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Development Breakthrough achieved enabling Weebit's emerging ReRAM solution to expand memory capacity

Radar Iron Limited ("Radar", ASX:RAD) and Weebit-Nano Ltd are pleased to confirm 'proof of concept' fabrication of 1 Kbit 1D-1R crossbar array consisting of SiOx bit-cells and diodes.

HIGHLIGHTS

- **'Proof of concept' fabrication delivering 1 Kbit 1D-1R crossbar array – the preferred architecture for 2D arrays and future 3D stacking.**
- **The 1kbit array demonstrates Weebit ability to integrate the ReRAM Resistor (R) with the diode (D) in a crossbar architecture.**
- **This breakthrough enables Weebit to target embedded applications for the Internet of Things (IoT). IoT application requires fast, low energy and compact embedded memory which can be integrated in micro-controllers to create System on Chip (SoC).**
- **The crossbar matrix is also the preferable architecture towards future 3D stacking, signaling Weebit's intention to develop ultra-high capacity ReRam to compete with traditional NAND Flash when Flash scalability reaches its limits.**
- **Recent discussions with industry research and development leaders confirm Weebit is on track to produce commercially viable ReRam technology within 18 months.**

The 1 Kbit 1D-1R crossbar array feasibility study included successful writing, storing and reading words in ASCII code to the device.

Performance metrics successfully demonstrated included:

- Switching behavior by conducting nano-filaments forming at a sub-5 nm scale
- Switching speed of sub-50 ns for set and reset process
- Capability of exhibiting multi-bit switching behavior at each cell

The crossbar array is the simplest and highest density architecture for ReRAM memory array, however diodes are needed to avoid sneak currents (leakage current between selected cell and unselected cells).

The diodes can be used in unipolar ReRAM devices which is advantageous from the schematic point of view over a bipolar array. Two-terminal diodes can be used for unipolar systems while bipolar ReRAM requires transistors which are larger 3-terminal devices.

The diodes are necessary at each memory bit to ensure isolation and reliability of the information. Such a structure is standard for ReRAM two-terminal devices.

Inventor of Weebit's ReRam technology, Professor James Tour stated:

"The materials for the diodes that match the voltage ranges required for the porous silicon oxide memory bits, and the design orientation for those diodes, have now been selected and tested to work.

We will now build a 2-dimensional 1 kilo-bit memory using the crossbar design with a diode atop each silicon oxide memory bit.

Once that is demonstrated, we will embark on the layering of that 2-dimensional design to make a truly 3-dimensional architecture."

Today's development milestone is the result of 12 months effort in Weebit labs by Professor James Tour and PhD materials scientists who designed, produced and tested a variety of materials to match the properties of the SiOx memory complex in the requisite 1D-1R architecture.

The selected diodes had to meet the requirements of sufficiently blocking the sneak currents while maintaining the high On-Off ratios needed for multi-bit capability.

The diodes are fabricated with CMOS-compatible non-toxic materials to be easily integrated in the most advanced silicon processes.

The diode selection enables further development towards the array prototype in both 2- and 3-dimensions.

Weebit is on track to meet its development timetable.

For and on behalf of Radar Iron Limited

Ananda Kathiravelu

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ABOUT WEEBIT

Weebit was incorporated in Israel in 2014. Domiciled in Tel Aviv, Weebit in partnership with Rice University is one of the world's foremost developers of Silicon Oxide (SiOx) ReRAM technology. It has been built around a revolutionary memory and semiconductor technology invented by Professor James Tour of Rice University in Houston, Texas. James Tour is a world-renowned leader in the field of materials engineering and nanotechnology, and retains the position of Chief Scientific Advisor. Weebit is developing Tour's new silicon oxide (SiOx) Resistive Random Access Memory (ReRAM) technology, and will be able to show a commercially viable product within 18 months. This quantum leap will allow semiconductor memory elements to become cheaper, faster, more reliable and more energy efficient than the existing Flash technology.

The Problem

Global data storage requirements are growing exponentially, doubling every two years. Moore's Law observes that the number of transistors in dense integrated circuits doubles approximately every two years. However, Moore's Law will soon become untenable in the field of data storage due to Flash technology reaching its scaling limits. With the explosion of Internet of Things, cloud based storage and the memory needs of consumer electronic devices, increased storage capacity is required.

The Opportunity

The current overall market size for Flash memory is estimated at US$37 billion, and the emerging non-volatile market alone is expected to grow from $580 million in 2015 to $3.6 billion in 2020. ReRAM technology can replace traditional Flash memory, and is expected to be used widely from 2018 onwards. Flash memory scalability below 16nm is a technological challenge, because at these dimensions electrons cannot be confined in a floating gate. This results in poor reliability and poor speed, compared to ReRAM.

The Technology

Weebit has demonstrated a working ReRAM SiOx device that outperforms Flash in every parameter:

Performance: 1,000 times faster; the ability to match the demand of faster devices.

Reliability: Reduces data corruption and eliminates errors.

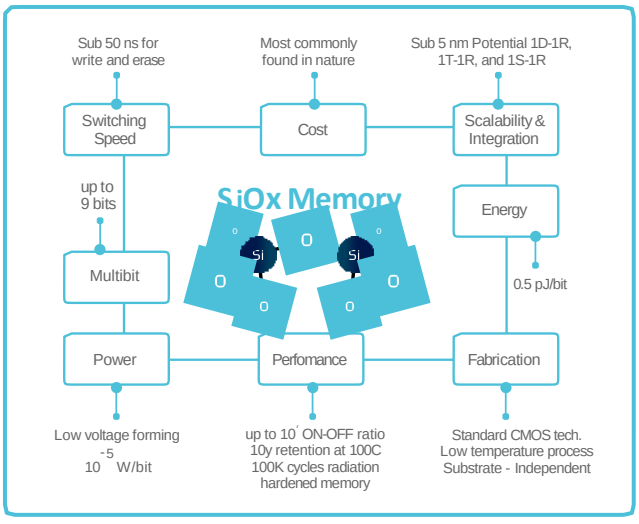
Energy efficiency: Lower power consumption and increased battery life.

Cost: Reduces production cost.

Scalability: 10x smaller cells; the ability to store more information on the same surface area.

Based on SiOx: The most common material in the semiconductor industry, avoiding capital expenditure required for re-tooling by fabricators.

Professor Tour demonstrated for the first time (published in the New York Times, 2010) that SiOx demonstrates superior memory element performance, compared to any other known material. More recently, he developed a new industry-applicable element employing a nano-porous SiOx material which outperforms the switching ability of any other unipolar memory. It is the first implementation of a nano-porous material in memory devices with industry accepted performance metrics. In simple words, Tour discovered that sending a current through silicon oxide, an insulator could create a conductive pathway of silicon crystals. Electrical pulses could then repeatedly break and reconnect the pathway, and can be read as zero or one, the building blocks of computer memory.



Weebit is currently negotiating with household name semiconductor manufacturers to begin the commercialisation process.

Multiple Applications

Smartphones and tablets:

The major application where non-volatile memory is used. Newer technologies such as ReRAM will revolutionise this application segment.

Automotive:

Navigation, Infotainment and safety components which require high reliability data storage devices.

Health Care:

Pacemakers, heart rate monitors, and blood pressure monitors. Non-volatile memory devices will outperform in this field due to higher read and write speeds.

Wearable:

Adoption of these devices is expanding rapidly, and non-volatile memory chips will be required for reliability, efficiency, and added functionality.

Internet of Things:

The Internet of Things (IoT) is the network of physical objects embedded with electronics, software, sensors and network connectivity, thus enabling these objects to collect and exchange data. The IoT allows objects to be sensed and controlled remotely across existing network infrastructure, promoting direct integration and communication between the physical world and computer-based systems. Over 50 billion electronic devices will be connected to the internet by 2020 and each device will require fast, cost effective and reliable memory technology.

Content

A forecasted 40 zettabytes of storable content will be produced annually by 2020, and that number is expected to continue doubling every 2 years. One zettabyte is equal to a thousand exabytes or a billion terabytes

Connectivity

Cloud Data Centres device connectivity requires ultrafast response time, which are currently implemented by expensive SSD Flash drives. These can be replaced by ReRAM memory storage.

Weebit and NASA

In 2012, Rice University in collaboration with NASA, sent several memory chips made of silicon oxide Tour's laboratory to the International Space Station for testing. The purpose of the experiment was to demonstrate robustness of the chip circuits when exposed to solar and other cosmic radiation. Powerful computers are essential to space technology, thus the ability to maintain coherence in such hostile environments is crucial. This is particularly important for satellite circuitry created for missions to Mars and beyond.

After 2 years in space, exposed to harsh radioactive solar and cosmic rays, Weebit's memory devices were still functioning, with zero deterioration or loss of performance. As a result Weebit's memory chips have received a "Hard-Rad" status, meaning that it is largely impervious to the effects of radiation. This renders Weebit's chip material ideal for space missions, satellite technology, and other radiation exposed applications.

Weebit's memory chips being

The ISS where the tests were made

Weebit's chips floating in zero gravity

Weebit in the Media

Rice's Silicon Oxide Memories catch Manufacturers' eye
http://phys.org/news/2014-07-rice-silicon-oxide-memories-eye.html

CNN Report: Here Comes the Terabyte Phone
http://edition.cnn.com/2014/12/31/tech/cnn-10-ideas-phone-storage/index.html

Nanotechweb.org: Nanoporous Oxide Makes Good Memory Device
http://nanotechweb.org/cws/article/tech/57925

Prof. James Tour named Scientist of the Year
http://news.rice.edu/2013/11/01/tour-named-scientist-of-the-year/

Weebit Management

Mr.Yossi Keret | CEO

Mr. Yossi Keret has extensive managerial and financial experience and has led a variety of international companies in different fields including industrial, financing, biotech and high-tech startups both in Europe and the USA. Mr. Keret has a vast experience in public and private companies and took a major part in M&A negotiations and implementation as well as in complex international tax planning. Mr. Keret has played a major part in Initial Public Offerings (IPO) in NASDAQ and has led successful private equity raising (PIPE) for public companies.

Prof. James Tour | Chief Scientific Advisor

Professor of Materials Science and Nano Engineering and a Professor of Computer Science at Rice University in Houston, Texas. He is well known for his work in molecular electronics and molecular switching molecules. Prof. Tour holds more than 60 US patents and has over 500 publications. He was named among "the 50 most Influential Scientists in the world today" in 2014 and was selected as Scientist of the Year by R&D magazine in 2013.

Dr. Moti Gross | Executive Director

Moti Gross has extensive experience leading technology companies, and developing business strategy for established and start-up ventures. Dr. Gross has promoted a broad range of technology projects including raising capital in both government and private sectors. Dr. Gross earned his PhD in Economics and Finance at Oxford University. Dr. Gross is also a Director of Dotz Nano Ltd. a specialized nano technology company focusing on Graphene Quantum Dots.

Mr. Amir Regev | VP Engineering

Amir brings to Weebit two decades of Device & Technology experience in the semiconductor industry, mainly in Flash memory technology. Prior to Weebit, Amir served as a Senior Engineer in leading technology companies in the semiconductor and memory business such as Intel (NASDAQ:INTC), SanDisk (NASDAQ:SNDK), Micron (NASDAQ:MU) and Marvell (NASDAQ:MRVL). Over the years Amir has gained wide knowledge and experience in multiple engineering fields including Device, Technology Development, Quality & Reliability, and ASIC R&D. As a Senior Device Engineer Amir recently took part in developing the most advanced 45nm NOR Flash technology to date. Amir hold an MSc in Electrical Engineering from Tel-Aviv University (Cum Laude) and BSc in Material Science and Engineering from Ben-Gurion University (Cum Laude).

Dr. Amiram Bornstein | Director

A leading specialist in plastic surgery, Dr.Bornstein is a well respected and influential investor in the venture capital scene in Israel and beyond. Dr. Bornstein brings to the Board of Directors broad knowledge and experience in the technology.

Mr. Rami Hadar | Director

Rami Hadar is the former CEO of Allot Communication (NASDAQ:ALLT). During the eight years he functioned as CEO, Mr. Hadar increased the company's sales above $100 million annually, performed 3 M&A's and led the company to an IPO on NASDAQ. Prior to Allot, Mr. Hadar was the CEO of 2 Israeli companies that executed successful exits for their investors Mr. Hadar was also one of the founders of Combox and was a director in the company when it was purchased by Terayon. Mr. Hadar is presently a partner in a new venture capital firm Eucalyptus Growth Capital that focuses on investment and assistance to mature Israeli companies.