

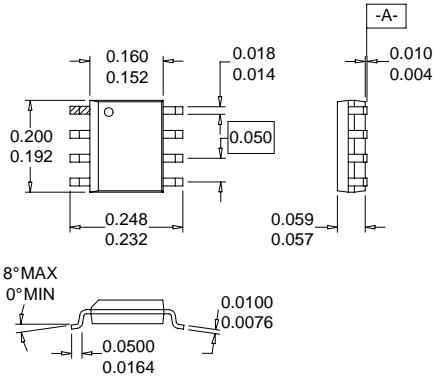
RoHS Compliant & Pb-Free Product

Typical Applications

- CATV Distribution Amplifiers
- Cable Modems
- Broadband Gain Blocks
- Laser Diode Driver
- Return Channel Amplifier
- Base Stations

Product Description

The RF2312 is a general purpose, low cost high linearity RF amplifier IC. The device is manufactured on an advanced Gallium Arsenide Heterojunction Bipolar Transistor (HBT) process, and has been designed for use as an easily cascadable 75Ω gain block. The gain flatness of better than 0.5dB from 5MHz to 1000MHz, and the high linearity, make this part ideal for cable TV applications. Other applications include IF and RF amplification in wireless voice and data communication products operating in frequency bands up to 2500MHz. The device is self-contained with 75Ω input and output impedances, and requires only two external DC biasing elements to operate as specified.



- NOTES:**
1. Shaded lead is pin 1.
 2. All dimensions are excluding flash, protrusions or burrs.
 3. Lead coplanarity: 0.005 with respect to datum "A".
 4. Package surface finish: Matte (Charmilles #24-27).

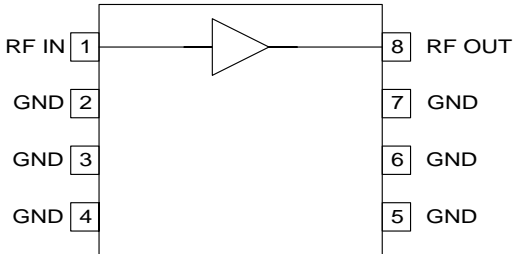
Optimum Technology Matching® Applied

- | | | |
|-------------------------------------|--|---------------------------------------|
| <input type="checkbox"/> Si BJT | <input checked="" type="checkbox"/> GaAs HBT | <input type="checkbox"/> GaAs MESFET |
| <input type="checkbox"/> Si Bi-CMOS | <input type="checkbox"/> SiGe HBT | <input type="checkbox"/> Si CMOS |
| <input type="checkbox"/> InGaP/HBT | <input type="checkbox"/> GaN HEMT | <input type="checkbox"/> SiGe Bi-CMOS |

Package Style: SOIC-8

Features

- DC to well over 2500MHz Operation
- Internally Matched Input and Output
- 15dB Small Signal Gain
- 3.8dB Noise Figure
- +20dBm Output Power
- Single 5V to 12V Positive Power Supply



Functional Block Diagram

Ordering Information

- | | |
|-------------|--|
| RF2312 | Linear General Purpose Amplifier |
| RF2312 PCBA | Fully Assembled Evaluation Board - 75Ω |
| RF2312 PCBA | Fully Assembled Evaluation Board - 50Ω |

RF Micro Devices, Inc. Tel (336) 664 1233
 7628 Thorndike Road Fax (336) 664 0454
 Greensboro, NC 27409, USA <http://www.rfmd.com>

RF2312

Absolute Maximum Ratings

Parameter	Rating	Unit
Input RF Power	+18	dBm
Output Load VSWR	20:1	
Ambient Operating Temperature	-40 to +85	°C
Storage Temperature	-40 to +150	°C



Caution! ESD sensitive device.

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Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Overall (50Ω)					T=25°C, V _{CC} =9V, Freq=900 MHz, R _C =30Ω, 50Ω System, P _{IN} =-4dBm 3dB Bandwidth
Frequency Range		DC to 2500		MHz	
Gain	14.5	15.1		dB	
Noise Figure		3.8	4.3	dB	From 50MHz to 300MHz, -30 to +70 °C
		4.2	4.8	dB	From 300MHz to 1000MHz, -30 to +70 °C
Input VSWR		1.7:1	2:1		Appropriate values for the DC blocking capacitors and bias inductor are required to maintain this VSWR at the intended operating frequency range.
Output VSWR		1.4:1	2:1		Appropriate values for the DC blocking capacitors and bias inductor are required to maintain this VSWR at the intended operating frequency range.
Output IP ₃	+40	+42		dBm	At 100MHz
Output IP ₃	+33	+36		dBm	At 500MHz
Output IP ₃	+30	+33		dBm	At 900MHz
Output P _{1dB}	+21	+22		dBm	At 100MHz
Output P _{1dB}	+20	+21		dBm	At 500MHz
Output P _{1dB}	+17	+18.5		dBm	At 900MHz
Saturated Output Power		+23		dBm	At 100MHz
Saturated Output Power		+22.5		dBm	At 500MHz
Saturated Output Power		+20.5		dBm	At 900MHz
Reverse Isolation		20		dB	
Thermal					
Theta _{JC}		114.9		°C/W	I _{CC} =100mA, P _{DISS} =0.555W, T _{AMB} =85°C, T _J =149°C No RF Input/Output
Mean Time To Failure		2170		years	T _{AMB} =+85°C
Theta _{JC}		114.05		°C/W	I _{CC} =120mA, P _{DISS} =0.702W, T _{AMB} =85°C, T _J =165°C No RF Input/Output
Mean Time To Failure		2170		years	T _{AMB} =+85°C
Power Supply					
Device Voltage (V _D)		5.5		V	On pin 8, I _{CC} =100mA
		5.0		V	On pin 8, I _{CC} =40mA
Operating Current Range	40	100	120	mA	V _{CC} =9.0V, R _C =30Ω

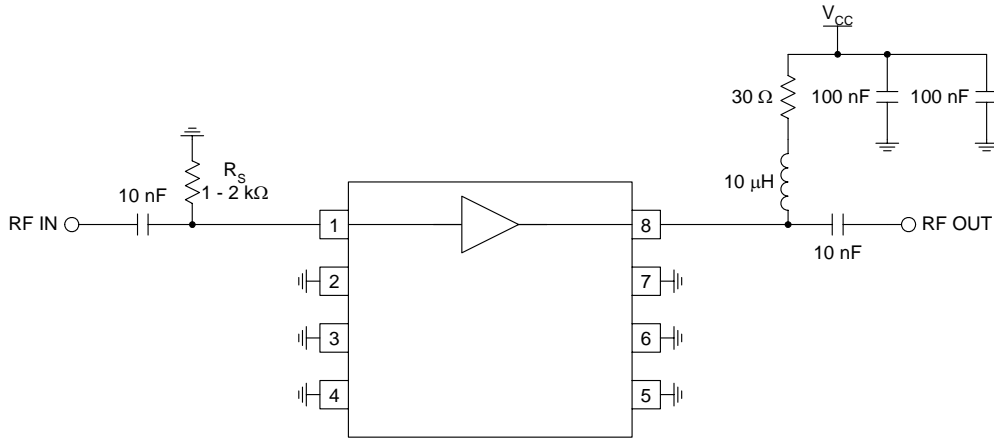
Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Overall (75Ω)					
Frequency Range		DC to 2500		MHz	T=25°C, V _{CC} =9V, Freq=900 MHz, R _C =30Ω, 75Ω System 3dB Bandwidth
Gain	14.5	16		dB	
Noise Figure		3.8	4.3	dB	From 50MHz to 300MHz, -30°C to +70°C.
		4.2	4.8	dB	From 300MHz to 1000MHz, -30°C to +70°C.
Input VSWR		1.3:1	2:1		From 50MHz to 900MHz, -30°C to +70°C. Appropriate values for the DC blocking capacitors and bias inductor are required to maintain this VSWR at the intended operating frequency range.
Output VSWR		1.2:1	1.75:1		From 50MHz to 300MHz, -30°C to +70°C. Appropriate values for the DC blocking capacitors and bias inductor are required to maintain this VSWR at the intended operating frequency range.
		1.4:1	2:1		From 300MHz to 500MHz, -30°C to +70°C.
		1.5:1	2:1		From 500MHz to 900MHz, -30°C to +70°C.
Output IP ₃	+36	+38		dBm	At 100MHz
Output IP ₃	+33	+36		dBm	At 500MHz
Output IP ₃	+28	+30		dBm	At 900MHz
Output P _{1dB}	+21	+22		dBm	At 100MHz
Output P _{1dB}	+20	+21		dBm	At 500MHz
Output P _{1dB}	+17	+18.5		dBm	At 900MHz
Saturated Output Power		+23		dBm	At 100MHz
Saturated Output Power		+22.5		dBm	At 500MHz
Saturated Output Power		+20.5		dBm	At 900MHz
Reverse Isolation		20		dB	
77 Channels					
CSO		>86		dBc	77 Channels to 550MHz at 10dBmV, 33 channels to 760MHz at 0dBmV flat at DUT input
		>86		dBc	61.25MHz
		76		dBc	83.25MHz
		72		dBc	193.25MHz
		64		dBc	313.2625MHz
CTB		>86		dBc	547.25MHz
		>86		dBc	61.25MHz
		86		dBc	83.25MHz
		84		dBc	193.25MHz
		83		dBc	313.2625MHz
CNR	65	66		dB	547.25MHz
110 Channels					
CSO		>86		dBc	110 Channels, 10dBmV/channel at input
		>86		dBc	61.25MHz
		76		dBc	83.25MHz
		70		dBc	193.25MHz
		64		dBc	313.2625MHz
CTB		84		dBc	547.25MHz
		86		dBc	61.25MHz
		85		dBc	83.25MHz
		81		dBc	193.25MHz
		80		dBc	313.2625MHz
Cross Modulation		77		dBc	547.25MHz
		74		dBc	61.25MHz
CNR	65	66		dB	445.25MHz

RF2312

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Overall (75Ω Push-Pull)					T=25°C, V _{CC} =9V or 24V, 75Ω System, RF _{IN} =-10dBm
Frequency Range		DC to 150		MHz	
Gain		15		dB	
Noise Figure		5.0		dB	From 5MHz to 150MHz, -30°C to +70°C.
Input VSWR		1.1:1			
Output VSWR		1.2:1			
Output IP ₂		+71		dBm	At 10MHz
		+72		dBm	At 30MHz
		+74		dBm	At 50MHz
Output IP ₃		+40		dBm	At 10MHz
		+40		dBm	At 30MHz
		+40		dBm	At 50MHz
Second Harmonic		-73		dBc	At 10MHz
		-65		dBc	At 30MHz
		-65		dBc	At 50MHz

Pin	Function	Description	Interface Schematic
1	RF IN	RF input pin. This pin is NOT internally DC-blocked. A DC-blocking capacitor, suitable for the frequency of operation, should be used in all applications. The device has internal feedback, and not using a DC-blocking capacitor will disable the temperature compensation. The bias of the device can be controlled by this pin. Adding an optional 1 k Ω resistor to ground on this pin reduces the bias level, which may be compensated for by a higher supply voltage to maintain the appropriate bias level. The net effect of this is an increased output power capability, as well as higher linearity for signals with high crest factors. DC-coupling of the input is not allowed, because this will override the internal feedback loop and cause temperature instability.	
2	GND	Ground connection. For best performance, keep traces physically short and connect immediately to ground plane. Each ground pin should have a via to the ground plane.	
3	GND	Same as pin 2.	
4	GND	Same as pin 2.	
5	GND	Same as pin 2.	
6	GND	Same as pin 2.	
7	GND	Same as pin 2.	
8	RF OUT	RF output and bias pin. Because DC is present on this pin, a DC-blocking capacitor, suitable for the frequency of operation, should be used in most applications. For biasing, an RF choke in series with a resistor is needed. The value for the resistor R_C is 30 Ω (0.5W) for $V_{CC}=9V$ and 21 Ω for $V_{CC}=8V$. The DC voltage on this pin is typically 6.0V with a current of 100mA. In lower power applications the value of R_C can be increased to lower the current and V_D on this pin.	

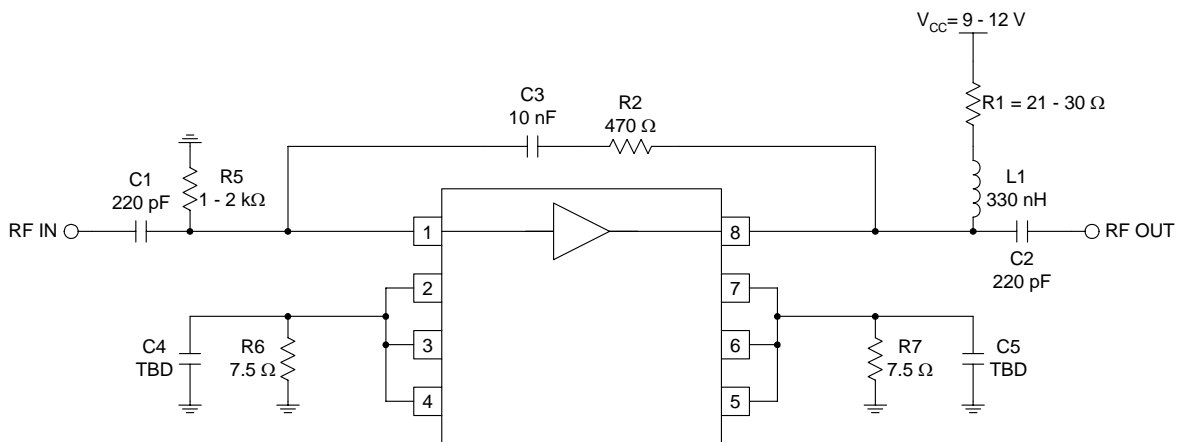
Application Schematic 5 MHz to 50 MHz Reverse Path



NOTE 1:

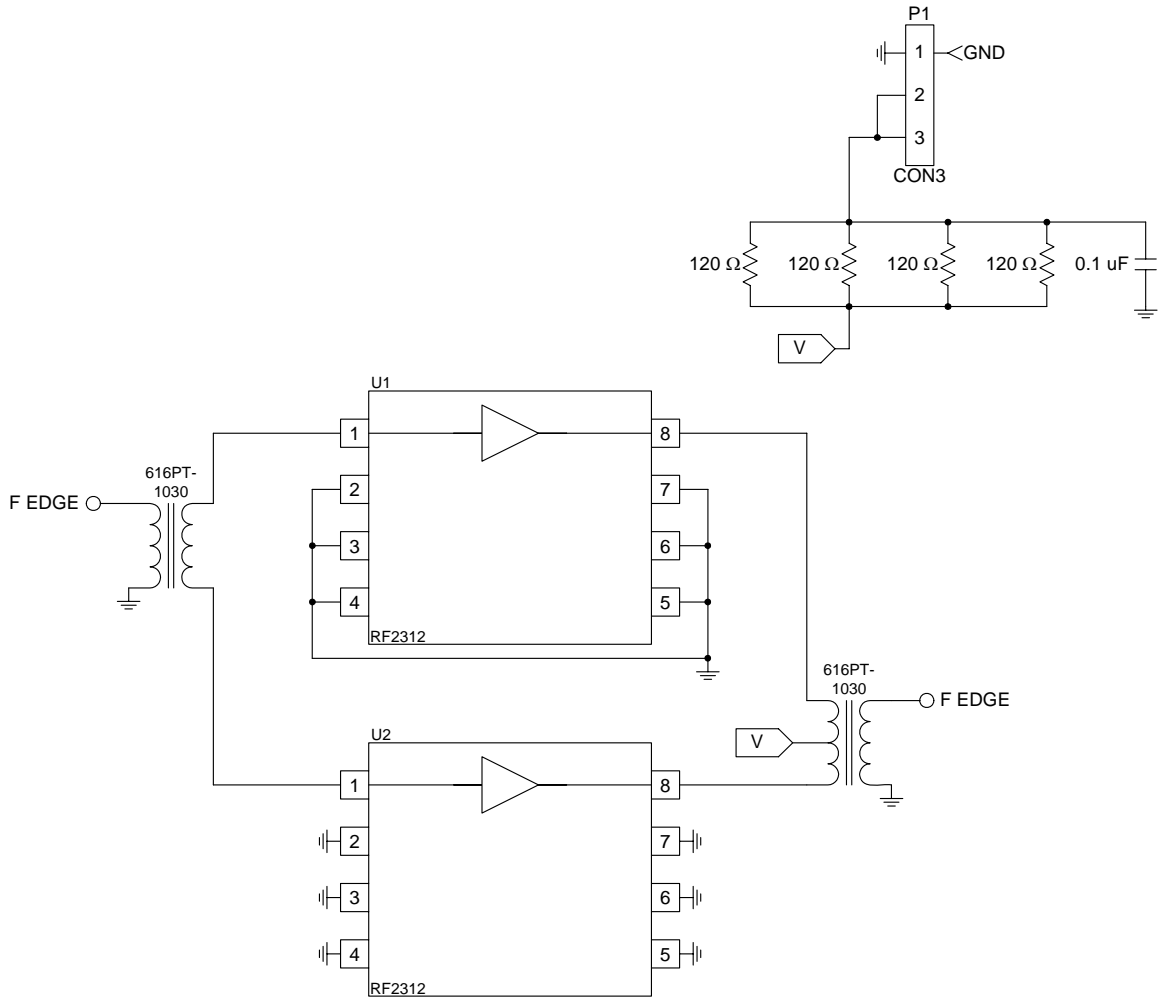
Optional resistor R_S can be used to maintain the correct bias level at higher supply voltages. This is used to increase output capability or linearity for signals with high crest factors.

Application Schematic 10dB Gain

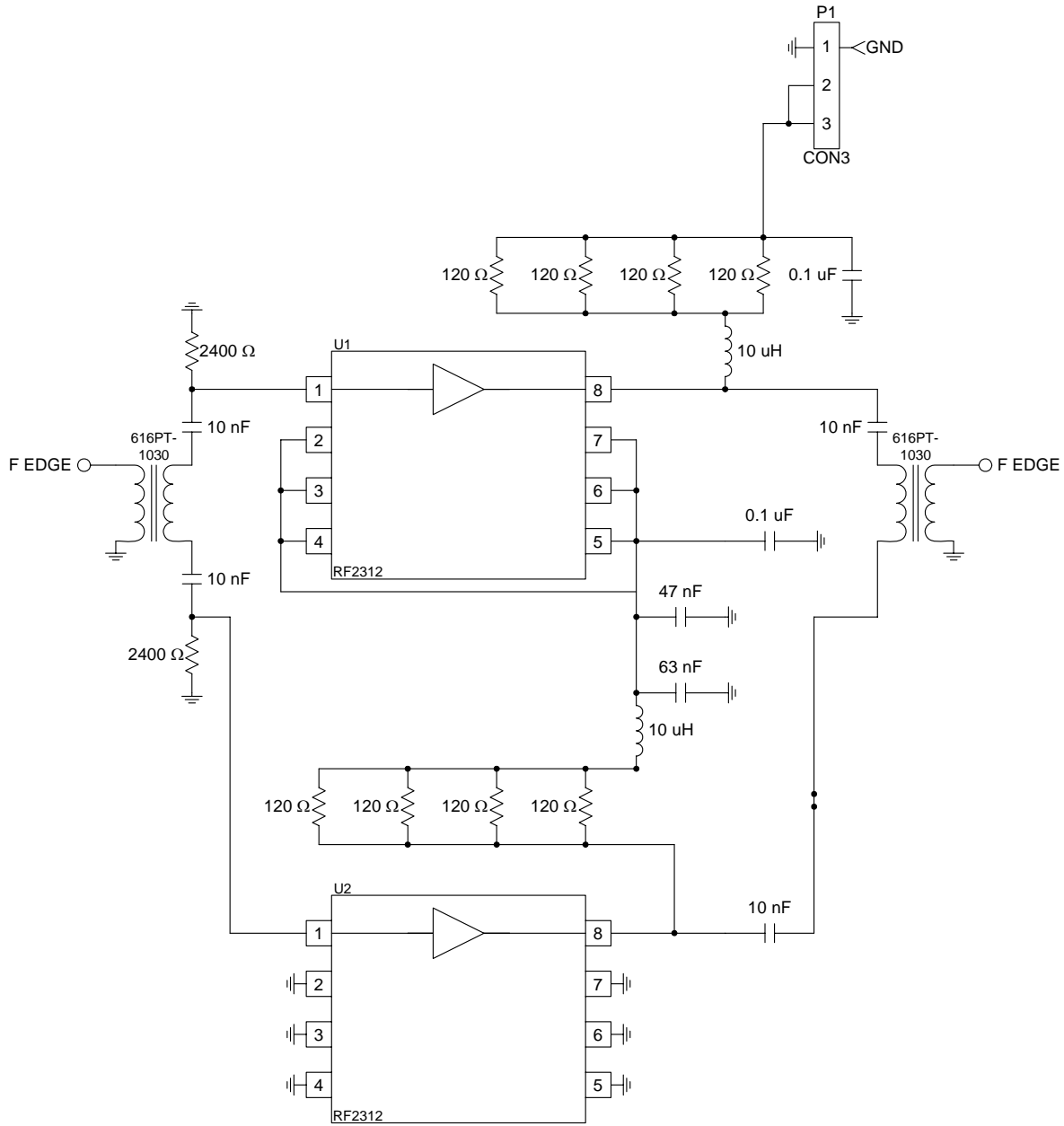


R_5 is used to maintain the correct bias level at higher supply voltages and is also required in this configuration. The RC network of R_2 and C_3 should be kept physically as short as possible. R_2 can be adjusted as required to improve the impedance matching. R_6 and R_7 reduce the typical gain by increasing the emitter resistance. L_1 should be at least 200Ω reactive at the lowest operating frequency. C_1 and C_2 should be less than 10Ω at the lowest operating frequency. C_4 and C_5 improve gain flatness.

Application Schematic Push-Pull Standard Voltage

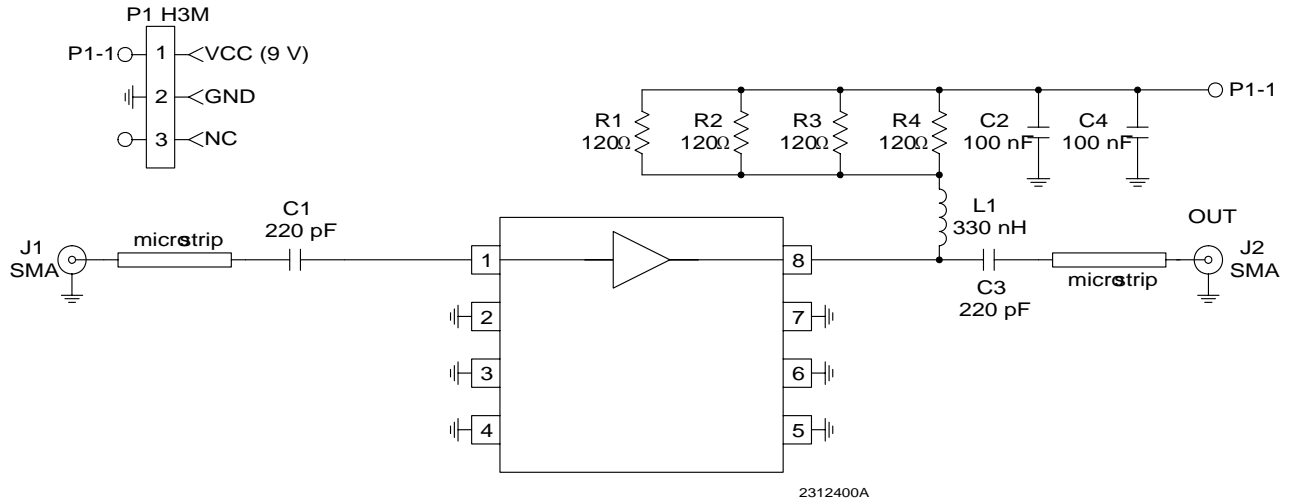


Application Schematic Push-Pull 24 V

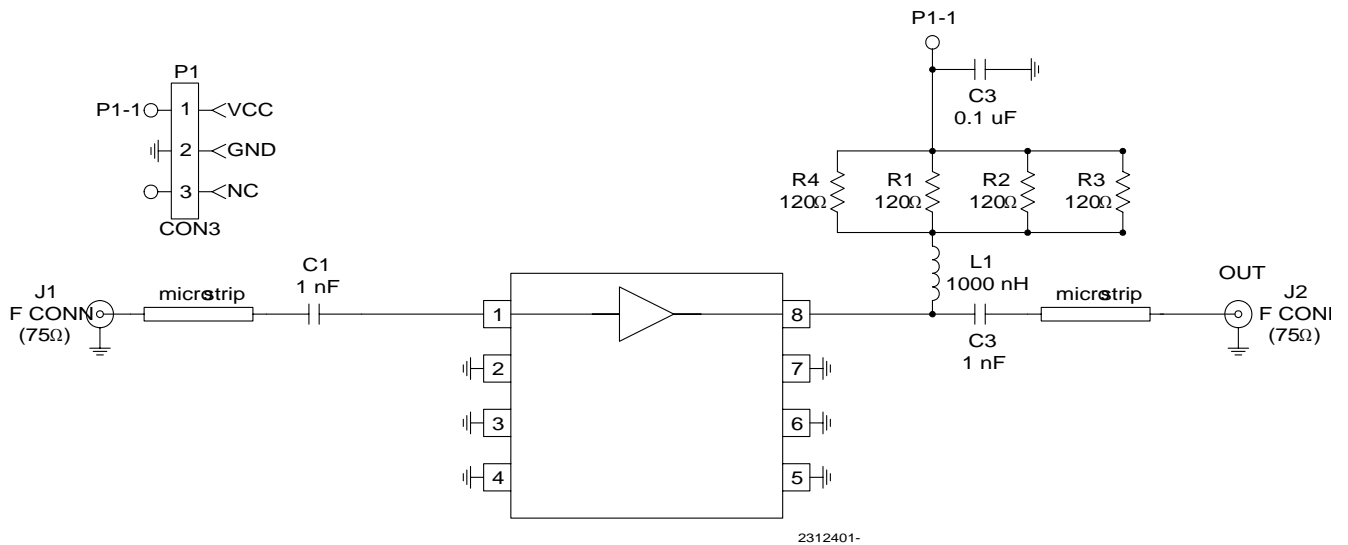


Evaluation Board Schematic - 50Ω

(Download [Bill of Materials](http://www.rfmd.com) from www.rfmd.com.)



Evaluation Board Schematic - 75Ω

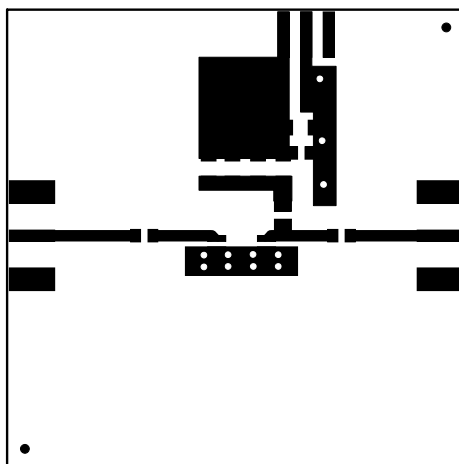
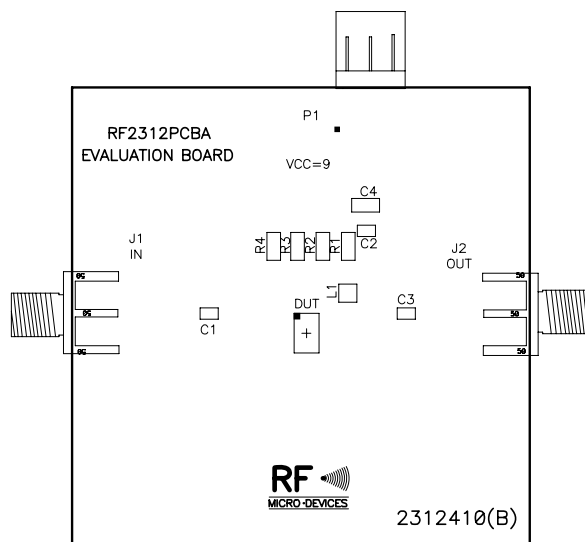


NOTE: For 5V applications, R1 to R4 may be removed (shorted). This will result in degraded distortion performance.

Evaluation Board Layout - 50Ω

2.02" x 2.02"

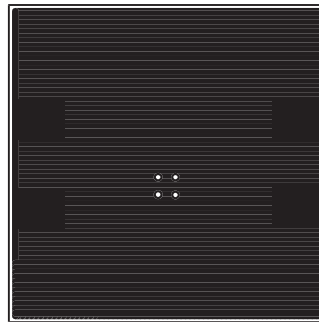
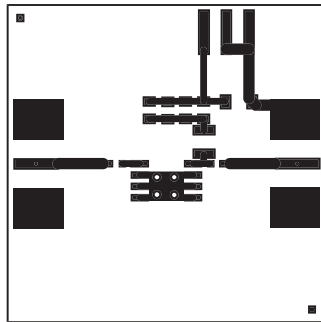
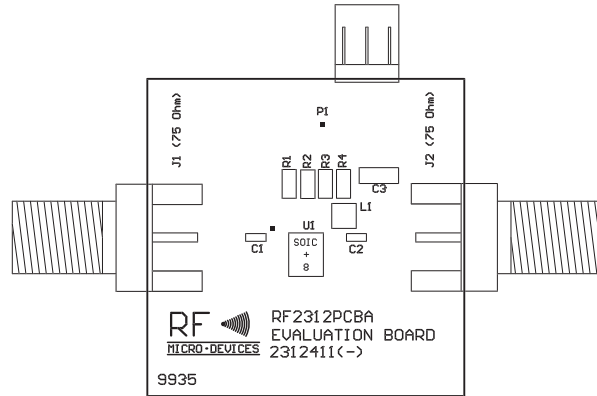
Board Thickness 0.031", Board Material FR-4



**Evaluation Board Layout - 75 Ω
Standard Voltage**

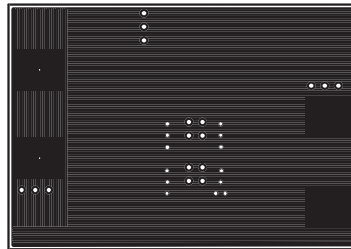
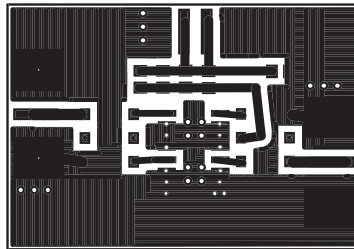
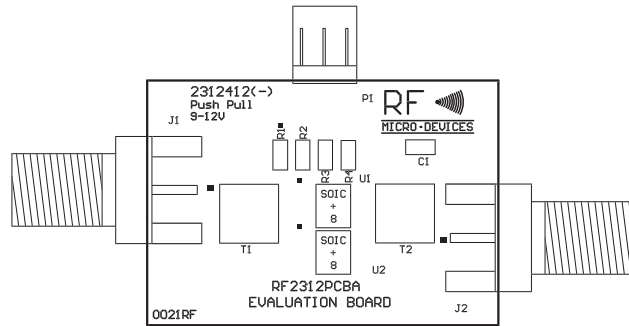
1.40" x 1.40"

Board Thickness 0.062", Board Material FR-4



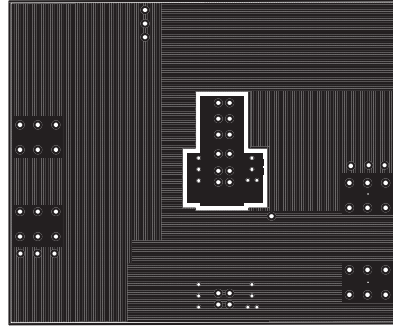
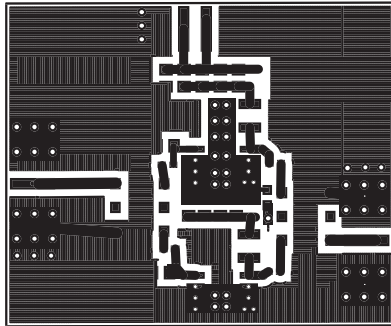
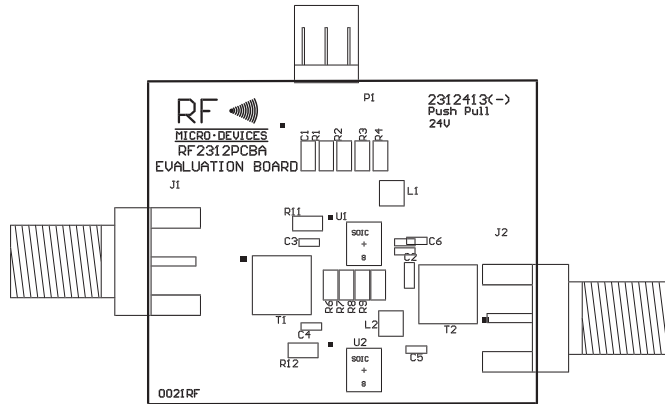
Evaluation Board Layout - 75Ω Push-Pull, Standard Voltage 1.70" x 1.50"

Board Thickness 0.062", Board Material FR-4

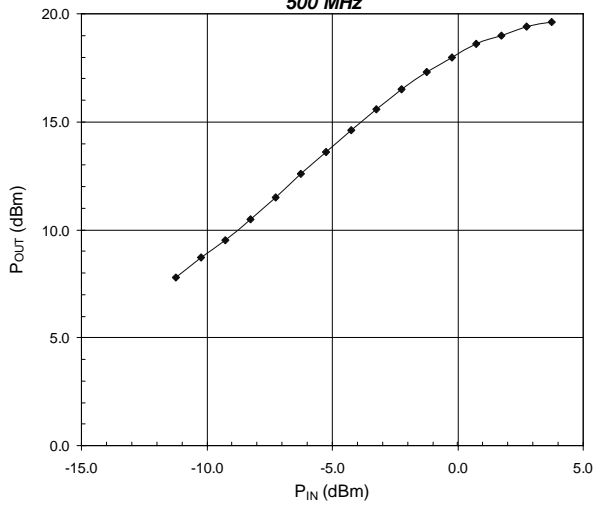


**Evaluation Board Layout - 75 Ω
Push-Pull, 24 V
1.70" x 1.50"**

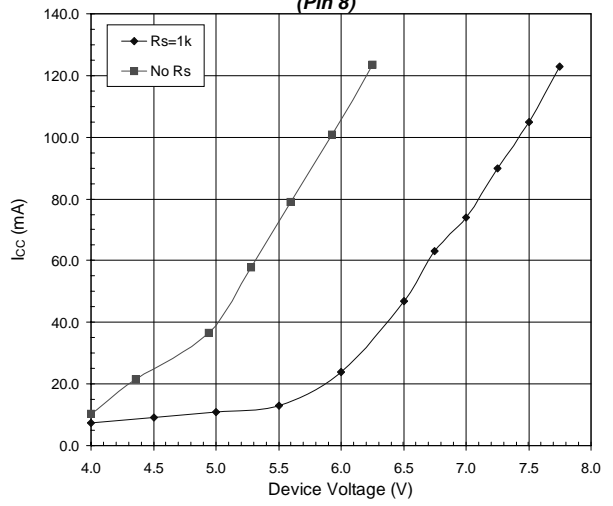
Board Thickness 0.062", Board Material FR-4



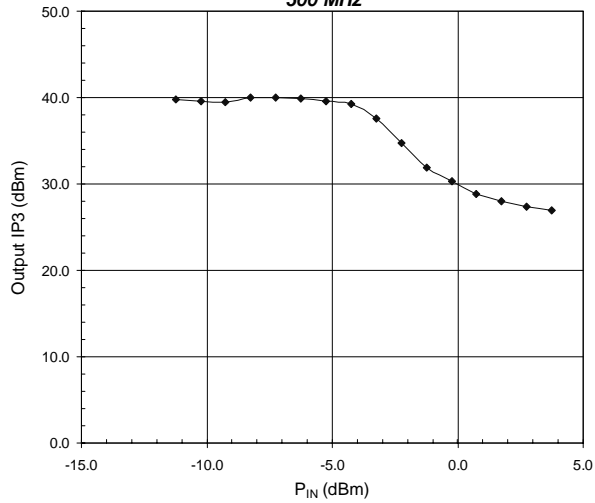
P_{OUT} versus P_{IN}
500 MHz



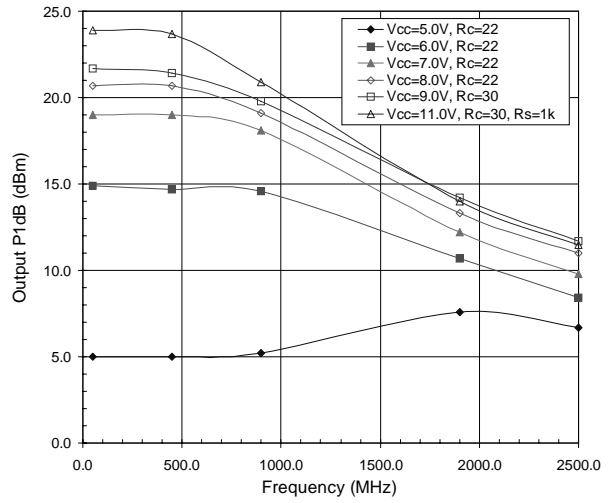
I_{CC} versus Device Voltage
(Pin 8)



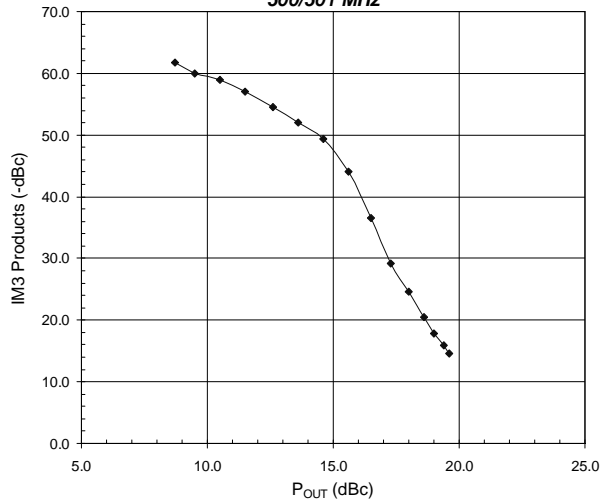
Output Third Order Intercept Point (OIP3) versus P_{IN}
500 MHz

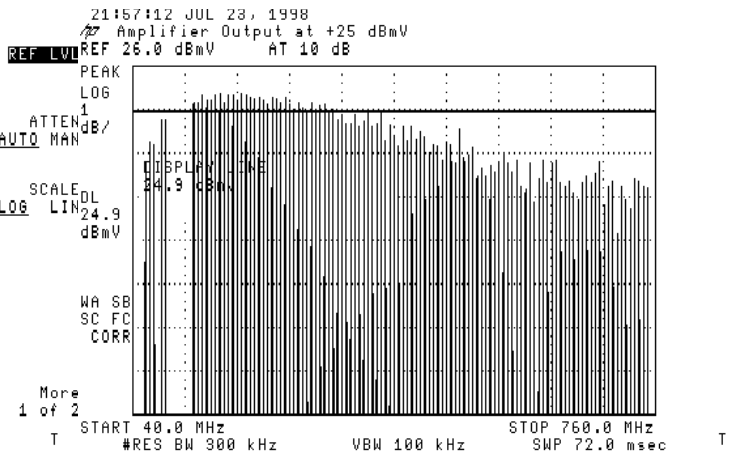
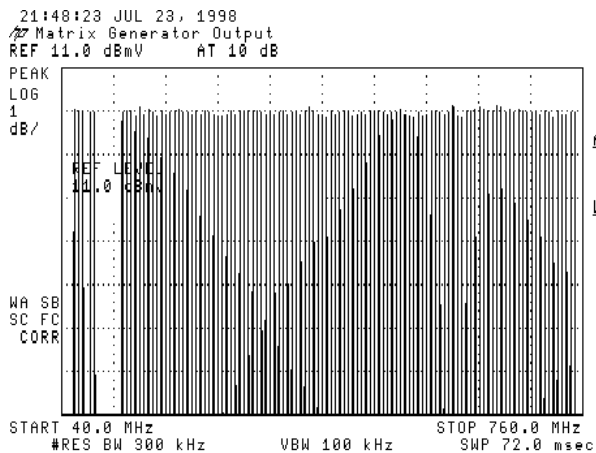
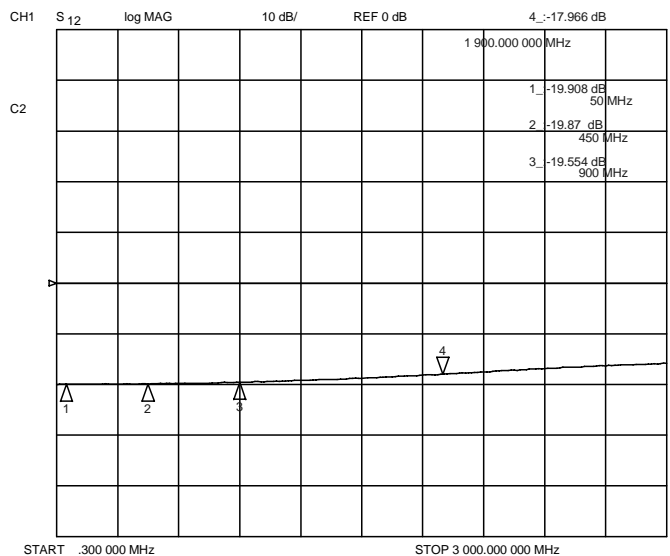
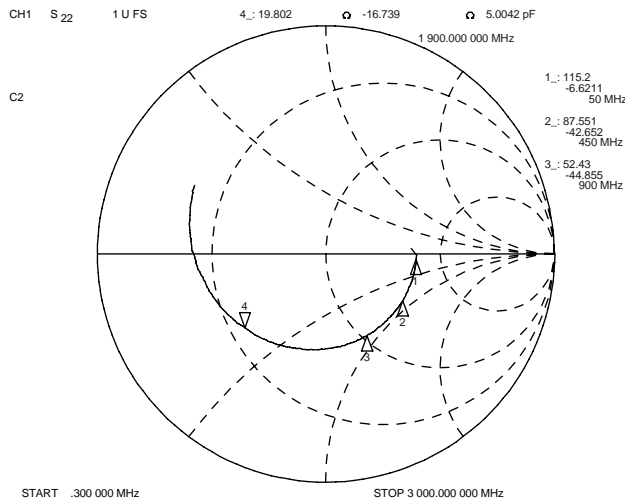
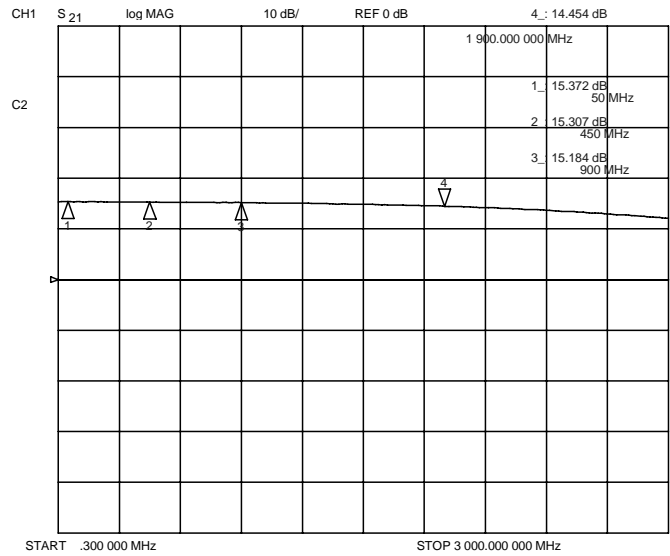
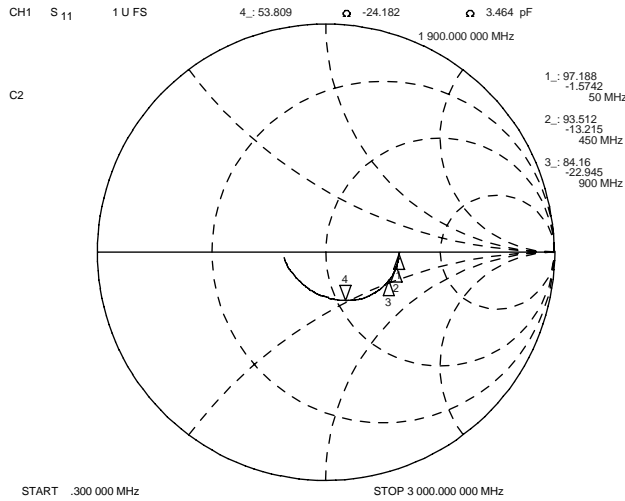


Output P1dB versus Frequency



IM3 Products versus P_{OUT}
500/501 MHz

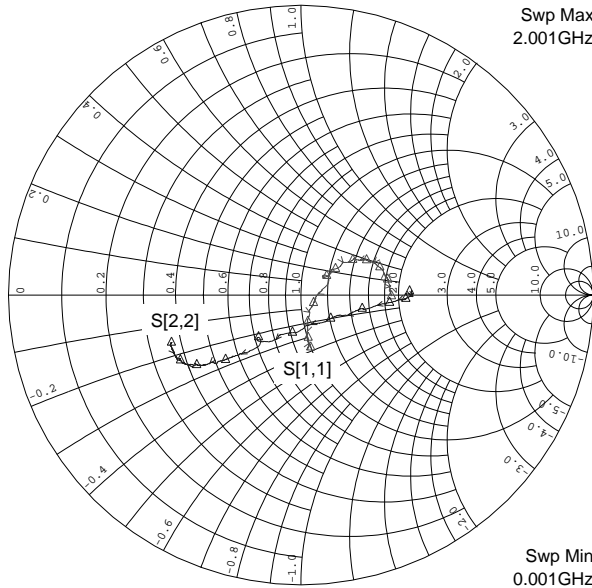




RF2312

75 Ohms, ICC = 100 mA, Temp = 25 °C

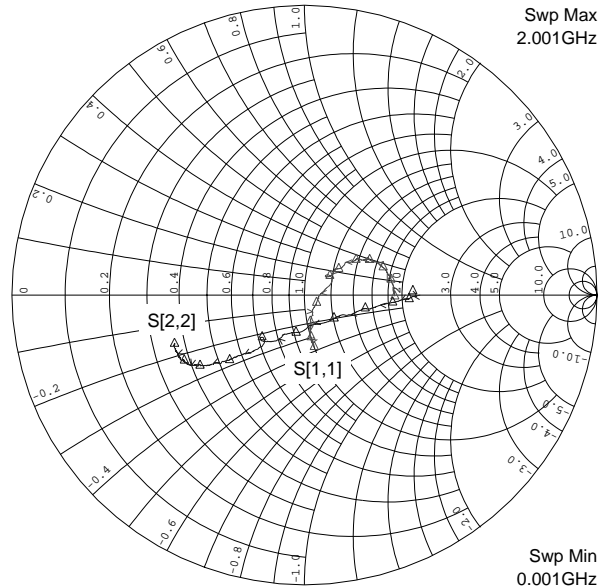
Swp Max
2.001GHz



Swp Min
0.001GHz

75 Ohms, ICC = 110 mA, Temp = 25 °C

Swp Max
2.001GHz



Swp Min
0.001GHz