PITT STREET RESEARCH

Weebit Nano Ltd.

Another major milestone achieved

Share Price: A$2.26

ASX: WBT

Sector: Technology Hardware & Equipment

30 June 2022

Tape out of ReRAM demo chip in commercial fab

Weebit Nano's (ASX:WBT) first commercial deal, with US-based semiconductor foundry SkyWater Technology (NASDAQ:SKYT), has reached the next level. The company announced it has completed the technology transfer phase and taped-out demonstration chips integrating its embedded Resistive Random Access Memory (ReRAM) module to a production fab for the first time. Tape out is the final result of the design process for integrated circuits, where the design is packaged and sent off for manufacturing.

Why this tape out is so important

This is not just a major milestone for Weebit's partnership with SkyWater, but for the company more generally as it seeks to commercialise ReRAM. It marks the first tape-out of Weebit's ReRAM technology to a production fab, marking the successful completion of the technology transfer to SkyWater's production facility. Once the chips return from production, Weebit will enter the qualification phase at the end of which the technology will be ready for mass production by SkyWater's customers.

Publicly demonstrating its ReRAM IP module

Earlier in June, Weebit's ReRAM module was demonstrated for the first time at the Leti Innovation Days event. This is an important in-person semiconductor industry conference held in France, attracting high level industry executives and decision makers. Weebit Nano demonstrated ReRAM as a non-volatile memory (NVM) memory block, being fed live images and retaining the data while powered-off, then displaying the data separately. The demonstration showed the speed of ReRAM, depicting its faster write speeds compared to typical flash memory technology.

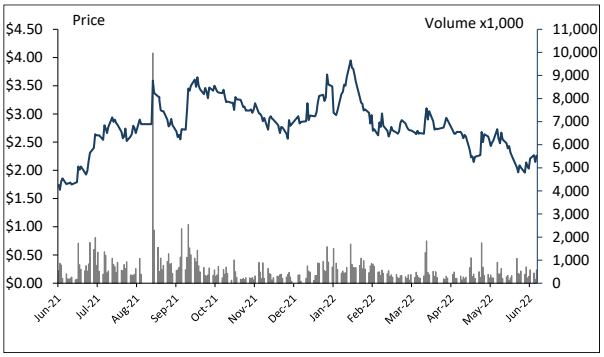
Valuation of A$4.75 per share

We reiterate our valuation for WBT of A$4.75 per share (see full valuation *here*), which we last updated on 14 January 2021. This represented an enterprise value of ~$750m, which is in line with past industry deals and based on the expectation of commercial deals. We are anticipating additional commercial deals in the near to medium term, helped, in part, by the tape out at SkyWater. Such deals should serve as catalysts for the share price and may, in turn, attract other prospects. Please see page 5 for an overview of key investment risks.

Market Cap. (A$ m)	389.4
# shares outstanding (m)	172.3
# share fully diluted	189.1
Market Cap Ful. Dil. (A$ m)	427.3
Free Float	100%
52-week high/low (A$)	$4.50 / $1.63
Average daily volume (x1,000)	603
Website	www.weebit-nano.com

Source: Company, Pitt Street Research

SHARE PRICE (A$) AND AVG. DAILY VOLUME (K, R.H.S.)



Source: Refinitiv, Pitt Street Research

Valuation metrics	
Valuation per share (A$)	4.75

Source: Pitt Street Research

ANALYSTS: MARC KENNIS, NICK SUNDICH

TEL: +61 (0)4 3483 8134

MARC.KENNIS@PITTSTREETRESEARCH.COM

Disclosure: Pitt Street Research directors own shares in Weebit Nano Ltd.

Table of Contents

The first tape out to a production fab is a very important milestone

Nine months since Weebit Nano sealed its first commercial deal with semiconductor foundry operator SkyWater, it has completed transferring its technology to SkyWater's 130nm CMOS fab and performed the first tape-out of its ReRAM technology in a production fab.

SkyWater customers can now use the demo chip as the final platform for testing & prototyping ahead of volume production

Taping-out is the process of packaging the design after verifying its functionality and delivering it to the fab. Weebit taped-out its demonstration chip, which consists of a complete sub-system incorporating its memory module together with a processor, communication and other key required elements. Once the chips return from manufacturing, Weebit and SkyWater will be able to qualify them, the last step before making it available to customers for mass production.

SkyWater's 130nm CMOS process is ideal for applications such as analog, power management, automotive, IoT and medical.

Moving further into the commercialisation phase

As we observed in our 20 September 2021 report on WBT, the SkyWater deal, and now the first tape-out, takes the company out of the development stage for young semiconductor companies and very much into the commercialisation stage.

No matter how impressive the underlying technology looks, would-be customers will typically not engage without proof it can be manufactured in an efficient and cost-effective manner. The qualification process will remove those concerns.

Success breeds success

WBT, having spent much time and resources on the technology transfer and tape-out at SkyWater, can now devote more of its attention to other prospects. With this tape-out success under its belt, we believe discussions with existing prospects will be a lot easier. Moreover, we expect engaging with new prospects should be easier as well as each step closer to qualification will increase their confidence in WBT's technology.

In other words, we expect this tape-out, and the subsequent qualification of the demo chips, may expedite WBT's commercialisation process.

Full throttle on creating industry awareness of ReRAM

Weebit demonstrated its ReRAM IP module for the first time.

Earlier in June, Weebit demonstrated its ReRAM IP module for the first time at the Leti Innovation Days event. This is an important in-person semiconductor industry conference held in France, attracting high level industry executives and decision makers. Weebit showed ReRAM as a NVM memory block, being fed live images and retaining the data while powered-off, then displaying the data separately.

The demonstration showed the speed of Weebit's ReRAM, depicting its faster write speed compared to typical flash memory technology. It is based on Weebit's embedded ReRAM module that included the ReRAM array, control logic, decoders, IOs (Input/Output communication elements) and error correcting code (ECC) as well as patent-pending analog and digital smart circuitry running smart algorithms, which significantly enhance the memory array's technical parameters.

This was not the only prestigious industry event Weebit participated at in recent months. In May, Weebit Nano's Chief Scientist Gabriel Molas presented at the International Memory Workshop (IMW) 2022 on ReRAM's

high temperature reliability. At the same time, Chief Technology Officer Ishai Naveh participated in a panel session. And in June, Vice President of Technology Development Amir Regev discussed emerging materials and technologies for ReRAM at the CIMTEC conference in Italy.

So, it's fair to say that the WBT team is going all-out when it comes to creating awareness of its ReRAM technology and the applications of it.

A healthy cash position

Weebit Nano remains well funded for the foreseeable future. As at 30 April 2022, it had $53.2m in cash, enough to last over four years at current burn rate, although we expect the burn rate to pick up as the company expedites its commercialisation.

It last raised capital in December 2021, raising a total of $35.6m - $25.7m from a private placement to major Israeli investors and $9.9m from an oversubscribed entitlement offer.

Well-funded to ride out the current Tech crunch

We also observe that during 3Q22, the company received $8.5m from the exercising of options. A further $300k was raised via the issuing of placement shares to three directors, as part of last year's capital raising, but only approved by shareholders in the last quarter. It was also able to achieve a cash inflow from R&D of $759k by offsetting expenses by a GST refund in France.

All in all, we believe WBT is in an excellent financial position to weather the current financial market turbulence that is hitting the Tech sector currently. We believe the current Tech crunch is hitting Tech companies that don't have their funding for the foreseeable future in order especially hard. WBT is not one of them, in our view.

Valuation for WBT of A$4.75 per share

Fair value of A$4.75 per share reiterated

In our research update on WBT from January 2021, available here, we valued the company at A$4.75 per share, representing an enterprise value of $750m. We derived this value using semiconductor industry M&A transactions and parallels to ASX-listed peer BrainChip (ASX:BRN). We reiterate this A$4.75 per share valuation.

Don't forget to watch our interview with CEO Coby Hanoch!

Key investment risks

- Alternative emerging memory technologies are being developed by WBT's competitors. These technologies could potentially be superior in nature and/or could be commercialised sooner than WBT's technology, which would inhibit the company's future growth.

  However, apart from 4DS Memory (ASX:4DS), we don't see the other ReRAM players, specifically Crossbar and Adesto, as potential competitors. Crossbar seems to have "evaporated" with no significant business activity in the last 18 months, while Adesto was acquired by Dialog Semiconductor for an EV of US$500m (A$758m at the time), specifically for its IP in the IoT space. Dialog was subsequentially acquired by Renesas (2021).
- Although WBT now seems adequately funded for the medium term, the company may need to raise further capital. That may be required, for instance, if its current development programs and technology transfer/qualification take longer than currently anticipated or multiple growth opportunities arise, resulting in dilution for existing shareholders (albeit at offer prices reflecting the company's progress).
- COVID-19 still poses a potential risk to WBT as potential inability to travel may pose challenges to WBT's technical and commercial people in its conversation with partners and prospects. This may slow down further commercialisation.

Please refer to www.pittstreetresearch.com for our initiating coverage report on WBT, including more elaborate risk assessments.

Appendix I – ReRAM technology

ReRAM technology: The right balance between Flash memory and DRAM

ReRAM is a fast, cost-effective and energy-efficient NVM technology. It can be considered a hybrid memory technology, as it is non-volatile like Flash memory and nearly as fast as DRAM, which is volatile, i.e., a DRAM cell will lose the value (1 or 0) that is stored if the power is switched off. WBT is developing SiOx ReRAM, which, in terms of performance metrics, sits right between Flash and DRAM.

How does it work?

Generally, in case of NAND Flash memory, the values of 1 and 0 are attributed on the basis of the trapped electrical charge present in the memory cell's floating gate. However, in case of a ReRAM cell, the values (1 and 0) are attributed based on the resistance level of the cell material sandwiched between the two electrodes (Figure 1). A value of 1 is attributed to a state of low resistivity, while a value of 0 is attributed to a state of high resistivity.

There are two ways of changing the resistance level of a ReRAM cell.

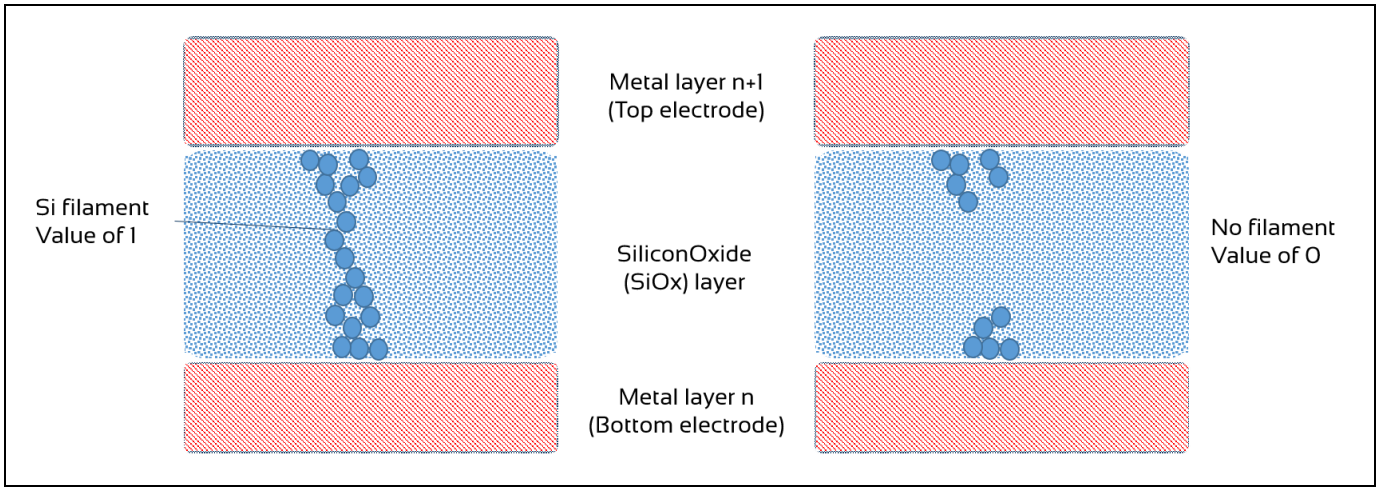
i) Through interface switching, which changes the resistivity of the entire layer between the electrodes or

ii) By creating a filament that connects the two electrodes.

WBT uses the latter.

The technology WBT is developing is based on the forming of a conductive channel between the two metal electrodes of a ReRAM cell. These electrodes are typically made of metals, such as titanium, tungsten, aluminium or copper. The conductive channel is formed inside a non-conductive SiOx layer.

Figure 1: Cell switching by forming and breaking a silicon filament in a SiOx switching layer



Source: Pitt Street Research

SiO_x has typically been used as an insulating component in semiconductor manufacturing. However, by applying a certain voltage to one of the electrodes, a switchable conductive pathway of silicon nanowires (filament) can be formed within the SiOx layer (Figure 1). In this high-conductivity, low-

resistance state, the cell value is 1. By subsequently applying a reverse voltage to the electrode, the filament can be broken down again, effectively switching the memory cell back to the original state of 0.

The actual filament is formed as the applied electrical voltage strips away some of the oxygen atoms in the SiOx layer, leaving the silicon atoms to cluster and form a conductive silicon pathway to the other electrode. The filament is ~5 nanometer (nm) to 7nm in diameter.

WBT uses SiOx in its ReRAM cells, a material that is understood well by the semiconductor industry and has been used in chip manufacturing for decades. We believe that the industry's familiarity with SiOx is a key factor in driving the adoption of WBT's technology among both semiconductor design houses and foundries.

ReRAM's technical parameters validate its commercial use

The endurance and retention levels demonstrated by WBT's technology open up many commercial opportunities

The key parameters for any non-volatile memory are retention and endurance. As demonstrated in the tests conducted by WBT's research partner Leti in May 2019, the company's ReRAM technology is at the forefront of the ReRAM market. The tests demonstrated data retention of over 10 years at 130-150°C, and endurance of a million cycles. Notably, these endurance levels are significantly higher than today's state-of-the-art Flash memory technologies.

Moreover, the retention levels that were achieved at these high temperatures have broadened the scope of potential commercial applications wherein WBT's technology can be used, including the most notable addressable market of electric vehicles.

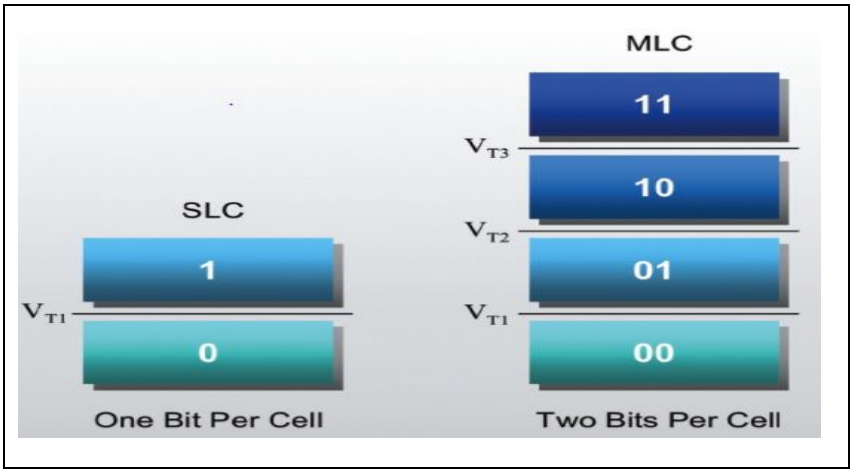
Appendix II – MLC technology

MLC technology: Putting more data in the same cell is another way to increase density

Traditionally, memory cells had two possible states, 1 and 0, and therefore could contain 1 bit of data. These cells are termed as single-level cells (SLC). However, now MLCs are available wherein the stored charge can be a variety of values and 2 bits of data can be stored in a single cell (Figure 2). MLC technology thus allows more data per unit of area to be packed on to a chip compared to SLC.

Typically, the cycling endurance and reliability required in end-user applications determine the appropriate storage technology to be used. SLCs have lower power consumption and therefore a longer lifespan compared to MLC (~100,000 cycles for SLC versus ~10,000 for MLC). Owing to higher reliability and faster speeds, SLC can be found in high-end storage applications, including data centre storage. However, MLCs are less expensive to manufacture per unit of storage and this makes MLC Flash the most used Flash, especially in consumer electronics such as mobile phones, cameras and tablets.

Figure 2: Relative voltage levels for SLC and MLC



Source: Pitt Street Research

Appendix III – Analyst Certification

Marc Kennis, lead analyst on this report, has been covering the semiconductor sector as an analyst since 1997.

- Marc obtained an MSc in Economics from Tilburg University, Netherlands, in 1996 and a post graduate degree in investment analysis in 2001.
- Since 1996, he has worked for a variety of brokers and banks in the Netherlands, including ING and Rabobank, where his main focus has been on the technology sector, including the semiconductor sector.
- After moving to Sydney in 2014, he worked for several Sydney-based brokers before setting up TMT Analytics Pty Ltd, an issuer-sponsored equity research firm.
- In July 2016, with Stuart Roberts, Marc co-founded Pitt Street Research Pty Ltd, which provides issuer-sponsored research on ASX-listed companies across the entire market, including technology companies.

Nick Sundich, lead analyst on this report, is an equities research analyst at Pitt Street Research.

- Nick obtained a Bachelor of Commerce/Bachelor of Arts from the University of Sydney in 2018. He has also completed the CFA Investment Foundations program
- He joined Pitt Street Research in January 2022. Previously he worked for over three years as a financial journalist at Stockhead.
- While at university, he worked for a handful of corporate advisory firms.

General advice warning, Disclaimer & Disclosures

Terms & Conditions

The information contained herein ("Content") has been prepared and issued by Pitt Street Research Pty Ltd ACN 626365615 ("Pitt Street Research"), an Authorised Representative (no: 1265112) of BR Securities Australia Pty Ltd. ABN 92 168 734 530, AFSL 456663. All intellectual property relating to the Content vests with Pitt Street Research unless otherwise noted.

Disclaimer

Pitt Street Research provides this financial advice as an honest and reasonable opinion held at a point in time about an investment's risk profile and merit and the information is provided by the Pitt Street Research in good faith. The views of the adviser(s) do not necessarily reflect the views of the AFS Licensee. Pitt Street Research has no obligation to update the opinion unless Pitt Street Research is currently contracted to provide such an updated opinion. Pitt Street Research does not warrant the accuracy of any information it sources from others. All statements as to future matters are not guaranteed to be accurate and any statements as to past performance do not represent future performance.

Assessment of risk can be subjective. Portfolios of equity investments need to be well diversified and the risk appropriate for the investor. Equity investments in a listed or unlisted company yet to achieve a profit or with an equity value less than $50 million should collectively be a small component of an individual investor's equity portfolio, with smaller individual investment sizes than otherwise. Investors are responsible for their own investment decisions, unless a contract stipulates otherwise.

Pitt Street Research does not stand behind the capital value or performance of any investment. Subject to any terms implied by law and which cannot be excluded, Pitt Street Research shall not be liable for any errors, omissions, defects or misrepresentations in the information (including by reasons of negligence, negligent misstatement or otherwise) or for any loss or damage (whether direct or indirect) suffered by persons who use or rely on the information. If any law prohibits the exclusion of such liability, Pitt Street Research limits its liability to the re-supply of the Information, provided that such limitation is permitted by law and is fair and reasonable.

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

Pitt Street Research has been commissioned to prepare the Content. From time to time, Pitt Street Research representatives or associates may hold interests, transact or hold directorships in, or perform paid services for, companies mentioned herein. Pitt Street Research 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.

Pitt Street Research 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 Pitt Street Research 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.