



Reliability Report

Report Title: Qualification of 0.18 μ m CMOS Wafer
Fabrication at ADI Beaverton Fab

Report Number: 21963

Revision: B

Date: 29 April 2024

Summary

This report documents the reliability qualification requirements for the release of the 0.18 μ m CMOS Wafer Fabrication Process in Analog Devices Beaverton, Oregon (ADBN) Wafer Fabrication Facility.

The products listed below were selected to qualify the technology being released.

- The AD8283 product is a 6-channel low noise preamplifier (LNA) with a programmable gain amplifier (PGA) and anti-aliasing filter (AAF) plus one direct-to-ADC channel, all integrated with a single 14-bit analog-to-digital converter (ADC), packaged in a 72 lead LFCSP. The AD8283 is qualified to AEC-Q100 Grade 2.
- The ADV7392 product is 10-Bit SD/HD Video Encoder packaged in a 40 lead LFCSP and is qualified to AEC-Q100 Grade 2.
- The ADDR9501 product is a complete satellite digital audio radio services (SDARS) RF front-end solution, providing a complete 12.5 MHz SDARS frequency translation to a baseband signal using a single RF branch. The ADDR9501 is packaged in a 48 lead LFCSP and is qualified to AEC-Q100 Grade 2.
- The MAX11390 product is a 24-bit, 6-channel, Delta-Sigma ADC packaged in a 6 x 6 bump array with 0.4mm bump pitch WLCSF.

AECQ100 Qualification Test Methods and Summary

AEC Test Group	AEC Stress Test Name	Abbreviation	AEC Test#	Reference
Group A ACCELERATED ENVIRONMENT STRESS TESTS	Preconditioning	PC	A1	Table 2 , and Table 4
	Temperature Humidity Bias or Biased-HAST	THB or HAST	A2	
	Autoclave or Unbiased HAST or Temperature Humidity (without Bias)	AC, UHST, or TH	A3	
	Temperature Cycle	TC	A4	
	Power Temperature Cycling	PTC	A5	
	High Temperature Storage Life	HTSL	A6	
Group B ACCELERATED LIFETIME SIMULATION TESTS	High Temperature Operating Life	HTOL	B1	Table 2 , and Table 4
	Early Life Failure Rate	ELFR	B2	
	NVM Endurance, Data Retention, and Operational Life	EDR	B3	
Group C PACKAGE ASSEMBLY INTEGRITY TESTS	Wire Bond Shear	WBS	C1	<ul style="list-style-type: none"> • Test C2 (and C1 for Cu Wire) are shown in Table 4. • Tests C3-6 are qualified and controlled with inline monitors and may be viewed on-site at Analog Devices.
	Wire Bond Pull Strength	WBP	C2	
	Solderability	SD	C3	
	Physical Dimensions	PD	C4	
	Solder Ball Shear	SBS	C5	
	Lead Integrity	LI	C6	
Group D DIE FABRICATION RELIABILITY TESTS	Electromigration	EM	D1	Die Fabrication Reliability data may be viewed on-site at Analog Devices.
	Time Dependent Dielectric Breakdown	TDDDB	D2	
	Hot Carrier Injection	HCI	D3	
	Negative Bias Temperature Instability	BTI	D4	
	Stress Migration	SM	D5	
Group E ELECTRICAL VERIFICATION TESTS	Pre- and Post-Stress Electrical Test	TEST	E1	Table 5 and Table 6
	Electrostatic Discharge Human Body Model	HBM	E2	
	Electrostatic Discharge Charged Device Model	CDM	E3	
	Latch-Up	LU	E4	<ul style="list-style-type: none"> • For Tests E5, E6 and E7, ADI New Product Yield Analysis Testing Guidelines meet AEC Q100 requirements. • Results for Tests E7-E11 are available as applicable on a case by case basis. • Test E12 results may be viewed on-site at Analog Devices
	Electrical Distributions	ED	E5	
	Fault Grading	FG	E6	
	Characterization	CHAR	E7	
	Electromagnetic Compatibility	EMC	E9	
	Short Circuit Characterization	SC	E10	
	Soft Error Rate	SER	E11	
	Lead (Pb) Free	LF	E12	
	Group F DEFECT SCREENING TESTS	Process Average Test	PAT	F1
Statistical Bin/Yield Analysis		SBA	F2	
Group G CAVITY PACKAGE INTEGRITY TESTS	Mechanical Shock	MS	G1	< Applicable only for Cavity-Packages >
	Variable Frequency Vibration	VFV	G2	
	Constant Acceleration	CA	G3	
	Gross/Fine Leak	GFL	G4	
	Package Drop	DROP	G5	
	Lid Torque	LT	G6	
	Die Shear	DS	G7	
	Internal Water Vapor	IWV	G8	

Die/Fab Product Characteristics

Table 1: Die/Fab Product Characteristics- 0.18 μ m CMOS at ADBN

Product Characteristics	Product(s) to be Qualified			
Generic/Root Part #	AD8283	ADV7392	ADDR9501	MAX11390
Die Id	ND01	ND03	ND04	AZ33C
Die Size (mm)	7.00 x 7.00	2.57 x 3.05	3.67 x 4.54	2.84 x 2.84
Wafer Fabrication Site	ADBN	ADBN	ADBN	ADBN
Wafer Fabrication Process	0.18 μ m CMOS	0.18 μ m CMOS	0.18 μ m CMOS	0.18 μ m CMOS
Die Substrate	Si	Si	Si	Si
Metallization / # Layers	AlCu / 5	AlCu / 5	AlCu / 6	AlCu / 5
Polyimide	Yes	No	Yes	No
Passivation	SiO ₂ /SiN	SiO ₂ /SiN	SiO ₂ /SiN	SiO ₂ /SiN

Die/Fab Test Results
Table 2: Die/Fab Test Results – 0.18 μ m CMOS at ADBN
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Test Name	AEC #	Spec	Conditions	Generic/Root Part #	Lot #	Fail/SS	eTest Temp
Early Life Failure Rate (ELFR)	B2	AEC Q100-008	T _A =125°C, 48 Hours	AD8283	J87618.1	0/1095	RH
				MAX11390	J90186.1	0/1050	RH
			T _A =105°C, 48	J88457.1	0/1000	RH	
				ADV7392	J87611.1	0/642	RH
High Temperature Operating Life (HTOL)	B1	JESD22-A108	125°C<T _j <135°C, Biased, 500 Hours, T _a =125°C	MAX11390	R44425A	0/77	RCH
				MAX11390	R44425B	0/77	RCH
			125°C<T _j <135°C, Biased, 1000 Hours	MAX11390	R44425C	0/77	RCH
				AD8283	Q19918.1.HO1P	0/77	RCH
Highly Accelerated Temperature and Humidity Stress Test (HAST) ¹	A2	JESD22-A110	130C 85%RH 33.3 psia, Biased, 96 Hours	AD8283	Q19918.3.HA1	0/77	RH
			130°C, 85%RH 33.3 psia, biased, 96 Hours	ADV7392	Q21963.1.HA1	0/77	RH
			110°C, 85%RH 33.3 psia, biased, 264 Hours	MAX11390	R44425A	0/77	RH

¹These samples were subjected to preconditioning at MSL 1/3 with 3x reflow peak temp of 260°C prior to the start of the stress test.

² One (1) VOS failure after 500 hours HTOL not shown to be related to fab site change.

Table 3: Package/Assembly Product Characteristics

Product Characteristics	Product(s) to be Qualified			
Generic/Root Part #	AD8283	ADV7392	ADDR9501	MAX11390
Package	72-LFCSP	40-LFCSP	48-LFCSP	36-Bump Thin WLP
Body Size (mm)	10.00 x 10.00 x 0.85	6.00 x 6.00 x 0.75	7.00 x 7.00 x 0.85	2.87 x 2.87 x 0.5
Assembly Location	STATS (STA)	AMKOR (AP3)	AMKOR (AP1)	ASE Kaohsiung, Taiwan
MSL/Peak Reflow Temperature(°C)	3 / 260°C	3 / 260°C	3 / 260°C	1 / 260°C
Mold Compound	Sumitomo G700E	Sumitomo G700	Sumitomo G700	N/A
Die Attach/Underfill/TIM	Ablestik 3230	Ablestik 3230	Ablestik 3230	N/A
Leadframe Material	Copper	Copper	Copper	N/A
Lead Finish	Sn	Sn	Sn	N/A
Wire Bond Material/Diameter (mils)	Gold / 1.00	Gold / 1.00	Gold / 1.00	N/A
Bump Pitch (mm)	N/A	N/A	N/A	0.4
Bump Height (mm)	N/A	N/A	N/A	0.19
Bump Material	N/A	N/A	N/A	SAC125Ni

Table 4: Package/Assembly Test Results

Test Name	AEC#	Spec	Conditions	Generic/Root Part #	Lot #	Fail/SS	eTest Temp
Preconditioning	A1	J-STD-020	MSL-3	ADV7392	Q21963.1.SH1	0/15	R
			MSL-1	MAX11390	R44425A	0/231	R
					R44425B	0/231	R
			MSL-3	AD8283	Q19918.1.SH1	0/15	R
				ADDR9501	Q19983.1.SH1	0/15	R
			High Temperature Storage Life (HTSL)	A6	JESD22-A103	+150°C, 500 Hours	ADV7392
+150°C, 1000 Hours	AD8283	Q19918.1.HS1				0/45	RH
	ADDR9501	Q19983.1.HS1				0/45	RH
	MAX11390	R44425A				0/77	RH
		R44425B				0/77	RH
Temperature Cycling (TC) ¹	A4	JESD22-A104	-55°C/+125°C, 500 Cycles	ADV7392	Q21963.1.TC1	0/77	RH
			-40°C/+125°C, 850 Cycles	MAX11390	R44425A	0/77	RH
					R44425B	0/77	RH
			-55°C/+125°C, 1000 Cycles	AD8283	Q19918.1.TC1	0/77	RH
				ADDR9501	Q19983.1.TC1	0/77	RH
Unbiased HAST (UHST) ¹	A3	JESD22-A118	+130°C, 85%RH 33.3 psia, 96 Hours	ADV7392	Q21963.1.UH1	0/77	R
				MAX11390	R44425A	0/77	R
					R44425B	0/77	R
				AD8283	Q19918.1.UH1	0/77	R
				ADDR9501	Q19983.1.UH1	0/77	R
Post-TCT WBP	C2	MIL-STD883 Method 2011	3gF	ADV7392	Q21963.1.WPPT1	0/5	N/A
				AD8283	Q19918.1.WPPT1	0/5	N/A
				ADDR9501	Q19983.1.WPPT1	0/5	N/A
						0/5	N/A

¹ These samples were subjected to preconditioning at MSL 1/3 with 3x reflow peak temp of 260°C prior to the start of the stress test.

ESD and Latch-Up Test Results

Table 5: ESD Test Results
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ESD Model	Generic/Root Part #	Package	ESD Test Spec	RC Network	Highest Pass Level	Class	eTest
FICDM	ADV7392	40-LFCSP	JS-002	1Ω, Cpkg	±500V	C2	RH
	MAX11390	36-Thin WLP			±1000V	C3	RH
	AD8283	72-LFCSP			±450V ¹	C1	RH
	ADDR9501	48-LFCSP			±750V	C2	RH
HBM	ADV7392	40-LFCSP	JS-001	1.5kΩ, 100pF	±2000V	1C	RH
	MAX11390	36-Thin WLP			±3000V	3A	RH
	AD8283	72-LFCSP			±2000V	1C	RH
	ADDR9501	48-LFCSP			±2000V	1C	RH

1. Control Material Passes Same Threshold

Table 6: Latch Up Test Results
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LU Test Spec	Generic/Root Part #	Passing Current	Passing Over-Voltage	Temperature (T _A)	Class	eTest
JESD78	ADV7392	+100mA, -100mA	+2.84V/+5.2V/+5.45V	+105°C	II	RH
	MAX11390	+250mA, -250mA	+3V/+5.4V	+85°C	II	RH
	AD8283	+200mA, -200mA	+2.85V, +5.1V	125°C	II	RH

Approvals

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