

# 4DS Memory Limited (4DS)

## Shaw and Partners Flashnote

### Monetisation in 2017 now looks to be increasingly likely

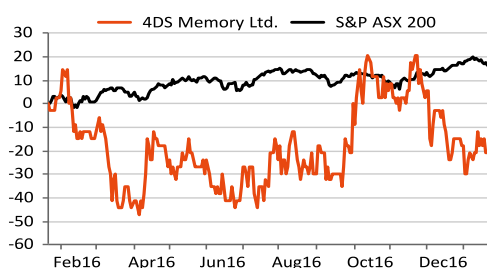
#### Key Information

Price (cps)	2.7
Market Cap (\$m) - fully diluted	26
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

Since Shaw and Partners raised \$4m for 4DS (Not Rated) in October 2016, we have seen a number of developments, such that it now looks increasingly likely that 4DS, after three years of joint development with Western Digital (WDC.US – the largest storage co. in the world), will monetise its Interface Switching (non filamentary) ReRAM technology over the course of 2017, possibly via a licensing deal or acquisition. We present our key thoughts.

#### Keypoints

- Over 2H16 WDC executives began publicly stating that ReRAM will be a part of WDC's future.** Comments include: i) In August 2016, at the Flash Memory Summit, Siva Sivaram, Head of Memory at WDC, made the first public disclosure that ReRAM was the technology that WDC would move ahead with. "We have evaluated all the options and have decided this [ReRAM] is the way we will go," "We are committed to ReRAM...it is scalable...with greater density, lower cost and latency and longer endurance" [than X-Point]. "You can build a universal memory over time with [ReRAM] technology." He added that he expects the ReRAM technology will ship before 2020 and stated ReRAMs will be the big wave of the future, ii) At WDC's December 2016 analyst day in California, WDC in an extensive presentation clarified where ReRAM will fit into its offering and the broader market. The company stated that it will continue to produce 3D NAND for flash memory, but will move to ReRAM for storage class memory. With falling cost of producing NAND it no longer views ReRAM as a lower cost option than 3D NAND, but recognises its superior performance relative to NAND, its lower prices than DRAM, and that it is more scalable than X-Point. We note these disclosures are consistent with the way 4DS management has previously set up our expectations regarding the prospects for its ReRAM.
- 4DS recently delivered requisite technical achievements; key catalysts for commercialisation.** i) In October 4DS announced it had created 40nm Interface Switching ReRAM memory cells, ii) in December 2016 it reported independent tests showing 97% endurance yield from its 50-140nm cells (data which no other ReRAM developer has publicly disclosed), iii) Data on 40nm is also expected to be published over the course of this half year.
- It makes sense that both 4DS and WDC will want to define a clear commercialisation path in 2017.** Catalysts for defining a path include: i) Additional relevant endurance data on 40nm along with data on speed and retention is likely to be the catalyst for commencing negotiation of commercial terms given 4DS does not intend to fund final chip development, ii) with other companies starting to show interest in 4DS's ReRAM technology it makes sense for 4DS to determine WDC's specific intentions especially given the wave of acquisitions occurring in the semiconductor space, iii) If WDC is to ship by 2020 it suggests it needs to be moving into commercial negotiations in 2017, iv) ReRAM addresses WDC's strategic and specific technology needs which suggests it won't allow the technology to slip away as a result of delaying negotiations now that it is increasingly clear that 4DS's ReRAM works.
- Risks remain.** WDC has alternative development opportunities; however our conclusion is that 4DS's ReRAM technology is likely to be the key part of WDC's long term scalable solutions, as WDC's in-house technology appears to have short comings. i) WDC acquired SanDisk in 2015 which brought its own ReRAM development program. SanDisk has developed what is believed to be a filamentary technology which is therefore inherently less scalable than 4DS's Interface Switching (or non filamentary) ReRAM, ii) WDC acquired 110 patents from IBM in January 2016 which included patents relating to non-volatile memory. This does however highlight WDC's desire to embrace non-volatile memory intellectual property.

#### Recommendation

Not Rated - There have been a number of significant developments since October and further announcements are expected which should help clarify the likelihood of commercialisation in 2017, the path that will be followed and value that can be realised.

**Darren Vincent | Senior Analyst**

+61 2 9238 1269

[dvincent@shawandpartners.com.au](mailto:dvincent@shawandpartners.com.au)

## Contacts Page

### Equities

<b>Head of Equities</b>	Mike Ryan	+612 9238 1527	mryan@shawandpartners.com.au
-------------------------	-----------	----------------	------------------------------

### Research

<b>Head of Research</b>	Martin Crabb	+612 9238 1352	mcrabb@shawandpartners.com.au
Executive Assistant	Melody Matthews	+612 9238 1299	mmatthews@shawandpartners.com.au
Banks, Insurance, Telecoms	David Spotswood	+613 9268 1115	dspotswood@shawandpartners.com.au
	Annabel Riggs	+613 9268 1147	ariggs@shawandpartners.com.au
Diversified Financials, Strategy	Martin Crabb	+612 9238 1352	mcrabb@shawandpartners.com.au
	Elliot Smith	+612 9238 1293	esmith@shawandpartners.com.au
Technology & Online, Contractors, Retailers	Danny Younis	+612 9238 1292	dyounis@shawandpartners.com.au
	Matthew Johnston	+612 9238 1311	mjohnston@shawandpartners.com.au
Life Sciences, Travel	Darren Vincent	+612 9238 1269	dvincent@shawandpartners.com.au
	Matthew Johnston	+612 9238 1311	mjohnston@shawandpartners.com.au
Metals & Mining	Peter O'Connor	+612 9238 1219	poconnor@shawandpartners.com.au
Real Estate	Peter Zuk	+612 9238 1211	pzuk@shawandpartners.com.au

### Income Strategies

	Cameron Duncan	+612 9238 1544	cduncan@shawandpartners.com.au
	Steve Anagnos	+612 9238 1513	sanagnos@shawandpartners.com.au

### Institutional Sales

	Chris Eldridge	+613 9268 1185	celdridge@shawandpartners.com.au
	David Erskine	+613 9268 1061	derskine@shawandpartners.com.au
	Phillip Janis	+612 9238 1503	pjanis@shawandpartners.com.au
	Rob Pizzichetta	+613 9268 1174	rpizzichetta@shawandpartners.com.au
	Sam Kanaan	+612 9238 1275	skanaan@shawandpartners.com.au
	Scott Coventry	+612 9238 1363	scoventry@shawandpartners.com.au

### Equity Capital Markets

	John Bowie Wilson	+612 9238 1253	jbowiewilson@shawandpartners.com.au
	Grace Belsito	+612 9238 1226	gbelsito@shawandpartners.com.au

### Corporate Finance

<b>Head of Corporate Finance</b>	Geoff Carrick	+612 9238 1339	gcarrick@shawandpartners.com.au
	Damian Rigney	+612 9238 1398	drigney@shawandpartners.com.au
	David Kells	+612 9238 1362	dkells@shawandpartners.com.au
	Edward Loneragan	+612 9238 1283	eloneragan@shawandpartners.com.au
	Greg Bittar	+612 9238 1597	gbittar@shawandpartners.com.au
	Max Smouha-Ho	+612 9238 1268	mismouha-ho@shawandpartners.com.au
	Robert Hallam	+612 9238 1594	rhallam@shawandpartners.com.au
	Jeremy D'Sylva	+612 9238 1239	jdsylva@shawandpartners.com.au

#### Sydney | Head Office

Level 15, 60 Castlereagh Street  
Sydney NSW 2000  
Telephone: +61 2 9238 1238  
Fax: +61 2 9232 1296  
Toll Free: 1800 636 625

#### Melbourne

Level 20, 90 Collins Street  
Melbourne VIC 3000  
Telephone: +61 3 9268 1000  
Fax: +61 3 9650 2277  
Toll Free: 1800 150 009

#### Brisbane

Level 28, 111 Eagle Street  
Brisbane QLD 4000  
Telephone: +61 7 3036 2500  
Fax: +61 7 3036 2599  
Toll Free: 1800 463 972

#### Perth

Level 14, 197 St Georges Terrace  
Perth WA 6000  
Telephone: +61 8 6188 7643  
Fax: +61 8 6188 7607  
Toll Free: 1800 636 625

#### Adelaide

Level 21, 25 Grenfell Street  
Adelaide SA 5000  
Telephone: +61 8 7109 6000  
Fax: +61 2 9232 1296  
Toll Free: 1800 636 625

## Rating Classification

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

## Risk Rating

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

**RISK STATEMENT:** Where a company is designated as ‘High’ risk, this means that the analyst has determined that the risk profile for this company is significantly higher than for the market as a whole, and so may not suit all investors. Clients should make an assessment as to whether this stock and its potential price volatility is compatible with their financial objectives. Clients should discuss this stock with their Shaw adviser before making any investment decision.

## Disclaimer

Shaw and Partners Limited ABN 24 003 221 583 (“Shaw”) is a Participant of ASX Limited, Chi-X Australia Pty Limited and holder of Australian Financial Services Licence number 236048.

**ANALYST CERTIFICATION:** The Research Analyst who prepared this report hereby certifies that the views expressed in this document accurately reflect the analyst's personal views about the Company and its financial products. The Research Analyst has not been, is not, and will not be receiving direct or indirect compensation for expressing the specific recommendations or views in this report. As at the date of this report the Research Analyst does have an interest in the financial products of the Company.

**DISCLAIMER:** This report is published by Shaw to its clients by way of general, as opposed to personal, advice. This means it has been prepared for multiple distribution without consideration of your investment objectives, financial situation and needs (“personal circumstances”). Accordingly, the advice given is not a recommendation that a particular course of action is suitable for you and the advice is therefore not to be acted on as investment advice. You must assess whether or not the advice is appropriate for your personal circumstances before making any investment decisions. You can either make this assessment yourself, or if you require a personal recommendation, you can seek the assistance of your Shaw client adviser. This report is provided to you on the condition that it not be copied, either in whole or in part, distributed to or disclosed to any other person. If you are not the intended recipient, you should destroy the report and advise Shaw that you have done so. This report is published by Shaw in good faith based on the facts known to it at the time of its preparation and does not purport to contain all relevant information with respect to the financial products to which it relates. Although the report is based on information obtained from sources believed to be reliable, Shaw does not make any representation or warranty that it is accurate, complete or up to date and Shaw accepts no obligation to correct or update the information or opinions in it. If you rely on this report, you do so at your own risk. Any projections are estimates only and may not be realised in the future. Except to the extent that liability under any law cannot be excluded, Shaw disclaims liability for all loss or damage arising as a result of any opinion, advice, recommendation, representation or information expressly or impliedly published in or in relation to this report notwithstanding any error or omission including negligence. This publication has been prepared in accordance with Shaw’s Research Policy. A copy of the Policy can be found at [www.shawandpartners.com.au](http://www.shawandpartners.com.au).

**DISCLOSURE:** Shaw will charge commission in relation to client transactions in financial products and Shaw client advisers will receive a share of that commission. Shaw, its authorised representatives, its associates and their respective officers and employees may have earned previously, or may in the future earn fees and commission from dealing in the Company's financial products. Shaw acted for the company in a corporate capacity within the past 12 months for which it received a fee.

**Sydney | Head Office**  
Level 15, 60 Castlereagh Street  
Sydney NSW 2000  
Telephone: +61 2 9238 1238  
Fax: +61 2 9232 1296  
Toll Free: 1800 636 625

**Melbourne**  
Level 20, 90 Collins Street  
Melbourne VIC 3000  
Telephone: +61 3 9268 1000  
Fax: +61 3 9650 2277  
Toll Free: 1800 150 009

**Brisbane**  
Level 28, 111 Eagle Street  
Brisbane QLD 4000  
Telephone: +61 7 3036 2500  
Fax: +61 7 3036 2599  
Toll Free: 1800 463 972

**Perth**  
Level 14, 197 St Georges Terrace  
Perth WA 6000  
Telephone: +61 8 6188 7643  
Fax: +61 8 6188 7607  
Toll Free: 1800 636 625

**Adelaide**  
Level 21, 25 Grenfell Street  
Adelaide SA 5000  
Telephone: +61 8 7109 6000  
Fax: +61 2 9232 1296  
Toll Free: 1800 636 625