

Strong test results from latest wafer batch

Interface Switching ReRAM further de-risked

On 20 February 2019 4DS Memory Ltd (ASX:4DS) announced that it had analysed a batch of 23 functional 300mm wafers the company received from its development partner imec.

Endurance analysis of the wafer with the best characteristics in this batch (wafer D17) showed that the number of times 4DS' Interface Switching ReRAM technology can be switched runs "into the millions of cycles".

In other words, the company's individual memory cells can be switched many more times than will be required in commercial settings, such as data centres.

Additionally, 4DS indicated that retention analysis had shown the best retention results to date on wafers manufactured outside of the company's own facilities.

Why are these test results so important?

In evaluating 4DS' technology, potential licensees or acquirers of the technology focus on four key metrics:

Endurance: The number of times a memory cell can be switched from a low resistive state (LRS), representing a value of 1, to a high resistive state (HRS), representing a value of 0, and back is called cycling endurance.

Retention: The amount of time a memory cell can stay in a LRS or HRS, and thus represent a value of 1 or 0.

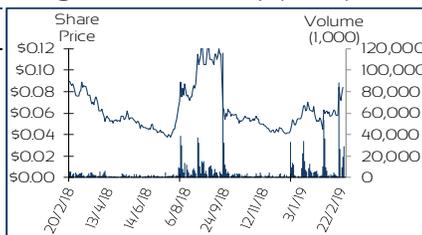
Access speed: The speed at which data can be written and read is called access speed. This needs to be sufficiently fast to make the technology suitable for various applications.

Scalability: Improving the resolution (linewidth) of the memory cell; lower is better as narrower circuitry allows for more memory cells on the same surface. This reduces production costs per unit of memory (e.g. per GB) and lowers energy consumption of the memory chip.

In 2017 4DS had already demonstrated extremely high access speeds for a non-volatile memory (NVM), i.e. close to DRAM speeds, while the individual memory cells had already been scaled down to a 40nm (nanometer) resolution in 2016.

With the number of switching cycles (endurance) into the millions, 4DS has now demonstrated endurance for its memory cells which is well in excess of what is currently required by Storage Class Memory (SCM)

Number of shares (m)	1051.3
Number of shares FD (m)	1171.1
Market capitalisation (A\$ m)	88.3
Free Float (%)	100%
12 month high/low A\$	0,115/0,018
Average daily volume	5,549



4DS Memory Ltd.

ASX:4DS

Semiconductors &
Semiconductor Equipment

Australia

Risk: High

4DS Memory (ASX:4DS) is a semiconductor development company aiming to provide an enterprise grade storage memory for cloud and data center storage markets. The company is developing a proprietary Interface Switching ReRAM technology leveraging expertise from a strategic partnership with a leading data storage player.

[SUBSCRIBE TO OUR RESEARCH HERE](#)

BUY

Current price: A\$ 0.084

Price target: A\$ 0.11

27 February 2019

Readers should be aware that TMT Analytics has been engaged and paid by the company covered in this report for ongoing research coverage. Please refer to the final page of this report for the General Advice Warning, disclaimer and full disclosures.

Analyst: Marc Kennis
marc.kennis@tmt-analytics.com.au
+61 (0)4 3483 8134

applications, such as storage in data centres and on mobile phones. Typical endurance of single-level NAND Flash cells (SLC) is up to 100,000 cycles, while endurance of multi-levels cells (MLC) is typically around 10,000 cycles. In other words, we believe the endurance box is now well and truly ticked by 4DS.

Next step is to expand on D17 results

As a next step in the iterative development process, 4DS will further analyse and characterize the memory arrays on wafer D17, the one with the best results in the previous batch. It will then have imec process another ~20 wafers based on wafer D17, i.e. D17.1, D17.2...etc, all with slight modifications compared to the original wafer D17. The company expects to be able to announce analysis results on this new batch of wafers in 2Q19 (June quarter).

This production and analysis process should result in 4DS being able to determine the optimal production process for its memory arrays.

A few more iterations may be required, but production and testing should go faster

We believe it is not possible at this stage to predict how many more iterative development steps will be required after this upcoming batch of wafers has been produced, analysed and classified. However, the company should now be able to turn around any upcoming test batches much quicker than before, i.e. 3 months instead of the earlier 6 months, which will speed up the development process as a whole.

Once the iterative process is complete, which could be as early as the end of Q2, 4DS will be ready to mount its array on imec's platform. This platform is imec's standard carrier for memory arrays and the integration is straightforward and very low risk.

Buy rating reiterated

Based on the announcement of 20 February, we believe the 4DS investment case has been de-risked further. Even though additional development is required, the company has taken another big step towards its end goal of delivering a competitive new storage technology that can be manufactured on today's mainstream semiconductor manufacturing equipment.

We reiterate our Buy recommendation for 4DS as well as our price target of A\$ 0.11 per share.

Please refer to <https://www.tmt-analytics.com.au/4dsmemory.html> for more in-depth reports and our initiating coverage report on 4DS.

GENERAL ADVICE WARNING, DISCLAIMER & DISCLOSURES

The information contained herein ("Content") has been prepared and issued by TMT Analytics Pty Ltd ABN 17 611 989 774 ("TMT Analytics"), an Authorised Representative (no: 1242594) of BR Securities Australia Pty Ltd, ABN 92 168 734 530, AFSL 456663. All intellectual property relating to the Content vests with TMT Analytics unless otherwise noted.

DISCLAIMER

The Content is provided on an as is basis, without warranty (express or implied). Whilst the Content has been prepared with all reasonable care from sources we believe to be reliable, no responsibility or liability shall be accepted by TMT Analytics for any errors or omissions or misstatements howsoever caused. Any opinions, forecasts or recommendations reflect our judgment and assumptions at the date of publication and may change without notice. TMT Analytics will not accept any responsibility for updating any advice, views, opinions or recommendations contained in this document. No guarantees or warranties regarding accuracy, completeness or fitness for purpose are provided by TMT Analytics, and under no circumstances will any of TMT Analytics, its officers, representatives, associates or agents be liable for any loss or damage, whether direct, incidental or consequential, caused by reliance on or use of the Content.

GENERAL ADVICE WARNING

The Content has been prepared for general information purposes only and is not (and cannot be construed or relied upon as) personal advice nor as an offer to buy/sell/subscribe to any of the financial products mentioned herein. No investment objectives, financial circumstances or needs of any individual have been taken into consideration in the preparation of the Content.

Financial products are complex, entail risk of loss, may rise and fall, and are impacted by a range of market and economic factors, and you should always obtain professional advice to ensure trading or investing in such products is suitable for your circumstances, and ensure you obtain, read and understand any applicable offer document.

DISCLOSURES

TMT Analytics has been commissioned to prepare the Content. From time to time, TMT Analytics' representatives or associates may hold interests, transact or hold directorships in, or perform paid services for, companies mentioned herein. TMT Analytics and its associates, officers, directors and employees, may, from time to time hold securities in the companies referred to herein and may trade in those securities as principal, and in a manner which may be contrary to recommendations mentioned in this document.

TMT Analytics receives fees from the company referred to in this document, for research services and other financial services or advice we may provide to that company. The analyst has received assistance from the company in preparing this document. The company has provided the analyst with communication with senior management and information on the company and industry. As part of due diligence, the analyst has independently and critically reviewed the assistance and information provided by the company to form the opinions expressed in the report. Diligent care has been taken by the analyst to maintain an honest and fair objectivity in writing this report and making the recommendation. Where TMT Analytics has been commissioned to prepare Content and receives fees for its preparation, please note that NO part of the fee, compensation or employee remuneration paid will either directly or indirectly impact the Content provided.

RECOMMENDATIONS

TMT Analytics' issues a BUY recommendation in case of an expected total shareholder return (TSR, share price appreciation plus dividend yield) in excess of 25% within the next twelve months, an ACCUMULATE recommendation in case of an expected TSR between 5% and 25%, a HOLD recommendation in case of an expected TSR between -5% and +5% within the next twelve months and a SELL recommendation in case of an expected total return lower than -5% within the next twelve months.