

Silicon Bipolar MMIC 1.5 GHz Variable Gain Amplifier

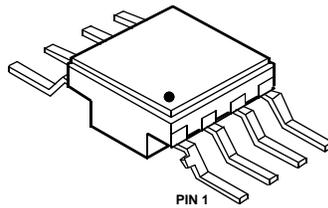
Technical Data

IVA-05128

Features

- **50 MHz to 1.5 GHz Bandwidth**
- **Data Rates up to 2.0 Gbit/s**
- **High Gain: 26 dB Typical**
- **Wide Gain Control Range: 30 dB Typical**
- **Differential Output Capability**
- **Bias $V_{CC} - V_{EE} = 5\text{ V}$**
- **5 V TTL Compatible V_{gc} Control Voltage, $I_{gc} < 3\text{ mA}$**
- **Hermetic Ceramic Surface Mount Package**

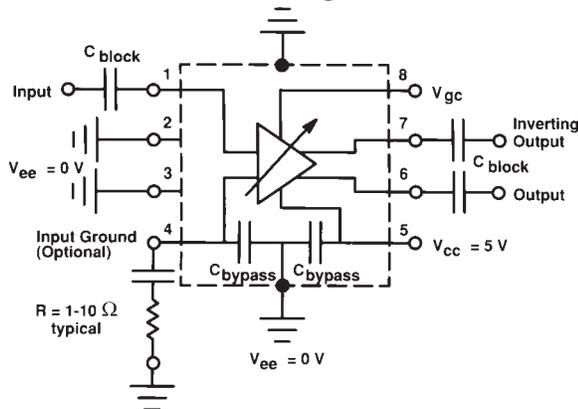
28 Package



Description

The IVA-05128 is a variable gain amplifier housed in a miniature ceramic hermetic surface mount package. It is designed for narrow or wide bandwidth commercial, industrial and military applications that require high gain and wide gain control range. The amplifier can be used in a single-ended or differential output configuration. For low frequency applications (<50 MHz) a bypass capacitor and series resistor are connected to pin 4, the AC Input Ground lead.

Typical Biasing Configuration and Functional Block Diagram



Typical applications include variable gain amplification for fiberoptic systems at data rates in excess of the 1.24 Gb/s SONET standard, mobile radio and satellite receivers, millimeter wave receiver IF amplifiers and communications 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.

Absolute Maximum Ratings

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

Thermal Resistance:^[2,4]

$$\theta_{jc} = 50^{\circ}\text{C/W}$$

Notes:

1. Permanent damage may occur if any of these limits are exceeded.
2. $T_{CASE} = 25^{\circ}\text{C}$.
3. Derate at 20 mW/°C for $T_c > 170^{\circ}\text{C}$.
4. See MEASUREMENTS section "Thermal Resistance" in Communications Components Catalog, for more information.

Electrical Specifications^[1], $T_A = 25^{\circ}\text{C}$

| Symbol | Parameters and Test Conditions ^[2] : $V_{CC} = 5\text{ V}, V_{ee} = 0\text{ V}, V_{gc} = 0\text{ V}, Z_O = 50\ \Omega$ | Units | Min. | Typ. | Max. |
|--------------|--|-------|------|-----------|------|
| G_P | Power Gain $ S_{21} $ ^[2] $f = 0.5\text{ GHz}$ | dB | 20 | 26 | |
| ΔG_P | Gain Flatness $f = 0.05\text{ to }1.0\text{ GHz}$ | dB | | ± 0.3 | |
| f_{3dB} | 3 dB Bandwidth ^[3] | GHz | 1.0 | 1.5 | |
| GCR | Gain Control Range ^[4] $f = 0.5\text{ GHz}, V_{gc} = 0\text{ to }5\text{ V}$ | dB | 25 | 30 | |
| ISO | Reverse Isolation ($ S_{12} $) ^[2] $f = 0.5\text{ GHz}, V_{gc} = 0\text{ to }5\text{ V}$ | dB | | 45 | |
| VSWR | Input VSWR $f = 0.05\text{ to }1.5\text{ GHz}, V_{gc} = 0\text{ to }5\text{ V}$ | | | 1.7:1 | |
| | Output VSWR $f = 0.05\text{ to }1.5\text{ GHz}, V_{gc} = 0\text{ to }5\text{ V}$ | | | 1.5:1 | |
| NF | 50 Ω Noise Figure $f = 0.5\text{ GHz}$ | dB | | 9 | |
| P_{1dB} | Output Power at 1 dB Compression $f = 0.5\text{ GHz}$ | dBm | | -2 | |
| IP_3 | Output Third Order Intercept Point $f = 0.5\text{ GHz}$ | dBm | | 8 | |
| t_D | Group Delay $f = 0.5\text{ GHz}$ | 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.
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 4.2 V may result in gain increase rather than gain decrease.

IVA-05128 Typical Performance, $T_A = 25^\circ\text{C}$, $V_{CC} = 5\text{ V}$, $V_{ee} = 0\text{ V}$
(unless otherwise noted)

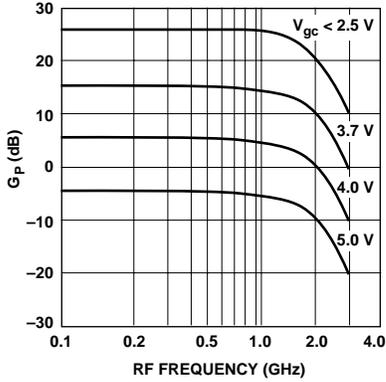


Figure 1. Typical Variable Gain vs. Frequency.

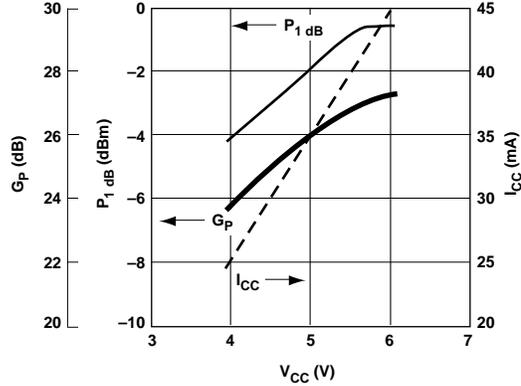


Figure 2. Power Gain and P_1 dB at 0.5GHz and I_{CC} vs. Bias Voltage with $V_{gc} = 0\text{ V}$.

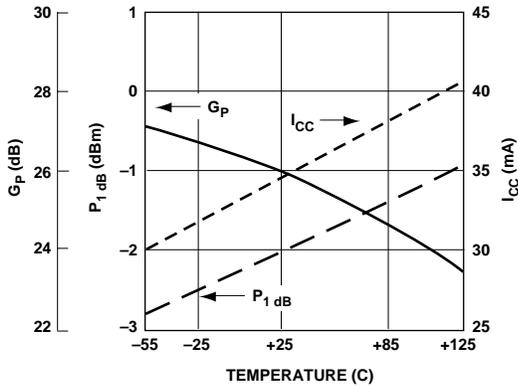


Figure 3. Power Gain and P_1 dB at 0.5GHz and I_{CC} vs. Case Temperature with $V_{gc} = 0\text{ V}$.

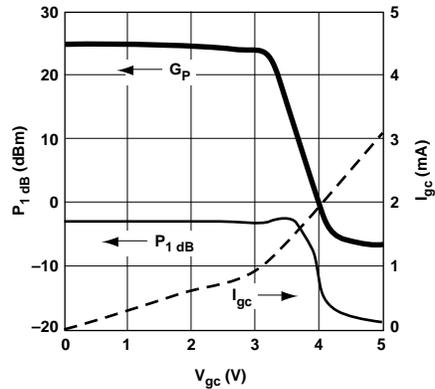


Figure 4. Power Gain and P_1 dB at 0.5GHz and I_{gc} vs. Gain Control Voltage.

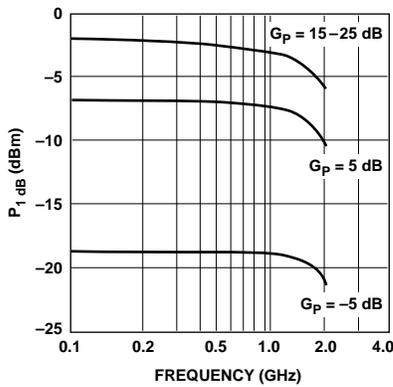


Figure 5. P_1 dB vs. Frequency.

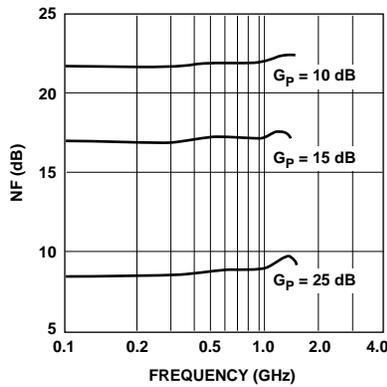


Figure 6. Noise Figure vs. Frequency.

IVA-05128 Typical Performance, $T_A = 25^\circ\text{C}$, $V_{CC} = 5\text{ V}$, $V_{ee} = 0\text{ V}$, continued
(unless otherwise noted)

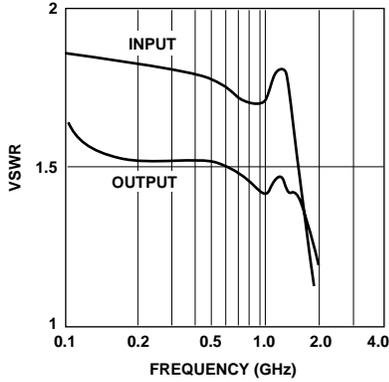


Figure 7. Input and Output VSWR vs. Frequency, $V_{gc} = 0-5\text{ V}$.

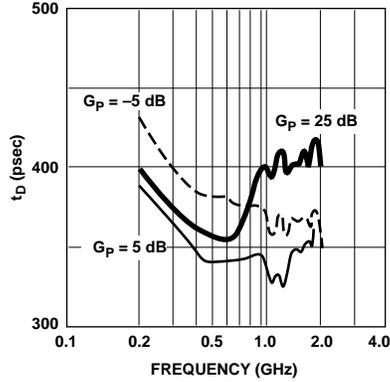


Figure 8. Group Delay vs. Frequency.

28 Package Outline

