

VG101

Cellular-band Variable Gain Amplifier



Product Features

- 700 – 1000 MHz bandwidth
- 28 dB Attenuation Range
- +40 dBm Output IP3
- +22 dBm P1dB
- Constant IP3 & P1dB over attenuation range
- Single voltage supply
- Pb-free 6mm 28-pin QFN package
- MTTF > 1000 years

Applications

- Xmit & Rcv AGC circuitry for mobile infrastructure

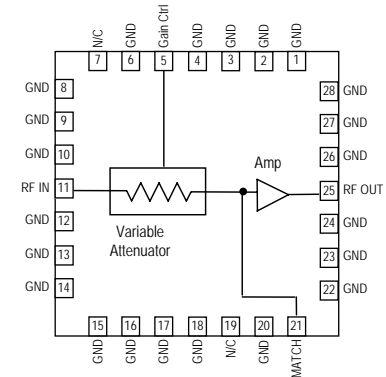
Product Description

The VG101 is a cellular-band high dynamic range variable gain amplifier (VGA) packaged in a low profile Pb-free / RoHS-compliant surface-mount leadless package that measures 6 x 6 mm square.

The +22 dBm output compression point and +40 dBm output intercept point of the amplifier are maintained over the entire attenuation range, making the VG101 ideal for use in transmitter and receiver AGC circuits and as a variable gain stage following an LNA in high dynamic range receiver front ends.

Superior thermal design allows the product to have a minimum MTTF rating of 1000 years at a mounting temperature of +85 °C. All devices are 100% RF & DC tested and packaged on tape and reel for automated surface-mount assembly.

Functional Diagram



Specifications ⁽¹⁾

| Parameter | Units | Min | Typ | Max | Conditions |
|---|-------|------|------|------|--|
| Operational Bandwidth | MHz | 700 | | 1000 | |
| Test Frequency | MHz | | 900 | | See note 1 |
| Gain at min. attenuation | dB | 15 | 16 | | |
| Input Return Loss | dB | | 12 | | |
| Output Return Loss | dB | | 14 | | |
| Output P1dB | dBm | | +22 | | |
| Output IP3 | dBm | +37 | +40 | | See note 2 |
| Noise Figure at min. attenuation | dB | | 3.5 | | V _{CTRL} = 0 V |
| Gain Variation Range | dB | 25.5 | 28.7 | 33.5 | See note 3 |
| Gain Variation Control Voltage, V _{CTRL} | V | 0 | | 4.5 | See note 1 |
| Group Delay | ns | | 1 | | Frequency = 900 MHz |
| Supply Voltage | V | | +5 | | |
| Operating Amplifier Current Range | mA | 120 | 150 | 180 | Pin 25 |
| Gain Control Pin Current | mA | | | 20 | V _{CTRL} = 4.5 V. See note 1. |

1. Test conditions unless otherwise noted: 25°C, V_{dd} = +5 V in a tuned application circuit. V_{ctrl} is the control voltage through a BJT transistor and a 100 Ω dropping resistor as shown in the same application circuit.
2. 3OIP measured with two tones at an output power of +5 dBm/tone separated by 10 MHz. The suppression on the largest IM3 product is used to calculate the 3OIP using a 2:1 rule.
3. The gain variation range is measured as the difference in gain with V_{ctrl} = 0V and V_{ctrl} = 4.5V at 0.9 GHz.

Absolute Maximum Rating

| Parameter | Rating |
|--|----------------|
| Operating Case Temperature | -40 to +85 °C |
| Storage Temperature | -55 to +125 °C |
| Amplifier Supply Voltage (pin 25) | +6 V |
| Pin 5 (Gain Control) Current | 30 mA |
| RF Input Power (continuous) | +12 dBm |
| Junction Temperature | +160 °C |
| Thermal Resistance, R _{th} ⁽¹⁾ | 59 °C / W |

Operation of this device above any of these parameters may cause permanent damage.

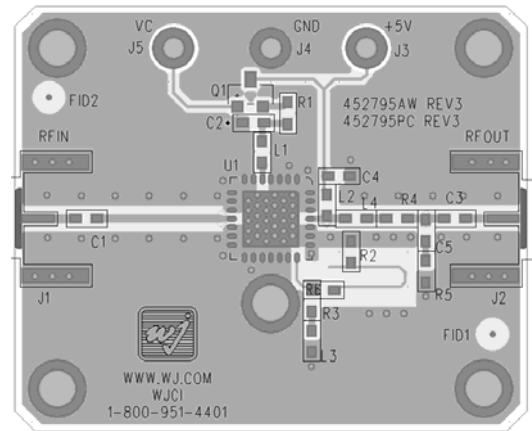
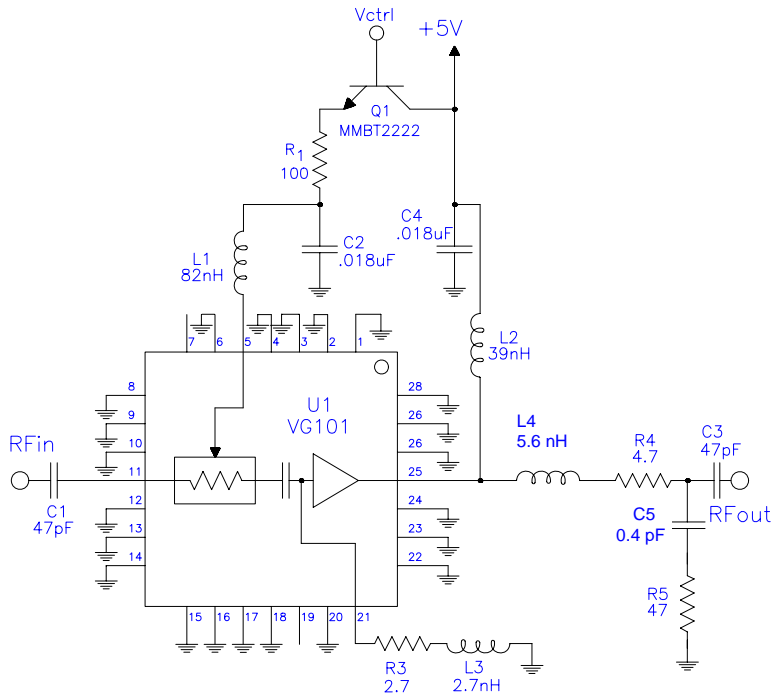
Ordering Information

| Part No. | Description |
|-----------|---|
| VG101-F | Cellular-band Variable Gain Amplifier (lead-free/RoHS-compliant QFN package) |
| VG101-PCB | Fully Assembled Application Board |

Standard tape / reel size = 500 pieces on a 7" reel

Specifications and information are subject to change without notice

Application Circuit: 700 – 1000 MHz (VG101-PCB)

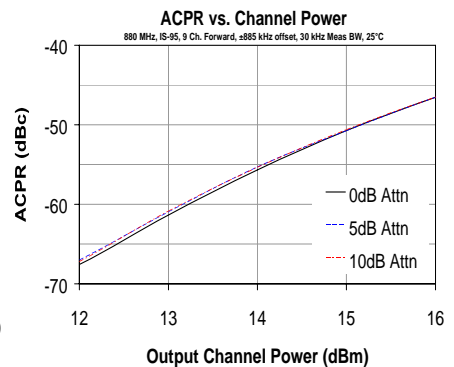
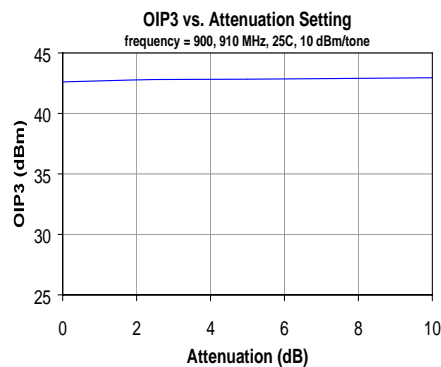
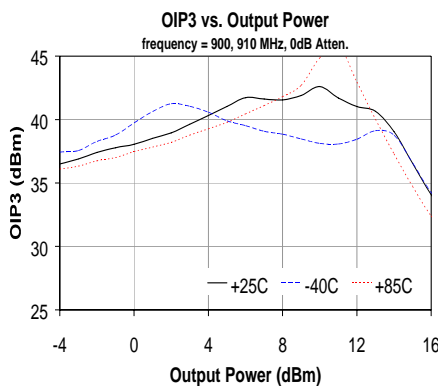


Circuit Board Material: .014" FR-4, 4 layers, .062" total thickness

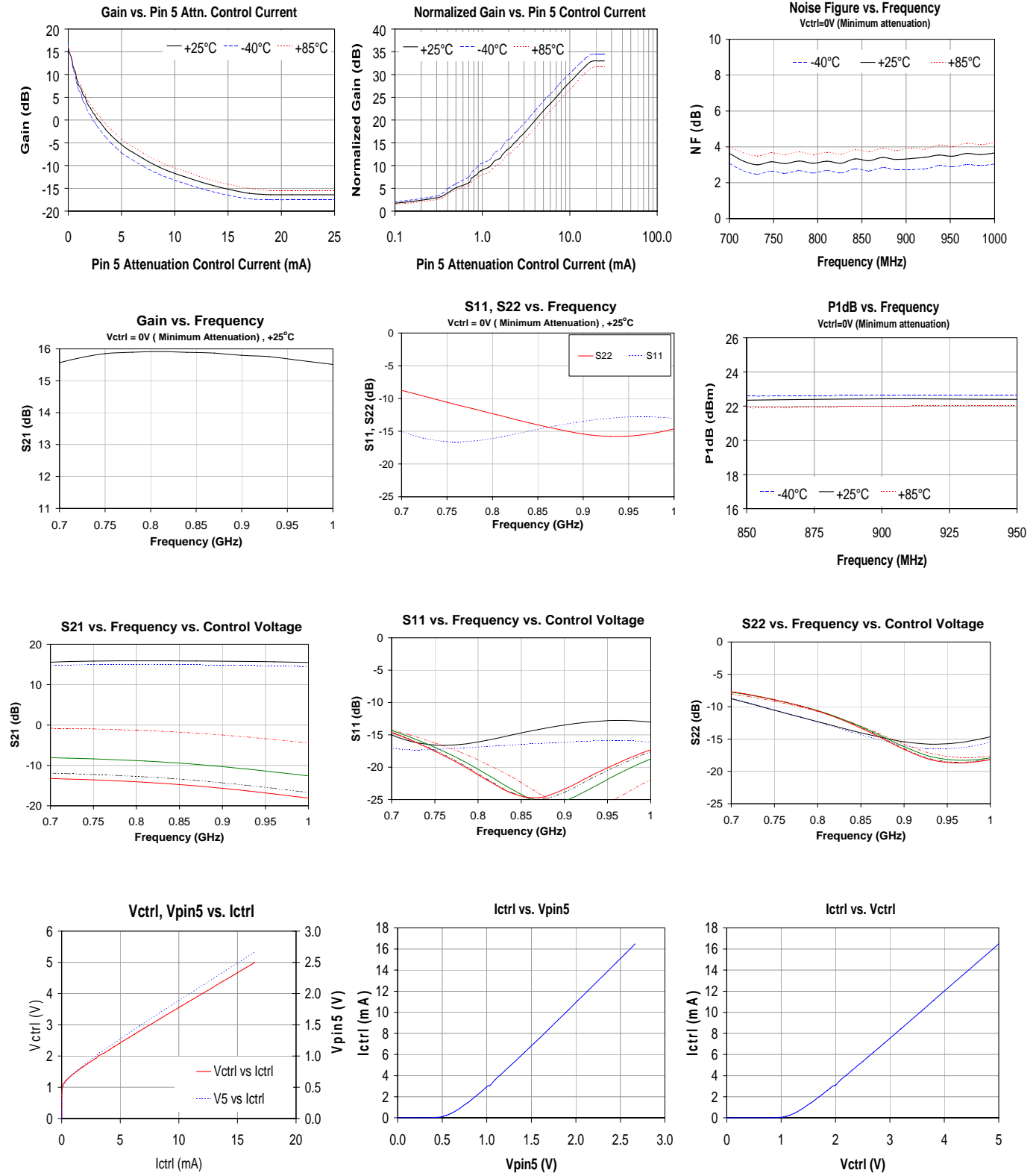
- The amplifier is biased through Pin 25 and should be connected directly into a voltage regulator.
- Distances are shown from the edge-to-edge for the land pattern.

Bill of Materials

| Ref. Des. | Value | Description | Manufacturer |
|-----------|----------|----------------------------------|--------------|
| C1, C3 | 47 pF | Chip, 0603, 50V, 5%, NPO | various |
| C2, C4 | 0.018 uF | Chip, 0603, 50V, 5%, X7R | various |
| C5 | 0.4 pF | Chip, 0603, 50V, 1% | various |
| L1 | 82 nH | Coil Wire-wound, 0603, 5% | Coilcraft |
| L2 | 39 nH | Coil Wire-wound, 0603, 5% | Coilcraft |
| L3 | 2.7 nH | Multilayer, 0603, +/-0.3 nH | various |
| L4 | 5.6 nH | Ceramic core, 0603, 5% | Coilcraft |
| R1 | 100 Ω | Chip, 0603, 5%, 1/16W | various |
| R3 | 2.7 Ω | Chip, 0603, 5%, 1/16W | various |
| R4 | 4.7 Ω | Chip, 0603, 5%, 1/16W | various |
| R5 | 47 Ω | Chip, 0603, 5%, 1/16W | various |
| Q1 | | NPN General Purpose Transistor | MMBT2222A |
| U1 | VG101-F | Variable Gain Amplifier, QFN 6x6 | TriQuint |



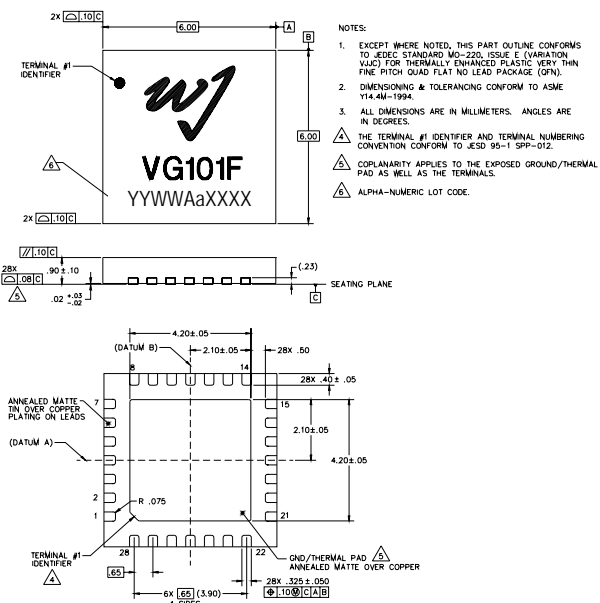
VG101-PCB Application Circuit Performance (cont'd)



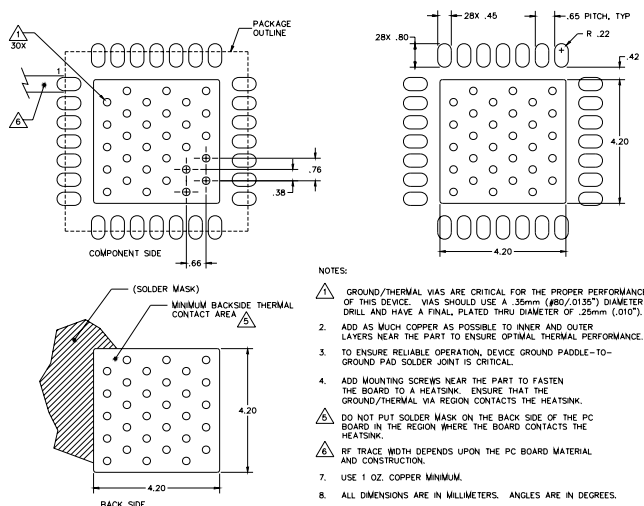
VG101-F Mechanical Information

This package is lead-free/RoHS-compliant. The plating material on the pins is annealed matte tin over copper. It is compatible with both lead-free (maximum 260 °C reflow temperature) and leaded (maximum 245 °C reflow temperature) soldering processes.

Outline Drawing



Mounting Configuration / Land Pattern



Product Marking

The component will be lasermarked with a "VG101F" designator followed by 10-digit numeric lot code. The "YY" represents the last digit of the year the part was manufactured, "WW" represents the workweek, the "Aa" is vendor code and "XXXX" is an auto-generated number.

Tape and reel specifications for this part will be located on the website in the "Application Notes" section.

ESD / MSL Information



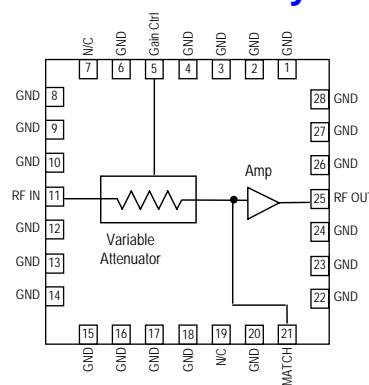
Caution! ESD sensitive device.

ESD Rating: Class 1B
 Value: Passes ≥ 500V to <1000V
 Test: Human Body Model (HBM)
 Standard: JEDEC Standard JESD22-A114

ESD Rating: Class IV
 Value: Passes ≥ 1000V to <2000V
 Test: Charged Device Model (CDM)
 Standard: JEDEC Standard JESD22-C101

MSL Rating: Level 2 at +260°C convection reflow
 Standard: JEDEC Standard J-STD-020

Functional Pin Layout



| Function | Pin No |
|---------------------|-----------------------------------|
| Gain Control | 5 |
| No Connect | 7, 19 |
| RF Input | 11 |
| Interstage Match | 21 |
| RF Output / DC bias | 25 |
| Ground | All other pins Backside copper |

The even numbered pins are hard grounded to the backside paddle internally.