

## High Frequency NP0 (C0G) Dielectrics

### Features

- High Q, low ESR
- A monolithic structure ensures high reliability and mechanical strength.
- 0603 (EIA 0201) Ultra-miniature size
- Suitable for high speed SMT placement on PCBs.
- Lead-Free Terminations
- Ni barrier termination highly resistance to migration.
- Lead-free termination is in compliance with the requirement of green plan and ROHS.

### Applications

- Cellular Phone, Cordless Phone
- GPS, VCO, RF Integrated Circuits
- Wireless LAN, RF Transceivers
- Communication Equipment
- Custom Applications

#### High Frequency C0G (NP0) Dielectric Characteristics

Capacitance Range	0.2pF ~ 22pF			
Size	0603 1005 1608 (0201) (0402) (0603)			
Test Voltage	1.0 ± 0.2Vrms			
Test Frequency	1.0 ± 0.2MHz			
Capacitance Tolerance	$\pm$ 0.25pF for cap $<$ 5pF ( $\pm$ 0.1pF available on request)			
	± 0.50pF for 5pF $\leq$ cap $<$ 10pF (± 0.1pF, ± 0.25pF available on request)			
	± 5% for cap $\ge$ 10pF (± 1%, ± 2% available on request)			
Operating Temperature Range	-55℃ to +125℃			
Temperature Coefficient	0 ± 30 ppm/°C (EIA C0G)			
Rated Voltage	16, 25 & 50 VDC			
*Quality Factor	1,000 min.			
*ESR ( ESR value @ 1GHz for cap<5.0pF; ESR value @ 500 MHz for cap≧5.0p)	$\label{eq:ESR} \begin{array}{l} { } { } { } { } { } { } { } { } { } $			
Insulation Resistance (+25 $^\circ$ C, RVDC)	10 GΩ min.			
Insulation Resistance (+125°C, RVDC)	1 GΩ min.			

\* Measurements are performed on HP4287A with fixture 16196A (for 1608) / 16196B (for 1005) / 16196C (for 0603), 0.5V; Environment 25°C +/-3°C, 30%~75%RH

## Multi-Layer Ceramic Capacitor

### NP0 – Low ESR/ High Q (Q Series)

CLASS	Class I						
TYPE	Low ESR/High Q						
T.C.	NP0(C0G)						
SIZE	*0603		1005			1608	
(EIA)	0201		0402			0603	
RV	25V	16V	25V	50V	16V	25V	50V
* 0.20 p	А	В	В	В	D	D	D
* 0.50 p	А	В	В	В	D	D	D
* 0.75 p	Α	В	В	В	D	D	D
1.0 p	А	В	В	В	D	D	D
1.2 p	А	В	В	В	D	D	D
1.5 p	Α	В	В	В	D	D	D
1.8 p	А	В	В	В	D	D	D
2.2 p	А	В	В	В	D	D	D
2.7 p	A	В	В	В	D	D	D
3.3 p	Α	В	В	В	D	D	D
3.9 p	A	В	В	В	D	D	D
4.7 p	A	В	В	В	D	D	D
5.6 p	A	В	В	В	D	D	D
6.8 p	Α	В	В	В	D	D	D
8.2 p	A	В	В	В	D	D	D
10 p	Α	В	В	В	D	D	D
12 p		В	В	В	D	D	D
15 p		В	В	В	D	D	D
18 p		В	В	В	D	D	D
22 p		В	В	В	D	D	D
27 p							
33 p							
39 p							
47 p							
56 p							
68 p							
82 p							
100 p							
120 p							
150 p							
180 p							
220 p							
270 p							
330 p			L	L		L, ,	

### Microwave (F Series)

C-S4-3-00

TYPE         Microwave           T.C.         NP0(COG)           SIZE         1005         1608           (EIA)         0402         0603           RV         25V         50V         25V         50V           *0.20 p         -         -         -           *0.50 p         B         B         D         D           *0.75 p         B         B         D         D           1.0 p         B         B         D         D           1.2 p         B         B         D         D           1.2 p         B         B         D         D           1.3 p         B         B         D         D           2.7 p         B         B         D         D           3.3 p         B         B         D         D           3.4 p         B         B         D         D           3.5 p         B         B         D         D           3.6 p         B         B         D         D           3.8 p         B         B         D         D           1.16 p         D         D         D	CLASS	Class I				
T.C.       NP0(COG)         SIZE       1005       1608         (EIA)       0402       0603         RV       25V       50V       25V       50V         * 0.20 p       -       -       -         * 0.50 p       B       B       D       D         * 0.75 p       B       B       D       D         1.0 p       B       B       D       D         1.2 p       B       B       D       D         1.2 p       B       B       D       D         1.2 p       B       B       D       D         1.3 p       B       B       D       D         2.7 p       B       B       D       D         3.3 p       B       B       D       D         3.4 p       B       B       D       D         3.9 p       B       B       D       D         4.7 p       B       B       D       D         5.6 p       B       B       D       D         12 p       D       D       D       D         15 p       D       D       D       <						
SIZE $1005$ $1608$ (EIA) $0402$ $0603$ RV $25V$ $50V$ $25V$ $50V$ * 0.20 p         * $50V$ $25V$ $50V$ * 0.50 p         B         B         D         D           * 0.75 p         B         B         D         D           1.0 p         B         B         D         D           1.2 p         B         B         D         D           1.8 p         B         B         D         D           2.7 p         B         B         D         D           3.3 p         B         B         D         D           3.3 p         B         B         D         D           3.6 p         B         B         D         D           6.8 p         B         D         D         D           10 p         B         B         D         D           12 p         D         D         D         D           12 p         D         D         D         D           22 p         D         D						
(EIA) $0402$ $0603$ RV $25V$ $50V$ $25V$ $50V$ * 0.20 p         * $50V$ $25V$ $50V$ * 0.50 p         B         B         D         D           * 0.75 p         B         B         D         D           1.0 p         B         B         D         D           1.2 p         B         B         D         D           1.2 p         B         B         D         D           1.4 p         B         B         D         D           1.8 p         B         B         D         D           2.7 p         B         B         D         D           3.3 p         B         B         D         D           3.9 p         B         B         D         D           6.8 p         B         D         D         D           8.2 p         B         B         D         D           10 p         B         B         D         D           12 p         D         D         D         D           22 p		10	```			
RV         25V         50V         25V         50V           * 0.20 p               50V         *         50         50         *         50         50         *         50						
* $0.50 p$ B       B       D       D         * $0.75 p$ B       B       D       D $1.0 p$ B       B       D       D $1.2 p$ B       B       D       D $1.2 p$ B       B       D       D $1.2 p$ B       B       D       D $1.5 p$ B       B       D       D $1.8 p$ B       B       D       D $2.2 p$ B       B       D       D $2.7 p$ B       B       D       D $3.9 p$ B       B       D       D $3.9 p$ B       B       D       D $5.6 p$ B       B       D       D $6.8 p$ B       D       D       D $10 p$ B       B       D       D $12 p$ C       D       D       D $2.2 p$ D       D       D       D $2.2 p$ C       D       D       D $2.2 p$ C				25V	50V	
* 0.75 p         B         B         D         D           1.0 p         B         B         D         D           1.2 p         B         B         D         D           1.5 p         B         B         D         D           1.5 p         B         B         D         D           1.8 p         B         B         D         D           2.2 p         B         B         D         D           2.7 p         B         B         D         D           3.3 p         B         B         D         D           3.9 p         B         B         D         D           3.9 p         B         B         D         D           5.6 p         B         B         D         D           6.8 p         B         D         D         D           10 p         B         B         D         D           12 p         D         D         D         D           22 p         D         D         D         D           23 p         D         D         D         D           33 p	* 0.20 p					
* 0.75 p         B         B         D         D           1.0 p         B         B         D         D           1.2 p         B         B         D         D           1.5 p         B         B         D         D           1.5 p         B         B         D         D           1.8 p         B         B         D         D           2.2 p         B         B         D         D           2.7 p         B         B         D         D           3.3 p         B         B         D         D           3.9 p         B         B         D         D           3.9 p         B         B         D         D           5.6 p         B         B         D         D           6.8 p         B         D         D         D           10 p         B         B         D         D           12 p         D         D         D         D           22 p         D         D         D         D           23 p         D         D         D         D           33 p	* 0.50 p	В	В	D	D	
1.2 p       B       B       D       D         1.5 p       B       B       D       D         1.8 p       B       B       D       D         2.2 p       B       B       D       D         2.7 p       B       B       D       D         3.3 p       B       B       D       D         3.4 p       B       B       D       D         4.7 p       B       B       D       D         5.6 p       B       B       D       D         6.8 p       B       B       D       D         10 p       B       B       D       D         12 p       D       D       D       D         22 p       D       D       D       D         23 p       D       D       D       D         33 p       D       D       D       D         33 p       D       D       D       D <td></td> <td>В</td> <td>В</td> <td>D</td> <td>D</td>		В	В	D	D	
1.5 p         B         B         D         D           1.8 p         B         B         D         D           2.2 p         B         B         D         D           2.7 p         B         B         D         D           3.3 p         B         B         D         D           3.9 p         B         B         D         D           4.7 p         B         B         D         D           5.6 p         B         B         D         D           8.2 p         B         B         D         D           10 p         B         B         D         D           12 p         D         D         D         D           22 p         D         D         D         D           23 p         D         D         D         D           33 p         D         D         D         D           33 p	1.0 p	В	В	D	D	
1.8 p         B         B         D         D           2.2 p         B         B         D         D           2.7 p         B         B         D         D           3.3 p         B         B         D         D           3.9 p         B         B         D         D           4.7 p         B         B         D         D           5.6 p         B         B         D         D           6.8 p         B         B         D         D           8.2 p         B         B         D         D           12 p         D         D         D         D           12 p         D         D         D         D           22 p         D         D         D         D           23 p         -         -         -         -           33 p         -         -         -         -           33 p	1.2 p	В	В	D	D	
1.8 p       B       B       D       D         2.2 p       B       B       D       D         2.7 p       B       B       D       D         3.3 p       B       B       D       D         4.7 p       B       B       D       D         5.6 p       B       B       D       D         6.8 p       B       B       D       D         10 p       B       B       D       D         12 p       -       D       D       D         13 p       -       -       -       -         33 p       -       -       -       -         33 p       -       -       -       -         33 p       -       -       -       -         68 p       -       -       -       -         100 p       -       -       -       -	1.5 p	В	В	D	D	
2.2 p       B       B       D       D         2.7 p       B       B       D       D         3.3 p       B       B       D       D         3.3 p       B       B       D       D         3.9 p       B       B       D       D         4.7 p       B       B       D       D         4.7 p       B       B       D       D         5.6 p       B       B       D       D         6.8 p       B       B       D       D         8.2 p       B       B       D       D         10 p       B       B       D       D         12 p       D       D       D       D         12 p       D       D       D       D         22 p       D       D       D       D         33 p       D       D       D       D         33 p       D       D       D       D         47 p       D       D       D       D         82 p       D       D       D       D         100 p       D       D       D       D		В	В	D	D	
2.7 p       B       B       D       D         3.3 p       B       B       D       D         3.9 p       B       B       D       D         4.7 p       B       B       D       D         4.7 p       B       B       D       D         5.6 p       B       B       D       D         6.8 p       B       B       D       D         8.2 p       B       B       D       D         10 p       B       B       D       D         12 p       D       D       D       D         15 p       D       D       D       D         22 p       D       D       D       D         33 p		В	В	D	D	
3.9 p       B       B       D       D         4.7 p       B       B       D       D         5.6 p       B       B       D       D         6.8 p       B       B       D       D         8.2 p       B       B       D       D         10 p       B       B       D       D         12 p       D       D       D         15 p       D       D       D         18 p       D       D       D         22 p       D       D       D         33 p       C       C       C         33 p       C       C       C         47 p       C       C       C         56 p       C       C       C         68 p       C       C       C         100 p       C       C       C         120 p       C       C       C         180 p       C       C       C         220 p       C       C       C         220 p       C       C       C		В	В	D	D	
4.7 p       B       B       D       D         5.6 p       B       B       D       D         6.8 p       B       B       D       D         8.2 p       B       B       D       D         10 p       B       B       D       D         12 p       D       D       D         15 p       D       D       D         18 p       D       D       D         22 p       D       D       D         33 p       C       C       C         33 p       C       C       C         47 p       C       C       C         68 p       C       C       C         100 p       C       C       C         120 p       C       C       C         180 p       C       C       C         220 p       C       C       C       C         220 p       C       C       C       C         270 p       C       C       C       C	3.3 p	В	В	D	D	
4.7 p       B       B       D       D         5.6 p       B       B       D       D         6.8 p       B       B       D       D         8.2 p       B       B       D       D         10 p       B       B       D       D         12 p       D       D       D         15 p       D       D       D         18 p       D       D       D         22 p       D       D       D         33 p       C       C       C         33 p       C       C       C         47 p       C       C       C         68 p       C       C       C         100 p       C       C       C         120 p       C       C       C         180 p       C       C       C         220 p       C       C       C       C         220 p       C       C       C       C         270 p       C       C       C       C	3.9 p	В	В	D	D	
5.6 p       B       B       D       D         6.8 p       B       B       D       D         8.2 p       B       B       D       D         10 p       B       B       D       D         12 p       D       D       D         15 p       D       D       D         18 p       D       D       D         22 p       D       D       D         23 p       D       D       D         33 p       O       O       O         47 p       O       O       O         56 p       O       O       O         82 p       O       O       O         100 p       O       O       O         120 p       O       O       O         180 p       O       O       O         220 p       O       O       O       O		В	В	D	D	
6.8 p       B       B       D       D         8.2 p       B       B       D       D         10 p       B       B       D       D         12 p       D       D       D         15 p       D       D       D         18 p       D       D       D         22 p       D       D       D         23 p       D       D       D         33 p       C       C       C         33 p       C       C       C         47 p       C       C       C         56 p       C       C       C         68 p       C       C       C         100 p       C       C       C         120 p       C       C       C         180 p       C       C       C         220 p       C       C       C         220 p       C       C       C         270 p       C       C       C		В	В	D	D	
10 p         B         B         D         D           12 p         D         D         D         D           15 p         D         D         D         D           18 p         D         D         D         D           22 p         D         D         D         D           27 p         D         D         D         D           33 p         D         D         D         D           37 p         D         D         D         D           37 p         D         D         D         D           37 p         D         D         D         D         D           38 p         D		В	В	D	D	
10 p         B         B         D         D           12 p         D         D         D           15 p         D         D         D           18 p         D         D         D           22 p         D         D         D           27 p         D         D         D           33 p         C         C         C           39 p         C         C         C           47 p         C         C         C           56 p         C         C         C           100 p         C         C         C           120 p         C         C         C           150 p         C         C         C           180 p         C         C         C           220 p         C         C         C         C	8.2 p	В	В	D	D	
15 p       D       D         18 p       D       D         22 p       D       D         27 p       D       D         33 p       -       -         33 p       -       -         39 p       -       -         47 p       -       -         56 p       -       -         82 p       -       -         100 p       -       -         120 p       -       -         180 p       -       -         220 p       -       -         270 p       -       -		В	В	D	D	
18 p     D     D       22 p     D     D       27 p     D     D       33 p     -     -       39 p     -     -       47 p     -     -       56 p     -     -       68 p     -     -       100 p     -     -       120 p     -     -       180 p     -     -       220 p     -     -	12 p			D	D	
18 p     D     D       22 p     D     D       27 p     D     D       33 p     -     -       39 p     -     -       47 p     -     -       56 p     -     -       68 p     -     -       100 p     -     -       120 p     -     -       180 p     -     -       220 p     -     -	15 p			D	D	
22 p     D     D       27 p				D	D	
33 p	22 p			D	D	
33 p	27 p					
39 p         47 p         56 p         68 p         82 p         100 p         120 p         150 p         180 p         220 p         270 p						
47 p         56 p         68 p         82 p         100 p         120 p         150 p         180 p         220 p         270 p	39 p					
56 p         68 p         82 p         100 p         120 p         150 p         180 p         220 p         270 p	47 p					
68 p         82 p         100 p         120 p         150 p         180 p         220 p         270 p						
82 p 100 p 120 p 150 p 180 p 220 p 270 p						
100 p 120 p 150 p 180 p 220 p 270 p						
150 p 180 p 220 p 270 p						
150 p 180 p 220 p 270 p	120 p					
220 p 270 p						
220 p 270 p	180 p					
270 р						
330 p	330 p					

Note : Thickness might be changed due to technology improvement.

#### Thickness Code

Code	Thickness (mm)
А	0.30+/-0.03
В	0.50+/-0.05
D	0.80+/-0.10

#### Taping Amount

Thickness (mm)		Amount per reel					
Thickness (mm)		180 mm (7")		250mm (10")		330mm (13")	
Code	Class	Paper	Embossed	Paper	Embossed	Paper	Embossed
А	0.30 +/- 0.03	15K	Х	Х	Х	Х	Х
В	0.50 +/- 0.05	10K	Х	Х	Х	50K	Х
D	0.80 +/- 0.10	4K	Х	10K	Х	15K	х

## Multi-Layer Ceramic Capacitor

### ■ High Frequency NP0 (C0G) Specifications

No.	Item	Specification	Tost Mothod		
NO. 1	Item Operating Temperature Range	Specification -55°C to 125°C	Test Method		
•	Operating remperature Kange		-		
2	Rated Voltage	16VDC, 25VDC and 50VDC	The rated voltage is defined as the maximum voltage, which may be applied continuously to the capacitor.		
3	Appearance	No defects or abnormalities.	Visual inspection		
4	Dimensions	Within the specified dimension.	Using calipers		
5	Dielectric Strength (Flash)	No defects or abnormalities.	No failure shall be observed when 250% of the rated voltage is applied between the terminations for 1 to 5 seconds, the charge and discharge current is less than 50mA.		
6	Insulation Resistance (I.R.)	I.R.≧10GΩ	The insulation resistance shall be measured with a DC voltage not exceeding the rated voltage at $25^{\circ}$ C and $75^{\circ}$ RH max, and within 1 minute of charging.		
7	Capacitance	Within the specified tolerance.	The capacitance/D.F. shall be measured at $25^{\circ}$ at the frequency and voltage shown in the tables.		
8	Quality Factor ( Q )	1,000 min.	Frequency 1.0±0.2Vrms		
9	Capacitance Temperature Characteristics	Capacitance change within 0±30ppm/°C under operating temperature range.	Temperature compensating type: The capacitance value at 25 $^{\circ}$ C and 85 $^{\circ}$ C shall be measured and calculated from the formula given below. T.C.=(C <sub>85</sub> -C <sub>25</sub> )/C <sub>25</sub> * $\Delta$ T*10 <sup>6</sup> (PPM/ $^{\circ}$ C)		
10	Termination Strength	No removal of the terminations or marking defect.	Apply a parallel force of 5N to a PCB mounted sample for 10±1sec. *2N for 0603 (EIA 0201).		
11	Deflection (Bending Strength)	Appearance: No cracking or marking defects. Capacitance change: within ±2.5% or ± 0.25pF. (whichever is larger)	Solder the capacitor to the test jig (glass epoxy boards) shown in Fig. a. using a eutectic solder. Then apply a force in the direction shown in Fig. b. The soldering shall be done with the reflow method and shall be conducted with care so that the soldering is uniform and free of defects such as heat shock.		
		$(\text{Unit in mm}) \xrightarrow{b} \phi 4.5 \\ \downarrow $	9 0.3 5 0.5 0 1.2 0 1.65 0 1.65		
12	Solderability of Termination	90% of the terminations are to be soldered evenly and continuously.	Immerse the test capacitor into a methanol solution containing rosin for 3 to 5 seconds, preheat it 150 to $180^{\circ}$ for 2 to 3 minutes and immerse it into molten solder of $230 \pm 5^{\circ}$ for 5±1seconds.		
13	Resistance to Appearance	No marking defects	Preheat the capacitor at 120 to $150^{\circ}$ for 1 minute.		
	Soldering Heat Cap. Change	NP0 within $\pm 2.5\%$ or $\pm 0.25pF$ . (whichever is larger)	Immerse the capacitor in an eutectic solder solution at $270\pm5^{\circ}$ C for $10\pm1$ seconds. Let sit at room temperature for $24\pm2$ hours, then measure.		
	Q	Initial Spec.			
	I.R.	Initial Spec.	1		

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## Multi-Layer Ceramic Capacitor

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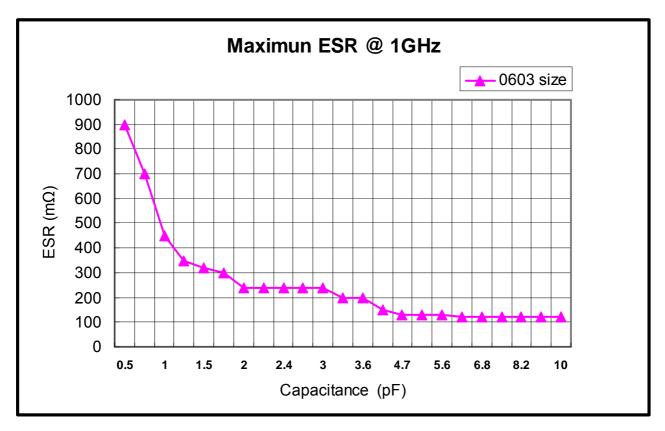
	Temperature Cycle (Thermal Shock)	Appearance	No marking defects	Solder the capacitor to supporting jig (glass epoxy board) and perform the five cycles according to the			
		Cap. Change	NP0 within ±2.5% or ±0.25pF. (whichever is larger)	four heat treatments listed in the following table. L sit for 24±2hrs at room temperature, then measur			
	Chicology	Q	Initial Spec.				
		I.R.	Initial Spec.	Step 1: Minimum operating temperature30±3minStep 2: Room temperature2~3 minStep 3: Maximum operating temperature30±3minStep 4: Room temperature2~3min			
15	Humidity Load	Appearance	No marking defects	Apply the rated voltage at 40±2℃ and 90 to 95%			
		Cap. Change	NP0 within ±5.0% or ±0.5pF. (whichever is larger)	humidity for 500±12 hours. Remove and let sit for 24±2 hours at room temperature, then measure.			
		Q	200 min.	The charge/discharge current is less than 50mA.			
		I.R.	I.R.≧500MΩ				
18	High Temperature	Appearance	No marking defects	Apply 200% of the rated voltage for 500 $\pm$ 12 hours at the maximum operating temperature $\pm$ 3°C. Let			
	Load (Life Test)	Cap. Change	NP0 within ±5.0% or ±0.5pF (whichever is large)	sit for $24\pm 2$ hours at room temperature, then measure. The charge/discharge current is less than			
		Q	350 min.	50mA.			
		I.R.	$I.R. \ge 1G\Omega$				

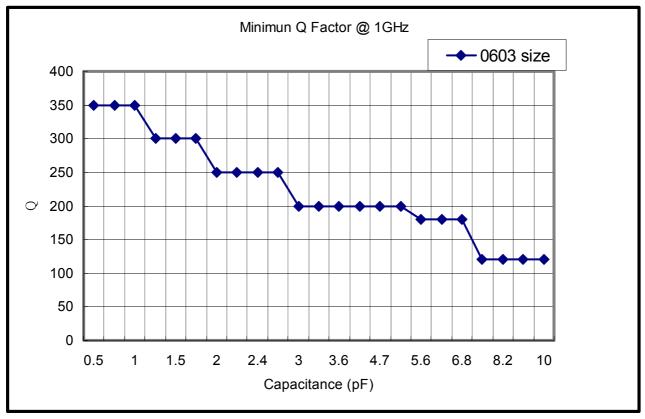




## **Multi-Layer Ceramic Capacitor**

Typical RF Characteristics for High Frequency NP0 (C0G) 0603 (EIA 0201) at 1GHz.

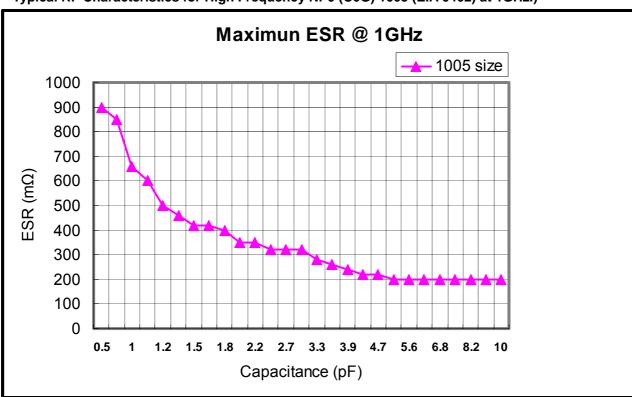




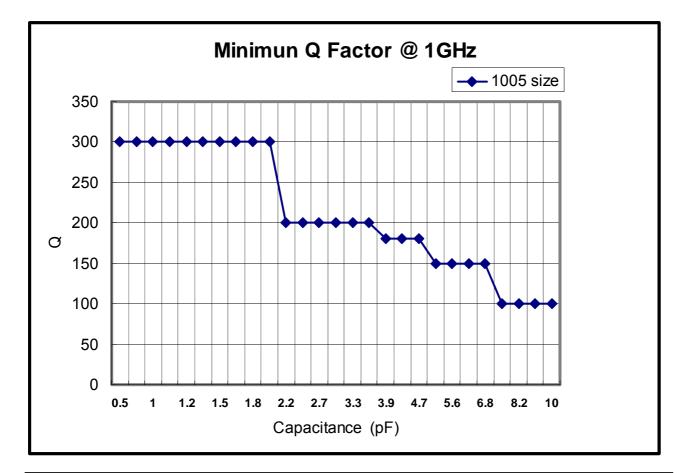
Measurements performed on a HP4287A with fixture 16196B and represent the typical capacitor performance.



## **Multi-Layer Ceramic Capacitor**



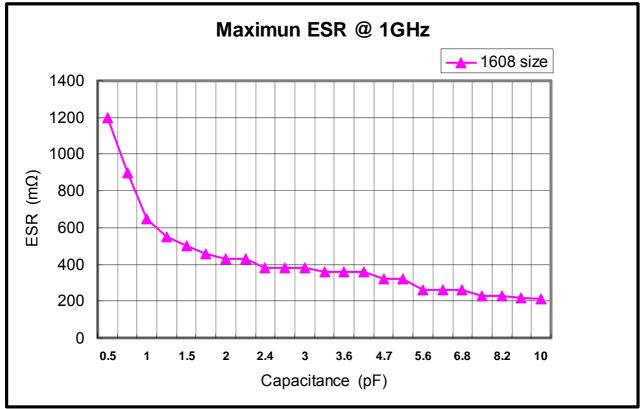
### Typical RF Characteristics for High Frequency NP0 (C0G) 1005 (EIA 0402) at 1GHz.)

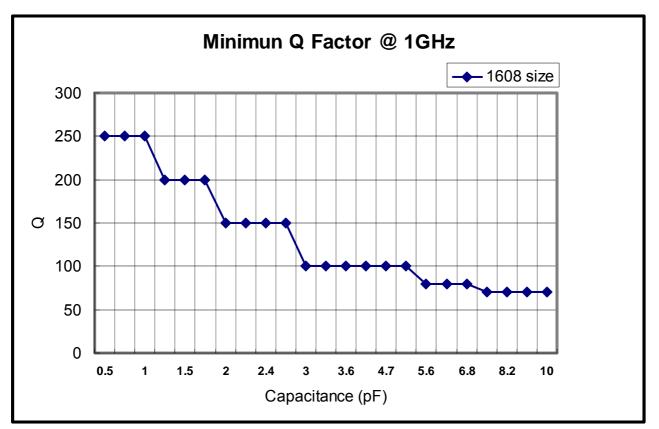




C-S4-3-00

Measurements performed on a HP4287A with fixture 16196A and represent the typical capacitor performance. Typical RF Characteristics for High Frequency NP0 (C0G) 1608 (EIA 0603) at 1GHz.





Measurements performed on a HP4287A with fixture 16196A and represent the typical capacitor performance.