



# ***Reliability Report***

**Report Title:** 0.6um CMOS Wafer Fabrication at  
ADI Limerick Fab Qualification

**Report Number:** 20900

**Revision:** D

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## Summary

This report documents the reliability qualification requirements for the release of the 0.6um CMOS Wafer Fabrication Process at Analog Devices Limerick Wafer Fabrication Facility. The products listed below were selected to cover the technology being released. Additional data from ADC and DAC products already running on the 0.6um CMOS process at ADI-Limerick are also included.

The products are:

The AD8648 product in a 14-TSSOP\_4.4 package is a quad, rail-to-rail, input and output, single-supply amplifier featuring low offset voltage, wide signal bandwidth, low input voltage, and low current noise.

The AD8694 product in a 14-TSSOP\_4.4 package is a low cost, quad rail-to-rail output, single-supply amplifiers featuring low offset and input voltages, low current noise, and wide signal bandwidth.

The 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.

The AD8608 product in a 14-SOICN package is a quad rail-to-rail input and output, single supply amplifier. It features a very low offset voltage, low input voltage and current noise, and wide signal bandwidth.

The AD8692 is a low cost, dual rail-to-rail output, single-supply amplifier featuring low offset and input voltages, low current noise, and wide signal bandwidth.

The AD8655 and AD8656 are the industry's lowest noise, precision CMOS amplifiers. They leverage the Analog Devices DigiTrim® technology to achieve high dc accuracy. The high precision performance of the AD8655/AD8656 improve the resolution and dynamic range in low voltage applications.

The AD8628 is a wide bandwidth auto-zero amplifier featuring rail-to-rail input and output swing and low noise. It has an ultralow offset, drift, and bias current.

**AECQ100 Qualification Test Methods and Summary**

AEC Test Group	AEC Stress Test Name	Abbreviation	AEC Test#	Reference
<b>Group A</b> ACCELERATED ENVIRONMENT STRESS TESTS	Preconditioning	PC	A1	<a href="#">Table 2</a> , and <a href="#">Table 6</a>
	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	
<b>Group B</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	
<b>Group C</b> PACKAGE ASSEMBLY INTEGRITY TESTS	Wire Bond Shear	WBS	C1	<ul style="list-style-type: none"> <li>• Test C2 (and C1 for Cu Wire) are shown in <a href="#">Table 4</a>.</li> <li>• Tests C3-6 are qualified and controlled with inline monitors and may be viewed on-site at Analog Devices.</li> </ul>
	Wire Bond Pull Strength	WBP	C2	
	Solderability	SD	C3	
	Physical Dimensions	PD	C4	
	Solder Ball Shear	SBS	C5	
	Lead Integrity	LI	C6	
<b>Group D</b> DIE FABRICATION RELIABILITY TESTS	Electromigration	EM	D1	Die Fabrication Reliability data may be viewed on-site at Analog Devices.
	Time Dependent Dielectric Breakdown	TDDDB	D2	
	Hot Carrier Injection	HCI	D3	
	Negative Bias Temperature Instability	BTI	D4	
	Stress Migration	SM	D5	
<b>Group E</b> ELECTRICAL VERIFICATION TESTS	Pre- and Post-Stress Electrical Test	TEST	E1	<a href="#">Table 8</a> , and <a href="#">Table 9</a>
	Electrostatic Discharge Human Body Model	HBM	E2	
	Electrostatic Discharge Charged Device Model	CDM	E3	
	Latch-Up	LU	E4	
	Electrical Distributions	ED	E5	<ul style="list-style-type: none"> <li>• For Tests E5, E6 and E7, ADI New Product Yield Analysis Testing Guidelines meet AEC Q100 requirements.</li> <li>• Results for Tests E7-E11 are available as applicable on a case by case basis.</li> <li>• Test E12 results may be viewed on-site at Analog Devices</li> </ul>
	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	
	<b>Group F</b> DEFECT SCREENING TESTS	Process Average Test	PAT	
Statistical Bin/Yield Analysis		SBA	F2	
<b>Group G</b> 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	AD8608/8YX09A
Die Id	6535Y	6526z	ADM2485IC	ADUM3200TC	6451z
Die Size (mm)	1.445 x 2.090	1.455 x 1.335	0.700 x 1.750	1.130 x 2.280	1.9 x 2.93
Wafer Fabrication Site	ADI-Limerick	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)	0.6um CMOS
Die Substrate	Si	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	AlCu(0.5%)/2
Polyimide	Yes	Yes	No	Yes	Yes
Passivation	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 - 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) <sup>1</sup>	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
				AD8608/8YX09A	Q20404.1.HO1_RES	0/77	R
High Temperature Operating Life (HTOL) <sup>2</sup>	B1	JESD22-A108	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) <sup>1</sup>	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) <sup>1</sup>	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) <sup>1</sup>	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) <sup>1</sup>	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) <sup>1</sup>	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) <sup>2</sup>	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) <sup>1</sup>	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) <sup>2</sup>	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) <sup>1</sup>	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) <sup>2</sup>	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

<sup>1</sup> 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.

<sup>2</sup> 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
Package	14-TSSOP_4.4	14-TSSOP_4.4
Body Size (mm)	5.00 x 4.40 x 1.00	5.00 x 4.40 x 1.00
Assembly Location	AMKOR (AP1)	AMKOR (AP1)
MSL/Peak Reflow Temperature(°C)	1 / 260°C	1 / 260°C
Mold Compound	Sumitomo G700K	Sumitomo G700K
Die Attach	Ablestik 8290 conductive	Ablestik 8290 conductive
Leadframe Material	Copper	Copper
Lead Finish	100Sn	100Sn
Wire Bond Material/Diameter (mils)	Gold / 1.00	Gold / 1.00

**Table 4: Package/Assembly Product Characteristics - 8-SOIC\_N at CARSEM (CRM)**

Product Characteristics	Product(s) to be qualified
Generic/Root Part #	ADuM3210/8YX19A and ADuM3210/8YL57F03
Package	8-SOIC_N
Body Size (mm)	3.00 x 3.00 x 0.85
Assembly Location	CARSEM (CRM)
MSL/Peak Reflow Temperature(°C)	3 / 260°C
Mold Compound	Sumitomo 6600H
Die Attach/Underfill/TIM	Ablestik 84-1 LMISR4 conductive
Leadframe Material	Copper
Lead Finish	100Sn
Wire Bond Material/Diameter (mils)	Tanaka 4N Gold / 1.30



**Table 5: Package/Assembly Product Characteristics - 14-SOIC\_N at ASE (AET)**

Product Characteristics	Product(s) to be qualified
Generic/Root Part #	AD8608/8YX09A
Package	14-SOIC_N
Body Size (mm)	8.75 x 4.00 x 1.50
Assembly Location	ASE (AET)
MSL/Peak Reflow Temperature(°C)	1 / 260°C
Mold Compound	Hitachi CEL 9240HF10AK
Die Attach/Underfill/TIM	Hitachi EN 4900GC conductive
Leadframe Material	Copper
Lead Finish	100Sn
Wire Bond Material/Diameter (mils)	Heraeus Relmax 2N Gold / 1.00

**Package/Assembly Test Results**
**Table 6: 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	AD8648/8YX12A	Q20329.1.HS1_RES	0/77	RH
Highly Accelerated Temperature and Humidity Stress Test (HAST) <sup>1</sup>	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
				AD8694/8YL18C	Q20385.1.HA1_RES	0/77	RH
					Q20385.2.HA2_RES	0/77	RH
					Q20385.3.HA3_RES	0/77	RH
Temperature Cycling (TC) <sup>1</sup>	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
				AD8694/8YL18C	Q20385.1.TC1_RES	0/77	H
					Q20385.2.TC2_RES	0/77	H
					Q20385.3.TC3_RES	0/77	H
Unbiased HAST (UHST) <sup>1</sup>	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
Wire Bond Pull – Post TC	C2	AEC-Q003	3 gF	AD8648/8YX12A	Q20329.1.WPPT1_RES	0/5	NA
Wire Bond Shear – Post TC	C1	AEC-Q001	5 gF	AD8648/8YX12A	Q20329.1.WBPT1_RES	0/5	NA

<sup>1</sup> 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.

<sup>2</sup> 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.

**Table 7: Package/Assembly Test Results - SOIC\_N at CARSEM (CRM)**

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	ADuM3210/8YX19A ADuM3210/8YL57F03	Q20381.1.HS1_RES	0/77	RH
Highly Accelerated Temperature and Humidity Stress Test (HAST) <sup>1</sup>	A2	JESD22-A110	130C 85%RH 33.3 psia, Biased, 96 Hours	ADuM3210/8YX19A ADuM3210/8YL57F03	Q20381.2.HA2_RES_EXP	0/77	RH
					Q20381.3.HA3_RES_EXP	0/77	RH
					Q20381.4.HA4_RES_EXP	0/77	RH
Temperature Cycling (TC) <sup>1</sup>	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) <sup>1</sup>	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

<sup>1</sup> 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 8: ESD Test Result** [Return](#)

ESD Model	Generic/Root Part #	Package	ESD Test Spec	RC Network	Highest Pass Level	Class	eTest Temp
FICDM	AD8648	14-TSSOP_4.4	JS-002	1Ω, Cpkg	±1250V	C3	RH
HBM			JS-001	1.5kΩ, 100pF	±4000V	3A	RH
FICDM	AD8694	14-TSSOP_4.4	JS-002	1Ω, Cpkg	±1250V	C3	RH
HBM			JS-001	1.5kΩ, 100pF	±4000V	3A	RH
FICDM	ADuM3210	8-SOIC_N	JS-002	1Ω, Cpkg	±1250V	C3	RH
HBM			JS-001	1.5kΩ, 100pF	±3500V	2	RH
FICDM	AD8692	8-MSOP	JS-002	1Ω, Cpkg	±1250V	C3	RH
HBM			JS-001	1.5kΩ, 100pF	±4000V	3A	RH
FICDM	AD8655	8-MSOP	JS-002	1Ω, Cpkg	±1250V	C3	RH
HBM			JS-001	1.5kΩ, 100pF	±3500V	2	RH
FICDM	AD8656	8-MSOP	JS-002	1Ω, Cpkg	±1250V	C3	RH
HBM			JS-001	1.5kΩ, 100pF	±3500V	2	RH
FICDM	AD8628	8-SOIC_N	JS-002	1Ω, Cpkg	±1250V	C3	RH
HBM			JS-001	1.5kΩ, 100pF	±4000V	3A	RH
FICDM		5-SOT23	JS-002	1Ω, Cpkg	±1250V	C3	RH
FICDM		5-TSOT	JS-002	1Ω, Cpkg	±1250V	C3	RH
FICDM	AD8608	14-SOIC_N	JS-002	1Ω, Cpkg	±1250V	C3	R
HBM			JS-001	1.5kΩ, 100pF	±3500V	2	R

**Table 9: Latch Up Test Result** [Return](#)

LU Test Spec	Generic/Root Part #	Passing Current	Passing Over-Voltage	Temperature (T <sub>A</sub> )	Class	eTest Temp
JESD78	AD8648	+200ma, -200ma	+4.125V	125°C	IIA	RH
JESD78	AD8694	+200ma, -200ma	+4.125V	125°C	IIA	RH
JESD78	ADuM3210	+150ma, -150ma	+8.25V, +8.25V	125°C	IIA	RH
JESD78	AD8692	+200ma, -200ma	+8.25V, +4.125V	125°C	IIA	RH
JESD78	AD8655	+200ma, -200ma	+8.25V, +4.125V	125°C	IIA	RH
JESD78	AD8656	+200ma, -200ma	+8.25V, +4.125V, -4.125V	125°C	IIA	RH
JESD78	AD8628	+200ma, -200ma	+8.25V	125°C	IIA	RH
JESD78	AD8608	+200ma, -200ma	+8.25V	125°C	IIA	RH

## Approvals

Reliability Engineer: Danilo Juinio Jr.

## Appendix

### Wire Bond Pull Post TCT [WBP Data]

WBP_AD8648W_Q20329.1.WPPT1_RES										
Unit	1		2		2		4		5	
Ball	Pull	Mode	Pull	Mode	Pull	Mode	Pull	Mode	Pull	Mode
1	7.18	a-1	7.35	a-2	7.59	a-2	7.32	a-1	7.33	a-1
2	7.63	a-1	7.36	a-1	7.72	a-1	7.59	a-1	7.51	a-2
3	7.79	a-1	8.30	a-2	8.08	a-2	8.08	a-1	8.02	a-1
4	7.95	a-1	7.51	a-2	6.74	a-1	7.81	a-1	7.12	a-1
5	7.20	a-1	7.37	a-2	7.78	a-2	7.68	a-1	7.56	a-1
6	6.86	a-1	7.58	a-1	7.62	a-2	7.75	a-1	7.33	a-1
7	7.54	a-2	7.53	a-1	7.35	a-2	7.74	a-1	7.04	a-1
8	7.98	a-1	7.97	a-2	7.85	a-2	7.79	a-1	7.30	a-2
9	7.04	a-2	7.05	a-1	7.44	a-2	7.53	a-1	6.99	a-1
10	7.35	a-1	7.56	a-1	8.03	a-2	7.04	a-1	7.48	a-1
MIN	6.86		7.05		6.74		7.04		6.99	
MAX	7.98		8.30		8.08		8.08		8.02	
AVE	7.45		7.56		7.62		7.63		7.37	
STDEV	0.39		0.35		0.39		0.29		0.30	

### Wire Bond Shear Post TCT [WBS Data] (Additional Test not required by AECQ; For Data gathering purposes only.)

WBS_AD8648W_Q20329.1.WBPT1_RES										
Unit	1		2		3		4		5	
Ball	Shear	Mode	Shear	Mode	Shear	Mode	Shear	Mode	Shear	Mode
1	68.25	B	66.55	B	64.49	B	59.82	B	68.36	B
2	62.25	B	62.86	B	67.29	B	64.40	B	68.02	B
3	61.55	B	63.98	B	68.28	B	62.77	B	69.01	B
4	67.83	B	65.34	B	69.56	B	57.01	B	58.37	B
5	63.36	B	65.93	B	67.93	B	57.28	B	63.47	B
6	64.48	B	65.93	B	69.01	B	65.66	B	67.49	B
7	61.16	B	66.16	B	55.43	B	68.88	B	62.83	B
8	62.52	B	66.54	B	59.42	B	64.27	B	62.77	B
MIN	61.16		62.86		55.43		57.01		58.37	
MAX	68.25		66.55		69.56		68.88		69.01	
AVE	63.93		65.41		65.18		62.51		65.04	
STDEV	2.74		1.32		5.13		4.18		3.75	