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, 2020

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

PHOTRONICS, INC.

(Exact name of registrant as specified in its charter)

Connecticut	**06-0854886**
(State or other jurisdiction of incorporation or organization)	*(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 has filed a report on and attestation to its management's assessment of the effectiveness of its internal control over financial reporting under Section 404(b) of the Sarbanes-Oxley Act ((§15 U.S.C 7262(b)) by the registered public accounting firm that prepared or issued its audit report. Yes ☒ No ☐

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 May 3, 2020, 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 $727,752,716 (based upon the closing price of $11.35 per share as reported by the NASDAQ Global Select Market on that date).

As of December 11, 2020, 63,916,262 shares of the registrant's common stock were outstanding.

DOCUMENTS INCORPORATED BY REFERENCE

Proxy Statement for the 2021 Annual Meeting of Shareholders to be held on March 11, 2021	Incorporated into Part III of this Form 10-K

PHOTRONICS, INC.
ANNUAL REPORT ON FORM 10-K
OCTOBER 31, 2020

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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; pandemics affecting our labor force, customers or suppliers; 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; 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; acts of war, construction of new facilities and acquisition of new equipment; dilutive issuances of the Company’s stock; 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 the world's leading manufacturer 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”), a variety of FPDs and, to a lesser extent, other types of electrical and optical components. We 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, Definitive Proxy Statements on Schedule 14A, 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 incorporating 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 support customers across the full spectrum of IC production and FPD technologies by manufacturing photomasks using electron beam or optical (laser-based) systems, the predominant technologies used for photomask manufacturing capable of producing the finer line resolution, tighter overlay, and 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 own a number of both high-end and mature electron beam and laser-based production systems.

The first several layers of photomasks are sometimes required to be delivered to customers within 24 hours from the time we receive customer 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.

State-of-the-art production for semiconductor masks is considered to be 28 nanometer and smaller for ICs and Generation 10.5+, active-matrix organic light-emitting diode (“AMOLED”) and low-temperature polysilicon (“LTPS”) display-based process technologies for FPDs. However, 32 nanometer and above geometries for semiconductors and Generation 8 and below (excluding AMOLED and LTPS) process technologies for displays 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 advanced-generation designs to continue to move to wafer fabrication throughout fiscal 2021, 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.

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 rare instances, captive manufacturers also sell to other semiconductor or FPD manufacturers. Previously, there was a trend towards the divesture 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, to reach certain roadmap milestones, some captive mask facilities have been investing at faster rates than independent manufacturers, 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-U.S. customers through both our domestic and foreign facilities and consider our presence in non-U.S. 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 8 and 15 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 2020, we sold our products to approximately 530 customers. Revenue from United Microelectronics Corp. Co., Ltd. accounted for approximately 16%, 15% and 15% of our total revenues in fiscal years 2020, 2019 and 2018, and revenue from Samsung Electronics Co., Ltd. accounted for approximately 14%, 16% and 16% of our total revenues in fiscal years 2020, 2019 and 2018, respectively. Our five largest customers, in the aggregate, accounted for approximately 45%, 46% and 47% of our revenue in fiscal years 2020, 2019 and 2018, 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 Boise, Idaho, facility, as well as at Photronics, Cheonan, Ltd. (formerly PK, Ltd.), 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 Photronics Cheonan, Ltd. 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 including data and services technology activities to support the early adoption of new photomasks or supporting data and services technology into our customers' applications. Currently, research and development photomask activities for IC photomasks are primarily focused on photomasks with enabling wafer geometrics of 14 nanometer node and smaller and, for FPDs, on Generations 8 and 10.5+ substrate size photomasks process enhancements for new TV technologies, emerging opportunities for micro- and mini-LED, together with photomask technology for complex FPD photomasks required 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 wafer and substrate optical lithography scaling continues to enable capabilities of high-end devices and displays. We incurred research and development expenses of $17.1 million, $16.4 million, and $14.5 million in fiscal years 2020, 2019 and 2018, 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, we further protect our IP rights, 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 typically enter into annual pricing agreements with our suppliers, some of which include volume-based incentives that have resulted in substantial cost savings; these agreements do not require us to purchase minimum dollar amounts or quantities of their subject materials.

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 twenty-four hours of receiving a customer's designs. Because of the short period between order and shipment dates (typically from one day to two 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 83%, 81% and 79% of our total revenues in fiscal 2020, 2019 and 2018, respectively. We believe that our ability to serve non-U.S. markets is enhanced by our having, among other things, a local presence in the markets 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 8 and 15 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, 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 $5.1 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., Shenzhen Quingyi Photomask, Ltd., SK-Electronics 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, and we expect such pressure to continue in the future.

Employees

As of October 31, 2020 we had approximately 1,728 full-time and part-time employees worldwide. Our business results depend in part on our ability to successfully manage our human capital resources, including attracting, identifying, and retaining key talent. Factors that may affect our ability to attract and retain qualified employees include employee morale, our reputation, competition from other employers, and availability of qualified individuals As of October 31, 2020, none of our employees at any of our worldwide facilities was represented by a union. We consider our employee relations to be good. We believe our commitment to our human capital resources is an important component of our mission to deliver superior photomasks and customer care. We provide all employees with the opportunity to share their opinions in open dialogues with our human resources department and senior management. We provide all employees a wide range of professional development experiences, both formal and informal. Our formal offerings include tuition reimbursement, leadership development experiences and vocational training. The safety of our employees is a paramount value for us. We provide mandatory safety trainings in our production facilities, which are designed to focus on empowering our employees with the knowledge and tools they need to make safe choices and to mitigate risks. Supervisors complete safety management courses as well. In response to the COVID-19 pandemic, we implemented significant changes that we determined were in the best interest of our employees and which comply with government orders in all the states and countries where we operate. In an effort to keep our employees safe and to maintain operations during the COVID-19 pandemic, we have implemented a number of new health-related measures including, the requirement to wear company provided face-masks at all times while on company property, implemented temperature taking protocols, increased hygiene, cleaning and sanitizing procedures at all locations, implemented social-distancing, implemented restrictions on visitors to our facilities, limiting in-person meetings and other gatherings. Further, the health and wellness of our employees are critical to our success. We provide our employees with access to a variety of innovative, flexible and convenient health and wellness programs. Such programs are designed to support employees' physical and mental health by providing tools and resources to help them improve or maintain their health status and encourage engagement in healthy behaviors. Additionally, we provide robust compensation and benefits. In addition to salaries, these programs, which vary by country/region, can include annual bonuses, stock-based compensation awards, a 401(k) plan with employee matching opportunities, healthcare and insurance benefits, health savings and flexible spending accounts, paid time off, family leave, family care resources, employee assistance programs, and tuition assistance.

ITEM 1A. RISK FACTORS

Set forth below are discussions of the risk factors we believe can make an investment in our business speculative or risky.

Concentration Related Risk Factors

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 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 usually 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 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 2020, 2019 and 2018, our two largest customers accounted for 29%, 31% and 31%, respectively, of our revenue. Our five largest customers accounted for 45%, 46% and 47% of our revenue in fiscal years 2020, 2019 and 2018, 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.

Financing Related Risk Factors

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.

Our credit facility restricts our business activities, limits our ability to obtain additional financing or 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 we can spend to repurchase shares of our common stock. Existing covenant restrictions, and noncompliance with covenants or cross default provisions could limit our ability to draw down on current facilities or our ability to obtain additional debt financing, and limit the amount of dividends, distributions, and redemptions we can pay on our common stock to an annual amount of $50 million. 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, to avoid default. Please also refer to Item 9A for discussion of material weakness.

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 2021 are expected to be approximately $100 million, of which approximately $15 million was included in *Accounts payable* on our October 31, 2020 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.

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.

Industry and Competitive Related Risk Factors

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.

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 challenging 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 2020, 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.

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

Cyberattacks or security breaches could compromise confidential, business-critical information, cause disruptions in our operations, or harm our reputation. We have important assets, including intellectual property, trade secrets, and other sensitive, business-critical and/or confidential information which may be vulnerable to such incidents. While we have 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 our financial results.

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 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., Shenzhen New Way Photomask Making Co., Ltd., Shenzhen Quingyi Photomask, Ltd., SK-Electronics 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.

Investment Related Risk Factors

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.

Our expansion into China entails substantial risks.

In 2019, we 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. In addition, as tensions have escalated between the U.S. and China, we believe there is an enhanced risk that our substantial investments in China may be subject to unforeseen restrictions, which may include expropriation of the investments by the Chinese government. 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.

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 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 performance 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.

Market Related Risk Factors

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 2020, we recorded a net loss from changes in foreign currency exchange rates of $0.5 million in our statement of income, while our net assets increased by $36.4 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 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 (when doing so would have mitigated our losses), 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 including (but not limited to) recessions, natural disasters, military actions, political instability, or social unrest; 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.

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, duties and tariffs. The imposition of additional regulations or controls including export controls, duties, tariffs, or changes to bilateral and regional trade agreements, could negatively impact our results of operations.

Operations Related Risk Factors

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, our capital investments could result 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.

Our substantial non-U.S. operations are subject to additional risks.

Revenues from our non-U.S. operations were approximately 83%, 81% and 79% of our total revenues in fiscal years 2020, 2019 and 2018, 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 and Asia, and building manufacturing facilities in Taiwan and 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 costs or our ability to generate revenues outside of the United States and, consequently, 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 warrantied, 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 guarantee 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.

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 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.

Regulatory Related Risk Factors

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 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 left the European Union on January 31, 2020, and is currently in a stand-still transition period which is scheduled to end on December 31, 2020.

Our products and technology could be subject to and negatively impacted by the recent expansion of the foreign-produced direct product rule.

In May 2019, the U.S. Department of Commerce, Bureau of Industry and Security (“BIS”) amended export administration regulations by adding Huawei Technologies Co., Ltd. (“Huawei”) and certain affiliates to the “Entity List” for actions contrary to the national security and foreign policy interests of the United States, imposing significant new restrictions on export, re-export and transfer of U.S. regulated technologies and products to Huawei. On August 17, 2020, BIS issued a final rule adding additional Huawei non-U.S. affiliates to the Entity List, confirming the expiration of a temporary general license applicable to Huawei, and amended the foreign-produced direct product rule in a manner that represents a significant expansion of its application to Huawei.

Expansion of the foreign-produced direct product rule and additional companies being added to the entity list may adversely affect our business in various ways, including by: increasing the cost of regulatory compliance for the export of our products, equipment, services, and technology from the United States and abroad; increasing the time necessary to obtain required authorizations; increasing the risk of monetary fines and other penalties for non-compliance, and negatively impacting our customers who may no longer be able to supply their customers and thereby reducing demand for their or our products. Any of these effects could result in lost revenue, additional product costs, increased lead times and deployment delays that could harm our business and customer relationships.

Our products and technology could be subject to U.S. export control laws and the export control laws of the foreign jurisdictions where we operate.

We are subject to various laws relating to the export of products we manufacture, and the technology related thereto, and our failure to comply with these laws could subject us to substantial fines, penalties, and even injunctions, the imposition of which could have a material adverse effect on the success of our business.

We are subject to the export control laws of the United States and the export control laws of the foreign jurisdictions where we operate. On April 28, 2020, the U.S. administration significantly expanded the reach of U.S. export controls over certain products and certain countries. The U.S. Department of Commerce has, among other things: expanded license requirements to China, Russia and Venezuela; broadened the list of products covered by these expanded license requirements; expanded the definition of “military end use”; created a new “reason for control”; created a new review policy for certain items to certain countries; added substantial electronic export information filing requirements; eliminated the license exception for civil end use for certain countries, including China, Russia and Venezuela; and proposed to remove those same countries from the list of those eligible for additional re-exports license exceptions. The final rules relating to most of these changes were effective June 29, 2020. Application of these laws may adversely affect our business in various ways, including by regulating the export of our products, equipment, services, and technology from the United States and abroad, increasing the time necessary to obtain required authorizations, and the possibility of monetary fines and other penalties for non-compliance.

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 cleanup 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.

General Risk Factors

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. In our assessment of internal control over financial reporting for the fiscal year ended October 31, 2020, we identified a material weakness. Please refer to Item 9A of this annual report on Form 10-K for further information.

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 (such as the COVID-19 pandemic), government responses such as shelter-in-place directives to limit the impact 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 conflicts within the Korean Peninsula, or between the People's Republic of China and the U.S. or the Republic of China (Taiwan), could have material adverse impacts on our revenue, cost and availability of raw materials, results of operations, cash flows, and financial condition.

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.

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.

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.

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

Please refer to Note 14 within Item 8 of this report for information on legal proceedings involving the Company.

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

Our common stock is traded on the NASDAQ Global Select Market ("NASDAQ") under the symbol PLAB. On December 11, 2020, the closing sale price of our common stock, per the NASDAQ Global Select Market, was $11.25. Based on available information, we estimate that we have approximately 8,400 shareholders.

To date, we have not paid any cash dividends on Photronics 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 Photronics stock.

In September 2020, 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 Securities Act"). Share repurchases under the program commenced on September 16, 2020.

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. This repurchase program was terminated on March 20, 2020.

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. The July 2018 repurchase program was completed in October 2018, and the October 2018 repurchase program was terminated on February 1, 2019.

All of the shares purchased under the above repurchase programs in fiscal 2020 were retired prior to the end of the fiscal year. All of the shares purchased under prior year repurchase programs were retired in fiscal year 2019. The tables below present additional information on the above repurchase programs.

September 2020 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 2020 repurchases				
September 14, 2020 – September 27, 2020	0.8	$ 9.93	0.8	$ 92.1
September 28, 2020 – October 31, 2020	0.9	$ 10.27	0.9	$ 82.5
Total	1.7	$ 10.11	1.7	

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 2020 repurchases				
November 1, 2019 – December 2, 2019	0.9	$ 12.01	0.9	$ 78.0
February 3, 2020 – March 1, 2020	0.1	$ 12.37	0.1	$ 77.0
March 2, 2020 – March 29, 2020	0.5	$ 10.48	0.5	$ 0.0*
Total	1.5	$ 11.54	1.5	
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	2.6	$	9.04	2.6		

* The share repurchase program was terminated on March 20, 2020.
** The share repurchase program was terminated on February 1, 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. 2021 Definitive Proxy Statement in Item 12 of Part III of this report. The 2021 Definitive Proxy Statement will be filed within 120 days after our fiscal year ended October 31, 2020.

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.

OPERATING DATA:	Year Ended October 31, 2020	October 31, 2019	October 31, 2018	October 29, 2017	October 30, 2016
Revenue	$ 609,691	$ 550,660	$ 535,276	$ 450,678	$ 483,456
Gross profit	$ 134,654	$ 120,841	$ 131,503	$ 91,315	$ 118,706
Gross margin	22.1%	21.9%	24.6%	20.3%	24.6%
Operating income	$ 63,928	$ 52,121	$ 65,627	$ 31,868	$ 52,475
Operating margin	10.5%	9.5%	12.3%	7.1%	10.9%
Effective tax rate (a)	34.5%	20.1%	10.7%	19.9%	7.9%
Net income (a), (b), (c)	$ 40,343	$ 40,491	$ 61,236	$ 21,289	$ 55,676
Net income attributable to Photronics, Inc. shareholders (a), (b), (c)	$ 33,820	$ 29,793	$ 42,055	$ 13,130	$ 46,200
Earnings per share:					
Basic (a), (b), (c)	$ 0.52	$ 0.45	$ 0.61	$ 0.19	$ 0.68
Diluted (a), (b), (c)	$ 0.52	$ 0.44	$ 0.59	$ 0.19	$ 0.64
Weighted-average diluted number of common shares outstanding:	65,470	69,155	74,821	69,288	76,354
Net cash provided by operating activities	$ 143,046	$ 68,386	$ 130,567	$ 96,833	$ 122,137
Purchases of property, plant and equipment	$ 70,815	$ 178,375	$ 92,585	$ 91,965	$ 50,147
Purchases of treasury stock	$ 34,394	$ 21,696	$ 23,111	$ -	$ -
Common shares repurchased	3,194	2,133	2,558	-	-
Employees	1,728	1,775	1,575	1,475	1,530

BALANCE SHEET DATA

	As of October 31, 2020	October 31, 2019	October 31, 2018	October 29, 2017	October 30, 2016
Working capital	$ 357,200	$ 275,573	$ 311,655	$ 367,348	$ 360,269
Property, plant and equipment, net	$ 631,475	$ 632,441	$ 571,781	$ 535,197	$ 506,434
Total assets	$ 1,188,182	$ 1,118,665	$ 1,110,009	$ 1,020,794	$ 987,988
Long-term debt	$ 54,980	$ 41,887	$ -	$ 57,337	$ 61,860
Total Photronics, Inc. shareholders’ equity	$ 804,962	$ 769,892	$ 759,671	$ 744,564	$ 710,363
Noncontrolling interests	$ 157,304	$ 141,200	$ 144,898	$ 120,731	$ 115,111

(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.

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 display designs and applications, particularly as they relate to the semiconductor industry's migration to more advanced product innovation, design methodologies, and fabrication processes. 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 display 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 display designs could reduce demand for photomasks – even if the demand for semiconductors and FPDs increases. Advances in semiconductor, display, and photomask design and 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 microelectronics 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 10.5+ and AMOLED and LTPS display-based process technologies for FPDs. However, 32 nanometer and above geometries for semiconductors and Generation 8 and below (excluding AMOLED and LTPS) process technologies for displays 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 advanced-generation designs to continue to move to production throughout fiscal 2021, 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 display 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 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 2020, 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 $342 million for the three fiscal years ended October 31, 2020, 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 2021.

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

During the fourth quarter of fiscal 2020, we entered into a Master Lease Agreement with a financing entity for the lease of an inspection tool with a maximum value of $10 million. The tool was delivered during the fourth quarter of fiscal year 2020, and the financing entity made a progress payment to the vendor of $6.5 million in the first quarter of fiscal year 2021. The progress payment will accrue interest at 1.56% payable monthly until the final payment for the tool is made, at which time the lease will begin.

In the fourth quarter of fiscal 2020, we were approved to borrow 200 million Chinese renminbi (RMB) (approximately $29.8 million, at the balance sheet date) from the China Construction Bank Corporation. We received initial proceeds of 41 million RMB (approximately $6.2 million) against this approval in November 2020. Loan proceeds have been, and will be, used for the purchase of two lithography tools at our facility in Hefei, China. Interest rate on the loan is variable and based on the RMB Loan Prime Rate of the National Interbank Funding Center less 0.45% (adjusted annually), and is to be repaid semiannually, over five years, commencing on March 5, 2022. The interest rate on the loan was 4.2% at the borrowing date. The first five semiannual loan repayments will each be for 7.5 percent of the approved 200 million RMB loan principal; the last five installments will each be for 12.5 percent of the approved loan principal, with the final installment due on September 30, 2026. Semiannual repayments of the initial $6.2 million borrowed will commence on March 5, 2022, with a repayment of $2.3 million; subsequent semiannual repayments will be in the amounts of $2.3 million and $1.6 million. The borrowings are secured by the Hefei facility, its related land use right, and certain manufacturing equipment, which had a combined carrying value of $87.8 million as of October 31, 2020.

In the fourth quarter of fiscal 2020, 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 Securities Act”). We repurchased 1.7 million shares at a cost of $17.5 million (an average price of $10.11 per share) under this authorization. All shares repurchased were retired in fiscal 2020.

In the fourth quarter of fiscal 2020, PDMC, the Company’s majority-owned IC subsidiary in Taiwan, paid a dividend of which 49.99%, or approximately $16.2 million, was paid to noncontrolling interests.

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 $6.5 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. Our adoption of Topic 842 did not 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 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 (ii) 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 variable and payable monthly at thirty-day LIBOR plus 1% (1.15% at October 31, 2020), and will continue to accrue until the borrowing is repaid or, as allowed under the MLA, we enter into a lease for the equipment. During the first quarter of fiscal 2021, this financing entity made an additional payment of $28 million to the equipment vendor on our behalf.

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). We repurchased 2.5 million shares at a cost of $27.9 million (an average price of $11.34 per share) under this authorization. The repurchase program was terminated on March 20, 2020.

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 345.0 million RMB (approximately $51.4 million, at the balance sheet date), 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 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, 2020, PDMCX had outstanding 336.0 million RMB ($50.1 million) against this approval. Payments on these borrowings are due semiannually through December 2025. See Note 7 of the consolidated 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 the equivalent of $25.0 million. As of October 31, 2020, PDMCX had outstanding 8.0 million RMB ($1.2 million) to fund operations, with repayments due one year from the borrowing dates of the separate loan agreements. As of October 31, 2020, PDMCX had outstanding 93.2 million RMB ($13.9 million) borrowed to pay VAT. Payments on these borrowings are due semiannually, in increasing amounts, through July 2023. See Note 7 of the consolidated financial statements for additional information on these loans.

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 Photronics 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 Photronics, Inc. consolidated financial statements. See Note 5 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, 2020	August 2, 2020	October 31, 2019
Revenue	100.0%	100.0%	100.0%
Cost of goods sold	78.6	76.1	75.6
Gross profit	21.4	23.9	24.4
Selling, general and administrative expenses	8.6	8.4	7.8
Research and development expenses	2.8	2.9	2.9
Operating income	10.0	12.6	13.7
Other income (expense), net	(1.9)	(1.3)	(3.9)
Income before income tax provision	8.1	11.3	9.8
Income tax provision	2.3	3.2	1.5
Net income	5.8	8.1	8.3
Net income attributable to noncontrolling interests	1.5	1.3	2.1
Net income attributable to Photronics, Inc. shareholders	4.3%	6.8%	6.2%

	Year Ended		
	October 31, 2020	October 31, 2019	October 31, 2018
Revenue	100.0%	100.0%	100.0%
Cost of goods sold	77.9	78.1	75.4
Gross profit	22.1	21.9	24.6
Selling, general and administrative expenses	8.8	9.5	9.6
Research and development expenses	2.8	2.9	2.7
Operating income	10.5	9.5	12.3
Other income (expense), net	(0.4)	(0.3)	0.5
Income before income tax provision	10.1	9.2	12.8
Income tax provision	3.5	1.9	1.4
Net income	6.6	7.3	11.4
Net income attributable to noncontrolling interests	1.1	1.9	3.5
Net income attributable to Photronics, Inc. shareholders	5.5%	5.4%	7.9%

Note: All the following tabular comparisons, unless otherwise indicated, are for the three months ended October 31, 2020 (Q4 FY20), August 2, 2020 (Q3 FY20) and October 31, 2019 (Q4 FY19), and for the fiscal years ended October 31, 2020 (FY20) and October 31, 2019 (FY19). Please refer to the MD&A in our 2019 Annual Report on Form 10-K for comparative discussion of our fiscal years ended October 31, 2019 and October 31, 2018.

Revenue

Our quarterly revenues can be affected by the seasonal purchasing practices of our customers. As a result, demand for our products is typically reduced 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.

At the beginning of fiscal year 2020, we changed the threshold for the definition of high-end FPD, from G8 and above and active matrix organic light-emitting diode (AMOLED) display screens, to G10.5^{+}, AMOLED, and low-temperature polysilicon (LTPS) display screens, to reflect the overall advancement of technology in the FPD industry. Our definition of high-end IC products remains as 28 nanometer or smaller. High-end photomasks typically have higher selling prices (ASPs) than mainstream products.

The following tables present changes in revenue disaggregated by product type and geographic origin, in Q4 FY20 and FY20 from revenue in prior reporting periods. Columns may not total due to rounding.

Quarterly Changes in Revenue by Product Type

	Q4 FY20 from Q3 FY20			Q4 FY20 from Q4 FY19	
	Revenue in Q4 FY20	Increase (Decrease)	Percent Change	Increase (Decrease)	Percent Change
IC					
High-end	$ 38.2	$ (0.5)	(1.3)%	$ (6.8)	(15.1)%
Mainstream	67.8	(2.2)	(3.2)%	0.2	0.3%
Total IC	$ 105.9	$ (2.7)	(2.5)%	$ (6.6)	(5.9)%
FPD					
High-end	$ 31.3	$ (5.4)	(14.6)%	$ 5.9	23.1%
Mainstream	12.1	(0.5)	(4.0)%	(6.2)	(34.1)%
Total FPD	$ 43.4	$ (5.9)	(11.9)%	$ (0.4)	(0.8)%
Total Revenue	$ 149.3	$ (8.6)	(5.5)%	$ (7.0)	(4.5)%

Quarterly Changes in Revenue by Geographic Origin

	Q4 FY20 from Q3 FY20			Q4 FY20 from Q4 FY19	
	Revenue in Q4 FY20	Increase (Decrease)	Percent Change	Increase (Decrease)	Percent Change
Taiwan	$ 56.6	$ (4.2)	(6.9)%	$ (12.3)	(17.8)%
Korea	36.6	(2.9)	(7.4)%	(0.8)	(2.1)%
United States	26.7	(1.7)	(5.9)%	(3.8)	(12.5)%
China	21.0	0.0	0.1%	9.7	85.6%
Europe	7.9	0.3	3.3%	0.1	1.0%
Other	0.5	(0.1)	(13.7)%	0.1	23.5%
Total revenue	$ 149.3	$ (8.6)	(5.5)%	$ (7.0)	(4.5)%

Revenue decreased 5.5% in Q4 FY20, compared with Q3 FY20, as FPD demand fell 11.9% due, in significant part, to U.S. trade sanctions placed on Huawei Technologies Co., Ltd. which negatively impacted their ability to release new mobile devices, thereby decreasing demand for new display panels and, ultimately, new FPD photomasks; consequentially, our mobile display panel revenue declined 21% from Q3 FY20. In addition, high prices and unit demand for current products resulted in panel producers extending production runs of current designs and delaying design changes, which led to decreased demand of masks used for production of LCD displays on G10.5+, and smaller substrates. FPD revenue attributable to China decreased 12% from Q3 FY20, while representing 56% of our total FPD revenue in Q4 FY20. IC revenue decreased from the prior quarter by 2.5%, as improvement at some logic foundries in the U.S. and Asia somewhat mitigated weakened demand for memory photomasks. IC revenue attributable to China increased 14% from Q3 FY20, and accounted for a quarter of our IC revenue in the current quarter.

Revenue decreased 4.5% in Q4 FY20, compared with Q4 FY19; IC demand declined 5.9%, due to weakened demand for memory photomasks, while FPD demand fell less than 1%, despite the disruptions to the China supply chain discussed above.

Year-over-Year Changes in Revenue by Product Type

	FY20 from FY19		
	Revenue in FY20	Increase (Decrease)	Percent Change
IC			
High-end	$ 156.1	$ (0.3)	(0.2)%
Mainstream	262.3	12.5	5.0%
Total IC	$ 418.4	$ 12.2	3.0%
FPD			
High-end	$ 139.6	$ 53.6	62.4%
Mainstream	51.7	(6.8)	(11.7)%
Total FPD	$ 191.3	$ 46.8	32.4%
Total Revenue	$ 609.7	$ 59.0	10.7%

Year-over-Year Changes in Revenue by Geographic Origin

	FY20 from FY19		
	Revenue in FY20	Increase (Decrease)	Percent Change
Taiwan	$ 239.1	$ (5.3)	(2.2)%
Korea	153.1	5.3	3.6%
United States	104.9	(0.1)	(0.1)%
China	79.4	60.4	317.5%
Europe	31.5	(1.1)	(3.3)%
Other	1.7	(0.2)	(10.2)%
Total Revenue	$ 609.7	$ 59.0	10.7%

Revenue increased 10.7% in FY20, compared with FY19, to a record high of $609.7 million, eclipsing our previous record set in FY19. FPD revenue increased 32.4%, on strong demand for high-end products, despite the disruptions to the China FPD supply chain encountered in Q4 FY20. IC revenue increased 3.0%, year-over-year; the increase was driven by higher demand for mainstream logic masks in Asia and the U.S. The outbreak of the COVID 19 pandemic in FY20 tempered revenue growth for both IC and FPD, as supply chains were, at least temporarily, disrupted and travel restrictions were imposed, resulting in delays to equipment installations and customer design team projects.

Gross Margin

	Q4 FY20	Q3 FY20	Q4 FY19	Percent Change Q4 FY20 from Q3 FY20	Percent Change Q4 FY20 from Q4 FY19
Gross profit	$ 31.9	$ 37.7	$ 38.2	(15.5)%	(16.4)%
Gross margin	21.4%	23.9%	24.4%		

Gross margin decreased by 2.5 percentage points in Q4 FY20, from Q3 FY20, primarily as a result of the above mentioned 5.5% decrease in revenue from the prior quarter. Gross margins decreased in Taiwan, Korea, and the U.S., primarily as a result of decreased revenue; gross margins at our China-based operations increased, overall, primarily due to lower glass blank costs. Total cost of goods sold decreased $2.7 million, or 2.3%, from the prior quarter, primarily due to a 6.1% decrease in material costs, which were essentially flat as a percentage of revenue. Labor costs decreased 1.9%, but were essentially flat as a percentage of revenue, while overhead costs increased $0.5 million, and 2.3 percentage points, as a percentage of revenue.

Gross margin decreased by 3.0 percentage points in Q4 FY20, from Q4 FY19, primarily as a result of the 4.5% decrease in revenue in the current year quarter. Gross margins at our China-based IC and FPD operations increased as they continue to ramp up to full production. Gross margins decreased in Taiwan, and the U.S., primarily as a result of decreased revenue. Total cost of goods sold decreased $0.7 million, or 0.6%, from the prior year quarter, with $1.9 million of the decrease resulting from lower materials costs, which fell 4.1%, but were essentially flat as a percentage of revenue. Labor costs increased 9.5%, up 1.5 percentage points of revenue, while overhead costs were essentially flat, and up 1.4 percentage points of revenue.

	FY20	FY19	Percent Change FY20 from FY19
Gross profit	$ 134.7	$ 120.8	11.4%
Gross margin	22.1%	21.9%	

Gross margin increased by 0.2 percentage points in YTD FY20, from YTD FY19, primarily as a result of the 10.7% increase in revenue from the prior year period. Gross margins at our China-based IC and FPD operations increased as these facilities continue to ramp up to full production. Gross margins decreased in Taiwan primarily due to lower revenue, and in the U.S due to overhead costs increasing, while revenue was, essentially, unchanged. Total cost of goods sold increased $45.2 million, or 10.5%, from the prior year period, with $19.6 million of the increase resulting from greater materials costs, which were up 12.0% from YTD FY19, and increased 0.4%, as a percentage of revenue. Labor costs increased 4.9%, but were down 0.6 percentage points against revenue, while overhead costs increased 11.2%, with increased equipment costs (which reflected our expanded installed tool base) comprising the majority of this increase.

As we operate in a high fixed cost environment, increases or decreases in our revenues and capacity utilization will generally positively or negatively impact our gross margin.

Selling, General and Administrative Expenses

Selling, general and administrative expenses were $12.8 million in Q4 FY20, compared with $13.3 million in Q3 FY20, and $12.1 million in Q4 FY19. The decrease from Q3 FY20 was primarily the result of decreased compensation and related expenses of $0.8 million, and the increase from the prior year quarter was primarily the result of increased compensation and related expenses of $1.2 million, which were partially offset by decreased travel costs of $0.6 million. Selling, general and administrative expenses increased $1.3 million, or 2.4%, in YTD FY20, from YTD FY19, primarily as a result of increased compensation and related expenses and professional fees of $2.7 million and $0.8 million, respectively, partially offset by decreased travel expenses of $1.7 million.

Research and Development Expenses

Research and development expenses consist of development efforts related to high-end process technologies for high-end IC and FPD applications.

Research and development expenses were $4.1 million in Q4 FY20, compared with $4.5 million in both Q3 FY20 and Q4 FY19. The decrease from Q3 FY20 was primarily the result of decreased development activities in the U.S., which were partially offset by increased activities in China, and the decrease from the prior year quarter was the result of decreased activities in China and Taiwan. Research and development expenses increased $0.8 million, or 4.6%, in YTD FY20 from YTD FY19, primarily due to increased development activities in China, which were partially offset by reduced activities in the U.S. and Taiwan.

Other Income (Expense), net

	Q4 FY20	Q3 FY20	Q4 FY19
Foreign currency transactions (losses) gains, net	$ (2.2)	$ (1.6)	$ (6.2)
Interest expense	(0.8)	(0.6)	(0.2)
Interest income and other income (expense), net	0.1	-	0.3
Total other income (expense)	$ (2.9)	$ (2.1)	$ (6.1)

The unfavorable change in Other income (expense), net of $0.8 million, from a loss of $2.1 million in Q3 FY20, to a loss of $2.9 million in Q4 FY20, was primarily due to increased foreign currency exchange losses of $0.7 million, and increased interest expense on our China-based debt. The majority of the interest on our China-based debt is eligible for reimbursements through subsidies, which we recognize upon receipt. Other income (expense), net increased $3.2 million from Q4 FY19, primarily due to less unfavorable foreign currency transaction results of $4.0 million, which were partially offset by increased interest expense of $0.6 million on our China-based debt; the increased interest expense reflected the higher average debt balance in the current year quarter.

	FY20	FY19
Interest expense	$ (2.4)	$ (1.4)
Interest income and other income (expense), net	0.5	1.3
Foreign currency transactions (losses) gains, net	(0.5)	(1.3)
Total other income (expense)	$ (2.3)	$ (1.4)

The unfavorable year-to-date change in Other income (expense), net of $0.9 million was primarily due to increased interest expense of $1 million on our China-based debt, and decreased interest income of $0.6 million. The effects of these decreases were partially offset by decreased foreign currency exchange losses of $0.8 million.

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, creating new taxes on certain foreign sourced income, and introducing new limitations on certain business deductions.

	Q4 FY20	Q3 FY20	Q4 FY19
Income tax provision	$ 3.5	$ 4.9	$ 2.3
Effective income tax rate	28.8%	27.7%	15.1%

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 increased in Q4 FY20, compared with Q3 FY20, due to the non-recognition of more tax benefits in Q4 FY20 on losses in the U.S. and in a non-U.S. jurisdiction; non-recognized tax benefits in both quarters were a result of valuation allowances applying to those provisions and benefits. The effective income tax rate increased in Q4 FY20, from Q4 FY19, due to the non-recognition of tax benefits in a non-U.S. jurisdiction during FY20; the non-recognized tax benefits in both quarters were a result of valuation allowances applying to those benefits. However, in Q4 FY19, tax benefits not recognized on U.S. quarterly income were somewhat reduced by the benefit of $0.9 million from a tax holiday in Taiwan.

	FY20	FY19
Income tax provision	$ 21.3	$ 10.2
Effective income tax rate	34.5%	20.1%

The increase in the effective income tax rate on a full-year basis in FY20, compared with FY19, is primarily due to the net increase in non-recognition of tax benefits in the US and in a non-U.S. jurisdiction during FY20; the non-recognition is the result of valuation allowances applying to those benefits, the $1.5 million post-settlements increase in the provision for unrecognized tax benefits, and a $1.9 million decrease in the benefit related to the FY20 tax holiday in Taiwan, which expired at the end of December 2019.

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 October 31, 2020 and October 31, 2019, are $2.0 million and $1.9 million respectively, recorded in *Other liabilities* in the consolidated balance sheets that, if recognized, would impact the effective tax rates.

Net Income Attributable to Noncontrolling Interests

	Q4 FY20	Q3 FY20	Q4 FY19	FY20	FY19
Net income attributable to noncontrolling interests	$ 2.1	$ 2.1	$ 3.3	$ 6.5	$ 10.7

Net income attributable to noncontrolling interests was $2.1 million in Q4 FY20, unchanged from Q3 FY20, and was the result of net income realized at our China-based IC facility in Q4 FY20, which realized a net loss in Q3 FY20, and decreased net income at our Taiwan-based IC facility. Net income attributable to noncontrolling interests decreased $1.2 million in Q4 FY20 from $3.3 million in Q4 FY19; decreased income at our Taiwan-based IC facility exceeded the favorable effect of our China-based IC facility income in the current year quarter, and a net loss in the prior year quarter.

On a year-to-date basis, net income attributable to noncontrolling interests decreased $4.2 million; the decrease was the result of decreased net income at our Taiwan-based IC facility, the effect of which was somewhat mitigated by a decreased net loss at our China-based IC facility. We hold 50.01% ownership interests in both the China-based and Taiwan-based IC facilities.

Liquidity and Capital Resources

	October 31, 2020 *(in $ millions)*	October 31, 2019 *(in $ millions)*
Cash and cash equivalents	$ 278.7	$ 206.5
Net cash provided by operating activities	$ 143.0	$ 68.4
Net cash used in investing activities	$ (65.7)	$ (151.4)
Net cash used in financing activities	$ (16.0)	$ (42.1)

We had cash and cash equivalents of $278.7 million at the end of Q4 FY20, compared with $206.5 million at the end of fiscal 2019. The net increase of $72.2 million was primarily attributable to:

- $143.0 million provided by operating activities;
- $17.6 million contributed to our China-based IC joint venture by noncontrolling interests;
- $5.3 million government incentives received in China;
- $4.2 million received from exercises of employee stock options;
- $20.3 million received from borrowings in China;
- $(70.8) million paid for property, plant, and equipment;
- $(34.4) million used to repurchase our common stock;
- $(16.2) million dividend paid to noncontrolling interest
- $(7.4) million used to repay debt;
- $11.0 million favorable effects of currency exchange rate changes on cash

Our working capital at the end of Q4 FY20 was $357.2 million, compared with $275.6 million at the end of fiscal 2019. The increase is primarily attributable to the following increases (decreases) in working capital:

- Increased cash and cash equivalents of $72.2 million;
- Increased inventories of $9.1 million, mainly acquired to protect against potential COVID-19 related supply chain disruptions;
- Increased compensation and related expenses accrual of ($2.1) million;
- Increased contract liabilities of $(3.7) million;
- Increased current debt of $(2.8) million;
- Increased current portion of operating leases of $(2.3) million, reflecting our adoption of ASC 842 at November 1, 2019.

The net cash provided by operating activities of $143.0 million in YTD FY20 was a $74.6 million increase from $68.4 million provided in YTD FY19. The net increase in YTD FY20 was primarily due to:

- Increased non-cash add backs to net income, including depreciation, amortization, share-based compensation, and deferred income taxes of $14.4 million;
- A comparative decrease in accounts receivable of $19.3 million;
- A comparative decrease in the build-up of inventories of $16.2 million, which was primarily the result of our initially supplying our China-based FPD facility in YTD FY19;
- A comparative increase in other current assets of $16.5 million, mostly related to increases in refundable income tax of $4.6 million, contract assets of $8.9 million and recoverable VAT of $2.2 million.
- A comparative increase in accounts payable, accrued liabilities and other of $8.5 million, mostly related to the net of the following comparative changes: an increase in noncurrent recoverable VAT of $28.3 million related to our China facilities, increase in contract liability of $5.3 million, decrease in accounts payable and accruals of $(24.5) million, and a decrease in income tax payable of $(3.2) million.

Net cash used in investing activities was $65.7 million in YTD FY20, a decrease of $85.7 million from $151.4 million used in YTD FY19. The net decrease in cash used was primarily attributable to decreased capital expenditures of $107.6 million; this was the result of a reduction in payments to equip our China-based facilities, which were in the start-up phase in the first half of fiscal year 2019. A reduction in investment incentives of $21.7 million in YTD FY20, from YTD FY19, also reduced net cash flows used in investing activities.

Net cash flows from financing activities changed from $42.1 million used in YTD FY19 to $16.0 million used in YTD FY20. Significant components of the $26.0 million net change were:

- Repayments of debt were $53.9 million less in YTD FY20 than in YTD FY19; the primary cause of the decrease was repayment (upon their maturity) of our convertible senior notes in YTD FY19;
- Dividends to DNP (related to their 49.99% interest in our IC facility in Taiwan) were $28.9 million less in YTD FY20;
- $(34.3) million less debt was incurred in YTD FY20 than in YTD FY19;
- $(11.8) million less contributed by DNP to maintain their proportionate ownership interest in our IC joint venture in China in YTD FY20 than in YTD FY19;
- $(12.7) million more paid in YTD FY20, than in YTD FY19, to acquire our common stock.

As of October 31, 2020 and October 31, 2019, our total cash and cash equivalents included $218.0 million and $147.2 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 sectors.

Since we operate in a high fixed cost environment, our liquidity is highly dependent on our revenue, cash conversion cycle, and the timing of our capital expenditures (which can vary significantly from period to period). 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. However, depending on conditions in the semiconductor and display 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 (which are discussed in Note 7 to the consolidated financial statements). Please also refer to Financing Related Risk Factors.

As of October 31, 2020, 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. As of the end of fiscal 2020, we had no unfulfilled commitments to fund our IC facility in China.

Cash Requirements

Our cash requirements in fiscal 2021 will primarily be for funding our operations, capital spending, 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 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, 2020:

	Payment due by period				
Contractual Obligations	**Total**	**Less Than 1 Year**	**1 - 3 Years**	**3 - 5 Years**	**More Than 5 Years**
Debt	$ 68,658	$ 13,678	$ 28,548	$ 19,221	$ 7,211
Operating leases	7,535	2,275	3,362	1,374	524
Purchase obligations	130,431	124,365	5,802	264	-
Interest	7,987	2,876	3,743	1,339	29
Other noncurrent liabilities	15,099	674	2,110	887	11,428
Total	$ 229,710	$ 143,868	$ 43,565	$ 23,085	$ 19,192

As of October 31, 2020, the Company had recorded accruals for uncertain tax positions and related interest and penalties of $2.7 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, Photronics, through its wholly owned Singapore subsidiary, entered into the PDMCX joint venture with DNP, through its wholly owned subsidiary “DNP Asia Pacific PTE, Ltd.” under which DNP obtained a 49.99% interest in our IC business in Xiamen, China. The joint venture was established to develop and manufacture photomasks for leading edge and advanced generation semiconductors. Under the joint venture’s operating 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 that cannot be resolved between the two parties. As of the date of issuance of this report, DNP had not indicated its intention to exercise this right. 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. 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, 2020, Photronics and DNP each had net investments in PDMCX of $54.8 million.

We lease certain office facilities and equipment under leases with terms of one year or less that may require us to pay taxes, insurance and maintenance expenses related to the properties. See Note 9 to the consolidated financial statements for additional information on these short-term 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 $6.5 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

While we, as always, caution that our outlook, due to our short back-log (which typically does not exceed two weeks) is limited, we expect revenue to increase, as a percentage of FY20 revenue, in the high single digits. We are also anticipating operating profit to grow at a rate similar to the 23% increase we experienced in FY20. The bases of our expectations include growth for both IC and FPD in FY2021. IC growth drivers include added capacity across our global operations including the completion of Phase 1 of our China IC facility ramp, growing demand for semiconductor masks in China, and increased demand in the IC memory space. For FPD, mobile displays are once again expected to be a sector of growth with additional demand coming from new large-screen TV technology, such as OLED, which will be supported by the implementation of the next phase of investment at our Asia-based FPD facilities. We are also encouraged by the impending distribution of recently developed coronavirus vaccines, as we think this supports a reasonable expectation that supply chain disruptions and travel restrictions will be eased, thereby reducing the impediments to growth they represented in FY20.

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 exiting the European Union cannot be predicted. However, we believe the impending change in leadership in the U.S. may lead to an improvement in its trade relationship with China, including the possible removal of sanctions on some Chinese enterprises, as well as a reduction in the likelihood of the impositions of additional sanctions.

We believe that a majority of the growth in the IC and FPD markets will come from the Asia region, predominantly in China. We expect to meet these demands both through the utilization of our facilities in China and by importing photomasks into China from our other facilities. 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, some of which are discussed in Part1, Item 1A of this report; a number of other unforeseeable 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:

- Revenue Recognition: Application of GAAP related to the measurement and recognition of revenue requires us to make judgments and estimates. Specifically, 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 and amount of our reported revenues and net income. Other significant judgments include the estimation of the point in the manufacturing process at which we are entitled to receive payment, as well as the progress of the job order to completion in order to determine the amount of arrangement consideration earned for contractual revenue recognized over time.

- Property, Plant and Equipment: Significant judgment and assumptions are employed when we establish estimated useful lives, depreciation periods and when depreciation should begin on such assets as this evaluation can significantly impact our gross margin and research and development expenses. Significant judgement is also required 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 as the recoverability assessment requires us to forecast future cash flows related to these assets; this evaluation can significantly impact our gross margin and operating expense.

- Leases: Significant judgement is applied in the determination of whether an arrangement is, or contains, a lease and, in certain instances, whether the lease should be classified as an operating lease or a finance lease, which can impact the timing and classification of lease costs.

- Contingencies: We are subject to the possibility of losses from various contingencies. Significant judgment is necessary to estimate the probability and amount of a loss, if any, from such contingencies. An accrual is made when it is probable that a liability has been incurred or an asset has been impaired and the amount of loss can be reasonably estimated. In accounting for the resolution of contingencies, significant judgment may be necessary to estimate amounts pertaining to periods prior to the resolution that are charged to operations in the period of resolution and amounts related to future periods.

- Income Taxes: Our annual tax rate is determined based on our income and the jurisdictions where it is earned, statutory tax rates, and the tax impacts of items treated differently for tax purposes than for financial reporting purposes. Also inherent in determining our annual tax rate are judgments and assumptions regarding the recoverability of certain deferred tax balances, and our ability to uphold certain tax positions. We are subject to complex tax laws, in the U.S. and numerous foreign jurisdictions and the manner in which they apply can be open to interpretation. Realization of deferred tax assets is dependent upon generating sufficient taxable income in the appropriate jurisdiction in future periods, which involves business plans, planning opportunities, and expectations about future outcomes. Our assessment relies on estimates and assumptions, and may involve a series of complex judgments about future events.

  Because there are a number of estimates and assumptions inherent in calculating the various components of our tax provision, future events such as changes in tax legislation, geographic mix of earnings, completion of tax audits or earnings repatriation plans could have an impact on those estimates and our effective tax rate.

Please refer to Notes 1, 8, 9, 12, and 14 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 23 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 functional currency of the transacting subsidiary. 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, 2020, 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, 2020, 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 $31.9 million, which represents a decrease of $1.2 million from the same movement as of October 31, 2019. The decrease in foreign currency rate change risk is primarily the result of decreased net exposure of the Chinese renminbi 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, 2020 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, 2020, consolidated financial statements.

ITEM 8. FINANCIAL STATEMENTS AND SUPPLEMENTARY DATA

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REPORT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

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

Opinions on the Financial Statements

We have audited the accompanying consolidated balance sheets of Photronics, Inc. and subsidiaries (the "Company") as of October 31, 2020 and October 31, 2019, the related consolidated statements of income, comprehensive income, equity, and cash flows for each of the three years in the period ended October 31, 2020, the related notes and the schedule listed in the Index at Item 15 (collectively referred to as the “financial statements”). In our opinion, the financial statements present fairly, in all material respects, the financial position of the Company as of October 31, 2020 and October 31, 2019, and the results of its operations and its cash flows for each of the three years in the period ended October 31, 2020, in conformity with accounting principles generally accepted in the United States of America.

We have also audited, in accordance with the standards of the Public Company Accounting Oversight Board (United States) (PCAOB), the Company's internal control over financial reporting as of October 31, 2020, based on criteria established in Internal Control — Integrated Framework (2013) issued by the Committee of Sponsoring Organizations of the Treadway Commission and our report dated January 14, 2021, expressed an adverse opinion on the Company's internal control over financial reporting because of a material weakness.

Basis for Opinions

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

We conducted our audits in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audits to obtain reasonable assurance about whether the financial statements are free of material misstatement, whether due to error or fraud. 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. We believe that our audits provide a reasonable basis for our opinions.

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 audit committee and that (1) relates to accounts or disclosures that are material to the financial statements and (2) involved our especially challenging, subjective, or complex judgments. The communication of critical audit matters does not alter in any way our opinion on the consolidated financial statements, taken as a whole, and we are not, by communicating the critical audit matter below, providing a separate opinion on the critical audit matter or on the accounts or disclosures to which it relates.

Revenue — Contracts with Customers— Refer to Note 1 to the 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, 2020 was $6.3 million.

We identified the determination of revenue recognized over time for in-process productions orders as of October 31, 2020 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, 2020.

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, 2020 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, 2020 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
January 14, 2021

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

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

	October 31, 2020	October 31, 2019
ASSETS		
Current assets:		
Cash and cash equivalents	$ 278,665	$ 206,530
Accounts receivable, net of allowance of $1,324 in 2020 and $1,334 in 2019	134,470	134,454
Inventories	57,269	48,155
Other current assets	29,735	38,388
Total current assets	500,139	427,527
Property, plant and equipment, net	631,475	632,441
Intangible assets, net	3,437	7,870
Deferred income taxes	22,070	20,779
Other assets	31,061	30,048
Total assets	$ 1,188,182	$ 1,118,665
LIABILITIES AND EQUITY		
Current liabilities:		
Short-term debt	$ 4,708	$ 8,731
Current portion of long-term debt	8,970	2,142
Accounts payable	75,378	91,379
Accrued liabilities	53,883	49,702
Total current liabilities	142,939	151,954
Long-term debt	54,980	41,887
Other liabilities	27,997	13,732
Total liabilities	225,916	207,573
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, 63,138 shares issued and outstanding at October 31, 2020, and 65,595 shares issued and outstanding at October 31, 2019	631	656
Additional paid-in capital	507,336	524,319
Retained earnings	279,037	253,922
Accumulated other comprehensive (loss) income	17,958	(9,005)
Total Photronics, Inc. shareholders' equity	804,962	769,892
Noncontrolling interests	157,304	141,200
Total equity	962,266	911,092
Total liabilities and equity	$ 1,188,182	$ 1,118,665

See accompanying notes to consolidated financial statements.

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

	Year Ended		
	October 31, 2020	October 31, 2019	October 31, 2018
Revenue	$ 609,691	$ 550,660	$ 535,276
Cost of goods sold	475,037	429,819	403,773
Gross profit	134,654	120,841	131,503
Operating expenses:			
Selling, general and administrative	53,582	52,326	51,395
Research and development	17,144	16,394	14,481
Total operating expenses	70,726	68,720	65,876
Operating income	63,928	52,121	65,627
Other income (expense):			
Interest expense	(2,367)	(1,425)	(2,262)
Interest income and other income (expense), net	541	1,271	4,829
Foreign currency transaction (losses) gains, net	(501)	(1,266)	377
Income before income tax provision	61,601	50,701	68,571
Income tax provision	21,258	10,210	7,335
Net income	40,343	40,491	61,236
Net income attributable to noncontrolling interests	6,523	10,698	19,181
Net income attributable to Photronics, Inc. shareholders	$ 33,820	$ 29,793	$ 42,055
Earnings per share:			
Basic	$ 0.52	$ 0.45	$ 0.61
Diluted	$ 0.52	$ 0.44	$ 0.59
Weighted-average number of common shares outstanding:			
Basic	64,866	66,347	68,829
Diluted	65,470	69,155	74,821

See accompanying notes to consolidated financial statements.

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

	Year Ended October 31, 2020	Year Ended October 31, 2019	Year Ended October 31, 2018
Net income	$ 40,343	$ 40,491	$ 61,236
Other comprehensive income (loss), net of tax:			
Foreign currency translation adjustments	36,381	(2,877)	(16,672)
Amortization of cash flow hedge	-	-	48
Other	(390)	(74)	101
Net other comprehensive income (loss)	35,991	(2,951)	(16,523)
Comprehensive income	76,334	37,540	44,713
Less: comprehensive income attributable to noncontrolling interests	15,551	11,786	14,515
Comprehensive income attributable to Photronics, Inc. shareholders	$ 60,783	$ 25,754	$ 30,198

See accompanying notes to consolidated financial statements.

PHOTRONICS, INC.
Consolidated Statements of Equity
Years Ended October 31, 2020, October 31, 2019 and October 29, 2018
(in thousands)

	Photronics, Inc. Shareholders							
	Common Stock		Additional Paid-In Capital	Retained Earnings	Treasury Stock	Accumulated Other Comprehensive Income (Loss)	Non-Controlling Interests	Total Equity
	Shares	Amount						
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 loss	-	-	-	-	-	(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
Net income	-	-	-	33,820	-	-	6,523	40,343
Other comprehensive income	-	-	-	-	-	26,963	9,028	35,991
Sale of common stock through employee stock option and purchase plans	482	5	3,742	-	-	-	-	3,747
Restricted stock awards vesting and expense	255	2	3,890	-	-	-	-	3,892
Share-based compensation expense	-	-	787	-	-	-	-	787
Contribution from noncontrolling interest	-	-	-	-	-	-	17,596	17,596
Dividends to noncontrolling interest	-	-	-	-	-	-	(16,151)	(16,151)
Repurchase of common stock of subsidiary	-	-	255	-	-	-	(892)	(637)
Purchases of treasury stock	-	-	-	-	(34,394)	-	-	(34,394)
Retirement of treasury stock	(3,194)	(32)	(25,657)	(8,705)	34,394	-	-	-
Balance at October 31, 2020	63,138	$ 631	$ 507,336	$ 279,037	$ -	$ 17,958	$ 157,304	$ 962,266

See accompanying notes to consolidated financial statements.

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

	Year Ended		
	October 31, 2020	October 31, 2019	October 31, 2018
Cash flows from operating activities:			
Net income	$ 40,343	$ 40,491	$ 61,236
Adjustments to reconcile net income to net cash provided by operating activities:			
Depreciation and amortization of property, plant and equipment	89,171	79,238	79,536
Amortization of intangible assets	4,643	4,641	4,797
Share-based compensation	4,927	3,680	3,180
Deferred income taxes	(445)	(3,662)	(273)
Changes in assets, liabilities, and other:			
Accounts receivable	6,986	(12,321)	(18,553)
Inventories	(6,938)	(23,088)	(6,162)
Other current assets	7,849	(8,631)	(11,731)
Accounts payable, accrued liabilities and other	(3,490)	(11,962)	18,537
Net cash provided by operating activities	143,046	68,386	130,567
Cash flows from investing activities:			
Purchases of property, plant and equipment	(70,815)	(178,375)	(92,585)
Government incentives	5,263	27,003	1,005
Purchases of intangible assets	(159)	(95)	(218)
Other	-	61	929
Net cash used in investing activities	(65,711)	(151,406)	(90,869)
Cash flows from financing activities:			
Proceeds from debt	20,340	54,633	-
Contributions from noncontrolling interests	17,596	29,394	17,996
Purchases of treasury stock	(34,394)	(21,696)	(23,111)
Dividends paid to noncontrolling interests	(16,151)	(45,050)	(8,166)
Repayments of debt	(7,392)	(61,319)	(4,639)
Proceeds from share-based arrangements	4,239	2,071	4,634
Other	(248)	(92)	(519)
Net cash used in financing activities	(16,010)	(42,059)	(13,805)
Effects of exchange rate changes on cash, cash equivalents, and restricted cash	10,986	2,381	(4,840)
Net increase (decrease) in cash, cash equivalents, and restricted cash	72,311	(122,698)	21,053
Cash, cash equivalents, and restricted cash at beginning of year	209,291	331,989	310,936
Cash, cash equivalents, and restricted cash at end of year	$ 281,602	$ 209,291	$ 331,989
Supplemental disclosure of non-cash information:			
Accrual for property, plant and equipment purchased during year	$ 13,062	$ 13,671	$ 29,602

See accompanying notes to consolidated financial statements.

PHOTRONICS, INC.
Notes to Consolidated Financial Statements
Years Ended October 31, 2020, October 31, 2019 and October 31, 2018
(in thousands, except share amounts)

NOTE 1 - SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES

Business

Photronics, Inc. ("Photronics", "the Company", "we", "our", or "us") is the world's leading manufacturer 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"), 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. Subsequent actual results may differ from such estimates. We review these estimates periodically and reflect any effects of revisions in the period in which they are determined.

Reclassifications

During fiscal 2020, we modified our consolidated statements of income to present foreign currency transaction (losses) gain, net as a separate line item. Previously, the results of our foreign currency transactions were included in Interest income and other income (expense), net. In addition, we modified our classifications of certain accrued liabilities presented in Note 6; prior period amounts have been conformed to the current period presentation.

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 collectability 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.

On November 1, 2020, we adopted Accounting Standards Update 2016-13 – "Measurement of Credit Losses" ("ASU 2016-13) which replaced the incurred loss model (which was required to be used to measure credit losses under previous accounting guidance) with an expected credit loss model. Our adoption of ASU 2016-13 did not have a material effect on our financial statements.

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 2020	October 31 2019
Raw materials	$ 56,389	$ 46,027
Work in process	767	2,122
Finished goods	113	6
	$ 57,269	$ 48,155

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* in our consolidated statements of income, 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.

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.

Intangible Assets

Intangible assets consist primarily of a technology license agreement and acquisition-related intangibles. These assets 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.

Restricted Cash

Restricted cash in the amounts of $2.9 million and $2.8 million are included in Other assets on our October 31, 2020 and October 31, 2019, consolidated balance sheets, respectively. The restrictions on these amounts are primarily related to land lease agreements and customs requirements.

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.

Revenue Recognition

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. 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, 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 uncompleted revenue contracts on which we have performed; for any such contracts under which 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. We report our revenue net of any sales or similar taxes we collect on behalf of governmental entities.

As stated above, photomasks are manufactured to customer specifications in accordance with their proprietary designs; 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. Contract assets of $6.3 million are included in *Other current assets*, and contract liabilities of $8.0 million and $5.2 million are included in *Accrued liabilities* and *Other liabilities*, respectively, in our October 31, 2020 consolidated balance sheet. Our October 31, 2019 condensed consolidated balance sheet includes contract assets of $7.6 million, included in *Other current assets*, and contract liabilities of $11.5 million, included in *Accrued liabilities*. We did not impair any contract assets in fiscal years 2020 or 2019. In fiscal 2020 and 2019, we recognized revenue of $2.8 million and $1.3 million, respectively, from the settlement of contract liabilities that existed at the beginning of those years.

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 collectability risk, we modify terms of sale, which may require payment in advance of performance. At the time of adoption, we elected the practical expedient allowed under ASC Topic 606 "Revenue from Contracts with Customers" ("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 generally not preceded the completion of our performance obligations by more than one year.

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 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.

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 we will typically repair, replace, or issue a refund for, 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.

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-U.S. 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.

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 statements of cash flows as either cash flows from operating activities or cash flows from investing activities, in accordance with how we expend the funds.

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.

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.

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.

Leases

We adopted ASU 2016-02 - "Leases (Topic 842)" ("ASU 2016-02") on November 1, 2019. As allowed by the guidance, we elected to adopt ASU 2016-02 using the modified retrospective method at the beginning of the period of adoption; our adoption resulted in our recognition of $6.5 million of right-of-use ("ROU") assets and $6.5 million of lease liabilities on our opening fiscal 2020 balance sheet. At the time of transition, we elected a number of practical expedients offered by the guidance, which are described in Notes 9 and 23. The following discussion is germane to our accounting for leases under Topic 842.

We determine if an arrangement is, or contains a lease, at the inception of the arrangement. An arrangement is determined to be a lease when it conveys to us the right to control the use of an identified asset for a period of time in exchange for consideration. Our determination as to whether we have the right to control the use of an identified asset centers on whether the arrangement conveys to us the rights to 1) obtain substantially all of the economic benefits of the identified asset and 2) direct the use of the identified asset.

If an arrangement is determined to be, or include, a lease, we then apply the classification criteria in Topic 842 to determine whether the lease is a finance lease or an operating lease. For both types of leases, at their commencement dates (which are the dates on which a lessor makes an underlying asset available for our use), we recognize ROU assets, which represent our use of the underlying assets, and lease liabilities which represent our obligation to make payments for our right to use the related assets. The initial measurement of both types of leases are the same and, in most cases, are determined by applying our incremental borrowing rate for collateralized borrowings over terms similar to the leases terms. The initial measurement of ROU assets may require further adjustments for lease prepayments and initial direct costs we incur. As allowed under Topic 842, we elected to not recognize short-term leases, which are defined as leases that have a term (at their commencement dates) of twelve months or less and do not include an option to purchase the underlying asset that we are reasonably certain to exercise.

Operating leases are expensed on a straight-line basis over the terms of the leases, and are included in the consolidated statement of income in Cost of goods sold, Selling, general and administrative, or Research and development expense in accordance with the use of the underlying asset. Finance lease ROU assets are amortized over the estimated useful life of the underlying asset; the expense is included in the consolidated statement of income on the line item associated with the underlying asset (similar to operating lease expenses). Finance lease liabilities are subsequently remeasured by increasing the liability to reflect interest accrued during a period and decreasing the liability to reflect payments made during the period. Interest expense incurred on finance leases are included in Interest expense on the consolidated statements of income.

Operating lease ROU assets are included in the fiscal year 2020 consolidated balance sheet in Other assets. Operating lease liabilities due within one year are predominantly included in the consolidated balance sheets in Accrued liabilities; noncurrent operating lease liabilities are included in Other liabilities. Finance lease ROU assets are included in the consolidated balance sheets in Property, plant and equipment. Finance lease liabilities are included in the fiscal year 2020 consolidated balance sheet in Current portion of long-term debt or Long-term debt, in accordance with the timing of their related lease payments.

NOTE 2 – OTHER CURRENT ASSETS

Other current assets consists of the following:

	October 31, 2020	October 31, 2019
Recoverable value added taxes	$ 16,539	$ 16,494
Contract assets	6,313	7,596
Prepaid expenses	6,153	6,506
Prepaid and refundable income taxes	122	2,642
Other	608	5,150
	$ 29,735	$ 38,388

NOTE 3 - PROPERTY, PLANT AND EQUIPMENT, NET

Property, plant and equipment, net consists of the following:

	October 31, 2020	October 31, 2019
Land	$ 12,422	$ 12,085
Buildings and improvements	179,162	172,340
Machinery and equipment	1,812,791	1,748,483
Leasehold improvements	21,157	19,921
Furniture, fixtures and office equipment	15,665	14,404
Construction in progress	70,915	28,135
	2,112,112	1,995,368
Accumulated depreciation and amortization	(1,480,637)	(1,362,927)
	$ 631,475	$ 632,441

NOTE 4 - INTANGIBLE ASSETS

Amortization expense of the Company's finite-lived intangible assets was $4.6 million, $4.6 million and $4.8 million in fiscal years 2020, 2019 and 2018, respectively.

Intangible assets consist of:

As of October 31, 2020	Gross Amount	Accumulated Amortization	Net Amount
Technology license agreement	$ 59,616	$ (57,298)	$ 2,318
Customer relationships	2,060	(1,245)	815
Software and other	6,496	(6,192)	304
	$ 68,172	$ (64,735)	$ 3,437
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
	$ 75,327	$ (67,457)	$ 7,870

The weighted-average amortization periods of intangible assets acquired in fiscal years 2020 and 2019, which are comprised of software, is three years.

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

Fiscal Years:

2021	$2,839
2022	$ 131
2023	$ 129
2024	$ 128
2025	$ 128
Thereafter	$ 82

NOTE 5 - PDMCX JOINT VENTURE

In January 2018, Photronics, through its wholly-owned Singapore subsidiary (hereinafter, within this Note "we", "Photronics", or "our"), 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 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 provides 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, 2020, Photronics and DNP had each contributed cash of approximately $65 million, and PDMCX obtained local financing of approximately $50 million; thus both parties have fulfilled and exceeded their initial investment commitments under the Agreement. As discussed in Note 7, liens were granted to the local financing entity on property, plant and equipment with a total carrying value of $94.5 million, as collateral for the loans.

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. As of the date of issuance of these financial statements, DNP had not indicated its intention to exercise this right. 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 $4.7 million, $4.9 million and $0.7 million in fiscal 2020, 2019 and 2018, respectively. General creditors of PDMCX do not have recourse to the assets of Photronics (other than the assets of PDMCX), and our maximum exposure to loss respectively from PDMCX at October 31, 2020, was $54.8 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 years reporting periods; thus, as required, the PDMCX financial results have been consolidated with Photronics. 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.

	October 31, 2020		October 31, 2019	
Classification	**Carrying Amount**	**Photronics Interest**	**Carrying Amount**	**Photronics Interest**
Current assets	$ 56,095	$ 28,053	$ 24,142	$ 12,074
Noncurrent assets	141,097	70,562	114,015	57,019
Total assets	197,192	98,615	138,157	69,093
Current liabilities	31,922	15,964	16,889	8,446
Noncurrent liabilities	55,676	27,844	42,094	21,051
Total liabilities	87,598	43,808	58,983	29,497
Net assets	$ 109,594	$ 54,807	$ 79,174	$ 39,596

NOTE 6 - ACCRUED LIABILITIES

Accrued liabilities consist of the following:

	October 31, 2020	October 31, 2019
Compensation related expenses	$ 16,405	$ 14,011
Income taxes	11,432	13,227
Contract liabilities	8,024	11,542
Property, plant, and equipment	2,355	288
Operating leases	2,175	-
Value added and other taxes	1,925	3,761
Contract manufacturing	1,275	422
Professional fees	1,254	537
Inventory	1,026	224
Telecommunications and utilities	1,006	710
Other	7,006	4,980
Accrued liabilities	$ 53,883	$ 49,702

NOTE 7 - LONG-TERM DEBT

Long-term debt consists of the following:

	October 31, 2020	October 31, 2019
Project Loans	$ 50,063	$ 34,490
Working Capital Loans (value added tax component)	13,887	9,539
	63,950	44,029
Current portion of long-term debt	(8,970)	(2,142)
Long-term debt	$ 54,980	$ 41,887

At October 31, 2020, maturities of our long-term debt over the next five fiscal years and thereafter were as follows:

2021	$ 8,970
2022	15,142
2023	13,406
2024	9,789
2025	9,432
Thereafter	7,211
	$ 63,950

As of October 31, 2020 and October 31, 2019, the weighted-average interest rates of our short-term debt were 2.02% and 3.84%, respectively. Interest payments, including capitalized interest of $0.1 million in fiscal 2020, were $2.6 million in fiscal 2020 and 2019, and $1.9 million in fiscal 2018.

Xiamen Project Loans

In November 2018, PDMCX was approved for credit of 345 million RMB (approximately $51.4 million, at the balance sheet date), 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 RMB, are being used to finance certain capital expenditures in China. PDMCX granted liens on its interest in land, building, and certain equipment, which had a combined carrying value of $94.5 million as of October 31, 2020, as collateral for the Project Loans. As of October 31, 2020, PDMCX had outstanding borrowings of 336.0 million RMB ($50.1 million) against this approval. Payments on these borrowings are due semiannually through December 2025; an initial payment of 9.0 million RMB ($1.3 million) was made in June 2020. The table below presents, in U.S. dollars, the timing of future payments against the borrowings.

	Fiscal Year					
	2021	2022	2023	2024	2025	2026
Principal payments	$ 6,705	$ 7,334	$ 9,592	$ 9,789	$ 9,432	$ 7,211

The interest rates on the Project Loans are variable and are based on the RMB Loan Prime Rate of the National Interbank Funding Center (4.9% at October 31, 2020). Interest incurred on the loans is eligible for reimbursement through incentives provided by the Xiamen Torch Hi-Tech Industrial Development Zone, which provide for such reimbursements up to a prescribed limit.

The Company has covenants and provisions in its Project loans, certain of which relate to the assets pledged as security for these agreements; the Company was not in compliance with those provisions as of October 31, 2020. The Company obtained waivers for all specified noncompliance.

Hefei Equipment Loan

In October 2020, we were approved to borrow 200 million RMB (approximately $29.8 million) from the China Construction Bank Corporation. We received initial proceeds of 41 million RMB (approximately $6.2 million) against this approval in November 2020. Loan proceeds have been, and will be, used for the purchase of two lithography tools at our facility in Hefei, China. The interest rate on the loan is variable and based on the RMB Loan Prime Rate of the National Interbank Funding Center less 0.45% (adjusted annually), and is to be repaid semiannually, over five years, commencing on March 5, 2022. The interest rate on the loan was 4.2% at the borrowing date. The first five semiannual loan repayments will each be for 7.5 percent of the approved 200 million RMB loan principal; the last five installments will each be for 12.5 percent of the approved loan principal, with the final installment due on September 30, 2026. Semiannual repayments of the initial $6.2 million borrowed will commence on March 5, 2022, with a repayment of $2.3 million; subsequent semiannual repayments will be in the amounts of $2.3 million and $1.6 million. The borrowings are secured by the Hefei facility, its related land use right, and certain manufacturing equipment, which had a combined carrying value of $87.8 million as of October 31, 2020.

Xiamen Working Capital Loans

In November 2018, PDMCX received approval for unsecured credit of the equivalent 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 the equivalent of $25.0 million. As of October 31, 2020, PDMCX had 93.2 million RMB ($13.9 million) outstanding against the approval to pay VAT. Payments on these borrowings are due semiannually, in increasing amounts, through July 2023. The table below presents, in U.S. dollars, the timing of future payments against these borrowings.

	Fiscal Year		
	2021	2022	2023
Principal payments	$ 2,265	$ 7,808	$ 3,814

As of October 31, 2020, PDMCX had 8.0 million RMB ($1.2 million) outstanding against the approval to fund operations; repayments are due one year from the borrowing dates; as such, we have classified this borrowing as short-term debt.

At October 31, 2020, the interest rate on the borrowing to fund operations is 4.6%, and interest rates on borrowings to pay VAT are approximately 4.53 to 4.61%; both rates are variable and are based on the RMB Loan Prime Rate of the National Interbank Funding Center, plus spreads that range from 40.00 to 76.00 basis points. Interest incurred on the VAT loans are eligible for reimbursement through incentives provided by the Xiamen Torch Hi-Tech Industrial Development Zone, which provide for such reimbursements up to a prescribed limit.

U.S. Equipment Loan #1

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 variable and payable monthly at thirty-day LIBOR plus 1% (1.15% at October 31, 2020), 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 2021; as such, we have classified this borrowing as short-term debt. All borrowings under the MLA are secured by the equipment to be leased or purchased. During the first quarter of fiscal 2021, this financing entity made an additional payment of $28 million to the equipment vendor on our behalf.

U.S. Equipment Loan #2

In October 2020, we entered into a Master Lease Agreement with a financing entity for the lease of an inspection tool with a maximum value of $10 million. The tool was delivered during the fourth quarter of fiscal year 2020, and the financing entity made a progress payment to the vendor of $6.5 million in the first quarter of fiscal year 2021. The progress payment will accrue interest at 1.56% payable monthly until the final payment for the tool is made, at which time the lease will begin.

Corporate 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 covenants around minimum interest coverage ratio, total leverage ratio, and minimum unrestricted cash balance (all of which we were in compliance with at October 31, 2020), and limits the amount of cash dividends, distributions, and redemptions we can pay on our common stock to an aggregate annual amount of $50 million. We had no outstanding borrowings against the Credit Agreement at October 31, 2020, and $50 million was available for borrowing. The interest rate on the Credit Agreement (1.14% at October 31, 2020) is based on our total leverage ratio at LIBOR plus a spread, as defined in the Credit Agreement.

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. In April 2019, the entire $57.5 million principal amount was repaid upon maturity.

NOTE 8 - 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 fiscal 2018 presented have not been adjusted for the effects of Topic 606. Please refer to Note 1 for information on our revenue recognition policies.

Disaggregation of Revenue

The following tables present our revenue for the years ended October 31, 2020 and October 31, 2019, disaggregated by product type, geographic origin, and timing of recognition.

Revenue by Product Type	**Year Ended October 31, 2020**	**Year Ended October 31, 2019**
IC		
High-end	$ 156,129	$ 156,418
Mainstream	262,281	249,773
Total IC	$ 418,410	$ 406,191
FPD		
High-end	$ 139,558	$ 98,832
Mainstream	51,723	45,637
Total FPD	$ 191,281	$ 144,469
	$ 609,691	$ 550,660

Revenue by Geographic Origin		
Taiwan	$ 239,101	$ 244,377
Korea	153,052	147,734
United States	104,949	105,045
China	79,374	19,010
Europe	31,501	32,585
All other Asia	1,714	1,909
	$ 609,691	$ 550,660

Revenue by Timing of Recognition		
Over time	$ 535,071	$ 497,942
At a point in time	74,620	52,718
	$ 609,691	$ 550,660

NOTE 9 - LEASES

We adopted Accounting Standards Update ("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 elected to apply the guidance at the beginning of the period of adoption and recorded, as of November 1, 2019, right-of-use (ROU) leased assets of $6.5 million. In conjunction with this, we recorded lease liabilities, which had been discounted at our incremental borrowing rates, of $6.5 million. The impact of our adoption of Topic 842 on our current and deferred income taxes was immaterial.

The guidance allows a number of elections and practical expedients, of which we elected 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.

Our involvement in lease arrangements has typically been as a lessee. We determine if an agreement is or contains a lease on the date of the lease agreement or commitment, if earlier. Our evaluation considers whether the arrangement includes an identified asset and whether it affords us the right to control the asset. Our having the right to control the identified asset is determined by whether we are entitled to substantially all of its economic benefits and can direct its use.

We recognize leases on our consolidated balance sheet when a lessor makes an asset underlying a lease having a term in excess of twelve months available for our use. The present value of lease payments over the term of the lease, which is determined using our incremental borrowing rate for collateralized loans at the commencement date of the lease, provides the basis for the initial measurement of ROU assets and their related lease liabilities. Variable lease payments, other than those that are dependent on an index or on a rate, are not included in the measurement of ROU assets and their related lease liabilities. Lease terms will include extension periods if the lease agreement includes an option to extend the lease that we are reasonably certain to exercise. Please refer to Note 1 for additional information on our leases accounting policies.

ROU assets underlying our leases include the land and facilities of some of our operating facilities, other real property, and machinery and equipment. As of October 31, 2020, we had ROU assets under operating leases of $7.7 million, included in Other Assets, and $2.2 million and $5.0 million of lease liabilities, included in Accrued liabilities and Other liabilities, respectively, on the consolidated balance sheet. The following tables present lease payments under non-cancellable leases as of October 31, 2020.

	Fiscal Year								
	2021	2022	2023	2024	2025	Thereafter	Total Lease Payments	Imputed Interest*	Total
Lease payments	$ 2,275	$ 2,157	$ 1,205	$ 756	$ 618	$ 524	$ 7,535	$ 352	$ 7,183

*Imputed interest represents difference between undiscounted cash flows and discounted cash flows.

As of October 31, 2020, we had entered into operating leases, which had not yet commenced, with aggregate underlying ROU assets and corresponding lease liabilities of $0.1 million.

The following table presents lease costs for the year ended October 31, 2020.

	Year Ended October 31, 2020
Operating lease costs	$ 3,076
Short-term lease costs	$ 359
Variable lease costs	$ 378

Presented below is other information related to our operating leases.

Supplemental cash flows information:

	Year Ended October 31, 2020
Operating cash flows used for operating leases	$ 3,584
ROU assets obtained in exchange for operating lease obligations	$ 2,681

	As of October 31, 2020
Weighted-average remaining lease term	4.1 years
Weighted-average discount rate	2.37%

Rent expense, as calculated under guidance in effect prior to our adoption of the new leases guidance, was $3.0 million in fiscal year 2019. At October 31, 2019, future minimum lease payments under non-cancelable operating leases with initial terms in excess of one year were as presented in the table below. The amounts are undiscounted and were calculated in accordance with guidance in effect prior to our adoption of the new leases guidance.

2020	$ 1,885
2021	1,613
2022	1,535
2023	742
2024	424
Thereafter	377
	$ 6,576

NOTE 10 – 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), 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 $4.9 million, $3.7 million, and $3.2 million in fiscal years 2020, 2019, and 2018, respectively. No share-based compensation cost was capitalized as part of an asset, and $0.2 million of related income tax benefits were recorded during the fiscal years presented.

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 values of the awards are determined on the date of grant, based on the closing stock price of our common stock. There were 538,000, 435,000, and 290,000 restricted stock awards granted during fiscal years, 2020, 2019 and 2018, respectively. The weighted-average grant-date fair values of those awards were $15.08, $9.80 and $8.62. The total fair value of awards for which restrictions lapsed was $3.0 million, $1.9 million and $1.4 million during fiscal years 2020, 2019 and 2018, respectively. As of October 31, 2020, the total compensation cost for restricted stock awards not yet recognized was approximately $6.9 million. That cost is expected to be recognized over a weighted-average amortization period of 2.8 years.

A summary of restricted stock award activity during fiscal year 2020 and the status of our outstanding restricted stock awards as of October 31, 2020, is presented below:

Restricted Stock	Shares	Weighted-Average Fair Value at Grant Date
Outstanding at October 31, 2019	640,113	$ 9.70
Granted	538,000	$ 15.08
Vested	(271,347)	$ 10.90
Cancelled	(94,450)	$ 12.41
Outstanding at October 31, 2020	812,316	$ 12.55
Expected to vest as of October 31, 2020	770,778	$ 12.48

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.

There were no stock option awards granted during fiscal year 2020. The weighted-average inputs and risk-free rate of return ranges used to calculate the grant-date fair value of stock options granted during fiscal years 2019 and 2018 are presented in the following table:

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

The table below presents a summary of stock options activity during fiscal year 2020 and information on stock options outstanding at October 31, 2020.

Options	Shares	Weighted-Average Exercise Price	Weighted-Average Remaining Contractual Life	Aggregate Intrinsic Value
Outstanding at October 31, 2019	2,170,767	$ 9.00		
Granted	-	-		
Exercised	(493,450)	$ 7.94		
Cancelled and forfeited	(56,200)	$ 10.33		
Outstanding at October 31, 2020	1,621,117	$ 9.27	4.6 years	$ 1,778
Exercisable at October 31, 2020	1,366,864	$ 9.21	4.2 years	$ 1,651
Vested and expected to vest as of October 31, 2020	246,055	$ 9.61	7.3 years	$ 123

The weighted-average grant date fair value of options granted during fiscal years 2019 and 2018 were $3.31 and $2.76, respectively. The total intrinsic value of options exercised during fiscal years 2020, 2019 and 2018 was $3.2 million, $1.3 million and $2.5 million, respectively.

We received cash from option exercises of $3.7 million, $2.1 million and $4.3 million in fiscal years 2020, 2019 and 2018, respectively. As of October 31, 2020, the total unrecognized compensation cost of unvested option awards was approximately $0.4 million. That cost is expected to be recognized over a weighted-average amortization period of 1.7 years.

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, 2020, 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, 2020. As of October 31, 2020, 0.1 million shares were subject to outstanding subscriptions.

NOTE 11 - 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 $0.7 million in fiscal years 2020, 2019 and 2018, respectively.

NOTE 12 - INCOME TAXES

Income before the income tax provisions consists of the following:

	Year Ended October 31, 2020	Year Ended October 31, 2019	Year Ended October 31, 2018
United States	$ (10,672)	$ (8,379)	$ (9,859)
Foreign	72,273	59,080	78,430
	$ 61,601	$ 50,701	$ 68,571

The income tax provisions consist of the following:

	Year Ended October 31, 2020	Year Ended October 31, 2019	Year Ended October 31, 2018
Current:			
Federal	$ -	$ (3,916)	$ (30)
State	4	11	-
Foreign	21,698	17,777	11,584
Deferred:			
Federal	-	3,673	(3,673)
State	8	10	(24)
Foreign	(452)	(7,345)	(522)
Total	$ 21,258	$ 10,210	$ 7,335

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, 2020	Year Ended October 31, 2019	Year Ended October 31, 2018
U.S. federal income tax at statutory rate	$ 12,936	$ 10,647	$ 16,059
Changes in valuation allowances	6,942	2,673	4,554
Foreign tax rate differentials	1,718	218	(2,078)
Tax credits	(1,562)	(1,268)	(1,530)
Uncertain tax positions, including reserves, settlements and resolutions	1,637	134	(1,791)
Employee stock option	-	-	(1,433)
Income tax holiday	(318)	(2,234)	(2,648)
Tax reform	-	-	(3,736)
Distributions from foreign subsidiaries	-	-	-
Tax on foreign subsidiary earnings	-	-	-
Other, net	(95)	40	(62)
	$ 21,258	$ 10,210	$ 7,335
Effective tax rate	34.5%	20.1%	10.7%

The fiscal year 2020 effective tax rate differs from the U.S. statutory rate of 21% primarily due to loss jurisdiction pre-tax losses not being benefited due to valuation allowances, non-U.S. pre-tax income being taxed at higher statutory rates in the non-U.S. jurisdictions (partially offset by the benefits of a tax holiday), and investment credits in foreign jurisdictions.

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.

We were granted a five-year tax holiday in Taiwan that expired on December 31, 2019. This tax holiday reduced foreign taxes by $0.1 million, $2.2 million and $2.6 million in fiscal years 2020, 2019 and 2018, respectively, with an $0.02 and $0.035 cents per share impact in fiscal 2019 and 2018, respectively, and an immaterial per share effect in fiscal 2020.

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, 2020	As of October 31, 2019
Deferred income tax assets:		
Net operating losses	$ 34,457	$ 32,229
Reserves not currently deductible	6,287	5,013
Tax credit carryforwards	9,481	9,164
Share-based compensation	1,306	860
Property, plant and equipment	3,887	-
Other	398	434
	55,816	47,700
Valuation allowances	(33,973)	(27,032)
	21,843	20,668
Deferred income tax liabilities:		
Property, plant and equipment	-	(251)
Other	-	-
	-	(251)
Net deferred income tax assets	$ 21,843	$ 20,417
Reported as:		
Deferred income tax assets	$ 22,070	$ 20,779
Deferred income tax liabilities	(227)	(362)
	$ 21,843	$ 20,417

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 2020 the valuation allowance increased as a result of management’s determination that tax benefits on losses incurred in a non-U.S. jurisdiction would not more likely than not be realized and, therefore, increased the valuation allowance to include these net operating losses. In fiscal 2019, the valuation allowance increased as a result of an increase in fully valued net operating losses.

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, 2020, and their related expiration periods:

Operating Loss Carryforwards	Amount	Expiration Periods
Federal	$ 90,125	2028-Indefinite
State	205,649	2020-2040
Foreign	14,895	2022-2030

Tax Credit Carryforwards	Amount	Expiration Period
Federal research and development	$ 4,796	2024-2040
State	5,928	2020-2034

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, for each share of the Company's common stock, par value $0.01 per share, 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, 2020	October 31, 2019	October 31, 2018
Balance at beginning of year	$ 1,758	$ 1,775	$ 3,384
Additions (reductions) for tax positions in prior years	227	(466)	(44)
Additions based on current year tax positions	1,576	1,286	498
Settlements	(992)	(204)	(56)
Lapses of statutes of limitations	(19)	(633)	(2,007)
Balance at end of year	$ 2,550	$ 1,758	$ 1,775

At October 31, 2020, October 31, 2019 and October 31, 2018, unrecognized tax benefits, which are included in Other liabilities, include $2.0 million $1.9 million, and $1.9 million, respectively, that, if recognized, would impact the effective tax rates. Included in each of these amounts were interest and penalties of $0.1 million, $0.2 million, and $0.1 million, at the end of fiscal years 2020, 2019, and 2018, 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 $0.4 million. Resolution of these uncertain tax positions may result from either or both the lapses of statutes of limitations and/or 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 2015.

Income tax payments were $23.0 million, $15.9 million and $6.1 million in fiscal 2020, 2019 and 2018, respectively. Cash received as refunds of income taxes paid in prior years amounted to $4.3 million in fiscal 2020, $1.1 million in fiscal 2018, and an immaterial amount in fiscal 2019.

NOTE 13 - EARNINGS PER SHARE

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

	Year Ended October 31, 2020	Year Ended October 31, 2019	Year Ended October 31, 2018
Net income attributable to Photronics, Inc. shareholders	$ 33,820	$ 29,793	$ 42,055
Effect of dilutive securities:			
Interest expense on convertible notes, net of tax	-	845	1,999
Earnings used for diluted earnings per share	$ 33,820	$ 30,638	$ 44,054
Weighted-average common shares computations:			
Weighted-average common shares used for basic earnings per share	64,866	66,347	68,829
Effect of dilutive securities:			
Share-based payment awards	604	448	450
Convertible notes	-	2,360	5,542
Potentially dilutive common shares	604	2,808	5,992
Weighted-average common shares used for diluted earnings per share	65,470	69,155	74,821
Basic earnings per share	$ 0.52	$ 0.45	$ 0.61
Diluted earnings per share	$ 0.52	$ 0.44	$ 0.59

The table below illustrates 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.

	Year Ended October 31, 2020	Year Ended October 31, 2019	Year Ended October 31, 2018
Share based payment awards	795	1,250	1,627
Total potentially dilutive shares excluded	795	1,250	1,627

Subsequent to October 31, 2020, we repurchased 0.1 million shares of our common stock. See Note 20 for information on our share repurchase programs.

NOTE 14 - COMMITMENTS AND CONTINGENCIES

As of October 31, 2020, we had outstanding purchase commitments of $130 million, $112 million of which was for capital equipment. As of October 31, 2020, we had recorded liabilities for the purchase of equipment of $15 million.

The Company’s wholly owned subsidiary in South Korea has been involved in litigation regarding a 2016 informational tax filing for its non-South Korean bank accounts that was not timely made under a then recently issued presidential decree. A fine (based solely on the amount in such accounts) in the amount of $2.2 million was assessed against our subsidiary. Our subsidiary appealed the fine on the grounds that it was not required to make the tax filing, and such appeal was pursued up to the Supreme Court in South Korea. Under South Korean law, the tax authorities were entitled to pursue the matter in both civil and criminal courts simultaneously, with the proviso that any criminal fine imposed would act to dismiss any civil fine. The prosecutor recommended a fine of $0.03 million. The civil matter has subsequently been dismissed. Photronics was notified on March 12, 2020, that the Supreme Court rendered a decision against our subsidiary on the issue of whether our subsidiary was required to make the tax filing and remanded the case to the appellate court for determination of the fine. We are awaiting a trial date from the appellate court. Prior to the Supreme Court decision, our assessment was that the possibility of a fine was deemed remote, based on advice of local counsel and the subsequent judgments in the lower courts having been in our favor. Our estimate of the possible range of loss is $0.03 million to $2.2 million with the most likely amount being $0.03 million (based on the prosecutor’s recommendation). Accordingly, during the three-month period ended May 3, 2020, we accrued a contingent loss of $0.03 million with a charge to Selling, general and administrative expense in the consolidated statements of income. It is reasonably possible that the estimated loss will change in the near term. Our maximum exposure to loss in excess of amounts accrued is $2.17 million. The imposition of the fine will not have a material impact on our financial position or financial performance.

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 15 - 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 fiscal 2020, 2019 and 2018 revenue by geographic origin and by IC and FPD products are presented below.

	Year Ended		
	October 31, 2020	**October 31, 2019**	**October 31, 2018**
Net revenue			
Taiwan	$ 239,101	$ 244,377	$ 237,039
Korea	153,052	147,734	147,066
United States	104,949	105,045	112,648
China	79,374	19,010	1,157
Europe	31,501	32,585	35,540
All other Asia	1,714	1,909	1,826
	$ 609,691	$ 550,660	$ 535,276
IC	$ 418,410	$ 406,191	$ 416,064
FPD	191,281	144,469	119,212
	$ 609,691	$ 550,660	$ 535,276

Our 2020 and 2019 long-lived assets by geographic area are presented below.

	As of October 31, 2020	As of October 31, 2019
Long-lived assets		
China	$ 262,800	$ 232,394
Taiwan	123,979	146,467
United States	130,164	130,935
Korea	110,815	117,755
Europe	3,717	4,890
	$ 631,475	$ 632,441

One customer accounted for 16%, 15%, and 15% of our revenue in fiscal years 2020, 2019 and 2018, respectively, and another customer accounted for 14%, 16% and 16% of our revenue in fiscal years 2020, 2019 and 2018, respectively.

NOTE 16 - 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, 2020 and October 31, 2019:

	Year Ended October 31, 2020		
	Foreign Currency Translation Adjustments	Other	Total
Balance at October 31, 2019	$ (8,331)	$ (674)	$ (9,005)
Other comprehensive income (loss)	36,381	(390)	35,991
Less: other comprehensive income (loss) attributable to noncontrolling interests	9,222	(194)	9,028
Balance at October 31, 2020	$ 18,828	$ (870)	$ 17,958

	Year Ended October 31, 2019		
	Foreign Currency Translation Adjustments	Other	Total
Balance at October 31, 2018	$ (4,328)	$ (638)	$ (4,966)
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	$ (8,331)	$ (674)	$ (9,005)

NOTE 17 – CONCENTRATIONS OF CREDIT RISK

Financial instruments that potentially subject us to credit risk principally consist of trade accounts receivable 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, 2020 and October 31, 2019, one of our customers accounted for 24% and 17% of our net accounts receivable, respectively.

NOTE 18 - RELATED PARTY TRANSACTIONS

On January 20, 2018, we entered into a four-year consulting agreement with DEMA Associates, LLC, of which the chairman of our board of directors is a member, for $0.4 million per year. We incurred expenses for services provided by this entity of $0.4 million and $0.3 million in fiscal years 2019 and 2018, respectively. Effective March 9, 2020, the agreement was amended to reduce the consideration under the contract to $0.1 million per year for its remaining term; in fiscal 2020, we incurred expenses for services provided by this entity of $0.2 million.

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 $96.4 million, $87.0 million and $78.4 million, in fiscal years 2020, 2019 and 2018, respectively. As of October 31, 2020 and October 31, 2019, we had accounts receivable of $32.7 million and $22.2 million, respectively, from this customer.

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 19 - 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 approximate their carrying values due to the variable nature of the underlying interest rates. We did not have any assets or liabilities measured at fair value, on a recurring or a nonrecurring basis, at October 31, 2020 or October 31, 2019.

NOTE 20 – SHARE REPURCHASE PROGRAMS

In September 2020, 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 Securities Act"). Repurchases under the program commenced on September 16, 2020.

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. The share repurchase program commenced on September 25, 2019, and was terminated on March 20, 2020.

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. 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. 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 in fiscal 2020 were retired prior to the end of the fiscal year. All of the shares purchased under prior year repurchase programs were retired in fiscal year 2019. The Table below presents information on the repurchase programs.

	Fiscal Year 2020 Purchases	Fiscal Year 2019 Purchases	Fiscal Year 2018 Purchases	Total Purchases Under Programs
Number of shares repurchased	3,194	2,133	2,558	7,885
Cost of shares repurchased	$ 34,394	$ 21,696	$ 23,111	$ 79,201
Average price paid per share	$ 10.77	$ 10.17	$ 9.04	$ 10.04

NOTE 21 – SUBSIDIARY DIVIDEND

In fiscal years 2020, 2019 and 2018, PDMC, the Company's majority owned subsidiary in Taiwan, paid dividends of which 49.99%, or approximately $16.2 million, $45.1 million and $8.2 million, respectively, were paid to noncontrolling interests.

NOTE 22 - QUARTERLY RESULTS OF OPERATIONS (UNAUDITED)

The following table sets forth certain unaudited quarterly financial data:

	First	Second	Third	Fourth	Year
Fiscal 2020:					
Revenue	$ 159,736	$ 142,774	$ 157,895	$ 149,286	$ 609,691
Gross profit	34,602	30,433	37,734	31,885	134,654
Net income	10,928	7,972	12,864	8,579	40,343
Net income attributable to Photronics, Inc. shareholders	10,300	6,284	10,776	6,460	33,820
Earnings per share:					
Basic	$ 0.16	$ 0.10	$ 0.17	$ 0.10	$ 0.52
Diluted	$ 0.16	$ 0.10	$ 0.17	$ 0.10	$ 0.52

	First	Second	Third	Fourth	Year
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

NOTE 23 - RECENT ACCOUNTING PRONOUNCEMENTS

Accounting Standards Updates Implemented

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 elected to apply the guidance at the beginning of the period of adoption and recorded, as of November 1, 2019, right-of-use (ROU) leased assets of $6.5 million. In conjunction with this, we recorded lease liabilities, which had been discounted at our incremental borrowing rates, of $6.5 million. Our adoption of Topic 842 did not affect our cash flows or our ability to comply with covenants under our credit agreement. Please see Note 9 for our leases disclosure.

Accounting Standards Updates to be Adopted

In March 2020, the FASB issued ASU 2020-04, “Reference Rate Reform (Topic 848): Facilitation of the Effects of Reference Rate Reform on Financial Reporting”, which provides optional expedients and exceptions to applying the guidance on contract modifications, hedge accounting, and other transactions, to simplify the accounting for transitioning from the London Interbank Offered Rate, and other interbank offered rates expected to be discontinued, to alternative reference rates. The guidance in this Update was effective upon its issuance; if elected, it is to be applied prospectively through December 31, 2022. We are currently evaluating the effect the potential adoption of this ASU will have on our consolidated financial statements.

In June 2016, the 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 impairment methodology, found in current GAAP, with a methodology that reflects expected credit losses and 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 was effective for Photronics in its first quarter of fiscal year 2021. We adopted ASU 2016-13 on November 1, 2020; the effect of the adoption was immaterial, and did not warrant our recording a cumulative-effect adjustment.

ITEM 9. CHANGES IN AND DISAGREEMENTS WITH ACCOUNTANTS ON ACCOUNTING AND FINANCIAL DISCLOSURE

None.

ITEM 9A. CONTROLS AND PROCEDURES

Evaluation of Disclosure Controls and Procedures

Our management, with the participation of our Chief Executive Officer and Chief Financial Officer, evaluated the effectiveness of our disclosure controls and procedures as of October 31, 2020. 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. Based on an evaluation of our disclosure controls and procedures as of October 31, 2020, and due to a material weakness in our internal control (see discussion below), our Chief Executive Officer and Chief Financial Officer concluded that, as of such date, our disclosure controls and procedures were not effective.

Notwithstanding this material weakness, our management, including our Chief Executive Officer and Chief Financial Officer, has concluded that our financial statements included in this Annual Report on Form 10-K present fairly, in all material respects, our financial position, results of operations and cash flows for the periods presented in accordance with accounting principles generally accepted in the United States of America.

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. Under the supervision and with the participation of our management, including our principal executive officer and principal financial officer, the Company conducted an evaluation of the effectiveness of the internal control over financial reporting based on criteria established in the Internal Control – Integrated Framework (2013) issued by the Committee of Sponsoring Organizations of the Treadway Commission (COSO).

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.

Management assessed the effectiveness of our internal control over financial reporting as of October 31, 2020, based on the criteria set forth by the COSO. 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 not effective as of October 31, 2020, due to the material weakness in our internal control over financial reporting relating to the accuracy and completeness of information used in the monitoring compliance with covenants stipulated by the Company's debt agreements. The Company has instituted new processes to ensure compliance with covenants in all material agreements.

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, 2020, as stated in their report on page 72 of this Form 10-K.

Changes in Internal Control over Financial Reporting

Other than the material weakness discussed above, there have been no other changes in our internal control over financial reporting during the fiscal quarter ended October 31, 2020 that has materially affected, or is reasonably likely to materially affect, our internal control over financial reporting.

REPORT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

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

Opinion on Internal Control over Financial Reporting

We have audited the internal control over financial reporting of Photronics, Inc. and subsidiaries (the "Company") as of October 31, 2020, 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, because of the effect of the material weakness identified below on the achievement of the objectives of the control criteria, the Company has not maintained effective internal control over financial reporting as of October 31, 2020, based on criteria established in *Internal Control — Integrated Framework (2013)* issued by COSO**.**

We have also audited, in accordance with the standards of the Public Company Accounting Oversight Board (United States) (PCAOB), the consolidated financial statements as of and for the year ended October 31, 2020, of the Company and our report dated January 14, 2021, expressed an unqualified opinion on those financial statements.

Basis for Opinion

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

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

Definition and Limitations of Internal Control over Financial Reporting

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.

Material Weakness

A material weakness is a deficiency, or a combination of deficiencies, in internal control over financial reporting, such that there is a reasonable possibility that a material misstatement of the company's annual or interim financial statements will not be prevented or detected on a timely basis. The following material weakness has been identified and included in management's assessment: the Company did not properly design and operate adequate internal control over accuracy and completeness of information used in the monitoring compliance with covenants stipulated by the Company's debt agreements. This material weakness was considered in determining the nature, timing, and extent of audit tests applied in our audit of the consolidated financial statements as of and for the year ended October 31, 2020, of the Company, and this report does not affect our report on such financial statements.

/s/ Deloitte & Touche LLP
Hartford, Connecticut
January 14, 2021

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 2021 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 2021 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 executive 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 2021 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 2021 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 2021 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 2021 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 2021 Definitive Proxy Statement under the captions "Independent Registered Public Accounting Firm Fees" 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:

		Page No.
1.	Financial Statements: See "INDEX TO CONSOLIDATED FINANCIAL STATEMENTS" in Part II, Item 8 of this Form 10-K for a list of financial statements filed as part of this report.	36
2.	Financial Statement Schedule:	
	Schedule II - Valuation and Qualifying Accounts for the years ended October 31, 2020, October 31, 2019 and October 31, 2018	76
	All other schedules are omitted because they are not applicable.	
3.	Exhibits	77

Schedule II

Valuation and Qualifying Accounts
for the Years Ended October 31, 2020, October 31, 2019
and October 31, 2018
(in $ thousands)

Allowance for Doubtful Accounts	**Balance at Beginning of Year**	**Charged to Costs and Expenses**	**Deductions**	**Balance at End of Year**
Year-ended October 31, 2020	$ 1,334	$ (22)	$ 12(a)	$ 1,324
Year-ended October 31, 2019	$ 1,526	$ (18)	$ (174)(a)	$ 1,334
Year ended October 31, 2018	$ 2,319	$ (809)	$ 16(a)	$ 1,526

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

ITEM 16. FORM 10-K SUMMARY

Not applicable.

EXHIBITS INDEX

Exhibit Number	Description	Incorporated by Reference			Filed or Furnished Herewith
		Form	Exhibit	Filing Date	
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.	10-K	3.1	12/20/2019	
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	10-K	4.1	12/20/2019	
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*	10-K	10.5	12/23/2019	
10.6	2016 Equity Incentive Compensation Plan.+	DEF 14A		2/29/2016	
10.7	The Company's 2007 Long-Term Equity Incentive Plan.+	DEF 14A		2/23/2007	

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	10.7	12/23/2019
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.+	10-K	10.18	12/23/2019
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	Executive Employment Agreement between Photronics Dai Nippon Mask Corporation and Frank Lee dated March 9, 2020	10-Q	10.36	3/11/2020
10.23	Consulting Agreement between the Company and DEMA Associates, LLC dated January 20, 2018.	10-K	10.21	12/21/2018
10.24	Amendment dated March 9, 2020 between DEMA Associates, LLC and the Company	10-Q	10.37	3/11/2020

10.25	Form of Amendment to Executive Employment Agreement dated March 16, 2012.+	10-K	10.23	12/23/2019	
10.26	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	
10.27	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	
10.28	Fixed Asset Loan Agreement between Photronics DNP Mask Corporation Xiamen and Industrial and Commercial Bank China Limited Xiamen Xiang'an Branch	10-K	10.26	12/21/2018	
10.29	Working Capital Loan Agreement between Industrial and Commercial Bank 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	
10.30	Investment Agreement between Xiamen Torch Hi-Tech Industrial Development Zone Management Committee and Photronics Singapore Pte. Ltd.	10-Q	10.35	9/2/2016	
10.31	Amendment No. 1 to the Investment Agreement between Xiamen Torch Hi-Tech Industrial Development Zone Management Committee and Photronics Singapore Pte, Ltd	10-K	10.29	12/23/2019	
10.32	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	
10.33	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	
10.34	Outsourcing Agreement dated May 16, 2017 among Photronics, DNP, Photronics DNP Photomask Corporation ("PDMC"), and PDMCX.#	10-Q/A	10.28	12/19/2017	
10.35	Amended and Restated License Agreement dated May 16, 2017 between DNP and PDMC.#	10-Q/A	10.29	12/19/2017	
10.36	Investment Cooperation Agreement between Hefei State Hi-tech Industry Development Zone and Photronics UK, Ltd.	10-K	10.42	12/20/2017	
10.37	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	
10.38	Master Lease Agreement dated October 12, 2020 between TD Equipment Finance and the Company				X
10.39	Fixed Asset Loan Contract dated October 1, 2020 between TD Equipment Finance,Inc. and the Company				X
10.40	Maximum Mortgage Contract dated October 1, 2020 between Photronics Mask Corporation Hefei and China Construction Bank Corporation Hefei Shusshan Branch				X
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 1350 as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002.				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.

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	/s/ John P. Jordan	By	/s/ Eric Rivera
	John P. Jordan Executive Vice President, Chief Financial Officer (Principal Financial Officer) January 14, 2021		Eric Rivera Vice President, Corporate Controller (Principal Accounting Officer) January 14, 2021

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	/s/ Peter S. Kirlin Peter S. Kirlin Chief Executive Officer Director (Principal Executive Officer)	January 14, 2021
By	/s/ John P. Jordan John P. Jordan Executive Vice President, Chief Financial Officer (Principal Financial Officer)	January 14, 2021
By	/s/ Eric Rivera Eric Rivera Vice President, Corporate Controller (Principal Accounting Officer)	January 14, 2021
By	/s/ Constantine S. Macricostas Constantine S. Macricostas Chairman of the Board	January 14, 2021
By	/s/ Walter M. Fiederowicz Walter M. Fiederowicz Director	January 14, 2021
By	/s/ Daniel Liao Daniel Liao Director	January 14, 2021
By	/s/ George Macricostas George Macricostas Director	January 14, 2021
By	/s/ Mary Paladino Mary Paladino Director	January 14, 2021
By	/s/ Mitchell G. Tyson Mitchell G. Tyson Director	January 14, 2021

Exhibit 10.38

MASTER LEASE AGREEMENT

This Master Lease Agreement ("Agreement") is dated as of October 12, 2020 by and between **TD EQUIPMENT FINANCE, INC.** ("Lessor"), having an office at 2059 Springdale Road, Cherry Hill, New Jersey 08003, and **PHOTRONICS, INC.** ("Lessee"). If more than one person or entity executes the Agreement as "Lessee," then the term "Lessee" shall mean each person or entity executing the Agreement both individually and Jointly, and each such person or entity shall have joint and several liability under the Agreement.

In consideration of the mutual agreements set forth below and the payment of rent as provided for herein, and intending to be legally bound, the parties agree as follows:

1. **LEASE**. This Agreement establishes the general terms and conditions under which lessor may from time to time lease equipment and other property to Lessee. The terms of this Agreement shall be deemed to form a part of each Master Lease Schedule (each a "Schedule") executed by Lessee and Lessor which references this Agreement. "Equipment'' shall mean all items of equipment and other property described on any Schedule. Each Schedule shall constitute a separate lease agreement ("Lease") incorporating all of the terms and conditions of this Agreement. In the event of a conflict between the provisions of any Lease and the provisions of this Agreement, the provisions of the Lease shall prevail.

2. **TERMS AND LEASE PAYMENTS**. This Agreement shall become effective when it is signed and accepted by Lessor and shall remain in effect until the last Lease term under any Schedule has expired. Individual Leases go into effect and the term of a Lease begins when it is signed and accepted by Lessor ("Commencement Date"). Lessee hereby authorizes Lessor to insert the Commencement Date on each Lease. Lessee shall pay to Lessor rent ("Lease Payments") for each item of Equipment in the amount and at the times specified in the Schedule for such Equipment. Unless otherwise provided by the Lease, the first Lease Payment is due on the date Lessor accepts the Lease or any later date designated by Lessor, and interim rent shall be due from the date Lessee accepts the Equipment. Subsequent Lease Payments will be due as invoiced by Lessor for successive months until the balance of the Lease Payments and any additional Lease Payment or expenses chargeable to Lessee under a Lease are paid in full. **LESSEE'S OBLIGATION TO PAY THE LEASE PAYMENTS AND OTHER LEASE OBLIGATIONS IS ABSOLUTE AND UNCONDITIONAL AND IS NOT SUBJECT TO CANCELLATION, DEFENSE, DEDUCTION, RECOUPMENT, REDUCTION, SETOFF, CLAIM OR COUNTERCLAIM. THIS AGREEMENT AND ALL LEASES ARE NON-CANCELLABLE**. All Payments will be made to Lessor as set forth on the Lease or any other place Lessor indicates in writing.

The amounts of each Lease Payment is based on the supplier's best estimate of the Equipment cost including (if applicable), any installation, other related costs and estimated sales or use tax. The Lease Payments will be adjusted proportionately upward or downward if the actual total cost of the Equipment or taxes is more or less than the estimate. In that event, Lessee authorizes Lessor to adjust the Lease Payments by up to ten percent (10%).

3. **DELIVERY AND ACCEPTANCE**. Lessee is responsible, at Lessee's own cost and expense, to arrange for the delivery and installation of the Equipment (unless such costs are included in the cost of the Equipment to Lessor). Lessee agrees that the signing of the Delivery and Acceptance Certificate supplied by Lessor constitutes full acceptance of the Equipment and commencement of the Lease.

4. **DISCLAIMER OF WARRANTIES**. Lessee acknowledges that Lessor is not the manufacturer of the Equipment, nor the manufacturer's or vendor's agent. Nor is the vendor an agent of Lessor. Lessee has selected the Equipment based upon Lessee's own judgment. Lessee disclaims any reliance upon any statements or representations made by Lessor and acknowledges that representations made by Vendor, unless specifically contained in this Agreement, shall not be binding upon Lessor. LESSOR HAS NOT MADE AND DOES NOT MAKE ANY REPRESENTATION OR WARRANTY OF ANY KIND, WHETHER DIRECT OR INDIRECT, EXPRESS OR IMPLIED, WITH RESPECT TO THE SUITABILITY, MATERIALS, DURABILITY, DESIGN, WORKMANSHIP, OPERATION OR CONDITION OF THE EQUIPMENT OR ANY PART THEREOF, ITS MERCHANTABILITY, FITNESS FOR USE FOR THE PARTICULAR PURPOSES AND USES OF LESSEE. Lessor shall not be liable to lessee for any loss, damage or expense of any kind or nature caused directly or indirectly by the Equipment or for any damages based on strict or absolute tort liability or lessor's or vendor's negligence, or due to the repair, service or adjustment of the Equipment, or by any delay or failure to provide any maintenance, repair, service or adjustment, or by any interruption of service, or for any loss of business however caused. NO DEFECT OR UNFITNESS OF THE EQUIPMENT OR THE FACT THAT THE EQUIPMENT SHALL NOT OPERATE OR THAT IT SHALL OPERATE IMPROPERLY SHALL RELIEVE LESSEE OF ANY OBLIGATION UNDER THE LEASE.

5. **TITLE. PERSONAL PROPERTY, LOCATION AND INSPECTION**. Lessor owns the Equipment and Lessee has the right to use the Equipment for the full Lease term provided Lessee complies with the terms and conditions of this Agreement and the Lease. Lessee will keep and use the Equipment only at the Equipment Location shown on the applicable Schedule. Although the Equipment may become attached to real estate, it remains personal property and Lessee agrees not to permit a lien to be placed upon the Equipment or to remove the Equipment from the Equipment Location without Lessor's prior written consent. The Equipment is removable from and is not essential to the premises at which the Equipment is located. If Lessor feels it is necessary, Lessee agrees to provide Lessor with waivers of interest or liens, from anyone claiming any interest in the real estate on which any item of Equipment is located. Lessor also has the right, at reasonable times, to inspect the Equipment. If the

Lessee elects in writing to return the Equipment at the end of term, the Lessor may enter the premises where the Equipment us located during normal business hours for the purpose of showing and demonstrating the Equipment to prospective purchasers or for an appraisal of the Equipment. The Lessee shall provide adequate electrical, power, lighting, heat, water and personnel sufficient to allow for normal demonstrations of the Equipment to potential buyers.

6. **MAINTENANCE.** Lessee shall use the Equipment in a careful and lawful manner; comply with and conform to all laws Ordinances and regulations related to the possession, use and maintenance of the Equipment. and maintain the Equipment so that it is certified for use by all regulatory agencies where applicable. Lessee shall use the Equipment exclusively for agricultural, business or commercial purposes. Lessee is required, at Lessee's own cost and expense, to keep the Equipment in good repair, condition and working order, except for ordinary wear and tear, and Lessee will supply all parts and servicing required. All replacement parts, attachments, accessories, upgrades and modifications; used or installed and repairs made to the Equipment will become Lessor's property. Lessee may, with Lessor's prior written consent, make modifications to the Equipment; so long as such modifications do not reduce the value or usefulness of the Equipment or result in the loss of any warranty or any certification necessary for the maintenance of the Equipment. Lessee shall enter into and maintain in force, for the term of the lease, a maintenance contract with the manufacturer of the equipment or with an approved service provider satisfactory to Lessor and take an actions necessary to cause the equipment to remain eligible for the manufacturer's maintenance program. This includes all replacements, upgrades, enhancements and software related to the Equipment that are required by the manufacturer for such eligibility. Lessee shall provide Lessor with a copy of the maintenance contract and maintenance log upon request. Subject to Lessor's prior approval, and as long as Lessee demonstrates the capabilities that it has the adequate skills and expertise Lessee may elect to maintain certain types of equipment with its own personnel. LESSEE ACKNOWLEDGES THAT LESSOR IS NOT RESPONSIBLE FOR PROVIDING ANY REQUIRED MAINTENANCE AND/OR SERVICE FOR THE EQUIPMENT. LESSEE WILL MAKE ALL CLAIMS FOR .SERVICE AND/OR MAINTENANCE SOLELY TO THE SUPPLIER AND/OR MANUFACTURER AND SUCH CLA.IMS WILL NOT AFFECT LESSEE'S OBLIGATION TO MAKE ALL REQUIRED LEASE PAYMENTS.

7. **ASSIGNMENT.** LESSEE AGREES NOT TO TRANSFER, SELL, SUBLEASE, ASSIGN, PLEDGE OR ENCUMBER EITHER THE EQUIPMENT OR ANY OF LESSEE'S RIGHTS UNDER THIS AGREEMENT OR ANY LEASE OR OTHERWISE PERMIT THE EQUIPMENT TO BE OPERATED OR USED BY, OR COME INTO OR REMAIN IN THE POSSESSION OF ANYONE BUT LESSEE; WITHOUT LESSOR'S PRIOR WRITTEN CONSENT. No sale, assignment, transfer or sublease, whether authorized herein or in violation of the terms hereof, shall relieve Lessee of its obligations, and Lessee shall remain primarily liable, hereunder and under each Lease. Lessee agrees that Lessor may sell, assign or transfer all or any part of any Lease and if Lessor does, the new owner will have the same rights and benefits that lessor now has and will not have to perform any of Lessor's obligations and that the rights of the new owner will not be subject to any claims, defenses, or setoffs that Lessee may have against Lessor. Any such assignment, sale or transfer of a Lease or the Equipment will not relieve Lessor of Lessor's obligations to Lessee under the Lease. Subject to the foregoing, this Agreement inures to the benefit of and is binding upon the successors and assigns of the parties hereto and thereto, as the case may be (and, without limiting the foregoing, shall bind all persons who become a "new debtor" to this Agreement and any Lease, as defined in Section 9-203(e) of Revised Article 9 of the UCC).

8. **PURCHASE. RETURN AND RENEWAL OF EQUIPMENT.** So long as no default or event of default shall have occurred and be continuing and the Lessee shall have given Lessor written notice to Lessor at least one hundred eighty (180) days, but not more than two hundred seventy (270) days prior to the expiration of the initial term or any renewal of any Lease, Lessee shall advise Lessor of Lessee's intention to (i) purchase all but not less than all of the Equipment for the then fair market value in use, in place plus applicable taxes; (ii) renew the lease on a month to month basis at the same rent payable in monthly installments in the same amount and due on the same date as during the initial term; or (iii) return the Equipment to Lessor at the end of the initial term or any renewal of such Lease. If Lessee falls to so notify lessor, or having notified Lessor, Lessee fails to return the Equipment as provided herein, the Lease shall renew for an additional term of four (4) months, and Lessee agrees to continue to make lease payments at the same monthly lease payment as set forth in this Lease, subject to the right of either party to terminate any renewal upon one hundred twenty (120) days written notice, in which case Lessee will immediately deliver the Equipment to Lessor as stated in this paragraph. Provided Lessee has given such timely notice to return the equipment, Lessee shall return all, but not less than all, of the Equipment. to any location within the continental United States as designated by Lessor. The Lessee must prepare the Equipment for shipping according to the manufacturer's instructions using approved packaging material and shall bear all risk of damage or loss until the Equipment is returned to us at the designated location. All costs and expenses associated with the packaging, shipping, delivery and inspection of the returned Equipment shall be paid by Lessee, including any cost Lessor incurs for deinstallation of alterations to the Equipment. Lessee shall be liable for all damage to the Equipment in excess of reasonable wear and tear.

9. **LOSS OR DAMAGE.** Lessee assumes and shall bear the entire risk of loss or destruction of, or damage to the Equipment from any cause whatsoever, whether or not insured. No such loss or damage relieves Lessee from any obligation under a Lease. Lessee agrees to promptly notify Lessor in writing of any loss or destruction or damage to the Equipment and Lessee will. at Lessor's option, (a) repair the Equipment to good condition and working order, (b) replace the Equipment with like Equipment in good repair, condition and working order, acceptable to Lessor and transfer clear title to such replacement Equipment to Lessor, such Equipment shall be subject to the Lease and be deemed the Equipment. or (c) pay to Lessor the present value of the total of all unpaid Lease Payments for the full Lease term plus the greater of either (i) the estimated fair market value of the Equipment at the end of the originally scheduled Lease term or (ii) Lessor's residual position (as determined by Lessor in its sole discretion), all discounted at a rate equal to, unless set forth in a separate Schedule, one percent (1.0%) per annum whereupon the Lease shall terminate. All proceeds of insurance received by Lessor as a result of such loss or damage will be applied, where applicable, toward the replacement or repair of the Equipment or the payment of Lessee's obligations.

10. **INDEMNITY.** lessee assumes liability for and agrees to indemnify, defend (if requested by Lessor) and hold harmless Lessor and its employees and agents from and against any and all liabilities, losses, damages, penalties, claims, suits and repossession or return of the Equipment, actions, costs and expenses, including court costs and Lessor's attorneys fees, of whatever kind imposed or incurred by or asserted against Lessor (collectively, "Claims"), whether based on a theory of strict

liability or otherwise, caused by or related to (a) the manufacture, selection, purchase, installation, ownership, use lease, possession, delivery, operation, storage, repair, disposition or return of tile Equipment, and if due to the action or inaction of Lessee or (b) any defects in the Equipment. Lessee agrees to reimburse Lessor for and to defend Lessor against any Claims. This indemnity will continue even after the termination or expiration of a Lease and repossession or return of the Equipment.

11. **<u>TAXES</u>.** Lessee agrees to pay all license and registration fees, sale and use taxes, personal property taxes and all other taxes and charges, relating to the ownership, leasing, rental, sale, purchase, possession or use of the Equipment as part of the Lease Payment or as billed by Lessor. Lessee agrees that if Lessor pays any taxes or charges on Lessee's behalf, Lessee will reimburse Lessor for all such payments and will pay Lessor interest and a late charge (as calculated in Section 14) on such payments with the next lease Payment, plus reasonable costs incurred in collecting and administering any taxes, assessments or fees and remitting them to the appropriate authorities. Lessor shall not be obligated to contest any valuation of a tax imposed oil the Equipment or on this Agreement or any Lease.

12. **<u>INSURANCE</u>.** During the term of a Lease, Lessee will keep the Equipment insured, at its sole cost and expense, against all risks of a loss or damage in an amount not less than the replacement cost of the Equipment without co-insurance other than by way of customary an reasonable deductibles. The insurance company shall be acceptable to Lessor in all respects in Lessor's sole discretion. Lessee well also obtain and maintain for the term of a Lease, comprehensive public liability insurance and such policy shall provide Lessor With thirty (30) days prior written notice of cancellation of termination of such policy covering both personal injury and property damage m an amount acceptable to Lessor. Lessor will be named the lender loss payee on the property insurance under a separate lender's loss payable clause and named as an additional insured on the public liability insurance, as its interests may appear. Lessee will pay all premiums for such insurance and Lessee shall deliver proof of insurance coverage to Lessor satisfactory to Lessor. If Lessee does not provide such insurance, Lessee agrees that Lessor has the right, but not the obligation, to obtain such insurance and charge Lessee for all costs. lessee irrevocably appoints Lessor as Lessee's attorney-in-fact to make claims for, receive payment of, and execute and endorse all documents, checks or drafts in payment for loss or damage under any said insurance policies.

13. **<u>DEFAULT</u>.** An "Event of Default" shall be deemed to exist if any of the following occurs: (a) Lessee fails to pay any Lease Payment or other sum due hereunder within fifteen (15) days of when due; (b) Lessee or any guarantor or surety of Lessee's obligations, if any, fails to observe or perform any other term, covenant or condition of this Agreement, any Lease, any Surety Agreement or any other agreement with Lessor and such failure continues for thirty (30) days after notice thereof of Lessor; (c) Lessee or any guarantor or surety of Lessee's obligations, if any, dies, or becomes insolvent or unable to pay its debts when due; stops doing business as a going concern; terminates its organizational existence, merges, consolidates, transfers, sells or otherwise disposes of a majority of its assets or a majority of its liquid assets, provided that (i) Lessee may merge with any other entity so long as Lessee is the surviving entity, (ii) any guarantor or surety of Lessee's obligations may merge with any other entity so long as such guarantor or surety is the surviving entity, and any such guarantor of surety may merge with and into a Qualified Subsidiary (as defined below), and (iii) Lessee may transfer, sell or otherwise dispose of its assets to a Qualified Subsidiary; (d) a writ of attachment or execution is levied upon the Equipment unless released, satisfied or stayed within thirty (30) days of such levy; (e) the filing by or against Lessee or any guarantor or surety of lessee's obligations, if any, of a petition under the Bankruptcy Code or under any insolvency law provided for relief of debtors unless with respect to a petition filed against Lessee, it is dismissed within forty-five (45) days; (f) the voluntary or involuntary making of an assignment for the benefit of creditors, the appointment of a receiver or trustee for Lessee or any guarantor or surety of Lessee's obligations, if any, or for their respective assets, or the commencement of any formal or informal proceeding for dissolution, liquidation, settlement of claims against or winding up of the affairs of Lessee or any guarantor or surety of Lessee's obligations, if any; (g) there is a change in the ownership or control of Lessee or any guarantor or surety of Lessee's obligations, if any, or a Change of Control (as defined below); (h) any representation, warranty or signature herein or made by Lessee or any guarantor or surety of Lessee's obligations, if any, in any document delivered to Lessor in connection with this Agreement or any Lease shall be false or misleading in any material respect when made; (i) Lessee or any guarantor or surety of Lessee's obligations, if any, is in default under any other agreement with Lessor or any affiliate of Lessor (including without limitation TD Bank, N.A. and its related affiliates of The Toronto-Dominion Bank) or any other person; O) Lessee or any guarantor or surety of Lessee's obligations, if any, engages in any criminal conduct that subjects the Equipment to seizure and/or confiscation by governmental authorities; (k) Lessee uses or permits use of the Equipment in a fashion not covered by the required insurance policies; (I) without the prior written consent of Lessor, Lessee attempts to remove, sell, transfer, encumber, part with possession, or sublet any item of Equipment; (m) Lessee or any guarantor or surety of Lessee's obligations, if any, suffers a material adverse change in its financial condition, business, operations or assets and, as a result, Lessor deems itself or any of its Equipment to be insecure;; or (n) any default under any guaranty agreement or surety agreement executed in connection with this Agreement or any Lease, if any. As used therein: (i) "Change of Control" means (y) the acquisition of ownership, directly or indirectly, beneficially or of record, by any person or group (within the meaning of the Securities Exchange Act of 1934 and the rules of the SEC thereunder as in effect on the date hereof), of equity interests representing more than 40% of the aggregate ordinary voting power represented by the issued and outstanding equity interests of Lessee, or (z) the acquisition of direct or indirect control by any person or group of the power to direct or cause the direction of the management or policies of Lessee, whether through the ability to exercise voting power, by contract or otherwise; and (ii) "Qualified Subsidiary" means a wholly-owned domestic subsidiary of Lessee that (y) satisfies Lessor's "know your customer" and other regulatory requirements, and (z) executes a Surety Agreement in form and substance satisfactory to Lessor to guarantee payment and performance of all of Lessee's obligations

14. **<u>REMEDIES</u>.** Lessor has the following remedies if an Event of Default should occur: (a) Lessor may cancel or terminate the Leases; (b) with notice to Lessee, declare the entire balance of the unpaid Lease Payments for the full term of all Leases plus the additional amount (as defined below) immediately due and payable, sue for and receive all Lease Payments and any other payments then accrued or accelerated under all Leases or any other agreement plus the greater of either (i) the estimated fair market value of the Equipment at the end of the originally scheduled term of all Leases or (ii) Lessor's residual position (as determined by Lessor in its sole discretion), and all accelerated Lease Payments and the estimated fair market value of the Equipment or the Lessor's residual position will be discounted to the date of the default at one percent (1.0%) per year, but only to the extent permitted by law, (c) charge Lessee interest on all monies due Lessor at the rate of twelve percent (12%) per annum from the date of default until paid, but in no event more than the maximum rate permitted by law; (d) charge lessee a return-check or non-sufficient funds charge ("NSF Charge") to reimburse lessor for the time and expense incurred with respect to a check that is returned for any reason including non-sufficient or uncollected funds such NSF Charge is stipulated and liquidated Twenty Five Dollars ($25.00); (e) require that Lessee return the Equipment to Lessor and in the event Lessee fails to return the Equipment, peaceably enter upon the premises after reasonable notice with or without legal process where the Equipment Is located and repossess the Equipment; (f) apply any security deposit to any amounts owing from Lessee to lessor; and/or (g) setoff against any account maintained with Lessor or any affiliate of Lessor (including without limitation any direct or indirect subsidiary of TD Bank US Holding Company) any and all amounts owing from Lessee to Lessor hereunder or under any lease. Such return or repossession of the Equipment will not constitute a termination of the applicable Lease unless Lessor expressly notifies lessee in writing. In the event the Equipment is returned or repossessed by Lessor and unless Lessor has terminated the applicable lease, Lessor will sell or re-lease the Equipment to any persons with any terms Lessor determines, at one or more public or private sales, with or without notice to Lessee, and apply the net proceeds deducting the costs and expenses of such sales or re-lease, to Lessee's obligations with Lessee remaining liable for any deficiency on the Leases and with any excess being retained by lessor. The credit for any sums to be received by Lessor from the Leases during the remaining portion of the lease Terms shall be discounted to the commencement date of such Leases at an annual rate equal to the implicit rate of interest with respect to such Lease. Lessee agrees that if notice of sale is required by law to be given, seven (7) days notice shall constitute reasonable notice.

If an Event of Default should occur, lessee shall indemnify Lessor on demand against any loss, premium, penalty or expense incurred, directly or indirectly, in repaying funds raised to finance any part or all of the Equipment or in unwinding any swap, forward interest rate agreement, or other financial instrument relating in whole or in part to Lessor's financing of the Equipment (including any interest, fees, penalties, breakage costs or other sums whatsoever paid or payable in connection therewith).

Lessee is also required to pay (i) all costs and expenses incurred by Lessor in connection with the enforcement of any remedies, including all expenses incurred in connection with the return, or other recovery of any Equipment or other collateral, sale, re-lease or other disposition (including without limitation costs of transportation, possession, storage, refurbishing, advertising and broker's fees), and all other pre-judgment and post-judgment enforcement related to actions taken by Lessor, and/or any actions taken by Lessor in any bankruptcy case involving Lessee, this Equipment or other collateral, and (ii) reasonable attorneys' fees (including consultation, drafting documents, sending notices or instituting, prosecuting or defending litigation or arbitration).

Whenever any lease Payment is not made within ten (10) days of when due, Lessee agrees to pay lessor, within one month of the original due date, a late charge of three percent (3.0%) for each delayed payment, as compensation for Lessor's internal operating expenses arising as a result of each delayed payment, but only to the extent permitted by law. This amount is payable in addition to all amounts payable by Lessee as a result of the exercise of any other remedies.

Lessee agrees that any delay or failure to enforce Lessor's rights under this Agreement or any Lease does not prevent Lessor from enforcing any- rights at a later time. No right or remedy referred to herein is intended to be exclusive, but each shall be cumulative and shall be in addition to any other remedy referred to above or otherwise available at law or in equity, and may be exercised concurrently or separately from time.to time. With respect to any exercise by Lessor of its right to recover and/or dispose of any Equipment or other collateral securing Lessee's obligations under any Lease, Lessee acknowledges and agrees that: (i) Lessor shall have no obligation, subject to the requirements of commercial reasonableness, to clean up or otherwise prepare the Equipment or any other collateral for disposition; and (ii) Lessor may comply with any applicable state or federal law required in connection With the disposition of the Equipment or other collateral, and any actions taken in connection therewith shall not be deemed to have adversely effected the commercial reasonableness of any disposition of such Equipment and/or other collateral.

15. **<u>SECURITY DEPOSIT/ADDITIONAL COLLATERAL</u>**. Lessor will retain any required security deposit to insure Lessee's performance of Lessee's obligations. Any security deposit is non-interest bearing. Lessor may apply any security deposit to cure any default by Lessee, in which event Lessee will promptly restore any amount so applied. If Lessee is not in default, any security deposit will be returned to Lessee at the termination of a Lease. In the event that lessee grants to any affiliate of lessor (including any direct or indirect subsidiary of TD Bank US Holding Company) a lien or security interest in any real or personal property. of lessee other than the Equipment, Lessee agrees that such lien or security interest shall, without further action, by Lessee also secure the Lease Payments and the Performance by Lessee of its obligations under the Lease and that such affiliate shall be deemed Lessor's agent for the purpose of perfecting such lien or security interest in such additional collateral.

16. **<u>COSTS AND EXPENSES</u>.** Lessee shall reimburse Lessor, upon demand, for all reasonable costs and expenses incurred in connection with this Agreement or any Lease, including without limitation attorneys' fees, processing fees, filing fees, overnight delivery costs, long distance. telephone charges, copying costs arid the cost of obtaining credit reports, certified articles of organization, good standing certificates, lien searches and UCC-1 title insurance.

17. **REPRESENTATIONS AND WARRANTIES.** Lessee warrants and represents to Lessor that (a) the Equipment will be used for business purposes, and not for personal, family or household purposes, (b) Lessee is an entity duly organized, validly existing and in good standing with the laws of the jurisdiction specified below Lessee's signature, and the organizational number assigned to lessee in such jurisdiction, if any, is as specified below Lessee's signature and Lessee (and each of its predecessors) as not, in the past five (5) years, changed its jurisdiction of formation, organizational structure or type, or any organizational number assigned by its jurisdiction of formation, (c) Lessee's full and accurate legal name is as first provided above, (d) Lessee has the power and capacity to enter into this Agreement, all documents related to the purchase of the Equipment and any other documents required to be delivered in connection herewith (collectively, the "Documents"), and (e) the Documents have been duly authorized, executed and delivered by Lessee and constitute valid, legal and binding agreements, enforceable in accordance with their terms, except to the extent that the enforcement of remedies herein or therein provided may be limited under applicable bankruptcy and insolvency laws.

18. FINANCIAL INFORMATION. (a) For so long as TD Equipment Finance, Inc. is Lessor under any Lease entered into pursuant to this Agreement, Lessee shall comply with all of the affirmative and negative covenants of the borrower, debtor or any guarantor or surety of Lessee's obligations (including, without limitation, those regarding financial reporting and compliance with financial criteria) contained in any credit, loan, security, or other agreement for or relating to the financing of Lessee or any guarantor or surety of Lessee's obligations (as such agreement may have been or is amended from time to time) which it has made or hereafter makes with TD Bank, N.A. or any other direct or indirect subsidiary of TD Bank US Holding Company other than TD Equipment Finance, Inc. as lender or creditor (or, if there is more than one such agreement, then that of the most recent date), with Lessee's obligation hereunder to comply with all of such covenants continuing in full force and effect in favor of Lessor for the duration of the initial and any renewal term of any such Lease, notwithstanding, *inter alia,* (X) the termination or satisfaction of such agreement or the payment or satisfaction of the obligations owed under or secured by such agreement, (y) any term in such agreement which serves to relieve. the borrower, debtor or any guarantor or surety of Lessee's obligations from its obligation to comply with such covenants upon such full or partial payment, termination or satisfaction, or (z) any term or provision of such agreement to similar effect or which would serve to reduce or eliminate the borrower's, debtor's or any guarantor or surety of Lessee's obligation to comply with such covenants. Upon such Lessor's request, Lessee promptly shall deliver to Lessor all financial statements, certificates of compliance and other documents specified in such covenants not previously delivered, or thereafter becoming due to be delivered, to the lender or creditor under such agreement.

(b) In the event that there is no agreement of the kind described in Section 18(a) hereof then in existence or such agreement contains no affirmative and negative covenants regarding financial reporting and compliance with financial criteria, then at Lessor's request, Lessee shall provide Lessor with (i) audited or reviewed (as required by Lessor) annual consolidated and consolidating financial statements, prepared in accordance with generally accepted accounting principles applied on a basis consistent with the most recent audited or reviewed, as applicable, financial statements provided to Lessor by Lessee, including balance sheets. income and cash flow statements, accompanied by the unqualified report thereon of an independent certified public accountant acceptable to Lessor; as soon as available, and in any event within 120 days after the end of each of Lessee's fiscal year; (ii) by April 15 of each calendar year, each guarantor's, if any, annual financial statement for the immediately preceding calendar year and copies of such guarantor's state and federal tax returns for the immediately preceding calendar year; (iii) such other reports and financial information as may be requested by Lessor and (iv) Lessee represents and warrants that any financial statements previously delivered to Lessor by Lessee or any guarantor and any financial statements delivered to Lessor pursuant preceding clauses (i) and (ii) are and will be complete and correct and fairly present the financial condition of the Lessee's and guarantors as of the dates of such financial statements and the results of Lessee's and guarantors' operations and cash flows for the periods referred to therein in accordance with generally accepted accounting principles, consistently applied.

(c) Lessee represents and warrants to Lessor that since the most recent submission of financial statements by Lessee and the guarantors to Lessor there has been no material adverse change in the financial condition or business of the Lessee or any guarantor.

19. UCC FILINGS. Lessee authorizes Lessor to file a financing statement with respect to the Equipment with or without Lessee's signature where permitted by the UCC and grant Lessor the right to sign such financing statement on Lessee's behalf. The filing of a financing statement is not to be construed as evidence that any security interest was intended to be created, but only to give public notice of Lessor's ownership of the Equipment. If a Lease is deemed at any time to be one intended as security then (x) Lessee grants Lessor a first priority security interest in the Equipment together with all related software (embedded therein or otherwise) and general intangibles, and all additions, accessories, attachments and accessions thereto whether furnished by the supplier of the Equipment, all subleases, chattel paper, accounts and security deposits relating thereto, and any and all substitutions, replacements or exchanges for such item of Equipment, in each such case in which Lessee shall from time to time acquire an interest, and any and all proceeds (including insurance proceeds) of the Equipment and other collateral in and against which a security interest is granted hereunder and (y) notwithstanding any other provision hereof, the Lease is subject to the express condition that at no time shall lessee be obligated or be required to pay interest at a rate which could subject Lessor either to civil or to criminal penalty as a result of being in excess of the maximum rate which Lessee is permitted by law to contract or agree to pay. If by the terms of the Lease, Lessee at any time is required or obligated to pay interest at a rate in excess of such maximum allowable rate, the rate of interest under the Lease shall be deemed to be immediately reduced to such maximum allowable rate and the interest payable here under shall be computed at such maximum allowable rate, and the portion of all prior interest payments made in excess of such maximum allowable rate shall be applied and shall be deemed to be payment made in reduction of the amounts due under the Lease. Lessee will promptly execute, or otherwise authenticate, and deliver to Lessor such further documents, instruments, assurances and other records, and take such further action as lessor from time to time may reasonably request in order to carry out the intent and purpose of this Agreement and to establish and protect the rights and remedies created or intended to be created in favor of lessor under the Documents (including without limitation (i) lien searches. and (ii) such UCC financing statements, fixture filings and waivers as reasonably may be required by Lessor in connection with any change in circumstances relating to Lessee, the Equipment or otherwise); provided, however, Lessee hereby authorizes Lessor to file any and all of the same without Lessee's authentication, to the extent permitted by applicable law. Lessee shall provide written notice to Lessor not less than thirty (30) days prior to any contemplated change in the name, the jurisdiction of organization, or address of the chief executive office, of Lessee.

20. NOTICE. Written notices will be deemed to have been given when delivered in person or if sent by certified mail, postage pre-paid return receipt requested, or by reliable nationally recognized overnight courier, addressed to the recipient at its address above or at any other address subsequently provided in writing.

21. UCC-ARTICLE 2A PROVISIONS. Lessee agrees that this Lease is a "finance lease" as that term is defined in Article 2A of the Uniform Commercial Code ("UCC"). Lessee acknowledges that Lessor has given Lessee the name of the Supplier of the Equipment for each Lease. Lessor hereby notifies Lessee that Lessee may have rights under the contract with the Supplier and Lessee may contact the Supplier for a description of any rights or warranties that Lessee may have under this supply contact. LESSEE ALSO WAIVES ANY AND ALL RIGHTS AND REMEDIES GRANTED LESSEE UNDER SECTIONS 2A-508 THROUGH 2A-522 OF THE UCC.

22. **CHOICE OF LAW.** This Agreement and all Leases were made in the state of New Jersey; and they are to be performed in the state of New Jersey by reason of the Lease Payments Lessee is required to pay Lessor in state of New Jersey. This Agreement and all Leases shall in all respects be interpreted and all transactions subject to this Agreement and all rights and liabilities of the parties under this Agreement and all leases shall be determined and governed as to their validity, interpretation, enforcement and effect by the laws of the state of New Jersey except for local filing requirements. Lessee consents to and agrees personal jurisdiction over Lessee and subject matter jurisdiction over the Equipment shall reside with any state or federal court in the state of New Jersey solely at Lessor's option with respect to any provision of this Agreement or any Lease. Lessee also waives Lessee's right to a trial by jury.

23. **ENTIRE AGREEMENT: SEYERABILITY; WAIVERS.** This Agreement and all Leases contain the entire agreement and understanding of the parties hereto. No agreements or understandings are binding on the parties unless set forth in writing and signed by the parties. Any provision of this Agreement or any Lease which for any reason may be held unenforceable in any jurisdiction shall, as to such jurisdiction. be ineffective without invalidating the remaining provisions of this Agreement and the Leases.

24. **Patriot Act.** (i) Lessee hereby represents, warrants and covenants to Lessor that (A) each Lessee Party is as of the Acceptance Date of each Lease Schedule, and will at all times thereafter remain, in compliance with the following (collectively, Anti Terrorism Law"): (1) the Trading with the Enemy Act, as amended, and each of the foreign assets control regulations of the United States Treasury Department (31 CFR, Subtitle B, Chapter V. as amended) and any other enabling legislation or executive order relating thereto, (2) the USA Patriot Act (Title III of Pub. L. 107 56 (signed into law October 26, 2001)); (3) Executive Order No. 13,224 of September 24, 2001, Blocking Property and Prohibiting Transactions with Persons Who Commit, Threaten to Commit or Support Terrorism, 66 U.S. Fed. Reg. 49,079 (2001), as amended ("Executive Order No. 13,224"), and (4) any statute, treaty, law (including common law), ordinance, regulation, rule, order, opinion, release, injunction, writ, decree or award of any governmental authority relating to terrorism or money laundering; (8) No Lessee Party nor any Affiliate of any Lessee Party, or to Lessee's knowledge, any of its respective agents acting or benefiting in any capacity in connection with any transactions hereunder, is any of the following (each a "Blocked Person"): (i) a person that is listed in the annex to, or is otherwise subject to the provisions of, the Executive Order No. 13224: (ii) a person owned or controlled by, or acting for or on behalf of, any person that is listed in the annex to, or is otherwise subject to the provisions of. the Executive Order No. 13224; (iii) a person with which TD Bank, N.A. is prohibited from dealing or otherwise engaging in any transaction by any Anti-Terrorism Law; (iv) a person that commits, threatens or conspires to commit or supports "terrorism" as defined in the Executive Order No. 13224; (v) a person that is named as a "specially designated national" on the most current list published by the U.S. Treasury Department Office of Foreign Asset Control at its official website or any replacement website or other replacement official publication of such list; or (vi) a person who is affiliated with a person listed above and (C) no Lessee Party shall, directly or indirectly, make any payments to any governmental official or employee, political party, official of a political party, candidate for political office, or anyone else acting in an official capacity, in order to obtain, retain or direct business or obtain any improper advantage, in violation of the United States Foreign Corrupt Practices Act of 1977, as amended. (ii) If and to the extent Lessor is subject to the requirements of the Patriot Act, Lessor hereby notifies the Lessee Parties that pursuant to the requirements of the Patriot Act, Lessor is required to obtain, verify and record information that identifies the Lessee Parties, which information includes the names and addresses of the Lessee Parties and other information that will allow Lessor to identify the Lessee Parties in accordance with the Patriot Act.

THIS AGREEMENT IS NOT BINDING UNTIL ACCEPTED
BY LESSOR

IN WITNESS WHEREOF, the undersigned parties have executed this Agreement as of the date first set forth above.

LESSEE:	**PHOTRONICS, INC.**	**LESSOR:**	**TD EQUIPMENT FINANCE, INC.**
By:	/s/ John P. Jordan	By:	/s/ Alison L. Sauter
Name:	**John P. Jordan**	Name:	Alison L. Sauter
Title:	**Executive Vice President and Chief Financial Officer**	Title:	Senior Manager

Jurisdiction of Organization: Connecticut
Organizational Number: **0036597**
Chief Executive Office: **15 Secor Road, Brookfield, CT 06804**

Exhibit 10.39

Fixed Asset Loan Contract

Contract No.: J.H.S. FCGZGDHT2020001

Borrower (Party A): Hefei Photronics Co., Ltd.

Domicile: R1606, Building F3, Innovative Industrial Park Phase II, No.2800, Chuangxin Avenue, High- tech Development District, Hefei

Postal code: 230000

Legal representative (person in charge): Peter Scott Kirlin

Fax: Tel: 0551-65126615

Lender (Party B): China Construction Bank Corporation Hefei Shushan Branch

Domicile: Liyuan Building E, No.398, Huanhu Road East, Shushan District, Hefei City

Postal code: 230011

Person in charge: Shi Tao

Fax: Tel: 0551-65816387 [seal; text cut off]

[seal; text cut off]

Whereas, Party A applies for a loan to Party B for the construction of "Hefei Photronics Co., Ltd., 10.5 generation plant new project," Party B agrees to issue the loan to Party A. In accordance with the relevant regulations and rules, Party A and Party B consent to execute and abide by the following contract through negotiation and consultation.

Article 1. Amount of borrowing

The amount that Party A borrows from Party B is RMB (in words) two hundred million.

Article 2. Purpose of the loan and source of repayment

Party A shall use the loan for fixed asset investment; without the written consent of Party B, Party A may not alter the purpose of the loan.

See attachment 1, "Basic information about the project and loan," for information about the real estate invested with the loan hereunder (hereinafter referred to as "project) and specific purpose of the loan, and source of repayment.

Article 3 Period of loan

The period of loan agreed herein is six years, from *October 1*, 2020, to *September 30*, 2026.

In case of any inconsistency between the starting date of the loan period hereunder and the loan transfer voucher (receipt of borrowing, same hereunder), the actual date of loaning indicated on the loan transfer voucher for the first-time issuance shall prevail, and the expiry date of the loan agreed in paragraph 1 hereof shall be adjusted accordingly.

The loan transfer voucher is a part of the contract hereof, and has equal legal effects to this contract.

Article 4. Loan interest rate, penalty interest rate and interest calculation and settlement

1. Loan interest rate

The loan interest rate hereunder is an annual interest rate, subject to type (4):

(1) Fixed interest rate, namely blank %, which remains unchanged during the period of loan;

(2) Fixed interest rate, namely LPR interest rate blank (select "plus" or "minus") base point (1 base point= 0.01%, accurate to 0.01 base point), which remains unchanged during the period of loan;

(3) Fixed interest rate, namely value date benchmark interest rate blank (select "up" or "down") by blank %, which remains unchanged during the period of loan;

(4) Floating interest rate, namely LPR minus (select "plus" or "minus") 45 base points (1 base point= 0.01%, accurate to 0.01 base point); the LPR for the current working day and the above plus/minus base points shall be adjusted based on the interest rate once every twelve months from the value date to the day of full repayment of the principal and interest hereunder. The day for interest adjustment is the corresponding day of the value date in the current month of adjustment; if there is no corresponding day of the value date, the last day of the current month shall be deemed as the day for interest adjustment.

(5) Floating interest rate, namely value date benchmark interest rate blank (select "up" or "down") by blank %; the benchmark interest rate of the current working day and the above increase/decrease percentage shall be adjusted based on the interest rate once every blank months from the value date to the day of full repayment of the principal and interest hereunder. The day for interest adjustment is the corresponding day of the value date in the current month of adjustment; if there is no corresponding day of the value date, the last day of the current month shall be deemed as the day for interest adjustment.

(6) Blank

2. Penalty interest rate

(1) If Party A fails to use the loan in line with the purpose stated herein, the penalty interest rate equals to loan interest rate plus 100%; if the loan interest rate is adjusted in accordance with the paragraph 1 (4) or (5) of the article hereof, the penalty interest rate shall be adjusted accordingly in light of the adjusted loan interest rate and said degree of increase hereunder.

(2) The penalty interest rate for loan delinquency hereunder is the loan interest rate plus 50%; if the loan interest rate is adjusted in accordance with the paragraph 1 (4) or (5) of the article hereof, the penalty interest rate shall be adjusted accordingly in light of the adjusted loan interest rate and said degree of increase hereunder.

(3) The penalty interest and compound interest shall be calculated according to the severer circumstance of the loan delinquency or misappropriation if they have occurred at the same time.

3. The value date hereof refers to the date when the loan issued for the first time hereunder is transferred to the loan account designated in Article 6 of this contract (hereinafter referred to as "loan account"). The LPR hereunder is determined in line with item (4):

(1) For the initial issuance of loan under this contract, the LPR refers to the one-year lending market- quoted interest rate (1Y LPR) of the national inter-bank borrowing center on the previous working date prior to the effective date of this contract; if the loan interest rate is adjusted according the aforementioned provisions, LPR interest rate is the one-year lending market-quoted interest rate (1Y LPR) of the national inter-bank borrowing center on the previous working day of the day of adjustment.

(2) For the initial issuance of loan under this contract, the LPR refers to the one-year lending market- quoted interest rate (1Y LPR) of the national inter-bank borrowing center on the previous working day prior to the value date; if the loan interest rate is adjusted according the aforementioned provisions, LPR interest rate is the one-year lending market-quoted interest rate (1Y LPR) of the national inter-bank borrowing center on the previous working day of the day of adjustment.

(3) For the initial issuance of loan under this contract, the LPR refers to the market-quoted interest rate for five-year or above loans (5Y LPR) of the national inter-bank borrowing center on the previous working day prior to the effective date of this contract; if the loan interest rate is adjusted according the aforementioned provisions, LPR interest rate is the market-quoted interest rate for five-year or above loans (5Y LPR) of the national inter-bank borrowing center on the previous working day of the day of adjustment.

(4) For the initial issuance of loan under this contract, the LPR refers to the market-quoted interest rate for five-year or above loans (5Y LPR) of the national inter-bank borrowing center on the previous working day prior to the value date; if the loan interest rate is adjusted according the aforementioned provisions, LPR interest rate is the market-quoted interest rate for five-year or above loans (5Y LPR) of the national inter-bank borrowing center on the previous working day of the day of adjustment.

Upon the first issuance of loan hereunder, the benchmark interest rate refers to the loan interest rate announced by the People’s Bank of China for the current period and for the same grade; thereafter, if the loan interest rate is adjusted as agreed above, the benchmark interest rate refers to the loan interest rate announced by the People’s Bank of China for the current period and for the same grade on the day of adjustment; if the People’s Bank of China no longer announces the interest rate for the current period and for the same grade, the benchmark interest rate denotes the loan interest rate for the current period and for the same grade recognized by the interbank or accepted generally on the day of adjustment, or the alternative interest rate designated by the People’s Bank of China, unless otherwise stipulated by both parties.

4. The loan interest shall accrue from the day when the loan is transferred to the loan account. The loan interest hereunder is calculated on a daily basis, with the daily interest rate equal to the annual interest rate/360. If Party A fails to pay the interest in line with the day of interest settlement agreed in the contract, compound interests would be charged from the next day.

5. Interest settlement

(1) For loan subject to the fixed interest rate, the interest shall be calculated in line with the agreed interest rate at the time of interest settlement. Regarding the loan subject to the floating interest rate, the interest shall be calculated in line with the interest rate determined for each floating period; In case of multiple interest rate floats during the single interest settlement period, the interest for each floating period shall be calculated first, and the interest for each float period shall be added up on the day of interest settlement to work out the interest for the current interest settlement period.

(2) The interest of the loan hereunder shall be settled in line with method <u>2</u>:

1. Monthly settlement, on the 20th day of each month;
2. Quarterly settlement, on the 20th day of the last month of each quarter;
3. <u>Blank</u>

Article 5. Issuance and payment of the loan

1. Preconditions for issuance of the loan

Unless waived by Party B in whole or in part, only when the following conditions are satisfied continuously is Party B liable to issue the loan:

1. Party A has properly completed the approval, registration, delivery, insurance and other statutory procedures related to the loan hereunder;

2. If a guarantee is created for this contract, the guarantee in conformity with the requirements of Party B has become and would remain effective;

3. Party A has opened an account for withdrawal and repayment in line with the requirements of Party B.

4. Party A does not have any of the default matters agreed in this contract, or any circumstance that may endanger the safety of Party B's creditor rights as agreed herein;

5. Laws, regulations or competent departments do not prohibit or restrict Party B from issuing the loan hereunder;

6. The capital of the same proportion to the loan to be issued has been in place in full, and the actual progress of the project corresponds to the amount already invested;

7. The major financial indicators of Party A continuously satisfy the requirements of Attachment 2, "Restrictive terms on financial indicators";

8. If the payment (disbursement) of a single installment satisfies any of following circumstances, Party A shall provide relevant materials to Party B prior to the issuance of the loan:

(1) The amount of a single installment paid (disbursed) exceeds 5% of the total investment of the project;

(2) The amount of a single installment paid (disbursed) exceeds RMB 5 million;

(3) Blank;

(4) Blank.

Under any of the above circumstances, Party A shall provide the following materials to Party B:

(1) Loan transfer voucher sealed by Party A and payment settlement voucher sealed by Party A;

(2) Proof that the capital has been in place and about the circumstances of use (such as certificate about registered capital, statement of the capital account, invoice for use of the capital, payment voucher);

(3) Transaction materials related to said payment (including but not limited to commodity/labor contract or invoice, and other transaction materials that may prove the actual existence of the event related to the payment);

(4) Other materials required to be provided by Party B.

9. If the amount of a single payment (disbursement) does not conform to any of the circumstances listed in subparagraph 8 of this article, Party A shall provide Party B with the plan of use corresponding to the loan to be issued and other materials requested by Party B.

10. The materials provided by Party A to Party B shall comply with following requirements:

(1) legal, authentic, complete, accurate, valid;

(2) blank;

(3) blank;

(4) Other requirements put forward by Party B.

11. Miscellaneous conditions:

Blank

2. Plan for fund use

The plan for fund use is determined in line with the following method (3):

(1) Plan for fund use as follows:

1. Mm/dd/yy, amount________;

2. Mm/dd/yy, amount________; [stamp:] This column is left blank

3. Mm/dd/yy, amount________;

4. Mm/dd/yy, amount________;

5. Mm/dd/yy, amount________; [stamp:] This column is left blank

6. Mm/dd/yy, amount________;

(2) Plan for fund use as follows:

1. Mm/dd/yy, amount________;

2. Mm/dd/yy, amount________; [stamp:] This column is left blank

3. Mm/dd/yy, amount________;

4. Mm/dd/yy, amount________;

5. Mm/dd/yy, amount________; [stamp:] This column is left blank

6. Mm/dd/yy, amount________;

(3) Apply for use of the funds at any time in light of the actual requirement of the project.

3. Party A shall use the funds in line with the plan for fund use agreed in paragraph 2; unless agreed by Party B in writing, Party A may not advance, delay, split or cancel the fund use.

Party A shall pay the loan commitment fee to Party B in line with the following provision:

<u>Blank</u>

The calculation formula for the loan commitment fee:

<u>Blank</u>

The loan commitment fee shall be paid by <u>Blank</u> [either of the following two items: (1) month (2) quarter]; Party A shall at latest pay the loan commitment fee for the previous <u>Blank</u> [either of the following two items: (1) month (2) quarter] within <u>Blank</u> working days at the start of each <u>Blank</u> [either of the following two items: (1) month (2) quarter].

(2) If Party A uses the fund by installments, the expiry date of the loan period shall still be determined in line with the provision of Article 3 hereof.

(3) Entrusted payment by Party B

1. As long as the single payment conforms to any of the circumstances listed in paragraph 1 subparagraph 8 of this article, Party A shall entrust Party B to pay the loan to the transaction counterparty of Party A. Party A may not pay directly the above loan to the transaction counterparty.

2. Under the mode of entrusted payment by Party B, Party B transfers the loan to the loan account, and then pays the loan directly from the loan account to the account of Party A's transaction counterparty. Party A may not dispose of the loan by any means (including but not limited to transfer or disbursement).

3. Party A shall conduct a formal examination on the payment amount, time, object, method and the handling account in line with the materials provided by Party A. If Party B considers the above payment elements meet its requirements after the formal examination, Party B may pay the loan to Party A's transaction counterparty.

4. The formal examination of the above payment elements by Party B does not mean that Party B confirms the authenticity and legality as well as compliance of the transaction, nor that Party B intervenes in the dispute between Part A and its transaction counterparty or the third party, or needs to assume the responsibilities and obligations of Party A. For all losses suffered by Party B due the act of the entrusted payment, Party A shall pay compensations.

5. Under the mode of entrusted payment by Party B, if the loan fund is unable to be paid successfully to the account of Party A's transaction counterparty as a result of the wrong information provided by Party A or other causes, it shall be handled in line with following provisions:

For all consequences incurred, including but not limited to all losses arising from unsuccessful payment of the loan fund or failure to pay timely to the account of Party A's transaction counterparty, Party A shall pay compensations;

Party A may not dispose of the above part of the loan fund in any way (including but not limited to transfer, withdrawal);

Party A is liable to refurnish materials or modify the materials as required by Party B within two working days.

6. Any risk, responsibility or loss related to freezing or deduction or transfer of the loan fund by the competent authority after entry into the loan account shall be assumed by Party A. Party A shall compensate the losses of Party B as a result.

(6) Any risk, responsibility or loss related to freezing or deduction or transfer of the loan fund by the competent authority after entry into the loan account shall be assumed by Party A. Party A shall compensate the losses of Party B as a result.

Article 6. Use and supervision of the account

1. Loan account

The loan account hereunder shall be determined in line with the following method (2):

(1) Within blank working days following the effective date of this contract and before the first issuance of the loan, Party A shall open a special loan account at Party B, which is used solely for the issuance and payment of all borrowings under this contract.

(2) Other account opened by Party A at Party B (account No.: *340501488808000001935*

2. Repayment reserve account

Within one working day following the effective date of this contract, Party A shall open a repayment reserve account at Party B, or use the existing account opened at Party B (account No.: *340501488808000001935*) as the repayment reserve account. The repayment reserve account shall satisfy following requirements:

(1) The income cash flow of the project or Party A (including but not limited to project income, other operating incomes of Part A, additional investments by Party A's shareholders) shall be transferred to this account in line with the following proportion: 50%.

(2) The average capital stock in the account shall meet following requirements:
Blank;

_____;

_____.

(3) Party A shall ensure that the account balance is not lower than the amount payable for the current period on the previous working day of each principal repayment day/ or interest payment day;

(4) Without the consent of Party B, Party A may not dispose of the fund in the repayment reserve account by any means (including but not limited to transfer, disbursement).

3. Party A has rights to supervise the following account opened by Party A at Party B:

(1) Account No.: *340501488808000001935*;

(2) Account No.: *340501488808000001936*;

The supervision measures taken by Party B include but are not limited to:

(1) Party B has rights to take various measures to track the capital flows of the account, and Party A shall cooperate unconditionally and provide conveniences (including but not limited to capital statement of the account opened at other financial institutions as required by Party B);

Without the consent of Party B, Party A may not dispose of the fund in any of the above accounts by any means (including but not limited to transfer, disbursement).

Article 7. Repayment

1. Principle of repayment

The repayment by Party A under this contract shall be made in line with following principles:

Party B has rights to use the repayment of Party A firstly to pay various fees that should be assumed by Party A but have been paid upfront by Party B as greed herein, and to pay the costs for Party B to realize the creditor's right; the remaining amount will be repaid in line with the principle of first repayment of the interest and then principal, and repayment of the principal and interest in one lump sum on the expiry date. However, for the loan where the principal is overdue for 90 days and still unpaid, loan where the interests are overdue for 90 days and still unpaid or loans provided for otherwise by regulations or rules, Party A shall make repayments in line with the principle of first repayment of the interest and then principal after having paid back the above fees.

2. Payment of interests

Party A shall pay Party B the due interests on the day of interest settlement. The first payment of interests falls on the first interest settlement day after the issuance of the loan. The principal and the interest shall be paid all in one lump sum upon repayment for the last time.

3. Schedule for repayment of principal

The schedule for repayment of principal is determined according to the following method (1):

(1) Schedule for repayment of principal as follows:

1. March 5, 2022, amount RMB 15 million;
2. September 5, 2022, amount RMB 15 million;
3. March 5, 2023, amount RMB 15 million;
4. September 5, 2023, amount RMB 15 million;
5. March 5, 2024, amount RMB 15 million;
6. September 5, 2024, amount RMB 25 million;
7. March 5, 2025, amount RMB 25 million;
8. September 5, 2025, amount RMB 25 million;
9. March 5, 2026, amount RMB 25 million;
10. *September 30*, 2026, amount RMB 25 million;

(2) This column is left blank

4. Method of repayment

Party A shall prepare a sufficient amount that is payable for the current period in the repayment reserve account or other account opened by Party B prior to the date of repayment agreed in this contract, and transfer the fund voluntarily to repay the loan (Party B also has rights to deduct the fund from the account to repay the loan), or transfer funds from other accounts to repay the loan on the repayment date agreed herein.

5. Advanced repayment

For advanced repayment of the principal, Party A shall submit a written application to Party B twelve working days in advance, and may repay the principal in whole or in part at an earlier time.

For advanced repayment of the principal by Party A, the interest shall be calculated based on the actual number of days of fund use and the loan interest rate agreed herein.

If Party B agrees Party A to repay the principal in advance, Party B has rights to collect compensation from Party A, the amount of which shall be determined in line with the following standard (2):

1. Amount of compensation = amount of principal repaid in advance x number of months advanced x 0.1%; the period less than one month shall be counted as one month;

2. This column is left blank.

If Party A makes repayments by installments, and repays partial principal at an earlier time, the repayment will follow an inverse order of the plan of repayment. After the advanced repayment, the amount that has not been made shall be subject to a loan interest rate as agreed in this contract.

Article 8. Rights and obligations of Party A

1. Rights of Party A

(1) Having rights to request Party B to issue the loan as stipulated in the contract;

(2) Having rights to use the loan in line with the purpose of use agreed in this contract;

(3) If in compliance with the conditions specified by Party B, having rights to apply for extension of the loan to Party B.

(4) Having rights to request Party B to keep confidential the relevant financial materials provided by Party A and commercial secrets about the production and operation, unless otherwise stipulated by laws and rules, required by the competent authority or agreed by both parties;

(5) Having rights to reject the collection of bribes by Party B and its staff, and regarding the above acts or Party B's acts in violation of national laws and regulations about credit loan interest rate and service charges, having rights to report to the relevant department.

2. Obligations of Party A

(1) Party A shall withdraw the fund and repay in full the principal and interests of the loan in accordance with the provisions of this contract, and assume various fees agreed herein;

(2) Party A shall, as requested by Party B, provide relevant financial and accounting materials, production and operation materials and other materials, including but not limited to providing Party B with the balance sheet of the end of the quarter, profit and loss statement as of the end of the quarter (income and expenditure statement for public institutions) within thirty-five working days at the end of each quarter, and provide in a timely manner the current-year cash-flow statement at the end of the year, and ensure that the materials provided are legal, authentic, complete, accurate and valid, and that no false materials are provided nor major operation or financial facts concealed;

(3) If Party A has any major adverse event that affects its debt-paying capability or other circumstances endangering the creditor's right of Party B, or changes the industrial and commercial registration items such as name, legal representative (person in charge), domicile, scope of business, registered capital or company (enterprise) articles of association, Party A shall notify Party B in writing within three days, and attach relevant materials after change.

(4) Party A shall use the loan for the purposes agreed in this contract, and may not squeeze, misappropriate or use the bank loan for transactions in violation of laws or regulations; shall cooperate and receive the inspection and supervision by Party B on its product and operation, financial activities, and use of the loan under this contract; may not illegally withdraw the funds, transfer the capital or use connected transactions to evade the debt of Party B; may not use the false contract with the connected party to discount or pledge the notes receivable without the actual transaction background or the accounts receivable or other creditor's rights so as to elicit capital or credit authorization from the bank.

(5) If Party A uses the loan under this contract for production, manufacturing and engineering construction, Party A shall comply with the national provisions about environmental protection.

(6) Prior to full repayment of the loan principal and interest of Party B, Party A may not provide guarantee for a third person with the asset formed with the loan hereunder without the consent of Party B.

(7) Party A, if as group client, shall inform Party B in time of the connected transaction of the above 10% of Party A’s net asset, including, (1) connected relationship of various transaction parties; (2) transaction item and nature; (3) amount or corresponding percentage of the transaction; (4) pricing policy (including the transaction having no amount or only having a symbolic amount);

(8) Party A shall ensure that the proposed project is approved by the relevant governmental authority and does not have any circumstance in violation of laws or regulations, and that the capital or other raised funds are in place in full in line with the time and percentage specified; Party A shall ensure that the project capital proportional to the loan is in place in full and used in combination with the loan, and that the project is completed in line with the schedule.

(9) Prior to merger, split, stock transfer, outward investment, substantial increase of debt and financing and other major events, Party A shall obtain the written consent of Party B. However, the written consent of Party B does not affect Party B’s right to take remedial measures agreed in this contract when Party B considers that the above act may jeopardize the security of its creditor’s rights.

(10) Party A shall, by a period of quarter [select either of the following: (1) month (2) quarter], report to Party B in summary the payment of loan on a regular basis. Party A may not at latest report to Party B in summary the payment of loan for the previous quarter [select either of the following: (1) month (2) quarter] within ten working days at the start of each quarter [select either of the following: (1) month (2) quarter].

(11) Party A shall coordinate and cooperate with Party B’s inspection and supervision of the production, operation and financial activities of the project sponsor and the project construction and operation conditions, and request the project sponsor to cooperate with the above inspection and supervision by Party B.

Article 9. Rights and obligations of Party B

1. Party B may request Party A to repay the loan principal, interest and fees as scheduled, manage and control the payment of the loan fund, monitor dynamically the income cash flow of the project and the overall cash flow of Party A, and exercise other rights agreed in this contract, as well as request Party A to fulfill its other obligations under this contract;

2. Party B shall issue the loan as specified in this contract, except the delay due to the cause of Party A or other causes that cannot be attributed to Party B;

3. Party B shall keep confidential the relevant financial materials and business secrets about the production and operation provided by Party A, unless otherwise stipulated by laws, regulations and rules, or otherwise required by the competent authority or otherwise agreed by both parties;

4. Party B may not provide bribes to Party A and its staff, or collect and receive bribes;

5. Party B may not have any dishonest act or act detrimental to the legal interests of Party A.

Article 10. Default responsibilities and remedial measures in case of circumstances endangering Party B's creditor's right

1. Default circumstances and default responsibilities of Party B

(1) If Party B fails to issue the loan as stipulated in this contract without a reasonable cause, Party A may require Party B to continue issuing the loan in line with the stipulations hereof;

(2) If Party B charges any unjustified interest or fee from Party B in violation of the prohibitory provisions of national laws and regulations, Party A may require Party B to issue a refund.

2. Default circumstances of Party B

(1) Party A violates any provision of this contract or any statutory obligation;

(2) Party A indicates expressly or indicates by its act that it would not fulfill any obligation under this contract.

3. Circumstances that may endanger the creditor right of Party B

(1) Any of the following circumstances that Party B deems may jeopardize the security of the creditor's right under this contract: Party A has contracting, trusteeship (takeover), leasing, reform through shareholding system, decrease of registered capital, investment, joint operation, combination, merger, acquisition and reconstruction, split, joint venture, equity transfer, financing by substantial increase of debt, (subject to) application for suspension of business for rectification, application for dissolution, subject to revocation, (subject to) application for bankruptcy, change of the controlling shareholder/actual controller, or major asset transfer, suspension of production, out of business, high penalty imposed by the competent authority, canceled registration, business license revoked, involvement in major legal dispute, production and operation with severe difficulty or deteriorated financial conditions, decline of credit status, or legal representative or main person-in charge unable to fulfill the duties normally;

(2) Any of the following circumstances that Party B deems may jeopardize the security of the creditor's right under this contract: Party A fails to fulfill other due debts (including the due debts to institutions at various branches of China Construction Bank or other third party), transfers the property at a low price or gratis, reduces the debt of the third party, fails to exercise the creditor's right or other rights, or provides guarantee for the third party; the financial indicators of Party A fail to continuously satisfy the requirements of attachment 2, "Restrictive terms on financial indicators"; Party A fails to pay the loan fund as agreed in this contract, or evades the entrusted payment of Party B by breaking the whole into parts; the progress of the project lags behind the schedule of fund use; the capital in any account of Party A (including but not limited to the repayment reserve account and other accounts supervised by Party B) has any abnormal fluctuation.

(3) The shareholder of Party A abuses the independent status of the company legal person or the limited responsibility of a shareholder to evade debts, which Party B considers may endanger the security of the creditor's right under this contract;

(4) Any precondition for issuance of the loan specified herein is not satisfied continuously;

(5) The guarantor has any of the following circumstances that Party B deems may endanger the security of the creditor's right under this contract:

1. The guarantor violates any provision of the guarantee contract, or the matter stated and guaranteed has any false, wrong or omitted information;

2. Occurrence of contracting, trusteeship (takeover), leasing, reform through shareholding system, decrease of registered capital, investment, joint operation, combination, merger, acquisition and reconstruction, split, joint venture, equity transfer, financing by substantial increase of debt, (subject to) application for suspension of business for rectification, application for dissolution, subject to revocation, (subject to) application for bankruptcy, change of the controlling shareholder/actual controller, or major asset transfer, suspension of production, out of business, high penalty imposed by the competent authority, canceled registration, business license revoked, involvement in major legal dispute, production and operation with severe difficulty or deteriorated financial conditions, decline of credit status, or legal representative or main person in charge unable to fulfill the duties normally, which may affect the capability of the guarantor to perform the guarantee;

3. Other circumstances resulting in loss or possible loss of the guarantee capability:

(6) Any of following circumstances about the mortgage or pledge that Party B deems may jeopardize the security of the creditor's right under this contract:

1. Damage, loss or depreciation of the mortgaged or pledged property due to the act of a third person, national collection, confiscation, requisition, retrieval for free, demolition and relocation, change of market conditions, or any other cause;

2. Sealing up, detention, freezing, deduction, lien, auction, supervision by administrative authority, or dispute about ownership with respect to the mortgaged or pledged property;

3. The mortgagor or pledger violates any provision of the mortgage contract or pledge contract, and the matters guaranteed have any false, wrong or omitted information;

4. Other circumstances that may jeopardize the realization of the mortgage right or pledge right Party B;

(7) The guarantee is not established, not effective, invalid, canceled or dissolved, the guarantor breaches the agreement or indicates explicitly or indicates by its behavior that it is no longer fulfilling the guarantee responsibility, or the guarantor loses the guarantee capability in part or in whole, or there are other circumstances that the value of the collateral decreases, which in the opinion of Party B may endanger the security of the creditor's right under this contract; or

(8) Other circumstances that Party B deems may endanger the security of the creditor's right under this contract.

4. Remedial measures of Party B

In the event of any circumstance specified in paragraph 2 or paragraph 3 of this article, Party B has rights to exercise any following right or rights:

(1) To stop issuing the loan;

(2) Declaring that the loan expires immediately, and requiring Party A to repay the principal, interest and fees for the debts already expired or not expired under this contract right away;

(3) If Party A fails to disburse the loan as specified in the contract, Party B may demand that Party A pay liquidated damages equivalent to blank % of the amount that has not been disbursed as stipulated, and prevent Party A from drawing on the remaining amount under this contract;

(4) If Party A fails to use the loan for the purpose agreed in this contract, regarding the part misappropriated by Party B, interests and compound interests would be charged at the penalty interest rate by the method of interest settlement agreed herein for the period from the day of failure to use the loan for the purpose stipulated herein to the day of full repayment of the principal and interest;

(5) In the event of overdue borrowing, for the principal borrowed and interest that Party A fails to pay back on time (including the principal borrowed and interest declared by Party B having expired at an earlier time in whole or in part), interests and compound interests would be charged at the penalty interest rate by the method of interest settlement agreed herein for the period from the expiry date to the day of full repayment of the principal and interest.

In the event of overdue loan, compound interests would be charged at the interest rate by the method of interest settlement agreed herein for the interest Party A fails to pay on time.

(6) Other remedial measures, including but not limited to:

1. to deduct the corresponding amount in RMB or other currencies from the account opened by Party A in the system of China Construction Bank, without giving notice in advance;

2. to exercise the right of guarantee;

3. to require Party A to provide new guarantees consistent with the requirements of Party B for all debts under this contract;

4. to dissolve this contract.

Article 11. Miscellaneous terms

1. Assumption of costs

(1) Costs incurred due to Party A's violation of any provision herein (including but not limited to the actual litigation fee, arbitration fee, property preservation fee, travel fee, execution fee, evaluation fee, auction fee, notarization fee, service fee, announcement fee, attorney fee and other costs incurred due to Party A's violation of the agreement) shall be borne by Party A;

(2) For other fees, Party A and Party B agree as follows:

This column is left blank

2. Use of Party A's information

Party A agrees that Party B may inquire about the credit status of Party B from the People's Bank of China, and the credit database approved by the competent credit investigation department, or relevant unit and department, and agrees that Party B provides the information of Party A to the People's Bank of China, and the credit database approved by the competent credit investigation department. Party A agrees that Party B may also use properly and disclose Party A's information out of the need of the business.

3. Collection by announcement

For the delayed repayment of the principal borrowed and interest or other default circumstances by Party A, Party B may report to the relevant department or unit, and may urge repayment by announcement on the news media.

4. Evidentiary effect of Party B

Unless there is reliable and proven evidence to the contrary, the internal financial records of Party B about the principal, interest and repayment records, the documents and vouchers generated during the business processes of withdrawal, repayment and payment of interests by Party B which have been prepared or saved by Party B, and the records and vouchers about collection of repayment of the loan by Party B shall constitute proven evidences that may effectively demonstrate the debtor-creditor relationship between Party A and Party B. Party A may not raise an objection solely on the ground that the above records, documentations, documents or vouchers are unilaterally prepared or saved by Party B.

5. Reservation of right

The rights of Party B hereunder do not affect or exclude any right that Party B is entitled to in line with the laws, regulations and other contracts. Any tolerance, grace, preference or delayed exercise of any right hereunder to the default or procrastination act shall not be deemed as a waiver of the rights and interests hereunder, nor as permission or recognition of any act in violation of this contract, and also shall not restrict, prohibit or hinder the continuous execution of such rights, or execution of its any other rights, and shall not cause Party B to assume obligations or responsibilities to Party A as a result.

6. Except the debt hereunder, if Party A still has other matured debts to Party B, Party B may deduct the fund in RMB or other currency in the account opened in China Construction Bank system to firstly pay off any matured debt, and Party A agrees without any objection.

7. In case of any change of the correspondence address or contact method of Party A, a written notice shall be given to Party B immediately, and any loss incurred due to failed timely notification shall be assumed by Party A.

8. Deduction of the amount receivable

For all amounts payable by Party A under this contract, Party B may deduct the corresponding amount in RMB or other currencies from the account opened by Party A in the China Construction Bank system, and does not need to notify Party A in advance. If there is a need to go through the procedures for the settlement and sale of exchange or transaction of foreign exchanges, Party A is liable to assist Party B, with the exchange rate risks borne by Party A.

9. Method for settlement of dispute

Any dispute arising from the implementation of this contract may be solved through negotiation; if no consensus is reached through negotiation, the dispute may be solved in line with method (1):

(1) to file a lawsuit to the people's court at the place where the domicile of Party B is located.

(2) to submit the dispute to blank arbitration committee (place of arbitration: blank) for arbitration in line with the current effective arbitration rules at the time of application for arbitration. The ruling of the arbitration is final and binding on both parties.

During the period of lawsuit or arbitration, the terms not in dispute in this contract shall continue to be implemented.

10. Conditions for the contract to take effect

This effect enters into effect after signature and affixation with the official seal by Party A's legal representative (person in charge) or authorized agent, and signature and affixation with the official seal by Party B's person-in-charge or authorized agent.

11. This contract is executed in triplicate.

12. Other matters agreed

(1) Party A and Party B agree with the following provisions regarding the address for service of the various notices, agreements and documents about this contract, and legal consequences:

1. Address of service

(1) The service address confirmed effective by Party A:

R1606, Building F3, Innovative Industrial Park Phase II, No.2800, Chuangxin Avenue, High- tech Development District, Hefei

(2) The service address confirmed effective by Party B:

Liyuan Building E, No.398, Huanhu Road East, Shushan District, Hefei City

2. Scope of application of the service address

The above service address applies to the service of various notices, agreements and documents related to this contract, including but not limited to the service of various notices, agreements and other documents during the period of performance of the contract, and service of relevant files and legal instruments upon occurrence of disputes about the contract, as well as service of relevant files during the first instance, second instance, retrial and execution proceedings and other proceedings after the dispute enters the arbitration or civil litigation procedure.

3. Change of the service address

(1) If Party A needs to change the service address, Party A shall notify Party B in writing ten working days in advance, and the written notice shall be delivered the service address of Party B;

(2) If Party B needs to change the service address, Party B shall notify Party A by mail.

(3) If either party changes the address in the arbitration or civil lawsuit, the party shall also notify in writing the arbitration institution and the court.

(4) If either party fulfills the obligation of notification about the change of address in line with the above provision, the changed service address shall be deemed effective, otherwise the service address having been confirmed previously shall remain valid.

4. Legal consequences

(1) If either party provides or confirms an inaccurate service address, or fails to fulfill the notification obligation in a timely manner in line with the aforementioned method after alteration of the service address, and the party or its designated receiver refuses to sign to acknowledge the receipt, causing the notice, agreement, legal instrument and various documents to be unable to be received actually by that party or served by mail, the day of return of the document shall be deemed as the date of service; for direct service, the day when the server indicates the circumstance on the return receipt of service on site shall be deemed as the date of service.

(2) The arbitration institute and court may deliver the document by direct mail to the above service address and arbitration institute; even if the party concerned fails to receive the document mailed by the arbitration institute or court, it shall also be deemed having been served due to the above provision.

2. (1) The prices and fees excluded in price under this contract refer to prices including the value added tax, unless otherwise stipulated by parties concerned.

(2) Invoice

2.1 Party B will issue the invoice in line with the following provision (1):

(1) If Party A puts forward the requirement for issuance of the invoice, Party B shall issue the value added tax invoice for the current payment amount in line with laws after receiving the amount paid by Party A.

(2) Other provisions: this column is left blank

2.2 Invoice information provided by Party A

Company name (full name): Hefei Photronics Co., Ltd.

Taxpayer identification No.: 91340100MA2PEQYY5T

Bank account: 1302049809201778828

Opening bank: China Industrial and Commercial Bank Corporation Hefei Keji branch

Address: R1606, Building F3, Innovative Industrial Park Phase II, No.2800, Chuangxin Avenue,

High-tech Development District, Hefei

Tel: 0551-65126615

2.3 If the invoice needs to be canceled or a red-letter invoice is issued, Party A shall provide timely assistance in line with the requirements of Party B. If an invoice cannot be canceled or a red-letter invoice cannot be issued due to the cause of Party A, Party A shall compensate all losses of Party B, including but not limited to the tax, surcharge, penalty or overdue fine.

(3) If Party A is an institute outside the territory of the People’s Republic of China, and the price and fees excluded in the price under this contract are entitled to tax preferences and need to go through tax filing in line with the laws, regulations, rules or relevant provisions of the related department; Party A shall provide adequate, accurate value-added tax preference filing materials to Party B in line with the requirement of Party B to assist Party B completing the taxation filing.”

3. Due to the deterioration of the credit status of Party A, including but not limited to occurrence of default situations by Party A as agreed herein, and occurrence of circumstances that may endanger the creditor’s right of Party B, Party A may, without giving an advanced notice, unilaterally adjust or revoke the relevant credit ceiling, and may unilaterally adjust the amount issued or refuse to issue the loan. Party A promises not to raise any objection regarding the above arrangement.

Article 12. Recital clauses

1. Party A is fully aware of the business scope and authorization and privilege of Party B.

2. Party A has read all terms of this contract. On the request of Party A, Party B has explained the corresponding terms of this contract. Party A has completely understood and fully comprehended the contents of the terms herein and the corresponding legal consequences.

3. The signing by Party A and fulfillment of the obligations hereunder conform to the provisions of laws, administrative regulations, rules and Party A’s articles of association or internal organization documents, and Party A has obtained the approval of the internal competent institution of the company and/or the national competent authority.

4. Party A complies with the national requirements on the eligibility of the investment entity of the project and business qualification;

5. The project conforms to the relevant national policies about the industry, land, environmental protection and investment management, and Party A has gone through the legal management procedure of the project as required;

6. The investment project of Party A conforms to the national provisions related to the investment project capital system;

7. Party A and its controlling shareholder have good credit status, without major adverse records.

8. Party A states that at the time of execution of this contract, Party A and its major connected party in China do not have any act or circumstance in violation of the environmental and social risk management laws, regulations and rules, and promise to strengthen the environmental and social risk management of its own and its major connected party in China after the execution of this contract, strictly abide aby laws, regulations and rules about environmental and social risk management, and put an end to any hazard and relevant risks to the environment and society in the construction, production and operation activities (including but not limited to energy consumption, pollution, land, health, safety, resettlement of immigrants, ecological protection, energy conservation and emission reduction, climate change and other environmental and social problems). Party A acknowledge that Party B has rights to supervise the environmental and social risk management situation of Party A, and may require Party A to submit the environmental and social risks report. If Party A makes false statements or fails to fulfill the above promises, or Party A may cause environmental or social risks, Party B has rights to suspend granting the credit to Party A (including but not limited to refuse issuing the loan, providing financing, issuing the letter of guarantee or letter of credit or bank acceptance bill), or declare that the principal and interest of the creditor’s right (including but not limited to loan, financing, advanced payment that has or may be effected) expire at an earlier time, or take other remedial measures agreed herein or permitted by laws.

[seal]

Party A (official seal):

Peter
Scott
kirlin

[seal of Hefei Photronics Co., Ltd.]

Legal representative (person in charge) or authorized agent (signature):

October 1, 2020

Party B (official seal):
[seal of China Construction Bank Corporation Hefei Shushan Branch]

Person-in-charge or authorized agent (signature): [signature:] *Xu Jun*

October 1, 2020

Attachment 1:

Basic information about the project and loan

1. Project name: Hefei Photronics Co., Ltd., 10.5 generation plant new project

2. Total investment of the project:

USD (amount in words) one hundred fifty-five million; unless an explicit written evidentiary document is provided by Party A and acknowledged by Party B, Party A may not claim an increase of the total investment amount of the project.

3. Location of the project: Hefei

4. Construction and operation period of the project:

Construction period of one year, and operation for a long term.

5. Specific purpose of use of the loan under this contract:

For Hefei Photronics Co., Ltd., 10.5 generation plant new project

6. Sources of repayment of the loan under this contract:

(1) The sources of repayment of the loan under this contract: operating income of the project, and other incomes and raised funds of Party A;

(2) Party A shall use the above sources of repayment to repay the loan under this contract in line with the following provision (time, frequency, method etc.):

Make repayments in line with the plan agreed herein.

Party A shall ensure the sources of repayment are true and that the cash flow for repayment is stable and sufficient.

7. Miscellaneous:

Attachment 2:

Restrictive terms on financial indicators

The financial indicators of Party A shall continuously satisfy the following restrictions:

1. Asset-liability ratio (total liability/total asset) no higher than 85%;

2. Flow ratio (current asset/current liability) no lower than 0.5;

3. No additional contingent liability.

After notifying Party A blank working days in advance, Party B may revise the above restrictions.

Exhibit 10.40

Maximum Mortgage Contract

Contract No: Jian He Shu FCGZDYHT2020002

Mortgager (Party A): Hefei Fengchuang Photomask Co., Ltd.

Address: Room 1606, Building F3, Innovation Industrial Park Section II, No. 2800 Chuangxin Avenue, High-tech District, Hefei Postal Code: 230000

Legal Representative (Person in Charge): Peter Scott Kirlin

Fax: Tel: 0551-65126615

Mortgagee (Party B): China Construction Bank Corporation Hefei Shushan branch

Address: Building E, Liyuan, No.398 Huanhu East Road, Shushan District , Hefei

Postal Code: 230088

Person in charge: Shi Tao

Fax:62816387 Tel: 0551- 62816387

In view of the fact that Party B is going to conduct (and/or have already conducted) the following credit business for Hefei Fengchuang Photomask Co., Ltd. (hereinafter referred to as the "debtor") on consecutive basis for the following (1),(2),(3) and (4) items from___mm__dd 2020 to___mm__dd 2021 (hereinafter referred to as "Determination Period of Claims") by concluding loan contract of RMB funds, loan contracts of foreign exchange funds, bank acceptance agreement, letter of credit issuance contract, letter of guarantee issuance agreements and/or other legal Documents (the aforementioned contracts, agreements and/or other legal documents concluded during the determination period of the claims are hereinafter referred to as the "Master Contract").

(1)Issuance of RMB/foreign currency loans;

(2)Acceptance of commercial drafts;

(3)Issuing letter of credit;

(4)Issuing letter of guarantee;

(5)Other credit business: this column is left blank.

Party A is willing to provide a maximum mortgage guarantee for the series of debts of the debtor under the master contract. In accordance with relevant laws, regulations and rules, both parties have reached an agreement through consultation to enter into this contract for mutual compliance and execution.

Article 1 Mortgaged Property

1. Party A shall establish mortgage with the property listed in the "List of Mortgaged property" of this contract.

2. Where the mortgaged property is reissued with a new certificate of ownership or other right, making the certificate of other right (mortgage) or certificate of the mortgage right which is shown on the "List of Mortgaged Property" hereof or received by Party B inconsistent with the aforementioned new certificate of rights or the relevant registration records at the registration authority, Party A shall not refuse to assume the guarantee liability for this reason.

3. Unless otherwise agreed by Party A and Party B or otherwise provided by law, the newly added items on the mortgaged property due to attachment, mixing, processing, reconstruction, etc., will also serve as the mortgage guarantee for Party B's claims. Party A shall handle the necessary procedures according to Party B's requirements. Mortgage registration and other procedures.

4. If the value of the mortgaged property has been or may be reduced, which affects the realization of Party B's claims, Party A shall provide a new guarantee in accordance with Party B's requirements.

Article 2 Scope of Guarantee and Maximum Debt Authority

1. The guarantee scope of this maximum mortgage shall cover all debts under the main contract, including but not limited to all principal, interest (including compound interest and penalty interest), liquidated damages, compensation, and other payments the debtor should pay to Party B (including but not limited to relevant service fees, telecommunication costs, miscellaneous fees advanced by Party B, and other bank-related expenses refused to be paid by the beneficiary under the letter of credit) , and costs by incurred Party Bin the realization of its claims and security rights (including but not limited to litigation fees, arbitration fees, property preservation fees, travel expenses, enforcement fees, evaluation fees, auction fees, notarization fees, delivery service fees, announcement fees, attorney fees, etc.).

2. The maximum limit of guarantee liability under this maximum mortgage is (currency) Renminbi (amount in capitals) Two Hundred Twenty Million Yuan. If Party A fulfills its guarantee obligations in accordance with this contract, the maximum amount shall be reduced accordingly.

3. Even if the actual formation time of the loan, advance, interest, expense or any other claims of Party B under the main contract exceeds the determination period of the claims, it shall still fall within the scope of the guarantee of this maximum mortgage. The expiry date of the debt performance period under the main contract shall not be restricted by the expiry date of the determination period of the claims.

Article 3 Mortgaged property Registration

The parties shall conduct the mortgage registration at the appropriate registration authorities within 5 working days after this contract is concluded. Party A shall submit the certificate of other rights of the mortgage property, original of the mortgage registration documents and other rights certificates to Party B on the date when the mortgage registration is completed.

Article 4 Changes of the main contract

1. where Party B signs the master contract with the debtor or makes any changes to the master contract (including but not limited to extending the debt performance period or increasing the principal amount of the claims), upon the agreement of both parties, Party A shall take the guarantee liability within the maximum amount and the scope of the guarantee specified in this contract.

2. Changes to the parties

Party A's guarantee liability shall not be reduced or exempted due to any of the following situations:

(1) The restructuring, merger, consolidation, division, increase or decrease of capital, joint venture, joint operation, name change of Party B or the debtor;

(2) Party B entrusts a third party to perform its obligations under the main contract;

3. If the claims under the main contract are transferred to a third party, the guarantee under this contract shall be transferred accordingly, and Party A shall assist Party B and the third party in handling the mortgage modification registration procedures required by law.

4. If the transfer of claims or debts under the main contract is not effective, invalided, cancelled, or terminated, Party A shall still bear the guarantee liability to Party B in accordance with this contract.

Article 5 Possession and custody of mortgaged property

1. Party A shall properly occupy, keep and maintain the mortgaged property, reasonably use the mortgaged property, maintain the integrity of the mortgaged property, and pay all taxes and fees related to the mortgaged property on time. Party B has the right to inspect the mortgaged property and may require Party A to deliver the original copy of rights certificates of the mortgaged property to Party B for safekeeping.

2. Where Party A entrusts or agrees to have a third party to occupy, keep, or use the mortgaged property, it shall inform the third party of the existence of the mortgage right, and request it to maintain the integrity of the mortgaged property, accept Party B's inspection of the mortgaged property, and not hinder the realization of the mortgage right by Party B. Party A shall not thereby be exempt from the obligations in the preceding paragraph, and shall at the same time be liable for the actions of the third party.

3. Party A shall be liable for compensation if the mortgaged property causes any personal or property damage. If a claim is raised against Party B who is held liable, or Party B has advanced the compensation for Party A, Party B shall have the right to claim compensation from Party A.

Article 6 Insurance of mortgaged property

1. Unless otherwise agreed upon by both parties, Party A shall procure insurance for the mortgaged property in accordance with the type of insurance, the period of insurance, and the amount of insurance specified by Party Bin accordance with relevant laws. The insurer shall have statutory qualifications and good reputation.

2. The content of the insurance policy shall meet the requirements of Party B and no restrictive conditions that may jeopardize the rights and interests of Party B shall be attached thereto. The insurance policy shall specifically indicate that Party B is the priority indemnitee (first beneficiary) of the insurance compensation; changes to the insurance policy shall be subject to the approval of Party B in writing; in the event of an insured event, the insurer shall directly transfer the insurance compensation to the account designated by Party B. If the mortgaged property is insured but the insurance policy does not indicate the above content, the insurance policy shall be endorsed or amended accordingly.

3. Party A shall ensure that the insurance is consecutively valid, and shall not cause the insurance to be interrupted, cancelled or invalidated for any reason, or cause the insurer to reduce or exempt its liability for compensation, or change the insurance policy without the consent of Party B. If the claims guaranteed by Party A are not fully paid when the insurance period expires, Party A shall renew the insurance and extend the insurance period accordingly.

4. Party A shall deliver the original insurance policy of the mortgaged property to Party B within five working days from the date of conclusion of this contract (if the mortgaged property insurance is renewed, from the date of the renewal completion), and shall reserve the documents necessary for the relevant insurance claim or the transfer of insurance rights with Party B.

5. Party B has the right to dispose of the insurance compensation obtained with respect to the mortgaged property in any of the following options, and Party A shall assist in conducting the relevant procedures:

(1) With the consent of Party B, to be used to repair the mortgaged property to restore the value of the same;

(2) To be used to pay off or pay off before maturity the principal and the interest of the debt under the main contract and related expenses;

(3) To be used to provide pledge guarantees for the debts under the main contract;

(4) to be disposed of by Party A at its own discretion upon providing new guarantee by Party A that meets the requirements of Party B.

Article 7 Restrictions on Party A's disposal of mortgaged property

1. Without the written consent of Party B, Party A shall not dispose of the mortgaged property in any way, including but not limited to abandonment, lease (including renewal of lease after the original lease contract expires), gift, transfer, capital contribution, repeated guarantee, relocation, and change to public welfare purposes, attaching with other things, rebuilding or dividing.

2. With the written consent of Party B, the price or other funds obtained from the disposal of the mortgaged property by Party A shall be deposited into the account designated by Party B. Party B has the right to dispose of the above payments by choosing from any of the options stipulated in items (2) to (4) of paragraph *5* of Article 6 of this contract, and Party A shall assist in conducting the relevant procedures.

Article 8 Obstructions by third parties

I. If the mortgaged property is expropriated, requisitioned, demolished, confiscated, or recovered free of charge by the state, or the mortgaged property is sealed, frozen, seized, supervised, retained, auctioned, forcibly possessed, damaged or otherwise disposed of by a third party, Party A shall immediately notify Party B and promptly take measures to stop, eliminate such actions or take remedial measures to prevent the loss from expanding; if requested by Party B, Party A shall provide new guarantee that meets Party B's requirements.

2. The remaining part of the mortgaged property after the occurrence of the situation described in the preceding paragraph shall still be used as a mortgage guarantee for Party B's claims. The indemnity or compensation obtained by Party A for the above reasons shall be deposited into the account designated by Party B. Party B has the right to dispose of the above payments by choosing from any of the options stipulated in items **(1)** to (4) of paragraph 5 of Article 6 of this contract, and Party A shall assist in conducting the relevant procedures.

Article 9 Realization of Mortgage Rights

1. If the debtor fails to perform the debts due under the main contract or fails to perform the debts that are announced to be due earlier, or violates other provisions of the main contract, Party **B** has the right to dispose of the mortgaged property.

2. The value of the mortgaged property recorded in the "List of Mortgaged Property" in this contract or separately agreed upon by both parties (hereinafter referred to as "tentative value"), whether recorded in the registry of the registration authority or not, does not indicate the final value of the mortgaged property. The final value shall be the net amount of the proceeds from the disposal of the mortgaged property by Party B after deducting various taxes and fees.

Where the mortgaged property is used to repay Party B's claims, the above-mentioned tentative value shall not be used as the basis for the mortgaged property to repay Party B's claims. The value of the mortgaged property shall by then be determined by mutual agreement or fair evaluation according to law.

3. Party B's proceeds from disposing of the mortgaged property shall, after paying the costs in the process of selling or auctioning (including but not limited to storage fees, evaluation fees, auction fees, transfer fees, taxes, fees for state-owned land use rights transfer, etc.), be used to pay off the debts under the main contract as a priority, and the remaining amount shall be refunded to Party A.

4. Where Party A and the debtor are the same person, Party B may apply for compulsory execution of the property other than the mortgaged property of Party A, and it shall not be preconditioned on giving up the mortgage or disposing of the mortgaged property in the first place.

5. Party A shall not prevent Party B from realizing mortgage rights in any way (including acts or omissions).

6. Regardless of whether Party B has other guarantees for the claims under the main contract (including but not limited to guarantees, mortgages, pledges, letters of guarantee, standby letters of credit, etc.), whether when the other guarantees are established, whether they are valid, or whether Party B claims against these other guarantors, and regardless of whether a third party agrees to assume all or part of the debts under the main contract, or whether such other guarantees are provided by the debtor on its own, Party A's guarantee liabilities under this contract shall not be reduced or exempted whatsoever. And Party B may directly request Party A to assume the guarantee liability within the scope of its guarantee in accordance with this contract. Party A undertakes not to claim that Party B shall realize its claims with the guarantees in rem provided by the debtor or guarantees provided by other guarantors in the first place. Party A agrees that Party B has the right to choose the order of realization of guarantees among various guarantees, and Party A shall not propose any objection.

7. Where the maximum limit of guarantee liability stipulated in this contract is lower than the actual balance of the claims under the main contract, and the claims under the main contract have not been fully repaid after Party **A** assumes the guarantee responsibility, Party A undertakes that its exercising (including pre-exercising) of its right of subrogation or right of recourse against the debtor or other guarantors shall not cause any damage to the interests of Party B, and agrees that the settlement of the debts under the master contract has priority over the realization of the right of subrogation or right of recourse of Party A.

Specifically, before Party B's claims are fully paid off,

(1) Party A agrees not to claim its right of subrogation or right of recourse against the debtor or other guarantors; if Party A realizes the above-mentioned rights for any reason, the proceeds so obtained shall be used to the payment of the unpaid claims of Party Bas a priority;

(2) If there is a guarantee in rem for the debt under the main contract, Party A agrees not to claim the guaranty or the proceeds from its disposal on the ground of exercising it right of subrogation or any other reason. The aforesaid guaranty and proceeds so obtained shall be used for the repayment of Party B's unpaid claims as a priority;

(3) If the debtor or other guarantors provide Party A with a counter-guarantee, the proceeds obtained by Party A based on the above-mentioned counter-guarantee shall be used for the repayment of Party B's unpaid claims as a priority.

8. If the main contract is not established, ineffective, invalid, partially invalid or revoked, or terminated, and Party A and the debtor are not the same person, then Party A shall, within the scope of the guarantee stipulated in this contract, take joint and several liabilities with the debtor with respect to the obligations of the debtor due to return of property or compensation for losses.

9. Party A has fully acknowledged the risk of the interest rate. Where Party B adjust the interest rate, interest calculation or settlement method according to the provisions of the main contract or based on the changes of the national policy, resulting in an increase in the interest, penalty interest, compound interest which are payable by the debtor, Party A shall also assume guarantee liability with respect to the increased part.

10. If, the debtor has other debts to Party B in addition to the debts under the main contract, Party B has the right to transfer the fund in RMB or other currencies in the account opened by the debtor in the China Construction Bank system for the payment of any of the due debt in the first place, and Party A's guarantee liability shall not be reduced or exempted accordingly.

Article 10 Liability for breach of contract

1. Party A's liability for breach of contract

(1) If Party A violates any of the provisions of this Contract, or any matter represented and guaranteed by Party A has any falseness, errors, or omissions, Party B has the right to take one or more of the following measures:

1. To require Party A correct the breach of contract within a time limit;

2. To require Party A to provide a new guarantee;

3. To require Party A to compensate for the loss;

4. To dispose of mortgaged property;

5. Other relief measures permitted by law.

(2) Party B has the right to choose any of the methods agreed in Article 6 Paragraph 5 (2) to (4) to deal with the proceeds from the disposal of the mortgaged property, and Party A shall assist in the relevant procedures.

(3) If the mortgage right is not effectively established, or the value of the mortgaged property is reduced, or Party B fails to timely or fully realize the mortgage due to the reasons of Party A, while Party A and the debtor are not the same person, Party B has the right to require Party A to assume joint liability with the debtor for the secured debt within the scope of the guarantee agreed in this Contract.

2. Party B's liability for breach of contract

If Party B loses the mortgage property rights certificate delivered by Party A due to its fault; or Party B fails to return the mortgage property rights certificate in lime after the debts under the master contract are paid off or fails to assist in the mortgage registration cancellation procedures after Party A submits an application, Party A has the right to take one or more of the following measures:

(1) To require Party B to bear the cost of re-issue of the mortgage property rights certificate;

(2) To require Party B to return the mortgage property rights certificate within a time limit or assist Party A to cancel the mortgaged property registration.

Article 11 Miscellaneous clauses

1. Costs and expenses

(1) Costs and expenses caused by Party A's breach of any of the provisions of this Contract (including but not limited to the legal costs, arbitration fees, property preservation fees, travel expenses, execution fees, evaluation fees, auction fees, notary costs, service fees, announcement fees, lawyer fees actually incurred by Party B due to Party A's breach of contract) shall be borne by Party A;

(2) As for other costs and expenses, Party A and Party B agree as follows: <u>this column is blank</u>

2. Transfer and reception of payables

As for all amounts payable by Party A under this Contract, Party B has the right to transfer and receive corresponding amounts in RMB or other currencies from the account opened by Party A in the China Construction Bank system without prior notice to Party A. If it is necessary to go through the foreign exchange settlement and sale or foreign exchange trading procedures, Party A is obliged to assist Party B to complete such procedures, and Party A shall bear the risk of exchange rate.

3. Use of Party A's information

Party A agrees that Party B may inquire about Party A's credit status with the credit database established with the approval from the People's Bank of China and the credit investigation authorities or relevant authorities and departments, and that Party B may provide Party A's information to the credit database established with the approval from the People's Bank of China and the credit investigation authorities. In addition, Party A agrees that Party B may reasonably use and disclose Party A's information for business needs.

4. Announcement about collection

For Party A's breach of contract, Party B has the right to notify relevant departments or authorities, and has the right to make an announcement about collection through the news media.

5. Evidentiary effect of Party B's records

Unless there is reliable and definite evidence to the contrary, Party B's internal accounting records related to principal, interest, costs and repayment records, etc., receipts and vouchers prepared or retained by Party B, which are incurred during the course of the debtor's business procedures such as withdrawal, repayment, interest payment, and the records and vouchers of Party B's loan collection, all constitute definite evidence that effectively proves the credit relationship under the master contract. Party A cannot raise objections just because the above-mentioned records, documentations, receipts, and vouchers were unilaterally prepared or retained by Party B.

6. Reservation of rights

Party B's rights under this Contract shall not affect and exclude any rights it enjoys in accordance with laws, regulations and other contracts. Any tolerance, indulgence, preference or delay in exercising any right under this Contract for any breach of contract or delay shall not be considered as a waiver of the rights and interests under this Contract or the permission or recognition of any breach of this Contract. It shall not affect, prevent or hinder the continuing exercise of such right or the exercise of any other rights, nor will it cause Party B to assume obligations and liabilities to Party A.

Even Party B does not exercise or delays in exercising any right under the master contract or does not exhaust any relief under the master contract, Party A's guarantee liability under this Contract will not be reduced or exempted, but if Party B reduces or exempts the debt under the master contract, Party A's guarantee liability under this Contract shall be reduced or exempted accordingly.

7. If Party A is divided, dissolves, enters bankruptcy proceedings, is revoked, has its business registration cancelled, has its business license revoked, the mortgaged property is damaged, lost, infringed or out of control of Party A due to natural factors or acts of a third party, and there is a dispute over the ownership of mortgaged property or the right certificate is cancelled, Party B shall be immediately notified.

8. Dissolution or bankruptcy of the debtor

As Party A knows that the debtor has entered the dissolution or bankruptcy proceedings, Party A shall immediately notify Party B to declare the claims, and at the same time, Party A shall participate in the dissolution or bankruptcy proceedings in time and exercise the right of recovery in advance. If Party A fails to timely exercise the right of recovery in advance as Party A knows or should know that the debtor has entered the dissolution or bankruptcy proceedings, Party A shall bear its own losses.

Notwithstanding the provision of Item 6 Paragraph 2 in this article, during the debtor's bankruptcy proceedings, if Party B and the debtor reach a settlement agreement or agree to a reorganization plan, Party B's rights under this Contract shall not be harmed by the settlement agreement or reorganization plan, and Party A's guarantee liability shall not be reduced or exempted. Party A shall not use the conditions stipulated in the settlement agreement and reorganization plan to oppose Party B's claims. In the settlement agreement and reorganization plan, Party B still has the right to require Party A to assume the guarantee responsibility for the part of the debt that has not been repaid by concessions to the debtor.

9. Dissolution or bankruptcy of Party A

In the event of Party A's dissolution or bankruptcy, even if Party B's claims under the master contract have not yet expired, Party B still has the right to participate in Party A's liquidation or bankruptcy proceedings and declare its claims.

10. If Party A's mailing address or contact information changes, Party B shall be notified in writing immediately, and Party A shall solely bear the losses caused by failure to notify in time.

11. Other agreed matters

(1) If there is a change in the mortgage registration matters and the alteration registration is required in accordance with the law, Party A shall go through the alteration registration procedures with Party B in accordance with Party B 's requirements

(2) Prior to the signing of this Contract, the debt under this column is blank signed between Party Band the debtor is also included in the scope of secured creditor's right guaranteed in this Contract.

(3) The scope of guarantee agreed in this Contract is the total amount of price and tax including value-added tax.

(4) As for the service addresses and legal consequences of various notices, agreements, and instruments relevant to this Contract, Party A and Party B agree as follows:

1. Address of service

(a) Party A confirms that its valid address of service is: Room 1606, Building F3, Phase 2, Innovation Industrial Park, No. 2800 of Chuangxin Avenue, High-tech, Zone, Hefei City

(b) Party 8 confirms that its valid address of service is: No. 398, Huanhu East Road, Shushan District. Hefei City

2. Applicable scope of address of service

The above addresses of service applies to the service of various notices, agreements, and instruments relevant to this Contract, including but not limited to the service of documents including various notices and agreements during the performance of the contract, and the service of relevant documents and legal instruments in the event of contract disputes, and also the service of relevant documents in the first instance, second instance, retrial and execution procedures and other procedures after the dispute enters arbitration, civil litigation procedures.

3. Change of address of service

(1) If Party A needs to change its address of service, it shall notify Party B in writing ten (10) working days in advance, and send a written notice to Party B 's address of service;

(2) If Party B needs to change its address of service, it shall notify Party A in writing.

(3) If a party changes its address during arbitration or civil litigation, that party shall also perform its obligation of notification in writing to the arbitration institution or the court.

(4) As a party performs its obligation of notice of address change as agreed above, its address of service after change shall be considered as the valid address of service, otherwise the previously confirmed address of service shall still be considered as the valid address of service.

d. Legal consequences

(1) If any party fails to actually receive various kinds of documents such as notices, agreements, legal instruments due to reasons that for example any party provides or confirms inaccurate address of service, the obligation of notification is not performed in the aforementioned manner after the change of the address of service, or such party or its designated recipient refuses to sign and receive such documents, and such documents are served by mail, the date on which the documents are returned shall be considered as the date of service; in case of direct service, the date on which the relevant information is recorded on the service receipt by the person serving such document shall be considered as the date of service.

(2) As for the above addresses of service, the arbitration institution and the court may directly serve by mail. Even if the parties fail to receive the documents served by mail from the arbitration institution or the court, they shall be deemed to have been served due to the above agreement.

12. Resolution method of contract disputes

Any dispute arising during the performance of this Contract can be resolved through negotiation. If negotiation fails, it shall be resolved according to the following method (1). During the process of litigation or arbitration, the terms of this Contract that do not involve disputes must still be fulfilled.

(1) Prosecuting to the People's Court in the place where Party B is domiciled

(2) Submitting this column is blank to the Arbitration Commission (with the location of arbitration at this column is blank) to conduct an arbitration in accordance with the Commission 's arbitration rules in effect at the time of applying for arbitration. The arbitration award is final, and binding on both parties.

13. Effectiveness of contract

This Contract shall become effective with the signature of the legal representative (person in charge) or authorized agent of Party A or the official stamp of Party A, and the signature of the person in charge or authorized agent of Party B or the official stamp of Party B.

14. This Contract is in quadruplicate.

Article 12 List of mortgaged property

The list of mortgaged properties under this Contract is as follows:

List of Collateral

Name of mortgaged property	Ownership certificate and other related certificate No.	Premises	Area or quantity	Value of mortgaged property (ten thousand yuan)	Amount of mortgage set for other claims (ten thousand yuan)	Remarks
Equipment	Name: Prexision-10# 1 Laser lithography machine Code: Prexl0M Name: Refurbishment of Prexision-10 system#2 Laser lithography machine Code: Prexl0N	No.360 Workshop Mingzhu Avenue, High-tech Zone	Two	Appraised value of RMB one hundred forty six point one million yuan (422.58 million yuan)	0	Wan'an H.Y.P.H. Z No. (2020) 0301 Equipment Status List Item 12 and 13 of Two Pieces of Equipment in the "Price Pre-evaluation Report"

Article 13 Representations and warranties of Party A

1. Party A is clearly aware of Party B's business scope and authorized authorities .

2. Party A has read all the provisions of this Contract and the master contract. At the request of Party A, Party B has made corresponding explanations about provisions of this contract and the master contract. Party A has been fully aware of and thoroughly understood the meaning and the corresponding legal consequences of provisions of this Contract and the master contract.

3. Party A is legally qualified as a guarantor, and Party A's guarantee behavior under this Contract complies with laws, administrative regulations, rules, and provisions of Party A's articles of association or internal organizational documents, and has obtained approval from the company's internal competent authority and/or the competent authority of the state. All liabilities arising from Party A's failure to obtain the right to sign this Contract shall be borne by Party A, including but not limited to full compensation for the loss suffered by Party B therefore.

4. Party A confirms that it has a full understanding of the debtor's information such as assets, debts, operations, credit, reputation, etc., whether it has the qualification and authority to sign the master contract and all the contents of the master contract.

5. Party A has the right to own or dispose of the mortgaged property in accordance with the law. The mortgaged property is not a public welfare facility, or property that is prohibited from circulation and transfer, and there is no dispute over ownership.

6. There are no other co-owners in the mortgaged property, or although there are other co-owners, such behavior of mortgage guarantee has obtained the written consent of other co-owners.

7. The mortgaged property does not have any defects or burdens that have not been notified to Party Bin writing, including but not limited to situations such as the mortgaged property being restricted from circulation, sealed up, seized, supervised, leased, with lien, and the mortgaged property's unpaid purchase price, repair and maintenance cost, construction project price, state taxes, land-use right transfer fees, damage compensation, etc. or the mortgaged property has established a guarantee for a third party.

8. All materials and information related to the mortgaged property provided by Party A to Party B are true, legal, accurate and complete.

9. Party A's provision of this mortgage guarantee does not harm the legitimate interests of any third party, and does not violate Party A's legal and agreed obligations.

10. If Party A or the debtor fails to comply with laws, regulations or rules related to environmental and social risk management, or may bring harm and related risks to the environment and society (including but not limited to energy consumption, pollution, land, health, safety, resettlement, ecological protection, energy conservation, emission reduction, climate change and other related environmental and social issues), Party B has the right to exercise the guarantee rights under this Contract in advance, and take other relief measures agreed in this Contract or allowed by laws.

Party A (official stamp):

Legal representative (person in charge) or authorized agent (signature):

MM/DD/YY

Party B (official stamp): Hefei Shushan Branch of China Construction Bank Corporation

Person in charge or authorized agent (signature):

MM/DD/YY

EXHIBIT 21

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. (2)	(Xiamen, P.R.C.)
Photronics UK, Ltd.	(United Kingdom)
Photronics Mask Corporation Hefei	(Hefei, P.R.C.)
Photronics Cheonan Co., Ltd.	(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 indirectly by Photronics, Inc. and 49.99% owned by Dai Nippon Printing Co., Ltd.

(2) 50.01% owned indirectly by Photronics, Inc. and 49.99% owned by DNP Asia Pacific Pte. Ltd.

Exhibit 23.1

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 January 14, 2021, relating to the consolidated financial statements and financial statement schedule of Photronics, Inc., and the effectiveness of Photronics, Inc.’s internal control over financial reporting appearing in this Annual Report on Form 10-K of Photronics, Inc. for the year ended October 31, 2020.

/s/ Deloitte & Touche LLP
Hartford, Connecticut
January 14, 2021

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
January 14, 2021

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
Chief Financial Officer
January 14, 2021

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, 2020 (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
January 14, 2021

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, 2020 (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
Chief Financial Officer
January 14, 2021