AND9692/D

DAB Band-III Amplifier Using the NSVF4017SG4

ON Semiconductor®

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APPLICATION NOTE

Overview

This application note explains about ON Semiconductor NSVF4017SG4 which is used as a Low Noise Amplifier (LNA) for DAB (Digital Audio Broadcast).

The NSVF4017SG4 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 band−III (170 MHz to 250 MHz), the product can provide 23 dB gain and 1.06 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.

Table 1. SUMMARY OF DATA

Ta = 25°C, Input Power = −40 dBm

Parameter	Symbol	Condition	Result			Unit
DC Voltage	Vcc		2.6	2.8	3.0	V
DC Current	Icc		8.5	9.4	10.3	mA
Gain	Gp1	f = 170 MHz	22.8	23.2	23.6	dB
	Gp2	f = 210 MHz	22.6	23.0	23.3	dB
	Gp3	f = 250 MHz	22.0	22.4	22.7	dB
Noise Figure	NF1	f = 170 MHz	–	0.93	–	dB
	NF2	f = 210 MHz	–	1.06	–	dB
	NF3	f = 250 MHz	–	1.12	–	dB
Input Return Loss	RLin1	f = 170 MHz	10.9	11.4	11.6	dB
	RLin2	f = 210 MHz	11.4	11.7	11.7	dB
	RLin3	f = 250 MHz	11.0	11.2	11.1	dB
Output Return Loss	RLout1	f = 170 MHz	13.3	14.6	15.9	dB
	RLout2	f = 210 MHz	13.9	15.3	16.7	dB
	RLout3	f = 250 MHz	14.0	14.9	15.8	dB
Isolation	ISL1	f = 170 MHz	26.0	26.4	26.7	dB
	ISL2	f = 210 MHz	26.0	26.4	26.7	dB
	ISL3	f = 250 MHz	26.2	26.6	27.0	dB
Gain 1 dB Compression Input Power	Pin1dB	f = 210 MHz	–	−20	–	dBm
Input 3rd Order Intercept Point	IIP3	f1 = 210 MHz f2 = 211 MHz Pin = −30 dBm	–	−7	–	dBm

Circuit Design

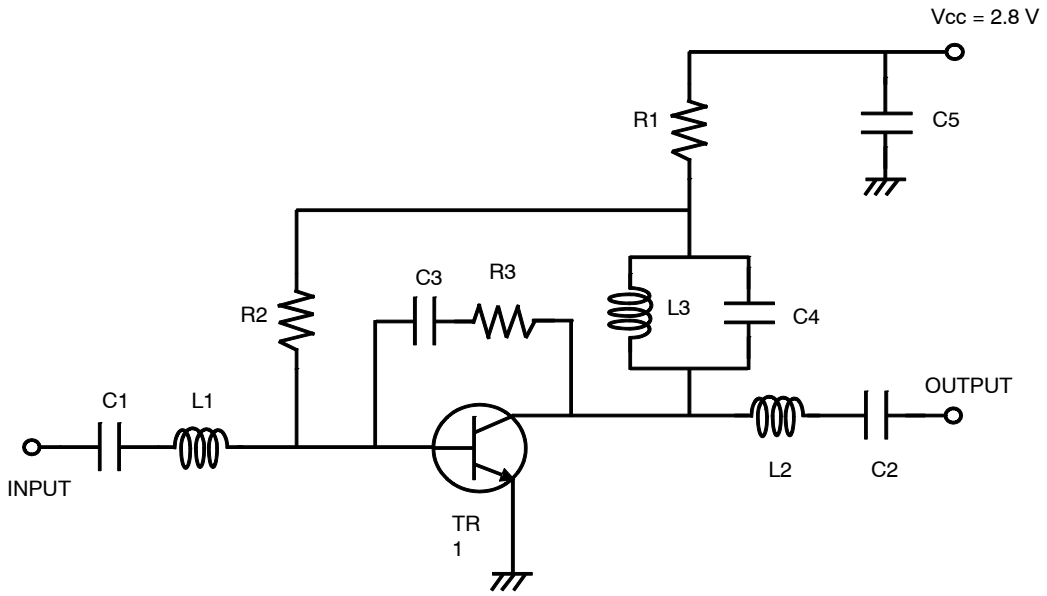

Figure 1. Circuit Design

Evaluation Board

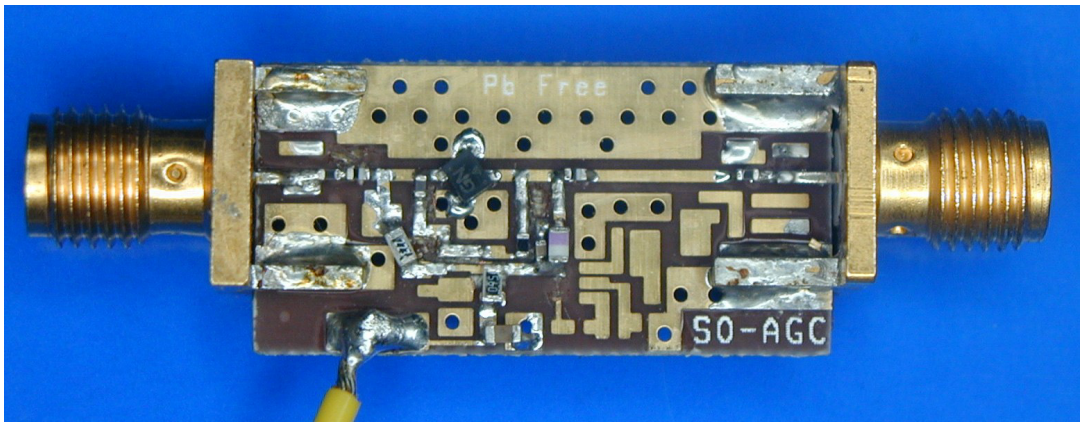

Figure 2. Evaluation Board

Table 2. BILL OF MATERIALS

Item	Symbol	Value	Manufacturer	Size
Bip−Tr	TR1	NSVF4017SG4	ON Semiconductor	SC82FL
Capacitor	C1,C2,C3	1000 pF	TAIYOYUDEN	1005
	C4	7 pF	TAIYOYUDEN	1005
	C5	0.1 uF	TAIYOYUDEN	1608
Resistor	R1	56 Ω	Various	1608
	R2	22 kΩ	Various	1608
	R3	1.2 kΩ	Various	1005
Inductor	L1,L2	12 nH	TOKO LL1005−FHL12NJ	1005
	L3	120 nH	TOKO LL1608−FS121N	1608
Material	−	FR4	−	25.4 x 12.7 mm

Power Gain

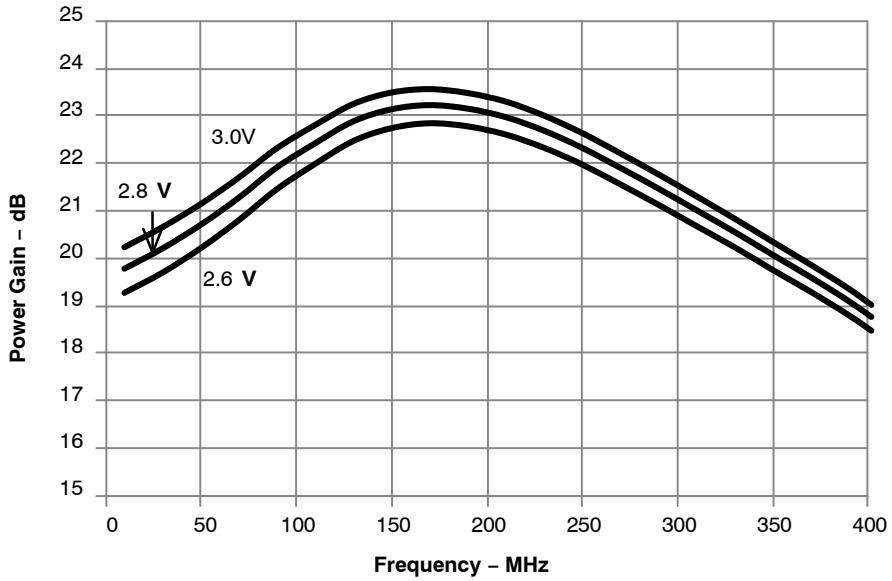

Figure 3. Power Gain

Isolation

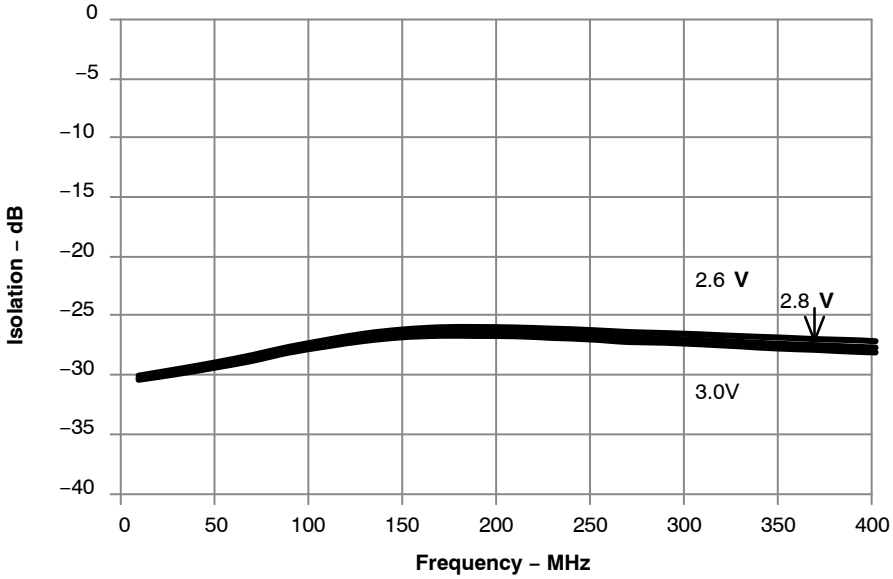

Figure 4. Isolation

Input Return Loss

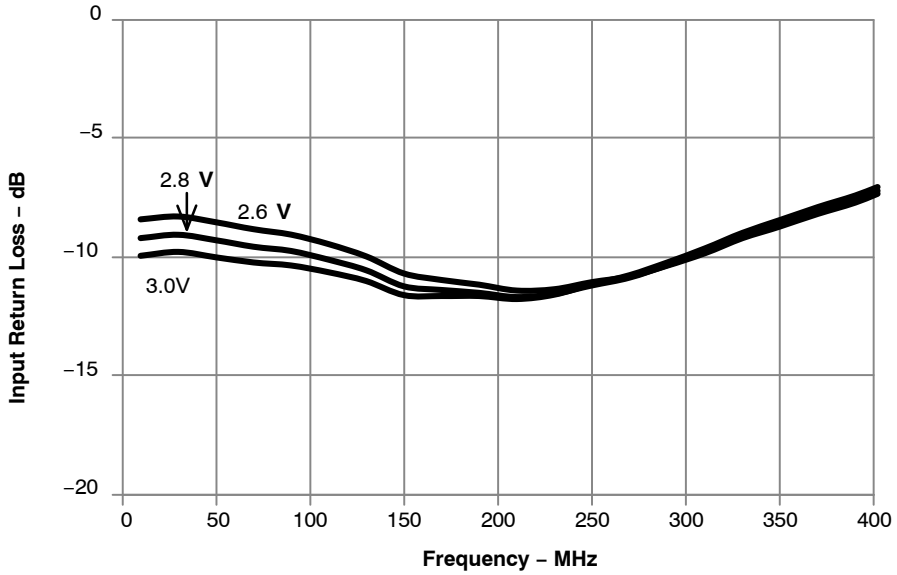

Figure 5. Input Return Loss

Output Return Loss

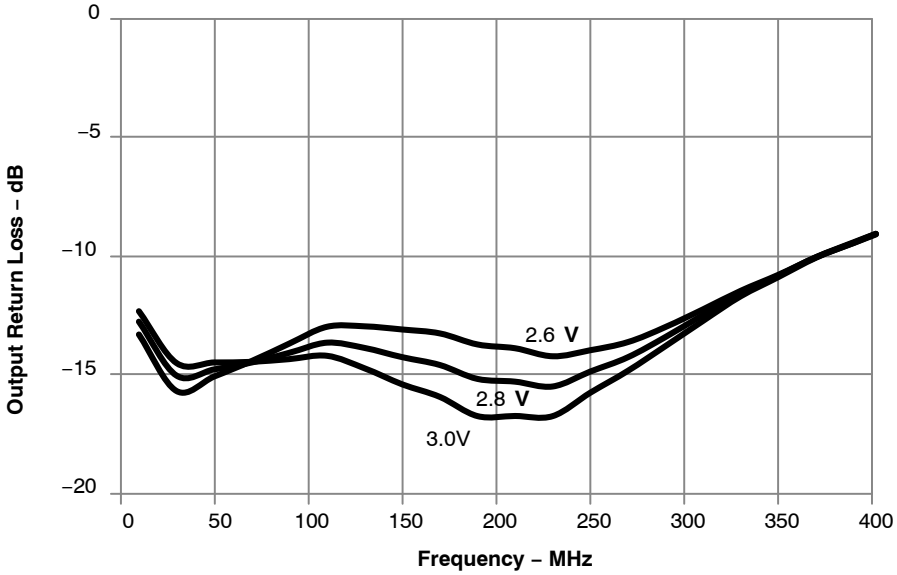

Figure 6. Output Return Loss

Noise Figure

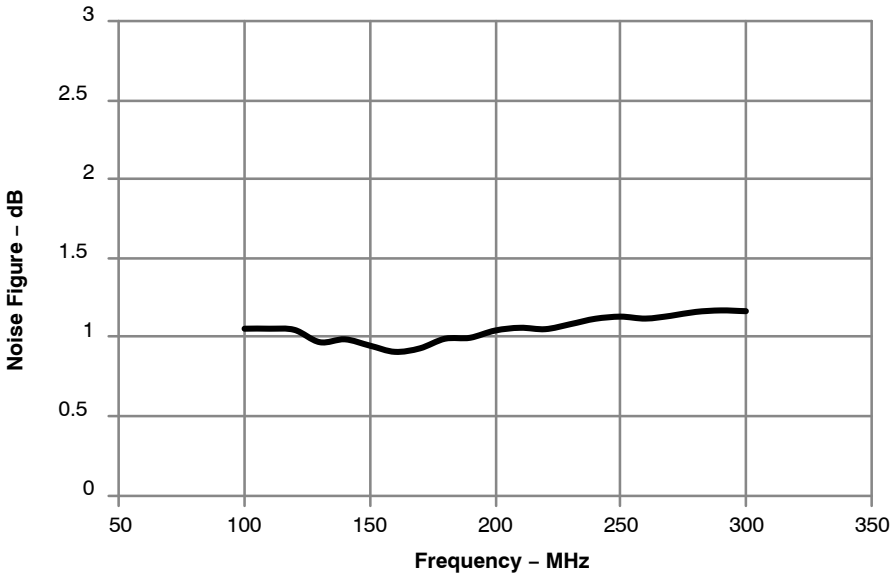

Figure 7. Noise Figure

S11, S21, S12, S22 Wide Span

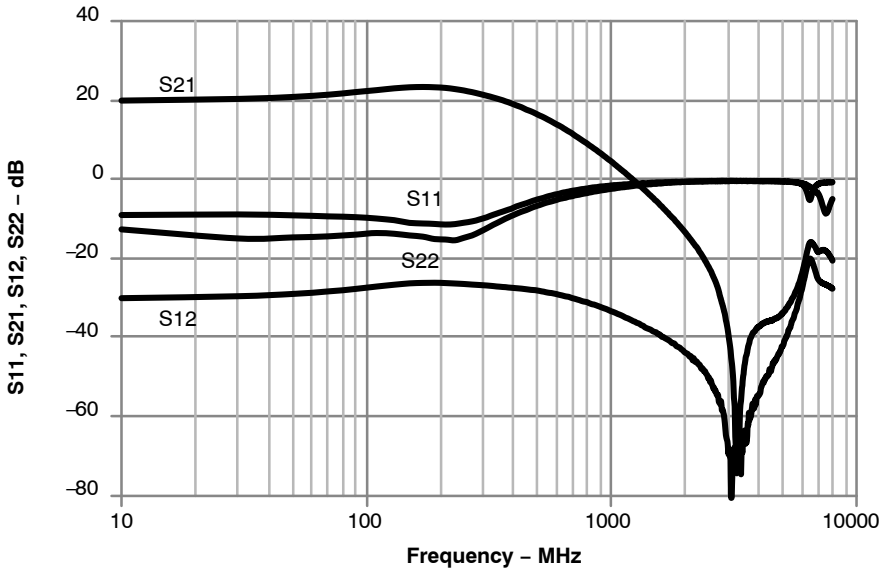

Figure 8. S11, S21, S12, S22 Wide Span

Smith Chart Input Return Loss

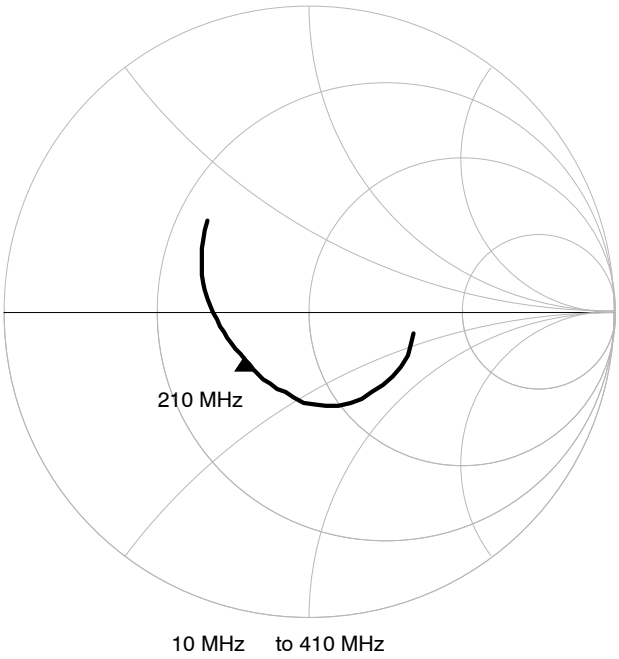

Figure 9. Smith Chart Input Return Loss

Smith Chart Output Return Loss

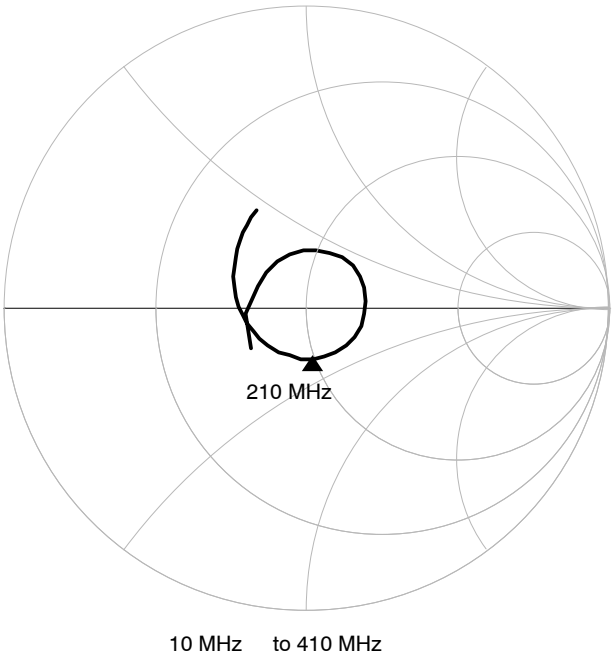

Figure 10. Smith Chart Output Return Loss

Gain 1 dB Compression Point

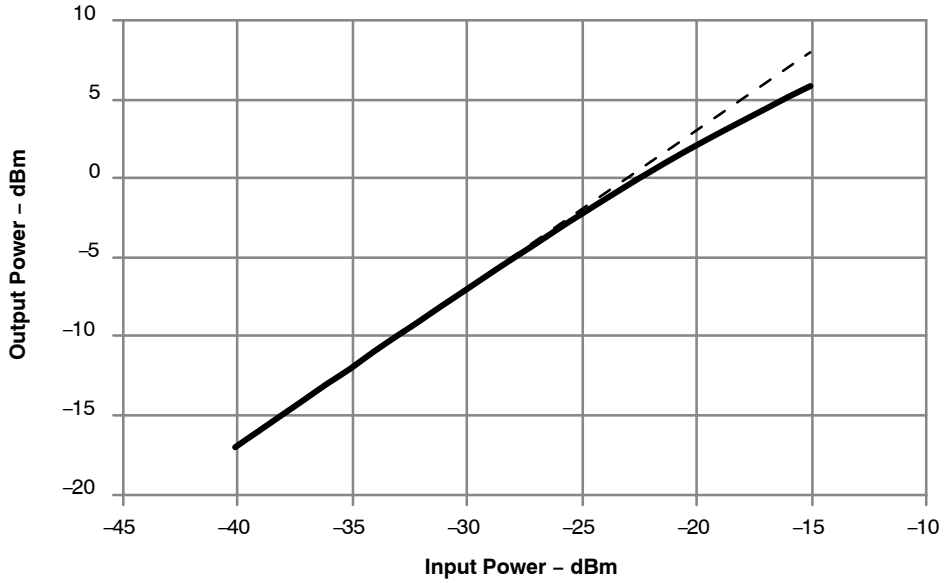

Figure 11. Gain 1 dB Compression Point

Input 3rd Order Intercept Point

f1 = 210 MHz, f2 = 211 MHz, Pin = −30 dBm

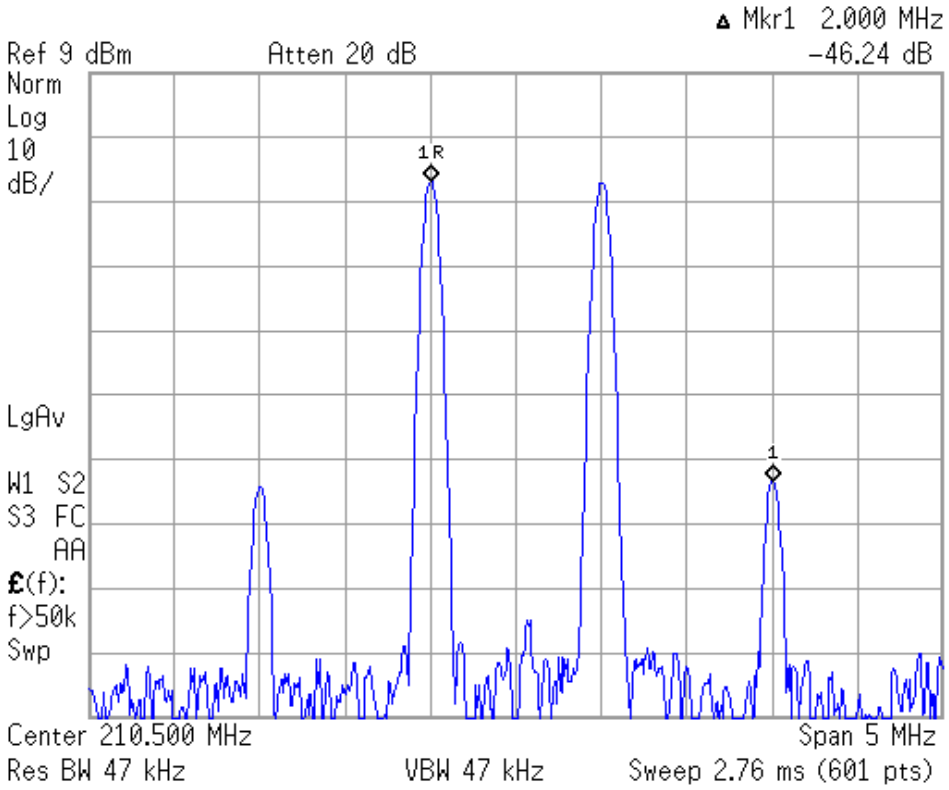

Figure 12. Input 3rd Order Intercept Point

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