

**UNITED STATES
SECURITIES AND EXCHANGE COMMISSION**
Washington, D.C. 20549

FORM 10-K

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

For the fiscal year ended October 31, 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 0-15451



PHOTRONICS, INC.

(Exact name of registrant as specified in its charter)

Connecticut

(State or other jurisdiction of incorporation or organization)

06-0854886

(IRS Employer Identification No.)

15 Secor Road, Brookfield, Connecticut 06804

(Address of principal executive offices)(Zip Code)

(203) 775-9000

(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	PLAB	NASDAQ Global Select Market
PREFERRED STOCK PURCHASE RIGHTS	N/A	N/A

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

None

Indicate by check mark if the registrant is a well-known seasoned issuer, as defined in Rule 405 of the Securities Act.

Yes No

Indicate by check mark if the registrant is not required to file reports pursuant to Section 13 or Section 15(d) of the Act.

Yes No

Indicate by check mark whether the registrant (1) has filed all reports required to be filed by Section 13 or 15(d) of the Securities Exchange Act of 1934 during the preceding 12 months (or for such shorter period that the registrant was required to file such reports), and (2) has been subject to such filing requirements for the past 90 days.

Yes No

Indicate by check mark whether the registrant has submitted electronically every Interactive Data File required to be submitted pursuant to Rule 405 of Regulation S-T (§232.405 of this chapter) during the preceding 12 months (or for such shorter period that the registrant was required to submit such files).

Yes No

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

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

As of April 28, 2019, which was the last business day of the registrant's most recently completed second fiscal quarter, the aggregate market value of the shares of the registrant's common stock held by non-affiliates was approximately \$617,084,612 (based upon the closing price of \$9.43 per share as reported by the NASDAQ Global Select Market on that date).

As of December 13, 2019, 65,416,365 shares of the registrant's common stock were outstanding.

DOCUMENTS INCORPORATED BY REFERENCE

Proxy Statement for the 2020
Annual Meeting of Shareholders
to be held on March 16, 2020

Incorporated into Part III
of this Form 10-K

Forward-Looking Statements

The Private Securities Litigation Reform Act of 1995 provides a “safe harbor” for forward-looking statements made by or on behalf of Photronics, Inc. (“Photronics”, the “Company”, “we”, “our”, or “us”). These statements are based on management’s beliefs, as well as assumptions made by, and information currently available to, management. Forward-looking statements may be identified by words like “expect,” “anticipate,” “believe,” “plan,” “project,” “could,” “estimate,” “intend,” “may,” “will” , “in our view” and similar expressions, or the negative of such terms, or other comparable terminology. All forward-looking statements involve risks and uncertainties that are difficult to predict. In particular, any statement contained in this annual report on Form 10-K or in other documents filed with the Securities and Exchange Commission in press releases or in the Company’s communications and discussions with investors and analysts in the normal course of business through meetings, phone calls, or conference calls regarding, among other things, the consummation and benefits of transactions, joint ventures, business combinations, divestitures and acquisitions, expectations with respect to future sales, financial performance, operating efficiencies, or product expansion, are subject to known and unknown risks, uncertainties, and contingencies, many of which are beyond the control of the Company. Various factors may cause actual results, performance, or achievements to differ materially from anticipated results, performance, or achievements expressed or implied by forward-looking statements. Factors that might affect forward-looking statements include, but are not limited to, overall economic and business conditions; economic and political conditions in international markets; the demand for the Company’s products; competitive factors in the industries and geographic markets in which the Company competes; the timing of orders received from customers; the gain or loss of significant customers; competition from other manufacturers; changes in accounting standards; federal, state and international tax requirements (including tax rate changes, new tax laws and revised tax law interpretations); changes in the jurisdictional mix of our earnings and changes in tax laws and rates; interest rate and other capital market conditions, including changes in the market price of the Company’s securities; foreign currency exchange rate fluctuations; changes in technology; technology or intellectual property infringement, including cybersecurity breaches, and other innovation risks; unsuccessful or unproductive research and development or capital expenditures; the timing, impact, and other uncertainties related to transactions and acquisitions, divestitures, business combinations, and joint ventures as well as decisions the Company may make in the future regarding the Company’s business, capital and organizational structures and other matters; the seasonal and cyclical nature of the semiconductor and flat panel display industries; management changes; changes in laws and government regulation impacting our operations or our products, including laws relating to export controls and import laws, rules and tariffs; the occurrence of regulatory proceedings, claims or litigation; damage or destruction to the Company’s facilities, or the facilities of its customers or suppliers, by natural disasters, labor strikes, political unrest, or terrorist activity; the ability of the Company to (i) place new equipment in service on a timely basis; (ii) obtain additional financing; (iii) achieve anticipated synergies and cost savings; (iv) fully utilize its tools; (v) achieve desired yields, pricing, product mix, and market acceptance of its products and (vi) obtain necessary import and export licenses. Any forward-looking statements should be considered in light of these factors. Accordingly, there is no assurance that the Company’s expectations will be realized. The Company does not assume responsibility for the accuracy and completeness of the forward-looking statements and does not assume an obligation to provide revisions to any forward-looking statements, except as otherwise required by securities and other applicable laws.

PART I

ITEM 1. BUSINESS

General

Photronics, Inc. (and its subsidiaries, collectively referred to herein as "Photronics", the "Company", "we", "our", or "us") is one of the world's leading manufacturers of photomasks, which are high precision photographic quartz or glass plates containing microscopic images of electronic circuits. Photomasks are a key element in the manufacture of semiconductors and flat-panel displays ("FPDs"), and are used as masters to transfer circuit patterns onto semiconductor wafers and FPD substrates during the fabrication of integrated circuits ("ICs" or "semiconductors"), and a variety of FPDs and, to a lesser extent, other types of electrical and optical components. We currently have eleven manufacturing facilities, which are located in Taiwan (3), Korea, the United States (3), Europe (2), and two recently constructed facilities in China. Our FPD Facility in Hefei, China, and our IC facility in Xiamen, China, commenced production in the second and third quarters of our fiscal 2019, respectively.

Photronics is a Connecticut corporation, organized in 1969. Our principal executive offices are located at 15 Secor Road, Brookfield, Connecticut 06804, telephone (203) 775-9000. Our website address is <http://www.photronics.com>. We make available, free of charge through our website, our Annual Reports on Form 10-K, Quarterly Reports on Form 10-Q, Current Reports on Form 8-K, and any amendments to these reports as soon as reasonably practicable after such materials are electronically filed with, or furnished to, the Securities and Exchange Commission ("SEC"). The information found on, or incorporated into, our website is not part of this or any other report we file with, or furnish to, the SEC. The SEC also maintains a website at <http://www.sec.gov> that contains reports, proxy statements and other information regarding SEC registrants, including Photronics.

Products and Manufacturing Technology

We manufacture photomasks, which are used as masters to transfer circuit patterns onto semiconductor wafers and FPD substrates. Photomasks are manufactured in accordance with circuit designs provided to us on a confidential basis by our customers. IC and FPD photomask sets are manufactured in layers, each having a distinct pattern which is etched onto a different photomask. The resulting series of photomasks is then used to image the circuit patterns onto each successive layer of a semiconductor wafer or FPD substrate. The typical manufacturing process for a photomask involves the receipt and conversion of circuit design data to manufacturing pattern data. A lithography system then exposes the circuit pattern onto the photomask blank. The exposed areas are developed and etched to produce that pattern on the photomask. The photomask is then inspected for defects and conformity to the customer's design data. After any defects are repaired, the photomask is cleaned, any required pellicles (protective translucent cellulose membranes) are applied and, after final inspection, the photomask is shipped to the customer.

We currently support customers across the full spectrum of IC production and FPD technologies by manufacturing photomasks using electron beam or optical (laser-based) systems, which are the predominant technologies used for photomask manufacturing, and are capable of producing the finer line resolution, tighter overlay, and larger IC chip size for the more complex circuits currently being designed. Electron beam and laser-generated photomasks can be used to produce the most advanced semiconductors and FPD photomasks for use in an array of products. However, in the case of IC production, the large majority of higher-cost critical layer photomasks are fabricated using electron beam technologies, while photomasks produced using laser-based systems are used for all FPD photomasks and less critical IC photomasks. End markets served with IC photomasks include devices used for microprocessors, memory, telecommunications, and related applications. We currently own a number of both high-end and mature electron beam and laser-based systems.

The first several layers of photomasks are sometimes required to be delivered by us within 24 hours from the time we receive the customers' design data. The ability to manufacture high-quality photomasks within short time periods is dependent upon robust processes, efficient manufacturing methods, high production yield, available manufacturing capacity, and high equipment reliability. We work to meet these requirements by making significant investments in research and development, capital equipment, manufacturing and data processing systems, and by utilizing statistical process control methods to optimize our manufacturing processes and reduce cycle times.

Quality control is an integral part of the photomask manufacturing process. Photomasks are manufactured in temperature, humidity, and particulate-controlled clean rooms because of the high level of precision, quality and manufacturing yield required. Each photomask is inspected several times during the manufacturing process to ensure compliance with customer specifications. We continue to make substantial investments in equipment to produce, inspect and repair photomasks to ensure that customer specifications are met.

The majority of IC photomasks produced for the semiconductor industry employ geometries larger than 28 nanometers. At these geometries, we can produce full lines of photomasks, and there is no significant technology employed by our commercial competitors that is not also available to us. We are also capable of producing full lines of photomasks for high-end IC and FPD applications. In the case of ICs, this includes photomasks at and below the 28 nanometer technology node and, for FPDs, at and above the Generation 8 technology node and active-matrix organic light-emitting diode (AMOLED) display screens. We hold customer-qualified manufacturing capability and own, or have access to, technology that enables us to compete in the high-end markets that serve IC and FPD applications.

Sales and Marketing

The market for photomasks primarily consists of domestic and non-US semiconductor and FPD manufacturers and designers. Photomasks are manufactured by independent merchant manufacturers like Photronics, and by semiconductor and FPD manufacturers that produce photomasks for their own use (captive manufacturers). In some instances, captive manufacturers also sell to other semiconductor or FPD manufacturers. Previously, there was a trend towards the divestiture or closing of captive photomask operations by semiconductor manufacturers, and an increase in the share of the market served by independent manufacturers. This trend was driven by the increased complexity and cost of capital equipment used in manufacturing photomasks and the lack of economy of scale for many semiconductor and FPD manufacturers to effectively utilize the equipment. However, more recently, some captive mask facilities have been investing at faster rates than independent manufacturers to reach certain roadmap milestones, particularly in the foundry logic and memory spaces. Nevertheless, most captive manufacturers maintain business and technology relationships with independent photomask manufacturers for ongoing support.

Generally, Photronics and each of its customers engage in a qualification and correlation process before we become an approved supplier. Thereafter, based on the customer's expectations, we typically negotiate pricing parameters for the customer's order. Some prices may remain in effect for an extended period of time. In many instances, we enter into sales arrangements with an understanding that, as long as our performance is competitive, we will receive a specified percentage of that customer's photomask requirements.

We conduct our sales and marketing activities primarily through a staff of full-time sales personnel and customer service representatives who work closely with the Company's management and technical personnel. We support non-US customers through both our domestic and foreign facilities and consider our presence in non-US markets to be an important factor in attracting new customers, as it provides global solutions to our customers, minimizes delivery time, and allows us to serve customers that utilize manufacturing foundries outside of the United States, principally in Asia. See Notes 7 and 14 to our consolidated financial statements for the amount of revenue and long-lived assets attributable to each of our geographic areas of operations.

Customers

We sell our products primarily to leading semiconductor and FPD manufacturers. During fiscal year 2019, we sold our products to approximately 550 customers. Revenue from Samsung Electronics Co. Ltd. accounted for approximately 16% of our total revenues in fiscal years 2019, 2018 and 2017, and revenue from United Microelectronics Corp. Co. Ltd. accounted for approximately 15%, 15% and 16% of our total revenues in fiscal years 2019, 2018 and 2017, respectively. Our five largest customers, in the aggregate, accounted for approximately 46%, 47% and 43% of our revenue in fiscal years 2019, 2018 and 2017, respectively. A significant decrease in the amount of revenue from any of these customers could have a material adverse effect on our financial performance and business prospects.

Seasonality

Our business is typically impacted during the first, and sometimes the second, quarter of our fiscal year by the North American, European, and Asian holiday periods, as some customers reduce their development and buying activities during those periods.

Research and Development

We primarily conduct research and development activities for IC photomasks at our U.S. nanoFab, which is located in Boise, Idaho, as well as at PK, Ltd. (“PKL”), our subsidiary in Korea and Photronics DNP Mask Corporation (“PDMC”), one of our joint venture subsidiaries in Taiwan. Research and development for FPD photomasks is primarily conducted at PKL. Additionally, we conduct site-specific research and development programs to support strategic customers. These research and development programs and activities are undertaken to advance our competitiveness in technology and manufacturing efficiency. We also conduct application-oriented research and development activities to support the early adoption of new photomask or supporting data and services technology into our customers' applications. Currently, research and development photomask activities for ICs are primarily focused on photomasks with wafer geometrics of 20 nanometer node and smaller and, for FPDs, on Generations 8 and 10.5+ substrate-size photomask process enhancements and photomask technology for complex FPD photomasks used in the manufacture of advanced mobile displays, such as AMOLED. We believe these core competencies will continue to be a critical part of semiconductor and FPD manufacturing, as optical lithography continues to scale capabilities on high-end devices. We incurred research and development expenses of \$16.4 million, \$14.5 million, and \$15.9 million in fiscal years 2019, 2018, and 2017, respectively. It is our belief that we own, control, or license the proprietary information, including trade secrets and patents that is necessary for our business, as it is presently conducted. We also believe that our intellectual property and trade secret know-how will continue to be important to our maintaining technical leadership in the field of photomasks.

Intellectual Property Rights

We have developed and hold ownership interests in intellectual property (“IP”) rights, in the forms of patents issued in the U.S., and other trademark and trademark registrations in the U.S. and other countries. Patents in which we hold ownership interests generally relate to the manufacture of photomasks or the use of photomasks to manufacture other products. While we believe that our IP rights are, and will continue to be, important to our technical leadership in the field of photomasks, our operations are not dependent on any one individual IP right. In addition to patenting, when practicable, our IP rights, we further protect them, and our other proprietary processes, by utilizing non-disclosure agreements with employees, customers, and vendors.

Materials, Supplies and Equipment

Raw materials used by Photronics generally include: high precision quartz plates (including large area plates), which are used as photomask blanks and are primarily obtained from Japanese and Korean suppliers; pellicles and electronic grade chemicals, which are used in the manufacturing process; and compacts, which are durable plastic containers in which photomasks are shipped. These materials are generally sourced from several suppliers. We believe that our utilization of a select group of strategic suppliers enables us to access the most technologically advanced materials available. On an ongoing basis, we continue to consider additional supply sources.

We rely on a limited number of equipment suppliers to develop and supply the equipment used in the photomask manufacturing process. Although, historically, we have been able to obtain equipment on a timely basis, an inability to obtain equipment when required could adversely affect our business and results of operations.

Backlog

The first several layers of a set of photomasks for a circuit pattern are often required to be shipped within 24 hours of receiving a customer's designs. Because of the short period between order and shipment dates (typically from 1 day to 2 weeks) for a significant amount of our revenue, the dollar amount of our current backlog is not a reliable indicator of future revenue.

International Operations

Revenues from our non-U.S. operations were approximately 81%, 79% and 77% of our total revenues in fiscal 2019, 2018 and 2017, respectively. We believe that our ability to serve non-US markets is enhanced by our having, among other things, a local presence in the markets that we serve. This requires significant investments in financial, managerial, operational, and other resources.

Operations outside of the United States are subject to inherent risks, including fluctuations in exchange rates, political and economic conditions in various countries, legal compliance and regulatory requirements, tariffs and other trade barriers, difficulties in staffing and managing international operations, longer accounts receivable collection cycles, potential restrictions on transfers of funds, and potentially adverse tax consequences. These factors may have a material adverse effect on our ability to generate revenue outside of the United States and to deploy resources where they could otherwise be used to their greatest advantage and, consequently, may adversely affect our financial condition and results of operations. Notes 7 and 14 of our consolidated financial statements, respectively, present revenue and long-lived assets by geographic area.

Competition

The photomask industry is highly competitive, and most of our customers utilize multiple photomask suppliers. Our ability to compete depends primarily upon the consistency of our product quality, timeliness of delivery, competitive pricing, technical capability, and service, which we believe are the principal factors considered by customers in selecting their photomask suppliers. An inability to meet these requirements could adversely affect our financial condition, results of operations, and cash flows. We also believe that geographic proximity to customers is an important factor in certain markets where cycle time from order to delivery is critical. While some of our competitors may have greater financial, technical, sales, marketing, or other resources than Photronics, we believe that we are able to compete effectively because of our dedication to customer service, investments in state-of-the-art photomask equipment and facilities, and experienced technical employees.

We estimate that, for the types of photomasks we manufacture (IC and FPD), the size of the total market (captive and merchant) is approximately \$5.0 billion. Our competitors include Compugraphics International, Ltd., Dai Nippon Printing Co., Ltd (outside of Taiwan and China), Hoya Corporation, LG Innotek Co., Ltd., Shenzhen New Way Photomask Making Co., Ltd., SK-Electronics Co. Ltd., Supermask Co. Ltd., Taiwan Mask Corporation, and Toppan Printing Co., Ltd. We also compete with semiconductor and FPD manufacturers' captive photomask manufacturing operations that supply photomasks for internal use and, in some instances, also for external customers and foundries. We expect to face continued competition which, in the past, has led to pressure to reduce prices. We believe the pressure to reduce prices, together with the significant investment required in capital equipment to manufacture high-end photomasks, has contributed to the decrease in the number of independent manufacturers; we expect such pressure to continue in the future.

Employees

As of October 31, 2019, we had approximately 1,775 employees. We believe we offer competitive compensation and other benefits, and that our employee relations are good.

ITEM 1A. RISK FACTORS

Technology failures or cyber security breaches could have a material adverse effect on our operations.

We rely on information technology systems to process, transmit, store, and protect electronic information. For example, a significant portion of the communications between our personnel, customers, and suppliers depends on information technology. Our information technology systems may be vulnerable to a variety of interruptions due to events beyond our control, including, but not limited to, natural disasters, terrorist attacks, telecommunications failures, computer viruses, hackers, and other security issues. Although we have technology and information security processes and disaster recovery plans in place to mitigate our risks to these vulnerabilities, these measures may not be adequate to ensure that our operations will not be disrupted, should such an event occur.

The General Data Protection Regulation (GDPR), which went into effect in the European Union (EU) on May 25, 2018, applies to the collection, use, retention, security, processing, and transfer of personally identifiable information of residents of EU countries. The GDPR created a range of new compliance obligations, and imposes significant fines and sanctions for violations. It is possible that the GDPR may be interpreted or applied in a manner that is adverse to, or unforeseen by us, including requirements that are inconsistent with our practices, or that we may otherwise fail to construe its requirements in ways that are satisfactory to the EU authorities.

Any failure, or perceived failure, by us to comply with the GDPR, or with any applicable regulatory requirements or orders, including but not limited to privacy, data protection, information security, or consumer protection related privacy laws and regulations, in one or more jurisdictions within the EU or elsewhere, could: result in proceedings or actions against us by governmental entities or individuals; subject us to significant fines, penalties, and/or judgments; require us to change our business practices; limit access to our products and services in certain countries, or otherwise adversely affect our business, as we would be at risk to lose both customers and revenue, and incur substantial costs.

The risk of loss of the Company's intellectual property, trade secrets or other sensitive business or customer confidential information or disruption of operations due to breaches of cybersecurity could negatively impact the Company's financial results.

Cyberattacks or security breaches could compromise confidential, business-critical information, cause disruptions in the Company's operations, or harm the Company's reputation. The Company has important assets, including intellectual property, trade secrets, and other sensitive, business-critical and/or confidential information which may be vulnerable to such incidents. While the Company has a comprehensive cybersecurity program that is continuously reviewed, maintained, and upgraded, a significant cyberattack could result in the loss of vital business or confidential information and/or could negatively impact operations, which could have a negative impact on the Company's financial results.

Our dependency on the microelectronics industry, which as a whole is volatile, could create volatility in our demand and have a negative material impact on our business.

We sell substantially all of our photomasks to semiconductor or FPD designers, manufacturers and foundries, as well as to other high performance electronics manufacturers. We believe that the demand for photomasks depends primarily on design activity rather than sales volume from products using photomask technologies. Consequently, an increase in semiconductor or FPD sales does not necessarily result in a corresponding increase in photomask sales. In addition, the reduced use of customized ICs, a reduction in design complexity, other changes in the technology or methods of manufacturing or designing semiconductors or FPDs, or a slowdown in the introduction of new semiconductor or FPD designs could reduce demand for photomasks – even if the demand for semiconductors and FPDs increases. Historically, the microelectronics industry has been volatile, with sharp periodic downturns and slowdowns. These downturns have been characterized by, among other things, diminished product demand, excess production capacity, and accelerated erosion of selling prices with a concomitant effect on revenue and profitability.

We may, in the future, incur net losses.

Although we have been profitable since fiscal 2010, we have, in the past, incurred net losses. We cannot provide assurance that we will not incur net losses in the future.

We have a high level of fixed costs.

As a consequence of the capital-intensive nature of the photomask manufacturing business, we have a high level of fixed costs and a high degree of operating leverage. Accordingly, should our sales volumes decline as a result of a decrease in design releases from our customers or for any other reason, we may have excess or underutilized production capacity which could significantly impact our operating margins or result in write-offs from asset impairments.

Our quarterly operating results fluctuate significantly, and may continue to do so in the future.

We have experienced fluctuations in our quarterly operating results, and we anticipate that such fluctuations will continue and could intensify in the future. Fluctuations in operating results may result in volatility in the prices of our common stock and financial instruments linked to its value. Operating results may fluctuate as a result of many factors, including the size and timing of orders and shipments, the loss of significant customers, changes in product mix, the flow of customer design releases, technological change, fluctuations in manufacturing yields, the actions of our competitors, and general economic conditions. We operate in a high fixed-cost environment and, should our revenues and asset utilization decrease, our operating margins could be negatively impacted.

Our customers generally order photomasks on an as-needed basis; thus our revenue in any quarter is dependent primarily on orders received during that quarter. Since we operate with little backlog, and the rate of new orders may vary significantly from quarter to quarter, our capital expenditures and, to some extent, expense levels are based primarily on sales forecasts and technological advancements in photomask manufacturing equipment. Consequently, if anticipated revenues in any quarter do not occur when expected, capital expenditures could be higher than needed, resulting in underutilized capacity and disproportionately high expense levels, causing operating results to be adversely affected. Due to the foregoing factors, we believe that quarter-to-quarter comparisons of our operating results cannot be relied upon as indicators of future performance. In addition, in future quarters, our operating results could be below guidance we may provide or the expectations of public market analysts and investors, which could have a material adverse effect on the market price of our common stock.

The photomask industry is subject to rapid technological change, and we might fail to remain competitive, which could have a material adverse effect on our business and results of operations.

The photomask industry has been, and is expected to continue to be, characterized by technological change and evolving industry standards. In order to remain competitive, we will be required to continually anticipate, respond to, and utilize changing technologies of increasing complexity in both traditional and emerging markets that we serve. In particular, we believe that, as semiconductor geometries continue to become smaller and FPDs become larger or otherwise more advanced, we will be required to manufacture increasingly complex photomasks. Additionally, the demand for photomasks has been, and could in the future be, adversely affected by changes in semiconductor and high-performance electronics fabrication methods that affect the type or quantity of photomasks utilized, such as changes in semiconductor demand that favor field-programmable gate arrays and other semiconductor designs that replace application-specific ICs. Furthermore, evidence of the viability and the corresponding market acceptance of alternative methods of transferring IC designs onto semiconductor wafers could reduce or eliminate the need for photomasks in the production of semiconductors. As of the end of fiscal 2019, one alternative method, direct-write lithography, has not been proven to be a commercially-viable alternative to photomasks, as it is considered to be too slow for high-volume semiconductor wafer production. However, should direct-write or any other alternative method of transferring IC or FPD designs without the use of photomasks achieve market acceptance, and if we are unable to anticipate, respond to, or utilize these or other technological changes, due to resource, technological, or other constraints, our business and results of operations could be materially adversely affected.

Our operations will continue to require substantial capital expenditures, for which we may be unable to provide or obtain funding.

The manufacture of leading-edge photomasks requires us to make substantial investments in high-end manufacturing capability. We expect that we will be required to continue to make substantial capital expenditures to meet the technological demands of our customers and to position us for future growth. Our capital expenditure payments for fiscal 2020 are expected to be approximately \$100 million, of which approximately \$14 million was included in accounts payable on our October 31, 2019 consolidated balance sheet. We cannot provide assurance that we will be able to obtain the additional capital required to fund our operations or capital expenditures on reasonable terms, if at all, or that any such inability will not have a material adverse effect on our business and results of operations.

We have been dependent on sales to a limited number of large customers; the loss of any of these customers or a significant reduction in orders from these customers could have a material adverse effect on our revenues and results of operations.

Historically, we have sold a significant proportion of photomasks to a limited number of IC and FPD manufacturers. During fiscal years 2019, 2018 and 2017, our two largest customers accounted for 31%, 31% and 32%, respectively, of our revenue. Our five largest customers accounted for 46%, 47% and 43% of our revenue in fiscal years 2019, 2018 and 2017, respectively. The loss of a significant customer, a significant reduction or delay in orders from any significant customer (including reductions or delays due to customer departures from recent buying patterns), or an unfavorable change in competitive conditions in the semiconductor or FPD industries could have a material adverse effect on our financial performance and business prospects. The consolidation of semiconductor manufacturers, or an economic downturn in the semiconductor industry, may increase the likelihood of losing a significant customer and could also have an adverse effect on our financial performance and business prospects.

We depend on a limited number of suppliers for equipment and raw materials and, if those suppliers fail to timely deliver their products to us, we may be unable to fulfill orders from our customers, which could adversely affect our business and results of operations.

We rely on a limited number of photomask equipment manufacturers to develop and supply the equipment we use. These equipment manufacturers currently require lead times of twelve months or longer between the order date and the delivery of certain photomask imaging and inspection equipment. The failure of our suppliers to develop or deliver such equipment on a timely basis could have a material adverse effect on our business and results of operations. In addition, the manufacturing equipment necessary to produce advanced photomasks could become prohibitively expensive, which could similarly affect us.

We use high-precision quartz photomask blanks, pellicles, and electronic grade chemicals in our manufacturing processes. There are a limited number of suppliers of these raw materials, and we do not have long-term contracts with these suppliers. Any delays or quality problems in connection with significant raw materials, particularly photomask blanks, could cause delays in the shipments of photomasks, which could have a material adverse effect on our business and results of operations. The fluctuation of foreign currency exchange rates, with respect to prices of equipment and raw materials used in manufacturing, could also have a material adverse effect on our business and results of operations.

We face risks associated with the use of sophisticated equipment and complex manufacturing processes and technologies. Our inability to effectively utilize such equipment and technologies and perform such processes could have a material adverse effect on our business and results of operations.

Our complex manufacturing processes require the use of expensive and technologically sophisticated equipment and materials, and are continually modified in an effort to improve manufacturing yields and product quality. Minute impurities, defects, or other difficulties in the manufacturing process can lower manufacturing yields and render products unmarketable. Moreover, the manufacture of leading-edge photomasks is more complex and time consuming than manufacturing less advanced photomasks, and their fabrication may result in delays in the manufacture of all levels of photomasks. We have, on occasion, experienced manufacturing difficulties and capacity limitations that have delayed our ability to deliver products within the time frames contracted for by our customers. We cannot provide assurance that we will not experience these or other manufacturing difficulties, or be subject to increased costs, which could result in a loss of customers or otherwise have a material adverse effect on our business and results of operations.

We could be subject to damages based on claims brought against us by our customers, or lose customers as a result of the failure of our products to meet certain quality specifications.

Our products provide important performance attributes to our customers' products. If a product fails to perform in a manner consistent with quality specifications, or has a shorter useful life than warranted, a customer could seek replacement of the product or damages for costs incurred as a result of the product failing to perform, particularly if such products are sold under agreements that contain limited performance and life cycle warranties. Our customers often require us to represent that our products conform to certain product specifications that they provide. Any failure to comply with such specifications could result in claims or legal action. A successful claim, or series of claims, against us could have a material adverse effect on our financial condition and results of operations, and could result in a loss of one or more customers.

Our credit facility restricts our business activities, limits our ability to obtain additional financing, pay cash dividends, and may obligate us to repay debt before its maturity.

Financial covenants related to our credit facility, which expires in September 2023, include a total leverage ratio, a minimum interest coverage ratio, and minimum unrestricted cash balances. Our credit facility may also limit our flexibility in planning for, or reacting to, changes in our business and industry, which may place us at a competitive disadvantage compared with our competitors. We are also subject to covenants that limit our operating flexibility, such as a limit on the amount of shares we can repurchase of our common stock. Existing covenant restrictions limit our ability to obtain additional debt financing, and limit the amount of dividends, distributions, and redemptions we can pay on our common stock in 2019 to an aggregate amount of \$100 million and \$50 million annually thereafter. Should we be unable to meet one or more of these covenants, our lenders may require us to repay any outstanding balance prior to the expiration date of the agreement. Our ability to comply with the financial and other covenants in our credit agreement may be affected by deteriorating economic or business conditions, or other events. We cannot assure that, under such circumstances, additional sources of financing would be available to fund operating requirements or repay any long-term borrowings, so as to avoid default.

Joint ventures may not operate according to their business plans if our partners fail to fulfill their obligations, which may adversely affect our results of operations and compel us to dedicate additional resources to these joint ventures.

The nature of a joint venture requires us to share control in certain areas with unaffiliated third parties. If our joint venture partner does not fulfill its obligations, the affected joint venture may not be able to operate in accordance with its business plan. Under such a scenario, our results of operations may be adversely affected and we may be compelled to increase the level of our resources devoted to the joint venture. Also, differing views among joint venture participants may result in delayed decisions, or failures to agree on major issues. If such differences caused a joint venture to deviate from its business plan, our results of operations could be adversely affected.

We may not be able to consummate future acquisitions or joint ventures or integrate acquisitions into our business, which could result in unanticipated expenses and losses.

As part of our business growth strategy, we have acquired businesses and entered into joint ventures in the past, and we may pursue acquisitions and joint venture opportunities in the future. Future efforts to grow the Company may include expanding into new or related markets or industries. Our ability to implement this component of our growth strategy may be limited by both our ability to identify appropriate acquisition or joint venture candidates and our financial resources, including our available cash and borrowing capacity. The expense incurred in consummating acquisitions or entering into joint ventures, the time it takes to integrate an acquisition, or our failure to integrate businesses successfully, could result in unanticipated expenses and losses. Furthermore, we may not be able to realize any of the anticipated benefits from acquisitions or joint ventures.

The process of integrating acquired operations into our existing operations may result in unforeseen operating difficulties, and may require significant financial resources that would otherwise be available for the ongoing development or expansion of existing operations. Some of the risks associated with the integration of acquisitions include: potential disruption of our ongoing business and distraction of management; unforeseen claims and liabilities, including unexpected environmental exposures; unforeseen adjustments, taxes, charges and write-offs; problems enforcing the indemnification obligations of sellers of businesses or joint venture partners for claims and liabilities; unexpected losses of customers of, or suppliers to, the acquired business; difficulty in conforming the acquired businesses' standards, processes, procedures and controls with our operations; variability in financial information arising from the implementation of purchase price accounting; inability to coordinate new product and process development; loss of senior managers and other critical personnel and problems with new labor unions; and challenges arising from the increased scope, geographic diversity and complexity of our operations.

Our expansion into China entails substantial risks.

We have recently commenced operations at our two newly-constructed manufacturing facilities in China. These investments are subject to substantial risks which may include, but are not limited to: the inability to protect our intellectual property rights under Chinese law, which may not offer as high a level of protection as U.S. law; unexpectedly long negotiation periods with Chinese suppliers and customers; quality issues related to materials sourced from local vendors; unexpectedly high labor costs due to a tight labor supply; and difficulty in repatriating funds and selling or transferring assets. Our investments in China also expose us to a significant additional foreign currency exchange risk, which we had not been subject to in recent years. These and other risks may result in our not realizing a return on, or losing some, or all, of our planned investments in China, which would have a material adverse effect on our financial condition and financial performance.

Our cash flows from operations and current holdings of cash may not be adequate for our current and long-term needs.

Our liquidity, as we operate in a high fixed-cost environment, is highly dependent on our revenue volume and the timing of our capital expenditures, which can vary significantly from period to period. Depending on conditions in the semiconductor and FPD markets, our cash flows from operations and current holdings of cash may not be adequate to meet our current and long-term needs for capital expenditures, operations and debt repayments. Historically, in certain years, we have used external financing to fund these needs. Due to conditions in the credit markets and covenant restrictions on our existing debt, some financing instruments used by us in the past may not be available. Therefore, we cannot provide assurance that additional sources of financing would be available to us on commercially favorable terms, if at all, should our cash requirements exceed our existing cash, operating cash flows, and cash available under our credit agreements.

We may incur unforeseen charges related to possible future facility closures or restructurings.

We cannot provide assurance that there will not be facility closures or restructurings in the near or long term, nor can we assure that we will not incur significant charges should there be any future facility closures or restructurings.

We operate in a highly competitive environment, and, should we be unable to meet our customers' requirements for product quality, timeliness of delivery or technical capabilities, our revenue could be adversely affected.

The photomask industry is highly competitive, and most of our customers utilize more than one photomask supplier. Our competitors include Compugraphics International, Ltd., Dai Nippon Printing Co., Ltd (outside of Taiwan and China), Hoya Corporation, LG Innotek Co., Ltd., Supermask Co., Ltd., SK-Electronics Co. Ltd., Shenzhen New Way Photomask Making Co., Ltd., Taiwan Mask Corporation, and Toppan Printing Co., Ltd. We also compete with semiconductor and FPD manufacturers' captive photomask manufacturing operations, some of which market their photomask manufacturing services to outside customers. We expect to face continued competition from these and other suppliers in the future. Some of our competitors have substantially greater financial, technical, sales, marketing, or other resources than we do. Also, when producing smaller geometry photomasks, some of our competitors may be able to more rapidly develop and produce such masks, and achieve higher manufacturing yields than we can. We believe that consistency of product quality, timeliness of delivery, competitive pricing, technical capability, and service are the principal factors considered by customers when selecting their photomask suppliers. Our inability to meet these competitive requirements could have a material adverse effect on our business and results of operations. In the past, competition has led to pressure to reduce prices and the need to invest in advanced manufacturing technology, which we believe contributed to the decrease in the number of independent photomask suppliers. These pressures may continue in the future.

We operate in a global, competitive environment which gives rise to operating and market risk exposure.

We sell our products in a competitive, global environment, and compete worldwide for sales on the basis of product quality, price, technology, and customer service. Sales of our products are also subject to federal, state, local, and foreign taxes, laws and regulations, trade agreements, import and export controls, and duties and tariffs. The imposition of additional regulations or controls including export controls and duties and tariffs or changes to bilateral and regional trade agreements, could negatively impact our results of operations.

Our substantial non-US operations are subject to additional risks.

Revenues from our non-U.S. operations were approximately 81%, 79% and 77% of our total revenues in fiscal years 2019, 2018 and 2017, respectively. We believe that maintaining significant international operations requires us to have, among other things, a local presence in the geographic markets that we supply. This requires significant investments in financial, managerial, operational, and other resources. Since 1996, we have significantly expanded our operations in international markets by acquiring existing businesses in Europe, acquiring majority equity interests in photomask manufacturing operations in Korea and Taiwan, building a manufacturing facility for FPD photomasks in Taiwan, and two manufacturing facilities in China. In order to enable us to optimize our investments and other resources, we closely monitor the semiconductor and FPD manufacturing markets for indications of geographic movement and, in conjunction with these efforts, continue to assess the locations of our manufacturing facilities. These assessments may result in the opening or closing of facilities.

Operations outside of the United States are subject to inherent risks, including: fluctuations in exchange rates; unstable political and economic conditions in various countries; changes in economic alliances; unexpected changes in regulatory requirements; compliance with a variety of burdensome foreign laws and regulations; compliance with anti-bribery and anti-corruption laws (such as the Foreign Corrupt Practices Act); tariffs and other trade barriers; difficulties in staffing and managing international operations; and longer accounts receivable payment cycles. In addition: foreign countries may enact other restrictions on foreign trade or investment, including currency exchange controls; trade sanctions could result in our losing access to customers and suppliers; legislation may cause agreements to be difficult to enforce; accounts receivable may be difficult to collect, or we may be subject to adverse tax consequences. These factors may have a material adverse effect on our ability to generate revenues outside of the United States and, consequently, on our business and results of operations.

Our business could suffer as a result of the United Kingdom’s decision to end its membership in the European Union.

The decision of the United Kingdom to exit from the European Union (generally referred to as “BREXIT”) could cause disruptions to, and create uncertainty surrounding, our business, including affecting our relationships with existing and potential customers, suppliers, and employees. The effects of BREXIT will depend on any agreements the United Kingdom makes to retain access to European Union markets either during a transitional period or more permanently. The measures could potentially disrupt some of our target markets and jurisdictions in which we operate, and adversely change tax benefits or liabilities in these or other jurisdictions. In addition, BREXIT could lead to legal uncertainty and potentially divergent national laws and regulations, as the United Kingdom determines which European Union laws to replace or replicate. BREXIT also may create global economic uncertainty, which may cause our customers and potential customers to monitor their costs and reduce their budgets for either our products or other products that incorporate our products. Any of these effects of BREXIT, among others, could materially adversely affect our business, business opportunities, results of operations, financial condition, and cash flows. The United Kingdom’s deadline to leave the European Union has twice been extended, from its original date of March 31, 2019, to its current date of January 31, 2020. In light of the recent UK elections, BREXIT is now a virtual certainty.

Changes in foreign currency exchange rates could have a material adverse effect on our results of operations, financial condition, or cash flows.

Our consolidated financial statements are prepared in accordance with accounting principles generally accepted in the United States of America (U.S. GAAP) and are reported in U.S. dollars. Our operations have transactions and balances denominated in currencies other than the U.S. dollar; primarily the South Korean won, New Taiwan dollar, Japanese yen, Chinese renminbi, euro, Singapore dollar, and the British pound sterling. In fiscal year 2019, we recorded a net loss from changes in foreign currency exchange rates of \$1.3 million in our statement of income, while our net assets decreased by \$2.9 million as a result of the translation of foreign currency financial statements to U.S. dollars. Significant foreign currency fluctuations may adversely affect our results of operations, financial condition, or cash flows.

Our business depends on managerial and technical personnel, who are in great demand, and our inability to attract and retain qualified employees could adversely affect our business and results of operations.

Our success depends, in part, upon key managerial and technical personnel, as well as our ability to continue to attract and retain additional qualified personnel. The loss of certain key personnel (i.e. CEO, CTO, etc.) could have a material adverse effect on our business and results of operations. We cannot offer assurance that we can retain our key managerial and technical employees, or that we can attract similar additional employees in the future.

We may be unable to enforce or defend our ownership and use of proprietary technology, and the utilization of unprotected company developed technology by our competitors could adversely affect our business, results of operations, and financial position.

We believe that the success of our business depends more on proprietary technology, information and processes, and know-how than on our patents or trademarks. Much of our proprietary information and technology related to manufacturing processes is not patented and may not be patentable. We cannot offer assurance that:

- we will be able to adequately protect our technology;
- competitors will not independently develop similar technology; or
- international intellectual property laws will adequately protect our intellectual property rights.

We may become the subject of infringement claims or legal proceedings by third parties with respect to current or future products or processes. Any such claims, with or without merit, or litigation to enforce or protect our intellectual property rights that require us to defend against claimed infringements of the rights of others, could result in substantial costs, diversion of resources, and product shipment delays or could force us to enter into royalty or license agreements, rather than dispute the merits of these claims. Any of the foregoing could have a material adverse effect on our business, results of operations, and financial position.

We may be unprepared for changes to environmental laws and regulations and may incur liabilities arising from environmental matters.

We are subject to numerous environmental laws and regulations that impose various environmental controls on, among other things, the discharge of pollutants into the air and water and the handling, use, storage, disposal, and clean-up of solid and hazardous wastes. Changes in these laws and regulations may have a material adverse effect on our financial position and results of operations, and inadequate compliance with their requirements could give rise to significant liabilities.

If we violate environmental, health or safety laws or regulations, in addition to being required to correct such violations, we can be held liable in administrative, civil, or criminal proceedings, and substantial fines and other sanctions could be imposed that could disrupt or limit our operations. Liabilities associated with the investigation and cleanup of hazardous substances, as well as personal injury, property damages or natural resource damages arising from the release of, or exposure to, such hazardous substances, may be imposed in many situations without regard to violations of laws or regulations or other fault, and may also be imposed jointly and severally (so that a responsible party may be held liable for more than its share of the losses involved, or even the entire loss). Such liabilities may also be imposed on many different entities with a relationship to the hazardous substances at issue, including, for example, entities that formerly owned or operated the property affected by the hazardous substances and entities that arranged for the disposal of the hazardous substances at the affected property, as well as entities that currently own or operate such property. The nature of our business, including historical operations at our current and former facilities, exposes us to risks of liability under these laws and regulations due to the production, storage, use, transportation and sale of materials that can cause contamination or personal injury if released into the environment. Additional information may arise in the future concerning the nature or extent of our liability with respect to identified sites and additional sites that may be identified, for which we are alleged to be liable.

Our production facilities could be damaged or disrupted by natural disasters or labor strikes, either of which could adversely affect our financial position, results of operations, and cash flows.

A major catastrophe, such as an earthquake or other natural disaster, labor strike, or work stoppage at any of our manufacturing facilities, or a manufacturing facility of our suppliers or customers, could result in a prolonged interruption of our business. A disruption resulting from any one of these events could cause significant delays in shipments of our products and the loss of revenue and customers, which could have a material adverse effect on our financial position, results of operations, and cash flows. Our facilities in Taiwan are located in a seismically-active area.

Our sales can be impacted by the health and stability of the general economy, which could adversely affect our results of operations and cash flows.

Unfavorable general economic conditions in the U.S. or other countries in which we or our customers conduct business may have the effect of reducing the demand for photomasks. Economic downturns may lead to a decrease in demand for end products whose manufacturing processes involve the use of photomasks, which may result in a reduction in new product design and development by semiconductor or FPD manufacturers, and adversely affect our results of operations and cash flows.

Additional taxes could adversely affect our financial results.

Our tax filings are subject to audits by tax authorities in the various jurisdictions in which we do business. These audits may result in assessments of additional taxes that are subsequently resolved with the taxing authorities or through the courts. Currently, we believe there are no outstanding assessments whose resolution would result in a material adverse financial result. However, we cannot offer assurances that unasserted or potential future assessments would not have a material adverse effect on our financial condition or results of operations.

Our business could be adversely impacted by global or regional catastrophic events.

Our business could be adversely affected by terrorist acts, widespread outbreaks of infectious diseases, or the outbreak or escalation of wars, especially in the Asian markets in which we generate a significant portion of our sales and in Japan where we purchase raw materials and capital equipment. Such events in the geographic regions in which we do business, including escalations of political tensions and military operations within the Korean Peninsula, where a significant portion of our foreign operations are located, could have material adverse impacts on our revenue, cost and availability of raw materials, results of operations, cash flows, and financial condition.

Servicing our debt requires a significant amount of cash, and we may not generate sufficient cash flows from our operations to pay our indebtedness.

Our ability to make scheduled payments of debt principal and interest, or to refinance our indebtedness, depends on our future performance, which is subject to economic, financial, competitive, and other factors beyond our control. Our business may not continue to generate sufficient cash flows from operations to fund operations, service our debt and make necessary capital expenditures. If we are unable to generate such cash flows, we may be required to adopt one or more alternatives, such as selling assets, restructuring debt, or obtaining additional equity capital on terms that may be onerous or highly dilutive. Our ability to refinance our indebtedness would depend upon the conditions in the capital markets and our financial condition at such time. We may not be able to engage in any of these activities or engage in these activities on desirable terms, which could result in a default on our debt obligations.

Our hedging activity could negatively impact our results of operations and cash flows.

We may enter into derivatives to manage our exposure to interest rate and currency movements. If we do not accurately forecast our results of operations, execute contracts that do not effectively mitigate our economic exposure to interest rates and currency rates, elect to not apply hedge accounting, or fail to comply with the complex accounting requirements for hedging transactions, our results of operations and cash flows could be volatile, as well as negatively impacted.

The market price of our common stock is subject to volatility and could fluctuate widely in response to various factors, many of which are beyond our control.

Factors that may influence the price of our common stock include, but are not limited to, the following:

- loss of any of our key customers or suppliers;
- additions or departures of key personnel;
- third party sales of common stock;
- our ability to execute our business plan, including but not limited to, our expansion into China;
- announcements and consummations of business acquisitions;
- operating results that fall below expectations;
- issuances or repurchases of our common stock;
- intellectual property disputes;
- industry developments;
- news or disclosures by competitors or customers;
- business combinations, divestitures, or bankruptcies by customers, suppliers, or competitors;
- economic and other external factors; and
- period-to-period fluctuations in our financial results.

In addition, securities markets have from time to time experienced significant price and volume fluctuations that are unrelated to the operating performance of particular companies. These market fluctuations may also materially and adversely affect the market price of our common stock. Such fluctuations may be the result of imbalances between buy and sell offers, or low trading volume which can magnify the effects of a small number of transactions on the price of a stock.

Ineffective internal controls could impact our business and operating results.

Our internal controls over financial reporting may not prevent or detect misstatements because of their inherent limitations in detecting human errors, the circumvention or overriding of controls, or fraud; even effective internal controls can provide only reasonable assurance with respect to the preparation and fair presentation of financial statements. If we: fail to maintain the adequacy of our internal controls, including any failure to implement required new or improved controls; otherwise fail to prevent financial reporting misstatements; or if we experience difficulties in implementing internal controls, our business and operating results could be harmed, and we could fail to meet our financial reporting obligations.

ITEM 1B. UNRESOLVED STAFF COMMENTS

None.

ITEM 2. PROPERTIES

The following table presents certain information about the Company's photomask manufacturing facilities:

Location	Type of Interest	
Allen, Texas	Owned	
Boise, Idaho	Owned	
Brookfield, Connecticut	Owned	
Bridgend, Wales	Leased	
Cheonan, Korea	Owned	
Hefei, China	Owned	(1)
Dresden, Germany	Leased	
Hsinchu, Taiwan	Owned	(1)
Hsinchu, Taiwan	Leased	
Taichung, Taiwan	Owned	(1)
Xiamen, China	Owned	(1)

(1) The Company owns its manufacturing facility in Hefei, Taichung, Xiamen, and one of its manufacturing facilities in Hsinchu. However, it leases the related land.

ITEM 3. LEGAL PROCEEDINGS

We are subject to various claims that arise in the ordinary course of business. We believe such claims, individually or in the aggregate, will not have a material adverse effect on our business.

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

The common stock of the Company is traded on the NASDAQ Global Select Market ("NASDAQ") under the symbol PLAB. On December 13, 2019, the closing sale price of our Common Stock, per the NASDAQ Global Select Market, was \$15.94. Based on available information, we estimate that we have approximately 9,400 shareholders.

To date, we have not paid any cash dividends on Photonics shares, and, for the foreseeable future, we anticipate that earnings will continue to be retained for use in our business. Further, our credit agreement limits the amount that can be paid as cash dividends on Photonics stock.

Issuer Purchases of Equity Securities

In August 2019, the Company's board of directors authorized the repurchase of up to \$100 million of its common stock, pursuant to a repurchase plan under Rule 10b5-1 of the Securities Act of 1933 (as amended). The repurchase program may be suspended or discontinued at any time.

In July 2018 and October 2018, the Company's board of directors authorized the repurchase of up to \$20 million and \$25 million, respectively, of its common stock, to have been executed in open-market transactions or in accordance with a repurchase plan under Rule 10b5-1 of the Securities Act of 1933 (as amended). The July 2018 repurchase program was completed in October 2018, and the October 2018 repurchase program was terminated on February 1, 2019.

August 2019 Authorization

	Total Number of Shares Purchased (in millions)	Average Price Paid Per share	Total Number of Shares Purchased as Part of Publicly Announced Program (in millions)	Dollar Value of Shares That May Yet Be Purchased (in millions)
Fiscal year 2019 repurchases				
September 23, 2019 – October 31, 2019	1.0	\$ 11.05	1.0	\$ 89.0
Total	1.0		1.0	

2018 Authorizations

	Total Number of Shares Purchased (in millions)	Average Price Paid Per share	Total Number of Shares Purchased as Part of Publicly Announced Program (in millions)	Dollar Value of Shares That May Yet Be Purchased (in millions)
Fiscal year 2019 repurchases				
November 1, 2018 – November 25, 2018	0.2	\$ 9.49	0.2	\$ 20.1
November 26, 2018 – December 23, 2018	0.7	\$ 9.38	0.7	\$ 13.4
December 24, 2018 – January 27, 2019	0.2	\$ 9.41	0.2	\$ 11.2*
Total	1.1	\$ 9.40	1.1	

Fiscal year 2018 repurchases

	Total Number of Shares Purchased (in millions)	Average Price Paid Per share	Total Number of Shares Purchased as Part of Publicly Announced Program (in millions)	Dollar Value of Shares That May Yet Be Purchased (in millions)
July 10, 2018 – July 29, 2018	0.8	\$ 8.72	0.8	\$ 13.2
July 30, 2018 – August 26, 2018	0.9	\$ 9.05	0.9	\$ 5.0
September 23, 2018 – October 31, 2018	0.9	\$ 9.46	0.9	\$ 21.9
Total	<u>2.6</u>	\$ 9.04	<u>2.6</u>	

* The share repurchase program was terminated on February 1, 2019, with no additional shares being purchased subsequent to January 27, 2019.

Securities authorized for issuance under equity compensation plans

The information regarding our equity compensation required to be disclosed by Item 201(d) of Regulation S-K is incorporated by reference from the Photronics, Inc. 2020 Definitive Proxy Statement in Item 12 of Part III of this report. The 2020 Definitive Proxy Statement will be filed within 120 days after our fiscal year ended October 31, 2019.

ITEM 6. SELECTED FINANCIAL DATA

The following selected financial data (in thousands, except per share amounts and employees) is derived from our audited consolidated financial statements. The data should be read in conjunction with the audited consolidated financial statements and notes thereto, and other financial information included elsewhere in this Annual Report on Form 10-K.

	Year Ended				
	October 31, 2019	October 31, 2018	October 29, 2017	October 30, 2016	November 1, 2015
OPERATING DATA:					
Revenue	\$ 550,660	\$ 535,276	\$ 450,678	\$ 483,456	\$ 524,206
Gross profit	\$ 120,841	\$ 131,503	\$ 91,315	\$ 118,706	\$ 143,136
Gross margin	21.9%	24.6%	20.3%	24.6%	27.3%
Operating income	\$ 52,121	\$ 65,627	\$ 31,868	\$ 52,475	\$ 72,233
Operating margin	9.5%	12.3%	7.1%	10.9%	13.8%
Effective tax rate (a)	20.1%	10.7%	19.9%	7.9%	18.8%
Net income (a), (b), (c), (d)	\$ 40,491	\$ 61,236	\$ 21,289	\$ 55,676	\$ 56,859
Net income attributable to Photronics, Inc. shareholders (a), (b), (c), (d)	\$ 29,793	\$ 42,055	\$ 13,130	\$ 46,200	\$ 44,625
Earnings per share:					
Basic (a), (b), (c), (d)	\$ 0.45	\$ 0.61	\$ 0.19	\$ 0.68	\$ 0.67
Diluted (a), (b), (c), (d)	\$ 0.44	\$ 0.59	\$ 0.19	\$ 0.64	\$ 0.63
Weighted-average diluted number of common shares outstanding:	69,155	74,821	69,288	76,354	78,383
Net cash provided by operating activities	\$ 68,386	\$ 130,567	\$ 96,833	\$ 122,137	\$ 133,195
Purchase of property, plant and equipment	\$ 178,375	\$ 92,585	\$ 91,965	\$ 50,147	\$ 104,033
Purchase of treasury stock	\$ 21,696	\$ 23,111	\$ -	\$ -	\$ -
Employees	1,775	1,575	1,475	1,530	1,550

BALANCE SHEET DATA

	As of				
	October 31, 2019	October 31, 2018	October 29, 2017	October 30, 2016	November 1, 2015
Working capital	\$ 275,573	\$ 311,655	\$ 367,348	\$ 360,269	\$ 168,237
Property, plant and equipment, net	\$ 632,441	\$ 571,781	\$ 535,197	\$ 506,434	\$ 547,284
Total assets	\$ 1,118,665	\$ 1,110,009	\$ 1,020,794	\$ 987,988	\$ 1,042,811
Long-term debt	\$ 41,887	\$ -	\$ 57,337	\$ 61,860	\$ 67,120
Total Photronics, Inc. shareholders' equity	\$ 769,892	\$ 759,671	\$ 744,564	\$ 710,363	\$ 646,555
Noncontrolling interests	\$ 141,200	\$ 144,898	\$ 120,731	\$ 115,111	\$ 115,511

- (a) In 2016, includes tax benefits in Taiwan of \$4.8 million primarily related to the recognition of prior period tax benefits and other tax positions no longer deemed necessary.
- (b) In 2018, includes \$0.6 million gain on sale of assets.
- (c) In 2016, includes \$8.8 million gain on sale of investment in a foreign entity and \$0.2 million gain on the sale of the Company's 49.99% interest in the MP Mask joint venture.
- (d) In 2015, includes \$0.9 million of financing expenses related to the exchange of \$57.5 million of 3.25% convertible senior notes.

ITEM 7. MANAGEMENT'S DISCUSSION AND ANALYSIS OF FINANCIAL CONDITION AND RESULTS OF OPERATIONS

Overview

We sell substantially all of our photomasks to semiconductor designers and manufacturers, and manufacturers of FPDs. Photomask technology is also being applied to the fabrication of other higher performance electronic products such as photonics, micro-electronic mechanical systems, and certain nanotechnology applications. Our selling cycle is tightly interwoven with the development and release of new semiconductor and FPD designs and applications, particularly as they relate to the semiconductor industry's migration to more advanced product innovation, design methodologies, and fabrication processes. We believe that the demand for photomasks primarily depends on design activity rather than sales volumes from products manufactured using photomask technologies. Consequently, an increase in semiconductor or FPD sales does not necessarily result in a corresponding increase in photomask sales. However, the reduced use of customized ICs, reductions in design complexity, other changes in the technology or methods of manufacturing or designing semiconductors, or a slowdown in the introduction of new semiconductor or FPD designs could reduce demand for photomasks – even if the demand for semiconductors and FPDs increases. Advances in semiconductor, FPD, and photomask design and semiconductor and FPD production methods that shift the burden of achieving device performance away from lithography could also reduce the demand for photomasks. Historically, the microelectronic industry has been volatile, experiencing periodic downturns and slowdowns in design activity. These downturns have been characterized by, among other things, diminished product demand, excess production capacity, and accelerated erosion of selling prices with a concomitant effect on revenue and profitability.

We are typically required to fulfill customer orders within a short period of time, sometimes within twenty-four hours. This results in a minimal level of backlog orders, typically one to two weeks of backlog for IC photomasks and two to three weeks of backlog for FPD photomasks.

The global semiconductor industry is driven by end markets which have been closely tied to consumer-driven applications of high-performance devices, including, but not limited to, mobile display devices, mobile communications, and computing solutions. While we cannot predict the timing of the industry's transition to volume production of next-generation technology nodes, or the timing of up and down cycles with precise accuracy, we believe that such transitions and cycles will continue into the future, beneficially and adversely affecting our business, financial condition, and operating results as they occur. We believe our ability to remain successful in these environments is dependent upon the achievement of our goals of being a service and technology leader and efficient solutions supplier, which we believe should enable us to continually reinvest in our global infrastructure.

We are focused on improving our competitiveness by advancing our technology and reducing costs and, in connection therewith, have invested and plan to continue to invest in manufacturing equipment to serve the high-end markets. As we face challenges in the current and near term that require us to make significant improvements in our competitiveness, we continue to evaluate further cost reduction initiatives.

State-of-the-art production for semiconductor masks is considered to be 28 nanometer and smaller for ICs and Generation 8 and above and AMOLED display-based process technologies for FPDs. However, 32 nanometer and above geometries for semiconductors and Generation 7 and below, excluding AMOLED, process technologies for FPDs constitute the majority of designs currently being fabricated in volume. At these geometries, we can produce full lines of photomasks, and there is no significant technology employed by our competitors that is not available to us. We expect 28 nanometer and below designs to continue to move to wafer fabrication throughout fiscal 2020, and we believe we are well positioned to service an increasing volume of this business as a result of our investments in manufacturing processes and technology in the regions where our customers are located.

The photomask industry has been, and is expected to continue to be, characterized by technological change and evolving industry standards. In order to remain competitive, we will be required to continually anticipate, respond to, and utilize changing technologies. In particular, we believe that, as semiconductor geometries continue to become smaller, and FPD designs become larger or otherwise more advanced, we will be required to manufacture even more complex optically-enhanced reticles, including optical proximity correction and phase-shift photomasks. Additionally, demand for photomasks has been, and could in the future be, adversely affected by changes in semiconductor and high-performance electronics fabrication methods that affect the type or quantity of photomasks used, such as changes in semiconductor demand that favor field-programmable gate arrays and other semiconductor designs that replace application-specific ICs, or the use of certain chip-stacking methodologies that lessen the emphasis on conventional lithography technology. Furthermore, increased market acceptance of alternative methods of transferring circuit designs onto semiconductor wafers could reduce or eliminate the need for photomasks in the production of semiconductors. As of the end of fiscal year 2019, one alternative method, direct-write lithography, has not been proven to be a commercially viable alternative to photomasks, as it is considered to be too slow for high-volume semiconductor wafer production, and we have not experienced a significant loss of revenue as a result of this or other alternative semiconductor design methodologies. However, should direct-write lithography or any other alternative method of transferring IC designs to semiconductor wafers without the use of photomasks achieve market acceptance, and we do not anticipate, respond to, or utilize these or other changing technologies due to resource, technological, or other constraints, our business and results of operations could be materially adversely affected.

Both our revenues and costs have been affected by the increased demand for high-end-technology photomasks that require more advanced manufacturing capabilities, but generally command higher average selling prices ("ASPs"). Our capital expenditure payments aggregated approximately \$363 million for the three fiscal years ended October 31, 2019, which has significantly contributed to our cost of goods sold. We intend to continue to make the required investments to support the technological demands of our customers that we believe will position the Company for future growth. In support of this effort, we expect capital expenditure payments to be approximately \$100 million in fiscal year 2020.

The manufacture of photomasks for use in fabricating ICs, FPDs, and other related products built using comparable photomask-based process technologies has been, and continues to be, capital intensive. Our employees and our integrated global manufacturing network represent a significant portion of our fixed operating cost base. Should our revenue decrease as a result of a decrease in design releases from our customers, we may have excess or underutilized production capacity, which could significantly impact our operating margins, or result in write-offs from asset impairments.

Recent Developments

In the first quarter of fiscal 2020, we acquired the remaining 0.2% of noncontrolling interests in PK, Ltd. for \$0.6 million.

In the first quarter of fiscal 2020, we adopted ASU 2016-02 and all subsequent amendments, collectively codified in Accounting Standards Codification Topic 842 - "Leases" ("Topic 842"). This guidance requires modified retrospective adoption, either at the beginning of the earliest period presented or at the beginning of the period of adoption; we elected to apply the guidance at the beginning of the period of adoption, and recognized right-of-use leased assets of approximately \$6.7 million, and corresponding lease liabilities, which were discounted at our incremental borrowing rates, on our November 1, 2019, consolidated balance sheet to reflect our adoption of the guidance. We do not expect our adoption of Topic 842 to affect our cash flows or our ability to comply with covenants under our credit agreements.

In the fourth quarter of fiscal 2019, our board of directors declared a dividend of one preferred stock purchase right (a "Right"), payable on or about October 1, 2019, for each share of common stock, par value \$0.01 per share, of the Company outstanding on September 30, 2019, to the stockholders of record on that date. In connection with the distribution of the Rights, we entered into a Section 382 Rights Agreement (the "Rights Agreement"), dated as of September 23, 2019, between the Company and Computershare Trust Company, N.A., a federally chartered trust company, as rights agent. The purpose of the Rights Agreement is to deter trading of our common stock that would result in a change in control (as defined in Internal Revenue Control Section 382), thereby preserving our future ability to use our historical federal net operating losses and other Tax Attributes (as defined in the Rights Agreement). Each Right entitles the registered holder to purchase from the Company one one-thousandth of a share of Series A Preferred Stock, par value \$0.01 per share, at a price of \$33.63, subject to adjustment. The Rights, which are described in the Company's Current Report on Form 8-K filed on September 24, 2019, are in all respects subject to and governed by the provisions of the Rights Agreement. The Rights will expire at the earliest to occur of (i) the close of business on the day following the certification of the voting results of the Company's 2020 annual meeting of stockholders, if at that meeting, or any other meeting of stockholders of the Company duly held prior to September 22, 2020, a proposal to approve this Rights Agreement is not passed by the affirmative vote of the majority of the voting interests; (ii) the date on which our board of directors determines, in its sole discretion, that the Rights Agreement is no longer necessary for the preservation of material valuable tax attributes, or the tax attributes have been fully utilized and may no longer be carried forward, and (iii) the close of business on September 22, 2022.

In the fourth quarter of fiscal 2019, PDMC, the Company's majority-owned IC subsidiary in Taiwan, paid a dividend of which 49.99%, or approximately \$18.9 million, was paid to noncontrolling interests.

In the fourth quarter of fiscal 2019, upon our request, a financing entity made an advance payment of \$3.5 million to an equipment vendor. We entered into a Master Lease Agreement ("MLA") with this financing entity, which became effective in July 2019. The MLA enables us to request advance payments or other funds to finance equipment to be leased or purchased in the U.S. In connection with this MLA, we have been approved for financing of \$35 million for the purchase of a high-end lithography tool. Interest on this borrowing is payable monthly at thirty-day LIBOR plus 1% (2.76% at October 31, 2019), and will continue to accrue until the borrowing is repaid or, as allowed under the MLA, we enter into a lease for the equipment. We intend to enter into a lease agreement for the related equipment in fiscal year 2020.

In the fourth quarter of fiscal 2019, the Company's board of directors authorized the repurchase of up to \$100 million of its common stock, pursuant to a repurchase plan under Rule 10b5-1 of the Securities Act of 1933 (as amended). As of October 31, 2019, we had repurchased 1.0 million shares at a cost of \$11.0 million (an average price of \$11.05 per share). The repurchase program may be suspended or discontinued at any time.

In the second quarter of fiscal 2019, we repaid, upon maturity, the entire \$57.5 million principal amount of the convertible senior notes we issued in April 2016.

In the first quarter of fiscal 2019, PDMC paid a dividend, of which 49.99%, or approximately \$26.1 million, was paid to noncontrolling interests.

In the first quarter of fiscal 2019, PDMCX was approved for credit of \$50 million, subject to certain limitations related to PDMCX registered capital at the time of the initial approval, pursuant to which PDMCX has and will enter into separate loan agreements ("the Project Loans") for intermittent borrowings. The Project Loans, which are denominated in Chinese renminbi (RMB), are being used to finance certain capital expenditures in China. PDMCX granted liens on its land, building, and certain equipment as collateral for the Project Loans. As of October 31, 2019, PDMCX had borrowed 243.4 million RMB (\$34.5 million) against this approval. Payments on these borrowings are due semi-annually through December 2025; the initial payment is scheduled for June 2020. See Note 6 of the financial statements for additional information on these loans.

In the first quarter of fiscal 2019, PDMCX received approval for unsecured credit of \$25.0 million, pursuant to which PDMCX may enter into separate loan agreements. Under this credit agreement (the "Working Capital Loans"), PDMCX can borrow up to 140.0 million RMB to pay value-added taxes ("VAT") and up to 60.0 million RMB to fund operations; combined total borrowings are limited to \$25.0 million. As of October 31, 2019, PDMCX had outstanding 36.8 million RMB (\$5.2 million) to fund operations, with repayments due one year from the borrowing dates of the separate loan agreements. As of October 31, 2019, PDMCX had outstanding 67.3 million RMB (\$9.5 million) borrowed to pay VAT. Payments on these borrowings are due semiannually, at an increasing rate, through January 2022. See Note 6 of the consolidated financial statements for additional information on these loans.

In the fourth quarter of fiscal 2018, we entered into a five-year amended and restated credit agreement (the "Credit Agreement"), with JPMorgan Chase Bank, N.A., as Administrative Agent and Collateral Agent, Bank of America, N.A., as Syndication Agent, each of JPMorgan Chase Bank, N.A. and Merrill Lynch, Pierce, Fenner & Smith Incorporated as joint bookrunners and joint lead arrangers, and each of JPMorgan Chase Bank, N.A., Bank of America, N.A., Citizens Bank, N.A., and TD Bank, N.A. as lenders from time to time party thereto. The Credit Agreement has a \$50 million borrowing limit, with an expansion capacity to \$100 million, and is secured by substantially all of our assets located in the United States and common stock we own in certain foreign subsidiaries. The Credit Agreement includes minimum interest coverage ratio, total leverage ratio, and minimum unrestricted cash balance covenants (all of which we were in compliance with at October 31, 2019), and limits the amount of dividends, distributions, and redemptions we can pay on our common stock to an aggregate amount in 2019 of \$100 million and \$50 million annually thereafter. We had no outstanding borrowings against the Credit Agreement at October 31, 2019, and \$50 million was available for borrowing. The interest rate on the Credit Agreement (2.78% at October 31, 2019) is based on our total leverage ratio at LIBOR plus a spread, as defined in the Credit Agreement.

In the fourth quarter of fiscal 2018, the Company's board of directors authorized the repurchase of up to \$25 million of its common stock, to have been executed in open-market transactions or in accordance with a repurchase plan under Rule 10b5-1 of the Securities Act of 1933 (as amended). The share repurchase program commenced, under Rule 10b5-1, on October 22, 2018, and was terminated on February 1, 2019. In total, we repurchased 1.5 million shares at a cost of \$13.8 million (an average of \$9.41 per share) under this authorization.

In the third quarter of fiscal 2018, the Company's board of directors authorized the repurchase of up to \$20 million of its common stock, which was effectuated in open-market transactions or in accordance with a repurchase plan under Rule 10b5-1 of the Securities Act of 1933 (as amended). The share repurchase program commenced on July 10, 2018, and ended in October 2018. In total, under this authorization, we repurchased 2.2 million shares at a cost of \$20.0 million (an average of \$8.97 per share).

In the third quarter of fiscal 2018, PDMC paid a dividend, of which 49.99%, or approximately \$8.2 million, was paid to noncontrolling interests.

In the first quarter of fiscal 2018, we announced the successful closing of the China joint venture agreement with Dai Nippon Printing Co., Ltd. ("DNP"), which we had agreed to enter into and announced in the third quarter of fiscal 2017. Under the agreement, our wholly-owned Singapore subsidiary owns 50.01% of the joint venture, which is named Xiamen American Japan Photonics Mask Co., Ltd. (PDMCX), and a subsidiary of DNP owns the remaining 49.99%. The financial results of the joint venture, which commenced production in the third quarter of 2019, are included in the Photonics, Inc. consolidated financial statements. See Note 4 of the consolidated financial statements for additional information on the joint venture.

Results of Operations

The following tables present selected operating information expressed as a percentage of revenue:

	Three Months Ended		
	October 31, 2019	July 28, 2019	October 31, 2018
Revenue	100.0%	100.0%	100.0%
Cost of goods sold	75.6	77.9	75.5
Gross profit	24.4	22.1	24.5
Selling, general and administrative expenses	7.8	9.5	9.3
Research and development expenses	2.9	2.9	2.7
Operating income	13.7	9.7	12.5
Other income (expense), net	(3.9)	(0.2)	1.5
Income before income tax provision	9.8	9.5	14.0
Income tax provision	1.5	2.4	2.4
Net income	8.3	7.1	11.6
Net income attributable to noncontrolling interests	2.1	2.5	3.0
Net income attributable to Photonics, Inc. shareholders	6.2%	4.6%	8.6%

	Year Ended		
	October 31, 2019	October 31, 2018	October 29, 2017
Revenue	100.0%	100.0%	100.0%
Cost of goods sold	<u>78.1</u>	<u>75.4</u>	<u>79.7</u>
Gross profit	21.9	24.6	20.3
Selling, general and administrative expenses	9.5	9.6	9.7
Research and development expenses	<u>2.9</u>	<u>2.7</u>	<u>3.5</u>
Operating income	9.5	12.3	7.1
Other income (expense), net	<u>(0.3)</u>	<u>0.5</u>	<u>(1.2)</u>
Income before income tax provision	9.2	12.8	5.9
Income tax provision	<u>1.9</u>	<u>1.4</u>	<u>1.2</u>
Net income	7.3	11.4	4.7
Net income attributable to noncontrolling interests	<u>1.9</u>	<u>3.5</u>	<u>1.8</u>
Net income attributable to Photronics, Inc. shareholders	<u>5.4%</u>	<u>7.9%</u>	<u>2.9%</u>

Note: All the following tabular comparisons, unless otherwise indicated, are for the three months ended October 31, 2019 (Q4 FY19), July 28, 2019 (Q3 FY19) and October 31, 2018 (Q4 FY18), and for the fiscal years ended October 31, 2019 (FY19) and October 31, 2018 (FY18). Please refer to the MD&A in our 2018 Annual Report on Form 10-K for comparative discussion of our fiscal years ended October 31, 2018 and October 29, 2017.

Revenue

Our quarterly revenues can be affected by the seasonal purchasing tendencies of our customers. As a result, demand for our products is typically negatively impacted during the first, and sometimes the second, quarters of our fiscal year, by the North American, European, and Asian holiday periods, as some of our customers reduce their development and, consequently, their buying activities during those periods. High-end photomask applications include mask sets for 28 nanometer and smaller products for IC, and G8 and above and active matrix organic light-emitting diode (AMOLED) display technologies for FPD products. High-end photomasks typically have higher selling prices (ASPs) than mainstream products.

The following tables present changes in disaggregated revenue in Q4 FY19 and FY 19 from revenue in prior reporting periods. Columns may not total due to rounding.

Quarterly Changes in Revenue by Product Type

	Q4 FY19 from Q3 FY19			Q4 FY19 from Q4 FY18	
	Revenue in Q4 FY19	Increase (Decrease)	Percent Change	Increase (Decrease)	Percent Change
IC					
High-end	\$ 45.0	\$ 6.5	16.9%	\$ 5.5	14.0%
Mainstream	<u>67.6</u>	<u>5.9</u>	9.5%	<u>(3.9)</u>	(5.4)%
Total IC	<u>\$ 112.5</u>	<u>\$ 12.4</u>	12.3%	<u>\$ 1.7</u>	1.5%
FPD					
High-end	\$ 28.5	\$ 2.5	9.8%	\$ 6.5	29.4%
Mainstream	<u>15.2</u>	<u>3.3</u>	27.2%	<u>3.5</u>	29.5%
Total FPD	<u>\$ 43.7</u>	<u>\$ 5.8</u>	15.3%	<u>\$ 9.9</u>	29.4%
Total Revenue	<u>\$ 156.3</u>	<u>\$ 18.1</u>	13.1%	<u>\$ 11.6</u>	8.0%

Quarterly Changes in Revenue by Geographic Origin

	<u>Q4 FY19 from Q3 FY19</u>			<u>Q4 FY19 from Q4 FY18</u>	
	<u>Revenue in</u> <u>Q4 FY19</u>	<u>Increase</u> <u>(Decrease)</u>	<u>Percent</u> <u>Change</u>	<u>Increase</u> <u>(Decrease)</u>	<u>Percent</u> <u>Change</u>
Taiwan	\$ 68.9	\$ 7.6	12.4%	\$ 6.6	10.6%
Korea	37.3	0.2	0.6%	(3.4)	(8.4)%
United States	30.5	5.1	20.1%	(0.2)	(0.8)%
Europe	7.9	(0.1)	(1.0)%	(1.9)	(19.6)%
China	11.3	5.4	89.8%	10.7	1,692.9%
Other	0.4	(0.1)	(16.6)%	(0.1)	(22.6)%
Total revenue	\$ 156.3	\$ 18.1	13.1%	\$ 11.6	8.0%

Revenue increased 13.1% in Q4 FY19, compared with Q3 FY19, as both mainstream and high-end revenue increased. The largest increases in percentages were in FPD mainstream and IC high-end masks, which increased 27.2% and 16.9%, respectively. Revenues from China-based customers represented 33% of our total revenues in Q4 FY19. While some of the China-based revenue reflected a 77.5% increase in revenue at our FPD plant in China, much of the increase was due to increased shipments into China from IC facilities in Taiwan and Korea, both of which operated at full capacity during Q4 FY19. Our IC facility in China was, and is expected to be for a significant part of fiscal 2020, in the qualification stage with many of its customers; however, revenues increased significantly from Q3 FY19.

Revenue increased 8.0% in Q4 FY19, compared with Q4 FY18, primarily as a result of increased mainstream and high-end FPD growth, both of which increased over twenty-nine percent from the prior year quarter. High-end IC revenue also contributed to the increase, growing at 14.0%. Our expansion into China, as a ship-to destination from our Taiwan and Korea facilities, and from local production was a significant driver of the increase.

Year-over-Year Changes in Revenue by Product Type.

	<u>FY19 from FY18</u>		
	<u>Revenue in</u> <u>FY19</u>	<u>Increase</u> <u>(Decrease)</u>	<u>Percent</u> <u>Change</u>
IC			
High-end	\$ 156.4	\$ (3.9)	(2.5)%
Mainstream	249.8	(5.9)	(2.3)%
Total IC	\$ 406.2	\$ (9.9)	(2.4)%
FPD			
High-end	\$ 98.8	\$ 22.7	29.9%
Mainstream	45.6	2.5	5.8%
Total FPD	\$ 144.5	\$ 25.3	21.2%
Total Revenue	\$ 550.7	\$ 15.4	2.9%

Year-over-Year Changes in Revenue by Geographic Origin

	FY19 from FY18		
	Revenue in FY19	Increase (Decrease)	Percent Change
Taiwan	\$ 244.4	\$ 7.3	3.1%
Korea	147.7	0.7	0.5%
United States	105.0	(7.6)	(6.7)%
Europe	32.6	(3.0)	(8.3)%
China	19.0	17.9	1,543.0%
Other	1.9	0.1	4.5%
Total Revenue	\$ 550.7	\$ 15.4	2.9%

Revenue increased 2.9% in FY19, compared with FY18, to a record high of \$550.7 million. A 29.9% increase in high-end FPD sales was primarily responsible for the increase, with strong demand for mobile displays driving much of the increase. Our China FPD facility, which commenced production late in the second quarter, contributed 11.4% of our total FPD revenue. Overall IC revenues decreased from FY18 by 2.4%, as both mainstream and high-end IC revenues fell between 2 to 3%. The decrease was geographically broad-based, with our Taiwan IC facility being a notable exception, as its revenue grew 3.8%.

We anticipate a softening of the demand for G10.5+ FPD photomasks, which we expect to be offset to some extent by a strengthening of the demand for AMOLED photomasks. We expect our customers to continue to focus on improving mobile displays, including the development of foldable smartphones. Should demand increase sufficiently, we will be ready to increase our capacity to meet customer demands by expanding the production capacity of our FPD facility in China. We currently have two lithography tools on order that will enable us to expand our Asian capacity for mainstream photomasks, which are often used for certain layers of high-end applications. We anticipate that IC demand will be stable to improving. As ASPs for high-end masks are high, a relatively small shift in the timing of their demand can have an out-sized effect on the timing of our revenues.

The impact, if any, on our business of changing geopolitical conditions, such as U.S.-China trade relations, tensions between the Republic of South Korea and Japan, and the effects of the United Kingdom potentially exiting the European Union cannot be predicted.

Gross Margin

	Q4 FY19	Q3 FY19	Q4 FY18	Percent Change	
				Q4 FY19 from Q3 FY19	Q4 FY19 from Q4 FY18
Gross profit	\$ 38.2	\$ 30.6	\$ 35.4	24.8%	7.7%
Gross margin	24.4%	22.1%	24.5%		

Gross margin increased 2.3% from Q3 FY19 to 24.4%, primarily as a result of the \$18.2 million increase in revenue discussed above. Contribution margin from our high operating leverage, 1.9% decrease in compensation and related expenses as a percent of revenue, offset increased overhead costs which were primarily driven by increased equipment costs of \$2.4 million and outside processing costs of \$0.5 million. Material costs, as a percent of revenue, decreased by 0.4% from the prior quarter.

Gross margin decreased by 0.1% from Q4 FY18, primarily due to a 11.3% increase in overhead costs as a percent of revenue. Significant increases from the prior year quarter included depreciation expense of \$3.6 million and service contract expense of \$1.2 million, both of which resulted from our increased installed tool base in China. Increases in other non-equipment related overhead costs of \$1.4 million were incurred at our two China-based manufacturing facilities, in which production commenced, but had not yet reached capacity, in fiscal 2019. On a consolidated basis, both material and compensation-related expenses, as a percentage of revenue, did not change significantly from the prior year quarter.

	<u>Percent Change</u>		
	<u>FY19</u>	<u>FY18</u>	<u>FY19 from FY18</u>
Gross profit	\$ 120.8	\$ 131.5	(8.1)%
Gross margin	21.9%	24.6%	

On a year-to-date basis, gross margin decreased 2.7%; increased losses at our two China-based facilities constituting the most significant causes. Our FPD facility in China commenced production late in Q2 FY19, and our IC facility commenced production in Q3 FY19.

Selling, General and Administrative Expenses

Selling, general and administrative expenses decreased by \$1.0 million, or 7.5%, to \$12.1 million in Q4 FY19, from \$13.1 million in Q3 FY19, and by \$1.4 million, or 10.1%, from \$13.5 million in Q4 FY18, primarily due to decreased compensation and related expenses of \$1.0 and \$1.3 million from the respective comparative periods. On a full-year basis, selling, general and administrative expenses increased \$0.9 million, or 1.8%, in FY19 to \$52.3 million, from \$51.4 million in FY18, primarily due to a reduction in bad debt recoveries of \$0.8 million in FY19, as compared with FY18.

Research and Development Expenses

Research and development expenses consist of development efforts related to high-end process technologies for 28nm and smaller IC nodes. In Asia, in addition to the focus on high-end IC process technology nodes, G8 and above FPDs and AMOLED applications are also under development.

Research and development expenses increased \$0.5 million to \$4.5 million in Q4 FY19, or 12.2%, from Q3 FY19, primarily as a result of increased development costs of \$0.9 million at our China facilities. A decrease from the prior quarter in research and development expense of \$0.8 million in the U.S. was somewhat offset by increased expenses of \$0.4 million at our other Asia-based facilities. Research and development expenses increased \$0.6 million, or 16.3%, in Q4 FY19 over Q4 FY18. The increase was due to \$1.1 million of expense incurred at our China-based facilities, both of which commenced operations in FY19; decreased expense in the U.S. of \$0.8 million was partially offset by increased spending of \$0.3 million at our other Asia-based facilities.

On a full-year basis, research and development expenses increased \$1.9 million in FY19, or 13.2%, to \$16.4 million. The increase is largely attributable to spending of \$1.6 million at our China-based facilities, which commenced operations in FY19. The remainder of the increase is primarily attributable to increased development spending at our IC facility in Taiwan.

Other Income (Expense), net

	<u>Q4 FY19</u>	<u>Q3 FY19</u>	<u>Q4 FY18</u>
Interest income and other income (expense), net	\$ (5.9)	\$ -	\$ 2.9
Interest expense	(0.2)	(0.4)	(0.6)
Total other income (expense)	<u>\$ (6.1)</u>	<u>\$ (0.4)</u>	<u>\$ 2.3</u>

Interest income and other income (expense), net decreased by \$5.9 million in Q4 FY19, compared with Q3 FY19, primarily as a result of increased foreign currency transaction losses of \$6.2 million. Interest expense, which is related to our China-based debt, decreased \$0.2 million in Q4 FY19 from Q3 FY19; interest on our China-based debt is partially subsidized by a local authority.

Interest income and other income (expense), net decreased by \$8.9 million in Q4 FY19, compared with Q4 FY18, primarily as a result of unrealized foreign currency remeasurement effect of \$7.9 million. Also contributing to the decrease was a reduction in interest income of \$0.5 million, which resulted from our lower average cash balances during the current year quarter, and the absence, in Q4 FY19, of \$0.4 million of gains realized on the sales of assets in Q4 FY18. Interest expense decreased \$0.4 million in Q4 FY19 from Q4 FY18. The decrease is attributable to the repayment of our \$57.5 million of 3.25% convertible senior notes in April 2019, the impact of which was somewhat offset by interest incurred on our China-based loans.

	<u>FY19</u>	<u>FY18</u>
Interest income and other income (expense), net	\$ -	\$ 5.2
Interest expense	<u>(1.4)</u>	<u>(2.3)</u>
Total other income (expense)	<u>\$ (1.4)</u>	<u>\$ 2.9</u>

Interest income and other income (expense), net decreased by \$5.2 million on a full-year basis in FY19, compared with FY18, primarily as a result of: unrealized foreign currency remeasurement effects of \$1.6 million; decreased interest income of \$1.5 million (due to our lower average cash balances); a reduction, in the current year, of \$1.0 million of gains realized on the sales of assets; and a decrease in subsidy income in China of \$0.7 million. Interest expense decreased \$0.9 million in FY19 from FY18. The decrease is attributable to the repayment of our \$57.5 million of 3.25% convertible senior notes in April 2019, the impact of which was somewhat offset by interest incurred on our China-based loans.

Income Tax Provision

Certain provisions of the U.S. Tax Cuts and Jobs Act, which was signed into law on December 22, 2017, were effective for tax years beginning on or after January 1, 2018. As a fiscal year U.S. taxpayer, these provisions were applied to our fiscal year 2019, including the elimination of the domestic manufacturing deduction, which created new taxes on certain foreign sourced income, and introduced new limitations on certain business deductions.

	<u>Q4 FY19</u>	<u>Q3 FY19</u>	<u>Q4 FY18</u>
Income tax provision	\$ 2.3	\$ 3.2	\$ 3.6
Effective income tax rate	15.1%	24.7%	17.5%

The effective income tax rate is sensitive to the jurisdictional mix of our earnings, due, in part, to the non-recognition of tax provisions and benefits on losses in jurisdictions with valuation allowances.

The effective income tax rate decreased in Q4 FY19, compared with Q3 FY19, primarily due to the non-recognition of tax provisions in Q4 FY19 on U.S. quarterly income, compared with the non-recognition of tax benefits in Q3 FY19 on losses in the U.S.; the non-recognition of tax provisions and benefits in both quarters was a result of valuation allowances applying to those provisions and benefits. The effective income tax rate decreased in Q4 FY19 from Q4 FY18, for the same reasons; however, the effective income tax rate decrease was somewhat reduced by a decrease in the benefit of \$0.9 million from a tax holiday in Taiwan.

	<u>FY19</u>	<u>FY18</u>
Income tax provision	\$ 10.2	\$ 7.3
Effective income tax rate	20.1%	10.7%

The increase in the effective income tax rate on a full-year basis in FY19, compared with FY18, was primarily due to FY18 recognition of a tax benefit related to \$3.7 million of alternative minimum tax credits that became fully refundable under U.S. tax reform, and an FY19 decrease of \$1.1 million in the recognition of previously unrecognized tax benefits; the change in unrecognized tax benefits resulted from the differences in audit settlements and expirations of assessment period statutes of limitations between the two periods.

We consider all available evidence when evaluating the potential future realization of deferred tax assets, and when, based on the weight of all available evidence, we determine that it is more likely than not that some portion or all of our deferred tax assets will not be realized, we reduce our deferred tax assets by a valuation allowance. We also regularly assess the potential outcomes of ongoing and future tax examinations and, accordingly, have recorded accruals for such contingencies. Included in the balance of unrecognized tax benefits as of both October 31, 2019 and October 31, 2018, are \$1.9 million, recorded in Other liabilities in the consolidated balance sheets that, if recognized, would impact the effective tax rates.

Net Income Attributable to Noncontrolling Interests

	<u>Q4 FY19</u>	<u>Q3 FY19</u>	<u>Q4 FY18</u>	<u>FY19</u>	<u>FY18</u>
Net income attributable to noncontrolling interest	\$ 3.3	\$ 3.5	\$ 4.3	\$ 10.7	\$ 19.2

The changes, for all comparative periods, in net income attributable to noncontrolling interests were due to changes in net income at our IC manufacturing facilities in Taiwan and China, in which noncontrolling interests hold 49.99% ownership interests.

Liquidity and Capital Resources

	<u>October 31, 2019</u>	<u>October 31, 2018</u>
	<i>(in \$ millions)</i>	<i>(in \$ millions)</i>
Cash and cash equivalents	\$ 206.5	\$ 329.3
Net cash provided by operating activities	\$ 68.4	\$ 130.6
Net cash used in investing activities	\$ (151.4)	\$ (90.9)
Net cash used in financing activities	\$ (42.1)	\$ (13.8)

We had cash and cash equivalents of \$206.5 million at the end of FY19, compared with \$329.3 million at the end of fiscal 2018. The net decrease is primarily attributable to:

- \$57.5 million used to repay our convertible senior notes;
- \$178.4 million used to purchase capital assets (the preponderance of which related to equipping our China-based facilities);
- \$21.7 million used to repurchase our common stock;
- \$15.7 million dividends, net of contributions, paid to noncontrolling interests
- \$54.6 million received from borrowings in China;
- \$27.0 million received from government incentives in China and the U.S.,
- \$68.4 million provided by operating activities.

As of October 31, 2019, our working capital was \$275.6 million, compared with \$311.7 million at the end of fiscal 2018. The \$36.1 million net decrease is primarily attributable to:

- Decreased cash and cash equivalents of \$65.2 million (net of \$57.5 million used to repay our convertible senior notes, which had no impact on working capital);
- Increased inventories of \$19.0 million, the predominance of which was to supply our China FPD facility and;
- Receivables for investment subsidies in China of \$3.2 million at the end of FY19,
- Increased value added tax prepayments at our China-based facilities of \$3.7 million.

The net cash provided by operating activities of \$68.4 million in FY19 decreased \$62.2 million, from \$130.6 million provided in FY18. The net decrease was due primarily to:

- Lower net income of \$20.7 million in YTD FY19;
- Increased trade accounts receivable of \$13.7 million, primarily attributable to our \$11.6 million increase in revenue in Q4 FY19, compared with Q4 FY18.
- A greater increase in the change in inventories balances of \$11.4 million in FY19 (primarily attributable to the stocking of our FPD facility in China) and;
- An increase in value added tax prepayments related to our China facilities of \$15.7 million in FY19. These prepayments are recoverable through future sales transactions of the facilities.

Net cash used in investing activities was \$151.4 million in FY19, an increase of \$60.5 million from \$90.9 million used in FY18. The net increase was primarily attributable to increased capital expenditures of \$85.8 million, the predominance of which related to the building and equipping of our China facilities. The increased capital expenditures were partially offset by \$27.0 million received in China and the U.S. from investment incentives in FY19.

Net cash flows from financing activities increased from funds used of \$13.8 million in FY18 to \$42.1 million of funds used in FY19. Significant components of the net decrease were:

- \$57.5 million used to repay (upon their maturity) our convertible senior notes;
- \$45.1 million used to pay dividends to DNP (related to their 49.99% interest in our IC facility in Taiwan);
- \$21.7 million used to acquire our common stock under share repurchase programs;
- \$54.6 million received from borrowings in China and,
- \$29.4 million contributed by DNP for their investment in our IC joint venture in China.

Foreign currency exchange rates contributed \$2.4 million to our reported cash balance at October 31, 2019.

As of October 31, 2019, and October 31, 2018, our total cash and cash equivalents included \$147.2 million and \$244.5 million, respectively, held by our foreign subsidiaries. The majority of earnings of our foreign subsidiaries are considered to be indefinitely reinvested. Repatriation of these funds to the U.S. may subject them to U.S. state income taxes and local country withholding taxes in certain jurisdictions. Furthermore, our foreign subsidiaries continue to grow through the reinvestment of earnings in additional manufacturing capacity and capability, particularly in the high-end IC and FPD areas.

Our liquidity, as we operate in a high fixed-cost environment, is highly dependent on our revenue, cash conversion cycle, and the timing of our capital expenditures (which can vary significantly from period to period). Depending on conditions in the semiconductor and FPD markets, our cash flows from operations and current holdings of cash may not be adequate to meet our current and long-term needs for capital expenditures, operations, and debt repayments. Historically, in certain years, we have used external financing to fund these needs. Due to conditions in the credit markets and covenant restrictions on our existing debt, some financing instruments we have used in the past may not be available to us when required. Consequently, we cannot assure that additional sources of financing would be available to us on commercially favorable terms, should our long-term cash requirements exceed our existing cash and cash available under our credit agreements.

As of October 31, 2019, we had outstanding capital commitments of approximately \$112 million. We intend to finance our capital expenditures with our working capital, contributions from our joint venture partners, cash generated from operations and, if necessary, additional borrowings. Our remaining funding commitment for our IC facility in China, which commenced production in the third quarter of fiscal 2019, was approximately \$7 million as of October 31, 2019; we will fulfill this commitment over the next several quarters.

Cash Requirements

Our cash requirements in fiscal 2020 will primarily be for funding our operations, capital spending, (including the completion of our two facilities in China, and the acquisition of additional high-end equipment at other sites), and debt repayments. At our option, should we deem it to be an optimal use of our cash, we may repurchase some of our common stock. We believe that our cash on hand, cash generated from operations and amounts available to borrow will be sufficient to meet our cash requirements for the next twelve months. We regularly review the availability and terms at which we might issue additional equity or debt securities in the public or private markets. However, we cannot assure that additional sources of financing would be available to us on commercially favorable terms, should our cash requirements exceed our existing cash and cash available under our credit agreements.

Contractual Obligations

The following table presents our contractual obligations as of October 31, 2019:

Contractual Obligations	Payment due by period				
	Total	Less Than 1 Year	1 - 3 Years	3 - 5 Years	More Than 5 Years
Debt (1)	\$ 52,760	\$ 10,873	\$ 20,735	\$ 10,029	\$ 11,123
Operating leases	6,701	2,010	3,148	1,166	377
Purchase obligations (1)	130,270	105,579	24,691	-	-
Interest	7,385	2,433	3,034	1,609	309
Other noncurrent liabilities	11,436	1,046	2,656	2,658	5,076
Total	\$ 208,552	\$ 121,941	\$ 54,264	\$ 15,462	\$ 16,885

(1) Included above, in the less-than-one-year amounts of Debt and Purchase Obligations, are \$3.5 million and \$30.8 million, respectively, which we intend to finance under a multi-year capital lease in fiscal 2020. As discussed in Note 6 of the consolidated financial statements, we have been approved for a lease to finance the purchase of a high-end lithography tool under an agreement entered into in fiscal 2019.

As of October 31, 2019, the Company had recorded accruals for uncertain tax positions and related interest and penalties of \$1.9 million; these accruals were not included in the above table due to the high degree of uncertainty regarding the timing of future payments related to such liabilities.

Off-Balance Sheet Arrangements

In January 2018, the Company, through its wholly owned Singapore subsidiary, and DNP, through its wholly owned subsidiary “DNP Asia Pacific PTE, Ltd.” entered into a joint venture under which DNP obtained a 49.99% interest in our IC business in Xiamen, China. The joint venture, known as “Xiamen American Japan Photonics Mask Co., Ltd.” (“PDMCX”), was established to develop and manufacture photomasks for leading-edge and advanced-generation semiconductors. Under the Joint Venture Operating Agreement of PDMCX (“the Agreement”), DNP is afforded, under certain circumstances, the right to “put” its interest in PDMCX to the Company. These circumstances include disputes regarding the strategic direction of PDMCX that may arise after the initial two-year term of the Agreement that cannot be resolved between the two parties. In addition, both the Company and DNP have the option to purchase, or put, their interest from, or to, the other party, should their ownership interest fall below 20% for a period of more than six consecutive months. Under all such circumstances, the sales of ownership interests would be at the exiting party’s ownership percentage of the joint venture’s net book value, with closing to take place within three business days of obtaining required approvals and clearance. Should DNP exercise an option to put their, or purchase our, interest in PDMCX we may, depending on the relationship of the fair and book value of PDMCX’s net assets, incur a loss. As of October 31, 2019, the Company and DNP each had net investments in PDMCX of approximately \$39.6 million.

We lease certain office facilities and equipment under operating leases that may require us to pay taxes, insurance and maintenance expenses related to the properties. Certain of these leases contain renewal or purchase options exercisable at the end of the lease terms. See Note 8 to the consolidated financial statements for additional information on these operating leases. In concurrence with our November 1, 2019, adoption of Accounting Standards Codification Topic 842 – “Leases”, we recognized right-of-use leased assets of approximately \$6.7 million and corresponding lease liabilities, which were discounted at our incremental borrowing rates. As a result, most of our lease agreements ceased to be off-balance sheet arrangements on that date.

Business Outlook

The majority of our revenue growth is expected to continue to come from the Asia region, with significant portion in China – in the forms of both shipments into China and masks produced in China. We are anticipating short-term seasonal softness, with growth in FPD potentially alleviating some portion of the seasonality. We are in the process of expanding our tool base to allow us to meet increased demand across all technology nodes, and, if warranted by market demand, are prepared to expand our production. Production at our China-based IC facility should begin to significantly increase during fiscal 2020. However, the timing of the increase is dependent on customer qualifications. Overall, in terms of IC business, we see opportunities for growth, either through the ramp-up of the China facility, or through a recovery in the memory market, which we believe to not be an unlikely scenario, sometime during the calendar year 2020.

We make continual assessments of our global manufacturing strategy and monitor our revenue and related cash flows from operations. These ongoing assessments could result in future facility closures, asset redeployments, impairments of intangible or long-lived assets, workforce reductions, or the addition of manufacturing facilities, all of which would be based on market conditions and customer requirements. Our future results of operations and the other forward-looking statements contained in this filing involve a number of risks and uncertainties. While various risks and uncertainties have been discussed, a number of other unforeseen factors could cause actual results to differ materially from our expectations.

Critical Accounting Estimates

Our consolidated financial statements are based on the selection and application of accounting policies, which require management to make significant estimates and assumptions. We believe the following to be the more critical areas that require judgment when applying our accounting policies:

- the determination of whether revenues related to our revenue contracts should be recognized over time or at a point in time, as these determinations impact the timing of our reported revenues and net income;
- the estimation of the point in the manufacturing process at which we are entitled to receive payment as we perform;
- the determination of the useful lives of our property, plant, and equipment and the timing of when depreciation should begin on such assets, as these determinations can significantly impact our gross margin and research and development expenses;
- the evaluation of the recoverability of our long-lived assets and definite-lived intangible assets, which requires us to forecast the future cash flows related to these assets; this evaluation can significantly impact our gross margin and operating expense;
- the estimation of the collectability of our accounts receivable which impacts our gross margin and operating expenses;
- the recognition and measurement of current and deferred income taxes, including the measurement of uncertain tax positions, which impacts our provision for income taxes and our tax-related asset and liability balances.

Please refer to Notes 1,7, and 11 to our consolidated financial statements for additional information related to these critical accounting estimates and our other significant accounting policies.

Recent Accounting Pronouncements

See “Item 8. Financial Statements and Supplementary Data – Notes to Consolidated Financial Statements – Note 22 Recent Accounting Pronouncements” for recent accounting pronouncements that may affect our financial reporting.

ITEM 7A. QUANTITATIVE AND QUALITATIVE DISCLOSURES ABOUT MARKET RISK

Foreign Currency Exchange Rate Risk

We conduct business in several major currencies throughout our worldwide operations, and our financial performance may be affected by fluctuations in the exchange rates of these currencies. Changes in exchange rates can positively or negatively affect our reported revenue, operating income, assets, liabilities, and equity. The functional currencies of our Asian subsidiaries are the South Korean won, the New Taiwan dollar, the Chinese renminbi and the Singapore dollar. The functional currencies of our European subsidiaries are the British pound and the euro. In addition, we engage in transactions and have exposures to the Japanese yen.

We attempt to minimize our risk of foreign currency transaction losses by producing products in the same country in which the products are sold (thereby generating revenues and incurring expenses in the same currency), and by managing our working capital. However, in some instances, we sell products in a currency other than the functional currency of the country where it was produced, or purchase products in a currency that differs from the functional currency of the purchasing entity. In addition, to the extent practicable, we attempt to reduce our exposure to foreign currency exchange fluctuations by converting cash and cash equivalents into the functional currency of the subsidiary which holds the cash. We may also enter into derivative contracts to mitigate our exposure to foreign currency fluctuations when we have a significant purchase obligation or significant receivable denominated in a currency that differs from the transacting subsidiaries' functional currencies. We do not enter into derivatives for speculative purposes. There can be no assurance that these practices will protect us from the need to recognize significant foreign currency transaction gains and losses, especially in the event of a significant adverse movement in the value of any foreign currency in which we conduct business against any of our functional currencies, including the U.S. dollar.

Our primary net foreign currency exposures as of October 31, 2019, included the South Korean won, the Japanese yen, the New Taiwan dollar, the Chinese renminbi, the Singapore dollar, the British pound sterling, and the euro. As of October 31, 2019, a 10% adverse movement in the value of these currencies against the functional currencies of our subsidiaries would have resulted in a net unrealized pre-tax loss of \$33.1 million, which represents an increase of \$19.9 million from the same movement as of October 31, 2018. The increase in foreign currency rate change risk is primarily the result of increased exposures of the Chinese renminbi and the South Korean won against the U.S. dollar. We do not believe that a 10% change in the exchange rates of other non-U.S. dollar currencies would have had a material effect on our October 31, 2019 consolidated financial statements.

Interest Rate Risk

A 10% adverse movement in the interest rates on our variable rate borrowings would not have had a material effect on our October 31, 2019, consolidated financial statements.

ITEM 8. FINANCIAL STATEMENTS AND SUPPLEMENTARY DATA

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REPORT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

To Shareholders and the Board of Directors of Photronics, Inc.
Brookfield, Connecticut

Opinions on the Financial Statements and Internal Control over Financial Reporting

We have audited the accompanying consolidated balance sheets of Photronics, Inc. and subsidiaries (the "Company") as of October 31, 2019 and 2018, the related consolidated statements of income, consolidated statements of comprehensive income, consolidated statements of equity, and consolidated statements of cash flows, for each of the three years in the period ended October 31, 2019, the related notes and the schedule listed in the Index at Item 15 (collectively referred to as the "financial statements"). We also have audited the Company's internal control over financial reporting as of October 31, 2019, based on criteria established in *Internal Control — Integrated Framework (2013)* issued by the Committee of Sponsoring Organizations of the Treadway Commission (COSO).

In our opinion, the financial statements referred to above present fairly, in all material respects, the financial position of the Company as of October 31, 2019 and 2018, and the results of its operations and its cash flows for each of the three years in the period ended October 31, 2019, in conformity with accounting principles generally accepted in the United States of America. Also, in our opinion, the Company maintained, in all material respects, effective internal control over financial reporting as of October 31, 2019, based on the criteria established in *Internal Control — Integrated Framework (2013)* issued by COSO.

Basis for Opinions

The Company's management is responsible for these 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 in Item 9A. Our responsibility is to express an opinion on these 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 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 financial statements included performing procedures to assess the risks of material misstatement of the financial statements, whether due to error or fraud, and performing procedures to respond to those risks. Such procedures included examining, on a test basis, evidence regarding the amounts and disclosures in the 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 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 financial statements that was communicated or required to be communicated to the Company's 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 critical audit matters does not alter in any way our opinion on the consolidated financial statements, taken as a whole, and we are not, by communicating the critical audit matter below, providing a separate opinion on the critical audit matter or on the accounts or disclosures to which it relates.

Revenue Recognition on In-Process Production Orders — Refer to Note 7 to the consolidated financial statements

Critical Audit Matter Description

The Company recognizes revenue over time for in-process production orders that have not shipped for contracts with customers for which it has an enforceable right to bill and collect consideration, inclusive of a reasonable profit, in the event the in-process orders are cancelled by the customers. This results in the Company recording a corresponding contract asset as of period end for these contracts. Significant judgment is exercised by the Company in determining the amount of revenue to recognize for these contracts and the corresponding contract asset, specifically in estimating the point within the production cycle at which the production orders stand in relation to the Company's enforceable right within the contract. Pursuant to these contracts, revenue recognized over time and the associated contract asset as of October 31, 2019 was \$7.6 million.

We identified the determination of revenue recognized over time for in-process production orders as of October 31, 2019 a critical auditing matter because of the significant estimates and assumptions management makes in determining the amount of revenue to recognize for these contracts. This required a high degree of audit judgment and an increased extent of effort when performing audit procedures to evaluate the reasonableness of management's determination of the progress point of in-process orders and the amount of revenue recognized over time and the corresponding contract asset as of October 31, 2019.

How the Critical Audit Matter Was Addressed in the Audit

Our audit procedures related to the Company's determination of the progress point of in-process orders and resulting revenue recognized over time and corresponding contract asset as of October 31, 2019 included the following:

- We tested the operating effectiveness of controls over management's determination of the point in the production process and correlation to stated contractual rights.
- We tested the mathematical accuracy of management's calculations of revenue and the associated timing of revenue recognized in the consolidated financial statements.
- We selected a sample of in-process production orders as of October 31, 2019 and performed the following procedures for each selection:
 - Obtained and read the contract.
 - Physically observed existence of the in-process production order.
 - Tested management's identification of significant contract terms and resulting revenue recognition for the in-process production order.
 - Tested management estimate of the production point for the in-process order and corresponding revenue recognition and contract asset based on the Company's enforceable right within the contract.

/s/ Deloitte & Touche LLP
Hartford, Connecticut
December 20, 2019

We have served as the Company's auditor since 1991.

PHOTRONICS, INC.
Consolidated Balance Sheets
(in thousands, except per share amounts)

	October 31, 2019	October 31, 2018
ASSETS		
Current assets:		
Cash and cash equivalents	\$ 206,530	\$ 329,277
Accounts receivable, net of allowance of \$1,334 in 2019 and \$1,526 in 2018	134,454	120,515
Inventories	48,155	29,180
Other current assets	38,388	23,759
Total current assets	<u>427,527</u>	<u>502,731</u>
Property, plant and equipment, net	632,441	571,781
Intangible assets, net	7,870	12,368
Deferred income taxes	20,779	18,109
Other assets	30,048	5,020
Total assets	<u>\$ 1,118,665</u>	<u>\$ 1,110,009</u>
LIABILITIES AND EQUITY		
Current liabilities:		
Short-term debt	\$ 8,731	\$ -
Current portion of long-term debt	2,142	57,453
Accounts payable	91,379	89,149
Accrued liabilities	49,702	44,474
Total current liabilities	<u>151,954</u>	<u>191,076</u>
Long-term debt	41,887	-
Other liabilities	13,732	14,364
Total liabilities	<u>207,573</u>	<u>205,440</u>
Commitments and contingencies		
Equity:		
Preferred stock, \$0.01 par value, 2,000 shares authorized, none issued and outstanding	-	-
Common stock, \$0.01 par value, 150,000 shares authorized, 65,595 shares issued and outstanding at October 31, 2019, and 69,700 shares issued and 67,142 outstanding at October 31, 2018	656	697
Additional paid-in capital	524,319	555,606
Retained earnings	253,922	231,445
Treasury stock, 0 shares at October 31, 2019 and 2,558 shares at October 31, 2018	-	(23,111)
Accumulated other comprehensive loss	(9,005)	(4,966)
Total Photronics, Inc. shareholders' equity	<u>769,892</u>	<u>759,671</u>
Noncontrolling interests	141,200	144,898
Total equity	<u>911,092</u>	<u>904,569</u>
Total liabilities and equity	<u>\$ 1,118,665</u>	<u>\$ 1,110,009</u>

See accompanying notes to consolidated financial statements.

PHOTRONICS, INC.
Consolidated Statements of Income
(in thousands, except per share amounts)

	Year Ended		
	October 31, 2019	October 31, 2018	October 29, 2017
Revenue	\$ 550,660	\$ 535,276	\$ 450,678
Cost of goods sold	429,819	403,773	359,363
Gross profit	<u>120,841</u>	<u>131,503</u>	<u>91,315</u>
Operating expenses:			
Selling, general and administrative	52,326	51,395	43,585
Research and development	16,394	14,481	15,862
Total operating expenses	<u>68,720</u>	<u>65,876</u>	<u>59,447</u>
Operating income	<u>52,121</u>	<u>65,627</u>	<u>31,868</u>
Other income (expense):			
Interest income and other income (expense), net	5	5,206	(3,068)
Interest expense	(1,425)	(2,262)	(2,235)
Income before income tax provision	50,701	68,571	26,565
Income tax provision	<u>10,210</u>	<u>7,335</u>	<u>5,276</u>
Net income	<u>40,491</u>	<u>61,236</u>	<u>21,289</u>
Net income attributable to noncontrolling interests	<u>10,698</u>	<u>19,181</u>	<u>8,159</u>
Net income attributable to Photronics, Inc. shareholders	<u>\$ 29,793</u>	<u>\$ 42,055</u>	<u>\$ 13,130</u>
Earnings per share:			
Basic	<u>\$ 0.45</u>	<u>\$ 0.61</u>	<u>\$ 0.19</u>
Diluted	<u>\$ 0.44</u>	<u>\$ 0.59</u>	<u>\$ 0.19</u>
Weighted-average number of common shares outstanding:			
Basic	<u>66,347</u>	<u>68,829</u>	<u>68,436</u>
Diluted	<u>69,155</u>	<u>74,821</u>	<u>69,288</u>

See accompanying notes to consolidated financial statements.

PHOTRONICS, INC.
Consolidated Statements of Comprehensive Income
(in thousands)

	Year Ended		
	October 31, 2019	October 31, 2018	October 29, 2017
Net income	\$ 40,491	\$ 61,236	\$ 21,289
Other comprehensive (loss) income, net of tax:			
Foreign currency translation adjustments	(2,877)	(16,672)	19,799
Amortization of cash flow hedge	-	48	129
Other	(74)	101	478
Net other comprehensive (loss) income	(2,951)	(16,523)	20,406
Comprehensive income	37,540	44,713	41,695
Less: comprehensive income attributable to noncontrolling interests	11,786	14,515	14,003
Comprehensive income attributable to Photronics, Inc. shareholders	<u>\$ 25,754</u>	<u>\$ 30,198</u>	<u>\$ 27,692</u>

See accompanying notes to consolidated financial statements.

PHOTRONICS, INC.
Consolidated Statements of Equity
Years Ended October 31, 2019, October 31, 2018 and October 29, 2017
(in thousands)

	Photronics, Inc. Shareholders							Total Equity
	Common Stock		Additional Paid-In Capital	Retained Earnings	Treasury Stock	Accumulated Other Comprehensive (Loss) Income	Non-Controlling Interests	
	Shares	Amount						
Balance at October 30, 2016	68,080	\$ 681	\$ 541,093	\$ 176,260	\$ -	\$ (7,671)	\$ 115,111	\$ 825,474
Net income	-	-	-	13,130	-	-	8,159	21,289
Other comprehensive income	-	-	-	-	-	14,562	5,844	20,406
Sales of common stock through employee stock option and purchase plan	459	5	2,877	-	-	-	-	2,882
Restricted stock awards vesting and expense	127	1	1,508	-	-	-	-	1,509
Share-based compensation expense	-	-	2,118	-	-	-	-	2,118
Dividends to noncontrolling interests	-	-	-	-	-	-	(8,383)	(8,383)
Balance at October 29, 2017	68,666	687	547,596	189,390	-	6,891	120,731	865,295
Net income	-	-	-	42,055	-	-	19,181	61,236
Other comprehensive income	-	-	-	-	-	(11,857)	(4,666)	(16,523)
Sales of common stock through employee stock option and purchase plan	870	9	4,683	-	-	-	-	4,692
Restricted stock awards vesting and expense	164	1	1,747	-	-	-	-	1,748
Share-based compensation expense	-	-	1,432	-	-	-	-	1,432
Contribution from noncontrolling interests	-	-	148	-	-	-	17,848	17,996
Dividends to noncontrolling interests	-	-	-	-	-	-	(8,196)	(8,196)
Purchases of treasury stock	-	-	-	-	(23,111)	-	-	(23,111)
Balance at October 31, 2018	69,700	697	555,606	231,445	(23,111)	(4,966)	144,898	904,569
Adoption of ASU 2014-09	-	-	-	1,083	-	-	121	1,204
Adoption of ASU 2016-16	-	-	-	(1,130)	-	-	(3)	(1,133)
Net income	-	-	-	29,793	-	-	10,698	40,491
Other comprehensive (loss) income	-	-	-	-	-	(4,039)	1,088	(2,951)
Sale of common stock through employee stock option and purchase plans	390	4	2,524	-	-	-	-	2,528
Restricted stock awards vesting and expense	196	2	2,497	-	-	-	-	2,499
Share-based compensation expense	-	-	1,183	-	-	-	-	1,183
Contribution from noncontrolling interest	-	-	-	-	-	-	29,394	29,394
Dividends to noncontrolling interest	-	-	-	-	-	-	(44,939)	(44,939)
Repurchase of common stock of subsidiary	-	-	-	-	-	-	(57)	(57)
Purchases of treasury stock	-	-	-	-	(21,696)	-	-	(21,696)
Retirement of treasury stock	(4,691)	(47)	(37,491)	(7,269)	44,807	-	-	-
Balance at October 31, 2019	65,595	\$ 656	\$ 524,319	\$ 253,922	\$ -	\$ (9,005)	\$ 141,200	\$ 911,092

See accompanying notes to consolidated financial statements.

PHOTRONICS, INC.
Consolidated Statements of Cash Flows
(in thousands)

	Year Ended		
	October 31, 2019	October 31, 2018	October 29, 2017
Cash flows from operating activities:			
Net income	\$ 40,491	\$ 61,236	\$ 21,289
Adjustments to reconcile net income to net cash provided by operating activities:			
Depreciation and amortization of property, plant and equipment	79,238	79,536	81,699
Amortization of intangible assets	4,641	4,797	4,874
Share-based compensation	3,680	3,180	3,627
Deferred income taxes	(3,662)	(273)	1,633
Changes in assets, liabilities, and other:			
Accounts receivable	(12,321)	(18,553)	(9,625)
Inventories	(23,088)	(6,162)	(602)
Other current assets	(8,631)	(11,731)	1,127
Accounts payable, accrued liabilities and other	(11,962)	18,537	(7,189)
Net cash provided by operating activities	68,386	130,567	96,833
Cash flows from investing activities:			
Purchases of property, plant and equipment	(178,375)	(92,585)	(91,965)
Government incentives	27,003	1,005	-
Purchases of intangible assets	(95)	(218)	(834)
Proceeds from sales of investments	-	-	167
Acquisition of business	-	-	(5,400)
Other	61	929*	17*
Net cash used in investing activities	(151,406)	(90,869)	(98,015)*
Cash flows from financing activities:			
Proceeds from debt	54,633	-	-
Contribution from noncontrolling interests	29,394	17,996	-
Repayments of debt	(61,319)	(4,639)	(5,428)
Dividends paid to noncontrolling interests	(45,050)	(8,166)	(8,298)
Purchases of treasury stock	(21,696)	(23,111)	-
Proceeds from share-based arrangements	2,071	4,634	2,830
Other	(92)	(519)	(32)
Net cash used in financing activities	(42,059)	(13,805)	(10,928)
Effects of exchange rate changes on cash, cash equivalents, and restricted cash	2,381	(4,840)*	6,247*
Net (decrease) increase in cash, cash equivalents, and restricted cash	(122,698)	21,053*	(5,863)*
Cash, cash equivalents, and restricted cash at beginning of year	331,989	310,936*	316,799
Cash, cash equivalents, and restricted cash at end of year	\$ 209,291	\$ 331,989*	\$ 310,936*
Supplemental disclosure of non-cash information:			
Accrual for property, plant and equipment purchased during year	\$ 13,671	\$ 29,602	\$ 2,767

* Amount has been modified to reflect the adoption of ASU 2016-18 (see Note 22).

See accompanying notes to consolidated financial statements.

PHOTRONICS, INC.
Notes to Consolidated Financial Statements
Years Ended October 31, 2019, October 31, 2018 and October 29, 2017
(in thousands, except share amounts)

NOTE 1 - SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES

Business

Photronics, Inc. ("Photronics", "the Company", "we", "our", or "us") is one of the world's leading manufacturers of photomasks, which are high-precision photographic quartz or glass plates containing microscopic images of electronic circuits. Photomasks are a key element in the manufacture of semiconductors and flat-panel displays ("FPDs"), and are used as masters to transfer circuit patterns onto semiconductor wafers and FPD substrates during the fabrication of integrated circuits ("ICs" or "semiconductors") and a variety of FPDs and, to a lesser extent, other types of electrical and optical components. We currently have eleven manufacturing facilities, which are located in Taiwan (3), Korea, the United States (3), Europe (2), and two recently constructed facilities in China. Our FPD Facility in Hefei, China, commenced production in the second quarter of fiscal 2019 and our IC facility in Xiamen, China, commenced production in the third quarter of fiscal 2019.

Consolidation

The accompanying consolidated financial statements include the accounts of Photronics, Inc., its wholly owned subsidiaries, and the majority-owned subsidiaries which it controls. All intercompany balances and transactions have been eliminated in consolidation.

Estimates and Assumptions

The preparation of financial statements in conformity with accounting principles generally accepted in the United States of America requires us to make estimates and assumptions that affect amounts reported in them. Estimates are based on historical experience and on various assumptions that are believed to be reasonable under the circumstances. Our estimates are based on the facts and circumstances available at the time they are made. Actual results we report may differ from such estimates. We review these estimates periodically and reflect any effects of revisions in the period in which they are determined.

Fiscal Year

Commencing with our 2018 fiscal year, our fiscal year ends on October 31. In prior years, our fiscal years ended on the Sunday closest to October 31. Prior year results in this Form 10-K have not been restated to reflect year-end dates of October 31.

Cash and Cash Equivalents

Cash and cash equivalents include cash and highly liquid investments with an original maturity of three months or less, readily convertible to known amounts of cash, and so near to their maturity that they present insignificant risk of changes in value because of changes in interest rates. The carrying values of cash equivalents approximate their fair values, due to the short-term maturities of these instruments.

Accounts Receivable and Allowance for Doubtful Accounts

We generally record our accounts receivable at their billed amounts. All outstanding past due customer invoices are reviewed for collectibility during, and at the end of, every period. To the extent that we believe a loss on the collection of a customer invoice is probable, we record the loss and credit the allowance for doubtful accounts. In the event that an amount is determined to be uncollectible, we charge the allowance for doubtful accounts and eliminate the related receivable.

Inventories

Inventories are stated at the lower of cost, determined under the first-in, first-out (“FIFO”) method, or net realizable value. Presented below are the components of inventory at the balance sheet dates:

	October 31	October 31
	2019	2018
Raw materials	\$ 46,027	\$ 25,110
Work in process	2,122	3,402
Finished goods	6	668
	<u>\$ 48,155</u>	<u>\$ 29,180</u>

Property, Plant and Equipment

Property, plant and equipment, except as explained below under “Impairment of Long-Lived Assets,” is stated at cost less accumulated depreciation and amortization. Repairs and maintenance, as well as renewals and replacements of a routine nature, are charged to operations as incurred, while those that improve, or extend the lives of, existing assets are capitalized. Upon sale or other disposition, the cost of the asset and its related accumulated depreciation are removed from the accounts, and any resulting gain or loss is reflected in earnings.

Depreciation and amortization, essentially all of which are included in cost of goods sold, are computed using the straight-line method over the estimated useful lives of the related assets. Buildings and improvements are depreciated over 10 to 39 years, machinery and equipment over 5 to 15 years, and furniture, fixtures and office equipment over 3 to 5 years. Leasehold improvements are amortized over the life of the lease or the estimated useful life of the improvement, whichever is less. We employ judgment and assumptions when we establish estimated useful lives and depreciation periods, as well as when we periodically review property, plant and equipment for any potential impairment in carrying values, whenever events such as a significant industry downturn, plant closures, technological obsolescence, or other change in circumstances indicate that their carrying amounts may not be recoverable.

Intangible Assets

Intangible assets consist primarily of a technology license agreement and acquisition-related intangibles. These assets, except as explained below, are stated at fair value as of the date acquired, less accumulated amortization. Amortization is calculated based on the estimated useful lives of the assets, which range from 3 to 15 years, using the straight-line method or another method that more fairly represents the utilization of the assets.

We periodically evaluate the remaining useful lives of our intangible assets to determine whether events or circumstances warrant a revision to the remaining periods of amortization. In the event that the estimate of an intangible asset’s remaining useful life has changed, the remaining carrying amount of the intangible asset is amortized prospectively over that revised remaining useful life. If it is determined that an intangible asset has an indefinite useful life, that intangible asset would be subject to impairment testing annually or whenever events or circumstances indicate that its carrying value may not, based on future undiscounted cash flows or market factors, be recoverable. An impairment loss, the recorded amount of which would be based on the fair value of the intangible asset at the measurement date, would be recorded in the period in which the impairment determination was made.

Impairment of Long-Lived Assets

Long-lived assets are reviewed for impairment whenever events or changes in circumstances indicate that the carrying amount of such assets may not be recoverable. Determinations of recoverability are based upon our judgment and estimates of undiscounted future cash flows resulting from the use of the assets and their eventual disposition. Measurement of an impairment loss for long-lived assets that we expect to hold and use is based on the fair value of the assets determined using a market or income approach compared with the carrying value of the asset. The carrying values of assets determined to be impaired would be reduced to their estimated fair values.

Restricted Cash

Restricted cash in the amounts of \$2.8 million and \$2.7 million are included in “Other assets” on our October 31, 2019 and October 31, 2018, consolidated balance sheets, respectively. The restrictions on these amounts are primarily related to land lease agreements and customs requirements.

Business Combinations

When acquiring other businesses, or participating in mergers or joint ventures in which we are deemed to be the acquirer, we generally recognize identifiable assets acquired, liabilities assumed and any noncontrolling interests at their acquisition date fair values, separately from any goodwill that may be required to be recognized. Goodwill, when recognizable, would be measured as the excess amount of any consideration transferred, which is generally measured at fair value, over the acquisition date fair values of the identifiable assets acquired and liabilities assumed.

Accounting for such transactions requires us to make significant assumptions and estimates and, although we believe any estimates and assumptions we make to be reasonable and appropriate at the time they are made, unanticipated events and circumstances may arise that affect their accuracy, which may cause actual results to differ from those we estimated. When required, we will adjust the values of the assets acquired and liabilities assumed against the acquisition gain or goodwill, as initially recorded, for a period of up to one year after the transaction.

Costs incurred to effect a merger or acquisition, such as legal, accounting, valuation and other third-party costs, as well as internal general and administrative costs incurred are charged to expense in the periods incurred. Costs incurred to issue any debt and equity securities are recognized in accordance with other applicable generally accepted accounting principles.

Investments in Joint Ventures

The financial results of investments in joint ventures in which we have a controlling financial interest are included in our consolidated financial statements. Investments in joint ventures over which we have the ability to exercise significant influence and that, in general, are at least twenty percent owned are accounted for under the equity method. An impairment loss would be recognized whenever a decrease in the fair value of such an investment below its carrying amount is determined to be other than temporary. In judging “other than temporary,” we would consider the length of time and the extent to which the fair value of the investment has been less than its carrying amount, the near-term and longer-term operating and financial prospects of the investee, and our longer-term intent of retaining our investment in the investee.

Variable Interest Entities

We account for the investments we make in certain legal entities in which equity investors do not have 1) sufficient equity at risk for the legal entity to finance its activities without additional subordinated financial support or, 2) as a group, the holders of the equity investment at risk do not have either the power, through voting or similar rights, to direct the activities of the legal entity that most significantly impact the entity’s economic performance or, 3) the obligation to absorb the expected losses of the legal entity or the right to receive expected residual returns of the legal entity as “variable interest entities”, or “VIEs”.

We consolidate the results of any such entity in which we have determined that we have a controlling financial interest. We would have a “controlling financial interest” (and thus be considered the “primary beneficiary” of the entity) in such an entity when we have both the power to direct the activities that most significantly affect the VIE’s economic performance and the obligation to absorb the losses of, or right to receive the benefits from, the VIE that could be potentially significant to the VIE. On a quarterly basis, we reassess whether we have a controlling financial interest in any investments we have in these entities.

We account for investments we make in VIEs in which we have determined that we do not have a controlling financial interest but have a significant influence over, and hold at least a twenty percent ownership interest in, using the equity method. Any such investment not meeting the parameters to be accounted for under the equity method would be accounted for using the cost method, unless the investment had a readily determinable fair value, at which value it would then be reported.

Income Taxes

The income tax provision is computed on the basis of the various tax jurisdictions' income or loss before income taxes. Deferred income taxes reflect the tax effects of differences between the carrying amounts of assets and liabilities for financial reporting purposes and their amounts used for income tax purposes, as well as the tax effects of net operating losses and tax credit carryforwards. We use judgment and make assumptions to determine if valuation allowances for deferred income tax assets are required, if their realization is not more likely than not, by considering future market growth, operating forecasts, future taxable income, and the mix of earnings among the tax jurisdictions in which we operate. Accordingly, income taxes charged against earnings may have been impacted by changes in the valuation allowances.

We consider income taxes in each of the tax jurisdictions in which we operate in order to determine our effective income tax rate. Our current income tax expense is thus identified, and temporary differences resulting from differing treatments of items for tax and financial reporting purposes are assessed. These differences result in deferred tax assets and liabilities, which are included in our consolidated balance sheets.

We account for uncertain tax positions by recording a liability for unrecognized tax benefits resulting from uncertain tax positions taken, or expected to be taken, in our tax returns. We include any applicable interest and penalties related to uncertain tax positions in our income tax provision.

Treasury Stock

We record treasury stock purchases under the cost method, recording the entire cost of the acquired stock as treasury stock. Gains and losses on subsequent reissuances would be credited or charged to additional paid-in capital, and we would employ the average cost method (with average cost being determined separately for each share repurchase program), in the event that we subsequently reissue shares.

Earnings Per Share

Basic earnings per share ("EPS") is based on the weighted-average number of common shares outstanding for the period, excluding any dilutive common share equivalents. Diluted EPS reflects the potential dilution that could occur if certain share-based payment awards or financial instruments were exercised, earned or converted.

Share-Based Compensation

We recognize share-based compensation expense over the service period that the awards are expected to vest. Share-based compensation expense includes the estimated effects of forfeitures, which are adjusted over the requisite service period to the extent actual forfeitures differ, or are expected to differ, from such estimates. Changes in estimated forfeitures are recognized in the period of change, and will impact the amount of expense to be recognized in future periods. Determining the appropriate option pricing model, calculating the grant date fair value of share-based awards and estimating forfeiture rates requires considerable judgment, including estimations of stock price volatility and the expected term of options granted.

We use the Black-Scholes option pricing model to value employee stock options. We estimate stock price volatility based on daily averages of our common stock's historical volatility over a term approximately equal to the estimated time period the grant will remain outstanding. The expected term of options and forfeiture rate assumptions are derived from historical data.

Research and Development

Research and development costs are expensed as incurred, and consist primarily of development efforts related to high-end process technologies for advanced subwavelength reticle solutions for IC and FPD photomask technologies.

Foreign Currency Translation

Our non-US subsidiaries maintain their accounts in their respective local currencies. Assets and liabilities of such subsidiaries are translated to U.S. dollars at year-end exchange rates. Income and expenses are translated at average rates of exchange prevailing during the year. Foreign currency translation adjustments are accumulated and reported in accumulated other comprehensive income, a component of equity. The effects of changes in exchange rates on foreign currency transactions, which are included in Interest income and other income (expense) net, were a net (loss)/gain of \$(1.3) million, \$0.4 million and \$(5.2) million in fiscal years 2019, 2018 and 2017, respectively.

Noncontrolling Interests

Substantially all of Noncontrolling interests represents the minority shareholders' proportionate share in the equity of two of the Company's majority-owned subsidiaries: Photronics DNP Mask Corporation ("PDMC") in Taiwan, and Xiamen American Japan Photronics Mask Co., Ltd ("PDMCX") in China, of which noncontrolling interests owned 49.99% as of October 31, 2019 and October 31, 2018. In addition, noncontrolling shareholders owned approximately 0.2% of PK Ltd. ("PKL") in Korea as of October 31, 2019 and October 31, 2018. In November 2019, we acquired the remaining noncontrolling interests' shares of PKL for approximately \$0.6 million

Derivative Instruments and Hedging Activities

We record derivatives in the consolidated balance sheets as assets or liabilities, measured at fair value. We do not engage in derivative instruments for speculative purposes. Gains or losses resulting from changes in the values of derivatives are reflected in earnings, or as accumulated other comprehensive income or loss, a separate component of equity, depending on the use of the derivatives and whether they qualify for hedge accounting. In order to qualify for hedge accounting, among other criteria, a derivative must be a hedge of an interest rate, price, foreign currency exchange rate, or credit risk that is expected to be highly effective at the inception of the hedge, be highly effective in achieving offsetting changes in the fair value or cash flows of the hedged item during the term of the hedge and formally documented at the inception of the hedge. In general, the types of risks we would hedge are those related to the variability of future cash flows caused by movements in foreign currency exchange and interest rates. We would document our risk management strategy and hedge effectiveness at the inception of, and during the term of, each hedge.

Revenue Recognition

We adopted Accounting Standards Update 2014-09 and all subsequent amendments which are collectively codified in Accounting Standards Codification Topic 606 - "Revenue from Contracts with Customers" ("Topic 606") - on November 1, 2018, under the modified retrospective transition method, only with respect to contracts that were not complete as of the date of adoption. This approach required prospective application of the guidance with a cumulative effect adjustment to retained earnings to reflect the impact of the adoption on contracts that were not complete as of the date of the adoption. In accordance with the modified retrospective transition method, the results of the prior year period presented have not been adjusted for the effects of Topic 606. Please see Note 7 for a detailed discussion of our revenue recognition and related accounting policies.

Product Warranty

Our photomasks are sold under warranties that generally range from one to twenty-four months. We warrant that our photomasks conform to customer specifications, and will typically repair, replace, or issue a refund, at our option, any photomasks that fail to do so. The warranties do not represent separate performance obligations in our revenue contracts. Historically, customer claims under warranty have been immaterial.

Government Grants

We account for funds we receive from government grants by reducing the costs of the assets or expenses to which we apply the funds. Funds we receive that cannot be attributed to specific assets or expenses would be recognized as other income, and included in Interest income and other income (expense), net in the Consolidated Statements of Income. Funds we receive from government grants are classified in our Consolidated Statement of Cash Flows as either cash flows from operating activities or cash flows from investing activities, in accordance with how we expend the funds.

NOTE 2 - PROPERTY, PLANT AND EQUIPMENT

Property, plant and equipment consists of the following:

	October 31, 2019	October 31, 2018
Land	\$ 12,085	\$ 11,139
Buildings and improvements	172,340	124,771
Machinery and equipment	1,748,483	1,566,163
Leasehold improvements	19,921	19,577
Furniture, fixtures and office equipment	14,404	12,415
Construction in progress	28,135	128,649
	<u>1,995,368</u>	<u>1,862,714</u>
Accumulated depreciation and amortization	<u>(1,362,927)</u>	<u>(1,290,933)</u>
	<u>\$ 632,441</u>	<u>\$ 571,781</u>

In January 2017, we entered into a noncash transaction with a customer which resulted in the acquisition of equipment with a fair value of approximately \$6.7 million in fiscal year 2018.

NOTE 3 - INTANGIBLE ASSETS

Amortization expense of the Company's finite-lived intangible assets was \$4.6 million, \$4.8 million and \$4.9 million in fiscal years 2019 2018 and 2017, respectively.

Intangible assets consist of:

	Gross Amount	Accumulated Amortization	Net Amount
As of October 31, 2019			
Technology license agreement	\$ 59,616	\$ (53,323)	\$ 6,293
Customer relationships	9,174	(8,186)	988
Software and other	6,537	(5,948)	589
	<u>\$ 75,327</u>	<u>\$ (67,457)</u>	<u>\$ 7,870</u>
As of October 31, 2018			
Technology license agreement	\$ 59,616	\$ (49,349)	\$ 10,267
Customer relationships	9,147	(7,959)	1,188
Software and other	6,519	(5,606)	913
	<u>\$ 75,282</u>	<u>\$ (62,914)</u>	<u>\$ 12,368</u>

The weighted-average amortization period of intangible assets acquired in fiscal year 2019, which is comprised of software, is three years. The weighted-average amortization period of intangible assets acquired in fiscal year 2018 was three years; these intangible assets were comprised of software.

Intangible asset amortization over the next five years is estimated to be as follows:

Fiscal Years:

2020	\$4,589
2021	\$2,721
2022	\$ 125
2023	\$ 123
2024	\$ 123

NOTE 4 - PDMCX JOINT VENTURE

In January 2018, Photronics, through its wholly-owned Singapore subsidiary (hereinafter, within this Note “we”, or “Photronics”), and Dai Nippon Printing Co., Ltd., through its wholly owned subsidiary “DNP Asia Pacific PTE, Ltd.” (hereinafter, within this Note “DNP”) entered into a joint venture under which DNP obtained a 49.99% interest in our recently established IC business in Xiamen, China. The joint venture, known as “Xiamen American Japan Photronics Mask Co., Ltd.” (hereinafter, “PDMCX”), was established to develop and manufacture photomasks for leading edge and advanced generation semiconductors. We entered into this joint venture to enable us to compete more effectively for the merchant photomask business in China, and to benefit from the additional resources and investment that DNP will provide to enable us to offer advanced-process technology to our customers. No gain or loss was recorded upon the formation of this joint venture.

The total investment per the PDMCX operating agreement (“the Agreement”) is \$160 million. As of October 31, 2019, Photronics and DNP had each contributed cash of approximately \$48 million, and PDMCX obtained local financing of \$34.5 million. The remaining \$29 million investment will be funded, over the next several quarters, with additional local financing of \$15 million and approximately \$14 million of cash contributions from Photronics and DNP.

Under the Agreement, DNP is afforded, under certain circumstances, the right to put its interest in PDMCX to Photronics. These circumstances include disputes regarding the strategic direction of PDMCX that may arise after the initial two-year term of the Agreement and cannot be resolved between the two parties. In addition, both Photronics and DNP have the option to purchase, or put, their interest from, or to, the other party, should their ownership interest fall below twenty percent for a period of more than six consecutive months. Under all such circumstances, the sales of ownership interests would be at the exiting party’s ownership percentage of the joint venture’s net book value, with closing to take place within three business days of obtaining required approvals and clearance.

We recorded net losses from the operations of PDMCX of approximately \$4.9 million and \$0.7 million in fiscal 2019 and 2018, respectively. General creditors of PDMCX do not have recourse to the assets of Photronics, Inc., and our maximum exposure to loss respectively from PDMCX at October 31, 2019, was \$39.6 million.

As required by the guidance in Topic 810 - “Consolidation” of the Accounting Codification Standards, we evaluated our involvement in PDMCX for the purpose of determining whether we should consolidate its results in our financial statements. The initial step of our evaluation was to determine whether PDMCX was a variable interest entity (“VIE”). Due to its lack of sufficient equity at risk to finance its activities without additional subordinated financial support, we determined that it is a VIE. Having made this determination, we then assessed whether we were the primary beneficiary of the VIE, and concluded that we were the primary beneficiary during the current and prior year reporting periods; thus, as required, the PDMCX financial results have been consolidated with Photronics, Inc. Our conclusion was based on the fact that we held a controlling financial interest in PDMCX (which resulted from our having the power to direct the activities that most significantly impacted its economic performance) and had both the obligation to absorb losses and the right to receive benefits that could potentially be significant to PDMCX. Our conclusions that we had the power to direct the activities that most significantly affected the economic performance of PDMCX during the current and prior year periods were based on our right to appoint the majority of its board of directors, which has, among others, the powers to manage the business (through its rights to appoint and evaluate PDMCX’s management), incur indebtedness, enter into agreements and commitments, and acquire and dispose of PDMCX’s assets. In addition, as a result of the 50.01% variable interest we held during the current and prior year periods, we had the obligation to absorb losses, and the right to receive benefits, that could potentially be significant to PDMCX.

The carrying amounts of PDMCX assets and liabilities included in our consolidated balance sheets are presented in the following table, together with our maximum exposures to loss related to these assets and liabilities.

Classification	October 31, 2019		October 31, 2018	
	Carrying Amount	Photronics Interest	Carrying Amount	Photronics Interest
Current assets	\$ 24,142	\$ 12,074	\$ 9,625	\$ 4,813
Non-current assets	114,015	57,019	43,415	21,708
Total assets	138,157	69,093	53,040	26,521
Current liabilities	16,889	8,446	21,205	10,603
Non-current liabilities	42,094	21,051	20	10
Total liabilities	58,983	29,497	21,225	10,613
Net assets	\$ 79,174	\$ 39,596	\$ 31,815	\$ 15,908

NOTE 5 - ACCRUED LIABILITIES

Accrued liabilities consist of the following:

	October 31, 2019	October 31, 2018
Compensation related expenses	\$ 14,011	\$ 15,359
Income taxes	13,227	10,369
Contract liabilities	11,542	7,834
Value added and other taxes	3,761	3,683
Professional fees	537	1,257
Other	6,624	5,972
	\$ 49,702	\$ 44,474

NOTE 6 - LONG-TERM DEBT

Long-term debt consists of the following:

	October 31, 2019	October 31, 2018
Project Loans	\$ 34,490	\$ -
Working Capital Loans (value added tax component)	9,539	-
3.25% convertible senior notes matured April 2019	-	57,453
	44,029	57,453
Current portion of long-term debt	(2,142)	(57,453)
Long-term debt	\$ 41,887	\$ -

At October 31, 2019, maturities of our long-term debt over the next five years and thereafter were as follows:

2020	\$ 2,142
2021	8,304
2022	12,430
2023	3,441
2024	6,589
Thereafter	11,123
	<u>\$44,029</u>

As of October 31, 2019, the weighted-average interest rate of our short-term debt was 3.84%. Interest payments were \$2.6 million, \$1.9 million, and \$2.1 million, in fiscal years 2019, 2018 and 2017, respectively.

Project Loans

In November 2018, PDMCX was approved for credit of \$50 million, subject to certain limitations related to PDMCX registered capital at the time of the initial approval, pursuant to which PDMCX has and will enter into separate loan agreements (“the Project Loans”) for intermittent borrowings. The Project Loans, which are denominated in Chinese renminbi (RMB), are being used to finance certain capital expenditures in China. PDMCX granted liens on its land, building, and certain equipment as collateral for the Project Loans. As of October 31, 2019, PDMCX had borrowed 243.4 million RMB (\$34.5 million) against this approval. Payments on these borrowings are due semi-annually through December 2025; the initial payment is scheduled for June 2020. The table below presents, in U.S. dollars, the timing of future payments against the borrowings.

	Fiscal Year						
	2020	2021	2022	2023	2024	2025	2026
Principal payments	\$ 1,275	\$ 6,377	\$ 5,685	\$ 3,441	\$ 6,589	\$ 6,305	\$ 4,818

The interest rates on the Project Loans are based on the benchmark lending rate of the People’s Bank of China (4.9% at October 31, 2019). Interest incurred on the loans will be reimbursed through incentives provided by the Xiamen Torch Hi-Tech Industrial Development Zone, which provide for such reimbursements up to a prescribed limit.

Working Capital Loans

In November 2018, PDMCX received approval for unsecured credit of \$25.0 million, pursuant to which PDMCX may enter into separate loan agreements. Under this credit agreement (the “Working Capital Loans”), PDMCX can borrow up to 140.0 million RMB to pay value-added taxes (“VAT”), and up to 60.0 million RMB to fund operations; combined total borrowings are limited to \$25.0 million. As of October 31, 2019, PDMCX had 67.3 million RMB (\$9.5 million) outstanding against the approval to pay VAT. Payments on these borrowings are due semiannually, at an increasing rate, through January 2022; PDMCX made installment payments totaling \$0.1 million during the year ended October 31, 2019. The table below presents, in U.S. dollars, the timing of future payments against these borrowings.

	Fiscal Year		
	2020	2021	2022
Principal payments	\$ 867	\$ 1,927	\$ 6,745

As of October 31, 2019, PDMCX had borrowed, in several transactions, 36.8 million RMB (\$5.2 million) against the approval to fund operations, all of which was outstanding as of that date; repayments are due one year from the borrowing dates. In November 2019, PDMCX borrowed an additional 8.0 million RMB (\$1.1 million) against this approval.

The interest rates on borrowings to fund operations are approximately 4.6% and interest rates on borrowings to pay VAT are approximately 4.9%; both rates are based on the RMB Loan Prime Rate of the National Interbank Funding Center, plus spreads that range from 25.75 to 67.75 basis points. Interest incurred on the loans will be reimbursed through incentives provided by the Xiamen Torch Hi-Tech Industrial Development Zone, which provide for such reimbursements up to a prescribed limit.

Equipment Loan

Effective July 2019, the Company entered into a Master Lease Agreement (“MLA”) which enables us to request advance payments or other funds to finance equipment to be leased or purchased in the U.S. In connection with this MLA, we were approved for financing of \$35 million for the purchase of a high-end lithography tool. In the fourth quarter of fiscal 2019, the financing entity, upon our request, made an advance payment of \$3.5 million to the equipment vendor on our behalf. Interest on this borrowing is payable monthly at thirty-day LIBOR plus 1% (2.76% at October 31, 2019), and will continue to accrue until the borrowing is repaid or, as allowed under the MLA, we enter into a lease for the equipment. We intend to enter into a lease agreement for the related equipment in fiscal year 2020; as such, we have classified this borrowing as current debt. All borrowings under the MLA are secured by the equipment to be leased or purchased.

3.25% Convertible Senior Notes

In January 2015, we privately exchanged \$57.5 million in aggregate principal amount of our 3.25% convertible senior notes with a maturity date of April 1, 2016, for new 3.25% convertible senior notes with an aggregate principal amount of \$57.5 million with a maturity date of April 1, 2019. The conversion rate of the new notes was the same as that of the exchanged notes, which were issued in March 2011 with a conversion rate of approximately 96 shares of common stock per \$1,000 note principal, equivalent to a conversion price of \$10.37 per share of common stock. In April 2019, the entire \$57.5 million principal amount was repaid upon maturity.

Credit Agreement

In September 2018, we entered into a five-year amended and restated credit agreement (the “Credit Agreement”), which has a \$50 million borrowing limit, with an expansion capacity to \$100 million. The Credit Agreement is secured by substantially all of our assets located in the United States and common stock we own in certain foreign subsidiaries. The Credit Agreement includes minimum interest coverage ratio, total leverage ratio, and minimum unrestricted cash balance covenants (all of which we were in compliance with at October 31, 2019), and limits the amount of cash dividends, distributions, and redemptions we can pay on our common stock to an aggregate amount of \$100 million in 2019 and \$50 million annually thereafter. We had no outstanding borrowings against the Credit Agreement at October 31, 2019, and \$50 million was available for borrowing. The interest rate on the Credit Agreement (2.78% at October 31, 2019) is based on our total leverage ratio at LIBOR plus a spread, as defined in the Credit Agreement.

NOTE 7 - REVENUE

We adopted Accounting Standards Update 2014-09 and all subsequent amendments which are collectively codified in Accounting Standards Codification Topic 606 - “Revenue from Contracts with Customers” (“Topic 606”) - on November 1, 2018, under the modified retrospective transition method, only with respect to contracts that were not complete as of the date of adoption. This approach required prospective application of the guidance with a cumulative effect adjustment to retained earnings to reflect the impact of the adoption on contracts that were not complete as of the date of the adoption. In accordance with the modified retrospective transition method, the results of the prior year period presented have not been adjusted for the effects of Topic 606.

Under Topic 606, we recognize revenue when, or as, control of a good or service transfers to a customer, in an amount that reflects the consideration to which we expect to be entitled in exchange for transferring those goods or services, whereas, prior to our adoption of Topic 606, we recognized revenue when we shipped to customers or, under some arrangements, when the customers received the goods. The following tables present the impacts of our adoption of Topic 606 on our consolidated balance sheet, and consolidated statements of income and cash flows for the year ended October 31, 2019.

Consolidated Balance Sheet
October 31, 2019

	<u>As Reported</u>	<u>Adjustments</u>	<u>Balance without Adoption of Topic 606</u>
Assets			
Accounts receivable	\$ 134,454	\$ (1,559)	\$ 132,895
Inventory	48,155	6,093	54,248
Other current assets	38,388	(7,595)	30,793
Deferred income taxes	20,779	90	20,869
Liabilities			
Accrued liabilities	\$ 49,702	\$ (110)	49,592
Equity			
Photronics, Inc. shareholders' equity	\$ 769,892	\$ (1,976)	\$ 767,916
Noncontrolling interests	141,200	(885)	140,315

Consolidated Statement of Income
Year Ended October 31, 2019

	<u>As Reported</u>	<u>Adjustments</u>	<u>Balance without Adoption of Topic 606</u>
Revenue	\$ 550,660	\$ (4,365)	\$ 546,295
Cost of goods sold	429,819	(2,256)	427,563
Gross profit	120,841	(2,109)	118,732
Provision for taxes	10,210	(379)	9,831
Net income	40,491	(1,730)	38,761
Noncontrolling interests	10,698	(749)	9,949
Income attributable to Photronics, Inc. shareholders	<u>\$ 29,793</u>	<u>\$ (981)</u>	<u>\$ 28,812</u>

Consolidated Statement of Cash Flows
Year Ended October 31, 2019

	<u>As Reported</u>	<u>Adjustments</u>	<u>Balance without Adoption of Topic 606</u>
Net Income	\$ 40,491	\$ (1,730)	\$ 38,761
Changes in operating accounts:			
Accounts receivable	\$ (12,321)	\$ 993	\$ (11,328)
Inventories	(23,088)	(2,503)	(25,591)
Other current assets	(8,631)	3,166	(5,465)
Accounts payable, accrued liabilities, and other	(11,962)	74	(11,888)

We account for an arrangement as a revenue contract when each party has approved and is committed to perform under the contract, the rights of the contracting parties regarding the goods or services to be transferred and the payment terms are identifiable, the arrangement has commercial substance, and collection of consideration is probable. Substantially all of our revenue comes from the sales of photomasks. We typically contract with our customers to sell sets of photomasks (referred to as "mask sets"), which are comprised of multiple layers, the predominance of which we invoice as they ship to customers. As the photomasks are manufactured to customer specifications, they have no alternative use to us and, as our contracts generally provide us with the right to payment for work completed to date, we recognize revenue as we perform, or "over time" on most of our contracts. We measure our performance to date using an input method, which is based on our estimated costs to complete the various manufacturing phases of a photomask. At the end of a reporting period, there will be a number of revenue contracts on which we have performed; for any such contracts that we are entitled to be compensated for our costs incurred plus a reasonable profit, we recognize revenue and a corresponding contract asset for such performance. We account for shipping and handling activities that we perform after a customer obtains control of a good as being activities to fulfill our promise to transfer the good to the customer, rather than as promised services, or performance obligations, under the contract.

As stated above, photomasks are manufactured in accordance with proprietary designs provided by our customers; thus, they are individually unique. Due to their uniqueness and other factors, their transaction prices are individually established through negotiations with customers; consequently, our photomasks do not have standard or “list” prices. The transaction prices of the vast majority of our revenue contracts include only fixed amounts of consideration. In certain instances, such as when we offer a customer an early payment discount, an estimate of variable consideration would be included in the transaction price, but only to the extent that a significant reversal of revenue would not occur when the uncertainty related to the variability is resolved.

Contract Assets, Contract Liabilities, and Accounts Receivable

We recognize a contract asset when our performance under a contract precedes our receipt of consideration from a customer, or before payment is due, and our receipt of consideration is conditional upon factors other than the passage of time. Contract assets reflect our transfer of control to customers of photomasks that are in process or completed but not yet shipped. A receivable is recognized when we have an unconditional right to payment for our performance, which generally occurs when we ship the photomasks. Our contract assets primarily consist of a significant amount of our in-process production orders and fully manufactured photomasks which have not yet shipped, for which we have an enforceable right to collect consideration (including a reasonable profit) in the event the in-process orders are cancelled by customers. On an individual contract basis, we net contract assets with contract liabilities (deferred revenue) for financial reporting purposes. Our contract assets and liabilities are typically classified as current, as our production cycle and our lead times are both under one year. Contract assets of \$7.6 million are included in “Other” current assets, and contract liabilities of \$11.5 million are included in Accrued liabilities in our October 31, 2019 consolidated balance sheet. At November 1, 2018, our date of adoption of Topic 606, we had contract assets of \$4.6 million and contract liabilities of \$7.8 million. We did not impair any contract assets during the year period ended October 31, 2019, and we recognized \$1.3 million of revenue from the settlement of contract liabilities that existed at the beginning of the year.

We generally record our accounts receivable at their billed amounts. All outstanding past due customer invoices are reviewed during, and at the end of, every period for collectibility. To the extent we believe a loss on the collection of a customer invoice is probable, we record the loss and credit the allowance for doubtful accounts. In the event that an amount is determined to be uncollectible, we charge the allowance for doubtful accounts and eliminate the related receivable. Credit losses incurred on our accounts receivable during the year ended October 31, 2019, were immaterial.

Our invoice terms generally range from net thirty to ninety days, depending on both the geographic market in which the transaction occurs and our payment agreements with specific customers. In the event that our evaluation of a customer’s business prospects and financial condition indicate that the customer presents a collectibility risk, we require payment in advance of performance. We have elected the practical expedient allowed under Topic 606 that permits us not to adjust a contract’s promised amount of consideration to reflect a financing component when the period between when we transfer control of goods or services to customers and when we are paid is one year or less.

In instances when we are paid in advance of our performance, we record a contract liability and, as allowed under the practical expedient in Topic 606, recognize interest expense only if the period between when we receive payment from the customer and the date when we expect to be entitled to the payment is greater than one year. Historically, advance payments we’ve received from customers have not preceded the completion of our performance obligations by more than one year.

Disaggregation of Revenue

The following tables present our revenue for the year ended October 31, 2019, disaggregated by product type, geographic origin, and timing of recognition.

	<u>Year Ended</u>
<u>Revenue by Product Type</u>	<u>October 31, 2019</u>
<u>IC</u>	
High-end	\$ 156,418
Mainstream	249,773
Total IC	<u>\$ 406,191</u>

<u>FPD</u>	
High-end	\$ 98,832
Mainstream	45,637
Total FPD	<u>\$ 144,469</u>
	<u>\$ 550,660</u>

<u>Revenue by Geographic Origin</u>	
Taiwan	\$244,377
Korea	147,734
United States	105,045
Europe	32,585
China	19,010
All other Asia	1,909
	<u>\$550,660</u>

<u>Revenue by Timing of Recognition</u>	
Over time	\$497,942
At a point in time	52,718
	<u>\$550,660</u>

Contract Costs

We pay commissions to third party sales agents for certain sales that they obtain for us. However, the bases of the commissions are the transaction prices of the sales, which are completed in less than one year; thus, no relationship is established with a customer that will result in future business. Therefore, we would not recognize any portion of these sales commissions as costs of obtaining a contract, nor do we currently foresee other circumstances under which we would recognize such assets.

Remaining Performance Obligations

As we are typically required to fulfill customer orders within a short time period, our backlog of orders is generally not in excess of one to two weeks for IC photomasks and two to three weeks for FPD photomasks. As allowed under Topic 606, we have elected not to disclose our remaining performance obligations, which represent the costs associated with the completion of the manufacturing process of in-process photomasks related to contracts that have an original duration of one year or less.

Sales and Similar Taxes

We report our revenue net of any sales or similar taxes we collect on behalf of governmental entities.

Product Warranty

Our photomasks are sold under warranties that generally range from one to twenty-four months. We warrant that our photomasks conform to customer specifications, and will typically repair, replace, or issue a refund, at our option, any photomasks that fail to do so. The warranties do not represent separate performance obligations in our revenue contracts. Historically, customer claims under warranty have been immaterial.

NOTE 8 - OPERATING LEASES

We lease various real estate and equipment under non-cancelable operating leases, for which rent expense was \$3.0 million, \$2.9 million, and \$3.0 million in fiscal 2019, 2018, and 2017, respectively.

At October 31, 2019, future minimum lease payments under non-cancelable operating leases with initial terms in excess of one year were as follows:

2020	\$1,885
2021	1,613
2022	1,535
2023	742
2024	424
Thereafter	377
	<u>\$6,576</u>

We adopted ASU 2016-02 and all subsequent amendments, collectively codified in ASC Topic 842 “Leases” (“Topic 842”), on November 1, 2019. The guidance requires modified retrospective adoption, either at the beginning of the earliest period presented or at the beginning of the period of adoption; we have elected to apply the guidance at the beginning of the period of adoption. See Note 22 for further information on our adoption of Topic 842.

NOTE 9 – SHARE-BASED COMPENSATION

In March 2016, shareholders approved a new equity incentive compensation plan (“the Plan”), under which incentive stock options, non-qualified stock options, stock grants, stock-based awards, restricted stock, restricted stock units, stock appreciation rights, performance units, performance stock, and other stock or cash awards may be granted. Shares to be issued under the Plan may be authorized and unissued shares, issued shares that have been reacquired by us (in the open-market or in private transactions), shares held in the treasury, or a combination thereof. The maximum number of shares of common stock approved that may be issued under the Plan is four million shares. Awards may be granted to officers, employees, directors, consultants, advisors, and independent contractors of Photronics or its subsidiaries. In the event of a change in control (as defined in the Plan), the vesting of awards may be accelerated. The Plan, aspects of which are more fully described below, prohibits further awards from being issued under prior plans. We incurred total share-based compensation expenses of \$3.7 million, \$3.2 million, and \$3.6 million in fiscal years 2019, 2018, and 2017, respectively. No share-based compensation cost was capitalized as part of an asset and no related income tax benefits were recorded during the fiscal years presented.

Stock Options

Option awards generally vest in one to four years, and have a ten-year contractual term. All incentive and non-qualified stock option grants must have an exercise price no less than the market value of the underlying common stock on the date of grant. The grant-date fair values of options are based on closing prices of our common stock on the dates of grant and are calculated using the Black-Scholes option pricing model. Expected volatility is based on the historical volatility of our common stock. We use historical option exercise behavior and employee termination data to estimate expected term, which represents the period of time that options granted are expected to remain outstanding. The risk-free rate of return for the estimated term of an option is based on the U.S. Treasury yield curve in effect at the date of grant.

The weighted-average inputs and risk-free rate of return ranges used to calculate the grant date fair value of options issued during fiscal years 2019, 2018 and 2017 are presented in the following table:

	Year Ended		
	October 31, 2019	October 31, 2018	October 29, 2017
Expected volatility	33.1%	31.7%	32.2%
Risk-free rate of return	2.5 - 2.9%	2.2 - 2.8%	1.9 - 2.0%
Dividend yield	0.0%	0.0%	0.0%
Expected term	5.1 years	5.0 years	5.0 years

The table below presents a summary of stock options activity during fiscal year 2019 and information on stock options outstanding at October 31, 2019.

Options	Shares	Weighted-Average Exercise Price	Weighted-Average Remaining Contractual Life	Aggregate Intrinsic Value
Outstanding at October 31, 2018	2,423,560	\$ 8.68		
Granted	132,000	\$ 9.77		
Exercised	(322,010)	\$ 6.43		
Cancelled and forfeited	(62,783)	\$ 11.47		
Outstanding at October 31, 2019	<u>2,170,767</u>	<u>\$ 9.00</u>	5.4 years	<u>\$ 6,206</u>
Exercisable at October 31, 2019	<u>1,615,225</u>	<u>\$ 8.61</u>	4.6 years	<u>\$ 5,242</u>
Vested and expected to vest as of October 31, 2019	<u>2,095,804</u>	<u>\$ 8.95</u>	5.3 years	<u>\$ 6,096</u>

The weighted-average grant date fair value of options granted during fiscal years 2019, 2018 and 2017 were \$3.31, \$2.76 and \$3.59, respectively. The total intrinsic value of options exercised during fiscal years 2019, 2018 and 2017 was \$1.3 million, \$2.5 million and \$1.9 million, respectively.

We received cash from option exercises of \$2.1 million, \$4.3 million and \$2.4 million in fiscal years 2019, 2018 and 2017, respectively. As of October 31, 2019, the total unrecognized compensation cost of unvested option awards was approximately \$0.9 million. That cost is expected to be recognized over a weighted-average amortization period of 2.1 years.

Restricted Stock

We periodically grant restricted stock awards, the restrictions on which typically lapse over a service period of one to four years. The fair value of an award is the closing stock price of our common stock on the date of grant. There were 435,000, 290,000, and 317,750 restricted stock awards granted during fiscal years, 2019, 2018 and 2017, respectively. The weighted-average grant date fair values of those awards were \$9.80, \$8.62 and \$10.94. The total fair value of awards for which restrictions lapsed was \$1.9 million, \$1.4 million and \$1.2 million during fiscal years 2019, 2018 and 2017, respectively. As of October 31, 2019, the total compensation cost for restricted stock awards not yet recognized was approximately \$4.3 million. That cost is expected to be recognized over a weighted-average amortization period of 2.6 years.

A summary of restricted stock award activity during fiscal year 2019 and the status of our outstanding restricted stock awards as of October 31, 2019, is presented below:

Restricted Stock	Shares	Weighted-Average Fair Value at Grant Date
Outstanding at October 31, 2018	419,297	\$ 9.58
Granted	435,000	\$ 9.80
Vested	(195,684)	\$ 9.65
Cancelled	(18,500)	\$ 9.82
Outstanding at October 31, 2019	<u>640,113</u>	<u>\$ 9.70</u>
Expected to vest as of October 31, 2019	<u>594,771</u>	<u>\$ 9.69</u>

Employee Stock Purchase Plan

Our Employee Stock Purchase Plan (“ESPP”) permits employees to purchase Photronics, Inc. common shares at 85% of the lower of the closing market price at the commencement or ending date of the Plan year (which is approximately one year). We recognize the ESPP expense during that same period. As of October 31, 2019, the maximum number of shares of common stock approved by our shareholders to be purchased under the ESPP was 1.85 million shares, of which approximately 1.5 million shares had been issued through October 31, 2019; No shares were subject to outstanding subscriptions as of October 31, 2019.

NOTE 10 - EMPLOYEE RETIREMENT PLANS

We maintain a 401(k) Savings and Profit Sharing Plan (“401(k) Plan”) which covers all full and certain part time U.S. employees who have completed three months of service and are 18 years of age or older. Under the terms of the 401(k) Plan, employees may contribute up to 50% of their salary, subject to certain maximum amounts, which will be matched by the Company at 50% of the employee’s contributions that are not in excess of 4% of the employee’s compensation. Employee and employer contributions vest immediately upon contribution. The total employer contributions for all of our defined contribution plans were \$0.7 million, \$0.7 million and \$0.6 million in fiscal years 2019, 2018 and 2017, respectively.

NOTE 11 - INCOME TAXES

Income before the income tax provisions consists of the following:

	Year Ended		
	October 31, 2019	October 31, 2018	October 29, 2017
United States	\$ (8,379)	\$ (9,859)	\$ (11,544)
Foreign	59,080	78,430	38,109
	<u>\$ 50,701</u>	<u>\$ 68,571</u>	<u>\$ 26,565</u>

The income tax provisions consist of the following:

	Year Ended		
	October 31, 2019	October 31, 2018	October 29, 2017
Current:			
Federal	\$ (3,916)	\$ (30)	\$ 173
State	11	-	(4)
Foreign	17,777	11,584	3,474
Deferred:			
Federal	3,673	(3,673)	-
State	10	(24)	15
Foreign	(7,345)	(522)	1,618
Total	\$ 10,210	\$ 7,335	\$ 5,276

The income tax provisions differ from the amount computed by applying the statutory U.S. federal income tax rate to income before income taxes as a result of the following:

	Year Ended		
	October 31, 2019	October 31, 2018	October 29, 2017
U.S. federal income tax at statutory rate	\$ 10,647	\$ 16,059	\$ 9,298
Changes in valuation allowances	2,673	4,554	(3,632)
Foreign tax rate differentials	218	(2,078)	(5,230)
Tax credits	(1,268)	(1,530)	(1,925)
Uncertain tax positions, including reserves, settlements and resolutions	134	(1,791)	(932)
Employee stock option	232	(1,433)	512
Income tax holiday	(2,234)	(2,648)	(743)
Tax reform	-	(3,736)	-
Distributions from foreign subsidiaries	-	-	6,471
Tax on foreign subsidiary earnings	-	-	1,712
Other, net	(192)	(62)	(255)
	<u>\$ 10,210</u>	<u>\$ 7,335</u>	<u>\$ 5,276</u>
Effective tax rate	<u>20.1%</u>	<u>10.7%</u>	<u>19.8%</u>

The fiscal year 2019 effective tax rate differs from the U.S. statutory rate of 21% due to the recognition of a benefit related to previously unrecognized tax positions, loss jurisdiction pre-tax losses being benefited at higher statutory rates than pre-tax income in income jurisdictions was taxed, changes in deferred tax asset valuation allowance, the benefits of a tax holiday, and investment credits in foreign jurisdictions.

The fiscal year 2018 effective tax rate differs from the U.S. federal blended rate of 23.42% primarily due to the impact of the U.S. Tax Cuts and Jobs Act (discussed below) allowing for the refund of AMT credits that caused a corresponding reversal of the related valuation allowance, the recognition of a benefit related to previously unrecognized tax positions, earnings being taxed at lower statutory rates in foreign jurisdictions, the benefits of a tax holiday, and investment credits in foreign jurisdictions.

The fiscal year 2017 effective tax rate differs from the U.S. statutory rate of 35% primarily due to earnings being taxed at lower statutory rates in foreign jurisdictions, changes in deferred tax asset valuation allowances, including the reversals noted below, together with the benefit of various investment credits in a foreign jurisdiction.

We were granted two five-year tax holidays in Taiwan, one that expired unused in 2017 and the other that expires at the end of calendar year 2019. The latter tax holiday reduced foreign taxes by \$2.2 million, \$2.6 million and \$0.7 million in fiscal years 2019, 2018 and 2017, respectively, with an \$0.02 and \$0.035 cents per share impact in fiscal 2019 and 2018, respectively, and a de minimis per share effect in the fiscal 2017.

On December 22, 2017, the U.S. Tax Cuts and Jobs Act (the “Act”), was signed into law, enacting significant changes to the United States Internal Revenue Code of 1986, as amended. Based on the enactment date, we accounted for the Act in our interim period ended January 28, 2018. In December 2017, the Securities and Exchange Commission released Staff Accounting Bulletin No. 118 (“SAB 118”) to address situations in which the accounting under Accounting Standards Codification Topic 740 – “Income Taxes” is incomplete for certain income tax effects of the Act. We adopted SAB 118 in our first quarter of fiscal year 2018, and finalized its effects in our fourth quarter of fiscal 2018. In the period ended January 28, 2018, we recognized the following effects in our provision for income taxes:

- The Act repealed the corporate alternative minimum tax (“AMT”) for tax years beginning after December 31, 2017, and provided that existing AMT credit carryforwards are fully refundable. We recognized a \$3.9 million benefit on AMT credit carryforwards that we previously determined were not more likely than not going to be realized and reversed the previously recorded valuation allowance.
- As of January 1, 2018, the Act reduced the corporate income tax rate from a maximum 35% to a flat 21%, requiring us to revalue our deferred tax assets and liabilities utilizing the rate applicable to the period when a temporary difference will reverse. Our net deferred tax asset is fully offset by a valuation allowance, and the revaluation of the deferred tax assets and liabilities resulted in a net-zero impact for the period.
- The Act imposed a transition tax for a one-time deemed repatriation of the accumulated earnings of foreign subsidiaries. The entire amount of transition tax was fully offset by tax credits (including carryforwards) that resulted in a provisional net-zero impact on the period.

On January 18, 2018, the Taiwan Legislature Yuan approved amendments to the Income Tax Act, enacting an increase in the corporate tax rate from 17% to 20%, which required us to revalue our deferred tax assets and liabilities utilizing the rate applicable to the period when a temporary difference will reverse. Accordingly, a net benefit of \$0.2 million is reflected in our tax provision in fiscal year 2018.

The net deferred income tax assets consist of the following:

	As of	
	October 31, 2019	October 31, 2018
Deferred income tax assets:		
Net operating losses	\$ 32,229	\$ 30,805
Reserves not currently deductible	5,013	4,703
Tax credit carryforwards	9,164	9,159
Share-based compensation	860	767
Alternative minimum tax credits	-	3,673
Other	434	1,210
	<u>47,700</u>	<u>50,317</u>
Valuation allowances	(27,032)	(24,383)
	<u>20,668</u>	<u>25,934</u>
Deferred income tax liabilities:		
Property, plant and equipment	(251)	(8,020)
Other	-	(448)
	<u>(251)</u>	<u>(8,468)</u>
Net deferred income tax assets	<u>\$ 20,417</u>	<u>\$ 17,466</u>
Reported as:		
Deferred income tax assets	\$ 20,779	\$ 18,109
Deferred income tax liabilities	(362)	(643)
	<u>\$ 20,417</u>	<u>\$ 17,466</u>

We have established a valuation allowance for a portion of our deferred tax assets because we believe, based on the weight of all available evidence, that it is more likely than not that a portion of our net operating loss carryforwards will expire prior to utilization. In fiscal year 2019, the valuation allowance increased as a result of increase in fully valued net operating losses. During fiscal year 2018, the valuation allowance decrease primarily resulted from the reversal of the valuation allowance related to alternative minimum tax credits of \$(3.9) million (as a consequence of the Act), prior year additional NOL utilization of \$(1.8) million, credit utilizations of \$(1.3) million, changes in the deferred tax liability of \$2.8 million, \$1.8 million from the adoption of ASU 2016-09 related to stock compensation, \$1.6 million from the corporate tax rate reduction, and other impacts of \$(0.4) million.

Due to the Act, as of fiscal year end 2018, U.S. deferred taxes were no longer provided on the undistributed earnings of non-U.S. subsidiaries. Our policy to indefinitely reinvest these earnings in non-U.S. operations remains unchanged for the purpose of determining deferred tax liabilities for U.S. state and foreign withholding taxes. Therefore, should we elect in the future to repatriate the remaining foreign earnings deemed to be indefinitely reinvested, we may incur additional state and withholding tax expense on those foreign earnings, the amount of which is not practicable to compute.

The following tables present our available operating loss and credit carryforwards as of October 31, 2019, and their related expiration periods:

Operating Loss Carryforwards	Amount	Expiration Periods
Federal	\$ 85,949	2028-Indefinite
State	206,513	2019-2039
Foreign	9,177	2022-2029

Tax Credit Carryforwards	Amount	Expiration
		Period
Federal research and development	\$ 4,522	2019-2039
State	5,870	2020-2029

In September 2019, we entered into a Section 382 Rights Agreement with Computershare Trust Company, N.A., a federally chartered trust company, as rights agent. The purpose of the Rights Agreement is to deter trading of our common stock that would result in a change in control (as defined in Internal Revenue Control Section 382), thereby preserving our future ability to use our historical federal net operating losses and other Tax Attributes (as defined in the Rights Agreement). In connection with our entry into the Rights Agreement, our board of directors declared a dividend of one preferred stock purchase right, payable on or about October 1, 2019, for each share of common stock, par value \$0.01 per share, of the Company's outstanding on September 30, 2019, to the stockholders of record on that date.

A reconciliation of the beginning and ending amounts of unrecognized tax benefits, excluding interest and penalties, is as follows:

	Year Ended		
	October 31, 2019	October 31, 2018	October 29, 2017
Balance at beginning of year	\$ 1,775	\$ 3,384	\$ 4,606
Additions (reductions) for tax positions in prior years	(466)	(44)	207
Additions based on current year tax positions	1,286	498	323
Settlements	(204)	(56)	(922)
Lapses of statutes of limitations	(633)	(2,007)	(830)
Balance at end of year	\$ 1,758	\$ 1,775	\$ 3,384

As of October 31, 2019, October 31, 2018 and October 29, 2017, the balance of unrecognized tax benefits, which are included in Other liabilities, includes \$1.9 million, \$1.9 million, and \$3.4 million, respectively, that, if recognized, would impact the effective tax rates. Included in each of these amounts were interest and penalties of \$0.2 million, \$0.1 million, and \$0.1 million, at the end of fiscal year 2019, 2018, and 2017, respectively. We include any applicable interest and penalties related to uncertain tax positions in our income tax provision. The amounts reflected in the table above include settlements of non-U.S. audits.

Although the timing of the expirations of statutes of limitations may be uncertain, as they can be dependent upon the settlement of tax audits, the Company believes that the amount of uncertain tax positions (including accrued interest and penalties, and net of tax benefits) that may be resolved over the next twelve months is immaterial. Resolution of these uncertain tax positions may result from either or both the lapses of statutes of limitations and tax settlements. The Company is no longer subject to tax authority examinations in the U.S., major foreign, or state tax jurisdictions for years prior to fiscal year 2014.

Income tax payments were \$15.9 million, \$6.1 million and \$9.3 million in fiscal years 2019, 2018 and 2017, respectively. Cash received as refunds of income taxes paid in prior years amounted to \$1.1 million and \$0.1 million in fiscal years 2018 and 2017, respectively, with an immaterial amount being received in fiscal year 2019.

Adoption of New Accounting Standard

In the first quarter of 2019, the Company adopted Accounting Standards Update No. 2016-16 – "Intra-Entity Transfers Other Than Inventory", which requires an entity to recognize the income tax consequences of an intra-entity transfer of an asset other than inventory when the transfer occurs. In connection therewith, we recorded a transition adjustment of \$1.1 million that reduced prepaid income taxes (included in Other current assets in the consolidated balance sheets) against beginning retained earnings.

NOTE 12 - EARNINGS PER SHARE

The calculation of basic and diluted earnings per share is presented as follows:

	Year Ended		
	October 31, 2019	October 31, 2018	October 29, 2017
Net income attributable to Photonics, Inc. shareholders	\$ 29,793	\$ 42,055	\$ 13,130
Effect of dilutive securities:			
Interest expense on convertible notes, net of related tax effects	845	1,999	-
Earnings for diluted earnings per share	<u>\$ 30,638</u>	<u>\$ 44,054</u>	<u>\$ 13,130</u>
Weighted-average common shares computations:			
Weighted-average common shares used for basic earnings per share	66,347	68,829	68,436
Effect of dilutive securities:			
Convertible notes	2,360	5,542	-
Share-based payment awards	448	450	852
Potentially dilutive common shares	<u>2,808</u>	<u>5,992</u>	<u>852</u>
Weighted-average common shares used for diluted earnings per share	<u>69,155</u>	<u>74,821</u>	<u>69,288</u>
Basic earnings per share	\$ 0.45	\$ 0.61	\$ 0.19
Diluted earnings per share	\$ 0.44	\$ 0.59	\$ 0.19

The table below shows the outstanding weighted-average share-based payment awards that were excluded from the calculation of diluted earnings per share because their exercise price exceeded the average market value of the common shares for the period or, under application of the treasury stock method, they were otherwise determined to be antidilutive. The table also shows convertible notes that, if converted, would have been antidilutive.

	Year Ended		
	October 31, 2019	October 31, 2018	October 29, 2017
Share based payment awards	1,250	1,627	1,308
Convertible notes	-	-	5,542
Total potentially dilutive shares excluded	<u>1,250</u>	<u>1,627</u>	<u>6,850</u>

Subsequent to October 31, 2019, we repurchased 0.9 million shares of our common stock. See Note 19 for information on our share repurchase programs.

NOTE 13 - COMMITMENTS AND CONTINGENCIES

As of October 31, 2019, we had outstanding purchase commitments of \$130.3 million, \$111.8 million of which was for capital equipment. Included in the latter amount is \$30.8 million which we intend to finance under a capital lease. As discussed in Note 6, we've been approved for a lease to finance the purchase of a high-end lithography tool under an agreement entered into in fiscal 2019. See Note 8 for information on our operating lease commitments.

As of October 31, 2019, we had recorded liabilities for the purchase of equipment of \$17.2 million.

We are subject to various claims that arise in the ordinary course of business. We believe such claims, individually and in the aggregate, will not have a material effect on our consolidated financial statements.

NOTE 14 - GEOGRAPHIC AND SIGNIFICANT CUSTOMER INFORMATION

We operate as a single operating segment as a manufacturer of photomasks, which are high precision quartz or glass plates containing microscopic images of electronic circuits for use in the fabrication of IC's and FPDs.

Our 2019, 2018 and 2017 revenue by geographic origin and by IC and FPD products are presented below.

	Year Ended		
	October 31, 2019	October 31, 2018	October 29, 2017
Net revenue			
Taiwan	\$ 244,377	\$ 237,039	\$ 187,818
Korea	147,734	147,066	122,165
United States	105,045	112,648	102,040
Europe	32,585	35,540	36,081
China	19,010	1,157	168
All other Asia	1,909	1,826	2,406
	<u>\$ 550,660</u>	<u>\$ 535,276</u>	<u>\$ 450,678</u>
IC	\$ 406,191	\$ 416,064	\$ 350,260
FPD	144,469	119,212	100,418
	<u>\$ 550,660</u>	<u>\$ 535,276</u>	<u>\$ 450,678</u>

Our 2019, 2018, and 2017 long-lived assets by geographic area are presented below.

	As of		
	October 31, 2019	October 31, 2018	October 29, 2017
Long-lived assets			
China	\$ 232,394	\$ 102,985	\$ 8,273
Taiwan	146,467	177,626	186,192
United States	130,935	156,948	180,095
Korea	117,755	127,764	147,265
Europe	4,890	6,458	13,372
	<u>\$ 632,441</u>	<u>\$ 571,781</u>	<u>\$ 535,197</u>

One customer accounted for 16% of our revenue in fiscal years 2019, 2018 and 2017, respectively, and another customer accounted for 15%, 15% and 16% of our revenue in fiscal years 2019, 2018 and 2017, respectively.

NOTE 15 - CHANGES IN ACCUMULATED OTHER COMPREHENSIVE INCOME BY COMPONENT

The following tables set forth the changes in our accumulated other comprehensive income by component (net of tax of \$0) for the years ended October 31, 2019 and October 31, 2018:

	Year Ended October 31, 2019		
	Foreign Currency Translation Adjustments	Other	Total
	Balance at October 31, 2018	\$ (4,328)	\$ (638)
Other comprehensive loss	(2,877)	(74)	(2,951)
Less: other comprehensive income (loss) attributable to noncontrolling interests	1,126	(38)	1,088
Balance at October 31, 2019	<u>\$ (8,331)</u>	<u>\$ (674)</u>	<u>\$ (9,005)</u>

	Year Ended October 31, 2018			
	Foreign Currency Translation Adjustments	Amortization of Cash Flow Hedge	Other	Total
	Balance at October 29, 2017	\$ 7,627	\$ (48)	\$ (688)
Other comprehensive income before reclassifications	(16,672)	-	101	(16,571)
Amounts reclassified from other accumulated comprehensive income	-	48	-	48
Net current period other comprehensive income	(16,672)	48	101	(16,523)
Less: other comprehensive (loss) income attributable to noncontrolling interests	(4,717)	-	51	(4,666)
Balance at October 31, 2018	<u>\$ (4,328)</u>	<u>\$ -</u>	<u>\$ (638)</u>	<u>\$ (4,966)</u>

Amortization of the cash flow hedge is included in cost of goods sold in the 2018 and 2017 consolidated statements of income.

NOTE 16 – CONCENTRATIONS OF CREDIT RISK

Financial instruments that potentially subject us to credit risk principally consist of trade accounts receivables and short-term cash investments. We sell our products primarily to semiconductor and FPD manufacturers in Asia, North America, and Europe. We believe that the concentration of credit risk in our trade receivables is substantially mitigated by our ongoing credit evaluation process and relatively short collection terms. We do not generally require collateral from customers. We establish an allowance for doubtful accounts based upon factors surrounding the credit risk of specific customers, historical trends and other information.

Our cash and cash equivalents are deposited in several financial institutions, including institutions located within all of the countries in which we manufacture photomasks. Portions of deposits in some of these institutions may exceed the amount of insurance available for such deposits at these institutions. As these deposits are generally redeemable upon demand and are held by high quality, reputable institutions, we consider them to bear minimal credit risk. We further mitigate credit risks related to our cash and cash equivalents by spreading such risk among a number of institutions.

As of October 31, 2019, one of our customers accounted for 17% of our net accounts receivable. As of October 31, 2018, two of our customers individually accounted for 20% and 10% of our net accounts receivable.

NOTE 17 - RELATED PARTY TRANSACTIONS

On January 20, 2018, Photonics, Inc. entered into a four-year consulting agreement with DEMA Associates, LLC, for \$0.4 million per year. Two members of our board of directors, including the chairman, and a member of the chairman's immediate family, are members of DEMA Associates, LLC. We incurred expenses for services provided by this entity of \$0.4 million and \$0.3 million in fiscal years 2019 and 2018, respectively.

In July 2016, we entered into a contract for information technology services with a parent entity for which members of our board of directors served as the executive chairman of the board and a director of a wholly owned subsidiary of that entity. In fiscal year 2018, we incurred expenses for services provided by the parent entity of \$0.1 million during the period in which our board members served on the board of directors of this entity and, in fiscal year 2017, we incurred expenses of \$0.5 million with the parent entity.

An officer of our company is related to an individual in a position of authority at one of our largest customers. We recorded revenue from this customer of \$87.0 million, \$78.4 million and \$73.6 million, in fiscal years 2019, 2018 and 2017, respectively. As of October 31, 2019 and October 31, 2018, we had accounts receivable of \$22.2 million and \$23.5 million, respectively, from this customer.

We purchase photomask blanks from an entity of which a former officer of ours is a significant shareholder. The Company purchased \$4.5 million of photomask blanks from this entity during the period in 2017 when the former officer was employed by us.

We believe that the terms of our transactions with the related parties described above were negotiated at arm's length and were no less favorable to us than terms we could have obtained from unrelated third parties.

NOTE 18 - FAIR VALUE MEASUREMENTS

The accounting framework for determining fair value includes a hierarchy for ranking the quality and reliability of the information used to measure fair value, which enables the reader of the financial statements to assess the inputs used to develop those measurements. The fair value hierarchy consists of three tiers as follows: Level 1, defined as quoted market prices (unadjusted) in active markets for identical securities; Level 2, defined as inputs other than Level 1 that are observable, either directly or indirectly; and Level 3, defined as unobservable inputs that are not corroborated by market data.

The fair values of our cash and cash equivalents (Level 1 measurements), accounts receivable, accounts payable, and certain other current assets and current liabilities (Level 2 measurements) approximate their carrying values due to their short-term maturities. The fair values of our variable rate debt instruments are a Level 2 measurement and approximates their carrying values due to the variable nature of the underlying interest rates. The fair values of our convertible senior notes is a Level 2 measurement, as it was determined using inputs that were either observable market data, or could be derived from, or corroborated with, observable market data. These inputs included our stock price and interest rates offered on debt issued by entities with credit ratings similar to ours. We did not have any assets or liabilities measured at fair value, on a recurring or a nonrecurring basis, at October 31, 2019 or October 31, 2018.

Fair Value of Financial Instruments Not Recorded at Fair Value

The fair value of our convertible senior notes was a Level 2 measurement, as it was determined using inputs that were either observable market data or could be derived from or corroborated with observable market data. These inputs included our stock price and interest rates offered on debt issued by entities with credit ratings similar to ours. The table below presents the fair and carrying values of our convertible senior notes at October 31, 2018.

	October 31, 2018	
	<u>Fair Value</u>	<u>Carrying Value</u>
3.25% convertible senior notes matured 2019	\$ 62,094	\$ 57,453

NOTE 19 – SHARE REPURCHASE PROGRAMS

In August 2019, the Company’s board of directors authorized the repurchase of up to \$100 million of its common stock, pursuant to a repurchase plan under Rule 10b5-1 of the Securities Act of 1933 (as amended).

In October 2018, the Company’s board of directors authorized the repurchase of up to \$25 million of its common stock, to have been executed in open-market transactions or in accordance with a repurchase plan under Rule 10b5-1 of the Securities Act of 1933 (as amended). The share repurchase program commenced on October 22, 2018, and was terminated on February 1, 2019.

In July 2018, the Company’s Board of Directors authorized the repurchase of up to \$20 million of its common stock, to have been executed in open-market transactions or in accordance with a repurchase plan under Rule 10b5-1 of the Securities Act of 1933 (as amended). The share repurchase program commenced on July 10, 2018, and was completed in October 2018, when the authorized amount was exhausted.

All of the shares purchased under the above repurchase programs were retired in fiscal year 2019. The Table below presents information on the repurchase programs.

	<u>Fiscal Year 2019 Purchases</u>	<u>Fiscal Year 2018 Purchases</u>	<u>Total Purchases Under Programs</u>
Number of shares repurchased	2,133	2,558	4,691
Cost of shares repurchased	\$ 21,696	\$ 23,111	\$ 44,807
Average price paid per share	\$ 10.17	\$ 9.04	\$ 9.55

NOTE 20 – SUBSIDIARY DIVIDEND

In fiscal years 2019 and 2018, PDMC, the Company’s majority owned subsidiary in Taiwan, paid dividends of which 49.99%, or approximately \$45.1 and \$8.2 million, respectively, were paid to noncontrolling interests.

NOTE 21 – QUARTERLY RESULTS OF OPERATIONS (UNAUDITED)

The following table sets forth certain unaudited quarterly financial data:

	<u>First</u>	<u>Second</u>	<u>Third</u>	<u>Fourth</u>	<u>Year</u>
Fiscal 2019:					
Revenue	\$ 124,712	\$ 131,580	\$ 138,112	\$ 156,256	\$ 550,660
Gross profit	26,102	26,010	30,570	38,159	120,841
Net income	7,768	9,852	9,834	13,037	40,491
Net income attributable to Photronics, Inc. shareholders	5,267	8,479	6,347	9,700	29,793
Earnings per share:					
Basic	\$ 0.08	\$ 0.13	\$ 0.10	\$ 0.15	\$ 0.45
Diluted	\$ 0.08	\$ 0.13	\$ 0.10	\$ 0.15	\$ 0.44
Fiscal 2018:	<u>First</u>	<u>Second</u>	<u>Third</u>	<u>Fourth</u>	<u>Year</u>
		(a)			(a)
Revenue	\$ 123,446	\$ 130,779	\$ 136,391	\$ 144,660	\$ 535,276
Gross profit	27,662	32,819	35,597	35,425	131,503
Net income	9,481	15,189	19,797	16,769	61,236
Net income attributable to Photronics, Inc. shareholders	5,898	10,665	13,005	12,487	42,055
Earnings per share:					
Basic	\$ 0.09	\$ 0.15	\$ 0.19	\$ 0.18	\$ 0.61
Diluted	\$ 0.09	\$ 0.15	\$ 0.18	\$ 0.18	\$ 0.59

(a) Includes \$0.6 million gain on sale of assets.

NOTE 22 - RECENT ACCOUNTING PRONOUNCEMENTS**Accounting Standards Updates to be Implemented**

In June 2016, the Financial Accounting Standards Board (“FASB”) issued ASU 2016-13 “Measurement of Credit Losses”, the main objective of which is to provide more useful information about expected credit losses on financial instruments and other commitments of an entity to extend credit. In support of this objective, the ASU replaces the incurred loss model, found in current GAAP, with an expected credit loss model; the new model requires consideration of a broader range of reasonable and supportable information to inform credit loss estimates. This ASU requires a cumulative-effect adjustment as of the beginning of the first reporting period in which the guidance is adopted. ASU 2016-13 is effective for Photronics, Inc. in its first quarter of fiscal year 2021, with early adoption permitted. We are currently evaluating the effect that this ASU will have on our consolidated financial statements.

In February 2016, the FASB issued ASU 2016-02 “Leases (Topic 842)”, which requires lessees to recognize right-of-use assets and corresponding liabilities for all leases with an initial term in excess of twelve months. We adopted ASU 2016-02 and all subsequent amendments, collectively codified in Topic 842, on November 1, 2019. The guidance requires modified retrospective adoption, either at the beginning of the earliest period presented or at the beginning of the period of adoption. We elected to apply the guidance at the beginning of the period of adoption, and recorded right-of-use (ROU) leased assets of approximately \$6.7 million, and corresponding lease liabilities, which were discounted at our incremental borrowing rates.

The guidance allows a number of elections and practical expedients, of which we have elected to employ the following:

- Election not to recognize short-term leases on the balance sheet.
- Practical expedient to not separate lease and non-lease components in a contract.
- Practical expedient “package” for transitioning to the new guidance:
 - * Not reassessing whether any expired or existing contracts are or contain leases.
 - * Not reassessing lease classification for any existing or expired leases.
 - * Not reassessing initial direct costs for any existing leases.

We do not expect our adoption of Topic 842 to affect our cash flows or our ability to comply with covenants under our credit agreements.

Accounting Standards Updates Implemented

In November 2016, the FASB issued ASU 2016-18 “Restricted Cash”, which requires that a statement of cash flows explain the change during the period in the total of cash, cash equivalents, and amounts generally described as restricted cash or restricted cash equivalents. Therefore, amounts generally described as restricted cash and restricted cash equivalents should be included with cash and cash equivalents when reconciling the beginning-of-period and end-of-period total amounts shown on the statement of cash flows. ASU 2016-18 was effective for Photronics, Inc. in its first quarter of fiscal year 2019 and was applied on a retrospective transition basis. Our adoption of this Update did not materially impact our cash flows statement.

In October 2016, the FASB issued ASU 2016-16 “Intra-Entity Transfers of Assets Other Than Inventory”, which eliminates the exception of recognizing, at the time of transfer, current and deferred income taxes for intra-entity asset transfers other than inventory. ASU 2016-16 was effective for us in our first quarter of fiscal year 2019 and applied on a modified retrospective transition basis. Please see Note 11 for a discussion of the effects of adopting this guidance.

In May 2014, the FASB issued ASU 2014-09 “Revenue from Contracts with Customers”, which superseded nearly all then existing revenue recognition guidance under accounting principles generally accepted in the United States. The core principle of this ASU is that revenue should be recognized for the amount of consideration expected to be received for promised goods or services transferred to customers. This ASU also requires additional disclosure about the nature, amount, timing, and uncertainty of revenue and cash flows arising from customer contracts, including significant judgments, and assets recognized for costs incurred to obtain or fulfill a contract. In August 2015, the FASB issued ASU 2015-14 which deferred the effective date of ASU 2014-09 by one year and allowed entities to early adopt, but no earlier than the original effective date. This update allowed for either full retrospective or modified retrospective adoption. In April 2016, the FASB issued ASU 2016-10 “Identifying Performance Obligations and Licensing” which amended guidance previously issued on these matters in ASU 2014-09. The effective date and transition requirements of ASU 2016-10 were the same as those for ASU 2014-09.

We adopted the new revenue and related guidance on November 1, 2018, using the modified retrospective approach, under which we increased our accounts receivable by \$0.6 million, recognized contract assets of \$4.6 million, reduced our inventories balance by \$3.7 million, and recorded an accrual for income taxes of \$0.3 million. The recognition of, and adjustments to, these items were reflected in increases to our retained earnings and noncontrolling interest balances of \$1.1 million and \$0.1 million, respectively. The most significant impact of the new guidance on our financial statements is its requirement for us to recognize revenue as we manufacture products for which, in the event that the customer cancels the contract, we are entitled to reasonable compensation for work we have completed prior to cancellation. Prior to our adoption of Topic 606, we recognized revenue when we shipped to customers or, under some arrangements, when the customers received the goods. The impact of the adoption of this guidance on our October 31, 2019 financial statements is presented in Note 7.

The guidance allows for a number of accounting policy elections and practical expedients. In addition to our above-mentioned election to use the modified retrospective application method for adopting the guidance, those we have employed that are most significant to us are summarized below.

Shipping and handling activities performed after control of a good is transferred to a customer

We have elected to treat shipping and handling activities that occur after control of a good is transferred to a customer as activities to fulfill our promise to transfer goods to the customer. Thus, such activities will not be considered to be separate performance obligations under contracts with our customers.

Non-recognition of financing component when we transfer goods to a customer and the period between when we transfer and when we are paid will be less than one year

We have elected the practical expedient that allows for the non-recognition, as a component of a customer contract, of a financing component when the period between when we transfer a good and when we are paid will be less than one year.

Exclusion of sales and similar taxes collected from customers in the transaction price

Consistent with our practice before adoption of the new guidance, we will not recognize sales and similar taxes we collect from customers as revenue.

Use of an “input method” to measure our progress towards the transfer of control of performance obligations to customers

As, in our judgment, an input method based on our efforts to satisfy our performance obligations will best serve to depict the transfer of control of our performance obligations to our customers, we have adopted an accounting policy to employ that method. Our decision was based primarily on the facts that our photomasks are not physically transferred to customers until they are complete, and that we can employ our input-based cost accumulation systems and methods to measure our progress towards the transfer of control of our performance obligations to customers.

Non-disclosure of the transaction prices of unsatisfied or partially satisfied performance obligations

For contracts that have an original expected duration of one year or less, we have elected the practical expedient that allows us not to disclose the aggregate transaction prices of unsatisfied or partially satisfied performance obligations that exist at the end of a reporting period.

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

We have established and currently maintain disclosure controls and procedures, as such term is defined in Rules 13a-15(e) and 15d-15(e) of the Securities Exchange Act of 1934, as amended (the “Exchange Act”), designed to provide reasonable assurance that information required to be disclosed in our reports filed under the Exchange Act, is recorded, processed, summarized and reported within the time periods specified in the Securities and Exchange Commission’s rules and forms, and that such information is accumulated and communicated to management, including our chief executive officer and chief financial officer, as appropriate, to allow for timely decisions regarding required disclosure. In designing and evaluating disclosure controls and procedures, management recognized that any controls and procedures, no matter how well designed and operated, can provide only reasonable assurance of achieving the desired control objectives, and management necessarily was required to apply its judgment in evaluating the cost-benefit relationship of possible controls and procedures.

Our management, under the supervision and with the participation of our chief executive officer and chief financial officer, evaluated the effectiveness of the design and operation of our disclosure controls and procedures as of the end of the period covered by this report. Based upon that evaluation, our chief executive officer and chief financial officer concluded that our disclosure controls and procedures were effective at a reasonable assurance level as of the end of the period covered by this report.

Changes in Internal Control over Financial Reporting

There was no change in our internal control over financial reporting during the fourth fiscal quarter that has materially affected, or is reasonably likely to materially affect, our internal control over financial reporting.

Management's Report on Internal Control over Financial Reporting

Management is responsible for establishing and maintaining adequate internal control over financial reporting, as such term is defined in Rules 13a-15(f) and 15d-15(f) of the Exchange Act. 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.

Management assessed the effectiveness of our internal control over financial reporting as of October 31, 2019, based on the criteria set forth by the Committee of Sponsoring Organizations of the Treadway Commission in its "Internal Control - Integrated Framework" (2013). Management, under the supervision and with the participation of our chief executive officer and chief financial officer, concluded that our internal control over financial reporting was effective as of October 31, 2019.

The Company's independent registered public accounting firm, Deloitte & Touche LLP, has audited the effectiveness of the Company's internal control over financial reporting as of October 31, 2019, as stated in their report on page 34 of this Form 10-K.

December 20, 2019

ITEM 9B. OTHER INFORMATION

None.

PART III

ITEM 10. DIRECTORS, EXECUTIVE OFFICERS AND CORPORATE GOVERNANCE

The information as to Directors required by Items 401, 405 and 407(c)(3)(d)(4) and (d)(5) of Regulation S-K is set forth in our 2020 Definitive Proxy Statement which will be filed with the Securities and Exchange Commission pursuant to Regulation 14A of the Exchange Act within 120 days after the end of the fiscal year covered by this Form 10-K under the caption “PROPOSAL 1 - ELECTION OF DIRECTORS,” “SECTION 16(A) BENEFICIAL OWNERSHIP REPORTING COMPLIANCE” and in the third paragraph under the caption “MEETINGS AND COMMITTEES OF THE BOARD,” and is incorporated in this report by reference. The information as to Executive Officers is included in our 2020 Definitive Proxy Statement under the caption “EXECUTIVE OFFICERS” and is incorporated in this report by reference.

We have adopted a code of ethics that applies to our principal executive officer, chief financial officer or principal financial officer and principal accounting officer. A copy of the code of ethics may be obtained, free of charge, by writing to the vice president, general counsel of Photronics, Inc. at 15 Secor Road, Brookfield, Connecticut 06804.

ITEM 11. EXECUTIVE COMPENSATION

The information required by Item 402 of Regulation S-K and paragraph (e)(4) and (e)(5) of Item 407 is set forth in our 2020 Definitive Proxy Statement under the captions “EXECUTIVE COMPENSATION”, “CERTAIN AGREEMENTS”, “DIRECTORS’ COMPENSATION”, “COMPENSATION COMMITTEE INTERLOCKS AND INSIDER PARTICIPATION” and “COMPENSATION COMMITTEE REPORT ON EXECUTIVE COMPENSATION”, respectively, and is incorporated in this report by reference.

ITEM 12. SECURITY OWNERSHIP OF CERTAIN BENEFICIAL OWNERS AND MANAGEMENT AND RELATED STOCKHOLDER MATTERS

The information required by Item 201(d) of Regulation S-K is set forth in our 2020 Definitive Proxy Statement under the caption “EQUITY COMPENSATION PLAN INFORMATION”, and is incorporated in this report by reference. The information required by Item 403 of Regulation S-K is set forth in our 2020 Definitive Proxy Statement under the caption “OWNERSHIP OF COMMON STOCK BY DIRECTORS, OFFICERS AND CERTAIN BENEFICIAL OWNERS”, and is incorporated in this report by reference.

ITEM 13. CERTAIN RELATIONSHIPS AND RELATED TRANSACTIONS, AND DIRECTOR INDEPENDENCE

The information required by Items 404 and Item 407(a) of Regulation S-K is set forth in our 2020 Definitive Proxy Statement under the captions “MEETINGS AND COMMITTEES OF THE BOARD” and “RELATED PARTY TRANSACTIONS”, respectively, and is incorporated in this report by reference.

ITEM 14. PRINCIPAL ACCOUNTANT FEES AND SERVICES

The information required by Item 9(e) of Rule 14a-101 of the Exchange Act is set forth in our 2020 Definitive Proxy Statement under the captions “Fees Paid to the Independent Registered Public Accounting Firm” and “AUDIT COMMITTEE REPORT”, and is incorporated in this report by reference.

PART IV

ITEM 15. EXHIBITS AND FINANCIAL STATEMENT SCHEDULES

The following documents are filed as part of this report:

	<u>Page No.</u>
1. Financial Statements: See “INDEX TO CONSOLIDATED FINANCIAL STATEMENTS” in Part II, Item 8 of this Form 10-K.	32
2. Financial Statement Schedule: Schedule II - Valuation and Qualifying Accounts for the years ended October 31, 2019, October 31, 2018 and October 29, 2017	72
All other schedules are omitted because they are not applicable.	
3. Exhibits	72

Schedule II
Valuation and Qualifying Accounts
for the Years Ended October 31, 2019, October 31, 2018
and October 29, 2017
(in \$ thousands)

	<u>Balance at Beginning of Year</u>	<u>Charged to Costs and Expenses</u>	<u>Deductions</u>	<u>Balance at End of Year</u>
Allowance for Doubtful Accounts				
Year-ended October 31, 2019	\$ 1,526	\$ (18)	\$ (174)(a)	\$ 1,334
Year-ended October 31, 2018	\$ 2,319	\$ (809)	\$ 16(a)	\$ 1,526
Year ended October 29, 2017	\$ 3,901	\$ (1,600)(b)	\$ 18(a)	\$ 2,319

(a) Uncollectible accounts written off, net, and impact of foreign currency translation.

(b) Reversal of valuation allowance.

ITEM 16. FORM 10-K SUMMARY

Not applicable.

EXHIBITS INDEX

<u>Exhibit Number</u>	<u>Description</u>	<u>Incorporated by Reference</u>			<u>Filed or Furnished Herewith</u>
		<u>Form</u>	<u>Exhibit</u>	<u>Filing Date</u>	
3.1	Certificate of Incorporation as amended July 9, 1986, April 9, 1990, March 16, 1995, November 13, 1997, April 15, 2002 and June 20, 2005.				X
3.2	Amended and Restated By-laws of the Company dated as of September 7, 2016.	8-K	3.2	9/13/2016	
4.1	Description of Securities of the Company				X
4.2	Certificate of Amendment with Respect to Series A Preferred Stock, dated September 24, 2019	8-K	3.1	9/24/2019	
4.4	Indenture dated January 22, 2015, by and between the Company and the Bank of New York Mellon Trust Company, N.A., as trustee.	8-K	4.2	1/28/2015	
10.1	The Company's 1992 Employee Stock Purchase Plan	10-K	10.1	12/20/2017	
10.2	Amendment to the Employee Stock Purchase Plan as of March 24, 2004. ⁺	10-K	10.2	1/6/2017	
10.3	Amendment to the Employee Stock Purchase Plan as of April 8, 2010. ⁺	10-K	10.4	1/7/2016	
10.4	Amendment to the Employee Stock Purchase Plan as of March 28, 2012. ⁺	10-K	10.4	12/21/2018	
10.5	Amendment to the Employee Stock Plan as of December 18, 2019*				X
10.6	2016 Equity Incentive Compensation Plan. ⁺	DEF 14A		2/29/2016	
10.7	The Company's 2007 Long-Term Equity Incentive Plan. ⁺				X

10.8	Amendment to the 2007 Long-Term Equity Incentive Plan as of April 8, 2010. ⁺	10-K	10.7	1/7/2016
10.9	Amendment to the 2007 Long Term Equity Incentive Plan as of April 11, 2014. ⁺	10-K	10.8	1/6/2015
10.10	2011 Executive Incentive Compensation Plan effective as of November 1, 2010. ⁺	10-K	10.9	1/6/2015
10.11	Joint Venture Framework Agreement dated November 20, 2013, between the Company and Dai Nippon Printing Co., Ltd. [#]	10-K/A	10.19	7/8/2015
10.12	Joint Venture Operating Agreement dated November 20, 2013, between the Company and Dai Nippon Printing Co., Ltd. [#]	10-K/A	10.20	7/8/2015
10.13	Outsourcing Agreement dated November 20, 2013, among the Company, Dai Nippon Printing Co., Ltd and Photronics Semiconductor Mask Corporation. [#]	10-K/A	10.21	7/8/2015
10.14	License Agreement dated November 20, 2013, between the Company and Photronics Semiconductor Mask Corporation. [#]	10-K/A	10.22	7/8/2015
10.15	License Agreement dated November 20, 2013, between Dai Nippon Printing Co., Ltd and Photronics Semiconductor Mask Corporation. [#]	10-K/A	10.23	7/8/2015
10.16	Margin Agreement dated November 20, 2013, among the Company, Dai Nippon Printing Co., Ltd and Photronics Semiconductor Mask Corporation. [#]	10-K/A	10.24	7/8/2015
10.17	Merger Agreement dated January 16, 2014, between Photronics Semiconductor Mask Corporation and DNP Photomask Technology Taiwan Co., Ltd. [#]	10-K/A	10.25	7/8/2015
10.18	Executive Employment Agreement between the Company and Christopher J. Progler, Vice President, Chief Technology Officer dated September 10, 2007. ⁺			X
10.19	Executive Employment Agreement between the Company and Peter S. Kirlin dated May 4, 2015. ⁺	10-Q	10.28	9/9/2015
10.20	Executive Employment Agreement between the Company and Richelle E. Burr dated May 21, 2010. ⁺	10-K	10.30	1/7/2016
10.21	Executive Employment Agreement between the Company and John P. Jordan dated September 5, 2017. ⁺	10-K	10.31	12/20/2017
10.22	Consulting Agreement between the Company and DEMA Associates, LLC dated January 20, 2018.	10-K	10.21	12/21/2018

10.23	Form of Amendment to Executive Employment Agreement dated March 16, 2012. ⁺				X
10.24	Fourth Amended and Restated Credit Agreement dated as of September 27, 2018 among Photronics, Inc. the Foreign Subsidiary Borrower Party Thereto, the Lender Party Thereto, JPMorgan Chase Bank, N.A. as Administrative and Collateral Agent and Bank of America, N.A. as syndication agent	10-K	10.24	12/21/2018	
10.25	Third Amended and Restated Security Agreement entered into as of September 27, 2018 by and among Photronics, Inc., the subsidiaries of the Company and JPMorgan Chase Bank N.A	10-K	10.25	12/21/2018	
10.26	Fixed Asset Loan Agreement between Photronics DNP Mask Corporation Xiamen and Industrial and Commercial Bureau China Limited Xiamen Xiang'an Branch effective as of November 29, 2012	10-K	10.26	12/21/2018	
10.27	Working Capital Loan Agreement between Industrial and Commercial Bureau China Limited Xiamen Xiang'an Branch and Photronics DNP Mask Corporation Xiamen effective as of November 7, 2018.	10-K	10.27	12/21/2018	
10.28	Investment Agreement between Xiamen Torch Hi-Tech Industrial Development Zone Management Committee and Photronics Singapore Pte. Ltd.	10-Q	10.35	9/2/2016	
10.29	Amendment No. 1 to the Investment Agreement between Xiamen Torch Hi-Tech Industrial Development Zone Management Committee and Photronics Singapore Pte, Ltd #*				X
10.30	Contribution Agreement dated May 16, 2017 among Dai Nippon Printing Co., Ltd. ("DNP"), DNP Asia Pacific Pte. Ltd. ("DNP Asia Pacific"), Photronics, Inc. ("Photronics"), Photronics Singapore Pte. Ltd., ("Photronics Singapore"), and Xiamen American Japan Photronics Mask Co., Ltd. ("PDMCX"). [#]	10-Q/A	10.26	12/19/2017	
10.31	Joint Venture Operating Agreement dated May 16, 2017 among Photronics, Photronics Singapore, DNP and DNP Asia Pacific. [#]	10-Q/A	10.27	12/19/2017	
10.32	Outsourcing Agreement dated May 16, 2017 among Photronics, DNP, Photronics DNP Photomask Corporation ("PDMC"), and PDMCX. [#]	10-Q/A	10.28	12/19/2017	
10.33	Amended and Restated License Agreement dated May 16, 2017 between DNP and PDMC. [#]	10-Q/A	10.29	12/19/2017	
10.34	Investment Cooperation Agreement between Hefei State Hi-tech Industry Development Zone and Photronics UK, Ltd.	10-K	10.42	12/20/2017	
10.35	Section 382 Rights Agreement, dated as September 23, 2019, between Photronics, Inc. and Computershare Trust Company, N.A. as rights agent.	8-K	4.1	9/24/2019	
21	List of Subsidiaries of the Company.*				X
23.1	Consent of Deloitte & Touche LLP, Independent Registered Public Accounting Firm*				X
31.1	Certification of Chief Executive Officer pursuant to Rule 13a-14(a)/15d-14(a) of the Securities Exchange Act of 1934, as adopted pursuant to Section 302 of the Sarbanes-Oxley Act of 2002.*				X
31.2	Certification of Chief Financial Officer pursuant to Rule 13a-14(a)/15d-14(a) of the Securities Exchange Act of 1934, as adopted pursuant to Section 302 of the Sarbanes-Oxley Act of 2002.*				X
32.1	Certification of Chief Executive Officer pursuant to 18 U.S.C. Section 1350 as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002.*				X
32.2	Certification of Chief Financial Officer pursuant to 18 U.S.C. Section				X

101.INS	XBRL Instance Document	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

+ Represents a management contract or compensatory plan or arrangement.

Portions of this exhibit have been omitted pursuant to a request for confidential treatment filed with the Securities and Exchange Commission.

* Represents an exhibit that is filed with this Annual Report on Form 10-K.

The Company will provide a copy of any exhibit upon receipt of a written request for the particular exhibit or exhibits desired. All requests should be addressed to the Company's general counsel at the address of the Company's principal executive offices.

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.

PHOTRONICS, INC.
(Registrant)

By	By	
<u>/s/ John P. Jordan</u>	<u>/s/ Eric Rivera</u>	
John P. Jordan	Eric Rivera	
Senior Vice President, Chief Financial Officer (Principal Financial Officer)	Vice President, Corporate Controller (Principal Accounting Officer)	
December 20, 2019	December 20, 2019	

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.

By		
<u>/s/ Peter S. Kirlin</u>		December 20, 2019
Peter S. Kirlin		
Chief Executive Officer Director (Principal Executive Officer)		

By		
<u>/s/ John P. Jordan</u>		December 20, 2019
John P. Jordan		
Senior Vice President, Chief Financial Officer (Principal Financial Officer)		

By		
<u>/s/ Eric Rivera</u>		December 20, 2019
Eric Rivera		
Vice President, Corporate Controller (Principal Accounting Officer)		

By		
<u>/s/ Constantine S. Macricosta</u>		December 20, 2019
Constantine S. Macricostas		
Chairman of the Board		

By		
<u>/s/ Walter M. Fiederowicz</u>		December 20, 2019
Walter M. Fiederowicz		
Director		

By		
<u>/s/ Joseph A. Fiorita, Jr.</u>		December 20, 2019
Joseph A. Fiorita, Jr.		
Director		

By		
<u>/s/ Liang-Choo Hsia</u>		December 20, 2019
Liang-Choo Hsia		
Director		

By		
<u>/s/ George Macricostas</u>		December 20, 2019
George Macricostas		
Director		

By

/s/ Mary Paladino

Mary Paladino

Director

December 20, 2019

By

/s/ Mitchell G. Tyson

Mitchell G. Tyson

Director

December 20, 2019

CERTIFICATE OF CORRECTION OF
CERTIFICATE OF AMENDMENT
OF
PHOTRONICS, INC.

To the Secretary of State
of the State of Connecticut

It is hereby certified that:

1. The name of the corporation (hereinafter called the "Corporation") is Photonics, Inc.
2. The Certificate of Amendment of the Corporation, which was filed by the Secretary of State of the State of Connecticut on April 15, 2002, is hereby corrected.
3. The incorrect statement in said document and the reason it is incorrect are:

Due to a scrivener's error, a portion of the first paragraph of Article Third was inadvertently omitted from the Certificate of Amendment filed with the Secretary of the State of the State of Connecticut on April 15, 2002.

4. The portion of the document in corrected form is as follows:

"3. The aggregate number of shares which the Corporation shall have the authority to issue is 152,000,000, of which 2,000,000 shares shall be shares of Preferred Stock having a par value of \$0.01 per share (hereinafter called "Preferred Stock") and 150,000,000 shares shall be shares of Common Stock having a par value of \$0.01 per share (hereinafter called "Common Stock")."

Signed on June 20, 2005

/s/ Edwin L. Lewis
Vice President, Secretary and General Counsel

CERTIFICATE OF AMENDMENT
STOCK CORPORATION

Office of the Secretary of the State
30 Trinity Street / P.O. Box 150470 / Hartford, CT 06115-0470 /Rev. 12/1999

Space For Office Use Only

1. NAME OF CORPORATION:

PHOTRONICS, INC.

2. THE CERTIFICATE OF INCORPORATION IS (check A., B. or C.):

A. AMENDED.

B. AMENDED AND RESTATED.

C. RESTATED.

3. TEXT OF EACH AMENDMENT / RESTATEMENT:

RESOLVED, that the Certificate of Incorporation be amended by striking the first paragraph of Article Third in its entirety and substituting therefor the following:

3. The aggregate number of shares which the Corporation shall have the authority to issue is 152,000,000 shares, of which 2,000,000 shares shall be shares of Preferred Stock having a par value of \$0.01 per share(hereinafter called "Common Stock").

The amendment shall be effective upon filing of this Certificate of Amendment with the Secretary of State.

(Please reference an 8 1/2 X 11 attachment if additional space is needed)

Space For Office Use Only

4. VOTE INFORMATION (check A., B. or C.):

XXX A. The resolution was approved by shareholders as follows:

(set forth all voting information required by Conn. Gen. Stat. Section 33-800 as amended in the space provided below)

There was only one class of shares outstanding entitled to vote on the amendment. That class was Common Stock, par value \$0.1 per share, of which 30,373,076 were outstanding on the record date for the vote. At the meeting to vote on the amendment, 25,725,980 shares of Common Stock were indisputably present. The vote on the amendment was 23,466,159 shares in favor of the amendment and such vote was sufficient for approval of the amendment.

The amendment was adopted by the shareholders on March 20, 2002 and by the Board of Directors on March 20, 2002.

B. The amendment was adopted by the board of directors without shareholder action. No shareholder vote was required for adoption.

C. The amendment was adopted by the incorporators without shareholder action. No shareholder vote was required for adoption.

5. EXECUTION:

Dated this 22nd day of March , 2002.

James A. Eder
Print or type name of signatory

Secretary
Capacity of signatory

/s/James A. Eder
Signature

CERTIFICATE OF AMENDMENT
STOCK CORPORATION

Office of the Secretary of the State

30 Trinity Street/P.O. Box 150470/Hartford, CT 06115-0470/new/1-97

Space For Office Use Only

1. NAME OF CORPORATION:

PHOTRONICS, INC.

2. THE CERTIFICATE OF INCORPORATION IS (check A., B., or C.):

- A. AMENDED.
 B. AMENDED AND RESTATED.
 C. RESTATED.

3. TEXT OF EACH AMENDMENT / RESTATEMENT:

RESOLVED, that the Certificate of Incorporation be amended by striking the first paragraph of Article Third in its entirety and substituting therefor the following:

- 3).The aggregate number of shares which the Corporation shall have the authority to issue is 77,000,000 shares, of which 2,000,000 shares shall be shares of Preferred Stock having a par value of \$0.01 per share(hereinafter called "Preferred Stock") and 75,000,000 shares shall be shares of Common Stock having a par value of \$0.01 per share(hereinafter call "Common Stock").

The amendment shall be effective upon filing of this Certificate of Amendment with the Secretary of State.

(Please reference an 8 1/2 X 11 attachment if additional space is needed)

Space For Office Use Only

4. VOTE INFORMATION (check A., B., or C.)

XXX A. The resolution was approved by shareholders as follows:

(set forth all voting information required by Conn. Gen. Stat. section 33-800 as amended in the space provided below)

There was only one class of shares outstanding entitled to vote on the amendment. That class was Common Stock, par value \$0.01 per share, of which 12,062,368 shares were outstanding on the record date for the vote. At the meeting to vote on the amendment, 10,156,367 shares of Common Stock were indisputably present at the meeting.

The vote on the amendment was 8,801,215 shares in favor of the amendment and such vote was sufficient for approval of the amendment.

The amendment was adopted by the shareholders on November 13, 1997 and by the Board of Directors on September 12, 1997.

 B. The amendment was adopted by the board of directors without shareholder action. No shareholder vote was required for adoption.

 C. The amendment was adopted by the incorporators without shareholder action. No shareholder vote was required for adoption.

5. EXECUTION:

Dated this 13th day of November, 1997

JEFFREY P. MOONAN
Print or type name of signatory

SECRETARY
Capacity of signatory

/s/ Jeffrey P. Moonan
Signature

STATE OF CONNECTICUT
SECRETARY OF THE STATE
30 TRINITY STREET
HARTFORD, CT 06106

1. Name of Corporation (Please enter name within lines)

PHOTRONICS, INC.

2. The Certificate of Incorporation is: (Check one)

- A. Amended only, pursuant to Conn. Gen. Stat. Section 33-360.
- B. Amended only, to cancel authorized shares (state number of shares to be cancelled, the class, the series, if any, and the par value, P.A. 90-107.)
- C. Restated only, pursuant to Conn. Gen. Stat. Section 33-362(a)
- D. Amended and restated, pursuant to Conn. Gen. Stat. Section 33-362(c).
- E. Restated and superseded pursuant to Conn. Gen. Stat. Section 33-362(d).

Set forth here the resolution of amendment and/or restatement. Use an 8 1/2x11 attached sheet if more space is needed. Conn. Gen. Stat. Section 1-9.

RESOLVED, that the Certificate of Incorporation be amended by striking the first paragraph of Article Third in its entirety and substituting therefor the following:

3) The aggregate number of shares which the Corporation shall have the authority to issue is 22,000,000 shares, of which 2,000,000 shares shall be shares of Preferred Stock having a par value of \$0.01 per share (hereinafter called "Preferred Stock") and 20,000,000 shares shall be shares of Common Stock having a par value of \$0.01 per share (hereinafter called "Common Stock").

(If 2A or 2B is checked, go to 5 & 6 to complete this certificate. If 2C or 2D is checked, complete 3A or 3B. If 2E is checked, complete 4.)

3. (Check one)

- A. This Certificate purports merely to restate but not to change the provisions of the original Certificate of Incorporation as supplemented and amended to date, and there is no discrepancy between the provisions of the original Certificate of Incorporation as supplemented and amended to date, and the provisions of this Restated Certificate of Incorporation. (If 3A is checked, go to 5 & 6 to complete this certificate.)
-

- B. This Restated Certificate of Incorporation shall give effect to the amendment(s) and purports to restate all those provisions now in effect not being amended by such new amendment(s). (If 3B is checked, check 4, if true, and go to 5 & 6 to complete this Certificate.)

4. (Check, if true)

- This restated Certificate of Incorporation was adopted by the greatest vote which would have been required to amend any provision of the Certificate of Incorporation as in effect before such vote and supersedes such Certificate of Incorporation.

5. The manner of adopting the resolution was as follow

- A. By the board of directors and shareholders pursuant to Conn. Gen. Stat. Section 33 – 360.
Vote of Shareholders: (Check (i) or (ii), and check (iii) if applicable.)

(i) No shares are required to be voted as a class; the shareholder's vote was as follows:

Vote Required for Adoption 3,288,639 Vote Favoring Adoption 5,151,790

- (ii) There are shares of more than one class entitled to vote as a class. The designation of each class required for adoption of the resolution and the vote of each class in favor of adoption were as follows:
(Use and 8 1/2 x 11 attached sheet if more space is needed. Conn. Gen. Stat. (S) 1 - 9.)

(iii) Check here if the corporation has 100 or more recordholders, as defined in Conn. Gen. Stat. (S) 33 - 311a(a)

- B. By the board of directors acting alone, pursuant to Conn. Gen. Stat.(S) 33 - 360(b)(2) or 33-362(a).

The number of affirmative votes required to adopt such resolution is: _____

The number of directors' voted in favor of resolution was:

We hereby declare, under the penalties of false statement, that the statements made in the foregoing certificate are true:

(Print or Type)

Signature

(Print or Type)

Signature

Name of Pres.

Michael J. Yomazzo

/s/ Michael J. Yomazzo

Name of Sec.

Jeffrey P. Moonan

/s/ Jeffrey P. Moonan

o C. The corporation does not have any shareholders. The resolution was adopted by vote of at least two-thirds of the incorporators before the organization meeting of the corporation and approved in writing by all subscribers for shares of the corporation. If there are no subscribers, state NONE below.

We (at least two-thirds of the incorporators) hereby declare, under the penalties of false statement, that the statements made in the foregoing certificate are true.

Signed Incorporator
Signed Subscriber

Signed Incorporator
Signed Subscriber

Signed Incorporator
Signed Subscriber

(Use an 8 1/2 x 11 attached sheet if more space is needed. Conn. Gen. Stat (S) 1 - 9)

6. Dated at Brookfield, CT this 16th day of March, 1995

Rec, CC. GS: (Type or Print)

CT Corporation System
One Commercial Plaza
Hartford, CT 06103-3597

Please provide filer's name and complete address for mailing receipt

CERTIFICATE AMENDING
CERTIFICATE OF INCORPORATION
OF
PHOTRONIC LABS, INC.

BY ACTION OF
BOARD OF DIRECTORS AND SHAREHOLDERS

I) The Certificate of Incorporation is amended only by the following resolutions adopted by the Corporations' shareholders and directors:

RESOLVED, that the Certificate of Incorporation of the Corporation be amended by striking Article FIRST in its entirety and substituting therefor the following:

1)The name of the corporation is Photonics, Inc.;

Be it further

RESOLVED, that the Certificate of Incorporation be amended by striking Article Third in its entirety and substituting therefor the following:

3)The aggregate number of shares which the Corporation shall have the authority to issue is 12,000,000 shares, of which 2,000,000 shares shall be shares of Preferred Stock having a par value of \$.01 per share (hereinafter called "Preferred Stock") and 10,000,000 shares shall be shares of Common Stock having a par value of \$.01 per share (hereinafter called "Common Stock").

The designations and the powers, preferences and rights, and the qualifications, limitations or restrictions thereof, of the Preferred Stock shall be as follows:

a) The Board of Directors is expressly authorized at any time, and from time to time, to provide for the issuance of shares of Preferred Stock in one or more series, with such voting powers, full or limited, or without voting powers and with such designations, preferences and relative, participating, optional or other special rights, and qualifications, limitations or restrictions thereof, as shall be stated and expressed in the resolution or resolutions providing for the issue thereof adopted by the Board of Directors, and as are not stated and expressed in this Certificate of Incorporation, or any amendment thereto, including (but without limiting the generality of the foregoing) the following:

- (i) The designation of such series;
- (ii) The dividend rate of such series, the conditions and dates upon which such dividends shall be payable, the preference or relation which such dividends shall bear to the dividends payable on any other class or classes of any other series of capital stock, and whether such dividends shall be cumulative or non-cumulative;
- (iii) Whether the shares of such series shall be subject to redemption by the Corporation, and, if made subject to such redemption, the times, prices and other terms and conditions of such redemption;
- (iv) The terms and amount of any sinking fund provided for the purchase or redemption of the shares of such series;
- (v) Whether or not the shares of such series shall be convertible into or exchangeable for shares or any other class or classes of capital stock of the Corporation, and, if provision be made for conversion or exchange, the times, prices, rates, adjustments, and other terms and conditions of such conversion or exchange;
- (vi) The extent, if any, to which the holders of the shares of such series shall be entitled to vote as a class or otherwise with respect to the election of the directors or otherwise;
- (vii) The restrictions, if any, on the issue or release of any additional Preferred Stock;
- (viii) The rights of the holders of the shares of such series upon the dissolution of, or upon the distribution of assets of, the Corporation.

b) Except as otherwise required by law and except for such voting powers with respect to the election of directors or other matters as may be stated in the resolutions of the Board of Directors creating any series of Preferred Stock, the holders of any such series shall have no voting power whatsoever.

Subject to the provisions of any applicable law, or except as otherwise provided by the resolution or resolutions providing for the issue of any series of Preferred Stock, the holders of outstanding shares of Common Stock shall exclusively possess voting power for the election of directors and for all other purposes, each holder of record of shares of Common Stock being entitled to one vote for each share of Common Stock standing in his name on the books of the Corporation.

Except as otherwise provided by the resolution or resolutions providing for the issue of any series of Preferred Stock, after payment shall have been made to the holders of Preferred Stock of the full amount of dividends to which they shall be entitled pursuant to the resolution or resolutions providing for the issue of any series of Preferred Stock, the holders of Common Stock shall be entitled, to the exclusion of the holders of Preferred Stock of any and all series, to receive such dividends as from time to time may be declared by the Board of Directors.

Except as otherwise provided by the resolution or resolutions providing for the issue of any series of Preferred Stock, in the event of any liquidation, dissolution or winding up of the Corporation, whether voluntary or involuntary, after payment shall have been made to the holders of Preferred Stock of the full amount to which they shall be entitled pursuant to the resolution or resolutions providing for the issue of any series of Preferred Stock, the holders of Common Stock shall be entitled, to the exclusion of the holders of Preferred Stock of any and all series, to share, ratably according to the number of shares of Common Stock held by them, in all remaining assets of the Corporation available for distribution to its shareholders.

Be it further

RESOLVED, that the Certificate of Incorporation of this Corporation be amended by adding Article EIGHTH in the following form:

8) The shareholders of the Corporation shall not have any pre-emptive or preferential rights to subscribe for, purchase or receive any shares of stock of the Corporation (or any obligation convertible into shares of stock, including without limitation, warrants, subscription rights or options to acquire shares) which the Corporation may issue or sell.

Be it further

RESOLVED, that the Certificate of Incorporation of this Corporation be amended by adding Article NINTH in the following form:

9) The personal liability of any Director to the Corporation or its shareholders for monetary damages for breach of duty as a Director is hereby limited to the amount of the compensation received by the Director for serving the Corporation during the year of the violation if such breach did not (a) involve a knowing and culpable violation of law by the Director, (b) enable the Director or an associate, as defined in subdivision (3) of Section 33-374d of the Connecticut General Statutes, to receive an improper personal economic gain, (c) show a lack of good faith and a conscious disregard for the duty of the Director to the Corporation under circumstances in which the Director was aware that his conduct or omission created an unjustifiable risk of serious injury to the Corporation, (d) constitute a sustained and unexcused pattern of inattention that amounted to an abdication of the Director's duty to the Corporation, or (e) create liability under Section 33-321 of the Connecticut General Statutes. This Article shall not limit or preclude the liability of any Director for any act or omission occurring prior to the effective date of this Article. Any repeal or modification of this Article by the shareholders of the Corporation shall not adversely affect any right or protection of a Director of the Corporation existing at the time of such repeal or modification.

II) The above resolutions were adopted by the Shareholders and the Board of Directors.

III) Number of Recordholders:

At the time of the shareholders vote approving these amendments to the Certificate of Incorporation, the Corporation had at least one hundred recordholders.

IV) Vote of Shareholders:

Number of Shares Entitled to Vote	Total Voting Power of Shares Entitled to Vote	Vote Required For Adoption	Favoring Adoption
3,191,100	3,191,100	1,594,801	2,507,209

Dated at Brookfield Center, Connecticut the 16th day of March, 1990.

We hereby declare under the penalties of false statement that the statements made in the foregoing certificate are true.

/s/ Constantine Macricostas

Constantine Macricostas
President

/s/ Jeffrey P. Moonan

Jeffrey P. Moonan
Secretary

CERTIFICATE AMENDING
CERTIFICATE OF INCORPORATION
OF PHOTRONIC LABS INCORPORATED

BY ACTION OF
BOARD OF DIRECTORS AND SHAREHOLDERS

1. The Certificate of Incorporation is amended only by the following resolutions adopted by the Corporations' shareholders and directors:

RESOLVED, that the Certificate of Incorporation of the Corporation be amended by striking Article FIRST in its entirety and replacing therefor:

1. The name of the Corporation is Photronic Labs, Inc.;

Be it further

RESOLVED, that the Certificate of Incorporation of this Corporation be amended by striking Article Third in its entirety and substituting therefor:

2. The total number of shares of stock which the Corporation shall have authority to issue is 5,000,000 shares with a par value of \$.01 each shall be Common Stock.

3. The above resolutions were adopted by the Shareholders and the Board of Directors.

4. Vote of Shareholders:

Number of Shares Entitled to Vote	Total Voting Power of Shares Entitled to Vote	Vote Required For Adoption	Vote Favoring Adoption
4200	4200	2101	4200

Dated at Brookfield Center, Connecticut the 20th day of June, 1986.

We hereby declare under the penalties of false statement that the statements made in the foregoing certificate are true.

/s/ Constantine Macricostas

Constantine Macricostas
President

/s/ Michael J. Yomazzo

Michael J. Yomazzo
Secretary

CERTIFICATE OF INCORPORATION
Stock Corporation
61-5 Rev. 9-65

STATE OF CONNECTICUT

SECRETARY OF THE STATE

We, the incorporators, certify that we hereby associate ourselves as a body politic and corporate under the Stock Corporation Act of the State of Connecticut.

1. The name of the corporation is Photronic Labs Incorporated
 2. The nature of the business to be transacted, or the purpose to be promoted or carried out by the corporation, are as follows:
 - a) To engage and participate in the business of precision scientific photography and related processes.
 - b) To purchase or otherwise acquire, own, mortgage, lease, sell, convey or otherwise dispose of or utilize or deal in and with real property, goods, wares, merchandise and personal property of every kind and description and wherever located.
 - c) To carry on any other lawful business whatever in connection with the foregoing, or calculated directly or indirectly, to promote the interests of this corporation, or to enhance the value of its properties; to have, enjoy, and exercise all rights, powers and privileges which are now or may hereafter be conferred upon business corporations organized under the general corporation laws of Connecticut; to do any and all things necessary or proper for the accomplishment of any of the purposes or the attainment of any objects hereinbefore set forth, and in general to do every other act or thing pertaining to the foregoing purposes or powers to the same extent that a natural person might lawfully do in any part of the world.
 - d) The foregoing clauses shall be construed as both objects and powers and the enumeration of specific objects or powers shall not be deemed to limit or restrict in any manner the objects and powers of this corporation. All such objects and powers shall be deemed to be furtherance of and in addition to the general powers conferred by the laws of the State of Connecticut upon business corporations organized under the general corporation laws of the State.
-

3. The designation of each class of shares, the authorized number of shares of each such class, and the par value (if any) of each share thereof, are as follows:

	Common Stock
x	5,000 Shares
x	\$10.00 par value

4. The terms, limitations and relative rights and preferences of each class of shares and series thereof (if any), or an express grant of authority to the board of directors pursuant to Section 33-341, 1959 Supp. Conn. G.S., are as follows:

All Common Stock with equal rights and preferences and no series or special authority.

5. The minimum amount of stated capital with which the corporation shall commence business is \$9,000.00 NINE THOUSAND AND NO/100 dollars. (Not less than one thousand dollars)

6. (x) Other provisions

The address of the corporation is 20 Ta'Agan Point Road, Danbury, Connecticut.

7. Said corporation is to commence operations immediately and its duration is unlimited.

Dated at Danbury this 24th day of February, 1969

We hereby declare, under the penalties of perjury, that the statements made in the foregoing certificate are true.

NAME OF INCORPORATOR (Print or Type)
1. Armindo J. Rebeiro
SIGNED (Incorporator)
1. /s/ Armindo J. Rebeiro
NAME OF INCORPORATOR (Print or Type)
4. Larry L. Sharp
SIGNED (Incorporator)
4. /s/ Larry L. Sharp

NAME OF INCORPORATOR(Print or Type)
2. Gerard P. Keehan
SIGNED (Incorporator)
2. /s/ Gerard P. Keehan
NAME OF INCORPORATOR(Print or Type)
5. Edward G. Keehan
SIGNED (Incorporator)
5. /s/ Edward G. Keehan

NAME OF INCORPORATOR (Print or Type)
3. Edward O. Law
SIGNED(Incorporator)
3. /s/Edward O. Law
NAME OF INCORPORATOR(Print or Type)
6. Constantine S. Macricostas
SIGNED(Incorporator)
6. /s/Constantine S. Macricostas

APPOINTMENT OF STATUTORY AGENT FOR SERVICE
DOMESTIC CORPORATION
61-6 Rev. 6-66

ACCOUNT NO.
P 52357

TO: The Secretary of the State of Connecticut

NAME OF CORPORATION

Photronic Labs Incorporated

APPOINTMENT

The above corporation appoints as its statutory agent for service, one of the following:

NAME OF NATURAL PERSON WHO IS RESIDENT OF CONNECTICUT BUSINESS ADDRESS
Armindo J. Rebeiro 20 Ta'Agan Point Road, Danbury

RESIDENCE ADDRESS
Ta'Agan Point Road, Danbury

NAME OF CONNECTICUT CORPORATION ADDRESS OF PRINCIPAL OFFICE IN CONN. (if none,
enter address of appointee' statutory agent
for services)

NAME OF CORPORATION not Original Under the Laws of Conn. ADDRESS OF PRINCIPAL OFFICE IN CONN.
(if none, enter "Secretary
or the State Connecticut")

Which has procured a Certificate of Authority to transact business or conduct affairs in this state.

AUTHORIZATION

NAME OF INCORPORATOR (Print or type)

SIGNED(Incorporator)

DATE

ORIGINAL APPOINTMENT
(Must be signed by a majority

Gerard P. Keehan
Edward O. Law
Edward G. Keehan

/s/ Gerard P. Keehan
/s/ Edward O. Law
/s/ Edward G. Keehan

February 24, 1969

NAME OF PRESIDENT, VICE PRESIDENT, OR SEC.

SIGNED(President or Vice
President, or Secretary)

DATE

SUBSEQUENT
APPOINTMENT

ACCEPTANCE

NAME OF STATUTORY AGENT FOR SERVICE (Print or Type)
Accepted: Armindo J. Rebeiro

SIGNED (Statutory Agent for service)
/s/ Armindo J. Rebeiro



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

As of October 31, 2019, Photronics, Inc. (the “Company”) has two classes of securities registered under Section 12 of the Securities Exchange Act of 1934, as amended (the “Exchange Act”): (1) our common stock, par value \$0.01 per share (the “Common Stock”) and (2) our preferred stock purchase rights, each of which entitles the holder to purchase one one-thousandth of a share of series A preferred stock, par value \$0.01 per share of the Company (the “Preferred Stock”) at a price of \$33.63, subject to adjustment (the “Rights”).

Common Stock*Voting Rights*

The holders of shares of Common Stock are entitled to one vote per share on all matters to be voted upon by shareholders. At a meeting of shareholders at which a quorum is present, a majority of the voting power of the shares represented decides all questions, unless the matter is one upon which, by express provision of the Company’s certificate of incorporation, as amended, the by-laws or statute, a different vote is required. There is no cumulative voting with respect to the election of directors, which means that the holders of a majority of the shares can elect all the directors if they choose to do so, and in such event, the holders of the remaining shares would not be able to elect any directors.

Dividend Rights

The holders of Common Stock are entitled to such dividends, if any, as may be declared by the Company’s board of directors in its discretion out of funds legally available for that purpose, subject to the payment of dividends on Preferred Stock, if any, then outstanding.

Liquidation Rights

In the event of the Company’s liquidation, dissolution or winding up, the holders of Common Stock are entitled to share ratably in all assets remaining after payment of liabilities, subject to the priority of Preferred Stock, if any, then outstanding.

Other Rights and Preferences

The holders of Common Stock have no preemptive rights, nor are there any redemption rights provisions with respect to Common Stock.

Listing

The Common Stock is traded on the Nasdaq Global Select Market under the trading symbol “PLAB.”

General

Until a Right is exercised, the holder thereof, as such, will have no rights as a stockholder of the Company, including, without limitation, the right to vote or to receive dividends. In connection with the distribution of the Rights, the Company entered into a Section 382 Rights Agreement (the "Rights Agreement"), dated as of September 23, 2019, between the Company and Computershare Trust Company, N.A., a federally chartered trust company, as rights agent. The Rights are in all respects subject to and governed by the provisions of the Rights Agreement.

Initially, the Rights will be attached to all Common Stock certificates (or other evidence of book-entry or other uncertificated ownership) and no separate certificates evidencing the Rights ("Right Certificates") will be issued. Until the Distribution Date (as defined below), the Rights will be transferred with and only with the Common Stock. As long as the Rights are attached to the Common Stock, the Company will issue one (1) Right with each new share of Common Stock so that all such shares of Common Stock will have Rights attached (subject to certain limited exceptions).

The Rights will separate and begin trading separately from the Common Stock, and Right Certificates will be caused to evidence the Rights, on the earlier to occur of (i) the Close of Business (as such term is defined in the Rights Agreement) on the tenth day following a public announcement, or the public disclosure of facts indicating (or the Company's Board of Directors becoming aware), that a Person or group of affiliated or associated Persons has acquired Beneficial Ownership of 4.9% or more of the outstanding Common Stock (an "Acquiring Person") (or, in the event that the Board of Directors determines to effect an exchange in accordance with Section 24 of the Rights Agreement and the Board of Directors determines that a later date is advisable, then such later date) and (ii) the Close of Business on the tenth (10th) Business Day (as such term is defined in the Rights Agreement) (or such later date as may be determined by action of the Board of Directors prior to such time as any Person becomes an Acquiring Person) following the commencement of, or the first public announcement of the intention to commence, a tender offer or exchange offer the consummation of which would result in the Beneficial Ownership by a Person or group of 4.9% or more of the outstanding Common Stock (the earlier of such dates, the "Distribution Date"). As soon as practicable after the Distribution Date, unless the Rights are recorded in book-entry or other uncertificated form, the Company will prepare and cause the Right Certificates to be sent to each record holder of Common Stock as of the Distribution Date.

An "Acquiring Person" will not include (i) the Company, (ii) any Subsidiary (as such term is defined in the Rights Agreement) of the Company, (iii) any employee benefit plan of the Company or of any Subsidiary of the Company, (iv) any entity holding Common Stock for or pursuant to the terms of any such employee benefit plan or (v) any Person who or which, together with all Affiliates and Associates (as such terms are defined in the Rights Agreement) of such Person, at the time of the first public announcement of the Rights Agreement, is a Beneficial Owner of 4.9% or more of the Common Stock then outstanding (a "Grandfathered Stockholder"). However, if a Grandfathered Stockholder becomes, after such time, the Beneficial Owner of any additional shares of Common Stock (regardless of whether, thereafter or as a result thereof, there is an increase, decrease or no change in the percentage of Common Stock then outstanding Beneficially Owned (as such term is defined in the Rights Agreement) by such Grandfathered Stockholder) then such Grandfathered Stockholder shall be deemed to be an Acquiring Person unless, upon such acquisition of Beneficial Ownership of additional shares of Common Stock, such person is not the Beneficial Owner of 4.9% or more of the Common Stock then outstanding. In addition, upon the first decrease of a Grandfathered Stockholder's Beneficial Ownership below 4.9%, such Grandfathered Stockholder will no longer be deemed to be a Grandfathered Stockholder. In the event that after the time of the first public announcement of the Rights Agreement, any agreement, arrangement or understanding pursuant to which any Grandfathered Stockholder is deemed to be the Beneficial Owner of Common Stock expires, is settled in whole or in part, terminates or no longer confers any benefit to or imposes any obligation on the Grandfathered Stockholder, any direct or indirect replacement, extension or substitution of such agreement, arrangement or understanding with respect to the same or different Common Stock that confers Beneficial Ownership of Common Stock shall be considered the acquisition of Beneficial Ownership of additional Common Stock by the Grandfathered Stockholder and render such Grandfathered Stockholder an Acquiring Person for purposes of the Rights Agreement unless, upon such acquisition of Beneficial Ownership of additional shares of Common Stock, such person is not the Beneficial Owner of 4.9% or more of the Common Stock then outstanding.

“Beneficial Ownership” is defined in the Rights Agreement to include any securities (i) which a Person or any of such Person’s Affiliates or Associates (a) actually owns (directly or indirectly) or would be deemed to actually or constructively own for purposes of Section 382 of the Code or the Treasury Regulations (as such terms are defined in the Rights Agreement) promulgated thereunder, including any coordinated acquisition of securities by any Persons who have a formal or informal understanding with respect to such acquisition (to the extent ownership of such securities would be attributed to such Persons under Section 382 of the Code and the Treasury Regulations promulgated thereunder), (b) beneficially owns, directly or indirectly, within the meaning of Rules 13d-3 or 13d-5 promulgated under the Exchange Act or (c) has the right or ability to vote, or the right to acquire, pursuant to any agreement, arrangement or understanding (except under limited circumstances), (ii) which are directly or indirectly Beneficially Owned by any other Person with which a Person has any agreement, arrangement or understanding for the purpose of acquiring, holding or voting such securities, or obtaining, changing or influencing control of the Company or (iii) in respect of which a Person or any of such Person’s Affiliates or Associates has a derivative position which is capable of being settled, in whole or in part, through delivery of cash or Common Stock (whether on a required or optional basis, and whether such settlement may occur immediately or only after the passage of time, the occurrence of conditions, the satisfaction of regulatory requirements or otherwise). In addition, Persons are not deemed to be part of a group that would constitute an Acquiring Person based on participation in discussions, negotiations or transactions with another Person for the purposes of restructuring the Company’s debt.

The Rights are not exercisable until the Distribution Date. The Rights will expire on the earliest to occur of (i) the Close of Business on the day following the certification of the voting results of the Company’s 2020 annual meeting of stockholders, if at such stockholder meeting a proposal to approve the Rights Agreement has not been passed by the affirmative vote of the majority of the votes cast at the 2020 annual meeting of stockholders or any other meeting of stockholders of the Company duly held prior to September 22, 2020, (ii) the date on which the Board of Directors determines in its sole discretion that (x) the Rights Agreement is no longer necessary for the preservation of material valuable Tax Attributes or (y) the Tax Attributes have been fully utilized and may no longer be carried forward and (iii) the Close of Business on September 22, 2022 (the “Final Expiration Date”).

Exempt Persons and Transactions

The Board of Directors may, in its sole and absolute discretion, determine that a Person is exempt from the Rights Agreement (an "Exempt Person"), so long as such determination is made prior to such time as such Person becomes an Acquiring Person. Any Person will cease to be an Exempt Person if the Board of Directors makes a contrary determination with respect to such Person regardless of the reason therefor. In addition, the Board of Directors may, in its sole and absolute discretion, exempt any transaction from triggering the Rights Agreement, so long as the determination in respect of such exemption is made prior to such time as any Person becomes an Acquiring Person. Any Person, together with all Affiliates and Associates of such Person, who proposes to acquire 4.9% or more of the outstanding Common Stock may apply to the Board of Directors in advance for an exemption in accordance with and pursuant to the terms of the Rights Agreement.

Flip-in Event

If a Person or group becomes an Acquiring Person at any time after the date of the Rights Agreement (with certain limited exceptions), the Rights will become exercisable for shares of Common Stock having a value equal to two times the exercise price of the Right. From and after the announcement that any Person has become an Acquiring Person, if the Rights evidenced by a Right Certificate are or were acquired or Beneficially Owned by an Acquiring Person or any Associate or Affiliate of an Acquiring Person, such Rights shall become void, and any holder of such Rights shall thereafter have no right to exercise such Rights. If the Board of Directors so elects, the Company may deliver upon payment of the exercise price of a Right an amount of cash, securities or other property equivalent in value to the Common Stock issuable upon exercise of a Right.

Exchange

At any time after any Person becomes an Acquiring Person, the Board of Directors may exchange the Rights (other than Rights owned by any Person which have become void), in whole or in part, at an exchange ratio of two shares of Common Stock per Right (subject to adjustment). The Company may issue, transfer or deposit such Common Stock (or other property as permitted under the Rights Agreement) to or into a trust or other entity created upon such terms as the Board of Directors may determine and may direct that all holders of Rights receive such Common Stock or other property only from the trust. In the event the Board of Directors determines, before the Distribution Date, to effect an exchange, the Board of Directors may delay the occurrence of the Distribution Date to such time as it deems advisable.

Flip-over Event

If, at any time after a Person becomes an Acquiring Person, (i) the Company consolidates with, or merges with, any other Person (or any Person consolidates with, or merges with, the Company) and, in connection with such consolidation or merger, all or part of the Common Stock are or will be changed into or exchanged for stock or other securities of any other Person or cash or any other property, or (ii) 50% or more of the Company's consolidated assets or Earning Power (as defined in the Rights Agreement) is sold, then proper provision will be made so that each holder of a Right will thereafter have the right to receive, upon the exercise thereof at the then current exercise price of the Right, that number of shares of Common Stock of the acquiring company which at the time of such transaction will have a market value of two times the exercise price of the Right.

Redemption

At any time prior to the earlier to occur of (i) the Close of Business on the tenth (10th) day following the Stock Acquisition Date (as defined in the Rights Agreement) (or, if the tenth day following the Stock Acquisition Date occurs before the Record Date, the Close of Business on the Record Date) and (ii) the Final Expiration Date, the Board of Directors may redeem the Rights in whole, but not in part, at a price of \$0.0001 per Right (the "Redemption Price"). The redemption of the Rights may be made effective at such time, on such basis and with such conditions as the Board of Directors in its sole discretion may establish. Immediately upon any redemption of the Rights, the right to exercise the Rights will terminate and the only right of the holders of Rights will be to receive the Redemption Price.

Amendment

The terms of the Rights may be amended by the Board of Directors without the consent of the holders of the Rights, except that from and after such time as any Person becomes an Acquiring Person no such amendment may adversely affect the interests of the holders of the Rights (other than the Acquiring Person and its Affiliates and Associates).

Preferred Stock Rights

Each one-thousandth of a share of Preferred Stock will entitle the holder thereof to the same dividends and liquidation rights as if the holder held one share of Common Stock and will be treated the same as Common Stock in the event of a merger, consolidation or other share exchange.

EMPLOYEE STOCK PURCHASE PLAN
(Amended and Current as of
December 18, 2019)

ARTICLE I - General

- 1.1 The purpose of Photronics, Inc. Employee Stock Purchase Plan is to provide eligible employees of the Company and its designated subsidiaries (if any) with an opportunity to acquire a proprietary interest in the Company by the purchase of shares of the Common Stock of the Company directly from the Company through payroll deductions. It is felt that employee participation in the ownership of the Company will be to the mutual benefit of both the employees and the Company.
- 1.2 The Plan is intended to qualify as an "employee stock purchase plan" within the meaning of Section 423 of the Internal Revenue Code of 1986, as amended (the "Code"). The provisions of the Plan shall, accordingly, be construed so as to extend and/or limit eligibility and participation in a manner consistent, and so as to otherwise comply, with the requirements of the Code.
- 1.3 Eligibility and participation in the Plan shall give any Employee only such rights as are set forth in the Plan and any amendments hereto and shall in no way affect or in any manner limit the Company's right to discharge the Employee, which right is expressly reserved by the Company, or impair the authority of the Plan Committee to limit the Employee's rights, claims or causes, as provided in the Plan.

ARTICLE II - Definitions

- 2.1 The following words and phrases, when used in the Plan, shall have the following respective meanings, unless the context clearly indicates otherwise:

"Authorized Leave of Absence"

Any leave of absence authorized under the Company's standard personnel practices, provided that all persons under similar circumstances must be treated equally in the granting of such Authorized Leave of Absence and provided further that the person returns to the employ of the Company upon the expiration of an Authorized Leave of Absence.

"Board of Directors"

The Board of Directors of Photronics, Inc.

"Code"

The Internal Revenue Code of 1986, as amended from time to time, and applicable Treasury Department regulations issued thereunder.

"Common Stock"

The Common Stock, par value \$0.01 per share, of the Company, or the securities adjusted or substituted therefor pursuant to Article XIV.

"Company"

Photronics, Inc., a Connecticut corporation, or its successor or successors or any present or future subsidiary of Photronics, Inc., which may be designated to participate in the Plan by the Board of Directors.

"Compensation"

The Compensation of an Eligible Employee shall be determined in accordance with procedures approved by the Plan Committee or the Board of Directors. In the absence of the adoption of specific procedures, Compensation of an Eligible Employee shall be the annualized salary or wages of such Employee based on such Employee's current rate of pay and work schedule, but excluding any discretionary overtime, sick pay, vacation pay or other benefits.

"Disability"

Disability shall have the same meaning set forth in Section 22(e)(3) of the Code or any successor provision thereto. At present, a disability is defined as a physical or mental impairment or incapacity which, can be expected to result in death or has lasted or can be expected to last for a continuous period of at least twelve (12) months and renders the Participant unable to engage in any substantial, gainful activity.

"Effective Date of the Plan"

The date on which the Plan shall have become effective pursuant to Article XVII, provided, however, that if the Plan shall not be approved by the stockholders of the Company as provided in Article XVII, the Plan and all rights granted hereunder shall be, and be deemed to have been, null and void.

"Eligible Employee"

An Employee who is eligible to participate in the Plan in accordance with provisions of Articles IV and V.

"Employee"

Any person who, on an Offering Date, is a common law employee of the Company and whose customary employment is for full time employees and part-time employees with scheduled hours greater than or equal to forty biweekly hours and for more than five (5) months per calendar year, other than any highly compensated employees (within the meaning of Section 414[q] of the Code or any successor provision thereto) of the Company who are excluded from participation hereunder by action of the Board of Directors. A person who is or has been on an Authorized Leave of Absence, and who in the absence of such Authorized Leave of Absence would have been classified as an Employee, shall in the discretion of the Plan Committee be considered to be an Employee, except to the extent that such determination is inconsistent with Section 423 of the Code. Such determination by the Plan Committee shall be final and conclusive.

"Offering"

An Offering in accordance with the provisions of Article V.

"Offering Date"

The date of an Offering as established by the Plan Committee pursuant to Section 5.1 hereof.

"Participant"

An Eligible Employee who subscribes for Shares pursuant to Article VI.

"Plan"

The Photonics, Inc. Employee Stock Purchase Plan set forth herein, as amended from time to time in accordance with the provisions of Article XV.

"Plan Committee"

The committee provided for in Article XII to administer the Plan.

"Purchase Date"

A Purchase Date as provided in Sections 8.1 or 10.3, as appropriate.

"Shares"

Shares of Common Stock offered under the Plan.

The masculine gender, whenever used in the Plan, shall be deemed to include the feminine gender, and whenever the plural is used it shall include the singular, if the context so requires.

ARTICLE III - Shares Subject to the Plan

- 3.1 Subject to the provisions of Article XIV hereof, the aggregate number of shares of Common Stock which may be issued under the Plan shall not exceed 1,850,000. The aggregate number of such shares which may be issued with respect to any Offering shall be determined by the Plan Committee with respect to such Offering. Such shares may be authorized but unissued shares of Common Stock or issued shares of Common Stock which are held by the Company. Any shares subscribed for under the Plan and not purchased as a result of the cancellation in whole or in part of such subscription shall (unless the Plan shall have terminated) be again available for issuance under the Plan.
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ARTICLE IV - *Eligibility*

- 4.1 Each Employee who has been continuously employed by the Company for the one complete calendar month (or such longer period as may be determined by the Plan Committee) ending immediately prior to an Offering Date shall be eligible to participate in the Offering under the Plan made on such Offering Date.
- 4.2 Notwithstanding the provisions of Section 4.1, no Employee shall be offered Shares if, immediately after he would subscribe for such Shares, such Employee would own capital stock (including shares of Common Stock which may be purchased under such subscription and under any other outstanding subscriptions under the Plan or options to purchase shares of Common Stock of the Company held by such Employee, as computed in accordance with Section 423[b][3] of the Code or any successor provision thereto) possessing 5% or more of the total combined voting power or value of all classes of stock of the Company. For purposes of determining the stock ownership of any Employee, the provisions of Section 424[d] of the Code shall apply.

ARTICLE V - *Offering Under the Plan*

- 5.1 Offerings under the Plan shall be made on such Offering Dates as shall be determined by the Plan Committee. Notwithstanding anything to the contrary, no Offering shall be made on any date prior to the date that a required registration statement with respect to such Offering filed under the Securities Act of 1933, as amended, has become effective. Nothing contained herein shall be deemed to require that an Offering be made in any year.
- 5.2 [a] Subject to the limitations set forth in Sections 5.2[b] and 6.3, and to the other terms and conditions of the Plan, in each offering under the Plan, each Eligible Employee on an Offering Date shall be offered the right during the Subscription Period as provided in Section 6.2, to subscribe to purchase Shares at the percentage designated by the Plan Committee for such offering (not to exceed 5%) of his Compensation would buy, at a price equal to the product of (i) the fair market value of a Share on the Offering Date, multiplied by (ii) the Purchase Price percentage utilized under Section 5.3 hereof.
- [b] Notwithstanding anything to the contrary contained in Sub-Section [a] of this Section 5.2, no Eligible Employee shall be eligible to subscribe for Shares in an Offering if, immediately after he would subscribe for such Shares, such subscription would permit his rights to purchase shares of Common Stock under all employee stock purchase plans of the Company to accrue at a rate which exceeds \$25,000 (or such other maximum amounts as may be prescribed from time to time under the Code) of the fair market value of such shares (determined as of the Offering Date for such Offering) for each calendar year in which such subscription would be outstanding at any time. For purposes of this limitation the provisions of Section 423[b][8] of the Code shall be applicable.
- 5.3 The Purchase Price per share subscribed for all Shares in a particular Offering shall be an amount equal to such percentages, not greater than 100% nor less than 85%, as shall be determined by the Plan Committee on or prior to the Offering Date, of the fair market value of a share of Common Stock (determined in accordance with the provisions of Article XIII) on one of the following dates with respect to such Offering, with such date to be determined by the Plan Committee on or prior to the Offering Date: (i) the Offering Date, (ii) the Purchase Date, or (iii) the Offering Date or the Purchase Date (whichever would result in a lower Purchase Price for the Common Stock).
- 5.4 In order to participate in any Offering, an Eligible Employee entitled to purchase Shares in such Offering shall comply with the subscription procedures set forth in Article VI.
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ARTICLE VI - *Subscriptions for Shares*

- 6.1 As soon as practicable after an Offering Date, the Company shall furnish to each Eligible Employee a Subscription Agreement to which such Eligible Employee may subscribe in such Offering, the fair market value per share of Common Stock on the Offering Date, the Purchase Price for Shares in such Offering and such other terms and conditions consistent with the Plan as shall be determined by the Plan Committee.
- 6.2 Within fifteen (15) days after receipt of such Subscription Agreement, an Eligible Employee desiring to participate in the Offering shall notify the Plan Committee of the percentage of Shares for which the employee desires to subscribe. Such notification shall be effected by the Eligible Employee's completing, executing and returning to the Secretary of the Company the Subscription Agreement or such other process as the Secretary of the Company shall provide. All such subscriptions shall be deemed to have been made as of the Offering Date. No subscription shall be accepted from any person who is not an Eligible Employee on the date his subscription is received by the Company.
- 6.3 The minimum number of Shares for which an Eligible Employee will be permitted to subscribe in any Offering is one (1) . If at any time the Shares available for an Offering are oversubscribed, the Number of Shares for which each Eligible Employee is entitled to subscribe pursuant to Section 5.2 shall be reduced, pro rata, to such lower number as may be necessary to eliminate such over-subscription.
- 6.4 If an Eligible Employee fails to subscribe within the period and in the manner prescribed in Section 6.2, he shall waive all rights to purchase Shares in that Offering.

ARTICLE VII - *Payment for Shares*

- 7.1 The aggregate Purchase Price for the Shares for which a Participant subscribes in any Offering in accordance with the provisions of Article VI of the Plan shall be paid by means of payroll deductions.
- 7.2 [a] The aggregate Purchase Price for Shares shall be paid by payroll deductions in equal amounts over a period of 24 months (or such shorter period as shall be determined by the Plan Committee in accordance with the Plan) from the Offering Date. The period over which such payroll deductions are to be made in hereinafter referred to as the "Payment Period".
- [b] Such payroll deductions with respect to an Offering shall commence as soon as practicable after the receipt of the Company of the executed Subscription Agreement authorizing such payroll deductions, and shall cease upon the earlier of the termination of the Payment Period or payment in full of the Purchase Price for such Shares. A Participant may cancel his subscription to the extent provided for in Article X, but no other change in terms of his Subscription Agreement may be made during the Payment Period and, in particular, in no event may a Participant change the amount of his payroll deductions under such Subscription Agreement. All payroll deductions withheld from a Participant under a Subscription Agreement shall be credited to his account under the Plan. In the event that payroll deductions are simultaneously being made with respect to more than one Subscription Agreement, the aggregate amount of such payroll deductions at any payday shall be credited first toward the payment for Shares subscribed for in the earliest Offering. A Participant may not make any separate cash payment into his account, provided, however, that a Participant who has been deemed to be in the employ of the Company while on an Authorized Leave of Absence without pay during the Payment Period, may upon his return to the actual employ of the Company, make a cash payment into his account in an amount not exceeding the aggregate of the payroll deductions which would have been made during such Authorized Leave of Absence.
- [c] All funds representing payroll deductions for the accounts of Participants will, except as provided in Section 7.3, be paid into the general funds of the Company. No interest will be paid or accrued under any circumstances on any funds withheld by the Company as payroll deductions pursuant to this Section 7.2 or on any other funds paid to the Company for purchases of Shares under the Plan.
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- 7.3 Notwithstanding anything in this Article VII to the contrary, with respect to any Offering which is made prior to the approval of the Plan by the stockholders of the Company, all payroll deductions withheld for the accounts of Participants shall, until the Plan is approved by the stockholders, be held by the Company in a special escrow account for the benefit of such Participants. No interest will be paid or accrued under any circumstances on such funds. No Shares will be issued to such Participants until after approval of the Plan by the stockholders. In the event that the Plan is not approved by the stockholders within the period specified in Article XVII, all such funds will thereupon be promptly refunded to the respective Participants.
- 7.4 Failure to pay for subscribed Shares as provided in this Article VII shall constitute the cancellation of such subscription to the extent that any such Shares shall not have been so paid for.

ARTICLE VIII - Issuance of Shares

- 8.1 At the end of the Payment Period for an Offering, (each of which dates is referred to as a "Purchase Date"), the balance of all amounts then held in the account of a Participant representing payroll deductions pursuant to a Subscription Agreement shall be applied to the purchase by the Participant from the Company of the number of Shares equal to the amount of such balance divided by the Purchase Price per share for such Shares applicable on such Purchase Date up to the number of Shares provided for in the respective Subscription Agreement. Any amount remaining in the Participant's account in excess of the sum required to purchase whole Shares on a Purchase Date shall be promptly refunded to the Participant. As soon as practicable after a Purchase Date, the Company will issue and deliver to the Participant a certificate representing the Shares purchased by him from the Company on such Purchase Date. No fractional shares will be issued at any time.
- 8.2 A Participant who disposes (whether by sale, exchange, gift or otherwise) of any of the Shares acquired by him pursuant to the Plan within two (2) years after the Offering Date for such Shares or within one (1) year after the issuance of Shares to him shall notify the Company in writing of such disposition within thirty (30) days after such disposition.

ARTICLE IX - Rights of Stockholders

- 9.1 A Participant shall not have any rights to dividends or any other rights as a stockholder of the Company with respect to any Shares until such Shares shall have been issued to him as reflected by the books and records maintained by the Company's transfer agent relating to stockholders of the Company.

ARTICLE X - Voluntary Withdrawal/Termination of Employment

- 10.1 A Participant may discontinue his payroll deductions at any time by giving written notice thereof to the stock plan administrator of the Company as well as the stock platform under which the employee subscribed, effective for all payroll periods commencing five (5) days after receipt of such notice received by the stock plan administrator as well as the stock platform. The balance in the account of such Participant following such discontinuance shall be promptly refunded to the Participant. Withdrawal from an Offering pursuant to this Section 10.1 shall not affect an Eligible Employee's eligibility to participate in any other Offering under the Plan.
- 10.2 If the Participant's employment with the Company is terminated for any reason other than death while still an Employee, such Participant's rights to purchase Shares under any Subscription Agreement shall immediately terminate. Any balance remaining in his account as of the date of such termination of employment shall be promptly refunded to the Participant.
- 10.3 In the event of the death of an Employee who was a Participant prior to the purchase of the Shares for which he subscribed pursuant to Article VI hereof, the person or persons who acquired by laws of descent and distribution (his "Estate") his rights to purchase Shares under his Subscription Agreement(s), shall have the right within ninety (90) days after the death of the Participant (but in no event later than the termination of the Payment Period) to purchase from the Company that number of Shares subscribed for and not issued to the Participant prior to his death which the balance in the Participant's payroll deduction account is sufficient to purchase. The failure of the person or persons so acquiring his rights to so give notice of intention to purchase shall constitute a forfeiture of all further rights of the Participant or other persons to purchase such Shares and in such event, the balance in the Participant's payroll deduction account will be refunded, without interest. If the Participant dies more than fifty (50) days prior to the termination of the Payment Period and his Estate elects to purchase the Shares subscribed for, the Purchase Price for his Shares shall be the percentage, designated pursuant to Section 5.3, of the fair market value on the Offering Date, irrespective of the Purchase Price for other Participants.
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ARTICLE XI - *Non-Transferability of Subscription Rights*

- 11.1 During the lifetime of a Participant, the Shares for which he subscribes may be purchased only by him. No Subscription Agreement of a Participant and no right under or interest in the Plan or any such Subscription Agreement (hereinafter collectively referred to as "Subscription Rights") may be assigned, transferred, pledged, hypothecated or disposed of in any way (whether by operation of law or otherwise), except by the Participant's will or by the applicable laws of descent and distribution, or may be subject to execution, attachment or similar process. Any assignment, transfer, pledge, hypothecation or other disposition of Subscription Rights, or any levy of execution, attachment or other process attempted upon Subscription Rights, shall be null and void and without effect, and in any such event all Subscription Rights shall, in the sole discretion of the Plan Committee (exercised by written notice to the Participant or to the person then entitled to purchase the Shares under the provisions of Sections 10.3 hereof), terminate as of the occurrence of any such event.

ARTICLE XII - *Administration of the Plan*

- 12.1 The Plan shall be administered by a Plan Committee which shall consist of two (2) or more members of the Board of Directors, none of whom shall be eligible to participate in the Plan. The members of the Plan Committee shall be appointed, and may be removed, by the Board of Directors. The Board of Directors shall have the power to remove and substitute for members of the Plan Committee and to fill any vacancy which may occur in the Plan Committee.
- 12.2 Unless otherwise determined by the Board of Directors, the members of the Plan Committee shall serve without additional compensation for their services. All expenses in connection with the administration of the Plan, including, but not limited to, clerical, legal and accounting fees, and other costs of administration, shall be paid by the Company.
- 12.3 The Chairman of the Plan Committee shall be designated by the Board of Directors. The Plan Committee shall select a Secretary who need not be a member of the Plan Committee. The Secretary, or in his absence, any member of the Plan Committee designated by the Chairman, shall keep the minutes of the proceedings of the Plan Committee and all data, records and documents relating to the administration of the Plan by the Plan Committee.
- 12.4 A quorum of the Plan Committee shall be such number as the Committee shall from time to time determine, but shall not be less than a majority of the entire Plan Committee. The acts of a majority of the members of the Plan Committee present at any meeting at which a quorum is present shall be the act of the Plan Committee. Members of the Plan Committee may participate in a meeting by means of telephone conference or similar communications procedure pursuant to which all persons participating in the meeting can hear each other. The Plan Committee may take action without a meeting if such action is evidenced by a writing signed by at least a majority of the entire Plan Committee.
- 12.5 The Plan Committee may, by an instrument in writing, delegate to one or more of its members or to an officer or officers of the Company any of its powers and its authority under the Plan, including the execution and delivery on its behalf of instruments, instructions and other documents.
- 12.6 It shall be the sole and exclusive duty and authority of the Plan Committee to interpret and construe the provisions of the Plan, to decide any disputes which may arise with regard to the status, eligibility and rights of Employees under the terms of the Plan, and any other persons claiming an interest under the terms of the Plan, and, in general, to direct the administration of the Plan.
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- 12.7 The Plan Committee may adopt, and from time to time amend, such rules and regulations consistent with the purposes and provisions of the Plan, as it deems necessary or advisable to administer and effectuate the Plan.
- 12.8 The Plan Committee may shorten, lengthen (but not beyond thirty (30) days) or waive the time required by the Plan for the filing of any notice or other form under the Plan.
- 12.9 The discretionary powers granted hereunder to the Plan Committee shall in no event be exercised in any manner that will discriminate against individual employees or a class of employees or discriminate in favor of employees who are shareholders, officers, supervisors or highly compensated employees of the Company.

ARTICLE XIII - Valuation of Shares of Common Stock

- 13.1 For purposes of the Plan, the "fair market value" of a share of Common Stock as of any date shall be determined as follows:
- [a] If the Common Stock is then listed on a national securities exchange, the "fair market value" shall be the closing price of a share of Common Stock on such exchange on such date, or, if there has been no sale of shares of Common Stock on that date, the closing price of a share of Common Stock on such exchange on the last preceding business day on which shares of Common Stock were traded.
- [b] If the Common Stock is then listed on the National Association of Securities Dealers Automatic Quotation System National Market System, the "fair market value" shall be the average of the high and low sales prices of a share of Common Stock on that date, or if there has been no sale of shares of Common Stock on that date, the average of the high and low sales prices of Common Stock on the last preceding business day on which shares of Common Stock were traded.

ARTICLE XIV - Adjustments in Certain Events

- 14.1 If (i) the Company shall at any time be involved in a transaction to which sub-section [a] of Section 424 of the Code is applicable, (ii) the Company shall declare a dividend payable in, or shall sub-divide or combine, its Common Stock, or (iii) any other event shall occur which in the judgment of the Board of Directors necessitates action by way of adjusting the terms of the outstanding Subscription Agreements, the Board of Directors shall take any such action as in its judgment shall be appropriate to preserve Participant rights substantially proportionate to the rights existing prior to such event. To the extent that such action shall include an increase or decrease in the number of shares of Common Stock subject to outstanding Subscription Agreements, the aggregate number of shares available under Article III hereof for issuance under the Plan pursuant to outstanding Subscription Agreements and Subscription Agreements which may be entered into, and the aggregate number of shares available for issuance in any Offering and the number which may be subscribed for, shall be proportionately increased or decreased, as the case may be. No action shall be taken by the Board of Directors under the provisions of this Article XIV which, in its judgment, would constitute a modification, extension or renewal of the Subscription Agreement (within the meaning of Section 424[h] of the Code), or would prevent the Plan from qualifying as an "employee stock purchase plan" (within the meaning of Section 423 of the Code). The determination of the Board of Directors with respect to any matter referred to in this Article XIV shall be conclusive and binding upon each Participant.

ARTICLE XV - Termination and Amendment of the Plan

- 15.1 The Board of Directors may, without further approval by the stockholders of the Company, at any time terminate or amend the Plan without notice, or make such modifications of the Plan as it shall deem advisable; provided that the Board of Directors may not, without prior approval by the holders of a majority of the outstanding shares of Common Stock of the Company, amend or modify the Plan so as to (i) increase the maximum number of shares of Common Stock which may be issued under the Plan (except as contemplated in Article XIV hereof), (ii) extend the term during which Offerings may be made under the Plan or (iii) increase the maximum number of Shares which an Eligible Employee is entitled to purchase (except as contemplated in Article XIV hereof); and provided further that the Board of Directors may not amend or modify the Plan in any manner which would prevent the Plan from qualifying as an "employee stock purchase plan" (within the meaning of Section 423 of the Code). No termination, amendment or modification of the Plan may, without the consent of a Participant, adversely affect the rights of such Participant under an outstanding Subscription Agreement.
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ARTICLE XVI - *Miscellaneous*

- 16.1 Unless otherwise expressly provided in the Plan, all notices or other communications by a Participant to the Company under or in connection with the Plan shall be deemed to have been duly given when received by the Secretary of the Company or when received in the form specified by the Company at the location and by the persons, designated by the Company for the receipt thereof.
- 16.2 Notwithstanding anything hereunder to the contrary, the offer, sale and delivery by the Company of Shares under the Plan to any Eligible Employee is subject to compliance with all applicable securities regulation and other federal and state laws. The terms of this Plan shall be construed under the laws of the State of Connecticut.

ARTICLE XVII - *Effective Date*

- 17.1 The Plan shall become effective at such time as the Plan has been adopted by the Board of Directors and has been approved by the holders of a majority of the outstanding shares of Common Stock of the Company.
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Photronics, Inc.
2007 Long Term Equity Incentive Plan
(as Amended on April 11, 2014)

1. Purposes of the Plan

The purposes of the Plan are to (a) promote the long-term success of the Company and its Subsidiaries and to increase stockholder value by providing Eligible Individuals with incentives to contribute to the long-term growth and profitability of the Company by offering them an opportunity to obtain a proprietary interest in the Company through the grant of equity-based awards and (b) assist the Company in attracting, retaining and motivating highly qualified individuals who are in a position to make significant contributions to the Company and its Subsidiaries.

Upon the Effective Date, no further Awards will be granted under the Prior Plans.

2. Definitions and Rules of Construction

(a) Definitions. For purposes of the Plan, the following capitalized words shall have the meanings set forth below:

“**Award**” means an Option, Restricted Stock, Restricted Stock Unit, Stock Appreciation Right, Performance Stock, Performance Unit or Other Award granted by the Committee pursuant to the terms of the Plan.

“**Award Document**” means an agreement, certificate or other type or form of document or documentation approved by the Committee that sets forth the terms and conditions of an Award. An Award Document may be in written, electronic or other media, may be limited to a notation on the books and records of the Company and, unless the Committee requires otherwise, need not be signed by a representative of the Company or a Participant.

“**Beneficial Owner**” and “**Beneficially Owned**” have the meaning set forth in Rule 13d-3 under the Exchange Act.

“**Board**” means the Board of Directors of the Company, as constituted from time to time.

“**Change of Control**” means:

(i) Any Person becomes the Beneficial Owner, directly or indirectly, of securities of the Company representing thirty-five percent (35%) or more of the combined voting power of the Company’s then outstanding securities; or

(ii) The following individuals cease for any reason to constitute a majority of the number of directors then serving: individuals who, on the Effective Date, constitute the Board and any new director (other than a director whose initial assumption of office is in connection with an actual or threatened election contest, including, but not limited to, a consent solicitation, relating to the election of directors of the Company) whose appointment or election by the Board or nomination for election by the Company’s stockholders was approved or recommended by a vote of at least a majority of the directors then still in office who either were directors on the Effective Date or whose appointment, election or nomination for election was previously so approved or recommended; or

(iii) There is consummated a merger or consolidation of the Company or any Subsidiary with any other corporation, other than (A) a merger or consolidation which would result in the voting securities of the Company outstanding immediately prior to such merger or consolidation continuing to represent (either by remaining outstanding or by being converted into voting securities of the surviving entity or any parent thereof), in combination with the ownership of any trustee or other fiduciary holding securities under an employee benefit plan of the Company or any Subsidiary of the Company, more than fifty percent (50%) of the combined voting power of the securities of the Company or such surviving entity or any parent thereof outstanding immediately after such merger or consolidation, or (B) a merger or consolidation effected to implement a recapitalization of the Company (or similar transaction) in which no Person is or becomes the Beneficial Owner, directly or indirectly, of securities of the Company representing thirty-five percent (35%) or more of the combined voting power of the Company's then outstanding securities; or

(iv) The stockholders of the Company approve a plan of complete liquidation or dissolution of the Company or there is consummated an agreement for the sale or disposition by the company of all or substantially all of the Company's assets, other than a sale or disposition by the Company of all or substantially all of the Company's assets to an entity, more than fifty percent (50%) of the combined voting power of the voting securities of which are owned by stockholders of the Company in substantially the same proportions as their ownership of the Company immediately prior to such sale.

Notwithstanding the foregoing, with respect to an Award that is subject to Section 409A of the Code and the payment or settlement of the Award will accelerate upon a Change of Control, no event set forth herein will constitute a Change of Control for purposes of the Plan or any Award Document unless such event also constitutes a "change in ownership," "change in effective control," or "change in the ownership of a substantial portion of the Company's assets" as defined under Section 409A of the Code.

"Code" means the Internal Revenue Code of 1986, as amended, and the applicable rulings and regulations promulgated thereunder.

"Committee" means the Compensation Committee of the Board, any successor committee thereto or any other committee appointed from time to time by the Board to administer the Plan, which committee shall meet the requirements of Section 162(m) of the Code, Section 16(b) of the Exchange Act and the applicable rules of the NASDAQ; *provided, however*, that, if any Committee member is found not to have met the qualification requirements of Section 162(m) of the Code and Section 16(b) of the Exchange Act, any actions taken or Awards granted by the Committee shall not be invalidated by such failure to so qualify.

"Common Stock" means the common stock of the Company, par value \$0.01 per share, or such other class of share or other securities as may be applicable under Section 13 of the Plan.

"Company" means Photronics, Inc., a Connecticut corporation, or any successor to all or substantially all of the Company's business that adopts the Plan.

"EBITDA" means earnings before interest, taxes, depreciation and amortization.

"Effective Date" means the date on which the Plan is adopted by the Board and approved by the Shareholders of the Company.

"Eligible Individuals" means the individuals described in Section 4(a) of the Plan who are eligible for Awards under the Plan.

"Exchange Act" means the Securities Exchange Act of 1934, as amended, and the rules and regulations promulgated thereunder.

“**Fair Market Value**” means, with respect to a share of Common Stock, the fair market value on the date of valuation of such Award as determined by the Compensation Committee; provided, however, that with respect to an incentive stock option issued to a 10% or more shareholder, Fair Market Value shall mean 110% of the fair market value or such other percentage as may be permitted by the Code and regulations promulgated thereunder.

“**Incentive Stock Option**” means an Option that is intended to comply with the requirements of Section 422 of the Code or any successor provision thereto.

“**NASDAQ**” means the NASDAQ Stock Market, Inc.

“**Non-Employee Director**” means any member of the Board who is not an officer or employee of the Company or any Subsidiary.

“**Nonqualified Stock Option**” means an Option that is not intended to comply with the requirements of Section 422 of the Code or any successor provision thereto.

“**Option**” means an Incentive Stock Option or Nonqualified Stock Option granted pursuant to Section 7 of the Plan.

“**Other Award**” means any form of Award other than an Option, Restricted Stock, Restricted Stock Unit or Stock Appreciation Right granted pursuant to Section 11 of the Plan.

“**Participant**” means an Eligible Individual who has been granted an Award under the Plan.

“**Performance Period**” means the period established by the Committee and set forth in the applicable Award Document over which Performance Targets are measured.

“**Performance Stock**” means a Target Number of Shares granted pursuant to Section 10(a) of the Plan.

“**Performance Target**” means the performance measures established by the Committee, from among the performance criteria provided in Section 6(g), and set forth in the applicable Award Document.

“**Performance Unit**” means a right to receive a Target Number of Shares or cash in the future granted pursuant to Section 10(b) of the Plan.

“**Permitted Transferees**” means (i) a Participant’s family member, (ii) one or more trusts established in whole or in part for the benefit of one or more of such family members, (iii) one or more entities which are beneficially owned in whole or in part by one or more such family members, or (iv) a charitable or not-for-profit organization.

“**Person**” means any person, entity or “group” within the meaning of Section 13(d)(3) or Section 14(d)(2) of the Exchange Act, except that such term shall not include (i) the Company or any of its Subsidiaries, (ii) a trustee or other fiduciary holding securities under an employee benefit plan of the Company, (iii) an underwriter temporarily holding securities pursuant to an offering of such securities, (iv) a corporation owned, directly or indirectly, by the stockholders of the Company in substantially the same proportions as their ownership of stock of the Company, or (v) a person or group as used in Rule 13d-1(b) under the Exchange Act.

“**Plan**” means this 2007 Long Term Equity Incentive Plan, as amended or restated from time to time.

“**Plan Limit**” means the maximum aggregate number of Shares that may be issued for all purposes under the Plan as set forth in Section 5(a) of the Plan.

“**Prior Plan**” means the 1996 Stock Option Plan, the 1998 Stock Option Plan, and the 2000 Stock Plan, as amended from time to time.

“**Restricted Stock**” means one or more Shares granted or sold pursuant to Section 8(a) of the Plan.

“**Restricted Stock Unit**” means a right to receive one or more Shares (or cash, if applicable) in the future granted pursuant to Section 8(b) of the Plan.

“**Shares**” means shares of Common Stock, as may be adjusted pursuant to Section 13(b).

“**Stock Appreciation Right**” means a right to receive all or some portion of the appreciation on Shares granted pursuant to Section 9 of the Plan.

“**Subsidiary**” means (i) a corporation or other entity with respect to which the Company, directly or indirectly, has the power, whether through the ownership of voting securities, by contract or otherwise, to elect at least a majority of the members of such corporation’s board of directors or analogous governing body, or (ii) any other corporation or other entity in which the Company, directly or indirectly, has an equity or similar interest and which the Committee designates as a Subsidiary for purposes of the Plan. For purposes of determining eligibility for the grant of Incentive Stock Options under the Plan, the term “Subsidiary” shall be defined in the manner required by Section 424(f) of the Code.

“**Substitute Award**” means any Award granted upon assumption of, or in substitution or exchange for, outstanding employee equity awards previously granted by a company or other entity acquired by the Company or with which the Company combines pursuant to the terms of an equity compensation plan that was approved by the stockholders of such company or other entity.

“**Target Number**” means the target number of Shares or cash value established by the Committee and set forth in the applicable Award Document.

(b) Rules of Construction. The masculine pronoun shall be deemed to include the feminine pronoun, and the singular form of a word shall be deemed to include the plural form, unless the context requires otherwise. Unless the text indicates otherwise, references to sections are to sections of the Plan.

3. Administration

(a) Committee. The Plan shall be administered by the Committee, which shall have full power and authority, subject to the express provisions hereof, to:

(i) select the Participants from the Eligible Individuals;

(ii) grant Awards in accordance with the Plan;

(iii) determine the number of Shares subject to each Award or the cash amount payable in connection with an Award;

(iv) determine the terms and conditions of each Award, including, without limitation, those related to term, permissible methods of exercise, vesting, cancellation, payment, settlement, exercisability, Performance Periods, Performance Targets, and the effect, if any, of a Participant’s termination of employment with the Company or any of its Subsidiaries or, subject to Section 6(d), a Change of Control of the Company;

(v) subject to Sections 16 and 17(e) of the Plan, amend the terms and conditions of an Award after the granting thereof;

(vi) specify and approve the provisions of the Award Documents delivered to Participants in connection with their Awards;

(vii) construe and interpret any Award Document delivered under the Plan;

(viii) make factual determinations in connection with the administration or interpretation of the Plan;

(ix) adopt, prescribe, amend, waive and rescind administrative regulations, rules and procedures relating to the Plan;

(x) employ such legal counsel, independent auditors and consultants as it deems desirable for the administration of the Plan and to rely upon any advice, opinion or computation received therefrom;

(xi) vary the terms of Awards to take account of tax and securities law and other regulatory requirements or to procure favorable tax treatment for Participants;

(xii) correct any defects, supply any omission or reconcile any inconsistency in any Award Document or the Plan; and

(xiii) make all other determinations and take any other action desirable or necessary to interpret, construe or implement properly the provisions of the Plan or any Award Document.

(b) Plan Construction and Interpretation. The Committee shall have full power and authority, subject to the express provisions hereof, to construe and interpret the Plan.

(c) Determinations of Committee Final and Binding. All determinations by the Committee in carrying out and administering the Plan and in construing and interpreting the Plan shall be made in the Committee's sole discretion and shall be final, binding and conclusive for all purposes and upon all persons interested herein.

(d) Delegation of Authority. To the extent not prohibited by applicable laws, rules and regulations, the Committee may, from time to time, delegate some or all of its authority under the Plan to a subcommittee or subcommittees thereof or other persons or groups of persons as it deems necessary, appropriate or advisable under such conditions or limitations as it may set at the time of such delegation or thereafter; *provided, however*, that the Committee may not delegate its authority (i) to make Awards to employees (A) who are subject on the date of the Award to the reporting rules under Section 16(a) of the Exchange Act, (B) whose compensation for such fiscal year may be subject to the limit on deductible compensation pursuant to Section 162(m) of the Code or (C) who are officers of the Company who are delegated authority by the Committee hereunder, or (ii) pursuant to Section 16 of the Plan. For purposes of the Plan, reference to the Committee shall be deemed to refer to any subcommittee, subcommittees, or other persons or groups of persons to whom the Committee delegates authority pursuant to this Section 3(d).

(e) Liability of Committee. Subject to applicable laws, rules and regulations: (i) no member of the Board or Committee (or its delegates) shall be liable for any good faith action or determination made in connection with the operation, administration or interpretation of the Plan and (ii) the members of the Board or the Committee (and its delegates) shall be entitled to indemnification and reimbursement in the manner provided in the Company's Certificate of Incorporation as it may be amended from time to time. In the performance of its responsibilities with respect to the Plan, the Committee shall be entitled to rely upon information and/or advice furnished by the Company's officers or employees, the Company's accountants, the Company's counsel and any other party the Committee deems necessary, and no member of the Committee shall be liable for any action taken or not taken in reliance upon any such information and/or advice.

(f) Action by the Board. Anything in the Plan to the contrary notwithstanding, subject to applicable laws, rules and regulations, any authority or responsibility that, under the terms of the Plan, may be exercised by the Committee may alternatively be exercised by the Board.

4. Eligibility

(a) Eligible Individuals. Awards may be granted to officers, employees, directors, Non-Employee Directors, consultants, advisors and independent contractors of the Company or any of its Subsidiaries or joint ventures, partnerships or business organizations in which the Company or its Subsidiaries have an equity interest; *provided, however*, that only employees of the Company or Subsidiary may be granted Incentive Stock Options. The Committee shall have the authority to select the persons to whom Awards may be granted and to determine the type, number and terms of Awards to be granted to each such Participant. Under the Plan, references to “employment” or “employed” include the engagement of Participants who are consultants, advisors and independent contractors of the Company or its Subsidiaries and the service of Participants who are Non-Employee Directors, except for purposes of determining eligibility to be granted Incentive Stock Options.

(b) Grants to Participants. The Committee shall have no obligation to grant any Eligible Individual an Award or to designate an Eligible Individual as a Participant solely by reason of such Eligible Individual having received a prior Award or having been previously designated as a Participant. The Committee may grant more than one Award to a Participant and may designate an Eligible Individual as a Participant for overlapping periods of time.

5. Shares Subject to the Plan

(a) Plan Limit. Subject to adjustment in accordance with Section 13 of the Plan, the maximum aggregate number of Shares that may be issued for all purposes under the Plan shall be nine million (9,000,000) plus any Shares that are available for issuance under the Prior Plans or that become available for issuance upon cancellation or expiration of awards granted under the Prior Plans without having been exercised or settled. Shares to be issued under the Plan may be authorized and unissued shares, issued shares that have been reacquired by the Company (in the open-market or in private transactions) and that are being held in treasury, or a combination thereof. All of the Shares subject to the Plan Limit may be issued pursuant to Incentive Stock Options.

(b) Rules Applicable to Determining Shares Available for Issuance. The number of Shares remaining available for issuance will be reduced by the number of Shares subject to outstanding Awards and, for Awards that are not denominated by Shares, by the number of Shares actually delivered upon settlement or payment of the Award. For purposes of determining the number of Shares that remain available for issuance under the Plan, (i) the number of Shares that are tendered by a Participant or withheld by the Company to pay the exercise price of an Award or to satisfy the Participant’s tax withholding obligations in connection with the exercise or settlement of an Award and (ii) all of the Shares covered by a stock-settled Stock Appreciation Right to the extent exercised, will not be added back to the Plan Limit. In addition, for purposes of determining the number of Shares that remain available for issuance under the Plan, the number of Shares corresponding to Awards under the Plan that are forfeited or cancelled or otherwise expire for any reason without having been exercised or settled or that is settled through issuance of consideration other than Shares (including, without limitation, cash) shall be added back to the Plan Limit and again be available for the grant of Awards; *provided, however*, that this provision shall not be applicable with respect to (i) the cancellation of a Stock Appreciation Right granted in tandem with an Option upon the exercise of the Option or (ii) the cancellation of an Option granted in tandem with a Stock Appreciation Right upon the exercise of the Stock Appreciation.

(c) Special Limits. Anything to the contrary in Section 5(a) above notwithstanding, but subject to adjustment under Section 13 of the Plan, the following special limits shall apply to Shares available for Awards under the Plan:

(i) the maximum number of Shares that may be issued pursuant to awards of Restricted Stock, Restricted Stock Units, Performance Stock, Performance Units, other full value awards, and Other Awards that are payable in Shares granted under the Plan shall equal one million (1,000,000) Shares in the aggregate;

(ii) the maximum amount of Awards (other than those Awards set forth in Section 5(c)) that may be awarded to any Eligible Individual in any calendar year is fifteen percent of the Shares measured as of the date of grant (with respect to Awards denominated in Shares).

(d) Any Shares underlying Substitute Awards shall not be counted against the number of Shares remaining for issuance and shall not be subject to Section 5(c).

6. Awards in General

(a) Types of Awards. Awards under the Plan may consist of Options, Restricted Stock, Restricted Stock Units, Stock Appreciation Rights, Performance Stock, Performance Units and Other Awards. Any Award described in Sections 7 through 11 of the Plan may be granted singly or in combination or tandem with any other Award, as the Committee may determine. Awards under the Plan may be made in combination with, in replacement of, or as alternatives to awards or rights under any other compensation or benefit plan of the Company, including the plan of any acquired entity.

(b) Terms Set Forth in Award Document. The terms and conditions of each Award shall be set forth in an Award Document in a form approved by the Committee for such Award, which Award Document shall contain terms and conditions not inconsistent with the Plan. Notwithstanding the foregoing, and subject to applicable laws, the Committee may accelerate (i) the vesting or payment of any Award, (ii) the lapse of restrictions on any Award or (iii) the date on which any Award first becomes exercisable. The terms of Awards may vary among Participants, and the Plan does not impose upon the Committee any requirement to make Awards subject to uniform terms. Accordingly, the terms of individual Award Documents may vary.

(c) Termination of Employment. The Committee shall specify at or after the time of grant of an Award the provisions governing the disposition of an Award in the event of a Participant's termination of employment with the Company or any of its Subsidiaries. Subject to applicable laws, rules and regulations, in connection with a Participant's termination of employment, the Committee shall have the discretion to accelerate the vesting, exercisability or settlement of, eliminate the restrictions and conditions applicable to, or extend the post-termination exercise period of an outstanding Award. Such provisions may be specified in the applicable Award Document or determined at a subsequent time.

(d) Change of Control. (i) The Committee shall have full authority to determine the effect, if any, of a Change of Control of the Company or any Subsidiary on the vesting, exercisability, settlement, payment or lapse of restrictions applicable to an Award, which effect may be specified in the applicable Award Document or determined at a subsequent time. Subject to applicable laws, rules and regulations, the Board or the Committee shall, at any time prior to, coincident with or after the effective time of a Change of Control, take such actions as it may consider appropriate, including, without limitation: (A) providing for the acceleration of any vesting conditions relating to the exercise or settlement of an Award or that an Award shall terminate or expire unless exercised or settled in full on or before a date fixed by the Committee; (B) making such adjustments to the Awards then outstanding as the Committee deems appropriate to reflect such Change of Control; (C) causing the Awards then outstanding to be assumed, or new rights substituted therefor, by the surviving corporation in such Change of Control; or (D) permit or require Participants to surrender outstanding Options and Stock Appreciation Rights in exchange for a cash payment, if any, equal to the difference between the highest price paid for a Share in the Change of Control transaction and the Exercise Price of the Award. In addition, except as otherwise specified in an Award Document (or a Participant's written employment agreement with the Company or any Subsidiary):

(1) any and all Options and Stock Appreciation Rights outstanding as of the effective date of the Change of Control shall become immediately exercisable, and shall remain exercisable until the earlier of the expiration of their initial term or the second (2nd) anniversary of the Participant's termination of employment with the Company;

(2) any restrictions imposed on Restricted Stock and Restricted Stock Units outstanding as of the effective date of the Change of Control shall lapse;

(3) the Performance Targets with respect to all Performance Units, Performance Stock and other performance-based Awards granted pursuant to Sections 6(g) or 10 outstanding as of the effective date of the Change of Control shall be deemed to have been attained at the specified target level of performance; and

(4) the vesting of all Awards denominated in Shares outstanding as of the effective date of the Change in Control shall be accelerated.

(ii) Subject to applicable laws, rules and regulations, the Committee may provide, in an Award Document or subsequent to the grant of an Award for the accelerated vesting, exercisability and/or the deemed attainment of a Performance Target with respect to an Award upon specified events similar to a Change of Control.

(iii) Notwithstanding any other provision of the Plan or any Award Document, the provisions of this Section 6(d) may not be terminated, amended, or modified upon or after a Change of Control in a manner that would adversely affect a Participant's rights with respect to an outstanding Award without the prior written consent of the Participant. Subject to Section 16, the Board, upon recommendation of the Committee, may terminate, amend or modify this Section 6(d) at any time and from time to time prior to a Change of Control.

(e) Dividends and Dividend Equivalents. The Committee may provide Participants with the right to receive dividends or payments equivalent to dividends or interest with respect to an outstanding Award, which payments can either be paid currently or deemed to have been reinvested in Shares, and can be made in Shares, cash or a combination thereof, as the Committee shall determine; *provided, however*, that the terms of any reinvestment of dividends must comply with all applicable laws, rules and regulations, including, without limitation, Section 409A of the Code. Notwithstanding the foregoing, no dividends or dividend equivalents shall be paid with respect to Options or Stock Appreciation Rights.

(f) Rights of a Stockholder. A Participant shall have no rights as a stockholder with respect to Shares covered by an Award (including voting rights) until the date the Participant or his nominee becomes the holder of record of such Shares. No adjustment shall be made for dividends or other rights for which the record date is prior to such date, except as provided in Section 13.

(g) Performance-Based Awards. (i) The Committee may determine whether any Award under the Plan is intended to be "performance-based compensation" as that term is used in Section 162(m) of the Code. Any such Awards designated to be "performance-based compensation" shall be conditioned on the achievement of one or more Performance Targets to the extent required by Section 162(m) of the Code and will be subject to all other conditions and requirements of Section 162(m). The Performance Targets will be comprised of specified levels of one or more of the following performance criteria as the Committee deems appropriate: net income; cash flow or cash flow on investment; pre-tax or post-tax profit levels or earnings; operating earnings; return on investment; earned value added expense reduction levels; free cash flow; free cash flow per share; earnings per share; net earnings per share; return on assets; return on net assets; return on equity; return on capital; return on sales; growth in managed assets; operating margin; total stockholder return or stock price appreciation; EBITDA; adjusted EBITDA; revenue; revenue before deferral, in each case determined in accordance with generally accepted accounting principles (subject to modifications approved by the Committee) consistently applied on a business unit, divisional, subsidiary or consolidated basis or any combination thereof. The Performance Targets may be described in terms of objectives that are related to the individual Participant or objectives that are Company-wide or related to a Subsidiary, division, department, region, function or business unit and may be measured on an absolute or cumulative basis or on the basis of percentage of improvement over time, and may be measured in terms of Company performance (or performance of the applicable Subsidiary, division, department, region, function or business unit) or measured relative to selected peer companies or a market index. In addition, for Awards not intended to qualify as "performance-based compensation" under Section 162(m) of the Code, the Committee may establish Performance Targets based on other criteria as it deems appropriate.

(ii) The Participants will be designated, and the applicable Performance Targets will be established, by the Committee within ninety (90) days following the commencement of the applicable Performance Period (or such earlier or later date permitted or required by Section 162(m) of the Code). Each Participant will be assigned a Target Number payable if Performance Targets are achieved. Any payment of an Award granted with Performance Targets shall be conditioned on the written certification of the Committee in each case that the Performance Targets and any other material conditions were satisfied. The Committee may determine, at the time of Award grant, that if performance exceeds the specified Performance Targets, the Award may be settled with payment greater than the Target Number, but in no event may such payment exceed the limits set forth in Section 5(c). The Committee retains the right to reduce any Award notwithstanding the attainment of the Performance Targets.

(h) Deferrals. In accordance with the procedures authorized by, and subject to the approval of, the Committee, Participants may be given the opportunity to defer the payment or settlement of an Award to one or more dates selected by the Participant; *provided, however*, that the terms of any deferrals must comply with all applicable laws, rules and regulations, including, without limitation, Section 409A of the Code. No deferral opportunity shall exist with respect to an Award unless explicitly permitted by the Committee on or after the time of grant.

(i) Repricing of Options and Stock Appreciation Rights. Notwithstanding anything in the Plan to the contrary, an Option or Stock Appreciation Right shall not be granted in substitution for a previously granted Option or Stock Appreciation Right being canceled or surrendered as a condition of receiving a new Award, if the new Award would have a lower exercise price than the Award it replaces, nor shall the exercise price of an Option or Stock Appreciation Right be reduced once the Option or Stock Appreciation Right is granted. The foregoing shall not (i) prevent adjustments pursuant to Section 13 or (ii) apply to grants of Substitute Awards.

7. Terms and Conditions of Options

(a) General. The Committee, in its discretion, may grant Options to Eligible Individuals and shall determine whether such Options shall be Incentive Stock Options or Nonqualified Stock Options. Each Option shall be evidenced by an Award Document that shall expressly identify the Option as an Incentive Stock Option or Nonqualified Stock Option, and be in such form and contain such provisions as the Committee shall from time to time deem appropriate.

(b) Exercise Price. The exercise price of an Option shall be fixed by the Committee at the time of grant or shall be determined by a method specified by the Committee at the time of grant. In no event shall the exercise price of an Option be less than one hundred percent (100%) of the Fair Market Value of a Share on the date of grant; *provided, however* that the exercise price of a Substitute Award granted as an Option shall be determined in accordance with Section 409A of the Code and may be less than one hundred percent (100%) of the Fair Market Value.

(c) Term. An Option shall be effective for such term as shall be determined by the Committee and as set forth in the Award Document relating to such Option, and the Committee may extend the term of an Option after the time of grant; *provided, however*, that the term of an Option may in no event extend beyond the tenth (10th) anniversary of the date of grant of such Option.

(d) Exercise; Payment of Exercise Price. Options shall be exercised by delivery of a notice of exercise in a form approved by the Company. Subject to the provisions of the applicable Award Document, the exercise price of an Option may be paid (i) in cash or cash equivalents, (ii) by actual delivery or attestation to ownership of freely transferable Shares already owned by the person exercising the Option, (iii) by a combination of cash and Shares equal in value to the exercise price, (iv) through net share settlement or similar procedure involving the withholding of Shares subject to the Option with a value equal to the exercise price or (v) by such other means as the Committee may authorize. In accordance with the rules and procedures authorized by the Committee for this purpose, the Option may also be exercised through a "cashless exercise" procedure authorized by the Committee from time to time that permits Participants to exercise Options by delivering irrevocable instructions to a broker to deliver promptly to the Company the amount of sale or loan proceeds necessary to pay the exercise price and the amount of any required tax or other withholding obligations or such other procedures determined by the Company from time to time.

(e) Incentive Stock Options. The exercise price per Share of an Incentive Stock Option shall be fixed by the Committee at the time of grant or shall be determined by a method specified by the Committee at the time of grant, but in no event shall the exercise price of an Incentive Stock Option be less than one hundred percent (100%) of the Fair Market Value of a Share on the date of grant. No Incentive Stock Option may be issued pursuant to the Plan to any individual who, at the time the Incentive Stock Option is granted, owns stock possessing more than ten percent (10%) of the total combined voting power of all classes of stock of the Company or any of its Subsidiaries, unless (i) the exercise price determined as of the date of grant is at least one hundred ten percent (110%) of the Fair Market Value on the date of grant of the Shares subject to such Incentive Stock Option and (ii) the Incentive Stock Option is not exercisable more than five (5) years from the date of grant thereof. No Participant shall be granted any Incentive Stock Option which would result in such Participant receiving a grant of Incentive Stock Options that would have an aggregate Fair Market Value in excess of one hundred thousand dollars (\$100,000), determined as of the time of grant, that would be exercisable for the first time by such Participant during any calendar year. No Incentive Stock Option may be granted under the Plan after the tenth anniversary of the Effective Date. The terms of any Incentive Stock Option granted under the Plan shall comply in all respects with the provisions of Section 422 of the Code, or any successor provision thereto, as amended from time to time.

8. Terms and Conditions of Restricted Stock and Restricted Stock Units

(a) Restricted Stock. The Committee, in its discretion, may grant or sell Restricted Stock to Eligible Individuals. An Award of Restricted Stock shall consist of one or more Shares granted or sold to an Eligible Individual, and shall be subject to the terms, conditions and restrictions set forth in the Plan and established by the Committee in connection with the Award and specified in the applicable Award Document. Restricted Stock may, among other things, be subject to restrictions on transferability, vesting requirements or other specified circumstances under which it may be canceled.

(b) Restricted Stock Units. The Committee, in its discretion, may grant Restricted Stock Units to Eligible Individuals. A Restricted Stock Unit shall entitle a Participant to receive, subject to the terms, conditions and restrictions set forth in the Plan and the applicable Award Document, one or more Shares. Restricted Stock Units may, among other things, be subject to restrictions on transferability, vesting requirements or other specified circumstances under which they may be canceled. If and when the cancellation provisions lapse, the Restricted Stock Units shall become Shares owned by the applicable Participant or, at the sole discretion of the Committee, cash, or a combination of cash and Shares, with a value equal to the Fair Market Value of the Shares at the time of payment.

9. Stock Appreciation Rights

(a) General. The Committee, in its discretion, may grant Stock Appreciation Rights to Eligible Individuals. A Stock Appreciation Right shall entitle a Participant to receive, upon satisfaction of the conditions to payment specified in the applicable Award Document, an amount equal to the excess, if any, of the Fair Market Value on the exercise date of the number of Shares for which the Stock Appreciation Right is exercised over the grant price for such Stock Appreciation Right specified in the applicable Award Document. The grant price per share of Shares covered by a Stock Appreciation Right shall be fixed by the Committee at the time of grant or, alternatively, shall be determined by a method specified by the Committee at the time of grant, but in no event shall the grant price of a Stock Appreciation Right be less than one hundred percent (100%) of the Fair Market Value of a Share on the date of grant; *provided, however*, that the grant price of a Substitute Award granted as a Stock Appreciation Rights shall be in accordance with Section 409A of the Code and may be less than one hundred percent (100%) of the Fair Market Value. Payments to a Participant upon exercise of a Stock Appreciation Right may be made in cash or Shares, having an aggregate Fair Market Value as of the date of exercise equal to the excess, if any, of the Fair Market Value on the exercise date of the number of Shares for which the Stock Appreciation Right is exercised over the grant price for such Stock Appreciation Right. The term of a Stock Appreciation Right settled in Shares shall not exceed seven (7) years.

(b) Stock Appreciation Rights in Tandem with Options. A Stock Appreciation Right granted in tandem with an Option may be granted either at the same time as such Option or subsequent thereto. If granted in tandem with an Option, a Stock Appreciation Right shall cover the same number of Shares as covered by the Option (or such lesser number of shares as the Committee may determine) and shall be exercisable only at such time or times and to the extent the related Option shall be exercisable, and shall have the same term as the related Option. The grant price of a Stock Appreciation Right granted in tandem with an Option shall equal the per-share exercise price of the Option to which it relates. Upon exercise of a Stock Appreciation Right granted in tandem with an Option, the related Option shall be canceled automatically to the extent of the number of Shares covered by such exercise; conversely, if the related Option is exercised as to some or all of the shares covered by the tandem grant, the tandem Stock Appreciation Right shall be canceled automatically to the extent of the number of Shares covered by the Option exercise.

10. Terms and Conditions of Performance Stock and Performance Units

(a) Performance Stock. The Committee may grant Performance Stock to Eligible Individuals. An Award of Performance Stock shall consist of a Target Number of Shares granted to an Eligible Individual based on the achievement of Performance Targets over the applicable Performance Period, and shall be subject to the terms, conditions and restrictions set forth in the Plan and established by the Committee in connection with the Award and specified in the applicable Award Document.

(b) Performance Units. The Committee, in its discretion, may grant Performance Units to Eligible Individuals. A Performance Unit shall entitle a Participant to receive, subject to the terms, conditions and restrictions set forth in the Plan and established by the Committee in connection with the Award and specified in the applicable Award Document, a Target Number of Shares or cash based upon the achievement of Performance Targets over the applicable Performance Period. At the sole discretion of the Committee, Performance Units shall be settled through the delivery of Shares or cash, or a combination of cash and Shares, with a value equal to the Fair Market Value of the underlying Shares as of the last day of the applicable Performance Period.

11. Other Awards

The Committee shall have the authority to specify the terms and provisions of other forms of equity-based or equity-related Awards not described above that the Committee determines to be consistent with the purpose of the Plan and the interests of the Company, which Awards may provide for cash payments based in whole or in part on the value or future value of Shares, for the acquisition or future acquisition of Shares, or any combination thereof.

12. Certain Restrictions

(a) Transfers. No Award shall be transferable other than pursuant to a beneficiary designation under Section 12(c), by last will and testament or by the laws of descent and distribution or, except in the case of an Incentive Stock Option, pursuant to a domestic relations order, as the case may be; *provided, however*, that the Committee may, subject to applicable laws, rules and regulations and such terms and conditions as it shall specify, permit the transfer of an Award, other than an Incentive Stock Option, for no consideration to a Permitted Transferee. Any Award transferred to a Permitted Transferee shall be further transferable only by last will and testament or the laws of descent and distribution or, for no consideration, to another Permitted Transferee of the Participant.

(b) Award Exercisable Only by Participant. During the lifetime of a Participant, an Award shall be exercisable only by the Participant or by a Permitted Transferee to whom such Award has been transferred in accordance with Section 12(a) above. The grant of an Award shall impose no obligation on a Participant to exercise or settle the Award.

(c) Beneficiary Designation. The beneficiary or beneficiaries of the Participant to whom any benefit under the Plan is to be paid in case of his death before he receives any or all of such benefit shall be determined under the Company's Group Life Insurance Plan. A Participant may, from time to time, name any beneficiary or beneficiaries to receive any benefit in case of his death before he receives any or all of such benefit. Each such designation shall revoke all prior designations by the same Participant, including the beneficiary designated under the Company's Group Life Insurance Plan, and will be effective only when filed by the Participant in writing (in such form or manner as may be prescribed by the Committee) with the Company during the Participant's lifetime. In the absence of a valid designation under the Company's Group Life Insurance Plan or otherwise, if no validly designated beneficiary survives the Participant or if each surviving validly designated beneficiary is legally impaired or prohibited from receiving the benefits under an Award, the Participant's beneficiary shall be the Participant's estate.

13. Recapitalization or Reorganization

(a) Authority of the Company and Stockholders. The existence of the Plan, the Award Documents and the Awards granted hereunder shall not affect or restrict in any way the right or power of the Company or the stockholders of the Company to make or authorize any adjustment, recapitalization, reorganization or other change in the Company's capital structure or business, any merger or consolidation of the Company, any issue of stock or of options, warrants or rights to purchase stock or of bonds, debentures, preferred or prior preference stocks whose rights are superior to or affect the Shares or the rights thereof or which are convertible into or exchangeable for Shares, or the dissolution or liquidation of the Company, or any sale or transfer of all or any part of its assets or business, or any other corporate act or proceeding, whether of a similar character or otherwise.

(b) Change in Capitalization. Notwithstanding any provision of the Plan or any Award Document, the number and kind of Shares authorized for issuance under Section 5 of the Plan, including the maximum number of Shares available under the special limits provided for in Section 5(c), may be equitably adjusted in the sole discretion of the Committee in the event of a stock split, reverse stock split, stock dividend, recapitalization, reorganization, partial or complete liquidation, reclassification, merger, consolidation, separation, extraordinary cash dividend, split-up, spin-off, combination, exchange of Shares, warrants or rights offering to purchase Shares at a price substantially below Fair Market Value, or any other corporate event or distribution of stock or property of the Company affecting the Shares in order to preserve, but not increase, the benefits or potential benefits intended to be made available under the Plan. In addition, upon the occurrence of any of the foregoing events, the number and kind of Shares subject to any outstanding Award and the exercise price per Share (or the grant price per Share, as the case may be), if any, under any outstanding Award may be equitably adjusted (including by payment of cash to a Participant) in the sole discretion of the Committee in order to preserve the benefits or potential benefits intended to be made available to Participants. Such adjustments shall be made by the Committee. Unless otherwise determined by the Committee, such adjusted Awards shall be subject to the same restrictions and vesting or settlement schedule to which the underlying Award is subject.

14. Term of the Plan

Unless earlier terminated pursuant to Section 16, the Plan shall terminate on the tenth (10th) anniversary of the Effective Date, except with respect to Awards then outstanding. No Awards may be granted under the Plan after the tenth (10th) anniversary of the Effective Date.

15. Effective Date

The Plan shall become effective on the Effective Date, subject to approval by the stockholders of the Company.

16. Amendment and Termination

Subject to applicable laws, rules and regulations, the Board may at any time terminate or, from time to time, amend, modify or suspend the Plan; *provided, however*, that no termination, amendment, modification or suspension (i) will be effective without the approval of the stockholders of the Company if such approval is required under applicable laws, rules and regulations, including the rules of NASDAQ and (ii) shall materially and adversely alter or impair the rights of a Participant in any Award previously made under the Plan without the consent of the holder thereof. Notwithstanding the foregoing, the Board shall have broad authority to amend the Plan or any Award under the Plan without the consent of a Participant to the extent it deems necessary or desirable (a) to comply with, take into account changes in, or interpretations of, applicable tax laws, securities laws, employment laws, accounting rules and other applicable laws, rules and regulations, (b) to take into account unusual or nonrecurring events or market conditions (including, without limitation, the events described in Section 13(b)), or (c) to take into account significant acquisitions or dispositions of assets or other property by the Company.

17. Miscellaneous

(a) Tax Withholding. The Company or a Subsidiary, as appropriate, may require any individual entitled to receive a payment of an Award to remit to the Company, prior to payment, an amount sufficient to satisfy any applicable tax withholding requirements. In the case of an Award payable in Shares, the Company or a Subsidiary, as appropriate, may permit or require a Participant to satisfy, in whole or in part, such obligation to remit taxes by directing the Company to withhold shares that would otherwise be received by such individual or to repurchase shares that were issued to the Participant to satisfy the minimum statutory withholding rates for any applicable tax withholding purposes, in accordance with all applicable laws and pursuant to such rules as the Committee may establish from time to time. The Company or a Subsidiary, as appropriate, shall also have the right to deduct from all cash payments made to a Participant (whether or not such payment is made in connection with an Award) any applicable taxes required to be withheld with respect to such payments.

(b) No Right to Awards or Employment. No person shall have any claim or right to receive Awards under the Plan. Neither the Plan, the grant of Awards under the Plan nor any action taken or omitted to be taken under the Plan shall be deemed to create or confer on any Eligible Individual any right to be retained in the employ of the Company or any Subsidiary or other affiliate thereof, or to interfere with or to limit in any way the right of the Company or any Subsidiary or other affiliate thereof to terminate the employment of such Eligible Individual at any time. No Award shall constitute salary, recurrent compensation or contractual compensation for the year of grant, any later year or any other period of time. Payments received by a Participant under any Award made pursuant to the Plan shall not be included in, nor have any effect on, the determination of employment-related rights or benefits under any other employee benefit plan or similar arrangement provided by the Company and the Subsidiaries, unless otherwise specifically provided for under the terms of such plan or arrangement or by the Committee.

(c) Securities Law Restrictions. An Award may not be exercised or settled, and no Shares may be issued in connection with an Award, unless the issuance of such shares (i) has been registered under the Securities Act of 1933, as amended, (ii) has qualified under applicable state “blue sky” laws (or the Company has determined that an exemption from registration and from qualification under such state “blue sky” laws is available) and (iii) complies with all applicable foreign securities laws. The Committee may require each Participant purchasing or acquiring Shares pursuant to an Award under the Plan to represent to and agree with the Company in writing that such Eligible Individual is acquiring the Shares for investment purposes and not with a view to the distribution thereof. All certificates for Shares delivered under the Plan shall be subject to such stock-transfer orders and other restrictions as the Committee may deem advisable under the rules, regulations, and other requirements of the Securities and Exchange Commission, any exchange upon which the Shares are then listed, and any applicable securities law, and the Committee may cause a legend or legends to be put on any such certificates to make appropriate reference to such restrictions.

(d) Section 162(m) of the Code. The Plan is intended to comply in all respects with Section 162(m) of the Code; *provided, however*, that in the event the Committee determines that compliance with Section 162(m) of the Code is not desired with respect to a particular Award, compliance with Section 162(m) of the Code will not be required. In addition, if any provision of this Plan would cause Awards that are intended to constitute “qualified performance-based compensation” under Section 162(m) of the Code, to fail to so qualify, that provision shall be severed from, and shall be deemed not to be a part of, the Plan, but the other provisions hereof shall remain in full force and effect.

(e) Section 409A of the Code. Notwithstanding any contrary provision in the Plan or an Award Document, if any provision of the Plan or an Award Document contravenes any regulations or guidance promulgated under Section 409A of the Code or would cause an Award to be subject to additional taxes, accelerated taxation, interest and/or penalties under Section 409A of the Code, such provision of the Plan or Award Document may be modified by the Committee without consent of the Participant in any manner the Committee deems reasonable or necessary. In making such modifications the Committee shall attempt, but shall not be obligated, to maintain, to the maximum extent practicable, the original intent of the applicable provision without contravening the provisions of Section 409A of the Code. Moreover, any discretionary authority that the Committee may have pursuant to the Plan shall not be applicable to an Award that is subject to Section 409A of the Code to the extent such discretionary authority would contravene Section 409A of the Code or the guidance promulgated thereunder.

(f) Awards to Individuals Subject to Laws of a Jurisdiction Outside of the United States. To the extent that Awards under the Plan are awarded to Eligible Individuals who are domiciled or resident outside of the United States or to persons who are domiciled or resident in the United States but who are subject to the tax laws of a jurisdiction outside of the United States, the Committee may adjust the terms of the Awards granted hereunder to such person (i) to comply with the laws, rules and regulations of such jurisdiction and (ii) to permit the grant of the Award not to be a taxable event to the Participant. The authority granted under the previous sentence shall include the discretion for the Committee to adopt, on behalf of the Company, one or more sub-plans applicable to separate classes of Eligible Individuals who are subject to the laws of jurisdictions outside of the United States.

(g) Satisfaction of Obligations. Subject to applicable law, the Company may apply any cash, Shares, securities or other consideration received upon exercise or settlement of an Award to any obligations a Participant owes to the Company and the Subsidiaries in connection with the Plan or otherwise, including, without limitation, any tax obligations or obligations under a currency facility established in connection with the Plan.

(h) No Limitation on Corporate Actions. Nothing contained in the Plan shall be construed to prevent the Company or any Subsidiary from taking any corporate action, whether or not such action would have an adverse effect on any Awards made under the Plan. No Participant, beneficiary or other person shall have any claim against the Company or any Subsidiary as a result of any such action.

(i) Unfunded Plan. The Plan is intended to constitute an unfunded plan for incentive compensation. Prior to the issuance of Shares, cash or other form of payment in connection with an Award, nothing contained herein shall give any Participant any rights that are greater than those of a general unsecured creditor of the Company. The Committee may, but is not obligated, to authorize the creation of trusts or other arrangements to meet the obligations created under the Plan to deliver Shares with respect to awards hereunder.

(j) Successors. All obligations of the Company under the Plan with respect to Awards granted hereunder shall be binding on any successor to the Company, whether the existence of such successor is the result of a direct or indirect purchase, merger, consolidation, or otherwise, of all or substantially all of the business and/or assets of the Company.

(k) Application of Funds. The proceeds received by the Company from the sale of Shares pursuant to Awards will be used for general corporate purposes.

(l) Award Document. In the event of any conflict or inconsistency between the Plan and any Award Document, the Plan shall govern and the Award Document shall be interpreted to minimize or eliminate any such conflict or inconsistency.

(m) Headings. The headings of Sections herein are included solely for convenience of reference and shall not affect the meaning of any of the provisions of the Plan.

(n) Severability. If any provision of this Plan is held unenforceable, the remainder of the Plan shall continue in full force and effect without regard to such unenforceable provision and shall be applied as though the unenforceable provision were not contained in the Plan.

(o) Expenses. The costs and expenses of administering the Plan shall be borne by the Company.

(p) Arbitration. Any dispute, controversy or claim arising out of or relating to the Plan that cannot be resolved by the Participant on the one hand, and the Company on the other, shall be submitted to arbitration in the State of Connecticut under the National Rules for the Resolution of Employment Disputes of the American Arbitration Association; *provided, however*, that any such submission by the Participant must be made within one (1) year of the date of the events giving rise to such dispute, controversy or claim. The determination of the arbitrator shall be conclusive and binding on the Company and the Participant, and judgment may be entered on the arbitrator's award in any court having jurisdiction. The expenses of such arbitration shall be borne by the Company; *provided, however*, that each party shall bear its own legal expenses unless the Participant is the prevailing party, in which case the Company shall promptly pay or reimburse the Participant for the reasonable legal fees and expenses incurred by the Participant in connection with such contest or dispute (excluding any fees payable pursuant to a contingency fee arrangement).

(q) Governing Law. Except as to matters of federal law, the Plan and all actions taken thereunder shall be governed by and construed in accordance with the laws of the State of Connecticut.

EMPLOYMENT AGREEMENT

THIS EMPLOYMENT AGREEMENT (this "Agreement") is entered into as of September 10, 2007 by and between Photronics, Inc., a Connecticut corporation (the "Company"), having a principal place of business at 15 Secor Road, Brookfield, CT 06804 and Christopher Proglar ("Executive") residing at 5901 Woodward Drive, Plano, Texas 75093.

WITNESSETH:

WHEREAS, the Company and Executive desire to enter into this Agreement to assure the Company of the continuing service of Executive and to set forth the terms and conditions of Executive's employment with the Company.

NOW, THEREFORE, in consideration of the mutual promises and covenants set forth herein, the parties agree as follows:

1. Term. The Company agrees to employ Executive and Executive hereby accepts such employment, in accordance with the terms of this Agreement. Subject to Section 5, the term of Executive's employment shall commence on the date hereof and continue for three (3) years thereafter unless this Agreement is earlier terminated as provided herein (the "Term"); provided, however, that unless the Company gives written notice to Executive at least thirty (30) days prior to the end of the Term of this Agreement (as the Term may be extended pursuant to this Section 1), on each anniversary of the date hereof, the Term of this Agreement shall automatically be extended for an additional one (1) year period.

2. Services. So long as this Agreement shall continue in effect, Executive shall devote Executive's full business time, energy and ability to the business, affairs and interests of the Company and its subsidiaries and matters related thereto. Executive shall use his best efforts and abilities to promote the Company's interests and shall perform faithfully the services contemplated by this Agreement in accordance with the Company's policies as established by the Board of Directors of the Company.

3. Duties and Responsibilities.

(a) Executive shall serve as the Vice President and Chief Technology Officer of the Company. In the performance of Executive's duties, Executive shall report directly to the CEO or as otherwise directed by the CEO or the Company's Board of Directors, and shall have such duties, responsibilities and authority as may from time to time be assigned to the Executive by the CEO or the Company's Board of Directors.

(b) In addition, Executive agrees to observe and comply with the policies, rules and regulations of the Company. The Company agrees that the duties which may be assigned to Executive shall be the customary duties of the office of Vice President and Chief Technology Officer and shall not be inconsistent with the provisions of the charter documents of the Company or applicable law.

4. Compensation.

(a) Base Compensation. During the Term, the Company agrees to pay Executive a base salary at the rate of \$242,999.90 per year payable in accordance with the Company's customary payroll practices generally applicable to similarly situated employees as may be in effect from time to time (the "Base Salary"). All payments required hereunder, including the payments required by this Section 4(a), may be allocated by the Company to one or more of its subsidiaries to which Executive renders services but the Company shall remain responsible for all payments hereunder and Executive shall have no obligation to seek payment from such subsidiaries.

(b) Periodic Review. The Compensation Committee or the Board of Directors of the Company shall review Executive's Base Salary and Benefits (as defined below) from time to time in accordance with the normal business practices of the Company. The Company may in its sole discretion increase the Base Salary during the Term. The amount of any increase combined with the previous year's Base Salary shall then constitute Executive's Base Salary for purposes of this Agreement.

(c) Additional Benefits. During the Term, the Executive shall be entitled to participate in the employee benefit plans and arrangements as the Company may establish from time to time in which other employees similarly situated are entitled to participate (which may include, without limitation, bonus plan(s), medical plan, dental plan, disability plan, basic life insurance and business travel accident insurance plan, 401(k) plan, stock option or stock purchase plans or any successor plans thereto (the "Benefits")). The Company shall have the right to terminate or change any such plans or programs at any time.

(d) Automobile Allowance. During the Term of this Agreement, the Company shall provide the Executive with an automobile allowance or company car consistent with the Company's policies and provisions applicable to other similarly situated executives of the Company.

(e) Vacation. During the Term of this Agreement, Executive shall be entitled to four (4) weeks' paid vacation per calendar year, which shall not be transferable to any subsequent year.

5. Termination. This Agreement and all rights and obligations hereunder, except the rights and obligations contained in this Section 5, Section 7 (Confidential Information), Section 8 (Non-Competition), Section 9 (Intellectual Property) and Section 10 (Remedies), which shall survive any termination hereunder, shall terminate upon the earliest to occur of any of the following:

(a) Resignation without Good Reason; Retirement. Upon the resignation by Executive without Good Reason (as defined below) following at least thirty (30) days written notice to the Company or retirement from the Company in accordance with the normal retirement policies of the Company, Executive shall be entitled to receive a payment in the amount of the sum of (A) Executive's Base Salary through the last day of employment to the extent not theretofore paid, (B) any compensation previously deferred by Executive (together with any accrued interest or earnings thereon), and (C) any accrued vacation pay according to Company U.S. Vacation Policy, in each case to the extent not theretofore paid (the sum of the amounts described in clauses (A), (B) and (C) shall be hereinafter referred to as the "Accrued Obligations"), in a lump sum, subject to statutory deductions and withholdings, in cash within ten (10) business days after the last day of employment or any earlier time required by applicable law.

(b) Death or Disability of Executive.

(i) If Executive's employment is terminated by reason of Executive's death or disability, this Agreement shall terminate without further obligations to Executive (or Executive's heirs or legal representatives) under this Agreement, other than for:

(1) Payment of any Accrued Obligations, which shall be paid to Executive or Executive's estate or beneficiary, as applicable, in a lump sum, subject to statutory deductions and withholdings, in cash within ten (10) business days after the date of termination or any earlier time required by applicable law.

(2) Payment to Executive or Executive's estate or beneficiary, as applicable, of any amount accrued pursuant to the terms of any other applicable benefit plan.

(ii) If Executive shall become disabled, Executive's employment may be terminated only by written notice from the Company to Executive.

(iii) For the purposes of this Agreement, "disability" or "disabled" shall mean a mental or physical incapacity which prevents Executive from performing Executive's duties with the Company for a period of three hundred sixty (360) consecutive calendar days, as certified by a physician selected by the Company or its insurers.

(c) Termination for Cause.

(i) The Company may terminate Executive's employment and all of Executive's rights to receive Base Salary, and any Benefits hereunder for Cause.

(ii) Upon such termination for Cause, Executive shall be entitled to receive any Accrued Obligations, which shall be paid to Executive in a lump sum, subject to statutory deductions and withholdings, in cash within ten (10) business days after the date of termination or any earlier time required by applicable law.

(iii) For purposes of this Agreement, the term "Cause" shall be defined as any of the following:

(1) Executive's material breach of any of any obligations under this Agreement (other than by reason of physical or mental illness, injury, or condition);

(2) Executive's conviction by, or entry of a plea of "guilty" or "nolo contendere" in a court of competent and final jurisdiction for any felony that impairs his ability to perform his duties to the Company or any crime of moral turpitude;

(3) Executive's commission of an act of fraud upon the Company;

(4) Executive's engaging in willful or reckless misconduct or gross negligence in connection with any property or activity of the Company or its Affiliates;

(5) Executive's repeated and intemperate use of alcohol or illegal drugs after written notice from the Board or Directors;

(6) Executive's material breach of any other material obligation to the Company (other than by reason of physical or mental illness, injury, or condition) that is or could reasonably be expected to result in material harm to the Company;

(7) Executive's becoming insolvent or filing for bankruptcy;

(8) Executive's becoming barred or prohibited by the SEC from holding my position with the Company; or

(9) Executive's violation of any duty of loyalty (i.e., engaging in self-interested transactions, misappropriation of business opportunities that belong to the Company, or a breach of Executive's fiduciary duties to the Company).

(d) Termination Without Cause; Resignation For Good Reason.

(i) Notwithstanding any other provision of this Section 5, (i) the Company may, at its option and at any time, provide to Executive: (A) up to twelve (12) months' advance written notice of termination of employment without Cause, or (B) written notice of a current material adverse change in the Executive's position (such notice in (A) or (B) being referred to herein as a "Working Notice"). If the Company issues a Working Notice to the Executive, any entitlement to a Severance Payment and Benefit Period (as defined below) shall be reduced in proportion to the period covered by the Working Notice. During the period covered by the Working Notice, the Executive shall continue to provide the services according to Section 2, hereof as an employee of the Company. If the Executive resigns during the period covered by the Working Notice, then Executive shall receive only the Accrued Obligations through the date of termination. Executive, upon thirty (30) days advance notice to the Company, shall have the right to resign for Good Reason.

(ii) If Executive is so terminated without Cause or resigns for Good Reason, Executive shall receive from the Company:

(1) Any Accrued Obligations through the date of termination, which shall be paid to Executive in a lump sum, subject to statutory deductions and withholdings, in cash within ten (10) business days after the date of termination or any earlier time required by applicable law.

(2) A payment ("Severance Payment") equal to twelve (12) months of Executive's current Base Salary. The Severance Payment shall be paid by the Company to Executive in equal installments, following the expiration of the Revocation Period defined in the Release referred to in Section 5(d)(iv), in accordance with the Company's customary payroll practices generally applicable to similarly situated employees as may be in effect from time and shall be subject to statutory deductions and withholdings.

(3) Payment of Executive's COBRA premiums for the 360-day period following termination of employment ("Benefit Period"), provided Executive elects to receive COBRA continuation coverage and is eligible for COBRA continuation coverage.

(iii) As used in this Agreement, the term "Good Reason" shall mean (i) (except as set forth in Section 5(e)) the relocation of the Company's principal executive offices to a location outside the contiguous 48 United States without the consent of Executive or (ii) a material diminution in Executive's overall employee benefits not the result of changes in benefit plans affecting other employees, without the consent of Executive.

(iv) As a condition to receiving the payment and benefits extension contemplated by Section 5(d) or 5(e), Executive agrees to execute and deliver to the Company the Release substantially in the form attached to this Agreement as Exhibit A.

(e) Change of Control.

(i) For purposes of the Agreement, a "change of control" means, and shall be deemed to have taken place, if;

(1) any individual, partnership, firm, corporation, association, trust, unincorporated organization or other entity or person, or any syndicate or group deemed to be a person under Section 14 (d) (2) of the Exchange Act, is or becomes the "beneficial owner" (as defined in Rule 13d-3 of the General Rules and Regulations under the Exchange Act), directly or indirectly, of securities of the Company representing 50% or more of the combined voting power of the Company's then outstanding securities entitled to vote in the election of directors of the Company;

(2) during any period of two (2) consecutive years (not including any period prior to the execution of this Agreement) individuals who at the beginning of such period constituted the Board and any new directors, whose election by the Board or nomination for election by the Company's shareholders was approved by a vote of at least three-fourths (3/4ths) of the directors then still in office who either were directors at the beginning of the period or whose election or nomination for election was previously so approved, cease for any reason to constitute a majority of the Board;

(3) there occurs a reorganization, merger, consolidation or other corporate transaction involving the Company (a "Transaction"), and shareholders of the Company immediately prior to such Transaction do not, immediately after the Transaction, own more than 50% of the combined voting power of the Company or other corporation resulting from such Transaction; or

(4) there is a "change in control" of the Company within the meaning of Section 280G of the U.S. Federal internal revenue code of 1986.

(iii) If during the period three (3) months before or two (2) years following a "change in control" of the Company (or any successor), the Executive is terminated by the Company for any reason (other than for Cause as defined in Section 5(c) thereof), including an election by the Company or its successor not to extend this Agreement pursuant to Section 1, or the Executive resigns for Good Reason as defined in Section 5(e)(ii)), "Executive shall be entitled to receive a cash payment equal to eighteen (18) months of Executive's current Base Salary and the benefits described in Section 5(d)(ii) of the Agreement. Upon such "change of control" during the Term, the Term of this Agreement shall automatically be the period equal to the longer of (i) two (2) years from the date of the "change of control" or (ii) the remaining period of the initial three (3) year Term after the "change of control". In no event shall Executive be entitled to receive both the Severance Payment described in Section 5(d) hereof and the "change of control" payment described in this Section 5(e).

(iv) Any payments to be made to Executive in connection with this Section 5(e) shall be made in a lump sum, subject to statutory deductions and withholdings, in cash within ten (10) business days after the date of termination or any earlier time required by applicable law, following the expiration of the Revocation Period defined in the Release referred to in Section 5(d)(iv).

(f) Tax Consideration.

(i) In the event that the aggregate of all payments or benefits made or provided to the Executive under this Agreement and under all other plans and programs of the Company (the "Aggregate Payment") is determined to constitute a Parachute Payment, as such term is defined in Section 280G(b)(2) of the Internal Revenue Code of 1986, as amended (the "Code"), the Company shall pay to the Executive an additional amount (the "Gross-Up Amount"), prior to the time any excise tax ("Excise Tax") is imposed by Section 4999 of the Code is payable with respect to such Aggregate Payment, which, after the imposition of all excise, federal, state and local income taxes, enables the Executive to retain a total amount equal to the Aggregate Payment prior to the payment of the Gross-Up Amount. Notwithstanding the foregoing, if it shall be determined that the Executive is entitled to receive the Gross-Up Amount, but the portion of the Aggregate Payment that would be treated as a Parachute Payment does not exceed 125% of the greatest amount that could be paid to the Executive such that the receipt of the Aggregate Payment would not give rise to any Excise Tax (the "Safe Harbor Amount"), then no Gross-Up Amount shall be paid to the Executive and the Aggregate Payment shall be reduced to the Safe Harbor Amount.

(ii) All determinations required to be made under this Section 5(f), including whether the Aggregate Payment constitutes a Parachute Payment, the amount of the Gross-Up Amount to be paid to the Executive, if any, and the determination of the Safe Harbor Amount, if applicable, shall be made in good faith by the by the Company's regular outside auditors (the "Accounting Firm"); provided, however, that such Accounting Firm presents its rationale and supporting calculations to the Executive upon his request and shall in good faith work to resolve any discrepancies raised by accountants or lawyers chosen by the Executive who present reasonable critiques of the determination. If a dispute over the methodology or conclusions of the Accounting Firm cannot be resolved between the parties, an impartial accounting firm shall be consulted to resolve the dispute. All fees and expenses of the Accounting Firm incurred in connection with the retention of the Accounting Firm pursuant to this Section 5(f) shall be borne by the Company. All fees and expenses of the accountants and lawyers chosen by the Executive and, if retained, the additional accounting firm, incurred in connection with the resolution of any disputes pursuant to this Section 5(f) shall be borne by the non-prevailing party.

(iii) As a result of uncertainty in the application of Sections 280G and 4999 of the Code at the time of the determination by the Accounting Firm, the parties hereto acknowledge and agree that it is possible that the Company will have paid a Gross-Up Amount that exceeds the amount that the Company should have paid pursuant to this Section 5(f) (the "Overpayment") or that the Company will have paid a Gross-Up Amount that is less than the amount that the Company should have paid pursuant to this Section 5(f) (the "Underpayment"). In the event the Accounting Firm, in a written opinion delivered to the Company and to the Executive, determines that, based upon the assertion of a deficiency by the Internal Revenue Service against the Executive, which the Accounting Firm believes has a high probability of success, an Overpayment has been made, then any such Overpayment shall, to the extent permitted under applicable law (including Section 402 of the Sarbanes-Oxley Act of 2002), be treated for all purposes as a loan to the Executive which the Executive shall promptly repay to the Company together with interest at the Applicable Federal Rate provided for in Section 7872(f)(2) of the Code; provided, however, the Executive may contest any such determination by the Accounting Firm at his own expense. In the event the Accounting Firm, based upon controlling precedent or other substantial authority, determines that an Underpayment has occurred, any such Underpayment shall be promptly paid by the Company to or for the benefit of the Executive together with interest at the Applicable Federal Rate provided for in Section 7872(f)(2) of the Code.

(g) Treatment of Stock Options Upon Change of Control or a Termination.

(i) All stock options or similar rights granted to Executive pursuant to the Company's stock option plans including, without limitation, any restricted stock shall immediately vest as of the effective date of such "change of control".

(ii) If this Agreement is terminated pursuant to clause (c) of this Section 5 or if Executive resigns his employment, all unvested stock options granted to Executive pursuant to the Company's stock plans shall terminate immediately.

To the extent that the Executive has been granted stock options intended to be incentive stock options under Section 422 of the Internal Revenue Code, such stock options shall cease to be incentive stock options and shall be treated as nonqualified stock options if the options are exercised by the Employee more than three (3) months (one year in case of death or disability as defined in Section 422 of the Internal Revenue Code) following termination of employment.

Except as expressly modified by this clause (g) of this Section 5, all stock options and similar rights granted under the Company's stock plans shall remain subject to all of the terms and conditions of the applicable stock plans and agreements evidencing the grants thereof.

(h) Exclusive Remedy. Executive agrees that the payments other benefits provided and contemplated by this Agreement shall constitute the sole and exclusive obligation of the Company in respect of Executive's employment with and relationship to the Company and that the full payment thereof shall be the sole and exclusive remedy for any termination of Executive's employment. Executive covenants not to assert or pursue any other remedies, at law or in equity, with respect to any termination of employment.

6. Business Expenses. During the Term of this Agreement, to the extent that such expenditures satisfy the criteria under the Internal Revenue Code or other applicable laws for deductibility by the Company (whether or not fully deductible by the Company) for federal income tax purposes as ordinary and necessary business expenses, the Company shall provide the Executive with reimbursement of reasonable business expenses incurred by the Executive while conducting Company business in a manner consistent with the Company's policies and provisions applicable to the Executives of the Company.

7. Confidential Information.

(a) Executive acknowledges that the nature of Executive's employment by the Company is such that Executive shall have access to information of a confidential and/or trade secret nature which has great value to the Company and which constitutes a substantial basis and foundation upon which the business of the Company is based. Such information includes (A) trade secrets, inventions, mask works, ideas, processes, manufacturing, formulas, source and object codes, data, programs, other works of authorship, know-how, improvements, discoveries, developments or experimental work, designs, and techniques; (B) information regarding plans for research, development, new products, marketing and selling, business plans, budgets and unpublished financial statements, licenses, prices and costs, suppliers and customers; (C) information regarding the skills and compensation of other employees the Company or its affiliates, including but not limited to, their respective business plans or clients (including, without limitation, customer lists and lists of customer sources), or information relating to the products, services, customers, sales or business affairs of the Company or its Affiliates (the "Confidential Information").

(b) Executive shall keep all such Confidential Information in confidence during the Term of this Agreement and at any time thereafter and shall not disclose any of such Confidential Information to any other person, except to the extent such disclosure is (i) necessary to the performance of this Agreement and in furtherance of the Company's best interests, (ii) required by applicable law, (iii) publicly known within the relevant industry, or (iv) authorized in writing by the Board. Upon termination of Executive's employment with the Company, Executive shall deliver to the Company all documents, records, notebooks, work papers, and all similar material containing any of the foregoing information, whether prepared by Executive, the Company or anyone else.

8. Non-Competition. Executive covenants and agrees that commencing on the date hereof and continuing for the entire Term of Executive's employment and for period of twelve (12) months thereafter (the "Restricted Period"), Executive shall not:

(a) Work or be affiliated with in any capacity (including as a founder, employee, owner, consultant, or otherwise), directly or indirectly, for himself or on behalf of any other entity, in any business that manufactures photomasks or that is otherwise competitive with the business of the Company or any subsidiary of the Company at any time during Executive's employment or during the Restricted Period, such as, for example and not as a limitation, Toppan, DNP and the photomask manufacturing operations of semiconductor manufacturers such as IBM and TSMC.

(b) Solicit, attempt to solicit, or assist others in soliciting or attempting to solicit, directly or indirectly, any business related to the business of the Company from any customers or prospective customers of the Company; for the purposes of this Section 8, the term "customer" means any entity or person who is or has been a client or customer of the Company during the time which Executive was employed with the Company, and the term "prospective customer" means a person or entity who became known to the Company during the time which Executive was employed with the Company as a result of that person's or entity's interest in obtaining the services or products of the Company; and

(c) Solicit, attempt to solicit, or assist others in soliciting or attempting to solicit, directly or indirectly, for employment or similar capacity, any person who is an employee of, or an independent contractor for, the Company or its direct or indirect subsidiaries, parents or Affiliates or who was such an employee within twelve (12) months prior to the date of such solicitation or attempted solicitation.

(d) Executive acknowledges that in the event of his employment with the Company terminates for any reason, Executive will be able to earn a livelihood without violating the foregoing restrictions.

(e) If any provision or clause, or portion thereof, within this Section 8 shall be held by any court or other tribunal of competent jurisdiction to be illegal, invalid, or unenforceable in such jurisdiction, the remainder of such provision shall not be thereby affected and shall be given full effect, without regard to the invalid portion. It is the intention of the parties that, if any court construes any provision or clause within this Section 8, or any portion thereof, to be illegal, void or unenforceable because of the duration of such provision or the geographic area or matter covered thereby, such court shall reduce the duration, area, or matter of such provision, and, in its reduced form, such provision shall then be enforceable and shall be enforced.

9. Intellectual Property.

(a) Executive has no interest (except as disclosed to the Company) in any inventions, designs, improvements, patents, copyrights and discoveries which are useful in or directly or indirectly related to the business of the Company or to any experimental work carried on by the Company. Except as may be limited by applicable law, all inventions, designs, improvements, patents, copyrights and discoveries conceived by Executive during the Term of this Agreement which are useful in or directly or indirectly related to the business of the Company or to any experimental work carried on by the Company, shall be the property of the Company. Executive will promptly and fully disclose to the Company all such inventions, designs, improvements, patents, copyrights and discoveries (whether developed individually or with other persons) and will take all steps necessary and reasonably required to assure the Company's ownership thereof and to assist the Company in protecting or defending the Company's proprietary rights therein.

(b) Executive also agrees to assist the Company in obtaining United States or foreign letters patent and copyright registrations covering inventions assigned hereunder to the Company and that Executive's obligation to assist the Company shall continue beyond the termination of Executive's employment but the Company shall compensate Executive at a reasonable rate for time actually spent by Executive at the Company's request with respect to such assistance. If the Company is unable because of Executive's mental or physical incapacity (for the period of such incapacity only) or for any other reason to secure Executive's signature to apply for or to pursue any application for any United States or foreign letters patent or copyright registrations covering inventions assigned to the Company (after reasonable efforts to contact employee), then Executive hereby irrevocably designates and appoints the Company, each of its duly authorized officers and agents as Executive's agent and attorney-in-fact to act for and in Executive's behalf and stead to execute and file any such applications and to do all other lawfully permitted acts to further the prosecution and issuance of letters patent or copyright registrations thereon with the same legal force and effect as if executed by Executive. Executive will perform all other lawful acts necessary to assist the Company to enforce any copyrights or patents obtained including, without limitation, testifying in any suit or proceeding involving any of the copyrights or patents or executing any documents deemed necessary by the Company, all without further consideration but at the expense of the Company. If Executive is called upon to render such assistance after the termination of Executive's employment, then Executive shall be entitled to a fair and reasonable per diem fee in addition to reimbursement of any expenses incurred at the request of the Company.

10. Remedies. The parties hereto agree that the services to be rendered by Executive pursuant to this Agreement, and the rights and privileges granted to the Company pursuant to this Agreement, are of a special, unique, extraordinary and intellectual character, which gives them a peculiar value, the loss of which cannot be reasonably or adequately compensated in damages in any action at law, and that a breach by Executive of any of the terms of this Agreement will cause the Company great and irreparable injury and damage. Executive hereby expressly agrees that the Company shall be entitled to the remedies of injunction, specific performance and other equitable relief to prevent a breach of this Agreement by Executive. This Section 10 shall not be construed as a waiver of any other rights or remedies which the Company may have for damages or otherwise.

11. Return of Property. Executive agrees to return, on or before his last day of employment, all property belonging to the Company, including but not limited to computers, PDA, telephone and other credit cards, Company business records, Company automobile (if applicable), etc.

12. Severability. If any provision of this Agreement is held to be unenforceable for any reason, it shall be adjusted rather than voided, if possible, to achieve the intent of the parties to the extent possible. In any event, all other provisions of this Agreement shall be deemed valid and enforceable to the extent possible.

13. Succession. This Agreement shall inure to the benefit of and be binding upon the Company and its successors and assigns and any such successor or assignee shall be deemed substituted for the Company under the terms of this Agreement for all purposes. As used herein, "successor" and "assignee" shall include any person, firm, corporation or other business entity which at any time, whether by purchase, merger or otherwise, directly or indirectly acquires the stock of the Company or to which the Company assigns this Agreement by operation of law or otherwise. The obligations and duties of Executive hereunder are personal and otherwise not assignable. Executive's obligations and representations under this Agreement will survive the termination of Executive's employment, regardless of the manner of such termination.

14. Notices. Any notice or other communication provided for in this Agreement shall be in writing and sent if to the Company to its principal office at:

Photronics, Inc.
15 Secor Road, PO Box 5226
Brookfield, Connecticut 06804

Attention: Chief Executive Officer
With a copy to the Vice President, Chief Financial Officer of Photronics, Inc.

or at such other address as the Company may from time to time in writing designate, and if to Executive at the address set forth above or at such address as Executive may from time to time in writing designate. Each such notice or other communication shall be effective (i) if given by written telecommunication, three (3) days after its transmission to the applicable number so specified in (or pursuant to) this Section 14 and a verification of receipt is received, (ii) if given by certified mail, once verification of receipt is received, or (iii) if given by any other means, when actually delivered to the addressee at such address and verification of receipt is received.

15. Adequate Consideration. Executive acknowledges that the cash severance and other benefits to be provided by the Company to Executive are not available under any current plan or policies of the Company. Accordingly, Executive further acknowledges that the payments and benefits under this Agreement provide adequate consideration for Executive's obligations to the Company contained in Section 7 (Confidential Information), Section 8 (Non-Competition), Section 10 (Remedies) and Exhibit A (Release).

16. Entire Agreement. This Agreement contains the entire agreement of the parties relating to the subject matter hereof and supersedes any prior agreements, undertakings, commitments and practices relating to Executive's employment by the Company.

17. Amendments. No amendment or modification of the terms of this Agreement shall be valid unless made in writing, duly executed by both parties.

18. Waiver. No failure on the part of any party to exercise or delay in exercising any right hereunder shall be deemed a waiver thereof or of any other right, nor shall any single or partial exercise preclude any further or other exercise of such right or any other right.

19. Governing Law. This Agreement, and the legal relations between the parties, shall be governed by and construed in accordance with the laws of the State of Connecticut without regard to conflicts of law doctrines and any court action arising out of this Agreement shall be brought in any court of competent jurisdiction within the State of Connecticut.

20. Withholding. All compensation payable hereunder, including salary and other benefits, shall be subject to applicable taxes, withholding and other required, normal or elected employee deductions.

21. Counterparts. This Agreement and any amendment hereto may be executed in one or more counterparts. All of such counterparts shall constitute one and the same agreement and shall become effective when a copy signed by each party has been delivered to the other party.

22. Headings. Section and other headings contained in this Agreement are for convenience of reference only and shall not affect in any way the meaning or interpretation of this Agreement.

IN WITNESS WHEREOF, the parties have executed this Agreement as of the date and year first above written.

THE COMPANY

PHOTRONICS, INC.

By: /s/ Edwin L. Lewis

Name: Edwin L. Lewis

Title: Senior Vice President, General Counsel and Secretary

EXECUTIVE

/s/ Christopher Progler

Name: Christopher Progler

Address: 5901 Woodwind Drive, Plano, Texas 75093

EXHIBIT A

RELEASE

1. I signed an Employment Agreement with Photronics, Inc. (the "Company"), dated _____ (the "Agreement"), wherein I agreed to the terms applicable to certain terminations of employment with the Company. Pursuant to the terms of the Agreement, I am entitled to certain severance payments and benefits, described in the Agreement, provided that I sign this Release.
2. In consideration of the severance payments described in the Agreement, I, on behalf of myself, my heirs, agents, representatives, predecessors, successors and assigns, hereby irrevocably release, acquit and forever discharge the Company and each of its respective agents, employees, representatives, parents, subsidiaries, divisions, affiliates, officers, directors, shareholders, investors, employees, attorneys, transferors, transferees, predecessors, successors and assigns, jointly and severally (the "Released Parties") of and from any and all debts, suits, claims, actions, causes of action, controversies, demands, rights, damages, losses, expenses, costs, attorneys' fees, compensation, liabilities and obligations whatsoever, suspected or unsuspected, known or unknown, foreseen or unforeseen, arising at any time up to and including the date of this Release, save and except for the parties' obligations and rights under this Release. In recognition of the consideration set forth in the Agreement, I hereby release and forever discharge the Released Parties from any and all claims, actions and causes of action, I have or may have as of the date of this Release arising under any federal, state, or local statute, regulation, ordinance, or law of any kind, including under the Age Discrimination in Employment Act of 1967, as amended, and the applicable rules and regulations promulgated thereunder ("ADEA"), the Connecticut Human Rights and Opportunities Law, the Connecticut Family and Medical Leave Law, and the Connecticut Age Discrimination and Employee Insurance Benefits Law, and including claims for wrongful discharge, breach of contract, or in tort.
3. I agree not to criticize, denigrate, or otherwise disparage the Company or any other Released Party.
4. This Release is not an admission of guilt or wrongdoing by either me or the Company. This Release constitutes the entire agreement between me and the Company with respect to the subject matter hereof, and I am not signing this Release in reliance on any representation not expressly set forth herein. No provisions of this Release may be modified, waived, amended or discharged except by a written document signed by me and a duly authorized Company representative. This Release binds my heirs, administrators, representatives, executors, successors, and assigns, and will inure to the benefit of all Released Parties and their respective heirs, administrators, representatives, executors, successors, and assigns. The invalidity or unenforceability of any provision of this Release shall not affect the validity or enforceability of any other provision of this Release, which shall remain in full force and effect. A waiver of any conditions or provisions of this Release in a given instance shall not be deemed a waiver of such conditions or provisions at any other time. If any of the provisions, terms or clauses of this Release are declared illegal, unenforceable or ineffective in a legal forum, those provisions, terms and clauses shall be deemed severable, such that all other provisions, terms and clauses of this Release shall remain valid and binding upon both parties. If any of the provisions, terms or clauses of this Release are found by a court to be overly broad, those provisions, terms and clauses shall be enforceable (and modified and enforced) to the broadest extent permissible under the law. The validity, interpretation, construction, and performance of this Release shall be governed by the internal laws of the State of Connecticut (excluding any that mandate the use of another jurisdiction's laws)
5. All payments to me under this Release shall be net of applicable withholdings and deductions.
6. The Company advised me to take this Release home, read it, and carefully consider all of its terms before signing it. The Company gave me at least 21 days in which to consider this Release, and I waive any right I might have to additional time beyond this consideration period within which to consider this Release. The Company advised me to discuss this Release with my own attorney (at my own expense) during this period if I wished to do so. I understand that I may revoke my acceptance of this Release within seven (7) days after I sign it ("Revocation Period"). I understand that if I revoke my acceptance of this Release, I will not be entitled to any payments or benefits hereunder or otherwise in connection with the termination of my employment with the Company, except as required by law in the absence of the Agreement and this Release. I have carefully read this Release, fully understand what it means, and am entering into it voluntarily.

Print Name

Date

Signature



March 16, 2012

[Name and Address of Executive]

Reference is made to the Employment Agreement entered into on _____ (the "Employment Agreement") between Photronics, Inc. (the "Company") and _____ (the "Executive").

The Company and Executive hereby agree to amend the Employment Agreement by (i) deleting Article 5(f) of the Employment Agreement and (ii) deleting all references to such Article in the Employment Agreement.

Except as amended above all other terms and conditions of the Employment Agreement remain in full force and effect.

Photronics, Inc.

By: _____

Title: _____

Agreed to and Accepted

[Executive]

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**Amended Agreement of
the Investment Agreement (1)**
关于投资协议的补充协议 (1)

XM20160810-01-A1

Parties:

协议各方:

Party A: Xiamen Torch Hi-Tech Industrial Development Zone Management Committee (hereinafter "Party A")

甲方: 厦门火炬高新技术产业开发管理委员会(“甲方”)

Party B: Photronics Singapore Pte, Ltd. (hereinafter "Party B")

乙方: Photronics Singapore Pte, Ltd. (“乙方”)

Party C: DNP Asia Pacific Pte. Ltd. (hereinafter "Party C")

丙方: DNP Asia Pacific Pte. Ltd. (“丙方”)

Party D: Xiamen American Japan Photronics Mask Co., Ltd. (hereinafter "Party D" or the "Project Company")

丁方: 厦门美日丰创光罩有限公司(“丁方”或“项目公司”)

Party A, B, C and D are collectively referred to as the "Parties".

甲方、乙方、丙方、丁方统称为“各方”。

Whereas:

鉴于:

Party A and Party B already signed the Investment Agreement with an agreement number NO. XM20160810-01 (hereinafter the "Investment Agreement"). To enhance the development of the integrated circuit industry, especially the development and expansion of photomask manufacturing for the integrated circuit industry, Party A welcomes Party C to join the Project Company, that Party B already set up in Xiamen. Party A will support Party D to alleviate the current financial difficulty. The Parties agree to amend the Investment Agreement (the "Amended Investment Agreement") as following:

甲方和乙方已签订了编号为 XM20160810-01 的投资协议(“投资协议”)。为促进集成电路产业的发展,特别是为集成电路产业中光罩生产业务的发展和壮大,甲方欢迎丙方加入乙方已在厦门设立的项目公司。甲方将支持丁方缓解当前经济困局。各方同意对投资协议修改如下(“补充协议”):



- I. Subject to the agreements set forth in this Amended Investment Agreement, Party C confirms and acknowledges the content of the above-mentioned Investment Agreement, and promises to be binding by the Investment Agreement as amended hereby. Subject to the agreements set forth in this Amended Investment Agreement, the rights and obligations enjoyed and burdened by Party B in the Investment Agreement are amended effective as of the date of this amendment. Notwithstanding the above, if Party C is no longer a shareholder of Party D, Party C will have no continuing obligation or liability under the Investment Agreement as amended hereby from the date that Party C is no longer a shareholder of Party D.

根据本补充协议之约定，丙方确认并认可前述投资协议的内容，并承诺受该经修订之投资协议的约束。根据本补充协议之约定，乙方在投资协议项下享有的权利和承担的义务自本补充协议生效之日起变更。但如丙方不再为丁方之股东，则丙方自不再为丁方之股东之日起，将不再继续承担该经修订之投资协议项下的义务或责任。

- II. The Parties agree to adjust Article I.a.iii and iv of the Investment Agreement as follows:

"iii. Investment Amount: The Project Company shall make [REDACTED] of investments. The total amount of the first tranche will be [REDACTED] million, which includes a [REDACTED] million registration capital. Party B and Party C will assess the demand from [REDACTED] and other [REDACTED] and subject to the board approval of Party B, C and the shareholders' meeting's approval of Party D, the total investment amount will be increased to [REDACTED] incrementally, and, the registration capital will be increased to [REDACTED] million incrementally."

"iv. Revenues: Party D hereby covenants that it shall generate all its revenues and pay all its taxes within Party A's jurisdiction for all products manufactured by Party D within such jurisdiction, that Party D shall take steps to obtain permits required for the commencement of construction immediately after it is established, that Party D shall complete the construction and commence with production within Three (3) years, and Party D will use reasonable efforts to reach annual production capacity – [REDACTED] Party D's obtaining the industrial land."

[REDACTED]



- III. The Parties agree that all the obligations under Article., I.b.i. and ii., V.b. and VII.b. reference to Party B will solely be obligations of Party D as of and after the effective date of this Amendment. The Parties further agree that, upon execution of this Amendment, Article VII.e. will be deleted.

各方同意投资协议第一条第(二)款之1及2, 第五条第(二)款以及第七条第(二)款中关于乙方应承担的义务自本补充协议生效之日起完全由丁方一方承担。各方进一步同意, 经本次修订, 删去投资协议第七条第五款。

- IV. The Parties agree to amend Article V.a. of the Investment Agreement as follows:

This Agreement is entered into and enforced in accordance with the relevant laws and regulations of the central government, the provincial government, the municipal government and the Hi-Tech Development Zone. To the extent that relevant policies governing this Agreement are amended due to the changes of the laws and/or regulations, the Parties agree to enforce this Agreement as amended accordingly. In the event that any amendment or change to the law causes a significant, material adverse impact on the operation of the Project Company, then Party B and Party C shall be authorized to liquidate and terminate Party D, which termination shall not be treated as a breach of this Agreement in accordance with PRC law; and if Party B and C chose to liquidate the Project Company in such incidence, Party A shall provide reasonable support to Party B, Party C and the Project Company, provided that the above shall be in compliance with the relevant PRC laws and regulations.

各方同意对投资协议第五条第(一)款作如下修改:

本协议根据中央政府、省政府、市政府和高新技术开发区有关法律、法规的规定, 订立并执行。本协议所适用的相关政策因法律和/或法规的变更而发生变化的, 各方同意执行经相应修订后的协议。如法律的任何修订和变更对项目公司的运营造成重大的实质性不利影响, 乙方和丙方有权对丁方进行清算和终止, 该终止依照中华人民共和国法律的规定不被视为对本协议的违反, 但上述清算终止程序应符合中华人民共和国有关法律法规的规定。如乙方和



丙方在此情形下选择对项目公司进行清算，甲方应向乙方、丙方和项目公司提供合理的支持。

- V. The Parties agree to amend V.c. of the Investment Agreement to delete the second sentence and replace it with the following:

For avoidance of doubt, in the event that Party D sustains significant, sustained losses, then Party B and Party C shall be authorized to liquidate and terminate Party D, which termination shall not be treated as a breach of this Agreement in accordance with PRC law, provided that the above shall be in compliance with the relevant PRC laws and regulations.

各方同意将投资协议第五条第（三）款第二句替换为：

为免生疑问，如丁方遭受重大、持续的损失，乙方和丙方有权对丁方进行清算和终止，该终止依照中华人民共和国法律的规定不被视为对本协议的违反，但上述清算终止程序应符合中华人民共和国有关法律法规的规定。

- VI. The Parties agree to delete Article III.b.i. of the Investment Agreement, which means that Party A cancels and stops providing the subsidies for the interests that the Project Company incurs with respect to the bank loans of project finance used exclusively for the construction of the plants of Party D.

各方同意删去投资协议第三条第（二）款之 1，即甲方取消并停止为项目公司仅用于兴建厂房之项目融资而产生的银行贷款利息提供补贴。

- VII. The Parties agree to add an article with respect to "clean-room subsidies" as following:

Party D will make a great investment for the construction of clean-room in Party A's governing area. The estimated construction [REDACTED] square meter, and the investment amount [REDACTED] (VAT not included). Party A agrees to provide [REDACTED] every square meter to Party D for the clean-room which is built in Party A's area, and the total subsidies do not exceed [REDACTED]. Application method: the subsidies will be paid once, after clean room is completed for construction and passed through the acceptance, Party D shall make an application for the clean-room subsidies, and provide purchase orders and construction contracts related to the clean-room which are signed by Party D, clean-room acceptance report, payment certification from Party D (including Invoices and transfer vouchers) and special auditor's report which provided by the Accounting Firm specially for the clean room. After checking by Party A, the payment will be made in the next 10 working days

upon Party A's approval.

- VIII. The Parties hereto agree to add Article e under Article VI of the Investment Agreement to reflect the agreement of the Parties hereto that in the event of a breach of confidentiality of Article VI the party who breaches will be solely liable for such breach.

本协议各方同意在投资协议第六条项下增加第（五）款，内容为：本协议各方同意在违反本第六条保密条款的情况下，由违约方独自承担违约责任。

IX. Miscellaneous

其它

- (1) For the avoidance of doubt, nothing in this Amended Investment Agreement will preclude Party D from outsourcing the manufacture of the products to third parties including its parent companies or affiliates

为免疑义，投资协议和本修正案并不禁止丁方将所接到订单的产品委托第三方（包含丁方的母公司或其关联公司）生产。

- (2) If there is any inconsistency between the Investment Agreement and this Amended Investment Agreement, this Amended Investment Agreement shall prevail. If any matter is not agreed upon in this Amended Investment Agreement, it will be still performed in accordance with the Investment Agreement.

投资协议与本补充协议不一致的，以补充协议为准。补充协议如有未尽事宜，仍按投资协议执行。

- (3) This Amended Investment Agreement has been entered into in four original copies. All four original copies shall be equally binding. The parties shall each maintain One (1) copy in the language of Chinese and English. All four copies shall take effect upon execution and stamping of seals. To the extent that there shall be conflicts between the Chinese and the English, the Chinese version shall control.

本补充协议一式四份。四份文本具有同等约束力。各方各执一(1)份。所有四份文本在签字盖章后生效。中文内容与英文内容如有抵触，以中文为准。

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以下无正文

[SIGNATURE AND SEAL PAGE]

【签章页】

PARTY A: Xiamen Torch Hi-Tech Industrial Development Zone Management Committee

甲方：厦门火炬高新技术产业开发管理委员会

Legal Representative: _____

法定代表人: _____



Or

或

Authorized Representative (signature): _____

授权代表 (签名): _____

Date: _____

日期: _____

PARTY B: Photronics Singapore Pte, Ltd.

乙方: Photronics Singapore Pte, Ltd.

Legal Representative: Richard B

法定代表人: Richard B



Or

或

Authorized Representative (signature): _____

授权代表 (签名): _____

Date: _____

日期: _____

PARTY C: DNP Asia Pacific Pte. Ltd.

丙方: DNP Asia Pacific Pte. Ltd.

Legal Representative: Tuneaki Niwa

法定代表人: Tuneaki Niwa



Or

或

Authorized Representative (signature): _____

授权代表（签名）： _____

Date: _____

日期： _____

PARTY D: Xiamen American Japan Photonics Photomask Co., Ltd.

丁方：厦门美日丰创光罩有限公司

Legal Representative: _____

法定代表人： _____

Or

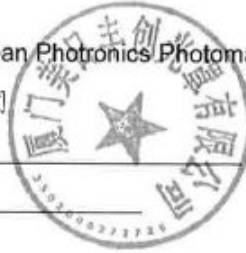
或

Authorized Representative (signature): _____

授权代表（签名）： _____

Date: _____

日期： _____



Peter
Scott
Kirlin

SUBSIDIARIES OF PHOTRONICS, INC.

	State or Jurisdiction of Incorporation or Organization
Align-Rite International, Ltd.	(United Kingdom)
Photronics (Wales) Limited	(United Kingdom)
Photronics California, Inc.	(California, USA)
Photronics Idaho, Inc.	(Idaho, USA)
Photronics Texas Allen, Inc.	(Texas, USA)
Photronics MZD, GmbH	(Germany)
Photronics Advanced Mask Corporation	(Taiwan, R.O.C.)
Photronics DNP Mask Corporation ⁽¹⁾	(Taiwan, R.O.C.)
PDMC Shanghai, Ltd.	(Shanghai, P.R.C.)
Photronics Singapore Pte, Ltd.	(Singapore)
Xiamen American Japan Photronics Mask Co., Ltd. ⁽¹⁾	(Xiamen, P.R.C.)
Photronics UK, Ltd.	(United Kingdom)
PMCH	(Hefei, P.R.C.)
PK, Ltd. ⁽²⁾	(Republic of Korea)
PKLT Co., Ltd.	(Taiwan, R.O.C.)
Trianja Technologies, Inc.	(Texas, USA)

Note: Entities directly owned by subsidiaries of Photronics, Inc. are indented and listed below their immediate parent. Ownership is 100% unless otherwise indicated.

- ⁽¹⁾ 50.01% owned by Photronics, Inc. and 49.99% owned by DNPJ
- ⁽²⁾ 99.75% owned by Photronics, Inc., and 0.25% owned by minority shareholders

CONSENT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

We consent to the incorporation by reference in Registration Statement Nos. 333-169296, 333-169295, 333-151763, 333-197890 and 333-217676 on Form S-8 of our report dated December 20, 2019, relating to the consolidated financial statements of Photonics, Inc. and subsidiaries, and the effectiveness of Photonics, Inc. and its subsidiaries' internal control over financial reporting, appearing in this Annual Report on Form 10-K for the year ended October 31, 2019.

/s/ Deloitte & Touche LLP
Hartford, Connecticut
December 20, 2019

EXHIBIT 31.1

I, Peter S. Kirlin, certify that:

1. I have reviewed this Annual Report on Form 10-K of Photronics, 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 annual report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this annual 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.

/s/ Peter S. Kirlin

Peter S. Kirlin
Chief Executive Officer
December 20, 2019

EXHIBIT 31.2

I, John P. Jordan, certify that:

1. I have reviewed this Annual Report on Form 10-K of Photronics, 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 annual report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this annual 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.

/s/ John P. Jordan

John P. Jordan
Senior Vice President
Chief Financial Officer
(Principal Financial Officer)
December 20, 2019

EXHIBIT 32.1

I, Peter S. Kirlin, Chief Executive Officer of Photronics, Inc. (the "Company"), certify, pursuant to Section 906 of the Sarbanes-Oxley Act of 2002, 18 U.S.C. Section 1350, that:

1. the Annual Report on Form 10-K of the Company for the year ended October 31, 2019 (the "Report") fully complies with the requirements of Section 13(a) or 15(d) of the Securities Exchange Act of 1934; and
2. the information contained in the Report fairly presents, in all material respects, the financial condition and results of operations of the Company.

/s/ Peter S. Kirlin

Peter S. Kirlin

Chief Executive Officer

December 20, 2019

EXHIBIT 32.2

I, John P. Jordan, Chief Financial Officer of Photronics, Inc. (the "Company"), certify, pursuant to Section 906 of the Sarbanes-Oxley Act of 2002, 18 U.S.C. Section 1350, that:

1. the Annual Report on Form 10-K of the Company for the year ended October 31, 2019 (the "Report") fully complies with the requirements of Section 13(a) or 15(d) of the Securities Exchange Act of 1934; and
2. the information contained in the Report fairly presents, in all material respects, the financial condition and results of operations of the Company.

/s/ John P. Jordan

John P. Jordan
Senior Vice President
Chief Financial Officer
(Principal Financial Officer)
December 20, 2019
