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DAB L-band Amplifier using the NSVF4020SG4



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Overview

This application note explains about ON Semiconductor's NSVF4020SG4 which is used as a Low Noise Amplifier (LNA) for DAB (Digital Audio Broadcast).

The NSVF4020SG4 is a silicon bipolar transistor best suited for high-frequency applications which is assembled in the 4-pin surface mount package.

For information about the performance, please refer to the datasheet of this product.

Since the evaluation board is adjusted to achieve optimal performance in L-band (1452 MHz to 1492 MHz), the product can provide 10 dB gain and 1.85 dB noise figure.

A standard material FR4 is used for the printed circuit board (PCB). Please note that the losses of the PCB and the SMA connector are not excluded from the noise figure.

APPLICATION NOTE

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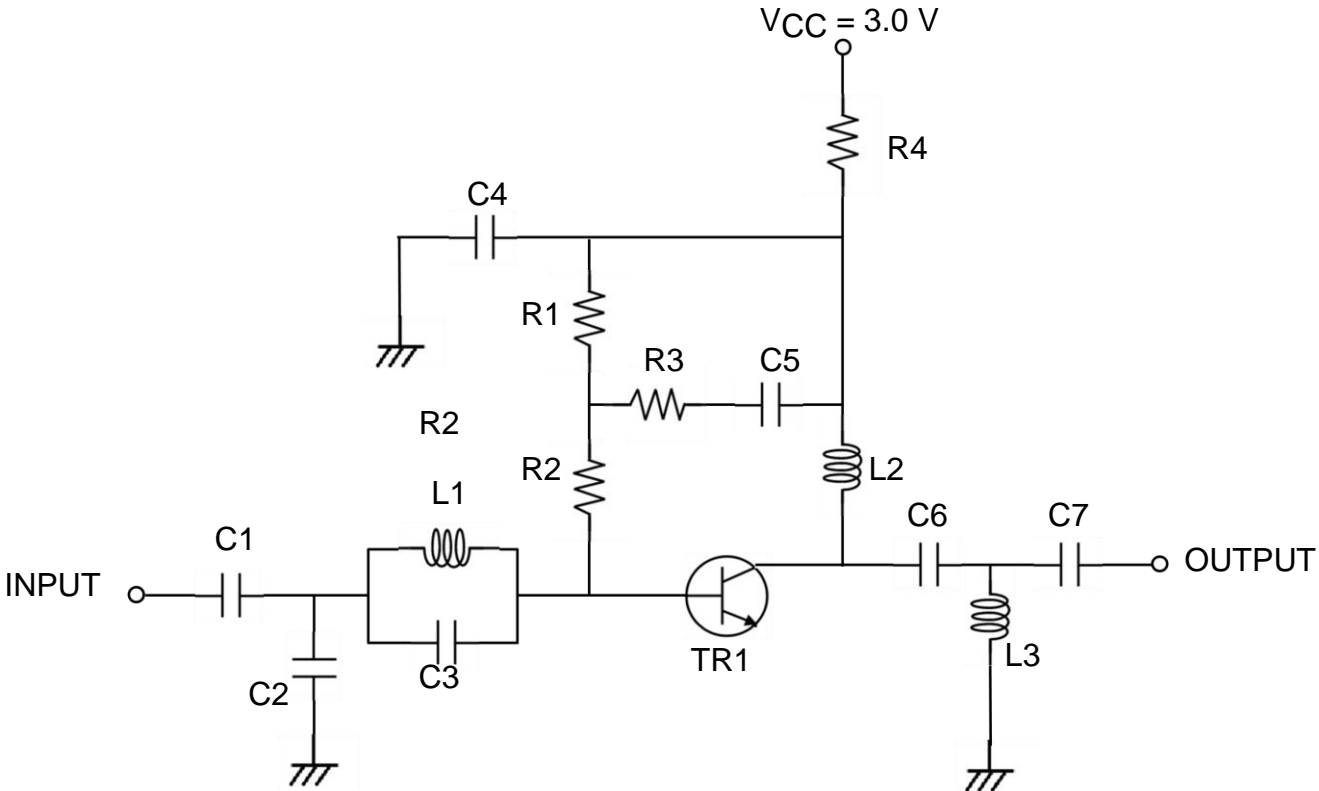
■ Summary of Data

Ta = 25°C, Input Power = -40 dBm

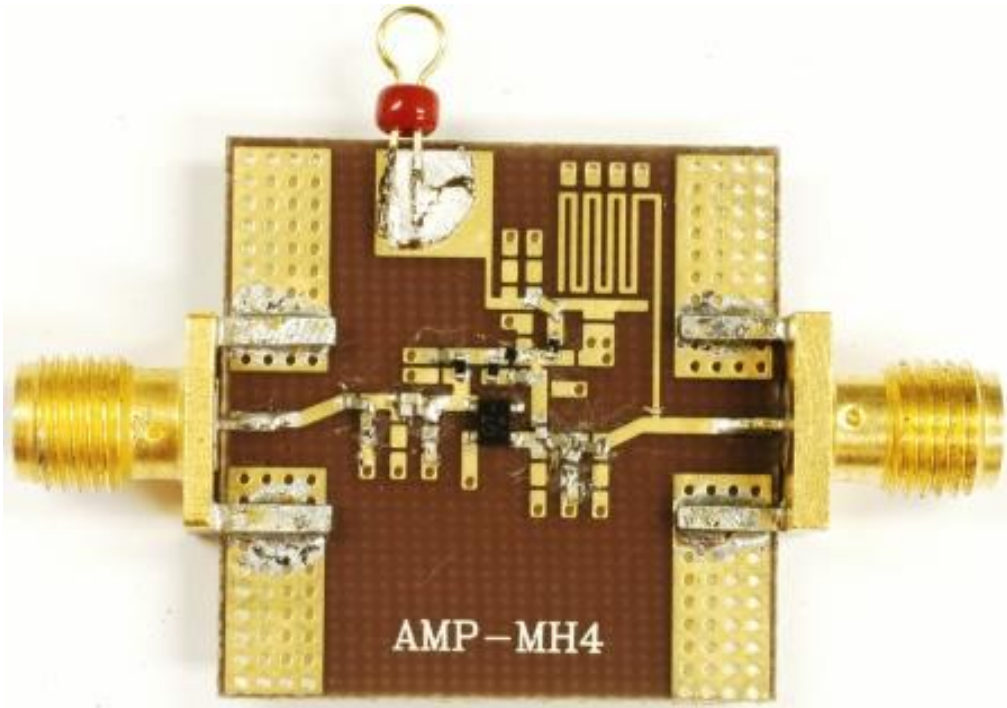
Parameter	Symbol	Condition	Result			Unit
DC Voltage	V _{CC}		2.7	3.0	3.3	V
DC Current	I _{CC}		6.4	7.4	8.4	mA
Gain	Gp1	f = 1452 MHz	9.9	10.1	10.2	dB
	Gp2	f = 1472 MHz	9.7	10.0	10.1	dB
	Gp3	f = 1492 MHz	9.7	9.9	10.1	dB
Noise Figure	NF1	f = 1452 MHz	1.67	1.69	1.74	dB
	NF2	f = 1472 MHz	1.81	1.85	1.88	dB
	NF3	f = 1492 MHz	1.86	1.90	1.94	dB
Input Return Loss	RLin1	f = 1452 MHz	29.9	41.8	35.3	dB
	RLin2	f = 1472 MHz	26.7	33.1	40.3	dB
	RLin3	f = 1492 MHz	22.3	24.8	26.6	dB
Output Return Loss	RLout1	f = 1452 MHz	8.6	8.4	8.2	dB
	RLout2	f = 1472 MHz	9.7	9.5	9.3	dB
	RLout3	f = 1492 MHz	9.9	9.7	9.5	dB
Isolation	ISL1	f = 1452 MHz	15.9	16.0	16.0	dB
	ISL2	f = 1472 MHz	15.8	15.9	15.9	dB
	ISL3	f = 1492 MHz	15.7	15.7	15.8	dB
Gain 1dB Compression Input Power	Pin1dB	f = 1472 MHz	-	-6.0	-	dBm
Input 3rd Order Intercept Point	IIP3	f1 = 1472 MHz f2 = 1473 MHz Pin = -20 dBm	-	7.0	-	dBm

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■ Circuit Design



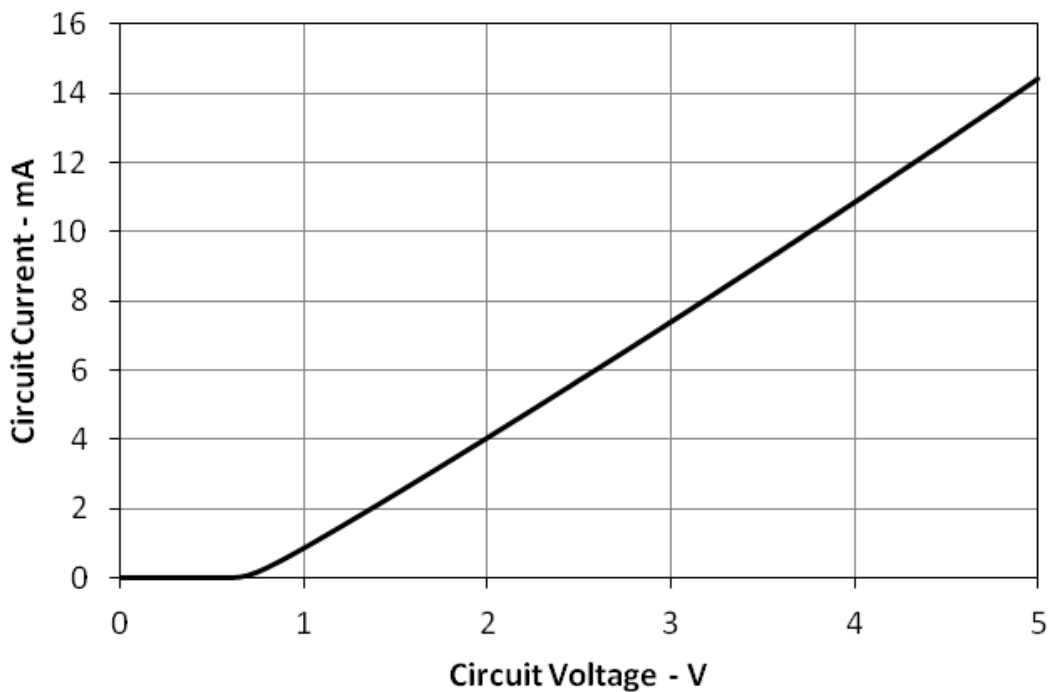
■ Evaluation Board



■ Bill of Materials

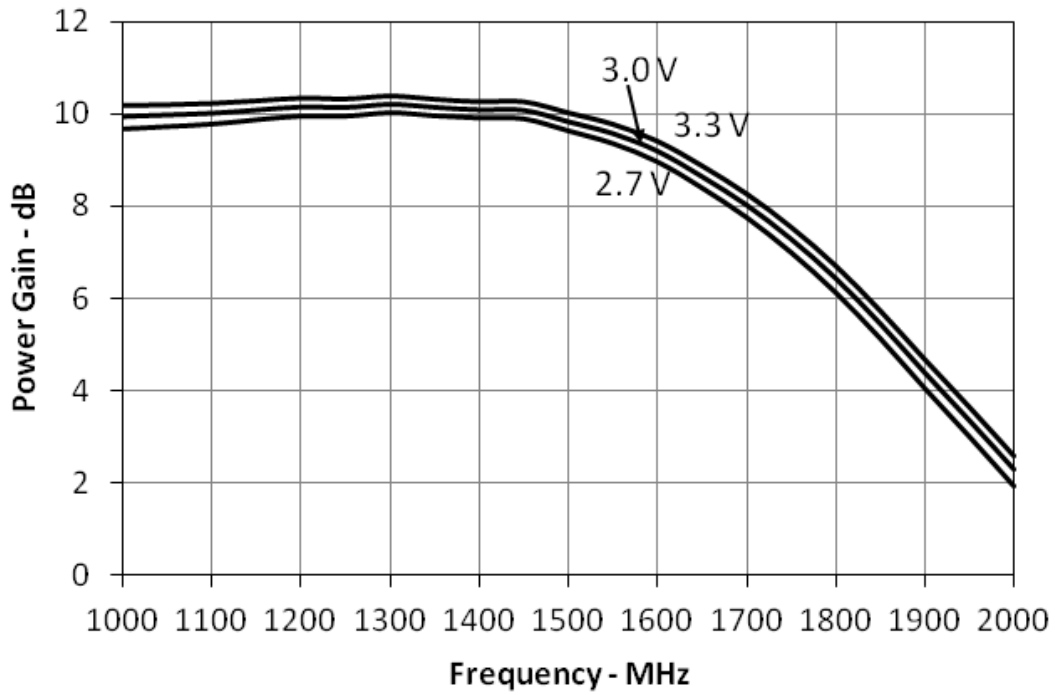
Item	Symbol	Value	Manufacturer	Size
Bip-Tr	TR1	NSVF4020SG4	ON Semiconductor	SC82
Capacitor	C1	56 pF	TAIYOYUDEN	1005
	C2	1.8 pF	TAIYOYUDEN	1005
	C3	1 pF	TAIYOYUDEN	1005
	C4	82 pF	TAIYOYUDEN	1005
	C5	120 pF	TAIYOYUDEN	1005
	C6	8 pF	TAIYOYUDEN	1005
	C7	120 pF	TAIYOYUDEN	1005
Resistor	R1	22 k Ω	Various	1005
	R2	820 Ω	Various	1005
	R3	150 Ω	Various	1005
	R4	47 Ω	Various	1005
Inductor	L1	2.7 nH	TOKO LL1005	1005
	L2	56 nH	TOKO LL1005	1005
	L4	3.9 nH	TOKO LL1005-FHL1N8S	1005
Material	-	FR4	-	25 x 25 mm

■ Circuit Current

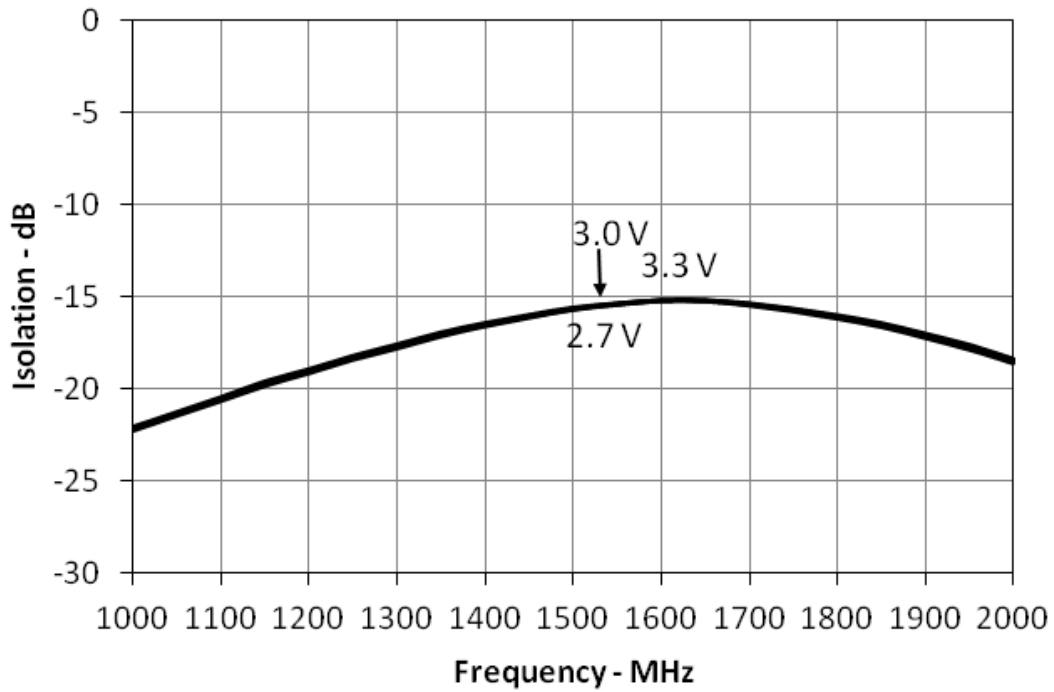


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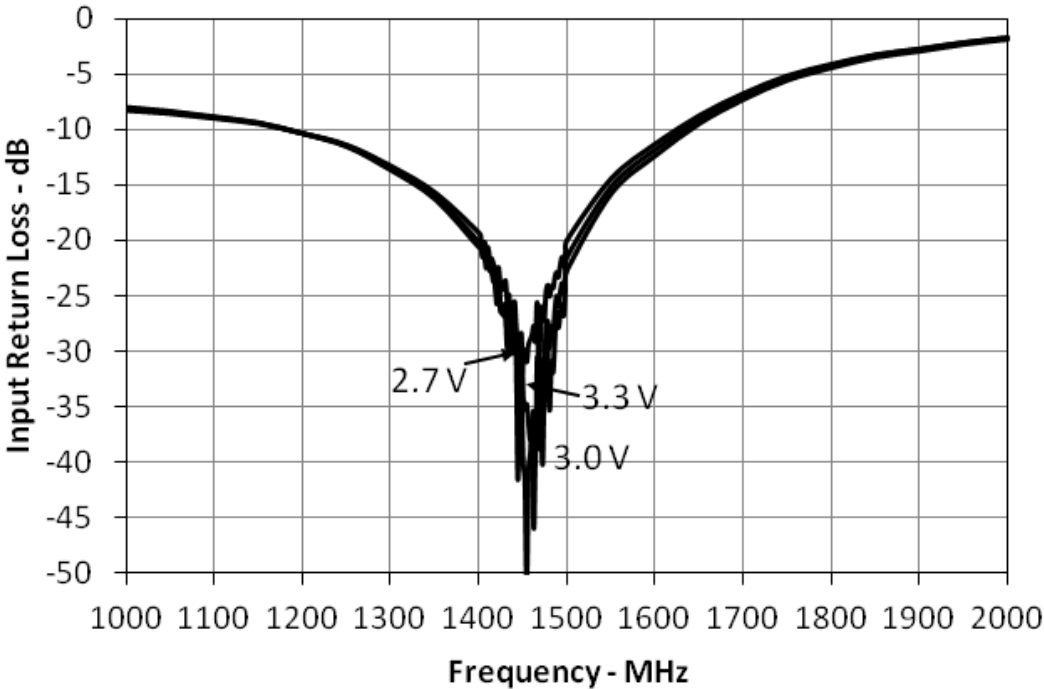
■ Power Gain



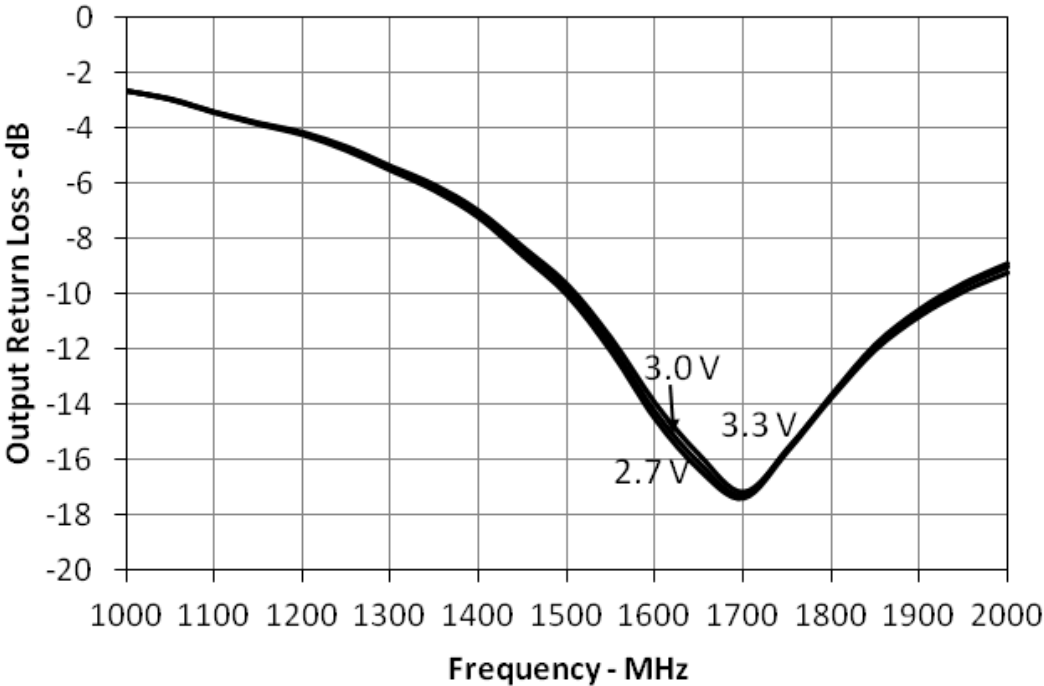
■ Isolation



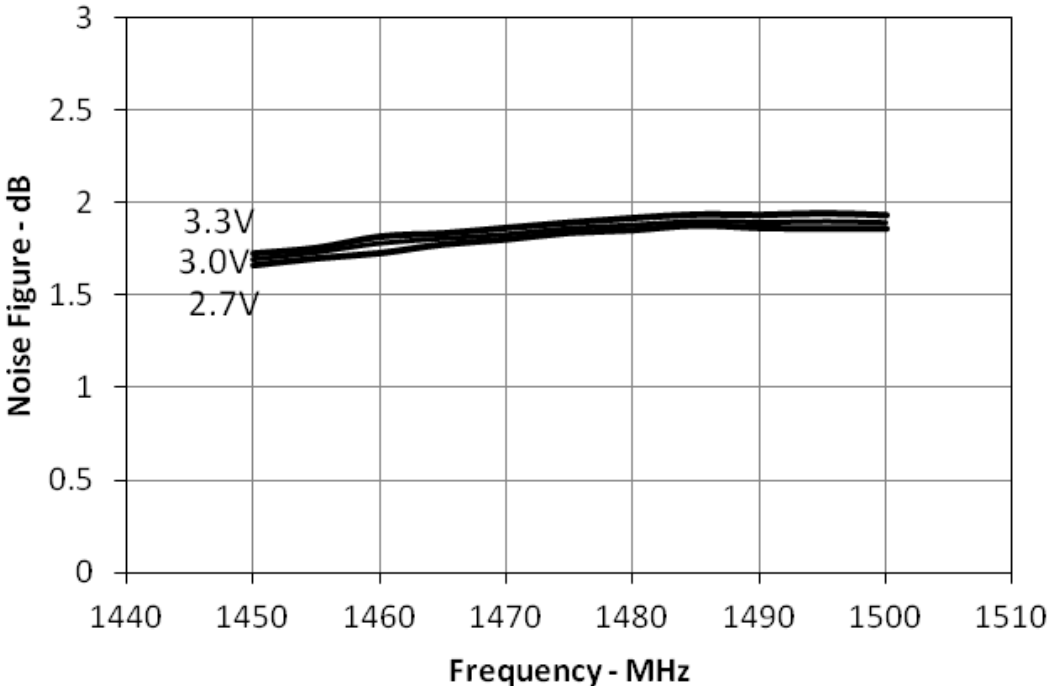
■ Input Return Loss



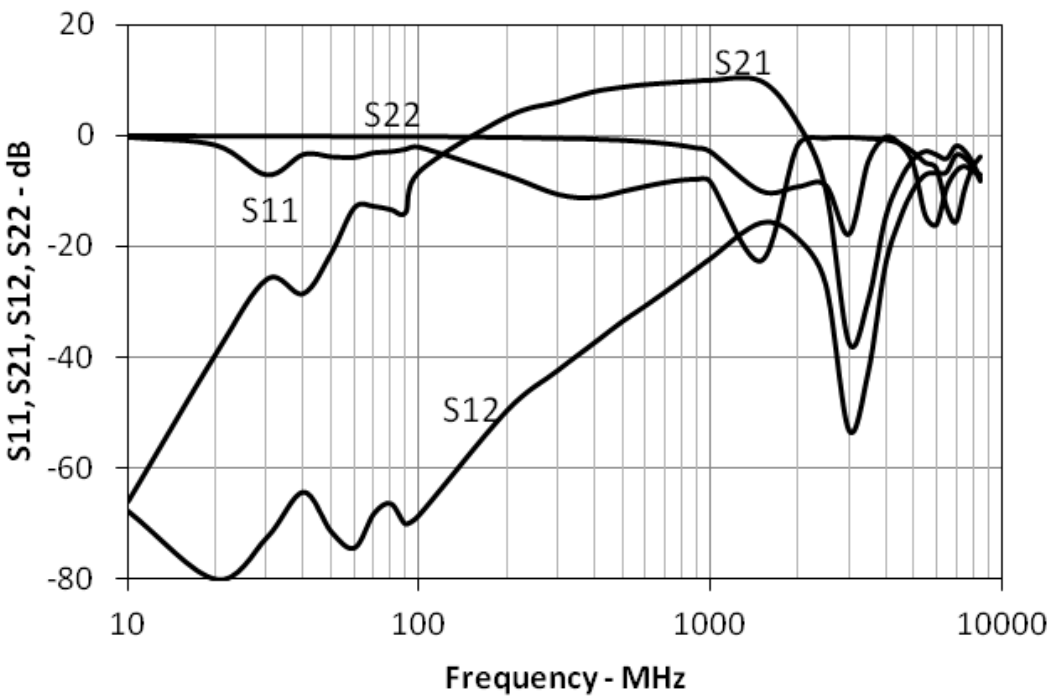
■ Output Return Loss



■ Noise Figure

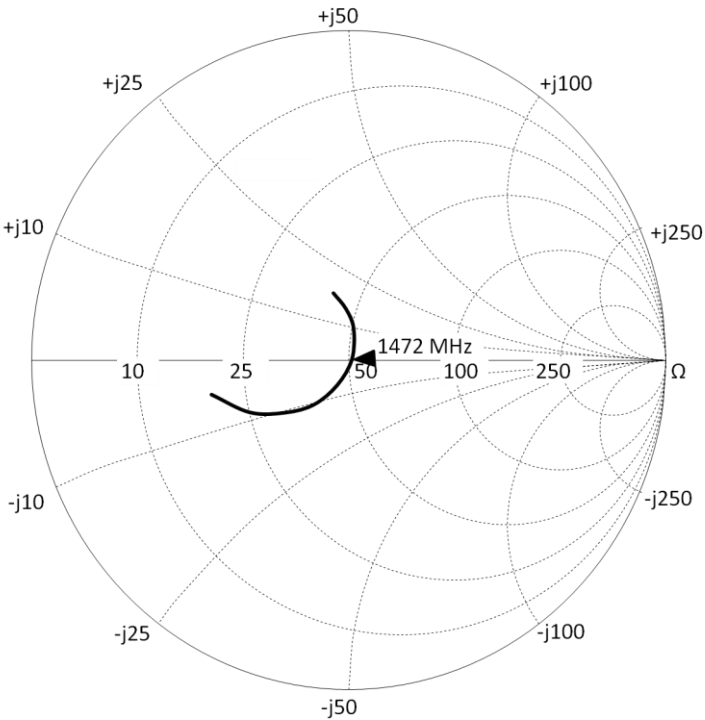


■ S11, S21, S12, S22 Wide Span



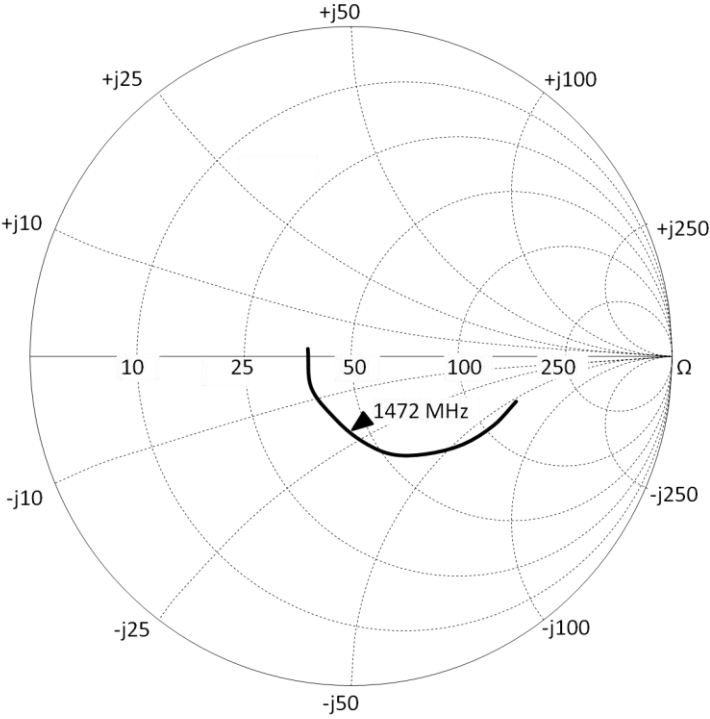
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■ Smith Chart
Input Return Loss



1.3 GHz to 1.7 GHz

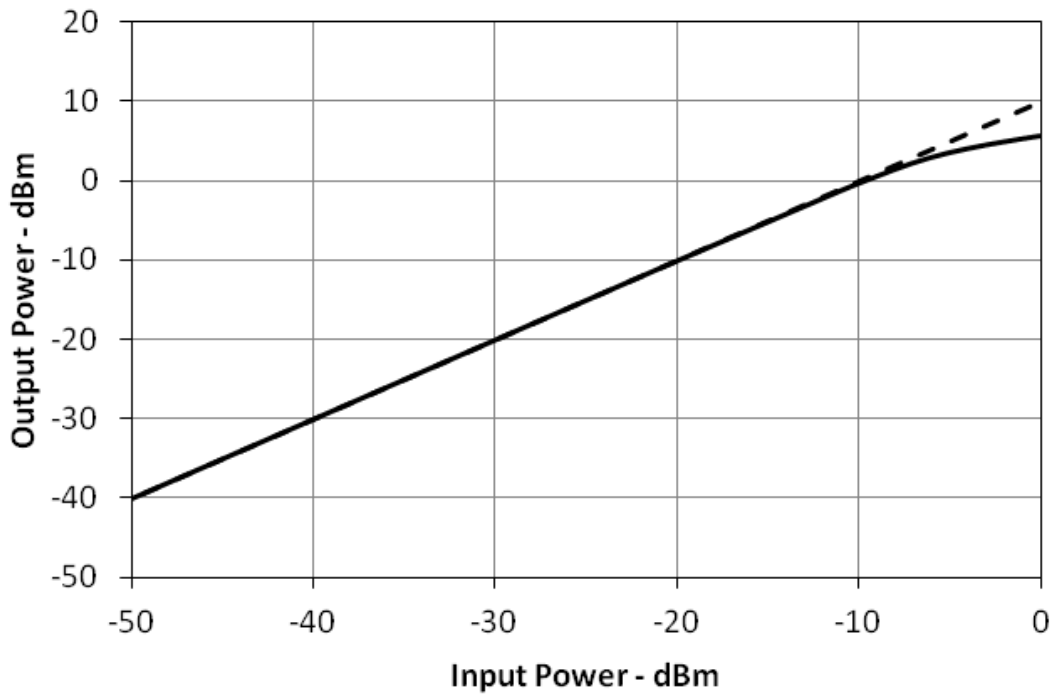
■ Smith Chart
Output Return Loss



1.3 GHz to 1.7 GHz

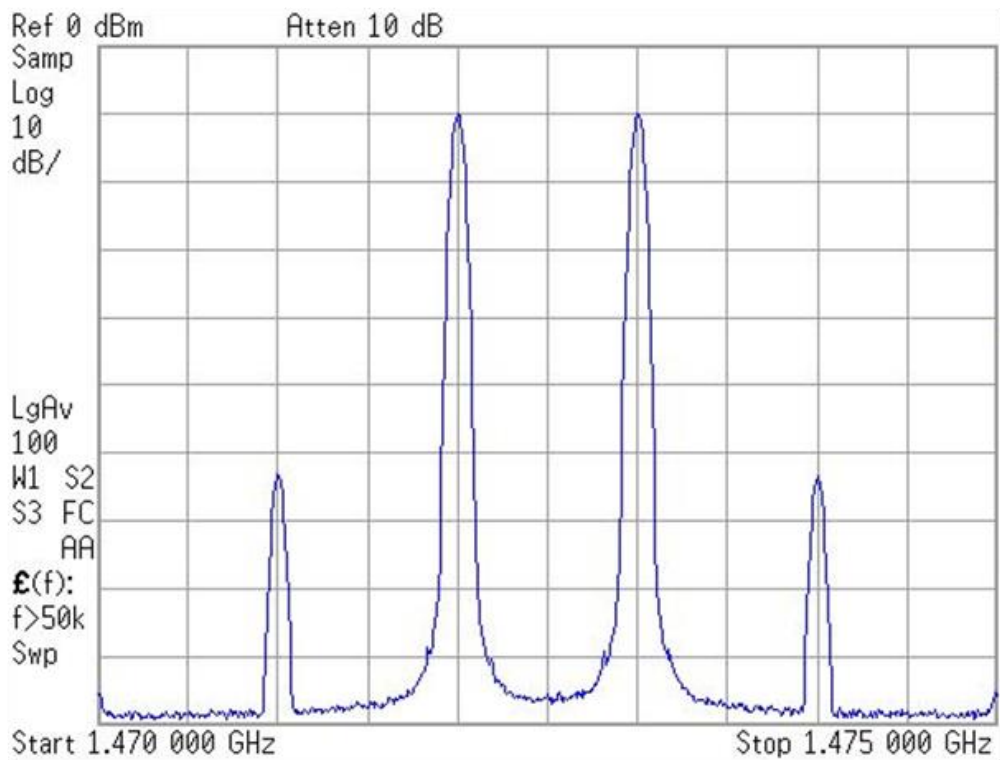
■ Gain 1 dB Compression Point

f = 1472 MHz



■ Input 3rd Order Intercept Point

f1 = 1472 MHz, f2 = 1473 MHz, Pin = -20 dBm



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