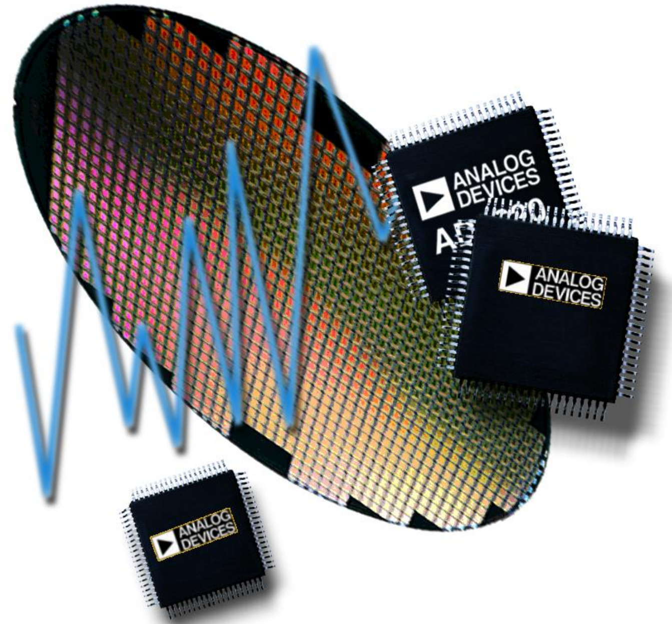

Reliability Report

Report Title: ADXL367 Sensor Die Transfer to Wilmington Qualification

Report Number: 20409

Revision: A

Date: 23 October 2023

Summary

This report documents the successful completion of the reliability qualification requirements for the release of the ADXL367 product in a 12-LGA package with XM367 Wilmington only flow MEMS sensor. The ADXL367 is an ultralow power, 3-axis microelectromechanical systems (MEMS) accelerometer with measurement ranges of ±2 g, ±4 g, and ±8 g.

Die/Fab Product Characteristics

Table 1.1: Die/Fab Product Characteristics- 0.18um CMOS

Product Characteristics	Product(s) to be qualified	Product(s) used for Substitution Data			
Generic/Root Part #	ADXL367	ADP1762	ADPD1080	ADXL351	ADXL367
Die Id	XA367B / TMMZ70 A	TMHJ03/A	TMJI34/A-T1	TMLB22 A	XA367B / TMMZ70 A
Die Size (mm)	1.79 x 1.63	1.00 x 1.51	1.44 x 2.50	2.87 x 2.58	1.79 x 1.63
Wafer Fabrication Site	TSMC Fab-11	TSMC Fab-11	TSMC Fab-11	TSMC Fab-11	TSMC Fab-11
Wafer Fabrication Process	0.18um CMOS	0.18um CMOS	0.18um CMOS	0.18um CMOS	0.18um CMOS
Die Substrate	Si	Si	Si	Si	Si
Metallization / # Layers	AlCu(0.5%)/5	AlCu/5	AlCu/5	AlCu(0.5%)/5	AlCu(0.5%)/5
Polyimide	No	No	Yes	No	No
Passivation	undoped-oxide/SiN	undoped-oxide/SiN	undoped-oxide/SiN	undoped-oxide/SiN	undoped-oxide/SiN

Table 1.2: Die/Fab Product Characteristics- MEMS

Product Characteristics	Product(s) to be qualified
Generic/Root Part #	ADXL367
Die Id	XM367
Die Size (mm)	1.33 x 1.26
Wafer Fabrication Site	ADI-Wilmington
Wafer Fabrication Process	MEMS
Die Substrate	Si
Metallization / # Layers	AlCu(0.5%)/1
Polyimide	No
Passivation	None

Die/Fab Test Results

Table 2.1: Die/Fab Test Results - 0.18um CMOS at TSMC Fab-11

Test Name	Spec	Conditions	Generic/Root Part #	Lot #	Fail/SS
Early Life Failure Rate (ELFR)[1]	AEC-Q100-008	Ta=125°C, 24 Hours	ADXL351	Q14372	0/2400
		Ta=125°C, 48 Hours	ADP1762	Q14221	0/2400
			ADPD1080	Q13298	0/2400
High Temperature Operating Life (HTOL)[2,3]	JESD22-A108	Ta=100°C, 1,000 Hours	ADXL367	Q18608.1.1	0/77
				Q18608.2.1	0/77
				Q18608.3.1	0/77

[1] Pre- and post-stress electrical test was performed at room and hot temperatures.
[2] Pre- and post-stress electrical test was performed at room temperature.
[3] 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, Soak: Unbiased Soak: 192 hrs @ 30°C, 60%RH, Reflow: 3 passes through an oven with a peak temperature of 260°C.

Table 2.2: Die/Fab Test Results - MEMS at ADI-Wilmington

Test Name	Spec	Conditions	Generic/Root Part #	Lot #	Fail/SS
Mechanical Sequence[2,5]	MIL-STD-883, M5005, M2007 Group D, Sub Group 4	Shock 1500g, Vibration 50g	ADXL367	Q20409.1.GDBM1_RES	0/39
				Q20409.2.GDBM2_RES	0/39
				Q20409.3.GDBM3_RES	0/39
Mechanical Sequence[3,5]	MIL-STD-883, M2001 Group D, Sub Group 4	Centrifuge 30kg	ADXL367	Q20409.1.GDLP1_RES	0/39
				Q20409.2.GDLP2_RES	0/39
				Q20409.3.GDLP3_RES	0/39
Guided Drop[5]	IEC 60068-2-32	1 x 6 axes, 1.2m drop, concrete, Single Duration	ADXL367	Q20409.1.GU1_RES	0/20
				Q20409.2.GU2_RES	0/20
				Q20409.3.GU3_RES	0/20
Mechanical Shock - Powered[5]	IEC 60068-2-27	10000g ,0.1ms, 5 shock pulses, Single Duration	ADXL367	Q20409.1.MS1_RES	0/32
				Q20409.2.MS2_RES	0/32
				Q20409.3.MS3_RES	0/32
Temperature Cycling (TC)[4,5]	JESD22-A104	-65ºC/+150ºC 500 Cycles	ADXL367	Q20409.1.TC1_RES	0/77
				Q20409.2.TC2_RES	0/77
				Q20409.3.TC3_RES	0/77
Unbiased Highly Accelerated Stress (UHAST)[4,5]	JESD22-A118	130ºC, 85%RH, 2 atm, Unbiased, 96 Hours	ADXL367	Q20409.1.UH1_RES	0/77
				Q20409.2.UH2_RES	0/77
				Q20409.3.UH3_RES	0/77

[1] Pre- and post-stress electrical test was performed at room and hot temperatures.
[2] Samples were board mounted to a 16-channel board for the stress test.
[3] Stress test conducted on loose parts.
[4] 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, Soak: Unbiased Soak: 192 hrs @ 30°C, 60%RH, Reflow: 3 passes through an oven with a peak temperature of 260°C.
[5] Pre- and post-stress electrical test was performed at room temperature.

Package/Assembly Product Characteristics

Table 3.1: Package/Assembly Product Characteristics - 12-LGA at ASE (AEK)

Product Characteristics	Product(s) to be qualified
Generic/Root Part #	ADXL367
Package	12-LGA
Body Size (mm)	2.20 x 2.30 x 0.87
Assembly Location	ASE (AEK)
MSL/Peak Reflow Temperature(°C)	3 / 260°C
Mold Compound	Nitto GE 100LFCS
Die Attach/Underfill	Lintec LE5000 film non-conductive / NA
Leadframe Material	BT
Lead Finish	Au
Wire Bond Material/Diameter (mils)	PdCuAu 4N / 0.70

Package/Assembly Test Results

Table 3.2: Package/Assembly Test Results - 12-LGA at ASE (AEK)

Test Name	Spec	Conditions	Generic/Root Part #	Lot #	Fail/SS
Mechanical Sequence[2,5]	MIL-STD-883, M5005, M2007 Group D, Sub Group 4	Shock 1500g, Vibration 50g	ADXL367	Q20409.1.GDBM1_RES	0/39
				Q20409.2.GDBM2_RES	0/39
				Q20409.3.GDBM3_RES	0/39
Mechanical Sequence[3,5]	MIL-STD-883, M2001 Group D, Sub Group 4	Centrifuge 30kg	ADXL367	Q20409.1.GDLP1_RES	0/39
				Q20409.2.GDLP2_RES	0/39
				Q20409.3.GDLP3_RES	0/39
Guided Drop[5]	IEC 60068-2-32	1 x 6 axes, 1.2m drop, concrete, Single Duration	ADXL367	Q20409.1.GU1_RES	0/20
				Q20409.2.GU2_RES	0/20
				Q20409.3.GU3_RES	0/20
High Temperature Storage (HTSL)[5]	JESD22-A103	150ºC 1,000 Hours	ADXL367	Q20409.1.HS1_RES	0/77
				Q20409.2.HS2_RES	0/77
				Q20409.3.HS3_RES	0/77
Temperature Cycling (TC)[4,5]	JESD22-A104	-65ºC/+150ºC 500 Cycles	ADXL367	Q20409.1.TC1_RES	0/77
				Q20409.2.TC2_RES	0/77
				Q20409.3.TC3_RES	0/77
Highly Accelerated Temperature and Humidity Stress Test (HAST)[4,5]	JESD22-A110	130ºC, 85%RH, 2 atm, Biased, 96 Hours	ADXL367	Q20409.1.HA1_RES	0/77
				Q20409.2.HA2_RES	0/77
				Q20409.3.HA3_RES	0/77
Unbiased Highly Accelerated Stress (UHAST)[4,5]	JESD22-A118	130ºC, 85%RH, 2 atm, Unbiased, 96 Hours	ADXL367	Q20409.1.UH1_RES	0/77
				Q20409.2.UH2_RES	0/77
				Q20409.3.UH3_RES	0/77

[1] Pre- and post-stress electrical test was performed at room and hot temperatures.

[2] Samples were board mounted to a 16-channel board for the stress test.

[3] Stress test conducted on loose parts.

[4] 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, Soak: Unbiased Soak: 192 hrs @ 30°C, 60%RH, Reflow: 3 passes through an oven with a peak temperature of 260°C.

[5] Pre- and post-stress electrical test was performed at room temperature.

ESD Test Results

The results of Human Body Model (HBM) and Field-Induced Charged Device Model (FICDM) ESD testing are summarized in Table 4. 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 4: ADXL367 ESD Test Results

ESD Model	Package	ESD Test Spec	RC Network	Highest Pass Level	First Fail Level	Class
FICDM	12-LGA	JS-002	1Ω, Cpkg	±1250V	NA	C3
HBM	12-LGA	ESDA/JEDEC JS-001	1.5kΩ, 100pF	±2000V	±2500V	2

Latch-Up Test Results

Three samples of the ADXL367 were latch-up tested at T_A=25°C per JEDEC Standard JESD78, Class I. All pins passed.

Passing Positive Current	Passing Negative Current	Passing Over-Voltage
+200mA	-200mA	+5.25V

Approvals

Reliability Engineer: Michael Walornyj