



Reliability Report

Report Title: AD5542 Family Die Rev & New Products

Report Number: 7973

Revision: A

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Summary

This report documents the successful completion of the reliability qualification requirements for release of the AD5512A, AD5541, AD5541A, AD5541A-1, AD5542, AD5542A, AD5542A-1, AD5551, AD5552 product in a 10-MINI_SO, 14-SOIC_N, 16-LFCSP, 16-TSSOP_4.4, 8-SOIC_N packages.

The AD5512A, AD5541, AD5541A, AD5541A-1, AD5542, AD5542A, AD5542A-1, AD5551, AD5552 consist of 12-bit Voltage Output DAC, 16-bit voltage output DAC, and 14-bit Voltage Output DAC.

Table 1: AD5542 Product Characteristics

Die/Fab

Device / Die ID	B41A
Die Size (mm)	1.53 x 1.65
Wafer Fabrication Site	Limerick 8"
Wafer Fabrication Process	H6_16VDPTMPNRSBX
Transistor Count	4 thousand
Passivation Layer	undoped-oxide/SiN
Bond Pad Metal Composition	AlCu
Maximum Current Density (mA/ μ m)	1.00
Die Overcoat	Polyimide

Package/Assembly

Available Package	14-SOIC_N
Body Size (mm)	8.75 x 4.00 x 1.50
Assembly Location	Amkor-P
Molding Compound	Sumitomo G600
Wire Type	Gold
Wire Diameter (mils)	1.20
Die Attach	Ablestik 8290
Lead Frame Material	Copper
Lead Finish	Tin Plate
Moisture Sensitivity Level	1
Maximum Peak Reflow Temperature ($^{\circ}$ C)	260

Table 2: AD5551 Product Characteristics

Die/Fab

Device / Die ID	B41A
Die Size (mm)	1.53 x 1.65
Wafer Fabrication Site	Limerick 8"

Wafer Fabrication Process	H6_16VDPTMPNRSBX
Transistor Count	4 thousand
Passivation Layer	undoped-oxide/SiN
Bond Pad Metal Composition	AlCu
Maximum Current Density (mA/μm)	1.00
Die Overcoat	Polyimide

Package/Assembly

Available Package	8-SOIC_N
Body Size (mm)	5.00 x 4.00 x 1.50
Assembly Location	Amkor-P
Molding Compound	Sumitomo G600
Wire Type	Gold
Wire Diameter (mils)	1.20
Die Attach	Ablestik 8290
Lead Frame Material	Copper
Lead Finish	Tin Plate
Moisture Sensitivity Level	1
Maximum Peak Reflow Temperature (°C)	260

Table 3: AD5542A Product Characteristics

Die/Fab

Device / Die ID	B41A
Die Size (mm)	1.53 x 1.65
Wafer Fabrication Site	Limerick 8"
Wafer Fabrication Process	H6_16VDPTMPNRSBX
Transistor Count	4 thousand
Passivation Layer	undoped-oxide/SiN
Bond Pad Metal Composition	AlCu
Maximum Current Density (mA/μm)	2.00
Die Overcoat	Polyimide

Package/Assembly

Available Package	16-TSSOP_4.4	16-LFCSP	10-MINI_SO
Body Size (mm)	5.00 x 4.40 x 1.00	3.00 x 3.00 x 0.75	3.00 x 3.00 x 0.85
Assembly Location	Amkor-P	SCM	Carsem-M
Molding Compound	Sumitomo G700K	Sumitomo G770HC	Sumitomo G600
Wire Type	Gold	Gold Tanaka GPG-2	Gold
Wire Diameter (mils)	1.00	1.00	1.00
Die Attach	Ablestik 8290	Ablestik 8290	Ablestik 84-1LMIS R4
Lead Frame Material	Copper	Copper	Copper
Lead Finish	Tin Plate	Tin Plate	Tin Plate
Moisture Sensitivity Level	1	3	1
Maximum Peak Reflow	260	260	260

Temperature (°C)			
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Table 4: AD5541A Product Characteristics
Die/Fab

Device / Die ID	B41A
Die Size (mm)	1.53 x 1.65
Wafer Fabrication Site	Limerick 8"
Wafer Fabrication Process	H6_16VDPTMPNRSBX
Transistor Count	4 thousand
Passivation Layer	undoped-oxide/SiN
Bond Pad Metal Composition	AlCu
Maximum Current Density (mA/μm)	2.00
Die Overcoat	Polyimide

Package/Assembly

Available Package	16-LFCSP
Body Size (mm)	3.00 x 3.00 x 0.75
Assembly Location	SCM
Molding Compound	Sumitomo G770HC
Wire Type	Gold Tanaka GPG-2
Wire Diameter (mils)	1.00
Die Attach	Ablestik 8290
Lead Frame Material	Copper
Lead Finish	Tin Plate
Moisture Sensitivity Level	3
Maximum Peak Reflow Temperature (°C)	260

Table 5: ad5512A Product Characteristics
Die/Fab

Device / Die ID	B41A
Die Size (mm)	1.53 x 1.65
Wafer Fabrication Site	Limerick 8"
Wafer Fabrication Process	H6_16VDPTMPNRSBX
Transistor Count	4 thousand
Passivation Layer	undoped-oxide/SiN
Bond Pad Metal Composition	AlCu
Maximum Current Density (mA/μm)	1.00
Die Overcoat	Polyimide

Package/Assembly

Available Package	16-LFCSP
Body Size (mm)	3.00 x 3.00 x 0.75
Assembly Location	SCM
Molding Compound	Sumitomo G770HC

Wire Type	Gold Tanaka GPG-2
Wire Diameter (mils)	1.00
Die Attach	Ablestik 8290
Lead Frame Material	Copper
Lead Finish	Tin Plate
Moisture Sensitivity Level	3
Maximum Peak Reflow Temperature (°C)	260

Description / Results of Tests Performed

Tables 6 and 7 provide a description of the qualification tests conducted and the associated test results for products manufactured on the same technologies as described in Tables 1, 2, 3, 4, and 5. All devices were electrically tested before and after each stress. Any device that did not meet all electrical data sheet limits following stressing would be considered a valid (stress-attributable) failure unless there was conclusive evidence to indicate otherwise.

Table 6: Package Qualification Test Results

Test Name	Spec	Conditions	Device	Package	Lot #	Sample Size	Qty. Failures
Autoclave (AC) ¹	JESD22-A102	121°C 100%RH 2atm 168 hours	ADF4106S P1	Amkor-P 16- TSSOP_4.4	N68628.1	77	0
					N68629.1	77	0
					N68630.1	77	0
			ADM1032	Amkor-P 8- SOIC_N	N80464.1	77	0
					N80465.1	77	0
					N80466.1	77	0
					AC51761.1	77	0
					AC51762.1	77	0
					AC51763.1	77	0
		121°C 100%RH 2atm 96 hours	AD5551	Carsem-M 8-MINI_SO	AC83260.1	77	0
					AC83261.1	77	0
					AC83262.1	77	0
			AD8220	Carsem-M 8-MINI_SO	Q7598.20	77	0
					Q7598.3	77	0
					Q7598.4	77	0
			AD8602	Carsem-M 8-MINI_SO	AB27866.1	77	0
					AB27867.1	77	0
					AB27868.1	77	0
AD8642	Amkor-P 8- SOIC_N	AC49671.1	77	0			
		AC49672.1	77	0			
		AC49673.1	77	0			
AD5660	Carsem-M 8-MINI_SO	Q6163.1	77	0			
		Q6163.2	77	0			
		Q6163.3	77	0			
Autoclave (AC) ²	JESD22-A102	121°C 100%RH 2atm 168 hours	ADXL330	Carsem-S 16-LFCSP	Q6163.1	77	0
					Q6163.2	77	0
					Q6163.3	77	0
Autoclave (AC) ²	JESD22-A102	121°C 100%RH 2atm 96 hours	ADF4153	Carsem-S 20-LFCSP	Q7435.16	77	0
					Q7435.17	77	0
					Q7435.18	77	0
			ADF7020	Carsem-S 48-LFCSP	Q7435.1	53	0
					Q7435.2	53	0
					Q7435.3	53	0

Test Name	Spec	Conditions	Device	Package	Lot #	Sample Size	Qty. Failures
Biased HAST (HAST) ²	JESD22-A110	130°C 85%RH 2atm, Biased 96 hours	ADF7020	Carsem-S 20-LFCSP	Q7435.4	77	0
Biased HAST (HAST) ¹	JESD22-A110	130°C 85%RH 2atm, Biased 96 hours	AD830	Amkor-P 8-SOIC_N	N53065.1	77	0
					N53066.1	77	0
					N53068.1	77	0
			AD8602	Carsem-M 8-MINI_SO	Q7598.24	77	0
					Q7598.5	77	0
					Q7598.8	77	0
			ADF4106S P1	Amkor-P 16-TSSOP_4.4	N68631.1	77	0
					N68632.1	77	0
					N68633.1	77	0
			ADM1032	Amkor-P 8-SOIC_N	N80475.1	77	0
					N80476.1	77	0
					N80477.1	77	0
Biased HAST (HAST) ²	JESD22-A110	130°C 85%RH 2atm, Biased 96 hours	ADXL330	Carsem-S 16-LFCSP	AB27213.1	77	0
					AB27214.1	77	0
					AB27215.1	77	0
Biased HAST (HAST) ²	JESD22-A110	130°C 85%RH 2atm, Biased 96 hours	ADF7020	Carsem-S 48-LFCSP	Q7435.5	53	0
					Q7435.6	53	0
Solder Heat Resistance (SHR) ¹	ADI-0049	See Footer	AD5541	Amkor-P 8-SOIC_N	Q7973.6	77	0
					Q7973.7	77	0
Solder Heat Resistance (SHR) ¹	ADI-0049	See Footer	AD8220	Carsem-M 8-MINI_SO	AC83264.1	11	0
					AC83265.1	11	0
			AD830	Amkor-P 8-SOIC_N	N53712.2	11	0
					N53713.2	11	0
					N53714.2	11	0
			AD8642		AB27871.1	11	0
					AB27872.1	11	0
					AB27873.1	11	0
			ADF4106S P1	Amkor-P 16-TSSOP_4.4	N68636.2	11	0
					N68637.2	11	0
					N68638.2	11	0
			AD8602	Carsem-M 8-MINI_SO	Q7598.13	16	0
Q7598.14	16	0					
Q7598.16	16	0					
AD5660		AC49679.1	11	0			
Solder Heat Resistance (SHR) ²	ADI-0049	See Footer	ADF4153	Carsem-S 20-LFCSP	Q7435.22	11	0
					Q7435.23	11	0
					Q7435.24	11	0
			ADF7020	Carsem-S 48-LFCSP	Q7435.10	11	0
					Q7435.11	11	0
					Q7435.12	11	0
Temperature Cycling (TC) ¹	JESD22-A104	-65°C / +150°C 500 cycles	AD5551	Amkor-P 8-SOIC_N	AC51771.1	77	0
					AC51772.1	77	0
					AC51773.1	77	0
			AD8220	Carsem-M 8-MINI_SO	AC83267.1	77	0
					AC83268.1	77	0
					AC83269.1	77	0
			AD830	Amkor-P 8-SOIC_N	N53712.1	77	0
					N53713.1	77	0
					N53714.1	77	0

Test Name	Spec	Conditions	Device	Package	Lot #	Sample Size	Qty. Failures
			AD8602	Carsem-M 8-MINI_SO	Q7598.11	77	0
					Q7598.28	77	0
					Q7598.29	77	0
			ADF4106S P1	Amkor-P 16- TSSOP_4.4	N68636.1	77	0
					N68637.1	77	0
					N68638.1	77	0
			ADM1032	Amkor-P 8- SOIC_N	N80469.1	77	0
					N80470.1	77	0
					N80471.1	77	0
			AD5660	Carsem-M 8-MINI_SO	AC49675.1	77	0
					AC49676.1	77	0
					AC49677.1	77	0
Temperature Cycling (TC) ²	JESD22- A104	-65°C / +150°C 500 cycles	ADXL330	Carsem-S 16-LFCSP	Q6163.7	77	0
					Q6163.8	77	0
					Q6163.9	77	0
Temperature Cycling (TC) ²	JESD22- A104	-65°C / +150°C 500 cycles	ADF4153	Carsem-S 20-LFCSP	Q7435.19	77	0
					Q7435.20	77	0
					Q7435.21	77	0
			ADF7020	Carsem-S 48-LFCSP	Q7435.7	53	0
					Q7435.8	53	0
Q7435.9	53	0					

1) These Samples were subjected to preconditioning (per J-STD-020 Level 1) prior to the start of the stress test. Level 1 preconditioning consists of the following: Bake: 24 hrs @ 125°C, Soak: Unbiased Soak: 168 hrs @ 85°C, 85%RH, Reflow: 3 passes through an oven with a peak temperature of 260°C.

2) These Samples were subjected to preconditioning (per J-STD-020 Level 3) prior to the start of the stress test. Level 3 preconditioning consists of the following: Bake: 24 hrs @ 125°C, Soak: Unbiased Soak: 192 hrs @ 30°C, 60%RH, Reflow: 3 passes through an oven with a peak temperature of 260°C.

Table 7: 0.6µm CMOS at Limerick 8" Fab Qualification Test Results

Test Name	Spec	Conditions	Device	Lot #	Sample Size	Qty. Failures	
Early Life Failure Rate (ELFR)	MIL-STD-883, Method 1015	125°C 168 hours	ADP3120A	LOT 1	225	0	
				LOT 2	225	0	
				LOT 3	150	0	
		125°C 48 hours		R31644.2	318	0	
				R39265.2	510	0	
				R39266.2	270	0	
				R39266.3	77	0	
R31644.3	352	0					
Biased HAST (HAST) ¹	JESD22-A110	130°C 85%RH 2atm, Biased 96 hours	ADP3120A	R42848.1	77	0	
				R42850.1	77	0	
				R42849.1	77	0	
High Temperature Operating Life (HTOL) ²	JESD22-A108	125°C < Tj < 135°C, Biased 1,000 hours	AD53559	Q7168.2	32	0	
				Q7168.7	32	0	
				Q7168.13	32	0	
		135°C < Tj < 150°C, Biased 1,000 hours		ADATE302	Q7167.4	45	0
				Q7167.20	45	0	
High Temperature Operating Life (HTOL)	JESD22-A108	125°C < Tj < 135°C, Biased 1,000 hours	ADP3120A	R39265.1	76	0	
				R39266.1	76	0	
				R31644.1	75	0	

Test Name	Spec	Conditions	Device	Lot #	Sample Size	Qty. Failures
		135°C < Tj < 150°C, Biased 1,000 hours	ADATE302	Q7167.3	45	0
High Temperature Operating Life (HTOL) ^{1,2}	JESD22-A108	125°C < Tj < 135°C, Biased 1,000 hours	AD5542	Q7973.100	77	0
High Temperature Operating Life (HTOL) ¹	JESD22-A108	125°C < Tj < 135°C, Biased 500 hours	AD8639	Q7030.18	163	0
High Temperature Storage Life (HTSL) ²	JESD22-A103	150°C 1,000 hours	ADATE302	Q7167.6	32	0
				Q7167.21	45	0
High Temperature Storage Life (HTSL)	JESD22-A103	150°C 1,000 hours	ADATE302	Q7167.8	45	0
			ADP3120A	R42851.1	77	0
				R42852.1	77	0
				R42853.1	77	0

1) These Samples were subjected to preconditioning (per J-STD-020 Level 1) prior to the start of the stress test. Level 1 preconditioning consists of the following: Bake: 24 hrs @ 125°C, Soak: Unbiased Soak: 168 hrs @ 85°C, 85%RH, Reflow: 3 passes through an oven with a peak temperature of 260°C.

2) Electrical test was performed at ambient temperatures.

Samples of the many devices manufactured with these package and process technologies are continuously undergoing reliability evaluation as part of the ADI Reliability Monitor Program. Additional qualification data is available on [Analog Devices' web site](#).

ESD Test Results

The results of Human Body Model (HBM), Machine Model (MM), and Field Induced Charge Device Model (FICDM) ESD testing are summarized in the ESD Results Table. ADI measures ESD results using stringent test procedures based on the specifications listed. Any comparison with another supplier's results should ensure that the same ESD test procedures have been used. For further details, please see the EOS/ESD chapter of the ADI Reliability Handbook (available via the 'Quality and Reliability' link at the Analog Devices Website ([Analog Website](#))).

Table 8: ESD Test Results

ESD Model	Package	Generic	ESD Test Spec	RC Network	Highest Pass Level	First Fail Level	Class
FICDM	14-SOIC_N	AD5542	ANSI/ESD STM5.3.1-1999	1Ω, Cpkg	±1500V	NA	C6
	16-TSSOP_4.4	AD5542A			±1500V	NA	C6

ESD Model	Package	Generic	ESD Test Spec	RC Network	Highest Pass Level	First Fail Level	Class
HBM	16-TSSOP_4.4	AD5542A	ANSI/ESD STM5.1-2007	1.5k Ω , 100pF	\pm 5000V	NA	3A
MM	16-TSSOP_4.4	AD5542A	ANSI/ESD STM5.2-1999	0 Ω , 200pF	\pm 200V	\pm 400V	M3

Latch-Up Test Results

Six samples of the AD5542A were Latch-up tested at Ta=25°C per JEDEC Standard JESD78, Class I, Level. All six devices passed.

Approvals

This report has been approved by electronic means (4.0). Reliability Engineer: Mark Forde

Additional Information

Data sheets and other additional information are available on [Analog Devices' web site](#).