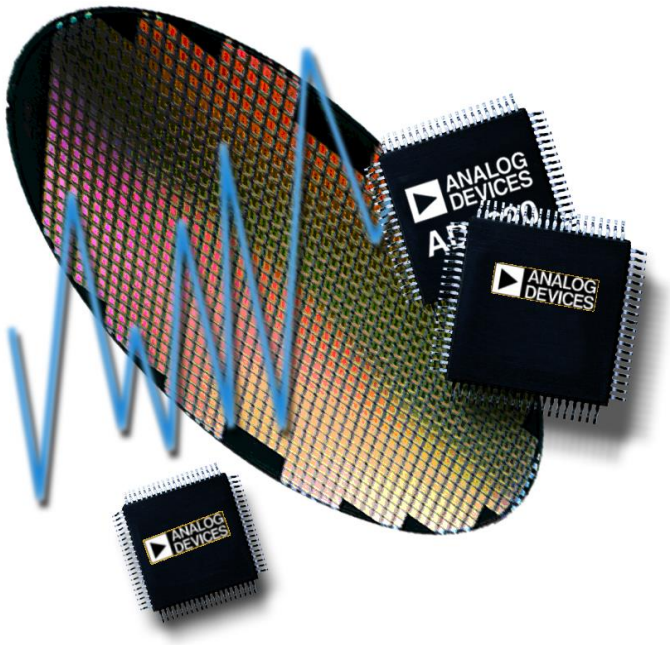

Reliability Report

Report Title: AD240x, AD241x and AD242x Automotive Grade 2 LFCSP_SS Copper Bondwire Qualification at SC3

Report Number: 23848

Revision: B

Date: 06 April 2025

Summary

This report documents the successful completion of the reliability qualification requirements of bond wire change from gold to copper wire for the AD2401, AD2403, AD2410, AD2401W, AD2402W, AD2410W, AD2423, AD2425, AD2421W, AD2422W, AD2423W, AD2425W, AD2426, AD2427, AD2428, AD2426W, AD2427W and AD2428W products in a 32-LFCSP and 32-LFCSP_SS package at SC3. The AD240x/AD240xW, AD241x/AD241xW and AD242x/ AD242xW are Audio Bus (A²B) Transceiver.

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	Not applicable for Assembly Site Change
	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 DMOS

Product Characteristics	Product(s) to be qualified			Product(s) used for Substitution Data			
Generic/Root Part #	AD2401, AD2403, AD2410, AD2401W, AD2402W, AD2410W	AD2423, AD2425, AD2421W, AD2422W, AD2423W, AD2425W	AD2426, AD2427, AD2428, AD2426W, AD2427W, AD2428W	AD2410W	ADP7183	AD2435W	AD2438W
Die Id	TMGC94 C	TMHM45 C	TMJR79 D	TMGC94 C	TMHN06 B	TMMS27 E	TMPZ36 A
Die Size (mm)	3.09 x 3.09	3.09 x 3.09	3.09 x 3.09	3.09 x 3.09	0.95 x 1.47	3.68 x 2.93	2.88 x 2.88
Wafer Fabrication Site	TSMC Fab-8B	TSMC Fab-8B	TSMC Fab-8B	TSMC Fab-8B	TSMC Fab-8B	TSMC Fab-8B	TSMC Fab-8B
Wafer Fabrication Process	0.18um BCDMOS	0.18um BCDMOS	0.18um BCDMOS	0.18um BCDMOS	0.18um BCDMOS	0.18um BCDMOS	0.18um BCDMOS
Die Substrate	Si	Si	Si	Si	Si	Si	Si
Metallization	AlCu(0.5%)	AlCu(0.5%)	AlCu(0.5%)	AlCu(0.5%)	AlCu(0.5%)	AlCu(0.5%)	AlCu(0.5%)
Polyimide	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Passivation	undoped-oxide/SiN	undoped-oxide/SiN	undoped-oxide/SiN	undoped-oxide/SiN	undoped-oxide/SiN	undoped-oxide/SiN	undoped-oxide/SiN

Die/Fab Test Results

Table 2: Die/Fab Test Results

Test Name	AEC #	Spec	Conditions	Generic/Root Part #	Lot #	Fail/SS	eTest Temp
High Temperature Operating Life (HTOL)	B1	JESD22-A108	125°C<Tj<135°C, Biased, 1,000 Hours	AD2425W	QL12126HTL01	0/77	RHC
					QL12804HTL01	0/77	RHC
				AD2435W	Q17160.1.1	0/77	RHC
					Q17361.1.1	0/77	RHC
				AD2428W	Q14314.1	0/77	RHC
					QL13389HTL01	0/77	RHC
				AD2410W	QL10667HTL01	0/77	RHC
					QL10667HTL03	0/77	RHC
			125°C<Tj<135°C, Biased, 2,000 Hours	AD2428W	Q18248.1.1	0/77	RHC
Early Life Failure Rate (ELFR)	B2	AEC Q100-008	Ta=125°C, 48 Hours	ADP7183	Q17782.1.EL1A	0/250	RH
					Q17782.1.EL1B	0/250	RH
					Q17782.1.EL1C	0/250	RH
					Q17782.1.EL1D	0/50	RH
					Q17782.2.EL2A	0/250	RH
					Q17782.2.EL2B	0/250	RH
					Q17782.2.EL2C	0/250	RH
					Q17782.2.EL2D	0/50	RH
					Q17782.3.EL3A	0/250	RH
					Q17782.3.EL3B	0/250	RH
					Q17782.3.EL3C	0/250	RH
					Q17782.3.EL3D	0/50	RH
High Temperature Storage Life (HTSL)	A6	JESD22-A103	150°C, 1,000 Hours	AD2435W	Q19515.1.4	0/45	RH
					Q19515.2.4	0/45	RH
					Q19515.3.4	0/45	RH
				AD2438W	Q19478.1.6	0/45	RH

Table 2: Die/Fab Test Results (cont.)

Test Name	AEC #	Spec	Conditions	Generic/Root Part #	Lot #	Fail/SS	eTest Temp
Highly Accelerated Temperature and Humidity Stress Test (HAST)[1]	A2	JESD22-A110	130C 85%RH 33.3 psia, Biased, P192	AD2435W	Q19515.1.1	0/77	RH
					Q19515.2.1	0/77	RH
					Q19515.3.1	0/77	RH
				AD2438W	Q19478.1.1	0/77	RH
					Q19478.2.1	0/77	RH
					Q19478.3.1	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.

Package/Assembly Product Characteristics

Table 3: Package/Assembly Product Characteristics

Product Characteristics	Product(s) to be qualified			Product(s) used for Substitution Data	
Generic/Root Part #	AD2401, AD2403, AD2410, AD2401W, AD2402W, AD2410W	AD2423, AD2425, AD2421W, AD2422W, AD2423W, AD2425W	AD2426, AD2427, AD2428, AD2426W, AD2427W, AD2428W	AD2435W	AD2438W
Package	32-LFCSP / 32-LFCSP_SS	32-LFCSP / 32-LFCSP_SS	32-LFCSP / 32-LFCSP_SS	48-LFCSP	32-LFCSP
Body Size (mm)	5.00 x 5.00 x 0.75	5.00 x 5.00 x 0.75	5.00 x 5.00 x 0.75	7.00 x 7.00 x 0.75	5.00 x 5.00 x 0.75
Assembly Location	STATS (SC3)	STATS (SC3)	STATS (SC3)	STATS (SC3)	STATS (SC3)
MSL/Peak Reflow Temperature(°C)	3 / 260°C	3 / 260°C	3 / 260°C	3 / 260°C	3 / 260°C
Mold Compound	Sumitomo G700LA	Sumitomo G700LA	Sumitomo G700LA	Sumitomo G700LA	Sumitomo G700LA
Die Attach	Hitachi EN 4900GC conductive	Hitachi EN 4900GC conductive	Hitachi EN 4900GC conductive	Hitachi EN 4900GC conductive	Hitachi EN 4900GC conductive
Leadframe Material	Copper	Copper	Copper	Copper	Copper
Lead Finish	100Sn	100Sn	100Sn	100Sn	100Sn
Wire Bond Material/Diameter (mils)	PdCuAu / 0.80	PdCuAu / 0.80	PdCuAu / 0.80	PdCuAu / 0.80	PdCuAu / 0.80

Package/Assembly Test Results

Table 4: Package/Assembly Test Results

Test Name	AEC #	Spec	Conditions	Generic/Root Part #	Lot #	Fail/SS	eTest Temp
High Temperature Storage Life (HTSL)	A6	JESD22-A103	150°C, 1,000 Hours	AD2435W	Q19515.1.4	0/45	RH
					Q19515.2.4	0/45	RH
					Q19515.3.4	0/45	RH
				AD2438W	Q19478.1.6	0/45	RH
Highly Accelerated Temperature and Humidity Stress Test (HAST)[1]	A2	JESD22-A110	130C 85%RH 33.3 psia, Biased, P192	AD2435W	Q19515.1.1	0/77	RH
					Q19515.2.1	0/77	RH
					Q19515.3.1	0/77	RH
				AD2438W	Q19478.1.1	0/77	RH
					Q19478.2.1	0/77	RH
					Q19478.3.1	0/77	RH
Solder Heat Resistance (SHR)	A1	J-STD-020	MSL-3	AD2435W	Q19515.1.3	0/11	R
					Q19515.2.3	0/11	R
					Q19515.3.3	0/11	R
				AD2438W	Q19478.1.2	0/11	R
					Q19478.2.2	0/11	R
					Q19478.3.2	0/11	R
Temperature Cycling (TC)[1]	A4	JESD22-A104	-55°C/+125°C, 2,000 Cycles	AD2435W	Q19515.1.2	0/77	RH
					Q19515.2.2	0/77	RH
					Q19515.3.2	0/77	RH
				AD2438W	Q19478.1.5	0/77	RH
					Q19478.2.3	0/77	RH
					Q19478.3.3	0/77	RH
Unbiased HAST (UHST)[1]	A3	JESD22-A118	130C 85%RH 33.3 psia, 96 Hours	AD2435W	Q19515.1.5	0/77	R
					Q19515.2.5	0/77	R
					Q19515.3.5	0/77	R
				AD2438	Q19259.1.5	0/45	R

[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.

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	AD2428W AD2410W AD2425W	32-LFCSP_SS	JS-002	1Ω, Cpkg	±1250V	C3	RH
HBM	AD2428W AD2410W AD2425W	32-LFCSP_SS	ESDA/JEDEC JS-001	1.5kΩ, 100pF	±2500V	2	RH

Table 6: Latch Up Test Result

LU Test Spec	Generic/Root Part #	Passing Current	Passing Over-Voltage	Temperature (T_A)	Class	eTest Temp
JESD78	AD2410W	+200mA, -200mA	+2.97V/+5.445V/+12V	125°C	II	RH
JESD78	AD2425W	+100mA, -100mA	+2.97V/+5.445V/+12V	125°C	II	RH
JESD78	AD2428W	+200mA, -200mA	+2.97/5.445/12V	105°C	II	RH

Approvals

Reliability Engineer: Lucille Jordan

Appendix

AEC -Q006 – Qualification Requirements for Products using Cu Wire Interconnections

Step	Stress Tests / Qualification Step	TC (-55°C to 125°C) JESD22-A104	HAST (130°C/85%RH) JESD22-A101	HTSL (150°C) JESD22-A103
1	Initial Sampling (T0)[1]	Sample size as required		
2	CSAM @ T0	Sample size as required		
3	Preconditioning to MSLx	3x77	3x77	--
4	CSAM after PC	3x22	3x22	--
5	ATE Test[1]	3x77	3x77	3x45
6	Stress 1x	3x77	3x77	3x45
7	ATE Test[1]	3x77	3x77	3x45
8	CSAM post-1x stress	3x22	3x22	--
9a	Ball + Stitch/Wedge Pull	3x3	3x3	--
9b	Ball Shear	3x3	3x3	--
10	Cross-section	3x1	3x1	3x1
11	Stress 2x	3x70	3x70	3x44
12	ATE Test[1]	3x70	3x70	3x44
13	CSAM post-2x Stress	3x22	3x22	--
14a	Ball + Stitch/Wedge Pull	3x2	3x2	--
14b	Ball Shear	3x2	3x2	--
15	Cross-section	3x1	3x1	3x1

[1] These samples were tested at the ATE in Ambient and Hot temperature

REL Lot number		Q19515.1.2	Q19515.1.1	Q19515.1.4	Q19515.2.2	Q19515.2.1	Q19515.2.4	Q19515.3.2	Q19515.3.1	Q19515.3.4
AEC #	**Test**	**TC**	**HAST**	**HTS**	**TC**	**HAST**	**HTS**	**TC**	**HAST**	**HTS**
1	Initial Sampling (T0)[1]	0/77	0/77	0/45	0/77	0/77	0/45	0/77	0/77	0/45
2	CSAM @ T0	0/77	0/77	--	0/77	0/77	--	0/77	0/77	--
3	Preconditioning to MSLx	0/77	0/77	--	0x77	0x77	--	0x77	0x77	--
4	CSAM after PC	0/77	0/77	--	0/77	0/77	--	0/77	0/77	--
5	ATE Test[1]	0x77	0x77	0/45	0x77	0x77	0/45	0x77	0x77	0/45
6	Stress 1x	0x77	0x77	0/45	0x77	0x77	0/45	0x77	0x77	0/45
7	ATE Test[1]	0x77	0x77	0/45	0x77	0x77	0/45	0x77	0x77	0/45
8	CSAM post-1x stress	0/77	0/77	--	0/77	0/77	--	0/77	0/77	--
9a	Ball + Stitch/Wedge Pull	0/3	0/3	--	0/3	0/3	--	0/3	0/3	--
9b	Ball Shear	0/3	0/3	--	0/3	0/3	--	0/3	0/3	--
10	Cross-section	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
11	Stress 2x	0/70	0/70	0/44	0/70	0/70	0/44	0/70	0/70	0/44
12	ATE Test[1]	0/70	0/70	0/44	0/70	0/70	0/44	0/70	0/70	0/44
13	CSAM post-2x Stress	0/70	0/70	--	0/70	0/77	--	0/77	0/77	--
14a	Ball + Stitch/Wedge Pull	0/2	0/2	--	0/2	0/2	--	0/2	0/2	--
14b	Ball Shear	0/2	0/2	--	0/2	0/2	--	0/2	0/2	--
15	Cross-section	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

[1] These samples were tested at the ATE in Ambient and Hot temperature.

REL Lot number		Q19478.1.5	Q19478.1.1	Q19478.1.6	Q19478.2.3	Q19478.2.1	Q19478.3.3	Q19478.3.1
AEC#	**Test**	**TC**	**HAST**	**HTS**	**TC**	**HAST**	**TC**	**HAST**
1	Initial Sampling (T0)[1]	0/77	0/77	0/45	0/77	0/77	0/77	0/77
2	CSAM @ T0	0/77	0/77	--	0/77	0/77	0/77	0/77
3	Preconditioning to MSLx	0/77	0/77	--	0x77	0x77	0x77	0x77
4	CSAM after PC	0/77	0/77	--	0/77	0/77	0/77	0/77
5	ATE Test[1]	0x77	0x77	0/45	0x77	0x77	0x77	0x77
6	Stress 1x	0x77	0x77	0/45	0x77	0x77	0x77	0x77
7	ATE Test[1]	0x77	0x77	0/45	0x77	0x77	0x77	0x77
8	CSAM post-1x stress	0/77	0/77	--	0/77	0/77	0/77	0/77
9a	Ball + Stitch/Wedge Pull	0/3	0/3	--	0/3	0/3	0/3	0/3
9b	Ball Shear	0/3	0/3	--	0/3	0/3	0/3	0/3
10	Cross-section	0/1	0/1	0/1	0/1	0/1	0/1	0/1
11	Stress 2x	0/70	0/70	0/44	0/70	0/70	0/70	0/70
12	ATE Test[1]	0/70	0/70	0/44	0/70	0/70	0/70	0/70
13	CSAM post-2x Stress	0/70	0/70	--	0/70	0/77	0/77	0/77
14a	Ball + Stitch/Wedge Pull	0/2	0/2	--	0/2	0/2	0/2	0/2
14b	Ball Shear	0/2	0/2	--	0/2	0/2	0/2	0/2
15	Cross-section	0/1	0/1	0/1	0/1	0/1	0/1	0/1