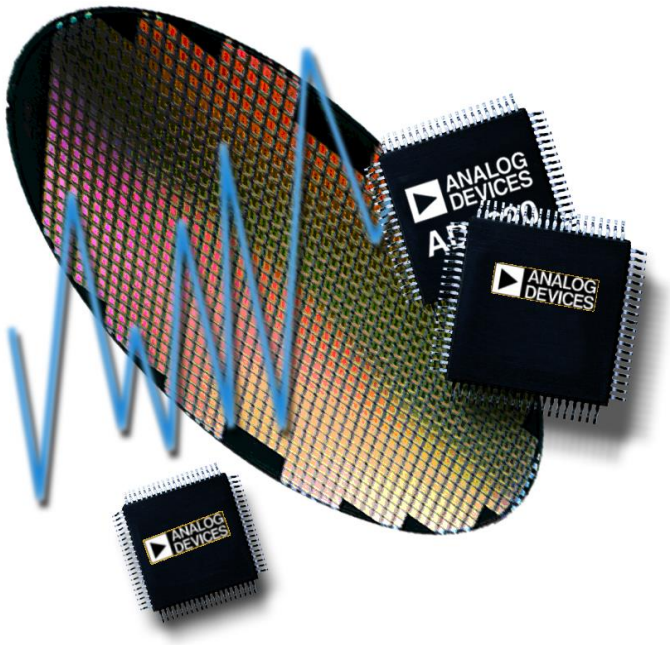

Reliability Report

Report Title: Qualification of 0.6um CMOS Isolator Products at ADI's Limerick Wafer Fabrication Site

Report Number: 20381

Revision: C

Date: 6 March 2024

Summary

This report documents the reliability qualification requirements for manufacturing Isolator products using the 0.6um CMOS Wafer Fabrication Process at Analog Devices Limerick Wafer Fabrication Facility.

The qualification vehicle, ADuM3210 product in an 8-SOICN package is a dual-channel digital isolator based on Analog Devices, Inc., iCoupler® technology. Combining high speed CMOS and monolithic transformer technology, this isolation component provides outstanding performance characteristics superior to alternatives such as optocoupler devices.

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	Table 5, and Table 6
	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- 0.6um CMOS

Product Characteristics	Product(s) to be qualified			
Generic/Root Part #	AD8648/8YX12A	AD8694/8YL18C	ADuM3210/8YX19A	ADuM3210/8YL57F03
Die Id	6535Y	6526z	ADM2485IC	ADUM3200TC
Die Size (mm)	1.445 x 2.090	1.455 x 1.335	0.700 x 1.750	1.130 x 2.280
Wafer Fabrication Site	ADI-Limerick	ADI-Limerick	ADI-Limerick	ADI-Limerick
Wafer Fabrication Process	0.6um CMOS	0.6um CMOS	0.6um CMOS	0.6um CMOS / 1M i20 (2x10um)
Die Substrate	Si	Si	Si	Si
Metallization / # Layers	AlCu(0.5%)/2	AlCu(0.5%)/2	AlCu(0.5%)/3	AlCu(0.5%)/3 and Au/1
Polyimide	Yes	Yes	No	Yes
Passivation	undoped-oxide/SiN	undoped-oxide/SiN	undoped-oxide/SiN	undoped-oxide/SiN

Die/Fab Test Results

Table 2: Die/Fab Test Results - 0.6um CMOS at ADI-Limerick Return

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	AD8648/8YX12A	Q20329.1.HS1_RES	0/77	RH
				ADuM3210/8YX19A ADuM3210/8YL57F03	Q20381.1.HS1_RES	0/77	RH
High Temperature Operating Life (HTOL)[1]	B1	JESD22-A108	125°C<Tj<135°C, Biased, 1000 Hours	AD8648/8YX12A	Q20329.1.HO1_RES	0/77	RHC
					Q20329.2.HO2_RES	0/77	RHC
					Q20329.3.HO3_RES	0/77	RHC
High Temperature Operating Life (HTOL)[2]			125°C<Tj<135°C, Biased, 1000 Hours	ADuM3210/8YX19A ADuM3210/8YL57F03	Q20381.1.HO1_RES	0/77	RHC
					Q20381.2.HO2_RES_EXP	0/77	RHC
					Q20381.3.HO3_RES_EXP	0/77	RHC
High Temperature Operating Life (HTOL)	B1	JESD22-A108	125°C<Tj<135°C, Biased, 1000 Hours	AD5620	Q20258.25	0/77	R
High Temperature Operating Life (HTOL)	B1	JESD22-A108	125°C<Tj<135°C, Biased, 1000 Hours	AD5220	Q19147.1	0/77	R
High Temperature Operating Life (HTOL)[1]	B1	JESD22-A108	125°C<Tj<135°C, Biased, 1000 Hours	AD5662W	Q8576.100	0/77	RHC
High Temperature Operating Life (HTOL)	B1	JESD22-A108	Ta = 125°C, Biased, 1000 Hours	AD7928	Q10205.17	0/45	R
				AD7928	Q10205.18	0/45	R
High Temperature Operating Life (HTOL)[1]	B1	JESD22-A108	125°C<Tj<135°C, Biased, 1000 Hours	AD9200	Q8831.HO2	0/77	R
High Temperature Operating Life (HTOL)	B1	JESD22-A108	Ta = 125°C, Biased, 1000 Hours	AD7887	Q15090.8	0/77	R

High Temperature Operating Life (HTOL)[1]	B1	JESD22-A108	125°C<Tj<135°C, Biased, 1000 Hours	ADUM1402W	Q11596.HO1	0/77	RHC
					Q11596.HO2	0/77	RHC
					Q11596.HO3	0/77	RHC
High Temperature Operating Life (HTOL)[1]	B1	JESD22-A108	125°C<Tj<135°C, Biased, 1000 Hours	ADUM1201W	Q11159.HO1	0/77	RHC
Early Life Failure Rate (ELFR)	B2	AEC-Q100-008	Ta=125C, 48 Hours	ADUM1201W	Q11159.EL1	0/800	RH
					Q11159.EL2	0/800	RH
					Q11159.EL3	0/800	RH
				AD7928	Q7951.200/201/202	0/800	RH
					Q7951.203/204/205	0/800	RH
					Q7951.206/207/208	0/800	RH
				AD8558	Q7174.17/18/19	0/800	RH
					Q7174.25/26/27	0/800	RH
					Q7174.28/29/30	0/800	RH
Temperature Cycling (TC)[1]	A4	JESD22-A104	-65°C/+150°C, 500 Cycles	AD8648/8YX12A	Q20329.1.TC1_RES	0/77	H
					Q20329.2.TC2_RES	0/77	H
					Q20329.3.TC3_RES	0/77	H
				AD8694	Q20385.1.TC1_RES	0/77	H
					Q20385.2.TC2_RES	0/77	H
					Q20385.3.TC3_RES	0/77	H
Temperature Cycling (TC)[2]	A4	JESD22-A104	65°C/+150°C, 500 Cycles	ADuM3210/8YX19A ADuM3210/8YL57F03	Q20381.1.TC1_RES	0/77	H
					Q20381.2.TC2_RES_EXP	0/77	H
					Q20381.3.TC3_RES_EXP	0/77	H

Unbiased HAST (UHST)[1]	A3	JESD22-A118	130C 85%RH 33.3 psia, 96 Hours	AD8648/8YX12A	Q20329.1.UH1_RES	0/77	R
					Q20329.2.UH2_RES	0/77	R
					Q20329.3.UH3_RES	0/77	R
Unbiased HAST (UHST)[2]	A3	JESD22-A118	130C 85%RH 33.3 psia, 96 Hours	ADuM3210/8YX19A ADuM3210/8YL57F03	Q20381.1.UH1_RES	0/77	R
					Q20381.2.UH2_RES_EXP	0/77	R
					Q20381.3.UH3_RES_EXP	0/77	R
Highly Accelerated Temperature and Humidity Stress Test (HAST)[1]	A2	JESD22-A110	130C 85%RH 33.3 psia, Biased, 96 Hours	AD8648/8YX12A	Q20329.1.HA1_RES	0/77	RH
					Q20329.2.HA2_RES	0/77	RH
					Q20329.3.HA3_RES	0/77	RH
				AD8694	Q20385.1.HA1_RES	0/77	RH
					Q20385.2.HA2_RES	0/77	RH
					Q20385.3.HA3_RES	0/77	RH
Highly Accelerated Temperature and Humidity Stress Test (HAST)[2]	A2	JESD22-A110	130C 85%RH 33.3 psia, Biased, 96 Hours	ADuM3210/8YX19A ADuM3210/8YL57F03	Q20381.1.HA1_RES	0/77	RH
					Q20381.2.HA2_RES_EXP	0/77	RH
					Q20381.3.HA3_RES_EXP	0/77	RH

[1] These samples were subjected to preconditioning at MSL 1 with 3x reflow peak temp of 260°C prior to the start of the stress test.
[2] 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 - 14-TSSOP_4.4 at AMKOR (AP1)

Product Characteristics	Product(s) to be qualified		
Generic/Root Part #	AD8648/8YX12A	AD8694/8YL18C	ADuM3210/8YX19A and 8YL57F03
Package	14-TSSOP_4.4	14-TSSOP_4.4	8-SOIC_N
Body Size (mm)	5.00 x 4.40 x 1.00	5.00 x 4.40 x 1.00	3.00 x 3.00 x 0.85
Assembly Location	AMKOR (AP1)	AMKOR (AP1)	CARSEM (CRM)
MSL/Peak Reflow Temperature(°C)	1 / 260°C	1 / 260°C	3 / 260°C
Mold Compound	Sumitomo G700K	Sumitomo G700K	Sumitomo 6600H
Die Attach	Ablestik 8290 conductive	Ablestik 8290 conductive	Ablestik 84-1 LMISR4 conductive
Leadframe Material	Copper	Copper	Copper
Lead Finish	100Sn	100Sn	100Sn
Wire Bond Material/Diameter (mils)	Gold / 1.00	Gold / 1.00	Gold / 1.30

Package/Assembly Test Results

Table 4: Package/Assembly Test Results - TSSOP_4.4 at AMKOR (AP1) Return

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	AD8648	Q20329.1.HS1_RES	0/77	RH
				ADuM3210/8YX19A ADuM3210/8YL57F03	Q20381.1.HS1_RES	0/77	RH
Highly Accelerated Temperature and Humidity Stress Test (HAST)[1]	A2	JESD22-A110	130C 85%RH 33.3 psia, Biased, 96 Hours	AD8648	Q20329.1.HA1_RES	0/77	RH
					Q20329.2.HA2_RES	0/77	RH
					Q20329.3.HA3_RES	0/77	RH
				AD8694	Q20385.1.HA1_RES	0/77	RH
					Q20385.2.HA2_RES	0/77	RH
					Q20385.3.HA3_RES	0/77	RH
Highly Accelerated Temperature and Humidity Stress Test (HAST)[2]	A2	JESD22-A110	130C 85%RH 33.3 psia, Biased, 96 Hours	ADuM3210/8YX19A ADuM3210/8YL57F03	Q20381.1.HA1_RES	0/77	RH
					Q20381.2.HA2_RES_EXP	0/77	RH
					Q20381.3.HA3_RES_EXP	0/77	RH
Temperature Cycling (TC)[1]	A4	JESD22-A104	-65°C/+150°C, 500 Cycles	AD8648	Q20329.1.TC1_RES	0/77	H
					Q20329.2.TC2_RES	0/77	H
					Q20329.3.TC3_RES	0/77	H
				AD8694	Q20385.1.TC1_RES	0/77	H
					Q20385.2.TC2_RES	0/77	H
					Q20385.3.TC3_RES	0/77	H
Temperature Cycling (TC)[2]	A4	JESD22-A104	-65°C/+150°C, 500 Cycles	ADuM3210/8YX19A ADuM3210/8YL57F03	Q20381.1.TC1_RES	0/77	H
					Q20381.2.TC2_RES_EXP	0/77	H
					Q20381.3.TC3_RES_EXP	0/77	H

Unbiased HAST (UHST)[1]	A3	JESD22-A118	130C 85%RH 33.3 psia, 96 Hours	AD8648	Q20329.1.UH1_RES	0/77	R
					Q20329.2.UH2_RES	0/77	R
					Q20329.3.UH3_RES	0/77	R
Unbiased HAST (UHST)[2]	A3	130C 85%RH 33.3 psia, 96 Hours	130C 85%RH 33.3 psia, 96 Hours	ADuM3210/8YX19A ADuM3210/8YL57F03	Q20381.1.UH1_RES	0/77	R
					Q20381.2.UH2_RES_EXP	0/77	R
					Q20381.3.UH3_RES_EXP	0/77	R
Wire Bond Pull – Post TC	C2	AEC-Q003	3 gF	AD8648	Q20329.1.WPPT1_RES	0/5	NA
Wire Bond Pull – Post TC	C2	AEC-Q003	3 gF	ADuM3210	Q20381.1.WPPT1_RES	0/5	NA
Wire Bond Shear – Post TC	C1	AEC-Q001	5 gF	AD8648	Q20329.1.WBPT1_RES	0/5	NA

[1] These samples were subjected to preconditioning at MSL 1 with 3x reflow peak temp of 260°C prior to the start of the stress test.
[2] 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 Return

ESD Model	Generic/Root Part #	Package	ESD Test Spec	RC Network	Highest Pass Level	Class	eTest Temp
FICDM	ADuM3210	8-SOIC_N	JS-002	1Ω, Cpkg	±1250V	C3	RH
HBM			JS-001	1.5kΩ, 100pF	±3500V	2	RH
FICDM	ADuM3200	8_SOIC_N	JS-002	1Ω, Cpkg	±1250V	C3	RH
HBM			JS-001	1.5kΩ, 100pF	±3500V	2	RH
FICDM	ADuM3301	16_SOIC_W	JS-002	1Ω, Cpkg	±1250V	C3	RH
HBM			JS-001	1.5kΩ, 100pF	±4000V	2	RH
FICDM	ADuM3400	16_SOIC_W	JS-002	1Ω, Cpkg	±1250V	C3	RH
HBM			JS-001	1.5kΩ, 100pF	±4000V	2	RH
FICDM	ADuM3220	8_SOIC_N	JS-002	1Ω, Cpkg	±1250V	C3	RH
HBM			JS-001	1.5kΩ, 100pF	±4000V	2	RH
FICDM	ADuM3221	8_SOIC_N	JS-002	1Ω, Cpkg	±1250V	C3	RH
HBM			JS-001	1.5kΩ, 100pF	±4000V	2	RH
FICDM	ADuM3221EP	8_SOIC_N	JS-002	1Ω, Cpkg	±1250V	C3	RH
HBM			JS-001	1.5kΩ, 100pF	±4000V	2	RH
FICDM	ADuM3301	16_SOIC_W	JS-002	1Ω, Cpkg	±1250V	C3	RH
HBM			JS-001	1.5kΩ, 100pF	±4000V	2	RH
FICDM	ADuM1200	8_SOIC_N	JS-002	1Ω, Cpkg	±1250V	C3	RH
HBM			JS-001	1.5kΩ, 100pF	±3000V	2	RH
FICDM	ADuM1201	8_SOIC_N	JS-002	1Ω, Cpkg	±1250V	C3	RH
HBM			JS-001	1.5kΩ, 100pF	±3000V	2	RH
FICDM	ADuM2200	16_SOIC_W	JS-002	1Ω, Cpkg	±1250V	C3	RH
HBM			JS-001	1.5kΩ, 100pF	±4000V	2	RH
FICDM	ADuM2201	16_SOIC_W	JS-002	1Ω, Cpkg	±1250V	C3	RH
HBM			JS-001	1.5kΩ, 100pF	±4000V	2	RH
FICDM	ADuM4401	16_SOIC_W	JS-002	1Ω, Cpkg	±1250V	C3	RH
HBM			JS-001	1.5kΩ, 100pF	±4000V	2	RH
FICDM	ADuM4402	16_SOIC_W	JS-002	1Ω, Cpkg	±1250V	C3	RH
HBM			JS-001	1.5kΩ, 100pF	±4000V	2	RH

FICDM	ADuM3300	16_SOIC_W	JS-002	1Ω, Cpkg	±1250V	C3	RH
HBM			JS-001	1.5kΩ, 100pF	±4000V	2	RH
FICDM	ADuM3211	8_SOIC_N	JS-002	1Ω, Cpkg	±1250V	C3	RH
HBM			JS-001	1.5kΩ, 100pF	±3500V	2	RH
FICDM	ADuM3201	8_SOIC_N	JS-002	1Ω, Cpkg	±1250V	C3	RH
HBM			JS-001	1.5kΩ, 100pF	±4000V	2	RH

Table 6: Latch Up Test Result Return

LU Test Spec	Generic/Root Part #	Passing Current	Passing Over-Voltage	Temperature (T_A)	Class	eTest Temp
JESD78	ADuM3210	+150ma, -150ma	+8.25V, +8.25V	125°C	IIA	RH
JESD78	ADuM3200	+150ma, -150ma	+8.25V, +8.25V	125°C	IIA	RH
JESD78	ADuM3301	+100ma, -100ma	+8.25V, +8.25V	125°C	IIA	RH
JESD78	ADuM3400	+100ma, -100ma	+8.25V, +8.25V	125°C	IIA	RH
JESD78	ADuM3220	+150ma, -150ma	+8.25V, +27V	125°C	IIA	RH
JESD78	ADuM3221	+150ma, -150ma	+8.25V, +27V	125°C	IIA	RH
JESD78	ADuM3221EP	+100ma, -100ma	+8.25V, +27V	125°C	IIA	RH
JESD78	ADuM3301	+100ma, -100ma	+8.25V, +8.25V	125°C	IIA	RH
JESD78	ADuM1200	+150ma, -150ma	+8.25V, +8.25V	125°C	IIA	RH
JESD78	ADuM1201	+150ma, -150ma	+8.25V, +8.25V	125°C	IIA	RH
JESD78	ADuM2200	+150ma, -150ma	+8.25V, +8.25V	125°C	IIA	RH
JESD78	ADuM2201	+200ma, -200ma	+8.25V, +8.25V	125°C	IIA	RH
JESD78	ADuM4401	+100ma, -100ma	+8.25V, +8.25V	125°C	IIA	RH
JESD78	ADuM4402	+100ma, -100ma	+8.25V, +8.25V	125°C	IIA	RH
JESD78	ADuM3300	+100ma, -100ma	+8.25V, +8.25V	125°C	IIA	RH
JESD78	ADuM3211	+200ma, -200ma	+8.25V, +8.25V	125°C	IIA	RH
JESD78	ADuM3201	+200ma, -200ma	+8.25V, +8.25V	125°C	IIA	RH

Approvals

Reliability Engineer: Danilo Juinio Jr.

Appendix 1

Wire Bond Pull WBP Data:

PCL - 5821_BT_ADUM3210_Q20381.1._AX47227.23_Rev1										
Unit	**1**		**2**		**3**		**4**		**5**	
Ball	**Pull**	**Mode**	**Pull**	**Mode**	**Pull**	**Mode**	**Pull**	**Mode**	**Pull**	**Mode**
1a	*15.49*	*a-2*	*15.84*	*a-2*	*15.63*	*a-2*	*15.66*	*a-2*	*15.61*	*a-2*
1b	*17.08*	*a-2*	*16.67*	*a-2*	*17.16*	*a-2*	*17.06*	*a-1*	*16.94*	*a-2*
1c	*15.68*	*a-2*	*15.86*	*a-2*	*16.22*	*a-2*	*15.91*	*a-2*	*15.66*	*a-2*
2	*18.85*	*a-2*	*20.81*	*a-2*	*19.17*	*a-1*	*19.50*	*a-2*	*19.26*	*a-2*
3	*19.30*	*a-2*	*20.26*	*a-1*	*20.56*	*a-2*	*21.57*	*a-2*	*20.49*	*a-2*
4	*18.15*	*a-2*	*18.56*	*a-2*	*19.15*	*a-2*	*18.15*	*a-2*	*17.88*	*a-2*
5	*16.16*	*a-2*	*18.53*	*a-2*	*18.40*	*a-2*	*17.94*	*a-1*	*18.08*	*a-2*
6	*15.41*	*a-2*	*19.43*	*a-2*	*20.33*	*a-2*	*18.58*	*a-2*	*19.71*	*a-2*
7	*19.02*	*a-2*	*19.20*	*a-2*	*19.66*	*a-2*	*20.56*	*a-1*	*18.67*	*a-2*
8a	*19.22*	*a-2*	*15.01*	*a-2*	*15.46*	*a-2*	*14.97*	*a-1*	*15.36*	*a-2*
8b	*18.47*	*a-2*	*16.32*	*a-2*	*16.61*	*a-1*	*16.25*	*a-2*	*16.57*	*a-2*
MIN	*15.41*		*15.01*		*15.46*		*14.97*		*15.36*	
MAX	*19.30*		*20.81*		*20.56*		*21.57*		*20.49*	
AVE	*17.53*		*17.86*		*18.03*		*17.83*		*17.66*	
STDEV	*1.59*		*1.99*		*1.88*		*2.11*		*1.77*	

Appendix 2

List of generics covered by this reliability report:

ADUM1200	ADM3054	ADUM4402
ADUM1201	ADM2481	ADM2483
ADM2484E	ADM2582E	ADM2486
ADM2485	ADM2587E	AD7400A
ADM2490E	ADM2682E	AD7400
ADM2491E	ADM2687E	AD7401A
ADUM3220	ADM3260	AD7401
ADUM3200	ADUM1250	ADM3251E
ADUM3201	ADUM3300	ADUM5240
ADUM3210	ADUM3301	ADUM5241
ADUM3221	ADUM3400	ADUM5242
ADM2482E	ADUM3401	ADUM3211
ADM2487E	ADUM3402	ADUM2200
ADM3052	ADUM4400	ADUM2201
ADM3053	ADUM4401	