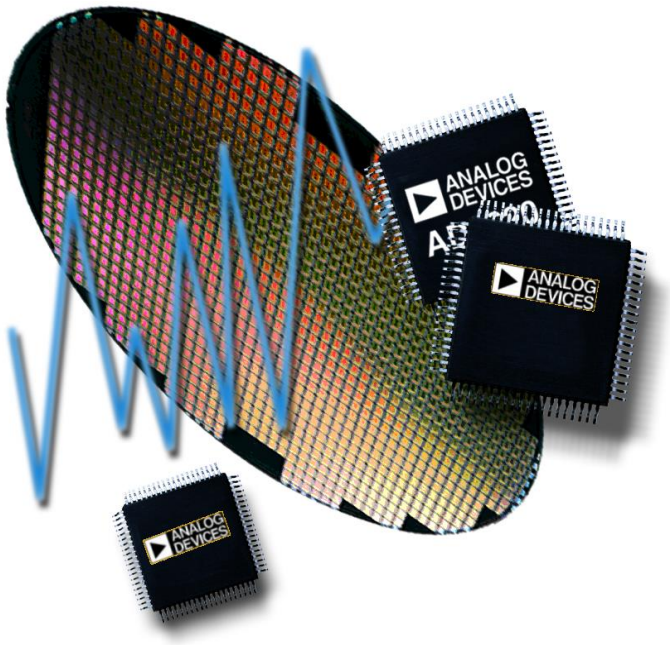

Reliability Report

Report Title: ADUCM431 Material Set Change Qualification

Report Number: 20431

Revision: A

Date: 31 August 2023

Summary

This report documents the successful completion of the reliability qualification requirements for the release of the ADUCM431 product in a 121-CSP_BGA package with the four layers laminate design. The ADUCM431 is a Precision Analog Microcontroller for 400G+ Direct Detection Optical Module.

Die/Fab Product Characteristics

Table 1.1: Die/Fab Product Characteristics

Product Characteristics	Product(s) to be qualified	Product(s) used for Substitution Data		
Generic/Root Part #	ADUCM431	ADPD4200	ADUCM430	ADUCM431
Die Id	TMPK20 A-T1	TMPG76 B	TMPK20 A-T1	TMPK20 A-T1
Die Size (mm)	3.75 x 3.75	1.844 x 2.659	3.75 x 3.75	3.75 x 3.75
Wafer Fabrication Site	E_TSMC1008	TSMC Fab-10	TSMC Fab-10	E_TSMC1008
Wafer Fabrication Process	152nm CMOS	152nm CMOS	152nm CMOS	152nm CMOS
Die Substrate	Si	Si	Si	Si
Metallization / # Layers	AlCu/6	AlCu/5	AlCu/6	AlCu/6
Polyimide	Yes	No	Yes	Yes
Passivation	undoped-oxide/SiN	undoped-oxide/SiN	undoped-oxide/SiN	undoped-oxide/SiN

Table 1.2: Die/Fab Product Characteristics

Product Characteristics	Product(s) to be qualified	Product(s) used for Substitution Data		
Generic/Root Part #	ADUCM431	ADUCM433	ADPD6000	AD1030
Die Id	TMPK20 A-T1	TMPK20 A-T1	TMPW42 A	TMPK20 A
Die Size (mm)	3.75 x 3.75	3.750 x 3.750	2.56 x 2.56	3.750 x 3.750
Wafer Fabrication Site	E_TSMC1008	TSMC Fab-10	TSMC Fab-10	TSMC Fab-10
Wafer Fabrication Process	152nm CMOS	152nm CMOS	152nm CMOS	152nm CMOS
Die Substrate	Si	Si	Si	Si
Metallization / # Layers	AlCu/6	AlCu / 6	AlCu/5	AlCu/6
Polyimide	Yes	Yes	Yes	No
Passivation	undoped-oxide/SiN	undoped-oxide/SiN	doped-oxide/SiN	undoped-oxide/SiN

Die/Fab Test Results

Table 2: Die/Fab Test Results - 152nm CMOS at TSMC Fab-10

Test Name	Spec	Conditions	Generic/Root Part #	Lot #	Fail/SS
Early Life Failure Rate (ELFR)	MIL-STD-883, M1015	125°C, 48 Hours	ADPD4200	Q18200.1.EL1a	0/667
				Q18200.2.EL2a	0/667
				Q18200.3.EL3a	0/667
High Temperature Operating Life (HTOL)	JESD22-A108	125°C<Tj<135°C, Biased, 1,000 Hours	ADUCM430	Q17666.1.HO1	0/77
				Q17666.2.HO2	0/77
				Q17666.3.HO3	0/77
			ADPD4200	Q18200.1.HO1	0/45
				Q18200.2.HO2	0/45
				Q18200.3.HO3	0/45
			ADPD6000	Q18722.1.HO1	0/45
				Q18722.2.HO2	0/45
				Q18722.2.HO3	0/45
High Temperature Storage Life (HTSL)	JESD22-A103	150°C, 1,000 Hours	ADUCM430	Q17666.1.HS1	0/45
			ADPD4200	Q18200.1.HO1	0/45
			ADUCM433	Q17800.1.HS1	0/32
Highly Accelerated Temperature and Humidity Stress Test (HAST)[1]	JESD22-A110	130C 85%RH 33.3 psia, Biased, 96 Hours	ADUCM430	Q17666.1.HA1	0/32
				Q17666.2.HA2	0/32
				Q17666.3.HA3	0/32

[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 - 121-CSP_BGA at STATS (SC3)

Product Characteristics	Product(s) to be qualified	Product(s) used for Substitution Data	
Generic/Root Part #	ADUCM431	ADUCM430	ADUCM433
Package	121-CSP_BGA	121-CSP_BGA	72-CSP_BGA
Body Size (mm)	5.00 x 5.00 x 1.184	5.00 x 5.00 x 1.184	5.00 x 5.00 x 0.946
Assembly Location	STATS (SC3)	STATS (SC3)	STATS (SC3)
MSL/Peak Reflow Temperature(°C)	3 / 260°C	3 / 260°C	3 / 260°C
Mold Compound	Sumitomo G770LC	Sumitomo G770LC	Sumitomo G770LC
Die Attach/Underfill/TIM	Ablestik 2025D non-conductive/Hitachi HR 5104 film non-conductive	Ablestik 2025D non-conductive/Hitachi HR 5104 film non-conductive	Ablestik 2025D non-conductive/Hitachi HR 5104 film non-conductive
Substrate Material	BT	BT	BT
Lead Finish	96.5Sn_3.0Ag_0.5Cu	96.5Sn_3.0Ag_0.5Cu	96.5Sn_3.0Ag_0.5Cu
Wire Bond Material/Diameter (mils)	2N Gold / 1.00	2N Gold / 1.00	2N Gold / 1.00

Package/Assembly Test Results

Table 4: Package/Assembly Test Results - CSP_BGA at STATS (SC3)

Test Name	Spec	Conditions	Generic/Root Part #	Lot #	Fail/SS
High Temperature Storage Life (HTSL)	JESD22-A103	150°C, 1,000 Hours	ADUCM430	Q17666.1.HS1	0/45
				Q18956.1.HS1	0/45
			ADUCM433	Q17800.1.HS1	0/32
Highly Accelerated Temperature and Humidity Stress Test (HAST)[1]	JESD22-A110	130C 85%RH 33.3 psia, Biased, 96 Hours	ADUCM430	Q17666.1.HA1	0/32
				Q17666.2.HA2	0/32
				Q17666.3.HA3	0/32
			ADUCM433	Q17800.1.HA1	0/32
Solder Heat Resistance (SHR)	J-STD-020	MSL-3	ADUCM431	Q20431.1.SH1	0/32
Temperature Cycling (TC)[1]	JESD22-A104	-40/125, Soak3, 10-14C/min, 1,000 Cycles	ADUCM430	Q17666.1.TC1	0/32
				Q17666.2.TC2	0/32
				Q17666.3.TC3	0/32
		-65°C/+150°C, 1,000 Cycles	ADUCM433	Q17800.1.TC1	0/32
Unbiased HAST (UHST)[1]	JESD22-A118	130C 85%RH 33.3 psia, 96 Hours	ADUCM430	Q17666.1.UH1	0/32
				Q17666.2.UH2	0/32
				Q17666.3.UH3	0/32

[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: ADUCM431 ESD Test Results

ESD Model	Package	ESD Test Spec	RC Network	Highest Pass Level	First Fail Level	Class
FICDM	121-CSP_BGA	JS-002	1Ω, Cpkg	±1250V	NA	C3
HBM	121-CSP_BGA	ESDA/JEDEC JS-001-2011	1.5kΩ, 100pF	±2000V	±2500V	2

Table 6: Latch Up Test Result

LU Test Spec	Generic/Root Part #	Passing Current	Passing Over-Voltage	Temperature (T_A)	Class
JESD78	ADUCM431	+200mA, -200mA	+3.63V, -3.63V	25°C	I

Approvals

Reliability Engineer: Leo Ouano