 = 10Vdc 100 = 100Vdc 016 = 16Vdc 160 = 160Vdc 025 = 25Vdc 200 = 200Vdc 035 = 35Vdc 250 = 250Vdc 050 = 50Vdc 400 = 400Vdc 063 = 63Vdc
Capacitance Code µF code: 1st two digits represent significant figures, 3rd digit represents multiplier (number of zeros to follow)									
Tolerance M = ±20%									

CASE DIMENSIONS millimeters (inches)

Code	D±0.50 (0.020)	L±0.50 (0.020)	W±0.20 (0.008)	H±0.20 (0.008)	C±0.20 (0.008)	R	P±0.30 (0.012)	V max
0608	6.30 (0.248)	8.00 (0.315)	6.60 (0.260)	6.60 (0.260)	7.30 (0.287)	0.50 - 0.80 (0.020 - 0.031)	2.00 (0.080)	0.30 (0.012)
0610	6.30 (0.248)	10.50 (0.413)	6.60 (0.260)	6.60 (0.260)	7.30 (0.287)	0.50 - 0.80 (0.020 - 0.031)	2.00 (0.080)	0.30 (0.012)
0810	8.00 (0.315)	10.50 (0.413)	8.30 (0.327)	8.30 (0.327)	9.00 (0.354)	0.70 - 1.10 (0.028 - 0.043)	3.20 (0.126)	0.30 (0.012)
0812	8.00 (0.315)	12.50 (0.492)	8.30 (0.327)	8.30 (0.327)	9.00 (0.354)	0.70 - 1.10 (0.028 - 0.043)	3.20 (0.126)	0.30 (0.012)
0813	8.00 (0.315)	13.50 (0.531)	8.30 (0.327)	8.30 (0.327)	9.00 (0.354)	0.70 - 1.10 (0.028 - 0.043)	3.20 (0.126)	0.30 (0.012)
0815	8.00 (0.315)	15.50 (0.610)	8.30 (0.327)	8.30 (0.327)	9.00 (0.354)	0.70 - 1.10 (0.028 - 0.043)	3.20 (0.126)	0.30 (0.012)
1010	10.00 (0.394)	10.50 (0.413)	10.30 (0.406)	10.30 (0.406)	11.00 (0.433)	0.70 - 1.10 (0.028 - 0.043)	4.50 (0.177)	0.30 (0.012)
1012	10.00 (0.394)	12.50 (0.492)	10.30 (0.406)	10.30 (0.406)	11.00 (0.433)	0.70 - 1.10 (0.028 - 0.043)	4.50 (0.177)	0.30 (0.012)
1013	10.00 (0.394)	13.50 (0.531)	10.30 (0.406)	10.30 (0.406)	11.00 (0.433)	0.70 - 1.10 (0.028 - 0.043)	4.50 (0.177)	0.30 (0.012)
1016	10.00 (0.394)	16.50 (0.650)	10.30 (0.406)	10.30 (0.406)	11.00 (0.433)	0.70 - 1.10 (0.028 - 0.043)	4.50 (0.177)	0.30 (0.012)
1213	12.50 (0.492)	13.50 (0.531)	13.00 (0.512)	13.00 (0.512)	13.70 (0.539)	1.10 - 1.40 (0.043 - 0.055)	4.50 (0.177)	0.40 (0.016)
1216	12.50 (0.492)	16.00 (0.630)	13.00 (0.512)	13.00 (0.512)	13.70 (0.539)	1.10 - 1.40 (0.043 - 0.055)	4.50 (0.177)	0.40 (0.016)

MARKING



SMD Aluminum Electrolytic Capacitors

AEK Series



TECHNICAL SPECIFICATIONS

Category Temperature Range:	-55°C to +105°C (6.3 - 100V), -40°C to +105°C (160 - 400V)		
Capacitance Range:	At 20°C, 120Hz	1.0μF to 1000μF	
Capacitance Tolerance:	At 20°C, 120Hz	±20%	
Dissipation Factor (%)	Measurement Frequency: 120Hz at 20°C	Please see the Ratings and Part Number Reference Table below	
Leakage Current	Rated voltage at 20°C*	6.3 - 100V	160 - 400V
		$I \leq 0.01CV$ or $3\mu A$, whichever is greater (2min)	$I \leq 0.04CV + 100\mu A$ (1min)

* Note: In the case of an anomalous reading, re-measure the leakage current after following voltage treatment:
Voltage treatment: DC rated voltage to be applied to the capacitors for 120 minutes at 105°C.

CAPACITANCE AND RATED VOLTAGE RANGE (FIGURE DENOTES CASE SIZE)

Capacitance		Rated Voltage DC (V _R)												
μF	Code	6.3V	10V	16V	25V	35V	50V	63V	80V	100V	160V	200V	250V	400V
1.0	1R0													0608*
1.5	1R5													0610
2.2	2R2												0608*	0610
3.3	3R3												0608*	0810
4.7	4R7												0810	0812
5.6	5R6													0812
6.8	6R8													0813
8.2	8R2													0815
10	100								0608	0608	1010	0810	0812	1013
15	150										0812	0813		1016
22	220						0608	0608	0810	0810	1012		1016	
33	330						0608	0810	0810	1010	1013			
47	470				0608	0608	0810	1010	1010	1010	1016			
100	101		0608	0608	0608	0810	1010	1010	1012	1213				
150	151			0608					1213					
220	221	0608	0608	0810	0810	1010		1213	1216					
330	331	0810	0810	0810	1010	1012	1216							
470	471		0810	1010	1012									
820	821		1010											
1000	102	1010												

Released ratings

* L dimensions (height) reduced to 7.70±0.50mm

RATINGS & PART NUMBER REFERENCE

Part Number	Case Size	Capacitance (μF)	Rated Voltage (V)	DF Max. (%)	ESR Max. @100kHz (Ω)	100kHz RMS Current (mA)
6.3 Volt						
AEK0608221M006R	0608	220	6.3	30	0.68	160
AEK0810331M006R	0810	330	6.3	40	0.3	340
AEK1010102M006R	1010	1000	6.3	40	0.28	860
10 Volt						
AEK0608101M010R	0608	100	10	24	0.68	175
AEK0608221M010R	0608	220	10	24	0.68	180
AEK0810331M010R	0810	330	10	30	0.3	340
AEK0810471M010R	0810	470	10	30	0.3	360
AEK1010821M010R	1010	820	10	30	0.28	860
16 Volt						
AEK0608101M016R	0608	100	16	20	0.68	175
AEK0608151M016R	0608	150	16	20	0.68	190
AEK0810221M016R	0810	220	16	26	0.3	500
AEK0810331M016R	0810	330	16	26	0.3	545
AEK1010471M016R	1010	470	16	26	0.28	800

All technical data relates to an ambient temperature of +25°C. Capacitance and DF are measured at 120Hz, 0.5RMS with DC bias of 2.2 volts. DCL is measured at rated voltage after 5 minutes.

* L dimension (height) reduced to 7.70±0.50mm

SMD Aluminum Electrolytic Capacitors

AEK Series

Part Number	Case Size	Capacitance (μF)	Rated Voltage (V)	DF Max. (%)	ESR Max. @100kHz (Ω)	100kHz RMS Current (mA)
25 Volt						
AEK0608470M025R	0608	47	25	16	0.68	180
AEK0608101M025R	0608	100	25	16	0.68	205
AEK0810221M025R	0810	220	25	16	0.3	550
AEK1010331M025R	1010	330	25	16	0.28	780
AEK1012471M025R	1012	470	25	16	0.15	875
35 Volt						
AEK0608470M035R	0608	47	35	14	0.68	210
AEK0810101M035R	0810	100	35	14	0.3	575
AEK1010221M035R	1010	220	35	14	0.28	835
AEK1012331M035R	1012	330	35	14	0.15	900
50 Volt						
AEK0608220M050R	0608	22	50	12	1.36	175
AEK0608330M050R	0608	33	50	12	1.36	180
AEK0810470M050R	0810	47	50	12	0.6	540
AEK1010101M050R	1010	100	50	12	0.45	700
AEK1216331M050R	1216	330	50	12	0.15	1180
63 Volt						
AEK0608220M063R	0608	22	63	12	4.2	150
AEK0810330M063R	0810	33	63	12	1.16	375
AEK0810470M063R	0810	47	63	12	1.16	450
AEK1010101M063R	1010	100	63	12	0.67	575
AEK1213221M063R	1213	220	63	12	0.28	890
80 Volt						
AEK0608100M080R	0608	10	80	12	4.8	140
AEK0810220M080R	0810	22	80	12	1.95	375
AEK0810330M080R	0810	33	80	12	1.95	450
AEK1010470M080R	1010	47	80	12	1.24	575
AEK1012101M080R	1012	100	80	12	1.24	600
AEK1213151M080R	1213	150	80	12	0.54	800
AEK1216221M080R	1216	220	80	12	0.46	960
100 Volt						
AEK0608100M100R	0608	10	100	12	5	135
AEK0810220M100R	0810	22	100	12	2.5	345
AEK1010330M100R	1010	33	100	12	1.6	560
AEK1010470M100R	1010	47	100	12	1.6	575
AEK1213101M100R	1213	100	100	12	0.65	680
160 Volt						
AEK1010100M160R	1010	10	160	15	16	90
AEK0812150M160R	0812	15	160	15	14	136
AEK1012220M160R	1012	22	160	15	12	170
AEK1013330M160R	1013	33	160	15	9	215
AEK1016470M160R	1016	47	160	15	8	380
200 Volt						
AEK0810100M200R	0810	10	200	15	16	110
AEK0813150M200R	0813	15	200	15	14	170
250 Volt						
AEK06082R2M250R*	0608	2.2	250	15	35	52
AEK06083R3M250R*	0608	3.3	250	15	32	68
AEK08104R7M250R	0810	4.7	250	15	20	96
AEK0812100M250R	0812	10	250	15	16	166
AEK1016220M250R	1016	22	250	15	12	300
400 Volt						
AEK06081R0M400R*	0608	1	400	20	78	28
AEK06101R5M400R	0610	1.5	400	20	75	36
AEK06102R2M400R	0610	2.2	400	20	35	44
AEK08103R3M400R	0810	3.3	400	20	32	64
AEK08124R7M400R	0812	4.7	400	20	26	78
AEK08125R6M400R	0812	5.6	400	20	24	96
AEK08136R8M400R	0813	6.8	400	20	22	108
AEK08158R2M400R	0815	8.2	400	20	20	130
AEK1013100M400R	1013	10	400	20	18	140
AEK1016150M400R	1016	15	400	20	16	174

All technical data relates to an ambient temperature of +25°C. Capacitance and DF are measured at 120Hz, 0.5RMS with DC bias of 2.2 volts. DCL is measured at rated voltage after 5 minutes.

* L dimension (height) reduced to 7.70±0.50mm

SMD Aluminum Electrolytic Capacitors

AEK Series



FREQUENCY COEFFICIENT OF PERMISSIBLE RIPPLE CURRENT

Rated Voltage (Vdc)	120 - 1K (Hz)	1K - 10K (Hz)	10K - 100K (Hz)	100K (Hz)
6.3 - 400	0.50	0.80	0.90	1.00

Internal heating produced by ripple current will reduce the lifetime of capacitors, at a rate of halving the lifetime with every 5°C rise. When long life performance is required in actual use the rms ripple current should be minimized.

QUALIFICATION TABLE

Test	AEK series								
	Condition	Characteristics							
Low Temperature Characteristics (Max. Impedance Ratio)	At 120Hz	Rated Voltage (V)	6.3	10	16	25	35 - 100	160 - 250	400
		Z(-25°C)/Z(+20°C)	4	3	2	2	2	6	6
		Z(-40°C)/Z(+20°C)	10	8	6	4	3	10	18
Endurance	The specifications shall be met when the capacitors are restored to 20°C after rated voltage is applied for a specified period of time at 105°C.	ΔC/C	≤ ± 20% of the initial limit						
		DF	≤ 200% of the initial specified limit						
		DCL	≤ the initial specified limit						
Shelf Life	The following specifications shall be satisfied when the capacitors are restored to 20°C after leaving them under no load at 105°C for 1,000 hours (6.3 - 100V: 500 hours).	ΔC/C	≤ ± 20% of the initial limit						
		DF	≤ 200% of the initial specified limit						
		DCL	≤ 200% of the initial specified limit						

REFLOW

Diameter (mm)	Φ6.3	Φ8	Φ10	Φ12.5
Peak Temperature	260°C, 5 sec. max.			
Preheat Temperature	100°C to 200°C, 180 sec. max.			100°C to 180°C, 150 sec. max.
Duration at 200°C or higher	90 sec. max.	90 sec. max.	60 sec. max.	60 sec. max.
Duration at 230°C or higher	40 sec. max.	30 sec. max.	30 sec. max.	30 sec. max.
Reflow Number	Twice* or less			

*if twice then need to be at least 2hrs between reflows

STORAGE

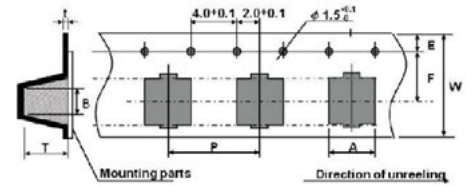
- It is recommended to keep capacitors between the ambient temperatures of 5°C to 35°C (If between 35 to 85°C, it should be less than three months), and the relative humidity of 75% or below.
- Confirm that the environment does not have any of the following conditions:
 - Damp conditions such as water, saltwater spray, or oil spray or fumes. High humidity or humidity condensation situations
 - In an atmosphere filled with toxic gasses (such as hydrogen sulfide, sulfurous acid, nitrous acid, chlorine, ammonia, etc.)
 - Being exposed to direct sunlight, ozone, ultraviolet ray, or radiation
 - Being exposed to acidic or alkaline solutions
 - Under severe conditions where vibration and / or mechanical shock exceed the applicable ranges of the specification
- Storage time:
 - Before unseal: within 2 years after delivery

SMD Aluminum Electrolytic Capacitors

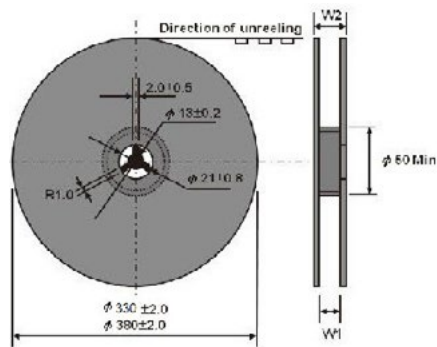
AEK Series

PACKAGE TAPE DIMENSIONS units (mm)

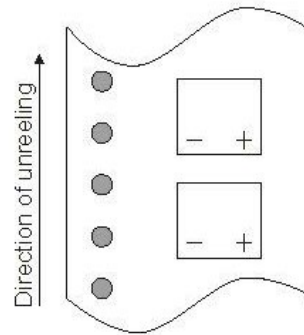
Size Code	A0±0.20	B0±0.20	W±0.30	F±0.10	E±0.10	P±0.10	t±0.10	T±0.05
0608	7.0	7.0	16.0	7.5	1.75	12.0	0.4	8.0
0610	7.0	7.0	16.0	7.5	1.75	12.0	0.4	11.0
0810	8.7	8.7	24.0	11.5	1.75	16.0	0.4	11.0
0812	8.7	8.7	24.0	11.5	1.75	16.0	0.4	13.0
0813	8.7	8.7	24.0	11.5	1.75	16.0	0.4	14.0
0815	8.7	8.7	24.0	11.5	1.75	16.0	0.4	16.0
1010	10.7	10.7	24.0	11.5	1.75	16.0	0.4	11.0
1012	10.7	10.7	24.0	11.5	1.75	16.0	0.4	13.0 - 13.5
1013	10.7	10.7	24.0	11.5	1.75	16.0	0.4	15.0
1016	10.7	10.7	24.0	11.5	1.75	16.0	0.4	17.5
1213	13.4	13.4	32.0	14.2	1.75	24.0	0.4	14.5
1216	13.4	13.4	32.0	14.2	1.75	24.0	0.4	16.5



REEL



POLARITY



DIMENSIONS

Size Code	W1±1.00	W2±1.00	Qty./Reel	Reel size (inch)
0608	18.0	22.0	1000	15
0610	18.0	22.0	1000	15
0810	18.0	22.0	550	15
0812	26.0	31.0	550	15
0813	26.0	31.0	550	15
0815	26.0	31.0	550	15
1010	26.0	31.0	550	15
1012	26.0	31.0	500	15
1013	26.0	31.0	450	15
1016	26.0	31.0	350	15
1213	34.0	39.0	200	13
1216	34.0	39.0	150	13

SMD Aluminum Hybrid Electrolytic Capacitors

AHA Series



FEATURES

- Low ESR
- High Voltage, Long Life
- 105°C, 5000 to 10,000 hours
- RoHS compliant

APPLICATIONS

- Industrial Equipment
- Base Station Equipment, etc.



LEAD-FREE
LEAD-FREE COMPATIBLE
COMPONENT



RoHS
COMPLIANT

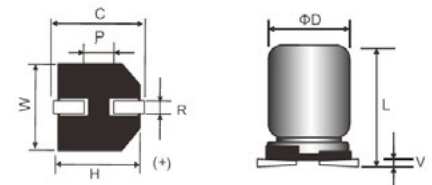
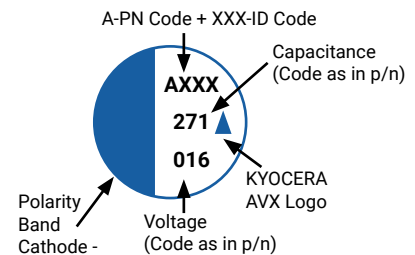
HOW TO ORDER

Product Type Aluminum	A	HA	0810	271	M	016	R	-	Special No Code = std
Series Type									Packaging R = Pure Tin 15" Reel
Case Size See table below									Rated DC Voltage 016 = 16Vdc 063 = 63Vdc 025 = 25Vdc 080 = 80Vdc 035 = 35Vdc 100 = 100Vdc 040 = 40Vdc 125 = 125Vdc 050 = 50Vdc
Capacitance Code µF code: 1st two digits represent significant figures, 3rd digit represents multiplier (number of zeros to follow)									
Tolerance M = ±20%									

CASE DIMENSIONS millimeters (inches)

Code	D±0.50 (0.020)	L±0.50 (0.020)	W±0.20 (0.008)	H±0.20 (0.008)	C±0.20 (0.008)	R	P±0.30 (0.012)	V max
0608	6.30 (0.248)	8.00 (0.315)	6.60 (0.260)	6.60 (0.260)	7.30 (0.287)	0.50 - 0.80 (0.020 - 0.031)	2.00 (0.080)	0.30 (0.012)
0810	8.00 (0.315)	10.50 (0.413)	8.30 (0.327)	8.30 (0.327)	9.00 (0.354)	0.70 - 1.10 (0.028 - 0.043)	3.20 (0.126)	0.30 (0.012)
1010	10.00 (0.394)	10.50 (0.413)	10.30 (0.406)	10.30 (0.406)	11.00 (0.433)	0.70 - 1.30 (0.028 - 0.051)	4.50 (0.177)	0.30 (0.012)
1012	10.00 (0.394)	12.50 (0.492)	10.30 (0.406)	10.30 (0.406)	11.00 (0.433)	0.70 - 1.30 (0.028 - 0.051)	4.50 (0.177)	0.30 (0.012)

MARKING



TECHNICAL SPECIFICATIONS

Category Temperature Range:	-55°C to + 105°C	
Capacitance Range:	At 20°C, 120Hz	10µF to 560µF
Capacitance Tolerance:	At 20°C, 120Hz	±20%
Dissipation Factor (%)	Measurement Frequency: 120Hz at 20°C	Please see the ratings and part number reference table below
Leakage Current:	After 2 minutes at rated working voltage at 20°C*	$I \leq 0.01CV$ or 3µA, whichever is greater

* Note: In the case of an anomalous reading, re-measure the leakage current after following voltage treatment:
Voltage treatment: DC rated voltage to be applied to the capacitors for 120 minutes at 105°C.

SMD Aluminum Hybrid Electrolytic Capacitors

AHA Series



CAPACITANCE AND RATED VOLTAGE RANGE (FIGURES DENOTES CASE SIZE)

Capacitance		Rated Voltage DC (V _R)								
μF	Code	16V	25V	35V	40V	50V	63V	80V	100V	125V
10	100						0608		1010	1010
12	120							1010	1010	
15	150					0608		1010	1012	
18	180							1012		
22	220						0810			
27	270		0608		0608					
33	330					0810	0810, 1010			
39	390							1010		
47	470			0608			1010			
56	560				0810	1010	1012			
68	680		0608							
82	820					1012				
100	101			0810	1010					
120	121	0608			1012					
150	151		0810	1010						
220	221			1012						
270	271	0810	1010							
330	331		1012							
470	471	1010								
560	561	1012								

Released ratings

RATINGS & PART NUMBER REFERENCE

Part No.	Case Size	Capacitance (μF)	Rated Voltage (V)	DCL Max. (μA)	DF Max. (%)	ESR Max. @ 100kHz (mΩ)	100kHz RMS Current (mA)/105°C
16 Volt							
AHA0608121M016R	0608	120	16	19	16	40	1500
AHA0810271M016R	0810	270	16	43	16	26	2000
AHA1010471M016R	1010	470	16	75	16	21	2600
AHA1012561M016R	1012	560	16	90	16	15	3000
25 Volt							
AHA0608270M025R	0608	27	25	7	16	70	1200
AHA0608680M025R	0608	68	25	17	16	45	1400
AHA0810151M025R	0810	150	25	38	16	27	1900
AHA1010271M025R	1010	270	25	68	16	22	2500
AHA1012331M025R	1012	330	25	83	16	16	2900
35 Volt							
AHA0608470M035R	0608	47	35	16	16	60	1300
AHA0810101M035R	0810	100	35	35	16	30	1800
AHA1010151M035R	1010	150	35	53	16	23	2400
AHA1012221M035R	1012	220	35	77	16	17	2800
40 Volt							
AHA0608270M040R	0608	27	40	11	16	70	1200
AHA0810560M040R	0810	56	40	22	16	32	1700
AHA1010101M040R	1010	100	40	40	16	24	2400
AHA1012121M040R	1012	120	40	48	16	18	2700
50 Volt							
AHA0608150M050R	0608	15	50	8	16	80	1200
AHA0810330M050R	0810	33	50	17	16	35	1600
AHA1010560M050R	1010	56	50	28	16	25	2300
AHA1012820M050R	1012	82	50	41	16	19	2600

All technical data relates to an ambient temperature of +25°C. Capacitance and DF are measured at 120Hz, 0.5RMS with DC bias of 2.2 volts. DCL is measured at rated voltage after 5 minutes.

SMD Aluminum Hybrid Electrolytic Capacitors

AHA Series



RATINGS & PART NUMBER REFERENCE

Part No.	Case Size	Capacitance (μF)	Rated Voltage (V)	DCL Max. (μA)	DF Max. (%)	ESR Max. @ 100kHz (mΩ)	100kHz RMS Current (mA)/105°C
63 Volt							
AHA0608100M063R	0608	10	63	6	16	100	1000
AHA0810220M063R	0810	22	63	14	16	40	1500
AHA0810330M063R	0810	33	63	21	16	40	1500
AHA1010330M063R	1010	33	63	21	16	30	2100
AHA1010470M063R	1010	47	63	30	16	30	2100
AHA1012560M063R	1012	56	63	35	16	22	2400
80 Volt							
AHA1010120M080R	1010	12	80	10	16	70	1600
AHA1010150M080R	1010	15	80	12	16	70	1600
AHA1012180M080R	1012	18	80	14	16	50	1800
AHA1010390M080R	1010	39	80	31	16	70	1600
100 Volt							
AHA1010100M100R	1010	10	100	10	16	80	1400
AHA1010120M100R	1010	12	100	12	16	80	1400
AHA1012150M100R	1012	15	100	15	16	80	1600
125 Volt							
AHA1010100M125R	1010	10	125	13	16	90	1200

All technical data relates to an ambient temperature of +25°C. Capacitance and DF are measured at 120Hz, 0.5RMS with DC bias of 2.2 volts. DCL is measured at rated voltage after 5 minutes.

FREQUENCY COEFFICIENT OF PERMISSIBLE RIPPLE CURRENT

Capacitance Range	100Hz ≤ F(Hz) < 1K	1K ≤ F(Hz) < 10K	10K ≤ F(Hz) < 100K	100K(Hz) ≤ F
4.7 < C ≤ 33	0.05	0.32	0.67	1.00
33 < C	0.10	0.35	0.70	1.00

QUALIFICATION TABLE

Test	AHA series (Temperature range -55°C to +105°C)		
	Condition	Characteristics	
Endurance	The following specifications shall be satisfied when the capacitors are restored to 20°C after the rated voltage is applied for 5000 to 10,000 hours at 105°C. Φ6.3 = 5000hrs, D≥ Φ8 = 10,000hrs	Visual examination	no visible damage
		ΔC/C	≤ ±30% of the initial limit
		DF	≤ 200% of the initial specified limit
		ESR	≤ 200% of the initial specified limit
		DCL	≤ Initial specified limit or less
Damp Heat (Steady State)	The following specifications shall be satisfied when the capacitors are restored to 20°C after subjection them to store at 60°C, 90 to 95% RH for 1000 hours, without DC applied.	Visual examination	no visible damage
		ΔC/C	≤ ±30% of the initial limit
		DF	≤ 200% of the initial specified limit
		ESR	≤ 200% of the initial specified limit
		DCL	≤ Initial specified limit or less
Surge Voltage	The capacitors shall be subjected to 1000 cycles each consisting of charge with the surge voltages specified at 15-35°C for 30 seconds. Through a protective resistor (R = 1kΩ) and discharge for 5 minutes 30 seconds.	Visual examination	no visible damage
		ΔC/C	≤ ±30% of the initial limit
		DF	≤ 200% of the initial specified limit
		ESR	≤ 200% of the initial specified limit
		DCL	≤ Initial specified limit or less

SMD Aluminum Hybrid Electrolytic Capacitors

AHA Series

REFLOW

Voltage Range (V)	16 - 63	80 - 125
Peak Temperature	260°C, 5 sec. max.	250°C, 5 sec. max.
Preheat Temperature	120°C, 120 sec. max.	
Duration at 200°C or higher	100 sec. max.	100 sec. max.
Duration at 220°C or higher	80 sec. max.	80 sec. max.
Duration at 230°C or higher	40 sec. max.	40 sec. max.
Reflow Number	Twice or less	Twice or less

STORAGE

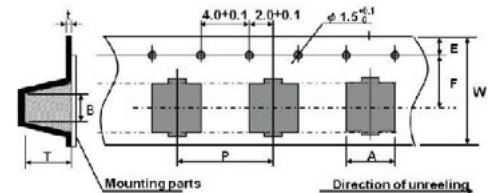
- It is recommended to keep capacitors between the ambient temperatures of 5°C to 35°C and a relative humidity of 75% or below.
- Confirm that the environment does not have any of the following conditions:
 - Damp conditions such as water, saltwater spray, or oil spray or fumes. High humidity or humidity condensation situations.
 - In an atmosphere filled with toxic gasses (such as hydrogen sulfide, sulfurous acid, nitrous acid, chlorine, ammonia, etc.).
 - Being exposed to direct sunlight, ozone, ultraviolet ray, or radiation.
 - Being exposed to acidic or alkaline solutions.
 - Under severe conditions where vibration and / or mechanical shock exceed the applicable ranges of the specification.

Category	Description	Storage Life
Mid-High Voltage	160V and above	2yrs, after 1yr, needs to check characteristics, if NG, needs to do aging
Low Voltage	120V and below	2yrs

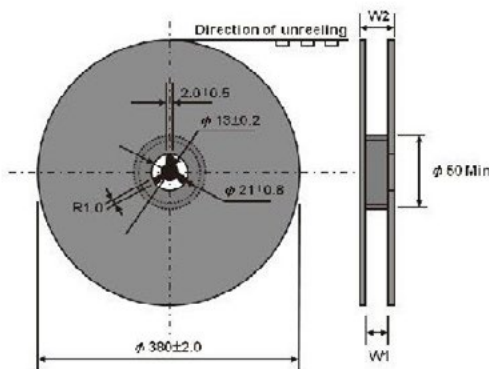
Remark: Re-aging condition depends on its own spec.

PACKAGE TAPE DIMENSIONS units (mm)

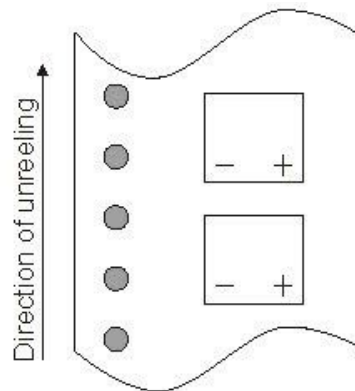
Size Code	A±0.20	B±0.20	W±0.30	F±0.10	E±0.10	P±0.10	t±0.10	T±0.20
0608	7.0	7.0	16.0	7.5	1.75	12.0	0.4	8.0
0810	8.7	8.7	24.0	11.5	1.75	16.0	0.4	11.0
1010	10.7	10.7	24.0	11.5	1.75	16.0	0.4	11.0
1012	10.7	10.7	24.0	11.5	1.75	16.0	0.4	13.0 - 13.5



REEL



POLARITY



DIMENSIONS units (mm)

Size Code	W1±1.00	W2±1.00	Qty./Reel
0608	18.0	22.0	1000
0810	26.0	31.0	500
1010	26.0	31.0	500
1012	26.0	31.0	400

SMD Aluminum Hybrid Electrolytic Capacitors

AHC Series



FEATURES

- Low ESR
- High Ripple Current Resistance
- 125°C, 4000 hours
- RoHS compliant

APPLICATIONS

- Commercial/Industrial power supply applications requiring high capacitance in energy-dense, in small-volume packages with a low ESR

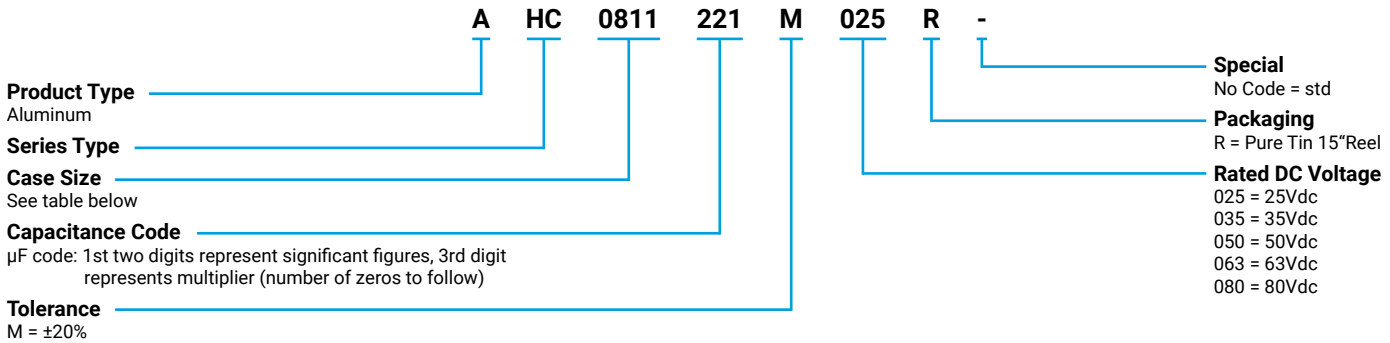


LEAD-FREE
LEAD-FREE COMPATIBLE
COMPONENT



RoHS
COMPLIANT

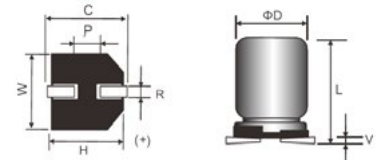
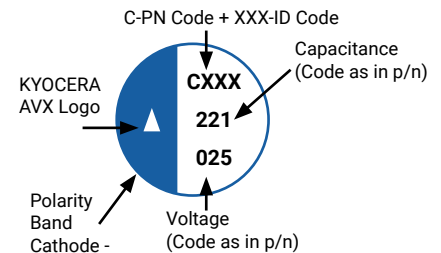
HOW TO ORDER



CASE DIMENSIONS millimeters (inches)

Code	D±0.50 (0.020)	L±0.50 (0.020)	W±0.20 (0.008)	H±0.20 (0.008)	C±0.20 (0.008)	R	P±0.30 (0.012)	V max
0609	6.30 (0.248)	9.30 (0.366)	6.60 (0.260)	6.60 (0.260)	7.30 (0.287)	0.50 - 0.80 (0.020 - 0.031)	2.00 (0.080)	0.30 (0.012)
0811	8.00 (0.315)	11.50 (0.453)	8.30 (0.327)	8.30 (0.327)	9.00 (0.354)	0.70 - 1.10 (0.028 - 0.043)	3.20 (0.126)	0.30 (0.012)
0812	8.00 (0.315)	12.00 (0.472)	8.30 (0.327)	8.30 (0.327)	9.00 (0.354)	0.70 - 1.10 (0.028 - 0.043)	3.20 (0.126)	0.30 (0.012)
1012	10.00 (0.394)	12.50 (0.492)	10.30 (0.406)	10.30 (0.406)	11.00 (0.433)	0.70 - 1.30 (0.028 - 0.051)	4.50 (0.177)	0.30 (0.012)

MARKING



TECHNICAL SPECIFICATIONS

Category Temperature Range:	-55°C to + 125°C	
Capacitance Range:	At 20°C, 120Hz	15µF to 470µF
Capacitance Tolerance:	At 20°C, 120Hz	±20%
Dissipation Factor (%)	Measurement Frequency: 120Hz at 20°C	Please see the ratings and part number reference table below
Leakage Current:	After 2 minutes at rated working voltage at 20°C*	I ≤ 0.01CV or 3µA, whichever is greater

* Note: In the case of an anomalous reading, re-measure the leakage current after following voltage treatment:
Voltage treatment: DC rated voltage to be applied to the capacitors for 120 minutes at 125°C.

SMD Aluminum Hybrid Electrolytic Capacitors

AHC Series



CAPACITANCE AND RATED VOLTAGE RANGE (FIGURES DENOTES CASE SIZE)

Capacitance		Rated Voltage DC (V _R)				
μF	Code	25V	35V	50V	63V	80V
15	150				0609	
22	220			0609	0609	
33	330			0609		
47	470		0609	0811		0812
68	680		0609			
100	101	0609				
220	221	0811	1012			
470	471	1012				

Released ratings

RATINGS & PART NUMBER REFERENCE

Part No.	Case Size	Capacitance (μF)	Rated Voltage (V)	DCL Max. (μA)	DF Max. (%)	ESR Max. @ 100kHz (mΩ)	100kHz RMS Current (mA)/125°C
25 Volt							
AHC0609101M025R	0609	100	25	25	12	30	1400
AHC0811221M025R	0811	220	25	55	12	27	1400
AHC1012471M025R	1012	470	25	117.5	12	20	2000
35 Volt							
AHC0609470M035R	0609	47	35	16.5	12	60	900
AHC0609680M035R	0609	68	35	23.8	12	40	1200
AHC1012221M035R	1012	220	35	77	12	30	1800
50 Volt							
AHC0609220M050R	0609	22	50	11	12	90	900
AHC0609330M050R	0609	33	50	16.5	12	40	1100
AHC0811470M050R	0811	47	50	23.5	12	35	1100
63 Volt							
AHC0609150M063R	0609	15	63	9.5	12	100	800
AHC0609220M063R	0609	22	63	13.9	12	80	800
80 Volt							
AHC0812470M080R	0812	47	80	37.6	12	40	1000

All technical data relates to an ambient temperature of +25°C. Capacitance and DF are measured at 120Hz, 0.5RMS with DC bias of 2.2 volts. DCL is measured at rated voltage after 5 minutes.

FREQUENCY COEFFICIENT OF PERMISSIBLE RIPPLE CURRENT

Frequency	120Hz ≤ F(Hz) < 1K	1K ≤ F(Hz) < 10K	10K ≤ F(Hz) < 100K	100K(Hz) ≤ F
Coefficient	0.05	0.30	0.70	1.00

QUALIFICATION TABLE

Test	AHC series (Temperature range -55°C to +125°C)	
	Condition	Characteristics
Endurance	The following specifications shall be satisfied when the capacitors are restored to normal temperature after storing them for 2000 hours under no-load at 125±2°C. The rated voltage with ripple current is applied for 4000 hours at 125°C.	Visual Examination
		no visible damage
		ΔC/C
		≤ ±30% of the initial limit
		DF
Humidity Resistance (On-Load)	The following specifications shall be satisfied when the rated voltage is applied for 2000 hours at 85±2°C and 85 to 90% RH.	≤ 200% of the initial specified limit
		ESR
		≤ 200% of the initial specified limit
		DCL
		≤ Initial specified limit or less
Humidity Resistance (On-Load)		Visual Examination
		≤ no visible damage
		ΔC/C
		≤ ±30% of the initial limit
		DF
Humidity Resistance (On-Load)		≤ 200% of the initial specified limit
		ESR
		≤ 200% of the initial specified limit
Humidity Resistance (On-Load)		DCL
		≤ Initial specified limit or less



The Important Information/Disclaimer is incorporated in the catalog where these specifications came from or available online at www.kyocera-avx.com/disclaimer/ by reference and should be reviewed in full before placing any order.

SMD Aluminum Hybrid Electrolytic Capacitors

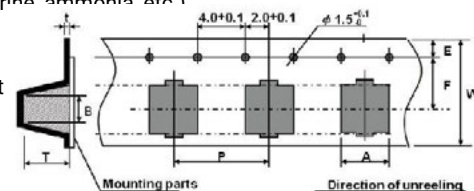
AHC Series

REFLOW

Peak Temperature	260°C, 10 sec. max.
Preheat Temperature	150°C to 180°C, 90 sec. max.
Duration at 200°C or higher	60 sec. max.
Duration at 230°C or higher	40 sec. max.
Reflow Number	Twice or less

STORAGE

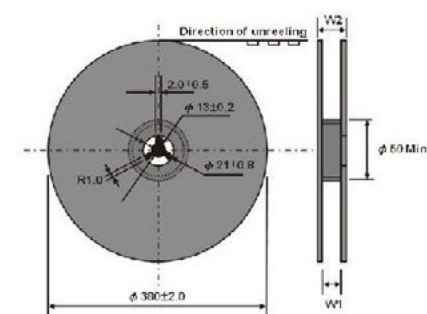
- It is recommended to keep capacitors between the ambient temperatures of 5°C to 35°C (If between 35 to 85°C, it should be less than three months), and the relative humidity of 75% or below.
- Confirm that the environment does not have any of the following conditions:
 - Damp conditions such as water, saltwater spray, or oil spray or fumes. High humidity or humidity condensation situations.
 - In an atmosphere filled with toxic gasses (such as hydrogen sulfide, sulfurous acid, nitrous acid, chlorine ammonia etc.)
 - Being exposed to direct sunlight, ozone, ultraviolet ray, or radiation.
 - Being exposed to acidic or alkaline solutions.
 - Under severe conditions where vibration and / or mechanical shock exceed the applicable ranges of t
- Storage time:
 - Before unseal: within 1 year after delivery
 - After seal: within 1 month from opening



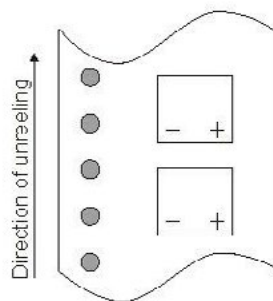
PACKAGE TAPE DIMENSIONS units (mm)

Size Code	A±0.20	B±0.20	W±0.30	F±0.10	E±0.10	P±0.10	t±0.10	T±0.20
0609	7.0	7.0	16.0	7.5	1.75	12.0	0.4	10.0
0811	8.7	8.7	24.0	11.5	1.75	16.0	0.4	12.0
0812	8.7	8.7	24.0	11.5	1.75	16.0	0.4	13.0
1012	10.7	10.7	24.0	11.5	1.75	16.0	0.4	13.0 - 13.5

REEL



POLARITY



DIMENSIONS units (mm)

Size Code	W1±1.00	W2±1.00	Qty./Reel
0609	18.0	22.0	800
0811	26.0	31.0	500
0812	26.0	31.0	500
1012	26.0	31.0	500

SMD Aluminum Conductive Polymer Electrolytic Capacitors

APA Series



FEATURES

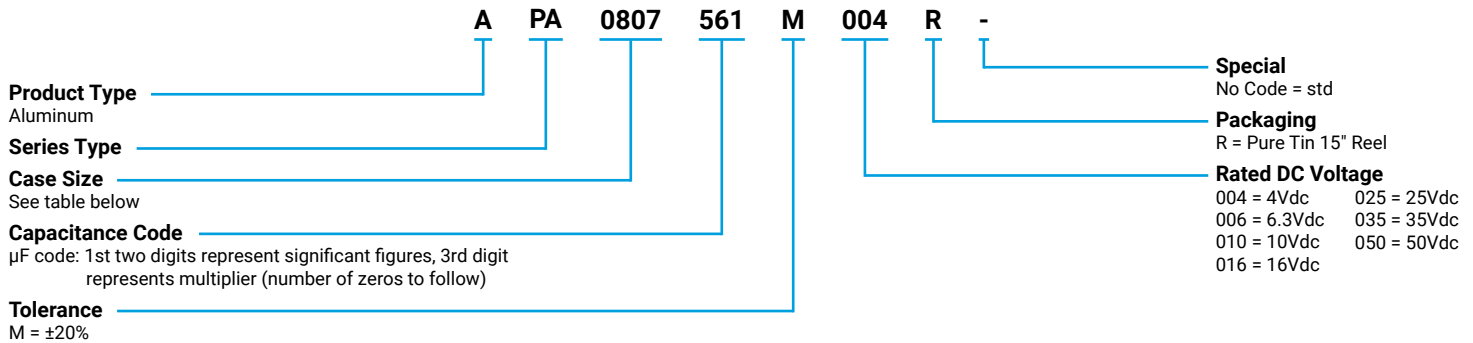
- Super Low ESR
- Long Life
- 105°C, 5000 hours
- RoHS compliant

APPLICATIONS

- DC/DC Converters
- Voltage Regulators
- Decoupling
- Computer Motherboards, etc



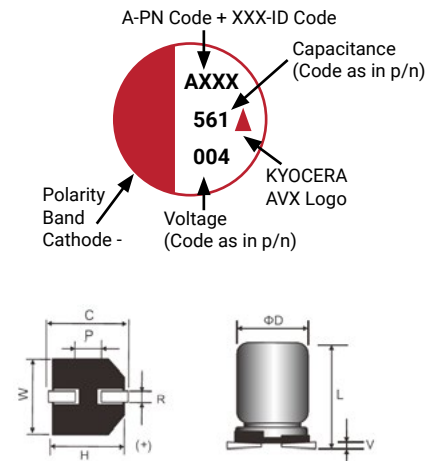
HOW TO ORDER



CASE DIMENSIONS millimeters (inches)

Code	D±0.50 (0.020)	L±0.50 (0.020)	W±0.20 (0.008)	H±0.20 (0.008)	C±0.20 (0.008)	R	P±0.30 (0.012)	V max
0606	6.30 (0.248)	6.00 (0.236)	6.60 (0.260)	6.60 (0.260)	7.30 (0.287)	0.50 - 0.80 (0.020 - 0.031)	2.00 (0.080)	0.30 (0.012)
0607	6.30 (0.248)	7.00 (0.276)	6.60 (0.260)	6.60 (0.260)	7.30 (0.287)	0.50 - 0.80 (0.020 - 0.031)	2.00 (0.080)	0.30 (0.012)
0608	6.30 (0.248)	8.00 (0.315)	6.60 (0.260)	6.60 (0.260)	7.30 (0.287)	0.50 - 0.80 (0.020 - 0.031)	2.00 (0.080)	0.30 (0.012)
0609	6.30 (0.248)	9.30 (0.366)	6.60 (0.260)	6.60 (0.260)	7.30 (0.287)	0.50 - 0.80 (0.020 - 0.031)	2.00 (0.080)	0.30 (0.012)
0807	8.00 (0.315)	7.00 (0.276)	8.30 (0.327)	8.30 (0.327)	9.00 (0.354)	0.50 - 0.80 (0.020 - 0.031)	3.20 (0.126)	0.30 (0.012)
0809	8.00 (0.315)	9.50 (0.374)	8.30 (0.327)	8.30 (0.327)	9.00 (0.354)	0.70 - 1.10 (0.028 - 0.043)	3.20 (0.126)	0.30 (0.012)
0812	8.00 (0.315)	12.00 (0.472)	8.30 (0.327)	8.30 (0.327)	9.00 (0.354)	0.70 - 1.10 (0.028 - 0.043)	3.20 (0.126)	0.30 (0.012)
1010	10.00 (0.394)	10.50 (0.413)	10.30 (0.406)	10.30 (0.406)	11.00 (0.433)	0.70 - 1.10 (0.028 - 0.043)	4.50 (0.177)	0.30 (0.012)
1012	10.00 (0.394)	12.50 (0.492)	10.30 (0.406)	10.30 (0.406)	11.00 (0.433)	0.70 - 1.10 (0.028 - 0.043)	4.50 (0.177)	0.30 (0.012)

MARKING



TECHNICAL SPECIFICATIONS

Category Temperature Range:	-55°C to +105°C	
Capacitance Range	At 25°C, 120Hz	10µF to 2200µF
Capacitance Tolerance:		±20%
Surge Voltage:	At 105°C	Rated voltage x 1.15
Dissipation Factor (%)	Measurement Frequency: 120Hz at 25°C	Please see the ratings and part number reference table below
Leakage Current:	After 2 minutes at rated working voltage at 25°C*	I ≤ 0.2CV or 300µA, whichever is greater

* Note: In the case of an anomalous reading, re-measure the leakage current after following voltage treatment:
Voltage treatment: DC rated voltage to be applied to the capacitors for 120 minutes at 105°C.



The Important Information/Disclaimer is incorporated in the catalog where these specifications came from or available online at www.kyocera-avx.com/disclaimer/ by reference and should be reviewed in full before placing any order.

SMD Aluminum Conductive Polymer Electrolytic Capacitors

APA Series



CAPACITANCE AND RATED VOLTAGE RANGE (FIGURES DENOTES CASE SIZE)

Capacitance		Rated Voltage DC (V _R)						
μF	Code	4V	6.3V	10V	16V	25V	35V	50V
10	100							0606
22	220						0606	
33	330							0609
47	470					0606		0809
68	680			0606			0609	0812
82	820							0812
100	101		0606	0606	0606	0609		1010, 1012
120	121						0809	
150	151						0812	
180	181					0809		1012
220	221	0606	0606	0607, 0608	0609	0812	1010	
270	271						1012	
330	331			0609	0809	1010		
470	471		0609		0812	1012		
560	561	0609, 0807	0609	0809	0812			
680	681			0812	1010			
820	821	0809	0809	1010	1012			
1000	102		0812	1010				
1200	122	0812	1010	1012				
1500	152	1010						
1800	182		1012					
2200	222	1012						

Released ratings

RATINGS & PART NUMBER REFERENCE

Part No.	Case Size	Capacitance (μF)	Rated Voltage (V)	DCL Max. (μA)	DF Max. (%)	ESR Max. @ 100kHz (mΩ)	100kHz RMS Current (mA)/105°C
4 Volt							
APA0606221M004R	0606	220	4	300	12	20	2800
APA0609561M004R	0609	560	4	448	12	20	3500
APA0807561M004R	0807	560	4	448	12	18	3700
APA0809821M004R	0809	820	4	656	12	15	4000
APA0812122M004R	0812	1200	4	960	12	15	4450
APA1010152M004R	1010	1500	4	1200	12	13	4500
APA1012222M004R	1012	2200	4	1760	12	13	5400
6.3 Volt							
APA0606101M006R	0606	100	6.3	300	12	22	2400
APA0606221M006R	0606	220	6.3	300	12	22	2600
APA0609471M006R	0609	470	6.3	592	12	22	3200
APA0609561M006R	0609	560	6.3	705	12	22	3200
APA0809821M006R	0809	820	6.3	1033	12	20	3850
APA0812102M006R	0812	1000	6.3	1260	12	20	4250
APA1010122M006R	1010	1200	6.3	1512	12	18	4350
APA1012182M006R	1012	1800	6.3	2268	12	18	5200
10 Volt							
APA0606680M010R	0606	68	10	300	12	30	2400
APA0606101M010R	0606	100	10	300	12	30	2400
APA0607221M010R	0607	220	10	440	12	30	2500
APA0608221M010R	0608	220	10	440	12	25	2500
APA0609331M010R	0609	330	10	660	12	30	3150
APA0809561M010R	0809	560	10	1120	12	25	3850
APA0812681M010R	0812	680	10	1360	12	25	4150
APA1010821M010R	1010	820	10	1640	12	20	4250
APA1010102M010R	1010	1000	10	2000	12	20	4250
APA1012122M010R	1012	1200	10	2400	12	20	5100

All technical data relates to an ambient temperature of +25°C. Capacitance and DF are measured at 120Hz, 0.5RMS with DC bias of 2.2 volts. DCL is measured at rated voltage after 5 minutes.

SMD Aluminum Conductive Polymer Electrolytic Capacitors

APA Series



RATINGS & PART NUMBER REFERENCE

Part No.	Case Size	Capacitance (μF)	Rated Voltage (V)	DCL Max. (μA)	DF Max. (%)	ESR Max. @ 100kHz (mΩ)	100kHz RMS Current (mA)/105°C
16 Volt							
APA0606101M016R	0606	100	16	320	12	30	2200
APA0609221M016R	0609	220	16	704	12	30	3050
APA0809331M016R	0809	330	16	1056	12	20	3450
APA0812471M016R	0812	470	16	1504	12	20	4050
APA0812561M016R	0812	560	16	1792	12	20	4150
APA1010681M016R	1010	680	16	2176	12	20	4150
APA1012821M016R	1012	820	16	2624	12	20	5100
25 Volt							
APA0606470M025R	0606	47	25	300	12	40	1500
APA0609101M025R	0609	100	25	500	12	35	2800
APA0809181M025R	0809	180	25	900	12	30	3250
APA0812221M025R	0812	220	25	1100	12	30	3900
APA1010331M025R	1010	330	25	1650	12	20	4100
APA1012471M025R	1012	470	25	2350	12	25	4500
35 Volt							
APA0606220M035R	0606	22	35	300	12	70	1450
APA0609680M035R	0609	68	35	476	12	60	1500
APA0809121M035R	0809	120	35	840	12	50	1800
APA0812151M035R	0812	150	35	1050	12	50	2850
APA1010221M035R	1010	220	35	1540	12	40	2950
APA1012271M035R	1012	270	35	1890	12	40	3200
50 Volt							
APA0606100M050R	0606	10	50	300	12	60	1400
APA0609330M050R	0609	33	50	330	12	30	1700
APA0809470M050R	0809	47	50	470	12	30	2000
APA0812680M050R	0812	68	50	680	12	28	2200
APA0812820M050R	0812	82	50	820	12	28	2300
APA1010101M050R	1010	100	50	1000	12	30	2300
APA1012101M050R	1012	100	50	1000	12	26	2650
APA1012181M050R	1012	180	50	1800	12	26	2950

All technical data relates to an ambient temperature of +25°C. Capacitance and DF are measured at 120Hz, 0.5RMS with DC bias of 2.2 volts. DCL is measured at rated voltage after 5 minutes.

FREQUENCY COEFFICIENT OF PERMISSIBLE RIPPLE CURRENT

Frequency	120Hz ≤ F(Hz) < 1K	1K ≤ F(Hz) < 10K	10K ≤ F(Hz) < 100K	100K(Hz) ≤ F<500K
Coefficient	0.05	0.30	0.70	1.00

SMD Aluminum Conductive Polymer Electrolytic Capacitors

APA Series



QUALIFICATION TABLE

Test	APA series (Temperature range -55°C to +105°C)		
	Condition	Characteristics	
Endurance	The following specifications shall be satisfied when the capacitors are restored to 20°C after the rated voltage is applied for 5000 hours at 105°C.	Visual examination	no visible damage
		ΔC/C	≤ ±20% of the initial limit
		DF	≤ 150% of the initial specified limit
		ESR	≤ 150% of the initial specified limit
		DCL	≤ Initial specified limit or less
Damp Heat (Steady State)	The following specifications shall be satisfied when the capacitors are restored to 20°C after subjection them to store at 60°C, 90 to 95% RH for 1000 hours, without DC applied.	Visual examination	≤ no visible damage
		ΔC/C	≤ ±20% of the initial limit
		DF	≤ 150% of the initial specified limit
		ESR	≤ 150% of the initial specified limit
		DCL	≤ Initial specified limit or less
Surge Voltage	The capacitors shall be subjected to 1000 cycles each consisting of charge with the surge voltages specified at 105°C for 30 seconds. Through a protective resistor (R = 1kΩ) and discharge for 5 minutes 30 seconds.	Visual examination	≤ no visible damage
		ΔC/C	≤ ±20% of the initial limit
		DF	≤ 150% of the initial specified limit
		ESR	≤ 150% of the initial specified limit
		DCL	≤ Initial specified limit or less

REFLOW

Peak Temperature	260°C, 10 + 1 sec.	250°C, 10 + 1 sec.
Preheat Temperature	150°C to 180°C, 90 ± 3 sec. max.	
Duration at 200°C or higher	60 sec. max.	60 sec. max.
Duration at 220°C or higher	50 sec. max.	50 sec. max.
Duration at 230°C or higher	40 sec. max.	40 sec. max.
Reflow Number	Once	Twice or less

STORAGE

1. It is recommended to keep capacitors between the ambient temperatures of 5°C to 35°C and a relative humidity of 75% or below.
2. Confirm that the environment does not have any of the following conditions:
 - Damp conditions such as water, saltwater spray, or oil spray or fumes. High humidity or humidity condensation situations.
 - In an atmosphere filled with toxic gasses (such as hydrogen sulfide, sulfurous acid, nitrous acid, chlorine, ammonia, etc.).
 - Being exposed to direct sunlight, ozone, ultraviolet ray, or radiation.
 - Being exposed to acidic or alkaline solutions.
 - Under severe conditions where vibration and / or mechanical shock exceed the applicable ranges of the specification.
- 3.

Category	Description	Storage Life
Mid-High Voltage	160V and above	2yrs, after 1yr, needs to check characteristics, if NG, needs to do aging
Low Voltage	120V and below	2yrs

Remark: Re-aging condition depends on its own spec.

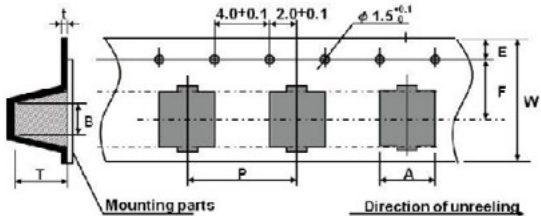
SMD Aluminum Conductive Polymer Electrolytic Capacitors

APA Series

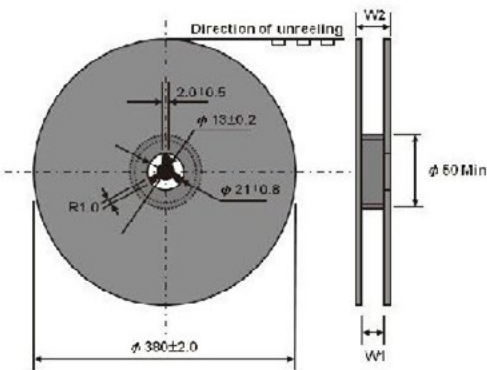


PACKAGE TAPE DIMENSIONS units (mm)

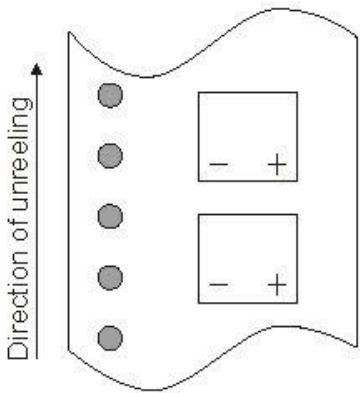
Size Code	A±0.20	B±0.20	W±0.30	F±0.10	E±0.10	P±0.10	t±0.10	T±0.20
0606	7.0	7.0	16.0	7.5	1.75	12.0	0.4	8.0
0607-0608	7.0	7.0	16.0	7.5	1.75	12.0	0.4	8.0
0609	7.0	7.0	16.0	7.5	1.75	12.0	0.4	10.0
0807	8.7	8.7	24.0	11.5	1.75	16.0	0.4	8.8
0809	8.7	8.7	24.0	11.5	1.75	16.0	0.4	10.5
0812	8.7	8.7	24.0	11.5	1.75	16.0	0.4	13.0
1010	10.7	10.7	24.0	11.5	1.75	16.0	0.4	11.0
1012	10.7	10.7	24.0	11.5	1.75	16.0	0.4	13.0 - 13.5



REEL



POLARITY



DIMENSIONS units (mm)

Size Code	W1±1.00	W2±1.00	Qty./Reel
0606-0608	18.0	22.0	1000
0609	18.0	22.0	800
0807-0809	26.0	31.0	500
1010	26.0	31.0	500
0812-1012	26.0	31.0	400

SMD Aluminum Conductive Polymer Electrolytic Capacitors

APD Series



LEAD-FREE
LEAD-FREE COMPATIBLE
COMPONENT



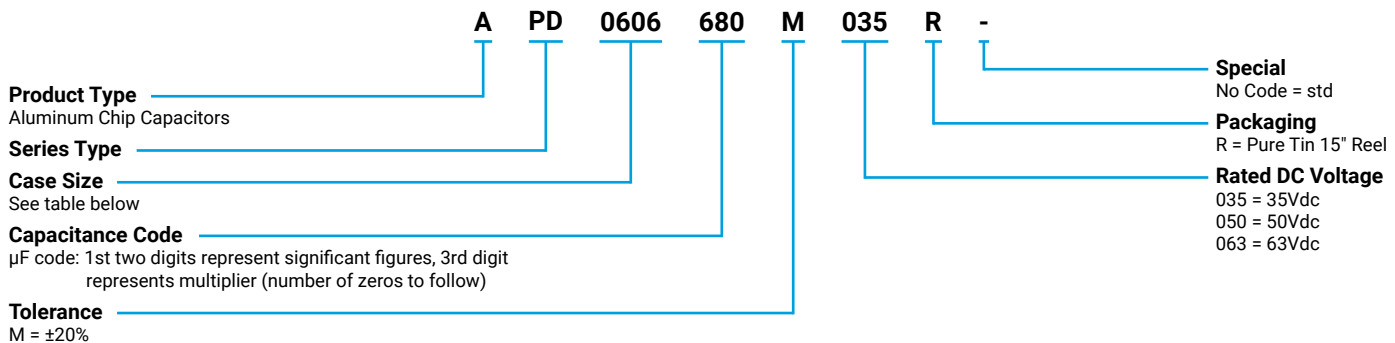
FEATURES

- Endurance: 2000 hours at 105°C
- High Voltage
- RoHS compliant

APPLICATIONS

- Lamps
- LED
- Power Supply

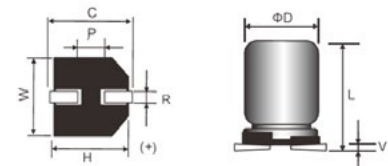
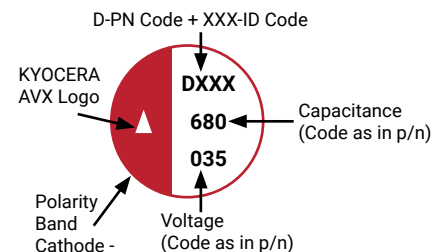
HOW TO ORDER



CASE DIMENSIONS millimeters (inches)

Code	D±0.50 (0.020)	L±0.50 (0.020)	W±0.20 (0.008)	H±0.20 (0.008)	C±0.20 (0.008)	R	P±0.30 (0.012)	V max
0606	6.30 (0.248)	6.00 (0.236)	6.60 (0.260)	6.60 (0.260)	7.30 (0.287)	0.50 - 0.80 (0.020 - 0.031)	2.00 (0.080)	0.30 (0.012)
0609	6.30 (0.248)	9.30 (0.366)	6.60 (0.260)	6.60 (0.260)	7.30 (0.287)	0.50 - 0.80 (0.020 - 0.031)	2.00 (0.080)	0.30 (0.012)
0809	8.00 (0.315)	9.50 (0.374)	8.30 (0.327)	8.30 (0.327)	9.00 (0.354)	0.70 - 1.10 (0.028 - 0.043)	3.20 (0.126)	0.30 (0.012)
0811	8.00 (0.315)	11.50 (0.453)	8.30 (0.327)	8.30 (0.327)	9.00 (0.354)	0.70 - 1.10 (0.028 - 0.043)	3.20 (0.126)	0.30 (0.012)
1012	10.00 (0.394)	12.50 (0.492)	10.30 (0.406)	10.30 (0.406)	11.00 (0.433)	0.70 - 1.30 (0.028 - 0.051)	4.50 (0.177)	0.30 (0.012)

MARKING



TECHNICAL SPECIFICATIONS

Category Temperature Range:	-55°C to +105°C	
Capacitance Range	At 20°C, 120Hz	22µF to 470µF
Capacitance Tolerance:	At 20°C, 120Hz	±20%
Dissipation Factor (%)	Measurement Frequency: 120Hz at 20°C	Please see the ratings and part number reference table below
Leakage Current:	After 2 minutes at rated working voltage at 20°C* $I \leq 0.2CV$ or 500µA, whichever is greater	

* Note: In the case of an anomalous reading, re-measure the leakage current after following voltage treatment:
Voltage treatment: DC rated voltage to be applied to the capacitors for 120 minutes at 105°C.

SMD Aluminum Conductive Polymer Electrolytic Capacitors

APD Series



CAPACITANCE AND RATED VOLTAGE RANGE (FIGURES DENOTES CASE SIZE)

Capacitance		Rated Voltage DC (V _R)		
μF	Code	35V	50V	63V
22	220	0606	0606	0606
27	270	0606		
33	330	0606	0606	0609
47	470	0606, 0609	0609	0809
56	560			0811
68	680	0606, 0609	0811	
82	820		0811, 1012	
100	101	0609, 0809, 0811	0809, 0811, 1012	1012
120	121		0811	
150	151	0811	1012	
220	221	0811	1012	
270	271	0811, 1012		
330	331	1012		
470	471	1012		

Released ratings

RATINGS & PART NUMBER REFERENCE

Part No.	Case Size	Capacitance (μF)	Rated Voltage (V)	DCL Max. (μA)	DF Max. (%)	ESR Max. @100kHz (mΩ)	100kHz RMS Current (mA)/105°C
35 Volt							
APD0606220M035R	0606	22	35	500	12	54	1100
APD0606270M035R	0606	27	35	500	12	54	1100
APD0606330M035R	0606	33	35	500	12	54	1100
APD0606470M035R	0606	47	35	500	12	40	1100
APD0609470M035R	0609	47	35	500	12	45	1500
APD0606680M035R	0606	68	35	500	12	40	1100
APD0609680M035R	0609	68	35	500	12	36	1800
APD0609101M035R	0609	100	35	700	12	36	2200
APD0809101M035R	0809	100	35	700	12	36	2900
APD0811101M035R	0811	100	35	700	12	27	3100
APD0811151M035R	0811	150	35	1050	12	27	3100
APD0811221M035R	0811	220	35	1540	12	27	2500
APD0811271M035R	0811	270	35	1890	12	27	2600
APD1012271M035R	1012	270	35	1890	12	27	2800
APD1012331M035R	1012	330	35	2310	12	27	2800
APD1012471M035R	1012	470	35	3290	12	27	3100
50 Volt							
APD0606220M050R	0606	22	50	500	12	72	840
APD0606330M050R	0606	33	50	500	12	72	890
APD0609470M050R	0609	47	50	500	12	54	1400
APD0811680M050R	0811	68	50	680	12	27	2100
APD0811820M050R	0811	82	50	820	12	27	2100
APD1012820M050R	1012	82	50	820	12	27	2100
APD0809101M050R	0809	100	50	1000	12	54	1500
APD0811101M050R	0811	100	50	1000	12	27	2100
APD1012101M050R	1012	100	50	1000	12	27	2200
APD0811121M050R	0811	120	50	1200	12	27	2100
APD1012151M050R	1012	150	50	1500	12	27	2200
APD1012221M050R	1012	220	50	2200	12	27	2400
63 Volt							
APD0606220M063R	0606	22	63	500	12	72	520
APD0609330M063R	0609	33	63	500	12	54	520
APD0809470M063R	0809	47	63	592	12	54	1000
APD0811560M063R	0811	56	63	706	12	36	1000
APD1012101M063R	1012	100	63	1260	12	36	1600

All technical data relates to an ambient temperature of +25°C. Capacitance and DF are measured at 120Hz, 0.5RMS with DC bias of 2.2 volts.
DCL is measured at rated voltage after 2 minutes.



The Important Information/Disclaimer is incorporated in the catalog where these specifications came from or available online at www.kyocera-avx.com/disclaimer/ by reference and should be reviewed in full before placing any order.

SMD Aluminum Conductive Polymer Electrolytic Capacitors

APD Series



FREQUENCY COEFFICIENT OF PERMISSIBLE RIPPLE CURRENT

Frequency	120Hz ≤ f(Hz) < 1kHz	1kHz ≤ f(Hz) < 10kHz	10kHz ≤ f(Hz) < 100kHz	100kHz ≤ f(Hz) < 500kHz
Coefficient	0.05	0.30	0.70	1.00

QUALIFICATION TABLE

Test	APD series (Temperature Range -55°C to +105°C)	
	Condition	Characteristics
Endurance	The following specifications shall be satisfied when the capacitors are restored to 20°C after the rated voltage is applied for 2000 hours at 105°C.	Visual examination
		no visible damage
		ΔC/C
		≤ ±20% of the initial limit
		DF
Damp Heat (Steady State)	The following specifications shall be satisfied when the capacitors are restored to 20°C after subjection them to store at 60°C, 90 to 95% RH for 2000 hours, without DC applied.	≤ 150% of the initial specified limit
		ESR
		≤ 150% of the initial specified limit
		DCL
		≤ Initial specified limit
Surge Voltage	The capacitors shall be subjected to 1000 cycles each consisting of charge with the surge voltages specified at normal temperature for 30 seconds. Through a protective resistor (R = 1kΩ) and discharge for 5 minutes 30 seconds.	Visual examination
		no visible damage
		ΔC/C
		≤ ±20% of the initial limit
		DF
		≤ 150% of the initial specified limit
		ESR
		≤ 150% of the initial specified limit
		DCL
		≤ Initial specified limit

REFLOW

Peak Temperature	260°C, 10 sec. max
Preheat Temperature	150°C to 180°C, 90 sec. max.
Duration at 200°C or higher	60 sec. max.
Duration at 230°C or higher	40 sec. max.
Reflow Number	Twice or less

STORAGE

- It is recommended to keep capacitors between the ambient temperatures of 5°C to 35°C (If between 35 to 85°C, it should be less than three months), and the relative humidity of 75% or below.
- Confirm that the environment does not have any of the following conditions:
 - Damp conditions such as water, saltwater spray, or oil spray or fumes. High humidity or humidity condensation situations.
 - In an atmosphere filled with toxic gases (such as hydrogen sulfide, sulfurous acid, nitrous acid, chlorine, ammonia, etc.).
 - Being exposed to direct sunlight, ozone, ultraviolet ray, or radiation.
 - Being exposed to acidic or alkaline solutions.
 - Under severe conditions where vibration and / or mechanical shock exceed the applicable ranges of the specification.
- Storage time:
 - Before unseal: within 1 year after delivery
 - After seal: within 1 month from opening

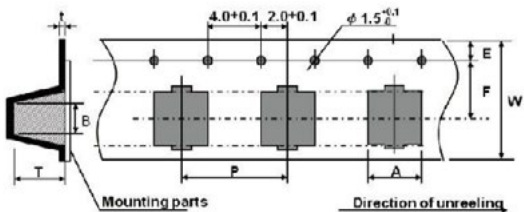
SMD Aluminum Conductive Polymer Electrolytic Capacitors

APD Series

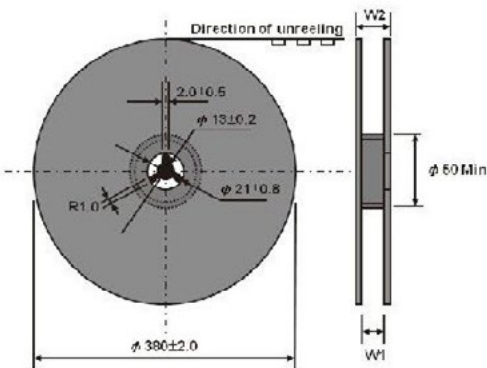


PACKAGE TAPE DIMENSIONS units (mm)

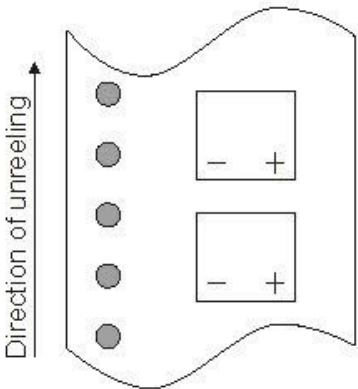
Size Code	A±0.20	B±0.20	W±0.30	F±0.10	E±0.10	P±0.10	t±0.10	T±0.20
0606	7.0	7.0	16.0	7.5	1.75	12.0	0.4	8.0
0609	7.0	7.0	16.0	7.5	1.75	12.0	0.4	10.0
0809	8.7	8.7	24.0	11.5	1.75	16.0	0.4	10.5
0811	8.7	8.7	24.0	11.5	1.75	16.0	0.4	12.0
1012	10.7	10.7	24.0	11.5	1.75	16.0	0.4	13.0- 13.5



REEL



POLARITY



DIMENSIONS units (mm)

Size Code	W1±1.00	W2±1.00	Qty./Reel
0606	18.0	22.0	1000
0609	18.0	22.0	800
0809	26.0	30.0	600
0811	26.0	31.0	500
1012	26.0	31.0	500

SMD Aluminum Conductive Polymer Electrolytic Capacitors

APV Series



FEATURES

- Endurance: 2000hours at 105°C
- Low ESR
- RoHS compliant

APPLICATIONS

- High order main board, server

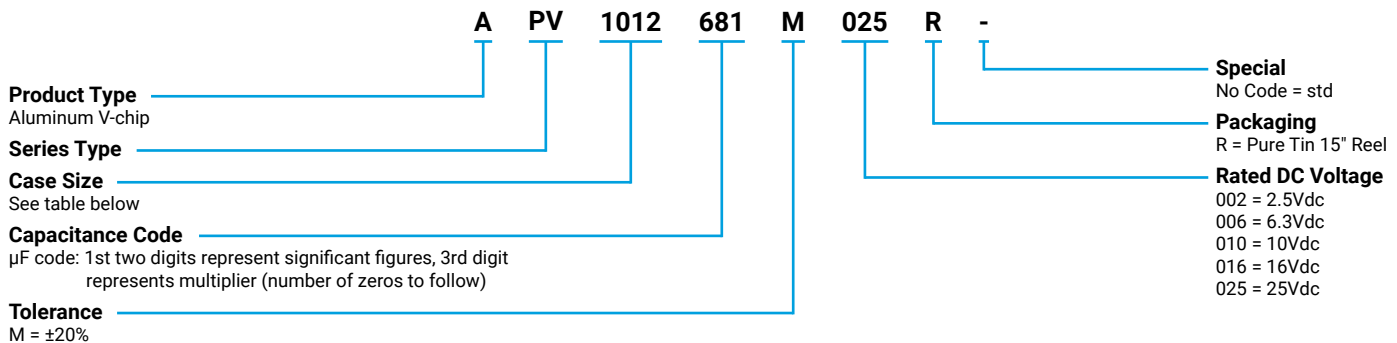


LEAD-FREE
LEAD-FREE COMPATIBLE
COMPONENT



RoHS
COMPLIANT

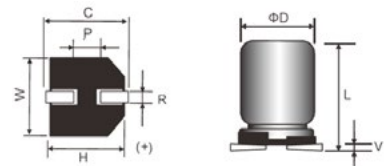
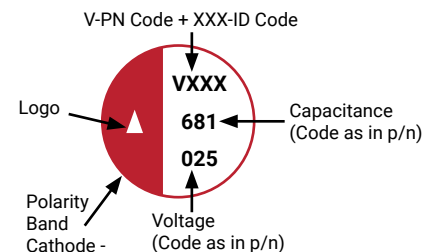
HOW TO ORDER



CASE DIMENSIONS millimeters (inches)

Code	D±0.50 (0.020)	L±0.50 (0.020)	W±0.20 (0.008)	H±0.20 (0.008)	C±0.20 (0.008)	R	P±0.30 (0.012)	V max
0606	6.30 (0.248)	6.00 (0.236)	6.60 (0.260)	6.60 (0.260)	7.30 (0.287)	0.50-0.80 (0.020-0.031)	2.00 (0.080)	0.30 (0.012)
0609	6.30 (0.248)	9.30 (0.366)	6.60 (0.260)	6.60 (0.260)	7.30 (0.287)	0.50-0.80 (0.020-0.031)	2.00 (0.080)	0.30 (0.012)
0809	8.00 (0.315)	9.50 (0.374)	8.30 (0.327)	8.30 (0.327)	9.00 (0.354)	0.70-1.10 (0.028-0.043)	3.20 (0.126)	0.30 (0.012)
0811	8.00 (0.315)	11.50 (0.453)	8.30 (0.327)	8.30 (0.327)	9.00 (0.354)	0.70-1.10 (0.028-0.043)	3.20 (0.126)	0.30 (0.012)
1012	10.00 (0.394)	12.50 (0.492)	10.30 (0.406)	10.30 (0.406)	11.00 (0.433)	0.70-1.30 (0.028-0.051)	4.50 (0.177)	0.30 (0.012)

MARKING



TECHNICAL SPECIFICATIONS

Category Temperature Range:	-55°C to +105°C	
Capacitance Range	At 20°C, 120Hz	27µF to 2200µF
Capacitance Tolerance:	At 20°C, 120Hz	±20%
Dissipation Factor (%)	Measurement Frequency: 120Hz at 20°C	Please see the ratings and part number reference table below
Leakage Current:	After 2 minutes at rated working voltage at 20°C*	I ≤ 0.2CV or 500µA, whichever is greater

* Note: In the case of an anomalous reading, re-measure the leakage current after following voltage treatment:
Voltage treatment: DC rated voltage to be applied to the capacitors for 120 minutes at 105°C.

SMD Aluminum Conductive Polymer Electrolytic Capacitors

APV Series



CAPACITANCE AND RATED VOLTAGE RANGE (FIGURES DENOTES CASE SIZE)

Capacitance		Rated Voltage DC (V _R)				
μF	Code	2.5V	6.3V	10V	16V	25V
27	270					0606
47	470				0606	0606, 0609
56	560					0606
68	680			0606	0606	0606
100	101				0606	0606, 0609
120	121			0606		
150	151				0606, 0609	0609
180	181				0606, 0609	
220	221		0606	0606, 0609	0609	0609, 0811
270	271		0606		0609, 0809	
330	331	0606	0606	0609	0609, 0811, 1012	0811, 1012
390	391	0606				
470	471	0606	0609	0609		0811, 1012
560	561	0606	0609	0811, 1012	0811	1012
680	681	0609			1012	1012
1000	102		0811	0811, 1012	1012	
1500	152		0811	1012		
2200	222		1012			

Released ratings

RATINGS & PART NUMBER REFERENCE

Part No.	Case Size	Capacitance (μF)	Rated Voltage (V)	DCL Max. (μA)	DF Max. (%)	ESR Max. @100kHz (mΩ)	100kHz RMS Current (mA)/105°C
2.5 Volts							
APV0606331M002R	0606	330	2.5	500	8	18	2800
APV0606391M002R	0606	390	2.5	500	8	18	2900
APV0606471M002R	0606	470	2.5	500	8	18	4000
APV0606561M002R	0606	560	2.5	500	8	18	4000
APV0609681M002R	0609	680	2.5	500	8	13	4500
6.3 Volt							
APV0606221M006R	0606	220	6.3	500	8	18	2900
APV0606271M006R	0606	270	6.3	500	8	18	3100
APV0606331M006R	0606	330	6.3	500	8	18	3200
APV0609471M006R	0609	470	6.3	592	8	13	3600
APV0609561M006R	0609	560	6.3	706	8	13	3800
APV0811102M006R	0811	1000	6.3	1260	8	13	4500
APV0811152M006R	0811	1500	6.3	1890	8	13	4600
APV1012222M006R	1012	2200	6.3	2772	8	13	5800
10 Volt							
APV0606680M010R	0606	68	10	500	12	45	2800
APV0606121M010R	0606	120	10	500	12	27	2800
APV0606221M010R	0606	220	10	500	12	27	2800
APV0609221M010R	0609	220	10	500	12	18	3100
APV0609331M010R	0609	330	10	660	12	18	3200
APV0609471M010R	0609	470	10	940	12	27	3500
APV0811561M010R	0811	560	10	1120	12	18	3700
APV1012561M010R	1012	560	10	1120	12	18	5200
APV0811102M010R	0811	1000	10	2000	12	13	4400
APV1012102M010R	1012	1000	10	2000	12	13	4600
APV1012152M010R	1012	1500	10	3000	12	13	4600
16 Volt							
APV0606470M016R	0606	47	16	500	12	36	1700
APV0606680M016R	0606	68	16	500	12	36	2100
APV0606101M016R	0606	100	16	500	12	27	2500
APV0606151M016R	0606	150	16	500	12	27	2500

All technical data relates to an ambient temperature of +25°C. Capacitance and DF are measured at 120Hz, 0.5RMS with DC bias of 2.2 volts.
DCL is measured at rated voltage after 5 minutes.



The Important Information/Disclaimer is incorporated in the catalog where these specifications came from or available online at www.kyocera-avx.com/disclaimer/ by reference and should be reviewed in full before placing any order.

SMD Aluminum Conductive Polymer Electrolytic Capacitors

APV Series



Part No.	Case Size	Capacitance (μF)	Rated Voltage (V)	DCL Max. (μA)	DF Max. (%)	ESR Max. @100kHz (mΩ)	100kHz RMS Current (mA)/105°C
APV0609151M016R	0609	150	16	500	12	22	2700
APV0606181M016R	0606	180	16	576	12	54	2600
APV0609181M016R	0609	180	16	576	12	22	2800
APV0609221M016R	0609	220	16	704	12	22	2600
APV0609271M016R	0609	270	16	864	12	22	2700
APV0809271M016R	0809	270	16	864	12	22	2900
APV0609331M016R	0609	330	16	1056	12	22	2700
APV0811331M016R	0811	330	16	1056	12	18	4200
APV1012331M016R	1012	330	16	1056	12	18	5200
APV0811561M016R	0811	560	16	1792	12	18	3600
APV1012681M016R	1012	680	16	2176	12	18	4200
APV1012102M016R	1012	1000	16	3200	12	18	4300
25 Volt							
APV0606270M025R	0606	27	25	500	12	45	1100
APV0606470M025R	0606	47	25	500	12	45	1800
APV0609470M025R	0609	47	25	500	12	31	2100
APV0606560M025R	0606	56	25	500	12	45	1800
APV0606680M025R	0606	68	25	500	12	45	1800
APV0606101M025R	0606	100	25	500	12	27	2500
APV0609101M025R	0609	100	25	500	12	45	2200
APV0609151M025R	0609	150	25	750	12	27	2600
APV0609221M025R	0609	220	25	1100	12	27	2600
APV0811221M025R	0811	220	25	1100	12	27	2700
APV0811331M025R	0811	330	25	1650	12	19	2900
APV1012331M025R	1012	330	25	1650	12	27	2800
APV0811471M025R	0811	470	25	2350	12	27	2900
APV1012471M025R	1012	470	25	2350	12	19	3200
APV1012561M025R	1012	560	25	2800	12	19	3400
APV1012681M025R	1012	680	25	3400	12	19	3400

All technical data relates to an ambient temperature of +25°C. Capacitance and DF are measured at 120Hz, 0.5RMS with DC bias of 2.2 volts.
DCL is measured at rated voltage after 5 minutes.

FREQUENCY COEFFICIENT OF PERMISSIBLE RIPPLE CURRENT

Frequency	120Hz ≤ F(Hz) < 1kHz	1kHz ≤ F(Hz) < 10kHz	10kHz ≤ F(Hz) < 100kHz	100kHz ≤ F(Hz) < 500kHz
Coefficient	0.05	0.30	0.70	1.00

QUALIFICATION TABLE

Test	APV series (Temperature Range -55°C to +105°C)	
	Condition	Characteristics
Endurance	The following specifications shall be satisfied when the capacitors are restored to 20°C after the rated voltage is applied for 2000 hours at 105°C.	Visual examination
		no visible damage
		ΔC/C
		≤ ±20% of the initial limit
		DF
Damp Heat (Steady State)	The following specifications shall be satisfied when the capacitors are restored to 20°C after subjection them to store at 60°C, 90 to 95% RH for 2000 hours, without DC applied.	≤ 150% of the initial specified limit
		ESR
		≤ 150% of the initial specified limit
		DCL
		≤ Initial specified limit
Surge Voltage	The capacitors shall be subjected to 1000 cycles each consisting of charge with the surge voltages specified at normal temperature for 30 seconds. Through a protective resistor (R = 1kΩ) and discharge for 5 minutes 30 seconds.	Visual examination
		no visible damage
		ΔC/C
		≤ ±20% of the initial limit
		DF
		≤ 150% of the initial specified limit
		ESR
		≤ 150% of the initial specified limit
		DCL
		≤ Initial specified limit

SMD Aluminum Conductive Polymer Electrolytic Capacitors

APV Series



REFLOW

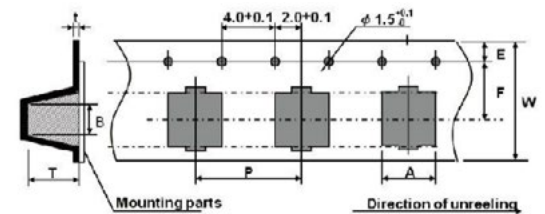
Peak Temperature	260°C, 10 sec. max.
Preheat Temperature	150°C to 180°C, 90 sec. max.
Duration at 200°C or higher	60 sec. max.
Duration at 230°C or higher	40 sec. max.
Reflow Number	Twice or less

STORAGE

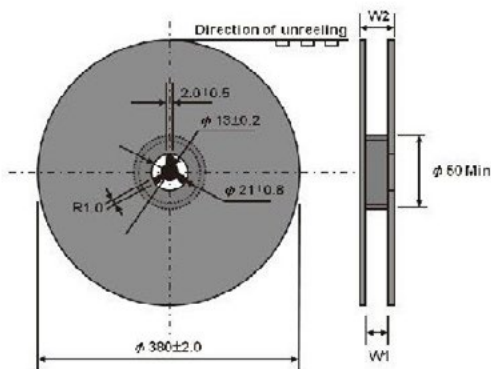
- It is recommended to keep capacitors between the ambient temperatures of 5°C to 35°C (If between 35 to 85°C, it should be less than three months), and the relative humidity of 75% or below.
- Confirm that the environment does not have any of the following conditions:
 - Damp conditions such as water, saltwater spray, or oil spray or fumes. High humidity or humidity condensation situations.
 - In an atmosphere filled with toxic gases (such as hydrogen sulfide, sulfurous acid, nitrous acid, chlorine, ammonia, etc.).
 - Being exposed to direct sunlight, ozone, ultraviolet ray, or radiation.
 - Being exposed to acidic or alkaline solutions.
 - Under severe conditions where vibration and / or mechanical shock exceed the applicable ranges of the specification.
- Storage Time
 - Before unseal: within 1 year after delivery
 - After seal: within 1 month from opening

PACKAGE TAPE DIMENSIONS units (mm)

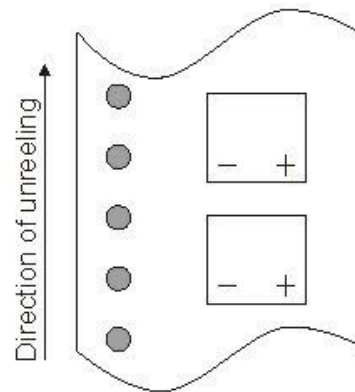
Size Code	A±0.20	B±0.20	W±0.30	F±0.10	E±0.10	P±0.10	t±0.10	T±0.20
0606	7.0	7.0	16.0	7.5	1.75	12.0	0.4	8.0
0609	7.0	7.0	16.0	7.5	1.75	12.0	0.4	10.0
0809	8.7	8.7	24.0	11.5	1.75	16.0	0.4	10.5
0811	8.7	8.7	24.0	11.5	1.75	16.0	0.4	12.0
1012	10.7	10.7	24.0	11.5	1.75	16.0	0.4	13.0-13.5



REEL



POLARITY



DIMENSIONS units (mm)

Size Code	W1±1.00	W2±1.00	Qty./Reel
0606	18.0	22.0	1000
0609	18.0	22.0	800
0809	26.0	30.0	600
0811	26.0	31.0	500
1012	26.0	31.0	500

SMD Aluminum Conductive Polymer Electrolytic Capacitors

APZ Series



FEATURES

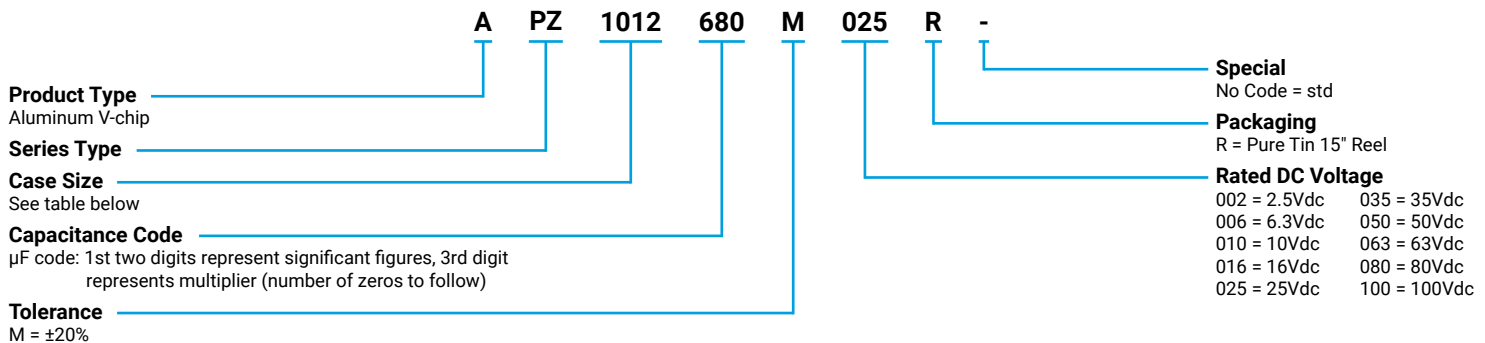
- Endurance: 2000 hours at 105°C
- Standard Substance
- RoHS compliant

APPLICATIONS

- Displace Card and System Board



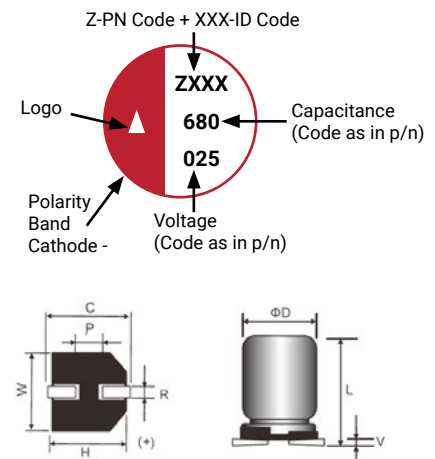
HOW TO ORDER



CASE DIMENSIONS millimeters (inches)

Code	D ± 0.50 (0.020)	L ± 0.50 (0.020)	W ± 0.20 (0.008)	H ± 0.20 (0.008)	C ± 0.20 (0.008)	R	P ± 0.30 (0.012)	V max
0604	6.30 (0.248)	4.50 (0.177)	6.60 (0.260)	6.60 (0.260)	7.30 (0.287)	0.50-0.80 (0.020-0.031)	2.00 (0.080)	0.30 (0.012)
0606	6.30 (0.248)	6.00 (0.236)	6.60 (0.260)	6.60 (0.260)	7.30 (0.287)	0.50-0.80 (0.020-0.031)	2.00 (0.080)	0.30 (0.012)
0609	6.30 (0.248)	9.30 (0.366)	6.60 (0.260)	6.60 (0.260)	7.30 (0.287)	0.50-0.80 (0.020-0.031)	2.00 (0.080)	0.30 (0.012)
0809	8.00 (0.315)	9.50 (0.374)	8.30 (0.327)	8.30 (0.327)	9.00 (0.354)	0.70-1.10 (0.028-0.043)	3.20 (0.126)	0.30 (0.012)
0811	8.00 (0.315)	11.50 (0.453)	8.30 (0.327)	8.30 (0.327)	9.00 (0.354)	0.70-1.10 (0.028-0.043)	3.20 (0.126)	0.30 (0.012)
1012	10.00 (0.394)	12.50 (0.492)	10.30 (0.406)	10.30 (0.406)	11.00 (0.433)	0.70-1.30 (0.028-0.051)	4.50 (0.177)	0.30 (0.012)

MARKING



TECHNICAL SPECIFICATIONS

Category Temperature Range:	-55°C to + 105°C	
Capacitance Range	At 20°C, 120Hz	15 μF to 2200 μF
Capacitance Tolerance:	At 20°C, 120Hz	$\pm 20\%$
Dissipation Factor (%)	Measurement Frequency: 120Hz at 20°C	Please see the ratings and part number reference table below
Leakage Current:	After 2 minutes at rated working voltage at 20°C* $I \leq 0.2\text{CV}$ or 500 μA , whichever is greater	

* Note: In the case of an anomalous reading, re-measure the leakage current after following voltage treatment:
Voltage treatment: DC rated voltage to be applied to the capacitors for 120 minutes at 105°C.

SMD Aluminum Conductive Polymer Electrolytic Capacitors

APZ Series



CAPACITANCE AND RATED VOLTAGE RANGE (FIGURES DENOTES CASE SIZE)

Capacitance		Rated Voltage DC (V _R)									
μF	Code	2.5V	6.3V	10V	16V	25V	35V	50V	63V	80V	100V
15	150					0604					
22	220					0604, 0606	0606	0606	0606		0811
27	270					0606	0606			0811	
33	330					0604	0606	0606	0609		
47	470				0604, 0606	0604, 0606, 0609	0606, 0609	0609	0809	1012	1012
56	560					0604, 0606			0811		
68	680				0606	0604, 0606	0606, 0609	0811		1012	
82	820							0811, 1012			
100	101			0604	0604, 0606	0604, 0606, 0609	0609, 0809, 0811	0811, 1012	1012		
120	121			0606	0604			0811			
150	151				0606, 0609	0609	0811	1012			
180	181				0606, 0609						
220	221	0604	0604, 0606	0606, 0609	0609	0609, 0811	0811	1012			
270	271		0606		0609, 0809		0811, 1012				
330	331	0604, 0606	0606	0609	0609, 0811, 1012	0811, 1012	1012				
390	391	0606									
470	471	0606	0609	0609, 0809		0811, 1012	1012				
560	561	0606	0609	0811, 1012	0811	1012					
680	681	0609			1012	1012					
820	821	0609									
1000	102		0811	0811, 1012	1012						
1500	152		0811	1012							
2200	222		1012								

Released ratings

RATINGS & PART NUMBER REFERENCE

Part No.	Case Size	Capacitance (μF)	Rated Voltage (V)	DCL Max. (μA)	DF Max. (%)	ESR Max. @100kHz (mΩ)	100kHz RMS Current (mA)/105°C
2.5 Volt							
APZ0604221M002R	0604	220	2.5	500	8	20	2700
APZ0604331M002R	0604	330	2.5	500	8	20	2700
APZ0606331M002R	0606	330	2.5	500	8	20	2700
APZ0606391M002R	0606	390	2.5	500	8	20	2800
APZ0606471M002R	0606	470	2.5	500	8	20	2900
APZ0606561M002R	0606	560	2.5	500	8	20	3000
APZ0609681M002R	0609	680	2.5	500	8	15	4300
APZ0609821M002R	0609	820	2.5	500	8	15	4300
6.3 Volt							
APZ0604221M006R	0604	220	6.3	500	8	20	2700
APZ0606221M006R	0606	220	6.3	500	8	20	2800
APZ0606271M006R	0606	270	6.3	500	8	20	3000
APZ0606331M006R	0606	330	6.3	500	8	20	2100
APZ0609471M006R	0609	470	6.3	592	8	15	3500
APZ0609561M006R	0609	560	6.3	706	8	15	3700
APZ0811102M006R	0811	1000	6.3	1260	8	15	4300
APZ0811152M006R	0811	1500	6.3	1890	8	15	4400
APZ1012222M006R	1012	2200	6.3	2772	8	15	5600
10 Volt							
APZ0604101M010R	0604	100	10	500	12	50	2500
APZ0606121M010R	0606	120	10	500	12	30	2700
APZ0606221M010R	0606	220	10	500	12	30	2700
APZ0609221M010R	0609	220	10	500	12	20	3000

All technical data relates to an ambient temperature of +25°C. Capacitance and DF are measured at 120Hz, 0.5RMS with DC bias of 2.2 volts. DCL is measured at rated voltage after 5 minutes.



The Important Information/Disclaimer is incorporated in the catalog where these specifications came from or available online at www.kyocera-avx.com/disclaimer/ by reference and should be reviewed in full before placing any order.

012422

— ALUMINUM CAPACITORS —

SMD Aluminum Conductive Polymer Electrolytic Capacitors

APZ Series



Part No.	Case Size	Capacitance (μF)	Rated Voltage (V)	DCL Max. (μA)	DF Max. (%)	ESR Max. @100kHz (mΩ)	100kHz RMS Current (mA)/105°C
APZ0609331M010R	0609	330	10	660	12	20	3100
APZ0609471M010R	0609	470	10	940	12	30	3400
APZ0809471M010R	0809	470	10	940	12	22	3400
APZ0811561M010R	0811	560	10	1120	12	20	3600
APZ1012561M010R	1012	560	10	1120	12	20	5000
APZ0811102M010R	0811	1000	10	2000	12	15	4200
APZ1012102M010R	1012	1000	10	2000	12	15	4400
APZ1012152M010R	1012	1500	10	3000	12	15	4400
16 Volt							
APZ0604470M016R	0604	47	16	500	12	50	2000
APZ0606470M016R	0606	47	16	500	12	40	1700
APZ0606680M016R	0606	68	16	500	12	40	2000
APZ0604101M016R	0604	100	16	500	12	50	2000
APZ0606101M016R	0606	100	16	500	12	30	2400
APZ0604121M016R	0604	120	16	500	12	50	2000
APZ0606151M016R	0606	150	16	500	12	30	2400
APZ0609151M016R	0609	150	16	500	12	25	2600
APZ0606181M016R	0606	180	16	576	12	60	2500
APZ0609181M016R	0609	180	16	576	12	25	2700
APZ0609221M016R	0609	220	16	704	12	25	2500
APZ0609271M016R	0609	270	16	864	12	25	2600
APZ0809271M016R	0809	270	16	864	12	25	2800
APZ0609331M016R	0609	330	16	1056	12	25	2600
APZ0811331M016R	0811	330	16	1056	12	20	4000
APZ1012331M016R	1012	330	16	1056	12	20	5000
APZ0811561M016R	0811	560	16	1792	12	20	3500
APZ1012681M016R	1012	680	16	2176	12	20	4000
APZ1012102M016R	1012	1000	16	3200	12	20	4100
25 Volt							
APZ0604150M025R	0604	15	25	500	12	100	400
APZ0604220M025R	0604	22	25	500	12	100	400
APZ0606220M025R	0606	22	25	500	12	80	1600
APZ0606270M025R	0606	27	25	500	12	50	1100
APZ0604330M025R	0604	33	25	500	12	100	400
APZ0604470M025R	0604	47	25	500	12	100	400
APZ0606470M025R	0606	47	25	500	12	50	1800
APZ0609470M025R	0609	47	25	500	12	35	2000
APZ0604560M025R	0604	56	25	500	12	60	1000
APZ0606560M025R	0606	56	25	500	12	50	1800
APZ0604680M025R	0604	68	25	500	12	60	900
APZ0606680M025R	0606	68	25	500	12	50	1800
APZ0604101M025R	0604	100	25	500	12	60	1000
APZ0606101M025R	0606	100	25	500	12	50	2100
APZ0609101M025R	0609	100	25	500	12	30	2400
APZ0609151M025R	0609	150	25	750	12	30	2500
APZ0609221M025R	0609	220	25	1100	12	30	2500
APZ0811221M025R	0811	220	25	1100	12	30	2600
APZ0811331M025R	0811	330	25	1650	12	30	2700
APZ1012331M025R	1012	330	25	1650	12	22	2800
APZ0811471M025R	0811	470	25	2350	12	30	2800
APZ1012471M025R	1012	470	25	2350	12	22	3100
APZ1012561M025R	1012	560	25	2800	12	22	3300
APZ1012681M025R	1012	680	25	3400	12	22	3300
35 Volt							
APZ0606220M035R	0606	22	35	500	12	60	1100
APZ0606270M035R	0606	27	35	500	12	60	1100
APZ0606330M035R	0606	33	35	500	12	60	1100
APZ0606470M035R	0606	47	35	500	12	45	1100
APZ0609470M035R	0609	47	35	500	12	50	1500
APZ0606680M035R	0606	68	35	500	12	45	1100
APZ0609680M035R	0609	68	35	500	12	40	1800
APZ0609101M035R	0609	100	35	700	12	40	2100

All technical data relates to an ambient temperature of +25°C. Capacitance and DF are measured at 120Hz, 0.5RMS with DC bias of 2.2 volts. DCL is measured at rated voltage after 5 minutes.

SMD Aluminum Conductive Polymer Electrolytic Capacitors

APZ Series



Part No.	Case Size	Capacitance (μF)	Rated Voltage (V)	DCL Max. (μA)	DF Max. (%)	ESR Max. @100kHz (mΩ)	100kHz RMS Current (mA)/105°C
APZ0809101M035R	0809	100	35	700	12	40	2800
APZ0811101M035R	0811	100	35	700	12	30	3000
APZ0811151M035R	0811	150	35	1050	12	30	3000
APZ0811221M035R	0811	220	35	1540	12	30	2400
APZ0811271M035R	0811	270	35	1890	12	30	2500
APZ1012271M035R	1012	270	35	1890	12	30	2700
APZ1012331M035R	1012	330	35	2310	12	30	2700
APZ1012471M035R	1012	470	35	3290	12	30	3000
50 Volt							
APZ0606220M050R	0606	22	50	500	12	80	800
APZ0606330M050R	0606	33	50	500	12	80	850
APZ0609470M050R	0609	47	50	500	12	60	1400
APZ0811680M050R	0811	68	50	680	12	30	2000
APZ0811820M050R	0811	82	50	820	12	30	2000
APZ1012820M050R	1012	82	50	820	12	30	2000
APZ0811101M050R	0811	100	50	1000	12	30	2000
APZ1012101M050R	1012	100	50	1000	12	30	2100
APZ0811121M050R	0811	120	50	1200	12	30	2000
APZ1012151M050R	1012	150	50	1500	12	30	2100
APZ1012221M050R	1012	220	50	2200	12	30	2300
63 Volt							
APZ0606220M063R	0606	22	63	500	12	80	450
APZ0609330M063R	0609	33	63	500	12	60	500
APZ0809470M063R	0809	47	63	592	12	60	1000
APZ0811560M063R	0811	56	63	706	12	40	1400
APZ1012101M063R	1012	100	63	1260	12	40	1600
80 Volt							
APZ0811270M080R	0811	27	80	500	12	50	600
APZ1012470M080R	1012	47	80	752	12	50	900
APZ1012680M080R	1012	68	80	1088	12	50	900
100 Volt							
APZ0811220M100R	0811	22	100	500	15	50	600
APZ1012470M100R	1012	47	100	940	15	50	900

All technical data relates to an ambient temperature of +25°C. Capacitance and DF are measured at 120Hz, 0.5RMS with DC bias of 2.2 volts. DCL is measured at rated voltage after 5 minutes.

FREQUENCY COEFFICIENT OF PERMISSIBLE RIPPLE CURRENT

Frequency	120Hz ≤ F(Hz) < 1kHz	1kHz ≤ F(Hz) < 10kHz	10kHz ≤ F(Hz) < 100kHz	100kHz ≤ F(Hz) < 500kHz
Coefficient	0.05	0.30	0.70	1.00

QUALIFICATION TABLE

Test	APZ series (Temperature Range -55°C to +105°C)	
	Condition	Characteristics
Endurance	The following specifications shall be satisfied when the capacitors are restored to 20°C after the rated voltage is applied for 2000 hours at 105°C.	Visual examination
		no visible damage
		ΔC/C
		≤ ±20% of the initial limit
		DF
Damp Heat (Steady State)	The following specifications shall be satisfied when the capacitors are restored to 20°C after subjection them to store at 60°C, 90 to 95% RH for 2000 hours, without DC applied.	≤ 150% of the initial specified limit
		ESR
		≤ 150% of the initial specified limit
		DCL
		≤ Initial specified limit
Surge Voltage	The capacitors shall be subjected to 1000 cycles each consisting of charge with the surge voltages specified at normal temperature for 30 seconds. Through a protective resistor (R = 1kΩ) and discharge for 5 minutes 30 seconds.	Visual examination
		no visible damage
		ΔC/C
		≤ ±20% of the initial limit
		DF
		≤ 150% of the initial specified limit
		ESR
		≤ 150% of the initial specified limit
		DCL
		≤ Initial specified limit

SMD Aluminum Conductive Polymer Electrolytic Capacitors

APZ Series



REFLOW

Peak Temperature	260°C, 10 sec. max.
Preheat Temperature	150°C to 180°C, 90 sec. max.
Duration at 200°C or higher	60 sec. max.
Duration at 230°C or higher	40 sec. max.
Reflow Number	Twice or less

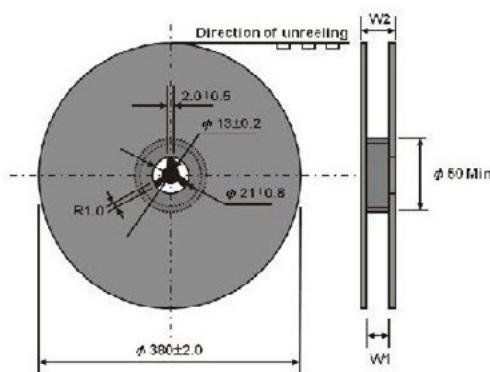
STORAGE

- It is recommended to keep capacitors between the ambient temperatures of 5°C to 35°C (If between 35 to 85°C, it should be less than three months), and the relative humidity of 75% or below.
- Confirm that the environment does not have any of the following conditions:
 - Damp conditions such as water, saltwater spray, or oil spray or fumes. High humidity or humidity condensation situations.
 - In an atmosphere filled with toxic gases (such as hydrogen sulfide, sulfurous acid, nitrous acid, chlorine, ammonia, etc.).
 - Being exposed to direct sunlight, ozone, ultraviolet ray, or radiation.
 - Being exposed to acidic or alkaline solutions.
 - Under severe conditions where vibration and / or mechanical shock exceed the applicable ranges of the specification.
- Storage Time
 - Before unseal: within 1 year after delivery
 - After seal: within 1 month from opening

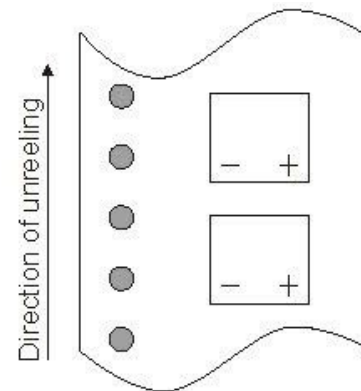
PACKAGE TAPE DIMENSIONS units (mm)

Size Code	A±0.20	B±0.20	W±0.30	F±0.10	E±0.10	P±0.10	t±0.10	T±0.20
0604	7.0	7.0	16.0	7.5	1.75	12.0	0.4	8.0
0606	7.0	7.0	16.0	7.5	1.75	12.0	0.4	8.0
0609	7.0	7.0	16.0	7.5	1.75	12.0	0.4	10.0
0809	8.7	8.7	24.0	11.5	1.75	16.0	0.4	10.5
0811	8.7	8.7	24.0	11.5	1.75	16.0	0.4	12.0
1012	10.7	10.7	24.0	11.5	1.75	16.0	0.4	13.0-13.5

REEL

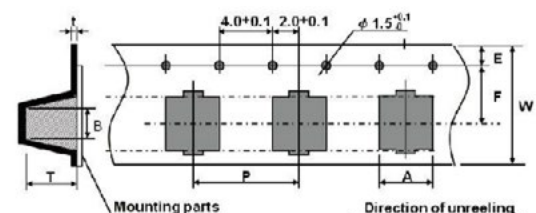


POLARITY



DIMENSIONS units (mm)

Size Code	W1±1.00	W2±1.00	Qty./Reel
0604	18.0	22.0	1200
0606	18.0	22.0	1000
0609	18.0	22.0	800
0809	26.0	30.0	600
0811	26.0	31.0	500
1012	26.0	31.0	500





Technical Section

Technical Information

Aluminum Electrolytic Capacitors (Q&A)

1. Do aluminum capacitors have polarity?

Yes, Aluminum Electrolytic Capacitors are polarized, this means it has positive and negative electrodes identified by the body marking. If it is used with the polarity reversed or AC voltage, it will cause a short circuit or venting.

2. What are the operating condition safety precautions for capacitors?

Make sure that no excess voltage that is higher than the rated voltage is applied to the capacitor. The peak voltage, which is the DC voltage overlapped by ripple voltage, should not exceed the rated voltage.

A surge voltage value, which exceeds the full rated voltage, is prescribed in the catalogs, but is a restricted condition for especially short periods of time.

In cases where more than two aluminum electrolytic capacitors are used in series, please make sure that applied voltage will be lower than rated voltage and the voltage will be applied to each capacitor equally using a balancing resistor in parallel with the capacitors.

Do not apply excessive current which exceeds the allowable ripple current.

The capacitor shall not be used in an ambient temperature which exceed the operation temperature specified in the specification, the use of a capacitor outside the maximum rated category temperature will shorten the capacitor life or cause the capacitor to vent.

Select the capacitor that will meet the life requirement of the device.

The aluminum case, cathode lead wire, anode lead wire and circuit pattern must be isolated, the sleeve of capacitors is not recognized as an insulator, and therefore, the standard capacitor should not be used in a place where insulation is needed.

Do not use capacitor in circuits where heavy charge and discharge are frequently repeated, as these heavy cycles will result in decreasing capacitance and damage to the capacitor due to general heat.

Non- solid Aluminum Electrolytic Capacitor, in general have a lifetime which ends in an open circuit, the period is dependent upon temperature. Therefore, the capacitor lifetime may be extended by reducing the ambient temperature and/ or ripple current.

Do not short-circuit the terminals of a capacitor by letting it come into contact with any conductive object or any conductive liquid such as acid or alkaline solutions.

Do not use capacitors in circumstances where they can be exposed to any of the following materials:

- Oil, water, salty water or damp location.
- Direct sunlight
- Toxic gases such as hydrogen sulfide, sulfurous acid, nitrous acid, chlorine or its compounds, and ammonium.
- Ozone, ultraviolet rays, or radiation.
- Sever vibration or mechanical shock conditions beyond the limits described on the catalog or the product specification.

In case of venting a non-solid Aluminum Electrolytic Capacitor expels gas, it will discharge odors or smoke, or burn in the case of a short-circuit failure, if this happen immediately turn off the power supply of the device.

When venting, a non-solid Aluminum Electrolytic Capacitor blows out gas with a temperature over 100°C, a solid Aluminum Electrolytic Capacitor discharges decomposition gas or burning gas while the outer resin case is burning, never expose the face close to a venting capacitor.

If your eyes inadvertently become exposed to the spouting gas or you inhale it, immediately flush the open eye with large amounts of water and gargle with water respectively. If electrolyte is on the skin, wash the electrolyte from the skin with soap and plenty water. Do not lick the electrolyte of non-solid Aluminum Electrolytic Capacitors.

In addition, avoid the use of Conductive Polymer Aluminum Electrolytic Capacitor in the following type of circuits because leakage current may increase:

- (A) High-impedance circuits
- (B) Coupling circuits
- (C) Time constant circuits
- (D) Connection of two or more capacitors in series for higher withstand voltage

It is recommended to store the capacitors between 5°C to 35°C and a relative humidity of 75% or below.

Operating temperature must be under the category temperature range of specification.

Do not apply over voltage conditions or current that exceeds the rated ripple current as this might result in shorter life or short circuit due to internal heat increase.

Do not use aluminum electrolytic capacitor on sudden charge and discharge as an excessive current surge by sudden charge or discharge may result in a short circuit or a high leakage current and affect the capacitor reliability.

In order to retain the capacitor reliability, it is recommended the use of protection circuits in the following conditions:

- (A) If surge current value exceeds 10A it is recommended to use protected resistor in any of following condition
- (B) The rush current exceeds 10 times the rated ripple current

Note: If the rush current exceeds 10 times the rated ripple current, use a protection resistor of approximately 1kΩ resistor for charge and discharge the capacitor during leakage current measurement.

3. What are the considerations for mounting on board?

The electrolytic paper and the electrolytic conductive electrolyte in a non-solid Aluminum Electrolytic Capacitor are flammable, leaking electrolyte on a PCB can gradually erode the copper traces and possibly cause smoke or burning by short circuiting the copper traces.

Design the appropriate hole spacing to match the terminal spacing of the capacitors.

Ensure enough free space above the capacitor vent so that the vent can operate correctly, use the following recommended clearances:

Case Diameter	Clearance
6.3mm to 16mm	2mm minimum
18mm to 35mm	3mm minimum
40mm or more	5mm minimum

Do not place any copper wire or traces over the vent of the capacitor.

Do not design a circuit board so that the heat generating component are placed near an Aluminum Electrolytic Capacitor or reverse side of the PCB under the capacitor.

Do not print copper traces under the terminal side seal of a capacitor, the traces must pass 2 mm spaced apart from the side of the capacitor body.

Technical Information

Aluminum Electrolytic Capacitors (Q&A)

4. What are the cautions for assembling the capacitors?

Once a capacitor has been assembled and power applied, even if the capacitor is discharged, an electric potential may exist between the terminals.

Electric potential between positive and negative may exist as result of returned electromotive force, to discharge the capacitor use a 1KΩ resistor.

Leakage current of Aluminum Electrolytic Capacitors may be increased during long storage time. In this case, the capacitors should be subjected to rated voltage treatment a 1KΩ resistor before using.

Confirm the voltage and capacitance rating and polarity before installing capacitors to a PCB.

Do not drop capacitor on the floor or damage the capacitor.

Confirm that lead spacing of the capacitor matches the holes in the PCB prior installation.

If the capacitors are place and fixed by an automatic insertion machine, please verify that the clinch force is not too strong.

5. What are the different types of soldering methods?

Soldering with a soldering iron

Soldering conditions, temperature and time, should be within the limits in the catalog or the product specification.

The hot tip of the soldering iron should never touch the Aluminum Electrolytic Capacitor body.

If the terminal spacing of a capacitor does not fit the terminal hole spacing of the PCB, reform the terminals in a manner to minimize a mechanical stress into the body of the capacitor.

Remove the capacitors from the PCB after the solder is completely melted, reworking by using a soldering iron minimize the mechanical stress to the capacitors

Flow soldering

Do not dip the body of the capacitor into the solder bath, only dip the terminals, the soldering must be done on the reverse side of the PCB

The recommended flow soldering conditions should be under the following ranges:

Conditions	Temperature	Time
Preheating	120°C or less	120 sec. or less
Soldering Conditions	Max 260°C	10 sec. or less

Do not apply flow soldering to SMD type

Do not apply flux to any part of the capacitor other than the terminals and make sure the capacitor does not come in contact to any other components while soldering.

Reflow Soldering

See the individual datasheets.

6. How do you go about handling after soldering?

Do not apply any mechanical stress to the Aluminum Electrolytic Capacitor after soldering onto the PCB.

Do not lean or twist the body of the capacitor after soldering the capacitor onto the PCB.

Do not use the capacitor for lifting or carrying the assembly board.

Do not hit or poke the capacitor after soldering to the PCB.

When stacking the assembly boards, make sure that other components do not touch the Aluminum Electrolytic Capacitors.

Do not drop the assembly board.

7. How do you clean the PCB after mounting?

Do not wash the Aluminum Electrolytic Capacitors using any of the following cleaning agents:

- (A) Halogenated solvents: cause the capacitors to fail due to corrosion.
- (B) Alkali system solvents: corrode, dissolve, an aluminum case.
- (C) Petroleum and terpene system solvents: causes rubber seal material to deteriorate.
- (D) Xylene: causes the rubber seal material to deteriorate.
- (E) Acetone: erase marking.

Solvent- proof capacitors are only suitable for washing within the cleaning conditions described in the catalog or the product specification. Ultrasonic cleaning will accelerate damaging capacitors.

Monitor conductivity, PH, specific gravity and the water content of cleaning agents; contamination adversely affects these characteristics.

Do not keep the capacitors in an atmosphere containing the cleaning agent or in an airtight container

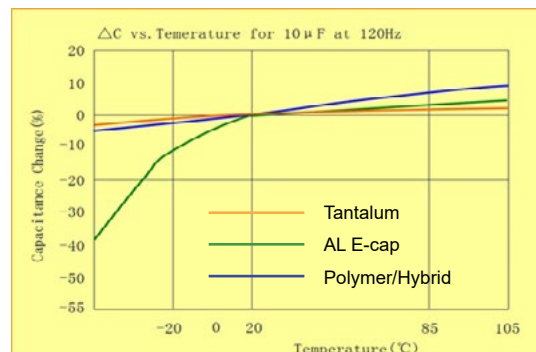
8. What is the de-rating by family?

Use up to 20% derating for high current and harsh environment applications, making sure not exceeding the rated voltage.

9. What is the difference between 125°C and 150°C rated parts?

Higher temperature parts (150°C) have high reliability components, higher anode foil VF, more stable on oxidation monomer, and higher temperature resistant characteristics of the rubber bung.

10. What is the relationship of capacitance and temperature for aluminum electrolytic, tantalum, and polymer/hybrid V-chip capacitors?



*typical data

Technical Information

Aluminum Electrolytic Capacitors (Q&A)

11. What solvents should not be used in a cleaning process?

Do not wash capacitors with these cleaning agents:

- Halogenated solvents: cause capacitors to fail due to corrosion.
- Alkali system solvents: corrode (dissolve) an aluminum case.
- Petroleum and terpene system solvents: cause the rubber seal material to deteriorate.
- Xylene: causes the rubber seal material to deteriorate.
- Acetone: erases markings.

We do not recommend using ultrasonic cleaning as it will damage capacitors.

12. What is the difference in life between radial and V-chip?

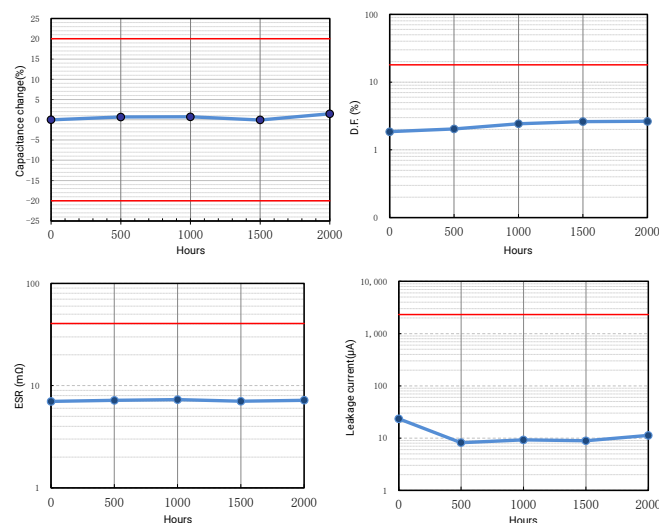
No difference

13. What is the response to high surge currents and voltage spike?

All three technologies: Electrolytic, Polymer, and Hybrid have a self-healing mechanism. The electrolytic and hybrid self heals by a electro-chemical reaction repairing the Aluminum Oxide Film Layer. The Polymer Cap self heals by peeling off the polymer layer creating insulation at the fault site.

14. What is aluminum polymer stability?

Test condition: 105°C with applied rated voltage (standard & hybrid electrolytic capacitors vary on electrolyte, hybrids offer similar capacitance and ESR stability as polymer).



*typical data

TECHNICAL PAPER

Aluminum Electrolytic Capacitor Use in Three-Phase BLDC Motor Controllers

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Abstract

The uses of industrial control systems and robotics are expanding rapidly due to their positive impact on costs and quality. This paper will discuss Aluminum Electrolytic capacitor roles as an output filter capacitor to improve power quality in Brushless DC Motor (BLDC) motor controller & drives. Aluminum Electrolytic capacitors can be used to provide exacting drive voltage to motors. This in turn improves system reliability and performance. The case studied will be a 3-phase, 24V / 30 watt BLDC motor with a rated speed of 4000rpm and rated torque of 0.072 N-m.

Aluminum Electrolytic Capacitor Use in Three-Phase BLDC Motor Controllers

INTRODUCTION

Both motors & actuators convert control signals into physical motion. Motors and actuators are of no use without being able to instruct their movement. Control of motors & actuators is commonly accomplished by low level ICs. Those ICs could be a simple Micro-controller, Microprocessor or FPGA – but regardless of the specific device, these ICs do not have sufficient output voltage to directly drive a motor. Thus the need for an interface between the control silicon and the motor load motor. Enter the motor controller.

A motor controller is a device that allows low level logic silicon control a motor. It essentially acts as an intermediate device between the silicon and the motors power source and the motor. Some motor controllers have enough processing power on board that they can control a motor directly. Hand adjusted variable speed motor drivers are a possible example of a motor controller having ample processing power on board. More complex feedback and control scenarios may require added processing power and potentially a data bus from control logic to a motor driver.

Motor controllers vary greatly depending upon the motor type, power level/size, level of control needed and a variety of other factors. Regardless of their exact configuration, motor controllers are an essential part of industrial controllers and robotics. The purpose of this investigation is to show the impact of properly sized Aluminum Electrolytic capacitors on the voltage drive lines to a common 3-phase motor used in robotics or industrial automation.

Motor types vary greatly and this study was based upon Brushless DC Motors (BLDC).

These motors are available in single-phase, two-phase and three-phase configurations. The 3-phase type is most commonly used and therefore the specific type investigated in this study.

BLDCs are used across a wide range of industries such as transportation, aerospace, appliances, consumer, instrumentation and industrial automation. Many times the voltage rating of the BLDC hints to its end use. BLDCs that are less than or equal to 48V are commonly used in automotive, robotics, small arm assists etc. In comparison, BLDCs that are >100V are commonly used in appliances and industrial automation.

At first glance, the most noted feature of BLDCs over other motor types is that BLDCs exhibit a higher ratio of torque relative to the motor size. This reduces the size of motor needed in many applications and makes BLDCs exceptionally useful in applications where volume and weight are at a premium.

However, BLDCs offer another major advantage – electrical efficiency. A BLDC can reduce energy consumption by 20 to 30 percent vs. traditional brushed motors given similar run & load conditions [1]. This is very significant and translates into an increase of 20 to 30 percent in run time assuming similar sized batteries. Alternatively – the battery for an end use BLDC can be 20 to 30% smaller thus making smaller, lighter products. The feature is particularly important in drones, hand held tools and robotics.

Aluminum Electrolytic Capacitor Use in Three-Phase BLDC Motor Controllers

INTRODUCTION

Additional features guiding designers to BLDC and a comparison to brushed DC motors are shown in Figure 1 [1]:

FEATURE	BLDC MOTOR	BRUSHED DC MOTOR
Commutation	Electronic Commutation based upon Hall position sensors	Brushed commutation
Maintenance	Less required due to absence of brushes	Periodic maintenance is required
Life	Longer	Shorter
Speed / Torque Characteristics	Flat – Enables operation at all speeds with rated load	Moderately flat – At higher speeds, brush friction increases, thus reducing useful torque
Efficiency	High – No voltage drop across brushes	Moderate
Output Power / Frame Size	High – Reduced size due to superior thermal characteristics. Because BLDC has the windings on the stator, which is connected to the case, the heat dissipation is better	Moderate/Low – The heat produced by the armature is dissipated in the air gap, thus increasing the temperature in the air gap and limiting specs on the output power/ frame size
Rotor Inertia	Low, because it has permanent magnets on the rotor. This improves the dynamic response	Higher rotor inertia which limits the dynamic characteristics
Speed Range	Higher – No mechanical limitation imposed by brushes/commutator	Lower – Mechanical limitations by the brushes
Electric Noise Generation	Low	Arcs in the brushes will generate noise causing EMI in the equipment nearby
Cost of Building	Higher – Since it has permanent magnets, building costs are higher	Low
Control	Complex and expensive	Simple and inexpensive
Control Requirements	A controller is always required to keep the motor running. The same controller can be used for variable speed control	No controller is required for fixed speed. A controller is required only if variable speed is desired

Figure 1: BLDC Compared to Brushed DC Motor

Aluminum Electrolytic Capacitor Use in Three-Phase BLDC Motor Controllers

INTRODUCTION

BLDC motors do not use brushes for commutation but instead utilize electronics to create a commutation function. Basically, the motor controller will create an electronically generated varying magnetic field by changing voltages and currents injected to the various phases of the motor.

Therefore a potential disadvantage of BLDCs is the added cost and complexity of motor controllers. However, costs of motor controllers are dropping based upon either:

1. Traditional & expected semiconductor cost reduction through efficiency optimization & volume growth
2. The integration of adequate power MCUs with potentially internal metal-oxide semiconductor field-effect transistors (MOSFETs). More powerful semiconductors can essentially act as a cost reduced System on Chip.

Numerous suppliers have created a wide array of motor controllers that are low cost & easy to implement. Modern motor controllers perform multiple functions of [2]:

- Regulates motor speed, torque, or power output
- Controls startup or soft starts
- Protects against circuit faults
- Smooths motor acceleration and deceleration
- Protects against overloads

To summarize, advances in semiconductor technology have delivered easy to use, powerful, cost effective motor controllers.

TEST PLATFORM

A major consideration for our testing a motor controller was to find one that's affordable, has high levels of reliability and supports a wide range of applications. An Allegro A4915 was chosen based upon our selection criteria.

The A4915 is a cost effective 3 phase BLDC motor driver that eliminates the need for a control microprocessor. The device's voltage rating and drive capability supports a wide range of motor loads with 5V minimum voltage & also offers an integrated sleep function. These features make it ideal for battery operated applications. The A4915 is suited for a variety of loads with gate drive voltages rated to 50 volts and supports to load currents up to 150 amps.

The A4915 has internal synchronous rectification control circuitry. It is provided to improve power dissipation in the external MOSFETs during PWM operation. Internal circuit protection includes latched thermal shutdown, dead time protection, and undervoltage lockout. Special power up sequencing is not required. The A4915 is supplied in a 28-pin TSSOP with an exposed thermal pad (suffix LP) and a 28-contact 5 × 5 mm QFN with an exposed thermal pad. [3]

The A4915 can be pulse width modulated (PWM) to control current. There are two methods by which PWM can be applied to the device:

- External PWM.
- Internal PWM – Speed controlled by applying a DC voltage to SPEED pin.

Aluminum Electrolytic Capacitor Use in Three-Phase BLDC Motor Controllers

TEST PLATFORM

Our testing utilized the internal PWM method. The motor chosen was an Applied Motion Products 3 phase BLDC with 24V DC voltage rating and rated Torque of 0.072 N-M.

The motors small size, light weight (0.32 kg) and speed 4000 RPM rated with 5000 RPM maximum makes it an ideal candidate for a variety of portable applications.

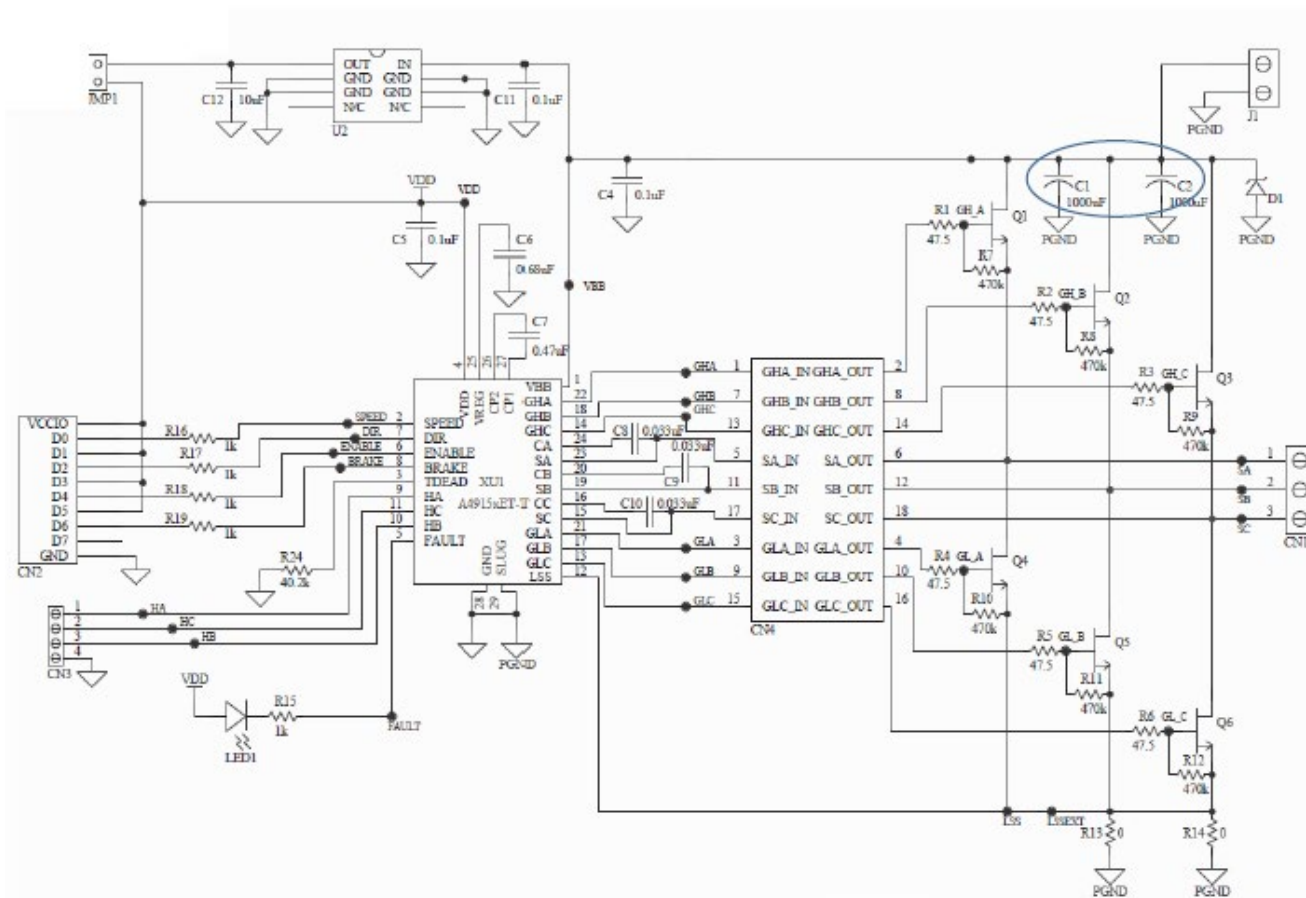


Figure 2: Allegro A4915 Evaluation Board Schematic [3]

TEST RESULTS AND DISCUSSIONS

Aluminum electrolytic capacitors are intended for applications where large capacitance values are required in relatively small, light packages. Tantalum capacitors technically offer a higher capacitance density but aluminum electrolytics meet the cost targets for general bulk capacitors required by all but the most miniature/micro sized BLDC motor drives.

Tests were conducted to illustrate the impact of the Aluminum electrolytic output capacitors effect under identical motor load conditions. In this test PWM output waveforms were captured at similar output driving ports.

Aluminum Electrolytic Capacitor Use in Three-Phase BLDC Motor Controllers

TEST RESULTS AND DISCUSSIONS

Three output capacitor scenarios were evaluated for capacitors C1 and C2. The location of C1 and C2 can be found in the circled region of Figure 2. This schematic is an excerpt from documentation on the Allegro 4915 evaluation board [3]. *The test cases were:*

Case 1 – No capacitors populated at C1 and C2

Case 2 – C1 and C2 both 1000 μ F 50V Radial Electrolytic Capacitors

Case 3 – C1 and C2 both 1500 μ F 80V Radial Electrolytic Capacitors

Similar motor loading, RPM and run time was used in comparing the drive waveform integrity. As expected, the elimination of capacitors C1 and C2 effect the output waveform with the introduction of measurable ringing (approximately 8 volts). Such ringing could reduce the drive control response and integrity of the motor.

The introduction of two 1000 μ F capacitors placed at C1 and C2 reduced the ringing greatly to approximately 4 volts.

Finally, the replacement of C1 and C2 by 1500 μ F Aluminum Electrolytic resulted in a ringing of $\sim$ 0.5 volts.

A summary of these test results are shown in Figure 3 - Output waveform quality vs bulk capacitor value.

Output capacitors value play a crucial role in the integrity of motor controllers. Specific capacitance values which are optimal for designs vary greatly since motor controllers come in various configurations and power levels intended to address the wide range of BLDCs and end applications.

Regardless of the exact value & capacitor configuration, aluminum electrolytic capacitors are ideal in these types of wide voltage range, low frequency pulsed applications. The capacitor should be sized such that surges do not exceed the rated DC voltage of the capacitor. As a general rule of thumb – aluminum electrolytic applications should be tolerant to excess capacitance values over the nominal value and in the case of polarized aluminum electrolytic capacitors – no reverse voltage should be applied.

The vast majority of motor controllers utilize Aluminum Electrolytic technology for output capacitors because of the above characteristics.

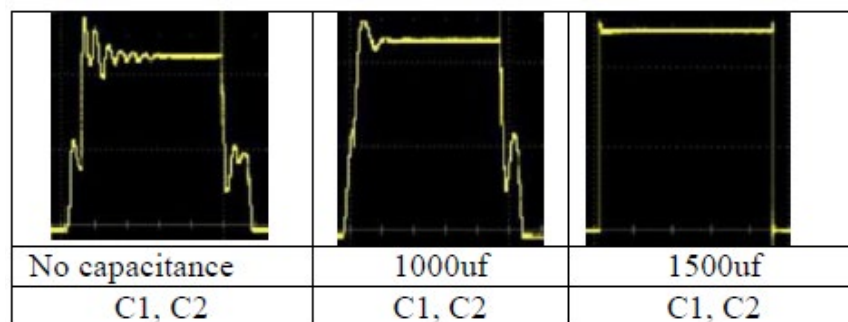


Figure 3: Output waveform quality vs. bulk capacitor value

Aluminum Electrolytic Capacitor Use in Three-Phase BLDC Motor Controllers

SUMMARY AND CONCLUSIONS

Brushless DC motors are experiencing widespread growth in across virtually all applications sectors. BLDCs are attractive to end users due to size efficiency and weight advantages over traditional brushed DC motors. Though motor controllers are needed for BLDC control – design costs and complexity can be kept to a minimum through a wide range of controllers available for virtually every type of BLDC and power level application. Further controller cost effectiveness is expected from accelerating advances in semiconductors used within BLDC controllers.

Output capacitors value play a crucial role in the integrity of motor controllers. Specific capacitance values which are optimal for designs vary greatly since motor controllers come in various configurations and power levels intended to address the wide range of BLDCs and end applications. Aluminum electrolytic capacitors are ideal for use in motor controllers due to their small size, light weight and attractive capacitance value range.

REFERENCES

- [1] MicroChip; AN885 - Brushless DC (BLDC) Motor Fundamentals, Padmaraja Yedamale, 2003; <https://ww1.microchip.com/downloads/en/appnotes/00885a.pdf>
- [2] David Schnauffer et al; Qorvo - Motor Control Fundamentals, ISBN 978-1-119-68172-4, John Wiley & Sons 2020
- [3] Allegro Microsystems; A4915 3-Phase MOSFET Driver data sheet; <https://www.allegromicro.com/en/products/motor-drivers/bldc-drivers/a4915>



Lifetime Calculation

Lifetime Calculation

Hybrid Cap Lifetime Calculation

CONDUCTIVE POLYMER HYBRID ALUMINUM ELECTROLYTIC CAPACITORS OPERATING TEMPERATURE AND LIFE EXPECTANCY

The following calculation formula can be applied at lower than the specified maximum temperature and higher than 40°C. The expected life time at below 40°C is equal to the expected life time at 40°C.

$$L = L_0 \times 2^{(T_0 - T_X) / 10} \times 2^{(\Delta T_0 - \Delta T_X) / 10}$$

L: Expected life time *(hrs) at T1 °C
L ₀ : Guaranteed life time (hrs) at T ₀ °C
T ₀ : Maximum operating temperature (°C)
T _X : Actual operating temperature (°C)
ΔT ₀ : Temperature rise when the rated ripple current applied (°C)
ΔT _X : Temperature rise when the actual ripple current applied (°C)

The following is the converted formula to use the actual ripple current value.

$$L = L_0 \times 2^{(T_0 - T_X) / 10} \times 2^{[1 - (I_X / I_0)^2] \times \Delta T_0 / 10}$$

I ₀ : Rated ripple current (Ar.m.s.)
I _X : Actual ripple current (Ar.m.s.)
Su-cap: (Conductive Polymer Hybrid Aluminum Electrolytic Capacitors)
ΔT ₀ : 10°C

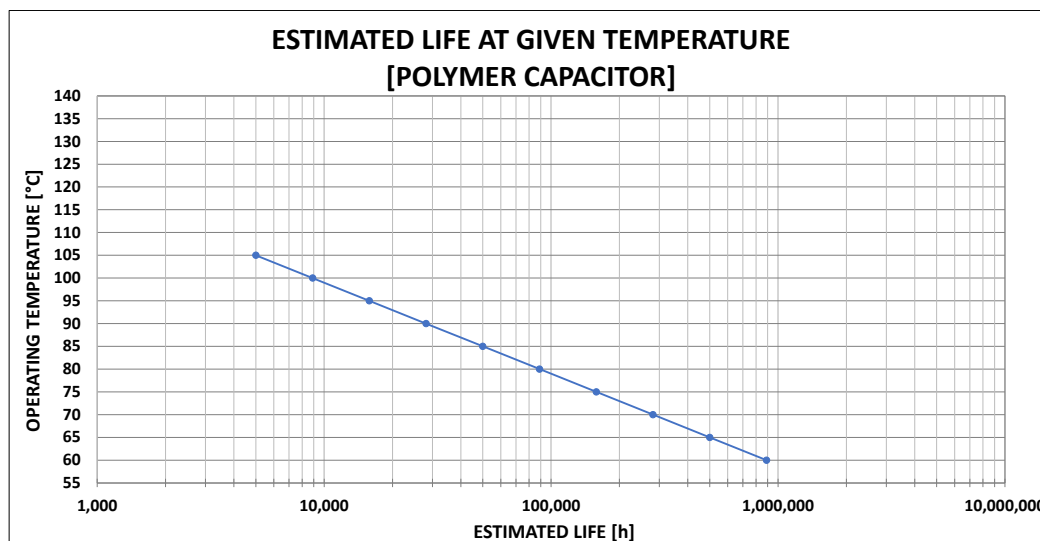
Notice:

Do not apply the excessive ripple current more than the maximum value specification. The maximum estimated lifetime is 15 years (131,400 hrs.) because of the degradation of the sealing rubber.

ALUMINUM POLYMER CAPACITOR ESTIMATED LIFE CALCULATOR

$$L_X = L_0 \times 10^{(T_0 - T) / 20}$$

L: Expected life time (hrs) at given temperature
T: Temperatura del cuerpo del capacitor
T ₀ : Rated max. operating temperature (°C):
L ₀ : Estimated Life time at max. Temp (h):



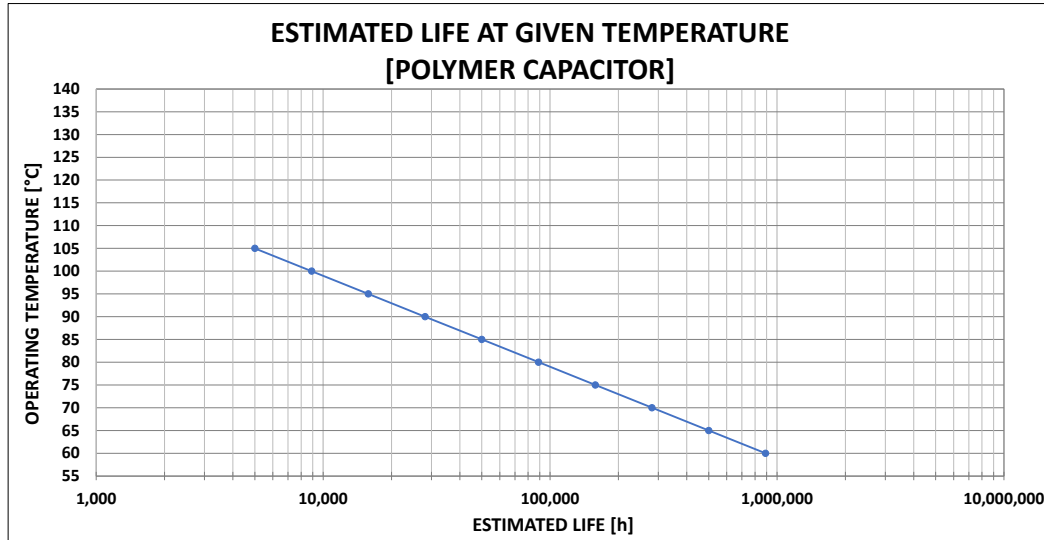
Lifetime Calculation

Hybrid Cap Lifetime Calculation

ALUMINUM POLYMER CAPACITOR ESTIMATED LIFE CALCULATOR

$$L_x = L_o \times 10^{(T_o - T)/20}$$

L: Expected life time (hrs) at given temperature
T: Temperatura del cuerpo del capacitor
To: Rated max. operating temperature (°C):
Lo: Estimated Life time at max. Temp (h):

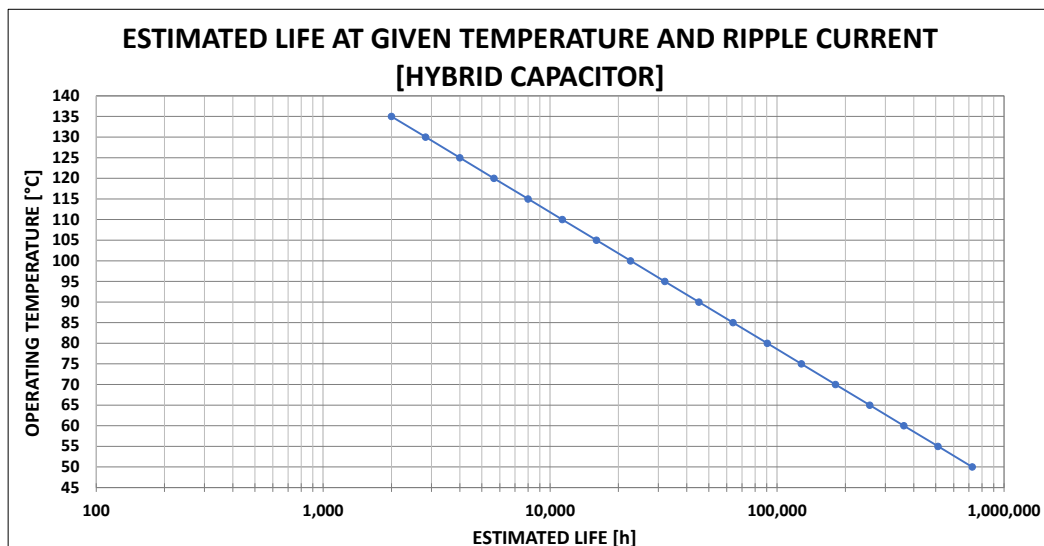


ALUMINUM HYBRID CAPACITOR ESTIMATED LIFE CALCULATOR

$$L = L_o \times 2^{(T_o - T_x)/10} \times 2^{(I_o - I_x)/10}$$

L: Expected life time *(hrs) at T1 °C
T _x : Actual operating temperature (°C)
T _o : Maximum operating temperature (°C)
L _o : Guaranteed life time (hrs) at T0 °C
I _o : Rated Ripple Current (mAr.m.s.)
I _x : Actual Ripple Current (mAr.m.s.)
ΔT _o : Rise of temperature when actual ripple current is applied (°C)***

*** Typically 10°C



Lifetime Calculation

Hybrid Cap Lifetime Calculation

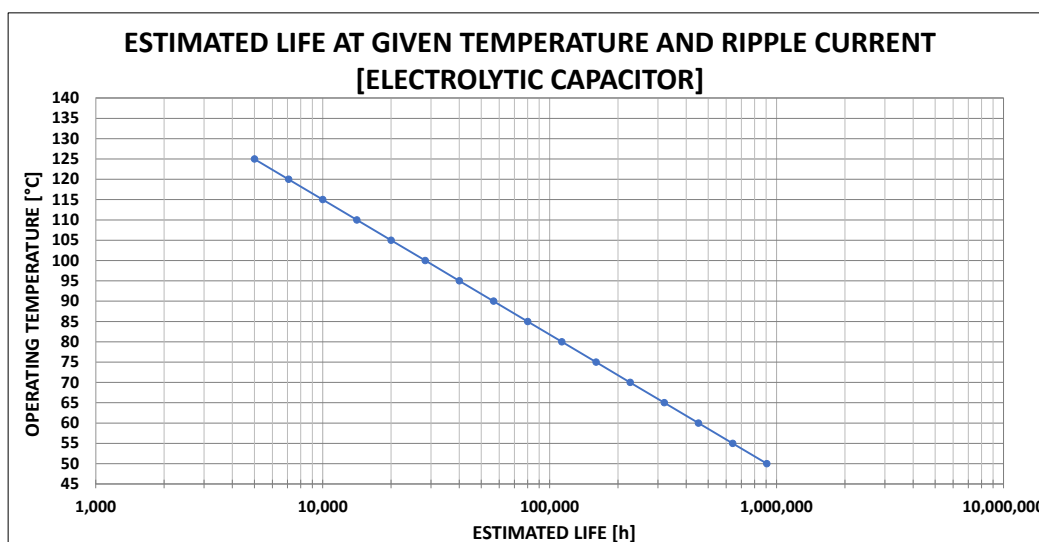
ALUMINUM ELECTROLYTIC CAPACITOR ESTIMATED LIFE CALCULATOR

$$L_x = L_o \times 2^{(T_o - T_x)/10} \times 2^{(\Delta T_o - \Delta T_x)/5}$$

L_o : Rated life time at max. Temperature (spec) [h]
T_o : Rated max. operating temperature (spec) [°C]
I_o : Rated Ripple Current (mAr.m.s.)
I_x : Actual Ripple Current (mAr.m.s.)
ΔT_o : Rise of temperature due to rated ripple current [°C] related to rated operating temperature (see table 1)***
ΔT_x : $(\Delta T_o)(I_x/I_o)^2$: Actual rise in the core temperature of the capacitor due to ripple current***

*** Automatic calculation

Rated Operating Temperature [°C]	ΔT_o
85	10
105	5
125	5
130	5





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A light gray world map is centered in the background of the lower half of the page. It shows the outlines of the continents. Overlaid on the map are five regional labels with their respective phone numbers.

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