

# SEMICONDUCTOR



APR 2020

FOCUSED ON EMERGING SEMICONDUCTOR COMPANIES

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## Startup Profiles

### Axonne

Axonne was founded in early 2018 to develop connectivity solutions for automotive and industrial applications. The company has received funding from Translink Capital. We believe the company is developing automotive ethernet ICs.

Gani Jusuf, Ph.D., Co-Founder and CEO (previously VP of engineering at Marvell)

William Lo, Co-Founder and CTO (previously VP, R&D Datacom Engineering at Marvell)

Sunnyvale, CA  
www.axonne.com

### Ethernovia

Ethernovia was founded in April 2018 to develop high-speed Ethernet solutions for automotive market.

Evolving autonomous technology requires high bandwidth, secure, standardized Ethernet solutions. Advanced Driver-Assistance Systems (ADAS) and increasing sensor bandwidth, driven by high resolution camera growth, is pushing the boundaries of network

bandwidth in the automotive market. Next generation cars require multiple layers of security protection to prevent, detect, and adapt to evolving threats. The auto industry is increasingly adopting Ethernet solutions and 2019 will see the international standardization (IEEE) of multi-gigabit Ethernet bandwidth rates for automotive applications.

Ethernovia is developing an Ethernet system sophisticated enough to process the bandwidth demands of future automotive systems by unifying in-vehicle networks into an end to end Ethernet system. Ethernovia is developing an Ethernet solution that will provide a unified, standards-based solution built to meet automotive functional safety requirements.

Ramin Shirani, co-founder & CEO (previously technical co-founder, Board Member and SVP of Engineering at Aquantia. Before that, GM Ethernet Transceiver Group at Lucent Micro)

Klaas Bult, GM Ethernovia BV and VP Data Acquisition Engineering (Professor, Part-time Technische Universiteit Delft. Previously an Independent Consultant with Analog Design Consult BV and VP & CTO CE at Broadcom)

Christopher Mash, VP of Business Development (previously Senior Dir. Automotive Apps, Product Definition and Architecture at Marvell)

Craig Farnsworth, GM and Senior Dir. of Engineering (previously Senior Director of Digital Design at Peraso)  
Ahmad Tavakoli, Sr. Director, Analog & Mixed-Signal Design (previously Sr. Hardware Engineer at Google and Verily Life Sciences, and Sr. Director of Engineering at Aquantia)

2050 Ringwood Ave Suite B  
San Jose, CA 95131  
www.ethernovia.com

### ONiO

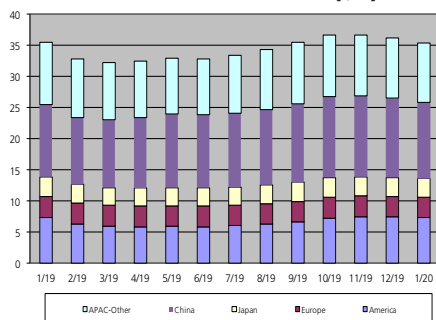
ONiO was founded in 2016 to develop self-powered, battery-free solutions for the healthcare IoT market.

Continuous temperature monitoring is not a recent phenomenon; however, it's not common today because it is labor intensive, expensive, and uncomfortable,

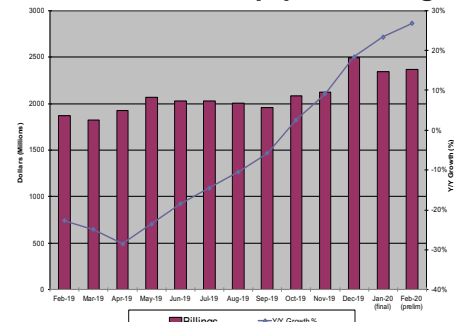
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SIA Global Sales (\$B)



SEMI's N. American Equipment Billings



## Startup Profiles

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leading to the disappearance of fever curves in modern medical care. ONiO has developed the technology to allow everyone to access Continuous Temperature in an affordable, reliable way.

With a smart adhesive patch, hub and app working together, ONiO measures continuous temperature of a fever, incorporates affects from environmental conditions, and creates patterns that can be used to identify the nature of the illness, from serious infections and diseases such as meningitis, malaria and pneumonia to common less dangerous illnesses, distinguishing between bacterial and viral infections.

The ONiO smart patch is a small sensor in an adhesive bandage that attaches to the forehead or other parts of the body. The smart patch securely transmits encrypted health info wirelessly to the ONiO hub for viewing in the mobile app. The app also offers extended features to register when and how much antipyretic drugs is administered and record the general condition of the person using ONiO. The hub also collects useful environmental data that may help care, such as room temperature and humidity.

Running from any type of battery means adding a step-down or boost circuit with

added cost and inefficiency. But ONiO argues that the real issue is shelf life. A shelf life of 5 to 10 years means that 99% of the battery capacity was expended from self-discharge during storage.

The ONiO smart patch is based on ONiO.zero, an ultra-low-power battery-free wireless MCU that uses energy harvesting technology. ONiO.zero supports a wide range of power sources from multi-frequency RF bands supporting GSM and ISM to optional external sources like solar, piezoelectric, thermal and voltaic cells.

The internal RF Rectifier supports multiple frequencies (800/900/1800/1900/2400MHz bands (ISM and GSM) with 40dBm sensitivity and a demodulator chain for RX. The range depends on the frequency and duty cycle of the energy bearer. As one application example, an RF beacon at +18 dBm at 1% TX duty cycle achieves 3 - 5m range. The maximum range at maximum allowed TX level is 10m. The internal power unit supports photovoltaic cells down to 400mV, pizeoelectric and thermal (1.8V to 3.6V).

ONiO.zero integrates a crystal-less BTLE transmitter with programmable output power (-40 to 0dBm), an IEEE 802.15.4 UWB transmitter that runs at 3.5GHz to 10GHz, and an optional 433MHz MICS radio transmitter for medical devices.

The IC has a RISC-V 16/32-bit architecture (RV32EMC) supporting high code density with compressed instructions. It run at 24MHz at 1.8V, 6MHz at 1.0V and 1MHz at 0.8V. From 450mV to 800mV, it supports asynchronous operation from ROM/RAM. The device has a range of peripherals including I2C, SPI, UART, AES module, GPIO, programmable current source, 12-bit ADC and more. It has 1KB of mask ROM, 2KB RAM, and 8/16/32KB ULP Flash with support for 100k writes and reads down to 850mV. While traditional solutions require over 15 external components and inductors, the ONiO.zero needs only 1 external component.

Kjetil Meisalm CEO & Founder (previously Senior Product Marketing Manager at Novelda)

Vemund Kval Bakken, CTO (previously Group Manager for System Architecture Group at Nordic Semiconductor)

Runar Finanger, Chief Marketing Officer & Founder (previously Senior Product Marketing Manager at Novelda)

Tobias Skylstad Kvernebo, Director of Life Sciences

Lille Grensen 3, 0159 Oslo  
Skippergata 14, 7042 Trondheim  
Norway  
onio.com

**wiliot**

VS  
who's better?  
↓

**ONiO®**

ARM cortex M0+ with fixed memory	+	RISK V 24MHz with in system programmable memory
BTLE with fixed payload	+	BTLE and UWB with fully programmable payloads
Targeting only RFID IoT markets	+	Targeting general purpose markets
Targeting RF energy harvesting	+	Targeting RF energy harvesting and others (solar, thermal, piezo and others)
Limited range (1m - 2m)	+	Extended Range up to 10m
Only transmit channel	+	Both transmit & receive channels
No custom programming	+	Custom programming (in system programmable)
Customers forced to Wiliot cloud	+	Open cloud solution
Covering limited (up to 8) sensing profiles	+	Fully flexible unlimited sensing profiles

Source: ONiO

## PETAiO

PETAiO was founded in 2016 to develop SSD controllers for distributed data center applications. Tim Ding, PETAiO Chairman, CEO and founder provided seed funding. The company has offices in Santa Clara, China and South Korea.

The company's first product is Titanium-DC, a PCIe Gen4x4, NVMe 1.4, 8 channel SSD controller delivering 7GB/sec sequential read, 6GB/sec sequential write, 1.2 MIOPS random read and 280 KIOPS sustained random write (assuming 3D-TLC Flash) with burst up to 1.2 MIOPS. Titanium's architecture and implementation achieved the industry's smallest area and power for this class of part, according to the company, with a die size of 29.9 mm<sup>2</sup> in TSMC 16/12nm FinFET, typical power of 2.75W and peak power < 3.5W for an 8TB TLC SSD configuration that can hit 100kIOPS/W random read and 80kIOPS/W random mix. With total read latency of 10uSec, Titanium-DC delivers best-in-class performance at low queue depth for response-time sensitive applications.

Thanks to its '4-able' architecture (Flexible, Scalable, Configurable and Customizable), PETAiO's Titanium roadmap includes an upcoming Titanium-XP with 16 Flash channels and PCIe Gen4x8 for extreme performance and capacity. Titanium-XP will support up to 64TB delivering 10GB/sec sequential read, 8GB/sec sequential write, 2 MIOPS random read and up to 2 MIOPS random write.

The company has also demonstrated the Titanium-XL architecture, which targets low latency Flash and SCM with 2.7uS total ASIC Read latency. PETAiO has completed Titanium-XL SoC design. Development was in concert with a leading NAND OEM partner.

Tim Ding, Chairman, CEO, Founder (Previously co-founder and CEO of TiDAL Systems, a SSD Controller company acquired by Micron in 2016 for ~\$200M. Before that, VP of WW

Sales/Marketing/Customer Services at Link-A-Media, which was acquired by SKHynix for >\$250M)

Lingqi Zeng, Ph.D., VP of Technology (previously a Director at SK Hynix memory solutions where he led an R&D cross functional team in Advanced ECC architecture, Flash memory technology, NAND management and FTL algorithms. Prior to SK Hynix, he was Senior Manager and ECC Architect at Link-A-Media)

Jongman Yoon, VP of Firmware (previously led Samsung SSD FW development team. Also worked at SK Hynix and Toshiba before taking leadership positions at several startups developing SSD)

Fan Yang, VP of ASIC (previously in charge of the CPU subsystem team at SK Hynix Memory Solutions)

Aldo Cometti, VP of Products (previously Senior Director in the CTO office of Western Digital)

4800 Patrick Henry Drive, #110

Santa Clara, CA 95054

Tel: 408.883.7382

PETAiO.com

## Vulcan Semiconductor

Vulcan Semiconductor was founded in 2019 "to create innovative solutions to power the next wave of industrial revolution, spanning robotics, autonomous machines, industrial networking and control." The company has open positions for people with experience in system architecture, ASIC design and verification, networking technology, analog mixed-signal design, motor control, firmware development, AI technologies for sensor, audio, and video data processing.

Ivan Lee, Co-Founder & CEO (previously a VP at Marvell)

Eugene Lee, VP of Engineering & Co-Founder

Lu Chang, Co-Founder (previously Sr. Dir, CTO Office at OmniVision and Sr. Dir, Mobile Products at Marvell)

Santa Clara, CA

vulcansemi.com ■

## People

**ASM International** has appointed **Benjamin Loh** as CEO, President and Chairman, succeeding **Chuck del Prado** who has retired. From the late nineties until 2005 he worked for Oerlikon, lastly as SVP responsible for Asia. After that, he joined Veeco where his last position was EVP responsible for Global Field Operations. He then moved to FEI Company in 2007 where he held various executive positions culminating in COO. In 2015, he joined VAT Vacuum Valves where, as Group Management Board member, he was responsible for worldwide Sales and Marketing until late 2017. Loh's remuneration package consists of a base salary of €630,000 in combination with a long-term share incentive and a short term cash incentive.

**Cyient**, a provider of technology services and solutions, has appointed **Karthikeyan Natarajan** as President and COO. Karthik previously headed the Integrated Engineering Services Business for Tech Mahindra.

**Efinix** has appointed **Harald Werner** as European Sales Director. Werner previously managed European Sales and Field Applications Engineering functions at Lattice. Efinix Trion FPGAs, offering 4K to 200K logic elements, have a small form-factor, low-power, and are priced for high-volume production.

**LeddarTech** has appointed **Stéphane Rousseau** as VP of Global Operations. **Dr. David Cheskis** was appointed VP of Product Line Management. **Michael Poulin**, who has been with LeddarTech for the past ten years, has been appointed VP of Strategic Partnerships and Corporate Development. He previously was VP of Product Line Management. **David Moon** was appointed Director of Automotive Products within the Product Line Management team.

## People

(Continued from page 3)

**MagnaChip's** CFO, EVP and Chief Accounting Officer, **Jonathan Kim**, is stepping down to pursue an executive opportunity outside of the semiconductor industry. The Company has initiated a search to identify a permanent CFO. **Shinyoung Park** has been promoted to Chief Accounting Officer. Ms. Park has been with MagnaChip since 2014, most recently serving as Corporate Controller and as a member of the executive team.

The company's strategic evaluation process continues to make progress, including having discussions with multiple interested parties toward a possible sale of its Foundry business and Fab 4, as well as consideration of accretive business conversions and other options related to that business.

**NXP** has appointed **Kurt Sievers** as President and CEO succeeding **Rick Clemmer**, who has led NXP since 2009. Since September 2018, Sievers has been President of NXP. Sievers joined NXP in 1995, and rapidly moved through a series of Marketing & Sales, Product Definition & Development, Strategy and General Management leadership positions across a broad number of market segments.

**Power Integrations** has named **Anita Ganti** to its board of directors. From 2015 to 2019 she served as SVP of the product engineering services organization of Wipro. From 2013 to 2015, she was VP of global technology at Flex and from 2008 to 2013 she was employed by TI, where she served as GM of the company's precision signal path division.

**SkyWater**, a solely U.S.-based and U.S.-owned, DMEA-accredited Category 1A Trusted Foundry, has appointed **Mark Litecky** as Chief Revenue Officer, a newly created role. Litecky has held executive level

leadership roles at GCM, Interlink Electronics, Soligie (Molex), Starkey Labs, August Technology (Rudolph Technologies), NT International (Entegris), and Rosemount (Emerson Process Controls).

**Western Digital** has appointed **David Goeckeler** as CEO and a member of the Board of Directors. Goeckeler previously served as EVP and GM of Cisco's \$34 billion Networking and Security Business. He succeeds Steve Milligan, who previously announced his intended retirement. ■

## Funding

**Ayar Labs** has received a strategic investment from Lockheed Martin Ventures. The funds will be used to accelerate the commercialization of Ayar's monolithic in-package optical I/O (MIPO) solution for applications that require high bandwidth, low latency and power efficient short reach interconnects. Focused application areas are in AI, High Performance Computing (HPC), and Digital Beamforming radar. Ayar demonstrated its monolithic electronic photonic TeraPHY chiplet at the Supercomputing 2019 conference and is now working with select semiconductor manufacturers, OEM systems builders, and end users on sampling and co-design partnerships in 2020.

**Blickfeld** has completed its Series A financing round led by the VC unit of Continental together with Wachstumsfonds Bayern, which is managed by Bayern Kapital, with participation of existing investors Fluxunit – OSRAM Ventures, High-Tech Gründerfonds, TEV (Tengelmann Ventures) and Unternehmertum Venture Capital Partners.

The solid-state sensor developed by Blickfeld delivers high-resolution, 3D environmental data and stands out due to its high performance, even in

adverse environmental conditions, and its small size. Blickfeld will use the new financial resources to ramp up production, qualify its LiDAR sensors for the automotive market and strengthen the application development and sales teams for industrial markets.

**Graphcore** has secured an additional \$150 million in new capital. The private placement has been made by leading financial asset managers, growth equity funds and investment trusts and includes new investors Baillie Gifford, Mayfair Equity Partners and M&G Investments alongside existing investors including Merian Chrysalis, Ahren Innovation Capital, Amadeus Capital Partners and Sofina. An extension of Graphcore's Series D round, which closed in December 2018, this new D2 round brings the total investment in Graphcore to date to over \$450 million at a valuation of \$1.95 billion. Graphcore is extremely well capitalized, holding over \$300M in cash reserves after this new investment.

Announced public customers include Microsoft, Citadel Securities, Carmot Capital and Qwant. Microsoft Azure IPU-Cloud launched November 2019 and is open for customers. The Dell DSS8440 IPU Server for enterprise datacenter customers launched in November 2019. Graphcore also launched the IPU-Bare Metal Cloud service in partnership with Cirrascale. Demand for Graphcore's Intelligence Processor Unit products is increasing at existing and new customers and the outlook for its business in Fiscal 2020 is extremely positive.

**Hailo**, a provider of Deep Learning processors, has raised \$60 million in Series B funding led by existing investors and joined by key strategic investors including ABB Technology Ventures, NEC and Latitude Ventures. Hailo has raised \$88 million to date. The Hailo-8 Deep Learning processor

for edge devices features up to 26 TOPS performance.

**ON Semi** has drawn down approx. \$1.17 billion from its revolving credit facility. The company has no immediate use of the funds and has made the withdrawal out of abundance of caution to have access to sufficient liquidity in an uncertain macroeconomic environment. With this withdrawal, the company has made full use of its \$1.97 billion revolving line of credit.

**Quantum Machines**, creator of the first complete hardware and software solution for the control and operation of quantum computers, has secured \$17.5M in funding to accelerate the already rapid adoption of the company's Quantum Orchestration Platform. The round was led by Avigdor Willenz and Harel with the participation of previous backers TLV Partners and Battery Ventures. QM's Orchestration Platform has already been adopted by multinational corporations and startups at the forefront of quantum computing, with many new paying customers joining every month.

**SambaNova** has raised \$250 million in Series C funding to further accelerate the software capabilities of its next-gen computing platform. The round was led by BlackRock with participation from existing investors including GV, Intel Capital, Walden International, WRVI Capital and Redline Capital.

SambaNova offers an integrated HW and SW solution with an architecture optimized for dataflow from algorithms to silicon, enabling a broad range of compute-intensive applications to run from the datacenter to the edge. Its reconfigurable dataflow architecture enables applications to drive optimized hardware configurations.

**Sensel**, developer of touch interfaces with PressureGrid™ technology, has closed the second tranche of its Series A financing, bringing the total raised

in this series to \$28 million. Investors include Susquehanna International Group, Morningside Group, SMiT, Palm Commerce Holdings, Chariot Gold, SV Tech Ventures, and Innolinks Ventures. The company has raised more than \$38 million since it was founded in 2013. Earlier investors include Green City Ventures, u.life fund, Waterwood Growth Technology, Stanford-StartX Fund, Inventec, CRCM Ventures, and Tuesday Capital.

Sensel's touch technology offers two functions in a single, ultra-thin sensor: position reporting with high accuracy, and force sensing with the ability to measure force from 1g to 5kg independently for each contact point. It responds to any object (styli, paintbrushes, fingernails), works in virtually any environment (underwater, with heavy gloves), and enables new form factors (foldable, flexible). It can be integrated behind a flexible AMOLED display, a non-display touchpad, steering wheel, or any surface area where a high-resolution force sensing experience is desired. Sensel is working with multiple OEMs to integrate its touch technology into next-gen consumer products.

**SiLC**, developer of integrated single-chip FMCW LiDAR solutions, has closed \$12 million in seed funding led by Dell Technologies Capital. Decent Capital, ITIC Ventures, and several prominent angel investors also participated. SiLC will use the funding to scale its R&D and operations to develop its frequency modulated continuous wave (FMCW) silicon photonic 4D+ Vision Chip platform. SiLC was founded in 2018. Founder and CEO Mehdi Asghari was part of the executive team that led Bookham to its IPO in 2000 and later joined the leadership team at Kotura, which was acquired by Mellanox in 2013.

At CES 2020, SiLC demonstrated the industry's first fully-integrated

FMCW chip and unprecedented long-range LiDAR resolution. Utilizing its second-generation FMCW silicon photonics 4D+ Vision Chip to generate scans, SiLC was able to detect objects smaller than one and a half inches at a range of nearly 200 meters, translating to an effective resolution of around 0.01 degrees vertically and horizontally.

**Transphorm**, a developer of high reliability, high performance gallium nitride (GaN) semiconductors for power conversion, has raised \$21.5 million in a private placement equity financing. The financing was led by existing investors including an affiliate of Kohlberg Kravis Roberts, a new strategic investor, Marelli, and new institutional investors. B. Riley FBR was the lead placement agent and Craig-Hallum Capital Group was the co-placement agent. Montrose Capital Partners was the sponsor. Yole Développement ("Yole") predicts that GaN power device revenues may approach \$400 million by 2023.

Prior to the financing, Transphorm completed a reverse merger with Peninsula Acquisition, a public Delaware corporation, whereby Transphorm became a wholly owned subsidiary of Peninsula. Following the merger, Peninsula changed its name to Transphorm and will continue the historical business of Transphorm. Previous members of Transphorm's Board of Directors, David Kerko, Eiji Yatagawa, Brittany Bagley, Mario Rivas and Dr. Umesh Mishra will remain as directors of the Company. ■

## Mergers & Acquisitions

**ams** confirms the public offer for **OSRAM** is expected to close in Q2'20 subject to receipt of the required remaining regulatory clearances. ams has increased its direct shareholding in OSRAM to 23.4% funded from existing cash resources, which further

## M&A

(Continued from page 5)

demonstrates the commitment to closing.

**Cypress** has been informed by the Committee on Foreign Investment in the United States (CFIUS) that CFIUS has completed its review of Cypress's previously announced merger transaction with **Infinion** and determined that there are no unresolved national security concerns with respect to the proposed merger. The merger remains subject to receipt of regulatory approval from China's State Administration for Market Regulation and other customary closing conditions under the merger agreement.

**Mellanox** has reached a definitive agreement to acquire **Titan IC**, a developer of network intelligence (NI) and security technology to accelerate search and big data analytics across a broad range of applications in data centers worldwide. The acquisition will further strengthen Mellanox's network intelligence capabilities delivered through the company's advanced ConnectX and BlueField families of SmartNIC and I/O Processing Unit (IPU) solutions. Titan IC's team in Belfast, Northern Ireland will become the center of advanced network intelligence R&D for Mellanox. Titan IC has worked with Mellanox for many years to integrate Titan's RXP regular expression processor into Mellanox's advanced line of BlueField IPUs.

**Nokia** plans to acquire **Elenion Technologies**, a U.S.-based company focusing on silicon photonics. Elenion develops highly integrated, low-cost silicon photonics technologies for short-reach and high-performance optical interfaces and has pioneered a design toolset that enables a simplified, low cost, scalable manufacturing process. Elenion's expertise, design platform and services will enable

Nokia to expand its market footprint by addressing the optical connectivity requirements of 5G, cloud and enterprise networking. Elenion was founded in 2014 and is headquartered in New York.

**Silicon Labs** has entered into a definitive asset purchase agreement with **Redpine Signals** to acquire the company's Wi-Fi and Bluetooth business, development center in Hyderabad, India, and extensive patent portfolio for \$308 million in cash. The Redpine Signals acquisition includes an at-scale design center with approximately 200 employees in Hyderabad, India.

The integration of the Redpine Signals technology will accelerate Silicon Labs' roadmap for Wi-Fi 6 silicon, software and solutions. The acquisition also includes Bluetooth Classic IP (including Extended Data Rate) for audio applications including wearables, hearables, voice assistants and smart speakers.

Silicon Labs expects the transaction to add approx. \$20 million in incremental revenue on an annualized basis for FY2020. The transaction will add approximately \$15 million of non-GAAP operating expenses on an annualized basis.

**SK Siltron**, a global maker of semiconductor wafers, has completed the \$450 million acquisition of **DuPont's Silicon Carbide Wafer (SiC Wafer) unit**. The primary site for the business is in Auburn, Mich., about 120 miles north of Detroit. SK Siltron is South Korea's only producer of semiconductor silicon wafers and one of the top five global wafer manufacturers with annual sales of 1.542 trillion won, accounting for about 17% of global silicon wafer sales (based on 300mm). The U.S. subsidiary, established in 2001, sells silicon wafers to eight customers, including Intel and Micron. SK Group is South Korea's third-largest conglomer-

ate with major operating companies in semiconductors, telecom, energy and life sciences.

**ST** has signed an agreement to acquire a majority stake in **Exagan**, a Gallium Nitride (GaN) innovator. Exagan's expertise in epitaxy, product development and application know-how will broaden and accelerate ST's power GaN roadmap and business for automotive, industrial and consumer applications. Terms were not disclosed. The transaction is funded with available cash. The agreement also provides for the acquisition by ST of the remaining minority stake in Exagan 24 months after closing. ■

## Business

**Alchip**, a high-performance ASIC company, has opened its North American headquarters in Milpitas, CA, led by **Hioryuki Nagashima**. Mr. Nagashima previously served in business development and business management roles in Alchip's Japan office.

Alchip will focus on Hyperscalers, OEMs and fabless IC companies. Initial demand has come from server farm and cloud computing companies seeking very tightly defined parameters for AI and ML applications. Alchip was founded in 2003 and is publicly traded on the Taiwan stock exchange. The company has designed ASICs for a number of global Fortune 500 companies headquartered in the Far East, USA, and, more recently, Israel.

**MagnaChip** has updated its financial guidance for the first quarter ending March 31, 2020. The Company raised its anticipated revenue guidance range to \$187 to \$197 million as compared to the previous guidance of \$180 to \$195 million.

**Marvell's** net income includes a pre-tax gain on sale of \$1.1 billion from the **divestiture of the Wi-Fi Connectivity**

**business to NXP.** The Company received \$1.7 billion in cash proceeds. The Company also completed an intra-entity asset transfer of certain of the Company's IP to a subsidiary in Singapore. The internal restructuring resulted in an income tax benefit of approx. \$763 million for Q4'FY20, which primarily captures the tax effect of future deductions.

**X-FAB** is the first pure-play foundry to add internal SiC epitaxy capabilities. X-FAB is committed to further expand its SiC capacity with the 26k wafers per month capacity at its Lubbock, TX facility. By offering an in-house epitaxy capability, X-FAB is taking control of an additional part of the process chain. The company is also undertaking further investments in characterization tools to improve the epi-layer quality and is working with the leading substrate manufacturers to ensure the long-term continuity of supply for essential raw materials.

**Xperi** is raising its first quarter 2020 billings outlook from \$100M-104M to \$108M -110M. Xperi has reached an agreement with **Toshiba** to settle and dismiss the pending litigation between **Tessera** and Toshiba. Xperi has had a business relationship with Toshiba for more than two decades and is pleased to have reached a resolution of this dispute. Terms and conditions of the settlement were not disclosed. ■

## COVID-19

COVID-19 will have a significant effect on the **worldwide semicon-**

**ductor market in 2020**, according to **IDC**. The new IDC report analyzes the impact of the COVID-19 pandemic on the global semiconductor market and provides a framework to evaluate the market impact through four scenarios that assess the range of possible outcomes.

There is nearly an 80% chance for significant contraction in worldwide semiconductor revenues in 2020, instead of a previously expected minor overall growth of 2%. There is still a one-in-five chance that a fast, strong bounce-back from COVID-19 in 2020 is possible. On a global level, the COVID-19 crisis is just beginning, with too many variables to immediately craft a single forecast in response. The impact to technology supply chains in China are significant, but the timing of the recovery is uncertain.

At this time, IDC believes the most likely outcome for this event will be a year-over-year revenue growth rate of -6% for the worldwide semiconductor market in 2020. IDC gives this scenario a 54% probability. Under this scenario, the supply chain will start to recover, and quarantines and travel bans will ease, over the summer. For the worldwide semiconductor market, the impact will be \$25.8 billion.

**AMD** expects the impact from COVID-19 in Q1 to be modest, potentially resulting in revenue coming in at the lower end of guidance of approx. \$1.8 billion, plus or minus \$50 million. Full year 2020 financial guidance remains unchanged.

**Analog Devices** has withdrawn the company's outlook for the fiscal second quarter, ending May 2, 2020 due to the COVID-19 pandemic.

**Applied Materials** is withdrawing its business outlook for Q2 fiscal 2020, ending April 26, 2020, because the evolving worldwide response to COVID-19 is impacting the company's supply chain and manufacturing operations.

**Cohu**, a supplier of back-end semiconductor equipment and services, is withdrawing its fiscal first quarter 2020 financial guidance due to the heightened uncertainty relating to the potential impact of COVID-19. Cohu and several of its key suppliers have manufacturing operations in the areas affected by the governments of Malaysia and the Philippines "movement control" orders.

Cohu manufacturing in Malaysia and the Philippines have received government exemptions to maintain partial operations. However, due to the impact across the supply chain, manufacturing output, other evolving global facility disruptions as well as the uncertainty of future government regulations, Cohu is unable to quantify the impact to its fiscal first quarter 2020 financial guidance.

**FormFactor** is withdrawing its fiscal first quarter 2020 financial outlook. The company is complying with the "shelter-in-place" orders by temporarily ceasing on-site manufacturing at its Livermore and San Jose facilities, which may impact its ability to meet

### 2020 Worldwide Semiconductor Revenue Growth Forecast Scenarios

	Technology Supply Chain Recovery	Global Disruption to Economy & Tech Demand	Impact on Broader Tech Industry & Initiatives
Scenario 1: Decline -12% or more	1-3 months	9-12+ months	9-12+ months
Scenario 2: Decline -3 to -6%	3-9 months	3-9 months	3-9 months
Scenario 3: Growth +2%	1-3 months	3-9 months	3-9 months
Scenario 4: Growth +6% or more	1-3 months	1-3 months	1-3 months

Source: IDC, March 2020

## COVID-19

(Continued from page 7)

its fiscal first quarter 2020 financial outlook.

**Infineon** is withdrawing its outlook for the 2020 fiscal year. Originally the company had anticipated to grow revenues by 5% Y/Y (+/- 2%). The impact of the coronavirus pandemic can result in a deviation from this expectation and can lead to a noticeable decline in revenue compared to the last fiscal year. For the current quarter ending on 31 March, revenue is expected to come in around the lower end of the guided range.

**Lam Research** is withdrawing its prior financial guidance for the fiscal quarter ending March 29, 2020. The California “shelter-in-place” order requires the Company to temporarily stop on-site work at its Fremont and Livermore locations for three weeks. Additionally, Lam has supply chain activities in Malaysia, and the Malaysian government issued an order to close certain business activities temporarily. The implementation of these orders prevents the Company from manufacturing products at its Livermore and Fremont, CA facilities and receiving required parts from key suppliers.

**Microchip** is providing the following business update for Q4’FY20. On February 4, 2020, as part of its Q4’FY20 earnings call, Microchip issued quarterly net sales guidance of up 2% to 9% sequentially, which was a wider than usual range, to reflect uncertainty related to the public health situation in China. Based on its current assessment, Microchip expects net sales for Q4 FY20 to be about flat sequentially.

Business in the Americas and Europe is trending towards original expectations. However, the company sees very weak demand in Asia, especially in

China, driven by COVID-19 fears and customers returning to work at a slower pace than anticipated. Its supply chain is also returning to normal operations at a slower pace than anticipated.

**NXP** provided an update to its Q1’20 revenue guidance due to potential impacts from COVID-19. NXP now believes that its expectations for total revenue in Q1’20 will be reduced due to the impact of coronavirus. NXP has seen lower than expected sell-through and order pushouts in both its distribution channel and with direct customers. NXP has not seen any material order cancellations but currently expect the impact to revenue in Q1 to be in the range of \$50 to \$150 million.

**ON Semi** provided an update to its first quarter 2020 revenue outlook, which incorporates the potential impact of COVID-19. ON Semi anticipates that revenue for Q1’20 will be \$1,275 to \$1,325 million, as compared to earlier guidance of \$1,355 to \$1,405 million. The company saw soft order trends in China in the weeks following Lunar New Year holidays, but orders have since picked up and the company has not seen any significant cancellations. Its factories in China have returned to normal levels of operations after mandatory shutdown following the end of Lunar New Year holidays.

ON Semi intends to take restructuring measures expected to result in annual cost savings of approx. \$90 million during Q1’20 to realign its investments. These targeted cost reductions are structural in nature, and do not impact the company’s ability to respond to a significant recovery in demand.

**Qorvo** provided updated financial guidance for the fiscal 2020 Q4, ending March 28, 2020. On January 29, Qorvo provided March 2020 quarterly revenue guidance of \$800 to \$840 million. Since then, COVID-19 has impacted the smartphone supply chain and

customer demand more than anticipated. Qorvo currently estimates revenue in the March quarter of approx. \$770, or \$50 million below the midpoint. However, the full impact of COVID-19 remains difficult to forecast.

**Silicon Labs** has updated financial guidance for the fiscal first quarter 2020, ending April 4, 2020, due to estimated impacts from COVID-19. The company now expects first quarter revenue to be in the range of \$200 to \$205 million, down from prior guidance of \$209 to \$219 million.

**Silicon Motion** provided an update to its Q1’20 guidance due to potential impacts from the COVID-19 outbreak. Management now expects non-GAAP revenue towards the low-end and non-GAAP gross margin towards the upper-end of the original guidance ranges issued on February 7, 2020. Management originally expected non-GAAP revenue to be in the range of \$130 to \$138 million and non-GAAP gross margin to be in the range of 44% to 46%.

**Skyworks** has updated its outlook for Q2’FY20 ending March 27, 2020 to reflect the unanticipated impact that the COVID-19 outbreak. The company now expects revenue between \$760 and \$770 million, compared to the prior outlook of between \$800 and \$820 million. Although COVID-19 has caused no significant disruption within Skyworks’ manufacturing operations to date, the current demand environment for its products has been negatively impacted by interruptions in global supply chains.

**Veeco** is withdrawing guidance for Q1, ending March 31, 2020 due to the California “shelter-in-place” directive related to the COVID-19 virus which has rendered its San Jose facility and possibly the facilities of certain customers unable to operate until April 7, 2020. ■



## Market Research

**Worldwide sales of semiconductors** were \$35.4 billion for the month of January 2020, a decrease of 0.3% from the January 2019 total of \$35.5 billion and 2.2% less than the December 2019 total of \$36.2 billion, reports the **SIA**.

**Global fab equipment spending** promises to rebound from its 2019 downturn and see a modest recovery this year before a sharp uptick drives record investments in 2021, reports **SEMI**. The report shows a slow recovery in 2020, -3% YoY growth to \$57.8 billion, owing in large part to an 18% expected slump in 1H'20 from 2H'19. The picture should brighten in 2H'20 as a recovery starts to take hold.

The COVID-19 outbreak has eroded fab equipment spending in China in 2020, prompting downward revisions. Despite continuing headwinds from the virus, China equipment spending will grow about 5% YoY to over \$12 billion this year and surge 22% YoY, or \$15 billion, in 2021. Investments by **Samsung**, **SK Hynix**, **SMIC** and **YMTC** will drive the growth.

Powered by **TSMC** and **Micron** investments, Taiwan will be the top region in spending in 2020 with nearly \$14 billion in equipment investments but drop to third in 2021 with over \$13 billion in spending, a 5% decline. In 2020, Korea will rank second in fab equipment spending on the strength of investments by **Samsung** and **SK Hynix**, logging 31% growth, to \$13 billion, before jumping to the top with a 26% advance, to \$17 billion, in 2021. Southeast Asia (mainly Singapore) will also register robust growth (33% YoY, to \$2.2 billion) in 2020 and 26% in 2021.

Of all regions, Europe/Mideast will show the strongest equipment spending growth with a surge of more than 50% to \$3.7 billion in 2020 and match that gain in 2021 on the back of investments

by **Intel**, **STMicro** and **Infineon**. In Japan, fab equipment spending growth will be negligible at almost 2% in 2020 and bump up to nearly 4% in 2021, with investments by **Kioxia/Western Digital**, **Sony** and **Micron** leading the way. Lagging the pack, the Americas will spend less in 2020 than in 2019, with fab equipment investments plunging 24% to \$6.2 billion, and extend the downturn with a 4% decline in 2021.

**EDA industry revenue** increased 2.2% for Q4'19 to \$2,626 million, compared to \$2,570 million in Q4'18, reports the **ESD Alliance**. For 2019, the EDA industry revenue reached \$10.2 billion, an 8.3% increase over 2018 and the tenth consecutive year of growth. Companies that were tracked employed 45,416 professionals in Q4'19, an increase of 6.1% compared to the 42,790 employed in Q4'18, and up 1% compared to Q3'19.

CAE generated revenue of \$874.4 million in Q4'19, a 1% increase compared to Q4'18. IC Physical Design & Verification revenue was \$466.4 million, a 3.9% decrease. PCB & MCM revenue was \$295.3 million, an increase of 19.4%. Semiconductor IP revenue totaled \$900.6 million, a 4% increase. Services revenue was \$89.6 million, a decrease of 15%.

The Americas, EDA's largest region, purchased \$1125.6 million of EDA products and services in Q4'19, a decrease of 2.9% compared to Q4'18. Revenue in EMEA increased 31% to \$445.1 million. Japan revenue decreased 6% to \$211.4 million. APAC revenue decreased 0.2% to \$844.2 million. ■

## Emerging Trends

**Infinera** and **Corning** delivered an 800 Gbps single wavelength with Infinera's sixth-generation Infinite Capacity Engine (ICE6) technology across 800 kilometers on Corning's TXF optical

fiber. The demonstration leveraged Infinera's ICE6 technology in a Groove (GX) Series platform transmitting 800G using 64QAM with probabilistic constellation shaping (PCS). This record-breaking achievement was accomplished using Corning's state-of-the-art TXF fiber, an ITU-T G.654.E compliant, ultra-low-loss, silica-core fiber with large effective area. ICE6 combines Infinera's sixth-generation photonic IC with its in-house-developed 7nm dual-channel 800G per-wave FlexCoherent DSP.

**Intel** has successfully integrated its 1.6 Tbps silicon photonics engine with its 12.8 Tbps programmable Ethernet switch. The co-packaged switch optimized for hyperscale data centers brings together the essential technology building blocks from Intel and its Barefoot Networks Division. The integrated switch package uses a P4-programmable Barefoot Tofino 2 switch ASIC co-packaged with 1.6 Tbps silicon photonics engines from Intel's Silicon Photonics Product Division. Intel acquired Barefoot Networks in 2019 to accelerate its delivery of Ethernet-based fabrics.

The silicon photonics interconnect platform features 1.6 Tbps photonic engines realized as 4 ports of 400GBase-DR4 interfaces. The engines are modular arrays of transceivers built around integrated silicon photonics chips with on-chip lasers and high-speed modulators and detectors, representing the evolution of the silicon photonics platform that has shipped in more than 3 million units of 100G pluggable transceivers and powers the 200G and 400G pluggable modules ramping to volume this year. ■

## Products

**AMD** detailed plans for its next phase of growth driven by multi-generational high-performance CPU and GPU roadmaps and aggressive technology

## Products

(Continued from page 9)

investments. AMD has shipped more than 260 million Zen x86 cores in its Ryzen and EPYC processors. The company plans to introduce the first processors based on its next-gen Zen 3 core in late 2020. The Zen 4 core is currently in design and is targeted to use a 5nm process.

AMD unveiled plans to expand its chiplet and die stacking leadership, including new X3D packaging that combines chiplets and hybrid 2.5D and 3D die stacking to deliver more than a 10x increase in bandwidth density. AMD announced its upcoming 3<sup>rd</sup> gen AMD Infinity Architecture with optimized CPU and GPU memory coherency that can enable significant performance improvements and simplify software programming for accelerated computing by allowing the CPU and GPU to seamlessly and coherently share the same memory.

To address the growing number and diversity of GPU workloads, AMD has a multi-generational roadmap to deliver two optimized graphics architectures for gaming and data center compute markets:

The AMD Radeon DNA (AMD RDNA) architecture was designed for gaming and is currently powering the AMD Radeon RX 5000 series GPUs. The next-gen RDNA 2 architecture is planned to deliver a 50% performance-per-watt improvement. It will support hardware-accelerated ray tracing, variable rate shading and other advanced features. The first RDNA 2-based products are expected to launch in late 2020.

The new AMD Compute DNA (AMD CDNA) architecture is designed to accelerate data center compute workloads. The first-generation CDNA architecture, planned to launch later this year, includes 2<sup>nd</sup> gen AMD Infinity

Architecture to enhance GPU to GPU connectivity and is optimized for machine learning and high-performance computing applications. The follow-up CDNA 2 architecture will support 3<sup>rd</sup> Infinity Architecture to enable next-gen exascale-class supercomputers.

AMD is continuing to gain traction with its 2<sup>nd</sup>-gen EPYC processors. In 2020, AMD expects more than 150 EPYC processor-powered cloud instances and 140 server platforms to be available. AMD expects to ramp its 7nm Zen 2-based 3<sup>rd</sup>-gen Ryzen processors designed for desktops and notebooks across the consumer and commercial segments. AMD is on track to deliver the first Zen 3-based Ryzen product in 2020. Extending the performance of the Radeon RX 5000 series, RDNA 2-based Navi 2X GPUs will bring uncompromised 4K gaming, new features including hardware-based ray tracing support and a significant performance uplift.

**Ampere** has begun shipping the Ampere Altra processor, the first 80-core server CPU and the first cloud native CPU for modern cloud and edge computing data centers. Ampere Altra is the company's next-gen cloud-focused product and first in a new class of CPUs rolling out on an annual basis. The Altra processor delivers 80 cores up to 210W. Altra is a 64-bit Arm processor based on the Arm Neoverse N1 platform and is fabricated on TSMC's advanced N7 process technology.

Altra features up to 80 single-threaded cores in a 1P and 160 cores in a 2P platform. It has 8 channels of DDR4-3200 at 2 DPC, supporting up to 4 TB memory per socket, 128 PCIe Gen4 lanes in 1P and 192 PCIe Gen4 lanes in 2P platforms, CCIX for coherent accelerator attach, and two 128-bit SIMD units.

Ampere Altra is already shipping to customers, including many of the top cloud service providers with both

2-socket and 1-socket platforms available. Altra is sampling now and will be in production in mid-2020.

**Anokiwave** announced the commercial high-volume availability of the industry's most advanced and complete portfolio of Silicon ICs for mmW 5G, according to the company. The latest generation brings a complete RF signal chain solution for all mmW bands in play (24/26 GHz, 28 GHz, and 37/39 GHz) to the market while providing extensive functionality that simplifies the active antenna array design. The scalable architecture underpinning the mmW 5G IC family supports everything from mmW 5G macro-cells to small-cells to customer premises equipment (CPE). Anokiwave's mmW IC portfolio is fabricated in GLOBALFOUNDRIES RF SOI process.

**Cadence** announced that software for Cadence Tensilica HiFi DSPs has been optimized to efficiently execute TensorFlow Lite for Microcontrollers, part of the TensorFlow end-to-end open-source platform for machine learning from Google.

**Cartesian** announced NanoEdge AI Studio, the first IDE that enables machine learning and inference directly on Arm Cortex-M MCUs. It's the only solution that can run both machine learning and inference in the microcontroller, according to the company. It enables the execution of **unsupervised** learning, inference and prediction on the device edge, opening new classes of small, low-power, low-cost devices to AI. NanoEdge AI Studio has been tested and deployed successfully at a number of European and US companies.

**CYNORA** has debuted its first commercial product, a fluorescent blue emitter that promises to significantly improve the efficiency of Organic Light Emitting Diode (OLED) displays used in mobile phones, laptops, TVs, and other applications. The emission layers

determine the overall performance of the OLED stack and exert a strong influence on power consumption. Blue is the least efficient emitter. With next-gen displays like QD OLEDs using blue emitters only, the need for ultra-high-efficiency options is even more urgent.

The product, known as the cyBlue-Booster, employs an advanced molecular design and is >15% more efficient than comparative emitters. It can be easily integrated into existing OLED stacks and is available in multiple shades of blue for application customization. The product is the first on a technology roadmap that will later include green and blue emitters based on the company's TADF materials platform.

**EPC** has introduced an 80V, 12.5A power stage IC designed for 48V DC-DC conversion. The EPC2152 is a single-chip driver plus eGaN FET half-bridge power stage using EPC's GaN IC technology. Input logic interface, level shifting, bootstrap charging and gate drive buffer circuits along with eGaN output FETs configured as a half-bridge are integrated within a monolithic chip. When operated in a 48V to 12V buck converter at 1 MHz switching frequency, the EPC2152 ePower Stage achieves a peak efficiency above 96% with a solution that is 33% smaller in size on the PCB compared to an equivalent multi-chip discrete implementation.

The EPC2152 is the first offering in what will be a wide-range family of integrated power stages available in chip scale packages as well as multi-chip quad flat modules. Within a year, the family will fill out with products capable of operating at high frequency up to 3 to 5 MHz range as well as high current from 15A to 30A per power stage.

**Inphi** is sampling its new Spica 800G 7nm PAM4 DSP, the world's first 800Gbps or 8x100Gbps PAM4 DSP to enable 800G optical transceiver modules in QSFP-DD800 or OSFP formfactors. The new low power, PAM4 DSP with integrated 56GBaud driver, enables either 2x400Gbps or 8x100Gbps optical modules with 100Gbps per lane electrical interfaces.

**Mellanox** announced that customer shipments of SN4000 Ethernet switches have commenced. The SN4000 family is powered by Mellanox Spectrum-3, the world's best performing, most scalable, and most flexible 12.8 Tbps Ethernet switch ASIC, according to the company. SN4000 platforms come in flexible formfactors supporting a combination of up to 32 ports of 400GbE, 64 ports of 200GbE and 128 ports of 100/50/25/10GbE.

Over the last several years, with the Spectrum and Spectrum-2 product lines, Mellanox has steadily grown its market share in the 100GbE top-of-rack Ethernet switch segment, according to Crehan Research. As of the most recent reported quarter, Mellanox moved up to the fourth overall position worldwide in this segment, with over 7% market segment share.

**MixComm** has unveiled its first production device, the SUMMIT 2629 beamforming front-end, which integrates novel power amplifiers, low noise amplifiers, T/R switching, beamformers, calibration, gain control, beam table memory, temperature and power telemetry, and high-speed SPI control for a front-end module with optimal partitioning for 5G infrastructure. The device is fabricated on GLOBALFOUNDRIES' 45RFSOI process. The SUMMIT 2629 operates from 26.5-29.5GHz and is the first in a family of MixComm mmWave devices. SUMMIT features efficiency more than 2X better than existing solutions, according to the company. Sample in

**Q2. Richardson RFPD**, an **Arrow Electronics** company, has entered into a global franchise agreement with MixComm.

**Taoglas** and MixComm have formed a technology partnership and co-developed a 5G new radio (NR) mmWave smart antenna subsystem covering the 26.5-29.5 GHz band. The subsystem can support both infrastructure and IoT OEMs' integration of 5G NR devices and is ideal for small cells, repeaters and customer-premises equipment (CPE) designs.

The co-development is based on Taoglas' KHA16.23C smart antenna subsystem. It includes Taoglas' patent pending design that has been integrated with MixComm's SUMMIT 2629 Front End IC. The KHA16.23C is a 2D antenna array integrated into a multi-layer PCB that contains the RFICs and 16 antenna elements; layers provided for power optimization and thermal control, digital control, and RF feed lines all in footprint of 53x84 mm. Depending on device implementation, the Taoglas design is scalable with arrays up to 1024 elements.

**Samsung** has successfully shipped one million 10nm-class (D1x) DDR4 DRAM modules based on EUV lithography technology. Samsung is the first to adopt EUV in DRAM production to overcome challenges in DRAM scaling. EUV technology reduces repetitive steps in multi-patterning and improves patterning accuracy, enabling enhanced performance and greater yields as well as shortened development time.

EUV will be fully deployed in Samsung's future generations of DRAM, starting with its fourth-generation 10nm-class (D1a) or the highly-advanced 14nm-class, DRAM. Samsung expects to begin volume production of D1a-based DDR5 and LPDDR5 next year, which would double manufacturing productivity of the 12-inch D1x wafers.

## Products

(Continued from page 11)

**Sanan IC**, a wafer foundry with an advanced compound semiconductor technology platform, has expanded its optical portfolio. Using the most advanced materials and foundry supply network, Sanan IC will provide the global optical market with large-scale foundry services for customized vertical-cavity surface-emitting lasers (VCSEL) and arrays, along with standard products for optical communication applications. According to LightCounting, the optical transceiver market will rise at a 15% CAGR from 2020 through 2024. Additionally, Yole Développement expects the global 3D imaging and sensing market to expand from \$5 billion in 2019 to \$15 billion in 2025, a 20% CAGR during this period.

Sanan IC is China's first 6-inch compound semiconductor wafer foundry. The company was founded in 2014 and is based in Xiamen City in the Fujian Province of China, operating as a subsidiary of Sanan Optoelectronics. The company develops and provides GaAs, GaN, SiC, and InP foundry services.

**SPARK Microsystems** has introduced the SR1000 series of low power ultra-wide band (UWB) wireless transceiver ICs. The SR1000 series offers an extremely low latency symmetrical bi-directional short-range (100m) data link coupled with ultra-low power consumption and provides high quality of service. Compared to Bluetooth Low Energy (BLE), which typically has an airtime of a few milliseconds causing noticeable latency of tens of milliseconds, the SR1000 can send 1 kb of data in only 50  $\mu$ s, yielding significantly shorter wireless latency in a wide range of applications, such as audio streaming.

The SPARK transceiver's power consumption, typically 1nJ / bit, is also significantly lower than BLE, typically 40x lower when operating at 1 Mbps.

With a data transfer rate up to 10x higher than BLE, the SR1000 series' 10 Mbps capability suits content-rich applications, such as video streaming, where high bandwidth low latency links are essential.

The SR1000 operates in the unlicensed 3.1GHz to 10.6GHz frequency range using a wide spectrum low power density, transmitting at levels that may be perceived as noise to other receivers. The SR1000 series comprises two pin-identical product variants, the SR1010 for 3.1GHz to 6GHz, and the SR1020 for 6GHz to 9.5GHz.

The SR1000 targets short-range wireless connectivity applications, including gaming peripherals and AR/VR headsets, smart home devices and battery-less IoT sensors. The SR1000 series can also be used for a variety of ranging and positioning applications. Spark provides SW stacks for P2P and Star protocol stacks and is evaluating standard stacks for mesh.

Production silicon is out of TSMC, with qualification expected in July. Samples are available now; production in Q3. High volume production is anticipated in 2022. Future plans include evolving the transceiver, an SoC variant, and support for legacy protocols. Spark has 22 patent filings with 9 granted. The company has raised more than \$6 million in funding plus more than \$6 million in grants and in-kind services, and plans to seek additional funding in mid-2021. **Sanjay Jha**, previously COO of Qualcomm and CEO of Motorola Mobility, recently joined SPARK's board of directors. Fares Mubarak, CEO, fares.mubara@sparkmicro.com

**UNISOC** has debuted UNISOC 8910DM, the first IoT wide area chip platform that is compliant with Cat.1bis, according to the company. This solution has completed field test and certification across 45 countries and 157 operators worldwide. Based

on a 28nm process, UNISOC 8910DM conforms to both R13 LTE Cat.1bis and GSM, with uplink rates of 5Mbps and downlink rates of 10Mbps. By seamlessly switching between 2G and LTE, it ensures a smooth transition for 2G IoT devices while greatly extending the service life of 2G users' equipment after upgrades for LTE. So far UNISOC 8910DM has been adopted by leading module manufacturers such as China Mobile IoT, Fibocom, Longsung, MeiG, and Neoway.

**Xilinx** announced Versal Premium, the third series in the Versal ACAP portfolio. The Versal Premium series features highly integrated, networked and power-optimized cores and the industry's highest bandwidth and compute density on an adaptable platform.

Developed on TSMC's 7nm process, Versal Premium combines software programmability with dynamically configurable hardware acceleration and pre-engineered connectivity and security features to enable a faster time-to-market. The Versal Premium series delivers up to 3X higher throughput compared to current generation FPGAs, with built-in Ethernet, Interlaken, and cryptographic engines that enable fast and secure networks. The series doubles the compute density of currently deployed mainstream FPGAs and provides the adaptability to keep pace with increasingly diverse and evolving cloud and networking workloads.

The Versal Premium series is built on a foundation of the currently shipping Versal AI Core and Versal Prime ACAP series. New and unique to Versal Premium are 112Gbps PAM4 transceivers, multi-hundred gigabit Ethernet and Interlaken connectivity, high-speed cryptography, and PCIe Gen5 with built-in DMA, supporting both CCIX and CXL.

Channelized Ethernet cores deliver up to 5Tb/s of throughput in a minimized footprint and high-speed cryptography

engines provide up to 1.6Tb/s of encrypted line-rate throughput and support for AES-GCM-256/128, MACsec, and IPsec. The Versal Premium series has over 120TB/s of on-chip memory bandwidth, coupled with the customizable memory hierarchy. The Versal Premium series will begin sampling with early access customers in 1H'21. ■

## Licensing & Partnerships

**BrainChip** announced that **Socionext** will offer customers an AI Platform that includes the BrainChip Akida AI SoC. BrainChip's AI technology provides a complete ultra-low power AI Edge Network for vision, audio, and smart transducers without the need for a host processor or external memory. Socionext has played an important role in the implementation of BrainChip's Akida IC, which required the engineering teams from both companies to work in concert. Akida samples to be available in Q3.

**CMC Microsystems** has signed an agreement with **GLOBALFOUNDRIES** that will provide access to GF's FinFET, RF SOI, FDX, SiGe, and Silicon Photonics platforms for CMC researchers at more than 60 Canadian universities and colleges, in addition to academic and commercial users globally. CMC customers will have access to the GF GlobalShuttle Multi-Project Wafer (MPW) program as well as dedicated prototype and production runs in GF technologies.

CMC has already announced support for GlobalShuttle MPW fabrication runs, and several designs are being fabricated on different GF technologies. Many new services will be added in 2020.

**Everspin** announced an amendment of its Spin-transfer Torque (STT-MRAM) joint development agreement with **GLOBALFOUNDRIES**. Everspin and GF have been partners on 40nm,

28nm, and 22nm STT-MRAM development and manufacturing processes and have now updated their agreement to set the terms for a future project on an advanced 12nm FinFET MRAM solution.

Everspin is in production of discrete STT-MRAM solutions on 40 and 28nm, including its 1Gb DDR4 device. GF has achieved initial production of embedded MRAM (eMRAM) on its 22FDX platform. Everspin has already shipped over 125M units of discrete MRAM products to date and has over 1000 customers.

**GT Advanced Technologies** (GTAT) and **ON Semi** have executed a five-year agreement, valued at a potential of \$50 million. GTAT will supply its CrystX silicon carbide (SiC) material to ON Semi. High-growth applications such as EV traction systems, hybrid and plug-in EVs, solar and energy storage, and EV charging all require a robust supply of SiC material. ON Semi will use GTAT's 150mm SiC crystal to make its SiC wafers to further accelerate its role as a vertically integrated supplier within the SiC supply chain supply.

**Inomize** selected **Synopsys'** silicon-proven DesignWare 56G Ethernet PHY IP to accelerate development of Inomize's high-performance computing, software-defined radio (SDR), and power-efficient communications SoC.

**Innovium**, a provider of high-performance switching solutions for data centers, and **Credo**, a provider of serial connectivity solutions, announced successful interoperability of Credo's MACsec chip family with Innovium's 12.8Tbps TERALYNX 7 switch silicon. This interoperability enables a MACsec enabled 1RU, 32 x 400G switch using Innovium's 12.8Tbps TERALYNX 7 switch silicon and Credo's dual 400G CMS50216 MACsec chip. Both these products have been adopted by leading

system partners and cloud companies. The Credo CMS50216 supports the IEEE 802.1AE Media Access Controller Security (MACsec) and Internet Protocol Security (IPSec) standard for 10G through 400G port interconnects.

**Marvell** is working with SSD vendor **KIOXIA** and ODMs **Foxconn-Ingrasys** and **Accton** to bring its Ethernet Bunch of Flash (EBOF) technology to market. The EBOF architecture offers an Ethernet fabric to scale flash and optimally disaggregate storage from compute. Marvell's EBOF platforms incorporate Marvell's NVMe over Fabrics (NVMe-oF) Ethernet SSD converter controllers and Presteria CX 8500 family of switches with Storage Aware Flow Engine technology.

Marvell's EBOF technology is designed to replace the Just a Bunch of Flash (JBOF) architecture, which uses a PCIe fabric, by integrating the Ethernet network interface directly into the flash drive. Compared to the existing JBOF architecture, Marvell's EBOF architecture can deliver 3X the performance while consuming lower power and enabling greater than 65% TCO savings.

The Foxconn-Ingrasys EBOF platform is a 2U chassis with 24 SSDs in a U.2 formfactor and 48 SSDs in an EDSFF E1.S formfactor. The Accton EBOF platform is a 2U chassis that can accommodate 24 SSDs in a U.2 or EDSFF E1.S and EDSFF E1.L (9.5 mm) formfactor. Customer samples in early Q2.

**Nokia** and **Marvell** are working together to develop 5G multi-RAT (Radio Access Technology) silicon innovations, including multiple generations of custom silicon and infrastructure processors to further expand the range of Nokia ReefShark chipsets available for 5G solutions. The companies are developing a new generation of custom

## Licensing & Partnerships

(Continued from page 13)

SoC and infrastructure processors combining Nokia's wireless technology with Marvell's multi-core Arm processor platforms. These new chipsets are designed to be deployed in several building blocks of the Nokia AirScale radio access solution, as part of Nokia's 5G "Powered by ReefShark" portfolio.

**SkyWater** and **Applied Novel Devices** have entered into a licensing and manufacturing agreement to offer an improved standard process flow for Si power MOSFETs. The partnership will enable AND to bring new power devices to market based on its patented technologies and SkyWater's high volume manufacturing capabilities. The licensing agreement will also enable SkyWater to offer the technology as a standard foundry process flow with near zero reverse recovery charge to improve system-level performance for low-voltage (12V – 30V) applications.

AND's high-performance Si power MOSFETs are based on novel channel and substrate engineering to improve critical figure of merits of the power MOSFET. These products offer low RDSon combined with low output capacitance/charge, low gate drive down to 2.5V and an industry-first near zero reverse recovery charge, enabling low switching losses. The thin body design makes the devices more robust against temperature variations and is

anticipated to provide inherent radiation-hardened characteristics. AND was founded in 2008 and is based in Austin, Texas.

**ST** announced the FDA901 class-D audio amplifier IC, with a semiconductor design that incorporates the audio design expertise of **Alps Alpine**, a major Japanese manufacturer of car audio equipment and information communication equipment. The new chip aims to contribute to the creation of multi-function, high-fidelity car audio systems that fuse the high efficiency of class-D amplifiers with the high-quality sound of ST's class-AB amplifiers.

The FDA901 is in volume production. For many years, Alpine Electronics has collaborated closely with ST. Starting from the adoption in 39 models of Alpine's "ALL New BigX series" after-market car navigation system to be released in 1H'20, the FDA901 will expand its market to several major car makers.

**TSMC** has collaborated with **Broadcom** on enhancing the Chip-on-Wafer-on-Substrate (CoWoS) platform to support the industry's first and largest 2X reticle size interposer. With an area of approx. 1,700mm<sup>2</sup>, this next generation CoWoS interposer technology significantly boosts computing power for advanced HPC systems by supporting more SoCs as well as being

ready to support TSMC's next-gen 5nm (N5) process technology.

This new gen CoWoS technology can accommodate multiple logic SoC dies, and up to 6 cubes of high-bandwidth memory (HBM), offering as much as 96GB of memory. It also provides bandwidth of up to 2.7 terabytes per second, 2.7X faster than TSMC's previously offered CoWoS solution in 2016.

Broadcom defined the complex top-die, interposer and HBM configuration while TSMC developed the manufacturing process to maximize yield and performance and meet the unique challenges of the 2X reticle size interposer. TSMC developed a mask-stitching process enabling expansion beyond full reticle size, to bring this enhancement to volume production. ■

## Design Wins

**Pixelworks'** fifth generation visual processor is in the new **OPPO** Find X2 series smartphones. As the inaugural devices launched under the recently announced collaboration agreement between the two companies, the Find X2 and Find X2 Pro push visual performance boundaries in smartphones with the integration of the first 120Hz variable refresh rate display and the latest Pixelworks processor and software, featuring content-optimized motion processing and an always-HDR video experience. ■

## Company Financials – March Releases

Company	Symbol	Next Qtr Outlook	Current Qtr			Last Qtr			Yr-ago Qtr			Sales Growth	Qtr	Ending	
			Sales	Net	Margin	GM	Sales	Net	GM	Sales	Net				GM
Ambarella	AMBA	\$52-57M	57	-13.0	-23%	58%	68	-4.3	58%	51	-4.5	60%	12%	4Q20	31-Jan
Broadcom	AVGO	\$5.55-5.85B	5858	311.0	5%	56%	5776	818.0	55%	5789	471.0	55%	1%	1Q20	2-Feb
ChipMOS	IMOS	n/a	186	16.7	9%	23%	174	15.0	21%	166	17.4	23%	12%	4Q19	31-Dec
Dialog	DLG	\$220-250M	381	44.8	12%	50%	409	68.2	49%	431	57.9	49%	-12%	4Q19	31-Dec
Everspin	MRAM	\$9.5-9.9M	10	-3.1		54%	9	-3.7	47%	12	-3.5	44%	-21%	4Q19	31-Dec
Immersion	IMMR	n/a	12	1.0	9%	99%	11	-1.4	99%	11	-3.1	99%	6%	4Q19	31-Dec
Kopin	KOPN	n/a	6	-7.3	-116%	19%	6	-6.6	23%	6	-10.0	72%	3%	4Q19	28-Dec
Marvell	MRVL	\$680M +5%	718	1772.7	247%	42%	663	-82.5	51%	745	-260.7	43%	-4%	4Q20	1-Feb
Micron	MU	\$4.6-5.2B	4797	405.0	8%	28%	5144	491.0	27%	5835	1619.0	49%	-18%	2Q20	27-Feb
Semtech	SMTC	\$125-135M	138	2.9	2%	61%	141	14.0	61%	160	13.7	62%	-14%	4Q20	26-Jan

### Philadelphia SOX Index



### TSMC – Foundry Barometer



### Micron – DRAM Barometer



### WD / SanDisk – FLASH Barometer



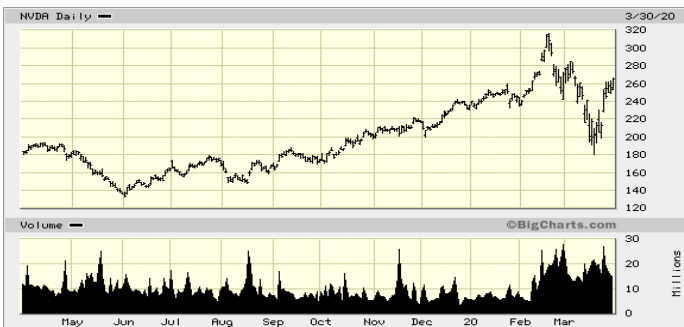
### Intel



### Broadcom



### NVIDIA



### Xilinx



## Startups In This Issue

- ✓ Axonne – Automotive Ethernet ICs
- ✓ Ethernovia – Automotive Ethernet ICs
- ✓ ONiO – Battery-Free Wireless MCU
- ✓ PETAiO – SSD Controllers for Data Centers
- ✓ Vulcan Semiconductor – Unknown

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**Tel:** 781.647.8800

**Email:** info@pinestream.com

**Web:** www.pinestream.com

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