C-/X-Band Gain Block, DIE
4 - 12 GHz

ENGLA00059
Rev. V1

Features

- Wideband Feedback
- IIP3 - High Linearity: 29 dBm
- OIP3: 36 dBm
- OIP2: 44 dBm
- P1dB: 20 dBm
- Gain Flatness: 7 dB
- Noise Figure: 6 dB
- Excellent Return Loss: 18 dB
- Die Size:
  2.46 x 1.43 x 0.1 mm
  0.097 x 0.056 x 0.004 inch
- RoHS* Compliant

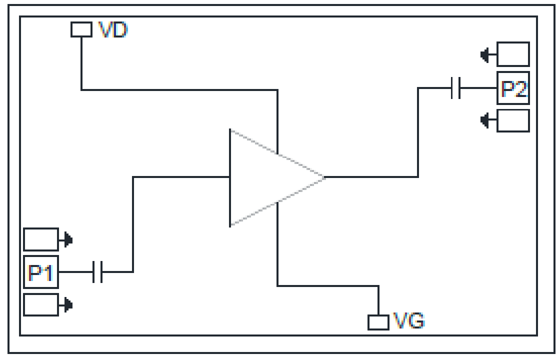
Applications

- Military Radar
- Telecom Infrastructure
- Space Hybrids

Description

The ENGLA00059 is a wideband GaAs MMIC feedback amplifier die which operates from 4 to 12 GHz. The design is matched to 50 Ω. The amplifier delivers 7 to 8 dB gain across the band. The amplifier is very linear with OIP3 typically 15 dB higher than P1dB. The MMIC has gold backside metallization and is designed to be silver epoxy attached. The RF interconnects are designed to account for wire bonds for optimal integrated return loss. No additional ground interconnects are required.

Functional Block Diagram



Ordering Information

Part Number	Package
ENGLA00059	Die

* Restrictions on Hazardous Substances, compliant to current RoHS EU directive.

Electrical Specifications:
Freq. = 4 - 12 GHz, T_A = +25°C, V_D = 6.5 - 7.5 V, V_G = -0.8 - -1.0 V, Z_0 = 50 Ω

Parameter	Units	Min.	Typ.	Max.
Gain	dB	6.0	7.3	—
Noise Figure	dB	—	6	—
Input Return Loss	dB	14	17	—
Output Return Loss	dB	15	18	—
Output P1dB	dBm	19	21	—
Output IP3	dBm	33	36	—
Output IP2	dBm	38	44	—
Supply Current	mA	—	100	—
Thermal Resistance	ºC/W	—	110	—

Recommended Operating Conditions

Parameter	Min.	Typ.	Max.	Units
Drain Voltage	5.0	6.5	8.0	V
Gate Voltage	-0.6	-0.8 to -1.0	-1.4	V
Drain Current	100	—	115	mA

Absolute Maximum Ratings[1,2]

Parameter	Absolute Maximum
Drain Voltage	+11 V
Gate Voltage	-6 V
RF Input Power	23 dBm
Junction Temperature	+165°C
Operating Temperature	-55°C to +85°C
Storage Temperature	-65°C to +85°C

1. Exceeding any one or combination of these limits may cause permanent damage to this device.
2. MACOM does not recommend sustained operation near these survivability limits.

Handling Procedures

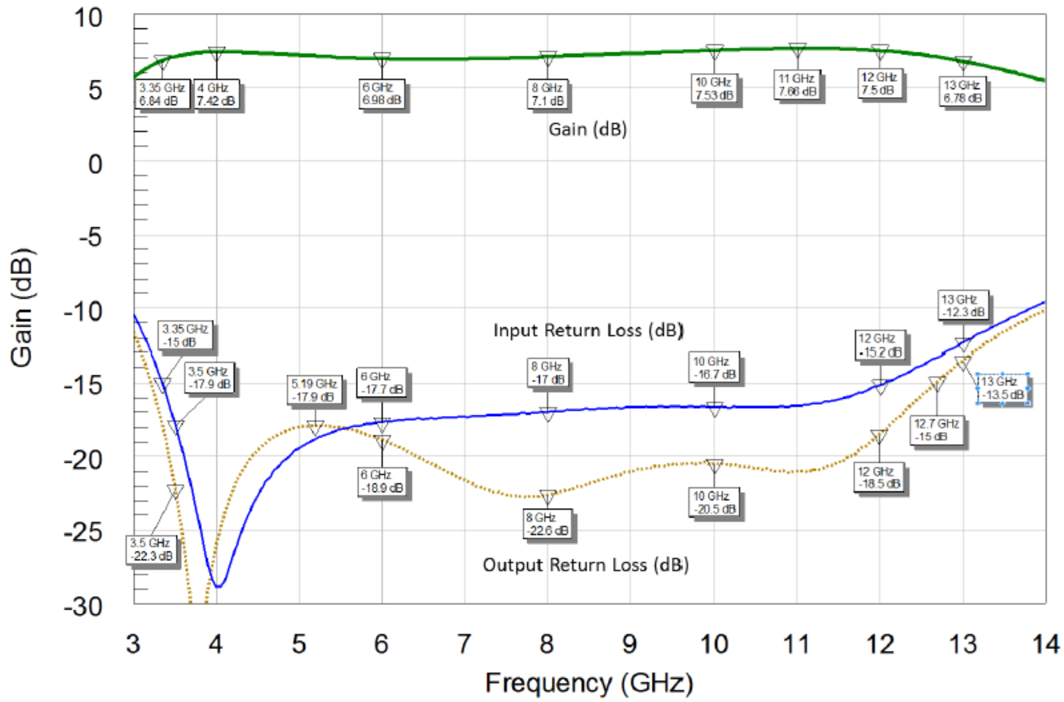
Please observe the following precautions to avoid damage:

Static Sensitivity

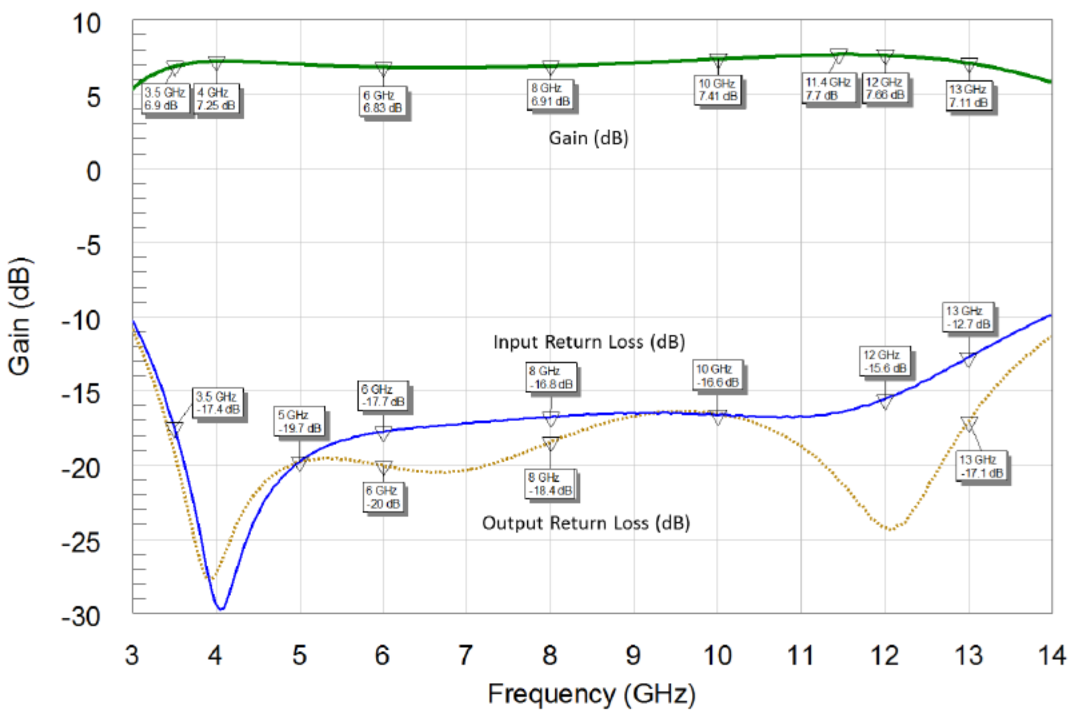
These electronic devices are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.

Measured RF Data with Wirebonds

Gain and In / Out Return Loss: V_D = 7 V; V_G = -1 V; I_D = 99 mA

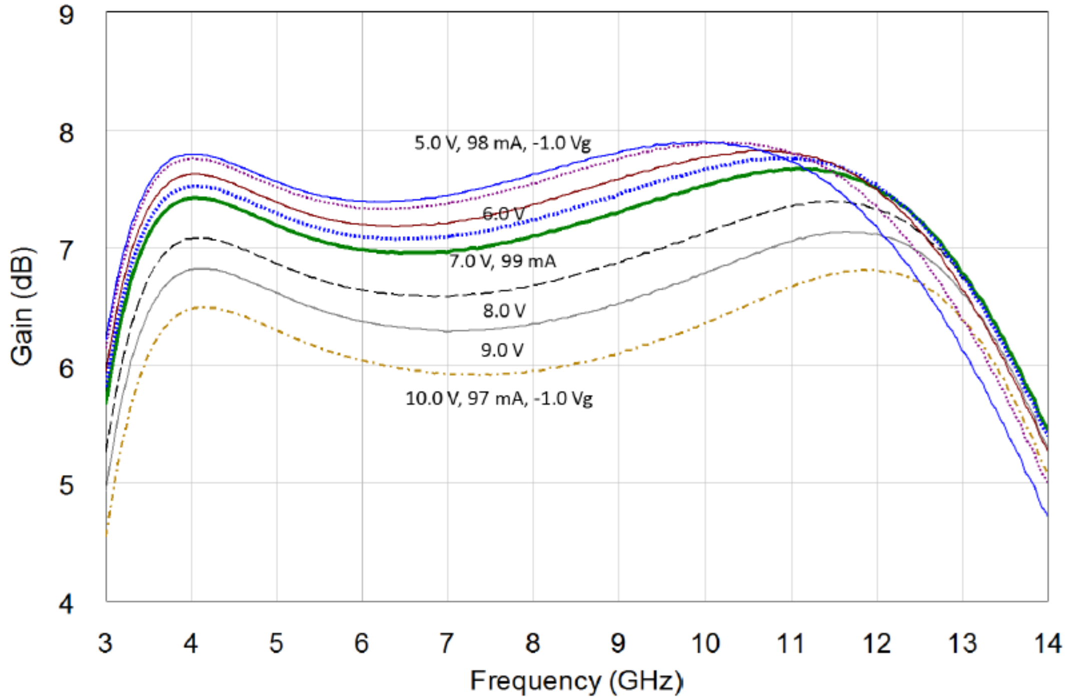


Gain and In / Out Return Loss: V_D = 7 V; V_G = -0.8 V; I_D = 112 mA

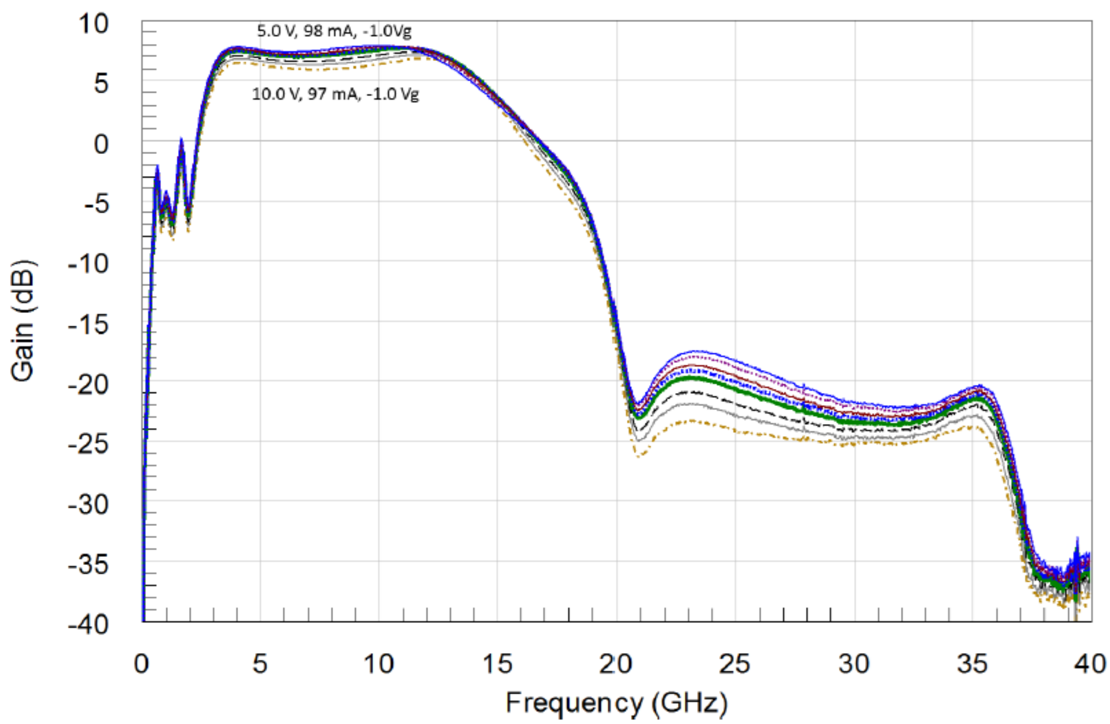


Measured RF Data with Wirebonds

Small Signal Gain: V_D = 5 - 10 V; V_G = -1 V; I_D = 99 to 97 mA

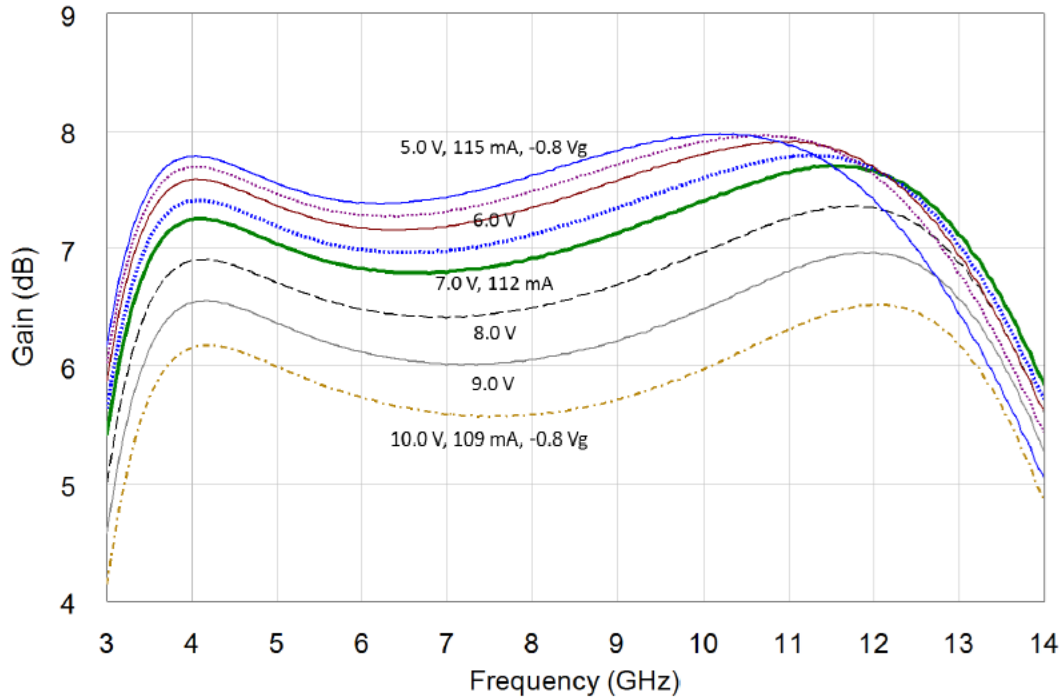


Small Signal Gain - Wideband: V_D = 5 - 10 V; V_G = -1 V; I_D = 99 to 97 mA



Measured RF Data with Wirebonds

Small Signal Gain: V_D = 5 - 10 V; V_G = -0.8 V; I_D = 115 to 109 mA



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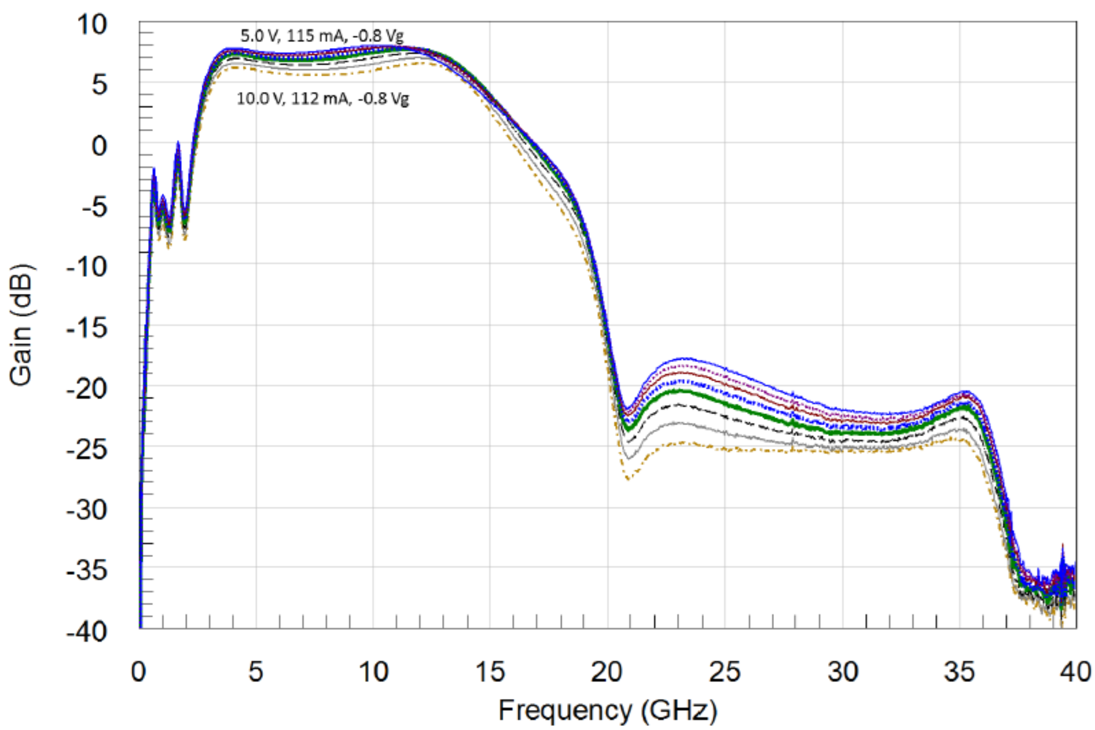
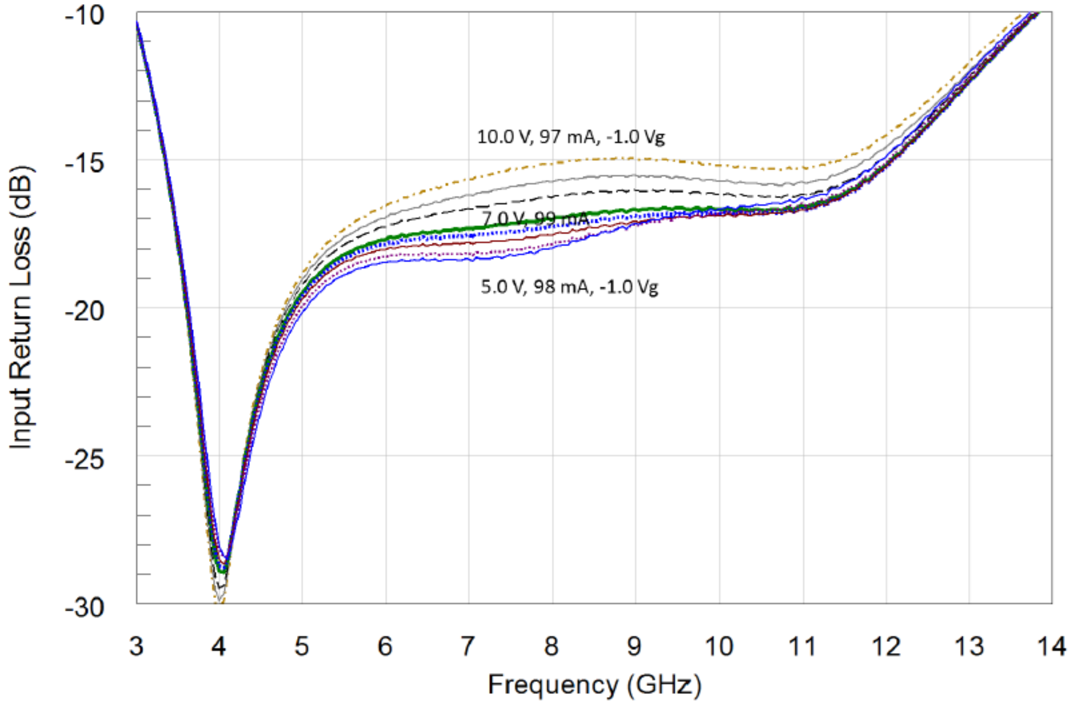
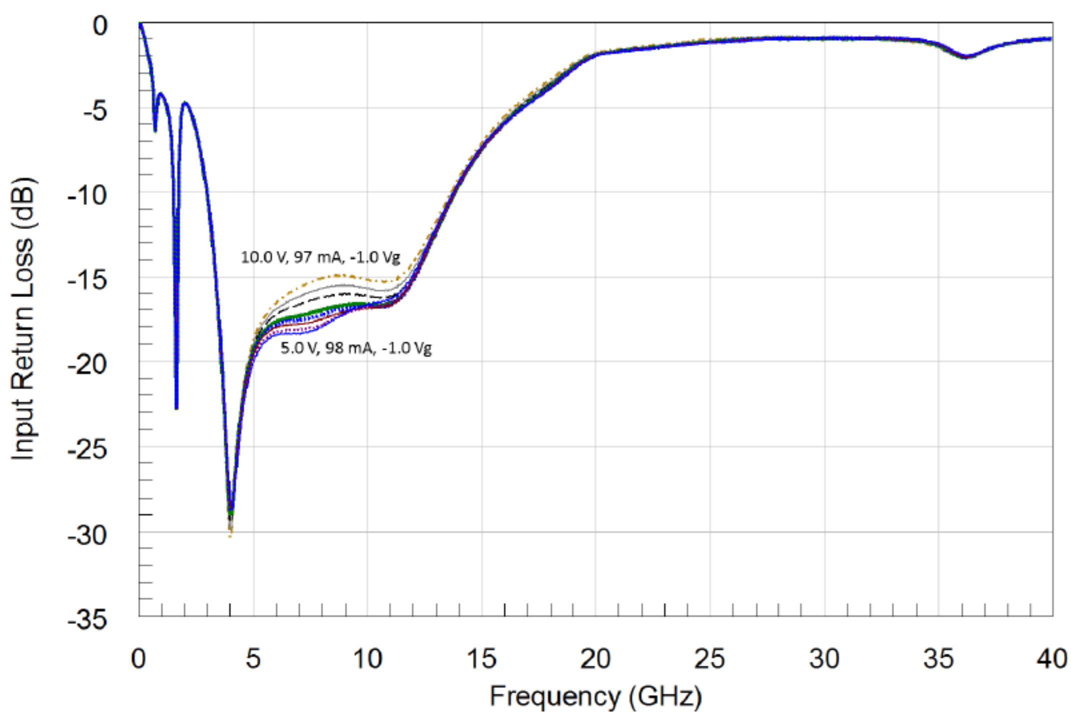


Measured RF Data with Wirebonds

Input Return Loss: V_D = 5 - 10 V; V_G = -1 V; I_D = 99 to 97 mA



Input Return Loss - Wideband: V_D = 5 - 10 V; V_G = -1 V; I_D = 99 to 97 mA



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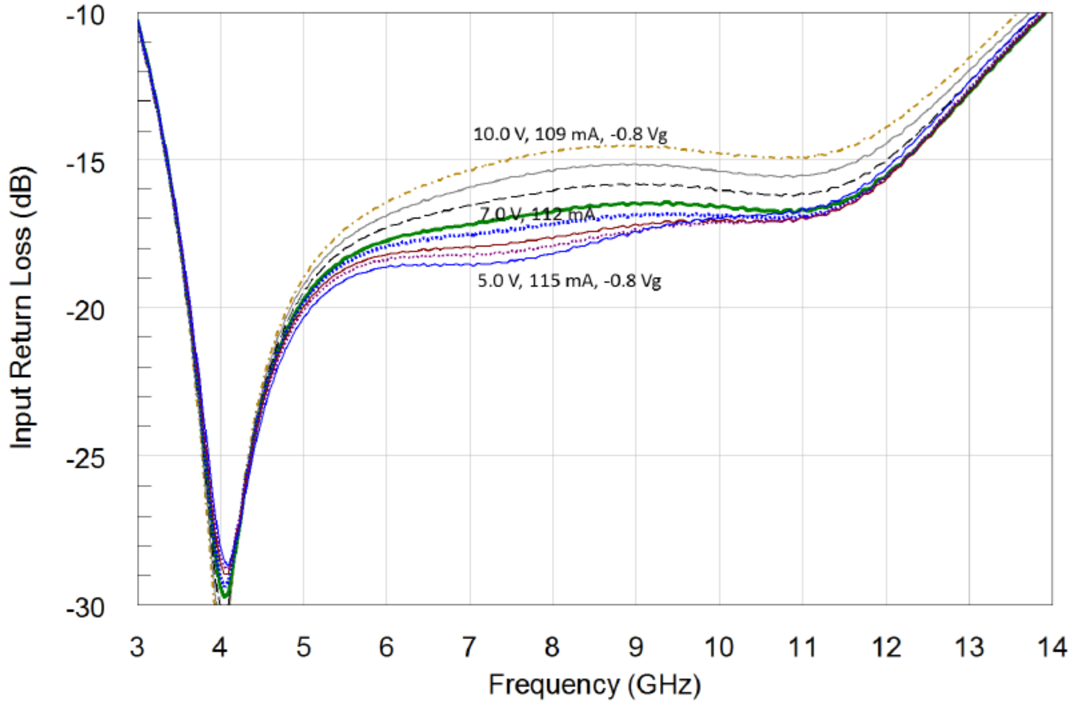
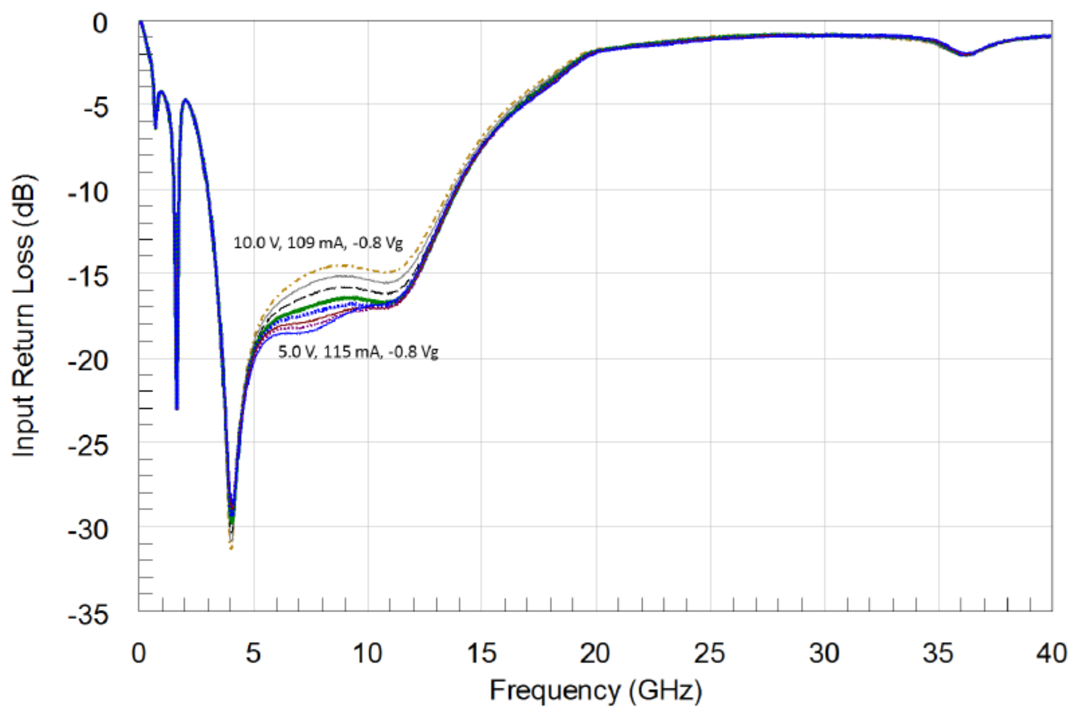
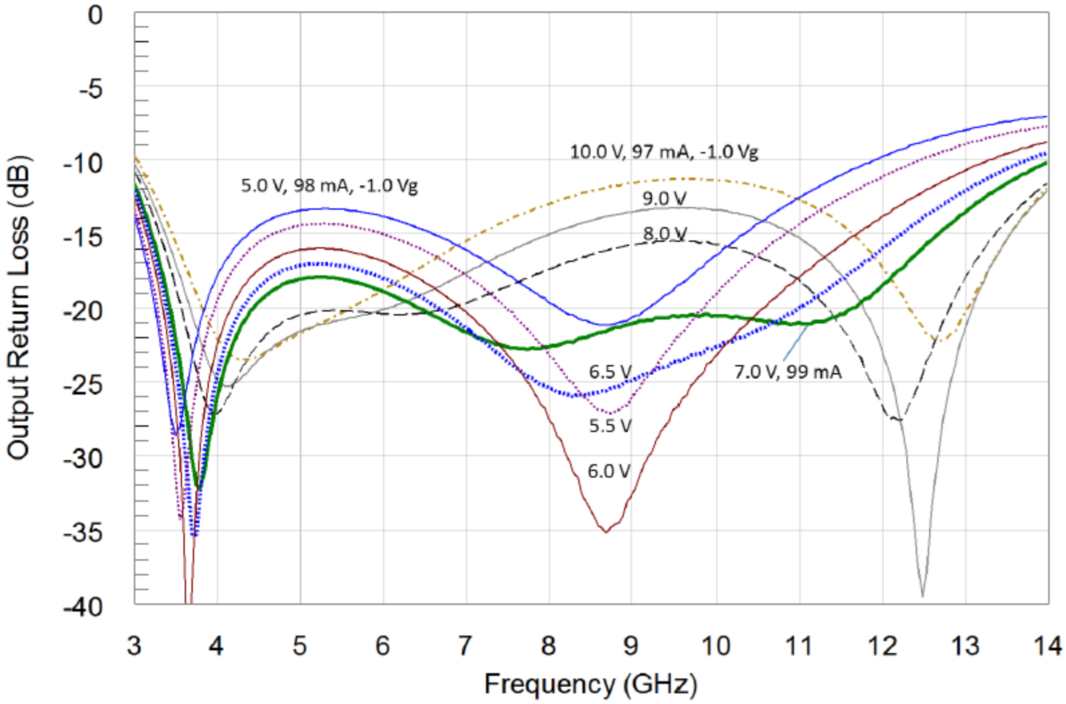


Input Return Loss - Wideband: V_D = 5 - 10 V; V_G = -0.8 V; I_D = 115 to 109 mA

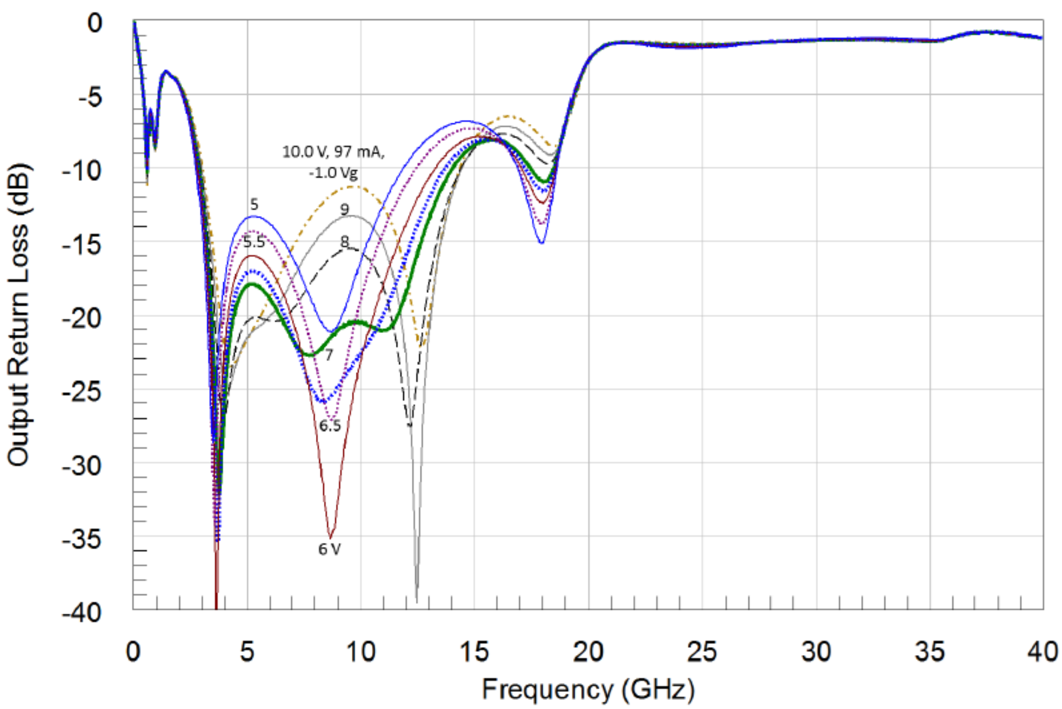


Measured RF Data with Wirebonds

Output Return Loss: V_D = 5 - 10 V; V_G = -1 V; I_D = 99 to 97 mA

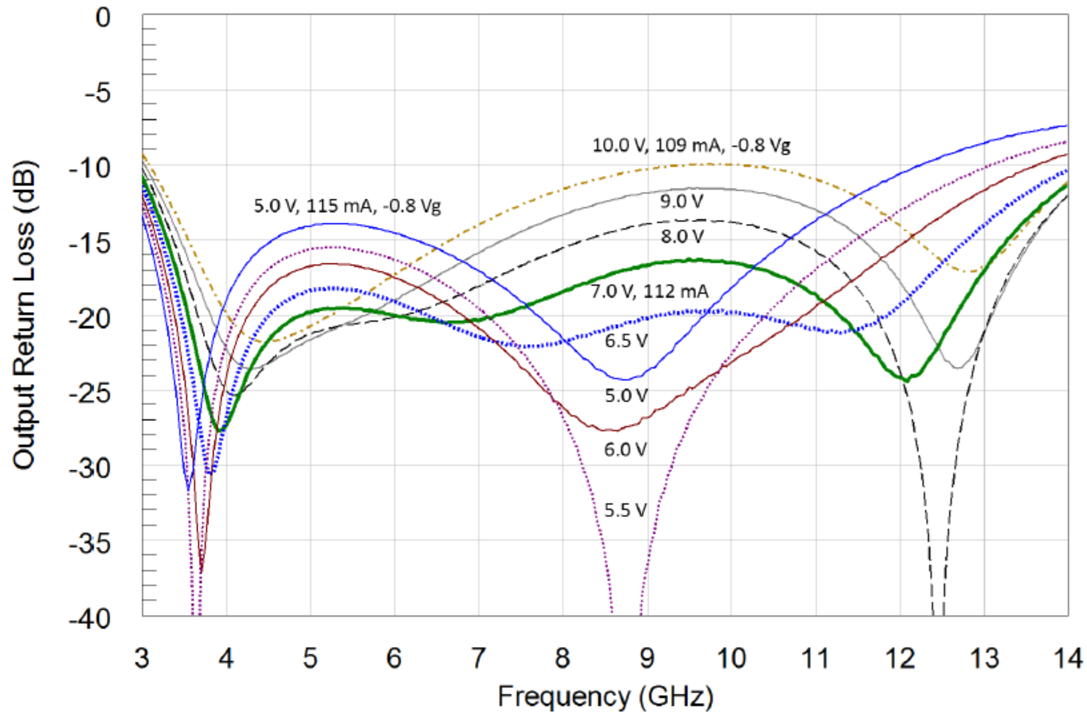


Output Return Loss - Wideband: V_D = 5 - 10 V; V_G = -1 V; I_D = 99 to 97 mA

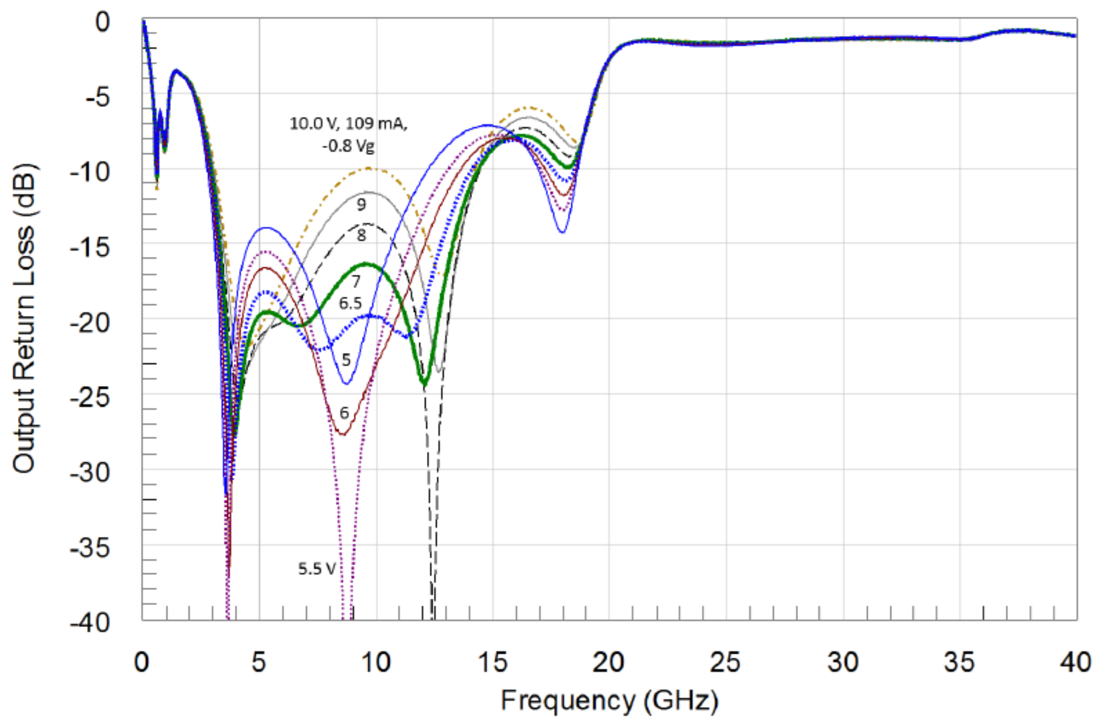


Measured RF Data with Wirebonds

Output Return Loss: V_D ***= 5 - 10 V;*** V_G ***= -0.8 V;*** I_D ***= 115 to 109 mA***

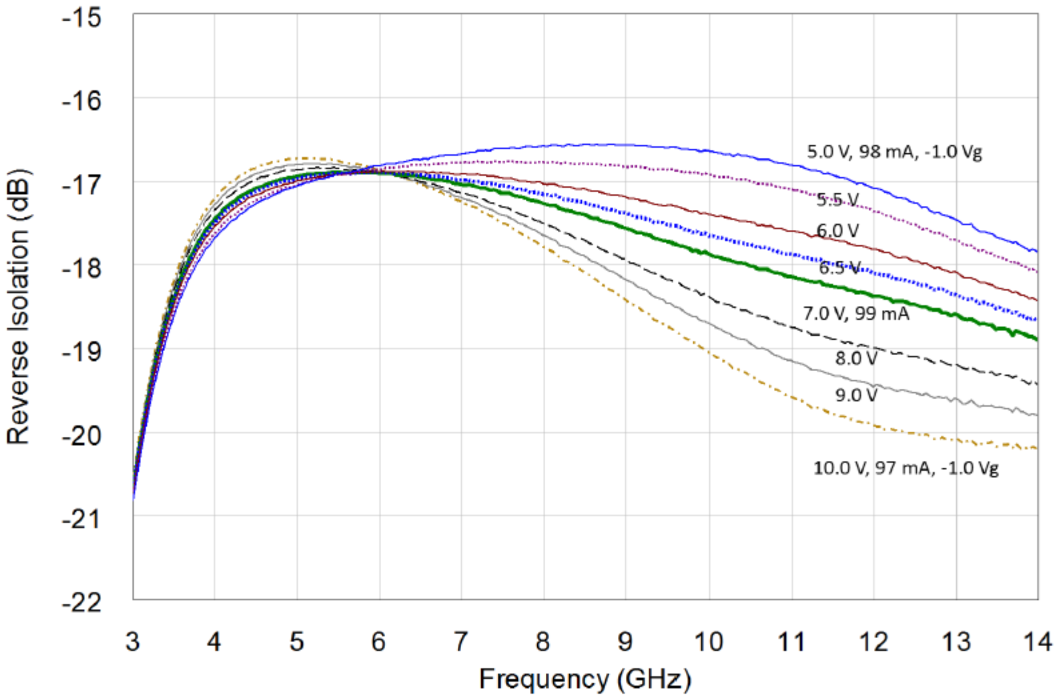


Output Return Loss - Wideband: V_D ***= 5 - 10 V;*** V_G ***= -0.8 V;*** I_D ***= 115 to 109 mA***

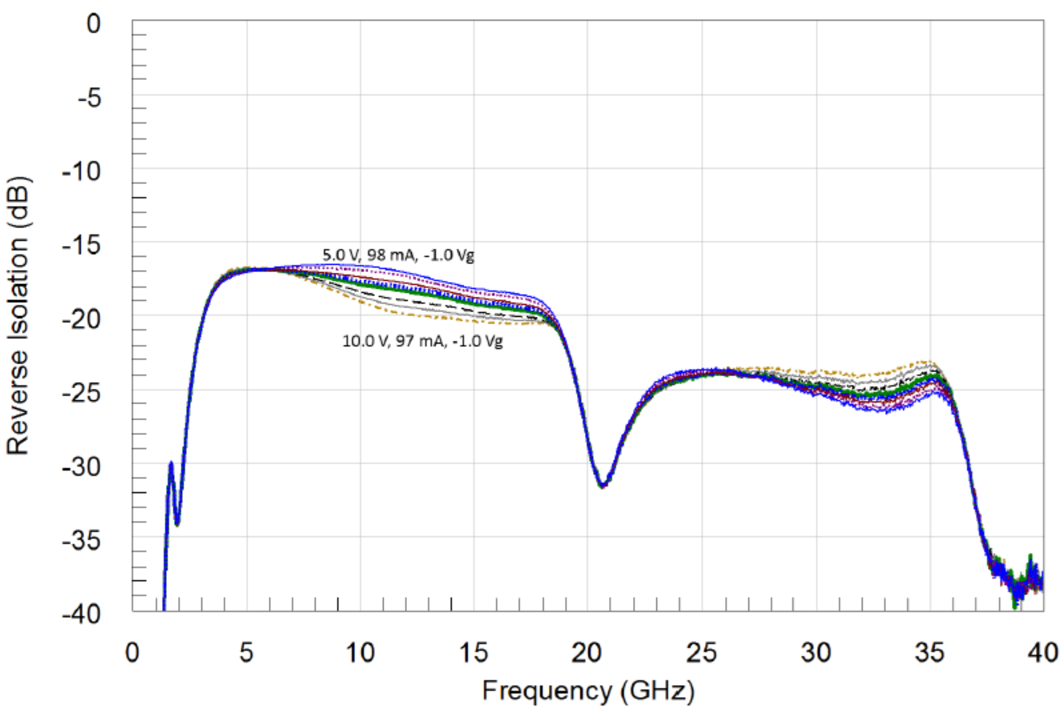


Measured RF Data with Wirebonds

Reverse Isolation: V_D = 5 - 10 V; V_G = -1 V; I_D = 99 to 97 mA



Reverse Isolation - Wideband: V_D = 5 - 10 V; V_G = -1 V; I_D = 99 to 97 mA



Measured RF Data with Wirebonds

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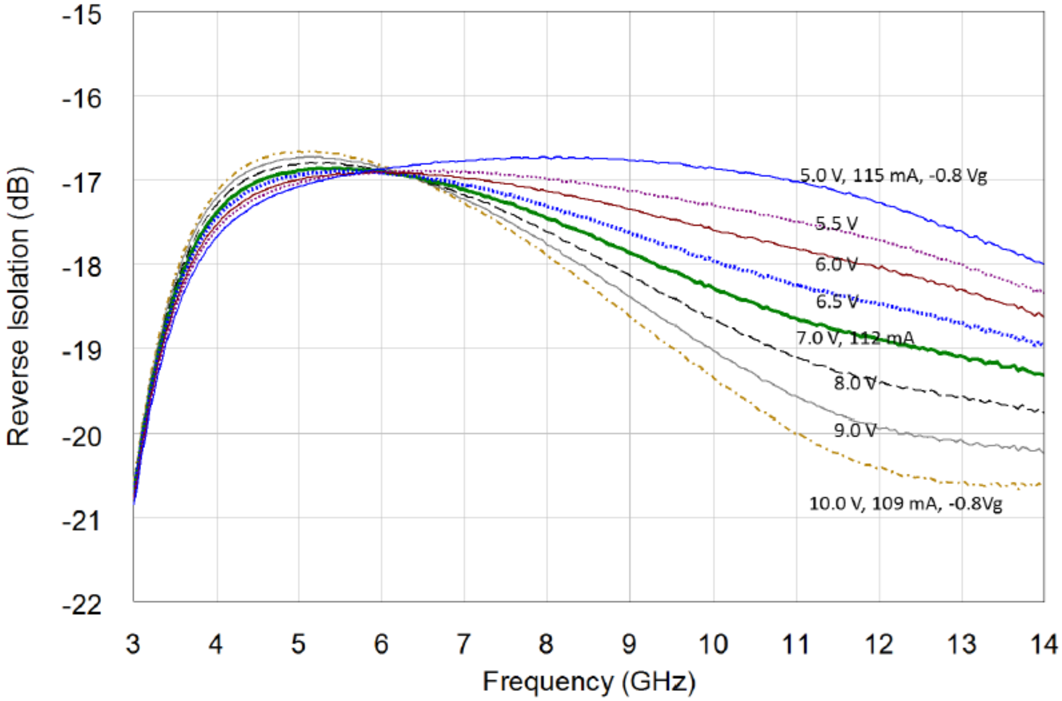
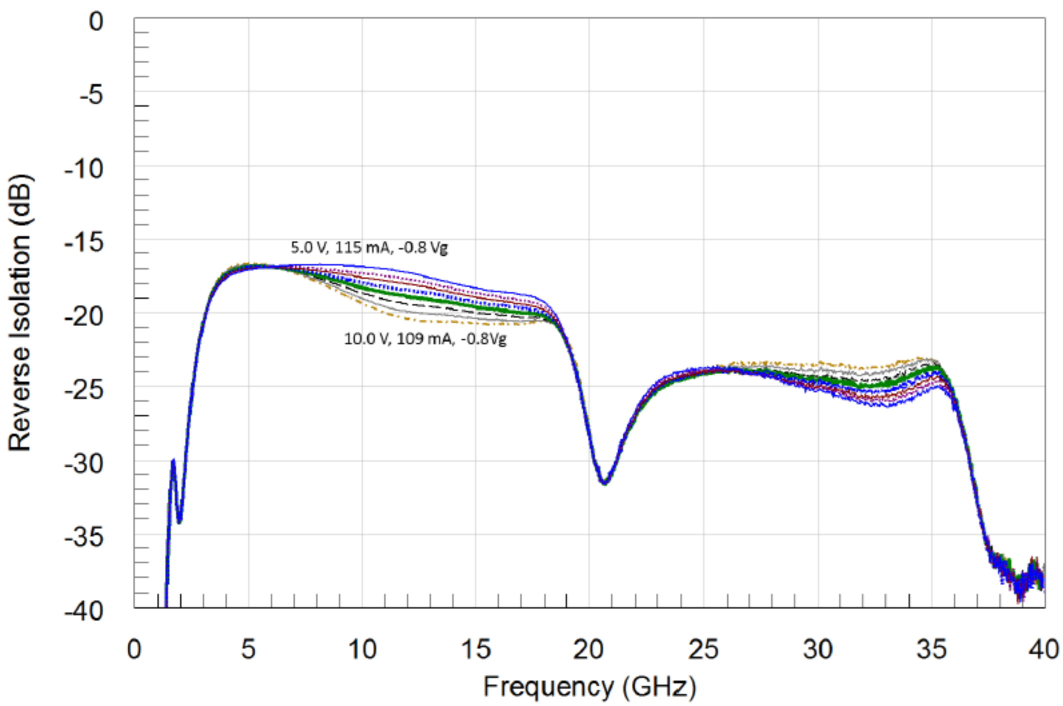


Reverse Isolation - Wideband: V_D = 5 - 10 V; V_G = -0.8 V; I_D = 115 to 109 mA



Measured Output Power @ 1-dB Gain Compression (OP1dB) Summary:

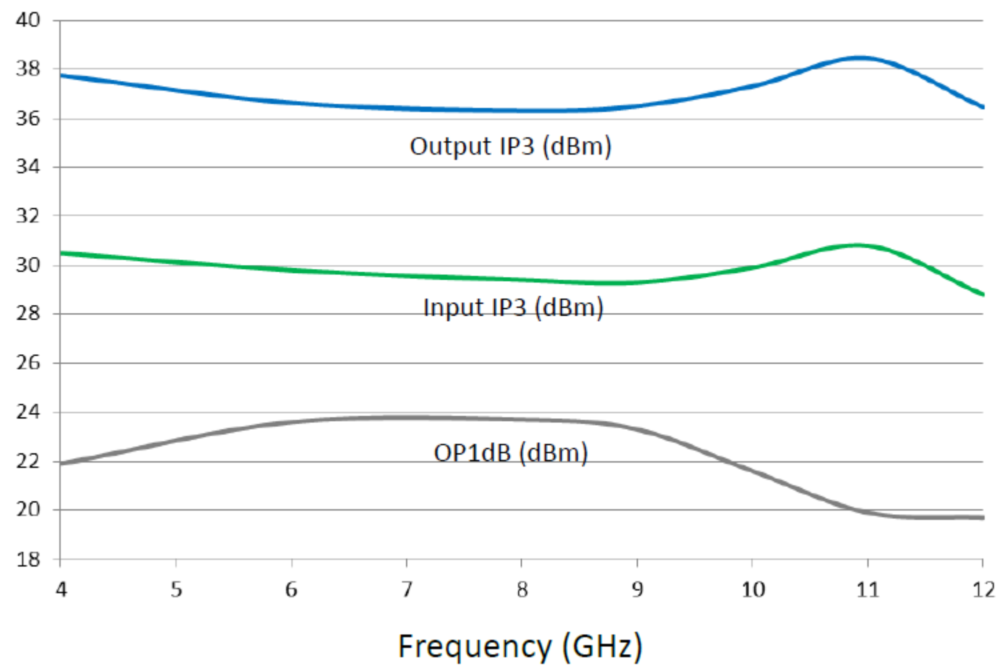
0 dBm Input per tone, 2 MHz spacings,
V_D = 7 V, V_G = -0.8 V, I_{DQ} = 112 mA,
OP1dB = ≥19.7 dBm, P_{SAT} = <24 dBm

RF Data with Wirebonds & External Microstrip Flare Pads

Frequency (GHz)	Output Power (dBm)			Drain Current (mA)			Gate Current (µA)		
	1 dB	2 dB	3 dB	1 dB	2 dB	3 dB	1 dB	2 dB	3 dB
4	21.9	22.4	22.5	115	115	118	-94	-468	-800
5	22.5	23.4	—	113	113	—	-855	-2380	—
6	23.6	23.7	—	122	125	—	-522	-1777	—
7	23.0	—	—	119	—	—	-243	—	—
8	23.7	—	—	123	—	—	355	—	—
9	23.3	—	—	115	—	—	328	—	—
10	21.6	22.6	23.1	114	108	103	144	319	-976
11	19.9	20.9	21.7	113	107	101	-5	72	409
12	19.7	20.5	21.1	113	109	104	40	91	306

Measured RF Data with Wirebonds & External Microstrip Flare Pads

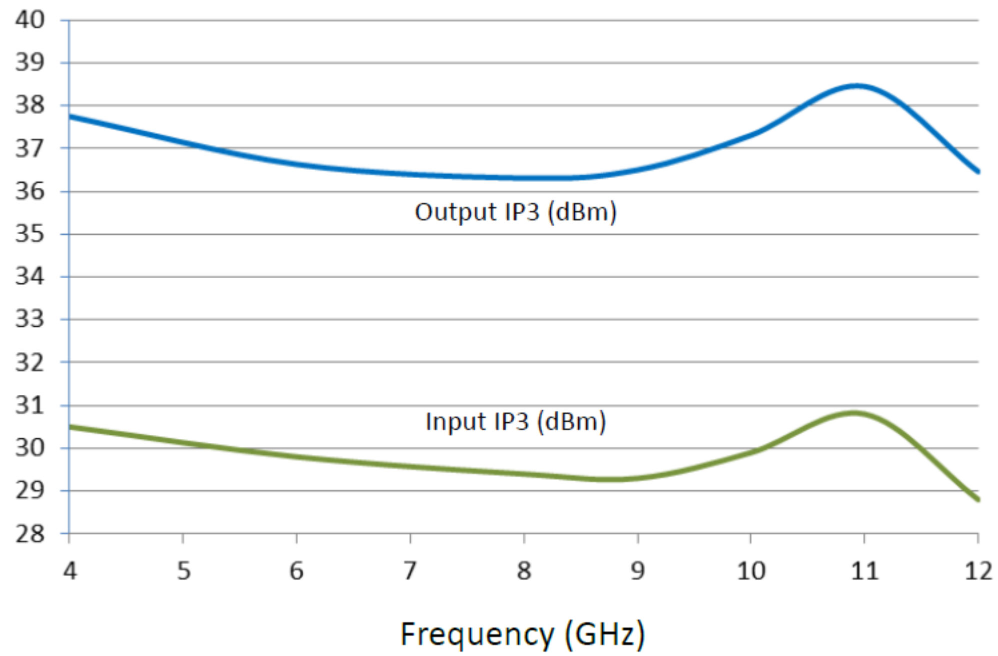
OIP3, IIP3, OP1dB: V_D = 7 V; V_G = -0.8 V; I_D = 112 mA; 0 dBm per tone, 2 MHz Spacing



Frequency (GHz)	OP1dB (dBm)	IIP3 (dBm)	OIP3 (dBm)	OIP3/P1dB (dB)
4	21.9	30.5	37.8	15.9
6	23.6	29.8	36.6	13.0
8	23.7	29.4	36.3	12.6
9	23.3	29.3	36.5	13.2
10	21.6	29.9	37.3	15.7
11	19.9	30.8	38.5	18.6
12	19.7	28.8	36.5	16.8

Measured RF Data with Wirebonds & External Microstrip Flare Pads

Measured OIP3: V_D = 7 V; V_G = -0.8 V; I_D = 112 mA; 0 dBm per tone, 2 MHz Spacing



Frequency (GHz)	IIP3 (dBm)	OIP3 (dBm)
4	30.5	37.8
6	29.8	36.6
8	29.4	36.3
9	29.3	36.5
10	29.9	37.3
11	30.8	38.5
12	28.8	36.5

Measured Input Third-Order Intermodulation Intercept Point (IIP3) Summary:

0 dBm Input per tone, 2 MHz spacings,
Optimum Bias for Maximum IIP3: V_D between 6.5 to 7.5 V; V_G near -0.8 V
V_D = 7.5 V, V_G = -0.8 V, IIP3 > 29 dBm across 4 - 12 GHz; OIP3 ≥ 36 dBm

RF Data with Wirebonds & External Microstrip Flare Pads

Frequency (GHz)	Drain Voltage (V)											
	6.5	7.0	7.5	6.5	7.0	7.5	6.5	7.0	7.5	6.5	7.0	7.5
	Gate Voltage (V)											
	-0.7			-0.8			-0.9			-1.0		
4	28.6	28.8	29.2	31.5	30.5	29.8	29.0	28.5	28.0	27.6	27.3	27.1
6	28.9	29.2	29.2	30.3	29.8	29.3	28.9	28.6	28.2	28.3	28.0	27.8
8	27.5	28.0	28.3	29.8	29.4	29.1	29.0	28.6	28.2	28.1	28.0	27.9
9	26.8	26.8	27.4	29.8	29.3	29.1	29.2	28.8	28.5	28.3	28.3	28.1
10	27.3	26.3	26.6	32.1	29.9	29.5	30.8	30.3	29.9	29.3	29.8	29.5
11	31.6	26.7	26.2	29.3	30.8	29.8	27.2	29.6	30.2	26.5	28.7	29.7
12	28.8	27.2	26.3	26.3	28.8	29.2	25.3	27.4	28.7	25.0	26.8	28.1
Min.	26.8	26.3	26.2	26.3	28.8	29.1	25.3	27.4	28.0	25.0	26.8	27.1
Avg.	28.5	27.6	27.6	29.9	29.8	29.4	28.5	28.8	28.8	27.6	28.1	28.3
Max.	31.6	29.2	29.2	32.1	30.8	29.8	30.8	30.3	30.2	29.3	29.8	29.7

optimum bias range for IIP3

Measured IIP3 @ 4, 6, & 8 GHz Summary:

0 dBm Input per tone, 2 MHz spacings; OIP3 is approximately 7.1 dB Higher
V_D = 5.5 - 7.5 V in 0.5 V steps, V_G = -0.7 - -1.2 V in 0.1 V steps

RF Data with Wirebonds & External Microstrip Flare Pads

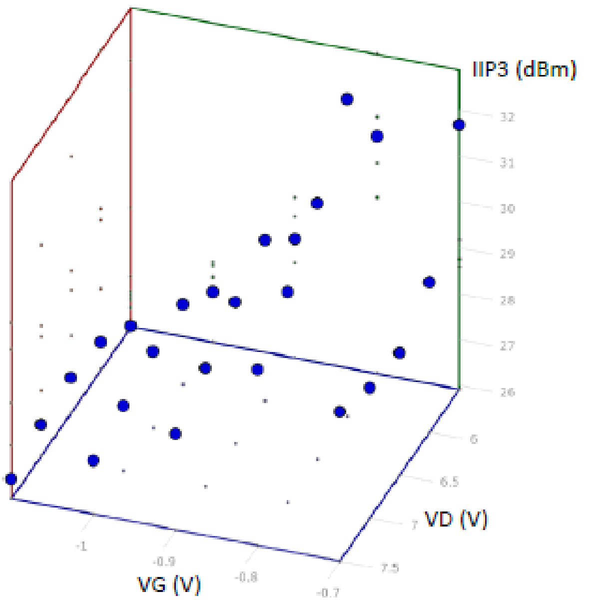
4 GHz			6 GHz			8 GHz		
V_D (V)	V_G (V)	IP3 (dBm)	V_D (V)	V_G (V)	IP3 (dBm)	V_D (V)	V_G (V)	IP3 (dBm)
5.5	-1.1	25.9	7.5	-1.1	27.4	6.5	-0.7	27.5
7.5	-1.1	26.3	5.5	-1.1	27.5	6.0	-1.1	27.5
6.0	-1.1	26.5	7.0	-1.1	27.6	5.5	-1.0	27.6
7.0	-1.1	26.6	6.5	-1.1	27.7	6.5	-1.1	27.7
6.5	-1.1	26.7	6.0	-1.1	27.8	7.5	-1.1	27.7
5.5	-1.0	27.0	7.5	-1.0	27.8	7.0	-1.1	27.8
7.5	-1.0	27.1	7.0	-1.0	28.0	6.0	-0.7	27.8
7.0	-1.0	27.3	7.5	-0.9	28.2	7.5	-1.0	27.9
6.5	-1.0	27.6	5.5	-1.0	28.3	7.0	-0.7	28.0
6.0	-1.0	27.7	6.0	-1.0	28.3	7.0	-1.0	28.0
7.5	-0.9	28.0	6.5	-1.0	28.3	6.5	-1.0	28.1
5.5	-0.9	28.5	7.0	-0.9	28.6	7.5	-0.9	28.2
7.0	-0.9	28.5	6.5	-0.7	28.9	6.0	-1.0	28.2
6.5	-0.7	28.6	6.5	-0.9	28.9	7.5	-0.7	28.3
7.0	-0.7	28.8	6.0	-0.7	29.0	5.5	-0.9	28.6
6.5	-0.9	29.0	7.0	-0.7	29.2	7.0	-0.9	28.6
7.5	-0.7	29.2	7.5	-0.7	29.2	6.5	-0.9	29.0
6.0	-0.7	29.2	7.5	-0.8	29.3	7.5	-0.8	29.1
6.0	-0.9	29.4	6.0	-0.9	29.3	6.0	-0.9	29.1
7.5	-0.8	29.8	5.5	-0.9	29.4	7.0	-0.8	29.4
7.0	-0.8	30.5	7.0	-0.8	29.8	6.5	-0.8	29.8
5.5	-0.8	31.1	6.5	-0.8	30.3	6.0	-0.8	30.3
6.5	-0.8	31.5	5.5	-0.7	30.8	5.5	-0.8	30.4
5.5	-0.7	31.7	6.0	-0.8	30.9	5.5	-0.7	31.2
6.0	-0.8	32.8	5.5	-0.8	31.5			

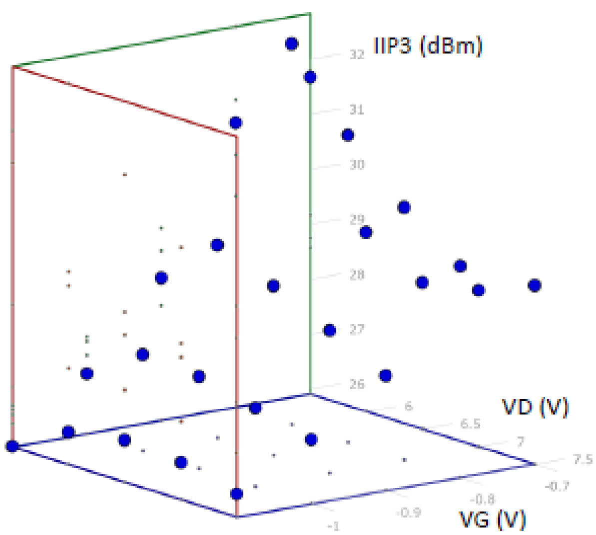
optimum bias range for IIP3

Measured IIP3 @ 4 GHz:

0 dBm Input per tone; OIP3 is approximately 7.4 dB higher
V_D = 5.5 to 7.5 V in 0.5 V steps; V_G = -0.7 to -1.2 V in 0.1 V steps

RF Data with Wirebonds & External Microstrip Flare Pads





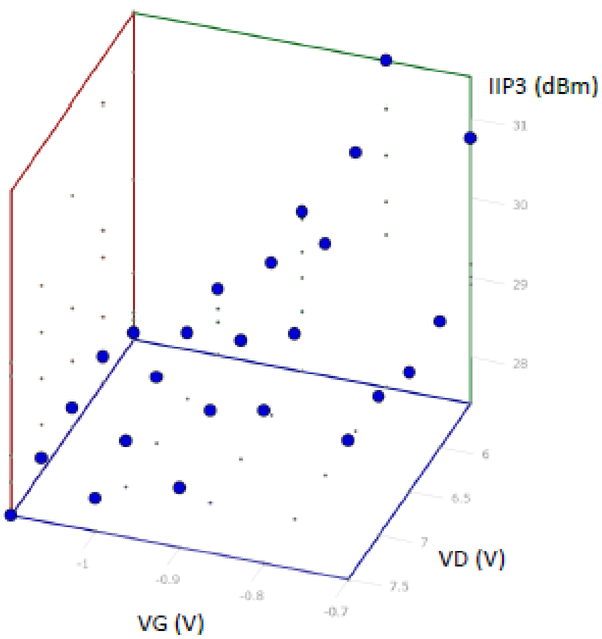
V_D (V)	V_G (V)	IIP3 (dBm)
5.5	-1.1	25.9
7.5	-1.1	26.3
6.0	-1.1	26.5
7.0	-1.1	26.6
6.5	-1.1	26.7
5.5	-1.0	27.0
7.5	-1.0	27.1
7.0	-1.0	27.3
6.5	-1.0	27.6
6.0	-1.0	27.7
7.5	-0.9	28.0
5.5	-0.9	28.5
7.0	-0.9	28.5
6.5	-0.7	28.6
7.0	-0.7	28.8
6.5	-0.9	29.0
7.5	-0.7	29.2
6.0	-0.7	29.2
6.0	-0.9	29.4
7.5	-0.8	29.8
7.0	-0.8	30.5
5.5	-0.8	31.1
6.5	-0.8	31.5
5.5	-0.7	31.7
6.0	-0.8	32.8

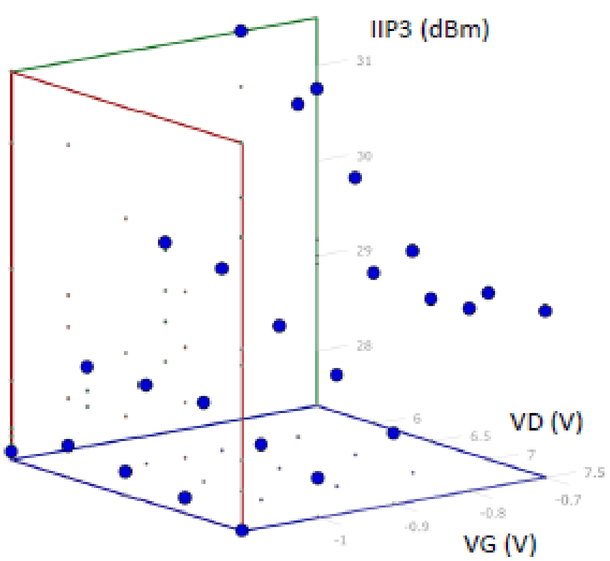
Optimum IIP3 Bias:
VD = 5.5 to 6.5 V
VG = -0.7 to -0.8 V
IIP3 > 31 dBm

Measured IIP3 @ 6 GHz:

0 dBm Input per tone; OIP3 is approximately 7.0 dB higher
V_D = 5.5 to 7.5 V in 0.5 V steps; V_G = -0.7 to -1.2 V in 0.1 V steps

RF Data with Wirebonds & External Microstrip Flare Pads





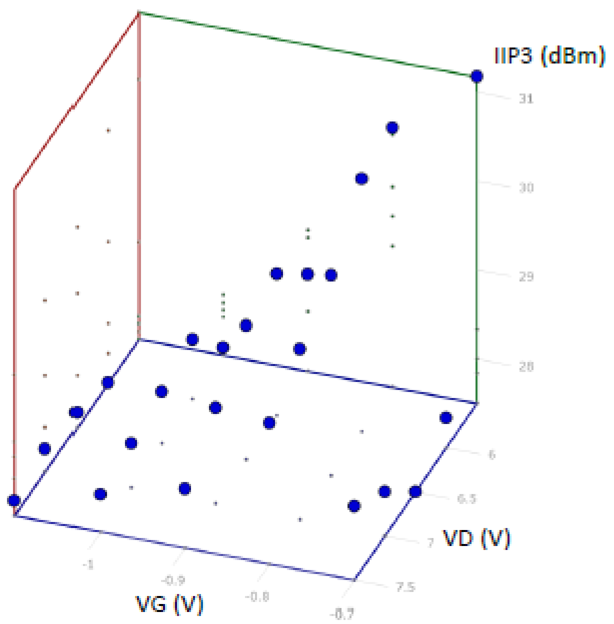
Optimum IIP3 Bias:
VD = 5.5 to 6.5 V
VG = -0.7 to -0.8 V
IIP3 > 30 dBm

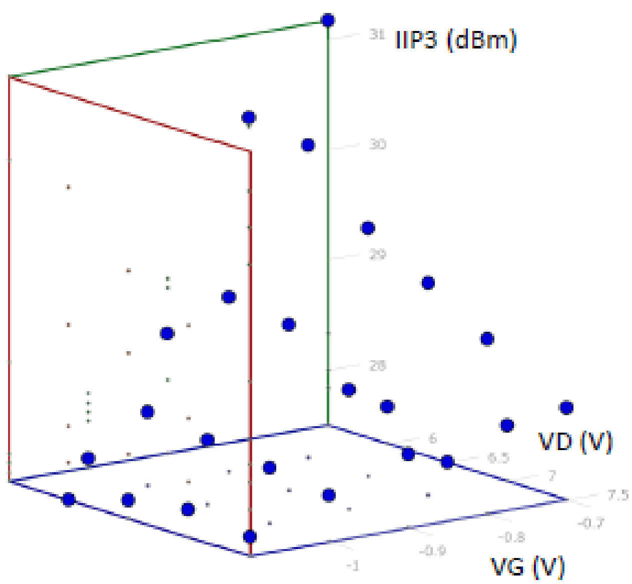
V_D (V)	V_G (V)	IIP3 (dBm)
7.5	-1.1	27.4
5.5	-1.1	27.5
7.0	-1.1	27.6
6.5	-1.1	27.7
6.0	-1.1	27.8
7.5	-1.0	27.8
7.0	-1.0	28.0
7.5	-0.9	28.2
5.5	-1.0	28.3
6.0	-1.0	28.3
6.5	-1.0	28.3
7.0	-0.9	28.6
6.5	-0.7	28.9
6.5	-0.9	28.9
6.0	-0.7	29.0
7.0	-0.7	29.2
7.5	-0.7	29.2
7.5	-0.8	29.3
6.0	-0.9	29.3
5.5	-0.9	29.4
7.0	-0.8	29.8
6.5	-0.8	30.3
5.5	-0.7	30.8
6.0	-0.8	30.9
5.5	-0.8	31.5

Measured IIP3 @ 8 GHz:

0 dBm Input per tone; OIP3 is approximately 7.1 dB higher
V_D = 5.5 to 7.5 V in 0.5 V steps; V_G = -0.7 to -1.2 V in 0.1 V steps

RF Data with Wirebonds & External Microstrip Flare Pads





Optimum IIP3 Bias:
VD = 5.5 to 6.5 V
VG = -0.7 to -0.8 V
IIP3 > 29.5 dBm

V_D (V)	V_G (V)	IIP3 (dBm)
6.5	-0.7	27.5
6.0	-1.1	27.5
5.5	-1.0	27.6
6.5	-1.1	27.7
7.5	-1.1	27.7
7.0	-1.1	27.8
6.0	-0.7	27.8
7.5	-1.0	27.9
7.0	-0.7	28.0
7.0	-1.0	28.0
6.5	-1.0	28.1
7.5	-0.9	28.2
6.0	-1.0	28.2
7.5	-0.7	28.3
5.5	-0.9	28.6
7.0	-0.9	28.6
6.5	-0.9	29.0
7.5	-0.8	29.1
6.0	-0.9	29.1
7.0	-0.8	29.4
6.5	-0.8	29.8
6.0	-0.8	30.3
5.5	-0.8	30.4
5.5	-0.7	31.2

Measured IIP3 @ 9, 10, 11 & 12 GHz Summary:

0 dBm Input per tone, 2 MHz spacings; OIP3 is approximately 7.4 dB Higher
V_D = 5.5 - 7.5 V in 0.5 V steps, V_G = -0.7 - -1.2 V in 0.1 V steps

RF Data with Wirebonds & External Microstrip Flare Pads

9 GHz			10 GHz			11 GHz			12 GHz		
V_D (V)	V_G (V)	IP3 (dBm)	V_D (V)	V_G (V)	IP3 (dBm)	V_D (V)	V_G (V)	IP3 (dBm)	V_D (V)	V_G (V)	IP3 (dBm)
5.5	-1.2	26.2	5.5	-0.7	21.1	5.5	-0.7	18.2	5.5	-0.7	18.0
5.5	-1.1	26.4	5.5	-0.8	22.6	5.5	-0.8	19.8	5.5	-0.8	19.4
5.5	-1.0	26.6	5.5	-0.9	23.3	5.5	-0.9	20.6	5.5	-0.9	20.3
6.5	-0.7	26.8	5.5	-1.0	23.5	5.5	-1.0	21.3	5.5	-1.0	21.0
7.0	-0.7	26.8	5.5	-1.1	23.7	5.5	-1.1	21.8	5.5	-1.1	21.4
5.5	-0.9	26.9	5.5	-1.2	23.8	5.5	-1.2	22.1	5.5	-1.2	21.8
6.0	-1.2	27.1	6.0	-1.2	25.7	6.0	-1.1	23.8	6.0	-0.7	22.5
7.5	-0.7	27.4	6.0	-1.1	26.0	6.0	-1.2	23.8	6.0	-0.8	22.7
6.5	-1.2	27.5	7.0	-0.7	26.3	6.0	-0.7	23.8	6.0	-0.9	22.8
6.0	-1.1	27.6	7.5	-0.7	26.6	6.0	-0.9	23.8	6.0	-1.0	22.9
7.5	-1.2	27.6	6.0	-1.0	26.7	6.0	-1.0	23.8	6.0	-1.1	23.0
7.0	-1.2	27.6	6.5	-1.2	27.3	6.0	-0.8	24.0	6.0	-1.2	23.1
6.0	-0.7	27.8	6.5	-0.7	27.3	6.5	-1.2	25.4	6.5	-1.2	24.4
7.5	-1.1	27.8	6.0	-0.9	27.4	6.5	-1.1	25.8	6.5	-1.1	24.8
7.0	-1.1	27.9	6.5	-1.1	28.1	7.5	-0.7	26.2	6.5	-1.0	25.0
6.5	-1.1	27.9	7.0	-1.2	28.3	6.5	-1.0	26.5	6.5	-0.9	25.3
5.5	-0.8	28.0	6.0	-0.8	28.5	7.0	-0.7	26.7	7.0	-1.2	25.8
6.0	-1.0	28.0	7.5	-1.2	28.8	7.0	-1.2	27.0	7.5	-0.7	26.3
7.5	-1.0	28.1	6.5	-1.0	29.3	6.5	-0.9	27.2	6.5	-0.8	26.3
6.5	-1.0	28.3	7.0	-1.1	29.3	7.0	-1.1	27.8	7.0	-1.1	26.3
7.0	-1.0	28.3	7.5	-1.1	29.3	7.5	-1.2	28.3	7.0	-1.0	26.8
7.5	-0.9	28.5	7.5	-0.8	29.5	7.0	-1.0	28.7	7.5	-1.2	27.0
7.0	-0.9	28.8	7.5	-1.0	29.5	7.5	-1.1	29.2	7.0	-0.7	27.2
7.5	-0.8	29.1	7.0	-1.0	29.8	6.5	-0.8	29.3	7.0	-0.9	27.4
6.5	-0.9	29.2	7.0	-0.8	29.9	7.0	-0.9	29.6	7.5	-1.1	27.7
6.0	-0.9	29.2	7.5	-0.9	29.9	7.5	-1.0	29.7	7.5	-1.0	28.1
7.0	-0.8	29.3	6.0	-0.7	30.1	7.5	-0.8	29.8	7.5	-0.9	28.7
6.5	-0.8	29.8	7.0	-0.9	30.3	7.5	-0.9	30.2	6.5	-0.7	28.8
6.0	-0.8	31.1	6.5	-0.9	30.8	7.0	-0.8	30.8	7.0	-0.8	28.8
5.5	-0.7	31.4	6.5	-0.8	32.1	6.5	-0.7	31.6	7.5	-0.8	29.2

optimum bias range for IIP3

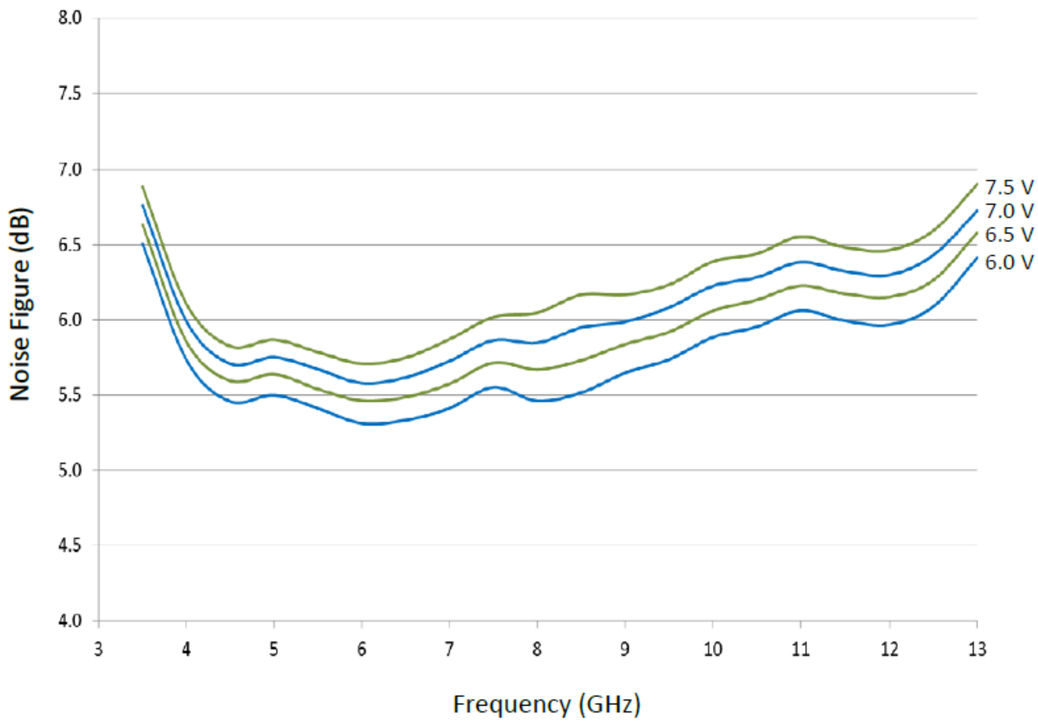
Measured IIP2 >37 dBm across 5 - 12 GHz, and >32 dBm @ 4 GHz:
0 dBm per Input Tone; NOTE FREQUENCY SPACINGS IN TABLE, OIP2 ~ 7 dB higher than IIP2
Measured 2nd harmonic level (2 * F2) also provided
V_D = 7 V, V_G = -0.8 V, I_D = 114 mA

RF Data with Wirebonds & External Microstrip Flare Pads

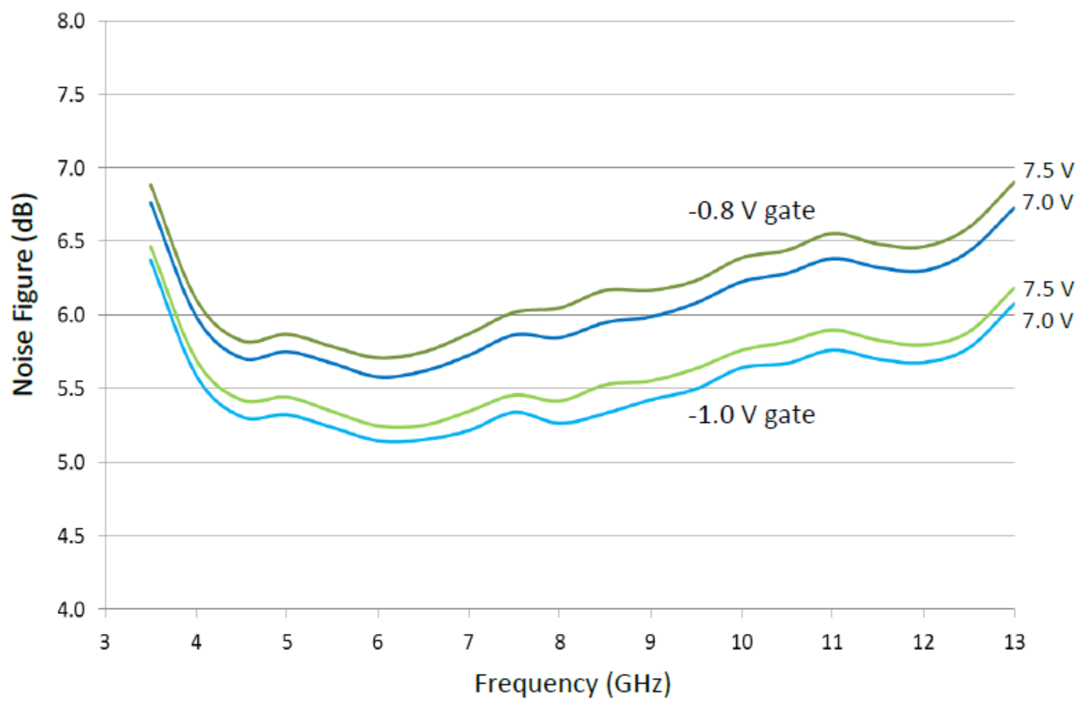
F1 (GHz)	F2 (GHz)	IIP2 (dBm)	2*F2 (dBc)
		high side	
4	4.002	32.3	-38
5	5.002	37.3	-43
8	8.002	38.3	-44
9	9.002	39.0	-45
10	10.002	50.5	-56
11	11.002	56.3	-62
12	12.002	55.3	-61
		low side	
		(2 GHz)	
8	10	42.7	-56
10	12	44.3	-61

Measured Noise Figure across 3.5 - 13.0 GHz @ 25°C

Noise Figure: V_D = 6.0 - 7.5 V in 0 .5 V steps V_G = -0.8 V

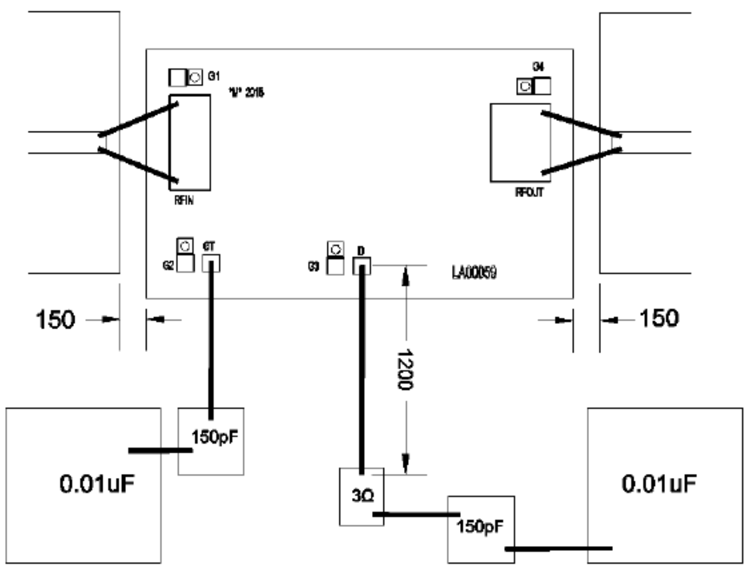


Noise Figure: V_D = 7.0 - 7.5 V, V_G = -0.8 V and -1.0 V



External I/O Microstrip Flare Dimensions (on 5-mil Alumina) and I/O Bond Wire Inductances for Optimum Insertion and Return Loss Performance
S-parameters can be supplied at DIE level such that optimal flare dimensions can be made for the substrate connection medium used (if different from 5-mil Alumina).

Pad Flare Dimension	Flare Width x-dim, (µm)	Flare Length y-dim, (µm)	Wire Inductance	Wire Length (µm)	# of Wires
RF Input	0	0	0.19	496	2
RF Output	0	0	0.18	478	2



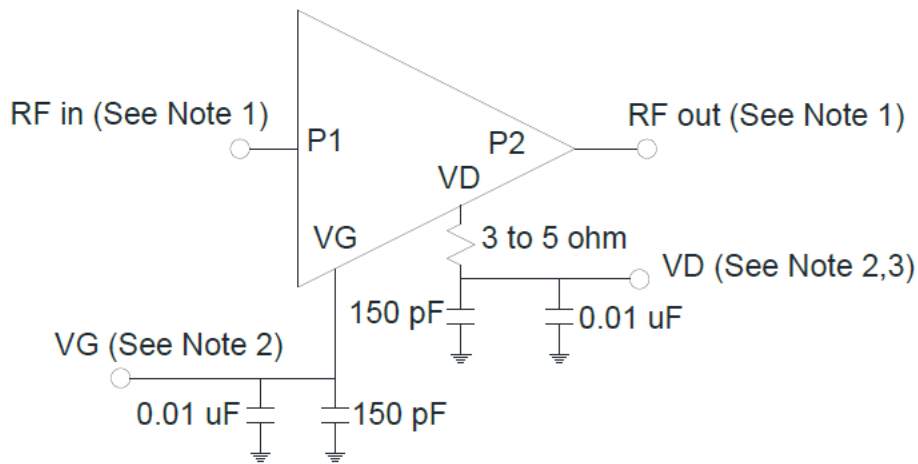
Notes:
To achieve bond wire inductance noted, bond the number of wires shown in parallel from each external flare to each associated MMIC RF bond pad as shown above.
Gold Wire details: Diameter: 25.4 µm (1 mil)
Spacing: 4 mils (~ 100 µm) typical
Height above Ground: 8 mils (~ 200 µm) typical (wedge bonds)

Wire Length is total length if the wire were made perfectly straight.

Assembly Guidelines

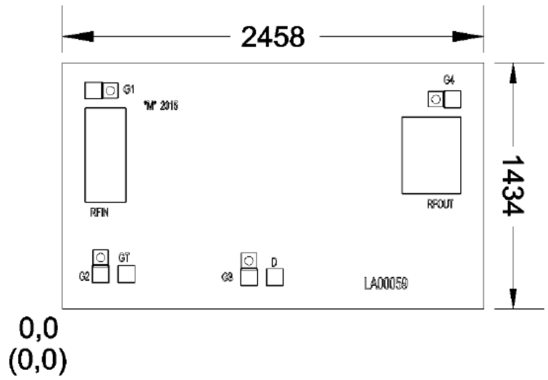
The backside metallization is RF/DC ground. Attachment should be accomplished with electrically and thermally conductive epoxy only. Eutectic attach is not recommended though product can be made that supports. This device supports high frequency performance. Care should be made to following the wirebond dimensions as shown in the flare diagram.

Application Circuit and Turn-on Procedure



1. Internal blocking capacitors on RF in/out ports (P1 and P2).
2. Gate Voltage (VG) must be applied prior to Drain Voltage (VD) Drain Voltage (VD) must be removed prior to Gate Voltage (VG).
3. Performance is optimized with VD set to 8 V.

Outline Drawing



Pad Dimensions

Pad Dimension	Length x-dim, (µm)	Width y-dim, (µm)	Length x-dim, (mils)	Width y-dim, (mils)
RF Input	238	550	9.4	21.7
RF Output	345	450	13.6	17.7
Drain Bias	100	100	3.9	3.9
Gate Bias	100	100	3.9	3.9

Bond Pad Center Point Locations

Pad Location	x-dim, (µm)	y-dim, (µm)	x-dim, (mils)	y-dim, (mils)
RF Input	252	897	9.9	35.3
RF Output	2153	896	84.8	35.3
Drain Bias	1240	187	48.8	7.4
Gate Bias	374	205	14.7	8.1

Notes:
All dimensions are given in both µm and mils.
Substrate thickness: 100 µm (0.004”).
Backside metallization is gold.
Bond pad metallization is gold.