AND9493/D

FM Radio Amplifier with Filter using the NSVF6003SB6

ON Semiconductor®

www.onsemi.com

APPLICATION NOTE

Overview

This application note explains about ON Semiconductor's NSVF6003SB6 which is used as a Low Noise Amplifier (LNA) for FM Radio.

The NSVF6003SB6 is a silicon bipolar transistor best suited for high-frequency applications which is assembled in the 6-pin surface mount package of the high collector dissipation.
For information about the performance, please refer to the datasheet of this product.

Since the evaluation board is adjusted to achieve optimal performance in worldwide FM band, the product can provide 16.5 dB gain and 2.1 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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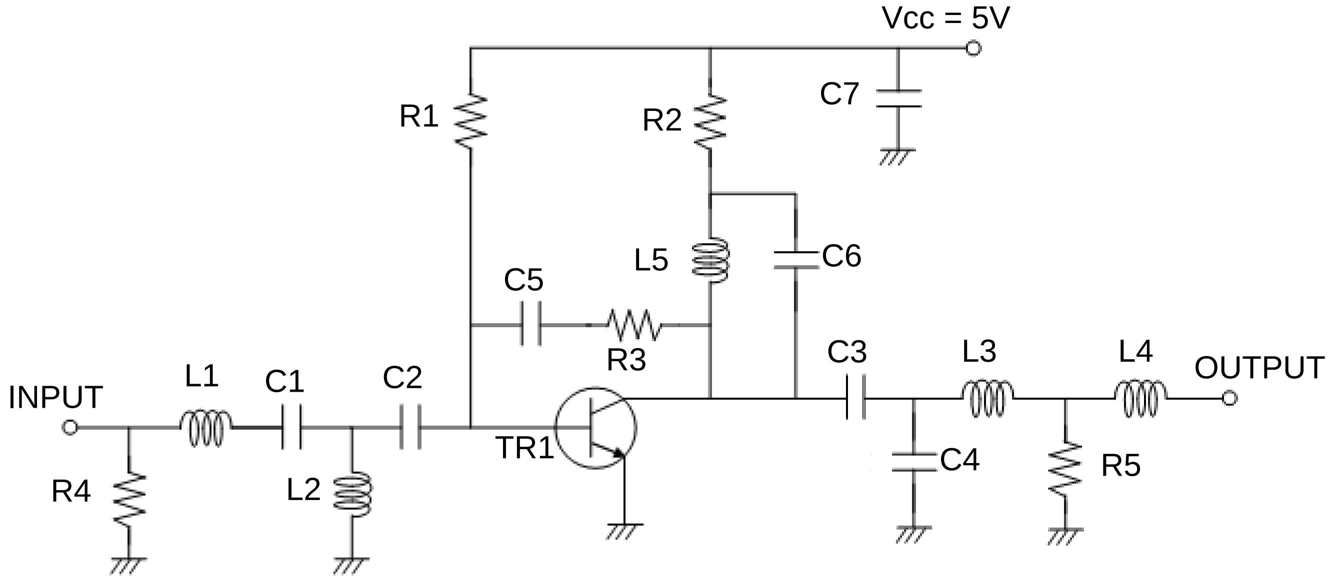
■Summary of Data

Ta = 25ºC, Input Power = –30 dBm, Zo = 50 Ω

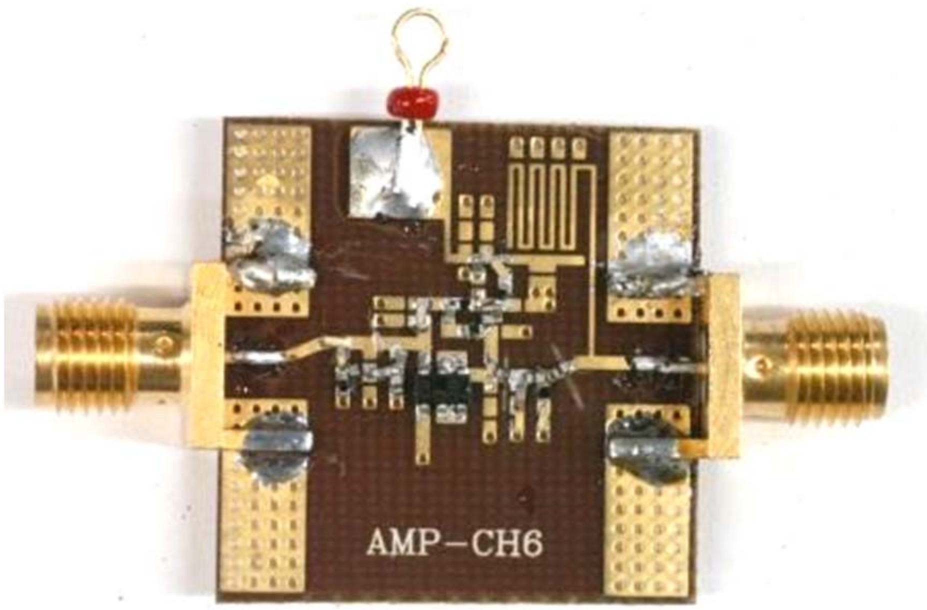
Parameter	Symbol	Condition	Result	Unit
DC Voltage	Vcc		5	V
DC Current	Icc		13.2	mA
Power Gain	Gp	f = 76 MHz	17.2	dB
		f = 90 MHz	17.6	
		f = 108 MHz	16.5	
Noise Figure	NF	f = 76 MHz	2.11	dB
		f = 90 MHz	1.75	
		f = 108 MHz	1.75	
Input Return Loss	RLin	f = 76 MHz	12.4	dB
		f = 90 MHz	13.5	
		f = 108 MHz	10.0	
Output Return Loss	RLout	f = 76 MHz	7.0	dB
		f = 90 MHz	11.5	
		f = 108 MHz	9.5	
Isolation	ISL	f = 76 MHz	36.8	dB
		f = 90 MHz	35.0	
		f = 108 MHz	34.8	
Gain 1dB Compression Input Power	Pin1dB	f = 100 MHz	–18	dBm
Input 3rd order Intercept Point	IIP3	f1 = 100 MHz f2 = 101 MHz Pin = –35dBm	–10	dBm

* Noise Figure includes the loss of PCB and SMA connector.

■ Circuit Design



■ Evalution Board



■ Bill of Materials

Item	Symbol	Value	Manufacture	Size
Bip-Tr	TR1	NSVF6003SB6	ON Semiconductor	SC-62
Capacitor	C1	22 pF	Murata GRM155	1005
	C2	82 pF	Murata GRM155	1005
	C3	22 pF	Murata GRM155	1005
	C4	2 pF	Murata GRM155	1005
	C5	10 pF	Murata GRM155	1005
	C6	0.1 uF	Murata GRM155	1005
	C7	0.1 uF	Murata GRM155	1005
Resistor	R1	39 kΩ	Various	1005
	R2	39 Ω	Various	1005
	R3	2.2 kΩ	Various	1005
	R4	100 kΩ	Various	1005
	R5	100 kΩ	Various	1005
Inductor	L1	100 nH	TDK MLG1005S	1005
	L2	82 nH	TOKO LL1005-FH	1005
	L3	100 nH	TOKO LL1608-FS	1608
	L4	39 nH	TDK MLG1005S	1005
	L5	100 nH	TOKO LL1608-FS	1608
Material		FR-4		25 x 16 mm

■ Measurement Results

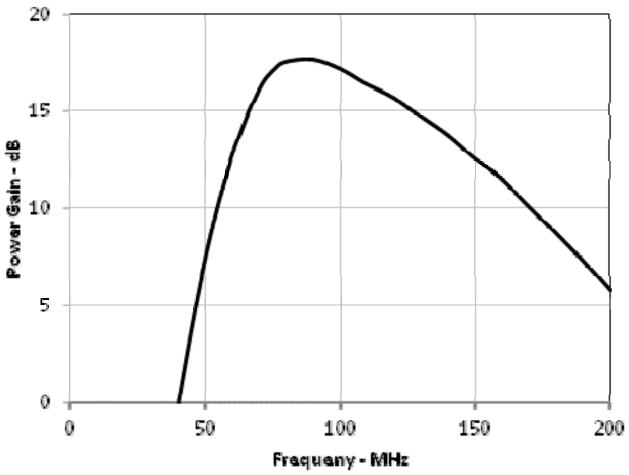


Figure 1 Power Gain vs. Frequency

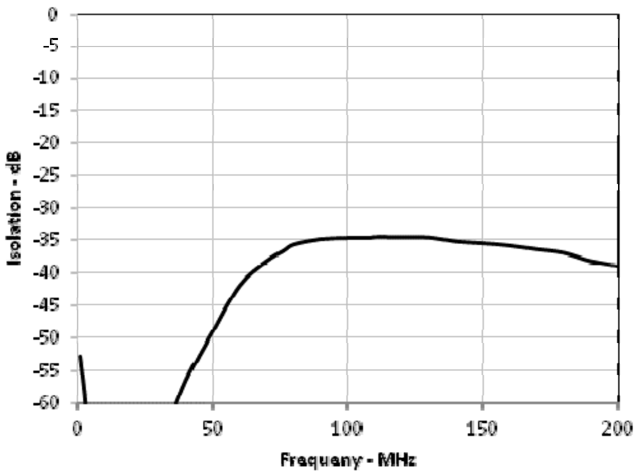


Figure 2 Isolation vs. Frequency

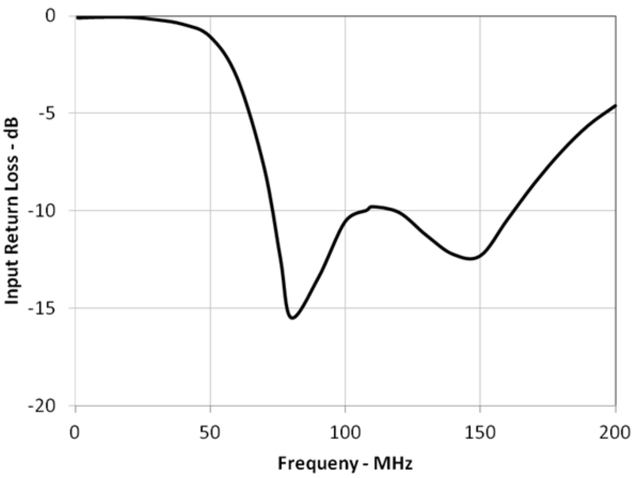


Figure 3 Input Return Loss vs. Frequency

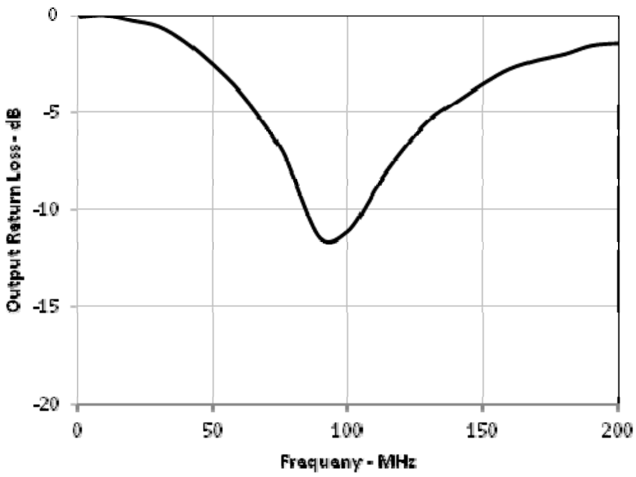
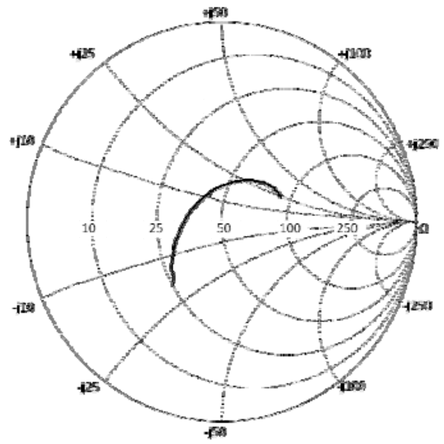
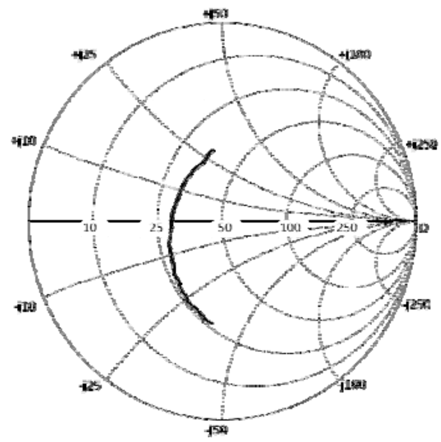


Figure 4 Output Return Loss vs. Frequency



70 MHz to 110 MHz

Figure 5 Smith Chart S11



70 MHz to 110 MHz

Figure 6 Smith Chart S22

■ Measurement Results

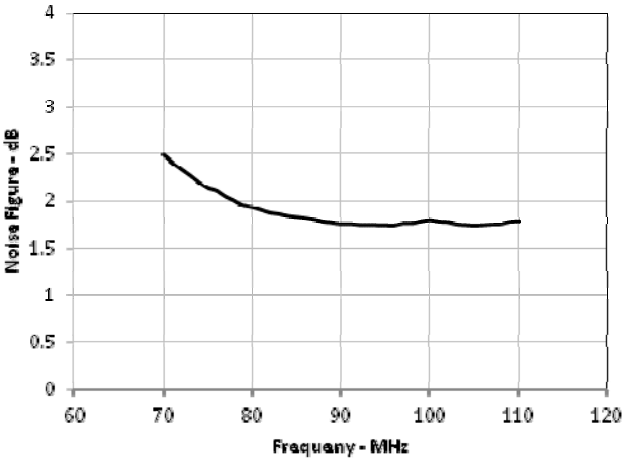


Figure 7 Noise Figure vs. Frequency

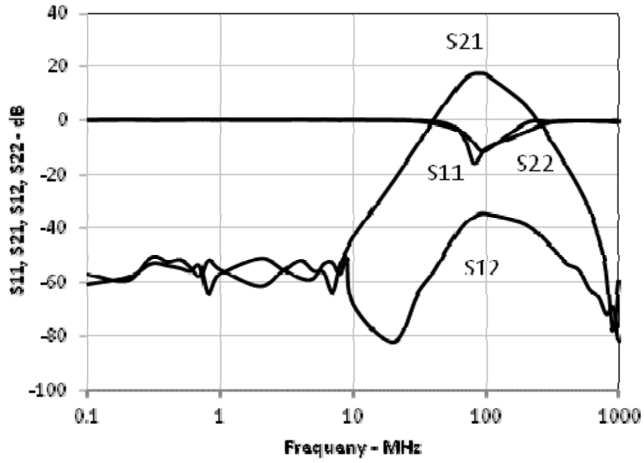


Figure 8 Wide Span

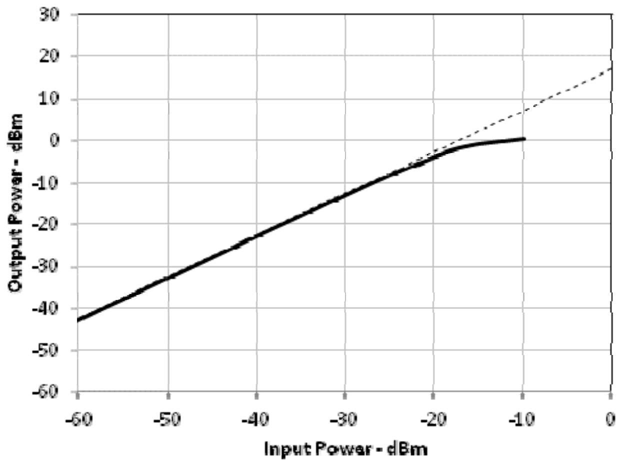


Figure 9 Output Power vs. Input Power

Pin = -35 dBm

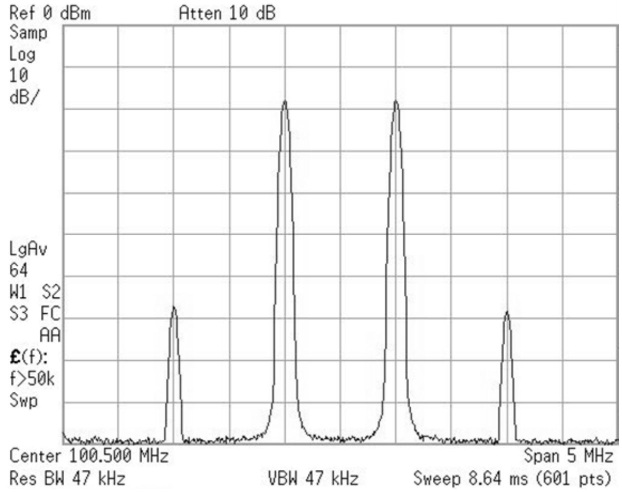


Figure 10 Input 3rd order Intercept Point

APPLICATIONS INFORMATION

Gain 1dB Compression Input Power (Pin1dB)
Pin1dB is measured the input power level when the power gain increase more 1 dB than that of linear range.

Input 3rd order Intercept Point (IIP3)
IIP3 is defined by the following equations.

$$IIP3 = Pin + (IM3 / 2) \quad \text{(eq. 1)}$$