

THE IDEAL CAPACITOR

The non-ideal characteristics of a real capacitor can be ignored at low frequencies. Physical size imparts inductance to the capacitor and dielectric and metal electrodes result in resistive losses, but these often are of negligible effect on the circuit. At the very high frequencies of radio communication (>100MHz) and satellite systems (>1GHz), these effects become important. Recognizing that a real capacitor will exhibit inductive and resistive impedances in addition to capacitance, the ideal capacitor for these high frequencies is an ultra low loss component which can be fully characterized in all parameters with total repeatability from unit to unit.

Until recently, most high frequency/microwave capacitors were based on fired-ceramic (porcelain) technology. Layers of ceramic dielectric material and metal alloy electrode paste are interleaved and then sintered in a high temperature oven. This technology exhibits component variability in dielectric quality (losses, dielectric constant and insulation resistance), variability in electrode conductivity and variability in physical size (affecting inductance). An alternate thin-film technology has been developed which virtually eliminates these variances. It is this technology which has been fully incorporated into Accu-P® and Accu-P® to provide high frequency capacitors exhibiting truly ideal characteristics.

The main features of Accu-P® may be summarized as follows:

- High purity of electrodes for very low and repeatable ESR.
- Highly pure, low-K dielectric for high breakdown field, high insulation resistance and low losses to frequencies above 40GHz.
- Very tight dimensional control for uniform inductance, unit to unit.
- Very tight capacitance tolerances for high frequency signal applications.

This accuracy sets apart these Thin-Film capacitors from ceramic capacitors so that the term Accu has been employed as the designation for this series of devices, an abbreviation for “accurate.”

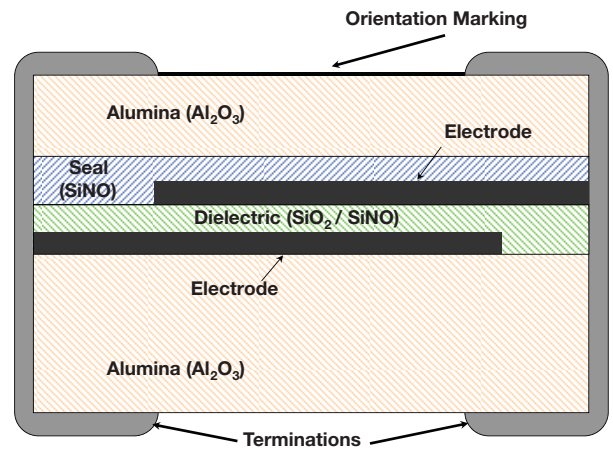


THIN-FILM TECHNOLOGY

Thin-film technology is commonly used in producing semiconductor devices. In the last two decades, this technology has developed tremendously, both in performance and in process control. Today's techniques enable line definitions of below 1µm, and the controlling of thickness of layers at 100Å (10-2µm). Applying this technology to the manufacture of capacitors has enabled the development of components where both electrical and physical properties can be tightly controlled.

The thin-film production facilities at KYOCERA AVX consist of:

- Class 1000 clean rooms, with working areas under laminar-flow hoods of class 100, (below 100 particles per cubic foot larger than 0.5µm).
- High vacuum metal deposition systems for high-purity electrode construction.
- Photolithography equipment for line definition down to 2.0µm accuracy.
- Plasma-enhanced CVD for various dielectric depositions (CVD=Chemical Vapor Deposition).
- High accuracy, microprocessor-controlled dicing saws for chip separation.
- High speed, high accuracy sorting to ensure strict tolerance adherence.



ACCU-P® CAPACITOR STRUCTURE

ACCU-P® TECHNOLOGY

The use of very low-loss dielectric materials, silicon dioxide and silicon oxynitride, in conjunction with highly conductive electrode metals results in low ESR and high Q. These high-frequency characteristics change at a slower rate with increasing frequency than for ceramic microwave capacitors.

Because of the thin-film technology, the above-mentioned frequency characteristics are obtained without significant compromise of properties required for surface mounting.

The main Accu-P® properties are:

- Internationally agreed sizes with excellent dimensional control.
- Ultra small size chip capacitors (1005) are available.
- Ultra tight capacitance tolerances.
- Low ESR at VHF, UHF and microwave frequencies.
- Enhanced RF power handling capability.
- High stability with respect to time, temperature, frequency and voltage variation.
- Nickel/solder-coated terminations to provide excellent solderability and leach resistance.

ACCU-P® FEATURES

Accu-P® meets the fast-growing demand for low-loss (high-Q) capacitors for use in surface mount technology especially for the mobile communications market, such as cellular radio of 450 and 900 MHz, UHF walkie-talkies, UHF cordless telephones to 2.3 GHz, low noise blocks at 11-12.5 GHz and for other VHF, UHF and microwave applications.

Accu-P® is currently unique in its ability to offer very low capacitance values (0.05pF) and very tight capacitance tolerances (± 0.01 pF).

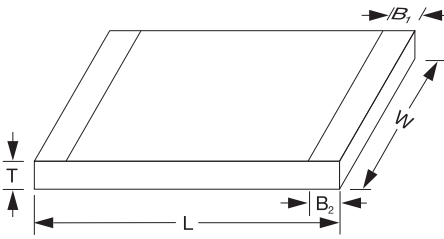
- The RF power handling capability of the Accu-P® allows for its usage in both small signal and RF power applications.
- Thin Film Technology guarantees minimal batch to batch variability of parameters at high frequency.
- Inspection test and quality control procedures in accordance with ISO 9001, CECC, IECQ and USA MIL Standards yield products of the highest quality.
- Hand soldering Accu-P®: Due to their construction utilizing relatively high thermal conductivity materials, Accu-P's have become the preferred device in R & D labs and production environments where hand soldering is used.

APPLICATIONS

- Cellular Communications
- CT2/PCN (Cordless Telephone/Personal Comm. Networks)
- Satellite TV
- Cable TV
- GPS (Global Positioning Systems)
- Vehicle Location Systems
- Vehicle Alarm Systems
- Paging
- Military Communications
- Radar Systems
- Video Switching
- Test & Measurements
- Filters
- VCO's
- Matching Networks
- RF Amplifiers

APPROVALS

- ISO 9001
- IATF 16949:2016



ACCU-P® (SIGNAL AND POWER TYPE CAPACITORS)

	01005*	0201*	0402*	0603*	0805*	1210
L	0.405±0.020 (0.016±0.001)	0.60±0.05 (0.023±0.002)	1.00±0.1 (0.039±0.004)	1.60±0.1 (0.063±0.004)	2.01±0.1 (0.079±0.004)	3.02±0.1 (0.119±0.004)
W	0.215±0.020 (0.0085±0.002)	0.325±0.050 (0.0128±0.002)	0.55±0.07 (0.022±0.003)	0.81±0.1 (0.032±0.004)	1.27±0.1 (0.050±0.004)	2.5±0.1 (0.100±0.004)
T	0.145±0.020 (0.006±0.001)	0.225±0.050 (0.009±0.002)	0.40±0.1 (0.016±0.004)	0.63±0.1 (0.025±0.004)	0.93±0.2 (0.036±0.008)	0.93±0.2 (0.036±0.008)
B1	0.00 ^{+0.1} _{-0.1} (0.004 ^{+0.004} _{-0.000})	0.10±0.10 (0.004±0.004)	(0.0 ^{+0.1} _{-0.1}) (0.00 ^{+0.004} _{-0.000})	0.35±0.15 (0.014±0.006)	0.30±0.1 (0.012±0.004)	0.43±0.1 (0.017±0.004)
B2	0.15±0.05 (0.000±0.002)	0.15±0.05 (0.006±0.002)	0.20±0.1 (0.008±0.004)	0.35±0.15 (0.014±0.006)	0.30±0.1 (0.012±0.004)	0.43±0.1 (0.017±0.004)

*Mount Black Side Up

DIMENSIONS: millimeters (inches)

HOW TO ORDER

0402	3	J	4R7	A	B	S	TR	\500
Size C005 0201 0402 0603 0805 1210*	Voltage 2 = 200V 1 = 100V 5 = 50V 3 = 25V Y = 16V Z = 10V	Temperature Coefficient (1) J = 0±30ppm/°C (-55°C to +125°C) K = 0±60ppm/°C (-55°C to +125°)	Capacitance Capacitance expressed in pF. (2 significant digits + number of zeros) for values <10pF, letter R denotes decimal point. Example: 68pF = 680 8.2pF = 8R2	Tolerance for Cs<2.0pF* Z = ±0.01pF P = ±0.02pF Q = ±0.03pF A = ±0.05pF B = ±0.1pF C = ±0.25pF for Cs<3.0pF Q = ±0.03pF A = ±0.05pF B = ±0.1pF C = ±0.25pF for Cs<5.6pF A = ±0.05pF B = ±0.1pF C = ±0.25pF for 5.6pF<C<10pF B = ±0.1pF C = ±0.25pF D = ±0.5pF for C<10pF F = ±1% G = ±2% J = ±5%	Specification Code B = Accu-P® technology	Termination Code W=Nickel/Solder Coated Accu-P® 0402 Sn90, Pb10*** T=Nickel/High Temperature Solder Coated Accu-P® 0805**, 1210** Sn96, Ag4 Nickel/Solder Coated Accu-P® 0603*** Sn63, Pb37 **S=Nickel/Lead Free Solder Coated Accu-P® 1005, 0201 0402, 0603 Sn100	Packaging Code TR = Tape & Reel	Option

**RoHS compliant
*** Not RoHS Compliant

The following 3 digit capacitance codes should be used for ordering Accu-P® capacitors	
CAPACITANCE CODE	EXAMPLE
0.00 to 0.99pF Rxx	0.15pF = 04023JR15ABSTR
1.00 to 1.99pF Axx	1.55pF = 04023JA55PBSTR
2.00 to 2.99pF Bxx	2.85pF =B85...
3.00 to 3.99pF Cxx	3.85pF =C85...
4.00 to 4.99pF Dxx	4.85pF =D85...
5.00 to 5.99pF Exx	5.85pF =E85...
6.00 to 6.99pF Fxx	6.85pF =F85...
7.00 to 7.99pF Gxx	7.85pF =G85...
8.00 to 8.99pF Hxx	8.85pF =H85...
9.00 to 9.99pF Jxx	9.85pF =J85...
10.0 to 19.9pF Kxx	13.8pF =K38...
20.0 to 29.9pF Lxx	22.5pF =L25...
30.0 to 39.9pF Mxx	33.8pF =M38...
40.0 to 49.9pF Nxx	43.5pF =N35...

(1) TC's shown are per EIA/IEC Specifications.
* Tolerances as tight as ±0.01pF are available.
Please consult the factory.



For RoHS compliant products, please select correct termination style.

ELECTRICAL SPECIFICATIONS

Operating and Storage Temperature Range	-55°C to +125°C
Temperature Coefficients (1)	0 ± 30ppm/°C dielectric code "J" / 0 ± 60ppm/°C dielectric code "K"
Capacitance Measurement	1 MHz, 1 Vrms
Insulation Resistance (IR)	≥1011 Ohms (≥10 ¹⁰ Ohms for 0201 and 0402 size)
Proof Voltage	2.5 U _R for 5 secs.
Aging Characteristic	Zero
Dielectric Absorption	0.01%

Thin-Film RF/Microwave Capacitor Technology

Accu-P® Series

Single and Power Type Capacitors



TEMP. COEFFICIENT CODE

“J” = 0±30PPM/°C (-55°C TO +125°C)⁽²⁾ “K” = 0±60PPM/°C (-55°C TO +125°C)⁽²⁾

Size			C005						0201						0402						0603						0805						1210									
Size Code			16		100		50		25		16		10		200		100		50		25		16		10		200		100		50		25		100		50		100		50	
Cap in pF	Cap code	Voltage																																								
0.1	—	0R1																																								
0.2	—	0R2																																								
0.3	—	0R3																																								
0.4	—	0R4																																								
0.5	—	0R5																																								
0.6	—	0R6																																								
0.7	—	0R7																																								
0.8	—	0R8																																								
0.9	—	0R9																																								
1.0	—	1R0																																								
1.1	—	1R1																																								
1.2	—	1R2																																								
1.3	—	1R3																																								
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9.1	—	9R1																																								
10.0	—	100																																								
11.0	—	110																																								
12.0	—	120																																								
13.0	—	130																																								
14.0	—	140																																								
15.0	—	150																																								
16.0	—	160																																								
17.0	—	170																																								
18.0	—	180																																								
19.0	—	190																																								
20.0	—	200																																								
21.0	—	210																																								
22.0	—	220																																								
24.0	—	240																																								
27.0	—	270																																								
30.0	—	300																																								
33.0	—	330																																								
39.0	—	390																																								
47.0	—	470																																								
56.0	—	560																																								
68.0	—	680																																								

- (1) For capacitance values higher than listed in table, please consult factory.
- (2) TC shown is per EIA/IEC Specifications.
- These values are produced with “K” temperature coefficient code only.

Intermediate values are available within the indicated range.



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

0201 Typical Electrical Tables

Capacitance @ 1MHz and Tolerance		Self Resonance Frequency (GHz) Typ.	Q Standard Value @ 1GHz		Frequency 900MHz			Frequency 1900MHz			Frequency 2400MHz		
C (pF)	Tol.		Typ.	Min.	C(eff) (pF) Typ.	Q Typ.	ESR (mOhm) Typ.	C(eff) (pF) Typ.	Q Typ.	ESR (mOhm) Typ.	C(eff) (pF) Typ.	Q Typ.	ESR (mOhm) Typ.
3.9	±0.05	4.3	227	125	4.030	265	167	4.359	91	213	4.620	66	219
4	±0.05	4.3	224	123	4.138	262	165	4.484	89	210	4.760	65	216
4.1	±0.05	4.2	222	122	4.247	259	162	4.610	88	207	4.901	64	213
4.2	±0.05	4.2	220	121	4.356	257	159	4.735	87	204	5.041	63	210
4.3	±0.05	4.1	218	120	4.464	254	157	4.860	86	201	5.181	62	207
4.4	±0.05	4.1	216	119	4.573	252	154	4.986	85	198	5.322	61	204
4.5	±0.05	4.0	214	118	4.682	249	152	5.111	83	195	5.462	60	201
4.6	±0.05	4.0	212	116	4.790	246	149	5.237	82	192	5.602	59	198
4.7	±0.05	3.9	209	115	4.899	244	147	5.362	81	189	5.743	58	195
5.1	±0.05	3.8	201	110	5.334	233	136	5.863	76	178	6.304	54	183
5.6	±0.05	3.6	190	105	5.877	220	124	6.490	70	163	7.006	49	168
6.2	±0.1	3.5	177	97	6.488	208	126	7.290	65	167	7.993	45	174
6.8	±0.1	3.3	164	90	7.100	195	128	8.090	60	171	8.980	41	179
7.5	±0.1	3.2	153	84	7.901	182	125	9.129	56	166	10.27	38	173
8.2	±0.1	3.0	142	78	8.701	168	121	10.17	52	160	11.56	34	167
9.1	±0.1	2.9	135	74	9.676	159	118	11.57	49	154	13.49	32	161
10	±1%	2.8	128	70	10.65	151	114	12.96	45	148	15.41	29	155
11	±1%	2.7	120	66	11.73	141	110	14.52	42	142	17.55	27	148
12	±1%	2.5	112	62	12.82	132	105	16.07	39	135	19.68	24	141
13	±1%	2.4	105	58	13.92	124	104	17.82	36	135	22.38	22	142
14	±1%	2.4	98	54	15.02	116	103	19.57	32	135	25.08	19	142
15	±1%	2.3	91	50	16.12	108	102	21.32	29	135	27.78	17	143
16	±1%	2.2	86	47	17.37	102	103	24.04	27	135	NA	NA	NA
17	±1%	2.2	81	44	18.63	96	105	26.76	25	136	NA	NA	NA
18	±1%	2.1	76	42	19.88	90	106	29.48	23	136	NA	NA	NA
19	±1%	2.1	71	39	21.14	83	108	32.20	21	136	NA	NA	NA
20	±1%	2.1	65	36	22.39	77	109	34.92	19	136	NA	NA	NA
22	±1%	2.0	55	30	24.90	65	112	40.36	15	137	NA	NA	NA

Thin-Film RF/Microwave Capacitor Technology

Accu-P® Series

0402 Typical Electrical Tables



Capacitance @ 1MHz and Tolerance		Self Resonance Frequency (GHz) Typ.	Q Standard Value @ 1GHz		Frequency 900MHz			Frequency 1900MHz			Frequency 2400MHz		
C (pF)	Tol.		Typ.	Min.	C(eff) (pF) Typ.	Q Typ.	ESR (mOhm) Typ.	C(eff) (pF) Typ.	Q Typ.	ESR (mOhm) Typ.	C(eff) (pF) Typ.	Q Typ.	ESR (mOhm) Typ.
3.9	±0.05	3.9	519	285	3.99	551	47	4.30	238	47	4.58	165	48
4	±0.05	3.9	513	282	4.10	545	47	4.42	235	47	4.73	162	48
4.1	±0.05	3.8	507	279	4.20	539	47	4.55	232	46	4.87	160	48
4.2	±0.05	3.8	501	275	4.30	534	46	4.67	228	46	5.01	157	48
4.3	±0.05	3.7	495	272	4.41	528	46	4.79	225	46	5.16	154	48
4.4	±0.05	3.7	489	269	4.51	522	46	4.92	222	46	5.30	151	47
4.5	±0.05	3.6	483	265	4.61	516	46	5.04	219	45	5.44	149	47
4.6	±0.05	3.6	477	262	4.72	511	45	5.16	216	45	5.59	146	47
4.7	±0.05	3.5	471	259	4.82	505	45	5.29	213	45	5.73	143	47
5.1	±0.05	3.4	446	245	5.23	482	44	5.78	200	43	6.30	133	47
5.6	±0.05	3.3	416	229	5.75	453	43	6.40	184	42	7.02	119	46
6.2	±0.1	3.0	388	213	6.41	427	44	7.26	167	44	8.11	107	47
6.8	±0.1	2.8	360	198	7.07	400	44	8.12	150	45	9.19	95	48
7.5	±0.1	2.7	338	186	7.85	378	45	9.17	139	47	10.57	86	49
8.2	±0.1	2.6	315	173	8.62	356	45	10.22	128	48	11.95	77	50
9.1	±0.1	2.5	292	160	9.63	333	45	11.75	115	47	14.23	69	50
10	±1%	2.4	268	148	10.65	310	45	13.28	103	47	16.50	61	49
11	±1%	2.3	242	133	11.77	285	44	14.98	89	46	19.04	51	49
12	±1%	2.2	217	119	12.90	259	44	16.68	75	45	21.57	42	48
13	±1%	2.2	202	111	14.03	241	44	18.83	68	47	25.73	38	49
14	±1%	2.1	187	103	15.17	223	44	20.97	62	49	29.89	33	49
15	±1%	2.1	172	94	16.30	204	45	23.12	56	51	34.05	29	50
16	±1%	2.0	157	87	17.53	187	44	25.91	50	49	41.44	25	49
17	±1%	1.9	143	79	18.75	169	43	28.70	45	46	48.82	21	47
18	±1%	1.8	129	71	19.98	152	42	31.49	39	44	56.21	17	46
19	±1%	1.8	121	67	21.11	143	42	33.51	36	44	60.92	15	47
20	±1%	1.8	110	61	22.25	131	41	35.53	33	43	65.63	14	48
22	±1%	1.8	98	54	24.51	116	41	39.57	26	42	75.05	10	51
24	±1%	1.8	87	48	27.51	104	37	54.94	21	35	NA	NA	NA
27	±1%	1.7	70	39	32.01	85	32	77.98	13	23	NA	NA	NA
30	±1%	1.7	65	36	35.89	78	28	106.50	10	12	NA	NA	NA
33	±1%	1.7	60	33	40.05	74	27	NA	NA	NA	NA	NA	NA
36	±1%	1.7	58	32	45.13	71	28	NA	NA	NA	NA	NA	NA
39	±1%	1.7	56	31	50.21	69	28	NA	NA	NA	NA	NA	NA
43	±1%	1.6	53	29	56.98	66	29	NA	NA	NA	NA	NA	NA
47	±1%	1.6	50	28	63.75	63	30	NA	NA	NA	NA	NA	NA
51	±1%	1.6	48	26	70.53	60	31	NA	NA	NA	NA	NA	NA
56	±1%	1.6	44	24	78.99	56	33	NA	NA	NA	NA	NA	NA
58	±1%	1.6	42	23	83.54	54	34	NA	NA	NA	NA	NA	NA
68	±1%	1.6	32	18	106.28	42	40	NA	NA	NA	NA	NA	NA

Capacitance @ 1MHz and Tolerance		Self Resonance Frequency (GHz) Typ.	Q Standard Value @ 1GHz		Frequency 900MHz			Frequency 1900MHz			Frequency 2400MHz		
C (pF)	Tol.		Typ.	Min.	C(eff) (pF) Typ.	Q Typ.	ESR (mOhm) Typ.	C(eff) (pF) Typ.	Q Typ.	ESR (mOhm) Typ.	C(eff) (pF) Typ.	Q Typ.	ESR (mOhm) Typ.
3.9	±0.05	2.9	311	171	4.193	360	118	5.018	112	150	5.925	70	161
4	±0.05	2.9	307	169	4.301	355	117	5.188	110	149	6.188	68	160
4.1	±0.05	2.8	303	167	4.410	351	116	5.358	108	148	6.450	67	159
4.2	±0.05	2.8	299	164	4.518	347	116	5.528	106	148	6.713	65	158
4.3	±0.05	2.7	295	162	4.627	342	115	5.698	104	147	6.975	64	157
4.4	±0.05	2.7	291	160	4.735	338	114	5.867	102	146	7.238	62	157
4.5	±0.05	2.7	287	158	4.843	333	113	6.037	100	146	7.500	61	156
4.6	±0.05	2.6	283	156	4.952	329	112	6.207	98	145	7.763	59	155
4.7	±0.05	2.6	279	154	5.060	324	112	6.377	96	144	8.025	58	154
5.1	±0.05	2.5	263	145	5.494	307	109	7.057	88	142	9.075	52	151
5.6	±0.05	2.4	244	134	6.035	285	105	7.906	78	138	10.39	44	147
6.2	±0.1	2.3	228	126	6.865	267	102	9.517	72	133	13.66	40	141
6.8	±0.1	2.2	213	117	7.694	250	100	11.13	66	128	16.93	35	135
7.5	±0.1	2.1	195	107	8.367	227	98	12.63	57	125	20.91	28	132
8.2	±0.1	2.0	176	97	9.041	205	96	14.14	49	123	24.88	21	129
9.1	±0.1	1.9	161	89	10.20	188	96	18.09	42	122	40.00	16	128
10	±1%	1.8	146	80	11.37	171	95	22.05	36	121	70.00	12	127
11	±1%	1.7	129	71	12.66	153	95	26.44	29	120	140.0	6	126
12	±1%	1.6	112	62	13.95	134	94	30.83	22	119	231.3	1	125
13	±1%	1.6	102	56	15.31	122	93	40.37	18	118	n/a	n/a	n/a
14	±1%	1.5	92	51	16.67	111	92	49.91	15	118	n/a	n/a	n/a
15	±1%	1.5	82	45	18.03	99	90	59.44	11	117	n/a	n/a	n/a
16	±1%	1.4	79	43	19.61	96	90	80.00	8	117	n/a	n/a	n/a
17	±1%	1.4	76	42	21.18	92	90	120.0	6	116	n/a	n/a	n/a
18	±1%	1.3	73	40	22.76	89	90	190.0	4	116	n/a	n/a	n/a
19	±1%	1.3	69	38	24.37	84	89	n/a	n/a	n/a	n/a	n/a	n/a
20	±1%	1.2	65	36	25.98	80	89	n/a	n/a	n/a	n/a	n/a	n/a
22	±1%	1.2	57	31	29.21	72	87	n/a	n/a	n/a	n/a	n/a	n/a
24	±1%	1.2	48	26	34.44	62	87	n/a	n/a	n/a	n/a	n/a	n/a
27	±1%	1.1	43	24	41.87	56	86	n/a	n/a	n/a	n/a	n/a	n/a
30	±1%	1.0	37	21	49.29	49	85	n/a	n/a	n/a	n/a	n/a	n/a
33	±1%	1.0	32	18	56.72	43	84	n/a	n/a	n/a	n/a	n/a	n/a
36	±1%	1.0	27	15	64.15	37	83	n/a	n/a	n/a	n/a	n/a	n/a
39	±1%	1.0	21	12	71.57	30	82	n/a	n/a	n/a	n/a	n/a	n/a

Capacitance @ 1MHz and Tolerance		Self Resonance Frequency (GHz) Typ.	Q Standard Value @ 1GHz		Frequency 900MHz			Frequency 1900MHz			Frequency 2400MHz		
C (pF)	Tol.		Typ.	Min.	C(eff) (pF) Typ.	Q Typ.	ESR (mOhm) Typ.	C(eff) (pF) Typ.	Q Typ.	ESR (mOhm) Typ.	C(eff) (pF) Typ.	Q Typ.	ESR (mOhm) Typ.
4.3	±0.05	2.7	366	202	4.564	422	97	5.965	134	111	7.881	81	111
4.4	±0.05	2.7	360	198	4.681	415	96	6.161	131	110	8.222	78	111
4.5	±0.05	2.7	355	195	4.798	409	96	6.357	128	110	8.562	75	110
4.6	±0.05	2.7	349	192	4.915	403	95	6.553	124	109	8.902	72	110
4.7	±0.05	2.6	343	188	5.032	397	94	6.749	121	109	9.242	69	109
5.1	±0.05	2.5	319	175	5.499	373	91	7.533	108	107	10.60	58	107
5.6	±0.05	2.4	289	159	6.083	342	88	8.513	91	104	12.30	44	104
6.2	±0.1	2.3	264	145	6.842	313	86	10.43	79	102	18.03	36	103
6.8	±0.1	2.2	239	131	7.601	283	84	12.35	68	101	23.76	28	102
7.5	±0.1	2.1	218	120	8.468	259	83	14.84	61	100	37.25	21	101
8.2	±0.1	2.0	198	109	9.334	234	82	17.32	55	100	50.74	15	100
9.1	±0.1	1.9	179	99	10.57	213	82	24.90	46	100	n/a	n/a	n/a
10	±1%	1.8	160	88	11.80	191	81	32.48	37	100	n/a	n/a	n/a
11	±1%	1.7	139	77	13.17	167	81	40.90	26	101	n/a	n/a	n/a
12	±1%	1.6	119	65	14.54	143	80	49.32	16	101	n/a	n/a	n/a
13	±1%	1.6	110	60	16.17	134	80	n/a	n/a	n/a	n/a	n/a	n/a
14	±1%	1.5	101	55	17.79	125	80	n/a	n/a	n/a	n/a	n/a	n/a
15	±1%	1.5	92	51	19.42	116	80	n/a	n/a	n/a	n/a	n/a	n/a
16	±1%	1.4	87	48	21.13	110	79	n/a	n/a	n/a	n/a	n/a	n/a
17	±1%	1.4	83	46	22.85	104	78	n/a	n/a	n/a	n/a	n/a	n/a
18	±1%	1.3	78	43	24.57	99	77	n/a	n/a	n/a	n/a	n/a	n/a
19	±1%	1.3	73	40	26.41	92	77	n/a	n/a	n/a	n/a	n/a	n/a
20	±1%	1.3	67	37	28.26	85	76	n/a	n/a	n/a	n/a	n/a	n/a
22	±1%	1.2	57	31	31.95	72	76	n/a	n/a	n/a	n/a	n/a	n/a
24	±1%	1.2	46	25	35.64	59	75	n/a	n/a	n/a	n/a	n/a	n/a
27	±1%	1.1	41	22	44.94	54	74	n/a	n/a	n/a	n/a	n/a	n/a
30	±1%	1.0	36	20	54.24	48	73	n/a	n/a	n/a	n/a	n/a	n/a
33	±1%	1.0	30	17	63.54	42	72	n/a	n/a	n/a	n/a	n/a	n/a
36	±1%	0.9	25	14	72.84	37	71	n/a	n/a	n/a	n/a	n/a	n/a
39	±1%	0.9	20	11	82.14	31	70	n/a	n/a	n/a	n/a	n/a	n/a
43	±1%	0.9	16	9	102.9	27	66	n/a	n/a	n/a	n/a	n/a	n/a
47	±1%	0.8	12	7	123.7	23	63	n/a	n/a	n/a	n/a	n/a	n/a

Thin-Film RF/Microwave Capacitor Technology

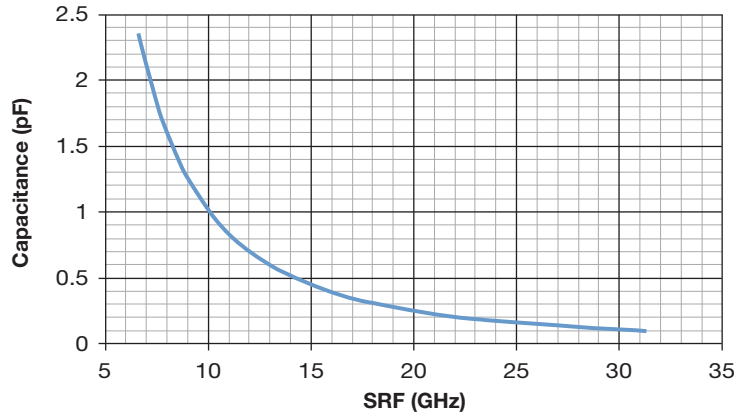
Accu-P® Series

1210 Typical Electrical Tables



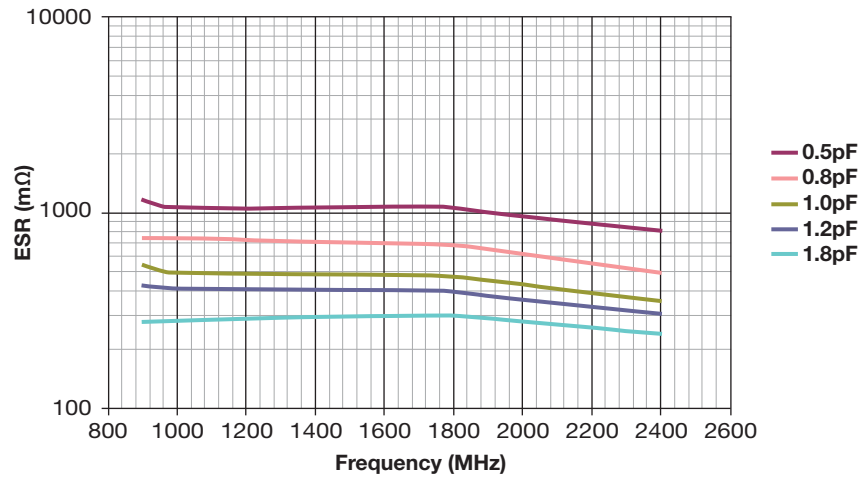
Capacitance @ 1MHz and Tolerance		Self Resonance Frequency (GHz) Typ.	Q Standard Value @ 1GHz		Frequency 900MHz			Frequency 1900MHz			Frequency 2400MHz		
C (pF)	Tol.		Typ.	Min.	C(eff) (pF) Typ.	Q Typ.	ESR (mOhm) Typ.	C(eff) (pF) Typ.	Q Typ.	ESR (mOhm) Typ.	C(eff) (pF) Typ.	Q Typ.	ESR (mOhm) Typ.
3.9	±0.05	2.4	479	264	3.973	534	80	4.304	191	102	4.616	129	112
4	±0.05	2.4	473	260	4.083	528	79	4.435	189	101	4.768	127	112
4.1	±0.05	2.4	467	257	4.192	522	78	4.565	186	100	4.919	125	111
4.2	±0.05	2.4	462	254	4.302	516	78	4.695	183	100	5.071	123	110
4.3	±0.05	2.3	456	251	4.411	511	77	4.825	180	99	5.223	121	110
4.4	±0.05	2.3	450	247	4.521	505	76	4.956	178	98	5.375	119	109
4.5	±0.05	2.3	444	244	4.630	499	75	5.086	175	98	5.526	117	108
4.6	±0.05	2.3	438	241	4.740	493	75	5.216	172	97	5.678	115	108
4.7	±0.05	2.2	432	238	4.849	487	74	5.347	170	96	5.830	113	107
5.1	±0.05	2.1	408	225	5.288	464	71	5.868	159	93	6.437	106	105
5.6	±0.05	2.0	379	208	5.835	435	67	6.519	145	90	7.195	96	102
6.2	±0.1	1.9	355	195	6.440	408	65	7.176	137	86	7.897	91	96
6.8	±0.1	1.8	330	182	7.044	380	62	7.832	129	83	8.599	85	91
7.5	±0.1	1.7	308	169	7.823	351	61	8.927	115	81	10.08	74	89
8.2	±0.1	1.7	285	157	8.601	322	60	10.02	100	78	11.55	63	87
9.1	±0.1	1.6	266	146	9.600	304	58	11.55	93	77	13.93	57	85
10	±1%	1.5	247	136	10.60	285	57	13.09	85	76	16.30	50	84
11	±1%	1.5	225	124	11.71	265	56	14.79	76	74	18.94	43	82
12	±1%	1.4	204	112	12.82	244	54	16.49	68	73	21.57	36	81
13	±1%	1.3	193	106	13.97	230	53	18.64	61	72	26.09	32	80
14	±1%	1.3	181	99	15.13	215	53	20.80	55	71	30.61	28	79
15	±1%	1.2	169	93	16.28	200	52	22.95	48	70	35.13	24	78
16	±1%	1.2	164	90	17.51	195	51	26.01	46	69	46.51	22	76
17	±1%	1.2	159	88	18.75	189	50	29.07	43	67	57.90	19	75
18	±1%	1.1	154	85	19.98	183	49	32.14	41	66	69.29	17	73
19	±1%	1.1	150	82	21.21	178	49	36.34	39	66	n/a	n/a	n/a
20	±1%	1.1	145	80	22.43	172	49	40.55	38	65	n/a	n/a	n/a
22	±1%	1.0	136	75	24.88	162	49	48.96	34	64	n/a	n/a	n/a
24	±1%	1.0	126	70	27.34	151	48	57.38	31	63	n/a	n/a	n/a
27	±1%	0.9	112	62	31.02	135	48	70.00	26	62	n/a	n/a	n/a
30	±1%	0.9	101	56	36.14	121	48	n/a	n/a	n/a	n/a	n/a	n/a
33	±1%	0.8	90	50	41.27	108	48	n/a	n/a	n/a	n/a	n/a	n/a
36	±1%	0.8	79	44	46.39	95	48	n/a	n/a	n/a	n/a	n/a	n/a
39	±1%	0.8	68	38	51.52	82	48	n/a	n/a	n/a	n/a	n/a	n/a
43	±1%	0.7	54	30	58.35	64	48	n/a	n/a	n/a	n/a	n/a	n/a
47	±1%	0.7	39	21	65.18	46	48	n/a	n/a	n/a	n/a	n/a	n/a
82	±1%	0.7	17	10	148.400	24	48	n/a	n/a	n/a	n/a	n/a	n/a

Accu-P® 01005 Typical SRF vs Capacitance



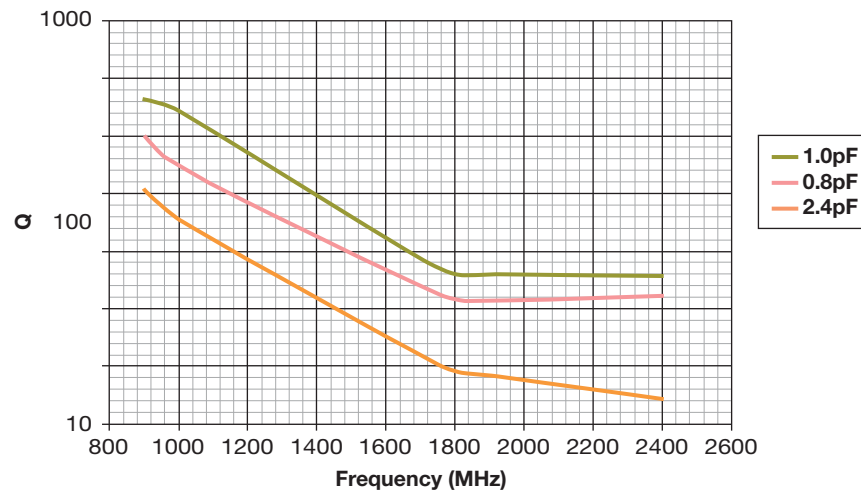
Measured on HP8720ES

Accu-P® 01005 Typical ESR vs Frequency

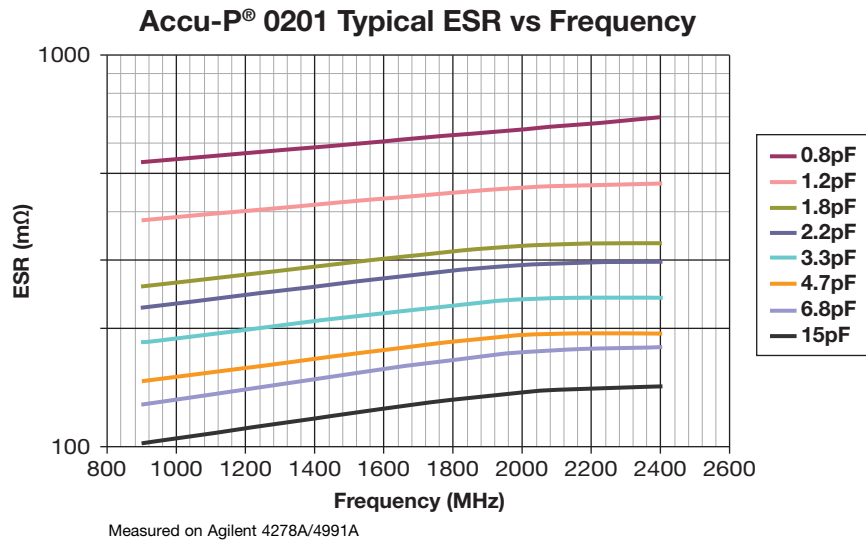
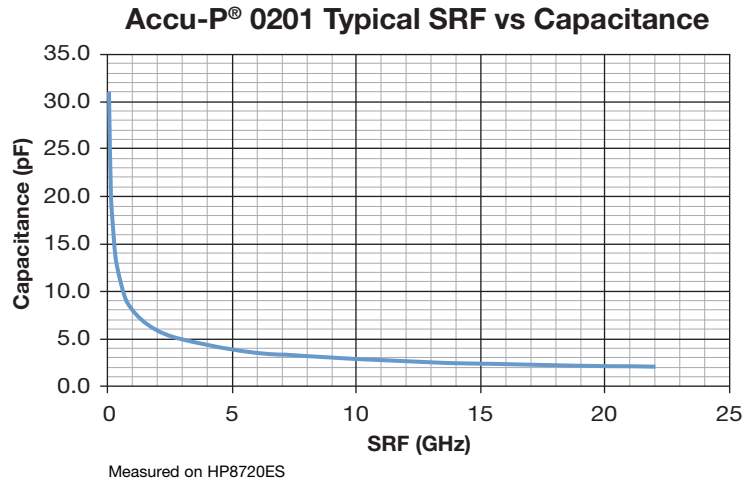


Measured on Agilent 4278A/4991A

Accu-P® 01005 Typical Q vs Frequency



Measured on Agilent 4278A/4991A

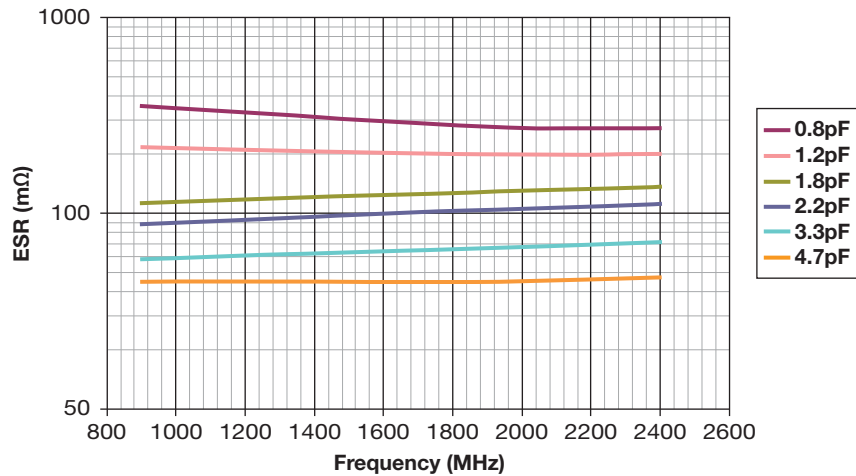


Accu-P® 0402 Typical SRF vs Capacitance



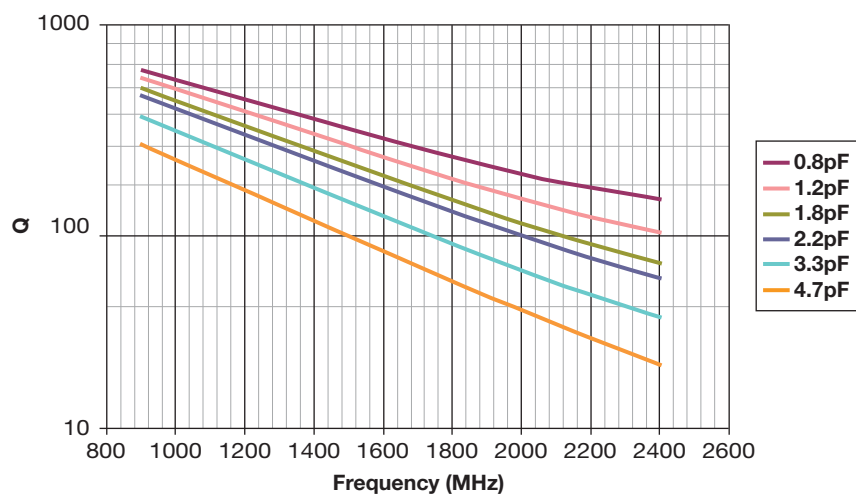
Measured on HP8720ES

Accu-P® 0402 Typical ESR vs Frequency

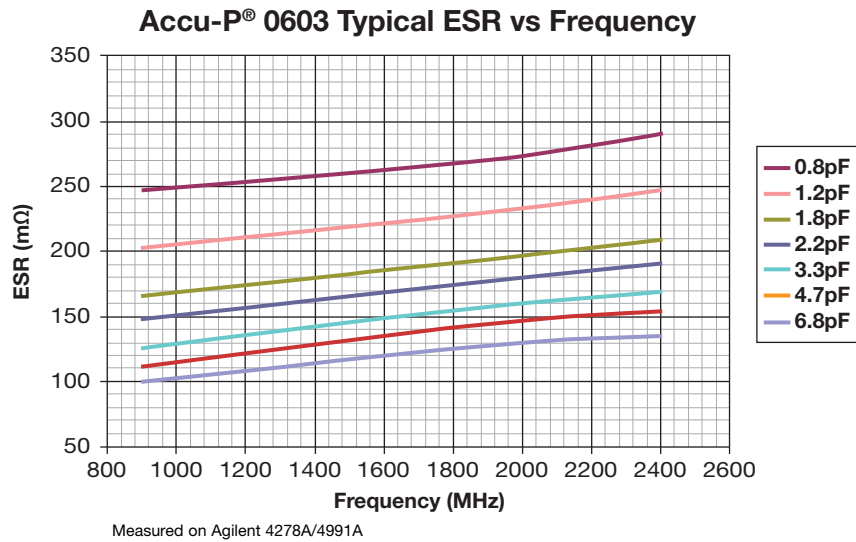
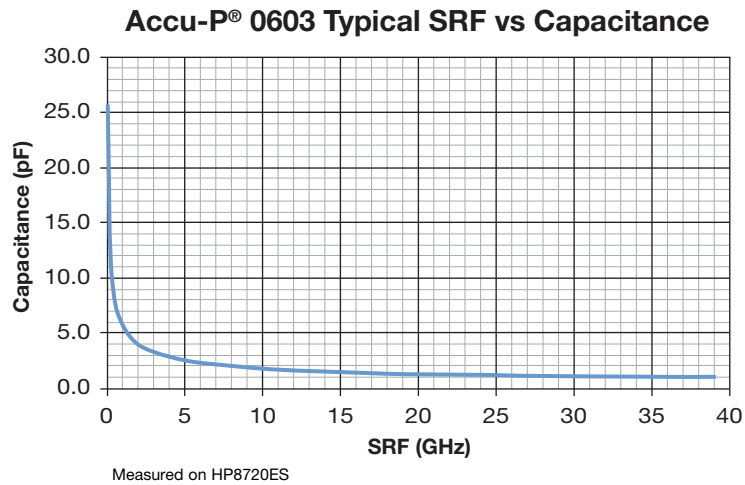


Measured on Agilent 4278A/4991A

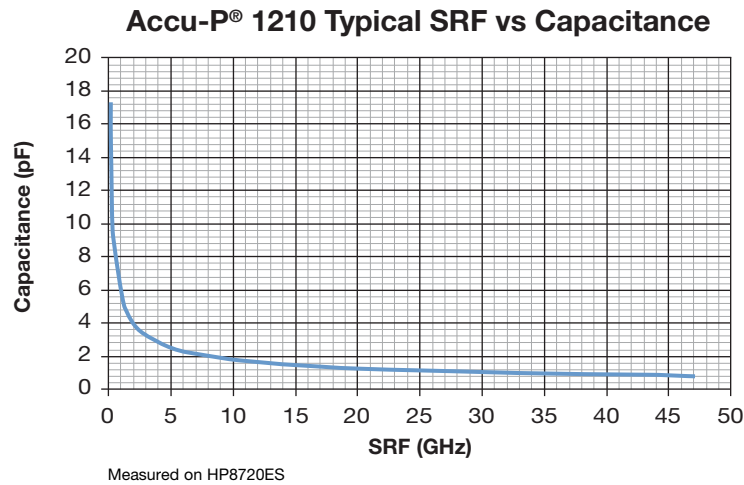
Accu-P® 0402 Typical Q vs Frequency



Measured on Agilent 4278A/4991A







ENVIRONMENTAL CHARACTERISTICS

TEST	CONDITIONS	REQUIREMENT
Life (Endurance) MIL-STD-202F Method 108A	125°C, 2UR, 1000 hours	No visible damage $\Delta C/C \leq 2\%$ for $C \geq 5pF$ $\Delta C \leq 0.25pF$ for $C < 5pF$
Accelerated Damp Heat Steady State MIL-STD-202F Method 103B	85°C, 85% RH, UR, 1000 hours	No visible damage $\Delta C/C \leq 2\%$ for $C \geq 5pF$ $\Delta C \leq 0.25pF$ for $C < 5pF$
Temperature Cycling MIL-STD-202F Method 107E MIL-STD-883D Method 1010.7	-55°C to +125°C, 15 cycles – Accu-P®	No visible damage $\Delta C/C \leq 2\%$ for $C \geq 5pF$ $\Delta C \leq 0.25pF$ for $C < 5pF$
Resistance to Solder Heat IEC-68-2-58	260°C ± 5°C for 10 secs	C remains within initial limits

MECHANICAL CHARACTERISTICS

TEST	CONDITIONS	REQUIREMENT
Solderability IEC-68-2-58	Components completely immersed in a solder bath at 235°C for 2 secs.	Terminations to be well tinned, minimum 95% coverage
Leach Resistance IEC-68-2-58	Components completely immersed in a solder bath at 260±5°C for 60 secs.	Dissolution of termination faces ≤15% of area Dissolution of termination edges ≤25% of length
Adhesion MIL-STD-202F Method 211A	A force of 5N applied for 10 secs.	No visible damage
Termination Bond Strength IEC-68-2-21 Amend. 2	Tested as shown in diagram D = 3mm Accu-P D = 1mm Accu-F	No visible damage $\Delta C/C \leq 2\%$ for $C \geq 5pF$ $\Delta C \leq 0.25pF$ for $C < 5pF$
Robustness of Termination IEC-68-2-21 Amend. 2	A force of 5N applied for 10 secs.	No visible damage
High Frequency Vibration MIL-STD-202F Method 201A, 204D (Accu-P® only)	55Hz to 2000Hz, 20G	No visible damage
Storage	12 months minimum with components stored in "as received" packaging	Good solderability

QUALITY & RELIABILITY

Accu-P® is based on well established thin-film technology and materials.

• ON-LINE PROCESS CONTROL

This program forms an integral part of the production cycle and acts as a feedback system to regulate and control production processes. The test procedures, which are integrated into the production process, were developed after long research work and are based on the highly developed semiconductor industry test procedures and equipment. These measures help KYOCERA AVX to produce a consistent and high yield line of products.

• FINAL QUALITY INSPECTION

Finished parts are tested for standard electrical parameters and visual/mechanical characteristics. Each production lot is 100% evaluated for: capacitance and proof voltage at 2.5 UR. In addition, production is periodically evaluated for:

- Average capacitance with histogram printout for capacitance distribution;
- IR and Breakdown Voltage distribution;
- Temperature Coefficient;
- Solderability;
- Dimensional, mechanical and temperature stability.

QUALITY ASSURANCE

The reliability of these thin-film chip capacitors has been studied intensively for several years. Various measures have been taken to obtain the high reliability required today by the industry. Quality assurance policy is based on well established international industry standards. The reliability of the capacitors is determined by accelerated testing under the following conditions:

Life (Endurance)	125°C, 2UR, 1000 hours
Accelerated Damp Heat Steady State	85°C, 85% RH, UR, 1000 hours.

Accu-P® Series

Performance Characteristics RF Power Applications

RF POWER APPLICATIONS

In RF power applications capacitor losses generate heat. Two factors of particular importance to designers are:

- Minimizing the generation of heat.
- Dissipating heat as efficiently as possible.

CAPACITOR HEATING

- The major source of heat generation in a capacitor in RF power applications is a function of RF current (I) and ESR, from the relationship:
- Power dissipation = $I_{RMS}^2 \times ESR$
- Accu-P® capacitors are specially designed to minimize ESR and therefore RF heating. Values of ESR for Accu-P® capacitors are significantly less than those of ceramic MLC components currently available.

HEAT DISSIPATION

- Heat is dissipated from a capacitor through a variety of paths, but the key factor in the removal of heat is the thermal conductivity of the capacitor material.
- The higher the thermal conductivity of the capacitor, the more rapidly heat will be dissipated.
- The table below illustrates the importance of thermal conductivity to the performance of Accu-P® in power applications.

Data used in calculating the graph:

Thermal impedance of capacitors:

- 0402 17°C/W
- 0603 12°C/W
- 0805 6.5°C/W
- 1210 5°C/W

PRODUCT	MATERIAL	THERMAL CONDUCTIVITY W/mK
Accu-P® Microwave MLC	Alumina Magnesium Titanate	18.9 6.0



Thermal impedance measured using RF generator, amplifier and strip-line transformer. ESR of capacitors measured on Boonton 34A

THERMAL IMPEDANCE

Thermal impedance of Accu-P® chips is shown below compared with the thermal impedance of Microwave MLC's.

The thermal impedance expresses the temperature difference in °C between chip center and termination caused by a power dissipation of 1 watt in the chip. It is expressed in °C/W.

ADVANTAGES OF ACCU-P® IN RF POWER CIRCUITS

The optimized design of Accu-P® offers the designer of RF power circuits the following advantages:

- Reduced power losses due to the inherently low ESR of Accu-P®.
- Increased power dissipation due to the high thermal conductivity of Accu-P®.
- The only true test of a capacitor in any particular application is its performance under operating conditions in the actual circuit.

CAPACITOR TYPE	CHIP SIZE	THERMAL IMPEDANCE (°C/W)
Accu-P®	0805	6.5
	1210	5
Microwave MLC	0505	12
	1210	7.5

PRACTICAL APPLICATION IN RF POWER CIRCUITS

- There is a wide variety of different experimental methods for measuring the power handling performance of a capacitor in RF power circuits. Each method has its own problems and few of them exactly reproduce the conditions present in "real" circuit applications.
- Similarly, there is a very wide range of different circuit applications, all with their unique characteristics and operating conditions which cannot possibly be covered by such "theoretical" testing.

GENERAL

Accu-P® SMD capacitors are designed for soldering to printed circuit boards or other substrates. The construction of the components is such that they will withstand the time/temperature profiles used in both wave and reflow soldering methods.

CIRCUIT BOARD TYPE

The circuit board types which may be used with Accu-P® are as follows:

All flexible types of circuit boards
(eg. FR-4, G-10) and also alumina.

For other circuit board materials, please consult factory.

HANDLING

SMD capacitors should be handled with care to avoid damage or contamination from perspiration and skin oils. The use of plastic tipped tweezers or vacuum pick-ups is strongly recommended for individual components. Bulk handling should ensure that abrasion and mechanical shock are minimized. For automatic equipment, taped and reeled product gives the ideal medium for direct presentation to the placement machine.

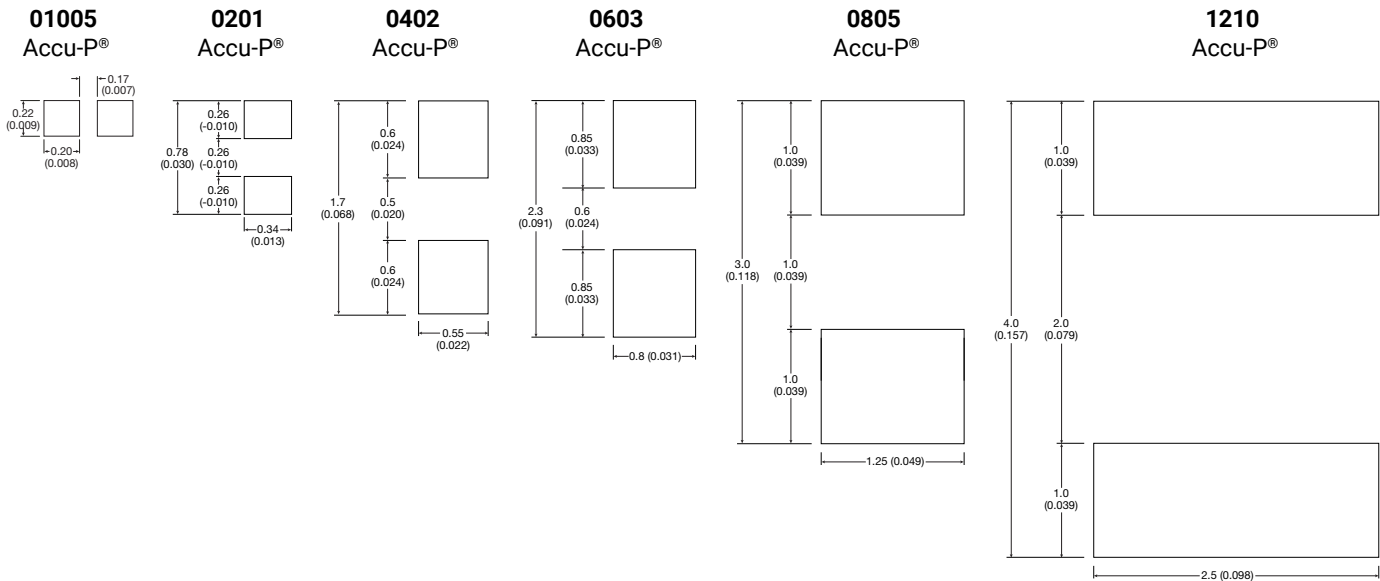
COMPONENT PAD DESIGN

Component pads must be designed to achieve good joints and minimize component movement during reflow soldering. Pad designs are given below for both wave and reflow soldering.

The basis of these designs is:

- Pad width equal to component width. It is permissible to decrease this to as low as 85% of component width but it is not advisable to go below this.
- Pad overlap 0.5mm beneath large components. Pad overlap about 0.3mm beneath small components.
- Pad extension of 0.5mm for reflow of large components and pad extension about 0.3mm for reflow of small components. Pad extension about 1.0mm for wave soldering.

REFLOW SOLDERING PAD DIMENSIONS: millimeters (inches)



PREHEAT & SOLDERING

The rate of preheat in production should not exceed 4°C/ second and a recommended maximum is about 2°C/second. Temperature differential from preheat to soldering should not exceed 100°C.

For further specific application or process advice, please consult KYOCERA AVX.

COOLING

After soldering, the assembly should preferably be allowed to cool naturally. In the event of assisted cooling, similar conditions to those recommended for preheating should be used.

HAND SOLDERING & REWORK

Hand soldering is permissible. Preheat of the PCB to 150°C is required. The most preferable technique is to use hot air soldering tools. Where a soldering iron is used, a temperature controlled model not exceeding 30 watts should be used and set to not more than 260°C.

CLEANING RECOMMENDATIONS

Care should be taken to ensure that the devices are thoroughly cleaned of flux residues, especially the space beneath the device. Such residues may otherwise become conductive and effectively offer a lossy bypass to the device. Various recommended cleaning conditions (which must be optimized for the flux system being used) are as follows:

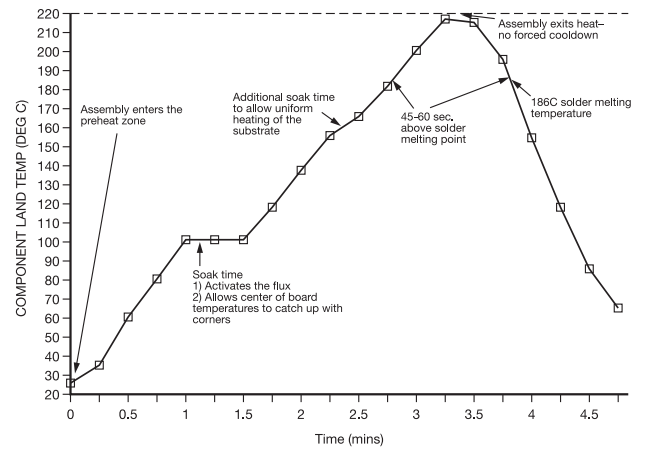
- Cleaning liquids i-propanol, ethanol, acetylacetone, water and other standard PCB cleaning liquids.
- Ultrasonic conditions power-20w/liter max. frequency-20kHz to 45kHz.
- Temperature 80°C maximum (if not otherwise limited by chosen solvent system).
- Time 5 minutes max.

STORAGE CONDITIONS

Recommended storage conditions for Accu-P® prior to use are as follows:

- Temperature 15°C to 35°C
- Humidity ≤65%
- Air Pressure 860mbar to 1060mbar

RECOMMENDED REFLOW SOLDERING PROFILE COMPONENTS WITH SNPB TERMINATIONS



RECOMMENDED REFLOW SOLDERING PROFILE LEAD FREE COMPONENTS WITH SN100 TERMINATIONS

