5 GHz Ultralow Distortion IF/RF AMP Differential RF/IF Amplifier

Preliminary Technical Data

ADL5565

AMES5

FEATURES

3 dB bandwidth of 5 GHz (A_V = 6 dB)
Pin strappable gain adjust: 6 dB, 12 dB, 15.5 dB
Differential or single-ended input to differential output
Low noise input stage: 2.25 nV/√Hz RTI @ A_V = 6 dB
Low broadband distortion (Av = 6dB) @ 5V
10 MHz: −113 HD2, −113 dBc HD3
100 MHz: −109 HD2, −110 dBc HD3
140 MHz: −96 HD2, −104 dBc HD3
250 MHz: −87 HD2, −87 dBc HD3
IMD3's of −101dBc @ 100MHz Center
OIP3 of 51dBm @ 100 MHz / 102 MHz
Slew rate: 12 V/ns
Fast settling and overdrive recovery of 2 ns
Single-supply operation: 3 V to 5 V
Power down
Fabricated using the high speed XFCB3 SiGe process

APPLICATIONS

Differential ADC drivers
Single-ended to differential conversion
RF/IF gain blocks
SAW filter interfacing

FUNCTIONAL BLOCK DIAGRAM

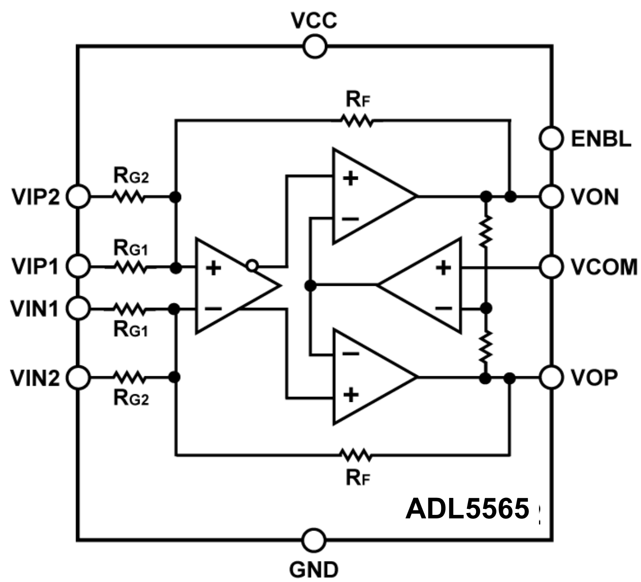

Figure 1.

GENERAL DESCRIPTION

The ADL5565 is a high performance differential amplifier optimized for RF and IF applications. The amplifier offers low noise of 2.25 nV/√Hz and excellent distortion performance over a wide frequency range making it an ideal driver for high speed 12-bit to 18-bit analog-to-digital converters (ADCs).

The ADL5565 provides three gain levels of 6dB, 12dB and 15.5dB through a pin strappable configuration. For the single ended input configuration the gains are reduced to 5.6dB, 11.1dB and 14.1dB. Using an external series input resistor expands the amplifiers' gain flexibility and allows for any gain selection from 0 to 15.5dB for differential and 0 dB to 14.1 dB for single ended input.

The quiescent current of the ADL5565 is typically 70mA and when disabled consumes less than 4mA offering excellent input to output isolation.

The device is optimized for wideband, low distortion performance. These attributes, together with its adjustable gain capability, make this device the amplifier of choice for general-purpose IF and broadband applications where low distortion, noise, and power are critical. This device is optimized for the best combination of slew speed, BW and broadband distortion. These attributes allow it to drive a wide variety of A/D converters and is ideally suited for driving mixers, pin diode attenuators, SAW filters, and multi-element discrete devices.

Fabricated on an Analog Devices, Inc., high speed SiGe process, the ADL5565 is supplied in a compact 3 mm × 3 mm, 16-lead LFCSP package and operates over the temperature range of −40°C to +85°C.

Rev. PrB
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REVISION HISTORY

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SPECIFICATIONS

V_S = 5 V, VCM=2.5 V, R_L = 200 Ω differential, Av= 6dB, C_L = 1 pF differential, f = 140 MHz, T = 25°C; parameters specified AC coupled differential input and differential output, unless otherwise noted.

Table 1.

Parameter	Conditions	Min	Typ	Max	Unit
DYNAMIC PERFORMANCE					
−3 dB Bandwidth	A_V = 6 dB, V_{OUT} ≤ 1.0 V p-p		5000		MHz
	A_V = 12 dB, V_{OUT} ≤ 1.0 V p-p		4500		MHz
	A_V = 15.5 dB, V_{OUT} ≤ 1.0 V p-p		4000		MHz
Bandwidth for 0.1 dB Flatness	V_{OUT} ≤ 1.0 V p-p		1000		MHz
Noise Figure	Av = 6dB / Av = 12dB		10.5 / 6		dB
Gain Accuracy			±1		dB
Gain Supply Sensitivity	V_S ± 5%		TBD		dB/V
Gain Temperature Sensitivity	−40°C to +85°C		TBD		mdB/°C
Slew Rate	Rise, A_V = 15.5 dB, R_L = 200Ω, V_{OUT} = 2 V step		12		V/ns
	Fall, A_V = 15.5 dB, R_L = 200Ω, V_{OUT} = 2 V step		12		V/ns
Settling Time	2 V step to 1%		2		ns
Overdrive Recovery Time	V_{IN} = 4 V to 0 V step, V_{OUT} ≤ ±10 mV		<3		ns
Reverse Isolation (S12)			70		dB
INPUT/OUTPUT CHARACTERISTICS					
Input Common Mode Range	Av = 6dB, 12dB, 15.5dB		1 to 3.8		V
Output Common Mode Range			1.4 to 3		V
Maximum Output Voltage Swing	1 dB compressed		8		V p-p
Output Common-Mode Offset	Referenced to VCC/2	−100		+20	mV
Output Common-Mode Drift	−40°C to +85°C		TBD		mV/°C
Output Differential Offset Voltage		−20		+20	mV
CMRR			TBD		dB
Output Differential Offset Drift	−40°C to +85°C		TBD		mV/°C
Input Bias Current			±5		µA
Input Resistance (Differential)	A_V = 6 dB		200		Ω
	A_V = 12 dB		100		Ω
	A_V = 15.5 dB		66		Ω
Input Resistance (Single-Ended)	A_V = 5.3 dB		158		Ω
	A_V = 10.3 dB		96		Ω
	A_V = 13 dB		74		Ω
Input Capacitance (Single-Ended)			TBD		pF
Output Resistance (Differential)			10		Ω
Output Capacitance			TBD		pF
POWER INTERFACE					
Supply Voltage		3	5	5	V
ENB Threshold			1.8		V
ENB Input Bias Current	ENB High		75		nA
	ENBL Low		−125		µA
Quiescent Current	ENB High		80		mA
	ENBL Low		3		mA

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Parameter	Conditions	Min	Typ	Max	Unit
NOISE/HARMONIC PERFORMANCE					
10 MHz					
Second/Third Harmonic Distortion	A_v = 6 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p		−113/−113		dBc
	A_v = 12 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p		−108/−108		dBc
	A_v = 15.5 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p		−105/−105		dBc
Output IP3 / Third Order Intermodulation Distortion	A_v = 6 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p composite. (2MHz spacing)		TBD / TBD		dBm / dBc
Output IP3/ Third Order Intermodulation Distortion	A_v = 12 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p composite. (2MHz spacing)		TBD / TBD		dBm / dBc
Output IP3 / Third Order Intermodulation Distortion	A_v = 15.5 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p composite. (2MHz spacing)		TBD / TBD		dBm / dBc
Noise Spectral Density (RTI)	A_v = 6 dB		2.25		nV/√Hz
	A_v = 12 dB		1.575		nV/√Hz
	A_v = 15.5 dB		1.16		nV/√Hz
1 dB Compression Point (RTO)			TBD		dBm
70 MHz					
Second / Third Harmonic Distortion	A_v = 6 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p		−123 / −117		dBc
	A_v = 12 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p		−99 / −107		dBc
	A_v = 15.5 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p		−99 / −105		dBc
Output IP3 / Third Order Intermodulation Distortion	A_v = 6 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p composite		TBD / TBD		dBm / dBc
Output IP3/ Third Order Intermodulation Distortion	A_v = 12 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p composite		TBD / TBD		dBm / dBc
Output IP3 / Third Order Intermodulation Distortion	A_v = 15.5 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p composite		TBD / TBD		dBm / dBc
Noise Spectral Density (RTI)	A_v = 6 dB		2.25		nV/√Hz
	A_v = 12 dB		1.575		nV/√Hz
	A_v = 15.5 dB		1.16		nV/√Hz
1 dB Compression Point (RTO)			TBD		dBm
100 MHz					
Second/Third Harmonic Distortion	A_v = 6 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p		−109/−110		dBc
	A_v = 12 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p		−89/−105		dBc
	A_v = 15.5 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p		−89/−104		dBc
Output IP3 / Third Order Intermodulation Distortion	A_v = 6 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p composite		+51 / −98		dBm / dBc
Output IP3/ Third Order Intermodulation Distortion	A_v = 12 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p composite		TBD / TBD		dBm / dBc
Output IP3 / Third Order Intermodulation Distortion	A_v = 15.5 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p composite		TBD / TBD		dBm / dBc
Noise Spectral Density (RTI)	A_v = 6 dB		2.25		nV/√Hz
	A_v = 12 dB		1.6		nV/√Hz
	A_v = 15.5 dB		1.17		nV/√Hz
1 dB Compression Point (RTO)			20		dBm

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Parameter	Conditions	Min	Typ	Max	Unit
140 MHz					
Second/Third Harmonic Distortion	A_V = 6 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p		−96 / −104		dBc
	A_V = 12 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p		−83 / −100		dBc
	A_V = 15.5 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p		−83 / −98		dBc
Output IP3 / Third Order Intermodulation Distortion	A_V = 6 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p composite		TBD / TBD		dBm / dBc
Output IP3/ Third Order Intermodulation Distortion	A_V = 12 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p composite		TBD / TBD		dBm / dBc
Output IP3 / Third Order Intermodulation Distortion	A_V = 15.5 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p composite		TBD / TBD		dBm / dBc
Noise Spectral Density (RTI)	A_V = 6 dB		2.5		nV/√Hz
	A_V = 12 dB		1.6		nV/√Hz
	A_V = 15.5 dB		1.2		nV/√Hz
1 dB Compression Point (RTO)			TBD		dBm
250 MHz					
Second/Third Harmonic Distortion	A_V = 6 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p		−87 / −87		dBc
	A_V = 12 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p		−71 / −85		dBc
	A_V = 15.5 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p		−72 / −85		dBc
Output IP3 / Third Order Intermodulation Distortion	A_V = 6 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p composite		TBD / TBD		dBm / dBc
Output IP3/ Third Order Intermodulation Distortion	A_V = 12 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p composite		TBD / TBD		dBm / dBc
Output IP3 / Third Order Intermodulation Distortion	A_V = 15.5 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p composite		TBD / TBD		dBm / dBc
Noise Spectral Density (RTI)	A_V = 6 dB		2.75		nV/√Hz
	A_V = 12 dB		1.65		nV/√Hz
	A_V = 15.5 dB		1.2		nV/√Hz
1 dB Compression Point (RTO)			TBD		dBm
500 MHz					
Second/Third Harmonic Distortion	A_V = 6 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p		−69 / −67		dBc
	A_V = 12 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p		−56 / −66		dBc
	A_V = 15.5 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p		−58 / −56		dBc
Output IP3 / Third Order Intermodulation Distortion	A_V = 6 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p composite		TBD / TBD		dBm / dBc
Output IP3/ Third Order Intermodulation Distortion	A_V = 12 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p composite		TBD / TBD		dBm / dBc
Output IP3 / Third Order Intermodulation Distortion	A_V = 15.5 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p composite		TBD / TBD		dBm / dBc
Noise Spectral Density (RTI)	A_V = 6 dB		TBD		nV/√Hz
	A_V = 12 dB		TBD		nV/√Hz
	A_V = 15.5 dB		TBD		nV/√Hz
1 dB Compression Point (RTO)			TDB		dBm

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Parameter	Conditions	Min	Typ	Max	Unit
1000 MHz					
Second/Third Harmonic Distortion	A_v = 6 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p		−53 / −52		dBc
	A_v = 12 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p		−47 / −52		dBc
	A_v = 15.5 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p		−47 / −52		dBc
Output IP3 / Third Order Intermodulation Distortion	A_v = 6 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p composite		TBD / TBD		dBm / dBc
Output IP3/ Third Order Intermodulation Distortion	A_v = 12 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p composite		TBD / TBD		dBm / dBc
Output IP3 / Third Order Intermodulation Distortion	A_v = 15.5 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p composite		TBD / TBD		dBm / dBc
Noise Spectral Density (RTI)	A_v = 6 dB		TBD		nV/√Hz
	A_v = 12 dB		TBD		nV/√Hz
	A_v = 15.5 dB		TBD		nV/√Hz
1 dB Compression Point (RTO)			TBD		dBm

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V_S = 3.3 V, VCM=1.7 V, R_L = 200 Ω differential, Av= 6dB, C_L = 1 pF differential, f = 140 MHz, T = 25°C; parameters specified AC coupled differential input and differential output, unless otherwise noted.

Table 2.

Parameter	Conditions	Min	Typ	Max	Unit
DYNAMIC PERFORMANCE					
−3 dB Bandwidth	A_V = 6 dB, V_{OUT} ≤ 1.0 V p-p		5000		MHz
	A_V = 12 dB, V_{OUT} ≤ 1.0 V p-p		4500		MHz
	A_V = 15.5 dB, V_{OUT} ≤ 1.0 V p-p		4000		MHz
Bandwidth for 0.1 dB Flatness	V_{OUT} ≤ 1.0 V p-p		1000		MHz
Noise Figure	Av = 6dB / Av = 12dB		11 / 6		dB
Gain Accuracy			±1		dB
Gain Supply Sensitivity	V_S ± 5%		TBD		dB/V
Gain Temperature Sensitivity	−40°C to +85°C		TBD		mdB/°C
Slew Rate	Rise, A_V = 15.5 dB, R_L = 200Ω, V_{OUT} = 2 V step		10		V/ns
	Fall, A_V = 15.5 dB, R_L = 200Ω, V_{OUT} = 2 V step		10		V/ns
Settling Time	2 V step to 1%		2		ns
Overdrive Recovery Time	V_{IN} = 4 V to 0 V step, V_{OUT} ≤ ±10 mV		<3		ns
Reverse Isolation (S12)			70		dB
INPUT/OUTPUT CHARACTERISTICS					
Input Common Mode Range	Av = 6dB, 12dB, 15.5dB		1 to 2.1		V
Output Common Mode Range			1.4 to 1.8		V
Maximum Output Voltage Swing	1 dB compressed		5		V p-p
Output Common-Mode Offset	Referenced to VCC/2	−100		+20	mV
Output Common-Mode Drift	−40°C to +85°C		TBD		mV/°C
Output Differential Offset Voltage		−20		+20	mV
CMRR			TBD		dB
Output Differential Offset Drift	−40°C to +85°C		TBD		mV/°C
Input Bias Current			±5		µA
Input Resistance (Differential)	A_v = 6 dB		200		Ω
	A_v = 12 dB		100		Ω
	A_v = 15.5 dB		66		Ω
*Input Resistance (Single-Ended)	A_V = 5.3 dB		158		Ω
	A_V = 10.3 dB		96		Ω
	A_V = 13 dB		74		Ω
Input Capacitance (Single-Ended)			TBD		pF
Output Resistance (Differential)			10		Ω
Output Capacitance			TBD		pF
POWER INTERFACE					
Supply Voltage		3	3.3	5	V
ENB Threshold			1.1		V
ENB Input Bias Current	ENB High		75		nA
	ENBL Low		−125		µA
Quiescent Current	ENB High		70		mA
	ENBL Low		3		mA

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Parameter	Conditions	Min	Typ	Max	Unit
NOISE/HARMONIC PERFORMANCE					
10 MHz					
Second/Third Harmonic Distortion	A_V = 6 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p		−108 / −117		dBc
	A_V = 12 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p		−103 / −114		dBc
	A_V = 15.5 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p		−107 / −112		dBc
Output IP3 / Third Order Intermodulation Distortion	A_V = 6 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p composite		TBD / TBD		dBm / dBc
Output IP3/ Third Order Intermodulation Distortion	A_V = 12 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p composite		TBD / TBD		dBm / dBc
Output IP3 / Third Order Intermodulation Distortion	A_V = 15.5 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p composite		TBD / TBD		dBm / dBc
Noise Spectral Density (RTI)	A_V = 6 dB		2.25		nV/√Hz
	A_V = 12 dB		1.575		nV/√Hz
	A_V = 15.5 dB		1.2		nV/√Hz
1 dB Compression Point (RTO)			12		dBm
70 MHz					
Second/Third Harmonic Distortion	A_V = 6 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p		−112 / −107		dBc
	A_V = 12 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p		−98 / −100		dBc
	A_V = 15.5 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p		−99 / −98		dBc
Output IP3 / Third Order Intermodulation Distortion	A_V = 6 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p composite		+47 / −99		dBm / dBc
Output IP3/ Third Order Intermodulation Distortion	A_V = 12 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p composite		TBD / TBD		dBm / dBc
Output IP3 / Third Order Intermodulation Distortion	A_V = 15.5 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p composite		TBD / TBD		dBm / dBc
Noise Spectral Density (RTI)	A_V = 6 dB		2.25		nV/√Hz
	A_V = 12 dB		1.575		nV/√Hz
	A_V = 15.5 dB		1.2		nV/√Hz
1 dB Compression Point (RTO)			12		dBm
100 MHz					
Second/Third Harmonic Distortion	A_V = 6 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p		−105 /−103		dBc
	A_V = 12 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p		−89 / −100		dBc
	A_V = 15.5 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p		−89 / −100		dBc
Output IP3 / Third Order Intermodulation Distortion	A_V = 6 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p composite		+47 / −99		dBm / dBc
Output IP3/ Third Order Intermodulation Distortion	A_V = 12 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p composite		TBD / TBD		dBm / dBc
Output IP3 / Third Order Intermodulation Distortion	A_V = 15.5 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p composite		TBD / TBD		dBm / dBc
Noise Spectral Density (RTI)	A_V = 6 dB		2.25		nV/√Hz
	A_V = 12 dB		1.65		nV/√Hz
	A_V = 15.5 dB		1.2		nV/√Hz
1 dB Compression Point (RTO)			12		dBm

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Parameter	Conditions	Min	Typ	Max	Unit
140 MHz					
Second/Third Harmonic Distortion	A_V = 6 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p		−95 / −97		dBc
	A_V = 12 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p		−82 / −95		dBc
	A_V = 15.5 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p		−82 / −94		dBc
Output IP3 / Third Order Intermodulation Distortion	A_V = 6 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p composite		+47 / −99		dBm / dBc
Output IP3/ Third Order Intermodulation Distortion	A_V = 12 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p composite		TBD / TBD		dBm / dBc
Output IP3 / Third Order Intermodulation Distortion	A_V = 15.5 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p composite		TBD / TBD		dBm / dBc
Noise Spectral Density (RTI)	A_V = 6 dB		2.5		nV/√Hz
	A_V = 12 dB		1.65		nV/√Hz
	A_V = 15.5 dB		1.2		nV/√Hz
1 dB Compression Point (RTO)			12		dBm
250 MHz					
Second/Third Harmonic Distortion	A_V = 6 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p		−83 / −85		dBc
	A_V = 12 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p		−69 / −83		dBc
	A_V = 15.5 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p		−70 / −83		dBc
Output IP3 / Third Order Intermodulation Distortion	A_V = 6 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p composite		TBD / TBD		dBm / dBc
Output IP3/ Third Order Intermodulation Distortion	A_V = 12 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p composite		TBD / −100.6		dBm / dBc
Output IP3 / Third Order Intermodulation Distortion	A_V = 15.5 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p composite		TBD / TBD		dBm / dBc
Noise Spectral Density (RTI)	A_V = 6 dB		2.75		nV/√Hz
	A_V = 12 dB		1.65		nV/√Hz
	A_V = 15.5 dB		1.2		nV/√Hz
1 dB Compression Point (RTO)			TBD		dBm
500 MHz					
Second/Third Harmonic Distortion	A_V = 6 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p		−69 / −64		dBc
	A_V = 12 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p		−56 / −63		dBc
	A_V = 15.5 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p		−57 / −63		dBc
Output IP3 / Third Order Intermodulation Distortion	A_V = 6 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p composite		TBD / TBD		dBm / dBc
Output IP3/ Third Order Intermodulation Distortion	A_V = 12 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p composite		TBD / TBD		dBm / dBc
Output IP3 / Third Order Intermodulation Distortion	A_V = 15.5 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p composite		TBD / TBD		dBm / dBc
Noise Spectral Density (RTI)	A_V = 6 dB		TBD		nV/√Hz
	A_V = 12 dB		TBD		nV/√Hz
	A_V = 15.5 dB		TBD		nV/√Hz
1 dB Compression Point (RTO)			TBD		dBm

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Parameter	Conditions	Min	Typ	Max	Unit
1000 MHz					
Second/Third Harmonic Distortion	A_V = 6 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p		−51 / −48		dBc
	A_V = 12 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p		−45 / −48		dBc
	A_V = 15.5 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p		−45 / −48		dBc
Output IP3 / Third Order Intermodulation Distortion	A_V = 6 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p composite		TBD / TBD		dBm / dBc
Output IP3/ Third Order Intermodulation Distortion	A_V = 12 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p composite		TBD / TBD		dBm / dBc
Output IP3 / Third Order Intermodulation Distortion	A_V = 15.5 dB, R_L = 200 Ω, V_{OUT} = 2 V p-p composite		TBD / TBD		dBm / dBc
Noise Spectral Density (RTI)	A_V = 6 dB		TBD		nV/√Hz
	A_V = 12 dB		TBD		nV/√Hz
	A_V = 15.5 dB		TBD		nV/√Hz
1 dB Compression Point (RTO)			TBD		dBm

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ABSOLUTE MAXIMUM RATINGS

Table 3.

Parameter	Rating
Supply Voltage (VCC)	TBD
VIP1, VIP2, VIN1, VIN2	TBD
Internal Power Dissipation	TBD
θ_{JA}	52°C/W
θ_{JC}	24.6°C/W
Maximum Junction Temperature	TBD
Operating Temperature Range	TBD
Operating Temperature Range	TBD

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.

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.

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PIN CONFIGURATION AND FUNCTION DESCRIPTIONS

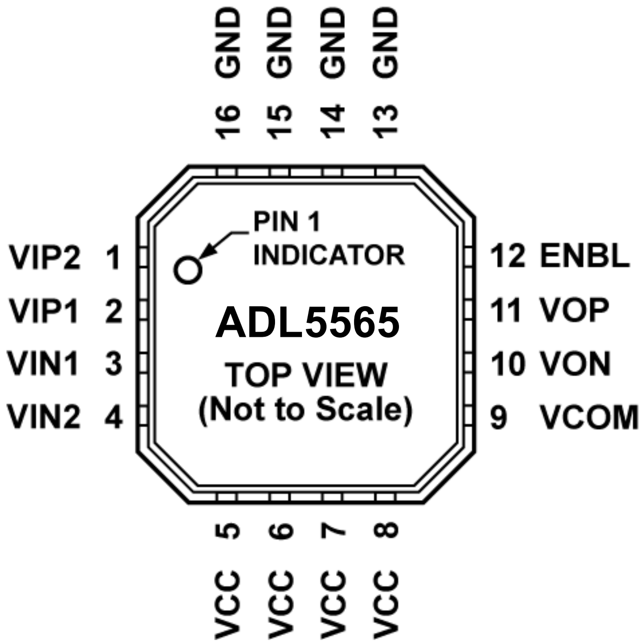

Figure 2. Pin Configuration

Table 4. Pin Function Descriptions

Pin No.	Mnemonic	Description
1	VIP2	Balanced Differential Input. Biased to VCOM, typically ac-coupled. Input for A_v = 12 dB gain, strapped to VIP1 for A_v = 15.5 dB.
2	VIP1	Balanced Differential Input. Biased to VCOM, typically ac-coupled. Input for A_v = 6 dB gain, strapped to VIP2 for A_v = 15.5 dB.
3	VIN1	Balanced Differential Input. Biased to VCOM, typically ac-coupled. Input for A_v = 6 dB gain, strapped to VIN2 for A_v = 15.5 dB.
4	VIN2	Balanced Differential Input. Biased to VCOM, typically ac-coupled. Input for A_v = 12 dB gain, strapped to VIN1 for A_v = 15.5 dB.
5, 6, 7, 8	VCC	Positive Supply.
9	VC0M	Common-Mode Voltage. A voltage applied to this pin sets the common-mode voltage of the input and output. Typically decoupled to ground with a 0.1 µF capacitor. With no reference applied, input and output common mode floats to midsupply (VCC/2).
10	VON	Balanced Differential Output. Biased to VCOM, typically ac-coupled.
11	VOP	Balanced Differential Output. Biased to VCOM, typically ac-coupled.
12	ENBL	Enable. Apply positive voltage (1.3 V < ENB < VCC) to activate device.
13, 14, 15, 16	GND	Ground. Connect to low impedance GND.

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TYPICAL PERFORMANCE CHARACTERISTICS

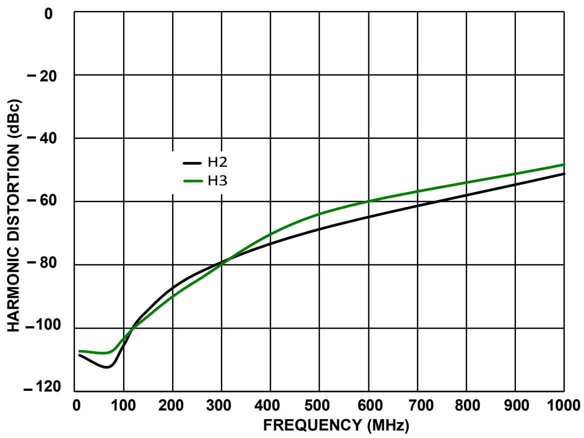

Figure 3 Harmonic Distortion (HD2/HD3) Vs. Frequency at $A_V = 6$ dB $V_{CC} = 5$ V, Output Level at 2 V p-p, $R_L = 200\ \Omega$

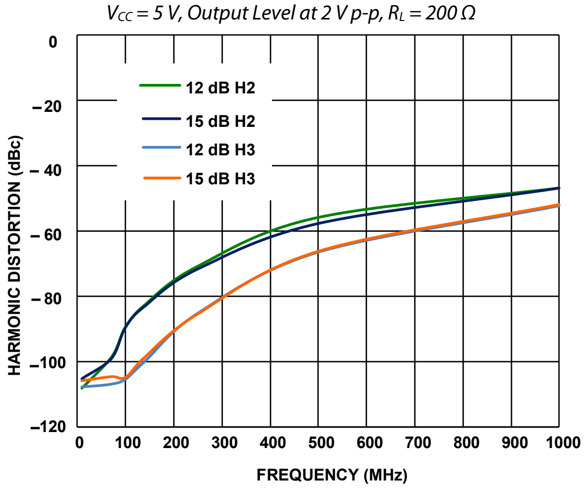

Figure 4 Harmonic Distortion (HD2/HD3) Vs. Frequency $A_V = 12$ dB, and $A_V = 15$ dB, $V_{CC} = 5$ V, Output Level at 2 V p-p, $R_L = 200\ \Omega$

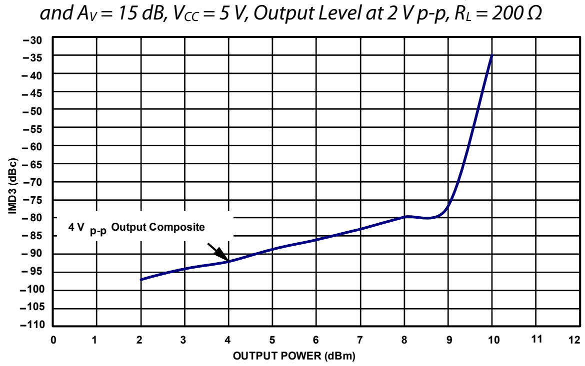

Figure 5. IMD3 vs. Output Power at $A_V = 6$ dB F1 = 100 MHz and F2 = 102 MHz, $V_{CC} = 5$ V, $R_L = 200\ \Omega$

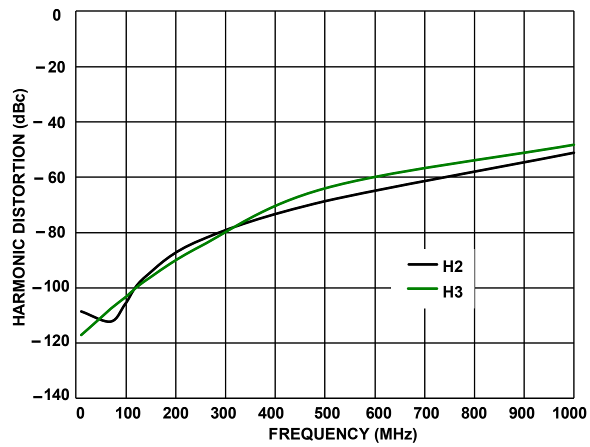

Figure 6 Harmonic Distortion (HD2/HD3) Vs. Frequency at $A_V = 6$ dB $V_{CC} = 3.3$ V, Output Level at 2 V p-p, $R_L = 200\ \Omega$

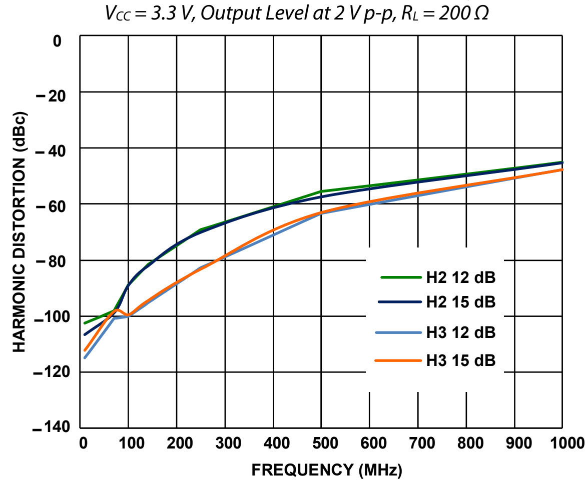

Figure 7 Harmonic Distortion (HD2/HD3) Vs. Frequency $A_V = 12$ dB and $A_V = 12$ dB $V_{CC} = 3.3$ V, Output Level at 2 V p-p, $R_L = 200\ \Omega$

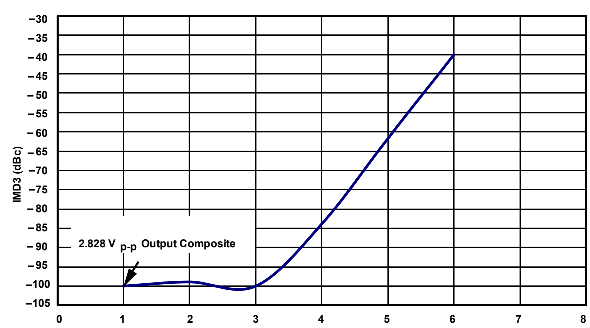

Figure 8. IMD3 vs. Output Power at $A_V = 6$ dB F1 = 100 MHz and F2 = 102 MHz, $V_{CC} = 3.3$ V, $R_L = 200\ \Omega$

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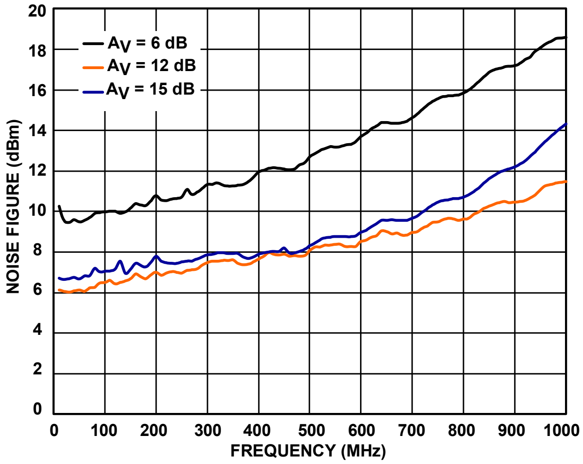

Figure 9. Noise Figure R_{Load} = 200 Ω V_{POS} = 5 V

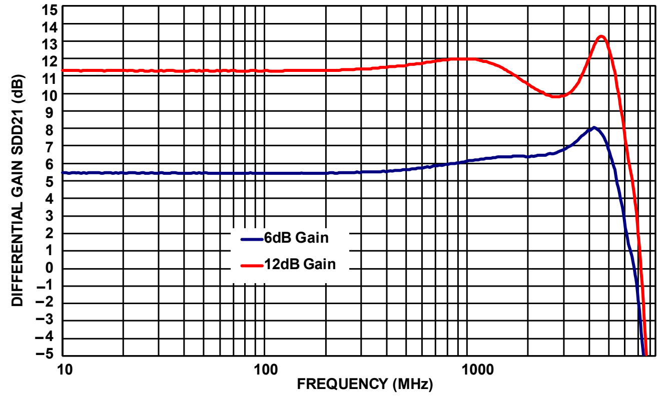

Figure 10. Gain, R_{Load} = 200 Ω, V_{POS} = 5 V

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EVALUATION BOARD

Figure 11 shows the schematic of the ADL5565 evaluation board. The board is powered by a single supply in the 3 V to 5 V range. The power supply is decoupled by 10 µF and 0.1 µF capacitors.

Table 5 details the various configuration options of the evaluation board. Figure 12 and Figure 13 show the component and circuit layouts of the evaluation board.

To realize the minimum gain (6 dB into a 200 Ω load), Input 1 (VIN1 and VIP1) must be used by installing 0 Ω resistors at R3 and R4, leaving R5 and R6 open. R1 and R2 must be 33.2 Ω for a 50 Ω input impedance.

Likewise, driving Input 2 (VIN2 and VIP2) realizes the middle gain (12 dB into a 200 Ω load) by installing 0 Ω at R5 and R6 and leaving R3 and R4 open. R1 and R2 must be 50 Ω for a 50 Ω input impedance.

For the maximum gain (15.5 dB into a 200 Ω load), both inputs are driven by installing 0 Ω resistors at R3, R4, R5, and R6. R1 and R2 are open for a 50 Ω input impedance.

The balanced input and output interfaces are converted to single ended with a pair of baluns (M/A-COM ETC1-1-13). The balun at the input, T1, provides a 50 Ω single-ended-to-differential transformation. The output balun, T2, and the matching components are configured to provide a 200 Ω to 50 Ω impedance transformation with an insertion loss of about 17 dB.

As an alternative, the input transformer, T1, can be replaced with one of the following transformers to provide a low loss balanced input to the ADL5565. 6 dB gain configuration, Mini Circuits, TC4-1W+, 12 dB gain configuration, Mini Circuits, TC2-1T+, 15 dB gain configuration, TC1.5-52T. When using these alternative transformers, R1 & R2 are left open. C1 & C2 should be replaced with a 0 ohm jumper and a 0.1 µF capacitor is added at C12.

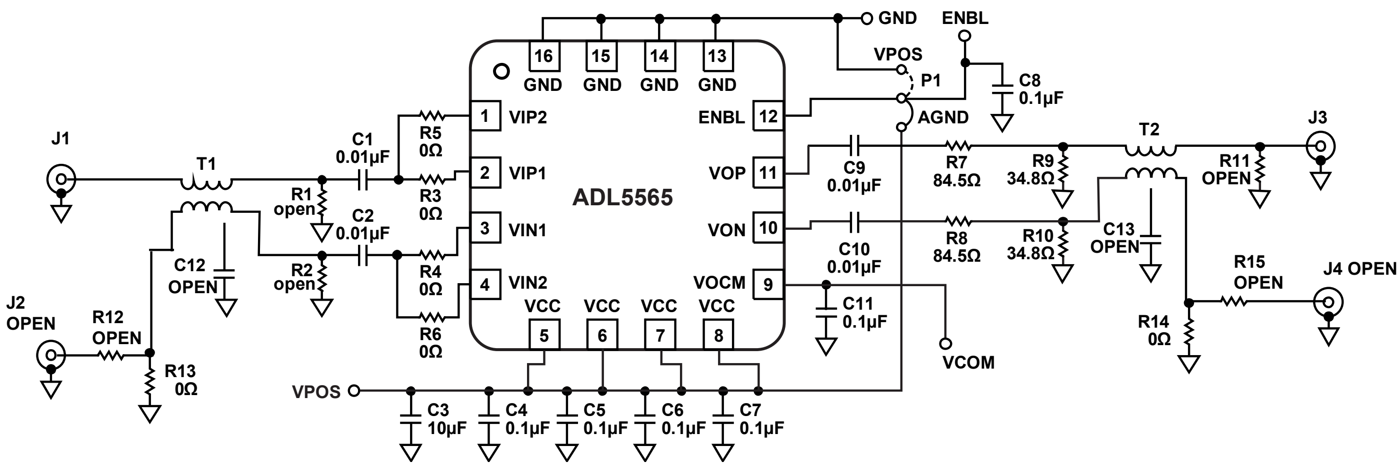

Figure 11. Evaluation Board Schematic

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Table 5. Evaluation Board Configuration Options

Component	Description	Default Condition
VPOS, GND	Ground and supply vector pins.	VPOS, GND = installed
C3, C4, C5, C6, C7, C11	Power supply decoupling. The supply decoupling consists of a 10 μF capacitor (C3) to ground. C4 to C7 are bypass capacitors. C11 ac couples VREF to ground.	C3 = 10 μF (Size D), C4, C5, C6, C7, C11 = 0.1 μF (Size 0402)
J1, J2, R1, R2, R3, R4, R5, R6, R12, R13, C1, C2, C12, T1	Input interface. The SMA labeled J1 is the input. T1 is a 1-to-1 impedance ratio balun to transform a single-ended input into a balanced differential signal. Removing R13 installing R12, 0 Ω and installing SMA connector, J2, allows driving from a differential source. C1 and C2 provide ac coupling. C12 is a bypass capacitor. R1 and R2 provide a differential 50 Ω input termination. R3 to R6 are used to select the input for the pin-strappable gain. Maximum gain: R3, R4, R5, R6 = 0 Ω; and R1, R2 = open. Middle gain: R5, R6 = 0 Ω; and R3, R4 = open; R1, R2 = 50 Ω. Minimum gain: R3, R4 = 0 Ω; and R5, R6 = open; R1, R2 = 33.2 Ω.	J1 = installed, J2 = not installed, R1, R2 = open, R3, R4, R5, R6, R13 = 0 Ω (Size 0402), R12, = open, C1, C2 = 0.01 μF (Size 0402), C12 = open, T1 = ETC1-1-13 (M/A-COM)
J3, J4, R7, R8, R9, R10, R11, R14, R15 C9, C10, C13, T2	Output interface. The SMA labeled J3 is the output. T2 is a 1-to-1 impedance ratio balun to transform a balanced differential signal to a single-ended signal. Removing R14 and installing R15, 0 Ω, and SMA connector, J4, allows differential loading. C13 is a bypass capacitor. R7, R8, R9, and R10 are provided for generic placement of matching components. The evaluation board is configured to provide a 200 Ω to 50 Ω impedance transformation with an insertion loss of 17 dB. C9 and C10 provide ac coupling.	J3 = installed, J4 = not installed, R7, R8 = 84.5 Ω (Size 0402), R9, R10 = 34.8 Ω (Size 0402), R11, R15 = open (Size 0402), R15 = 0 Ω (Size 0402) C9, C10 = 0.01 μF (Size 0402), C13 = open T2 = ETC1-1-13 (M/A-COM)
ENBL, P1, C8	Device enable. C8 is a bypass capacitor. When the P1 jumper is set toward the VPOS label, the ENBL pin is connected to the supply, enabling the device. In the opposite direction, toward the GND label, the ENBL pin is grounded, putting the device in power-down mode.	ENBL, P1= installed, C8 = 0.1 μF (Size 0402)

Table 6. Differential Values for Figure 11

GAIN (dB)	R1 (Ω)	R2 (Ω)
6	33.2	33.2
12	50	50
15.5	open	open

Table 7. Alternative Differential Input Configuration Figure 11

GAIN (dB)	R1 & R2 (Ω)	C12 (μF)	C1 & C2	T1
6	open	0.1	0 Ω	Mini Circuits TC4-1W+
12	open	0.1	0 Ω	Mini Circuits TC2-1T+
15.5	open	0.1	0 Ω	Mini Circuits TC1.5-52T+

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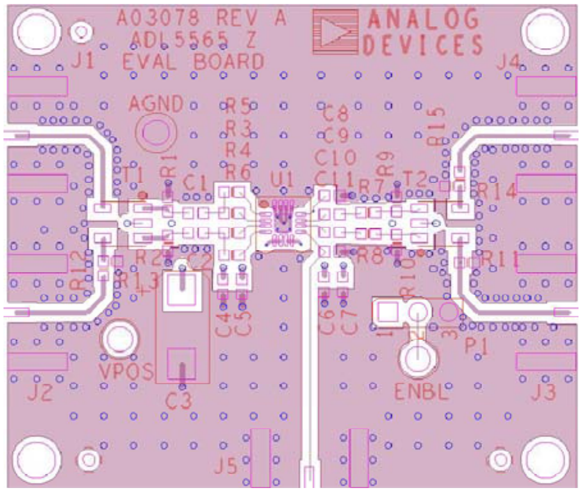

Figure 12. Layout of Evaluation Board, Component Side

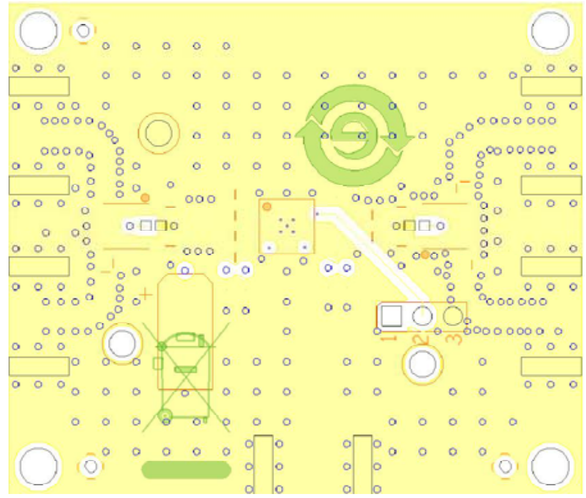

Figure 13. Layout of Evaluation Board, Circuit Side

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OUTLINE DIMENSIONS

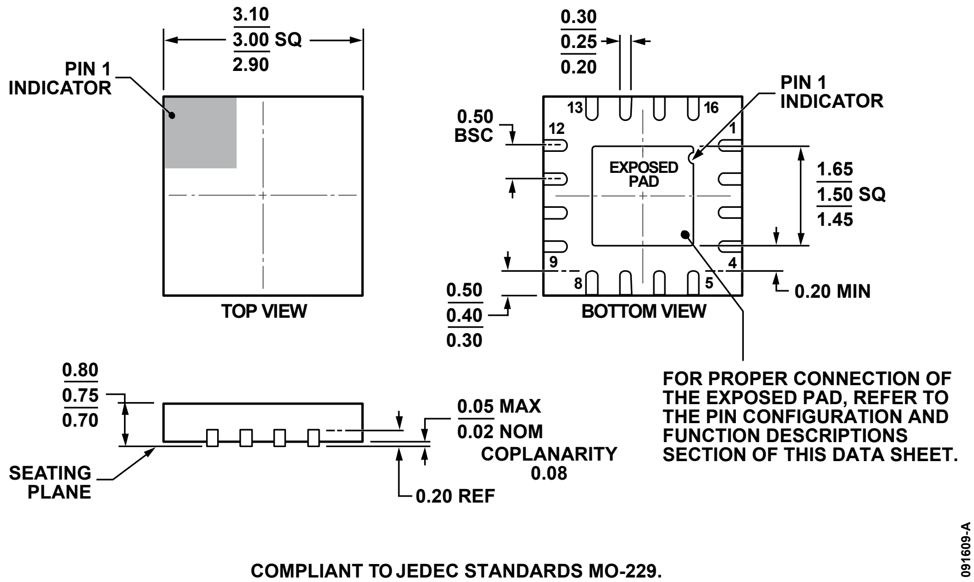

Figure 14. 16-Lead Lead Frame Chip Scale Package [LFCSP_VQ]
3 mm × 3 mm Body, Very Thin Quad
(CP-16-27)
Dimensions shown in millimeters

ORDERING GUIDE

Model	Temperature Range	Package Description	Package Option
ADL5565AXPZ-R7[1]	−40° C to + 85° C	16-Lead Lead Frame Chip Scale Package [LFCSP_VQ], 7" Reel	CP-16-27
ADL5565AXPZ-WP[1]	−40° C to + 85° C	16-Lead Lead Frame Chip Scale Package [LFCSP_VQ], Waffle Pack	CP-16-27
ADL5565-EVALZ[1]		Evaluation Board	

[1] Z = RoHS Compliant Part

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