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AND9632/D

FM Radio Amplifier with Filter using the NSVF6001SB6

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APPLICATION NOTE

Overview

This application note explains about ON Semiconductor's NSVF6001SB6 which is used as a Low Noise Amplifier (LNA) for FM Radio.

The NSVF6001SB6 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 24.9 dB gain and 1.6 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.

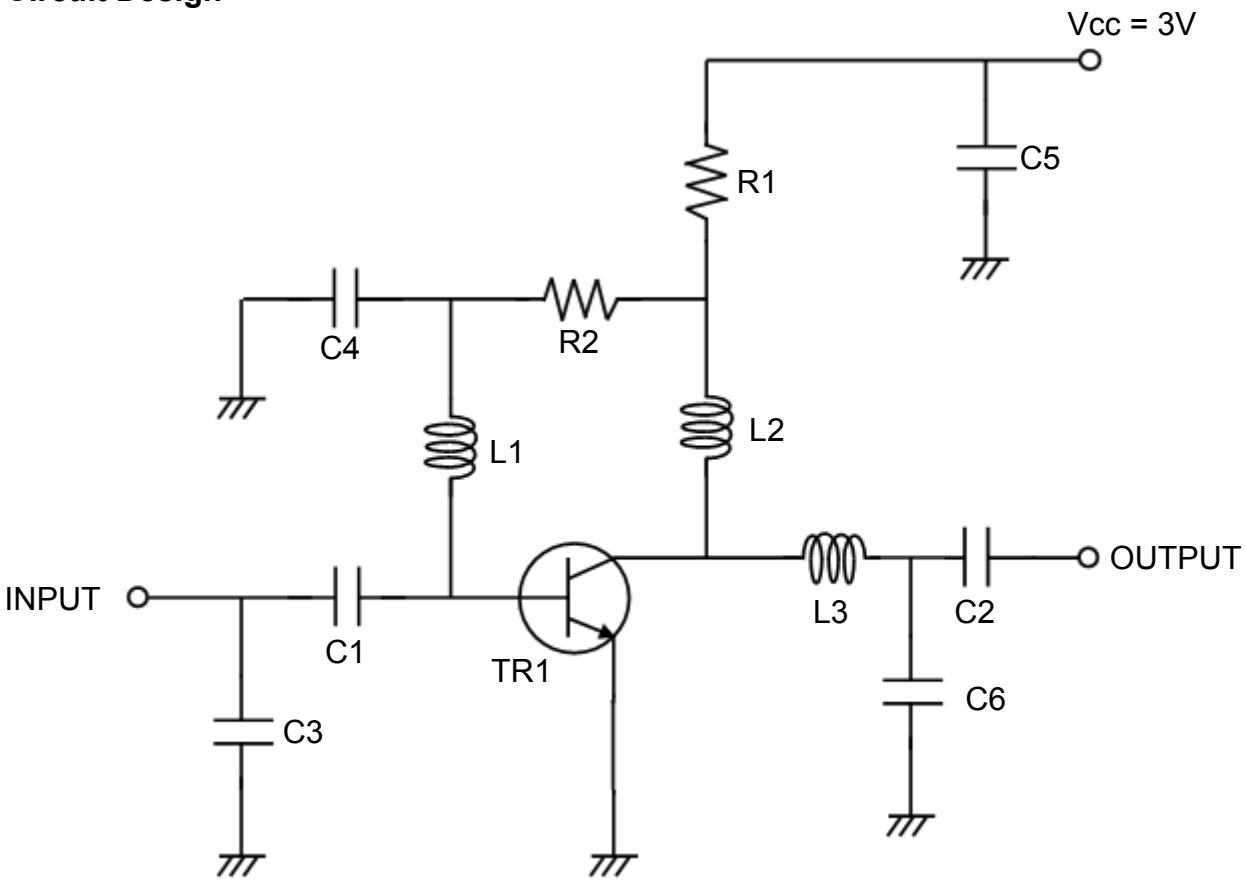
■ Summary of Data

Ta = 25°C, Input Power = −40 dBm, Zo = 50 Ω

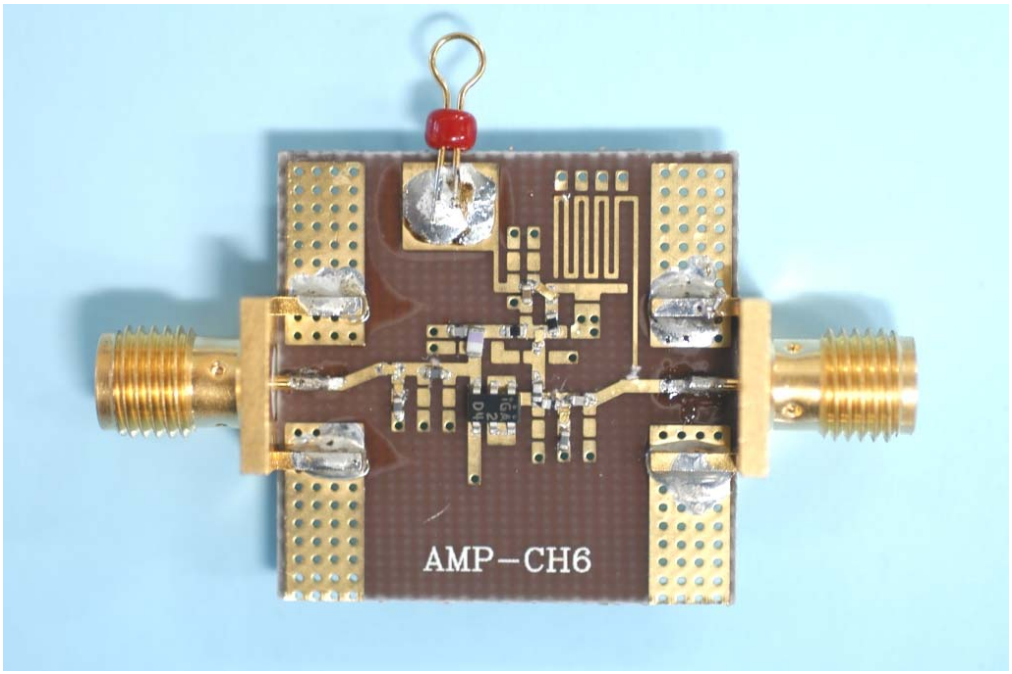
Parameter	Symbol	Condition	Result	Unit
DC Voltage	Vcc		5	V
DC Current	Icc		23.5	mA
Power Gain	Gp	f = 76 MHz	26.5	dB
		f = 90 MHz	25.8	
		f = 108 MHz	24.9	
Noise Figure	NF	f = 76 MHz	2.0	dB
		f = 90 MHz	1.7	
		f = 108 MHz	1.6	
Input Return Loss	RLin	f = 76 MHz	−26.5	dB
		f = 90 MHz	−15.7	
		f = 108 MHz	−10.8	
Output Return Loss	RLout	f = 76 MHz	−11.2	dB
		f = 90 MHz	−13.6	
		f = 108 MHz	−17.2	
Isolation	ISL	f = 76 MHz	−37.1	dB
		f = 90 MHz	−35.7	
		f = 108 MHz	−34.4	
Gain 1 dB Compression Input Power	Pin1dB	f = 100 MHz	−16.9	dBm
Input 3rd Order Intercept Point	IIP3	f1 = 100 MHz f2 = 101 MHz Pin = −35 dBm	−3.6	dBm

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

■ Circuit Design



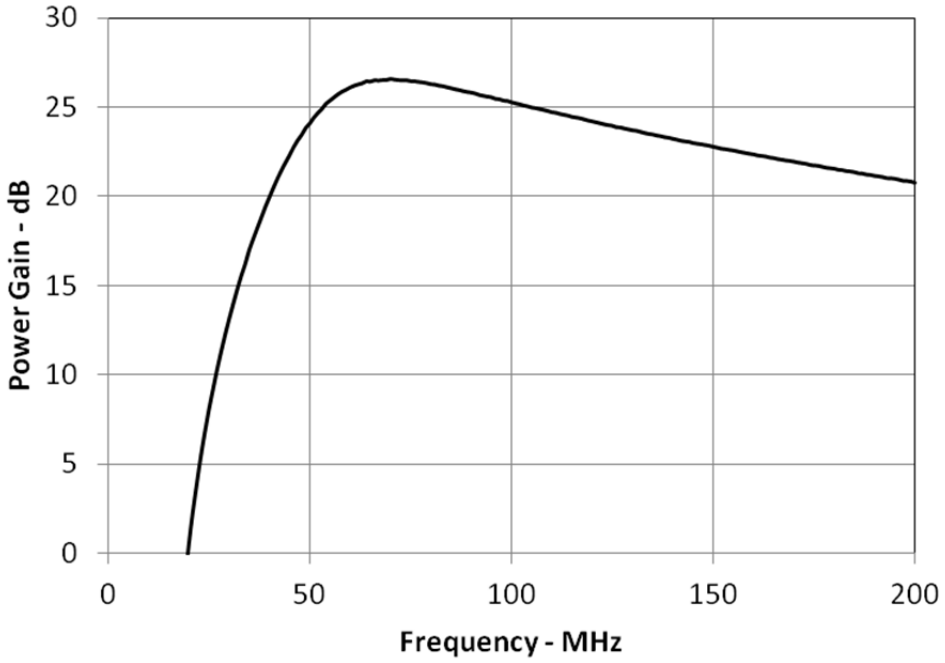
■ Evaluation Board



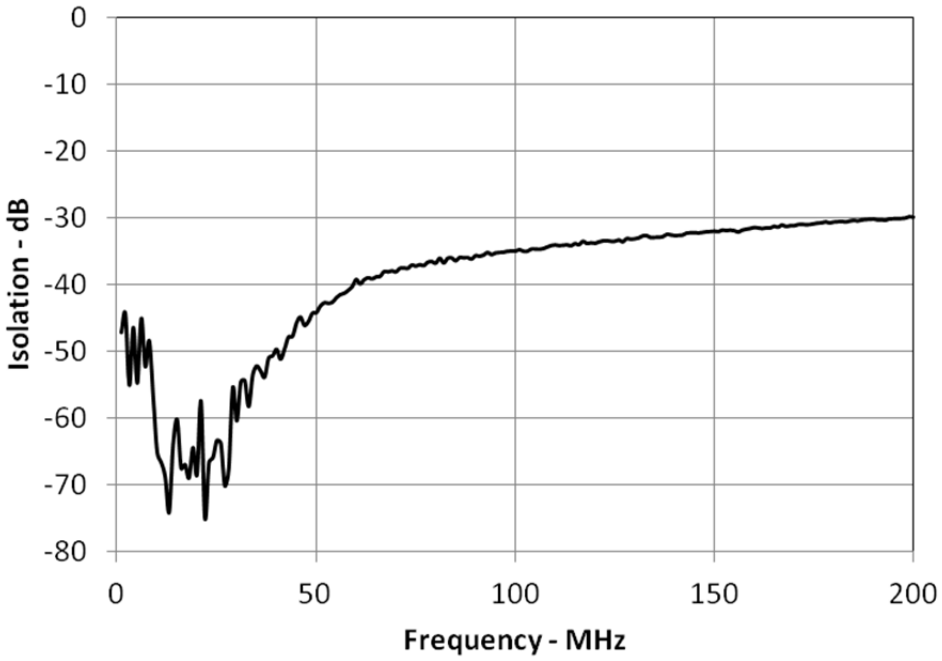
■ Bill of Materials

Item	Symbol	Value	Manufacturer	Size
Bip-Tr	TR1	NSVF6001SB6	ON Semiconductor	SC62
Capacitor	C1	47 pF	Murata GRM155	1005
	C2	100 pF	Murata GRM155	1005
	C3	7 pF	Murata GRM155	1005
	C4	1000 pF	Murata GRM155	1005
	C5	0.1 μF	Murata GRM155	1005
	C6	5 pF	Murata GRM155	1005
Resistor	R1	47 Ω	Various	1005
	R2	22 kΩ	Various	1005
Inductor	L1	120 nH	Toko LL1608-FS	1608
	L2	68 nH	Toko LL1005-FHL	1005
	L3	12 nH	Toko LL1005-FHL	1005
Material	–	FR4	–	25 x 25 mm

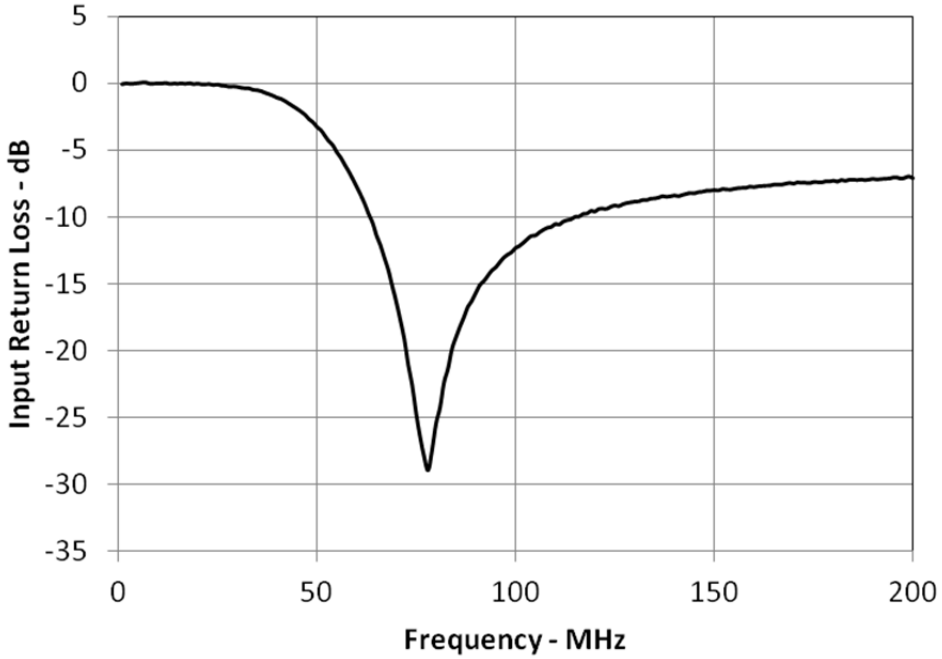
■ Power Gain



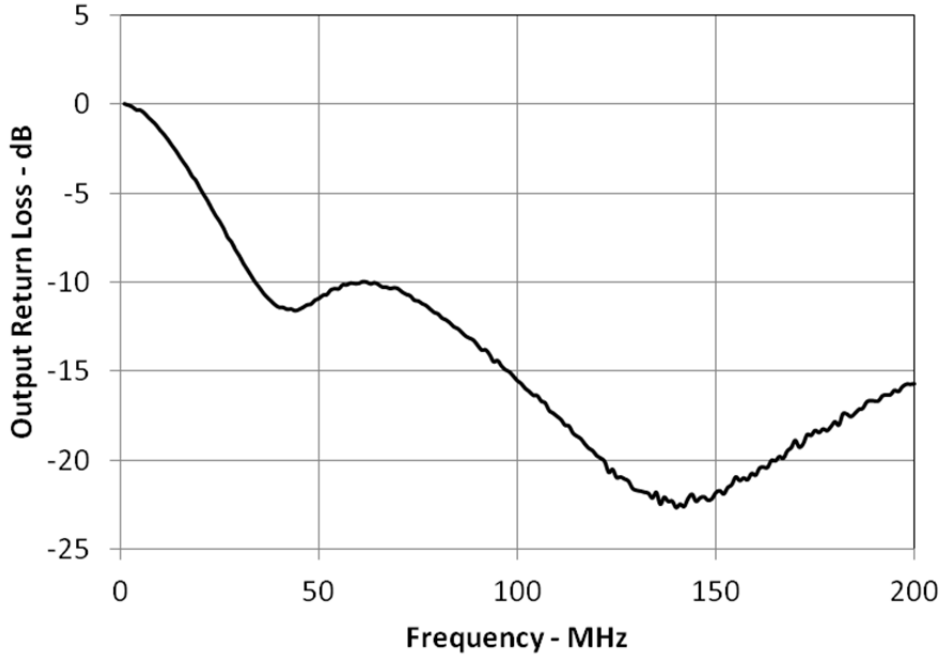
■ Isolation



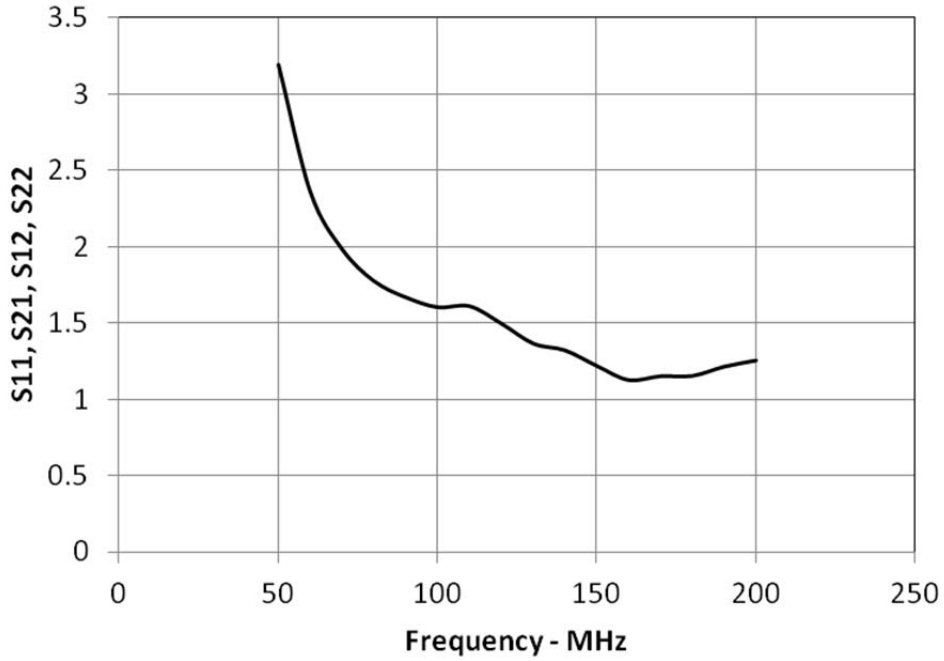
■ Input Return Loss



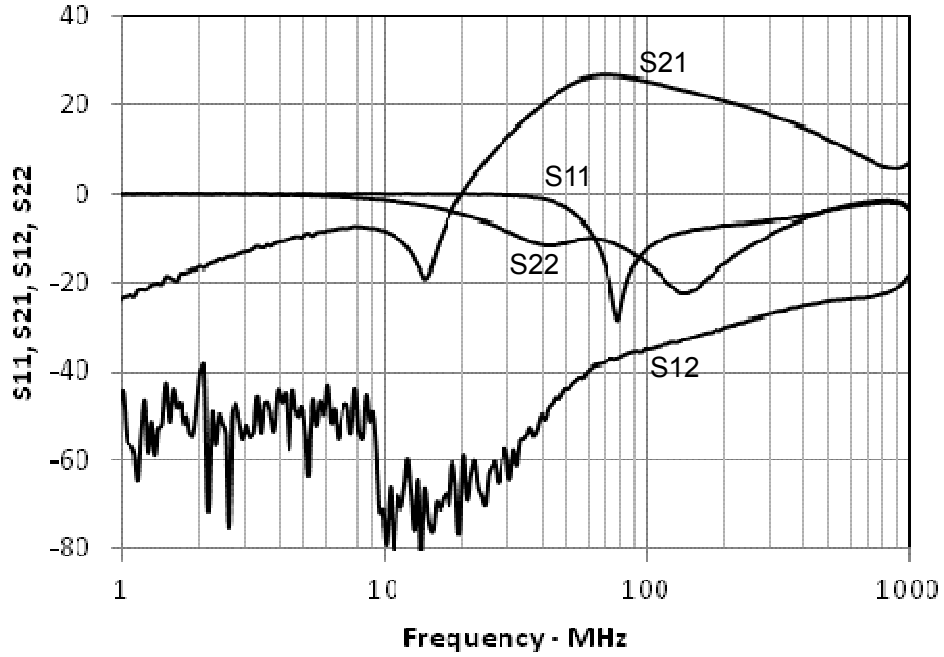
■ Output Return Loss



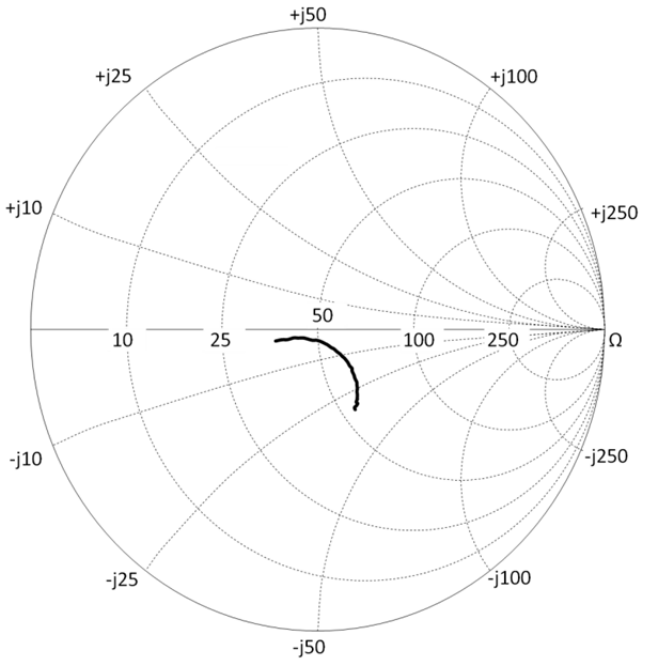
■ Noise Figure



■ S11, S

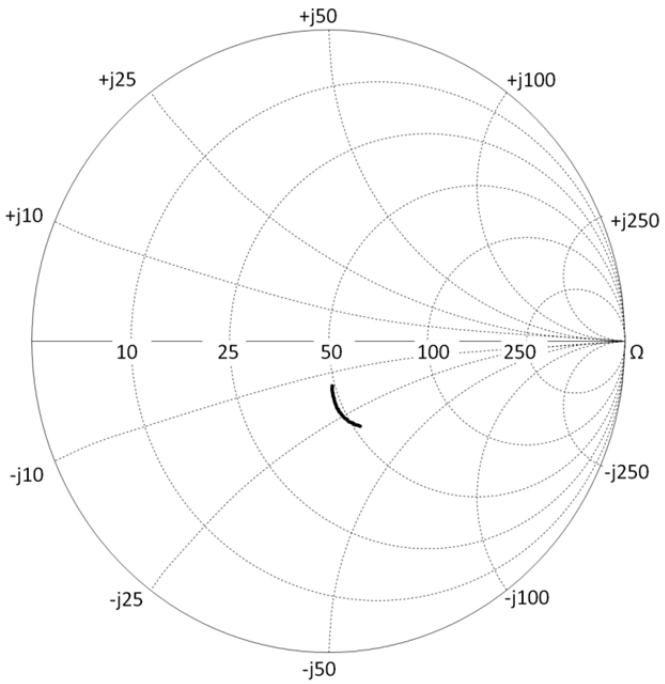


■ Smith Chart
Input Return Loss



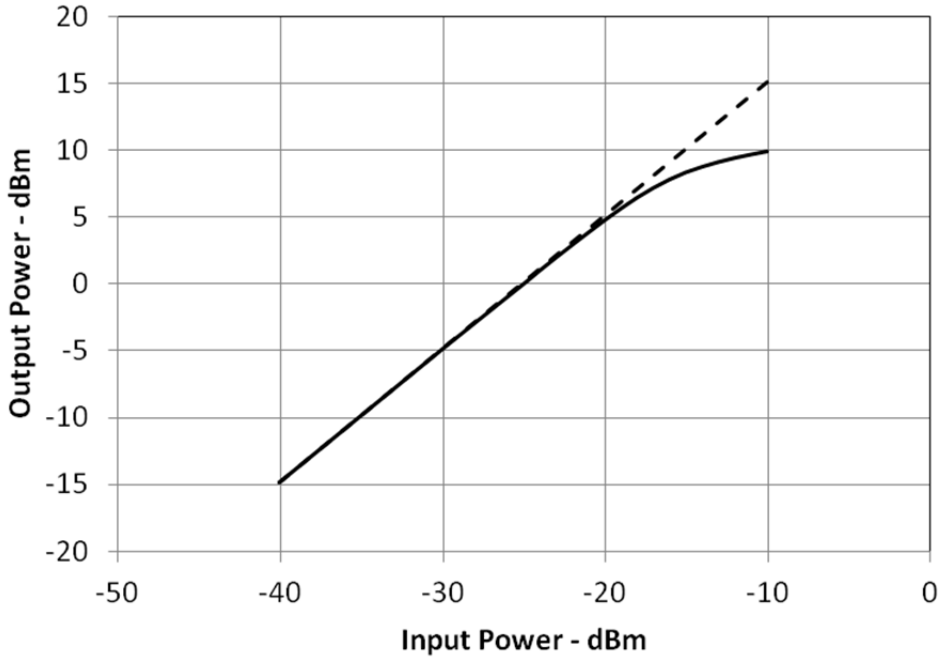
70 MHz to 110 MHz

■ Smith Chart
Output Return Loss



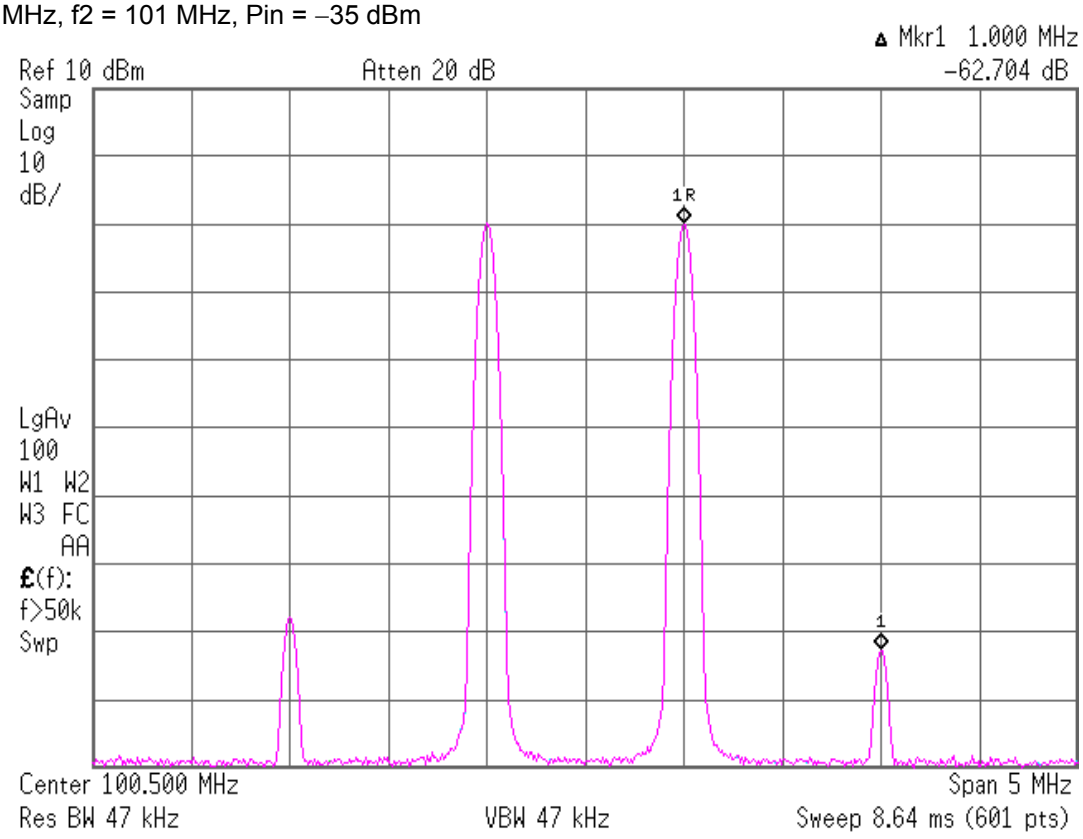
70 MHz to 110 MHz

■ Gain 1 dB Compression Point



■ Input 3rd Order Intercept Point

f1 = 100 MHz, f2 = 101 MHz, Pin = −35 dBm



Gain 1 dB 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.

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