D/TEC-QCA Final Presentation Day - May 25th, 2005

Co-60 TID Evaluation of SDRAMs from Elpida, EDS2508APTA 256Mbit, from Samsung, K4S510432B 512 Mbit and from Micron, MT48LC16M8A2 128Mbit, using Auto-refresh and Self-refresh mode of operation

- ESTEC Contract No. 13528/99/NL/MV, COO-15

- Hirex Engineering SAS

- *F.X. Guerre, J.F. Pascal, O. Perrotin*

- Estec Technical Officer

- *Reno Harboe Sorensen*

D/TEC-QCA Final Presentation Day - May 25th, 2005

Co-60 TID Evaluation of SDRAMs from Elpida, EDS2508APTA 256Mbit, from Samsung, K4S510432B 512 Mbit and from Micron, MT48LC16M8A2 128Mbit, using Auto-refresh and Self-refresh mode of operation

- ## Components tested

| Manufacturer	Part Number	Description	TID Report
Elpida Memory Inc.	EDS2508APTA	SDRAM 8Mb x 8 x 4 , 133MHz	ESA_QCA0419T_C
Samsung	K4S510432B	SDRAM 32Mb x 4 x 4 , 133MHz	ESA_QCA0420T_C
Micron Technology Inc.	MT48LC16M8A2	SDRAM 4 Mb x 8 x 4 banks	ESA_QCA0421T_C

Co-60 TID Evaluation of SDRAMs from Elpida, EDS2508APTA 256Mbit, from Samsung, K4S510432B 512 Mbit and from Micron, MT48LC16M8A2 128Mbit, using Auto-refresh and Self-refresh mode of operation

- ## Test conditions
  - Exposures: 9, 18, 32, 51, 69 & 98 Krad(Si) @ Room
  - Dose rate: 200 Rad/hour
  - Annealing: 24H @ Room + 168H @ 100°C under bias
  - Bias conditions, 2 modes: Self-refresh & Auto-refresh
  - Electrical parameters: Main static & Dynamic including functionality (4 patterns), timing parameters, Voh/Vol, Iih/Iil, Vih/Vil, Op. & standby Currents, Self & Auto refresh currents.
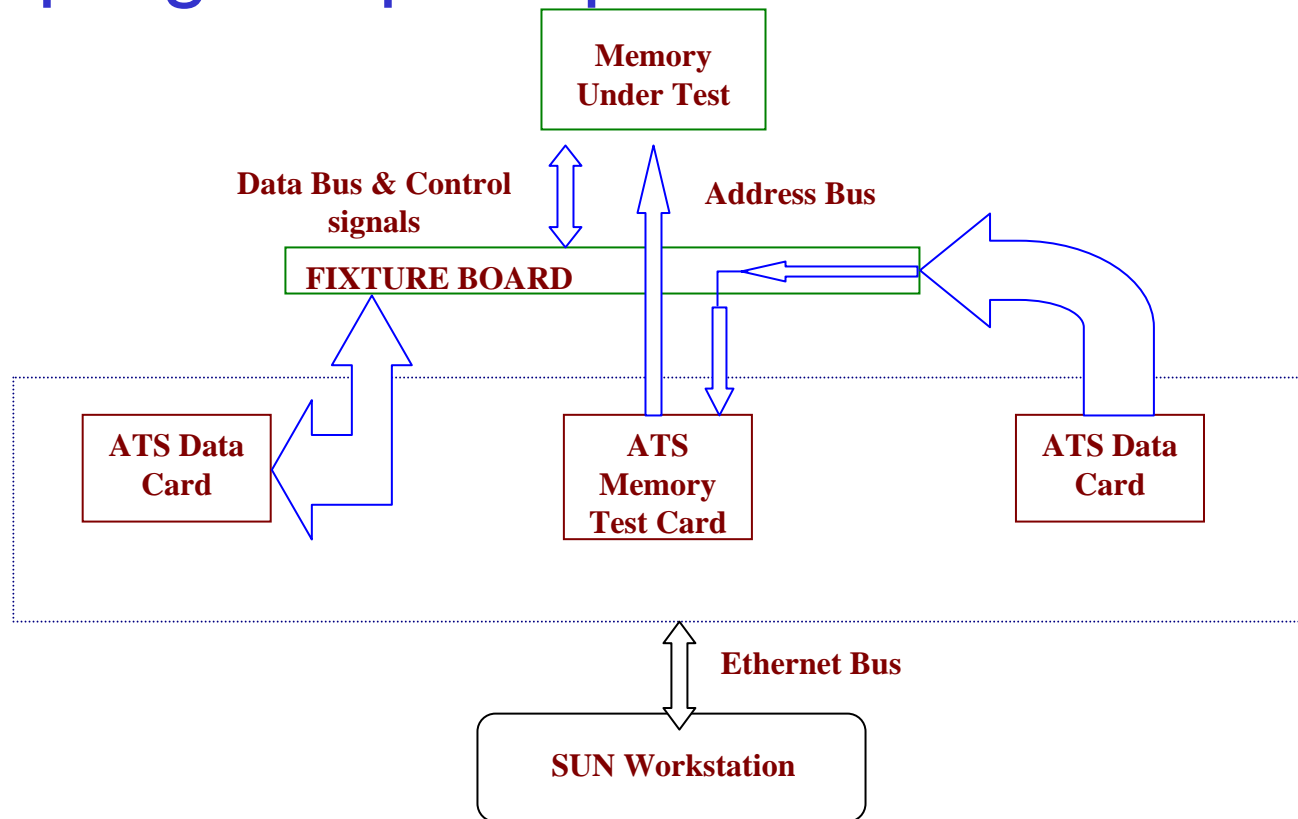
Co-60 TID Evaluation of SDRAMs from Elpida, EDS2508APTA 256Mbit, from Samsung, K4S510432B 512 Mbit and from Micron, MT48LC16M8A2 128Mbit, using Auto-refresh and Self-refresh mode of operation

- # Bias conditions principle
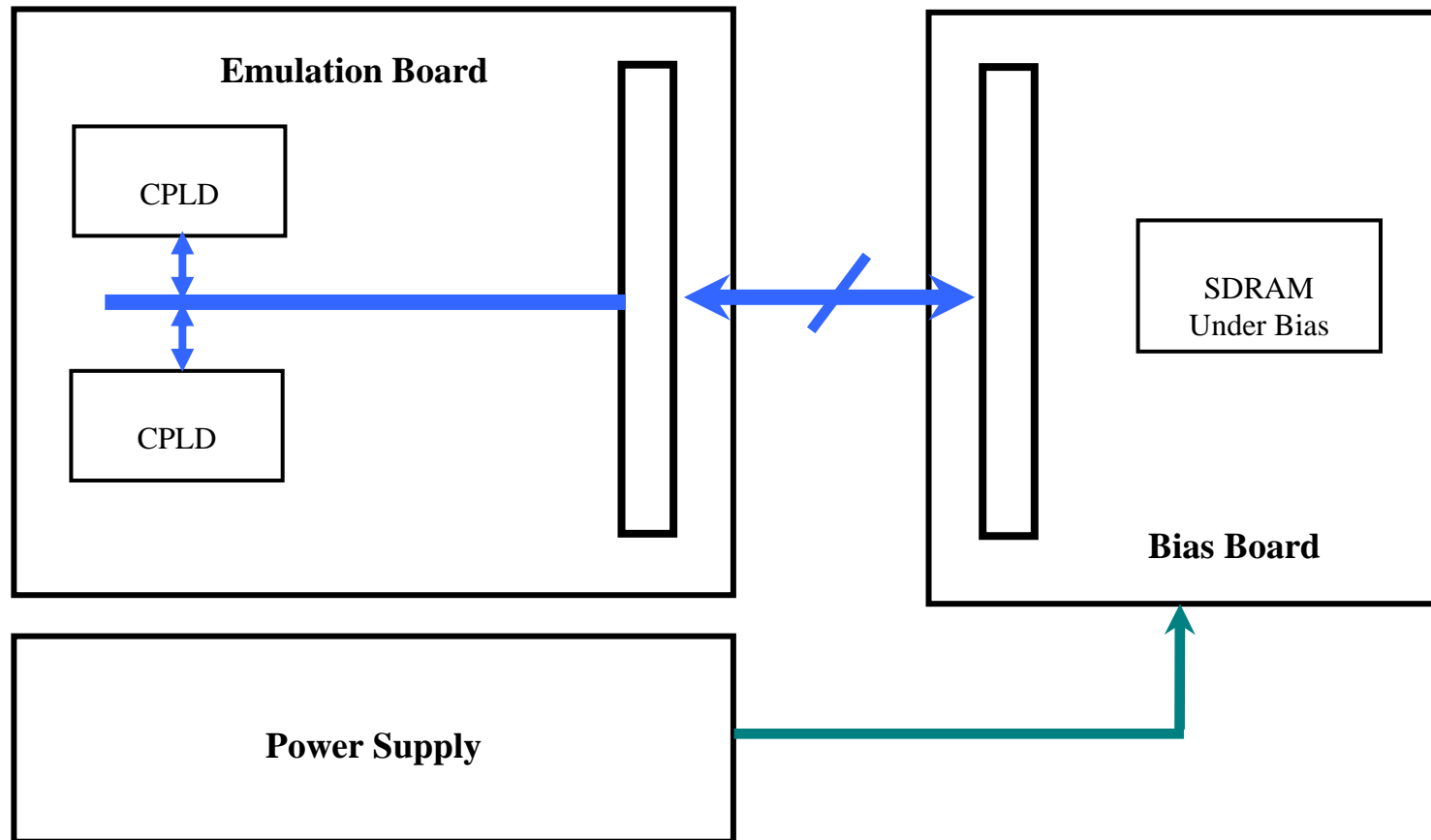
Emulation Board

CPLD

CPLD

SDRAM
Under Bias

Bias Board

Power Supply

Co-60 TID Evaluation of SDRAMs from Elpida, EDS2508APTA 256Mbit, from Samsung, K4S510432B 512 Mbit and from Micron, MT48LC16M8A2 128Mbit, using Auto-refresh and Self-refresh mode of operation

- ## Test program principle

Co-60 TID Evaluation of SDRAMs from Elpida, EDS2508APTA 256Mbit, from Samsung, K4S510432B 512 Mbit and from Micron, MT48LC16M8A2 128Mbit, using Auto-refresh and Self-refresh mode of operation

- ## Test Results Elpida, EDS2508APTA

  – All samples during irradiation exposures and annealing steps did not exhibit any failure.

  – In particular none noticeable differences were recorded when considering the two different bias conditions used during exposures and annealing.

HIREX ENGINEERING S.A.S.

Co-60 TID Evaluation of SDRAMs from Elpida, EDS2508APTA 256Mbit, from Samsung, K4S510432B 512 Mbit and from Micron, MT48LC16M8A2 128Mbit, using Auto-refresh and Self-refresh mode of operation

- ## Test Results Samsung, K4S510432B
  - The most affected parameter was ICC6 the supply current in self refresh mode, that failed specification limits after 51 Krad(Si) of dose exposure. No recovery was observed after annealing.
  - It should be noted that functionality of most samples were lost at 69 Krad(Si).
  - Some of these samples have recovered their functionality after the last annealing step.
  - No significant differences were noted between samples operating in self-refresh and auto-refresh modes during exposures and annealing.

Co-60 TID Evaluation of SDRAMs from Elpida, EDS2508APTA 256Mbit, from Samsung, K4S510432B 512 Mbit and from Micron, MT48LC16M8A2 128Mbit, using Auto-refresh and Self-refresh mode of operation

- ## Test Results Micron, MT48LC16M8A2

  – Generally this device exhibited a fairly good resistance to total dose induced effects. However, it should be noted that samples biased in self-refresh mode had a different behaviour than samples biased in auto-refresh mode.

  * Samples biased in self refresh mode :

  – Lost of functionally after 98 KRad(Si). Recovery after annealing step.

  – Parameters $Idd1$, $Idd3$, $Idd4$, $Idd5$, $Idd6$, $Idd7$, $IozL$, $IozH$, IiL (on pins CLK, CKE, /CS), IiH (on pins CLK, CKE, /CS) failed specification limits after 98 KRad(Si). Recovery after annealing step.

  *Samples biased in auto refresh mode :

  – Samples passed specification limits for all parameters and remained functional all along testing.

HIREX ENGINEERING S.A.S.