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Pivotal Systems

In bed with all major chip players

Share Price: A$0.315

ASX: PVS

Sector: Semiconductors & Semiconductor Equipment

3 May 2022

Pivotal Systems (ASX:PVS) is a US-based and ASX-listed provider of gas flow control (GFC) platforms that are used in semiconductor chip manufacturing tools. PVS' GFCs are technologically advanced with the highest degree of flow accuracy and fastest turn on and turn off, contributing to both higher semiconductor output and production yields (good chips per wafer).

Technology-based moat to support market share gains

The technological advantages of PVS' products have enabled it to become the leading technology partner for some of the market's leading chipmakers, foundries and Original Equipment Manufacturers (OEMs).

Consequently, PVS is gradually gaining market share by displacing its competition. With chipmakers expanding their capacity to meet the global surge in chip demand, we believe PVS is well-positioned to benefit from this global capacity expansion spree.

Innovation to support future growth prospects

Backed by its technology and innovation, PVS is expected to diversify into industries other than semiconductors. It has already initiated a process to identify new products and signed agreements to develop relevant technologies for end markets such as lithium-ion battery component manufacturing and renewable energy.

Valuation range of A$1.11–1.40 per share

At a minimum, we value PVS at A$1.11 per share base case and A$1.40 per share optimistic case, using a composite of relative and DCF valuations, implying substantial upside.

Our assumptions are based on expected growth in the semiconductor industry, expansion of PVS' customised and innovative product portfolio, and entry into new end markets. Execution and economic uncertainties remain key risks.

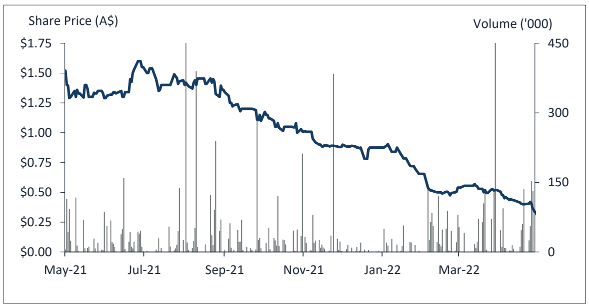
Year to December (US$)	2020	2021	2022F	2023F	2024F
Sales (m)	21.8	29.2	37.1	48.7	64.1
EBITDA (m)	(12.3)	(7.1)	(4.6)	(0.0)	2.1
Net Profit (m)	(12.9)	(6.9)	(3.7)	(0.2)	1.4
EBITDA Margin (%)	NM	NM	NM	NM	3.3%
RoA (%)	NM	NM	NM	NM	4.4%
EPS (cents)	(0.11)	(0.06)	(0.02)	(0.00)	0.01
DPS	NA	NA	NA	NA	NA
EV/Sales	3.6x	2.6x	0.8x	0.7x	0.5x
EV/EBITDA	NM	NM	NM	NM	16.4x
P/E	NM	NM	NM	NM	36.1x

Source: Company, Pitt Street Research

Market cap. (A$m)	50.2
# shares outstanding (m)	159.4
# shares fully diluted (m)	176.1
Market cap. fully diluted (A$m)	55.5
Free float	33.1%
52-week high/low (A$)	1.54 / 0.30
Avg. 12M daily volume ('1000)	35.5
Website	www.pivotalsys.com

Source: Company, Pitt Street Research

Share price (A$) and avg. daily volume (k, r.h.s.)



Source: Refinitiv Eikon, Pitt Street Research

Valuation metrics	
DCF valuation range (A$)	1.32–1.85
Relative valuation range (A$)	0.89–0.96
Blended valuation range (A$)	1.11–1.40

Source: Pitt Street Research

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Profit & Loss (US$ '000)	2021	2022F	2023F	2024F	2025F	2026F
Total Revenue	**29,245.0**	**37,062.0**	**48,662.7**	**64,078.5**	**80,807.6**	**97,620.4**
Operating expenses	(16,362.0)	(15,936.6)	(16,302.0)	(21,145.9)	(25,050.4)	(27,333.7)
EBITDA	**(7,095.0)**	**(4,611.5)**	**(41.0)**	**2,132.9**	**4,272.9**	**8,076.4**
Depn & Amort	(366.0)	(206.6)	(202.3)	(210.5)	(232.5)	(266.8)
EBIT	**(7,461.0)**	**(4,818.1)**	**(243.3)**	**1,922.4**	**4,040.4**	**7,809.6**
Net Interest	(120.0)	(60.6)	(52.5)	(40.4)	(32.3)	(32.3)
Profit/(Loss) before tax	**(6,831.0)**	**(4,893.9)**	**(315.8)**	**1,855.7**	**3,974.9**	**7,737.3**
Tax expense	(48.0)	1,223.5	79.0	(463.9)	(993.7)	(1,934.3)
NPAT	**(6,879.0)**	**(3,670.4)**	**(236.9)**	**1,391.7**	**2,981.2**	**5,802.9**

Cash Flow (US$ '000)	2021	2022F	2023F	2024F	2025F	2026F
Operating cashflow	**(8,294.0)**	**(5,218.8)**	**(2,471.2)**	**(1,977.1)**	**807.9**	**2,291.7**
Payments for purchase of plant and equipment	(185.0)	(185.3)	(243.3)	(320.4)	(404.0)	(488.1)
Other investing activities	0.0	0.0	0.0	0.0	0.0	0.0
Investing cashflow	**(185.0)**	**(185.3)**	**(243.3)**	**(320.4)**	**(404.0)**	**(488.1)**
Net proceeds from borrowings	(1,000.0)	0.0	0.0	0.0	0.0	0.0
Other Financing activities	5,928.0	10,000.0	0.0	0.0	0.0	0.0
Net change in cash	(3,551.0)	4,595.9	(2,714.5)	(2,297.5)	403.8	1,803.6
Cash at End Period	**3,988.0**	**8,583.9**	**5,869.4**	**3,571.9**	**3,975.7**	**5,779.3**

Balance Sheet (US$ '000)	2021	2022F	2023F	2024F	2025F	2026F
Cash	3,988.0	8,583.9	5,869.4	3,571.9	3,975.7	5,779.3
Total Assets	21,903.0	29,295.9	30,210.6	33,033.1	37,808.5	45,527.7
Total Liabilities	6,754.0	7,817.3	8,968.8	10,399.6	12,193.9	14,110.0
Shareholders' Funds	3,830.0	10,159.6	9,922.8	11,314.5	14,295.7	20,098.6

Ratios	2021F	2022F	2023F	2024F	2025F	2026F
Net debt (cash)/Equity	-83.0%	-76.5%	-51.0%	-24.4%	-22.2%	-24.7%
Total Cash / Total Assets	18.2%	29.3%	19.4%	10.8%	10.5%	12.7%
Return on Assets (%)	NM	NM	NM	4.4%	8.4%	13.9%
Return on Equity (%)	NM	NM	NM	13.1%	23.3%	33.7%

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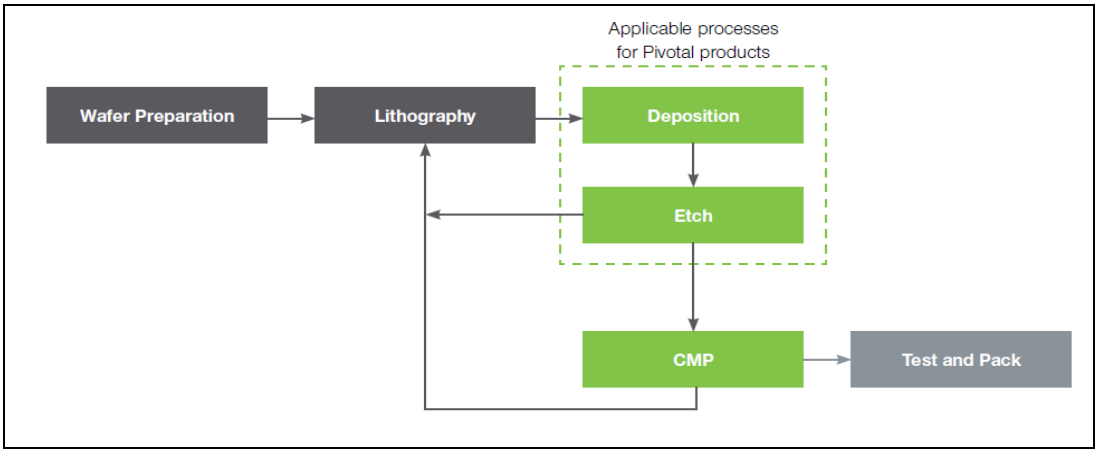
Pivotal Systems (ASX:PVS) in a nutshell

PVS caters to OEMs, foundries and IDMs alike

Based in Freemont, California (USA), Pivotal Systems (ASX:PVS) is an ASX-listed provider of one of the best-in-class gas flow monitoring and control technology platform that is used in the global semiconductor industry. PVS got started in 2003 and reorganised in 2012 to address certain inefficiencies in the measurement of gas flow as used in highly complex semiconductor manufacturing processes. Management realised the need for expedited technological developments in order to make efficient gas flow controllers (GFCs) that could be used in etching and deposition processes. Both are critical in the semiconductor manufacturing process.

Today, PVS offers a platform (hardware and software) that controls the flow of gas into reaction chambers with the highest degree of accuracy and the fastest output, resulting in higher yields (good chips per wafer). GFCs are used as a critical component in semiconductor chip manufacturing tools and are required by original equipment manufacturers (OEMs), semiconductor foundries (that manufacture for third parties) and integrated device manufacturers (IDMs). PVS caters to all groups with customers like Applied Materials, Samsung, SK Hynix, Lam Research and Tokyo Electron.

Figure 1: Semiconductor manufacturing process involves multiple critical sub-processes



Source: Company

PVS has patented hardware with integrated upgradeable software to control gas flows

PVS combines proprietary hardware designs and upgradable machine learning software. The company's innovative designs provide enhanced measurement and more accurate control of gas flows, leading to increased production yields and process efficiencies. Its products are technologically superior and require less maintenance than competing products. PVS' positive positional flow control platforms have been a step-up from the thermal-based platforms and pressure-based platforms used in the past.

Innovation drives customisation and provides competitive edge

PVS is displacing its competition within customer accounts

Semiconductor manufacturing is a complex and capex-heavy proposition, so only a relatively limited number of IDMs and foundries are involved in chip manufacturing. Because of the complexities and the costs involved, a high degree of validation is required for any new technology to become part of the chip manufacturing process. Because of its detailed technological qualification process, PVS has been able to enter into development partnerships with leading OEMs, foundries and IDMs. This has resulted in PVS displacing its competition at these customers. The growing installed base (over 65,000 units) drives additional recurring revenues from software upgrades and retrofits.

Investment Case: Key reasons to look at PVS

I. A vital cog in the semiconductor manufacturing process

PVS' GFC platforms form a critical subsystem in the etching and deposition steps of the semiconductor manufacturing process. Effective management of gas flows impacts the yield and efficiency of the wafer manufacturing process used by chip manufacturers. Since semiconductor manufacturing is a complex, expensive and competitive process, a small number of players compete on costs and yields. PVS' software-supported, nanotechnology-driven products provide accurate and relatively fast control systems. They offer significant competitive advantages to OEMs and IDMs alike. PVS offers an opportunity to invest in the rapidly growing semiconductor equipment manufacturing industry.

II. Being qualified supplier provides an operational moat

Validation by industry leaders is supporting PVS to displace competition

OEMs and chip manufacturers require flow control suppliers to undertake significant and lengthy validation processes. PVS has mastered the art of qualifying the technological audits, thereby receiving validation from industry leaders. The company has been improving the value of its product by developing products in collaboration with its OEM customers. The company has become the exclusive supplier for multiple OEMs and chip manufacturers. This facilitates easy integration of PVS' products into etching and deposition tools. The complex and critical nature of GFCs ensures that their substitution require significant investment. This means sizeable entry barriers and higher switching costs if customers would want to swap to competing products.

III. Semiconductor shortage provides significant tailwind

The current semiconductor chip shortages and related industry-wide production capacity expansion efforts provide a great opportunity for PVS. With the proliferation of newer technologies, such as artificial intelligence and the Internet of Things (IoT), the consumption and manufacturing of semiconductors will accelerate. This will invariably lead to higher demand for GFCs benefitting PVS directly.

IV. Expansion into newer verticals enhances competitive edge

Through recent memorandums of understanding (MoUs), PVS is aiming to enter new market verticals by determining the gas flow requirement across lithium-ion battery manufacturing and fuel cell systems in renewable energy applications. It is also exploring opportunities within the healthcare space. We believe that as PVS starts partnering with global companies from other industries, its brand and product visibility will expand, improving the investor's interest.

V. Growing market base ensures higher recurring revenue

PVS has secured multiple repeat orders across geographies, i.e. Japan, Europe, Taiwan, North America and Korea. Through the ability to gain market acceptance for its GFCs from early users, PVS has expanded its business across a broader range of OEMs and chip manufacturers. The growing installed base is likely to drive recurring revenue from software upgrades and retrofits.

VI. Consistent revenue growth, but still highly undervalued

Current valuation does not reflect the true potential of PVS in across various industries

We believe that PVS' current valuation does not accurately reflect its growth potential. Despite registering consistent growth in revenue for the last seven quarters, a strong upward trend in the underlying industry and market share gains for its GFC's, the stock still trades at a discount to its peers. This makes PVS a very attractive investment opportunity within the fast-growing semiconductor manufacturing tool industry, in our view.

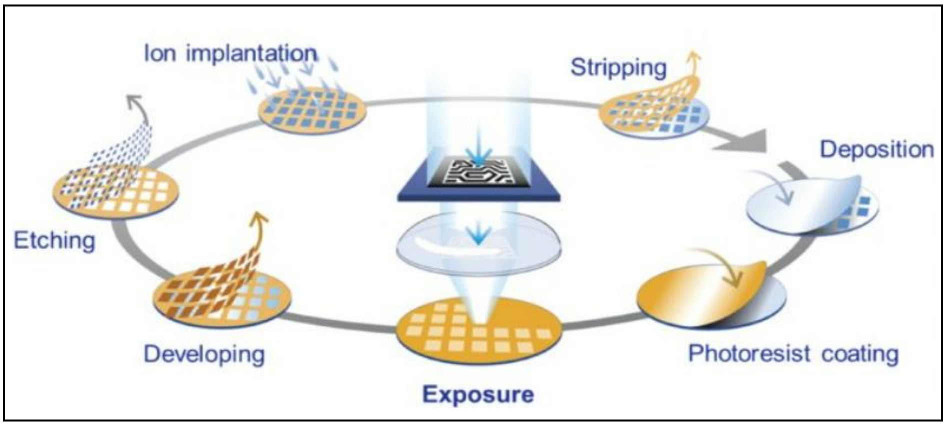
Semiconductor manufacturing 101

Semiconductor manufacturing is complex, expensive and competitive. A small number of very large players compete on costs and yields

Manufacturing of semiconductors is a complex procedure and requires high degree of precision involving sophisticated equipment and tools. Semiconductors are developed by a sequence of nanofabrication processes performed on the surface of substrates made from single-crystal silicon. The substrates are known as wafers with the most common diameters of 300 mm or 200 mm.

Of the numerous process steps that the wafers go through, there are eight main processes — Wafer Processing, Oxidation, Lithography, Etching, Film Deposition, Interconnection, Testing and Packaging (Figure 2). Deposition and Etching are two critical steps in the manufacturing process and require gas flow controllers.

Figure 2: Semiconductor manufacturing involves multiple processes



Source: SPIE Digital Library

The process starts with a silicon wafer, which is sliced from an ingot of 99.99% pure silicon. After wafer polishing, thin layers of aluminium, silicon oxide and other metals (depending on the process step) are deposited on the wafer using various methods, including:

- Chemical Vapour Deposition (CVD)
- Physical Vapour Deposition, or sputtering
- Thermal Oxidation
- Electrodeposition

Once a photo resistive material is applied, the actual pattern of the particular layer of circuitry that is being worked on in that process step is exposed onto the wafer through a process called lithography. After exposure, the wafer is developed and the subsequent etching process uses liquid gas or plasma to eliminate any excess materials. What remains is the semiconductor circuit that needs to be filled with copper or aluminium.

This process is repeated for every layer of the specific semiconductor that is being manufactured on the wafer. In total, a wafer may undergo more than 400 of these process steps to create the chips on that wafer. It can take around 3 months for a wafer to go through all required process steps.

One of the key things in chip manufacturing is the accuracy with which thin films can be deposited onto the wafer, which we'll discuss next.

Thin film deposition with CVD and ALD

Thin film deposition is the process of depositing thin films on a substrate material (wafer), which improves certain characteristics of the substrate. Thin film deposition processes are at the heart of microelectronic device fabricating and find significant usage across various industries, such as semiconductors, solar panels, disk drives and optical devices.

Thin film deposition requires Mass Flow Controllers (MFCs) and GFCs that are used in CVD, and ALD tools.

What is a thin film?

Thin films provide an enhanced degree of surface protection, along with improving material properties

In semiconductor manufacturing the term “thin film” refers to a layer of material that is typically less than 1 micron thick, although certain films can be just 1 nano meter (nm) thick. Thin films have distinct advantages over bulk coatings as the former have the capability to provide an enhanced degree of surface protection, better optical and electrical properties, and provide a barrier to gas penetration.

There are various methods of deposition

There is no one one-size fits all process for thin film deposition. No one method is a perfect solution. There are several primary methods to deposit a thin film in semiconductor manufacturing, including physical vapour deposition (PVD), chemical vapour deposition (CVD) and atomic layer deposition:

- **Physical vapour deposition (PVD)** is the process of condensation of vaporised solid material on top of a solid surface under partial vacuum conditions. PVD has relatively low deposition rates and is not suitable for substrates with complex geometries.
- **Chemical vapour deposition (CVD)** targets elements in the vapour phase to react onto the surface of the substrate, leading to the growth of a thin film. CVD is a thermodynamically complex process and requires specific conditions (such as specific temperature, pressure, reaction rates, and mass and energy transfer) to ensure that the desired quality of the thin film is produced.

  Manufacturers can alter these reaction parameters to produce deposition layers on both simple and complex geometry substrates with relative ease at generally low temperatures. This gives CVD an advantage over other deposition techniques, making it the preferred choice for thin film deposition.
- **Atomic layer deposition (ALD)** is a modified version of CVD and is superior to the conventional process. ALD can be used to deposit layers just 1 atom in thickness.

PVS’ gas flow controllers can be found in CVD and ALD tools

PVS’ gas flow controllers can be found in CVD and ALD tools from various OEMs, while the company also supplies its GFC’s directly to foundry and IDM end-customers.

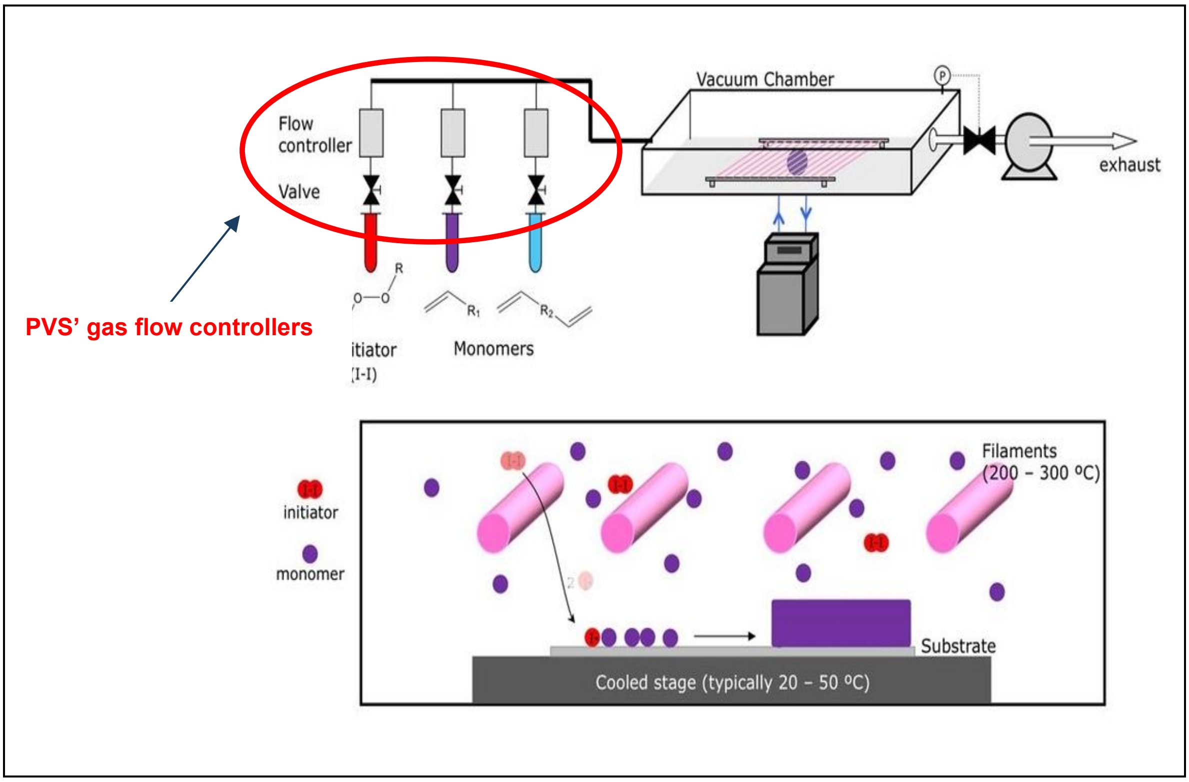
Chemical vapour deposition (CVD)

CVD is a thin film deposition method used to form a coating/layer on the surface of a heated substrate via thermally- induced chemical reactions in the presence of gaseous reagents. This process helps to produce uniform coatings of metals and polymers, even on contoured surfaces.

CVD for semiconductors

The CVD process for semiconductor materials is complex as the reaction involves atoms from multiple materials and/or metals with nitrogen atoms. However, silicon, one of the main semiconductor materials, is comparatively simpler to produce. Silicon thin films are manufactured in a CVD reactor using silane (SiH_4). Silicon dioxide (which is widely used in semiconductor technology) is produced by silane's reaction in the presence of oxygen.

Figure 3: Simplified representation of a CVD process with PVS' gas flow controllers



Source: Massachusetts Institute of Technology

Use of precursors and carrier gasses

GFC's control the flow of gasses into the reaction chamber with very high accuracy

PVS' products are used to control the flow of the carrier gases within heat and reactor chambers. The thin films created with these precursors and gasses ultimately form the individual components of a computer chip on a wafer (or substrate). It is this step where PVS plays an important part in the manufacturing of semiconductor chips.

Substrate (or wafer)

The substrate, or semiconductor wafer, is the surface on which the semiconductors are formed. Vaporised precursor atoms (see below) get deposited and disintegrate on the substrate to form thin films.

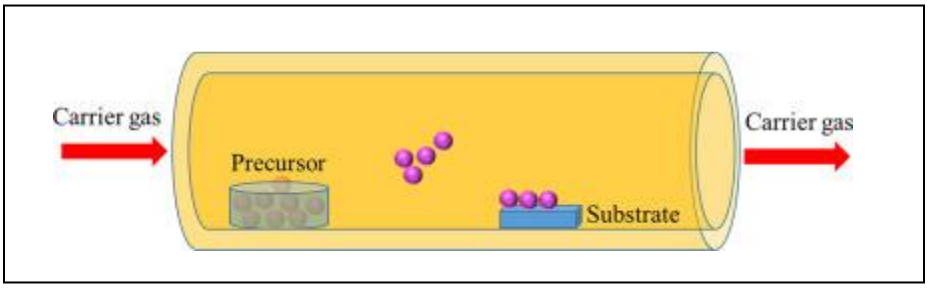
Precursors

Precursors disintegrate on the heated substrate to produce thin films during the deposition process. These precursors are delivered into the reaction chamber (generally diluted in carrier gases) at approximately ambient temperatures. As they come into contact with a heated substrate, they decompose into a solid that is deposited onto the substrate. Some of the different types of precursor materials include halides, hydrides, metal-organic compounds, metal alkyls, metal alkoxides and metal carbonyls.

Carrier gasses

Carrier gasses infuse the vaporised precursor atoms into the reaction chamber, carry them over the substrate surface to deposit a thin film and exit the chamber with residuals. The rate at which gasses flow into and inside the chamber can change the structure and properties of the layer that is being built.

Figure 4: Path of carrier gas in CVD



Source: ScienceDirect

Accurate gas flow controllers are critical in manufacturing defect-free semiconductors

CVD reactors are designed to control parameters, such as film thickness, film composition, surface morphology, crystal structure, etc. The characteristics of most of these parameters are highly dependent on the gas flows coming into and inside the reactor. Hence, accurate gas flow controllers are critical to building high-yielding wafers, i.e. wafers with the highest possible number of defect-free chips.

Atomic layer deposition (ALD)

The ALD process is based on the self-limiting reactions between two gaseous precursors that allow the deposition of thin films layer-by-layer, i.e. one atomic layer at a time. The process enables the deposition of highly uniform films on structures with a high aspect ratio, at a relatively low temperature and pressure.

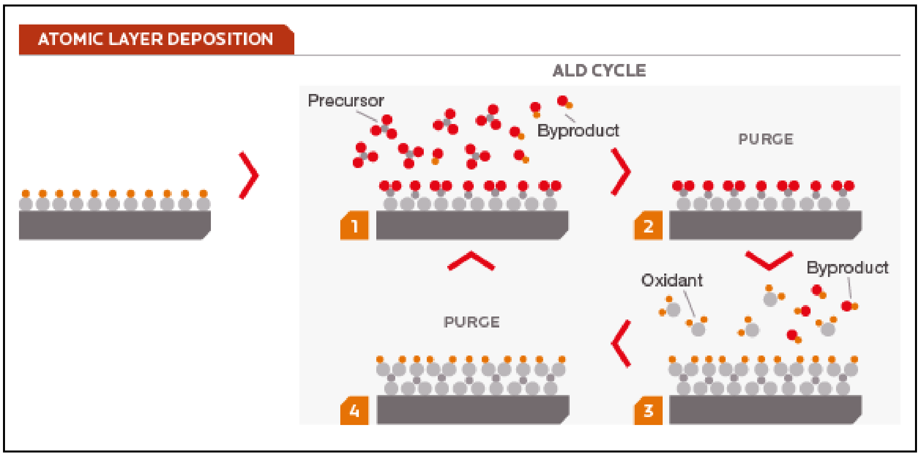
ALD enables to manufacturing of ultra-thin layers

ALD has attracted the interest of manufacturers, driven by its characteristic of self-limited growth, which allows for the production of ultra-thin layers, and the high level of control ALD provides when it comes to regulating the film thickness and atomic level composition. Hence, it serves as a better choice over alternative deposition methods, such as CVD and PVD.

A generic ALD process (Figure 5) consists of sequential alternating pulses of gaseous chemical precursors that react with the substrate. These individual reactions between the gas and surface are called half-reactions. During each half-reaction, the precursor is pulsed into a chamber under vacuum for a fixed amount of time. This allows the precursor to react with the substrate surface through a self-limiting process that leaves only a single monolayer on the surface.

Subsequently, the chamber is purged with an inert carrier gas (typically Nitrogen or Argon) to remove any unreacted precursor or by-product. This is followed by the counter-reactant precursor pulse and purge, creating up to one layer of the desired material. This process is continued in cycles, until the desired film thickness is achieved.

Figure 5: ALD process



Source: ASM International

ALD in semiconductors

The semiconductor industry has been one of the largest adopters of ALD. It became commercially viable in the early 2000s, when the industry started to adopt ALD to manufacture high-performance, complementary metal-oxide semiconductor (CMOS) transistors.

Owing to its ability to produce pinhole-free transistors, ALD has become a reliable tool for semiconductor manufacturing

The process has enabled the fabrication of energy-efficient semiconductor devices, which are highly uniform and pinhole-free, which improves the reliability substantially. Therefore, ALD has been accepted as a reliable tool for the production of thin films in the microelectronics industry.

Dielectrics and metal electrodes for DRAM capacitors are now routinely produced by ALD, which is the only technique capable of uniformly coating the interior of narrow structures.

Benefits of ALD

ALD can create a high-quality film with conformity and at relatively low temperatures. The process is exceptionally effective at coating surfaces that require multilayer films with superior quality interfaces. Some of the key benefits of ALD include:

The ALD technique facilitates the use of wider variety of substrates, making it the preferred choice for semiconductor manufacturers

- Higher quality thin films.
- Better uniformity of film thickness.
- Ability to use of a wide variety of substrates.
- Suitability for low-temperature processing.
- Better process control.
- Ability to deposit multiple layers on a single surface.

ALD has applications in other high-growth areas

ALD is highly effective in areas where film uniformity and thickness control is a prerequisite

The exciting thing about ALD, and the attractiveness for PVS, is that ALD can also be used in a variety of high-growth applications other than semiconductors, including capacitors, solar cells, fuel cells and catalysis. The latter is an essential technology for accelerating and directing chemical transformations.

By providing highly accurate GFCs for ALD tools, PVS essential opens up its addressable market well beyond "just" the semiconductor industry.

Pivotal Systems' strategic advantages

GFCs play a strategic role in CVD and ALD processes

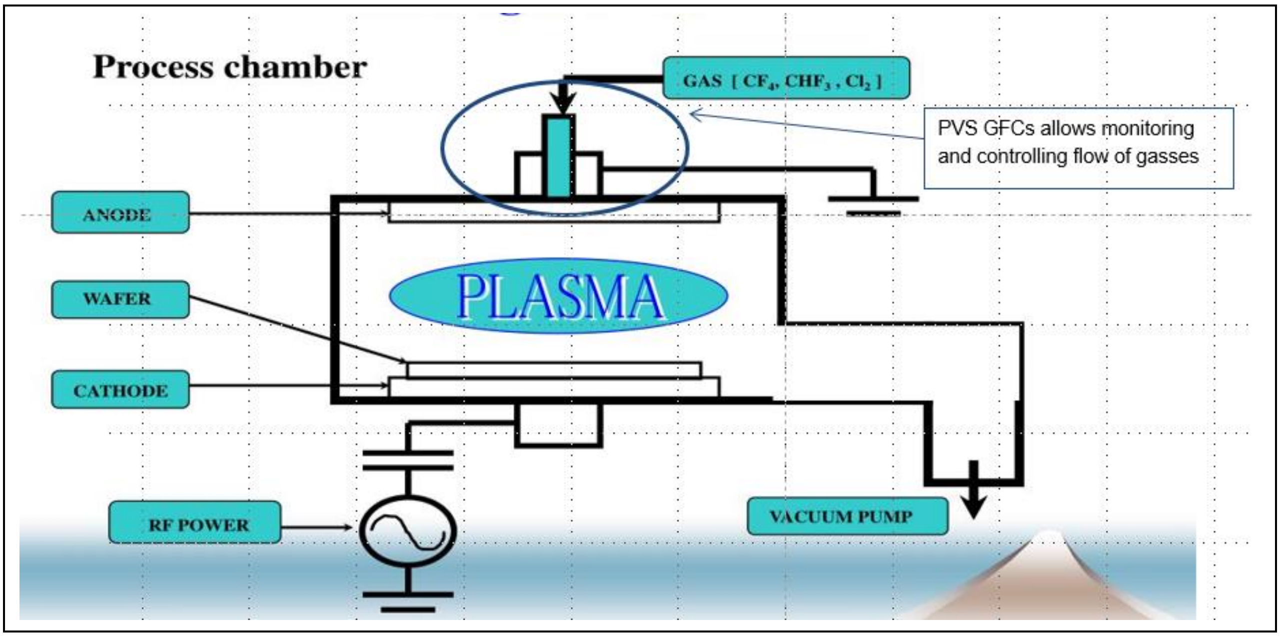
In plasma-etch and CVD processes, accurate metering of gas flows into the process chamber is critical because, beyond the process wafer, all materials that are part of the etch or deposition process are introduced in gas form.

Manufacturers need to:

- control how much gas is used,
- the location where gases enter the reaction chamber,
- the speed at which these enter, and
- the mix ratio of gases in case a mix is used (Figure 6).

PVS' GFCs provide the ability to very accurately control these metrics enabling its customers to optimise production yields (percentage of good chips on the wafer).

Figure 6: GFCs are a critical part of etching/deposition tools



Source: SlideShare, Pitt Street Research

PVS' GFCs allow semiconductor manufacturers to monitor and control the flow of gases that are introduced into the process. The company's GFC's ranging from 0.025 standard cubic centimetres per minute (sccm) to 200sccm are used primarily in the etch stage of the semiconductor manufacturing process.

New high-flow GFC's qualified by all three major OEMs

The 2 standard litre per minute (slm) to 50slm models are used in the deposition stage of the semiconductor manufacturing process (Figure 7).

PVS' new high-flow GFCs flow up to 50slm and have been qualified by leading OEMs. These companies need high-flow GFCs in their deposition tools for the most advanced CVD and ALD processes.

Figure 7: PVS' product portfolio

	Product	Manufacturing vertical	Flow range (scm)	Stage/process	Classification
Existing products	GFC 5 sccm	IC	0.025 – 5	Etch	Ultra Low
	GFC 20 sccm	IC	0.1 – 20	Etch	Low flow
	GFC 200 sccm	IC	1 – 200	Etch	High flow
	GFC 1000 sccm	IC	5 – 1,000	Etch	High flow
	GFC 2000 sccm	IC	10 – 2,000	Etch	High flow
	GFC 5L	IC	100 – 5,000	Deposition	High flow
	GFC 20L	IC	400 – 20,000	Deposition	High flow
	GFC 50L	IC	1,000 – 50,000	Deposition	High flow
	Ultra High Speed Flow Controller[1]	IC		Etch & Deposition	High speed
Pipeline	GFC 100L	OSD	20,000 – 100,000	Deposition	High flow
	GFC 300L	OSD	6,000 – 300,000	Deposition	High flow

Source: Company

PVS' technological platforms (Figure 8) are a combination of the following:

I. **Hardware**: Innovative valve design that has the ability to measure internal volume to a traceable measurement of accuracy, as per National Institute of Standards of Technology.

II. **Software**: A robust software platform, which complements the innovative hardware design with strong analytical, machine learning and diagnostic capabilities.

Figure 8: PVS' platform includes leading edge hardware and upgradable software

Hardware	Software
The **control-valve** uses nanotechnology to deliver industry-leading accuracy in gas flows. The valve can be controlled to the nanometre and at the millisecond (or at the microsecond for the ultra-high-speed device), which allows the device to make adjustments in real time to deliver the required gas flow into the reaction chamber.	**Machine learning**: The rate of flow, pressure and temperature of gases are constantly monitored within the device and the device software processes this information against the expected gas flow. The outcomes of each gas flow are updated into the GFCs 'lookup table', thereby creating a feedback loop to adjust the valve position depending on variations in the GFCs operating condition. This learning process ensures the quantity of gas delivered into the process tool is accurate and repeatable throughout the manufacturing process regardless of changes in the operating conditions, such as downstream pressure of the gas.
The **internal volume** is measured on each device in order to classify the device to a National Institute of Standards and Technology traceable primary flow standard. This volume, together with the pressure transducer, which measures the change in pressure, enable accurate monitoring of gas flows in real-time, every micro or millisecond. This measurement methodology avoids the need for recalibration of the device and provides the user with meaningful information regarding real-time flow accuracy.	**Diagnostics**: By recording data from each process run and comparing it against the expected results, the system software can provide the manufacturer and/or OEM with actionable insights allowing them to identify performance inhibitors, including gas leakage points, upstream pressure issues, temperature control issues and other facility-level issues, such as upstream contamination, or if the line is running low or contains the incorrect gas.

High speed with accuracy: PVS' ultra-high-speed GFCs operate at speeds down to <=10msec on/off for process set point response time. This represents a significant speed improvement over other suppliers in the industry whose speed ranges from <=50msec to 1sec. At the same time, the company can guarantee flow accuracy of ±0.5% of a set point for the actual gas at these speeds. This leads to better process outcomes (yields).	**Interoperability**: PVS has developed its GFC to be interoperable with the major OEMs from a system programming language perspective. Leading OEMs, such as Applied Materials, Lam Research and Tokyo Electron, may use a different operating language and MFC suppliers typically need to provide a different MFC model for each OEM. From a chip manufacturer's perspective, the ability of PVS' GFCs to operate across different OEM products can reduce the inventory of spare gas flow devices that an IDM needs to maintain at each facility.

Source: Company, Pitt Street Research

Technologically advanced GFCs are replacing traditional MFCs

Traditional thermal (Mass Flow Controllers) MFCs rely on flow sensors based on the principle of heating and cooling temperature. Consequently, the flow sensor's response time is a function of both the heat capacity of the temperature sensor and the quality of its thermal communication with the gas. The response time for thermal MFCs is in the order of 1 second, implying inherent limitations.

PVS is now labelled as the "Go to" technology development partner in flow control in the semiconductor industry

Pressure-based MFCs rely on a pressure transducer as its primary feedback sensor. Flow is controlled by varying the pressure of a calibrated flow restriction upstream with a response time of < 1 ms, allowing for fast measurement of flow. However, since pressure-based MFCs are less sensitive to upstream pressure variations, the response time of the pressure-based flow controller is limited by the time it takes for the gas in the pressure-controlled volume to be evacuated into the process chamber. This can take several seconds for some devices.

Slow and less accurate MFCs are increasingly replaced by more advanced GFCs

Due to the inherent limitations in response time and accuracy, traditional MFCs are being swiftly replaced by more advanced GFCs (Figure 9). PVS' GFCs have two independent control systems for measuring and controlling flow.

- The primary system is a fast, map-based valve control system that allows the device to respond rapidly to changes in set point and upstream pressure.
- The secondary system, the Gas Flow Monitor (GFM), measures the flow of the GFC using a pressure-rate-of-change flow measurement. This system is used to validate and, if necessary, update the control map.

PVS combines a high accuracy GFM system with patented valve control technology. It goes beyond the current MFC technology by offering an order of magnitude improvement on key flow metrics, thereby enabling advanced wafer-manufacturing processes.

Figure 9: Positive positional GFCs have performance advantage over MFCs

KPIs	Positional Control GFC (PVS Systems)	Thermal-based MFC	Pressure-based MFC
Technology	Direct real time control of valve position at all times	Metal tube, heater, thermometer to measure flow	Control of pressure upstream of a flow restrictor to control flow
Key limitations	NA	Buildup of temperature inherently limits speed	Buildup of temperature inherently limits speed
Response Speed	10 milliseconds	1000 milliseconds	500-800 milliseconds
Verifiable Accuracy	Accurate to ±0.5% with continuous realtime verification	No verification or correction possible; with inherent drift	No correction possible, limited verification
Dynamic Flow Shaping	Yes; dynamic ability to shape the gas flow throughout the cycle	None	None

Source: Company, Pitt Street Research

PVS' positive positional control technology enables much higher speed, better accuracy and dynamic flow, rendering other platforms obsolete

Ultra-fast GFCs results in better yields and cost efficiencies

The ultra-high speeds of PVS' GFCs increase the yield of semiconductor manufacturing tools by reducing variability in the production process. To illustrate, the company's GFC technology increases the production output by more than 16%, which alleviates some of the pressures on bottleneck in the broader production process. Following are its main distinction from competition (Figure 10):

a) PVS' GFC offers enhanced diagnostics and speed, increasing overall production capacity for the entire manufacturing line leading to increased yields.
b) Its GFCs avoid catastrophic production errors, tighten process windows and eliminate the need for offline flow calibration.
c) Inadequate flow control technology requires expensive upstream and downstream equipment to be added to the process tools. PVS' innovative hardware design eliminates the need for supporting upstream or downstream machinery.

Figure 10: GFCs from PVS are more accurate and relatively faster than competing products

	Description	PIVOTAL SYSTEMS	Competitor 1	Competitor 2	Competitor 3
Flow sensor type	Underlying process technology used to measure and control gas flow	Positive Position Controlled	Pressure	Pressure	Thermal
Accuracy	Degree to which you can accurately control desired gas flow	0.5%	1.0%	1.0%	1.0%
Turn on speed	The time required to switch on gas flow	0.1 sec	≤0.5 sec	<1 sec	1.0 sec
Turn off speed	The time required to switch off gas flow	<0.1 sec	≤0.5 sec	<1 sec	1.0 sec
Self-diagnostic monitoring	Ability to recalibrate during operation	✓	✗	✗	✗
Machine learning	Ability to calibrate and adjust flow settings in real time to maintain speed and accuracy in the production process	✓	✗	✗	✗

Source: Company

Advantages to both OEMs and manufacturers

PVS' GFCs have been designed to address the following operational issues faced by OEMs, foundries and IDMs in the manufacturing of semiconductors (Figure 11).

Figure 11: GFCs are critical for higher efficiency of etching process

Advantages to OEMs	Advantages to chip manufacturers
Reduced process tool hardware costs. While PVS' pricing reflects a premium product, its superior product performance can reduce manufacturing costs for OEMs in relation to the ancillary equipment required to improve the performance of MFCs, such as pressure regulators, high-speed switching valves and off-line calibration equipment.	**Efficient use of process gases**. PVS' GFCs help in reducing production errors and the scrapping of entire wafers through the efficient use of process gases. PVS achieves this through traceable measurement of accuracy as per the National Institute of Standards of Technology, real-time monitoring and continuous machine learning.
Reduced warranty costs. OEMs are generally required to provide a 1 to 2- year warranty on production tools. The warranty can include/cover maintenance, engineering support and replacement MFCs in order to keep the tool operational. Traditionally, gas flow control errors represent a large fraction of OEMs' total warranty costs. PVS' technology dramatically reduces such costs.	**Reduced downtime**. Traditional flow controllers require more downtime since they require manual recalibration in case of any 'drift' in sensors or any other factory specification. PVS' GFCs reduce this production downtime by providing the ability to calibrate and adjust flow settings in real time and by maintaining the accuracy and repeatability of gas flow during the production process.
Improved product development. PVS believes that its superior product characteristics, particularly in relation to speed and accuracy, can assist OEMs in developing their next-generation production tools to assist their customers in developing smaller, faster and more energy-efficient semiconductors.	**Product longevity and replacement cycle**. PVS' products have a life span of up to 20 years and have also proven to be very robust with corrosive gases.
	Lower inventory required. The ability to flow a wide range of gas flows through PVS' GFCs together with the interoperability across OEM process tool platforms means that fewer spare devices are required to cover a fabrication plant's requirements.
	Easy to install. PVS products are tool-agnostic and interoperable across different OEM tools and software platforms. This means they are capable of being specified into any OEM production tool or can be easily retrofitted onto existing production tools.

Source: Company, Pitt Street Research

With higher ALD adoption, high-flow GFCs will gain traction

A large fabrication plant operating at full capacity will need >75,000 GFCs installed across a number of process tools

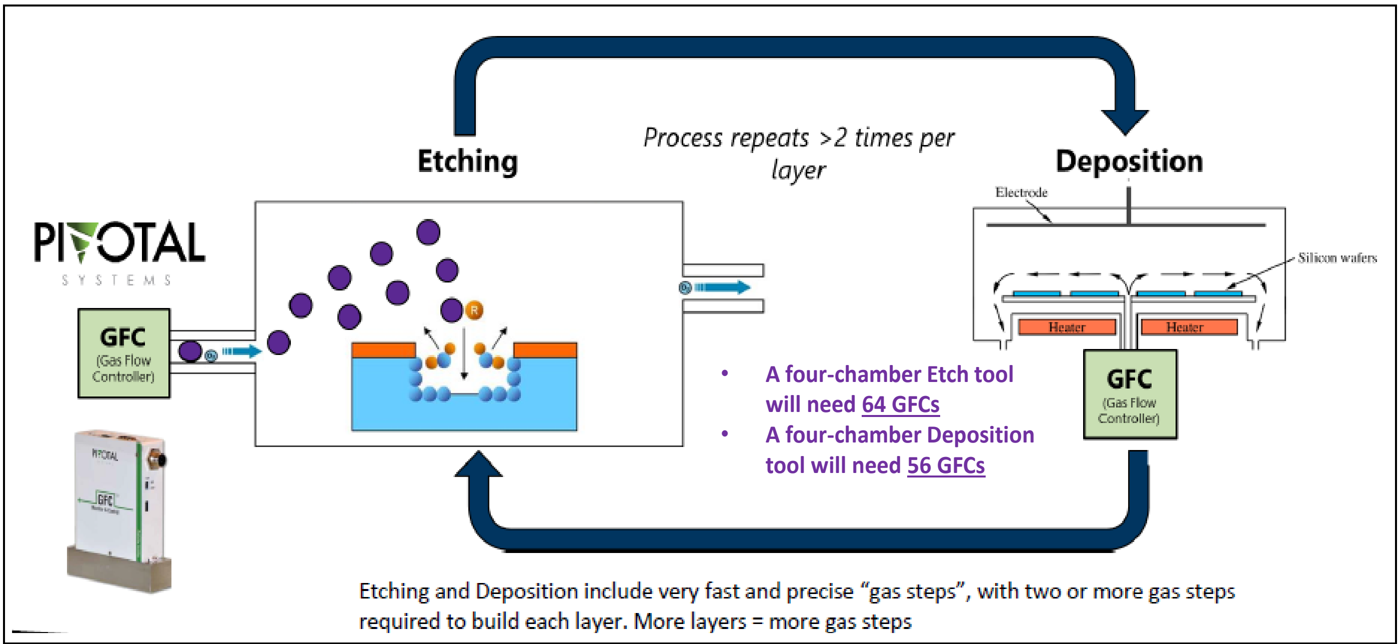
According to Cisco, there will be around 500 billion devices connected to the internet by 2030. Each device includes sensors that collect data, interact with the environment and communicate over a network. These applications need miniaturised storage devices and integrated circuits. The increasing amount of data generated from the growing number of connected devices will boost the demand for storage devices, thereby driving the market growth.

As semiconductors continue to shrink, requiring use of new materials and designs for advanced chip manufacturing, demand for ALD tools is increasing. According to Global Market Estimates, the ALD market is expected to reach US$3.37bn in 2026 for a CAGR of 12% over 2019-2026.

Given PVS' product range from 5slm to 50slm GFC models, the growth in the ALD market will create growth opportunities for PVS in the years to come.

In its FY2021 conference call, the company's management sounded optimistic on high-flow GFCs gaining traction amid the growing ALD market as PVS' high-flow (deposition) GFC share increased to 4% of revenue in 2021 vs 1% historically.

Figure 12: As ALD adoption expands, PVS GFCs business will increase



Source: Company, Pitt Street Research

Customer validation is supporting PVS in displacing competition

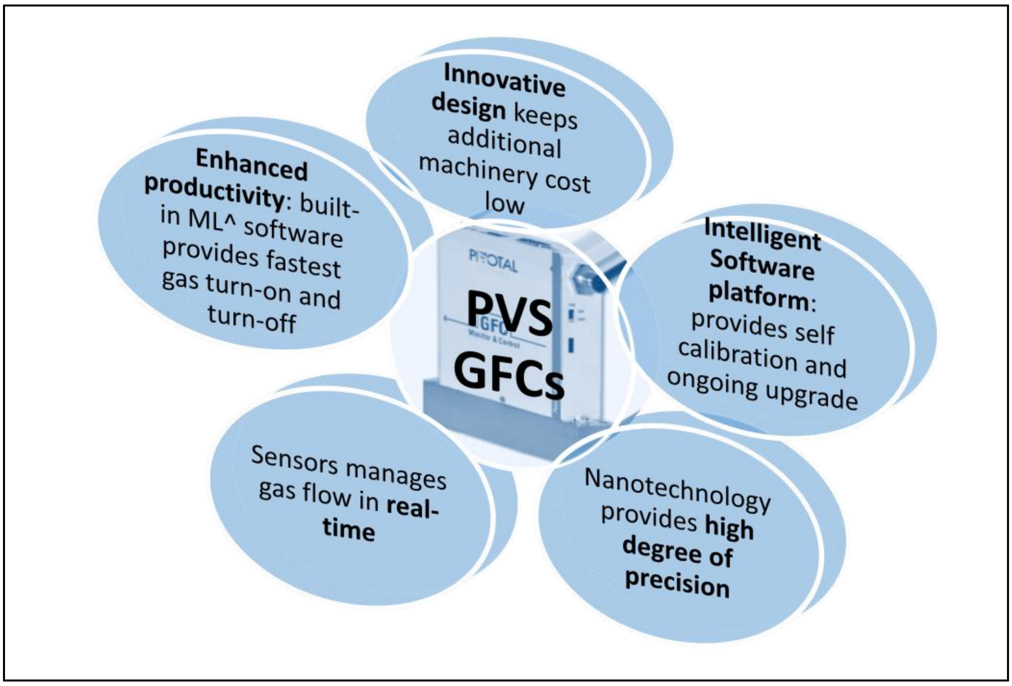
Close relationship with leading OEMs and manufacturers helps PVS to build a highly defendable business model

Since semiconductor chip manufacturing requires high precision and substantial capital outlays are involved, OEMs, foundries and IDMs require flow control suppliers to undertake significant and lengthy validation processes before approving a new technology. PVS has developed a durable technical advantage by clearing multiple 'qualification audits'.

The company has been collaborating with leading IDMs and universities on the research and development of the next generation of semiconductor manufacturing equipment. It has become an exclusive partner for the leading OEMs and IDMs and is developing customised GFCs, which reduces development costs. Due to superior product characteristics (Figure 13), PVS has been able to gain market share with each OEM across all flow control processes, thereby displacing competition.

Being an exclusive partner has helped PVS build sizeable entry barriers and higher switching costs for its GFC business.

Figure 13: PVS' GFCs have fundamental advantages for OEMs and IDMs



Source: Company, Pitt Street Research

Strong patent and software protection

Suitable IP coverage provides PVS with essential risk management for its market leading technologies

PVS' core technology platform is supported by strong intellectual property (IP) protection. The company has significant coverage with 36 issued patents and 389 patent claims. All of the IP assets are owned solely by the company.

Given the revolutionary design of the technology, management has sought patent protection for not only its core software and hardware assets, but also for its 'methods'. In addition, all employees are required to sign IP assignment and confidentiality agreements in order to ensure that the company's proprietary information is well protected.

In terms of software protection, PVS maintains strict control of its source code. Contract manufacturers only handle assembly, but the software is loaded at the company's transformation center.

PVS has multiple growth levers

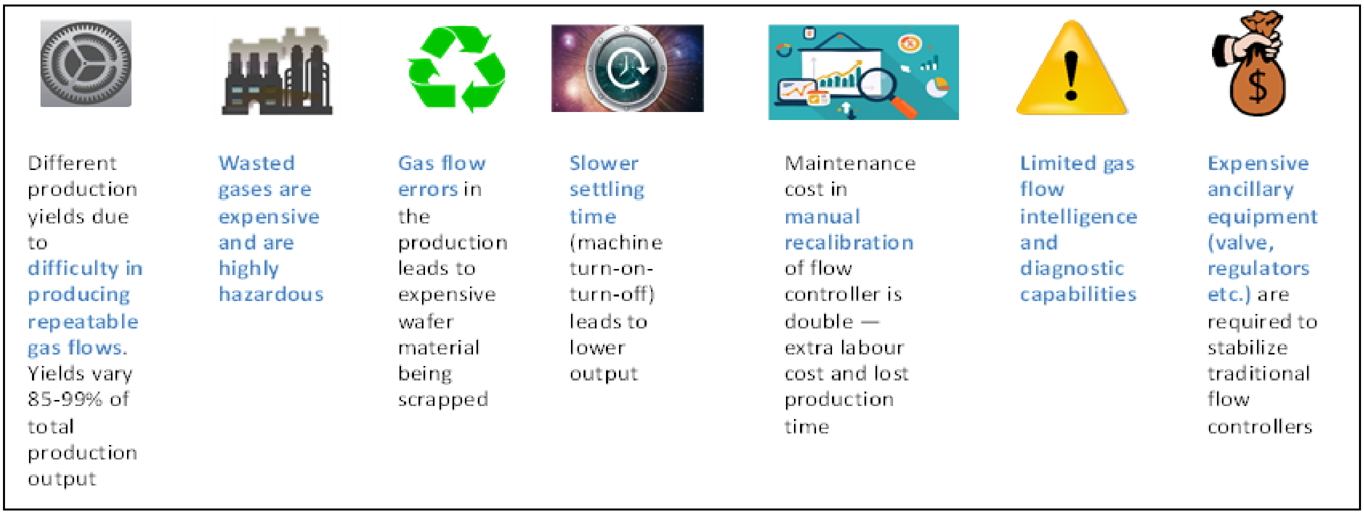
US and European push for more local chip production will drive semiconductor equipment growth

Historically, semiconductor manufacturers have been dealing with a lot of issues pertaining to gas flow control and restricted yields (Figure 14). PVS, through its industry-leading technology, has been delivering solution-oriented platforms and consequently is becoming an integral part of the fabrication process for OEMs and manufacturers alike.

PVS is executing a well-defined growth strategy, which includes leveraging its technological advantage, designing customised solutions and diversifying through innovation and product portfolio expansion.

With governments around the world pushing for more local semiconductor fabrication capabilities, especially in the US and Europe, we expect PVS to see strong growth in the years ahead.

Figure 14 : Semiconductor manufacturers face multiple issues with respect to gas flow controls



Source: Company, Pitt Street Research

PVS' products maintain flow accuracy to NIST standards

I. **Different and better than competition**: PVS claims that no other currently available technology offers flow control with such high accuracy at high speeds.

Not only are PVS' GFCs faster and better than competing technologies, the exclusive R&D partnerships with OEMs and IDMs put the company in a unique position to experiment and innovate.

PVS recently presented its fastest GFC, which has a response speed of <100msec, three times faster than competing MFC technology.

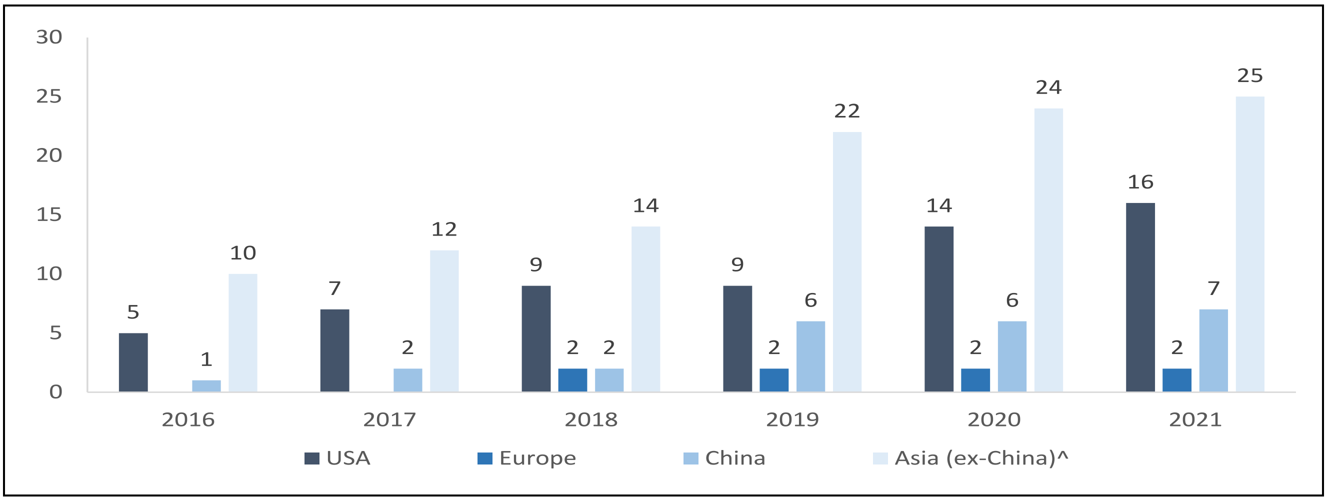
II. **New verticals for GFCs:** The management is consistently focussing on developing new market verticals. Subsequently, PVS has recently signed MOUs with South 8 and Forge Nano (leaders in energy storage solution and surface engineering, respectively).

PVS aims to seek potential revenue streams by entering different market verticals across high growth end markets, such as lithium-ion battery component manufacturing, clean energy and healthcare, where fast and accurate flow controllers can improve production efficiencies.

III. **Geographical diversification:** PVS has presence mainly in Asia and North America (Figure 15). There is still a lot of scope in terms of geographic diversification for PVS as countries try to develop or expand domestic semiconductor manufacturing facilities.

Pivotal is well-positioned to leverage this potential with its cutting-edge products, especially since the longer-term outlook for the wafer fabrication equipment market remains robust.

Figure 15: PVS' global customer base



Note: Asia (ex-China) includes Korea, Japan, Taiwan and Singapore
Source: Company

PVS has a strong track record of research and innovation

IV. **Expansion of portfolio through customised product innovation:** PVS has a continuously expanding product portfolio that has received validation from several key customers. It has the capability to develop sophisticated, highly differentiated and innovative products (Figure 16) in a cost-effective and timely manner through its strong R&D efforts. In FY21, the company's R&D expenses increased by 22.5% to reach US$6.5m, which is 22.3% of sales (Figure 17).

Figure 16: Cumulative products launched

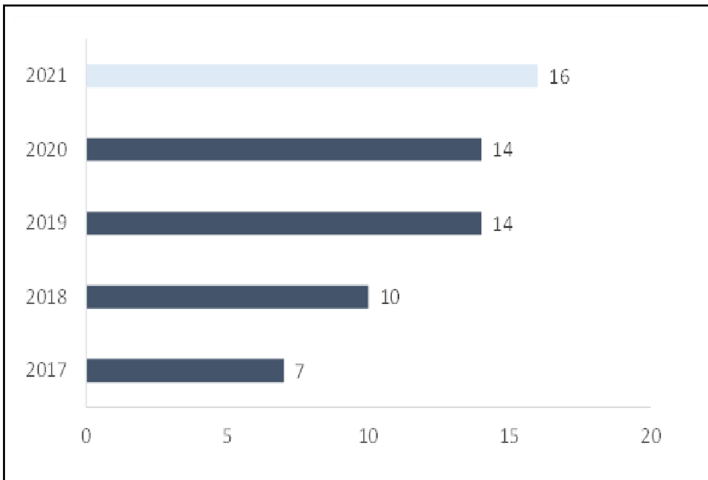
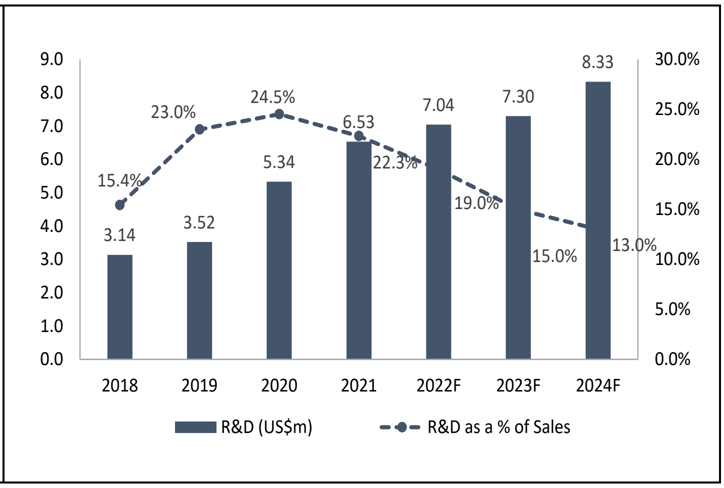


Figure 17: R&D Expenses



Source: Company, Pitt Street Research

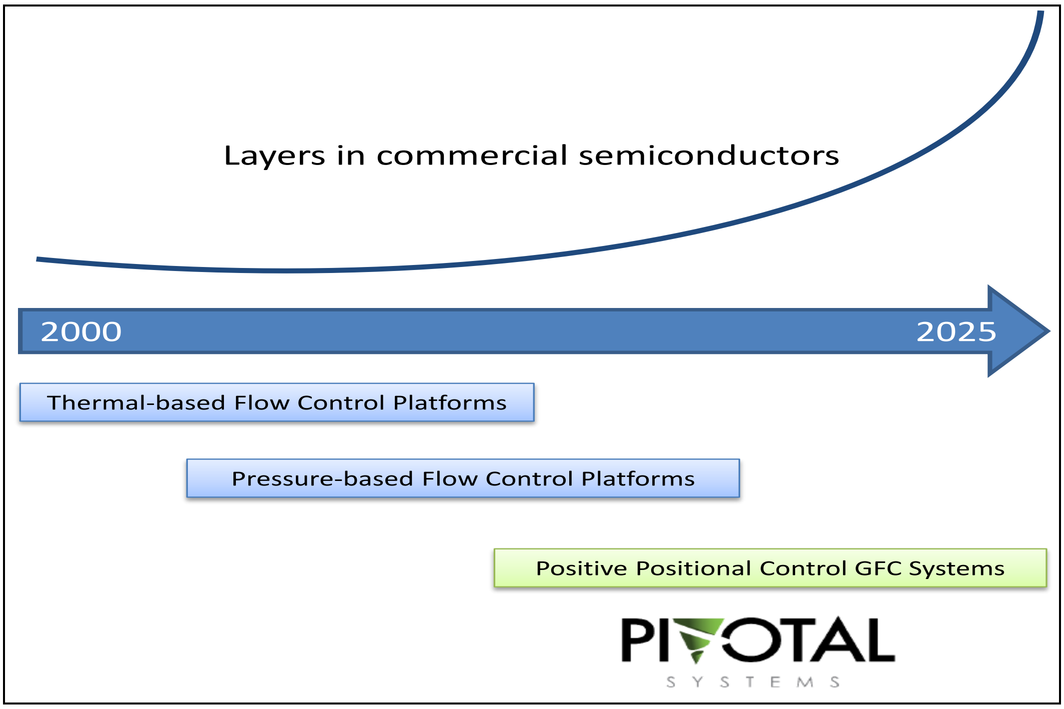
The company has slowly moved from being a qualified supplier to being a preferred supplier and now to being an exclusive supplier. This has supported ongoing market share gain for the company. We believe PVS recently completed an NRE (Non-Recurring Engineering) agreement with Tokyo Electron, Japan's largest OEM, to develop next-generation GFC products for incorporation into its ALD semiconductor production equipment. According to MarketWatch, a Kenneth Research report published in December 2021, the ALD tools

Well-positioned in the fast-growing ALD market

market is expected to grow at a CAGR of 29% to US$8bn by 2024 and PVS is well placed to leverage on this growth (Figure 18). The majority of the company's R&D expenses in FY21 were driven by ALD related projects.

Moreover, the growing installed base of GFCs drives recurring revenue streams for PVS through software upgrades and retrofits.

Figure 18: As ALD adoption expands, so will adoption of GFCs



Source: Company

V. **Continued government initiatives to support domestic manufacturing:** Governments across the US, South Korea, Japan and Europe are spending actively to promote their domestic semiconductor manufacturing facilities (Figure 19).

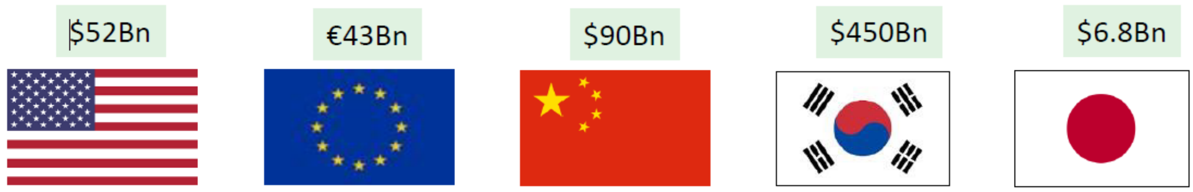
a) In February 2022, the US approved US$52bn in grants to subsidise domestic semiconductor manufacturing;

b) Also in February 2022, the EU announced mobilisation of EUR43bn towards the semiconductor industry under its CHIPS Act;

c) In late 2021, the Japanese government announced US$6.8bn in funding for domestic semiconductor investments.

These new government initiatives contribute to the long-term growth profile ancillary component manufacturers, such as PVS.

Figure 19: Recent government initiatives to drive domestic manufacturing and tech sovereignty



February 2022 – House passes the America COMPETES Act of 2022 including robust funding for the CHIPS Act programs representing **US$52 billion** in grants to subsidize semiconductor manufacturing. Since the beginning of 2021, the semiconductor industry has announced nearly US$80 billion in new investments in the United States through 2025[1,2]

February 2022 – EU "CHIPS" Act to mobilise more than **€43 billion** of public and private investments and set measures to prevent, prepare, anticipate and swiftly respond to any future supply chains disruption, together with Member States and international partners[3]

November 2021 – Japanese government announcement of **US$6.8 billion** in funding for domestic semiconductor investment[4]

May 2021 – South Korean **US$450 billion** investment in semiconductor investment over ten years, with government contributing 40-50 percent tax credits for R&D investments and 10-20 percent for new facilities[5]

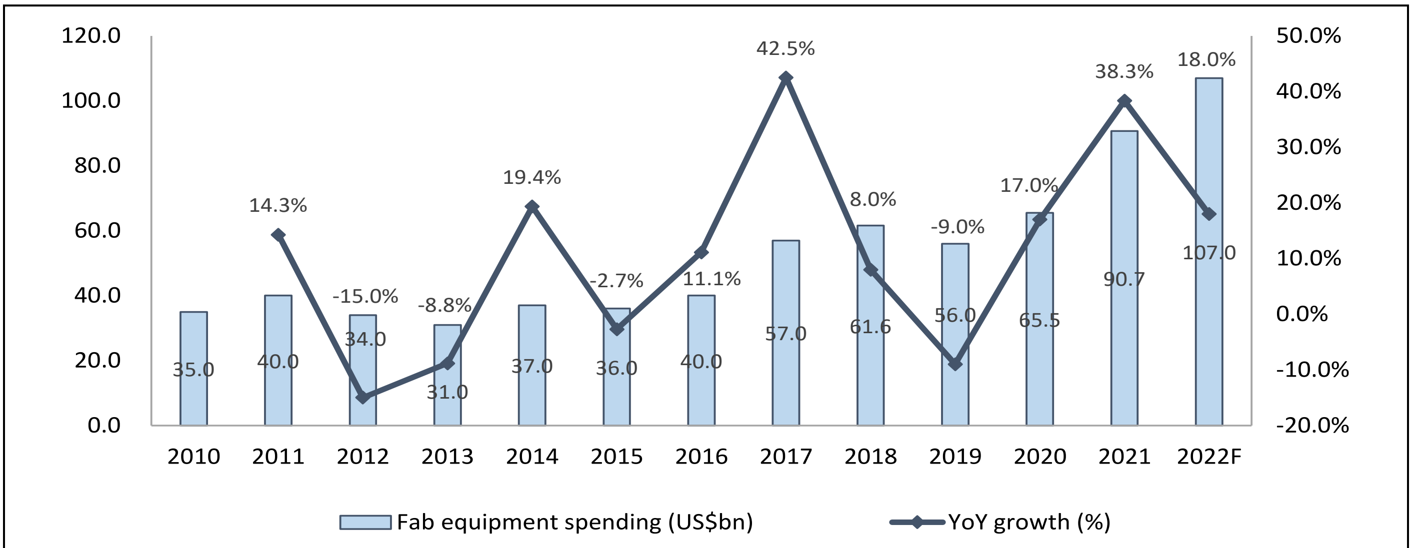
Investment of **US$90 Billion** by China National IC Industry Investment Fund II (US$35B) and Provincial Funds (US$45B) with a goal for China to manufacture 70% of all semi chips it consumes by 2025[6]

Source: Company

Chip equipment spending consistently strong

As per the World Fab Forecast report published by SEMI, global fab equipment spending is projected to increase by 18% YoY to reach ~US$107bn in 2022 (Figure 20). The foundry segment is expected to account for 50% of total spending in 2022, followed by the memory segment at 35%. Further, as per SEMI, fab equipment and semiconductor sales are projected to reach US$200bn and US$1tn, respectively, in the early 2030s.

Figure 20: Despite the inherent cyclicality, Fab Equipment spending will remain robust



Source: SEMI

Chip manufacturing equipment clearly has strong secular drivers. On the demand side, investments in digital infrastructure, greater dependence on chips across various end markets and government incentives will act as

Strong end demand and supply chain issues support growth of global semiconductor and fab equipment sales

growth catalysts. Consequently, many chip manufacturers are investing in new fabs to expand capacity.

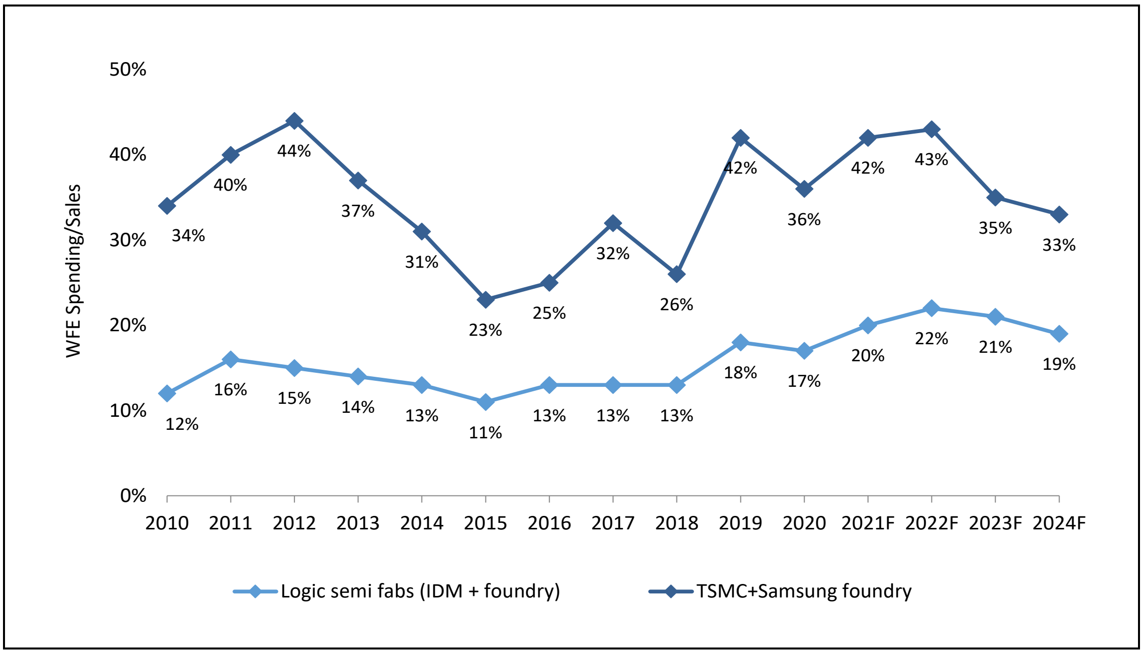
In 2021, 19 new fab plants commenced construction and in 2022 another 10 plants are likely to be added. On the supply side, chip shortages are likely to continue in the near term. As per KPMG's Global Semiconductor Industry Outlook 2022, 56% of semiconductor industry leaders expect the chip shortages to last into 2023 on account of various supply chain issues and strong, COVID-induced demand.

Capital intensity is increasing

Another useful leading indicator for the GFC market is the capex plans of foundries and IDMs. The investment plans of leading manufacturers drive tool development by OEMs, which in turn impacts the demand for products from companies such as PVS.

Figure 21 depicts the long-term trend and forecast for capital intensity of global semiconductor players. From 2021 to 2023, leading foundries are likely to undergo a cycle of massive equipment investment. The industry-wide capital intensity ratio will exceed 20% to offer a big opportunity for global wafer fab equipment vendors. TSMC, Samsung and Intel will remain the leaders in capital spending, all setting up their new lines locally as well as in the US.

Figure 21: Capital Intensity trend in global semiconductor fab industry



Source: Counterpoint Research

Sizeable addressable market for GFCs and scope to replace MFCs in retrofit market

We believe that the growth prospects for GFC market are promising driven by the strong potential of the underlying fab equipment industry. As per SEMI and company estimates, the total addressable market for GFCs is over US$1bn. About 70% – or US$706m – relates to semiconductor manufacturing. Currently, almost all demand for GFCs is generated from new orders (95%) with retrofit contributing about 5%. PVS' GFCs hold a technological edge over less capable MFCs and can potentially replace MFCs at least in the retrofit market.

Smart sales strategy drives customer growth

PVS primarily generates revenues from design, development, manufacturing and unit sales of its flow controllers to OEMs. It also sells spare parts and replacements directly to foundries and IDMs. Sales growth from both OEMs and end customers mainly depends on their capital expenditure plans for new fabs and tool replacements in existing fabs. A smaller portion of the company's sales comes from the upgrades of ancillary software services (Figure 22).

PVS reported a 50% QoQ growth rate of its backlog in 4Q21

As PVS' comprehensive platform is integrated into existing equipment designs, the bulk of its revenue comes from repeat orders. The ability to grow its business mainly depends on the company's strong relationships with end-customers and its distribution reach. Since semiconductor manufacturing is concentrated with a relatively small amount of large players, management's main focus remains on retaining existing end-customers and generating demand from new customers by trying to displace the competition.

Consequently, despite the pandemic-induced disruptions in the global semiconductor supply chain and the impact on the wafer fab equipment market, PVS' management was able to successfully navigate these constraints. In FY21, PVS attracted repeat orders from OEMs and chip manufacturers, and reported significant growth in revenue, backlog and new orders.

Figure 22: PVS has a diversified customer base

Usage	Revenue Model	End-User	Revenue Contribution (FY2021)
New fabrication plant	Repeat unit orders for the fit out of new fabrication plants	OEMs	79.5%
Retrofits	Sales of flow controllers to replace old or non-performing GFCs already installed	IDMs	15.0%
Software	Sale of software platfrom through licensing software upgrades	IDMs	5.4%

Source: Company, Pitt Street Research

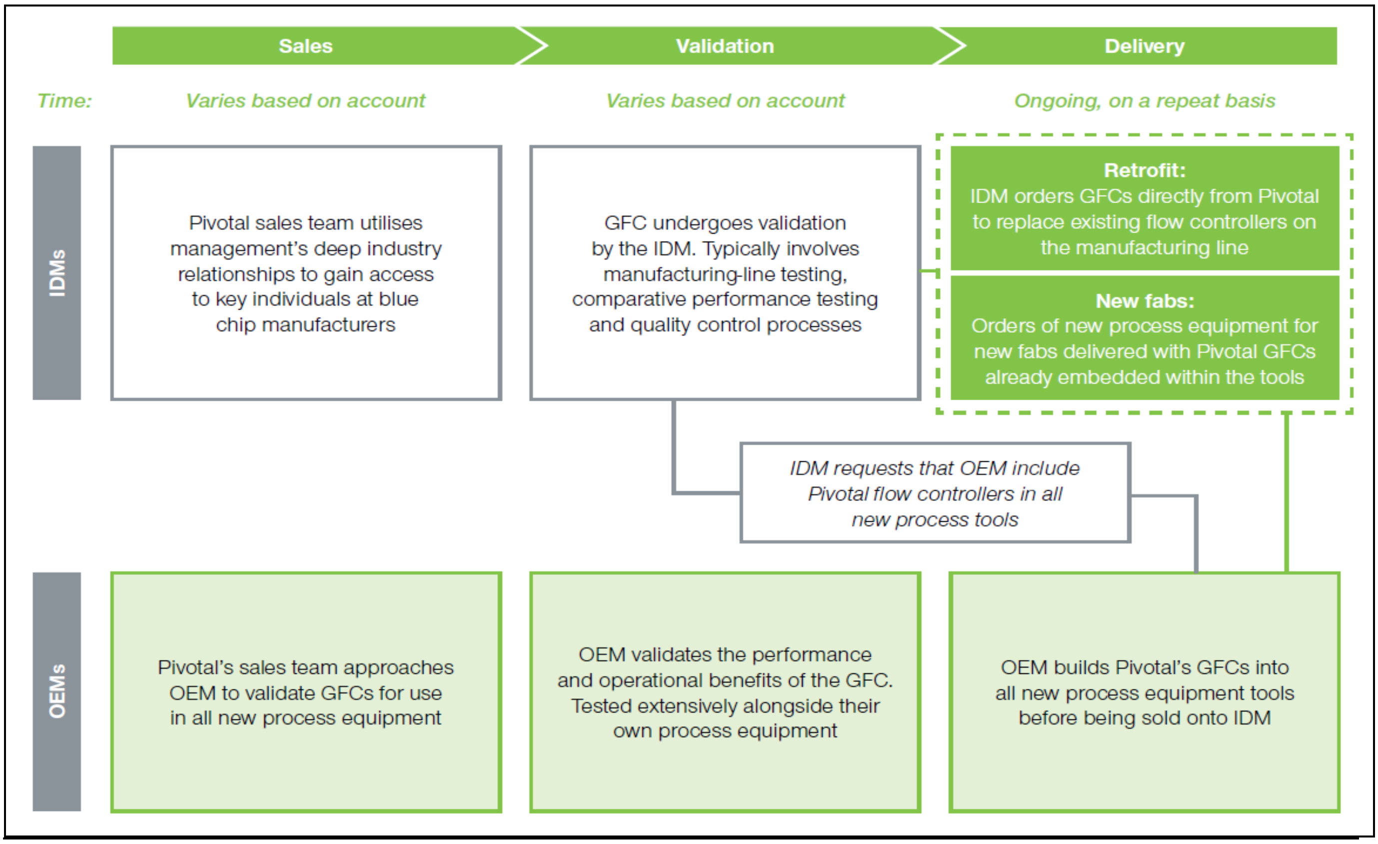
Sales model is multidimensional

The company primarily generates sales only after receiving validation from the end-customers that have to design GFCs into their semiconductor processing tools. Rather than competing on unit price, PVS develops a differentiated product that allows it to directly target OEMs and manufacturers.

Once the sales channel manages to connect with the end-customer, PVS undertakes a lengthy and critical validation process to establish its technology for the existing tools with IDMs. This supports PVS' position and helps it gain acceptance for its technology in the existing production environment. The company offers initial sales and support to customers while they are in the process of testing and validating the technology. Once validated by the end customer, PVS' sales focus shifts to the tool supplier (i.e. the OEM) for that particular end customer (Figure 23).

Currently, PVS is focussed on working with OEMs on developing customised solutions where its advanced technology is embedded as a standard element of the tool.

Figure 23: PVS has a multidimensional sales model



Source: Company

FY21 results signal operational strength

Despite COVID-19 restrictions and global supply chain issues in 2021, PVS was able to achieve 34.4% YoY revenue growth in FY21. Apart from the seventh straight quarter of revenue growth, PVS registered significant acceleration in new orders and its backlog, +44.8% YoY and +11.4% YoY, respectively.

Figure 24: New orders have been growing significantly

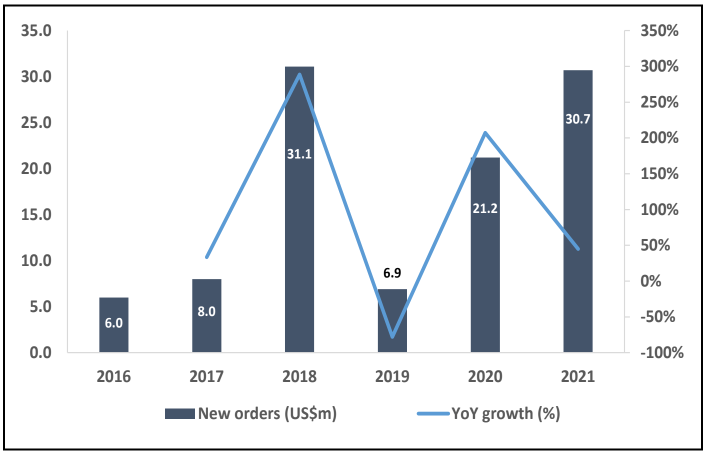
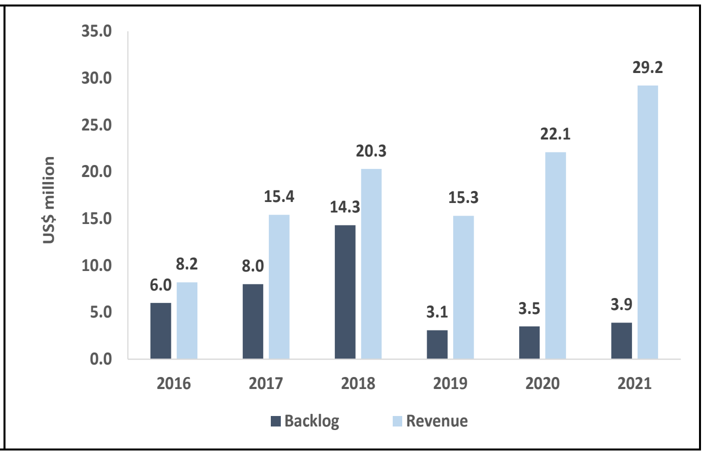


Figure 25: Stable backlog despite higher new orders represents capacity expansion



Source: Company

The company exhibited continued expansion in its customer base, with global customers increasing to 50 in FY21 (vs. 46 in FY20). The top-line growth achieved in the year was mainly due to some large US-based OEMs, a large Japan-based OEM and chip manufacturers in Taiwan and China.

US semiconductor initiatives to drive growth in US customer base

PVS US customer base will likely be strengthened in the next few years, driven by the significant new domestic manufacturing initiatives in the US and the development of new verticals.

Increasing financial strength creates opportunities

On the profitability front, it is important to note that the higher-than-expected loss was mainly due to the accounting standard shift from IFRS to US GAAP, the expensing of IPO costs linked to exploration of a NASDAQ listing and related R&D cost accounting adjustments. All other costs items witnessed a steady decline, indicating that PVS is expected to break-even in the medium term. The net loss was lower than the previous year, despite one-off adjustments, and is expected to remain on the same trajectory going forward.

Regarding PVS' balance sheet (Figure 29), we believe it enables the company to expand its business without having to worry too much about its financial obligations. This also provides PVS with options in terms of potential bolt-on acquisitions to bridge potential technological and distribution channel gaps.

PVS has guided for revenue growth of 16% to 37% in FY22

With consistent investments, technological progress, entry into new industries, exclusive partnerships with end customers and ongoing proliferation of semiconductors, we expect PVS to achieve strong revenue growth in the next few years — ~27% CAGR over 2021-2026 (Figure 27).

Figure 26: PVS is expected to report strong revenue growth over FY2021-2026

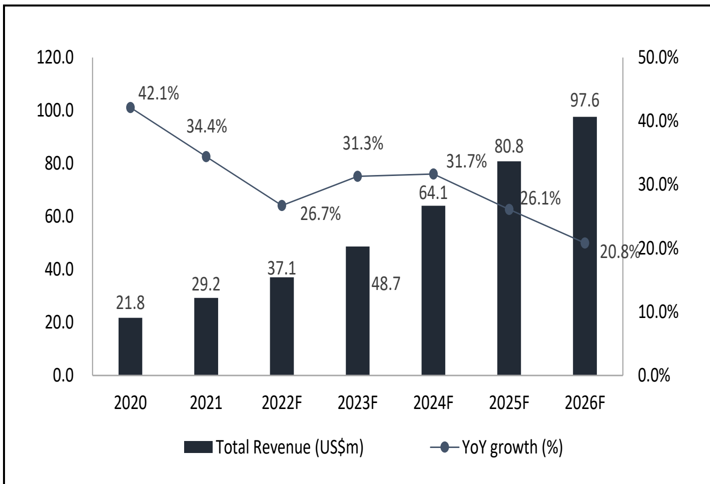
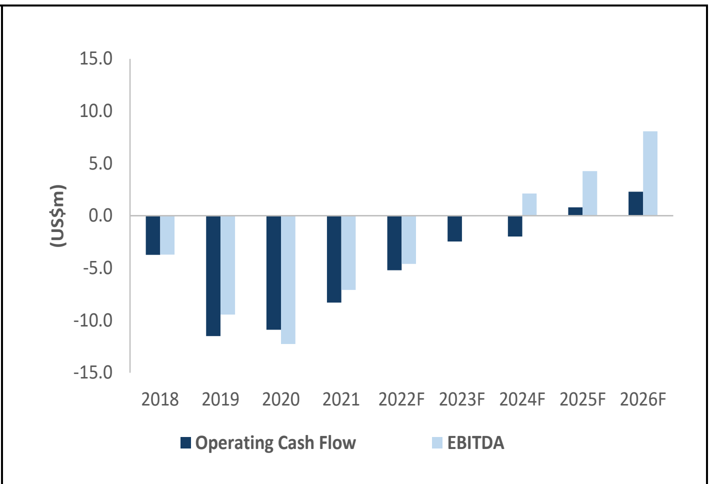


Figure 27: Cash generating ability is expected to improve over medium term



Source: Company, Pitt Street Research

EBITDA break-even during FY23

Though the company has been witnessing consistent top-line growth over the years, it is yet to achieve operational breakeven. This is primarily due to relatively high R&D expenses.

In the medium-to-long run, PVS is expected to reap the benefits of its current R&D investments

FY21 already saw a decline in the company's net loss. We believe that as PVS gains higher share of wallet at existing customers, enters new end-markets and expands its exclusive partnerships, the company's operating expenses will stabilise. As a result, we believe the company will get to EBITDA break-even during FY23 (Figure 28) and will start to generate a positive return on equity in FY24 (Figure 29).

Figure 28: PVS' margins

Margins (%)	FY 21A	FY 22F	FY 23F	FY 24F	FY 25F	FY 26F
EBITDA margin	-24.3%	-12.4%	-0.1%	3.3%	5.3%	8.3%
EBIT margin	-25.5%	-13.0%	-0.5%	3.0%	5.0%	8.0%
Profit margin	-23.5%	-9.9%	-0.5%	2.2%	3.7%	5.9%

Source: Company, Pitt Street Research

Figure 29: Balance Sheet profile of PVS

Balance Sheet Ratios (%)	FY 21A	FY 22F	FY 23F	FY 24F	FY 25F	FY 26F
Net Debt (Cash) to Equity	-83.0%	-76.5%	-51.0%	-24.4%	-22.2%	-24.7%
RoA	NM	NM	NM	4.4%	8.4%	13.9%
RoE	NM	NM	NM	13.1%	23.3%	33.7%

Source: Company, Pitt Street Research

PVS is substantially undervalued

To derive PVS' long-term value, we have used a weighted average valuation methodology based on equal weights for a peer group-based relative valuation and a DCF valuation.

Peer group valuation suggests significant upside potential

Our peer group consists of global precision tool and flow control manufacturers. Since there are very few listed peers, we have considered the two most important MFC manufacturers, i.e. Illinois Tool Works and Horiba. We have also considered analytical and measurement instrument manufacturers (Figure 30).

While the market is fragmented, all these companies have a well-diversified suite of services. Despite all peers providing solutions to a variety of end-industries and being significantly larger in size, we believe that PVS should trade at a premium to the average peer multiple given the technological superiority of its products, its growth trajectory and its smart sales strategy.

Figure 30: Peer multiples^

Company Name	Ticker	M-Cap	EV / Sales		
		(A$ m)	2022F	2023F	2024F
Horiba	TSE:6856	2,744.8	0.8x	0.8x	0.8x
Shimadzu	TSE:7701	12,860.1	2.5x	2.4x	2.2x
Illinois Tool Works	NYSE:ITW	88,246.6	4.5x	4.3x	4.2x
Jeol	TSE:6951	3,205.1	1.9x	1.8x	1.7x
Average		**26,764.1**	**2.5x**	**2.3x**	**2.2x**
Median		**8,032.6**	**2.2x**	**2.1x**	**1.9x**

Note: ^ Calendarised multiples

Source: S&P Capital IQ, Pitt Street Research

Using the average FY22 EV/Sales of 2.5x from the peer group and applying premiums of 20% and 30%, we arrive at a valuation of A$0.89 per share in our base case and A$0.96 per share in our bullish case (Figure 31).

Figure 31: Peer group valuation: Base case

Equity value (US$' 000 unless specified)	EV / Sales
Sector Average Multiple	2.5x
Discount/ Premium	20.0%
Sales 2022F	37,062.0
Implied EV	**109,069**
Net debt (cash)	(8,490)
Minority interest	-
Provisions	-
Equity/Book value	**117,559**
Diluted shares ('000)	175,601
Implied price (A$)	**0.89**
Current price (A$)	0.315
Upside (%)	*182.8%*

Bull case

Equity value (US$' 000 unless specified)	EV / Sales
Sector Average Multiple	2.5x
Discount/ Premium	30.0%
Sales 2022F	37,062.0
Implied EV	**118,158**
Net debt (cash)	(8,490)
Minority interest	-
Provisions	-
Equity/Book value	**126,648**
Diluted shares ('000)	175,601
Implied price (A$)	**0.96**
Current price (A$)	0.315
Upside (%)	*204.7%*

Source: Pitt Street Research

DCF valuation also suggests a substantial upside potential

Applying an 11% WACC to our free cash flow projections through FY31 and using a terminal growth rate of 3% yields a value of A$1.32 per share in base case and A$1.85 in the bull case (Figure 32).

Figure 32: DCF valuation: Base case

Pivotal Systems (US$'000 except per share data)	
Enterprise value	167,440
Net debt (cash)	(7,776)
Minority Interest	-
Other Investments	-
Equity value	**175,216**
Share outstanding (diluted, '000)	176,137
Implied price (A$)	1.32
Current price (A$)	0.315
Upside (%)	320.3%

Bull case

Pivotal Systems (US$'000 except per share data)	
Enterprise value	237,553
Net debt (cash)	(7,776)
Minority Interest	-
Other Investments	-
Equity value	**245,329**
Share outstanding (diluted, '000)	176,137
Implied price (A$)	1.85
Current price (A$)	0.315
Upside (%)	488.4%

Source: Pitt Street Research

Fair value of A$1.11-1.40 per share

Our base case valuation of A$1.11 per share has been derived using a weighted average valuation methodology, which assigns equal weight to our relative valuation and DCF valuation (Figure 33). Our bull case results in a valuation of A$1.40 per share. Both the cases imply substantial upside from the current share price.

Figure 33: Weighted average valuation: Base case

Base Case	Weights (%)	Share price (A$)
DCF	50.0%	1.32
Relative valuation	50.0%	0.89
Composite Value		**1.11**
Current Price		0.315
Upside/ Downside (%)		**251.5%**

Bull case

Bull Case	Weights (%)	Share price (A$)
DCF	50.0%	1.85
Relative valuation	50.0%	0.96
Composite Value		**1.41**
Current Price		0.315
Upside/ Downside (%)		**346.6%**

Source: Pitt Street Research

Re-rating PVS

PVS' stock is currently trading well below our base case valuation. We see multiple factors driving a rerating of the company's share price towards our valuation range:

– Ongoing tailwinds in the semiconductor industry, i.e. ongoing semiconductor proliferation, strategic initiatives in the US, Europe and other geographies regarding security of semiconductor supply etc. This is expected to provide PVS with increased growth opportunity across geographies.

– Growing market share with existing customers as well as new customer wins on the back of PVS' sales strategy.

– Increased traction for new products for new industries, i.e. other than semiconductors.

– Improving margins as the company moves towards break-even.

Risks

The main risks to our investment thesis include:

- **Execution risk**: As with many technology and manufacturing companies, Interruptions in manufacturing, lack of further development in platform features and delays in new product roll outs can jeopardise future growth.
- **Supply chain risk**: PVS relies on select few suppliers for critical elements as required in the manufacturing of GFCs. Any disruption in the supply side can have an adverse impact on PVS's ability to honour commitments within stipulated costs. While management had been able to manage disruptions during COVID-19, any further disturbance could impact PVS' top-line and cost base.
- **Overdependence on a few customers**: For FY21, the top three customers generated ~72% of the total group revenue. Though it is less than ~96% as generated from the same customer-set in FY20, any strain in key customer relationships may severely impact PVS' operations.
- **Cyclicality of the semiconductor industry**: PVS is expected to continue to generate a significant portion of its revenue from the semiconductor industry. This industry is notoriously cyclical. A industry downturn will very likely impact PVS' results.

Leadership with strong technology experience

PVS' management has decades of high-tech and semiconductor industry experience and brings strong relationships with leading OEMs and IDMs to the table. PVS announced certain board and management changes in 2022 and the key members of the new leadership team are as shown in Figure 34. Further, the company recently established a Scientific Advisory Board with Professor Stacey Bent from Stanford University as its first member.

Figure 34: Board and management team members

	Name	Designation	Affiliations (Current and Past)
	John Hoffman	Current Executive Chairman and CEO	Applied Materials
	Kevin Hill	CEO and Executive Director from 1 June 2022	Apple, Applied Materials, IBM, Flextronics, Collins Aerospace
	Dr. Joseph Monkowski	President and Chief Technology Officer	Lam Research, Pacific Scientific, Photon Dynamics

	Ron Warrington	Chief Financial Officer	Sandy Hill Ventures, PACE Funding Group, SoftTech Crossover Ventures, DigitalPersona, Communications Central Inc
	Cameron Worsham	Head of Worldwide Operations from 1 June 2022	Applied Materials, Lam Research, IBM
	Todd Braaton	Vice President, Sales and Marketing	Azbil North America, Advanced Energy, Spirax Sarco

Source: Company

John Hoffman is Pivotal's Executive Chairman and CEO. John joined Pivotal in 2010 and has 35 years of global technology management experience in both the semiconductor and information technology markets. For 18 yeasrs, John was a corporate officer and worked in various general manager (GM) roles at Applied Materials, including President of the Etch Business Group, VP and GM of Process Control and Diagnostic Business Group and GM of the Customer Service Division. John holds a B.S., United States Military Academy at West Point and an Executive MBA (AEA) from Stanford University.

Kevin Hill who is currently the company's Chief Operating Officer will be appointed as the new CEO and Executive Director w.e.f. 1 June 2022. He has over 25 years of experience in the global high-tech industry across companies such as Apple, Applied Materials and IBM. Kevin has a BS from the US Military Academy at West Point and an MSBA from Boston University. He is also a Certified Product Manager.

Dr. Joseph Monkowski is the founder of PVS. He has extensive experience in the semiconductor industry with a focus on providing process equipment and metrology solutions. During his career, Dr. Monkowski has designed and built a number of CVD and plasma etch systems, won several R&D awards and authored various publications.

Ron Warrington has over 30 years of experience as an operating executive, venture investor, strategic advisor and management consultant. He has had significant exposure to public/private financing, IPOs and M&As. Ron holds an MBA from Harvard University and a BA from University of California, Berkeley.

Cameron Worsham will be appointed as the Head of Worldwide Operations w.e.f. 1 June 2022. Cameron has over 25 years of technology sector experience and has led operations teams at leading companies such as Applied Materials, Lam Research and IBM. He has completed his BS from the US Military Academy at West Point and MS from Pepperdine University.

Todd Braaton has over 20 years of experience in the semiconductor industry. Todd has experience in RF power and gas delivery systems for plasma processes and has held leadership roles in US and Japan for sales, marketing and global service. He holds a BS in Mechanical Engineering.

Appendix I – Analyst Qualifications

Marc Kennis has been covering the Semiconductor sector 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 equities research firm, in 2016.
- In July 2018, 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.

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