GaAs, pHEMT, MMIC, Low Noise Amplifier, 0.01 GHz to 20 GHz

FEATURES

- Low noise figure: 2.5 dB typical at 6 GHz to 14 GHz
- Single positive supply (self biased)
- High gain: 20 dB typical from 0.01 GHz to 6 GHz
- High OIP3: 38 dBm typical from 0.01 GHz to 6 GHz
- RoHS-compliant, 2 mm × 2 mm, 8-lead LFCSP

APPLICATIONS

- Satellite communication
- Telecommunications
- Civilian radars
- Military radars
- Weather radars
- Electronic warfare

GENERAL DESCRIPTION

The ADL8100 is a gallium arsenide (GaAs), monolithic microwave integrated circuit (MMIC), pseudomorphic high electron mobility transistor (pHEMT), wideband low noise amplifier (LNA) that operates from 0.01 GHz to 20 GHz. The ADL8100 provides a typical gain of 20 dB at 0.01 GHz to 6 GHz, a 2.5 dB typical noise figure at 6 GHz to 14 GHz, and a typical output third-order intercept (OIP3) of 38 dBm at 0.01 GHz to 6 GHz, requiring only 220 mA from a 5 V supply voltage. The power dissipation can be lowered at the expense of OIP3 and output power. The ADL8100 also features inputs and outputs that are DC-coupled and internally matched to 50 Ω.

The ADL8100 is housed in a RoHS-compliant, 2 mm × 2 mm, 8-lead LFCSP.

FUNCTIONAL BLOCK DIAGRAM

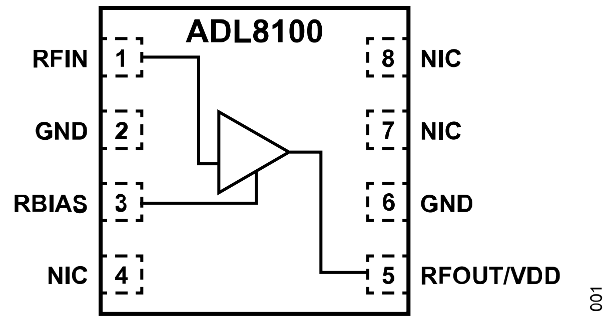

Figure 1. Functional Block Diagram

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REVISION HISTORY

7/2023—Revision 0: Initial Version

SPECIFICATIONS

0.01 GHz TO 6 GHz FREQUENCY RANGE

Supply voltage (V_{DD}) = 5 V, quiescent current (I_{DQ}) = 220 mA, bias resistance (R_{BIAS}) = 560 Ω, and T_C = 25°C, unless otherwise noted.

Table 1. 0.01 GHz to 6 GHz Frequency Range

Parameter	Min	Typ	Max	Unit	Test Conditions/Comments
FREQUENCY RANGE	0.01		6	GHz	
GAIN	18	20		dB	
Gain Variation over Temperature		0.011		dB/°C	
NOISE FIGURE		3.5		dB	
RETURN LOSS					
Input (S11)		12		dB	
Output (S22)		13		dB	
OUTPUT					
Power for 1 dB Compression (OP1dB)	19	21		dBm	
Saturated Power (P_{SAT})		23		dBm	
OIP3		38		dBm	Measurement taken at output power (P_{OUT}) per tone = 6 dBm
Second-Order Intercept (OIP2)		47		dBm	Measurement taken at P_{OUT} per tone = 6 dBm
POWER ADDED EFFICIENCY (PAE)		19		%	Measured at P_{SAT}

6 GHz TO 14 GHz FREQUENCY RANGE

V_{DD} = 5 V, I_{DQ} = 220 mA, R_{BIAS} = 560 Ω, and T_C = 25°C, unless otherwise noted.

Table 2. 6 GHz to 14 GHz Frequency Range

Parameter	Min	Typ	Max	Unit	Test Conditions/Comments
FREQUENCY RANGE	6		14	GHz	
GAIN	16.5	19		dB	
Gain Variation over Temperature		0.016		dB/°C	
NOISE FIGURE		2.5		dB	
RETURN LOSS					
S11		15		dB	
S22		16.5		dB	
OUTPUT					
OP1dB	19	21.5		dBm	
P_{SAT}		23		dBm	
OIP3		35		dBm	Measurement taken at P_{OUT} per tone = 6 dBm
OIP2		34		dBm	Measurement taken at P_{OUT} per tone = 6 dBm
PAE		17		%	Measured at P_{SAT}

SPECIFICATIONS

14 GHz TO 20 GHz FREQUENCY RANGE

V_{DD} = 5 V, I_{DQ} = 220 mA, R_{BIAS} = 560 Ω, and T_C = 25°C, unless otherwise noted.

Table 3. 14 GHz to 20 GHz Frequency Range

Parameter	Min	Typ	Max	Unit	Test Conditions/Comments
FREQUENCY RANGE	14		20	GHz	
GAIN	15.5	18.5		dB	
Gain Variation over Temperature		0.02		dB/°C	
NOISE FIGURE		3.2		dB	
RETURN LOSS					
S11		14.5		dB	
S22		11		dB	
OUTPUT					
OP1dB	17	19		dBm	
P_{SAT}		21		dBm	
OIP3		31		dBm	Measurement taken at P_{OUT} per tone = 6 dBm
OIP2		40		dBm	Measurement taken at P_{OUT} per tone = 6 dBm
PAE		12		%	Measured at P_{SAT}

DC SPECIFICATIONS

Table 4. DC Specifications

Parameter	Min	Typ	Max	Unit
SUPPLY CURRENT				
I_{DQ}		220		mA
Amplifier Current (I_{DQ_AMP})		215		mA
RBIAS Current (I_{RBIAS})		5		mA
SUPPLY VOLTAGE				
V_{DD}	3	5	6	V

ABSOLUTE MAXIMUM RATINGS

Table 5. Absolute Maximum Ratings

Parameter	Rating
V_{DD}	6.5 V
RFIN	23 dBm
Continuous Power Dissipation (P_{DISS}), T_C = 85°C (Derate 18.98 mW/°C Above 85°C)	1.7 W
Temperature	
Storage Range	−65°C to +150°C
Operating Range	−40°C to +85°C
Quiescent Channel (T_C = 85°C, V_{DD} = 5 V, I_{DQ} = 220 mA, Input Power (P_{IN}) = Off)	143.3°C
Maximum Channel	175°C

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_{JC} is the channel to case thermal resistance.

Table 6. Thermal Resistance[1]

Package Type	θ_{JC}	Unit
CP-8-30		
Quiescent, T_C = 25°C	43.2	°C/W
Worst Case[2], T_C = 85°C	52.7	°C/W

1 Thermal resistance varies with operating conditions.

2 Worst case across all specified operating conditions.

ELECTROSTATIC DISCHARGE (ESD) RATINGS

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

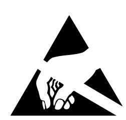
Human body model (HBM) per ANSI/ESDA/JEDEC JS-001.

ESD Ratings for ADL8100

Table 7. ADL8100, 8-Lead LFCSP

ESD Model	Withstand Threshold (V)	Class
HBM	±1250	1C

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

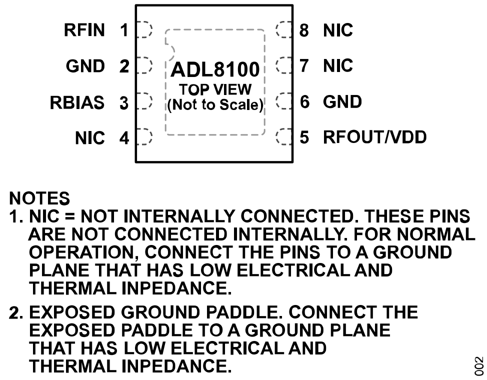


Figure 2. Pin Configuration

Table 8. Pin Function Descriptions

Pin No.	Mnemonic	Description
1	RFIN	RF Input. The RFIN pin is DC-coupled and matched to 50 Ω. See Figure 3 for the interface schematic.
2, 6	GND	Ground. Connect the GND pins to a ground plane that has low electrical and thermal impedance. See Figure 4 for the interface schematic.
3	RBIAS	Bias Setting Resistor. Connect a resistor between RBIAS and VDD to set the I_{DQ}. See Figure 105 and Table 9 for more details. See Figure 5 for the interface schematic.
4, 7, 8	NIC	Not Internally Connected. These pins are not connected internally. For normal operation, connect the pins to a ground plane that has low electrical and thermal impedance.
5	RFOUT/VDD	RF Output/Drain Bias Voltage. The RF output is DC-coupled and also serves as the drain biasing node. For the drain bias voltage, connect a DC bias network to provide the drain current and AC-couple the RF output path (see the Figure 105 for more information). See Figure 6 for the interface schematic.
	EXPOSED PADDLE	Exposed Ground Paddle. Connect the exposed paddle to a ground plane that has low electrical and thermal impedance.

INTERFACE SCHEMATICS

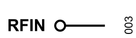


Figure 3. RFIN Interface Schematic

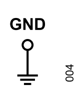


Figure 4. GND Interface Schematic

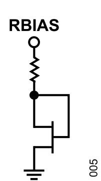


Figure 5. RBIAS Interface Schematic

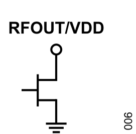


Figure 6. RFOUT/VDD Interface Schematic

TYPICAL PERFORMANCE CHARACTERISTICS

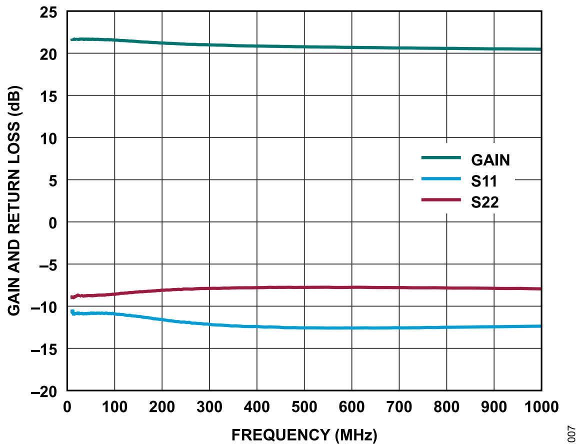


Figure 7. Gain and Return Loss vs. Frequency, 10 MHz to 1 GHz, V_{DD} = 5 V, I_{DQ} = 220 mA

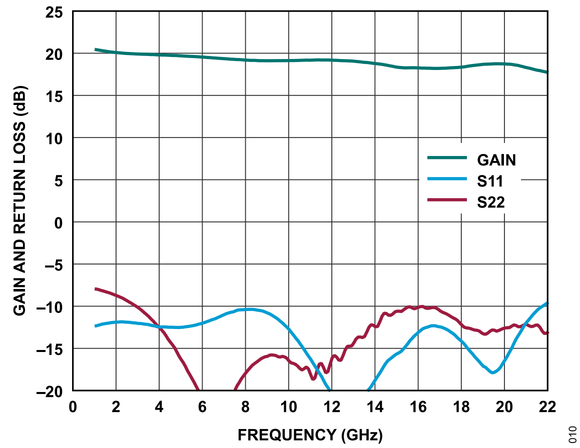


Figure 10. Gain and Return Loss vs. Frequency, 1 GHz to 22 GHz, V_{DD} = 5 V, I_{DQ} = 220 mA

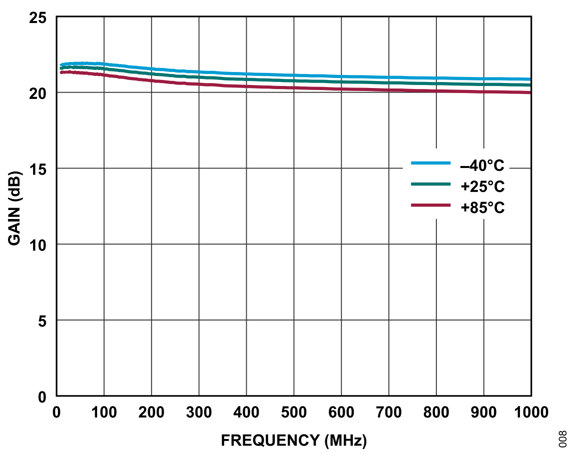


Figure 8. Gain vs. Frequency for Various Temperatures, 10 MHz to 1 GHz, V_{DD} = 5 V, I_{DQ} = 220 mA, R_{BIAS} = 560 Ω

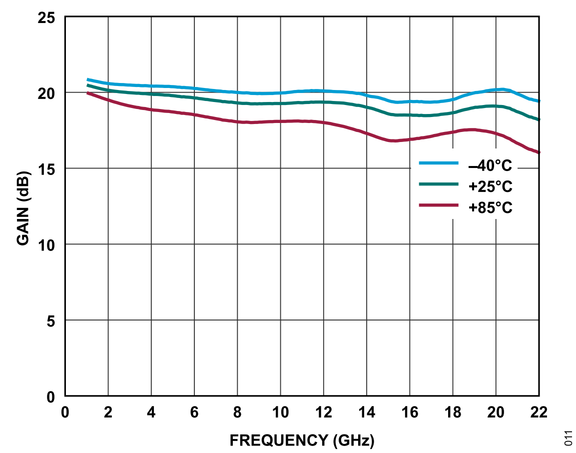


Figure 11. Gain vs. Frequency for Various Temperatures, 1 GHz to 22 GHz, V_{DD} = 5 V, I_{DQ} = 220 mA, R_{BIAS} = 560 Ω

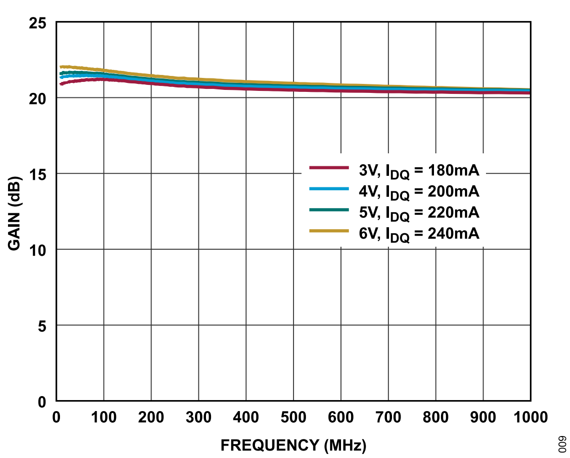


Figure 9. Gain vs. Frequency for Various Supply Voltages and I_{DQ} Values, 10 MHz to 1 GHz, R_{BIAS} = 560 Ω

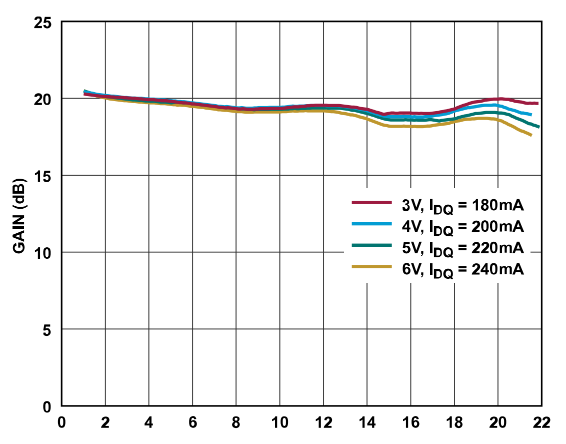


Figure 12. Gain vs. Frequency for Various Supply Voltages and I_{DQ} Values, 1 GHz to 22 GHz, R_{BIAS} = 560 Ω

TYPICAL PERFORMANCE CHARACTERISTICS

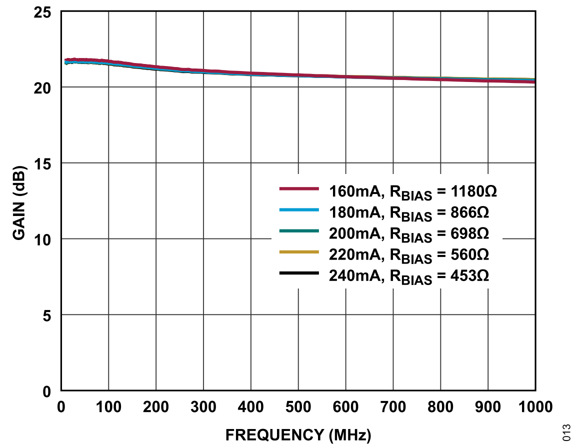


Figure 13. Gain vs. Frequency for Various I_{DQ} and R_{BIAS} Values, 10 MHz to 1 GHz, V_{DD} = 5 V

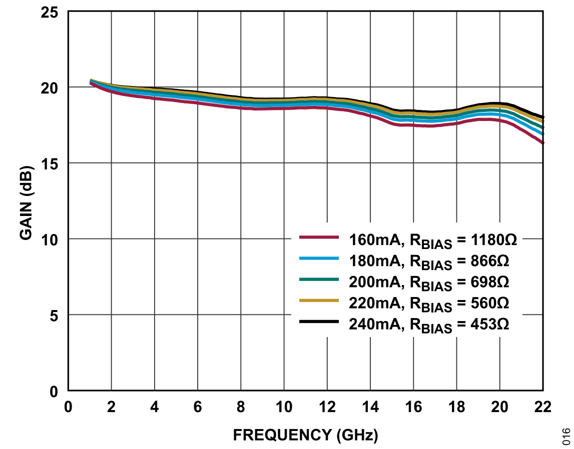


Figure 16. Gain vs. Frequency for Various I_{DQ} and R_{BIAS} Values, 1 GHz to 22 GHz, V_{DD} = 5 V

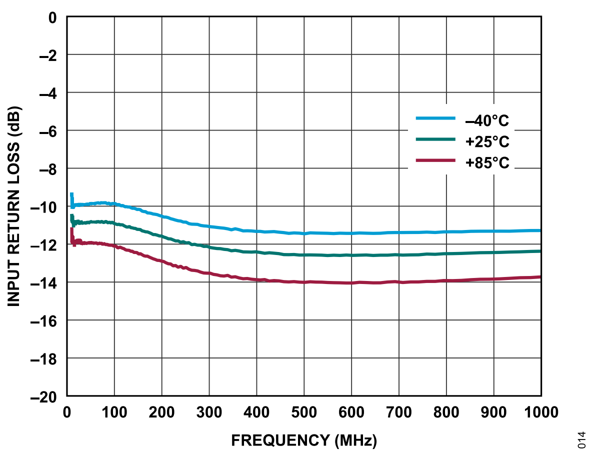


Figure 14. Input Return Loss vs. Frequency for Various Temperatures, 10 MHz to 1 GHz, V_{DD} = 5 V, I_{DQ} = 220 mA, R_{BIAS} = 560 Ω

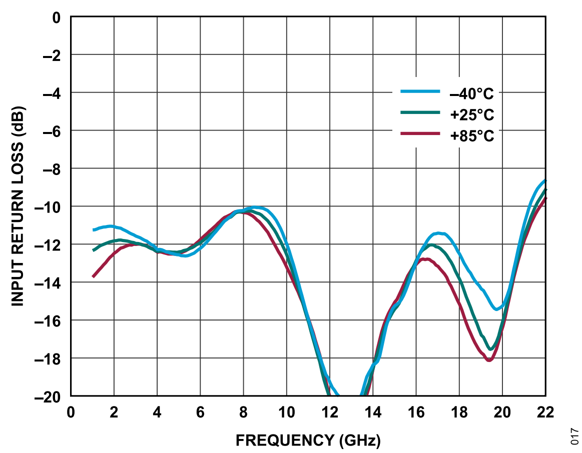


Figure 17. Input Return Loss vs. Frequency for Various Temperatures, 1 GHz to 22 GHz, V_{DD} = 5 V, I_{DQ} = 220 mA, R_{BIAS} = 560 Ω

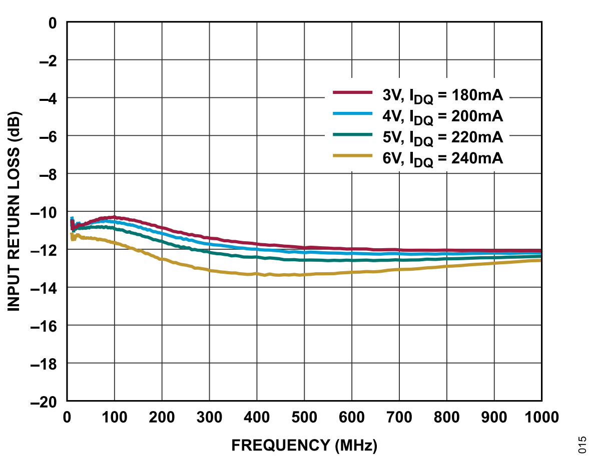


Figure 15. Input Return Loss vs. Frequency for Various Supply Voltages and I_{DQ} Values, 10 MHz to 1 GHz, R_{BIAS} = 560 Ω

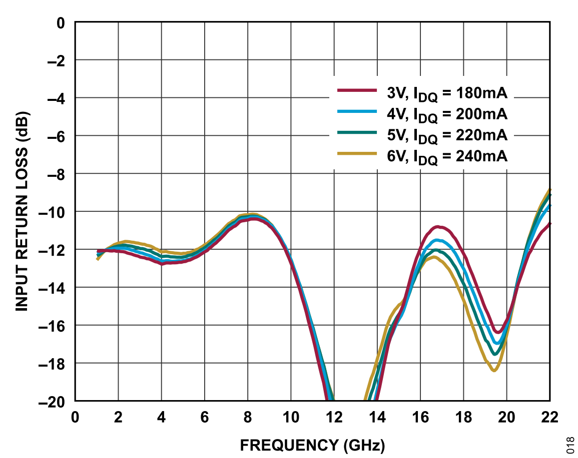


Figure 18. Input Return Loss vs. Frequency for Various Supply Voltages and I_{DQ} Values, 1 GHz to 22 GHz, R_{BIAS} = 560 Ω

TYPICAL PERFORMANCE CHARACTERISTICS

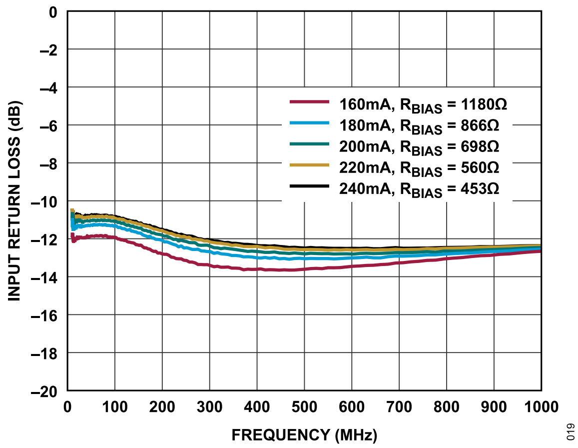


Figure 19. Input Return Loss vs. Frequency for Various I_{DQ} and R_{BIAS} Values, 10 MHz to 1 GHz, V_{DD} = 5 V

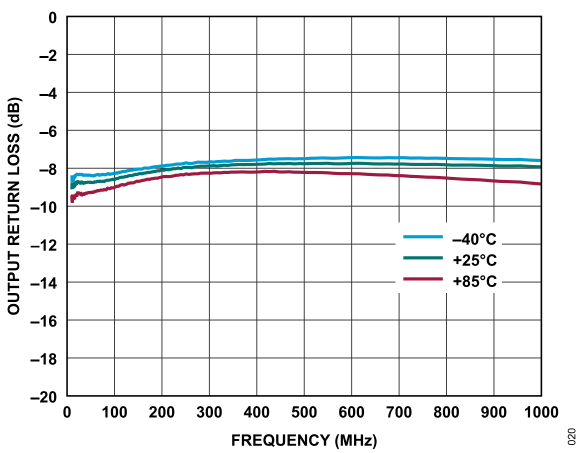


Figure 20. Output Return Loss vs. Frequency for Various Temperatures, 10 MHz to 1 GHz, V_{DD} = 5 V, I_{DQ} = 220 mA, R_{BIAS} = 560 Ω

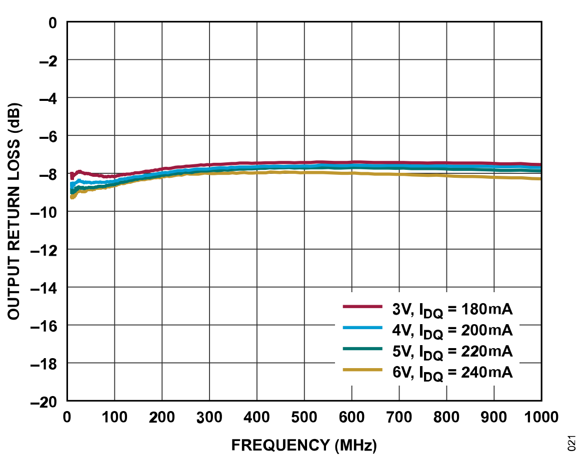


Figure 21. Output Return Loss vs. Frequency for Various Supply Voltages and I_{DQ} Values, 10 MHz to 1 GHz, R_{BIAS} = 560 Ω

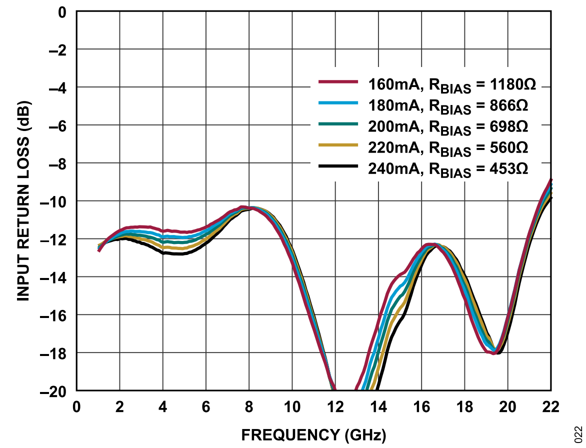


Figure 22. Input Return Loss vs. Frequency for Various I_{DQ} and R_{BIAS} Values, 1 GHz to 22 GHz, V_{DD} = 5 V

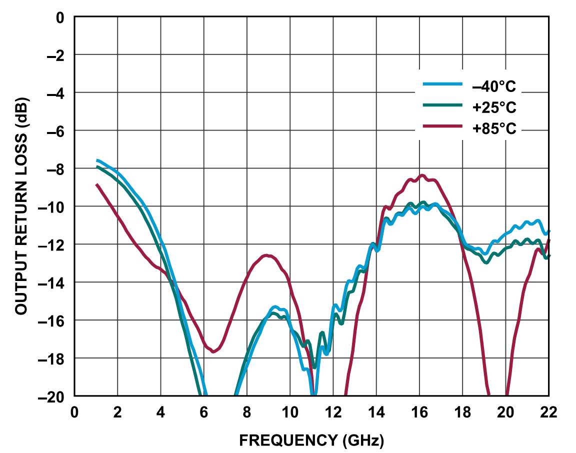


Figure 23. Output Return Loss vs. Frequency for Various Temperatures, 1 GHz to 22 GHz, V_{DD} = 5 V, I_{DQ} = 220 mA, R_{BIAS} = 560 Ω

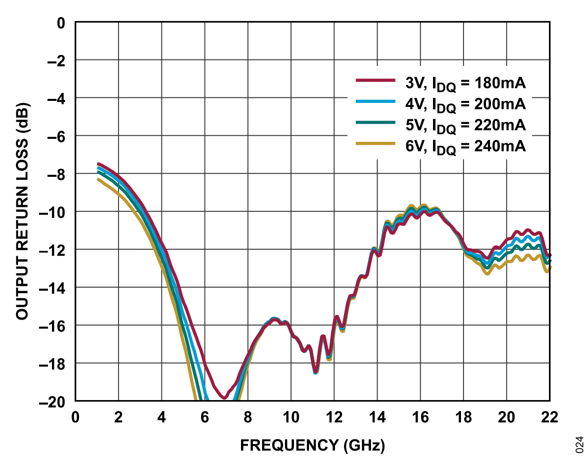


Figure 24. Output Return Loss vs. Frequency for Various Supply Voltages and I_{DQ} Values, 1 GHz to 22 GHz, R_{BIAS} = 560 Ω

TYPICAL PERFORMANCE CHARACTERISTICS

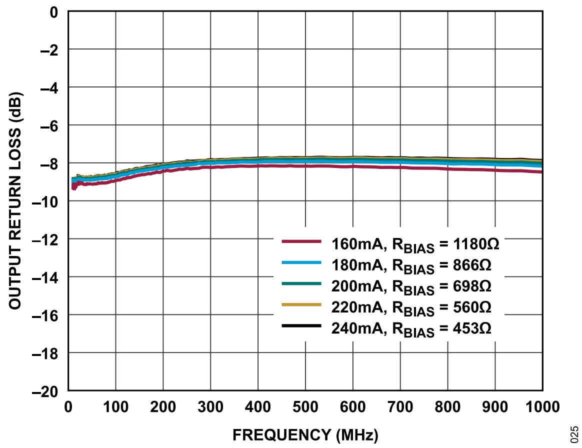


Figure 25. Output Return Loss vs. Frequency for Various I_{DQ} and R_{BIAS} Values, 10 MHz to 1 GHz, V_{DD} = 5 V

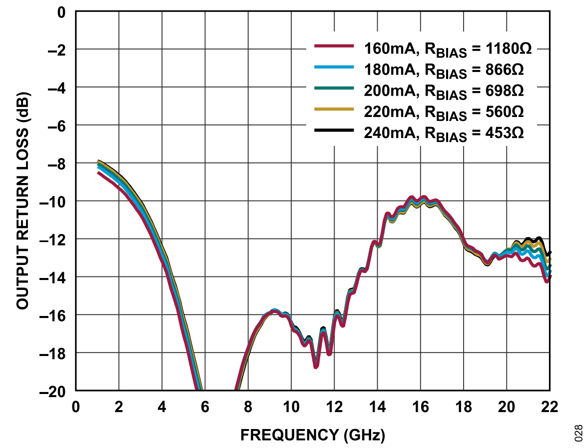


Figure 28. Output Return Loss vs. Frequency for Various I_{DQ} and R_{BIAS} Values, 1 GHz to 22 GHz, V_{DD} = 5 V

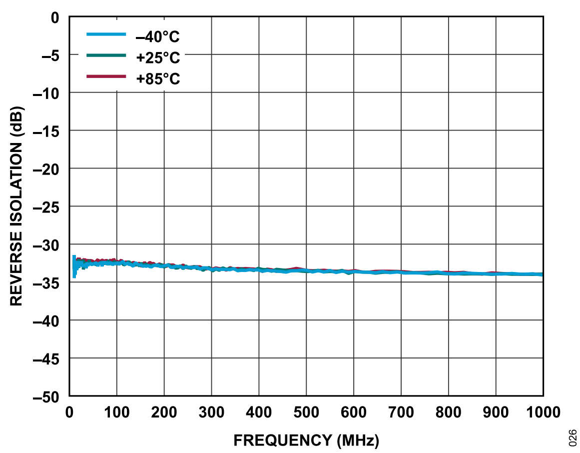


Figure 26. Reverse Isolation vs. Frequency for Various Temperatures, 10 MHz to 1 GHz, V_{DD} = 5 V, I_{DQ} = 220 mA, R_{BIAS} = 560 Ω

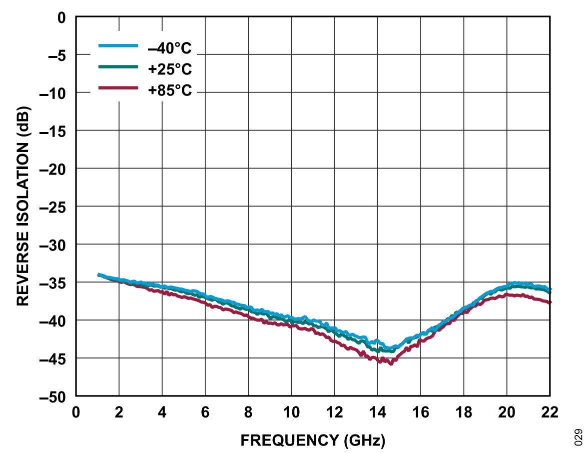


Figure 29. Reverse Isolation vs. Frequency for Various Temperatures, 1 GHz to 22 GHz, V_{DD} = 5 V, I_{DQ} = 220 mA, R_{BIAS} = 560 Ω

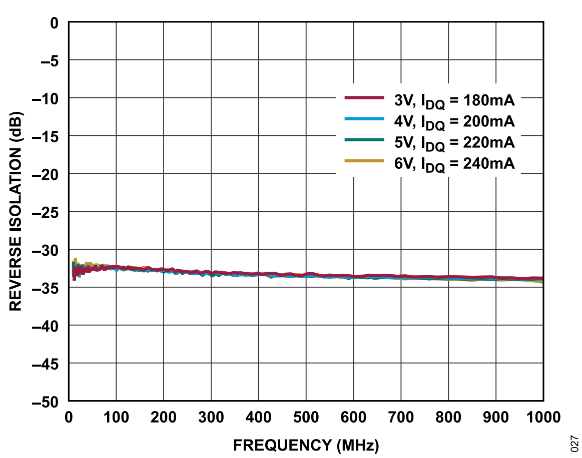


Figure 27. Reverse Isolation vs. Frequency for Various Supply Voltages and I_{DQ} Values, 10 MHz to 1 GHz, R_{BIAS} = 560 Ω

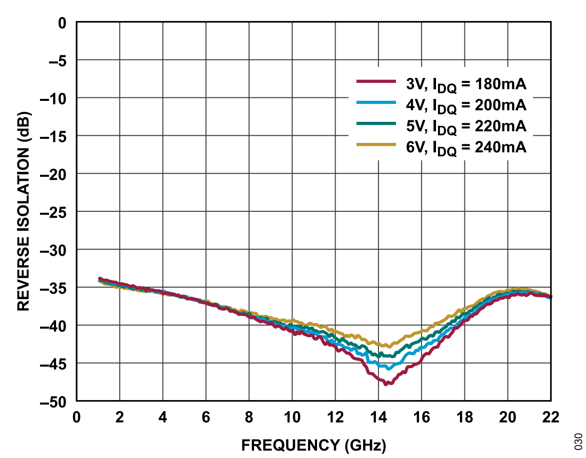


Figure 30. Reverse Isolation vs. Frequency for Various Supply Voltages and I_{DQ} Values, 1 GHz to 22 GHz, R_{BIAS} = 560 Ω

TYPICAL PERFORMANCE CHARACTERISTICS

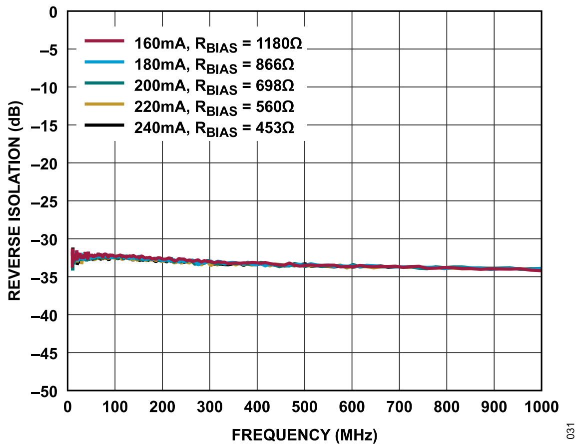


Figure 31. Reverse Isolation vs. Frequency for Various I_{DQ} and R_{BIAS} Values, 10 MHz to 1 GHz, V_{DD} = 5 V

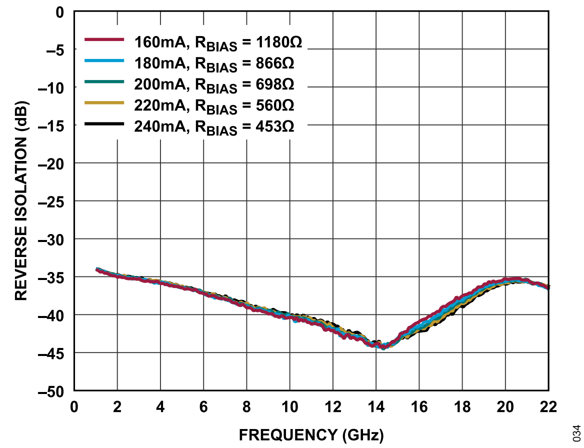


Figure 34. Reverse Isolation vs. Frequency for Various I_{DQ} and R_{BIAS} Values, 1 GHz to 22 GHz, V_{DD} = 5 V

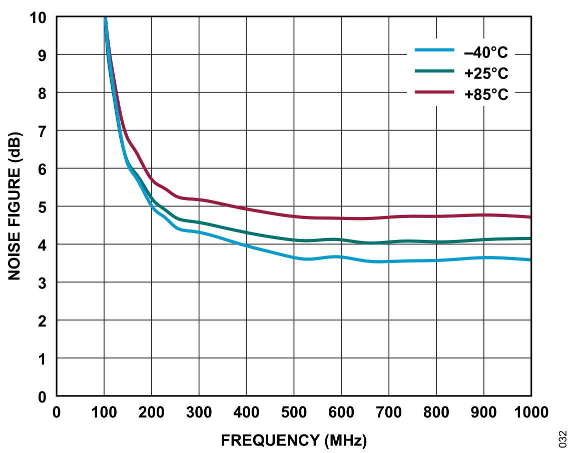


Figure 32. Noise Figure vs. Frequency for Various Temperatures, 10 MHz to 1 GHz, V_{DD} = 5 V, I_{DQ} = 220 mA, R_{BIAS} = 560 Ω

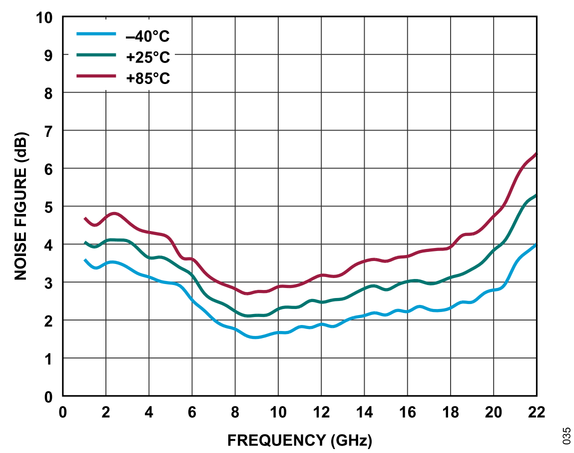


Figure 35. Noise Figure vs. Frequency for Various Temperatures, 1 GHz to 22 GHz, V_{DD} = 5 V, I_{DQ} = 220 mA, R_{BIAS} = 560 Ω

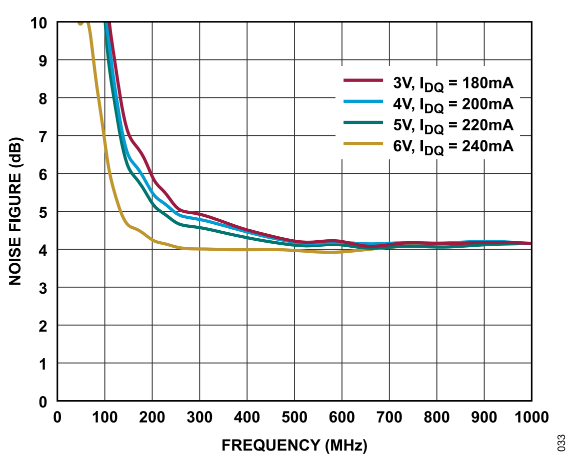


Figure 33. Noise Figure vs. Frequency for Various Supply Voltages and I_{DQ} Values, 10 MHz to 1 GHz, R_{BIAS} = 560 Ω

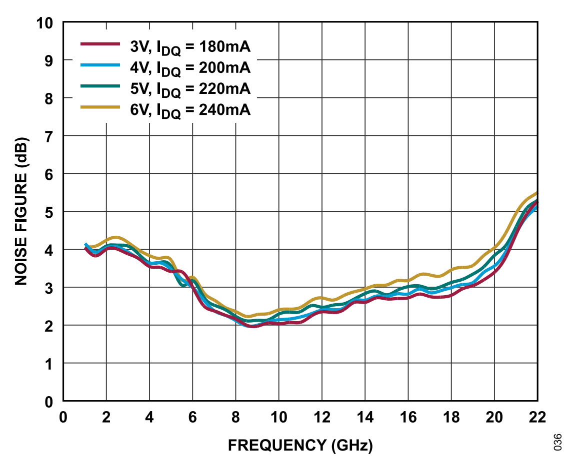


Figure 36. Noise Figure vs. Frequency for Various Supply Voltages and I_{DQ} Values, 1 GHz to 22 GHz, R_{BIAS} = 560 Ω

TYPICAL PERFORMANCE CHARACTERISTICS

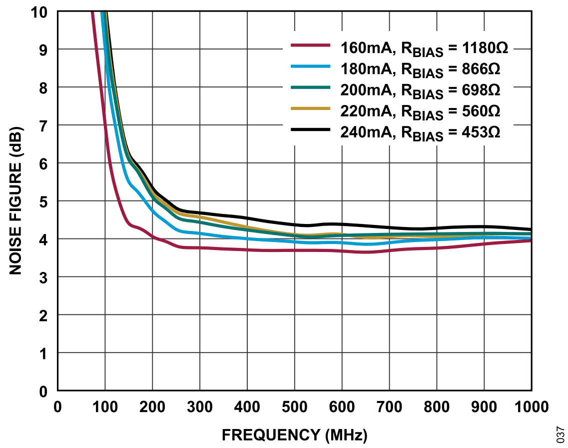


Figure 37. Noise Figure vs. Frequency for Various I_{DQ} and R_{BIAS} Values, 10 MHz to 1 GHz, V_{DD} = 5 V

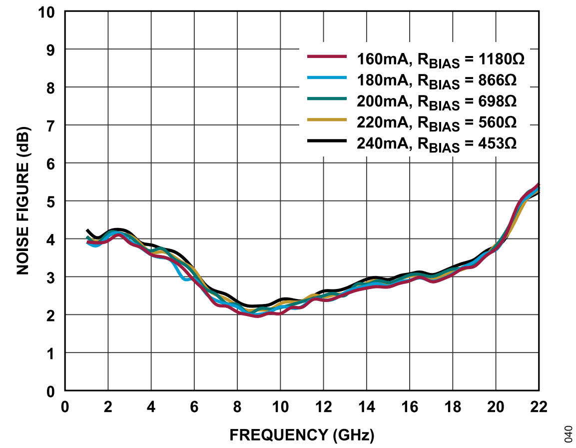


Figure 40. Noise Figure vs. Frequency for Various I_{DQ} and R_{BIAS} Values, 1 GHz to 22 GHz, V_{DD} = 5 V

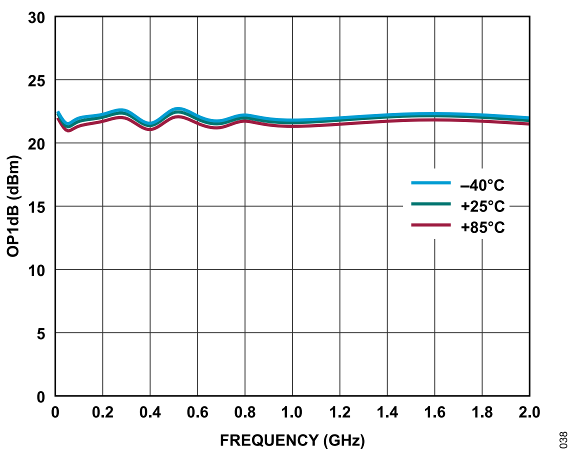


Figure 38. OP1dB vs. Frequency for Various Temperatures, 10 MHz to 2 GHz, V_{DD} = 5 V, I_{DQ} = 220 mA, R_{BIAS} = 560 Ω

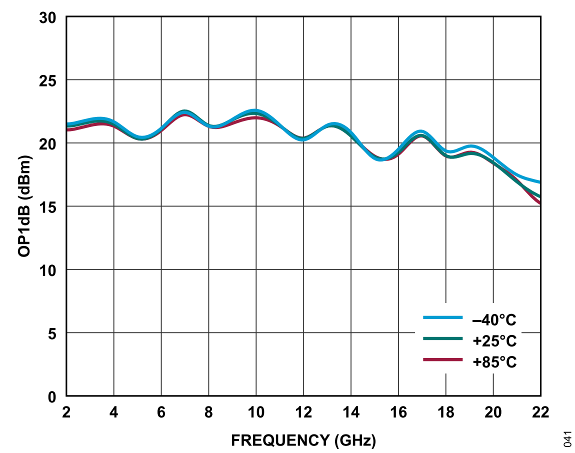


Figure 41. OP1dB vs. Frequency for Various Temperatures, 2 GHz to 22 GHz, V_{DD} = 5 V, I_{DQ} = 220 mA, R_{BIAS} = 560 Ω

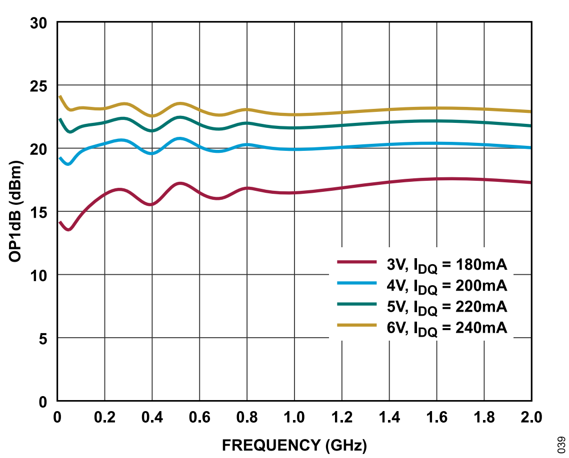


Figure 39. OP1dB vs. Frequency for Various Supply Voltages and I_{DQ} Values, 10 MHz to 2 GHz, R_{BIAS} = 560 Ω

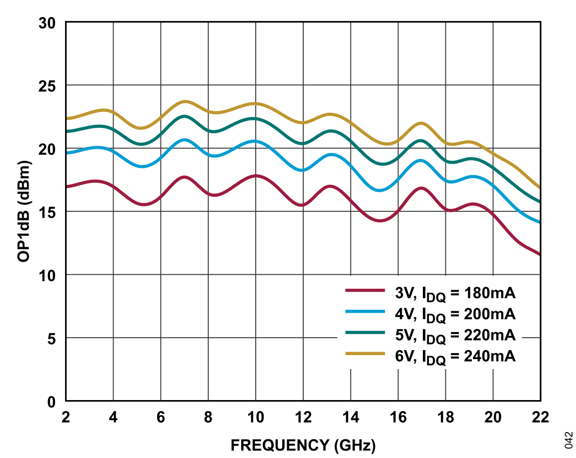


Figure 42. OP1dB vs. Frequency for Various Supply Voltages and I_{DQ} Values, 2 GHz to 22 GHz, R_{BIAS} = 560 Ω

TYPICAL PERFORMANCE CHARACTERISTICS

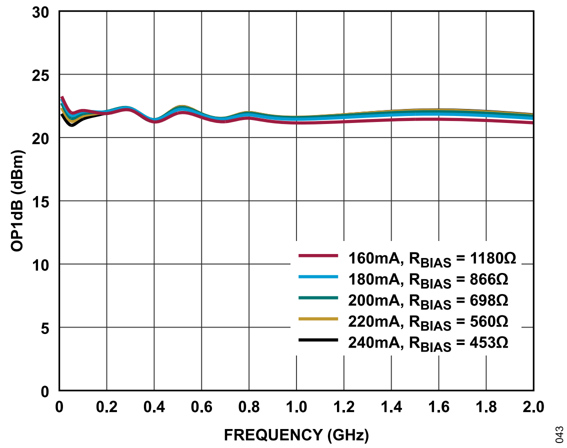


Figure 43. OP1dB vs. Frequency for Various I_{DQ} and R_{BIAS} Values, 10 MHz to 2 GHz, V_{DD} = 5 V

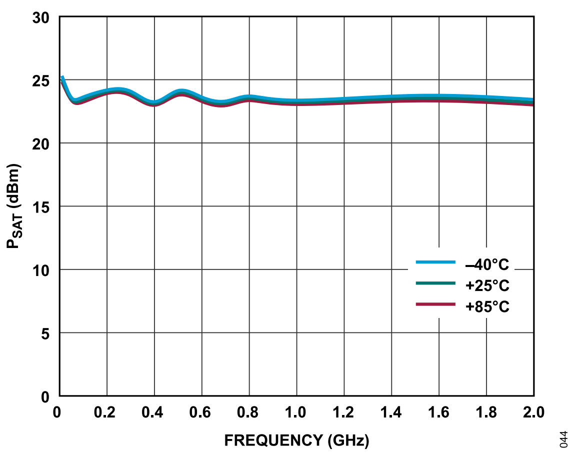


Figure 44. P_{SAT} vs. Frequency for Various Temperatures, 10 MHz to 2 GHz, V_{DD} = 5 V, I_{DQ} = 220 mA, R_{BIAS} = 560 Ω

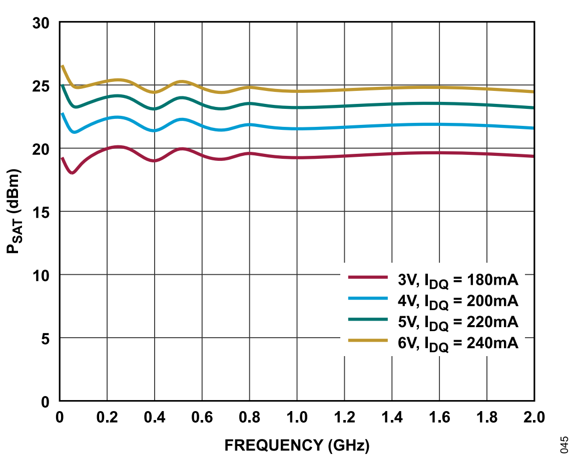


Figure 45. P_{SAT} vs. Frequency for Various Supply Voltages and I_{DQ} Values, 10 MHz to 2 GHz, R_{BIAS} = 560 Ω

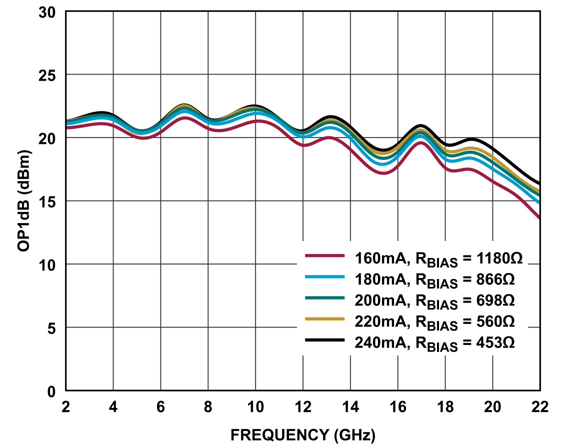


Figure 46. OP1dB vs. Frequency for Various I_{DQ} and R_{BIAS} Values, 2 GHz to 22 GHz, V_{DD} = 5 V

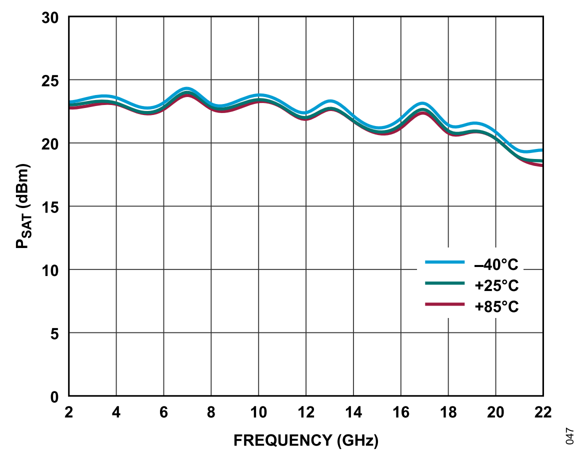


Figure 47. P_{SAT} vs. Frequency for Various Temperatures, 2 GHz to 22 GHz, V_{DD} = 5 V, I_{DQ} = 220 mA, R_{BIAS} = 560 Ω

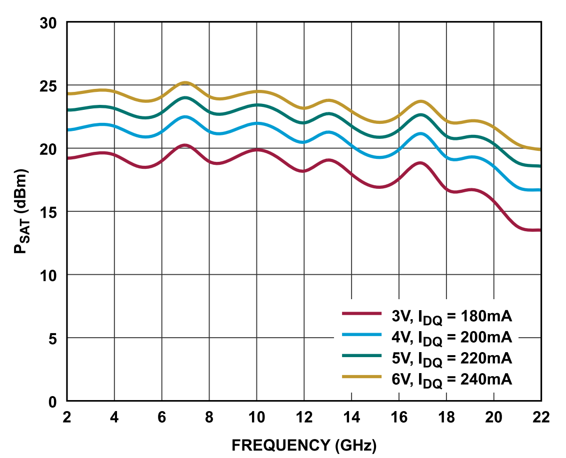


Figure 48. P_{SAT} vs. Frequency for Various Supply Voltages and I_{DQ} Values, 2 GHz to 22 GHz, R_{BIAS} = 560 Ω

TYPICAL PERFORMANCE CHARACTERISTICS

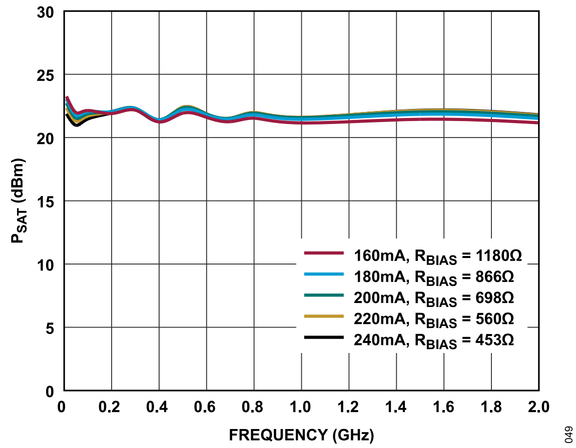


Figure 49. P_{SAT} vs. Frequency for Various I_{DQ} and R_{BIAS} Values, 10 MHz to 2 GHz, V_{DD} = 5 V

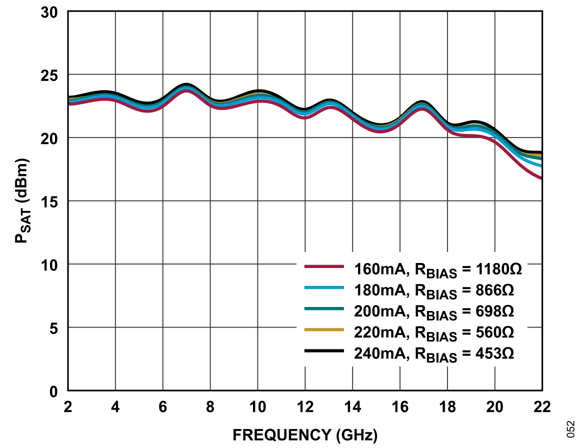


Figure 52. P_{SAT} vs. Frequency for Various I_{DQ} and R_{BIAS} Values, 2 GHz to 22 GHz, V_{DD} = 5 V

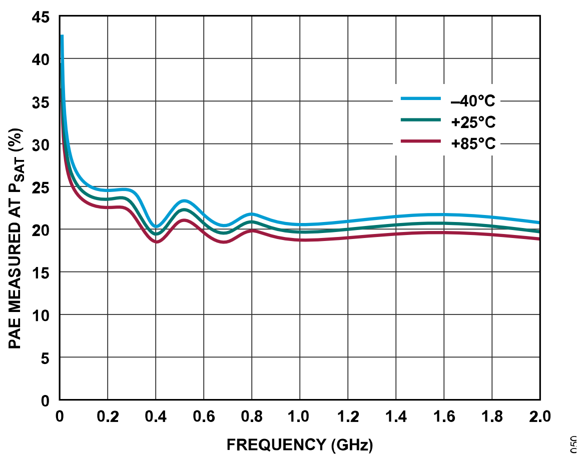


Figure 50. PAE Measured at P_{SAT} vs. Frequency for Various Temperatures, 10 MHz to 2 GHz, V_{DD} = 5 V, I_{DQ} = 220 mA, R_{BIAS} = 560 Ω

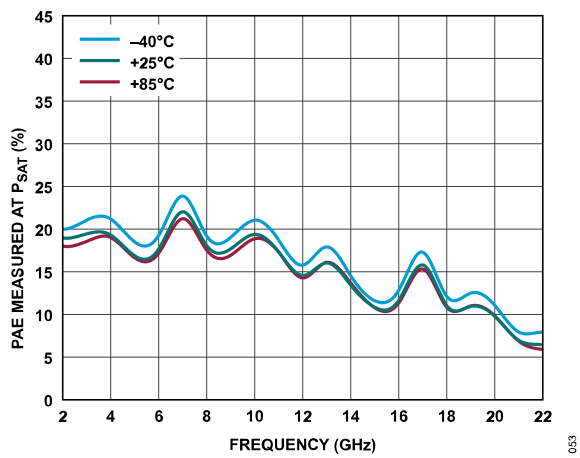


Figure 53. PAE Measured at P_{SAT} vs. Frequency for Various Temperatures, 2 GHz to 22 GHz, V_{DD} = 5 V, I_{DQ} = 220 mA, R_{BIAS} = 560 Ω

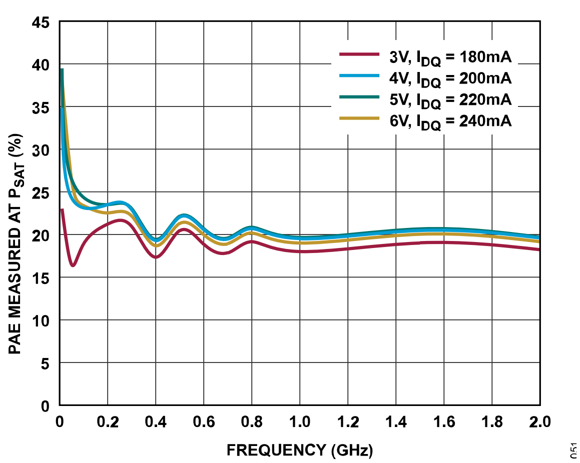


Figure 51. PAE Measured at P_{SAT} vs. Frequency for Various Supply Voltages and I_{DQ} Values, 10 MHz to 2 GHz, R_{BIAS} = 560 Ω

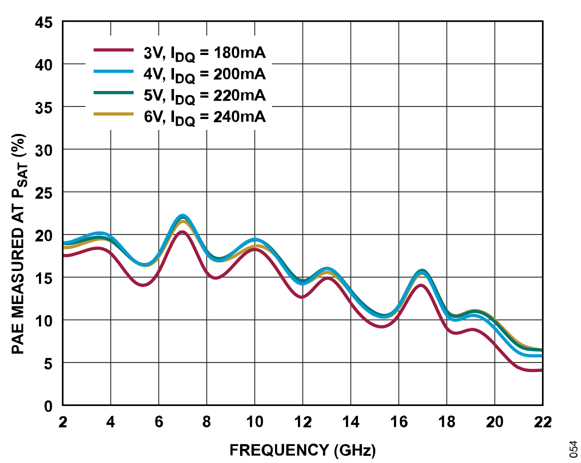


Figure 54. PAE Measured at P_{SAT} vs. Frequency for Various Supply Voltages and I_{DQ} Values, 2 GHz to 22 GHz, R_{BIAS} = 560 Ω

TYPICAL PERFORMANCE CHARACTERISTICS

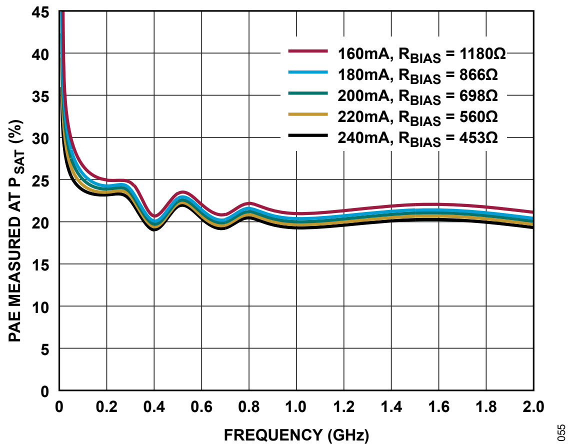


Figure 55. PAE Measured at P_{SAT} vs. Frequency for Various I_{DQ} and R_{BIAS} Values, 10 MHz to 2 GHz, V_{DD} = 5 V

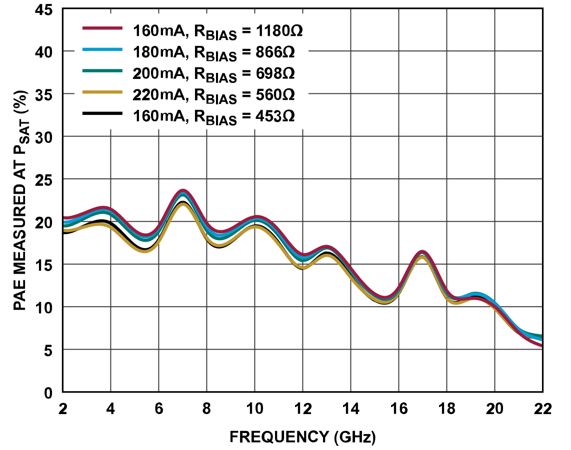


Figure 58. PAE Measured at P_{SAT} vs. Frequency for Various I_{DQ} and R_{BIAS} Values, 2 GHz to 22 GHz, V_{DD} = 5 V

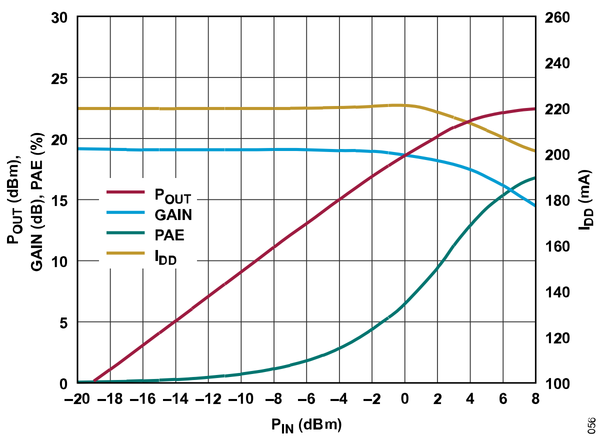


Figure 56. P_{OUT}, Gain, PAE, and Power Supply Current (I_{DD}) vs. P_{IN} at 5 GHz, V_{DD} = 5 V, R_{BIAS} = 560 Ω

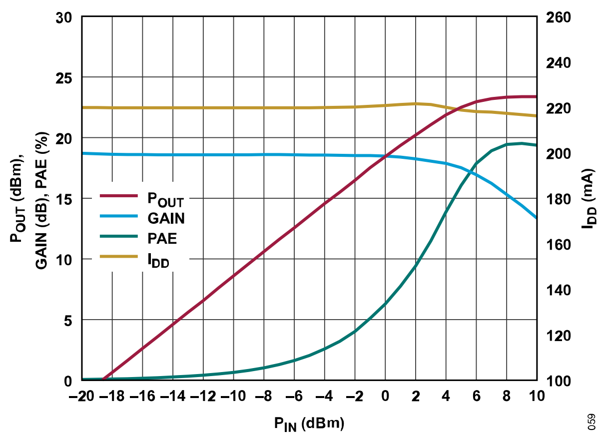


Figure 59. P_{OUT}, Gain, PAE, and I_{DD} vs. P_{IN} at 15 GHz, V_{DD} = 5 V, R_{BIAS} = 560 Ω

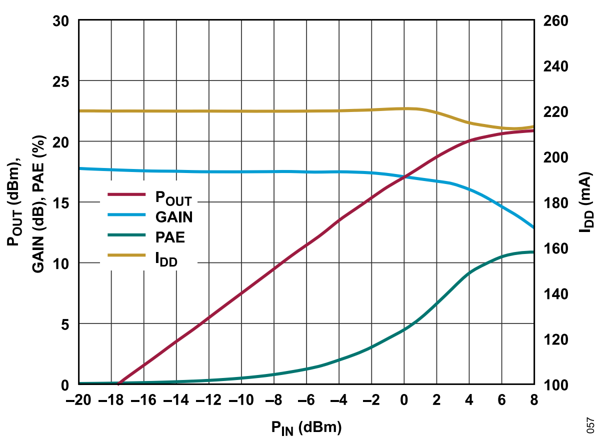


Figure 57. P_{OUT}, Gain, PAE, and I_{DD} vs. P_{IN} at 10 GHz, V_{DD} = 5 V, R_{BIAS} = 560 Ω

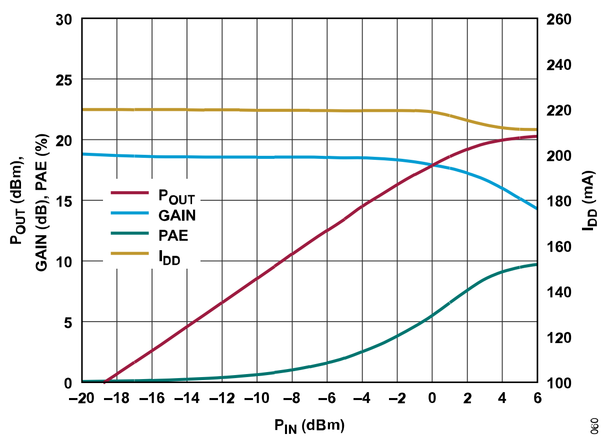


Figure 60. P_{OUT}, Gain, PAE, and I_{DD} vs. P_{IN} at 20 GHz, V_{DD} = 5 V, R_{BIAS} = 560 Ω

TYPICAL PERFORMANCE CHARACTERISTICS

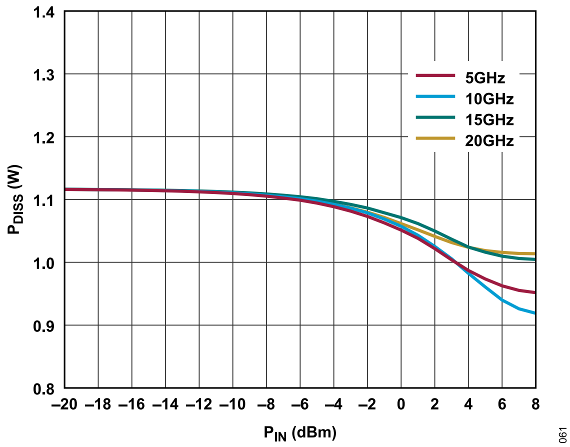


Figure 61. P_{DISS} vs. P_{IN} at Various Frequencies at 85°C, V_{DD} = 5 V, I_{DQ} = 220 mA

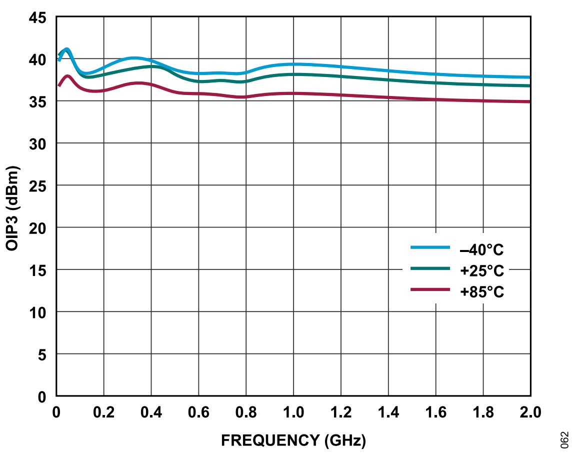


Figure 62. OIP3 vs. Frequency for Various Temperatures, 10 MHz to 2 GHz, V_{DD} = 5 V, I_{DQ} = 220 mA, R_{BIAS} = 560 Ω

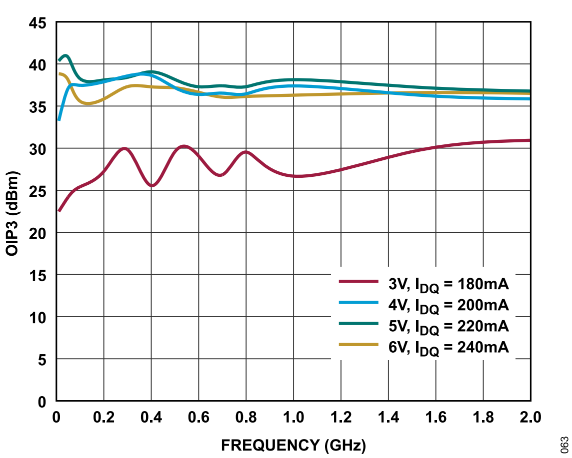


Figure 63. OIP3 vs. Frequency for Various Supply Voltages and I_{DQ} Values, 10 MHz to 2 GHz, R_{BIAS} = 560 Ω

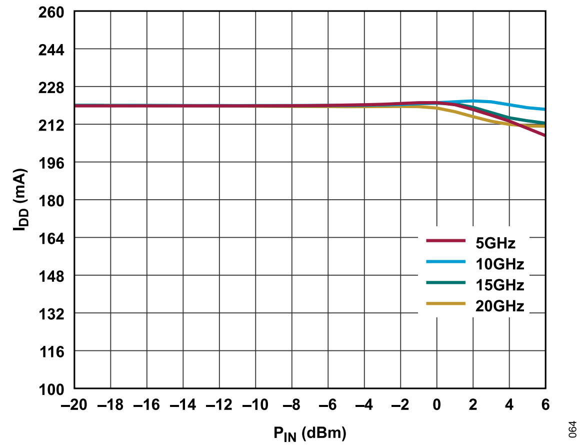


Figure 64. I_{DD} vs. P_{IN} at Various Frequencies, V_{DD} = 5 V

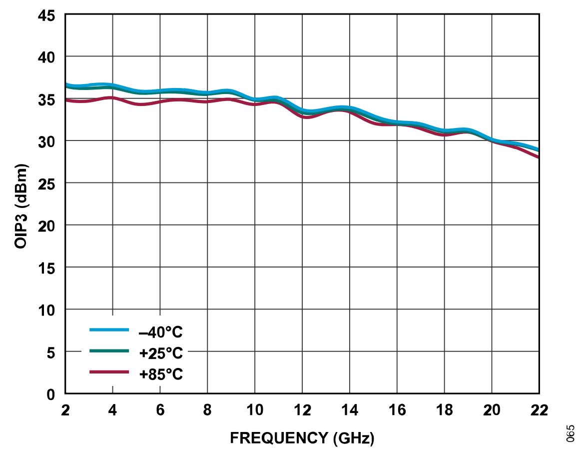


Figure 65. OIP3 vs. Frequency for Various Temperatures, 2 GHz to 22 GHz, V_{DD} = 5 V, I_{DQ} = 220 mA, R_{BIAS} = 560 Ω

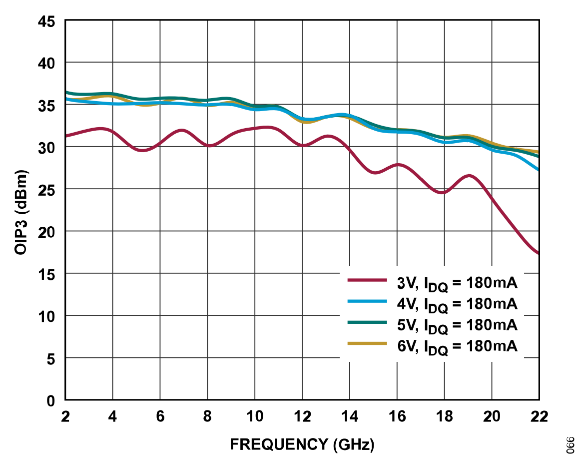


Figure 66. OIP3 vs. Frequency for Various Supply Voltages and I_{DQ} Values, 2 GHz to 22 GHz, R_{BIAS} = 560 Ω

TYPICAL PERFORMANCE CHARACTERISTICS

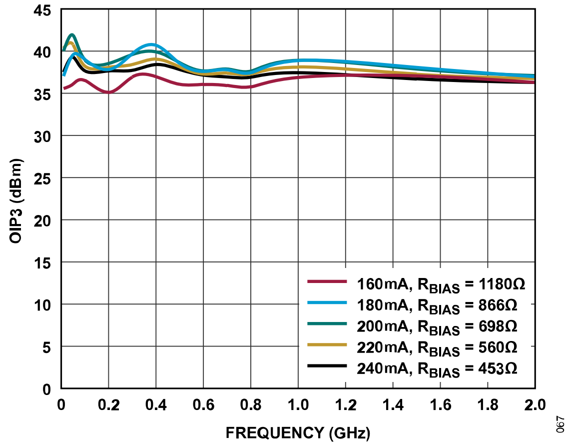


Figure 67. OIP3 vs. Frequency for Various I_{DQ} and R_{BIAS} Values, 10 MHz to 2 GHz, V_{DD} = 5 V

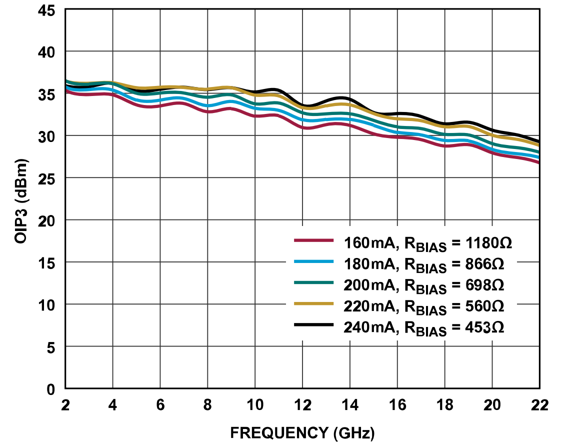


Figure 70. OIP3 vs. Frequency for Various I_{DQ} and R_{BIAS} Values, 2 GHz to 22 GHz, V_{DD} = 5 V

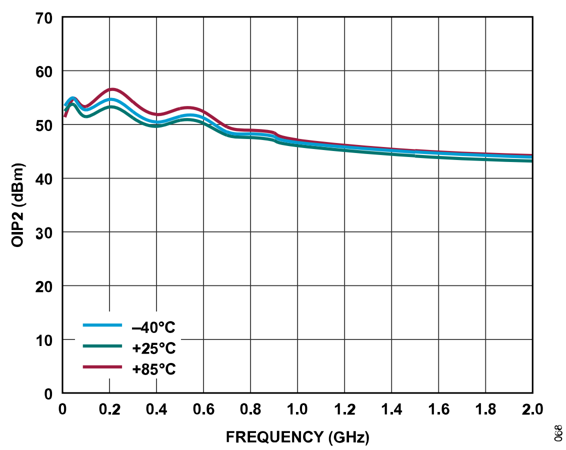


Figure 68. OIP2 vs. Frequency for Various Temperatures, 10 MHz to 2 GHz, V_{DD} = 5 V, I_{DQ} = 220 mA, R_{BIAS} = 560 Ω

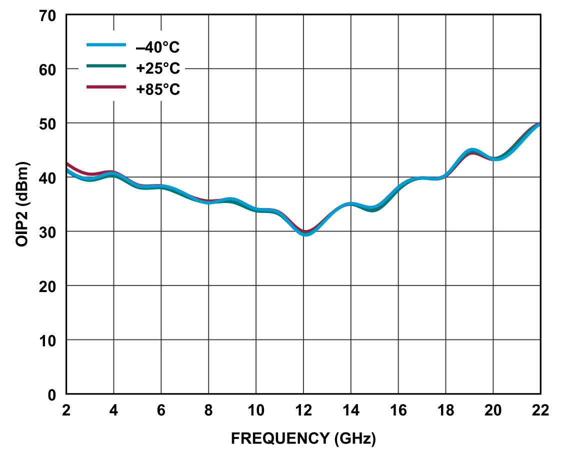


Figure 71. OIP2 vs. Frequency for Various Temperatures, 2 GHz to 22 GHz, V_{DD} = 5 V, I_{DQ} = 220 mA, R_{BIAS} = 560 Ω

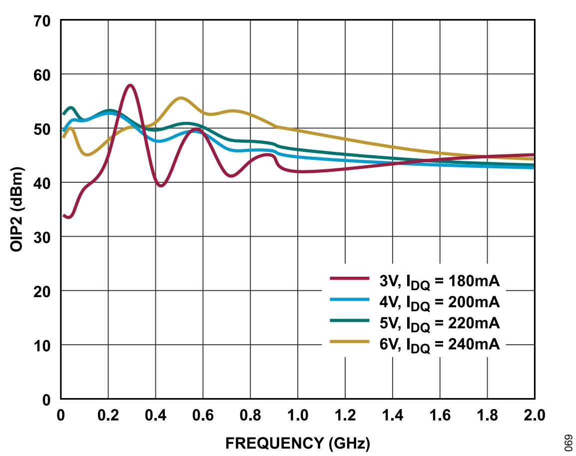


Figure 69. OIP2 vs. Frequency for Various Supply Voltages and I_{DQ} Values, 10 MHz to 2 GHz, R_{BIAS} = 560 Ω

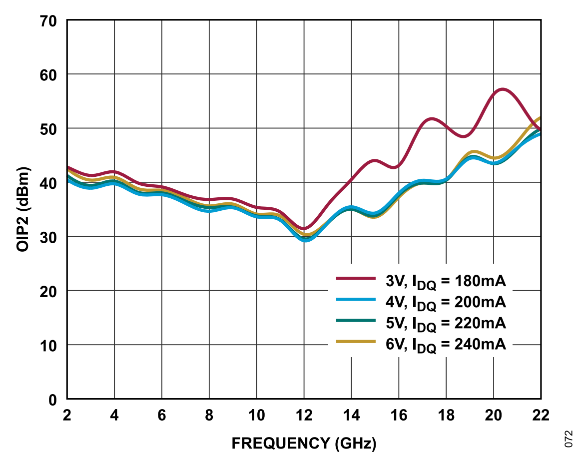


Figure 72. OIP2 vs. Frequency for Various Supply Voltages and I_{DQ} Values, 2 GHz to 22 GHz, R_{BIAS} = 560 Ω

TYPICAL PERFORMANCE CHARACTERISTICS

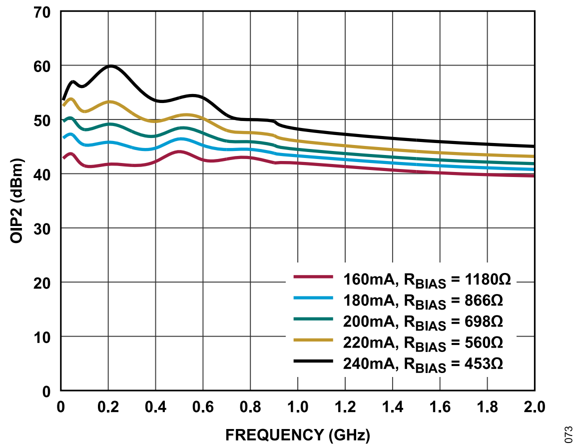


Figure 73. OIP2 vs. Frequency for Various I_{DQ} and R_{BIAS} Values, 10 MHz to 2 GHz, V_{DD} = 5 V

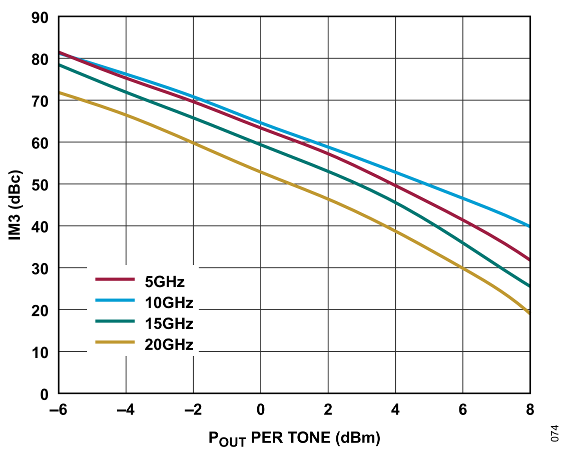


Figure 74. Third-Order Intermodulation (IM3) vs. P_{OUT} per Tone at Various Frequencies, V_{DD} = 3 V, R_{BIAS} = 560 Ω

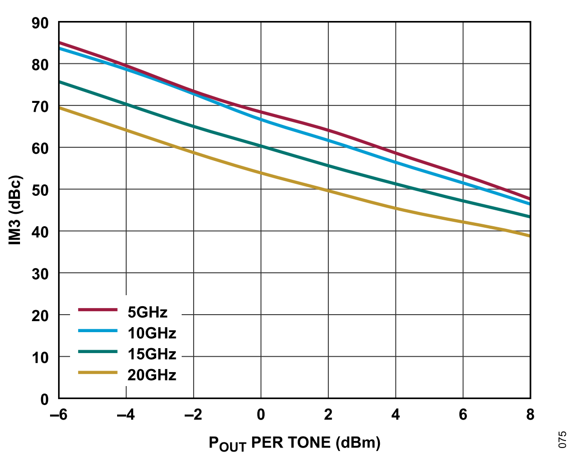


Figure 75. IM3 vs. P_{OUT} per Tone at Various Frequencies, V_{DD} = 5 V, R_{BIAS} = 560 Ω

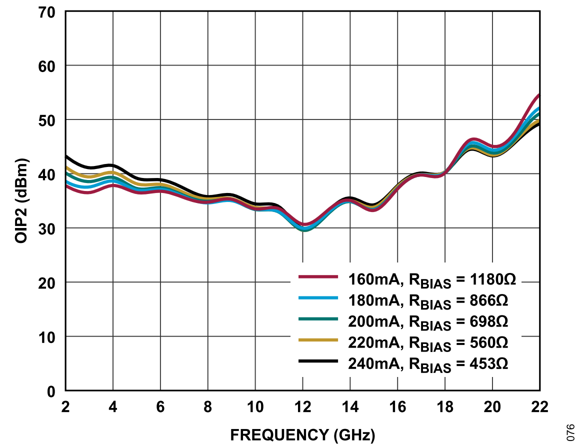


Figure 76. OIP2 vs. Frequency for Various I_{DQ} and R_{BIAS} Values, 2 GHz to 22 GHz, V_{DD} = 5 V

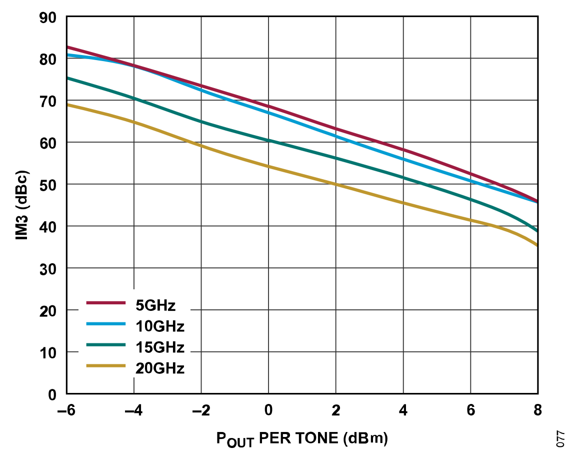


Figure 77. IM3 vs. P_{OUT} per Tone at Various Frequencies, V_{DD} = 4 V, R_{BIAS} = 560 Ω

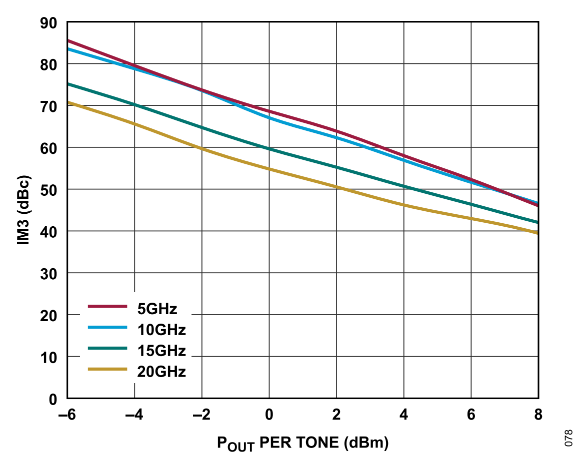


Figure 78. IM3 vs. P_{OUT} per Tone at Various Frequencies, V_{DD} = 6 V, R_{BIAS} = 560 Ω

TYPICAL PERFORMANCE CHARACTERISTICS

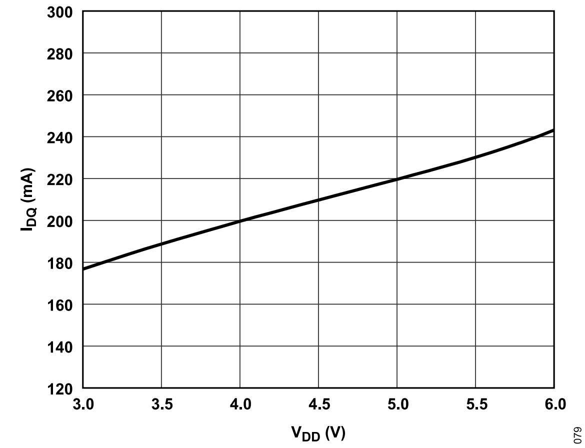


Figure 79. I_{DQ} vs. V_{DD}, R_{BIAS} = 560 Ω

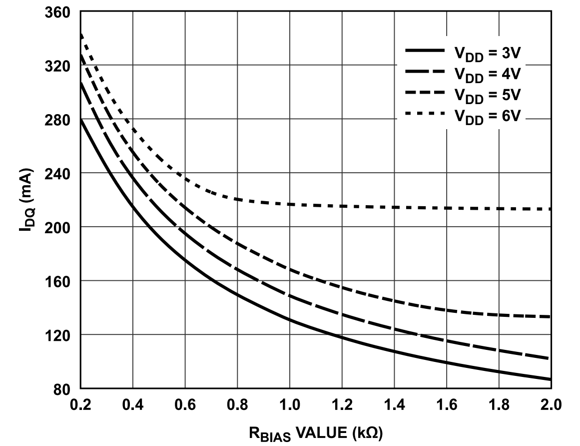


Figure 82. I_{DQ} vs. R_{BIAS} Value for Various Supply Voltages

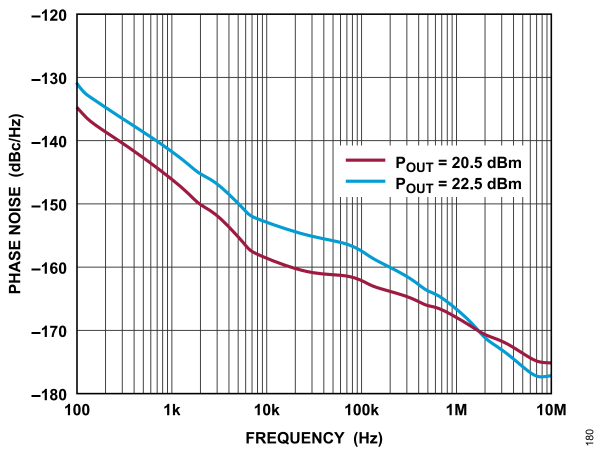


Figure 80. Phase Noise vs. Frequency at 5 GHz for Various P_{OUT} Values

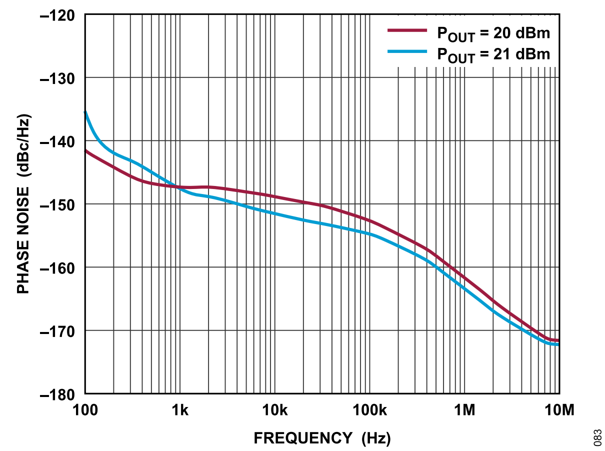


Figure 83. Phase Noise vs. Frequency at 15 GHz for Various P_{OUT} Values

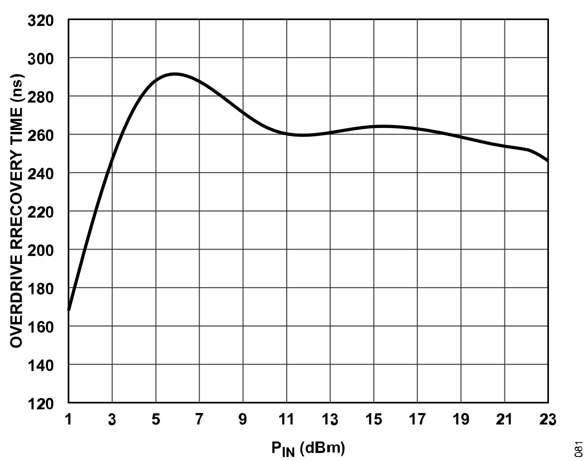


Figure 81. Overdrive Recovery Time vs. P_{IN} at 10 GHz, Recovery to Within 90% of Small Signal Gain Value, V_{DD} = 5 V, R_{BIAS} = 560 Ω

TYPICAL PERFORMANCE CHARACTERISTICS

EVALUATION BOARD WITH BIAS TEE

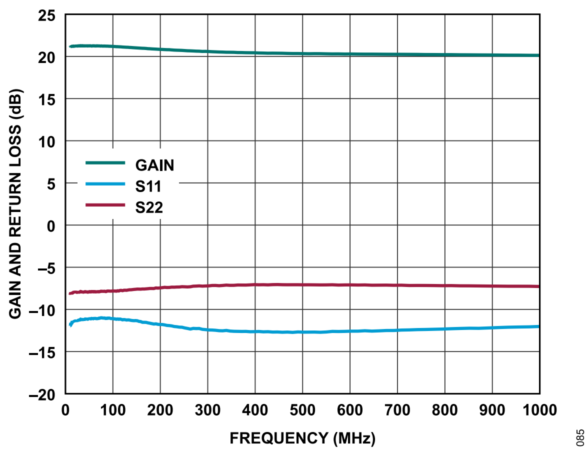


Figure 84. Gain and Return Loss vs. Frequency, 10 MHz to 1 GHz, V_{DD} = 5 V, I_{DQ} = 220 mA

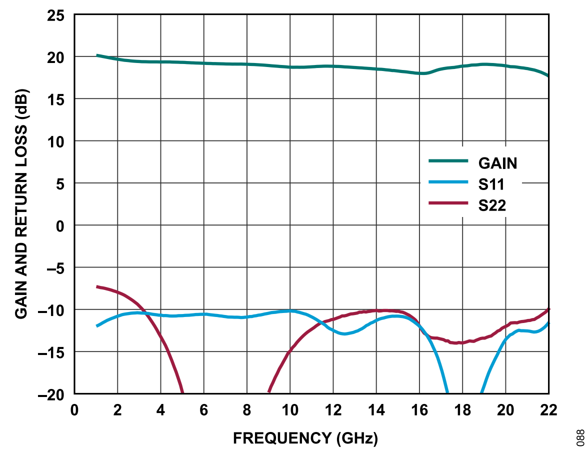


Figure 87. Gain and Return Loss vs. Frequency, 1 GHz to 22 GHz, V_{DD} = 5 V, I_{DQ} = 220 mA

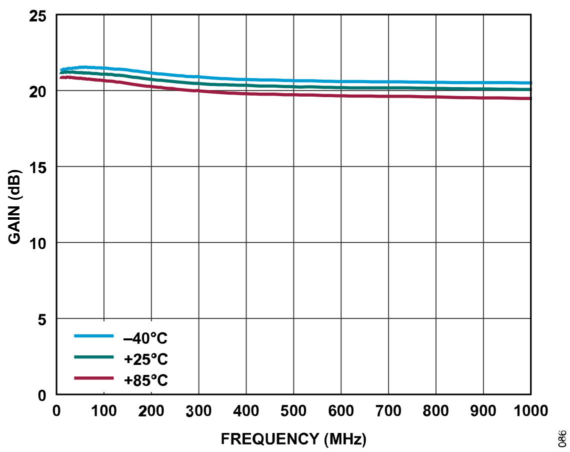


Figure 85. Gain vs. Frequency for Various Temperatures, 10 MHz to 1 GHz, V_{DD} = 5 V, I_{DQ} = 220 mA, R_{BIAS} = 560 Ω

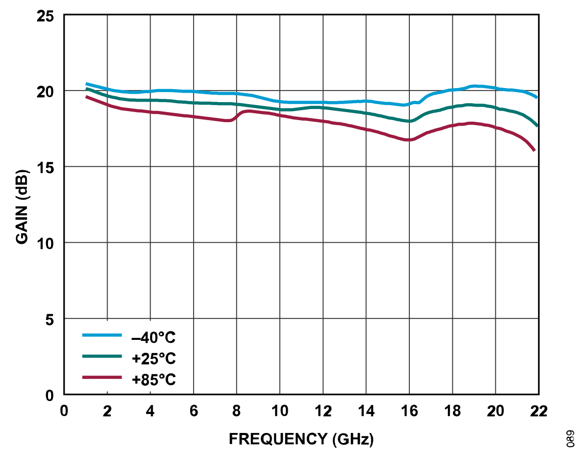


Figure 88. Gain vs. Frequency for Various Temperatures, 1 GHz to 22 GHz, V_{DD} = 5 V, I_{DQ} = 220 mA, R_{BIAS} = 560 Ω

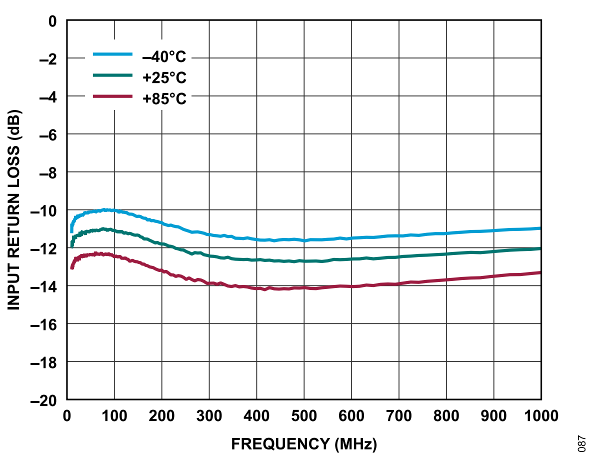


Figure 86. Input Return Loss vs. Frequency for Various Temperatures, 10 MHz to 1 GHz, V_{DD} = 5 V, I_{DQ} = 220 mA, R_{BIAS} = 560 Ω

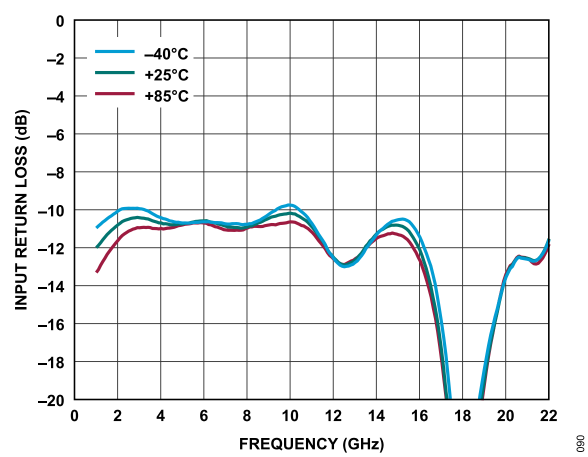


Figure 89. Input Return Loss vs. Frequency for Various Temperatures, 1 GHz to 22 GHz, V_{DD} = 5 V, I_{DQ} = 220 mA, R_{BIAS} = 560 Ω

TYPICAL PERFORMANCE CHARACTERISTICS

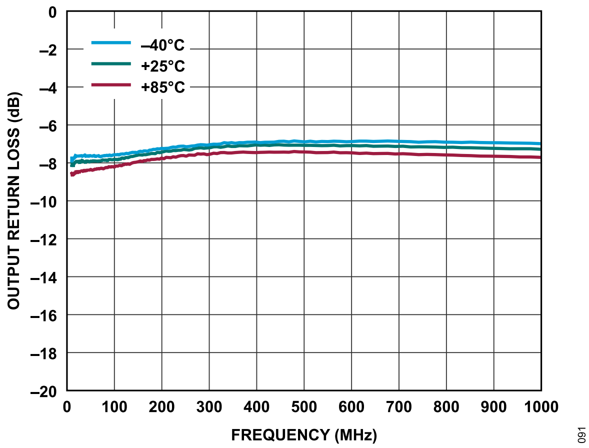


Figure 90. Output Return Loss vs. Frequency for Various Temperatures, 10 MHz to 1 GHz, V_{DD} = 5 V, I_{DQ} = 220 mA, R_{BIAS} = 560 Ω

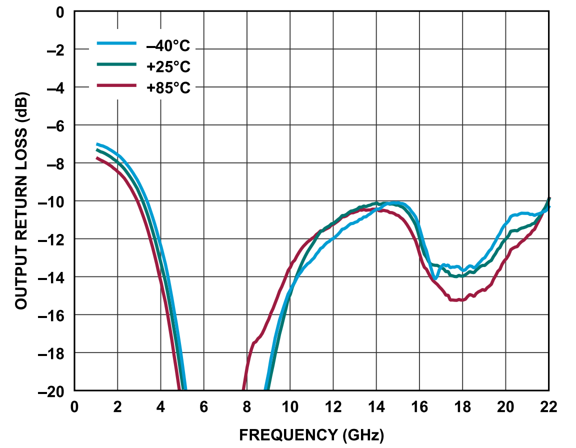


Figure 93. Output Return Loss vs. Frequency for Various Temperatures, 1 GHz to 22 GHz, V_{DD} = 5 V, I_{DQ} = 220 mA, R_{BIAS} = 560 Ω

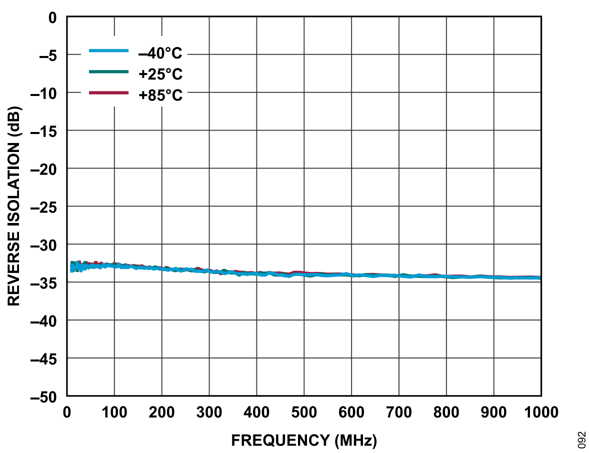


Figure 91. Reverse Isolation vs. Frequency for Various Temperatures, 10 MHz to 1 GHz, V_{DD} = 5 V, I_{DQ} = 220 mA, R_{BIAS} = 560 Ω

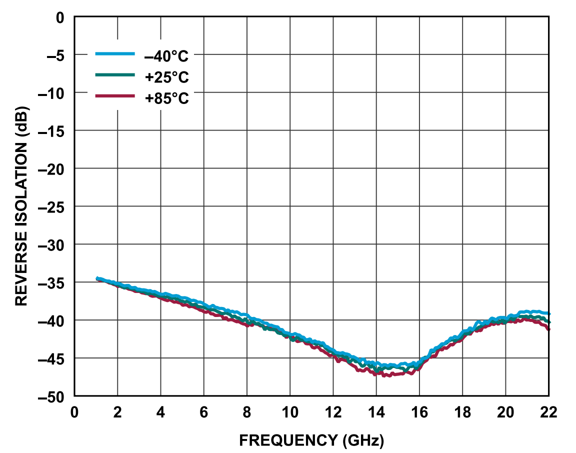


Figure 94. Reverse Isolation vs. Frequency for Various Temperatures, 1 GHz to 22 GHz, V_{DD} = 5 V, I_{DQ} = 220 mA, R_{BIAS} = 560 Ω

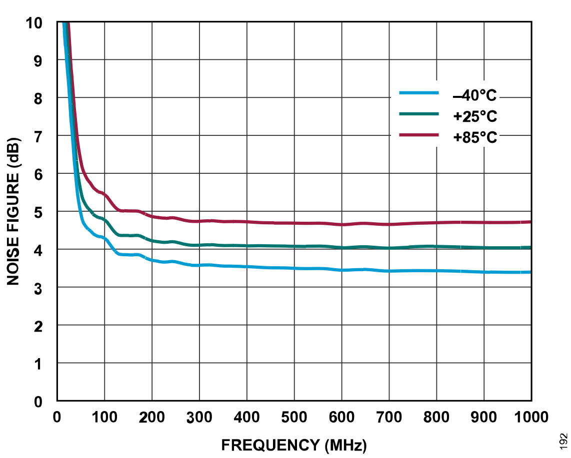


Figure 92. Noise Figure vs. Frequency for Various Temperatures, 10 MHz to 1 GHz, V_{DD} = 5 V, I_{DQ} = 220 mA, R_{BIAS} = 560 Ω

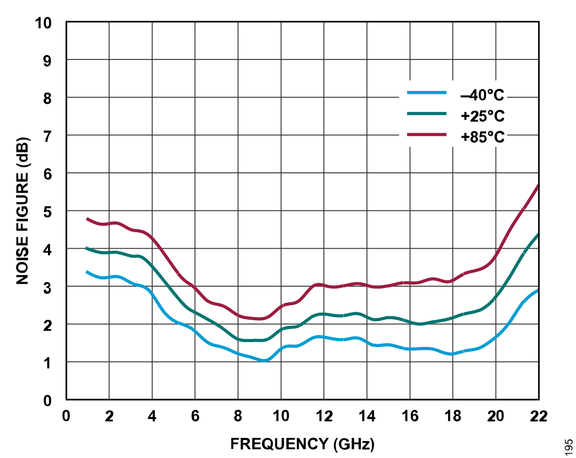


Figure 95. Noise Figure vs. Frequency for Various Temperatures, 1 GHz to 22 GHz, V_{DD} = 5 V, I_{DQ} = 220 mA, R_{BIAS} = 560 Ω

TYPICAL PERFORMANCE CHARACTERISTICS

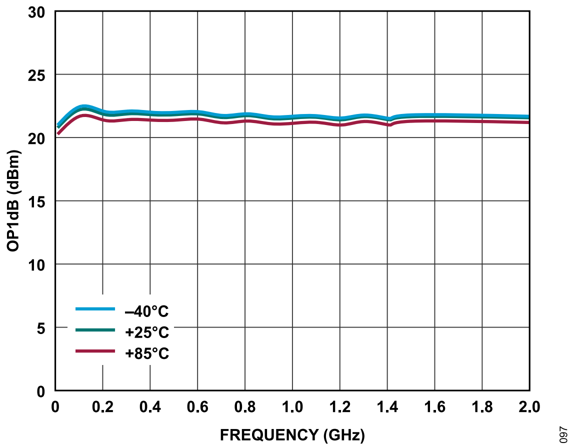


Figure 96. OP1dB vs. Frequency for Various Temperatures, 10 MHz to 2 GHz, V_{DD} = 5 V, I_{DQ} = 220 mA, R_{BIAS} = 560 Ω

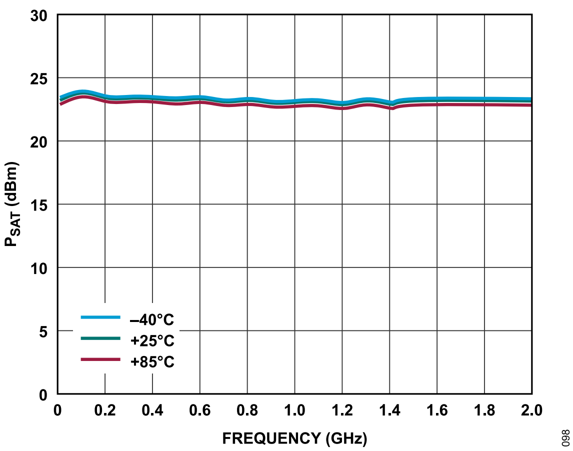


Figure 97. P_{SAT} vs. Frequency for Various Temperatures, 10 MHz to 2 GHz, V_{DD} = 5 V, I_{DQ} = 220 mA, R_{BIAS} = 560 Ω

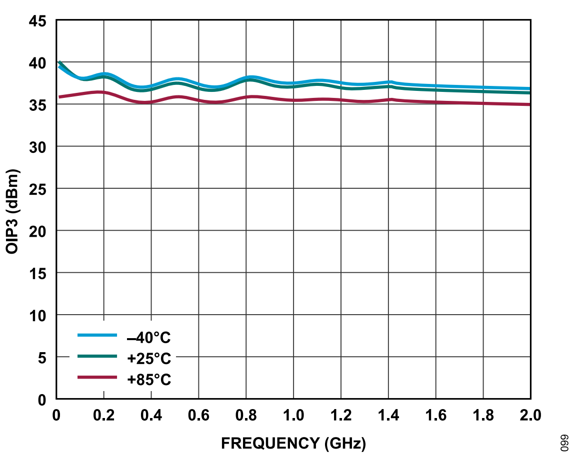


Figure 98. OIP3 vs. Frequency for Various Temperatures, 10 MHz to 2 GHz, V_{DD} = 5 V, I_{DQ} = 220 mA, R_{BIAS} = 560 Ω

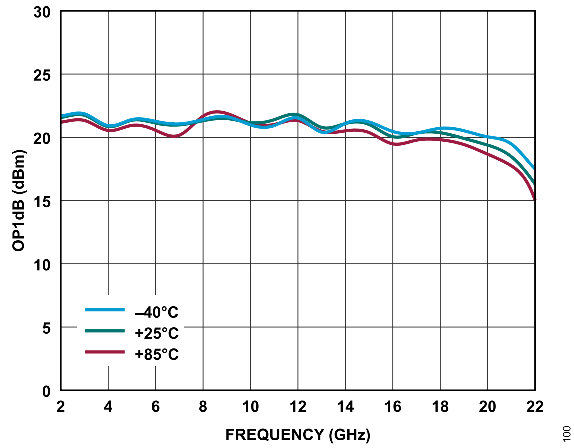


Figure 99. OP1dB vs. Frequency for Various Temperatures, 2 GHz to 22 GHz, V_{DD} = 5 V, I_{DQ} = 220 mA, R_{BIAS} = 560 Ω

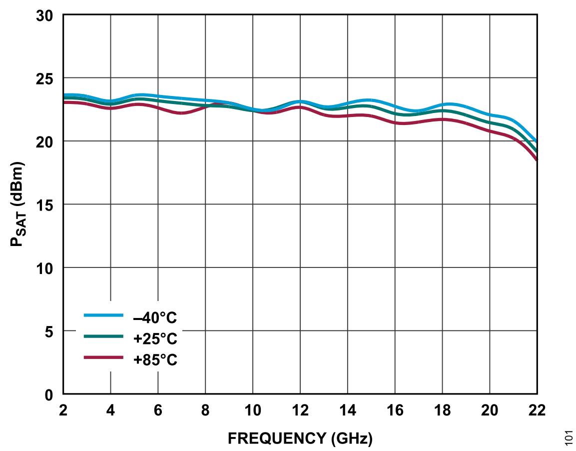


Figure 100. P_{SAT} vs. Frequency for Various Temperatures, 2 GHz to 22 GHz, V_{DD} = 5 V, I_{DQ} = 220 mA, R_{BIAS} = 560 Ω

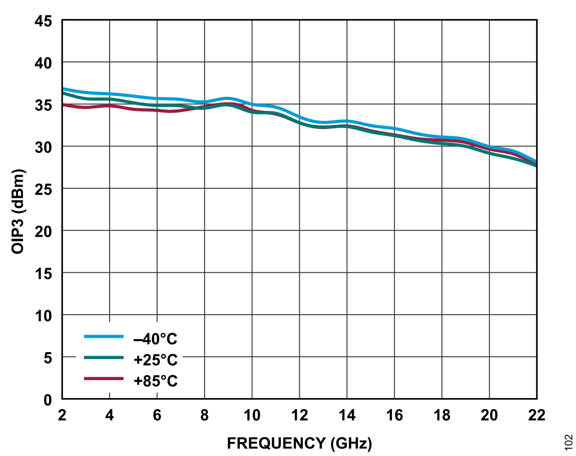


Figure 101. OIP3 vs. Frequency for Various Temperatures, 2 GHz to 22 GHz, V_{DD} = 5 V, I_{DQ} = 220 mA, R_{BIAS} = 560 Ω

TYPICAL PERFORMANCE CHARACTERISTICS

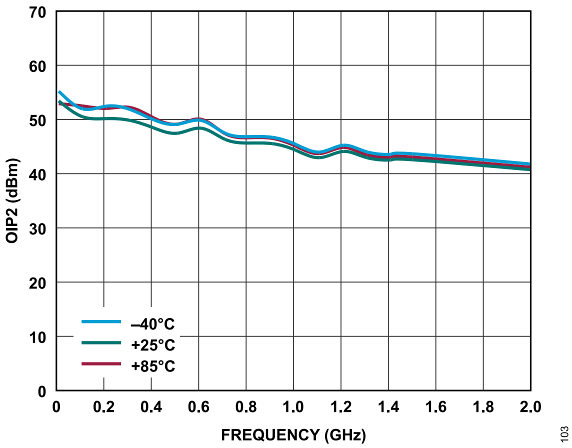


Figure 102. OIP2 vs. Frequency for Various Temperatures, 10 MHz to 2 GHz, V_{DD} = 5 V, I_{DQ} = 220 mA, R_{BIAS} = 560 Ω

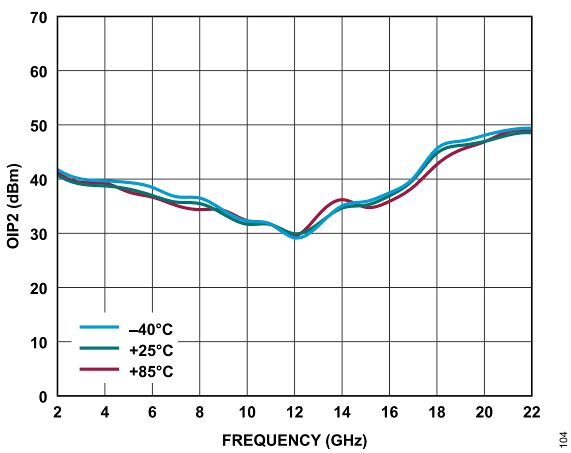


Figure 103. OIP2 vs. Frequency for Various Temperatures, 2 GHz to 22 GHz, V_{DD} = 5 V, I_{DQ} = 220 mA, R_{BIAS} = 560 Ω

THEORY OF OPERATION

The ADL8100 is a GaAs, MMIC, pHEMT, wideband LNA. A simplified block diagram is shown in Figure 104. The RFIN and RFOUT pins are DC-coupled and matched to 50 Ω.

The ADL8100 operates from a single positive supply, and I_{DQ} is set by connecting a resistor between the RBIAS pin and the external supply voltage. The drain bias voltage is normally provided via an external bias tee.

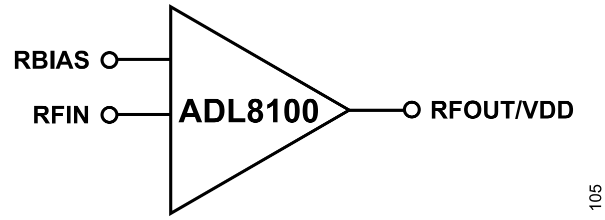


Figure 104. Simplified Schematic

APPLICATIONS INFORMATION

The basic connections for operating the ADL8100 are shown in Figure 105. The bias current is set by connecting a resistor between the RBIAS and VDD pins. When using 5 V V_{DD}, a resistor value of 560 Ω (R1) is recommended to achieve an I_{DQ} of 220 mA. Table 9 details the resulting I_{DQ} for the various R_{BIAS} values where the resistor is tied to 5 V.

The drain voltage is applied to the VDD pin through an external connectorized bias tee (Marki BT-0040). For more information on this circuit, refer to the EVAL-ADL8100 user guide.

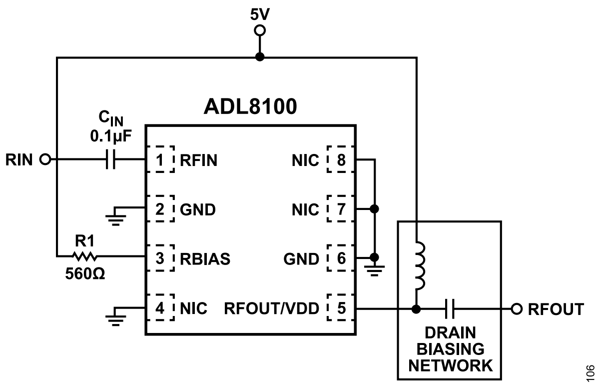


Figure 105. Typical Application Circuit (C_{IN} Is the Input Capacitance.)

RECOMMENDED BIAS SEQUENCING

See the EVAL-ADL8100 user guide for the recommended bias sequencing information.

Table 9. Recommended Bias Resistor Values for V_{DD} = 5 V

R_{BIAS} (Ω)	I_{DQ} (mA)	I_{DQ_AMP} (mA)	I_{RBIAS} (mA)
453	240	234	6
560	220	215	5
698	200	195.5	4.5
866	180	176	4
1180	160	157	3

OPERATION WITH A SURFACE-MOUNT BIAS TEE

Figure 106 shows the ADL8100 operating with a bias tee composed of surface-mount components. For more information on this circuit and for a comparison of the two biasing techniques, refer to the ADL8100-EVALZ user guide.

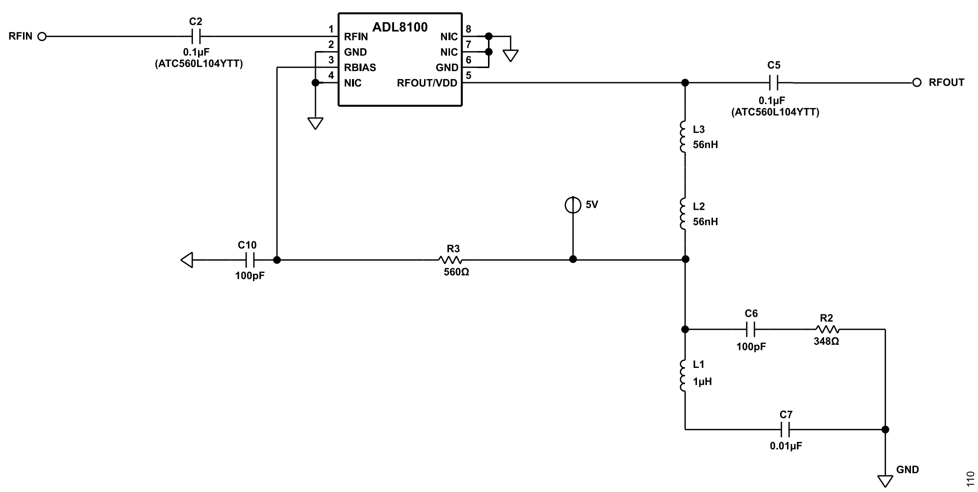


Figure 106. ADL8100 Operated with a Surface-Mount Bias Tee Circuit

RECOMMENDED POWER MANAGEMENT CIRCUIT

Figure 107 shows a recommended power management circuit for the ADL8100. The LT8607 step-down regulator is used to step down a 12 V rail to a 6.5 V rail, which is then applied to the LT3045 low dropout (LDO) linear regulator to generate a low noise 5 V output. Even though the circuit shown in Figure 107 has an input voltage of 12 V, the input range to the LT8607 can be as high as 42 V.

The 6.54 V regulator output of the LT8607 is set by the R2 and R3 resistors, according to the following equation:

R2 = R3((VOUT/0.778 V) – 1)

The switching frequency (f_{SW}) is set to 2 MHz by the 18.2 kΩ resistor (R1) on the RT pin of the LT8607. The LT8607 data sheet provides a table of resistor values that can be used to select other switching frequencies ranging from 0.2 MHz to 2.2 MHz.

The output voltage of the LT3045 is set by the R4 resistor connected to the SET pin, according to the following equation:

VOUT = 100 μA × R4

The PGFB resistors are chosen to trigger the power-good (PG) signal when the output is just under 95% of the target voltage of 5 V. The output of the LT3045 has 1% initial tolerance and another 1% variation over temperature. The PGFB tolerance is roughly 3% over temperature, and adding resistors results in a bit more (5%). Therefore, putting 5% between the output and PGFB works well. In addition, the PG open-collector is pulled up to the 5 V output to give a convenient 0 V to 5 V voltage range. Table 10 provides the recommended resistor values for operation at 5 V, 3.3 V, and 3 V.

Table 10. Recommended Resistor Values for Operating at 5 V, 3.3 V, and 3 V

LDO VOUT (V)	R4 (kΩ)	R7 (kΩ)	R8 (kΩ)
5	49.9	442	30.1
3.3	33.2	287	30.1
3	30.1	255	30.1

The LT8607 can source a maximum current of 750 mA, and the LT3045 can source a maximum current of 500 mA. If the 5 V power supply voltage is being developed as a bus supply to serve another component, higher current devices can be used. The LT8608 and LT8609 step-down regulators can source a maximum current to 1.5 A and 3 A, respectively, and these devices are pin compatible with the LT8607.

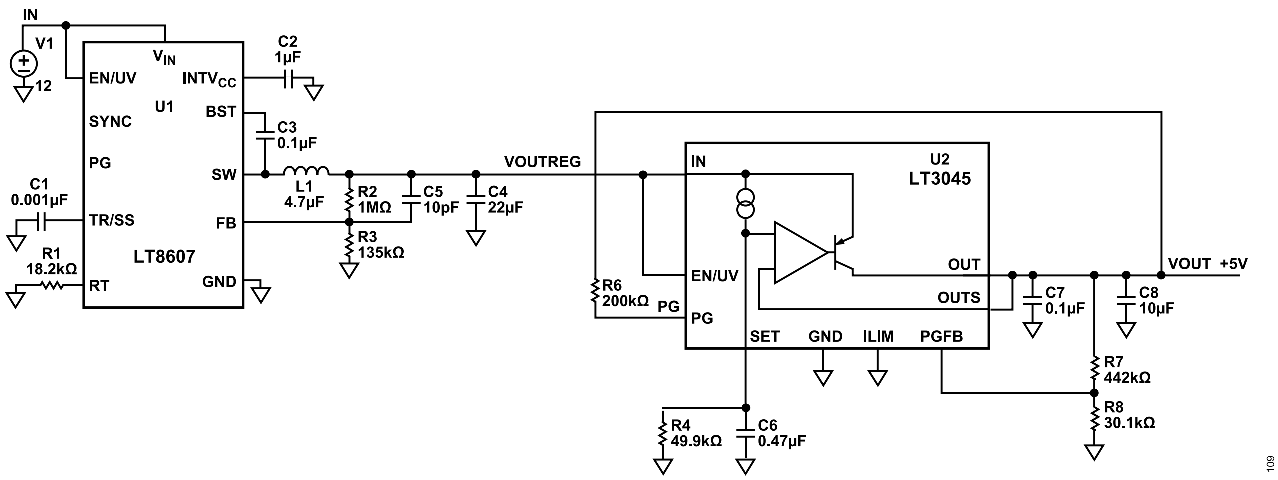


Figure 107. Recommended Power Management Circuit

OUTLINE DIMENSIONS

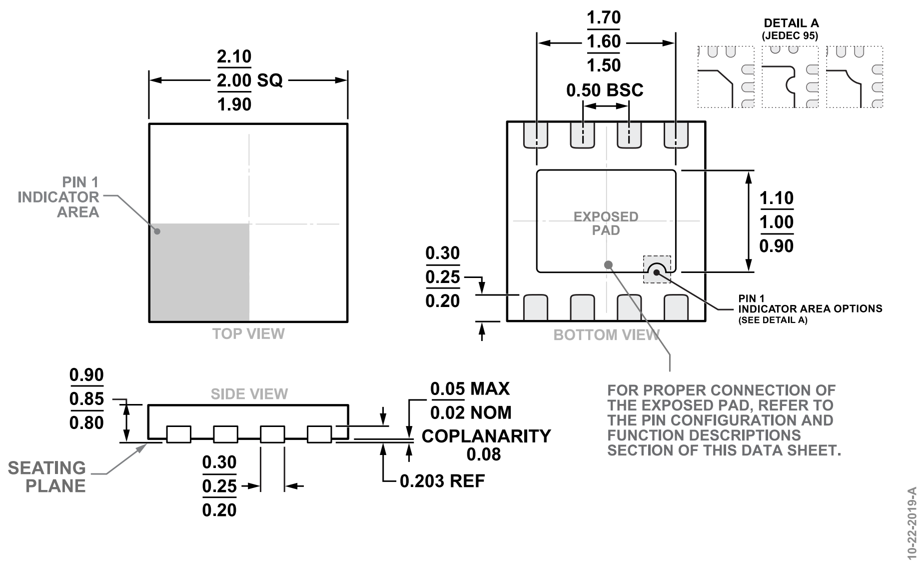


Figure 108. 8-Lead Lead Frame Chip Scale Package [LFCSP]
2 mm × 2 mm Body and 0.85 mm Package Height
(CP-8-30)
Dimensions shown in millimeters

Updated: June 21, 2023

ORDERING GUIDE

Model[1, 2]	Temperature Range	Package Description	Packing Quantity	Package Option
ADL8100ACPZN	−40°C to +85°C	8-Lead Lead Frame Chip Scale Package [LFCSP]		CP-8-30
ADL8100ACPZN-R7	−40°C to +85°C	8-Lead Lead Frame Chip Scale Package [LFCSP]	Reel, 3000	CP-8-30

1 Z = RoHS Compliant Part.

2 The lead finish of the ADL8100ACPZN and the ADL8100ACPZN-R7 is nickel palladium gold.

EVALUATION BOARDS

Model[1]	Description
ADL8100-EVALZ	Evaluation Board
ADL8100-EVAL1Z	Evaluation Board with Bias Tee

1 Z = RoHS Compliant Part.