

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, 2023

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
*(State or other jurisdiction of
Incorporation or organization)*

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

25-1701361
*(I.R.S. Employer
Identification No.)*

95050
(Zip Code)

(408) 280-7900

(Registrant's telephone number, including area code)

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

Title of each class	Trading Symbol(s)	Name of each exchange on which registered
Common Stock, \$0.00015 par value	PDFS	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

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, indicate 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 has filed a report on and attestation to its management's assessment of the effectiveness of its internal control over financial reporting under Section 404(b) of the Sarbanes-Oxley Act (15 U.S.C. 7262(b)) by the registered public accounting firm that prepared or issued its audit report.

If securities are registered pursuant to Section 12(b) of the Act, indicate by check mark whether the financial statements of the registrant included in the filing reflect the correction of an error to previously issued financial statements.

Indicate by check mark whether any of those error corrections are restatements that required a recovery analysis of incentive-based compensation received by any of the registrant's executive officers during the relevant recovery period pursuant to §240.10D-1 (b).

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 \$1.3 billion 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 38,581,819 shares of the Registrant's Common Stock outstanding as of February 23, 2024.

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, 2023.

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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; the impact of rising global inflation and increased interest rates; expectations regarding recent and future acquisitions; current semiconductor industry trends; expectations of the success and market acceptance of our intellectual property and our solutions; the continuing impact of macroeconomic conditions on the semiconductor industry and our business; supply chain disruptions; possible impacts from the evolving trade regulatory environment and geopolitical tensions; 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,” “projected,” “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, Inc.

PART I

Item 1. *Business*

We provide comprehensive data solutions designed to empower organizations across the semiconductor and electronics ecosystems to improve the yield and quality of their products and operational efficiency for increased profitability. We derive revenues from two sources, Analytics and Integrated Yield Ramp. Our offerings contribute to Analytics revenue through contract fees for on-premise software and hardware system licenses, software-as-a-service (“SaaS”), and other professional services. Certain of our Characterization services engagements contribute to Integrated Yield Ramp revenue through contract fees and a value-based, variable fee or royalty, which we call Gainshare. We are headquartered in Santa Clara, California and also operate worldwide with offices in Canada, China, France, Germany, Italy, Japan, South Korea, and Taiwan.

Business Overview

Our customers include Fortune 500 companies across the semiconductor and electronics ecosystem. These companies use our products and services to achieve various goals depending on whether they are integrated device manufacturers (“IDMs”), fabless semiconductor companies, foundries, equipment manufacturers, electronics manufacturing suppliers (“EMS”), original device manufacturers (“ODMs”), outsourced semiconductor assembly and test (“OSATs”), or system houses. 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. Higher yields in less time can also mean less total raw materials and process runs, which help lower customers’ total cost and minimize environmental impact. Also, equipment manufacturers and factories use our connectivity products to implement evolving industry standards for their equipment or operations, respectively, with required quality and stability. By way of further example, our IDM 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 designs to meet performance requirements with fewer iterations and faster time-to-market. For final example, our foundry and OSAT customers use the AI and ML applications of our software to optimize for process control, assembly, and/or test.

Our mission is to provide innovative solutions to create, access, and organize data to enable analysis and control for semiconductor and electronics companies to achieve better time-to-market, yields, quality, and operational efficiencies. Our strategy to achieve this is as follows:

- *Offer a Common, Flexible Platform for a Broad Group of Customers Across the Supply Chain.* As semiconductor and electronics products are made with the efforts of equipment manufacturers, front-end foundries, chip and system designers, design automation, intellectual property (“IP”) providers, and OSATs, there is a need to analyze data across this whole chain to optimize yields, operational efficiencies, time to market, quality, and reliability. Our comprehensive platform is designed based on industry standards and integrated with leading solutions providers to enable these different participants to analyze the relevant end-to-end data in near real-time, with cloud or on-premise data stores from 10s to 100s of terabytes (“TBs”) and flexible configurations for IDM, foundry, fabless, and OSAT specific needs. Our ML solutions combine professional services with our Exensio software to further enable our customers to push their analytics “to the edge” of their global supply chains and shift the analysis and decision-making processes closer to where their data is being generated. We believe enabling edge analytics will further increase our customers’ ability to improve product yield, quality, performance, and profitability, and therefore, should drive the market for our products and services.
- *Drive Tool-Level Software Installations to Create an Infrastructure of Connected Equipment and Enable Smart Factories.* We believe that driving installation of our Exensio and Cimatrix software products at the tool level will help provide an infrastructure of connected equipment and help to enable smart factories. Our Cimatrix products are based on open standards for equipment control and connectivity to equipment manufacturers and factories, which we believe will be more in demand in the smart manufacturing era. Further, we believe that the

benefits from integration between analytics on equipment, the factory, and in the cloud will provide synergies with our existing end-to-end analytics offerings.

- *Create Differentiated Data Sources for Better Analytics.* Historically, companies have only used data that was generated from their manufacturing and test process to drive improvements. We offer unique IP (such as Characterization Vehicle® test chips, also branded CV® test chips) that is not part of an integrated circuit’s (“IC”) functionality, but significantly improves the manufacturing process by improving yield learning and reducing time to market. Also, our Design-for-Inspection™ system (also branded DFI™ system) identifies blockers that impact product yield and quality up to months earlier than any other hardware- or software-based methodology from proprietary e-beam measurement of product layout or provided on-chip instrumentation. We believe that in the More-than-Moore (“MtM”) era, the differentiated data we provide can play an important role in enabling our customers to bring new products to market faster and with higher quality and performance, and, ultimately, more profitability.
- *Collaborate with Other Industry Leaders to Bring Additional Unique Data to Our Platform and Enable New and Differentiated Applications.* We believe that the value we bring to semiconductor manufacturing can be leveraged with additional data and through differentiated applications. For example, in 2023, we started offering an enterprise application integration module called Sapience™ Manufacturing Hub, which is designed to collect and unify data from enterprise applications, such as manufacturing execution systems (“MES”), enterprise resource planning systems (“ERP”) like SAP S/4HANA®, and our Exensio software, and make such data available through a central interface. Also in 2023, working with Siemens Digital Industries Software, we started offering two new Exensio modules, Exensio AIM Scan Analytics and Exensio AIM Scan Systematics Diagnostics, which are designed to enable diagnostic accuracy and efficiency of fail mode to help our customers that also use Siemens’s Tessent software determine the electrical and physical failing locations for product and process improvements. Building relationships with other industry leaders is intended to provide more ways for mutual customers to leverage their process and product data as part of their Industry 4.0 initiatives. Differentiated applications that make use of this shared data are designed to provide unique insights to help customers achieve sustained profitability in their manufacturing.

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 under the symbol “PDFS”.

From 2000 through 2009, we expanded our technology footprint and our operations in various countries through acquisitions. From 2009 to 2019, 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 royalties. In 2013, we leveraged our extensive experience in yield simulation software and CV® test chip development and started research and development on an e-beam solution for non-contact, inline electrical inspection and process control for wafer inspection.

In a parallel effort, starting in 2014, we re-architected our point-solution software tools into a new generation, highly-integrated data analytics Exensio software, which resulted in accelerated growth in revenues from software through 2019. Starting in 2020, after our acquisition of Cimatrix Incorporated (“Cimatrix”), we began providing software products based on open standards for equipment control and connectivity to equipment manufacturers and factories.

We released our first eProbe tool in 2015, the second generation in 2019, and the third generation in late 2022. The improvements in the third generation included:

- higher resolution and improved beam vector targeting, enabling use for leading-edge, middle-of-line applications;
- higher throughput; and
- better manufacturability and repeatable column performance.

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 Internet of Things – which utilize mature process nodes and require 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 field-programmable gate arrays (“FPGA”) 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, among other things, 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.

Technology and Intellectual Property Protection

Our success is largely dependent upon our proprietary software. We believe the creative skills and technological ability of our personnel, product enhancements, and new product development are necessary to maintaining our position as a leading provider. We rely primarily on trade secret rights, copyright laws, and nondisclosure and other contractual agreements to protect our software.

In addition, our success is dependent on various inventions we have made and we seek to protect certain of our IP under patent laws. As of December 31, 2023, we held 115 U.S. patents, with expiration dates on issued patents ranging from 2024 through 2042. We intend to prepare additional patent applications when we feel it is beneficial. Some of the technology we protect by patent includes elements of our CV and DFI systems and inventions related to AI/ML.

We protect our trademarks with registration of marks, including Characterization Vehicle, Cimetrix, CV, eProbe, Exensio, pdfAsTest, PDF Solutions, and the PDF Solutions and Cimetrix logos. We have common law rights to additional trademarks, including ALPS, DFI, DirectProbe, DirectScan, Fire, and Sapience.

We enter into confidentiality and inventions assignment agreements with our employees and confidentiality and license agreements with our customers and the various parties we partner with to resell, distribute, and, in some cases, integrate our products. Further, we limit access to and distribution of our software, documentation and other proprietary information.

Third parties could in any case develop competing technologies that include similar functionality or features, or otherwise are substantially equivalent or superior to our technologies. In addition, effective patent, copyright, trademark and trade secret protection may be unavailable or limited in certain foreign countries where we operate. Our business could suffer significantly if we fail to protect our proprietary technology.

In addition, 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 systems, our engineers create designs of experiments (“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 strive to continually enhance our core technologies through the codification of knowledge that we gain in the use of our products and delivery of services.

Products and Services

Products

The primary software products and software and hardware systems of our platform include the following:

Exensio Software. Our Exensio software products address the big data manufacturing challenge of today's advanced process nodes and highly integrated products, by providing a common environment throughout the supply chain for different data types, including 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. Exensio products are designed to enable 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. By integrating silos of data and applying AI and ML, Exensio products resolve the limitation of local optimization and provide better visibility across the entire production process, reducing the time it takes to make critical decisions that can drive higher product yield, quality and reliability. Our collaboration with strategic partners is intended to also integrate data from those partners' products to make it available in Exensio and also to develop new applications to inter-operate with those products and enhance the value to mutual customers. For example, in 2023, we started offering Sapience™ Manufacturing Hub, which provides a single, common connectivity platform between enterprise applications, such as MES, ERP, and our Exensio software. Sapience Manufacturing Hub enables advanced applications – including those for top management – that benefit from more real-time and detailed insight into manufacturing. Our Exensio Foundry Product Costing module, which leverages Sapience Manufacturing Hub, provides more accurate insight into the gap between plan costs and actual costs, enabling actions to improve profitability. Exensio Foundry Product Costing module integrates with SAP S4/HANA due to our collaboration with SAP SE to enable this capability.

Exensio software is available as either an on-premise license or SaaS and is offered in four main, separately-offered Exensio products targeting the needs of the customer's business model: Exensio IDM, Exensio Fables, Exensio Foundry, and Exensio OSAT. Each of these products are comprised of two or more modules to provide specific capabilities to address a particular type of company's needs and requirements; however, there are common features, functionality, and purpose across some of the key modules as follows:

- *Manufacturing Analytics* – This module uses our proprietary database schema to store collected data in a common, unified environment with a consistent view. For example, product engineers use it to identify and analyze production yield, performance, reliability and other issues. Elements of this module are designed to handle very large and complex data sets that are commonplace in the semiconductor industry. To support the multi-dimensional product requirements of our customers, the powerful, interactive visualization and analysis capabilities in this product are highly flexible and user-configurable.
- *Process Control* – This module provides failure detection and classification (“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 designed to rapidly identify sources of process variations and manufacturing excursions. When used together with Manufacturing Analytics and related modules, the accretive data mining and correlation capabilities are designed to enable identification of tool level sources of yield loss and process variation and enable predictive and proactive optimization decisions for process control, process adjustments, preventive maintenance scheduling, tool corrective actions, wafer dispatching, and wafer level and final test to impact end of line product yield, performance, and reliability.
- *Test Operations* – This module provides comprehensive data collection and analysis capabilities for data generated during manufacturing test operations designed to optimize test operations management overall, including improving test productivity, performing part average test, supporting test floor operations, and implementing adaptive test. Test Operations is also designed to provide predictive insights based on proprietary analytics during test, assembly and packaging to maximize the efficiency of test operations, productivity improvements and yield reclamation.

- *Assembly Operations* – This module provides the capability to link assembly and packaging data with other product lifecycle data, including fabrication and characterization data, across the product life cycle. Data sources could include manufacturing, wafer acceptance test, wafer sort, test and assembly, final test, and field use. The proprietary data linkage enabled by Assembly Operations is also designed to enable device manufacturers to maintain full traceability of their finished products back to the source wafer without the need for Electronic Chip IDs (“ECIDs”). This capability is becoming an essential requirement for safety-critical market segments such as automotive and military-aerospace.

Design-for-Inspection System. Our DFI™ system, which we have provided under a lease arrangement to some customers, leverages our production-proven design and analysis infrastructure and is designed to enable customers to achieve non-contact, inline electrical inspection of either our proprietary on-chip instruments or their product chip layout structures. The electrical measurements augment and enhance existing inline defect inspection and metrology methods for more effective process control and inline, direct inspection of product wafers. The DirectScan application of the DFI system includes our proprietary Exensio Characterization and Fire™ layout analysis software and the eProbe® non-contact e-beam tool. The original application of the DFI system also included our on-chip instruments. These elements are described as follows:

- *Proprietary Software* – Our Fire module is designed to analyze IC product layout features to help determine which parts of the product layout to inspect. Our Exensio Characterization module is designed to analyze the billions of measurements collected using the eProbe tool. As part of the system offering, we generally use the Characterization module to provide our customers analysis services, a summary of our findings, and recommendations.
- *DFI On-Chip Instruments* – Our on-chip measurement instruments are tuned to capture key features of our customers’ product layouts, including those identified using the Fire module. As part of the system offering, we generally provide design services to create these instruments. These DFI instruments 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 for contactless measurement of the electrical response of the DFI instruments and suitable product layout structures. As part of the system offering, we generally provide tool support services to customers to operate this tool. The third generation tool includes advances in accuracy and sensitivity and, in addition to enabling DFI on-chip instruments to be used for inline control for leading-edge semiconductor process nodes, is designed to enable customers to see defects in product wafers inline within acceptable queue time and much higher throughput.

Characterization Vehicle System (also branded as our CV™ System). Our CV system is a combination of CV test chips, hardware to test such products, software to analyze the test results, and related services. This system is 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. This system includes physical IP in the form of test structures and DOEs that are tuned to our customers’ product and/or process specifics, tester hardware, data analysis, and training. The primary software and hardware products included in the CV system are as follows:

- *CV™ Test Chips* – Our proprietary test chips are designed by our professional engineers using our proprietary Fire software. These test chips are run through a customer’s manufacturing process, with intentional process modifications, to provide unique, differentiated data 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. Types of CV test chips include:
 - Our full-reticle and shared-reticle CV test chips are designed to provide a fast-learning cycle and are fully integrated with third-party failure analysis and inspection tools for a complete diagnosis to

understand root causes. Our full-reticle CV test chips use a shortened process flow to provide a faster learning cycle for specific process modules.

- Our Scribe CV test chips are inserted directly on customers' product wafers to collect data about critical layers.
- Our DirectProbe™ CV test chips are designed to enable ultra-fast yield learning for new product designs by allowing our customers to measure components of actual product layout and identify yield issues.
- *pdFasTest® Electrical Tester* – Our proprietary electrical test hardware is optimized to quickly test our CV test chips, enabling fast defect and parametric characterization of manufacturing processes. As part of the system offering, we provide test programs for each CV test chip that are tuned to the customer's process. This automated system provides parallel functional testing, thus minimizing the time required to perform millions of electrical measurements to test our CV test chips. We provide services to analyze the unique, differentiated data output of this tester using the Exensio Characterization software to provide actionable insights to our customers.
- *Exensio Characterization software* – This module, which is designed to integrate seamlessly with the rest of the Exensio software, collects the data generated from our CV test products, generating models of the performance effects of process variations on these design building blocks. As part of the system offering, we also offer analysis services, if the customer elects not to do such analysis itself.

Cimetrix® Software Products. Our Cimetrix software products enable equipment manufacturers in the semiconductor and electronics industries to provide standard interfaces on their products for efficient equipment communication, control, and data collection. Numerous industry standards have been established for equipment connectivity and control, including the SEMI (Semiconductor Equipment and Materials International) defined SECS (SEMI Equipment Communication Standard), GEM (Generic Equipment Model), GEM300, and EDA (equipment data acquisition) standards. Our Cimetrix products are designed to fully support these industry standards to enable equipment manufacturers to implement robust, turnkey support for these connectivity and control standards without needing to invest engineering resources to develop their own interfaces to these standards. Factories that purchase manufacturing equipment enabled with Cimetrix-supported interfaces, benefit from consistent and robust implementations of industry standards, enabling faster and more efficient implementation of smart manufacturing initiatives that depend on the collection and analysis of manufacturing and product data. Cimetrix products are sold via perpetual licenses and typically sold as part of a software development kit (“SDK”) that helps equipment manufacturers implement them quickly. We charge a one-time fee per equipment product type for the SDK license and a one-time fee for each piece of equipment shipped that includes the Cimetrix runtime license.

- *Equipment Factory Connectivity* – Our products for equipment factory connectivity primarily include the following:
 - *Cimetrix CIMConnect™* is a SEMI SECS/GEM interface to the factory host for automated control and data collection. The Cimetrix CIMConnect module supports multiple-host interfaces simultaneously, which allows customers to support legacy, custom, and GEM interfaces. Cimetrix CIMConnect is used in semiconductor wafer fabrication, semiconductor back-end (test, assembly, and packaging), PV, HB-LED, disk drive, flat panel displays, printed circuit boards and other electronics manufacturing. In addition to enabling the implementation of the SEMI SECS/GEM standards E4, E5, E30, E37, E172, and E173, Cimetrix CIMConnect also supports SEMI PV2 (PVECI), A3 (PCBECI), and HB4 (HB-LED ECI) standards.
 - *Cimetrix CIM300™* is a GEM interface for 300mm equipment using SEMI standards, including E39, E40, E87, E90, E94, E116, E148, and E157. These SEMI standards allow for the full automation required in manufacturing 300mm wafers. Cimetrix CIM300 manages the interdependencies between the standards and simplifies complex scenarios for easy implementation of the standards. These GEM300 standards are required for full automation in manufacturing of 300mm wafers. Cimetrix

CIM300 works with Cimatrix CIMConnect to implement the GEM300 and the original GEM suite of standards.

- *Cimatrix CIMPortal™ Plus* is an interface for EDA, also known as Interface A. The EDA standards are E120, E125, E132, E134, E138, E147, and E164. Cimatrix CIMPortal Plus implements the EDA standards in a flexible architecture that collects data from multiple sources and routes the data to multiple clients simultaneously. Factories can use the data gathered through EDA interfaces for FDC, run-to-run advanced process control, equipment health monitoring, chamber/tool matching, predictive maintenance, virtual metrology, diagnostics, and many other equipment-related analytical applications.
- *Equipment Factory Connectivity Testing* – We provide the following products for testing the interfaces developed using our equipment factory connectivity products: Cimatrix EquipmentTest™, for testing and validating compliance with the GEM and GEM300 standards, Cimatrix EDATester™, for testing and validating compliance with the EDA/Interface A standards, and performance testing of the interface, and Cimatrix ECCE Plus™ for quick testing of the EDA/Interface A interface.
- *Equipment Control* – Our equipment control product is the Cimatrix CIMControlFramework™ (“Cimatrix CCF”) software, which includes components for supervisory control, material handling, operator interface, platform control, and factory automation requirements, to allow equipment manufacturers to meet the requirements of fabrication facilities. Developers can leverage framework components through configuration and extension or customize the framework when unique requirements exist. Cimatrix CCF is designed to allow data generated at any point on the equipment to be quickly and easily accessed by other modules or external applications. Cimatrix CIMConnect, Cimatrix CIM300, and Cimatrix CIMPortal Plus are integrated with Cimatrix CCF to support the SEMI GEM, GEM300, and EDA/Interface A standards.

Services

Our services are almost always sold together with, or to support, our products and include the following:

Software-as-a-Service – We provide services to make our Exensio software available to our customers via the Internet, generally hosted by third-party providers. SaaS is considered part of cloud computing since the software is hosted on the Internet, or the “cloud.” Since our SaaS applications are accessed from a remote server rather than installed on individual machines, it is easier to maintain. For example, when the remote software is updated, the customer’s interface is also updated for all users. Cloud computing is designed to eliminate incompatibilities between different software versions and allow us to make incremental updates without requiring software downloads. Additionally, our customers can save data to a central online location, which is designed to allow increased project collaboration. As part of these services, we also typically provide hosted management services for the software and the customer’s data stored in our cloud. These services include environment set-up and configuration, system health monitoring, data integration maintenance, integration monitoring, system updates, security, and data upload/download, and license administration.

Software Related Services – We provide software maintenance and support (“M&S”), data management services, various value-added services (“VAS”) to install, configure, or create analysis templates, and other professional services to achieve customers’ specific outcomes using our software. We call this last type of services our solutions offering and, in these cases, we tailor the use of one or more Exensio products to achieve a desired result. For example, our AIM YieldAware™ FDC solution offering is designed to identify the process control variables that have the greatest impact on product yield through professional services that analyze the data from both Exensio Process Control and elements of Exensio Manufacturing Analytics and make recommendations for the customer to implement. VAS are provided by our professional service personnel with expertise that enhances and complements the engineering teams at our customers. For example, VAS includes our data cleaning and monitoring services. One requirement of big data analytics is to have clean, harmonized data to analyze. This service offering outsources the data wrangling and management effort to free the customer to focus their efforts on analysis, which has a greater ROI to the company than data management.

Characterization Services – These services are designed to characterize key product and/or process elements, primarily into CV test structures or DFI on-chip measurement instruments, and typically do not include performance

incentives based on the customers' yield achievement. We provide these services, typically together with all elements of our CV system, to foundry customers in connection with new process technology development and/or yield ramp. In Characterization engagements, we generally provide the analysis of our CV test chips and provide summary findings and recommendations to the customer. Characterization engagements can include DFI systems.

Customers

Our existing customers include foundries, IDMs, fabless semiconductor design companies, OSATs, equipment manufacturers, EMS, and ODMs, including those that embed and distribute our Assembly Operations modules 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. We often have multiple contracts with a single customer or customer group, with no interdependent performance obligations. In general, our customer contracts are non-cancellable.

One customer accounted for 35% of our revenues for 2023, two customers accounted for 41% of our revenues for 2022 and two customers accounted for 27% of our revenues for 2021. No other customers accounted for 10% or more of our revenues in 2023, 2022 and 2021. Also, two customers accounted for 50% of our gross accounts receivable as of December 31, 2023, and three customers accounted for 53% of our gross accounts receivable as of December 31, 2022. We generally do not require collateral or other security to support accounts receivable. 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 44%, 50% and 55% of our total revenues for 2023, 2022 and 2021, respectively. We base these calculations on the geographic location of where the work is performed or where the customer is located. Revenues from customers by geographic area based on the location of the customers' work sites for the 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.

Sales and Marketing

Our sales strategy is primarily to pursue targeted accounts through a combination of our direct sales force, our service teams, and strategic alliances. After we are engaged by a customer and early in the services process, our engineers seek to establish relationships in the organization and gain an understanding of our customers' business issues. Our direct sales and service teams combine their efforts to deepen our customer relationships by expanding our penetration across customers' products, processes, and technologies. This close working relationship with each customer has the added benefit of helping us to 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.

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 for our comprehensive platform, including our Exensio software, Cimetrix connectivity and control products, and DFI and CV systems, as well as other software products and enhancements to our existing solutions, such as field applications for DFI

and CV and new applications targeted to inter-operate with strategic partner products. 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 standards, 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 certain technical areas. Our training also extends to focusing on ways to enhance customer service skills. Although it fluctuates, we can have up to one quarter of our research and development engineers assigned to one or more projects, 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 IC companies benefit from a combination of 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. As a result, we face competition from three primary groups: internal customer development or design programs, equipment solutions providers, and providers of analytical and design software. We face indirect competition from internal groups at IC companies that offer tools with varying degrees of optimization 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 addition, companies providing general ML and analytics software may focus on semiconductor companies and compete with us. In each of the market segments we compete in, we face competition from established and potential competitors, some of whom may have greater financial, research, engineering, manufacturing and marketing resources than we have.

We currently face indirect competition from the internal groups at IC companies and direct competition from providers of (i) yield management and/or prediction systems, such as KLA Corporation (“KLA”), Siemens AG (“Siemens”), Onto Innovation, Inc. (“Onto”), and Synopsys, Inc. (“Synopsys”); (ii) semiconductor manufacturing software, such as Applied Materials, Inc (“Applied Materials”), Synopsys, Invantest, Inc., Emerson Electric Co., Onto, and Siemens; (iii) inline inspection, metrology and electrical test equipment providers, such as ASML Holding N.V. (“ASML”), Applied Materials, KLA, and Keysight Technologies, Inc.; and, (iv) connectivity software or integration products/services supporting factory equipment connectivity or control needs of customers, such as PEER Group, Inc., Kontron AIS, GmbH, Yokogawa Electric Corp., Advantest, and Kornic Automation Co. Ltd. There may be other providers of competitive commercial solutions of which we are not aware, and we may compete with the products or offerings of these named companies or additional companies if we expand our offerings through acquisitions or development. For example, since our acquisition of Cimetrix in late 2020, we now face competition in the products/services supporting the connectivity, control and integration of factory equipment. The demand for solutions that address the need for better integration between the silicon design and manufacturing processes may encourage direct competitors to enter our market. For example, in 2020, two of our competitors were acquired by larger entities, Synopsys acquired Qualtera and NI, Inc. acquired Optimal+, and each has increased marketing or pricing competition with us. For example, in 2023, Emerson Electric Co. acquired NI, Inc. This competition in our market may intensify in the future, which could lead to increased pricing pressure, negatively impacting our revenues, and slow our ability to grow or execute our strategy. Also, 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 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. See the discussions in “Risk Factors” under Item 1A for more information about risks associated with our competition.

Human Capital Management

We believe that our future success will depend, in part, on our continued ability to hire and retain qualified management, sales, and technical employees. Consequently, we seek to engage in sound ethical and organizational governance, promote business ethics and integrity, and embrace equality, diversity, and inclusion throughout our organization.

As of December 31, 2023, we had 493 employees worldwide, including 171 field application engineers and consultants, 155 in research and development, 106 in sales and marketing, and 61 in general and administrative functions. Of these employees, 285 are located in the United States, 172 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.

Our commitment to human capital management is embedded in our governance structure

At the Board level, our Compensation and Human Capital Management Committee is tasked with oversight of the development, implementation and effectiveness of our policies and strategies relating to human capital management, including strategies regarding recruiting, selection, career development and progression, and diversity and employment practices. Further, our Nominating and Corporate Governance Committee is tasked with primary oversight for governance and ESG issues.

Talent Development

We are committed to the development and growth of our employees because we believe this is crucial for our long-term success. This includes offering training, mentorship, and other development opportunities to further enhance the talent we have today, but also entails having the right skill sets for our future.

To this end, we are working to implement a planned set of actions around increasing formal programs to achieve these goals. 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 certain technical areas.

We also fund attendance at continuing education courses, symposia, and participation in professional organizations.

Employee Engagement

Employee engagement is crucial for the overall health of the organization. In 2023, we conducted a survey of all our employees to assess overall employee engagement.

In addition to our efforts to address employee engagement, we are committed to supporting our employees and creating an engaged workforce by prioritizing the items below:

- personal growth through training and development;
- recognizing and rewarding our people for their commitment to our values and our organization;
- flexible work locations and schedules; and
- providing a sense of organizational community by hosting online as well as in-person events where our people can gather and connect.

Health and Safety

We are committed to ensuring that proper working conditions exist for the safety of our employees, such as developing, implementing, and improving health and safety systems and conditions, and providing appropriate preparation, education, reporting, and controls.

Diversity, Equity, and Inclusion

We work to ensure that our business practices support diversity and inclusion to build an innovative workforce and to strive toward having our organization reflect the complexion of our customers and suppliers. In February 2024, after considering the recommendation of the Nominating and Corporate Governance Committee, the Compensation and Human Capital Management Committee approved, and then our Board adopted, a Human Rights policy and a Diversity, Equity, and Inclusion (“DEI”) Policy to better implement our core values and relevant standards into our governance structure.

We are strengthening our diversity and inclusion programs with actions around organizational training, on-going education and focus on our company values, and a revitalized recruitment strategy.

We value a range of diverse perspectives with reference to our business model and specific needs, including, but not limited to, gender, age, race, language, cultural background, educational background, industry experience, professional experience, and veteran and active armed service status or other similar characteristics.

Information about our Executive Officers

The following table and notes set forth information about our current executive officers as of the date of this Form 10-K.

Name	Age	Position
John K. Kibarian, Ph.D.	59	President, Chief Executive Officer, and Director
Adnan Raza	51	Executive Vice President, Finance and Chief Financial Officer
Kimon W. Michaels, Ph.D.	57	Executive Vice President, Products and Solutions and Director
Andrzej Strojwas, Ph.D.	71	Chief Technology Officer

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 on our Board of Directors 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.

Adnan Raza, joined in January 2020 as Executive Vice President, Finance, and was appointed Chief Financial Officer effective in March 2020. Prior to joining the Company, Mr. Raza served as an independent strategy consultant for private and public companies from July 2019 to January 2020. Prior to that, Mr. Raza served in various roles at Synaptics Inc., a developer of human interface technologies, including as Senior Vice President of Corporate Development from August 2017 to June 2019 and Vice President of Corporate Development from February 2015 to August 2017. Prior roles include technology investment banking at Goldman, Sachs & Co. and UBS Investment Bank, strategic advising at Blackreef Capital, engineering and marketing at Azanda Network Devices, and engineering at Lucent Technologies. Mr. Raza also served as a Board Member at FIDO Alliance, an alliance of leading technology companies to enhance user security and authentication. Mr. Raza holds an M.B.A. from The Wharton School at the University of Pennsylvania, a M. Eng. in Electrical Engineering from Cornell University, and a B.S. in Electrical Engineering from Valparaiso University.

Kimon W. Michaels, Ph.D., one of our founders, has served as Vice President, Products and Solutions since July 2010 and was designated as 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 served as a director on our Board of Directors since November 1995. From March 1993 through December 2005, he served in various vice presidential capacities. He also served as Chief Financial Officer of the Company from November 1995 to July 1998. Dr. Michaels received a B.S. in Electrical Engineering, and M.S. E.C.E. and a Ph.D. E.C.E. from Carnegie Mellon University.

Andrzej Strojwas, Ph.D., served as a technical advisor to the Company from our founding until 2021 and as chief technologist from 1997 to 2021. He joined the Company as an employee in July 2021 as Vice President and Technical General Manager, and was appointed Chief Technology Officer effective December 2021. From October 1982 to July 2021, Dr. Strojwas was the Keithley Professor of Electrical and Computer Engineering at Carnegie Mellon University. In addition, Dr. Strojwas has held senior technical positions at Harris Semiconductor Co., AT&T Bell Labs, Texas Instruments, NEC, Hitachi, SEMATECH, and KLA. He holds an M.S. in Electronic Engineering from Warsaw Technical University and a Ph.D. in Electrical Engineering 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.

Item 1A. Risk Factors

A description of the risk factors associated with our business is set forth below. Some of these risks are highlighted in the following discussion, and in Management's Discussion and Analysis of Financial Condition and Results of Operations, Legal Proceedings, and Quantitative and Qualitative Disclosures About Market Risk. The occurrence of any of these risks or additional risks and uncertainties not presently known to us or that we currently believe to be immaterial could materially and adversely affect our business, operating results, financial condition, and stock price. These risks and uncertainties could cause our actual results to differ materially from the results contemplated by the forward-looking statements contained in this report. Investors should carefully consider all relevant risks and uncertainties before investing in our common stock.

Risk Factors Summary

Risks Associated with Our Business

- We have invested significant resources into research and development of our DFI system and Exensio software and if we fail to successfully carry out these initiatives on the expected timeline or at all, our business, financial condition, or results of operations could be adversely impacted.
- 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 supported their evaluation of our technology, which could result in delays in recognizing revenue and could negatively impact our results of operations in a quarter or result in lower revenue than we expected if a contract is not consummated.
- We rely on sole-source providers for certain software as well as for specialized parts for our eProbe hardware and supply-chain delays or disruptions could increase our costs or impact our ability to provide complete software solutions or to build additional hardware tools or meet customer expectations or deadlines, which could result in lost sales and lower earnings.
- Our fixed-fee services for product or system installations/configurations may take longer than budgeted, which could slow our revenue recognition and may result in a lost contract or a claim of breach by our customers, which would negatively affect our financial and operating results.
- Our ability to sell our products, systems, and solutions depends in part on the quality of our support and services offerings, and the failure to offer high-quality support and services could negatively affect our sales and results of operations.
- 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.
- Objectionable disclosure of our customers' confidential information or our failure to comply with our customers' security rules, including for those related to SaaS access, AI use, or our 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.
- We generate a significant portion of our revenues from a limited number of customers, and a large percentage of our revenues from one customer, so defaults or decreased business with, or the loss of, any one of these customers, or pricing pressure, or customer consolidation could significantly reduce our revenues or margins and negatively impact results of operations.
- If we do not continuously meet our development milestones of key research and development projects or successfully commercialize our DFI system, our future market opportunity and revenues will suffer, and our costs may not be recouped.

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- We are required to comply with governmental export and import requirements that could subject us to liability and restrict our ability to sell our products and services, which could impair our ability to compete in international markets.
- 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 Integrated Yield Ramp revenue to suffer.
- We acquired an early-stage battery-solutions provider and have been investing in research and development for new products and services beyond our traditional semiconductor focus, and it could take a long time to reach market acceptance and recoup our costs, if at all.
- Our success depends upon our ability to effectively plan and manage our resources and restructure our business through rapidly fluctuating economic and market conditions, which actions may have an adverse effect on our financial and operating results.
- Our business may be negatively impacted by social, political, geopolitical, economic instability, unrest, war, terrorism, or other circumstances that could interrupt our business operations, which could cause us to lose sales or delay or be unable to fulfill contractual commitments, which may have an adverse effect on our financial and operating results.
- Global economic conditions or semiconductor market conditions could materially adversely impact demand for our products and services, decrease our sales, or delay our sales cycle.
- We face challenges in providing a comprehensive solution outside of the semiconductor industry due to limitations on the business areas in which we can use current third-party licensed technology, which may make it prohibitively expensive to sell our solution for applications outside of our traditional industry.

Risks Related to Our Technology

- If we fail to protect our IP 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 revenues, or increase our costs.
- We are exposed to risks related to information technology infrastructure, information management and protection, cybersecurity threats, and cyber incidents.
- We and our customers are subject to laws and regulations concerning data privacy, data security, consumer protection, and advertising and these laws and regulations are continually evolving, which exposes us to potential material risks.
- Our technologies could infringe the IP rights of others, causing costly litigation and the loss of significant rights.
- Competition in the market for data analytics and related systems and services may intensify in the future, which could impede our ability to grow or execute our strategy.
- Generative AI and the user other advanced AI technologies for software development may subject us to claims of misappropriation of others' IP, bugs/errors, and ambiguous ownership of created content.

Risks Related to Our Operations

- Measurement of our variable consideration sometimes require data collection and customers' use of estimates and are contingent upon customers' consent and may be later offset if actual data differ from customers' estimates, which can result in uncertainty and cause quarterly results to fluctuate.

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- We have customers with past due balances and our failure to collect a significant portion of such balances could adversely affect our cash, require us to write-off receivables, or increase our expense or allowance for credit losses.
- We face operational and financial risks associated with international operations that could negatively impact our revenues.
- Our business is subject to evolving corporate governance and public disclosure regulations and expectations, including with respect to ESG matters that could expose us to numerous risks.
- Provision of certain of our data services relies on installing, configuring, and operating proprietary configuration of hardware and software systems located in third-party facilities and errors affecting such facilities' operations could lead to liability for us, and any objection from such third-party facility or delay in providing us physical or logical access to our systems may adversely impact our ability to timely perform our contract obligations or lead to confidentiality, integrity, availability, security, or privacy controls exceptions.

Tax Risks

- U.S. federal tax reform and changes in foreign tax laws could change our tax burden and adversely affect our business and financial condition.
- Future events may impact our deferred tax asset position, including the utilization of net operating loss and tax credit carryforwards.

Risks Related to Our Strategic Transactions

- We may devote significant time and resources to developing strategic relationships but we may not realize the benefits of such efforts, which could have an adverse effect on our business and results of operations.
- Our acquisitions create special risks and challenges that could adversely affect our financial results.

General Risk Factors

- If we are not able to retain, attract, motivate, and strategically locate talented employees, including some key executives, our business may suffer.
- Our earnings per share and other operating results may vary quarter to quarter, which could result in not meeting investors' expectations and stock price volatility.
- 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.

Risks Associated with Our Business

We have invested significant resources into research and development of our DFI system and Exensio software and if we fail to successfully carry out these initiatives on the expected timeline or at all, 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 in research and development efforts to develop our DFI system and Exensio software. New competitors, technological advances in the semiconductor industry or other competitive factors may require us to further invest significantly greater resources than we anticipate. If we invest significantly greater resources than anticipated without a corresponding increase in revenue, our operating results could decline. The technologies and products that we invest in may not result in products that create additional revenue, and we

may not recoup our investments, which could cause our results to suffer. If our DFI system and Exensio software do not anticipate technological changes in our industry or fail to meet market demand, we may not capture the market share we anticipate, we may lose our competitive position, our products may become obsolete, and our business, financial condition or results of operations could be adversely affected. Additionally, our periodic research and development expenses may be independent of our level of revenue, which could negatively impact our financial results.

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 supported their evaluation of our technology, which could result in delays in recognizing revenue and could negatively impact our results of operations in a quarter or result in lower revenue than we expected if a contract is not consummated.

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 enforcement of our complex contractual provisions is difficult to predict. If we do not successfully negotiate certain key complex contractual provisions, if there are disputes regarding such provisions, or if they are not enforceable as we intended, our revenues and results of operations would suffer. Further, our customers sometimes delay starting negotiations until they begin developing a new process, have a need for 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 may defer associated costs until execution of a final contract, which, if significant, could negatively impact our results of operations in the periods before we execute a final contract. Further, if we were to incur significant costs 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 increase our costs and expenses and could result in significant operating losses.

We rely on sole-source providers for certain software as well as for specialized parts for our eProbe hardware and supply-chain delays or disruptions could increase our costs or impact our ability to provide complete software solutions or to build additional hardware tools or meet customer expectations or deadlines, which could result in lost sales and lower earnings.

We provide some enabling technology under license and support from sole-source providers and some of our vendors provide highly specialized, differentiated products and services related to our eProbe system. In the event these licensors or vendors delay or discontinue providing such products and services to us, it may be difficult and costly or impossible for us to replace such suppliers or parts. In the case of licensed software, this could impact our ability to grow our sales or to meet the support expectations of our customers and we may need to resort to legal action, which could limit our future sales, harm our reputation, increase our costs, and harm our earnings. For example, in November 2023, a provider of enabling technology abruptly stopped providing maintenance and support of their software product to us. As a result, we resorted to legal action, which caused us to incur increased legal expenses beginning in the fourth quarter of 2023. The matter is ongoing, and the long-term impact of this provider's actions on our business and our customers is unknown at this time. In the case of vendors related to our eProbe tool, such disruptions or delays could delay or stop our ability to complete and deliver our DFI systems as currently designed to our customers, which would negatively impact our bookings and revenue related to such systems. In addition, such delays or disruptions to our supply chain could significantly increase our component costs, or personnel-related costs if we need to build a replacement solution in the case of certain software elements, and could impact our ability to build future generations or models of our eProbe tools, any of which would decrease or delay our sales, earnings, and liquidity and could otherwise adversely affect our business and result in increased costs. Such a delay or disruption could occur as a result of any number of events, including, but not limited to: failure to comply with existing contracts, higher priority alternative buyers, inflation and global interest rates increasing component costs, a closure or slowdown at our suppliers' plants or shipping delays including, for example, those made to combat the spread of COVID-19, market shortages for critical components, increases in prices, the imposition of regulations, quotas, embargoes or tariffs on components or our products, labor stoppages or shortages, our suppliers' supply chain disruptions, third-party interference, cyberattacks, severe weather conditions including the adverse effects of climate change-related events, geopolitical developments, war or terrorism, and disruptions in utilities and other services. In addition, the

development, licensing, or acquisition of new products in the future may increase the complexity of supply chain management. Failure to effectively manage our supply of components and products could adversely affect our business.

Our fixed-fee services for product or system installations/configurations may take longer than budgeted, which could slow our revenue recognition and may result in a lost contract or a claim of breach by our customers, which would negatively affect our financial and operating results.

Our fixed-fee services, including for Characterization, 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 accurately estimate the amount of time and resources needed to complete these types of services to determine when the engineers will be able to commence their next engagement. In addition, our accounting for contracts with such services, which generate fixed fees, sometimes requires adjustments to profit and 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. If we fail to meet a customer's expectations, the customer could terminate their contract with us or claim that we breached our obligations, which could negatively affect our financial and operating results.

Our ability to sell our products, systems, and solutions depends in part on the quality of our support and services offerings, and the failure to offer high-quality support and services could negatively affect our sales and results of operations.

Once our 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 SaaS Services, which requires us to maintain adequate server hardware and internet infrastructure, including system redundancies, we are required 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 on-going support and the privacy and data security capabilities required by our customers, we may face contractual penalties or customers may not renew subscriptions or services in the future, which would negatively impact our results of operations. 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 or fail to adequately address our customers' support needs, our customers may choose our competitors' products instead of ours in the future, which would negatively affect our revenues and results of operations.

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 customers contain defects that negatively impact customers' ability to use our systems or software, increase our customers' cost of goods sold or time-to-market, or damage our customers' property, such defects could significantly decrease the market acceptance of our products and services or could result in warranty or other claims. We must adequately train our new personnel, especially our customer 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. We have and may further incorporate AI solutions and related technologies for use in product development, or into our platform, offerings, services and features, and these applications may become important in our operations over time. If the content, analyses, recommendations, or other output that AI applications assist in producing are or are alleged to be deficient, inaccurate, or imprecise, our business, financial condition, and results of operations may be adversely affected. 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, which means that we may not discover the errors or defects until after customer implementation. 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.

Objectionable disclosure of our customers' confidential information or our failure to comply with our customers' security rules, including for those related to SaaS access, AI use, or our 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.

In the ordinary course of providing SaaS or other services engagements, we may collect customers' product, process, and test information, personally-identifiable data about their employees needed to administer licenses, and other confidential information. Our customers consider most of this information to be competitively sensitive and, in some cases, require us to comply with strict protection frameworks, including security rules for on-site or remote access to, hosting of, or transfer of their confidential information. As a result of increased regulatory and customer scrutiny of all data processing activities, as well as increasing and evolving regulation of such practices, we have security obligations on how we collect, transfer and use data (including personal data), which could require us to expend money and resources to comply with those requirements, and if compromised again, could have a material adverse effect on our business, financial condition, and results of operations, including the potential for regulatory investigations, enforcement actions, lawsuits, and a loss of business and a degradation of our reputation. If we fail to implement industry standard protections and processing procedures, the growing awareness of our customers and potential customers regarding privacy and data security requirements and/or adverse media coverage or regulatory scrutiny could limit the use and adoption of our services. 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. We recently started using third party AI/ML systems for research and development purposes. If these third-party AI/ML systems misuse or fail to properly protect the data we input, our use of such AI systems may result in the unauthorized disclosure of sensitive, proprietary, or confidential information belonging to us or our customers. For example, if the information we input into a third-party AI/ML system is used to train the underlying AI/ML models, such inputs could be revealed to others. The third-party AI/ML system may also provide outputs that appear to be correct but are incomplete, inaccurate, or otherwise flawed and may lead us to make erroneous decisions or recommendations to customers, which could result in harm to our reputation and competitive position, customer loss, and legal liability.

We generate a significant portion of our revenues from a limited number of customers, and a large percentage of our revenues from one customer, so defaults or decreased business with, or the loss of, any one of these customers, or pricing pressure, or customer consolidation could significantly reduce our revenues or margins and negatively impact results of operations.

Historically, we have had a small number of large customers that contribute significant revenues. In the year ended December 31, 2023, one customer accounted for 35% of our total revenues. We have in the past and could in the future lose a customer due to its decision not to develop or produce its own future process node or not to engage us on future process nodes. We could also lose customers as a result of industry factors, including but not limited to reduced manufacturing volume or consolidation. 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 or prevented if a key customer uses its leverage to push for terms that are worse for us and we delay entering into the contract to negotiate for better terms or decide not to enter into the contract at all, in which case revenue in any particular quarter or year may fail to meet expectations and our reliance on our remaining customers could increase.

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. For example, in 2023, 2022 and 2021, we incurred expenses in the amount of \$2.6 million, \$1.9 million and \$2.0 million, respectively, related to the arbitration with SMIC New Technology Research & Development (Shanghai) Corporation due to SMIC's failure to pay fees due to us under a series of contracts. In 2024, we may continue to incur substantial additional expenses related to an arbitration hearing to resolve this matter. The loss of revenue from any of our key customers would 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 do not continuously meet our development milestones of key research and development projects or successfully commercialize our DFI system, our future market opportunity and revenues will suffer, and our costs may not be recouped.

We have invested significantly in the design and development of our eProbe tool and related IP. Key customers failing to purchase, renew, or expand the number or use of such systems on our expected timeline or at all will cause our results to miss expectations. Also, if the results of our DFI system, including new applications, are not as we expect, we may not be able to successfully commercialize this system or such applications on schedule, or at all, and we may miss the market opportunity and not recoup our investment. Further, our eProbe tool could cause unexpected damage to wafers or delay processing wafers, which we could be liable for, or which could make customers unwilling to use the tool. If we are not able to create significant interest and show reliable and useful results without significant damage to wafers, our investment may not be recouped and our future results may suffer.

We are required to comply with governmental export and import requirements that could subject us to liability and restrict our ability to sell our products and services, which could impair our ability to compete in international markets.

We are required to comply with export controls and economic sanctions laws and regulations that restrict selling, shipping, or transmitting our products and services and transferring our technology outside the United States. These requirements also restrict domestic release of software and technology to foreign nationals. In addition, we are subject to customs and other import requirements that regulate imports that are important for our business. If we fail to comply with the U.S. Export Administration Regulations (“EAR”) or other U.S. or non-U.S. export or economic sanctions laws and regulations (collectively, “Export Regulations”), we could be subject to substantial civil and criminal penalties, including fines for the Company and the possible loss of the ability to engage in exporting and other international transactions. Due to the nature of our business and technology, Export Regulations may also subject us to governmental inquiries regarding transactions between us and certain foreign entities.

Export Regulations are fluid, complex, and uncertain, and there are ongoing efforts throughout the industry in coordination with regulators to revise, clarify, and interpret Export Regulations. The U.S. Congress and regulators continue to consider significant changes in laws and regulations. For example, the U.S. government is reportedly considering whether and/or how to impose restrictions directly on cloud-hosted services and further restrictions directly on U.S. person activity. We cannot predict the impact that additional legal changes may have on our business in the future. For example, in October 2022 the U.S. Bureau of Industry and Security (“BIS”) promulgated broad, novel Export Regulations relating to China that temporarily caused us to pause some deliveries while we interpreted the application of the new regulations on our business, given current and evolving operations. Also, BIS has placed certain entities on its entity list (the “Entity List”), which restricts supply of items to or in connection with the named entities. Further, in some circumstances Export Regulations require a license to export an item if the recipient will use the item to design or produce an item for a Huawei-affiliated company or certain other organizations on the Entity List. These regulations can also require licenses for exports that involve Chinese military or intelligence-related end users or end uses.

Future changes in Export Regulations, including changes in the enforcement and scope of such regulations, may create delays in the introduction of our products or services in international markets or could prevent our customers with international operations from deploying our products or services globally. In some cases, such changes could prevent the export of our products or services to certain countries, governments, entities or individuals altogether. Any such delays or restrictions could adversely affect our business, financial condition and results of operations. For further discussion, see Item 7. “Management’s Discussion and Analysis of Financial Condition and Results of Operations.”

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 Integrated Yield Ramp revenue to suffer.

Our Integrated Yield Ramp revenue includes amounts largely determined by variable wafer volumes at manufacturing sites covered by our contracts and, in some cases, determined by 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. We have seen a significant reduction in our Integrated Yield Ramp revenue in recent years and expect this trend to continue. 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 Integrated Yield Ramp revenue will continue to decrease, which could negatively affect our financial results. Further, reduced demand for semiconductor products or protectionist policies like those stemming from the complex relationships among China, Hong Kong, Taiwan, and the United States has from time to time decreased and may continue to decrease the volume of wafers and, in some cases, products our customers are able to make or sell, which would also decrease our Integrated Yield Ramp revenue. Also, our customers may unilaterally decide to implement changes to their manufacturing processes during the period that volume is covered by royalty contracts, which could negatively affect yield results and, thus, our Integrated Yield Ramp 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 have been and may continue to be adversely affected by negative changes at those sites or in those products, including slowdowns in manufacturing due to external factors, such as U.S. trade restrictions, rising inflation and global interest rates, or continued or worsening supply chain disruptions. Also, 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 royalties, revenues associated with such volumes or products would be negatively impacted. This could significantly reduce our Integrated Yield Ramp revenue and our results of operations could fail to meet 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 revenue, in the other facility or product.

We acquired an early-stage battery-solutions provider and have been investing in research and development for new products and services beyond our traditional semiconductor focus, and it could take a long time to reach market acceptance and recoup our costs, if at all.

In July 2023, we acquired Lantern Machinery Analytics, Inc., an early-stage company providing products and services for battery manufacturers, which is beyond our traditional semiconductor focus. We have also invested in research and development to expand the application of our existing products and services to battery manufacturers. If we do not create products and services battery manufacturers desire, we may not be able to successfully commercialize our solutions for battery manufacturing on schedule, or at all. In this case, we may miss the market opportunity, which would mean lower sales than we expect, the loss of our investments in battery manufacturing solutions, which would mean lower earnings.

Our success depends upon our ability to effectively plan and manage our resources and restructure our business through rapidly fluctuating economic and market conditions, which 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 appropriately scale and adjust our business and business models in response to fluctuating market opportunities and conditions, which has in the past and could in the future continue to require us to increase headcount, acquire new companies or engage in restructurings from time to time. For example, while we have increased investment in our business by increasing headcount, acquiring companies, and increasing our investment in research and development, sales and marketing, and other parts of our business from time to time, at other times we have undertaken restructuring initiatives to reduce expenses and align our operations with our 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 headcount. 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 capitalize on the market opportunity and achieve cost savings and other benefits from restructuring initiatives within the expected time frame requires significant management input and leadership and 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, and we are unsuccessful at implementing changes, or if other unforeseen events occur, our business and results of operations could be adversely affected.

Our business may be negatively impacted by social, political, geopolitical, economic instability, unrest, war, terrorism, or other circumstances that could interrupt our business operations, which could cause us to lose sales or delay or be unable to fulfill contractual commitments, which may have an adverse effect on our financial and operating results.

Our business operations may be negatively impacted by social, political, economic instability, unrest, war, terrorism, or other circumstances in a region in which we operate. Such events may result in restrictions, curfews, or other actions and give rise to significant changes in regional and global economic conditions and cycles, which may adversely affect our financial and operating results. Further geopolitical uncertainties, including relations between the United States and each of China and Russia, between Israel and Palestine, social activism, economic instability, war, terrorism, or other circumstances that interrupt our ability to conduct business could cause damage to, disrupt, or cancel sales of our products and services on a global or regional basis, which could have a material adverse effect on our business or vendors with which we do business. Due to the significance of our China market for our profit and growth, we are exposed to risks in China, including the risks mentioned elsewhere and the following: the effects of current U.S.-China relations, including rounds of tariff increases and retaliations and increasing restrictive regulations, potential boycotts and increasing anti-Americanism; escalating U.S.-China tension and increasing political sensitivities in China; the effects of China government funding in the development of domestic solutions and customer preference for domestic suppliers creating additional competition in China; and unexpected governmental regulations and restrictions in China as a result of renewed efforts to contain the COVID-19 pandemic, which could negatively impact our local operations. Such events could also make it difficult or impossible for us to deliver products and services to our customers. In addition, territorial invasions can lead to cybersecurity attacks on technology companies, such as ours, located far outside of the conflict zone. We do not have a business continuity plan developed to account for all continuity risks (please see Item 1C. Cybersecurity for more information about our cybersecurity risk management program). In the event of prolonged business interruptions or negative broad economic and security conditions due to political, geopolitical events, we could incur significant losses, require substantial recovery time, and experience significant expenditures in order to resume our business operations. In addition, our insurance policies typically contain a war exclusion of some description and we do not know how our insurers are likely to respond in the event of a loss alleged to have been caused by geopolitical uncertainties.

Global economic conditions or semiconductor market conditions could materially adversely impact demand for our products and services, decrease our sales, or delay our sales cycle.

Our customers are global semiconductor companies, which means that our operations and performance depend significantly on worldwide economic conditions as well as semiconductor market specific changes. Uncertainty about global economic conditions including war, terrorism, geopolitical uncertainties and other business interruptions could result in damage to, disruption, postponement or cancellation of sales of our products or services on a global or regional basis. Furthermore, tighter credit, higher interest rates, inflationary concerns, large-scale unemployment, negative financial news and/or declines in income or asset values and other macroeconomic factors could have a material adverse effect on demand for our products and services and, accordingly, on our business, results of operations or financial condition and/or vendors with which we do business. 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. Further, any economic and political uncertainty caused by the United States tariffs imposed on goods from China or enhanced U.S. export regulations relating to 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. Further, 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 and could be longer than anticipated. Any of these events could negatively affect our revenues and make it challenging or impossible for us to deliver products and services to our customers 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 credit losses.

We face challenges in providing a comprehensive solution outside of the semiconductor industry due to limitations on the business areas in which we can use current third-party licensed technology, which may make it prohibitively expensive to sell our solution for applications outside of our traditional industry.

Since our software requires certain third-party programs to run as intended and some of our contracts with licensors limit the industry in which we can resell such third-party programs, we face challenges to provide a comprehensive solution to battery manufacturers. If we or our customers are unable to procure required third-party programs that can be used in connection with our products for battery manufacturing, or the cost to do so is higher than expected, we may miss the market opportunity, which would mean lower sales than expected, or our costs may be higher, which would mean lower earnings than expected.

Risks Related to Our Technology

If we fail to protect our IP 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 revenues, or increase our costs.

Our success depends largely on the protection of our proprietary technology. 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 IP 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. 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 are exposed to risks related to information technology infrastructure, information management and protection, cybersecurity threats, and cyber incidents.

We are heavily reliant on our technology and infrastructure, as well as the public cloud to an increasing degree, to provide our products and services to our customers. 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. Bad actors may make increased use of widely available access to generative AI technology, such as ChatGPT, for more sophisticated and frequent cyber-attacks or fraudulent impersonations against us. These attacks could come from either Advanced Persistent Threat actors or other individual organized or unorganized malicious actors. The expense to purchase, update, and configure security information systems to detect and/or neutralize increasingly complex and sophisticated attacks may increase our costs and, failure to acquire the right expertise or systems may leave us vulnerable to attacks, which could expose our confidential or competitive information or that of our customers, which could expose us to liability and have a negative impact on our reputation and business opportunity.

We rely on third-party service providers to enable key services to our customers, including for cloud services, enterprise software, customer support portal software, and co-location computing facilities. We have experienced in the past, and may experience in the future, interruptions in our information systems on which our global operations depend or unplanned downtime of the infrastructure that delivers our SaaS. Such an unplanned interruption, even if temporary, could stop SaaS customers from accessing their hosted data or on-premise customers from downloading licensed software or critical security patches, or from accessing our support portal, which could mean that we may not meet our contractual commitments for such services to customers, which could reduce our revenue, incur liability, or result in damage to our reputation and negatively impact future sales. Further, the information technology and infrastructure that stores and processes our and our customers' data is susceptible to continually evolving cybersecurity threats that become more

complex over time, especially with the rapid evolution of AI technologies, and may not be recognized until launched against a target, all of which could result in unauthorized access to, or acquisition of, our data, and interruption or disruption of our business. We and our third-party service providers, with whom we may share data, may be unable to anticipate these techniques or may not implement adequate preventative measures to prevent either unauthorized access to our systems or services that could compromise customer data or other confidential information or result in a disruption of our services. In particular, like our peers, we are often the target of cyber-attacks by third parties seeking unauthorized access to confidential or sensitive data, including customer confidential information, or to disrupt our ability to provide services from a broad range of threat actors, including foreign governments, criminals, competitors, computer hackers, cyber terrorists and politically motivated groups or individuals. To date, we have not incurred any material costs from these attacks. The security measures we have integrated into our internal systems, SaaS, and software products, which are designed to detect unauthorized intrusions or activity and prevent or minimize security breaches, vary in maturity across our business and may not function as expected or may not be sufficient to protect against certain attacks. Additionally, we may not have sufficient audit logs to fully understand the nature of a cyber-attack. In some cases, we do not have contracts to provide legal protection or recourse for breaches of our security protections, which may increase our exposure to expenses related to such attacks and negatively impact our results.

Ransomware attacks are becoming increasingly prevalent and severe, and can lead to significant interruptions in our operations, loss of data and income, reputational loss, diversion of funds, and may result in fines, litigation and unwanted media attention. Extortion payments may alleviate the negative impact of a ransomware attack, but we may be unwilling or unable to make such payments due to, for example, applicable laws or regulations prohibiting payments. Territorial invasions like Russia's invasion of Ukraine or other geopolitical events can lead to cybersecurity attacks on technology companies, such as ours, located far outside of the conflict zone. In the event of prolonged business interruptions due to a security breach or disruption, we could incur significant losses, require substantial recovery time and experience significant expenditures in order to resume our business operations.

Our information systems are susceptible to computer viruses, cyber-related security breaches, and similar disruptions from unauthorized intrusions, tampering, misuse, criminal acts including phishing, or other events or developments that we may be unable to anticipate or fail to mitigate. Our security measures may also be circumvented or bypassed due to employee errors or malfeasance. Third parties may attempt to fraudulently induce employees or customers to disclose information in order to gain access to our data or our customers' data, including account credentials, customer personnel information, or other information. If we fail to have adequate controls or safeguards, the security of our internal networks, electronic systems, or physical facilities could be compromised, which could result in significant legal and financial exposure, a loss of confidence in the security of our SaaS and other software products, interruptions, or malfunctions in our operations, account lock outs, and, ultimately, harm to our business, financial condition and results of operations.

We face information technology security and fraud risks due to continued support of our employee's remote or hybrid work environment, which may create additional information security vulnerabilities and/or magnify the impact of any disruption in our information technology systems. Our increased reliance on work-from-anywhere technologies and even our employees' expanded reliance on company-approved bring-your-own-mobile-devices may increase the risk of cybersecurity or data breaches from possible circumvention of security and monitoring systems, denial-of-service attacks or other cyber-attacks, hacking, "phishing" attacks, computer viruses, ransomware, malware, employee or insider error, malfeasance, social engineering, deep-fake impersonations, physical breaches, or other actions.

Our insurance policies may not cover losses incurred in the event our systems or data are comprised, and they are subject to retention amounts that could be substantial. Moreover, we cannot be certain that such insurance policies will continue to be available to us on economically reasonable terms, or at all, or that any insurer will not deny coverage as to any future claim.

Many of our customers and our technical partners require us to complete annual vendor security assessments which may include a requirement to complete information security self-assessments, third-party assessments, or obtain independent certifications from standards organizations. Any exception of controls found during such assessments or certification, especially if published in a report such as for SOC 2 Type 2, may need to be disclosed to a large number of customers and potential customers. Such publication of controls weaknesses could cause customers to re-evaluate their purchasing or renewal decisions, which could cause us to lose sales and, as a result, have lower earnings than expected.

Part of our business includes the acquisition of other companies which involves the integration of various business processes, technologies, and data systems. While such acquisitions offer strategic opportunities for growth and diversification, they also expose us to cybersecurity risks that may arise during the integration process and thereafter. Challenges in integrating information technology systems and networks may create vulnerabilities and expose the organization to unauthorized access and data breaches. The transfer and consolidation of sensitive information during acquisitions heighten data security and privacy concerns, potentially leading to regulatory compliance issues and reputational damage. Third-party relationships established by the acquired company introduce additional cybersecurity risks if not properly assessed and mitigated. Moreover, cultural differences, compliance obligations, and resource constraints further complicate the effective management of cybersecurity risks associated with acquisitions, potentially impacting the organization's financial performance and reputation.

If we experience a security event, we may have to conduct an investigation and notify individuals, customers, partners, service providers and state, federal and local governmental authorities and regulators in the U.S. and elsewhere around the globe. Accordingly, security events could lead to significant costs and fees for legal advice, investigation support, remediation, and result in legal risk exposure, damage and harm to our reputation, and impact on our ability to keep and attract customers.

We and our customers are subject to laws and regulations concerning data privacy, data security, consumer protection, and advertising and these laws and regulations are continually evolving, which exposes us to potential material risks.

We collect, use, store or disclose (collectively, “process”) 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.

In the United States, we are subject to numerous federal, state and local data privacy and security laws and regulations governing the processing of information about individuals, including federal laws (e.g., FTC Act) and state privacy laws (e.g., the California Privacy rights Act and the Virginia Consumer Data Protection Act), marketing and communications laws, laws regarding credit reports, data breach notification laws, and consumer protection laws, many of which carry significant potential for active enforcement and penalties.

Abroad, our customers may be subject to the EU GDPR and UK GDPR or similar local or regional frameworks that impose a strict data protection compliance regime. Our customers may impose these obligations on us by contract, which could require us to expend resources to comply with those requirements.

More generally, given the rapidly changing data privacy and data security laws, regulations, policies and legal obligations discussed above, and because any current compliance is subject to change based on this shifting and inconsistent landscape, we could incur costs of complying with these laws and regulations, which in some cases can be enforced by our customers, other private parties in addition to government entities, are high and likely to increase in the future, particularly as the degree of regulation increases, our business grows and our geographic scope and member base expands. The impact of these laws and regulations may disproportionately affect our business in comparison to our peers in the technology sector that have greater resources.

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

Significant litigation regarding IP rights exists in the semiconductor industry. It is possible that a third party may claim that our technologies infringe their IP rights or misappropriate their trade secrets, which has happened in the past. Any claim, even if without merit, could be time consuming to defend, result in costly litigation, require us to enter into royalty or licensing agreements, which may not be available to us on acceptable terms, or at all, subject us to damages or injunctions restricting our sale of products, invalidate a patent or family of patents, require us to refund license fees to our customers or to forgo future payments or require us to redesign certain of our products, any one of which could adversely affect our sales opportunities, expenses, and revenues.

Competition in the market for data analytics and related systems and services may intensify in the future, which could impede our ability to grow or execute our strategy.

Our industry is marked by rapid technological developments and innovations (such as the use of AI and ML) and evolving industry standards. If we are unable to innovate quickly enough to keep pace with our competitors in incorporating such technological developments in our product offerings, our business could be harmed. See the discussion in “Competition” in Part 1, Item 1. “Business” section for more information about our current competitors. There may be other competitors of which we are not aware, and we may compete with the products or offerings of our existing competitor companies or additional companies if we expand our offerings through acquisitions or development. The demand for solutions that address the need for better integration between the silicon design and manufacturing processes may encourage new direct competitors to enter our market. Increased competition could lead to increased pricing pressure, negatively impacting our revenues, or a decreased ability to grow or execute our strategy. Also, 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.

Generative AI and the user other advanced AI technologies for software development may subject us to claims of misappropriation of others’ IP, bugs/errors, and ambiguous ownership of created content.

Uncertainty around new and emerging AI applications such as generative AI content creation may require additional investment to protect our proprietary datasets, ML models, and systems to test for accuracy, bias and other variables, which may be costly and could impact our profit margin if we decide to expand generative AI into our product offerings. Developing, testing, and deploying secure and reliable AI systems and tested software made using such AI systems may also increase the cost profile of our offerings. We would be liable for any inaccuracies or errors in software that we release that causes downtime or other damage to our customers’ facilities or production lines, which could greatly increase our expenses and decrease our earnings.

Risks Related to Our Operations

Measurement of our variable consideration sometimes require data collection and customers’ use of estimates and are contingent upon customers’ consent and may be later offset if actual data differ from customers’ estimates, which can result in uncertainty and cause quarterly results to fluctuate.

We can only recognize volume- or average selling price- (“ASP”) based royalties once we have reached agreement with our customers on their level of yield performance improvements or ASP and quarterly agreements are sometimes based on estimates of volume results or ASP for each quarter. Measuring the amount of yield improvement is inherently complicated and dependent on our customers’ internal processes and on certain non-public information that may not be directly available to us. Thus, there may be uncertainty as to some components of measurement or calculation. Also, some variable consideration can be highly susceptible to delays in our customers’ measurement of key factors such as reporting volumes results and level of yield or ASP. Therefore, we may have to estimate revenue related to contingent variable fees or usage- or sales-based royalties prior to the receipt of performance reports, such as royalty acknowledgements, or other related information from customers. These estimates are subject to 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 Integrated Yield Ramp revenue than expected that may later be offset when actual results become available if such results differ from estimates.

We have customers with past due balances and our failure to collect a significant portion of such balances could adversely affect our cash, require us to write-off receivables, or increase our expense or allowance for credit losses.

If our customers fail to pay receivable balances when due, our cash will decrease and we may have to incur additional expenses in an attempt to collect such receivables, to write-off a portion or all of such receivables, or to increase our expense or allowance for credit losses. Our accounts receivable balance, net of allowance for credit losses, was \$44.9 million and \$42.2 million as of December 31, 2023 and 2022, respectively. Unbilled accounts receivable, included in

accounts receivable, totaled \$16.4 million and \$13.5 million as of December 31, 2023 and 2022, respectively. Unbilled accounts receivable that are not expected to be billed and collected during the succeeding twelve-month period are recorded in other non-current assets and totaled \$1.1 million and \$0.8 million as of December 31, 2023 and 2022, respectively. Two customers accounted for 50% of our gross accounts receivable as of December 31, 2023, and three customers accounted for 53% of our gross accounts receivable as of December 31, 2022. The total allowance for credit losses was \$0.9 million as of December 31, 2023 and 2022. We generally do not require collateral or other security to support accounts receivable. Despite the financial ability of these customers to pay for on-going services by PDF under valid contracts, customers may delay payments. Our allowances for potential credit losses, if any, could be insufficient, and we may need to adjust our allowance for credit losses from current estimates or write-off receivables depending on such claims in the future. If we are forced to pursue legal remedies to collect receivables, our expenses could rise significantly and our business relationship and future business with these customers could suffer.

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

In recent years, we have derived nearly half of our revenues from sales outside of the United States, and we expect our international business to continue to grow. We have in the past expanded and reorganized, at different times, our operations, including international operations, and may in the future continue such expansions or reorganizations 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 potential 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 is 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 IP in foreign jurisdictions;
- greater difficulty in collecting account receivables resulting in longer collection periods, credit losses, and increased costs to collect;
- language and other cultural differences may inhibit our sales and marketing efforts and create internal communication problems between our U.S. and foreign teams, increasing the difficulty of managing multiple, remote locations and negatively impacting sales and revenue;
- 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 others, issues related to human resources, 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 certain of our payables and our international offices' payables are denominated in foreign currencies, including the Euro, Yen, and RMB, while predominantly 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;
- geopolitical instability or changes in government, including in the United States of America, could disrupt our operations or our customers' purchases or operations or those of related supply chain participants;
- quarantine, travel restrictions, or business disruptions in regions affecting our operations, stemming from actual, imminent or perceived outbreaks of contagious diseases, including COVID-19; or
- economic or political instability, including but not limited to armed conflict, terrorism, interference with information or communication of networks or systems, including strained or worsening relations between the United States and China, occupation or war involving Russia and Ukraine and most recently between Israel and Hamas, and the resulting disruption to economic activity and business operations.

Further, our employees and contractors include professionals located in various international locations, including Shanghai, China and Ramallah, Palestine, and Israel, and Taiwan who provide software-related development, quality assurance, maintenance, and other technical support services for certain of our software products. Conflicts in these regions or impacting these regions, or policy changes, including policies covering export controls, that affect these or other international operations could disrupt or limit the work our employees and contractors perform and may negatively affect the range of services we are able to provide 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 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. Given the high level of complexity of these laws, there is a risk that some provisions may be inadvertently or intentionally breached, for example through fraudulent or negligent behavior of individual employees, our failure to comply with certain formal documentation requirements or otherwise. 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. Additionally, we may be held liable for actions taken by our local dealers and partners. A significant violation could significantly negatively impact our sales opportunities, operations, and financial results. Some companies in China have indicated to us that they have decided to use only local vendors as a precaution. If more companies respond to changing regulations by using local vendors, then our operations and ability to deliver products and services to customers in China and elsewhere could be significantly negatively impacted. In such case, our expected international business may be slower than expected or not materialize at all, in which case, our sales opportunities, operations, and financial results would suffer.

Further, the U.S. government has imposed broad sanctions on Russia, Belarus and certain companies and high-wealth individuals relating to the invasion of Ukraine, and has additionally maintained a bipartisan consensus favoring increased confrontation of China on trade practices and economic matters, national security, and human rights. The current U.S. Administration views technology as a domain of strategic competition in which the U.S. and its allies must stay ahead of China and has identified semiconductor, AI, 5G technologies, and the protection of U.S. supply chains as priority efforts. As a result of these government actions and policies, unless and until related restrictions are lifted, we are generally not able to supply many products, services and technologies to affected entities and countries. Our standard operations include development, distribution processes, software download sites, and professional service centers and processes located in various geographies around the world. Some customers have expressed concerns that continued action by the U.S. government could potentially interrupt their ability to make use of our products or services. The continuing tension between the U.S. government and each of the Chinese and Russian governments in trade and security matters or the perception of that tension could lead to further disruptions or reductions in international trade, deter or prevent customer purchasing activity, and may negatively impact our financial results.

Our business is subject to evolving corporate governance and public disclosure regulations and expectations, including with respect to ESG matters that could expose us to numerous risks.

We are subject to changing rules and regulations promulgated by a number of governmental and self-regulatory organizations, including the SEC, the Nasdaq Stock Market, and the Financial Accounting Standards Board (“FASB”). These rules and regulations continue to evolve in scope and complexity and many new requirements have been created in response to laws enacted by U.S. Congress, making compliance difficult and uncertain, including a new rule effective in late 2023 that requires us to report to the SEC all material cyber security incidents through the filing of a Form 8-K. In addition, increasingly regulators, customers, investors, employees, and other stakeholders are focusing on ESG matters and related disclosures. These changing rules, regulations and stakeholder expectations have resulted in, and are likely to continue to result in, increased general and administrative expenses and increased management time and attention spent complying with or meeting such regulations and expectations. For example, developing and acting on ESG initiatives, and collecting, measuring, and reporting ESG information and metrics can be costly, difficult and time consuming and is subject to evolving reporting standards, including the SEC’s proposed climate-related reporting requirements. We may also communicate certain initiatives and goals regarding environmental matters, diversity, responsible sourcing, social investments, and other ESG matters in our SEC filings or in other public disclosures. These initiatives and goals could be difficult and expensive to implement, the technologies needed to implement them may not be cost effective and may not advance at a sufficient pace, and we could be criticized for the accuracy, adequacy, or completeness of the disclosure of our ESG initiatives. Further, statements about our ESG initiatives and goals, and progress against those goals, may be based on standards for measuring progress that are still developing, internal controls and processes that continue to evolve, and assumptions that are subject to change. In addition, we could be criticized for the scope or nature of such initiatives or goals, or for any revisions to these goals. If our ESG-related data, processes and reporting are incomplete or inaccurate, or if we fail to achieve progress with respect to our ESG goals on a timely basis, or at all, our reputation, business, financial performance and growth could be adversely affected.

Provision of certain of our data services relies on installing, configuring, and operating proprietary configuration of hardware and software systems located in third-party facilities and errors affecting such facilities’ operations could lead to liability for us, and any objection from such third-party facility or delay in providing us physical or logical access to our systems may adversely impact our ability to timely perform our contract obligations or lead to confidentiality, integrity, availability, security, or privacy controls exceptions.

In connection with our data services offerings, we rely on installing, configuring, and operating proprietary configurations of hardware and software systems in facilities owned and operated by third parties around the world. If the third-party facility owner/operator does not allow us to install, access and maintain, or otherwise operate as intended these systems, we may not timely fulfill our contractual obligations to, or expectations of, our customers. Also, any intentional or unintentional disruption of the operation of these proprietary systems may lead to customer dissatisfaction, which could cause us to lose future bookings and reduce revenue and negatively impact our earnings. Additionally, any potential or actual malicious cybersecurity incident or accidental misconfiguration resulting in a data security incident involving these proprietary systems may require complex diagnosis and mitigation because they are located at third-party facilities and this may lead to delays, errors, lack of system availability, loss or our customers’ data integrity, or further unauthorized disclosure of customer confidential or privacy data. Further, if our system causes downtime or other disruption or loss to such third-party facility, we could be liable for damages associated with such event, which could increase our expenses and distract management, and cause other third-party facilities to not want to work with us.

Installing and maintaining such proprietary systems around the world requires that we manage the complexity of global operations of individual installations at a large number of different third parties in various countries. The cost and complexity of obtaining support, installing updated security patches, and addressing any other critical vulnerabilities in each individual physical system may lead to exceptions in controls of confidentiality, availability, integrity, security, and privacy, which could negatively impact the availability of our data services to customers, damage our reputation, or lead to lower bookings or sales.

Tax Risks

U.S. federal tax reform and changes in foreign tax laws could change our tax burden and adversely affect our business and financial condition.

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 changes in tax laws or the interpretation of such tax laws, insufficient taxable income to realize deferred tax assets, 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.

On August 9, 2022, the CHIPS and Science Act of 2022 (the “CHIPS Act”) was enacted in the United States to provide certain financial incentives to the semiconductor industry, primarily for manufacturing activities within the United States. On January 19, 2024 the House Ways and Means Committee passed with bipartisan support a proposed “tax bill” which would retroactively restore the three expired business tax provisions from the Tax Cuts and Jobs Act through the end of 2025, including the requirement to capitalize and amortize Section 174 research and experimentation (“R&E”) expenditures. The provision would delay the date when taxpayers must begin capitalizing and amortizing their “domestic” R&E expenditures until taxable years beginning after December 31, 2025, while leaving the requirement to capitalize foreign research unchanged. This change would be retroactive for taxpayers who have already filed tax returns for taxable year 2022. The tax bill is pending vote in the House and Senate. We are continuing to monitor the CHIPS Act and the proposed tax bill and related regulatory developments to evaluate their potential impact on our business and operating results. For further discussion of the CHIPS Act, see Item 7. “Management’s Discussion and Analysis of Financial Condition and Results of Operations”.

Future events may impact our deferred tax asset position, including the utilization of net operating loss and tax credit carryforwards.

Realization of our deferred tax assets is dependent primarily upon future taxable income in the applicable jurisdiction. We previously recorded a full valuation allowance against all of our U.S. federal and state deferred tax assets due to the uncertainty surrounding the future realization of these deferred tax assets. Therefore, no benefit has been recognized for the net operating loss carryforwards, tax credit carryforwards, and other deferred tax assets. The net operating loss and tax credits could expire unused and be unavailable to reduce future income tax liabilities. We intend to continue maintaining a full valuation allowance on these deferred tax assets until there is sufficient evidence to support the reversal of all or some portion of these allowances. We evaluate our deferred tax assets for realizability each reporting period. The impact of releasing some or all of such valuation allowance in a future period could be a material benefit in the period in which such release occurs.

Risks Related to Our Strategic Transactions

We may devote significant time and resources to developing strategic relationships but we may not realize the benefits of such efforts, which could have an adverse effect on our business and results of operations.

We have in the past devoted, and plan in the future to devote, time and resources to identifying, developing, and promoting strategic relationships with other suppliers to provide combined, integrated, or interoperable solutions to the semiconductor, electronics, and automotive industries. For example, from July 2020 through August 2023, we announced strategic relationships or collaborations with Advantest Corporation, Siemens, Kulicke & Soffa Industries, Inc., SAP SE, proteanTecs Ltd, and Voltaiq, Inc. The full extent of the future impact of these strategic relationships on our financial condition and results of operations is currently unknown and the failure to reap the anticipated benefits of these companies’ financial resources, technology, customer relationships, and global footprint and/or to successfully develop combined,

integrated, or interoperable solutions with such companies could have an adverse effect on our business and results of operations.

Our acquisitions create special risks and challenges that could adversely affect our financial results.

Our success depends on our ability to continually enhance and broaden our product offerings in response to changing technologies, customer demands, and competitive pressures. To this end, we have, from time to time, engaged in the process of identifying, analyzing, and negotiating possible acquisition transactions, and, from time to time, acquiring one or more businesses, and we expect to continue to do so in the future. We may choose to acquire new and complementary businesses, products, technologies and/or services instead of developing them ourselves. For example, we acquired Cimatrix in December 2020 for a gross purchase price of approximately \$37.5 million (\$31.6 million net of cash acquired) for all of its outstanding equity. We may, however, face competition for acquisition targets from larger and more established companies with greater financial resources, making it more difficult for us to complete acquisitions. We may not be successful in consummating future acquisitions on favorable terms and we may not realize the benefits that we anticipate from one or more acquisitions that we consummate. Integrating any business, product, technology, or service into our current operations could be expensive and time-consuming and/or disrupt our ongoing business. Further, there are numerous risks associated with acquisitions and potential acquisitions, including, but not limited to, problems combining the purchased operations, technologies or products, unanticipated costs, liabilities, litigation, and diversion of management's attention from our core businesses, adverse effects on existing business relationships with suppliers and customers, risks associated with entering markets in which we have no or limited prior experience, and where competitors in such markets have stronger market positions, initial dependence on unfamiliar supply chains or relatively small supply partners, failure of our due diligence processes to identify significant problems, liabilities or other challenges of an acquired company or technology, and the potential loss of key employees, customers, distributors, vendors, and other business partners of the companies we acquire.

We may not be able to successfully integrate businesses, products, technologies, or personnel that we might acquire and the transaction may not advance our business strategy. The integration of businesses that we may acquire is likely to be a complex, time-consuming, and expensive process and we may not realize the anticipated revenues or other benefits associated with our acquisitions. If we fail to successfully manage, operate, or integrate any acquired business or if we are unable to efficiently operate as a combined organization, including through the use of common information and communication systems, operating procedures, financial controls, and human resources practices, we could be required to write-down investments and our business, financial condition, and results of operations may be adversely affected. We may also be unable to protect or enforce the IP rights of any target business that we acquire, or such target businesses may become subject to claims of IP infringement. Further, if we become subject to liabilities as a result of an acquisition, the liabilities we incur may be substantial and the amounts of such liabilities may not be covered by and/or may exceed any liability protections.

In connection with certain acquisitions, we have in the past and may in the future issue common stock, or assume equity awards, that dilute the ownership of our current stockholders, use a substantial portion of our cash resources, assume liabilities (both known and unknown), record goodwill and amortizable intangible assets that will be subject to impairment testing on a regular basis and potential periodic impairment charges, incur amortization expenses related to certain intangible assets, and incur large and immediate write-offs and restructuring and other related expenses, all of which could harm our financial condition and results of operations.

General Risk Factors

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 recruiting and 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 the past the United States has and, in the future, the United States may again increase the level of scrutiny in granting H-1(b), L-1, and other business visas. Compliance with United States immigration and labor laws could require us to incur additional unexpected labor costs and expenses or could restrain our ability to retain skilled professionals. 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 earnings per share and other operating results may vary quarter to quarter, which could result in not meeting investors' expectations and stock price volatility.

Our stock price has fluctuated widely during the last few years. 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. 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 our 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.

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 our company. Shareholder activists frequently propose to involve themselves in the governance, strategic direction, and operations of a 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.

Item 1B. Unresolved Staff Comments

None.

Item 1C. Cybersecurity

Cybersecurity Risk Management and Strategy

We recognize the importance of assessing, identifying, and managing material risks associated with cybersecurity threats, as such term is defined in Item 106(a) of Regulation S-K. These risks include, among other things, operational risks, intellectual property theft, fraud, extortion, harm to employees or customers, violation of privacy or security laws and other litigation and legal risk, and reputational risks. We have implemented several cybersecurity processes, technologies, and controls to aid in our efforts to assess, identify, and manage such material risks.

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Our process for identifying and assessing material risks from cybersecurity threats operates alongside our broader overall risk assessment process, covering all company risks. As part of this process appropriate disclosure personnel will collaborate with subject matter specialists, at least annually and more frequently as necessary due to business changes or external changes, to gather insights for identifying and assessing material cybersecurity threat risks, their severity, and potential mitigations.

We also have a cybersecurity specific risk assessment process, which helps identify our cybersecurity threat risks. As part of this process, and our processes to provide for the availability of critical data and systems, maintain regulatory compliance, identify and manage our risks from cybersecurity threats, and to protect against, detect, and respond to cybersecurity incidents, as such term is defined in Item 106(a) of Regulation S-K, we undertake the below listed activities, among others:

- maintain a risk register and risk assessment process based on The National Institute of Standards and Technology (“NIST”) Cybersecurity Framework;
- use various third-party software testing products and services designed to test and assess the security of our software;
- closely monitor emerging data protection laws and implement changes to our processes designed to comply with such laws;
- undertake an annual review of our policies and statements related to cybersecurity;
- proactively inform our customers of substantive changes related to customer data handling through disclosures in our SOC 2 Type 2 report or other contractually mandated disclosures;
- conduct annual cybersecurity training for employees and contractors with access to PDF systems and sensitive data;
- conduct incident management training and practice for individuals with responsibilities responding to a cyber incident;
- conduct regular phishing email simulations for employees and contractors with access to corporate email systems to enhance awareness and responsiveness to such possible threats;
- use findings and root cause analysis of cybersecurity incidents to improve our cybersecurity processes and technologies;
- maintain technologies designed to provide network and endpoint monitoring, regular vulnerability assessments, and annual penetration testing to improve our information systems, as such term is defined in Item 106(a) of Regulation S-K;
- carry information security risk insurance that provides protection against the potential losses arising from a cybersecurity incident;
- maintain an employee handbook, Code of Conduct, and Acceptable Use policy that makes clear the importance of cybersecurity and protection of PDF and customer intellectual property; and
- our incident response policy and plan specify the activities we take to prepare for, detect, respond to and recover from cybersecurity incidents, which include processes to triage, assess severity for, escalate, contain, investigate, and remediate the incident, as well as to comply with potentially applicable legal and reporting obligations and mitigate brand and reputational damage. We regularly exercise and update the plan after actual incident responses or simulated incident response scenarios.

We subscribe to several external independent monitoring services to score and assess our externally facing network and information services and we engage a third-party security firm at least annually to conduct external and web penetration testing exercises on our corporate network and our commercial SaaS service platform.

Our processes also address cybersecurity threat risks associated with our use of third-party service providers, including those in our supply chain or who have access to our customer and employee data or to our systems. Third-party risks are included within our broader overall risk assessment and management process, as well as our cybersecurity-specific risk identification program, both of which are discussed above. In addition, cybersecurity considerations affect the selection and oversight of our third-party service providers during vendor onboarding and during periodic reviews. We perform diligence on third parties that have access to our systems, data or facilities that house such systems or data, and regularly monitor cybersecurity threat risks identified through such diligence. Additionally, we generally require those third parties that could introduce significant cybersecurity risk to us to agree by contract to manage their cybersecurity risks in specified ways, and to agree to be subject to cybersecurity audits or independent information security assessments or certifications. Additionally, we have processes designed to monitor public and federal government database and other sources for evidence of known and/or exploited vulnerabilities in third-party services including those provided as SaaS and we take action to remediate or establish compensating controls if those systems are determined to be critical to our cybersecurity. We also maintain disaster recovery plans in place for all mission critical parts of the business, although we do not have a business continuity plan developed to account for all continuity risks.

We describe whether and how risks from identified cybersecurity threats, including as a result of any previous cybersecurity incidents, have materially affected or are reasonably likely to materially affect us, including our business strategy, results of operations, or financial condition, under the headings “We are exposed to risks related to information technology infrastructure, information management and protection, cybersecurity threats, and cyber incidents.” and “Our business is subject to evolving corporate governance and public disclosure regulations and expectations, including with respect to environmental, social and governance matters that could expose us to numerous risks.” included as part of our risk factor disclosures at Item 1A of this Annual Report on Form 10-K.

For more than 5 years, we have not experienced any material cybersecurity incidents and the expenses we have incurred from cybersecurity incidents were immaterial. This includes penalties and settlements, of which there were none.

Cybersecurity Governance

Information technology and data security, particularly cybersecurity, is a top area of focus for our Board of Directors, who views our focus in these areas as essential for the success of our company and the broader technology industry in which we operate.

As described in the Audit Committee Charter of the Board of Directors, the Audit Committee is tasked with oversight of certain risk issues, including cybersecurity. The Audit Committee is comprised entirely of independent directors, two of whom have significant work experience related to information security issues or oversight. Management reports high severity security incidents to the Audit Committee after they are discovered. Additionally, management provides a summary four times per year of all security incidents to the Audit Committee. The full Board of Directors is also provided an annual assessment of our security program, our internal response preparedness, and assessments led by outside assessors and auditors.

Our Audit Committee is regularly involved in reviewing cybersecurity risk management. At least quarterly, the Vice President of Operations presents and reviews key security metrics with the Audit Committee including a review of cybersecurity events, cybersecurity initiatives and new or developing cybersecurity risks relevant to the business. The Audit Committee, which comprises at least two individuals with experience in cybersecurity and related matters, meets with these members of senior management to review our information technology and data security policies and practices, and to assess current and projected threats, cybersecurity incidents, and related risks. Our Vice President of Operations reports directly to our executive management team and advises the company on cybersecurity risks and assesses the effectiveness of information technology and data security processes and business policies impacting our overall cybersecurity risk.

Our cybersecurity risk management and strategy processes, which are discussed in greater detail above, are led by our Vice President of Operations and a cross section of subject matter experts from Information Technology, Exensio Cloud Operations and Corporate Legal and team. Such individuals have collectively over 30 years of prior work experience in various roles involving managing information security, data privacy risks and regulatory frameworks, developing cybersecurity strategy, implementing effective information and cybersecurity programs and experience in security controls testing and the planning and executing of independent cybersecurity assessments.

Our Incident Response Policy is reviewed annually and documents the controls and procedures for timely and accurate reporting of material cybersecurity incidents to the relevant parties, including the Audit Committee when applicable. Our Incident Response Team leads the response to any reported cybersecurity event and comprises experts from Engineering, Information Technology, Legal, Cloud Operations, and Data Security.

The Vice President of Operations and Executive Vice President of Products and Solutions are informed about and monitor the prevention, mitigation, detection, and remediation of cybersecurity incidents through their management of, and participation in, the cybersecurity risk management and strategy processes described above including the incident response.

Item 2. *Properties*

Our principal executive offices are located in Santa Clara, California, where we lease approximately 20,800 square feet of office space under a lease agreement that expires in August 2028. We also lease additional facilities and offices in Milpitas, California; Pittsburgh, Pennsylvania; Richardson, Texas; Salt Lake City, Utah; Deer Park, Illinois; Shanghai, China; Canada; France; Germany; Italy; Japan; South Korea; and Taiwan for local sales, product development and technical support.

We believe our existing and planned facilities and offices 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, the Company is subject to various claims and legal proceedings that arise in the ordinary course of business. The Company accrues 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, 2023, the Company was not party to any material legal proceedings for which a loss was probable or an amount was accrued.

On May 6, 2020, the Company initiated an arbitration proceeding with the Hong Kong International Arbitration Center against SMIC New Technology Research & Development (Shanghai) Corporation (“SMIC”) due to SMIC’s failure to pay fees due to the Company under a series of contracts. The Company seeks to recover the unpaid fees, a declaration requiring SMIC to pay fees under the contracts in the future (or a lump sum payment to end the contract), and costs associated with bringing the arbitration proceeding. SMIC denies liability and an arbitration hearing was held in February 2023. Final written submissions were submitted by the parties at the end of August 2023. A decision is currently expected in 2024.

Item 4. *Mine Safety Disclosures*

Not applicable.

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 February 23, 2024, we had approximately 24 stockholders of record. The number of stockholders of record does not include individuals whose stock is in nominee or “street name” accounts through brokers.

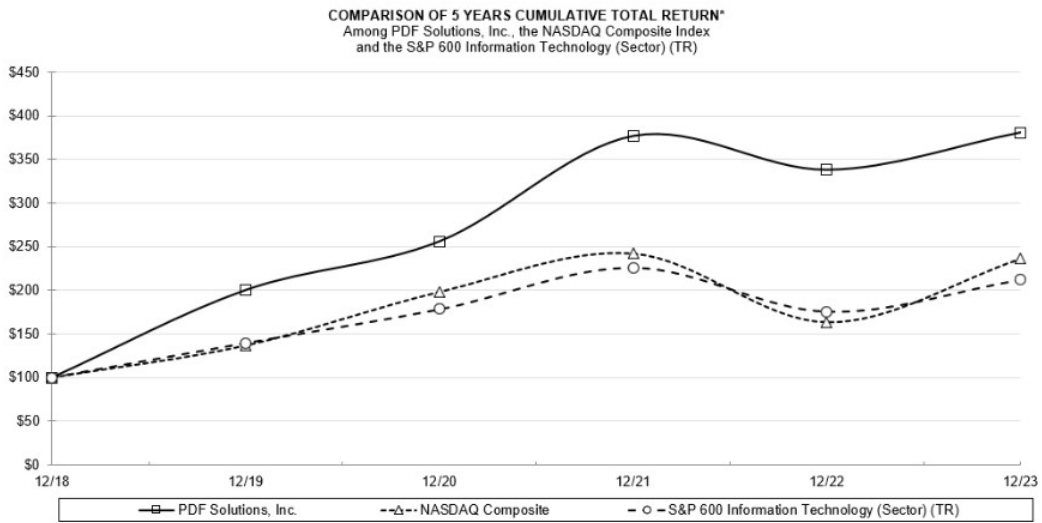
Dividend Policy

No cash dividends were declared or paid in 2023, 2022 and 2021. We currently intend to retain all available funds to finance future growth, product development, and stock repurchases and, therefore, do not anticipate paying any cash dividends on our common stock for the foreseeable future.

Stock Performance Graph

The performance graph shall not be deemed “filed” for purposes of Section 18 of the Exchange Act, or otherwise subject to the liabilities under that Section and shall not be deemed to be incorporated by reference into any filing of PDF Solutions under the Securities Act, or the Exchange Act.

The following graph and tables compare the cumulative total stockholder return data for our stock since December 31, 2018, to the cumulative return over such period of (i) The Nasdaq Composite Index and (ii) The S&P 600 Information Technology (Sector) (TR) Index. The graph assumes that \$100 was invested on December 31, 2018. 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 \$8.43 (closing price on December 31, 2018) and that 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.



*\$100 invested on 12/31/2018 in stock or index, including reinvestment of dividends. Fiscal year ending December 31.

Unregistered Sales of Equity Securities

None.

Purchases of Equity Securities by the Issuer and Affiliated Purchasers

On April 11, 2022, the Board of Directors adopted a new stock repurchase program (the “2022 Program”) to repurchase up to \$35.0 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, 2023, the Company repurchased 21,340 shares under the 2022 Program at an average price of \$34.81 per share for an aggregate total price of \$0.7 million. During the year ended December 31, 2022, the Company repurchased 714,600 shares under the 2022 Program at an average price of \$23.36 per share for an aggregate total price of \$16.7 million. In total, the Company has repurchased 735,940 shares under the 2022 Program at an average price of \$23.69 per share for an aggregate total price of \$17.4 million.

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 the Company’s common stock during the fourth quarter ended December 31, 2023.

Item 6. Reserved

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

Overview

We offer products and services designed to empower organizations across the semiconductor and electronics ecosystems to connect, collect, manage, and analyze data about design, equipment, manufacturing, and test to improve the yield and quality of their products. We derive revenues from two sources: Analytics and Integrated Yield Ramp. Our offerings combine proprietary software, professional services using proven methodologies and third-party cloud-hosting platforms for SaaS, electrical measurement hardware tools, and physical IP for IC designs. We primarily monetize our offerings through license fees and contract fees for professional services and SaaS. In some cases, especially on our historical Integrated Yield Ramp engagements, we also receive a value-based variable fee or royalty, which we call Gainshare. Our products, services, and solutions have been sold to IDMs, fabless semiconductor companies, foundries, OSATs, capital equipment manufacturers and system houses.

Industry Trends

Certain trends may affect our Analytics revenue specifically. In particular, the confluence of Industry 4.0 (i.e. the fourth industrial revolution, or the automation and data exchange in manufacturing technologies and processes) and cloud computing (i.e. the on-demand availability of computing resources and data storage without direct active management by the user) is driving increased innovation in semiconductor and electronics manufacturing and analytics, as well as in the organization of information technology (“IT”) networks and computing at semiconductor and electronics companies across the ecosystem. First, the ubiquity of wireless connectivity and sensor technology enables any manufacturing company to augment its factories and visualize its entire production line. In parallel, the cost per terabyte of data storage has generally decreases over time. The combination of these two trends means that more data is collected and stored than ever before. Further, semiconductor companies are striving to analyze these very large data sets in real-time to make rapid decisions that measurably improve manufacturing efficiency and quality. In parallel, the traditional practice of on-site data storage, even for highly sensitive data, is changing. The ability to cost-effectively and securely store, analyze, and retrieve massive quantities of data from the cloud versus on-premise enables data to be utilized across a much broader population of users, frequently resulting in greater demands on analytics programs. The combination of these latter two trends means that cloud-based, analytic programs that effectively manage identity management, physical security, and data protection are increasingly in demand for insights and efficiencies across the organizations of these companies. We believe that all these trends will continue for the next few years, and the challenges involved in adopting Industry 4.0 and secure cloud computing will create opportunities for our combination of advanced analytics capabilities, proven and established supporting infrastructure, and professional services to configure our products to meet customers’ specialized needs.

Other trends may continue to affect our Characterization services business and Integrated Yield Ramp revenue specifically. For example, semiconductor manufacturers have recently been experiencing lower wafer shipments, which has negatively impacted our Integrated Yield Ramp gainshare revenue. The logic foundry market at the leading-edge nodes, such as 7nm, 5nm, and smaller, underwent significant change over the past few years. The leading foundry continues to dominate market share. This trend will likely continue to impact our Characterization services business on these nodes. We expect most logic foundries to invest in derivatives of older process nodes, such as 28nm and 14nm, to extract additional value as many of their customers will not move to advanced nodes due to either technological barriers or restrictive economics. Foundries that participate at leading edge nodes are expected to continue to invest in new technologies such as memory, packaging, and multi-patterned and extreme ultraviolet lithography, as well as new innovations in process control and variability management. We expect China's investment in semiconductors to continue. Compliance with changing U.S. export restrictions limit our possible business with Chinese semiconductor manufacturers on advanced nodes. As a result of these market developments, we have chosen to focus our resources and investments in products, services, and solutions for analytics.

There are other global or business trends that may affect our business opportunities generally as follows:

- *Macroeconomy, inventories, and demand.* The worldwide economy did not recover as strongly or quickly as expected after the COVID-19 pandemic, and recession fears persist. As a result of the slow recovery, inventories of semiconductor devices remain elevated in many instances. The strength of demand for semiconductor products has varied by region and product segment. For example, demand for graphical processing unit products is strong, while demand for smart phones is weak. With high inventories and soft demand, semiconductor fab utilization rates are also low and semiconductor capital equipment orders have been impacted for some vendors and market segments. As a result of these trends, customers are being cautious with their spend and some purchase cycles are lengthening and other purchase decisions are being delayed, particularly with respect to larger deals.
- *Changing export controls and sanctions.* The U.S. government continues to expand and intensify export controls and sanctions, with a major focus on the destinations of the People's Republic of China ("P.R.C."), Russian Federation, and Belarus. After an internal evaluation, we determined that a large percentage of our software products are not of U.S. origin and are, thus, not subject to the EAR. Our standard operations include development, distribution processes, software download sites, and professional service centers and processes located in various geographies around the world to better serve our customers. Some customers in the P.R.C., in particular, have nonetheless expressed concerns to us that continued action by the U.S. government could potentially interrupt their ability to make use of our products or services, which has in some cases, and could in the future, negatively impact the demand for our products and services by these customers. In October 2022 and October 2023, the U.S. government issued interim final rules adding novel and complex export control restrictions, some exclusions, and requests for public comment. In light of questions about some restrictions and guidance, the U.S. government announced on November 6, 2023 that it was developing revisions to such rules to make corrections and clarifications. We believe the government will issue these revisions in 2024, along with additional restrictions. U.S. government policy and regulation remain fluid and uncertain. Other countries and jurisdictions with important roles in our industry are updating some of their export control regulations to further align with those of the U.S. government and, in some cases, to counter U.S. regulations. For example, the P.R.C. has imposed restrictions on imports of certain memory ICs offered by U.S. companies and has been developing its legal authorities to counter foreign sanctions. The U.S. government is renewing and amplifying its caution that visitors to the P.R.C. are subject to arbitrary enforcement of local laws and wrongful detention, a risk that could deter or hinder certain business activities. Based on our current assessments, we expect the near-term impact of these expanded trade restrictions on our business to be limited, but revisions, clarifications, and proposals that are still in government development and open questions of interpretation leave much unknown. We will continue to monitor for any further trade restrictions, other regulatory or policy changes by the U.S. or foreign governments and any actions in response. The uncertainty caused by these recent regulations and the potential for additional future restrictions could negatively affect our future sales in the P.R.C. market.
- *Investments in semiconductor manufacturing.* In 2022, the U.S. Congress passed into law funding programs from the bipartisan CHIPS Act, authorizing the Department of Commerce, Department of Defense, and Department of State to develop onshore domestic manufacturing of semiconductors considered critical to U.S. competitiveness

and national security. It is expected that U.S. semiconductor companies, especially manufacturers, will increase spending as a result of receiving funds under these programs. Recipients of funding under such programs may be required to agree to separate restrictions on certain commercial activity in the P.R.C., where we currently commercially operate. If our customers engage us for projects funded by these programs, we will evaluate all restrictions, and their impact on our existing business, before entering into any contracts associated with these programs.

- *Geopolitical tensions/conflicts.* Geopolitical tensions and conflicts in various locations around the world continue to increase, including on the issue of Taiwan in Asia, Ukraine and Russia, and most recently between Israel and Hamas. These current situations have created volatility in the global financial markets and may have further global economic consequences, including potential disruptions of the global supply chain and heightened volatility of commodity and raw material prices. This has increased fears of a global recession. We have contractors located in the West Bank and in Israel, who are providing software development and customer technical support services, and have developed contingency plans to use alternative resources to continue serving customers, if needed. Any escalations could lead to disruptions or reductions in international trade, deter or prevent purchasing activity of customers, and negatively impact our development timelines and customer support (with respect to the Israel-Hamas conflict) or China sales (with respect to U.S.-P.R.C. tensions) and financial results in general (with respect to global tensions).

Financial Highlights

The following are our financial highlights for the year ended December 31, 2023:

- Total revenues were \$165.8 million, an increase of \$17.3 million, or 12%, compared to the year ended December 31, 2022. Analytics revenue was \$152.1 million, an increase of \$21.6 million, or 17%, compared to the year ended December 31, 2022. The increase in Analytics revenue was driven by increases in revenue from DFI and CV systems, including sales-type leases of DFI assets, and an increase in revenue from Exensio software licenses, partially offset by a decrease in revenues from Cimetrix software licenses due to a decrease in orders for runtime licenses. Integrated Yield Ramp revenue decreased \$4.3 million, or 24%, compared to the year ended December 31, 2022, primarily due to a decrease in hours worked on fixed fee engagements and a decrease in Gainshare from decreased customer wafer shipments at non-leading-edge nodes.
- Costs of revenues increased \$3.8 million for the year ended December 31, 2023, compared to the year ended December 31, 2022, primarily due to increases in hardware costs, travel expenses, subcontractor fees and software licenses and maintenance costs. These increases were partially offset by decreases in personnel-related costs.
- Net income was \$3.1 million for the year ended December 31, 2023, compared to a net loss of \$3.4 million for the year ended December 31, 2022. The increase in net income was primarily attributable to (i) an increase in total revenues, (ii) an increase in interest income, (iii) a decrease in research and development expenses and (iv) a decrease in income tax expenses, partially offset by increases in (a) costs of revenues, (b) selling, general, and administrative expenses, which were primarily related to increases in personnel-related costs, travel expenses, legal fees related to the arbitration proceeding over a disputed customer contract, third-party cloud-services related costs, property tax expenses, general legal expenses, trade conference-related expenses, and business acquisition costs, and (c) foreign currency transaction exchange losses.
- Cash, cash equivalents and short-term investments decreased \$3.7 million to \$135.5 million as of December 31, 2023, from \$139.2 million as of December 31, 2022, primarily due to payments to vendors, payments of accrued bonuses and income taxes, purchases of and prepayments for property and equipment, payments of taxes related to net share settlement of equity awards, payments for a business acquisition, and repurchases of common stock, partially offset by cash collection from customers, interest income from cash, cash equivalents and short-term investments, and proceeds from purchases under our employee stock purchase plan and exercise of stock options.

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. Notes 1 and 2 of Notes to the Consolidated Financial Statements describe 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.

Revenue Recognition

We derive revenue from two sources: Analytics and Integrated Yield Ramp.

Analytics Revenue

Analytics revenue is derived from the following primary offerings: licenses and services for standalone Software (which consists primarily of Exensio and Cimatrix products), SaaS (which consists primarily of Exensio products), and DFI and CV systems (including Characterization services) that do not include performance incentives based on customers' yield achievement.

Revenue from standalone software is recognized depending on whether the license is perpetual or time-based. Perpetual (one-time charge) license software is recognized at the time of the inception of the arrangement when control transfers to the customers, if the software license is distinct from the services offered by us. Revenue from post-contract support is recognized over the contract term on a straight-line basis, because we are providing (i) support and (ii) unspecified software updates on a when-and-if available basis over the contract term. Revenue from time-based-licensed software is allocated to each performance obligation and is recognized either at a point in time or over time as follows. The license component is recognized at the time when control transfers to customers, with the post-contract support component recognized ratably over the committed term of the contract. For contracts with any combination of licenses, support, and other services, distinct performance obligations are accounted for separately. For contracts with multiple performance obligations, we allocate the transaction price of the contract to each performance obligation on a relative basis using the standalone selling price ("SSP") attributed to each performance obligation.

Revenue from SaaS arrangements, which allow for the use of a cloud-based software product or service over a contractually determined period of time without taking possession of software, is accounted for as subscriptions and is recognized as revenue ratably, on a straight-line basis, over the subscription period beginning on the date the service is first made available to customers.

Revenue from DFI systems and CV systems (including Characterization services) that do not include performance incentives based on customers' yield achievement is recognized primarily as services are performed. Where there are distinct performance obligations, we allocate revenue to all deliverables based on their SSPs. For these contracts with multiple performance obligations, we allocate the transaction price of the contract to each performance obligation on a relative basis using SSP attributed to each performance obligation. Where there are not discrete performance obligations, historically, revenue is primarily 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. The estimation of percentage of completion method is complex and subject to many variables that require significant judgment.

The Company also leases some of its DFI system and CV system assets to some customers. The Company determines the existence of a lease when the customer controls the use of these identified assets for a period of time defined in the lease agreement and classifies such leases as operating leases or sales-type leases. A lease is classified as a sales-type lease if it meets certain criteria under Topic 842, Leases; otherwise, it is classified as an operating lease. Operating lease revenue is recognized on a straight-line basis over the lease term. Sales-type lease revenue and corresponding lease receivables are

recognized at lease commencement based on the present value of the future lease payments, and related interest income on lease receivable is recognized over the lease term and are recorded under Analytics Revenue in the Consolidated Statements of Comprehensive Income (Loss). Payments under sales-type leases are discounted using the interest rate implicit in the lease. When the Company's leases are embedded in contracts with customers that include non-lease performance obligations, the Company allocates consideration in the contract between lease and non-lease components based on their relative SSPs. Assets subject to operating leases remain in Property and equipment, net and continue to be depreciated. Assets subject to sales-type leases are derecognized from Property and equipment at lease commencement and a net investment in the lease asset is recognized in Prepaid expenses and other current assets and Other non-current assets in the Consolidated Balance Sheets.

Integrated Yield Ramp Revenue

Integrated Yield Ramp revenue is derived from our yield ramp engagements that include Gainshare or other performance incentives based on customers' yield achievement.

Revenue under these project-based contracts, which are delivered over a specific period of time typically for a fixed fee component paid on a set schedule, is recognized as services are performed using a percentage of completion method based on costs or labor-inputs, whichever is the most appropriate measure of the progress towards completion of the contract. Where there are distinct performance obligations, we allocate revenue to all deliverables based on their SSPs and allocate the transaction price of the contract to each performance obligation on a relative basis using SSP. Similar to the services provided in connection with DFI systems and CV systems that are contributing to Analytics revenue, due to the nature of the work performed in these arrangements, the estimation of percentage of completion method is complex and subject to many variables that require significant judgment.

The Gainshare royalty contained in yield ramp contracts is a variable fee related to continued usage of our IP after the fixed-fee service period ends, based on the customers' yield achievement. Revenue derived from Gainshare is contingent upon our customers reaching certain defined production yield levels. Gainshare royalty periods are generally subsequent to the delivery of all contractual services and performance obligations. We record Gainshare as a usage-based royalty derived from customers' usage of IP and record it in the same period in which the usage occurs.

Income Taxes

We are required to assess whether it is "more likely than not" that we will realize our deferred tax assets. If we believe that they are not likely to be fully realizable before the expiration dates applicable to such assets, then to the extent we believe that recovery is not likely, we must establish a valuation allowance. Based on all available evidence, both positive and negative, we determined a full valuation allowance was still appropriate for our U.S. federal and state net deferred tax assets ("DTAs"), primarily driven by a cumulative loss incurred over the 12-quarter period ended December 31, 2023, and the likelihood that we may not utilize tax attributes before they expire. The valuation allowance was approximately \$64.2 million and \$59.2 million as of December 31, 2023 and 2022, respectively. We will continue to evaluate the need for a valuation allowance and may change our conclusion in a future period based on changes in facts (e.g., 12-quarter cumulative profit, significant new revenue, etc.). If we conclude that we are more likely than not to utilize some or all of our U.S. DTAs, we will release some or all of our valuation allowance and our tax provision will decrease in the period in which we make such determination.

We evaluate our DTAs for realizability considering both positive and negative evidence, including our historical financial performance, projections of future taxable income, future reversals of existing taxable temporary differences, tax planning strategies and any carryback availability. In evaluating the need for a valuation allowance, we estimate future taxable income based on management approved business plans. This process involves significant management judgment about assumptions that are subject to change from period to period based on changes in tax laws or variances between future projected operating performance and actual results. Changes in the net DTAs, less offsetting valuation allowance, in a period are recorded through the income tax provision and could have a material impact on the Consolidated Statements of Comprehensive Income (Loss).

Our income tax calculations are based on the application of applicable U.S. federal, state, and/or foreign tax law. Our tax filings, however, are subject to audit by the respective tax authorities. Accordingly, we recognize tax liabilities based upon our estimate of whether, and the extent to which, additional taxes will be due when such estimates are more-likely-than-not to be sustained. An uncertain income tax position will not be recognized if it has less than a 50% likelihood of being sustained. To the extent the final tax liabilities are different than the amounts originally accrued, the increases or decreases are recorded as income tax expense or benefit in the Consolidated Statements of Comprehensive Income (Loss). As of December 31, 2023, no deferred taxes have been provided on undistributed earnings from our international subsidiaries. We intend to reinvest the earnings of our non-U.S. subsidiaries in those operations indefinitely. As such, we have not provided for any foreign withholding taxes on the earnings of foreign subsidiaries as of December 31, 2023. The earnings of our foreign subsidiaries are taxable in the U.S. in the year earned under the Global Intangible Low-Taxed Income rules implemented under 2017 Tax Cuts and Jobs Act.

The CHIPS Act was signed into U.S. law on August 9, 2022. The CHIPS Act is intended to increase domestic competitiveness in semiconductor manufacturing capacity, increase research and development in computing, AI, clean energy, and nanotechnology through federal government programs and incentives over the next ten years. The CHIPS Act includes an advanced manufacturing tax credit equal to 25% of qualified investments in property purchased for an advanced manufacturing facility. We have begun to see some benefit from the CHIPS Act to our business, but the extent of future benefit is still unknown.

Stock-Based Compensation

We account for stock-based compensation using the fair value method, which requires us to measure stock-based compensation based on the grant-date fair value of the awards and recognize the compensation expense over the requisite service period. As stock-based compensation expense recognized is based on awards ultimately expected to vest, it has been reduced for estimated forfeitures. Forfeitures are estimated at the time of grant and revised, if necessary, in subsequent periods if actual forfeitures differ from those estimates.

The fair value of our restricted stock units is equal to the market value of our common stock on the date of the grant. These awards are subject to time-based vesting which generally occurs over a period of four years.

The fair value of our stock options and purchase rights granted under employee stock purchase plans is estimated using the Black-Scholes-Merton option-pricing model, which incorporates various assumptions including volatility, expected life and interest rates. The expected volatility is based on the historical volatility of our common stock over the most recent period commensurate with the estimated expected life of our stock options and purchase rights granted under employee stock purchase plans. The expected life is based on historical experience and on the terms and conditions of the options granted and purchase rights granted under employee stock purchase plans. The interest rate assumption is based upon observed Treasury yield curve rates appropriate for the expected life of our stock options and purchase rights granted under employee stock purchase plans.

Business Combinations

We allocate the fair value of purchase consideration to the tangible assets acquired, liabilities assumed and intangible assets acquired based on their estimated fair values at the date of the business combination. The excess of the fair value of purchase consideration over the fair values of these identifiable assets and liabilities is recorded as goodwill. Such valuations require us to make significant estimates and assumptions, especially with respect to intangible assets. Significant estimates in valuing certain intangible assets include, but are not limited to, estimated replacement costs and future expected cash flows from acquired customers, acquired technology, acquired patents, and trade names from a market participant perspective, useful lives and discount rates. The estimates of fair value are based upon assumptions believed to be reasonable, but which are inherently uncertain and unpredictable and, as a result, actual results may differ from estimates. Allocation of purchase consideration to identifiable assets and liabilities affects our amortization expense, as acquired finite-lived intangible assets are amortized over their useful life, whereas any indefinite lived intangible assets, including in-process research and development and goodwill, are not amortized. During the measurement period, which is not to exceed one year from the acquisition date, we record adjustments to the assets acquired and liabilities assumed,

with the corresponding offset to goodwill. Upon the conclusion of the measurement period, any subsequent adjustments are recorded to earnings in the Consolidated Statements of Comprehensive Income (Loss).

Valuation of Long-lived Assets including Goodwill and Intangible Assets

We record goodwill when the purchase consideration of an acquisition exceeds the fair value of the net tangible and identified intangible assets as of the date of acquisition. We have one operating segment and one operating unit. We perform an annual impairment assessment of goodwill during the fourth quarter of each calendar year or more frequently, if required to determine if any events or circumstances exist, such as an adverse change in business climate or a decline in the overall industry demand, that would indicate that it would more likely than not reduce the fair value of a reporting unit below its carrying amount, including goodwill. If events or circumstances do not indicate that the fair value of a reporting unit is below its carrying amount, then goodwill is not considered to be impaired and no further testing is required. If the carrying amount exceeds its fair value, an impairment loss would be recognized equal to the amount of excess, limited to the amount of total goodwill. There was no impairment of goodwill for the years ended December 31, 2023, 2022 and 2021.

Our long-lived assets, excluding goodwill, consist of property, equipment, and intangible assets. We periodically review our long-lived assets for impairment. For assets to be held and used, we initiate our review whenever events or changes in circumstances indicate that the carrying amount of a long-lived asset group may not be recoverable. Recoverability of an asset group is measured by comparison of its carrying amount to the expected future undiscounted cash flows that the asset group is expected to generate. If it is determined that an asset group is not recoverable, an impairment loss is recorded in the amount by which the carrying amount of the asset group exceeds its fair value. There was no impairment of intangible assets for the years ended December 31, 2023, 2022 and 2021. In fiscal 2021, we wrote down the value of property and equipment aggregating \$3.2 million pertaining to our first-generation of e-beam tools for DFI™ systems where carrying values may not be fully recoverable due to lack of market demand and future needs of our customers for these tools.

Leases

We have operating leases for our administrative and sales offices, research and development laboratory and clean room. We recognize our long-term operating lease rights and commitments as operating lease right-of-use assets, operating lease liabilities and operating lease liabilities, non-current, respectively, on our Consolidated Balance Sheets.

We determine if an arrangement is, or contains, a lease at inception. Operating lease right-of-use assets, and operating lease liabilities are initially recorded based on the present value of lease payments over the lease term. Lease terms include the minimum unconditional term of the lease, and may include options to extend or terminate the lease when it is reasonably certain at the commencement date that such options will be exercised. The decision to include these options involves consideration of our overall future business plans and other relevant business economic factors that may affect our business. Since the determination of the lease term requires an application of judgment, lease terms that differ in reality from our initial judgment may potentially have a material impact on our Consolidated Balance Sheets. In addition, our leases do not provide an implicit rate. In determining the present value of our expected lease payments, the discount rate is calculated using our incremental borrowing rate determined based on the information available, which requires additional judgment.

Recent Accounting Pronouncements and Accounting Changes

See our Note 1, “Description of Business and Summary of Significant Accounting Policies” of “Notes to Consolidated Financial Statements” included under Part II, Item 8 of this Form 10-K for a description of recent accounting pronouncements and accounting changes, including the dates of adoption and estimated effects, if any, on our consolidated financial statements.

Results of Operations**Discussion of Financial Data for the years ended December 31, 2023 and 2022****Revenues, Costs of Revenues, and Gross Margin**

(Dollars in thousands)	Year Ended December 31,			\$ Change	% Change	\$ Change	% Change
	2023	2022	2021	2022 to 2023		2021 to 2022	
Revenues:							
Analytics	\$ 152,085	\$ 130,480	\$ 93,415	\$ 21,605	17 %	\$ 37,065	40 %
Integrated Yield Ramp	13,750	18,069	17,645	(4,319)	(24)%	424	2 %
Total revenues	165,835	148,549	111,060	17,286	12 %	37,489	34 %
Costs of revenues	51,749	47,907	44,193	3,842	8 %	3,714	8 %
Gross profit	\$ 114,086	\$ 100,642	\$ 66,867	\$ 13,444	13 %	\$ 33,775	51 %
Gross margin	69 %	68 %	60 %				

<i>Analytics revenue as a percentage of total revenues</i>	92 %	88 %	84 %
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<i>Integrated Yield Ramp revenue as a percentage of total revenues</i>	8 %	12 %	16 %
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Analytics Revenue

Analytics revenue was \$152.1 million for the year ended December 31, 2023, an increase of \$21.6 million, or 17%, compared to the year ended December 31, 2022. The increase in Analytics revenue was driven by increases in revenue from DFI and CV systems, including sales-type leases of DFI assets, and an increase in revenue from Exensio software licenses, partially offset by a decrease in revenues from Cimetrix software licenses due to a decrease in orders for runtime licenses.

Integrated Yield Ramp Revenue

Integrated Yield Ramp revenue was \$13.8 million for the year ended December 31, 2023, a decrease of \$4.3 million, or 24%, compared to the year ended December 31, 2022, primarily due to a decrease in hours worked on fixed fee engagements and a decrease in Gainshare from decreased customer wafer shipments at non-leading-edge nodes.

Our Integrated Yield Ramp revenue may continue to fluctuate from period to period primarily due to the contribution of Gainshare royalty, which is dependent on many factors that are outside our control, including among others, continued production of ICs by our customers at facilities at which we generate Gainshare, sustained yield improvements by our customers, and whether we enter into new contracts containing Gainshare.

Our revenues may also fluctuate in the future due to other factors, including the semiconductor industry's continued acceptance of our products, services and solutions, the timing of purchases by existing and new customers, cancellations by existing customers, our ability to attract new customers and penetrate new markets, supply chain challenges and further penetration of our current customer base. Fluctuations in future results may also occur if any of our significant customers renegotiate pre-existing contractual commitments, including due to adverse changes in their own business.

Costs of Revenues

Costs of revenues consist primarily of costs incurred to provide and support our services, costs recognized in connection with licensing our software, IT and facilities-related costs and amortization of acquired technology. Service costs include material costs, hardware costs (including cost of leased assets under sales-type leases), personnel-related costs (including compensation, employee benefits, bonus and stock-based compensation expense), subcontractor costs,

overhead costs, travel expenses, and allocated facilities-related costs. Software license costs consist of costs associated with third-party cloud-delivery related expenses and licensing third-party software used by us in providing services to our customers in solution engagements or sold in conjunction with our software products.

The increase in costs of revenues of \$3.8 million for the year ended December 31, 2023, compared to the year ended December 31, 2022, was primarily due to (i) a \$3.5 million increase in hardware costs, (ii) a \$0.4 million increase in travel expenses, (iii) a \$0.2 million increase in subcontractor fees, and (iv) a \$0.2 million increase in software licenses and maintenance costs. These increases were partially offset by a \$0.4 million decrease in personnel-related costs due to lower compensation expenses, partially offset by an increase in stock-based compensation expense.

Gross Margin

Gross margin for the year ended December 31, 2023, was 69% compared to 68% for the year ended December 31, 2022, or an increase of 1 percentage point. The higher gross margin during the year ended December 31, 2023, was primarily due to higher total revenue when compared to the year ended December 31, 2022.

Operating Expenses:

Research and Development

(Dollars in thousands)	Year Ended December 31,			\$ Change 2022 to 2023	% Change	\$ Change 2021 to 2022	% Change
	2023	2022	2021				
Research and development	\$ 50,736	\$ 56,126	\$ 43,780	\$ (5,390)	(10)%	\$ 12,346	28 %
<i>As a percentage of total revenues</i>	<i>31 %</i>	<i>38 %</i>	<i>39 %</i>				

Research and development expenses consist primarily of personnel-related costs (including compensation, employee benefits, bonus and stock-based compensation expense), outside development services, travel expenses, third-party cloud-services related costs, IT and facilities cost allocations to support product development activities.

Research and development expenses decreased \$5.4 million for the year ended December 31, 2023, compared to the year ended December 31, 2022, primarily due to (i) a \$5.8 million decrease in personnel-related costs mostly resulting from a lower stock-based and other compensation expenses, partially offset by worldwide salary increases and increases in headcount, and (ii) a \$0.5 million decrease in facilities and IT-related costs including depreciation expense. These were partially offset by (a) a \$0.3 million increase in third-party cloud-services related costs, (b) a \$0.3 million increase in travel expenses, and (c) a \$0.2 million increase in subcontractor expenses primarily related to Cimatrix and Exensio software.

We anticipate our expenses in research and development will fluctuate in absolute dollars from period to period as a result of the size and the timing of product development projects.

Selling, General, and Administrative

(Dollars in thousands)	Year Ended December 31,			\$ Change 2022 to 2023	% Change	\$ Change 2021 to 2022	% Change
	2023	2022	2021				
Selling, general, and administrative	\$ 62,216	\$ 45,338	\$ 37,649	\$ 16,878	37 %	\$ 7,689	20 %
<i>As a percentage of total revenues</i>	<i>38 %</i>	<i>31 %</i>	<i>34 %</i>				

Selling, general, and administrative expenses consist primarily of personnel-related costs (including compensation, employee benefits, bonus, commission and stock-based compensation expense for sales, marketing, and general and

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administrative personnel), legal, tax and accounting services, marketing communications and trade conference-related expenses, third-party cloud-services related costs, travel, IT, and facilities cost allocations.

Selling, general, and administrative expenses increased \$16.9 million for the year ended December 31, 2023, compared to the year ended December 31, 2022, primarily due to (i) a \$14.5 million increase in personnel-related costs mainly resulting from increases in stock-based and other compensation expense, commission, employee benefit costs, headcount and worldwide salary increases, (ii) a \$0.8 million increase in travel expenses, (iii) a \$0.7 million increase in legal fees related to the arbitration proceeding over a disputed customer contract, (iv) a \$0.4 million increase in third-party cloud-services related costs, (v) a \$0.3 million increase in property tax expense, (vi) a \$0.3 million increase in general legal expenses, (vii) a \$0.3 million increase in trade conference-related expenses, and (viii) a \$0.2 million increase in business acquisition costs. These increases were partially offset by a \$0.4 million decrease in subcontractor expenses.

We anticipate our selling, general and administrative expenses will fluctuate in absolute dollars from period to period as a result of cost control initiatives and to support increased selling efforts in the future.

Amortization of acquired intangible assets

(Dollars in thousands)	Year Ended December 31,			\$ Change 2022 to 2023	% Change	\$ Change 2021 to 2022	% Change
	2023	2022	2021				
Amortization of acquired intangible assets	\$ 1,285	\$ 1,270	\$ 1,255	\$ 15	1 %	\$ 15	1 %

Amortization of acquired intangible assets primarily consists of amortization of intangibles acquired as a result of certain business combinations and was consistent for the year ended December 31, 2023 compared to the year ended December 31, 2022.

Write-down in value of property and equipment

(Dollars in thousands)	Year Ended December 31,			\$ Change 2022 to 2023	% Change	\$ Change 2021 to 2022	% Change
	2023	2022	2021				
Write-down in value of property and equipment	\$ —	\$ —	\$ 3,183	\$ —	— %	\$ (3,183)	(100) %

In fiscal 2021, we wrote down the value of property and equipment aggregating \$3.2 million pertaining to our first-generation of e-beam tools for DFITM systems where carrying values may not be fully recoverable due to lack of market demand and future needs of our customers for these tools.

Interest and Other Expense (Income), Net

(Dollars in thousands)	Year Ended December 31,			\$ Change 2022 to 2023	% Change	\$ Change 2021 to 2022	% Change
	2023	2022	2021				
Interest and other expense (income), net	\$ (5,020)	\$ (2,562)	\$ (683)	\$ 2,458	96 %	\$ 1,879	275 %

Interest and other expense (income), net primarily consists of interest income and foreign currency transaction exchange gains and losses.

Interest and other expense (income), net increased \$2.5 million for the year ended December 31, 2023, compared to the year ended December 31, 2022, primarily due to an increase in interest income of \$4.0 million from cash, cash equivalents and short-term investments resulting from higher interest rates, partially offset by net unfavorable fluctuations in foreign currency exchange rates.

Income Tax Expense

(Dollars in thousands)	Year Ended December 31,			\$ Change	% Change	\$ Change	% Change
	2023	2022	2021	2022 to 2023		2021 to 2022	
Income tax expense	\$ (1,764)	\$ (3,899)	\$ (3,171)	\$ (2,135)	(55)%	\$ 728	23 %

Income tax expense decreased \$2.1 million for the year ended December 31, 2023, compared to the year ended December 31, 2022, primarily due to decreases in state tax expense, foreign withholding taxes and changes in the geographic mix of worldwide income, which is subject to taxation at different statutory tax rates.

Any significant change in our future effective tax rates could adversely impact our consolidated financial position, results of operations, and cash flows. Our future tax rates may be adversely affected by a number of factors including increase in expenses not deductible for tax purposes, new or changing tax legislation in the United States and in foreign countries where we are subject to tax jurisdictions, the geographic composition of our pre-tax income, the amount of our pre-tax income as business activities fluctuate, our ability to use tax attributes such as research and development tax credits and net operation losses, the tax effects of employee stock activity, audit examinations with adverse outcomes, changes in general accepted accounting principles and the effectiveness of our tax planning strategies.

Discussion of Financial Data for the years ended December 31, 2022 and 2021

For a discussion of our results of operations for the years ended December 31, 2022 and 2021, please see our Annual Report on Form 10-K for the year ended December 31, 2022, filed with the SEC on March 1, 2023.

Liquidity and Capital Resources

As of December 31, 2023, our working capital, defined as total current assets less total current liabilities, was \$147.0 million, compared to \$135.2 million as of December 31, 2022. Cash, cash equivalents and short-term investments, on a consolidated basis, were \$135.5 million as of December 31, 2023, compared to \$139.2 million as of December 31, 2022. As of December 31, 2023, and 2022, cash and cash equivalents held by our foreign subsidiaries were \$10.0 million and \$8.8 million, respectively. We believe that our existing cash resources and anticipated funds from operations will satisfy our cash requirements to fund our operating activities, capital expenditures, and other obligations, for at least the next twelve months.

Repurchase of Company's Common Stock

On June 4, 2020, the Company's Board of Directors adopted a stock repurchase program (the "2020 Program") to repurchase up to \$25.0 million of the Company's common stock both on the open market and in privately negotiated transactions, including through Rule 10b5-1 plans, over the next two years. During the year ended December 31, 2022, 218,858 shares were repurchased by the Company under the 2020 Program at an average price of \$26.40 per share for an aggregate total price of \$5.8 million. During the year ended December 31, 2021, 251,212 shares were repurchased by the Company under the 2020 Program at an average price of \$18.01 per share for an aggregate total price of \$4.5 million. In total, 470,070 shares were repurchased under the 2020 Program at an average price of \$21.91 per share, for an aggregate total price of \$10.3 million.

On April 11, 2022, the Board of Directors terminated the 2020 Program, and adopted a new program (the "2022 Program") to repurchase up to \$35.0 million of the Company's common stock both on the open market and in privately negotiated transactions, including through Rule 10b5-1 plans, from time to time, over the next two years. During the year ended December 31, 2023, 21,340 shares were repurchased by the Company under the 2022 Program at an average price of \$34.81 per share for an aggregate total price of \$0.7 million. During the year ended December 31, 2022, 714,600 shares were repurchased by the Company under the 2022 Program at an average price of \$23.36 per share for an aggregate total price of \$16.7 million. In total, the Company has repurchased 735,940 shares under the 2022 Program at an average price of \$23.69 per share for an aggregate total price of \$17.4 million.

Consolidated Statements of Cash Flows Data

(In thousands)	Year Ended December 31,			\$ Change	
	2023	2022	2021	2022 to 2023	2021 to 2022
Net cash flows provided by (used in):					
Operating activities	\$ 14,600	\$ 32,298	\$ 4,243	\$ (17,698)	\$ 28,055
Investing activities	(28,991)	84,599	(4,667)	(113,590)	89,266
Financing activities	(5,890)	(24,307)	(5,525)	18,417	(18,782)
Effect of exchange rate changes on cash and cash equivalents	(365)	(650)	(182)	285	(468)
Net change in cash and cash equivalents	<u>\$ (20,646)</u>	<u>\$ 91,940</u>	<u>\$ (6,131)</u>	<u>\$ (112,586)</u>	<u>\$ 98,071</u>

Net Cash Provided by Operating Activities

Cash flows provided by operating activities during the year ended December 31, 2023, consisted of net income, adjusted for certain non-cash items which primarily consisted of depreciation and amortization, stock-based compensation expense, amortization of acquired intangible expense, amortization of costs capitalized to obtain revenue contracts, net accretion of discounts on short-term investments and net change in operating assets and liabilities.

Net cash flows provided by operating activities was \$14.6 million for the year ended December 31, 2023, compared to net cash flows provided by operating activities of \$32.3 million for the year ended December 31, 2022. The \$17.7 million decrease in cash flows provided by operating activities between the years was driven primarily by payments made to vendors and employees, including under the Company's bonus plan, partially offset by an increase in net income compared to the year ended December 31, 2022. Net income was \$3.1 million for the year ended December 31, 2023, compared to a net loss of \$3.4 million for the year ended December 31, 2022.

The major contributors to the net change in operating assets and liabilities for the year ended December 31, 2023, were as follows:

- Accounts receivable increased by \$2.7 million, primarily due to an increase in sales, an increase in unbilled accounts receivables due to timing of billing, and revenue recognition and higher contractual invoicing activity, partially offset by collections from customers;
- Prepaid expense and other current assets increased by \$7.3 million, primarily due to the timing of billing of contract assets related to fixed-price service contracts, an increase in lease receivable from sales-type leases, and an increase in income tax receivable, partially offset by a decrease in prepaid expenses related to third party software licenses and cloud-subscription costs;
- Other non-current assets increased by \$4.2 million primarily due to non-current assets from sales-type leases, increases in non-current contract assets and costs capitalized to obtain revenue contracts, partially offset by the amortization of non-current prepaid expenses;
- Accounts payable decreased by \$2.1 million primarily due to the timing of payments of vendor invoices; and
- Accrued compensation and related benefits decreased by \$2.2 million primarily due to the payments of accrued bonuses net of new bonus accruals, a decrease in accrued commissions, partially offset by additional contributions to the employee stock purchase plan.

Net Cash Provided by (Used in) Investing Activities

Net cash used in investing activities was \$29.0 million for the year ended December 31, 2023, compared to net cash provided by investing activities of \$84.6 million for the year ended December 31, 2022.

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For the year ended December 31, 2023, cash used in investing activities primarily related to purchases of short-term investments of \$59.6 million, purchases of and prepayments for property and equipment of \$11.3 million primarily related to our DFI and CV systems, payment for a business acquisition, net of cash acquired, of \$1.8 million, partially offset by proceeds from maturities and sales of short-term investments of \$43.8 million.

For the year ended December 31, 2022, cash provided by investing activities primarily related to proceeds from maturities and sales of short-term investments of \$151.5 million, partially offset by purchases of short-term investments of \$58.3 million, and purchases of and prepayments for property and equipment of \$8.4 million primarily related to our DFI systems and CV systems.

Net Cash Used in Financing Activities

Net cash used in financing activities was \$5.9 million for the year ended December 31, 2023, compared to net cash used in financing activities of \$24.3 million for the year ended December 31, 2022.

For the year ended December 31, 2023, net cash used in financing activities primarily consisted of \$9.5 million in cash payments for taxes related to net share settlement of equity awards and \$0.7 million for the repurchase of shares of our common stock and, partially offset by \$4.3 million of proceeds from our employee stock purchase plan and exercise of stock options.

For the year ended December 31, 2022, net cash used in financing activities primarily consisted of \$22.5 million for the repurchase of shares of our common stock and \$6.5 million in cash payments for taxes related to net share settlement of equity awards, partially offset by \$4.7 million of proceeds from our employee stock purchase plans and exercise of stock options.

Related Party Transactions

Refer to Note 13, “Strategic Partnership Agreement with Advantest and Related Party Transactions” of the Notes to Consolidated Financial Statements (Item 8 of Part II of this Annual Report) for a discussion on related party transactions between the Company and Advantest.

Off-Balance Sheet Arrangements

We do not have any off-balance sheet arrangements, investments in special purpose entities or undisclosed borrowings or debt.

Contractual Obligations

The following table summarizes our known contractual obligations as of December 31, 2023 (in thousands):

Contractual Obligations	Payments Due by Period					
	2024	2025	2026	2027	2028	Total
Operating lease obligations (1)	\$ 1,706	\$ 1,611	\$ 1,039	\$ 916	\$ 551	\$ 5,823
Purchase obligations (2)	17,557	7,290	1,097	244	61	26,249
Total (3)	\$ 19,263	\$ 8,901	\$ 2,136	\$ 1,160	\$ 612	\$ 32,072

(1) Refer to Note 5 of “Notes to Consolidated Financial Statements” (Item 8 of Part II of this Annual Report) for further discussion.

(2) Purchase obligations consist of agreements to purchase goods and services entered in the ordinary course of business.

- (3) The contractual obligation table above excludes liabilities for uncertain tax positions of \$2.6 million, which are not practicable to assign to any particular years due to the inherent uncertainty of the tax positions. See Note 9 of “Notes to Consolidated Financial Statements” (Item 8 of Part II of this Annual Report) for further discussion.

Item 7A. *Quantitative and Qualitative Disclosures About Market Risk*

The following discusses our exposure to market risk related to changes in interest rates and foreign currency exchange rates. We do not currently own any equity investments, nor do we expect to own any in the foreseeable future. This discussion contains forward-looking statements that are subject to risks and uncertainties. Actual results could vary materially as a result of a number of factors.

Interest Rate Risk. As of December 31, 2023, we had cash and cash equivalents and short-term investments of \$135.5 million. Cash and cash equivalents consisted of cash and highly liquid money market instruments. Short-term investments consisted of U.S. Government securities. We would not expect our operating results or cash flows to be affected to any significant degree by the effect of a sudden change in market interest on our portfolio. A hypothetical increase in market interest rates of 100 basis points from the market rates in effect at December 31, 2023, would cause the fair value of short-term investments to decrease by an immaterial amount which would not have significantly impacted our financial position or results of operations.

As of December 31, 2023, and periodically throughout the year, we have maintained cash balances in various operating accounts in excess of federally insured limits. We limit the amount of credit exposure to any financial institution by evaluating the creditworthiness of the financial institutions with which we invest and investing through more than one financial institution.

Foreign Currency and Exchange Risk. Certain of our receivables and payables for our international offices are denominated in the local currency, including the Euro, Yen and RMB. Therefore, a portion of our revenues and operating expenditures are subject to foreign currency risks. From time to time, we enter into foreign currency forward contracts to reduce the exposure to foreign currency exchange rate fluctuations on certain foreign currency denominated monetary assets and liabilities. We do not use foreign currency forward contracts for speculative or trading purposes. We record these forward contracts at fair value. The counterparty to these foreign currency forward contracts is a financial institution that we believe is creditworthy, and therefore, we believe the credit risk of counterparty non-performance is not significant. The change in fair value of these contracts is recorded in earnings as a component of other income (expense), net and offsets the change in fair value of foreign currency denominated monetary assets and liabilities, which is also recorded in other income (expense), net. As of December 31, 2023, we had no outstanding forward contracts.

Item 8. Financial Statements and Supplementary Data

REPORT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

**To the Board of Directors and Stockholders of
PDF Solutions, Inc.**

Opinion on the Consolidated Financial Statements

We have audited the accompanying consolidated balance sheets of PDF Solutions, Inc. (a Delaware corporation) and its subsidiaries (the “Company”) as of December 31, 2023 and 2022, and the related consolidated statements of comprehensive income (loss), stockholders’ equity, and cash flows for each of the three years in the period ended December 31, 2023, and the related notes (collectively referred to as the “consolidated financial statements”). In our opinion, the consolidated financial statements present fairly, in all material respects, the financial position of the Company as of December 31, 2023 and 2022, and the results of its operations and its cash flows for each of the three years in the period ended December 31, 2023, in conformity with accounting principles generally accepted in the United States of America.

We also have audited, in accordance with the standards of the Public Company Accounting Oversight Board (United States) (“PCAOB”), the Company’s internal control over financial reporting as of December 31, 2023, based on criteria established in *Internal Control—Integrated Framework (2013)* issued by the Committee of Sponsoring Organizations of the Treadway Commission, and our report dated February 27, 2024, expressed an unqualified opinion.

Basis for Opinion

These consolidated financial statements are the responsibility of the Company’s management. Our responsibility is to express an opinion on the Company’s consolidated financial statements based on our audits. We are a public accounting firm registered with the PCAOB and are required to be independent with respect to the Company in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audits in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the consolidated financial statements are free of material misstatement, whether due to error or fraud. Our audits included performing procedures to assess the risks of material misstatement of the consolidated financial statements, whether due to error or fraud, and performing procedures that respond to those risks. Such procedures included examining, on a test basis, evidence regarding the amounts and disclosures in the consolidated financial statements. Our audits also included evaluating the accounting principles used and significant estimates made by management, as well as evaluating the overall presentation of the consolidated financial statements. We believe that our audits provide a reasonable basis for our opinion.

Critical Audit Matter

The critical audit matter communicated below is a matter arising from the current period audit of the consolidated financial statements that was communicated or required to be communicated to the audit committee and that: (1) relates to accounts or disclosures that are material to the consolidated financial statements and (2) involved our especially challenging, subjective, or complex judgments. The communication of critical audit matters does not alter in any way our opinion on the consolidated financial statements, taken as a whole, and we are not, by communicating the critical audit matter below, providing separate opinions on the critical audit matter or on the accounts or disclosures to which they relate.

Revenue Recognition

As described in Note 2 to the consolidated financial statements, the Company derives revenue from Analytics and Integrated Yield Ramp. Contracts with customers can include various combinations of licenses, subscriptions, products and services, some of which are distinct and are accounted for as separate performance obligations. Significant judgment

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is exercised by the Company in determining revenue recognition for customer agreements, including determining whether licenses, subscriptions, and services are distinct performance obligations, determining the standalone selling price (“SSP”) attributed to each performance obligation, establishing the pattern of delivery for each distinct performance obligation, and estimating variable consideration when determining the amount of revenue to recognize. In addition, for revenue under project-based contracts for fixed-price services, revenue is recognized as services are performed using a percentage-of-completion (“POC”) method based on costs or labor-hours input method.

Estimated costs to complete each contract are based on i) future labor and product costs and ii) expected productivity efficiencies. Changes in these estimates can have a material effect on revenue recognized and/or related costs. Finally, the Company recognizes Gainshare royalty revenue in the same period in which the usage occurs. The Company accrues the related revenue based on estimates of customers’ underlying sales achievements. These estimates are based on historical data, trends, seasonality, changes in contract rate, knowledge of changes in the industry and changes in the customer’s manufacturing environment learned through discussions with customers and sales personnel.

The principal audit considerations for our determination that performing procedures related to the Company’s revenue recognition for customer agreements is a critical audit matter are the significant amount of judgment required by management in this process. Significant judgment is required in determining SSP as the Company rarely licenses software on a standalone basis, so the Company is required to estimate the range of SSPs for each performance obligation, which in turn leads to significant auditor judgment, subjectivity and effort in performing audit procedures in assessing the allocation of SSPs to performance obligations. In addition, significant judgment is required in determining the total estimated contract costs for fixed-price contracts, which in turn leads to significant auditor judgment, subjectivity, and effort in performing audit procedures and in evaluating audit evidence relating to the total estimated contract costs. Significant judgment is also required in recording Gainshare royalty revenue in the same period in which the usage occurs. The Company generally does not receive acknowledgment reports from customers during a given quarter, so the Company is required to accrue the related revenue based on estimates of customers underlying sales achievement, which in turn leads to significant auditor judgment, subjectivity, and effort in evaluating the reasonableness of these estimates based on historical data, trends, seasonality and other factors.

Addressing the matter involved performing procedures and evaluating audit evidence in connection with forming our overall opinion on the consolidated financial statements. These procedures included testing the effectiveness of internal controls relating to the revenue recognition process, including internal controls related to (1) the identification of distinct performance obligations and data used to establish SSP for licenses, subscriptions, products and services, (2) project estimates to completion for fixed fee arrangements accounted for under POC and (3) estimates of Gainshare royalty revenue accrual and subsequent true-ups. These procedures also included, among others, evaluating management’s significant accounting policies related to these customer agreements for reasonableness. In addition, for a sample of customer agreements, we obtained and read contract source documents, including master agreements and other documents that were part of the agreement, tested management’s identification of significant terms for completeness, including the identification of distinct performance obligations and variable consideration, assessed the terms in the customer agreements and evaluated the appropriateness of management’s application of their accounting policies, along with their use of estimates, in the determination of revenue recognition conclusions, and tested the mathematical accuracy of management’s calculations of revenue and the associated timing of revenue recognized in the consolidated financial statements. In addition, we evaluated the reasonableness of management’s estimates of SSP for projects and services that are not sold separately, where applicable, costs to complete for project-based contracts for fixed-price services and customers’ underlying achievements for royalty revenue.

/s/ BPM LLP

We have served as the Company’s auditor since 2018.

San Jose, California
February 27, 2024

REPORT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

**To the Board of Directors and Stockholders of
PDF Solutions, Inc.**

Opinion on Internal Control over Financial Reporting

We have audited the internal control over financial reporting of PDF Solutions, Inc. (a Delaware corporation) and its subsidiaries (the “Company”) as of December 31, 2023, based on criteria established in *Internal Control—Integrated Framework (2013)* issued by the Committee of Sponsoring Organizations of the Treadway Commission (“COSO”). In our opinion, the Company maintained, in all material respects, effective internal control over financial reporting as of December 31, 2023, based on criteria established in *Internal Control—Integrated Framework (2013)* issued by COSO.

We also have audited, in accordance with the standards of the Public Company Accounting Oversight Board (United States) (“PCAOB”), the consolidated balance sheets as of December 31, 2023 and 2022 and the related consolidated statements of comprehensive income (loss), stockholders’ equity, and cash flows for each of the three years in the period ended December 31, 2023 and the related notes (collectively referred to as the “consolidated financial statements”) of the Company, and our report dated February 27, 2024 expressed an unqualified opinion on those consolidated financial statements.

Basis for Opinion

The Company’s management is responsible for maintaining effective internal control over financial reporting and for its assessment of the effectiveness of internal control over financial reporting, included in the accompanying Management’s Report on Internal Control Over Financial Reporting. Our responsibility is to express an opinion on the entity’s internal control over financial reporting based on our audit. We are a public accounting firm registered with PCAOB and are required to be independent with respect to the Company in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audit in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether effective internal control over financial reporting was maintained in all material respects. Our audit of internal control over financial reporting included obtaining an understanding of internal control over financial reporting, assessing the risk that a material weakness exists, and testing and evaluating the design and operating effectiveness of internal control based on the assessed risk. Our audit also included performing such other procedures as we considered necessary in the circumstances. We believe that our audit provides a reasonable basis for our opinion.

Definition and Limitations of Internal Control over Financial Reporting

An entity’s internal control over financial reporting is a process designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of consolidated financial statements for external purposes in accordance with accounting principles generally accepted in the United States of America. An entity’s internal control over financial reporting includes those policies and procedures that (1) pertain to the maintenance of records that, in reasonable detail, accurately and fairly reflect the transactions and dispositions of the assets of the entity; (2) provide reasonable assurance that transactions are recorded as necessary to permit preparation of consolidated financial statements in accordance with accounting principles generally accepted in the United States of America, and that receipts and expenditures of the entity are being made only in accordance with authorizations of management and directors of the entity; and (3) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use, or disposition of the entity’s assets that could have a material effect on the consolidated financial statements.

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Because of its inherent limitations, internal control over financial reporting may not prevent or detect misstatements. Also, projections of any evaluation of effectiveness to future periods are subject to the risk that controls may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may deteriorate.

/s/ BPM LLP

San Jose, California
February 27, 2024

PDF SOLUTIONS, INC.
CONSOLIDATED BALANCE SHEETS
(in thousands, except par values)

	December 31,	
	2023	2022
ASSETS		
Current assets:		
Cash and cash equivalents	\$ 98,978	\$ 119,624
Short-term investments	36,544	19,557
Accounts receivable, net of allowance for credit losses	44,904	42,164
Prepaid expenses and other current assets	17,422	12,063
Total current assets	197,848	193,408
Property and equipment, net	37,338	40,174
Operating lease right-of-use assets, net	4,926	6,002
Goodwill	15,029	14,123
Intangible assets, net	15,620	18,055
Deferred tax assets, net	157	64
Other non-current assets	19,218	6,845
Total assets	\$ 290,136	\$ 278,671
LIABILITIES AND STOCKHOLDERS' EQUITY		
Current liabilities:		
Accounts payable	\$ 2,561	\$ 6,388
Accrued compensation and related benefits	14,800	16,948
Accrued and other current liabilities	4,633	5,581
Operating lease liabilities – current portion	1,529	1,412
Deferred revenues – current portion	25,750	26,019
Billings in excess of recognized revenues	1,570	1,852
Total current liabilities	50,843	58,200
Long-term income taxes	2,972	2,622
Non-current portion of operating lease liabilities	4,657	5,932
Other non-current liabilities	2,718	1,905
Total liabilities	61,190	68,659
Commitments and contingencies (Note 6)		
Stockholders' equity:		
Preferred stock, \$0.00015 par value, 5,000 shares authorized, no shares issued and outstanding	—	—
Common stock, \$0.00015 par value, 70,000 shares authorized; shares issued 49,749 and 48,613, respectively; shares outstanding 38,289 and 37,431, respectively	6	6
Additional paid-in capital	473,295	447,415
Treasury stock at cost, 11,460 and 11,182 shares, respectively	(143,923)	(133,709)
Accumulated deficit	(98,045)	(101,150)
Accumulated other comprehensive loss	(2,387)	(2,550)
Total stockholders' equity	228,946	210,012
Total liabilities and stockholders' equity	\$ 290,136	\$ 278,671

See Accompanying Notes to Consolidated Financial Statements.

PDF SOLUTIONS, INC.
CONSOLIDATED STATEMENTS OF COMPREHENSIVE INCOME (LOSS)
(in thousands, except per share amounts)

	Year Ended December 31,		
	2023	2022	2021
Revenues:			
Analytics	\$ 152,085	\$ 130,480	\$ 93,415
Integrated Yield Ramp	13,750	18,069	17,645
Total revenues	<u>165,835</u>	<u>148,549</u>	<u>111,060</u>
Costs and Expenses:			
Costs of revenues	51,749	47,907	44,193
Research and development	50,736	56,126	43,780
Selling, general, and administrative	62,216	45,338	37,649
Amortization of acquired intangible assets	1,285	1,270	1,255
Write-down in value of property and equipment	—	—	3,183
Interest and other expense (income), net	(5,020)	(2,562)	(683)
Income (loss) before income tax expense	<u>4,869</u>	<u>470</u>	<u>(18,317)</u>
Income tax expense	(1,764)	(3,899)	(3,171)
Net income (loss)	<u>\$ 3,105</u>	<u>\$ (3,429)</u>	<u>\$ (21,488)</u>
Other comprehensive income (loss):			
Foreign currency translation adjustments, net of tax	148	(1,493)	(825)
Change in unrealized gain (loss) related to available-for-sale debt securities, net of tax	15	7	(14)
Total other comprehensive income (loss)	<u>163</u>	<u>(1,486)</u>	<u>(839)</u>
Comprehensive income (loss)	<u>\$ 3,268</u>	<u>\$ (4,915)</u>	<u>\$ (22,327)</u>
Net income (loss) per share:			
Basic	<u>\$ 0.08</u>	<u>\$ (0.09)</u>	<u>\$ (0.58)</u>
Diluted	<u>\$ 0.08</u>	<u>\$ (0.09)</u>	<u>\$ (0.58)</u>
Weighted average common shares used to calculate net income (loss) per share:			
Basic	<u>38,015</u>	<u>37,309</u>	<u>37,138</u>
Diluted	<u>38,937</u>	<u>37,309</u>	<u>37,138</u>

See Accompanying Notes to Consolidated Financial Statements.

PDF SOLUTIONS, INC.
CONSOLIDATED STATEMENTS OF STOCKHOLDERS' EQUITY
(in thousands)

	Common Stock		Additional Paid-In Capital	Treasury Stock		Accumulated Deficit	Accumulated Other Comprehensive Loss	Total Stockholders' Equity
	Shares	Amount		Shares	Amount			
Balances, January 1, 2021	36,850	\$ 6	407,173	9,550	\$ (96,215)	\$ (76,233)	\$ (225)	\$ 234,506
Repurchase of common stock	(251)	—	—	251	(4,523)	—	—	(4,523)
Issuance of common stock in connection with employee stock purchase plan	109	—	1,035	—	—	—	—	1,035
Issuance of common stock in connection with exercise of options	216	—	1,930	—	—	—	—	1,930
Vesting of restricted stock units	487	—	—	—	—	—	—	—
Purchases of treasury stock in connection with tax withholdings on vesting of restricted stock	—	—	—	202	(3,967)	—	—	(3,967)
Stock-based compensation expense	—	—	12,931	—	—	—	—	12,931
Comprehensive loss	—	—	—	—	—	(21,488)	(839)	(22,327)
Balances, December 31, 2021	<u>37,411</u>	<u>6</u>	<u>423,069</u>	<u>10,003</u>	<u>(104,705)</u>	<u>(97,721)</u>	<u>(1,064)</u>	<u>219,585</u>
Repurchase of common stock	(933)	—	—	933	(22,471)	—	—	(22,471)
Issuance of common stock in connection with employee stock purchase plan	187	—	3,011	—	—	—	—	3,011
Issuance of common stock in connection with exercise of options	150	—	1,686	—	—	—	—	1,686
Vesting of restricted stock units	616	—	—	—	—	—	—	—
Purchases of treasury stock in connection with tax withholdings on vesting of restricted stock	—	—	—	246	(6,533)	—	—	(6,533)
Stock-based compensation expense	—	—	19,649	—	—	—	—	19,649
Comprehensive loss	—	—	—	—	—	(3,429)	(1,486)	(4,915)
Balances, December 31, 2022	<u>37,431</u>	<u>6</u>	<u>447,415</u>	<u>11,182</u>	<u>(133,709)</u>	<u>(101,150)</u>	<u>(2,550)</u>	<u>210,012</u>
Repurchase of common stock	(21)	—	—	21	(743)	—	—	(743)
Issuance of common stock in connection with employee stock purchase plan	224	—	3,832	—	—	—	—	3,832
Issuance of common stock in connection with exercise of options	30	—	492	—	—	—	—	492
Vesting of restricted stock units	625	—	—	—	—	—	—	—
Purchases of treasury stock in connection with tax withholdings on vesting of restricted stock	—	—	—	257	(9,471)	—	—	(9,471)
Stock-based compensation expense	—	—	21,556	—	—	—	—	21,556
Comprehensive income	—	—	—	—	—	3,105	163	3,268
Balances, December 31, 2023	<u>38,289</u>	<u>\$ 6</u>	<u>\$ 473,295</u>	<u>11,460</u>	<u>\$ (143,923)</u>	<u>\$ (98,045)</u>	<u>\$ (2,387)</u>	<u>\$ 228,946</u>

See Accompanying Notes to Consolidated Financial Statements.

PDF SOLUTIONS, INC.
CONSOLIDATED STATEMENTS OF CASH FLOWS
(in thousands)

	Year Ended December 31,		
	2023	2022	2021
Cash flows from operating activities:			
Net income (loss)	\$ 3,105	\$ (3,429)	\$ (21,488)
Adjustments to reconcile net income (loss) to net cash provided by operating activities:			
Depreciation and amortization	4,986	5,526	6,218
Stock-based compensation expense	21,484	19,649	12,931
Amortization of acquired intangible assets	3,551	3,484	3,334
Amortization of costs capitalized to obtain revenue contracts	2,142	1,550	674
Net accretion of discounts on short-term investments	(1,174)	(187)	(14)
Write-down in value of property and equipment	—	—	3,183
Deferred taxes	(108)	(4)	1,373
Other	(198)	—	161
Changes in operating assets and liabilities:			
Accounts receivable	(2,748)	(2,143)	(5,980)
Prepaid expenses and other current assets	(7,329)	(5,787)	1,136
Operating lease right-of-use assets	1,205	1,821	1,414
Other non-current assets	(4,166)	2,258	(1,336)
Accounts payable	(2,145)	(1,423)	(86)
Accrued compensation and related benefits	(2,188)	7,720	1,264
Accrued and other liabilities	110	1,671	(648)
Deferred revenues	(358)	1,822	5,028
Billings in excess of recognized revenues	(282)	1,852	(1,337)
Operating lease liabilities	(1,287)	(2,082)	(1,584)
Net cash provided by operating activities	14,600	32,298	4,243
Cash flows from investing activities:			
Proceeds from maturities and sales of short-term investments	43,800	151,500	171,000
Purchases of short-term investments	(59,598)	(58,321)	(168,560)
Proceeds from sale of property and equipment	105	—	—
Purchases of property and equipment	(11,236)	(8,409)	(3,672)
Prepayment for the purchase of property and equipment	(89)	(21)	(381)
Purchases of intangible assets	(150)	(150)	—
Payment for business acquisition, net of cash acquired	(1,823)	—	(3,054)
Net cash provided by (used in) investing activities	(28,991)	84,599	(4,667)
Cash flows from financing activities:			
Proceeds from exercise of stock options	492	1,686	1,930
Proceeds from employee stock purchase plans	3,832	3,011	1,035
Payments for taxes related to net share settlement of equity awards	(9,471)	(6,533)	(3,967)
Repurchases of common stock	(743)	(22,471)	(4,523)
Net cash used in financing activities	(5,890)	(24,307)	(5,525)
Effect of exchange rate changes on cash and cash equivalents	(365)	(650)	(182)
Net change in cash and cash equivalents	(20,646)	91,940	(6,131)
Cash and cash equivalents at beginning of year	119,624	27,684	33,815
Cash and cash equivalents at end of year	\$ 98,978	\$ 119,624	\$ 27,684

Continued on next page.

PDF SOLUTIONS, INC.
CONSOLIDATED STATEMENTS OF CASH FLOWS – CONTINUED
(in thousands)

	Year Ended December 31,		
	2023	2022	2021
Supplemental disclosure of cash flow information:			
Cash paid during the year for taxes	\$ 3,783	\$ 2,850	\$ 1,873
Cash paid for amounts included in the measurement of operating lease liabilities	\$ 1,648	\$ 1,744	\$ 1,947
Supplemental disclosure of noncash information:			
Property and equipment received and accrued in accounts payable and accrued and other liabilities	\$ 1,599	\$ 3,201	\$ 1,359
Advances for purchase of fixed assets transferred from prepaid assets to property and equipment	\$ 66	\$ 336	\$ 963
Operating lease liabilities arising from obtaining right-of-use assets	\$ 131	\$ 2,502	\$ 161
Property and equipment transferred to sales-type leases	\$ 8,076	\$ —	\$ —

See Accompanying Notes to Consolidated Financial Statements.

PDF SOLUTIONS, INC.
NOTES TO CONSOLIDATED FINANCIAL STATEMENTS

1. DESCRIPTION OF BUSINESS AND SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES

Description of Business

PDF Solutions, Inc. (the “Company” or “PDF”), provides products and services designed to empower organizations across the semiconductor and electronics ecosystem to connect, collect, manage, and analyze data about design, equipment, manufacturing, and test to improve the yield and quality of their products and operational efficiency. The Company’s products, services, and solutions include proprietary software, physical intellectual property (“IP”) for integrated circuit (“IC”) designs, electrical measurement hardware tools, proven methodologies, and professional services.

Basis of Presentation

The consolidated financial statements include the accounts of the Company and its wholly-owned subsidiaries after the elimination of all significant intercompany balances and transactions.

Use of Estimates

The preparation of financial statements in conformity with generally accepted accounting principles in the United States (“U.S. GAAP”) requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities, the disclosure of contingent assets and liabilities at the date of the financial statements and the reported amounts of revenues and expenses during the reporting period. Significant estimates in these financial statements include revenue recognition, the estimated useful lives of property and equipment and intangible assets, assumptions made in analysis of allowance for credit losses, fair values of assets acquired and liabilities assumed in business combinations, impairment of goodwill and long-lived assets, valuation for deferred tax assets, and accounting for lease obligations, stock-based compensation expense, and income tax uncertainties and contingencies. Actual results could differ from those estimates and may result in material effects on the Company’s operating results and financial position.

Concentration of Credit Risk

Financial instruments that potentially expose the Company to concentrations of credit risk consist primarily of cash and cash equivalents, short-term investments, and accounts receivable. As of December 31, 2023, and periodically throughout the year, the Company had cash balances in various operating accounts in excess of federally insured limits. The Company maintains its cash and cash equivalents and short-term investments with what it considers high credit quality financial institutions.

The Company primarily sells its products and services to companies in Asia, Europe, and North America within the semiconductor industry. As of December 31, 2023, two customers accounted for 50% of the Company’s gross accounts receivable and one customer accounted for 35% of the Company’s total revenues for 2023. As of December 31, 2022, three customers accounted for 53% of the Company’s gross accounts receivable and two customers accounted for 41% of the Company’s revenues for 2022. Two customers accounted for 27% of the Company’s revenues for 2021. See Note 11 for further details. The Company does not require collateral or other security to support accounts receivable. To reduce credit risk, management performs ongoing credit evaluations of its customers’ financial condition. The Company maintains allowances for potential credit losses.

The allowance for credit losses, which was based on management’s best estimates, could be adjusted in the near term from current estimates depending on actual experience. Such adjustments could be material to the consolidated financial statements.

Supplier Concentration

Some of the Company's vendors provide highly specialized, differentiated products and services related to the Company's eProbe system and some licensors provide key enabling software for the Company's products and services. In the event any of these suppliers delay or discontinue providing such products and services to the Company, it may be difficult for the Company to replace such suppliers, software, or parts in a timely manner or at all, which could delay or make impossible the Company's ability to deliver or adequately support its software systems or to complete and deliver its eProbe systems to its customers, and could negatively impact the Company's future financial results of operations.

Cash and Cash Equivalents, and Short-term Investments

The Company considers all highly liquid investments with effective maturities of 90 days or less on the date of purchase to be cash equivalents and investments with effective maturities greater than 90 days but less than one year to be short-term investments. The Company classifies its securities with readily determinable market values as "available-for-sale". Short-term investments include available-for-sale securities and are carried at estimated fair value, with the unrealized gains and unrealized non-credit-related losses, net of tax, reported as a component of accumulated other comprehensive income (loss) in stockholders' equity. Unrealized credit-related losses are recorded to interest and other expense (income), net in the Consolidated Statements of Comprehensive Income (Loss) with a corresponding allowance for credit-related losses in the Consolidated Balance Sheets. Realized gains and losses are based on the specific identification method and are included as a component of interest and other expense (income), net in the Consolidated Statements of Comprehensive Income (Loss).

The Company periodically reviews short-term investments for impairment. For investments in unrealized loss positions, the Company assesses whether any portion of the decline in fair value below the amortized cost basis is due to credit-related factors if the Company neither intends to sell nor anticipates that it is more likely than not that it will be required to sell prior to recovery of the amortized cost basis. The Company considers factors such as the extent to which the market value has been less than the amortized cost basis, any noted failure of the issuer to make scheduled interest or principal payments, changes to the rating of the security by a rating agency and other relevant credit-related factors in determining whether or not a credit loss exists. There was no allowance for credit-related losses on any of the Company's investments recognized in the years ended December 31, 2023, 2022 and 2021.

As of December 31, 2023, and 2022, short-term investments consisted solely of U.S. Government securities. The cost of these securities approximated fair value and there was no material gross realized or unrealized gains or losses as of December 31, 2023 and 2022. Refer to Note 12, "Fair Value Measurements" for further discussion on the Company's investments.

The Company recorded interest income from its cash, cash equivalents, and short-term investments of \$5.5 million, \$1.5 million and \$0.1 million in the years ended December 31 2023, 2022 and 2021, respectively.

Accounts Receivable

Accounts receivable include amounts that are unbilled at the end of the period that are expected to be billed and collected within a 12-month period. Unbilled accounts receivable are determined on an individual contract basis. Unbilled accounts receivable, included in accounts receivable, totaled \$16.4 million and \$13.5 million as of December 31, 2023 and 2022, respectively. Unbilled accounts receivable that are not expected to be billed and collected during the succeeding 12-month period are recorded in other non-current assets and totaled \$1.1 million and \$0.8 million as of December 31, 2023 and 2022, respectively.

The Company performs ongoing credit evaluations of its customers' financial condition. An allowance for credit losses is maintained for probable credit losses based upon the Company's assessment of the expected collectibility of the accounts receivable. The allowance for credit losses is reviewed on a quarterly basis to assess the adequacy of the allowance.

The changes in allowance for credit losses are summarized below (in thousands):

	Balance at Beginning of Period	Charged to Expense (1)	Deductions/ Write-offs of Accounts Receivable	Balance at End of Period
2023	\$ 890	\$ 20	\$ (20)	\$ 890
2022	\$ 890	\$ 11	\$ (11)	\$ 890
2021	\$ 963	\$ —	\$ (73)	\$ 890

(1) Additions to the accounts receivable reserve for credit losses are charged to bad debt expense.

Property and Equipment

Property and equipment are stated at cost and are depreciated using the straight-line method over the estimated useful lives (in years) of the related asset as follows:

Computer equipment	3
Software	3
Furniture, fixtures, and equipment	5-10
Laboratory and test equipment	3-10
Leasehold improvements	Shorter of estimated useful life or term of lease

Intangible Assets

Intangible assets consist of acquired technology, certain contract rights, customer relationships, patents, trademarks and trade names. These intangible assets may be acquired through business combinations or direct purchases. Intangible assets are amortized on a straight-line basis over their estimated useful lives which range from one to ten years. The Company continually monitors events and changes in circumstances that could indicate carrying amounts of long-lived assets, including property and equipment and intangible assets, may not be recoverable. When such events or changes in circumstances occur, the Company assesses the recoverability of long-lived assets. Recoverability of an asset group is measured by comparison of its carrying amount to the expected future undiscounted cash flows that the asset group is expected to generate. If it is determined that an asset group is not recoverable, an impairment loss is recorded in the amount by which the carrying amount of the asset group exceeds its fair value.

Goodwill

The Company records goodwill when the purchase consideration of an acquisition exceeds the fair value of the net tangible and identified intangible assets as of the date of acquisition. The Company has one operating segment and one operating unit. The Company performs a qualitative analysis when testing a reporting unit's goodwill for impairment. The Company performs an annual impairment assessment of goodwill during the fourth quarter of each calendar year or more frequently, if required to determine if any events or circumstances exist, such as an adverse change in business climate or a decline in the overall industry demand, that would indicate that it would more likely than not reduce the fair value of a reporting unit below its carrying amount, including goodwill. If events or circumstances do not indicate that the fair value of a reporting unit is below its carrying amount, then goodwill is not considered to be impaired and no further testing is required. If the carrying amount exceeds its fair value, an impairment loss would be recognized equal to the amount of excess, limited to the amount of total goodwill.

Leases

The Company has operating leases for administrative and sales offices, research and development laboratory and clean room. The Company recognizes long-term operating lease rights and commitments as operating lease right-of-use

(“ROU”) assets, operating lease liabilities and operating lease liabilities, non-current, respectively, in the Consolidated Balance Sheets. The Company elected to not separate lease and non-lease components for all of its leases.

The Company determines if an arrangement is, or contains, a lease at inception. Operating lease ROU assets, and operating lease liabilities are initially recorded based on the present value of lease payments over the lease term. Lease terms include the minimum unconditional term of the lease, and may include options to extend or terminate the lease when it is reasonably certain at the commencement date that such options will be exercised. The decision to include these options involves consideration of the Company’s overall future business plans and other relevant business economic factors that may affect its business. Since the determination of the lease term requires an application of judgment, lease terms that differ in reality from the Company’s initial judgment may potentially have a material impact on the Company’s Consolidated Balance Sheets. In addition, the Company’s leases do not provide an implicit rate. In determining the present value of the Company’s expected lease payments, the discount rate is calculated using the Company’s incremental borrowing rate determined based on the information available, which requires additional judgment.

Software Development Costs

Internally developed software is software developed to meet the Company’s internal needs to provide certain services to the customers. The Company’s capitalized software development costs consist of internal compensation related costs and external direct costs incurred during the application development stage and are amortized over their useful lives, generally five to six years.

The costs to develop software that is marketed externally consisting of external direct costs and internal compensation related costs are capitalized once technological feasibility of the software product has been established. Costs incurred prior to establishing technological feasibility are expensed as incurred. Technological feasibility is established when the Company has completed all planning, designing, coding, and testing activities that are necessary to establish that the software product can be produced to meet its design specifications. Capitalization of such costs ceases when the software product is generally available to customers. These software development costs are amortized using the greater of the straight-line method or the usage method over its estimated useful life.

Cost of Revenues

Costs of revenues consist primarily of costs incurred to provide and support the Company’s services, costs recognized in connection with licensing its software, IT and facilities-related costs and amortization of acquired technology. Service costs include material costs, hardware costs (including cost of leased assets under sales-type leases), personnel-related costs (including compensation, employee benefits, bonus and stock-based compensation expense), subcontractor costs, overhead costs, travel, and allocated facilities-related costs. Software license costs consist of costs associated with cloud-delivery related expenses and licensing third-party software used by the Company in providing services to its customers in solution engagements or sold in conjunction with the Company’s software products.

Research and Development Expenses

Research and development expenses consist primarily of personnel-related costs (including compensation, employee benefits, bonus and stock-based compensation expense), outside development services, travel, third-party cloud-services related costs, IT and facilities cost allocations to support product development activities. Research and development expenses are charged to operations as incurred.

Selling, General and Administrative Expenses

Selling, general and administrative expenses consist primarily of personnel-related costs (including compensation, employee benefits, bonus, commission and stock-based compensation expense for sales, marketing and general and administrative personnel), legal, tax and accounting services, marketing communications and trade conference-related expenses, third-party cloud-services related costs, travel, IT and facilities cost allocations.

Stock-Based Compensation

The Company accounts for stock-based compensation using the fair value method, which requires the Company to measure stock-based compensation based on the grant-date fair value of the awards and recognize the compensation expense over the requisite service period. As stock-based compensation expense recognized is based on awards ultimately expected to vest, it has been reduced for estimated forfeitures. Forfeitures are estimated at the time of grant and revised, if necessary, in subsequent periods if actual forfeitures differ from those estimates.

The fair value of the Company's restricted stock units ("RSUs") is equal to the market value of the Company's common stock on the date of the grant. These awards are subject to time-based vesting which generally occurs over a period of four years.

The fair value of the Company's stock options is estimated using the Black-Scholes-Merton option-pricing model, which incorporates various assumptions including volatility, expected life and interest rates. The expected volatility is based on the historical volatility of the Company's common stock over the most recent period commensurate with the estimated expected life of the Company's stock options. The expected life is based on historical experience and on the terms and conditions of the stock options granted. The interest rate assumption is based upon observed Treasury yield curve rates appropriate for the expected life of the Company's stock options.

Income Taxes

The Company's provision for income tax comprises its current tax liability and change in deferred tax assets and liabilities. Deferred tax assets and liabilities are recognized for the expected tax consequences of temporary differences between the tax bases of assets and liabilities. The measurement of current and deferred tax assets and liabilities is based on provisions of enacted tax laws; the effect of future changes in tax laws or rates are not anticipated. Valuation allowances are provided to reduce deferred tax assets to an amount that in management's judgment is more likely than not to be recoverable against future taxable income. No U.S. taxes are provided on earnings of non-U.S. subsidiaries, to the extent such earnings are deemed to be permanently invested. The Company's income tax calculations are based on application of applicable U.S. federal and state or foreign tax laws. The Company's tax filings, however, are subject to audit by the respective tax authorities. Accordingly, the Company recognizes tax liabilities based upon its estimate of whether, and the extent to which, additional taxes will be due when such estimates are more likely than not to be sustained. An uncertain income tax position will not be recognized if it has less than a 50% likelihood of being sustained. To the extent the final tax liabilities are different from the amounts originally accrued, the increases or decreases are recorded as income tax expense or benefit in the Consolidated Statements of Comprehensive Income (Loss).

Net Income (Loss) Per Share

Basic net income (loss) per share is computed by dividing net income (loss) by weighted average number of common shares outstanding for the period (excluding outstanding stock options and shares subject to repurchase). Diluted net income (loss) per share is computed using the weighted-average number of common shares outstanding for the period plus the potential effect of dilutive securities which are convertible into common shares (using the treasury stock method), except in cases in which the effect would be anti-dilutive. Dilutive potential common shares consist of incremental common shares issuable upon exercise of stock options, upon vesting of RSUs, contingently issuable shares for all periods and assumed issuance of shares under the Company's employee stock purchase plan. No dilutive potential common shares are included in the computation of any diluted per share amount when a loss from continuing operations was reported by the Company.

Foreign Currency Translation

The functional currency of the Company's foreign subsidiaries is the local currency for the respective subsidiary. The assets and liabilities are translated at the period-end exchange rate, and statements of comprehensive income (loss) are translated at the average exchange rate during the year. Gains and losses resulting from foreign currency translations are included as a component of other comprehensive income (loss). Gains and losses resulting from foreign currency transactions are included in the Consolidated Statements of Comprehensive Income (Loss).

Derivative Financial Instruments

The Company operates internationally and is exposed to potentially adverse movements in foreign currency exchange rates. From time to time, the Company enters into foreign currency forward contracts to reduce the exposure to foreign currency exchange rate fluctuations on certain foreign currency denominated monetary assets and liabilities. The Company does not use foreign currency contracts for speculative or trading purposes. The Company records these forward contracts at fair value. The counterparty to these foreign currency forward contracts is a financial institution that the Company believes is creditworthy, and therefore, we believe the credit risk of counterparty non-performance is not significant. These foreign currency forward contracts are not designated for hedge accounting treatment. Therefore, the change in fair value of these derivatives is recorded into earnings as a component of interest and other income (expense), net and offsets the change in fair value of the foreign currency denominated monetary assets and liabilities, which are also recorded in interest and other income (expense), net. The duration of these forward contracts is usually three months.

Business Combinations

The Company allocates the fair value of purchase consideration to the tangible assets acquired, liabilities assumed and intangible assets acquired based on their estimated fair values at the date of the business combination. The excess of the fair value of purchase consideration over the fair values of these identifiable assets and liabilities is recorded as goodwill. Such valuations require management to make significant estimates and assumptions, especially with respect to intangible assets. Significant estimates in valuing certain intangible assets include, but are not limited to, estimated replacement costs and future expected cash flows from acquired customers, acquired technology, acquired patents, and trade names from a market participant perspective, useful lives and discount rates. Management's estimates of fair value are based upon assumptions believed to be reasonable, but which are inherently uncertain and unpredictable and, as a result, actual results may differ from estimates. Allocation of purchase consideration to identifiable assets and liabilities affects the Company's amortization expense, as acquired finite-lived intangible assets are amortized over their useful life, whereas any indefinite lived intangible assets, including in-process research and development, and goodwill, are not amortized but tested annually for impairment. During the measurement period, which is not to exceed one year from the acquisition date, the Company records adjustments to the assets acquired and liabilities assumed, with the corresponding offset to goodwill. Upon the conclusion of the measurement period, any subsequent adjustments are recorded to earnings.

Litigation

From time to time, the Company is subject to various claims and legal proceedings that arise in the ordinary course of business. The Company accrues for losses related to litigation when a potential loss is probable and the loss can be reasonably estimated in accordance with Financial Accounting Standards Board ("FASB") requirements. See Note 6, "Commitments and Contingencies".

Accounting Standards Adopted

In June 2016, the FASB issued Accounting Standards Update ("ASU") No. 2016-13, Financial Instruments – Credit Losses (Topic 326): Measurement of Credit Losses on Financial Instruments ("ASU No. 2016-13"), which requires measurement and recognition of expected credit losses for financial assets held at the reporting date based on internal information, external information, or a combination of both relating to past events, current conditions, and reasonable and supportable forecasts. ASU No. 2016-13 replaces the existing incurred loss impairment model with a forward-looking expected credit loss model, which will result in earlier recognition of credit losses. Subsequent to the issuance of ASU No. 2016-13, the FASB issued ASU No. 2018-19, Codification Improvements to Topic 326, Financial Instruments – Credit Losses, ASU No. 2019-04, Codification Improvements to Topic 326, Financial Instruments – Credit Losses, Topic 815, Derivatives and Hedging, and Topic 825, Financial Instrument, ASU No. 2019-05, Financial Instruments – Credit Losses (Topic 326) Targeted Transition Relief, ASU No. 2016-13, ASU No. 2019-10 Financial Instruments-Credit Losses (Topic 326), Derivatives and Hedging (Topic 815), and Leases (Topic 842), and ASU No. 2019-11 Codification Improvements to Topic 326, Financial Instruments-Credit Losses. The subsequent ASUs do not change the core principle of the guidance in ASU No. 2016-13. Instead, these amendments are intended to clarify and improve operability of certain topics included within ASU No. 2016-13.

The Company adopted this standard on January 1, 2023, using a modified retrospective approach, which requires a cumulative-effect adjustment to accumulated deficit as of the beginning of the period of adoption with prior periods not restated. The adoption of ASU No. 2016-13 did not have a material impact on the Company's consolidated financial statements.

Recently Issued Accounting Pronouncements

In November 2023, the FASB issued ASU No. 2023-07, Segment Reporting (Topic 280): Improvements to Reportable Segment Disclosures, which requires disclosure of incremental segment information on an annual and interim basis. This ASU is effective for fiscal years beginning after December 15, 2023, and interim periods within fiscal years beginning after December 15, 2024, and requires retrospective application to all prior periods presented in the financial statements. Early adoption is permitted. The Company is currently evaluating the impact of the new standard on the consolidated financial statements.

In December 2023, the FASB issued ASU 2023-09, Income Taxes (Topic 740): Improvements to Income Tax Disclosures. This ASU is intended to improve the transparency of income tax disclosures by requiring (1) consistent categories and greater disaggregation of information in the rate reconciliation and (2) income taxes paid disaggregated by jurisdiction. It also includes certain other amendments to improve the effectiveness of income tax disclosures. The ASU's amendments are effective for public business entities for annual periods beginning after December 15, 2024. Entities are permitted to early adopt the standard for "annual financial statements that have not yet been issued or made available for issuance." Adoption is either prospectively or retrospectively, the Company will adopt this ASU on a prospective basis. The Company is currently evaluating the impact of the new standard on the consolidated financial statements and related disclosures.

Management has reviewed other recently issued accounting pronouncements issued or proposed by the FASB and does not believe any of these accounting pronouncements has had or will have a material impact on the consolidated financial statements.

2. REVENUE

The Company derives revenue from two sources: Analytics revenue and Integrated Yield Ramp revenue.

The Company recognizes revenue in accordance with FASB Accounting Standard Codification ("ASC") Topic 606, *Revenue from Contracts with Customers*, and its related amendments (collectively known as "ASC 606"). ASC 606 outlines a single comprehensive model to use in accounting for revenue arising from contracts with customers. Revenue is recognized when control of products or services is transferred to customers, in an amount that reflects the consideration the Company expects to be entitled to in exchange for those promised products or services.

The Company determines revenue recognition through the following five steps:

- Identification of the contract, or contracts, with a customer
- Identification of the performance obligations in the contract
- Determination of the transaction price
- Allocation of the transaction price to the performance obligations in the contract
- Recognition of revenue when, or as, performance obligations are satisfied

The Company accounts for a contract when it has approval and commitment from both parties, the rights of the parties are identified, payment terms are identified, the contract has commercial substance, and collectability of consideration is probable.

Contracts with multiple performance obligations

The Company enters into contracts that can include various combinations of licenses, products and services, some of which are distinct and are accounted for as separate performance obligations. For contracts with multiple performance obligations, the Company allocates the transaction price of the contract to each performance obligation on a relative basis using the standalone selling price (“SSP”).

Analytics Revenue

Analytics revenue is derived from the following primary offerings: licenses and services for standalone software (which is primarily Exensio® and Cimatrix® products), SaaS (which is primarily Exensio products), and DFI™ systems and CV® systems (including Characterization services) that do not include performance incentives based on customers’ yield achievement.

Revenue from standalone software is recognized depending on whether the license is perpetual or time-based. Perpetual (one-time charge) license software is recognized at the time of the inception of the arrangement when control transfers to the customers, if the software license is considered as a separate performance obligation from the services offered by the Company. Revenue from post-contract support is recognized over the contract term on a straight-line basis, because we are providing (i) support and (ii) unspecified software updates on a when-and-if available basis over the contract term. Revenue from time-based-licensed software is allocated to each performance obligation and is recognized either at a point in time or over time as follows. The license component is recognized at the time when control transfers to customers, with the post-contract support component recognized ratably over the committed term of the contract. For contracts with any combination of licenses, support, and other services, distinct performance obligations are accounted for separately. For contracts with multiple performance obligations, we allocate the transaction price of the contract to each performance obligation on a relative basis using the SSP attributed to each performance obligation.

Revenue from SaaS arrangements, which allow for the use of a cloud-based software product or service over a contractually determined period of time without the customer having to take possession of software, is accounted for as a subscription and is recognized as revenue ratably, on a straight-line basis, over the subscription period beginning on the date the service is first made available to customers. For contracts with any combination of SaaS and related services, distinct performance obligations are accounted for separately. For contracts with multiple performance obligations, we allocate the transaction price of the contract to each performance obligation on a relative basis using SSP attributed to each performance obligation.

Revenue from DFI systems and CV systems (including Characterization services) that do not include performance incentives based on customers’ yield achievement is recognized primarily as services are performed. Where there are distinct performance obligations, the Company allocates revenue to all deliverables based on their SSPs. For those contracts with multiple performance obligations, the Company allocates the transaction price of the contract to each performance obligation on a relative basis using SSP attributed to each performance obligation. Where there are not discrete performance obligations, historically, revenue is primarily 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. The estimation of percentage of completion method is complex and subject to many variables that require significant judgement. Please refer to “Significant Judgments” section of this Note for further discussion.

The Company also leases some of its DFI system and CV system assets to some customers. The Company determines the existence of a lease when the customer controls the use of these identified assets for a period of time defined in the lease agreement and classifies such leases as operating leases or sales-type leases. A lease is classified as a sales-type lease if it meets certain criteria under Topic 842, Leases; otherwise it is classified as an operating lease. Operating lease revenue is recognized on a straight-line basis over the lease term. Sales-type lease revenue and corresponding lease receivables are recognized at lease commencement based on the present value of the future lease payments, and related interest income on lease receivable is recognized over the lease term and are recorded under Analytics Revenue in the Consolidated Statements of Comprehensive Income (Loss). Payments under sales-type leases are discounted using the interest rate implicit in the lease. When the Company’s leases are embedded in contracts with customers that include non-lease

performance obligations, the Company allocates consideration in the contract between lease and non-lease components based on their relative SSPs. Assets subject to operating leases remain in Property and equipment and continue to be depreciated. Assets subject to sales-type leases are derecognized from Property and equipment, net at lease commencement and a net investment in the lease asset is recognized in Prepaid expenses and other current assets and Other non-current assets in the Consolidated Balance Sheets.

Integrated Yield Ramp Revenue

Integrated Yield Ramp revenue is derived from the Company's fixed-fee engagements that include performance incentives based on customers' yield achievement (which consists primarily of Gainshare royalties) typically based on customer's wafer shipments, pertaining to these fixed-price contracts, which royalties are variable.

Revenue under these project-based contracts, which are delivered over a specific period of time, typically for a fixed fee component paid on a set schedule, is recognized as services are performed using a percentage of completion method based on costs or labor-inputs, whichever is the most appropriate measure of the progress towards completion of the contract. Where there are distinct performance obligations, the Company allocates revenue to all deliverables based on their SSPs and allocates the transaction price of the contract to each performance obligation on a relative basis using SSP. Similar to the services provided in connection with DFI systems and CV systems that are contributing to Analytics revenue, due to the nature of the work performed in these arrangements, the estimation of percentage of completion method is complex and subject to many variables that require significant judgement. Please refer to "Significant Judgments" section of this Note for further discussion.

The Gainshare royalty contained in Integrated Yield Ramp contracts is a variable fee related to continued usage of the Company's IP after the fixed-fee service period ends, based on a customer's yield achievement. Revenue derived from Gainshare is contingent upon the Company's customers reaching certain defined production yield levels. Gainshare royalty periods are generally subsequent to the delivery of all contractual services and performance obligations. The Company records Gainshare as a usage-based royalty derived from customers' usage of IP and records it in the same period in which the usage occurs.

Disaggregation of Revenue

The Company disaggregates revenue from contracts with customers into the timing of the transfer of goods and services and the geographical regions. The Company determined that disaggregating revenue into these categories achieves the disclosure objective to depict how the nature, amount, timing, and uncertainty of revenue and cash flows are affected by economic factors.

The Company's performance obligations are satisfied either over time or at a point-in-time. The following table represents a disaggregation of revenue by timing of revenue:

	Year Ended December 31,		
	2023	2022	2021
Over time	71 %	69 %	65 %
Point-in-time	29 %	31 %	35 %
Total	100 %	100 %	100 %

International revenues accounted for approximately 44%, 50% and 55% of total revenues for the years ended December 31, 2023, 2022 and 2021, respectively. See Note 11, "Customer and Geographic Information".

Significant Judgments

Judgments and estimates are required under ASC 606. Due to the complexity of certain contracts, the actual revenue recognition treatment required under ASC 606 for the Company's arrangements may be dependent on contract-specific terms and may vary in some instances.

For revenue under project-based contracts for fixed-price implementation services, revenue is recognized as services are performed using a percentage-of-completion method based on costs or labor-hours input method, 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 percentage of completion method is complex, subject to many variables and requires significant judgment. Key factors reviewed by the Company 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 extent of progress toward completion, revisions to the estimates are made. These revisions may result in increases or decreases in estimated revenues or costs, and such revisions are reflected in revenue on a cumulative catch-up basis in the period in which the circumstances that gave rise to the revision become known.

The Company's contracts with customers often include promises to transfer products, licenses software and provide services, including professional services, technical support services, and rights to unspecified updates to a customer. Determining whether licenses and services are distinct performance obligations that should be accounted for separately, or not distinct and thus accounted for together, requires significant judgment. The Company rarely licenses software on a standalone basis, so the Company is required to estimate the range of SSPs for each performance obligation. In instances where SSP is not directly observable because the Company does not license the software or sell the service separately, the Company determines the SSP using information that may include market conditions and other observable inputs.

The Company is required to record Gainshare royalty revenue in the same period in which the usage occurs. Because the Company generally does not receive the acknowledgment reports from its customers during a given quarter within the time frame necessary to adequately review the reports and include the actual amounts in quarterly results for such quarter, the Company accrues the related revenue based on estimates of customers underlying sales achievement. The Company's estimation process can be based on historical data, trends, seasonality, changes in the contract rate, knowledge of the changes in the industry and changes in the customer's manufacturing environment learned through discussions with customers and sales personnel. As a result of accruing revenue for the quarter based on such estimates, adjustments will be required in the following quarter to true-up revenue to the actual amounts reported.

Contract Balances

The Company performs its obligations under a contract with a customer by licensing software or providing services in exchange for consideration from the customer. The timing of the Company's performance often differs from the timing of the customer's payment, which results in the recognition of a receivable, a contract asset or a contract liability.

The Company classifies the right to consideration in exchange for software or services transferred to a customer as either a receivable or a contract asset. A receivable is a right to consideration that is unconditional, as compared to a contract asset, which is a right to consideration that is conditional upon factors other than the passage of time. The majority of the Company's contract assets represent unbilled amounts related to fixed-price service contracts when the revenue recognized exceeds the amount billed to the customer. The contract assets are generally classified as current and are recorded on a net basis with deferred revenue (i.e. contract liabilities) at the contract level. As of December 31, 2023 and 2022, contract assets of \$6.8 million and \$3.3 million, respectively, are included in prepaid expenses and other current assets in the accompanying Consolidated Balance Sheets. As of December 31, 2023 and 2022, contract assets of \$0.9 million and nil, respectively, are included in other non-current assets in the accompanying Consolidated Balance Sheets. The Company did not record any asset impairment charges related to contract assets during fiscal years 2023, 2022 and 2021.

Deferred revenues and billings in excess of recognized revenues consist substantially of amounts invoiced in advance of revenue recognition and are recognized as the revenue recognition criteria are met. Deferred revenues that will be recognized during the succeeding twelve-month period are recorded as current deferred revenues and the remaining portion is recorded in other non-current liabilities in the accompanying Consolidated Balance Sheets. As of December 31, 2023 and 2022, the non-current portion of deferred revenues included in non-current liabilities was \$1.8 million and \$1.9 million, respectively. Revenue recognized for the years ended December 31, 2023, 2022 and 2021, that was included in the deferred revenues and billings in excess of recognized revenues balances at the beginning of each reporting period was \$24.8 million, \$24.9 million and \$16.9 million, respectively.

As of December 31, 2023, the aggregate amount of the transaction price allocated to the remaining performance obligations related to customer contracts that were unsatisfied or partially unsatisfied was approximately \$229.8 million. Given the applicable contract terms with customers, the majority of this amount is expected to be recognized as revenue over the next three years, with the remainder in the following three years. This amount does not include significant contracts to which the customer is not committed, future sales-based or usage-based royalty payments in exchange for a license of IP, and future payments for performance obligations from on-demand arrangements. This amount is subject to change due to future revaluations of variable consideration, terminations, other contract modifications, or currency adjustments. The estimated timing of the recognition of remaining unsatisfied performance obligations is subject to change and is affected by changes to the scope, change in timing of delivery of products and services, or contract modifications.

The adjustment to revenue recognized in the years ended December 31, 2023, 2022 and 2021 from performance obligations satisfied (or partially satisfied) in previous periods was an increase of \$3.7 million, an increase of \$0.4 million and a decrease \$0.4 million, respectively. These amounts primarily represent changes in estimated percentage-of-completion based contracts and changes in actual versus estimated Gainshare royalty.

Costs to obtain or fulfill a contract

The Company capitalizes the incremental costs to obtain or fulfill a contract with a customer, including direct sales commissions and related fees, when it expects to recover those costs. Amortization expense related to these capitalized costs is recognized over the period associated with the revenue from which the cost was incurred. Total capitalized direct sales commission costs included in prepaid expenses and other current assets in the accompanying Consolidated Balance Sheets as of December 31, 2023 and 2022 was \$2.0 million and \$1.7 million, respectively. Total capitalized direct sales commission costs included in other non-current assets in the accompanying Consolidated Balance Sheets as of December 31, 2023 and 2022 was \$2.6 million and \$2.1 million, respectively. Amortization of these assets for each of the years ended December 31, 2023, 2022 and 2021 was \$2.1 million, \$1.5 million and \$0.7 million, respectively. There was no impairment loss in relation to the costs capitalized for the periods presented.

Practical Expedients

The Company does not adjust transaction price for the effects of a significant financing component when the period between the transfers of the promised good or service to the customer and payment for that good or service by the customer is expected to be one year or less. The Company assessed each of its revenue generating arrangements in order to determine whether a significant financing component exists, and determined its contracts did not include a significant financing component for the years ended December 31, 2023, 2022 and 2021.

3. PROPERTY AND EQUIPMENT

Property and equipment consist of (in thousands):

	December 31,	
	2023	2022
Computer equipment	\$ 12,515	\$ 11,853
Software	5,596	5,395
Furniture, fixtures, and equipment	2,501	2,484
Leasehold improvements	6,475	6,467
Laboratory and other equipment	4,891	4,431
Test equipment	25,044	28,403
Property and equipment in progress:		
DFI™ system assets	22,864	22,231
CV® system and other assets	6,977	5,105
	<u>86,863</u>	<u>86,369</u>
Less: Accumulated depreciation and amortization	(49,525)	(46,195)
Total	<u>\$ 37,338</u>	<u>\$ 40,174</u>

Test equipment mainly includes DFI™ systems and CV® systems assets at customer sites that are contributing to revenue. Property and equipment in progress represent the development or construction of property and equipment that have not yet been placed in service for the Company's intended use and are not depreciated.

Depreciation and amortization expense for the years ended December 31, 2023, 2022 and 2021 was \$5.0 million, \$5.5 million and \$6.2 million, respectively.

In 2021, the Company wrote down the value of its property and equipment by \$3.2 million related to its first-generation of e-beam tools for DFI systems wherein carrying values may not be fully recoverable due to lack of market demand and future needs of its customers for these tools.

4. GOODWILL AND INTANGIBLE ASSETS

The Company completed the acquisition of Lantern Machinery Analytics, Inc. in the year ended December 31, 2023. Refer to Note 14 for additional information related to the goodwill and intangible assets added from this acquisition.

As of December 31, 2023 and 2022, the carrying amount of goodwill was \$15.0 million and \$14.1 million, respectively. The following table summarizes goodwill transaction for the years ended December 31, 2023, 2022 and 2021 (in thousands):

	Year Ended December 31,		
	2023	2022	2021
Balance at beginning of year	\$ 14,123	\$ 14,123	\$ 15,774
Addition	895	—	—
Measurement period acquisition adjustment	—	—	(1,651)
Foreign currency translation adjustment	11	—	—
Balance at end of year	<u>\$ 15,029</u>	<u>\$ 14,123</u>	<u>\$ 14,123</u>

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Intangible assets balance was \$15.6 million and \$18.1 million as of December 31, 2023 and 2022, respectively.

Intangible assets as of December 31, 2023 and 2022, consist of the following (in thousands):

	Amortization Period (Years)	December 31, 2023			December 31, 2022		
		Gross Carrying Amount	Accumulated Amortization	Net Carrying Amount	Gross Carrying Amount	Accumulated Amortization	Net Carrying Amount
Acquired identifiable intangibles:							
Customer relationships	1-10	\$ 9,508	\$ (7,335)	\$ 2,173	\$ 9,407	\$ (6,684)	\$ 2,723
Developed technology	4-9	34,650	(22,094)	12,556	33,635	(19,647)	13,988
Tradename and trademarks	2-10	1,598	(1,025)	573	1,598	(918)	680
Patent	6-10	2,100	(1,782)	318	2,100	(1,696)	404
Noncompetition agreements	3	848	(848)	—	848	(588)	260
Total		\$ 48,704	\$ (33,084)	\$ 15,620	\$ 47,588	\$ (29,533)	\$ 18,055

The weighted average amortization period for acquired identifiable intangible assets was 5.3 years as of December 31, 2023. The following table summarizes intangible assets amortization expense in the Consolidated Statements of Comprehensive Income (Loss) (in thousands):

	Year Ended December 31,		
	2023	2022	2021
Amortization of acquired technology included under costs of revenues	\$ 2,266	\$ 2,214	\$ 2,079
Amortization of acquired intangible assets presented separately under costs and expenses	1,285	1,270	1,255
Total amortization of acquired intangible assets	\$ 3,551	\$ 3,484	\$ 3,334

The Company expects annual amortization of acquired identifiable intangible assets to be as follows (in thousands):

Year Ending December 31,	Amount
2024	\$ 3,237
2025	3,072
2026	2,903
2027	2,750
2028	2,445
2029 and thereafter	1,213
Total future amortization expense	\$ 15,620

There were no impairment charges for goodwill and intangible assets for the years ended December 31, 2023, 2022 and 2021.

5. LEASES

In 2022, the Company early terminated an office lease contract. The termination of this lease reduced the Company's operating lease ROU assets and lease liabilities by approximately \$0.5 million and \$0.6 million, respectively. The gain from the lease termination of approximately \$0.1 million was recorded under selling, general and administrative expense in the accompanying Consolidated Statement of Comprehensive Loss for the year ended December 31, 2022.

Lease expense was comprised of the following (in thousands):

	Year Ended December 31,		
	2023	2022	2021
Operating lease expense (1)	\$ 1,534	\$ 1,457	\$ 1,860
Short-term lease and variable lease expense (2)	923	1,032	822
Total lease expense	\$ 2,457	\$ 2,489	\$ 2,682

- (1) Net of gain recognized upon lease termination of \$0.1 million in the year ended December 31, 2022.
- (2) Leases with an initial term of 12 months or less are not recorded on the Consolidated Balance Sheets, and the Company recognizes lease expense for these leases on a straight-line basis over the lease term. Variable lease expense for the periods presented primarily included common area maintenance charges.

Supplemental consolidated balance sheets information related to leases was as follows:

	December 31,	
	2023	2022
Weighted average remaining lease term under operating leases (in years)	4.4	5.3
Weighted average discount rate for operating lease liabilities	4.96 %	4.87 %

Maturity of operating lease liabilities as of December 31, 2023, are as follows (in thousands):

Year Ending December 31,	Amount (1)
2024	\$ 1,663
2025	1,611
2026	1,355
2027	1,294
2028	929
2029	63
Total future minimum lease payments	6,915
Less: Interest (2)	(729)
Present value of future minimum lease payments under operating lease liabilities (3)	\$ 6,186

- (1) As of December 31, 2023, the total operating lease liability includes \$1.0 million related to an option to extend a lease term that is reasonably certain to be exercised.
- (2) Calculated using incremental borrowing interest rate for each lease.
- (3) Includes the current portion of operating lease liabilities of \$1.5 million as of December 31, 2023.

6. COMMITMENTS AND CONTINGENCIES

Strategic Partnership with Advantest

See Note 13 for the discussion about the Company's commitments under the strategic partnership with Advantest.

Operating Leases

Refer to Note 5, "Leases", for the discussion about the Company's lease commitments.

Indemnifications

The Company generally provides a warranty to its customers that its software will perform substantially in accordance with documented specifications typically for a period of 90 days following delivery of its products. The Company also indemnifies certain customers from third-party claims of IP infringement relating to the use of its products. Historically, costs related to these guarantees have not been significant. The Company is unable to estimate the maximum potential impact of these guarantees on its future results of operations.

Purchase Obligations

The Company has purchase obligations with certain suppliers for the purchase of goods and services entered in the ordinary course of business. As of December 31, 2023, total outstanding purchase obligations were \$26.2 million, the majority of which are due within the next 2 years.

Indemnification of Officers and Directors

As permitted by the Delaware general corporation law, the Company has included a provision in its certificate of incorporation to eliminate the personal liability of its officers and directors for monetary damages for breach or alleged breach of their fiduciary duties as officers or directors, other than in cases of fraud or other willful misconduct.

In addition, the Bylaws of the Company provide that the Company is required to indemnify its officers and directors even when indemnification would otherwise be discretionary, and the Company is required to advance expenses to its officers and directors as incurred in connection with proceedings against them for which they may be indemnified. The Company has entered into indemnification agreements with its officers and directors containing provisions that are in some respects broader than the specific indemnification provisions contained in the Delaware general corporation law. The indemnification agreements require the Company to indemnify its officers and directors against liabilities that may arise by reason of their status or service as officers and directors other than for liabilities arising from willful misconduct of a culpable nature, to advance their expenses incurred as a result of any proceeding against them as to which they could be indemnified, and to obtain directors' and officers' insurance if available on reasonable terms. The Company has obtained directors' and officers' liability insurance in amounts comparable to other companies of the Company's size and in the Company's industry. Since a maximum obligation of the Company is not explicitly stated in the Company's Bylaws or in its indemnification agreements and will depend on the facts and circumstances that arise out of any future claims, the overall maximum amount of the obligations cannot be reasonably estimated.

Litigation

From time to time, the Company is subject to various claims and legal proceedings that arise in the ordinary course of business. The Company accrues 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, 2023, except as disclosed below, the Company was not party to any material legal proceedings for which a loss was probable or an amount was accrued. From time to time, the Company may enter into contingent fee arrangements with external legal firms that may represent the Company in legal proceedings related to disputes. Contingent legal fees are accrued by the Company when they are probable and reasonably estimable.

On May 6, 2020, the Company initiated an arbitration proceeding with the Hong Kong International Arbitration Center against SMIC New Technology Research & Development (Shanghai) Corporation ("SMIC") due to SMIC's failure to pay fees due to the Company under a series of contracts. The Company seeks to recover the unpaid fees, a declaration requiring SMIC to pay fees under the contracts in the future (or a lump sum payment to end the contract), and costs associated with bringing the arbitration proceeding. SMIC denies liability and an arbitration hearing was held in February 2023. Final written submissions were submitted by the parties at the end of August 2023. A decision is currently expected in 2024.

7. STOCKHOLDERS' EQUITY

Stock Repurchase Program

On June 4, 2020, the Company's Board of Directors adopted a stock repurchase program (the "2020 Program") to repurchase up to \$25.0 million of the Company's common stock both on the open market and in privately negotiated transactions, including through Rule 10b5-1 plans, over the next two years. During the year ended December 31, 2022, 218,858 shares were repurchased by the Company under the 2020 Program at an average price of \$26.40 per share for an aggregate total price of \$5.8 million. During the year ended December 31, 2021, 251,212 shares were repurchased by the Company under the 2020 Program at an average price of \$18.01 per share for an aggregate total price of \$4.5 million. In total, 470,070 shares were repurchased under the 2020 Program at an average price of \$21.91 per share, for an aggregate total price of \$10.3 million.

On April 11, 2022, the Board of Directors terminated the 2020 Program, and adopted a new program (the "2022 Program") to repurchase up to \$35.0 million of the Company's common stock both on the open market and in privately negotiated transactions, including through Rule 10b5-1 plans, from time to time, over the next two years. During the year ended December 31, 2023, 21,340 shares were repurchased by the Company under the 2022 Program at an average price of \$34.81 per share for an aggregate total price of \$0.7 million. During the year ended December 31, 2022, 714,600 shares were repurchased by the Company under the 2022 Program at an average price of \$23.36 per share for an aggregate total price of \$16.7 million. In total, the Company has repurchased 735,940 shares under the 2022 Program at an average price of \$23.69 per share for an aggregate total price of \$17.4 million.

8. EMPLOYEE BENEFIT PLANS

On December 31, 2023, the Company had the following stock-based compensation plans:

Employee Stock Purchase Plans

In July 2001, the Company's stockholders initially approved the 2001 Employee Stock Purchase Plan, which was subsequently amended and restated in 2010 (as amended, the "2010 Purchase Plan") to extend the term of the plan through May 17, 2020. Under the 2010 Purchase Plan, eligible employees can contribute up to 10% of their compensation, as defined in the Purchase Plan, towards the purchase of shares of PDF common stock at a price of 85% of the lower of the fair market value at the beginning of the offering period or the end of the purchase period. The 2010 Purchase Plan provided for twenty-four-month offering periods with four six-month purchase periods in each offering period. The 2010 Purchase Plan expired on May 17, 2020. Existing offering periods under the 2010 Plan continued through the applicable expiration date and the final offering period expired on January 31, 2022. On June 15, 2021, the Company's stockholders approved the 2021 Employee Stock Purchase Plan, which has a ten-year term (the "2021 Purchase Plan" and, together with the 2010 Purchase Plan, the "Employee Purchase Plans"). The terms of 2021 Purchase Plan are substantially similar to those of the 2010 Purchase Plan. A twenty-four-month offering period under the 2021 Purchase Plan commenced on August 1, 2021.

The Company estimated the fair value of purchase rights granted under the Employee Purchase Plans during the period using the Black-Scholes-Merton option-pricing model with the following weighted average assumptions, resulting in the following weighted average fair values:

	2021 Purchase Plan		
	Year Ended December 31,		
	2023	2022	2021
Expected life (in years)	1.25	1.25	1.25
Volatility	43.66 %	48.73 %	48.00 %
Risk-free interest rate	5.15 %	2.75 %	0.11 %
Expected dividend	—	—	—
Weighted average fair value of purchase rights granted during the period	\$ 15.71	\$ 10.00	\$ 6.71

During the years ended December 31, 2023 and 2022, a total of 223,608 and 182,083 shares, respectively, were issued under the 2021 Purchase Plan, at a weighted-average purchase price of \$17.14 per share and \$16.15 per share, respectively. During the years ended December 31, 2022 and 2021 a total of 5,203 and 108,623 shares, respectively, were issued under the 2010 Purchase Plan, at a weighted-average purchase price of \$13.40 per share and \$9.53 per share, respectively. As of December 31, 2023, unrecognized compensation cost related to the 2021 Purchase Plan was \$3.0 million. This estimated unrecognized cost is expected to be recognized over a weighted average period of 1.5 years.

As of December 31, 2023, 594,309 shares were available for future issuance under the 2021 Purchase Plan.

Stock Incentive Plans

On November 16, 2011, the Company's stockholders initially approved the 2011 Stock Incentive Plan, which has been amended and restated and approved by the Company's stockholders a number of times since then (as amended, the "2011 Plan"). Under the 2011 Plan, the Company may award stock options, stock appreciation rights ("SARs"), stock grants or stock units covering shares of the Company's common stock to employees, directors, non-employee directors and contractors. The aggregate number of shares reserved for awards under the 2011 Plan is 13.8 million shares, plus up to 3.5 million shares previously issued under the 2001 Stock Plan adopted by the Company in 2001, which expired in 2011 (the "2001 Plan") that are either (i) forfeited or (ii) repurchased by the Company or are shares subject to awards previously issued under the 2001 Plan that expire or that terminate without having been exercised or settled in full on or after November 16, 2011. In case of awards other than options or SARs, the aggregate number of shares reserved under the 2011 Plan will be decreased at a rate of 1.33 shares issued pursuant to such awards. The exercise price for stock options must generally be at prices no less than the fair market value at the date of grant. Stock options generally expire ten years from the date of grant and become vested and exercisable over a four-year period.

As of December 31, 2023, 14.3 million shares of common stock were reserved to cover stock-based awards under the 2011 Plan, of which 3.7 million shares were available for future grant. The number of shares reserved and available under the 2011 Plan includes 0.5 million shares that were subject to awards previously made under the 2001 Plan and were forfeited, expired or repurchased by the Company after the adoption of the 2011 Plan through December 31, 2023. As of December 31, 2023, there were no outstanding awards that were granted outside of the 2011 or 2001 Plans (collectively, the "Stock Plans").

The Company has elected to use the Black-Scholes-Merton option-pricing model, which incorporates various assumptions including volatility, expected life, interest rate and expected dividend. The expected volatility is based on the historical volatility of the Company's common stock over the most recent period commensurate with the estimated expected life of the Company's stock options. The expected life of an award is based on historical experience and on the terms and conditions of the stock awards granted to employees. The interest rate assumption is based upon observed Treasury yield curve rates appropriate for the expected life of the Company's stock options.

No stock options were granted during the years ended December 31, 2023, 2022 and 2021.

Stock-based compensation is estimated at the grant date based on the award's fair value and is recognized on a straight-line basis over the vesting periods, generally four years. As stock-based compensation expense recognized is based on awards ultimately expected to vest, it has been reduced for estimated forfeitures. Forfeitures are estimated at the time of grant and revised, if necessary, in subsequent periods if actual forfeitures differ from those estimates.

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Stock-based compensation expenses related to the Company's stock plans and employee stock purchase plans were allocated as follows (in thousands):

	Year Ended December 31,		
	2023	2022	2021
Costs of revenues	\$ 4,169	\$ 2,974	\$ 2,563
Research and development	7,711	9,391	5,515
Selling, general, and administrative	9,604	7,284	4,853
Stock-based compensation expense	<u>\$ 21,484</u>	<u>\$ 19,649</u>	<u>\$ 12,931</u>

Stock-based compensation capitalized in the capitalized software development costs included in property and equipment, net, was \$0.1 million for the year ended December 31, 2023, and nil for the years ended December 31, 2022 and 2021.

Additional information with respect to options under the Plans is as follows:

	Outstanding Options		Weighted Average Remaining Contractual Term (Years)	Aggregate Intrinsic Value (in thousands)
	Number of Options (in thousands)	Weighted Average Exercise Price per Share		
Outstanding, January 1, 2023	68	\$ 16.11		
Granted	—	—		
Exercised	(30)	16.36		
Canceled	—	—		
Expired	—	—		
Outstanding, December 31, 2023	<u>38</u>	<u>\$ 15.92</u>	4.05	\$ 619
Vested and expected to vest, December 31, 2023	<u>38</u>	<u>\$ 15.91</u>	4.05	\$ 619
Exercisable, December 31, 2023	<u>37</u>	<u>\$ 15.84</u>	3.97	\$ 599

The aggregate intrinsic value in the table above represents the total intrinsic value based on the Company's closing stock price of \$32.14 as of December 31, 2023, which would have been received by the option holders had all option holders exercised their options as of that date.

The total intrinsic value of options exercised during the years ended December 31, 2023, 2022 and 2021 was as follows (in thousands):

	Year Ended December 31,		
	2023	2022	2021
Intrinsic value of options exercised	\$ 630	\$ 2,287	\$ 2,972

Total remaining unrecognized compensation cost related to unvested stock options as of December 31, 2023, which is expected to be fully recognized in 2024, and total fair value of shares vested during the year ended December 31, 2023, was immaterial.

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Nonvested shares (restricted stock units) were as follows:

	Shares	Weighted
	(in thousands)	Average Grant
		Date Fair Value
		Per Share
Nonvested, January 1, 2023	2,124	\$ 21.29
Granted	783	43.46
Vested	(882)	21.00
Forfeited	(30)	27.60
Nonvested, December 31, 2023	<u>1,995</u>	<u>\$ 30.03</u>

The weighted average grant date fair values of restricted stock units granted during fiscal 2023, 2022 and 2021 were \$43.46, \$23.23 and \$19.43, respectively.

The total fair value of restricted stock units vested during fiscal 2023, 2022 and 2021 was as follows (in thousands):

	Year Ended December 31,		
	2023	2022	2021
Fair value of restricted stock units vested	\$ 32,786	\$ 22,676	\$ 13,617

As of December 31, 2023, there was \$45.4 million of total unrecognized compensation cost related to restricted stock units. That cost is expected to be recognized over a weighted average period of 2.5 years. Restricted stock units do not have rights to dividends prior to vesting.

401(k) Savings Plan

The Company sponsors a 401(k) Retirement Savings Plan (the “401(k) Plan”) covering substantially all of its US employees. The Company’s 401(k) Plan is a defined contribution plan with a 401(k) salary deferral arrangement qualified under appropriate provisions of the Internal Revenue Code (the “Code”) and applicable state laws. Under the 401(k) Plan, eligible employees may make pre-tax salary or after-tax contributions up to 60% of annual compensation, as defined by the 401(k) Plan. In addition, participants who have reached the age of 50 can elect to withhold additional catch-up contributions subject to the Code and the 401(k) Plan limits. Participants may also contribute amounts representing distributions from other qualified plans (rollovers). The Company may make discretionary matching contributions. In fiscal 2023 and 2022, the Company matched from 50% to 100% of each employee’s contribution up to a maximum of 4% of the employee’s total eligible earnings. The Company’s matching contributions to the 401(k) Plan aggregated \$1.7 million and \$1.6 million for the years ended December 31, 2023 and 2022. No discretionary Company contributions were made to the Plan through December 31, 2021.

9. INCOME TAXES

During the years ended December 31, 2023, 2022 and 2021, income (loss) before income tax expense from U.S. operations was \$3.2 million, (\$1.2) million and (\$19.7) million, respectively, and income before income tax expense from foreign operations was \$1.7 million, \$1.7 million and \$1.4 million, respectively.

	Year Ended December 31,		
	2023	2022	2021
	(In thousands)		
U.S.			
Current	\$ (353)	\$ 1,210	\$ (67)
Deferred	3	13	1,318
Foreign			
Current	453	577	237
Withholding	1,770	2,111	1,591
Deferred	(109)	(12)	92
Total income tax expense	<u>\$ 1,764</u>	<u>\$ 3,899</u>	<u>\$ 3,171</u>

The income tax expense differs from the amount estimated by applying the statutory federal income tax rate (21% for 2023, 2022 and 2021) for the following reasons (in thousands):

	Year Ended December 31,		
	2023	2022	2021
Federal statutory tax expense	\$ 1,016	\$ 106	\$ (3,847)
State tax provision	(65)	949	239
Stock compensation expense	(1,747)	(898)	(499)
Tax credits	(3,214)	(2,877)	(2,676)
Foreign tax, net	1,859	2,195	1,653
Foreign-derived intangible income (FDII) deduction	(1,612)	(830)	—
Change in valuation allowance	5,043	5,122	8,099
Section 162(m) limitation	424	92	—
Unrealized tax benefit reserve changes	99	136	(151)
Other	(39)	(96)	353
Total income tax expense	<u>\$ 1,764</u>	<u>\$ 3,899</u>	<u>\$ 3,171</u>

As of December 31, 2023, the Company had federal and California net operating loss carry-forwards (“NOLs”) of approximately \$7.2 million and \$12.7 million, respectively. Some of the federal NOLs, acquired as part of a past acquisition, have expirations at the end of this fiscal year and onwards, and the California NOLs begin expiring in 2028 onwards.

As of December 31, 2023, the Company had federal and state research and experimental and other tax credit (“R&D credits”) carry-forwards of approximately \$23.7 million and \$24.5 million, respectively. The federal credits began to expire in 2022, while the California credits have no expiration. The extent to which the federal and state credit carry-forwards can be used to offset future tax liabilities, respectively, may be limited, depending on the extent of ownership changes within any three-year period as provided in the Tax Reform Act of 1986 and the California Conformity Act of 1987.

The Company assesses its deferred tax assets for recoverability on a regular basis, and where applicable, a valuation allowance is recorded to reduce the total deferred tax asset to an amount that will, more likely than not, be realized in the future. Based on all available evidence, both positive and negative, the Company determined a full valuation allowance was still appropriate for its federal and state net deferred tax assets (“DTAs”) as of December 31, 2023, primarily driven by a cumulative loss incurred over the 12-quarter period ended December 31, 2023 and the likelihood that the Company will not utilize tax attributes before they begin to expire. The valuation allowance was approximately \$64.2 million and \$59.2 million as of December 31, 2023 and 2022, respectively. The increase in the valuation allowance from December

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31, 2022 to December 31, 2023 was primarily driven by an increase in capitalized research and experimental expenses and credits generated in the current year which require a valuation allowance. Management will continue to evaluate the need for a valuation allowance and may change its conclusion in a future period based on any change in facts (e.g. 12-quarter cumulative profit, significant new revenue, and other relevant factors). If the Company concludes that it is more likely than not to utilize some or all of its U.S. DTAs, it will release some or all of its valuation allowance and the Company's tax provision will decrease in the period in which such determination is made. Net deferred tax assets, after the U.S. valuation allowance, were immaterial as of December 31, 2023 and 2022.

The components of the net deferred tax assets are comprised of (in thousands):

	December 31,	
	2023	2022
Deferred tax assets		
Net operating loss carry forward	\$ 3,005	\$ 3,861
Research and development and other credit carry forward	30,633	28,046
Foreign tax credit carry forward	7,611	11,764
Capitalized research and experimental expenses	20,403	10,069
Accruals deductible in different periods	4,037	7,713
Leases	1,282	1,623
Stock-based compensation	1,882	1,948
Total deferred tax assets	68,853	65,024
Less: valuation allowance	(64,152)	(59,215)
Deferred tax assets, net of valuation allowance	4,701	5,809
Deferred tax liabilities		
Property and equipment, net	(612)	(540)
Operating lease right-of-use assets	(1,266)	(1,635)
Intangible assets	(2,995)	(3,617)
Deferred tax liabilities	(4,873)	(5,792)
Net deferred tax assets (liabilities)	\$ (172)	\$ 17

The Company classifies its liabilities for income tax exposures as long-term. The Company includes interest related to unrecognized tax benefits within the Company's income tax provision. As of December 31, 2023, 2022 and 2021, the Company had accrued interest related to unrecognized tax benefits of \$0.7 million. In the years ended December 31, 2023, 2022 and 2021, the Company recognized (reversal of) charges for interest related to unrecognized tax benefits of (\$15,000), (\$61,000) and (\$89,000) respectively, in the Consolidated Statements of Comprehensive Income (Loss).

The Company's total amount of unrecognized tax benefits, excluding interest, as of December 31, 2023 was \$15.9 million, of which \$2.0 million, if recognized, would impact the Company's effective tax rate. As of December 31, 2023, the Company has recorded unrecognized tax benefits of \$2.6 million, including interest of \$0.7 million, as long-term income taxes payable in its Consolidated Balance Sheet. The remaining \$14.0 million has been recorded within DTAs, which is subject to a full valuation allowance. The Company does not expect the change in unrecognized tax benefits over the next twelve months to materially impact its results of operations and financial position.

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A reconciliation of the beginning and ending amount of unrecognized tax benefits is as follows (in thousands):

	Amount
Gross unrecognized tax benefits, January 1, 2021	\$ 14,300
Increases in tax positions for current year	853
Increases in tax positions for prior years	1
Lapse in statute of limitations	(411)
Gross unrecognized tax benefits, December 31, 2021	14,743
Increases in tax positions for current year	988
Increases in tax positions for prior years	—
Lapse in statute of limitations	(622)
Gross unrecognized tax benefits, December 31, 2022	15,109
Increases in tax positions for current year	1,469
Increases in tax positions for prior years	91
Lapse in statute of limitations	(732)
Gross unrecognized tax benefits, December 31, 2023	\$ 15,937

The Company does not provide deferred taxes on undistributed earnings of its foreign subsidiaries as it intends to indefinitely reinvest those earnings.

The Company conducts business globally and, as a result, files numerous consolidated and separate income tax returns in the U.S. federal, various state and foreign jurisdictions. For U.S. federal and California income tax purposes, the statute of limitations currently remains open for the years ended 2020 to present and 2019 to present, respectively. In addition, all of the NOLs and R&D credit carry-forwards that may be utilized in future years may be subject to federal and state examination. The Company is not currently under income tax examinations in the U.S. or in any other of its major foreign subsidiaries' jurisdictions.

Valuation allowance for DTAs is summarized (in thousands):

	Balance at Beginning of Period	Charged to Income Tax Expense	Deductions/ Write-offs of Accounts	Balance at End of Period
2023	\$ 59,215	\$ 4,937	\$ —	\$ 64,152
2022	\$ 51,586	\$ 7,629	\$ —	\$ 59,215
2021	\$ 41,859	\$ 9,727	\$ —	\$ 51,586

10. NET INCOME (LOSS) PER SHARE

Basic net income (loss) per share is computed by dividing net income (loss) by weighted average number of common shares outstanding for the period (excluding outstanding stock options and shares subject to repurchase). Diluted net income (loss) per share is computed using the weighted average number of common shares outstanding for the period plus the potential effect of dilutive securities which are convertible into common shares (using the treasury stock method), except in cases in which the effect would be anti-dilutive. The following is a reconciliation of the numerators and denominators used in computing basic and diluted net income (loss) per share (in thousands except per share amount):

	Year Ended December 31,		
	2023	2022	2021
Numerator:			
Net income (loss)	\$ 3,105	\$ (3,429)	\$ (21,488)
Denominator:			
Basic weighted average shares outstanding	38,015	37,309	37,138
Effect of dilutive stock options, unvested restricted stock units, and shares of common stock expected to be issued under employee stock purchase plan(s)	922	—	—
Diluted weighted average shares outstanding	38,937	37,309	37,138
Net income (loss) per share:			
Basic	\$ 0.08	\$ (0.09)	\$ (0.58)
Diluted	\$ 0.08	\$ (0.09)	\$ (0.58)

For the years ended December 31, 2022 and 2021, because the Company was in a loss position, basic net loss per share is the same as diluted net loss per share as the inclusion of the potential common shares would have been anti-dilutive.

The following table sets forth potential shares of common stock that are not included in the diluted net income (loss) per share calculation above because to do so would be anti-dilutive for the periods indicated (in thousands):

	Year Ended December 31,		
	2023	2022	2021
Outstanding options	—	56	170
Non-vested restricted stock units	351	787	968
Employee Stock Purchase Plan	—	84	33
Total	351	927	1,171

11. CUSTOMER AND GEOGRAPHIC INFORMATION

Operating segments are defined as components of an enterprise about which separate financial information is available that is evaluated regularly by the chief operating decision maker, or group, in deciding how to allocate resources and in assessing performance.

The Company's chief operating decision maker, the chief executive officer, reviews discrete financial information presented on a consolidated basis for purposes of regularly making operating decisions, allocation of resources, and assessing financial performance. Accordingly, the Company considers itself to be in one operating and reporting segment, specifically the provision of services for differentiated data and analytics solutions to the semiconductor and electronics industries.

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Revenues from individual customers that are approximately 10% or more of the Company's consolidated total revenues are as follows:

Customer	Year Ended December 31,		
	2023	2022	2021
A	35 %	31 %	17 %
B	* %	10 %	* %
D	* %	* %	10 %

Gross accounts receivable balances (including amounts that are unbilled) from individual customers that are approximately 10% or more of the Company's gross accounts receivable balance are as follows:

Customer	December 31,	
	2023	2022
A	39 %	29 %
B	* %	12 %
C	* %	12 %
G	11 %	* %

* represents less than 10%

Revenues from customers by geographic area based on the location of the customers' work sites are as follows (in thousands):

	Year Ended December 31,					
	2023		2022		2021	
	Revenues	Percentage of Revenues	Revenues	Percentage of Revenues	Revenues	Percentage of Revenues
United States	\$ 92,798	56 %	\$ 73,625	50 %	\$ 50,374	45 %
China	26,488	16	24,494	16	14,267	13
Japan	10,465	6	13,916	9	11,097	10
Rest of the world	36,084	22	36,514	25	35,322	32
Total revenue	<u>\$ 165,835</u>	<u>100 %</u>	<u>\$ 148,549</u>	<u>100 %</u>	<u>\$ 111,060</u>	<u>100 %</u>

Long-lived assets, net by geographic area is as follows (in thousands):

	December 31,	
	2023	2022
United States (1)	\$ 45,619	\$ 44,730
Rest of the world	1,362	1,446
Total long-lived assets, net	<u>\$ 46,981</u>	<u>\$ 46,176</u>

(1) Includes assets deployed at customer sites which could be outside the U.S.

12. FAIR VALUE MEASUREMENTS

Fair value is the exit price, or the amount that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants as of the measurement date. The multiple assumptions used to value financial instruments are referred to as inputs, and a hierarchy for inputs used in measuring fair value is established, that maximizes the use of observable inputs and minimizes the use of unobservable inputs by requiring that the most observable inputs be used when available. Observable inputs reflect assumptions market participants would use in pricing an asset or liability based on market data obtained from independent sources while unobservable inputs reflect a reporting entity's

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pricing based upon its own market assumptions. These inputs are ranked according to a fair value hierarchy that prioritizes the inputs to valuation techniques used to measure fair value into three broad levels.

- Level 1 - Inputs are quoted prices in active markets for identical assets or liabilities.
- Level 2 - Inputs are quoted prices for similar assets or liabilities in an active market, quoted prices for identical or similar assets or liabilities in markets that are not active, inputs other than quoted prices that are observable and market-corroborated inputs which are derived principally from or corroborated by observable market data.
- Level 3 - Inputs are derived from valuation techniques in which one or more significant inputs or value drivers are unobservable.

The following table represents the Company's assets measured at fair value on a recurring basis as of December 31, 2023 and the basis for that measurement (in thousands):

	Fair Value Measurements Using			
	December 31, 2023	Quoted Prices in Active Markets for Identical Assets (Level 1)	Significant Other Observable Inputs (Level 2)	Significant Unobservable Inputs (Level 3)
Assets				
Cash equivalents				
Money market mutual funds	\$ 83,810	\$ 83,810	\$ —	\$ —
Short-term investments (available-for-sale debt securities)				
U.S. Government securities (1)	36,544	36,544	—	—
Total	\$ 120,354	\$ 120,354	\$ —	\$ —

The following table represents the Company's assets measured at fair value on a recurring basis as of December 31, 2022 and the basis for that measurement (in thousands):

	Fair Value Measurements Using			
	December 31, 2022	Quoted Prices in Active Markets for Identical Assets (Level 1)	Significant Other Observable Inputs (Level 2)	Significant Unobservable Inputs (Level 3)
Assets				
Cash equivalents				
Money market mutual funds	\$ 75,738	\$ 75,738	\$ —	\$ —
U.S. Government securities (1)	1,990	1,990	—	—
Short-term investments (available-for-sale debt securities)				
U.S. Government securities (1)	19,557	19,557	—	—
Total	\$ 97,285	\$ 97,285	\$ —	\$ —

- (1) The carrying amount of the Company's investments in U.S. Government securities approximate fair value due to their short-term maturities, and there have been no events or changes in circumstances that would have had a significant effect on the fair value of these securities as of December 31, 2023 and 2022.

13. STRATEGIC PARTNERSHIP AGREEMENT WITH ADVANTEST AND RELATED PARTY TRANSACTIONS

In July 2020, the Company entered into a long-term strategic partnership with Advantest Corporation through its wholly-owned subsidiary, Advantest America, Inc. (collectively referred to herein as “Advantest”), which includes: (i) a Securities Purchase Agreement wherein the Company issued and sold to Advantest America, Inc., an aggregate of 3,306,924 shares of its common stock, for aggregate gross proceeds of \$65.2 million; (ii) a significant agreement for its assistance in development of cloud-based applications for Advantest tools that leverages our Exensio analytics software ; (iii) a commercial agreement providing for the license to third parties of solutions that result from the development work that combine Advantest’s testing applications and our Exensio platform; and (iv) a 5-year cloud-based subscription for Exensio analytics software and related services.

Analytics revenue recognized from Advantest during the years ended December 31, 2023, 2022 and 2021 was \$9.0 million, \$10.3 million and \$10.6 million, respectively. Accounts receivable from Advantest were not material as of December 31, 2023 and amounted to \$0.3 million as of December 31, 2022. Deferred revenue amounted to \$9.4 million and \$7.1 million as of December 31, 2023 and 2022, respectively.

The Company carries out transactions with Advantest on arm’s length commercial customary terms.

14. BUSINESS COMBINATION

On July 5, 2023 (the “Acquisition Date”), the Company, through its wholly-owned subsidiary in Canada, PDF Solutions Canada, Ltd., acquired 100% of the equity interest in Lantern Machinery Analytics, Inc. headquartered in Canada, a privately-held provider of automated image analysis and feature extraction AI/ML software for critical inspection and metrology steps at battery cell development and manufacturing processes for the electric vehicle industry. This software will enhance the Company’s Exensio analytics software and product offerings to new and existing battery manufacturer customers. The total cash consideration for this acquisition was \$1.8 million, net of cash acquired, for all of the outstanding equity of Lantern Machinery Analytics, Inc.

The Company accounted for this acquisition as a business combination in accordance with FASB ASC Topic 805, *Business Combinations*. This method requires that assets acquired and liabilities assumed in a business combination be recognized at their respective estimated fair values as of the Acquisition Date. The excess of purchase consideration over the fair value of net tangible and identifiable intangible assets acquired was recorded as goodwill. The goodwill recorded from this acquisition represents business benefits the Company anticipates from the acquired workforce and expectation for expanded sales opportunities to foster further business growth. Due to the nature of the transaction, the goodwill associated with the acquisition is not deductible for tax purposes. As of December 31, 2023, payment made for this acquisition, net of cash acquired, amounted to \$1.8 million and was funded from available cash of the Company.

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The allocation of the purchase price for this acquisition, as of the date of the acquisition, is as follows (in thousands, except amortization period):

	<u>Amount</u>	<u>Amortization Period (Years)</u>
Allocation of Purchase Price:		
Assets		
Fair value of tangible assets (including cash of \$265)	\$ 450	
Fair value of intangible assets:		
Developed technology	1,010	8
Customer relationships	100	6
Goodwill	895	N/A
Total assets acquired	<u>2,455</u>	
Liabilities		
Deferred tax liabilities	294	
Accounts payable and accrued expenses	73	
Total liabilities assumed	<u>367</u>	
Total purchase price allocation	<u>\$ 2,088</u>	

Pro forma results of operations have not been presented because the effect of the acquisition was not material to the Company's financial results.

Item 9. Changes in and Disagreements with Accountants on Accounting and Financial Disclosure

None.

Item 9A. Controls and Procedures**Evaluation of Disclosure Controls and Procedures**

Our management, with the participation of our principal executive officer and principal financial and accounting officer, evaluated the effectiveness of our "disclosure controls and procedures" as defined in Exchange Act Rules 13a-15(e) and 15d-15(e) as of December 31, 2023, in connection with the filing of this Annual Report on Form 10-K. Based on that evaluation, as of December 31, 2023, our principal executive officer and principal financial and accounting officer concluded that our disclosure controls and procedures were effective to ensure that information we are required to disclose in reports that we file or submit under the Exchange Act is recorded, processed, summarized and reported within the time periods specified in the rules and forms of the SEC and is accumulated and communicated to our management as appropriate to allow timely decisions regarding required disclosure.

Management's Report on Internal Control over Financial Reporting

Our management is responsible for establishing and maintaining adequate internal control over financial reporting, as defined in Rules 13a-15(f) and 15d-15(f) under the Exchange Act, for the Company. Our management, with the participation of our principal executive officer and principal financial and accounting officer, assessed the effectiveness of our internal control over financial reporting (ICFR) as of December 31, 2023. This evaluation was based on the framework established in *Internal Control—Integrated Framework (2013)* issued by the Committee of Sponsoring Organizations of the Treadway Commission ("COSO"). Based on our assessment under the COSO framework, our management concluded that our internal control over financial reporting was effective as of December 31, 2023.

The effectiveness of the Company's internal control over financial reporting as of December 31, 2023, has been audited by BPM LLP, the Company's independent registered public accounting firm, as stated in their report which appears in this Annual Report on Form 10-K.

Changes in Internal Control over Financial Reporting

There were no changes in internal control over financial reporting during the fourth quarter ended December 31, 2023, which has materially affected, or is reasonably likely to materially affect, our internal control over financial reporting.

Item 9B. *Other Information.*

Insider Adoption or Termination of Trading Arrangements

During the quarter ended December 31, 2023, none of our directors or officers informed us of the adoption or termination of a “Rule 10b5-1 trading arrangement” or “non-Rule 10b5-1 trading arrangement,” as those terms are defined in Regulation S-K, Item 408.

Item 9C. *Disclosure Regarding Foreign Jurisdictions that Prevent Inspections.*

None.

PART III

Pursuant to Paragraph (3) of the General Instructions to Form 10-K, certain of the information required by Part III of this Form 10-K is incorporated by reference from our Proxy Statement as set forth below. The Proxy Statement is expected to be filed within 120 days of December 31, 2023.

Item 10. *Directors, Executive Officers and Corporate Governance.*

Information with respect to our directors and our Audit Committee appears in our Proxy Statement under “Proposal No. 1 — Election of Class II Directors — Nominees for Class II Directors” and is incorporated herein by reference. Information with respect to our executive officers appears in Part I, Item 1 — “Information about our Executive Officers” of this Form 10-K.

With regard to the information required by this item regarding compliance with Section 16(a) of the Exchange Act, we will provide disclosure of delinquent Section 16(a) reports, if any, in our Proxy Statement, and such disclosure, if any, is incorporated herein by reference.

Our Board of Directors has adopted a Code of Ethics (“Code of Ethics”), which is applicable to all employees of the Company, including our principal executive officer and our principal financial and accounting officer. Our Code of Ethics is available on our website at www.pdf.com, on the investor relations page. 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. You may also request a copy of our Code of Ethics in writing by sending your request to PDF Solutions, Inc., Attention: Investor Relations, 2858 De La Cruz Blvd., Santa Clara, California 95050. If we make any substantive amendments to our Code of Ethics or grant any waiver, including any implicit waiver, from a provision of the Code of Ethics to our Chief Executive Officer or Chief Financial Officer, we will disclose the nature of such amendment or waiver on our website or in a current report on Form 8-K.

Item 11. *Executive Compensation.*

The information required by this item is incorporated herein by reference to the section entitled “Executive Compensation” in our Proxy Statement.

Item 12. *Security Ownership of Certain Beneficial Owners and Management and Related Stockholder Matters.*

The information required by this item is incorporated herein by reference to the section entitled “Security Ownership of Certain Beneficial Owners and Management” in our Proxy Statement. Also incorporated by reference is the information in the table under the heading “Equity Compensation Plan Information” in our Proxy Statement.

Item 13. *Certain Relationships and Related Transactions, and Director Independence.*

The information required by this item is incorporated herein by reference to the section entitled “Certain Relationships and Related Transactions” and “Corporate Governance — Director Independence” in our Proxy Statement.

Item 14. *Principal Accountant Fees and Services.*

Information with respect to Principal Accountant Fees and Services is incorporated by reference to “Proposal No. 2: Ratification of Appointment of Independent Registered Public Accounting Firm” in our Proxy Statement.

PART IV

Item 15. Exhibits and Financial Statement Schedules

(a) The following documents are filed as part of this report:

- (1) Consolidated Financial Statements and Reports of Independent Registered Public Accounting Firms

The following documents are included as Part II, Item 8 of this Form 10-K:

	Page
Reports of BPM LLP, Independent Registered Public Accounting Firm (PCAOB ID: 207)	53
Consolidated Balance Sheets as of December 31, 2023 and 2022	57
Consolidated Statements of Comprehensive Income (Loss) for the Years Ended December 31, 2023, 2022 and 2021	58
Consolidated Statements of Stockholders' Equity for the Years Ended December 31, 2023, 2022 and 2021	59
Consolidated Statements of Cash Flows for the Years Ended December 31, 2023, 2022 and 2021	60
Notes to Consolidated Financial Statements	62

- (2) Financial Statement Schedules

All financial statement schedules have been omitted, since the required information is not applicable or is not present in amounts sufficient to require submission of the schedule, or because the information required is included in the consolidated financial statements and notes thereto included in this Form 10-K.

- (3) Exhibits required by Item 601 of Regulation S-K

See Item 15(b) below.

(b) Exhibits

INDEX TO EXHIBITS

Exhibit Number	Exhibit Description	Incorporated by Reference				Provided Herewith
		Form	Filing Date	Exhibit Number	SEC File Number	
3.01	Third Amended and Restated Certificate of Incorporation of PDF Solutions, Inc.	S-1/A	7/9/2001	3.2	333-43192	
3.02	Amended and Restated Bylaws of PDF Solutions, Inc.	8-K	5/1/2019	3.1	000-31311	
4.01	Stockholder Agreement by and between PDF Solutions, Inc. and Advantest America, Inc. dated July 30, 2020	10-Q	11/6/2020	4.2	000-31311	
4.02	Description of the Registrant's Securities Registered Pursuant to Section 12 of the Securities Exchange Act of 1934	10-K	3/1/2022	4.03	000-31311	
10.01	Form of Indemnification Agreement between PDF Solutions, Inc. and certain of its senior executive officers and directors*	10-K	3/16/2009	10.17	000-31311	
10.02	PDF Solutions, Inc. 2021 Employee Stock Purchase Plan*	DEF14A	4/28/2021	Appendix A	000-31311	
10.03	PDF Solutions, Inc. Eighth Amended and Restated 2011 Stock Incentive Plan*	DEF14A	4/27/2023	Appendix A	000-31311	
10.04	Form of Stock Option Agreement (Non-statutory) under PDF Solutions, Inc. 2011 Stock Incentive Plan*	10-K	3/15/2012	10.18	000-31311	
10.05	Form of Stock Unit Agreement under PDF Solutions, Inc. 2011 Stock Incentive Plan*	10-K	3/15/2012	10.19	000-31311	
10.06	Board of Directors Acceleration Agreement*					X
10.07	Employment offer to Adnan Raza, dated January 23, 2020*	10-K	3/10/2020	10.17	000-31311	

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Exhibit Number	Exhibit Description	Incorporated by Reference				Provided Herewith
		Form	Filing Date	Exhibit Number	SEC File No.	
10.08	Software License and Related Services Agreement by and between PDF Solutions, Inc. and Advantest America, Inc. dated March 25, 2020 and Amendment No.1 thereto dated July 29, 2020+	10-Q	11/6/2020	10.1	000-31311	
10.9	Amendment #1 to Amendment #1 to Software License and Related Services Agreement by and between PDF Solutions, Inc. and Advantest America, Inc., dated June 5, 2022, by and between PDF Solutions, Inc. and Advantest America, Inc.+	10-Q	11/10/2022	10.01	000-31311	
10.10	Amendment #2 to Amendment #1 to Software License and Related Services Agreement by and between PDF Solutions, Inc. and Advantest America, Inc., signed November 11, 2022, by and between PDF Solutions, Inc. and Advantest America, Inc.+	10-K	3/1/2023	10.13	000-31311	
10.11	Amended and Restated Master Development Agreement by and between PDF Solutions, Inc. and Advantest America, Inc. dated July 29, 2020+	10-Q	11/6/2020	10.2	000-31311	
10.12	Addendum #1 to Revised 2020 Contract, signed March 17, 2023, by and between PDF Solutions, Inc. and Advantest America, Inc.+	10-Q	8/8/2023	10.2	000-31311	
10.13	Master Commercial Terms and Support Services Agreement by and between PDF Solutions, Inc. and Advantest America, Inc. dated July 29, 2020+	10-Q	11/6/2020	10.3	000-31311	
10.14	Securities Purchase Agreement by and between PDF Solutions, Inc. and Advantest America, Inc. dated July 29, 2020+	10-Q	11/6/2020	4.1	000-31311	
21.01	Subsidiaries of Registrant					X
23.01	Consent of BPM LLP, Independent Registered Public Accounting Firm					X

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Exhibit Number	Exhibit Description	Incorporated by Reference			Provided Herewith
		Form	Filing Date	Exhibit Number	
31.01	Certifications of the principal executive officer and principal financial and accounting officer pursuant to Exchange Act Rules 13a-14(a) and 15d-14(a), as adopted pursuant to Section 302 of the Sarbanes-Oxley Act of 2002				X
31.02	Certifications of the principal executive officer and principal financial and accounting officer pursuant to Exchange Act Rules 13a-14(a) and 15d-14(a), as adopted pursuant to Section 302 of the Sarbanes-Oxley Act of 2002				X
32.01	Certification pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002†				X
32.02	Certification pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002†				X
97.01	Compensation Recovery Policy				X
101	The following financial statements from the Company's Annual Report on Form 10-K for the year ended December 31, 2023, formatted in Inline XBRL: (i) Consolidated Balance Sheets as of December 31, 2023 and 2022, (ii) Consolidated Statements of Comprehensive Income (Loss) for the Years Ended December 31, 2023, 2022 and 2021, (iii) Consolidated Statements of Changes in Stockholders' Equity for the Years Ended December 31, 2023, 2022 and 2021, (iv) Consolidated Statements of Cash Flows for the Years Ended December 31, 2023, 2022 and 2021, and (v) Notes to Consolidated Financial Statements, tagged as blocks of text and including detailed tags.				X

Exhibit Number	Exhibit Description	Incorporated by Reference			SEC File No.	Provided Herewith
		Form	Filing Date	Exhibit Number		
104	Cover Page Interactive Data File (formatted as Inline XBRL and contained in Exhibit 101)					

* Indicates management contract or compensatory plan or arrangement.

† Furnished, and not filed.

+ Certain portions of this document that constitute confidential information have been redacted in accordance with Regulation S-K, Item 601(b)(10).

Item 16. Form 10-K Summary

Not applicable.

SIGNATURES

Pursuant to the requirements of Section 13 or 15(d) of the Securities Exchange Act of 1934, the Registrant has duly caused this report to be signed on its behalf by the undersigned, thereunto duly authorized.

PDF SOLUTIONS, INC.

By: /s/ John K. Kibarian

John K. Kibarian
President and Chief Executive Officer
(Principal executive officer)

By: /s/ Adnan Raza

Adnan Raza
Executive Vice President, Finance and Chief
Financial Officer
(Principal financial and accounting officer)

Date: February 27, 2024

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Pursuant to the requirements of the Securities Exchange Act of 1934, this report has been signed below by the following persons on behalf of the registrant and in the capacities and on the dates indicated.

<u>Date</u>	<u>Signature</u>	<u>Title</u>
February 27, 2024	<u>/s/ JOHN K. KIBARIAN</u> John K. Kibarian	Director, President and Chief Executive Officer (Principal executive officer)
February 27, 2024	<u>/s/ ADNAN RAZA</u> Adnan Raza	Executive Vice President, Finance and Chief Financial Officer (Principal financial and accounting officer)
February 27, 2024	<u>/s/ JOSEPH R. BRONSON</u> Joseph R. Bronson	Lead Independent Director
February 27, 2024	<u>s/ CHI-FOON CHAN</u> Chi-Foon Chan	Director
February 27, 2024	<u>/s/ NANCY ERBA</u> Nancy Erba	Director
February 27, 2024	<u>/s/ MICHAEL B. GUSTAFSON</u> Michael Gustafson	Director
February 27, 2024	<u>s/ YE JANE LI</u> Ye Jane Li	Director
February 27, 2024	<u>s/ KIMON MICHAELS</u> Kimon Michaels	Director
February 27, 2024	<u>s/ SHUO ZHANG</u> Shuo Zhang	Director

Acceleration Agreement

THIS ACCELERATION AGREEMENT (the “Agreement”) is entered into as of the Effective Date, by and between _____ (the “Award Recipient”) and PDF Solutions, Inc., a Delaware corporation (the “Company”).

1. Definitions. The following definitions shall apply for all purposes under this Agreement:

(a) **Acceleration Event**. “Acceleration Event” means the occurrence of a Change of Control on or after the Effective Date with respect to Covered Awards:

(b) **Change in Control**. “Change in Control” for all Covered Awards means a “Change of Control” as defined in Section 2(g) of the 2011 Stock Incentive Plan (as amended).

(c) **Covered Award**. “Covered Award” means any equity award granted to the Award Recipient by the Company, whether such equity award was granted before, on, or after the Effective Date.

2. Benefits.

(a) **Acceleration**. Notwithstanding anything to the contrary in any plan pursuant to which any Covered Award was granted or any applicable stock option agreement, the vesting schedule for all Covered Awards that are outstanding as of the date of an Acceleration Event shall be accelerated to provide that all such Covered Awards shall be immediately vested (and exercisable, if applicable) in full.

(b) **Conditions**. All benefits provided under this Section 2 are conditioned on (i) the Award Recipient’s continuing compliance with this Agreement, any employment agreement or other agreement between the Company the Award Recipient, and the Company’s policies and by-laws, and (ii) the Award Recipient’s execution of a general release of any and all claims in a form prescribed by the Company.

(c) **Excise Taxes**. In the event that any benefit received by Award Recipient pursuant to this Agreement would be subject to the excise tax imposed by Section 4999 of the Internal Revenue Code of 1986, as amended (the “Excise Tax”), then Award Recipient shall be entitled to either the full amount of the benefits or such lesser amount that would result in no portion of the benefits being subject to the Excise Tax, whichever of the foregoing amounts results in the receipt by Award Recipient, on an after-tax basis, of the greater benefit. Unless the Company and Award Recipient agree otherwise in writing, any calculation required under this Section 2(c) shall be made in writing by independent public accountants agreed to by the Company and Award Recipient, whose calculation shall be conclusive and binding upon the Company and Award Recipient for all purposes. The Company and Award Recipient shall furnish to the accountants such information and documents as the accountants may reasonably request in order to make a determination under this Section 2(c). All fees and expenses of the accounting firm shall be borne solely by the Company.

3. Successors.

(a) **Company’s Successors**. Any successor to all or substantially all of the Company’s business and/or assets (whether direct or indirect and whether by purchase, lease, merger, consolidation, liquidation or otherwise), shall be obligated to perform this Agreement in the same manner and to the same extent as the Company would be required to perform it in the absence of a succession.

(b) **Award Recipient’s Successors**. This Agreement and all rights of the Award Recipient hereunder shall inure to the benefit of, and be enforceable by, the Award Recipient’s personal or legal representatives, executors, administrators, successors, heirs, distributees, devisees and legatees.

4. Miscellaneous Provisions.

(a) **Notice**. Notices and all other communications contemplated by this Agreement shall be in writing and shall be deemed to have been duly given when personally delivered or when mailed by U.S. registered or certified mail, return receipt requested and postage prepaid. In the case of the Award Recipient, mailed notices shall be addressed to him or her at the home address which he or she most recently communicated to the Company in writing. In the case of the Company, mailed notices shall be addressed to its corporate headquarters, and all notices shall be directed to the attention of its Chief Financial Officer.

(b) **Waiver**. No provision of this Agreement shall be modified, waived or discharged unless the modification, waiver or discharge is agreed to in writing and signed by the Award Recipient and by an authorized officer of the Company (other than the Award Recipient). No waiver by either party of any breach of, or of compliance with, any condition or provision of this Agreement by the other party shall be considered a waiver of any other condition or provision or of the same condition or provision at another time.

(c) **Whole Agreement**. This Agreement contains all the legally binding understandings and agreements between Award Recipient and the Company pertaining to the subject matter of this Agreement and supersedes all such agreements, whether oral

or in writing, previously entered into between the parties. Any and all stock option agreements regarding the Covered Awards are hereby modified and amended as necessary to comport with this Agreement. To the extent that any such stock option agreement is inconsistent with this Agreement or conflicts with this Agreement, then the terms of this Agreement shall control.

(d) Choice of Law. The validity, interpretation, construction and performance of this Agreement shall be governed by the laws of the State of California without regard to the conflicts of laws principles thereof.

(e) Severability. The invalidity or unenforceability of any provision or provisions of this Agreement shall not affect the validity or enforceability of any other provision hereof, which shall remain in full force and effect.

(f) No Assignment. The rights of the Award Recipient to benefits under this Agreement shall not be made subject to option or assignment, either by voluntary or involuntary assignment or by operation of law, including (without limitation) bankruptcy, garnishment, attachment or other creditor's process, and any action in violation of this subsection (f) shall be void.

(g) Retention Rights. This Agreement does not give the Award Recipient the right to be retained by the Company in any capacity. The Company reserves the right to terminate Award Recipient's engagement at any time and for any reason.

5. Term of Agreement. This Agreement shall continue in effect until the Company shall have given the Award Recipient written notice of cancellation, which notice may not be given by the Company in contemplation of or immediately after a Change in Control. This Agreement shall terminate automatically in the event the Award Recipient ceases to provide services to Company prior to an Acceleration Event. Notwithstanding the foregoing, this Agreement shall remain effective if, in connection with an impending Change in Control, the Company terminates the Award Recipient's engagement for any reason.

IN WITNESS WHEREOF, each of the parties has executed this Agreement, in the case of the Company by its duly authorized officer, as of the day and year first above written.

Award Recipient

By: _____
Full Legal Name

PDF SOLUTIONS, INC.

By: _____
Name:
Title:



Subsidiaries of Registrant

Name of Entity	Jurisdiction of Incorporation or Organization
Cimetrix Incorporated	Nevada
Cimetrix International, Inc.	Nevada
Cimetrix Japan KK	Japan
Cimetrix Software (Shanghai) Co., Ltd.	China
PDF Solutions Asia Services, Inc.	Delaware
PDF Solutions Canada Ltd.	Canada
PDF Solutions GmbH	Germany
PDF Solutions International Services, Inc.	Delaware
PDF Solutions KK	Japan
PDF Solutions Pacific Services, Inc.	Delaware
PDF Solutions SARL	France
PDF Solutions Semiconductor Technology (Korea) Limited	Korea
PDF Solutions Semiconductor Technology (Shanghai) Co. Ltd.	China
PDF Solutions Semiconductor Technology Taiwan Ltd.	Taiwan

CONSENT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

We hereby consent to the incorporation by reference in the Registration Statements on Form S 8 (Nos. 333-257792, 333-233070, 333-202455, 333-180324, 333-167533, 333-159211, 333-149281, 333 141660, 333-133332, 333-112728, 333-109809, and 333-102509) of PDF Solutions, Inc. of our reports dated February 27, 2024 relating to the consolidated financial statements and internal control over financial reporting, which appear in this Annual Report on Form 10-K.

/s/ BPM LLP

San Jose, California
February 27, 2024

CERTIFICATIONS

I, John K. Kibarian, certify that:

1. I have reviewed this annual report on Form 10-K of PDF Solutions, Inc.;

2. Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;

3. Based on my knowledge, the financial statements, and other financial information included in this report, fairly present in all material respects the financial condition, results of operations and cash flows of the registrant as of, and for, the period presented in this report;

4. The registrant's other certifying officer(s) and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) and internal control over financial reporting (as defined in Exchange Act Rules 13a-15(f) and 15d-15(f)) for the registrant and have:

(a) Designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to the registrant, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;

(b) Designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under our supervision, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles;

(c) Evaluated the effectiveness of the registrant's disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and

(d) Disclosed in this report any change in the registrant's internal control over financial reporting that occurred during the registrant's most recent fiscal quarter (the registrant's fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial reporting; and

5. The registrant's other certifying officer(s) and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the registrant's auditors and the audit committee of registrant's board of directors (or persons performing the equivalent functions):

(a) All significant deficiencies and material weaknesses in the design or operation of internal control over financial reporting which are reasonably likely to adversely affect the registrant's ability to record, process, summarize and report financial information; and

(b) Any fraud, whether or not material, that involves management or other employees who have a significant role in the registrant's internal control over financial reporting.

/s/ John K. Kibarian

John K. Kibarian

President and Chief Executive Officer

(principal executive officer)

February 27, 2024

CERTIFICATIONS

I, Adnan Raza, certify that:

1. I have reviewed this annual report on Form 10-K of PDF Solutions, Inc.;

2. Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;

3. Based on my knowledge, the financial statements, and other financial information included in this report, fairly present in all material respects the financial condition, results of operations and cash flows of the registrant as of, and for, the periods presented in this report;

4. The registrant's other certifying officer(s) and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) and internal control over financial reporting (as defined in Exchange Act Rules 13a-15(f) and 15d-15(f)) for the registrant and have:

(a) Designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to the registrant, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;

(b) Designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under our supervision, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles;

(c) Evaluated the effectiveness of the registrant's disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and

(d) Disclosed in this report any change in the registrant's internal control over financial reporting that occurred during the registrant's most recent fiscal quarter (the registrant's fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial reporting; and

5. The registrant's other certifying officer(s) and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the registrant's auditors and the audit committee of registrant's board of directors (or persons performing the equivalent functions):

(a) All significant deficiencies and material weaknesses in the design or operation of internal control over financial reporting which are reasonably likely to adversely affect the registrant's ability to record, process, summarize and report financial information; and

(b) Any fraud, whether or not material, that involves management or other employees who have a significant role in the registrant's internal control over financial reporting.

/s/ Adnan Raza

Adnan Raza

*Executive Vice President, Finance and Chief
Financial Officer*

(Principal financial and accounting officer)

February 27, 2024

**CERTIFICATION PURSUANT TO
18 U.S.C. SECTION 1350,
AS ADOPTED PURSUANT TO
SECTION 906 OF THE SARBANES-OXLEY ACT OF 2002**

In connection with the Annual Report of PDF Solutions, Inc. (the "Company") on Form 10-K for the year ended December 31, 2023 as filed with the Securities and Exchange Commission on February 27, 2024 (the "Report"), I, John K. Kibarian, President and Chief Executive Officer of the Company, certify, pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002, that, to my knowledge:

(1) The Report fully complies with the requirements of section 13(a) or 15(d) of the Securities Exchange Act of 1934; and

(2) The information contained in the Report fairly presents, in all material respects, the financial condition and result of operations of the Company.

/s/ John K. Kibarian

John K. Kibarian

President and Chief Executive Officer

(principal executive officer)

February 27, 2024

**CERTIFICATION PURSUANT TO
18 U.S.C. SECTION 1350,
AS ADOPTED PURSUANT TO
SECTION 906 OF THE SARBANES-OXLEY ACT OF 2002**

In connection with the Annual Report of PDF Solutions, Inc. (the "Company") on Form 10-K for the year ended December 31, 2023 as filed with the Securities and Exchange Commission on February 27, 2024 (the "Report"), I, Adnan Raza, Executive Vice President, Finance and Chief Financial Officer of the Company, certify, pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002, that, to my knowledge:

(1) The Report fully complies with the requirements of section 13(a) or 15(d) of the Securities Exchange Act of 1934; and

(2) The information contained in the Report fairly presents, in all material respects, the financial condition and result of operations of the Company.

/s/ Adnan Raza

Adnan Raza
*Executive Vice President, Finance and Chief
Financial Officer
(principal financial and accounting officer)*

February 27, 2024

COMPENSATION RECOVERY POLICY

(Adopted and approved on November 29, 2023
and effective as of October 2, 2023)

1. Purpose

PDF Solutions, Inc. (collectively with its subsidiaries, the “*Company*”) is committed to promoting high standards of honest and ethical business conduct and compliance with applicable laws, rules and regulations. As part of this commitment, the Company has adopted this Compensation Recovery Policy (this “*Policy*”). This Policy is designed to comply with Section 10D of the Securities Exchange Act of 1934, as amended (the “*Exchange Act*”) and explains when the Company will be required to seek recovery of Incentive Compensation awarded or paid to a Covered Person. Please refer to Exhibit A attached hereto (the “*Definitions Exhibit*”) for the definitions of capitalized terms used throughout this Policy.

2. Miscalculation of Financial Reporting Measure Results

In the event of a Restatement, the Company will seek to recover, reasonably promptly, all Recoverable Incentive Compensation from a Covered Person. Such recovery, in the case of a Restatement, will be made without regard to any individual knowledge or responsibility related to the Restatement. Notwithstanding the foregoing, if the Company is required to undertake a Restatement, the Company will not be required to recover the Recoverable Incentive Compensation if the Compensation Committee determines it Impracticable to do so, after exercising a normal due process review of all the relevant facts and circumstances.

If such Recoverable Incentive Compensation was not awarded or paid on a formulaic basis, the Company will seek to recover the amount that the Compensation Committee determines in good faith should be recouped.

3. Other Actions

The Compensation Committee may, subject to applicable law, seek recovery in the manner it chooses, including by seeking reimbursement from the Covered Person of all or part of the compensation awarded or paid, by electing to withhold unpaid compensation, by set-off, or by rescinding or canceling unvested stock.

In the reasonable exercise of its business judgment under this Policy, the Compensation Committee may in its sole discretion determine whether and to what extent additional action is appropriate to address the circumstances surrounding a Restatement to minimize the likelihood of any recurrence and to impose such other discipline as it deems appropriate.

4. No Indemnification or Reimbursement

Notwithstanding the terms of any other policy, program, agreement or arrangement, in no event will the Company or any of its affiliates indemnify or reimburse a Covered Person for any loss under this Policy and in no event will the Company or any of its affiliates pay premiums on any insurance policy that would cover a Covered Person’s potential obligations with respect to Recoverable Incentive Compensation under this Policy.

5. Administration of Policy

The Compensation Committee will have full authority to administer this Policy. The Compensation Committee will, subject to the provisions of this Policy and Rule 10D-1 of the Exchange Act, and the

Company's applicable exchange listing standards, make such determinations and interpretations and take such actions in connection with this Policy as it deems necessary, appropriate or advisable. All determinations and interpretations made by the Compensation Committee will be final, binding and conclusive.

6. Other Claims and Rights

The remedies under this Policy are in addition to, and not in lieu of, any legal and equitable claims the Company or any of its affiliates may have or any actions that may be imposed by law enforcement agencies, regulators, administrative bodies, or other authorities. Further, the exercise by the Compensation Committee of any rights pursuant to this Policy will not impact any other rights that the Company or any of its affiliates may have with respect to any Covered Person subject to this Policy.

7. Acknowledgement by Covered Persons; Condition to Eligibility for Incentive Compensation

The Company will provide notice and seek acknowledgement of this Policy, in substantially the form included as Exhibit B attached hereto, from each Covered Person, provided that the failure to provide such notice or obtain such acknowledgement will have no impact on the applicability or enforceability of this Policy. After the Effective Date, the Company must be in receipt of a Covered Person's acknowledgement as a condition to such Covered Person's eligibility to receive Incentive Compensation. All Incentive Compensation subject to this Policy will not be earned, even if already paid, until the Policy ceases to apply to such Incentive Compensation and any other vesting conditions applicable to such Incentive Compensation are satisfied.

8. Amendment; Termination

The Board or the Compensation Committee may amend or terminate this Policy at any time.

9. Effectiveness

Except as otherwise determined in writing by the Compensation Committee, this Policy will apply to any Incentive Compensation that is Received by a Covered Person on or after the Effective Date. Further, as of the Effective Date, this Policy amends and supersedes in their entirety any prior recovery of incentive compensation policy and any recoupment provisions which appear in a Covered Person's equity award agreements or otherwise (the "*Prior Policies*"). Notwithstanding the foregoing, the *Prior Policies* shall remain in full force and effect as to any compensation that, without the existence, and satisfaction, of conditions as set forth in the *Prior Policies*, may otherwise have been deemed earned prior to the Effective Date. This Policy will survive and continue notwithstanding any termination of a Covered Person's employment with the Company and its affiliates.

10. Successors

This Policy shall be binding and enforceable against all Covered Persons and their successors, beneficiaries, heirs, executors, administrators, or other legal representatives.

Exhibit A

PDF SOLUTIONS, INC.

COMPENSATION RECOVERY POLICY

DEFINITIONS EXHIBIT

“Applicable Period” means the three completed fiscal years of the Company immediately preceding the earlier of (i) the date the Board, a committee of the Board, or the officer or officers of the Company authorized to take such action if Board action is not required, concludes (or reasonably should have concluded) that a Restatement is required or (ii) the date a court, regulator, or other legally authorized body directs the Company to prepare a Restatement. The “Applicable Period” also includes any transition period (that results from a change in the Company’s fiscal year) within or immediately following the three completed fiscal years identified in the preceding sentence.

“Board” means the Board of Directors of the Company.

“Compensation Committee” means the Company’s committee of independent directors responsible for executive compensation decisions, or in the absence of such a committee, a majority of the independent directors serving on the Board.

“Covered Person” means any person who is, or was at any time, during the Applicable Period, an Executive Officer of the Company. For the avoidance of doubt, a Covered Person may include a former Executive Officer that left the Company, retired, or transitioned to an employee role (including after serving as an Executive Officer in an interim capacity) during the Applicable Period.

“Effective Date” means October 2, 2023.

“Executive Officer” means the Company’s president, principal executive officer, principal financial officer, principal accounting officer (or if there is no such accounting officer, the controller), any vice-president in charge of a principal business unit, division, or function (such as sales, administration, or finance), any other officer who performs a policy-making function, or any other person (including an officer of the Company’s parent(s) or subsidiaries) who performs similar policy-making functions for the Company.

“Financial Reporting Measure” means a measure that is determined and presented in accordance with the accounting principles used in preparing the Company’s financial statements (including, but not limited to, “non-GAAP” financial measures, such as those appearing in the Company’s earnings releases or Management Discussion and Analysis), and any measure that is derived wholly or in part from such measure. Stock price and total shareholder return (and any measures derived wholly or in part therefrom) shall be considered Financial Reporting Measures.

“Impracticable.” The Compensation Committee may determine in good faith that recovery of Recoverable Incentive Compensation is “Impracticable” if: (i) pursuing such recovery would violate home country law of the jurisdiction of incorporation of the Company where that law was adopted prior to November 28, 2022 and the Company provides an opinion of home country counsel to that effect acceptable to the Company’s applicable listing exchange; (ii) the direct expense paid to a third party to assist in enforcing this Policy would exceed the Recoverable Incentive Compensation and the Company has (A) made a reasonable attempt to recover such amounts and (B) provided documentation of such attempts to recover to the Company’s applicable listing exchange; or (iii) recovery would likely cause an otherwise tax-qualified retirement plan, under which benefits are broadly available to employees of the Company, to fail to meet the requirements of Section 401(a)(13) or Section 411(a) of the Internal Revenue Code of 1986, as amended.

“Incentive Compensation” means any compensation that is granted, earned, or vested based wholly or in part upon the attainment of a Financial Reporting Measure. Incentive Compensation does not include any base salaries (except with respect to any salary increases earned wholly or in part based on the attainment of a Financial Reporting Measure performance goal); bonuses paid solely at the discretion of the Compensation Committee or Board that are not paid from a “bonus pool” that is determined by satisfying a Financial Reporting Measure performance goal; bonuses paid solely upon satisfying one or more subjective standards and/or completion of a specified employment period; non-equity incentive plan awards earned solely upon satisfying one or more strategic measures or operational measures; and equity awards that vest based solely upon service and/or the passage of time and/or attaining one or more non-Financial Reporting Measures.

“Received.” Incentive Compensation is deemed “Received” in the Company’s fiscal period during which the Financial Reporting Measure specified in the Incentive Compensation award is attained, even if the payment or grant of the Incentive Compensation occurs after the end of that period.

“Recoverable Incentive Compensation” means the amount of any Incentive Compensation (calculated on a pre-tax basis) Received by a Covered Person during the Applicable Period that is in excess of the amount that otherwise would have been Received if the calculation were based on the Restatement. For the avoidance of doubt Recoverable Incentive Compensation does not include any Incentive Compensation Received by a person (i) before such person began service in a position or capacity meeting the definition of an Executive Officer, (ii) who did not serve as an Executive Officer at any time during the performance period for that Incentive Compensation, or (iii) during any period the Company did not have a class of its securities listed on a national securities exchange or a national securities association. For Incentive Compensation based on (or derived from) stock price or total shareholder return where the amount of Recoverable Incentive Compensation is not subject to mathematical recalculation directly from the information in the applicable Restatement, the amount will be determined by the Compensation Committee based on a reasonable estimate of the effect of the Restatement on the stock price or total shareholder return upon which the Incentive Compensation was Received (in which case, the Company will maintain documentation of such determination of that reasonable estimate and provide such documentation to the Company’s applicable listing exchange).

“Restatement” means an accounting restatement of any of the Company’s financial statements filed with the Securities and Exchange Commission under the Exchange Act, or the Securities Act of 1933, as amended, due to the Company’s material noncompliance with any financial reporting requirement under U.S. securities laws, regardless of whether the Company or Covered Person misconduct was the cause for such restatement. “Restatement” includes any required accounting restatement to correct an error in previously issued financial statements that is material to the previously issued financial statements (commonly referred to as “Big R” restatements), or that would result in a material misstatement if the error were corrected in the current period or left uncorrected in the current period (commonly referred to as “little r” restatements).

Exhibit B

PDF SOLUTIONS, INC.

COMPENSATION RECOVERY POLICY

ACKNOWLEDGMENT

By signing below, the undersigned acknowledges that they have read and understood, and they agree to be subject to the terms of, the PDF Solutions, Inc. Compensation Recovery Policy.

Date: _____

Signature: _____

Printed Name: _____