



TGA2512-SM

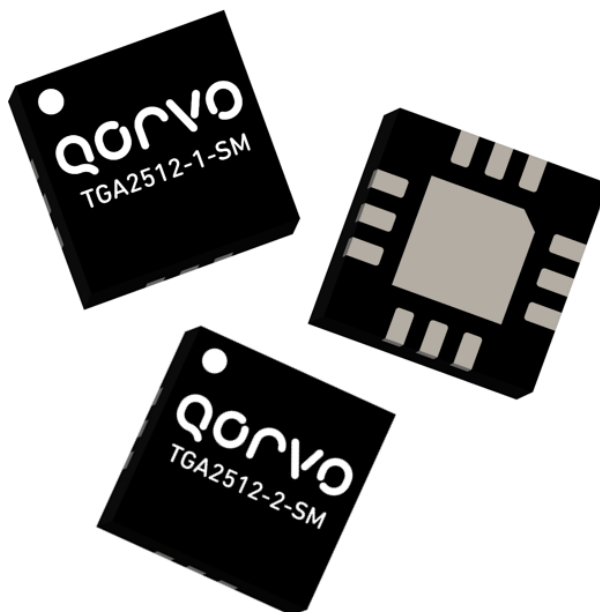
4 -14 GHz GaAs Balanced LNA

Product Description

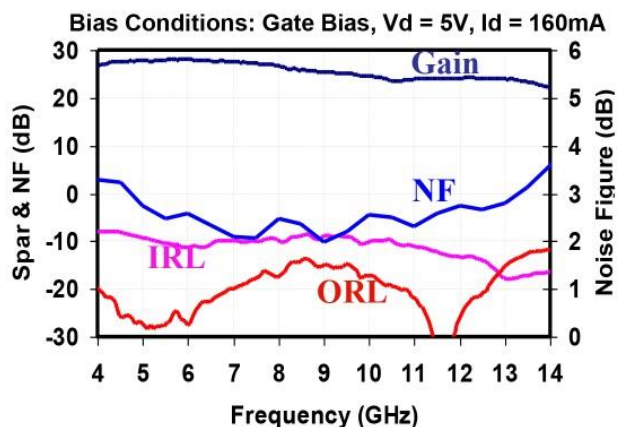
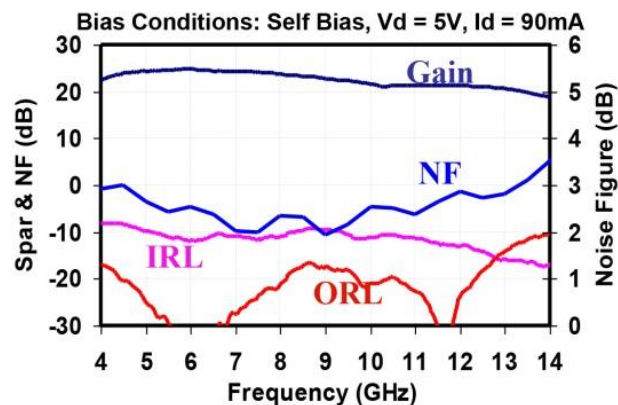
The Qorvo TGA2512-SM is a packaged X-band balanced LNA with AGC amplifier for EW, ECM, and RADAR receiver or driver amplifier applications. Based on Qorvo's GaAs 3MI pHEMT process, the TGA2512-SM provides excellent noise performance with typical midband NF of 2.3 dB, with a high gain of 25 dB from 4-14.2 GHz

The TGA2512-SM is designed for maximum ease of use. TGA2512-SM can handle up to 21 dBm input power reliably, while the build-in gain control provides 15 dB of typical gain control range. The part can be used in self-biased mode, with a single +5 V supply connection, or in gate biased mode, allowing the user to control the current for a particular application.

In self-biased mode the TGA2512-SM achieves 6 dBm typical P1 dB, while in gate-biased mode the typical P1 dB is over 13 dBm.



Measured Data



Key Features

- Frequency Range: 4–14.2 GHz
- 2.3 dB Nominal Noise Figure
- 25 dB Nominal Gain
- 15 dB AGC Range
- 13 dBm Nominal P1dB
- 24 dBm Nominal OIP3
- Bias: 5 V, 160 mA Gate Bias, 5 V, 90 mA Self Bias
- Package Dimensions: 4.0 x 4.0 x 0.9 mm

Applications

- X-Band Radar
- EW, ECM
- Point-to-Point Radio

Ordering Information

Part No.	Package Style
TGA2512-1-SM	QFN 4 x 4 Surface Mount – Self Bias
TGA2512-2-SM	QFN 4 x 4 Surface Mount – Gate Bias
1059405	TGA2512-1-SM Evaluation Board
TGA2512-2-SMEVB1	TGA2512-2-SM Evaluation Board

MAXIMUM RATINGS 1/

Symbol	Parameter	Value	Notes
V _D	Drain Voltage	Gate Bias: $[4 + (0.009)(I_D)]$ V	<u>2/</u> <u>3/</u>
		Self Bias: $[3.5 + (0.022)(I_D)]$ V	
V _G	Gate Voltage Range	-1 TO +0.5 V	
I _D	Drain Current (gate biased)	240 mA	<u>2/</u>
I _G	Gate Current	7.04 mA	
P _{IN}	Input Continuous Wave Power	21 dBm	
P _D	Power Dissipation	1.56 W	<u>2/</u> <u>4/</u>
T _{CH}	Operating Channel Temperature	200 °C	<u>5/</u>
	Mounting Temperature (30 Seconds)	260 °C	
T _{STG}	Storage Temperature	-65 to 150 °C	

1/ These ratings represent the maximum operable values for this device.

2/ Combinations of supply voltage, supply current, input power, and output power shall not exceed P_D.

3/ Unit for I_D is mA.

4/ When operated at this bias condition with a base plate temperature of 85 °C, the median life is 9.3E4 hours.

5/ Junction operating temperature will directly affect the device median time to failure (T_m). For maximum life, it is recommended that junction temperatures be maintained at the lowest possible levels.

Electrical Characteristics

$T_A = 25\text{ }^{\circ}\text{C}$, Nominal

Parameter	Self Bias TGA2512-1-SM	Gate Bias TGA2512-2-SM	Units
Frequency Range	4–14.2	4–14.2	GHz
Drain Voltage, V_D	5.0	5.0	V
Drain Current, I_D	160	160	mA
Gate Voltage, V_G	-	-0.1	V
Small Signal Gain, S21	22	25	dB
Input Return Loss, S11	-10	-10	dB
Output Return Loss, S22	-20	-20	dB
Noise Figure, NF	2.3	2.3	dB
Output Power @ 1 dB Gain Compression, P1 dB	6	13	dBm
OIP3	16	24	dBm
Temperature Gain Coefficient	-0.02	-0.02	dB/ $^{\circ}\text{C}$

Note: Table II Lists the RF Characteristics of typical devices as determined by fixture measurements.

TGA2512-2-SM Electrical Characteristics

$V_D = 5\text{ V}$, $I_D = 160\text{ mA}$, $V_{CTRL} = 0\text{ V}$, $T_A = 25\text{ }^{\circ}\text{C}$, Nominal

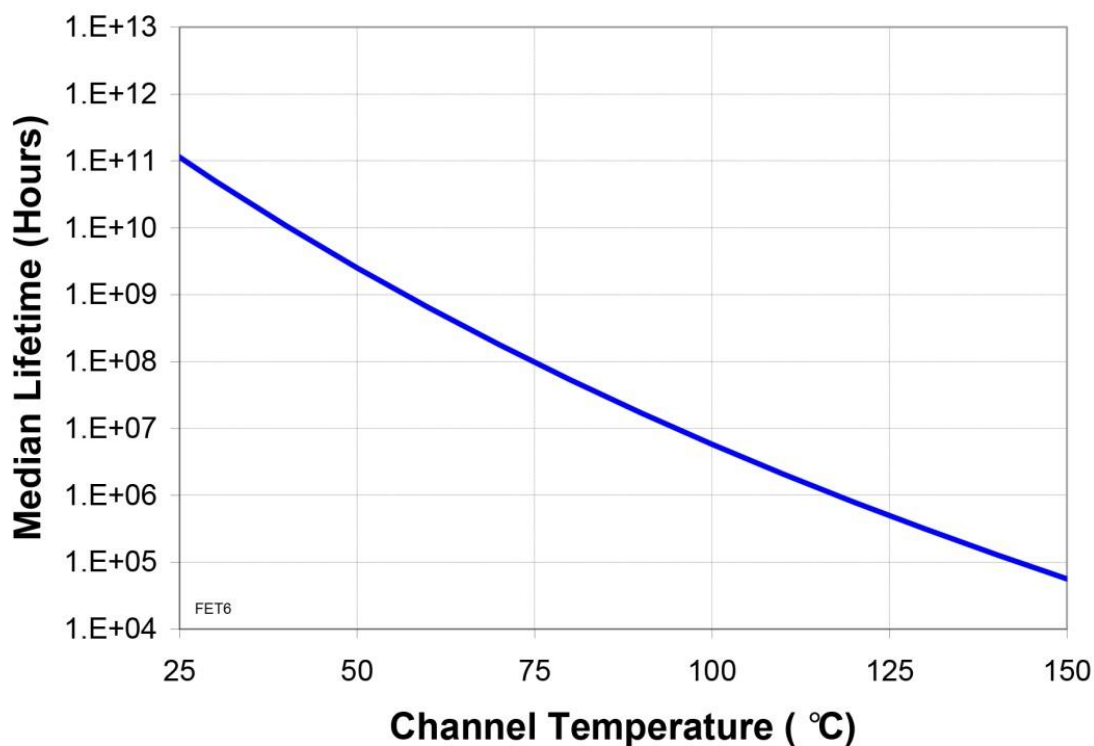
Parameter	Min	Typ	Max	Units
Frequency Range	11		14.2	GHz
Drain Current, I_D		160	200	mA
Gate Voltage, V_G	-0.4	-0.1	0.2	V
Small Signal Gain, S21	19	24		dB
Input Return Loss, S11	-7	-12		dB
Output Return Loss, S22	-7	-12		dB
Noise Figure, NF		3	4.5	dB
Output Power @ 1 dB Gain Compression, P1 dB	10	13		dBm
OIP3	16	22		dBm

Thermal Information

Parameter	Test Conditions	T _{CH} (°C)	Θ _{JC} (°C/W)	T _M (HRS)
Θ _{JC} Thermal Resistance (channel to Case)	V _D = 5 V I _D = 160 mA Gate Bias P _{diss} = 0.80 W	115	37.6	1.3E+6
Θ _{JC} Thermal Resistance (channel to Case)	V _D = 5 V I _D = 90 mA Self Bias P _{DISS} = 0.45 W	97.7	28.2	7.2E+6

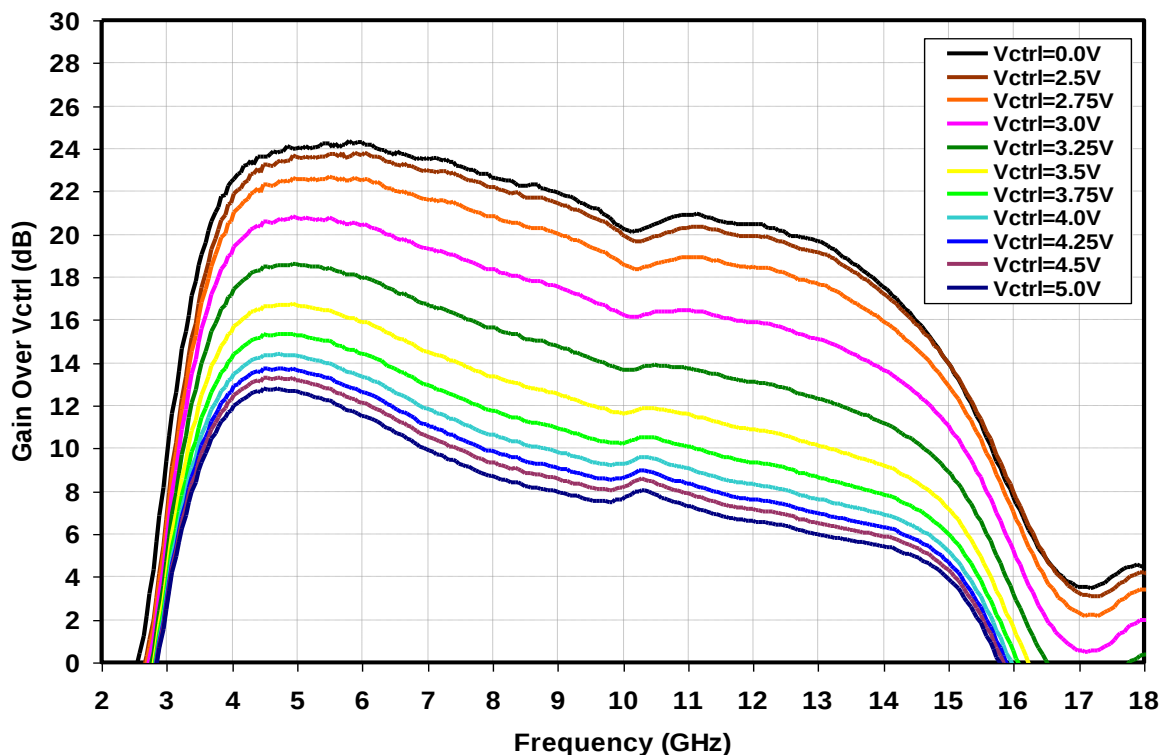
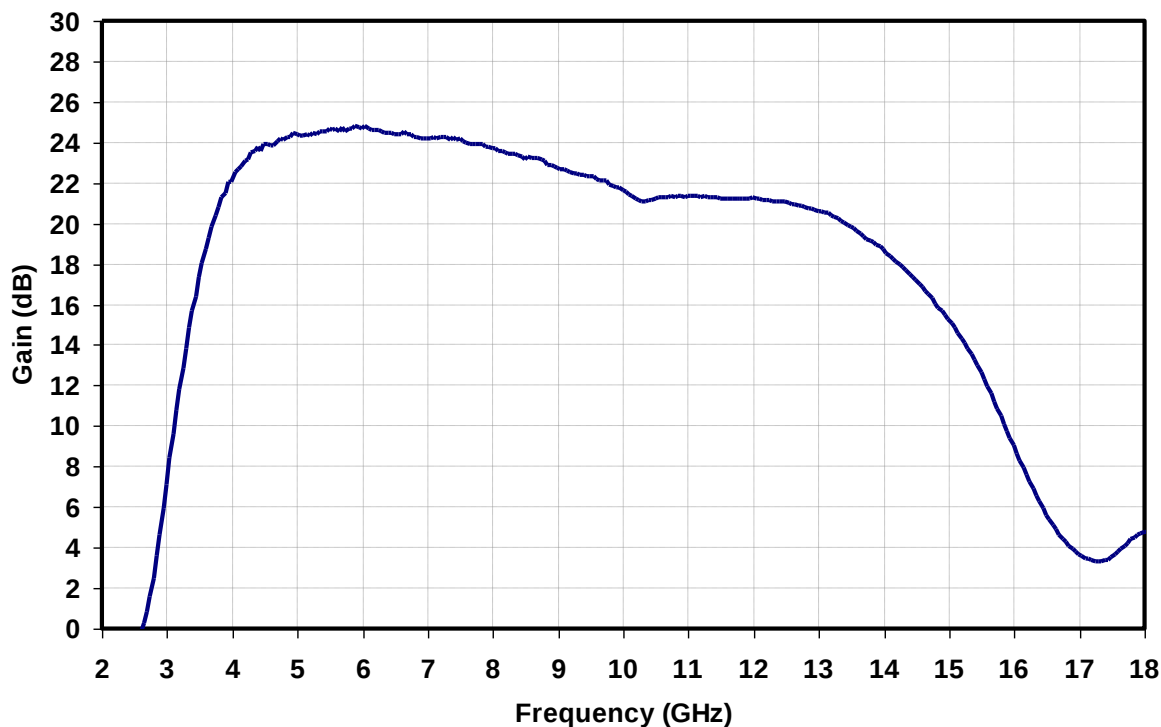
Note: Worst case condition with no RF applied. 100% of DC power is dissipated. Case temperature at 85 °C

Median Lifetime (T_m) vs. Channel Temperature



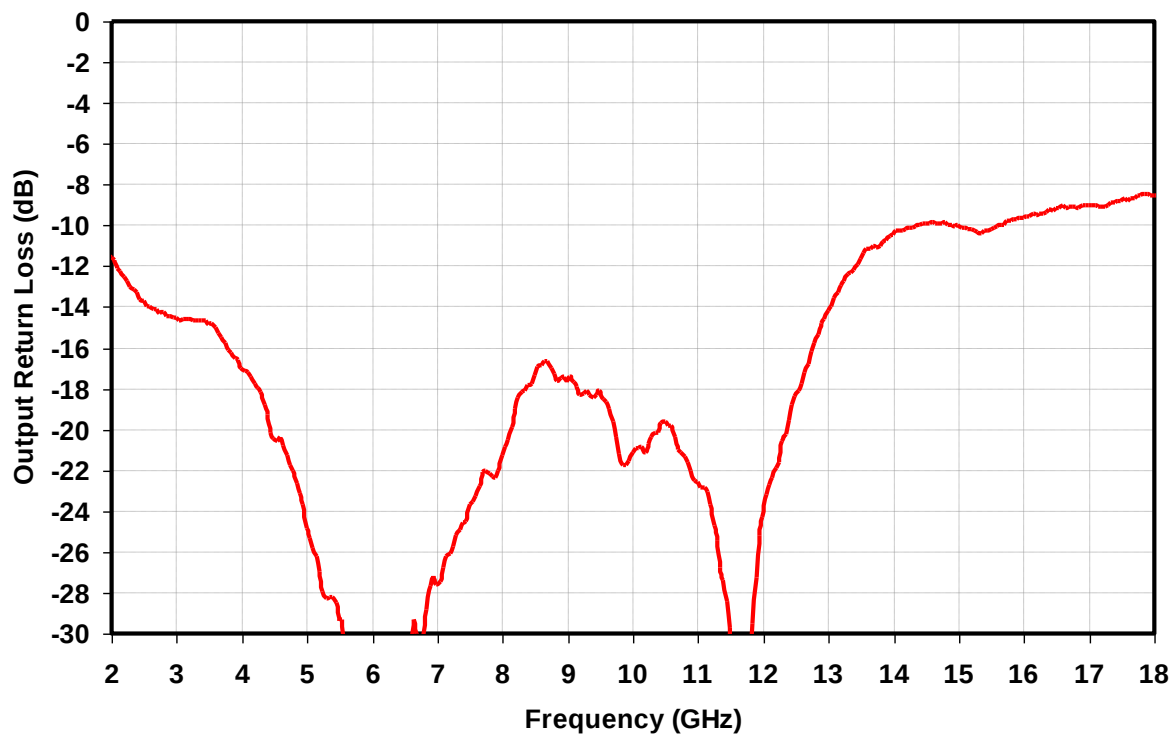
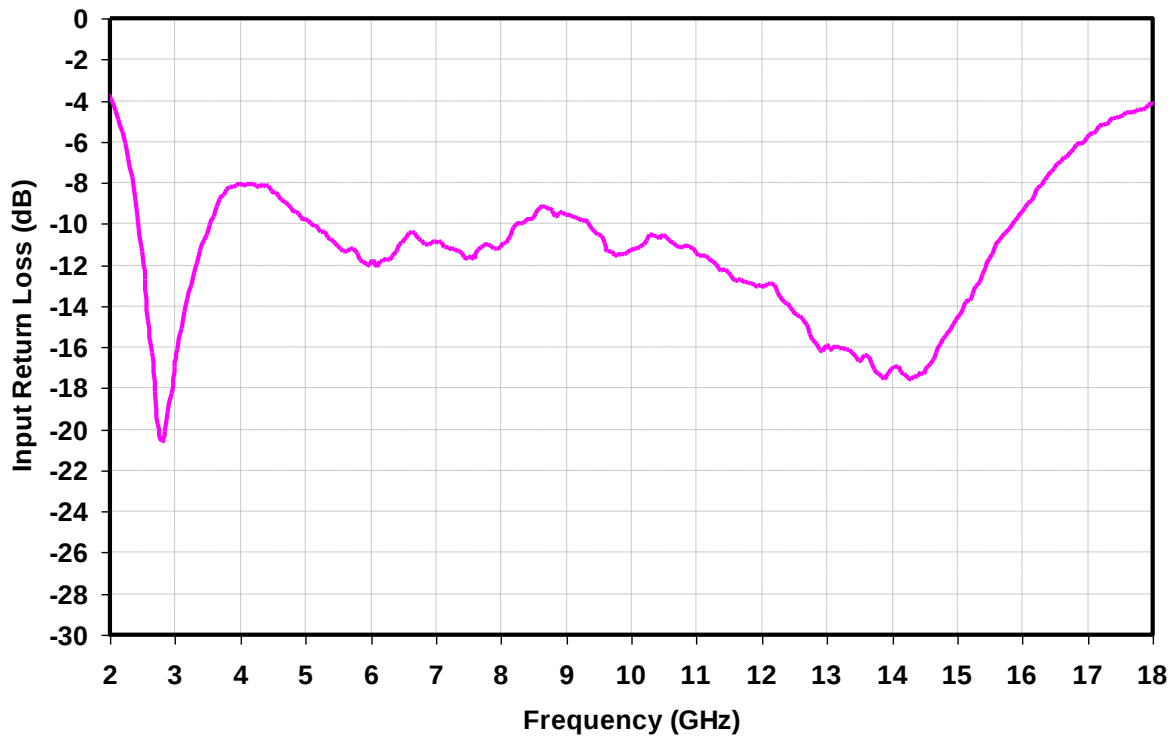
Measured Data

Bias Conditions: Self Bias, $V_D = 5\text{ V}$, $I_D = 90\text{ mA}$



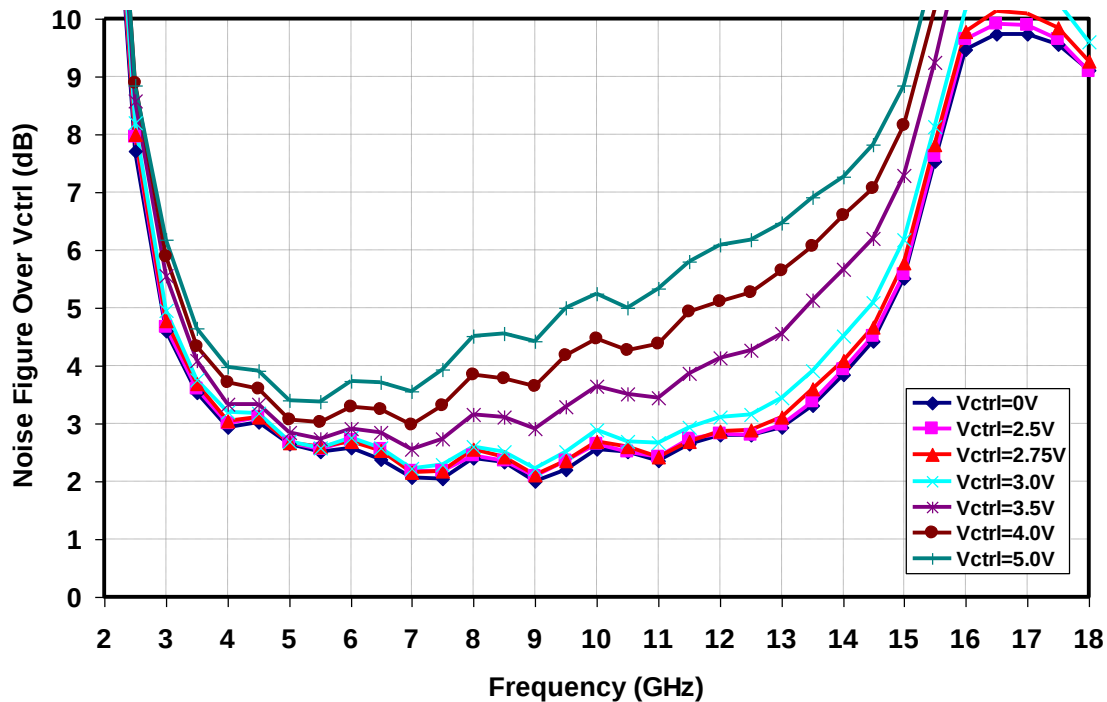
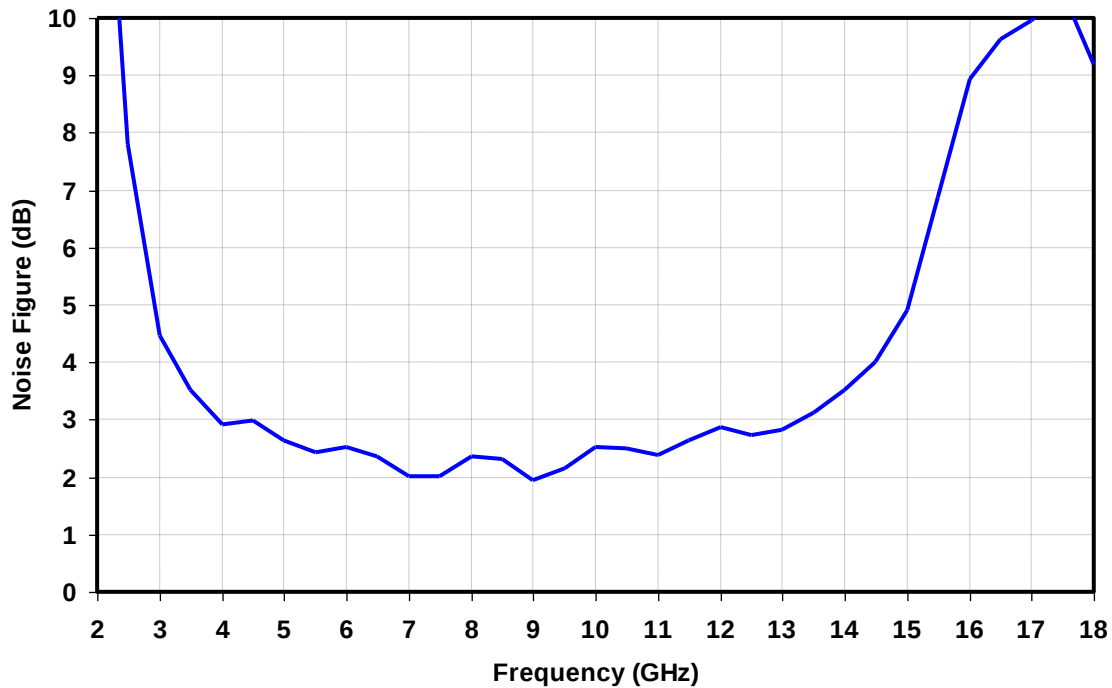
Measured Data

Bias Conditions: Self Bias, $V_D = 5\text{ V}$, $I_D = 90\text{ mA}$



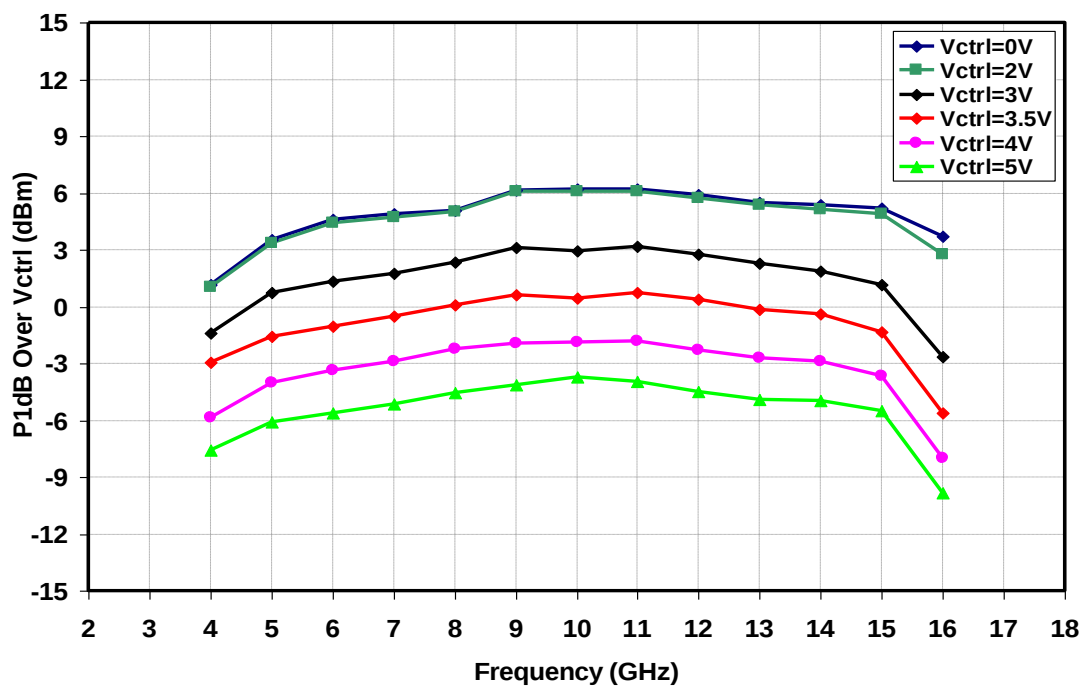
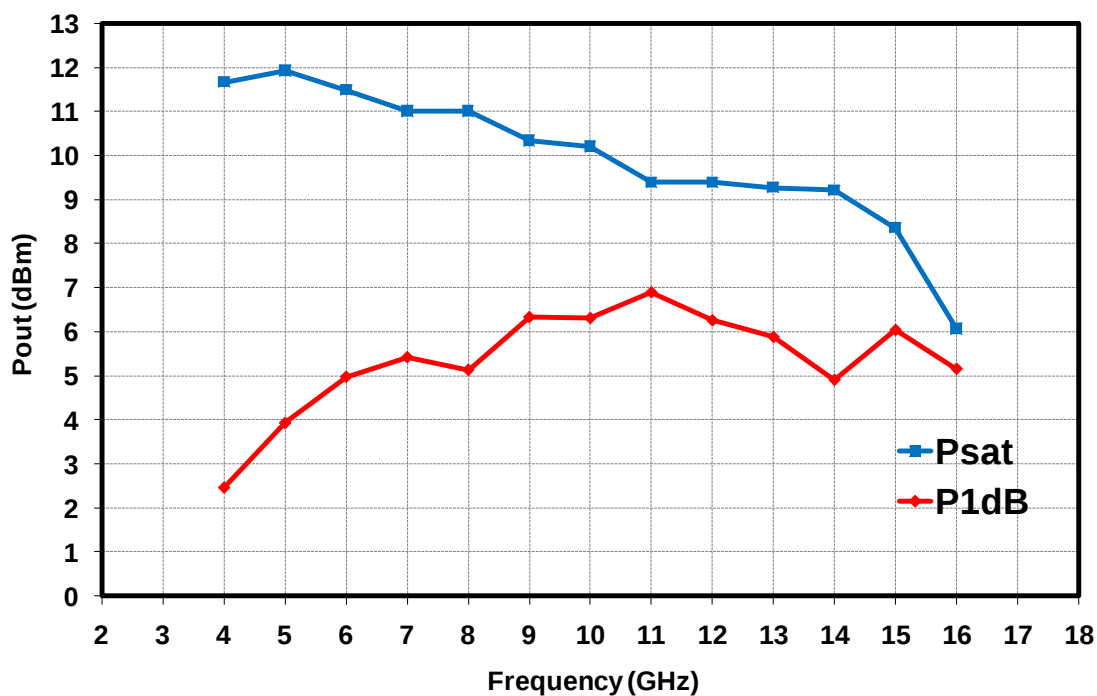
Measured Data

Bias Conditions: Self Bias, $V_D = 5\text{ V}$, $I_D = 90\text{ mA}$



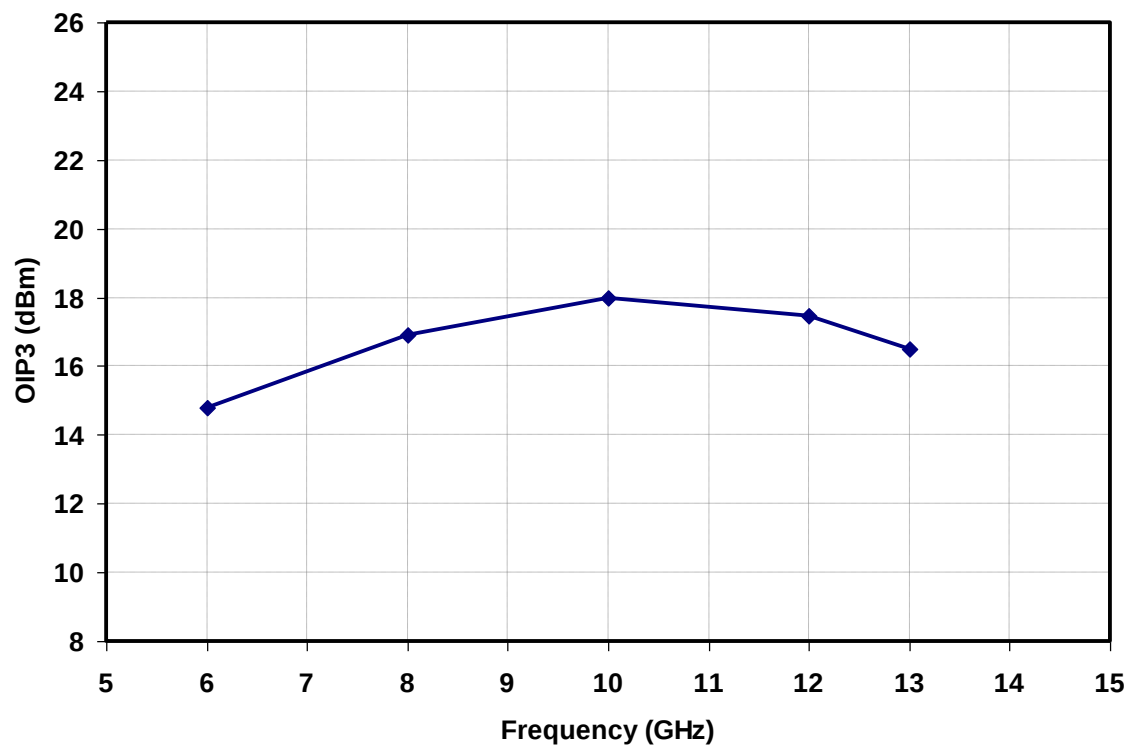
Measured Data

Bias Conditions: Self Bias, $V_D = 5\text{ V}$, $I_D = 90\text{ mA}$



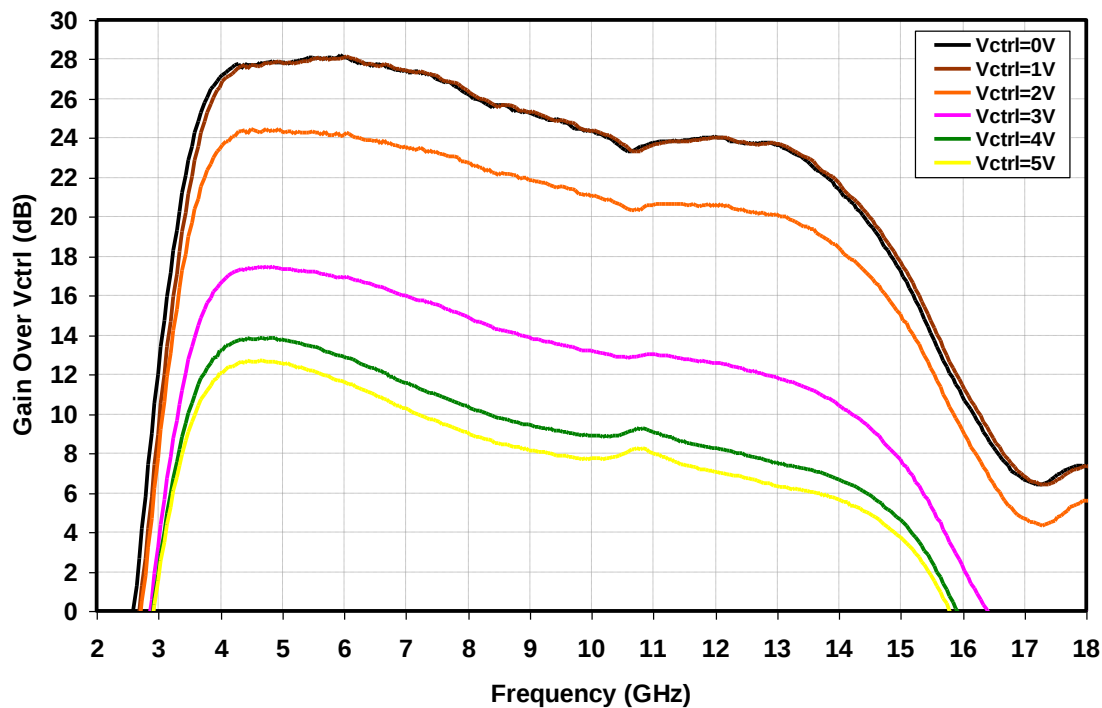
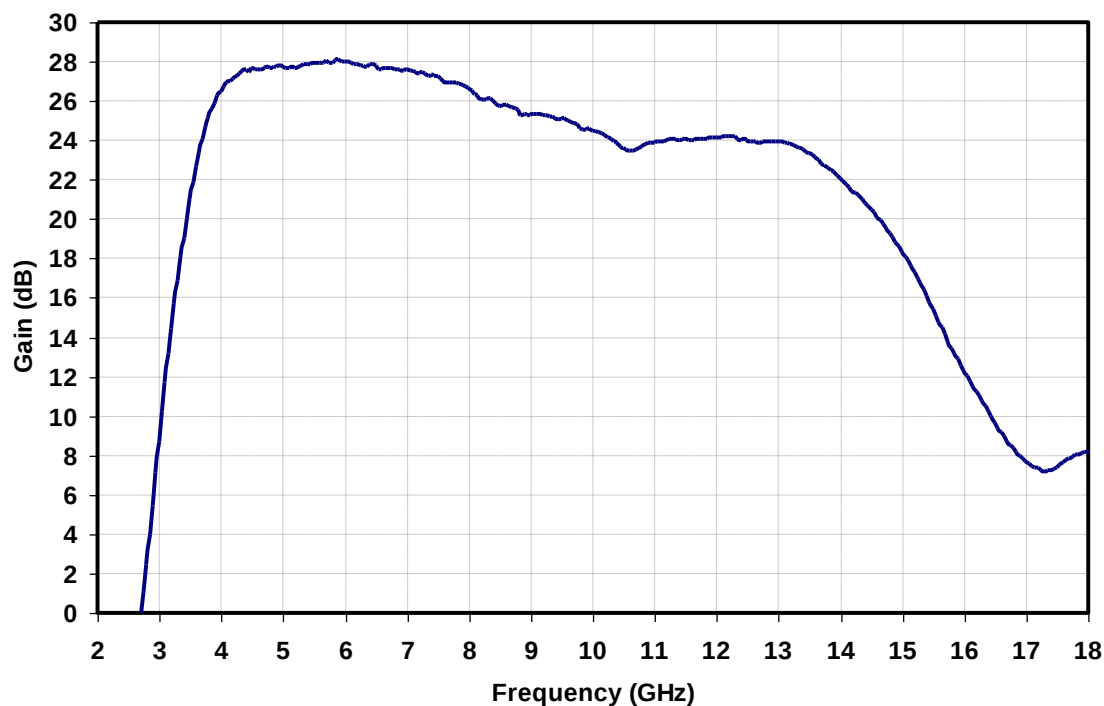
Measured Data

Bias Conditions: Self Bias, $V_D = 5\text{ V}$, $I_D = 90\text{ mA}$



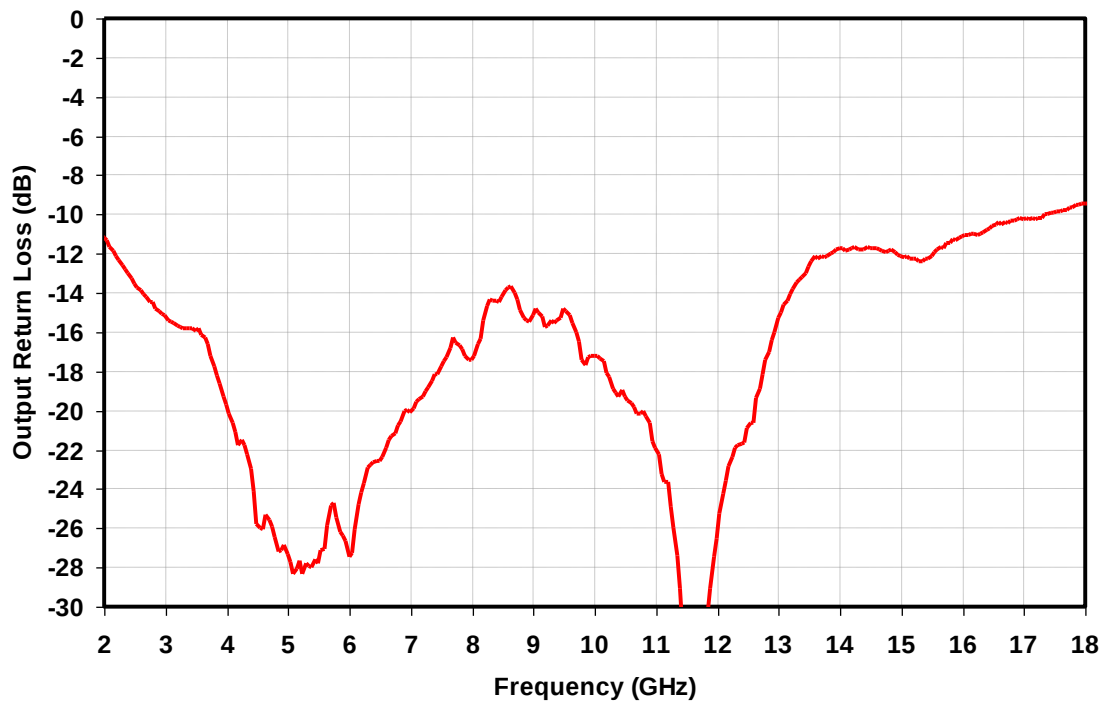
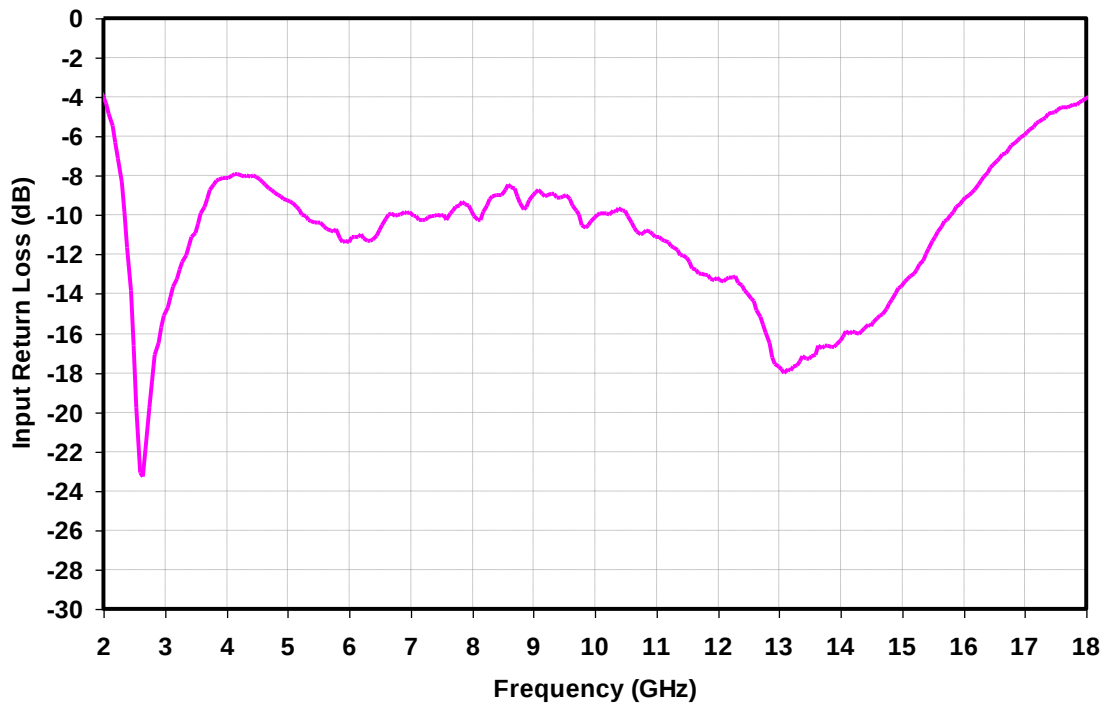
Measured Data

Bias Conditions: Gate Bias, $V_D = 5\text{ V}$, $I_D = 160\text{ mA}$



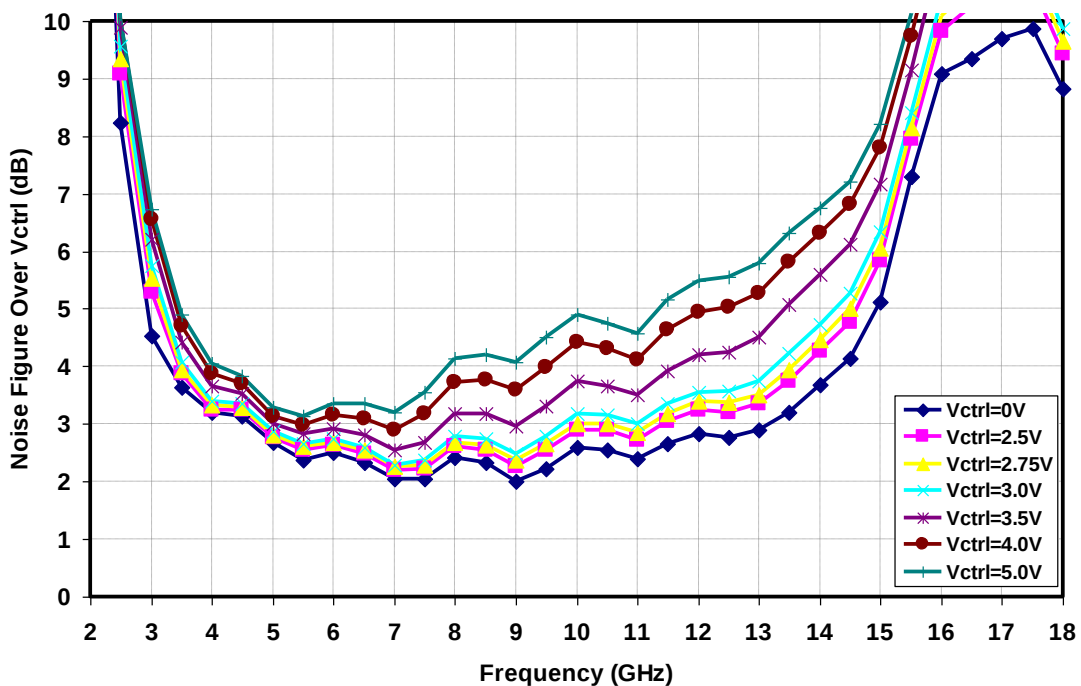
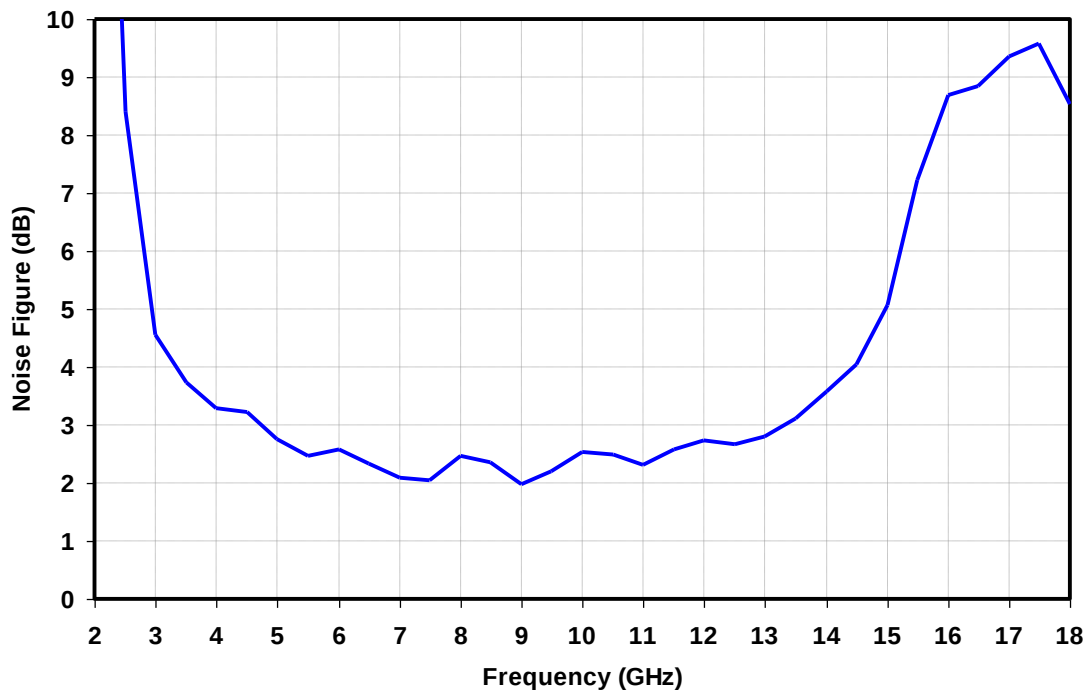
Measured Data

Bias Conditions: Gate Bias, $V_D = 5\text{ V}$, $I_D = 160\text{ mA}$



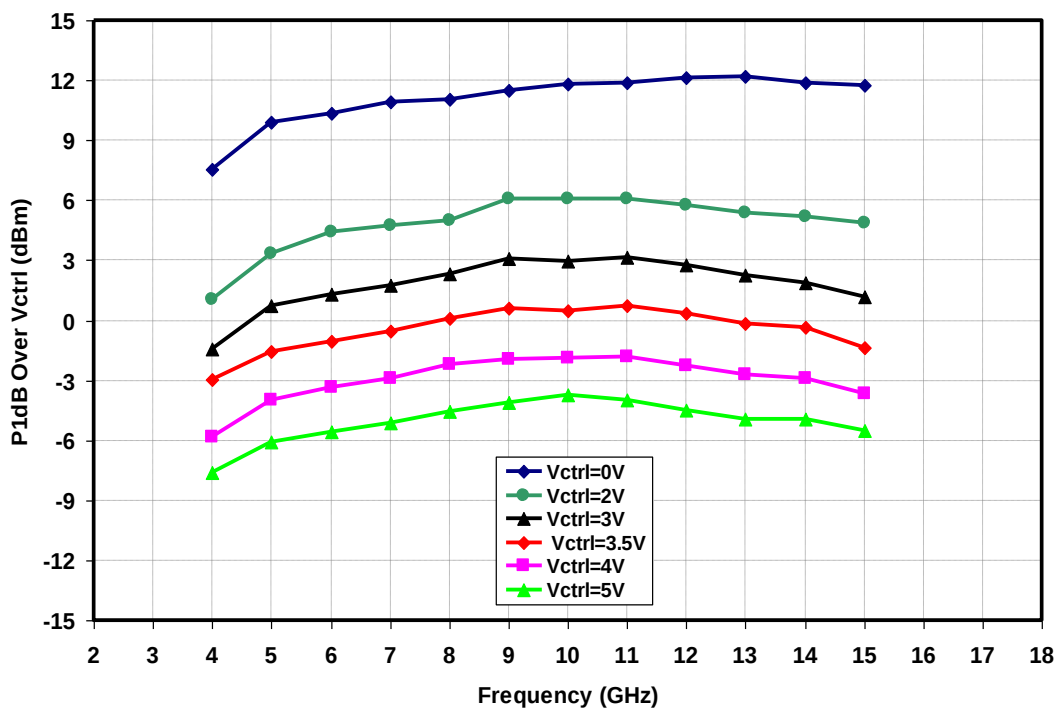
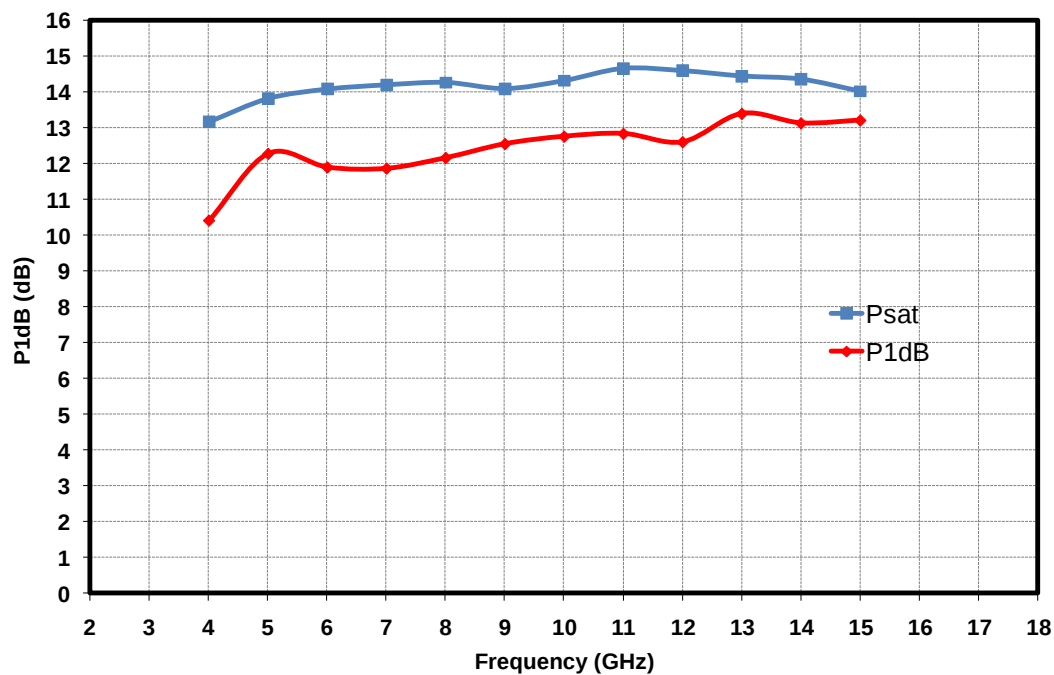
Measured Data

Bias Conditions: Gate Bias, $V_D = 5\text{ V}$, $I_D = 160\text{ mA}$



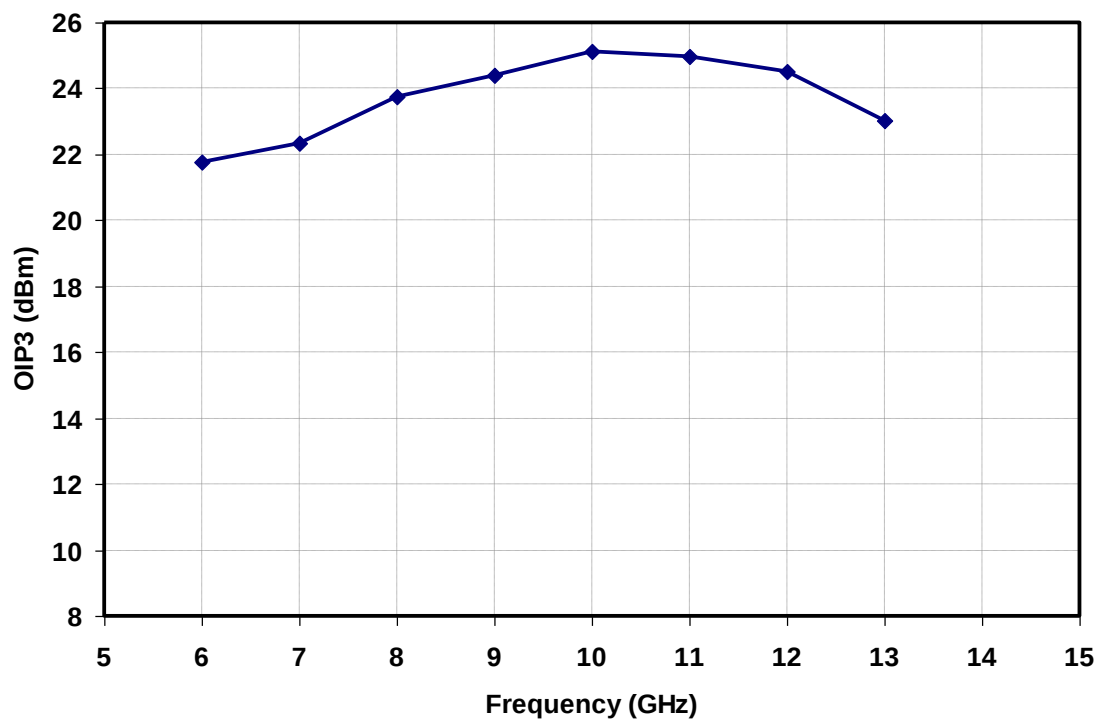
Measured Data

Bias Conditions: Gate Bias, $V_D = 5\text{ V}$, $I_D = 160\text{ mA}$

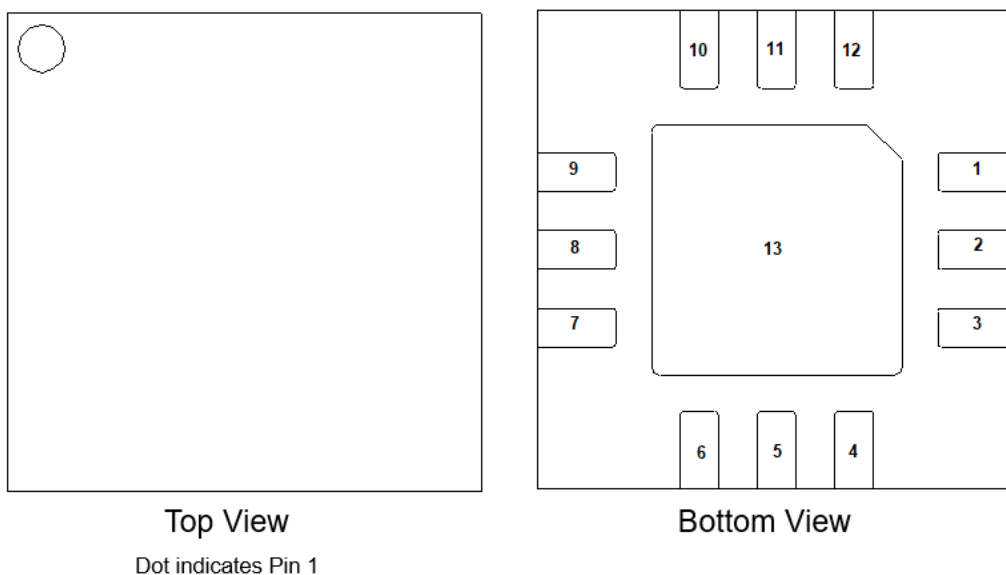


Measured Data

Bias Conditions: Gate Bias, $V_D = 5\text{ V}$, $I_D = 160\text{ mA}$



Package Pinout Diagram



Self Bias

Pin	Description
1,3, 4, 5, 6, 7, 9, 12	NC
2	RF Input
8	RF Output
10	Vd
11	Vctrl
13	GND

Self Bias: $V_D = 5\text{ V}$ ($I_D = \sim 90\text{ mA}$), $V_{CTRL} = 0\text{ to }+5\text{ V}$ for Gain adjustment

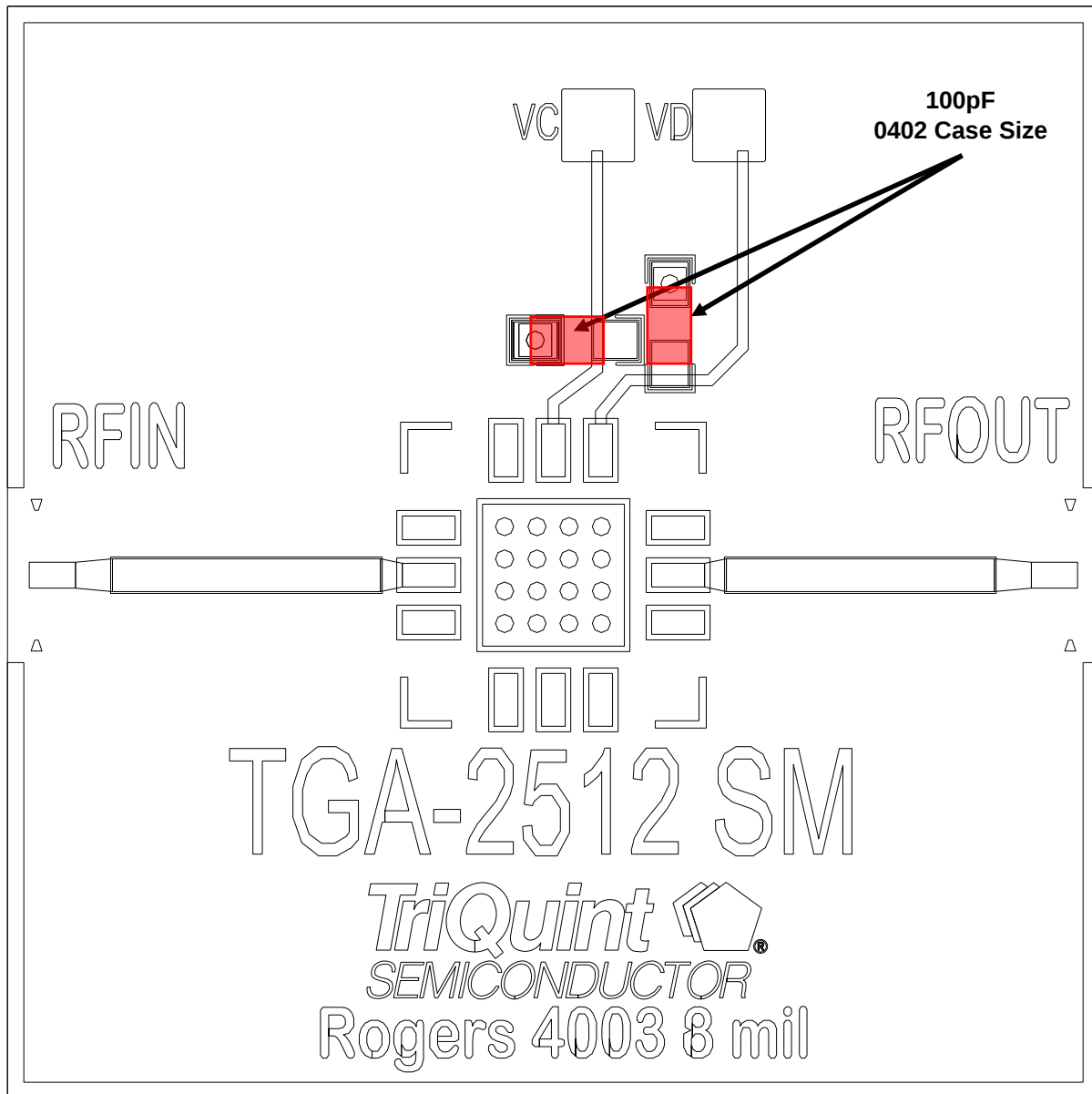
Gate Bias

Pin	Description
1,3, 4, 5, 6, 7, 9	NC
2	RF Input
8	RF Output
10	Vd
11	Vctrl
12	Vg
13	GND
13	Gnd

Gate Bias: $V_D = 5\text{ V}$, $V_{CTRL} = 0\text{ to }+5\text{ V}$ for Gain adjustment $V_G = \text{Range, } -0.5\text{ to }0$, typically ~ -0.1 will provide $\sim 160\text{ mA}$ of I_d .

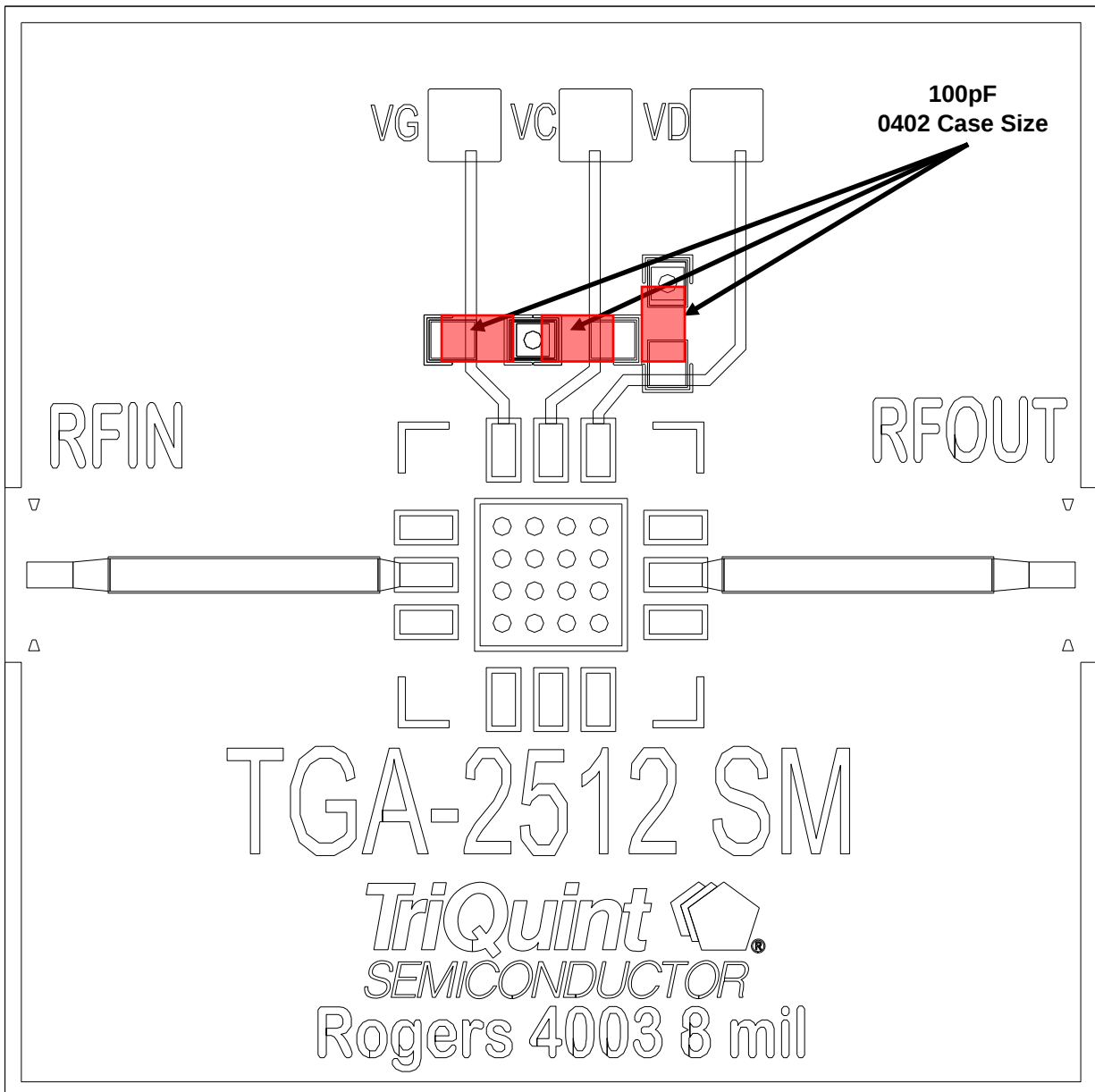
Recommended Board Layout Assembly

Self Bias



Recommended Board Layout Assembly

Gate Bias



Handling Precautions

Parameter	Rating	Standard
ESD – Human Body Model (HBM)	TBD	ANSI/ESD/JEDEC JS-001



Caution!

ESD-Sensitive Device

Solderability

Use only AuSn (80/20) solder, and limit exposure to temperatures above 300 °C to 3 – 4 minutes, maximum.

RoHS Compliance

This part is compliant with 2011/65/EU RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment) as amended by Directive 2015/863/EU.

This product also has the following attributes:

- Lead Free
- Halogen Free (Chlorine, Bromine)
- Antimony Free
- TBBP-A (C15H12Br4O2) Free
- PFOS Free
- SVHC Free

Contact Information

For the latest specifications, additional product information, worldwide sales and distribution locations:

Web: www.qorvo.com

Tel: 1-844-890-8163

Email: customer.support@qorvo.com

Important Notice

The information contained herein is believed to be reliable; however, Qorvo makes no warranties regarding the information contained herein and assumes no responsibility or liability whatsoever for the use of the information contained herein. All information contained herein is subject to change without notice. Customers should obtain and verify the latest relevant information before placing orders for Qorvo products. The information contained herein or any use of such information does not grant, explicitly or implicitly, to any party any patent rights, licenses, or any other intellectual property rights, whether with regard to such information itself or anything described by such information. **THIS INFORMATION DOES NOT CONSTITUTE A WARRANTY WITH RESPECT TO THE PRODUCTS DESCRIBED HEREIN, AND QORVO HEREBY DISCLAIMS ANY AND ALL WARRANTIES WITH RESPECT TO SUCH PRODUCTS WHETHER EXPRESS OR IMPLIED BY LAW, COURSE OF DEALING, COURSE OF PERFORMANCE, USAGE OF TRADE OR OTHERWISE, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.**

Without limiting the generality of the foregoing, Qorvo products are not warranted or authorized for use as critical components in medical, life-saving, or life-sustaining applications, or other applications where a failure would reasonably be expected to cause severe personal injury or death.

Copyright 2019 © Qorvo, Inc. | Qorvo is a registered trademark of Qorvo, Inc.