

# 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

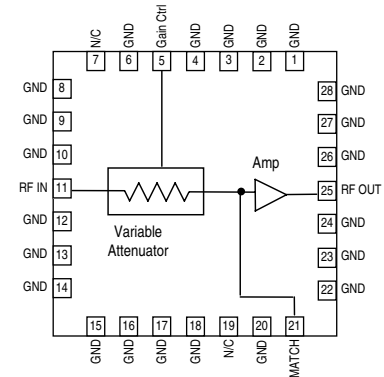
### Product Description

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 <sup>(1)</sup>

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 <sub>CTRL</sub> = 0 V
Gain Variation Range	dB	25.5	28.7	33.5	See note 3
Gain Variation Control Voltage, V <sub>CTRL</sub>	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 <sub>CTRL</sub> = 4.5 V. See note 1.

1. Test conditions unless otherwise noted: 25°C, V<sub>dd</sub> = +5 V in a tuned application circuit. V<sub>ctrl</sub> 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<sub>ctrl</sub> = 0V and V<sub>ctrl</sub> = 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 <sub>th</sub> <sup>(1)</sup>	59 °C / W

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

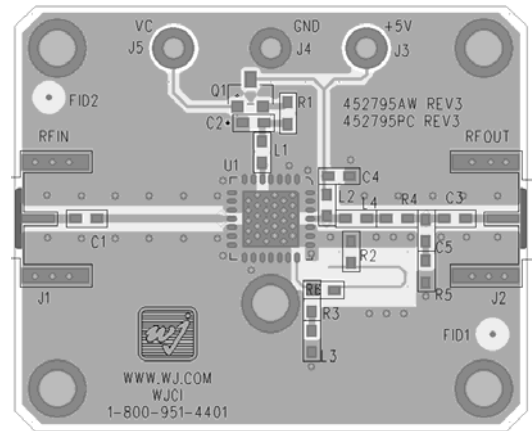
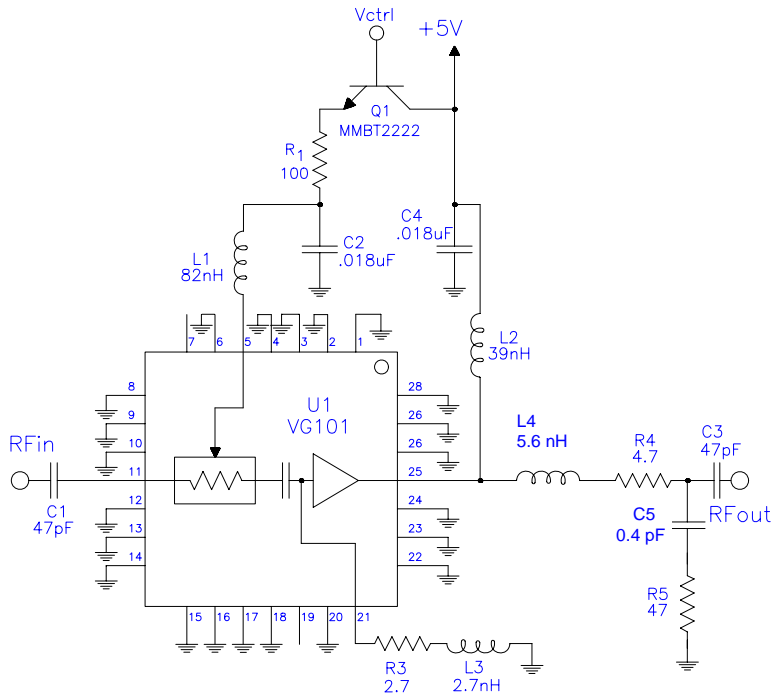
### Ordering Information

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)

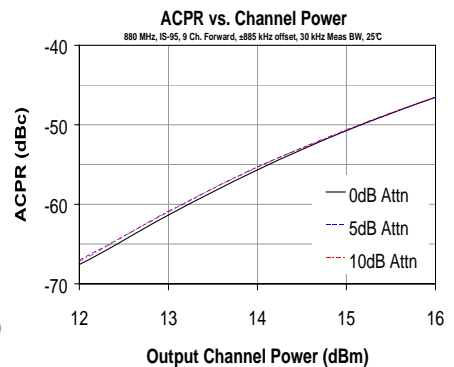
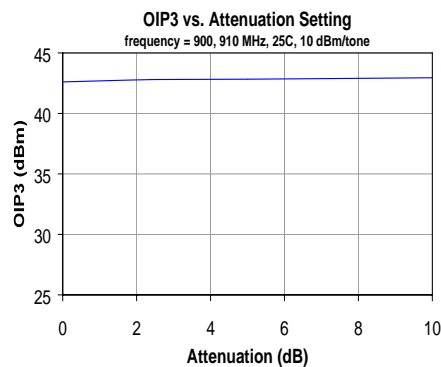
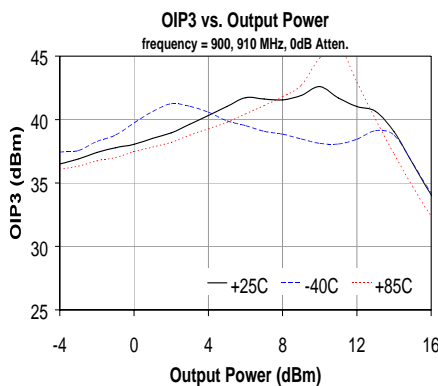


Circuit Board Material: .014" FR-4, 4 layers, .062" total thickness

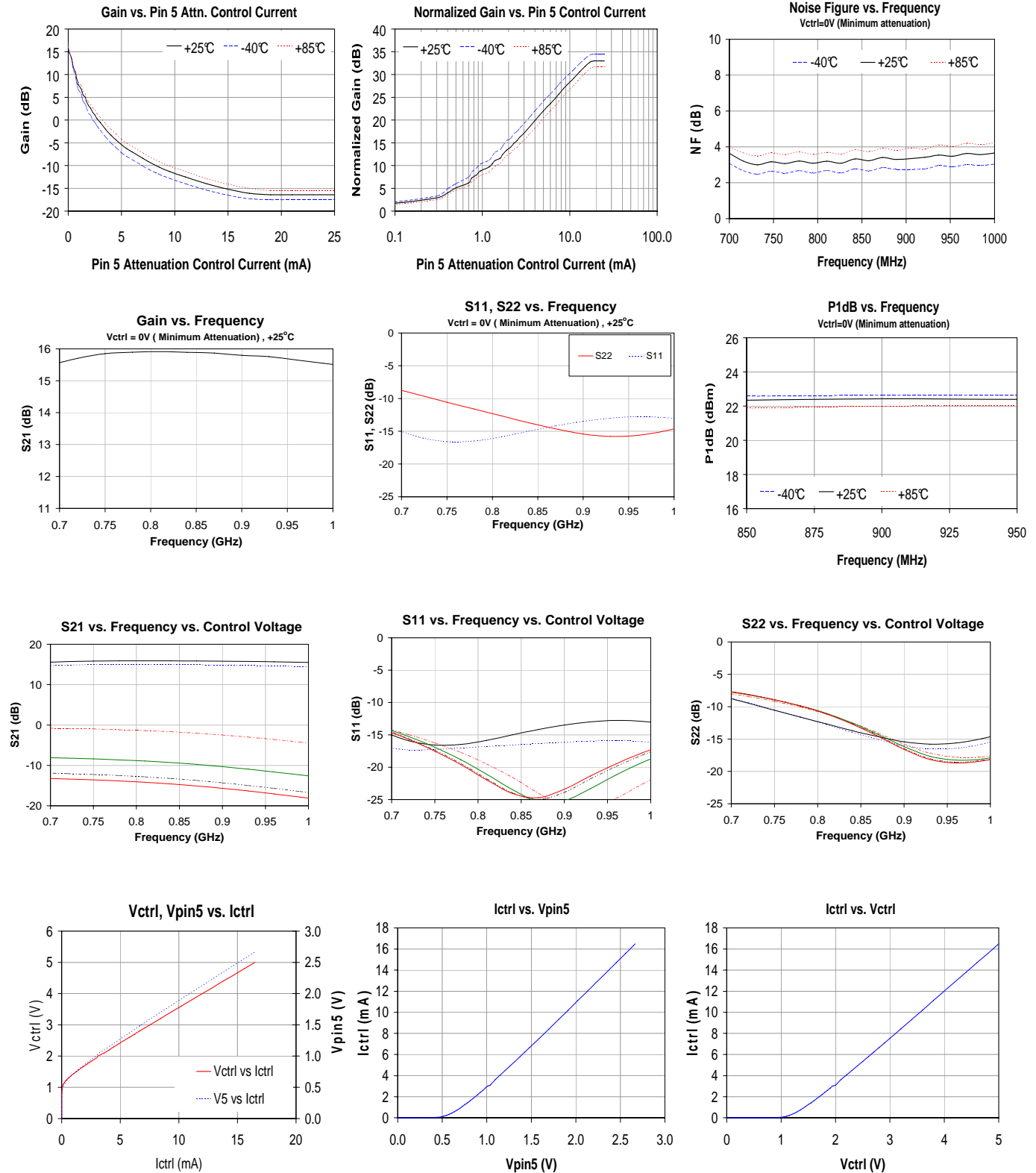
- The amplifier is biased through Pin 25 and should be connected directly into a voltage regulator.
- Distances are shown from the edge-to-edge for the land pattern.

### 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



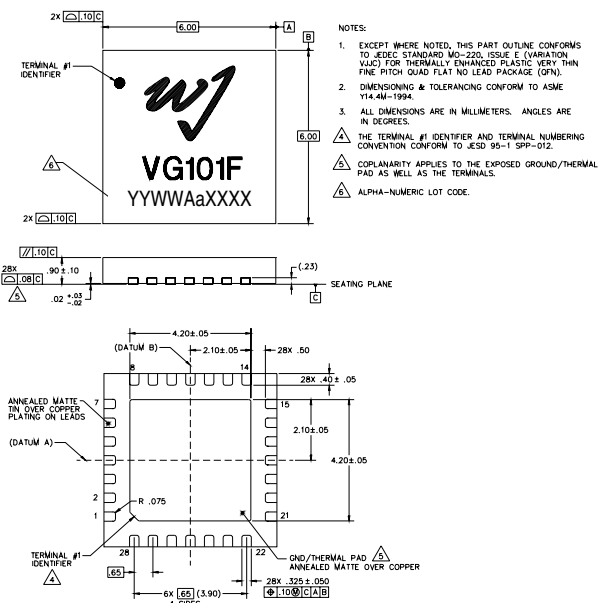
### VG101-PCB Application Circuit Performance (cont'd)



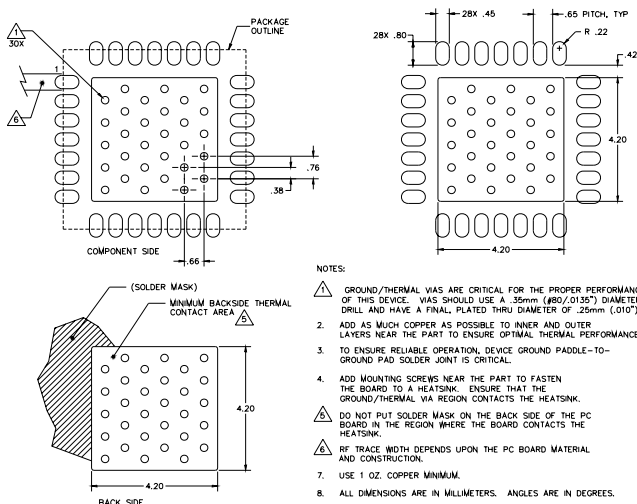
## VG101-F Mechanical Information

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



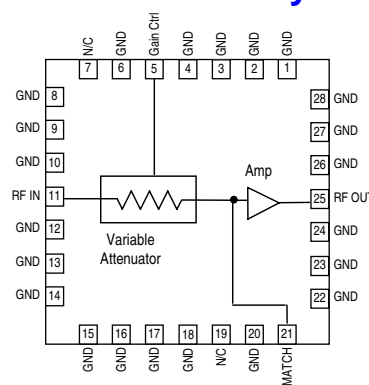
Caution! ESD sensitive device.

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.