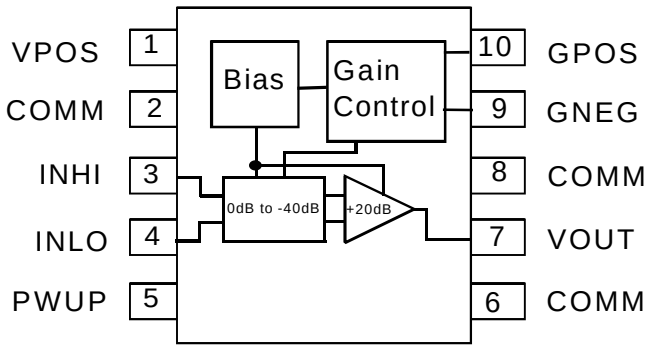
a

10-2500 GHz, Linear-in-dB Variable Gain Amplifier

RF/IF Concept AD8365

FEATURES
"Linear-in-dB" Gain Control
40dB Control Range
20dB Gain, 20dB Attenuation
Performance from 10 to 2500 GHz
+3dBm Output Drive Capability
Open Collector Option to +10dBm
50 ohm Input/Output Impedance
5 dB Noise Figure (at max gain)
+/-1 dB Gain Control Accuracy
Power-Down Feature

APPLICATIONS
RF/IF AGC Amplifier
Power Amplifier Pre-Driver



10 Pin Micro-SO Package

PRODUCT DESCRIPTION

The AD8365 is a variable gain amplifier for use in RF AGC systems. It provides accurate performance from 10 to 2500 MHz. The decibel gain and attenuation is Linear-in-dB, accurately calibrated and stable over temperature and supply voltage. The device offers 40 dB control range, with 20 dB gain and 20 dB attenuation.

The differential control interface allows a positive or negative gain control transfer function. Single-ended gain control is easily implemented by grounding either GPOS or GNEG.

The output drivers are capable, in full bias operation, of providing +3 dBm output power into a 50 ohm load. An open collector option is offered which enables drive levels up to +10dBm. Noise figure is targeted at 5 dB at maximum gain. Output IP3 design goal is +25 dBm. The device operates from a single supply over a 2.7 to 5.5 volt range, requiring a nominal 20 mA of quiescent current.

This RF VGA is useful as a predriver and gain control device for RF transmitter power amplifiers up to 2500 MHz. It can also be used as receiver AGC amplifier. Cellular base stations and terminals, microwave radios, CATV, Wireless LAN and other systems can benefit from the Linear-in-dB performance at high frequencies.

The AD8365 uses a proprietary circuit topology- the X-AMP™. The X-AMP comprises a variable attenuator, followed by a fixed gain amplifier. The front end attenuator allows the fixed gain stage to avoid coping with large input signal levels. A proprietary interpolation technique provides a continuous gain control function which is Linear-in-dB.

The AD8365 is specified for operation from -40°C to +85°C and is available in an 8 pin micro-SO package. It is fabricated on an Analog Devices proprietary high Ft silicon bipolar process.

Rev A 10/15/98

SPECIFICATIONS (@25°C, Vs=+5V, R_L=50Ω, Pwrdn= (N.C.), Tmin = -40°C, Tmax = +85°C, unless otherwise noted)

AD8365	Conditions	Min	Typ	Max	Units
DYNAMIC PERFORMANCE					
–3 dB Small Signal Bandwidth	G=+1, Vout = 0.5 V p-p	TBD	350		MHz
	G=+5, Vout = 0.5 V p-p		175		MHz
Bandwidth for 0.1 dB Flatness	Vout = 0.2 V p-p	TDB	TDB		MHz
Large Signal Bandwidth	Vout = 4Vp-p		2		MHz
Peaking	Vout = 0.2Vp-p, <50MHz		TBD		dB
Slew Rate	Vout = 2 Vp-p, G=+2		900		V/µs
Rise and Fall time	Vout = 2 V p-p		2		ns
Settling Time	0.1%, Vout = 2Vp-p		TBD		ns
Input Overdrive recovery time	Vin < 150% of Vs		TBD		ns
NOISE/DISTORTION PERFORMANCE					
Distortion	Vout = 2 V p-p				
2nd Harmonic	fc = 1 MHz, Rl = 100Ω/ 25Ω		-66/TBD		dBc
	10 MHz		TBD		dBc
3rd Harmonic	fc = 1 MHz, Rl = 100Ω/ 25Ω		-67/TBD		dBc
	10 MHz		TBD		dBc
Multitone Input Power Ratio	26kHz to 1.1MHz, Rl = 100Ω/ 25Ω		-65/TBD		dBc
IMD	10MHz, Delta f=50kHz, Rl = 100Ω/ 25Ω		TBD		MHz
IP3	5MHz, Rl = 100Ω/ 25Ω		TBD		MHz
Voltage Noise (RTI)	f = 100 kHz		4.6		nV/√Hz
Input Current Noise	f = 100 kHz		17		pA/√Hz
Differential Gain	NTSC, Rl=150 Ω		TBD		%
Differential Phase	NTSC, Rl=150 Ω		TBD		Degrees
INPUT CHARACTERISTICS					
RTI Offset Voltage			TBD	TBD	mV
	Tmin to Tmax			TBD	mV
Input Bias Current			TBD	TBD	µA
	Tmin to Tmax			TBD	µA
Input Resistance			TBD		MΩ
Input Capacitance			2		pF
Input Common Mode Voltage Range		TBD		TBD	V
OUTPUT CHARACTERISTICS					
Output Voltage Swing	Single Ended, Rl=25Ω	-10		+10	V
Linear Output Current	Tmin to Tmax	400	500		mA
Turn on output Glitch	1VDC input		TBD		mV
Capacitive Load Drive	Rs = 10Ω		TBD		pF
POWER SUPPLY					
Operating Range		+5		+/-13	V
Quiescent Current			12.5	TBD	mA/Amp
	Tmin to Tmax			TBD	mA
	Shutdown		4.5		mA/Amp
Turn off time	To rated shutdown current		TBD		us
Turn on time	To 0.1% of final output, 1VDC input		TBD		us
Power Supply Rejection Ratio	Delta Vs = +/-1V		TBD		dB
OPERATING TEMPERATURE RANGE		-40		+85	°C

SPECIFICATIONS **(@25°C, Vs=+12V, R_L=100Ω, Pwrdn= (N.C.), Tmin = -40°C, Tmax = +85°C, unless otherwise noted)**

AD8016	Conditions	Min	Typ	Max	Units
DYNAMIC PERFORMANCE					
–3 dB Small Signal Bandwidth	G=+1, Vout = 0.5 V p-p	TBD	400		MHz
	G=+5, Vout = 0.5 V p-p		175		MHz
Bandwidth for 0.1 dB Flatness	Vout = 0.2 V p-p	TDB	TDB		MHz
Large Signal Bandwidth	Vout = 4Vp-p		2		MHz
Peaking	Vout = 0.2Vp-p, <50MHz		TBD		dB
Slew Rate	Vout = 2 Vp-p, G=+2		1000		V/µs
Rise and Fall time	Vout = 2 V p-p		2		ns
Settling Time	0.1%, Vout = 2Vp-p		TBD		ns
Input Overdrive recovery time	Vin < 150% of Vs		TBD		ns
NOISE/DISTORTION PERFORMANCE					
Distortion	Vout = 2 V p-p				
2nd Harmonic	fc = 1 MHz, Rl = 100Ω/ 25Ω		-66		dBc
	10 MHz		TBD		dBc
3rd Harmonic	fc = 1 MHz, Rl = 100Ω/ 25Ω		-67		dBc
	10 MHz		TBD		dBc
Multitone Input Power Ratio	26kHz to 1.1MHz, Rl = 100Ω/ 25Ω		-65		dBc
IMD	10MHz, Delta f=50kHz, Rl = 100Ω/ 25Ω		TBD		MHz
IP3	5MHz, Rl = 100Ω/ 25Ω		TBD		MHz
Voltage Noise (RTI)	f = 100 kHz		4.6		nV/√Hz
Input Current Noise	f = 100 kHz		17		pA/√Hz
Differential Gain	NTSC, Rl=150 Ω		TBD		%
Differential Phase	NTSC, Rl=150 Ω		TBD		Degrees
INPUT CHARACTERISTICS					
RTI Offset Voltage			TBD	TBD	mV
	Tmin to Tmax			TBD	mV
Input Bias Current			TBD	TBD	µA
	Tmin to Tmax			TBD	µA
Input Resistance			TBD		MΩ
Input Capacitance			2		pF
Input Common Mode Voltage Range		TBD		TBD	V
OUTPUT CHARACTERISTICS					
Output Voltage Swing	Single Ended, Rl=25Ω	-10		+10	V
Linear Output Current	Tmin to Tmax	400	500		mA
Turn on output Glitch	1VDC input		TBD		mV
Capacitive Load Drive	Rs = 10Ω		TBD		pF
POWER SUPPLY					
Operating Range		+5		+13	V
Quiescent Current			12.5	TBD	mA/Amp
	Tmin to Tmax			TBD	mA
	Shutdown		4.5		mA/Amp
Turn off time	To rated shutdown current		TBD		us
Turn on time	To 0.1% of final output, 1VDC input		TBD		us
Power Supply Rejection Ratio	Delta Vs = +/-1V		TBD		dB
OPERATING TEMPERATURE RANGE		-40		+85	°C

Applications: