



RELIABILITY QUALIFICATION REPORT FOR LEAD-FREE/ROHS COMPLIANT 28-PIN 6x6mm QFN PACKAGED RF SEMICONDUCTORS

I. SUMMARY

The 28-Pin QFN 6X6 mm package has been lead-free/RoHS qualified to a maximum reflow profile of 260°C, and the MSL rating at this reflow profile is level 2. The lead finish is 100% Matte-Tin, 300-800 micro-inches thick and is post plating annealed, bake of 150°C for a minimum of 1 hour within 24 hours of plating, to improve solder joint robustness.

II. SCOPE

This report summarizes the reliability qualification of the 28-Pin QFN 6X6 mm package based on the qualification of the VG101 and CV210-1F. The only difference between leaded (VG101) and the lead-free version (CV210-1F) is with the exterior package plating; the plating on the VG101 is 80Sn/20Pb, while the plating on the CV210-1F is Matte Tin. Qualification for the VGxxx product families using the 6mm QFN package were previously completed with a reflow profile up to 260°C and thus the results are also used in this report for all stress tests except for solderability. The Application Note “453654-000 Solderability Test Report for WJ Products With Lead-Free Package Finish” has a detailed description of the lead-free solderability tests; results of the solderability testing are shown in Section IV. 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	Reference Document	Part Tested
Preconditioning Level 1 Lead Free	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 600 parts	0	JESD22-A113C JESD22-A101-B JESD22-B101 JESD22-A103-B J-STD-020B	CV210-1F
Temperature Cycle	Test Condition C Temp. -65°C (+0°/-10°C) to +150°C (+10°/-0°C) Dwell time = 10 to 15 min.	500 cycles	3 lots, a total of 135 parts	0	JESD22-A104-B	CV210-1F
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	JESD22-A102-C	CV210-1F
Unbiased High Temperature Storage (HTB)	Temp. 150°C (+ 5°C, -0°C)	1000 hours	1 lot, a total of 80 parts	0	JESD22-A103-B	VG101

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Stress or Test	Procedures/Conditions	Device Hours/ Cycles	Sample Size	Failed Units	Reference Document	Part Tested
Physical Dimensions	N/A	N/A	2 lots, a total of 2 parts	0	JESD22-B100-A	CV210-3
Solderability Lead-Free solder	Lead-Free Solder: Sn96Ag4 Flux Type: R145 Solder Bath Requirements: 260°C	N/A	3 lot, a total of 30 parts / 280 pins	0	IPC/EIA/JEDEC J-STD-002B Method 2003)	CV210-1F
Solderability Lead solder	Lead-Free Solder: Sn63Pb37 Flux Type: R145 Solder Bath Requirements: 245°C	N/A	3 lot, a total of 30 parts / 280 pins	0	IPC/EIA/JEDEC J-STD-002B Method 2003)	CV210-1F
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	JESD22-A110-B	CV210-1F
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	JESD22-A108-B	VG101
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	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. One control board consisting of ten VG101 devices and another control board with ten CV210-1F devices were tested before and after each set of the stressed devices to ensure measurement accuracy and repeatability.

Components are considered to have failed if any of the following occurs after being tested post-stress and compared to respective pre-stressed testing parameters for the CV210-1F: a variation 10% or greater in a) supply current, b) conversion gain, c) OIP3, or d) OIP2. The parameters monitored for the qualification tests for the VG101 were Supply Current, Gain, OIP3 and Attenuation Range. Failures are defined as any variation of 10% or greater. Acceptance criterion consists of having zero failures out of 45 parts to meet WJ's requirement of LTPD=5 for each test.

2. Pre-Conditioning Level 1

A total of 600 CV210-1F devices from three lots completed Pre-conditioning Level 1 with no electrical failures. All of devices underwent pre- and post- stress scanning acoustic microscope inspection with no failures. The preconditioned devices are used for the following stress tests: Temperature Cycle, Unbiased Autoclave, and Highly Accelerated Temperature and Humidity.

3. Temperature Cycle (TC)



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A total of 135 CV210-1F devices from three lots passed Temperature Cycle with no failures or anomalies.

4. Unbiased Autoclave

A total of 135 CV210-1F devices from three lots passed Unbiased Autoclave with no failures or anomalies.

5. Unbiased High Temperature Storage (HTB)

A total of 80 CV210-3 devices from one lot completed 1000 hours of Unbiased High Temperature Storage with 0 failures.

6. Physical Dimensions

A total of 2 CV210-3 devices completed inspection for physical dimensions with no failures.

7. Solderability

A total of 30 devices (280 pins) CV210-1F devices completed Solderability Testing using lead-free solder (reflow up to 260°C) and leaded solder (reflow up to 245°C) with no failures.

8. Highly Accelerated Temperature and Humidity (HAST)

A total of 135 CV210-1F devices from three lots completed HAST with 0 failures.

9. High Temp Op Life (HTOL)

A total of 240 VG101 devices from three lots passed HTOL with no failures or anomalies.

10. Moisture / Reflow Sensitivity Classification (MSL)

The 28-pin QFN 6X6 mm package is being MSL rated level 2 for the lead-free reflow profile. The parts did pass the MSL level 1 preconditioning, but the conservative level 2 rating ensures proper handling of the parts.

VI. CONCLUSIONS

The Reliability Qualification Data demonstrates that the 28-Pin QFN 6X6 mm package is lead-free/RoHS qualified, and demonstrates high reliability and quality levels. The maximum reflow profile temperature is 260°C, and the MSL rating at this reflow profile is level 2



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