



≠ **Product Features**

- High Q
- High Power
- Low ESR/ESL
- Low Noise
- High Self-Resonance
- Ultra Stable Performance
- Capacitance Range:  
0.1pF to 33pF
- Working Voltage: 200V

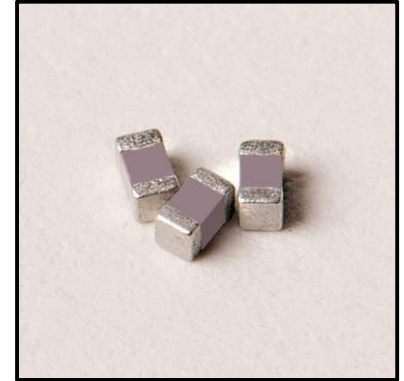
≠ **Product Applications**

**Typical Functional Applications**

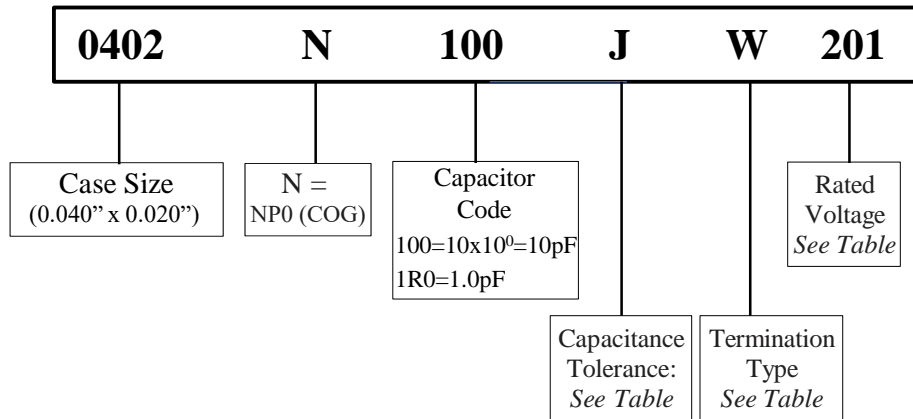
- Tuning • Bypass • Coupling
- Feedback • D.C. Blocking
- Impedance Matching

**Typical Circuit Applications**

- UHF/Microwave RF Power Amplifiers
- Mixers • Oscillators • Filter Networks
- Low Noise Amplifiers • Timing Circuits and Delay Lines



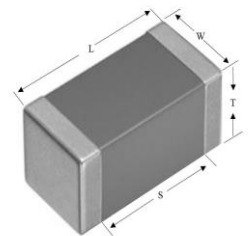
≠ **Part Numbering**



≠ **Capacitor Dimensions**

Unit: inch (millimeter)

Code	Term.	Length	Width	Thickness	Overlap
		Lc	Wc	Tc	B
W	Chip	0.040 ± 0.004 (1.02 ± 0.10)	0.020 ± 0.004 (0.51 ± 0.10)	0.020 ± 0.004 (0.51 ± 0.10)	0.010 ± 0.006 (0.25 ± 0.15)



≠ **Capacitance Tolerance Codes**

Code	A	B	C	D	F	G	J	K
Tol.	±0.05pF	±0.1pF	±0.25pF	±0.5pF	±1%	±2%	±5%	±10%



EIA Low ESR  
Multi-Layer Ceramic Capacitors

**0402N (0.040" x 0.020")**

≠ Terminations Type and Code

Termination Code	Termination
W	100% Sn Solder over Nickel Plating

≠ Voltage Codes

Voltage	Code
50V	500
200V	201
250V	251



≠ 0402N Capacitance Values

For special capacitances, tolerances and WVDC, please contact PPI.

Cap. pF	Cap Code	Tol.	Rated WVDC		Cap. pF	Cap Code	Tol.	Rated WVDC		Cap. pF	Cap Code	Tol.	Rated WVDC	
			Std.	Ext.				Std.	Ext.				Std.	Ext.
0.1	OR1	A,B, C,D	50V or 200V	250V	1.7	1R7	A,B, C,D	50V or 200V	250V	6.8	6R8	A,B, C	50V or 200V	N/A
0.2	OR2				1.8	1R8				7.5	7R5			
0.3	OR3				1.9	1R9				8.2	8R2			
0.4	OR4				2.0	2R0	50V or 200V	250V	9.1	9R1				
0.5	OR5				2.1	2R1			10	100				
0.6	OR6				2.2	2R2			11	110				
0.7	OR7				2.4	2R4			12	120				
0.8	OR8				2.7	2R7			13	130				
0.9	OR9				3.0	3R0			15	150				
1.0	1R0				3.3	3R3	16	160	F,G, J,K	50V or 200V	N/A			
1.1	1R1				3.6	3R6	18	180						
1.2	1R2				3.9	3R9	20	200						
1.3	1R3				4.3	4R3	22	220						
1.4	1R4				4.7	4R7	A,B, C,D	50V or 200V	N/A	24	240			
1.5	1R5				5.1	5R1				27	270			
1.6	1R6				5.6	5R6				30	300	F,G, J,K	50V	N/A
		6.2	6R2	33	330									



### ⚡ Electrical Specifications

Quality Factor (Q)	2,000 at 1 MHz
Insulation Resistance (IR)	10 <sup>5</sup> Megaohms min. @ +25°C rated WVDC 10 <sup>4</sup> Megaohms min. @ +125°C rated WVDC
Rated Voltage	See Rated Voltage
Dielectric Withstanding Voltage (WVDC)	250% of Rated Voltage of 5 seconds
Operating Temperature Range	-55°C to 175°C
Temperature Coefficient (TC)	0±30ppm/°C
Capacitance Drift	±0.02% or ±0.02pF, whichever is greater
Piezoelectric Effects	None

### ⚡ Environmental Specifications

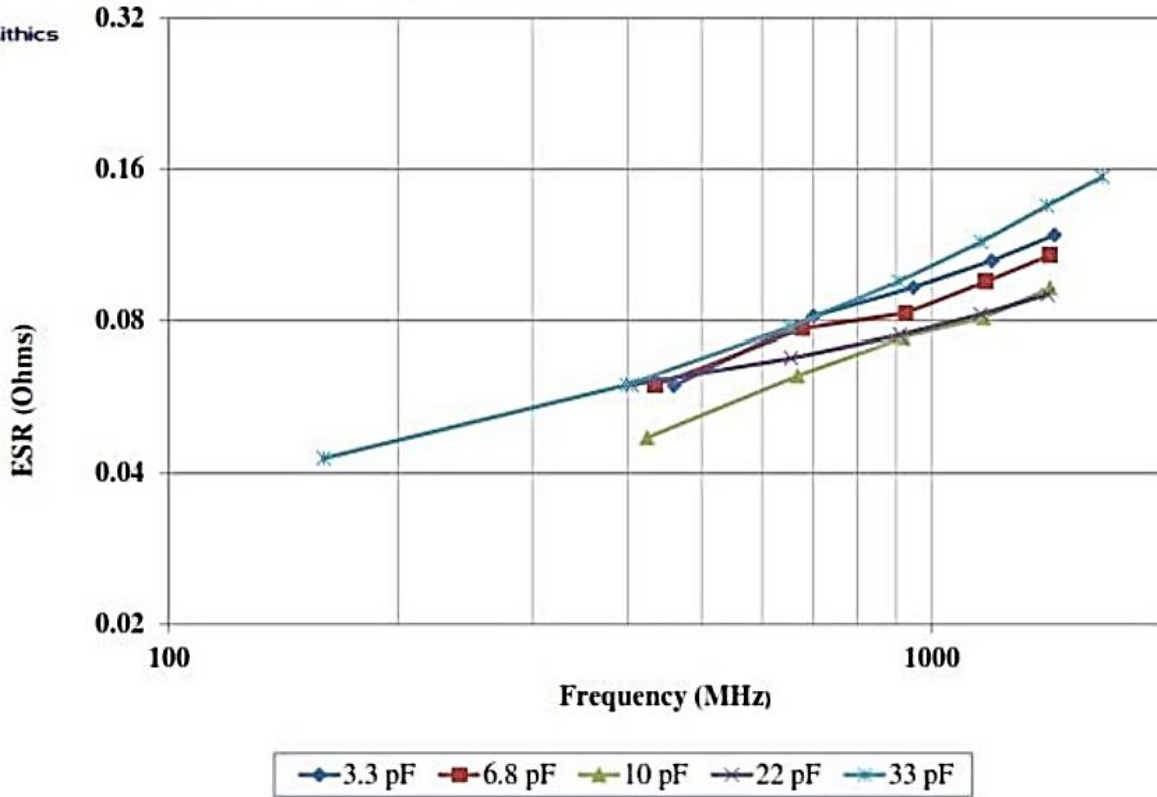
	Specification	Test Parameters
Thermal Shock	No mechanical damage <b>Capacitance Change:</b> ±0.5% or 0.5pF max <b>IR:</b> >1 G Ohms Q>2000 Breakdown Voltage: 2.5x WVDC	MIL-STD-202, Method 107, Condition A. At the maximum rated temperature (-55°C and 175°C) stay 30 minutes, the time of removing shall not be more than 3 minutes. Perform five cycles.
Humidity (Steady State)	No mechanical damage <b>Capacitance Change:</b> ±0.5% or 0.5pF max <b>IR:</b> >1 G Ohms Q>300 Breakdown Voltage: 2.5x WVDC	MIL-STD-202, Method 106
Low Voltage Humidity	No mechanical damage <b>Capacitance Change:</b> ±0.3% or 0.3pF max <b>IR:</b> >1 G Ohms Q>300 Breakdown Voltage: 2.5x WVDC	MIL-STD-202, Method 103, Condition A, with 1.5 Volts DC applied while subjected to an environment of 85°C with 85% relative humidity for 240 hours minimum.
Life	No mechanical damage <b>Capacitance Change:</b> ±2.0% or 0.5pF max <b>IR:</b> >1 G Ohms Q>500 Breakdown Voltage: 2.5x WVDC	MIL-STD-202, Method 108. For 1000 hours, at 175°C. 200% of Voltage for Capacitors
Terminal Adhesion	Termination should not pull off. Ceramic should remain undamaged	Linear pull force exerted on axial leads soldered to each terminal 2.0lbs.
Resistance to Soldering Heat	No mechanical damage <b>Capacitance Change:</b> -1.0%~+2.0% <b>IR:</b> >10 G Ohms Q>500 Breakdown Voltage: 2.5x WVDC	Preheat device to 150°C -180°C for 60 seconds. Dip in 260°C ±5°C solder for 10 ±1 second. Measure after 24± 2 hour cooling period.

Capacitors are designed and manufactured to meet the requirements of MIL-PRF-55681 and MIL-PRF-123.

≡ ESR vs. Frequency



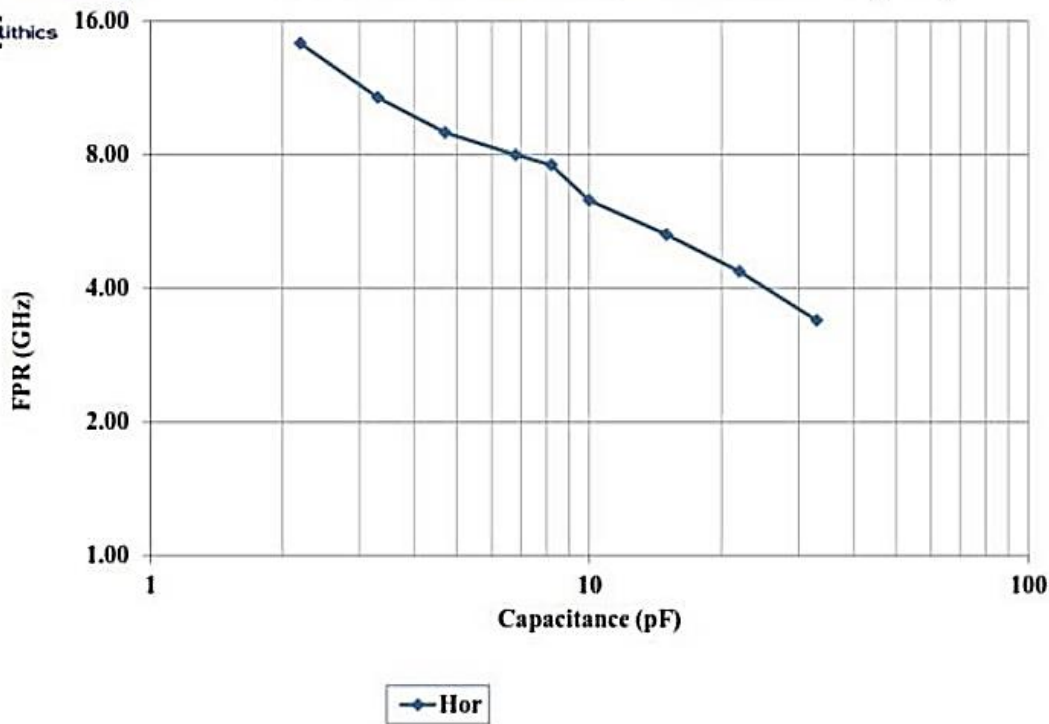
0402N Equivalent Series Resistances (ESRs)



## ≠ First Parallel Resonance



0402N Horizontal First Parallel Resonance (FPR)



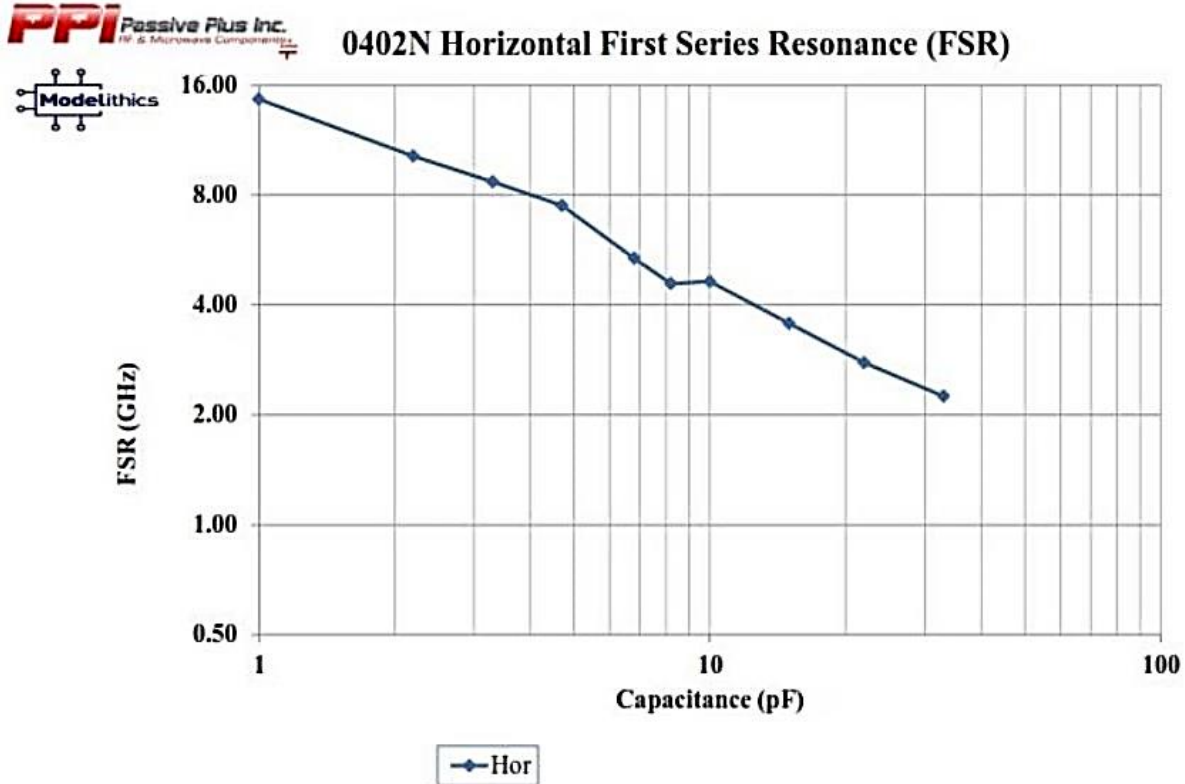
## ≠ Definitions and Measurement Conditions

The **First Parallel Resonance, FPR**, is defined as the lowest frequency at which a suckout or notch appears in  $|S_{21}|$ . It is generally independent of substrate thickness or dielectric constant, but does depend on capacitor orientation. A vertical orientation means the electrode planes are perpendicular to the substrate.

The definitions on the charts are for a capacitor in a series configuration, i.e., mounted across a gap in a microstrip trace with 50-Ohm termination. The measurement conditions are: substrate – Rogers RO4350; substrate dielectric constant = 3.48; substrate thickness (mils) = 10; gap in microstrip trace (mils) = 15; microstrip trace width (mils) = 22; Reference planes at sample edges.

All data has been derived from electrical models created by Modelithics, Inc., a specialty vendor contracted by PPI. The models are derived from measurements on a large number of parts disposed on several different substrates.

## ≡ First Series Resonance



## ≡ Definitions and Measurement Conditions

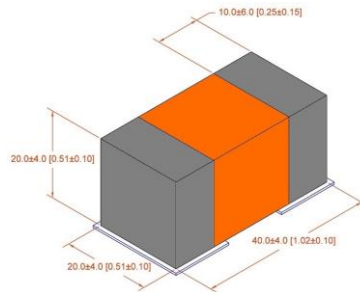
The **First Series Resonance, FSR**, is defined as the lowest frequency at which the imaginary part of the input impedance,  $\text{Im}[Z_{in}]$ , equals zero. Should  $\text{Im}[Z_{in}]$  or the real part of the input impedance,  $\text{Re}[Z_{in}]$ , not be monotonic with frequency at frequencies lower than those at which  $\text{Im}[Z_{in}] = 0$ , the FSR shall be considered as undefined (represented as a gap in the plot). FSR is dependent on internal capacitor structure; substrate thickness and dielectric constant; capacitor orientation, as defined alongside the FPR plot; and mounting pad dimensions.

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All data has been derived from electrical models created by Modelithics, Inc., a specialty vendor contracted by PPI. The models are derived from measurements on a large number of parts disposed on several different substrates.

## ≡ Capacitor Application Program

Passive Plus, Inc.'s brand new **online Capacitor Application Program (C.A.P.)** helps Engineers and Designers select capacitors according to parameters such as cap value and frequency. C.A.P. allows engineers to insert capacitors requirements (Cap value, Frequency), producing Scattering Matrices (S2P) Charts while providing options (Case Size, Terminations, Mounting), and parameters (ESR, Q, Impedance) along with Datasheets. Once engineers have determined their capacitor requirements, C.A.P. also includes online Requests For Quotes (RFQs) and/or sample requests.



## ≡ Modelithics Vendor Program

PPI offers design engineers a Free 90-Day Trial license for the Modelithics PPI Component Library. This program provides engineers access to extremely accurate scalable simulation models for Passive Plus capacitors with advanced features that enable a more precise and rapid design process.

Microwave Global Models include every part value in a series and permit users to input substrate thickness, dielectric constant, and loss tangent, as well as mounting pad layout dimensions. Selected models also include capacitor orientation – vertical or horizontal – as an input. Engineers can request FREE use of the models, by either visiting the [Passive Plus Resources page \(http://passiveplus.com/addldocs\\_resources.php\)](http://passiveplus.com/addldocs_resources.php).



### ≠ Recommended Land Pattern Dimensions

When mounting the capacitor to substrate, it's important to carefully consider that the amount of solder (size of fillet) used has a direct effect upon the capacitor once it's mounted.

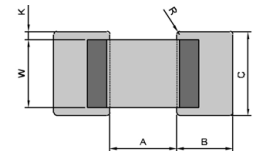
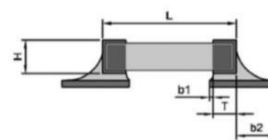


1) The greater the amount of solder, the greater the stress to the elements. This may cause the substrate to break or crack.

2) In the situation where two or more devices are mounted onto a common land, be sure to separate the device into exclusive pads by using soldering resist.

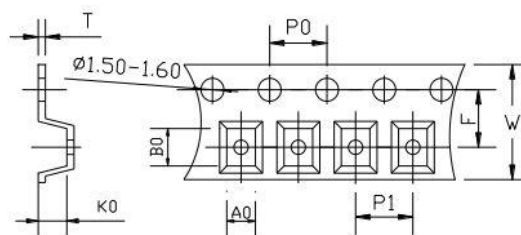
### ≠ Horizontal Mounting Dimensions: mm

A	B	C
0.41	0.41	0.54



### ≠ Tape & Reel Specifications Dimensions: mm

#### Horizontal Orientation



Orientation	A0	B0	K0	W	P0	P1	T	F	Qty Min	Qty/reel	Tape Material
Horizontal	0.60	1.10	1.00	8.00	4.00	2.00	0.20	3.50	500	500	Paper



EIA Low ESR  
Multi-Layer Ceramic Capacitors

**0402N (0.040" x 0.020")**

## ≠ Engineering Design Kits

PPI offers Design Kits for engineers who are building and testing prototypes. Each kit contains 16 values; 10 pieces per value.

Kits are 100% RoHS compliant.



Kit Number	Value Range	Values	
DKD0402N01	0.1 - 2.0pF	0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0, 1.2, 1.5, 1.6, 1.8, 2.0pF	
DKD0402N02	1.0 - 10pF	1.0, 1.2, 1.5, 1.8, 2.0, 2.2, 2.4, 2.7, 3.0, 3.3, 3.9, 4.7, 5.6, 6.8, 8.2, 10pF	
DKD0402N03	10 - 33pF	10, 12, 13, 15, 16, 18, 20, 22, 24, 27, 30, 33pF	

**PPI**  
Passive Plus Inc.  
RF & Microwave Components

**DKD0402N01**

**0402N Series 0.1 — 2.0pF**

Size: 0.040" x 0.020"  
TC = NP0 WVDC = 200V

**Hi-Q Low ESR Capacitor Design Kit**

[www.passiveplus.com](http://www.passiveplus.com)

**PPI**  
Passive Plus Inc.  
RF & Microwave Components

**DKD0402N02**

**0402N Series 1.0 — 10pF**

Size: 0.040" x 0.020"  
TC = NP0 WVDC = 200V

**Hi-Q Low ESR Capacitor Design Kit**

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**PPI**  
Passive Plus Inc.  
RF & Microwave Components

**DKD0402N03**

**0402N Series 10 — 33pF**

Size: 0.040" x 0.020"  
TC = NP0 WVDC = 200V

**Hi-Q Low ESR Capacitor Design Kit**

[www.passiveplus.com](http://www.passiveplus.com)