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5.5 GHz to 8.6 GHz, GaAs, MMIC, I/Q Upconverter

Data Sheet **HMC6505A**

FEATURES

- Conversion gain: 15 dB typical
- Sideband rejection: 22 dBc typical
- Output P1dB compression at maximum gain: 22 dBm typical
- Output IP3 at maximum gain: 35 dBm typical
- LO to RF isolation: 4 dB typical
- LO to IF isolation: 9 dB typical
- RF return loss: 20 dB typical
- LO return loss: 10 dB typical
- IF return loss: 20 dB typical
- Exposed paddle, 5 mm × 5 mm, 32-terminal, leadless chip carrier package

APPLICATIONS

- Point to point and point to multipoint radios
- Military radars, electronic warfare (EW), and electronic intelligence (ELINT)
- Satellite communications
- Sensors

FUNCTIONAL BLOCK DIAGRAM

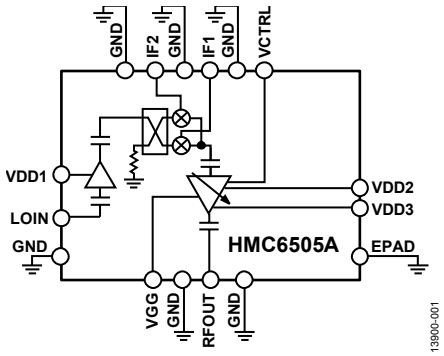

Figure 1.

GENERAL DESCRIPTION

The HMC6505A is a compact gallium arsenide (GaAs), pseudomorphic (pHEMT), monolithic microwave integrated circuit (MMIC) upconverter in a RoHS compliant package that operates from 5.5 GHz to 8.6 GHz. This device provides a small signal conversion gain of 15 dB with 22 dBc of sideband rejection. The HMC6505A uses a variable gain amplifier (VGA) preceded by an in-phase and quadrature (I/Q) mixer that is driven by an active local oscillator (LO). The IF1 and IF2 mixer inputs are provided, and an external 90° hybrid is needed to select the required sideband. The I/Q mixer topology reduces the need for filtering of unwanted sideband. The HMC6505A is a smaller alternative to hybrid style single sideband (SSB) upconverter assemblies, and it eliminates the need for wire bonding by allowing the use of surface-mount manufacturing techniques.

The HMC6505A is available in 5 mm × 5 mm, 32-terminal leadless chip carrier (LCC) package and operates over a −40°C to +85°C temperature range. An evaluation board for the HMC6505A is also available upon request.

Rev. 0 Document Feedback

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Technical Support www.analog.com

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REVISION HISTORY

8/2017—Revision 0: Initial Version

SPECIFICATIONS

T_A = 25°C, IF = 350 MHz, VDDx = 5 V, VCTRL = −4 V, LO power = 4 dBm. Measurements performed with lower sideband selected and external 90° hybrid at the IF ports, unless otherwise noted.

Table 1.

Parameter	Symbol	Min	Typ	Max	Unit
OPERATING CONDITIONS					
Frequency Range					
Radio Frequency	RF	5.5		8.6	GHz
Local Oscillator	LO	2.5		11.6	GHz
Intermediate Frequency	IF	DC		3	GHz
Control Voltage Range	VCTRL	−4		0	V
LO Drive Range		−2	+4	+6	dBm
PERFORMANCE					
Conversion Gain		12	15		dB
Dynamic Range		20	25		dB
Sideband Rejection		18	22		dBc
Output Power for 1 dB Compression at Maximum Gain	OP1dB		22		dBm
Output Third-Order Intercept at Maximum Gain	OIP3	31	35		dBm
Isolation					
LO to RF		−1	+4		dB
LO to IF			9		dB
Noise Figure	NF		15		dB
Return Loss					
RF			20		dB
LO			10		dB
IF			20		dB
POWER SUPPLY					
Total Supply Current					
LO Amplifier	IDD1		125		mA
RF Amplifier	IDD2, IDD3		120		mA

ABSOLUTE MAXIMUM RATINGS

Table 2.

Parameter	Rating
Drain Bias Voltage (VDD1, VDD2, and VDD3)	5.5 V
Gate Bias Voltage	
VGG	−3 V to 0 V
VCTRL	−5 V to +0.3 V
Input Power	
LO	10 dBm
IF	20 dBm
Moisture Sensitivity Level (MSL) Rating[1]	MSL3
Maximum Junction Temperature	175°C
Storage Temperature Range	−65°C to +150°C
Operating Temperature Range	−40°C to +85°C
Reflow Temperature	260°C
Electrostatic Discharge Sensitivity	
Human Body Model (HBM)	500 V
Field Induced Charged Device Model (FICDM)	750 V

[1] See the Ordering Guide.

Stresses at or above those listed under Absolute Maximum Ratings may cause permanent damage to the product. This is a stress rating only; functional operation of the product at these or any other conditions above those indicated in the operational section of this specification is not implied. Operation beyond the maximum operating conditions for extended periods may affect product reliability.

THERMAL RESISTANCE

Thermal performance is directly linked to printed circuit board (PCB) design and operating environment. Careful attention to PCB thermal design is required.

Table 3. Thermal Resistance

Package Type	θ_{JA}	θ_{JC}	Unit
E-32-1[1]	66.7	54.6	°C/W

[1] Thermal impedance simulated values are based on JEDEC 2S2P test board with 5 × 5 thermal vias. Refer to JDEC standard JESD51-2 for additional information.

ESD CAUTION

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

PIN CONFIGURATION AND FUNCTION DESCRIPTIONS

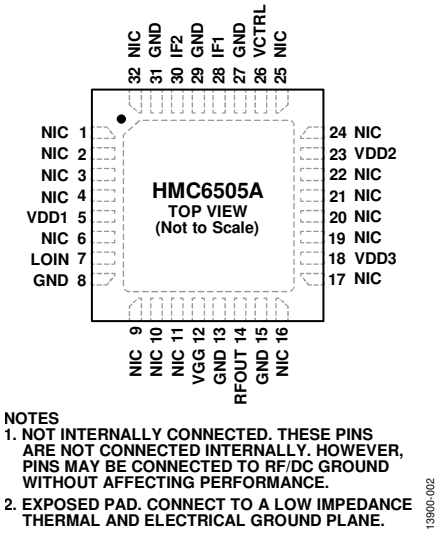

Figure 2. Pin Configuration

Table 4. Pin Function Descriptions

Pin No.	Mnemonic	Description
1 to 4, 6, 9 to 11, 16, 17, 19 to 22, 24, 25, 32	NIC	Not Internally Connected. These pins are not connected internally. However, pins may be connected to RF/dc ground without affecting performance.
5	VDD1	Power Supply Voltage for LO Amplifier. See Figure 3 for the interface schematic. Refer to the typical application circuit (see Figure 103) for the required external components.
7	LOIN	Local Oscillator Input. See Figure 4 for the interface schematic. This pin is ac-coupled and matched to 50 Ω.
8, 13, 15, 27, 29, 31	GND	Ground Connect. See Figure 5 for the interface schematic. These pins and package bottom must be connected to RF/dc ground.
12	VGG	Gate Voltage for the Variable Gain Amplifier. See Figure 6 for the interface schematic. Refer to the typical application circuit (see Figure 103) for the required external components.
14	RFOUT	Radio Frequency Output. See Figure 7 for the interface schematic. This pin is ac-coupled and matched to 50 Ω.
18, 23	VDD3, VDD2	Power Supply Voltage for the Variable Gain Amplifier. See Figure 8 for the interface schematic. Refer to the typical application circuit (see Figure 103) for the required external components.
26	VCTRL	Gain Control Voltage for the Variable Gain Amplifier. See Figure 9 for the interface schematic. Refer to the typical application circuit (see Figure 103) for the required external components.
28, 30	IF1, IF2	Quadrature Intermediate Frequency Inputs. See Figure 10 for the interface schematic. For applications not requiring operation to dc, use an off chip dc blocking capacitor. For operation to dc, these pins must not source or sink more than ±3 mA of current or device malfunction and failure can result.
	EPAD	Exposed Pad. Connect to a low impedance thermal and electrical ground plane.

INTERFACE SCHEMATICS

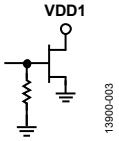

Figure 3. VDD1 Interface

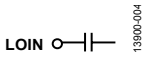

Figure 4. LOIN Interface

Figure 5. GND Interface

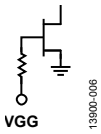

Figure 6. VGG Interface

Figure 7. RFOUT Interface

Figure 8. VDD2, VDD3 Interface

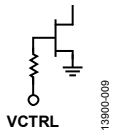

Figure 9. VCTRL Interface

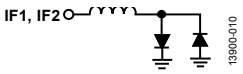

Figure 10. IF1, IF2 Interface

TYPICAL PERFORMANCE CHARACTERISTICS

IF = 350 MHz, IF INPUT POWER = −6 dBm, LOWER SIDEBAND (HIGH-SIDE LO)

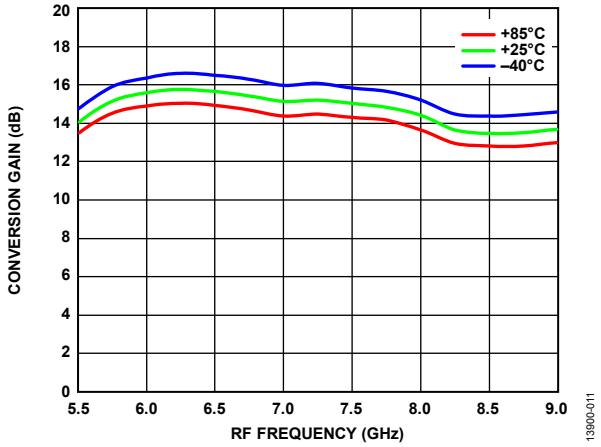

Figure 11. Conversion Gain vs. RF Frequency over Temperatures, LO Power = 4 dBm, Voltage Control = −4 V

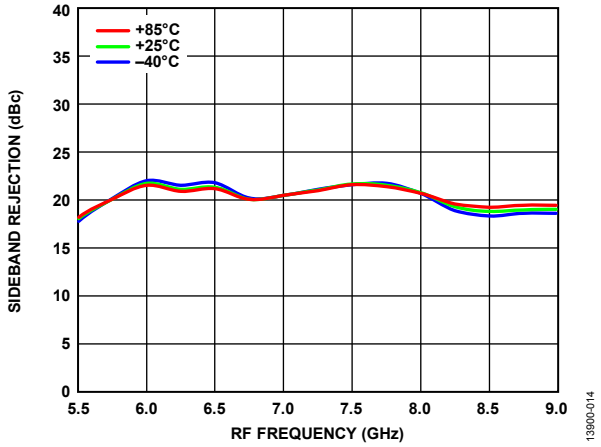

Figure 14. Sideband Rejection vs. RF Frequency over Temperatures, Voltage Control = −4 V

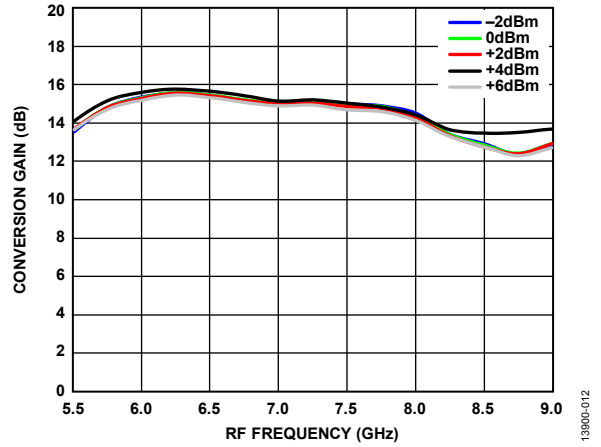

Figure 12. Conversion Gain vs. RF Frequency over LO Powers, T_A = 25°C, Voltage Control = −4 V

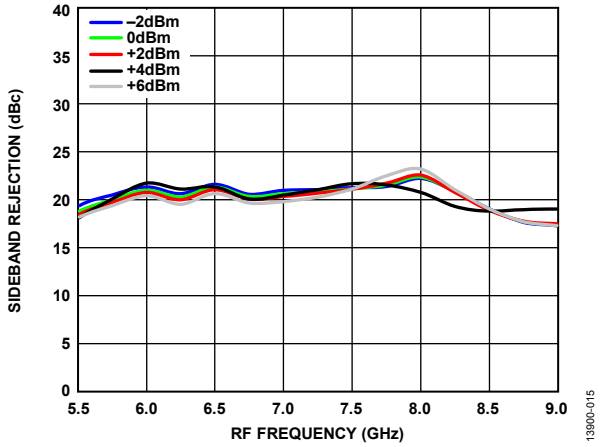

Figure 15. Sideband Rejection vs. RF Frequency over LO Powers, T_A = 25°C, Voltage Control = −4 V

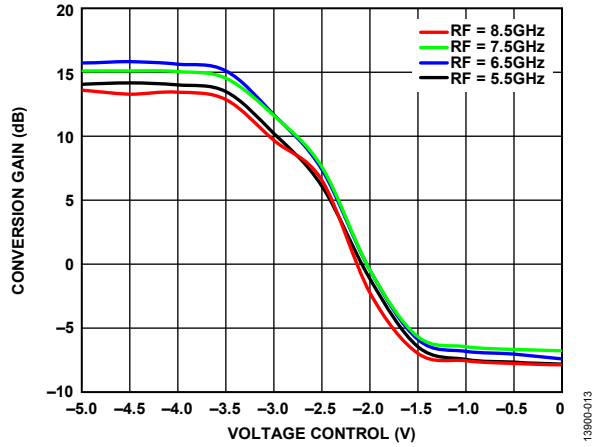

Figure 13. Conversion Gain vs. Voltage Control over RF, T_A = 25°C, LO Power = 4 dBm

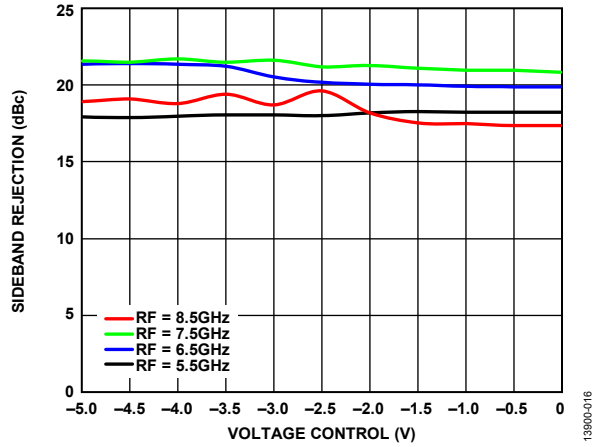

Figure 16. Sideband Rejection vs. Voltage Control over RF, T_A = 25°C, LO Power = 4 dBm

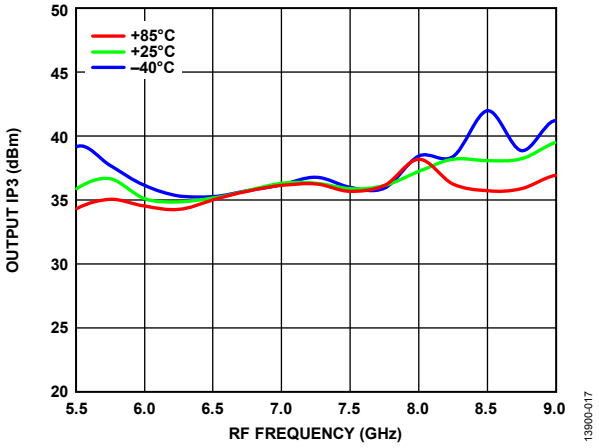

Figure 17. Output IP3 vs. RF Frequency over Temperatures, LO Power = 4 dBm, Voltage Control = −4 V

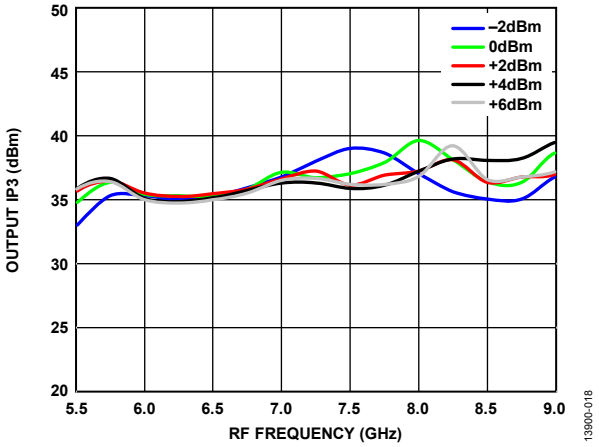

Figure 18. Output IP3 vs. RF Frequency over LO Powers T_A = 25°C, Voltage Control = −4 V

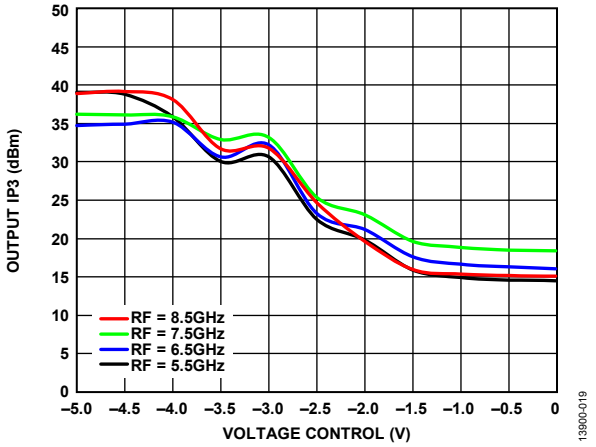

Figure 19. Output IP3 vs. Voltage Control over RF Frequencies, T_A = 25°C, LO Power = 4 dBm

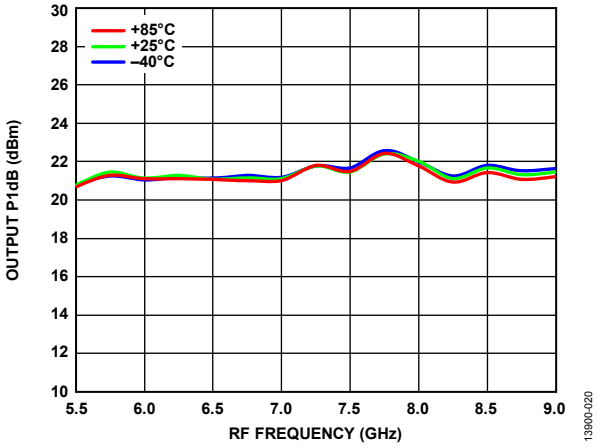

Figure 20. Output P1dB vs. RF Frequency over Temperatures, LO Power = 4 dBm, Voltage Control = −4 V

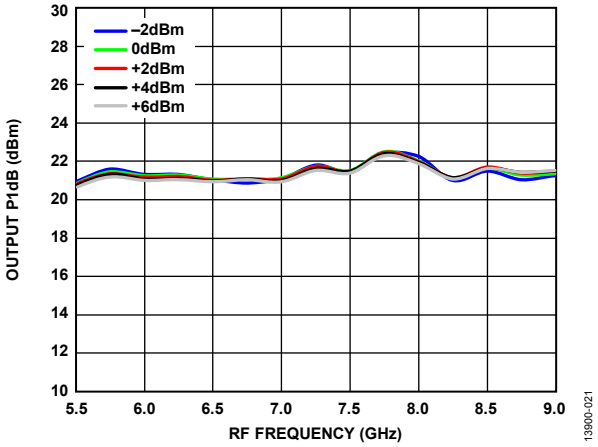

Figure 21. Output P1dB vs. RF Frequency over LO Powers, T_A = 25°C, Voltage Control = −4 V

IF = 1000 MHz, IF INPUT POWER = −6 dBm, LOWER SIDEBAND (HIGH-SIDE LO)

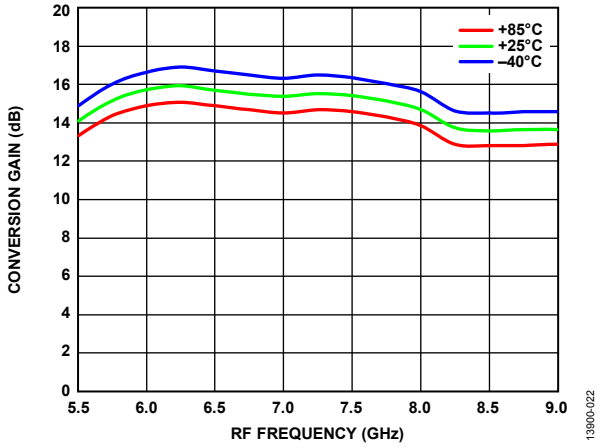

Figure 22. Conversion Gain vs. RF Frequency over Temperatures, LO Power = 4 dBm, Voltage Control = −4 V

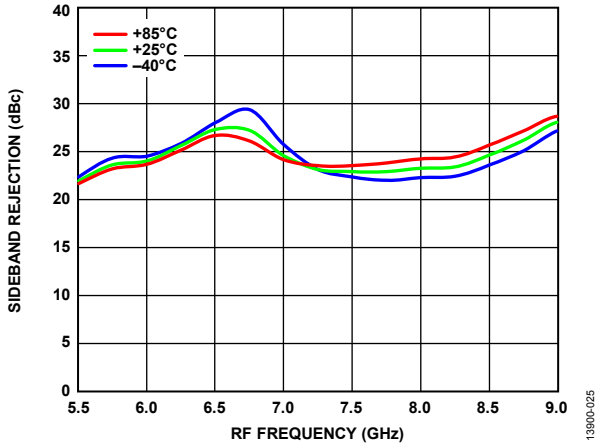

Figure 25. Sideband Rejection vs. RF Frequency over Temperatures, Voltage Control = −4 V

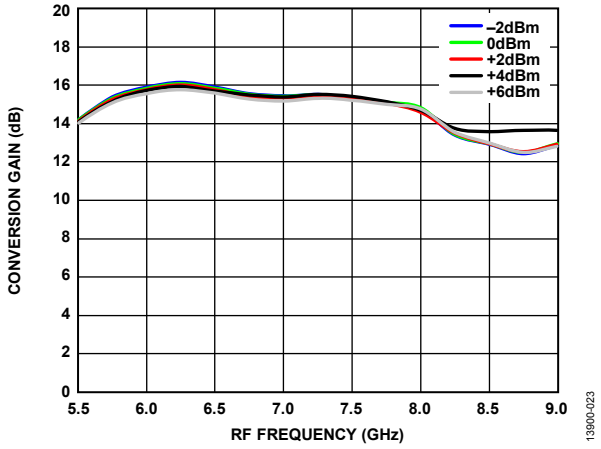

Figure 23. Conversion Gain vs. RF Frequency over LO Powers, T_A = 25°C, Voltage Control = −4 V

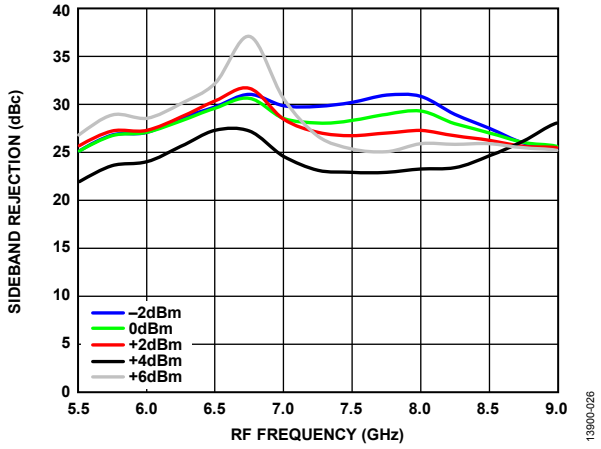

Figure 26. Sideband Rejection vs. RF Frequency over LO Powers, T_A = 25°C, Voltage Control = −4 V

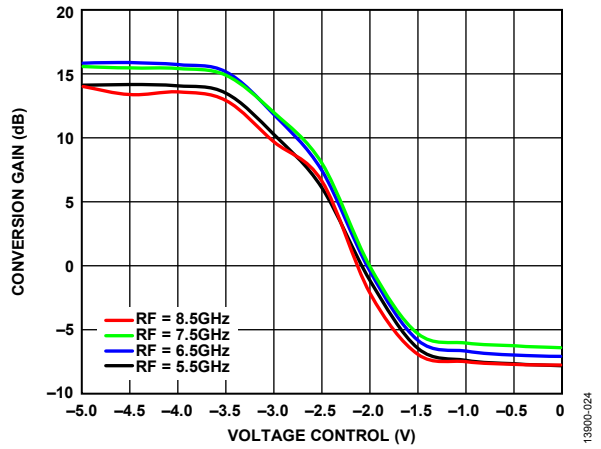

Figure 24. Conversion Gain vs. Voltage Control over RF, T_A = 25°C, LO Power = 4 dBm

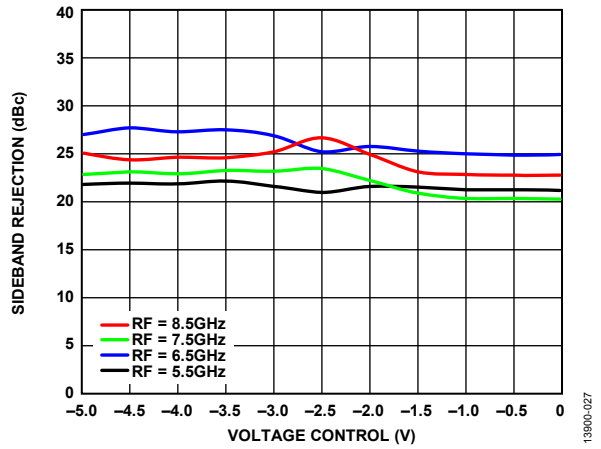

Figure 27. Sideband Rejection vs. Voltage Control over RF, T_A = 25°C, LO Power = 4 dBm

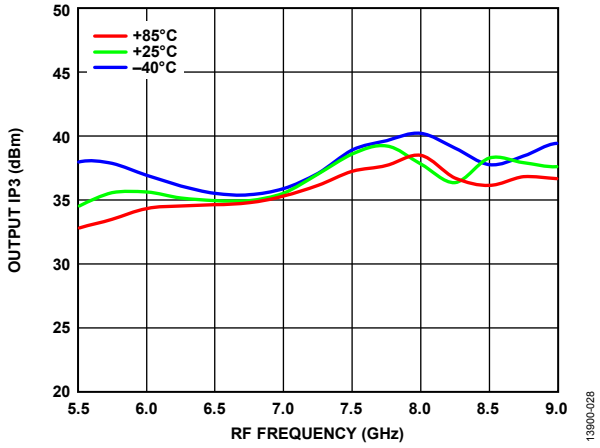

Figure 28. Output IP3 vs. RF Frequency over Temperatures, LO Power = 4 dBm, Voltage Control = −4 V

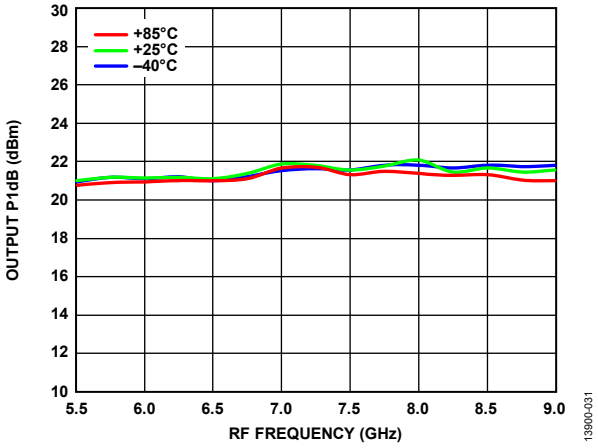

Figure 31. Output P1dB vs. RF Frequency over Temperatures, LO Power = 4 dBm, Voltage Control = −4 V

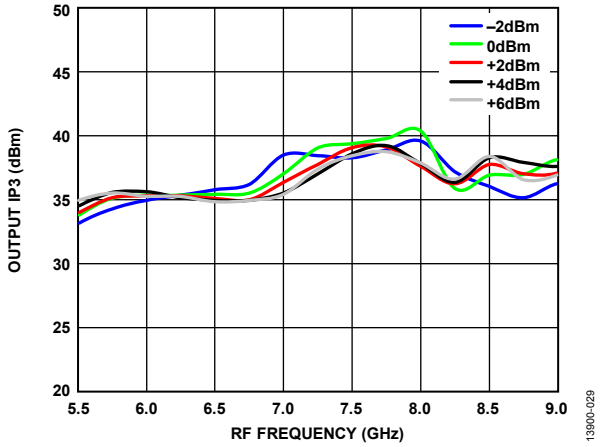

Figure 29. Output IP3 vs. RF Frequency over LO Powers T_A = 25°C, Voltage Control = −4 V

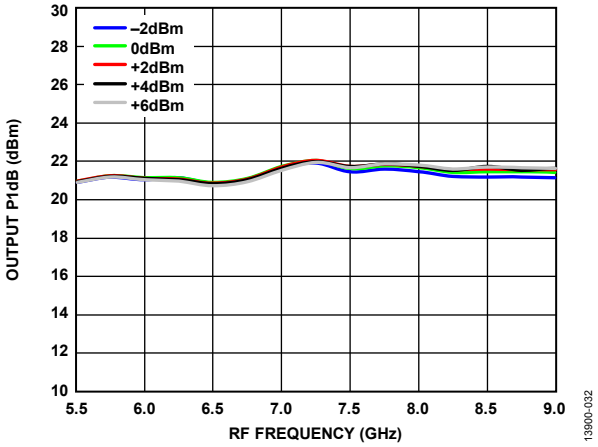

Figure 32. Output P1dB vs. RF Frequency over LO Powers, T_A = 25°C, Voltage Control = −4 V

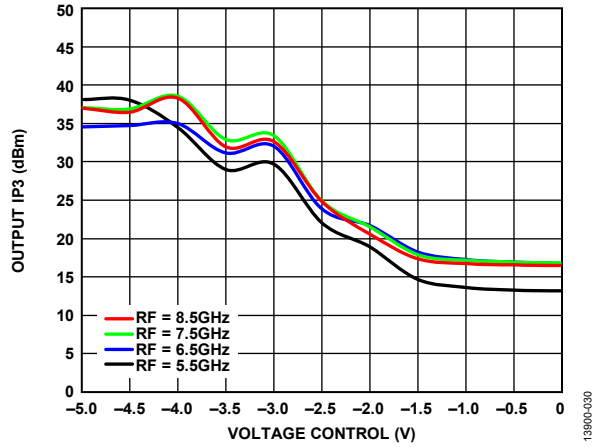

Figure 30. Output IP3 vs. Voltage Control over RF, T_A = 25°C, LO Power = 4 dBm

IF= 2500 MHz, IF INPUT POWER = −6 dBm, LOWER SIDEBAND (HIGH-SIDE LO)

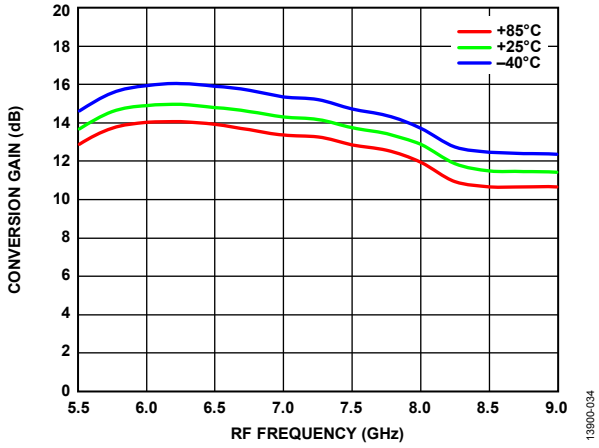

Figure 33. Conversion Gain vs. RF Frequency over Temperatures, LO Power = 4 dBm, Voltage Control = −4 V

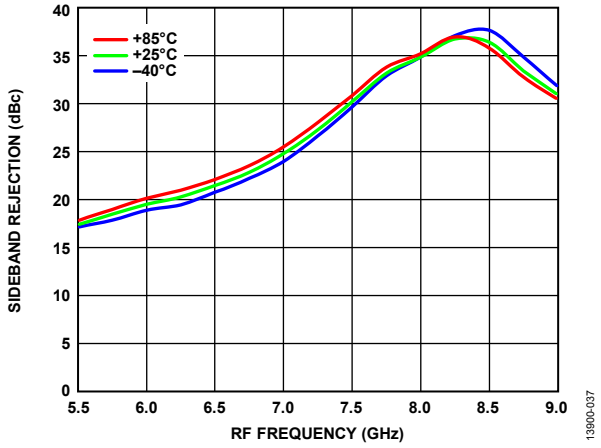

Figure 36. Sideband Rejection vs. RF Frequency over Temperatures, Voltage Control = −4 V

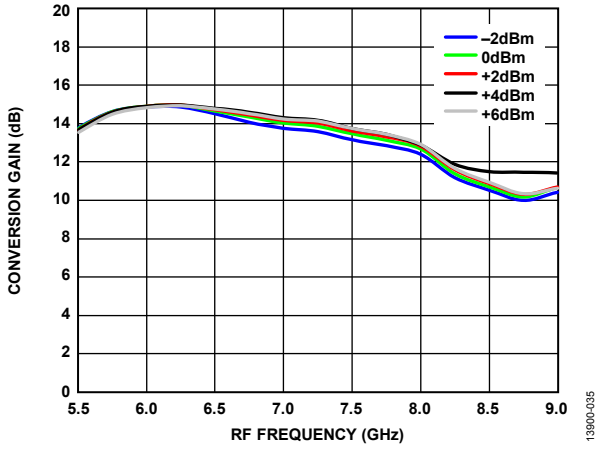

Figure 34. Conversion Gain vs. RF Frequency over LO Powers, T_A = 25°C, Voltage Control = −4 V

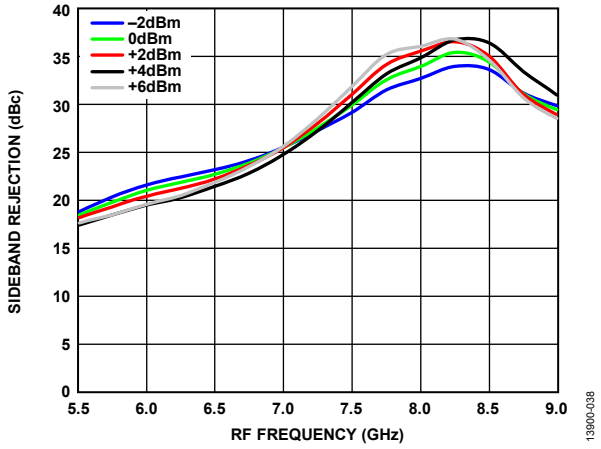

Figure 37. Sideband Rejection vs. RF Frequency over LO Powers, T_A = 25°C, Voltage Control = −4 V

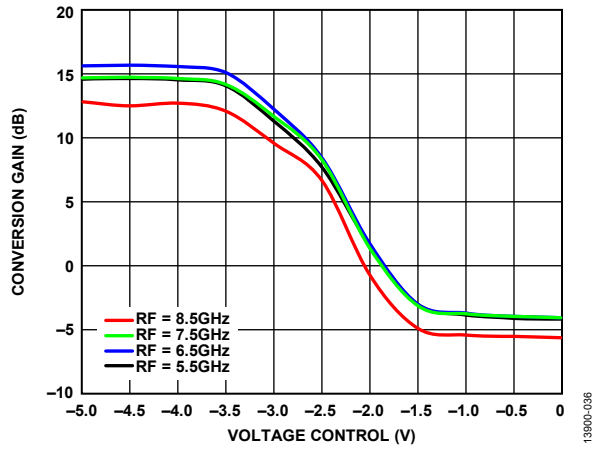

Figure 35. Conversion Gain vs. Voltage Control over RF, T_A = 25°C, LO Power = 4 dBm

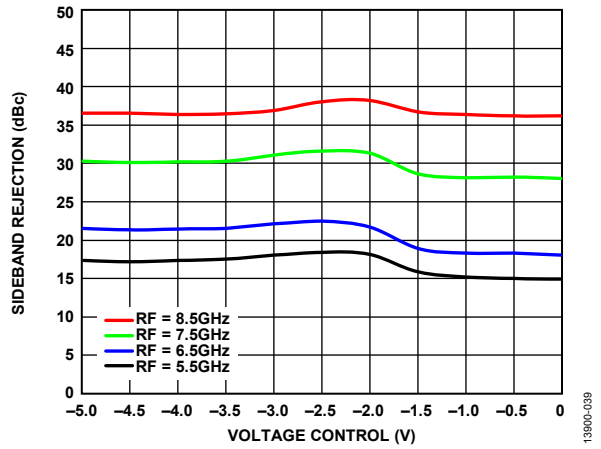

Figure 38. Sideband Rejection vs. Voltage Control over RF, T_A = 25°C, LO Power = 4 dBm

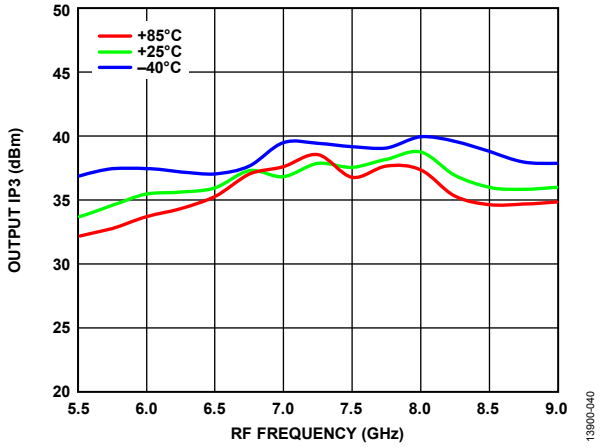

Figure 39. Output IP3 vs. RF Frequency over Temperatures, LO Power = 4 dBm, Voltage Control = −4 V

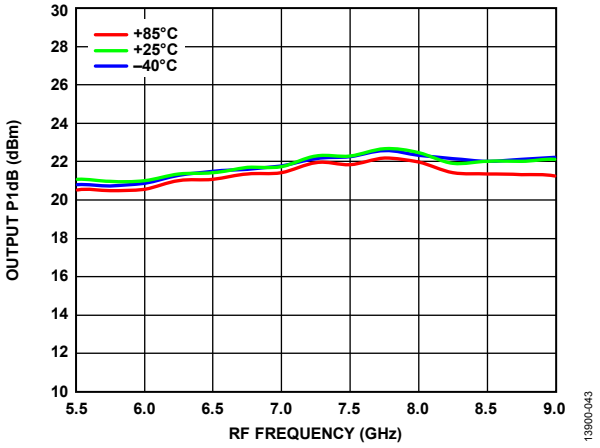

Figure 42. Output P1dB vs. RF Frequency over Temperatures, LO Power = 4 dBm, Voltage Control = −4 V

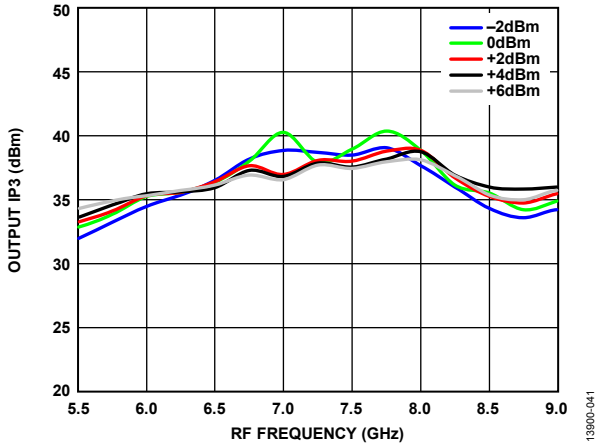

Figure 40. Output IP3 vs. RF Frequency over LO Powers T_A = 25°C, Voltage Control = −4 V

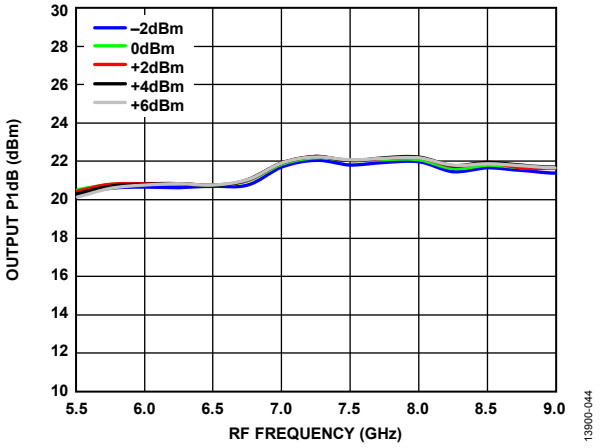

Figure 43. Output P1dB vs. RF Frequency over LO Powers, T_A = 25°C, Voltage Control = −4 V

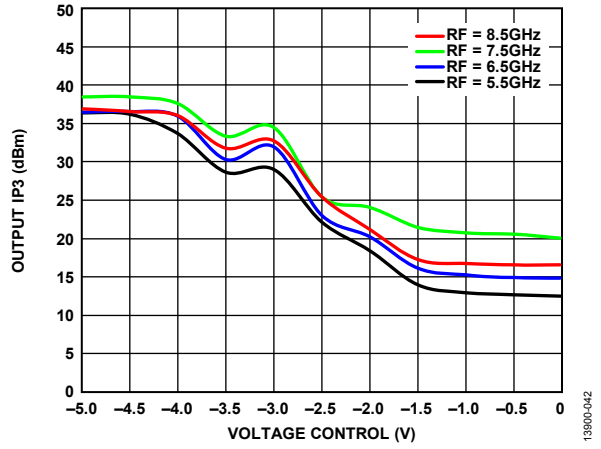

Figure 41. Output IP3 vs. Voltage Control over RF, T_A = 25°C, LO Power = 4 dBm

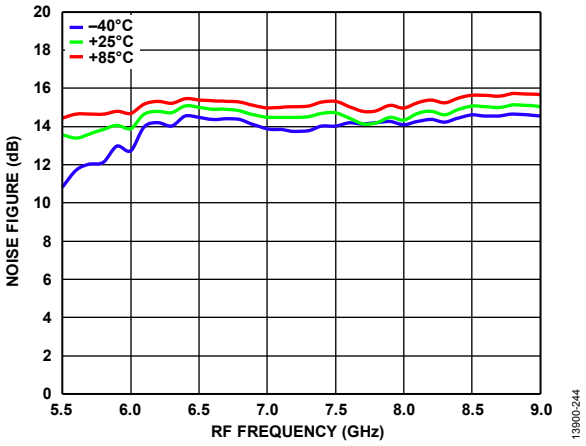

Figure 44. Noise Figure vs. RF Frequency over Temperatures, LO Power = 4 dBm, Voltage Control = –4 V

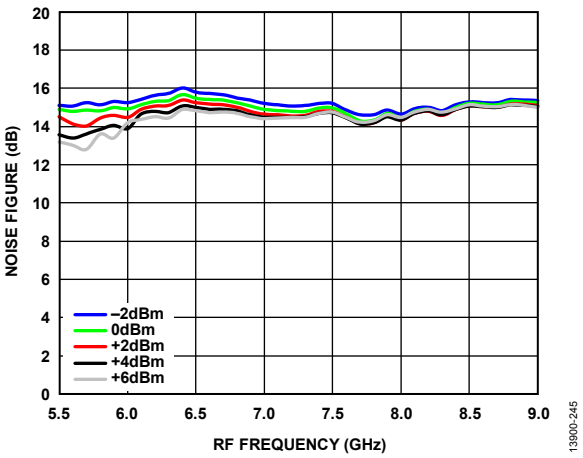

Figure 45. Noise Figure vs. RF Frequency over LO Powers T_A = 25°C, Voltage Control = –4 V

IF = 350 MHz, IF INPUT POWER = −6 dBm, UPPER SIDEBAND (LOW-SIDE LO)

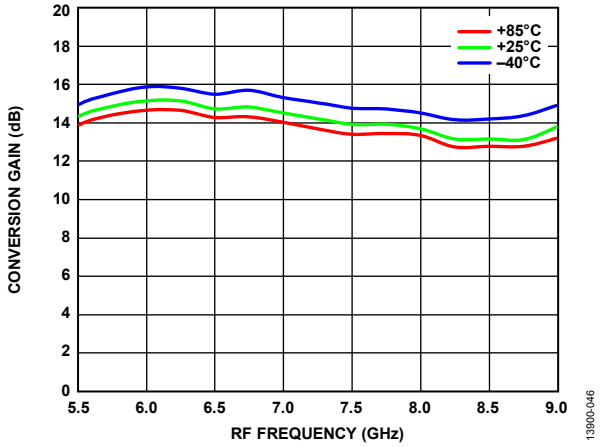

Figure 46. Conversion Gain vs. RF Frequency over Temperatures, LO Power = 4 dBm, Voltage Control = −4 V

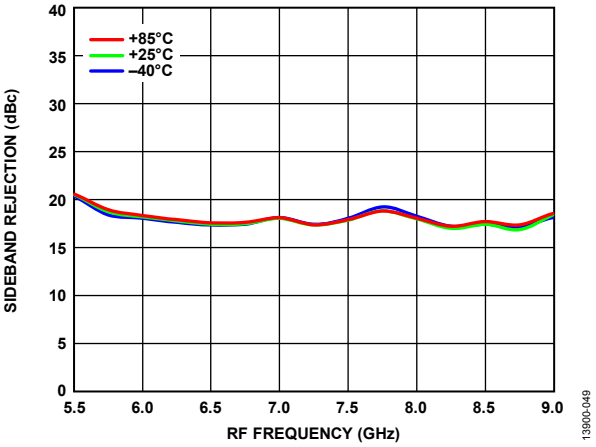

Figure 49. Sideband Rejection vs. RF Frequency over Temperatures, Voltage Control = −4 V

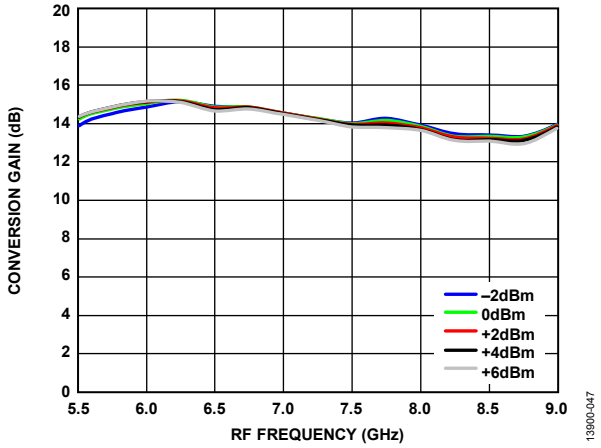

Figure 47. Conversion Gain vs. RF Frequency over LO Powers, T_A = 25°C, Voltage Control = −4 V

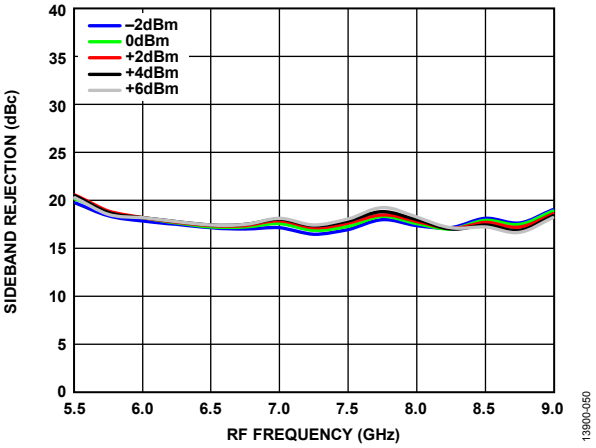

Figure 50. Sideband Rejection vs. RF Frequency over LO Powers, T_A = 25°C, Voltage Control = −4 V

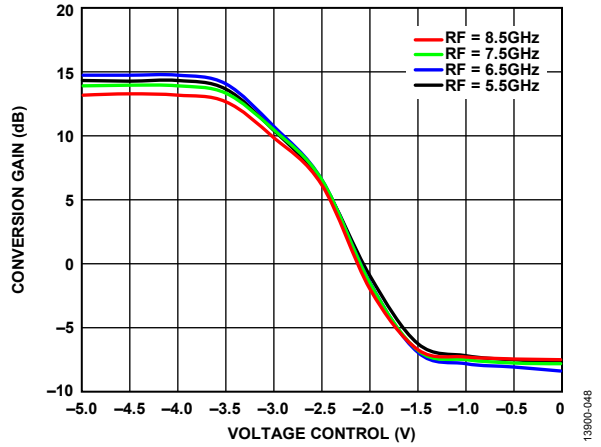

Figure 48. Conversion Gain vs. Voltage Control over RF, T_A = 25°C, LO Power = 4 dBm

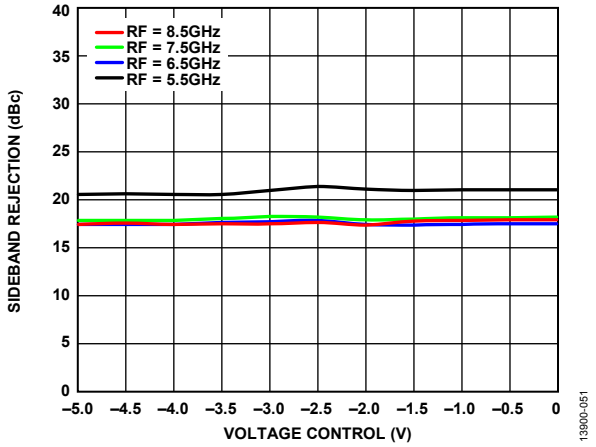

Figure 51. Sideband Rejection vs. Voltage Control over RF, T_A = 25°C, LO Power = 4 dBm

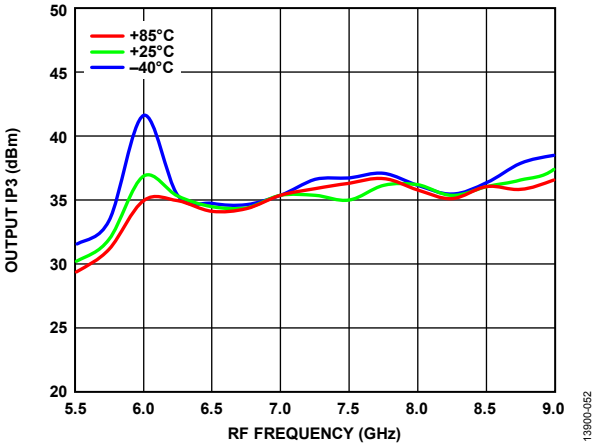

Figure 52. Output IP3 vs. RF Frequency over Temperatures, LO Power = 4 dBm, Voltage Control = −4 V

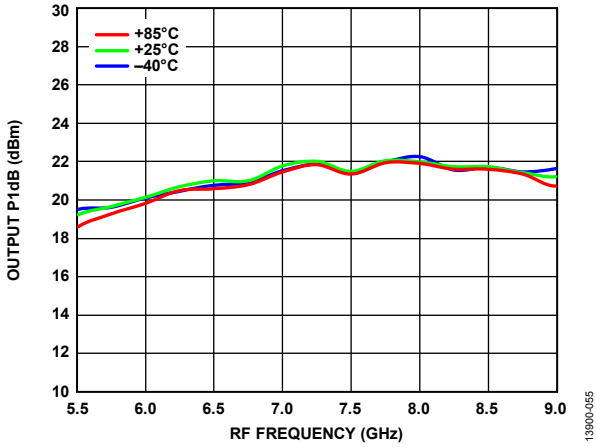

Figure 55. Output P1dB vs. RF Frequency over Temperatures, LO Power = 4 dBm, Voltage Control = −4 V

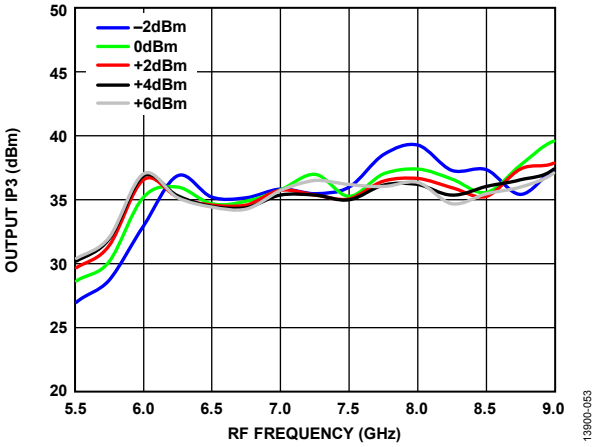

Figure 53. Output IP3 vs. RF Frequency over LO Powers T_A = 25°C, Voltage Control = −4 V

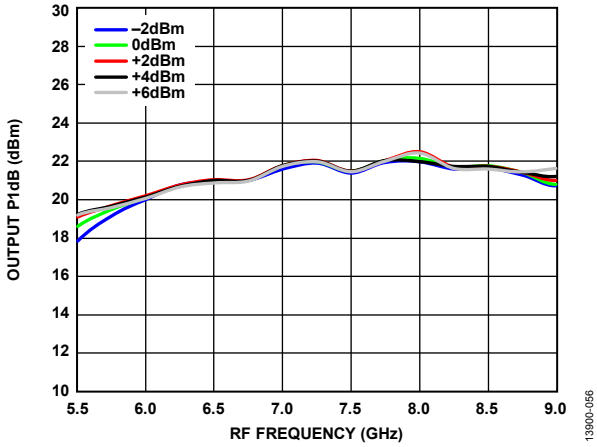

Figure 56. Output P1dB vs. RF Frequency over LO Powers, T_A = 25°C, Voltage Control = −4 V

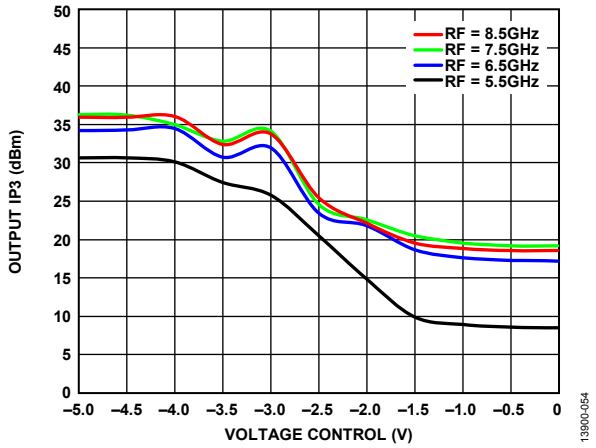

Figure 54. Output IP3 vs. Voltage Control over RF, T_A = 25°C, LO Power = 4 dBm

IF = 1000 MHz, IF INPUT POWER = −6 dBm, UPPER SIDEBAND (LOW-SIDE LO)

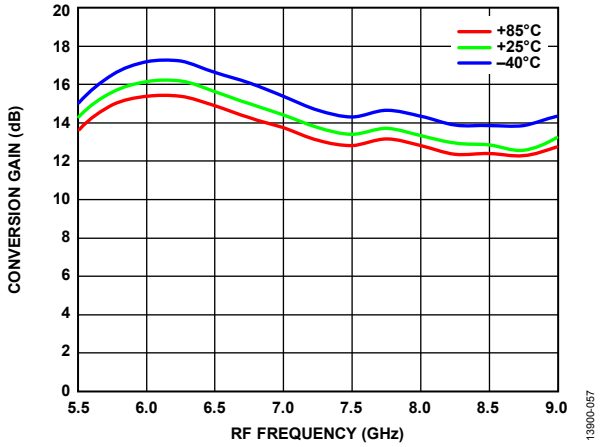

Figure 57. Conversion Gain vs. RF Frequency over Temperatures, LO Power = 4 dBm, Voltage Control = −4 V

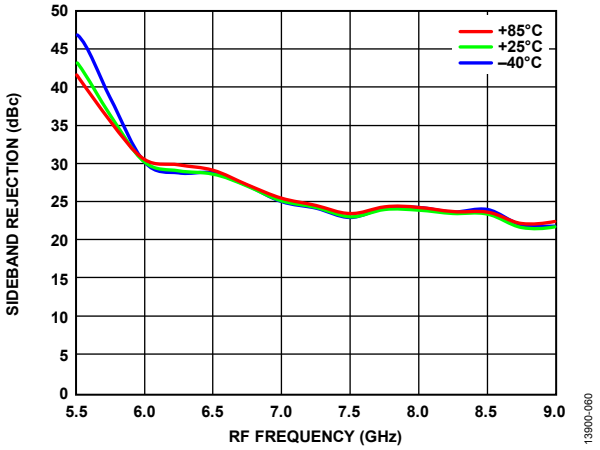

Figure 60. Sideband Rejection vs. RF Frequency over Temperatures, Voltage Control = −4 V

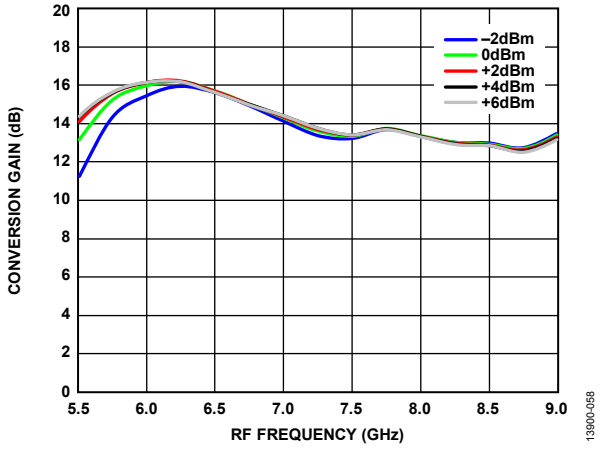

Figure 58. Conversion Gain vs. RF Frequency over LO Powers, T_A = 25°C, Voltage Control = −4 V

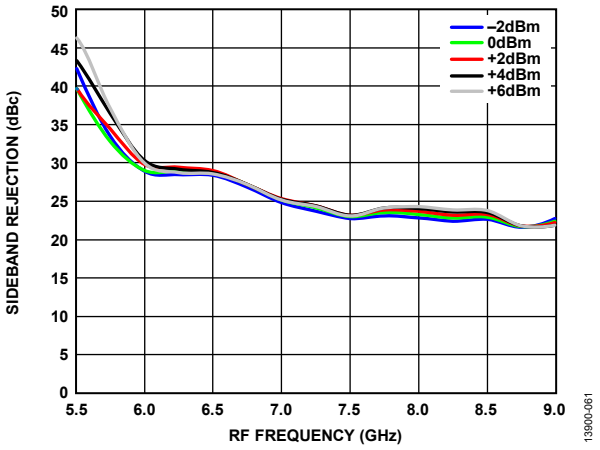

Figure 61. Sideband Rejection vs. RF Frequency over LO Powers, T_A = 25°C, Voltage Control = −4 V

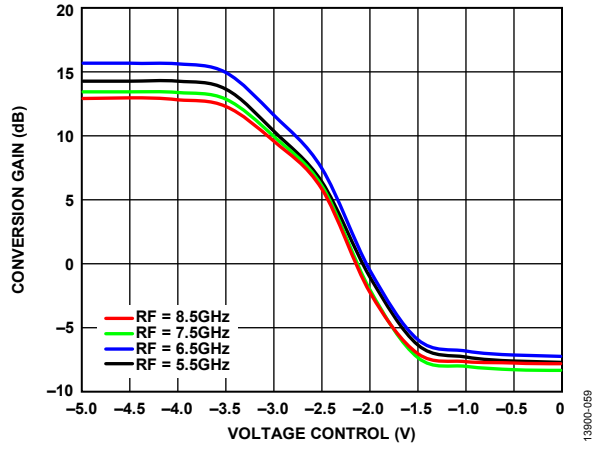

Figure 59. Conversion Gain vs. Voltage Control over RF, T_A = 25°C, LO Power = 4 dBm

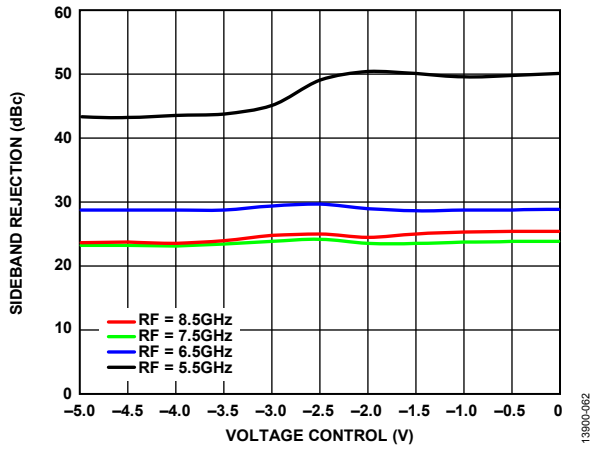

Figure 62. Sideband Rejection vs. Voltage Control over RF, T_A = 25°C, LO Power = 4 dBm

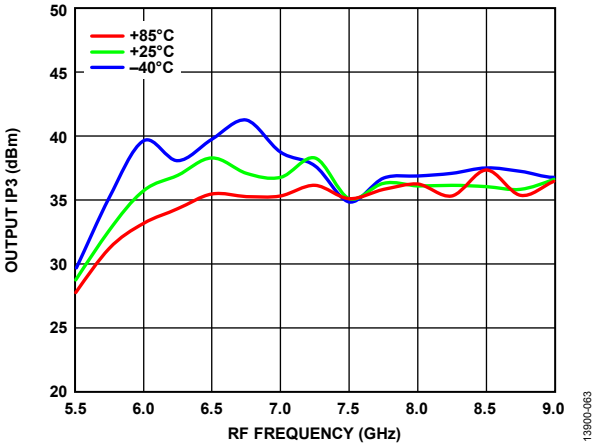

Figure 63. Output IP3 vs. RF Frequency over Temperatures, LO Power = 4 dBm, Voltage Control = −4 V

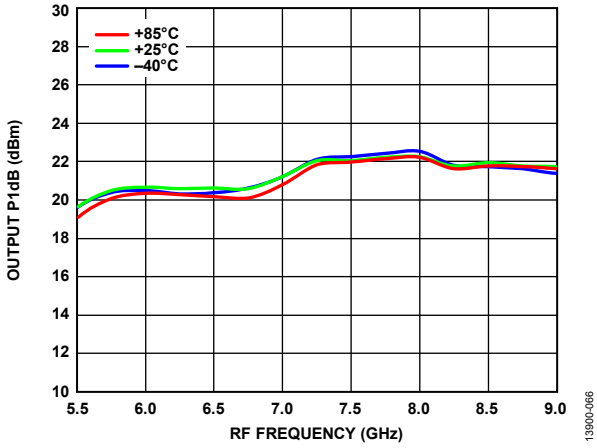

Figure 66. Output P1dB vs. RF Frequency over Temperatures, LO Power = 4 dBm, Voltage Control = −4 V

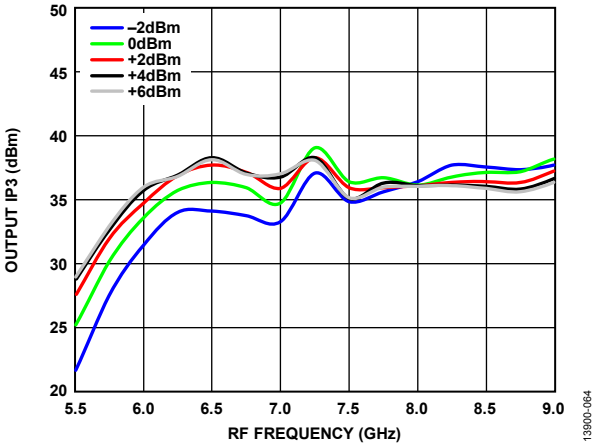

Figure 64. Output IP3 vs. RF Frequency over LO Powers T_A = 25°C, Voltage Control = −4 V

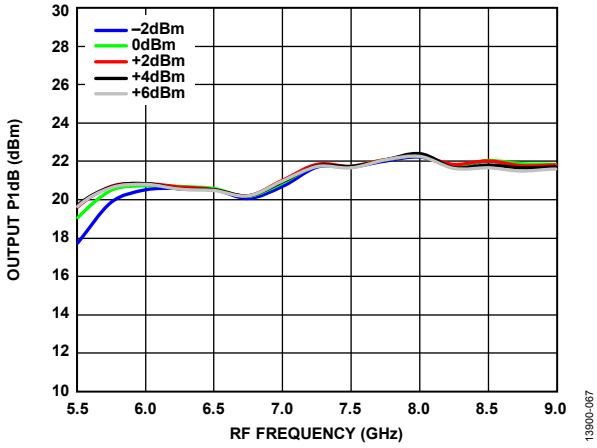

Figure 67. Output P1dB vs. RF Frequency over LO Powers, T_A = 25°C, Voltage Control = −4 V

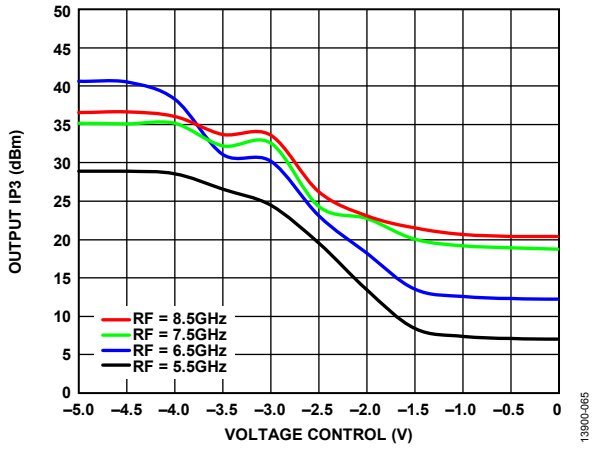

Figure 65. Output IP3 vs. Voltage Control over RF, T_A = 25°C, LO Power = 4 dBm

IF= 2500 MHz, IF INPUT POWER = –6 dBm, UPPER SIDEBAND (LOW-SIDE LO)

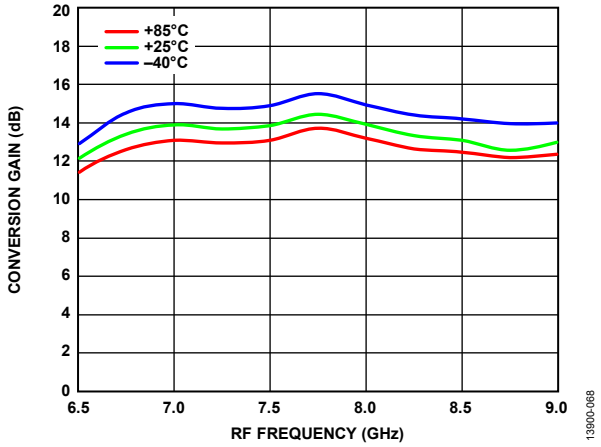

Figure 68. Conversion Gain vs. RF Frequency over Temperatures, LO Power = 4 dBm, Voltage Control = –4 V

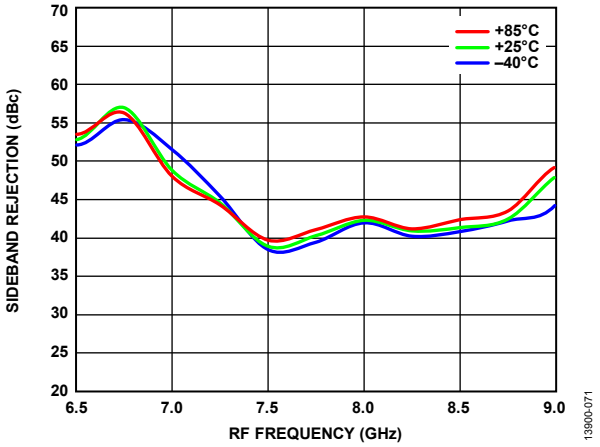

Figure 71. Sideband Rejection vs. RF Frequency over Temperatures, Voltage Control = –4 V

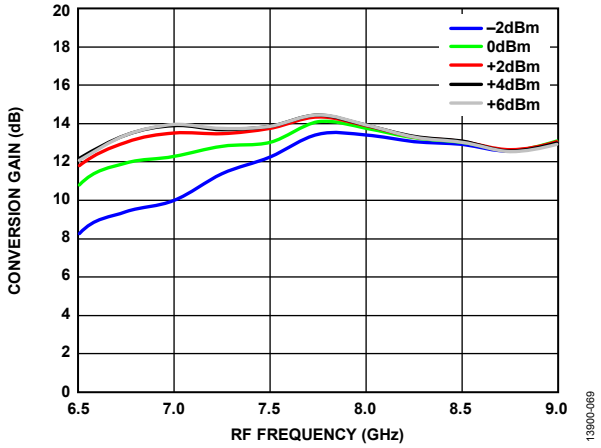

Figure 69. Conversion Gain vs. RF Frequency over LO Powers, T_A = 25°C, Voltage Control = –4 V

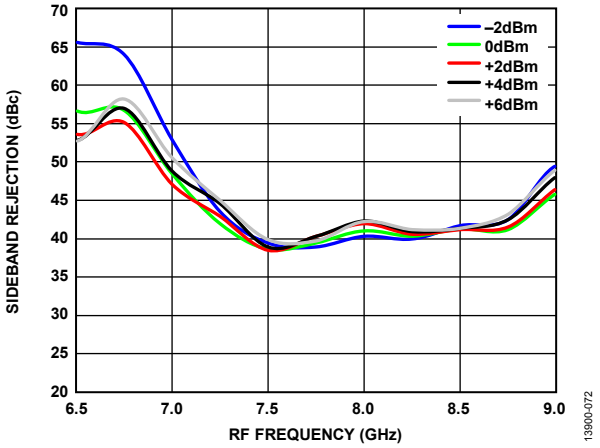

Figure 72. Sideband Rejection vs. RF Frequency over LO Powers, T_A = 25°C, Voltage Control = –4 V

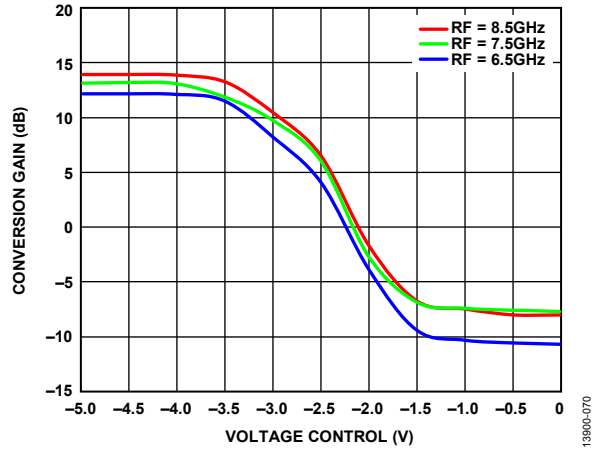

Figure 70. Conversion Gain vs. Voltage Control over RF, T_A = 25°C, LO Power = 4 dBm

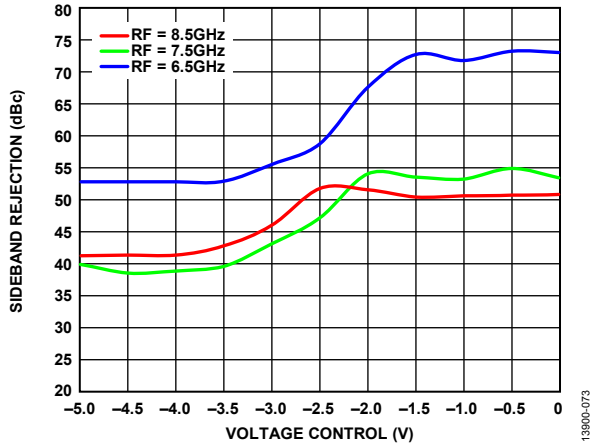

Figure 73. Sideband Rejection vs. Voltage Control over RF, T_A = 25°C, LO Power = 4 dBm

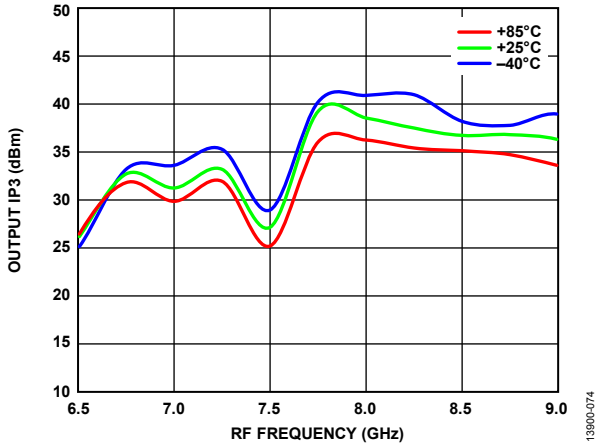

Figure 74. Output IP3 vs. RF Frequency over Temperatures, LO Power = 4 dBm, Voltage Control = −4 V

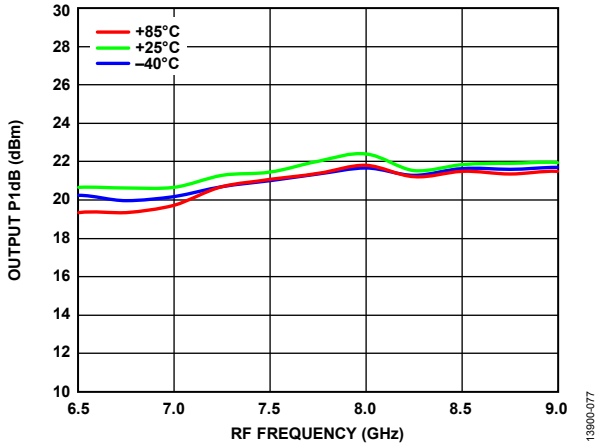

Figure 77. Output P1dB vs. RF Frequency over Temperatures, LO Power = 4 dBm, Voltage Control = −4 V

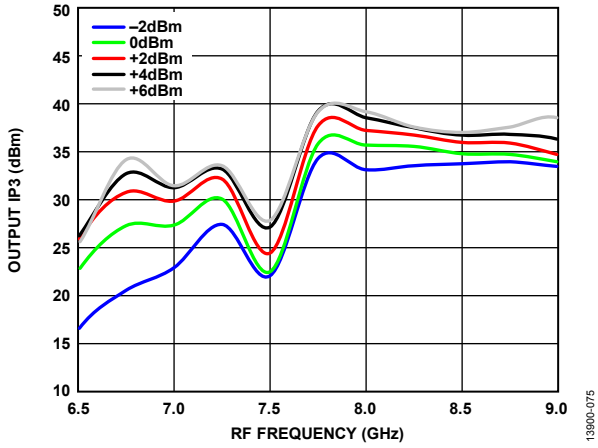

Figure 75. Output IP3 vs. RF Frequency over LO Powers, T_A = 25°C, Voltage Control = −4 V

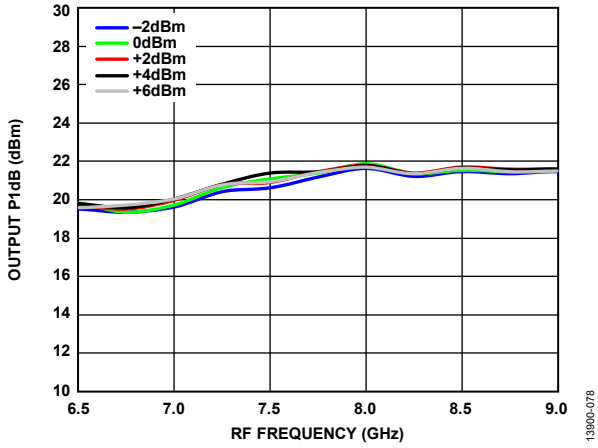

Figure 78. Output P1dB vs. RF Frequency over LO Powers, T_A = 25°C, Voltage Control = −4 V

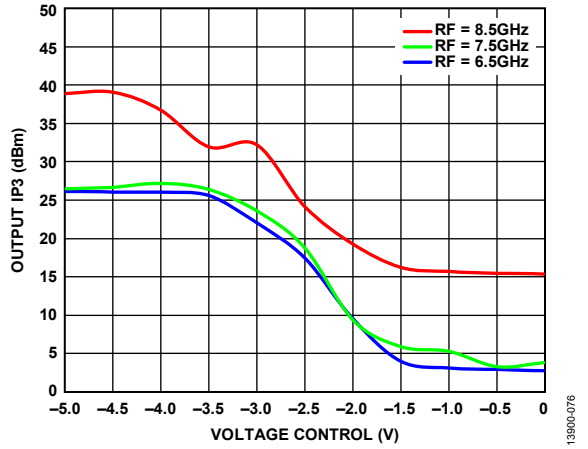

Figure 76. Output IP3 vs. Voltage Control over RF, T_A = 25°C, LO Power = 4 dBm

ISOLATION AND RETURN LOSS

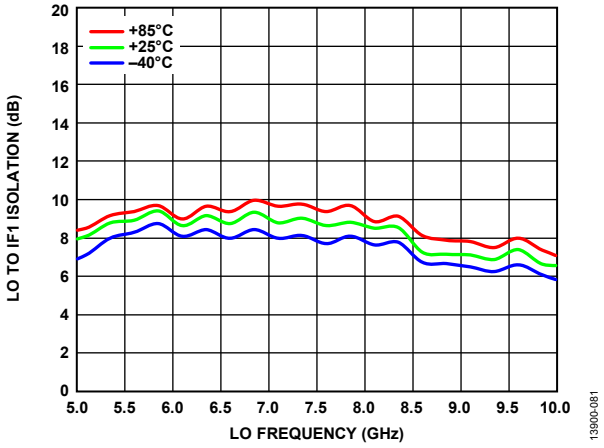

Figure 79. LO to IF1 Isolation vs. LO Frequency over Temperatures, IF = 350 MHz, LO Power = 4 dBm, Voltage Control = −4 V

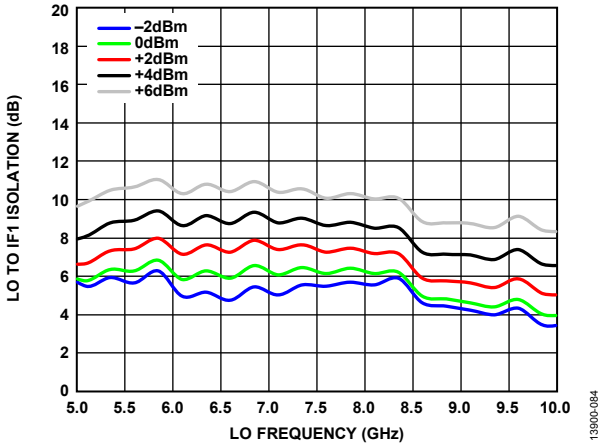

Figure 82. LO to IF1 Isolation vs. LO Frequency over LO Powers, T_A = 25°C, Voltage Control = −4 V

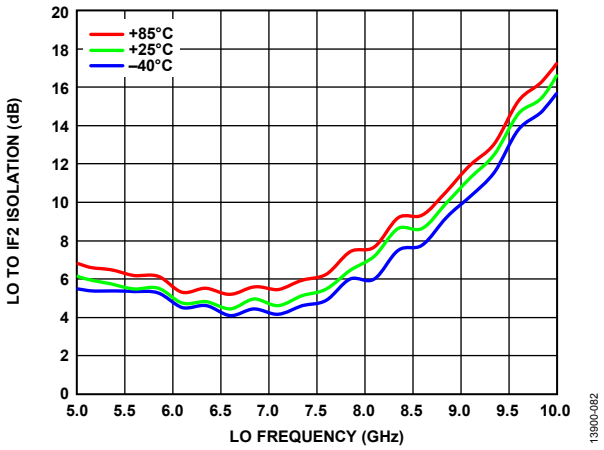

Figure 80. LO to IF2 Isolation vs. LO Frequency over Temperatures, IF = 350 MHz, LO Power = 4 dBm, Voltage Control = −4 V

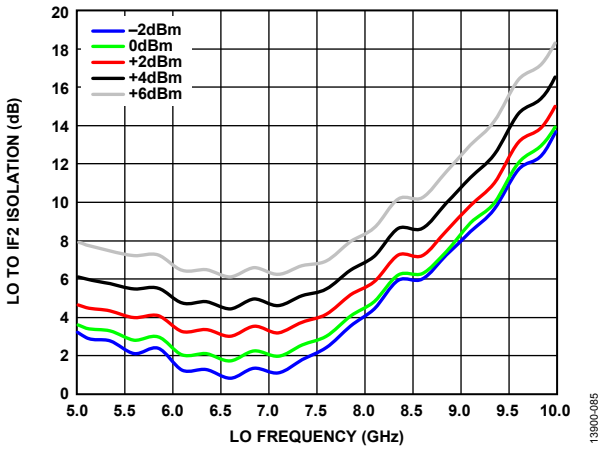

Figure 83. LO to IF2 Isolation vs. LO Frequency over LO Powers, T_A = 25°C, Voltage Control = −4 V

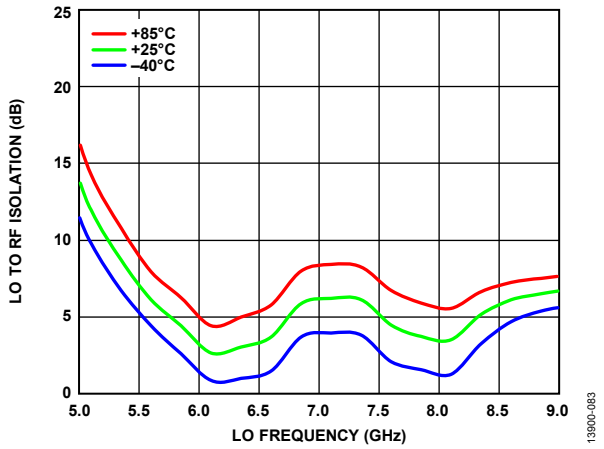

Figure 81. LO to RF Isolation vs. LO Frequency over Temperatures, LO Power = 4 dBm, Voltage Control = −4 V

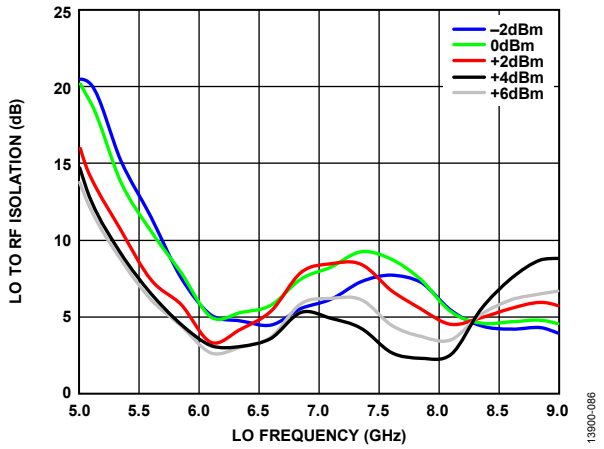

Figure 84. LO to RF Isolation vs. LO Frequency over LO Powers, T_A = 25°C, Voltage Control = −4 V

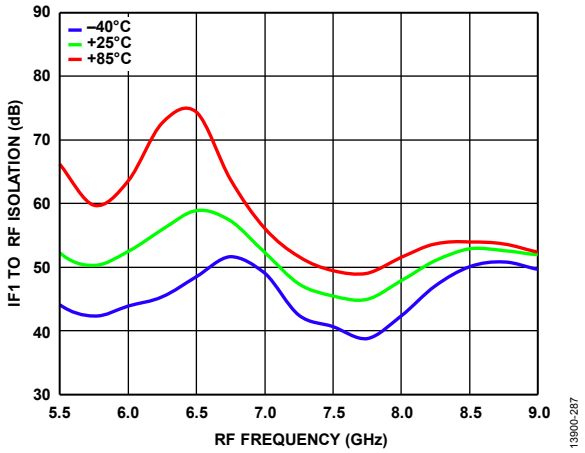

Figure 85. IF1 to RF Isolation vs. RF Frequency over Temperatures, LO Power = 4 dBm, Voltage Control = −4 V

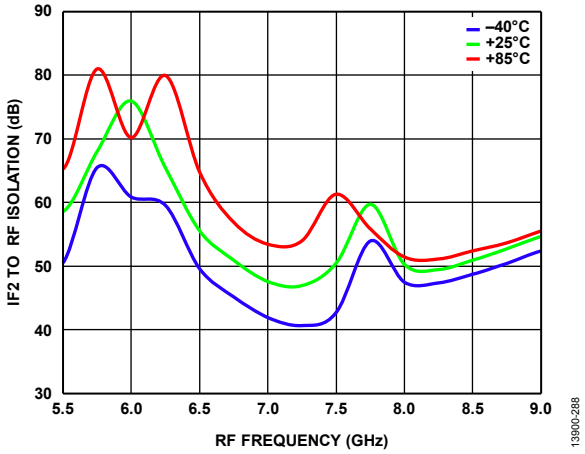

Figure 86. IF2 to RF Isolation vs. RF Frequency over Temperatures, LO Power = 4 dBm, Voltage Control = −4 V

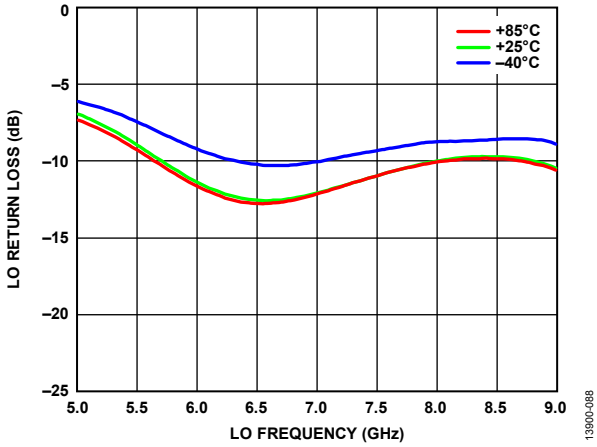

Figure 87. LO Return Loss vs. LO Frequency over Temperatures, LO Power = 4 dBm, Voltage Control = −4 V

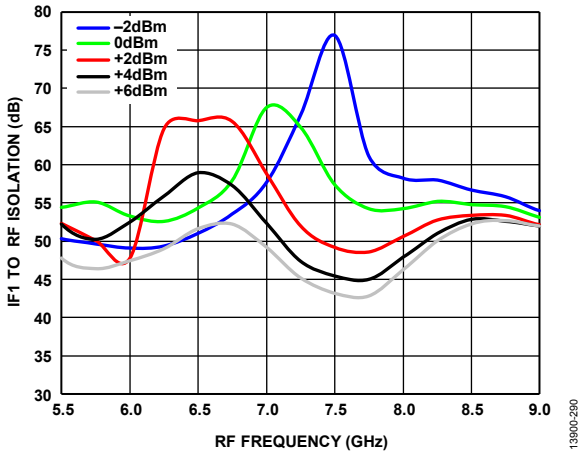

Figure 88. IF1 to RF Isolation vs. RF Frequency over LO Powers, T_A = 25°C, Voltage Control = −4 V

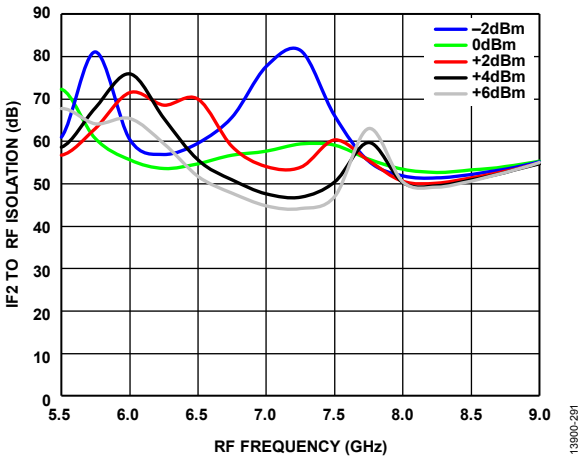

Figure 89. IF2 to RF Isolation vs. RF Frequency over LO Powers, T_A = 25°C, Voltage Control = −4 V

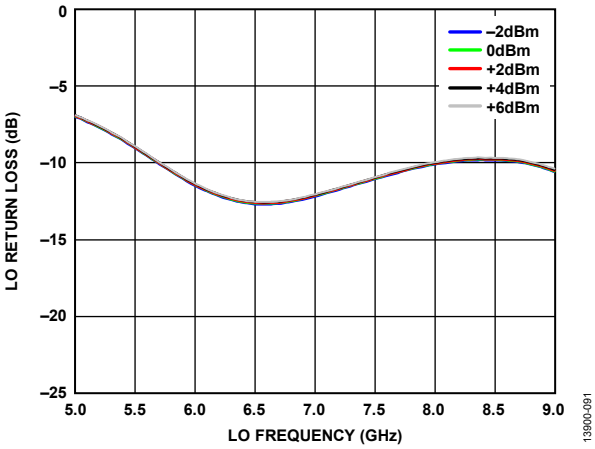

Figure 90. LO Return Loss vs. LO Frequency over LO Powers, T_A = 25°C, Voltage Control = −4 V

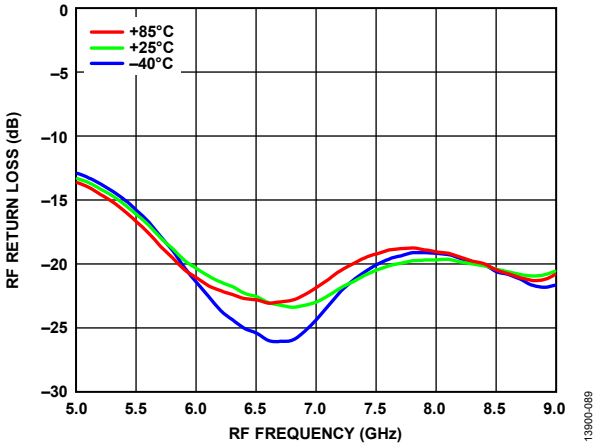

Figure 91. RF Return Loss vs. RF Frequency over Temperatures, LO Frequency = 7 GHz, LO Power = 4 dBm, Voltage Control = −4 V

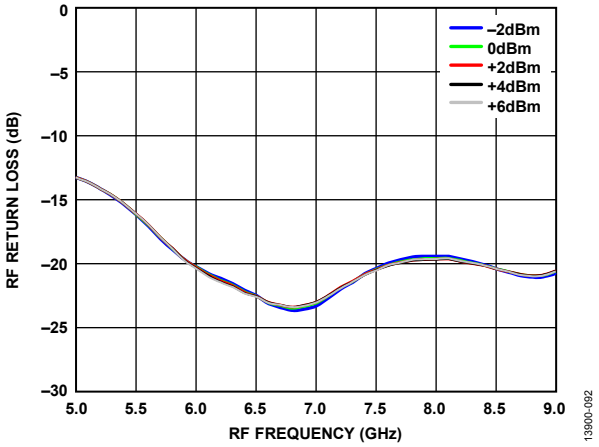

Figure 92. RF Return Loss vs. RF Frequency over LO Powers, LO Frequency = 7 GHz, T_A = 25°C, Voltage Control = −4 V

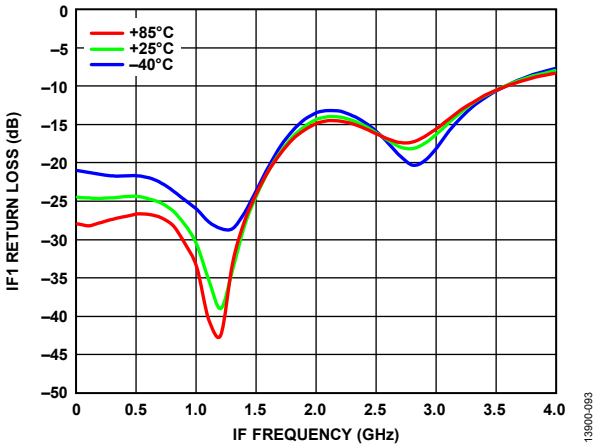

Figure 93. IF1 Return Loss vs. IF Frequency over Temperatures, LO Frequency = 7 GHz, LO Power = 4 dBm, Voltage Control = −4 V

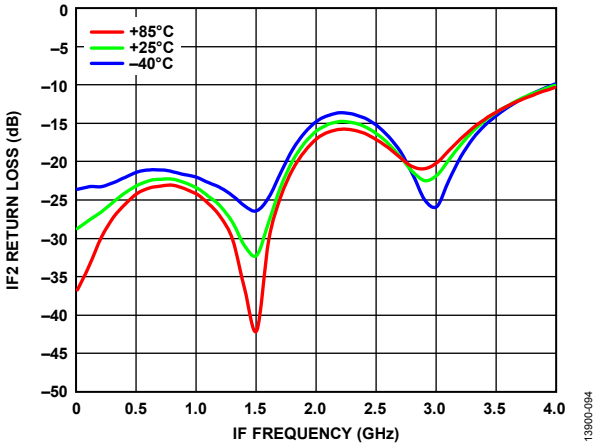

Figure 94. IF2 Return Loss vs. IF Frequency over Temperatures, LO Frequency = 7 GHz, LO Power = 4 dBm, Voltage Control = −4 V

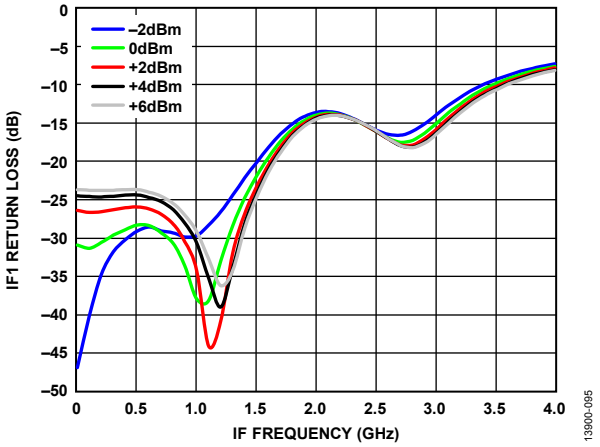

Figure 95. IF1 Return Loss vs. IF Frequency over LO Powers, LO Frequency = 7 GHz, T_A = 25°C, Voltage Control = −4 V

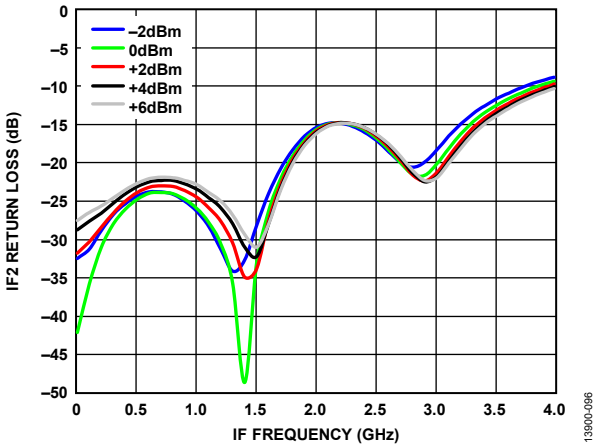

Figure 96. IF2 Return Loss vs. IF Frequency over LO Powers, LO Frequency = 7 GHz, T_A = 25°C, Voltage Control = −4 V

IF BANDWIDTH PERFORMANCE: LOWER SIDEBAND (HIGH-SIDE LO)

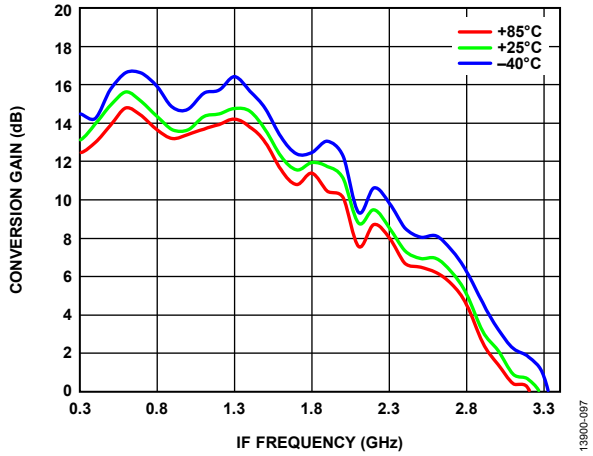

Figure 97. Conversion Gain vs. IF Frequency over Temperatures, LO Frequency = 7 GHz, LO Power = 4 dBm, Voltage Control = –4 V

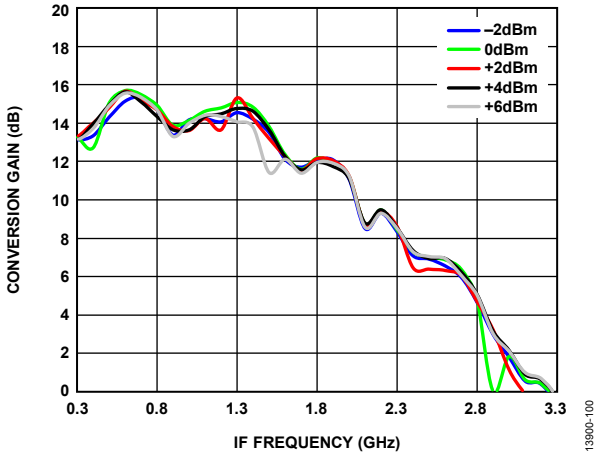

Figure 100. Conversion Gain vs. IF Frequency over LO Powers, LO Frequency = 7 GHz, T_A = 25°C, Voltage Control = –4 V

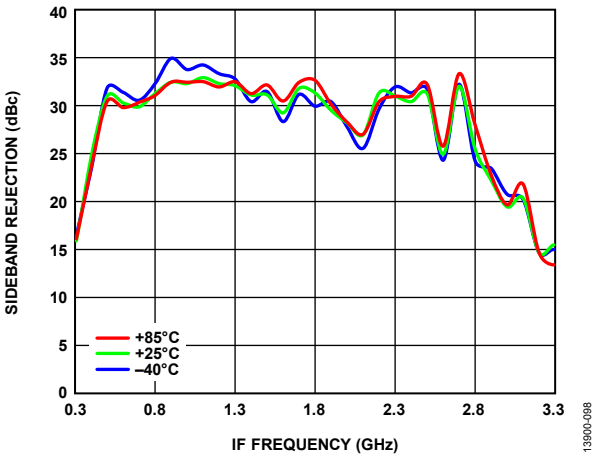

Figure 98. Sideband Rejection vs. IF Frequency over Temperatures, LO Frequency = 7 GHz, LO Power = 4 dBm, Voltage Control = –4 V

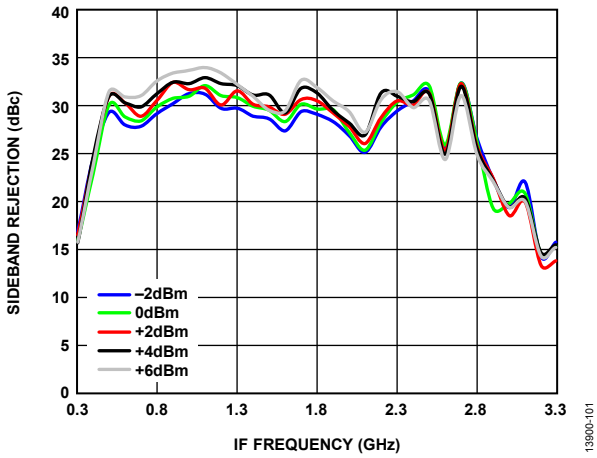

Figure 101. Sideband Rejection vs. IF Frequency over LO Powers, LO Frequency = 7 GHz, T_A = 25°C, Voltage Control = –4 V

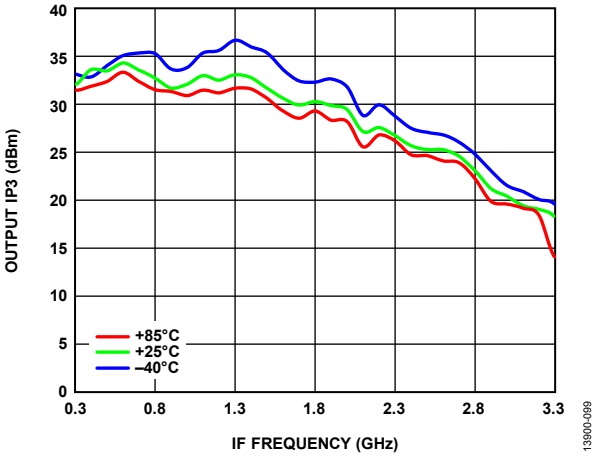

Figure 99. Output IP3 vs. IF Frequency over Temperatures, LO Frequency = 7 GHz, LO Power = 4 dBm, Voltage Control = –4 V

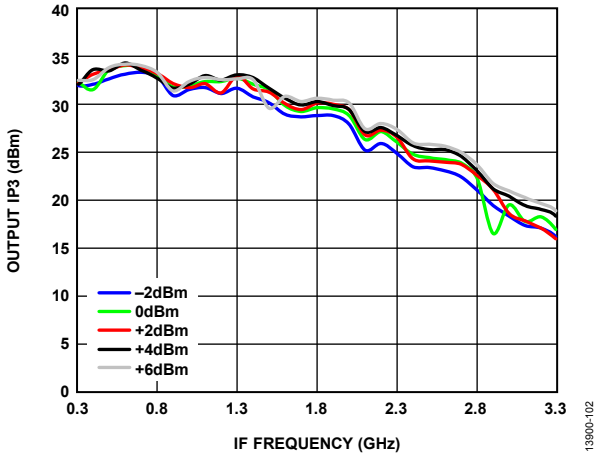

Figure 102. Output IP3 vs. IF Frequency over LO Powers, LO Frequency = 7 GHz, T_A = 25°C, Voltage Control = –4 V

SPURIOUS PERFORMANCE

Mixer spurious products are measured in dBc from the RF output power level. Spur values are (M × IF) − (N × LO). N/A means not applicable.

M × N Spurious Outputs, IF = 350 MHz

RF = 5500 MHz, LO frequency = 5850 MHz at LO input power = 4 dBm, IF input power = −6 dBm.

		N × LO					
		0	**1**	**2**	**3**	**4**	**5**
M × IF	**0**	N/A	11	3	18	41	53
	1	75	0	38	36	50	62
	2	79	51	34	61	60	81
	3	100	73	78	60	87	81
	4	101	88	80	94	86	111
	5	121	102	108	98	111	101

RF = 7000 MHz, LO frequency = 7350 MHz at LO input power = 4 dBm, IF input power = −6 dBm.

		N × LO					
		0	**1**	**2**	**3**	**4**	**5**
M × IF	**0**	N/A	13	8	44	51	57
	1	79	0	43	39	73	75
	2	78	51	34	73	67	94
	3	105	72	86	65	98	87
	4	118	82	96	105	93	103
	5	122	91	107	111	108	105

RF = 8500 MHz, LO frequency = 8850 MHz at LO input power = 4 dBm, IF input power = −6 dBm. N/A is not applicable.

		N × LO					
		0	**1**	**2**	**3**	**4**	**5**
M × IF	**0**	N/A	8	21	53	53	N/A
	1	76	0	27	56	68	N/A
	2	81	50	36	61	83	N/A
	3	104	95	79	71	92	N/A
	4	114	83	101	105	99	N/A
	5	120	92	111	108	103	N/A

M × N Spurious Output, IF = 1000 MHz

RF = 5500 MHz, LO frequency = 6500 MHz at LO input power = 4 dBm, IF input power = −6 dBm.

		N × LO					
		0	**1**	**2**	**3**	**4**	**5**
M × IF	**0**	N/A	7	8	57	43	59
	1	49	0	37	39	66	72
	2	63	55	33	60	66	90
	3	83	82	69	65	84	90
	4	95	120	100	97	91	104
	5	112	121	109	113	108	108

RF = 7000 MHz, LO frequency = 8000 MHz at LO input power = 4 dBm, IF input power = −6 dBm.

		N × LO					
		0	**1**	**2**	**3**	**4**	**5**
M × IF	**0**	N/A	7	11	43	59	71
	1	50	0	40	43	74	79
	2	66	44	35	68	73	91
	3	88	85	71	67	98	92
	4	80	80	81	100	96	104
	5	85	88	79	101	113	107

RF = 8500 MHz, LO frequency = 9500 MHz at LO input power = 4 dBm, IF input power = −6 dBm. N/A is not applicable.

		N × LO					
		0	**1**	**2**	**3**	**4**	**5**
M × IF	**0**	N/A	8	41	63	66	N/A
	1	50	0	31	77	88	N/A
	2	66	44	38	63	81	N/A
	3	101	82	74	72	93	N/A
	4	105	105	108	107	102	N/A
	5	120	118	112	109	107	N/A

M × N Spurious Outputs, IF = 2500 MHz

RF = 5500 MHz, LO frequency = 8000 MHz at LO input power = 4 dBm, IF input power = −6 dBm.

		N × LO					
		0	**1**	**2**	**3**	**4**	**5**
M × IF	**0**	N/A	6	10	41	57	70
	1	43	0	34	42	70	79
	2	57	64	34	64	78	93
	3	76	113	80	65	87	92
	4	97	115	94	96	94	107
	5	116	115	119	112	110	113

RF = 7000 MHz, LO frequency = 9500 MHz at LO input power = 4 dBm, IF input power = −6 dBm. N/A is not applicable.

		N × LO					
		0	**1**	**2**	**3**	**4**	**5**
M × IF	**0**	N/A	7	41	62	67	N/A
	1	46	0	36	73	84	N/A
	2	57	56	37	63	103	N/A
	3	108	87	83	69	104	101
	4	100	122	101	112	101	101
	5	115	121	118	112	111	106

RF = 8500 MHz, LO frequency = 11000 MHz at LO input power = 4 dBm, IF input power = −6 dBm. N/A is not applicable.

		N × LO					
		0	**1**	**2**	**3**	**4**	**5**
M × IF	**0**	N/A	7	59	46	N/A	N/A
	1	47	0	39	80	N/A	N/A
	2	50	54	40	73	97	N/A
	3	92	83	83	77	98	N/A
	4	109	120	105	108	104	N/A
	5	113	120	115	109	104	N/A