

4DS Memory Limited (4DS)

Flashnote – Not Rated

Speed and No Errors Confirmed: a Unique Offering, is it the ‘Holy Grail’?

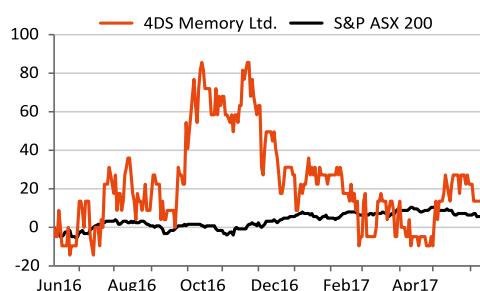
Key Information

Price (cps)	2.9
Market Cap (\$m) - fully diluted	28
52 week Hi-Lo (cps)	4.3 - 1.9
Cash (\$m)	3.1
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 Interface Switching 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
BNP Paribas Nom	7.6%
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
David McAuliffe	Executive Director
Howard Digby	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 (Not Rated) has delivered the results investors were looking for with the announcement that testing of its Interface Switching ReRAM technology has confirmed the read speed (read access time) required of next generation memory (near to DRAM) and that it does not generate read errors of significance. The combination of these two characteristics results in multiple benefits which sees 4DS's Interface Switching ReRAM now ticking most of the key boxes required to license or sell the technology.

Highlights

- **The Holy Grail of memory technology** lies somewhere in the space between the two main memory technologies used today; NAND FLASH (high retention of data ~3 years, but low read speed) and DRAM (high read speed 50 nanoseconds - 500x faster than FLASH, but low retention ~seconds). This is the battleground for next generation memory technology, referred to as Storage Class Memory. FLASH & DRAM are separate markets worth ~USD40bn and ~USD50bn pa respectively; Storage Class Memory, according to industry estimates, if it were here today would potentially be worth USD30bn. In the future, at the rate data is accumulating it could be worth a lot more.
- **4DS's ReRAM is starting to tick all the boxes.** The combination of speed and no errors that 4DS has reported, once incorporated into a 4DS ReRAM chip, will deliver most of the characteristics required. In order of importance, they are: non-volatile (4DS's ReRAM ticks this box ✓), is fast to read (4DS ✓), excellent endurance (4DS ✓), high density (4DS ✓), reduced power consumption (4DS ✓), all while remaining affordable (4DS ✓). The last remaining box for 4DS to tick is data retention. A data retention update is expected next quarter; a retention closer to NAND FLASH than DRAM with read speed close to DRAM would be industry transforming.
- **The competition has disappointed.** Industry has invested billions looking for something to sit in between FLASH and DRAM, but 4DS is not aware of any other ReRAM technology that can make the same latency (read speed) claim that it now can and the only competing soon to be commercially available technology is 3D X Point by Intel and Micron. Initially they stated 3D XPoint would be 1000x faster than NAND FLASH, it has since turned out to be a disappointing 10x faster leaving it miles behind DRAM (and now 4DS). It is 125x more dense than DRAM, but not that dense compared with NAND FLASH and it is expected to cost ~\$2.40 per gigabyte (DRAM costs ~\$5 per gig; FLASH is ~25 cents per gig). Despite all this disappointment industry observers still expect 3D XPoint will find a place in the market because the properties of DRAM and NAND FLASH are so far apart, there is room for many successful new memory products with very different properties.
- **This announcement opens the door to business development discussions.** With retention data expected next quarter, the technology will be unique and ready to be put into a chip, an undertaking 4DS has always indicated it would look to partner to achieve, possibly via a licensing deal or more likely acquisition.

Recommendation

Not Rated – While 4DS remains a speculative investment it has worked with the world's largest storage company (Western Digital) for three years developing its Interface Switching ReRAM technology and it has just passed through the key technology hurdle asked of it. 4DS is not locked into a future with Western Digital, but it has a clear advantage over other memory companies that will now come knocking; and end users such as Google and Apple. These companies are increasingly acquiring early stage technology to position themselves for next generation technology applications: Apple 20 acquisitions in two years including: Artificial intelligence - Lattice Data for USD200mn in May 2017, Machine Learning - Turi for USD200m in 2016, a stake in Chinese ride sharing software - Didi for USD1bn. Google 36 acquisitions in two years including: predictive analytics – Apigee USD625mn in 2016, and cloud software- Orbitera USD100m in 2016.

Contacts Page

Equities

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

Chief Investment Officer

	Martin Crabb	+612 9238 1352	mcrabb@shawandpartners.com.au
--	--------------	----------------	-------------------------------

Research

Executive Assistant, Corporate Access Banks, Insurance, Telecoms	Melody Matthews	+612 9238 1299	mmatthews@shawandpartners.com.au
	David Spotswood	+613 9268 1115	dspotswood@shawandpartners.com.au
	Annabel Riggs	+613 9268 1147	ariggs@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
Oil & Gas	Stuart Baker	+613 9268 1148	sbaker@shawandpartners.com.au
Real Estate	Peter Zuk	+612 9238 1211	pzuk@shawandpartners.com.au
Small Caps	Andrew Moller	+612 9238 1256	amollier@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

Business Development Officer	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
	Roger Gamble	+613 9268 1107	rgamble@shawandpartners.com.au
	Sam Kanaan	+612 9238 1275	skanaan@shawandpartners.com.au
	Scott Coventry	+612 9238 1363	scoventry@shawandpartners.com.au
	Kirsty Riley	+612 9238 1221	kriley@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

Head of Corporate Finance	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
	Max Smouha-Ho	+612 9238 1268	msmouha-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

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

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.

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