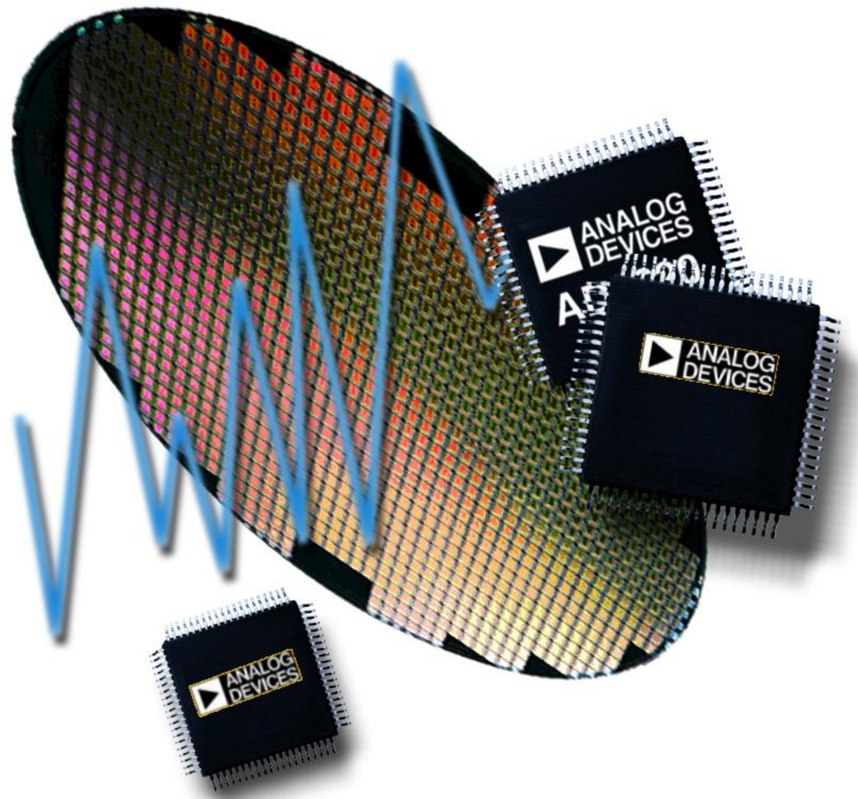

Reliability Report

Report Title: **LFCSP at ASE Korea Qualification**

Report Number: **19670**

Revision: **A**

Date: **25 March 2022**

Summary

This report summarizes the reliability qualification data for sawn lead frame chip scale package (LFCSP) assembled at ASE Korea (AEK).

The AD9695, AD9512, AD7689, ADF41513, SSM3302, ADF4157, HMC637ALP5E, ADF7250, ADF5902, ADAU1979W, and ADV7380 at ASE Korea (AEK) are used as device vehicles for this qualification.

- The AD9695 is a dual, 14-bit, 1300 MSPS/625 MSPS analog-to-digital converter (ADC). The device has an on-chip buffer and a sample-and-hold circuit designed for low power, small size, and ease of use. Table 1 describes the AD9695 product characteristics.
- The AD9512 provides a multi-output clock distribution function for input signals up to 1.6 GHz. The design emphasizes low jitter and low phase noise in order to maximize data converter clocking performance. Table 2 describes the AD9512 product characteristics.
- The AD7689 are 4-channel/8-channel, 16-bit, charge redistribution successive approximation register (SAR) analog-to-digital converters (ADCs) that operate from a single power supply, VDD. Table 3 describes the AD7689 product characteristics.
- The ADF41513 is an ultralow noise frequency synthesizer that can be used to implement local oscillators (LOs) as high as 26.5 GHz in the upconversion and downconversion sections of wireless receivers and transmitters. Table 4 describes the AD7689 product characteristics.
- The SSM3302 is a fully integrated, high efficiency, stereo Class-D audio amplifier. The application circuit requires minimal external components and operates from a single 7 V to 18 V supply. The device is capable of delivering 2 × 10 W of continuous output power into a 4 Ω load (or 2 × 8 W into 8 Ω) with <1% THD + N from a 12 V supply. Table 5 describes the SSM3302 product characteristics.
- The ADF4157 is a 6 GHz fractional-N frequency synthesizer with a 25-bit fixed modulus, allowing subhertz frequency resolution at 6 GHz. It consists of a low noise digital phase frequency detector (PFD), a precision charge pump, and a programmable reference divider. There is a Σ-Δ based fractional interpolator to allow programmable fractional-N division. Table 6 describes the ADF4157 product characteristics.
- The HMC637ALP5E is a gallium arsenide (GaAs), monolithic microwave integrated circuit (MMIC), pseudomorphic high electron mobility transistor (pHEMT) distributed power amplifier which operates between 0.1 GHz and 6 GHz. The amplifier provides 13 dB of gain, 44 dBm output third-order intercept (IP3), and 29 dBm of output power at 1 dB gain compression while requiring 400 mA from a 12 V supply. Table 7 describes the HMC637ALP5E product characteristics.

- The ADF7250 is a low power integrated radio transceiver that supports Bluetooth low energy and other GFSK signaling modes. Key features include ultralow power operation, and best in class sensitivity. Table 8 describes the ADF7250 product characteristics.
- The ADF5902 is a 24 GHz transmitter (Tx) monolithic microwave integrated circuit (MMIC) with an on-chip, 24 GHz voltage controlled oscillator (VCO). The VCO features a fractional-N frequency synthesizer with waveform generation capability with programmable grid array (PGA) and dual transmitter channels for radar systems. Table 9 describes the ADF5902 product characteristics.
- The ADAU1979 incorporates four high performance, analog-to-digital converters (ADCs) with 4.5 V rms capable ac-coupled inputs. The ADCs use a multibit sigma-delta (Σ-Δ) architecture with continuous time front end for low EMI. Table 10 describes the ADAU1979W product characteristics.
- The ADV7380 is a point-to-point Camera Link chip developed to enable the transmission of high definition (HD) video from a remote camera module to an Electronic Camera Unit (ECU) or a Head Unit in an automotive vehicle. Table 11 describes the ADV7380 product characteristics.

Table 1: AD9695 Product Characteristics

Die/Fab

Die Id	TMIB72 A3 /B
Die Size (mm)	3.91 x 3.91
Wafer Fabrication Site	TSMC Fab15
Wafer Fabrication Process	28nm CMOS
Passivation Layer	undoped-oxide/SiN
Bond Pad Metal Composition	AlCu
Polyimide	Yes
Maximum Power Dissipation (W)	3.000

Package/Assembly

Package	64-LFCSP
Body Size (mm)	9.00 x 9.00 x 0.75
Assembly Location	ASE-AEK
Molding Compound	Sumitomo G700LYT
Wire Type	MKE R 2N Gold
Wire Diameter (mils)	0.80
Die Attach	Hitachi EN-4900GC
Lead Frame Material	Copper
Lead Finish	Matte Sn
Moisture Sensitivity Level	3
Maximum Peak Reflow Temperature (C)	260

Table 2: AD9512 Product Characteristics

Die/Fab

Die Id	TML838 / C
Die Size (mm)	3.14 x 3.21
Wafer Fabrication Site	TSMC Fab-3C
Wafer Fabrication Process	0.35µm CMOS
Passivation Layer	undoped-oxide/SiN
Bond Pad Metal Composition	AlCu
Polyimide	No
Maximum Power Dissipation (W)	0.70

Package/Assembly

Package	48-LFCSP
Body Size (mm)	7.00 x 7.00 x 0.75
Assembly Location	ASE (AEK)
Molding Compound	Sumitomo G700LYT
Wire Type	MKE R 2N Gold
Wire Diameter (mils)	0.80
Die Attach	Hitachi EN-4900GC
Lead Frame Material	Copper
Lead Finish	NiPdAu
Moisture Sensitivity Level	3
Maximum Peak Reflow Temperature (C)	260

Table 3: AD7689 Product Characteristics

Die/Fab

Die Id	TMX307/E
Die Size (mm)	2.43 x 2.43
Wafer Fabrication Site	TSMC Fab-9
Wafer Fabrication Process	0.5µm CMOS
Passivation Layer	undoped-oxide/SiN
Bond Pad Metal Composition	AlCu
Polyimide	No
Maximum Power Dissipation (W)	0.013

Package/Assembly

Package	20-LFCSP
Body Size (mm)	4.00 x 4.00 x 0.85
Assembly Location	ASE-AEK
Molding Compound	Sumitomo G700
Wire Type	4N Gold
Wire Diameter (mils)	1.00
Die Attach	Ablestik 8290
Lead Frame Material	Copper Alloy 194
Lead Finish	Matte Sn
Moisture Sensitivity Level	3
Maximum Peak Reflow Temperature (°C)	260

Table 4: ADF41513 Product Characteristics

Die/Fab

Die Id	TMJK97/A
Die Size (mm)	1.63 x 1.63
Wafer Fabrication Site	TSMC Fab 4
Wafer Fabrication Process	0.18µm BiCMOS
Passivation Layer	undoped-oxide/SiN
Bond Pad Metal Composition	AlCu
Polyimide	No
Maximum Power Dissipation (W)	0.300

Package/Assembly

Package	24-LFCSP
Body Size (mm)	4.00 x 4.00 x 0.75
Assembly Location	ASE-AEK
Molding Compound	Sumitomo G700
Wire Type	MKE R 2N Gold
Wire Diameter (mils)	0.80
Die Attach	Ablestik 8290
Lead Frame Material	Copper
Lead Finish	Matte Sn
Moisture Sensitivity Level	3
Maximum Peak Reflow Temperature (C)	260

Table 5: SSM3302 Product Characteristics

Die/Fab

Die Id	TMX307 F
Die Size (mm)	3.23 x 3.23
Wafer Fabrication Site	E_TSMC1008
Wafer Fabrication Process	0.35µm DMOS
Passivation Layer	undoped-oxide/SiN
Bond Pad Metal Composition	AlCu
Polyimide	Yes
Maximum Power Dissipation (W)	3.0

Package/Assembly

Package	40-LFCSP
Body Size (mm)	6X6X0.75
Assembly Location	ASE (AEK)
Molding Compound	Sumitomo G700
Wire Type	4N Gold
Wire Diameter (mils)	1.3
Die Attach	Hitachi EN 4900GC conductive
Lead Frame Material	Copper
Lead Finish	100Sn
Moisture Sensitivity Level	3
Maximum Peak Reflow Temperature (C)	260

Table 6: ADF4157 Product Characteristics

Die/Fab

Die Id	ADF4156
Die Size (mm)	1.39 x 1.47
Wafer Fabrication Site	TSMC 3C 8”
Wafer Fabrication Process	0.35µm BiCMOS DPTM 5.0/3.3V
Approximate Transistor Count	32 thousand
Passivation Layer	undoped-oxide/SiN
Bond Pad Metal Composition	AlCu
Polyimide	No
Maximum Power Dissipation (W)	0.050

Package/Assembly

Package	20-LFCSP
Body Size (mm)	4.00 x 4.00 x 0.75
Operating Temperature Range	-40°C to +85°C
Assembly Location	ASE-AEK
Molding Compound	Sumitomo G700
Wire Type	Gold MKE-R
Wire Diameter (mils)	0.80
Die Attach	Ablestik 8290
Lead Frame Material	Copper
Lead Finish	Matte Sn
Moisture Sensitivity Level	3
Maximum Peak Reflow Temperature (°C)	260

Table 7: HMC637ALP5E Product Characteristics

Die/Fab

Die Id	E5901
Die Size (mm)	2.78 x 2.98
Wafer Fabrication Site	E_WINS0106
Wafer Fabrication Process	0.15µm GaAs pHEMT
Passivation Layer	undoped-oxide/SiN
Bond Pad Metal Composition	Au

Package/Assembly

Package	32-LFCSP
Body Size (mm)	5.00 x 5.00 x 0.75
Assembly Location	ASE (AEK)
Molding Compound	Sumitomo G700LYT
Wire Type	MKE R 2N Gold
Wire Diameter (mils)	0.80
Die Attach	Hitachi EN-4900GC
Lead Frame Material	Copper
Lead Finish	NiPdAu
Moisture Sensitivity Level	3
Maximum Peak Reflow Temperature (°C)	260

Table 8: ADF7250 Product Characteristics

Die/Fab

Die Id	TMJC62B
Die Size (mm)	3.30 x 2.72
Wafer Fabrication Site	TSMC 14
Wafer Fabrication Process	90nm CMOS
Passivation Layer	undoped-oxide/SiN
Bond Pad Metal Composition	AlCu

Package/Assembly

Package	40-LFCSP
Body Size (mm)	6.00 x 6.00 x 0.75
Assembly Location	ASE (AEK)
Molding Compound	Sumitomo G700LYT
Wire Type	MKE R 2N Gold
Wire Diameter (mils)	0.80
Die Attach	Hitachi EN-4900GC
Lead Frame Material	Copper
Lead Finish	Matte Sn
Moisture Sensitivity Level	3
Maximum Peak Reflow Temperature (°C)	260

Table 9: ADF5902 Product Characteristics

Die/Fab

Die Id	TMFW14 / B-T1
Die Size (mm)	1.97 x 2.63
Wafer Fabrication Site	TSMC Fab 4
Wafer Fabrication Process	0.18µm BiCMOS
Approximate Transistor Count	150,000
Passivation Layer	undoped-oxide/SiN
Bond Pad Metal Composition	AlCu

Package/Assembly

Package	32-LFCSP
Body Size (mm)	5.00 x 5.00 x 0.75
Operating Temperature Range	-40°C < TA < 105°C
Assembly Location	ASE (AEK)
Molding Compound	Sumitomo G700
Die Attach Material	Hitachi EN-4900GC
Wire Type	MKE R 2N Gold
Wire Diameter (mills)	1.00
Lead Frame Material	Copper
Lead Finish	Matte Sn
Moisture Sensitivity Level	3
Maximum Peak Reflow Temperature (°C)	260

Table 10: ADAU1979W Product Characteristics

Die/Fab

Die Id	TMDS48 / B0002B
Die Size (mm)	3.46 x 2.63
Wafer Fabrication Site	TSMC Fab-8B
Wafer Fabrication Process	0.18µm CMOS
Approximate Transistor Count	368,000
Passivation Layer	doped-oxide/OxyNitride
Bond Pad Metal Composition	AlCu
Polyimide	Yes
Maximum Power Dissipation (W)	0.060

Package/Assembly

Package	40-LFCSP
Body Size (mm)	6.00 x 6.00 x 0.75
Operating Temperature Range	-40°C to +105°C
Assembly Location	ASE-AEK
Molding Compound	Sumitomo G700
Wire Type	MKE R 2N Gold
Wire Diameter (mils)	0.80
Die Attach	Hitachi EN-4900GC
Lead Frame Material	Copper Alloy 194
Lead Finish	Matte Sn
Moisture Sensitivity Level	3
Maximum Peak Reflow Temperature (°C)	260

Table 11: ADV7380 Product Characteristics

Die/Fab

Die Id	TMJW69 / A
Die Size (mm)	4.82 x 4.00
Wafer Fabrication Site	TSMC Fab-6
Wafer Fabrication Process	0.16µm CMOS
Approximate Transistor Count	6.00 million
Passivation Layer	undoped-oxide/SiN
Bond Pad Metal Composition	AlCu
Polyimide	Yes
Maximum Power Dissipation (W)	0.800

Package/Assembly

Package	48-LFCSP
Body Size (mm)	7.00 x 7.00 x 0.75
Operating Temperature Range	-40°C to +105°C
Assembly Location	ASE-AEK
Molding Compound	Sumitomo G700LYT
Wire Type	MKE R 2N Gold
Wire Diameter (mils)	0.80
Die Attach	Hitachi EN-4900GC
Lead Frame Material	Copper
Lead Finish	Matte Sn
Moisture Sensitivity Level	3
Maximum Peak Reflow Temperature (°C)	260

Description / Results of Tests Performed

Table 12 provides a description of the qualification tests conducted and the associated test results for products manufactured on the same technologies as described in Table 1 and 2. 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 12: LFCSP at ASE (AEK) Package Qualification Test Results

Test Name	Specification	Conditions	Device	Lot #	Sample Size	Qty. Failures
Autoclave (AC) [1]	JESD22-A102	121C 100%RH 33.3 psia, 96 Hours	ADF4157	Q8667.PC4	77	0
				Q8667.PC5	77	0
				Q8667.PC6	77	0
High Temperature Storage Life (HTSL)	JESD22-A103	150°C, 1,000 Hours	AD7689	Q13940.HS1	77	0
			AD9512	Q12863.HS1	77	0
			ADAU1979W	Q12963.HS1	77	0
			ADF41513	Q12163.18	45	0
			ADF4157	Q8667.HS2	32	0
			ADV7380	Q13235.HS1	32	0
Solder Heat Resistance (SHR) [1]	J-STD-020	MSL-3	AD7689	Q13940.SH1	11	0
				Q13940.SH2	11	0
				Q13940.SH3	11	0
			AD9512	Q12863.SH1	11	0
				Q12863.SH2	11	0
				Q12863.SH3	11	0
			AD9695	Q11437.SH1	11	0
				Q11437.SH2	11	0
				Q11437.SH3	11	0
			ADF41513	Q12163.10	11	0
				Q12163.17	11	0
				Q12163.6	11	0
			ADF4157	Q8667.SH4	11	0
				Q8667.SH5	11	0
				Q8667.SH6	11	0
			SSM3302	Q12461.SH1	11	0
				Q12461.SH2	11	0
				Q12461.SH3	11	0
Temperature Cycling (TC) [1]	JESD22-A104	-65°C/+150°C, 1,000 Cycles	AD9512	Q12863.TC1	77	0
				Q12863.TC2	77	0
				Q12863.TC3	77	0
			HMC637ALP5E	Q16109.TC1	77	0
				Q16109.TC2	77	0
				Q16109.TC3	77	0
			SSM3302	Q12461.TC1	77	0
				Q12461.TC2	77	0
				Q12461.TC3	77	0
			AD7689	Q13940.TC1	77	0
				Q13940.TC2	77	0

Test Name	Specification	Conditions	Device	Lot #	Sample Size	Qty. Failures
		-65°C/+150°C, 500 Cycles		Q13940.TC3	77	0
			ADF41513	Q12163.12	77	0
				Q12163.5	77	0
				Q12163.7	77	0
			ADF4157	Q8667.TC4	77	0
				Q8667.TC5	77	0
				Q8667.TC6	77	0
Unbiased HAST (UHST) [1]	JESD22-A118	130C 85%RH 33.3 psia, 96 Hours	AD7689	Q13940.UH1	77	0
				Q13940.UH2	77	0
				Q13940.UH3	77	0
			ADF41513	Q12163.13	77	0
				Q12163.15	77	0
				Q12163.9	77	0
			ADF5902	Q13626.UH2	77	0
				Q13626.UH3	77	0
				Q13626.UH4	77	0
			ADF7250	Q13825.11	77	0
				Q13825.6	77	0
				Q13825.9	77	0
			SSM3302	Q12461.UH1	77	0
				Q12461.UH2	77	0
				Q12461.UH3	77	0

[1] 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, Unbiased Soak: 192 hrs @ 30°C, 60%RH, Reflow: 3 passes through an oven with a peak temperature of 260°C.

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 Field-Induced Charged Device Model (FICDM) ESD testing is summarized in Table 13. All parts were electrically tested at room and hot temperatures pre- and post-stress. 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 on Analog Devices' web site)

Table 13: FICDM ESD Results

Device	Package	ESD Test Spec	RC Network	Highest Pass Level	First Fail Level	Class
ADAU1979W	40-LFCSP	JS-002	1Ω, Cpkg	±1250V	NA	C3
ADF41513	24-LFCSP	JS-002	1Ω, Cpkg	±1250V	NA	C3
ADF7250	40-LFCSP	JS-002	1Ω, Cpkg	±500V	±1000V	C2a
AD9695	64-LFCSP	JS-002	1Ω, Cpkg	±500V	±750V	III
ADF4157	20-LFCSP	JS-002	1Ω, Cpkg	±1500V	NA	IV
AD9512	48-LFCSP	JS-002	1Ω, Cpkg	±1250V	NA	C3
AD7689	20-LFCSP	JS-002	1Ω, Cpkg	±1250V	NA	C3
ADV7380	48-LFCSP	JS-002	1Ω, Cpkg	±1250V	NA	C3

Approvals

Reliability Engineer: Pernell Mosuela

Additional Information

Data sheets and other additional information are available on Analog Devices' web site

BOM CHANGE SUMMARY

ANALOG DEVICES
AHEAD OF WHAT'S POSSIBLE™

- From 4 BOM at UG1 to 1 BOM at AEK.
  - 4 different Adhesive material at UG1 will become 1 Adhesive material at AEK

Assembly Site	From - UNISEM Malaysia (UG1)	To - ASE Korea (AEK)
Wire	Au/1.0	Au/1.0
Die Attach	**Ablestik 2815A conductive** **Hysol QMI 519 conductive** **Sumitomo CRM 1076NS conductive** **Sumitomo CRM 1076DJ conductive**	Hitachi EN 4900GC conductive
Mold Compound	Sumitomo G770HCD	Sumitomo G700LYT
Plating	100Sn	100Sn

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BOM CHANGE SUMMARY

- BOM for 0.8 mil wire

Assembly Site	From - UNISEM Malaysia (UG1)	To - ASE Korea (AEK)
Wire	Au/0.8	Au/0.8
Die Attach	Hysol QMI 519 conductive	Hitachi EN 4900GC conductive
Mold Compound	Sumitomo G770HCD	Sumitomo G700LYT
Plating	100Sn	100Sn

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BOM CHANGE SUMMARY

ANALOG DEVICES
AHEAD OF WHAT'S POSSIBLE™

- BOM for NiPdAu Terminal Finish Composition

Assembly Site	From - UNISEM Malaysia (UG1)	To - ASE Korea (AEK)
Wire	Au/1.0	Au/1.0
Die Attach	Hysol QMI 519 conductive	Hitachi EN 4900GC conductive
Mold Compound	Sumitomo G770HCD	Sumitomo G700LYT
Plating	Ni_Pd_Au	Ni_Pd_Au

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