

## ASX RELEASE

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### 4DS ACHIEVES WORKING 40nm ReRAM CELLS

- **4DS, an industry leader in Interface Switching ReRAM, has achieved working 40nm cells for the first time**
- **40nm is a breakthrough development at a scale which is smaller than existing 3D Flash memory**
- **Ability to scale down to 40nm is essential for mass market adoption of storage class memory**
- **This significant milestone was achieved in collaboration with HGST, a subsidiary of Western Digital, the global leader in digital storage**
- **In the last 2 years, 4DS has consistently improved the scalability of cells from 800nm to 40nm**
- **Patented technology demonstrates potential for 4DS to deliver memory cells which are significantly faster, cheaper and more energy efficient than existing Flash memory**
- **Flash memory is an estimated US\$40 billion global market**

4DS Memory Limited (ASX:4DS) (**4DS**) (the **Company**) today announced it has successfully developed and tested 40 nanometre (**nm**) Interface Switching resistive random access memory (**ReRAM**) cells.

This milestone is a significant breakthrough as it represents a digital memory cell size which is smaller than the current large scale volume production sizes of existing non-volatile memory technology, 3D NAND Flash (**3D Flash**).

Flash memory is the work horse of silicon storage, but with semiconductor manufacturers continuously working to make computer memory chips smaller and smaller, Flash memory has started to run into physical limitations – Flash memory can't get any smaller without malfunctioning.

Chief Executive Officer and Managing Director, Dr Guido Arnout, said “We are proud of achieving this breakthrough development. 4DS is an emerging memory technology leader with working Interface Switching ReRAM cells at 40nm, which is significantly smaller than the current volume production scale for 3D Flash memory of between 45nm and 50nm. It also represents the target cell size needed to prove the value of this leading technology to memory makers.”

4DS has been developing its patented Interface Switching ReRAM, also known as Non-Filamentary ReRAM, with Western Digital subsidiary HGST for the past two years under a joint development agreement (**JDA**). The JDA was renewed in July 2016 for a further 12 months and is focused on optimising scalability and cycling endurance of ReRAM cells for the mobile and cloud gigabyte silicon storage market.

The JDA, which has focused on the functional behaviour of memory cells at a small scale, has resulted in a significant improvement in the scalability of cells from 800nm, when the JDA commenced, to 40nm, achieving the geometries essential for creating long-term storage class memory (**SCM**).

Approximately US\$12 million has been invested in research and development in the past decade representing a low cash burn rate for an emerging memory technology developer.

## ReRAM is the memory of choice

At the 2016 Flash Memory Summit in August in Santa Clara, California, Western Digital confirmed that 3D ReRAM is its memory technology of choice for SCM. ReRAM offers improved scalability and efficiency, together with lower latency, lower cost and superior endurance.

## 40nm breakthrough vital for storage class memory

4DS' ReRAM cells are constructed using an advanced perovskite material, which has the same crystal structure as the inorganic compound calcium titanium oxide, and allows for the controlled movement of oxygen ions between electrodes. As the cells have no filaments they are inherently scalable and do not have the same physical limitations as Flash or Filamentary ReRAM.

The ability to scale down 4DS' technology is vital for the creation of stacked ReRAMs into 3D structures, which are essential for mobile and cloud gigabyte SCM. SCM is required for high capacity data storage applications, such as cloud and data storage, which require low energy consumption and high endurance rates.

4DS' patented technology is well suited to SCM due to its advantages over traditional and other emerging non-volatile memory storage technologies. These advantages include scalability of cells, low power consumption and high endurance levels.

Dr Guido Arnout, said "The Flash memory market is valued at US\$40 billion and is based on a 30-year-old memory technology with diminishing capacity to reliably scale down to meet the exponential growth of data demands globally. The amount of data created, replicated and consumed worldwide will reach a staggering 50 zettabytes in 2020 driving the increasing need for a SCM solution across diverse applications.

"The limitation of traditional data storage creates a multi-billion-dollar market for emerging, next generation memory developers, such as 4DS.

"With our unique patented technology and our proven ability to successfully scale down to 40nm, 4DS is positioned to be the first to deliver the breakthrough technology that enables high density memory to operate with lower power consumption, improved performance and increased processing efficiency."

## Next steps

4DS will continue to make improvements to the core intellectual property of its ReRAM technology with the near term goal of meeting key endurance performance milestones (terms of which can be found in Section 14.2 of the [Prospectus](#) dated 19 October 2015).

In order to validate and demonstrate commercial viability of a particular storage technology, all memory developers follow a very specific development process.

During this multi-step process, memory cells are scaled down, then tested for cycling endurance, access speed and data retention – essential characteristics for a functional memory technology. The cell architecture and manufacturing process is continually being optimised to achieve the targeted goals for these metrics.

Through the JDA with HGST, 4DS is able to carry out this validation and demonstration without incurring the expense of fabricating fully functional 3D ReRAM prototypes.

## Outlook

Commenting on the outlook for 2017, Dr Arnout said, "With this significant and important breakthrough of developing 40nm memory cells, 4DS is now focussed on optimising the performance and reliability of its ReRAM technology and demonstrating commercial viability for storage class memory."

**ENDS**

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## About 4DS

4DS Memory Limited (ASX: 4DS), with facilities located in Silicon Valley, is a semiconductor development company of non-volatile memory technology, pioneering Interface Switching ReRAM (Non-Filamentary ReRAM), for next generation gigabyte storage in mobile and cloud. Established in 2007, 4DS owns a patented IP portfolio, comprising 16 US patents granted and 7 patents pending, which has been developed in-house to create high density storage class memory. 4DS has a joint development agreement with Western Digital subsidiary HGST, a global storage leader, which accelerates the evolution of 4DS' technology.

For more information, please visit [www.4dsmemory.com](http://www.4dsmemory.com).

## Disclaimer

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