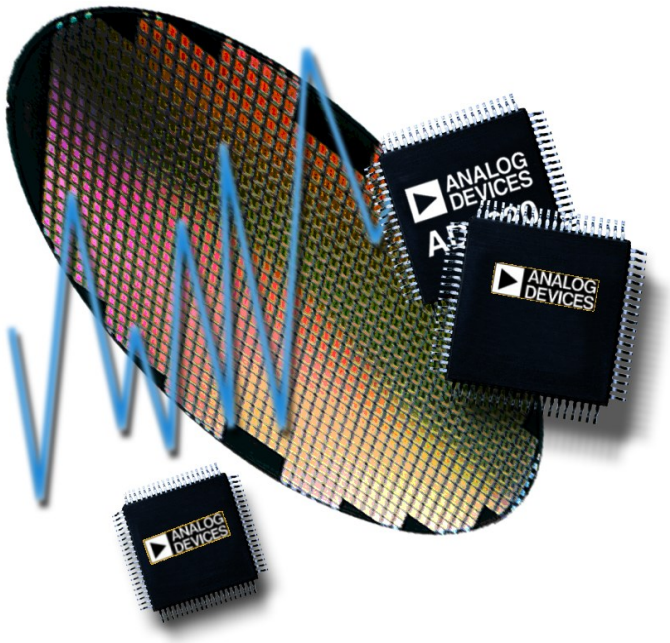

Reliability Report

Report Title: Qualification of ADI Camas Wafer Fab CBCMOS1 and CBCMOS2 Processes for AEC Grade 1 and Non-Automotive Products

Report Number: 23945

Revision: B

Date: 8 May 2025

Summary

This report documents the reliability qualification requirements for the release of the CBCMOS1 and CBCMOS2 Processes at Analog Devices Camas Wafer Fabrication Facility. The products listed below were selected to cover the technology being released.

The products are:

The AD8223 is an integrated single-supply instrumentation amplifier that delivers rail-to-rail output swing on a single supply (3 V to 24 V). The AD8223 conforms to the 8-lead industry standard pinout configuration.

The ADP3338 is a precision, low dropout (LDO), anyCAP voltage regulators. The ADP3338 operates with an input voltage range of 2.7 V to 8 V and delivers a load current up to 1 A.

The AD8202 is a single-supply difference amplifier for amplifying and low-pass filtering small differential voltages in the presence of a large common-mode voltage (CMV). The input CMV range extends from −6 V to +28 V at a typical supply voltage of 5 V. The AD8202 is qualified under AEC Grade 1.

The REF195 is a precision band gap voltage reference which uses a patented temperature drift curvature correction circuit and laser trimming of highly stable, thin-film resistors to achieve a very low temperature coefficient and high initial accuracy.

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- CBCMOS1 and CBCMOS2 at ADI Camas

Product Characteristics	Product(s) to be qualified			
Generic/Root Part #	AD8202	AD8223	ADP3338	REF195
Die Id	6W8202YXV*01 A	6W8223YXV*01 A	6WP3338RXV*01 A	6WREF195V*01 A
Die Size (mm)	1.18 x 1.17	1.37 x 1.82	1.74 x 1.38	1.02 x 1.50
Wafer Fabrication Site	ADI-Camas	ADI-Camas	ADI-Camas	ADI-Camas
Wafer Fabrication Process	CBCMOS2	CBCMOS2	CBCMOS2	CBCMOS1
Die Substrate	Si	Si	Si	Si
Metallization / # Layers	AlCu(1.0%)/2	AlCu(1.0%)/2	AlCu(1.0%)/2	AlCu(1.0%)/1
Polyimide	Yes	Yes	No	No
Passivation	doped-oxide/OxyNitride	doped-oxide/OxyNitride	doped-oxide/SiN	doped-oxide/SiN

Die/Fab Test Results

Table 2.1: Die/Fab Test Results – CBCMOS1 and CBCMOS2 at ADI Camas

Test Name	AEC #	Spec	Conditions	Generic/Root Part #	Lot #	Fail/SS	eTest Temp
High Temperature Operating Life (HTOL)[1]	B1	JESD22-A108	125°C<Tj<135°C, Biased, 1,000 Hours	AD8223	Q21232.1.HO1_RES	0/77	R
					Q21232.2.HO2_RES	0/77	R
					Q21232.3.HO3_RES	0/77	R
				ADP3338	Q21285.1.HO1_RES	0/77	R
					Q21285.3.HO3_RES	0/77	R
			125°C<Tj<135°C, Biased, 500 Hours	REF195	Q21587.1.HO1_RES	0/77	R
				AD8202	Q21238.1.HO1_RES	0/77	RHC
					Q21238.2.HO2_RES	0/77	RHC
					Q21238.3.HO3_RES	0/77	RHC
				REF195	Q21587.1.HO1_RES	0/77	R
Early Life Failure Rate (ELFR)	B2	AEC-Q100-008	Ta=105C, 48 Hours	AD8202	Q21238.1.EL1_RES	0/800	RH
					Q21238.2.EL2_RES	0/800	RH
					Q21238.3.EL3_RES	0/800	RH
High Temperature Storage Life (HTSL)	A6	JESD22-A103	150°C, 1,000 Hours	AD8223	Q21232.1.HS1_RES	0/77	R
				ADP3338	Q21285.1.HS1_RES	0/77	R
				REF195	Q21587.1.HS1_RES	0/77	R
				AD8202	Q21238.1.HS1_RES	0/77	RH
Highly Accelerated Temperature and Humidity Stress Test (HAST)[1]	A2	JESD22-A110	130C 85%RH 33.3 psia, Biased, 96 Hours	AD8202	Q21238.1.HA1_RES	0/77	RH
					Q21238.2.HA2_RES	0/77	RH
					Q21238.3.HA3_RES	0/77	RH
				AD8223	Q21232.1.HA1_RES	0/77	R
					Q21232.3.HA3_RES	0/77	R
				ADP3338	Q21285.1.HA1_RES	0/77	R
					Q21285.2.HA2_RES	0/77	R
					Q21285.3.HA3_RES	0/77	R
				REF195	Q21587.1.HA1_RES	0/77	R

Unbiased HAST (UHST)[1]	A3	JESD22-A118	130C 85%RH 33.3 psia, 96 Hours	AD8202	Q21238.1.UH1_RES	0/77	R
					Q21238.2.UH2_RES	0/77	R
					Q21238.3.UH3_RES	0/77	R
				AD8223	Q21232.1.UH1_RES	0/77	R
					Q21232.2.UH2_RES	0/77	R
					Q21232.3.UH3_RES	0/77	R
				ADP3338	Q21285.1.UH1_RES	0/77	R
					Q21285.2.UH2_RES	0/77	R
					Q21285.3.UH3_RES	0/77	R
				REF195	Q21587.1.UH1_RES	0/77	R
Temperature Cycling (TC)[1]	A4	JESD22-A104	-65°C/+150°C, 500 Cycles	AD8223	Q21232.1.TC1_RES	0/77	R
					Q21232.2.TC2_RES	0/77	R
					Q21232.3.TC3_RES	0/77	R
				ADP3338	Q21285.1.TC1_RES	0/77	R
					Q21285.2.TC2_RES	0/77	R
					Q21285.3.TC3_RES	0/77	R
				REF195	Q21587.1.TC1_RES	0/77	R
			-65°C/+150°C, 1000 Cycles	AD8202	Q21238.1.TC1_RES	0/77	RH
					Q21238.2.TC2_RES	0/77	RH
					Q21238.3.TC3_RES	0/77	RH

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

Package/Assembly Product Characteristics

Table 3.1: Package/Assembly Product Characteristics - 3-SOT_223 at CARSEM (CRM)

Product Characteristics	Product(s) to be qualified
Generic/Root Part #	ADP3338
Package	3-SOT_223
Body Size (mm)	6.50 x 3.50 x 1.60
Assembly Location	CARSEM (CRM)
MSL/Peak Reflow Temperature(°C)	1 / 260°C
Mold Compound	Hitachi CEL 9240HF10
Die Attach/Underfill/TIM	Ablestik 84-3J non-conductive
Leadframe Material	Copper
Lead Finish	100 Sn
Wire Bond Material/Diameter (mils)	Tanaka C 4N Gold / 1.30

Table 3.2: Package/Assembly Product Characteristics - 8-MINI_SO at CARSEM (CRM)

Product Characteristics	Product(s) to be qualified
Generic/Root Part #	AD8202
Package	8-MINI_SO
Body Size (mm)	3.20 x 3.20 x 0.95
Assembly Location	CARSEM (CRM)
MSL/Peak Reflow Temperature(°C)	1 / 260°C
Mold Compound	Sumitomo G600
Die Attach/Underfill/TIM	Ablestik 84-1 LMISR4 conductive
Leadframe Material	Copper
Lead Finish	100 Sn
Wire Bond Material/Diameter (mils)	Tanaka M3 4N Gold / 1.00

Table 3.3: Package/Assembly Product Characteristics - 8-SOIC_N at AMKOR (AP1)

Product Characteristics	Product(s) to be qualified	
Generic/Root Part #	AD8223	REF195
Package	8-SOIC_N	8-SOIC_N
Body Size (mm)	5.00 x 4.00 x 1.50	5.00 x 4.00 x 1.50
Assembly Location	AMKOR (AP1)	AMKOR (AP1)
MSL/Peak Reflow Temperature(°C)	1 / 260°C	1 / 260°C
Mold Compound	Sumitomo G600	Sumitomo G600
Die Attach	Ablestik 84-1 LMISR4 conductive	Ablestik 84-1 LMISR4 conductive
Leadframe Material	Copper	Copper
Lead Finish	100 Sn	100 Sn
Wire Bond Material/Diameter (mils)	Gold / 1.00	4N Gold / 1.20

Package/Assembly Test Results

Table 4.1: Package/Assembly Test Results - SOIC_N at AMKOR (AP1)

Test Name	AEC #	Spec	Conditions	Generic/Root Part #	Lot #	Fail/SS	eTest Temp
Solder Heat Resistance (SHR)	A1	J-STD-020	MSL-1	AD8223	Q21232.1.SH1_RES	0/16	R
					Q21232.2.SH2_RES	0/16	R
					Q21232.3.SH3_RES	0/16	R
				REF195	Q21587.1.SH1_RES	0/16	R
Highly Accelerated Temperature and Humidity Stress Test (HAST)[1]	A2	JESD22-A110	130°C 85%RH 33.3 psia, Biased, 96 Hours	AD8223	Q21232.1.HA1_RES	0/77	R
					Q21232.3.HA3_RES	0/77	R
				REF195	Q21587.1.HA1_RES	0/77	R
Unbiased HAST (UHST) [1]	A3	JESD22-A118	130°C 85%RH 33.3 psia, 96 Hours	AD8223	Q21232.1.UH1_RES	0/77	R
					Q21232.2.UH2_RES	0/77	R
					Q21232.3.UH3_RES	0/77	R
				REF195	Q21587.1.UH1_RES	0/77	R
Temperature Cycling (TC)[1]	A4	JESD22-A104	-65°C/+150°C, 500 Cycles	AD8223	Q21232.1.TC1_RES	0/77	R
					Q21232.2.TC2_RES	0/77	R
					Q21232.3.TC3_RES	0/77	R
				REF195	Q21587.1.TC1_RES	0/77	R
High Temperature Storage Life (HTSL)	A6	JESD22-A103	150°C, 1,000 Hours	AD8223	Q21232.1.HS1_RES	0/77	R
				REF195	Q21587.1.HS1_RES	0/77	R

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

Table 4.2: Package/Assembly Test Results - MINI_SO at CARSEM (CRM)

Test Name	AEC #	Spec	Conditions	Generic/Root Part #	Lot #	Fail/SS	eTest Temp
Solder Heat Resistance (SHR)	A1	J-STD-020	MSL-1	AD8202	Q21238.1.SH1_RES	0/16	R
					Q21238.2.SH2_RES	0/16	R
					Q21238.3.SH3_RES	0/16	R
Highly Accelerated Temperature and Humidity Stress Test (HAST)[1]	A2	JESD22-A110	130°C 85%RH 33.3 psia, Biased, 96 Hours	AD8202	Q21238.1.HA1_RES	0/77	RH
					Q21238.2.HA2_RES	0/77	RH
					Q21238.3.HA3_RES	0/77	RH
Unbiased HAST (UHST)[1]	A3	JESD22-A118	130°C 85%RH 33.3 psia, 96 Hours	AD8202	Q21238.1.UH1_RES	0/77	R
					Q21238.2.UH2_RES	0/77	R
					Q21238.3.UH3_RES	0/77	R
Temperature Cycling (TC)[1]	A4	JESD22-A104	-65°C/+150°C, 1000 Cycles	AD8202	Q21238.1.TC1_RES	0/77	RH
					Q21238.2.TC2_RES	0/77	RH
					Q21238.3.TC3_RES	0/77	RH
Wire Bond Pull – Post TC	C2	AEC-Q001	3 gF	AD8202	Q21238.1.WPT	0/5	NA

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

Table 4.3: Package/Assembly Test Results - SOT_223 at CARSEM (CRM)

Test Name	AEC #	Spec	Conditions	Generic/Root Part #	Lot #	Fail/SS	eTest Temp
Solder Heat Resistance (SHR)	A1	J-STD-020	MSL-1	ADP3338	Q21285.1.SH1_RES	0/16	R
					Q21285.2.SH2_RES	0/16	R
					Q21285.3.SH3_RES	0/16	R
Highly Accelerated Temperature and Humidity Stress Test (HAST)[1]	A2	JESD22-A110	130°C 85%RH 33.3 psia, Biased, 96 Hours	ADP3338	Q21285.1.HA1_RES	0/77	R
					Q21285.2.HA2_RES	0/77	R
					Q21285.3.HA3_RES	0/77	R
Unbiased HAST (UHST)[1]	A3	JESD22-A118	130°C 85%RH 33.3 psia, 96 Hours	ADP3338	Q21285.1.UH1_RES	0/77	R
					Q21285.2.UH2_RES	0/77	R
					Q21285.3.UH3_RES	0/77	R
Temperature Cycling (TC)[1]	A4	JESD22-A104	-65°C/+150°C, 500 Cycles	ADP3338	Q21285.1.TC1_RES	0/77	R
					Q21285.2.TC2_RES	0/77	R
					Q21285.3.TC3_RES	0/77	R

[1] These samples were subjected to preconditioning at MSL 1 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 Result

ESD Model	Generic/Root Part #	Package	ESD Test Spec	RC Network	Highest Pass Level	Class	eTest Temp
FICDM	AD8223	8-SOIC_N	JS-002	1Ω, Cpkg	±1000V	C3	R
	REF195				±1250V	C3	R
	ADP3338	3-SOT_223			±1250V	C3	R
HBM	AD8223	8-SOIC_N	JS-001	1.5kΩ, 100pF	±3500V	2	R
	REF195				±4000V	3A	R
	ADP3338	3-SOT_223			±1500V	1C	R

Table 6: Latch Up Test Result

LU Test Spec	Generic/Root Part #	Passing Current	Passing Over-Voltage	Temperature (T_A)	Class	eTest Temp
JESD78	AD8223	+100mA, -100mA	+14.4V	25°C	I	R
JESD78	ADP3338	+200mA, -200mA	+12V	25°C	I	R
JESD78	REF195	+200mA, -200mA	+22.5V	25°C	I	R

Approvals

Reliability Engineer: Charles Ryan Cabasa