PDF SOLUTIONS INC
Form 10-K
March 08, 2019

Table of Contents

UNITED STATES SECURITIES AND EXCHANGE COMMISSION

Washington, D.C. 20549

Form 10-K

(Mark One)
ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934
For the fiscal year ended December 31, 2018

or
TRANSITION REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934
For the transition period from to

000-31311

(Commission file number)

PDF SOLUTIONS, INC.

(Exact name of registrant as specified in its charter)

Delaware	**25-1701361**
(State or other jurisdiction of Incorporation or organization)	*(I.R.S. Employer Identification No.)*

2858 De La Cruz Blvd. **95050**
Santa Clara, California *(Zip Code)*
(Address of Registrant's principal executive offices)

(408) 280-7900

(Registrant's telephone number, including area code)

Securities registered pursuant to Section 12(b) of the Act:

Title of Class	**Name of Each Exchange on Which Registered**
Common Stock, $0.00015 par value	The NASDAQ Stock Market LLC

Securities registered pursuant to Section 12(g) of the Act:

None

Indicate by check mark if the registrant is a well-known seasoned issuer (as defined in Rule 405 of the Securities Act). Yes No

Indicate by check mark if the registrant is not required to file reports pursuant to Section 13 or Section 15(d) of the Act. Yes No

Indicate by check mark whether the registrant (1) has filed all reports required to be filed by Section 13 or 15(d) of the Securities Exchange Act of 1934 during the preceding 12 months (or for such shorter period that the Registrant was required to file such reports), and (2) has been subject to such filing requirements for the past 90 days. Yes No

Indicate by check mark whether the registrant has submitted electronically every Interactive Data File required to be submitted pursuant to Rule 405 of Regulation S-T (§ 232.405 of this chapter) during the preceding 12 months (or for such shorter period that the registrant was required to submit such files). Yes No

Table of Contents

Indicate by check mark if disclosure of delinquent filers pursuant to Item 405 of Regulation S-K (§ 229.405 of this chapter) is not contained herein, and will not be contained, to the best of registrant's knowledge, in definitive proxy or information statements incorporated by reference in Part III of this Form 10-K or any amendment to this Form 10-K.

Indicate by check mark whether the registrant is a large accelerated filer, an accelerated filer, a non-accelerated filer, a smaller reporting company, or an emerging growth company. See the definitions of "large accelerated filer," "accelerated filer," "smaller reporting company," and "emerging growth company" in Rule 12b-2 of the Exchange Act.

Large accelerated filer	Accelerated filer
Non-accelerated filer	Smaller reporting company
Emerging growth company	

If an emerging growth company, indicated by check mark if the registrant has elected not to use the extended transition period for complying with any new or revised financial accounting standards provided pursuant to Section 13(a) of the Exchange Act.

Indicate by check mark whether the registrant is a shell company (as defined in Rule 12b-2 of the Act). Yes No

The aggregate market value of the voting stock held by non-affiliates of the Registrant was approximately $291.1 million as of the last business day of the Registrant's most recently completed second fiscal quarter, based upon the closing sale price on the NASDAQ Global Market reported for such date. Shares of Common Stock held by each officer and director and by each person who owns 10% or more of the outstanding Common Stock have been excluded in that such persons may be deemed to be affiliates. This determination of affiliate status is not necessarily a conclusive determination for other purposes.

There were 32,595,723 shares of the Registrant's Common Stock outstanding as of March 1, 2019.

DOCUMENTS INCORPORATED BY REFERENCE

Part III incorporates certain information by reference from the definitive Proxy Statement to be filed within 120 days from December 31, 2018.

2

Table of Contents

TABLE OF CONTENTS

Table of Contents

SPECIAL NOTE REGARDING FORWARD LOOKING STATEMENTS

This Annual Report on Form 10-K, particularly in Item 1 "Business" and Item 7 "Management's Discussion and Analysis of Financial Condition and Results of Operations," includes forward-looking statements within the meaning of Section 27A of the Securities Act of 1933, as amended (the "Securities Act") and Section 21E of the Securities Exchange Act of 1934, as amended (the "Exchange Act"). These statements include, but are not limited to, statements concerning: expectations about the effectiveness of our business and technology strategies; expectations regarding global economic trends; expectations regarding recent and future acquisitions; current semiconductor industry trends; expectations of the success and market acceptance of our intellectual property and our solutions; and our ability to obtain additional financing if needed. Our actual results could differ materially from those projected in the forward-looking statements as a result of a number of factors, risks and uncertainties discussed in this Form 10-K, especially those contained in Item 1A of this Form 10-K. The words "may," "anticipate," "plan," "continue," "could," "proj "expect," "believe," "intend," and "assume," the negative of these terms and similar expressions are used to identify forward-looking statements. All forward-looking statements and information included herein is given as of the filing date of this Form 10-K with the Securities and Exchange Commission ("SEC") and based on information available to us at the time of this report and future events or circumstances could differ significantly from these forward-looking statements. Unless required by law, we undertake no obligation to update publicly any such forward-looking statements.

The following information should be read in conjunction with the Consolidated Financial Statements and notes thereto included in this Annual Report on Form 10-K. All references to fiscal year apply to our fiscal year that ends on December 31. All references to "we", "us", "our", "PDF", "PDF Solutions" or "the Company" refer to PDF Solutions, I

PART I

Item 1. ***Business***

Business Overview

PDF Solutions offers products and services designed to empower engineers and data scientists across the semiconductor ecosystem to improve the yield, quality, and profitability of their products. Our solutions combine

proprietary software, physical intellectual property (or IP) for integrated circuit (or IC) designs, electrical measurement hardware tools, proven methodologies, and professional services. We primarily monetize our solutions through time-based license fees and contract revenue for professional services. In some cases, especially on our historical yield ramp engagements, we also receive a value-based royalty that we call a Gainshare performance incentive. Our products and services have been sold to integrated device manufacturers (or IDMs), fabless semiconductor companies, foundries, out-sourced semiconductor assembly and test (or OSATs), and system houses.

The key benefits of our products and services are improved product yields and product quality with faster time-to-market, which collectively increases profitability for our customers. For example, our foundry customers generate and analyze key manufacturing data using our solutions to shorten the time necessary for technology development and to provide their fabless customers with a higher yielding process with improved electrical performance, which are both critical metrics for market success. Also, for example, our integrated device manufacturers (or IDMs) and fabless customers use our solutions to generate unique, differentiated data that can be analyzed with our machine learning (ML) and artificial intelligence (AI) algorithms to predict downstream manufacturing issues, resulting in shorter time for initial designs to meet performance requirements with fewer iterations and faster time-to-market. For further example, our foundry and OSAT customers use the AI and ML applications of our software to optimize for process control, assembly, and/or test.

Table of Contents

Our long-term business strategy is to be the solutions provider of choice for the semiconductor and electronic supply chain to enable our customers to optimize processes, designs, and fabrication for high yield, low cost, time-to-market, and high performance. To achieve this, we intend to:

Expand Our Market Opportunity By Offering Complete Solutions. We intend to increase the breadth and depth of the use of our solutions by focusing on complete offerings instead of only point products at both new and existing customers. For example, with deployments of our 1st and 2nd generation DFI systems and with DFI on-chip instruments embedded in over 100 customer chips from 28nm down to 7nm, we believe there is a ready market for our analysis software, which is co-optimized with the measurement instruments for comprehensiveness and efficiency to identify blockers that impact product yield and quality weeks or months earlier than with any other hardware- or software-based methodology. We believe the foresight provided by this application will be of significant interest to companies across the semiconductor industry and will provide a solid footprint that can be expanded in subsequent years with the license of additional analysis applications, such as yield, fault detection and classification (or FDC), and test.

Expand in China. China represents a significant opportunity for the semiconductor industry over the next few decades. Success in China will depend on the successful engagement with customers in three key categories: fabless semiconductor vendors, pure-play foundries, and memory vendors. PDF has customers in all three categories that are well-known and highly respected by other prospective customers in China. We intend to leverage our success with these customers to further penetrate the China market. We also intend to leverage our foresight capabilities, led by the combination of our DFI solutions and Exensio platform, to provide compelling capabilities for the emerging China semiconductor ecosystem as they ramp to the most advanced process nodes.

Align Our Business to the Evolving Semiconductor Marketplace. As fewer companies continue down the path of Moore's Law, the vast majority of other companies are embracing a "More than Moore" (or MtM) approach, seeking to achieve higher performance and smaller form-factors but without the design and manufacturing costs of the most advanced process nodes. Due to our extensive knowledge about every process node currently in mass production at the majority of the world's leading foundries, we are in position to be the provider of choice for semiconductor companies embracing an MtM approach to bring their new products to market. Combined with the differentiated data generated by our solutions, our products and services are designed to accelerate how quickly customers can achieve fast yield ramps for products based on manufacturing techniques such as system-in-package (or SiP) and multi-chip-packages (or MCPs) that are popular with MtM design approaches.

Brief History

PDF Solutions was incorporated in Pennsylvania in November 1992, and we reincorporated in California in November 1995. In July 2000, we reincorporated in Delaware, and in July 2001, we completed an initial public offering. Our shares of common stock are currently traded on the NASDAQ Global Market as PDFS. From 2000 through 2009, we expanded our technology footprint and our operations in various countries through acquisitions. From 2009 to 2018, we primarily focused on the pervasive application of our technology to leading edge logic manufacturing and achieving yield targets with our clients that maximized Gainshare revenues. In 2013, we leveraged our extensive experience in yield simulation software and Characterization Vehicle test chip development and started research and development on an e-beam solution for non-contact, inline electrical characterization and process control

for wafer inspection. The first generation e-beam tool was completed in 2015, and the second generation was commercially deployed in 2018. In a parallel effort, starting in 2014, we re-architected our point-solution software tools into a new generation, highly-integrated data analytics platform, which resulted in accelerated growth in software through 2018. Headquartered in Santa Clara, California, we also operate worldwide in Canada, China, France, Germany, Italy, Japan, Korea, and Taiwan.

Industry Background

Rapid technological innovation with increasingly shorter product life cycles has fueled the economic growth of the semiconductor industry since the days of the PC revolution. IC companies have historically ramped production slowly, produced at high volume once a product gained market acceptance, and slowly reduced production volume when price and demand started to decrease near the end of the product's life cycle. Today there are many different business models across the semiconductor industry: products that follow the traditional life cycle just described, products targeted towards fast-moving market segments like IoT, utilizing mature process nodes and requiring a fast ramp to volume with a relatively short life cycle, and products focused on long term market segments like automotive and industrial where product life cycles can last a decade or longer. There is a lot of variation across these business models depending on the level of design complexity and the maturity of the process node used for product implementation. Processors, memory and FPGAs continue to leverage the most advanced process nodes and experience significant challenges to achieve competitive initial yields and optimized performance. Some products and market segments, however, are content to utilize older process nodes. Regardless of the process node used for implementation or how long the product will be sold in the market, success for every semiconductor company is predicated on fast product yield ramp and the ability to optimize manufacturing and test metrics, such as yield reclamation, product quality, and test efficiency, throughout a product's life cycle. Thus, technologies or capabilities that can accelerate yield ramp, improve product quality, and optimize production efficiencies are highly sought after because they typically lead to cost reduction and revenue generation concurrently, causing a leveraged effect on profitability.

Table of Contents

Technology and Intellectual Property Protection

Through yield, performance, and reliability improvement services over more than 20 years, we have accumulated a vast library of physical IP in the form of test structures. As part of our DFI and CV solutions, our engineers create designs of experiments (or DOEs) and layouts for targeted fail modes. We have also developed electrical measurement hardware tools and proprietary extraction, design, and analysis software. In addition, our technology embodies many production-proven and patented algorithms. Further, our IP includes proven methodologies that our implementation teams use as guidelines to drive our customers' use of our technology. We continually enhance our core technologies through the codification of knowledge that we gain in the use of our products and delivery of services.

Our future success and competitive position rely to some extent upon our ability to protect these proprietary technologies and IP, to generate revenue from the licensed sale and support of our software and hardware to customers, and to prevent competitors from using our systems, methods, and technologies in their products or solutions. To accomplish this, we rely primarily on a combination of contractual provisions, confidentiality procedures, trade secrets, and patent, copyright, mask work, and trademark laws. We license our products and technologies pursuant to non-exclusive license agreements that impose restrictions on customers' use. In addition, we seek to avoid disclosure of our trade secrets, including requiring employees, customers, and others with access to our proprietary information to execute confidentiality agreements with us, and restricting access to our source code. We also seek to protect our software, documentation, and other written materials under trade secret and copyright laws. We seek to protect our IP under patent laws and as of December 31, 2018, we held 140 U.S. patents. Our issued patents have expiration dates from 2019 through 2037. We intend to prepare additional patent applications when we feel it is beneficial. We also employ protection of our trademarks, with registration of marks, including Characterization Vehicle, CV, eProbe, Exensio, pdFasTest, PDF Solutions, the PDF Solutions logo. We have common law rights to additional trademarks, including ALPS, Design-for-Inspection, DFI, DirectProbe, and DirectScan.

Products and Services

Through organic development and targeted acquisitions over more than 20 years, we have accumulated an array of highly-integrated and co-designed proprietary software, physical IP for IC designs, electrical measurement tools, and proven methodologies. Subsets of this array are selected to address each customer's specific technical and business requirements. For example, a fabless customer designing a new product may use our proprietary on-wafer instruments and cell libraries to design physical IP to enhance their design for manufacturability or inspection. By way of another example, a fabless company in volume manufacturing may use our data analytic software tools, which are also available to their foundry partners, to monitor how their designs are performing at their foundry partners. The following gives more information about our products and services, including when combined into solutions.

Solutions

Data Analytics Solutions. Our Exensio®-based solutions are designed to link the critical data streams from the entire manufacturing process – from bare wafer to packaged part or system – to improve yield and yield recovery, provide both better operational and process control of tools and testers, and maintain comprehensive traceability from starting wafer through to final packaged part or system. When used in conjunction with our Characterization Vehicle solutions, our data analytics solutions enable customers to correlate the unique, differentiated CV*i* data with other manufacturing data, to improve yield and yield recovery while simultaneously reducing the overhead of manufacturing and test operations. The services we provide with this solution include data analysis, integration and configuration for MES or facility-wide deployment, tool connections, development of filter plans, data collection, management, and training.

Design-for-Inspection™ (or DFI)™ Solutions. Our DFI solutions are designed to enable our customers to achieve non-contact, inline electrical characterization and process control. DFI provides customers an ability to insert on-chip instruments with calibrated electrical responses directly in the product wafer without any die area penalty. In addition, DFI is designed to be high-throughput, enabling inline use. The electrical measurements augment and enhance existing inline defect inspection and metrology methods. The services we provide with this solution include design of the on-chip instruments tuned to our customers' product and/or process specifics, design synthesis support for DFI instrument insertion, on-site tool support services, data analysis, and training

Foundry Solution. We provide our foundry customers a complete DFI system for inline characterization and process control. This DFI infrastructure includes not only on-wafer IP, or on-chip instruments, but also the eProbe® measurement tool and the Exensio® Characterization software for DFI data processing and analysis. All aspects of the foundry solution are optimized for high data contrast, fast data handling, and comprehensive data analysis to provide foresight into downstream issues that could impact product yield, quality, or performance.

Table of Contents

Fabless IP. We work closely with our fabless customers to tune the DFI on-chip instruments to reflect the key aspects of their product designs. We also provide proprietary software that is designed to efficiently distribute DFI filler cells across the die, for maximum issue coverage with fast readout. DFI is designed to enable every fabless company designing products at 28 nanometers and below to achieve better manufacturing results.

Characterization Vehicle Solutions. We offer solutions that are designed to accelerate the efficiency of yield learning by shortening the learning cycle, learning more per cycle, and reducing the number of silicon wafers required in manufacturing processes. The services we provide with this solution include designing test structures and DOEs that are tuned to our customers' product and/or process specifics, tester support, data analysis, and training. Our targeted offerings include:

Process R&D. Our process R&D solutions are designed to help customers increase the robustness of their manufacturing processes by characterizing and reducing the variability of unit processes and device performance with respect to layout characteristics within anticipated process design rules.

Process Integration and Yield Ramp. Our process integration and yield ramp solutions are designed to enable our customers to more quickly ramp the yield of new products early in the manufacturing process by characterizing the process-design interactions within each key process module, simulating product yield loss by process module, and prioritizing quantitative yield improvement by design block in real products.

Design-Specific Characterization Vehicle Infrastructure. Leveraging our learnings from Characterization Vehicle test structures to accelerate foundry process development, we are now applying that technology to specific designs via CV™ Core. By implementing Characterization Vehicle test structures as physical IP embedded within a semiconductor customer's design, we can collect differentiated data related to the performance and reliability of each chip. Using that data in our Exensio platform, we can deliver product-specific insights that enable them to prioritize engineering efforts and deliver improved and more predictable IC reliability and performance.

Products

Our solutions incorporate our various proprietary software and hardware products and other technologies, depending on the customers' needs. The Exensio platform and modules are also offered on a standalone licensed basis. Our software and hardware products and other technologies include the following:

Exensio Platform. Our Exensio platform addresses the big data manufacturing challenge of today's advanced process nodes and highly integrated products, by linking across YMS, FDC, test floor, and other enterprise data types. These data types include inline and end-of-line metrology, yield, parametric, performance, manufacturing consumables, tool-level sensor data, test floor data, logistical data, as well as custom data types. By providing a common environment for all these different data types from many different points in the manufacturing and test process, our Exensio platform enables customers to rapidly perform root cause diagnosis of yield, performance, and quality issues that impact manufacturing and test operations. This same platform also enables predictive and proactive optimization

decisions for process control, process adjustments, PM scheduling, tool corrective actions, wafer dispatching, and wafer level and final test. Collectively, our Exensio platform enables real-time rapid diagnosis and understanding of key manufacturing and test metrics during both inline and end-of-line wafer processing, helping customers reduce product variability and cost simultaneously. The platform currently consists of five main modules in the field today. These modules can be used separately, or combined to provide seamless integration of these traditionally disparate data flows and applications. Certain Exensio functionality is available as either an on-premise installation or through our software-as-a-service (or SaaS) offering. The five main modules of the Exensio platform are as follows:

Exensio Yield collects yield data and stores it in an embedded, analysis-ready database. This database provides a common environment and a consistent view of all product yield data, enabling product engineers to identify and analyze production yield, performance, reliability and other issues. The Exensio Yield module is designed to handle very large data sets, commonplace in the semiconductor industry, and, in combination with our proprietary analytics tools, aids engineers in diagnosing complex issues that negatively impact productivity, yield, and time-to-market for the products they develop. To support the multi-dimensional product requirements of our customers, the powerful, interactive visualization and analysis capabilities in Exensio Yield are highly flexible and user-configurable.

Table of Contents

Exensio Control provides FDC capabilities for monitoring, alarming and control of manufacturing tool sets. These capabilities include proprietary data collection and analysis of tool sensor trace data and summary indicators to rapidly identify sources of process variations and manufacturing excursions. When used together with the above Exensio Yield module, the accretive data mining and correlation capabilities enable identification of tool level sources of yield loss and process variation that impact end of line product yield, performance and reliability.

Exensio Test provides comprehensive data collection and analysis capabilities for data generated during manufacturing test operations. These capabilities include the overall optimization of test operations management, including improving test productivity, supporting test floor operations, and implementing adaptive test. This module also provides predictive insights based on proprietary analytics during test, assembly and packaging — maximizing the efficiency of test operations, productivity improvements and yield reclamation.

Exensio Characterization encapsulates test structure analysis functionality of both electrical and inline inspection data from our proprietary Characterization Vehicle test chips and DFI on-chip instruments.

Exensio ALPS provides device manufacturers with the capability to link all device data, including fabrication and characterization data, from every step of the product life cycle. This includes data from manufacturing, test and assembly, final test, and field use. This proprietary data linkage also enables device manufacturers to maintain full traceability of their finished products back to the source wafer without the need for Electronic Chip IDs, or ECIDs. This capability is becoming an essential requirement for safety-critical market segments such as automotive and mil-aero.

Design-for-Inspection (or DFI) System. Our DFI IP design engineers develop designs-of-experiments (or DOEs) to determine how IC design building blocks interact with the manufacturing process. These on-chip instruments are inserted into test and product wafers and measured on custom e-beam measurement hardware. The DFI system leverages our production-proven design and analysis infrastructure, and includes:

DFI On-Chip Instruments. Our on-chip characterization instruments are developed with the same proprietary design software as our CV test chips and are tuned to capture key features of our customers' product layouts using our proprietary FIRE™ layout analysis software. These DFI instruments are based on our Characterization Vehicle technology and are designed to be placed in test chips, scribe lines, or in product die, without any area penalty, and to exhibit specific electrical responses.

eProbe® Non-Contact E-Beam Tool. Our eProbe e-beam tools are designed to measure the electrical response of the DFI instruments. This new measure, which we call an Electrical Response Index (or ERI), allows for more precise inline characterization of design-process interactions. The second generation tool includes orders of magnitude advances in throughput and accuracy that now enable DFI on-chip instruments to be used for inline control for leading-edge semiconductor process nodes.

Exensio® Characterization Software. Exensio Characterization software, also a part of our Exensio platform, is designed to analyze the billions of measurements collected from DFI on-chip instruments using the eProbe tool.

Characterization Vehicle Infrastructure. Our engineers develop a DOE to determine how IC design building blo cks interact with the manufacturing process. Our software utilizes the DOE, in combination with our proprietary library of building blocks that highlight potential yield and performance issues, to generate CV test chip layouts. Our CV infrastructure includes:

CV Test Chips. Our family of proprietary test chip products is run through the manufacturing process with intentional process modifications to explore the effects of potential process improvements given natural manufacturing variations. Our custom-designed CV test chips are optimized for our test hardware and analysis software and include DOEs tuned to each customer's process. Our full-reticle short-flow CV test chips provide a fast learning cycle for specific process modules and are fully integrated with third-party failure analysis and inspection tools for a complete diagnosis to understand root causes. Our Scribe CV products are inserted directly on customers' product wafers and collect data about critical layers. Our DirectProbe™ CV test chips enable ultra-fast yield learning for new product designs by allowing our clients to measure components of actual product layout.

Table of Contents

Exensio Characterization software. Exensio Characterization software, also a part of our Exensio platform, collects data from our CV test chips, enabling models of the performance effects of process variations on these design building blocks to be generated for use with our FIRE™ software.

pdFasTest® Electrical Tester. Our proprietary hardware system enables fast defect and parametric characterization of manufacturing processes. This automated system provides parallel functional testing, thus minimizing the time required to perform millions of electrical measurements to test our CV test chips.

FIRE *Software.* Our FIRE software analyzes an IC design to perform design attribute extraction and feature-based yield modeling to compute both systematic and random yield loss due to optical proximity effects, etch micro-lading, dishing in CM, and other basic process issues. FIRE Software is driven by a combination of industry-standard layout data and proprietary yield models created from our CV test chips described above.

Template Technology. Our Template technology includes Templatyzer software and IP for identifying and developing a set of layout patterns that are tailored to a given manufacturing process and target product application, and checks the proposed designs against this set of patterns for optimal manufacturability.

Customers

Our existing customers include foundries, IDMs, fabless semiconductor design companies, OSATs, as well as some equipment manufacturers, including those that embed and distribute our Exensio ALPS products in their equipment. Our semiconductor customers' targeted product segments vary significantly, including microprocessors, memory, graphics, image sensor solutions, and communications. We believe that the adoption of our solutions by such companies for usage in a wide range of products validates the application of our solutions to the broader semiconductor market.

GLOBALFOUNDRIES Inc., which, together with its subsidiaries, we collectively call GlobalFoundries, represented 37% of our revenues for 2018 and 40% of our revenues for 2017. GlobalFoundries and Samsung represented 41% and 11%, respectively, of our revenues for 2016. No other customer accounted for 10% or more of our revenues in 2018, 2017, and 2016.

Although a substantial portion of our total revenues are concentrated in a small number of customers, the total revenues for each of these customers in any period is the result of our Design-to-silicon-yield solutions and Gainshare performance incentives revenues being recognized in the period under multiple, separate contracts, with no interdependent performance obligations. In general, our customer contracts are non-cancellable. These contracts were all entered into in the ordinary course of our business and contain general terms and conditions that are standard across most of our yield improvement solutions customers, including providing services typically targeted to one

manufacturing process node, for example, the 28 or 14 nanometer node. Fluctuations in future results may occur if any of these customers default on contractual commitments or renegotiate pre-existing contractual commitments, including due to adverse changes in their own business. For example, during the third quarter of 2018, a major customer publicly announced that it was indefinitely suspending the development and production of its 7nm technology node. This customer's decision negatively impacted our Design-to-silicon-yield solutions revenues in the fourth quarter of 2018. We cannot assess the ultimate resolution of this non-cancellable contract at the current time, pending further discussion with the customer. We expect that Gainshare performance incentives revenues related to this contract will not be recognized in the long-term as Gainshare performance incentives revenues are based on future production of the customer. See the discussion in "Risk Factors" under Item 1A for more information about risks associated with customer concentration and contractual provisions.

International revenues accounted for approximately 60% of our total revenues for 2018 compared to 61% for 2017 and 64% for 2016. We base these calculations on the geographic location of where the work is performed. Revenues from customers by geographic area based on the location of the customers' work sites for our last three fiscal years can be found in Note 11, "Customer and Geographic Information" to the consolidated financial statements. Additional discussion regarding the risks associated with international operations can be found under Item 1A, "Risk Factors".

See our "Notes to Consolidated Financial Statements", included under Part II, Item 8. "Financial Statements and Supplementary Data" for additional geographic information.

Table of Contents

Sales and Marketing

Our sales strategy is to pursue targeted accounts through a combination of our direct sales force, our solution service teams, and strategic alliances. After we are engaged by a customer and early in the solution services, our engineers seek to establish relationships in the organization and gain an understanding of our customers' business issues. Our direct sales and solution service teams combine their efforts to deepen our customer relationships by expanding our penetration across the customer's products, processes and technologies. This close working relationship with the customer has the added benefit of helping us identify new product areas and technologies in which we should next focus our research and development efforts. From time-to-time, we use sales representatives/agents in various locations to augment direct sales in certain territories. For example, in 2018, we engaged Abrolex in China, Recynergy in Taiwan, Tessolve in India and Southeast Asia. We expect to continue to establish strategic alliances with process licensors, vendors in the electronic design automation software, capital equipment for IC production, and test silicon IP and mask-making software segments to create and take advantage of sales channel and co-marketing opportunities. Additionally, we expect to form relationships with key value chain participants, including foundries and OSATs, to provide services and value across the manufacturing supply chain.

Research and Development

Our research and development focuses on developing and introducing new proprietary technologies, including our DFI solution as well as other software products and enhancements to our existing solutions, such as field applications for DFI. We use a rapid-prototyping paradigm in the context of the customer engagement to achieve these goals. We have made, and expect to continue to make, substantial investments in research and development. The complexity of our technologies requires expertise in physical IC design and layout, transistor design and semiconductor physics, semiconductor process integration, numerical algorithms, e-beam technology, hardware, statistics and software development. We believe that our team of engineers will continue to advance our market and technological leadership. We conduct in-house training for our engineers in the technical areas. Our training also extends to focusing on ways to enhance client service skills. Although it fluctuates, we can have up to one quarter of our research and development engineers operating in the field, partnered with solution services engineers in a deliberate strategy to provide direct feedback between technology development and customer needs. We also utilize a variety of skilled independent contractors for specialized development.

Competition

The semiconductor industry is highly competitive and driven by rapidly changing design and process technologies, evolving standards, short product life cycles, and decreasing prices. We expect market competition to continue to develop and increase as the market for data and analytics continues to evolve. We believe the solution to address the needs of IC companies requires a comprehensive and unified platform comprised of a big data management infrastructure, AI/ML-based analytics engines, and products that generate and collect differentiated data that enrich

the analytics process. Currently, we are a leading provider of comprehensive commercial hardware, software and IP solutions for optimizing and improving design, manufacturing and test operations processes through the application of differentiated data and advanced analytics. We face indirect competition from internal groups at IC companies that use disparate and ad hoc tools not optimized to accelerate process-design integration or test operations. Some providers of semiconductor manufacturing software, inspection equipment, electronic design automation, or design IP may seek to broaden their product offerings and compete with us. In each of the market segments we compete in, we face competition from established and potential competitors, some of which may have greater financial, research, engineering, manufacturing and marketing resources than we have.

We face competition for some of the point applications of our products, including some of those used by the internal groups at IC companies. Specifically there are several suppliers of (i) yield management and/or prediction systems, such as KLA-Tencor, Siemens AG (“Siemens”), Rudolph Technologies, Inc. (“Rudolph”), Synopsys, Inc., and Qualtera, (ii) semiconductor manufacturing software, such as Applied Materials, Inc., BISTel Inc., Invantest, Inc., Optimal+, Rudolph, and Siemens and, (iii) inline inspection, metrology and electrical test equipment providers, such as Applied Materials and Keysight Technologies, Inc. Further, we may compete with the products or offerings of the same or additional companies if we expand our offerings, or they expand their offerings, through acquisition or development.

We believe that our solutions compare favorably with respect to competition because we have demonstrated results and reputation, strong core technology, ability to create innovative technology, and ability to implement solutions for new technology and product generations.

Table of Contents

Employees

As of December 31, 2018, we had 365 employees worldwide, including 219 on client service teams, 83 in research and development, 26 in sales and marketing, and 37 in general and administrative functions. Of these employees, 155 are located in the United States and Canada, 174 in Asia, and 36 in Europe.

None of our employees are represented by a labor union. Our employees in France and Italy are subject to collective bargaining agreements in those countries. We believe our relationship with our employees is good. Competition is intense in the recruiting of personnel in our industry. We believe that our future success will depend, in part, on our continued ability to hire and retain qualified management, marketing and technical employees.

Executive Officers

The following table and notes set forth information about our current executive officers as of February 28, 2019.

Name	Age	Position
John K. Kibarian, Ph.D.	54	President, Chief Executive Officer, and Director
Christine A. Russell	69	Executive Vice President, Finance and Chief Financial Officer
Kimon Michaels, Ph.D.	52	Executive Vice President, Products and Solutions

John K. Kibarian, Ph.D., one of our founders, has served as President since November 1991 and has served as our Chief Executive Officer since July 2000. Dr. Kibarian has served as a director since December 1992. Dr. Kibarian received a B.S. in Electrical Engineering, an M.S. E.C.E. and a Ph.D. E.C.E. from Carnegie Mellon University.

Christine A. Russell, joined in July 2018 as Vice President, Finance, and was appointed Chief Financial Officer effective August 10, 2018. Ms. Russell was designated an Executive VP in February 2019. Prior to joining the Company, Ms. Russell served as Chief Financial Officer, UniPixel, Inc. (Nasdaq:UNXL), a touch sensor company, from May 2015 to August 2017. Prior to UniPixel, she was Chief Financial Officer of Vendavo, Inc. from May 2014 to March 2015, a SaaS based pricing and margin optimization software company. She also served as Chief Financial Officer of Evans Analytical Group from May 2009 to September 2013, a global provider of analytical testing for technology companies including major semiconductor, chemicals and pharmaceuticals firms. Prior to EAG, she served in the roles of both Chief Financial Officer and EVP Business Development at Virage Logic (Nasdaq:VIRL), a semiconductor intellectual property company. Prior positions include Chief Financial Officer for OuterBay Technologies, a database archiving software company and Chief Financial Officer of Ceva, Inc. (Nasdaq: CEVA), a DSP IP company. She currently serves as Audit Committee Chair and Director for both QuickLogic Corporation and

eGain Corporation. Ms. Russell holds a B.A. and M.B.A. from the University of Santa Clara.

Kimon Michaels, Ph.D., one of our founders, has served as Vice President, Products and Solutions since July 2010 and was designated an Executive VP in February 2019. Dr. Michaels served as Vice President, Design for Manufacturability from June 2007 through June 2010. Prior to that, Dr. Michaels served as Vice President, Field Operations for Manufacturing Process Solutions from January 2006 through May 2007, and has been a Director since November 1995. From March 1993 through December 2005, he served in various vice presidential capacities. He also served as Chief Financial Officer from November 1995 to July 1998. Dr. Michaels received a B.S. in Electrical Engineering, an M.S. E.C.E. and a Ph.D. E.C.E. from Carnegie Mellon University

Available Information

We file or furnish various reports, such as registration statements, periodic and current reports, proxy statements and other materials with the SEC. Our Internet website address is www.pdf.com. You may obtain, free of charge on our website, copies of our annual reports on Form 10-K, quarterly reports on Form 10-Q, current reports on Form 8-K, and amendments to those reports filed or furnished pursuant to Section 13(a) or 15(d) of the Exchange Act, as soon as reasonably practicable after we electronically file such material with, or furnish it to, the SEC. The Company's website address provided is not intended to function as a hyperlink, and the information on the Company's website is not, and should not be considered, part of this Annual Report on Form 10-K and is not incorporated by reference herein.

The SEC maintains a Web site (http://www.sec.gov) that contains reports, proxy and information statements and other information regarding issuers, such as us, that file electronically with the SEC.

Table of Contents

Item 1A. Risk Factors

We generate most of our revenues from a limited number of customers, and a large percentage of our revenues from a single customer, so decreased business with, or the loss of, any one of these customers, or pricing pressure, or customer consolidation could significantly reduce our revenue or margins, negatively impact results of operations, and require us to accept lower margin business on future nodes.

Historically, we have had a small number of large customers for our core solutions and that contribute significant Gainshare performance incentives revenue. In the year ended December 31, 2018, one customer, GlobalFoundries, accounted for 37% of our revenues. We could lose a customer due to its decision not to engage us on future process nodes, its decision to reduce the scope of our services or technology used, which is permitted in certain of our contracts if the customer company's business materially adversely changes, its decision not to develop its own future process node, or as a result of industry factors, including but not limited to consolidation. During the third quarter of 2018, a major customer announced that it was suspending indefinitely the development and production of its 7nm technology node. This customer’s decision negatively impacted our Design-to-silicon-yield solutions revenues in the fourth quarter of 2018. Gainshare performance incentives revenues will be negatively affected in the long-term as Gainshare performance incentives revenues are based on future production of the customer. Consolidation among our customers could also lead to increased customer bargaining power, or reduced customer spending on software and services. Further, new business may be delayed if a key customer uses its leverage to push for terms that are worse for us and we nonetheless continue to negotiate for better terms, in which case Solutions revenue in any particular quarter or year may fail to meet expectations. Also, the loss of any of these customers or the failure to secure new contracts with these customers could further increase our reliance on our remaining customers. Further, if any of our key customers default, declare bankruptcy or otherwise delay or fail to pay amounts owed, or we otherwise have a dispute with any of these customers, our results of operations would be negatively affected in the short term and possibly the long term. These customers may seek to renegotiate pre-existing contractual commitments due to adverse changes in their own businesses, which would harm our operating results. These events could cause significant fluctuations in results of operations because our expenses are fixed in the short term and it takes us a long time to replace customers or reassign resources

If we are unable to complete development and qualification of our e-beam measurement tool for inline wafer inspection on schedule or at all, or successfully commercialize our Design-for-Inspection (DFI) solution, our future market opportunity and revenues will suffer and our costs may not be recouped.

Certain use cases of our DFI solution remain to be proven, and the inline version still needs to be qualified by the first commercial customer. To date, we have invested significantly in the design and development of our DFI eProbe tool and related intellectual property. If existing foundry customers fail to renew or expand the number or use of the systems they are using, or new foundry customers fail to adopt our DFI solution, our results will suffer. For example, in 2018 an early adopter of our DFI solution at 7nm elected to exercise an early exit under the contract in connection with its decision to suspend indefinitely further development and production at 7nm, which negatively impacted the long-term revenue we expected under this contract and possibility for renewal or expansion. Also, if the results of our

DFI solution are not as we expect, we may not be able to successfully commercialize these technologies on schedule, or at all, and we may miss the market opportunity and not recoup our investment. Further, our DFI tool may cause unexpected damage to wafers or delay processing wafers, which we could be liable for, or which may make customers unwilling to use it. If we are not able to create significant interest and show reliable and useful results, our investment may not be recouped and our future results may suffer.

Table of Contents

Decreases in wafer volumes at our customers' manufacturing sites or the volume of ICs that some of our customers are able to sell to their customers would cause our Gainshare performance incentives revenue to suffer.

Our Gainshare performance incentives revenue is largely determined by wafer volumes at manufacturing sites covered by our contracts and, in some cases, the volume of an IC product that our customer is able to sell to its customers. Both of these factors are outside of our control. Further, some of our manufacturing customers' business is largely dependent on customers that use our manufacturing customer as a second or third source. If those customers consolidate and/or otherwise move the orders to manufacturing facilities not covered by our contracts, or suspend their manufacturing at covered facilities for any reason, including consolidation, our Gainshare revenue will decrease. Reduced demand for semiconductor products decreases the volume of wafers and, in some cases, products our customers are able to sell, which would also directly decrease our Gainshare revenue. For example, 28nm volumes were lower in 2018 than expected. Also, our customers may unilaterally decide to implement changes to their manufacturing processes during the period that is covered by Gainshare, which could negatively affect yield results and our revenue. Since we currently work on a small number of large projects at specified manufacturing sites and, in some cases, on specific IC products, our results of operations are adversely affected by negative changes at those sites or in those products. For example, if wafer orders from sites covered by our contracts are not secured by our customers, if an end product does not achieve commercial viability, if a process line or, in some cases, a specific product, does not achieve significant increases in yield or sustain significant volume manufacturing during the time we receive Gainshare, revenues associated with such volumes or products would be negatively impacted. This could significantly reduce our revenue and results of operations below expectations. In addition, if we work with two directly competitive manufacturing facilities or products, volume in one may offset volume, and thus any of our related Gainshare, in the other facility or product.

If semiconductor designers and manufacturers and their suppliers do not continue to adopt, or they significantly delay adoption of, our products and solutions, our revenues will suffer.

If semiconductor designers and manufacturers and their suppliers do not continue to adopt our products and solutions, both as currently comprised and as we may offer them in the future, our revenues will decline. We may not be successful if we do not continue to enter into long-term agreements with existing customers and new customers that cover a larger number of IC products, processes, or manufacturing and test/assembly facilities. If we do not continue to develop customer relationships with companies that are integrated device manufacturers (or IDMs), fabless semiconductor companies, foundries, and out-sourced assembly and test companies (or OSATs), as well as system houses, the market acceptance of our solutions will suffer. Factors that may limit adoption of our products and solutions by semiconductor companies include:

- our existing and potential customers' delay in their adoption or suspension of the current or next process technology including derivatives of older nodes;
- our inability to keep pace with the rapidly evolving technologies and equipment used in the semiconductor design and manufacturing processes;

- our inability to convince foundry customer to adopt or expand adoption of DFI solution or fabless customers to include our on-chip measurement devices in tape outs;
- our customers' failure to achieve satisfactory results using our solutions;
- the lack of proven results with new technologies and solutions that we may develop; and
- our inability to develop, market, or sell effective solutions that are outside of our traditional logic focus of manufacturing process solutions, for example, 3-D memory processes or our DFI IP and hardware technology.

The semiconductor market is volatile and unpredictable and is exacerbated by economic uncertainty, which limits our ability to forecast our business and could negatively impact our results of operations.

The semiconductor industry historically has been volatile with up cycles and down cycles, due to sudden changes in customers' manufacturing capacity requirements and spending, which depend in part on capacity utilization, demand for customers' IC products by consumers, inventory levels relative to demand, and access to affordable capital. As a result of the various factors that affect this volatility, the timing and length of any cycles can be difficult to predict. Economic uncertainty exacerbates negative trends in consumer spending and can cause some of our customers to delay or refrain altogether from entering into new engagements, licensing new or additional software products, or renewing maintenance and support for existing licensed software. Difficulties in obtaining capital and deteriorating market conditions may also lead to the inability of some customers to obtain affordable financing for other purchases, which could tie up funds otherwise budgeted for purchases of our solutions and technologies. For example, the timing of the build-out of the semiconductor market in China depends significantly on governmental funding on both local and national levels and a delay in this funding could negatively affect our revenues. Any of these events could negatively affect our revenues and make it challenging for us to forecast our operating results, make business decisions, and identify the risks that may affect our business, financial condition and results of operations. Customers with liquidity issues may also lead to additional bad debt expense.

Table of Contents

Our solution implementations or system installation/configurations may take longer than budgeted, which could slow our revenue recognition and may also result in a loss contract, which would negatively affect our operating results.

Our solution implementations require a team of engineers to collaborate with our customers to address complex issues by using our software and other technologies, and the installation and configuration of our software into our customers' fabrication and test/assembly facilities requires experienced engineers working with our customers on active foundry and test/assembly equipment. We must estimate the amount of resources needed to complete both of these types of services in order to estimate when the engineers will be able to commence the next engagement. In addition, our accounting for contracts with such services, which generate fixed fees, sometimes requires adjustments to profit (loss) based on revised estimates during the performance of the contract. These adjustments may have a material effect on our results of operations in the period in which they are made. The estimates giving rise to these risks, which are inherent in fixed-price contracts, include the forecasting of costs and schedules, and contract revenues related to contract performance.

Our sales cycle is lengthy and customers may delay entering into contracts or decide not to adopt our products or solutions after we have performed services or provided evaluation licenses, which could result in delays in recognizing revenue and negatively impact our results of operations in a quarter or result in lower revenue than we expected if a contract is not consummated at all.

On-going negotiations and evaluation projects for new products, with new customers or in new markets may not result in significant revenues for us if we are unable to close new engagements on terms favorable to us, in a timely manner, or at all. Unexpected delays in our sales cycle could cause our revenues to fall short of expectations. Further, the timing and length of negotiations required to enter into agreements with our customers and the ultimate enforcement of complex negotiated contractual provisions as we intended is difficult to predict. If we do not successfully negotiate certain key complex contractual provisions, there are disputes regarding such provisions or they are not enforced as we intended, the future available market for our solutions could decrease and our revenues and results of operations would suffer. Further, our customers sometimes delay starting negotiations until they begin developing a new process, need to insert a new product, or experience specific yield issues. This means that on occasion we have, and may continue to provide technology and services under preliminary documentation before executing the final contract. In these cases, we would not recognize revenue and would defer associated costs until execution of the final contract, which, if significant, could negatively impact our results of operations in the periods before we execute the final contract. Further, if we were to incur significant effort and then fail to enter into a final contract, we would have to write-off such deferred costs in the period in which the negotiations ended, which would decrease our gross margin and could result in significant operating losses.

If we fail to protect our intellectual property rights, customers or potential competitors may be able to use our technologies to develop their own solutions which could weaken our competitive position, reduce our revenue, or increase our costs.

Our success depends largely on the proprietary nature of our technologies. Our contractual, patent, copyright, trademark, and trade secret protection may not be effective against any particular threat or in any particular location. Our pending patent applications may not result in issued patents, and even if issued, they may not be sufficiently broad to protect our proprietary technologies. Some foreign countries do not currently provide effective legal protection for intellectual property and our ability to prevent the unauthorized use of our products in those countries is therefore limited. Our trade secrets may also be stolen, otherwise become known, or be independently developed by competitors. Litigation may be necessary from time to time to enforce our IP rights or to determine the validity and scope of the proprietary rights of others. As a result of any such litigation, we could lose our proprietary rights and incur substantial unexpected operating costs. Litigation could also divert our resources, including our managerial and engineering resources. If we are unable to exclude others from using our proprietary technologies and methods without compensation to us, through litigation or otherwise, it could impede our ability to grow our business and our revenues may suffer.

We pursue new product and technology initiatives, including our DFI solution and Exensio platform, from time to time, and if we fail to successfully carry out these initiatives, our business, financial condition, or results of operations could be adversely impacted.

As part of the evolution of our business, we have made substantial investments to develop new products, including our DFI solution and Exensio platform, and enhancements to existing products through our research and development efforts. If we are unable to anticipate technological changes in our industry by introducing new or enhanced products in a timely and cost-effective manner, or if we fail to introduce products that meet market demand, we may lose our competitive position, our products may become obsolete, and our business, financial condition or results of operations could be adversely affected.

Table of Contents

We may have to invest more resources in research and development than anticipated, which could increase our operating expenses and negatively affect our operating results.

We devote substantial resources to research and development. New competitors, technological advances in the semiconductor industry or by competitors, our entry into new markets, or other competitive factors may require us to invest significantly greater resources than we anticipate. If we are required to invest significantly greater resources than anticipated without a corresponding increase in revenue, our operating results could decline. Additionally, our periodic research and development expenses may be independent of our level of revenue, which could negatively impact our financial results. Finally, there can be no guarantee that our research and development investments will result in products that create additional revenue.

We face operational and financial risks associated with international operations that could negatively impact our revenue.

We derive over half of our revenue from sales outside of the United States, and we expect our international business to continue to grow, in particular in China. We have in the past expanded and reorganized, at different times, our non-U.S. operations and may in the future continue such expansion or reorganization by establishing or restructuring international subsidiaries, offices, or contractor relationships in locations, if and when, deemed appropriate by our management. Thus, the success of our business is subject to risks inherent in doing business internationally, including in particular:

- our growth in China is dependent upon continued investments in the semiconductor industry by both private and public entities within China. Should circumstances change such that the level of investments are substantially reduced, our future growth potential may be limited;
- some of our key engineers and other personnel are foreign nationals and they may not be permitted access to certain technical information under U.S. export laws or by certain of our customers and may have difficulty gaining access to the United States and other countries in which our customers or our offices may be located and it may be difficult for us to recruit and retain qualified technical and managerial employees in foreign offices;
- ineffective or inadequate protection or enforcement of our intellectual property in foreign jurisdictions;
- greater difficulty in collecting account receivables resulting in longer collection periods or bad debt;
- language and other cultural differences may inhibit our sales and marketing efforts and create internal communication problems among our U.S. and foreign teams, increasing the difficulty of managing multiple, remote locations performing various development, quality assurance, and yield ramp analysis projects;
- compliance with, inconsistencies among, and unexpected changes in, a wide variety of foreign laws and regulatory environments with which we are not familiar, including, among other issues, with respect to employees, personal

data, tax, protection of our IP, and a wide variety of operational regulations and trade and export controls under domestic, foreign, and international law;

- currency risk due to the fact that certain of our payables and for our international offices are denominated in the foreign currency, including the Euro, Yen, and RMB, while virtually all of our revenues is denominated in U.S. dollars, or in the event a larger portion of our revenues becomes denominated in foreign currencies, we would be subject to a potentially significant exchange rate risk;
- inadequate local infrastructure that could result in business disruptions;
- additional taxes, interest, and potential penalties, and uncertainty around changes in tax laws of various countries;
- quarantine, private travel limitation, or business disruption in regions affecting our operations, stemming from actual, imminent or perceived outbreak of human pandemic or contagious disease; or
- economic or political instability, including but not limited to armed conflict, terrorism, interference with information or communication of networks or systems, and the resulting disruption to economic activity and business operations.

Table of Contents

Further, our employees and contractors include professionals located in various international locations, including Shanghai, China, who provide primarily CV test chip-related services, and Ramallah, Palestine, who provide software-related development, quality assurance, maintenance, and other technical support services for certain of our software products. Political changes, including policies regarding export control, that affect these or other international operations could disrupt or limit the work our employees and contractors are able to perform, and thus negatively affect the range of services we are able to provide our customers or our cost for such services.

In addition, our global operations are subject to numerous U.S. and foreign laws and regulations, including those related to anti-corruption, tax, corporate governance, imports and exports, financial and other disclosures, privacy and labor relations. These laws and regulations are complex and may have differing or conflicting legal standards, making compliance difficult and costly. In addition, there is uncertainty regarding how proposed, contemplated or future changes to these complex laws and regulations could affect our business. We may incur substantial expense in complying with the new obligations to be imposed by these laws and regulations, and we may be required to make significant changes in our business operations, all of which may adversely affect our revenues and our business overall. If we violate these laws and regulations we could be subject to fines, penalties or criminal sanctions, and may be prohibited from conducting business in one or more countries. Although we have implemented policies and procedures to help ensure compliance with these laws and regulations, there can be no assurance that our employees, contractors, agents or partners will not violate such laws and regulations. Any violation individually or in the aggregate could have a material adverse effect on our operations and financial condition.

Inadvertent disclosure of our customers' confidential information or our failure to comply with our client's security rules, including for hosted solutions or on-site access could result in costly litigation, cause us to lose existing and potential customers, or negatively impact on-going business with existing customers.

Our customers consider their product yield information and other confidential information, which we must collect in the course of our engagement with the customer or through our software tools, to be extremely competitively sensitive. Many of our clients have strict security rules for on-site access to, or hosting, to their confidential information. If we inadvertently disclosed or were required to disclose this information, or if we fail to adequately comply with customers' security protocols for accessing or hosting confidential information, we would likely lose existing and potential customers, could be subject to costly litigation, or our on-going business could be negatively impacted. In addition, to avoid potential disclosure of confidential information to competitors, some of our customers may, in the future, ask us not to work with key products or processes, which could limit our revenue opportunities.

Our ability to sell our products may depend on the quality of our support and services offerings, including delivering of software as a service (SaaS), and our failure to offer high-quality support and services could negatively affect our sales and results of operations.

Once our software products are integrated within our customers' hardware and software systems, our customers may depend on our support organization to resolve any issues relating to our products. Further, in connection with delivering our software as a service, which requires us to maintain adequate server hardware and internet infrastructure, including system redundancies, we will need to meet contractual uptime obligations. A high level of system and support is critical for the successful marketing and sale of our products. If we do not effectively provide subscription access to our SaaS customers, assist our customers in deploying our products, succeed in helping our customers quickly resolve post-deployment issues, and provide effective ongoing support and data security, our ability to sell our software products to existing customers may be negatively affected, our results of operations could be negatively impacted if we must provide credits for system downtime, and our reputation with potential customers could be harmed. If our software customers have a poor perception of our support and services offerings, they may choose not to purchase via SaaS, renew software support and maintenance or term-based licenses when the current period expires. In addition, due to our international operations, our system and support organization faces challenges associated with delivering support, hours that support is available, training, and documentation where the user's native language may not be English. If we fail to maintain high-quality support and services, our customers may choose our competitors' products instead of ours in the future, which would negatively affect our revenues and results of operations.

Table of Contents

Defects in our proprietary technologies, hardware and software tools, and failure to effectively remedy any such defects could decrease our revenue and our competitive market share.

If the software, hardware, or proprietary technologies we provide to a customer contain defects that negatively impact customers' ability to use our solutions or software, increase our customers' cost of goods sold and time-to-market or damage our customers' property, these defects could significantly decrease the market acceptance of our solutions or results in warranty or other claims. We must adequately train our new personnel, especially our client service and technical support personnel, to effectively and accurately, respond to and support our customers. If we fail to do this, it could lead to dissatisfaction among our customers, which could slow our growth. Further, the cost of support resources required to remedy any defects in our technologies, hardware, or software tools could exceed our expectations. Any actual or perceived defects with our software, hardware, or proprietary technologies may also hinder our ability to attract or retain industry partners or customers, leading to a decrease in our revenue. These defects are frequently found during the period following introduction of new software, hardware, or proprietary technologies or enhancements to existing software, hardware, or proprietary technologies. Our software, hardware, and proprietary technologies may contain errors not discovered until after customer implementation of the silicon design and manufacturing process recommended by us. If our software, hardware, or proprietary technologies contain errors or defects, it could require us to expend significant resources to remedy these problems or defend/indemnify claims, which could reduce margins and result in the diversion of technical and other resources from our other customer implementations and development efforts.

If we do not effectively manage, support, and safeguard our worldwide information systems, and integrate recent and planned growth, our business strategy may fail.

We are heavily reliant on our technology and infrastructure to provide our products and services to our customers. We have experienced in the past, and may experience in the future, interruptions in our information systems on which our global operations depend. Further, we may face attempts by others to gain unauthorized access through the Internet to our information technology systems whether hosted by us or service providers, to intentionally hack, interfere with, or cause physical or digital damage to or failure of such systems (such as significant viruses or worms), which attempts we or they may be unable to prevent. Our security measures may also be breached due to employee errors, malfeasance, or otherwise. Third parties may also attempt to influence employees, users, suppliers or customers to disclose sensitive information in order to gain access to our, our customers' or business partners' data. Additionally, third parties with whom we work, such as vendors or developers, may violate applicable laws or our policies and such violations can place personal information of our customers at risk.

We or our service providers could be unaware of an incident or its magnitude and effects until after it is too late to prevent it and the damage it may cause. The theft, unauthorized use, or a cybersecurity attack that results in the publication of our trade secrets and other confidential business information as a result of such an incident could negatively affect our competitive position, the value of our investment in product or research and development, and third parties might assert against us or our customers claims related to resulting losses of confidential or proprietary information or end-user data and/or system reliability. In any such event, our business could be subject to significant

disruption, which could impact our revenues or cause customers to cease doing business with us, and we could suffer monetary and other losses, including reputational harm, which costs we may not be able to recover from our service providers. Our operations are dependent upon our ability to protect our technology infrastructure against damage from business continuity events that could have a significant disruptive effect on our operations.

In addition, we collect, use, store or disclose (collectively, “process”) an increasingly large amount of personal information, including from employees and customers, in connection with the operation of our business. The personal information we process is subject to an increasing number of federal, state, local and foreign laws regarding privacy and data security, as well as contractual commitments. Any failure or perceived failure by us to comply with such obligations may result in governmental enforcement actions, fines, litigation, or public statements against us by consumer advocacy groups or others and could cause our customers to lose trust in us, which could have an adverse effect on our reputation and business. Additionally, changes to applicable privacy or data security laws could impact how we process personal information, and therefore limit the effectiveness of our solutions or our ability to develop new solutions. For example, the European Union General Data Protection Regulation, which becomes fully effective on May 25, 2018, imposes more stringent data protection requirements, and provides for greater penalties for noncompliance of up to the greater of €20 million or four percent of worldwide annual revenues.

Additionally, we must frequently expand our internal information system to meet increasing demand in storage, computing and communication, which may result in increased costs. Our internal information system is expensive to expand and must be highly secure due to the sensitive nature of our customers’ information that we transmit. Building and managing the support necessary for our growth places significant demands on our management and resources. These demands may divert these resources from the continued growth of our business and implementation of our business strategy.

Table of Contents

If we are not able to retain, attract, motivate, and strategically locate talented employees, including some key executives, our business may suffer.

Our success and competitiveness depend on our ability to retain, attract, motivate, and strategically locate in our offices around the globe, talented employees, including some of our key executives. Achieving this objective may be difficult due to many factors, including fluctuations in global economic and industry conditions, changes in our management or leadership, the hiring practices at our competitors or customers, cost reduction activities, and the effectiveness of our compensation programs, including equity-based programs. Further, we have had, and expect to continue to have, difficulty in obtaining visas permitting entry for some of our employees that are foreign nationals into the United States, and delays in obtaining visas permitting entry into other key countries, for several of our key personnel, which disrupts our ability to strategically locate our personnel. In recent years, the United State has increased the level of Security in granting H-1(b), L-1 and other business visas. The Trump administration has indicated that immigration reform is a priority. If we lose the services of certain of our key executives or a significant number of our engineers, it could disrupt our ability to implement our business strategy. If we do not successfully attract, retain, and motivate key employees, including key executives, we may be unable to realize our business objectives and our operating results may suffer.

Our stock price has been volatile in the past, and our earnings per share and other operating results may vary quarter to quarter, which could result in not meeting investors' expectations and cause our stock price to drop.

Our stock price has fluctuated widely during the last few years, from a low closing price of $7.73 per share in October 2018 to a high closing price of $24.16 per share in December 2016. A factor in the volatility may be that our historical quarterly operating results have fluctuated. Our future quarterly operating results will likely fluctuate from time to time and may not meet the expectations of securities analysts and investors in some future period, which could cause our stock price to decrease again. A significant reduction in our stock price negatively impacts our ability to raise equity capital in the public markets and increases the cost to us, as measured by dilution to our existing shareholders, of equity financing. In addition, the reduced stock price also increases the cost to us, in terms of dilution, of using our equity for employee compensation or for acquisitions of other businesses. A greatly reduced stock price could also have other negative results, including the potential loss of confidence by employees, the loss of institutional investor interest, a hostile take-over bid, and fewer business development opportunities. Also, significant volatility in the stock price could be followed by a securities class action lawsuit, which could result in substantial costs and a diversion of our management's attention and resources.

Competition in the market for yield improvement solutions and increased integration between IC design and manufacturing may intensify in the future, which could impede our ability to grow or execute our strategy.

Competition in our market may intensify in the future, which could slow our ability to grow or execute our strategy and could lead to increased pricing pressure, negatively impacting our revenues. Our current and potential customers

may choose to develop their own solutions internally, particularly if we are slow in deploying our solutions or improving them to meet market needs. These and other competitors may be able to operate with a lower cost structure than our engineering organization, which would give any such competitor's products a competitive advantage over our solutions. We currently face indirect competition from the internal groups at IC companies and some direct competition from providers of (i) yield management and/or prediction systems, such as KLA-Tencor, Siemens AG ("Siemens"), Rudolph Technologies, Inc. ("Rudolph"), Synopsys, Inc., and Qualtera, (ii) semiconductor manufacturing software, such as Applied Materials, Inc., BISTel Inc., Invantest, Inc., Optimal+, Rudolph, and Siemens and, (iii) inline inspection, metrology and electrical test equipment providers, such as Applied Materials and Keysight Technologies, Inc. Further, we may compete with the products or offerings of these named companies or additional companies if we expand our offerings through acquisition or development. There may be other providers of commercial solutions for systematic IC yield and performance enhancement of which we are not aware. Further, some providers of yield management software or inspection equipment may seek to broaden their product offerings and compete with us. In addition, we believe that the demand for solutions that address the need for better integration between the silicon design and manufacturing processes may encourage direct competitors to enter into our market. For example, large integrated organizations, such as IDMs, electronic design automation software providers, IC design service companies or semiconductor equipment vendors, may expand their product offerings or decide to spin-off a business unit to compete with us. Other potential competitors include fabrication facilities that may decide to offer solutions competitive with ours as part of their value proposition to their customers. If these potential competitors change the pricing environment or are able to attract industry partners or customers faster than we can, we may not be able to grow and execute our strategy as quickly or at all.

Table of Contents

Measurement of our Gainshare performance incentives and other variable consideration requires data collection and customers' use of estimates in some cases, and is subject to customer agreement and later offset if actual data differ from customers' estimates, which can result in uncertainty and cause quarterly results to fluctuate.

We can only recognize revenue based on Gainshare performance incentives once we have reached agreement with our customers on their level of yield performance improvements and quarterly agreements are sometimes based on estimates of volume results each quarter. Measuring the amount of yield improvement is inherently complicated and dependent on our customers' internal processes, thus, there may be uncertainty as to some components of measurement. Also, some variable considerations can be highly susceptible to delays in the customer measurement of key factors such as reporting volumes results and level of yield. Therefore, we may have to estimate revenue related to contingent variable fees or usage-based or sales-based royalties prior to the receipt of performance reports, such as Gainshare acknowledgements, or other related information from customers. These estimates are subject judgment to evaluate whether it is probable that a significant revenue reversal will not occur in future periods, which could result in our recognition of less revenue than expected in any particular period and later offset when actual results become available.

Changes in the structure of our customer contracts, including the mix between fixed and variable revenue and the inclusion of acceptance criteria can adversely affect the amount and timing of our total revenues.

Our long-term success is largely dependent upon our ability to structure our future customer contracts in line with market condition. In addition, if we are unsuccessful in selling our software on a time-basis or the mix shifts toward more Gainshare, we may increase the variability or timing of recognition of our revenue, and therefore increase the risk that our total future revenues will be lower than expected and fluctuate significantly from period to period. Further, if we agree to contractual acceptance criteria in contracts and fail to meet them, the total revenues we receive under a contract could be delayed or decline.

We have experienced losses in the past and we may incur losses again in the future.

We have experienced losses in the past and we may incur losses again in the future if we are not able to adequately control our costs or if total revenues fail to meet expectations. In addition, virtually all of our quarterly operating expenses are fixed, so any shortfall in anticipated quarterly revenue could significantly reduce our operating results below expectations. Our accumulated deficit was $30.5 million as of December 31, 2018. We expect to continue to incur significant expenses in connection with:

- funding for research and development;

- expansion of our solution implementation teams;
- restructuring costs related to our cost control and management efforts;
- expansion of our sales and marketing efforts; and
- additional non-cash charges relating to amortization and stock-based compensation.

Our technologies could infringe the intellectual property rights of others, causing costly litigation and the loss of significant rights.

Significant litigation regarding intellectual property rights exists in the semiconductor industry. It is possible that a third party may claim that our technologies infringe their intellectual property rights or misappropriate their trade secrets. Any claim, even if without merit, could be time consuming to defend, result in costly litigation, or require us to enter into royalty or licensing agreements, which may not be available to us on acceptable terms, or at all. A successful claim of infringement against us in connection with the use of our technologies could adversely affect our business.

Table of Contents

Changes in effective tax rates could positively affect our earnings, thereby raising investors' expectations, while the final tax rates that are determined could be significantly higher, thereby lowering our earnings and causing us to miss investors' expectations, which could cause our stock price to drop, and we may not be able to use tax credits before their expiration if we fail to have sufficient future income.

We conduct our business globally and, as a result, are subject to taxation in the United States and foreign countries. Our future tax rates could be affected by numerous factors, including recent changes in tax laws or the interpretation of such tax laws and changes in accounting policies. Our filings are subject to reviews or audit by the Internal Revenue Service and state, local and foreign taxing authorities. We cannot be sure that any final determination in an audit would not be materially different than the treatment reflected in our historical income tax provisions and accruals. If additional taxes are assessed as a result of an audit, there could be a significant negative effect on our income tax provision and our operating results in the period or periods for which that determination is made. Any changes in our geographical earnings mix in various tax jurisdictions, including those resulting from transfer pricing adjustments, could materially increase our effective tax rate. Furthermore, we maintain deferred tax assets related to federal, foreign and certain state tax credits. Our ability to use these credits prior to their expiration is dependent upon having sufficient future income.

Uncertainties in the interpretation and application of the 2017 Tax Cuts and Jobs Act could materially affect our tax obligations and effective tax rate.

The 2017 Tax Cuts and Jobs Act (the Tax Act) was enacted on December 22, 2017, and significantly changes how the U.S. imposes income tax on multinational corporations. The U.S. Department of Treasury has broad authority to issue regulations and interpretative guidance that may significantly impact how we will apply the law and affect our results of operations in the period issued. The Tax Act requires complex computations not previously provided in U.S. tax law. As such, the application of accounting guidance for such items is currently uncertain. Further, compliance with the Tax Act and the accounting for such provisions require accumulation of information not previously required or regularly produced. As a result, we have provided a provisional estimate on the effect of the Tax Act in our financial statements. Accounting for certain of these provisions requires the exercise of significant judgment. As additional regulatory guidance is issued by the applicable taxing authorities, accounting treatment is clarified, we perform additional analysis on the application of the law, and we refine estimates in calculating the impact, our final analysis, which will be recorded in the period completed, may be different from our current provisional amounts, which could materially affect our tax obligations and effective tax rate.

Our business could be negatively affected as a result of actions of activist shareholders, and such activism could impact the trading value of our securities.

In recent years, shareholder activists have become involved in numerous public companies, including PDF Solutions. Shareholder activists frequently propose to involve themselves in the governance, strategic direction and operations of

the Company. Such proposals may disrupt our business, increase our expenses, and divert the attention of our Board of Directors and our management and employees, and any perceived uncertainties as to our future direction resulting from such a situation could result in the loss of potential business opportunities, interfere with our ability to execute our strategic plan be exploited by our competitors, cause concern to our current or potential customers, and make it more difficult to attract and retain qualified personnel and business partners, all of which could adversely affect our business. A proxy contest for the election of directors at our annual meeting could also require us to incur significant legal fees and proxy solicitation expenses. In addition, actions of activist shareholders may cause significant fluctuations in our stock price based on temporary or speculative market perceptions or other factors that do not necessarily reflect the underlying fundamentals and prospects of our business.

Our success depends upon our ability to effectively plan and manage our resources and restructure our business through rapidly fluctuating economic and market conditions, and such actions may have an adverse effect on our financial and operating results.

Our ability to successfully offer our products and services in a rapidly evolving market requires an effective planning, forecasting, and management process to enable us to effectively scale and adjust our business and business models in response to fluctuating market opportunities and conditions.

Table of Contents

From time to time, we have increased investment in our business by, for example, increasing headcount, acquiring companies, and increasing our investment in R&D, sales and marketing, and other parts of our business. Conversely, in 2018, we initiated a restructuring plan to reduce expenses and align its operations with evolving business needs. Some of our expenses related to such efforts are fixed costs that cannot be rapidly or easily adjusted in response to fluctuations in our business or numbers of employees. Rapid changes in the size, alignment or organization of our workforce, including sales account coverage, could adversely affect our ability to develop and deliver products and services as planned or impair our ability to realize our current or future business and financial objectives. Our ability to achieve the anticipated cost savings and other benefits from our restructuring initiatives within the expected time frame is subject to many estimates and assumptions, which are subject to significant economic, competitive and other uncertainties, some of which are beyond our control. If these estimates and assumptions are incorrect, if we are unsuccessful at implementing changes, or if other unforeseen events occur, our business and results of operations could be adversely affected.

Global economic conditions could materially adversely impact demand for our products and services.

Our operations and performance depend significantly on worldwide economic conditions. Uncertainty about global economic conditions could result in customers postponing purchases of our products and services in response to tighter credit, unemployment, negative financial news and/or declines in income or asset values and other macroeconomic factors, which could have a material negative effect on demand for our products and services and, accordingly, on our business, results of operations or financial condition. For example, any economic and political uncertainty caused by the United States tariffs imposed on goods from China, among other potential countries, and any corresponding tariffs from China or such other countries in response, may negatively impact demand and/or increase the cost for our products.

Item 1B. ***Unresolved Staff Comments***

None.

Item 2. ***Properties***

Our principal executive offices are located in Santa Clara, California, where we lease approximately 20,800 square feet of office space expiring in August 2028.

Additionally, as of December 31, 2018, our facilities include the following:

In Milpitas, California, we lease approximately 17,800 square feet of office and laboratory facilities expiring in January 2023.

In La Jolla, California, Pittsburgh, Pennsylvania and Richardson, Texas, we lease an aggregate of approximately 12,700 square feet of office space under various leases that expire at different times through October 2022.

In Shanghai, China, we lease approximately 18,400 square feet of office space expiring in November 2023.

In France, Germany, Italy, Japan, Korea, and Taiwan, we lease an aggregate of approximately 17,600 square feet of office space under various leases that expire at different times through April 2024.

We believe our existing and planned facilities are adequate to meet our current needs and are being utilized consistently with our past practice. We consistently look for opportunities to minimize costs related to office space through improved efficiencies and intend to make changes to leased facilities in the future as appropriate to reflect changes in worldwide operations and headcount.

Item 3. ***Legal Proceedings***

From time to time, we are subject to various claims and legal proceedings that arise in the ordinary course of business. We accrue for losses related to litigation when a potential loss is probable and the loss can be reasonably estimated in accordance with FASB requirements. As of December 31, 2018, we were not party to any material legal proceedings, thus no loss was probable and no amount was accrued.

Item 4. ***Mine Safety Disclosures***

None.

Table of Contents

PART II

Item 5. ***Market For Registrant's Common Equity, and Related Stockholder Matters and Issuer Purchases of Equity Securities***

Our common stock trades on the NASDAQ Global Market under the symbol "PDFS." As of March 1, 2019, we had approximately 32 stockholders of record. The number of stockholders of record does not include individuals whose stock is in nominee or "street name" accounts through brokers.

Dividend Policy

No cash dividends were declared or paid in 2018, 2017 or 2016. We currently intend to retain all available funds to finance future internal growth and product development and stock repurchases and therefore do not anticipate paying any cash dividends on our common stock for the foreseeable future.

Table of Contents

Stock Performance Graph

The following graph and tables compare the cumulative total stockholder return data for our stock since December 31, 2013 to the cumulative return over such period of (i) The NASDAQ Composite Index and (ii) the RDG Technology Composite Index. The graph assumes that $100 was invested on December 31, 2013. The graph and tables further assume that such amount was initially invested in the Common Stock of the Company at a per share price of $25.62 (closing price on December 31, 2013) and that of any dividends were reinvested. This performance graph and the corresponding tables are not “soliciting material,” are not deemed filed with the SEC and are not to be incorporated by reference in any filing by us under the Securities Act or the Exchange Act whether made before or after the date hereof and irrespective of any general incorporation language in any such filing. The stock price performance on the following graph and tables is not necessarily indicative of future stock price performance.

	12/13	12/14	12/15	12/16	12/17	12/18
PDF Solutions, Inc.	100.00	58.00	42.31	88.02	61.28	32.90
NASDAQ Composite Index	100.00	114.62	122.81	133.19	172.11	165.84
RDG Technology	100.00	117.81	122.23	138.28	189.14	190.13

Table of Contents

Purchases of Equity Securities by the Issuer and Affiliated Purchasers

On October 25, 2016, the Board of Directors adopted a program that was effective immediately to repurchase up to $25.0 million of the Company's common stock both on the open market and in privately negotiated transactions over the next two years. On May 29, 2018, the Board of Directors terminated that 2016 stock repurchase program, and adopted a new program to repurchase up to $25.0 million of the Company's common stock both on the open market and in privately negotiated transactions, from time to time, over the next two years. During the year ended December 31, 2018, the Company repurchased 437,000 shares for $5.2 million under the 2016 program and no shares were repurchased under the 2018 program. As of December 31, 2018, 1,279,000 shares had been repurchased at an average price of $14.59 per share under the 2016 program, for a total purchase of $18.7 million. Under the 2018 program, as of December 31, 2018, $25.0 million of the Company's common stock remained available for future repurchases.

There were no purchases made by or on behalf of the Company or any "affiliated purchaser" (as the term is defined in Rule 10b-18(a)(3) under the Exchange Act) of our common stock during the fourth quarter ended December 31, 2018.

Item 6. ***Selected Financial Data.***

The following selected consolidated financial information has been derived from the audited consolidated financial statements. The information set forth below is not necessarily indicative of results of future operations and should be read in conjunction with Item 7. "Management's Discussion and Analysis of Financial Condition and Results of Operations" and the consolidated financial statements and notes to those statements included therein and in Part IV of this Form 10-K.

	Year Ended December 31,				
	2018	2017	2016	2015	2014
	(In thousands, except per share amounts)				
Consolidated Statements of Operations Data:					
Revenues:					
Design-to-silicon-yield solutions	$60,081	$74,436	$77,162	$63,839	$52,769
Gainshare performance incentives	25,713	27,435	30,299	34,138	47,394
Total revenues	85,794	101,871	107,461	97,977	100,163
Cost of Design-to-silicon-yield solutions:					
Direct costs of Design-to-silicon-yield solutions	42,228	47,050	44,074	38,847	37,822
Amortization of acquired technology	575	471	374	176	—

Impairment of deferred costs	—	—	—	—	1,892
Total cost of Design-to-silicon-yield solutions	42,803	47,521	44,448	39,023	39,714
Gross profit	42,991	54,350	63,013	58,954	60,449
Operating expenses:					
Research and development	27,998	30,078	27,559	19,096	14,064
Selling, general and administrative	23,934	23,684	22,056	20,421	18,457
Amortization of other acquired intangible assets	435	398	432	196	31
Restructuring charges	576	—	—	—	57
Total operating expenses	52,943	54,160	50,047	39,713	32,609
Income (loss) from operations	(9,952)	190	12,966	19,241	27,840
Interest and other income (expense), net	493	(264)	(10)	181	119
Income (loss) before taxes	(9,459)	(74)	12,956	19,422	27,959
Income tax provision (benefit)	(1,743)	1,263	3,853	7,015	9,497
Net income (loss)	$(7,716)	$(1,337)	$9,103	$12,407	$18,462
Net income (loss) per share:					
Basic	$(0.24)	$(0.04)	$0.29	$0.39	$0.60
Diluted	$(0.24)	$(0.04)	$0.28	$0.39	$0.58
Weighted average common shares:					
Basic	32,169	32,038	31,373	31,424	30,743
Diluted	32,169	32,038	32,431	32,164	31,939

Table of Contents

	December 31,				
	2018	2017	2016	2015	2014
	(In thousands)				
Consolidated Balance Sheets Data:					
Cash and cash equivalents	$96,089	$101,267	$116,787	$126,158	$115,464
Working capital	137,693	144,263	151,757	148,795	147,032
Total assets	225,905	224,176	222,329	191,769	177,438
Long-term obligations	6,582	6,171	5,004	3,006	3,227
Total stockholders' equity	199,795	198,368	198,803	174,307	161,823

Item 7. ***Management's Discussion and Analysis of Financial Condition and Results of Operations***

Overview

We provide hardware, software and IP products to integrated circuit (or IC) vendors and their supply chain that are used to create, generate and collect differentiated data about their manufacturing process. This data can then be managed and analyzed by our software tools to optimize and improve the design, manufacturing and test operations processes used by these IC vendors to improve the yield, quality, and profitability of the products they develop. We package our solutions in various ways to meet our customers' specific business and budgetary needs, each of which provides us with various revenue streams. We receive a mix of license and service fees for use of our hardware and software and related installation, integration, training, and maintenance and support services, and, in some cases, a variable, performance-based fee.

Industry Trend

The logic foundry market at the leading edge nodes, such as 10nm and 7nm, is undergoing significant change. The leading foundry has increased market share as other foundries either suspended 7nm development or forecasted a later start of mass production. This trend will likely negatively impact our future Integrated Yield Ramp business on these nodes. For many foundries, utilization rates for 28nm fabs remain suppressed. We expect most logic foundries to invest in derivatives of older process nodes, such as 28nm and 20nm, to extract additional value as many of their customers will not move to advanced nodes due to either technological barriers or restrictive economics. Leading foundries that are continuing to invest in leading edge nodes are expected to continue to invest in new technologies such as memory, and packaging, multi-patterned and EUV lithography, as well as new innovations in process control and variability management. We expect China's investment in semiconductors to continue for at least the next few years. In order for these trends to provide opportunities for us to increase our business in process control and electrical

characterization, Chinese semiconductors manufacturers will need to increase their production volumes on advanced technology nodes.

Generally, the demand for consumer electronics and communications devices continues to drive technological innovation in the semiconductor industry as the need for products with greater performance, lower power consumption, reduced costs and smaller size continues to grow with each new product generation. In addition, advances in computing systems and mobile devices have fueled demand for higher capacity memory chips. To meet these demands, IC manufacturers and designers are constantly challenged to improve the overall performance of their ICs by designing and manufacturing ICs with more embedded applications to create greater functionality while lowering power and cost per transistor. As this trend continues, companies will continually be challenged to improve process capabilities to optimally produce ICs with minimal random and systematic yield loss, which is driven by the lack of compatibility between the design and its respective manufacturing process. We believe that these difficulties will create a greater need for products and services that address yield loss across the IC product life cycle.

The interest in Industry 4.0 is another trend that will drive increased innovation in semiconductor and electronics manufacturing. The ability to add cost-effective sensors to monitor every step of a manufacturing process and the continual reduction in the cost per terabyte of data storage is moving companies that manufacture products directly or through a supply chain to collect as much manufacturing and test data as possible in order to analyze it and optimize every aspect of manufacturing and test operations to lower costs and improve product quality and profitability. Many software companies, both large and small, are developing advanced analytics solutions that employ both artificial intelligence and machine learning algorithms to identify and optimize these inefficiencies in the manufacturing supply chain. We believe that this trend will continue for the next few years, and the challenges involved in finding new insights will create opportunities for companies that have a combination of advanced analytics capabilities, domain-specific IP, and professional services.

Table of Contents

Financial Highlights

The following were our financial highlights for the year ended December 31, 2018:

- Total revenues were $85.8 million, which was a decrease of $16.1 million, or 16%, compared to the year ended December 31, 2017. Design-to-silicon-yield solutions revenue was $60.1 million, which was a decrease of $14.4 million, or 19%, compared to the year ended December 31, 2017. The decrease in Design-to-silicon-yield solutions revenue was primarily related to lower hours incurred across multiple contracts and customers. Additionally, a major customer suspended the development and production of its 7nm technology node, which impacted the Company's Design-to-silicon-yield solutions revenue in the fourth quarter of 2018. These decreases were partially offset by increases in revenue from Exensio big data and DFI solutions driven by strong business activity in the year. Gainshare performance incentives revenue was $25.7 million, a decrease of $1.7 million, or 6%, compared to the year ended December 31, 2017. The decrease in Gainshare performance incentives revenue was primarily due to lower incentives revenue from the 28nm technology nodes, partially offset by higher incentives revenue from the 14nm technology nodes from two of our major customers. Gross margin was 50%, compared to 53% for the year ended December 31, 2017.

- Net loss was $7.7 million, compared to $1.3 million for the year ended December 31, 2017. The increase in net loss was attributable to 16% lower revenue for the year ended December 31, 2018, partially offset by a $5.9 million decrease in cost of sales and operating expenses that was primarily related to decrease in personnel-related cost driven by lower headcount and a decrease in stock-based compensation expense, and a $3.0 million decrease in income tax provision due primarily to the impact of the recently enacted U.S. Tax Cuts and Jobs Act, which provide for, among other things, a decrease in the maximum federal tax rate from 35% to 21% and higher pre-tax operating loss, partially offset by lower excess tax benefits related to employee stock compensation.

- Net loss per basic and diluted share was $0.24, which was an increase in net loss of $0.20 per basic and diluted share compared to net loss per basic and diluted share of $0.04 for the year ended December 31, 2017.

- Cash, cash equivalents and investments decreased $5.2 million to $96.1 million at December 31, 2018, from $101.3 million at December 31, 2017, primarily due to cash used in investing activities related to property and equipment purchased for the development of our DFI solution, new office headquarters and expansion of our research and development laboratory and clean room, and cash used in financing activities primarily due to repurchases of our common stock, partially offset by cash generated from operating activities during the year.

Critical Accounting Estimates

The preparation of financial statements and related disclosures in conformity with accounting principles generally accepted in the United States requires us to make judgments, assumptions, and estimates that affect the amounts reported in the Consolidated Financial Statements and accompanying notes. Note 1 of Notes to Consolidated Financial

Statements describes the significant accounting policies and methods used in the preparation of the Consolidated Financial Statements. We consider the accounting policies described below to be our critical accounting policies. These critical accounting policies are impacted significantly by judgments, assumptions, and estimates used in the preparation of the Consolidated Financial Statements and actual results could differ materially from the amounts reported based on these policies.

Table of Contents

Revenue Recognition

We derive revenues from two sources: Design-to-silicon-yield Solutions and Gainshare performance incentives.

Design-to-silicon-yield solutions — We recognize revenue for each element of Design-to-silicon-yield solutions as follows:

We generate a significant portion of our Design-to-silicon-yield solutions revenue from fixed-price solution implementation service contracts delivered over a specific period of time. Revenue under project–based contracts for solution implementation services is recognized as services are performed using a percentage of completion method based on costs or labor-hours inputs, whichever is the most appropriate measure of the progress towards completion of the contract. Due to the nature of the work performed in these arrangements, the estimation of costs or hours at completion is complex, subject to many variables and requires significant judgment. Key factors reviewed by us to estimate costs to complete each contract are future labor and product costs and expected productivity efficiencies. If circumstances arise that change the original estimates of revenues, costs, or the extent of progress toward completion, revisions to the estimates are made. These revisions may result in increases or decreases in estimated revenues or costs. Losses on fixed-price solution implementation contracts are recognized in the period when they become probable. Revisions in profit estimates are reflected in the period in which the conditions that require the revisions become known and can be estimated (cumulative catch-up method).

On occasion, we include our products as a component of our fixed-price service contracts. In such instances, we determine whether the services performed and products included are distinct. In most cases, the arrangement is a single performance obligation and therefore, follows the pattern of transfer as the service is provided. We apply a measure of progress (typically hours-to-hours or cost