



# VG101 and VG111 QUALIFICATION REPORT

## I. SUMMARY

The VG101 and VG111 are high dynamic range variable gain amplifiers (VGA) packaged in a 6x6 mm QFN surface mount package. The VG101 and VG111 both consist of a MESFET amplifier and a pin-diode attenuation network. The parameters monitored for the qualification tests were Supply Current, Gain, OIP3 and Attenuation Range. Failures are defined as any variation of 10% or greater.

## II. SCOPE

This report summarizes the reliability qualification of the VG101. The VG111 is qualified by similarity to the VG101. The amplifier circuit topology used in the VG101 is almost identical to the amplifier used in the VG111. The only difference is the passive circuitry on the amplifier die that is used to set the amount of feedback. Changes to the passive circuitry adhere to the design guidelines of the MESFET amplifier process technology, and do not change the inherent reliability of the amplifier die. In addition, the passive matching die topology used in the VG101 are virtually identical to the passive matching die used in the VG111. The only difference is the values of the passive components to accommodate the higher frequency of operation of the VG111. Changes to the passive circuitry adhere to the design guidelines of the process technology, and do not change the inherent reliability of the amplifier die. Both devices are assembled in a 6 x 6 mm QFN surface mount plastic package. The reliability data are obtained through the performance of specified accelerated stress tests described in this document.

## III. APPLICABLE DOCUMENTS

All the test procedures and test methods are consistent with industry standards. The standards referenced in this document are JEDEC standard 22.

## IV. QUALIFICATION TEST PLAN

Stress or Test	Procedures/Conditions	Device Hours/ Cycles	Sample Size	Failed Units	Date	Reference Document	Part Tested
Preconditioning Level 1 Lead Free 260°C	External visual 40x High Temp. Storage Life 24 hrs @+125°C. Temp. & Humidity Test 168 hrs. @ +85°C/ 85% RH Convection Solder Reflow test 3 cycles w/flux immersion, peak temperature 260°C	N/A	3 lots, a total of 1200 parts	0	Q2 2003	JESD22-A113C JESD22-A101-B JESD22-B101 JESD22-A103-B J-STD-020B	VG101
Temperature Cycle	Test Condition C Temp. -65°C (+0°/-10°C) to +150°C (+10°/-0°C) Dwell time = 15 min.	500 cycles	3 lots, a total of 135 parts	0	Q3 2003	JESD22-A104-B	VG101
Temperature Shock	Test Condition D Temp. -65°C (+0°/-10°C) to +150°C (+10°/-0°C)	15 Cycles	3 lots, a total of 135 parts	0	Q3 2003	JESD22-A106-A	VG101
Unbiased Autoclave	Test Condition C Temp. 121°C (+/-1°C) Pressure = 15 +/-1psig Relative Humidity = 100%	96 (-1, +5) hours	3 lots, a total of 135 parts	0	Q3 2003	JESD22-A102-C	VG101



401 River Oaks Parkway  
San Jose, CA 95134

SIZE

A

DWG. NO.

453418

SCALE

REV.

-

SHEET

2

Unbiased High Temperature Storage (HTB)	Temp. 150°C (+ 5°C, -0°C)	1000 hours	1 lot, a total of 80 parts	0	Q1 2003	JESD22-A103-B	CV210-3
ESD Complete details see section V ESD	Charged Device Model (CDM)	N/A	1 lot, a total of 15 parts	0 failures thru 500 volts	Q2 2003	JESD22-C101-A	VG101
	Human Body Model (HBM)	N/A	1 lot, a total of 18 parts	0 failures thru 500 volts	Q2 2003	JESD22-A114-B	
Physical Dimensions	N/A	N/A	2 lots, a total of 2 parts	0	Q1 2003	JESD22-B100-A	CV210-3
Solderability	N/A	N/A	3 lot, a total of 3 parts	0	Q1 2003	JESD22-B102-C	CV210-3
Highly-Accelerated Temperature and Humidity Stress Test (HAST)	Test Condition A Temp. 130°C (+/- 2°C) Pressure = 33.3 +/-1psig Relative Humidity = 85%	96 (-0, +2) hours	3 lots, a total of 135 parts	0	Q3 2003	JESD22-A110-B	VG101
High Temp Op Life (HTOL)	Test Condition B Temp. 125°C (+5, -0°C)	1,000 (-0, +10) hours	3 lots, a total of 240 parts	0	Q1 2003	JESD22-A108-B	CV210-3
Moisture/Reflow Sensitivity (MSL) MSL level 1 lead free	Electrical test External Visual C-SAM Die, Paddle and leads Dry Bake 125°C, 24 hours 85°C/85 RH, 168 hours Convection reflow 260°C, 3X External Visual Electrical test C-SAM Die, Paddle and leads	N/A	1 lot, a total of 100 parts	0	Q2 2003	J-STD-20B	VG101

## V. DISCUSSION OF RESULTS

### 1. Testing procedures

All of the qualification tests were performed using loose parts except HAST and HTOL which were mounted to a PCB. The PCB layout is the same as the application circuit published in the WJ Communications Data Sheet. The application circuit was duplicated ten times on one large PCB for the qualification testing. A control board consisting of ten VG101s was tested before and after each set of the stressed devices to ensure measurement accuracy and repeatability.

### 2. Pre-Conditioning

Three lots of 400, a total of 1200 VG101 devices, completed pre-conditioning with no electrical failures.

### 3. Temperature Cycle

Devices from three lots, 135 VG101 devices, completed 500 temperature cycles with 0 failures.

### 4. Temperature Shock

Devices from three lots, 135 VG101 devices, completed 15 temperature shock cycles with 0 failures.

### 5. Unbiased Autoclave

Devices from three lots, 135 VG101 devices, completed unbiased Autoclave with 0 failures.

### 6. Unbiased High Temperature Storage (HTB)

The VG101 HTB is qualified by similarity to the CV210-3. The VG101 and the CV210-3 contain the same internal amplifier die, where the VG101 contains one amplifier and the CV210-3 contains two of the same amplifier



401 River Oaks Parkway  
San Jose, CA 95134

SIZE

A

DWG. NO.

453418

SCALE

REV.

-

SHEET

3

(amongst other devices). They use the same package including a common mold compound, leadframe and attach material. A total of 80 CV210-3 devices completed 1000 hours of Unbiased High Temperature Storage with 0 failures.

7. ESD

A total of 33 VG101 devices from lot F002 completed CDM and HBM ESD testing at a variety of different voltage levels with no unexpected failures. The VG101 device has been classified as a Class 1B device (Highest Voltage Level Passed between 500V and 1000V) for Human Body Model (HBM) testing according to JEDEC Standard JESD22-A114-B and as a Class III device (Highest Voltage Level Passed between 500V and 1000V) for Charged Device Model (CDM) testing according to JEDEC Standard JESD22-C101-A.

The CDM test voltages were 100, 200, 500, 1,000 and 2,000 volts. The HBM test voltages were 250, 500, 750, 1,000, 1,500 and 2,000 volts. Failures occurred above 500 volts for both CDM and HBM ESD tests. The failed devices displayed a complete loss of functionality as opposed to partial degradation of RF characteristics. If any one of the three devices failed at a given voltage level, the device was said to fail at that level. The classification level was assigned according to the last voltage level at which all three parts passed post-ESD RF testing according to the test specifications set by WJ Communications.

8. Physical Dimensions

The VG101 Physical Dimensions are qualified by similarity to the CV210-3 since both devices use the same package. A total of 2 CV210-3 devices completed Inspection with no failures.

9. Solderability

The VG101 Solderability is qualified by similarity to the CV210-3 since both devices use the same package. A total of 3 CV210-3 devices completed Solderability testing with no failures.

10. Highly Accelerated Temperature and Humidity (HAST)

Devices from three lot, 135 VG101 devices, completed HAST with 0 failures.

11. High Temp Op Life (HTOL)

The VG101 HTOL is qualified by similarity to the CV210-3. The VG101 and the CV210-3 contain the same internal amplifier die, where the VG101 contains one amplifier and the CV210-3 contains two of the same amplifier (amongst other devices). They use the same package including a common mold compound, leadframe and attach material. Devices from three lots, 240 CV210-3 devices, completed 1,000 hours of HTOL with 0 failures.

12. Moisture/Reflow Sensitivity Classification (MSL)

A total of 100 VG101s completed MSL level 1 lead free (260°C) testing with no failures

**VI. CONCLUSIONS**

The Reliability Qualification Data presented demonstrates that the VG101 and VG111 meet WJ's rigorous quality standards and conform to WJ's long history of producing high quality products. The test results described in this document meet the requirements set forth by JEDEC for establishment of reliability through accelerated life testing, and support the full qualification of the VG101 and VG111.



SIZE	DWG. NO.		
A	453418		
SCALE	REV.	SHEET	
	-	4	