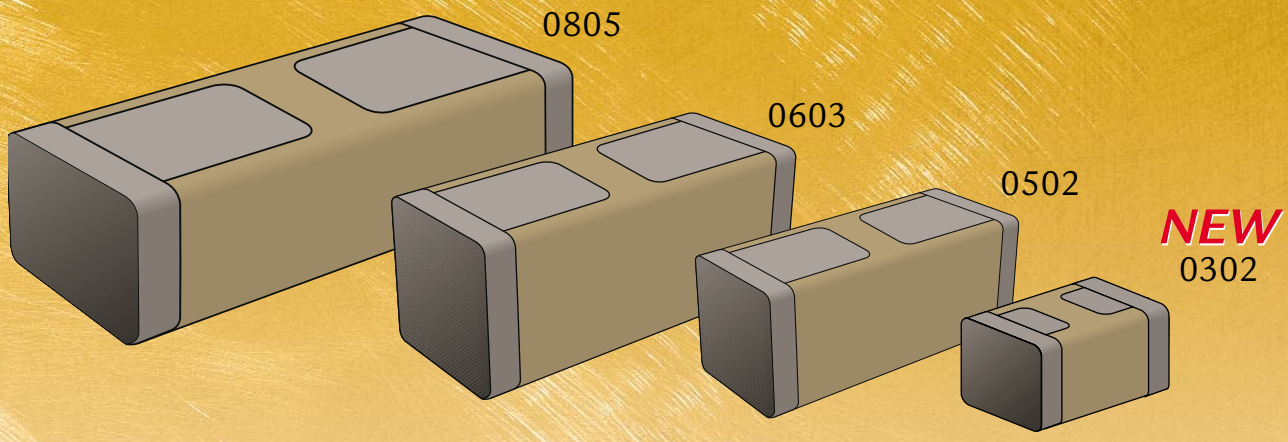
PRESIDIO COMPONENTS, INC.

BURIED BROADBAND CAPACITORS™*

An Integration of Microwave Single Layer and Multilayer Ceramic Capacitor Technology



Single Layer Capacitor:
GHz Range

NEW

FREE DOWNLOAD
Equivalent Circuit Model for
BB0502X7R104M16VP820
from 16 kHz to 50 GHz
www.presidiocomponents.com/BB

Multilayer Capacitor:
kHz-MHz Range

For DC Blocking up to 100 GHz

Rev. B

*Patent Pending

Quick Select by Size and Resonant Free Bandwidth

Case Size	Resonant Free Bandwidth*	Application	Typical Insertion Loss (S21)**	2 Cap. Values in parallel (pF)	Temp. Coeff.***	Presidio Part Number
0502	16 kHz to 40 GHz +	OC192 / OC768	-0.2 dB at 10 GHz -0.9 dB at 40 GHz	100,000 & 82	± 15%	BB0502X7R104M16VNT9820
0302	130 kHz to 100 GHz	Test Instruments	-1.2 dB at 100 GHz -0.55 dB at 40 GHz	12,000 & 82	± 15%	BB0302X7R123M16VNT9820
0502	15 GHz to 26 GHz	High Frequency Broadband	-0.55 dB at 25 GHz	820 & 82	0 ± 30 ppm	BB0502NPO821M16VNT9820
0502	7 kHz to 40 GHz +	Temp. Stable Environment	-0.6 dB at 40 GHz	220,000 & 82	+22%, -82%	BB0502Y5V224M16VNT9820****
0603	10 kHz to 20 GHz +		-0.45 dB at 10 GHz	150,000 & 220	± 15%	BB0603X7R154M16VNT9221
0805	10 kHz to 20 GHz +		-0.5 dB at 10 GHz	150,000 & 220	± 15%	BB0805X7R154M16VNT9221
0805	30 kHz to 20 GHz +			56,000 & 220	± 15%	BB0805X7R563M75VNT9221
0805	0.4 MHz to 20 GHz +	RF Broadband	-1.4 dB at 20 GHz	4,000 & 220	± 15%	BB0805X7R402M2NT9221

* -3.0 dB at low frequency point
** Average de-embedded data
*** From -55°C to +125°C except for BB0502Y5V224M16VNT9820: -30°C to +85°C
**** Because of Class III, Y5V dielectric, BB0502Y5V224M16VNT9820 exhibits a parallel resonance at 2.5 GHz at +85°C

Recommended Mounting Methods

PC Board Observations

(a) Soft or hard substrates (alumina) are typically used at microwave frequencies. For lowest reflection loss fused silica substrates are recommended at millimeterwave frequencies.

(b) Microstrip line width should match or come close to capacitor width to optimize capacitor performance. Fanning out the microstrip line to match the capacitor width may degrade capacitor loss at millimeterwave frequencies.

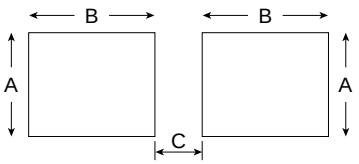
Microstrip Line Gap

Option 1: 0.015" to 0.010" (.381 mm to .254 mm) microstrip line gap for broadband performance at microwave frequencies (example 16 kHz to 10 GHz).

Option 2: 0.005" to 0.002" (0.127 mm to 0.051 mm) microstrip line gap for very broadband performance at millimeterwave frequencies (example 16 kHz to 40 GHz +).

Mounting Pad Dimensions (general recommendation*)

	Inches			Millimeters		
Case Size	A min	B min	C min*	A min	B min	C min*
0302	0.020	0.015	0.003	0.508	0.381	0.076
0502	0.020	0.025	0.010	0.508	0.635	0.254
0603	0.030	0.030	0.015	0.762	0.762	0.381
0805	0.060	0.040	0.020	1.524	1.016	0.508



Centerline of the capacitor should be located in the center of the gap in the microstrip line.

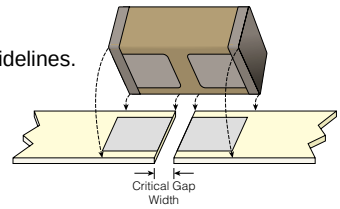
*Disclaimer: Gap dimension, substrate material and microstrip line width impact circuit performance. Consult factory for application specific recommendations.

Recommended Attachment to Substrate

(a) Solder Attach (wave reflow, vapor phase or convection tunnel oven). See termination codes for guidelines.

(b) Conductive Epoxy

It is recommended that both mounting pads be bonded simultaneously and that the pre-heat, soldering or curing, and post-heat temperatures be controlled.



PRESIDIO COMPONENTS, INC.
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www.presidiocomponents.com • email: info@presidiocomponents.com

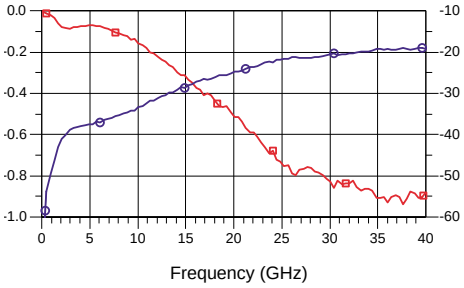
High Frequency Performance Data

Disclaimer: The results are only valid as per described test set up. Other configurations will lead to different results.

BB0502X7R104M16VP820

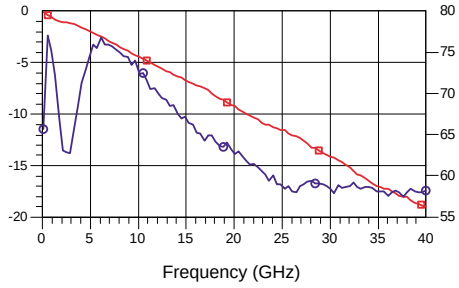
Evaluated on .010" thick fused silica substrate. Line width .023", gap width .005", transmission line effects and capacitance to ground removed.

Transmission and Return Loss (S21, S11)



S21= Red Line with Squares
S11= Blue Line with Circles

Phase (Degree) (S21, S11)



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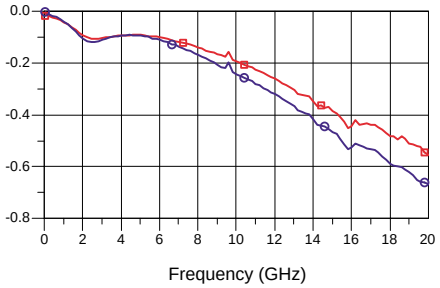
Transmission Loss over Temperature (S21)

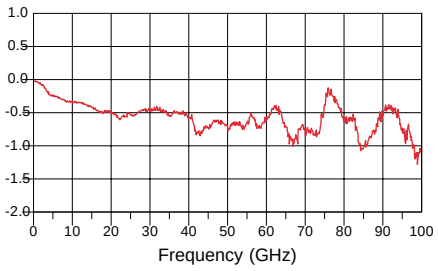


+25°C = Red Line with Squares
+85°C = Blue Line with Circles

BB0302X7R123M16VP820 - Tested up to 100 GHz (courtesy of Agilent Technologies)

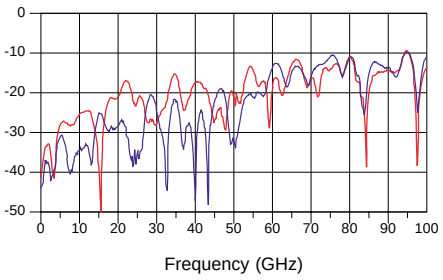
Evaluated on .010" thick fused silica substrate (11 mm long) in a 1 mm coaxial fixture. Line width .020", gap width .002".

Transmission Loss (S21)



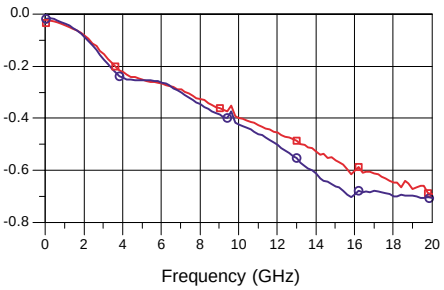
Thruline and 1 mm connector loss removed

Return Loss (S11)



1 mm connector loss not removed
Blue Line = 11 mm thruline
Red Line = Presidio 0302_X7R_10nf

Transmission Loss over Temperature (S21)

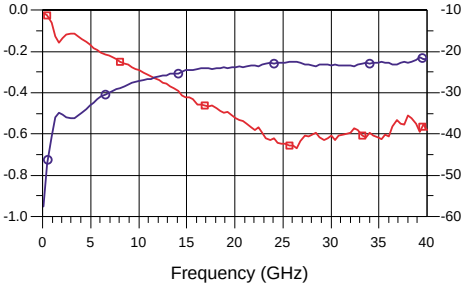


+25°C = Red Line with Squares
+85°C = Blue Line with Circles

BB0502Y5V224M16VP820

Evaluated on .010" thick fused silica substrate. Line width .023", gap width .005", transmission line effects and capacitance to ground removed.

Transmission and Return Loss (S21, S11)



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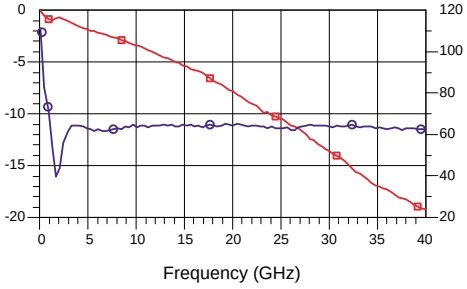
Phase (Degree) (S21, S11)



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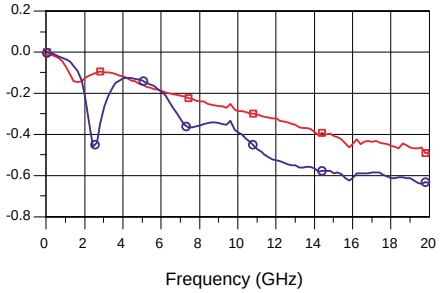
Transmission Loss over Temperature (S21)



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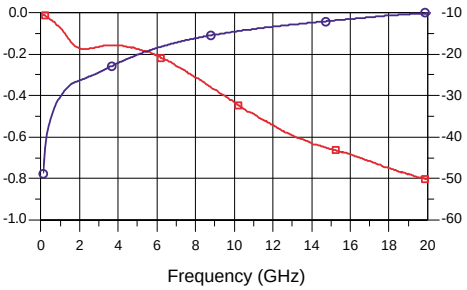
BB0603X7R154M16VP221

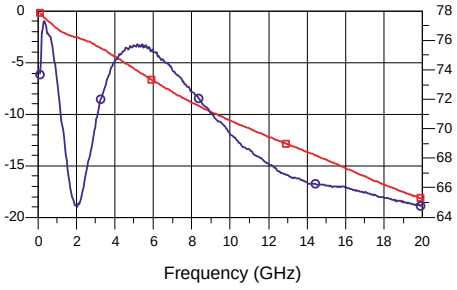
Evaluated on .008" thick Rogers 4003 (Er = 3.38) substrate. Line width .017", pad width .038", gap width .022", transmission line effects and capacitance to ground removed.

Transmission and Return Loss (S21, S11)



S21= Red Line with Squares
S11= Blue Line with Circles

Phase (Degree) (S21, S11)



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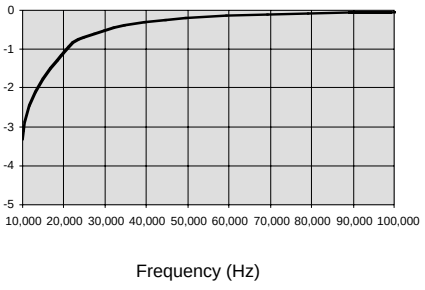
Low Frequency Modeled Loss (S21)

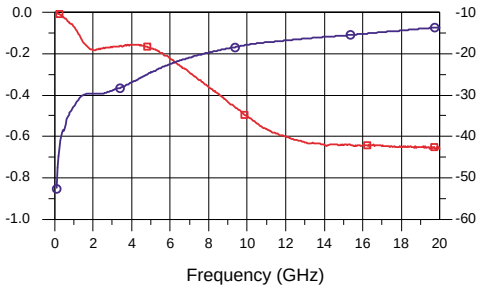


150nF

BB0805X7R154M16VP221

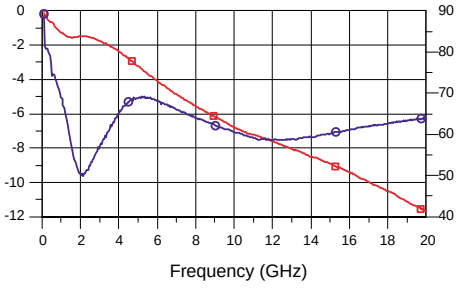
Evaluated on .008" thick Rogers 4003 (Er = 3.38) substrate. Line width .017", pad width .038", gap width .022", transmission line effects and capacitance to ground removed.

Transmission and Return Loss (S21, S11)



S21= Red Line with Squares
S11= Blue Line with Circles

Phase (Degree) (S21, S11)



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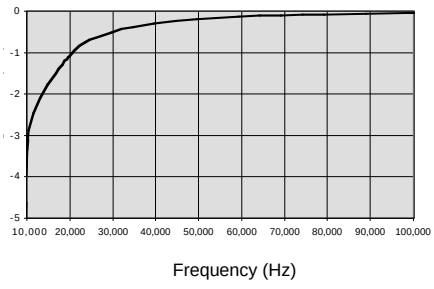
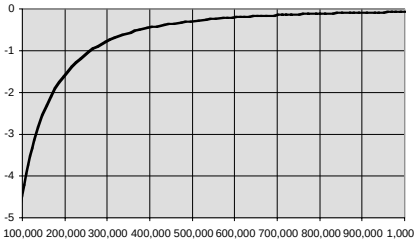
Low Frequency Modeled Loss (S21)



150nF

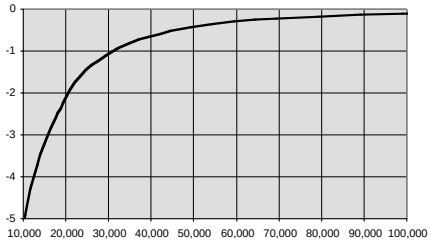
Low Frequency Modeled Loss (S21)

BB0302X7R123M16VP820



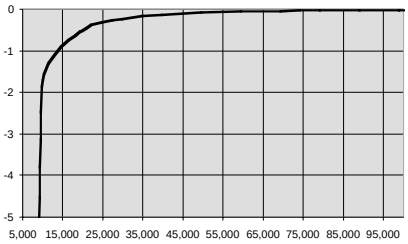
12nF

BB0502X7R104M16VP820



100nF

BB0502Y5V224M16VP820



220nF

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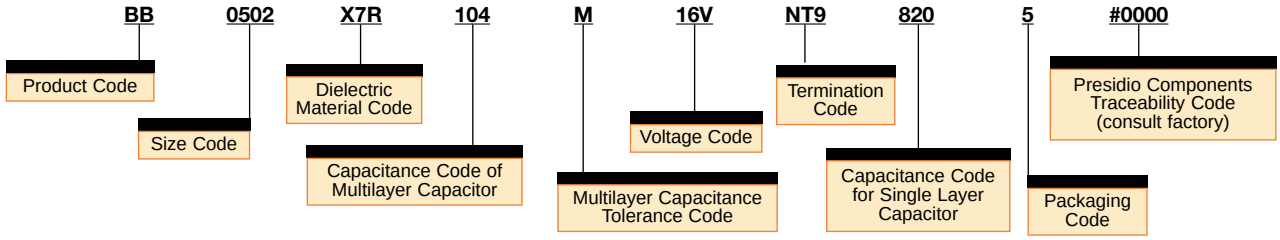
Part Number Example (How to Order)



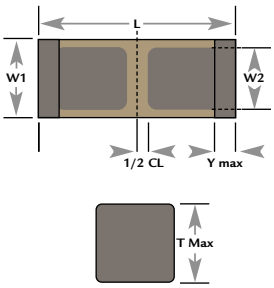
Size Codes

In Inches

Product Size	Length L	Width W 1	Height T max.	Band Y max.	1/2 Gap Between Surface Pads CL	Surface Pad Width W 2
0302	0.031 ± .003	0.020 ± .002	0.020	0.008	.00425 ± 0.0015	0.010 ± 0.002
0502	0.050 ± .006	0.022 ± .004	0.036	0.010	0.005 ± 0.003	0.020 ± 0.002
0603	0.065 ± .006	0.032 ± .006	0.036	0.015	0.006 ± 0.004	0.023 ± 0.003
0805	0.080 ± .010	0.050 ± .010	0.036	0.020	0.006 ± 0.004	0.040 ± 0.003
0805*	0.080 ± .010	0.050 ± .010	0.036	0.020	0.004 ± 0.004	0.032 ± 0.005

In Millimeters (reference only)

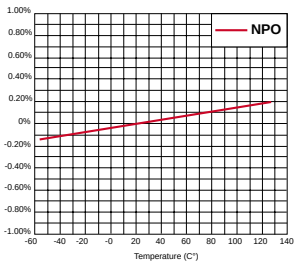
0302	0.787 ± 0.076	0.508 ± 0.051	0.508	0.203	0.108 ± 0.038	0.254 ± 0.051
0502	1.270 ± 0.152	0.559 ± 0.102	0.914	0.254	0.127 ± 0.076	0.508 ± 0.051
0603	1.651 ± 0.152	0.813 ± 0.152	0.914	0.381	0.152 ± 0.102	0.584 ± 0.076
0805	2.032 ± 0.254	1.270 ± 0.254	0.914	0.508	0.152 ± 0.102	1.016 ± 0.076
0805*	2.032 ± 0.254	1.270 ± 0.254	0.914	0.508	0.102 ± 0.102	0.813 ± 0.127

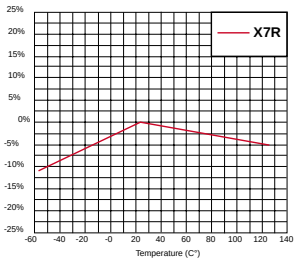


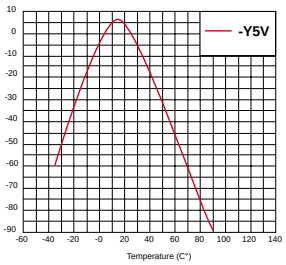
* This dimension applies only to BB0805X7R402M2NT9221

Dielectric Material Codes & Electrical Specification

Material Code:	NPO	X7R	Y5V
Dissipation Factor:	0.15% max	3.5% max	7.0% max
Insulation Resistance at 25°C:	> 1000 Ohm-Farads	> 1000 Ohm-Farads	> 100 Ohm-Farads
Dielectric Withstanding Voltage:	40 VDC	40 VDC	40 VDC
Test Voltage:	32 VDC	32 VDC	32 VDC
Working Voltage:	16 VDC	16 VDC	16 VDC
Temperature Coefficient over Operating Temp.:	0 ± 30 ppm	± 15%	+22%, -82%
Operating Temperature:	-55°C to +125°C	-55°C to +125°C	-30°C to +85°C
Aging Rate:	None	2.5% max per decade/hour	5% per decade/hour







Capacitance Codes for Multilayer Capacitor

First Two Digits = Significant figures of capacitance in picofarads
Third Digit = Additional number of zeros
Example: 100 = 10 pF
102 = 1,000 pF
104 = 100,000 pF

Capacitance Codes for Single Layer Capacitor

Code	Nominal Capacitance
820	82 pF
221	220 pF

Standard Working Voltage Code

Code	WVDC
16V	16
75V	75
2	50

Standard Capacitance Tolerance Code

Code	Tol.
M	± 20%

Packaging Codes

1 = Tape and Reel
5 = Waffle Pack (standard)

Termination Codes

Code	Typical Application	Termination Build up	Recommended Reflow Temp.
NT9	Solder Reflow by IR, vapor phase, wave, convection tunnel oven	Palladium-Silver Nickel Barrier Plated 90/10 Tin Lead	220°C to 260°C typical*
P	Conductive Epoxy Non-Magnetic	Palladium-Silver	Cure Epoxy as per manufacturer's spec.
G	Conductive Epoxy, Wire Bondable	Palladium-Silver Nickel Barrier 100 µ" thick Gold typical	Cure Epoxy as per manufacturer's spec.

***Typical temperature guidelines for solder attachment:**
Reflow: Preheating — 2°C /seconds up to 100 seconds
Soldering — 220°C to 260°C for 20 to 60 seconds
Gradual Cooling: Exit less than 100°C

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BURIED BROADBAND CAPACITORS™*

Key Features

- -0.2 dB insertion loss at 10 GHz (OC192)
- Resonant free at critical 1.6 to 1.8 GHz
- ± 15% capacitance change over temperature
- Patented integration of high and low frequency capacitors
- Free equivalent circuit capacitor model for easy design
- Sizes 0805, 0603, 0502 and 0302
- Rugged monolithic body for easy pick and place
- Solder or Conductive Epoxy mounting
- Tape and Reel

Key Applications

- Broadband DC Blocking and Decoupling
- From DC to 100 GHz
- Transponders and Transceivers for OC 192, OC768
- Broadband Microwave
- Millimeterwave Test Equipment
- XAUI 10 Gbit Interface

Environmental Parameters

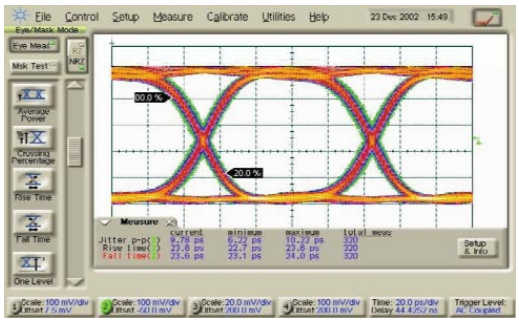
	Mil-Std-202	
	Method	**Condition**
Thermal Shock and Immersion	107	A
Resistance to Soldering Heat	210	C
Low Voltage Humidity	103	A

Mechanical Parameters

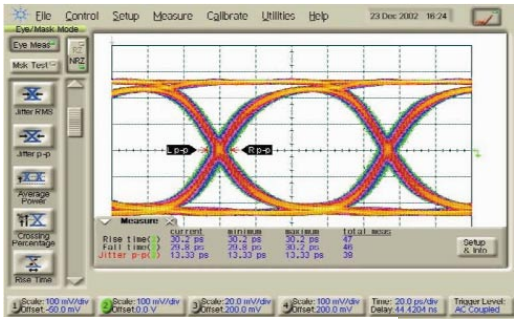
Terminal Strength 2 lbs typical

Eye Diagram Comparison

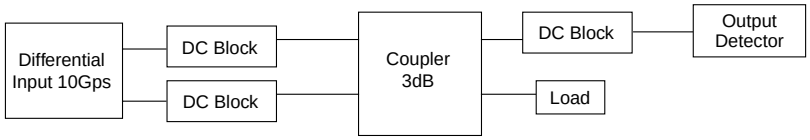
Presidio Components, Inc.
BB0502X7R104M16VP820 DC Block



Generic MLC
0402 X7R100pF DC Block

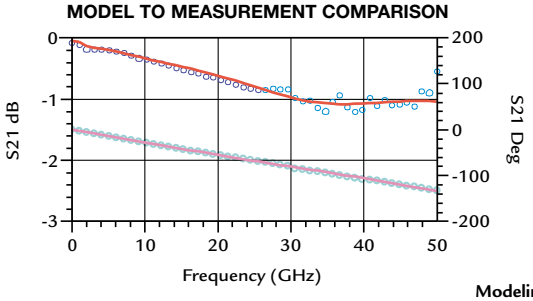


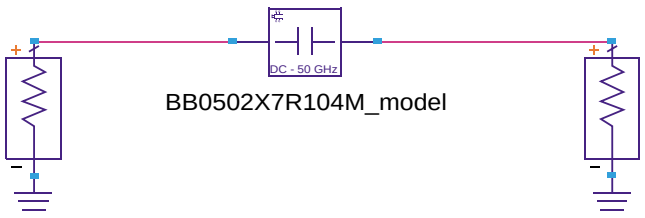
Test Setup



Courtesy of Phyworks

FREE MODEL DOWNLOAD





Modeling services by Modelithics

www.presidiocomponents.com/BB

April 2004

*Patent Pending

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