HEWLETT® PACKARD

Silicon Bipolar MMIC 1.5 GHz Variable Gain Amplifier Differential Option

Technical Data

IVA-05228

Features

- **Differential Input and Output Capability**
- **DC to 1.5 GHz Bandwidth; 2.0 Gb/s Data Rates**
- **High Gain:** 30 dB Typical
- **Wide Gain Control Range:** 30 dB Typical
- **5 V Bias**
- **5 V V_{gc} Control Voltage, I_{gc} < 3mA**
- **Fast Gain Control Response:** < 10 ns Typical
- **Hermetic Ceramic Package**

Applications

- **LNA or Gain Stage for 2.4 GHz and 5.7 GHz ISM Bands**
- **Front End Amplifier for GPS Receivers**
- **LNA or Gain Stage for PCN and MMDS Applications**
- **C-Band Satellite Receivers**
- **Broadband Amplifier for Instrumentation**

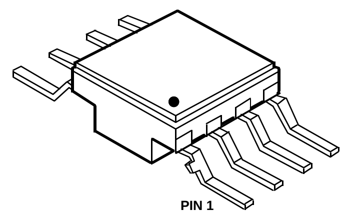
Description

The IVA-05228 is a variable gain amplifier housed in a miniature ceramic hermetic surface mount package. This device can be used in any combination of single-ended or differential inputs or outputs (see Functional Block Diagram). The lowest frequency of operation is limited only by the values of user selected blocking and bypass capacitors.

Typical applications include variable gain amplification for fiber optic systems (e.g., SONET) with data rates up to 2.0 Gb/s, mobile radio and satellite receivers, millimeter wave receiver IF amplifiers and communication receivers.

The IVA series of variable gain amplifiers is fabricated using HP's 10 GHz f_T, 25 GHz f_{MAX} ISOSAT™-I silicon bipolar process. This process uses nitride self-alignment, submicrometer lithography, trench isolation, ion implantation, gold metallization and polyimide inter-metal dielectric and scratch protection to achieve excellent performance, uniformity and reliability.

28 Package



Absolute Maximum Ratings

Symbol	Parameter	Units	Absolute Maximum[1]
V_{CC}-V_{ee}	Device Voltage	V	8
	Power Dissipation[2,3]	mW	600
	Input Power	dBm	+14
V_{gc}-V_{ee}		V	7
T_J	Junction Temperature	°C	200
T_{STG}	Storage Temperature	°C	-65 to 200

Thermal Resistance: [2,4]
θ_{jc} = 50°C/W

Notes:
1. Permanent damage may occur is any of these limits are exceeded.
2. T_{CASE} = 25°C.
3. Derate at 20 mW/°C for T_C > 170°C.
4. See MEASUREMENTS section "Thermal Resistance" in Communications Components Catalog for more information.

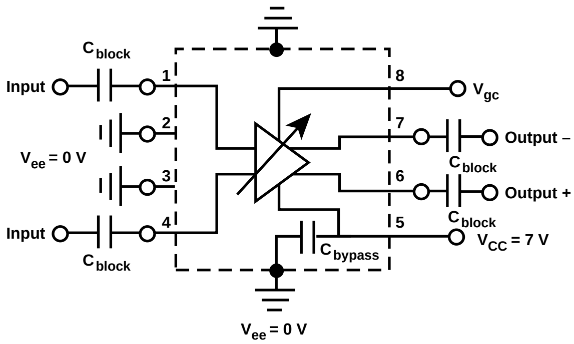
IVA-05228 Electrical Specifications[1], T_A = 25°C

Symbol	Parameters and Test Conditions:[2] V_{CC} = 5 V, V_{ee} = 0 V, V_{gc} = 0 V, Z_O = 50 Ω		Units	Min.	Typ.	Max.
Gp	Power Gain ($\|S_{21}\|^2$)	f = 0.5 GHz	dB	25	30	
ΔGp	Gain Flatness	f = 0.05 to 1.0 GHz	dB		± 0.5	
f_{3dB}	3 dB Bandwidth[3]		GHz	1.0	1.5	
GCR	Gain Control Range[4]	f = 0.05 GHz V_{gc} = 0 to 5 V	dB	25	30	
ISO	Reverse Isolation ($\|S_{21}\|^2$)	f = 0.05 GHz V_{gc} = 0 to 5 V	dB	25	30	
VSWR	Input VSWR	f = 0.05 to 1.5 GHz V_{gc} = 0 to 5 V			1.7:1	
	Output VSWR	f = 0.05 to 1.5 GHz V_{gc} = 0 to 5 V			1.5:1	
NF_{50}	50 Ω Noise Figure	f = 0.5 GHz	dB		9	
P_{1dB}	Output Power at 1 dB Gain Compression	f = 0.5 GHz	dBm		-3	
V_{OUT}	Peak-to-Peak Single-Ended Output Voltage	f = 0.5 GHz	mVpp		450	
IP_3	Output Third Order Intercept Point	f = 0.5 GHz	dBm		7	
t_D	Group Delay	f = 0.5 GHz	psec		400	
I_{CC}	Supply Current		mA	25	35	45

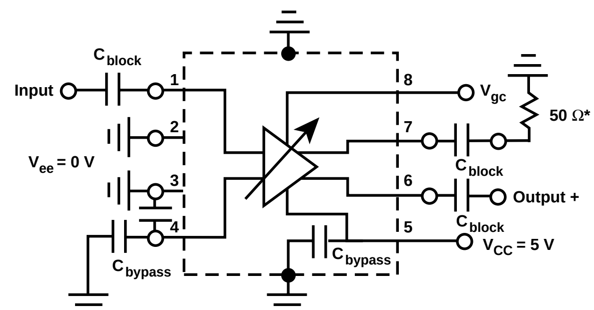
Notes:
1. The recommended operating voltage range for this device is 4 to 6 V. Typical performance as a function of voltage is on the following page.
2. As measured using Input Pin 1 and Output Pin 6, with Output Pin 7 terminated into 50 ohms and Input Pin 4 at AC ground.
3. Referenced from 50 MHz Gain.
4. The recommended gain control range for these devices for dynamic control is 0 to 4.2 V. Operation at gain control settings above 4.2V may result in gain increase rather than gain decrease.

Typical Biasing Configuration and Functional Block Diagram

Differential Input/Differential Output



Single Ended Input/Single Ended Output



* Optional: For Single-Ended Output operation, Pin 7 may be left unterminated (no C_{block} or 50 Ω)
C_{bypass} = 1000 pF typical
Good grounding of Pins 2, 3 is critical for proper operation and good VSWR performance of this part.

IVA-05228 Typical Performance, $T_A = 25°C, V_{CC} = 5\ V, V_{ee} = 0\ V$

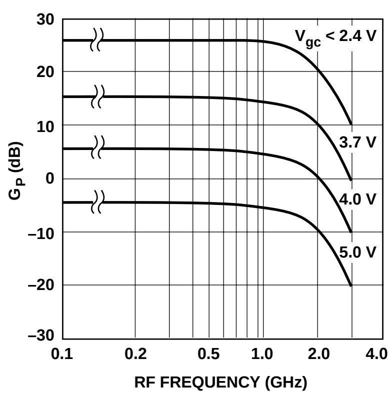


Figure 1. Typical Variable Gain vs. Frequency.

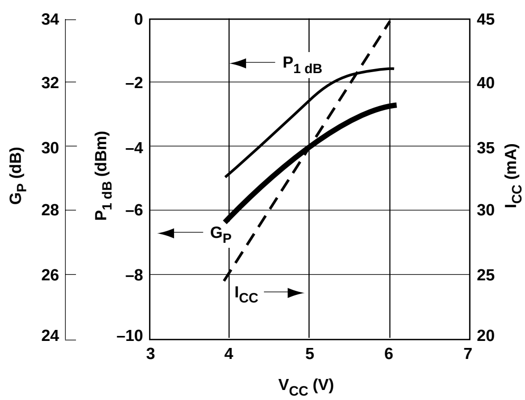


Figure 2. Power Gain and $P_{1\ dB}$ at 0.5GHz and I_{CC} vs. Bias Voltage with V_{gc} = 0 V.

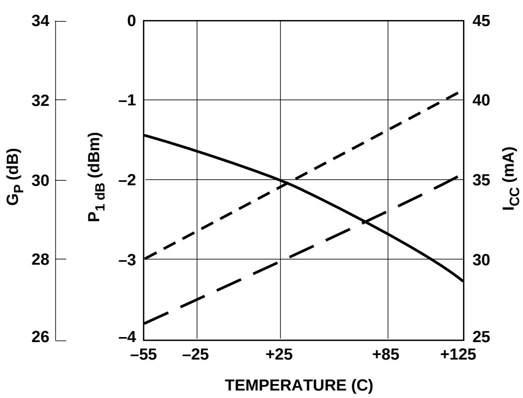


Figure 3. Power Gain and $P_{1\ dB}$ at 0.5GHz and I_{CC} vs. Case Temperature with V_{gc} = 0 V.

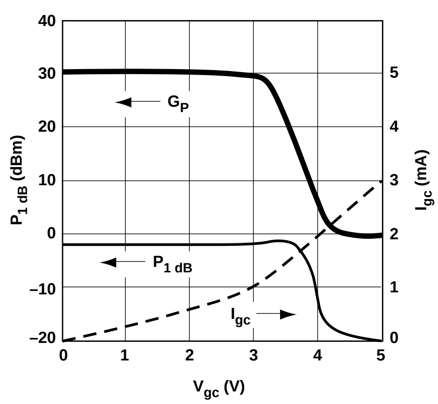


Figure 4. Power Gain and $P_{1\ dB}$ at 0.5GHz and I_{gc} vs. Gain Control Voltage.

IVA-05228 Typical Performance, continued, $T_A = 25°C, V_{CC} = 5\,V, V_{ee} = 0\,V$

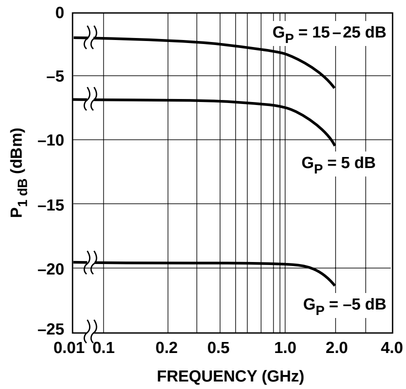


Figure 5. $P_{1\,dB}$ vs. Frequency.

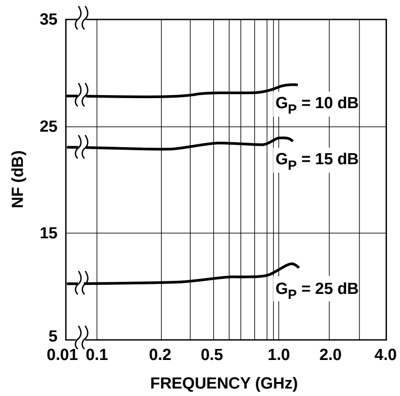


Figure 6. Noise Figure vs. Frequency.

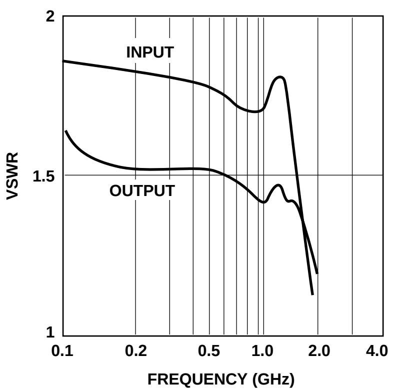


Figure 7. Input and Output VSWR vs. Frequency, V_{gc} = 0–5 V.

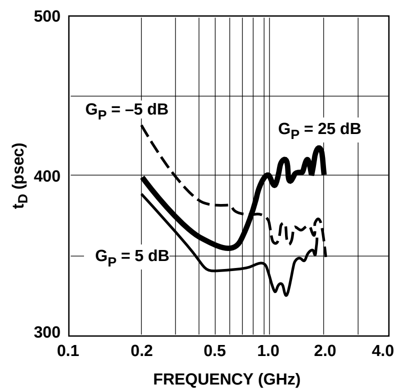
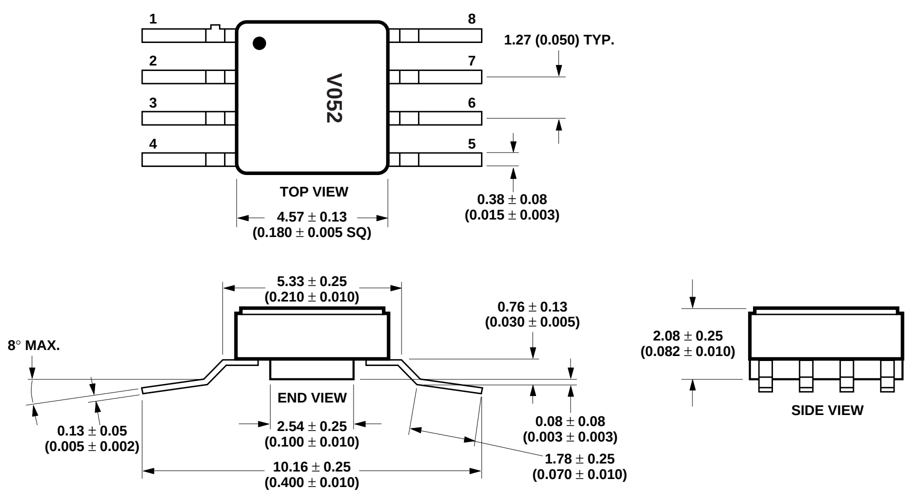


Figure 8. Group Delay vs. Frequency.

28 Package Outline



DIMENSIONS ARE IN MILLIMETERS (INCHES)