800 MHz – 2.7 GHz Quadrature Modulator

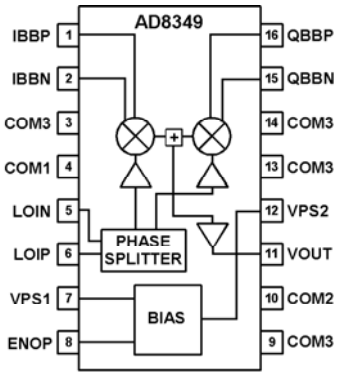
Preliminary Technical Data AD8349

FEATURES

- Output Frequency Range 800 MHz – 2.7 GHz
- Modulation Bandwidth DC-200 MHz
- Output Level +2 dBm @ 2.1 GHz
- Noise Floor –156 dBm/Hz
- High Accuracy
  - Phase Quadrature Error 0.5 degree rms
  - Amplitude Balance 0.1 dB
- Single Supply 4.5-5.5 V
  - 107 mA Total Current
- Output disable Function
- Pin Compatible With AD8346 / AD8345
- 16-lead exposed paddle TSSOP package

APPLICATIONS

- Cellular Communication Systems
  - W-CDMA/CDMA/GSM/PCS/DCS
- Wireless LAN / Wireless Local Loop
- Broadband Wireless Access Systems



PRODUCT DESCRIPTION

The AD8349 is a silicon monolithic RFIC quadrature modulator, designed for use from 0.8 to 2.7 GHz. Its excellent phase accuracy and amplitude balance enable high performance direct RF modulation.

The differential LO signal first passes through a polyphase phase splitter. The I- and Q-channel outputs of the phase splitter are buffered to drive the LO inputs of two Gilbert-cell mixers. Two differential V-to-I converters connected to the I- and Q-channel baseband inputs provide the tail currents for the mixers. The outputs of the two mixers are summed together by a differential buffer to drive 50 ohm loads. The device also features an output disable function.

The AD8349 can be used as a direct-to-RF transmit modulator in digital communication systems such as GSM, CDMA, W-CDMA basestations and QPSK or QAM broadband wireless access transmitters. It can also be used as the IF modulator within LMDS transmitters.

Additionally, this quadrature modulator can be used with direct digital synthesizers in hybrid phase-locked loops to generate signals over a wide frequency range with millihertz resolution.

The AD8349 is supplied in a 16-lead exposed-paddle TSSOP package. Its performance is specified over a -40 to +85 ^{o}C temperature range. This device is fabricated on Analog Devices' advanced Complementary Silicon Bipolar process.

Rev. Prl 1/11/03

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AD8349-SPECIFICATIONS

(V_{supply} = 5 V; $T_{ambient}$ = 25 °C; LO = 2.1 GHz, -2 dBm; Baseband I/Q inputs = 1.2 V p-p differential swing with a 0.5 V DC bias. i.e. +0.5 V ±0.3 V on each baseband input pin; Baseband frequency = 1 MHz; LO source & RF output load impedances are 50 Ω)

Parameters	Conditions	Min	Typ	Max	Units
RF OUTPUT	Pin VOUT				
Operating Frequency		0.8		2.7	GHz
Output Power		0	+2		dBm
Compression Level (P_{1dB})			+5		dBm
Compression Level ($P_{0.1dB}$)			TBD		dBm
Nominal Impedance			50		Ω
Output Return Loss			-18		dB
Noise Floor	Δf ≥ 20MHz from carrier		-156		dBm/Hz
Quadrature Error			±0.5		deg. rms
I/Q Amplitude Balance			±0.1		dB
LO leakage			-45		dBm
Sideband Rejection			-44		dBc
3rd order distortion	$f_{LO} = \pm 3 \times f_{BB}$		-33		dBc
LO INPUTS	Pins LOIP & LOIN				
LO Drive level		-10		0	dBm
Nominal Impedance			50		Ω
Input Return Loss			-12		dB
BASEBAND INPUTS	Pins IBBP & IBBN				
Input bias current			17		µA
Input capacitance			2		pF
Bandwidth (0.2dB)		20	TBD		MHz
Bandwidth (3dB)			200		MHz
OUTPUT ENABLE	Pin ENOP				
Turn-on (ENOP = High)	RF output settles to 0.1dB		40		ns
Turn-off (ENOP = Low)	RF output < -30 dBm		40		ns
ENOP High Threshold (logic 1)				2.0	V
ENOP Low Threshold (logic 0)		0.5			V
POWER SUPPLIES	Pins VPS1 & VPS2				
Voltage		4.5		5.5	Volts
Current active			107		mA
Current (output disabled)			103		mA

ABSOLUTE MAXIMUM RATINGS*

Supply Voltage VPOS ……...…….5.5 V
IBBN& IBBP……...….TBD dBm
Equivalent Voltage ……..…TBD V
LOIN& LOIP……TBD dBm
Equivalent Voltage ……TBD V
Internal Power Dissipation ….……..TBD
. θ_{JA} (Exposed Paddle Soldered Down) ……..30°C/W
θ_{JA} (Exposed Paddle not Soldered Down)……...95°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.**

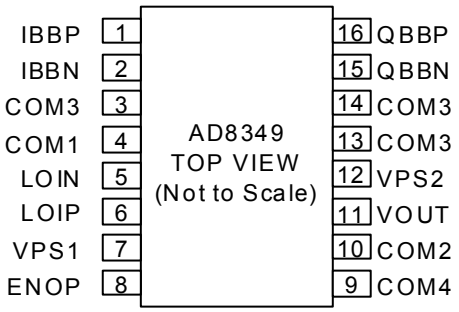
CAUTION

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 AD8349 features proprietary ESD protection circuitry, permanent damage may occur on devices subjected to high energy [>TBD 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	Package Option
AD8349ARE	-40 °C to +85 °C	Tube, 16-Lead TSSOP	
AD8349ARE-REEL7		7" Tape and Reel	
AD8349-EVAL		Evaluation Board	

PIN CONFIGURATION



Pin Function Descriptions

Pin	Name	Description	Equivalent Circuit
1,2	IBBP, IBBN	Differential In-Phase Channel Baseband Inputs. These high impedance inputs must be DC biased to approximately +0.5 VDC and must be driven from a low-impedance source. Nominal characterized AC signal swing is 600 mV p-p on each pin (200 mV to 800 mV). This results in a differential drive of 1.2 V p-p with a +0.5 V DC bias. These inputs are not self-biased and must be externally biased.	
3, 9, 13, 14	COM3	Common Pin for Input V-to-I Converters and Mixer Cores. Connect via low impedance to circuit ground.	
4	COM1	Common Pin for LO Phase Splitter and LO Buffers. Connect via low impedance to circuit ground.	
5, 6	LOIN, LOIP	Differential Local Oscillator Inputs. Internally DC biased to approximately 1.8 V when V_S = 5.0 V. Pins must be AC-coupled. Single-ended or differential drive is acceptable.	
7	VPS1	Positive supply voltage for the Bias Cell and LO Buffers. 4.5 – 5.5 V. Ensure adequate external bypassing (0.01 µF and 1000 pF capacitors) for proper device operation.	
8	ENOP	Output Enable. This pin can be used to enable or disable the RF output. Connect to High level for normal operation. Connect to Low level to disable output.	
10	COM2	Common Pin for the Output Stage of the Output Amplifier. Connect via low impedance to circuit ground.	
11	VOUT	Device Output. Single-ended, 50 Ω DC-Coupled RF Output. Pin must be AC-coupled.	
12	VPS2	Positive Supply Voltage For The Baseband Input V-To-I Converters And Mixer Cores. 4.5 – 5.5 V. Ensure adequate external bypassing (0.01 µF and 1000 pF capacitors) for proper device operation.	
15, 16	QBBP, QBBN	Differential Quadrature Channel Baseband Inputs. These high impedance inputs must be DC biased approximately +0.5 VDC and must be driven from a low-impedance source. Nominal characterized AC signal swing is 600 mV p-p on each pin (200 mV to 800 mV). This results in a differential drive of 1.2 V p-p with a +0.5 V DC bias. These inputs are not self-biased and must be externally biased.	

Evaluation Board

A populated AD8349 Evaluation Board is available.

The AD8349 has an exposed paddle underneath the package. For thermal and electrical grounding reasons, this paddle is soldered to the ground plane of the evaluation board. The AD8349-EVAL is designed without any components on the underside of the board for ease of removal of the DUT.

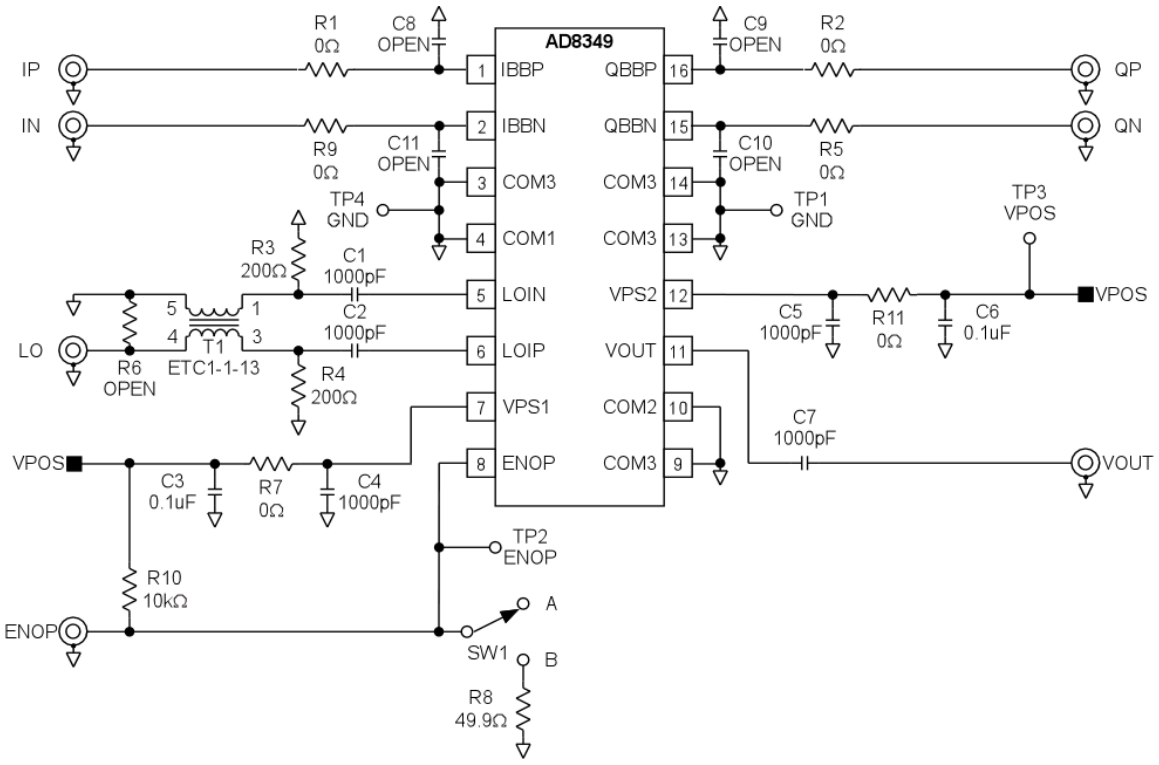


Figure 1. Evaluation Board Schematic.

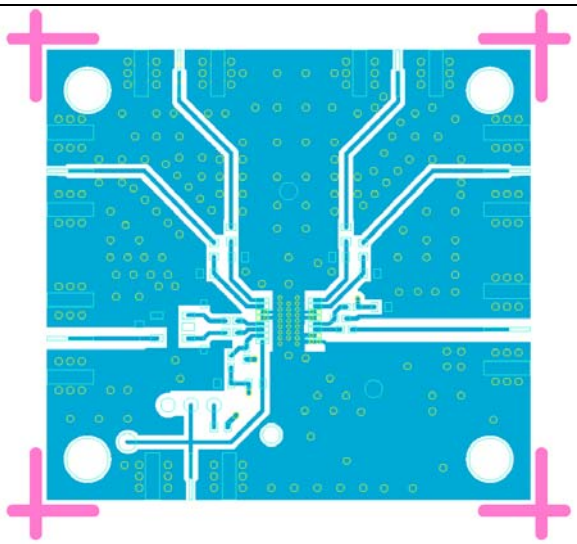


Figure 2. Component Side Layout

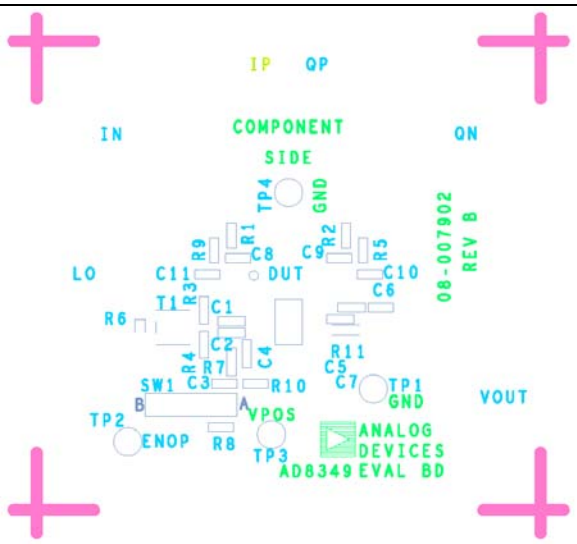


Figure 3. Component Side Silkscreen

Table I Evaluation Board Configuration Options

Component	Function	Default Condition
TP1, TP4, TP3	**Power Supply and Ground Vector Pins**	Not Applicable
SW1, ENOP, TP2	**Output Enable:** Place in the A position to connect the ENOP pin to +Vs via pull-up resistor R10. Place in the B position to disable the device by grounding the pin ENOP through a 49.9 Ohm pull-down resistor. The device may be enabled via an external voltage applied to the SMA connector ENOP or TP2.	SW1 = A
R1, R2, R5, R9, C8 – C11	**Baseband Input Filters:** These components can be used to implement a low-pass filter for the baseband signals.	R1, R2, R5, R9 = 0 Ohms C8 – C11 = OPEN

OUTLINE DIMENSIONS

16-Lead HTSSOP Package
(RE-16)
Dimensions shown in inches and (mm)