SEMICONDUCTOR TIMES

OCTOBER 2021 FOCUSED ON EMERGING SEMICONDUCTOR COMPANIES VOL 26, ISSUE 10

Startup Profiles

Alif Semiconductor

Alif Semiconductor (see 7/20 issue) was founded in 2019 to develop secure, connected, AI-enabled and power efficient fusion processors. The company's vision is "to address the rapidly growing market need for broad, scalable, and connected AI-enabled embedded computing solutions that are genuinely power efficient."

Alif has raised roughly $73 million in Series A and B funding from Kleiner Perkins, Lightspeed, Horizon Ventures, and WRVI Captial and has approx. 200 employees. The company has offices in Silicon Valley, Irvine California, Bangalore and Singapore. For cellular modem expertise, Alif acquired Mymo Wireless in April 2019.

Alif's "fusion processors" combine innovative low-power techniques, unparalleled functional integration, accelerated AI and ML edge processing, high security, ubiquitous wireless connectivity, and operating system diversity. Alif's Autonomous Intelligent Power Management (aiPM) technology allows fine-grained control of when resources in the chip are being powered.

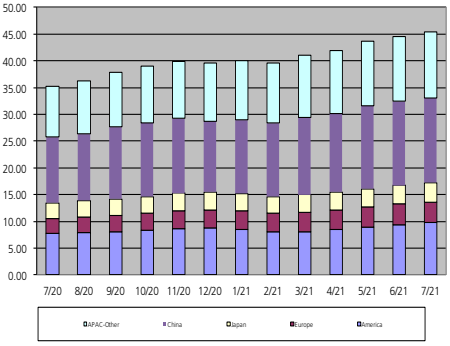
The company recently launched its Ensemble and Crescendo product families for always-connected IoT products. The Ensemble family ranges from single CPU core to quad CPU core, plus AI/ML acceleration. The Crescendo family adds LTE Cat-M1 and NB-IoT Cellular IoT connectivity, with optional integrated SIM (iSIM), and GNSS positioning. The devices also integrate multi-layered security.

The Ensemble family scales from a single Arm Cortex-M55 MCU to up to two Cortex-M55 MCU cores plus up to two Cortex-A32 MPU cores capable of running high-level operating systems and up to two Arm Ethos-U55 microNPUs for AI and machine learning acceleration. Ensemble family devices contain an advanced secure enclave that provides multiple layers of security, such as device integrity protection, secure identity, strong root-of-trust, secure lifecycle management, and more. Other features include a large on-chip SRAM and non-volatile memory, accelerated graphics, imaging, and class-leading power characteristics.

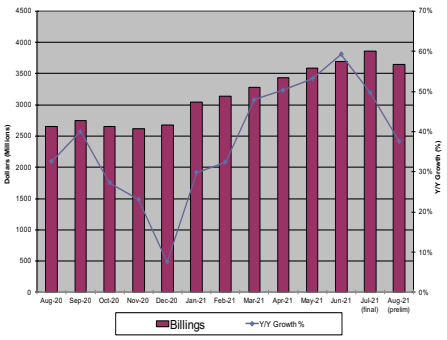
The Crescendo family offers the same functionality as the Ensemble family, and adds LTE Cat-M1 and NB-IoT Cellular connectivity, optional iSIM for simplified subscriber management, integrated RF, power amplifiers, and a concurrent GNSS receiver for positioning.

Alif was founded to address a gap in the market for scalable, genuinely power efficient devices that integrate AI/ML acceleration, multi-layered security, LTE Cat-M1 and NB-IoT connectivity, GNSS positioning, and plenty of integrated memory to enable design of products that seamlessly integrate into everyday life. The company believes that there are no comparable products that offer the same level of functional

SIA Global Sales ($B)



SEMI's N. American Equipment Billings



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density and range in the embedded market today.

Ensemble and Crescendo devices are sampling now to lead customers, including multiple Tier 1 OEMs. Production qualification will be complete in Q1'22.

Syed Ali, co-founder & CEO (previously co-founded Cavium Networks, where he served as President, CEO and Chairman, which was acquired by Marvell for $6B+)

Reza Kazerounian, Ph.D., co-founder & President (previously SVP and GM of the Microcontroller and Connectivity Business Unit at Atmel until its acquisition in 2016)

Edward Youssoufian, VP of Engineering (previously Senior Director at NXP and Sr. Director, RF at Atmel)

Sondur Lakshmipathi, CTO (founded Mymo Wireless, which Alif acquired in 2019)

Steve Pancoast, VP Software & Systems Engineering (previously COO & VP Engineering at Secure Thingz and VP Software Development and Applications Support at Atmel)

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Aviva Links

Aviva Links was founded in late 2020 to develop automotive in-vehicle multi-gigabit connectivity links. The company has raised $26.5 million in Series A funding led by Dr. Sehat Sutardja and Weili Dai (founders of Marvell) and other prominent semiconductor industry investors with participation from SAFE round investors, bringing the total raised to date to more than $33 million.

Aviva Links in-vehicle connectivity ICs will enable next-generation vehicles to move vast amounts of data at multi-gigabit speeds while meeting the performance, power, security and cost requirements of the automotive market.

The automotive connectivity silicon market is rapidly growing and expected to exceed $10B in the near future. Currently, competitors are traditional analog connectivity chip suppliers, according to Aviva. Existing chips were designed for the pre-self-driving era that needed basic functionality for human vision (such as backup and surround view cameras) applications. Aviva believes there is a need for moving high-resolution uncompressed data for machine vision applications as well as infotainment functions. Competitive advantages will include the highest network performance coupled with low power consumption and integrated security.

The company is working closely with top car makers and tier-1 suppliers who supply components like cameras, sensors and processing units to the car makers. Aviva plans to launch its first product in 2022.

David Young, co-founder and CEO (previously a Venture Partner at BlueRun Ventures, SVP & Chief Innovation Officer at LG Electronics and VP & GM at Marvell)

Kamal Dalmia, co-founder and COO (previously VP, Automotive Solutions, Strategic Business Development at Synaptics, SVP at Aquantia, VP at Teranetics and Director, Ethernet Phy at Marvell)

Hiok-Tiaq Ng, Co-Founder (previously VP of Analog Engineering at Aquantia)

Sachin Goel, VP, Digital & Systems Engineering (previously VP, Digital Engineering at Marvell and Aquantia)

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Axelera AI

Axelera AI was founded to develop "the world's most efficient and advanced solutions for AI at the edge." Axelera AI was incubated by Bitfury Group in 2019, formerly operating as Bitfury AI until the company was spun out in 2021. The company has raised a $12 million seed round led by Bitfury and joined by imec, Innovation Industries and imec.xpand. The company will open a Series A round in Q1'022 – amount TBD. Over time, the company's aims to raise more than 100 Meuro.

Founded in 2011, Bitfury is a leading security and infrastructure provider for the Bitcoin Blockchain. In addition to securing the Bitcoin Blockchain, Bitfury also designs and produces hardware that keeps cryptocurrencies and blockchains secure, including custom semiconductor and mobile data centers.

Axelera AI has joined forces with imec since early 2020 to develop groundbreaking computing architecture for high-performance AI. Headquartered in the AI Innovation Center of the High-Tech Campus in Eindhoven, Axelera AI also has R&D offices in Leuven, Belgium, Zurich, Switzerland and Pisa, Italy. The company currently has 28 employees.

The company's technology integrates a custom dataflow architecture with multicore in-memory computing to deliver extremely high performance at a power envelope of a few watts and flexibility

to support multiple networks. Axelera AI's products will be fully integrated with the leading open-sourced AI frameworks when it launches.

The company is targeting heavy AI workloads at the edge, where multiple data streams need to be processed requiring high computation power. Competitors include all companies delivering high performance at the edge like Nvidia AGX. Axelera believes it will deliver high performance at a fraction of the cost and of the power of today incumbents.

The first chip, to be fabricated on a "two-digit" nm process node, will be ready next year and accessible to selected partners; open access is anticiapted in 2023. The company is in talks with multiple companies in robotics, retail, security, and healthcare.

Fabrizio del Maffeo, CEO and co-founder (previously Head of AI at Bitfury and VP/Managing Director of Asus Group company AAEON Europe)

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Radical Semi

Radical Semiconductor was founded in 2019 to develop analog cryptographic IDs to defend against quantum and physically-invasive attacks. The company believes that the future of hardware security is analog due to its low power and resilience against probing attacks and side channel analyses. Radical Semi is developing mixed-signal, uncloneable, tamper-proof accelerators for post-quantum cryptography, otherwise called analog chips for non-linear computation. The company has received seed funding from Root Ventures, 8VC, and Indicator Fund.

Sean Hackett, Founder & CEO (previously Financial Analyst & Business Development Associate at Prince Street Capital Management Internship and TomKat Energy Impact Fellowship at Stanford)

Zach Belateche, Founder & CTO (previously Research Assistant, Brains in Silicon Lab at Stanford)

Chandler Watson, Founder & Cryptography Lead (previously REU Researcher at Stanford)

radicalsemiconductor.com

Raxium

Raxium was founded in 2017 to develop "the world's highest performance ultra-high density monolithic RGB µLED displays." Raxium is bringing monolithic integration to MicroLEDs, enabling a new class of smaller and more powerful displays. The company has raised roughly $85 million to date.

Craig Peters, CEO (previously CEO of Plant PV and COO of Stockback)

Rick Schneider, Ph.D., Chief Development Officer (previously CTO of Glo,Senior Manager at Sandia and VP, Photonic IC Products Group at Infinera)

Gang He, Ph.D., CTO (previously CTO of Alta Devices and Manager, PIC Process Interaction at Infinera)

Michael Klug, VP of Systems Strategy & Business Development (previously Corporate VP, Advanced Photonics at Magic Leap and CTO at Zebra Imaging)

Chris Champion, VP of Sales & Business Development (previously SVP Sales and VP BD & Strategic Alliances at Infinera)

Sheila Hurtt, Ph.D., VP Epitaxy (previously Advanced Tech Integration Engineer at Qorvo & Product engineer, Photonic IC Group at Infinera)

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Thess IC

Thess IC was founded in January 2020 as a fabless ASIC design company that develops its own IoT chip solutions. The team that established Thess IC was working together in Central Europe, designing mixed signal products, and has now repatriated in Greece along with additional repatriating senior designers and graduates from Greek Universities. The processor IP portfolio of Cortus serves as the foundation for the team to build IoT controllers.

The company's first generation IoT controller features a RISC-V core, and wireless communications based on the DASH7 Alliance protocol, an open-source wireless sensor and actuator network protocol that operates in the sub-Gigahertz (433/868/915 MHz) unlicensed ISM band. DASH7 provides 2km range outdoors, 300m range indoors, low latency, a small protocol stack, AES 128-bit shared-key encryption support, and up to 167kbps data transfer rates. The IC will support up to 10 year battery life. The test chip taped-out in May 2021 and includes blocks that will be used in a new line of products, targeting the automotive market.

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People

AKHAN Semiconductor has appointed **Tom Lacey** as Interim CEO in addition to his role as Board Chairman. AKHAN specializes in the fabrication and application of synthetic, lab grown, electronics-grade diamonds for applications across several markets including consumer electronics and glass coatings, semiconductors, optics and others.

Analog Devices has appointed **Janene Asgeirsson** as SVP, Chief Legal Officer and Corporate Secretary. She is also responsible for internal audit and risk functions as Chief Risk Officer. Asgeirsson previously served as Chief Legal Officer, Chief Compliance Officer and Secretary at Acacia Communications, which was acquired by Cisco.

Applied Materials announced that **Dan Durn**, SVP and CFO, is departing the company to become the CFO at Adobe. Former Applied Materials CFO **Bob Halliday** has been appointed interim CFO and is serving in the role until a successor is in place.

Cirrus Logic has named **Raghib Hussain** to the Board of Directors. Hussain currently serves as president, Products and Technologies for Marvell. Prior to joining Marvell in 2018 as chief strategy officer, he was co-founder, CTO and COO of Cavium, which was acquired by Marvell in 2018.

CMC Microsystems has named **David Lynch** as VP, Technology. Lynch has been involved with CMC for >30 years throughout his career as a Board member, Chair of the Strategic Technology Council and has also served as a judge for events such CMC's annual TEXPO. Lynch has served as COO / VP Technology at Kapik Integration, CEO & Co-Founder of AlephIC, founding CEO and Director of StarIC, VP & GM Media Processors at Sigma Designs and SVP & GM & CTO at Gennum.

Codasip, a supplier of customizable RISC-V processor IP and tools, is opening offices in Bristol and Cambridge and is looking to hire more than 100 engineers over the coming quarters. These sites complement Codasip's existing development teams in Design Center Villeneuve Loubet, France; Headquarters Munich, Germany; and R&D Center Brno, Czech Republic.

The new design center will be headed by newly appointed Director, UK Design Center, **Simon Bewick**, who recently joined Codasip's management supervisory board. Bewick was most recently a VP Engineering at Mindtech Global where he led the development of several complex, advanced-node ASICs. Prior to that he was an EVP at Imagination and a Director of ASIC development at Ericsson.

D-Wave Systems, a leader in quantum computing systems, software, and services, has appointed **John Markovich** as CFO. Markovich previously was CFO of Xant, OmniGuide Holdings, Veritone, NanoH2O, EMCORE, Optical Coating Laboratories, and Tickets.com.

GlobalFoundries has appointed **Elissa Murphy** to the company's board of directors. Currently a VP of Engineering at Google, Murphy previously served as the CTO and EVP of Cloud Platforms at GoDaddy.

Movellus has appointed **Matthew Raggett** as VP of Growth. Raggett was VP of Sales at NetSpeed until its acquisition by Intel, VP of Sales at CLK Design Automation, and CEO of Analog Design Automation until its acquisition by Synopsys.

Paragraf, a developer of graphene electronic devices, has appointed **Charles Platts** as CFO.

QP Technologies (formerly Quik-Pak), a provider of packaging and assembly solutions, has added multiple new positions and capabilities to accommodate rising customer requirements. The company experienced double-digit growth (year over year) in fiscal 2020, and is poised to sustain this going forward.

Darin Valley was appointed director of quality assurance reporting directly to COO Ken Molitor. Valley previously served as GM ay Cohu's Delta Design Philippines operation. **Tom Bianchi** was named director of sales and marketing reporting to Rosie Medina, VP of sales and marketing. Most recently, Bianchi served as VP of sales and marketing, for 3D Glass Solutions, and prior to that, he was VP of North American sales, for Carsem.

Ronald Jankov has passed away. Jankov was the founder and CEO of GlobalLink1 Capital, a seed and early stage investor in technology companies, and had served on the board of directors of Knowles and Xilinx. He was the President and CEO of NetLogic, which was acquired by Broadcom for $3.8B

in 2012, whereupon he served as the SVP and GM, Processors and Wireless Infrastructure BU.

SambaNova has appointed **Matt Taylor** as VP of Strategic Sales and Partnerships to expand cloud, hybrid and on-premise AI deployments and accelerate adoption of SambaNova's AI services platform, Dataflow-as-a-Service. Taylor previously led worldwide sales and business development at Ampere and served as VP of Sales and Business Development at Qualcomm.

Prabhdeep Singh was named VP of Software Product. Singh previously served as Head of AI Products at UiPath, where he founded the company's AI product team and led the development of the AI-powered process automation platform. **Poonacha Kongetira** was named VP of Hardware. At Google, Kongetira led a team of engineers developing custom silicon accelerators for machine learning, video transcode, and datacenter infrastructure. He also led NVIDIA's Bangalore design center for mobile and GPU chips with a team of more than 800 engineers.

Silvaco, a supplier of TCAD, EDA software and design IP, announced the resignation of **Babak Taheri** as CEO and member of the board after two years in the role.

Summit Wireless has hired three industry veterans to increase the proliferation of the WiSA standard and to drive Summit Wireless revenue growth. **Eric Almgren** was co-founder and GM of the business unit that launched and built the HDMI standard. He has served as founder, chairman and CEO of several companies focused on wireless, standards, and audio technologies. **Steve Venuti** worked with Eric on the launch of HDMI at HDMI Licensing, LLC where he served as president. He also served as Chairman of the WirelessHD consortium. **Roger Isaac** recently served as CTO of a high-speed wireless connector company.

Synopsys has appointed **Sassine Ghazi** as president and COO. **Chi-Foon Chan** will transition from his co-CEO position over the first half of fiscal 2022, after which he will continue to support the company's long-term success in a new role. Ghazi joined Synopsys in 1998. Prior to becoming COO, he was GM of Synopsys' Design Group. Chan was appointed co-CEO in 2012, after serving as president and COO for 14 years.

Teradyne has elected **Ford Tamer, Ph.D.,** to its Board of Directors. Tamer was also appointed to the Board's Audit Committee. From 2012 until its acquisition by Marvell in 2021, Tamer was the CEO of INPHI. Prior to that, he was the CEO of Telegent Systems, and held senior leadership positions at Broadcom and Agere, which he co-founded. ■

Funding

Astera Labs has raised $50M as part of an oversubscribed Series-C funding round at a $950M valuation led by Fidelity Management and Research. Fidelity was joined by Atreides Management and Valor Equity Partners, with continued participation from existing investors Avigdor Willenz Group, GlobalLink1 Capital, Intel Capital, Sutter Hill Ventures, and VentureTech Alliance. Prior to this round, Astera raised only $35M over three years.

Astera has design wins at the five most significant CPU/GPU/AI processor platforms in the world and the majority of Cloud customers. This positions the company well to capitalize on CXL's new capabilities for cache-coherent and memory interconnects. Astera's Aries Smart Retimer portfolio for Compute Express Link (CXL) 2.0 and PCI Express (PCIe) 5.0 enables workload-optimized platforms in the cloud.

Deep Vision, developer of an AI processor and software development suite for edge computing applications, has received $35 million in an oversubscribed Series B financing round, led by Tiger Global and joined by Series A investors Exfinity Venture Partners, SiliconMotion, and Western Digital. When combined with its existing revenue streams, the funding will help Deep Vision expand the capabilities of its AI processor and software tools and support its rapidly growing customer base.

Deep Vision's patented AI processor, named ARA-1, delivers a ground-breaking combination of performance, power, and price for camera-based applications like smart retail, driver-monitoring systems, smart city, drones, and factory automation. Although best known for its ability to perform real- time video analytics, the company's processor also provides natural language processing (NLP) capabilities for voice-controlled applications. Deep Vision was started in 2014 based on research done

Funding

(Continued from page 5)

by the founders while at Stanford University.

Metanoia, a manufacturer of xD-SL/G. fast chipsets, has raised a new round of funding to spearhead its 5G Strategy. The company has diversified into the 5G market with the introduction of the MT3812 2x2 5G-NR RF transceiver. Metanoia is a subsidiary of Elan Microelectronics.

ONiO, a fabless IoT company that brings self-powered, batteryless solutions to the market, has secured a $2.3 million equity investment agreement with MP Pensjon (TINE Pension Fund) and the European Innovation Council (EIC) Fund, as part of its EIC Accelerator program. This financing round will enable ONiO to further accelerate the roll-out of ONiO.zero, a general purpose wireless microcontroller capable of true batteryless operation.

proteanTecs announced a $50 million extension to their Growth Equity Round led by Koch Disruptive Technologies and joined by strategic investors MediaTek and Advantest, together with Porsche SE, the major shareholder of Volkswagen Group, and Allied Group subsidiary Champion Motors, as well as current investors. This brings the company's total funding to $150 million.

Based on deep data derived from Universal Chip Telemetry™ (UCT), proteanTecs provides cloud and edge enterprise SW solutions for electronics' health and performance monitoring. Addressing end-to-end needs of mission-critical markets, the company serves companies in Datacenter, Automotive and Communications. In 2020-2021, the company onboarded key customers, including cloud hyperscalers, leading system OEMs, and key fabless startups, and ASIC houses.

QuickLogic announced two of its long-time investors have purchased, in separate private placement transactions, 198,664 shares, or 1.7% of the current shares outstanding, raising gross proceeds of approx. $1.08 million. Following its $2 million eFPGA Contract, interest in the company's QORC (QuickLogic Open Reconfigurable Computing) initiative has grown at a faster pace. The additional capital provides the resources to continue to execute on near-term eFPGA growth objectives and meet profitability targets in early fiscal 2022.

Vesper, a provider of MEMS microphones, has closed a $18M financing round led by Accomplice and including Applied Materials Ventures, Sands Capital, Bose, Amazon Alexa Fund, Gopher Asset Management, ITIC, World Peace Group, Unitrontech, and MegaChips. The company has raised $73M to date. Vesper's ZeroPower Listening™ architecture brings an order of magnitude improvement in power consumption to always listening systems. The funding will enable Vesper to accelerate hyper-scaling of its smart microphones and accelerometers from tens of millions of units per year to hundreds of millions per year, support R&D, and expand into new markets.

Wirepas has raised 10M euros from existing investors Karma and Tesi aimed at accelerating the development of the its purpose-built non-cellular 5G technology. The company targets to have the commercial launch in 2022. Wirepas' current solution, Wirepas Massive, a large-scale mesh connectivity software for massive IoT, is deployed with >200 clients including Fujitsu, Prologis, Wurth, Schaeffler, Orange and Fagerhult.

Wirepas Private 5G will be based on the new global IoT standard, currently called DECT-2020 NR. Wirepas has been the key contributor in developing the new standard, which isowned by ETSI (European Telecom Standards Institute). DECT-2020 NR will be the first non-cellular 5G technology.

Like the existing Wirepas Massive, products based on the new standard can be deployed anywhere by anyone thanks to its de-centralized device-based decisions. The network runs autonomously with minimal maintenance effort and with no need for separate network infrastructure deployment. With its dedicated license-free global frequency band at around 1900 MHz the new standard offers coverage worldwide. ■

Mergers & Acquisitions

Brooks Automation has entered into a definitive agreement to sell its **Semiconductor Solutions Group business** to **Thomas H. Lee Partners** for $3 billion in cash. The automation business reported approx. $613 million in revenue in the last 12 months ended June 30, 2021. The proceeds will be used to accelerate growth of the life sciences business.

Brooks' automation business is a provider of high precision, high throughput vacuum robots and systems as well as contamination control solutions to the global semiconductor capital equipment industry. Recently, the business expanded into collaborative robotics for multi-market applications.

Following completion of the sale, expected in 1H'22, the semiconductor automation business will transition to THL along with the Brooks Automation name and brand. The remaining life sciences business will then operate as a standalone publicly traded life sciences company, under a new name to be announced.

JSR has signed an agreement for the acquisition of Corvallis, OR based **Inpria**, an innovator of metal oxide photoresist design, development and manufacturing for EUV lithography, for $514 million. In 2017 and 2020, JSR participated in Inpria's funding rounds, which resulted in JSR owning 21% of Inpria's outstanding shares. Inpria has been developing its non-chemically amplified metal oxide EUV resists since the company was established in 2007 and has achieved the world's highest resolution using EUV exposure systems, according to the company.

Murata has completed the acquisition of **Eta Wireless**, a developer of Digital Envelope Tracking Technology. ■

Business

Excelitas has opened a new plant for its German subsidiary, **Qioptiq Photonics** in Göttingen, Germany. The new facility expands the company's capacity for assembly of optomechanical systems and components for the semiconductor industry. Excelitas' investment amounted to approx. 25 million euros for facilities and an additional 5 million euros for capital equipment.

Infineon has opened its high-tech chip factory for power electronics on 300mm thin wafers at its Villach site in Austria. At 1.6 billion euros, the investment represents one of the largest such projects in the microelectronics sector in Europe. On the group level, the new factory will give Infineon additional sales potential of around two billion euros per year.

Lam Research announced the expansion of its manufacturing footprint in Oregon with a new 45,000 square foot facility in the city of Sherwood, planned to open in December 2021. The new facility is Lam's fifth manufacturing site in the US. Lam expects its new facility to create approximately 300 new jobs. ■

Market Research

Global semiconductor industry sales were $45.4 billion in July 2021, an increase of 29% over the July 2020 total of $35.2 billion and 2.1% more than the June 2021 total of $44.5 billion, reports the **SIA**.

North America-based semiconductor equipment manufacturers posted $3.65 billion in billings worldwide in August 2021, according to **SEMI**. The billings figure is 5.4% lower than final July 2021 billings of $3.86 billion and 37.6% higher than August 2020 billings of $2.65 billion.

Global semiconductor equipment billings surged 48% Y/Y to a record high of $24.9 billion in Q2'21, a 5% increase from the prior quarter, reports **SEMI**.

IC Insights has released its compilation of Q3 sales growth expectations for the **top-25 semiconductor suppliers**. For Q3, sales growth outlooks for the top-25 suppliers range from 16th-ranked Sony's 34% increase at the high end, to Intel's 3% decline on the low end.

In advance of an expected surge in demand for 5G smartphones during the upcoming holiday season, Qualcomm and Apple anticipate significant increases in their 3Q21 semi sales. The big three memory suppliers (Samsung, SK Hynix, Micron) are each expected to post a 10%

Global Semiconductor Equipment Billings

Region	2Q21	1Q21	2Q20	2Q21/1Q21	2Q21/2Q20
China	8.22	5.96	4.59	38%	79%
Korea	6.62	7.31	4.48	-9%	48%
Taiwan	5.04	5.71	3.51	-12%	44%
Japan	1.77	1.66	1.72	7%	2%
North America	1.68	1.34	1.64	25%	2%
Rest of World	0.84	1.02	0.37	-18%	129%
Europe	0.71	0.58	0.46	22%	54%
Total	24.87	23.57	16.77	5%	48%

Sources: SEMI (www.semi.org) and SEAJ (www.seaj.or.jp), September 2021

Market Research

(Continued from page 7)

increase and Kioxia is anticipated to show an 11% jump in 3Q21 sales as demand remains strong for memory in data center servers, enterprise computing, and for 5G smartphones and related infrastructure. ■

Top 15 Semiconductor Sales Leaders
3Q21 Forecast, $M

3Q21F Rank	2Q21 Rank	Company	Headquarters	2Q21 Total Semi Actual	3Q21 Total Semi Forecast	3Q21/2Q21 % Change
1	1	Samsung	South Korea	20,297	22,320	10%
2	2	Intel	U.S.	19,304	18,785	-3%
3	3	TSMC	Taiwan	13,315	14,750	11%
4	4	SK Hynix	South Korea	9,213	10,135	10%
5	5	Micron	U.S.	7,681	8,465	10%
6	6	Qualcomm	U.S.	6,472	7,250	12%
7	7	Nvidia	U.S.	5,540	5,965	8%
8	8	Broadcom Inc.	U.S.	4,890	5,220	7%
9	9	MediaTek	Taiwan	4,496	4,600	2%
10	10	TI	U.S.	4,299	4,300	0%
11	11	AMD	U.S.	3,850	4,100	6%
12	13	Apple*	U.S.	3,100	3,500	13%
13	12	Infineon	Europe	3,280	3,495	7%
14	14	ST	Europe	2,983	3,200	7%
15	15	Kioxia	Japan	2,800	3,110	11%
—	—	Top-15 Total		111,520	119,195	7%

*Custom processors/devices for internal use.

Source: Company reports, IC Insights' *Strategic Reviews* database

Emerging Trends

Intel CEO Pat Gelsinger predicts the "digitization of everything" will push the share of semiconductors in the total new premium vehicle BOM to more than 20% by 2030, up more than 5X from 4% in 2019. The TAM for automotive silicon will more than double by the end of the decade to $115 billion, approx. 11% of the entire silicon market. To address rising demand, Intel plans to build new chip manufacturing facilities in Europe, establish committed foundry capacity at its Ireland site, and launch the Intel Foundry Services Accelerator to help foundry customers move automotive designs to advanced nodes. ■

Products

AMD has announced a goal to deliver a 30x increase in energy efficiency for AMD EPYC CPUs and AMD Instinct accelerators in AI training and High Performance Computing (HPC) applications running on accelerated compute nodes by 2025.

Axis Communications has unveiled its 8th generation of its custom-designed SoC made for network video. The ARTPEC-8 SoC was designed first and foremost to create new opportunities for analytics applications based on deep learning on the edge. In addition, the new SoC features superior imaging, enhanced security, and powerful compression. The ARTPEC-8 was designed in-house giving Axis a level of control crucial to cybersecurity. Going forward, the new chip will be the basis for the vast majority of Axis network video products. Some of the first cameras to include this chip are the soon-to-be-launched AXIS Q3536-LVE/38-LVE Dome Cameras and AXIS Q1656-LE Box Camera.

Efinix, a provider of programmable product platforms and technology, announced AEC-Q100 qualification for several members of its popular Trion line of FPGAs and a major initiative to extend both its Trion and Titanium product lines into automotive markets.

NEWRACOM, a supplier of IoT-enabled Wi-Fi SoCs, has demonstrated Wi-Fi HaLow-enabled sensor networking. The Wi-Fi HaLow sensor network, powered by NEWRACOM's NRC7292 Wi-Fi HaLow SoC is used in home and industrial sensor nodes to monitor process changes and relevant ambient condition. The SoC is fully compliant with the IEEE 802.11ah standard operating in the Sub 1GHz license-exempt band.

Seeing Machines (LSE: SEE), a computer vision company that designs AI-powered operator monitoring systems to improve transport safety, has unveiled its 8th generation Occula Neural Processing Unit (NPU). Occula is highly optimized for human detection and tracking. The Seeing Machines FOVIO Chip, enabled by the Occula NPU, is an application specific processor for implementing Driver and Occupant Monitoring Systems in vehicles. It is already being employed across more than one-third of its ongoing automotive programs. The Occula

NPU design is available for license. **Omnivision** is the first license.

Driver Monitoring (DMS) on its way to becoming mandatory in vehicles worldwide. In November 2019, the EU Council of Ministers passed a general safety regulation mandating automakers to install advanced safety systems in all new cars on the EU market. These advanced safety systems include camera-based driver monitoring to detect inattention or drowsiness in the driver, and to issue a warning if driver distraction is identified. By 2026, the law will include all newly produced cars on the EU market. In 2020, the U.S. House of Representatives passed the Moving Forward Act, which requires the installation of technology that detects inattentive or intoxicated driving in new vehicles.

DMS revenue from embedded units installed in private vehicles is on track to outgrow aftermarket DMS revenues in the commercial vehicles vertical in 2024 and reach $1.8 billion by 2030. Considering upcoming regulation and OEM announcements, **ABI Research** predicts that shipments of DMS will increase from 0.05 million in 2019 to 19 million in 2022, generating $502 million in revenues, and 83 million in 2030.

Sony Semi has released two types of stacked event-based vision sensors for industrial equipment. Event-based vision sensors asynchronously detect luminance changes for each pixel and output the changed data only, combining it with information on pixel position (xy coordinates) and time, thereby enabling high-speed, low latency data output. The two new sensors employ stacking technology leveraging Sony's Cu-Cu connection and combine Sony's CMOS image sensor technology with **Prophesee's** event-based vision sensing technology.

StoreDot, a pioneer of extreme fast charging battery technology for electric vehicles, revealed its silicon-dominant technology applied in extreme fast charging (XFC) cylindrical cells. The company demonstrated the prototype 4680 form factor that is fully charged in just 10 minutes. Cylindrical cell samples are now ramping up the production lines at EVE Energy, StoreDot's manufacturing partner in China. Global automotive manufacturers will be able to use StoreDot's XFC batteries, which deliver a 50% reduction in charging time at the same cost, in both pouch and cylindrical cell forms. Both formats are undergoing scale up process at EVE Energy and will be ready for mass production in 2024.

Syntiant has introduced the NDP102 Neural Decision Processor for sensor applications that delivers 100x improvement in efficiency and performance compared to current MCU-based offerings. Capable of performing sensor processing at under 100uW, the NDP102 can operate as a standalone always-on component of a larger system. Samples now; production in Q4.

Syntiant has also introduced the NDP200 NDP, the company's first chip designed for vision processing that can provide highly accurate inference at under 1mW. Packaged with the Syntiant Core 2, the NDP200 can run multiple applications simultaneously with minimal power consumption, including AI vision features such as person detection, object classification, motion tracking and occupancy monitoring.

The NDP200 is equipped with an Arm Cortex M0 processor and a HiFi-3 DSP to support feature extraction and signal processing for image and voice enhancements. The device features hardware acceleration over 6.4GOP/s and supports more than 7 million parameters. ■

Licensing & Partnerships

Edgewater Wireless and **CMC Microsystems**, manager of Canada's National Design Network, have signed a Memorandum of Understanding (MOU) for expanded technology sharing. Edgewater will provide CMC with access to their Spectrum Slicing Development Kit for IoT devices for residential and industrial applications. CMC will facilitate access to CAD, fab prototype services and equipment for device validation. CMC will also provide pre-fabrication support.

The goal of this MOU is to accelerate the commercialization of Edgewater's Spectrum Slicing silicon solutions for use in IoT applications. Wi-Fi Spectrum Slicing enables the spectrum to be divided, allowing more radio signals to operate in a given area in the same band. Edgewater Wireless develops Wi-Fi silicon, Access Points, and IP licensing designed to meet the high-density and high quality-of-service needs of service providers and their customers. A recently completed PoC with a major

Licensing & Partnerships

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Tier 1 Service Provider showed 7x to 18x performance gains in 75% of homes surveyed.

GlobalFoundries and **Qualcomm** are extending their RF collaboration on 5G multi-Gigabit speed RF front-end products.

The Industrial Development Bureau (IDB) under the Ministry of Economic Affairs (**MOEA**) is supporting the Industrial Technology Research Institute (**ITRI**) and **Arm** in providing critical resources to make IC design accessible to startups in Taiwan through a new initiative called the IC Design Platform for Startups. The combination of services and support from ITRI and access to Arm technology through its Arm Flexible Access for Startups program will assist startups in accessing critical IP and accelerating product development.

The Department of Industrial Technology (DoIT) of the Ministry of Economic Affairs (**MOEA**) is supporting the commencement of cooperation between Industrial Technology Research Institute (**ITRI**), the AI on Chip Taiwan Alliance (**AITA**), and the UCLA Center for Heterogeneous Integration and Performance Scaling (**CHIPS**). ITRI, AITA and UCLA CHIPS signed an MOU on Sep. 14 to foster cooperation on AI chip development.

Through the use of the UCLA CHIPS platform, Taiwan's D2D technology will be able to be promoted internationally. UCLA CHIPS has the latest heterogeneous integration technology, which will help connect international system integration requirements with Taiwan's semiconductor ecosystem.

AITA connects the resources of Taiwan's semiconductor-related industries with those of the government and academia and is strengthening cooperative relationships with global innovators. Since its inception in 2019, AITA now has over 125 member companies, working to develop AI chip technology for AIoT system applications. ITRI was founded in 1973 and has been dedicated to incubating startups and spinoffs, including well-known names such as UMC and TSMC.

Omni Design Technologies and **LeddarTech** are collaborating in next-generation LiDAR SoCs that will enable LiDAR manufacturers to design their solid-state LiDAR products for various end markets. LeddarTech's LiDAR SoC integrates analog-to-digital converters (ADC) and a multi-channel analog front-end from Omni Design.

ROHM, together with **Geely Automobile Group**, a Chinese automobile manufacturer, have entered into a strategic partnership to develop advanced technologies in the automotive field. The companies have been collaborating on a variety of automotive applications since 2018, when they first agreed to a technical exchange. This partnership will further promote cooperation and accelerate innovation for automotive applications. As a first step, traction inverters equipped with ROHM's SiC power devices are being integrated in electric vehicle platforms currently being developed by Geely.

Tower Semi and **Quintessent**, a leader in laser integration with silicon photonic ICs, are collaborating to create a Silicon Photonics (SiPho) process with integrated quantum dot lasers. According to Yole, the silicon photonics transceivers market for datacenters is expected to grow at a CAGR of 40% to reach $3.5B in 2025.

The new foundry process will build upon Tower's PH18 production silicon photonics platform and add Quintessent's III-V quantum dot-based lasers and optical amplifiers to enable a complete suite of active and passive silicon photonic elements. The augmented PH18 process is part of DARPA's Lasers for Universal Microscale Optical Systems (LUMOS) program. The initial process development kit (PDK) is planned in 2021, with multi-project wafer runs (MPWs) following in 2022.

Weebit Nano and **SkyWater** announced an agreement to take Weebit's Resistive RAM (ReRAM) technology to volume production. In addition, SkyWater has licensed the technology for use with customer designs. SkyWater intends to offer it to customers as embedded, non-volatile memory IP on the company's 130nm CMOS process.

X-FAB is now able to support volume heterogeneous integration via Micro-Transfer Printing (MTP), thanks to a licensing agreement with **X-Celeprint**. X-Celeprint's massively-parallel pick-and-place MTP technology stacks and fans-out ultra-thin dies based on different process nodes, technologies, and wafer sizes resulting in the formation of virtually monolithic 3D stacked ICs. ■

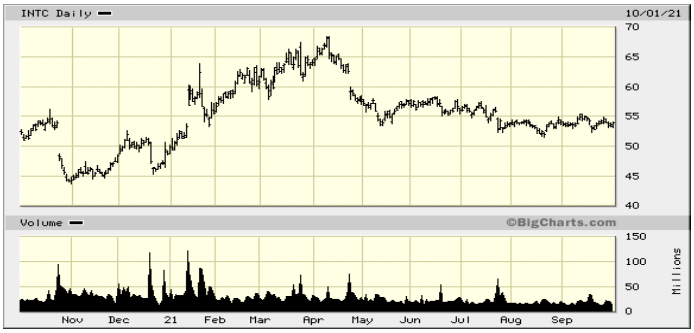
Philadelphia SOX Index

TSMC – Foundry Barometer

Micron – DRAM Barometer

Western Digital – Flash Barometer

Intel



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Publisher: Cliff Hirsch, cliff@pinestream.com

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ISSN 1097-2927

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