

SYM	REVISIONS DESCRIPTION	DATE	APPROVED
1	ENGINEERING REL. ERC# E0260R	2/17/84	RAA


ENVIRONMENTAL/RELIABILITY ENGINEERING

TEST REPORT

5200L (5100) VIDEO GAME CONSOLE

DESIGN VALIDATION REPORT

ENGINEERING RELEASED

REVISIONS				DRAWN BY	DATE	Atari, Inc. 2455 Augustine Dr. Santa Clara, CA 95050  A Warner Communications Company		
SYM	DESCRIPTION	DATE	APPV'D	CHECKED	TITLE			
					5200L (5100) Video Game Console Design Validation Report			
				ENGINEER <i>[Signature]</i> 2-16-84	SIZE	DRAWING NO.		REV
				PROJECT ENGINEER <i>[Signature]</i> Feb 15 1984	A	C024673-152		1
				MFG ENGINEER <i>[Signature]</i>	SCALE		SHEET 1 OF 25	

REFERENCE DOCUMENTS:

1. 5100 Design Validation test plan (C024673-130)
2. 5100 Reliability Guidelines (C024673-131)
3. 5100 Console Reliability Prediction (C024673-132)
4. 5100 Current Requirements (C024673-143)
5. 5100 Console Test Specification (C024142)

SUMMARY:

- A. The hardware audit tests results indicate an acceptable unit with the following exception. When an incorrect A.C. power adaptor is used, computer peripheral adaptor, the voltage regulators in the 5100 fail. The A.C. output of the above mentioned adaptor is not compatible with the D.C. console input requirement. This situation arises because the computer peripheral power adaptor output jack can plug directly into the 5100 console which requires a D.C. power adaptor.

Recommended Alternatives:

1. Add a manual note that only the supplied D.C. power adaptor can be used. Further, provide an adequate warning label at the power inlet of the 5100.
 2. Add a high power series diode in 5100 console for console protection.
 3. Longer term. Change the power input connector to accept the 7 pin DIN used on the 800XL. This situation will allow one to eliminate the use of the incorrect power adaptor. (See reference memo C024673-143)
- B. Thirty six game cartridges were reviewed and exhibited acceptable performance.

ENVIRONMENTAL TEST RESULTS:

The following environmental tests were performed with no console failures noted:

1. Temperature Shock Test
2. Sine Vibration Test
3. Transportation Test
4. High and Low Temperature Tests
5. Temperature and Humidity Tests



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ESD console evaluation, with plug-in cartridge, meets the ESD product specification C021703.

The details of the tests are enclosed in C024673-149.

FUNCTIONAL TESTS:

The functional tests showed that the unit conformed to requirements. Areas for future consideration are as follows:

1. Power supply adaptor current requirement. (Reference C024673-143). Changing to the 1.5 amp power adaptor used on the 600 and 800XL units will provide increased unit cost, approximately \$4.00, increased performance and elimination of the possibility of plugging in the incorrect power adaptor. (The cost of this change will be a re-design of the power supply front end.)
2. Evaluate the addition of a series power diode, with (3) amp capability, to half wave rectify the A.C. input. This change will protect against console failure when an incorrect A.C. power adaptor is utilized.
3. Game played the following (36) 5200 and 5200L cartridge with acceptable results. (Reference Table I). Minor software up dates will improve game play.
4. D-RAM read/write cycle timing is acceptable. However, with this new 16K X 4 Bit device the enclosed screening requirements must be followed for the first six months of production.

SAFETY:

The fact that the incorrect power adaptor, computer peripheral power adaptor, can be connected to the 5200L (5100) console by human error, poses a potential product liability. When the incorrect power adaptor is connected, the console voltage regulators fail within seconds. Alternate solutions to this problem are as follows:

1. Series power diode to half wave rectify the A.C. input.
2. Note in manual that only the supplied D.C. power adaptor can be used with the 5100. Further, provide adequate warning lable at the power inlet of the 5100.



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LIFE TESTS:

Three units were operated for approximately seven days (2/1 to 2/8/84) without any console failures. Effectivity accumulated 2,533 operating hours as of 2/8/84, based on the following conditions.

1. Units were operated at 39° C instead of normal operating temperature of 23° C.
2. Units were operated with power on for 30 minutes and then power off for 15 minutes. ...

Items 1 and 2 are accelerated life test conditions. The resultant acceleration factor is 7.5.

3. The total cummulated run time is as follows:

$$\begin{array}{rcccccccc}
 3 & \times & (7) & \times & 24 & \times & (2/3) & \times & 7.5 & = & 2,533 \text{ hrs.} \\
 \text{units} & & \text{days} & & \text{hrs/day} & & \text{Actual} & & \text{Acceleration} & & \\
 & & & & & & \text{Duty} & & \text{Factor} & & \\
 & & & & & & \text{Cycle} & & & &
 \end{array}$$

The 5100 in the use situation will operate approximately (2) hours per day or approximately 730 hours per year. This indicates that each unit has operated for > 1 year without failure in the normal use situation. The units in test (3) will be continued to acquire an initial reading on MTBF.

RELIABILITY PREDICTION:

Reference enclosed: Memo to Pete Gerrard dated 12/19/83 indicates a console return rate of < 2% over the 90 day warranty period. Prediction assumptions and screening requirements are enclosed.



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TABLE I

5100 SOFTWARE

<u>TITLE</u>	<u>COMMENTS</u>	<u>RATING</u>
Tennis	Too many controller functions	Good
Xevious	Occasionally no audio on ground explosion.	Good
Soccer		Good
Space Dungeon		Fair
AE		Good
Pole Position	Car should always run, hit trigger button to slow down.	Good
Qix		Good
Missile Command		Good
Moon Patrol		Fair
Ms. Pacman		Good
Pengo		Good
Mini Golf		Fair
Robotron 2084		Good
Stargate		Good
Milipede		Good
Star Raiders		Good
Dig Dug		Good
Galaxian		Good
Joust		Good
Mario Bros.		Fair
Kangaroo	Game just ends, but doesn't reset back to game menu.	Good
Meebzork		Good
Vanguard		Good
Xari Arena		Good
Football	Two player game	Good
Space Invaders		Good
Baseball		Good
Centipede		Good
Basketball	Game is too easy.	Good/Fair
Berzerk		Good
Jungle Hung		Good
Defender		Good
Counter Measure		Good
Choplifter		Good
Spitfire	Good graphics, but difficult to maneuver ship.	Good
Asteroids		Fair



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ENVIRONMENTAL TEST REPORT NO. C024673-149

ENVIRONMENTAL EVALUATION OF VIDEO GAME M/N 5100

DATE: FEBRUARY 8, 1984

1.0 INTRODUCTION

The environmental tests covered in this report were designed to simulate, under controlled laboratory conditions, the entire lifetime of the product. To accelerate this simulated life into a reasonable time period, the actual test conditions are probably more severe than most units will see in normal use.

The package qualification tests were performed at Package Analysis Laboratory, an independent test laboratory. The remaining tests were conducted by Atari environmental engineers at the Atari San Jose plant. It is the intent of this report to supply only a brief description of the tests. Supplemental details may be found in the test data included at the end of this report and in the "Environmental Engineering Manual" C061616 (rev. 1A).

2.0 TEST PROCEDURES

2.1 THERMAL MAPPING

A thermal mapping test is performed to determine if any component part of the specimen could cause or be affected by adverse thermal conditions.

The first portion of a thermal mapping test is a thermal survey of all components to identify any potential problems. For this portion of the test, a specimen is removed from its case for complete access to all components, and operated. Each component of the operating specimen was individually monitored with a temperature indicating device to determine if it was operating well within the manufacturer's specifications. All of the components operated at temperatures well below 45° C., so no further testing was deemed necessary.

2.2 HIGH TEMPERATURE

The high temperature test is a two part test. For the first portion of the test (60° C.) the specimen is nonoperating and is intended to simulate the storage conditions a unit may encounter during its normal service life. For the second portion of the test (45° C.) the specimen is operating and is intended to simulate the worst case conditions a unit is likely to be subjected to in normal service.



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2.3 LOW TEMPERATURE

The low temperature test is also a two part test. For the first portion of the test (- 30 ° C.) the specimen is non-operating and is intended to simulate the storage conditions a unit may encounter in normal service. For the second portion of the test (10 degrees C), the specimen is operating and is intended to simulate the worst case conditions that a unit is likely to be subjected to in normal service life.

2.4 TEMPERATURE SHOCK

The temperature shock test is a nonoperating test which is performed to simulate the rapid transfer from one temperature extreme to another that often occurs during transportation.

2.5 TEMPERATURE AND HUMIDITY

The temperature and humidity test is an operating test performed to simulate the adverse climatic conditions that exist worldwide. The first time this test was performed on this product, the specimen stopped functioning. The test was terminated and the failure was analyzed. The test specimen itself operated normally but the power supply, which was not in the test chamber, had been shorted. A visual examination of the test specimen revealed that the flux had not been removed from the printed circuit board after the soldering process. It was believed that the flux had reacted with the high humidity to short out the power supply. The flux was cleaned from the specimen and the test was restarted. This time the specimen operated normally for the entire duration of the test.

2.6 VIBRATION

A vibration test is performed to simulate the abuse a product may receive during transportation or throughout a normal service life. The frequency range and levels used to perform this test cover the vibratory conditions common to transportation by land, sea, and air.

2.7 PACKAGE QUALIFICATION

The package qualification tests are performed to verify that the packing method used to ship the product will adequately protect that product. There are two package qualification tests, the transportation vibration and the package drop.

The test procedures used to perform these tests were in accordance with the specifications used by the National Safe Transit Association. For these tests the product is packed in its normal shipping configurations. In this case it meant that three units were combined into a single package.



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The transportation vibration test is performed by placing the package on the table of a vibration machine, in one of its normal shipping positions, and slowly increasing the vibration frequency until the package decouples from the table by at least 0.060". The package is vibrated in this manner for about 30 minutes. The package is then rotated to another of its normal shipping positions and the above procedure is repeated.

The drop test is performed by placing the package on the table of the drop machine in one of the required orientations. The package is then allowed to freefall from a height of 30" and impact on a steel base. The above procedure is repeated with the package reoriented until it has been dropped in all ten of the required orientations.

2.8 ELECTROSTATIC DISCHARGE

An electrostatic discharge test is performed to simulate the conditions that would occur if an operator walked across a carpeted floor and touched an operating product.

2.9 LIFE

The Life test is performed to simulate the normal usage a consumer might expect from our product. Three specimens were placed in a temperature chamber and connected to a timer that cycled the power on and off. The ambient temperature within the chamber was increased to 39° C. The specimens were programmed to operate for 30 minutes followed by 15 minutes off. This power on/off cycling at elevated temperature was continued for one week. Due to the acceleration factors introduced by the elevated temperature and the power cycling this equates to about 3.5 years of normal consumer use.

3.0 CONCLUSIONS

The video game M/N 5100 proved to be mechanically and electrically rugged and to have wide margins in its design and construction. The fact that the 5100 will accept Atari power adapters that supply AC voltage could lead to 5100 damage. Adequate warning labels are to be positioned at power inlet of the 5100.



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Date Started	Specimen Description
1-31-84	Video Game m/n 5100
Date Completed	Type of Test
1-31-84	Thermal Mapping
Engineer (Signature)	Manufacturer
J. D. Angeman	ATARI
Technician (Signature)	Test Specification
J. D. Angeman	ECM 0611616 (REV 1A) Para. 3.2.1
Specimen	
Number	Remarks
5	The specimen was removed from its case and placed in an operating mode. Each component was individually monitored for thermal conditions. No component had an operating temperature above 45°C, so no further testing was deemed necessary.



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DATE STARTED	SPECIMEN DESCRIPTION
1-26-84	Videa Gans mlv 5100
DATE COMPLETED	TYPE OF TEST
1-26-84	High Temperature
ENGINEER (SIGNATURE)	MANUFACTURER
J. D. Drummer	Atari
TECHNICIAN (SIGNATURE)	TEST SPECIFICATION
J. D. Drummer	EFM C041616 (REV 1A) Para 3.2.3.4.1

Specimen #	Temp	Remarks
Number	Time (OC)	
4	0705	amb START Temperature increase
	0815	60 START STABILIZATION
	0820	60
	0825	60
	0830	60 START 4 hour Conditioning
	0910	60
	1037	60
	1132	60
	1230	60 START Temperature decrease
	1300	45 START STABILIZATION
	1305	45
	1310	45
	1315	45 START 1 hour Conditioning
4	1415	45 Specimen operates Normal - No discrepancies noted due to this Test



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Date Started		Specimen Description	
1-27-84		Video Game m/n 5100	
Date Completed		Type of Test	
1-27-84		Low Temperature	
Equipment (Signature)		Manufacturer	
J.D. Aronson		Atari	
Technician (Signature)		Test Specification	
J.D. Aronson		FEM C061616 (REV 1A) Para. 3.2.3	
Specimen	Temp		
Number	Time (°C)	Remarks	
4	0705	Amb	START Temperature decrease
	0830	-30	START STABILIZATION
	0835	-30	
	0840	-30	
	0845	-30	START 4 hour conditioning
	0940	-30	
	1043	-30	
	1245	-30	START Temperature increase
	1400	10	START STABILIZATION
	1405	10	
	1410	10	
	1415	10	START 1 hour conditioning
	1445	10	
4	1515	10	specimen operates normally - no discrepancies noted due to this test



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Date started 1-30-84	Specimen Description Video Game min 500
Date Completed 1-30-84	Type of Test Temperature Shock
Engineer (Signature) M.D. Amman	Manufacturer Atari
Technician (Signature) M.D. Amman	Test Specification EEM C-1616 (Rev. 1A) Para. 3.2.3.4.3

Specimen Number	Time	Temp. (°C)	Cycle No.	Remarks
4	0800	-30	1	START TEST
	0900	-30	1	
	0900	60	1	
	1000	60	1	
	1000	-30	2	
	1100	-30	1	
	1100	60	1	
	1200	60	2	
	1200	-30	3	
	1315	-30	1	
	1315	60	1	
4	1415	60	3	Specimen operator normal - no discrepancies noted due to this test



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Date started	Specimen Description
1-20-84	Video Game MLW 5100
Date Completed	Type of Test
1-23-84	Temperature and Humidity
Engineer (Signature)	Manufacturer
J. D. Dwyer	Atari
Technician (Signature)	Test Specification
J. D. Dwyer	SEM Col 616 (REV. 1A) Para. 3.2.4

Date	Time	Temp (°C)	Humidity (%)	Remarks
1-20-84	0915	Amb	Amb	Specimen in the chamber and operating - START
	0950	45	50	TEMPERATURE INCREASE (SPECIMEN #4)
	1015	45	90	START HUMIDITY INCREASE
	1800	45	90	START CONDITIONING
1-20-84	1800	45	90	
1-21-84	0000	45	90	
	0600	45	90	
	1200	45	90	
1-21-84	1800	45	90	
1-22-84	0000	45	90	
	0600	45	90	
	1200	45	90	
1-22-84	1800	45	90	
1-23-84	0000	45	90	
	0730	45	90	SPECIMEN NOT OPERATING
	0800	45	90	START TEMPERATURE & HUMIDITY DECREASE
1-23-84	0830	Amb	Amb	and SPECIMEN NOT OPERATING - TEST TERMINATED
<p>Note: A post test evaluation revealed the specimen was operating normal, but the power adapter (which was not in the chamber) was shorted out. A visual examination of the specimen showed large amounts of flux on the PCB. The PCB was cleaned and the test was re-started.</p>				



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Date Started 1-27-84	Specimen Description Video Game n/v 5100
Date Completed 1-31-84	Type of Test Temperature and Humidity
Engineer (Signature) H. D. Duncan	Manufacturer Atari
Technician (Signature) H. D. Duncan	Test Specification EEM Cal 6166 (REV. 1A) Para. 3.2.4

Date	Time (cc)	Temp (°C)	Humidity (%)	Remarks
1-27-84	0900	44	44	Specimen # 4 ⁵ in the chamber and operating - start
				Temperature increase
	1030	45	90	Start conditioning
	1830	45	90	
1-27-84	2230	45	90	
1-28-84	0630	45	90	
	1230	45	90	
1-28-84	1830	45	90	
1-29-84	0030	45	90	
	0430	45	90	
	1030	45	90	
	1630	45	90	
1-29-84	2230	45	90	
1-30-84	0430	45	90	
	1030	45	90	
	1630	45	90	
1-30-84	2230	45	90	
1-31-84	0430	45	90	
1-31-84	0930	45	90	Specimen operates normal - No discrepancies noted due to this test



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Date Started 1-25-84	Specimen Description Video Game MIN 5100
Date Completed 1-25-84	Type of Test VIBRATION
Requester (Signature) J.D. Dwyer	Manufacturer Atari
Technician (Signature) J.D. Dwyer	Test Specification EEM 6061616 (REV 1A) Para. 3.3.2.5.1 (PARTS B+C)

Cycling

Specimen Number	Axis	Time Start	Time Stop	Remarks
1	Z	0739	0744	No Resonance Noted - No discrepancies noted
1	Y	0811	0836	No Resonance Noted - No discrepancies noted
1	X	0904	0919	No Resonance Noted - No discrepancies noted

Note: The specimen was cycled from 5Hz - 100Hz - 5Hz
at 0.015" DA

Dwell

Specimen Number	Axis	Time Start	Time Stop	Freq (Hz)	Remarks
1	Z	0748	0758	30	No discrepancies noted
1	Y	0836	0846	30	No discrepancies noted
1	X	0920	0930	30	No discrepancies noted

Note: No physical or functional discrepancies were noted due to this test.



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PAL PACKAGE ANALYSIS LABORATORY

500 LAURELWOOD ROAD, SUITE 5
 SANTA CLARA, CALIFORNIA 95050
 (408) 970-0606



Customer: ATARI INC. Date: 1-31-84
 Product: 5100 GAME 3 PACK P. O. No. V-59213X REL NO. 1
 Package O.D. 20 7/8 x 13 1/4 x 13 5/8 200# S.W. Temp. 67°F
 Gross Wt. 31 LBS Product Wt. _____ Humid. 55% R.H.
 Package Description: 3 EA. 20 1/2 x 12 3/4 x 4 1/2" O.P.F.

Vibrations:

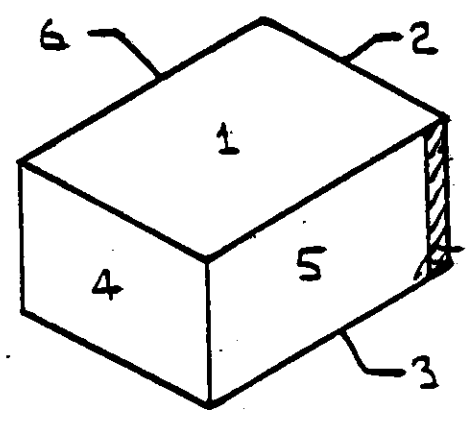
90° ROTATION

	1	2	3	4	5	6
Speed	220 CPM	195 CPM				
Time	55 MIN	37 MIN				

Drop Tests:

Surface	Ref. No.	G's	Time
CORNER	2-3-5		
S. EDGE	2-3		
MSD EDGE	2-5		
L. EDGE	3-5		
	4		
	2		
	6		
	5		
	2		
	3		

Drop Height: 30"



Remarks: PASSED

Witness: H. D. [Signature] Signed: [Signature]



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Date Started		Specimen Description	
1-26-84		Video Game m/v 5100	
Date Completed		Type of Test	
1-26-84		Electrostatic Discharge	
Engineer (Signature)		Manufacturer	
H.D. Druman		Atari	
Technician (Signature)		Test Specifications	
H.D. Druman		EEM C061616 (REV 1A) Para. 3.4.1 (modified)	
Specimen	Voltage	Remarks	
Number (KVDC)			
90			
75	15	No discrepancies noted	
	20	Arcs near all Top Vents, Power Switch, Right Controller Connector, RF Connector, and Power Connector - No discrepancies noted	
		ARC To The Cartridge caused Junk on The Screen - The Specimen Power was Turned off and back on To Reset The Program	
	25	Arcs To The Right Seam, back middle Seam, RF Connector, Power Connector, Top Vents, and Power Switch - No discrepancies noted	
90		Arc To The left Seam - Reset game	
75		ARC To The Cartridge - Reset game	
		Note: The Test Fixtures To be used with This Product were NOT available at The Time This Test was performed	



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Date Started		Specimen Description			
2-1-84		Video Game M/N 5100			
Date Completed		Type of Test			
2-8-84		Life			
Engineer (Signature)		Manufacturer			
H. D. Duncan		Atari			
Technician (Signature)		Test Specification			
H. D. Duncan		Verbal Instructions			
Specimen			Temp	Operating	
Number	Date	Time	(°C)	(h)	Remarks
1, 2, 93	2-1-84	1520	35	✓	Specimens started in power cycling test at elevated temperature. The power cycle consists of 30 minutes power on followed by 15 minutes power off.
	2-1-84	1520	39	✓	
	2-2-84	0715	38	✓	
		1130	38	✓	
	2-2-84	1545	38	✓	
	2-3-84	0710	38	✓	
		1145	38	✓	
	2-3-84	1520	38	✓	
	2-4-84	0720	38	✓	
	2-6-84	1510	38	✓	
	2-7-84	0715	38	✓	
	2-7-84	1145	39	✓	
	2-8-84	0715	38	✓	
1, 2, 93	2-8-84	1222	39	✓	



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Inter Office Memo



Consumer Electronics Division

To: Pete Gerrard

From: Gil Seymour/Terry Musto *T.M.*

Subject: 5200L (5100) CURRENT REQUIREMENTS (C024673-143) Date: 01/30/84

Five different consoles were measured for current drain under varying load conditions. (Reference current readings Tables I through V). The maximum current drain was 794 ma (Unit #5) under the conditions of 108 to 132 VAC line voltage and presently known maximum load of PSA (VCS Adaptor), cartridge, 5200 trakball and 5100 console.

Current requirement comments:

1. One amp power adaptor for the 5100. The present current needs will be met with a one-amp power adaptor. However, with the extended life of the 5100 and the possible addition of new products, it is recommended that the present 1.4 amp 5100 power adaptor be used for increased current capability. (NOTE: The 1.4 amp power adaptor was designed to be used with the 5100.)

2. Future cost/performance improvement recommendation:

Presently, we use a 1.5 amp power adaptor for the 600XL and the 800XL. This same power adaptor can be used with the 5100 under the following changes:

- o Console cost changes: PCB redesign removing heat sinks, voltage regulators and associated parts. Also, add power input connector to accept the 1.5 amp XL power adaptor.
- o Console benefit will be the elimination of components and heat within the console.

The above recommendation can be a future cost reduction and product improvement.

GS/rh

Attachments

cc: Gene Kuczynski
Ghee Munoz
Ken Ashton
PROJECT FILE



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Inter Office Memo



Consumer Electronics Division

To: Pete Garrard

From: Gil Seymour 

Subject: 5100 Console Reliability Prediction (C024673-132)

Date: 12/19/83

The present 5100 console predicted return rate is approximately 2.4% over an operating time of 180 hours with no IC burn-in. The basis of this prediction is as follows:

1. Reliability Guidelines C024673-131
2. Return Rate Summary - Table I
3. Cost/Benefit Analysis - Table II

Further analysis of component requirements, IC burn-in impact on return rate (Table I) and cost/benefit analysis of IC burn-in (Table II) show the following results:

1. Burn-in of the new 16K x 4 Bit D-RAMS, for the first six (6) months of production, provides a 5100 console predicted return rate of approximately 1.8% over an operating time of 180 hours.
2. Burn-in of the D-RAMS, Antic and GTIA provides a 5100 console predicted return rate of approximately 1.3% over an operating time of 180 hours.
3. The cost/benefit analysis, Table II, for enhanced 5100 console reliability, based on failure rates, repair cost and in-house burn-in cost indicates the D-RAMS require burn-in (Method II).

Method II is the most favorable based on a net savings of \$190,000 per million population of the 5100 console. Whereas, Method III, D-RAM, ANTIC and GTIA burn-in indicates a net loss of \$170,000 per million population of the 5100 console when compared to the non burn-in condition.

Conclusion:

The 1.8% return rate (Method II) for 180 hours of 5100 console operation is achievable provided burn-in and component requirement (Reliability Guidelines) are accomplished.



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RETURN RATE SUMMARY

TABLE I
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	FIRST SIX MONTHS OF PRODUCTION		AFTER SIX MONTHS OF PRODUCTION		MTBF (HOURS)
	FAILURE RATE	RETURN RATE	FAILURE RATE	RETURN RATE	
1 METHOD I					
2 NO BURN-IN					7,500
3					11,500
4					
5 O FAILURE RATE (F/ID ⁶ h.s.)	133.40		88.40		
6 O RETURN RATE (%)	2.4%		1.6%		
7					
8					
9					
10					
11 METHOD II					
12 LIMITED BURN-IN					
13 (D-RAMS BURN-IN)					
14					
15					
16					
17 O FAILURE RATE	99.30		77.80		10,050
18					12,350
19 O RETURN RATE	1.0%		1.4%		
20					
21					
22 METHOD III					
23 LIMITED BURN-IN					
24 (D-RAMS, ANTIC & GTIA BURN-IN)					
25					
26					
27 O FAILURE RATE	70.90		50.80		14,100
28					19,700
29 O RETURN RATE	1.3%		0.92%		
30					
31					
32					
33					
34					
35					
36					
37					
38					
39					
40					

Date 12/16/83

Prepared by GIL SEYMOUR

ENVIRONMENTAL/RELIABILITY ENGINEERING

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COST/BENEFIT ANALYSIS

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CONSOLE (4) RETURN RATE	PREDICTION WARRANTY (3) COST/UNIT	IN-HOUSE (2) REPAIR COST	IN-HOUSE BURN-IN COST (3) PER UNIT	TOTAL UNIT COST	NET SAVINGS PER UNIT
2.4%	0.72	0.70	0	1.44	
1.8%	0.54	0.47	(2) D-RAM Sub-total .24	1.25	0.19
1.3%	0.39	0.28	(2) LSI (2) D-RAM Sub-total 0.94	1.61	(0.17)
<p>(1) Warranty Repair - labor and material approximately \$10/unit (console)</p> <p>(2) Approx. 2% savings on IC material & repair labor cost due to full IC burn-in.</p> <p>(3) In-house Burn-in costs taken from Jibe Specht's Ram Burn-in proposals dated 5/16/82 and 6/16/82 first a device sample = 0.25% AQL = If lot does not pass, then provide for 100% burn-in.</p> <p>(4) Warranty time is three months or 180 hours of operation.</p>					

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5100 SYSTEM

ATTACHMENT I

RELIABILITY PREDICTION ASSUMPTIONS

1. Failure rates are due to chance only, and the failure rate is constant.
2. Preliminary production testing and/or burn-in has removed the early failures, and wearout has not begun to occur.
3. Normal average operating temperature of 40 degrees C inside of console.
4. Reliability figures are taken from MIL-217D Handbook.
5. Connections computed by taking all component solder connections x 1.5 allow for soldered through holes, etc.
6. Any component failures will cause sub-system malfunction since there are no redundant components.
7. Since all reliability figures are based on MIL Spec. parts, and we are using commercial grade parts, the parts failure per million hours is multiplied by a quality factor.
8. Independence among all system elements is assumed unless otherwise stated.
9. Game play is an average of approximately two (2) hours per day. The total operating time is 180 hours over a warranty period of three (3) months.
10. Cartridge changes per day are a maximum of approximately six (6) cartridges per day.
11. Power on/off cycling is a maximum of five (5) times per day.
12. No design escapes exist.
13. System components less console has a return rate < 0.5% over an operating time of 180 hours.



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5100 SCREENING REQUIREMENTS

ATTACHMENT II

COMPONENT REQUIREMENTS (ELECTRICAL)

Predetermined sampling plans for components may be used when the cost of not 100% testing is justified (one will always receive faulty components, and sampling plans do not reduce failures on the circuit board or in the field).

A. New 16K x 4 BIT D-RAM:

1. First six months of production shipments, D-RAM will receive a 100% static burn-in at 125 degrees C, with an applied voltage of 6.0 volts, for 48 hours prior to test. Devices to be processed through a 100% screen for all functional electrical parameters.
2. After six months of production shipments: Unless exempted by a predetermined sampling plan, the D-RAM chip will receive a static burn-in at 125 degrees C for 48 hours prior to test. Further, devices will be processed through a 100% screen for prime functional electrical parameters.

B. LSI

Devices to be processed through a 100% screen for all functional electrical parameters unless exempted by a predetermined sampling plan.

C. IC (Various MSI and SSI devices & ROM)

ICs to be processed through a 100% screen for all functional electrical parameters unless exempted by a predetermined sampling plan.

D. MODULATOR, OPERATIONAL AMPLIFIERS, VOLTAGE REGULATORS AND LINEAR DEVICES

Components to be processed through a predetermined sampling plan for all critical electrical parameters.

E. POWER ADAPTOR AND SWITCHBOX ASSEMBLIES

Assemblies to be processed through a 100% screen for all functional electrical parameters unless exempted by a predetermined sampling plan.



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F. TRANSISTORS AND DIODES

Simple active devices to be parametrically tested on a 100% basis, unless exempted by a predetermined sampling plan.

G. PASSIVE PARTS (RESISTORS, CAPACITORS, INDUCTORS AND OTHER ELECTRICAL COMPONENTS)

Components shall be sampled for acceptability to predetermined sampling plans.



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