

4DS Memory Limited

Shaw and Partners Flashnote

Expectations Surpassed by the Development of Working 40nm ReRAM Memory Cells

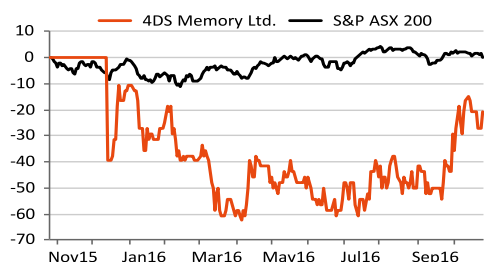
Key Information

Price (cps)	3.5
Market Cap (\$m) - fully diluted	33
52 week Hi-Lo (cps)	4.3 - 2.0
Cash (\$m)	4.5
Debt (\$m)	0.0

Investment Fundamentals

30-Jun	FY14	FY15	FY16
Gross Income (\$m)	0.0	0.0	0.0
Operating loss	-1.1	-1.5	-2.8
PBT (\$m)	-2.4	-4.4	-12.4
Cash (\$m)	0.2	1.1	1.2

4DS vs S&P/ASX Market Index



Company Activities

4DS engages in research and development of non-volatile memory technology in its facilities located in Silicon Valley, USA. Over the last ten years it has pioneered the development of non-filamentary resistive random access memory (ReRAM) for next generation gigabyte silicon storage. The company was listed on the ASX in 2015 and is headquartered in Perth, Western Australia.

Major Shareholders

	Shareholding
Jim Dorrian	5.3%
Kurt Pfluger	3.8%
Bjd Beresford Family Trust	3.8%

Directors and Management

Jim Dorrian	Non-Executive Chairman
Guido Arnout, PhD	CEO & MD
Howard Digby	Non-Executive Director
David McAuliffe	Non-Executive Director

Disclaimer

Shaw and Partners acted for 4DS in a corporate capacity within the past 12 months raising \$4m at 3.4cps for which it received a fee. See the back page of this report for the full disclaimer.

Event

4DS Memory (4DS), in collaboration with HGST, a subsidiary of Western Digital- the largest memory/storage company in the world (enterprise value US\$25b) has made a significant technical breakthrough, with the creation of working 40nm ReRAM memory cells. Below we look at the likely implications for the global data market and the 4DS share price.

Highlights

- 40nm ReRAM – an unexpected and significant development.** Investors had been hoping for a 45nm cell, but 4DS surpassed expectations delivering 40nm cells which are significantly smaller than the incumbent 45nm to 50nm 3D NAND Flash cells, and provide the basis for a compelling commercial proposition. We believe that reaching 40nm has significantly reduced investor risk.
- 40nm ReRAM cells equate to a 30% to 50% uplift in storage capacity over incumbent technology.** In addition, the 4DS patented interface switching technology, due to its non-filamentary mechanism, has physical characteristics that will enable scaling down to even smaller sizes over future years, further lifting storage capacity; whereas the scalability for 3D Flash looks to have been exhausted. 4DS will now seek to characterise its cells over a larger sample set that reflects statistical significance; ahead of, we expect, demonstrating commercial viability of its technology in CY17.
- Exponential growth in data storage demand.** The Flash technology currently used in data centres, PCs and mobiles is 30 years old and has a diminishing ability to scale too much further, but the US\$40bn non-volatile memory market is growing exponentially and requires a technology that can be cost efficiently scaled to reduce size, minimise power consumption and improve durability. There is also a gap emerging between data generation and memory production - by 2020 industry sources suggest, demand for capacity is forecast to outstrip production by six zettabytes, or nearly double the demand of 2013.
- ReRAM is Western Digital's storage class memory technology of choice.** 4DS has a Joint Development Agreement with HGST, a subsidiary of Western Digital - the largest memory /storage company in the world. The companies are in their 3rd year of jointly developing the 4DS technology at HGST's facility in California. HGST provides 4DS with a dedicated team of engineers and insight into its requirements for creating a new type of memory class. In August 2016, Western Digital publicly stated that ReRAM technology will be the big wave of the future and that it expects it will ship products in 2020.
- Competitive next generation data centre storage technology hasn't yet been commercialised.** Interface Switching ReRAM is an emerging, non-volatile memory technology, unique to 4DS, that can potentially be scaled down to even smaller sizes, essential for data centres and cloud storage. We believe that 4DS is the only non-filamentary ReRAM company with a global partner. The long lead times to develop such technology (10+ years), suggests that it is unlikely that there will be a short term challenge to the 4DS technology, which has been in development over the past decade, as the next generation non-volatile memory solution forecast to take US\$6-7b share of the US\$40b Flash memory market by 2020.

Recommendation

Not rated. Despite 4DS's significant technical progress, with the global leader in memory, towards delivering the next generation in storage (a market worth \$40b), and its recent \$4m capital raise which now has it funded through to establishing a viable memory capable of licensing or acquisition prior to commercialisation, it has a relatively small market capitalisation of \$33m. Potential near term announcements, which could be share price catalysts, include: (i) third party verification of endurance performance milestone, which triggers conversion of performance shares, is likely before year end, (ii) further characterisation and optimisation of performance parameters, endurance, access speed, and data retention, and (iii) IP licensing in CY17.

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Buy	Expected to outperform the overall market
Hold	Expected to perform in line with the overall market
Sell	Expected to underperform the overall market
Not Rated	Shaw has issued a factual note on the company but does not have a recommendation

Risk Rating

High	Higher risk than the overall market – investors should be aware this stock may be speculative
Medium	Risk broadly in line with the overall market
Low	Lower risk than the overall market

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