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Low Distortion Low Noise Amplifier for FM Band Using the NSVF6003SB6

AND90085/D

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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 for high−frequency applications. The 6−pin surface mount package is contribute the high collector dissipation. For detail information about the individual performance of the product, please refer to the datasheet of the product.

Since the evaluation board is adjusted to achieve optimal performance in worldwide FM band, the product can provide 22.8 dB gain and 1.58 dB noise figure. In addition, this application shows the low distortion performance, OIP3 = 20.3 dBm.

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.

Summary of Data

Table 1. SUMMARY OF DATA (T_A = 25°C, Input Power = −35 dBm, Z_O = 50 Ω)

Parameter	Symbol	Condition	Value	Unit
DC Voltage	V_{CC}		5	V
DC Current	I_{CC}		18.8	mA
Power Gain	Gp	f = 76 MHz	24.2	dB
		f = 98 MHz	22.8	
		f = 108 MHz	22.2	
Noise Figure	NF	f = 76 MHz	2.02	dB
		f = 98 MHz	1.58	
		f = 108 MHz	1.51	
Input Return Loss	RLin	f = 76 MHz	10.0	dB
		f = 98 MHz	7.5	
		f = 108 MHz	6.9	
Output Return Loss	RLout	f = 76 MHz	7.0	dB
		f = 98 MHz	9.9	
		f = 108 MHz	11.3	
Isolation	ISL	f = 76 MHz	33.8	dB
		f = 98 MHz	32.2	
		f = 108 MHz	31.7	
Gain 1 dB Compression Output Power	Pout1dB (CP1)	f = 98 MHz	6.9	dBm
Output 3rd Order Intercept Point	OIP3	f1 = 98 MHz, f2 = 99 MHz, Pin = −35 dBm	20.3	dBm

NOTE: Include Board Loss

Evaluation Board

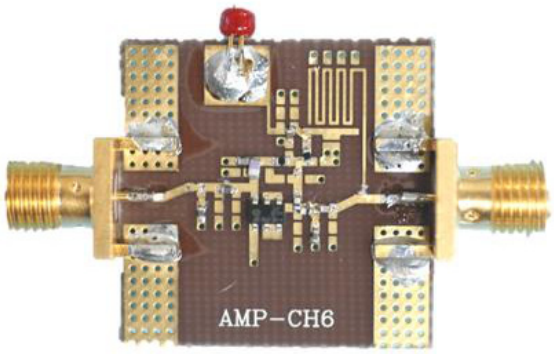

Figure 1. Evaluation Board

Circuit Design

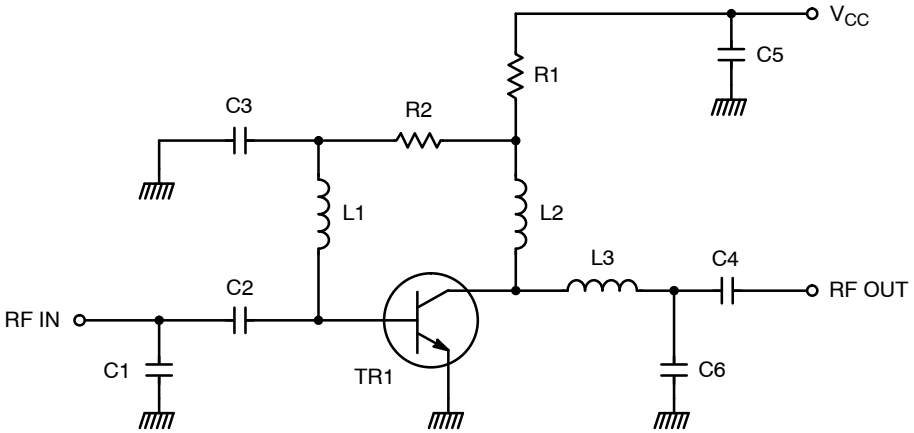

Figure 2. Circuit Design

Bill of Materials

Table 2. SUMMARY OF DATA (T_A = 25°C, Input Power = −35 dBm, Z_O = 50 Ω)

Item	Symbol	Value	Manufacturer	Size
Bip−Tr	TR1	NSVF6003SB6	ON Semiconductor	SC74
Capacitor	C1	7 pF	Murata GRM155	1005
	C2	47 pF	Murata GRM155	1005
	C3	1000 pF	Murata GRM155	1005
	C4	100 pF	Murata GRM155	1005
	C5	0.1 μF	Murata GRM155	1005
	C6	5 pF	Murata GRM155	1005
Resistor	R1	68 Ω	Various	1005
	R2	22 kΩ	Various	1005
Inductor	L1	120 nH	Various	1608
	L2	68 nH	Various	1005
	L3	12 nH	Various	1005
Material	–	FR4	–	25 × 25 mm

Measurement Result

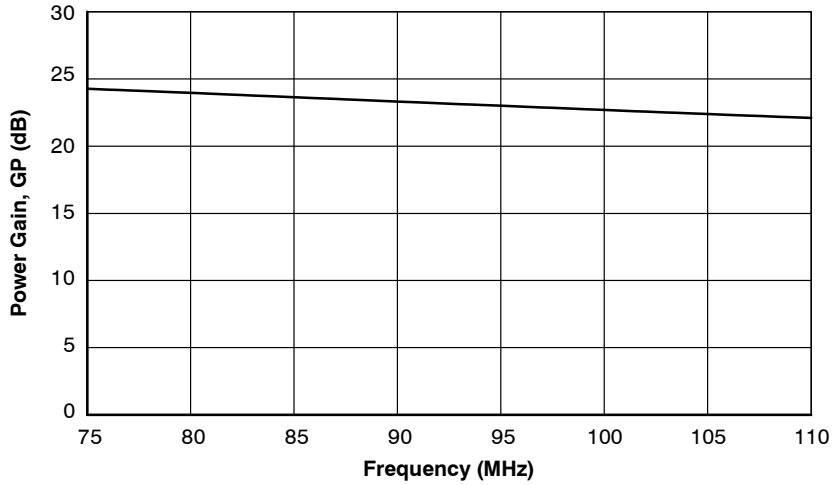

Figure 3. Gain – F

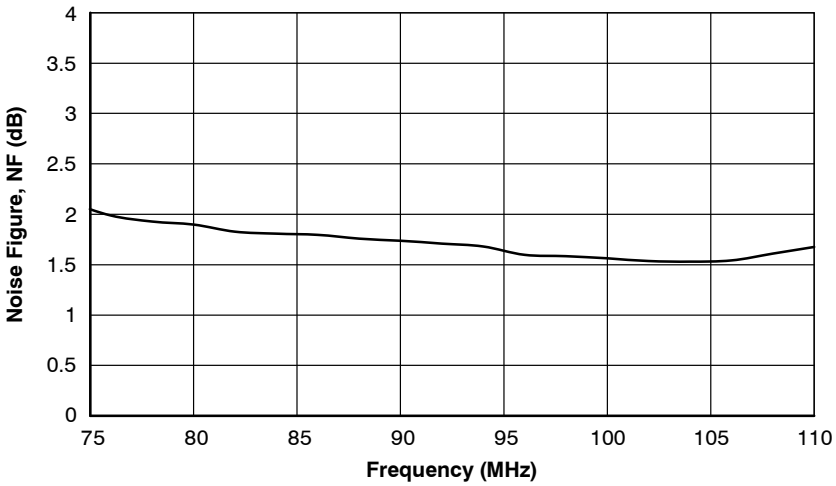

Figure 4. NF – F

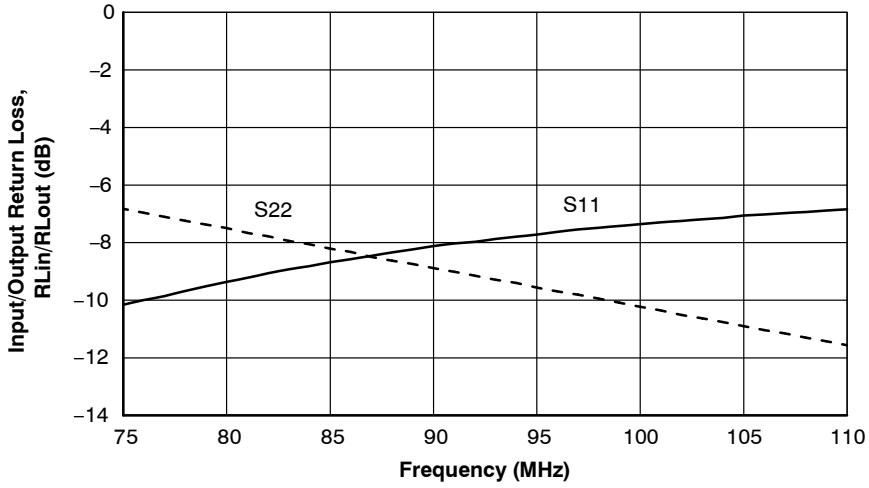

Figure 5. RL – F

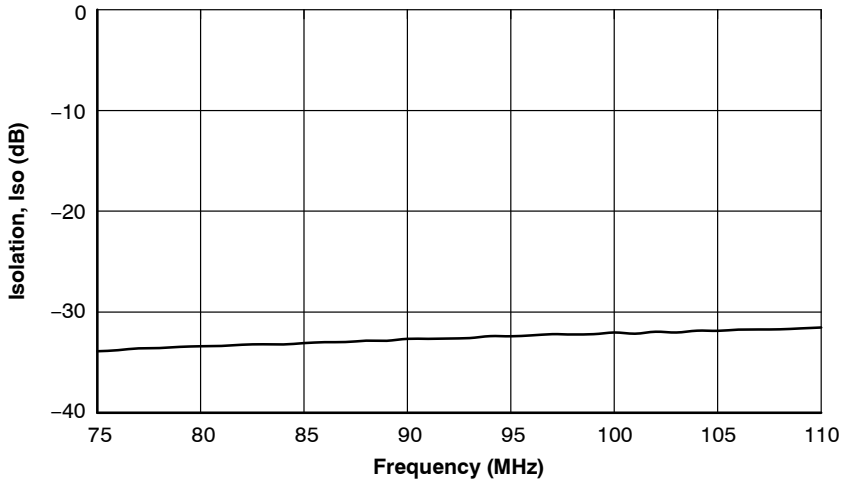

Figure 6. Iso − F

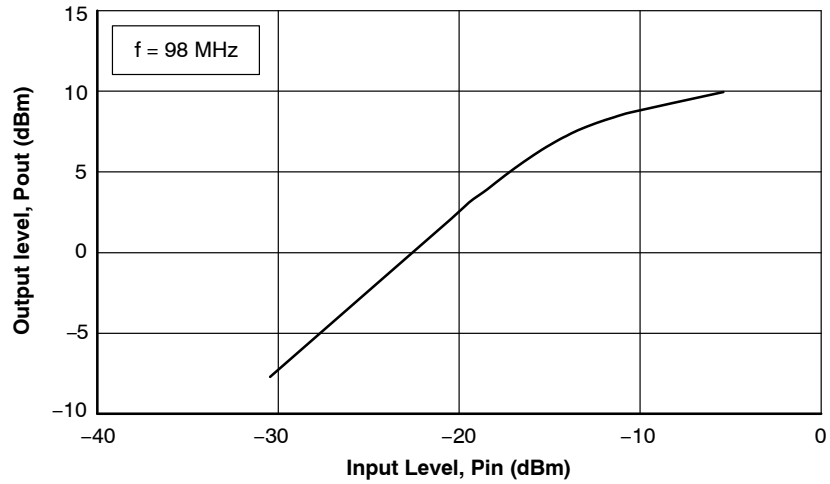

Figure 7. Pin − Pout

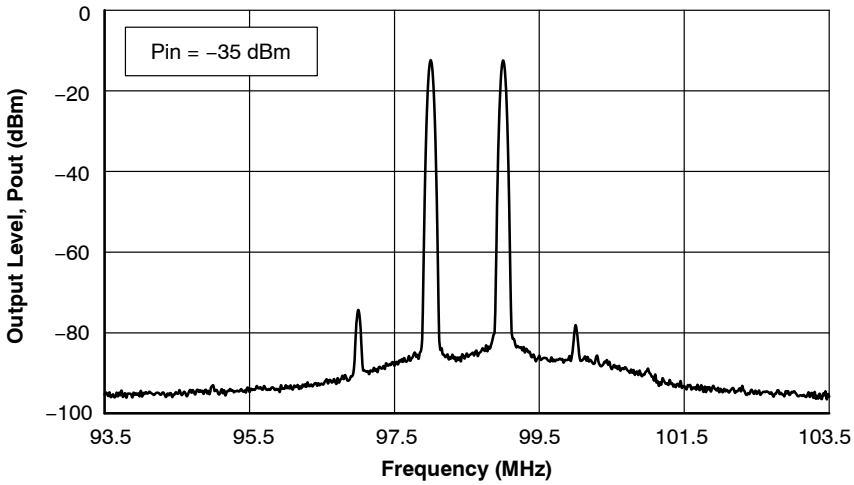

Figure 8. Pout − F

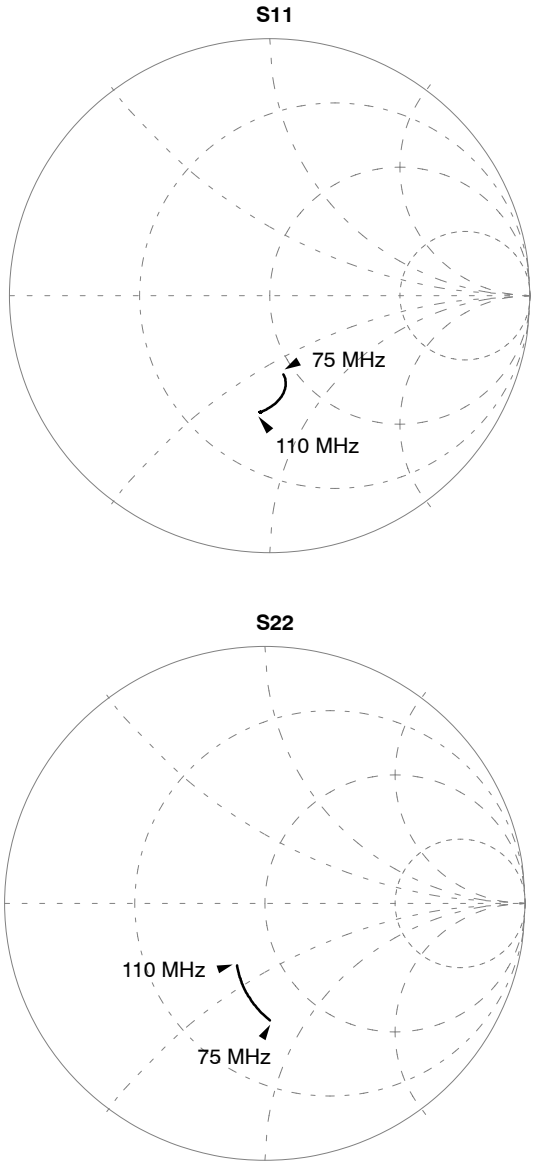

Figure 9.

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