

Product Features

- 1800 – 2200 MHz bandwidth
- 29 dB Attenuation Range
- +40 dBm Output IP3
- +21 dBm P1dB
- Constant IP3 & P1dB over attenuation range
- Single voltage supply
- 6x6 mm 28-pin QFN package
- MTTF > 100 years

Applications

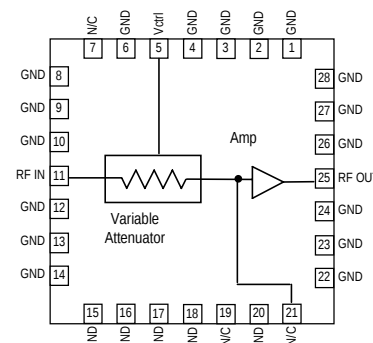
- Xmit & Rcv AGC circuitry for mobile infrastructure

Product Description

The VG111 is a PCS / UMTS-band high dynamic range variable gain amplifier (VGA) packaged in a 6x6 mm surface-mount package. The +21 dBm output compression point and +40 dBm output intercept point of the amplifier are maintained over the entire attenuation range, making the VG111 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 100 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



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

Specifications

Parameter	Units	Min	Typ	Max	Conditions
Frequency Range	MHz	1800	1900	2100	2200 See note 1
Gain at min. attenuation	dB	12	14	14	
Input Return Loss	dB		9	12	
Output Return Loss	dB		9	12	
Output P1dB	dBm		+21.5	+21	
Output IP3	dBm		+40	+37.5	See note 2
Noise Figure at min. attenuation	dB		4.0	4.1	$V_{CTRL} = 0$ V
Gain Variation Range	dB		29	30	See note 3
Gain Variation Control Voltage, V_{CTRL}	V	0		4.5	
Group Delay	ns		0.6		
Supply Voltage	V		+5		
Operating Amplifier Current Range	mA	120	150	180	Pin 25
Gain Control Pin Current Range	mA	0		25	Pin 5 draws no current at maximum gain
Thermal Resistance	°C / W			59	
Junction Temperature	°C			160	See note 4

Test conditions unless otherwise noted.

1. $T = 25^{\circ}\text{C}$, $V_{dd} = +5$ V, Frequency = 800 MHz in an application circuit.

2. 3OIP measured with two tones at an output power of +10 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 with 16 mA of current on gain control pin 5.

4. The junction temperature ensures a minimum MTBF rating of 1 million hours of usage.

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
Attenuation Control Voltage	+5.5 V
RF Input Power (continuous)	+12 dBm
Junction Temperature	+220° C

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

Ordering Information

Part No.	Description
VG111	PCS/UMTS-band Variable Gain Amplifier
VG111-PCB1900	1.8 – 2.0 GHz Fully Assembled Application Board
VG111-PCB2100	2.0 – 2.2 GHz Fully Assembled Application Board

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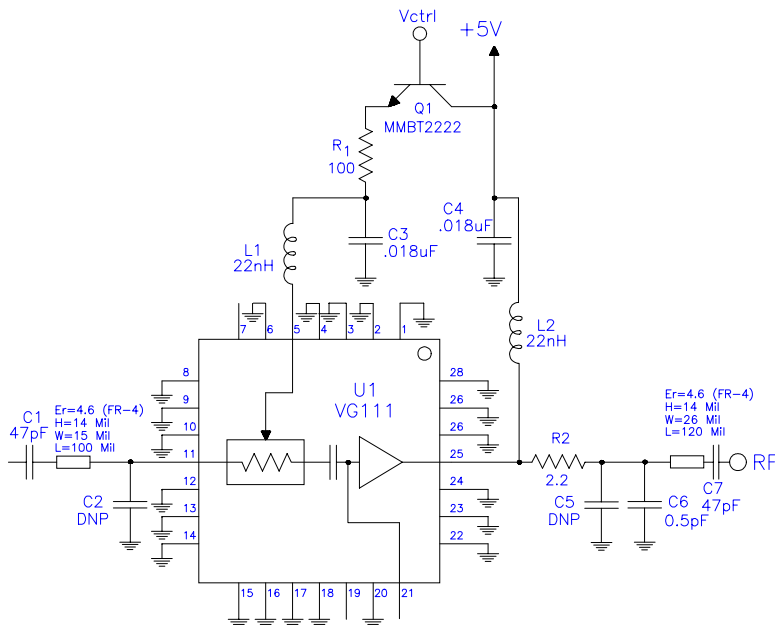
VG111

PCS/UMTS-band Variable Gain Amplifier

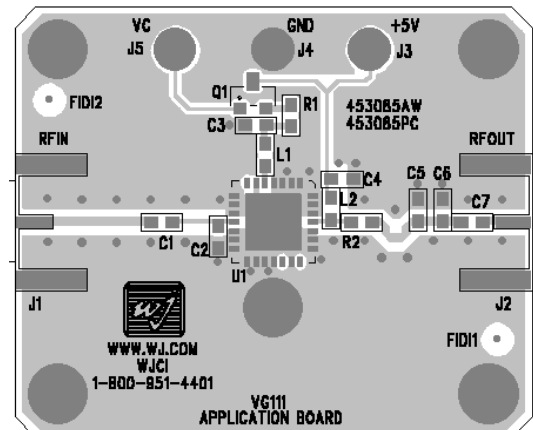
The Communications Edge™

Product Information

Application Circuit: 1.8 – 2.0 GHz (VG111-PCB1900)



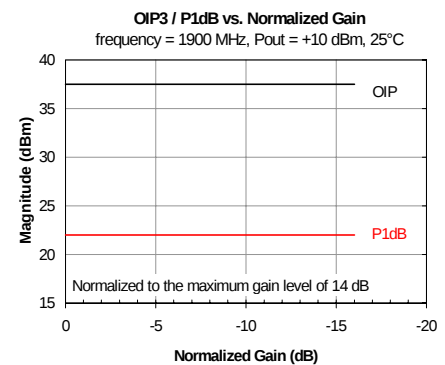
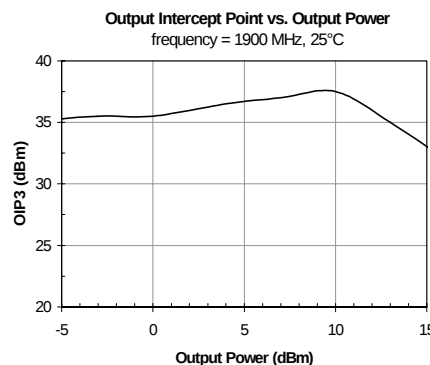
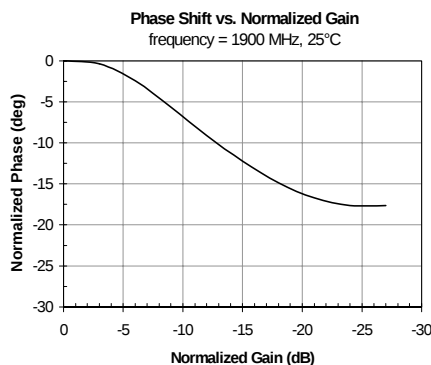
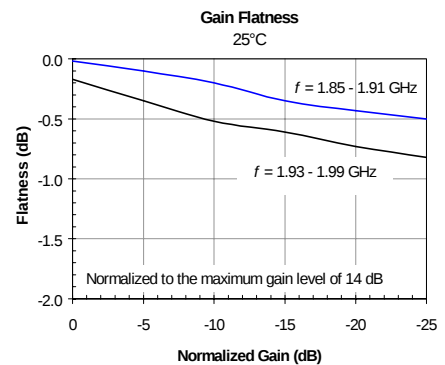
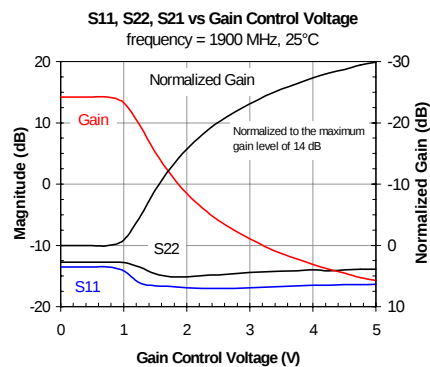
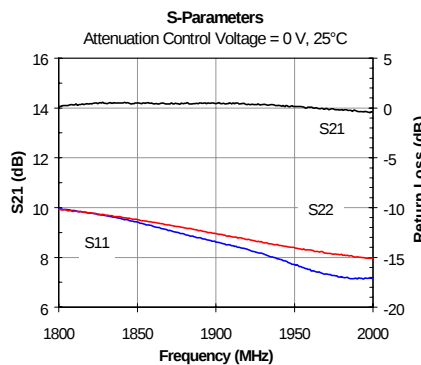
- Pins 7, 19, and 21 should not be connected.
- The amplifier is biased through Pin 25 and should be connected directly into a voltage regulator.
- DNP represents Do Not Place.
- Distances are shown from the edge-to-edge for the land pattern.



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

Bill of Materials

Ref. Des.	Description	Size
C1, C7	47 pF Chip Capacitor	0603
C2, C5	Do Not Place	
C3, C4	0.01 μ F Chip Capacitor	0603
C6	0.5 pF Chip Capacitor	0603
L1, L2	22 nH Chip Inductor	0603
R1	100 Ω Chip Resistor	0603
R2	2.2 Ω Chip Resistor	0603
Q1	MMBT2222 Motorola Transistor	SOT-23
U1	VG111 Variable Gain Amplifier	QFN 6x6



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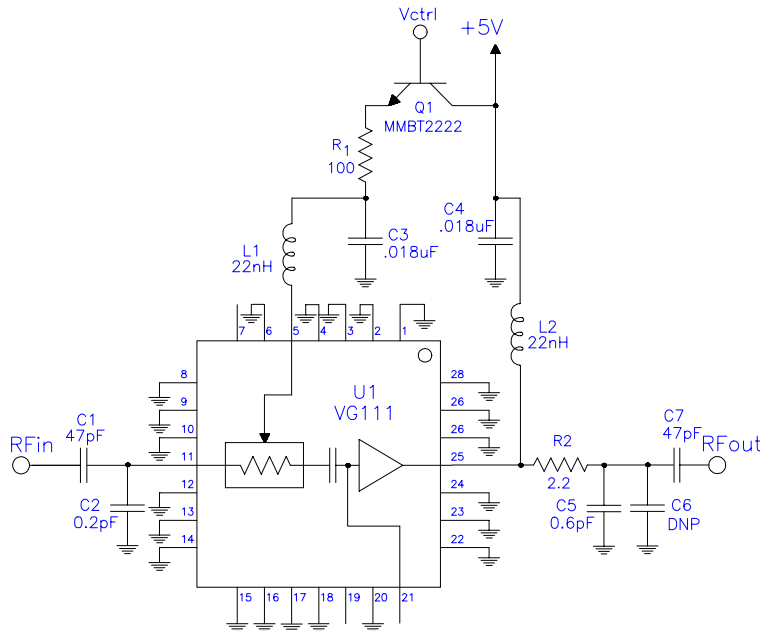
VG111

PCS/UMTS-band Variable Gain Amplifier

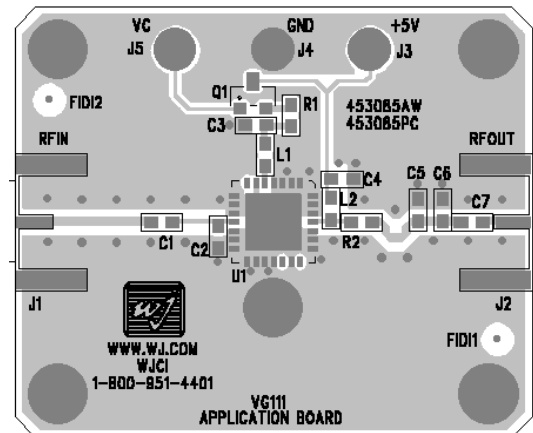
The Communications Edge™

Product Information

Application Circuit: 2.0 – 2.2 GHz (VG111-PCB2100)



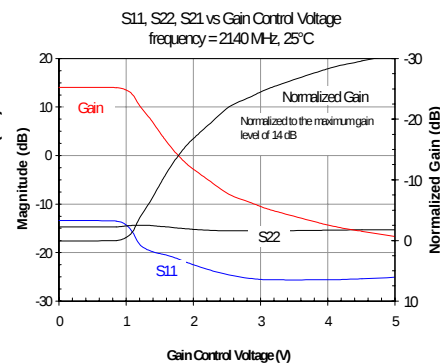
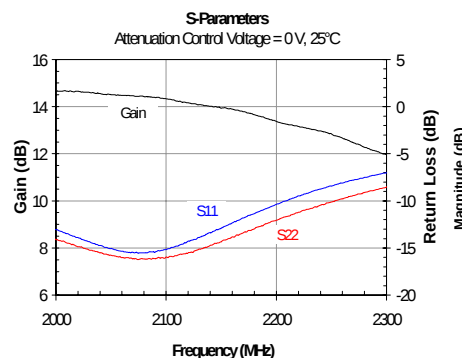
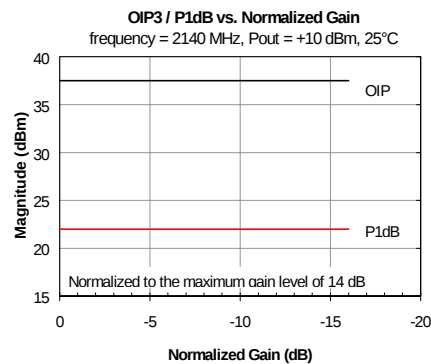
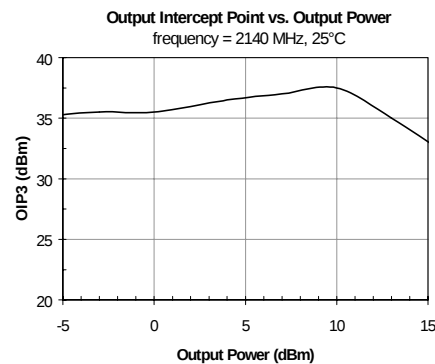
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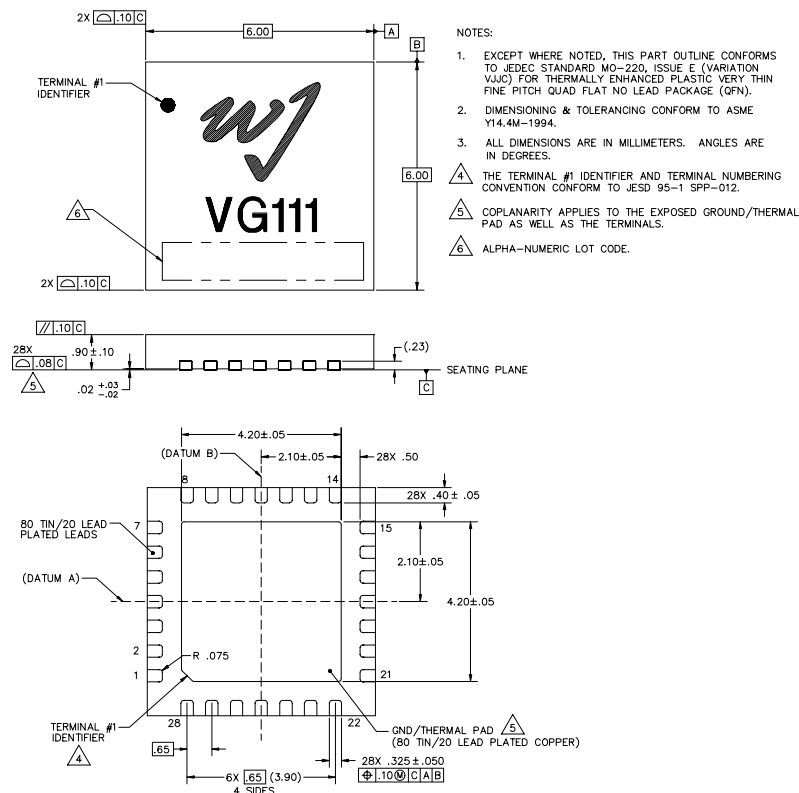
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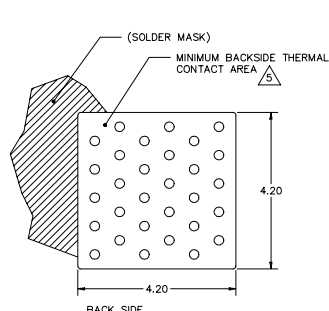
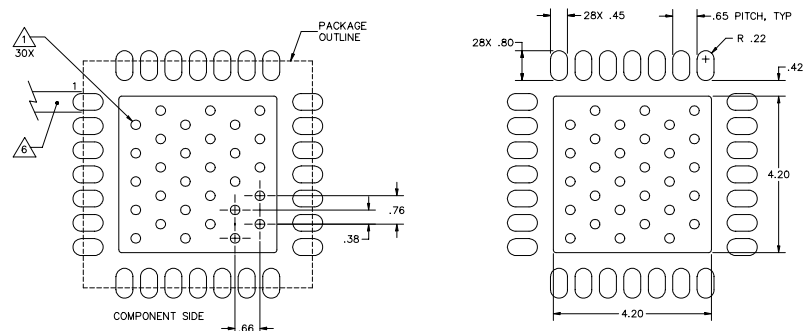


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Outline Drawing



Mounting Configuration / Land Pattern



- NOTES:
1.  GROUND/THERMAL VIAS ARE CRITICAL FOR THE PROPER PERFORMANCE OF THIS DEVICE. VIAS SHOULD USE A .35mm (#80/.0135") DIAMETER DRILL AND HAVE A FINAL PLATED THRU DIAMETER OF .25mm (.010").
 2. ADD AS MUCH COPPER AS POSSIBLE TO INNER AND OUTER LAYERS NEAR THE PART TO ENSURE OPTIMAL THERMAL PERFORMANCE.
 3. TO ENSURE RELIABLE OPERATION, DEVICE GROUND PADDLE-TO-GROUND PAD SOLDER JOINT IS CRITICAL.
 4. ADD MOUNTING SCREWS NEAR THE PART TO FASTEN THE BOARD TO A HEATSINK. ENSURE THAT THE GROUND/THERMAL VIA REGION CONTACTS THE HEATSINK.
 5.  DO NOT PUT SOLDER MASK ON THE BACK SIDE OF THE PC BOARD IN THE REGION WHERE THE BOARD CONTACTS THE HEATSINK.
 6.  RE TRACE WIDTH DEPENDS UPON THE PC BOARD MATERIAL AND CONSTRUCTION.
 7. USE 1 OZ. COPPER MINIMUM.
 8. ALL DIMENSIONS ARE IN MILLIMETERS. ANGLES ARE IN DEGREES.

Product Marking

The component will be lasermarked with a “VG111” designator with a four-digit alphanumeric lot code on the top surface of the package. 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 Classification:	Class 1B
Value:	Passes 600 V
Test:	Human Body Model (HBM)
Standard:	JEDEC Standard JESD22-A114

ESD Classification:	Class IV
Value:	Passes 1000 V
Test:	Charged Device Model (CDM)
Standard:	JEDEC Standard JESD22-C101

MSL Rating: Level 1 at +250 °C convection reflow
Standard: JEDEC Standard J-STD-020B

Functional Pin Layout

Pin	FUNCTION	Pin	FUNCTION
1	GND	15	GND
2	GND	16	GND
3	GND	17	GND
4	GND	18	GND
5	Gain control pin	19	N/C
6	GND	20	GND
7	N/C	21	N/C
8	GND	22	GND
9	GND	23	GND
10	GND	24	GND
11	RF Input	25	RF Output / Bias
12	GND	26	GND
13	GND	27	GND
14	GND	28	GND