

# 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



LEAD-FREE  
LEAD-FREE COMPATIBLE  
COMPONENT



RoHS  
COMPLIANT

### HOW TO ORDER

**Product Type** Aluminum

**Series Type** See table below

**Case Size** See table below

**Capacitance Code**  $\mu\text{F}$  code: 1st two digits represent significant figures, 3rd digit represents multiplier (number of zeros to follow)

**Tolerance** M =  $\pm 20\%$

**Special** No Code = std

**Packaging** R = Pure Tin 15" Reel

**Rated DC Voltage**

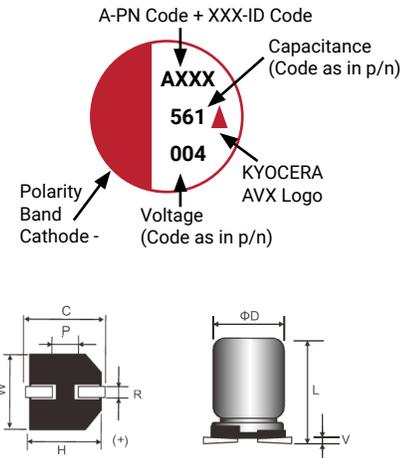
002 = 2.5Vdc	016 = 16Vdc
004 = 4Vdc	025 = 25Vdc
006 = 6.3Vdc	035 = 35Vdc
010 = 10Vdc	050 = 50Vdc

Ordering code example: **A PA 0807 561 M 004 R -**

### CASE DIMENSIONS millimeters (inches)

Code	D $\pm 0.50$ (0.020)	L $\pm 0.50$ (0.020)	W $\pm 0.20$ (0.008)	H $\pm 0.20$ (0.008)	C $\pm 0.20$ (0.008)	R	P $\pm 0.30$ (0.012)	V max	Typical Weight (g)
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)	0.24
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)	0.32
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)	0.41
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)	0.41
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)	0.42
0677	6.30 (0.248)	7.70 (0.303)	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)	0.41
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)	0.53
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)	0.64
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)	0.84
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)	1.17
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)	1.46

### MARKING



### TECHNICAL SPECIFICATIONS

<b>Category Temperature Range:</b>	-55°C to +105°C	
<b>Capacitance Range:</b>	At 25°C, 120Hz	10 $\mu\text{F}$ to 2200 $\mu\text{F}$
<b>Capacitance Tolerance:</b>		$\pm 20\%$
<b>Surge Voltage:</b>	At 105°C	Rated voltage x 1.15
<b>Dissipation Factor (%):</b>	Measurement Frequency: 120Hz at 25°C	Please see the ratings and part number reference table below
<b>Leakage Current:</b>	After 2 minutes at rated working voltage at 25°C*	$I \leq 0.2\text{CV}$ or 300 $\mu\text{A}$ , 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.



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### CAPACITANCE AND RATED VOLTAGE RANGE (FIGURES DENOTES CASE SIZE)

Capacitance		Rated Voltage DC (V <sub>R</sub> )							
μF	Code	2.5	4V	6.3V	10V	16V	25V	35V	50V
10	100								0606
15	150						0604		
22	220							0606	
33	330						0604		0609
47	470					0604	0606		0809
68	680				0606			0609	0812
82	820					0604			0812
100	101			0606	0604, 0606	0606	0609		1010, 1012
120	121							0809	
150	151							0812	
180	181						0809		1012
220	221	0604	0606	0604, 0606	0607, 0608	0609	0812	1010	
270	271							1012	
330	331	0604			0609	0809	1010		
470	471			0609		0812	1012		
560	561	0606	0609, 0807	0609	0809	0812			
680	681				0812	1010			
820	821	0677	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
<b>2.5 Volt</b>							
APA0604221M002R	0604	220	2.5	300	12	20	2100
APA0604331M002R	0604	330	2.5	300	12	20	2400
APA0606561M002R	0606	560	2.5	300	12	10	2800
APA0677821M002R	0677	820	2.5	410	12	7	3000
<b>4 Volt</b>							
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
<b>6.3 Volt</b>							
APA0606101M006R	0606	100	6.3	300	12	22	2400
APA0604221M006R	0604	220	6.3	300	12	17	1500
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
<b>10 Volt</b>							
APA0606680M010R	0606	68	10	300	12	30	2400
APA0604101M010R	0604	100	10	300	12	40	1500

\*+125°C operating temperature rating with 2000hrs endurance

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.

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### 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
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
<b>16 Volt</b>							
APA0604470M016R	0604	47	16	300	12	50	1100
APA0604820M016R	0604	82	16	300	12	40	1500
APA0606101M016R*	0606	100	16	320	12	20	1500
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
<b>25 Volt</b>							
APA0604150M025R	0604	15	25	300	12	45	930
APA0604330M025R	0604	33	25	300	12	100	1020
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
<b>35 Volt</b>							
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
<b>50 Volt</b>							
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

\*+125°C operating temperature rating with 2000hrs endurance

All technical data relates to an ambient temperature of +25C. 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.

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### 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

### 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

- 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.

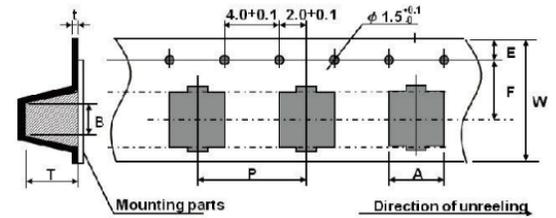
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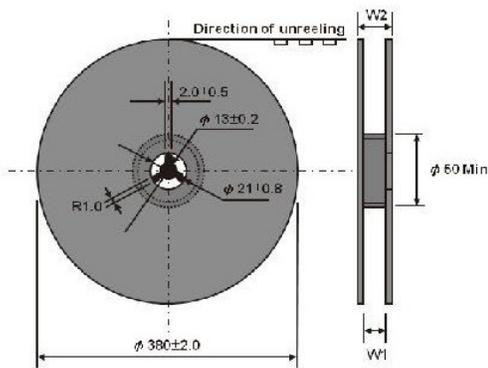


### PACKAGE TAPE DIMENSIONS units (mm)

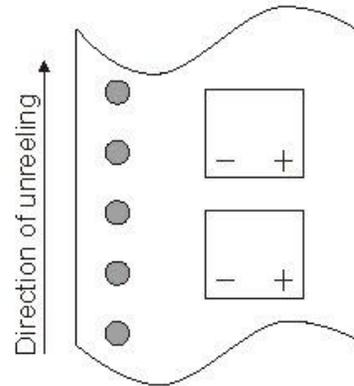
Size Code	A±0.20	B±0.20	W±0.30	F±0.10	E±0.10	P±0.10	t±0.10	T±0.20
0604	7.0	7.0	16.0	7.5	1.75	12.0	0.4	8.0
0606	7.0	7.0	16.0	7.5	1.75	12.0	0.4	8.0
0607-0608	7.0	7.0	16.0	7.5	1.75	12.0	0.4	8.0
0609	7.0	7.0	16.0	7.5	1.75	12.0	0.4	10.0
0677	7.0	7.0	16.0	7.5	1.75	12.0	0.4	8.3
0807	8.7	8.7	24.0	11.5	1.75	16.0	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 <td 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
0604	18.0	22.0	1200
0606-0608	18.0	22.0	1000
0609	18.0	22.0	800
0677	18.0	22.0	1000
0807-0809	26.0	31.0	500
1010	26.0	31.0	500
0812-1012	26.0	31.0	400

### RECOMMENDED LAND PATTERN DIMENSION OF PCB

Size Code	A (mm)	B (mm)	C (mm)
0604	1.9	3.5	1.6
0606	1.9	3.5	1.6
0607	1.9	3.5	1.6
0608	1.9	3.5	1.6
0609	1.9	3.5	1.6
0677	1.9	3.5	1.6
0807	3.0	3.5	2.5
0809	3.0	3.5	2.5
0812	3.0	3.5	2.5
1010	4.0	4.0	2.5
1012	4.0	4.0	2.5

