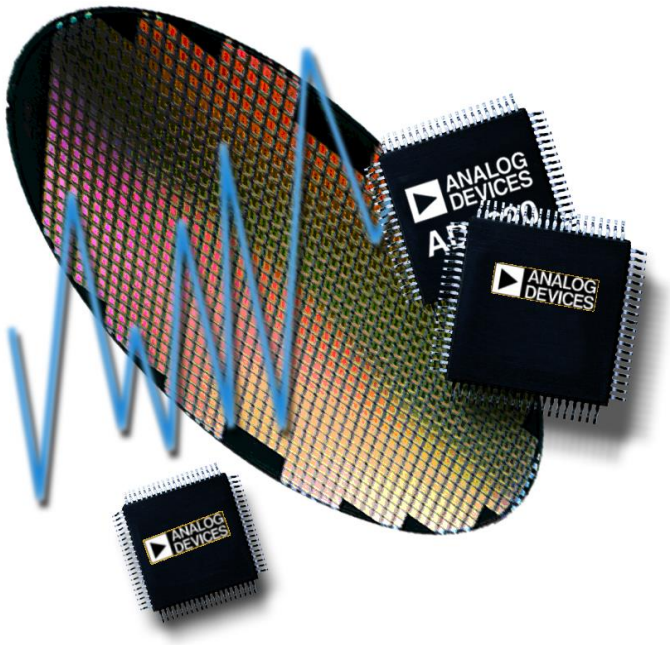

Reliability Report

Report Title: ADXL345 Sensor Fab Site Transfer from TSMC to ADWL Qualification

Report Number: 20368

Revision: A

Date: 13 April 2023

Summary

This report documents the successful completion of the reliability qualification requirements for the release of the ADXL345 product in 14-LGA package with XC312A Wilmington only flow MEMS sensor. The ADXL345 is an ultralow power 3 Axis Low g accelerometer with digital output.

Substitution data was used as applicable where equivalent sensor structures were previously qualified on the Wilmington full flow or where the cap seal dimensions were the same

Die/Fab Product Characteristics

Table 1.1: Die/Fab Product Characteristics- 0.35µm CMOS

Product Characteristics	Product(s) to be qualified
Generic/Root Part #	ADXL345
Die Id	TMAF24 A_T1 / XA345D
Die Size (mm)	2.25 x 1.45
Wafer Fabrication Site	TSMC Fab-11
Wafer Fabrication Process	0.35µm CMOS
Approximate Transistor Count	80,200
Die Substrate	Si
Metallization / # Layers	AlCu / 3
Polyimide	No
Passivation	undoped-oxide/SiN

Table 1.2: Die/Fab Product Characteristics- MEMS

Product Characteristics	Product(s) to be qualified	Product(s) used for Substitution Data	
Generic/Root Part #	ADXL345	ADXL313	ADXL335
Die Id	XC312A	XC365	TC335B 1
Die Size (mm)	1.29 x 1.52	1.29 x 1.52	1.29 x 1.52
Wafer Fabrication Site	ADI-Wilmington	ADI-Wilmington	TSMC Fab-2b
Wafer Fabrication Process	MEMS	MEMS	MEMS
Die Substrate	Si	Si	Si
Polyimide	No	No	No
Passivation	doped-oxide/SiN	doped-oxide/SiN	doped-oxide/SiN

Table 1.3: Die/Fab Product Characteristics- MEMS Cap

Product Characteristics	Product(s) to be qualified	Product(s) used for Substitution Data	
Generic/Root Part #	ADXL345	ADXL313	ADXL335
Die Id	C345B	C313	ADXL335CAP
Die Size (mm)	1.29 x 1.52	1.29 x 1.52	1.29 x 1.52
Wafer Fabrication Site	ADI-Wilmington	ADI-Wilmington	ADI-Wilmington
Wafer Fabrication Process	MEMS cap	MEMS Cap	MEMS Cap
Die Substrate	Si	Si	Si
Polyimide	No	No	No
Passivation	None	None	None

Die/Fab Test Results

Table 2.1: Die/Fab Test Results – MEMS at ADI-Wilmington

Test Name	Specification	Conditions	Device	Lot #	Fail/SS
Group D [2]	MIL-STD-883, M5005	Sub 4, Shock/Vib./Cent., Single Duration	ADXL313	Q10157.DG1	0/39
				Q10157.DG2	0/39
				Q10157.DG3	0/39
Mechanical Shock Powered[2]	IEC 68 Part 2-27 Testgroup Ea	10,000g, 5 Shock Pulses, 0.5ms, Single Duration	ADXL313	Q10157.PM1	0/10
				Q10157.PM2	0/10
				Q10157.PM3	0/10
Random Drop [2]	AEC-Q100 Test G5	10 drops from 1.2m Single Duration	ADXL313	Q10157.RD1	0/25
				Q10157.RD2	0/25
				Q10157.RD3	0/25
Autoclave (AC)[1]	JESD22-A102	121°C, 100%RH, 2atm, 96 Hours	ADXL335	Q8304.1	0/77
				Q8304.2	0/77
				Q8304.4	0/77
Temperature Cycling (TC)[1]	JESD22-A104	-55°C/+125°C, 1,000 Cycles	ADXL335	Q9169.TC1	0/77
				Q9169.TC2	0/77
				Q9169.TC3	0/77
				Q9169.TC4	0/77

[1] These samples were subjected to preconditioning (per J-STD-020 Level 3) prior to the start of the stress test. Level 3 preconditioning consists of the following: Bake: 24 hrs @ 125°C, Unbiased Soak: 192 hrs @ 30°C, 60%RH, Reflow: 3 passes through an oven with a peak temperature of 260°C.

[2] Electrical test was performed at room temperature.

Table 3: Die/Fab Test Results – 0.35µm CMOS at TSMC Fab-11

Test Name	Specification	Conditions	Device	Lot #	Fail/SS
Early Life Failure Rate (ELFR)	MIL-STD-883, Method 1015	150°C, 48 Hours	ADXL345	Q8378.14	0/320
				Q8378.15	0/320
				Q8378.16	0/160
				Q8378.19	0/160
				Q8378.20	0/320
				Q8378.21	0/320
				Q8378.22	0/160
Highly Accelerated Temperature and Humidity Stress Test (HAST) [1]	JESD22-A110	130°C, 85%RH, 2atm, Biased, 96 Hours	ADXL345	Q9681.10	0/77
				Q9681.11	0/77
				Q9681.12	0/77
High Temperature Storage Life (HTSL)	JESD22-A103	150°C, 1,000 Hours	ADXL345	Q9681.19	0/77
				Q9681.20	0/77
				Q9681.21	0/77
				Q9681.31	0/77
				Q9681.32	0/77
High Temperature Operating Life (HTOL) [1]	JESD22-A108	Ta=150C, Biased, 500 Hours	ADXL345	Q9681.1	0/77
				Q9681.2	0/77
				Q9681.3	0/77

[1] These samples were subjected to preconditioning (per J-STD-020 Level 3) prior to the start of the stress test. Level 3 preconditioning consists of the following: Bake: 24 hrs @ 125°C, Unbiased Soak: 192 hrs @ 30°C, 60%RH, Reflow: 3 passes through an oven with a peak temperature of 260°C.

Package/Assembly Product Characteristics

Table 4: Package/Assembly Product Characteristics - 14-LGA at AMKOR (AP3)

Product Characteristics	Product(s) to be qualified
Generic/Root Part #	ADXL345
Package	14-LGA
Body Size (mm)	3.00 x 5.00 x 0.95
Assembly Location	AMKOR (AP3)
MSL/Peak Reflow Temperature(°C)	3 / 260
Mold Compound	Sumitomo G770
Die Attach/Underfill/TIM	Ablestik 2300 / N/A
Leadframe Material	BT Resin / HL-832NX-A
Lead Finish	Au
Wire Bond Material/Diameter (mils)	Tanaka GPG 2N Gold / 1.00

Package/Assembly Test Results

Table 5: Package/Assembly Test Results - 14-LGA at AMKOR (AP3)

Test Name	Specification	Conditions	Device	Lot #	Fail/SS
Unbiased HAST (UHST) [1]	JESD22-A118	130°C, 85%RH, 2atm, 96 Hours	ADXL345	Q9681.13	0/77
				Q9681.14	0/77
				Q9681.15	0/77
Group D	MIL-STD-883, M5005	Sub 4, Shock/Vib./Cent./Seal, Single Duration	ADXL345	Q9327.13	0/20
				Q9327.14	0/20
				Q9327.15	0/20
Random Drop	CAM0091	10 drops from 1.2m, Single Duration	ADXL345	Q9681.25	0/35
				Q9681.26	0/35
				Q9681.27	0/35
Highly Accelerated Temperature and Humidity Stress Test (HAST)[1]	JESD22-A110	130°C, 85%RH, 2atm, Biased, 96 Hours	ADXL345	Q9681.10	0/77
				Q9681.11	0/77
				Q9681.12	0/77
Temperature Cycling (TC)[1]	JESD22-A104	-65°C/+150°C, 500 Cycles	ADXL345	Q9681.7	0/77
				Q9681.8	0/77
				Q9681.9	0/77
Temperature Cycling (TC)[1]	JESD22-A104	-65°C/+150°C, 1000 Cycles, 1 Cycle per Hour	ADXL345	Q9681.4	0/77
				Q9681.5	0/77
				Q9681.6	0/77
Solder Heat Resistance (SHR)[1]	ADI-0049	MSL-3	ADXL345	Q9327.16	0/11
				Q9327.17	0/11
				Q9327.23	0/11
High Temperature Storage Life (HTSL)	JESD22-A103	150°C, 1,000 Hours	ADXL345	Q9681.19	0/77
				Q9681.20	0/77
				Q9681.21	0/77
				Q9681.31	0/77
				Q9681.32	0/77

[1] These samples were subjected to preconditioning (per J-STD-020 Level 3) prior to the start of the stress test. Level 3 preconditioning consists of the following: Bake: 24 hrs @ 125°C, Unbiased Soak: 192 hrs @ 30°C, 60%RH, Reflow: 3 passes through an oven with a peak temperature of 260°C.

ESD Test Results

The results of Human Body Model (HBM), Machine Model (MM), and Field-Induced Charged Device Model (FICDM) ESD testing are summarized in Table 6. ADI measures ESD results using stringent test procedures based on the specifications listed. 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 on Analog Devices' web site).

Table 6: ADXL345 ESD Test Results

ESD Model	Package	ESD Test Spec	RC Network	Highest Pass Level	First Fail Level	Class
FICDM	14-LGA	ANSI/ESD STM5.3.1-1999	1Ω, Cpkg	±1500V	NA	NA
		JESD22-C101		±1500V	NA	IV
HBM	14-LGA	ANSI/ESD STM5.1-2007	1.5kΩ, 100pF	±2000V	NA	NA
		ESDA/JEDEC JS-001-2011		±2000V	NA	2
MM	14-LGA	ANSI/ESD STM5.2-1999	0Ω, 200pF	±200V	NA	M3
		JESD22-A115		±200V	NA	NA

Approvals

Reliability Engineer: Michael Walornyj

Additional Information

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