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FEATURES

Conversion loss: 8 dB
LO to RF isolation: 50 dB
LO to IF isolation: 35 dB
Input third-order intercept (IP3): 18 dBm
Input second-order intercept (IP2): 55 dBm
LO port return loss: 8 dBm
RF port return loss: 10 dBm
Passive double balanced topology
Wide IF bandwidth: dc to 3 GHz
24-terminal ceramic leadless chip carrier package

APPLICATIONS

WiMAX and fixed wireless
Point to point radios
Point to multipoint radios
Test equipment and sensors
Military end use

GENERAL DESCRIPTION

The [HMC557A](#) is a general-purpose, double balanced mixer in a 24-terminal, ceramic leadless chip carrier, RoHS-compliant package. The device can be used as an upconverter or down-converter from 2.5 GHz to 7.0 GHz. This mixer is fabricated in a gallium arsenide (GaAs) metal semiconductor field effect transistor (MESFET) process and requires no external components or matching circuitry.

FUNCTIONAL BLOCK DIAGRAM

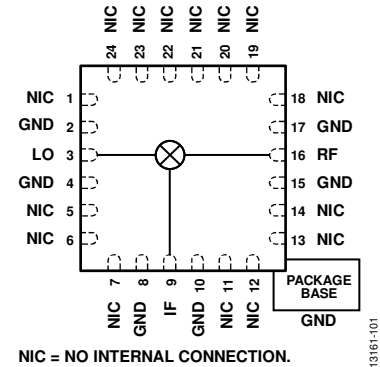


Figure 1.

13161-101

The [HMC557A](#) provides excellent local oscillator (LO) to radio frequency (RF) and LO to intermediate frequency (IF) isolation due to optimized balun structures. The RoHS-compliant [HMC557A](#) eliminates the need for wire bonding and is compatible with high volume surface-mount manufacturing techniques.

HMC557A* PRODUCT PAGE QUICK LINKS

Last Content Update: 02/23/2017

COMPARABLE PARTS

View a parametric search of comparable parts.

EVALUATION KITS

- HMC557A Evaluation Board

DOCUMENTATION

Data Sheet

- HMC557A: GaAs, MMIC Fundamental Mixer, 2.5 GHz to 7.0 GHz Data Sheet

TOOLS AND SIMULATIONS

- HMC557A S-Parameters

DESIGN RESOURCES

- HMC557A Material Declaration
- PCN-PDN Information
- Quality And Reliability
- Symbols and Footprints

DISCUSSIONS

View all HMC557A EngineerZone Discussions.

SAMPLE AND BUY

Visit the product page to see pricing options.

TECHNICAL SUPPORT

Submit a technical question or find your regional support number.

DOCUMENT FEEDBACK

Submit feedback for this data sheet.

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REVISION HISTORY

8/2016—Rev. B to Rev. C

| | |
|---------------------------------|----|
| Changes to Ordering Guide | 23 |
|---------------------------------|----|

1/2016—Rev. A to Rev. B

| | |
|--|---|
| Change to LO to RF Isolation Parameter, Table 2..... | 3 |
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9/2015—Rev. 0 to Rev. A

| | |
|---|----|
| Changes to Features Section..... | 1 |
| Added Maximum Peak Reflow Temperature Parameter, Table 3 | 4 |
| Updated Outline Dimensions | 23 |
| Changes to Ordering Guide | 23 |

7/2015—Revision 0: Initial Version

ELECTRICAL SPECIFICATIONS

2.5 GHz TO 5.0 GHz FREQUENCY RANGE

$T_A = 25^\circ\text{C}$, IF = 100 MHz, LO drive = 15 dBm. All measurements performed as a downconverter with the upper sideband selected, unless otherwise noted.

Table 1.

| Parameter | Min | Typ | Max | Unit |
|---|-----|-----|------|------|
| OPERATING CONDITIONS | | | | |
| RF Frequency Range | 2.5 | | 5.0 | GHz |
| LO Frequency Range | 2.5 | | 5.0 | GHz |
| IF Frequency Range | DC | | 3 | GHz |
| PERFORMANCE | | | | |
| Conversion Loss | | 8 | 10.5 | dB |
| Noise Figure, Single Sideband (SSB) | | 8 | | dB |
| LO to RF Isolation | 40 | 50 | | dB |
| LO to IF Isolation | 26 | 35 | | dB |
| RF to IF Isolation | | 20 | | dB |
| Input Third-Order Intercept (IP3) | 14 | 18 | | dBm |
| Input Second-Order Intercept (IP2) | | 55 | | dBm |
| Input Power for 1 dB Compression (P1dB) | | 10 | | dBm |
| RF Port Return Loss | | 10 | | dB |
| LO Port Return Loss | | 8 | | dB |

5.0 GHz TO 7.0 GHz FREQUENCY RANGE

$T_A = 25^\circ\text{C}$, IF = 100 MHz, LO drive = 15 dBm. All measurements performed as a downconverter with the upper sideband selected, unless otherwise noted.

Table 2.

| Parameter | Min | Typ | Max | Unit |
|---|-----|-----|------|------|
| OPERATING CONDITIONS | | | | |
| RF Frequency Range | 5.0 | | 7.0 | GHz |
| LO Frequency Range | 5.0 | | 7.0 | GHz |
| IF Frequency Range | DC | | 3 | GHz |
| PERFORMANCE | | | | |
| Conversion Loss | | 8.5 | 10.5 | dB |
| Noise Figure, Single Sideband (SSB) | | 8.5 | | dB |
| LO to RF Isolation | 37 | 43 | | dB |
| LO to IF Isolation | 25 | 33 | | dB |
| RF to IF Isolation | | 25 | | dB |
| Input Third-Order Intercept (IP3) | 14 | 18 | | dBm |
| Input Second-Order Intercept (IP2) | | 55 | | dBm |
| Input Power for 1 dB Compression (P1dB) | | 10 | | dBm |
| RF Port Return Loss | | 12 | | dB |
| LO Port Return Loss | | 12 | | dB |

ABSOLUTE MAXIMUM RATINGS

Table 3.

| Parameter | Rating |
|---|-------------------|
| RF Input Power | 25 dBm |
| LO Input Power | 27 dBm |
| Channel Temperature | 175°C |
| Continuous P _{DISS} (T = 85°C), Derate 10.81 mW/°C Above 85°C | 972 mW |
| Thermal Resistance (Channel to Ground Pad) | 92.5°C/W |
| Maximum Peak Reflow Temperature | 260°C |
| Storage Temperature Range | –65°C to +150°C |
| Operating Temperature Range | –40°C to +85°C |
| ESD Sensitivity, Human Body Model (HBM) | 1000 V (Class 1C) |

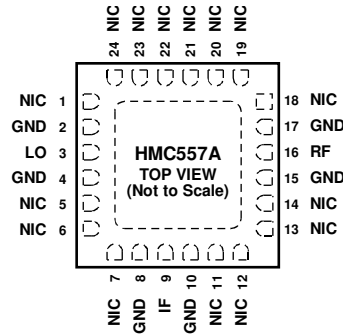
Stresses at or above those listed under Absolute Maximum Ratings may cause permanent damage to the product. This is a stress rating only; functional operation of the product at these or any other conditions above those indicated in the operational section of this specification is not implied. Operation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

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



- NOTES**
1. NIC = NO INTERNAL CONNECTION.
 2. CONNECT THE EXPOSED PAD TO A LOW IMPEDANCE THERMAL AND ELECTRICAL GROUND PLANE.

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Figure 2. Pin Configuration

Table 4. Pin Function Descriptions

| Pin No. | Mnemonic | Description |
|-------------------------------|----------|--|
| 1, 5 to 7, 11 to 14, 18 to 24 | NIC | No Internal Connection. No connection is required on these pins. These pins are not internally connected. However, all data is measured with these pins connected to RF/dc ground externally. |
| 2, 4, 8, 10, 15, 17 | GND | Ground Connect. Connect these pins and the package bottom to RF/dc ground. |
| 3 | LO | Local Oscillator Port. This pin is dc-coupled and matched to 50 Ω. |
| 9 | IF | Intermediate Frequency Port. This pin is dc-coupled. For applications not requiring operation to dc, block this pin externally using a series capacitor with a value chosen to pass the necessary IF frequency range. For operation to dc, this pin must not source or sink more than 2 mA of current or device nonfunctionality or device failure may result. |
| 16 | RF | Radio Frequency Port. This pin is dc-coupled and matched to 50 Ω. |
| | EPAD | Exposed Pad. Connect the exposed pad to a low impedance thermal and electrical ground plane. |

INTERFACE SCHEMATICS



Figure 3. GND Interface Schematic

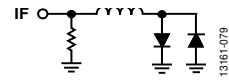


Figure 5. IF Interface Schematic

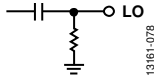


Figure 4. LO Interface Schematic

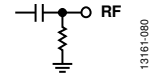


Figure 6. RF Interface Schematic

TYPICAL PERFORMANCE CHARACTERISTICS

DOWNCONVERTER PERFORMANCE WITH UPPER SIDEBAND SELECTED, IF = 100 MHz

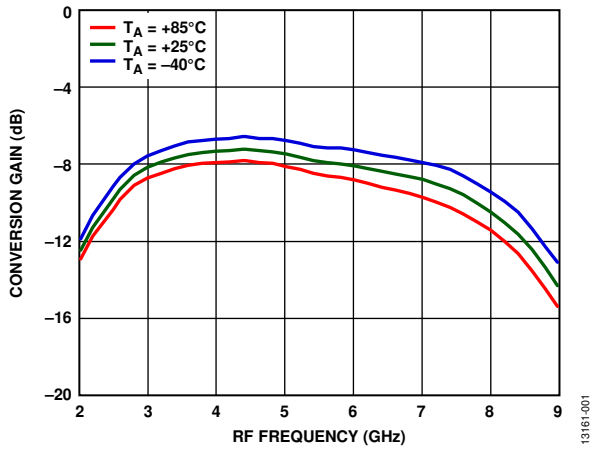


Figure 7. Conversion Gain vs. RF Frequency at Various Temperatures, LO Drive = 15 dBm

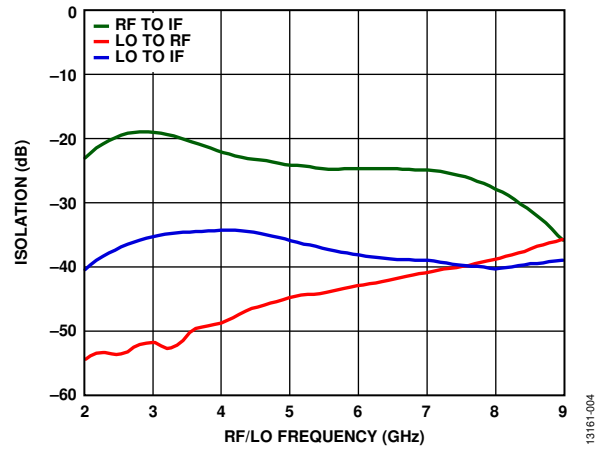


Figure 10. Isolation vs. RF/LO Frequency

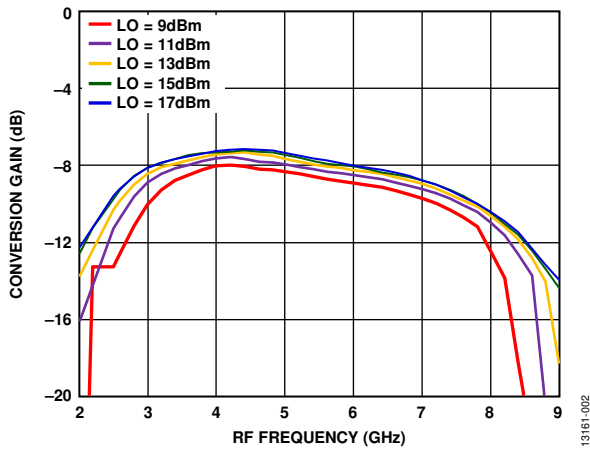


Figure 8. Conversion Gain vs. RF Frequency at Various LO Drives

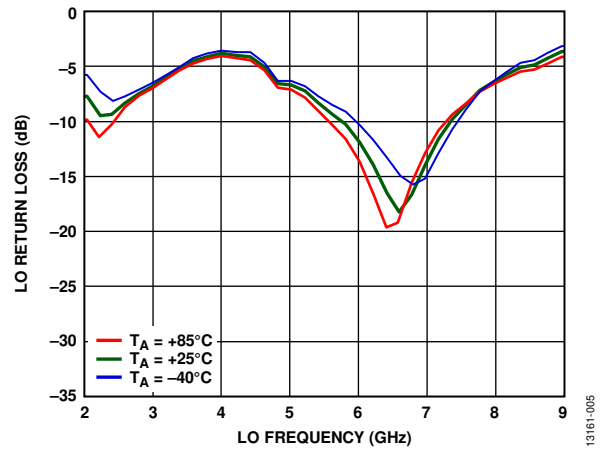


Figure 11. LO Port Return Loss vs. LO Frequency, LO Drive = 15 dBm

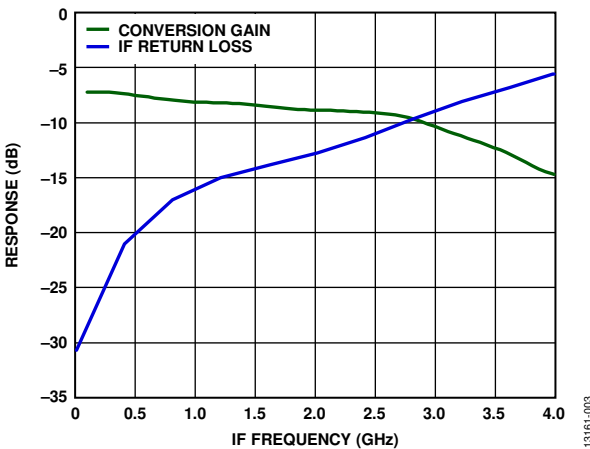


Figure 9. Conversion Gain and IF Return Loss Response vs. IF Frequency, LO Frequency = 4.5 GHz

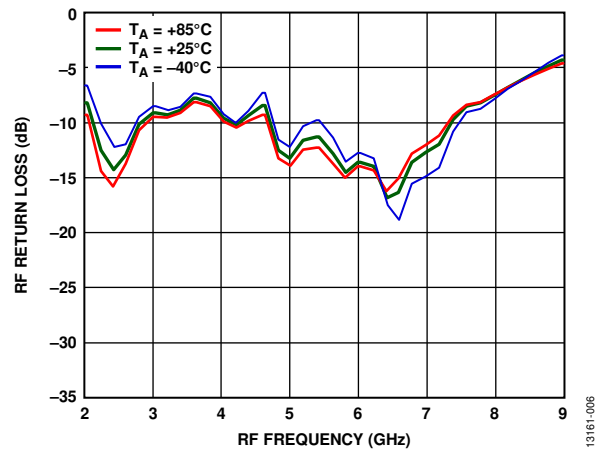


Figure 12. RF Port Return Loss vs. RF Frequency, LO Frequency = 4.6 GHz, LO Drive = 15 dBm

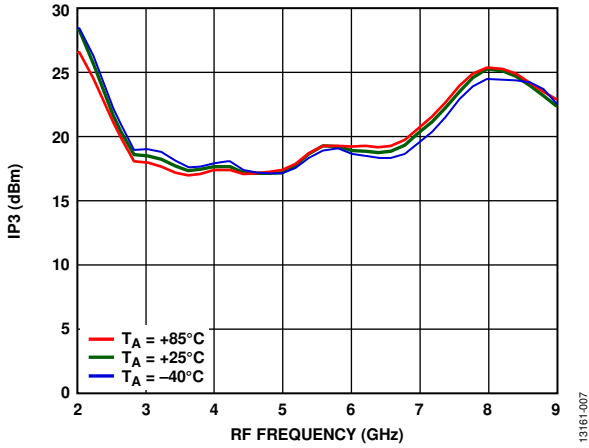


Figure 13. Input IP3 vs. RF Frequency at Various Temperatures, LO Drive = 15 dBm

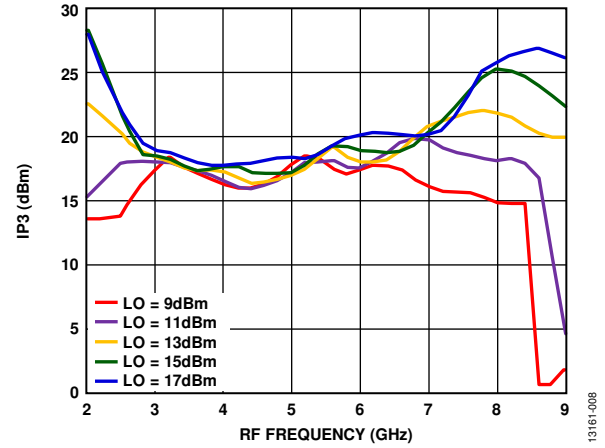


Figure 15. Input IP3 vs. RF Frequency at Various LO Drives

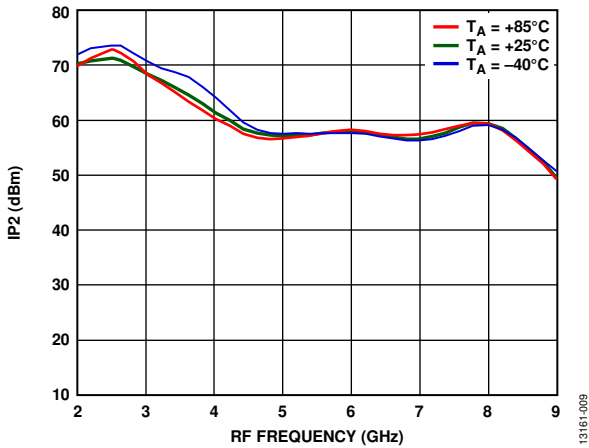


Figure 14. Input IP2 vs. RF Frequency at Various Temperatures, LO Drive = 15 dBm

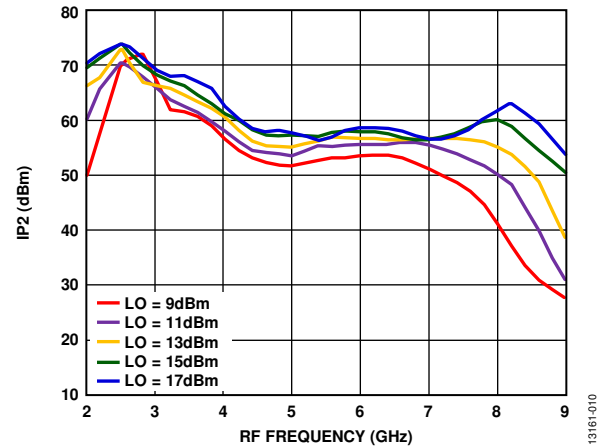


Figure 16. Input IP2 vs. RF Frequency at Various LO Drives

DOWNCONVERTER PERFORMANCE WITH UPPER SIDEBAND SELECTED, IF = 1000 MHz

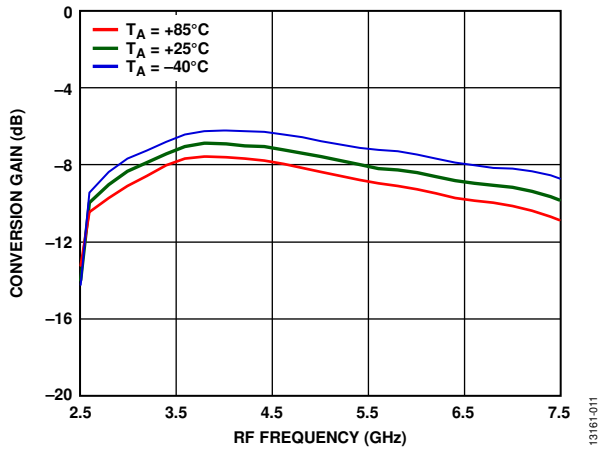


Figure 17. Conversion Gain vs. RF Frequency at Various Temperatures, LO Drive = 15 dBm

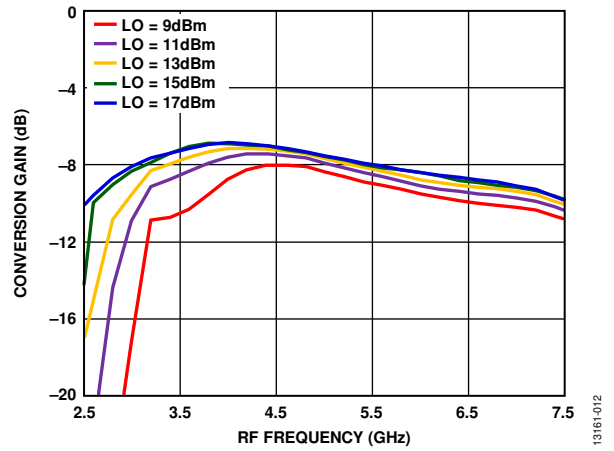


Figure 20. Conversion Gain vs. RF Frequency at Various LO Drives

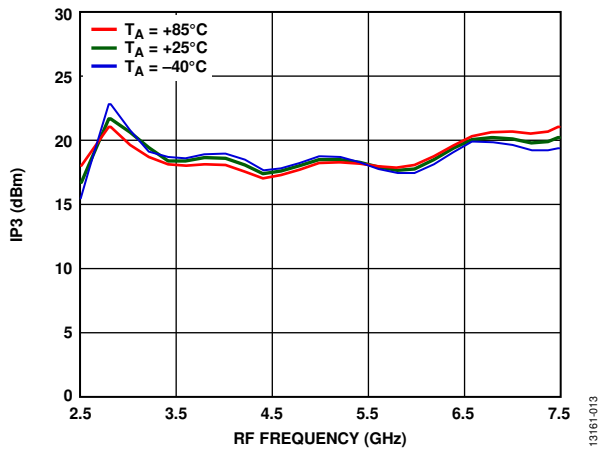


Figure 18. Input IP3 vs. RF Frequency at Various Temperatures, LO Drive = 15 dBm

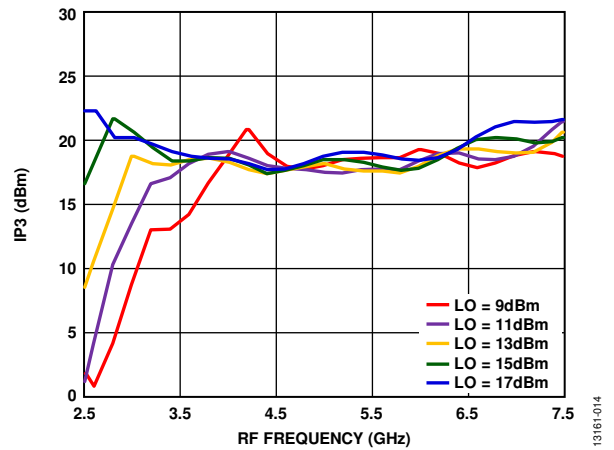


Figure 21. Input IP3 vs. RF Frequency at Various LO Drives

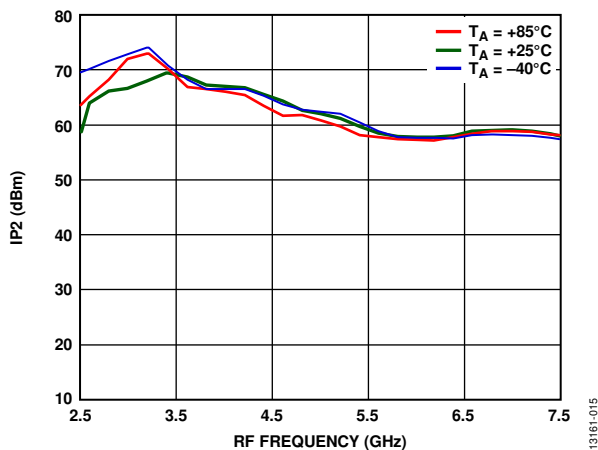


Figure 19. Input IP2 vs. RF Frequency at Various Temperatures, LO Drive = 15 dBm

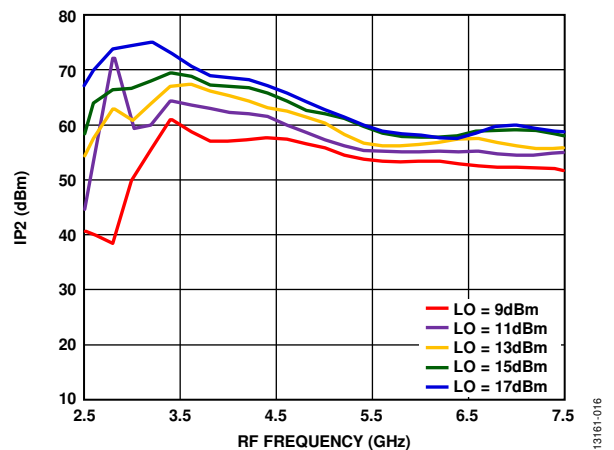


Figure 22. Input IP2 vs. RF Frequency at Various LO Drives

DOWNCONVERTER PERFORMANCE WITH UPPER SIDEBAND SELECTED, IF = 2000 MHz

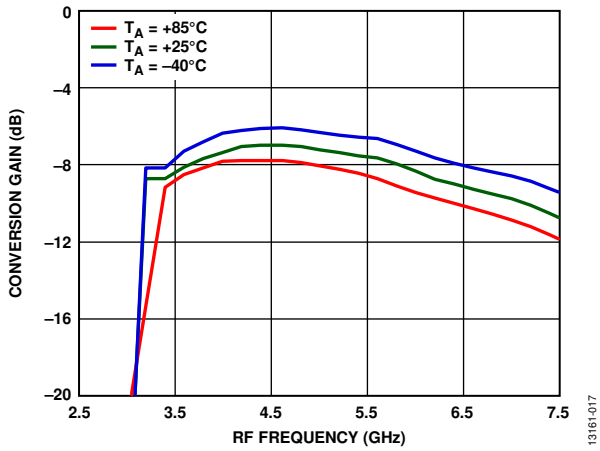


Figure 23. Conversion Gain vs. RF Frequency at Various Temperatures, LO Drive = 15 dBm

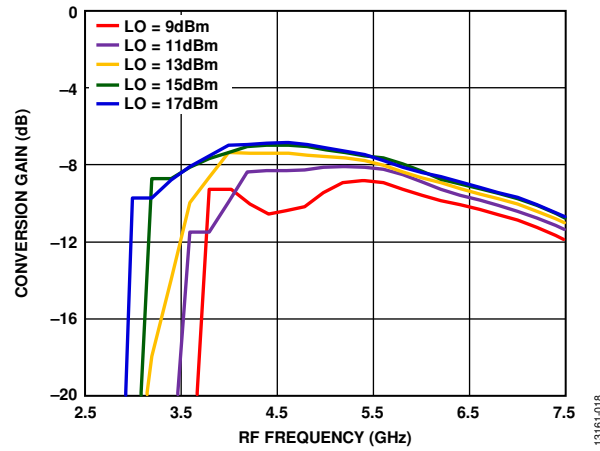


Figure 26. Conversion Gain vs. RF Frequency at Various LO Drives

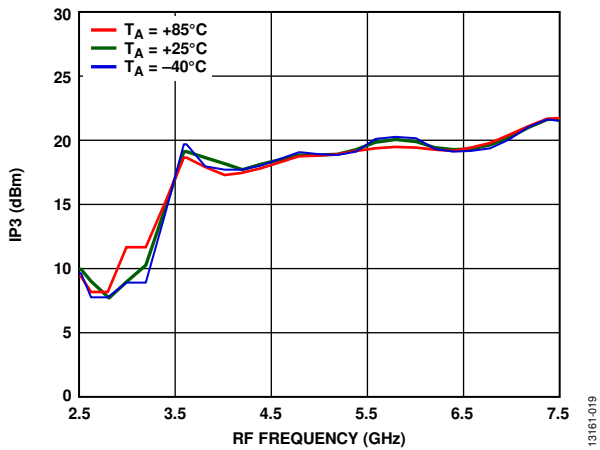


Figure 24. Input IP3 vs. RF Frequency at Various Temperatures, LO Drive = 15 dBm

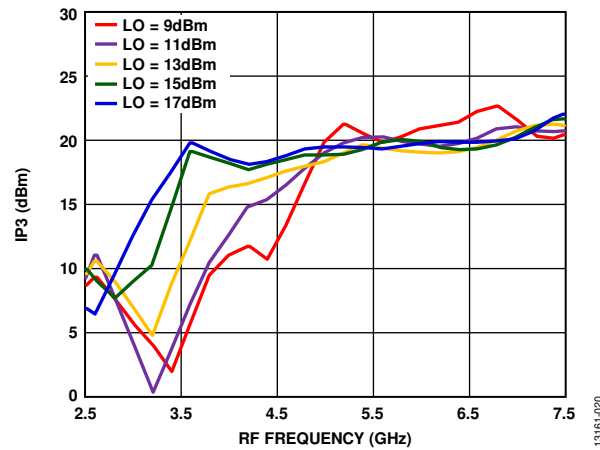


Figure 27. Input IP3 vs. RF Frequency at Various LO Drives

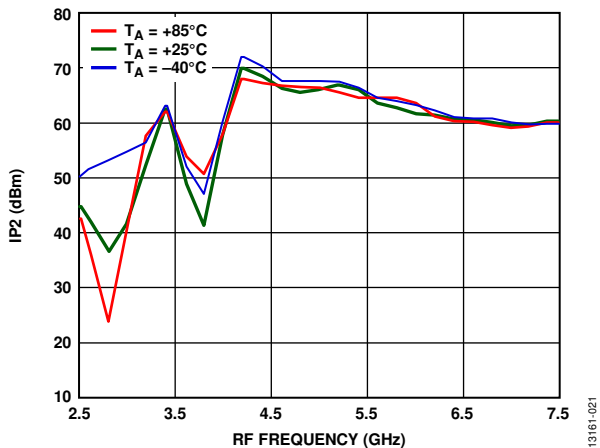


Figure 25. Input IP2 vs. RF Frequency at Various Temperatures, LO Drive = 15 dBm

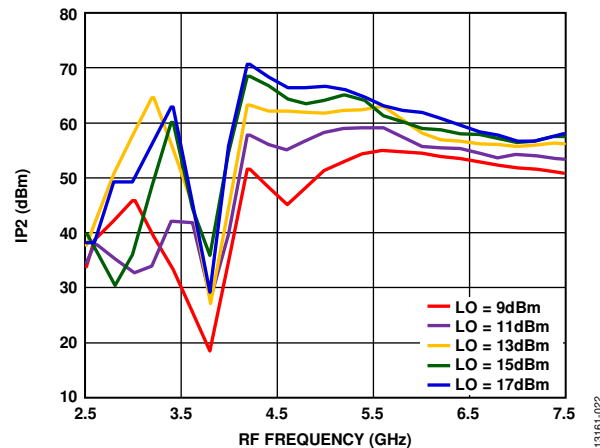


Figure 28. Input IP2 vs. RF Frequency at Various LO Drives

DOWNCONVERTER PERFORMANCE WITH LOWER SIDEBAND SELECTED, IF = 100 MHz

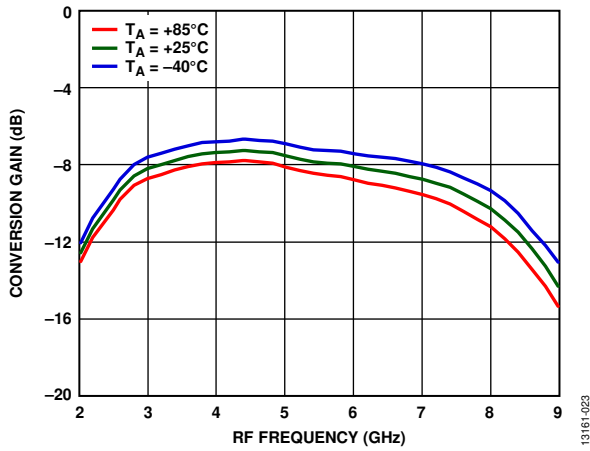


Figure 29. Conversion Gain vs. RF Frequency at Various Temperatures, LO Drive = 15 dBm

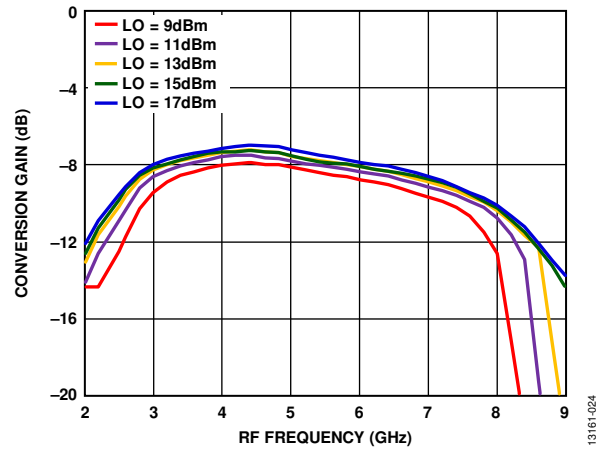


Figure 32. Conversion Gain vs. RF Frequency at Various LO Drives

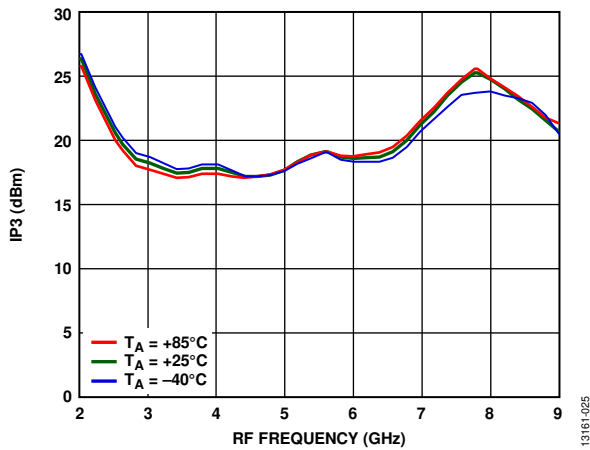


Figure 30. Input IP3 vs. RF Frequency at Various Temperatures, LO Drive = 15 dBm

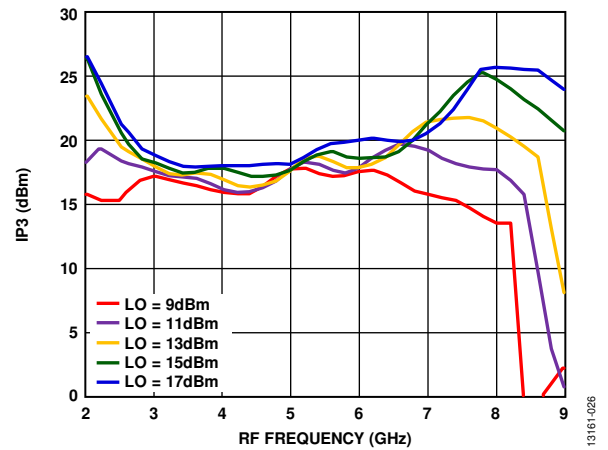


Figure 33. Input IP3 vs. RF Frequency at Various LO Drives

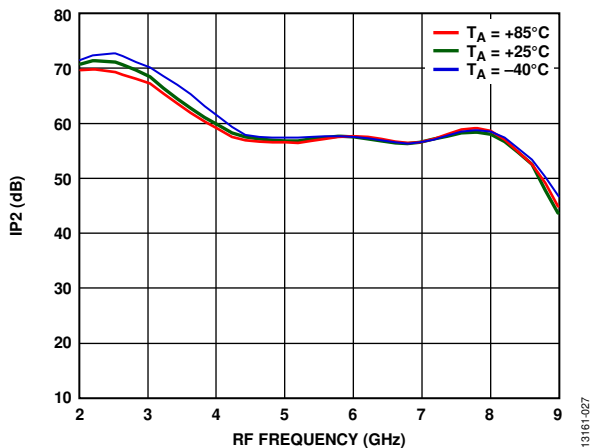


Figure 31. Input IP2 vs. RF Frequency at Various Temperatures, LO Drive = 15 dBm

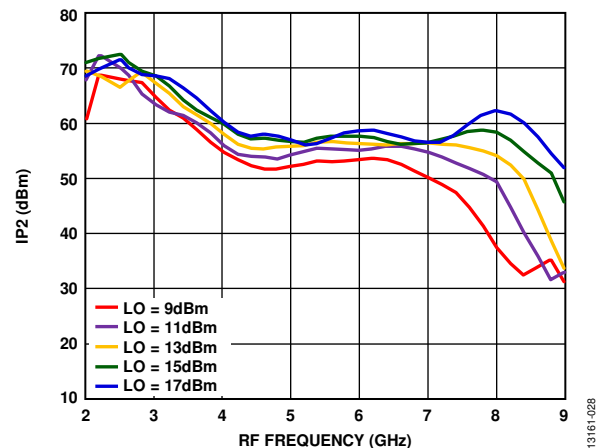


Figure 34. Input IP2 vs. RF Frequency at Various LO Drives

DOWNCONVERTER PERFORMANCE WITH LOWER SIDEBAND SELECTED, IF = 1000 MHz

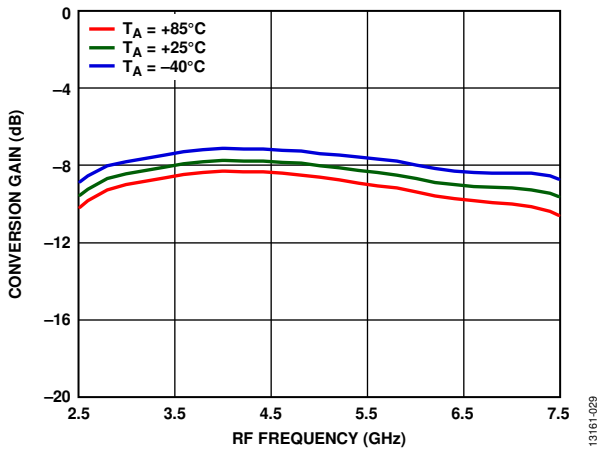


Figure 35. Conversion Gain vs. RF Frequency at Various Temperatures, LO Drive = 15 dBm

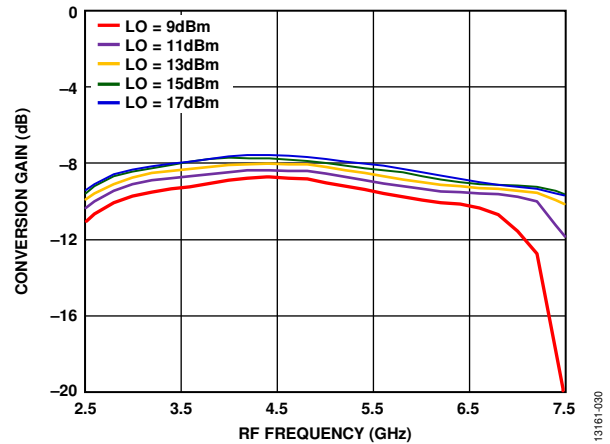


Figure 38. Conversion Gain vs. RF Frequency at Various LO Drives

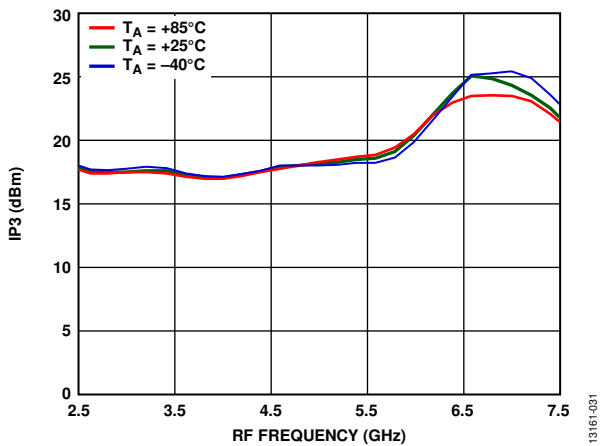


Figure 36. Input IP3 vs. RF Frequency at Various Temperatures, LO Drive = 15 dBm

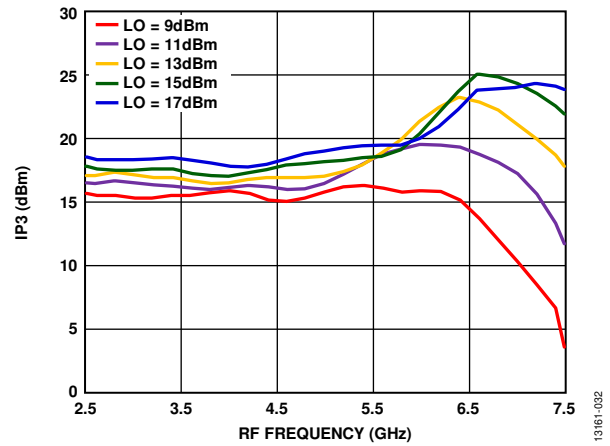


Figure 39. Input IP3 vs. RF Frequency at Various LO Drives

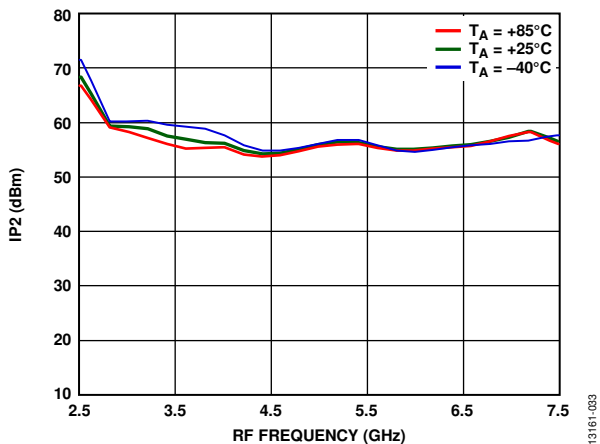


Figure 37. Input IP2 vs. RF Frequency at Various Temperatures, LO Drive = 15 dBm

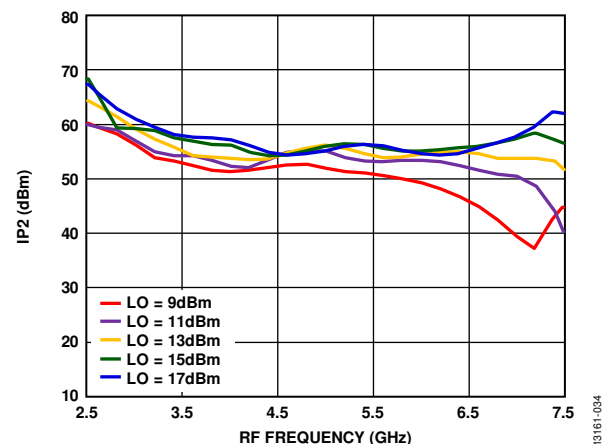


Figure 40. Input IP2 vs. RF Frequency at Various LO Drives

DOWNCONVERTER PERFORMANCE WITH LOWER SIDEBAND SELECTED, IF = 2000 MHz

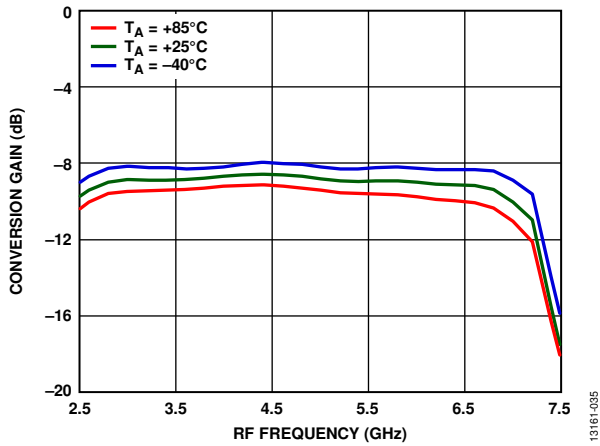


Figure 41. Conversion Gain vs. RF Frequency at Various Temperatures, LO Drive = 15 dBm

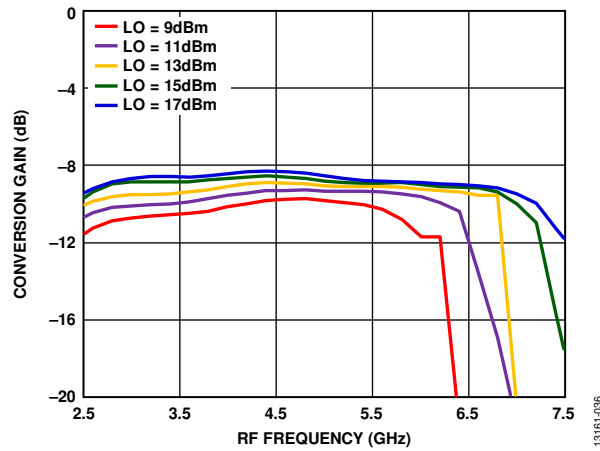


Figure 44. Conversion Gain vs. RF Frequency at Various LO Drives

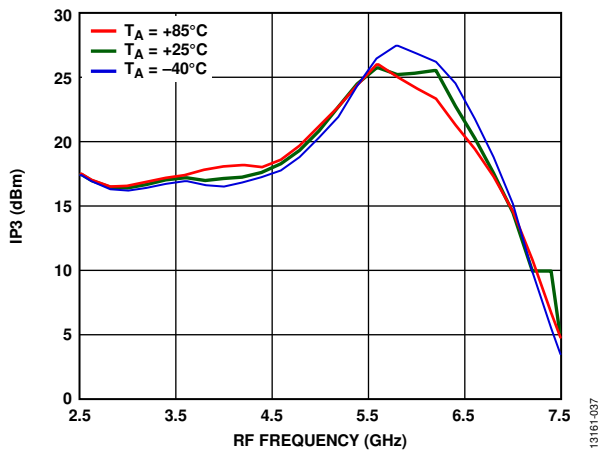


Figure 42. Input IP3 vs. RF Frequency at Various Temperatures, LO Drive = 15 dBm

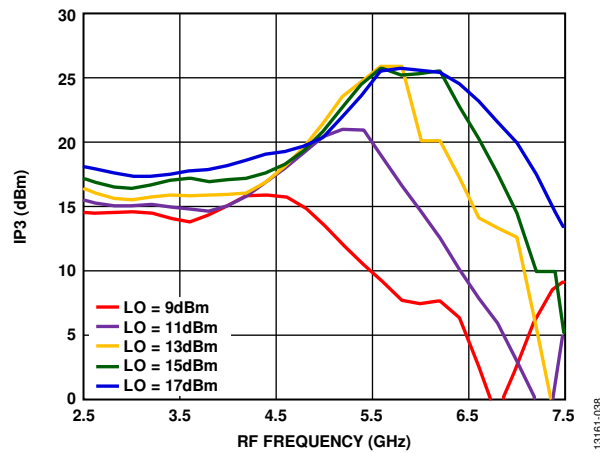


Figure 45. Input IP3 vs. RF Frequency at Various LO Drives

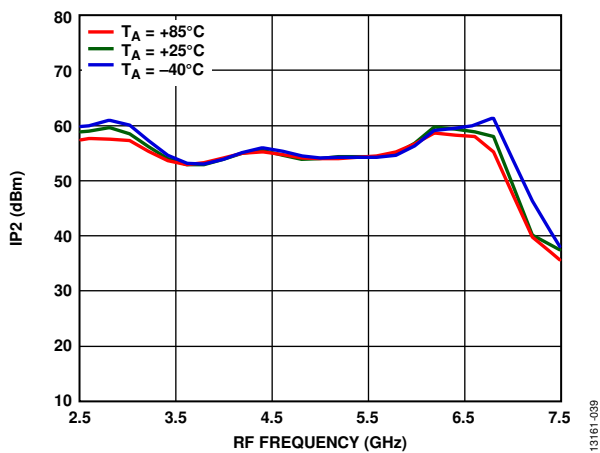


Figure 43. Input IP2 vs. RF Frequency at Various Temperatures, LO Drive = 15 dBm

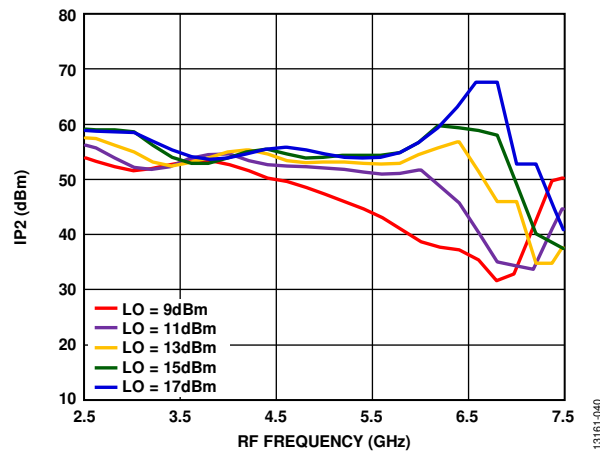


Figure 46. Input IP2 vs. RF Frequency at Various LO Drives

P1dB PERFORMANCE WITH DOWNCONVERTER MODE SELECTED AT LO DRIVE = 15 dBm

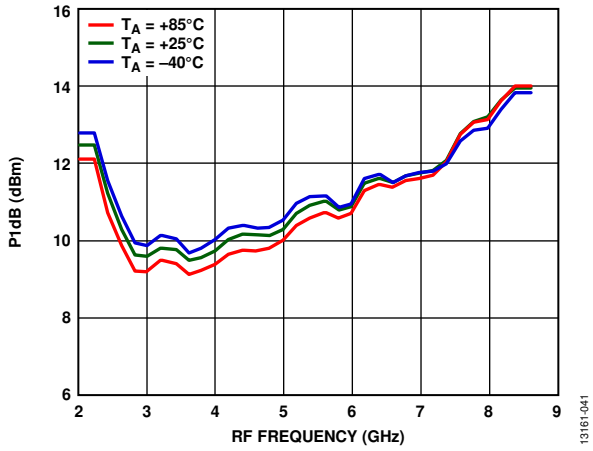


Figure 47. Input P1dB vs. RF Frequency at Various Temperatures, IF = 100 MHz, USB

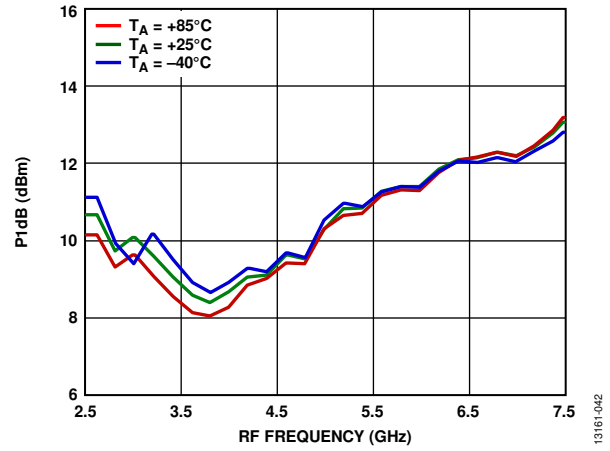


Figure 50. Input P1dB vs. RF Frequency at Various Temperatures, IF = 1000 MHz, USB

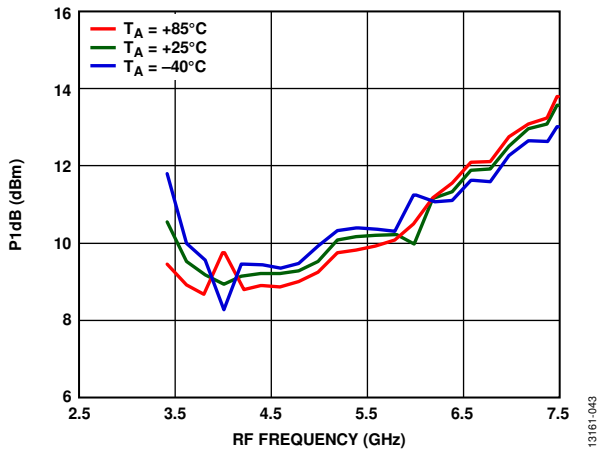


Figure 48. Input P1dB vs. RF Frequency at Various Temperatures, IF = 2000 MHz, USB

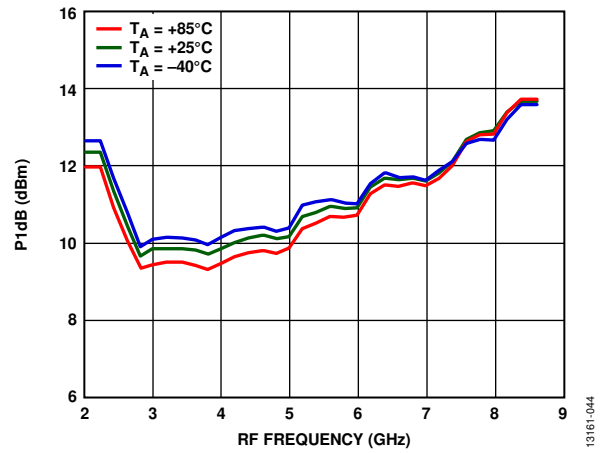


Figure 51. Input P1dB vs. RF Frequency at Various Temperatures, IF = 100 MHz, LSB

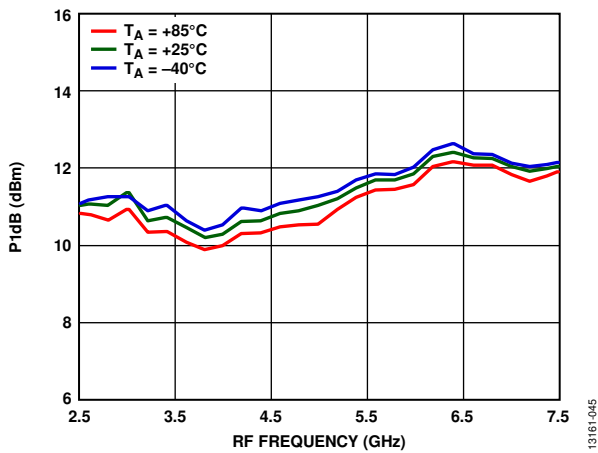


Figure 49. Input P1dB vs. RF Frequency at Various Temperatures, IF = 1000 MHz, LSB

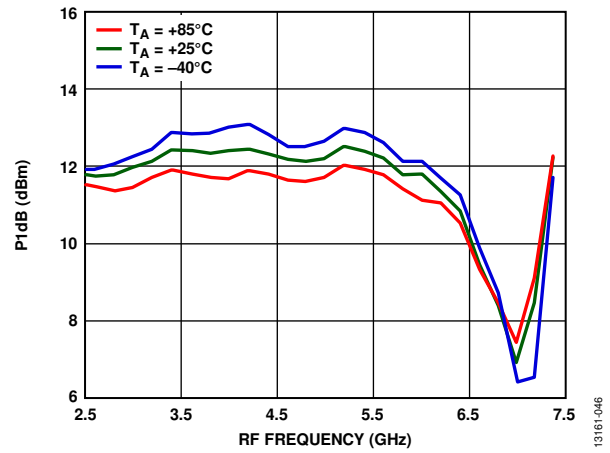


Figure 52. Input P1dB vs. RF Frequency at Various Temperatures, IF = 2000 MHz, LSB

UPCONVERTER PERFORMANCE WITH UPPER SIDEBAND SELECTED, IF = 100 MHz

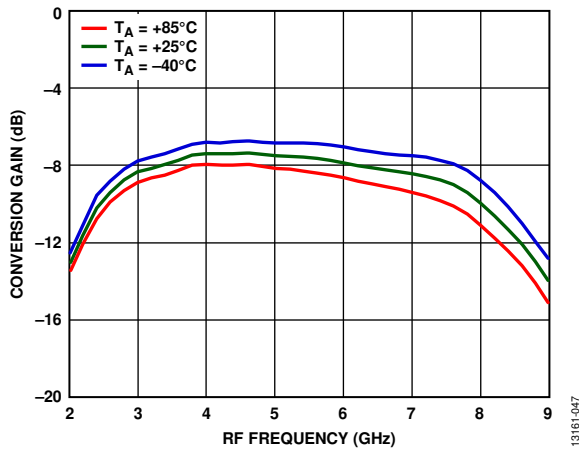


Figure 53. Conversion Gain vs. RF Frequency at Various Temperatures, LO Drive = 15 dBm

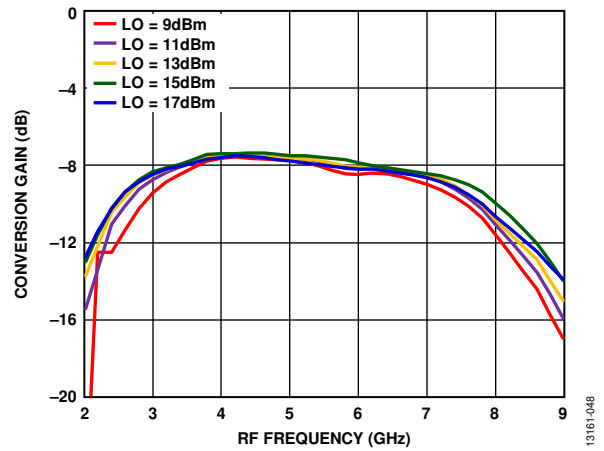


Figure 56. Conversion Gain vs. RF Frequency at Various LO Drives

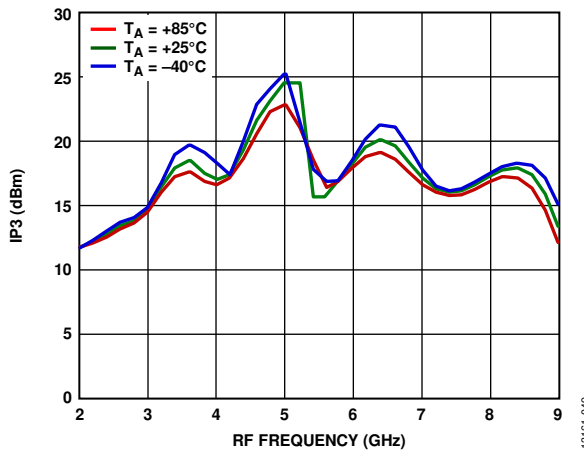


Figure 54. Input IP3 vs. RF Frequency at Various Temperatures, LO Drive = 15 dBm

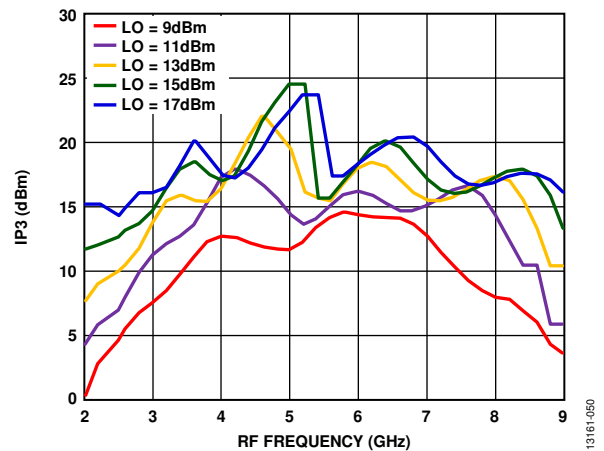


Figure 57. Input IP3 vs. RF Frequency at Various LO Drives

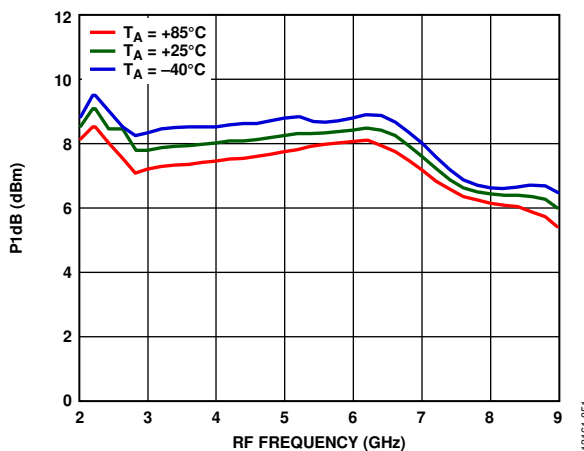


Figure 55. Input P1dB vs. RF Frequency at Various Temperatures, LO Drive = 15 dBm

UPCONVERTER PERFORMANCE WITH UPPER SIDEBAND SELECTED, IF = 1000 MHz

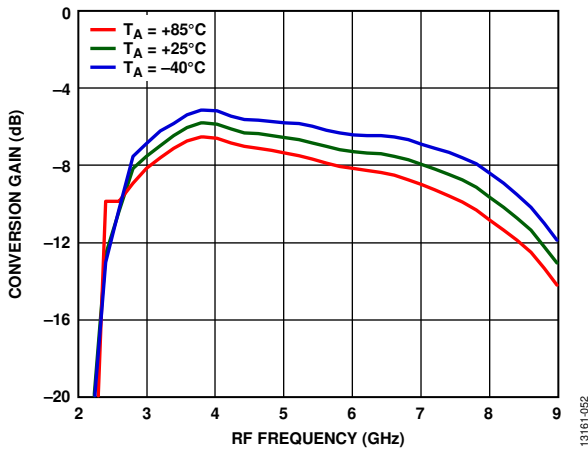


Figure 58. Conversion Gain vs. RF Frequency at Various Temperatures, LO Drive = 15 dBm

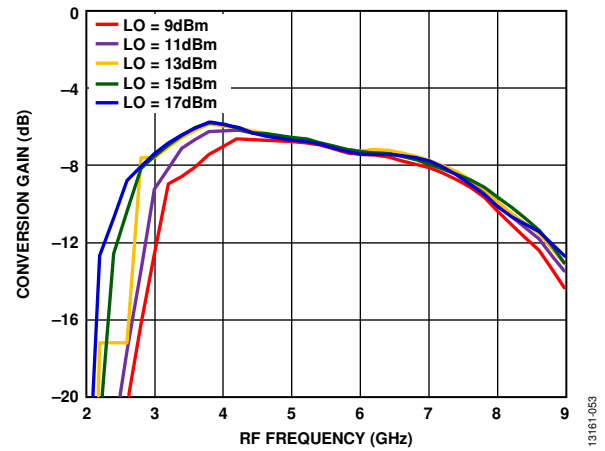


Figure 61. Conversion Gain vs. RF Frequency at Various LO Drives

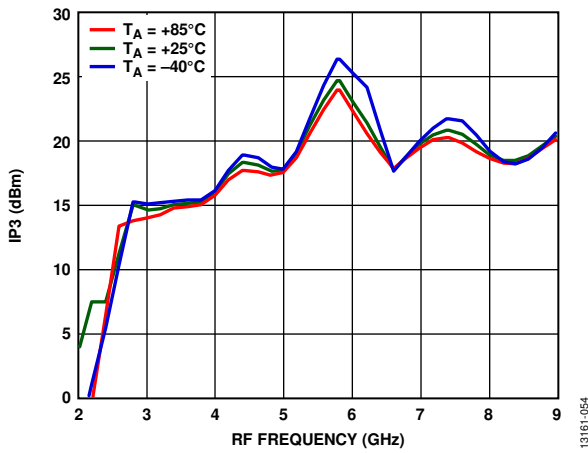


Figure 59. Input IP3 vs. RF Frequency at Various Temperatures, LO Drive = 15 dBm

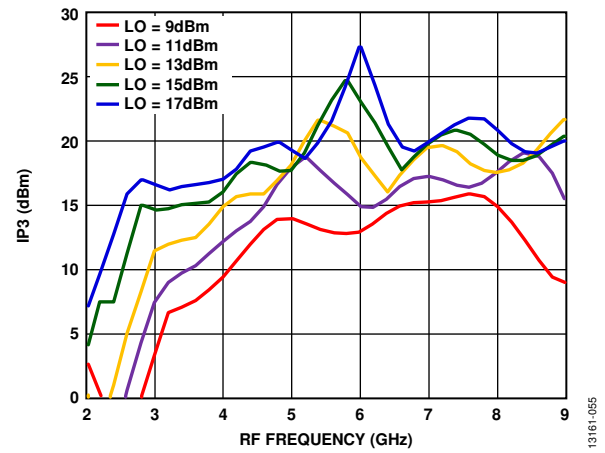


Figure 62. Input IP3 vs. RF Frequency at Various LO Drives

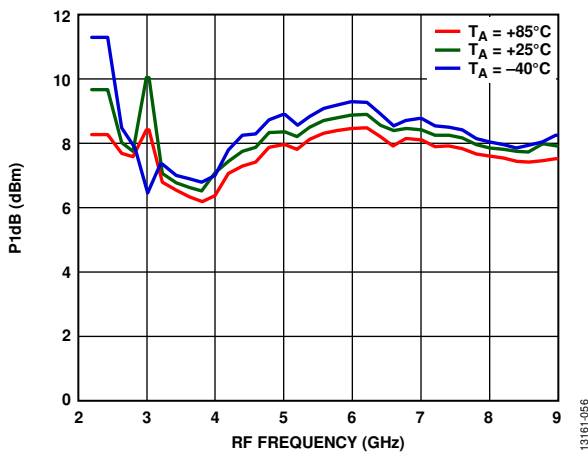


Figure 60. Input P1dB vs. RF Frequency at Various Temperatures, LO Drive = 15 dBm

UPCONVERTER PERFORMANCE WITH UPPER SIDEBAND SELECTED, IF = 2000 MHz

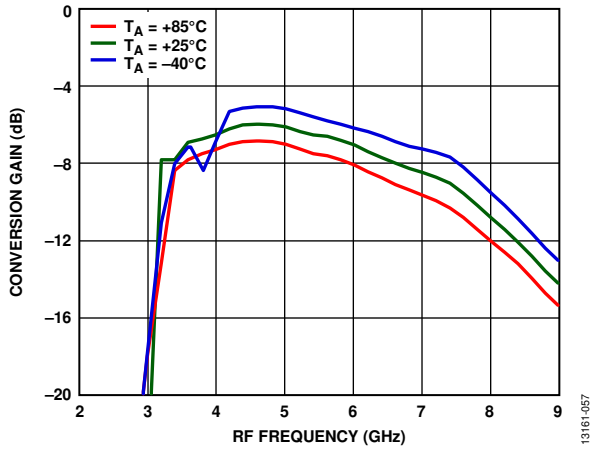


Figure 63. Conversion Gain vs. RF Frequency at Various Temperatures, LO Drive = 15 dBm

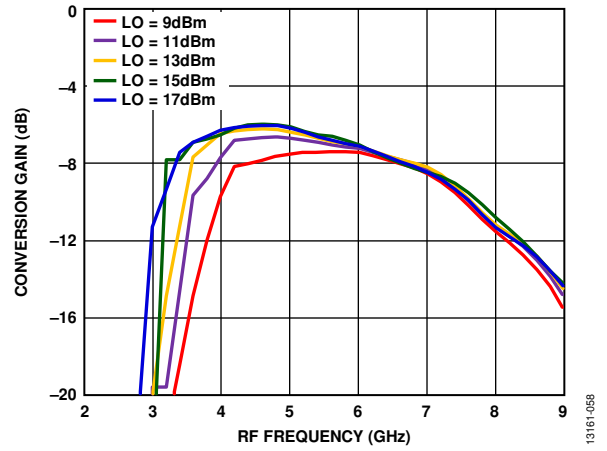


Figure 66. Conversion Gain vs. RF Frequency at Various LO Drives

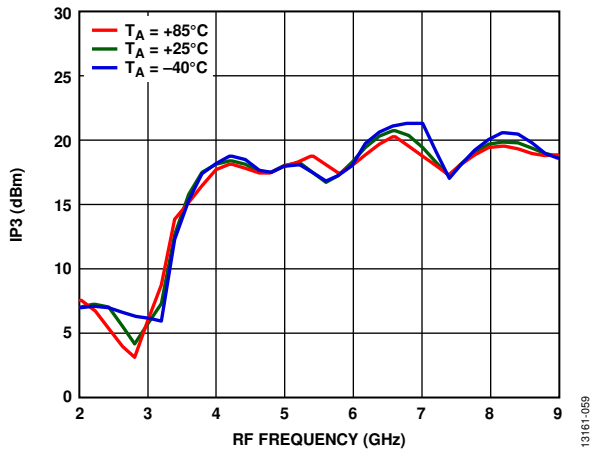


Figure 64. Input IP3 vs. RF Frequency at Various Temperatures, LO Drive = 15 dBm

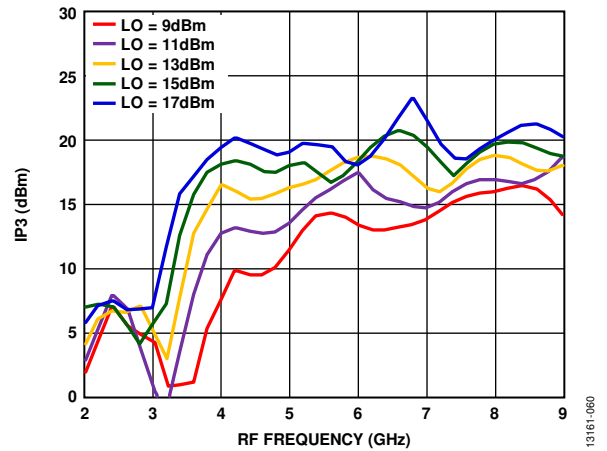


Figure 67. Input IP3 vs. RF Frequency at Various LO Drives

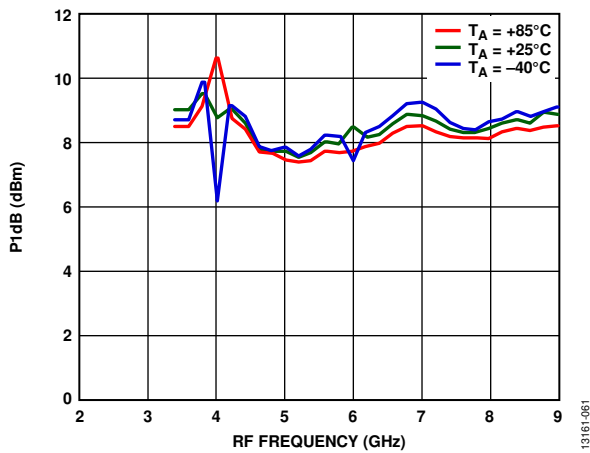


Figure 65. Input P1dB vs. RF Frequency at Various Temperatures, LO Drive = 15 dBm

UPCONVERTER PERFORMANCE WITH LOWER SIDEBAND SELECTED, IF = 100 MHz

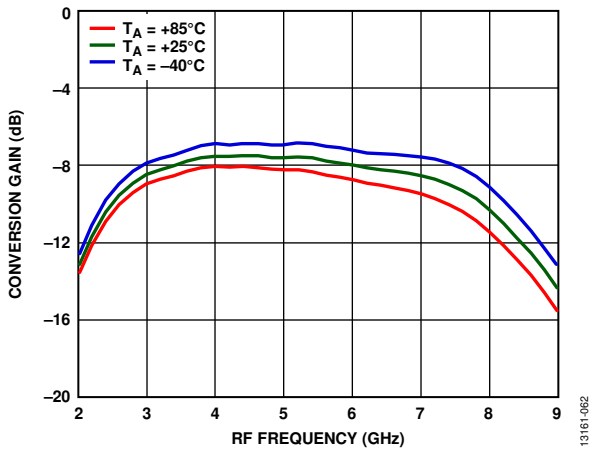


Figure 68. Conversion Gain vs. RF Frequency at Various Temperatures, LO Drive = 15 dBm

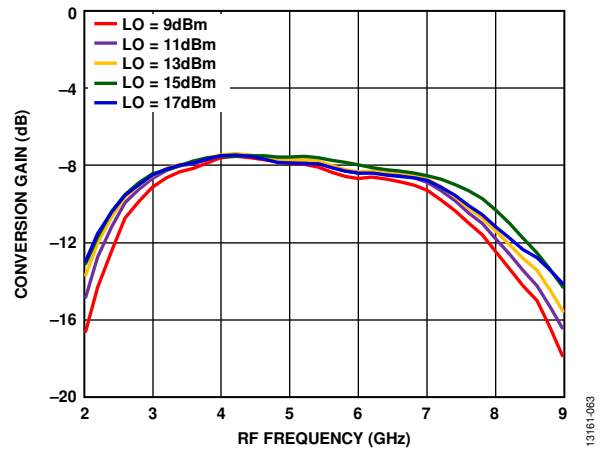


Figure 71. Conversion Gain vs. RF Frequency at Various LO Drives

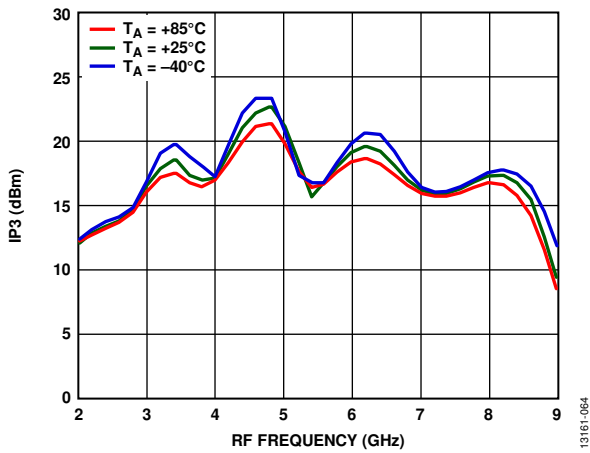


Figure 69. Input IP3 vs. RF Frequency at Various Temperatures, LO Drive = 15 dBm

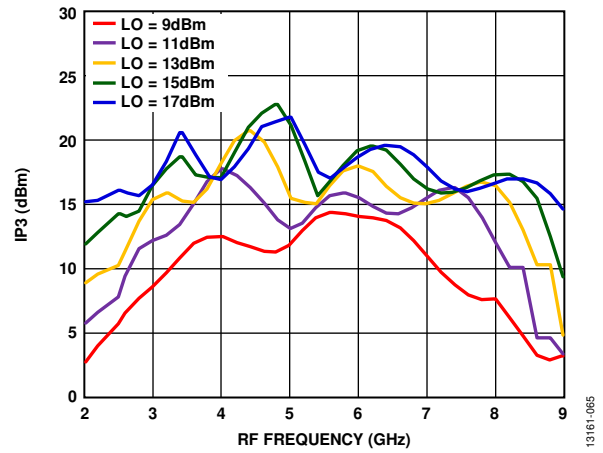


Figure 72. Input IP3 vs. RF Frequency at Various LO Drives

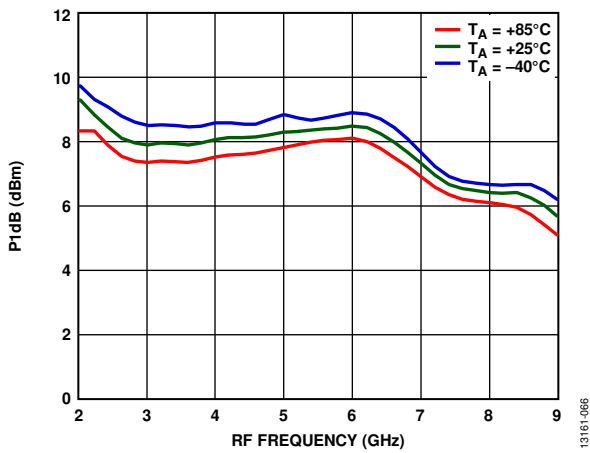


Figure 70. Input P1dB vs. RF Frequency at Various Temperatures, LO Drive = 15 dBm

UPCONVERTER PERFORMANCE WITH LOWER SIDEBAND SELECTED, IF = 1000 MHz

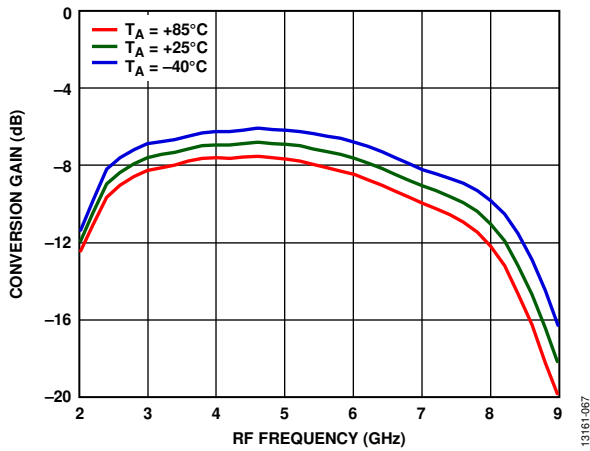


Figure 73. Conversion Gain vs. RF Frequency at Various Temperatures, LO Drive = 15 dBm

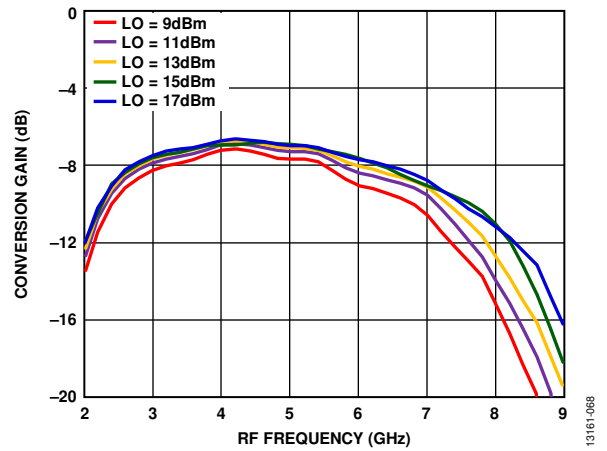


Figure 76. Conversion Gain vs. RF Frequency at Various LO Drives

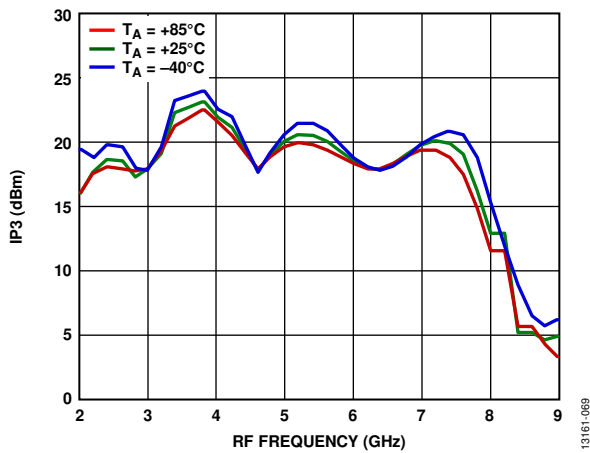


Figure 74. Input IP3 vs. RF Frequency at Various Temperatures, LO Drive = 15 dBm

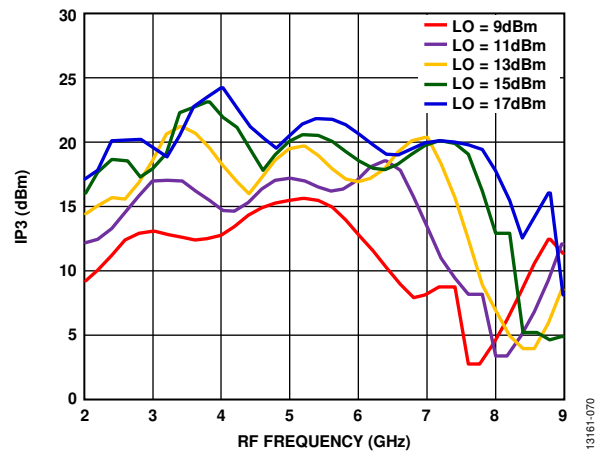


Figure 77. Input IP3 vs. RF Frequency at Various LO Drives

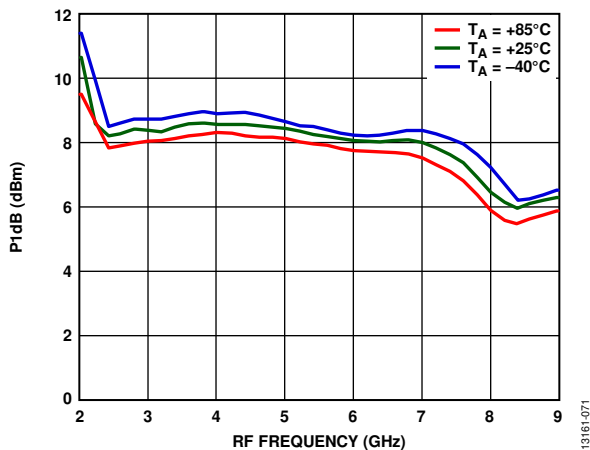


Figure 75. Input P1dB vs. RF Frequency at Various Temperatures, LO Drive = 15 dBm

UPCONVERTER PERFORMANCE WITH LOWER SIDEBAND SELECTED, IF = 2000 MHz

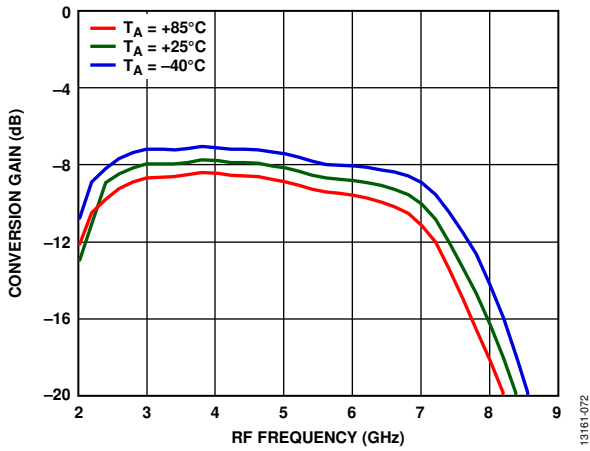


Figure 78. Conversion Gain vs. RF Frequency at Various Temperatures, LO Drive = 15 dBm

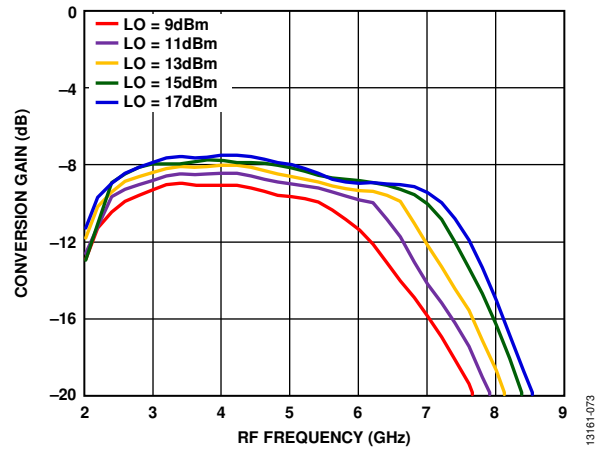


Figure 81. Conversion Gain vs. RF Frequency at Various LO Drives

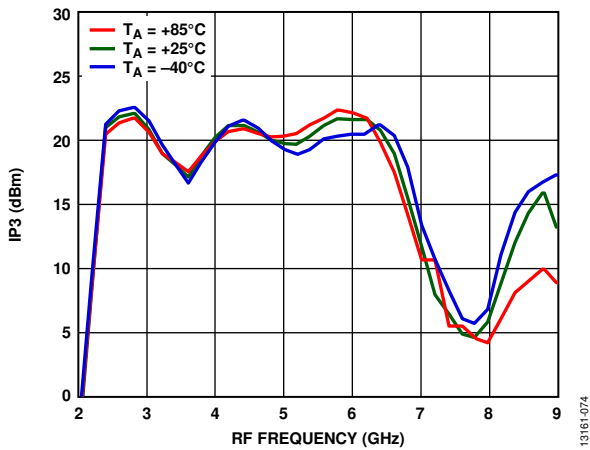


Figure 79. Input IP3 vs. RF Frequency at Various Temperatures, LO Drive = 15 dBm

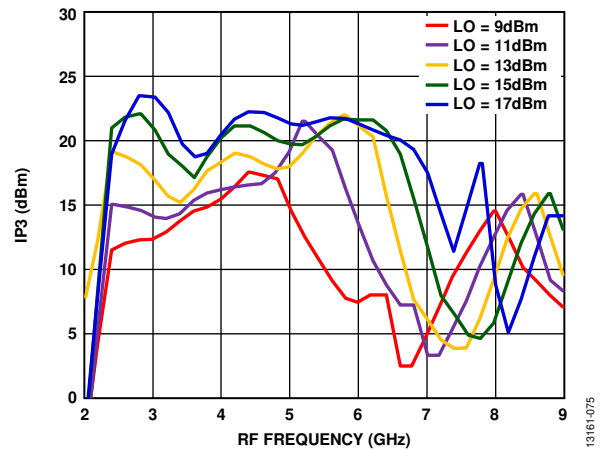


Figure 82. Input IP3 vs. RF Frequency at Various LO Drives

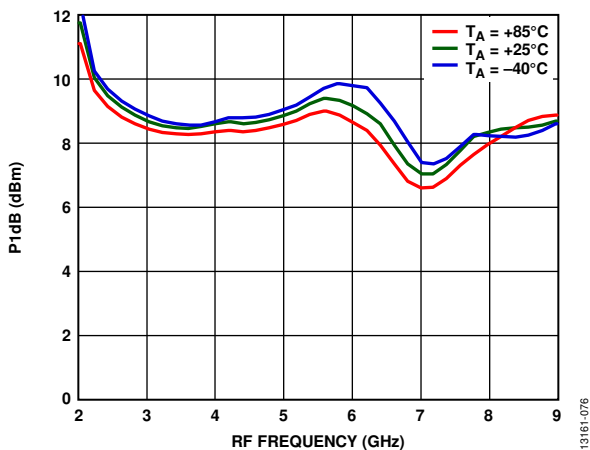


Figure 80. Input P1dB vs. RF Frequency at Various Temperatures, LO Drive = 15 dBm

SPURIOUS PERFORMANCE WITH UPPER SIDEBAND SELECTED, IF = 100 MHz

Mixer spurious products are measured in dBc from the IF output power level. Spur values are $(M \times RF) - (N \times LO)$.

M × N Spurious Outputs

RF frequency = 5 GHz, RF input power = -10 dBm, LO frequency = 4.9 GHz, LO drive = 15 dBm.

| | | N × LO | | | | | |
|---------------|----------|------------------|----------|----------|----------|----------|----------|
| | | 0 | 1 | 2 | 3 | 4 | 5 |
| M × RF | 0 | N/A ¹ | +3.6 | +33.3 | +25.2 | +43.3 | +28.6 |
| | 1 | +15.9 | +0.00 | +31.7 | +38.1 | +60.8 | +73.4 |
| | 2 | +74.8 | +64.7 | +61.2 | +63.6 | +79.5 | +75.1 |
| | 3 | +74.2 | +78.6 | +80.8 | +72 | +78.5 | +79.2 |
| | 4 | +73.2 | +77.5 | +75.3 | +78 | +90.7 | +79.3 |
| | 5 | -92.8 | +72.7 | +76.7 | +77.6 | +81.3 | +88.9 |

¹ N/A means not applicable.

APPLICATIONS INFORMATION

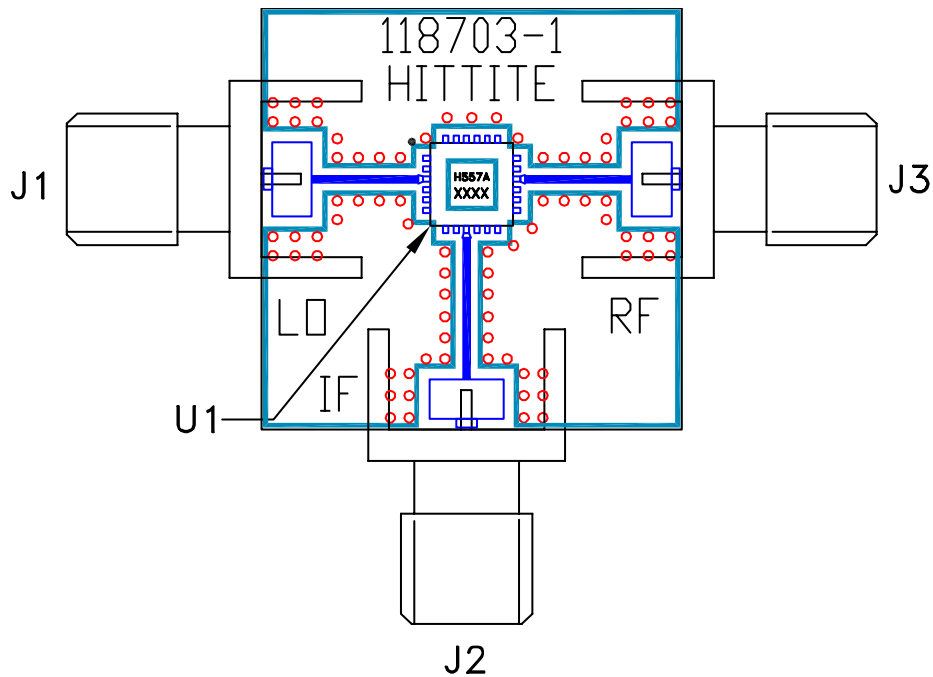


Figure 83. Evaluation Printed Circuit Board (PCB)

13161-082

Table 5. List of Materials for Evaluation PCB
EV1HMC557ALC4¹

| Item | Description |
|------------------|------------------------------------|
| J1, J2, J3 | Johnson SMA connector |
| U1 | HMC557ALC4 mixer |
| PCB ² | 118703 evaluation PCB ³ |

¹ Reference this number when ordering the complete evaluation PCB.

² The circuit board material is Rogers 4350.

³ This is the bare PCB of the evaluation PCB kit (see Figure 83).

It is recommended that the application circuit board use RF circuit design techniques. Use signal lines with a 50 Ω impedance, and connect the package ground leads and exposed pad directly to the ground plane. Use a sufficient number of via holes to connect the top and bottom ground planes. The evaluation circuit board shown in Figure 83 is available from Analog Devices, Inc., upon request.

OUTLINE DIMENSIONS

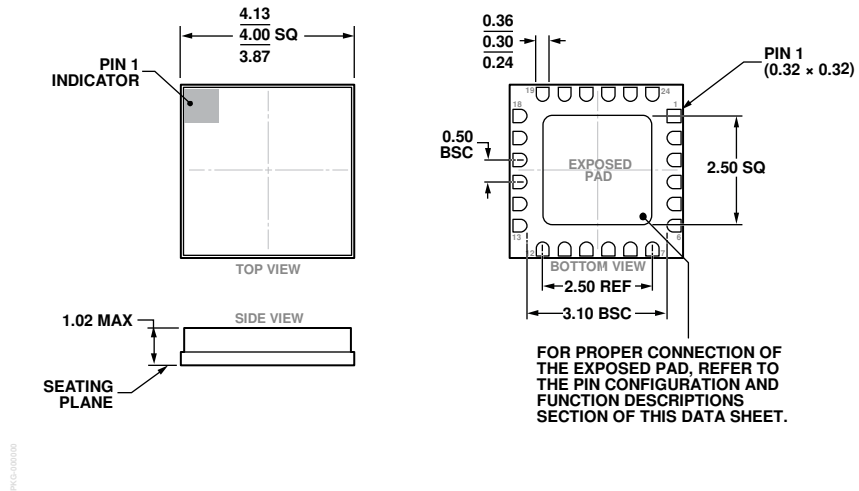


Figure 84. 24-Terminal Ceramic Leadless Chip Carrier [LCC] (E-24-1)
Dimensions shown in millimeters

ORDERING GUIDE

| Model | Temperature Range | Package Body Material | Lead Finish | MSL Rating ¹ | Branding ² | Package Description | Package Option |
|-----------------|-------------------|-----------------------|------------------|-------------------------|-----------------------|---------------------|----------------|
| HMC557ALC4 | -40°C to +85°C | Alumina Ceramic | Gold over Nickel | MSL3 | H557A XXXX | 24-Lead LCC | E-24-1 |
| HMC557ALC4TR | -40°C to +85°C | Alumina Ceramic | Gold over Nickel | MLS3 | H557A XXXX | 24-Lead LCC | E-24-1 |
| HMC557ALC4TR-R5 | -40°C to +85°C | Alumina Ceramic | Gold over Nickel | MLS3 | H557A XXXX | 24-Lead LCC | E-24-1 |
| EV1HMC557ALC4 | | | | | | Evaluation Board | |

¹ Maximum peak reflow temperature of 260°C.

² Four-digit lot number = XXXX.