

Reliability Report

Report Title: Wilmington Capping *i*MEMS[®] -
ADXR620

Report Number: 7505

Revision: A

Date: 17 September 2009

Summary

This report documents the successful completion of the reliability qualification requirements for release of the Wilmington Capping Process. The ADXRS620 product in a 32-CBGA package was used as the qualification vehicle. The ADXRS620 is a Capped whitespace version of XRS610.

Table 1: ADXRS620 Product Characteristics

Die/Fab

Maximum Power Dissipation (W)	0.017
Device / Die ID	GC620R10
Die Size (mm)	3.44 x 3.40
Wafer Fabrication Site	I_WILM1B06
Wafer Fabrication Process	iMEMS3
Transistor Count	400
Passivation Layer	doped-oxide/SiN
Bond Pad Metal Composition	AlCu

Package/Assembly

Available Package	32-CBGA
Body Size (mm)	7.00 x 7.00 x 2.70
Lead Pitch (mm)	0.8
Operating Temperature Range	-55°C ≤ TA ≤ +125°C
Assembly Location	Amkor-P
Molding Compound	NA
Wire Type	Aluminum
Wire Diameter (mils)	1.25
Die Attach	Sumioxy 700
Maximum Peak Reflow Temperature (°C)	260

Description / Results of Tests Performed

Tables 2 and 3 provide a description of the qualification tests conducted and the associated test results for products manufactured on the same technologies as described in Table 1. All devices were electrically tested before and after each stress. Any device that did not meet all electrical data sheet limits following stressing would be considered a valid (stress-attributable) failure unless there was conclusive evidence to indicate otherwise.

Table 2: Package Qualification Test Results

Test Name	Specification	Conditions	Device	Package	Lot #	Sample Size	Qty. Failures		
Group D ¹	MIL-STD-883, M5005	Sub 4, MEMS Gyro, Shock/Vib./Cent-10kg/Seal Single Duration	ADXRS620	Amkor-P 32-CBGA	Q7505.1	15	0		
					Q7505.18	15	0		
					Q7505.2	15	0		
				Sub 6, Residual Gas Analysis Single Duration	ADXRS620	Amkor-P 32-CBGA	Q7505.3	15	0
							Q7505.19	3	0
							Q7505.4	3	0
							Q7505.5	3	0
					Q7505.6	3	0		
High Temperature Storage Life (HTSL) ¹	JESD22-A103	150°C 1,000 hours	ADXRS620	Amkor-P 32-CBGA	Q7505.14	77	0		
Mechanical Shock - Powered	IEC 68 Part 2-27 Testgroup Ea	2000g, 5 shock pulses, 0.5ms Single Duration	ADXRS620	Amkor-P 32-CBGA	Q7505.20	10	0		
					Q7505.7	10	0		
					Q7505.8	10	0		
					Q7505.9	10	0		
Random Drop ¹	CAM0091	10 drops from 1.2m Single Duration	ADXRS620	Amkor-P 32-CBGA	Q7505.10	45	0		
					Q7505.12	45	0		
					Q7505.21	45	0		
Solder Heat Resistance (SHR) ^{2,1}	ADI-0049	See Below	ADXRS620	Amkor-P 32-CBGA	Q7505.15	10	0		
					Q7505.16	10	0		
					Q7505.22	10	0		
Temperature Cycling (TC) ^{2,1}	JESD22-A104	-55°C / +125°C 1,000 cycles	ADXRS620	Amkor-P 32-CBGA	Q7505.17	77	0		
					Q7505.23	77	0		
					Q7505.24	77	0		

- 1) Pre- and post-stress electrical test was performed at hot, ambient and cold temperatures.
- 2) These Samples were subjected to preconditioning (per J-STD-020 Level Other) prior to the start of the stress test. Preconditioning consists of the following: Reflow: 3 passes through an oven with a peak temperature of 260°C.

Table 3: Process Qualification Test Results

Test Name	Specification	Conditions	Device	Fab Process	Lot #	Sample Size	Qty. Failures
Early Life Failure Rate (ELFR)	MIL-STD-883, Method 1015	TA = 125°C 48 hours	ADXRS610	iMEMS3	Q7411.10	235	0
					Q7411.11	110	0
					Q7411.12	235	0
					Q7411.13	232	0
					Q7411.14	235	0
					Q7411.15	235	0
					Q7411.24	235	0
					Q7411.25	235	0
					Q7411.27	103	0
High Temperature Operating Life (HTOL) ¹	JESD22-A108	TA = 125°C < Tj < 135°C, Biased 1,000 hours	ADXRS610	iMEMS3	Q7411.8	230	0
					Q7411.9	235	0
					Q7411.16	77	0
					Q7411.17	77	0
					Q7411.18	77	0

- 1) These Samples were subjected to preconditioning prior to the start of the stress test. The preconditioning consisted of Reflow: 3 passes through an oven with a peak temperature of 260°C.
- 2) ELFR tested at room and hot temperatures. HTOL tested at room, hot and cold temperatures.

Samples of the many devices manufactured with these package and process technologies are continuously undergoing reliability evaluation as part of the ADI Reliability Monitor Program. Additional qualification data is available on Analog Devices' web site.

ESD Test Results

The results of ESD testing are summarized in the ESD Results Table. All parts were electrically tested at room and hot temperatures pre- and post-stress. ADI measures ESD results using stringent test procedures based on the specifications listed in Table 4. Any comparison with another supplier's results should ensure that the same ESD test procedures have been used. For further details, please see the EOS/ESD chapter of the ADI Reliability Handbook (available via the 'Quality and Reliability' link at <http://www.analog.com>).

Table 4: ESD Test Results

ESD Model	Package	ESD Test Spec	RC Network	Highest Pass Level	First Fail Level	Class
FICDM ¹	32-CBGA	ANSI/ESD STM5.3.1-1999	1Ω, Cpkg	±250V	±500V	C3
HBM ¹	32-CSP_BGA	ESD Assoc. STM5.1-2007	1.5kΩ, 100pF	±1500V	±2000V	Class 1
MM ¹	32-CSP_BGA	ANSI/ESD STM5.2-1999	0Ω, 200pF	±100V	±200V	M2

- 1) Pre- and post-stress electrical test was performed at ambient and hot temperatures.

Latch-Up Test Results

Six samples of the ADXRS610 were Latch-up tested at $T_a=125^{\circ}\text{C}$ per JEDEC Standard JESD78, Class II, Level A. All six devices passed.

Approvals

Reliability Engineer: Denis Belisle

This report has been approved by electronic means (4.0)

Additional Information

Data sheets and other additional information are available on Analog Devices' web site:

<http://www.analog.com>

Appendix

A: Bond Pull Data

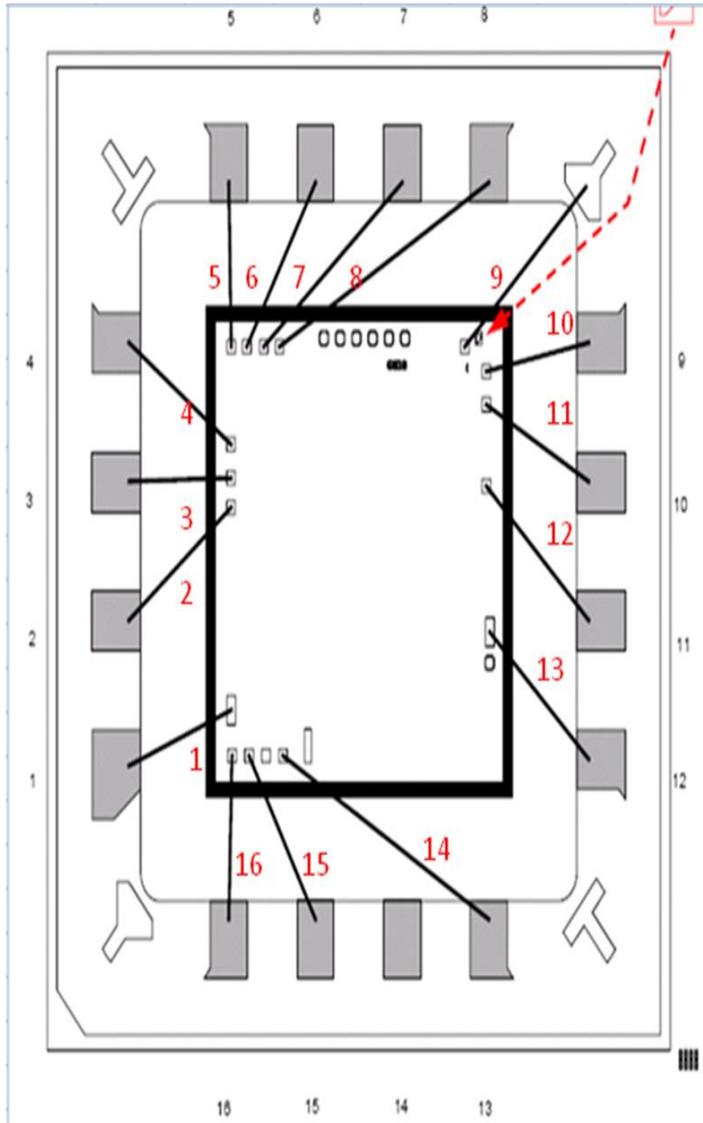
Appendix A: Bond Pull Data

Bond Pull Data Post 1000 Temperature Cycles Minimum Pull Strength after Temperature Cycle > 3 grams

Readings are in GramForce Units.										
ADXRS610 RQ7411.1										
Unit	1		2		3		4		5	
Ball	Pull	Mode								
1	6.90	B	6.65	C	8.35	C	6.10	B	7.90	B
2	5.20	B	6.75	B	7.30	B	6.30	B	9.10	B
3	7.75	C	5.10	B	7.70	B	6.05	B	5.10	B
4	7.00	B	6.20	B	8.30	C	7.60	C	7.10	B
5	7.45	C	5.85	B	7.50	B	6.45	B	4.85	B
6	6.55	B	8.65	D	8.25	C	7.20	B	7.30	B
7	7.35	B	7.25	D	6.55	B	7.60	B	5.95	B
8	6.50	C	5.25	B	7.45	B	8.35	C	6.50	B
9	6.30	C	6.90	B	7.35	B	6.90	B	6.25	B
10	5.55	B	7.55	B	5.95	B	6.10	B	7.20	B
11	6.90	B	6.95	C	7.15	C	7.55	B	8.95	B
12	5.75	B	7.30	B	8.05	B	5.95	B	7.40	C
13	5.40	B	7.85	C	7.40	C	6.95	B	6.35	B
14	6.55	C	6.40	B	6.40	D	8.00	B	6.90	C
15	5.40	B	7.25	B	8.30	C	7.00	C	7.75	B
16	5.50	B	7.70	B	6.40	B	5.50	B	7.70	B
Min	5.20		5.10		5.95		5.50		4.85	
Max	7.75		8.65		8.35		8.35		9.10	
Ave	6.38		6.85		7.40		6.85		7.02	
Stdev	0.82		0.94		0.76		0.82		1.18	

ADXRS610 RQ7411.2										
Unit	1		2		3		4		5	
Ball	Pull	Mode								
1	6.30	B	5.95	B	7.65	B	7.00	B	7.55	B
2	5.85	B	6.85	B	7.10	B	6.90	B	7.30	B
3	6.40	B	4.90	B	7.05	B	5.85	B	6.65	B
4	6.90	B	5.80	B	7.40	B	6.50	B	6.70	B
5	5.90	B	6.10	B	6.75	B	5.40	B	5.80	B
6	5.75	B	6.85	C	6.85	B	6.20	B	5.60	B
7	6.45	B	6.35	B	6.50	B	7.05	C	6.00	B
8	6.70	D	5.55	B	5.65	D	6.02	B	6.10	B
9	7.60	C	6.90	B	6.55	B	7.40	B	7.00	B
10	6.90	B	6.10	B	7.15	B	5.80	B	5.85	B
11	6.35	B	5.85	B	5.60	B	4.80	B	4.05	B
12	5.64	B	5.40	B	5.35	B	4.65	B	5.85	B
13	7.70	C	5.70	B	6.10	B	5.95	B	6.20	B
14	6.55	B	5.85	B	5.25	B	6.40	B	5.40	B
15	6.90	D	6.15	B	6.70	B	5.40	B	6.00	B
16	6.90	B	4.70	B	6.95	B	6.90	B	5.45	B
Min	5.64		4.70		5.25		4.65		4.05	
Max	7.70		6.90		7.65		7.40		7.55	
Ave	6.55		5.94		6.54		6.14		6.09	
Stdev	0.60		0.63		0.74		0.81		0.84	

ADXRS610 RQ7411.3										
Unit	1		2		3		4		5	
Ball	Pull	Mode								
1	4.90	B	6.15	B	6.65	C	5.90	B	6.20	B
2	4.80	B	7.80	D	5.65	B	7.20	B	5.40	B
3	5.25	B	6.20	B	7.05	B	5.30	B	6.00	B
4	5.25	B	6.20	B	5.50	B	5.15	B	5.40	B
5	6.90	B	6.75	B	6.95	C	7.30	B	6.15	B
6	6.90	B	5.85	B	7.50	C	6.45	B	7.75	B
7	6.75	B	5.70	B	6.30	B	6.55	B	6.55	B
8	5.35	B	7.05	B	5.25	B	5.70	D	6.10	B
9	6.50	B	5.65	B	6.50	B	6.35	B	6.20	B
10	5.30	B	4.80	B	5.10	B	5.35	B	7.50	B
11	5.90	B	5.70	B	7.55	C	5.20	B	7.00	C
12	5.00	B	4.70	B	7.25	B	6.25	B	7.00	B
13	5.40	B	5.80	B	7.30	B	7.10	B	5.90	D
14	6.20	B	5.15	D	5.70		6.05	B	6.15	D
15	4.80	B	5.15	B	7.75	C	5.60	B	5.70	B
16	6.15	B	5.55	B	6.45	C	5.55	B	6.30	B
Min	4.80		4.70		5.10		5.15		5.40	
Max	6.90		7.80		7.75		7.30		7.75	
Ave	5.71		5.89		6.53		6.06		6.33	
Stdev	0.76		0.81		0.87		0.72		0.68	



WIRE PULL FAILURE MODES

