TID	ATLAS STANDARD TID TEST REPORT revision 3 (12-Jun-01)	Page 1/5 Ref. DB:

Please complete and submit this ATLAS Standard Form to ATLAS RHA Coordinator (ARC), at least 2 weeks after the date of the test.

1. General information:

1.1	Date of the test:	April 10,2003
1.2	Pre-selection, or Qualification? (specify)	Qualification
1.3	Name of the ATLAS (or other) System:	Atlas Muon CSC
1.4	Name of the board in the System:	ASMII
1.5	Person responsible for the test:	Anand Kandasamy
1.6	Institute:	BNL
1.7	Email:	anand@bnl.gov
1.8	Person responsible for RHA of the Board:	M.Denton
1.9	Institute:	
1.10	Email:	

2. Component:

2.1	Name:	**ASM2MUX**
2.2	Part Number:	
2.3	Type (see section 10.1):	Digital Multiplexor
2.4	Function (see section 10.1):	Digital Multiplexing
2.5	Main specification of the component:	
2.6	Design (specify: COTS/ASIC):	ASIC
2.7	Design center (if known):	BNL
Manufacturer:		
2.8	Name of the manufacturer:	Agilent
2.9	Address of the manufacturer (if known):	
2.10	Phone of the manufacturer (if known):	
2.11	Email of the manufacturer (if known):	
2.12	Web URL of the manufacturer (if known):	
Sampling:		
2.13	Number of tested components (irradiated):	4
2.14	Number of reference components (un-irradiated):	1
Batch origin:		
2.15	Batch origin (Homogeneous/Unknown):	Homogeneous
2.16	Manufacturing date code (for homogeneous batch):	
2.17	Manufacturing line code (for homogeneous batch):	
Technology:		
2.18	Name of the technology (if known):	HP AMOS14TB
2.19	Technology (CMOS/BiCMOS/Bipolar/AsGa/Other):	CMOS
2.20	Minimum geometry (μm) :	0.5
Package:		
2.21	Type:	QFP
2.22	Part number:	
2.23	Number of pin:	44
2.24	Ceramic ? Plastic ? hybrid ? (specify)	Plastic

3. Radiation:

3.1	Name of the radiation facility:	BNL
3.2	Address of the radiation facility:	BNL
3.3	Radiation source (see 12.2) :	^{60}Co
3.4	Radiation type (see 12.2) :	Gamma
3.5	Radiation energy:	1.173 MeV and 1.332 MeV
3.6	Dose rate (Gray/s) :	50Gray/s & 100Gray/s
3.7	Total dose after last step (Gray) :	16310Gray
3.8	NIEL (if any) after last step (1 MeV eq. n/cm2) :	No
3.9	Dosimetry / Calibration method:	Ion chamber

4. Radiation test method (see 12.3): (put an "X" to designate your answer. Specify in 4.10 if necessary)

4.1	Extended TID test method for pre-selection of CMOS devices?	No
4.2	Simplified TID test method for pre-selection of CMOS devices?	Yes
4.3	Extended TID test method for pre-selection of bipolar devices?	No
4.4	Simplified TID test method for pre-selection of bipolar devices?	No
4.5	Extended TID test method for qualification of CMOS batches?	No
4.6	Simplified TID test method for qualification of CMOS batches?	No
4.7	Extended TID test method for qualification of bipolar or BiCMOS batches?	No
4.8	Simplified TID test method for qualification of bipolar or BiCMOS batches?	No
4.9	Other TID test method?	No
4.10	Which other TID test method (specify) ?	

5. Total dose: (if the irradiation is made in one single step, answer to question 5.1 and 5.2 only)

5.1	Total number of irradiation steps:	3
5.2	TID (Gray) after step 1:	2340Gray
5.3	TID (Gray) after step 2 (if more than one step):	7040Gray
5.4	TID (Gray) after step 3 (if more than two steps):	16310Gray
5.5	TID (Gray) after step 4 (if more than three steps):	
5.6	TID (Gray) after step 5 (if more than four steps):	
5.7	TID (Gray) after step 6 (if more than five steps):	

6. Simulation of Low Dose Rate Effects (see 12.4):

Bipolar devices only:		
6.1	Did you perform irradiation at elevated temperature to simulate low dose rate effects (Y/N) ?	NA
6.2	If "yes" to Q.6.1, how much irradiation pre-tests did you perform to determine the worst case temperature?	NA
6.3	If "yes" to Q.6.1, what is the worst temperature determined from pre-tests (^{o}C)?	NA
6.4	If "no" to Q.6.1, which safety factor do you use to represent low dose rate effects?	NA
CMOS and BiCMOS only:		
6.5	Did you perform post-irradiation aging to simulate low dose rate effects (Y/N) ?	No
6.6	If "no" to Q.6.5, which safety factor do you use to represent low dose rate effects?	5

7. Thermal and voltage stresses:

During irradiation:		
7.1	Temperature (°C) ?	25^{0}C
7.2	Supply voltage (Y/N) ?	Y
7.3	If "yes" to 7.2, value of supply voltage:	3.3V
7.4	AC operation (Y/N) ?	No
7.5	If "yes" to 7.4, which AC operation?	
7.6	If "yes" to 7.4, which frequency?	
During post irradiation annealing:		
7.7	Did you perform post-irradiation annealing (Y/N) ?	No
7.8	If "yes" to 7.7, annealing temperature (°C) ?	
7.9	If "yes" to 7.7, duration?	
7.10	If "yes" to 7.7, supply voltage (Y/N) ?	
7.11	If "yes" to 7.7 and 7.10, which supply voltage?	
7.12	If "yes" to 7.7, AC operation (Y/N) ?	
7.13	If "yes" to 7.7 and 7.12, which AC operation?	
7.14	If "yes" to 7.7 and 7.12, which AC frequency?	
During post irradiation accelerated aging:		
7.15	Did you perform post-irradiation ageing (Y/N) ?	No
7.16	If "yes" to 7.15, aging temperature (°C) ?	
7.17	If "yes" to 7.15, duration?	
7.18	If "yes" to 7.15, supply voltage (Y/N) ?	
7.19	If "yes" to 7.15 and 7.18, which supply voltage?	
7.20	If "yes" to 7.15, AC operation (Y/N) ?	
7.21	If "yes" to 7.15 and 7.20, which AC operation?	
7.22	If "yes" to 7.15 and 7.20, which AC frequency?	

8. Electrical measurement:

During irradiation:		
8.1	Did you perform on-line measurement (Y/N) ?	No
8.2	If "yes" to 8.1, at which temperature (°C) ?	
8.3	If "yes" to 8.1, describe on-beam operation and measurements:	
After irradiation:		
8.4	Did you perform electrical measurements just after irradiation (Y/N) ?	Yes
8.5	Duration between irradiation and electrical measurement?	5min
8.6	Temperature during electrical measurement (°C) ?	25^{0}C
After annealing:		
8.7	Did you perform electrical measurements after annealing (Y/N) ?	No
8.8	Duration between annealing and electrical measurement?	No
8.9	Temperature during electrical measurements?	No

8. Electrical measurement (cont.):

After accelerated aging:		
8.10	Did you perform electrical measurements after aging (Y/N) ?	No
8.11	Duration between aging and electrical measurement?	NA
8.12	Temperature during electrical measurement (°C) ?	NA

Description of off-line measurements (after irradiation; after annealing or after aging):

Devices were tested for functionality, and were found to be functional.

9. Rejection criteria:

	Measured parameter	Rejection Criteria
9.1	Functionality	Functional failure
9.2	Tr=Rise time, Tf=Fall time PDlh=Propogation delay, low to High PDhl= propagation delay high to low Idd=supply current.	PDlh<12.5ns (Half the maximum clock frequency) >6nS (round trip delays on the whole ASMII length) Idd* (Refer to the comments below)

Chip ID 1

Dose Gy	Tr	Tf	PDlh	PDhl	Idd
0	0.955	0.795	3.522	3.422	1.326
2340	0.955	0.821	3.630	3.570	1.352
7040	1.137	0.808	3.776	3.769	1.351
16310	1.157	0.816	3.976	3.955	1.322
%Change	**21.2%**	**2.6%**	**12.9%**	**15.6%**	**0.3%**

Chip ID 2

Dose Gy	Tr	Tf	PDlh	PDhl	Idd
0	1.069	0.766	3.535	3.455	1.333
2340	0.997	0.854	3.535	3.401	1.329
7040	1.264	0.842	3.858	3.739	1.319
16310	1.478	0.745	4.115	3.965	1.304
%Change	**38.3%**	**2.7%**	**16.4%**	**14.8%**	**2.1%**

Chip ID 3

Dose Gy	Tr	Tf	PDlh	PDhl	Idd
0	0.935	0.821	3.435	3.360	1.329
2340	1.010	0.837	3.535	3.413	1.327
7040	1.117	0.775	3.642	3.520	1.313
16310	1.112	0.797	3.818	3.743	1.298
%Change	**18.9%**	**2.9%**	**11.1%**	**11.4%**	**2.3%**

	Chip ID 4 (table below)	
9.3		
9.4		
9.5		

Chip ID	4				
Dose Gy	**Tr**	**Tf**	**PDlh**	**PDhl**	**Idd**
0	1.003	0.838	3.543	3.483	1.330
2340	1.011	0.793	3.650	3.553	1.364
7040	1.216	0.761	3.783	3.721	1.368
16310	1.198	0.855	4.080	3.962	1.327
%Change	**19.4%**	**2.0%**	**15.1%**	**13.8%**	**0.2%**

Chip ID	5				
Dose Gy	**Tr**	**Tf**	**PDlh**	**PDhl**	**Idd**
0	1.002	0.831	3.737	3.386	1.325
2340	0.996	0.857	3.633	3.436	1.328
7040	1.017	0.862	3.790	3.636	1.322
16310	1.275	0.818	4.092	3.835	1.302
%Change	**27.2%**	**1.6%**	**9.5%**	**13.3%**	**1.8%**

9.3		
9.4		
9.5		

10. Results:

	10.1	10.2	10.3	10.4	10.5	10.6
	Serial number of the device under test	Max. applied total dose (Gy)	Failure dose (Gy) if any failure during irradiation	Failure during annealing (Y/N)?	Failure during ageing (Y/N)?	Failure mechanism (if any): for component "dead" or out of specification, give explanations and numbers
1	1	16310	No	No	No	
2	2	16310	No	No	No	
3	3	16310	No	No	No	
4	4	16310	No	No	No	
5	5	16310	No	No	No	
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11. Comments

Use the space below to comment test results, or to report them if the above-dedicated space is inappropriate for you.
The devices were tested for rise and fall times and low to high and high to low propagation delays on their output lines. The supply current was also monitored for each device, 5 minutes after it was irradiated. The results are tabulated in the measurement section above. They are well within the acceptable limits. The regulator headroom left sets Idd limit. 3.3V adjustable LHC regulator on ASMII is powering 8 ASM2MUXs, with a current limit of 3Amps. Each ASM2MUX needs about 2 mAmps current at the maximum. The 3.3V regulator will be loaded with 25mAmps of current in the worst case. The current increase seen is not significant, and the regulator has a plenty of headroom left.

12. Guidelines

12.1 Type and Function

Type	Function
Analogue device	ADC; Analogue memory; Analogue multiplexor; DAC; LVDS driver; LVDS receiver; Modulator/Demodulator; Voltage/Frequency converter
Data transmission Component	Receiver; Transceiver; Transmitter
Front-end electronic device	Drift Time Measurement; Multiple functions; Readout memory
Linear device	Amplifier; Comparator; Operational amplifier; Voltage reference;
Memory	SRAM
Microprocessor or peripheral	Microcontroller; Microprocessor
Optoelectronic component	Laser; Light emitting diode – LED; PIN diode; VCSEL
Power device	DC-DC converter; Power transistor; Voltage regulator
Programmable device	EEPROM; FPGA; Lookup table; Programmable delay
Passive component	Capacitor
Interfaces/Communication	LVDS; Switch
Mixed A/D device	Multiple functions
Logic gates	NOR, NAND, etc.

12.2 Radiation source and type

Source of radiation	Type of radiation
Accelerator	Electron, proton, spallation neutron
Am-241	Ions (fission products)
Cf-252	Ions (fission products)
Co-60	Photon gamma 1.173 MeV and 1.332 MeV
Cs-137	Photon gamma 0.662 MeV
Cyclotron	Proton, ion (specify), spallation neutron
Reactor	Neutron
Tandem accelerator	Protons, ions
Van-de-Graaf	Electron
X-Ray generator	Photon X

12.3 Radiation test methods:

see ATLAS Policy on Radiation Tolerant Electronics rev. 2, pp. 20-26
http://atlas.web.cern.ch/Atlas/GROUPS/FRONTEND/WWW/RAD/RadWebPage/ATLASPolicy/APRTE_rev2_250800.pdf

12.4 Low dose rate effects:

see ATLAS Policy on Radiation Tolerant Electronics rev. 2, pp. 11
http://atlas.web.cern.ch/Atlas/GROUPS/FRONTEND/WWW/RAD/RadWebPage/ATLASPolicy/APRTE_rev2_250800.pdf