18 GHz to 55 GHz, GaAs, MMIC, Wideband I/Q Mixer

FEATURES

- Conversion loss: 8 dB typical
- Input IP3: 23 dBm typical
- Input P1dB: 15 dBm typical
- Image rejection: 25 dBc typical
- LO to RF isolation: 45 dB typical
- LO to IF isolation: 40 dB typical
- RF to IF isolation: 45 dB typical
- IF pin frequency: DC to 20 GHz
- Passive: no DC bias required
- 20-terminal, RoHS compliant, 5 mm × 5 mm, LGA package

APPLICATIONS

- Microwave and very small aperture terminal (VSAT) radios
- Test equipment
- Military electronic warfare (EW)
- Electronic countermeasure (ECM)
- Command, control, communications, and intelligence (C3I)

FUNCTIONAL BLOCK DIAGRAM

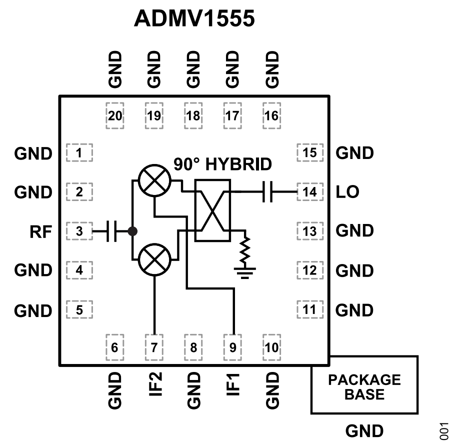

Figure 1. Functional Block Diagram

GENERAL DESCRIPTION

The ADMV1555 is a compact, in-phase/quadrature (I/Q) mixer in a leadless, RoHS compliant, surface-mount technology (SMT), land grid array (LGA) package. The device can be used as either an image reject mixer or a single sideband upconverter. The ADMV1555 uses two standard double balanced mixer cells and a 90° hybrid fabricated in a gallium arsenide (GaAs), monolithic microwave integrated circuit (MMIC) process and requires no external components or matching circuitry. It is a much smaller alternative to a hybrid style image reject mixer and a single sideband upconverter assembly. The RoHS compliant ADMV1555 eliminates the need for wire bonding, allowing the use of surface-mount manufacturing techniques. The ADMV1555 is available in a compact, 5 mm × 5 mm, 20-terminal LGA package and operates over −40°C to +85°C temperatures range.

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REVISION HISTORY

6/2024—Revision 0: Initial Version

SPECIFICATIONS

T_A = 25°C, intermediate frequency (IF) = 1 GHz, low oscillator (LO) drive level = 21 dBm, and upper sideband, unless otherwise noted.

Table 1. Specifications

Parameter	Test Conditions/Comments	Min	Typ	Max	Unit
FREQUENCY RANGE					
RF		18		55	GHz
LO		18		55	GHz
IF		DC		20	GHz
LO AMPLITUDE		19	21	23	dBm
RF PERFORMANCE					
Downconverter (IF Output (IF_{OUT}))	Taken as image reject mixer				
Conversion Loss			8		dB
Input Third-Order Intercept (IP3)			20		dBm
Input 1 dB Compression Point (P1dB)			15		dBm
Image Rejection			25		dBc
Upconverter (RF Output (RF_{OUT}))	Taken as single sideband upconverter mixer				
Conversion Loss			8	13	dB
IP3		20	23		dBm
P1dB			15		dBm
Sideband Rejection		19	25		dBc
Isolation	Taken without external 90° IF hybrid				
LO to RF		38	45		dB
LO to IF			40		dB
RF to IF			45		dB
I/Q Imbalance	Taken without external 90° IF hybrid				
Phase			5		Degree
Amplitude			0.5		dB
Return Loss					
RF			10		dB
LO			12		dB
IF			5		dB

ABSOLUTE MAXIMUM RATINGS

Table 2. Absolute Maximum Ratings

Parameter	Rating
RF Input Power	26 dBm
LO Input Power	27 dBm
IF Input Power	26 dBm
IF Current	39 mA
Peak Reflow Temperature (Moisture Sensitivity Level 3 (MSL3))[1]	260°C
Continuous Power Dissipation (P_{DISS}) (T_A = 85°C, Derates 5.26 mW/°C above 85°C)	342 mW
Temperature	
T_J	150°C
Lifetime at Maximum T_J	1 Million Hours
Operating	−40°C to +85°C
Storage	−65°C to +150°C
Lead	−65°C to +150°C

1 Based on IPC/JEDEC J-STD-20 MSL classifications.

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.

θ_{JA} is the junction to ambient thermal resistance.

θ_{JC} is the junction to case thermal resistance.

Table 3. Thermal Resistance

Package Type[1]	θ_{JA}	θ_{JC}	Unit
CC-20-16	32.71	190	°C/W

1 Thermal resistance values specified are simulated based on JEDEC specifications in compliance with JESD-51.

ELECTROSTATIC DISCHARGE (ESD) RATINGS

The following ESD information is provided for handling of ESD-sensitive devices in an ESD protected area only.

Human body model (HBM) per ANSI/ESDA/JEDEC JS-001.

Field induced charged device model (FICDM) per ANSI/ESDA/JEDEC JS-002.

ESD Ratings for ADMV1555

Table 4. ADMV1555, 20-Terminal LGA

ESD Model	Withstand Threshold (V)	Class
HBM	500	1B
FICDM	1250	C3

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

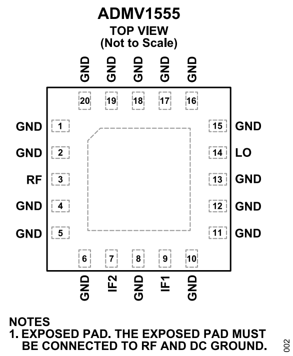

Figure 2. Pin Configuration

Table 5. Pin Function Descriptions

Pin No.	Mnemonic	Description
1, 2, 4 to 6, 8, 10 to 13, 15 to 20	GND	Ground. The GND pins must be connected to RF and DC ground. See Figure 3 for the interface schematic.
3	RF	RF Port. The RF pin is AC-coupled and matched to 50 Ω. See Figure 4 for the interface schematic.
7	IF2	Second Quadrature Intermediate Frequency Port. The IF2 pin is DC-coupled. For applications not requiring operation to DC, DC block this port externally using a series capacitor of a value chosen to pass the necessary IF frequency range. For operation to DC, the IF2 pin must not source or sink more than 39 mA of current. Otherwise, die malfunction or die failure may result. See Figure 6 for the IFx interface schematic.
9	IF1	First Quadrature Intermediate Frequency Port. The IF1 pin is DC-coupled. For applications not requiring operation to DC, DC block this port externally using a series capacitor of a value chosen to pass the necessary IF frequency range. For operation to DC, the IF1 pin must not source or sink more than 39 mA of current. Otherwise, die malfunction or die failure may result. See Figure 6 for the IFx interface schematic.
14	LO	LO Port. The LO pin is AC-coupled and matched to 50 Ω. See Figure 5 for the interface schematic.
	EPAD	Exposed Pad. The exposed pad must be connected to RF and DC ground.

INTERFACE SCHEMATICS

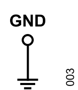

Figure 3. GND Interface Schematic

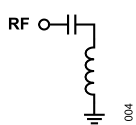

Figure 4. RF Interface Schematic

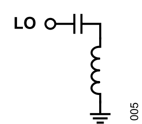

Figure 5. LO Interface Schematic

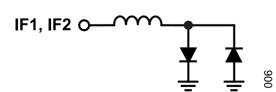

Figure 6. IFx Interface Schematic

TYPICAL PERFORMANCE CHARACTERISTICS

DOWNCONVERTER PERFORMANCE, IF = 1 GHz

Upper Sideband (Low-Side LO)

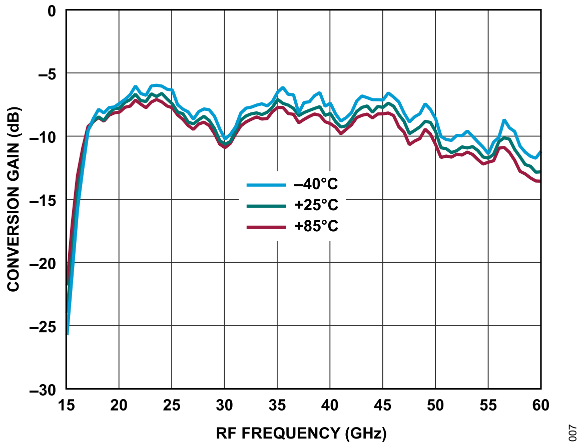

Figure 7. Conversion Gain vs. RF Frequency at Various Temperatures, LO = 21 dBm

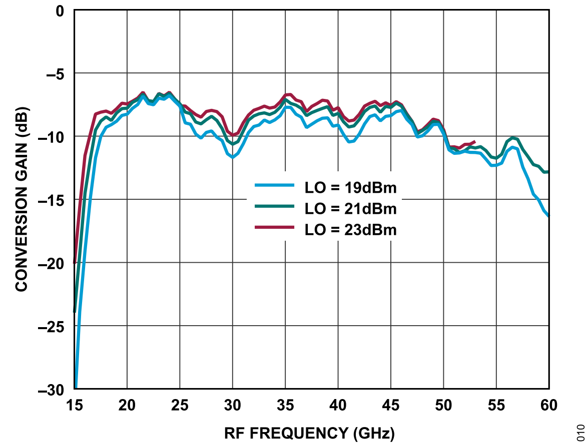

Figure 10. Conversion Gain vs. RF Frequency at Various LO Power Levels, T_A = 25°C

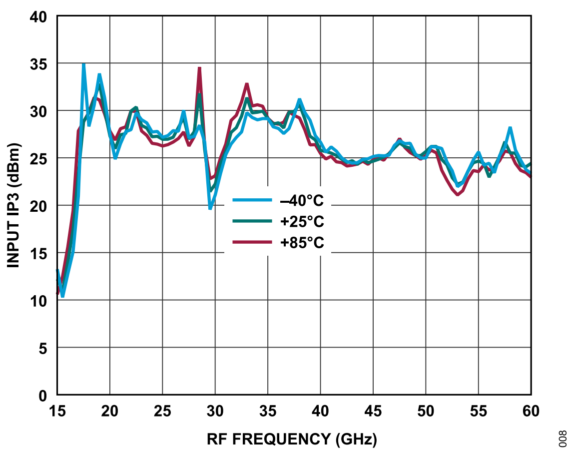

Figure 8. Input IP3 vs. RF Frequency at Various Temperatures, LO = 21 dBm

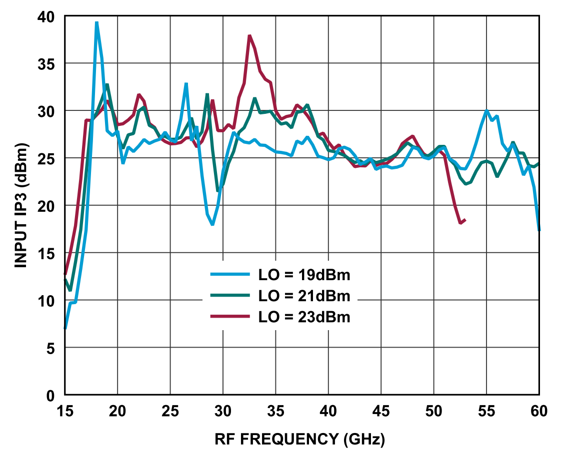

Figure 11. Input IP3 vs. RF Frequency at Various LO Power Levels, T_A = 25°C

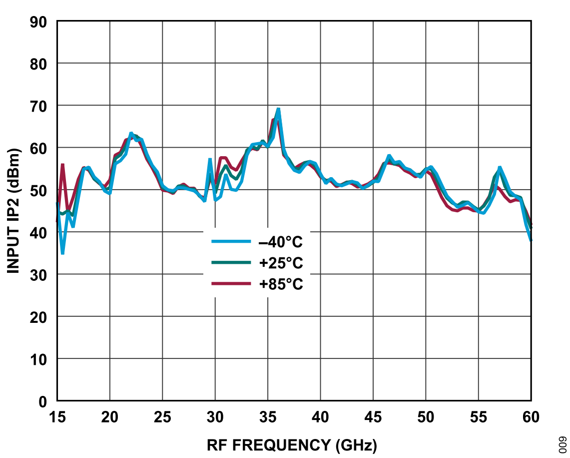

Figure 9. Input IP2 vs. RF Frequency at Various Temperatures, LO = 21 dBm

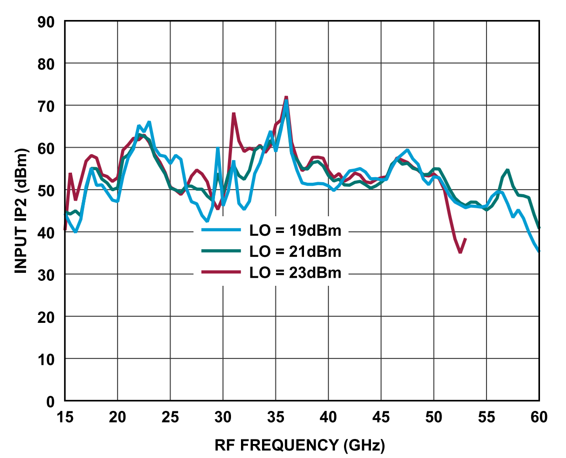

Figure 12. Input IP2 vs. RF Frequency at Various LO Power Levels, T_A = 25°C

TYPICAL PERFORMANCE CHARACTERISTICS

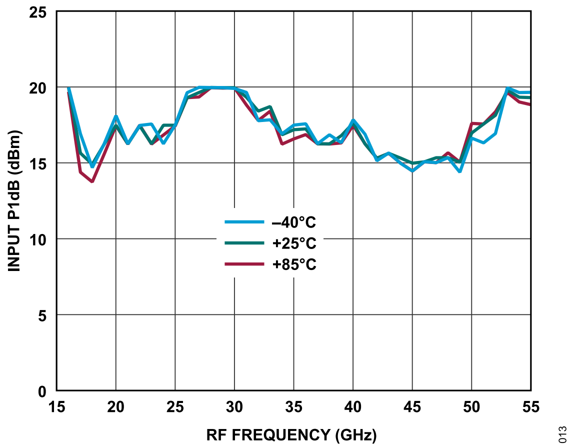

Figure 13. Input P1dB vs. RF Frequency at Various Temperatures, LO = 21 dBm

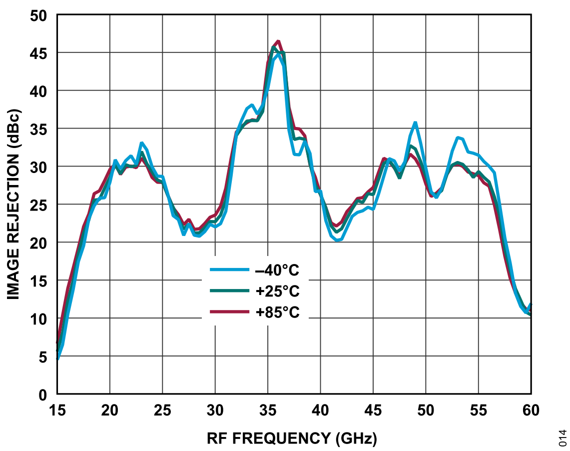

Figure 14. Image Rejection vs. RF Frequency at Various Temperatures, LO = 21 dBm

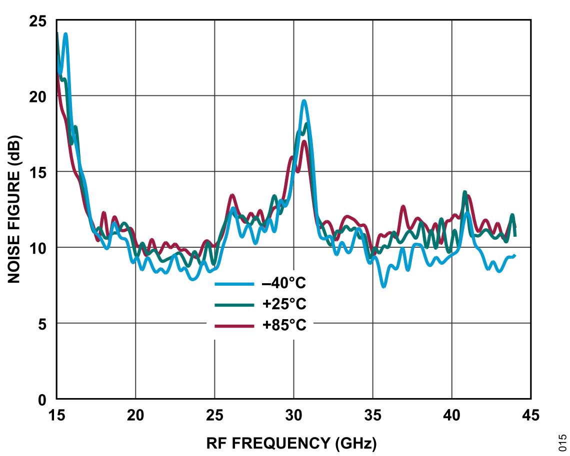

Figure 15. Noise Figure vs. RF Frequency at Various Temperatures, LO = 21 dBm

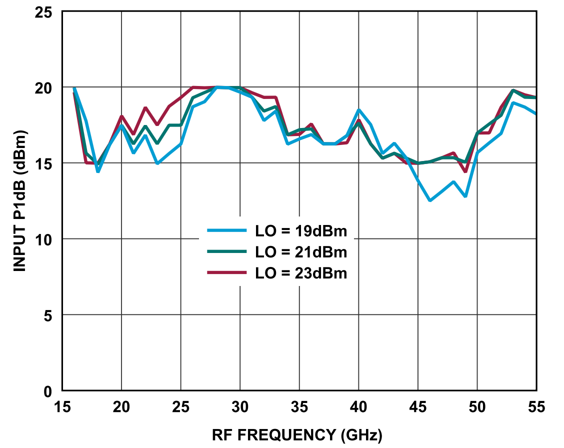

Figure 16. Input P1dB vs. RF Frequency at Various LO Power Levels, T_A = 25°C

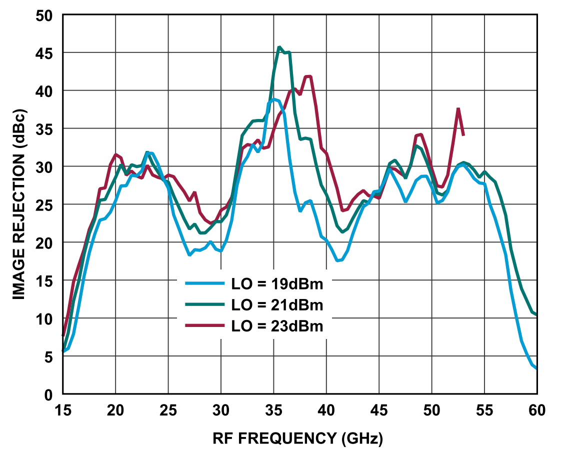

Figure 17. Image Rejection vs. RF Frequency at Various LO Power Levels, T_A = 25°C

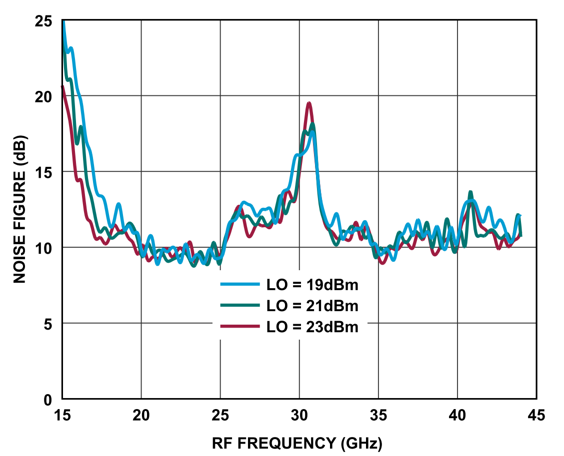

Figure 18. Noise Figure vs. RF Frequency at Various LO Power Levels, T_A = 25°C

TYPICAL PERFORMANCE CHARACTERISTICS

Lower Sideband (High-Side LO)

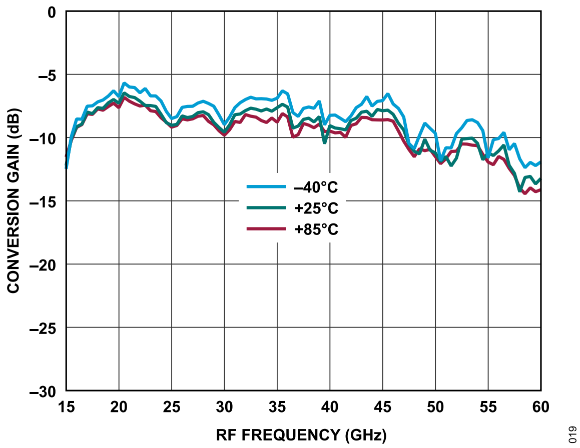

Figure 19. Conversion Gain vs. RF Frequency at Various Temperatures, LO = 21 dBm

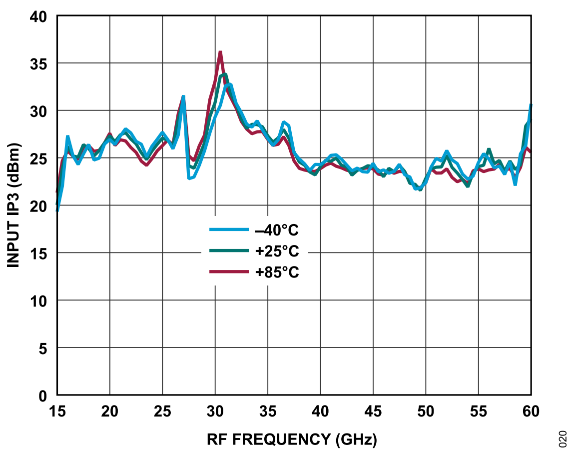

Figure 20. Input IP3 vs. RF Frequency at Various Temperatures, LO = 21 dBm

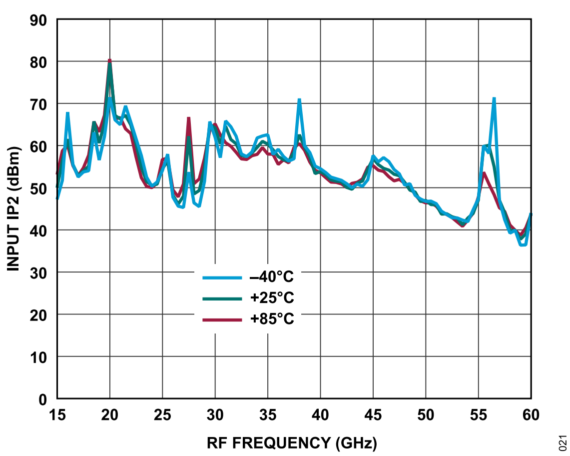

Figure 21. Input IP2 vs. RF Frequency at Various Temperatures, LO = 21 dBm

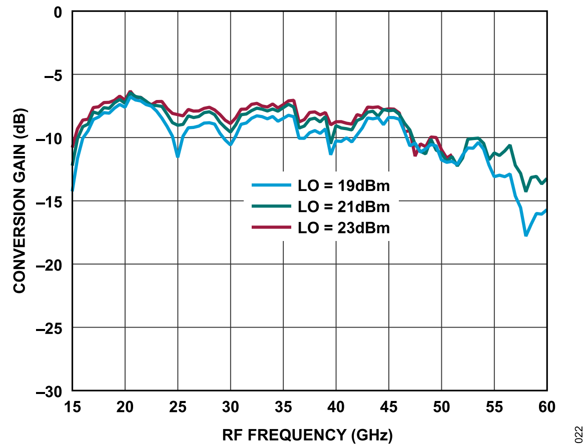

Figure 22. Conversion Gain vs. RF Frequency at Various LO Power Levels, T_A = 25°C

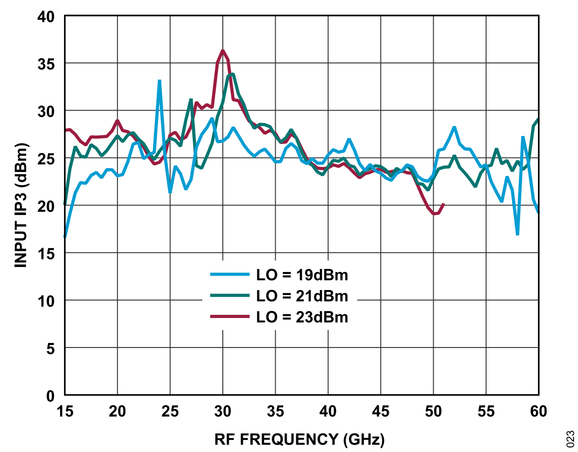

Figure 23. Input IP3 vs. RF Frequency at Various LO Power Levels, T_A = 25°C

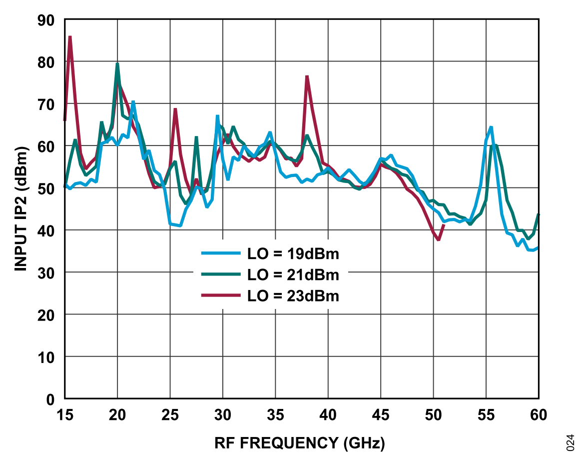

Figure 24. Input IP2 vs. RF Frequency at Various LO Power Levels, T_A = 25°C

TYPICAL PERFORMANCE CHARACTERISTICS

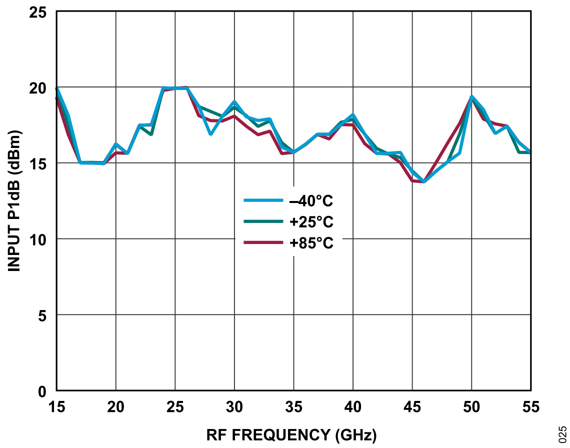

Figure 25. Input P1dB vs. RF Frequency at Various Temperatures, LO = 21 dBm

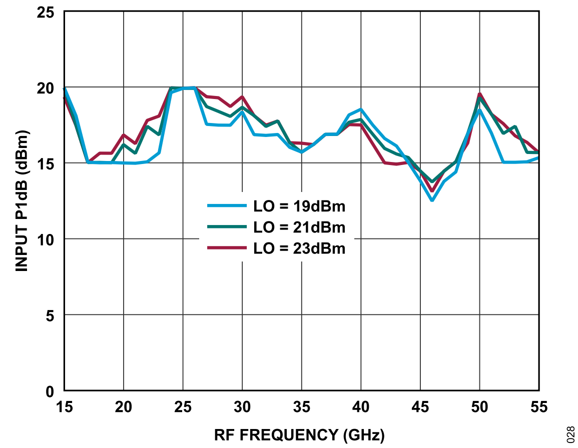

Figure 28. Input P1dB vs. RF Frequency at Various LO Power Levels, T_A = 25°C

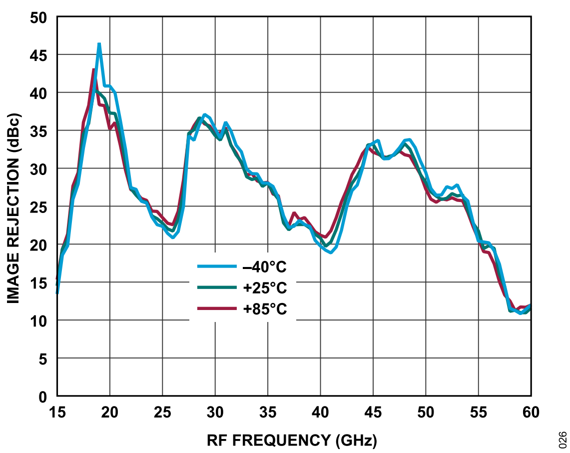

Figure 26. Image Rejection vs. RF Frequency at Various Temperatures, LO = 21 dBm

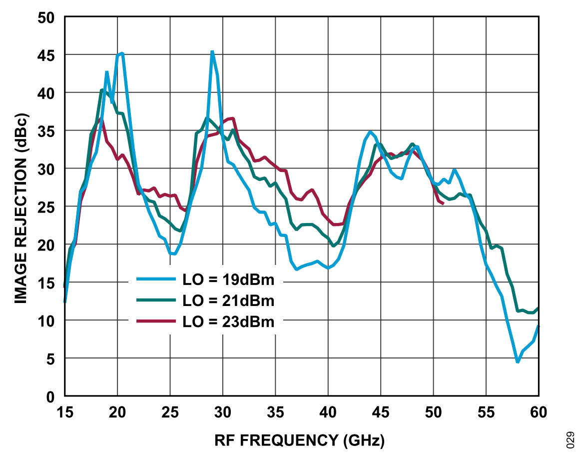

Figure 29. Image Rejection vs. RF Frequency at Various LO Power Levels, T_A = 25°C

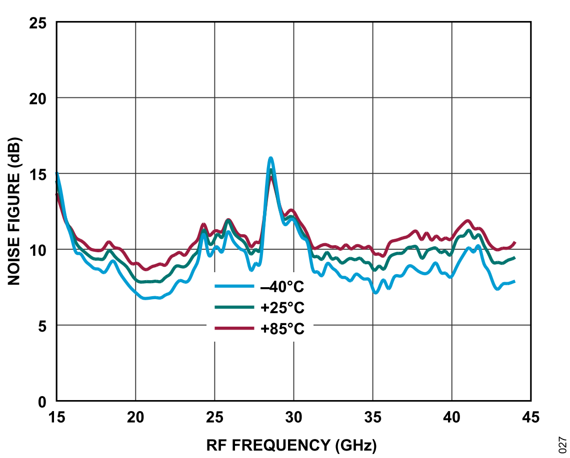

Figure 27. Noise Figure vs. RF Frequency at Various Temperatures, LO = 21 dBm

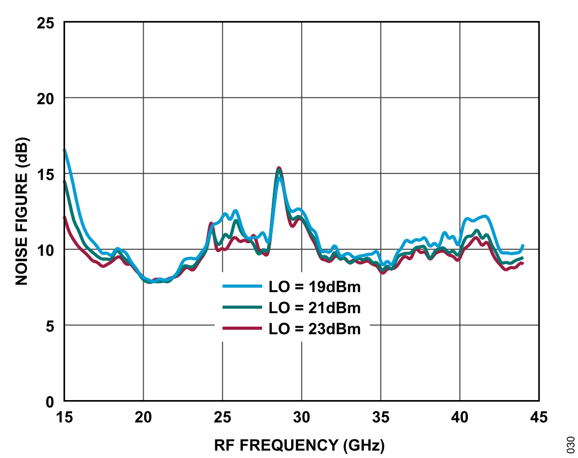

Figure 30. Noise Figure vs. RF Frequency at Various LO Power Levels, T_A = 25°C

TYPICAL PERFORMANCE CHARACTERISTICS

DOWNCONVERTER PERFORMANCE, IF = 10 GHz

Upper Sideband (Low-Side LO)

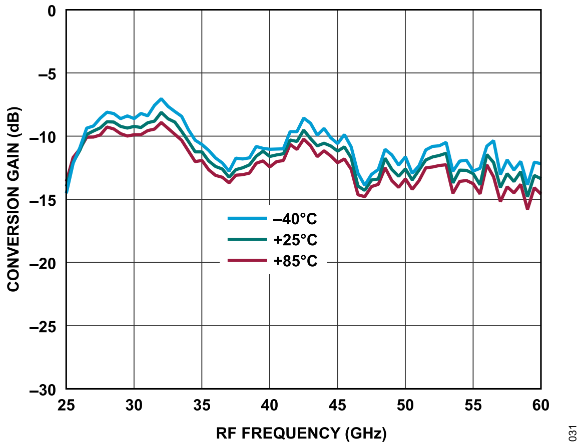

Figure 31. Conversion Gain vs. RF Frequency at Various Temperatures, LO = 21 dBm

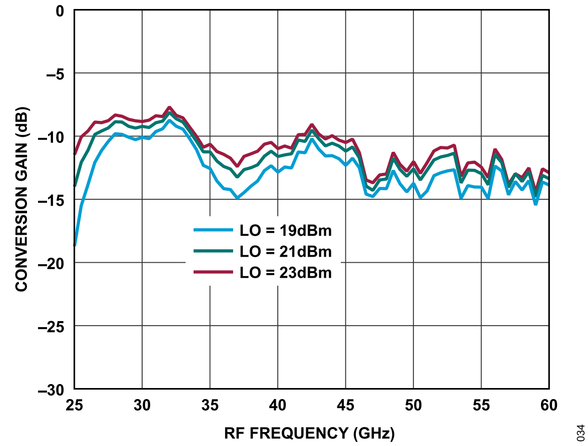

Figure 34. Conversion Gain vs. RF Frequency at Various LO Power Levels, T_A = 25°C

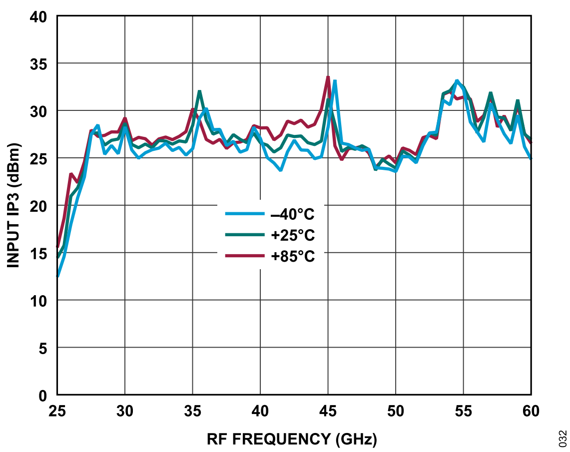

Figure 32. Input IP3 vs. RF Frequency at Various Temperatures, LO = 21 dBm

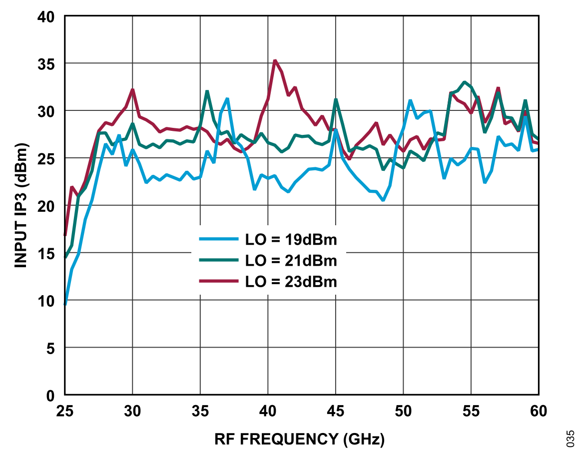

Figure 35. Input IP3 vs. RF Frequency at Various LO Power Levels, T_A = 25°C

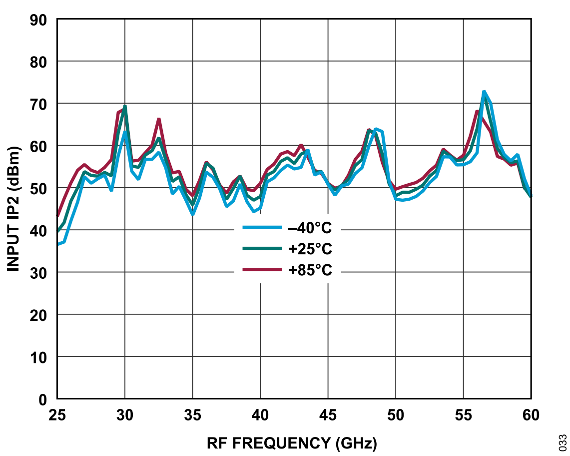

Figure 33. Input IP2 vs. RF Frequency at Various Temperatures, LO = 21 dBm

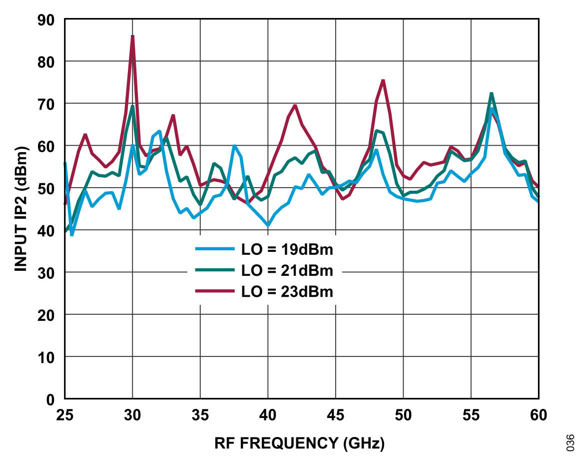

Figure 36. Input IP2 vs. RF Frequency at Various LO Power Levels, T_A = 25°C

TYPICAL PERFORMANCE CHARACTERISTICS

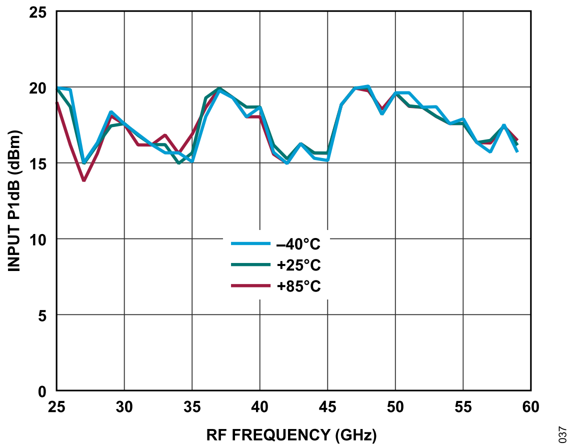

Figure 37. Input P1dB vs. RF Frequency at Various Temperatures, LO = 21 dBm

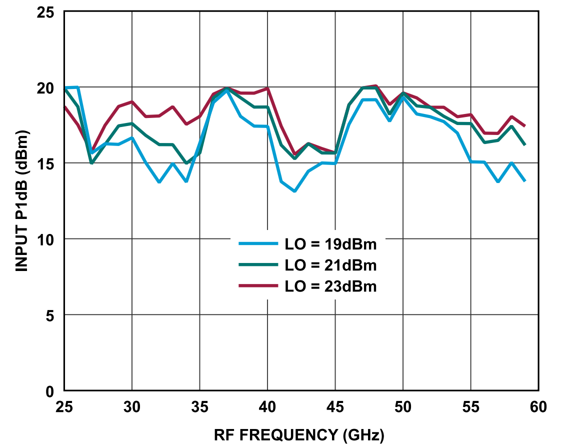

Figure 39. Input P1dB vs. RF Frequency at Various LO Power Levels, T_A = 25°C

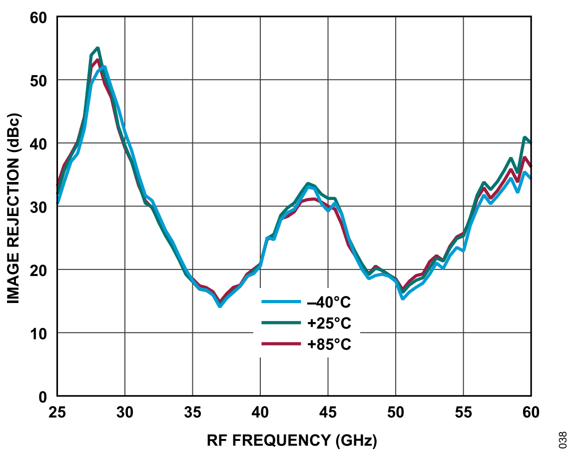

Figure 38. Image Rejection vs. RF Frequency at Various Temperatures, LO = 21 dBm

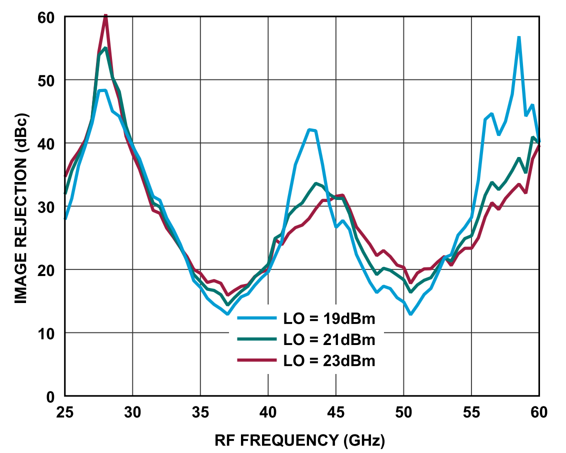

Figure 40. Image Rejection vs. RF Frequency at Various LO Power Levels, T_A = 25°C

TYPICAL PERFORMANCE CHARACTERISTICS

Lower Sideband (High-Side LO)

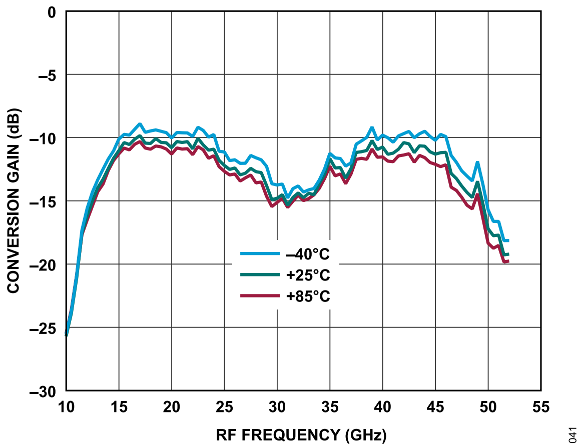

Figure 41. Conversion Gain vs. RF Frequency at Various Temperatures, LO = 21 dBm

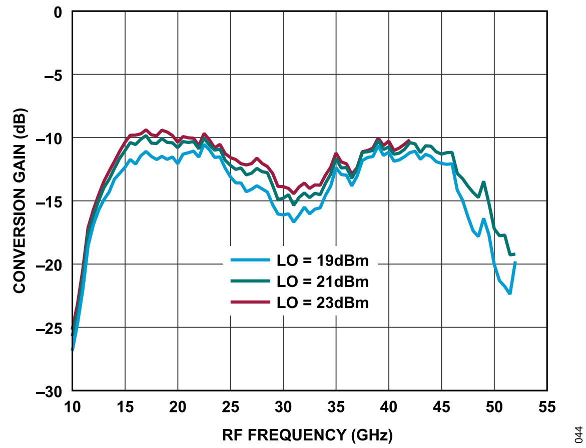

Figure 44. Conversion Gain vs. RF Frequency at Various LO Power Levels, T_A = 25°C

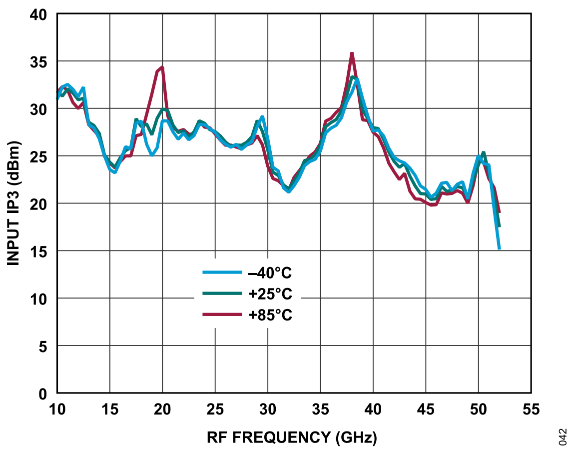

Figure 42. Input IP3 vs. RF Frequency at Various Temperatures, LO = 21 dBm

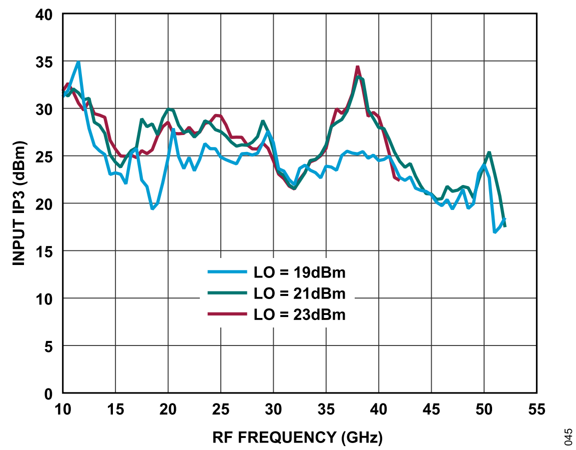

Figure 45. Input IP3 vs. RF Frequency at Various LO Power Levels, T_A = 25°C

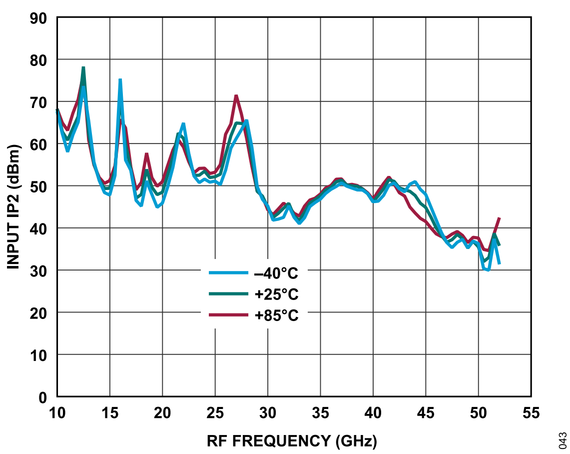

Figure 43. Input IP2 vs. RF Frequency at Various Temperatures, LO = 21 dBm

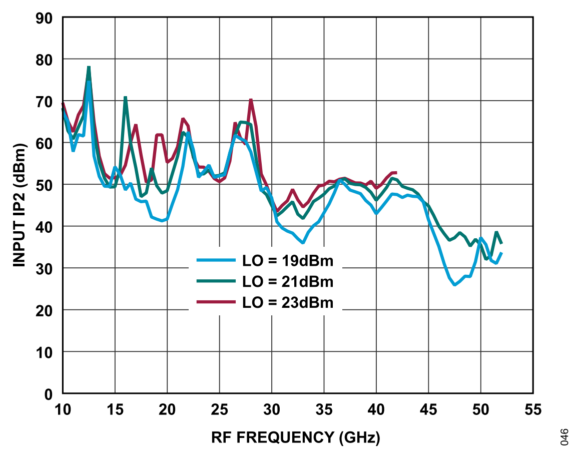

Figure 46. Input IP2 vs. RF Frequency at Various LO Power Levels, T_A = 25°C

TYPICAL PERFORMANCE CHARACTERISTICS

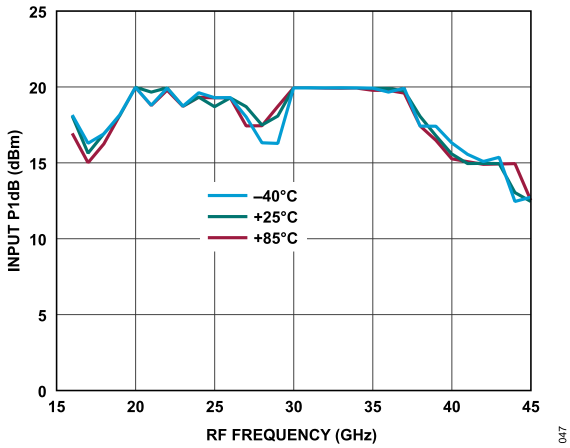

Figure 47. Input P1dB vs. RF Frequency at Various Temperatures, LO = 21 dBm

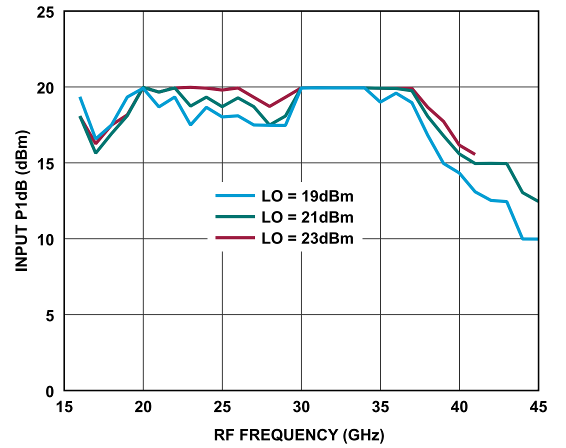

Figure 49. Input P1dB vs. RF Frequency at Various LO Power Levels, T_A = 25°C

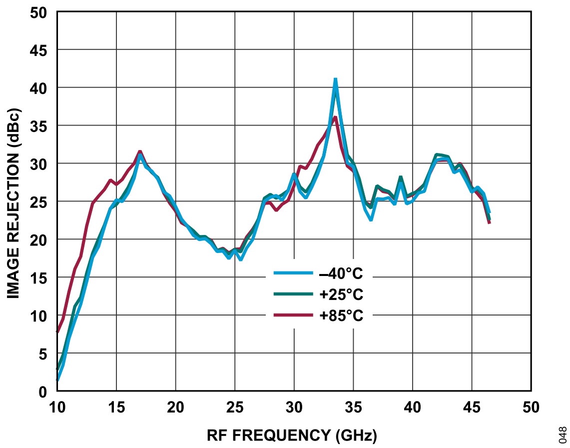

Figure 48. Image Rejection vs. RF Frequency at Various Temperatures, LO = 21 dBm

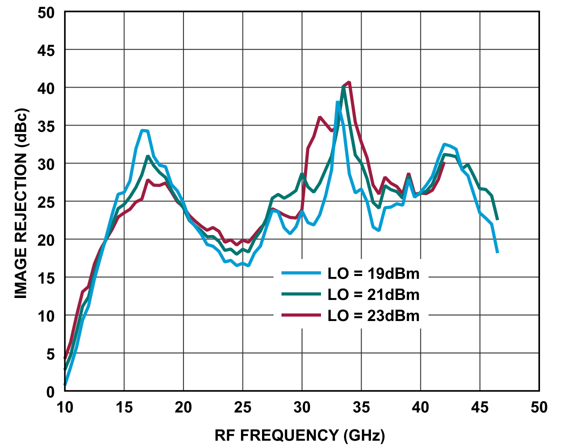

Figure 50. Image Rejection vs. RF Frequency at Various LO Power Levels, T_A = 25°C

TYPICAL PERFORMANCE CHARACTERISTICS

DOWNCONVERTER PERFORMANCE, IF = 20 GHz

Upper Sideband (Low-Side LO)

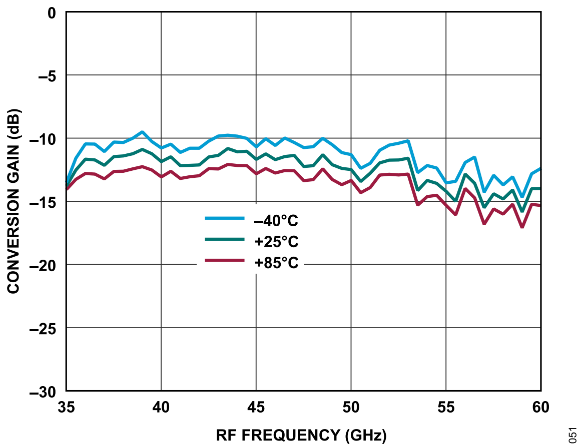

Figure 51. Conversion Gain vs. RF Frequency at Various Temperatures, LO = 21 dBm

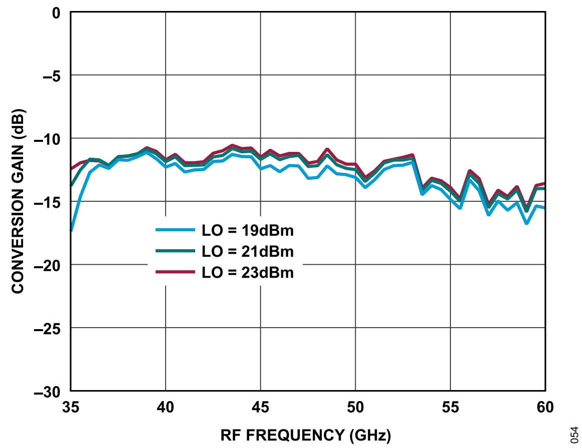

Figure 54. Conversion Gain vs. RF Frequency at Various LO Power Levels, T_A = 25°C

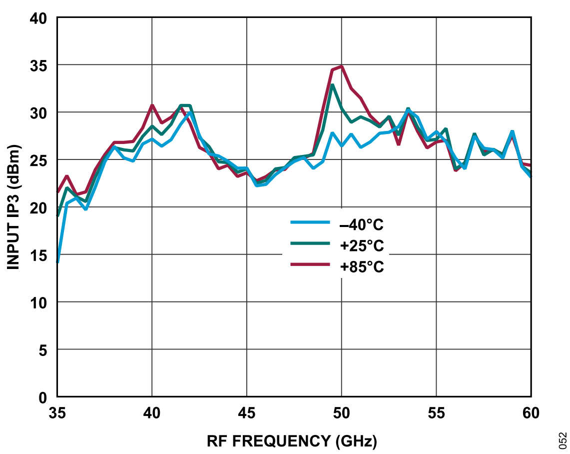

Figure 52. Input IP3 vs. RF Frequency at Various Temperatures, LO = 21 dBm

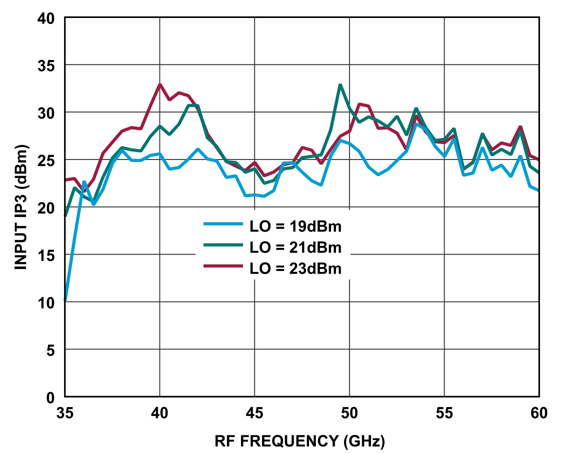

Figure 55. Input IP3 vs. RF Frequency at Various LO Power Levels, T_A = 25°C

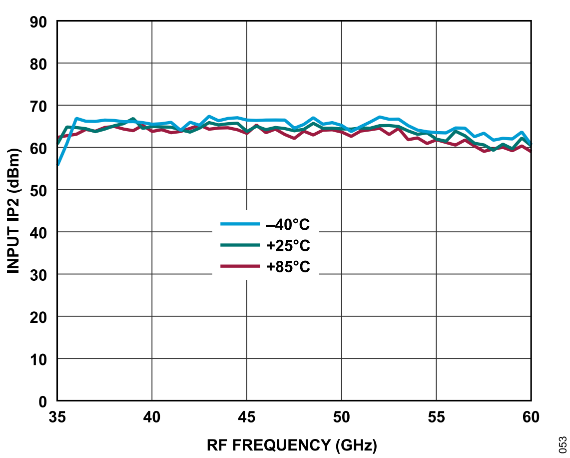

Figure 53. Input IP2 vs. RF Frequency at Various Temperatures, LO = 21 dBm

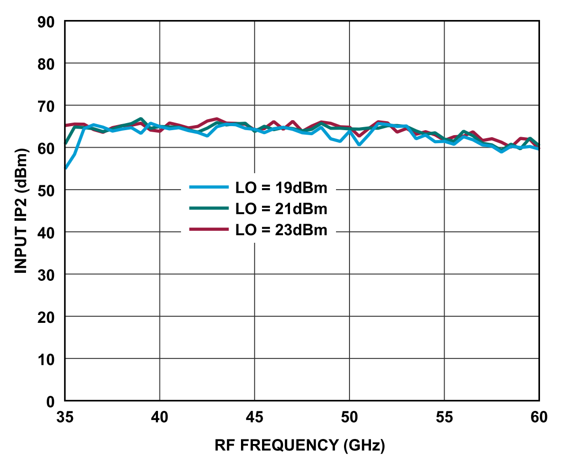

Figure 56. Input IP2 vs. RF Frequency at Various LO Power Levels, T_A = 25°C

TYPICAL PERFORMANCE CHARACTERISTICS

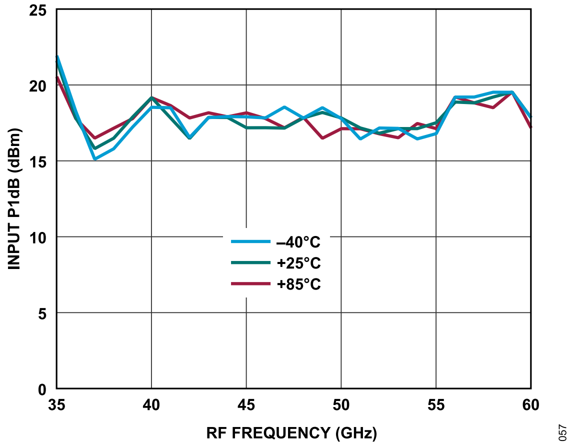

Figure 57. Input P1dB vs. RF Frequency at Various Temperatures, LO = 21 dBm

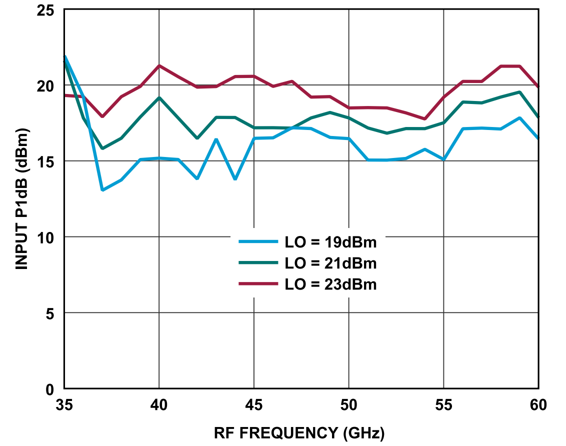

Figure 59. Input P1dB vs. RF Frequency at Various LO Power Levels, T_A = 25°C

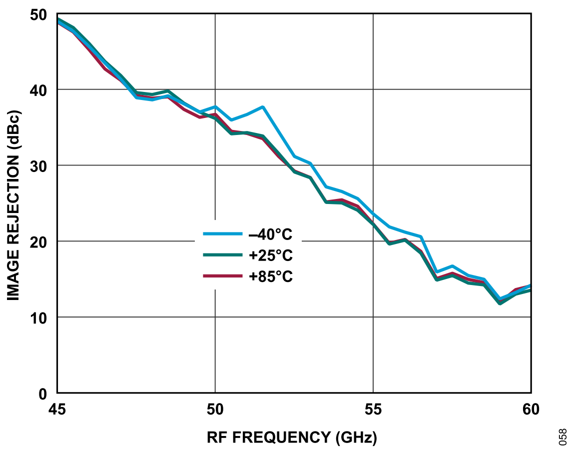

Figure 58. Image Rejection vs. RF Frequency at Various Temperatures, LO = 21 dBm

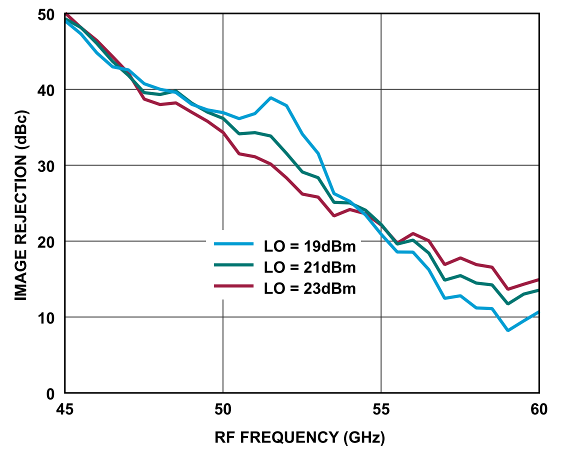

Figure 60. Image Rejection vs. RF Frequency at Various Power Levels, T_A = 25°C

TYPICAL PERFORMANCE CHARACTERISTICS

Lower Sideband (High-Side LO)

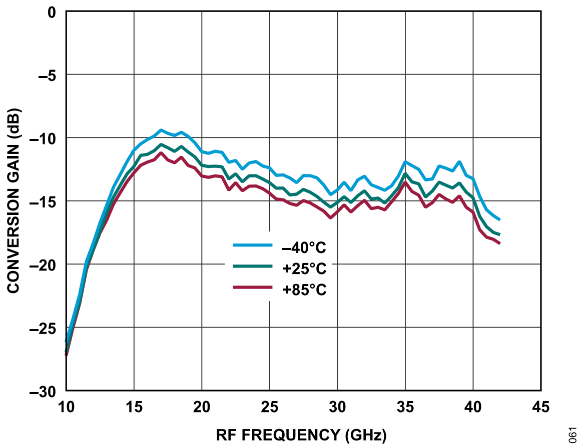

Figure 61. Conversion Gain vs. RF Frequency at Various Temperatures, LO = 21 dBm

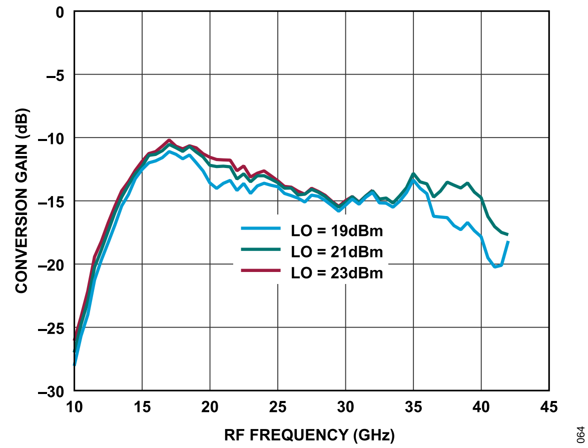

Figure 64. Conversion Gain vs. RF Frequency at Various LO Power Levels, T_A = 25°C

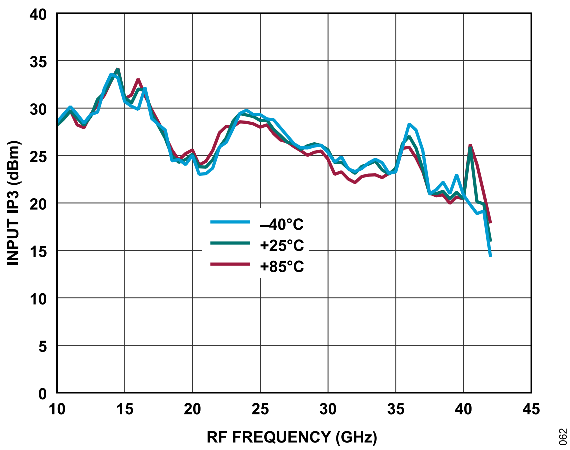

Figure 62. Input IP3 vs. RF Frequency at Various Temperatures, LO = 21 dBm

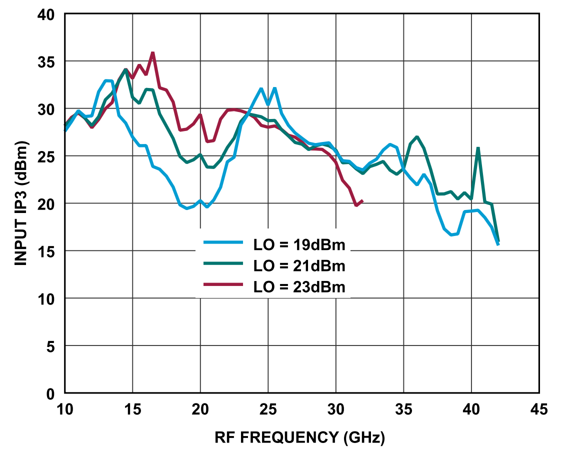

Figure 65. Input IP3 vs. RF Frequency at Various LO Power Levels, T_A = 25°C

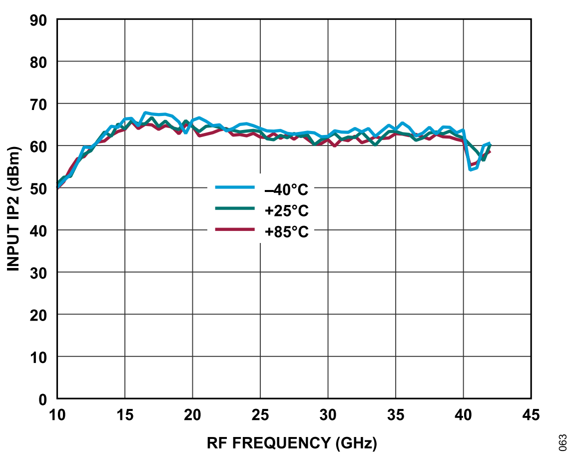

Figure 63. Input IP2 vs. RF Frequency at Various Temperatures, LO = 21 dBm

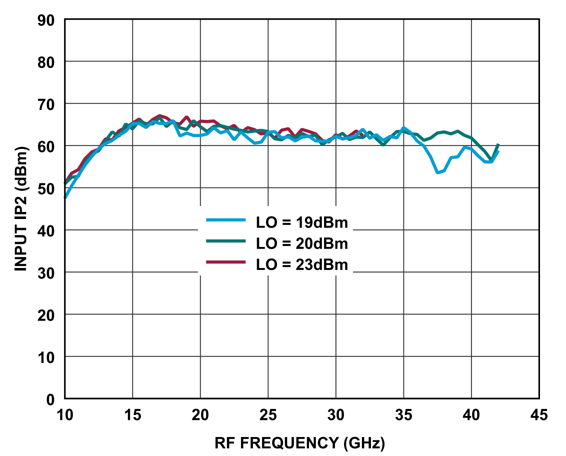

Figure 66. Input IP2 vs. RF Frequency at Various LO Power Levels, T_A = 25°C

TYPICAL PERFORMANCE CHARACTERISTICS

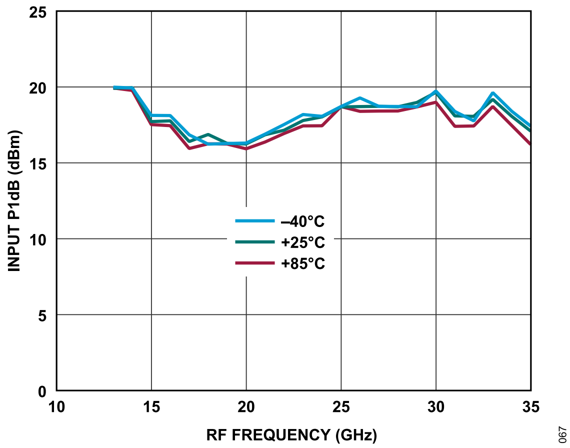

Figure 67. Input P1dB vs. RF Frequency at Various Temperatures, LO = 21 dBm

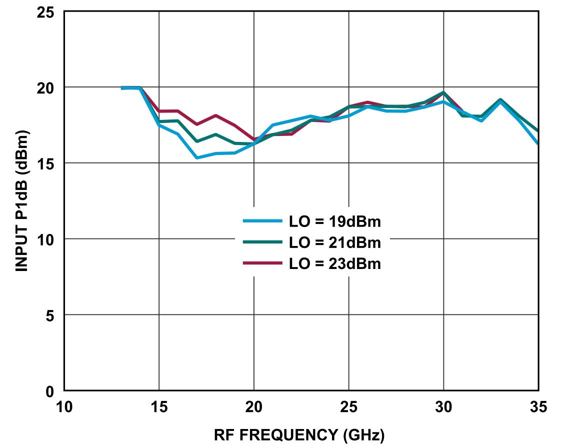

Figure 69. Input P1dB vs. RF Frequency at Various LO Power Levels, T_A = 25°C

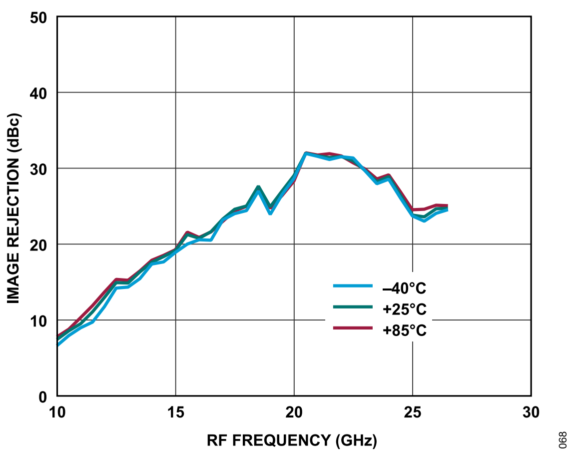

Figure 68. Image Rejection vs. RF Frequency at Various Temperatures, LO = 21 dBm

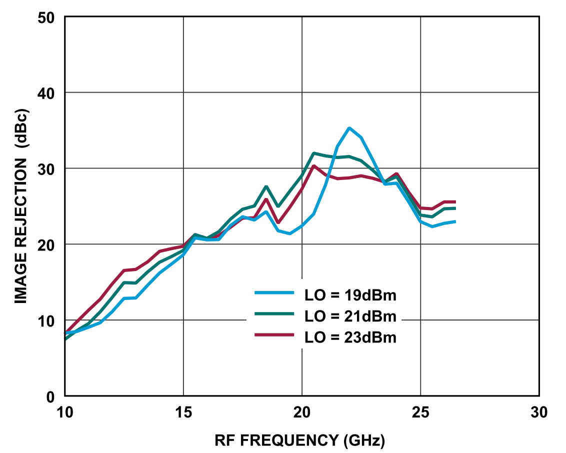

Figure 70. Image Rejection vs. RF Frequency at Various LO Power Levels, T_A = 25°C

TYPICAL PERFORMANCE CHARACTERISTICS

UPCONVERTER PERFORMANCE, IF = 1 GHz

Upper Sideband (Low-Side LO)

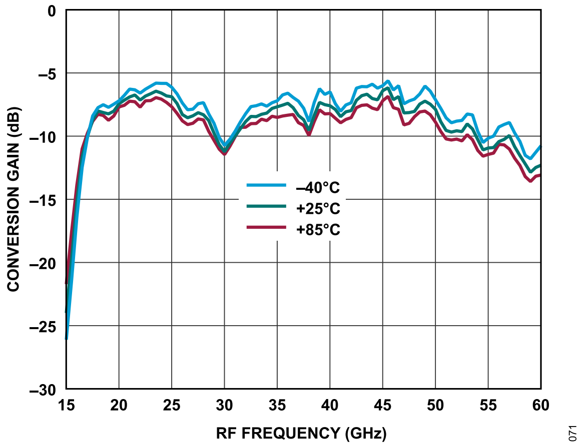

Figure 71. Conversion Gain vs. RF Frequency at Various Temperatures, LO = 21 dBm

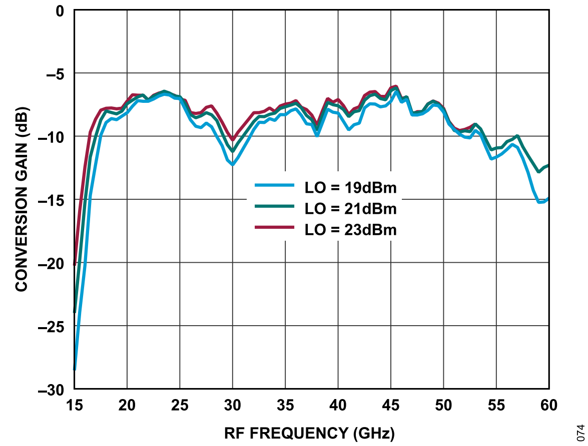

Figure 74. Conversion Gain vs. RF Frequency at Various LO Power Levels, T_A = 25°C

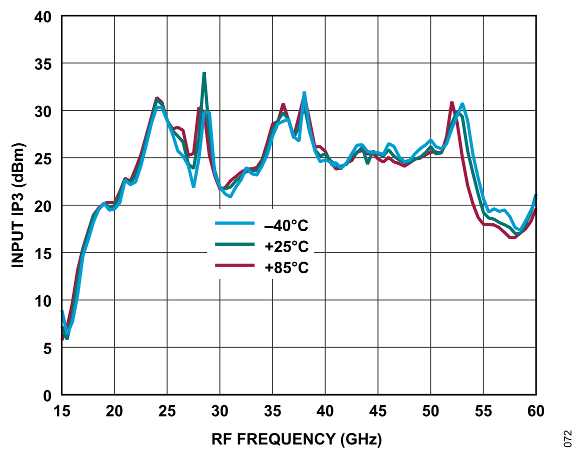

Figure 72. Input IP3 vs. RF Frequency at Various Temperatures, LO = 21 dBm

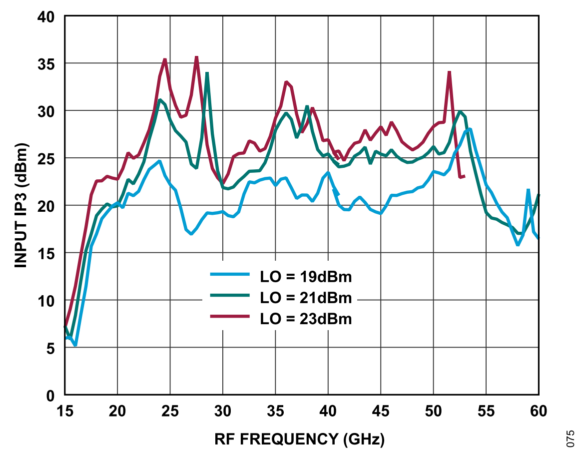

Figure 75. Input IP3 vs. RF Frequency at Various LO Power Levels, T_A = 25°C

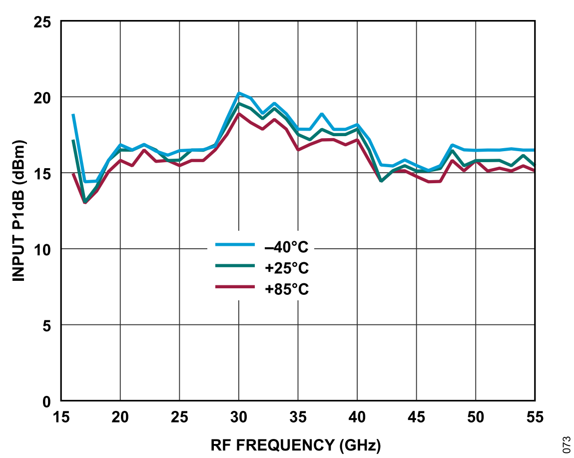

Figure 73. Input P1dB vs. RF Frequency at Various Temperatures, LO = 21 dBm

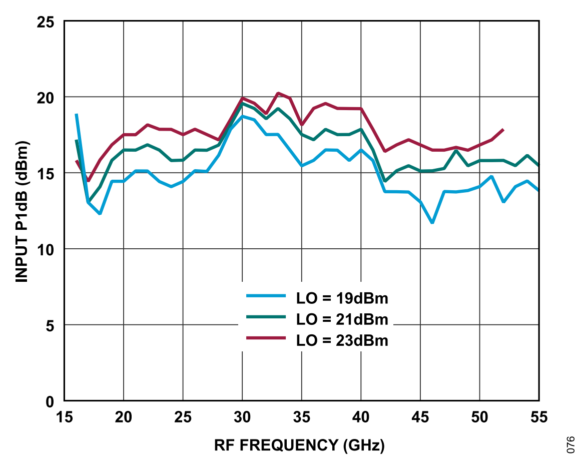

Figure 76. Input P1dB vs. RF Frequency at Various LO Power Levels, T_A = 25°C

TYPICAL PERFORMANCE CHARACTERISTICS

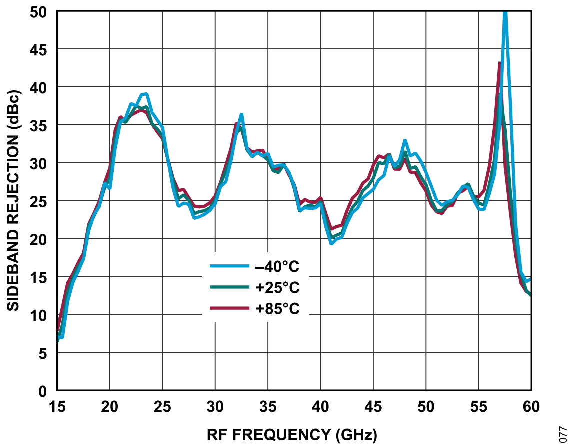

Figure 77. Sideband Rejection vs. RF Frequency at Various Temperatures, LO = 21 dBm

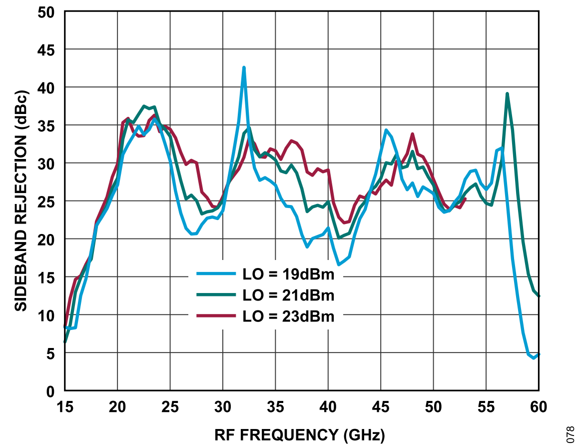

Figure 78. Sideband Rejection vs. RF Frequency at Various LO Power Levels, T_A = 25°C

TYPICAL PERFORMANCE CHARACTERISTICS

Lower Sideband (High-Side LO)

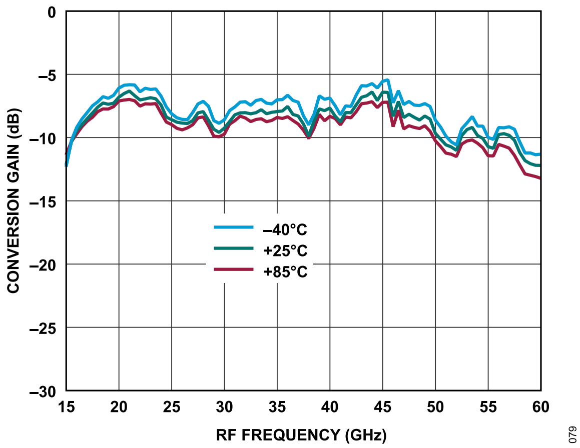

Figure 79. Conversion Gain vs. RF Frequency at Various Temperatures, LO = 21 dBm

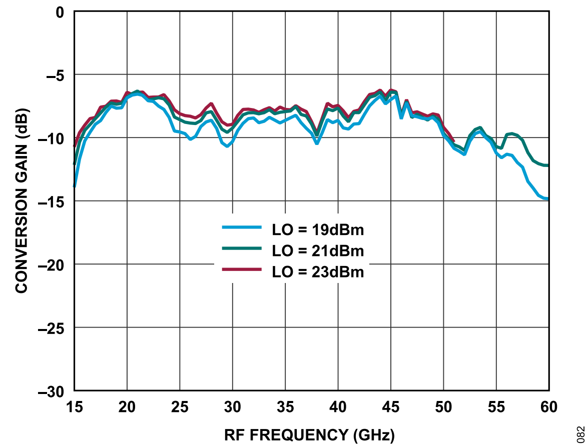

Figure 82. Conversion Gain vs. RF Frequency at Various LO Power Levels, T_A = 25°C

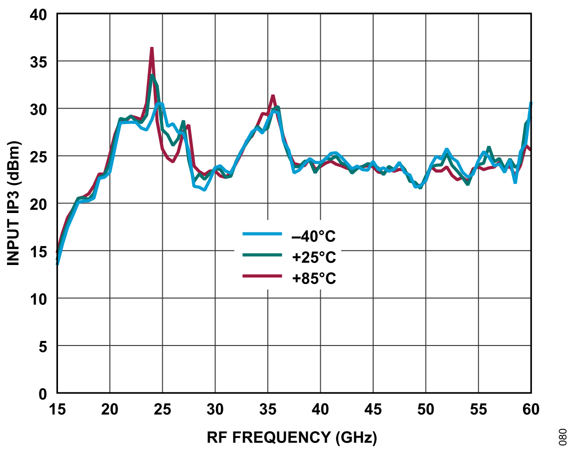

Figure 80. Input IP3 vs. RF Frequency at Various Temperatures, LO = 21 dBm

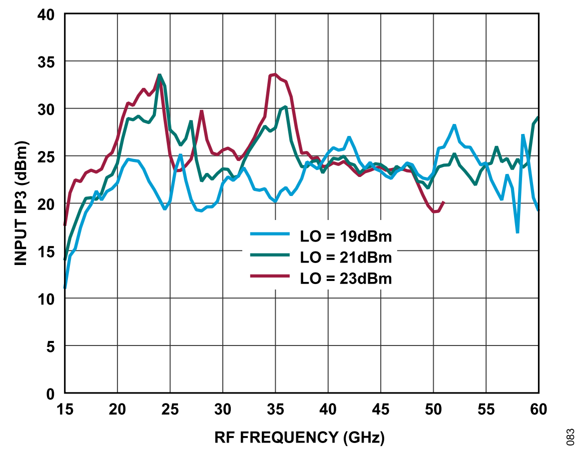

Figure 83. Input IP3 vs. RF Frequency at Various LO Power Levels, T_A = 25°C

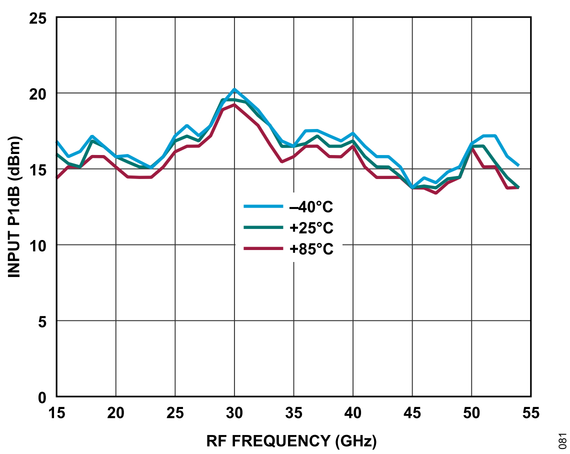

Figure 81. Input P1dB vs. RF Frequency at Various Temperatures, LO = 21 dBm

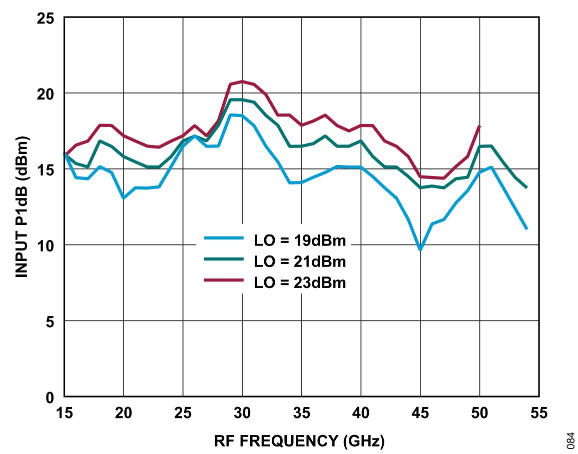

Figure 84. Input P1dB vs. RF Frequency at Various LO Power Levels, T_A = 25°C

TYPICAL PERFORMANCE CHARACTERISTICS

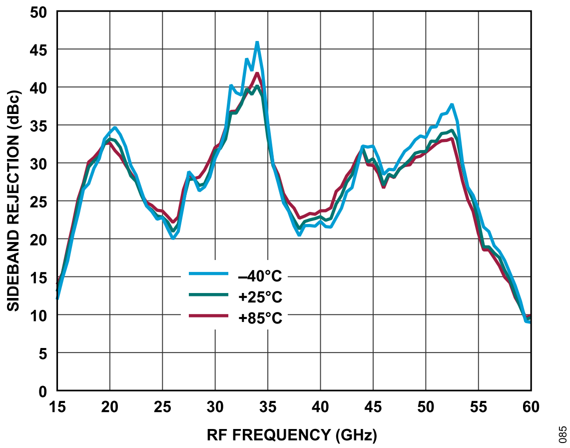

Figure 85. Sideband Rejection vs. RF Frequency at Various Temperatures, LO = 21 dBm

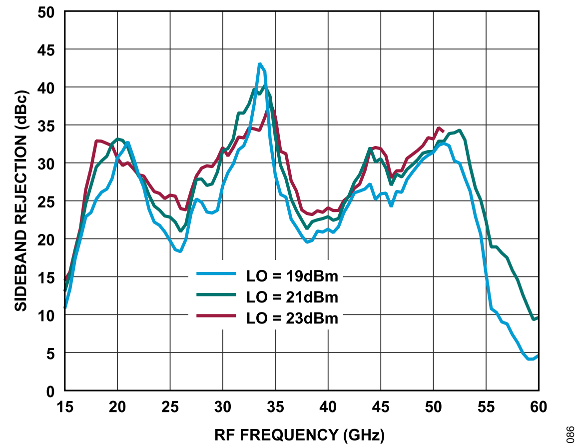

Figure 86. Sideband Rejection vs. RF Frequency at Various LO Power Levels, T_A = 25°C

TYPICAL PERFORMANCE CHARACTERISTICS

UPCONVERTER PERFORMANCE, IF = 10 GHz

Upper Sideband (Low-Side LO)

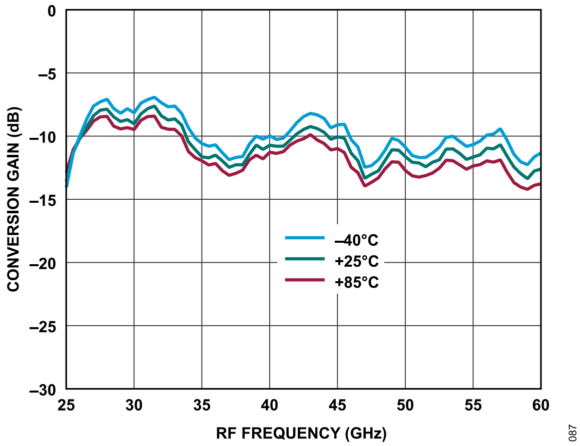

Figure 87. Conversion Gain vs. RF Frequency at Various Temperatures, LO = 21 dBm

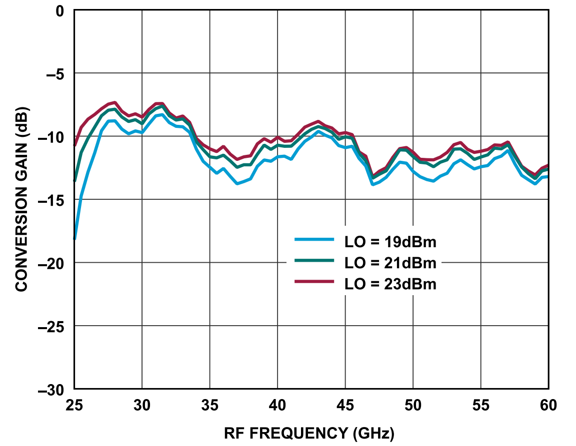

Figure 90. Conversion Gain vs. RF Frequency at Various LO Power Levels, T_A = 25°C

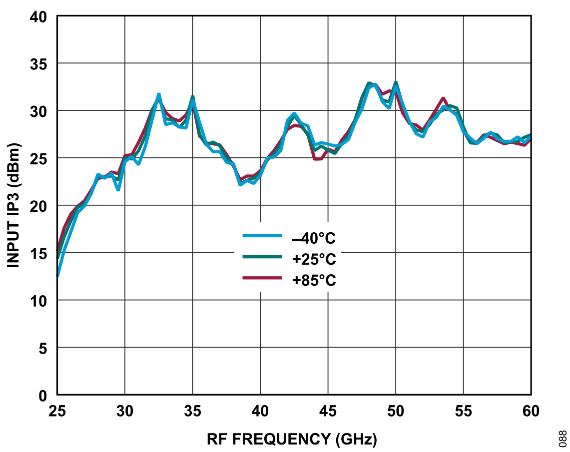

Figure 88. Input IP3 vs. RF Frequency at Various Temperatures, LO = 21 dBm

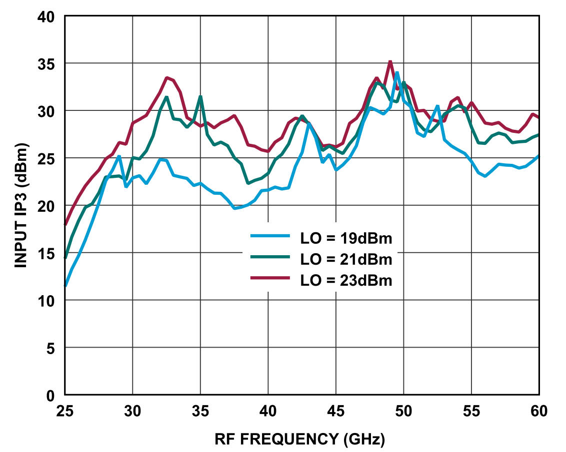

Figure 91. Input IP3 vs. RF Frequency at Various LO Power Levels, T_A = 25°C

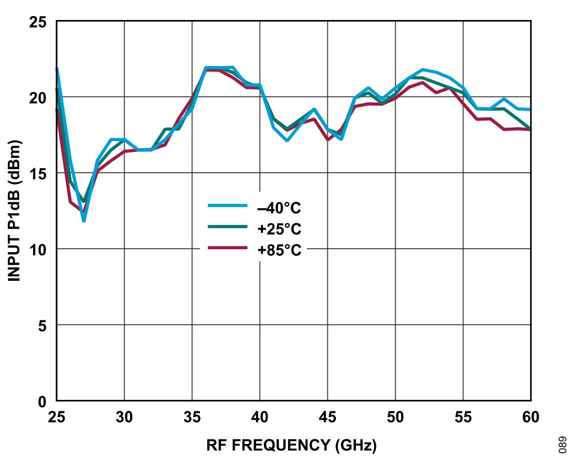

Figure 89. Input P1dB vs. RF Frequency at Various Temperatures, LO = 21 dBm

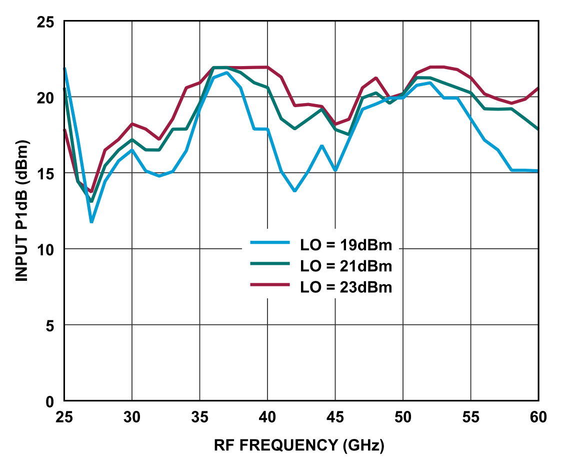

Figure 92. Input P1dB vs. RF Frequency at Various LO Power Levels, T_A = 25°C

TYPICAL PERFORMANCE CHARACTERISTICS

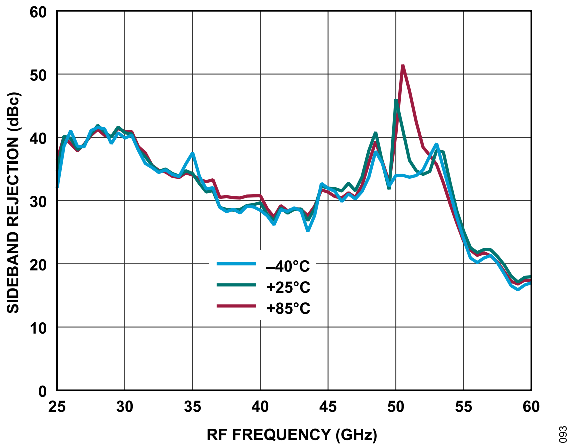

Figure 93. Sideband Rejection vs. RF Frequency at Various Temperatures, LO = 21 dBm

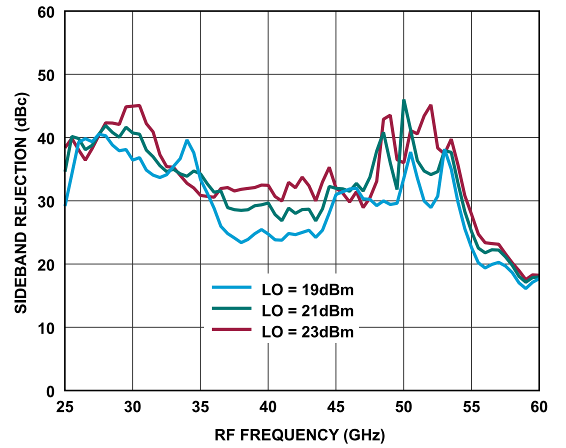

Figure 94. Sideband Rejection vs. RF Frequency at Various LO Power Levels, T_A = 25°C

TYPICAL PERFORMANCE CHARACTERISTICS

Lower Sideband (High-Side LO)

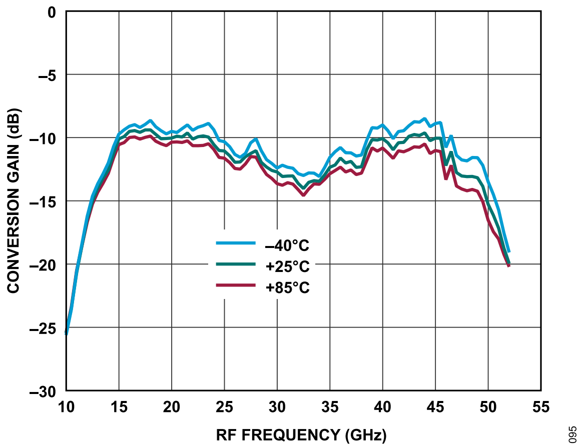

Figure 95. Conversion Gain vs. RF Frequency at Various Temperatures, LO = 21 dBm

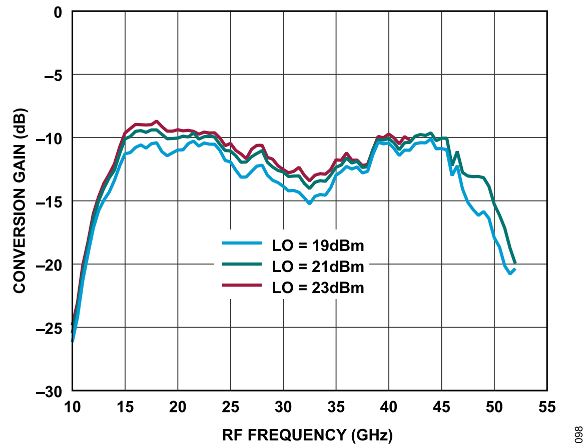

Figure 98. Conversion Gain vs. RF Frequency at Various LO Power Levels, T_A = 25°C

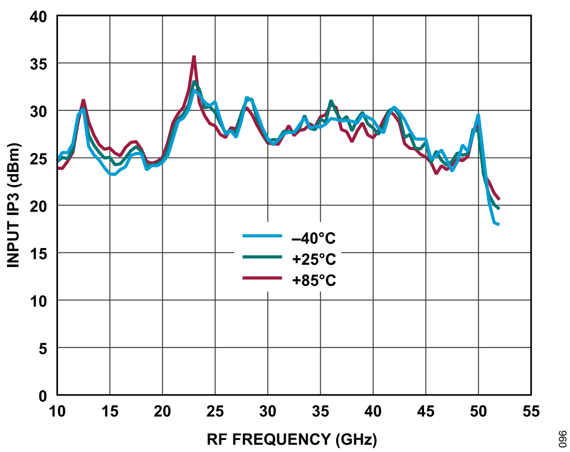

Figure 96. Input IP3 vs. RF Frequency at Various Temperatures, LO = 21 dBm

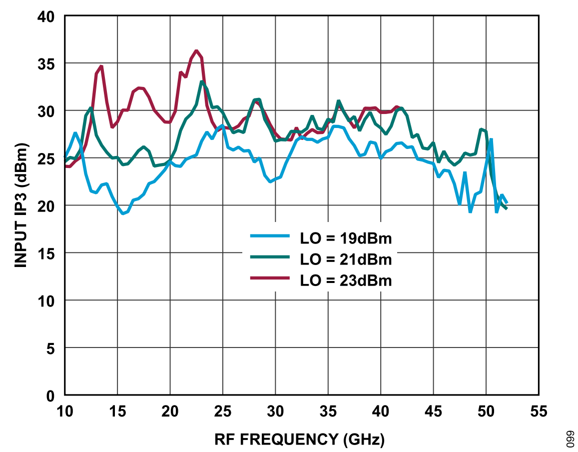

Figure 99. Input IP3 vs. RF Frequency at Various LO Power Levels, T_A = 25°C

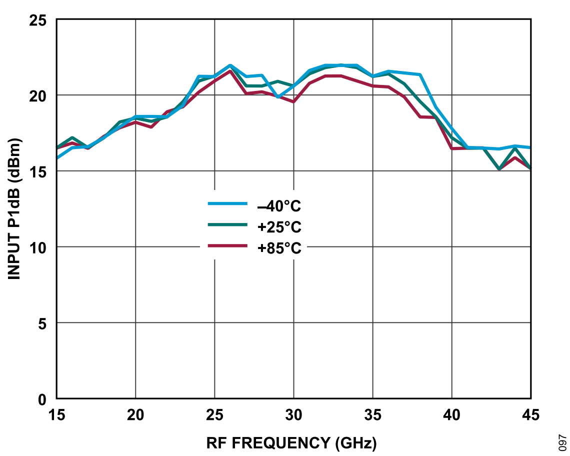

Figure 97. Input P1dB vs. RF Frequency at Various Temperatures, LO = 21 dBm

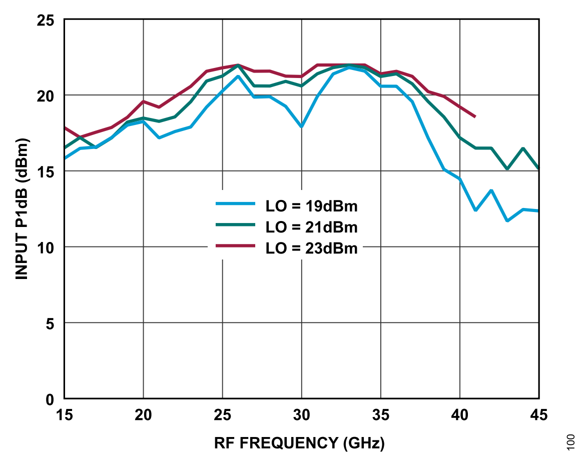

Figure 100. Input P1dB vs. RF Frequency at Various LO Power Levels, T_A = 25°C

TYPICAL PERFORMANCE CHARACTERISTICS

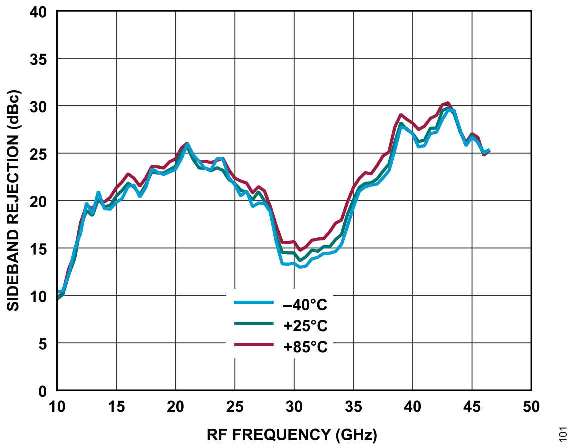

Figure 101. Sideband Rejection vs. RF Frequency at Various Temperatures, LO = 21 dBm

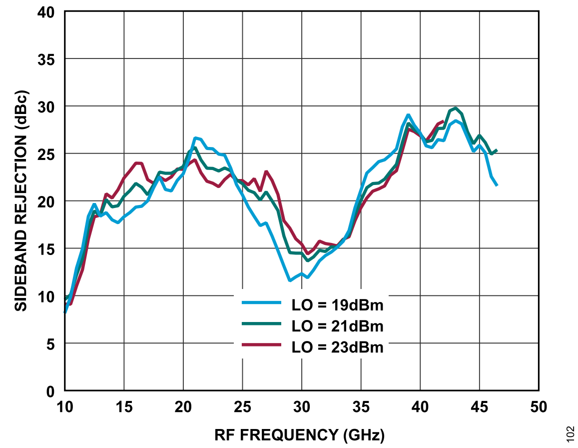

Figure 102. Sideband Rejection vs. RF Frequency at Various LO Power Levels, T_A = 25°C

TYPICAL PERFORMANCE CHARACTERISTICS

UPCONVERTER PERFORMANCE, IF = 20 GHz

Upper Sideband (Low-Side LO)

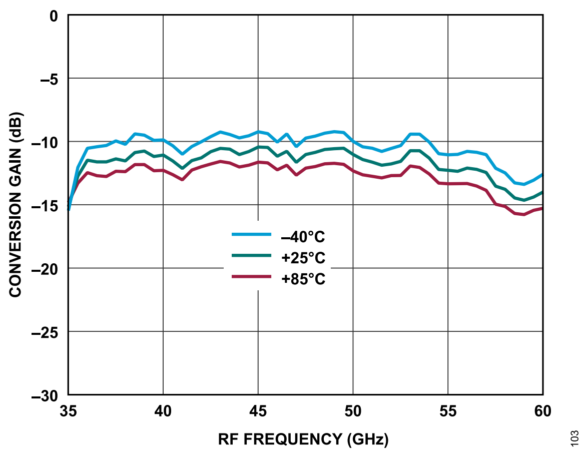

Figure 103. Conversion Gain vs. RF Frequency at Various Temperatures, LO = 21 dBm

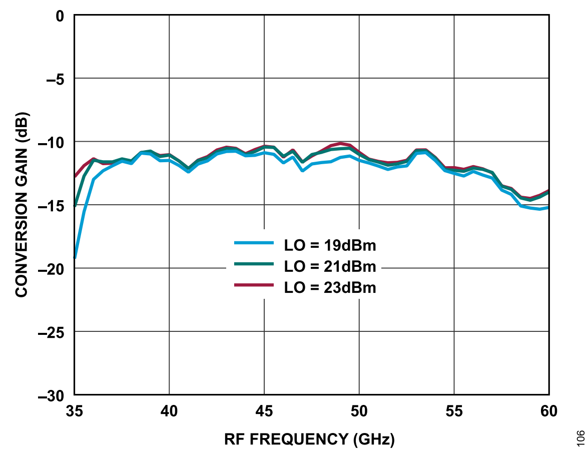

Figure 105. Conversion Gain vs. RF Frequency at Various LO Power Levels, T_A = 25°C

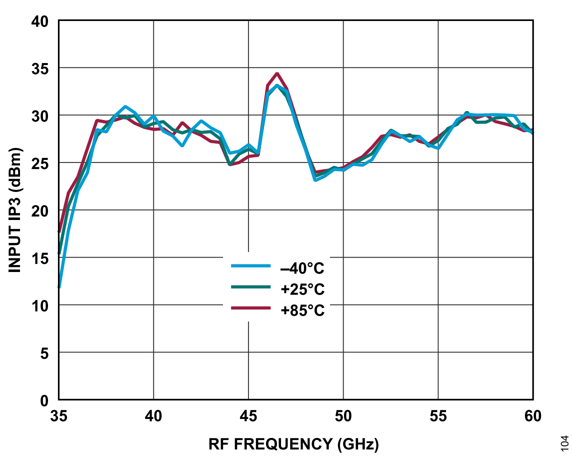

Figure 104. Input IP3 vs. RF Frequency at Various Temperatures, LO = 21 dBm

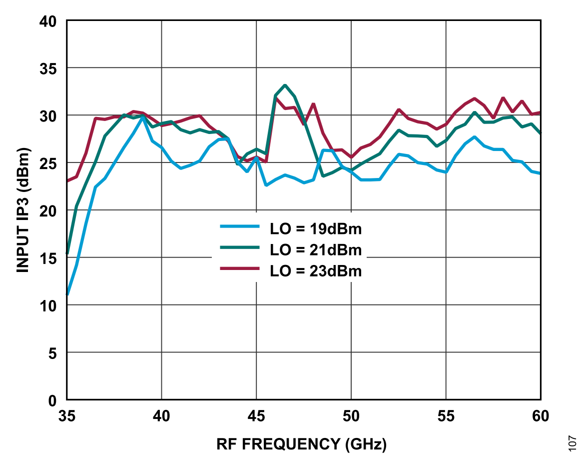

Figure 106. Input IP3 vs. RF Frequency at Various LO Power Levels, T_A = 25°C

TYPICAL PERFORMANCE CHARACTERISTICS

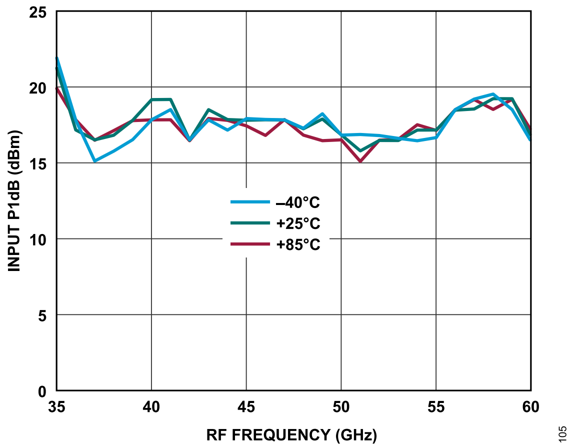

Figure 107. Input P1dB vs. RF Frequency at Various Temperatures, LO = 21 dBm

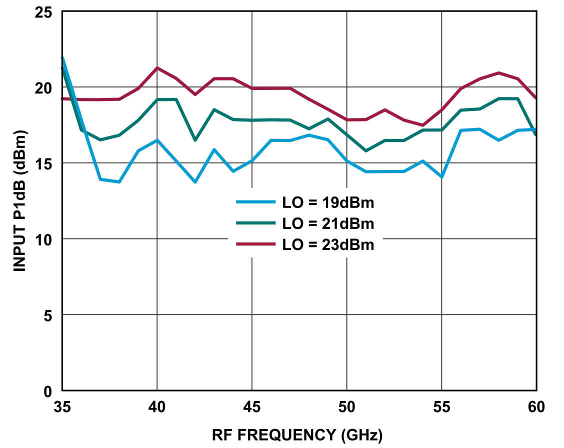

Figure 109. Input P1dB vs. RF Frequency at Various LO Power Levels, T_A = 25°C

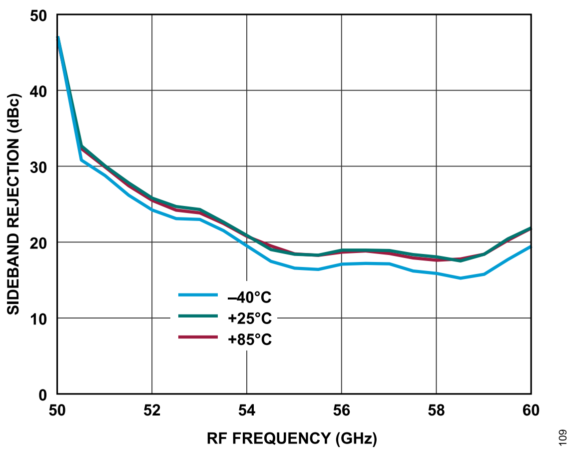

Figure 108. Sideband Rejection vs. RF Frequency at Various Temperatures, LO = 21 dBm

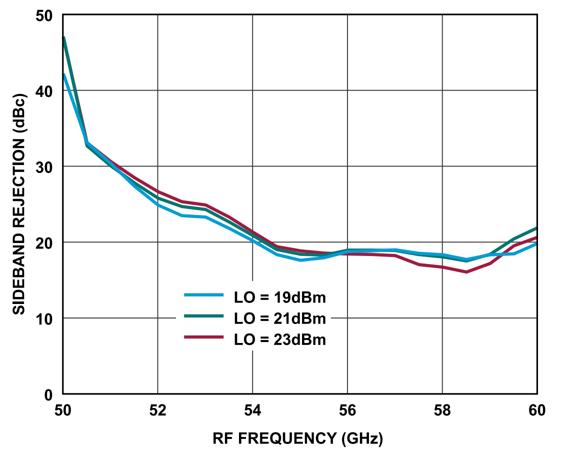

Figure 110. Sideband Rejection vs. RF Frequency at Various LO Power Levels, T_A = 25°C

TYPICAL PERFORMANCE CHARACTERISTICS

Lower Sideband (High-Side LO)

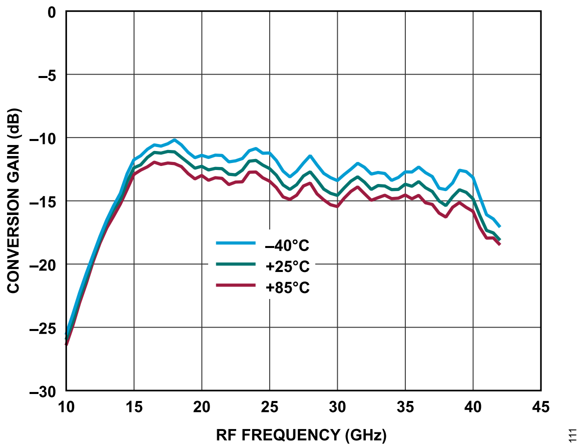

Figure 111. Conversion Gain vs. RF Frequency at Various Temperatures, LO = 21 dBm

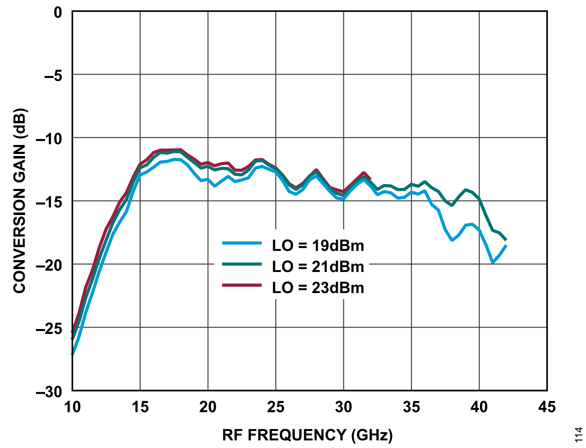

Figure 114. Conversion Gain vs. RF Frequency at Various LO Power Levels, T_A = 25°C

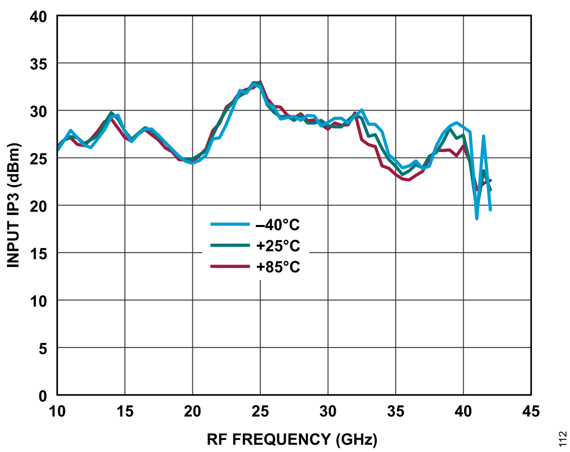

Figure 112. Input IP3 vs. RF Frequency at Various Temperatures, LO = 21 dBm

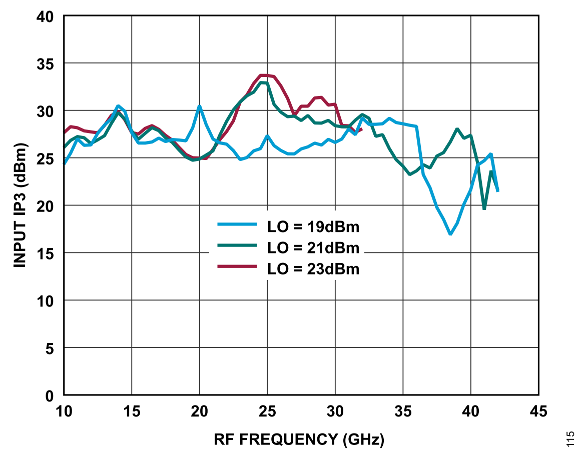

Figure 115. Input IP3 vs. RF Frequency at Various LO Power Levels, T_A = 25°C

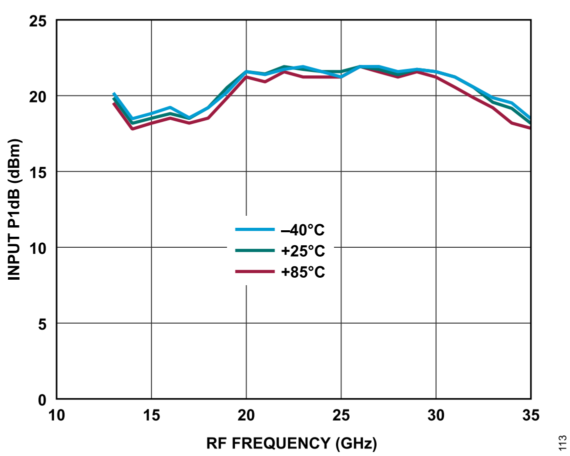

Figure 113. Input P1dB vs. RF Frequency at Various Temperatures, LO = 21 dBm

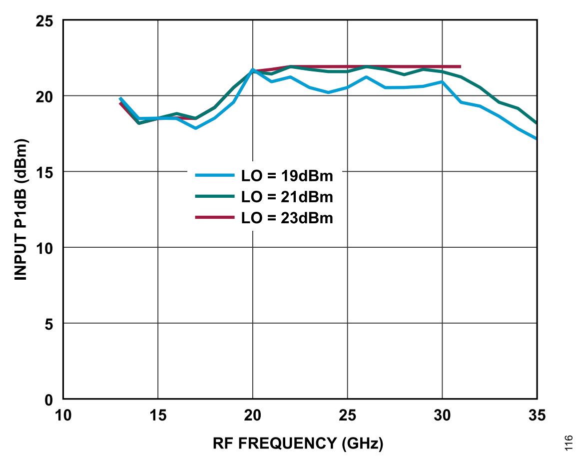

Figure 116. Input P1dB vs. RF Frequency at Various LO Power Levels, T_A = 25°C

TYPICAL PERFORMANCE CHARACTERISTICS

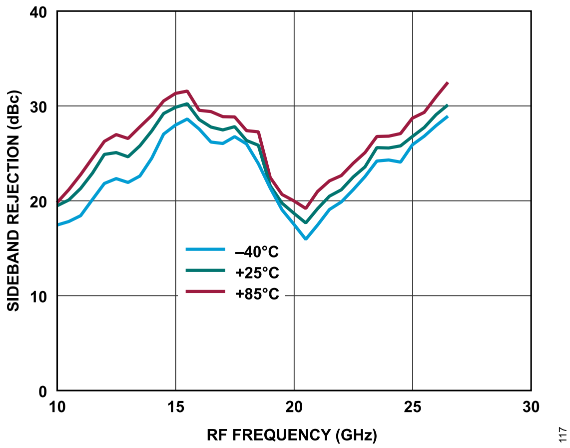

Figure 117. Sideband Rejection vs. RF Frequency at Various Temperatures, LO = 21 dBm

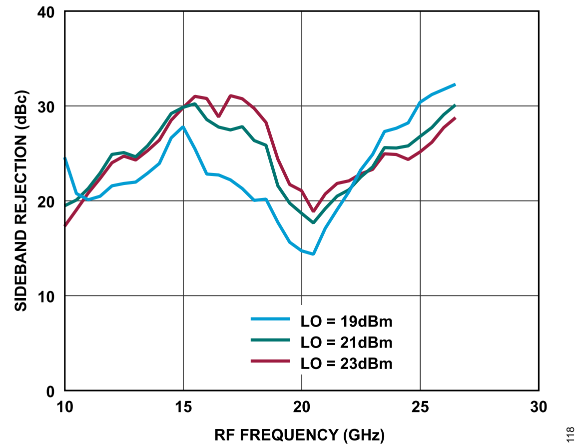

Figure 118. Sideband Rejection vs. RF Frequency at Various LO Power Levels, T_A = 25°C

TYPICAL PERFORMANCE CHARACTERISTICS

ISOLATION AND RETURN LOSS

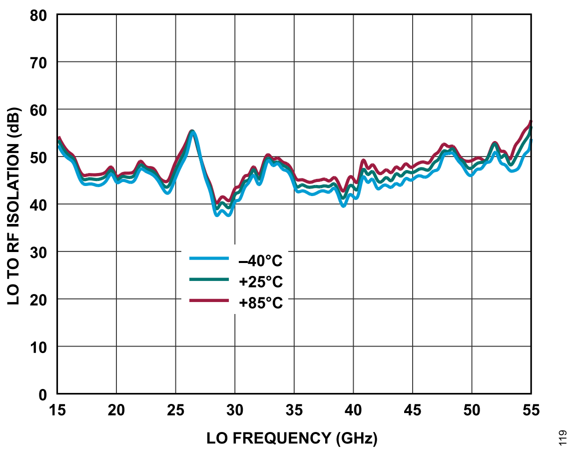

Figure 119. LO to RF Isolation vs. LO Frequency at Various Temperatures, LO = 21 dBm

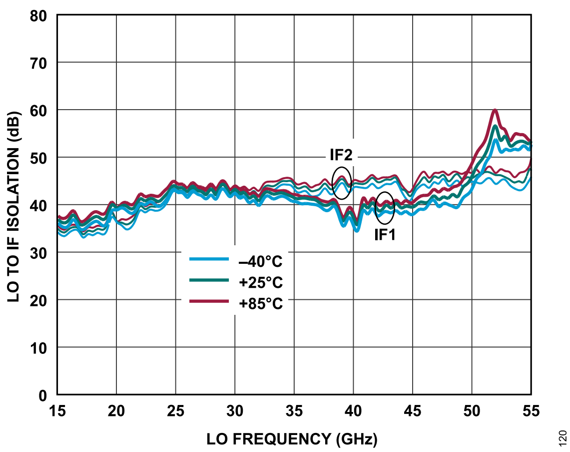

Figure 120. LO to IF Isolation vs. LO Frequency at Various Temperatures, LO = 21 dBm

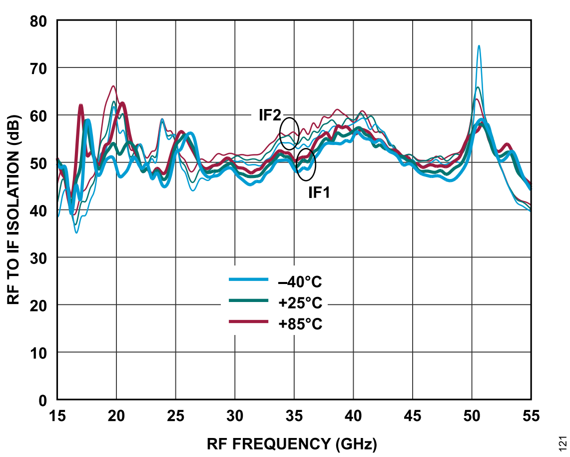

Figure 121. RF to IF Isolation vs. RF Frequency at Various Temperatures, LO = 21 dBm

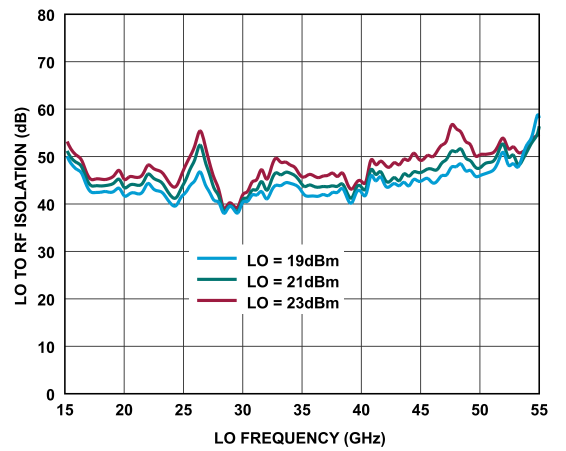

Figure 122. LO to RF Isolation vs. LO Frequency at Various LO Power Levels, T_A = 25°C

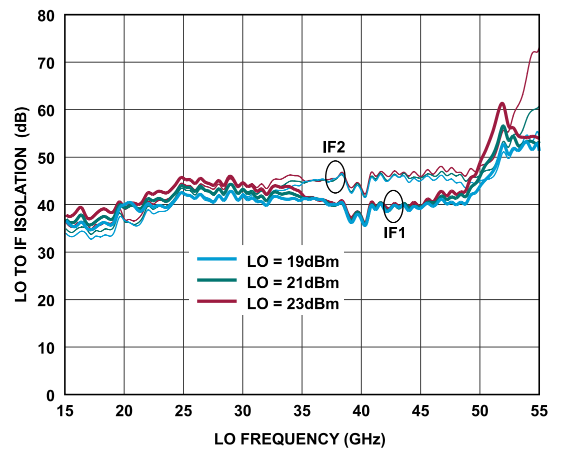

Figure 123. LO to IF Isolation vs. LO Frequency at Various LO Power Levels, T_A = 25°C

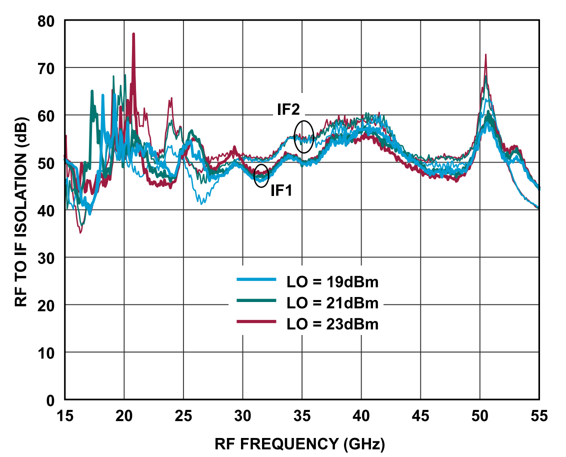

Figure 124. RF to IF Isolation vs. RF Frequency at Various LO Power Levels, T_A = 25°C

TYPICAL PERFORMANCE CHARACTERISTICS

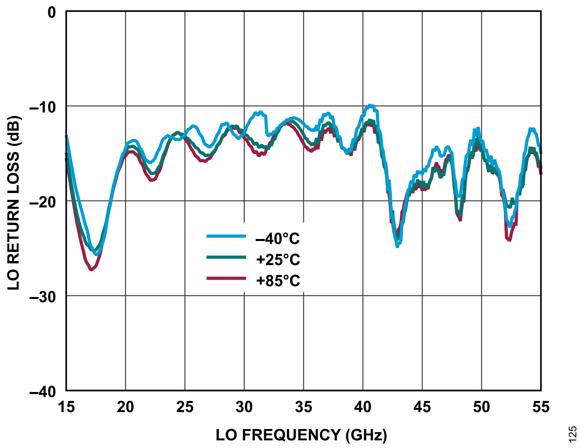

Figure 125. LO Return Loss vs. LO Frequency at Various Temperatures, LO = 21 dBm

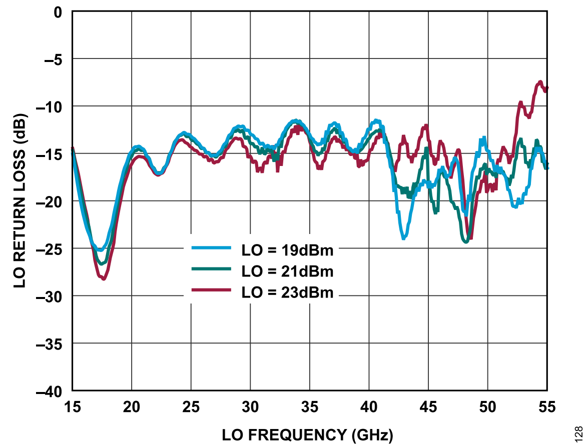

Figure 128. LO Return Loss vs. LO Frequency at Various LO Power Levels, T_A = 25°C

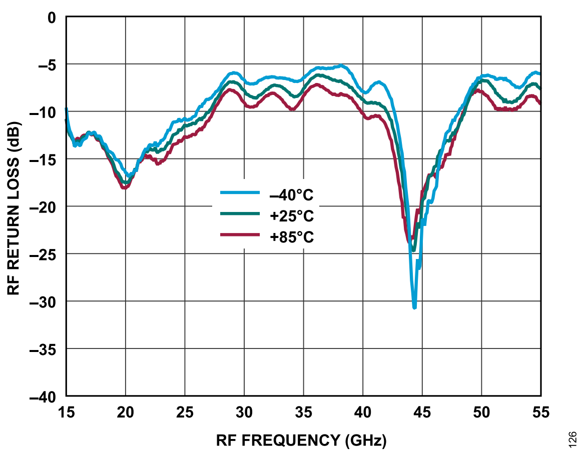

Figure 126. RF Return Loss vs. RF Frequency at Various Temperatures, LO = 21 dBm and LO Frequency = 30 GHz

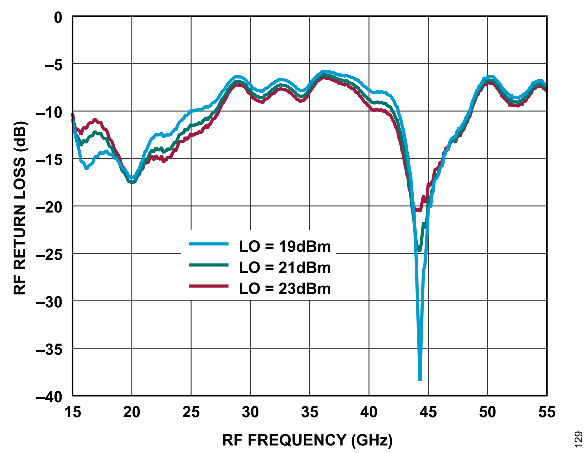

Figure 129. RF Return Loss vs. RF Frequency at Various LO Power Levels, T_A = 25°C and LO Frequency = 30 GHz

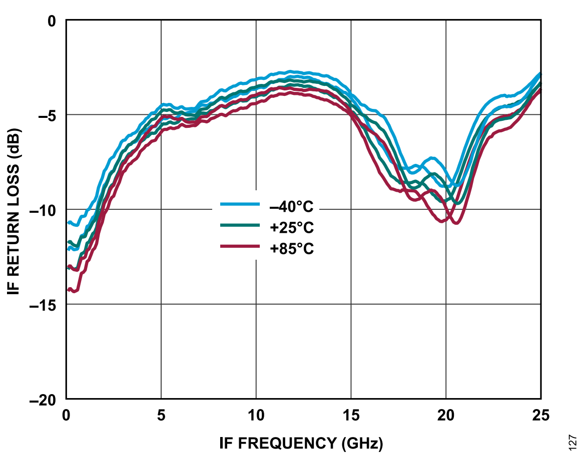

Figure 127. IF Return Loss vs. IF Frequency at Various Temperatures, LO = 21 dBm and LO Frequency = 30 GHz

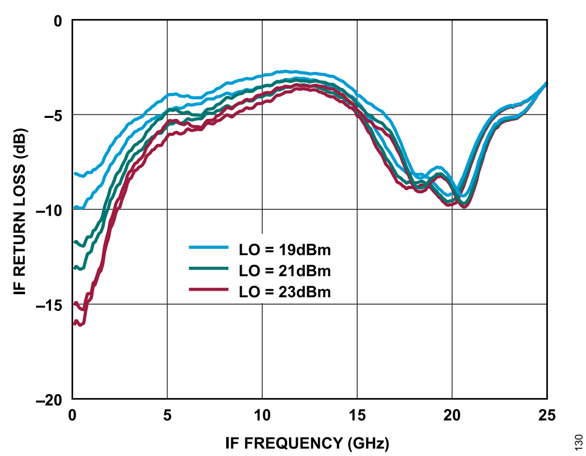

Figure 130. IF Return Loss vs. IF Frequency at Various LO Power Levels, T_A = 25°C and LO Frequency = 30 GHz

TYPICAL PERFORMANCE CHARACTERISTICS

IF BANDWIDTH—DOWNCONVERTER

Upper Sideband, LO Frequency = 20 GHz

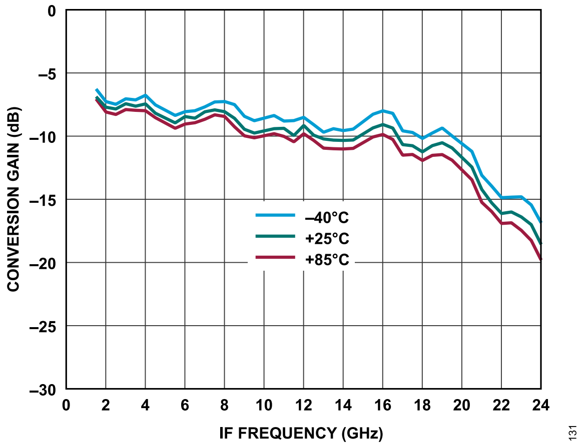

Figure 131. Conversion Gain vs. IF Frequency at Various Temperatures, LO = 21 dBm

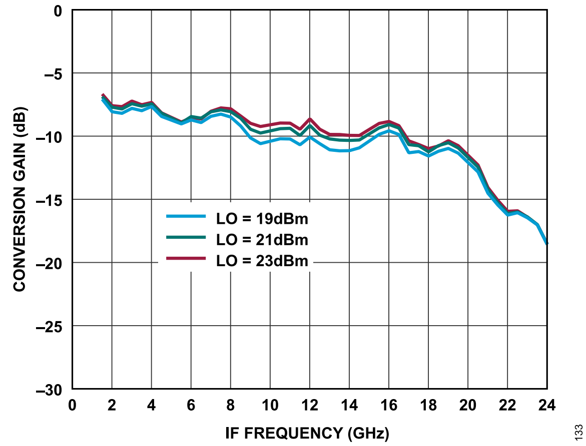

Figure 133. Conversion Gain vs. IF Frequency at Various LO Power Levels, T_A = 25°C

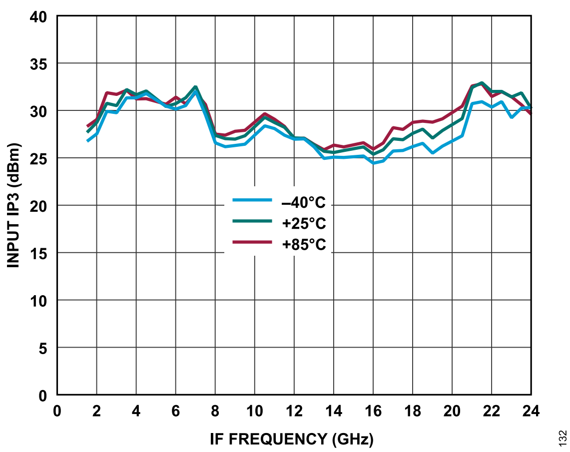

Figure 132. Input IP3 vs. IF Frequency at Various Temperatures, LO = 21 dBm

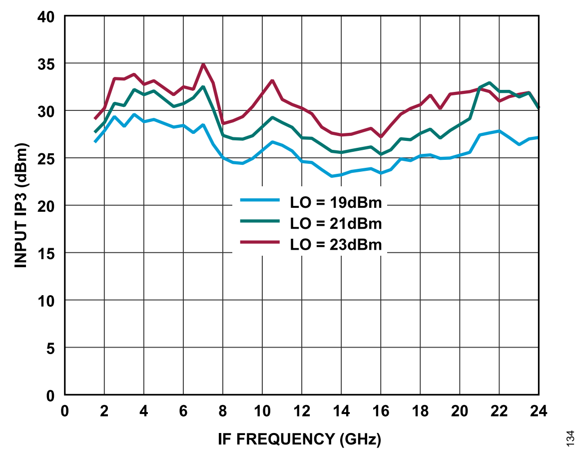

Figure 134. Input IP3 vs. IF Frequency at Various LO Power Levels, T_A = 25°C

TYPICAL PERFORMANCE CHARACTERISTICS

Lower Sideband, LO Frequency = 55 GHz

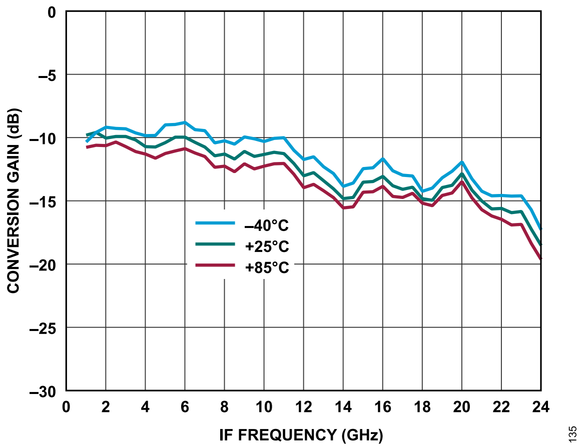

Figure 135. Conversion Gain vs. IF Frequency at Various Temperatures, LO = 21 dBm

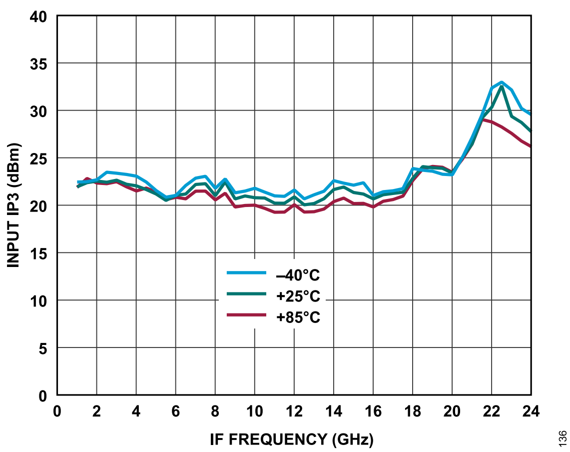

Figure 136. Input IP3 vs. IF Frequency at Various Temperatures, LO = 21 dBm

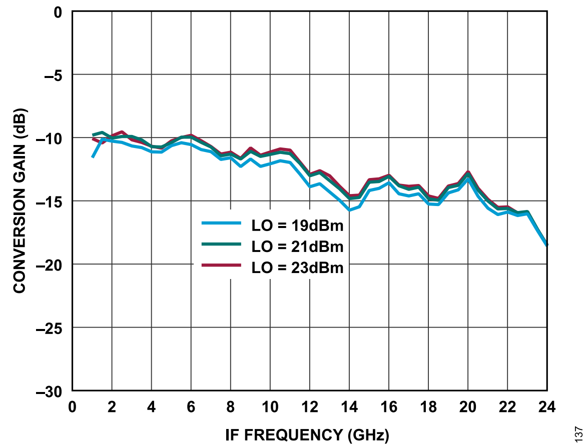

Figure 137. Conversion Gain vs. IF Frequency at Various LO Power Levels, T_A = 25°C

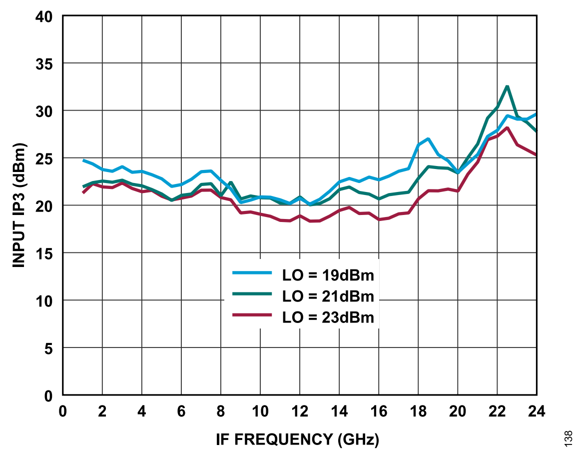

Figure 138. Input IP3 vs. IF Frequency at Various LO Power Levels, T_A = 25°C

TYPICAL PERFORMANCE CHARACTERISTICS

IF BANDWIDTH—UPCONVERTER

Upper Sideband, LO Frequency = 20 GHz

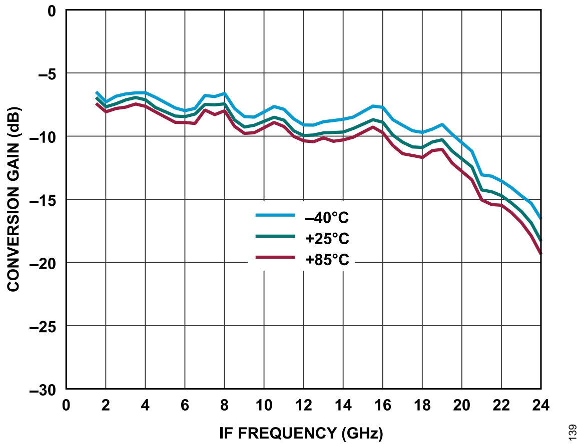

Figure 139. Conversion Gain vs. IF Frequency at Various Temperatures, LO = 21 dBm

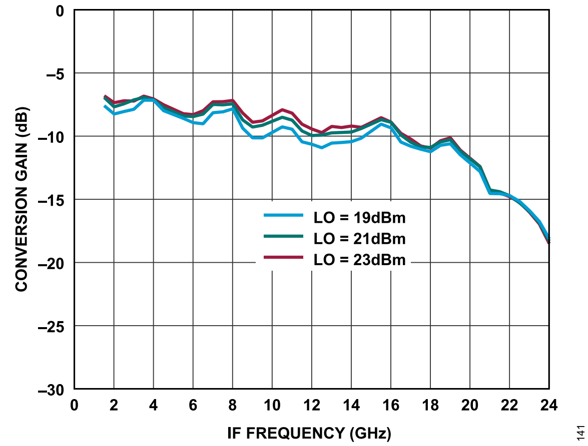

Figure 141. Conversion Gain vs. IF Frequency at Various LO Power Levels, T_A = 25°C

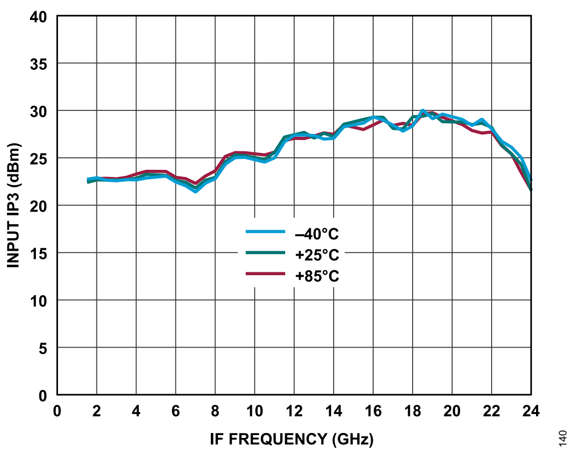

Figure 140. Input IP3 vs. IF Frequency at Various Temperatures, LO = 21 dBm

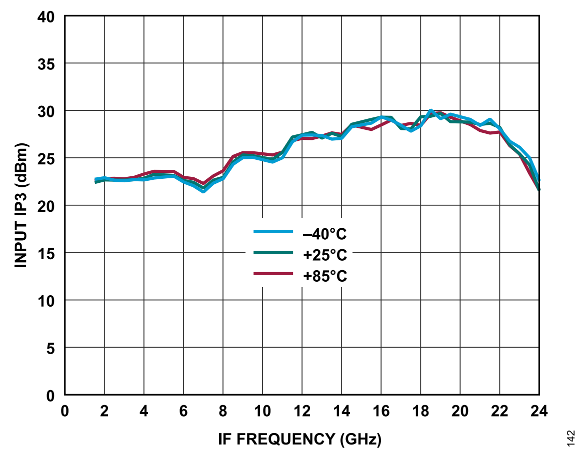

Figure 142. Input IP3 vs. IF Frequency at Various LO Power Levels, T_A = 25°C

TYPICAL PERFORMANCE CHARACTERISTICS

Lower Sideband, LO Frequency = 55 GHz

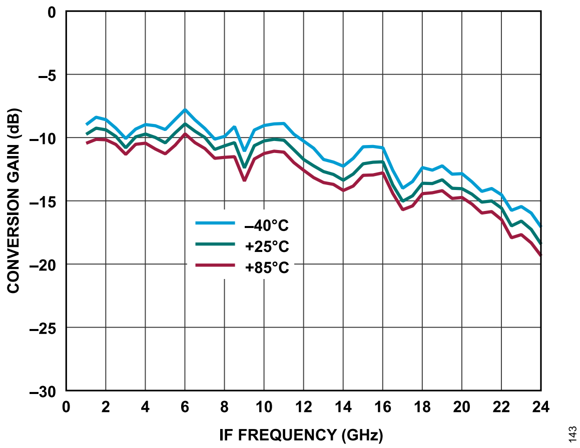

Figure 143. Conversion Gain vs. IF Frequency at Various Temperatures, LO = 21 dBm

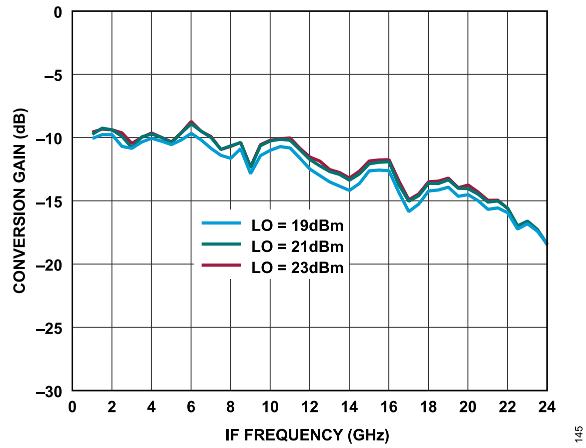

Figure 145. Conversion Gain vs. IF Frequency at Various LO Power Levels, T_A = 25°C

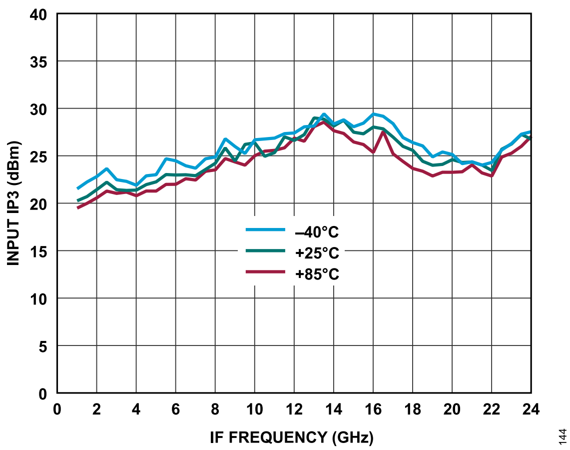

Figure 144. Input IP3 vs. IF Frequency at Various Temperatures, LO = 21 dBm

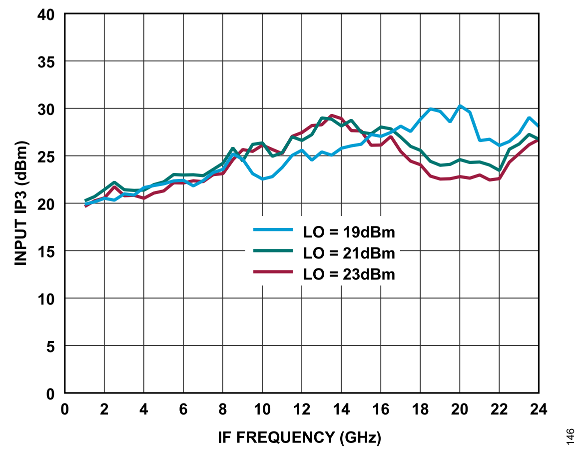

Figure 146. Input IP3 vs. IF Frequency at Various LO Power Levels, T_A = 25°C

TYPICAL PERFORMANCE CHARACTERISTICS

AMPLITUDE AND PHASE IMBALANCE

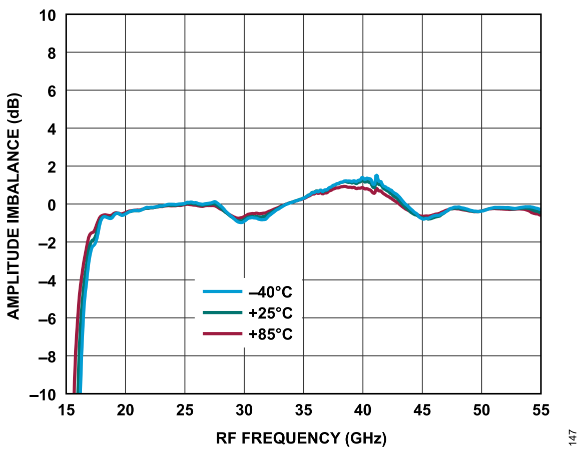

Figure 147. Amplitude Imbalance vs. RF Frequency at Various Temperatures, LO = 21 dBm

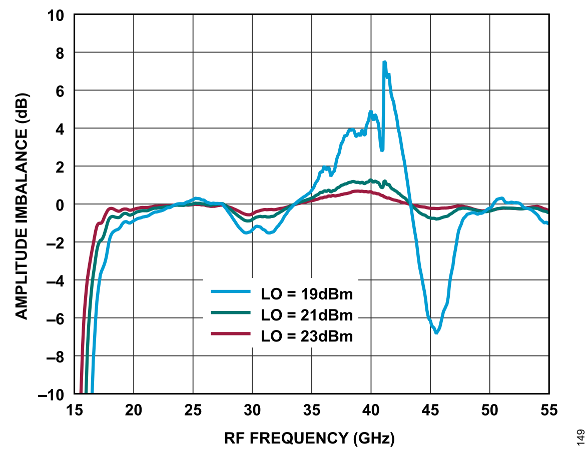

Figure 149. Amplitude Imbalance vs. RF Frequency at Various LO Power Levels, T_A = 25°C

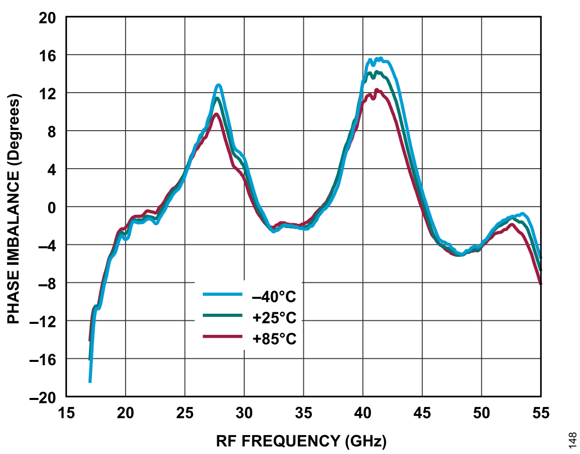

Figure 148. Phase Imbalance vs. RF Frequency at Various Temperatures, LO = 21 dBm

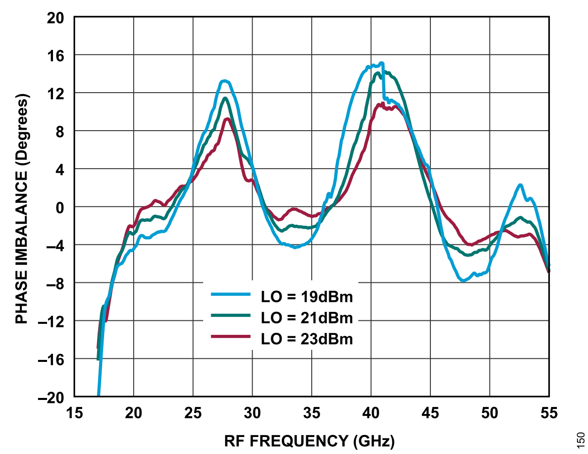

Figure 150. Phase Imbalance vs. RF Frequency at Various LO Power Levels, T_A = 25°C

TYPICAL PERFORMANCE CHARACTERISTICS

M × N SPURIOUS OUTPUTS

Downconverter, Upper Sideband

Mixer spurious products are measured in dBc from the IF output power level. Spur values are (M × RF) + (N × LO). N/A means not applicable or beyond 67 GHz.

IF output (IF_{OUT}) = 1 GHz, RF input (RF_{IN}) = 21 GHz at −10 dBm, and LO = 20 GHz at +21 dBm.

		N × LO				
		0	−1	−2	−3	−4
M × RF	0	N/A	−12	+31	−2	N/A
	1	+31	0	+30	+51	+43
	2	+59	+56	+75	+46	+60
	3	+50	+54	+70	+96	+69
	4	N/A	+53	+48	+68	+97

IF_{OUT} = 1 GHz, RF_{IN} = 31 GHz at −10 dBm, and LO = 30 GHz at +21 dBm.

		N × LO				
		0	−1	−2	−3	−4
M × RF	0	N/A	−9	+7	N/A	N/A
	1	+33	0	+37	+34	N/A
	2	+55	+62	+72	+63	+58
	3	N/A	+48	+60	+90	+64
	4	N/A	N/A	+53	+63	+92

IF_{OUT} = 1 GHz, RF_{IN} = 41 GHz at −10 dBm, and LO = 40 GHz at +21 dBm.

		N × LO				
		0	−1	−2	−3	−4
M × RF	0	N/A	−10	N/A	N/A	N/A
	1	+46	0	+52	N/A	N/A
	2	N/A	+58	+69	+56	N/A
	3	N/A	N/A	+51	+97	+54
	4	N/A	N/A	N/A	+44	+93

IF_{OUT} = 1 GHz, RF_{IN} = 51 GHz at −10 dBm, and LO = 50 GHz at +21 dBm.

		N × LO				
		0	−1	−2	−3	−4
M × RF	0	N/A	−8	N/A	N/A	N/A
	1	+42	0	+49	N/A	N/A
	2	N/A	+54	+69	+56	N/A
	3	N/A	N/A	+58	+91	+63
	4	N/A	N/A	N/A	+55	+92

Downconverter, Lower Sideband

Mixer spurious products are measured in dBc from the IF output power level. Spur values are (M × RF) + (N × LO). N/A means not applicable or beyond 67 GHz.

IF output (IF_{OUT}) = 1 GHz, RF input (RF_{IN}) = 19 GHz at −10 dBm, and LO = 20 GHz at +21 dBm.

		N × LO				
		0	1	2	3	4
M × RF	0	N/A	−8	+31	+4	N/A
	−1	+39	0	+42	+53	+55
	−2	+59	+52	+76	+59	+60
	−3	+56	+56	+68	+95	+69
	−4	N/A	+55	+58	+71	+95

IF_{OUT} = 1 GHz, RF_{IN} = 29 GHz at −10 dBm, and LO = 30 GHz at +21 dBm.

		N × LO				
		0	1	2	3	4
M × RF	0	N/A	−7	+10	N/A	N/A
	−1	+32	0	+40	+37	N/A
	−2	+57	+63	+71	+62	+55
	−3	N/A	+54	+64	+91	+62
	−4	N/A	N/A	+54	+64	+94

IF_{OUT} = 1 GHz, RF_{IN} = 39 GHz at −10 dBm, and LO = 40 GHz at +21 dBm.

		N × LO				
		0	1	2	3	4
M × RF	0	N/A	−13	N/A	N/A	N/A
	−1	+37	0	+44	N/A	N/A
	−2	N/A	+55	+74	+60	N/A
	−3	N/A	N/A	+56	+91	+52
	−4	N/A	N/A	N/A	+60	+93

IF_{OUT} = 1 GHz, RF_{IN} = 49 GHz at −10 dBm, and LO = 50 GHz at +21 dBm.

		N × LO				
		0	1	2	3	4
M × RF	0	N/A	−6	N/A	N/A	N/A
	−1	+35	0	+41	N/A	N/A
	−2	N/A	+52	+66	+56	+53
	−3	N/A	N/A	+64	+92	+60
	−4	N/A	N/A	N/A	+46	+93

TYPICAL PERFORMANCE CHARACTERISTICS

Upconverter, Upper Sideband

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 or beyond 67 GHz.

IF input (IF_{IN}) = 1 GHz, RF output (RF_{OUT}) = 21 GHz at −10 dBm, and LO = 20 GHz at +21 dBm.

		N × LO				
		0	1	2	3	4
M × IF	0	N/A	5	13	9	N/A
	1	55	0	39	43	43
	2	96	49	64	65	65
	3	97	78	65	75	75
	4	>97	80	60	76	73

IF_{IN} = 1 GHz, RF_{OUT} = 31 GHz at −10 dBm, and LO = 30 GHz at +21 dBm.

		N × LO				
		0	1	2	3	4
M × IF	0	N/A	−1	+31	N/A	N/A
	1	+52	0	+30	N/A	N/A
	2	+96	+46	+72	N/A	N/A
	3	>97	+73	+71	N/A	N/A
	4	>97	>97	+71	N/A	N/A

IF_{IN} = 1 GHz, RF_{OUT} = 41 GHz at −10 dBm, and LO = 40 GHz at +21 dBm.

		N × LO				
		0	1	2	3	4
M × IF	0	N/A	1	N/A	N/A	N/A
	1	55	0	N/A	N/A	N/A
	2	>97	47	N/A	N/A	N/A
	3	>97	>97	N/A	N/A	N/A
	4	>97	>97	N/A	N/A	N/A

IF_{IN} = 1 GHz, RF_{OUT} = 51 GHz at −10 dBm, and LO = 50 GHz at +21 dBm.

		N × LO				
		0	1	2	3	4
M × IF	0	N/A	1	N/A	N/A	N/A
	1	54	0	N/A	N/A	N/A
	2	>97	49	N/A	N/A	N/A
	3	>97	>97	N/A	N/A	N/A
	4	>97	>97	N/A	N/A	N/A

THEORY OF OPERATION

The ADMV1555 is a compact, in-phase/quadrature, double balanced mixer that can be used as an upconverter or a downconverter from 18 GHz to 55 GHz.

When used as a downconverter, the ADMV1555 downconverts RFs between 18 GHz and 55 GHz to IFs between DC and 20 GHz.

When used as an upconverter, the mixer upconverts IFs between DC and 20 GHz to RFs between 18 GHz and 55 GHz.

APPLICATIONS INFORMATION

TYPICAL APPLICATION CIRCUIT

Figure 151 shows the typical application circuit for the ADMV1555. The ADMV1555 is a passive device that does not require any external components. The LO and RF pins are internally AC-coupled. The IFx pins are internally DC-coupled. To select the appropriate sideband, an external 90° hybrid is needed. For applications not requiring operation to DC, DC block this port externally using a series capacitor of a value chosen to pass the necessary IF frequency range. For applications that require suppression of the LO signal at the output, use a bias tee or RF feed as shown in Figure. Ensure that the source or sink current used for LO suppression is < 39 mA for each IFx port to prevent damage to the device. The common-mode voltage for each IFx port is 0 V.

To select the upper sideband when using the ADMV1555 as an downconverter, connect the IF1 pin to the 90° port of the hybrid, and connect the IF2 pin to the 0° port of the hybrid. To select the lower sideband, connect the IF1 pin to the 0° port of the hybrid and the IF2 pin to the 90° port of the hybrid. The input is from the sum port of the hybrid, and the difference port is 50 Ω terminated.

To select the upper sideband (low-side LO) when using as up-converter, connect the IF1 pin to the 0° port of the hybrid and connect the IF2 pin to the 90° port of the hybrid. To select the lower sideband (high-side LO), connect the IF1 pin to the 90° port of the hybrid and connect the IF2 pin to the 0° port of the hybrid. The output is from the sum port of the hybrid, and the difference port is 50 Ω terminated.

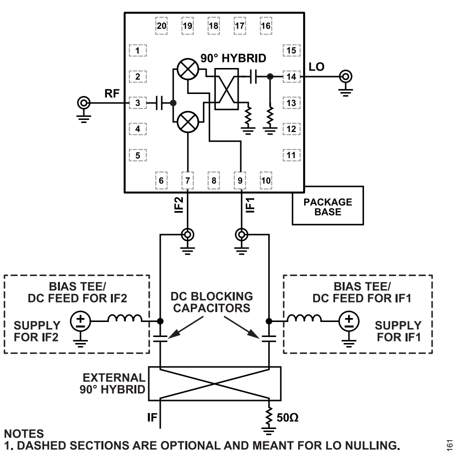

Figure 151. Typical Application Circuit

EVALUATION PCB INFORMATION

The circuit board used in the application must use RF circuit design techniques. Signal lines must have 50 Ω impedance, and the package grounds leads and exposed pad must be connected directly to the ground plane similarly to that shown in Figure 152. Use a sufficient number of via holes to connect the top and bottom ground planes. The evaluation circuit board shown in Figure 152 is available from Analog Devices, Inc., upon request.

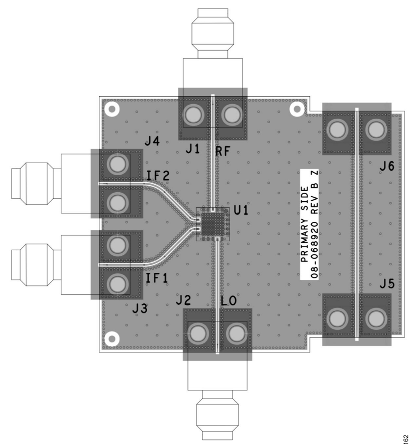

Figure 152. Evaluation PCB Top Layer

Table 6. Bill of Materials for the ADMV1555-EVALZ Evaluation PCB

Quantity	Reference Designator	Description	Manufacturer	Part Number
1		PCB, evaluation board		08-068920
4	J1 to J4	Connectors, 1.85 mm, 67 GHz	Southwest Microwave	1892-04-9
1	U1	Device under test (DUT)	Analog Devices	ADMV1555ACCZ

OUTLINE DIMENSIONS

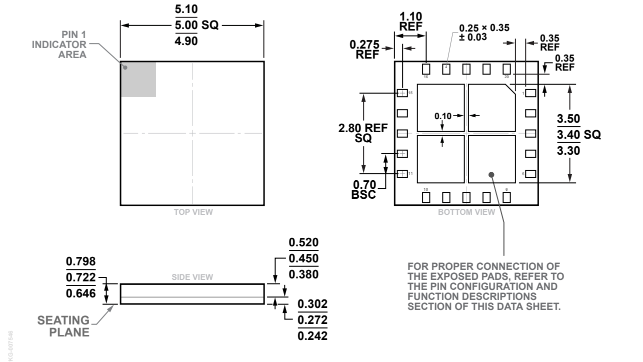

Figure 153. 20-Terminal Land Grid Array [LGA]
5.00 mm × 5.00 mm Body and 0.732 mm Package Height
(CC-20-16)
Dimensions shown in millimeters

Updated: April 04, 2024

ORDERING GUIDE

Model[1]	Temperature Range	Package Description	Packing Quantity	Package Option
ADMV1555ACCZ	−40°C to +85°C	20-Terminal LGA (5 mm × 5 mm × 0.722 mm)		CC-20-16
ADMV1555ACCZ-RL7	−40°C to +85°C	20-Terminal LGA (5 mm × 5 mm × 0.722 mm)	REEL, 1000	CC-20-16

[1] Z = RoHS Compliant Part.

EVALUATION BOARDS

Table 7. Evaluation Boards

Model[1]	Description
ADMV1555-EVALZ	Evaluation Board

[1] Z = RoHS Compliant Part.