CFRA

Industry Surveys

Electronic Equipment, Instruments & Components

JULY 2022

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CHARTS & FIGURES

NEW THEMES

What's Changed: Under the Key Industry Drivers section, we added the Global Supply Chain Pressure Index chart, which tracks the state of global supply chains using data from the transportation and manufacturing sectors. Check out page 10.

What's Changed: Silicon carbide has unique properties that make it ideally suited for advanced high-power and high-frequency semiconductor devices. Read more on page 16.

EXECUTIVE SUMMARY

CFRA has a neutral outlook on the Electronic Equipment, Instruments & Components industry. Following the massive recovery in company fundamentals, we think investors should deploy a more selective approach for investment prospects in the industry, favoring companies with best-in-class operating metrics. We touch on themes to watch for in the second half of 2022 below.

Global PMI Remains in Expansion Mode

The Manufacturing Purchasing Manager Index (PMI) printed at 53.0 in June 2022, a 3.1% decline from the 56.1 reading in May. June marked the 25th consecutive month of expansion for the manufacturing economy since the abrupt drawdown from Covid-19 as facilities that were shuttered earlier in 2020 were restored swiftly. New orders led the path down posting 49.2, down ~6% from May alongside employment at 47.3 and backlog of orders down 5.5% to 53.2 in June. We think the June PMI reading has been artificially propped up by inventories and deliveries and is realistically close to contractionary territory if not already there (sub-50 print). This is concerning for overall electronic equipment/instruments demand.

Component Shortages Remain the Key Industry Overhang

Limited availability of components, including capacitors, ceramics, and discrete semiconductors, has constrained the ability to deliver finished products, creating elevated inventories and operating inefficiencies (*i.e.,* higher bill of materials) for many companies. Furthermore, the resurgence of infections and fears around Covid-19 Omicron variants leading to reinforced government closures of production facilities in China has further extended tight supply chain conditions and mute some optimism for expansion, although we believe industry setbacks have mostly been reflected in near-term estimates. We think that orders are strong for electronics in the near term and success could depend on how effectively companies are able to utilize capacity, shift contract structures, and navigate labor/freight costs, while material availability will likely constrain companies from compressing backlogs.

Original Equipment Manufacturers Use Component Distributors to Consolidate Supply Chains

Original Equipment Manufacturers (OEMs) are placing an increased emphasis on transparency and consolidation for their supply chains and, as such, prefer suppliers to work with electronic distributors, such as Avnet (AVT) and Arrow Electronics (ARW). The recent moves in the Global Supply Chain Pressures Index suggest, for now, a stabilization of global supply chain pressures at historically high levels, but off the April peak levels. These supply chain pressures, although down sequentially, remain a headwind for Electronic Manufacturing Service companies. We note a deterioration in cash conversion cycles for some companies like Jabil (JBL) and Flex (FLEX), which are above historical averages due to issues related to inventory build, potentially signaling a pull-forward of revenue.

The Roadmap of Current Valuations

Forward multiples that were extended over historical averages (between 20x and 23x NTM P/E) in 2021 have for the most part been compressed to well below historical trading averages with the five-year average being 18.6x NTM P/E. The S&P 1500 Electronic Equipment, Instruments & Components industry is currently trading at ~14.2x NTM P/E – we note that the Covid-19 2020 low was ~13x. We think that forward earnings estimates for certain names need to be revised down and, as such, believe the current forward valuation on industry is more in line with a slight discount to historical averages, somewhere between 16x-17x forward earnings, which for companies that have the ability to generate economic returns above their weighted average cost of capital (WACC), this slight discount to historical valuations could prove an attractive investment even in an economic downturn. We also appreciate companies that have controlled cash cycle days during more turbulent times, where they could be less susceptible to future cash flow issues or inventory impairments if a slowdown in demand or uptick in supply chain issues persists longer than expected.

ELECTRONIC EQUIPMENT, INSTRUMENTS, & COMPONENTS

Outlook: Neutral

MARKET CAP BREAKDOWN*

(as of July 21, 2022)

RANK NO.	COMPANY NAME	MARKET CAP ($ billion)
1	Amphenol	41.8
2	TE Connectivity	40.3
3	Corning	29.4
4	Keysight Technologies	27.6
5	CDW Corp	23.1
	Others†	161.2

Source: CFRA, S&P Global Market Intelligence.
*Companies included in the S&P 1500 index.
†Refer to the Comparative Company Analysis section of this survey for other companies in the industry.

ETF FOCUS

VGT Vanguard Information Technology	AUM ($B) 40.99	Expense Ratio 0.10
XLK Technology Select Sector SPDR	AUM ($B) 38.33	Expense Ratio 0.12
IYW iShares U.S. Technology	AUM ($B) 6.46	Expense Ratio 0.43
FTEC Fidelity MSCI Information Technology Index	AUM ($B) 5.14	Expense Ratio 0.08
PSCT Invesco S&P SmallCap Information Technology	AUM ($B) 0.37	Expense Ratio 0.29

BY THE NUMBERS

25 months of consecutive expansion of the manufacturing economy; PMI prints 53.0 in June 2022

3x Multiple that some companies in the industry are expected to outgrow GDP in 2022

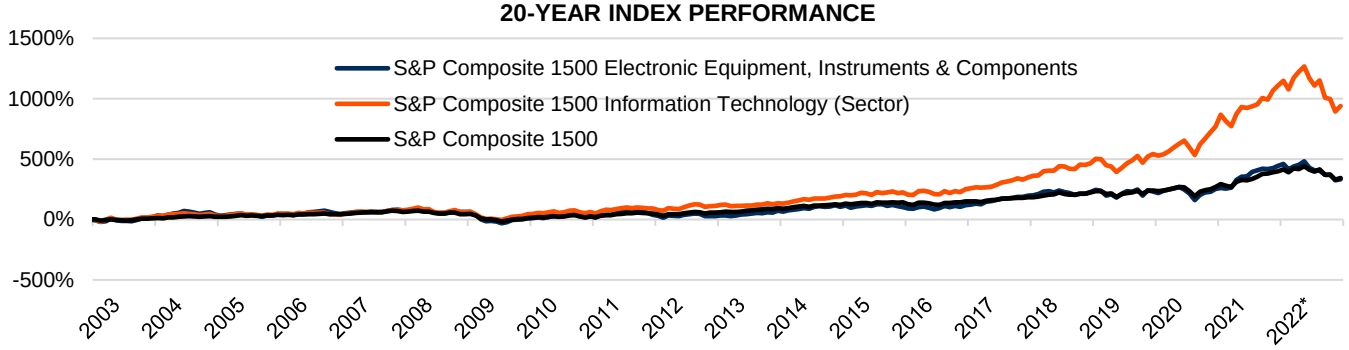
2.41 GSCPI reading in June 2022 – off its high of 4.35 in Dec 2021, eveluated above historical average

14.2x NTM P/E – the average industry valuation, below 5-year average 18.6x, above 2020 low ~13x

$1.07 billion Expected automotive silicon carbide (SiC) power component market in 2022

86% of electronics manufacturers report rising labor costs in 1H 2022 vs 58% of European manufacturers

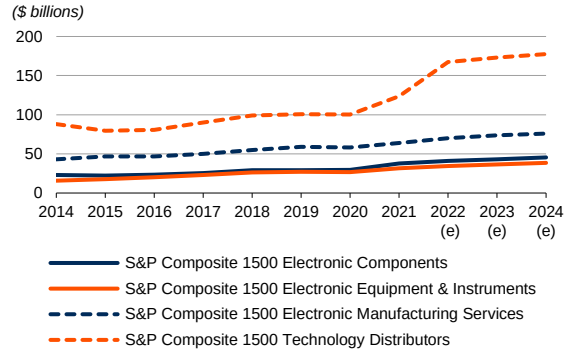
20-YEAR INDEX PERFORMANCE



*Data through July 11, 2022.
Source: CFRA, S&P Global Market Intelligence.

FINANCIAL METRICS

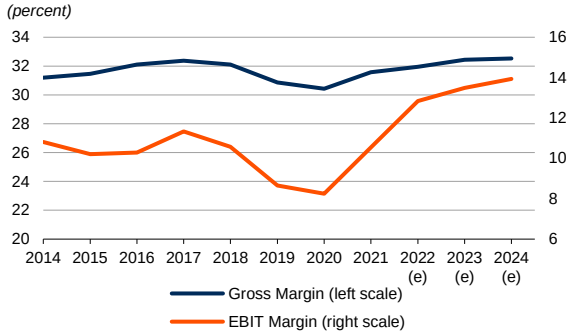
Total Revenue



Source: CFRA, S&P Global Market Intelligence.

- CFRA projects industry revenue to rise 22.1% in 2022 and slow down to 4.2% in 2023, driven primarily by trends in electronic devices, including 5G, Internet of Things (IoT), big data, and artificial intelligence (AI). However, this demand is limited by the ongoing global supply chain constraints, which is expected to persist until the end of 2023.
- CFRA thinks the technology supply chain is still going through a range of problems such as shortages of labor and materials, logistics challenges, nationalistic policies, and ESG factors.

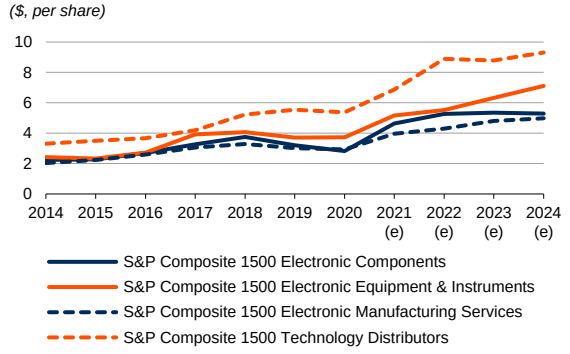
Industry Margins



Source: CFRA, S&P Global Market Intelligence.

- CFRA projects gross margins of 32% in 2022 and 32.4% in 2023 (versus 31.6% in 2021) and EBIT margins of 12.8% in 2022 and 13.5% in 2023 (10.5% in 2021) for the S&P Composite 1500 Electronic Equipment, Instruments & Components (EEQ) index.
- CFRA forecasts margin expansion will be driven by revenue growth and a positive mix shift towards software solutions in 2022 and 2023, mainly due to huge demand in industrial, IT data communications, and broadband markets. CFRA expects many of the EEQ companies to offset higher costs related to supply chain disruptions through aggressive cost controls.

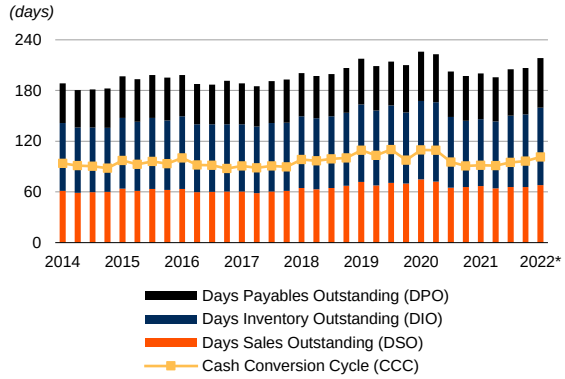
Normalized EPS



Source: CFRA, S&P Global Market Intelligence.

- CFRA projects normalized EPS growth of 38.7% in 2022 and 14.7% in 2022 (versus a 3.5% decline in 2020) for the S&P Composite 1500 Electronic Equipment, Instruments & Components index.
- Our projected EPS growth is in line with our projected rise in both revenue and margins. Longer term, EPS growth may be supported by investments made by superior EEQ companies entering new market segments with higher growth rates and margins.

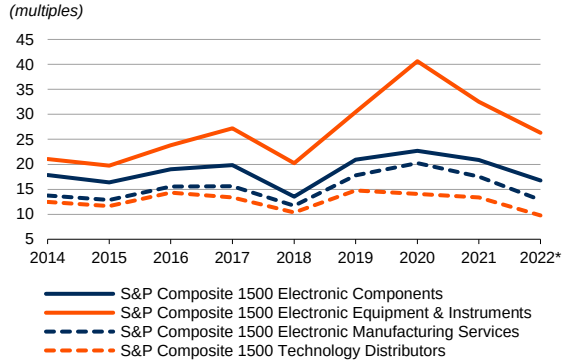
Cash Conversion Cycle (CCC)



*Data through first quarter of 2022.
Source: CFRA, S&P Global Market Intelligence.

- Average CCC for the industry deteriorated to 101.4 days in the first quarter of 2022, versus 91.4 days in the first quarter of 2021, on higher days sales outstanding (up 1.1 days) and days inventory outstanding (up 12.9 days), as well as days payable outstanding (up 4.1 days) due to existing supply chain issues and the lockdowns in China.
- Many companies were still recovering from pre-2020 supply chain issues when Covid-19 sparked additional disruptions. In a worst-case scenario, many EEQ companies could be left holding significant amounts of unused inventory if they are unable to procure critical components to fulfill orders due to the supply chain shortages, which could weigh on future cash flow or lead to future impairments.

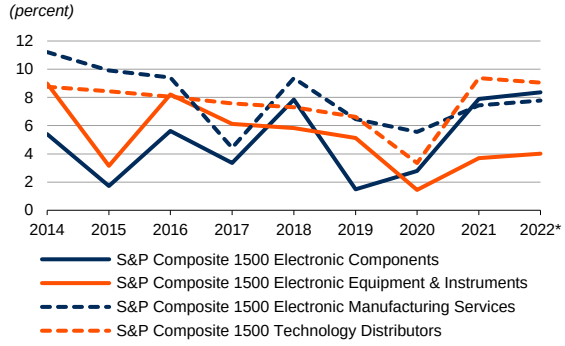
Forward Price-to-Earnings (P/E) Ratio



*Data as of June 30, 2022.
Source: CFRA, S&P Global Market Intelligence.

- Forward P/E for the industry was 17.5x as of June 30, 2022, compared to 23.1x as of June 30, 2021.
- Multiples have come further down since the beginning of 2022 due to the rising interest rate environment, higher inflation level, ongoing pandemic, and Russia-Ukraine crisis. This leaves limited room for further share price outperformance until supply chain woes are resolved, in our view.
- It should be noted that the relatively low P/E multiples of many electronic manufacturing services companies and technology distributors are justified by their thin margins and limited pricing power with customers.

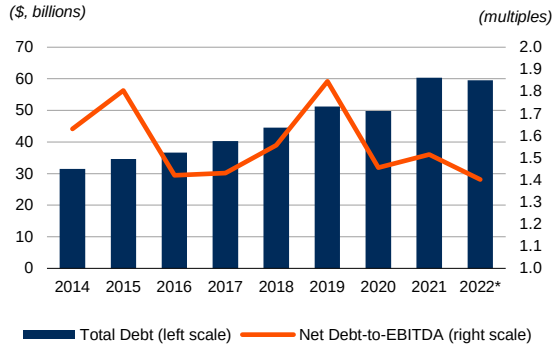
Return on Invested Capital (ROIC)



*Trailing twelve months through first quarter of 2022.
Source: CFRA, S&P Global Market Intelligence.

- Average ROIC for the industry is expected to improve to 6.8% in 2022 from 6.6% in all of 2021. Superior EEQ companies have been able to maintain exceptional ROICs despite material shortages in 2021, given they have already withdrawn from lower-value projects and pruned underperforming business lines, enabling them to pursue more profitable work.
- Exceptional EEQ companies have been able to outperform their weighted average cost of capital (typically 10%) by as much as 10 percentage points for overall ROICs of 20%.

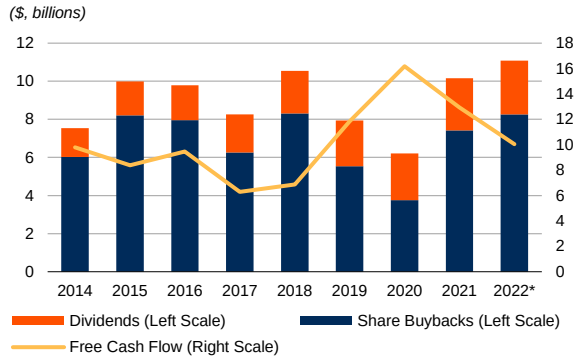
Leverage Profile



*Trailing twelve months through first quarter of 2022.
Source: CFRA, S&P Global Market Intelligence

- The balance sheets of EEQ companies are typically countercyclical: higher demand leads to capacity expansion, which leads to the need to raise debt. Industry debt reduced by 1.3% in the trailing twelve months (TTM) through the first quarter of 2022 compared to the end of 2021, while net debt-to-EBITDA stood at 1.4x.
- As new foundry capacity installation becomes faster than expected, supply constraints will ease and demand will normalize. EEQ companies may be stuck with excess inventory, leading to a cash flow problem and a need to increase borrowing.

Total Shareholders' Return

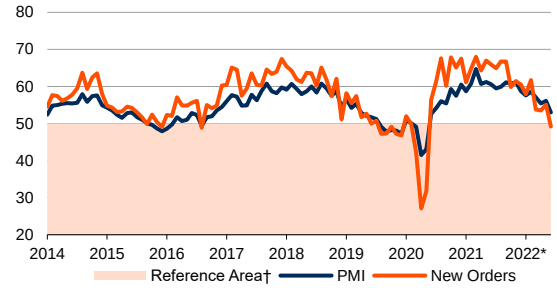


*Trailing twelve months through the first quarter of 2022.
Source: CFRA, S&P Global Market Intelligence.

- Share buybacks for the industry increased 11.4% to $8.3 billion in TTM through the first quarter of 2022 (from $7.4 billion in 2021) as many companies increased their share repurchases as Covid-19-related economic uncertainties eased. Dividends paid eased down to 3.2% to $2.8 billion in the same period.
- Free cash flow fell 22.3% to $10.1 billion in TTM 2022 through the first quarter of 2022 from $12.9 billion in 2021, driven by lower operating cash flows (due to elevated freight expenses and higher procurement costs of resins, capacitors, and connectors) and increased capital expenditures from the previous year.
- Many companies in this industry have balance sheets and cash flow profiles that are counter-cyclical. In contractionary periods, companies can release inventories and boost cash flows. If tight supply chain conditions prevent order fulfillment and depress sales, cash flow generation could be constrained.

KEY INDUSTRY DRIVERS

Global Purchasing Managers' Index (PMI)



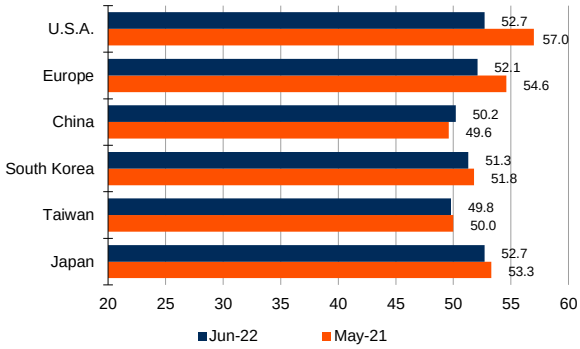
*Data through June 2022.

†All points within the shaded area represents contraction; otherwise expansion.

Source: Institute for Supply Management

- Total production, orders, shipments, and demand for the Electronic Equipment, Instruments & Components industry are highly correlated to manufacturing composites like the PMI.
- Global PMI stood at 53.0 in June 2022, representing the 25th consecutive month the manufacturing economy has been in expansion territory since the peak impact from Covid-19 in April 2020. Purchasing and supply executives have reported that they continue struggling to meet increasing demand.
- At the same time, the new orders index stood at 49.2 in June 2022, down from 55.1 in May 2022, with Petroleum & Coal Products and Computer & Electronic Products sectors having expanded at moderate to strong levels in June.

Regional PMI



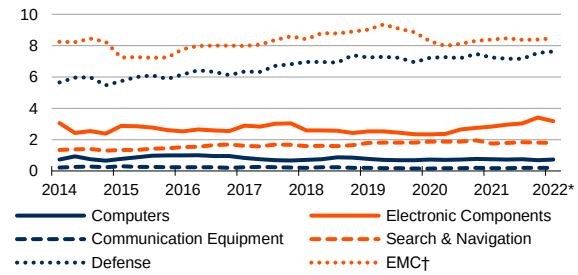
*Above 50 = Growth. Below 50 = Contraction.

Source: Markit Economics.

- Asia-Pacific has not been immune to the supply chain disruptions or lockdowns due to new Covid-19 cases. Taiwan manufacturing PMI in June 2022 showed signs of a slowdown, in part due to weaker customer demand.
- Meanwhile, China's factory activity was weighed down by severe lockdown imposed by Beijing, which in turn impacted Asian countries that depend on materials from China. Soft consumer spending did not help the situation further.

Electronic Equipment Orders per End-Market

($ billions monthly)



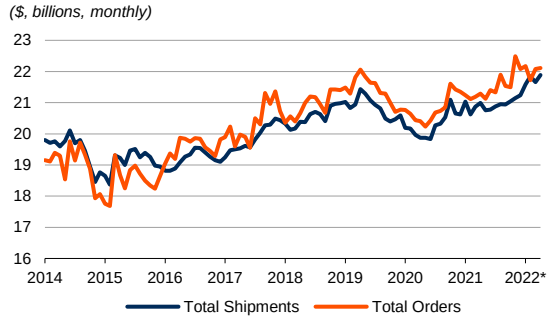
† EMC (Electromedical, Measuring and Control Instrument).

*Data through April 2022.

Source: U.S. Census Bureau.

- In the first quarter of 2022, electronic equipment order patterns were powered by demand for defense (5.2% increase) and EMC (0.9% increase). We note orders for other end-market categories increased in the first quarter 2022, most notably communications equipment and electronic components markets.
- In 2021, total electronic equipment orders increased 3.5% from the prior-year period. We note strong orders for all end-market categories except for computers in 2021, which we suspect could be partly attributed to many large upstream customers (OEMs) double-ordering to circumvent the supply chain constraints.

U.S. Electronic Equipment Orders & Shipments



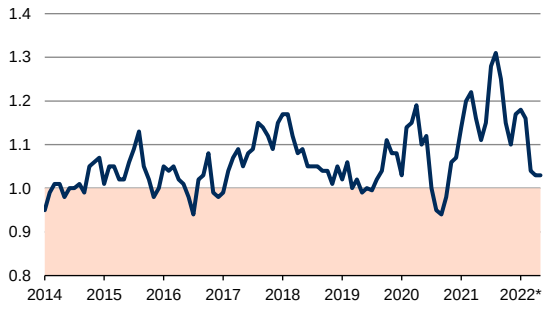
*Data through April 2022.
Source: U.S. Census Bureau.

- Electronic equipment orders and shipments have surged to record highs in April 2022, aided by trends related to connectivity needs for remote healthcare, work-from-home, and data centers.
- Although we expect orders to sustain current levels in the first half of 2022, recent pandemic-related disruptions (*e.g.,* Omicron BA.5 variant) and tight supply chain conditions(surging crude oil prices) reduce the chance for meaningful demand upside in the second half of 2022, in our view.

Global Supply Chain Pressure Index (GSCPI)

- The Global Supply Chain Pressure Index (GSCPI) from the New York Federal Reserve (not an official estimate) tracks the state of global supply chains using data from the transportation (Baltic Dry Index, Harpex Index and BLS airfreight cost indices) and manufacturing (PMI surveys) sectors.
- Global supply chain pressures worsened in April 2022 due to the increase in Chinese “delivery times” component, the increase in airfeight costs from the U.S. to Asia, and the euro “delivery times” component.
- CFRA thinks the increase in delivery times was due to the strict lockdown in the Shanghai port (and cities along the Yangtze River Delta region) for two months and the Russia-Ukraine conflict (severe congestions in North Europe ports according to Maersk’s Asia Pacific market update in June 2022).

North American Printed Circuit Board Book-To-Bill Ratio

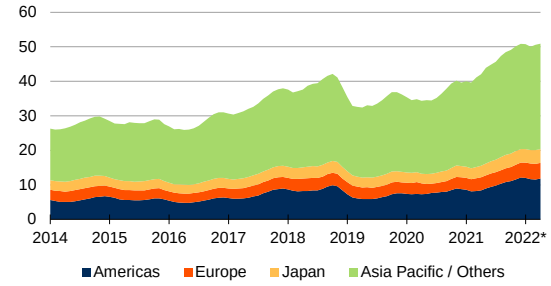


*Data through May.
Source: Association Connecting Electronics Industries (IPC).

- According to Association Connecting Electronics Industries (IPC), North American printed circuit board (PCB) shipments in May 2022 were up 3.4% year-over-year and rose 1.1% from the preceding month. Meanwhile, PCB bookings in May 2022 declined 9.2% year-over-year and fell 10.3% sequentially.
- The PCB book-to-bill ratio stood at 1.03 in May 2022, due to strong demand and signs of normalization. Shipments are picking up and will lead to congestion in North American ports as export volumes to North America in June and July are expected to show a slight uptick with demand strengthening from mid-July into August according to Maersk’s market update (June 2022).

Total Semiconductor Billings

($, billions monthly)

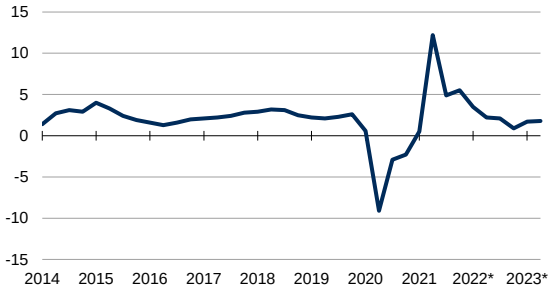


*Data through April 2022.
Source: Semiconductor Industry Association.

- CFRA expects spending at the semiconductor level to drive a large portion of production trends in the electronic equipment & instruments sub-industry as overall capital intensity levels remain correlated to revenues.
- We forecast semiconductor sales growth of 9% in 2022 and 5%-7% growth for 2023, driven by continued strong investments in cloud/enterprise and the transition of smartphones to 5G capabilities.
- Semiconductor equipment demand remains robust despite supply chain uncertainties and new regulatory constraints. CFRA notes that global semiconductor equipment billings in the first quarter of 2022 rose 5% year-over-year to $24.7 billion, according to SEMI. This was mainly driven by accelerated fab capacity expansion to address the global chip shortage.

U.S. Real GDP Growth

(percent change, Y/Y)



*Actual data through Q1 2022. Projected data by Action Economics.
Source: Bureau of Economic Analysis, Action Economics.

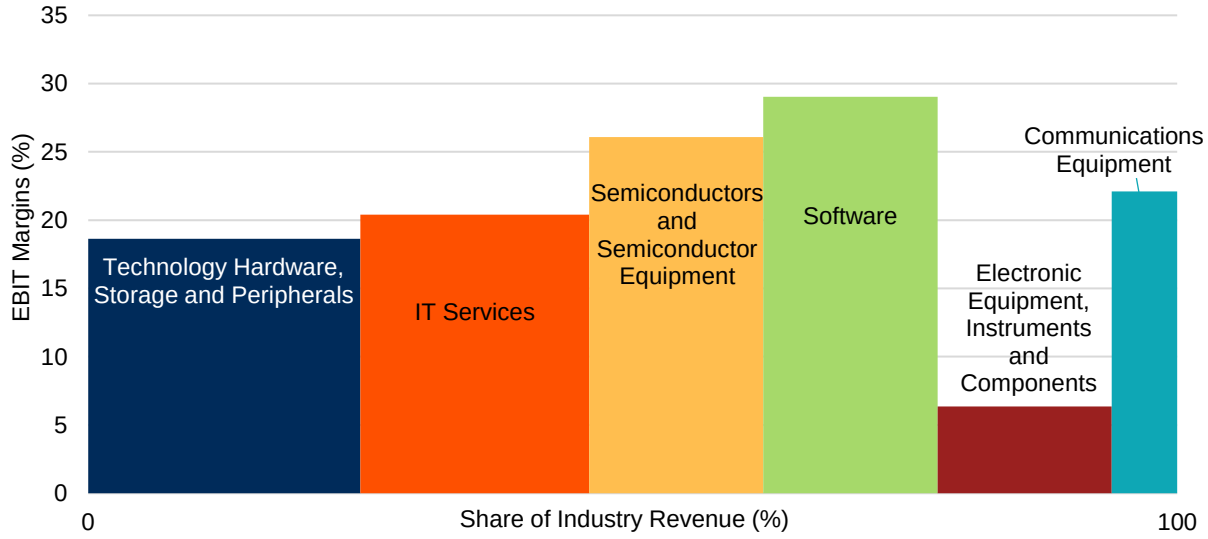
- U.S. GDP grew 3.5% year-over-year in the first quarter of 2022, an improvement from a 0.5% year-over-year growth in the first quarter of 2021. Action Economics revised their projections of annual GDP to 2.2% in 2022. CFRA expects 2022 to be a challenging year due to soaring inflation, new rate-tightening cycle, Russia-Ukraine conflict, ongoing supply chain disruption, and a possible recession.
- Many companies use GDP to gauge company-specific performance (*e.g.,* IT Distributors). Exceptional distributors have revenue growth that has continually outpaced GDP by as much as 3x.

INDUSTRY TRENDS

Profit Pools

Within the Information Technology sector, the Electronic Equipment, Instruments & Components industry is ranked third in terms of industry revenue but ranked near the bottom in terms of EBIT margin during the 12-month period between March 31, 2021, and March 31, 2022. However, CFRA notes that margins could remain pressured for the rest of 2022 and potentially into 2023 due to rising raw material costs, elevated freight expenses, and supply chain disruptions.

PROFIT SHARE MAP OF INFORMATION TECHNOLOGY SECTOR
(Trailing twelve months through the first quarter of 2022)

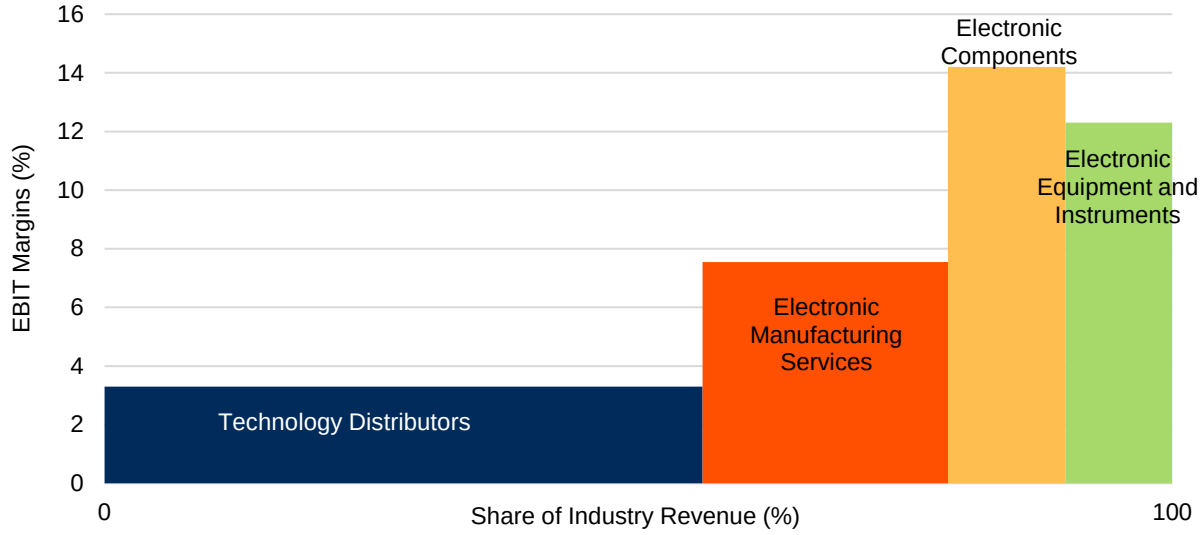


*Companies within the S&P Composite 1500 Index as of July 4, 2022.
Source: CFRA, Company Reports.

Although they are not easily referenced by name, you have likely interacted with the finished electronic products that companies in this industry manufacture large quantities of before your first cup of coffee in the morning. The Electronic Equipment, Instruments & Components industry encompasses four sub-industries: electronic components, electronic manufacturing services (EMS), electronic equipment and instruments, and technology distributors. These sub-industries take up middle-market positions in the supply chain, playing an important role in the designing, manufacturing, and distribution of finished electronic products to end markets. Please refer to the *How the Industry Operates* section of this industry survey for a comprehensive discussion of how the sub-industries operate.

Among the four sub-industries, we note that the technology distributors sub-industry generates the most revenue but has the lowest operating margin profile at 3.3%, while the other three sub-industries have operating margins around 7% to 15%. On the other end of the spectrum, electronic components comprises the second-smallest level of revenue share but has the highest profitability across all sub-industries. For reference, our profit pool analysis is based only on constituents of the S&P Composite 1500 index and uses an equal-weighted approach to all constituents.

PROFIT SHARE MAP OF ELECTRONIC EQUIPMENT, INSTRUMENTS AND COMPONENTS INDUSTRY*
(Trailing twelve months through the first quarter of 2022)



*Companies within the S&P Composite 1500 Index as of July 4, 2022.
Source: CFRA, Company Reports.

Operating Environment

Global PMI in Expansionary Territory for 25th Straight Month in June 2022
As of June 2022, the Global Purchasing Manager Index (PMI) stood at 53.0, representing the 25th consecutive month the manufacturing economy has been in expansion territory, first recovering in June 2020 with a reading of 52.6 from a nadir of 41.5 in April 2020. The Manufacturing Business Survey Committee panelists – a composition of purchasing and supply executives – reported that their companies improved their process on dealing with moderate-term labor shortages at all tiers of the supply chain. May was the third straight month of slight easing of price expansion, but volatility in global energy markets continues. From CFRA's view, despite the PMI coming in at 53.0 for June 2022, this figure seems to be overstated by inventories and deliveries, and is realistically close to contractionary territory if not already there (sub-50 print). New orders and employment came in at 49.2 and 47.3 for June 2022, down 5.9% and 2.3% from May respectively. Additionally, backlog of orders were down 5.5% to 53.2 in June 2022. This is concerning for overall electronic equipment and instruments demand.

According to the Institute for Supply Management (ISM), all segments of the manufacturing economy are still affected by price elevation and extended lead times resulting in a continued slowing in new order rates across the supply chain. Key issues continuing to limit the growth potential of manufacturing are due to labor force constraints, though with more signs of improvement, according to the ISM. Panelists in the computer & electronic products industry noted that backlogs expanded in May at a quicker rate, as output remains constrained and new orders continue at moderate levels.

We expect the PMI to remain in expansionary territory for the rest of 2022. We think investors should focus on forward indicators like lead times and order cancellations in companies' upcoming earnings reports to better gauge industry and company-specific health.

Asia-Pacific has not been immune to supply chain disruptions. South Korean and Japanese manufacturers reported softer improvements in operating conditions in June 2022. However, material supply shortages and rising costs were cited for the slower rise in production levels. Nonetheless,

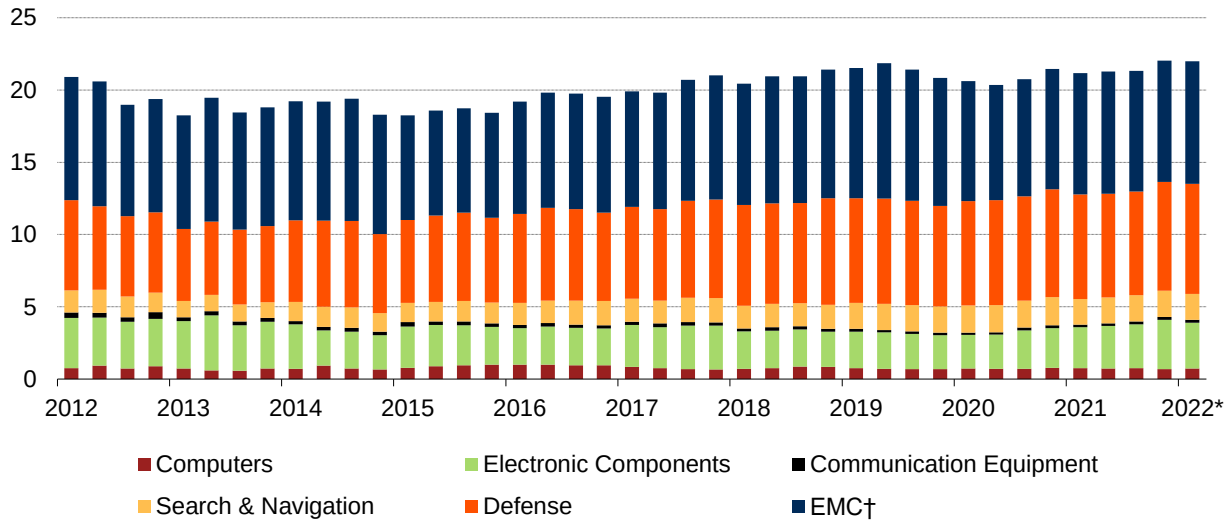
Japanese manufacturers continued to increase holdings of raw materials to boost safety stocks if faced with potential lockdowns but were hindered by delivery delays, material shortages, and higher prices.

Meanwhile, China's factory activity rose from the three months of decline in June 2022 as the government lifted stringent lockdowns in Shanghai. Although growth in production and new orders increased, headwinds remained due to the slump in the property market, weak consumer spending, and concern for further lockdowns due to the pandemic.

CFRA continues to see frozen and deferred orders and double bookings as well as extended product lead times for component manufacturers. In our view, the upshot is that because customers are not canceling orders, they are implying manageable levels of inventory, which could extend demand growth (albeit at moderate levels compared to 2018) for the rest of 2022. These developments have been largely burdened by the escalation of the U.S.-China tariff trade war, which resulted in higher costs across the industry supply chain and was exacerbated by pandemic-related disruptions and shutdowns.

We observe that the moderating growth in wireless handsets has been largely offset by advancing trends in the automotive, wearables, and connected home segments. Sensor and connector demand for testing applications has been a tailwind for larger electronic manufacturing services (EMS) companies, and passive component suppliers and distributors have also benefited.

U.S. ELECTRONIC PRODUCTION BY VERTICAL
(in $ billions quarterly)



† EMC (Electromedical, Measuring and Control Instrument).
*Data through April.
Source: U.S. Census Bureau.

While new products continue to drive this capital-intensive industry, short product lifespans and cyclicality tend to accelerate pronounced corrections during economic downturns, which constrains overall growth at the industry and company level.

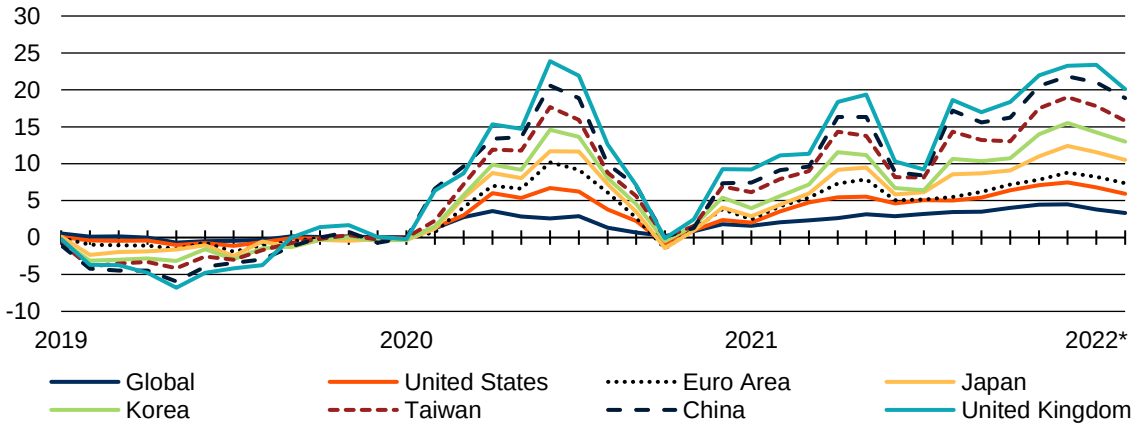
More recently, companies have tried to minimize cyclicality by diversifying their revenue mix (i.e., no isolated customer accounting for large amounts of revenue) and enhancing customer relationships by providing a more comprehensive suite of products and/or services. Companies are also implementing portfolio pruning and cost takeouts to deal with the devastation of Covid-19.

Component Constraints Continue, Which Hurts Deliveries, Revenue, and Margins

Electronic components, particularly capacitors, resistors, and discrete semiconductors, have – for years – been increasingly difficult to procure due to elevated demand levels from trends in the automotive, mobile, and Internet of Things (IoT) segments. As a result, many suppliers quote extended lead times due to manufacturing capacity constraints and having to place customers on product allocations.

LOCAL SUPPLY CHAIN PRESSURE INDICES

(Standard deviations from average value)



Source: Federal Reserve Bank of New York Liberty Street Economics.

Meanwhile, the ongoing Omicron wave further worsens the situation. During the depths of the pandemic, at a time when end-market (*e.g.,* auto) supplier inventories are still recovering from pandemic-related factory shutdowns and component shortages, surging freight costs combined with higher fuel prices have contributed to an already fatigued supply chain.

Because of this, end markets panicked and attempted to procure any available inventory in order to replenish from past shortages and build sufficient inventory levels for future demand. Combined with raw material shortages from past disruptions and surging logistics costs, these factors have brewed a perfect storm for a severe component shortage.

When electronic equipment, instruments, and components companies are unable to procure these critical components required to fulfill customer orders, they are forced to turn down orders or delay deliveries, losing out on incremental revenue growth. One example of this is Itron Disclosing in the first quarter 2022 earnings call that it missed out on revenue of over $100 million due to component constraints, impacting their networked solutions segment, and they expect to continue to battle supply constraints through 2022.

This failure to deliver orders has weighed on sales growth, margins, and cash flow. If the situation becomes a worst-case scenario – which is end markets double-ordering to stockpile for future needs, leading to a sharp decline in future demand – electronic equipment, instruments, and components companies will get stuck with excess inventory, which will cannibalize margins and cash flow, leading to impairments. The worst-case conditions will be accelerated if new capacity is put in place faster than expected, meeting demand from the double-ordering, and smoothing out supply shortages.

We think investors should keep an eye on electronic equipment, instruments, and components companies' cash conversion cycles, particularly their days inventory outstanding (DIO). A significant rise in DIO will pressure cash flows, similar to past stretches of tight supply-chain conditions. We would not be too concerned with a slight increase in DIO, however, as some companies have made investments in inventory to support customers in this tight supply environment. That said, certain companies with

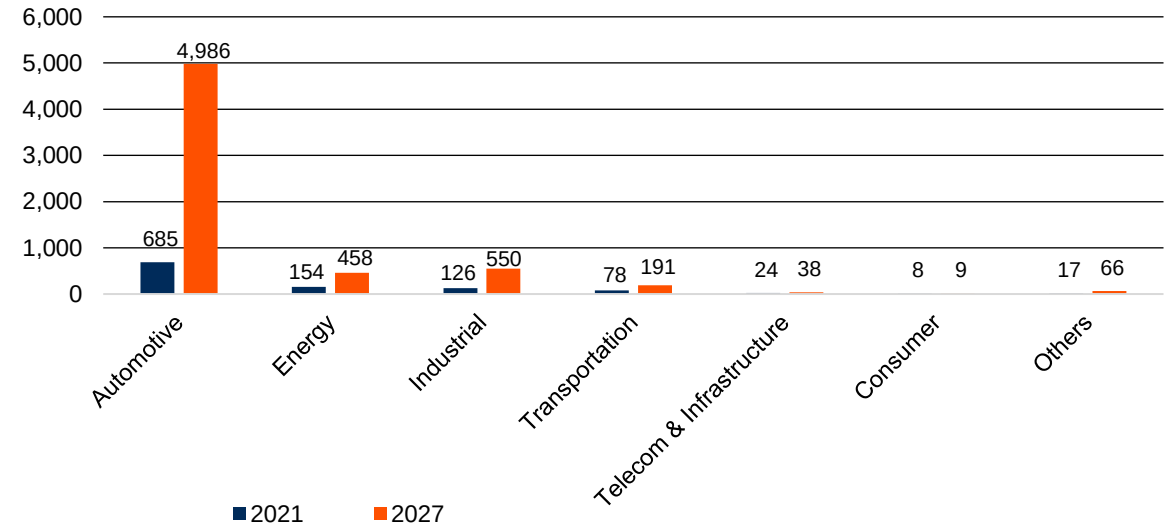
factories and operations dispersed across different locations globally may be able to bypass the constraints and meet orders. Investors should also focus on economic return metrics such as return on invested capital (ROIC). Superior electronic equipment, instruments, and components companies have previously done the heavy lifting to obtain high-quality work, which can be seen in ROICs in excess of 500 basis points over their cost of capitals. However, the fact remains that most companies in the industry still operate lower-quality business models with razor-thin margins and are heavily reliant on upstream suppliers and end markets for future orders.

Silicon Carbide (SiC) to Power Electric Vehicles

Silicon carbide (SiC) is a semiconductor base material that consists of pure silicon and pure carbon. The unique electronics and thermal properties of SiC make it ideally suited for advanced high-power and high-frequency semiconductor devices that operate well beyond the capabilities of either silicon or gallium arsenide devices, according to II-VI. Higher power density, reduced switching losses, increased bandwith capability, and better heat dissipation are some of the key advantages of SiC-based technology. SiC is considered to be environmentally friendly as SiC technology includes switching power supplies, industrial motor drives, inverters for solar and windmill energy generation, HEV and EV vehicles, and smart-grid power switching.

POWER SiC MARKET DEVICES BY SEGMENT

($ millions)



Source: Power SiC 2022 report, Yole Developpement (2022).

Automotive Market Pinned Under Omicron, as Secular Growth Trends Remain a Bright Spot

Geopolitical tensions and just-in-time manufacturing practices contributed to the semi shortage. Due to geopolitical concerns, certain consumer electronics companies have significantly stockpiled their chip inventories to get through a period of limited access to semiconductors. McKinsey & Co. estimates that such stockpiling increased semiconductor demand by 5% to 10% in the wireless space – equivalent to one-third of the auto market chip sales. Just-in-time manufacturing is widely adopted in the industry as it results in cost savings and increased efficiency in normal times, but during unexpected shocks such as the ongoing semi shortage, the practice could cause an immediate disruption of the entire supply chain.

Unfortunately, surging Covid-19 cases and semiconductor shortage themes are expected to haunt car manufacturers for the third year running in 2022 as relief for this industry is believed to ease in the first

half of 2023. General Motors, Volkswagen, and Toyota cited a drop in sales during the second quarter of 2022 due to the semiconductor shortage.

The shift from Level 1/Level 2 vehicles to Level 3/Level 4 offers a major inflection in terms of content growth (see definitions for ADAS Levels in the table below). CFRA notes that content per vehicle of $100-$150 at Level 1 and 2 jumps to $600 at Level 3 and $900 at Level 4. Complete autonomous cars (Level 5) will command an average silicon content increase of $1,200 compared to vehicles with no automation. The inflection at Level 3 and above vehicles largely represents the greater need for sensors related to radar, cameras, LiDAR, and V2X (vehicle-to-everything).

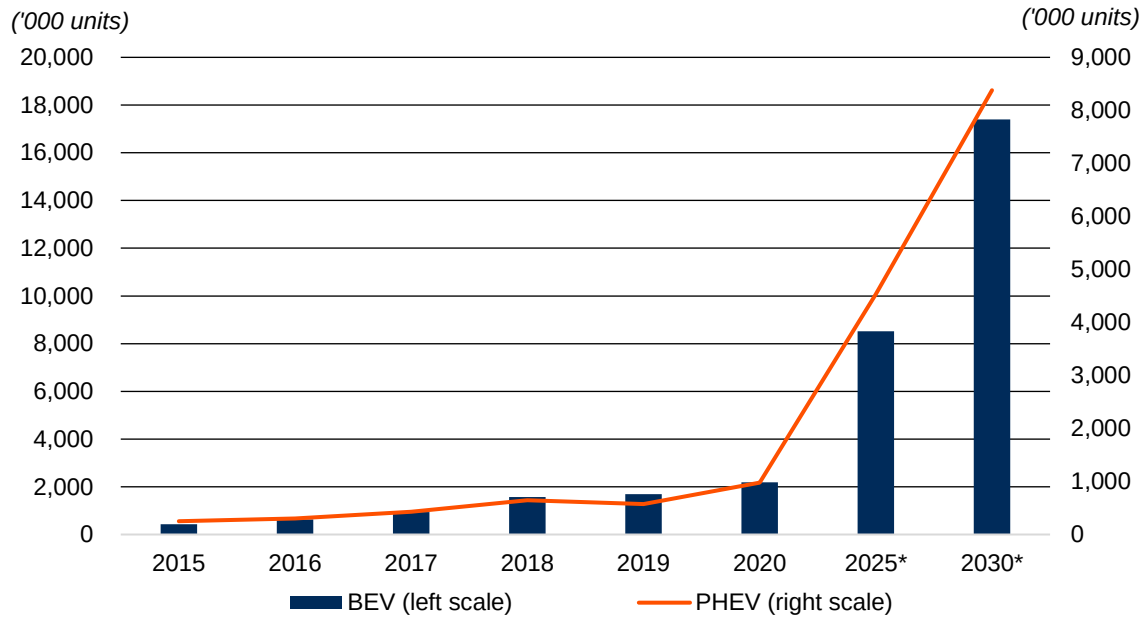
ADVANCED DRIVER ASSIST SYSTEMS SAE LEVEL DEFINITIONS AND POTENTIAL CONTENT GROWTH

Level	Description	Human Role	Vehicle Role	$ Content Increase
0	None	All driver control	No autonomous functions	No Automation
1	Limited + Safety	Almost all driver control	ABS, traction control	+$100
2	Limited , Active Safety, Convenience	Mostly driver control	Lane keeping, emergency braking, adaptive cruise control, parking assist	+$150
3	Significant Autonomy	Driver can disengage completely at times	Advanced controls in simple conditions (highway, slow-moving traffic, good weather)	+$600
4	High Autonomy	Driver not needed in some locations or conditions	Full conditional autonomous capabilities, more difficult conditions/locations not autonomous	+$900
5	Complete Autonomy	No driver needed	Autonomous driving in all locations/conditions possible, driver controls (brakes, steering wheel) not necessary	+$1,200

Source: CFRA, LMC Automotive, NXPI

The International Energy Agency (IEA) predicts that electric vehicles (EVs) are to be a more common sight on the world's roads in the 2020s as many countries are setting targets to phase out sales of internal combustion engine (ICE) cars along with several car manufacturers. The U.S. government announced in November 2021 an ambitious 50% electrification target for new cars by 2030. The EU Commission in Europe proposed to bring the CO_2 emission standard for new cars to zero by 2035. Volkswagen and Ford expect 40% to 50% of their sales to be electric by 2030. Since EVs require around twice as many chips as ICE cars, due to additional power electronic components, progress toward EVs will gradually revolutionize the automotive landscape and drive significant growth for the Electronic Equipment, Instruments & Components industry, in CFRA's view.

GLOBAL ELECTRIC VEHICLES (EV) SALES OUTLOOK



*forecasts
Source: International Energy Agency (IEA).
Notes: BEVs are battery electric vehicles. PHEVs are plug-in hybrid electric vehicles. EVs refer to all electric vehicles (BEVs + PHEVs) including cars, buses, trucks, vans.

Select companies are gradually expanding to interconnect products for next-generation automobiles, including hybrid, electric, and autonomous cars. In our view, while eco-friendly vehicles and infotainment will require significant R&D expenses, innovative connectors and cables that meet the expectations of end markets can augment growth, going forward, for industry leaders.

Connector and Sensor Markets Remain Imperative

TE Connectivity (TEL) and Amphenol (APH) are among the largest firms in the connector and sensor market. CFRA expects revenue growth from 5% to 7% in financial year 2022 and financial year 2023 for both TEL and APH. As global supply chain issues persist, both TEL and APH experienced tempered demand in the third quarter of 2021. However, CFRA believes that end-market diversity is strong, as interconnect products and assemblies are used in automotive, energy, broadband, commercial, industrial, military, and mobile devices. Virtually every electronic component that carries a connection or contains a sensor has exposure to this industry. Everything – from antennas that connect homes in the IoT segment to sensors that put infotainment-enabled cars in motion – benefits from the innovation of these products.

Per TEL, internal combustion engines (or ICEs) still dominate the overall composition of global automobiles, with around 96% of current production. However, the confluence of both government and consumer factors is likely to drive a ~40% CAGR for EVs through 2025. We think that increases in average selling prices (ASPs) will likely follow suit, as TEL estimates EV content value more than triples ICE component counterparts ($200 vs. $60).

Sensors remain another key lever to supercharging content per vehicle growth, in CFRA's view. In total, there are about 30-40 sensors in aggregate on the physical layer of newer cars, worth approximately $400 in content. This does not include ADAS or full autonomous sensing via lidar and/or radar. While lower-margin content like sensors could seem unappealing from a profit and/or margin perspective, some

of these wins are a result of brand new business, derived from perpetual complexity in autos. As such, small amounts of additional share can go a long way (*e.g.,* new content multiplied by auto production).

The connectivity platform also touches on newer trends that could provide tailwinds for content providers, in our view. Through these advances (*e.g.,* over-the-air updates via integrated software, shared mobility, infotainment, and telematics), we think emerging applications regarding vehicle-to-everything (V2X) communication could be further implemented in autos to address traffic congestion and accident avoidance, and they could provide another attractive market opportunity for content providers.

Industrial Segment Bridging the Digital and Physical Worlds

The industrial segment, a diverse market, covers a wide breadth of categories for companies in the electric components sub-industry, including industrial controls, robotics, aerospace and defense, industrial communication, and power distribution. Medical companies also integrate products from this market into diagnostic, therapeutic, surgical, and interventional applications. Elevators/escalators, security, light rails, and trains also use products from this market.

On June 15, 2022, Trimble announced the implementation of its map-based localization system for land-based autonomous vehicle applications. IHI Corporation (a heavy industry manufacturer based in Japan) will retrofit its existing container and haulage trucks with a customized Applanix POS LV® system as part of its broader autonomy capabilities for the shipment of goods around industrial facilities. Map-based localization provides precise positioning and orientation estimation, augmenting GNSS/inertial data, which is vital for safe and efficient autonomous vehicle operations. With this system in place, IHI Corporation can deliver robust positioning for their autonomous fleet without additional site infrastructure, lowering capital expenditure costs and improving scalability.

Due to the industrial segment's diverse product market and low customer concentration, sales in this segment are highly correlated to global GDP growth, which Action Economics forecasts at 2.2% in 2022. While the majority of companies in this segment fall under the electronic manufacturing services and electronic components sub-industries, some companies in the electronic equipment and instruments industry (*e.g.,* FLIR Systems acquired by Teledyne Technologies) cater to government defense markets, which are influenced less by actual GDP growth and more by social and political factors.

Construction and agriculture applications had shown solid growth trends, but Covid-19 caused a significant slowdown in construction activity. Recent data on workers' hours analyzed by construction technology firm Procore, however, indicates that construction activity is returning to pre-virus levels in 34 U.S. states. A recovery would be good news, as a recent survey by the Associated General Contractors of America showed the pandemic's devastation on the construction industry, with 61% of firms reporting having had at least one project halted or canceled due to the pandemic and one in four firms reporting that construction materials shortages are causing delays on current projects.

Any support for infrastructure spending by the U.S. government could be a shot in the arm for this industry, though we think it will likely benefit only select companies. Corning views the government spending plans related to broadband infrastructure as a multibillion-dollar opportunity for its Optical Communications business line. Meanwhile, Ouster – a company that builds high-resolution 3D lidar sensors – is optimistic about the plan's effect of accelerating the modernization of bridges, highways, roads, etc., as its digital lidar offerings could augment or replace CCTV cameras or radar systems in use today. Badger Meter – a leading manufacturer of metering products – thinks the Biden administration's goal to upgrade and modernize America's drinking water, wastewater, and stormwater systems could accelerate or add to underlying secular drivers for its digital water solutions.

On November 15, 2021, President Biden signed the Infrastructure Investment and Jobs Act, which will cost $1.2 trillion over eight years, with $550 billion in new spending. Some spending on child and elder

care, as well as education, was also cut from Biden's original plan, and the corporate tax rate increase to fund the plan originally proposed will not be included in the new plan. However, the plan is still some ways from becoming law as there remains some dissatisfaction from certain parties. Check out CFRA's "Infrastructure" Industry Survey for more information.

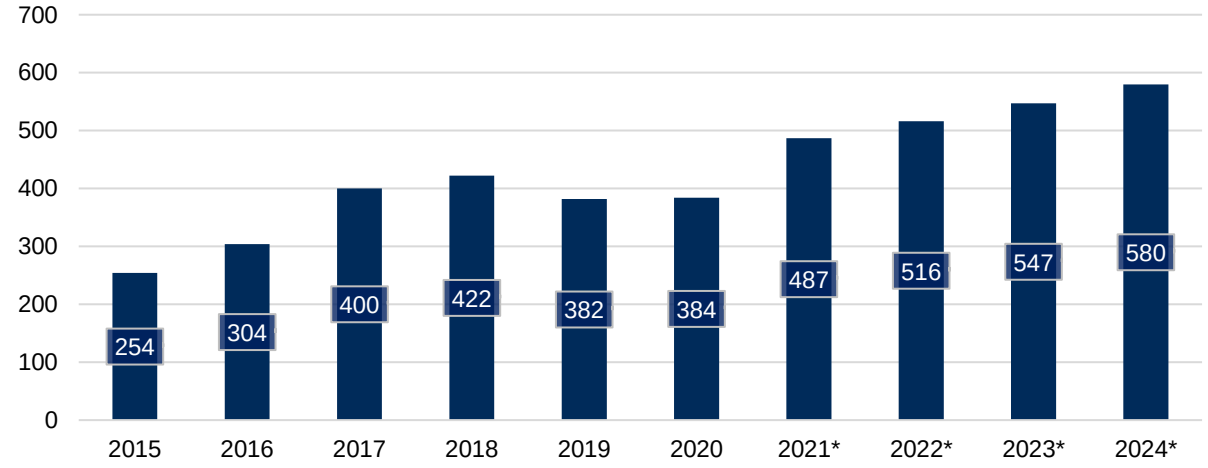
Meanwhile, Research and Markets expects the global precision agriculture market to reach $43.4 billion by 2025, while Allied Market Research estimates the market for visualization and 3D rendering software – a process of generating an image based on three-dimensional data – will reach $8.0 billion by 2027 from $1.5 billion in 2019 (latest available), growing at a 23.1% CAGR.

Leveraging Economies of Scale with Automation and Robotics

Burgeoning labor costs, a shrinking workforce due to retiring baby boomers, and government policies to deter the offshoring of jobs to lower-cost countries have all been underlying catalysts for the implementation of more automation across factories, in CFRA's view. In October 2021, the International Federation of Robotics (IFR) estimated that robot installations in 2021 grew at the rate of 27% year-o**ver**-year at 486,700 industrial robots. This high double-digit growth represents a strong recovery of the international robotics markets. Despite IFR's optimism on robotics trend for 2022 and beyond, CFRA views it as quite difficult to achieve later year growth estimates given potential for prolonged recession in 2023. **On top of that**, CFRA **observes**, there **are** growing instances of inventory build ups in the **robotics/industrial automation** space which could pressure margins in the future.

ANNUAL INSTALLATIONS OF INDUSTRIAL ROBOTS

('000 of units)



Forecast data. 2021 data is based on preliminary findings.
Source: CFRA, International Federation of Robotics (IFR).

In what seems to be a perpetual state of evolution, corporations continue to leverage automation to retain competitiveness and create end-to-end seamless intelligence in machines. CFRA thinks this will eventually set the stage for new technological advancements, such as Cyber-Physical Systems, or structures that utilize algorithms and connectivity to integrate levels of manufacturing from sensors to equipment. Companies such as Flex and Zebra Technologies continue to push boundaries by driving efficiencies in supply chain manufacturing as well as warehouse automation and tracking.

Globally, Covid-19 has brought change to our "normal" and brought together a "new normal", but also offers a chance for modernization and digitalization of production on the way to recovery. The range of industrial robots continues to expand – from traditional caged robots capable of handling all payloads

quickly and precisely to new collaborative robots that work safely alongside humans, fully integrated into workbenches. In the long run, the benefits of increasing robot installations remain the same: rapid production and delivery of customized products at competitive prices. Automation also enables manufacturers to keep production in developed economies – or reshore it – without sacrificing cost efficiency.

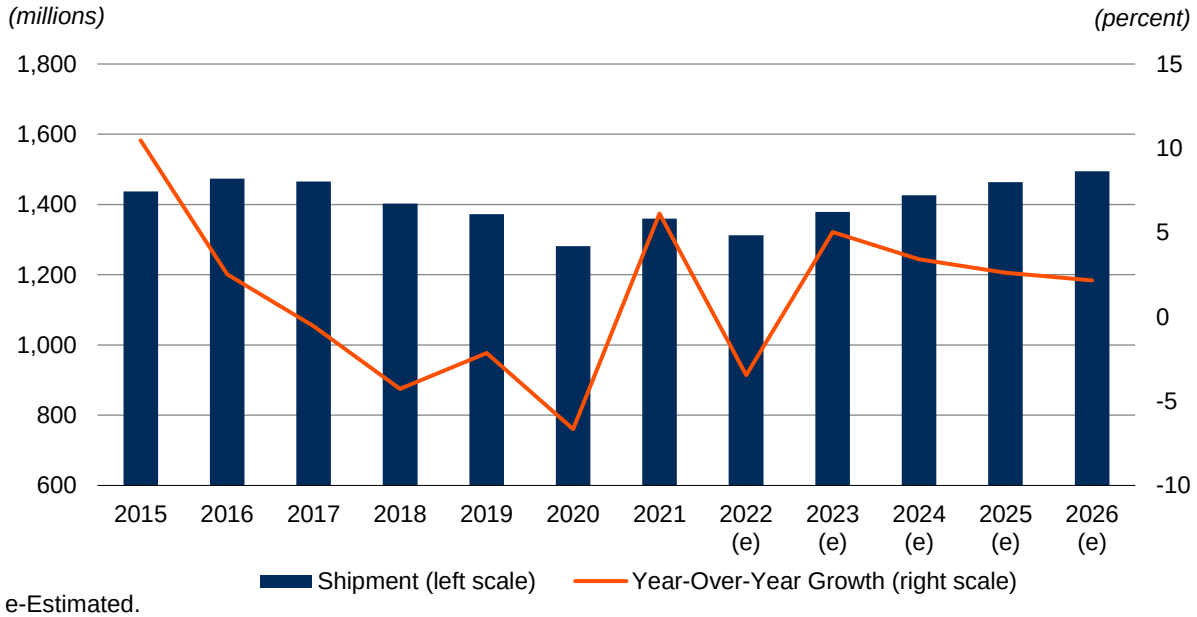
Demand for Consumer Devices Set to Improve as China Reopens, Only Partially Offsetting Softening Demand for Consumer Devices

China's economic reopening will provide some relief for smartphone and PC vendors while also improving the supply side of the equation. While the smartphone and PC markets are mature industries and lack significant growth prospects, they have been headwinds for the hardware and semiconductor industries in recent months, with most of the downward pressure seen in China. Importantly, we would highlight that smartphones and PCs combine for about 40% of total semiconductor sales, with demand needing to at least be stable in order to prevent an inventory overhang from taking place in 2023.

Acceleration towards integration of digital technology globally drove demand for consumer devices at unprecedented levels these past two years. The global traditional PC market grew an astonishing 15% in 2021, the highest growth in a decade, driven by the effects of remote work and distance learning, according to IDC. IDC expects the worldwide PC market to contract in 2022, decreasing to 8.2%, as purchases are expected to normalize to pre-pandemic levels. Check out CFRA's "Technology Hardware, Storage & Peripherals" Industry Survey for more information.

Meanwhile, IDC sees the tablet market declining by 6.2% in 2022 as the market is expected to be squeezed further by rising inflation and higher costs. As the tablet market is consumer-centric, increased economic headwinds are causing the market to further stall, according to IDC. A growing millennial and Gen-Z workforce will be essential to continued growth of the detachables (typically a fully-featured tablet that is connected to a docking device to provide users with a full keyboard; for example, the Microsoft Surface) market, which offers mobility and flexibility in the workplace. Supporting tablet demand is its growing use in the commercial space.

WORLDWIDE SMARTPHONE FORECAST



e-Estimated.

Source: IDC, June 2022.

For 2022, IDC forecasts worldwide smartphone shipments to decline 3.5% to 1.36 billion units. Unsurprisingly, the total shipments of all three devices (PCs, tablets, and smartphones) will be dictated by supply instead of demand due to the current immense pressure on supply chains, which has led to significant backlogs.

For the global wearables market, IDC is forecasting a 17.4% growth in 2022, driven by a combination of incumbents and new vendors gaining market share at the expense of other vendors leaving the market, emerging products gaining salience, and strong demand for hearables (a.k.a. earwear) and smartwatches. IDC predicts a 7.9% CAGR for the wearables market shipments between 2022 and 2026, with smart wearables expected to grow at a higher rate of 12.7%, compared to the 7.0% for basic wearables during the same period. By wearables product type, IDC forecasts that modular will have the fastest growth, posting a 26.9% CAGR between 2022 and 2026, followed by clothing, with an expected 11.3% CAGR during that period.

Meanwhile, the IoT trend continues to play an ever-increasing role in everyday activities, including work, personal communication, education, and home management. Seamless connectivity is a demand trend CFRA expects will continue in the long term. IDC estimates IoT spending will increase at an 11.4% CAGR from 2022 to 2025. Asia-Pacific is expected to capture the largest portion of the spending (about 44.6%), followed by the Americas and EMEA (about 28.7% and 26.6 respectively).

Is 5G Technology Actually Driving Growth for Networking Solutions?

The network solutions segment provides electronic components used in broadband equipment, wireless infrastructure, data center equipment, and mobile networks and devices. We think that 5G will be essential in driving growth for EMS/original design manufacturers (ODM) with networking and communications segments.

5G technology is key for the success of other emerging technologies across different industries, such as smart cities and autonomous driving. 5G networks could usher in smart city solutions by enabling seamless connection across various components (*e.g.,* cameras, cars, homes, etc.) within a city while tackling major concerns in many urban locations like increases in energy consumption, crime, and traffic congestion. 5G could also unlock quicker ways of harvesting and processing data, improving the effectiveness of autonomous cars.

Consumer adoption of 5G has not been dependent on the innate appeal of the technology itself. Many consumers will become 5G subscribers not as an intentional purchasing decision, but rather as a byproduct of their normal smartphone upgrade cycle. 5G is rapidly becoming the standard in an increasing number of smartphones across all price points. According to IDC, by 2025, 98% of smartphone shipments will be 5G enabled and 5G services should be a standard offering on the majority of wireless service plans. Though the smartphone upgrade cycle is now approaching three years for many customers – due to the high price of new devices and lack of new features between generations – we believe there is a fair amount of pent-up demand caused by Covid-19-related restrictions that may spur an acceleration of upgrades in the near term. According to IDC, 5G connections in the U.S. will expand at an 86.3% CAGR between 2021 and 2025, from 54 million to 245.2 million. The main issue currently facing service providers when trying to convince customers to upgrade to 5G is that the majority of smartphone applications are neither bandwidth nor latency sensitive and there has yet to emerge 5G-specific applications that leverage the technologies key features.

Consumers' unwillingness to pay extra for 5G has been a hurdle to 5G monetization. Given consumer adoption of 5G has been more a function of the device upgrade cycle rather than an interest in the underlying technology, it isn't surprising that most consumers are unwilling to pay extra for 5G. Even as the cost for 5G devices come down, providing buyers a tangible use for all that speed and, eventually, low latency is critical for accelerating the adoption of 5G. The first step towards new use cases enabled by 5G

will be achieved through the development of new software and apps that provide a differentiated user experience on a 5G-enabled smartphone. These new apps will enable service providers to charge more for 5G enabled plans, but also differentiate their networks once deployments reach critical mass. We view the augmented reality and virtual reality spaces as an attractive area that could be very attractive to consumers.

Technology Distributors: The New Solution for Supply Chain Issues?

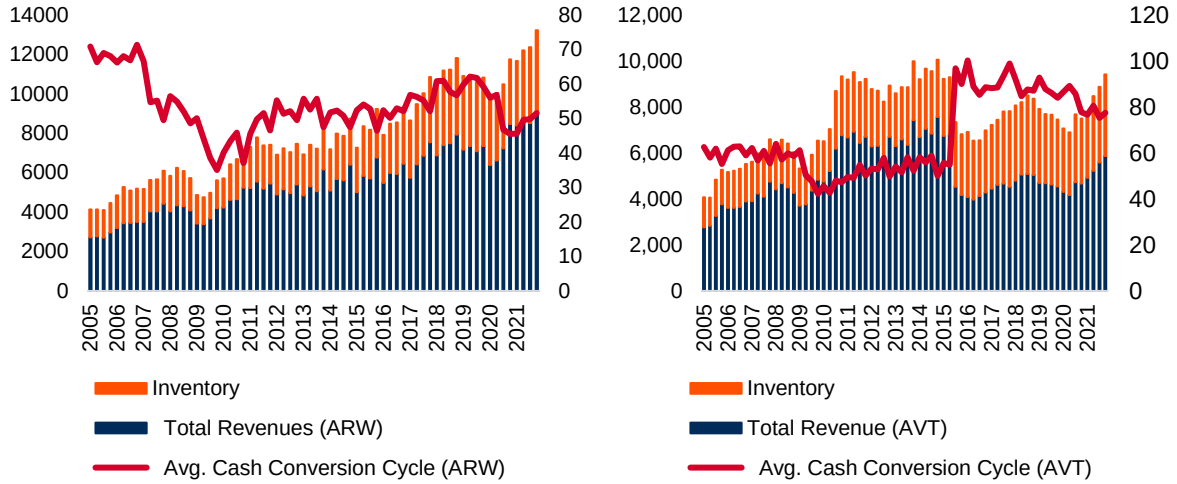
The complex technology supply chain is playing whack-a-mole with input shortages and the only thing persisting is the supply of problems: labor, materials, logistics, nationalistic policies, ESG factors, etc. The technology supply chain has become increasingly difficult to navigate since the onset of the Covid-19 pandemic in 2020, with OEMs unable to service demand on their own. Global supply chains have become a battleground for customer retention as supply/demand imbalances and rapidly changing technology trends are becoming increasingly difficult to navigate. These trends that are negatively impacting OEMs and electronic manufacturing services (EMS) companies are greatly benefitting electronic component distributors as supply chain management (SCM) has never been more important, accelerating the adoption of Supply-Chain-as-a-Service (SCaaS).

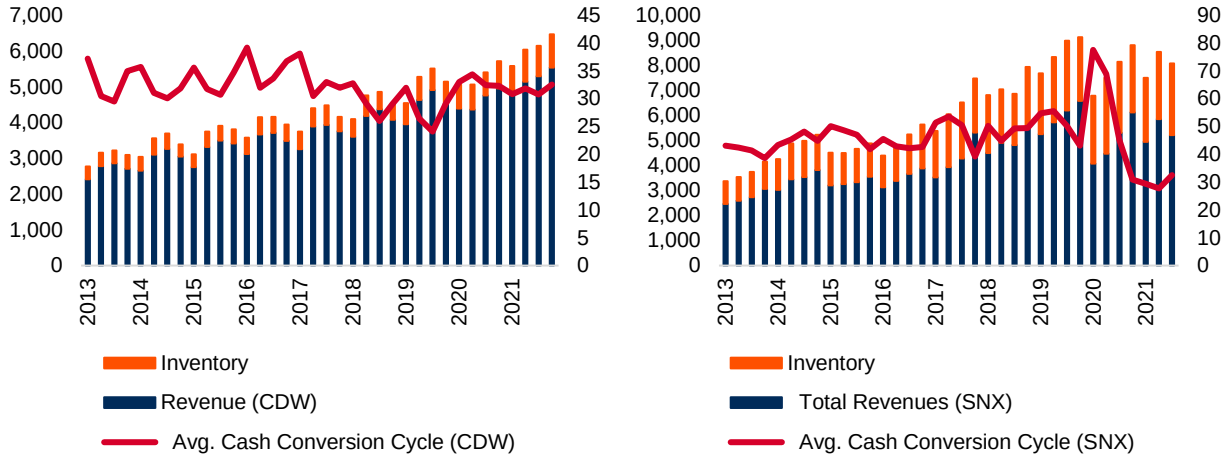
Component distributors are bridging the gap between component and semiconductor suppliers and equipment manufacturer customers. Transparency and consolidation are two very important attributes that OEM and consumer electronics manufacturers want in their supply chains; these attributes become more and more important as supply chain pressures increase. Many OEMs ask suppliers specifically for component distributor relationships to provide exactly these attributes to their supply chains.

Technology Distributors Have Historically Exhibited Counter Cyclical Balance Sheets

The charts below show the negative correlation that cash conversion cycles historically have with revenue growth for distributors, which is somewhat counter-intuitive. This is a reason why we see distributors as resilient to any future economic downturns, because when demand slows, these technology distributor companies can sit back, collect their receivables, and increase free cash flow due to a lower capital-intensive environment. There has also been a trend of higher inventories in the distributor space – under the more traditional model, this might be alarming, but in the current supply chain environment where certain suppliers and equipment manufacturers are paying distributors to hold and maintain inventory for them, this trend is not concerning, in our view.

Distributor Revenue & Inventory ($ Millions) vs. Avg. Cash Conversion Cycles (Right-Scale)



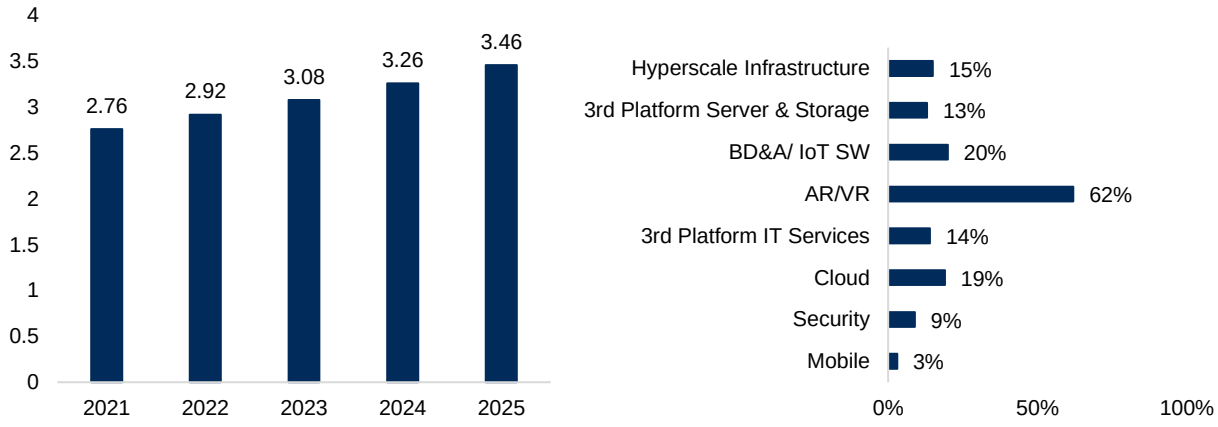


Source: Company Filings.

Enterprise IT Spending Remains Well Above GDP and is Far More Resilient

We expect IT spending to grow 25% from $2.76 trillion in 2021 to $3.46 trillion in 2025. We expect IT spending to outperform global GDP by more than 200 basis points in 2022 and 2023. Even in a down economy over the next several quarters, we believe that IT spending will remain resilient and post positive returns. The figure below shows our IT spending forecast alongside four-year growth rates for some notable sections of IT – most interestingly 62% growth in augmented reality/virtual reality and 20% growth in the Internet of Things.

IT Spending Forecast ($ Trillions) and Sub-Sector Growth Rates from 2021 to 2025



Source: CFRA, TD SYNNEX Corporation.

Competitive Environment

The Electronic Equipment, Instruments & Components industry remains fiercely competitive, as equipment providers fight for optimal customer exposure. Despite sustained technological advancement, companies in the industry attempt to capture growth by properly capitalizing on emerging product cycles.

Porter's Five Forces

	COMPETITIVE RIVALRY AMONG EXISTING FIRMS	CUSTOMER BARGAINING POWER	SUPPLIER BARGAINING POWER	THREAT OF NEW ENTRY	THREAT OF NEW SUBSTITUTES
Electronic Components	Moderate Industry consolidation has reduced the number of electronic component constituents. Competition has decreased as a result.	High Customer concentration can be significant and represent a large portion of sales.	Moderate Supply can be largely driven by volatile pricing of materials to construct products, which limits bargaining power, even in higher demand markets.	Low High initial barriers to entry, largely crafted by sizable intellectual property (IP) rules, protect companies in this industry from new entrants.	Low Like the threat of new entrants, patents largely insulate the few remaining companies that operate in this sub-industry.
Electronic Equipment and Instruments	Low Niche finished products (e.g., FLIR with thermal imaging) prevent a perfectly competitive market.	High Cyclicality and demand drivers outside sub-industry participants' control provide some bargaining power, despite differentiated products.	Moderate Vertically integrated manufacturing operations help control pricing over key materials and components.	Moderate Years of experience in developing products and large R&D budget capabilities help prevent new entry into the space.	Low Unique and technical products restrict the level of like-kind substitutes. Some test and instrument products have legitimate substitutes.
Electronic Manufacturing Services	High Low product differentiation prompts companies to turn their focus on building and maintaining customer relationships while also expanding their product catalog to remain ahead of their competition.	High Commoditized nature of outsourced products tilts the bargaining power in favor of customers. That said, secular areas (5G and IoT) could help boost pricing for EMS companies.	Low Supply is largely driven by volatile pricing in materials to construct products, which limits bargaining power, even in higher demand markets.	Moderate Buildout of the necessary products and facilities is capital intensive, which deters new entrants.	High Concentrated subsets of EMS companies can be interchangeable in many cases by end-market customers.
Technology Distributors	Moderate An oligopoly exists between both front-end semi distributors (Arrow and Avnet) and retail distribution (Synnex and Tech Data), given the limited subset of contracts with suppliers, value-added resellers, and direct customers.	Low Limited customer concentration and commoditized products largely prevent pricing power at end markets.	High Distributors need to weather large variances in pricing due to financial incentives (rebates and discounts) from product suppliers.	Low The large capital outlay and scale needed to set up a distribution network creates high barriers to entry for the sub-industry.	Moderate Little product differentiation could prompt customers and/or VARs to source distribution needs from direct competitors if needed.

Source: CFRA.

Due to the ongoing tightness in the supply chain, supplier bargaining power has increased across the four sub-industries. Many electronic manufacturing services companies, for example, have had to sign supply agreements with multiple suppliers in attempts to procure the necessary components to manufacture electronic components and perform assemblies for original equipment manufacturers (OEMs) to fulfill orders.

Key trends that affect a company's likelihood for success in this industry include:

◆ To fully battle customer churn, companies must keep a global footprint for distribution channels with a wide portfolio of leading technology solutions and end-to-end capabilities. Many companies deploy large networks of services and/or products through hundreds of facilities and have scale across more than 30 countries in Asia, America, and Europe.

◆ Barriers to entry are high, as intense pricing pressure, logistics, and initial capital requirements are needed for competitive scale and present challenges for newcomers. In addition, a sharper focus on research and development (R&D) costs has emerged to keep pace with the innovation curve.

◆ Military contracts comprise a significant portion of revenue for select companies in the Electronic Equipment, Instruments & Components industry (*e.g.,* FLIR Systems, TE Connectivity, and Amphenol). In May 2021, the U.S. Department of Defense (DoD) requested a budget of $715 billion for financial year 2022 (Sep.), a nearly 2.0% increase from its financial year 2021 request of $705 billion. CFRA thinks that companies with public sector exposure should benefit from sustained demand for electronic products and manufacturing services needed to maintain current capabilities across military and national security markets.

Heated Rivalry in Electronic Equipment, Instruments & Components Industry

Companies in the Electronic Equipment, Instruments & Components industry face a small peer group in their respective sub-industry arena of competitors (either an oligopoly or a duopoly). As barriers to entry are high, CFRA thinks the landscape will maintain its highly competitive nature. Industry consolidation from end consumers could amplify competition and present setbacks to suppliers and equipment manufacturers as they compete for a smaller number of contracts. Historically, this has been more pronounced during market downturns, as reduced demand prompts lower working capital.

Innovation must be constant to ensure a competitive advantage, in CFRA's view. New products or efficiency improvements are vital in maintaining or expanding market share, growing sales, and providing barriers to possible new entrants. Companies that fail to manage attractive product alternatives and maintain quality face significant demand impact, reputational effects, and/or loss of market share.

Pricing Pressure Comes Full Circle

Average selling prices (ASPs) continue to come under pressure as new products, performance capabilities, and feature sets enter the market. As EMS/equipment suppliers compete for business with OEMs, pricing concessions are often used to lock in customer wins.

This pricing strategy is readily present, as companies with non-existing footprints in a given market or relationship with a particular OEM are willing to offer deep discounts to win contracts. While this gives a temporary lift to the revenue profile in that specific market, the contract winner is often not fully qualified to operate in that business. Quality control of the given product can decline and the OEM will eventually return to a more suited top provider. This presents a meaningful cycle, and most importantly, enables prices to move lower than the market rate – a scenario in which margins remain range-bound and are sensitive to small movements in either direction. The average gross margin across EMS companies is expected to be around 20.3% in 2022, compared to 20.5% in 2021. Such small movements in margins can have large effects on profitability.

Capital Intensity Keeps New Entrants at Bay

CFRA thinks potential new entrants continue to face an uphill battle as establishing a spot in the supply chain is capital intensive. Only a few firms operate worldwide, and this adds to the rigor needed for new entrants to be competitive at scale, considering the diverse product portfolios needed to win contracts. Consolidation has become a key theme as companies look to enhance product scale or international

distribution capabilities by completing accretive transactions to compete in the never-ending pricing battle. One such example is private equity firm Apollo Global Management's acquisition of technology distributor Tech Data for about $6 billion in June 2020.

As there are many obstacles for new entrants to the market, the Electronic Equipment, Instruments & Components industry has not seen initial public offerings (IPOs) recently. Nonetheless, smaller companies that operate in new disruptive technologies (IoT and others) could build presence in the future. On the distribution side, many regional companies have sought to be acquired after deciding not to undertake the capital expenditures to build out the infrastructure to compete on a similar exchange in the global marketplace. CFRA notes that a few midsized players have gained presence, albeit with niche products and a confined geographic reach.

In addition, many companies in the industry have steep R&D budgets to fully respond to rapidly changing markets and technologies. In 2021, total industry R&D budgets comprised about 8.2% of company revenues on average. National Instruments was among the highest, with more than 22% of revenues devoted to R&D, while Jabil was one of the lowest, with less than 1% of total revenues spent on R&D.

Location, Location, Location

The global footprints of companies in the electronic components sub-industry have evolved to be of the utmost importance. Companies across the supply chain have realized that locations closer to end markets dramatically improve time to market. This can be beneficial for trade and tariff policies and can be the deciding factor for many clients with heightened needs to win valuable contracts.

Given the global reach of many electronics companies, many customers and suppliers have approached them for guidance to manage and mitigate the impact of the tariff war between the U.S. and China. We noted that many companies have been looking to relocate and reroute their inventories and shipments to avoid entering the U.S. in effort to reduce the impact of tariffs. CFRA thinks that technology distributors could be key beneficiaries of this trend as they can use their worldwide presence to offer solutions for manufacturers across the supply chain.

Furthermore, instead of only targeting low-cost labor markets, we think near-term capital expenditures to expand into other locations could improve cost structure and ultimately increase profitability in the long run. For example, Amphenol has major cost advantages, as its global manufacturing footprint covers approximately 30 countries, including facilities in China, Malaysia, Mexico, India, Eastern Europe, and North Africa. As the facilities cover both regional and global markets, we think this proficiency is hard to replicate on a large scale.

The Covid-19 pandemic highlighted the risk of having operations in diverse geographies. In 2021, the failure to contain the virus outbreak in some developing Asian countries such as Indonesia and Malaysia, which experienced a resurgence of Covid-19 cases since the second quarter of 2021 until the first quarter of 2022, significantly affected manufacturing capacities in those countries.

M&A Environment

Industry players' focus has turned to rationalization of portfolios already on hand (walking away from unprofitable contracts and/or customers) to reduce exposure to commoditized business; this focus has only increased in importance as the world continues to face the fallout from Covid-19. Below, we highlight the notable transactions in the industry over the past year. Industry players allocated a large portion of capital toward M&A deals as they looked for expansion of capabilities along the supply chain and geographic reach to differentiate themselves from their competition.

On July 1, 2022, II-VI Incorporated completed the acquisition of Coherent, Inc. for $6.7 billion, which was paid in cash (each share of Coherent common stock was converted into the right to receive $220 in cash and 0.91 of a share of II-VI common stock). The combined entity will be more distributed across the value chain from materials to components, systems, and service. II-VI's expertise in materials and Coherent's expertise in laser systems complement each other at the value chain levels. This merger will operate four markets of industrial, communications, electronics, and instrumentation, which together represent a total addressable market of $65 billion.

On December 1, 2021, CDW completed the acquisition of Sirius Computer Solutions, Inc for $2.5 billion, which will be paid in cash. Sirius is a leading provider of secure, mission-critical technology-based solutions for large and mid-sized customers concentrated in the government, health care, insurance, and retail industries. CFRA expects the proposed acquisition to be immediately beneficial to gross margins and operating income margins by approximately 110bps and 20bps, respectively. Sirius will also further diversify CDW's services and software solutions, increasing services sales by 45%. The company expects an initial leverage ratio of 3.3x at close, targeting 2.5x-3x by the end of 2022.

NOTABLE M&A ACTIVITY

(Deals of at least $1 billion, as of July 11, 2022)

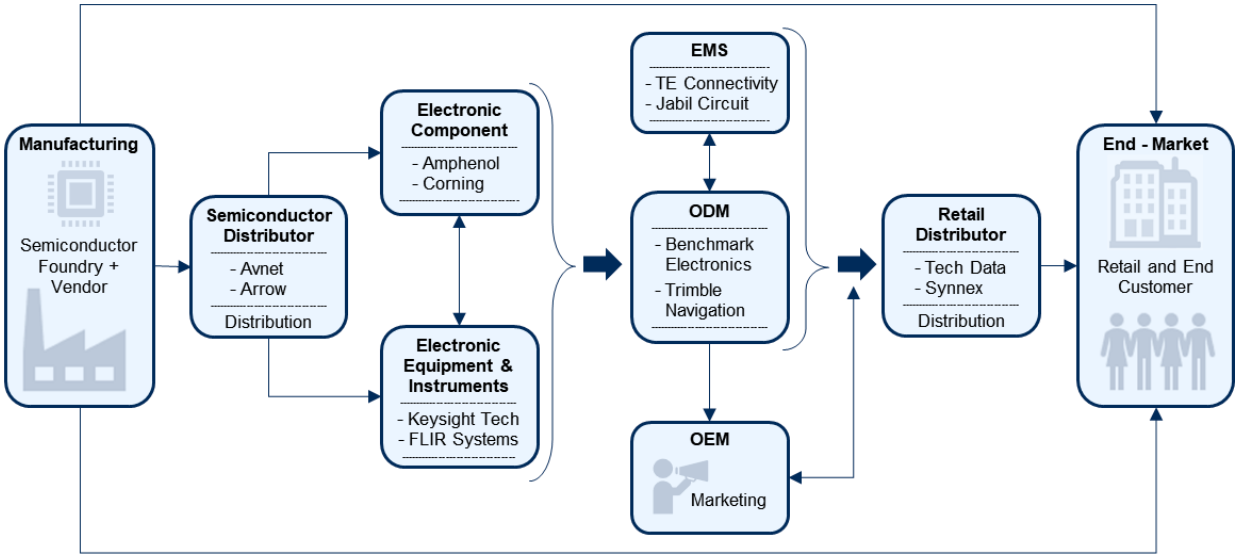
DATE ANNOUNCED	BUYER	TARGET	PRICE PAID / OFFERED ($M)	TRANSACTION STATUS	DATE CLOSED	TYPE OF FINANCING
3/22/2021	SYNNEX	Tech Data Corp	9,901	Closed	9/1/2021	Elections
1/4/2021	Teledyne Technologies	FLIR Systems	7,473	Closed	5/14/2021	Combinations
2/12/2021	II-VI, Inc.	Coherent, Inc.	6,775	Closed	7/1/2022	Cash
11/2/2021	DuPont De Nemours	Rogers Corp	5,275	Announced	-	Cash
9/7/2021	Blackstone	Chamberlain Group Inc.	5,000	Closed	11/3/2021	Cash
10/18/2021	CDW Corp	Sirius Computer Solutions, Inc	2,500	Closed	12/1/2021	Cash
6/14/2021	LINE Games Corp	UJU Electronics Co. Ltd	1,267	Closed	6/7/2021	Cash

Sources: CFRA, S&P Global Market Intelligence.

HOW THE INDUSTRY OPERATES

The Electronic Equipment, Instruments & Components industry is spread throughout the supply chain, which spans from manufacturing and marketing to distribution. While duties of mid-market industry constituents have had a very limited scope of tasks to original equipment manufacturers (OEMs) in the past, CFRA notes that many companies have evolved beyond traditional services to encompass a more diverse array of design, manufacturing, and post-market services, and subsequently have moved up the value chain. Still, while vertical specific roles in the supply chain continue to blur, to properly characterize general electronic equipment and instrument roles, we have illustrated the supply chain in the diagram below.

ELECTRONIC EQUIPMENT, INSTRUMENTS & COMPONENTS SUPPLY CHAIN



EMS-Electronic Manufacturing Services; ODM-Original Design Manufacturer; OEM-Original Equipment Manufacturer.
Source: CFRA.

From a high-level overview, constituents in the Electronic Equipment, Instruments & Components industry are operating between semiconductor manufacturers and end customers within the industry supply chain. With reference to the diagram above, *semiconductor distributors* are located at the upper level of the supply chain and they facilitate the distribution of semiconductors to companies in the *electronic component* and *electronic equipment and instruments* sub-industries.

Following that, mid-market electronic components, equipment, and instruments manufacturers typically market their products to constituents in the *electronic manufacturing services* (EMS) sub-industry, ODMs, and/or OEMs which ultimately flow to *retail distributors* for final distribution to individual retailers and end customers.

While it is important to keep in mind that the industry covers roles in between semiconductor manufacturing and the end market, we believe that the inclusion of the 'beginning and end' of the supply chain in our discussion will provide a more comprehensive understanding of the industry. Further elaboration on semiconductors could be found in CFRA's 'Semiconductors' industry survey.

Manufacturing: Semiconductor Foundry and Vendor

A semiconductor fabrication plant, also known as a "fab" or "foundry," is a factory where devices such as integrated circuits and microchips are manufactured. Foundries may be large chipmakers that sell excess manufacturing capacity or that produce chips exclusively for companies looking to outsource their manufacturing operations. Taiwan Semiconductor Manufacturing Co. (TSMC) is the world's largest

dedicated independent semiconductor foundry. Other foundries include GlobalFoundries, United Microelectronics (UMC), and Semiconductor Manufacturing International (SMI). Samsung has also aggressively ramped up capacity over the last several years and is now the second largest foundry player globally.

Foundries experience a robust fiscal year when sales of electronic gadgets and devices are on the rise, particularly during disruptive technological trends such as the Internet of Things (IoT). These fabs are capital intensive; a high-maintenance environment like this requires not only the finest technology to manufacture to a billionth of a meter, but also high-standard practices to keep the tiniest dust particles away from the products and the machines.

Semiconductor manufacturing process

Semiconductor chips used in electronic equipment are produced through what is perhaps the most advanced and complex manufacturing process in the world, involving two basic stages: front end (materials preparation and wafer processing) and back end (assembly, packaging, and testing).

◆ **Materials Preparation.** This process includes circuit design, photomask making, and the manufacture of raw wafers.

◆ **Wafer Processing.** There are four types of operations in wafer processing which are layering, patterning, doping, and heat treatments.

◆ **Assembly.** In the assembly process, the wafers and chips go through three steps known as wafer dicing, die bonding, and wire bonding.

◆ **Packaging.** The packaging of chips commonly involves encapsulation of the die and lead frame in molded plastic packages that protect the chips and help to dissipate heat.

◆ **Testing.** Finished packages are subjected to a final test process. Environmental tests check the package's resistance to temperature change and leakage; if air can get in, then it can contaminate the chip with particles and moisture. Electrical tests ensure that the chip functions within required parametric specifications.

Semiconductor Distribution

Technology distributors comprise 16.2% of the total Electronic Equipment, Instruments & Components industry on a market capitalization-weighted basis as of July 10, 2022. Within the supply chain, distributors are positioned between semiconductor vendors and electronic component/EMS companies, and between OEMs and end consumers. Applications include industrial equipment (automation, robotics, and machine tools) and consumer products for telecommunications, automotive, aerospace, medical, and wireless. Distributors often gauge business performance off overall GDP. Exceptional distributors have continually outpaced the metric by as much as three-fold.

Semiconductor distributors serve as intermediaries; they supply EMS and electronic equipment companies with materials from vendors, and these companies then supply the OEMs. Semiconductor distributors also deliver chips and components to companies that manufacture end products. Inventory on hand helps normalize the supply chain and buffer volatility, while international exposure helps properly balance imports and exports.

Avnet Inc. and Arrow Electronics are two global leaders in the distribution of electronic components and enterprise computing solutions. Their customer base consists of OEMs, contract manufacturers, and others, including manufacturers of industrial equipment (machine tools, factory automation, and robotics) and consumer products in the telecommunications, automobile, aerospace & defense, health care, and other industries.

Traditionally, global components remain the largest portion of business for distributors. Sales are usually dominated by semiconductor products (sometimes as much of 70% of overall mix), but also are

generated from passive electromechanical and interconnect products (capacitors, resistors, relays, and connectors). Additionally, computing- and memory-related products make up large portions of sales in some cases. To supplant efficiencies, distributors have also implemented enterprise resource planning systems, or fully integrated business process management software, to standardize component distribution worldwide by fully phasing out legacy systems.

In addition, many distributors have enhanced focus on broadening their portfolio of applications to computing solutions (data center, cloud, security, and analytics). Many distributors will work closely with value-added resellers (VARs) to help enhance supplier relationships, productivity, and help address complex IT solutions for end-users. While legacy storage and server trends continue to persist, transitions to new offerings – hyper-converged and solid-state drives (SSDs) – continue to offset.

Electronic Components

Electronic component constituents currently comprise around 30.2% of the total industry on a market capitalization-weighted basis as of July 10, 2022. Industry participants in the sub-industry sell and manufacture a broad portfolio of products to OEMs.

Recently, OEMs have seen consolidation of their lists of qualified suppliers, which further highlights the need of electronic component makers to gain more intimate customer relationships on a global scale. Key players are Amphenol and Corning, which supply a wide breadth of products that can include anything from connectors to antennas and sensors, to cover display glass (Corning). Some materials used in the manufacture of these products include cables and fiber optics, which are used to complete electronic products. Many electronic component products are used in industrial and defense equipment, while antennas and electromechanical components are used in mobile applications.

Here, we list some of the manufacturing capabilities of Amphenol, the market leader in interconnect systems for harsh environment applications, to give a clear picture of what electronic component companies do:

◆ **Computer Numerical Control (CNC) machining**. This a process used in the manufacture of computers that involves the use of control machine tools. Machines are programmed with CNC machining language, which controls features such as feed rate, coordination, location, and speed. CNC machining enables the computer to control exact position and velocity.

◆ **Die-casting and molding**. This is a manufacturing process characterized by the molding of metal into a cavity. It can produce geometrically complex metal parts using reusable molds called “dies.”

◆ **Impact and extruding**. This is a manufacturing process by which products are made into a die or mold with a metal slug, which is pressed at a high velocity and with extreme force.

◆ **Plating**. This method refers to covering a metal deposited on a conductive surface. Plating methods may include covering a solid surface with a metal sheet, and applying heat and pressure to fuse them.

◆ **Screw machining**. This refers to machining components by spinning on a rapidly rotating lathe, shaving the metal to the desired size.

◆ **Process controls**. This engineering discipline deals with the design, mechanism, and algorithm for maintaining the output of a process. These automated controls are used in industries that handle mass production.

Sub-industry success hinges around timely delivery of components to customers. Any delay in the supply chain could result in a significant reduction in sales and/or product shipments.

Many companies in the electronic components sub-industry rely on a limited number of key suppliers for their raw materials, which can create disruptions if alternate suppliers aren't easily found. In addition, significant input cost inflation (raw materials, precious metals, and equipment) can hurt profitability at the company level.

The Rise of Organic Light-Emitting Diodes (OLEDs)

OLED display panels have been gaining traction among the consumer segment as more manufacturers are replacing traditional liquid-crystal display (LCD) panels with OLED panels in smartphones, TVs, wearables, etc. (Apple's iPhone X was the first generation of iPhone to use an OLED screen). OLEDs are monolithic, solid-state devices that are made from a series of organic thin films sandwiched between two thin-film conductive electrodes that emit a bright light when electrical current is applied.

OLED is likely the future of display technology, as it produces better quality images compared to LCDs. On top of that, according to Universal Display Corporation, a pioneer and leader in OLED technology development, OLED screens consume less power and can be made flexible and transparent. As an example, through 2030, the market for OLED display is expected to grow to $63 billion from around $30.3 billion in 2019, according to market research firm IDTechEx. In our view, the increasing adoption of OLED technology in the consumer market will be the driving force behind demand and we forecast that it will soon become a requirement for most next-generation consumer display products internationally.

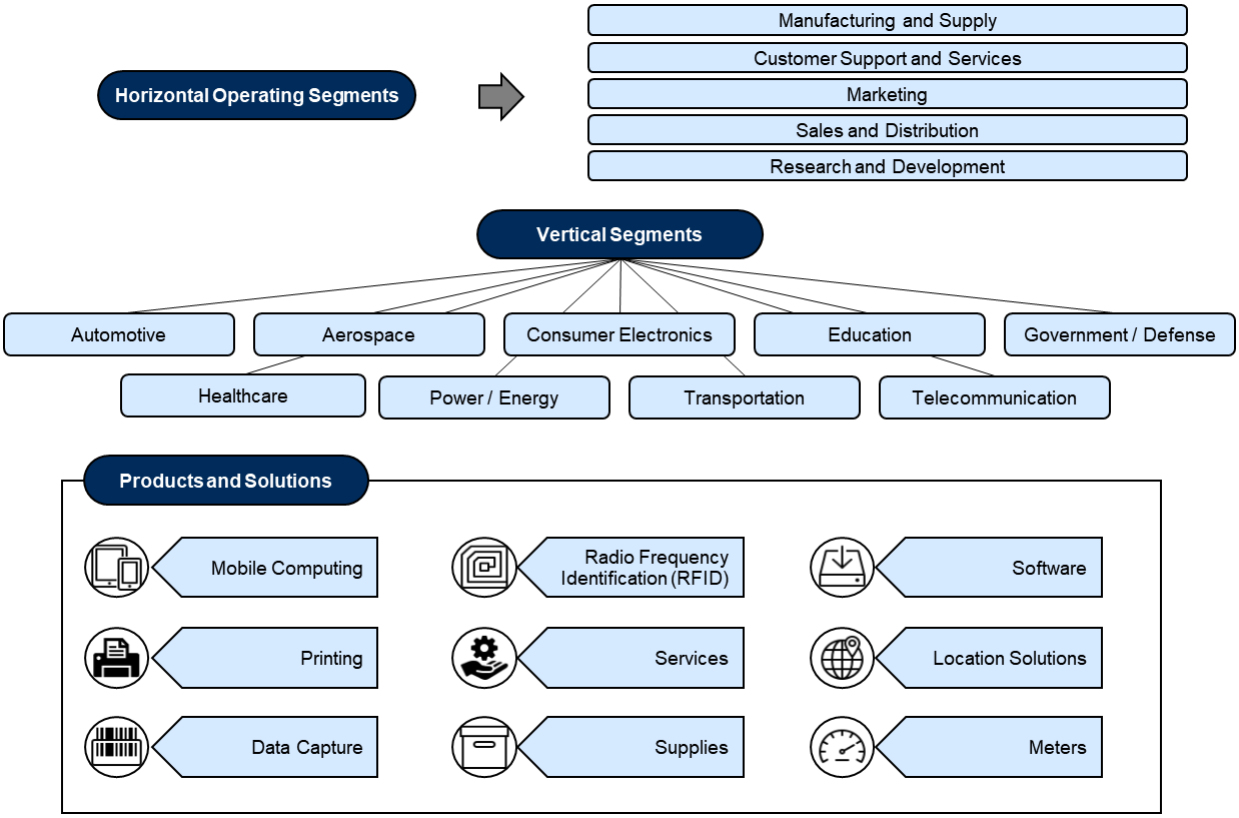
Electronic Equipment and Instruments

Companies in the electronic equipment & instruments sub-industry comprise about 33.2% of the total industry, on a market capitalization-weighted basis as of July 10, 2022; these companies provide a broad range of products and services, from designing and manufacturing hardware and accessories, to purchasing and selling electronic instruments and systems.

Products range from thermal, radiation, and water measurement industrial hardware to mobile enterprise computing, data capture, and radio frequency identification (RFID) technology. Further, many companies in the sub-industry operate in the Automatic Identification and Data Capture market and real-time location systems supplies and related application software, which continue to be driven by strong underlying secular trends (IoT, mobility, and cloud-based analytics).

End-user markets served include retail, transportation and logistics, manufacturing, health care, hospitality, warehouse and distribution, energy and utilities, and education markets around the world. Products and solutions are sold through distributors, and like other sub-industries, VARs and independent software vendors (ISVs), which strive to properly align customers with the needed hardware, software, accessories, and services.

EQUIPMENT AND INSTRUMENTS SUB-INDUSTRY OVERVIEW



Source: Company Reports; icons obtained from icons8.com.

Key companies in the electronic equipment & instruments sub-industry are Keysight Technologies, Zebra Technologies, FLIR Systems, and National Instruments Corp. Outlined below are operating segments of these companies, to show the typical operations of companies in the Electronic Equipment, Instruments & Components industry.

◆ **Manufacturing and supply**. National Instruments manufactures a substantial portion of its product volume in Hungary and Malaysia. Subcontractors produce the majority of the company's electronic cable assemblies, but some are manufactured on an exception basis, according to the company. In addition, the company's manufacturing processes use large volumes of high-quality components and subassemblies from suppliers, and several of these components have limited availability.

In other instances, third-party electronics manufacturers perform the final assembly of hardware products (e.g., Zebra). The company's mobile computing and data capture products are located in Brazil, Israel, Mexico, and China, while its printer manufacturing facility is in China. While manufacturers produce Zebra's products according to its specifications, Zebra claims that it maintains control over portions of the supply chain, including supplier selection and price negotiation. Certain products are manufactured according to the procurement regulations and international trade agreements.

◆ **Customer support and services.** These services provide repair and calibration support, as well as maximize the value of electronic measurement equipment. The management of instrument trade-in programs and refurbishment or selling of used instruments is included in this service.

◆ **Marketing.** To focus on educating engineers and scientists about the benefits of its graphical system design approach, National Instruments actively markets its products in higher education environments, and has many colleges, universities, and technical schools as key accounts.

Zebra sells its products and solutions through distributors, vendors, direct marketers, and OEMs. The company also sells directly to a select number of customers through its in-house sales force. Some OEMs resell Zebra-manufactured products under the buyers' own products. These VARs provide customers with hardware, accessories, application software, and systems integration expertise, and Zebra's distribution increases as OEMs and VARs buy, stock, and sell various components, according to the company.

◆ **Sales and distribution.** National Instruments distributes and sells software and hardware products through a direct sales organization. Like other companies in the electronic equipment & instruments industry, National Instruments uses independent distributors, OEMs, VARs, system integrators, and consultants to market and sell products. After an order is received, products are shipped immediately; hence, the need to maintain significant inventories. Obsolete inventory is a risk to the company due to frequent engineering changes, shifting customer demand, emerging industry standards, and rapid technological advances.

◆ **Research and development.** High-quality hardware and software products require R&D efforts. Some test and equipment companies (like National Instruments) have large R&D budgets to ensure proper designs and manufacturing are in place to produce products for customers efficiently.

EMS and OEMs

EMS companies are in charge of design, production, and testing of electronic components and printed circuit board (PCB) assemblies for OEMs—their customers. The electronic manufacturing services sub-industry makes up around 20.4% of the Electronic Equipment, Instruments & Components industry as of July 10, 2022.

EMS companies provide manufacturing services that range from design to assembly and testing. These companies may be contracted at many points in the manufacturing process, and may provide additional services, such as PCB etching, or provide these services through another contractor, according to IHS.

Electronic manufacturing involves different levels of automation, depending on the company and the project. Companies that produce large runs of products typically use heavily automated manufacturing. Providers specializing in prototypes or small production runs typically assemble PCBs manually to save the time and cost involved in setting up automated assembly equipment.

Often, the electronic manufacturing services sub-industry is synonymously associated with original design manufacturers (ODMs). EMS/ODM companies both assemble electronic systems—PCs, notebooks, handsets, LCD televisions (TVs), and networking products—in higher-volume markets. While similar in many ways, EMS and ODM companies do have their differences. Firstly, ODMs do not usually manufacture high-mix products in medical, industrial, or defense businesses, while some EMS companies do.

Secondly, unlike EMS providers, ODMs are usually responsible for R&D resources, which are needed to implement the actual design and production of electronic systems. Examples of ODM customers include HP, Cisco, Dell, Sony, and Nokia.

Also often confused with ODMs, an OEM makes equipment or components that are marketed by its client, another manufacturer, or a reseller, usually under that reseller's own name. An OEM may make complete devices or only certain components, both of which can be configured by the reseller. Recent business trends in the EMS and ODM segments include the willingness of companies to adjust designs to accommodate their OEM customers' needs. Increasing complexity and sophistication of electronics are large catalysts for EMS companies to expand their roles throughout the manufacturing process. The scope, in CFRA's opinion, continues to evolve and encompass deeper strategic relationships with OEMs in attempts to exploit efficiencies in design, capital investment, and supply chain management.

Retail Distributors

Between OEMs and end consumers are wholesale equipment distributors, who help serve as an intermediary to distribute products to individual retailers and, in some cases, to customers, through online catalogs. One example of a company in those verticals is TD Synnex.

Since the merger of Synnex and Tech Data (TD Synnex currently) in September 2021, this behemoth of a company now distributes more than 200,000 technology products from more than 1,500 IT, CE, and OEM suppliers to more than 150,000 resellers, system integrators, and retailers around the world. The market for IT products is generally known by declining unit prices and short product life cycles.

End Market

Despite the high barriers to entry, the Electronic Equipment, Instruments & Components industry—much like the semiconductors & equipment industry—manufactures products with various life cycles and for different end markets, such as automobiles and communications.

Demand for electronic products mostly comes from the industry's end markets, which include communications, computers, consumer electronics, and automotive electronics, as well as industrial, medical, and government or military contracts. FLIR Systems specializes in the design and production of thermal imaging cameras, components, and sensors. According to the company, its "surveillance" business unit addresses high-end military and governmental thermal imaging markets, while the five remaining segments are focused on other commercial and industrial segments.

Amphenol—maker of electrical, electronic and fiber optic connectors, interconnect systems, antennas, and high-speed specialty cable—has generated more than half of its revenues from information technology and communications markets. However, the company is also increasing its exposure in automotive, industrial, military, and commercial aerospace segments.

For Corning—maker of glass substrates—the increasing demand for larger LCD televisions, tablets, and PC stabilization is driving glass volume growth. CFRA expects the IoT theme to drive product demand from homes and workplaces. With more devices being connected, including digital televisions and wearables, demand for consumer electronics will likely rise in the coming years.

Automation in factories, hospitals, research centers, and smart cities, as well as consumers' insatiable demand for new technologies, mostly contribute to the need for products and services from the electronic equipment, instruments & components industry.

HOW TO ANALYZE A COMPANY IN THIS INDUSTRY

When analyzing a company in the Electronic Equipment, Instruments & Components industry, investors must consider both financial and nonfinancial factors. Recognizing leading indicators is key, and being able to identify the stage of the given cycle is imperative when approaching individual companies. The investor must closely examine the income statement and the balance sheet for early signs of trouble or improvement.

Other key factors that influence a company's future prospects should be considered, such as management expertise and experience. Looking back at management's past success or failure of in the product life cycles stages can be a good indicator of future performance. In addition, an investor needs to examine and be aware of macro-environment themes and how these affect the given company. Relative peer analysis is also vital in recognizing proper valuation of the individual company, and such analysis can yield insight into the scope of the company's distribution channels and strength of customer relationships for current and future contract wins.

Recognizing Cyclical Trends

Given the competitive nature of the industry, identifying cycles is of upmost importance to extrapolate a company's current position and valuation. Cycle durations have compressed recently, and range from two to four years compared with historical cycles of four to seven years. New cycles have been driven by inventory more than by supply. This has softened the severity of peaks and troughs, as industry revenue normally oscillates around 20%.

Companies in the Electronic Equipment, Instruments & Components industry have tried to establish greater normalization of their revenue profile, as management teams implement big restructuring programs to run leaner operations, and cut costs to help offset downturns. Some examples are shifting manufacturing to lower-cost countries, increasing the mix of high-margin specialized products, and completing acquisitions that diversify the breadth of given product portfolios or specific capabilities to capture more sales.

CFRA thinks that these new trends implemented throughout the supply chain will help buffer the effects of cycle shifts and aid in companies being better positioned for cycle corrections.

Analyzing Financial Statements

A company's financial statements give the investor important insight into its current position and prospects for growth. The following discussion highlights some of the key line items and financial ratios found on the income statement and balance sheet.

Income Statement Analysis

The income statement portrays the operating results of a company over a stated period. Recognizing trends in growth rates, and a full review of all sales, costs, expenses, and earnings is an important aspect of all companies.

As many companies in other sectors have more normalized trends in financial metrics, year-over-year analysis is sufficient. However, in the electronic equipment, instruments & components industry, evaluating companies on a sequential basis and comparing the previous quarter with the most recent results add more value to the analysis. Quarterly comparisons allow investors to see short-term trends and to conclude if any reoccurring theme is changing business conditions on a material level.

Segments of the industry can be seasonal, which shadows demand patterns for end-market products. Typically, sales in the second half of the year are higher than sales in the first half, due to holidays and increased consumer spending. Another contributing factor to the slowdown in the first half of the year is

the many celebrations that take place in Asian countries in the first quarter, which contribute to a significant hiatus in product orders.

◆ **Sales.** Quarterly results should be compared on a year-over-year basis and on a sequential basis (*i.e.*, compared with the preceding quarter). These initial indications can set the tone for the entire business. It is also common to see recurring themes from many companies operating in the same industry on a quarterly basis. For instance, a strong dollar and weak growth in China was a common occurrence in 2016. It is important to pay close attention to individual operating segments (automobiles with TE Connectivity equipment, for example) in order to predict visibility in future quarters. In addition, common themes can be articulated through sub-industries, and recognizing these movements in companies can help identify cycles and short- and long-term trends.

Order trends are a leading indicator of current order backlog and potential sales growth in the near term. Many electronic components companies recognize a book-to-bill ratio (quarterly orders divided by quarterly sales); a book-to-bill ratio or more than 1.0x indicates that orders are healthy and greater than current sales. A ratio of less than 1.0x indicates that demand is weaker than one would like. In addition, one should be cognizant of order trends because many companies are vulnerable to delays and cancelations.

Watch Out! *Companies may hide a revenue slowdown by recognizing revenue in an earlier period than originally expected. There are many available tactics that management can use to accelerate revenue, some of which include allocating a higher proportion of transaction price to elements delivered upfront in contracts with multiple deliverables or performance obligations, faster recognition of deferred revenue, large shipments at period-end, a change in revenue recognition policy, and a change in the interpretation of the revenue recognition policy.*

◆ **Margins.** Given the competitive arena of companies operating in the industry, profit margins for companies in the electronic equipment, instruments & components industry are thin, and small variance from quarter to quarter can have huge effects on the company being analyzed. Other big components affecting margins are raw material pricing, operational efficiencies, and product mix. In addition, specialized products early in their cycle usually have higher average selling prices (ASPs), and therefore higher margins. Products that are late in their cycle, or that have many substitutes, are at the mercy of market trends with little or no pricing power. Incremental dollar increases in sales are a large driver of net income growth (more so than variable costs), as operating leverage can drive large variance in earnings throughout each cycle. Companies continue to aim for sound efficiency and mix, and are constantly cutting back costs; this helps buoy margins and prevent large cyclical swings.

Watch Out! *Estimates required to establish reserves against certain assets - i.e. provisions for doubtful accounts, sales returns, warranties, etc. - can be used by management to manipulate revenues, earnings, and margins.*

◆ **Operating expenses.** The major operating expense line items—selling, general, and administrative (SG&A) costs and research and development (R&D)—should be reviewed against peers. It is common that stronger companies will scale up capital budgets for R&D during downturns to help retain or possibly gain business.

Financial statement analysis would be incomplete without some discussion of return on investment (ROI), of which the most popular measure is return on equity (ROE), or net income divided by average common shareholders' equity. Again, a comparison with industry norms should prove useful, making sure to compensate for differences in operating and financial leverage and net cash positions, which can affect ROE.

Balance Sheet Analysis

The balance sheet, or statement of financial condition, shows the status of a company's assets, liabilities, and shareholder equity on a given date. With these data, an investor can determine much about a company's financial health, including its liquidity, solvency, asset turnover, and capital structure.

◆ **Liquidity.** Liquidity is an important indicator of a firm's ability to fund its day-to-day operational needs. The simplest measure of liquidity is working capital, or the excess of current assets over current liabilities. Working capital represents a liquid reserve that companies can draw upon to finance the cash cycle of the business (the time required to convert raw materials into finished goods, finished goods into sales, and accounts receivable into cash).

Two other liquidity measures are the current ratio (current assets divided by current liabilities) and the quick ratio (current assets less inventory, divided by current liabilities). These financial ratios show a company's ability to pay its current obligations out of current assets.

Many companies have revolving credit facilities, which serve as a credit line for future capital spending, acquisitions, or everyday activities. This can help differentiate strong liquidity positions among firms and can serve as an indicator to capitalize on future growth activities.

◆ **Inventories.** The inventory turnover ratio (cost of goods sold divided by average inventory) provides a measure of a company's inventory management. A higher ratio indicates that inventory turns rapidly and is a sign of strength, while a low turnover ratio is a sign of excess inventory (potentially obsolete), which can be augmented by downturns. In addition, one should also read between the lines, as numbers do not always indicate the given situation in an individual company. It is also important to pay attention to product demands as companies in the electronic equipment, instruments & components industry can build inventory when anticipating upturns in cycles and can indicate a positive leading indicator.

Watch Out! *A substantial increase in inventory may be a leading indicator of an upcoming decline in margins. Specifically, when a company's inventory rises faster than cost of goods sold, CFRA cautions that the inventory growth may be due to the company's inability to sell the inventory (which raises the risk of future obsolescence charges) or that the company may be leaving costs on its balance sheet in the form of inventory rather than expensing these costs on its income statement, raising concerns about the sustainability of earnings and margin growth.*

◆ **Accounts receivable turnover.** The accounts receivable turnover ratio is calculated by dividing total credit sales by accounts receivable during an accounting period. The ratio, which measures the number of times that the receivables portfolio has been collected during the period, is used to determine bad debt risk. A rising ratio could indicate that customers face cash flow problems and cannot pay their account balances. Many companies in the industry have significant sales exposure to Asian countries; given the region's history of credit crunches, one should keep a close eye on this metric.

◆ **Debt.** The industry is capital intensive because it needs to continuously expand the capabilities of sales channels or meet customer needs for products. Most companies carry a modest level of debt on their balance sheets. The ratio of long-term debt-to-total capital is useful in determining the relative risk that a company takes when employing financial leverage. A higher ratio indicates that a company must allocate a larger level of internally generated cash flow to service debt obligations.

◆ **Cash flow.** The statement of cash flows reports a firm's sources and its use of cash, and it is categorized into operations, investments, and financing activities. It contains valuable information about a company's transactions, and can provide additional details that the income statement cannot. The statement illustrates, among other things, how companies generate or use cash, fund capex, and issue equity or debt.

Watch Out! *Some companies engage in supplier financing arrangements (aka reverse factoring). There are several variations of these programs, but basically, a company arranges for a financial institution to pay its suppliers and the company repays the financial institution later. This effectively lengthens the supplier payment terms and thus improves working capital. However, operating cash flows can be overstated if the cash payment to the financial institution is presented as financing outflows rather than operating cash flows, which would be the case if the company pays the supplier directly.*

Free cash flow is the amount of excess cash that the company holds after paying off its obligations. The investor should determine how the company expects to use its free cash flow. Possible strategies include repurchasing shares of the company's common stock, paying dividends to shareholders, reinvesting the cash in the business, or pursuing acquisitions.

Performance and Valuation Metrics to Consider

Drawing from both the income statement and the balance sheet, two important measures of a company's overall financial performance are return on assets (ROA) and return on equity (ROE). These measures, along with growth projections, provide key indicators for a valuation analysis.

In evaluating the relative attractiveness of a company's current stock price, performance metrics and growth rates should be considered alongside price-related valuation ratios such as price-to-earnings (P/E), price-to-sales (P/S), and price-to-cash flow (P/CF). Meanwhile, the cash conversion cycle (CCC) reflects how readily a company can generate cash from its short-term assets given its liabilities. The investor should compare valuation and performance ratios with the company's own historical ratios and with those of peer companies and the overall stock market.

◆ **ROA and ROE.** Any financial statement analysis would be incomplete without some discussion of ROI, of which the two most popular measures are ROA and ROE. ROA (net income divided by average total assets) measures a company's operating efficiency or the return earned on assets under management's discretion. ROE (net income divided by average total shareholders' equity) measures the return earned on shareholders' capital. Both ratios measure management's ability to earn a reasonable profit on the assets and capital entrusted to them.

◆ **ROIC.** An alternative ROI measure is ROIC, which measures management's efficiency at allocating the capital under its control to profitable investments. It is calculated as net operating profit less adjusted taxes divided by invested capital (or net operating assets). The ratio should be compared to a company's weighted average cost of capital to determine whether the company is creating value.

◆ **P/E and PEG.** To arrive at the P/E ratio, simply take the stock price and divide by the current year's projected earnings. For a forward projection, one can use the forecast earnings for the next year. A variation of this ratio, which can be used to weigh the strength of earnings growth as part of valuation assessments for a given company relative to its peers, is referred to as the P/E growth (PEG) ratio, or the P/E divided by the company's projected average five-year earnings growth rate.

◆ **P/S ratio.** The P/S ratio is derived by dividing the current share price of the company by its projected revenues for the current year on a per-share basis. This ratio is used in times when earnings are not available (e.g., the company is operating at a loss), or when earnings forecasts are in question.

◆ **P/CF ratio.** To calculate the P/CF ratio, take the company's stock price, and divide it by the sum of the current year's forecasted cash flow. The most commonly used proxy for a company's cash flow is earnings before income tax, depreciation, and amortization (EBITDA). The real-world use of this ratio is generally derived using the forecast of EBITDA for the next year. P/CF is typically used in cases where a company's earnings are penalized by high capital intensity.

◆ **Cash Conversion Cycle (CCC).** The CCC can be calculated by getting the sum of the company's days sales outstanding and days of inventory on hand, to be subtracted with the number of days payable. This measure reflects the amount of time it takes a company to turn cash investment into inventory back to cash through collection from sales. High conversion cycles are seen as undesirable and could indicate too much cash is tied up in the conversion process, while lower measures could imply efficient operations. This measure can also give insight into overall liquidity, given its close look at short-term obligations.

◆ **Day Sales Outstanding (DSO).** Refers to the length of time (in days) needed to collect sales or accounts receivable, or how efficiently a company can collect cash owed from customers. Lower figures are desired and would imply efficient operations in collecting outstanding sales from customers. This ratio is calculated by dividing 365 (or the number of days in the period) by receivables turnover (annual sales divided by average receivables).

◆ **Days Inventory Outstanding (DIO).** An additional measure of inventory is DIO. Since these periods tend to affect sales and margins, it is important to keep a close eye on inventory, in CFRA's view. Commonly used in the CCC, the DIO can also gauge inventory health, especially when compared with historical and seasonal averages. It is useful to run the analysis for companies throughout the supply chain so that investors can watch for inventory buildups. DIO is calculated by dividing 365 (or the number of days in the period) by the inventory turnover ratio (listed above).

◆ **Day Payables Outstanding (DPO).** Refers to the length of time (in days) companies take to pay invoices from creditors. Higher figures could imply liquidity pressures and the inability to pay outstanding balances. That said, this can also mean cash is held onto longer and can help support higher working capital. This ratio is calculated by dividing 365 (or the number of days in the period) by payables turnover (purchases divided by average trade payables).

GLOSSARY

Analog components—Circuits with quantities such as voltage or current varying at a continuous rate.

Autonomous—Processes and functions that can be done independently or without direct control (*i.e.,* autonomous or driverless cars).

Cable—A bound or sheathed group of mutually insulated conductors.

Capacitor—A device used in electrical circuits. The capacitor stores an electrical charge for a short time, and then returns it to the circuit. Common types of capacitors include tantalum, electrolytic, ceramic, and film capacitors.

Chipset—A group of integrated circuits that perform a set of related functions.

Circuit—A configuration of electrically or electromagnetically connected components or devices.

Commoditized—When goods or services become indistinguishable from competing offerings and compete solely on price.

Conductor—Conductors, such as an electrical connector, are materials that readily conduct electric current through electrical conduction.

Connected car—A car equipped with internet access and wireless local area network (WLAN), allowing the car to share access with other devices inside and outside the vehicle.

Connectors—A device that joins to other conductors and to the terminals of apparatus and equipment.

Data Center—A building, dedicated space within a building, or a group of buildings used to house servers and associated components, such as telecommunications and storage systems.

Detachable—This device is typically a fully-featured tablet, which is connected to a docking device to provide users with a full keyboard. When connected, the tablet becomes the “screen” of the laptop.

Die bonding—The process of attaching the semiconductor die either to its package or to some substrate. This starts with picking the target die from wafer of waffle tray.

Digital components—Circuits with quantities that can be precisely counted. In contrast with *analog components*, of which quantities can only be approximated.

Doping—Operations where specific amounts of impurities (called dopant atoms) are introduced through exposed portions of the wafer to create electrically active areas.

Dynamic Random-Access Memory (DRAM)—A type of random-access memory used in PCs and other computing devices. Accesses the memory directly, holds for a short period, before losing its data when the power is shut off.

Electromagnet—A magnet consisting basically of a coil of insulated wire wrapped around a soft iron core that is magnetized only when current flows through the wire.

Fab—See *Foundry*.

Factory automation—Integration of factory operations toward more effective processes aided by technology.

Fiber-to-the-home (FTTH)—A communications architecture in which the final connection to the subscriber home or premises is optical fiber.

Flash memory—Non-volatile memory chip that can be used for storage and transferring data between digital devices (*i.e.,* USB and solid-state drive (SSD)).

Foundry—A semiconductor fabrication plant that is commonly called “fab.” This is where devices such as integrated circuits are manufactured.

Fuse—A device that protects an electric circuit from excessive current.

Geospatial—A data that contains geographic element. Geospatial analysis employs geographic information systems (GIS) to capture, store, manipulate, analyze, manage, and present all types of geographical data for analysis across industries such as defense, intelligence, utilities, energy, etc.

Global Positioning System (GPS)—A satellite-based radionavigation system owned by the U.S. government that provides users with positioning, navigation, and timing services.

Independent service vendors (ISVs)—Vendors that are not owned or controlled by a hardware manufacturer (*i.e.,* IBM) that distribute software.

Inductors—A device for introducing inductance into a circuit.

Infotainment—A type of media that is intended to deliver entertainment and information content.

Integrated circuit—A microscopic array of electronic circuits and components that has been diffused or implanted onto the surface of a single chip of semiconducting material such as silicon.

Internet of Things (IoT)—The concept wherein a device with an on-and-off switch—from cellphones to wearables—is connected to the internet (and/or to each other).

Light Detection and Ranging (Lidar)—A method for determining ranges by targeting an object with a laser and measuring the time for the reflected light to return to the receiver.

Liquid Crystal Display (LCD)—A flat display panel that uses the light-modulating properties of liquid crystals to produce images. LCDs require the use of a backlight or reflector as a light source to illuminate the liquid crystals.

Mid-market—In terms of a supply chain, mid-market refers to a firm's position between the manufacturer/distributor of materials and the manufacturer/distributor of end products.

NAND flash memory—A type of nonvolatile memory capable of fast data writing. NAND flash memory can retain information, even when there is no power. The acronym NAND stands for "not and," which refers to logic rules applied in digital technology.

Organic Light-Emitting Diode (OLED)—A film of organic compound that emits light in response to an electric current. Argued to be of better quality, cheaper, and lighter than LCDs.

Passive components—Electronic components that can perform functions even without an energy source.

Patterning—Involves the transfer of a circuit design to the wafer surface. This process, also known as photolithography or photomasking, is very similar to the photographic process.

Relay—A device that responds to a small current or voltage change by activating switches or other devices in an electric circuit.

Resistance—A measurement of the difficulty encountered by a power source in forcing electric current through an electrical circuit, and hence the amount of power dissipated in the circuit. Resistance is measured in ohms.

Resistor—A component that resists an electric current by producing a voltage drop between its terminals in accordance with Ohm's law.

Radio Frequency Identification (RFID)—A type of small chip and antenna that is capable of storing data. It is usually implanted into small electronic devices and its data is read through an RFID scanner. RFID allows the information to be scanned over a farther range, allowing for contactless data transmission.

Semi-autonomous—Processes and functions that can be done with some degree of independence. (*i.e.,* semi-autonomous cars or cars with extended functions, such as sensors for lane guidance, pre-crash emergency braking, etc.).

Semiconductor—A solid material, the electrical conductivity of which at room temperature is between that of a conductor and that of an insulator. The most significant semiconductor is the transistor.

Sensors—A sensor is a type of transducer. Since a significant change involves an exchange of energy, sensors can be classified according to the type of energy transfer that they detect.

Smart Cities—An urban area that uses different types of technology to manage assets and resources efficiently. Data collected are processed and analyzed to monitor various systems such as traffic and transportation, power plants, water supply networks, etc. This concept integrates information and communication technology (ICT) and physical devices connected to a network (the IoT) to optimize efficiency of the city's operations.

Static Random-Access Memory (SRAM)—A volatile random-access memory that does not need refreshing. Keeps data and performs a lot faster compared with *DRAM*.

Terminal—A position in a circuit or device at which a connection is normally established or broken.

Thermal Imaging—A method of improving visibility through detecting infrared radiations and producing an image based on that information. Thermal imaging technology is usually applied through the use of a thermographic camera, could be useful for many applications, especially in military and surveillance.

Transistor—A small electronic device containing a semiconductor and having at least three electrical contacts, used in a circuit as an amplifier, detector, or switch. A solid-state device involved in amplifying small electrical signals and in processing of digital information. Transistors act as the key element in amplification, detection, and switching of electrical voltages and currents.

Value added resellers (VARs)—Companies that enhance products that it resells, usually by including complementary products (*i.e.,* in the computer segment, VARs may provide installation services, troubleshooting, additional hardware, and more).

Vendors—Also known as supplier, refers to the party that provides goods or services to a company or individuals.

Voltage—The force, or pressure, of electricity; also known as potential.

Wafer—Also called a slice or substrate. A thin slice of semiconductor material, such as a crystalline silicon, used in electronics for the fabrication of integrated circuits and in photovoltaics for conventional, wafer-based solar cells.

Wearables—Also called wearable technology; pertains to a category of technology devices that can be worn by a customer and often include tracking information related to fitness and health. Wearable gadgets include devices that have small motion sensors.

Wire—A usually pliable metallic strand manufactured in many lengths and diameters. It is sometimes clad and often electrically insulated, and is used mainly to conduct electricity.

Wire bonding—The method of making interconnections between an integrated circuit or other semiconductor device and is packaging during semiconductor device fabrication.

Wireless—Use of radio waves to connect devices to the internet. In terms of telecommunications, radio signals that make it possible for devices such as mobile and smartphones to connect with each other.

Wireline—Network with interlinked connection and redistribution systems that allows information, such as voice, data, and internet, to travel electronically.

INDUSTRY REFERENCES

PERIODICALS

Evertiq
evertiq.com
News network that delivers market and financial news about the electronics design and manufacturing supply chain.

Semiconductor Industry Association's (SIA) Global Sales Report
semiconductors.org
Covers the three-month moving average of semiconductor sales activity tabulated by the World Semiconductor Trade Statistics (WSTS) organization.

Liberty Street Economics
libertystreeteconomics.newyorkfed.org
Features insight and analysis from New York Fed ecopnomists working at the intersection of research and policy.

TRADE ASSOCIATIONS

Association Connecting Electronics Industries (IPC)
ipc.org
A trade association for participants in the electronics industry including designers, board manufacturers, assembly companies, suppliers, and OEMs. IPC releases industry data for printed circuit board (PCB).

Electronic Components Industry Association (ECIA)
ecianow.org
Consolidation of National Electronic Distributors Association (NEDA) and Electronic Component Association (ECA). This helps blend all elements of the electronic components supply chain, including manufacturers, distributors, and independent manufacturer representatives.

Semiconductor Equipment and Materials International (SEMI)
semi.org
Global trade association for the micro- and nano-electronics manufacturing supply chain. Provides the "Book-to-Bill Report," which includes the book-to-bill ratio of the semiconductor manufacturing segment.

MARKET RESEARCH AND CONSULTING FIRMS

Allied Market Research
alliedmarketresearch.com
A market research and advisory company providing business insights and market research reports.

Bain and Co.
bain.com
A global management consulting firm that publishes industry analysis and estimates on China's semiconductor market.

The Conference Board Inc. (CB)
conference-board.org
A private research organization that publishes The Conference Board Leading Economic Index (LEI), which has shown some accuracy in predicting PC sales.

Custer Consulting Group
custerconsulting.com
Provides market research, news, business analyses, and forecasts for the electronic equipment segment.

Gartner, Inc.
gartner.com/technology/home.jsp
Provides worldwide market coverage on various sectors of information technology, including semiconductors, computer systems and peripherals, communications, document management, software, and services.

IDTechEx
idtechex.com
A research and consulting firm that specializes in latest technology trends including 3D printing, RFID, and flexible displays. Publishes analysis and forecast regarding the OLED market.

IHS Markit
ihs.com
A global information company, providing in-depth research in energy, economics, technology, automotive, and supply chain management.

Institute for Supply Management (ISM)
instituteforsupplymanagement.org
Not-for-profit association providing national and international leadership in purchasing and supply management research and education; publishes monthly ISM Report on Business.

International Federation of Robotics (IFR)
ifr.org
International non-profit organization that promotes the robotic industry and provides worldwide robotic and automation market data.

International Data Corp. (IDC)
idc.com
Leading provider of information technology data, analysis, and consulting.

McKinsey & Company
mckinsey.com
An American worldwide management consulting firm that advises on strategic management to corporations, governments, and other organizations.

Research and Markets
researchandmarkets.com
World's largest market research store and offers insight into over 800 industries.

GOVERNMENT AGENCIES

Board of Governors of the Federal Reserve System
federalreserve.gov
The Federal Reserve releases reports on industrial production and capacity utilization for semiconductor and other electronic component manufacturing in the U.S.

U.S. Bureau of Economic Analysis (BEA)
bea.gov
Agency within the U.S. Department of Commerce; its mandate is to collect economic data.

COMPARATIVE COMPANY ANALYSIS

Operating Revenues

Ticker		Company		Yr. End	Million $ 2021	2020	2019	2018	2017	2016	2015	CAGR (%) 10-Yr.	5-Yr.	1-Yr.	Index Basis (2013=100) 2021	2020	2019	2018	2017	2016
ELECTRONIC EQUIPMENT AND INSTRUMENTS																				
AEIS	§	ADVANCED ENERGY INDUSTRIES, INC.		DEC	1,456.0	1,415.8	788.9	718.9	671.0	483.7	414.8	10.9	24.7	2.8	351	341	190	173	162	117
ARLO	§	ARLO TECHNOLOGIES, INC.		DEC	435.1	357.2	370.0	464.9	370.7	184.6	184.6	NA	18.7	21.8	236	193	200	252	201	100
BMI	§	BADGER METER, INC.		DEC	505.2	425.5	424.6	433.7	402.4	393.8	377.7	6.7	5.1	18.7	134	113	112	115	107	104
CGNX	†	COGNEX CORPORATION		DEC	1,037.1	811.0	725.6	806.3	766.1	529.5	450.6	12.4	14.4	27.9	230	180	161	179	170	118
FARO	§	FARO TECHNOLOGIES, INC.		DEC	337.8	303.8	381.8	403.6	360.9	325.6	317.5	2.9	0.7	11.2	106	96	120	127	114	103
ITRI	§	ITRON, INC.		DEC	1,981.6	2,173.4	2,502.5	2,376.1	2,018.2	2,013.2	1,883.5	-2.0	-0.3	-8.8	105	115	133	126	107	107
KEYS	[]	KEYSIGHT TECHNOLOGIES, INC.		OCT	4,941.0	4,221.0	4,303.0	3,878.0	3,189.0	2,918.0	2,856.0	4.1	11.1	17.1	173	148	151	136	112	102
NATI	†	NATIONAL INSTRUMENTS CORPORATION		DEC	1,469.7	1,286.7	1,353.2	1,359.1	1,289.4	1,228.2	1,225.5	3.7	3.7	14.2	120	105	110	111	105	100
OSIS	§	OSI SYSTEMS, INC.		JUN	1,146.9	1,166.0	1,182.1	1,089.3	961.0	829.7	958.2	5.7	6.7	-1.6	120	122	123	114	100	87
TDY	[]	TELEDYNE TECHNOLOGIES INCORPORATEI	#	JAN	0.0	4,614.3	3,163.6	2,901.8	2,603.8	2,603.8	2,149.9	9.0	16.5	49.5	0	215	147	135	121	121
TRMB	[]	TRIMBLE INC.		DEC	3,659.1	3,659.1	3,147.7	3,108.4	2,646.5	2,362.1	2,362.1	8.3	9.1	16.2	155	155	133	132	112	100
VNT	†	VONTIER CORPORATION		DEC	2,990.7	2,704.6	2,772.1	2,665.9	2,498.2	2,388.1	2,388.1	NA	4.6	10.6	125	113	116	112	105	100
ZBRA	[]	ZEBRA TECHNOLOGIES CORPORATION		DEC	5,627.0	4,448.0	4,485.0	4,218.0	3,722.0	3,574.0	3,650.0	19.1	9.5	26.5	154	122	123	116	102	98
ELECTRONIC COMPONENTS																				
APH	[]	AMPHENOL CORPORATION		DEC	10,876.3	8,598.9	8,225.4	8,202.0	7,011.3	6,286.4	5,568.7	10.7	11.6	26.5	195	154	148	147	126	113
BDC	†	BELDEN INC.		DEC	2,408.1	1,862.7	2,131.3	2,165.7	2,087.2	2,356.7	2,309.2	2.5	0.4	29.3	104	81	92	94	90	102
GLW	[]	CORNING INCORPORATED		DEC	14,082.0	11,303.0	11,503.0	11,290.0	10,116.0	9,390.0	9,111.0	6.0	8.4	24.6	155	124	126	124	111	103
IIVI	†	II-VI INCORPORATED		JUN	3,105.9	2,380.1	1,362.5	1,158.8	972.0	827.2	742.0	20.0	30.3	30.5	419	321	184	156	131	111
KN	§	KNOWLES CORPORATION		DEC	868.1	764.3	854.8	826.9	744.2	755.7	753.6	-1.2	2.8	13.6	115	101	113	110	99	100
LFUS	†	LITTELFUSE, INC.	#	JAN	0.0	1,445.7	1,503.9	1,718.5	1,221.5	1,056.2	1,056.2	12.1	14.5	43.9	0	137	142	163	116	100
ROG	§	ROGERS CORPORATION		DEC	932.9	802.6	898.3	879.1	821.0	656.3	641.4	5.5	7.3	16.2	145	125	140	137	128	102
VSH	†	VISHAY INTERTECHNOLOGY, INC.		DEC	3,240.5	2,501.9	2,668.3	3,034.7	2,599.4	2,317.3	2,300.5	2.3	6.9	29.5	141	109	116	132	113	101

ELECTRONIC MANUFACTURING SERVICES																			
BHE	§	BENCHMARK ELECTRONICS, INC.		DEC	2,255.3	2,053.1	2,268.1	2,566.5	2,454.5	2,322.3	2,540.9	0.0	-0.6	9.8	89	81	89	101	97	91
CTS	§	CTS CORPORATION		DEC	512.9	424.1	469.0	470.5	423.0	396.7	382.3	6.2	5.3	21.0	134	111	123	123	111	104
FN	§	FABRINET		JUN	1,879.4	1,641.8	1,584.3	1,371.9	1,420.5	976.7	773.6	9.7	14.0	14.5	243	212	205	177	184	126
IPGP	†	IPG PHOTONICS CORPORATION		DEC	1,460.9	1,200.7	1,314.6	1,459.9	1,408.9	1,006.2	901.3	11.9	7.7	21.7	162	133	146	162	156	112
JBL	†	JABIL INC.		AUG	29,285.0	27,266.0	25,282.0	22,095.4	19,063.1	18,353.1	17,899.2	5.9	9.8	7.4	164	152	141	123	107	103
MEI	§	METHODE ELECTRONICS, INC.	#	MAY	1,163.6	1,088.0	1,023.9	1,000.3	908.3	816.5	809.1	9.8	6.1	6.3	144	134	127	124	112	101
PLXS	§	PLEXUS CORP.		OCT	3,368.9	3,390.4	3,164.4	2,873.5	2,528.1	2,556.0	2,654.3	4.2	5.7	-0.6	127	128	119	108	95	96
SANM	§	SANMINA CORPORATION		OCT	6,756.6	6,960.4	8,233.9	7,110.1	6,868.6	6,481.2	6,374.5	0.2	0.8	-2.9	106	109	129	112	108	102
TEL	[]	TE CONNECTIVITY LTD.		SEP	14,923.0	12,172.0	13,448.0	13,988.0	12,185.0	11,352.0	12,233.0	0.8	5.6	22.6	122	100	110	114	100	93
TTMI	§	TTM TECHNOLOGIES, INC.	#	JAN	0.0	2,105.3	2,133.2	2,237.7	2,237.7	2,658.6	2,095.5	4.6	-2.4	6.8	0	100	102	107	107	127
TECHNOLOGY DISTRIBUTORS																			
ARW	†	ARROW ELECTRONICS, INC.		DEC	34,477.0	28,673.4	28,916.8	29,676.8	26,554.6	23,487.9	23,282.0	4.9	8.0	20.2	148	123	124	127	114	101
AVT	†	AVNET, INC.		JUL	19,534.7	17,634.3	19,518.6	19,036.9	17,440.0	16,740.6	17,655.3	-3.0	3.1	10.8	111	100	111	108	99	95
CDW	[]	CDW CORPORATION		DEC	20,820.8	18,467.5	18,032.4	16,240.5	14,832.9	13,672.7	12,988.7	8.0	8.8	12.7	160	142	139	125	114	105
PLUS	§	EPLUS INC.	#	MAR	1,821.0	1,568.3	1,588.4	1,372.7	1,418.8	1,331.8	1,204.2	8.1	5.4	-1.3	151	130	132	114	118	111
NSIT	§	INSIGHT ENTERPRISES, INC.		DEC	9,436.1	8,340.6	7,731.2	7,080.1	6,703.6	5,485.5	5,373.1	6.0	11.5	13.1	176	155	144	132	125	102
CNXN	§	PC CONNECTION, INC.		DEC	2,892.6	2,590.3	2,820.0	2,699.5	2,911.9	2,692.6	2,574.0	3.2	1.4	11.7	112	101	110	105	113	105
SCSC	§	SCANSOURCE, INC.		JUN	3,150.8	3,047.7	3,249.8	3,164.7	3,568.2	3,540.2	3,218.6	1.7	-2.3	3.4	98	95	101	98	111	110
SNX	†	TD SYNNEX CORPORATION		NOV	31,614.2	19,977.2	19,070.0	19,767.9	16,771.1	14,061.8	13,338.4	11.7	17.6	58.3	237	150	143	148	126	105

Note: Data as originally reported. CAGR-Compound annual growth rate.
[]Company included in the S&P 500. †Company included in the S&P MidCap 400. §Company included in the S&P SmallCap 600. #Of the following calendar year.
Souce: S&P Capital IQ.

Net Income

Ticker		Company		Yr. End	Million $ 2021	2020	2019	2018	2017	2016	2015	CAGR (%) 10-Yr.	5-Yr.	1-Yr.	Index Basis (2013=100) 2021	2020	2019	2018	2017	2016
ELECTRONIC EQUIPMENT AND INSTRUMENTS																				
AEIS	§	ADVANCED ENERGY INDUSTRIES, INC.		DEC	134.7	134.7	64.9	147.0	137.9	127.5	-158.5	14.0	1.1	0.0	-85	-85	-41	-93	-87	-80
ARLO	§	ARLO TECHNOLOGIES, INC.		DEC	-56.0	-101.3	-86.0	-75.5	6.5	-13.7	-13.7	NA	32.5	-44.7	408	737	625	549	-48	100
BMI	§	BADGER METER, INC.		DEC	60.9	49.3	47.2	27.8	34.6	32.3	25.9	12.3	13.5	23.4	235	190	182	107	133	125
CGNX	†	COGNEX CORPORATION		DEC	279.9	176.2	203.9	219.3	176.7	143.7	187.1	14.9	14.3	58.9	150	94	109	117	94	77
FARO	§	FARO TECHNOLOGIES, INC.		DEC	-40.0	0.6	-62.1	4.9	-14.5	11.1	12.8	NA	NM	NM	-312	5	-485	38	-113	87
ITRI	§	ITRON, INC.		DEC	-81.3	-58.0	49.0	-99.3	57.3	31.8	12.7	-16.8	NM	40.2	-641	-457	387	-783	452	251
KEYS	[]	KEYSIGHT TECHNOLOGIES, INC.		OCT	894.0	627.0	621.0	165.0	102.0	335.0	513.0	1.3	21.7	42.6	174	122	121	32	20	65
NATI	†	NATIONAL INSTRUMENTS CORPORATION		DEC	89.3	143.7	162.2	155.1	52.4	82.7	95.3	-0.5	1.5	-37.8	94	151	170	163	55	87
OSIS	§	OSI SYSTEMS, INC.		JUN	74.0	75.3	64.8	-29.1	21.1	26.2	65.2	8.3	23.1	-1.6	114	116	99	-45	32	40
TDY	[]	TELEDYNE TECHNOLOGIES INCORPORATED	#	JAN	0.0	445.3	402.3	333.8	227.2	227.2	190.9	5.7	18.5	10.8	0	233	211	175	119	119
TRMB	[]	TRIMBLE INC.		DEC	492.7	492.7	389.9	282.8	118.4	132.4	132.4	12.6	30.1	26.4	372	372	294	214	89	100
VNT	†	VONTIER CORPORATION		DEC	413.0	342.0	436.5	385.5	373.3	304.7	304.7	NA	6.3	20.8	136	112	143	127	123	100
ZBRA	[]	ZEBRA TECHNOLOGIES CORPORATION		DEC	837.0	504.0	544.0	421.0	17.0	-137.0	-158.0	17.0	NM	66.1	-530	-319	-344	-266	-11	87
ELECTRONIC COMPONENTS																				
APH	[]	AMPHENOL CORPORATION		DEC	1,590.8	1,203.4	1,155.0	1,205.0	650.5	822.9	763.5	11.7	14.1	32.2	208	158	151	158	85	108
BDC	†	BELDEN INC.		DEC	63.9	-55.2	-377.0	160.9	93.2	128.0	66.2	-5.6	-13.0	NM	97	-83	-569	243	141	193
GLW	[]	CORNING INCORPORATED		DEC	1,906.0	512.0	960.0	1,066.0	-497.0	3,695.0	1,339.0	-3.8	-12.4	272.3	142	38	72	80	-37	276
IIVI	†	II-VI INCORPORATED		JUN	297.6	-67.0	107.5	88.0	95.3	65.5	66.0	13.7	35.4	NM	451	-102	163	133	144	99
KN	§	KNOWLES CORPORATION		DEC	150.4	6.6	49.1	67.7	68.3	-42.3	-233.8	4.3	NM	2,178.8	-64	-3	-21	-29	-29	18
LFUS	†	LITTELFUSE, INC.	#	JAN	0.0	130.0	139.1	164.6	119.5	104.5	104.5	12.5	22.1	118.3	0	124	133	157	114	100
LFUS	†	ROGERS CORPORATION		DEC	108.1	50.0	47.3	87.7	80.5	48.3	46.3	11.3	17.5	116.3	233	108	102	189	174	104
VSH	†	VISHAY INTERTECHNOLOGY, INC.		DEC	298.0	122.9	163.9	345.8	-20.3	48.8	-108.5	2.2	43.6	142.4	-275	-113	-151	-319	19	-45

ELECTRONIC MANUFACTURING SERVICES																				
BHE	§	BENCHMARK ELECTRONICS, INC.		DEC	35.8	14.1	23.4	22.8	-31.9	63.9	95.4	-3.7	-11.0	154.5	37	15	25	24	-33	67
CTS	§	CTS CORPORATION		DEC	-41.9	34.7	36.1	46.5	14.4	34.4	7.0	NA	NM	NM	-602	499	520	669	208	494
FN	§	FABRINET		JUN	148.3	113.5	121.0	84.2	97.1	61.9	43.6	8.7	19.1	30.7	340	260	277	193	223	142
IPGP	†	IPG PHOTONICS CORPORATION		DEC	278.4	159.6	180.2	404.0	347.6	260.8	242.2	9.0	1.3	74.5	115	66	74	167	144	108
JBL	†	JABIL INC.		AUG	696.0	54.0	287.0	86.3	129.1	254.1	284.0	6.2	22.3	1,188.9	245	19	101	30	45	89
MEI	§	METHODE ELECTRONICS, INC.	#	MAY	102.2	122.3	123.4	91.6	57.2	92.9	84.6	20.2	7.6	-0.9	121	145	146	108	68	110
PLXS	§	PLEXUS CORP.		OCT	138.9	117.5	108.6	13.0	112.1	76.4	94.3	4.5	12.7	18.2	147	125	115	14	119	81
SANM	§	SANMINA CORPORATION		OCT	269.0	139.7	141.5	-95.5	138.8	187.8	377.3	14.6	7.4	92.5	71	37	38	-25	37	50
TEL	[]	TE CONNECTIVITY LTD.		SEP	2,261.0	-241.0	1,844.0	2,565.0	1,683.0	2,009.0	2,420.0	6.1	2.4	NM	93	-10	76	106	70	83
TTMI	§	TTM TECHNOLOGIES, INC.	#	JAN	0.0	177.5	41.3	173.6	173.6	124.2	-25.9	2.7	9.3	-69.4	0	-686	-160	-671	-671	-480
TECHNOLOGY DISTRIBUTORS																				
ARW	†	ARROW ELECTRONICS, INC.		DEC	1,108.2	584.4	-204.1	716.2	402.2	522.8	497.7	6.3	16.2	89.6	223	117	-41	144	81	105
AVT	†	AVNET, INC.		JUL	193.1	-31.1	176.3	-156.4	525.3	506.5	571.9	-11.7	-17.5	NM	34	-5	31	-27	92	89
CDW	[]	CDW CORPORATION		DEC	988.6	788.5	736.8	643.0	523.1	425.1	403.1	50.0	18.4	25.4	245	196	183	160	130	105
PLUS	§	EPLUS INC.	#	MAR	105.6	74.4	69.1	63.2	55.1	50.6	44.7	12.1	10.7	7.7	236	166	154	141	123	113
NSIT	§	INSIGHT ENTERPRISES, INC.		DEC	219.3	172.6	159.4	163.7	90.7	84.7	75.9	8.1	21.0	27.1	289	228	210	216	120	112
CNXN	§	PC CONNECTION, INC.		DEC	69.9	55.8	82.1	64.6	54.9	48.1	46.8	9.3	7.8	25.4	149	119	175	138	117	103
SCSC	§	SCANSOURCE, INC.		JUN	10.8	-192.7	57.6	33.2	69.2	63.6	65.4	-17.5	-29.9	NM	17	-294	88	51	106	97
SNX	†	TD SYNNEX CORPORATION		NOV	395.1	529.2	500.7	300.0	300.2	234.9	208.5	10.1	11.0	-25.3	189	254	240	144	144	113

Note: Data as originally reported. CAGR-Compound annual growth rate.

[]Company included in the S&P 500. †Company included in the S&P MidCap 400. §Company included in the S&P SmallCap 600. #Of the following calendar year.

Souce: S&P Capital IQ.

Ticker		Company		Yr. End	Return on Revenues (%) 2021	2020	2019	2018	2017	2016	Return on Assets (%) 2021	2020	2019	2018	2017	2016	Return on Equity (%) 2021	2020	2019	2018	2017	2016
ELECTRONIC EQUIPMENT AND INSTRUMENTS																						
AEIS	§	ADVANCED ENERGY INDUSTRIES, INC.		DEC	9.3	9.5	8.2	20.5	20.5	26.3	7.4	8.2	4.2	18.0	18.8	22.3	16.0	18.1	8.8	26.1	29.8	35.7
ARLO	§	ARLO TECHNOLOGIES, INC.		DEC	NM	NM	NM	NM	1.8	NM	NM	NM	NM	NM	2.4	NM	NM	NM	NM	NM	6.6	0.0
BMI	§	BADGER METER, INC.		DEC	12.1	11.6	11.1	6.4	8.6	8.2	11.5	10.5	11.2	7.1	8.8	9.2	15.9	14.3	14.9	9.6	13.0	13.2
CGNX	†	COGNEX CORPORATION		DEC	27.0	21.7	28.1	27.2	23.1	27.1	14.0	9.8	10.8	17.0	13.7	13.8	20.8	13.5	16.4	19.7	17.2	16.1
FARO	§	FARO TECHNOLOGIES, INC.		DEC	NM	0.2	NM	1.2	NM	3.4	NM	0.1	NM	1.0	NM	2.6	NM	0.2	NM	1.4	NM	3.3
ITRI	§	ITRON, INC.		DEC	NM	NM	2.0	NM	2.8	1.6	NM	NM	1.8	NM	2.7	2.0	NM	NM	6.8	NM	8.3	5.5
KEYS	[]	KEYSIGHT TECHNOLOGIES, INC.		OCT	18.1	14.9	14.4	4.3	3.2	11.5	11.5	8.7	9.4	2.8	1.7	8.8	25.3	19.9	22.8	7.0	5.3	23.8
NATI	†	NATIONAL INSTRUMENTS CORPORATION		DEC	6.1	11.2	12.0	11.4	4.1	6.7	4.2	7.6	9.8	9.3	3.3	5.5	7.3	12.0	13.4	13.1	4.7	7.5
OSIS	§	OSI SYSTEMS, INC.		JUN	6.5	6.5	5.5	NM	2.2	3.2	5.3	5.9	5.1	NM	1.7	2.6	12.2	13.4	12.4	NM	3.8	4.7
TDY	[]	TELEDYNE TECHNOLOGIES INCORPORATEI	#	JAN	0.0	9.7	13.0	12.7	11.5	8.7	NA	3.1	7.9	8.8	8.8	5.9	0.0	8.2	13.5	16.3	16.0	13.0
TRMB	[]	TRIMBLE INC.		DEC	13.5	12.4	15.8	9.1	4.5	5.6	6.9	5.7	7.7	4.9	2.7	3.6	13.1	11.6	17.8	11.1	5.0	5.8
VNT	†	VONTIER CORPORATION		DEC	13.8	12.6	15.7	14.5	14.9	12.8	9.5	11.1	15.4	12.9	12.9	NA	107.9	34.1	24.2	21.7	0.0	0.0
ZBRA	[]	ZEBRA TECHNOLOGIES CORPORATION		DEC	14.9	11.3	12.1	10.0	0.5	NM	13.5	9.4	11.5	9.7	0.4	NM	32.6	25.3	34.3	38.8	2.1	NM
ELECTRONIC COMPONENTS																						
APH	[]	AMPHENOL CORPORATION		DEC	14.6	14.0	14.0	14.7	9.3	13.1	10.8	9.8	10.7	12.0	6.5	9.7	26.7	24.1	26.9	30.0	17.0	23.8
BDC	†	BELDEN INC.		DEC	2.7	NM	NM	7.4	4.5	5.4	1.9	NM	NM	4.3	2.4	3.4	7.3	6.3	9.3	11.8	7.1	11.2
GLW	[]	CORNING INCORPORATED		DEC	13.5	4.5	8.3	9.4	NM	39.4	6.3	1.7	3.3	3.9	NM	13.2	14.7	3.9	7.1	7.2	NM	20.1
IIVI	†	II-VI INCORPORATED		JUN	9.6	NM	7.9	7.6	9.8	7.9	4.6	NM	5.5	5.0	6.4	5.4	9.6	NM	10.0	9.1	11.3	8.7
KN	§	KNOWLES CORPORATION		DEC	17.3	0.9	5.7	8.2	9.2	NM	8.7	0.4	3.0	4.4	4.4	NM	10.9	0.2	4.0	5.6	0.6	2.0
LFUS	†	LITTELFUSE, INC.	#	JAN	0.0	13.6	9.0	9.2	9.6	9.8	NA	9.0	4.7	5.4	6.3	6.9	0.0	16.2	8.4	9.4	13.7	13.7
ROG	§	ROGERS CORPORATION		DEC	11.6	6.2	5.3	10.0	9.8	7.4	6.8	4.0	3.7	6.9	7.2	4.6	10.1	5.1	5.3	10.9	11.5	7.9
VSH	†	VISHAY INTERTECHNOLOGY, INC.		DEC	9.2	4.9	6.1	11.4	NM	2.1	8.4	3.9	5.3	11.1	NM	1.6	18.0	8.1	11.5	24.6	NM	3.1

ELECTRONIC MANUFACTURING SERVICES																							
BHE	§	BENCHMARK ELECTRONICS, INC.		DEC	1.6	0.7	1.0	0.9	NM	2.8	1.9	0.8	1.3	1.2	NM	3.2	3.6	1.4	2.2	1.8	NM	4.8
CTS	§	CTS CORPORATION		DEC	NM	8.2	7.7	9.9	3.4	8.7	NM	5.5	5.6	8.5	2.7	6.6	NM	8.4	9.2	12.9	4.4	11.5
FN	§	FABRINET		JUN	7.9	6.9	7.6	6.1	6.8	6.3	9.2	8.2	9.6	7.7	9.4	7.2	14.2	12.4	15.1	11.8	15.7	12.0
IPGP	†	IPG PHOTONICS CORPORATION		DEC	19.1	13.3	13.7	27.7	24.7	25.9	8.8	5.4	6.6	15.7	14.7	14.6	10.4	6.4	7.8	19.1	19.4	18.5
JBL	†	JABIL INC.		AUG	2.4	0.2	1.1	0.4	0.7	1.4	4.2	0.4	2.2	0.7	1.2	2.5	35.2	3.1	15.0	4.0	5.3	10.6
MEI	§	METHODE ELECTRONICS, INC.	#	MAY	8.8	11.2	12.1	9.2	6.3	11.4	7.4	8.3	9.0	7.4	6.2	13.2	11.2	14.4	16.8	13.9	9.8	18.4
PLXS	§	PLEXUS CORP.		OCT	4.1	3.5	3.4	0.5	4.4	3.0	5.6	5.1	5.4	0.7	5.7	4.3	13.9	12.7	12.2	1.3	11.5	8.7
SANM	§	SANMINA CORPORATION		OCT	4.0	2.0	1.7	NM	2.0	2.9	6.4	3.7	3.6	NM	3.6	5.2	15.3	8.5	9.1	NM	8.5	12.0
TEL	[]	TE CONNECTIVITY LTD.		SEP	15.2	NM	13.7	18.3	13.8	17.7	10.5	NM	9.4	12.6	8.7	11.4	22.3	NM	18.2	25.1	16.9	20.4
TTMI	§	TTM TECHNOLOGIES, INC.	#	JAN	0.0	2.4	8.4	1.9	7.8	4.7	NA	1.8	6.1	1.2	5.0	4.5	0.0	3.8	NM	2.5	12.1	13.6
TECHNOLOGY DISTRIBUTORS																							
ARW	†	ARROW ELECTRONICS, INC.		DEC	3.2	2.0	NM	2.4	1.5	2.2	5.7	3.4	NM	4.0	2.4	3.7	21.2	11.7	NM	13.9	8.6	12.1
AVT	†	AVNET, INC.		JUL	1.0	NM	0.9	NM	3.0	3.0	2.2	NM	2.1	NM	5.4	4.5	4.9	NM	4.0	NM	5.3	8.3
CDW	[]	CDW CORPORATION		DEC	4.7	4.3	4.1	4.0	3.5	3.1	7.5	8.4	9.2	9.0	7.5	6.1	98.7	69.9	76.1	65.6	51.5	39.7
PLUS	§	EPLUS INC.	#	MAR	5.8	4.7	4.3	4.6	3.9	3.8	9.1	6.9	7.6	8.0	7.3	6.8	17.3	14.2	15.2	15.9	15.3	15.2
NSIT	§	INSIGHT ENTERPRISES, INC.		DEC	2.3	2.1	2.1	2.3	1.4	1.5	4.7	4.0	3.8	5.9	3.4	3.8	15.4	13.8	14.8	17.9	11.6	12.1
CNXN	§	PC CONNECTION, INC.		DEC	2.4	2.2	2.9	2.4	1.9	1.8	6.5	5.5	8.8	8.0	7.3	7.0	10.6	9.0	14.6	12.8	12.0	11.7
SCSC	§	SCANSOURCE, INC.		JUN	0.3	NM	1.8	1.0	1.9	1.8	0.6	NM	2.8	1.7	4.0	4.3	6.4	NM	7.3	4.2	8.6	8.0
SNX	†	TD SYNNEX CORPORATION		NOV	1.2	2.6	2.6	1.5	1.8	1.7	1.4	3.9	4.3	2.6	3.9	4.5	6.5	8.2	10.0	10.5	14.1	12.4

Note: Data as originally reported. CAGR-Compound annual growth rate.

[]Company included in the S&P 500. †Company included in the S&P MidCap 400. §Company included in the S&P SmallCap 600. #Of the following calendar year.

Souce: S&P Capital IQ.

				Current Ratio						Debt/Capital Ratio (%)						Debt as a % of Net Working Capital					
Ticker		Company	Yr. End	2021	2020	2019	2018	2017	2016	2021	2020	2019	2018	2017	2016	2021	2020	2019	2018	2017	2016
ELECTRONIC EQUIPMENT AND INSTRUMENTS																					
AEIS	§	ADVANCED ENERGY INDUSTRIES, INC.	DEC	3.1	3.3	2.7	5.2	5.6	4.6	30.1	27.2	32.2	0.0	0.0	0.0	47.4	44.5	58.8	0.0	0.0	0.0
ARLO	§	ARLO TECHNOLOGIES, INC.	DEC	1.4	1.5	1.6	1.8	1.9	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BMI	§	BADGER METER, INC.	DEC	3.2	3.3	3.5	2.7	1.7	2.0	0.0	0.0	1.4	6.0	16.1	14.8	0.0	0.0	3.1	17.3	68.0	50.5
CGNX	†	COGNEX CORPORATION	DEC	3.4	4.5	5.0	8.5	5.6	8.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FARO	§	FARO TECHNOLOGIES, INC.	DEC	2.8	3.0	3.0	3.2	3.9	4.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ITRI	§	ITRON, INC.	DEC	1.5	1.7	1.5	1.4	1.7	1.8	28.3	51.8	53.8	57.4	42.5	30.9	181.1	237.5	286.2	405.9	173.8	91.0
KEYS	[]	KEYSIGHT TECHNOLOGIES, INC.	OCT	2.9	3.1	3.2	1.6	2.7	2.9	32.1	35.2	37.3	34.7	46.9	41.9	70.9	78.0	80.8	140.9	150.1	90.3
NATI	†	NATIONAL INSTRUMENTS CORPORATION	DEC	2.1	2.2	3.1	3.6	3.3	3.2	19.7	7.0	0.0	0.0	0.0	2.2	61.7	19.7	0.0	0.0	0.0	4.4
OSIS	§	OSI SYSTEMS, INC.	JUN	2.1	1.9	1.7	1.5	1.9	1.5	30.2	38.9	42.7	49.0	42.5	24.0	75.8	113.4	133.6	174.6	112.3	69.9
TDY	[]	TELEDYNE TECHNOLOGIES INCORPORATEI#	JAN	0.0	1.6	2.3	1.7	1.5	1.9	NA	35.0	17.5	21.6	21.5	35.4	NA	440.3	71.0	136.2	155.0	226.9
TRMB	[]	TRIMBLE INC.	DEC	1.2	1.0	1.0	1.0	1.7	1.4	24.7	26.4	34.2	39.0	24.5	17.5	493.6	NM	7,554.4	5,051.0	145.9	168.5
VNT	†	VONTIER CORPORATION	DEC	1.6	1.4	1.2	1.2	1.2	0.0	81.9	90.9	2.2	12.0	10.4	NA	474.9	525.4	26.3	143.4	196.4	NA
ZBRA	[]	ZEBRA TECHNOLOGIES CORPORATION	DEC	0.9	0.7	0.9	0.9	1.1	1.3	23.6	29.8	37.2	51.8	72.4	77.1	NM	NM	NM	NM	3,477.8	978.4
ELECTRONIC COMPONENTS																					
APH	[]	AMPHENOL CORPORATION	DEC	2.4	2.4	2.0	1.9	2.9	2.2	42.9	40.0	41.1	40.8	46.7	41.4	136.6	114.1	154.1	132.4	115.1	134.7
BDC	†	BELDEN INC.	DEC	2.0	2.1	1.9	1.8	2.0	2.6	60.4	67.5	59.8	51.3	52.1	52.6	195.1	272.4	219.7	270.1	225.2	178.3
GLW	[]	CORNING INCORPORATED	DEC	1.6	2.1	2.1	2.1	2.8	3.3	35.2	36.6	36.5	30.2	23.2	16.9	239.1	182.4	189.2	161.0	84.7	58.0
IIVI	†	II-VI INCORPORATED	JUN	4.1	2.7	3.0	3.2	3.8	3.4	24.1	51.3	28.1	29.0	26.3	21.6	57.1	195.9	81.7	79.8	62.2	52.3
KN	§	KNOWLES CORPORATION	DEC	2.3	1.4	2.6	2.6	2.6	1.9	4.6	0.0	10.8	11.5	14.5	22.2	32.7	0.0	66.2	70.8	79.2	213.7
LFUS	†	LITTELFUSE, INC. #	JAN	0.0	2.9	4.4	4.5	3.5	3.5	NA	24.4	29.9	30.9	31.7	34.5	NA	73.2	73.0	85.9	92.9	86.2
ROG	§	ROGERS CORPORATION	DEC	3.6	4.3	4.6	4.5	4.0	4.5	14.5	2.4	11.7	21.2	14.6	27.1	45.2	6.9	34.1	60.3	38.4	66.0
VSH	†	VISHAY INTERTECHNOLOGY, INC.	DEC	2.9	3.0	3.3	2.8	3.9	4.1	20.7	20.0	25.1	26.3	20.5	18.5	34.6	34.8	42.2	43.4	22.7	25.4

ELECTRONIC MANUFACTURING SERVICES																						
BHE	§	BENCHMARK ELECTRONICS, INC.		DEC	2.1	2.5	2.6	2.6	3.4	3.7	11.7	11.5	11.8	11.2	12.3	13.0	18.6	17.8	18.4	16.4	16.3	18.2
CTS	§	CTS CORPORATION		DEC	2.5	2.2	2.4	2.3	2.3	2.2	9.8	11.7	19.8	11.7	18.2	22.1	28.8	43.8	71.0	36.9	58.2	76.6
FN	§	FABRINET		JUN	3.0	3.4	3.3	3.2	2.6	2.6	2.4	3.9	6.3	7.6	8.2	7.2	3.0	4.9	8.1	10.4	11.8	10.2
IPGP	†	IPG PHOTONICS CORPORATION		DEC	7.5	10.0	9.9	7.3	8.8	8.2	0.6	1.3	1.6	1.9	2.2	2.4	0.8	1.8	2.2	2.7	2.9	3.3
JBL	†	JABIL INC.		AUG	1.0	1.0	1.0	1.0	1.0	1.1	57.4	59.6	53.1	55.9	40.4	45.8	1,487.1	3,540.8	NM	781.5	NM	739.9
MEI	§	METHODE ELECTRONICS, INC.	#	MAY	3.3	3.0	3.9	2.5	3.5	4.3	17.8	19.7	30.1	28.6	8.3	4.8	44.8	49.9	79.8	101.6	14.5	6.7
PLXS	§	PLEXUS CORP.		OCT	1.7	1.8	1.8	2.1	1.8	2.2	12.7	13.4	14.2	13.9	2.5	16.7	18.7	19.5	21.2	19.1	3.7	23.5
SANM	§	SANMINA CORPORATION		OCT	1.9	1.9	1.7	1.3	1.6	1.7	14.6	16.8	17.4	15.4	23.4	22.5	21.2	25.4	28.0	37.4	47.6	47.1
TEL	[]	TE CONNECTIVITY LTD.		SEP	1.6	1.6	1.6	1.4	1.5	1.6	25.2	27.2	24.5	22.5	27.7	30.6	139.1	169.1	170.3	175.3	179.4	218.8
TTMI	§	TTM TECHNOLOGIES, INC.	#	JAN	0.0	2.5	2.4	1.4	1.8	1.7	NA	38.9	37.3	49.2	54.5	49.0	NA	109.2	117.4	312.6	274.9	194.3
TECHNOLOGY DISTRIBUTORS																						
ARW	†	ARROW ELECTRONICS, INC.		DEC	1.4	1.4	1.5	1.5	1.6	1.5	30.0	29.3	36.9	40.5	37.7	39.0	49.9	52.9	65.0	72.4	67.1	76.9
AVT	†	AVNET, INC.		JUL	2.3	2.8	2.7	2.6	3.1	1.8	23.0	27.7	25.5	25.1	25.7	24.2	29.6	35.2	33.1	33.4	35.0	36.0
CDW	[]	CDW CORPORATION		DEC	1.3	1.5	1.2	1.4	1.3	1.4	96.6	85.0	87.5	86.9	88.4	89.1	521.2	213.2	440.6	363.6	424.2	396.5
PLUS	§	EPLUS INC.	#	MAR	2.0	1.7	1.7	1.7	1.6	1.6	23.1	20.1	34.2	29.1	31.9	40.1	35.5	36.8	63.9	54.7	56.9	64.8
NSIT	§	INSIGHT ENTERPRISES, INC.		DEC	1.4	1.4	1.6	1.5	1.5	1.4	36.0	44.6	55.0	42.2	54.0	25.9	63.9	83.6	95.3	62.1	76.6	35.8
CNXN	§	PC CONNECTION, INC.		DEC	2.5	2.5	2.5	2.6	2.5	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SCSC	§	SCANSOURCE, INC.		JUN	1.7	1.7	2.1	1.9	2.0	2.1	16.2	24.5	26.3	22.3	10.4	9.0	29.1	45.5	42.1	38.2	15.6	11.9
SNX	†	TD SYNNEX CORPORATION		NOV	1.2	1.6	1.6	1.4	1.4	1.6	34.4	26.6	42.3	44.4	33.3	23.5	116.7	49.5	96.6	121.9	67.0	40.0

Note: Data as originally reported. CAGR-Compound annual growth rate.
[]Company included in the S&P 500. †Company included in the S&P MidCap 400. §Company included in the S&P SmallCap 600. #Of the following calendar year.
Souce: S&P Capital IQ.

Ticker		Company		Yr. End	Price/Earnings Ratio (High-Low) 2021	2020	2019	2018	2017	2016	Dividend Payout Ratio (%) 2021	2020	2019	2018	2017	2016	Dividend Yield (High-Low, %) 2021	2020	2019	2018	2017	2016
ELECTRONIC EQUIPMENT AND INSTRUMENTS																						
AEIS	§	ADVANCED ENERGY INDUSTRIES, INC.		DEC	35 - 23	29 - 10	42 - 24	21 - 10	27 - 16	18 - 8	11.4	0.0	0.0	0.0	0.0	0.0	0.6 - 0.4	0.5 - 0.3	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0
ARLO	§	ARLO TECHNOLOGIES, INC.		DEC	NM - NM	NM - NM	NM - NM	NM - NM	NA - NA	NA - NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0
BMI	§	BADGER METER, INC.		DEC	53 - 43	55 - 25	41 - 29	59 - 43	43 - 29	34 - 24	36.4	41.2	39.4	58.5	41.1	38.6	1.1 - 0.7	0.9 - 0.7	1.6 - 0.9	1.3 - 1.0	1.3 - 1.0	1.3 - 1.0
CGNX	†	COGNEX CORPORATION		DEC	59 - 46	81 - 38	48 - 30	55 - 27	71 - 31	38 - 17	15.5	22.2	17.2	14.5	16.4	17.5	0.6 - 0.3	0.3 - 0.2	0.6 - 0.3	0.6 - 0.4	0.5 - 0.3	0.5 - 0.2
FARO	§	FARO TECHNOLOGIES, INC.		DEC	NM - NM	2089 - 1025	NM - NM	239 - 134	NM - NM	60 - 32	0.0	0.0	0.0	0.0	0.0	0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0
ITRI	§	ITRON, INC.		DEC	NM - NM	NM - NM	69 - 37	NM - NM	54 - 40	79 - 36	0.0	0.0	0.0	0.0	0.0	0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0
KEYS	[]	KEYSIGHT TECHNOLOGIES, INC.		OCT	38 - 22	33 - 23	31 - 16	75 - 47	78 - 56	17 - 11	0.0	0.0	0.0	0.0	0.0	0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0
NATI	†	NATIONAL INSTRUMENTS CORPORATION		DEC	70 - 57	42 - 19	39 - 31	45 - 34	114 - 76	48 - 40	160.2	95.0	81.3	78.4	209.0	124.4	3.6 - 2.4	2.8 - 2.2	4.9 - 2.2	2.6 - 1.9	2.3 - 1.7	2.7 - 1.8
OSIS	§	OSI SYSTEMS, INC.		JUN	25 - 16	28 - 13	32 - 19	NM - NM	73 - 49	71 - 37	0.0	0.0	0.0	0.0	0.0	0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0
TDY	[]	TELEDYNE TECHNOLOGIES INCORPORATEI	#	JAN	38 - 20	35 - 20	22 - 16	21 - 13	20 - 12	20 - 14	0.0	0.0	0.0	0.0	0.0	0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0
TRMB	[]	TRIMBLE INC.		DEC	49 - 34	43 - 14	22 - 15	40 - 27	91 - 62	58 - 36	0.0	0.0	0.0	0.0	0.0	0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0
VNT	†	VONTIER CORPORATION		DEC	15 - 12	17 - 13	NA - NA	NA - NA			3.1	0.0	0.0	0.0	0.0	0.0	0.5 - 0.3	0.3 - 0.3	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0
ZBRA	[]	ZEBRA TECHNOLOGIES CORPORATION		DEC	39 - 24	41 - 17	26 - 15	23 - 13	362 - 258	NM - NM	0.0	0.0	0.0	0.0	0.0	0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0
ELECTRONIC COMPONENTS																						
APH	[]	AMPHENOL CORPORATION		DEC	33 - 23	33 - 17	28 - 19	24 - 19	43 - 31	26 - 17	21.8	24.7	24.2	21.1	31.5	21.0	1.3 - 0.9	1.0 - 0.7	1.5 - 0.9	1.2 - 0.9	1.1 - 0.8	1.0 - 0.8
BDC	†	BELDEN INC.		DEC	48 - 28	NM - NM	NM - NM	28 - 12	63 - 47	30 - 14	14.2	NM	NM	26.8	46.5	12.6	0.4 - 0.3	0.5 - 0.3	0.7 - 0.4	0.5 - 0.3	0.4 - 0.2	0.3 - 0.2
GLW	[]	CORNING INCORPORATED		DEC	35 - 27	70 - 33	32 - 24	30 - 22	NM - NM	7 - 5	45.7	153.7	77.3	64.3	NM	17.5	3.4 - 2.3	2.7 - 2.1	5.0 - 2.3	3.0 - 2.1	2.7 - 1.8	2.4 - 1.9
IIVI	†	II-VI INCORPORATED		JUN	40 - 15	NM - NM	30 - 17	38 - 24	26 - 12	22 - 14	6.8	0.0	0.0	0.0	0.0	0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0
KN	§	KNOWLES CORPORATION		DEC	14 - 11	306 - 160	42 - 23	24 - 15	26 - 19	NM - NM	0.0	0.0	0.0	0.0	0.0	0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0
LFUS	†	LITTELFUSE, INC.	#	JAN	25 - 9	38 - 28	42 - 27	33 - 23	30 - 19	25 - 18	0.0	17.5	36.0	32.1	24.3	26.6	0.8 - 0.6	1.8 - 0.8	1.3 - 0.8	1.1 - 0.6	0.9 - 0.7	1.2 - 0.8
ROG	§	ROGERS CORPORATION		DEC	47 - 26	59 - 29	76 - 37	37 - 19	38 - 17	29 - 16	0.0	0.0	0.0	0.0	0.0	0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0
VSH	†	VISHAY INTERTECHNOLOGY, INC.		DEC	13 - 9	27 - 14	20 - 13	11 - 7	NM - NM	50 - 31	18.7	44.7	32.6	13.5	NM	75.3	2.3 - 1.8	2.0 - 1.5	3.2 - 1.6	2.6 - 1.5	2.0 - 1.1	1.7 - 1.1

ELECTRONIC MANUFACTURING SERVICES																				
BHE	§ BENCHMARK ELECTRONICS, INC.		DEC	32 - 23	97 - 38	58 - 34	65 - 41	NM - NM	24 - 14	65.0	163.9	99.4	92.1	0.0	0.0	3.1 - 2.4	2.8 - 2.0	4.3 - 1.6	3.0 - 1.7	2.7 - 2.0	0.0 - 0.0
CTS	§ CTS CORPORATION		DEC	NM - NM	32 - 17	31 - 23	28 - 17	64 - 44	23 - 13	NM	14.9	14.5	11.4	36.4	15.2	0.5 - 0.4	0.5 - 0.4	0.9 - 0.5	0.7 - 0.5	0.6 - 0.4	0.8 - 0.6
FN	§ FABRINET		JUN	24 - 15	22 - 15	19 - 11	21 - 11	19 - 12	22 - 10	0.0	0.0	0.0	0.0	0.0	0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0
IPGP	† IPG PHOTONICS CORPORATION		DEC	50 - 29	74 - 34	53 - 32	35 - 14	38 - 15	21 - 15	0.0	0.0	0.0	0.0	0.0	0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0
JBL	† JABIL INC.		AUG	13 - 7	122 - 52	17 - 12	63 - 49	44 - 29	19 - 13	7.2	92.6	18.1	67.0	46.4	24.6	0.6 - 0.4	1.0 - 0.5	1.7 - 0.7	1.5 - 1.0	1.3 - 1.0	1.6 - 1.0
MEI	§ METHODE ELECTRONICS, INC.	#	MAY	15 - 7	12 - 7	18 - 9	31 - 24	19 - 11	22 - 11	20.0	14.2	13.2	17.8	25.7	14.7	1.4 - 0.9	1.8 - 0.9	1.9 - 1.1	2.1 - 1.0	1.2 - 0.8	1.3 - 0.8
PLXS	§ PLEXUS CORP.		OCT	20 - 14	20 - 9	20 - 14	167 - 133	19 - 14	21 - 13	0.0	0.0	0.0	0.0	0.0	0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0
SANM	§ SANMINA CORPORATION		OCT	10 - 6	17 - 9	17 - 11	NM - NM	23 - 15	12 - 7	0.0	0.0	0.0	0.0	0.0	0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0
TEL	[] TE CONNECTIVITY LTD.		SEP	22 - 14	NM - NM	18 - 13	14 - 11	18 - 13	12 - 10	28.6	NM	33.0	22.9	32.4	25.3	2.0 - 1.2	2.0 - 1.3	3.5 - 1.8	2.5 - 1.8	2.0 - 1.5	2.4 - 1.9
TTMI	§ TTM TECHNOLOGIES, INC.	#	JAN	29 - 17	9 - 5	50 - 23	12 - 8	12 - 4	31 - 14	0.0	0.0	0.0	0.0	0.0	0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0
TECHNOLOGY DISTRIBUTORS																				
ARW	† ARROW ELECTRONICS, INC.		DEC	9 - 6	13 - 5	NM - NM	11 - 8	19 - 15	13 - 8	0.0	0.0	0.0	0.0	0.0	0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0
AVT	† AVNET, INC.		JUL	23 - 13	NM - NM	31 - 21	NM - NM	12 - 9	12 - 10	43.7	NM	49.4	NM	16.9	17.5	2.8 - 2.1	3.4 - 1.9	4.2 - 1.7	2.3 - 1.5	2.0 - 1.6	2.0 - 1.4
CDW	[] CDW CORPORATION		DEC	29 - 18	26 - 14	28 - 15	23 - 16	21 - 15	21 - 13	23.8	27.9	24.9	21.7	20.4	18.5	1.3 - 1.0	1.3 - 0.8	1.9 - 1.1	1.6 - 0.9	1.4 - 0.9	1.3 - 0.9
PLUS	§ EPLUS INC.	#	MAR	19 - 10	19 - 9	22 - 14	24 - 16	18 - 11	17 - 11	0.0	0.0	0.0	0.0	0.0	0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0
NSIT	§ INSIGHT ENTERPRISES, INC.		DEC	17 - 12	15 - 7	16 - 9	12 - 7	19 - 14	18 - 9	0.0	0.0	0.0	0.0	0.0	0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0
CNXN	§ PC CONNECTION, INC.		DEC	21 - 16	26 - 15	17 - 9	17 - 10	15 - 12	16 - 11	0.0	0.0	0.0	0.0	0.0	0.0	2.5 - 1.8	2.3 - 0.6	1.0 - 0.6	1.2 - 0.6	1.4 - 0.8	1.5 - 1.1
SCSC	§ SCANSOURCE, INC.		JUN	78 - 43	NM - NM	19 - 13	35 - 25	16 - 11	18 - 12	0.0	0.0	0.0	0.0	0.0	0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0
SNX	† TD SYNNEX CORPORATION		NOV	26 - 12	16 - 6	13 - 7	20 - 10	18 - 14	20 - 13	12.7	3.9	15.3	19.9	13.9	14.4	1.3 - 0.7	1.0 - 0.0	2.4 - 0.0	1.9 - 1.3	1.9 - 0.9	1.0 - 0.8

Note: Data as originally reported. CAGR-Compound annual growth rate.

[]Company included in the S&P 500. †Company included in the S&P MidCap 400. §Company included in the S&P SmallCap 600. #Of the following calendar year.

Souce: S&P Capital IQ.

Ticker		Company		Yr. End	Earnings per Share ($) 2021	2020	2019	2018	2017	2016	Tangible Book Value per Share ($) 2021	2020	2019	2018	2017	2016	Share Price (High-Low, $) 2021	2020	2019	2018	2017	2016
ELECTRONIC EQUIPMENT AND INSTRUMENTS																						
AEIS	§	ADVANCED ENERGY INDUSTRIES, INC.		DEC	3.5	3.5	1.7	3.7	3.4	3.2	13.3	11.4	7.6	11.8	10.9	8.1	125.6 - 81.7	104.4 - 33.4	72.3 - 40.8	78.0 - 38.7	95.0 - 53.8	57.3 - 24.3
ARLO	§	ARLO TECHNOLOGIES, INC.		DEC	-0.7	-1.3	-1.1	-1.1	0.1	-0.2	1.2	1.5	2.5	3.4	1.7	0.0	10.9 - 5.5	8.9 - 1.2	10.5 - 2.7	23.8 - 8.8	0.0 - 0.0	0.0 - 0.0
BMI	§	BADGER METER, INC.		DEC	2.1	1.7	1.6	1.0	1.2	1.1	7.8	7.3	7.1	5.9	5.2	5.3	112.4 - 89.0	96.0 - 41.5	66.6 - 47.6	57.1 - 41.0	52.1 - 34.4	39.4 - 26.4
CGNX	†	COGNEX CORPORATION		DEC	1.6	1.0	1.2	1.2	1.0	0.8	6.7	5.7	6.2	5.9	5.6	5.0	101.8 - 72.9	83.1 - 35.2	57.3 - 35.6	70.0 - 34.9	73.0 - 31.2	33.0 - 14.0
FARO	§	FARO TECHNOLOGIES, INC.		DEC	-2.2	0.0	-3.6	0.3	-0.9	0.7	12.0	16.1	15.2	16.0	16.5	16.2	97.9 - 63.3	76.2 - 35.2	57.6 - 37.6	70.2 - 38.9	54.4 - 31.9	40.2 - 20.7
ITRI	§	ITRON, INC.		DEC	-1.8	-1.4	1.2	-2.5	1.5	0.8	-1.7	-11.1	-12.8	-16.7	3.5	2.8	122.3 - 59.8	97.8 - 40.5	85.4 - 45.5	77.4 - 44.3	80.0 - 57.8	66.1 - 29.0
KEYS	[]	KEYSIGHT TECHNOLOGIES, INC.		OCT	4.8	3.3	3.3	0.9	0.6	2.0	10.3	7.6	7.0	3.3	-2.3	3.3	209.1 - 129.1	132.6 - 77.9	110.0 - 58.2	70.4 - 41.6	45.7 - 35.1	38.3 - 21.1
NATI	†	NATIONAL INSTRUMENTS CORPORATION		DEC	0.7	1.1	1.2	1.2	0.4	0.6	3.2	4.5	6.4	6.5	5.6	5.8	47.4 - 38.1	47.9 - 20.4	48.2 - 38.0	53.6 - 38.8	46.3 - 29.8	31.2 - 25.9
OSIS	§	OSI SYSTEMS, INC.		JUN	4.0	4.1	3.5	-1.6	1.1	1.3	10.7	7.3	6.1	3.1	11.2	19.1	102.2 - 88.0	102.6 - 50.0	117.2 - 70.2	82.9 - 50.5	96.6 - 53.8	88.3 - 48.2
TDY	[]	TELEDYNE TECHNOLOGIES INCORPORATEI	#	JAN	0.0	10.1	10.6	10.7	9.0	6.3	0.0	-66.5	18.1	6.4	4.2	-6.4	465.4 - 350.0	399.0 - 195.3	351.5 - 198.2	250.9 - 172.8	186.5 - 119.7	129.4 - 73.7
TRMB	[]	TRIMBLE INC.		DEC	1.9	1.6	2.0	1.1	0.5	0.5	-2.2	-3.4	-5.0	-6.4	-1.0	-0.4	96.5 - 65.3	67.9 - 20.0	46.3 - 30.9	45.7 - 29.8	44.0 - 28.6	30.8 - 18.4
VNT	†	VONTIER CORPORATION		DEC	2.4	2.0	2.6	2.3	0.0	0.0	-10.1	-6.9	2.3	0.0	0.0	0.0	37.1 - 28.6	39.0 - 26.4	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0	0.0 - 0.0
ZBRA	[]	ZEBRA TECHNOLOGIES CORPORATION		DEC	15.5	9.4	10.0	7.8	0.3	-2.7	-14.0	-23.3	-19.6	-25.8	-36.3	-40.6	615.0 - 372.5	388.9 - 150.1	260.3 - 146.5	184.8 - 102.8	117.4 - 81.0	88.0 - 46.1
ELECTRONIC COMPONENTS																						
APH	[]	AMPHENOL CORPORATION		DEC	2.5	2.0	1.9	1.9	1.0	1.3	-1.4	-0.1	-1.3	-0.8	-0.8	-0.8	88.4 - 58.6	67.8 - 31.5	54.7 - 37.5	48.8 - 37.6	45.6 - 33.0	34.6 - 22.3
BDC	†	BELDEN INC.		DEC	1.4	-1.2	-9.3	3.1	1.4	2.7	-11.1	-17.7	-13.7	-4.6	-14.0	-11.5	68.9 - 40.2	56.9 - 25.5	64.3 - 40.7	87.1 - 37.8	86.9 - 64.6	81.3 - 36.5
GLW	[]	CORNING INCORPORATED		DEC	1.3	0.5	1.1	1.1	-0.7	3.2	10.6	9.4	9.8	10.5	12.6	14.3	46.8 - 34.8	38.4 - 17.4	35.3 - 26.7	36.6 - 26.1	32.8 - 24.1	25.3 - 16.1
IIVI	†	II-VI INCORPORATED		JUN	2.4	-0.8	1.6	1.4	1.5	1.0	9.0	0.9	10.6	9.9	8.2	6.9	100.4 - 54.4	79.8 - 19.0	43.5 - 26.9	53.1 - 29.3	52.6 - 27.3	32.5 - 16.1
KN	§	KNOWLES CORPORATION		DEC	1.6	0.1	0.5	0.7	0.8	-0.5	4.6	3.4	3.1	3.0	2.2	0.7	23.5 - 17.9	22.2 - 11.1	22.8 - 12.2	18.3 - 10.9	19.9 - 14.1	17.5 - 9.7
LFUS	†	LITTELFUSE, INC.	#	JAN	0.0	11.4	5.3	5.6	6.5	5.2	0.0	22.5	20.4	14.5	11.7	11.9	334.8 - 234.6	256.5 - 103.6	206.0 - 149.8	238.1 - 155.2	215.0 - 146.9	156.5 - 90.6
ROG	§	ROGERS CORPORATION		DEC	5.7	2.7	2.5	4.7	4.3	2.7	30.6	33.9	27.6	22.1	20.2	16.1	274.1 - 147.9	159.3 - 75.7	206.4 - 93.3	184.0 - 89.2	168.1 - 75.9	78.4 - 41.9
VSH	†	VISHAY INTERTECHNOLOGY, INC.		DEC	2.1	0.8	1.1	2.2	-0.1	0.3	10.4	9.3	8.8	8.1	8.5	9.2	26.5 - 19.0	23.3 - 11.2	22.9 - 14.4	26.5 - 16.7	23.5 - 15.4	16.8 - 10.0

ELECTRONIC MANUFACTURING SERVICES																								
BHE	§	BENCHMARK ELECTRONICS, INC.		DEC	1.0	0.4	0.6	0.5	-0.6	1.3	20.4	20.0	20.2	20.7	21.5	21.8	32.6	- 22.3	37.4	- 14.1	35.9	- 20.6	32.5	- 20.0	35.8	- 29.0	31.2	- 18.4
CTS	§	CTS CORPORATION		DEC	-1.3	1.1	1.1	1.4	0.4	1.0	8.8	7.3	6.6	7.5	6.2	5.9	39.5	- 28.7	35.4	- 17.9	34.3	- 25.0	39.2	- 24.1	28.4	- 19.3	24.8	- 12.9
FN	§	FABRINET		JUN	4.0	3.0	3.2	2.2	2.6	1.7	30.1	26.4	23.2	20.1	18.0	15.3	122.5	- 75.7	78.5	- 44.0	65.9	- 42.3	54.7	- 24.0	49.6	- 28.4	46.5	- 21.3
IPGP	†	IPG PHOTONICS CORPORATION		DEC	5.2	3.0	3.4	7.4	6.4	4.9	50.1	46.6	42.4	38.1	35.7	28.3	262.6	- 151.3	227.1	- 98.0	182.2	- 107.5	264.1	- 104.6	248.2	- 95.0	102.9	- 73.6
JBL	†	JABIL INC.		AUG	4.6	0.4	1.8	0.5	0.7	1.3	8.6	6.0	6.6	6.3	8.2	8.3	72.1	- 40.9	45.4	- 17.6	44.2	- 22.9	31.8	- 21.5	31.7	- 22.8	25.1	- 16.8
MEI	§	METHODE ELECTRONICS, INC.	#	MAY	2.7	3.2	3.3	2.4	1.5	2.5	12.8	11.8	8.3	5.2	13.8	14.5	50.2	- 37.3	39.6	- 21.8	41.7	- 22.6	45.5	- 21.0	48.4	- 36.1	44.1	- 23.8
PLXS	§	PLEXUS CORP.		OCT	4.8	3.9	3.5	0.4	3.2	2.2	36.7	33.7	29.6	28.7	30.7	27.4	101.2	- 72.5	86.5	- 35.2	79.6	- 48.2	66.8	- 47.6	64.1	- 49.1	55.0	- 28.7
SANM	§	SANMINA CORPORATION		OCT	4.0	2.0	2.0	-1.4	1.8	2.4	29.2	25.1	23.6	21.3	22.0	22.0	43.6	- 30.6	35.0	- 18.3	34.7	- 22.5	35.6	- 22.3	43.0	- 30.0	37.2	- 16.3
TEL	[]	TE CONNECTIVITY LTD.		SEP	6.8	-0.7	5.4	7.3	4.7	5.4	10.7	7.8	9.7	10.0	6.4	3.1	166.4	- 116.9	121.2	- 48.6	98.0	- 72.2	108.2	- 69.8	97.2	- 66.2	71.9	- 51.7
TTMI	§	TTM TECHNOLOGIES, INC.	#	JAN	0.0	0.5	1.7	0.4	1.4	1.0	0.0	5.6	4.9	2.3	0.8	5.3	15.4	- 11.7	16.3	- 8.1	15.3	- 8.5	19.9	- 9.0	19.5	- 12.8	15.0	- 4.7
TECHNOLOGY DISTRIBUTORS																								
ARW	†	ARROW ELECTRONICS, INC.		DEC	15.1	7.4	-2.4	8.1	4.5	5.7	44.2	36.6	30.7	27.3	25.0	18.9	137.0	- 96.3	100.1	- 39.3	86.6	- 62.4	87.3	- 62.7	84.5	- 68.6	73.2	- 45.2
AVT	†	AVNET, INC.		JUL	1.9	-0.3	1.6	-1.3	4.1	3.8	32.3	29.2	30.0	30.1	30.5	31.8	45.4	- 34.8	43.0	- 17.9	49.0	- 34.6	49.4	- 33.6	48.2	- 35.7	51.5	- 37.1
CDW	[]	CDW CORPORATION		DEC	7.0	5.5	5.0	4.2	3.3	2.6	-39.4	-12.3	-15.3	-14.9	-15.6	-15.4	207.7	- 125.5	147.0	- 73.4	145.0	- 76.1	96.8	- 66.9	71.5	- 50.5	55.5	- 30.4
PLUS	§	EPLUS INC.	#	MAR	3.9	2.8	2.6	2.3	2.0	1.8	18.9	14.7	12.4	10.1	9.8	10.1	69.7	- 40.8	46.2	- 21.3	49.8	- 33.5	53.6	- 32.8	48.9	- 27.1	29.8	- 15.4
NSIT	§	INSIGHT ENTERPRISES, INC.		DEC	6.0	4.9	4.4	4.6	2.5	2.3	24.8	19.0	13.2	20.0	17.1	17.8	107.9	- 74.1	77.3	- 28.3	71.8	- 39.5	56.9	- 32.1	53.2	- 35.3	41.8	- 18.3
CNXN	§	PC CONNECTION, INC.		DEC	2.7	2.1	3.1	2.4	2.0	1.8	23.0	21.2	19.6	16.8	14.8	13.1	55.2	- 40.9	56.3	- 30.1	52.7	- 29.5	43.0	- 22.7	30.5	- 23.5	29.7	- 19.2
SCSC	§	SCANSOURCE, INC.		JUN	0.4	-7.6	2.2	1.3	2.7	2.4	16.0	13.5	19.0	16.9	21.0	24.6	40.8	- 23.5	37.4	- 13.8	40.6	- 26.8	44.3	- 31.4	45.3	- 33.6	43.5	- 27.5
SNX	†	TD SYNNEX CORPORATION		NOV	6.2	10.2	9.7	7.2	7.5	5.9	-9.7	72.9	7.3	-2.9	20.9	30.2	130.9	- 79.1	164.7	- 52.1	131.0	- 76.9	141.9	- 71.8	138.1	- 101.5	128.1	- 75.9

Note: Data as originally reported. CAGR-Compound annual growth rate.

[]Company included in the S&P 500. †Company included in the S&P MidCap 400. §Company included in the S&P SmallCap 600. #Of the following calendar year.

Souce: S&P Capital IQ.

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