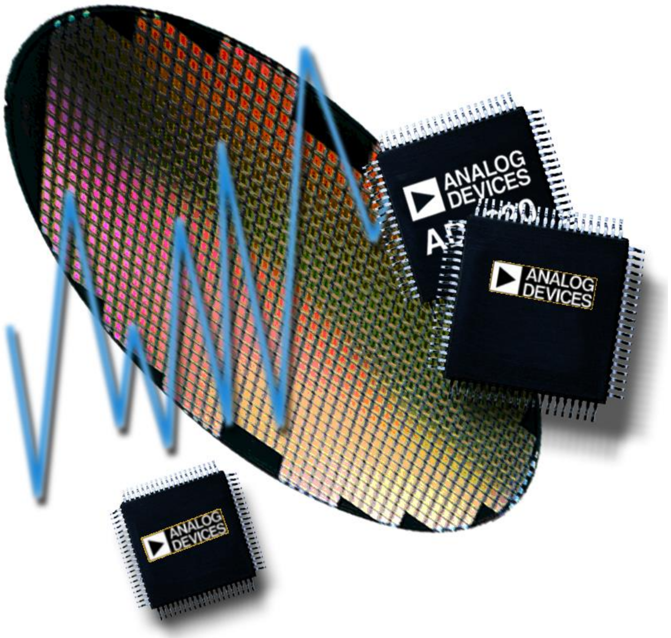

Reliability Report

Report Title: **ADXL350 Sensor Fab Site Transfer from TSMC to ADWL Qualification**

Report Number: **20049**

Revision: **A**

Date: **10 February 2023**

Summary

This report documents the successful completion of the reliability qualification requirements for the release of the ADXL350 product in a 16-LGA_CAV package with XC350 Wilmington only flow MEMS sensor. The ADXL350 is a high performance small, thin, low power, 3-axis accelerometer with high resolution (13-bit) and selectable measurement ranges up to ±8g.

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- 0.35um CMOS

Product Characteristics	Product(s) to be qualified
Generic/Root Part #	ADXL350
Die Id	TMAF24 A_T1 / XA345D
Die Size (mm)	2.25 x 1.40
Wafer Fabrication Site	TSMC Fab-11
Wafer Fabrication Process	0.35um CMOS
Die Substrate	Si
Approximate Transistor Count	80,200
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 #	ADXL350	ADXL375	AD22365	ADXL313
Die Id	XC350 1	XC377 0	XC365 5	XC313 1
Die Size (mm)	1.155 x 1.34	1.155 x 1.34	1.29 x 1.515	1.29 x 1.515
Wafer Fabrication Site	ADI-Wilmington	ADI-Wilmington	ADI-Wilmington	ADI-Wilmington
Wafer Fabrication Process	MEMS	MEMS	MEMS	MEMS
Die Substrate	Si	Si	Si	Si
Metallization / # Layers	AlCu / 1	AlCu / 1	AlCu / 1	AlCu / 1
Polyimide	No	No	No	No
Passivation	None	None	None	None

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 #	ADXL350	ADXL375	AD22365	ADXL313
Die Id	C350	C345C	C365	C313
Die Size (mm)	1.155 x 1.34	1.155 x 1.34	1.29 x 1.515	1.29 x 1.515
Wafer Fabrication Site	ADI-Wilmington	ADI-Wilmington	ADI-Wilmington	ADI-Wilmington
Wafer Fabrication Process	MEMS	MEMS	MEMS	MEMS
Die Substrate	Si	Si	Si	Si
Polyimide	No	No	No	No
Passivation	None	None	None	None

Die/Fab Test Results

Table 2: Die/Fab Test Results – MEMS at ADI-Wilmington

Test Name	Spec	Conditions	Generic/Root Part #	Lot #	Fail/SS
Group D	MIL-STD-883, M5005	Sub 4, MEMS XL, Shock/Vib./Cent-30kg/Seal	AD22365	Q8641.22	0/20
				Q8641.23	0/20
				Q8641.24	0/20
		Sub 4, Shock/Vib/Cent., Single Duration	ADXL313	Q10262.GD1	0/39
				Q10157.GD1	0/39
				Q10157.GD2	0/39
				Q10157.GD3	0/39
Mechanical Shock - Powered	IEC 60068-2-27	2,000g, 5 Shock Pulses, 0.5ms, Single Duration	AD22365	Q19470.1.3	0/20
				Q19470.2.3	0/20
				Q19470.3.3	0/20
		10,000g, 5 Shock Pulses, 0.1ms, Single Duration	AD22365	Q8641.43	0/10
				Q8641.44	0/10
				Q8641.45	0/10
				Q17046.1.3	0/32
			ADXL313	Q17046.1.4	0/32
				Q17046.2.2	0/32
				Q10157.PM1	0/10
				Q10157.PM2	0/10
				Q10157.PM3	0/10
Mechanical Shock – Un-Powered	IEC 60068-2-27	2,000g, 5 Shock Pulses, 0.5ms, Single Duration	AD22365	Q19470.1.4	0/15
				Q19470.2.4	0/15
				Q19470.3.4	0/15
		10,000g, 5 Shock Pulses, 0.1ms, Single Duration	AD22365	Q17046.1.6	0/32
			ADXL313	Q17046.1.5	0/32
				Q17046.2.3	0/32
Random Drop	AEC-Q100 Test G5	10 drops from 1.2m, Single Duration	AD22365	Q8641.40	0/35
				Q8641.41	0/35
				Q8641.42	0/35
			ADXL313	Q10262.RD1	0/25
				Q10157.RD1	0/25
				Q10157.RD2	0/25
				Q10157.RD3	0/25
Temperature Cycling (TC)[1]	JESD22-A104	-65°C/+150°C, 1,000 Cycles	ADXL375	Q19936.TC1	0/77
				Q19936.TC2	0/77
				Q19936.TC3	0/77
Unbiased HAST (UHST)[1]	JESD22-A118	110C 85%RH 17.7 psia, P264	ADXL375	Q19936.UH1	0/77
				Q19936.UH2	0/77
				Q19936.UH3	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.

Table 3: Die/Fab Test Results – MEMS Cap at ADI-Wilmington

Test Name	Spec	Conditions	Generic/Root Part #	Lot #	Fail/SS
Temperature Cycling (TC)[1]	JESD22-A104	-65°C/+150°C, 1,000 Cycles	ADXL375	Q19936.TC1	0/77
				Q19936.TC2	0/77
				Q19936.TC3	0/77
Unbiased HAST (UHST)[1]	JESD22-A118	110C 85%RH 17.7 psia, P264	ADXL375	Q19936.UH1	0/77
				Q19936.UH2	0/77
				Q19936.UH3	0/77

Table 4: Die/Fab Test Results – 0.35um CMOS at TSMC Fab-11

Test Name	Spec	Conditions	Generic/Root Part #	Lot #	Fail/SS
High Temperature Storage Life (HTSL)	JESD22-A103	150°C, 1,000 Hours	ADXL350	Q9692.10	0/77
				Q9692.11	0/77
				Q9692.12	0/77
High Temperature Operating Life (HTOL) [1]	JESD22-A108	125°C<Tj<135°C, Biased, 1,000 Hours	ADXL350	Q9572.1	0/77
				Q9572.2	0/77
				Q9572.3	0/77
Highly Accelerated Temperature and Humidity Stress Test (HAST) [1]	JESD22-A110	130°C, 85%RH, 2atm, Biased, 96 Hours	ADXL350	Q9692.1	0/77
				Q9692.2	0/77
				Q9692.3	0/77
Early Life Failure Rate (ELFR)	MIL-STD-883, M1015	125°C, 48 Hours	ADXL345	Q10844.62	0/2010
				Q10554	0/1750
				Q10206	0/2210

[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 5: Package/Assembly Product Characteristics - 16-LGA_CAV at AMKOR (AP3)

Product Characteristics	Product(s) to be qualified
Generic/Root Part #	ADXL350
Package	16-LGA_CAV
Body Size (mm)	4.00 x 3.00 x 1.2
Assembly Location	AMKOR (AP3)
MSL/Peak Reflow Temperature(°C)	3 / 260°C
Mold Compound	N/A
Die Attach/Underfill	Dow Corning 7920 non-conductive / N/A
Leadframe Material	BT Resin
Lead Finish	Au
Wire Bond Material/Diameter (mils)	Tanaka GPG 2N Gold / 1.00

Package/Assembly Test Results

Table 6: Package/Assembly Test Results – LGA at AMKOR (AP3)

Test Name	Spec	Conditions	Generic/Root Part #	Lot #	Fail/SS
Group D	MIL-STD-883, M5005	Sub 4, Shock/Vib./Cent., Single Duration	ADXL350	Q9692.13	0/20
				Q9692.14	0/20
				Q9692.15	0/20
Random Drop	CAM0091	10 drops from 1.2m, Single Duration	ADXL350	Q9080.31	0/10
				Q9080.32	0/10
				Q9080.33	0/10
Temperature Cycling (TC)[1]	JESD22-A104	-65°C/+150°C, 500 Cycles	ADXL350	Q9692.4	0/77
				Q9692.5	0/77
				Q9692.6	0/77
Unbiased HAST (UHST)[1]	JESD22-A118	130C 85%RH, 2atm, 96 Hours	ADXL350	Q9692.7	0/77
				Q9692.8	0/77
				Q9692.9	0/77
High Temperature Storage Life (HTSL)	JESD22-A103	150°C, 1,000 Hours	ADXL350	Q9692.10	0/77
				Q9692.11	0/77
				Q9692.12	0/77
Highly Accelerated Temperature and Humidity Stress Test (HAST)[1]	JESD22-A110	130°C, 85%RH, 2atm, Biased, 96 Hours	ADXL350	Q9692.1	0/77
				Q9692.2	0/77
				Q9692.3	0/77
Solder Heat Resistance (SHR)[1]	ADI-0049	MSL-3	ADXL350	Q9692.16	0/11
				Q9692.17	0/11
				Q9692.18	0/11

[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 7. 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 7: ADXL350 ESD Test Results

ESD Model	Package	ESD Test Spec	RC Network	Highest Pass Level	First Fail Level	Class
FICDM	16-LGA_CAV	JESD22-C101	1Ω, Cpkg	±750V	±1000V	III
HBM	16-LGA_CAV	ESDA/JEDEC JS-001-2011	1.5kΩ, 100pF	±2000V	NA	2
MM	16-LGA_CAV	JESD22-A115	0Ω, 200pF	±200V	NA	NA

Latch-Up Test Results

Six samples of the ADXL350 were latch-up tested at T_A=25°C per JEDEC Standard JESD78, Class I, Level A. All samples passed.

Approvals

Reliability Engineer: Michael Walornyj