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High IP3, 10 MHz to 6 GHz, Active Mixer

Data Sheet **ADL5801**

FEATURES

Broadband upconverter/downconverter
Power conversion gain of 1.8 dB
Broadband RF, LO, and IF ports
SSB noise figure (NF) of 9.75 dB
Input IP3: 28.5 dBm
Input P1dB: 13.3 dBm
Typical LO drive: 0 dBm
Single-supply operation: 5 V at 130 mA
Adjustable bias for low power operation
Exposed paddle, 4 mm × 4 mm, 24-lead LFCSP package

APPLICATIONS

Cellular base station receivers
Radio link downconverters
Broadband block conversion
Instrumentation

FUNCTIONAL BLOCK DIAGRAM

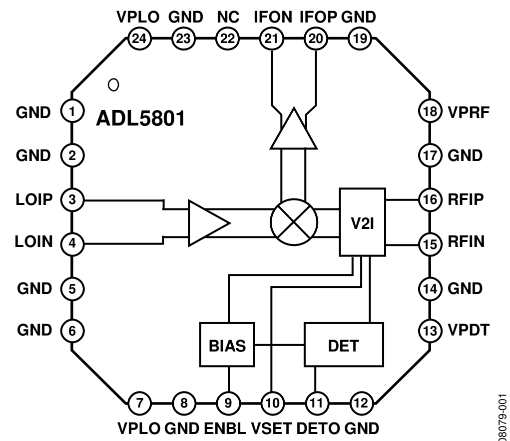

Figure 1.

GENERAL DESCRIPTION

The ADL5801 uses a high linearity, doubly balanced, active mixer core with integrated LO buffer amplifier to provide high dynamic range frequency conversion from 10 MHz to 6 GHz. The mixer benefits from a proprietary linearization architecture that provides enhanced input IP3 performance when subject to high input levels. A bias adjust feature allows the input linearity, SSB noise figure, and dc current to be optimized using a single control pin. An optional input power detector is provided for adaptive bias control. The high input linearity allows the device to be used in demanding cellular applications where in-band blocking signals may otherwise result in degradation in dynamic performance. The adaptive bias feature allows the part to provide high input IP3 performance when presented with large blocking signals. When blockers are removed, the ADL5801 can automatically bias down to provide low noise figure and low power consumption.

The balanced active mixer arrangement provides superb LO-to-RF and LO-to-IF leakage, typically better than −40 dBm. The IF outputs are designed to provide a typical voltage conversion gain of 7.8 dB when loaded into a 200 Ω load. The broad frequency range of the open-collector IF outputs allows the ADL5801 to be applied as an upconverter for various transmit applications.

The ADL5801 is fabricated using a SiGe high performance IC process. The device is available in a compact 4 mm × 4 mm, 24-lead LFCSP package and operates over a −40°C to +85°C temperature range. An evaluation board is also available.

Rev. E Document Feedback

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Last Content Update: 02/23/2017

COMPARABLE PARTS

View a parametric search of comparable parts.

EVALUATION KITS

- ADL5801 Evaluation Board

DOCUMENTATION

Data Sheet

- ADL5801: High IP3, 10 MHz to 6 GHz, Active Mixer Data Sheet

TOOLS AND SIMULATIONS

- ADIsimPLL™
- ADIsimRF

REFERENCE DESIGNS

- CN0239
- CN0360
- CN0369

REFERENCE MATERIALS

Press

- Analog Devices' 4-GHz PLL Synthesizer Offers Leading Phase Noise Performance
- New Analog Devices' PLL Synthesizers Deliver Utmost Flexibility and Phase Noise Performance
- New PLLs Deliver Widest Frequency Range Coverage and Lowest VCO Phase Noise in a Single Device

Product Selection Guide

- RF Source Booklet

Technical Articles

- MS-2739: High Dynamic IF Receiver Simplifies Design of Next Generation μW Point-to-Point Modems

DESIGN RESOURCES

- ADL5801 Material Declaration
- PCN-PDN Information
- Quality And Reliability
- Symbols and Footprints

DISCUSSIONS

View all ADL5801 EngineerZone Discussions.

SAMPLE AND BUY

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8/13—Rev. B to Rev. C

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2/10—Revision 0: Initial Version

SPECIFICATIONS

V_S = 5 V, T_A = 25°C, f_{RF} = 900 MHz, f_{LO} = (f_{RF} − 153 MHz), LO power = 0 dBm, Z_0[1] = 50 Ω, VSET = 3.6 V, unless otherwise noted.

Table 1.

Parameter	Test Conditions	Min	Typ	Max	Unit
RF INPUT INTERFACE					
Return Loss	Tunable to >20 dB over a limited bandwidth		12		dB
Input Impedance			50		Ω
RF Frequency Range		10		6000	MHz
OUTPUT INTERFACE					
Output Impedance	Differential impedance, f = 200 MHz		230		Ω
IF Frequency Range	Can be matched externally to 3000 MHz	LF		600	MHz
DC Bias Voltage[2]	Externally generated	4.75	V_S	5.25	V
LO INTERFACE					
LO Power		−10	0	+10	dBm
Return Loss			15		dB
Input Impedance			50		Ω
LO Frequency Range		10		6000	MHz
POWER INTERFACE					
Supply Voltage		4.75	5	5.25	V
Quiescent Current	Resistor programmable		130	200	mA
Disable Current	ENBL pin high to disable the device		50		mA
Disable Voltage	ENBL pin high to disable the device	2.5		5	V
Enable Voltage	ENBL pin low to enable the device	0		1.8	V
Enable Time	Time from ENBL pin low to enable		182		ns
Disable Time	Time from ENBL pin high to disable		28		ns
DYNAMIC PERFORMANCE at f_{RF} = 900 MHz/1900 MHz[3]					
Power Conversion Gain[4]	f_{RF} = 900 MHz		1.8		dB
	f_{RF} = 1900 MHz		1.8		dB
Voltage Conversion Gain[5]	f_{RF} = 900 MHz		7.8		dB
	f_{RF} = 1900 MHz		7.8		dB
SSB Noise Figure	f_{CENT} = 900 MHz, VSET = 2.0 V		9.75		dB
	f_{CENT} = 1900 MHz, VSET = 2.0 V		11.5		dB
SSB Noise Figure Under Blocking[6]	f_{CENT} = 900 MHz		19.5		dB
	f_{CENT} = 1900 MHz		20		dB
Input Third-Order Intercept[7]	f_{CENT} = 900 MHz		28.5		dBm
	f_{CENT} = 1900 MHz		26.4		dBm
Input Second-Order Intercept[8]	f_{CENT} = 900 MHz		63		dBm
	f_{CENT} = 1900 MHz		49.7		dBm
Input 1 dB Compression Point	f_{RF} = 900 MHz		13.3		dBm
	f_{RF} = 1900 MHz		12.7		dBm
LO-to-IF Output Leakage	Unfiltered IF output		−27		dBm
LO-to-RF Input Leakage			−30		dBm
RF-to-IF Output Isolation			−35		dBc
IF/2 Spurious[9]	0 dBm input power, f_{RF} = 900 MHz		−67.5		dBc
	0 dBm input power, f_{RF} = 1900 MHz		−53		dBc
IF/3 Spurious[9]	0 dBm input power, f_{RF} = 900 MHz		−65.5		dBc
	0 dBm input power, f_{RF} = 1900 MHz		−72.6		dBc

Parameter	Test Conditions	Min	Typ	Max	Unit
DYNAMIC PERFORMANCE at f_{RF} = 2500 MHz[10]					
Power Conversion Gain[11]			−6.1		dB
Voltage Conversion Gain[5]			−0.1		dB
SSB Noise Figure	f_{CENT} = 2500 MHz, VSET = 2.0 V		10.6		dB
Input Third-Order Intercept[12]	f_{CENT} = 2500 MHz		25.5		dBm
Input Second-Order Intercept[13]	f_{CENT} = 2500 MHz		45.3		dBm
Input 1 dB Compression Point	f_{CENT} = 2500 MHz		13.8		dBm
LO-to-IF Output Leakage	Unfiltered IF output		−31.5		dBm
LO-to-RF Input Leakage			−31.2		dBm
RF-to-IF Output Isolation			−42.5		dBc
IF/2 Spurious[9]	0 dBm input power, f_{RF} = 2600 MHz		−50.6		dBc
IF/3 Spurious[9]	0 dBm input power, f_{RF} = 2600 MHz		−59.8		dBc
DYNAMIC PERFORMANCE at f_{RF} = 3500 MHz[14]					
Power Conversion Gain[15]			−6.44		dB
Voltage Conversion Gain[5]			−0.44		dB
SSB Noise Figure	f_{CENT} = 3500 MHz, VSET = 3.6 V		15.8		dB
Input Third-Order Intercept[7]	f_{CENT} = 3500 MHz, VSET = 3.6 V		26.5		dBm
Input Second-Order Intercept[8]	f_{CENT} = 3500 MHz, VSET = 3.6 V		42.3		dBm
Input 1 dB Compression Point			12.5		dBm
LO-to-IF Output Leakage	Unfiltered IF output		−30.2		dBm
LO-to-RF Input Leakage			−29.4		dBm
RF-to-IF Output Isolation			−29.7		dBc
IF/2 Spurious[9]	0 dBm input power, f_{RF} = 3800 MHz		−47.1		dBc
IF/3 Spurious[9]	0 dBm input power, f_{RF} = 3800 MHz		−57.8		dBc
DYNAMIC PERFORMANCE at f_{RF} = 5500 MHz[16]					
Power Conversion Gain[17]			−5.2		dB
Voltage Conversion Gain[5]			0.8		dB
SSB Noise Figure	f_{CENT} = 5500 MHz, VSET = 3.6 V		16.2		dB
Input Third-Order Intercept[7]	f_{CENT} = 5500 MHz, VSET = 3.6 V		22.7		dBm
Input Second-Order Intercept[8]	f_{CENT} = 5500 MHz, VSET = 3.6 V		35.4		dBm
Input 1 dB Compression Point			11.3		dBm
LO-to-IF Output Leakage	Unfiltered IF output		−42.6		dBm
LO-to-RF Input Leakage			−28.9		dBm
RF-to-IF Output Isolation			−46.7		dBc
IF/2 Spurious[9]	0 dBm input power, f_{RF} = 5800 MHz		−44		dBc
IF/3 Spurious[9]	0 dBm input power, f_{RF} = 5800 MHz		−47		dBc
DYNAMIC PERFORMANCE at f_{IF} = 900 MHz[18]					
Power Conversion Gain[19]			−6		dB
Voltage Conversion Gain[5]			0		dB
SSB Noise Figure	f_{IF} = 900 MHz, f_{RF} = 250 MHz, VSET = 2.0 V		10.6		dB
Output Third-Order Intercept[20]	f_{CENT} = 153 MHz, VSET = 3.6 V		30.6		dBm
Output Second-Order Intercept[21]	f_{CENT} = 153 MHz, VSET = 3.6 V		68.7		dBm
Output 1 dB Compression Point			11.1		dBm
LO-to-IF Output Leakage	Unfiltered IF output		−33.8		dBm
LO-to-RF Input Leakage			−33.4		dBm
IF/2 Spurious[9]	0 dBm input power, f_{RF} = 140 MHz, f_{IF} = 806 MHz		−62.6		dBc
IF/3 Spurious[9]	0 dBm input power, f_{RF} = 140 MHz, f_{IF} = 806 MHz		−68.9		dBc

Parameter	Test Conditions	Min	Typ	Max	Unit
DYNAMIC PERFORMANCE at f_{IF} = 2140 MHz[22]					
Power Conversion Gain[23]			−7.25		dB
Voltage Conversion Gain[5]			−1.25		dB
SSB Noise Figure	f_{IF} = 2140 MHz, f_{RF} = 190 MHz, VSET = 2.0 V		13.6		dB
Output Third-Order Intercept[24]	f_{CENT} = 170 MHz, VSET = 3.6 V		24		dBm
Output Second-Order Intercept[25]	f_{CENT} = 170 MHz, VSET = 3.6 V		70		dBm
Output 1 dB Compression Point			9.9		dBm
LO-to-IF Output Leakage	Unfiltered IF output		−23.8		dBm
LO-to-RF Input Leakage			−33.2		dBm
IF/2 Spurious[9]	0 dBm input power, f_{RF} = 140 MHz, f_{IF} = 2210 MHz		−51.5		dBc

1 Z_0 is the characteristic impedance assumed for all measurements and the PCB.
2 Supply voltage must be applied from an external circuit through choke inductors
3 V_S = 5 V, T_A = 25°C, f_{RF} = 900 MHz/1900 MHz, f_{LO} = (f_{RF} – 153 MHz), LO power = 0 dBm, Z_0[1]= 50 Ω, VSET = 3.8 V, unless otherwise noted.
4 Excluding 4:1 IF port transformer (TC4-1W+), RF and LO port transformers (TC1-1-13M+), and PCB loss.
5 Z_{SOURCE} = 50 Ω, differential; Z_{LOAD} = 200 Ω differential; Z_{SOURCE} is the impedance of the source instrument; Z_{LOAD} is the load impedance at the output.
6 f_{RF} = f_{CENT}, $f_{BLOCKER}$ = (f_{CENT} − 5) MHz, f_{LO} = (f_{CENT} − 153) MHz, blocker level = 0 dBm.
7 f_{RF1} = (f_{CENT} − 1) MHz, f_{RF2} = (f_{CENT}) MHz, f_{LO} = (f_{CENT} – 153) MHz, each RF tone at −10 dBm.
8 f_{RF1} = (f_{CENT}) MHz, f_{RF2} = (f_{CENT} + 100) MHz, f_{LO} = (f_{CENT} – 153) MHz, each RF tone at −10 dBm.
9 For details, see the Spur Performance section.
10 V_S = 5 V, T_A = 25°C, f_{RF} = 2500 MHz, f_{LO} = (f_{RF} – 211 MHz), LO power = 0 dBm, Z_0[1] = 50 Ω, VSET = 3.8 V, unless otherwise noted.
11 Including 4:1 IF port transformer (TC4-1W+), RF and LO port transformers (TC1-1-43M+ and TC1-1-13M+ respectively), and PCB loss.
12 f_{RF1} = (f_{CENT} − 1) MHz, f_{RF2} = (f_{CENT}) MHz, f_{LO} = (f_{CENT} – 211) MHz, each RF tone at −10 dBm.
13 f_{RF1} = (f_{CENT}) MHz, f_{RF2} = (f_{CENT} + 100) MHz, f_{LO} = (f_{CENT} – 211) MHz, each RF tone at −10 dBm
14 V_S = 5 V, T_A = 25°C, f_{RF} = 3500 MHz, f_{LO} = (f_{RF} – 153 MHz), LO power = 0 dBm, Z_0[1] = 50 Ω, VSET = 3.6 V, unless otherwise noted.
15 Including 4:1 IF port transformer (TC4-1W+), RF and LO port transformers (3600BL14M050), and PCB loss.
16 V_S = 5 V, T_A = 25°C, f_{RF} = 5500 MHz, f_{LO} = (f_{RF} – 153 MHz), LO power = 0 dBm, Z_0[1] = 50 Ω, VSET = 3.6 V, unless otherwise noted.
17 Including 4:1 IF port transformer (TC4-1W+), RF and LO port transformers (5400BL14B050), and PCB loss.
18 V_S = 5 V, T_A = 25°C, f_{RF} = 153 MHz, f_{LO} = (f_{RF} + 900 MHz), LO power = 0 dBm, Z_0[1] = 50 Ω, VSET = 3.6 V, unless otherwise noted.
19 Including 4:1 IF port transformer (TC4-14+), RF and LO transformers (TC1-1-13M+), and PCB loss.
20 f_{RF1} = (f_{CENT} − 1) MHz, f_{RF2} = (f_{CENT}) MHz, f_{LO} = (f_{CENT} + 900 MHz), each RF tone at −10 dBm.
21 f_{RF1} = (f_{CENT}) MHz, f_{RF2} = (f_{CENT} + 100) MHz, f_{LO} = (f_{CENT} + 900) MHz, each RF tone at −10 dBm.
22 V_S = 5 V, T_A = 25°C, f_{RF} = 153MHz, f_{LO} = (f_{RF} + 2140 MHz), LO power = 0 dBm, Z_0[1] = 50 Ω, VSET = 4 V, unless otherwise noted.
23 Including 4:1 IF port transformer (1850BL15B200), RF and LO port transformers (TC1-1-13M+), and PCB loss.
24 f_{RF1} = (f_{CENT} − 1) MHz, f_{RF2} = (f_{CENT}) MHz, f_{LO} = (f_{CENT} + 2140 MHz), each RF tone at −10 dBm.
25 f_{RF1} = (f_{CENT}) MHz, f_{RF2} = (f_{CENT} + 100) MHz, f_{LO} = (f_{CENT} + 2140) MHz, each RF tone at −10 dBm.

ABSOLUTE MAXIMUM RATINGS

Table 2.

Parameter	Rating
Supply Voltage, VPOS	5.5 V
VSET, ENBL	5.5 V
IFOP, IFON	5.5 V
RFIN Power	20 dBm
Internal Power Dissipation	1.2 W
θ_{JA} (Exposed Paddle Soldered Down)[1]	26.5°C/W
θ_{JC} (at Exposed Paddle)	8.7°C/W
Maximum Junction Temperature	150°C
Operating Temperature Range	−40°C to +85°C
Storage Temperature Range	−65°C to +150°C

[1] As measured on the evaluation board. For details, see the Evaluation Board section.

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

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

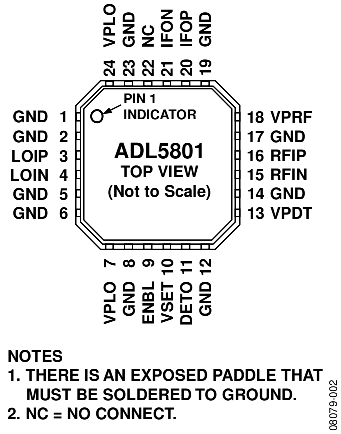

Figure 2. Pin Configuration

Table 3. Pin Function Descriptions

Pin No.	Mnemonic	Description
1, 2, 5, 6, 8, 12, 14, 17, 19, 23	GND	Device Common (DC Ground).
3, 4	LOIP, LOIN	Differential LO Input Terminal. Internally matched to 50 Ω. Must be ac-coupled.
7, 24	VPLO	Positive Supply Voltage for LO System.
9	ENBL	Detector and Mixer Bias Enable. Pull the pin high to disable the internal detector and mixer bias circuit. The device can be operated in this mode by setting the bias level using an external supply or connecting a resistor from the VSET pin to the positive supply. See the Circuit Description section for more details. Pull the pin low to enable the internal detector and mixer bias circuit.
10	VSET	Input IP3 Bias Adjustment. The voltage presented to the VSET pin sets the internal bias of the mixer core and allows for adaptive control of the input IP3 and NF characteristics of the mixer core.
11	DETO	Detector Output. The DETO pin should be loaded with a capacitor to ground. The developed voltage is proportional to the rms input level. When the DETO output voltage is connected to the VSET input pin, the part auto biases and increases input IP3 performance when presented with large signal input levels.
13	VPDT	Positive Supply Voltage for Detector.
15, 16	RFIN, RFIP	Differential RF Input Terminal. Internally matched to 50 Ω differential input impedance. Must be ac-coupled.
18	VPRF	Positive Supply Voltage for RF Input System.
20, 21	IFOP, IFON	Differential IF Output Terminal. Bias must be applied through pull-up choke inductors or the center tap of the IF transformer.
22	NC	Not Connected.
	EPAD	The exposed paddle must be soldered to ground.

TYPICAL PERFORMANCE CHARACTERISTICS

DOWNCONVERTER MODE WITH A BROADBAND BALUN

V_S = 5 V, T_A = 25°C, VSET = 3.8 V, IF = 153 MHz, as measured using a typical circuit schematic with low-side local oscillator (LO), unless otherwise noted. Insertion loss of input and output baluns (TC1-1-13M+, TC4-1W+) is extracted from the gain measurement.

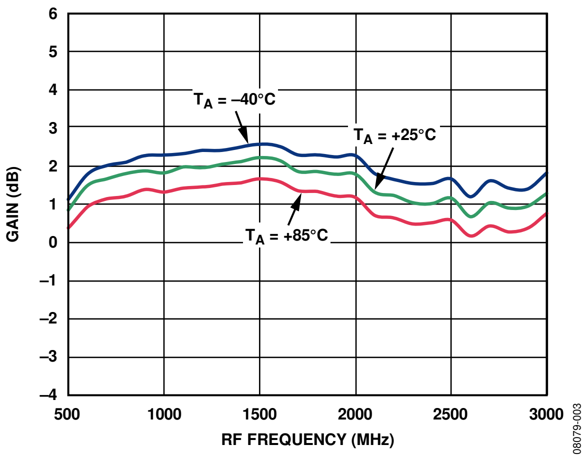

Figure 3. Power Conversion Gain vs. RF Frequency

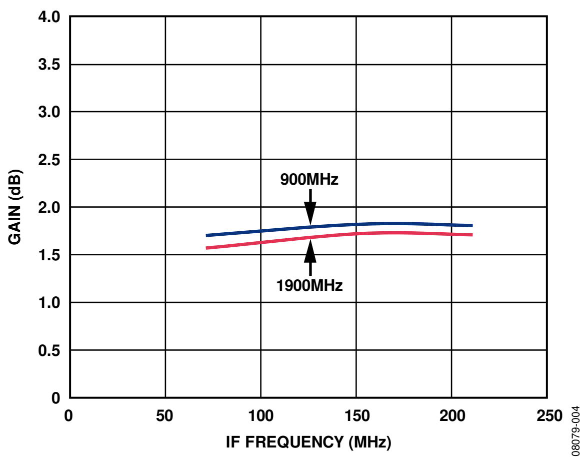

Figure 4. Power Conversion Gain vs. IF Frequency

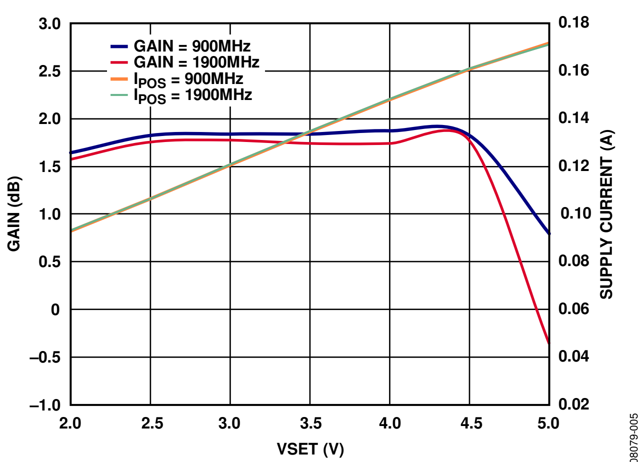

Figure 5. Power Conversion Gain and Supply Current vs. VSET

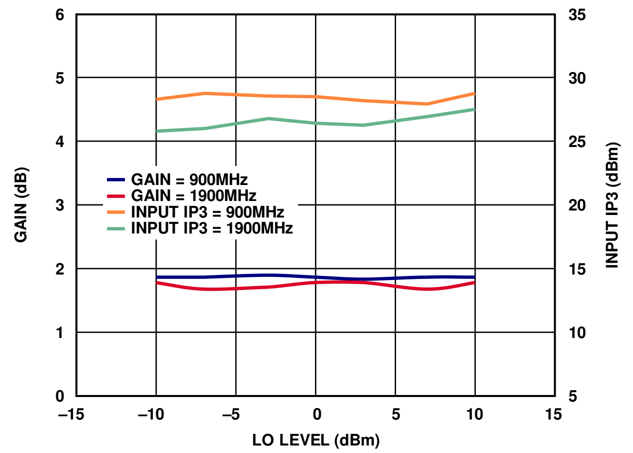

Figure 6. Power Conversion Gain and Input IP3 vs. LO Power

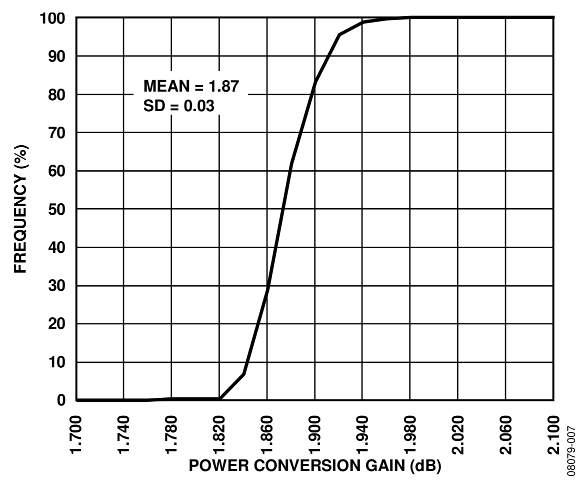

Figure 7. Power Conversion Gain Distribution

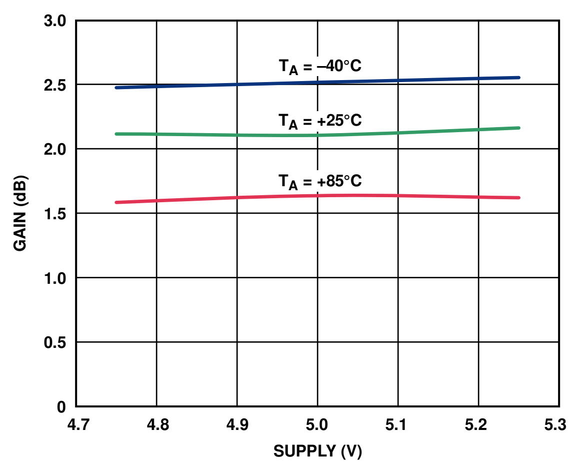

Figure 8. Power Conversion Gain vs. Supply Voltage

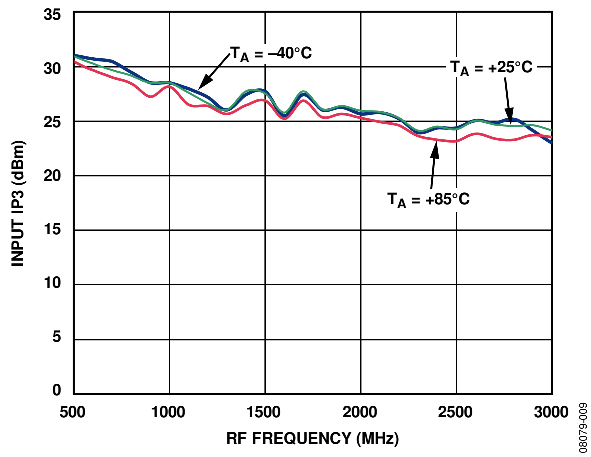

Figure 9. Input IP3 vs. RF Frequency

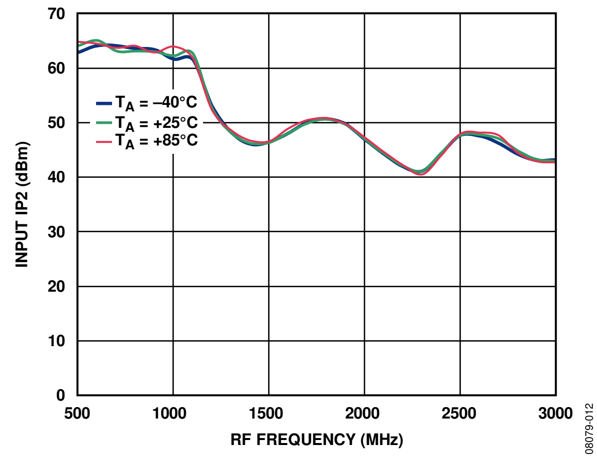

Figure 12. Input IP2 vs. RF Frequency

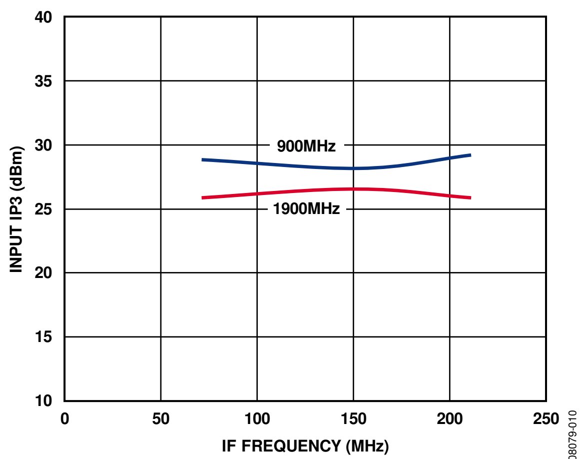

Figure 10. Input IP3 vs. IF Frequency

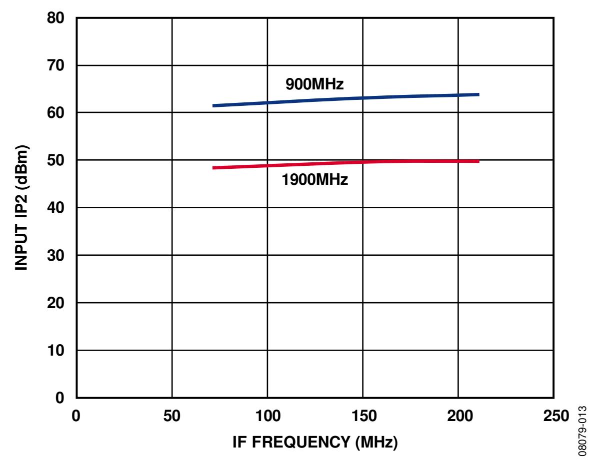

Figure 13. Input IP2 vs. IF Frequency

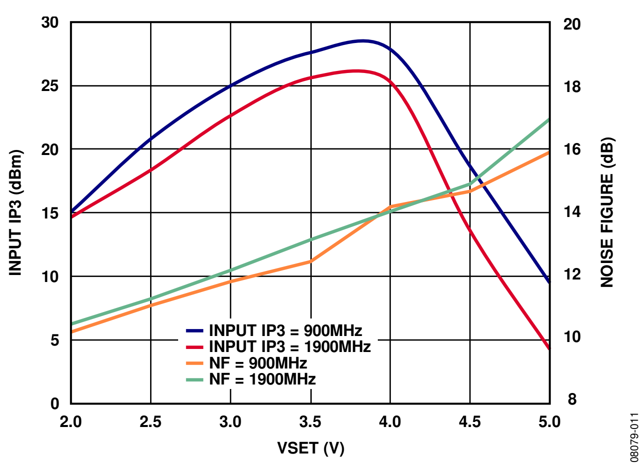

Figure 11. Input IP3 and Noise Figure vs. VSET

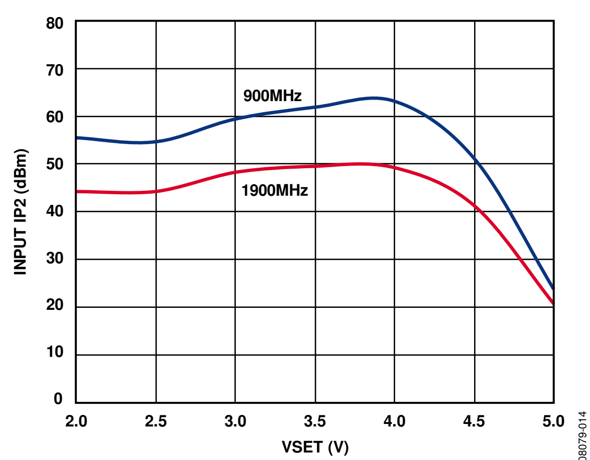

Figure 14. Input IP2 vs. VSET

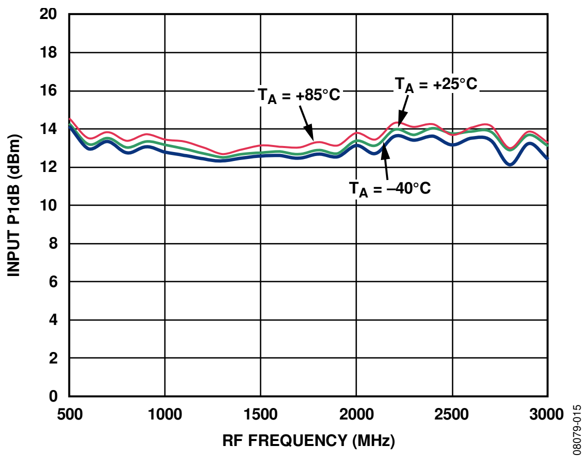

Figure 15. Input P1dB vs. RF Frequency

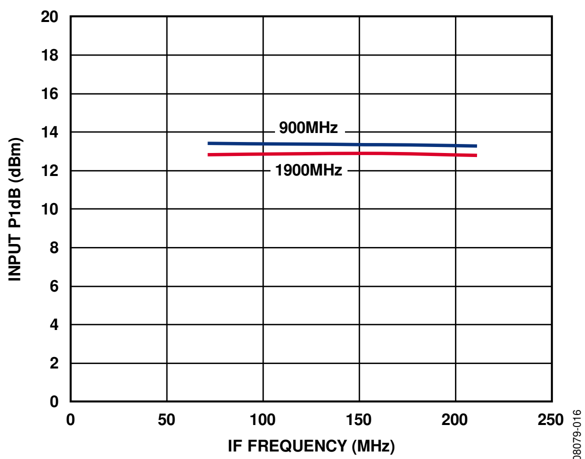

Figure 16. Input P1dB vs. IF Frequency

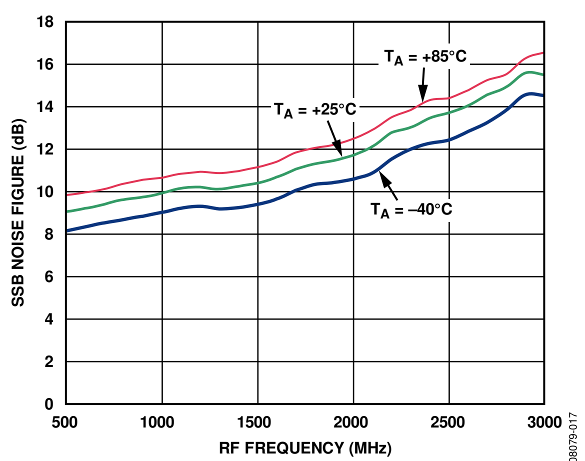

Figure 17. SSB Noise Figure vs. RF Frequency (VSET = 2.0 V)

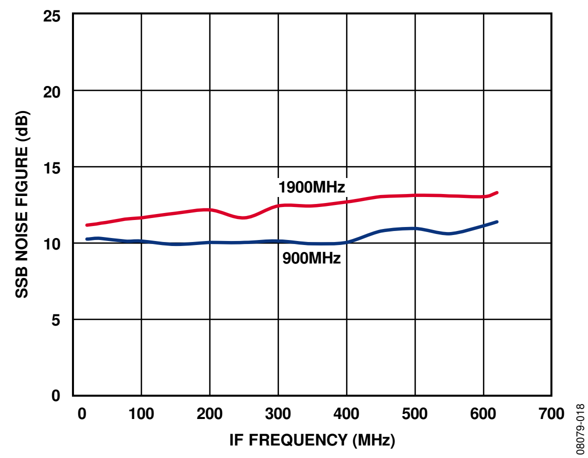

Figure 18. SSB Noise Figure vs. IF Frequency (VSET = 2.0 V)

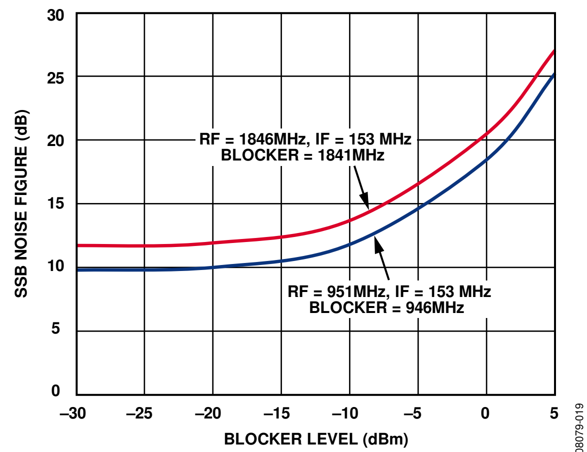

Figure 19. SSB Noise Figure vs. Blocker Level (VSET = 2.0 V)

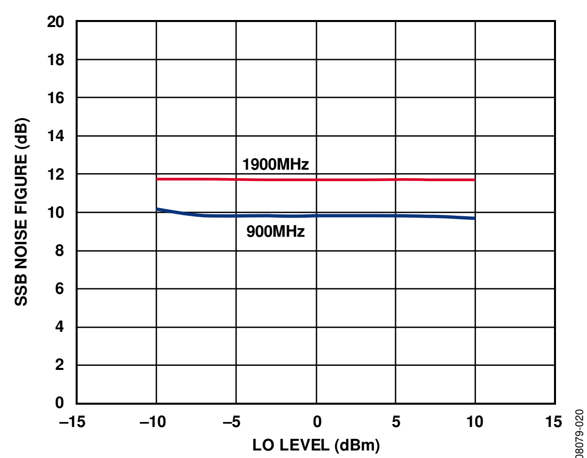

Figure 20. SSB Noise Figure vs. LO Power (VSET = 2.0 V)

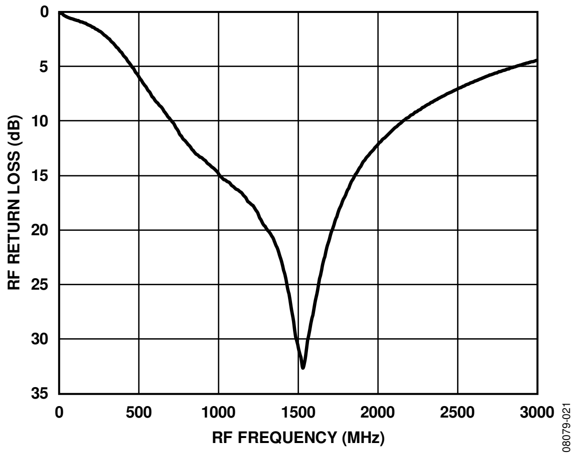

Figure 21. RF Return Loss vs. RF Frequency

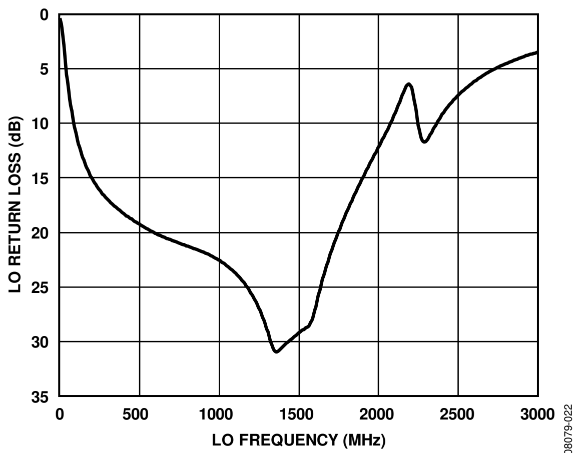

Figure 22. LO Return Loss vs. LO Frequency

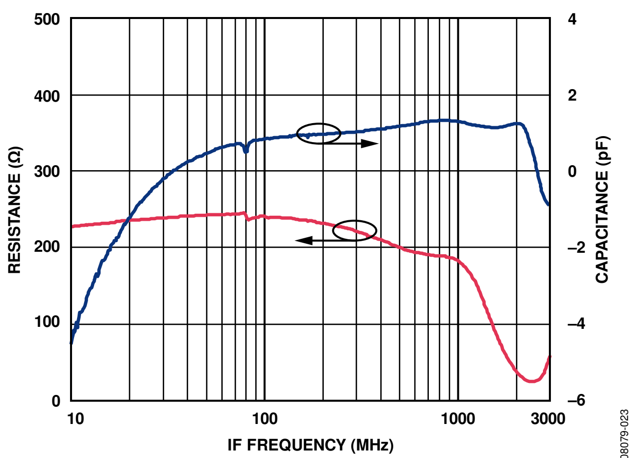

Figure 23. IF Differential Output Impedance (R Parallel C Equivalent)

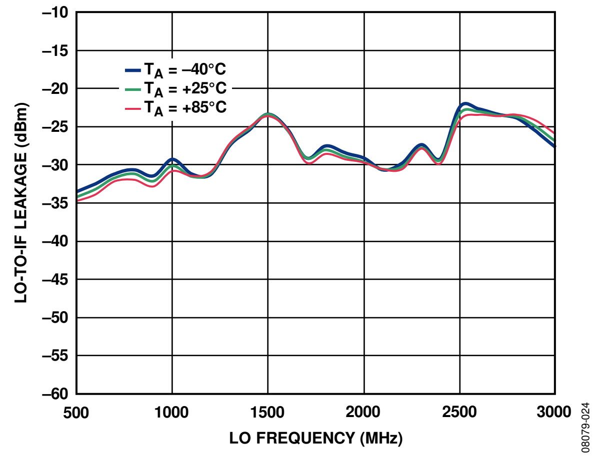

Figure 24. LO-to-IF Leakage vs. LO Frequency

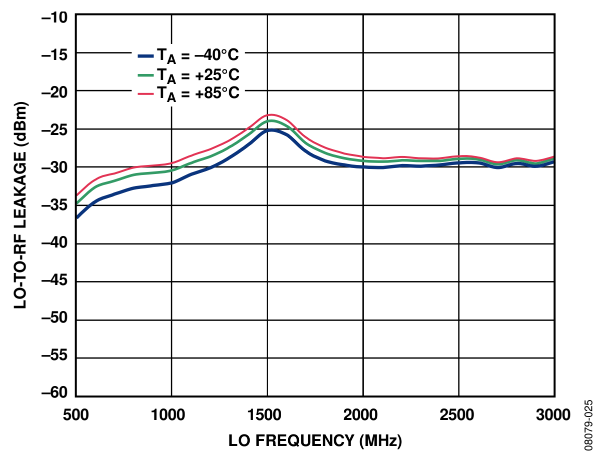

Figure 25. LO-to-RF Leakage vs. LO Frequency

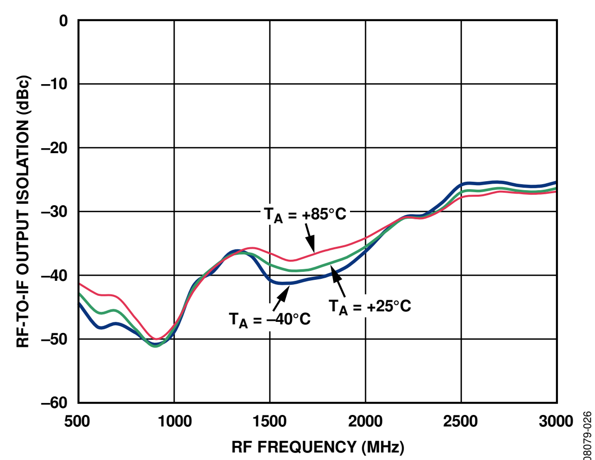

Figure 26. RF-to-IF Leakage vs. RF Frequency

DOWNCONVERTER MODE WITH A MINI-CIRCUITS® TC1-1-43M+ INPUT BALUN

V_S = 5 V, T_A = 25°C, VSET = 3.8 V, IF = 211 MHz, as measured using a typical circuit schematic with low-side local oscillator (LO), unless otherwise noted. Insertion loss of input and output baluns (TC1-1-43M+, TC4-1W+) is included in the gain measurement.

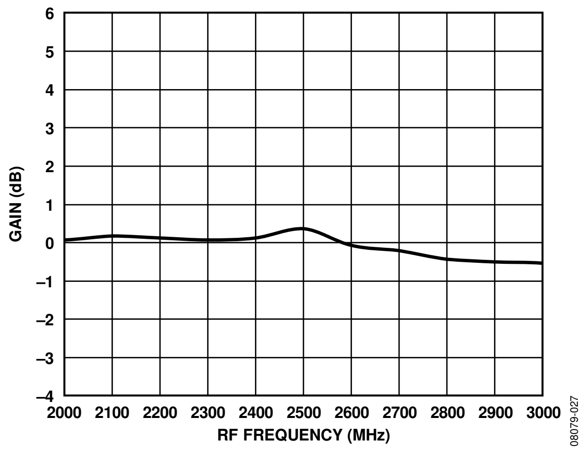

Figure 27. Power Conversion Gain vs. RF Frequency

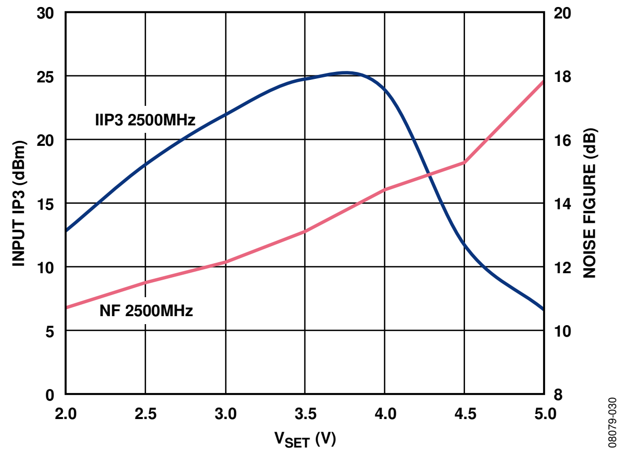

Figure 30. Input IP3 and Noise Figure vs. V_{SET}

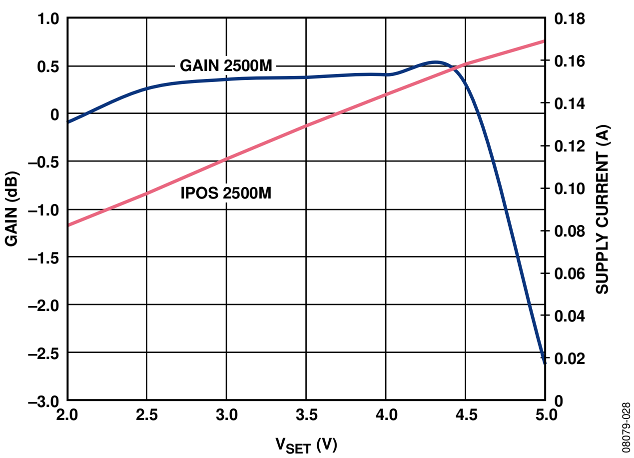

Figure 28. Power Conversion Gain and IPOS vs. V_{SET}

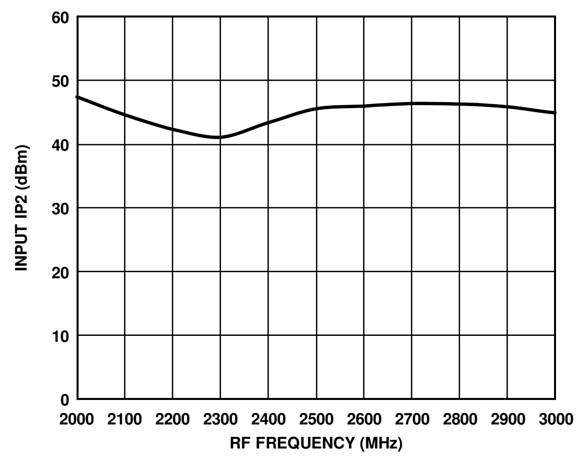

Figure 31. Input IP2 vs. RF Frequency

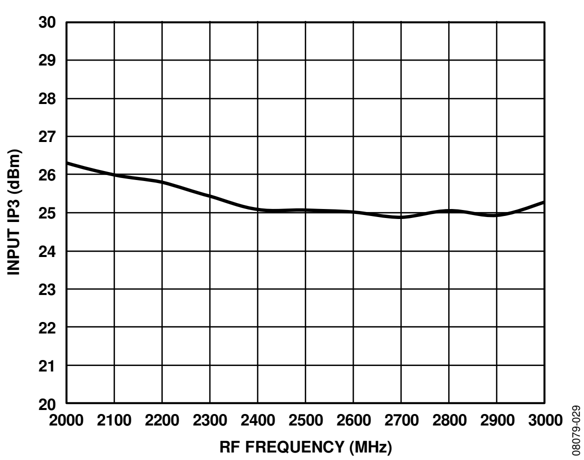

Figure 29. Input IP3 vs. RF Frequency

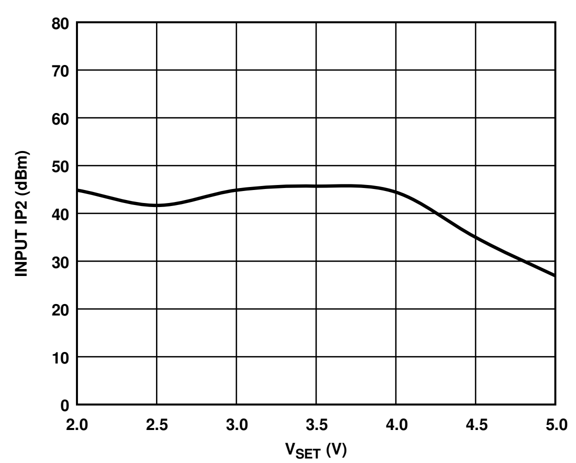

Figure 32. Input IP2 vs. V_{SET}

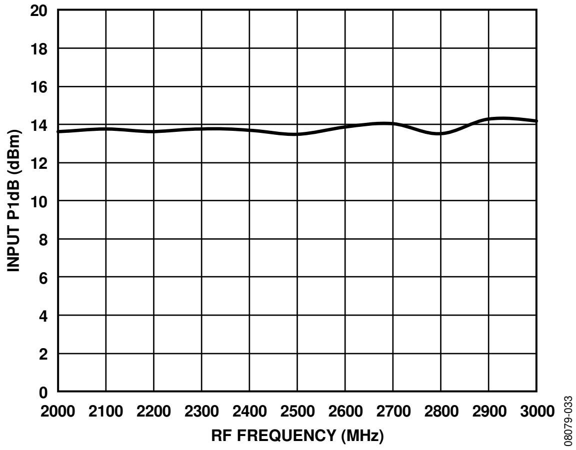

Figure 33. Input P1dB vs. RF Frequency

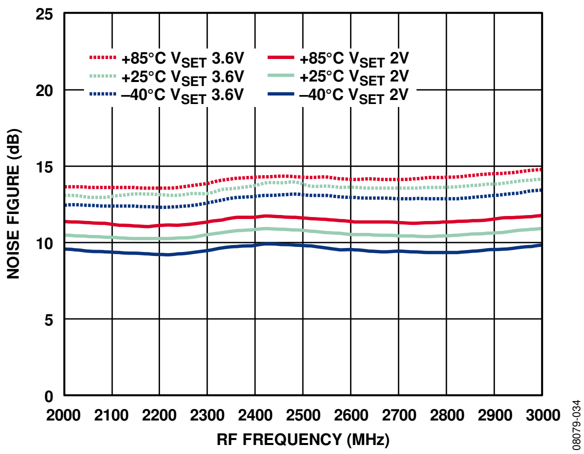

Figure 34. Noise Figure vs. RF Frequency

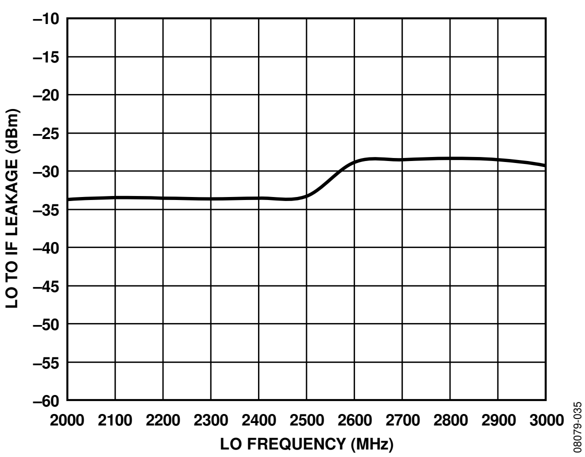

Figure 35. LO to IF Leakage vs. LO Frequency

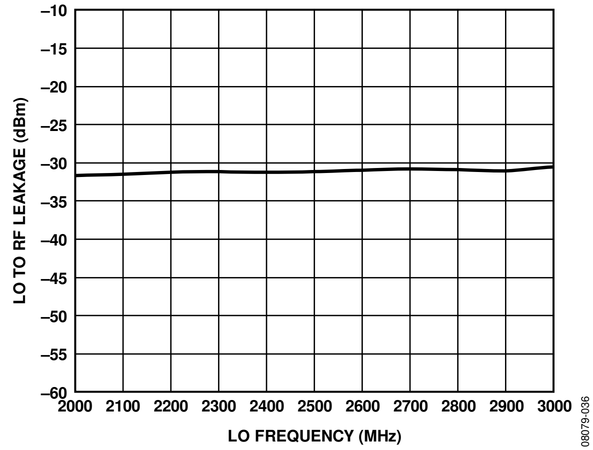

Figure 36. LO to RF Leakage vs. LO Frequency

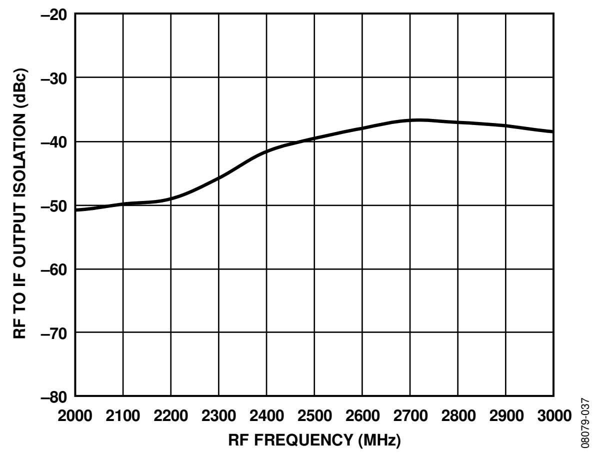

Figure 37. RF to IF Output Isolation vs. RF Frequency

DOWNCONVERTER MODE WITH A JOHANSON 3.5 GHZ INPUT BALUN

V_S = 5 V, T_A = 25°C, VSET = 3.6 V, IF = 153 MHz, as measured using a typical circuit schematic with low-side local oscillator (LO), unless otherwise noted. Insertion loss of input and output baluns (3600BL14M050, TC4-1W+) is included in the gain measurement.

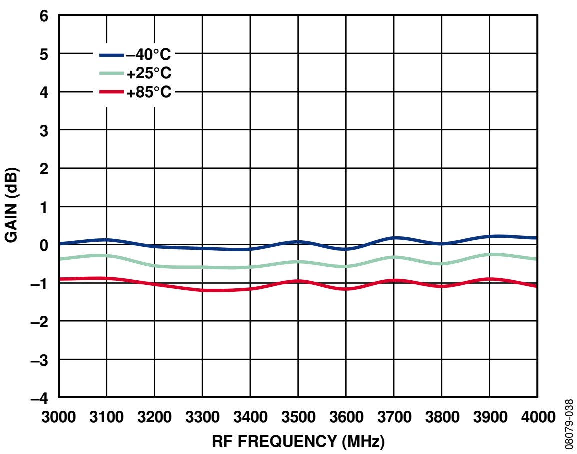

Figure 38. Power Conversion Gain vs. RF Frequency

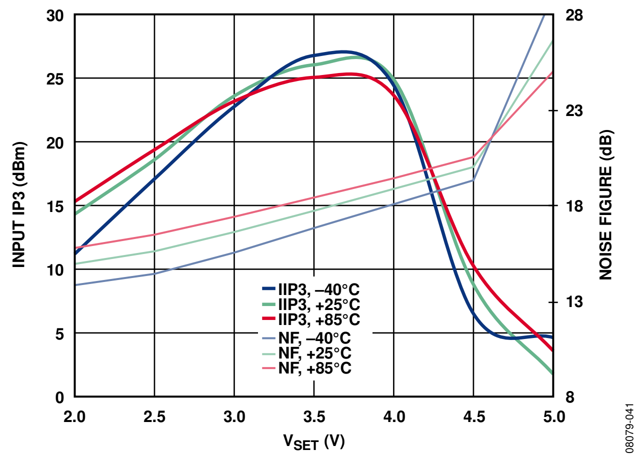

Figure 41. Input IP3 and Noise Figure vs. V_{SET}

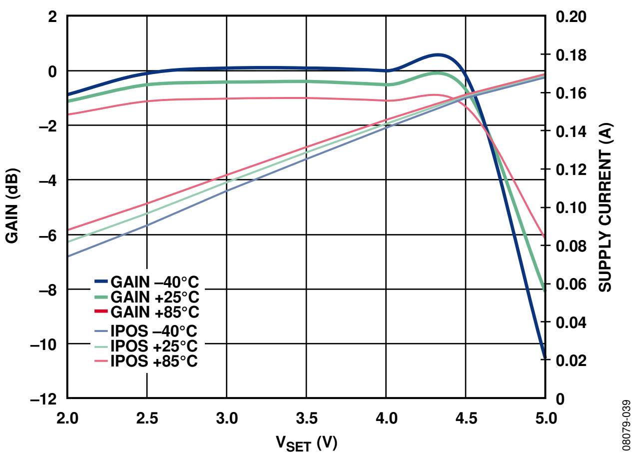

Figure 39. Power Conversion Gain and IPOS vs. V_{SET}

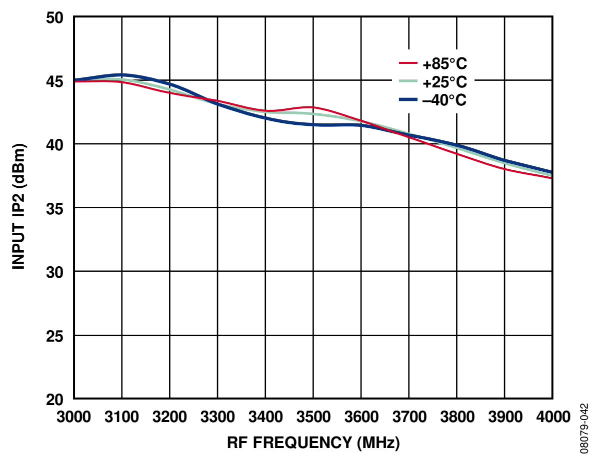

Figure 42. Input IP2 vs. RF Frequency

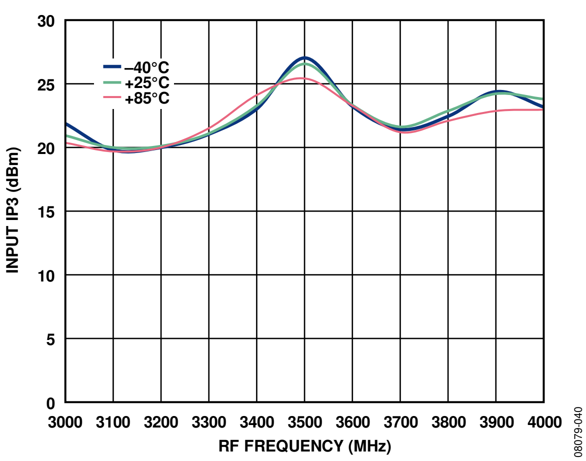

Figure 40. Input IP3 vs. RF Frequency

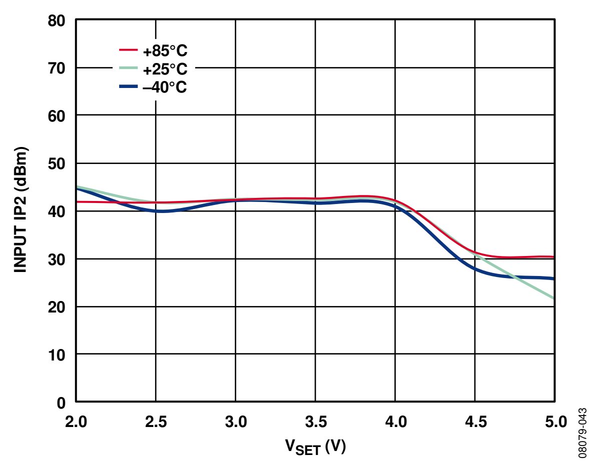

Figure 43. Input IP2 vs. V_{SET}

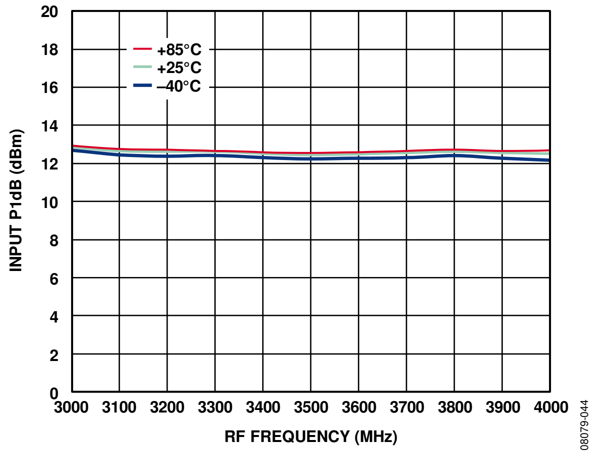

Figure 44. Input P1dB vs. RF Frequency

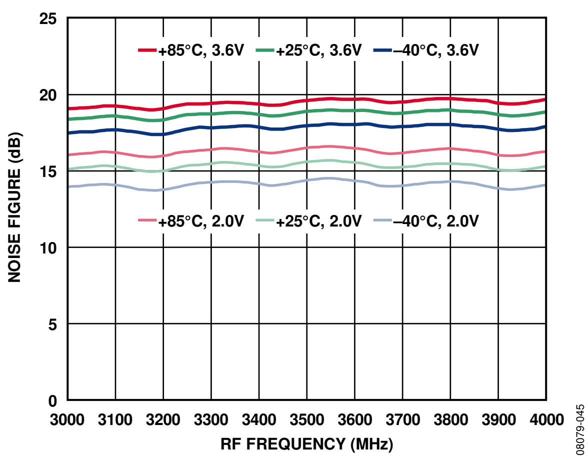

Figure 45. Noise Figure vs. RF Frequency

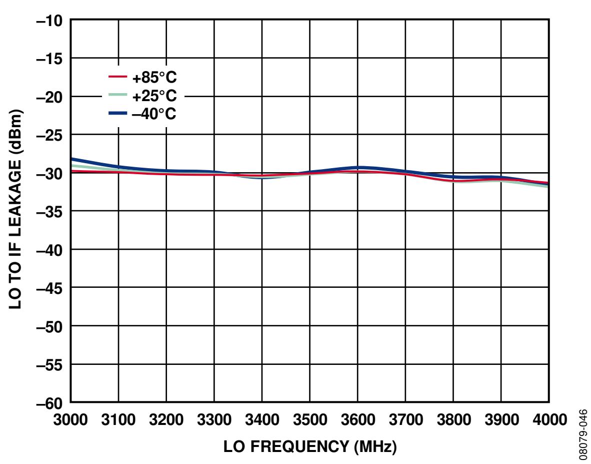

Figure 46. LO to IF Leakage vs. LO Frequency

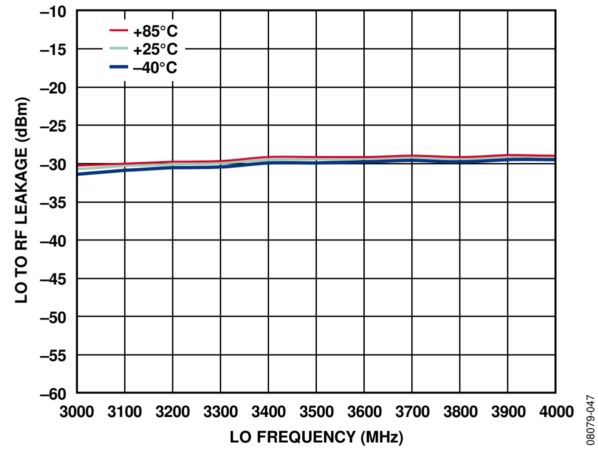

Figure 47. LO to RF Leakage vs. LO Frequency

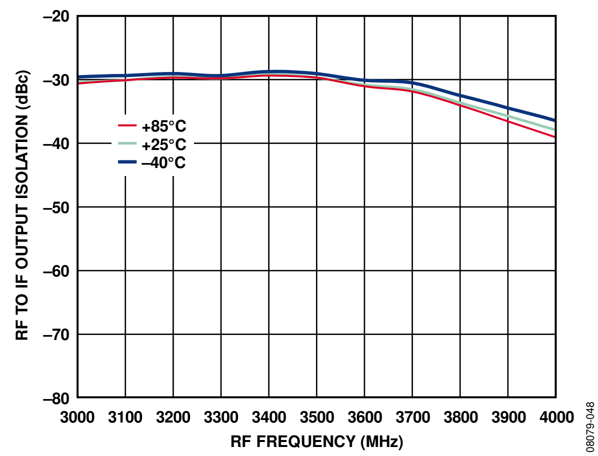

Figure 48. RF to IF Output Isolation vs. RF Frequency

DOWNCONVERTER MODE WITH A JOHANSON 5.7 GHZ INPUT BALUN

V_S = 5 V, T_A = 25°C, VSET = 3.6 V, IF = 153 MHz, as measured using a typical circuit schematic with low-side local oscillator (LO), unless otherwise noted. Insertion loss of input and output baluns (5400BL14B050, TC4-1W+) is included in the gain measurement.

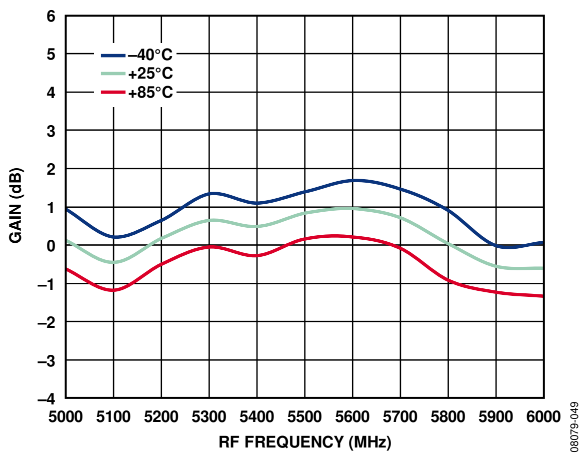

Figure 49. Power Conversion Gain vs. RF Frequency

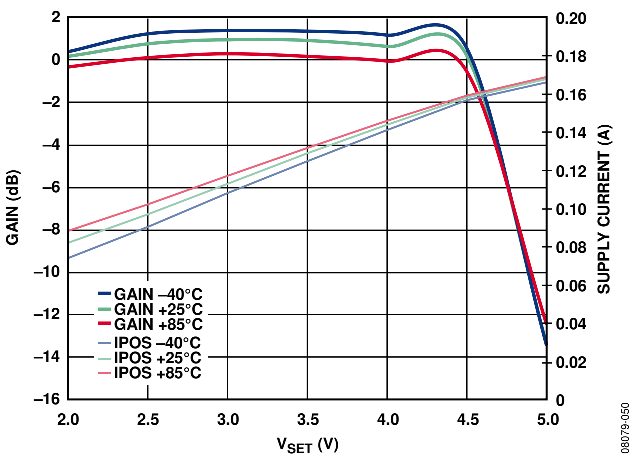

Figure 50. Power Conversion Gain and IPOS vs V_{SET}

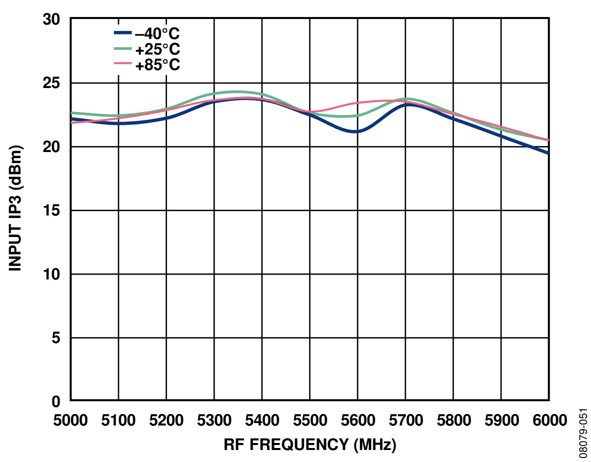

Figure 51. Input IP3 vs. RF Frequency

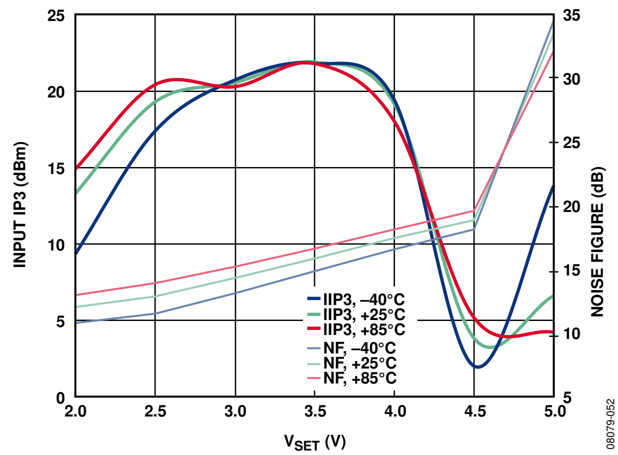

Figure 52. Input IP3 and Noise Figure vs. V_{SET}

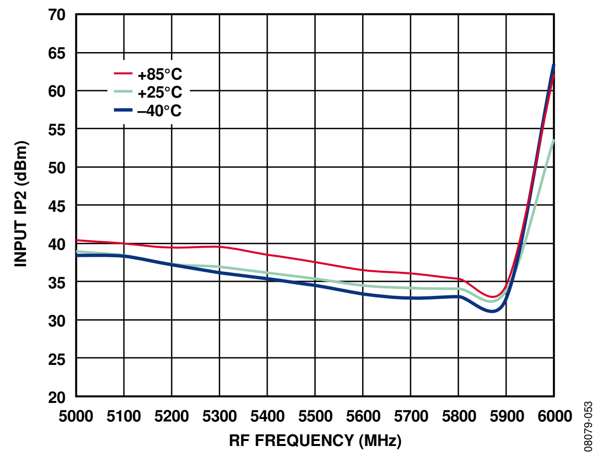

Figure 53. Input IP2 vs. RF Frequency

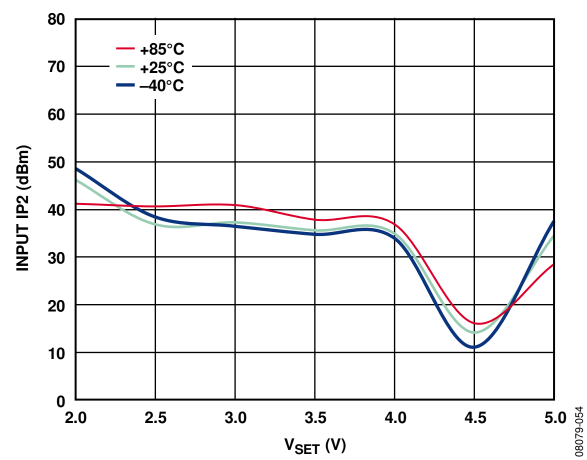

Figure 54. Input IP2 vs. V_{SET}

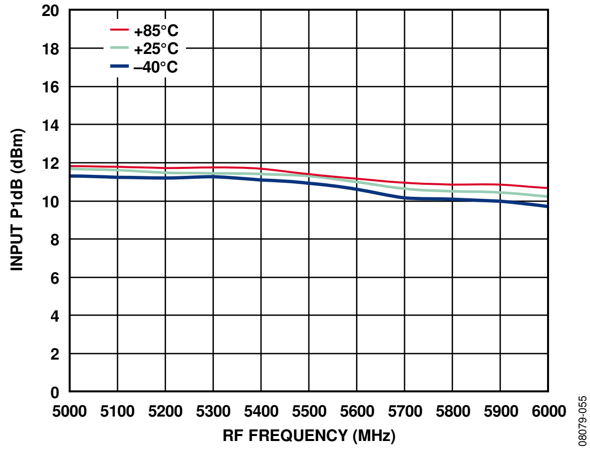

Figure 55. Input P1dB vs. RF Frequency

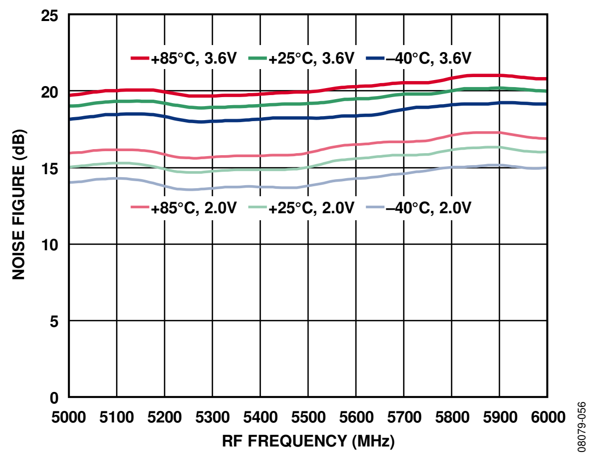

Figure 56. Noise Figure vs. RF Frequency, V_{SET} = 3.6 V

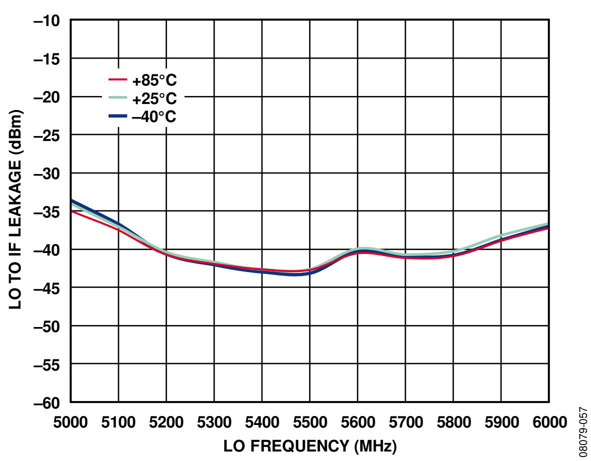

Figure 57. LO to IF Leakage vs. LO Frequency

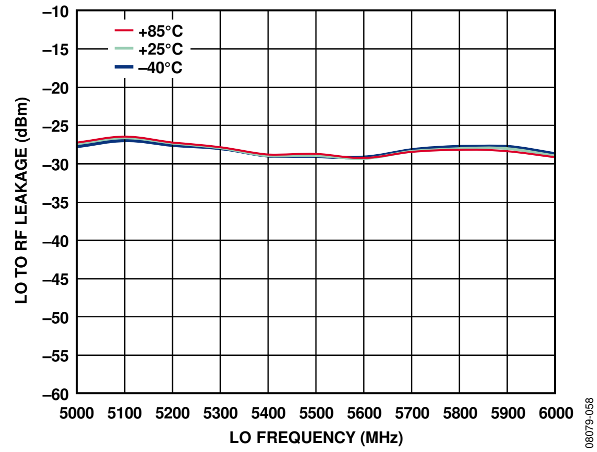

Figure 58. LO to RF Leakage vs. LO Frequency

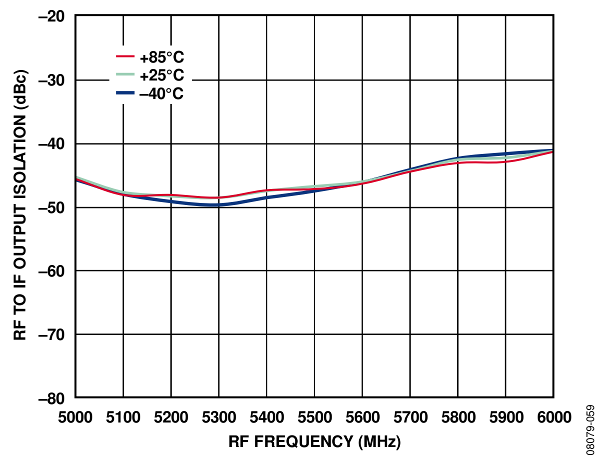

Figure 59. RF to IF Output Isolation vs. RF Frequency

UPCONVERTER MODE WITH A 900 MHZ OUTPUT MATCH

V_S = 5 V, T_A = 25°C, VSET = 3.6 V, RF = 153 MHz, as measured using a typical circuit schematic with low-side local oscillator (LO), unless otherwise noted. Insertion loss of input and output baluns (TC1-1-13M+, TC4-14) is included in the gain measurement.

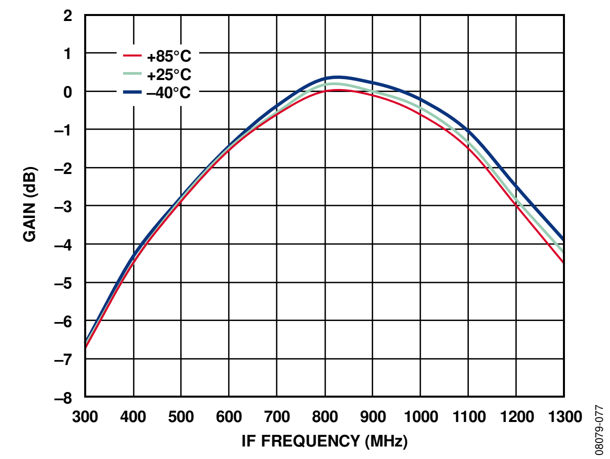

Figure 60. Power Conversion Gain vs. IF Frequency

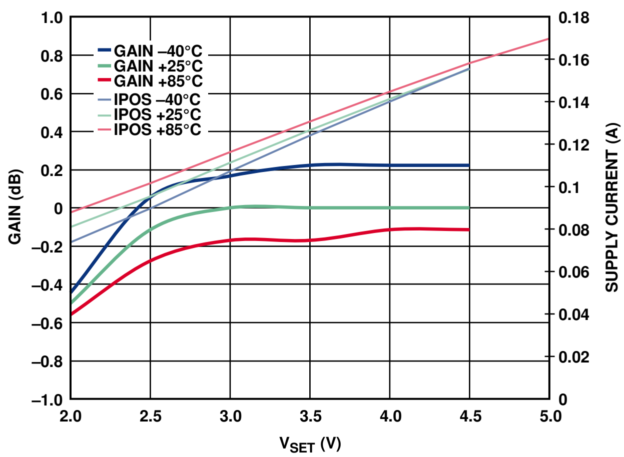

Figure 61. Power Conversion Gain and IPOS vs. V_{SET}

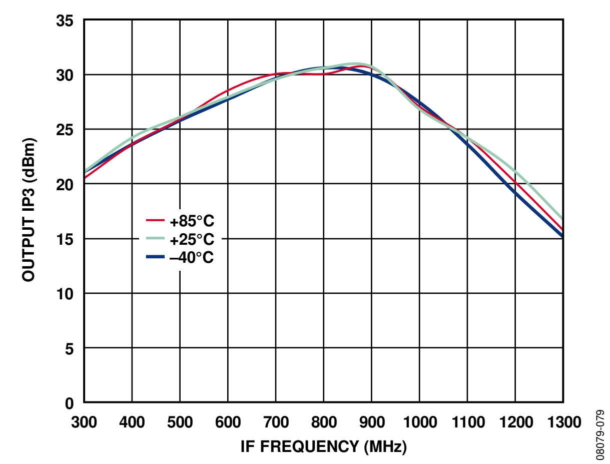

Figure 62. Output IP3 vs. IF Frequency

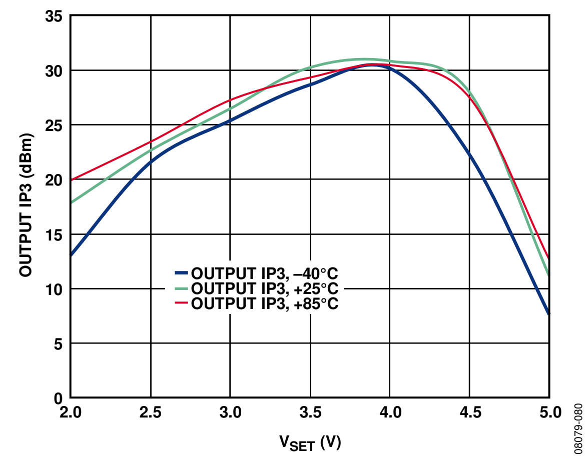

Figure 63. Output IP3 vs. V_{SET}

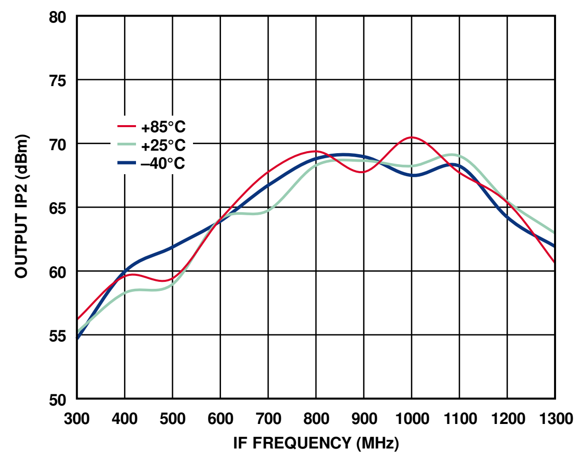

Figure 64. Output IP2 vs. IF Frequency

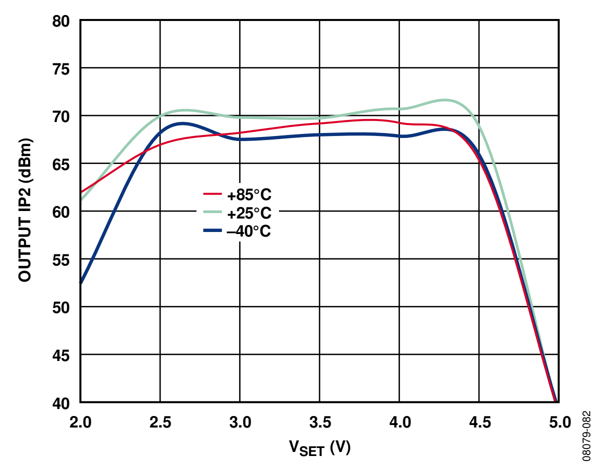

Figure 65. Output IP2 vs. V_{SET}

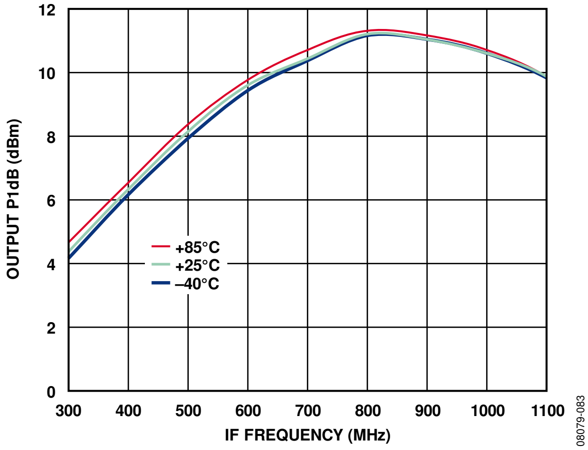

Figure 66. Output P1dB vs. IF Frequency

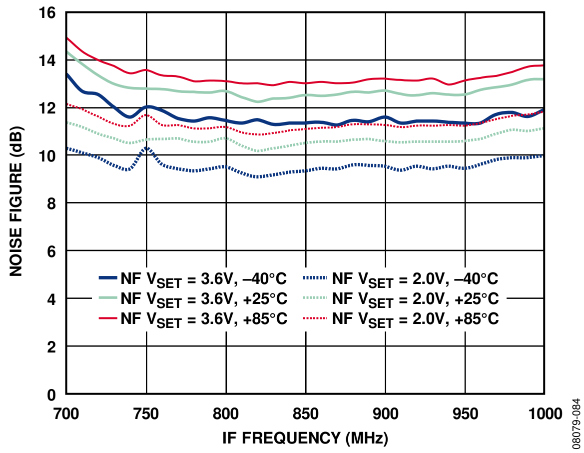

Figure 67. Noise Figure vs. IF Frequency, F_{LO} = 650 MHz

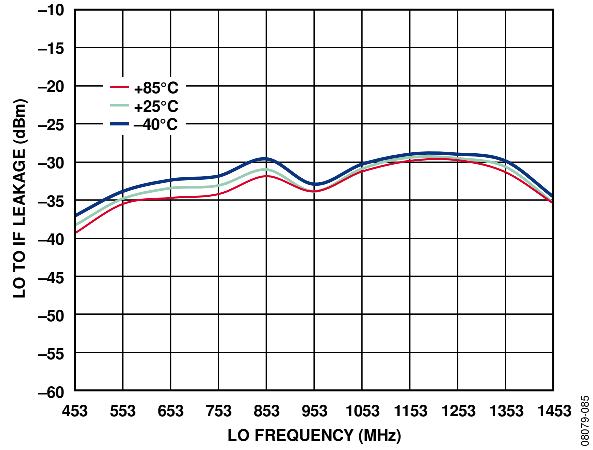

Figure 68. LO to IF Leakage vs. LO Frequency

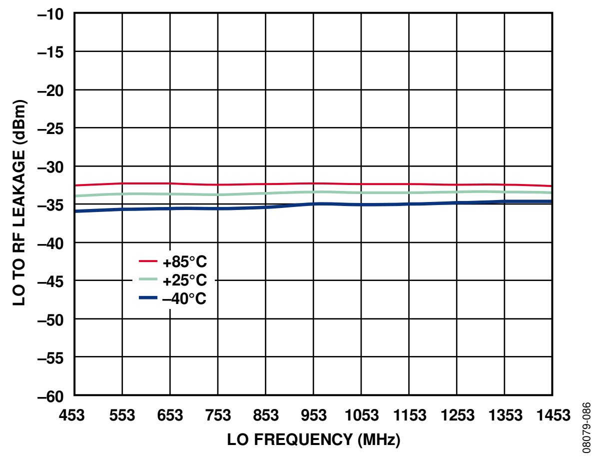

Figure 69. LO to RF Leakage vs. LO Frequency

UPCONVERTER MODE WITH A 2.1 GHZ OUTPUT MATCH

V_S = 5 V, T_A = 25°C, VSET = 4 V, RF = 170 MHz, as measured using a typical circuit schematic with low-side local oscillator (LO), unless otherwise noted. Insertion loss of input and output baluns (TC1-1-13M+, 1850BL15B200) is included in the gain measurement.

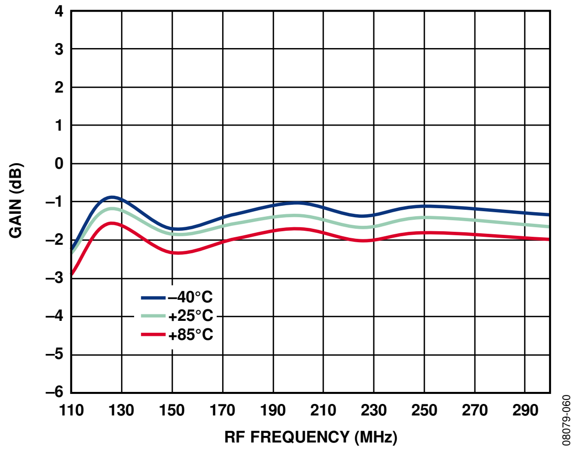

Figure 70. Power Conversion Gain vs. RF Frequency

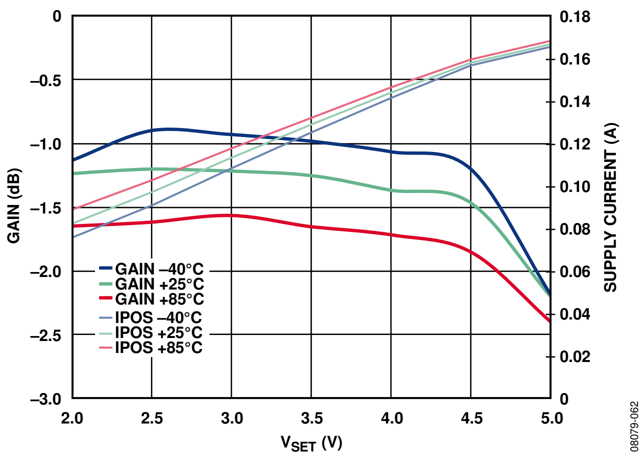

Figure 71. Power Conversion Gain and IPOS vs. V_{SET}

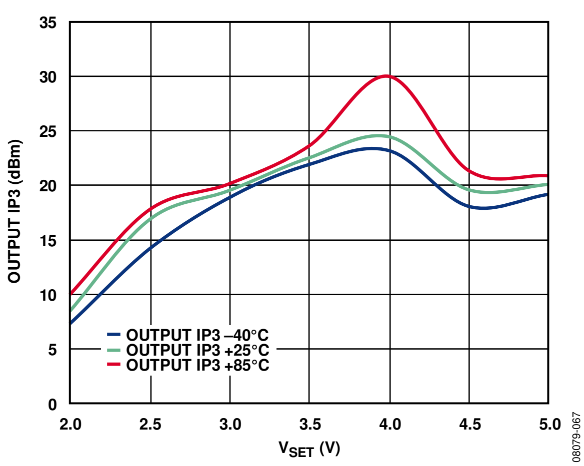

Figure 72. Output IP3 vs. V_{SET}

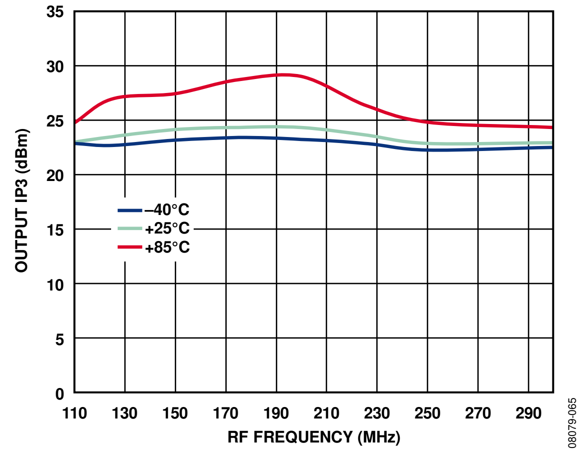

Figure 73. Output IP3 vs. RF Frequency

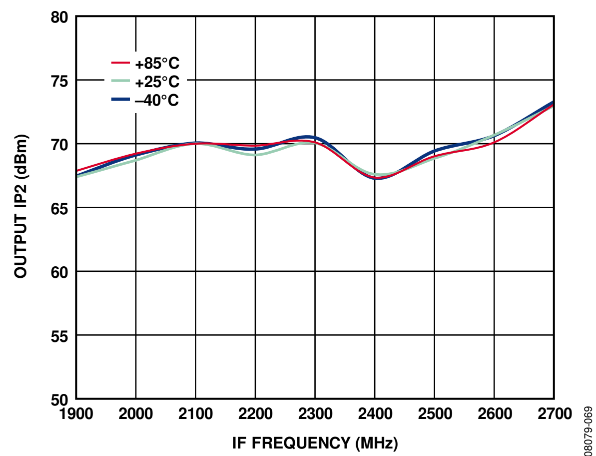

Figure 74. Output IP2 vs. IF Frequency

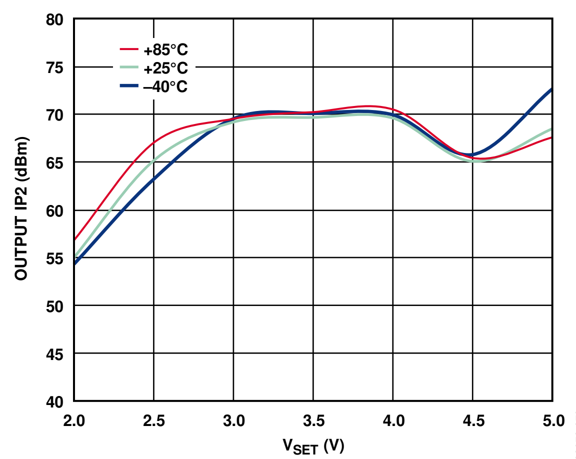

Figure 75. Output IP2 vs. V_{SET}

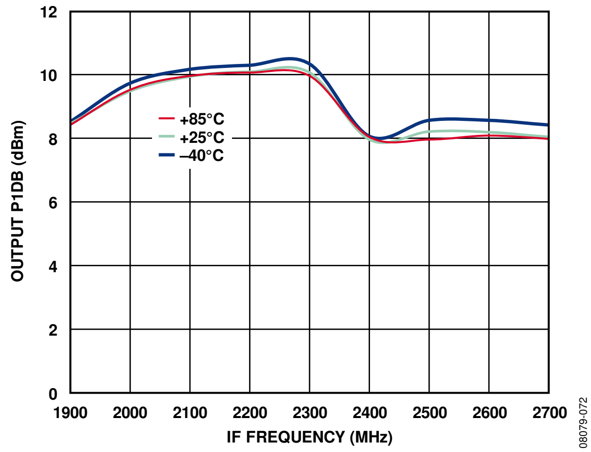

Figure 76. Output P1dB vs. IF Frequency

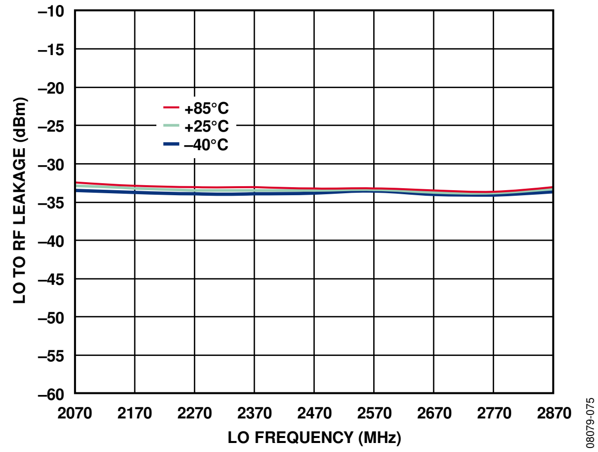

Figure 79. LO to RF Leakage vs. LO Frequency

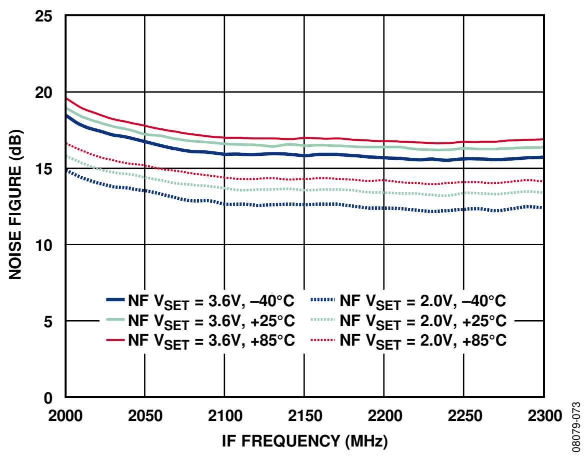

Figure 77. Noise Figure vs. IF Frequency, F_{LO} = 1950 MHz

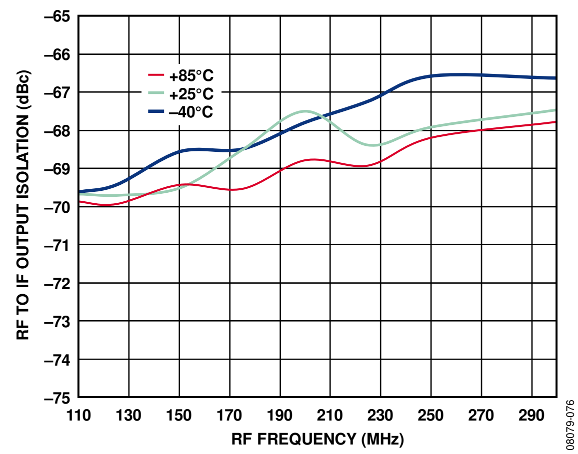

Figure 80. RF to IF Output Isolation vs. RF Frequency

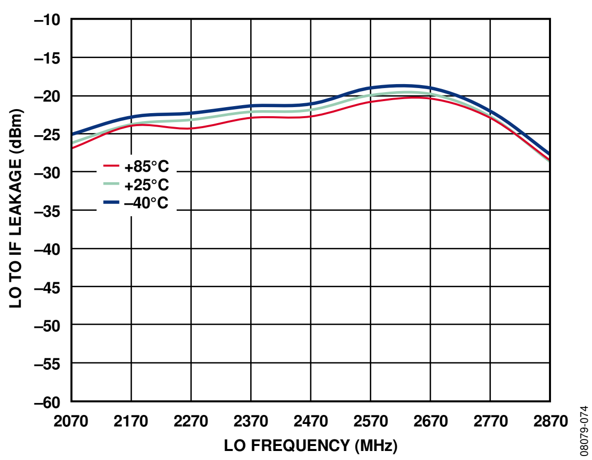

Figure 78. LO to IF Leakage vs. LO Frequency

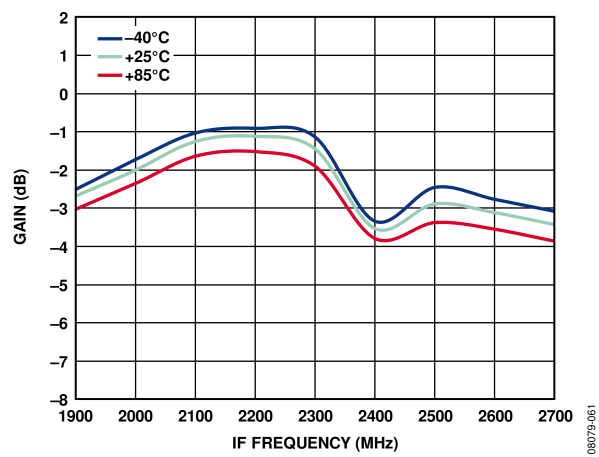

Figure 81. Power Conversion Gain vs. IF Frequency

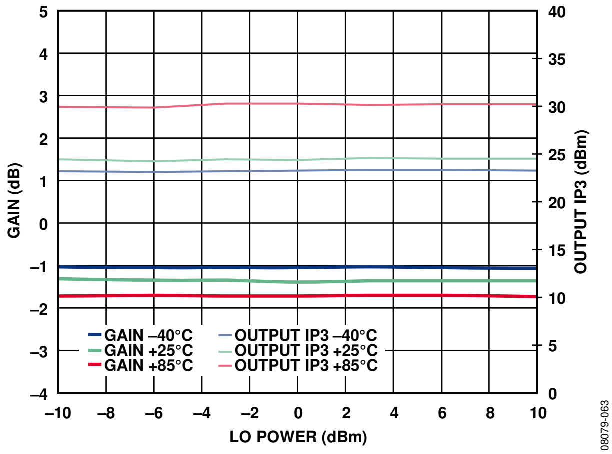

Figure 82. Power Conversion Gain and Output IP3 vs. LO Power

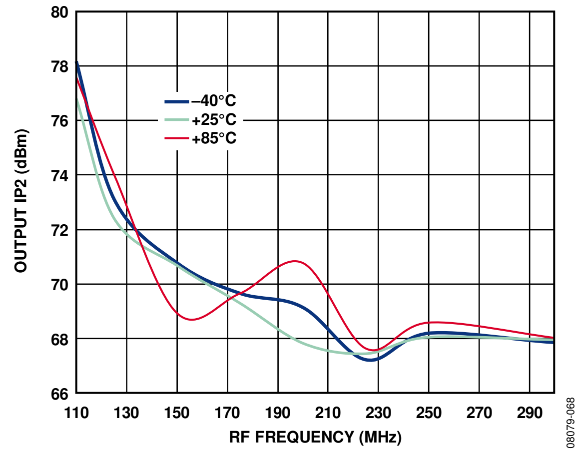

Figure 85. Output IP2 vs. RF Frequency

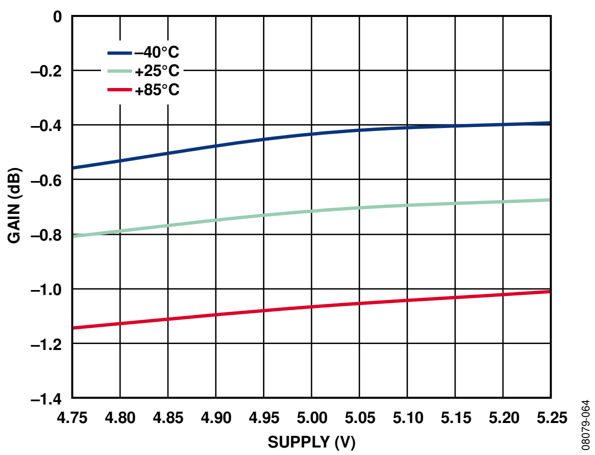

Figure 83. Power Conversion Gain vs. Supply

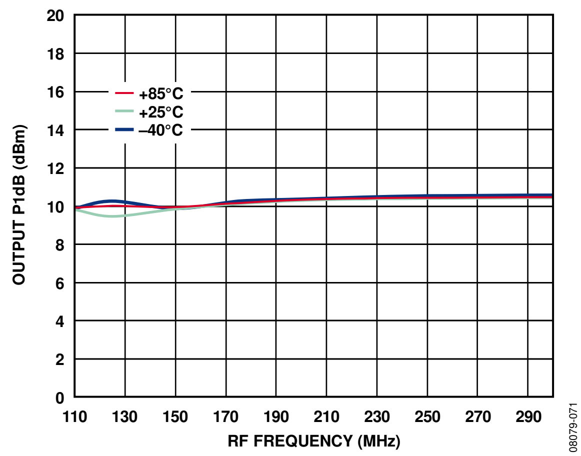

Figure 86. Output P1dB vs. RF Frequency

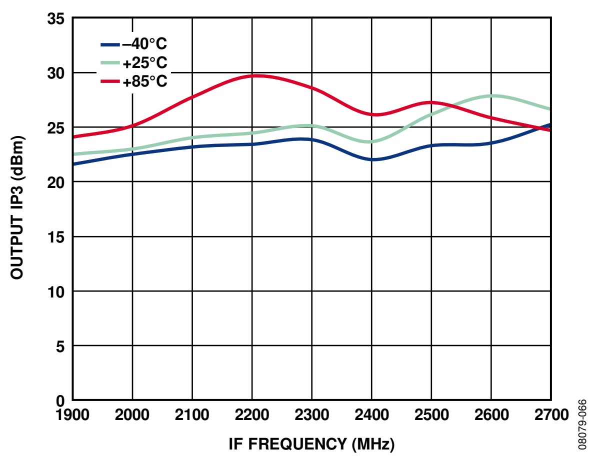

Figure 84. Output IP3 vs. IF Frequency

SPUR PERFORMANCE

All spur tables are (N × f_{RF}) − (M × f_{LO}) and were measured using the standard evaluation board (see the Evaluation Board section). Mixer spurious products are measured in decibels relative to the carrier (dBc) from the IF output power level. Data was measured for frequencies less than 6 GHz only. The typical noise floor of the measurement system is −100 dBm.

900 MHz Downconvert Performance

V_S = 5 V, VSET = 3.8 V, T_A = 25°C, RF power = 0 dBm, LO power = 0 dBm, f_{RF} = 900 MHz, f_{LO} = 703 MHz, Z_0 = 50 Ω.

		M														
		0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
	0		−33.1	−23.3	−45.8	−23.6	−45.9	−30.7	−55.4	−41.5						
	1	−48.8	0.0	−51.5	−19.0	−65.1	−29.6	−78.0	−50.3	−74.4	−57.7					
	2	−35.9	−74.9	−67.5	−66.1	−73.5	−80.5	−65.0	−89.8	−71.3	−88.5	−86.8	−98.8			
	3	−68.8	−64.8	−94.3	−65.9	−86.3	−70.2	−76.3	−70.6	−74.5	−81.4	≤−100	−99.6	≤−100		
	4	−47.5	−80.7	−78.0	−78.4	−95.1	−73.5	−89.4	−87.3	≤−100	−92.7	−99.5	−99.4	≤−100	≤−100	
	5	−95.6	−74.7	−89.8	−70.7	−84.8	−90.7	−86.7	−86.4	−83.1	−73.7	−78.7	−80.7	−91.1	≤−100	≤−100
	6	−85.7	−96.4	−83.1	−98.5	−83.3	−96.7	≤−100	−89.4	−99.6	−96.1	−96.1	−95.4	−95.5	≤−100	≤−100
N	**7**		≤−100	≤−100	−95.9	≤−100	−97.2	−83.1	−84.1	≤−100	≤−100	−99.7	−87.9	−88.8	−85.7	≤−100
	8			≤−100	≤−100	−99.0	−99.8	−86.0	≤−100	≤−100	≤−100	≤−100	≤−100	≤−100	≤−100	≤−100
	9				≤−100	≤−100	≤−100	−90.9	−88.4	−83.5	−87.6	≤−100	≤−100	≤−100	≤−100	≤−100
	10						≤−100	≤−100	≤−100	−97.9	−95.5	−99.0	≤−100	≤−100	≤−100	≤−100
	11							≤−100	≤−100	−92.6	−87.4	−88.2	−92.3	−99.3	≤−100	≤−100
	12								≤−100	≤−100	≤−100	≤−100	≤−100	≤−100	≤−100	≤−100
	13										≤−100	≤−100	−95.1	−96.5	−90.4	≤−100
	14											≤−100	≤−100	≤−100	≤−100	≤−100
	15												≤−100	≤−100	≤−100	≤−100

1900 MHz Downconvert Performance

V_S = 5 V, VSET = 3.8 V, T_A = 25°C, RF power = 0 dBm, LO power = 0 dBm, f_{RF} = 1900 MHz, f_{LO} = 1703 MHz, Z_0 = 50 Ω.

		M														
		0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
	0		−31.4	−17.1	−51.4											
	1	−40.4	0.0	−53.6	−38.5	−71.0										
	2	−38.4	−66.0	−52.9	−68.1	−64.2	−86.8									
	3	≤−100	−66.2	−73.2	−72.6	−79.9	−65.2	−92.8								
	4		≤−100	−89.4	−86.4	−94.6	−87.4	−81.5	≤−100							
	5				−83.7	−66.2	−79.3	−89.0	−75.2	≤−100	≤−100					
	6					≤−100	−86.4	≤−100	−99.0	−87.7	≤−100	≤−100				
N	7						≤−100	−92.4	−92.7	≤−100	−98.4	≤−100	≤−100			
	8							≤−100	≤−100	−97.5	≤−100	−95.4	≤−100	≤−100		
	9								≤−100	≤−100	≤−100	≤−100	≤−100	≤−100	≤−100	
	10									≤−100	−97.2	−95.6	≤−100	≤−100	≤−100	≤−100
	11										≤−100	≤−100	≤−100	≤−100	≤−100	≤−100
	12											≤−100	≤−100	≤−100	≤−100	≤−100
	13												≤−100	≤−100	≤−100	≤−100
	14														≤−100	≤−100
	15															≤−100

2600 MHz Downconvert Performance

V_S = 5 V, VSET = 3.8 V, T_A = 25°C, RF power = 0 dBm, LO power = 0 dBm, f_{RF} = 2600 MHz, f_{LO} = 2350 MHz, Z_0 = 50 Ω.

		M															
		0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
N	**0**		−31.5	−30.3													
	1	−40.3	0.0	−55.8	−33.8												
	2	−71.7	−73.6	−50.6	−70.4	−64.8											
	3		−83.9	−66.5	−59.8	−71.3	−84.7										
	4			−94.7	−77.6	−92.6	−83.8	−90.6									
	5				−91.4	−71.1	−89.7	−98.2	−96.3	<100							
	6						−83.1	−90.3	−92.9	−97.3	<100						
	7							<100	−91.4	<100	<100	<100					
	8								<100	−96.6	<100	−91.8	<100				
	9									<100	−97.9	<100	−98.5	<100			
	10										<100	−93.5	<100	−98.8	<100		
	11											<100	<100	<100	<100	<100	
	12												<100	<100	<100	<100	<100
	13													<100	<100	<100	<100
	14														<100	<100	<100
	15																<100

3800 MHz Downconvert Performance

V_S = 5 V, VSET = 3.8 V, T_A = 25°C, RF power = 0 dBm, LO power = 0 dBm, f_{RF} = 3800 MHz, f_{LO} = 3500 MHz, Z_0 = 50 Ω.

		M															
		0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
N	**0**		−27.3														
	1	−33.7	0.0	−54.9													
	2		−78.5	−47.1	−66.4												
	3			−63.6	−57.8	−81.4											
	4				−89.6	−77.2	−72.2	−99.2									
	5					<100	−88.0	−80.4	<100								
	6						<100	−90.0	−90.4	<100							
	7							<100	−79.1	<100	<100						
	8								<100	−85.2	<100	<100					
	9										<100	<100	<100				
	10											<100	−95.9	<100			
	11												<100	<100	<100		
	12													<100	<100	<100	
	13														<100	<100	<100
	14															<100	<100
	15																<100