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AND9515/D

Single stage LNA for GPS using the NSVF4009SG4

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APPLICATION NOTE

Overview

This application note explains about ON Semiconductor's NSVF4009SG4 which is used as a Low Noise Amplifier (LNA) for GPS (Global Positioning System).

The NSVF4009SG4 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 GPS (1575 MHz), the product can provide 14.1 dB gain and 1.5 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.

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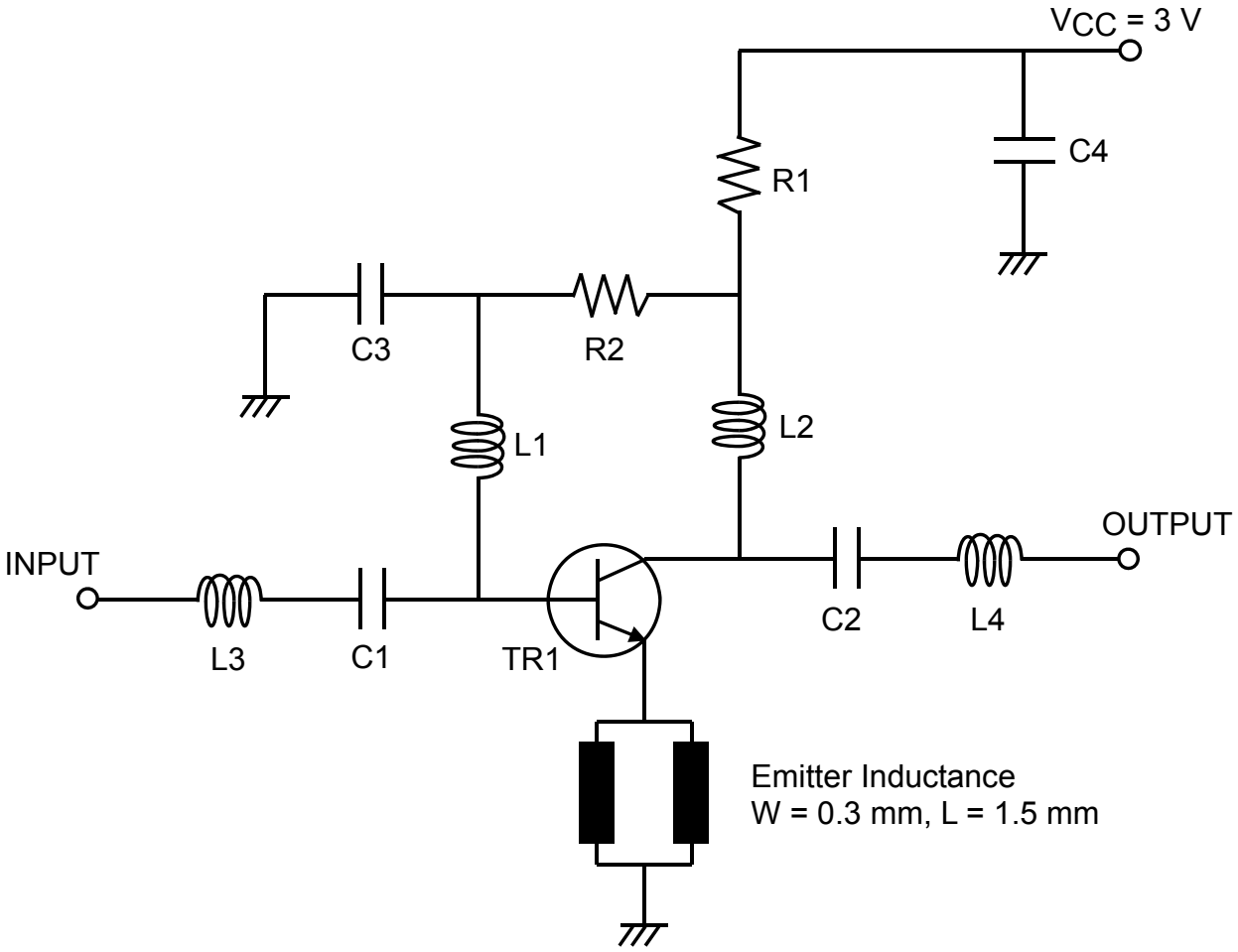
■ Summary of Data

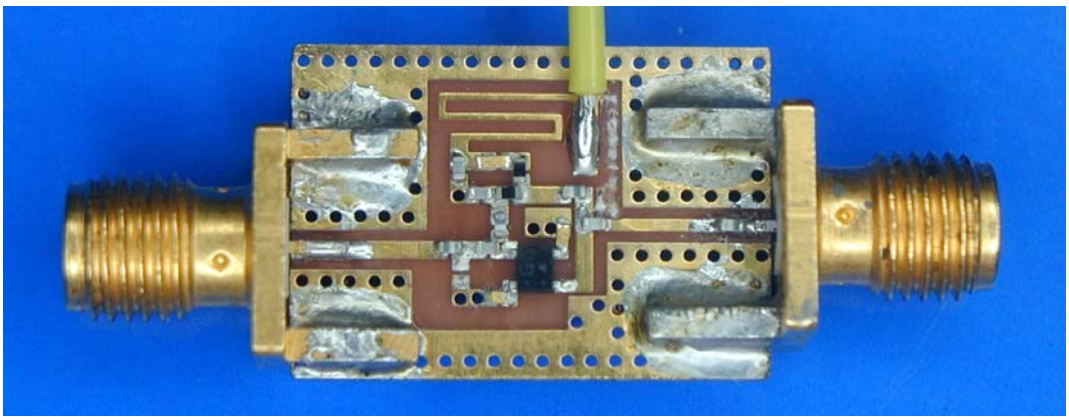
Ta = 25°C, Input Power = −40 dBm

Parameter	Symbol	Condition	Result	Unit
DC Voltage	V_{CC}		3.0	V
DC Current	I_{CC}		4.9	mA
Power Gain	Gp	f = 1575 MHz	14.1	dB
Noise Figure	NF	f = 1575 MHz	1.5	dB
Input Return Loss	RLin	f = 1575 MHz	10.4	dB
Output Return Loss	RLout	f = 1575 MHz	8.4	dB
Isolation	ISL	f = 1575 MHz	21.1	dB
Gain 1 dB Compression Input Power	Pin1dB	f = 1575 MHz	–15	dBm
Input 3rd Order Intercept Point	IIP3	f1 = 1575 MHz f2 = 1576 MHz Pin = −26 dBm	–0.5	dBm

■ Circuit Design



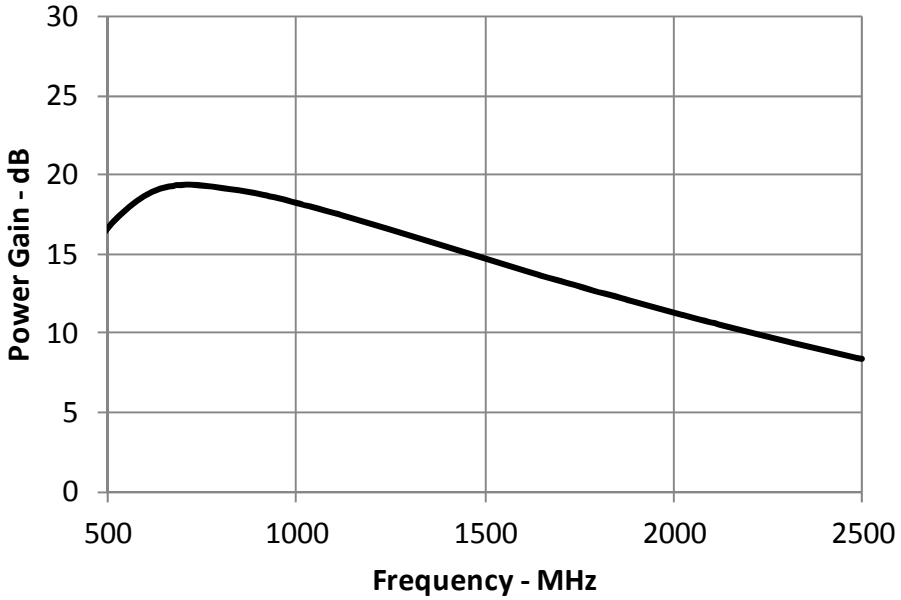
■ Evaluation Board



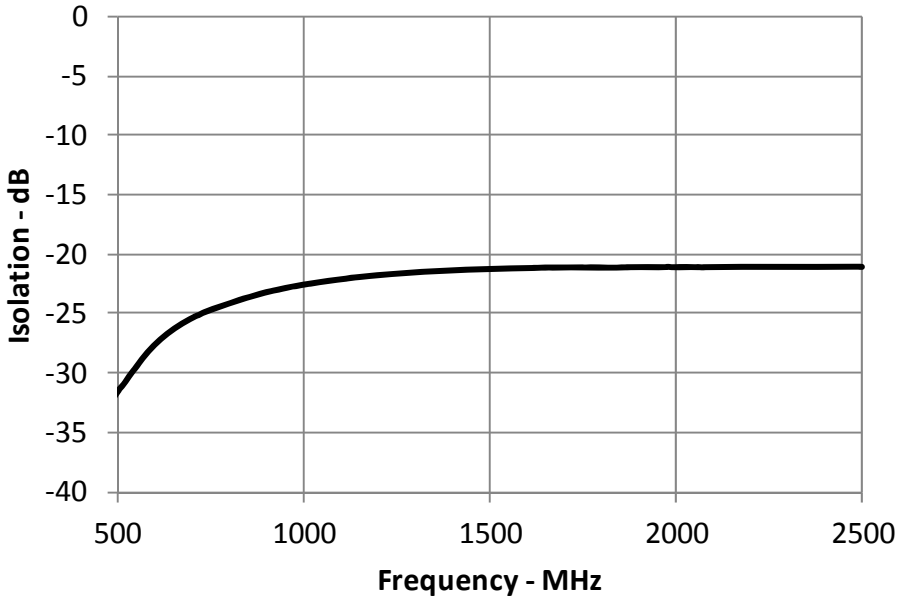
■ Bill of Materials

Item	Symbol	Value	Manufacturer	Size
Bip-Tr	TR1	NSVF4009SG4	ON Semiconductor	SC82
Capacitor	C1	6 pF	Murata GRM155	1005
	C2	100 pF	Murata GRM155	1005
	C3	1000 pF	Murata GRM155	1005
	C4	1000 pF	Murata GRM155	1005
Resistor	R1	150 Ω	Various	1005
	R2	22 kΩ	Various	1005
Inductor	L1	8.2 nH	TDK MLG1005S	1005
	L2	33 nH	TDK MLG1005S	1005
	L3	1 nH	TDK MLG1005S	1005
	L4	2.7 nH	TDK MLG1005S	1005
Material	-	FR4	–	20 x 14 mm

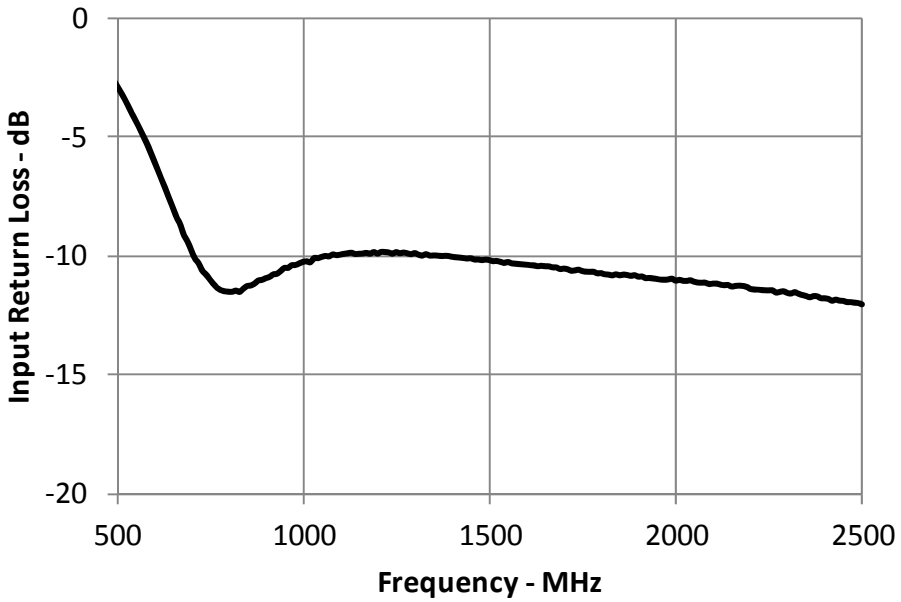
■ Power Gain



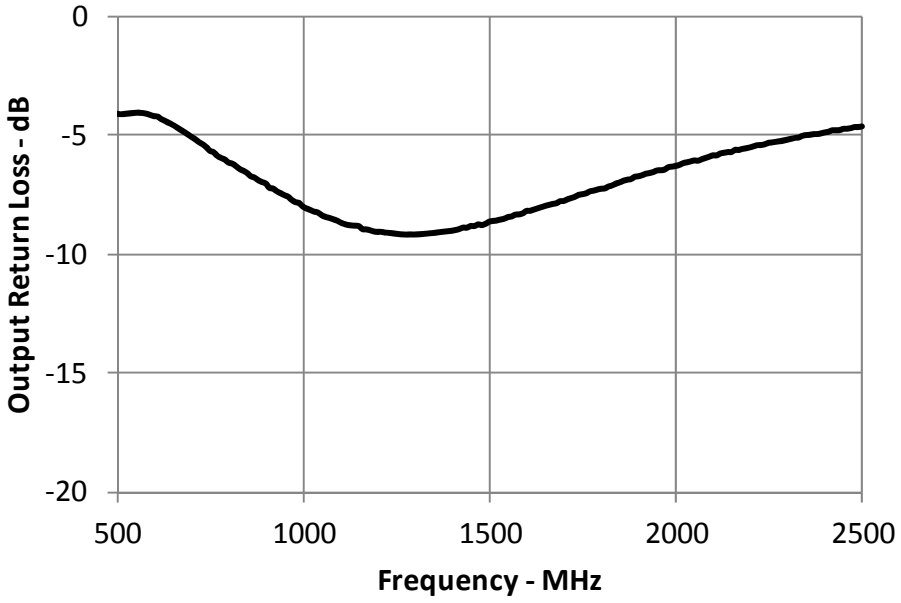
■ Isolation



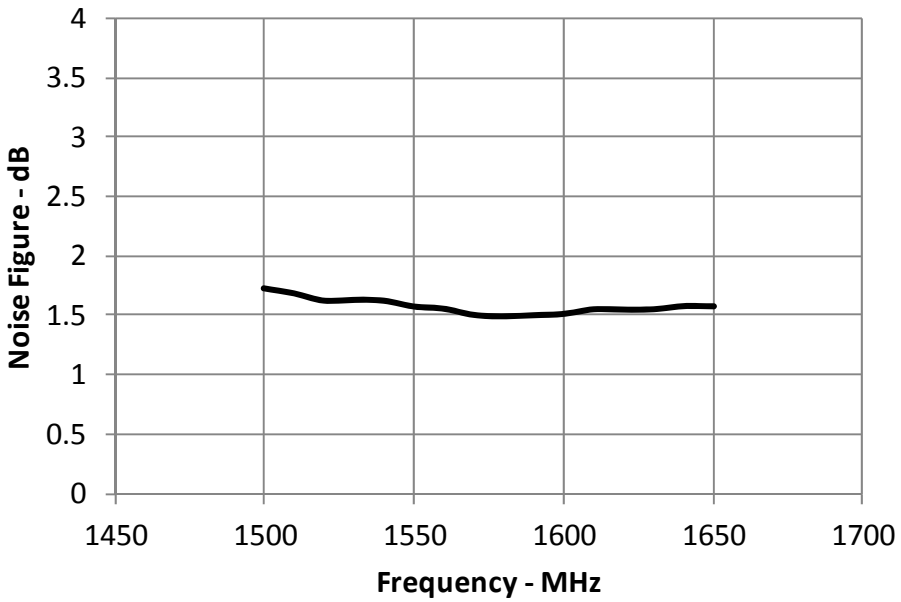
■ Input Return Loss



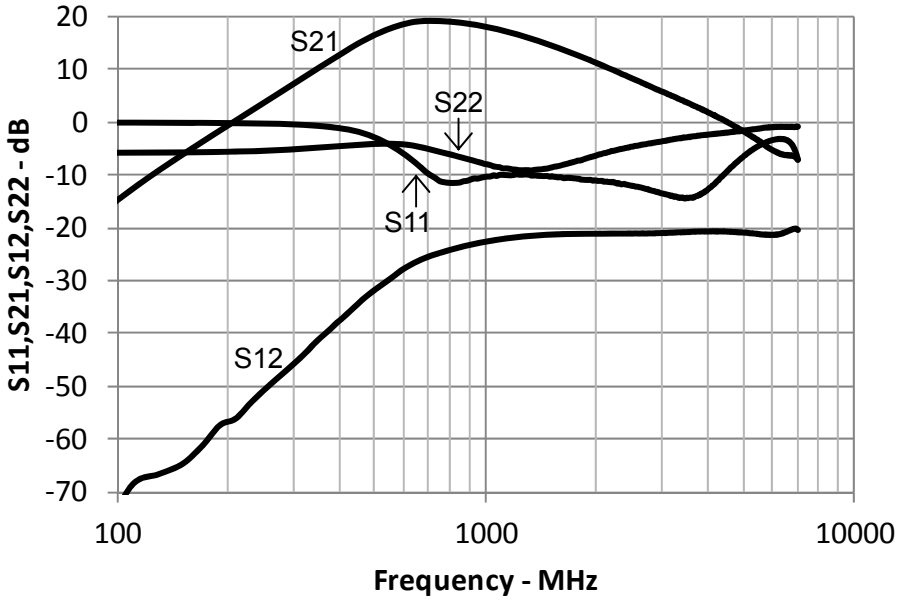
■ Output Return Loss



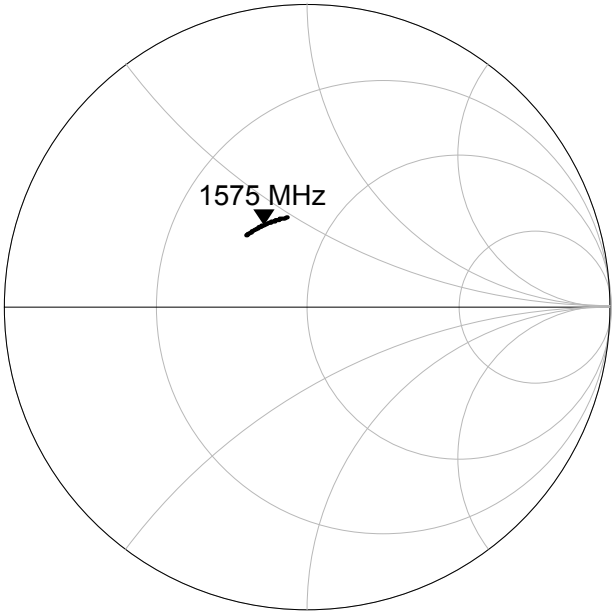
■ Noise Figure



■ S11, S21, S12, S22 Wide Span

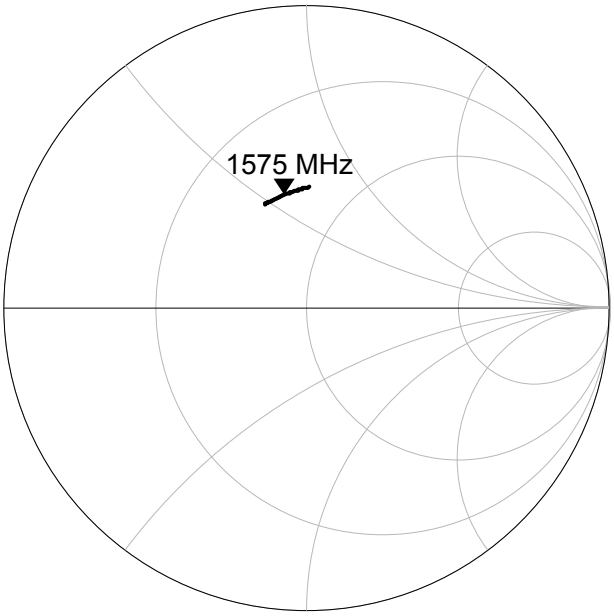


■ Smith Chart
Input Return Loss



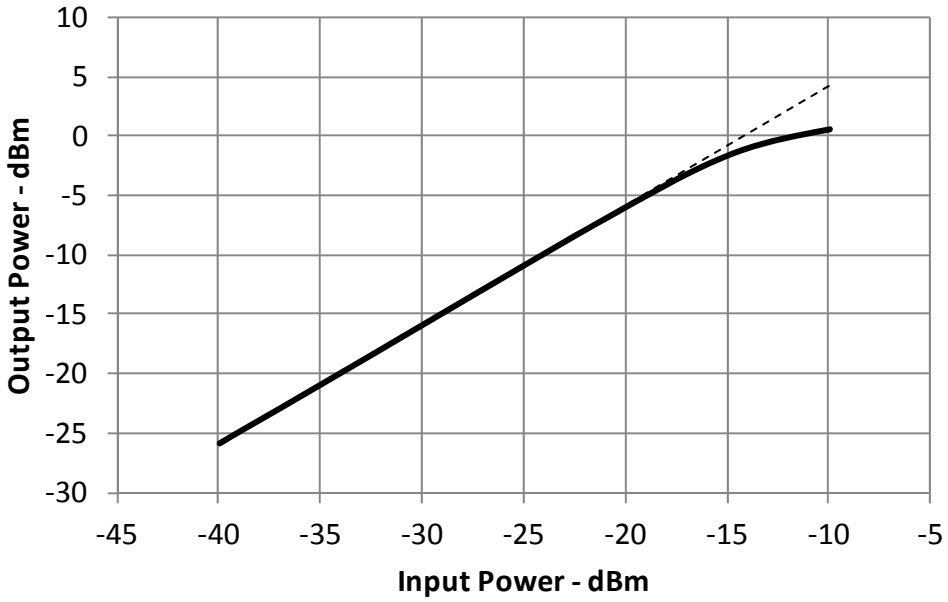
1500 MHz to 1650 MHz

■ Smith Chart
Output Return Loss



1500 MHz to 1650 MHz

■ Gain 1 dB Compression Point



■ Input 3rd Order Intercept Point

f1 =1575 MHz, f2 = 1576 MHz, Pin = −26 dBm