

Reliability Report

Report Title: iMEMS3 Wilmington Fab Transfer

Report Number: 7411

Revision: B

Date: 6 April 2009

Summary

This report documents the successful completion of the reliability qualification requirements for release of the iMEMS 3 Wafer Fabrication process at Analog Devices Wilmington Wafer Fabrication Facility. The XRS610 product in a 32-CSP_BGA package was chosen as the qualification vehicle.

iMEMS3 is an integrated BiMOS and MEMS process currently being fabricated at Analog Devices Cambridge Wafer Fabrication facility and being transferred to the Wilmington Wafer Fabrication facility . iMEMS3 features complimentary MOS devices with minimum feature sizes of 3 um, vertical NPN, PNP and lateral PNP bipolar as well as MOSCAPS. The process is rated at 24V. The surface micro-machined structures are composed of 4 um thick polysilicon silicon separated from the patterned polysilicon ground plane by 2 um.

Table 1: XRS610 Product Characteristics

Die/Fab

Maximum Power Dissipation (W)	0.017
Device / Die ID	XRS610
Die Size (mm)	3.30 x 3.30
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-CSP_BGA
Body Size (mm)	7.00 x 7.00 x 2.70
Solder Ball Pitch (mm)	0.8
Solder Ball Diameter (mm)	0.5
Assembly Location	Amkor-P
Wire Type	Aluminum
Wire Diameter (mils)	1.25
Die Attach	IS700
Substrate Laminate Supplier	Kyocera
Moisture Sensitivity Level	1
Maximum Peak Reflow Temperature (°C)	260°C

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	MIL-STD-883, M5005	Sub 4, Shock/Vib./Cent./Seal Single Duration	XRS610	Amkor-P 32-CSP_BGA	Q7411.20	42	0
				Amkor-P 32-CSP_BGA	Q7411.21	42	0
				Amkor-P 32-CSP_BGA	Q7411.22	42	0
High Temperature Storage Life (HTSL)	JESD22-A103	150°C 1,000 hours	XRS610	Amkor-P 32-CSP_BGA	Q7411.7	77	0
Mechanical Shock - Powered	IEC 68 Part 2-27 Testgroup Ea	2000g, 5 shock pulses, 0.5ms Single Duration	XRS610	Amkor-P 32-CSP_BGA	Q7411.29	10	0
					Q7411.30	10	0
					Q7411.31	10	0
Random Drop	CAM0091	5 drops from 1.2m Single Duration	XRS610	Amkor-P 32-CSP_BGA	Q7411.18	24	0
Temperature Cycling (TC) ²	JESD22-A104	-55°C / +125°C 1,000 cycles	XRS610	Amkor-P 32-CSP_BGA	Q7411.01	77	0
					Q7411.02	77	0
					Q7411.03	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) Complete Post Temperature Cycle Bond Pull results are presented in Appendix A of this report.
- 3) HTSL, TC, tested at Room and Hot Temperatures. Group D, Mech Shock Powered and Random Drop tested at Room Temperature.

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 125°C 48 hours	XRS610	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 125°C < Tj < 135°C, Biased 1,000 hours	XRS610	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-CSP_BGA	ANSI/ESD STM5.3.1-1999	1Ω, Cpkg	±250V	±500V	C3
HBM	32-CSP_BGA	ESD Assoc. STM5.1-2007	1.5kΩ, 100pF	±1500V	±2000V	Class 1
MM	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 XRS610 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>

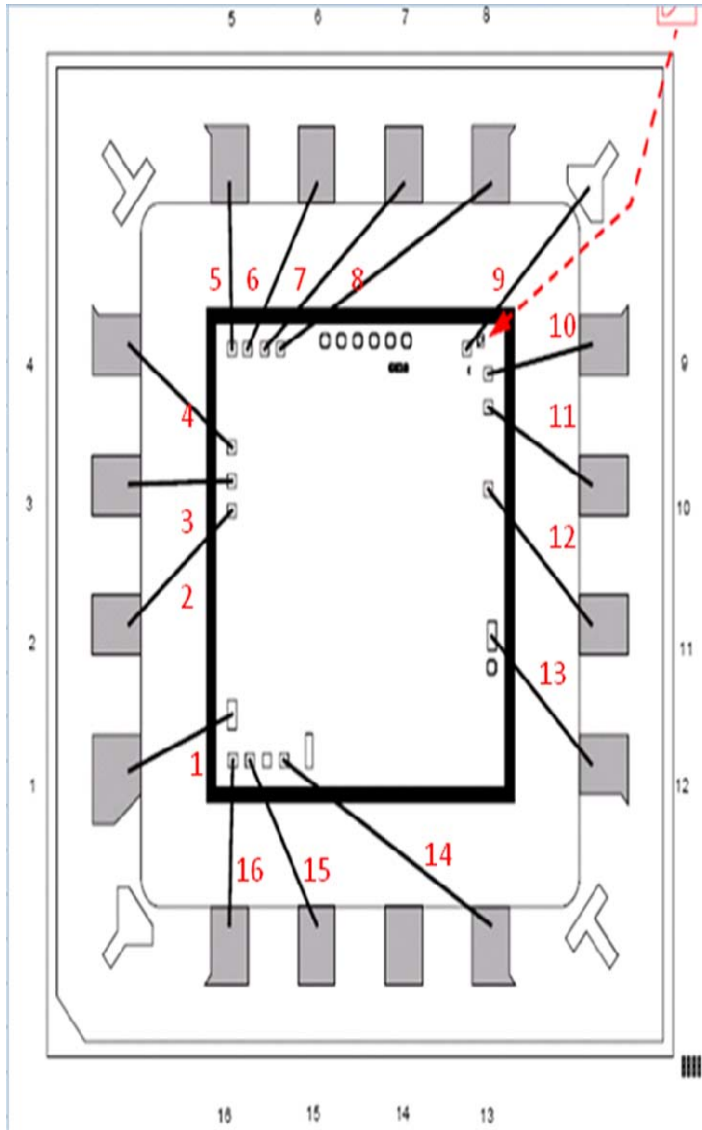
Appendix A: Bond Pull Data

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	Pull	Mode	Pull	Mode	Pull	Mode	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	Pull	Mode	Pull	Mode	Pull	Mode	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	Pull	Mode	Pull	Mode	Pull	Mode	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

