

ON Semiconductor

Is Now

onsemi™

To learn more about onsemi™, please visit our website at
www.onsemi.com

onsemi and **onsemi** and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi** product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner. Other names and brands may be claimed as the property of others.

Low Distortion Low Noise Amplifier for FM Band Using the NSVF6003SB6



ON Semiconductor®

www.onsemi.com

AND90085/D

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 ($T_A = 25^\circ\text{C}$, Input Power = -35 dBm, $Z_O = 50 \Omega$)

Parameter	Symbol	Condition	Value	Unit
DC Voltage	V_{CC}		5	V
DC Current	I_{CC}		18.8	mA
Power Gain	G_p	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 3 rd Order Intercept Point	OIP3	f1 = 98 MHz, f2 = 99 MHz, Pin = -35 dBm	20.3	dBm

NOTE: Include Board Loss

AND90085/D

Evaluation Board

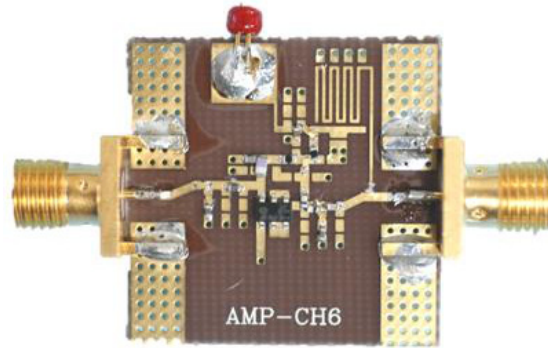


Figure 1. Evaluation Board

Circuit Design

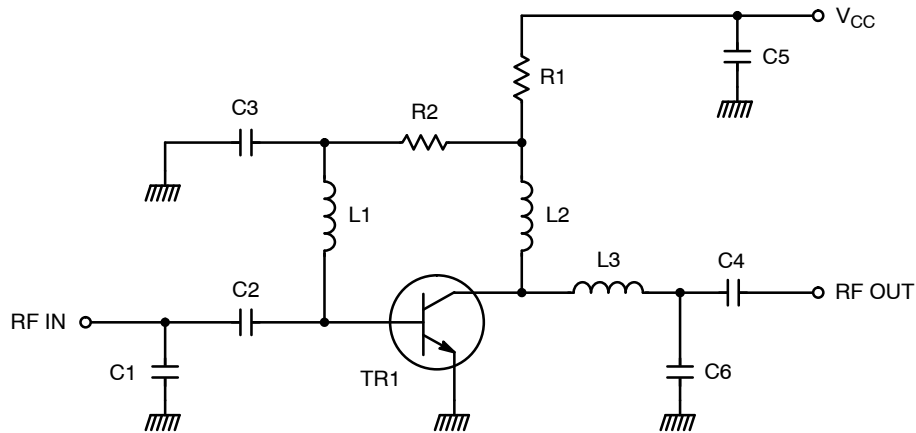


Figure 2. Circuit Design

Bill of Materials

Table 2. SUMMARY OF DATA ($T_A = 25^\circ\text{C}$, Input Power = -35 dBm, $Z_O = 50 \Omega$)

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 k Ω	Various	1005
Inductor	L1	120 nH	Various	1608
	L2	68 nH	Various	1005
	L3	12 nH	Various	1005
Material	-	FR4	-	25 x 25 mm

AND90085/D

Measurement Result

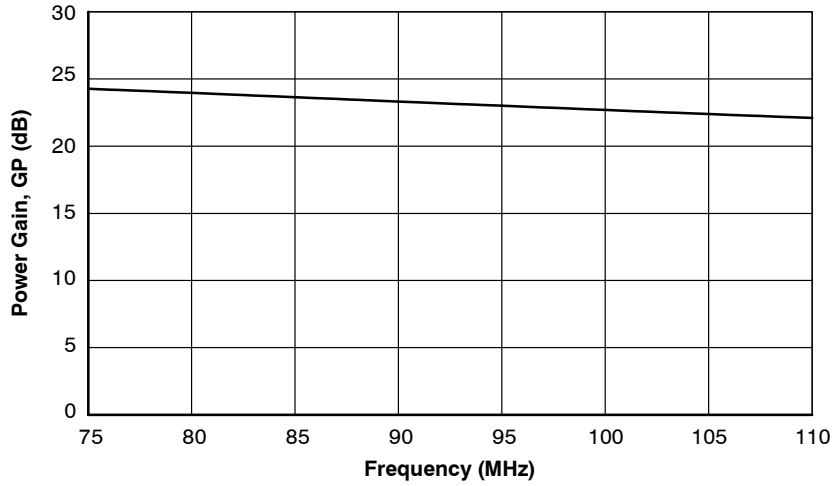


Figure 3. Gain - F

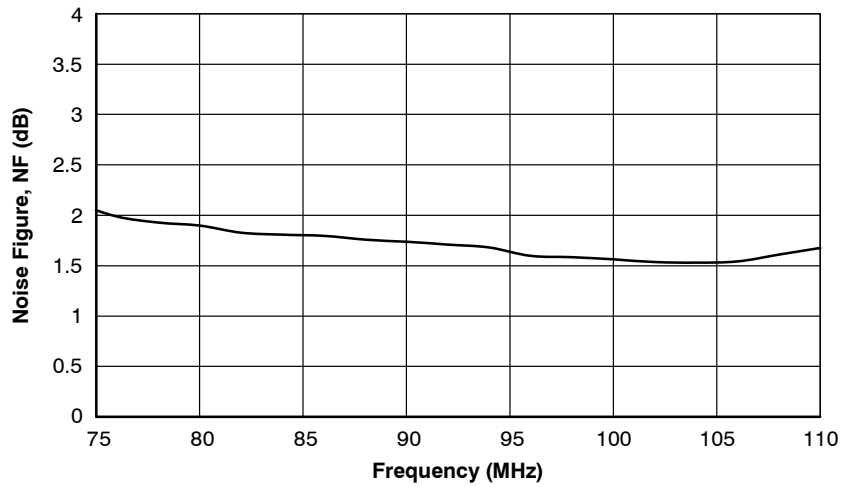


Figure 4. NF - F

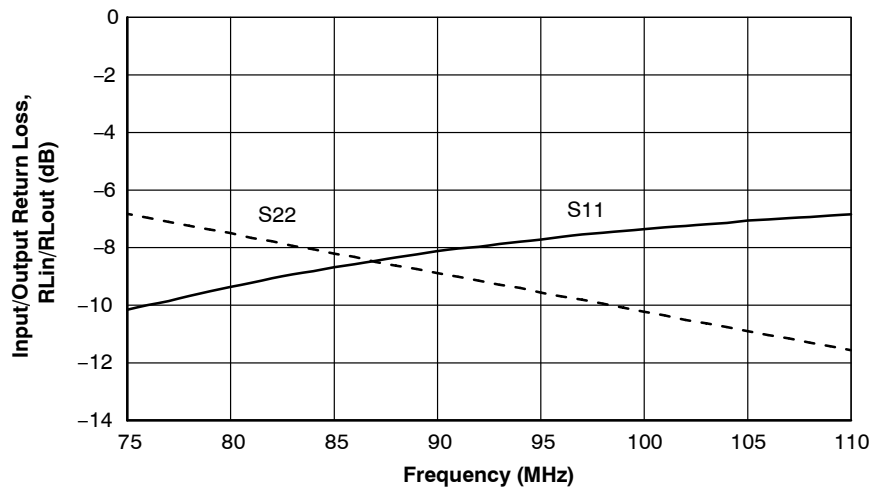


Figure 5. RL - F

AND90085/D

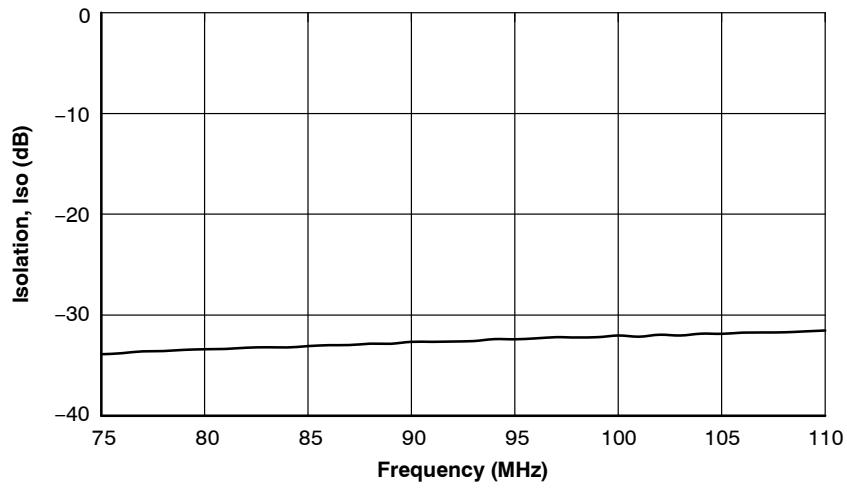


Figure 6. Iso - F

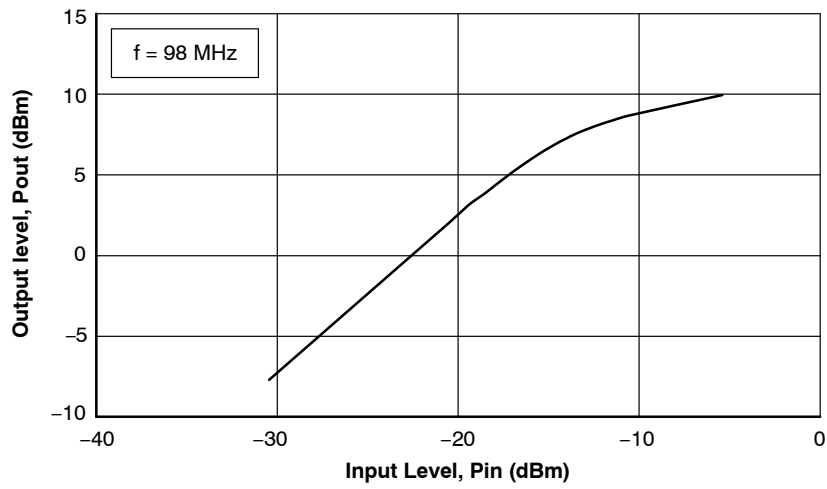


Figure 7. Pin - Pout

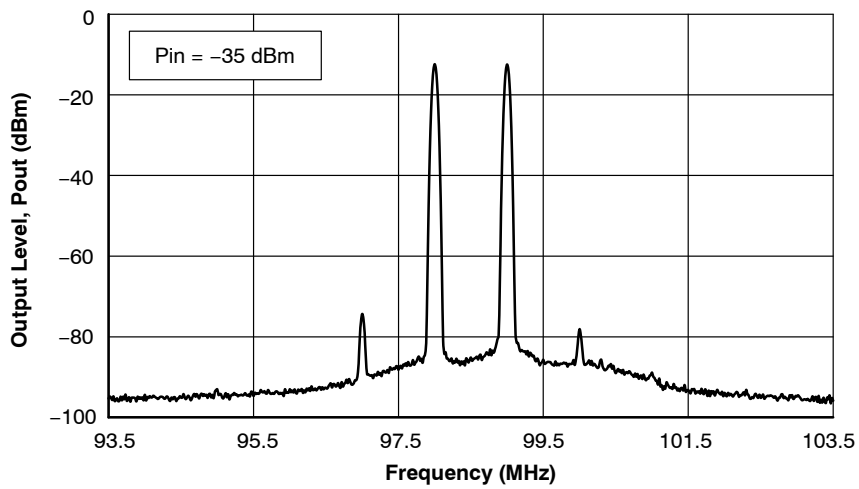


Figure 8. Pout - F

AND90085/D

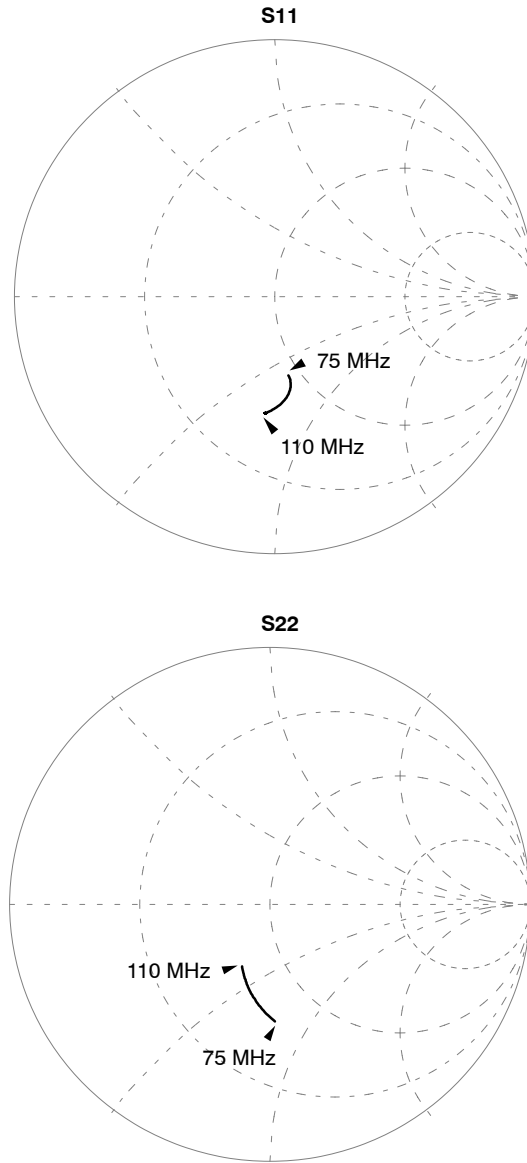



Figure 9.

ON Semiconductor and  are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Email Requests to: orderlit@onsemi.com

ON Semiconductor Website: www.onsemi.com

TECHNICAL SUPPORT
North American Technical Support:
Voice Mail: 1 800-282-9855 Toll Free USA/Canada
Phone: 011 421 33 790 2910

Europe, Middle East and Africa Technical Support:
Phone: 00421 33 790 2910
For additional information, please contact your local Sales Representative