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 28, 2019

Or

☐ **TRANSITION REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934**

For the transition period from to

Commission file number: 000-50307

FormFactor, Inc.

(Exact name of registrant as specified in its charter)

Delaware	**13-3711155**
(State or other jurisdiction of incorporation or organization)	(I.R.S. Employer Identification No.)

7005 Southfront Road, Livermore, California 94551

(Address of principal executive offices, including zip code)

(925) 290-4000

(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, $0.001 par value	**FORM**	**Nasdaq Global Market**

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 submitted electronically every Interactive Data File required to be submitted pursuant to Rule 405 of the 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 is a shell company (as defined in Rule 12b-2 of the Exchange Act). Yes ☐ No ☒

Aggregate market value of registrant's common stock held by non-affiliates of the registrant, based upon the closing price of a share of the registrant's common stock on June 29, 2019 (the last business day of the registrant's most recently completed second quarter) as reported by Nasdaq Global Market on that date: $546,284,970.

The number of shares of the registrant's common stock, par value $0.001 per share, outstanding as of February 14, 2020 was 76,148,088 shares.

DOCUMENTS INCORPORATED BY REFERENCE

Portions of the registrant's definitive Proxy Statement for the 2020 Annual Meeting of Stockholders, which will be filed within 120 days of the end of the registrant's fiscal year ended December 28, 2019, are incorporated by reference in Part III hereof. Except with respect to information specifically incorporated by reference in this Annual Report on Form 10-K, the Proxy Statement is not deemed to be filed as a part of this Annual Report on Form 10-K.

FORMFACTOR, INC.

Form 10-K for the Fiscal Year Ended December 28, 2019

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Throughout this Annual Report on Form 10-K, we refer to FormFactor, Inc. and its consolidated subsidiaries as "the Company," "FormFactor," "we," "us," and "our." Our fiscal year ends on the last Saturday in December. Our last three fiscal years ended on December 28, 2019, December 29, 2018 and December 30, 2017.

NOTE REGARDING FORWARD-LOOKING STATEMENTS

This Annual Report on Form 10-K contains forward-looking statements within the meaning of the Securities Exchange Act of 1934 and the Securities Act of 1933, which are subject to known and unknown risks and uncertainties. The forward-looking statements include statements concerning, among other things, our business strategy (including the influence of anticipated trends and developments in our business and the markets in which we operate), financial results, operating results, revenues, gross margin, operating expenses, products, projected costs and capital expenditures, research and development programs, sales and marketing initiatives and competition. In some cases, you can identify these statements by our use of forward-looking words, such as "may," "might," "will," "could," "should," "expect," "plan," "anticipate," "believe," "estimate," "predict," "intend" and "continue," the negative or plural of these words and other comparable terminology. Forward-looking statements are based on information available to us as of the filing date of this Annual Report on Form 10-K and our current expectations about future events, which are inherently subject to change and involve known and unknown risks and uncertainties. You should not place undue reliance on these forward-looking statements. We have no obligation to update any of these statements, and we assume no obligation to do so. Actual events or results may differ materially from those expressed or implied by these statements due to various factors, including but not limited to the matters discussed below in the section entitled "Item 1A: Risk Factors," and elsewhere in this Annual Report on Form 10-K.

Our operating results have fluctuated in the past and are likely to continue to fluctuate. You should not rely on period-to-period comparisons of our financial results as indicators of our future performance. Some of the important factors that could cause our revenues, operating results and outlook to fluctuate from period to period include:

- customer demand for and adoption of our products;
- market and competitive conditions in our industry, the semiconductor industry and the economy as a whole;
- the timing and success of new technologies and product introductions by our competitors and by us;
- our ability to work efficiently with our customers on their qualification of our new technologies and products;
- our ability to deliver reliable, cost-effective products that meet our customers’ testing requirements in a timely manner;
- our ability to transition to new product architectures to solve next-generation semiconductor test and measurement challenges, and to bring new products into volume production on time and at acceptable yields and cost;
- our ability to implement measures for enabling efficiencies and supporting growth in our design, applications, manufacturing and other operational activities;
- the reduction, rescheduling or cancellation of orders by our customers;
- our ability to collect accounts receivables owed by our customers;
- our product and customer sales mix and geographical sales mix;
- a reduction in the price or the profitability of our products due to competitive pressures or other factors;
- the timely availability or the cost of components and materials utilized in our products;
- our ability to efficiently optimize manufacturing capacity and production yields as necessary to meet customer demand and ramp variable production volumes at our manufacturing facilities;
- our ability to protect our intellectual property against infringement and continue our investment in research and development and design activities;
- any disruption in the operation of our manufacturing facilities;
- changes in trade, tariff or export regulations in the markets where we produce or sell our products;
- factors impacting political and global economic stability, including natural disasters, epidemics (such as the current COVID-19, or coronavirus), military conflicts, climate change, and other factors acting alone or in combination; and
- the timing of and return on our investments in research and development.

PART I

Item 1: *Business*

General
FormFactor, Inc., headquartered in Livermore, California, is a leading provider of semiconductor test and measurement technologies. We provide a broad range of high-performance probe cards, analytical probes, probe stations, metrology systems, and thermal sub-systems to both semiconductor companies and scientific institutions. Our products provide electrical and optical information from a variety of semiconductor and electro-optical devices and integrated circuits from research, through development to production. Customers use our products and services to lower production costs, improve yields, and enable development of their complex next generation products.

FormFactor, Inc. was incorporated in 1993, and we introduced our first product in 1995. In October 2012, we acquired Astria Semiconductor Holdings, Inc., including its subsidiary Micro-Probe Incorporated (together "MicroProbe"), in June 2016, we acquired Cascade Microtech, Inc. ("Cascade Microtech" or "CMI"), and in October 2019, we acquired FRT GmbH. These acquisitions helped transform our business into a broader semiconductor test and measurement market leader with greater scale, diversification and market opportunities.

As of December 28, 2019, we operate in two reportable segments consisting of the Probe Cards Segment and the Systems Segment. Sales of our probe cards and analytical probes are included in the Probe Cards Segment, while sales of our probe stations, metrology systems, and thermal sub-systems are included in the Systems Segment.

Products
We design, manufacture and sell multiple product lines, including probe cards, analytical probes, probe stations, metrology systems, thermal sub-systems, and related services.

Probe cards. Our probe cards utilize a variety of technologies and product architectures, including micro-electromechanical systems (MEMS) technologies. We use advanced design and automation technologies to enable our rapid and cost-effective manufacturing of resilient composite contact elements with characteristic length scales of a few microns. These contact elements are designed to provide a specific range of forces on, and across, a chip’s bond pad, solder bump, or copper pillar, during the test process and maintain their shape and position over a range of compression levels. In addition, while maintaining these mechanical characteristics, the contact elements must achieve reliable and high-fidelity electrical contact through wafer surfaces that are generally oxidized or otherwise contaminated, and must maintain these attributes over hundreds of thousands, and even millions, of compression cycles. Our range of capabilities enable us to rapidly produce customer-design specific probe cards that deliver leading precision, reliability, and electro-mechanical performance.

Our probe cards are customized for our customers’ unique wafer and chip designs by modifying and adapting our standard product architectures to meet an individual customer’s design layout and electrical test requirements. We offer probe cards to test a variety of semiconductor device types, including systems on a chip, mobile application processors, microprocessors, microcontrollers, graphic processors, radio frequency, analog, mixed signal, image sensors, electro-optical, DRAM memory, NAND flash memory and NOR flash memory devices.

For many advanced applications, our products must maintain tens of thousands of simultaneous high-fidelity low-impedance electrical contacts with the corresponding chip contacts on the wafer. Our present technologies enable probe cards with over 100,000 contact elements with spacings as small as 40 microns over geometries as large as 300mm. In addition, for high signal-fidelity devices such as wireless radio frequency transceivers and automotive radar chips, our probe card technologies are capable of testing at millimeter-wave frequencies range, currently up to 81 GHz.

We have invested, and intend to continue to invest, considerable resources in proprietary probe card design tools and processes. These tools and processes are intended to enable the rapid and accurate customization of products required to meet customer requirements, including automated routing and trace length adjustment within our probe cards, to rapidly design complex structures.

In addition, some of our customers test certain chips over a large range of operating temperatures, such as for automotive applications. We design probe cards to provide for a precise match with the thermal expansion characteristics of the wafer under test across the range of test operating temperatures. For many of our products, our customers can use the same probe card for both low and high temperature testing. We also design probe cards for customers that require extreme positional accuracy at a specific temperature.

Through ongoing investments in both our technology and operations, we continue to innovate and improve so that our products will meet customers' future technical roadmap performance, quality, and commercial requirements. We also focus upon leveraging these ongoing investments across all advanced probe card markets to realize synergies and economies of scale to benefit our competitiveness, time-to-market and overall profitability.

Analytical Probes. We offer over 50 different analytical probe models for engineering and production testing. Analytical probes are used for a diverse set of applications, including device characterization, electrical simulation model development, failure analysis, and prototype design debugging. Our customers for analytical probes include universities, research institutions, semiconductor integrated device manufacturers, semiconductor foundries, and fabless semiconductor companies. We continue to add new models of analytical probes that address measurements with higher complexities and at higher frequencies.

Probe Stations. Probe stations, also referred to as probing systems, are a critical tool for the development of new generations of semiconductor and electro-optical processes and designs. Probe stations are highly configurable for the required measurements, the size and type of wafer under test, the characteristics of the device design to be tested, and the temperatures at which testing is to be performed. Process development and design complexities have continually increased with each new generation of semiconductor technology to accommodate smaller design geometries, complex 3-D architectures, new materials and more layers. Probing systems are a fundamental tool for characterizing and verifying electrical performance and reliability to enable new semiconductor technologies. We design our probing systems for semiconductor design engineers to capture and analyze more accurate data in a shorter amount of time.

We build upon our probe stations to create integrated measurement systems that provide complete solutions for our customers' complex measurement requirements. These systems include test instrumentation, probe, cabling configurations, and software to enable fast, accurate, on-wafer data collection for complex application and measurement needs. We offer pre-configured and customized measurement systems for production testing, power device characterization, vacuum probing, cryogenic probing, high-pressure probing, photonics testing, and a variety of other specific applications.

Metrology Systems. As a result of our acquisition of FRT GmbH in October 2019, we began offering surface metrology systems for various applications including the development, production and quality control of semiconductor products. With resolution down to nanometer scales, these systems measure topography, structure, step height, roughness, wear, thickness variation, film thickness and other parameters. The modular architecture of the systems allows for exact sensor configuration to be customized for the application on a common platform. These systems integrate hybrid metrology capabilities and proprietary software to enable non-destructive and rapid measurement of multiple features and parameters simultaneously, which has multiple applications but is particularly useful in the growing space of advanced packaging and MEMS applications.

Thermal Subsystems. Our thermal subsystems produce thermal chucks and other test systems used in probe stations. Thermal chuck systems enable the testing of devices at precise temperatures or across a range of temperatures. These systems are both marketed externally and allow for vertical integration with our probe stations.

Services and Support. In addition to routine installation services at the time of sale, we offer services to enable our customers to maintain and more effectively utilize our products and to enhance our customer relationships. In addition to traditional maintenance services, our applications engineers assist our customers in test methodologies to make advanced measurements during process and product development, and during mass production.

Customers

Our customers include companies, universities and institutions that design or make semiconductor, and semiconductor related products in the Foundry & Logic, DRAM, Flash, Display and Sensor markets. Our customers use our products to test nearly all semiconductor device types, including mobile application processors, microprocessors, microcontrollers, graphic processors, radio frequency, analog, mixed signal, image sensors, opto-electrical, DRAM memory, NAND flash memory and NOR flash memory devices.

Fabless semiconductor suppliers do not manufacture their own semiconductors, but they purchase our analytical probes and probe stations for research and development, and device characterization. They also purchase, or direct their foundries or wafer test facilities to purchase, our probe cards to test wafers manufactured for them.

We believe our customers consider timely service and support to be an important aspect of our relationship as they are frequently associated with high-volume manufacturing and design-specific product ramps. Our probe stations are installed at customer sites either by us, our manufacturers' representatives or our distributors, depending on the complexity of the installation and the customer's geographic location. We assist our customers in the selection, integration and use of our products through application engineering support. We also provide worldwide on-site probe card maintenance and service training, seminars and telephone support. In certain geographic regions, and for selected products, our manufacturers' representatives and distributors provide additional service and support.

Information concerning revenue by geographic region and by country based upon ship-to location appears under Item 7: Management's Discussion and Analysis of Financial Condition and Results of Operations - Revenues - Revenues by Geographic Region and Note 15 of the Notes to Consolidated Financial Statements included in Part II, Item 8 of this Annual Report on Form 10-K.

Information concerning revenue concentration by customer appears under Note 2 of the Notes to Consolidated Financial Statements included in Part II, Item 8 of this Annual Report on Form 10-K. The following customers represent 10% or more of our quarterly revenues:

	Fiscal Quarters Ended							
	Dec. 28, 2019	Sep. 28, 2019	June 29, 2019	Mar. 30, 2019	Dec. 29, 2018	Sep. 29, 2018	June 30, 2018	Mar. 31, 2018
Intel Corporation	28.6 %	23.9 %	26.1 %	21.3 %	21.9 %	24.4 %	15.1 %	14.0 %
Samsung Electronics., LTD.	14.8 %	*	11.1 %	13.8 %	13.8 %	*	*	10.1 %
SK Hynix Inc.	*	13.5 %	*	*	*	*	11.5 %	*
Micron Technology, Inc.	*	11.9 %	10.1 %	*	*	12.0 %	*	*
Taiwan Semiconductor Manufacturing Co.,LTD.	*	*	*	*	10.9 %	*	*	*
	43.4 %	49.3 %	47.3 %	35.1 %	46.6 %	36.4 %	26.6 %	24.1 %

***** Less than 10% of revenues.

Segment and Enterprise-Wide Disclosures

See Note 15 of the Notes to Consolidated Financial Statements included in Part II, Item 8 of this Annual Report on Form 10-K for certain financial information related to our segments and our enterprise-wide disclosures.

Manufacturing

Our probe cards are designed for each of our customers' unique designs, by modifying and adapting our product architectures to meet an individual customer's chip layout and test requirements. Our proprietary manufacturing processes for our probe cards include a complex interconnection system-level design process; a front-end process, which may include wire bonding, photolithography, plating and metallurgical processes, dry and electro-deposition, pick and place assembly; and a back-end process, which includes general assembly and test. Critical steps in our manufacturing process are performed in a variety of clean room environments as stringent as a Class 100, depending on the requirements of the specific manufacturing processes.

Our probe stations and metrology systems are designed to provide highly accurate electrical and optical measurements enabled by precise and reliable mechanical components and assemblies. We prototype and perform robust testing of our product designs and components to ensure high electrical signal integrity, mechanical accuracy and safety. We also monitor our product quality throughout the various stages of our manufacturing processes using a variety of process control methods and tests.

We depend on suppliers for materials and some critical components of our manufacturing processes, including ceramic and organic substrates and complex printed circuit boards. We also rely on suppliers to provide certain contact elements and interconnects that are incorporated into our products. Some of these components and materials are supplied by a single vendor, and some are subject to certain minimum order quantities. Generally, we rely on purchase orders rather than long-term contracts with our suppliers, which subjects us to risks, including price increases, manufacturing capacity constraints and component shortages. We continually assess and evaluate alternative sources of supply for all components and materials.

Our primary manufacturing facilities are located in Livermore, San Jose and Carlsbad, California, Beaverton, Oregon, United States, and in Thiendorf, Germany. We also perform manufacturing operations in our facilities in Munich and Bergisch Gladbach, Germany; Suzhou, China; and Yokohama, Japan.

We maintain repair and service capabilities in Livermore, San Jose, and Carlsbad, California and Beaverton, Oregon, United States; Thiendorf, Dresden and Munich, Germany; Montbonnot Saint Martin, France; Bundang, South Korea; Yokohama and Hiroshima, Japan; Suzhou and Shanghai, China; Hsinchu, Taiwan; and Singapore.

Research, Development and Engineering

The semiconductor industry is subject to rapid technological change and new product introductions and enhancements. We believe that our continued commitment to research and development and our timely introduction of new and enhanced products and technologies are integral to maintaining and enhancing our competitive position. We allocate significant resources to these efforts and prioritize those resources to prepare for our customers' next generation electrical test and measurement challenges. We also increasingly seek to deploy our resources to solve fundamental challenges that are both common to, and provide competitive advantage across, our probe card and system product offerings and roadmaps.

Sales and Marketing

We sell our products worldwide through a global direct sales force and through a combination of manufacturers' representatives and distributors.

Our direct sales and marketing staff is located in the United States, China, France, Germany, Italy, United Kingdom, Japan, Singapore, South Korea, and Taiwan. They work closely with customers in the effort to understand their businesses, anticipate trends and define products that will provide significant technical and economic advantages to our customers. We employ a highly skilled team of application and customer support engineers that support our customers as they integrate our products into their research, development and manufacturing processes. Through these customer relationships, we seek to develop a close understanding of customer and product requirements to align our capabilities with our customers' roadmaps and production ramps.

We also have a network of representatives and distributors across the globe to broaden our reach. We engage sales representatives to act as independent third parties that agree to promote our products, at our prices and on terms set by us, in return for a commission based on sales. We typically use sales representatives in areas that we believe require greater levels of customer support than we can deliver from our own sales offices and where local language capabilities can offer an advantage. Our distributors purchase our products and resell them at prices and upon terms set by the particular distributor. We typically use distributors in particular geographies due to local regulations or business customs.

Environmental Matters

We are subject to U.S. federal, state, local, and foreign governmental laws and regulations relating to the protection of the environment, including those governing the discharge of pollutants into the air and water, the management and disposal of hazardous substances and wastes, the clean-up of contaminated sites and the maintenance of a safe workplace. We believe that we comply in all material respects with the environmental laws and regulations that apply to us as of December 28, 2019. We did not receive any notices of violations of environmental laws and regulations in fiscal 2019, 2018 or 2017. In the future, we may receive notices of violations of environmental regulations, or otherwise learn of such violations. Environmental contamination or violations may negatively impact our business.

Competition

The markets for our products are highly competitive and we anticipate that these markets will continually evolve and be subject to rapid technological change. Our current and potential competitors are as below:

Probe Card Market. The probe card market comprises of many domestic and foreign companies, and has historically been fragmented with many local suppliers servicing individual customers in often differentiated applications. Our primary competitors are Advantest Corporation, AMST Co., Ltd., Feinmetall GmbH, Japan Electronic Materials Corporation, Korea Instrument Co., Ltd., M2N Co., Ltd., Microfriend Inc., Micronics Japan Co., Ltd., MPI Corporation, Micro Square Technology Inc., NHK Spring Co., Ltd., Soulbrain Engineering, Nidec SV TCL, Synergie CAD, TechnoProbe S.p.A, TSE Co., Ltd., WinWay Technology Co., Ltd., WILL-Technology Co., Ltd., Yokowo and Unity SC, among others.

Probe card vendors such as Japan Electronic Materials Corporation, Micronics Japan Company, Ltd. and TechnoProbe, offer probe cards built using similar types of lithographic patterning as do we. The high capital investment and other costs associated with the development of lithographically defined probe cards and the time and high cost of the customer evaluation process represent significant barriers to entry for this type of technology.

We believe that the primary competitive factors in the production probe card market depend upon the type of integrated circuit being tested, but also include customer service, knowledge of measurement techniques, delivery time, price, probe card lifetime, chip damage prevention, probe tip touch-down accuracy, speed and frequency of the probe card, number of chips contacted in parallel, number of probe tips and their layout, signal integrity, and frequency and effectiveness of any required cleaning. As a result of our relative strengths in these areas, we believe that we compete favorably in the advanced probe card market, and in probe cards for parallel testing of chips with densely-packed bond pads, bumps or pillars, and in high signal integrity testing of wireless radio frequency devices that operate up to millimeter-wave frequencies, a capability needed for components used in 5G applications.

Analytical Probes. Our primary competitor in the analytical probe market is GGB Industries Inc. Regional competitors include Yokowo and TechnoProbe Co Ltd. in Japan, and MPI/Allstron in Taiwan. We believe that the primary competitive factors in this market are breadth of probe types, probe frequency and electrical signal integrity, contact integrity and the related cleaning required, knowledge of measurement techniques, calibration support, delivery time and price. We believe that we compete favorably with respect to these factors.

Probe Stations. Our primary competitors in the probe station market are HiSOL, Inc., LTD/Accretech, The Micromanipulator Company Inc., MPI Corporation, Semiprobe, Signatone Corporation, Tokyo Electron ("TEL"), Tokyo Seimitsu Co., Vector Semiconductor Co. Ltd., and Wentworth Laboratories Inc. We believe that the primary competitive factors in the probe station market are measurement accuracy and versatility, measurement speed, automation features, knowledge of measurement techniques, completeness of the measurement solutions, delivery time and price. We believe that we compete favorably with respect to these factors.

Metrology Systems. Our primary competitors in the metrology system market are Filmetrics, Nova Measuring Instruments Ltd., Bruker Corporation, Camtek Ltd., Cohu, Inc., Nanometrics Incorporated (recently acquired by Rudolph Tehnologies, Inc.) and Unity SC. We believe that the primary competitive factors in this market are breadth of measurement types, measurement accuracy, measurement speed and throughput, ability apply algorithms to multiple sensor inputs to indirectly measure attributes not otherwise directly observable, knowledge of measurement techniques and applications, delivery time and price. We believe that we compete favorably with respect to these factors.

Thermal Subsystems. In the market for thermal subsystems, we compete principally against ERS Electronic GmbH, Espec Corp, and Temptronic Corporation. In addition, many of our probe station competitors develop and produce their own thermal subsystems for use in their products. We believe the primary competitive factors in this market are thermal performance, reliability, flexibility and completeness of product offerings. We believe that we compete favorably with respect to these factors.

Some of our competitors are also suppliers of other types of test and measurement equipment or other semiconductor equipment and may have greater financial and other resources than we do. Our competitors may enhance their current products and may introduce new products that will be competitive with ours. New alternatives to our products may also be introduced, by our current competitors or others, which may reduce the value of one or more of our products.

Semiconductor manufacturers may implement chip designs that include capabilities or use other methodologies that increase test throughput and reduce test content. This may reduce or eliminate some or all of our current products' advantages. Semiconductor manufacturers may also increase their use of test strategies that include low performance semiconductor testers, less complex probe cards, or test procedures that do not involve our products. Our ability to compete favorably may also adversely affect the long-standing relationships between our competitors and certain semiconductor manufacturers.

Intellectual Property

Our success depends in part upon our ability to continue to innovate and invest in research and development to meet the testing requirements of our customers, to maintain and protect our proprietary technology, and to conduct our business without infringing on the proprietary rights of others. We rely on a combination of patents, trade secrets, trademarks and contractual restrictions on disclosure to protect our intellectual property rights. We have filed actions to enforce those rights against third parties in the past, and may pursue such actions in the future.

We have generated, and continue to generate and maintain, patents and other intellectual property rights covering innovations that are intended to create a competitive advantage, and to support the protection of our investments in research and development. We believe that we possess one of the most substantial patent portfolios relevant to our products.

Although we believe that our patents and other intellectual property rights have significant value for each of our segments, we do not believe that maintaining or growing our business is materially dependent on any single patent. Due to the rapid pace of innovation within the markets that we serve, it is possible that our protection through patents may be less important than factors such as our technological expertise, continuing development of new products and technologies, protection of trade secrets, market penetration, customer relationships, and our ability to provide comprehensive support and service to customers worldwide.

No assurance can be given that any patents will not be challenged, invalidated or circumvented, or that the rights granted thereunder will provide us with a sustained competitive advantage. In addition, there can be no assurance that we will be able to protect our technology, or that competitors will not be able to independently develop similar or functionally competitive technologies, design around our patents, or attempt to manufacture and sell infringing products in countries that do not strongly enforce intellectual property rights.

Employees

As of December 28, 2019, we had 1,836 regular full-time employees, including 1,067 in operations, 355 in research and development, 265 in sales and marketing and 149 in general and administrative functions. By region, 1,248 of our employees were in North America, 328 in Asia and 260 in Europe. No employees are currently covered by a collective bargaining agreement. However, certain employees at our manufacturing facility in Thiendorf, Germany, are represented by a works council. We believe that, overall, our relations with our employees are good.

Available Information

We maintain a website at *http://www.formfactor.com*. We make available free of charge on our website 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 United State Securities and Exchange Commission, or SEC. The reference to our website does not constitute incorporation by reference of the information contained at the site.

Directors and Executive Officers

The information required by this item is incorporated by reference to the proxy statement for our 2020 Annual Meeting of Stockholders.

Item 1A: *Risk Factors*

In addition to the other information in this Annual Report on Form 10-K, you should carefully consider the risk factors discussed in this Annual Report on Form 10-K in evaluating FormFactor and our business. If any of the identified risks actually occur, our business, financial condition and results of operations could be materially adversely affected, the trading price of our common stock could decline, and you may lose all or part of your investment in our common stock. The risks and uncertainties described in this Annual Report on Form 10-K are not the only ones we face. Additional risks that we currently do not know about, or that we currently believe to be sufficiently important to describe here, may also impair our business operations or the trading price of our common stock.

Risks Relating to the Nature and Operations of Our Business

The markets in which we participate are competitive, and if we do not compete effectively, our operating results could be harmed.

We have experienced increased competition in the markets in which we operate, and we expect competition to intensify in the future. Increased competition has resulted in, and in the future is likely to result in, price reductions, reduced gross margins or loss of market share. Competitors might introduce new competitive products for the same markets that our products currently serve. These products may have better performance, lower prices, shorter delivery times or broader acceptance than our products.

In addition, it is possible that new competitors, including test equipment manufacturers, may offer new technologies that reduce the value of our products. Also, semiconductor manufacturers may implement chip designs or methodologies that increase test throughput, reduce test content, or change their test procedures, thereby eliminating some or all of our current product advantages.

Our current or potential competitors may have larger customer bases, more established customer relationships or greater financial, technical, manufacturing, marketing and other resources than we do. As a result, they might be able to respond more quickly to new or emerging technologies and changes in customer requirements, devote greater resources to the development, promotion, sale and support of their products, and reduce prices to increase market share.

If we do not innovate and keep pace with technological developments in the semiconductor industry, our products might not be competitive, and our revenues and operating results could suffer.

We must continue to innovate and to invest in research and development to improve our competitive position and to meet the test and measurement requirements of our customers. Our future growth depends, in significant part, upon our ability to work effectively with and anticipate the future technical and operational needs of our customers and to develop and support new products and product enhancements to meet these needs on a timely and cost-effective basis. Our customers' needs are becoming more challenging as the semiconductor industry continues to experience rapid technological change driven by the demand for complex circuits that are shrinking in size, are increasing in speed and functionality, and are produced on shorter cycle times and at reduced unit cost.

Successful product design, development and introduction on a timely basis require that we:

- collaborate with customers to understand their future requirements;
- design innovative and performance-enhancing product architectures, technologies and features that differentiate our products from those of our competitors;
- in some cases, engage with third parties who have particular expertise in order to complete one or more aspects of the design and manufacturing process;
- qualify with the customer(s) the new product, or an existing product incorporating new technology;
- transition our products to new manufacturing technologies;
- offer our products for sale at competitive price levels while maintaining our gross-margins within our financial model;
- identify emerging technological trends in our target markets;
- maintain effective marketing strategies;
- respond effectively to technological changes or product announcements by others; and
- adjust to changing market conditions quickly and cost-effectively.

Not only do we need the technical expertise to implement the changes necessary to keep our technologies current, but we must also rely heavily on the judgment of our management to anticipate future market trends. If we are unable to timely predict industry changes or industry trends, or if we are unable to modify our products or design, manufacture and deliver new products on a timely basis, or if a third party with which we engage does not timely deliver a component or service for one of our product modifications or new products, we might lose customers or market share. In addition, we might not be able to recover our research and development expenditures, which could harm our operating results.

We depend upon the sale of our probe card products for the substantial majority of our revenues.
We derive the majority of our revenues from the sale of our probe card products, primarily to manufacturers of microprocessor, foundry & logic and memory devices, despite progress in diversifying our product offerings. We anticipate that sales of probe cards will represent a substantial majority of our revenues for the foreseeable future. Our success depends in large part upon the continued acceptance of our products on the basis of a variety of factors including performance, quality, timely delivery and price, and depends upon our ability to continue to develop and introduce new products that meet our customers' requirements. The degree to which we depend upon the sales of our probe card products for our revenues may increase our susceptibility to failures to satisfy the customers for such products, which may adversely affect our revenues and our ability to grow our business.

We derive a substantial portion of our revenues from a small number of customers.
A relatively small number of customers account for a significant portion of our revenues. Two customers represented a combined 37% of total revenues in fiscal 2019 and one customer represented 19% and 26% of total revenues in fiscal 2018 and 2017, respectively. We anticipate that sales of our products to a relatively small number of customers will continue to account for a significant portion of our revenues and can, as demonstrated in fiscal 2019, drive material fluctuations in sales volume. Consolidation in the semiconductor industry may increase this concentration. In the future, the loss of any of these customers, or cancellation, reduction or deferral of even a small number of purchases of our products by these customers could significantly reduce our revenues. Cancellations, reductions, deferrals or non-payment of invoices, could result from another downturn in the semiconductor industry, manufacturing delays, quality or reliability issues with our products, or from interruptions to our customers' operations due to fire, natural disasters or other events, or other issues with the financial stability of our customers. Furthermore, because our probe cards are custom products designed for our customers' unique wafer designs, any cancellations, reductions or delays can result in significant, non-recoverable costs. In some situations, our customers might be able to cancel or reduce orders without a significant penalty.

If our relationships with our customers deteriorate, our product development activities could be harmed.
The success of our product development efforts depends upon our ability to anticipate market trends and to collaborate closely with our customers. Our relationships with these customers provide us with access to valuable information regarding manufacturing and process technology trends in the semiconductor industry, which enables us to better plan our product development activities. These relationships also provide us with opportunities to understand the performance and functionality requirements of our customers, which improves our ability to customize our products to fulfill their needs. Our relationships with our customers could deteriorate as a result of a variety of factors, such as if they become concerned about our ability to deliver quality products on a timely basis or to protect their intellectual property. Many of our customers are large companies that place significant orders with us, and the consequences of deterioration in our relationship with any of these companies

could be significant due to the competitiveness of our industry and the significant influence that these companies exert in our market.

Consolidation in the semiconductor industry and within the semiconductor test equipment market could adversely affect the market for our products and negatively impact our ability to compete.

Consolidation in the semiconductor industry may reduce our customer base and could adversely affect the market for our products, which could cause a decline in our revenues. With consolidation, the number of actual and potential customers for our products has decreased in recent years. Consolidation may lead to relatively fewer opportunities to sell our products if we are not chosen as a supplier by any given prospective customer, and may lead to increased pricing pressures from customers that have greater volume purchasing power.

There has also been consolidation within the semiconductor test equipment market. This consolidation trend could change our interactions and relationships with complementary tester, instrument, and prober suppliers and negatively impact our revenue and operating results.

Changes in customers' test strategies, equipment and processes could decrease customer demand for our products.

The demand for our products depends in large part upon the number of semiconductor designs, the pace of technology and architecture transitions in chip designs and overall semiconductor unit volume. The number of probe cards involved in a customer's wafer testing can depend upon the number of devices being tested, the complexity of these devices, the test software program, the test equipment itself, and the utilization of chip designs featuring design-for-testability capabilities. Customers may demand fewer probe cards or probing systems if they use test strategies that reduce the technical requirements on test equipment, improve available data on device performance earlier in the manufacturing process, or test devices later in the manufacturing process. Changes in the effectiveness of test technologies and test strategies used by customers may cause us to lose sales and revenues.

We may also lose sales if new semiconductor technologies or designs are implemented which cannot be efficiently tested using the products that we offer, or if semiconductor manufacturers reduce the amount or degree of testing that they perform. We may also incur significant research and development expenses in order to introduce new product architectures and platforms to serve the testing needs of new semiconductor technologies.

Cyclicality in the semiconductor industry may adversely impact our sales.

The semiconductor industry has historically been cyclical and is characterized by wide fluctuations in product supply and demand. From time to time, this industry has experienced significant downturns, often in connection with, or in anticipation of, maturing product and technology cycles, excess inventories and declines in general economic conditions. The global economic and semiconductor downturns have caused and may in the future cause our operating results to decline dramatically from one period to the next. Global economic stability can be negatively affected by a variety of factors and interrelationships, including the potential impact of Brexit, epidemics (such as the current COVID-19), military conflicts, climate change, trade barriers and other factors acting alone or in combination. Some of these factors can also have a more direct adverse impact upon our operations to varying degrees. Our business depends heavily upon the development and manufacture of new semiconductors, the rate at which semiconductor manufacturers make transitions to smaller nanometer technology nodes and implement tooling cycles, the volume of production by semiconductor manufacturers and the overall financial strength of our customers, which, in turn, depend upon the current and anticipated market demand for semiconductors and products, such as servers, personal computers, automobiles and cell phones, that use semiconductors. During industry downturns, semiconductor manufacturers sharply curtail their spending, including their spending on our products, which may adversely impact our revenues, gross margins and results of operations. Further, a protracted downturn could cause one or more of our customers to become insolvent, resulting in a loss of revenue and impacting our ability to collect on accounts receivable. The timing, length and severity of these cyclical downturns are difficult to predict and our business depends on our ability to plan for and react to these cyclical changes.

Because we generally do not have a sufficient backlog of unfilled orders to meet our quarterly revenue targets, revenues in any quarter are substantially dependent upon customer orders received and fulfilled in that quarter.

Our revenues are difficult to forecast because we generally do not have sufficient backlog of unfilled orders to meet our quarterly revenue targets at the beginning of a quarter. Rather, a substantial percentage of our revenues in any quarter depend upon customer orders for our products that we receive and fulfill in that quarter. Because our expense levels are based in part on our expectations as to future revenues and to a large extent are fixed in the short term, we might be unable to adjust spending in time to compensate for any unexpected shortfall in revenues. Accordingly, any significant shortfall of revenues in relation to our expectations could hurt our operating results.

If our ability to forecast demand for our products or the predictability of our manufacturing yields deteriorates, we could incur high inventory losses.
Each semiconductor chip design requires a custom probe card. Because our products are design-specific, demand for our products is difficult to forecast. Due to our customers' short delivery time requirements, we often design and procure materials and, at times, produce our products in anticipation of demand for our products rather than in response to an order. Our manufacturing yields and inventory requirements, particularly for new probe card products or when we are operating at high output levels, have at times been unpredictable. If we do not obtain orders as we anticipate, if we suffer manufacturing errors, or if we build additional inventory to compensate for unpredictable manufacturing yields, we could have excess or obsolete inventory that we may not be able to sell, which would likely result in inventory write-offs or material charges for scrap.

If we are unable to efficiently manufacture our existing and new products, our business may be materially adversely affected.
We must continuously improve our manufacturing processes in an effort to increase yields and product performance, lower our costs and reduce the time required for us to design, manufacture and deliver our products in volume. If we cannot do these things, both our existing products and our new products may not be commercially successful, our revenues may be adversely affected, our customer relationships and our reputation may be harmed and our business may be materially adversely affected.

To improve our manufacturing processes, we have incurred, and may incur in the future, substantial costs in an effort to optimize capacity and yields, open new manufacturing facilities, implement new manufacturing technologies, methods and processes, purchase new equipment, upgrade existing equipment and train technical personnel. We have experienced, and may experience in the future, manufacturing delays and other inefficiencies in connection with implementation of these improvements and customer qualifications of new processes, which have caused and could cause in the future, our operating results to decline. These delays and other inefficiencies may arise from a variety of factors, including disruptions to or the unavailability of sufficient electrical power as a result of insufficient electrical power infrastructure in the regions where we have manufacturing facilities such as in California.

We have also experienced, and may experience in the future, difficulties in manufacturing our complex products in volume on time, and at acceptable yields and cost and installation issues in the field due to the complexity of customer design requirements, including integration of probe cards with varying customer test cell environments and testing of semiconductor devices over a wide temperature range.

If we are unable to continue to reduce the time it takes for us to design and produce products, our growth could be impeded.
Our customers continuously seek to reduce the time it takes them to introduce new products to market. The cyclicality of the semiconductor industry, coupled with changing demands for semiconductor products, requires our customers to be flexible and highly adaptable to changes in the design, volume and mix of products they must produce. We may be unable to design, configure and produce our products within the short cycle times required to respond to such rapid changes. We have lost sales in the past where we were unable to meet a customer's required delivery schedules. If we are unable to continue to reduce the time it takes for us to design, manufacture and ship our products in response to the needs of our customers, our competitive position could be harmed and we could lose sales.

Products that do not meet specifications or that contain defects could damage our reputation, decrease market acceptance of our technology, cause us to lose customers and revenues, and result in liability to us.
The complexity and ongoing development of our product designs and manufacturing processes could lead to design or manufacturing problems. Problems might result from a number of factors, including design defects, materials failure, failure of components manufactured by our suppliers to meet our specifications, contamination in the manufacturing environment, impurities in the materials used, and unknown sensitivities to process conditions such as temperature and humidity, and equipment failures. Any errors or defects could:

- cause lower than anticipated yields and lengthen delivery schedules;
- cause delays in product shipments;
- cause delays in new product introductions;
- cause us to incur warranty expenses;
- result in increased costs and diversion of development resources;
- cause us to incur increased charges due to unusable inventory;
- require design modifications; or
- decrease market acceptance or customer satisfaction with these products.

The occurrence of any one or more of these events could adversely affect our business, reputation and operating results.

As part of our sales process, we could incur substantial sales and engineering expenses that do not result in revenues.
Our customers generally expend significant efforts evaluating and qualifying our products prior to placing an order. While our customers are evaluating our products, we might incur substantial sales, marketing, and research and development expenses. For example, we typically expend significant resources educating our prospective customers regarding the uses and benefits of our products and customizing them to the potential customer's needs, for which we might not be reimbursed. The substantial resources we commit to our sales efforts may not result in any revenues from a customer. For example, many semiconductor processes, architectures, and designs never reach production, including those for which we may have expended development effort and expense. In addition, prospective customers might decide not to use our products or use our products for a relatively small percentage of their requirements after we have expended significant effort and expense toward product design, development, and/or manufacture.

We obtain some of the components and materials we use in our products from a sole source or a limited group of suppliers, and the partial or complete loss of one of these suppliers could cause production delays.
We obtain some of the components and materials used in our products, such as printed circuit board assemblies, plating materials and ceramic substrates, from a sole source or a limited group of suppliers, and in some cases alternative sources are not currently available. Because we rely on purchase orders rather than long-term contracts with the majority of our suppliers, we cannot guarantee our ability to obtain components and materials in the long term. A sole or limited source supplier could increase prices, which could lead to a decline in our gross profit. Our dependence upon sole or limited source suppliers exposes us to several other risks, including inability to obtain an adequate supply of materials, late deliveries, poor component quality, and business disruptions while we seek to identify and qualify alternative suppliers. The occurrence of any of these risks could adversely impact our business, results of operations and financial condition.

Our operations, or those of our important suppliers, business partners and customers could be adversely affected by events outside of our control such as epidemics and natural disasters.

We may be affected by natural disasters, epidemics or other events outside of our control. These events may impact our operations directly, or may disrupt the operations of our important suppliers, business partners and customers, in ways that can adversely affect our results of operations or financial condition.

For example, there is a developing epidemic originating in China identified as COVID-19. The COVID-19 epidemic is resulting in restrictions on travel and business operations in China and elsewhere. We ship a significant percentage of our products into China, and some of our customers' operations in China are currently being negatively affected by the COVID-19 epidemic. We have delayed or canceled certain planned events intended to promote our products and activities with businesses in China. Some of the multi-national companies which drive the demand for our products are reporting that the COVID-19 epidemic is expected to negatively impact their operations and sales. It remains unknown how severely global supply chains, including for parts and materials that we use to manufacture our products, have been or will be affected by this epidemic. Similarly, the impacts of this epidemic upon the demand for our products remain uncertain. We could experience shortages, increased costs or reduced demand for our products particularly as this epidemic continues or worsens. In addition, the circumstances which give rise to new or existing infectious diseases becoming epidemics or pandemics with similar impacts are expected to persist indefinitely.

Another example of events outside of our control relates to the fact that our manufacturing facilities and corporate headquarters in California are located in seismically active areas. The manufacturing equipment and processes that we use can be severely disrupted by seismic activity. A significant seismic event in the areas of our operations could have a materially negative impact on our operations, financial results or financial condition.

Because we conduct most of our business internationally, we are subject to operational, economic, financial and political risks abroad.
Sales of our products to customers outside of the United States represent a significant part of our past and anticipated revenues. Our international sales as a percentage of our revenues were 74%, 75% and 66% for fiscal 2019, 2018 and 2017, respectively. Certain of our non-U.S. based customers also purchase through their subsidiaries in the United States. In the future, we expect international sales, to continue to account for a significant percentage of our revenues. Accordingly, we will be subject to risks and challenges that we would not otherwise face if we conducted our business solely in the United States.

These risks and challenges include:

- compliance with a wide variety of foreign laws and regulations;
- legal uncertainties regarding taxes, tariffs, quotas, export controls, export licenses and other trade barriers;

- political and economic instability or foreign conflicts, including trade wars, that involve or affect the countries of our customers;
- difficulties in collecting accounts receivable and longer accounts receivable payment cycles;
- difficulties in staffing and managing personnel, distributors and representatives;
- reduced protection for intellectual property rights in some countries;
- currency exchange rate fluctuations, which could affect the value of our assets denominated in local currency, as well as the price of our products relative to locally produced products;
- the impact of pandemics or other disruptions to trade and production;
- seasonal fluctuations in purchasing patterns in other countries; and
- fluctuations in freight rates and transportation disruptions.

Any of these factors could harm our existing international operations, impair our ability to continue expanding into international markets or materially adversely affect our operating results. Political developments in the United States and elsewhere may increase the risks and uncertainties associated with conducting international business, including the possibilities of greater tariffs and other trade barriers in the regions where we conduct business. In fiscal 2019, we observed a continuing trend of increasing risks and challenges in the conduct of our international business activities, including with ongoing expanded tariffs and trade controls affecting the United States and China. Additionally, we are required to comply with foreign import and export requirements, customs and value added tax standards that can be unclear or complex. Our failure to meet these requirements and standards could negatively impact our business operations.

Our foreign operations expose us to additional risks relating to currency fluctuations.

Our international operations are significant to our revenues and net income, and we plan to continue to grow internationally. We have significant business operations located in Germany. While we report our financial results in U.S. dollars, we incur certain costs in other currencies, and have certain foreign currency denominated assets and liabilities. We, therefore, face exposure to fluctuations in currency exchange rates. Significant fluctuations in exchange rates between the U.S. dollar and foreign currencies may adversely affect our revenues and earnings, despite our hedging of a portion of our international currency exposures. Additionally, hedging programs are inherently risky and could expose us to additional costs and risks that could adversely affect our financial condition and results of operations.

If we fail to protect our proprietary rights, our competitors might gain access to our technology, which could adversely affect our ability to compete successfully in our markets.

If we choose not to protect our proprietary rights or fail in our efforts to protect our proprietary rights, our competitors might gain access to our technology. Unauthorized parties might attempt to copy aspects of our products or to obtain and use information that we regard as proprietary. Others might independently develop similar or competing technologies or methods or design around our patents. In addition, the laws of many foreign countries in which we or our customers do business do not protect our intellectual property rights to the same extent as the laws of the United States. As a result, our proprietary rights could be compromised, our competitors might offer products similar to ours and we might not be able to compete successfully. We also cannot assure that:

- our means of protecting our proprietary rights will be adequate;
- patents will be issued from our pending or future applications;
- our existing or future patents will be sufficient in scope or strength to provide any meaningful protection or commercial advantage to us;
- our patents or other intellectual property will not be invalidated, circumvented or successfully challenged in the United States or foreign countries; or
- others will not misappropriate our proprietary technologies or independently develop similar technologies, duplicate our products or design around any of our patents or other intellectual property, or attempt to manufacture and sell infringing products in countries that do not strongly enforce intellectual property rights.

We have spent and may be required to spend in the future, significant resources to monitor and protect our intellectual property rights. Any litigation, whether or not resolved in our favor, and whether initiated by us or by a third party, could result in significant and possibly material expenses to us and divert the efforts of our management and technical personnel.

We might be subject to claims of infringement of other parties' proprietary rights.

In the future, as we have in the past, we might receive claims that we are infringing intellectual property rights of others and inquiries about our interest in a license or assertions that we need a license to such intellectual property. The semiconductor industry is characterized by uncertain and conflicting intellectual property claims and vigorous protection and pursuit of these rights. The resolution of any claims of this nature, with or without merit, could be time consuming, result in costly litigation or cause product shipment delays. In the event of an adverse ruling or settlement, we might be required to pay substantial damages, cease the use or sale of infringing products, spend significant resources to develop non-infringing technology, discontinue the use of certain technology and/or enter into license agreements. License agreements, if required, might not be available on terms acceptable to us or at all. The loss of access to any of our intellectual property or the ability to use any of our technology could harm our business. Finally, certain of our customer contracts contain provisions that require us to defend or indemnify our customers for third party intellectual property infringement claims, which would increase the cost to us of an adverse ruling or settlement.

We have recorded restructuring, inventory write-offs and asset impairment charges in the past and may do so again in the future, which could have a material negative impact on our business.

We recorded restructuring charges in fiscal 2019, 2018 and 2017. We may implement restructuring plans in the future, which would require us to take additional, potentially material, restructuring charges related to employee terminations, asset disposal or exit costs. We may also be required to write off additional inventory if our product build plans or usage of inventory experience declines, and such additional write-offs could constitute material charges. In addition, significant adverse changes in market conditions could require us to take additional material impairment charges related to our long-lived assets if the changes impact the critical assumptions or estimates that we use in our assessment of the recoverability of our long-lived assets. Any such additional charges, whether related to restructuring, asset impairment or factory underutilization may have a material negative impact on our operating results and related financial statements.

We rely on the security and integrity of our electronic data systems and our business could be damaged by a disruption, security breach or other compromise of these systems.

We rely on electronic data systems to operate and manage our business and to process, maintain, and safeguard information, including information belonging to our customers, partners, and personnel. These systems may be subject to failures or disruptions as a result of, among other things, natural disasters, accidents, power disruptions, telecommunications failures, new system implementations, acts of terrorism or war, physical security breaches, computer viruses, or other cyber security attacks. Such system failures or disruptions could subject us to downtimes and delays, compromise or loss of sensitive or confidential information or intellectual property, destruction or corruption of data, financial losses from remedial actions, liabilities to customers or other third parties such as under privacy laws, or damage to our reputation or customer relationships. Any of the foregoing could have a material adverse effect on our business, operating results and financial condition.

We may not be able to recruit or retain qualified personnel.

We believe our ability to manage successfully and grow our business and to develop new products depends, in large part, on our ability to recruit and retain qualified employees, particularly highly skilled technical, sales, management, and key staff personnel. Competition for qualified resources is intense and other companies may have greater resources available to provide substantial inducements to lure key personnel away from us or to offer more competitive compensation packages to individuals we are trying to hire.

Our failure to comply with environmental laws and regulations could subject us to significant fines and liabilities, and new laws and regulations or changes in regulatory interpretation or enforcement could make compliance more difficult and costly.

We are subject to various U.S. federal, state and local, and foreign governmental laws and regulations relating to the protection of the environment, including those governing the discharge of pollutants into the air and water, the management and disposal of hazardous substances and wastes, the cleanup of contaminated sites and the maintenance of a safe workplace. We could incur substantial costs, including cleanup costs, civil or criminal fines or sanctions and third-party claims for property damage or personal injury, as a result of violations of or liabilities under environmental laws and regulations or non-compliance with the environmental permits required at our facilities.

These laws, regulations and permits also could require the installation of costly pollution control equipment or operational changes to limit pollution emissions or decrease the likelihood of accidental releases of hazardous substances. In addition, changing laws and regulations, new laws and regulations, stricter enforcement of existing laws and regulations, the discovery of previously unknown contamination at our or others' sites or the imposition of new cleanup requirements could require us to curtail our operations, restrict our future expansion, subject us to liability and cause us to incur future costs that could harm our operations, thereby adversely impacting our operating results and cash flow.

Natural and man-made disasters may negatively impact our business.

Our business is vulnerable to the direct and indirect impact of natural and man-made disasters, such as floods, earthquakes, volcanic eruptions, nuclear accidents, and acts of terrorism, epidemics (such as the current COVID-19), military conflicts, climate change, and other factors acting alone or in combination. Material parts of our manufacturing and research and development operations are located in areas of California and Oregon that are prone to earthquakes and could be substantially disrupted in the event of an earthquake. It is also possible that future natural and man-made disasters could negatively impact the sales of our products as a result of impacts upon our customers' ability to make or sell their products, or impacts upon our suppliers' ability to supply components to us on a timely basis.

Risks Relating to Our Acquisitions

We may make additional acquisitions and investments in the future, which could put a strain on our resources, cause ownership dilution to our stockholders and adversely affect our financial results.

We may in the future make other acquisitions or investments, which may subject us to new or heightened risks. Integrating any newly acquired businesses, products or technologies into our company could put a strain on our resources, could be expensive and time consuming, could substantially reduce our cash reserves, could cause delays in product delivery and might not be successful. Future acquisitions and investments could divert management's attention from other business concerns and expose our business to unforeseen liabilities or risks associated with entering new markets. In addition, we might lose key employees while integrating new organizations. We might not be successful in integrating any acquired businesses, products or technologies, and might not achieve anticipated revenues and cost benefits. Investments that we make may not result in a return consistent with our projections upon which such investments are made, or may require additional investment that we did not originally anticipate. In addition, future acquisitions could result in customer dissatisfaction, performance problems with an acquired company, potentially dilutive issuances of equity securities or the incurrence of debt and restrictive debt covenants, contingent liabilities, possible impairment charges related to goodwill or other intangible assets or other unanticipated events or circumstances. If any of these risks were to come about, our business, financial results and stock price could be materially and adversely affected.

If goodwill or other intangible assets that we recorded in connection with our past acquisitions become impaired, we could be required to take significant charges against earnings.

In connection with our accounting for business that we acquired, we have recorded a significant amount of goodwill and other intangible assets. Under U.S. generally accepted accounting principles, or GAAP, we must assess, at least annually and potentially more frequently, whether the value of goodwill and other indefinite-lived intangible assets have been impaired. Finite-lived intangible assets will be assessed for impairment in the event of an impairment indicator. Any reduction or impairment of the value of goodwill or other intangible assets will result in a charge against earnings, which could materially adversely affect our results of operations and stockholders' equity in future periods. Refer to Note 2 to Notes to Consolidated Financial Statements for further details relating to our annual goodwill impairment assessment.

Risks Relating to Owning Our Stock

If we fail to maintain an effective system of internal and disclosure controls and procedures, we may not be able to accurately report our financial results or prevent fraud.

Effective internal and disclosure controls and procedures are necessary for us to provide reliable financial reports, to prevent fraud and to operate successfully as a public company. If we cannot provide reliable financial reports or prevent fraud, our business and reputation may be harmed. We regularly review and assess our internal controls over financial reporting and our disclosure controls and procedures. As part of that process, we may discover material weaknesses in our internal controls. If we fail to maintain effective controls or timely effect any necessary improvement of our internal and disclosure controls, we may not have accurate information to make management decisions, our operating results could be harmed or we may fail to meet our reporting obligations. Ineffective internal and disclosure controls could also cause stockholders to lose confidence in our reported financial information and our ability to manage our business, which would likely have a negative effect on the trading price of our securities.

The trading price of our common stock has been and is likely to continue to be volatile, and you might not be able to sell your shares at or above the price that you paid for them.

The trading prices of the securities of technology companies have been highly volatile. During fiscal 2019, our stock price (Nasdaq Global Market close price) ranged from $12.88 per share to $26.14 per share. The trading price of our common stock is likely to continue to be subject to wide fluctuations. Factors affecting the trading price of our common stock could include:

- variations in our operating results;
- our forecasts and financial guidance for future periods;
- announcements of technological innovations, new products or product enhancements, new product adoptions at semiconductor customers or significant agreements by us or by our competitors;
- reports regarding our ability to bring new products into volume production efficiently;
- the gain or loss of significant orders or customers;
- changes in the estimates of our operating results or changes in recommendations by any securities analysts that elect to follow our common stock;

- rulings on litigation and proceedings;
- seasonality, principally due to our customers' purchasing cycles;
- market and competitive conditions in our industry, the entire semiconductor industry and the economy as a whole;
- recruitment or departure of key personnel; and
- announcements of mergers and acquisition transactions and the ability to successfully integrate the business activities of the acquired/merged company; and
- political and global economic instability, including as a result of trade barriers, natural disasters, epidemics (such as the current COVID-19), military conflicts, climate change, and other factors acting alone or in combination.

In addition, if the market for technology stocks or the stock market in general experiences loss of investor confidence, the trading price of our common stock could decline for reasons unrelated to our business, operating results or financial condition. The trading price of our common stock also might decline in reaction to events that affect other companies in our industry even if these events do not directly affect us.

Provisions of our certificate of incorporation and bylaws or Delaware law might discourage, delay or prevent a change of control of our company or changes in our management and, therefore, depress the trading price of our common stock.

Delaware corporate law and our certificate of incorporation and bylaws contain provisions that could discourage, delay or prevent a change in control of our company or changes in our management that the stockholders of our company may deem advantageous. These provisions:

- establish a classified board of directors so that not all members of our board are elected at one time;
- provide that directors may only be removed “for cause” and only with the approval of 66.7% of our stockholders;
- require super-majority voting to amend some provisions in our certificate of incorporation and bylaws;
- authorize the issuance of “blank check” preferred stock that our board could issue to increase the number of outstanding shares and to discourage a takeover attempt;
- limit the ability of our stockholders to call special meetings of stockholders;
- prohibit stockholder action by written consent, which requires all stockholder actions to be taken at a meeting of our stockholders;
- provide that the board of directors is expressly authorized to make, alter or repeal our bylaws; and
- establish advance notice requirements for nominations for election to our board or for proposing matters that can be acted upon by stockholders at stockholder meetings.

In addition, Section 203 of the Delaware General Corporation Law may discourage, delay or prevent a change in control of our company. In addition, each of our named executive officers and certain other executives of the company have entered into change of control severance agreements, which were approved by our Compensation Committee, which could increase the costs associated with a change of control and thus, potentially deter such a transaction.

Item 1B: ***Unresolved Staff Comments***

None.

Item 2: ***Properties***

Our corporate headquarters, which includes sales, marketing, administration, manufacturing, engineering, and research and development facilities, is located in Livermore, California, United States. Our corporate headquarters comprises a campus of four buildings totaling approximately 213,000 square feet. We presently lease those four buildings. In addition, we lease office, repair and service, manufacturing and/or research and development space both inside and outside of the United States. The leases expire at various times through 2034. We believe that our existing and planned facilities are suitable for our current needs. We entered into a long-term lease agreement for 44,000 square feet of manufacturing space co-located with our existing facilities in Livermore, California, with the lease term beginning January 1, 2020, which is included in the table below.

Information concerning our properties as of December 28, 2019 is set forth below:

Location	Principal Use	Square Footage	Ownership
Livermore, California, United States	Corporate headquarters, sales, marketing, administration, product design, manufacturing, service and repair, distribution, research and development	212,835	Leased
Beaverton, Oregon, United States	Sales, marketing, administration, product design, manufacturing, service and repair, distribution, research and development	98,946	Leased
Carlsbad, California, United States	Sales, product design, administration, manufacturing, service and repair, distribution, research and development	30,876	Leased
San Jose, California, United States	Administration, product design, manufacturing, service and repair, distribution, research and development	24,700	Leased
Thiendorf, Germany	Sales, marketing, administration, manufacturing, service and repair, distribution, research and development	54,361	Leased
Munich, Germany	Sales, manufacturing, service and repair, distribution, research and development	10,656	Leased
Dresden, Germany	Sales and service	2,960	Leased
Bergisch Gladbach, Germany	Manufacturing, service and repair, distribution, research and development	13,075	Leased
Singapore	Sales, administration, product design, service, and field service	24,413	Leased
Jubei City, Hsinchu, Taiwan	Sales, administration, product design, field service and repair center	18,568	Leased
Bundang, South Korea	Sales, administration, product design, field service, and repair center	17,161	Leased
Yokohama City, Japan	Sales, marketing, administration, product design, manufacturing, service and repair, distribution, research and development	13,309	Leased
Hiroshima, Japan	Repair center	1,007	Leased
Suzhou, China	Sales, marketing, administration, product design, manufacturing, service and repair, distribution, research and development	15,177	Leased
Shanghai, China	Sales and service	4,101	Leased
Montbonnot Saint Martin, France	Sales and service	4,736	Leased
Legnano, Italy	Sales office	215	Leased

Item 3: ***Legal Proceedings***

From time to time, we may be subject to legal proceedings and claims in the ordinary course of business. As of December 28, 2019, and as of the filing of this Annual Report on Form 10-K, we were not involved in any material legal proceedings. In the future, we may become a party to additional legal proceedings that may require us to spend significant resources, including proceedings designed to protect our intellectual property rights. Litigation can be expensive and disruptive to normal business operations. Moreover, the results of legal proceedings are difficult to predict, and the costs incurred in litigation can be substantial, regardless of outcome.

Item 4: ***Mine Safety Disclosures***

Not applicable.

PART II

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

Market Information

Our common stock is listed on the Nasdaq Global Market under the symbol "FORM." As of February 14, 2020, there were 158 registered holders of record of our common stock.

Dividends

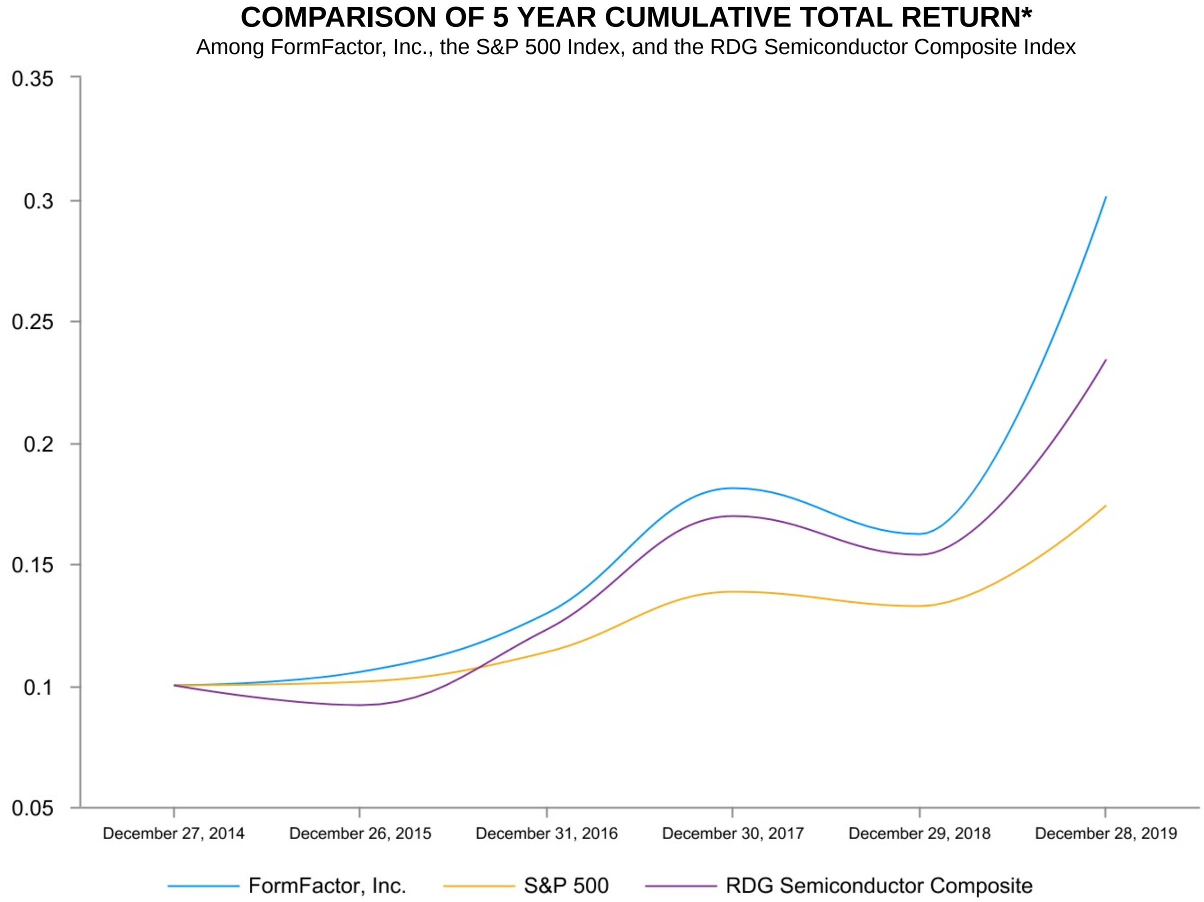
No cash dividends have been declared on shares of our common stock, and the Company currently does not intend to pay dividends in the future.

Repurchase of Common Stock

In February 2017, our Board of Directors authorized a program to repurchase up to $25 million of outstanding common stock to offset potential dilution from issuances of common stock under our employee stock purchase plan and equity incentive plan. The share repurchase program expired on February 1, 2020. During fiscal 2019 and 2018, we did not repurchase any shares. During fiscal 2017, we repurchased 1,367,617 shares of common stock for $19.0 million.

Stock Price Performance Graph

The following graph shows the total stockholder return of an investment of $100 in cash on December 27, 2014 through December 28, 2019 for (1) our common stock, (2) the S&P 500 Index and (3) the RDG Semiconductor Composite Index. All values assume reinvestment of the full amount of all dividends. Stockholder returns over the indicated period are based on historical data and are not necessarily indicative of future stockholder returns.



*$100 invested on December 27, 2014 in stock or index, including reinvestment of dividends.

	Cumulative Total Return					
	December 27, 2014	December 26, 2015	December 31, 2016	December 30, 2017	December 29, 2018	December 28, 2019
FormFactor, Inc.	$ 100.00	$ 105.32	$ 129.48	$ 180.92	$ 161.97	$ 301.04
S&P 500	100.00	101.38	113.51	138.29	132.23	173.86
RDG Semiconductor Composite	100.00	91.76	122.76	169.41	153.35	234.06

Item 6: ***Selected Financial Data***

The following selected consolidated financial data is derived from our consolidated financial statements. This data should be read in conjunction with our consolidated financial statements and the related notes, and Item 7: *Management's Discussion and Analysis of Financial Condition and Results of Operations* contained elsewhere in this Annual Report on Form 10-K.

	Fiscal 2019 (2)	Fiscal 2018 (1)(2)	Fiscal 2017 (2)	Fiscal 2016 (2)(3)(5)	Fiscal 2015 (2)(4)
	(Dollars in thousands, except per share data)				
Consolidated Statements of Operations Data:					
Revenues	$ 589,464	$ 529,675	$ 548,441	$ 383,881	$ 282,358
Gross profit	237,496	210,339	215,597	102,682	85,738
Net income (loss)	39,346	104,036	40,913	(6,557)	(1,523)
Basic net income (loss) per share	0.52	1.42	0.57	(0.10)	(0.03)
Diluted net income (loss) per share	0.51	1.38	0.55	(0.10)	(0.03)
Consolidated Balance Sheets Data:					
Cash, cash equivalents and marketable securities	$ 220,872	$ 149,003	$ 140,172	$ 108,905	$ 187,589
Working capital	282,483	235,302	213,693	172,002	214,437
Total assets	839,882	728,222	646,574	618,982	342,723
Term loan, net of current portion	15,639	34,971	87,228	125,475	—
Total stockholders' equity	640,997	580,164	458,637	401,056	294,681
Number of employees	1,836	1,676	1,685	1,571	958

(1) Fiscal 2018 net income includes an income tax benefit of $75.8 million from a valuation allowance release against certain U.S. deferred tax assets. See Note 13 of Notes to Consolidated Financial Statements.

(2) Fiscal 2019, 2018, 2017, 2016, and 2015 net income (loss) includes restructuring charges, net, of $0.5 million, $0.2 million, $0.8 million, $7.3 million and $0.6 million, respectively.

(3) Fiscal 2016 net loss includes impairment charges of $12.4 million.

(4) Fiscal 2015 net loss includes the following: i) a $1.5 million gain from a business interruption insurance claim relating to a factory fire at a customer's facility; and ii) a $1.0 million net gain from the sale of intellectual property.

(5) Fiscal 2016 includes the following as a result of the Cascade Microtech acquisition: i) $82.6 million in revenue; ii) $27.8 million of intangible amortization expense; and iii) a $7.6 million charge for inventory-related step-up amortization.

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

The following discussion and analysis of our financial condition and results of operations should be read in conjunction with our consolidated financial statements and the related notes included elsewhere in this Annual Report on Form 10-K. In addition to historical consolidated financial information, the following discussion and analysis contains forward-looking statements that involve risks, uncertainties and assumptions as described under the "Note Regarding Forward-Looking Statements" that appears earlier in this Annual Report on Form 10-K. Our actual results could differ materially from those anticipated by these forward-looking statements as a result of many factors, including those discussed under "Item 1A: Risk Factors" and elsewhere in this Annual Report on Form 10-K.

Overview

FormFactor, Inc., headquartered in Livermore, California, is a leading provider of electrical test and measurement solutions. We provide a broad range of high-performance probe cards, analytical probes, probe stations, metrology systems, and thermal sub-systems to both semiconductor companies and scientific institutions. Our products provide electrical and optical information from a variety of semiconductor and electro-optical devices and integrated circuits from development to production. Customers use our products and services to lower production costs, improve yields, and enable development of complex next-generation products.

On October 9, 2019, we acquired 100% of the shares of FRT GmbH ("FRT"), a German-based company, for total consideration of $25.9 million, net of cash acquired of $1.7 million. The fair value of the purchase consideration was comprised of a $22.2 million cash payment and $5.4 million of contingent consideration. This acquisition strengthens our leadership in test and measurement by expanding our addressable market into 3D hybrid surface metrology and extending the optical applications scope of our existing Systems segment. We also entered into a term loan with a lender for an aggregate amount of $23.4 million to finance the acquisition. See Notes 4 and 5 of Notes to Consolidated Financial Statements for additional information.

We operate in two reportable segments consisting of the Probe Cards segment and the Systems segment. Sales of our probe cards and analytical probes are included in the Probe Cards segment, while sales of our probe stations and thermal sub-systems are included in the Systems segment.

We generated net income of $39.3 million in fiscal 2019 compared to net income of $104.0 million in fiscal 2018 and net income of $40.9 million in fiscal 2017. The decrease in net income in fiscal 2019 compared to fiscal 2018 was primarily due to a $75.8 million income tax benefit recognized in fiscal 2018 related to the release of valuation allowances against certain U.S. deferred tax assets and the increase in provision for income taxes due to the recognition of deferred tax expense. The increase in net income in fiscal 2018 compared to fiscal 2017 was primarily due to a $75.8 million income tax benefit recognized in fiscal 2018 related to the release of valuation allowances against certain U.S. deferred tax assets, partially offset by lower revenues and higher operating expenses.

Fiscal Year

We operate on a 52/53 week fiscal year, whereby the fiscal year ends on the last Saturday of December. The fiscal years ended December 28, 2019, December 29, 2018 and December 30, 2017 each included 52 weeks.

Use of Estimates

Preparation of our financial statements requires management to make estimates and assumptions that affect the reported amounts of assets, liabilities, revenues and expenses. Management bases its estimates on historical experience and on various other assumptions that it believes to be reasonable under the circumstances, the results of which form the basis for making judgments about the carrying values of assets and liabilities that are not readily apparent from other sources. Actual results may differ from these estimates under different assumptions or conditions.

Critical Accounting Policies

Our discussion and analysis of our financial condition and results of operations are based upon our consolidated financial statements, which have been prepared in accordance with generally accepted accounting principles ("GAAP"). The preparation of these financial statements requires us to make estimates and assumptions that affect the reported amounts of assets and liabilities at the date of the financial statements and the reported amounts of net revenue and expenses in the reporting period. Our accounting policies are fundamental to understanding our financial condition and results of operations reported in our financial statements and related disclosures. We have identified the following accounting policies as being critical because they require our management to make particularly difficult, subjective and/or complex judgments about the effect of matters that are inherently uncertain. Our management has discussed the development, selection, application and disclosure of these critical accounting policies with the Audit Committee of our Board of Directors.

Inventory Valuation
We state our inventories at the lower of cost (principally standard cost which approximates actual cost on a first in, first out basis) or net realizable value. We continually assess the value of our inventory and will periodically write down its value for estimated excess inventory and product obsolescence based upon an analysis of existing inventory quantities compared to estimated future consumption. Future consumption is estimated based upon assumptions about how past consumption, recent purchases, backlog and other factors indicate future consumption. On a quarterly basis, we review existing inventory quantities in comparison to our past consumption, recent purchases, backlog and other factors to determine what inventory quantities, if any, may not be sellable. Based on this analysis, we record an adjustment to the cost basis of inventory when evidence exists that the net realizable value of inventory is lower than its cost, which occurs when we have excess and/or obsolete inventory.

At the point of loss recognition, a new, lower cost basis for that inventory is established, and subsequent changes in facts and circumstances do not result in the restoration or increase in that newly established cost basis. Market conditions are subject to change, and demand for our products can fluctuate significantly. Actual consumption of inventories could differ from forecasted demand, and this difference could have a material impact on our gross profit and inventory balances based on additional provisions for excess or obsolete inventories or a benefit from the sale of inventories previously written down.

Revenue Recognition
We recognize revenue upon transferring control of products and services, and the amounts recognized reflect the consideration we expect to be entitled to receive in exchange for these products and services. An arrangement may include some or all of the following products and services: probe cards, systems, accessories, installation services, service contracts and extended warranty contracts.

A performance obligation is a promise in a contract to transfer a distinct good or service to the customer. In contracts with multiple performance obligations, we identify each performance obligation and evaluate whether the performance obligation is distinct within the context of the contract at contract inception. Performance obligations that are not distinct at contract inception are combined and accounted for as one unit. Generally, the performance obligations in a contract are considered distinct within the context of the contract and are accounted for as separate units.

Our products may be customized to our customers' specifications, however, control of our product is typically transferred to the customer at the point in time the product is either shipped or delivered, depending on the terms of the arrangement, as the criteria for over time recognition are not met. In limited circumstances, substantive acceptance by the customer exists, which results in the deferral of revenue until acceptance is formally received from the customer. Judgment may be required in determining if the acceptance clause is substantive.

Installation services are routinely provided to customers purchasing our systems. Installation services are a distinct performance obligation apart from the systems and are recognized in the period they are performed. Service contracts, which include repair and maintenance service contracts, and extended warranty contracts are also distinct performance obligations and are recognized over the contractual service period, which ranges from one to three years. For service contracts recognized over time, we use a days-elapsed input to measure progress.

A contract's transaction price is allocated to each distinct performance obligation and recognized as revenue when, or as, the performance obligation is satisfied. In determining the transaction price, we evaluate whether the price is subject to refund or adjustment to determine the net consideration to which we expect to be entitled. We generally do not grant return privileges, except for defective products during the warranty period. Sales incentives and other programs that we may make available to customers are considered to be a form of variable consideration, which is estimated in determining the contract's transaction price to be allocated to the performance obligations.

For contracts with multiple performance obligations, we allocate the contract's transaction price to each performance obligation based on its relative stand-alone selling price. The stand-alone selling prices are determined based on observable prices, which are the prices at which we separately sell the products. For items which do not have observable prices, we use our best estimate of the stand-alone selling prices.

We account for tax assessed by a governmental authority that is directly imposed on a revenue-producing transaction (i.e., sales, use, value added) on a net (excluded from revenue) basis.

Results of Operations

In this section, we discuss the results of our operations for the year ended December 28, 2019 compared to the year ended December 29, 2018. For a discussion of the year ended December 29, 2018 compared to the year ended December 30, 2017, please refer to Part II, Item 7, "Management's Discussion and Analysis of Financial Condition and Results of Operations" in our Annual Report on Form 10-K for the year ended December 29, 2018.

The following table sets forth our operating results as a percentage of revenues:

	Fiscal 2019	Fiscal 2018	Fiscal 2017
Revenues	100.0 %	100.0 %	100.0 %
Cost of revenues	59.7	60.3	60.7
Gross profit	40.3	39.7	39.3
Operating expenses:			
Research and development	13.8	14.2	13.5
Selling, general and administrative	18.0	18.7	17.4
Total operating expenses	31.8	32.9	30.9
Operating income	8.5	6.8	8.4
Interest income	0.5	0.3	0.1
Interest expense	(0.3)	(0.6)	(0.8)
Other income (expense), net	*	*	*
Income before income taxes	8.7	6.5	7.7
Provision (benefit) for income taxes	2.0	(13.2)	0.2
Net income	6.7 %	19.7 %	7.5 %

***** Amounts insignificant and not greater than 0.1%.

Revenues by Segment

	Fiscal 2019	Fiscal 2018	Fiscal 2017
		(In thousands)	
Probe Cards	$ 491,363	$ 434,269	$ 454,794
Systems	98,101	95,406	93,647
Total	$ 589,464	$ 529,675	$ 548,441

Revenues by Market

	Fiscal 2019	% of Revenues	Fiscal 2018	% of Revenues	Change $	Change %
			(In thousands, except percentages)			
Probe Cards Markets:						
Foundry & Logic	$ 318,552	54.0 %	$ 258,459	48.8 %	$ 60,093	23.3 %
DRAM	147,257	25.0	135,333	25.6	11,924	8.8
Flash	25,554	4.3	40,477	7.6	(14,923)	(36.9)
Systems Market:						
Systems	98,101	16.7	95,406	18.0	2,695	2.8
Total revenues	$ 589,464	100.0 %	$ 529,675	100.0 %	$ 59,789	11.3 %

	Fiscal 2018	% of Revenues	Fiscal 2017	% of Revenues	Change $	Change %
	(In thousands, except percentages)					
Probe Cards Markets:						
Foundry & Logic	$ 258,459	48.8 %	$ 313,714	57.2 %	$ (55,255)	(17.6)%
DRAM	135,333	25.6	124,685	22.7	10,648	8.5
Flash	40,477	7.6	16,395	3.0	24,082	146.9
Systems Market:						
Systems	95,406	18.0	93,647	17.1	1,759	1.9
Total revenues	$ 529,675	100.0 %	$ 548,441	100.0 %	$ (18,766)	(3.4)%

The increase in Foundry & Logic product revenue in fiscal 2019 compared to fiscal 2018 was primarily driven by higher demand in 2019 from two major customers, resulting primarily from increased demand in traditional server and end-user computing, as well as growth in new market applications, including 5G. The relative increase with respect to fiscal 2018 was compounded by lower 2018 revenues from one larger customer resulting from node transitions. These major customers accounted for 25.3% and 11.5% of total revenues for fiscal 2019, compared to 19.0% and less than 10%, respectively for fiscal 2018.

The increase in DRAM and decrease in Flash product revenues in fiscal 2019 compared to fiscal 2018 were driven by changes in unit sales that we believe were driven in part by increased market share, designs that require new probe cards and node transitions.

The increase in Systems product revenue in fiscal 2019 compared to fiscal 2018 was driven by increased sales of probe stations, which includes a new 200mm platform, and the additional revenue from the newly acquired FRT GmbH, partially offset by lower revenue from thermal sub-systems.

Revenues by Geographic Region

	Fiscal 2019	% of Revenues	Fiscal 2018	% of Revenues	Fiscal 2017	% of Revenues
	(In thousands, except percentages)					
United States	$ 155,202	26.3 %	$ 133,648	25.2 %	$ 186,654	34.0 %
South Korea	116,882	19.8	91,247	17.2	81,727	14.9
China	106,256	18.0	77,851	14.7	61,100	11.1
Taiwan	86,539	14.7	107,476	20.3	96,903	17.7
Japan	52,584	8.9	49,814	9.4	44,559	8.1
Europe	41,473	7.0	39,671	7.5	45,086	8.2
Asia-Pacific [(1)]	21,468	3.7	25,980	4.9	29,902	5.5
Rest of the world	9,060	1.6	3,988	0.8	2,510	0.5
Total Revenues	$ 589,464	100.0 %	$ 529,675	100.0 %	$ 548,441	100.0 %

[(1)] Asia-Pacific includes all countries in the region except Taiwan, South Korea, China and Japan, which are disclosed separately.

Geographic revenue information is based on the location to which we ship the product. For example, if a certain South Korean customer purchases through their U.S. subsidiary and requests the products to be shipped to an address in South Korea, this sale will be reflected in the revenue for South Korea rather than U.S.

Changes in revenue by geographic region in fiscal 2019 compared to fiscal 2018 were primarily attributable to changes in customer demand, shifts in customer regional manufacturing strategies, and product sales mix with the increase in the United States, South Korea and China relating primarily to increased sales to two customers in 2019 that also comprised greater than 10% of consolidated sales as further described in Note 2 of Notes to Consolidated Financial Statements.

Cost of Revenues and Gross Margins

Cost of revenues consists primarily of manufacturing materials, payroll, shipping and handling costs, manufacturing-related overhead and amortization of certain intangible assets. Our manufacturing operations rely on a limited number of suppliers to provide key components and materials for our products, some of which are a sole source. We order materials and supplies based on backlog and forecasted customer orders. Tooling and setup costs related to changing manufacturing lots at our suppliers are also included in the cost of revenues. We expense all warranty costs, inventory provisions and amortization of certain intangible assets as cost of revenues.

Gross profit and gross margin by segment were as follows (dollars in thousands):

	Fiscal 2019			
	Probe Cards	Systems	Corporate and Other	Total
Gross profit	$ 211,382	$ 50,927	$ (24,813)	$ 237,496
Gross margin	43.0 %	51.9 %	— %	40.3 %

	Fiscal 2018			
	Probe Cards	Systems	Corporate and Other	Total
Gross profit	$ 187,320	$ 47,074	$ (24,055)	$ 210,339
Gross margin	43.1 %	49.3 %	— %	39.7 %

	Fiscal 2017			
	Probe Cards	Systems	Corporate and Other	Total
Gross profit	$ 195,903	$ 46,647	$ (26,953)	$ 215,597
Gross margin	43.1 %	49.8 %	— %	39.3 %

Probe Cards

Gross profit in the Probe Cards segment increased in fiscal 2019 compared to fiscal 2018 primarily due to increased sales, offset by higher variable costs and by less favorable product mix.

Systems

Gross profit and gross margin in the Systems segment increased in fiscal 2019 compared to fiscal 2018 due to increased sales.

Corporate and Other

Corporate and Other includes unallocated expenses relating to amortization of intangible assets, share-based compensation, restructuring charges, net, and acquisition-related costs, including charges related to inventory stepped up to fair value and other costs, which are not used in evaluating the results of, or in allocating resources to, our reportable segments.

Overall

Gross profit and gross margin fluctuate with revenue levels, product mix, selling prices, factory loading and material costs. For fiscal 2019 compared to fiscal 2018, gross profit increased due to increased sales while gross margins remained relatively consistent with fluctuations in product mix.

Stock-based compensation expense included in gross profit for fiscal 2019 and 2018 was $4.1 million and $3.5 million, respectively.

Research and Development

	Fiscal Year Ended			
	December 28, 2019	December 29, 2018	$ Change	% Change
	(Dollars in thousands)			
Research and development	$ 81,499	$ 74,976	$ 6,523	8.7 %
% of revenues	13.8 %	14.2 %		

	Fiscal Year Ended			
	December 29, 2018	December 30, 2017	$ Change	% Change
	(Dollars in thousands)			
Research and development	$ 74,976	$ 73,807	$ 1,169	1.6 %
% of revenues	14.2 %	13.5 %		

The increase in research and development expenses in fiscal 2019 compared to fiscal 2018 was primarily driven by an increase in employee compensation costs caused by increases in headcount, annual compensation and benefit adjustments and employee performance-based compensation, partially offset by a decrease in project material costs. The components of this increase were as follows (in millions):

	Fiscal 2019 compared to Fiscal 2018
Employee compensation costs	$ 4.6
Stock-based compensation	1.0
Project material costs	(0.5)
Depreciation	0.5
Other	0.9
	$ 6.5

Stock-based compensation expense included within research and development in fiscal 2019 and 2018 was $6.4 million and $5.4 million, respectively.

Selling, General and Administrative

	Fiscal Year Ended			
	December 28, 2019	December 29, 2018	$ Change	% Change
	(Dollars in thousands)			
Selling, general and administrative	$ 106,335	$ 99,254	$ 7,081	7.1 %
% of revenues	18.0 %	18.7 %		

	Fiscal Year Ended			
	December 29, 2018	December 30, 2017	$ Change	% Change
	(Dollars in thousands)			
Selling, general and administrative	$ 99,254	$ 95,489	$ 3,765	3.9 %
% of revenues	18.7 %	17.4 %		

The increase in selling, general and administrative in fiscal 2019 compared to fiscal 2018 was primarily due to higher variable costs on increased sales volumes, primarily related to increases in headcount costs and employee incentive compensation, as well as additional costs from the FRT acquisition, offset partially by a decrease in the amortization of intangible assets.

The components of this increase were as follows (in millions):

	Fiscal 2019 compared to Fiscal 2018
Employee compensation costs	$ 4.1
Stock-based compensation	3.9
Depreciation and amortization	(1.2)
Consulting fees	(0.8)
Other	1.1
	$ 7.1

Stock-based compensation expense included within selling, general and administrative in fiscal 2019 and 2018 was $12.8 million, and $8.9 million, respectively.

Interest Income and Interest Expense

	Fiscal Year Ended		
	December 28, 2019	December 29, 2018	December 30, 2017
		(Dollars in thousands)	
Interest income	$ 2,714	$ 1,356	$ 548
Weighted average balance of cash and investments	$ 179,526	$ 138,467	$ 124,637
Weighted average yield on cash and investments	2.05 %	1.51 %	0.84 %
Interest expense	$ 1,915	$ 3,314	$ 4,491
Average debt outstanding	$ 56,776	$ 90,086	$ 127,598
Weighted average interest rate on debt	4.09 %	3.98 %	3.07 %

Interest income is earned on our cash, cash equivalents, restricted cash and marketable securities. The increase in interest income in fiscal 2019 compared to fiscal 2018 was attributable to higher investment yields, related in part to longer duration investments, as well as higher average investment balances.

Interest expense primarily includes interest on our term loans, partially offset by income from our interest-rate swap derivative contracts, as well as term loan issuance costs amortization charges. The decrease in interest expense in fiscal 2019 compared to fiscal 2018 was primarily due to lower outstanding debt balances related to the CMI acquisition as a result of principal payments made, partially offset by additional interest expense related to the term loan originated to finance the acquisition of FRT.

Other Income (Expense), Net

Other income (expense), net primarily includes the effects of foreign currency impact and various other gains and losses.

Provision (Benefit) For Income Taxes

	Fiscal Year Ended		
	December 28, 2019	December 29, 2018	December 30, 2017
		(Dollars in thousands)	
Provision (benefit) for income taxes	$ 11,717	$ (70,109)	$ 1,293
Effective tax rate	22.9 %	(206.6)%	3.1 %

Provision for income taxes reflects the tax provision on our operations in foreign and U.S. jurisdictions, offset by tax benefits from a partial release of valuation allowance against U.S. federal and state deferred tax assets ("DTAs") and from lapsing of statute of limitations related to uncertain tax positions in foreign jurisdictions. As of December 28, 2019, we maintain a valuation allowance of $36.6 million primarily against our California deferred tax assets and foreign tax credits, due to uncertainty about the future realization of these assets.

The benefit for income taxes in fiscal 2018 includes a $75.8 million reduction to our valuation allowance on our U.S. deferred tax assets as sufficient positive evidence existed to support the realization of such DTAs. The effective tax rate in fiscal 2018 also benefited from a lower statutory tax rate in the U.S., partially offset by higher profits in foreign jurisdictions.

Our effective tax rate may vary from period to period based on changes in estimated taxable income or loss by jurisdiction, changes to the valuation allowance, changes to U.S. federal, state or foreign tax laws, future expansion into areas with varying country, state, and local income tax rates, deductibility of certain costs and expenses by jurisdiction.

Liquidity and Capital Resources

Capital Resources

Our working capital increased to $282.5 million at December 28, 2019 compared to $235.3 million at December 29, 2018 primarily due to higher cash, cash equivalents and investment balances resulting from cash generated from operations on higher sales and strong collections, partially offset by higher accrued liabilities on higher volumes and higher current debt balance due to timing of debt payments.

Cash and cash equivalents primarily consist of deposits held at banks and money market funds. Marketable securities primarily consist of U.S. agency securities and corporate bonds. We typically invest in highly-rated securities with low probabilities of default. Our investment policy requires investments to be rated single A or better, and limits the types of acceptable investments, issuer concentration and duration of the investment.

Our cash, cash equivalents and marketable securities totaled approximately $220.9 million at December 28, 2019 compared to $149.0 million at December 29, 2018. We believe that we will be able to satisfy our working capital requirements for at least the next twelve months with the liquidity provided by our existing cash, cash equivalents, marketable securities and cash provided by operations. To the extent necessary, we may consider entering into short and long-term debt obligations, raising cash through a stock issuance, or obtaining new financing facilities, which may not be available on terms favorable to us. Our future capital requirements may vary materially from those now planned.

We utilize a variety of tax planning and financing strategies in an effort to manage our worldwide cash and deploy funds to locations where they are needed. As part of these strategies, we indefinitely reinvest a portion of our foreign earnings. Should we require additional capital in the U.S., we may elect to repatriate indefinitely-reinvested foreign funds or raise capital in the U.S.

Cash Flows

	Fiscal Year Ended		
	December 28, 2019	**December 29, 2018**	**December 30, 2017**
		(Dollars in thousands)	
Net cash provided by operating activities	$ 121,048	$ 68,700	$ 86,323
Net cash used in investing activities	(66,352)	(21,295)	(59,425)
Net cash used in financing activities	$ (6,578)	$ (39,329)	$ (39,470)

Operating Activities

Net cash provided by operating activities in fiscal 2019 was primarily attributable to net income of $39.3 million, which included $89.9 million of net non-cash items, offset by changes in operating assets and liabilities using $8.2 million of cash as discussed in more detail below.

Accounts receivable increased $2.6 million to $97.9 million at December 28, 2019 compared to $95.3 million at December 29, 2018 as a result of strong collections despite increased revenues and changes in payment terms related to customer mix.

Inventories, net, increased $5.6 million to $83.3 million at December 28, 2019 compared to $77.7 million at December 29, 2018 as a result of higher sales volumes, partially offset by a $10.4 million increase to our provision for excess and obsolete inventories.

Accrued liabilities increased $8.7 million to $36.4 million at December 28, 2019 compared to $27.7 million at December 29, 2018, as a result of an increase in employee performance-based compensation and benefits and an increase in accrued income taxes due to timing of payments.

Accounts payable increased $0.9 million to $40.9 million at December 28, 2019 compared to $40.0 million at December 29, 2018, as a result of higher volumes mostly offset by the impact of timing of vendor payments.

Investing Activities
Net cash used in investing activities in fiscal 2019 primarily related to $20.8 million of cash used in the acquisition of property, plant and equipment, $20.5 million paid (net of cash acquired) as part of the consideration for the acquisition of FRT, and $25.1 million used for the purchase of marketable securities, net of maturities.

Financing Activities
Net cash used in financing activities in fiscal 2019 primarily related to $30.0 million of principal payments made towards the repayment of our term loan and $8.0 million related to tax withholdings associated with the net share settlements of our equity awards, largely offset by $23.4 million of proceeds from a term loan to fund the acquisition of FRT and $8.1 million of proceeds received from issuances of common stock under our stock incentive plans.

Debt

CMI Term Loan
On June 24, 2016, we entered into a credit agreement (the “Credit Agreement”) with HSBC Bank USA, National Association ("HSBC"). Pursuant to the Credit Agreement, the lenders provided us with a senior secured term loan facility of $150 million (the "CMI Term Loan"). The proceeds of the CMI Term Loan were used to finance a portion of the purchase price paid in connection with the acquisition of Cascade Microtech in fiscal 2016. As of December 28, 2019, the balance outstanding was $35 million.

The CMI Term Loan bears interest at a rate equal to, at our option, (i) the applicable London Interbank Offered Rate ("LIBOR") rate plus 2.00% per annum or (ii) Base Rate (as defined in the Credit Agreement) plus 1.00% per annum. We have currently elected to pay interest at 2.00% over the one-month LIBOR rate. Interest payments are payable in monthly installments over a five-year period. As of December 28, 2019, the interest rate pursuant to the CMI Term Loan was 3.71%.

On July 25, 2016, we entered into an interest rate swap agreement with HSBC and other lenders to hedge the interest payments on the CMI Term Loan for the notional amount of $95.6 million. As future levels of LIBOR over the life of the loan are uncertain, we entered into these interest-rate swap agreements to hedge the exposure in interest rate risks associated with movement in LIBOR rates. By entering into the agreements, we convert a floating rate interest at one-month LIBOR plus 2% into a fixed rate interest at 2.939%. As of December 28, 2019, the notional amount of the loan that is subject to this interest rate swap is $22.5 million. See Note 7 of Notes to Condensed Consolidated Financial Statements for additional information.

The CMI Term Loan amortizes in equal quarterly installments, which began June 30, 2016, in annual amounts equal to 5% for year one, 10% for year two, 20% for year three, 30% for year four and 35% for year five. The Credit Agreement allows voluntary prepayment to be made at any time to prepay the CMI Term Loan in whole or in part without penalty or premium. As of December 28, 2019 and December 29, 2018, we have made prepayments of $40.0 million with no prepayments made during fiscal 2019. The planned final payment on the CMI Term Loan is scheduled for the third quarter of fiscal 2020.

The obligations under the CMI Term Loan are guaranteed by substantially all of our assets and the assets of our domestic subsidiaries, subject to certain customary exceptions.

The Credit Agreement contains negative covenants customary for financing of this type, as well as certain financial maintenance covenants. As of December 28, 2019, we were in compliance with all covenants under the Credit Agreement.

FRT Term Loan
On October 25, 2019, we entered into a $23.4 million three-year term loan agreement (the "FRT Term Loan") with HSBC Trinkaus & Burkhardt AG, Germany to fund the acquisition of FRT GmbH, which we acquired on October 9, 2019. See Note 4 of Notes to Consolidated Financial Statements for further details of the acquisition.

The FRT Term Loan bears interest at a rate equal to the Euro Interbank Offered Rate ("EURIBOR") plus 1.75 % per annum and will be repaid in quarterly installments of approximately $1.9 million plus interest beginning January 25, 2020.

See Note 5 of Notes to Consolidated Financial Statements for additional information relating to the term loans.

Stock Repurchase Program

In February 2017, our Board of Directors authorized a program to repurchase up to $25 million of outstanding common stock to offset potential dilution from issuances of common stock under our stock-based incentive plans. The share repurchase program expired on February 1, 2020. During fiscal 2019 and 2018, we did not repurchase any shares. During fiscal 2017, we repurchased 1,367,617 shares of common stock for $19.0 million.

Contractual Obligations and Commitments

The following table summarizes our significant contractual commitments to make future payments in cash under contractual obligations as of December 28, 2019 (in thousands):

	Payments Due In Fiscal Year						
	2020	2021	2022	2023	2024	2025 and thereafter	Total
Operating leases	$ 7,387	$ 6,647	$ 5,477	$ 4,937	$ 4,770	$ 22,165	$ 51,383
Term loans - principal payments	42,838	7,838	7,838	—	—	—	58,514
Term loans - interest payments[1]	777	155	47	—	—	—	979
Total	$ 51,002	$ 14,640	$ 13,362	$ 4,937	$ 4,770	$ 22,165	$ 110,876

[1] Represents our minimum interest payment commitments at 1.35% per annum for the FRT Term Loan and 3.71% per annum for the CMI Term Loan.

The table above excludes our gross liability for unrecognized tax benefits, which totaled $28.8 million as of December 28, 2019. The timing of any payments which could result from these unrecognized tax benefits will depend upon a number of factors. Accordingly, the timing of payment cannot be estimated and has been excluded from the table above.

Off-Balance Sheet Arrangements

Historically, we have not participated in transactions that have generated relationships with unconsolidated entities or financial partnerships, such as entities often referred to as structured finance or special purpose entities, which would have been established for the purpose of facilitating off-balance sheet arrangements or other contractually narrow or limited purposes. As of December 28, 2019, we were not involved in any off-balance sheet arrangements.

Indemnification Agreements

We have entered, and may from time to time in the ordinary course of our business enter, into contractual arrangements with third parties that include indemnification obligations. Under these contractual arrangements, we have agreed to defend, indemnify and/or hold the third party harmless from and against certain liabilities. These arrangements include indemnities in favor of customers in the event that our products or services infringe a third party's intellectual property or cause property or other indemnities in favor of our lessors in connection with facility leasehold liabilities that we may cause. In addition, we have entered into indemnification agreements with our directors and certain of our officers, and our bylaws contain indemnification obligations in favor of our directors, officers and agents. These indemnity arrangements may limit the type of the claim, the total amount that we can be required to pay in connection with the indemnification obligation and the time within which an indemnification claim can be made. The duration of the indemnification obligation may vary, and for most arrangements, survives the agreement term and is indefinite. We believe that substantially all of our indemnity arrangements provide either for limitations on the maximum potential future payments we could be obligated to make, or for limitations on the types of claims and damages we could be obligated to indemnify, or both. However, it is not possible to determine or reasonably estimate the maximum potential amount of future payments under these indemnification obligations due to the varying terms of such obligations, a lack of history of prior indemnification claims, the unique facts and circumstances involved in each particular contractual arrangement and in each potential future claim for indemnification, and the contingency of any potential liabilities upon the occurrence of events that are not reasonably determinable. We have not had any material requests for indemnification under these arrangements. We have not recorded any liabilities for these indemnification arrangements on our Consolidated Balance Sheets as of December 28, 2019 or December 29, 2018.

New Accounting Pronouncements

See Note 6 and Note 17 of Notes to Consolidated Financial Statements.

Item 7A: *Quantitative and Qualitative Disclosures about Market Risk*

Foreign Currency Exchange Risk

We conduct certain operations in foreign currencies. We enter into currency forward exchange contracts to hedge a portion, but not all, of existing foreign currency denominated amounts. Gains and losses on these contracts are generally recognized in Other income (expense), net in our Consolidated Statements of Income. Because the effect of movements in currency exchange rates on the currency forward exchange contracts generally offsets the related effect on the underlying items being hedged, these financial instruments are not expected to subject us to risks that would otherwise result from changes in currency exchange rates as of December 28, 2019. We do not use derivative financial instruments for trading or speculative purposes. We recognized a net gain from our foreign exchange of $0.4 million in fiscal 2019 and a net loss of $0.3 million and $0.6 million, respectively in fiscal 2018 and 2017.

Interest Rate Sensitivity

Our exposure to market risk for changes in interest rates relates primarily to our investment portfolio. We invest in a number of securities including U.S. agency discount notes, money market funds and commercial paper. We attempt to maintain the safety and preservation of our invested principal funds by limiting default risk, market risk and reinvestment risk. We mitigate default risk by investing in high grade investment securities. By policy, we limit the amount of credit exposure to an issuer, except U.S. Treasuries and U.S. agencies.

Our exposure to interest rate risk arising from our Term Loan (see Note 5 of Notes to Consolidated Financial Statements) is insignificant as a result of the interest-rate swap agreement (see Note 7 of Notes to Consolidated Financial Statements) that we entered into with HSBC and other lenders to hedge the interest payments on our Term Loan.

We use interest rate derivative instruments to manage certain interest rate exposures. We do not use derivative instruments for trading or speculative purposes. The fair market value of our fixed rate securities may be adversely impacted by increases in interest rates while income earned on floating rate securities may decline as a result of decreases in interest rates. A hypothetical 100 basis-point (one percentage point) increase or decrease in interest rates compared to rates at December 28, 2019 and December 29, 2018 would have affected the fair value of our investment portfolio by $1.3 million and $0.7 million, respectively.

Item 8: *Financial Statements and Supplementary Data*

Consolidated Financial Statements

The consolidated financial statements and supplementary data required by this item are included in the section entitled "Consolidated Financial Statements" of this Annual Report on Form 10-K. See Item 15 for a list of our consolidated financial statements.

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

Based on our management’s evaluation (with the participation of our principal executive officer and principal financial officer), as of the end of the period covered by this report, our principal executive officer and principal financial officer have concluded that our disclosure controls and procedures (as defined in Rules 13a-15(e) and 15d-15(e) under the Securities Exchange Act of 1934, as amended, (the “Exchange Act”)) were effective to ensure that information required to be disclosed by us in reports that we file or submit under the Exchange Act is recorded, processed, summarized and reported within the time periods specified in Securities and Exchange Commission rules and forms and is accumulated and communicated to our management, including our principal executive officer and principal financial officer, as appropriate to allow timely decisions regarding required disclosure.

Changes in Internal Control over Financial Reporting

There have been no changes in our internal control over financial reporting (as defined in Rules 13a-15(f) and 15d-15(f) under the Exchange Act) that occurred during the fiscal year ended December 28, 2019, that have materially affected, or are reasonably likely to materially affect, our internal control over financial reporting.

On October 9, 2019, we acquired FRT GmbH and are integrating the acquired business into our overall internal control over financial reporting process. Our management is in the process of assessing the internal control over financial reporting and is implementing or revising internal controls where necessary.

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. Internal control over financial reporting is a process designed by, or under the supervision of, our Principal Executive Officer and Principal Financial Officer, and effected by our board of directors, management and other personnel and consultants, 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, and includes those policies and procedures that:

(i) pertain to the maintenance of records that in reasonable detail accurately and fairly reflect our transactions and dispositions of assets;

(ii) provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with generally accepted accounting principles, and that our receipts and expenditures are being made only in accordance with the authorization of our management and directors; and

(iii) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use or disposition of our assets that could have a material effect on the financial statements.

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.

We acquired FRT GmbH on October 9, 2019, and we have not yet completed the process of integrating the acquired business' internal control over financial reporting into our overall internal control over financial reporting process. Accordingly, we excluded from our assessment of internal control over financial reporting as of December 28, 2019, the internal control over financial reporting of FRT GmbH. Associated with FRT GmbH are total assets of $35.2 million, including goodwill and identified intangibles, and net revenues of $3.9 million included in our consolidated financial statements as of and for the fiscal year ended December 28, 2019.

Under the supervision and with the participation of our management, including our Principal Executive Officer and Principal Financial Officer, we conducted an assessment of the effectiveness of our internal control over financial reporting as of December 28, 2019. In making this assessment, our management used the criteria set forth in *Internal Control-Integrated Framework (2013)* issued by the Committee of Sponsoring Organizations of the Treadway Commission ("COSO"). Based on the results of this assessment, management has concluded that our internal control over financial reporting was effective as of December 28, 2019.

The effectiveness of our internal control over financial reporting as of December 28, 2019 has been audited by KPMG LLP, an independent registered public accounting firm, as stated in their report which appears in this Annual Report on Form 10-K.

Limitations on the Effectiveness of Controls

Control systems, no matter how well designed and operated, can provide only reasonable, not absolute, assurance that the control systems' objectives are being met. Further, the design of any control systems must reflect the fact that there are resource constraints, and the benefits of all controls must be considered relative to their costs. Because of the inherent limitations in all control systems, no evaluation of controls can provide absolute assurance that all control issues and instances of fraud, if any, within our company have been detected. These inherent limitations include the realities that judgments in decision making can be faulty and that breakdowns can occur because of simple error or mistake. Control systems can also be circumvented by the individual acts of some persons, by collusion of two or more people, or by management override of the controls. The design of any system of controls is based, in part, on certain assumptions about the likelihood of future events, and there can be no assurance that any design will succeed in achieving its stated goals under all potential future conditions. Over time, controls may become inadequate because of changes in conditions or deterioration in the degree of compliance with policies or procedures.

CEO and CFO Certifications

We have attached as exhibits to this Annual Report on Form 10-K the certifications of our Chief Executive Officer and Chief Financial Officer, which are required in accordance with the Exchange Act. We recommend that this Item 9A be read in conjunction with the certifications for a more complete understanding of the subject matter presented.

Item 9B: ***Other Information***

None.

PART III

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

The information required by this item is incorporated by reference to the proxy statement for our 2020 Annual Meeting of Stockholders.

Item 11: ***Executive Compensation***

The information required by this item is incorporated by reference to the proxy statement for our 2020 Annual Meeting of Stockholders under the caption Executive Compensation and Related Information.

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

The information required by this item is incorporated by reference to the proxy statement for our 2020 Annual Meeting of Stockholders under the caption Security Ownership of Certain Beneficial Owners and Management and Related Stockholder Matters.

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

The information required by this item is incorporated by reference to the proxy statement for our 2020 Annual Meeting of Stockholders under the caption Certain Relationships and Related Transactions.

Item 14: ***Principal Accountant Fees and Services***

The information required by this item is incorporated by reference to the proxy statement for our 2020 Annual Meeting of Stockholders under the caption Principal Auditor Fees and Services.

PART IV

Item 15: ***Exhibits, Financial Statement Schedules***

Financial Statements and Schedules

The Consolidated Financial Statements, together with the report thereon of KPMG LLP, are included on the pages indicated below:

Financial statement schedules have been omitted because they are not applicable or the required information is shown in the consolidated financial statements or notes thereto.

Exhibits

The exhibits listed in the accompanying index to exhibits are filed or incorporated by reference as part of this Annual Report on Form 10-K.

Item 16: ***Form 10-K Summary***

None.

EXHIBIT INDEX

Exhibit Number	Exhibit Description	Incorporated by Reference Form	File No	Date of First Filing	Exhibit Number	Filed Herewith
3.1	Amended and Restated Certificate of Incorporation of the Registrant as filed with the Delaware Secretary of State on June 17, 2003	S-1	333-109815	10/20/2003	3.01	
3.2	Amended and Restated Bylaws of the Registrant	8-K	000-50307	7/22/2016	3.2	
4.1	Specimen Common Stock Certificate	S-1/A	333-86738	5/28/2002	4.01	
4.2	Description of Securities	—	—	—	—	X
10.1	Credit Agreement among FormFactor, Inc. as Borrower, the Guarantors that are from time to time parties thereto, HSBC Bank USA, National Association, as Administrative Agent, Lead Lender, Co-Lead Arranger, Sole Bookrunner, Syndication Agent and Lender, the Lenders that are from time to time parties thereto, and Silicon Valley Bank, as Co-Lead Arranger and Documentation Agent, dated as of June 24, 2016	8-K	000-50307	6/28/2016	10.1	
10.2	First Amendment to Credit Agreement dated April 19, 2017 among FormFactor, Inc. and HSBC Bank USA, National Association.	10-K	000-50307	2/27/2018	10.2	
10.3+	Form of Indemnity Agreement	S-1/A	333-86738	5/28/2002	10.01	
10.4+	Form of Change of Control Severance Agreement	10-K	000-50307	3/14/2005	10.48	
10.9+	Employee Incentive Plan, as amended and restated effective October 1, 2019	—	—	—	—	X
10.10+	Equity Incentive Plan, as amended and restated effective May 17, 2019	DEF 14A	000-50307	3/4/2019	Appendix A	
10.11+	Employee Stock Purchase Plan, as amended and restated May 18, 2018	DEF 14A	000-50307	4/3/2018	Appendix A	
10.12	Pacific Corporate Center Lease (Building 1) by and between Greenville Holding Company LLC (successor to Greenville Investors, L.P.) ("Greenville") and the Registrant dated May 3, 2001	S-1/A	333-86738	6/10/2003	10.18	
10.13	First Amendment to Pacific Corporate Center Lease (Building 1) by and between Greenville and the Registrant dated January 31, 2003	S-1/A	333-86738	5/7/2003	10.18.1	
10.14	Pacific Corporate Center Lease (Building 2) by and between Greenville and the Registrant dated May 3, 2001	S-1/A	333-86738	6/10/2003	10.19	
10.15	First Amendment to Pacific Corporate Center Lease (Building 2) by and between Greenville and the Registrant dated January 31, 2003	S-1/A	333-86738	5/7/2003	10.19.1	
10.16	Pacific Corporate Center Lease (Building 3) by and between Greenville and the Registrant dated May 3, 2001	S-1/A	333-86738	6/10/2003	10.20	
10.17+	First Amendment to Pacific Corporate Center Lease (Building 3) by and between Greenville and the Registrant dated January 31, 2003	S-1/A	333-86738	5/7/2003	10.20.1	
10.18	Third Amendment, dated December 19, 2016, between FormFactor, Inc. and MOHR PCC, LP, to Pacific Corporate Center Leases (Buildings 1, 2 and 3), dated May 3, 2001, by and between Greenville Investors, L.P. and FormFactor, Inc., as amended	8-K	000-50307	12/23/2016	10.2	
10.19+	Pacific Corporate Center Lease by and between Greenville and the Registrant dated September 7, 2004, as amended by First Amendment to Building 6 Lease dated August 16, 2006	10-Q	000-50307	11/7/2006	10.01	
10.20	Second Amendment, dated December 19, 2016, between FormFactor, Inc. and MOHR PCC, LP, to Pacific Corporate Center Lease, dated October 5, 2004, by and between Greenville Investors, L.P. and FormFactor, Inc., as amended	8-K	000-50307	12/23/2016	10.1	
10.21	Third Amendment, dated October 1, 2018, between FormFactor, Inc. and MOHR PCC, LP, to Pacific Corporate Center Lease, dated October 5, 2004, by and between Greenville Investors, L.P. and FormFactor, Inc., as amended	8-K	000-50307	10/2/2018	10.1	

10.22	Fourth Amendment, dated October 1, 2018, between FormFactor, Inc. and MOHR PCC, LP, to Pacific Corporate Center Lease, dated October 5, 2004, by and between Greenville Investors, L.P. and FormFactor, Inc., as amended	8-K	000-50307	10/2/2018	10.2	
10.23	Lease Agreements I and II between Amberjack, Ltd. and Cascade Microtech, Inc. dated August 20, 1997, and Amendment No. 2 to Lease Agreement I dated July 23, 1998, and Amendment No. 2 to Lease Agreement II dated April 12, 1999.	S-1	333-47100	10/2/2000	10.9	
10.24	Third Amendment dated August 11, 2006 to Lease Agreement I dated August 20, 1997 between Amberjack, LTD. and Cascade Microtech, Inc.	10-Q	000-51072	11/9/2006	10.2	
10.25	Third Amendment dated August 11, 2006 to Lease Agreement II dated August 20, 1997 between Amberjack, LTD. and Cascade Microtech, Inc.	10-Q	000-51072	11/9/2006	10.3	
10.26	Assignment, Assumption and Amendment of Lease dated as of September 22, 2011 by and among Cascade Microtech, Inc. and R&D Sockets, Inc.	8-K	000-51072	9/26/2011	10.1	
10.27	Rental Agreement by and between Cascade Microtech Dresden GmbH and Süss Grundstücksverwaltungs GbR dated as of June 17, 2011.	10-Q	000-51072	8/10/2011	10.3	
10.28	Lease dated April 2, 1999 between Spieker Properties, L.P. and Cascade Microtech, Inc.	S-1	333-47100	10/2/2000	10.8	
10.29	First Amendment to Lease dated January 10, 2007, between Nimbus Center LLC (as successor in interest to Spieker Properties, L.P.) and Cascade Microtech, Inc.	10-Q	000-51072	5/9/2014	10.1	
10.30	Second Amendment to Lease dated February 25, 2013, between Nimbus Center LLC and Cascade Microtech, Inc.	10-Q	000-51072	5/8/2013	10.2	
10.31	Third Amendment to Lease dated January 23, 2014, between Nimbus Center LLC and Cascade Microtech, Inc.	10-Q	000-51072	5/9/2014	10.2	
10.32	Fourth Amendment to Lease dated March 31, 2014, between Nimbus Center LLC and Cascade Microtech, Inc.	10-Q	000-51072	5/9/2014	10.3	
10.33	Fifth Amendment to Lease dated September 24, 2014, between Nimbus Center LLC and Cascade Microtech, Inc.	10-K	000-51072	3/72016	10.22	
10.34	Sixth Amendment to Lease dated July 8, 2015, between Nimbus Center LLC and Cascade Microtech, Inc.	10-K	000-51072	3/72016	10.23	
10.35+	Employment Offer Letter, dated August 29, 2012 to Mike Slessor	10-K	000-50307	3/13/2013	10.19+	
10.37+	CEO Change of Control and Severance Agreement, dated April 28, 2016 by and between Mike Slessor and the Registrant	10-K	000-50307	3/15/2017	10.35	
10.38+	Change of Control and Severance Agreement, dated April 28, 2016 by and between Michael Ludwig and the Registrant	10-K	000-50307	3/15/2017	10.36	
10.39+	Employment Offer Letter, dated February 15, 2018 to Shai Shahar	10-Q	000-50307	5/8/2018	10.1	
21.1	List of Registrant's subsidiaries	—	—	—	—	X
23.1	Consent of Independent Registered Public Accounting Firm - KPMG LLP	—	—	—	—	X
24.1	Power of Attorney (included on the signature page of this Form 10-K)	—	—	—	—	X
31.1	Certification of Chief Executive Officer pursuant to 15 U.S.C. Section 7241, as adopted pursuant to Section 302 of the Sarbanes-Oxley Act of 2002	—	—	—	—	X
31.2	Certification of Chief Financial Officer pursuant to 15 U.S.C. Section 7241, as adopted pursuant to Section 302 of the Sarbanes-Oxley Act of 2002	—	—	—	—	X
32.1*	Certification of Chief Executive Officer and Chief Financial Officer pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002	—	—	—	—	X

101**	The following financial statements from the Company’s Annual Report on Form 10-K for the year ended December 28, 2019, formatted in Inline XBRL: (i) Consolidated Balance Sheets, (ii) Consolidated Statements of Income, (iii) Consolidated Statements of Comprehensive Income, (iv) Consolidated Statements of Cash Flows, and (v) Notes to Consolidated Financial Statements, tagged as blocks of text and including detailed tags.	—	—	—	—	X
101.SCH**	XBRL Taxonomy Extension Schema Document	—	—	—	—	X
101.CAL**	XBRL Taxonomy Extension Calculation Linkbase Document	—	—	—	—	X
101.DEF**	XBRL Taxonomy Extension Definition Linkbase Document	—	—	—	—	X
101.LAB**	XBRL Taxonomy Extension Label Linkbase Document	—	—	—	—	X
101.PRE**	XBRL Taxonomy Extension Presentation Linkbase Document	—	—	—	—	X
104	The cover page from the Company’s Annual Report on Form 10-K for the year ended December 28, 2019, formatted in Inline XBRL (included as Exhibit 101).	—	—	—	—	X

* This exhibit shall not be deemed "filed" for purposes of Section 18 of the Securities Exchange Act of 1934 or otherwise subject to the liabilities of that section, nor shall it be deemed incorporated by reference in any filing under the Securities Act of 1933 or the Securities Exchange Act of 1934, whether made before or after the date hereof and irrespective of any general incorporation language in any filings.

** Pursuant to Rule 406T of Regulation S-T, these interactive data files are deemed not filed or part of a registration statement or prospectus for purposes of Sections 11 or 12 of the Securities Act of 1933 or Section 18 of the Securities Exchange Act of 1934 and otherwise are not subject to liability.

*** The schedules, exhibits, and annexes to this exhibit have been omitted in reliance on Item 601(b)(2) of Regulation S-K and will be furnished supplementally to the SEC upon request.

+ Indicates a management contract or compensatory plan or arrangement.

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.

		FORMFACTOR, INC.	
Date:	February 21, 2020	By:	/s/ SHAI SHAHAR
			Shai Shahar *Chief Financial Officer* *(Principal Financial Officer and Principal Accounting Officer)*

POWER OF ATTORNEY

KNOW BY ALL PERSONS BY THESE PRESENTS, that each of the undersigned whose signature appears below constitutes and appoints Shai Shahar and Jason Cohen, and each of them, the undersigned's true and lawful attorneys in-fact and agents with full power of substitution, for the undersigned and in the undersigned's name, place and stead, in any and all capacities, to sign any and all amendments to this Annual Report on Form 10-K and any other documents in connection therewith, and to file the same, with all exhibits thereto, with the Securities and Exchange Commission, granting unto said attorneys-in-fact and agents, and each of them, full power and authority to do and perform each and every act requisite and necessary to be done with respect to this Annual Report on Form 10-K, including amendments, as fully to all intents and purposes as the undersigned might or could do in person, hereby ratifying and confirming all that said attorneys-in-fact and agents, or his or their substitute or substitutes, may lawfully do or cause to be done by virtue hereof.

IN WITNESS WHEREOF, each of the undersigned has executed this Power of Attorney as of the date indicated below.
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.

Signature	Title	Date
Principal Executive Officer: /s/ MICHAEL D. SLESSOR Michael D. Slessor	Chief Executive Officer and Director	February 21, 2020
Principal Financial Officer and Principal Accounting Officer: /s/ SHAI SHAHAR Shai Shahar	Chief Financial Officer	February 21, 2020

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.

Signature	Title	Date
Additional Directors:		
/s/ LOTHAR MAIER Lothar Maier	Director	February 21, 2020
/s/ EDWARD ROGAS, JR Edward Rogas, Jr	Director	February 21, 2020
/s/ KELLEY STEVEN-WAISS Kelley Steven-Waiss	Director	February 21, 2020
/s/ SHERI RHODES Sheri Rhodes	Director	February 21, 2020
/s/ RAYMOND LINK Raymond Link	Director	February 21, 2020
/s/ REBECA OBREGON-JIMENEZ Rebeca Obregon-Jimenez	Director	February 21, 2020
/s/ THOMAS ST. DENNIS Thomas St. Dennis	Director	February 21, 2020

Report of Independent Registered Public Accounting Firm

To the Stockholders and Board of Directors
FormFactor, Inc.:

Opinions on the Consolidated Financial Statements and Internal Control Over Financial Reporting

We have audited the accompanying consolidated balance sheets of FormFactor, Inc. and subsidiaries (the Company) as of December 28, 2019 and December 29, 2018, the related consolidated statements of income, comprehensive income, stockholders' equity, and cash flows for each of the years in the three-year period ended December 28, 2019, and the related notes (collectively, the consolidated financial statements). We also have audited the Company's internal control over financial reporting as of December 28, 2019, based on criteria established in *Internal Control - Integrated Framework (2013)* issued by the Committee of Sponsoring Organizations of the Treadway Commission.

In our opinion, the consolidated financial statements referred to above present fairly, in all material respects, the financial position of the Company as of December 28, 2019 and December 29, 2018, and the results of its operations and its cash flows for each of the years in the three-year period ended December 28, 2019, in conformity with U.S. generally accepted accounting principles. Also in our opinion, the Company maintained, in all material respects, effective internal control over financial reporting as of December 28, 2019, based on criteria established in *Internal Control - Integrated Framework (2013)* issued by the Committee of Sponsoring Organizations of the Treadway Commission.

The Company acquired FRT GmbH during 2019, and management excluded from its assessment of the effectiveness of the Company's internal control over financial reporting as of December 28, 2019, FRT GmbH's internal control over financial reporting associated with total assets of $35.2 million and total revenues of $3.9 million included in the consolidated financial statements of the Company as of and for the year ended December 28, 2019. Our audit of internal control over financial reporting of the Company also excluded an evaluation of the internal control over financial reporting of FRT GmbH.

Change in Accounting Principle

As discussed in Note 6 to the consolidated financial statements, the Company has changed its method of accounting for leases as of December 30, 2018 due to the adoption of Accounting Standards Update (ASU) 2016-02, "Leases (Topic 842)," ASU 2018-10, "Codification Improvements to Topic 842, Leases," ASU 2018-11, "Leases (Topic 842): Targeted Improvements," and ASU 2019-01, "Leases (Topic 842): Codification Improvements."

As discussed in Note 2 to the consolidated financial statements, the Company has changed its method of accounting for revenue from contracts with customers as of December 31, 2017 due to the adoption of Accounting Standards Codification 606, "Revenue from Contracts with Customers."

Basis for Opinions

The Company's management is responsible for these consolidated financial statements, 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 appearing under Item 9A. Our responsibility is to express an opinion on the Company's consolidated financial statements and an opinion on the Company's internal control over financial reporting based on our audits. We are a public accounting firm registered with the Public Company Accounting Oversight Board (United States) (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 audits to obtain reasonable assurance about whether the consolidated financial statements are free of material misstatement, whether due to error or fraud, and whether effective internal control over financial reporting was maintained in all material respects.

Our audits of the consolidated financial statements 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. 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 audits also included performing such other procedures as we considered necessary in the circumstances. We believe that our audits provide a reasonable basis for our opinions.

Definition and Limitations of Internal Control Over Financial Reporting

A company's internal control over financial reporting is a process designed 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. A company'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 company; (2) provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with generally accepted accounting principles, and that receipts and expenditures of the company are being made only in accordance with authorizations of management and directors of the company; and (3) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use, or disposition of the company's assets that could have a material effect on the financial statements.

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.

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 judgment. The communication of a critical audit matter 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 a separate opinion on the critical audit matter or on the accounts or disclosures to which it relates.

Evaluation of inventory excess and obsolescence

As discussed in Notes 2 and 3 to the consolidated financial statements, the Company's net inventories were$83.3 million as of December 28, 2019, and inventory write downs totaled $10.4 million for the year ended December 28, 2019. The Company states its inventories at the lower of cost or net realizable value. The Company records an adjustment to the cost basis of inventory when evidence exists that the net realizable value of inventory is lower than its cost, which occurs when the Company has excess and/or obsolete inventory. The Company's model to estimate the excess and/or obsolete inventory is based on an analysis of existing inventory quantities compared to estimated future consumption. Future consumption is estimated based upon assumptions about how past consumption, recent purchases, backlog or other factors indicate future consumption.

We identified the evaluation of inventory excess and obsolescence as a critical audit matter. Complex auditor judgment was required to evaluate that past consumption, recent purchases, or backlog accurately indicate future consumption and thus meet the accounting objective of recording inventory at the lower of its cost or net realizable value.

The primary procedures we performed to address this critical audit matter included the following. We tested certain internal controls over the Company's process to develop the assumptions used to predict future consumption of inventory. We assessed the Company's assumptions about how past consumption, recent purchases, or backlog indicate future consumption by: (1) Evaluating historical cumulative write down trends and relevant changes to the overall business environment, including key customers and product lines in order to evaluate the Company's methodology that actual past consumption history, recent purchases, or backlog are relevant as predictors of future inventory consumption, and (2) Selecting a sample of products within inventory and for each sample selection (a) evaluating how past consumption, recent purchases, or backlog indicate future consumption of the specific sampled inventory product, and (b) recalculating the Company's estimate of the cumulative inventory write downs based on the actual quantity of product on hand compared to the estimate of future consumption.

/s/ KPMG LLP

We have served as the Company's auditor since 2013.

Portland, Oregon
February 21, 2020

FORMFACTOR, INC.

CONSOLIDATED BALANCE SHEETS

	December 28, 2019	December 29, 2018
	(In thousands, except share and per share data)	
ASSETS		
Current assets:		
Cash and cash equivalents	$ 144,545	$ 98,472
Marketable securities	76,327	50,531
Accounts receivable, net	97,868	95,333
Inventories, net	83,258	77,706
Restricted cash	1,981	849
Prepaid expenses and other current assets	15,064	14,929
Total current assets	419,043	337,820
Restricted cash	1,411	1,225
Operating lease, right-of-use-assets	31,420	—
Property, plant and equipment, net	58,747	54,054
Goodwill	199,196	189,214
Intangibles, net	57,610	67,640
Deferred tax assets	71,252	77,301
Other assets	1,203	968
Total assets	$ 839,882	$ 728,222
LIABILITIES AND STOCKHOLDERS' EQUITY		
Current liabilities:		
Accounts payable	$ 40,914	$ 40,006
Accrued liabilities	36,439	27,731
Current portion of term loans, net of unamortized issuance cost of $29 and $160	42,846	29,840
Deferred revenue	9,810	4,941
Operating lease liabilities	6,551	—
Total current liabilities	136,560	102,518
Term loan, less current portion, net of unamortized issuance cost of $0 and $29	15,639	34,971
Deferred tax liabilities	6,986	2,355
Long-term operating lease liabilities	29,088	—
Other liabilities	10,612	8,214
Total liabilities	198,885	148,058
Stockholders' equity:		
Preferred stock, $0.001 par value:		
10,000,000 shares authorized; no shares issued and outstanding	—	—
Common stock, $0.001 par value:		
250,000,000 shares authorized; 75,764,990 and 74,139,712 shares issued and outstanding	76	74
Additional paid-in capital	885,821	862,897
Accumulated other comprehensive income (loss)	(659)	780
Accumulated deficit	(244,241)	(283,587)
Total stockholders' equity	640,997	580,164
Total liabilities and stockholders' equity	$ 839,882	$ 728,222

The accompanying notes are an integral part of these consolidated financial statements.

FORMFACTOR, INC.

CONSOLIDATED STATEMENTS OF INCOME

	Fiscal Year Ended		
	December 28, 2019	December 29, 2018	December 30, 2017
	(In thousands, except per share data)		
Revenues	$ 589,464	$ 529,675	$ 548,441
Cost of revenues	351,968	319,336	332,844
Gross profit	237,496	210,339	215,597
Operating expenses:			
Research and development	81,499	74,976	73,807
Selling, general and administrative	106,335	99,254	95,489
Total operating expenses	187,834	174,230	169,296
Operating income	49,662	36,109	46,301
Interest income	2,714	1,356	548
Interest expense	(1,915)	(3,314)	(4,491)
Other income (expense), net	602	(224)	(152)
Income before income taxes	51,063	33,927	42,206
Provision (benefit) for income taxes	11,717	(70,109)	1,293
Net income	$ 39,346	$ 104,036	$ 40,913
Net income per share:			
Basic	$ 0.52	$ 1.42	$ 0.57
Diluted	$ 0.51	$ 1.38	$ 0.55
Weighted-average number of shares used in per share calculations:			
Basic	74,994	73,482	72,292
Diluted	77,286	75,182	74,239

The accompanying notes are an integral part of these consolidated financial statements.

FORMFACTOR, INC.
CONSOLIDATED STATEMENTS OF COMPREHENSIVE INCOME

	Fiscal Year Ended		
	December 28, 2019	December 29, 2018	December 30, 2017
	(In thousands)		
Net income	$ 39,346	$ 104,036	$ 40,913
Other comprehensive income (loss), net of tax:			
Translation adjustments and other	(1,028)	(1,902)	6,764
Unrealized gains (losses) on available-for-sale marketable securities	316	(8)	(206)
Unrealized gains (losses) on derivative instruments	(727)	(331)	203
Other comprehensive income (loss), net of tax	(1,439)	(2,241)	6,761
Comprehensive income	$ 37,907	$ 101,795	$ 47,674

The accompanying notes are an integral part of these consolidated financial statements.

FORMFACTOR, INC.
CONSOLIDATED STATEMENTS OF STOCKHOLDERS' EQUITY

	Common Stock		Additional Paid-in Capital	Accumulated Other Comprehensive Income (Loss)	Accumulated Deficit	Total
	Shares	Amount				
			(In thousands, except shares)			
Balances, December 31, 2016	70,907,847	$ 71	$ 833,341	$ (3,740)	$ (428,616)	$ 401,056
Issuance of common stock pursuant to exercise of options for cash	1,473,389	1	13,836	—	—	13,837
Issuance of common stock pursuant to vesting of restricted stock units, net of stock withheld for tax	862,596	1	(6,886)	—	—	(6,885)
Issuance of common stock under the Employee Stock Purchase Plan	655,961	1	5,694	—	—	5,695
Purchase and retirement of common stock	(1,367,617)	(1)	(18,969)	—	—	(18,970)
Stock-based compensation	—	—	16,230	—	—	16,230
ASU 2016-09 Adoption	—	—	(130)	—	130	—
Other comprehensive income	—	—	—	6,761	—	6,761
Net income	—	—	—	—	40,913	40,913
Balances, December 30, 2017	72,532,176	73	843,116	3,021	(387,573)	458,637
Issuance of common stock under the Employee Stock Purchase Plan	610,297	1	6,661	—	—	6,662
Issuance of common stock pursuant to exercise of options for cash	134,609	—	1,158	—	—	1,158
Issuance of common stock pursuant to vesting of restricted stock units, net of stock withheld for tax	862,630	—	(5,791)	—	—	(5,791)
Stock-based compensation	—	—	17,753	—	—	17,753
ASU 2017-12 Adoption	—	—	—	—	(50)	(50)
Other comprehensive loss	—	—	—	(2,241)	—	(2,241)
Net income	—	—	—	—	104,036	104,036
Balances, December 29, 2018	74,139,712	74	862,897	780	(283,587)	580,164
Issuance of common stock under the Employee Stock Purchase Plan	544,271	1	6,806	—	—	6,807
Issuance of common stock pursuant to exercise of options for cash	162,956	—	1,176	—	—	1,176
Issuance of common stock pursuant to vesting of restricted stock units, net of stock withheld for tax	918,051	1	(8,026)	—	—	(8,025)
Stock-based compensation	—	—	22,968	—	—	22,968
Other comprehensive loss	—	—	—	(1,439)	—	(1,439)
Net income	—	—	—	—	39,346	39,346
Balances, December 28, 2019	75,764,990	$ 76	$ 885,821	$ (659)	$ (244,241)	$ 640,997

The accompanying notes are an integral part of these consolidated financial statements.

FORMFACTOR, INC.
CONSOLIDATED STATEMENTS OF CASH FLOWS

	Fiscal Year Ended		
	December 28, 2019	December 29, 2018	December 30, 2017
		(In thousands)	
Cash flows from operating activities:			
Net income	$ 39,346	$ 104,036	$ 40,913
Adjustments to reconcile net income to net cash provided by operating activities:			
Depreciation	17,185	14,314	13,626
Amortization	27,672	29,373	30,940
Amortization (accretion) of discount on investments	(365)	(10)	38
Reduction in the carrying amount of right-of-use assets	5,269	—	—
Stock-based compensation expense	23,176	17,827	16,339
Amortization of debt issuance costs	160	390	619
Deferred income tax provision (benefit)	4,954	(74,908)	(590)
Benefit for doubtful accounts receivable	—	—	(99)
Provision for excess and obsolete inventories	10,421	10,479	9,259
Acquired inventory step-up amortization	465	—	569
Loss on disposal of long-lived assets	486	325	510
Foreign currency transaction losses (gains)	408	125	(1,717)
Loss (gain) on derivative instruments	110	—	(10)
Changes in assets and liabilities:			
Accounts receivable	481	(13,830)	(10,651)
Inventories	(14,295)	(21,298)	(15,635)
Prepaid expenses and other current assets	230	1,204	457
Other assets	(441)	707	61
Accounts payable	(27)	3,050	741
Accrued liabilities	7,517	(6,219)	872
Other liabilities	166	3,109	111
Deferred revenues	3,130	26	(30)
Operating lease liabilities	(5,000)	—	—
Net cash provided by operating activities	121,048	68,700	86,323
Cash flows from investing activities:			
Acquisition of property, plant and equipment	(20,847)	(19,869)	(17,756)
Acquisition of FRT GmbH, net of cash acquired	(20,524)	—	—
Proceeds from sale of subsidiary	132	94	68
Proceeds from sale of property and property, plant and equipment	—	23	—
Purchases of marketable securities	(76,327)	(30,566)	(50,733)
Proceeds from maturities of marketable securities	51,214	29,023	8,996
Net cash used in investing activities	(66,352)	(21,295)	(59,425)
Cash flows from financing activities:			
Proceeds from issuances of common stock	8,093	7,712	19,510
Purchase and retirement of common stock	—	—	(18,970)
Tax withholdings related to net share settlements of equity awards	(8,025)	(5,791)	(6,885)
Proceeds from term loan	23,354	—	—
Payments on term loan	(30,000)	(41,250)	(33,125)
Net cash used in financing activities	(6,578)	(39,329)	(39,470)
Effect of exchange rate changes on cash, cash equivalents and restricted cash	(727)	(256)	2,702
Net increase (decrease) in cash, cash equivalents and restricted cash	47,391	7,820	(9,870)
Cash, cash equivalents and restricted cash, beginning of year	100,546	92,726	102,596
Cash, cash equivalents and restricted cash, end of year	$ 147,937	$ 100,546	$ 92,726

FORMFACTOR, INC.
CONSOLIDATED STATEMENTS OF CASH FLOWS

	Fiscal Year Ended		
	December 28, 2019	December 29, 2018	December 30, 2017
		(In thousands)	
Supplemental disclosure of non-cash investing and financing activities:			
Operating lease, right-of-use assets obtained in exchange for lease obligations	$ 36,709	$ —	$ —
Contingent consideration payable related to FRT acquisition	5,364	—	—
Change in accounts payable and accrued liabilities related to property, plant and equipment purchases	$ 866	$ 2,290	$ (33)
Supplemental disclosure of cash flow information:			
Income taxes paid, net	$ 4,324	$ 4,576	$ 3,172
Cash paid for interest	1,405	3,113	3,836

The accompanying notes are an integral part of these consolidated financial statements.

Note 1—Formation and Nature of Business

FormFactor, Inc. was incorporated in Delaware on April 15, 1993 and is headquartered in Livermore, California. We are a leading provider of electrical test and measurement technologies. We provide a broad range of high-performance probe cards, analytical probes, probe stations, metrology systems, and thermal sub-systems to both semiconductor companies and scientific institutions. Our products provide electrical and optical metrology information from a variety of semiconductor and electro-optical devices and integrated circuits from research, to development through production. Customers use our products and services to lower production costs, improve yields, and enable development of complex next generation products. We believe our technology leadership enables critical roadmap advances for our customers.

We also design, develop, manufacture and market advanced wafer probing and thermal solutions for the electrical and optical measurement and testing of high performance semiconductor devices. Design, development and manufacturing operations are located in Beaverton, Oregon, United States and Bergisch Gladbach, Munich and Thiendorf, Germany, and sales, service and support operations are located in the United States, Germany, France, South Korea, Japan, Taiwan, China and Singapore.

Fiscal Year

Our fiscal year ends on the last Saturday in December. The fiscal years ended on December 28, 2019, December 29, 2018 and December 30, 2017 each consisted of 52 weeks, respectively.

Reclassifications

Certain immaterial reclassifications were made to the prior year financial statements to conform to the current year presentation.

Note 2—Summary of Significant Accounting Policies

Basis of Consolidation and Foreign Currency Translation

The consolidated financial statements include our accounts and those of our wholly-owned subsidiaries. All intercompany balances and transactions have been eliminated.

On October 9, 2019, we completed the acquisition of FRT GmbH and, accordingly, our Consolidated Statements of Income include the results of operations of FRT GmbH since that date. See Note 4.

The functional currencies of certain of our foreign subsidiaries are the local currencies and, accordingly, all assets and liabilities of these foreign operations are translated to U.S. Dollars at current period-end exchange rates, and revenues and expenses are translated to U.S. Dollars using average exchange rates in effect during the period. The gains and losses from the foreign currency translation of these subsidiaries' financial statements are included as a separate component of stockholders' equity on our Consolidated Balance Sheets under Accumulated other comprehensive income (loss).

Certain other of our foreign subsidiaries use the U.S. Dollar as their functional currency. Accordingly, monetary assets and liabilities in non-functional currencies of these subsidiaries are remeasured using exchange rates in effect at the end of the period. Revenues and costs in local currency are remeasured using average exchange rates for the period, except for costs related to those balance sheet items that are remeasured using historical exchange rates. The resulting remeasurement gains and losses are included in the Consolidated Statements of Income as a component of Other income (expense), net as incurred.

Use of Estimates

The preparation of consolidated financial statements in conformity with accounting principles generally accepted in the United States of America ("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. Estimates may change as new information is obtained. We believe that the estimates, assumptions and judgments involved in revenue recognition, fair value of marketable securities, fair value of derivative financial instruments used to hedge both foreign currency and interest rate exposures, allowance for doubtful accounts, reserves for product warranty, valuation of obsolete and slow moving inventory, assets acquired and liabilities assumed in business combinations, legal contingencies, valuation of goodwill, the assessment of recoverability of long-lived assets, valuation and recognition of stock-based compensation, provision for income taxes and valuation of deferred tax assets have the greatest potential impact on our consolidated financial statements. Actual results could differ from those estimates.

Business Acquisitions

Our consolidated financial statements include the operations of acquired businesses after the completion of their respective acquisitions. We account for acquired businesses using the acquisition method of accounting, which requires, among other things, that assets acquired and liabilities assumed be recognized at their estimated fair values as of the acquisition date, and that the fair value of acquired intangibles be recorded on the balance sheet. Transaction costs are expensed as incurred. Any excess of the purchase price over the assigned fair values of the net assets acquired is recorded as goodwill.

Cash and Cash Equivalents and Marketable Securities

Cash and cash equivalents consist of deposits and financial instruments which are readily convertible into cash and have original maturities of 90 days or less at the time of acquisition. Marketable securities consist primarily of highly liquid investments with maturities of greater than 90 days when purchased. We classify our marketable securities as available-for-sale and, accordingly, report them at fair value with the related unrealized gains and losses included in Accumulated other comprehensive income (loss) in our Consolidated Balance Sheets. Any unrealized losses which are considered to be other-than-temporary are recorded in Other income (expense), net, in the Consolidated Statements of Income. Realized gains and losses on the sale of marketable securities are determined using the specific-identification method and recorded in Other income (expense), net, in the Consolidated Statements of Income.

All of our available-for-sale investments are subject to a periodic impairment review. We record a charge to earnings when a decline in fair value is significantly below cost basis and judged to be other-than-temporary, or have other indicators of impairments. If the fair value of an available-for-sale investment is less than its amortized cost basis, an other-than-temporary impairment is triggered in circumstances where (1) we intend to sell the instrument; (2) it is more likely than not that we will be required to sell the instrument before recovery of its amortized cost basis; or (3) a credit loss exists where we do not expect to recover the entire amortized cost basis of the instrument. If we intend to sell, or it is more likely than not that we will be required to sell, the available-for-sale investment before recovery of its amortized cost basis, we recognize an other-than-temporary impairment charge equal to the difference between the investment's amortized cost basis and its fair value. We did not record any other-than-temporary impairments during fiscal 2019, 2018 or 2017.

Foreign Exchange Management

We transact business in various foreign currencies. We enter into forward foreign exchange contracts in an effort to mitigate the risks associated with currency fluctuations on certain foreign currency balance sheet exposures and certain operational costs denominated in local currency impacting our statement of income. For accounting purposes, certain of our foreign currency forward contracts are not designated as hedging instruments and, accordingly, we record the fair value of these contracts as of the end of our reporting period in our Consolidated Balance Sheets with changes in fair value recorded within Other income (expense), net in our Consolidated Statements of Income for both realized and unrealized gains and losses. Certain of our foreign currency forward contracts are designated as cash flow hedges, and, accordingly, we record the fair value of these contracts as of the end of our reporting period in our Consolidated Balance Sheets with changes in fair value recorded as a component of accumulated other comprehensive income (loss) and reclassified into earnings in the same period in which the hedged transaction affects earnings, and in the same line item on the Consolidated Statements of Income as the impact of the hedge transaction. We do not use derivative financial instruments for trading or speculative purposes.

Accounts Receivable and Allowance for Doubtful Accounts

The majority of our accounts receivable are derived from sales to large multinational semiconductor manufacturers throughout the world, are recorded at their invoiced amount and do not bear interest.

In order to monitor potential credit losses, we perform ongoing credit evaluations of our customers' financial condition. An allowance for doubtful accounts is maintained based upon our assessment of the expected collectability of all accounts receivable. The allowance for doubtful accounts is reviewed and assessed for adequacy on a quarterly basis. We take into consideration (1) any circumstances of which we are aware of a customer's inability to meet its financial obligations and (2) our judgments as to prevailing economic conditions in the industry and their impact on our customers. If circumstances change, and the financial condition of our customers is adversely affected and they are unable to meet their financial obligations, we may need to take additional allowances, which would result in an increase in our operating expense.

Activity related to our allowance for doubtful accounts receivable was as follows (in thousands):

	Fiscal Year Ended		
	December 28, 2019	December 29, 2018	December 30, 2017
Balance at beginning of year	$ 185	$ 200	$ 299
Charges (reversals) to costs and expenses	37	(15)	(99)
Balance at end of year	$ 222	$ 185	$ 200

Inventories

We state our inventories at the lower of cost (principally standard cost which approximates actual cost on a first in, first out basis) or net realizable value. We continually assess the value of our inventory and will periodically write down its value for estimated excess inventory and product obsolescence based upon an analysis of existing inventory quantities compared to estimated future consumption. Future consumption is estimated based upon assumptions about how past consumption, recent purchases, backlog and other factors indicate future consumption. On a quarterly basis, we review existing inventory quantities in comparison to our past consumption, recent purchases, backlog and other factors to determine what inventory quantities, if any, may not be sellable. Based on this analysis, we record an adjustment to the cost basis of inventory when evidence exists that the net realizable value of inventory is lower than its cost, which occurs when we have excess and/or obsolete inventory. Once the value is adjusted, the original cost of our inventory, less the related inventory write-down, represents the new cost basis. Reversal of these write downs is recognized only when the related inventory has been scrapped or sold. Shipping and handling costs are classified as a component of Cost of revenues in the Consolidated Statements of Income.

We design, manufacture and sell a custom product into a market that has been subject to cyclicality and significant demand fluctuations. Many of our products are complex, custom to a specific chip design and have to be delivered on short lead-times. Probe cards are manufactured in low volumes, but, for certain materials, the purchases are often subject to minimum order quantities in excess of the actual underlying probe card demand. It is not uncommon for us to acquire production materials and commence production activities based on estimated production yields and forecasted demand prior to, or in excess of, actual demand for our probe cards. These factors result in normal recurring inventory valuation charges to Cost of revenues.

Inventory write downs totaled $10.4 million, $10.5 million and $9.3 million for fiscal 2019, 2018 and 2017, respectively.

Restricted Cash

Restricted cash is comprised primarily of funds held by our foreign subsidiaries for employee obligations, office leases, customer deposits, and temporary customs import permits.

Property, Plant, and Equipment

Property, plant and equipment is stated at cost less accumulated depreciation and amortization. Depreciation is provided on a straight-line method. Machinery and equipment, computer equipment and software, and furniture and fixtures are depreciated over 1 to 5 years.

Leasehold improvements are amortized over the shorter of the lease term or the estimated useful life of the related asset. Construction-in-progress assets are not depreciated until the assets are placed in service. Upon sale or retirement of assets, the cost and related accumulated depreciation or amortization are removed from the Consolidated Balance Sheets and the resulting gain or loss is reflected in Operating income in our Consolidated Statements of Income.

Goodwill

Goodwill represents the excess of the purchase price over the fair value of identifiable assets acquired and liabilities assumed. Goodwill is not amortized, rather assessed, at least annually, for impairment at a reporting unit level. Impairment of goodwill exists when the carrying amount of a reporting unit exceeds its fair value. A goodwill impairment loss is recognized for the amount that the carrying amount of the reporting unit, including goodwill, exceeds its fair value, limited to the total amount of goodwill allocated to that reporting unit. If the fair value of a reporting unit exceeds the carrying amount, goodwill of the reporting unit is not considered impaired.

We evaluate impairment by first assessing qualitative factors to determine whether it is necessary to perform a quantitative impairment test. If we determine, as a result of the qualitative assessment, that it is more likely than not that the fair value of a reporting unit is less than its carrying amount, then the quantitative impairment test is required. Otherwise, no further testing is required.

We perform our annual goodwill impairment test in the fourth quarter of each year by assessing qualitative factors, including, but not limited to an assessment of our market capitalization, which was significantly higher than our book value. Based on these tests, we determined that the quantitative impairment test was not required and no impairment charges were recorded in fiscal 2019, 2018 or 2017.

The evaluation of goodwill for impairment requires the exercise of judgment. In the event of future changes in business conditions, we will be required to reassess and update our forecasts and estimates used in future impairment analysis. If the results of these analysis are lower than current estimates, a material impairment charge may result at that time.

See Note 9 for additional information.

Intangible Assets

Intangible assets consist of acquisition related intangible assets and intellectual property. The intangible assets are being amortized over periods of 1 to 10 years, which reflect the pattern in which economic benefits of the assets are expected to be realized. We perform a review of intangible assets when facts and circumstances indicate that the useful life is shorter than originally estimated or that the carrying amount of assets may not be recoverable. Such facts and circumstances include significant adverse changes in the business climate or legal factors; current period cash flow or operating losses combined with a history of losses or a forecast of continuing losses associated with the use of the intangible assets; and current expectation that the intangible assets will more likely than not be sold or disposed of before the end of their estimated useful lives. We assess the recoverability of identified intangible assets by comparing the projected undiscounted net cash flows associated with the related asset or group of assets over their remaining lives against their respective carrying amounts. Impairments, if any, are based on the excess of the carrying amount over the fair value of those assets.

See Note 9 for additional information.

Impairment of Long-Lived Assets

We test long-lived assets or asset groups, such as property, plant and equipment and intangible assets, for recoverability when events or changes in circumstances indicate that their carrying amounts may not be recoverable. Circumstances which could trigger a review include, but are not limited to: significant decreases in the market price of the asset; significant adverse changes in the business climate or legal factors; accumulation of costs significantly in excess of the amount originally expected for the acquisition or construction of the asset; current period cash flow or operating losses combined with a history of losses or a forecast of continuing losses associated with the use of the asset; and current expectation that the asset will more likely than not be sold or disposed of before the end of its estimated useful life.

Recoverability is assessed based on the carrying amounts of the asset or asset group and the sum of the undiscounted cash flows expected to result from the use and the eventual disposal of the asset. An impairment loss is recognized when the carrying amount is not recoverable and exceeds fair value.

Concentration of Credit Risk and Other Risks and Uncertainties

Financial instruments that potentially subject us to concentrations of credit risk consist primarily of cash equivalents, marketable securities and accounts receivable. Our cash equivalents and marketable securities are held in safekeeping by large, credit worthy financial institutions. We invest our excess cash primarily in U.S. banks, government and agency bonds, money market funds and corporate obligations. We have established guidelines relative to credit ratings, diversification and maturities that seek to maintain safety and liquidity. Deposits in these banks may exceed the amounts of insurance provided on such deposits. To date, we have not experienced any losses on our deposits of cash and cash equivalents. We market and sell our products to a relatively narrow base of customers and generally do not require collateral.

The following customers represented 10% or more of our revenues:

	Fiscal Year Ended		
	December 28, 2019	**December 29, 2018**	**December 30, 2017**
Intel Corporation	25.3 %	19.0 %	25.9 %
Samsung Electronics., LTD.	11.5 %	*	*

***** Less than 10% of revenues.

At December 28, 2019, three customers accounted for 25.7%, 15.1% and 11.5% of gross accounts receivable, respectively. At December 29, 2018, two customers accounted for 27.8% and 13.0% of gross accounts receivable, respectively. No other customers accounted for 10% or more of gross accounts receivable for these fiscal period ends. We operate in the competitive semiconductor industry, including the Dynamic Random Access Memory, or DRAM, Flash memory, and Foundry & Logic and probe stations markets, which have been characterized by price erosion, rapid technological change, short product life cycles and heightened foreign and domestic competition. Significant technological changes in the industry could adversely affect our operating results.

We are exposed to non-performance risk by counterparties on our derivative instruments used in hedging activities. We seek to minimize risk by diversifying our hedging program across multiple financial institutions. These counterparties are large international financial institutions, and, to date, no such counterparty has failed to meet its financial obligations to us.

Certain components for our products that meet our requirements are available only from a limited number of suppliers. The rapid rate of technological change and the necessity of developing and manufacturing products with short life cycles may intensify our reliance on such suppliers. The inability to obtain components as required, or to develop alternative sources, if and as required in the future, could result in delays or reductions in product shipments, which in turn could have a material adverse effect on our business, financial condition, results of operations or cash flows.

Revenue Recognition

Revenue is recognized upon transferring control of products and services, and the amounts recognized reflect the consideration we expect to be entitled to receive in exchange for these products and services. Revenue is recognized net of any taxes collected from customers, which are subsequently remitted to governmental authorities. An arrangement may include some or all of the following products and services: probe cards, systems, accessories, installation services, service contracts and extended warranty contracts. We sell our products and services direct to customers and to partners in two distribution channels: global direct sales force and through a combination of manufacturers’ representatives and distributors.

We adopted Accounting Standards Codification ("ASC") Topic No. 606 effective on December 31, 2017, the first day of fiscal year 2018, using the modified retrospective method. We applied ASC 606 to all contracts not completed as of the date of adoption in order to determine any adjustment to the opening balance of accumulated deficit as of December 31, 2017. We did not restate any prior financial statements presented. No adjustment was recorded to accumulated deficit as of the adoption date and reported revenue would not have been different under legacy GAAP.

A performance obligation is a promise in a contract to transfer a distinct good or service to the customer. In contracts with multiple performance obligations, we identify each performance obligation and evaluate whether the performance obligation is distinct within the context of the contract at contract inception. Performance obligations that are not distinct at contract inception are combined and accounted for as one unit of account. Generally, the performance obligations in a contract are considered distinct within the context of the contract and are accounted for as separate units of account.

Our products may be customized to our customers’ specifications, however, control of our product is typically transferred to the customer at the point in time the product is either shipped or delivered, depending on the terms of the arrangement, as the criteria for overtime recognition is not met. In limited circumstances, substantive acceptance by the customer exists which results in the deferral of revenue until acceptance is formally received from the customer. Judgment may be required in determining if the acceptance clause is substantive.

Installation services are routinely provided to customers purchasing our systems. Installation services are a distinct performance obligation apart from the systems and recognized in the period they are performed. Service contracts, which include repair and maintenance service contracts, and extended warranty contracts are also distinct performance obligations and recognized over the contractual service period, which ranges from one to three years. For these service contracts recognized over time, we use an input measure, days elapsed, to measure progress.

A contract’s transaction price is allocated to each distinct performance obligation and recognized as revenue when, or as, the performance obligation is satisfied. In determining the transaction price, we evaluate whether the price is subject to refund or adjustment to determine the net consideration to which we expect to be entitled. We generally do not grant return privileges, except for defective products during the warranty period. Sales incentives and other programs that we may make available to these customers are considered to be a form of variable consideration, which is estimated in determining the contract’s transaction price to be allocated to the performance obligations. We have elected the practical expedient under ASC 606-10-32-18 to not assess whether a contract has a significant financing component as our standard payment terms are less than one year.

For contracts with multiple performance obligations, we allocate the contract's transaction price to each performance obligation based on its relative stand-alone selling price. The stand-alone selling prices are determined based on observable prices, which are the prices at which we separately sell these products. For items which do not have observable prices, we use our best estimate of the stand-alone selling prices.

Transaction price allocated to the remaining performance obligations: On December 28, 2019, we had $4.1 million of remaining performance obligations, which were comprised of deferred service contracts and extended warranty contracts not yet delivered. We expect to recognize approximately 75.1% of our remaining performance obligations as revenue in fiscal 2020, approximately 15.0% in fiscal 2021, and approximately 9.9% in fiscal 2022 and thereafter. The foregoing excludes the value of remaining performance obligations that have original durations of one year or less, and also excludes information about variable consideration allocated entirely to a wholly unsatisfied performance obligation.

Contract balances: The timing of revenue recognition may differ from the timing of invoicing to customers. Accounts receivable is recorded at the invoiced amount, net of an allowance for doubtful accounts. A receivable is recognized in the period we deliver goods or provide services or when our right to consideration is unconditional. A contract asset is recorded when we have performed under the contract but our right to consideration is conditional on something other than the passage of time. Contract assets as of December 28, 2019 and December 29, 2018 were $0.9 million and $0.3 million, respectively, and are reported on the Consolidated Balance Sheets as a component of Prepaid expenses and other current assets.

Contract liabilities include payments received in advance of performance under a contract and are satisfied as the associated revenue is recognized. Contract liabilities are reported on the Consolidated Balance Sheets on a contract-by-contract basis at the end of each reporting period as a component of Deferred revenue and Other liabilities. Contract liabilities totaled $10.8 million and $5.7 million at December 28, 2019 and December 29, 2018, respectively. During fiscal 2019, we recognized $4.2 million of revenue that was included in contract liabilities as of December 29, 2018.

Costs to obtain a contract: We generally expense sales commissions when incurred as a component of Selling, general and administrative expense as the amortization period is typically less than one year.

Revenue by Category: Refer to Note 15 for further details.

Warranty Obligations
We offer warranties on certain products and record a liability for the estimated future costs associated with warranty claims at the time revenue is recognized. The warranty liability is based upon historical experience and our estimate of the level of future costs. While we engage in product quality programs and processes, our warranty obligation is affected by product failure rates, material usage and service delivery costs incurred in correcting a product failure. We continuously monitor product returns for warranty and maintain a reserve for the related expenses based upon our historical experience and any specifically identified field failures. As we sell new products to our customers, we must exercise considerable judgment in estimating the expected failure rates. This estimating process is based on historical experience of similar products, as well as various other assumptions that we believe to be reasonable under the circumstances.

We provide for the estimated cost of product warranties at the time revenue is recognized. Warranty costs are reflected in the Consolidated Statement of Income as a Cost of revenues.

A reconciliation of the changes in our warranty liability is as follows (in thousands):

	Fiscal Year Ended		
	December 28, 2019	December 29, 2018	December 30, 2017
Balance at beginning of year	$ 2,102	$ 3,662	$ 2,972
Accruals	3,881	3,181	8,115
Settlements	(4,041)	(4,741)	(7,425)
Balance at end of year	$ 1,942	$ 2,102	$ 3,662

Research and Development
Research and development expenses include expenses related to product development, engineering and material costs. All research and development costs are expensed as incurred.

Income Taxes
We utilize the asset and liability method of accounting for income taxes, under which deferred taxes are determined based on the temporary differences between the financial statement and tax basis of assets and liabilities using tax rates expected to be in effect during the years in which the basis differences reverse and for operating losses and tax credit carryforwards. We estimate our provision for income taxes and amounts ultimately payable or recoverable in numerous tax jurisdictions around the world. Estimates involve interpretations of regulations and are inherently complex. Resolution of income tax treatments in individual jurisdictions may not be known for many years after completion of any fiscal year. We are required to evaluate the realizability of our deferred tax assets on an ongoing basis to determine whether there is a need for a valuation allowance with respect to such deferred tax assets. A valuation allowance is recorded when it is more likely than not that some or all of the deferred tax assets will not be realized. In evaluating the ability to recover deferred tax assets, we consider all available positive and negative evidence giving greater weight to our recent cumulative income, our historical ability to utilize net operating losses in recent years and our forecast of future taxable income, including the reversal of temporary differences and the implementation of feasible and prudent tax planning strategies.

We recognize and measure uncertain tax positions taken or expected to be taken in a tax return if it is more likely than not that the tax position will be sustained on examination by the taxing authorities, based on the technical merits of the position. The tax benefits recognized are then measured based on the largest benefit that has a greater than 50 percent likelihood of being realized upon ultimate settlement. We report a liability for unrecognized tax benefits resulting from uncertain tax positions taken or expected to be taken in a tax return. We adjust these reserves in light of changing facts and circumstances, such as the closing of a tax audit or the refinement of an estimate. To the extent that the final tax outcome of these matters is different than the amounts recorded, such differences will impact the provision for income taxes in the period in which such determination is made. The provision for income taxes includes the impact of reserve provisions and changes to reserves that are considered appropriate, as well as the related net interest. We recognize interest and penalties related to unrecognized tax benefits within the income tax provision. Accrued interest and penalties are included within the related tax liability in the Consolidated Balance Sheets.

We file annual income tax returns in multiple taxing jurisdictions around the world. A number of years may elapse before an uncertain tax position is audited and finally resolved. While it is often difficult to predict the final outcome or the timing of resolution of any particular uncertain tax position, we believe that our related liability reflects the most likely outcome. We adjust the liability, as well as the related interest, in light of changing facts and circumstances. Settlement of any particular position could require the use of cash.

See Note 13 for additional information, including the Tax Cuts and Jobs Act enacted in December 2017.

Stock-Based Compensation
We recognize compensation expense for all stock-based awards based on the grant-date estimated fair values, net of an estimated forfeiture rate. The value of the portion of the award that is ultimately expected to vest is recognized as expense ratably over the requisite service periods in our Consolidated Statements of Income. The fair value of stock options is measured using the Black-Scholes option pricing model, while the fair value for restricted stock units ("RSUs") is measured based on the closing market price of our common stock on the date of grant. The fair value of Performance RSUs ("PRSU") is based on certain market performance criteria is measured using the Monte Carlo simulation pricing model.

See Notes 11 and 12 for additional information.

Net Income Per Share
Basic net income per share is computed by dividing net income by the weighted-average number of common shares outstanding for the period. Diluted net income per share is computed giving effect to all potentially dilutive common stock and common stock equivalents, including stock options, RSUs and common stock subject to repurchase.

The following table reconciles the shares used in calculating basic net income per share and diluted net income per share (in thousands):

	Fiscal Year Ended		
	December 28, 2019	**December 29, 2018**	**December 30, 2017**
Weighted-average shares used in computing basic net income per share	74,994	73,482	72,292
Add potentially dilutive securities	2,292	1,700	1,947
Weighted-average shares used in computing basic and diluted net income per share	77,286	75,182	74,239

Accumulated Other Comprehensive Income (Loss)

Accumulated other comprehensive income (loss) ("OCI") includes the following items, the impact of which has been excluded from earnings and reflected as components of stockholders' equity as shown below (in thousands):

	December 28, 2019	December 29, 2018
Unrealized losses on available-for-sale marketable securities	$ (352)	$ (668)
Translation adjustments and other	53	1,081
Unrealized gains (losses) on derivative instruments	(360)	367
Accumulated other comprehensive income (loss)	$ (659)	$ 780

Note 3—Balance Sheet Components

Marketable Securities

Marketable securities consisted of the following (in thousands):

December 28, 2019	Amortized Cost	Gross Unrealized Gains	Gross Unrealized Losses	Fair Value
U.S. Treasuries	$ 10,458	$ 11	$ —	$ 10,469
Commercial paper	3,914	1	(4)	3,911
Corporate bond	33,867	68	(7)	33,928
Certificate of deposit	3,584	5	—	3,589
Agency securities	24,408	38	(16)	24,430
	$ 76,231	$ 123	$ (27)	$ 76,327

December 29, 2018	Amortized Cost	Gross Unrealized Gains	Gross Unrealized Losses	Fair Value
U.S. Treasuries	$ 7,997	$ 1	$ (1)	$ 7,997
Commercial paper	2,296	—	(1)	2,295
Corporate bond	30,833	1	(160)	30,674
Certificate of deposit	960	—	(3)	957
Agency securities	8,667	—	(59)	8,608
	$ 50,753	$ 2	$ (224)	$ 50,531

We classify our marketable securities as available-for-sale. All marketable securities represent the investment of funds available for current operations, notwithstanding their contractual maturities. Such marketable securities are recorded at fair value and unrealized gains and losses are recorded in Accumulated other comprehensive income (loss) until realized.

We typically invest in highly-rated securities with low probabilities of default. Our investment policy requires investments to be rated single A or better, limits the types of acceptable investments, concentration as to security holder and duration of the investment. The gross unrealized gains and losses in fiscal 2019 and 2018 were caused primarily by changes in interest rates.

The longer the duration of marketable securities, the more susceptible they are to changes in market interest rates and bond yields. As yields increase, those securities with a lower yield-at-cost show a mark-to-market unrealized loss. We anticipate recovering the full cost of the securities either as market conditions improve, or as the securities mature. Accordingly, we believe that the unrealized losses are not other-than-temporary. When evaluating the investments for other-than-temporary impairment, we review factors such as the length of time and extent to which fair value has been below the amortized cost basis, current market liquidity, interest rate risk, the financial condition of the issuer, and credit rating downgrades. As of December 28, 2019 and December 29, 2018, gross unrealized losses related to our marketable securities portfolio were not material.

The contractual maturities of marketable securities were as follows (in thousands):

	December 28, 2019		December 29, 2018	
	Amortized Cost	Fair Value	Amortized Cost	Fair Value
Due in one year or less	$ 38,899	$ 38,944	$ 35,269	$ 35,172
Due after one year to five years	37,332	37,383	15,484	15,359
	$ 76,231	$ 76,327	$ 50,753	$ 50,531

See also Note 8.

Inventories, net

Inventories consisted of the following (in thousands):

	December 28, 2019	December 29, 2018
Raw materials	$ 38,528	$ 43,380
Work-in-progress	29,720	20,431
Finished goods	15,010	13,895
	$ 83,258	$ 77,706

Property, Plant and Equipment, net

Property, plant and equipment, net consisted of the following (in thousands):

	December 28, 2019	December 29, 2018
Machinery and equipment	$ 201,861	$ 192,108
Computer equipment and software	35,192	32,906
Furniture and fixtures	6,756	6,478
Leasehold improvements	76,081	75,285
Sub-total	319,890	306,777
Less: Accumulated depreciation and amortization	(273,001)	(263,102)
Net property, plant and equipment	46,889	43,675
Construction-in-progress	11,858	10,379
Total	$ 58,747	$ 54,054

Accrued Liabilities

Accrued liabilities consisted of the following (in thousands):

	December 28, 2019	December 29, 2018
Accrued compensation and benefits	$ 21,329	$ 15,600
Accrued employee stock purchase plan contributions withheld	3,331	3,174
Accrued warranty	1,942	2,102
Accrued income and other taxes	6,846	4,222
Other accrued expenses	2,991	2,633
	$ 36,439	$ 27,731

Note 4—Acquisition

On October 9, 2019, we acquired 100% of the shares of FRT GmbH ("FRT"), a German-based company, for total consideration of $25.9 million, net of cash acquired of $1.7 million. The fair value of the purchase consideration was comprised of a $22.2 million cash payment and $5.4 million of contingent consideration. The contingent consideration is a cash amount equal to 1.5x Earnings Before Interest and Tax ("EBIT") as defined in the purchase agreement, from a minimum of zero up to a maximum of €10.3 million, payable subject to the performance of the acquired business in calendar 2020. We estimated the fair value of contingent consideration using a probability weighted approach. Key assumptions in determining the fair value of contingent consideration include estimating the probability of achieving certain EBIT levels and discounting at an appropriate discount rate. This acquisition strengthens our leadership in test and measurement by expanding our addressable market into 3D hybrid surface metrology and extending the optical applications scope of our existing Systems segment.

The acquisition was accounted for using the acquisition method of accounting, with FormFactor treated as the acquirer. The acquired assets and liabilities of FRT were recorded at their respective fair values including an amount for goodwill representing the difference between the acquisition consideration and the fair value of the identifiable net assets.

During fiscal 2019, we incurred approximately $0.5 million in transaction costs related to the acquisition, which primarily consisted of legal, accounting and valuation-related expenses. These expenses were recorded in Selling, general and administrative expense in the accompanying Consolidated Statements of Income.

Our Consolidated Statements of Income include the financial results of FRT subsequent to the acquisition date of October 9, 2019. Revenue related to FRT since the acquisition date that was included in our Consolidated Statements of Income for fiscal 2019 was approximately $3.9 million.

Separate from the purchase agreement, we entered into a term loan agreement with a lender for an aggregate amount of $23.4 million to finance the acquisition. See Note 5 for additional information.

The acquisition price was allocated to the tangible and identified intangible assets acquired and liabilities assumed as of the closing date of the acquisition based upon their respective fair values. The fair values assigned to assets acquired and liabilities assumed were based on management's assumptions as of the reporting date. We have not yet finalized the purchase accounting as certain amounts are preliminary, specifically related to the valuation of intangible assets, and due to ongoing validation of acquired tangible assets and liabilities. The amounts reported below and in the Consolidated Statements of Income and Consolidated Balance Sheets represent our best estimate of the fair value based on information available to us at this time.

The table below summarizes the estimated fair value of assets acquired and liabilities assumed following the adjustments mentioned above (in thousands) as of the acquisition date:

	Amount
Cash and cash equivalents	$ 1,683
Accounts receivable	3,057
Inventory	2,643
Property, plant and equipment	696
Operating lease, right-of-use-assets	335
Prepaid expenses and other current assets	838
Tangible assets acquired	9,252
Customer deposits	(2,013)
Accounts payable and accrued liabilities	(1,235)
Operating lease liabilities	(335)
Deferred tax liabilities	(5,796)
Total tangible assets acquired and liabilities assumed	(127)
Intangible assets	17,550
Goodwill	10,148
Net assets acquired	$ 27,571

The intangible assets as of the closing date of the acquisition included (in thousands):

	Amount	Weighted Average Useful Life (in years)
Developed technologies	$ 12,626	8.0
Customer relationships	3,071	6.0
Order backlog	1,645	0.5
Trade names	208	2.0
Total intangible assets	$ 17,550	7.0

Indications of fair value of the intangible assets acquired in connection with the acquisition were determined using either the income, market or replacement cost methodologies. The intangible assets are being amortized over periods which reflect the pattern in which economic benefits of the assets are expected to be realized.

Identifiable Intangible Assets
Valuation of intangible assets involves multiple assumptions. The key assumptions are described below.

Developed technology acquired primarily consists of existing technology related to hybrid 3D surface metrology measurement equipment. We valued the developed technology using the multi-period excess earnings method under the income approach. Using this approach, the estimated fair values were calculated using expected future cash flows from specific products discounted to their net present values at an appropriate risk-adjusted rate of return.

Customer relationships represent the fair value of future projected revenues that will be derived from the sale of products to FRT's existing customers. We valued customer relationships using the incremental cash flow method. This method estimates value based on the incremental cash flow afforded by having the customers relationships in place on the acquisition date versus having no relationships in place and needing to replicate or replace those relationships. The incremental cash flows are then discounted to a present value to arrive at an estimate of fair value for this asset class.

Order backlog represents business under existing contractual obligations. Expected cash flow from order backlog was valued on a direct cash flow basis.

The identified trade names intangibles relate to the estimated fair value of future cash flows related to the FRT brand. We valued trade names by applying the relief-from-royalty method under the income approach. This method is based on the application of a royalty rate to forecasted revenue under the trade name.

Goodwill
The excess of purchase price over the fair value assigned to the assets acquired and liabilities assumed represents the amount of goodwill resulting from the acquisition. We believe the factors that contributed to goodwill include synergies that are specific to our consolidated business, such as cost savings and operational efficiencies, and the acquisition of a talented workforce that expands our expertise in business development and commercializing semiconductor test products, none of which qualify for recognition as a separate intangible asset. We do not expect any portion of this goodwill to be deductible for tax purposes. The goodwill attributable to the acquisition was recorded as a non-current asset and is not amortized, but is subject to an annual review for impairment.

The goodwill arising from the acquisition was allocated to the FRT reporting unit within the Systems reportable segment.

We have not presented unaudited combined pro forma financial information as the FRT acquisition was not significant to our consolidated results of operations and financial position.

Note 5—Debt

Our debt consisted of the following (in thousands):

	December 28, 2019	December 29, 2018
Term loans	$ 58,514	$ 65,000
Less unamortized issuance costs	(29)	(189)
Term loans less issuance costs	$ 58,485	$ 64,811

CMI Term Loan
On June 24, 2016, we entered into a Credit Agreement (the “Credit Agreement”) with HSBC Bank USA, National Association ("HSBC"), as administrative agent, co-lead arranger, sole bookrunner and syndication agent, other lenders that may from time-to-time be a party to the Credit Agreement, and certain guarantors. Pursuant to the Credit Agreement, the lenders have provided us with a senior secured term loan facility of $150 million (the “CMI Term Loan”). The proceeds of the CMI Term Loan were used to finance a portion of the purchase price paid in connection with the Cascade Microtech acquisition in fiscal 2016 and to pay related bank fees and expenses.

The CMI Term Loan bears interest at a rate equal to, at our option, (i) the applicable London Interbank Offered Rate ("LIBOR") rate plus 2.00% per annum or (ii) Base Rate (as defined in the Credit Agreement) plus 1.00% per annum. We have initially elected to pay interest at 2.00% over the one-month LIBOR rate. Interest payments are payable in quarterly installments over a five-year period. The interest rate at December 28, 2019 was 3.71%.

The principal payments on the CMI Term Loan are paid in equal quarterly installments that began June 30, 2016, in an annual amount equal to 5% for year one, 10% for year two, 20% for year three, 30% for year four and 35% for year five. In addition to quarterly installments, we made prepayments totaling $15.0 million in fiscal 2018 and $20.0 million in fiscal 2017. We did not make any prepayments in fiscal 2019. The planned final payment on the CMI Term Loan is scheduled for the third quarter of fiscal 2020.

On July 25, 2016, we entered into an interest-rate swap agreement with HSBC and other lenders to hedge the interest payments on the CMI Term Loan. See Note 7 for additional information.

The obligations under the CMI Term Loan are fully and unconditionally guaranteed by certain of our existing and subsequently acquired or organized direct and indirect domestic subsidiaries and are secured by a perfected first priority security interest in substantially all of our assets and the assets of those guarantors, subject to certain customary exceptions.

The CMI Term Loan contains negative covenants customary for financing of this type, including covenants that place limitations on the incurrence of additional indebtedness, the creation of liens, the payment of dividends; dispositions; fundamental changes, including mergers and acquisitions; loans and investments; sale leasebacks; negative pledges; transactions with affiliates; changes in fiscal year; sanctions and anti-bribery laws and regulations, and modifications to charter documents in a manner materially adverse to the Lenders. The CMI Term Loan also contains affirmative covenants and representations and warranties customary for financing of this type.

In addition, the CMI Term Loan contains financial maintenance covenants requiring:
- a ratio of total debt to earnings before interest, taxes, depreciation and amortization ("EBITDA") not in excess of 2.50 to 1.00; and
- a fixed charge coverage ratio of not less than 1.50 to 1.00, stepping down to 1.30 to 1.00 at the end of the fiscal quarter ended June 30, 2018 and to 1.20 to 1.00 at the end of the fiscal quarter ending June 30, 2019.

As of December 28, 2019, we were in compliance with all of the financial covenants.

The CMI Term Loan contains customary events of default, including (subject to certain materiality thresholds and grace periods) payment default, failure to comply with covenants, material inaccuracy of representation or warranty, bankruptcy or insolvency proceedings, change of control, certain material Employee Retirement Security Act ("ERISA") events and cross event of default and cross-acceleration in respect of other material debt.

FRT Term Loan
On October 25, 2019, we entered into a $23.4 million three-year credit facility loan agreement (the "FRT Term Loan") with HSBC Trinkaus & Burkhardt AG, Germany, to fund the acquisition of FRT GmbH, which we acquired on October 9, 2019. See Note 4 for further details of the acquisition.

The FRT Term Loan bears interest at a rate equal to the Euro Interbank Offered Rate ("EURIBOR") plus 1.75 % per annum and will be repaid in quarterly installments of approximately $1.9 million plus interest beginning January 25, 2020.

The obligations under the FRT Term Loan are fully and unconditionally guaranteed by FormFactor, Inc. The Credit Facility contains negative covenants customary for financing of this type, including covenants that place limitations on the incurrence of additional indebtedness, the creation of liens, the payment of dividends; dispositions; fundamental changes, including mergers and acquisitions; loans and investments; sale leasebacks; negative pledges; transactions with affiliates; changes in fiscal year; sanctions and anti-bribery laws and regulations, and modifications to charter documents in a manner materially adverse to the Lenders. The FRT Term Loan also contains affirmative covenants and representations and warranties customary for financing of this type.

Future principal and interest payments on our term loans as of December 28, 2019, based on the interest rate in effect at that date were as follows (in thousands):

	Payments Due In Fiscal Year			
	2020	2021	2022	Total
Term loans - principal payments	$ 42,838	$ 7,838	$ 7,838	$ 58,514
Term loans - interest payments[(1)]	777	155	47	979
Total	$ 43,615	$ 7,993	$ 7,885	$ 59,493

[(1)] Represents our minimum interest payment commitments at 1.35% per annum for the FRT Term Loan and 3.71% per annum for the CMI Term Loan.

Note 6—Leases

Adoption of New Accounting Standards

ASU 2016-02, ASU 2018-10, ASU 2018-11 and ASU 2019-01

In February 2016, the Financial Accounting Standards Board ("FASB") issued Accounting Standards Update ("ASU") 2016-02, "Leases (Topic 842)," which requires the recognition of right-of-use assets and lease liabilities for all long-term leases, including operating leases, on the balance sheet. ASU 2016-02 was amended in July 2018 by both ASU 2018-10, "Codification Improvements to Topic 842, Leases," and ASU 2018-11, "Leases (Topic 842): Targeted Improvements" and in March 2019 by ASU 2019-01, "Leases (Topic 842): Codification Improvements." ASU 2016-02, provides additional guidance on the measurement of the right-of-use assets and lease liabilities and requires enhanced disclosures about our leasing arrangements. Topic 842 replaced the prior existing lease accounting rules under Accounting Standards Codification 840, "Leases (Topic 840)."

We adopted Topic 842 and all related amendments on December 30, 2018, the first day of fiscal 2019, using the modified transition approach. The modified transition approach permits a company to use its effective date as the date of initial application to apply the standard to its leases, and, therefore, not restate comparative prior period financial information. Consequently, prior period financial information is not updated, and the disclosures required under the new standard will not be provided for dates and periods before December 30, 2018.

The standard provides several optional practical expedients in transition. We elected the "package of practical expedients," which permits us to not reassess, under the new standard, our prior conclusions about lease identification, lease classification and initial direct costs. We did not elect the use-of-hindsight or the practical expedient pertaining to land easements; the latter not being applicable to us. The new standard also provides practical expedients for an entity’s ongoing accounting. We elected the short-term lease recognition exemption. This means, for those leases that qualify, we will not recognize a right-of-use asset or lease liability, and this includes not recognizing right-of-use assets or lease liabilities for existing short-term leases of those assets in transition. We also elected the practical expedient to not separate lease and non-lease components for all our leases. The adoption of the lease standard did not have any effect on our previously reported Consolidated Statements of Income and did not result in a cumulative catch-up adjustment to opening equity.

Upon adoption, we recognized operating lease liabilities of approximately $40.0 million based on the present value of the remaining minimum rental payments. We also recognized corresponding operating lease, right-of-use-assets of approximately $35.7 million, net of deferred rent, which is classified separately in our Consolidated Balance Sheets.

These operating lease, right-of-use assets relate to real estate space under non-cancelable operating lease agreements for commercial and industrial space, as well as for our corporate headquarters located in Livermore, California. Our leases have remaining terms of 1 to 15 years, and some leases include options to extend up to 20 years. We also have operating leases for automobiles with remaining lease terms of 1 to 4 years. We did not include any of our renewal options in our lease terms for calculating our lease liability as the renewal options allow us to maintain operational flexibility and we are not reasonably certain we will exercise these options at this time. The weighted-average remaining lease term for our operating leases was 7 years at December 28, 2019 and the weighted-average discount rate was 4.70% based on our incremental borrowing rate as of the adoption date of Topic 842.

The components of lease expense for the year ended December 28, 2019 upon the adoption of ASC 842 were as follows (in thousands):

	Lease Expense
Operating lease expense	$ 6,985
Short-term lease expense	142
Variable lease expense	1,286
	$ 8,413

Rent expense under prior lease accounting rules (Topic 840) for fiscal 2018 and 2017 was $8.4 million and $7.9 million, respectively.

Future minimum payments under our non-cancelable operating leases under the new lease accounting rules (Topic 842) were as follows as of December 28, 2019 (in thousands):

Fiscal Year	Amount
2020	$ 7,387
2021	6,647
2022	5,477
2023	4,937
2024	4,770
Thereafter	22,165
Total minimum lease payments	51,383
Less: interest	(15,744)
Present value of net minimum lease payments	35,639
Less: current portion	(6,551)
Total long-term operating lease liabilities	$ 29,088

Future minimum payments under our non-cancelable operating leases under prior lease accounting rules (Topic 840) were as follows as of December 29, 2018 (in thousands):

Fiscal Year	Amount
2019	$ 6,256
2020	6,522
2021	5,742
2022	4,786
2023	4,355
Thereafter	20,382
	$ 48,043

Note 7—Derivative Financial Instruments

Foreign Exchange Derivative Contracts

We operate and sell our products in various global markets. As a result, we are exposed to changes in foreign currency exchange rates. We utilize foreign currency forward contracts to hedge against future movements in foreign exchange rates that affect certain existing foreign currency denominated assets and liabilities and forecasted foreign currency revenue and expense transactions. Under this program, our strategy is to have increases or decreases in our foreign currency exposures mitigated by gains or losses on the foreign currency forward contracts in order to mitigate the risks and volatility associated with foreign currency transaction gains or losses.

We do not use derivative financial instruments for speculative or trading purposes. For accounting purposes, certain of our foreign currency forward contracts are not designated as hedging instruments and, accordingly, we record the fair value of these contracts as of the end of our reporting period in our Consolidated Balance Sheets with changes in fair value recorded within Other income (expense), net in our Consolidated Statements of Income for both realized and unrealized gains and losses. Certain of our foreign currency forward contracts are designated as cash flow hedges, and, accordingly, we record the fair value of these contracts as of the end of our reporting period in our Consolidated Balance Sheets with changes in fair value recorded as a component of accumulated other comprehensive income (loss) and reclassified into earnings in the same period in which the hedged transaction affects earnings, and in the same line item on the Consolidated Statements of Income as the impact of the hedge transaction. At December 28, 2019, we expect to reclassify $0.1 million of the amount accumulated in other comprehensive income (loss) to earnings during the next 12 months, due to the recognition in earnings of the hedged forecasted transactions.

The fair value of our foreign exchange derivative contracts was determined based on current foreign currency exchange rates and forward points. All of our foreign exchange derivative contracts outstanding at December 28, 2019 will mature by the third quarter of fiscal 2020.

The following table provides information about our foreign currency forward contracts outstanding as of December 28, 2019 (in thousands):

Currency	Contract Position	Contract Amount (Local Currency)	Contract Amount (U.S. Dollars)
Euro	Buy	(3,367)	$ (3,932)
Japanese Yen	Sell	2,553,864	23,343
Korean Won	Buy	(2,669,885)	(2,304)
Total USD notional amount of outstanding foreign exchange contracts			$ 17,107

Our foreign currency contracts are classified within Level 2 of the fair value hierarchy as they are valued using pricing models that utilize observable market inputs.

The location and amount of gains (losses) related to non-designated derivative instruments in the Consolidated Statements of Income were as follows (in thousands):

Derivatives Not Designated as Hedging Instruments	Location of Gain (Loss) Recognized on Derivatives	Fiscal Year Ended December 28, 2019	December 29, 2018	December 30, 2017
Foreign exchange forward contracts	Other income (expense), net	$ 248	$ 906	$ (2,505)

The location and amount of gains (losses) related to derivative instruments designated as cash flow hedges on our Consolidated Statements of Income was as follows (in thousands):

	Amount of Loss Recognized in Accumulated OCI on Derivative	Location of Loss Reclassified from Accumulated OCI into Income	Amount of Loss Reclassified from Accumulated OCI into Income
Fiscal 2019	$ 93	Cost of revenues	$ 526
		Research and development	75
		Selling, general and administrative	172
			$ 773
Fiscal 2018	$ —		$ —

Interest Rate Swaps

Pursuant to our interest rate and risk management strategy, during fiscal 2016 we entered into an interest rate swap agreement with HSBC and other lenders to hedge the interest payments on the Term Loan for the notional amount of $95.6 million. As future levels of LIBOR over the life of the loan are uncertain, we entered into these interest-rate swap agreements to hedge the exposure in interest rate risks associated with the movement in LIBOR rates. By entering into the agreements, we convert a floating rate interest at one-month LIBOR plus 2.00% into a fixed rate interest at 2.94%. As of December 28, 2019, the notional amount of the loan that is subject to this interest rate swap was $22.5 million. See Note 5 for additional information.

For accounting purposes, the interest-rate swap contracts qualify for and are designated as cash flow hedges. All hedging relationships are formally documented, and the hedges are designed to offset changes to future cash flows on hedged transactions. We evaluate hedge effectiveness at hedge inception and on an ongoing basis. Amounts expected to be reclassified from Other comprehensive income (loss) into earnings in the next twelve months were insignificant at December 28, 2019.

The fair value of our interest rate swap contracts is determined at the end of each reporting period based on valuation models that use interest rate yield curves as inputs. For accounting purposes, our interest rate swap contracts qualify for, and are designated as, cash flow hedges. The cash flows associated with the interest rate swaps are reported in Net cash provided by operating activities in our Consolidated Statements of Cash Flows.

The estimated fair value of the interest rate swaps as of December 28, 2019 and December 29, 2018 was reported as a derivative asset of approximately $0.1 million and $0.9 million, respectively, within Prepaid expenses and other current assets and Other assets in our Consolidated Balance Sheets.

The impact of the interest rate swaps on the Consolidated Statements of Income was as follows (in thousands):

	Amount of Gain or (Loss) Recognized in OCI on Derivative (Effective Portion)	Location of Gain or (Loss) Reclassified from Accumulated OCI into Income (Effective Portion)	Amount of Gain or (Loss) Reclassified from Accumulated OCI into Income (Effective Portion)	Location of Gain or (Loss) Recognized in Income on Derivative (Ineffective Portion)	Amount of Gain or (Loss) Recognized in Income on Derivative (Ineffective Portion)
Fiscal 2019	$ (86)	Other income (expense), net	$ 548	Other income (expense), net	$ —
Fiscal 2018	$ 340	Other income (expense), net	$ 721	Other income (expense), net	$ —
Fiscal 2017	$ 287	Other income (expense), net	$ 84	Other income (expense), net	$ 29

See also Note 8.

Note 8—Fair Value

Whenever possible, the fair values of our financial assets and liabilities are determined using quoted market prices of identical securities or quoted market prices of similar securities from active markets. The three levels of inputs that may be used to measure fair value are as follows:

- Level 1 valuations are obtained from real-time quotes for transactions in active exchange markets involving identical securities;
- Level 2 valuations utilize significant observable inputs, such as quoted prices for similar assets or liabilities, quoted prices near the reporting date in markets that are less active, or other inputs that are observable or can be corroborated by observable market data for substantially the full term of the assets or liabilities; and
- Level 3 valuations utilize unobservable inputs to the valuation methodology and include our own data about assumptions market participants would use in pricing the asset or liability based on the best information available under the circumstances.

We did not have any transfers of assets or liabilities measured at fair value on a recurring basis to or from Level 1, Level 2 or Level 3 during fiscal 2019, 2018 or 2017.

The carrying values of Cash, Accounts receivable, net, Restricted cash, Prepaid expenses and other current assets, Accounts payable, Accrued liabilities, and short-term Term loan approximate fair value due to their short maturities.

No changes were made to our valuation techniques during fiscal 2019.

Cash Equivalents
The fair value of our cash equivalents is determined based on quoted market prices for similar or identical securities.

Marketable Securities

We classify our marketable securities as available-for-sale and value them utilizing a market approach. Our investments are priced by pricing vendors who provide observable inputs for their pricing without applying significant judgment. Broker pricing is used mainly when a quoted price is not available, the investment is not priced by our pricing vendors or when a broker price is more reflective of fair value. Our broker-priced investments are categorized as Level 2 investments because fair value is based on similar assets without applying significant judgments. In addition, all of our investments have a sufficient level of trading volume to demonstrate that the fair value is appropriate.

Contingent Consideration

Contingent consideration, arising from the acquisition of FRT (see Note 4), is a cash amount equal to 1.5x EBIT as defined in the purchase agreement, up to a maximum of €10.3 million, payable subject to the performance of the acquired business in calendar 2020. We estimated the fair value of contingent consideration using a probability weighted approach. Key assumptions in determining the fair value of contingent consideration include estimating the probability of achieving certain EBIT levels and discounting at an appropriate discount rate. There was no change in the value of contingent consideration since the acquisition of FRT and as of December 28, 2019.

Assets and liabilities Measured at Fair Value on a Recurring Basis

Assets and liabilities measured at fair value on a recurring basis were as follows (in thousands):

December 28, 2019	**Level 1**	**Level 2**	**Level 3**	**Total**
Assets:				
Cash equivalents:				
Money market funds	$ 17,056	$ —	$ —	$ 17,056
Marketable securities:				
U.S. Treasuries	10,468	—	—	10,468
Certificates of deposit	—	3,590	—	3,590
Agency securities	—	24,430	—	24,430
Corporate bonds	—	33,928	—	33,928
Commercial paper	—	3,911	—	3,911
	10,468	65,859	—	76,327
Foreign exchange derivative contracts	—	41	—	41
Interest rate swap derivative contracts	—	26	—	26
Total assets	$ 27,524	$ 65,926	$ —	$ 93,450
Liabilities:				
Foreign exchange derivative contracts	$ —	$ (240)	$ —	$ (240)
Contingent consideration	—	—	(5,364)	(5,364)
Total liabilities	$ —	$ (240)	$ (5,364)	$ (5,604)

December 29, 2018	**Level 1**	**Level 2**	**Total**
Assets:			
Cash equivalents:			
Money market funds	$ 1,184	$ —	$ 1,184
Marketable securities:			
U.S. Treasuries	7,997	—	7,997
Certificates of deposit	—	957	957
Agency securities	—	8,608	8,608
Corporate bonds	—	30,674	30,674
Commercial paper	—	2,295	2,295
	7,997	42,534	50,531
Interest rate swap derivative contracts	—	871	871
Total assets	$ 9,181	$ 43,405	$ 52,586

We did not have any liabilities measured at fair value on a recurring basis at December 29, 2018.

Assets and Liabilities Measured at Fair Value on a Non-Recurring Basis
We measure and report goodwill and intangible assets at fair value on a non-recurring basis if we determine these assets to be impaired or in the period when we make a business acquisition. Other than as discussed in Note 4, there were no assets or liabilities measured at fair value on a nonrecurring basis during fiscal 2019, 2018 or 2017.

Note 9—Goodwill and Intangible Assets

Goodwill
Goodwill by reportable segment was as follows (in thousands):

	Probe Cards	Systems	Total
Goodwill, gross, as of December 31, 2016	$ 172,482	$ 15,528	$ 188,010
Foreign currency translation	—	1,910	1,910
Goodwill, gross, as of December 30, 2017	172,482	17,438	189,920
Foreign currency translation	—	(706)	(706)
Goodwill, gross, as of December 29, 2018	172,482	16,732	189,214
Additions - FRT GmbH acquisition	—	10,148	10,148
Foreign currency translation	—	(166)	(166)
Goodwill, gross, as of December 28, 2019	$ 172,482	$ 26,714	$ 199,196

We have not recorded any goodwill impairments as of December 28, 2019.

Intangible Assets
Intangible assets were as follows (in thousands):

	December 28, 2019			December 29, 2018		
Other Intangible Assets	**Gross**	**Accumulated Amortization**	**Net**	**Gross**	**Accumulated Amortization**	**Net**
Existing developed technologies	$ 154,951	$ 116,138	$ 38,813	$ 143,408	$ 97,111	$ 46,297
Trade name	7,816	6,976	840	12,023	9,173	2,850
Customer relationships	44,229	27,057	17,172	40,146	21,653	18,493
Backlog	1,676	891	785	—	—	—
	$ 208,672	$ 151,062	$ 57,610	$ 195,577	$ 127,937	$ 67,640

During fiscal 2019, we disposed of certain fully amortized trade names.

Amortization expense was included in our Consolidated Statements of Income as follows (in thousands):

	Fiscal Year Ended		
	December 28, 2019	**December 29, 2018**	**December 30, 2017**
Cost of revenues	$ 20,036	$ 20,530	$ 22,800
Selling, general and administrative	7,636	8,843	8,140
	$ 27,672	$ 29,373	$ 30,940

The estimated future amortization of intangible assets is as follows (in thousands):

Fiscal Year	Amount
2020	$ 26,270
2021	14,739
2022	5,553
2023	3,813
2024	2,073
Thereafter	5,162
Total	$ 57,610

We did not record any impairment of intangible assets in fiscal 2019, 2018 and 2017.

Note 10—Commitments and Contingencies

Leases
See Note 6.

Environmental Matters
We are subject to U.S. federal, state, local, and foreign governmental laws and regulations relating to the protection of the environment, including those governing the discharge of pollutants into the air and water, the management and disposal of hazardous substances and wastes, the clean-up of contaminated sites and the maintenance of a safe workplace. We believe that we comply in all material respects with the environmental laws and regulations that apply to us. We did not receive any notices of violations of environmental laws and regulations in fiscal 2019, 2018 or 2017. In the future, we may receive notices of violations of environmental regulations, or otherwise learn of such violations. Environmental contamination or violations may negatively impact our business.

Indemnification Arrangements
We have entered, and may from time to time in the ordinary course of our business enter, into contractual arrangements with third parties that include indemnification obligations. Under these contractual arrangements, we have agreed to defend, indemnify and/or hold the third party harmless from and against certain liabilities. These arrangements include indemnities in favor of customers in the event that our products or services infringe a third party's intellectual property or cause property or other indemnities in favor of our lessors in connection with facility leasehold liabilities that we may cause. In addition, we have entered into indemnification agreements with our directors and certain of our officers, and our bylaws contain indemnification obligations in favor of our directors, officers and agents. These indemnity arrangements may limit the type of the claim, the total amount that we can be required to pay in connection with the indemnification obligation and the time within which an indemnification claim can be made. The duration of the indemnification obligation may vary, and for most arrangements, survives the agreement term and is indefinite. We believe that substantially all of our indemnity arrangements provide either for limitations on the maximum potential future payments we could be obligated to make, or for limitations on the types of claims and damages we could be obligated to indemnify, or both. However, it is not possible to determine or reasonably estimate the maximum potential amount of future payments under these indemnification obligations due to the varying terms of such obligations, a lack of history of prior indemnification claims, the unique facts and circumstances involved in each particular contractual arrangement and in each potential future claim for indemnification, and the contingency of any potential liabilities upon the occurrence of events that are not reasonably determinable. We have not had any material requests for indemnification under these arrangements. We have not recorded any liabilities for these indemnification arrangements on our Consolidated Balance Sheets as of December 28, 2019 or December 29, 2018.

Legal Matters
From time to time, we may be subject to legal proceedings and claims in the ordinary course of business. As of December 28, 2019, and as of the filing of these financial statements, we were not involved in any material legal proceedings. In the future, we may become a party to additional legal proceedings that may require us to spend significant resources. Litigation can be expensive and disruptive to normal business operations. The results of legal proceedings are difficult to predict, and the costs incurred in litigation can be substantial, regardless of outcome.

Note 11—Stockholders' Equity

Preferred Stock
We have authorized 10,000,000 shares of undesignated preferred stock, $0.001 par value, none of which is issued and outstanding. Our Board of Directors shall determine the rights, preferences, privileges and restrictions of the preferred stock, including dividends rights, conversion rights, voting rights, terms of redemption, liquidation preferences, sinking fund terms and the number of shares constituting any series or the designation of any series.

Common Stock
Each share of common stock has the right to one vote. The holders of common stock are also entitled to receive dividends whenever funds are legally available and when declared by the Board of Directors, subject to the prior rights of holders, if any, of all classes of stock outstanding having priority rights as to dividends. No dividends have been declared or paid as of December 28, 2019.

Common Stock Repurchase Program
In February 2017, our Board of Directors authorized a program to repurchase up to $25 million of outstanding common stock to offset potential dilution from issuances of common stock under our stock-based incentive plans. The share repurchase program expired on February 1, 2020. During fiscal 2019 and 2018, we did not repurchase any shares. During fiscal 2017, we repurchased 1,367,617 shares of common stock for $19.0 million.

Equity Incentive Plan
We currently grant equity-based awards under our Equity Incentive Plan, as amended (the "2012 Plan") which was approved by our stockholders. As amended, the 2012 Plan has authorized for issuance a total of 15.0 million shares, 4.6 million of which were available for grant as of December 28, 2019.

RSUs granted under the 2012 Plan generally vest over three years in annual tranches, though we have granted, and will continue to grant, such awards that vest over a shorter term for employee retention purposes.

The 2012 Plan provides that incentive stock options may be granted to our employees and nonqualified stock options, and all awards other than incentive stock options, may be granted to employees, directors and consultants. The exercise price of incentive stock options must be at least equal to the fair market value of our common stock on the date of grant. All restricted stock units and options granted under the 2012 Plan generally vest over three years and expire after seven years, unless otherwise determined by the Compensation Committee of the Board of Directors.

Stock Options
Stock option activity was as follows:

	Outstanding Options			
	Number of Shares	Weighted Average Exercise Price	Weighted Average Remaining Contractual Life in Years	Aggregate Intrinsic Value
Outstanding at December 29, 2018	524,725	$ 8.00		
Options exercised	(162,956)	7.21		
Outstanding at December 28, 2019	361,769	$ 8.35	2.16	$ 6,400,367
Vested and expected to vest at December 28, 2019	361,769	$ 8.35	2.16	$ 6,400,367
Exercisable at December 28, 2019	361,769	$ 8.35	2.16	$ 6,400,367

Restricted Stock Units

RSUs, including Performance Restricted Stock Units ("PRSUs") are converted into shares of our common stock upon vesting on a one-for-one basis. The vesting of RSUs is subject to the employee's continuing service. RSU activity was as follows:

	Number of Shares	Weighted Average Grant Date Fair Value
Restricted stock units at December 29, 2018	3,102,226	$ 12.79
Granted	1,510,211	15.12
Vested	(1,391,373)	11.91
Canceled	(152,064)	13.47
Restricted stock units at December 28, 2019	3,069,000	14.30

The PRSUs granted in fiscal 2019, 2018 and 2017 listed below vest based on us achieving certain market performance criteria. The performance criteria are based on a metric called Total Shareholder Return ("TSR") for the performance period of two or three years, relative to the TSR of the companies identified as being part of the S&P Semiconductor Select Industry Index (FormFactor peer companies) as of a specific date.

Of the 195,000 PRSUs granted in fiscal 2016, 60,000 shares were forfeited. Therefore, 135,000 shares vested in fiscal 2019. These shares achieved 119.7% TSR performance, which resulted in 161,595 shares released in 2019.

PRSU grant activity was as follows:

	Fiscal Year Ended		
	December 28, 2019	December 29, 2018	December 30, 2017
Grant Date	June 4, 2019	August 16, 2018	July 20, 2017
Performance period	July 1, 2019 - June 30, 2022	July 1, 2018 - June 30, 2021	July 1, 2017 - June 30, 2020
Number of shares	273,000	318,100	333,333
TSR as-of date	June 4, 2019	August 16, 2018	July 1, 2017
Stock-based compensation	$4.4 million	$4.7 million	$4.1 million

Employee Stock Purchase Plan

Our 2012 Employee Stock Purchase Plan (the "ESPP"), as amended, allows for the issuance of a total of 7,000,000 shares. The offering periods under the ESPP are 12 months commencing on February 1 of each calendar year and ending on January 31 of the subsequent calendar year, and a six-month fixed offering period commencing on August 1 of each calendar year and ending on January 31 of the subsequent calendar year. The 12-month offering period consists of two six-month purchase periods and the six-month offering period consists of one six-month purchase period. The price of the common stock purchased is 85% of the lesser of the fair market value of the common stock on the first day of the applicable offering period or the last day of each purchase period.

During fiscal 2019, employees purchased 544,271 shares under this program at a weighted average exercise price of $12.51 per share, which represented a weighted average discount of $3.40 per share from the fair value of the stock purchased. As of December 28, 2019, 2,657,222 shares remained available for issuance.

Note 12—Stock-Based Compensation

Stock-Based Compensation Expense

Certain information regarding our stock-based compensation was as follows (in thousands, except per share amounts):

	Fiscal Year Ended		
	December 28, 2019	December 29, 2018	December 30, 2017
Weighted average grant date per share fair value of RSUs granted	$ 15.12	$ 13.79	$ 13.20
Total intrinsic value of stock options exercised	1,814	631	5,946
Fair value of RSUs vested	$ 23,450	$ 17,541	$ 18,339

Stock-based compensation expense was included in the Consolidated Statements of Income as follows (in thousands):

	Fiscal Year Ended		
	December 28, 2019	December 29, 2018	December 30, 2017
Stock-based compensation expense included in:			
Cost of revenues	$ 4,055	$ 3,525	$ 3,539
Research and development	6,367	5,398	5,341
Selling, general and administrative	12,754	8,904	7,459
Total stock-based compensation	$ 23,176	$ 17,827	$ 16,339

Unrecognized Stock-Based Compensation Expense

Unrecognized stock-based compensation expense at December 28, 2019 consisted of the following (in thousands):

	Unrecognized Expense	Weighted Average Recognition Period (Years)
Restricted stock units	$ 24,038	1.9
Performance restricted stock units	6,570	2.0
Employee stock purchase plan	287	0.1
Total unrecognized stock-based compensation expense	$ 30,895	1.9

Valuation Assumptions

The following assumptions were used in estimating the fair value of PRSUs:

	Fiscal Year Ended		
	December 28, 2019	December 29, 2018	December 30, 2017
PRSUs:			
Dividend yield	— %	— %	— %
Expected volatility	47.34%	45.61%	45.99%
Risk-free interest rate	1.83%	2.67%	1.50%
Expected life (in years)	3.07	2.87	2.95

The following assumptions were used in estimating the fair value of shares under the Employee Stock Purchase Plan:

	Fiscal Year Ended		
	December 28, 2019	December 29, 2018	December 30, 2017
Employee Stock Purchase Plan:			
Dividend yield	— %	— %	— %
Expected volatility	36.60% - 59.51%	44.85% - 48.94%	46.20% - 46.33%
Risk-free interest rate	2.04% - 2.46%	0.83% - 2.22%	0.65% - 1.15%
Expected life (in years)	0.5 - 1.0	0.5 - 1.0	0.5 - 1.0

Note 13—Income Taxes

Components of Income Before Income Taxes

The components of income before income taxes were as follows (in thousands):

	Fiscal Year Ended		
	December 28, 2019	December 29, 2018	December 30, 2017
United States	$ 41,115	$ 20,877	$ 31,492
Foreign	9,948	13,050	10,714
	$ 51,063	$ 33,927	$ 42,206

Provision for Income Taxes

The components of the provision (benefit) for income taxes are as follows (in thousands):

	Fiscal Year Ended		
	December 28, 2019	December 29, 2018	December 30, 2017
Current provision (benefit):			
Federal	$ 179	$ 79	$ (2,130)
State	2,302	388	17
Foreign	4,202	4,687	4,069
	6,683	5,154	1,956
Deferred provision (benefit):			
Federal	8,128	(72,295)	66
State	(1,898)	(2,056)	—
Foreign	(1,196)	(912)	(729)
	5,034	(75,263)	(663)
Total provision (benefit) for income taxes	$ 11,717	$ (70,109)	$ 1,293

Tax Rate Reconciliation

The following is a reconciliation of the difference between income taxes computed by applying the federal statutory rate of 21% and the provision (benefit) from income taxes for fiscal 2019 and 2018 and applying the federal statutory rate of 35% and the provision for income taxes for 2017 (in thousands):

	Fiscal Year Ended		
	December 28, 2019	December 29, 2018	December 30, 2017
U.S. statutory federal tax rate	$ 10,723	$ 7,125	$ 14,772
State taxes, net of federal benefit	441	778	951
Stock-based compensation	(911)	(453)	(1,428)
Research and development credits	(6,436)	(3,213)	(1,979)
Foreign taxes at rates different than the U.S.	1,454	1,287	(271)
Other permanent differences	(148)	152	160
Global intangible low-taxed income	1,369	1,828	—
Mandatory deemed repatriation	—	—	1,655
Change in valuation allowance	2,567	(75,803)	(12,207)
Other	2,658	(1,810)	(360)
Total	$ 11,717	$ (70,109)	$ 1,293

Deferred Tax Assets and Liabilities

Deferred tax assets and liabilities are recognized for the future tax consequences of differences between the carrying amounts of assets and liabilities and their respective tax basis using enacted tax rates in effect for the year in which the differences are expected to be reversed.

Significant deferred tax assets and liabilities consisted of the following (in thousands):

	As of	
	December 28, 2019	December 29, 2018
Tax credits	$ 44,696	$ 39,586
Inventory reserve	12,350	10,850
Other reserves and accruals	5,852	5,398
Non-statutory stock options	2,982	2,722
Depreciation and amortization	27,758	1,979
Net operating loss carryforwards	21,410	61,275
Gross deferred tax assets	115,048	121,810
Valuation allowance	(36,604)	(34,037)
Total deferred tax assets	78,444	87,773
Acquired intangibles and fixed assets	(13,997)	(12,667)
Unrealized investment gains	(106)	(107)
Tax on undistributed earnings	(75)	(53)
Total deferred tax liabilities	(14,178)	(12,827)
Net deferred tax assets	$ 64,266	$ 74,946

We are required to evaluate the realizability of our deferred tax assets in both our U.S. and non-U.S. jurisdictions on an ongoing basis to determine whether there is a need for a valuation allowance with respect to such deferred tax assets. From the fourth quarter of fiscal 2009 to the third quarter of fiscal 2018, we maintained a 100% valuation allowance against most of our U.S. deferred tax assets because there was insufficient positive evidence to overcome the existing negative evidence such that it was not more likely than not that the U.S. deferred tax assets were realizable. While we reported U.S. pre-tax income in fiscal 2015 and fiscal 2017, because we reported U.S. pre-tax losses during the previous seven fiscal years, we continued to maintain the 100% valuation allowance through the third quarter of fiscal 2018.

As of December 29, 2018, we had reported positive operating performance in the U.S. for two consecutive fiscal years and had also reported a cumulative three-year U.S. pre-tax profit. In addition, during the fourth quarter of fiscal 2018, we completed our financial plan for fiscal 2019 and expected continued positive operating performance in the U.S. We also considered forecasts of future taxable income and evaluated the utilization of net operating losses and tax credit carryforwards prior to their expiration. After considering these factors, we determined that the positive evidence overcame any negative evidence and concluded that it was more likely than not that the U.S. deferred tax assets were realizable. As a result, we released the valuation allowance against a significant portion of the U.S. federal deferred tax assets and a portion of the U.S. state deferred tax assets during the fourth quarter of fiscal 2018.

The valuation allowance decreased by $75.8 million in fiscal 2018, primarily due to the release of the valuation allowance on U.S. deferred tax assets. As of December 28, 2019, we maintained a valuation allowance of $36.6 million, primarily related to California deferred tax assets and foreign tax credit carryovers, due to uncertainty about the future realization of these assets.

Tax Credits and Carryforwards

Tax credits and carryforwards available to us at December 28, 2019 consisted of the following (in thousands):

	Amount	Latest Expiration Date
Federal research and development tax credit	$ 37,494	2021-2039
Federal net operating loss carryforwards	14,589	2031-2035
Foreign tax credit carryforwards	1,134	2020-2027
Alternative minimum tax credits	195	Indefinite
California research credits	39,228	Indefinite
State net operating loss carryforwards	243,934	2024-2036
Singapore net operating loss carryforwards	$ 8,340	Indefinite

Undistributed Earnings

As of December 28, 2019, unremitted earnings of foreign subsidiaries was estimated at $26.1 million. We intend to permanently invest $12.0 million of undistributed earnings indefinitely outside of the U.S. To the extent we repatriate the remaining $14.1 million of undistributed foreign earnings to the U.S., we established a deferred tax liability of $0.1 million for foreign withholding taxes.

Unrecognized Tax Benefits

We recognize the benefits of tax return positions if we determine that the positions are “more-likely-than-not” to be sustained by the taxing authority. Interest and penalties accrued on unrecognized tax benefits are recorded as tax expense in the period incurred.

The following table reflects changes in the unrecognized tax benefits (in thousands):

	Fiscal Year Ended		
	December 28, 2019	December 29, 2018	December 30, 2017
Unrecognized tax benefit, beginning balance	$ 25,224	$ 18,296	$ 17,978
Additions based on tax positions related to the current year	3,679	1,677	694
Additions based on tax positions from prior years	—	5,332	—
Reductions for tax positions of prior years	(5)	(7)	—
Reductions due to lapse of the applicable statute of limitations	(98)	(74)	(376)
Unrecognized tax benefit, ending balance	$ 28,800	$ 25,224	$ 18,296
Interest and penalties recognized as a component of Provision (benefit) for income taxes	$ 59	$ 71	$ 67
Interest and penalties accrued at period end	212	230	218

Of the unrecognized tax benefits at December 28, 2019, $13.4 million would impact the effective tax rate if recognized.

The amount of income taxes we pay is subject to ongoing audits by federal, state and foreign tax authorities which might result in proposed assessments. Our estimate for the potential outcome for any uncertain tax issue is judgmental in nature. However, we believe we have adequately provided for any reasonably foreseeable outcome related to those matters. Our future results may include favorable or unfavorable adjustments to our estimated tax liabilities in the period the assessments are made or resolved or when statutes of limitation on potential assessments expire. As of December 28, 2019, changes to our uncertain tax positions in the next 12 months that are reasonably possible are not expected to have a significant impact on our financial position or results of operations.

At December 28, 2019, our tax years 2016 through 2019, 2015 through 2019 and 2014 through 2019, remain open for examination in the federal, state and foreign jurisdictions, respectively. However, to the extent allowed by law, the taxing authorities may have the right to examine prior periods where net operating losses and credits were generated and carried forward, and make adjustments up to the net operating loss and credit carryforward amounts.

Tax Cuts and Jobs Act of 2017

The Tax Act was enacted in December 2017. The Tax Act significantly changes U.S. tax law effective January 1, 2018 by, among other things, lowering U.S. corporate income tax rates from 35% to 21%, repealing corporate alternative minimum tax, implementing a territorial tax system and imposing a one-time transition tax on deemed repatriated earnings of foreign subsidiaries.

The Tax Act provided for the repeal of corporate alternative minimum tax and made AMT tax credits fully refundable in future years. As a result, we reassessed the realizability of our deferred tax assets and released the valuation allowance against $0.8 million of AMT tax credits at December 30, 2017.

Deferred tax assets and liabilities are measured using enacted tax rates expected to apply to taxable income in the years in which those temporary differences are expected to reverse. As a result of the reduction in the U.S. corporate income tax rate, we revalued our ending U.S. deferred tax assets at December 30, 2017, offset by a corresponding change in the U.S. valuation allowance with no material impact to the fiscal 2017 tax provision.

The Tax Act provided for a one-time transition tax on the deemed repatriation of post-1986 undistributed foreign subsidiary earnings and profits (“E&P”). The estimated tax effects of the provisional income inclusion of $15.7 million for the deemed repatriation transition tax was fully offset by the benefit of current and carryforward foreign tax credits previously subjected to a full valuation allowance. We paid no U.S. federal cash taxes on the deemed repatriation. The deemed repatriation of undistributed foreign earnings also resulted in a reassessment of the permanent reinvestment of undistributed foreign earnings and profits and we established a deferred tax liability of $66 thousand for withholding taxes associated with those earnings which were not permanently reinvested as of December 30, 2017.

The SEC staff issued Staff Accounting Bulletin No. 118 (“SAB 118”) to address the application of U.S. GAAP in situations when a registrant does not have the necessary information available, prepared, or analyzed (including computations) in reasonable detail to complete the accounting for certain income tax effects of the Tax Act and allows the registrant to record provisional amounts during a measurement period not to extend beyond one year of the enactment date. We recognized the provisional impacts related to the one-time transition tax, the revaluation of deferred tax balances and reassessment of the realizability of deferred tax assets and included these estimates in our consolidated financial statements for the year ended December 30, 2017. We completed our analysis within the measurement period in accordance with SAB 118 and did not have a material impact to our consolidated financial statements.

Note 14—Employee Benefit Plans

We have an employee savings plan that qualifies as a deferred salary arrangement under Section 401(k) of the Internal Revenue Code. The plan is designed to provide employees with an accumulation of funds for retirement on a tax-deferred basis and provide for annual discretionary employer contributions. The total charge to net Income under the 401(k) plan for fiscal 2019, 2018 and 2017 aggregated $2.1 million, $2.0 million and $1.9 million, respectively.

Note 15—Segments and Geographic Information

We operate in two reportable segments consisting of the Probe Cards Segment and the Systems Segment.

Our chief operating decision maker ("CODM") is our Chief Executive Officer, who reviews operating results to make decisions about allocating resources and assessing performance for the entire company.

The following table summarizes the operating results by reportable segment (dollars in thousands):

	Fiscal 2019			
	Probe Cards	Systems	Corporate and Other	Total
Revenues	$ 491,363	$ 98,101	$ —	$ 589,464
Gross profit	$ 211,382	$ 50,927	$ (24,813)	$ 237,496
Gross margin	43.0 %	51.9 %	— %	40.3 %

	Fiscal 2018			
	Probe Cards	Systems	Corporate and Other	Total
Revenues	$ 434,269	$ 95,406	$ —	$ 529,675
Gross profit	$ 187,320	$ 47,074	$ (24,055)	$ 210,339
Gross margin	43.1 %	49.3 %	— %	39.7 %

	Fiscal 2017			
	Probe Cards	Systems	Corporate and Other	Total
Revenues	$ 454,794	$ 93,647	$ —	$ 548,441
Gross profit	$ 195,903	$ 46,647	$ (26,953)	$ 215,597
Gross margin	43.1 %	49.8%	— %	39.3 %

Operating results provide useful information to our management for assessment of our performance and results of operations. Certain components of our operating results are utilized to determine executive compensation along with other measures.

Corporate and Other includes unallocated expenses relating to amortization of intangible assets, share-based compensation expense, acquisition-related costs, including charges related to inventory stepped up to fair value, and other costs, which are not used in evaluating the results of, or in allocating resources to, our reportable segments. Acquisition-related costs include transaction costs and any costs directly related to the acquisition and integration of acquired businesses.

The following table summarizes revenue, by geographic region, as a percentage of total revenues based upon ship-to location:

	Fiscal Year Ended		
	December 28, 2019	December 29, 2018	December 30, 2017
United States	26.3 %	25.2 %	34.0 %
South Korea	19.8	17.2	14.9
China	18.0	14.7	11.1
Taiwan	14.7	20.3	17.7
Japan	8.9	9.4	8.1
Europe	7.0	7.5	8.2
Asia-Pacific (1)	3.7	4.9	5.5
Rest of the world	1.6	0.8	0.5
Total Revenues	100.0 %	100.0 %	100.0 %

(1)Asia-Pacific includes all countries in the region except Taiwan, South Korea, China, and Japan, which are disclosed separately.

The following table summarizes revenue by market (in thousands):

	Fiscal Year Ended		
	December 28, 2019	December 29, 2018	December 30, 2017
Foundry & Logic	$ 318,552	$ 258,459	$ 313,714
DRAM	147,257	135,333	124,685
Flash	25,554	40,477	16,395
Systems	98,101	95,406	93,647
Total revenues	$ 589,464	$ 529,675	$ 548,441

The following table summarizes revenue by timing of revenue recognition (in thousands):

	Fiscal Year Ended								
	December 28, 2019			December 29, 2018			December 30, 2017		
	Probe Cards	Systems	Total	Probe Cards	Systems	Total	Probe Cards	Systems	Total
Products transferred at a point in time	$ 488,925	$ 93,837	$ 582,762	$ 432,033	$ 91,514	$ 523,547	$ 452,946	$ 90,107	$ 543,053
Services transferred over time	2,438	4,264	6,702	2,236	3,892	6,128	1,848	3,540	5,388
Total	$ 491,363	$ 98,101	$ 589,464	$ 434,269	$ 95,406	$ 529,675	$ 454,794	$ 93,647	$ 548,441

Long-lived assets, comprised of Operating lease, right-of-use-assets, Property, plant and equipment, net, Goodwill and Intangibles, net, reported based on the location of the asset was as follows (in thousands):

	December 28, 2019	December 29, 2018	December 30, 2017
United States	$ 287,600	$ 280,405	$ 299,574
Europe	52,309	26,118	30,922
Asia-Pacific	7,064	4,385	3,662
Total	$ 346,973	$ 310,908	$ 334,158

Note 16—Selected Quarterly Financial Data (Unaudited)

The following selected quarterly financial data should be read in conjunction with our consolidated financial statements and the related notes and Item 7: Management's Discussion and Analysis of Financial Condition and Results of Operations. This information has been derived from our unaudited consolidated financial statements that, in our opinion, reflect all recurring adjustments necessary to fairly present this information when read in conjunction with our consolidated financial statements and the related notes. The results of operations for any quarter are not necessarily indicative of the results to be expected for any future period.

	Fiscal Quarters Ended							
	Dec. 28, 2019	Sep. 28, 2019	June 29, 2019	March 30, 2019	Dec. 29, 2018(1)	Sep. 29, 2018	June 30, 2018	March 31, 2018
	(in thousands, except per share data)							
Revenues	$ 178,629	$ 140,604	$ 138,018	$ 132,213	$ 140,887	$ 134,989	$ 135,509	$ 118,290
Cost of revenues	104,324	85,286	82,666	79,692	84,865	82,019	79,291	73,161
Gross profit	74,305	55,318	55,352	52,521	56,022	52,970	56,218	45,129
Operating Expenses:								
Research and development	21,606	20,096	20,074	19,723	18,398	18,857	19,675	18,046
Selling, general and administrative	28,981	25,887	26,283	25,184	25,828	24,745	25,232	23,449
Total operating expenses	50,587	45,983	46,357	44,907	44,226	43,602	44,907	41,495
Operating income	23,718	9,335	8,995	7,614	11,796	9,368	11,311	3,634
Interest income	726	724	684	580	404	369	326	257
Interest expense	(376)	(422)	(522)	(595)	(660)	(777)	(910)	(967)
Other income (expense), net	379	226	81	(84)	117	121	50	(512)
Income before income taxes	24,447	9,863	9,238	7,515	11,657	9,081	10,777	2,412
Provision (benefit) for income taxes	5,811	1,584	2,290	2,032	(73,443)	1,393	1,654	287
Net income	$ 18,636	$ 8,279	$ 6,948	$ 5,483	$ 85,100	$ 7,688	$ 9,123	$ 2,125
Net income per share:(2)								
Basic	$ 0.25	$ 0.11	$ 0.09	$ 0.07	$ 1.15	$ 0.10	$ 0.12	$ 0.03
Diluted	$ 0.24	$ 0.11	$ 0.09	$ 0.07	$ 1.13	$ 0.10	$ 0.12	$ 0.03
Weighted average number of shares used in per share calculations:								
Basic	75,731	75,280	74,478	74,362	74,108	73,837	73,157	72,826
Diluted	78,055	77,291	76,189	76,009	75,416	74,962	74,533	74,342

(1) In the fourth quarter of fiscal 2018, the tax benefit included a $75.8 million benefit from a valuation allowance release against certain U.S. deferred tax assets.
(2) Quarterly net income per share amounts may not add to the yearly totals due to rounding.

Note 17—New Accounting Pronouncements

ASU 2018-15
In August 2018, the Financial Accounting Standard Board ("FASB") issued Accounting Standards Update ("ASU") 2018-15, "Intangibles-Goodwill and Other-Internal-Use Software (Subtopic 350-40): Customer’s Accounting for Implementation Costs Incurred in a Cloud Computing Arrangement That Is a Service Contract." The new guidance clarifies the accounting for implementation costs in cloud computing arrangements. ASU 2018-15 is effective for fiscal years, including interim periods within those fiscal years, beginning after December 15, 2019. Early adoption is permitted. ASU 2018-15 should be applied

either retrospectively or prospectively to all implementation costs incurred after the date of adoption. We have not yet determined the impact of this standard on our financial statements.

ASU 2016-13
In June 2016, the FASB issued ASU No. 2016-13, "Measurement of Credit Losses on Financial Instruments" (Topic 326). The provisions of this standard require financial assets measured at amortized cost to be presented at the net amount expected to be collected. An allowance account would be established to present the net carrying value at the amount expected to be collected. ASU 2016-13 also provides that credit losses relating to available-for-sale debt securities should be recorded through an allowance for credit losses. The guidance was amended through various ASU's subsequent to ASU 2016-13, all of which will be effective for us beginning fiscal 2020. We do not expect the adoption of ASU 2016-13 to have a material effect on our financial position, results of operations or cash flows.

Exhibit 4.2

DESCRIPTION OF SECURITIES REGISTERED PURSUANT TO SECTION 12 OF THE SECURITIES EXCHANGE ACT OF 1934

The following summary describes the common stock, $0.001 par value per share, of FormFactor, Inc. (the “Company,” “we,” “us” and “our”), which is the only class of securities of the Company registered pursuant to Section 12 of the Securities Exchange Act of 1934, as amended.

Description of Common Stock

The following description of our common stock is based upon our amended and restated certificate of incorporation (our “certificate of incorporation”), our amended and restated bylaws (our “bylaws”) and applicable provisions of law. We have summarized certain portions of our certificate of incorporation and bylaws below. The summary is not complete. Our certificate of incorporation and our bylaws have been incorporated by reference as exhibits to the Annual Report on Form 10-K of which this Exhibit 4.2 is a part. You should read our certificate of incorporation and bylaws for the provisions that are important to you.

Certain provisions of the Delaware General Corporation Law, our certificate of incorporation and our bylaws may have an anti-takeover effect. This may delay, defer or prevent a tender offer or takeover attempt that a stockholder might consider in its best interests, including those attempts that might result in a premium over the market price for shares of our common stock.

Authorized Capital Stock

Our authorized capital stock consists of 250,000,000 shares of common stock, $0.001 par value per share, and 10,000,000 shares of undesignated preferred stock, $0.001 par value per share.

Dividend Rights

Subject to preferences that may apply to shares of preferred stock outstanding at the time, the holders of outstanding shares of our common stock are entitled to receive dividends out of assets legally available at the times and in the amounts that our board of directors may determine from time to time.

Voting Rights

Each holder of common stock is entitled to one vote for each share of common stock held on all matters submitted to a vote of stockholders. We have not provided for cumulative voting for the election of directors in our certificate of incorporation. This means that the holders of a majority of the shares voted can elect all of the directors then standing for election. In addition, our certificate of incorporation and bylaws provide that certain actions require the approval of two-thirds, rather than a majority, of the shares entitled to vote. For a description of these actions, see “Anti-Takeover Effects of Delaware Law and our Certificate of Incorporation and Bylaws” below.

No Preemptive, Conversion or Redemption Rights

Our common stock is not entitled to preemptive rights and is not subject to conversion, redemption or sinking fund provisions.

Right to Receive Liquidation Distributions

Upon our liquidation, dissolution or winding-up, the holders of common stock are entitled to share in all assets remaining after payment of all liabilities and the liquidation preferences of any outstanding preferred stock. Each outstanding share of common stock is fully paid and nonassessable.

Anti-Takeover Effects of Delaware Law and Our Certificate of Incorporation and Bylaws

Certain provisions of Delaware law and our certificate of incorporation and bylaws may have the effect of delaying, deferring or discouraging another party from acquiring control of us.

Delaware Law

We are subject to the provisions of Section 203 of the Delaware General Corporation Law regulating corporate takeovers. In general, Section 203 prohibits a Delaware corporation from engaging in any business combination with any interested stockholder for a period of three years following the date that the stockholder became an interested stockholder, unless:

- the transaction is approved by the board of directors before the date the interested stockholder attained that status;
- upon consummation of the transaction that resulted in the stockholder becoming an interested stockholder, the interested stockholder owned at least 85% of the voting stock of the corporation outstanding at the time the transaction commenced; or
- on or after the date the business combination is approved by the board of directors and authorized at a meeting of stockholders by at least two-thirds of the outstanding voting stock that is not owned by the interested stockholder.

Section 203 defines "business combination" to include the following:

- any merger or consolidation involving the corporation and the interested stockholder;
- any sale, transfer, pledge or other disposition of 10% or more of the assets of the corporation involving the interested stockholder;
- subject to certain exceptions, any transaction that results in the issuance or transfer by the corporation of any stock of the corporation to the interested stockholder;
- any transaction involving the corporation that has the effect of increasing the proportionate share of the stock of any class or series of the corporation beneficially owned by the interested stockholder; or
- the receipt by the interested stockholder of the benefit of any loans, advances, guarantees, pledges or other financial benefits provided by or through the corporation.

In general, Section 203 defines an interested stockholder as any entity or person beneficially owning 15% or more of the outstanding voting stock of the corporation and any entity or person affiliated with or controlling or controlled by any of these entities or persons.

A Delaware corporation may opt out of Section 203 either with an express provision in its original certificate of incorporation or in an amendment to its certificate of incorporation or bylaws approved by its stockholders. We have not opted out of this provision. Section 203 could prohibit or delay mergers or other takeover or change in control attempts and, accordingly, may discourage attempts to acquire us.

Certificate of Incorporation and Bylaws

Our certificate of incorporation and bylaws provide that:

- no action can be taken by stockholders except at an annual or special meeting of the stockholders called in accordance with our bylaws, and stockholders may not act by written consent;
- the approval of holders of two-thirds of the shares entitled to vote at an election of directors is required to adopt, amend or repeal our bylaws or amend or repeal the provisions of our certificate of incorporation regarding the election and removal of directors and the ability of stockholders to take action;

- our board of directors is expressly authorized to make, alter or repeal our bylaws;
- stockholders may not call special meetings of the stockholders or fill vacancies on the board of directors;
- our board of directors is divided into three classes serving staggered three-year terms. This means that only one class of directors will be elected at each annual meeting of stockholders, with the other classes continuing for the remainder of their respective terms;
- our board of directors is authorized to issue preferred stock without stockholder approval;
- directors may only be removed for cause by the holders of two-thirds of the shares entitled to vote at an election of directors; and
- we will indemnify officers and directors against losses that they may incur in investigations and legal proceedings resulting from their services to us, which may include services in connection with takeover defense measures.

Transfer Agent and Registrar

The transfer agent and registrar for our common stock is Computershare Trust Company, N.A.

Listing

Our common stock is listed on the NASDAQ Global Market under the trading symbol “FORM.”

Exhibit 10.9

FORMFACTOR™

EMPLOYEE INCENTIVE PLAN

(Amended and Restated as of October 1, 2019)

I. PURPOSE

This Employee Incentive Plan (this "Plan") is designed to support FormFactor, Inc. (the "Company") in being competitive within the industry to attract and retain key talent and to provide an incentive, in addition to other compensation, to those employees of the Company who have the opportunity to influence achievement of important corporate objectives and Company growth. In addition, this Plan is to closely align the interests of participating employees with Company and stockholder interests, and is intended as a primary purpose to encourage and induce continued employment of eligible employees with the Company.

Participants in this Plan may include the Company's executives, senior vice presidents, vice presidents, senior directors, directors, managers and other full-time employees not on the Sales Incentive Plan as determined by the chief executive officer, chief financial officer and senior human resources executive.

II. BONUS AWARDS

Bonus awards under this Plan are payable as wages, less any applicable withholdings. Actual bonus awards are based on achievement of the corporate objective(s) and business unit objective(s). The chief executive officer, chief financial officer, and senior human resources executive shall determine the period during which the corporate objective(s) and business unit objective(s) are to be measured (the "Measurement Period"). Typically, this will be a quarterly Measurement Period aligned with the Company's fiscal quarters with quarterly payment periods. However, the measurement or payment periods may be an annual period, a six-month period, a quarterly period or any such other period approved in advance by the chief executive officer, chief financial officer, and senior human resources executive. Specific bonus target percentages, expressed as a percentage of annual base salary for exempt employees and as a percentage of gross wages for non-exempt employees (as defined below), and actual bonus awards for the chief executive officer and participants directly reporting to the chief executive officer will be determined by the Compensation Committee of the Board of Directors of the Company (the "Committee"). For the purposes of this Plan, exempt employees are those who are not overtime eligible under controlling law and non-exempt employees are those who are overtime eligible under controlling law. Bonus target percentages may be different for each participant.

Each employee's bonus will be based upon a "Bonus Target" which is the product of their gross earnings (exclusive of housing or car allowances, bonuses, equity compensation, benefits, reimbursed expenses, and similar items) during the measurement period ("EE$") multiplied by the employee's target bonus percentage ("Bonus %"). The authorized communication of an employee's target bonus percentage to the employee is a condition precedent to the employee's eligibility to receive a bonus award under the Plan.

For employees within the business unit organizations (i.e., Probes BU and Systems BU), fifty percent of the Bonus Target will then be multiplied by the Corporate Objective(s) achievement percentage ("Corporate %") and fifty percent of the Bonus Target will then be multiplied by the Business Unit achievement percentage ("Business Unit %") to achieve the participant's final bonus amount ("Final Bonus").

EE$ * Bonus % = Bonus Target

Bonus Target * 50% * Corporate % = Corporate Portion

Bonus Target * 50% * Business Unit % = Business Unit Portion Corporate Portion + Business Unit

Portion = Final Bonus

For employees within the corporate functions (e.g., marketing, human resources, sales, service, finance and accounting) who do not participate in the Sales Incentive Plan, one hundred percent of the Bonus Target will be multiplied by the Corporate % to determine the participant's Final Bonus.

EE$ * Bonus % = Bonus Target

Bonus Target * 100% * Corporate % = Final Bonus

III. OBJECTIVES

The objective(s) for any given Measurement Period of this Plan, including any threshold, target, and maximum levels for each objective(s), shall be determined by the chief executive officer, chief financial officer and senior human resources executive and approved by the Committee. There may be one or more objectives and these objectives may include various financial, operational and other measures of corporate and business unit performance, all as defined by the chief executive officer, chief financial officer and senior human resources executive and approved by the Committee. Different objectives and measures may be used for different participating employee groups (product groups, executives, corporate, etc.). The communication of the EIP achievement table by the chief executive officer setting forth the corporate or business unit objectives applicable to the Measurement Period is a condition precedent to any bonus award being payable under this Plan in respect of such Measurement Period.

For Measurement Periods where multiple objectives are used within one participating employee group, the weight of each objective shall be determined by the chief executive officer, chief financial officer and senior human resources executive and approved by the Committee. The Committee may require that the Company must achieve certain minimum performance in an applicable Measurement Period as a condition for any bonus awards under this Plan to be payable in such Measurement Period. Participants may have the potential to receive bonus amounts above the Bonus Target if the Company exceeds certain performance targets as determined by the Committee.

After the end of each Measurement Period the Committee shall approve whether the objective(s) for such period were achieved and, if so, the level of achievement of such objective(s).

V. GROSS EARNINGS

The gross earnings (exclusive of housing or car allowances, bonuses, equity compensation, benefits, reimbursed expenses, and similar items), except as provided in any local sub-plan for non-U.S. employees, earned by a participant in the applicable Measurement Period will be used for calculating the bonus award payable in relation to such Measurement Period.

VI. MISCELLANEOUS PROVISIONS

A. Administration

The Committee has full power and authority to administer and interpret this Plan and to adopt such rules and regulations consistent with the terms of this Plan as such committee may deem necessary or advisable to carry out the provisions of this Plan. All determinations and interpretations of the Committee or its authorized designees with respect to the exercise of their respective responsibilities shall be binding on the participants.

B. Eligibility; Termination of Employment

In order to be eligible for a bonus award under this Plan, an employee must be a full-time or part-time employee, in good standing and employed with the Company on the payment date of the applicable bonus period. This is consistent with one of the primary purposes of the Plan to induce continued employment of the eligible employees. Eligible participants who enter the Plan during a Measurement Period will only be eligible to receive bonus payments starting with their first full Measurement Period.

C. Change in Control of Company

In the event of (1) a merger or consolidation in which the Company is not the surviving corporation (other than a merger or consolidation with a wholly-owned subsidiary or a reincorporation of the Company in a different jurisdiction), (2) a merger in which the Company is the surviving corporation but after which the stockholders of the Company immediately prior to such merger (other than any stockholder that merges, or which owns or controls another corporation that merges, with the Company in such merger) cease to own their shares or other equity interest in the Company, (3) the sale of substantially all of the assets of the Company, or (4) the acquisition, sale, or transfer of more than 50% of the outstanding shares of the Company by tender offer or similar transaction, all bonus awards will be deemed to have been earned at 100% of the Bonus Target value for the Measurement Period (and for the next consecutive Measurement Period if it falls within the same fiscal year) in which such change of control of the Company is consummated and will be paid to the eligible participants immediately prior to the change of control.

D. Transfer of Rights

The rights and interests of a participant under this Plan may not be assigned or transferred, except for bonus awards that are payable to a participant under this Plan, which may be assigned or transferred by will and the laws of descent or distribution.

E. Right to Employment

Employment at the Company is at-will. Participation in this Plan shall not confer on any employee the right to continued employment in the same or any other capacity, nor shall this Plan interfere with the right of the Company to discharge any participant at any time for any reason with or without cause or advance notice.

F. Rights to Plan

No employee or other person shall have any claim or right to be granted a bonus award under this Plan, nor shall participation in this Plan in one Measurement Period grant any right to participate in this Plan in any subsequent Measurement Period. Notwithstanding anything in this Plan to the contrary, the Chief Executive Officer, Chief Financial Officer and Committee shall have the power to terminate any individual’s participation in this Plan or to reduce the bonus award payable to any participant (or to determine that no bonus award shall be payable to such participant) prior to the time the amount otherwise would have become payable under this Plan.

G. Withholding

The Company shall have the right to deduct from each bonus award paid under this Plan any taxes or other withholdings required by law, or any 401(k), employee stock purchase plan or other benefit elections previously approved in writing by a participant to be withheld with respect to such awards.

H. <u>Unallocated Funds</u>

Monies that are not determined to be payable under this plan, as determined by the Committee, will be retained by the Company's without any obligation hereunder.

I. <u>Duration, Amendment, Suspension and Termination</u>

This Plan is applicable to each Measurement Period beginning on and after September 1, 2019. Each plan year shall be the Company's fiscal year. The Committee reserves the right to amend or suspend this Plan, in whole or in part, or terminate this Plan at any time with respect to the current or any subsequent Measurement Period.

EXHIBIT 21.1

LIST OF REGISTRANT'S SUBSIDIARIES

SUBSIDIARY NAME	JURISDICTION OF ORGANIZATION
FormFactor International, Inc.	Delaware, United States
FormFactor, K.K.	Japan
FormFactor Korea, Inc.	South Korea
FormFactor Singapore Pte. Ltd.	Singapore
Microprobe HongKong Limited	Hong Kong
Microprobe Technology (Suzhou) Co. Ltd.	People's Republic of China
FormFactor Beaverton, Inc.	Oregon, United States
FormFactor GmbH	Germany
Cascade Microtech Singapore Pte, Ltd	Singapore
Cascade International (Shanghai) Trading Co., Ltd.	People's Republic of China
Advanced Temperature Test Systems GmbH	Germany

EXHIBIT 23.1

CONSENT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

The Board of Directors
FormFactor, Inc.:

We consent to the incorporation by reference in the registration statement on Form S3 (No. 333-198760) and Form S-8 (Nos. 333-232990, 333-226432, 333-222551, 333-212587, 333-195744, 333-188363, 333-181450, 333-179589, 333-172318, 333-165058, 333-157610, 333-149411, 333-148198, 333-139074, 333-125918, 333-115137, and 333-106043) of FormFactor, Inc. of our report dated February 21, 2020, with respect to the consolidated balance sheets of FormFactor Inc. and subsidiaries as of December 28, 2019 and December 29, 2018, and the related consolidated statements of income, comprehensive income, stockholders' equity, and cash flows for each of the years in the three-year period ended December 28, 2019, and the related notes, and the effectiveness of internal control over financial reporting as of December 28, 2019, which report appears in the December 28, 2019 annual report on Form 10-K of FormFactor, Inc.

Our report refers to a change in the method of accounting for leases in 2019 and a change in the method of accounting for revenue from contracts with customers in 2018 due to the adoption of new accounting standards.

Our report dated February 21, 2020, on the effectiveness of internal control over financial reporting as of December 28, 2019 contains an explanatory paragraph that states that the Company excluded from its assessment of the effectiveness of the Company's internal control over financial reporting an acquired entity's internal control over financial reporting and our audit of internal control over financial reporting of the Company also excluded an evaluation of the internal control over financial reporting of this entity.

/s/ KPMG LLP
Portland, Oregon
February 21, 2020

EXHIBIT 31.1

CERTIFICATION OF CHIEF EXECUTIVE OFFICER
PURSUANT TO 15 U.S.C. SECTION 7241, AS
ADOPTED PURSUANT TO SECTION 302 OF THE SARBANES-OXLEY ACT OF 2002

I, Michael D. Slessor, certify that:

1. I have reviewed the Annual Report on Form 10-K of FormFactor, 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 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 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 the 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.

Date: February 21, 2020

/s/ MICHAEL D. SLESSOR

Michael D. Slessor
Chief Executive Officer
(Principal Executive Officer and Director)

EXHIBIT 31.2

CERTIFICATION OF CHIEF FINANCIAL OFFICER
PURSUANT TO 15 U.S.C. SECTION 7241,
AS ADOPTED PURSUANT TO SECTION 302 OF THE SARBANES-OXLEY ACT OF 2002

I, Shai Shahar, certify that:

1. I have reviewed the Annual Report on Form 10-K of FormFactor, 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 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 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 the 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.

Date: February 21, 2020

/s/ SHAI SHAHAR

Shai Shahar
Chief Financial Officer
(Principal Financial Officer and Principal Accounting Officer)

EXHIBIT 32.1

CERTIFICATION OF
CHIEF EXECUTIVE OFFICER AND CHIEF FINANCIAL OFFICER
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 on Annual Report on Form 10-K of FormFactor, Inc., a Delaware corporation, for the period ended December 28, 2019, as filed with the Securities and Exchange Commission, each of the undersigned officers of FormFactor, Inc. certifies pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002, that, to his respective knowledge:

(1) the annual report fully complies with the requirements of Section 13(a) or 15(d) of the Securities Exchange Act of 1934, as amended; and

(2) the information contained in the annual report fairly presents, in all material respects, the financial condition and results of operations of FormFactor, Inc. for the periods presented therein.

Date:	February 21, 2020	/s/ MICHAEL D. SLESSOR
		Michael D. Slessor *Chief Executive Officer* *(Principal Executive Officer and Director)*
Date:	February 21, 2020	/s/ SHAI SHAHAR
		Shai Shahar *Chief Financial Officer* *(Principal Financial Officer and Principal Accounting Officer)*