

#### THE IDEAL CAPACITOR

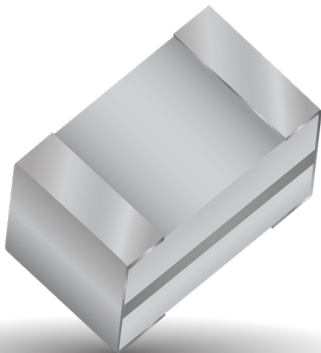
The non-ideal characteristics of a real capacitor can be ignored at low frequencies. Physical size imparts inductance to the capacitor and dielectric and metal electrodes result in resistive losses, but these often are of negligible effect on the circuit. At the very high frequencies of radio communication (>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."

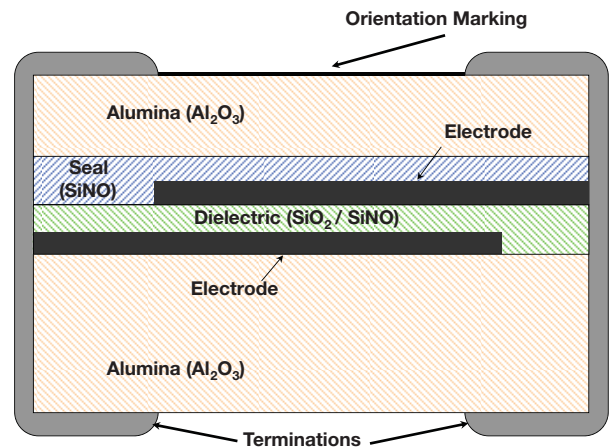


#### THIN-FILM TECHNOLOGY

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

# Thin-Film RF/Microwave Capacitor Technology

## Accu-P® Series

### Thin-Film Technology



#### 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 ( $\pm 0.01$ 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

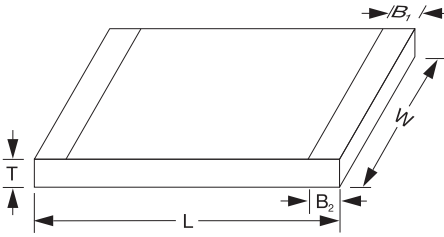
#### APPROVALS

- ISO 9001
- IATF 16949:2016

# Thin-Film RF/Microwave Capacitor Technology

## Accu-P® Series

### Thin-Film Chip Capacitors



#### ® (SIGNAL AND POWER TYPE CAPACITORS)

|    | 0201*                         | 0402*                                      | 0603*                      | 0805*                     |
|----|-------------------------------|--------------------------------------------|----------------------------|---------------------------|
| L  | 0.60±0.05<br>(0.023±0.002)    | 1.00±0.1<br>(0.039±0.004)                  | 1.60±0.1<br>(0.063±0.004)  | 2.01±0.1<br>(0.079±0.004) |
| W  | 0.325±0.050<br>(0.0128±0.002) | 0.55±0.07<br>(0.022±0.003)                 | 0.81±0.1<br>(0.032±0.004)  | 1.27±0.1<br>(0.050±0.004) |
| T  | 0.225±0.050<br>(0.009±0.002)  | 0.40±0.1<br>(0.016±0.004)                  | 0.63±0.1<br>(0.025±0.004)  | 0.93±0.2<br>(0.036±0.008) |
| B1 | 0.10±0.10<br>(0.004±0.004)    | (0.0 <sup>+0.004</sup> <sub>-0.004</sub> ) | 0.35±0.15<br>(0.014±0.006) | 0.30±0.1<br>(0.012±0.004) |
| B2 | 0.15±0.05<br>(0.006±0.002)    | 0.20±0.1<br>(0.008±0.004)                  | 0.35±0.15<br>(0.014±0.006) | 0.30±0.1<br>(0.012±0.004) |

\*Mount Black Side Up

DIMENSIONS: millimeters (inches)

#### HOW TO ORDER

| 0402                         | 3                                                                | J                                                                          | 4R7                                                                                                                                                                    | A                                                                                                                                                                                                                                                                                                                                                        | B                      | S                                                                                                                                                                                                                                                                               | TR               | \500   |
|------------------------------|------------------------------------------------------------------|----------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|--------|
| Size                         | Voltage                                                          | Temperature Coefficient (1)                                                | Capacitance                                                                                                                                                            | Tolerance                                                                                                                                                                                                                                                                                                                                                | Specification Code     | Termination Code                                                                                                                                                                                                                                                                | Packaging Code   | Option |
| 0201<br>0402<br>0603<br>0805 | 2 = 250V<br>1 = 100V<br>5 = 50V<br>3 = 25V<br>Y = 16V<br>Z = 10V | J = 0±30ppm/°C<br>(-55°C to +125°C)<br>K = 0±60ppm/°C<br>(-55°C to +125°C) | Capacitance expressed in pF.<br>(2 significant digits + number of zeros)<br>for values <10pF, letter R denotes decimal point.<br>Example:<br>68pF = 680<br>8.2pF = 8R2 | for C≤2.0pF*<br>Z = ±0.01pF<br>P = ±0.02pF<br>Q = ±0.03pF<br>A = ±0.05pF<br>B = ±0.1pF<br>C = ±0.25pF<br>for C≤3.0pF<br>Q = ±0.03pF<br>A = ±0.05pF<br>B = ±0.1pF<br>C = ±0.25pF<br>for C≤5.6pF<br>A = ±0.05pF<br>B = ±0.1pF<br>C = ±0.25pF<br>for 5.6pF<C<10pF<br>B = ±0.1pF<br>C = ±0.25pF<br>D = ±0.5pF<br>for C≥10pF<br>F = ±1%<br>G = ±2%<br>J = ±5% | B = Accu-P® technology | W=Nickel/Solder Coated<br>Accu-P® 0402 Sn90, Pb10***<br>T=Nickel/High Temperature Solder Coated<br>Accu-P® 0805**, 1210**<br>Sn96, Ag4<br>Nickel/Solder Coated<br>Accu-P® 0603***<br>Sn63, Pb37<br>**S=Nickel/Lead Free Solder Coated<br>Accu-P® 1005, 0201 0402, 0603<br>Sn100 | TR = Tape & Reel |        |

\*\*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 = ....8B5...     |
| 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.

#### 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 <sup>10</sup> Ohms for 0201 and 0402 size)          |
| Proof Voltage                           | 2.5 U <sub>R</sub> for 5 secs.                                      |
| Aging Characteristic                    | Zero                                                                |
| Dielectric Absorption                   | 0.01%                                                               |



For RoHS compliant products, please select correct termination style.

## Single and Power Type Capacitors

**TEMP. COEFFICIENT CODE**

"J" = 0±30PPM/°C (-55°C TO +125°C)<sup>(2)</sup> "K" = 0±60PPM/°C (-55°C TO +125°C)<sup>(2)</sup>

| Size      |   |          |      |    |    |    |    |      |     |    |    |    |      |     |     |    |      |     |    |      |     |    |
|-----------|---|----------|------|----|----|----|----|------|-----|----|----|----|------|-----|-----|----|------|-----|----|------|-----|----|
| Size Code |   |          | 0201 |    |    |    |    | 0402 |     |    |    |    | 0603 |     |     |    | 0805 |     |    | 1210 |     |    |
| Voltage   |   |          | 100  | 50 | 25 | 16 | 10 | 200  | 100 | 50 | 25 | 16 | 10   | 250 | 100 | 50 | 25   | 100 | 50 | 25   | 100 | 50 |
| Cap in pF |   | Cap code |      |    |    |    |    |      |     |    |    |    |      |     |     |    |      |     |    |      |     |    |
| 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      |      |    |    |    |    |      |     |    |    |    |      |     |     |    |      |     |    |      |     |    |
| 1.4       | — | 1R4      |      |    |    |    |    |      |     |    |    |    |      |     |     |    |      |     |    |      |     |    |
| 1.5       | — | 1R5      |      |    |    |    |    |      |     |    |    |    |      |     |     |    |      |     |    |      |     |    |
| 1.6       | — | 1R6      |      |    |    |    |    |      |     |    |    |    |      |     |     |    |      |     |    |      |     |    |
| 1.7       | — | 1R7      |      |    |    |    |    |      |     |    |    |    |      |     |     |    |      |     |    |      |     |    |
| 1.8       | — | 1R8      |      |    |    |    |    |      |     |    |    |    |      |     |     |    |      |     |    |      |     |    |
| 1.9       | — | 1R9      |      |    |    |    |    |      |     |    |    |    |      |     |     |    |      |     |    |      |     |    |
| 2.0       | — | 2R0      |      |    |    |    |    |      |     |    |    |    |      |     |     |    |      |     |    |      |     |    |
| 2.1       | — | 2R1      |      |    |    |    |    |      |     |    |    |    |      |     |     |    |      |     |    |      |     |    |
| 2.2       | — | 2R2      |      |    |    |    |    |      |     |    |    |    |      |     |     |    |      |     |    |      |     |    |
| 2.3       | — | 2R3      |      |    |    |    |    |      |     |    |    |    |      |     |     |    |      |     |    |      |     |    |
| 2.4       | — | 2R4      |      |    |    |    |    |      |     |    |    |    |      |     |     |    |      |     |    |      |     |    |
| 2.5       | — | 2R5      |      |    |    |    |    |      |     |    |    |    |      |     |     |    |      |     |    |      |     |    |
| 2.6       | — | 2R6      |      |    |    |    |    |      |     |    |    |    |      |     |     |    |      |     |    |      |     |    |
| 2.7       | — | 2R7      |      |    |    |    |    |      |     |    |    |    |      |     |     |    |      |     |    |      |     |    |
| 2.8       | — | 2R8      |      |    |    |    |    |      |     |    |    |    |      |     |     |    |      |     |    |      |     |    |
| 2.9       | — | 2R9      |      |    |    |    |    |      |     |    |    |    |      |     |     |    |      |     |    |      |     |    |
| 3.0       | — | 3R0      |      |    |    |    |    |      |     |    |    |    |      |     |     |    |      |     |    |      |     |    |
| 3.1       | — | 3R1      |      |    |    |    |    |      |     |    |    |    |      |     |     |    |      |     |    |      |     |    |
| 3.2       | — | 3R2      |      |    |    |    |    |      |     |    |    |    |      |     |     |    |      |     |    |      |     |    |
| 3.3       | — | 3R3      |      |    |    |    |    |      |     |    |    |    |      |     |     |    |      |     |    |      |     |    |
| 3.4       | — | 3R4      |      |    |    |    |    |      |     |    |    |    |      |     |     |    |      |     |    |      |     |    |
| 3.5       | — | 3R5      |      |    |    |    |    |      |     |    |    |    |      |     |     |    |      |     |    |      |     |    |
| 3.6       | — | 3R6      |      |    |    |    |    |      |     |    |    |    |      |     |     |    |      |     |    |      |     |    |
| 3.7       | — | 3R7      |      |    |    |    |    |      |     |    |    |    |      |     |     |    |      |     |    |      |     |    |
| 3.8       | — | 3R8      |      |    |    |    |    |      |     |    |    |    |      |     |     |    |      |     |    |      |     |    |
| 3.9       | — | 3R9      |      |    |    |    |    |      |     |    |    |    |      |     |     |    |      |     |    |      |     |    |
| 4.0       | — | 4R0      |      |    |    |    |    |      |     |    |    |    |      |     |     |    |      |     |    |      |     |    |
| 4.1       | — | 4R1      |      |    |    |    |    |      |     |    |    |    |      |     |     |    |      |     |    |      |     |    |
| 4.2       | — | 4R2      |      |    |    |    |    |      |     |    |    |    |      |     |     |    |      |     |    |      |     |    |
| 4.3       | — | 4R3      |      |    |    |    |    |      |     |    |    |    |      |     |     |    |      |     |    |      |     |    |
| 4.4       | — | 4R4      |      |    |    |    |    |      |     |    |    |    |      |     |     |    |      |     |    |      |     |    |
| 4.5       | — | 4R5      |      |    |    |    |    |      |     |    |    |    |      |     |     |    |      |     |    |      |     |    |
| 4.6       | — | 4R6      |      |    |    |    |    |      |     |    |    |    |      |     |     |    |      |     |    |      |     |    |
| 4.7       | — | 4R7      |      |    |    |    |    |      |     |    |    |    |      |     |     |    |      |     |    |      |     |    |
| 5.1       | — | 5R1      |      |    |    |    |    |      |     |    |    |    |      |     |     |    |      |     |    |      |     |    |
| 5.6       | — | 5R6      |      |    |    |    |    |      |     |    |    |    |      |     |     |    |      |     |    |      |     |    |
| 6.2       | — | 6R2      |      |    |    |    |    |      |     |    |    |    |      |     |     |    |      |     |    |      |     |    |
| 6.8       | — | 6R8      |      |    |    |    |    |      |     |    |    |    |      |     |     |    |      |     |    |      |     |    |
| 7.5       | — | 7R5      |      |    |    |    |    |      |     |    |    |    |      |     |     |    |      |     |    |      |     |    |
| 8.2       | — | 8R2      |      |    |    |    |    |      |     |    |    |    |      |     |     |    |      |     |    |      |     |    |
| 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.

# Thin-Film RF/Microwave Capacitor Technology

## Accu-P® Series

### 0201 Typical Electrical Tables



| Capacitance<br>@ 1MHz<br>and Tolerance |       | Self<br>Resonance<br>Frequency<br>(GHz)<br>Typ. | Q Standard Value<br>@ 1GHz |      | Frequency 900MHz    |           |                       | Frequency 1900MHz   |           |                       | Frequency 2400MHz   |           |                       |
|----------------------------------------|-------|-------------------------------------------------|----------------------------|------|---------------------|-----------|-----------------------|---------------------|-----------|-----------------------|---------------------|-----------|-----------------------|
| C (pF)                                 | Tol.  |                                                 | Typ.                       | Min. | C(eff) (pF)<br>Typ. | Q<br>Typ. | ESR<br>(mOhm)<br>Typ. | C(eff) (pF)<br>Typ. | Q<br>Typ. | ESR<br>(mOhm)<br>Typ. | C(eff) (pF)<br>Typ. | Q<br>Typ. | ESR<br>(mOhm)<br>Typ. |
| 0.05                                   | ±0.02 | 20.9                                            | 599                        | 402  | 0.055               | 650       | 3220                  | 0.056               | 265       | 4010                  | 0.057               | 195       | 4450                  |
| 0.1                                    | ±0.02 | 19.4                                            | 574                        | 316  | 0.110               | 614       | 2682                  | 0.112               | 246       | 3036                  | 0.113               | 188       | 3113                  |
| 0.15                                   | ±0.02 | 17.9                                            | 510                        | 280  | 0.163               | 550       | 2087                  | 0.166               | 220       | 2404                  | 0.168               | 170       | 2441                  |
| 0.2                                    | ±0.02 | 16.4                                            | 445                        | 245  | 0.216               | 520       | 1693                  | 0.220               | 210       | 1971                  | 0.223               | 160       | 1970                  |
| 0.25                                   | ±0.02 | 15.5                                            | 436                        | 240  | 0.262               | 510       | 1371                  | 0.268               | 204       | 1604                  | 0.272               | 153       | 1646                  |
| 0.3                                    | ±0.02 | 14.6                                            | 427                        | 235  | 0.309               | 500       | 1149                  | 0.316               | 199       | 1337                  | 0.320               | 146       | 1421                  |
| 0.35                                   | ±0.02 | 14.1                                            | 423                        | 232  | 0.360               | 494       | 1001                  | 0.369               | 196       | 1177                  | 0.374               | 144       | 1265                  |
| 0.4                                    | ±0.02 | 12.5                                            | 418                        | 230  | 0.411               | 489       | 874                   | 0.421               | 193       | 1038                  | 0.427               | 142       | 1129                  |
| 0.45                                   | ±0.02 | 11.9                                            | 413                        | 227  | 0.461               | 484       | 819                   | 0.473               | 191       | 972                   | 0.481               | 140       | 1066                  |
| 0.5                                    | ±0.02 | 11.3                                            | 408                        | 224  | 0.512               | 478       | 765                   | 0.526               | 188       | 906                   | 0.535               | 138       | 1003                  |
| 0.55                                   | ±0.02 | 10.9                                            | 403                        | 222  | 0.563               | 473       | 710                   | 0.578               | 186       | 840                   | 0.588               | 137       | 940                   |
| 0.6                                    | ±0.02 | 10.4                                            | 398                        | 219  | 0.614               | 468       | 667                   | 0.631               | 183       | 791                   | 0.642               | 135       | 882                   |
| 0.65                                   | ±0.02 | 10.0                                            | 394                        | 217  | 0.664               | 462       | 624                   | 0.683               | 181       | 742                   | 0.695               | 133       | 825                   |
| 0.7                                    | ±0.02 | 9.5                                             | 389                        | 214  | 0.715               | 457       | 580                   | 0.735               | 178       | 693                   | 0.749               | 131       | 767                   |
| 0.75                                   | ±0.02 | 9.3                                             | 384                        | 211  | 0.766               | 452       | 557                   | 0.788               | 176       | 664                   | 0.802               | 129       | 729                   |
| 0.8                                    | ±0.02 | 9.1                                             | 379                        | 209  | 0.817               | 446       | 534                   | 0.840               | 173       | 635                   | 0.856               | 127       | 692                   |
| 0.85                                   | ±0.02 | 8.9                                             | 374                        | 206  | 0.868               | 441       | 511                   | 0.893               | 171       | 606                   | 0.909               | 126       | 654                   |
| 0.9                                    | ±0.02 | 8.8                                             | 370                        | 203  | 0.918               | 436       | 487                   | 0.945               | 168       | 577                   | 0.963               | 124       | 616                   |
| 0.95                                   | ±0.02 | 8.6                                             | 365                        | 201  | 0.969               | 430       | 464                   | 0.998               | 166       | 548                   | 1.016               | 122       | 579                   |
| 1                                      | ±0.02 | 8.4                                             | 360                        | 198  | 1.020               | 425       | 441                   | 1.050               | 163       | 519                   | 1.070               | 120       | 541                   |
| 1.05                                   | ±0.02 | 8.2                                             | 358                        | 197  | 1.078               | 421       | 426                   | 1.112               | 161       | 502                   | 1.134               | 119       | 523                   |
| 1.1                                    | ±0.02 | 8.0                                             | 355                        | 195  | 1.135               | 418       | 410                   | 1.173               | 159       | 486                   | 1.199               | 117       | 505                   |
| 1.15                                   | ±0.02 | 7.8                                             | 353                        | 194  | 1.193               | 414       | 395                   | 1.235               | 157       | 469                   | 1.263               | 116       | 488                   |
| 1.2                                    | ±0.02 | 7.6                                             | 350                        | 193  | 1.251               | 411       | 379                   | 1.296               | 155       | 452                   | 1.327               | 115       | 470                   |
| 1.25                                   | ±0.02 | 7.5                                             | 348                        | 191  | 1.308               | 407       | 364                   | 1.358               | 153       | 436                   | 1.392               | 114       | 452                   |
| 1.3                                    | ±0.02 | 7.4                                             | 345                        | 190  | 1.366               | 403       | 348                   | 1.419               | 151       | 419                   | 1.456               | 112       | 434                   |
| 1.35                                   | ±0.02 | 7.3                                             | 343                        | 189  | 1.424               | 400       | 333                   | 1.481               | 149       | 402                   | 1.520               | 111       | 416                   |
| 1.4                                    | ±0.02 | 7.2                                             | 340                        | 187  | 1.481               | 396       | 317                   | 1.542               | 147       | 386                   | 1.585               | 110       | 398                   |
| 1.45                                   | ±0.02 | 7.1                                             | 338                        | 186  | 1.539               | 393       | 302                   | 1.604               | 145       | 369                   | 1.649               | 109       | 381                   |
| 1.5                                    | ±0.02 | 7.0                                             | 335                        | 184  | 1.597               | 389       | 287                   | 1.665               | 144       | 353                   | 1.713               | 107       | 363                   |
| 1.55                                   | ±0.02 | 6.8                                             | 332                        | 183  | 1.642               | 386       | 282                   | 1.714               | 142       | 347                   | 1.764               | 106       | 358                   |
| 1.6                                    | ±0.02 | 6.7                                             | 330                        | 181  | 1.687               | 382       | 277                   | 1.762               | 141       | 342                   | 1.815               | 105       | 352                   |
| 1.65                                   | ±0.02 | 6.6                                             | 327                        | 180  | 1.732               | 378       | 272                   | 1.810               | 140       | 337                   | 1.866               | 104       | 347                   |
| 1.7                                    | ±0.02 | 6.5                                             | 324                        | 178  | 1.777               | 375       | 267                   | 1.859               | 138       | 331                   | 1.917               | 103       | 342                   |
| 1.75                                   | ±0.02 | 6.4                                             | 321                        | 176  | 1.822               | 371       | 262                   | 1.907               | 137       | 326                   | 1.968               | 102       | 337                   |
| 1.8                                    | ±0.02 | 6.3                                             | 318                        | 175  | 1.866               | 367       | 257                   | 1.955               | 136       | 321                   | 2.018               | 101       | 331                   |
| 1.85                                   | ±0.02 | 6.2                                             | 315                        | 173  | 1.911               | 364       | 252                   | 2.003               | 134       | 316                   | 2.069               | 100       | 326                   |
| 1.9                                    | ±0.02 | 6.2                                             | 312                        | 172  | 1.956               | 360       | 247                   | 2.052               | 133       | 310                   | 2.120               | 99        | 321                   |
| 1.95                                   | ±0.02 | 6.1                                             | 309                        | 170  | 2.001               | 357       | 242                   | 2.100               | 132       | 305                   | 2.171               | 98        | 316                   |
| 2                                      | ±0.03 | 6.0                                             | 306                        | 168  | 2.046               | 353       | 237                   | 2.148               | 131       | 300                   | 2.222               | 97        | 310                   |
| 2.1                                    | ±0.03 | 5.9                                             | 301                        | 166  | 2.150               | 348       | 232                   | 2.263               | 128       | 293                   | 2.344               | 95        | 303                   |
| 2.2                                    | ±0.03 | 5.7                                             | 296                        | 163  | 2.254               | 343       | 227                   | 2.377               | 125       | 287                   | 2.467               | 93        | 296                   |
| 2.3                                    | ±0.03 | 5.6                                             | 292                        | 160  | 2.358               | 337       | 222                   | 2.491               | 122       | 281                   | 2.590               | 91        | 289                   |
| 2.4                                    | ±0.03 | 5.5                                             | 287                        | 158  | 2.462               | 332       | 217                   | 2.606               | 120       | 274                   | 2.712               | 89        | 282                   |
| 2.5                                    | ±0.03 | 5.4                                             | 282                        | 155  | 2.566               | 327       | 212                   | 2.720               | 117       | 268                   | 2.835               | 87        | 275                   |
| 2.6                                    | ±0.03 | 5.3                                             | 277                        | 152  | 2.670               | 322       | 207                   | 2.834               | 114       | 262                   | 2.958               | 85        | 268                   |
| 2.7                                    | ±0.03 | 5.2                                             | 272                        | 150  | 2.773               | 317       | 202                   | 2.949               | 112       | 255                   | 3.080               | 83        | 261                   |
| 2.8                                    | ±0.03 | 5.1                                             | 269                        | 148  | 2.878               | 312       | 199                   | 3.066               | 110       | 252                   | 3.209               | 81        | 258                   |
| 2.9                                    | ±0.03 | 5.0                                             | 265                        | 146  | 2.983               | 308       | 196                   | 3.184               | 108       | 248                   | 3.337               | 80        | 254                   |
| 3                                      | ±0.03 | 4.9                                             | 261                        | 144  | 3.088               | 304       | 193                   | 3.301               | 106       | 245                   | 3.465               | 78        | 251                   |
| 3.1                                    | ±0.05 | 4.8                                             | 257                        | 141  | 3.192               | 299       | 190                   | 3.419               | 105       | 241                   | 3.593               | 77        | 247                   |
| 3.2                                    | ±0.05 | 4.7                                             | 253                        | 139  | 3.297               | 295       | 187                   | 3.536               | 103       | 238                   | 3.722               | 76        | 244                   |
| 3.3                                    | ±0.05 | 4.6                                             | 250                        | 137  | 3.402               | 291       | 185                   | 3.654               | 101       | 234                   | 3.850               | 74        | 240                   |
| 3.4                                    | ±0.05 | 4.6                                             | 246                        | 135  | 3.506               | 286       | 182                   | 3.771               | 99        | 231                   | 3.978               | 73        | 237                   |
| 3.5                                    | ±0.05 | 4.5                                             | 242                        | 133  | 3.611               | 282       | 179                   | 3.889               | 98        | 227                   | 4.107               | 71        | 233                   |
| 3.6                                    | ±0.05 | 4.5                                             | 238                        | 131  | 3.716               | 278       | 176                   | 4.006               | 96        | 224                   | 4.235               | 70        | 230                   |
| 3.7                                    | ±0.05 | 4.4                                             | 234                        | 129  | 3.820               | 273       | 173                   | 4.124               | 94        | 220                   | 4.363               | 69        | 226                   |
| 3.8                                    | ±0.05 | 4.4                                             | 230                        | 127  | 3.925               | 269       | 170                   | 4.241               | 92        | 217                   | 4.492               | 67        | 223                   |

# Thin-Film RF/Microwave Capacitor Technology

## Accu-P® Series

### 0201 Typical Electrical Tables



| Capacitance<br>@ 1MHz<br>and Tolerance |       | Self<br>Resonance<br>Frequency<br>(GHz)<br>Typ. | Q Standard Value<br>@ 1GHz |      | Frequency 900MHz    |           |                       | Frequency 1900MHz   |           |                       | Frequency 2400MHz   |           |                       |
|----------------------------------------|-------|-------------------------------------------------|----------------------------|------|---------------------|-----------|-----------------------|---------------------|-----------|-----------------------|---------------------|-----------|-----------------------|
| C (pF)                                 | Tol.  |                                                 | Typ.                       | Min. | C(eff) (pF)<br>Typ. | Q<br>Typ. | ESR<br>(mOhm)<br>Typ. | C(eff) (pF)<br>Typ. | Q<br>Typ. | ESR<br>(mOhm)<br>Typ. | C(eff) (pF)<br>Typ. | Q<br>Typ. | ESR<br>(mOhm)<br>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                    |

| Capacitance<br>@ 1MHz<br>and Tolerance |       | Self<br>Resonance<br>Frequency<br>(GHz)<br>Typ. | Q Standard Value<br>@ 1GHz |      | Frequency<br>900MHz |           |                       | Frequency<br>1900MHz |           |                       | Frequency<br>2400MHz |        |                       |
|----------------------------------------|-------|-------------------------------------------------|----------------------------|------|---------------------|-----------|-----------------------|----------------------|-----------|-----------------------|----------------------|--------|-----------------------|
| C (pF)                                 | Tol.  |                                                 | Typ.                       | Min. | C(eff) (pF)<br>Typ. | Q<br>Typ. | ESR<br>(mOhm)<br>Typ. | C(eff) (pF)<br>Typ.  | Q<br>Typ. | ESR<br>(mOhm)<br>Typ. | C(eff) (pF)<br>Typ.  | Q Typ. | ESR<br>(mOhm)<br>Typ. |
| 0.05                                   | ±0.02 | 20.9                                            | 856                        | 471  | 0.06                | 881       | 1411                  | 0.06                 | 562       | 1216                  | 0.06                 | 498    | 983                   |
| 0.1                                    | ±0.02 | 19.4                                            | 848                        | 466  | 0.11                | 873       | 1316                  | 0.11                 | 554       | 1115                  | 0.11                 | 490    | 914                   |
| 0.15                                   | ±0.02 | 17.9                                            | 840                        | 462  | 0.16                | 866       | 1222                  | 0.16                 | 547       | 1013                  | 0.16                 | 482    | 845                   |
| 0.2                                    | ±0.02 | 16.4                                            | 832                        | 457  | 0.21                | 858       | 1128                  | 0.21                 | 539       | 912                   | 0.22                 | 474    | 776                   |
| 0.25                                   | ±0.02 | 15.5                                            | 823                        | 453  | 0.26                | 850       | 1033                  | 0.27                 | 532       | 810                   | 0.27                 | 465    | 707                   |
| 0.3                                    | ±0.02 | 14.6                                            | 815                        | 448  | 0.31                | 842       | 939                   | 0.32                 | 525       | 708                   | 0.32                 | 457    | 638                   |
| 0.35                                   | ±0.02 | 14.1                                            | 807                        | 444  | 0.36                | 834       | 844                   | 0.37                 | 517       | 607                   | 0.37                 | 449    | 569                   |
| 0.4                                    | ±0.02 | 12.5                                            | 799                        | 439  | 0.41                | 827       | 750                   | 0.42                 | 510       | 505                   | 0.42                 | 441    | 500                   |
| 0.45                                   | ±0.02 | 11.9                                            | 791                        | 435  | 0.46                | 819       | 667                   | 0.47                 | 502       | 458                   | 0.48                 | 432    | 453                   |
| 0.5                                    | ±0.02 | 11.3                                            | 783                        | 430  | 0.51                | 811       | 583                   | 0.52                 | 495       | 410                   | 0.53                 | 424    | 407                   |
| 0.55                                   | ±0.02 | 10.9                                            | 774                        | 426  | 0.57                | 803       | 500                   | 0.57                 | 487       | 363                   | 0.58                 | 416    | 360                   |
| 0.6                                    | ±0.02 | 10.4                                            | 766                        | 421  | 0.62                | 796       | 465                   | 0.62                 | 480       | 343                   | 0.63                 | 408    | 339                   |
| 0.65                                   | ±0.02 | 10.0                                            | 758                        | 417  | 0.67                | 788       | 431                   | 0.67                 | 472       | 322                   | 0.68                 | 399    | 317                   |
| 0.7                                    | ±0.02 | 9.5                                             | 750                        | 413  | 0.72                | 780       | 396                   | 0.72                 | 465       | 302                   | 0.73                 | 391    | 296                   |
| 0.75                                   | ±0.02 | 9.3                                             | 746                        | 410  | 0.77                | 776       | 375                   | 0.78                 | 456       | 290                   | 0.79                 | 381    | 285                   |
| 0.8                                    | ±0.02 | 9.1                                             | 743                        | 408  | 0.82                | 772       | 354                   | 0.83                 | 447       | 277                   | 0.84                 | 370    | 273                   |
| 0.85                                   | ±0.02 | 9.0                                             | 739                        | 406  | 0.87                | 768       | 334                   | 0.88                 | 438       | 265                   | 0.89                 | 360    | 262                   |
| 0.9                                    | ±0.02 | 8.8                                             | 735                        | 404  | 0.92                | 764       | 313                   | 0.93                 | 429       | 253                   | 0.95                 | 350    | 250                   |
| 0.95                                   | ±0.02 | 8.4                                             | 732                        | 402  | 0.97                | 760       | 292                   | 0.98                 | 420       | 240                   | 1.00                 | 339    | 239                   |
| 1                                      | ±0.02 | 8.0                                             | 728                        | 400  | 1.02                | 756       | 271                   | 1.04                 | 411       | 228                   | 1.05                 | 329    | 227                   |
| 1.05                                   | ±0.02 | 7.9                                             | 725                        | 398  | 1.07                | 752       | 258                   | 1.09                 | 406       | 221                   | 1.11                 | 323    | 221                   |
| 1.1                                    | ±0.02 | 7.8                                             | 721                        | 397  | 1.12                | 749       | 245                   | 1.14                 | 401       | 214                   | 1.16                 | 318    | 214                   |
| 1.15                                   | ±0.02 | 7.6                                             | 718                        | 395  | 1.17                | 745       | 232                   | 1.20                 | 396       | 207                   | 1.22                 | 312    | 208                   |
| 1.2                                    | ±0.02 | 7.4                                             | 714                        | 393  | 1.22                | 742       | 218                   | 1.25                 | 391       | 200                   | 1.27                 | 306    | 202                   |
| 1.25                                   | ±0.02 | 7.2                                             | 711                        | 391  | 1.27                | 738       | 205                   | 1.31                 | 386       | 193                   | 1.32                 | 301    | 195                   |
| 1.3                                    | ±0.02 | 7.0                                             | 707                        | 389  | 1.32                | 734       | 192                   | 1.36                 | 381       | 185                   | 1.38                 | 295    | 189                   |
| 1.35                                   | ±0.02 | 6.9                                             | 704                        | 387  | 1.37                | 731       | 179                   | 1.41                 | 376       | 178                   | 1.43                 | 289    | 183                   |
| 1.4                                    | ±0.02 | 6.8                                             | 700                        | 385  | 1.42                | 727       | 165                   | 1.47                 | 371       | 171                   | 1.49                 | 283    | 177                   |
| 1.45                                   | ±0.02 | 6.7                                             | 697                        | 383  | 1.47                | 724       | 152                   | 1.52                 | 366       | 164                   | 1.54                 | 278    | 170                   |
| 1.5                                    | ±0.02 | 6.5                                             | 693                        | 381  | 1.52                | 720       | 139                   | 1.58                 | 361       | 157                   | 1.60                 | 272    | 164                   |
| 1.55                                   | ±0.02 | 6.5                                             | 690                        | 379  | 1.56                | 716       | 135                   | 1.62                 | 358       | 153                   | 1.65                 | 269    | 159                   |
| 1.6                                    | ±0.02 | 6.5                                             | 686                        | 377  | 1.61                | 713       | 130                   | 1.67                 | 355       | 148                   | 1.70                 | 267    | 155                   |
| 1.65                                   | ±0.02 | 6.5                                             | 683                        | 375  | 1.66                | 709       | 126                   | 1.72                 | 352       | 143                   | 1.76                 | 264    | 150                   |
| 1.7                                    | ±0.02 | 6.4                                             | 679                        | 373  | 1.71                | 705       | 122                   | 1.77                 | 349       | 139                   | 1.81                 | 261    | 146                   |
| 1.75                                   | ±0.02 | 6.3                                             | 676                        | 372  | 1.75                | 702       | 118                   | 1.82                 | 347       | 134                   | 1.86                 | 259    | 141                   |
| 1.8                                    | ±0.02 | 6.2                                             | 672                        | 370  | 1.80                | 698       | 113                   | 1.87                 | 344       | 130                   | 1.92                 | 256    | 137                   |
| 1.85                                   | ±0.02 | 6.1                                             | 669                        | 368  | 1.85                | 694       | 109                   | 1.92                 | 341       | 125                   | 1.97                 | 253    | 132                   |
| 1.9                                    | ±0.02 | 6.0                                             | 665                        | 366  | 1.90                | 690       | 105                   | 1.97                 | 338       | 121                   | 2.02                 | 251    | 128                   |
| 1.95                                   | ±0.02 | 5.9                                             | 662                        | 364  | 1.94                | 687       | 101                   | 2.01                 | 335       | 116                   | 2.08                 | 248    | 123                   |
| 2                                      | ±0.03 | 5.7                                             | 658                        | 362  | 1.99                | 683       | 96                    | 2.06                 | 332       | 112                   | 2.13                 | 245    | 119                   |
| 2.1                                    | ±0.03 | 5.4                                             | 651                        | 358  | 2.10                | 676       | 93                    | 2.18                 | 326       | 108                   | 2.26                 | 241    | 115                   |
| 2.2                                    | ±0.03 | 5.1                                             | 643                        | 354  | 2.21                | 669       | 89                    | 2.30                 | 321       | 104                   | 2.38                 | 236    | 112                   |
| 2.3                                    | ±0.03 | 5.0                                             | 636                        | 350  | 2.31                | 662       | 85                    | 2.42                 | 315       | 101                   | 2.51                 | 231    | 109                   |
| 2.4                                    | ±0.03 | 4.9                                             | 629                        | 346  | 2.42                | 656       | 81                    | 2.54                 | 309       | 97                    | 2.64                 | 226    | 106                   |
| 2.5                                    | ±0.03 | 4.7                                             | 622                        | 342  | 2.53                | 649       | 77                    | 2.65                 | 303       | 94                    | 2.76                 | 221    | 102                   |
| 2.6                                    | ±0.03 | 4.6                                             | 614                        | 338  | 2.64                | 642       | 74                    | 2.77                 | 298       | 90                    | 2.89                 | 216    | 99                    |
| 2.7                                    | ±0.03 | 4.5                                             | 607                        | 334  | 2.75                | 635       | 70                    | 2.89                 | 292       | 86                    | 3.02                 | 211    | 96                    |
| 2.8                                    | ±0.03 | 4.5                                             | 600                        | 330  | 2.85                | 628       | 68                    | 3.01                 | 288       | 83                    | 3.15                 | 207    | 92                    |
| 2.9                                    | ±0.03 | 4.4                                             | 592                        | 326  | 2.95                | 621       | 66                    | 3.13                 | 283       | 80                    | 3.28                 | 203    | 88                    |
| 3                                      | ±0.03 | 4.4                                             | 585                        | 322  | 3.06                | 614       | 64                    | 3.24                 | 279       | 76                    | 3.41                 | 200    | 84                    |
| 3.1                                    | ±0.05 | 4.4                                             | 578                        | 318  | 3.16                | 607       | 62                    | 3.36                 | 274       | 73                    | 3.54                 | 196    | 80                    |
| 3.2                                    | ±0.05 | 4.3                                             | 570                        | 314  | 3.27                | 600       | 60                    | 3.48                 | 270       | 70                    | 3.67                 | 192    | 76                    |
| 3.3                                    | ±0.05 | 4.3                                             | 563                        | 310  | 3.37                | 593       | 58                    | 3.60                 | 265       | 67                    | 3.80                 | 188    | 72                    |
| 3.4                                    | ±0.05 | 4.3                                             | 556                        | 306  | 3.47                | 586       | 57                    | 3.71                 | 261       | 63                    | 3.93                 | 184    | 68                    |
| 3.5                                    | ±0.05 | 4.2                                             | 548                        | 302  | 3.58                | 579       | 55                    | 3.83                 | 256       | 60                    | 4.06                 | 180    | 64                    |
| 3.6                                    | ±0.05 | 4.2                                             | 541                        | 298  | 3.68                | 572       | 53                    | 3.95                 | 252       | 57                    | 4.19                 | 177    | 60                    |
| 3.7                                    | ±0.05 | 4.1                                             | 534                        | 294  | 3.78                | 565       | 51                    | 4.06                 | 247       | 54                    | 4.32                 | 173    | 56                    |
| 3.8                                    | ±0.05 | 4.0                                             | 526                        | 289  | 3.89                | 558       | 49                    | 4.18                 | 243       | 50                    | 4.45                 | 169    | 52                    |

# Thin-Film RF/Microwave Capacitor Technology

## Accu-P® Series

### 0402 Typical Electrical Tables



| Capacitance<br>@ 1MHz<br>and Tolerance |       | Self<br>Resonance<br>Frequency<br>(GHz)<br>Typ. | Q Standard Value<br>@ 1GHz |      | Frequency<br>900MHz |           |                       | Frequency<br>1900MHz |           |                       | Frequency<br>2400MHz |        |                       |
|----------------------------------------|-------|-------------------------------------------------|----------------------------|------|---------------------|-----------|-----------------------|----------------------|-----------|-----------------------|----------------------|--------|-----------------------|
| C (pF)                                 | Tol.  |                                                 | Typ.                       | Min. | C(eff) (pF)<br>Typ. | Q<br>Typ. | ESR<br>(mOhm)<br>Typ. | C(eff) (pF)<br>Typ.  | Q<br>Typ. | ESR<br>(mOhm)<br>Typ. | C(eff) (pF)<br>Typ.  | Q Typ. | ESR<br>(mOhm)<br>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<br>@ 1MHz<br>and Tolerance |       | Self<br>Resonance<br>Frequency<br>(GHz)<br>Typ. | Q Standard Value<br>@ 1GHz |      | Frequency<br>900MHz |           |                       | Frequency<br>1900MHz |           |                       | Frequency<br>2400MHz |        |                       |
|----------------------------------------|-------|-------------------------------------------------|----------------------------|------|---------------------|-----------|-----------------------|----------------------|-----------|-----------------------|----------------------|--------|-----------------------|
| C (pF)                                 | Tol.  |                                                 | Typ.                       | Min. | C(eff)<br>(pF) Typ. | Q<br>Typ. | ESR<br>(mOhm)<br>Typ. | C(eff)<br>(pF) Typ.  | Q<br>Typ. | ESR<br>(mOhm)<br>Typ. | C(eff)<br>(pF) Typ.  | Q Typ. | ESR<br>(mOhm)<br>Typ. |
| 0.05                                   | ±0.02 | 25.6                                            | 1200                       | 660  | 0.06                | 1333      | 945                   | 0.06                 | 556       | 832                   | 0.06                 | 397    | 880                   |
| 0.1                                    | ±0.02 | 18.1                                            | 1156                       | 636  | 0.11                | 1284      | 675                   | 0.11                 | 535       | 628                   | 0.11                 | 382    | 667                   |
| 0.15                                   | ±0.02 | 14.8                                            | 1111                       | 611  | 0.16                | 1235      | 555                   | 0.16                 | 514       | 533                   | 0.16                 | 367    | 567                   |
| 0.2                                    | ±0.02 | 12.8                                            | 1067                       | 587  | 0.21                | 1185      | 483                   | 0.21                 | 494       | 474                   | 0.22                 | 353    | 505                   |
| 0.25                                   | ±0.02 | 11.4                                            | 1022                       | 562  | 0.26                | 1136      | 433                   | 0.27                 | 473       | 433                   | 0.27                 | 338    | 462                   |
| 0.3                                    | ±0.02 | 10.4                                            | 978                        | 538  | 0.31                | 1086      | 397                   | 0.32                 | 453       | 402                   | 0.32                 | 323    | 430                   |
| 0.35                                   | ±0.02 | 9.7                                             | 933                        | 513  | 0.36                | 1037      | 368                   | 0.37                 | 432       | 378                   | 0.37                 | 309    | 404                   |
| 0.4                                    | ±0.02 | 9.0                                             | 889                        | 489  | 0.41                | 988       | 345                   | 0.42                 | 412       | 358                   | 0.42                 | 294    | 383                   |
| 0.45                                   | ±0.02 | 8.5                                             | 844                        | 464  | 0.46                | 938       | 326                   | 0.47                 | 391       | 341                   | 0.48                 | 279    | 365                   |
| 0.5                                    | ±0.02 | 8.1                                             | 800                        | 440  | 0.51                | 889       | 310                   | 0.52                 | 370       | 327                   | 0.53                 | 265    | 350                   |
| 0.55                                   | ±0.02 | 7.7                                             | 788                        | 434  | 0.57                | 875       | 296                   | 0.57                 | 363       | 315                   | 0.58                 | 261    | 337                   |
| 0.6                                    | ±0.02 | 7.4                                             | 777                        | 427  | 0.62                | 860       | 283                   | 0.62                 | 356       | 304                   | 0.63                 | 258    | 326                   |
| 0.65                                   | ±0.02 | 7.1                                             | 765                        | 421  | 0.67                | 846       | 273                   | 0.67                 | 348       | 294                   | 0.68                 | 255    | 315                   |
| 0.7                                    | ±0.02 | 6.8                                             | 754                        | 414  | 0.72                | 832       | 263                   | 0.72                 | 341       | 285                   | 0.73                 | 252    | 306                   |
| 0.75                                   | ±0.02 | 6.6                                             | 742                        | 408  | 0.77                | 817       | 254                   | 0.78                 | 334       | 277                   | 0.79                 | 248    | 298                   |
| 0.8                                    | ±0.02 | 6.4                                             | 730                        | 402  | 0.82                | 803       | 247                   | 0.83                 | 326       | 270                   | 0.84                 | 245    | 290                   |
| 0.85                                   | ±0.02 | 6.2                                             | 719                        | 395  | 0.87                | 789       | 239                   | 0.88                 | 319       | 264                   | 0.89                 | 242    | 283                   |
| 0.9                                    | ±0.02 | 6.0                                             | 707                        | 389  | 0.92                | 775       | 233                   | 0.93                 | 312       | 258                   | 0.95                 | 239    | 277                   |
| 0.95                                   | ±0.02 | 5.9                                             | 696                        | 383  | 0.97                | 760       | 227                   | 0.98                 | 304       | 252                   | 1.00                 | 235    | 271                   |
| 1                                      | ±0.02 | 5.7                                             | 684                        | 376  | 1.019               | 746       | 216                   | 1.061                | 297       | 242                   | 1.101                | 232    | 260                   |
| 1.05                                   | ±0.02 | 5.6                                             | 667                        | 367  | 1.076               | 731       | 213                   | 1.126                | 290       | 239                   | 1.171                | 226    | 256                   |
| 1.1                                    | ±0.02 | 5.4                                             | 649                        | 357  | 1.134               | 717       | 210                   | 1.190                | 282       | 236                   | 1.241                | 220    | 253                   |
| 1.15                                   | ±0.02 | 5.3                                             | 632                        | 347  | 1.192               | 702       | 206                   | 1.254                | 275       | 233                   | 1.311                | 214    | 250                   |
| 1.2                                    | ±0.02 | 5.2                                             | 614                        | 338  | 1.250               | 687       | 203                   | 1.318                | 267       | 230                   | 1.381                | 209    | 247                   |
| 1.25                                   | ±0.02 | 5.1                                             | 605                        | 333  | 1.307               | 677       | 200                   | 1.382                | 262       | 227                   | 1.451                | 203    | 244                   |
| 1.3                                    | ±0.02 | 5.0                                             | 596                        | 328  | 1.365               | 667       | 197                   | 1.446                | 257       | 224                   | 1.521                | 197    | 241                   |
| 1.35                                   | ±0.02 | 4.9                                             | 587                        | 323  | 1.423               | 658       | 194                   | 1.511                | 252       | 221                   | 1.591                | 191    | 238                   |
| 1.4                                    | ±0.02 | 4.8                                             | 578                        | 318  | 1.481               | 648       | 190                   | 1.575                | 247       | 218                   | 1.661                | 185    | 235                   |
| 1.45                                   | ±0.02 | 4.8                                             | 569                        | 313  | 1.538               | 638       | 187                   | 1.639                | 242       | 215                   | 1.731                | 179    | 232                   |
| 1.5                                    | ±0.02 | 4.7                                             | 560                        | 308  | 1.596               | 628       | 184                   | 1.703                | 237       | 212                   | 1.801                | 173    | 229                   |
| 1.55                                   | ±0.02 | 4.6                                             | 551                        | 303  | 1.645               | 620       | 181                   | 1.760                | 233       | 209                   | 1.866                | 170    | 226                   |
| 1.6                                    | ±0.02 | 4.5                                             | 542                        | 298  | 1.694               | 611       | 178                   | 1.817                | 228       | 206                   | 1.930                | 166    | 222                   |
| 1.65                                   | ±0.02 | 4.5                                             | 534                        | 293  | 1.743               | 603       | 175                   | 1.874                | 224       | 203                   | 1.995                | 163    | 219                   |
| 1.7                                    | ±0.02 | 4.4                                             | 525                        | 289  | 1.792               | 595       | 172                   | 1.931                | 219       | 200                   | 2.060                | 159    | 216                   |
| 1.75                                   | ±0.02 | 4.3                                             | 516                        | 284  | 1.841               | 587       | 169                   | 1.988                | 215       | 197                   | 2.124                | 156    | 213                   |
| 1.8                                    | ±0.02 | 4.2                                             | 507                        | 279  | 1.890               | 578       | 166                   | 2.045                | 211       | 194                   | 2.189                | 153    | 209                   |
| 1.85                                   | ±0.02 | 4.2                                             | 498                        | 274  | 1.939               | 570       | 163                   | 2.102                | 206       | 191                   | 2.253                | 149    | 206                   |
| 1.9                                    | ±0.02 | 4.1                                             | 490                        | 269  | 1.988               | 562       | 160                   | 2.158                | 202       | 188                   | 2.318                | 146    | 203                   |
| 1.95                                   | ±0.02 | 4.1                                             | 481                        | 264  | 2.037               | 553       | 157                   | 2.215                | 197       | 185                   | 2.383                | 142    | 199                   |
| 2                                      | ±0.03 | 4.0                                             | 472                        | 260  | 2.086               | 545       | 154                   | 2.272                | 193       | 182                   | 2.447                | 139    | 196                   |
| 2.1                                    | ±0.03 | 3.9                                             | 462                        | 254  | 2.190               | 535       | 151                   | 2.402                | 187       | 180                   | 2.604                | 134    | 193                   |
| 2.2                                    | ±0.03 | 3.8                                             | 452                        | 249  | 2.295               | 524       | 148                   | 2.532                | 181       | 177                   | 2.761                | 129    | 191                   |
| 2.3                                    | ±0.03 | 3.8                                             | 442                        | 243  | 2.400               | 514       | 145                   | 2.662                | 175       | 175                   | 2.917                | 124    | 188                   |
| 2.4                                    | ±0.03 | 3.7                                             | 433                        | 238  | 2.504               | 503       | 143                   | 2.793                | 168       | 172                   | 3.074                | 118    | 186                   |
| 2.5                                    | ±0.03 | 3.6                                             | 423                        | 232  | 2.609               | 493       | 140                   | 2.923                | 162       | 170                   | 3.230                | 113    | 183                   |
| 2.6                                    | ±0.03 | 3.6                                             | 413                        | 227  | 2.714               | 482       | 137                   | 3.053                | 156       | 167                   | 3.387                | 108    | 181                   |
| 2.7                                    | ±0.03 | 3.5                                             | 403                        | 222  | 2.818               | 472       | 134                   | 3.183                | 150       | 165                   | 3.543                | 103    | 178                   |
| 2.8                                    | ±0.03 | 3.4                                             | 395                        | 217  | 2.933               | 463       | 133                   | 3.336                | 147       | 164                   | 3.742                | 100    | 177                   |
| 2.9                                    | ±0.03 | 3.4                                             | 388                        | 213  | 3.047               | 453       | 131                   | 3.489                | 144       | 162                   | 3.940                | 97     | 175                   |
| 3                                      | ±0.03 | 3.3                                             | 380                        | 209  | 3.162               | 444       | 130                   | 3.642                | 140       | 161                   | 4.139                | 95     | 174                   |
| 3.1                                    | ±0.05 | 3.2                                             | 372                        | 205  | 3.276               | 435       | 129                   | 3.795                | 137       | 160                   | 4.337                | 92     | 172                   |
| 3.2                                    | ±0.05 | 3.2                                             | 365                        | 201  | 3.391               | 425       | 127                   | 3.947                | 134       | 159                   | 4.536                | 89     | 171                   |
| 3.3                                    | ±0.05 | 3.1                                             | 357                        | 196  | 3.506               | 416       | 126                   | 4.100                | 131       | 157                   | 4.734                | 86     | 169                   |
| 3.4                                    | ±0.05 | 3.1                                             | 349                        | 192  | 3.620               | 407       | 125                   | 4.253                | 128       | 156                   | 4.933                | 84     | 168                   |
| 3.5                                    | ±0.05 | 3.1                                             | 342                        | 188  | 3.735               | 397       | 123                   | 4.406                | 125       | 155                   | 5.131                | 81     | 166                   |
| 3.6                                    | ±0.05 | 3.0                                             | 334                        | 184  | 3.849               | 388       | 122                   | 4.559                | 121       | 154                   | 5.330                | 78     | 165                   |
| 3.7                                    | ±0.05 | 3.0                                             | 326                        | 179  | 3.964               | 379       | 121                   | 4.712                | 118       | 152                   | 5.528                | 75     | 164                   |
| 3.8                                    | ±0.05 | 3.0                                             | 318                        | 175  | 4.078               | 369       | 119                   | 4.865                | 115       | 151                   | 5.727                | 73     | 162                   |

# Thin-Film RF/Microwave Capacitor Technology

## Accu-P® Series

### 0603 Typical Electrical Tables



| Capacitance<br>@ 1MHz<br>and Tolerance |       | Self<br>Resonance<br>Frequency<br>(GHz)<br>Typ. | Q Standard Value<br>@ 1GHz |      | Frequency<br>900MHz |           |                       | Frequency<br>1900MHz |           |                       | Frequency<br>2400MHz |        |                       |
|----------------------------------------|-------|-------------------------------------------------|----------------------------|------|---------------------|-----------|-----------------------|----------------------|-----------|-----------------------|----------------------|--------|-----------------------|
| C (pF)                                 | Tol.  |                                                 | Typ.                       | Min. | C(eff)<br>(pF) Typ. | Q<br>Typ. | ESR<br>(mOhm)<br>Typ. | C(eff)<br>(pF) Typ.  | Q<br>Typ. | ESR<br>(mOhm)<br>Typ. | C(eff)<br>(pF) Typ.  | Q Typ. | ESR<br>(mOhm)<br>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<br>@ 1MHz<br>and Tolerance |       | Self<br>Resonance<br>Frequency<br>(GHz)<br>Typ. | Q Standard Value<br>@ 1GHz |      | Frequency<br>900MHz |           |                       | Frequency<br>1900MHz |           |                       | Frequency<br>2400MHz |        |                       |
|----------------------------------------|-------|-------------------------------------------------|----------------------------|------|---------------------|-----------|-----------------------|----------------------|-----------|-----------------------|----------------------|--------|-----------------------|
| C (pF)                                 | Tol.  |                                                 | Typ.                       | Min. | C(eff)<br>(pF) Typ. | Q<br>Typ. | ESR<br>(mOhm)<br>Typ. | C(eff)<br>(pF) Typ.  | Q<br>Typ. | ESR<br>(mOhm)<br>Typ. | C(eff)<br>(pF) Typ.  | Q Typ. | ESR<br>(mOhm)<br>Typ. |
| 0.1                                    | ±0.02 | 17.2                                            | 880                        | 484  | 0.125               | 890       | 3296                  | 0.125                | 545       | 2417                  | 0.126                | 447    | 2265                  |
| 0.15                                   | ±0.02 | 14.1                                            | 872                        | 480  | 0.176               | 885       | 2073                  | 0.178                | 530       | 1626                  | 0.181                | 434    | 1546                  |
| 0.2                                    | ±0.02 | 12.3                                            | 864                        | 475  | 0.228               | 880       | 1492                  | 0.231                | 516       | 1227                  | 0.235                | 420    | 1178                  |
| 0.25                                   | ±0.02 | 11.0                                            | 857                        | 471  | 0.279               | 874       | 1156                  | 0.284                | 501       | 986                   | 0.290                | 407    | 955                   |
| 0.3                                    | ±0.02 | 10.1                                            | 849                        | 467  | 0.331               | 869       | 938                   | 0.337                | 487       | 825                   | 0.344                | 394    | 804                   |
| 0.35                                   | ±0.02 | 9.4                                             | 841                        | 462  | 0.382               | 864       | 787                   | 0.390                | 472       | 710                   | 0.399                | 380    | 695                   |
| 0.4                                    | ±0.02 | 8.8                                             | 833                        | 458  | 0.433               | 859       | 675                   | 0.443                | 458       | 623                   | 0.453                | 367    | 613                   |
| 0.45                                   | ±0.02 | 8.3                                             | 825                        | 454  | 0.485               | 853       | 590                   | 0.496                | 443       | 555                   | 0.508                | 353    | 549                   |
| 0.5                                    | ±0.02 | 7.9                                             | 817                        | 450  | 0.536               | 848       | 523                   | 0.549                | 429       | 501                   | 0.562                | 340    | 497                   |
| 0.55                                   | ±0.02 | 7.5                                             | 811                        | 446  | 0.584               | 843       | 469                   | 0.600                | 420       | 456                   | 0.616                | 331    | 454                   |
| 0.6                                    | ±0.02 | 7.2                                             | 805                        | 443  | 0.631               | 838       | 425                   | 0.651                | 411       | 419                   | 0.670                | 322    | 418                   |
| 0.65                                   | ±0.02 | 6.9                                             | 798                        | 439  | 0.679               | 834       | 387                   | 0.702                | 402       | 387                   | 0.724                | 313    | 388                   |
| 0.7                                    | ±0.02 | 6.7                                             | 792                        | 436  | 0.726               | 829       | 356                   | 0.753                | 393       | 360                   | 0.778                | 304    | 362                   |
| 0.75                                   | ±0.02 | 6.5                                             | 786                        | 432  | 0.774               | 824       | 329                   | 0.804                | 384       | 337                   | 0.832                | 295    | 339                   |
| 0.8                                    | ±0.02 | 6.3                                             | 779                        | 429  | 0.822               | 819       | 306                   | 0.855                | 375       | 316                   | 0.886                | 286    | 319                   |
| 0.85                                   | ±0.02 | 6.1                                             | 773                        | 425  | 0.869               | 814       | 285                   | 0.906                | 366       | 298                   | 0.940                | 277    | 301                   |
| 0.9                                    | ±0.02 | 5.9                                             | 767                        | 422  | 0.917               | 810       | 267                   | 0.957                | 357       | 282                   | 0.994                | 268    | 285                   |
| 0.95                                   | ±0.02 | 5.8                                             | 760                        | 418  | 0.964               | 805       | 251                   | 1.008                | 348       | 267                   | 1.049                | 260    | 271                   |
| 1                                      | ±0.02 | 5.6                                             | 754                        | 415  | 1.012               | 800       | 231                   | 1.059                | 339       | 235                   | 1.103                | 251    | 242                   |
| 1.05                                   | ±0.02 | 5.5                                             | 747                        | 411  | 1.065               | 794       | 223                   | 1.120                | 335       | 228                   | 1.170                | 247    | 235                   |
| 1.1                                    | ±0.02 | 5.4                                             | 740                        | 407  | 1.119               | 788       | 215                   | 1.181                | 330       | 221                   | 1.237                | 244    | 228                   |
| 1.15                                   | ±0.02 | 5.3                                             | 732                        | 403  | 1.172               | 782       | 208                   | 1.242                | 326       | 214                   | 1.304                | 240    | 220                   |
| 1.2                                    | ±0.02 | 5.1                                             | 725                        | 399  | 1.225               | 776       | 200                   | 1.304                | 322       | 207                   | 1.371                | 237    | 213                   |
| 1.25                                   | ±0.02 | 5.0                                             | 718                        | 395  | 1.279               | 770       | 192                   | 1.365                | 318       | 200                   | 1.438                | 233    | 206                   |
| 1.3                                    | ±0.02 | 4.9                                             | 711                        | 391  | 1.332               | 764       | 184                   | 1.426                | 313       | 193                   | 1.505                | 230    | 199                   |
| 1.35                                   | ±0.02 | 4.9                                             | 704                        | 387  | 1.386               | 758       | 176                   | 1.487                | 309       | 186                   | 1.573                | 226    | 192                   |
| 1.4                                    | ±0.02 | 4.8                                             | 696                        | 383  | 1.439               | 752       | 169                   | 1.548                | 305       | 179                   | 1.640                | 223    | 184                   |
| 1.45                                   | ±0.02 | 4.7                                             | 689                        | 379  | 1.492               | 746       | 161                   | 1.609                | 300       | 172                   | 1.707                | 219    | 177                   |
| 1.5                                    | ±0.02 | 4.6                                             | 682                        | 375  | 1.546               | 740       | 153                   | 1.670                | 296       | 165                   | 1.774                | 216    | 170                   |
| 1.55                                   | ±0.02 | 4.6                                             | 675                        | 371  | 1.600               | 733       | 151                   | 1.734                | 292       | 163                   | 1.850                | 212    | 168                   |
| 1.6                                    | ±0.02 | 4.5                                             | 668                        | 367  | 1.654               | 726       | 148                   | 1.799                | 287       | 161                   | 1.927                | 208    | 165                   |
| 1.65                                   | ±0.02 | 4.4                                             | 660                        | 363  | 1.708               | 719       | 146                   | 1.864                | 283       | 159                   | 2.003                | 204    | 163                   |
| 1.7                                    | ±0.02 | 4.3                                             | 653                        | 359  | 1.762               | 712       | 143                   | 1.928                | 278       | 157                   | 2.079                | 200    | 160                   |
| 1.75                                   | ±0.02 | 4.3                                             | 646                        | 355  | 1.816               | 705       | 141                   | 1.993                | 274       | 155                   | 2.156                | 197    | 158                   |
| 1.8                                    | ±0.02 | 4.2                                             | 639                        | 351  | 1.870               | 698       | 139                   | 2.058                | 269       | 152                   | 2.232                | 193    | 155                   |
| 1.85                                   | ±0.02 | 4.2                                             | 632                        | 347  | 1.924               | 691       | 136                   | 2.122                | 265       | 150                   | 2.308                | 189    | 153                   |
| 1.9                                    | ±0.02 | 4.1                                             | 624                        | 343  | 1.978               | 684       | 134                   | 2.187                | 260       | 148                   | 2.385                | 185    | 150                   |
| 1.95                                   | ±0.02 | 4.1                                             | 617                        | 339  | 2.033               | 677       | 131                   | 2.252                | 256       | 146                   | 2.461                | 181    | 148                   |
| 2                                      | ±0.03 | 4.0                                             | 610                        | 336  | 2.087               | 670       | 129                   | 2.316                | 251       | 144                   | 2.537                | 177    | 145                   |
| 2.1                                    | ±0.03 | 3.9                                             | 597                        | 328  | 2.183               | 658       | 127                   | 2.440                | 245       | 142                   | 2.690                | 171    | 143                   |
| 2.2                                    | ±0.03 | 3.8                                             | 584                        | 321  | 2.280               | 646       | 124                   | 2.563                | 239       | 139                   | 2.843                | 165    | 141                   |
| 2.3                                    | ±0.03 | 3.8                                             | 571                        | 314  | 2.377               | 634       | 122                   | 2.687                | 233       | 137                   | 2.996                | 159    | 139                   |
| 2.4                                    | ±0.03 | 3.6                                             | 557                        | 307  | 2.474               | 623       | 119                   | 2.810                | 227       | 135                   | 3.149                | 154    | 136                   |
| 2.5                                    | ±0.03 | 3.6                                             | 544                        | 299  | 2.571               | 611       | 117                   | 2.934                | 221       | 133                   | 3.301                | 148    | 134                   |
| 2.6                                    | ±0.03 | 3.6                                             | 531                        | 292  | 2.668               | 599       | 114                   | 3.057                | 215       | 130                   | 3.454                | 142    | 132                   |
| 2.7                                    | ±0.03 | 3.4                                             | 518                        | 285  | 2.764               | 587       | 112                   | 3.181                | 209       | 128                   | 3.607                | 136    | 130                   |
| 2.8                                    | ±0.03 | 3.4                                             | 507                        | 279  | 2.875               | 575       | 111                   | 3.348                | 204       | 127                   | 3.850                | 132    | 129                   |
| 2.9                                    | ±0.03 | 3.4                                             | 497                        | 273  | 2.987               | 564       | 110                   | 3.514                | 199       | 125                   | 4.093                | 129    | 127                   |
| 3                                      | ±0.03 | 3.3                                             | 486                        | 267  | 3.098               | 552       | 109                   | 3.681                | 194       | 124                   | 4.335                | 125    | 126                   |
| 3.1                                    | ±0.05 | 3.3                                             | 475                        | 261  | 3.209               | 540       | 108                   | 3.848                | 189       | 123                   | 4.578                | 121    | 125                   |
| 3.2                                    | ±0.05 | 3.2                                             | 465                        | 256  | 3.320               | 528       | 107                   | 4.014                | 183       | 122                   | 4.821                | 118    | 123                   |
| 3.3                                    | ±0.05 | 3.1                                             | 454                        | 250  | 3.431               | 517       | 106                   | 4.181                | 178       | 120                   | 5.064                | 114    | 122                   |
| 3.4                                    | ±0.05 | 3.1                                             | 443                        | 244  | 3.542               | 505       | 105                   | 4.348                | 173       | 119                   | 5.307                | 110    | 121                   |
| 3.5                                    | ±0.05 | 3.1                                             | 433                        | 238  | 3.653               | 493       | 104                   | 4.515                | 168       | 118                   | 5.549                | 107    | 119                   |
| 3.6                                    | ±0.05 | 3.0                                             | 422                        | 232  | 3.764               | 481       | 103                   | 4.681                | 163       | 116                   | 5.792                | 103    | 118                   |
| 3.7                                    | ±0.05 | 3.0                                             | 412                        | 226  | 3.875               | 470       | 102                   | 4.848                | 158       | 115                   | 6.035                | 99     | 116                   |
| 3.8                                    | ±0.05 | 3.0                                             | 401                        | 220  | 3.986               | 458       | 101                   | 5.015                | 153       | 114                   | 6.278                | 96     | 115                   |
| 3.9                                    | ±0.05 | 2.9                                             | 390                        | 215  | 4.097               | 446       | 100                   | 5.182                | 148       | 113                   | 6.521                | 92     | 114                   |
| 4                                      | ±0.05 | 2.9                                             | 384                        | 211  | 4.214               | 440       | 99                    | 5.378                | 144       | 112                   | 6.861                | 89     | 113                   |
| 4.1                                    | ±0.05 | 2.9                                             | 378                        | 208  | 4.331               | 434       | 98                    | 5.574                | 141       | 112                   | 7.201                | 86     | 113                   |
| 4.2                                    | ±0.05 | 2.8                                             | 372                        | 205  | 4.448               | 428       | 98                    | 5.769                | 138       | 111                   | 7.541                | 84     | 112                   |

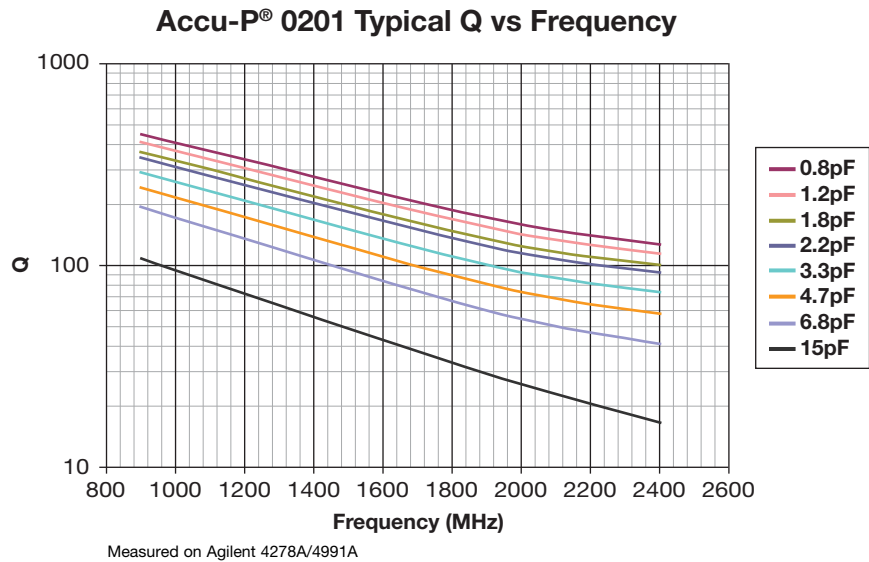
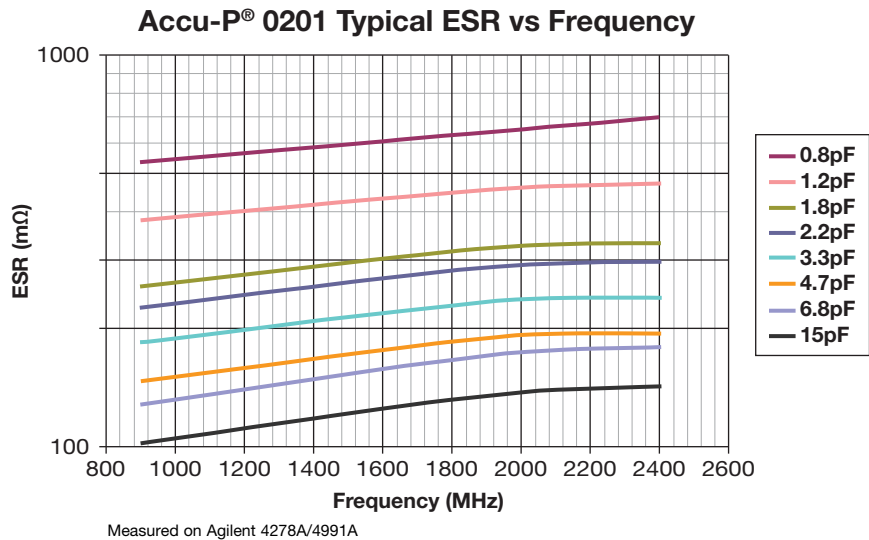
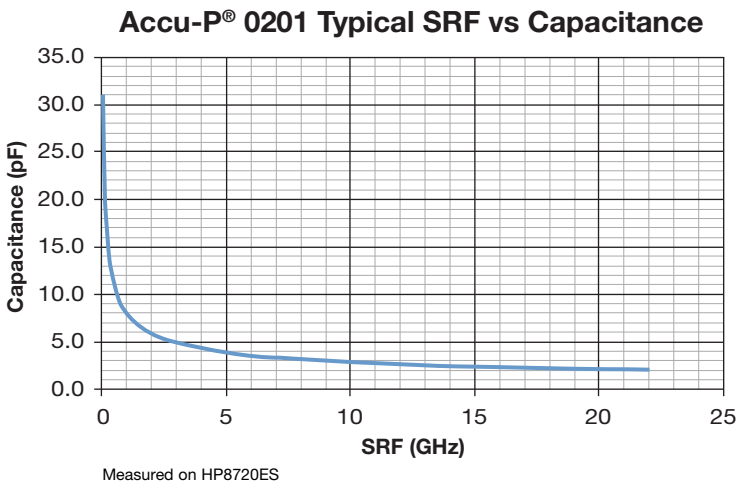
# Thin-Film RF/Microwave Capacitor Technology

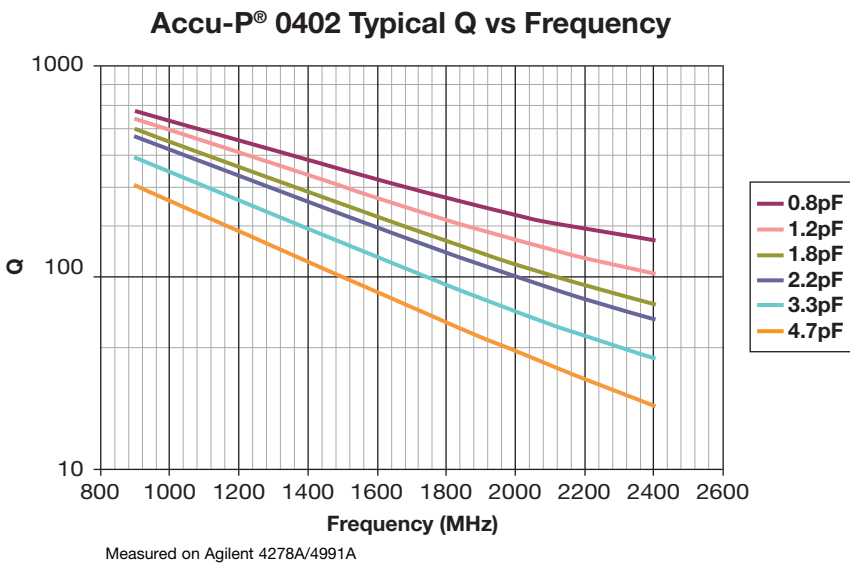
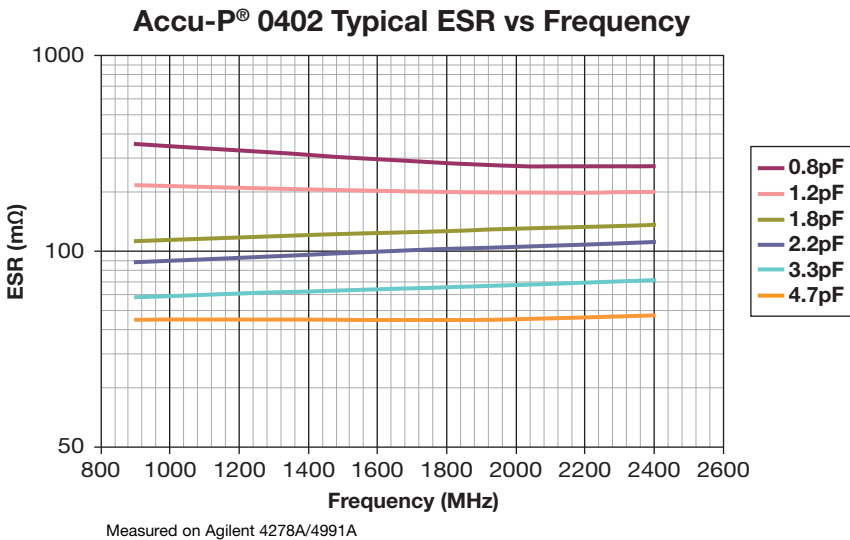
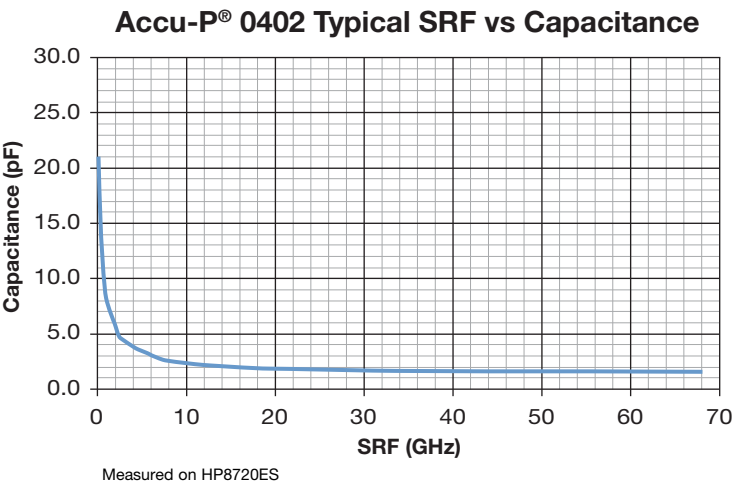
## Accu-P® Series

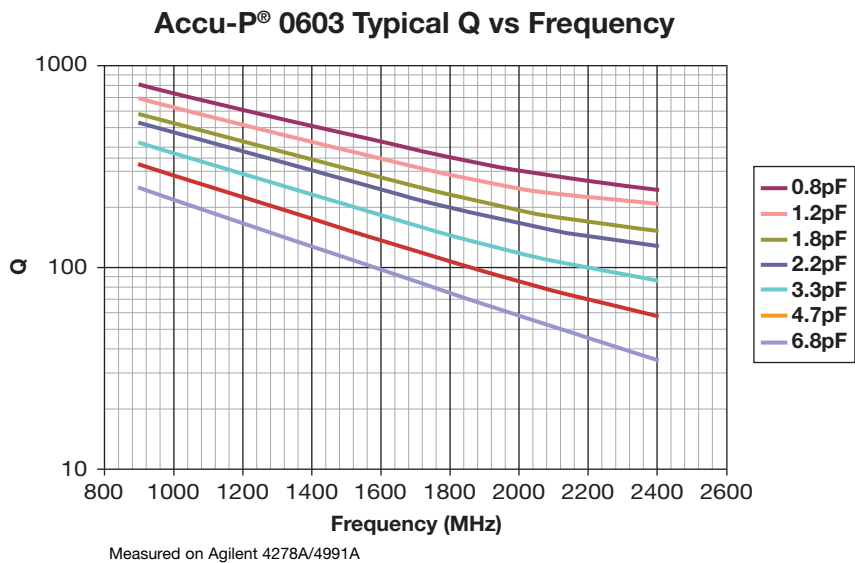
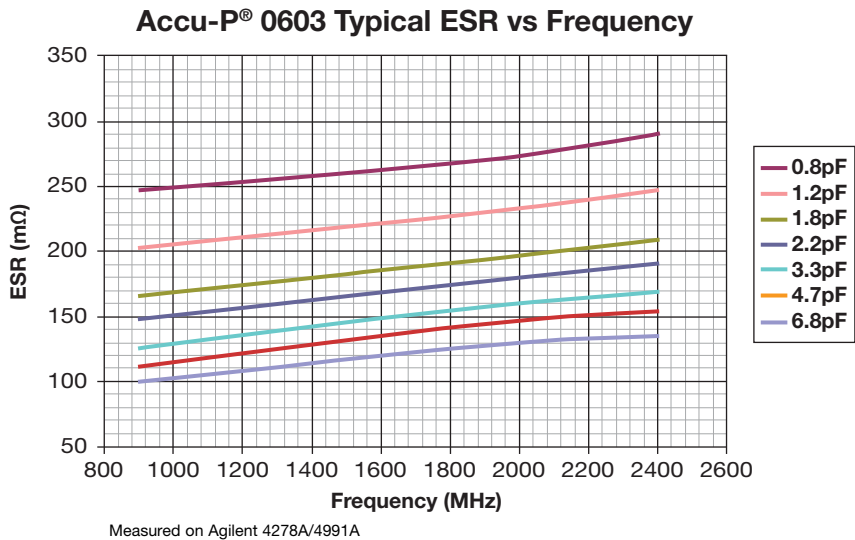
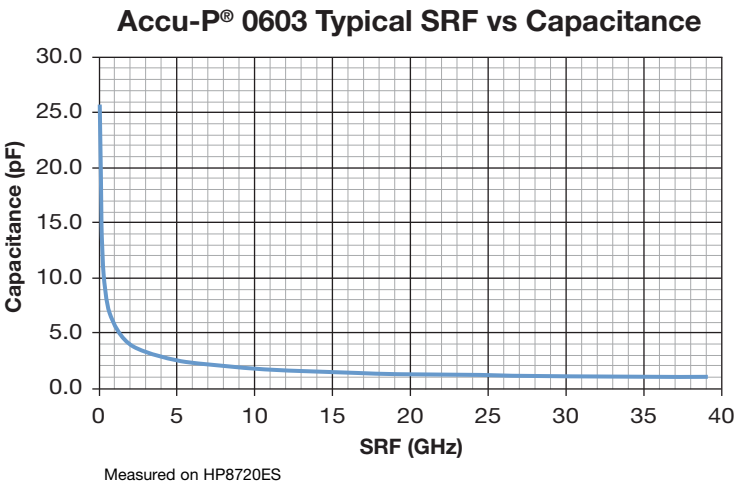
### 0805 Typical Electrical Tables

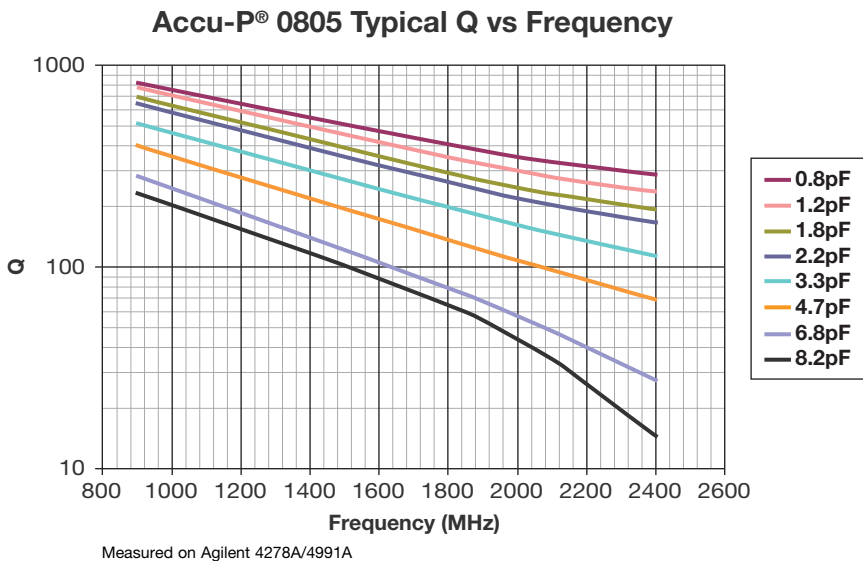
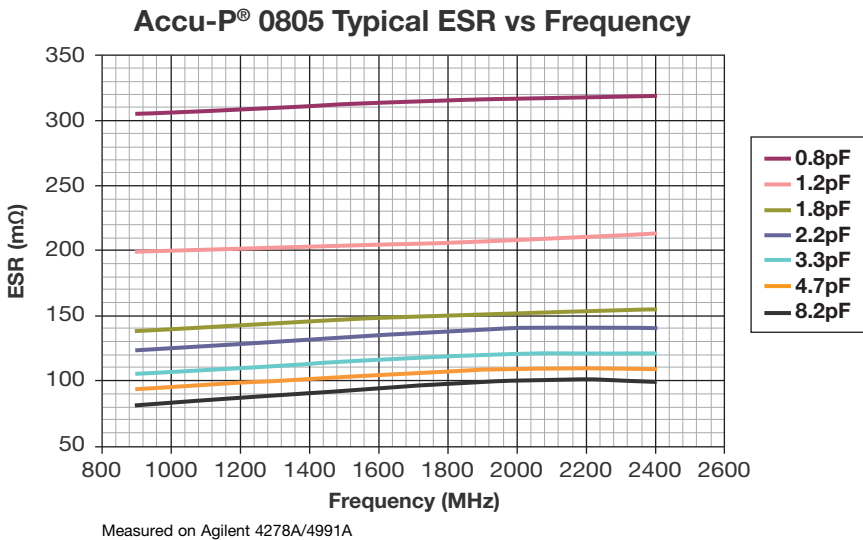
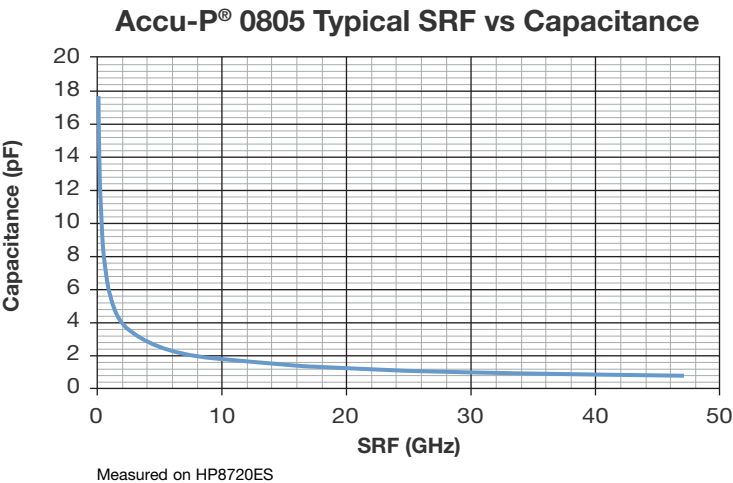


| Capacitance<br>@ 1MHz<br>and Tolerance |       | Self<br>Resonance<br>Frequency<br>(GHz)<br>Typ. | Q Standard Value<br>@ 1GHz |      | Frequency<br>900MHz |           |                       | Frequency<br>1900MHz |           |                       | Frequency<br>2400MHz |        |                       |
|----------------------------------------|-------|-------------------------------------------------|----------------------------|------|---------------------|-----------|-----------------------|----------------------|-----------|-----------------------|----------------------|--------|-----------------------|
| C (pF)                                 | Tol.  |                                                 | Typ.                       | Min. | C(eff)<br>(pF) Typ. | Q<br>Typ. | ESR<br>(mOhm)<br>Typ. | C(eff)<br>(pF) Typ.  | Q<br>Typ. | ESR<br>(mOhm)<br>Typ. | C(eff)<br>(pF) Typ.  | Q Typ. | ESR<br>(mOhm)<br>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                   |







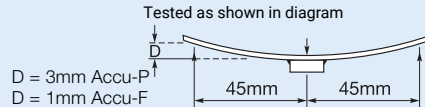




#### ENVIRONMENTAL CHARACTERISTICS

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

#### MECHANICAL CHARACTERISTICS

| TEST                                                                      | CONDITIONS                                                                                                       | REQUIREMENT                                                                                                              |
|---------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| Solderability<br>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<br>IEC-68-2-58                                           | Components completely immersed in a solder bath at 260 $\pm$ 5°C for 60 secs.                                    | Dissolution of termination faces $\leq 15\%$ of area<br>Dissolution of termination edges $\leq 25\%$ of length           |
| Adhesion<br>MIL-STD-202F Method 211A                                      | A force of 5N applied for 10 secs.                                                                               | No visible damage                                                                                                        |
| Termination Bond Strength<br>IEC-68-2-21 Amend. 2                         | Tested as shown in diagram<br> | No visible damage<br>$\Delta C/C \leq 2\%$ for $C \geq 5\text{pF}$<br>$\Delta C \leq 0.25\text{pF}$ for $C < 5\text{pF}$ |
| Robustness of Termination<br>IEC-68-2-21 Amend. 2                         | A force of 5N applied for 10 secs.                                                                               | No visible damage                                                                                                        |
| High Frequency Vibration<br>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<br>Heat Steady State | 85°C, 85% RH, UR, 1000 hours. |

# Thin-Film RF/Microwave Capacitor Technology

## 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

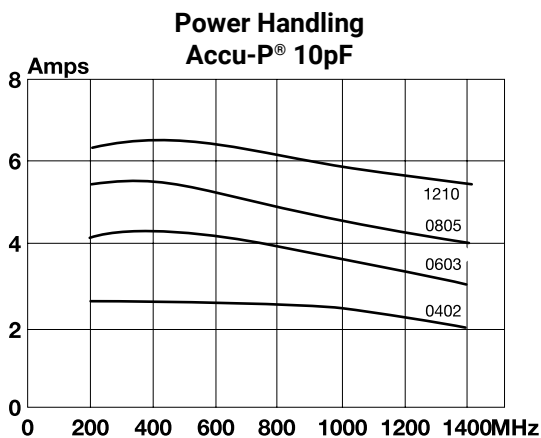
- Heat is dissipated from a capacitor through a variety of paths, but the key factor in the removal of heat is the thermal conductivity of the capacitor material.
- The higher the thermal conductivity of the capacitor, the more rapidly heat will be dissipated.
- The table below illustrates the importance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

| PRODUCT                  | MATERIAL                      | THERMAL CONDUCTIVITY W/mK |
|--------------------------|-------------------------------|---------------------------|
| Accu-P®<br>Microwave MLC | Alumina<br>Magnesium Titanate | 18.9<br>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.

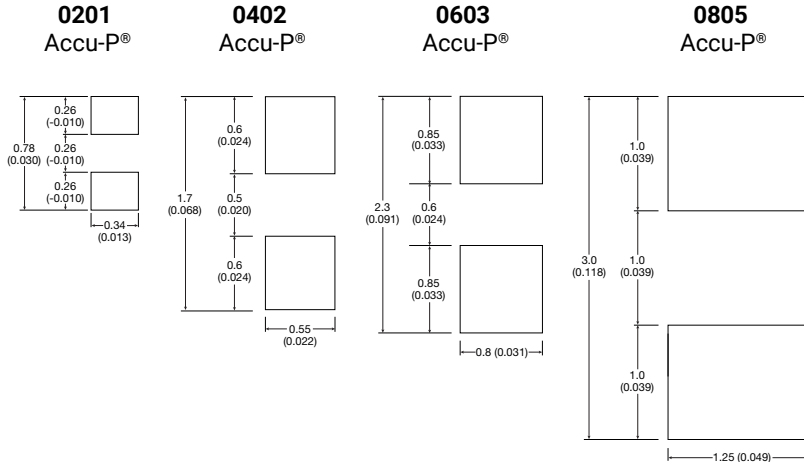
#### COMPONENT PAD DESIGN

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:

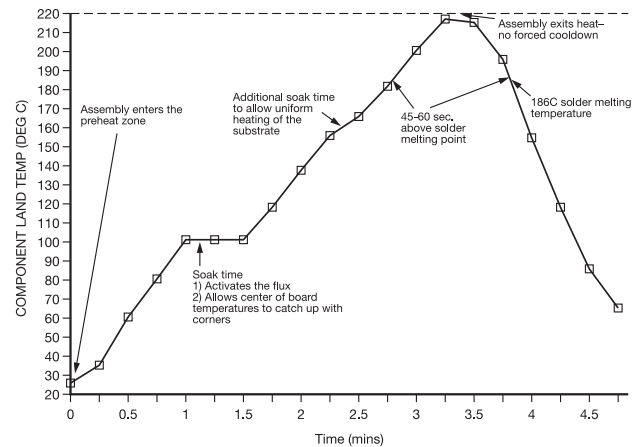
- Cleaning liquids.....i-propanol, ethanol, acetylacetone, water and other standard PCB cleaning liquids.
- Ultrasonic conditions .....power-20w/liter max.  
frequency-20kHz to 45kHz.
- Temperature .....80°C maximum (if not otherwise limited by chosen solvent system).
- Time .....5 minutes max.

#### STORAGE CONDITIONS

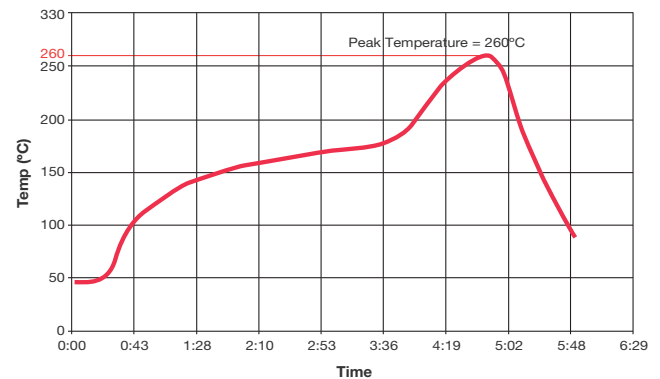
Recommended storage conditions for Accu-P® prior to use are as follows:

- 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



# Thin-Film RF/Microwave Capacitor Technology

## Accu-P® Series

### Automatic Insertion Packaging



#### TAPE & REEL

All tape and reel specifications are in compliance with EIA 481-1-A.  
(equivalent to IEC 286 part 3).

- 8mm carrier
- Reeled quantities: Reels of 3,000 per 7" reel or 10,000 pieces per 13" reel  
0201, and 0402 = 5,000 pieces per 7" reel and 20,000 pieces per 13" reel

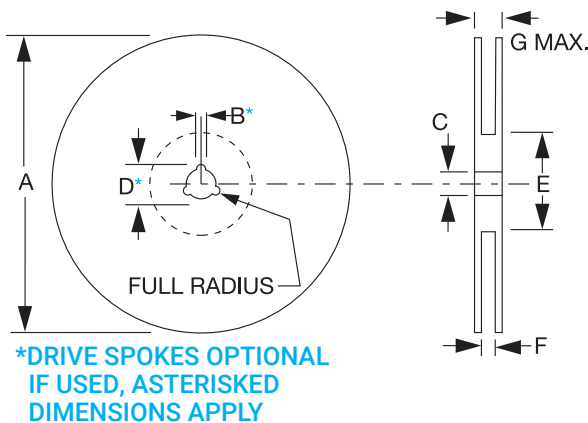
#### REEL DIMENSIONS: millimeters (inches)

| A(1)                     | B                        | C                         | D                         | E                       | F                          | G                         |
|--------------------------|--------------------------|---------------------------|---------------------------|-------------------------|----------------------------|---------------------------|
| 180±1.0<br>(7.087±0.039) | 1.5 min.<br>(0.059 min.) | 13±0.2<br>(0.512 ± 0.008) | 20.2 min.<br>(0.795 min.) | 50 min.<br>(1.969 min.) | 9.6±1.5<br>(0.370 ± 0.050) | 14.4 max.<br>(0.567 max.) |

Metric dimensions will govern.

Inch measurements rounded and for reference only.

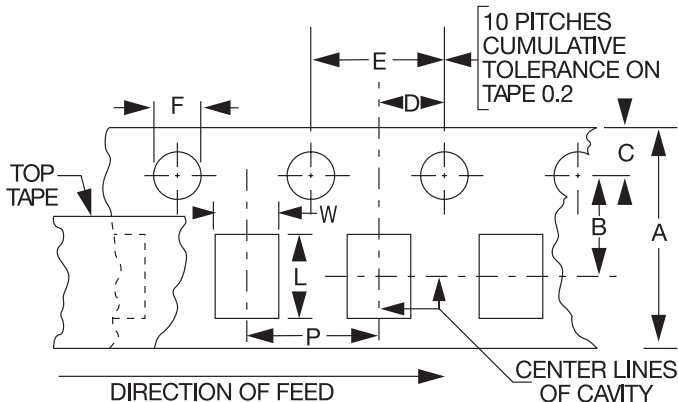
(1) 330mm (13 inch) reels are available.



#### CARRIER DIMENSIONS: millimeters (inches)

| A                            | B                             | C                             | D                             | E                            | F                            |
|------------------------------|-------------------------------|-------------------------------|-------------------------------|------------------------------|------------------------------|
| 8.0 ± 0.3<br>(0.315 ± 0.012) | 3.5 ± 0.05<br>(0.138 ± 0.002) | 1.75 ± 0.1<br>(0.069 ± 0.004) | 2.0 ± 0.05<br>(0.079 ± 0.002) | 4.0 ± 0.1<br>(0.157 ± 0.004) | 1.5 ± 0.1<br>(0.059 ± 0.004) |

The nominal dimensions of the component compartment (W,L) are derived from the component size.



P = 4mm for 0603, 0805  
P = 2mm for 0201, and 0402