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100 MHz – 2.7 GHz RF Gain Block

Preliminary Technical Data AD8354

FEATURES

Fixed gain of 20 dB

Operational Frequency to 100 MHz to 2.7GHz

Linear output power up to 4 dBm

Input/Output internally matched to 50 ohms

Temperature and power supply stable

Noise figure 3.9 dB

Power supply 3 V or 5 V

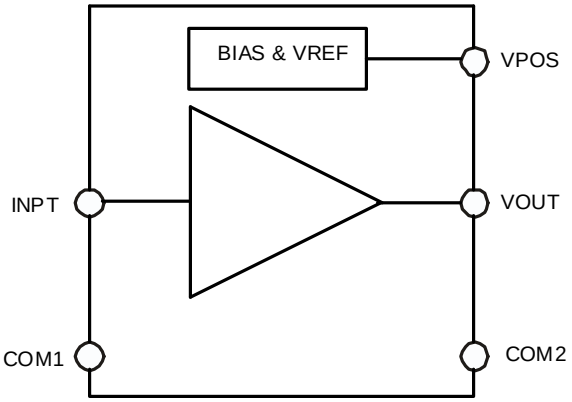
APPLICATIONS

VCO Buffers

General Tx/Rx amplification

Power amplifier predriver

Low power antenna driver



PRODUCT DESCRIPTION

The AD8354 is a broadband, fixed-gain linear amplifier that operates at frequencies from 100 MHz up to 2.7 GHz. It is intended for use in a wide variety of wireless devices including cellular, broadband, CATV and LMDS/MMDS applications.

By taking advantage of Analog Devices' high performance complementary Si bipolar process, these gain blocks provide excellent stability over process, temperature and power supply. This amplifier is singled-ended and internally matched to 50 ohms with a return loss of greater than 10 dB over the full operating frequency range.

The AD8354 provides linear output power of nearly 4.3 dBm with 20 dB of gain at 900 MHz when biased at 3 V and an external RF choke is connected between the power supply and the output pin. The DC supply current is 24 mA. At 900 MHz, the output third order intercept (OIP3) is greater than +18 dBm, and is +13 dBm at 2.7 GHz.

The noise figure is 3.9 dB at 900 MHz. The reverse isolation (s_{12}) is -33 dB at 900 MHz.

The AD8354 can also operate with a 5 V power supply, in which case no external inductor is required. Under these conditions, the AD8354 delivers 4.4 dBm with 20 dB of gain at 900 MHz. The DC supply current is 26 mA. At 900 MHz, the OIP3 is greater than +19 dBm and is +14 dBm at 2.7 GHz. The noise figure is 3.9 dB at 900 MHz. The reverse isolation (s_{12}) is –33 dB.

The AD8354 is fabricated on Analog Devices' proprietary, high performance 25 GHz Si complementary bipolar IC process. The AD8354 is available in a chip scale package which utilizes an exposed paddle for excellent thermal impedance and low impedance electrical connection to ground. It operates over a -40 to +85 °C temperature range.

An evaluation board is available.

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AD8354-SPECIFICATIONS

(Unless otherwise noted, V_{POS} = 3V, T=27°C, 100 nH external inductor between VOUT and VPOS, Z_o = 50 Ω)

Parameters	Conditions	Min	Typ	Max	Units
OVERALL FUNCTION					
Frequency Range		0.1		2.7	GHz
Gain	f = 900 MHz		19.3		dB
	f = 1.9 GHz		18.6		dB
	f = 2.7 GHz		17		dB
Delta Gain	f = 900 MHz, -40 °C ≤ T_A ≤ 85 °C				dB
	f = 1.9 GHz, -40 °C ≤ T_A ≤ 85 °C				dB
	f = 2.7 GHz, -40 °C ≤ T_A ≤ 85 °C				dB
Gain Supply Sensitivity	V_{POS} ± 10%		0.6		dB/V
Reverse Isolation (s_{12})	f = 900 MHz		-33		dB
	f = 1.9 GHz		-33		dB
	f = 2.7 GHz		-33.4		dB
RF INPUT INTERFACE	Pin RFIN				
Input Return Loss	f = 900 MHz		23.2		dB
	f = 1.9 GHz		25		dB
	f = 2.7 GHz		19.5		dB
RF OUTPUT INTERFACE	Pin VOUT				
Output Compression Point	f = 900 MHz, 1 dB compression		4.3		dBm
	f = 1.9 GHz		3.3		dBm
	f = 2.7 GHz		2.3		dBm
	f = 900 MHz, -40 °C ≤ T_A ≤ 85 °C				dBm
	f = 1.9 GHz, -40 °C ≤ T_A ≤ 85 °C				dBm
	f = 2.7 GHz, -40 °C ≤ T_A ≤ 85 °C				dBm
Maximum Output Power	f = 900 MHz, saturated		6		dBm
Output Return Loss	f = 900 MHz		24		dB
	f = 1.9 GHz		17.2		dB
	f = 2.7 GHz		14.7		dB
DISTORTION/ NOISE					
Output Third Order Intercept	f = 900 MHz, Δf = 1 MHz, P_{IN} = –28 dBm		19		dBm
	f = 1.9 GHz, Δf = 1 MHz, P_{IN} = –28 dBm		15.9		dBm
	f = 2.7 GHz, Δf = 1 MHz, P_{IN} = –28 dBm		13.8		dBm
Output Second Order Intercept	f = 900 MHz, Δf = 1 MHz, P_{IN} = –28 dBm		TBD		dBm
	f = 1.9 GHz, Δf = 1 MHz, P_{IN} = –28 dBm		TBD		dBm
	f = 2.7 GHz, Δf = 1 MHz, P_{IN} = –28 dBm		TBD		dBm
Noise Figure	f = 900 MHz		3.9		dB
	f = 1.9 GHz		TBD		dB
	f = 2.7 GHz		TBD		dB
POWER INTERFACE	Pin VPOS				
Supply Voltage		2.7	3	3.3	V
Total Supply Current		23	24	27	mA
vs. Temperature	-40°C ≤ T_A ≤ 85°C	22		27	mA
Supply Voltage Sensitivity		6	6.5	7.3	mA/V
Temperature Sensitivity	-40°C ≤ T_A ≤ 85°C	40	41	44	µA/°C

AD8354-SPECIFICATIONS

(Unless otherwise noted, V_{POS} = 5V, T=27°C, NO external inductor between VOUT and VPOS, Z_o = 50 Ω)

Parameters	Conditions	Min	Typ	Max	Units
OVERALL FUNCTION					GHz
Frequency Range		0.1		2.7	dB
Gain	f = 900 MHz		19.4		dB
	f = 1.9 GHz		18.5		dB
	f = 2.7 GHz		17.2		dB/°C
Delta Gain	f = 900 MHz, -40 °C ≤ T_A ≤ 85 °C				dB
	f = 1.9 GHz, -40 °C ≤ T_A ≤ 85 °C				dB
	f = 2.7 GHz, -40 °C ≤ T_A ≤ 85 °C				dB
Gain Temperature Sensitivity	-40 °C to 85 °C	-0.0063	-0.0065	-0.0081	dB/V
Gain Supply Sensitivity	V_{POS} ± 10%		0.54		dB
Reverse Isolation (s_{12})	f = 900 MHz		-33.7		dB
	f = 1.9 GHz		-37		dB
	f = 2.7 GHz		-33		GHz
RF INPUT INTERFACE	Pin RFIN				
	f = 900 MHz		24.3		dB
Input Return Loss					
	f = 1.9 GHz		38		dB
	f = 2.7 GHz		22		dB
RF OUTPUT INTERFACE	Pin VOUT				
Output 1 dB Compression	f = 900 MHz		4.4		dBm
	f = 1.9 GHz		4.1		dBm
	f = 2.7 GHz		3.1		dBm
Maximum Output Power	f = 900 MHz, saturated		7.0		dBm
Output Return Loss	f = 900 MHz		27.3		dB
	f = 1.9 GHz		38		dB
	f = 2.7 GHz		19		dB
DISTORTION/ NOISE					
Output Third Order Intercept	f = 900 MHz, Δf = 50 MHz, P_{IN} = –30 dBm		19.3		dBm
	f = 1.9 GHz, Δf = 50 MHz, P_{IN} = –30 dBm		17		dBm
	f = 2.7 GHz, Δf = 50 MHz, P_{IN} = –30 dBm		14.8		dBm
Output Second Order Intercept	f = 900 MHz, Δf = 1 MHz, P_{IN} = –28 dBm		TBD		dBm
	f = 1.9 GHz, Δf = 1 MHz, P_{IN} = –28 dBm		TBD		dBm
	f = 2.7 GHz, Δf = 1 MHz, P_{IN} = –28 dBm		TBD		dBm
Noise Figure	f = 900 MHz		3.9		dB
	f = 1.9 GHz		TBD		dB
	f = 2.7 GHz		5.2		dB
POWER INTERFACE	Pin VPOS				
Supply Voltage		4.5	5	5.5	V
Total Supply Current	T_A = 27 °C	24	26	28	mA
vs. Temperature	-40°C ≤ T_A ≤ 85°C	23		28	mA
Supply Voltage Sensitivity		3.9	4.3	4.9	mA/V
Temperature Sensitivity	-40°C ≤ T_A ≤ 85°C		28	36	µA/°C

AD8354

ABSOLUTE MAXIMUM RATINGS*

Supply Voltage VPOS……...…...…… .5.5V
Input Power (re: 50 Ω)……..……..……+10 dBm
Equivalent Voltage …….700 mVRMS
Internal Power Dissipation …..……..TBD
θ_{JA} ……..…TBD °C/W
Maximum Junction Temperature ……..…+125 °C
Operating Temperature Range …..-40 °C to +85 °C
Storage Temperature Range …….-65 °C to +150 °C
Lead Temperature Range (Soldering 60 sec)..+300 °C

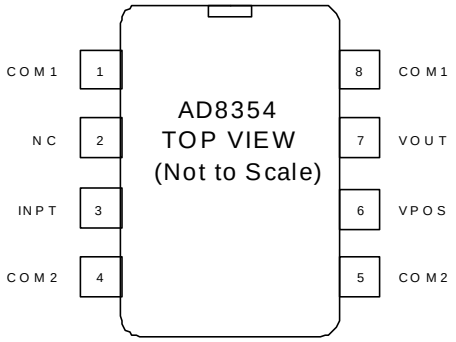
***Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only; functional operation of the device at these or any other conditions above those indicated in the operational section of this specification is not implied. Exposure to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

CAUTION
ESD (electrostatic discharge) sensitive device. Electrostatic charges as high as 4000 V readily accumulate on the human body and test equipment and can discharge without detection. Although the AD8366 features proprietary ESD protection circuitry, permanent damage may occur on devices subjected to high energy [>250 V HBM] electrostatic discharges. Therefore, proper ESD precautions are recommended to avoid performance degradation or loss of functionality.

ORDERING GUIDE

Model	Temp. Range	Package Description
AD8354ACP	-30 °C to +85 °C	Tube, 8-Lead micro_SOIC
AD8354ACP-REEL7		7" Tape and Reel
AD8354-EVAL		Evaluation Board

PIN CONFIGURATION



Pin Function Descriptions

Pin	Name	Description	Equivalent Circuit
1,8	COM1	Device Common. Connect to low impedance ground.	
2	INPT	RF Input Connection. Must be AC coupled.	Circuit A
3,4	COM2	Device Common. Connect to low impedance ground.	
5	VPOS	Positive Supply Voltage.	Circuit A
6	NC	No Connection.	
7	VOUT	RF Output Connection. Must be AC Coupled.	Circuit A

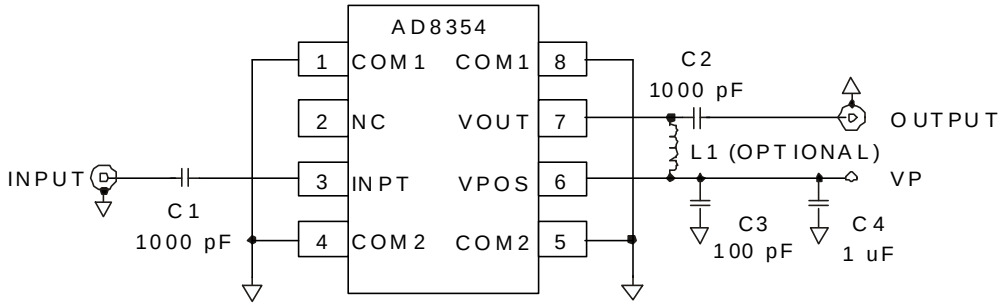


Figure 40. Evaluation Board Schematic

Evaluation Board

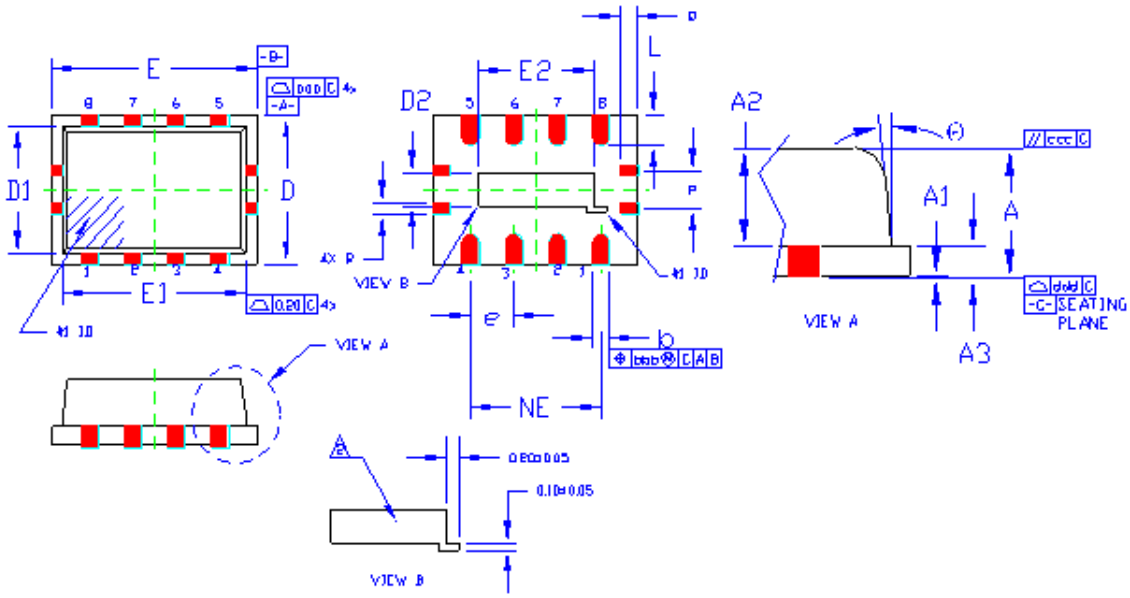
Figure 40. shows the schematic of the AD8354 evaluation board. Note that L1 is shown as an optional component, which is used to obtain maximum gain only when V_P = 3 V. The board is powered by a single supply in the range, +2.7 to +5.5V. The power supply is decoupled by a 0.47 µF and a 100 pF capacitor .

Table II Evaluation Board Configuration Options

Component	Function	Default Value
C1, C2	AC coupling capacitors	1000 pF, 0603
C3	High frequency bypass capacitor	100 pF, 0603
C4	Low frequency bypass capacitor	0.047 µF, 0603
L1	**Optional** RF choke, used to increase current through output stage when V_P = 3 V. Not recommended for use when V_P = 5 V.	100 nH, 0603

AD8354

8L LFCSP (ANVIL) 2x3mm
Package Outline



Dim	Min.	Nom.	Max
D	1.75	2.00	2.25
D1	1.55	1.75	1.95
D2	0.30	0.45	0.60
E	2.75	3.00	3.25
E1	2.55	2.75	2.95
E2	1.59	1.74	1.89
L	0.30	0.40	0.55
NE	1.50 BSC.		
P	0.30	0.45	0.60
Q	0.15	0.25	0.50
R	0.13	0.17	0.23

Position Tolerance			
Dim	Min.	Nom.	Max
b	0.18	0.23	0.30
e	0.50 BSC		
aaa	0.25		
bbb	0.10		
ccc	0.10		
ddd	0.08		

Dim	Min.	Nom.	Max
A	0.80	0.90	1.00
A1	0.00	0.02	0.05
A2		0.65	0.75
A3	0.25 REF		
θ	0°		12°
N	8		

NOTES:

1.Controlling Dimensions are in Millimeters(mm)

2.Paddle is copper plated with lead finish.