



Reliability Report

Report Title: ADSP-SC58x/ADSP-2158x (Griffin)
Automotive Grade 2 Cu Wire
Qualification in 349 CSP-BGA at SK3

Report Number: 17932

Revision: A

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Summary

This report documents the successful completion of the reliability qualification requirements for the release of the ADSP-SC58X/ADSP-2158X family of products in a 349-CSP_BGA. The ADSP-SC58X/ADSP-2158X family of products are DSPs with dual SHARC+ cores and an Arm Cortex-A5 core.

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	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	<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	
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- 40nm CMOS

Product Characteristics	Product(s) to be qualified	Product(s) used for Substitution Data				
Generic/Root Part #	ADSP-SC58X/ADSP-2158X	ADSP-BF707	ADSP-SC589	ADSP-SC573	ADSP-SC584	ADSP-SC587W-12
Die Id	TMHI91/B	TMFM06_M/A	TMGA88/A	TMGZ92/A	TMGA88/A	TMHI91/B
Die Size (mm)	8.62 x 6.97	4.22 x 4.09	8.62 x 6.97	7.39 x 5.62	8.62 x 6.97	8.62 x 6.97
Wafer Fabrication Site	TSMC Fab-14	TSMC Fab-14	TSMC Fab-14	TSMC Fab-14	TSMC Fab-14	TSMC Fab-14
Wafer Fabrication Process	40nm CMOS	40nm CMOS	40nm CMOS	40nm CMOS	40nm CMOS	40nm CMOS
Die Substrate	Si	Si	Si	Si	Si	Si
Metallization/# Layers	AlCu/7	AlCu/7	AlCu/7	AlCu/7	AlCu/7	AlCu/7
Polyimide	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

Die/Fab Test Results
Table 2: Die/Fab Test Results - 40nm CMOS at TSMC Fab-14

Test Name	AEC #	Spec	Conditions	Generic/Root Part #	Lot #	Fail/SS	eTest Temp
Data Retention Bake	B3	JESD22-A117	150°C, 1000 Hours	ADSP-BF707	QL11074HTS01	0/77	RH
					QL11074HTS02	0/77	RH
					QL11074HTS03	0/77	RH
Early Life Failure Rate (ELFR)	B2	AEC-Q100-008	T _a = 105°C, T _j = 133°C, 48 Hours	ADSP-SC589	QL11376 Lot 1	0/800	RH
					QL11376 Lot 2	0/800	RH
					QL11376 Lot 3	0/800	RH
			T _a = 115°C, T _j = 133°C, 48 Hours	ADSP-SC573	QL12110 Lot 1	0/800	RH
					QL12110 Lot 2	0/800	RH
					QL12110 Lot 3	0/800	RH
			T _a = 125°C, T _j = 135°C, 48 Hours	ADSP-BF707	QL11074 Lot 1	0/800	RH
					QL11074 Lot 2	0/800	RH
					QL11074 Lot 3	0/800	RH
High Temperature Operating Life (HTOL) ¹	B1	JESD22-A108	T _a = 112°C, 125°C < T _j < 135°C, Biased, 1,000 Hours	ADSP-SC573	QL12110HTL01	0/77	RHC
					QL12110HTL02	0/77	RHC
					QL12110HTL03	0/77	RHC
			T _a = 109°C, 125°C < T _j < 135°C, Biased, 1,000 Hours	ADSP-SC589	QL11376HTL01	0/77	RHC
					QL11376HTL02	0/77	RHC
					QL11376HTL03	0/77	RHC
			T _a = 125°C, 125°C < T _j < 135°C, Biased, 4500 Hours	ADSP-BF707	QL12079HTL02	0/77	RHC
					QL11074HTL03	0/77	RHC
					QL11074HTL01	0/77	RHC
					QL11074HTL02	0/77	RHC
High Temperature Storage Life (HTSL)	A6	JESD22-A103	150°C, 1,000 Hours	ADSP-SC573	QL12110HTS01	0/45	RH
				ADSP-SC584	QL12419HTS01	0/45	RH
				ADSP-SC587W-12	Q19498.1.5	0/77	RH
				ADSP-SC589	QL11376HTS01	0/45	RH
					QL12416HTS01	0/45	RH
					QL12417HTS01	0/45	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.

Test Name	AEC #	Spec	Conditions	Generic/Root Part #	Lot #	Fail/SS	eTest Temp
Temperature Humidity Bias (THB) ¹	A2	JESD22-A101	85°C, 85%RH, Biased, 2000 Hours	ADSP-SC584	Q17932.1.1	0/77	RH
					Q17932.2.1	0/77	RH
					Q17932.3.1	2/77 ²	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 FA concluded contact to poly short. Reference FA222239 and CAPA2021531040B.

Package/Assembly Product Characteristics

Table 3: Package/Assembly Product Characteristics - 349-CSP_BGA at STATS (SK3)

Product Characteristics	Product(s) to be qualified	Product(s) used for Substitution Data
Generic/Root Part #	ADSP-SC582(W10)/3(W10)/4(W10) and ADSP-21583(W10)/4(W10)	ADSP-SC589
Package	349-CSP_BGA	529-CSP_BGA
Body Size (mm)	19.00 x 19.00 x 1.36	19.00 x 19.00 x 1.36
Assembly Location	STATS ChipPAC Korea (SK3)	STATS ChipPAC Korea (SK3)
MSL/Peak Reflow Temperature(°C)	3/260	3/260
Mold Compound	Kyocera KE G2280TS	Kyocera KE G2280TS
Die Attach/Underfill/TIM	Ablestik 2000B conductive/Not Applicable/Not Applicable	Ablestik 2000B conductive/Not Applicable/Not Applicable
Lead Finish	96.5Sn_3.0Ag_0.5Cu	96.5Sn_3.0Ag_0.5Cu
Wire Bond Material/Diameter (mils)	PdCuAu 2N/0.80	PdCuAu 2N/0.80
Laminate Stack	4 Layer Laminate	4 Layer Laminate

Package/Assembly Test Results
Table 4: Package/Assembly Test Results - CSP_BGA at STATS ChipPAC Korea (SK3)

Test Name	AEC #	Spec	Conditions	Generic/Root Part #	Lot #	Fail/SS	eTest Temp
High Temperature Storage Life (HTSL)	A6	JESD22-A103	150°C, 2,000 Hours	ADSP-SC589	QL11375HTS01	0/45	RH
					QL11375HTS02	0/45	RH
					QL11375HTS03	0/45	RH
Solder Heat Resistance (SHR) ¹	A1	J-STD-020	MSL-3	ADSP-SC584	Q17932.1.2	0/11	R
					Q17932.2.2	0/11	R
					Q17932.3.2	0/11	R
Temperature Cycling (TC) ¹	A4	JESD22-A104	-55°C/+125°C, 2,000 Cycles	ADSP-SC584	Q17932.1.3	0/77	RH
					Q17932.2.3	0/77	RH
					Q17932.3.3	0/77	RH
		-55°C/+125°C, 5000 Cycles	ADSP-SC589	QL11375TCT01	0/77	RH	
				QL11375TCT02	0/77	RH	
				QL11375TCT03	0/77	RH	
Temperature Humidity Bias (THB) ¹	A2	JESD22-A101	85°C, 85%RH, Biased, 2000 Hours	ADSP-SC584	Q17932.1.1	0/77	RH
					Q17932.2.1	0/77	RH
					Q17932.3.1	2/77 ²	RH
Unbiased HAST (UHST) ¹	A3	JESD22-A118	130°C, 85%RH, 33.3 psia, 96 Hours	ADSP-SC589	QL11375UHS01	0/77	R
					QL11375UHS02	0/77	R
					QL11375UHS03	0/77	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.

² FA concluded contact to poly short. Reference FA222239 and CAPA2021531040B. A corrective action has been implemented and validated.

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	ADSP-SC587W	529-CSP_BGA	JS-002	1Ω, Cpkg	±500V	C2a	RH
HBM	ADSP-SC587W	529-CSP_BGA	ESDA/JEDEC JS-001	1.5kΩ, 100pF	±2000V	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	ADSP-SC587W	+200mA, -200mA	+1.8V/+5.205V/+2.85V/+1.425V	105°C	II	RH

Approvals

Reliability Engineer: Eric Marks

Appendix

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

Step	Qualification Step	Stress Test	TC (-65°C to 150°C) JESD22-A104	THB (85°C/85% RH) JESD22A-101	PTC (-40°C to 125°C) JESD22-A104	HTSL (150°C) JESD22-A103
1	Initial Sampling (T ₀) [†]		Sample Sizes as required			
2	CSAM @ T ₀		Sample Sizes as required			
3	Preconditioning to MSLx		3x77	3x77	1x45	--
4	CSAM after PC		3x22	3x22	1x22	--
5	ATE Test [†]		3x77	3x77	1x45	3x45
6	Stress 1x		3x77	3x77	1x45	3x45
7	ATE Test [†]		3x77	3x77	1x45	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	1x45	3x44
12	ATE Test [†]		3x70	3x70	1x45	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

[†] This footnote should highlight the ATE temperature used.

REL Lot number		Q17932.1.3 QL11375TCT01	Q17932.1.1	QL11375HTS01	Q17932.2.3 QL11375TCT02	Q17932.2.1	QL11375HTS02	Q17932.3.3 QL11375TCT03	Q17932.3.1	QL11375HTS03
AEC#	Test	TC	THB	HTS	TC	THB	HTS	TC	THB	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	0/22	0/22	--	0/22	0/22	--	0/22	0/22	--
3	Preconditioning to MSL 3	0/77	0/77	--	0x77	0x77	--	0x77	0x77	--
4	CSAM after PC	0/22	0/22	--	0/22	0/22	--	0/22	0/22	--
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	0/22	0/22	--	0/22	0/22	--	0/22	0/22	--
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	0/22	0/22	--	0/22	0/22	--	0/22	0/22	--
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.