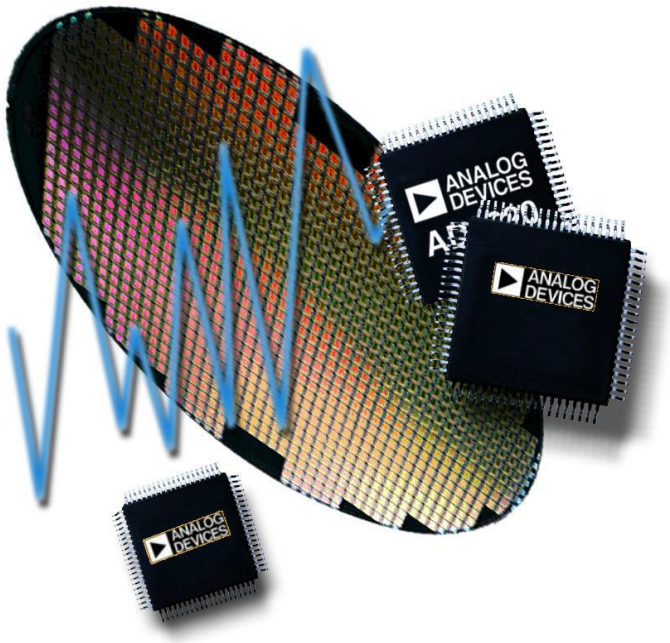

Reliability Report

Report Title: Qualification of 0.18µm Mixed Mode CMOS Wafer Fabrication at ADI Beaverton Fab

Report Number: 21963

Revision: C

Date: 15 November 2024

Summary

This report documents the reliability qualification requirements for the release of the 0.18µm Mixed Mode 1.8V/3.3V 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.

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	• 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	TDDB	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	
	Electrical Distributions	ED	E5	• 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
	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	ADI New Product Yield Analysis Testing Guidelines meet AECQ100 Requirements.
	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- 0.18µm CMOS at ADBN

Product Characteristics	Product(s) to be Qualified		
Generic/Root Part #	AD8283	ADV7392	ADDR9501
Die Id	ND01	ND03	ND04
Die Size (mm)	7.00 x 7.00	2.57 x 3.05	3.67 x 4.54
Wafer Fabrication Site	ADBN	ADBN	ADBN
Wafer Fabrication Process	0.18µm CMOS	0.18µm CMOS	0.18µm CMOS
Die Substrate	Si	Si	Si
Metallization / # Layers	AlCu / 5	AlCu / 5	AlCu / 6
Polyimide	Yes	No	Yes
Passivation	SiO_2/SiN	SiO_2/SiN	SiO_2/SiN

Die/Fab Test Results

Table 2: Die/Fab Test Results – 0.18μm CMOS at ADBN

Return

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	J90090.1	0/810	RH
					J91522.1	0/810	RH
					J91669.4	0/810	RH
			T_A=105°C, 48	ADV7392	J91084.5	1/810[2]	RH
					J90861.1	1/810[2]	RH
High Temperature Operating Life (HTOL)	B1	JESD22-A108	125°C‹Tj‹135°C, Biased, 1000 Hours	AD8283	J90090.1	0/77	RCH
					J91522.1	0/77	RCH
					J91669.4	1/77[2]	RCH
			125°C<Tj<135°C, Biased, 500 Hours, Ta=125°C	ADV7392	J91084.5	0/77	RCH
					J90861.1	0/77	RCH
					J90912.1	0/77	RCH
			125°C‹Tj‹135°C, Biased, 1000 Hours	ADDR9501	J90227.3	0/77	RCH
					J90830.1	0/77	RCH
					J90914.1	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	J90090.1	1/77[2]	RH
					J91522.1	0/77	RH
					J91669.4	0/77	RH
			130°C, 85%RH 33.3 psia, biased, 96 Hours	ADV7392	J91084.5	0/77	RH
					J90861.1	0/77	RH
					J90912.1	0/77	RH
			130°C, 85%RH 33.3 psia, biased, 96 Hours	ADDR9501	J90227.3	0/77	RH
					J90830.1	0/77	RH
					J90914.1	0/77	RH

[1] These samples were subjected to preconditioning at MSL 3 with 3x reflow peak temp of 260°C prior to the start of the stress test.
[2] These failures are attributed to silicon defects. See 8D Report 264269.

Table 3: Package/Assembly Product Characteristics

Product Characteristics	Product(s) to be Qualified		
Generic/Root Part #	AD8283	ADV7392	ADDR9501
Package	72-LFCSP	40-LFCSP	48-LFCSP
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
Assembly Location	STATS (STA)	AMKOR (AP3)	AMKOR (AP1)
MSL/Peak Reflow Temperature(°C)	3 / 260°C	3 / 260°C	3 / 260°C
Mold Compound	Sumitomo G700E	Sumitomo G700	Sumitomo G700
Die Attach/Underfill/TIM	Ablestik 3230	Ablestik 3230	Ablestik 3230
Leadframe Material	Copper	Copper	Copper
Lead Finish	Sn	Sn	Sn
Wire Bond Material/Diameter (mils)	Gold / 1.00	Gold / 1.00	Gold / 1.00

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	J91084.5	0/15	R
					J90861.1	0/15	R
					J90912.1	0/15	R
				AD8283	J90090.1	0/15	R
					J91522.1	0/15	R
					J91669.4	0/15	R
				ADDR9501	J90227.3	0/15	R
					J90830.1	0/15	R
					J90914.1	0/15	R
High Temperature Storage Life (HTSL)	A6	JESD22-A103	+150°C, 500 Hours	ADV7392	J91084.5	0/45	RH
			+150°C, 1000 Hours	AD8283	J90090.1	0/45	RH
				ADDR9501	J90227.3	0/45	RH
Temperature Cycling (TC)[1]	A4	JESD22-A104	-55°C/+125°C, 1000 Cycles	ADV7392	J91084.5	0/77	RH
					J90861.1	0/77	RH
					J90912.1	0/77	RH
				AD8283	J90090.1	0/77	RH
					J91522.1	0/77	RH
					J91669.4	0/77	RH
				ADDR9501	J90227.3	0/77	RH
					J90830.1	0/77	RH
					J90914.1	0/77	RH
Unbiased HAST (UHST)[1]	A3	JESD22-A118	+130°C, 85%RH 33.3 psia, 96 Hours	ADV7392	J91084.5	0/77	R
					J90861.1	0/77	R
					J90912.1	1/77[2]	R
				AD8283	J90090.1	0/77	R
					J91522.1	0/77	R
					J91669.4	0/77	R
				ADDR9501	J90227.3	0/77	R
					J90830.1	0/77	R
					J90914.1	0/77	R
Post-TCT WBP	C2	MIL-STD883 Method 2011	3gF	ADV7392	J91084.5	0/5	N/A
				AD8283	J90090.1	0/5	N/A
				ADDR9501	J90227.3	0/5	N/A

[1] These samples were subjected to preconditioning at MSL 3 with 3x reflow peak temp of 260°C prior to the start of the stress test.
[2] These failures are attributed to silicon defects. See 8D Report 264269

ESD and Latch-Up Test Results

Table 5: ESD Test Results

Return

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
	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
	AD8283	72-LFCSP			±2000V	1C	RH
	ADDR9501	48-LFCSP			±2000V	1C	RH

1. Control Material Passes Same Threshold

Table 6: Latch Up Test Results

Return

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
	AD8283	+100mA, -100mA	+2.85V, +5.1V	125°C	II	RH
	ADDR9501	+100mA, -100mA	+2.85V, +5.1V	+85°C	II	RH

Approvals

Reliability Engineer: Denis Belisle