

Summer Camp:
IC Design Your
Future
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Sembcorp:
Sustainable
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FOREWORD BY Executive Director

We are in the last quarter of 2022 as we wrap up September with our biggest and highly anticipated event – SSIA Summit and Semiconductor Dinner. This year sees the most successful and strong showing of support from industry partners with more than 100 companies participating in the Summit and Dinner. This support demonstrates the robustness of the semiconductor industry and how we have grown in the last 2 years since the pandemic. And undeniably of course, we certainly are all looking forward to catching up with old and new friends to continue to build rapport after such a long hiatus. I believe this event brings about much reprieve to the industry as we all come together. On this note, I thank all the sponsors once again.

2022 has been defined by new realities presented by COVID-19 and the mounting climate crisis and most recently, the energy crisis that has plagued many of our companies in our industry. And yet, the pandemic has not put a dent in our vision and resilience to make concerted efforts to bring us closer to Singapore's Manufacturing vision to grow 50% by 2030. And some of these milestones have come to fruition with one of the global manufacturing stalwart, GlobalFoundries expanding their operations here in Singapore amongst others; cementing our importance and position as the semiconductor hub in South-east Asia. And congratulations to GlobalFoundries on their new Fab at Woodlands. I believe this will be the launchpad of many more companies to come.

That being said, the semiconductor is indeed facing some major headwinds as the world is mired in many uncertainties that have caused and will potentially cause a significant impact on the industry such as the ongoing Russia-Ukraine war, the US-Sino escalating trade tensions and the faltering of the global economy. The war has precipitated a fuel and energy crisis globally and caused a price hike of electricity and gas across many countries; where Singapore is not spared. In fact, it is compounded by our lack of natural resources.

The energy crisis has fuelled an impetus and opportunity for businesses to pivot manufacturing to ensure security and environmental sustainability without compromising on economic competitiveness. The faster uptake of circular-economy principles and development of market mechanisms such as the adoption of renewable energy and recyclable water would be definitive steps to counter the crisis; not completely but a win-win for all for now.

In view of the world situation at large, we will focus on sustainability in semiconductors this year. The

theme for this year's Summit is "Advancing Technologies Towards A Sustainable Future". The semiconductor industry is expanding due to the surge in chip demand and is expected to grow further in the coming years. The demand for chips is expected to grow at a compound annual rate of 10 percent between 2020 and 2025, driven by rising demand for semiconductor products. According to the World Semiconductor Trade Statistics (WSTS), Asia-Pacific, the largest region, the semiconductor industries are expected to grow 10.5%.

On the other hand, we will require semiconductors to power technologies that support global climate goals, such as electric vehicles and solar panels that unfortunately will inherently cause a debilitating effect on the environment. The Summit will tackle this important contradiction and explore how the industry could balance these two ambitions.

Finally, I will touch on the topic of our industry's talent pool as people is the greatest asset of our industry. Our industry is expanding despite the economic slowdown and we need to do a lot more to attract talents to join us. My team will continue to collaborate closely with companies, government agencies and our partners to work on this front. We will announce new strategic programs and initiatives to grow and develop our talent pool in the coming months.

My team has also expanded and we have a new team undertaking several key portfolios and they will be reaching out to you and in fact, they might have already reached out to you. We will be creating more awareness about our industry, especially the young people in the next few months working closely with our economic agencies and hereby, I seek your support on this front as we galvanise our efforts on this area in time to come. Case in point, for this issue of Voice, this cover has been illustrated by a young talent who is keen on joining the industry and this is her depiction of green technology. We will continue more of such fresh endeavours in our future activities.

I believe that Singapore's semiconductor industry will weather all of the headwinds and challenges and the outlook for Singapore's semiconductor industry remains positive, with growth expected in the next year. Let us come together to make our industry a vibrant and dynamic one. I look forward to catching up with you soon.

ANG WEE SENG
Executive Director
Singapore Semiconductor Industry Association (SSIA)

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SSIA EVENTS

JAN 2023

Electronics Industry Day

The Electronics Industry Day brings together diversified businesses and partners within the semiconductor and electronics ecosystem to showcase our industry's vibrancy and resilience; regardless if you are totally new to the industry or mid-career switchers, find your niche in semiconductor.

7-10 FEB 2023 & 28 FEB - 3 MAR 2023

Singapore Semiconductor Leadership Accelerator

A custom program designed to inspire emerging technical and business leaders to continue creating revolutionary possibilities with semiconductors. It was conceived as part of the Singapore Semiconductor Vision (SSV) 2020, a taskforce comprising the private and public sectors to increase competitiveness in Singapore's semiconductor manufacturing industry. Delivered as two modules, the programme is an immersive hands-on learning experience designed to accelerate personal and professional growth for leaders to succeed in the increasingly volatile, uncertain, complex and ambiguous (VUCA) global environment.

9 MAR 2023

Semiconductor Women's Forum 2023

Launched in 2021, organised by the Singapore Semiconductor Industry Association (SSIA) and supported by EDB, WSG, e2i, Global Semiconductor Alliance and the Semiconductor industry. This event aims to raise awareness on diversity and inclusion, attract more female talents to join the semiconductor industry, and inspire the current female workforce to stay and thrive in the industry.

APR 2023

Semiconductor Business Connect 2023

Backed by the MNCs, this platform aims to strengthen and grow the local Semiconductor and Electronics ecosystem by facilitating innovation through business collaboration. With a focus to grow businesses, Semiconductor Business Connect aims to connect the Semiconductor network, to innovate solutions and collaborate for success. The business forum will include keynote presentations from supporting agencies that will help business leaders develop strategies of the future, discuss trending current affairs topics such as supply chain disruptions, sustainability in manufacturing. Most importantly, providing business matching opportunities, connecting manufacturers and solution providers to optimize operations through Industry 4.0, sustainable manufacturing and supply chain management.



Singapore Semiconductor Industry Association (SSIA)



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Find out more with us at secretariat@ssia.org.sg



SUMMER CAMP - IC DESIGN YOUR FUTURE

Back in July, the IC Design Committee proudly brought the inaugural Summer Camp - IC Design Your Future to the students. This is in partnership with NTU, NUS and SUTD; and strongly supported by EDB.

It was a 3-Days immersive program from 20 to 22 July 2022, which gave the university undergraduates in the faculties of Electrical, Electronics, Computing and Design Engineering, who might be interested to join the IC Design sector in the near future a glimpse of the semiconductor industry.

This program provided the students an opportunity to learn more about the Semiconductor and Electronics industry, IC Design career prospect, visits to leading multi-national companies such as AMD and GlobalFoundries; and most importantly, to provide the opportunities to interact with various Semiconductor companies' industry leaders and members to experience the vibrancy, focus and passion of the semiconductor industry.

Industry leaders and experts were invited to share about the Semiconductor and Electronics industry trends, IC Design sector driving new innovations, overview of wafer Fab processing and Backend packaging & test, as well as panellists sharing vast experiences of their career in the industry. And lastly, not forgetting the #AskMeAnything sessions with AMD and GF team, sharing their experiences by their very own team members.

The visit at AMD allowed students to experience the work nature at product company, ID Designers roles and career prospect. They got to appreciate the value-add of chip design enabling powerful computing processing applications, providing solutions to modern world challenges. They also got to experience the culture of teamwork and collaboration, as well as the semiconductor industry emphasis on diversity and inclusion.



"Chip design has become one of the key differentiators at major tech companies. We're in a renaissance for the semiconductor industry, which makes it the perfect time to capitalize on the high level of awareness and interest, to build an even stronger pipeline of IC design talents to accelerate growth in this sector." - **Mr Eu Gene Goh, Senior Director, Design Engineering, AMD, and Co-Chair of IC Design Committee**



#AskMeAnything at GlobalFoundries



"I hope to encourage women to join a traditionally male-dominated industry and persevere through unique yet rewarding challenges. With a consistent pipeline of talents from future generations, Singapore can continue to attract world-class semiconductor companies to set-up or expand operations here." - **Ms Gn Fang Hong, Senior Director, GlobalFoundries, and IC Design Committee member**

At GlobalFoundries, the students experienced the manufacturing Fab - enabler of fabrication of integrated circuit chips. The students had the

privilege to experience a Fab tour into the cleanroom, getting first-hand experience of Operations Excellence; in terms of how GF plans and executes the Fab tour, Failure Analysis Lab Tour and SPICE simulation Lab Tour for multiple groups concurrently.

The Summer Camp wrapped up with an Innovation Day where the students experienced hands-on setup, solutioning and problem-solving with the PYNQ-car mini competition, supported by the AMD team. PYNQ is a Python productivity on Zynq, which is an open-source software framework that makes it convenient for engineers to develop embedded systems on AMD/Xilinx Zynq SoC devices. The students had an immersive experience using

hardware and software to execute certain route challenges with the PYNQ-car. The can-do attitude exhibited by the young talents and learning experience were most remarkable.

It was delightful to see the active engagement by the students and their vibrant smiles throughout the IC Design Summer Camp. We look forward to many more young talents joining the semiconductor industry in the very near future.

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IC Design Committee



SUMMER CAMP - IC DESIGN YOUR FUTURE

DAY 1 — AMD Campus

Talks, #AskMeAnything, Networking

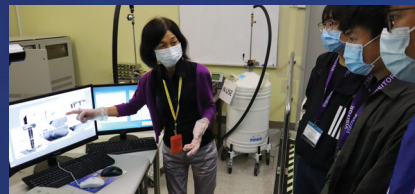


DAY 2 — GlobalFoundries Campus

Talks, Networking

Fab Tour

Line Tour

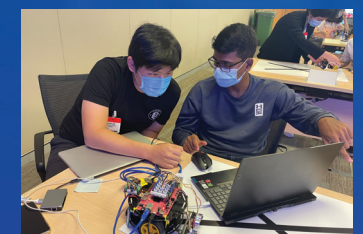
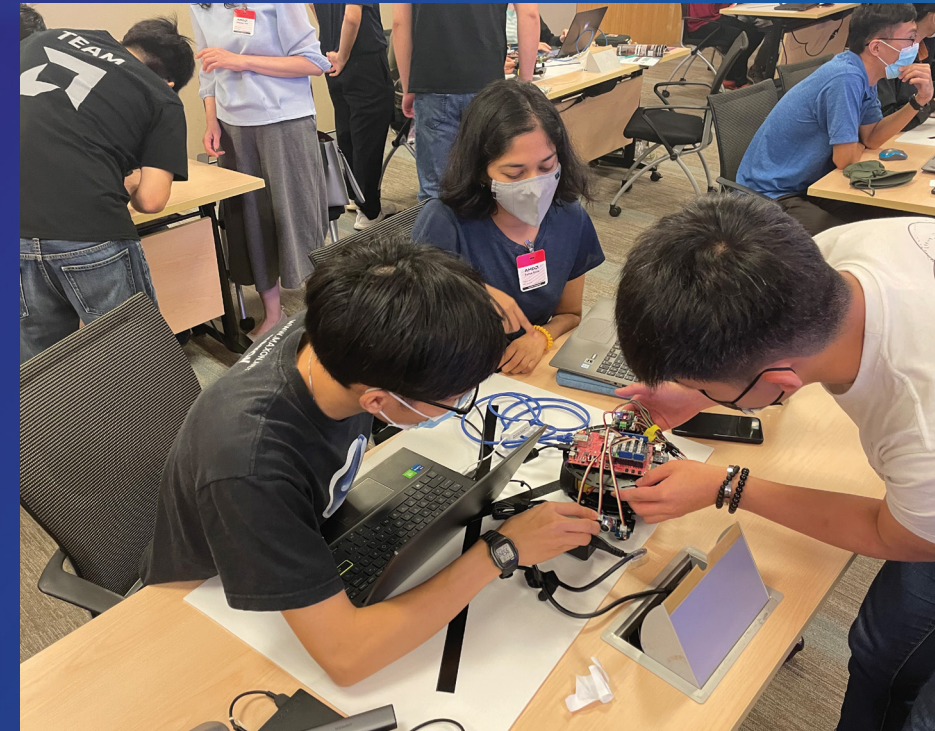


GF Organising Team



DAY 3 — AMD Campus

Innovation Day



Participants playing games with PYNQCar, a programmable device with sensors

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Opening ceremony of the SP Advantest Test Engineering Centre

Advantest and Singapore Polytechnic Jointly Set Up New Test Engineering Centre to Boost Capabilities of Integrated Circuit Test Engineers in Southeast Asia

Singapore Polytechnic (SP) and leading semiconductor test equipment supplier Advantest (Singapore) Pte. Ltd. inked a strategic partnership to establish a Test Engineering Centre (TEC) in SP. The TEC aims to enhance and upgrade the test development and product characterisation capabilities of semiconductor test engineers in Southeast Asia. This collaboration is Advantest's first with an Institute of Higher Learning in Singapore.

Officially opened by Minister of State for Education and Manpower, Ms Gan Siow Huang, on 30 June 2022, the TEC is equipped with the state-of-the-art test system, V93000 and M4841 handler; a scalable system that is widely adopted by the semiconductor testing industry. It supports a wide range of device testing applications in both engineering development and high-volume manufacturing. This integrated test cell solution is a key enabler for test floor automation and smart manufacturing.

The TEC also features an info wall jointly created by SP and SSIA. Unveiled by Ms Georgina Phua, SP Deputy Principal (Development), and Ms Jennifer Teong, SSIA Board member

during the launch, the info-wall serves as a learning journey for students and visitors on the importance of the semiconductor industry in Singapore.

Mr Ang Wee Seng, Executive Director of SSIA shares, "The info wall aims to help students understand the industry better. Through this initiative, SSIA hopes to encourage more students to consider a career in the semiconductor sector where the development of a robust talent pipeline is pivotal."



Tour of the centre



Launch of the info wall

As part of SP's industry co-location initiative, the tie-up with Advantest will enable SP to bridge the gap between industry and academia. Staff and learners will have access to the TEC's cutting-edge facilities and the latest industry technologies and practices.

Advantest and SP will co-create hands-on learning experiences for both Pre-Employment Training (PET) students and Continuing Education & Training (CET) learners. The curricula will be developed with a strong focus on semiconductor testing to provide practical and up-to-date industry-related knowledge for learners of all ages.

SP also plans to use the facility and equipment to conduct short courses through SkillsFuture Singapore for engineers and technicians in the semiconductor test industry. With the establishment of the TEC, SP, Advantest and SSIA plan to launch short courses in Integrated Circuit testing for adult learners in November 2022.

"Advantest is honoured to support these industry skill-development initiatives together with Singapore Polytechnic. We enthusiastically support this collaboration which will help lay the foundation, as well as create value, for the entire semiconductor value chain," said **Mr Ricky Sim, Managing Director and CEO of Advantest Singapore.**

Mr Soh Wai Wah, Principal and CEO of Singapore Polytechnic, said, "The semiconductor industry powers billions of devices around the world. As semiconductor designs

become more complex and market pressures rise, highly skilled semiconductor test engineers will play an increasingly critical role in achieving manufacturing and testing excellence so that their products can meet the advanced computational power and capacity standards to create technological breakthroughs. Partnering with Advantest will enable us to jointly expand and strengthen a regional talent pool with the specialised expertise for semiconductor companies to tap on and scale up their business with a clear competitive edge in a fast-growing digital world."



Students showing their work

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ADVANTEST

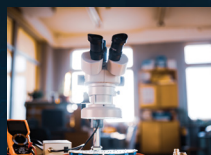
SP Singapore Polytechnic

TRAIN, UPGRADE & RESKILL

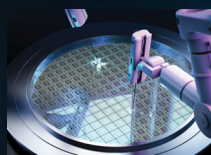
As the semiconductor and electronics sector strengthen our local ecosystem and relook at ways to attract and retain talents, training, up or re-skilling and upgrading remain critical in staying relevant and future-proofing ourselves. Check out programmes in the pipeline, brought to you by SSIA and our learning partners.



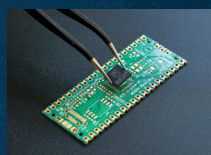
Introduction to Vacuum and Plasma Technology (1 day)



Microscopy and Thin Film Characterization for Failure Analysis (1 day)



Wafer Fabrication in Semiconductor Industry (3 days)



Digital Integrated Circuit (IC) Testing



Advanced Manufacturing Inspection Workshop (4 days)



Semiconductor Processes (2 days)



Check out [SSIA website](https://ssia.org.sg) or scan the QR code for full list of events, training and courses. Or contact Cindy Chong at cindy@ssia.org.sg.



COURSE

Digital Integrated Circuit (IC) Testing

This course would equip participants with essential knowledge of integrated circuit (IC) testing and developing test program for digital IC testing on a System on Chip (SoC) tester integrated with handler widely used in Integrated Device Manufacturing (IDMs) and foundries.



COURSE DATES:
07 Nov to 9 Nov 2022



REGISTRATION PERIOD:
10 Aug to 10 Oct 2022



DURATION:
24 hours



TIME:
8:30am to 5:30pm



MODE OF TRAINING:
Facilitated Learning (F2F) and Practical Training



VENUE:
Singapore Polytechnic

COURSE OBJECTIVE

This course covers participants with the essential knowledge and skills in digital integrated circuit testing. Participants would be introduced to the various types of IC technologies, packaging and fundamentals of integrated circuit (IC) test methodologies. Participants would understand the various aspects of IC test such as Direct Current (DC), Alternating Current (AC) parametric and functional tests and developing a test program for digital testing on a System on Chip (SoC) tester integrated with a handler

widely used in the Integrated Device Manufacturing (IDMs) and foundries

COURSE OUTLINE

By the end of the course, participants will be able to:

1. Describe the Integrated Circuit (IC) manufacturing cycle
2. Interpret the different types of IC technologies and packaging
3. Explain the application of automatic test system in Wafer Test, QA Test, Reliability Test, Burn-in and Characterization Test.
4. Explain the different IC test; methodologies; DC, AC and functional tests
5. Describe the architecture of a SoC tester
6. Develop test program for a digital IC to perform DC, AC and functional test.
7. Test and debug on an industrial SoC tester with handler

Topics to be covered

1. Overview of IC manufacturing cycle and IC testing. Different types of IC technologies and IC packaging. Application of Automatic Test System in the following areas: wafer test, final test, QA test, reliability test, burn-in and characterization test. Outline the evolution of ATS and its future trends.

2. General concepts of digital test methodologies: DC test, AC test and Functional test. Need of temperature testing. Overview of IC datasheet.
3. Architecture of a SoC Test System. Introduction to pattern generator, timing, source & measurement unit and waveform in a test system.
4. Develop test program for digital IC to perform DC, AC and functional test on a SoC tester. Testing and debugging on a SoC tester.
5. Overview and Demonstration of test cell process.

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ITE qualifications and above.

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- **Certificate of Attendance** (electronic Certificate will be issued) A Certificate of Attendance will be awarded to participants who meet at least 75% attendance rate
- **Certificate of Performance** (electronic Certificate will be issued) A Certificate of Performance will be awarded to participants who pass the examination and meet at least 75% attendance rate



Scan the QR code for more details.

Social Sustainability: A Goal to Work Towards

With the demand for semiconductors continuing to surge, companies must act to make considerable room for sustainability issues on their corporate agendas.

Forward-thinking organisations understand that sustainability drives innovation as well as business efficiencies. They are also aware that by focusing corporate strategy on sustainability they will see lower energy use and less waste among their operations. In adopting a values-driven approach they will protect their brand, mitigate risk and contribute to safeguarding the environment and effecting meaningful societal change.

The global push to decelerate climate change raises a great deal of issues for semiconductor companies. Once these issues are considered, they should translate to action items. Many leading companies have set quantifiable sustainability

targets while looking to fine-tune sourcing for materials and reduce waste and emissions.

Yet the environment is not the only pillar of sustainability. Two others exist - *economic* and *social*, the latter of which refers to people. As a recruitment consultant in the semiconductor industry, I would like to share some of my thoughts on talent attraction, engagement, diversity and inclusion as they pertain to social sustainability.

Semiconductors are essential for building new technologies. As a result, there is a continuous need for new skills. However, talent shortages in the industry are a significant issue. To create a strong and flexible workforce for the years ahead, organisations need to take a broad and proactive approach encompassing talent acquisition, talent management, and

succession planning as it requires years of specialised education and training.

“STEM education is a critical initiative. Bridging the STEM skills gap among students globally and forming partnerships with academic institutions is a meaningful way to build a pipeline of sustainable talent.”

To retain their workforce, companies also need to consider creating exciting career development opportunities. This involves defining clear career paths that offer young workers a professional framework. Doing so will nurture their ambitions and demonstrate the different opportunities available in the world of semiconductors. By offering continual training alongside these plans, organisations will keep staff engaged and motivated, mitigating the chances of them exiting the industry.

Providing a comprehensive benefits package is important too. While it will always be difficult to compete with tech giants like Google, Apple, Amazon, etc., semiconductor companies may be able to hold on to skilled workers by providing a thorough set of enticing benefits.

The digital revolution has changed the workplace. It has also changed candidates' expectations of culture and innovation. This will have a knock-on effect, as forward-thinking organisations



build modern work environments that allow their employees to be passionate, innovative and flexible. These organisations will make for stiff competition in acquiring work-life balance and purpose-oriented talent.

Inspiring future talent through current employees is one effective way to attract and engage new personnel. Current staff, who are treated well and kept motivated, make for great company ambassadors. If they enjoy working for an organisation they will showcase opportunities and promote their place of work.

Semiconductor is traditionally a male-dominated industry. Though steps have been taken to help integrate women, they remain in the

minority among many organisations' workforces. There is no justification for only men to hold specific position types as modern, automated work is more flexible and less dependent on physicality.

The industry needs to look for competent people, regardless of their gender, ethnicity, sexuality or age. For this to become standard practice, and for unconscious biases to be addressed, it will take some time. Diversity and inclusion require a purposeful re-evaluation of culture and mindset. I am hopeful that the semiconductor industry is on the right track.

It is important that the semiconductor industry continues to strive towards the goal of total social equity and remains accountable at all junctures. The development of new technologies necessitates an innovative, diverse and forward-thinking workforce. We need to continue our progress in the realm of sustainability to strengthen talent pipelines for further growth and success.

Kerry Consulting's Semiconductor Practice partners with global semiconductor companies, providing solutions to overcome their talent shortage challenges and achieve business growth by devising customized, effective, and sustainable acquisition and retention strategies.

For more information reach out to Michelle Lee, Semiconductor Practice Lead at Kerry Consulting: michelle@kerryconsulting.com



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KERRY
CONSULTING

Silicon Labs' aim in driving the initiative is to pay it forward, to help create the next generation of engineers. Through various sessions we intend on lifting the veil of semiconductor industry, showcasing the impact of engineers or industry in general and create a spark of interest in the evolving minds to choose STEM for further studies and as part of their career.

Students often ask, "Why do we need to study Science and Math in school?" Asking this to an industry professional is guaranteed to leave majority of them perplexed – trying to find right words to explain the necessity of logical thinking and rational fact finding. Now, perhaps we have a hint of an answer on what would help students understand the why's and how's of studying STEM in school.

THE PROGRAM

In early 2021, Silicon Labs partnered with Science Center for the STEM initiative. The long-term goal being to promote STEM program among school students by giving them a peek into how the semiconductor industry works and working closely with industry professionals.

The project kicked off with Science Center matching us with Chua Chu Kang Secondary School (CCKSS) The school successfully runs a Robotics club through their Applied Learning Program; hence we had a good starting point with a group of students passionate about STEM. We started communicating with the school during May 2021 to



establish short- and long-term goals. The short-term process would include reviewing teaching materials, knowledge-sharing sessions with students, and mentoring students on projects of their interest. Long-term process would include establishing a project framework to help students across multiple years of school.

A teacher with CCKSS, Audrey Tan shared, "The guidance provided by the mentors from Silicon Lab is invaluable as they are able to share not only their

technical expertise but also encourage students to explore alternative solutions to curated problems in their projects. More importantly, the sharing of the mentors' thought processes and

industrial experiences gave students a different outlook and insight on skills to solve real world problems."

THE VIRTUAL SESSION

First interaction with the school happened virtually in June 2021, as was the norm at the peak of pandemic.

The aim of the session was to interact with students, teachers and parents and give them a glimpse into the world of IoT and working of semiconductor industry.

We talked about what IoT means and how it is changing our lives for the better. To help students on their way towards successful careers in STEM, our HR team gave presentations on what skills and subject expertise companies in the STEM industry are looking out for.

Finally, our engineers gave a perspective on how their day-to-day work looks like. Through their stories, they also portrayed how each engineer's contribution gets pieced together to create the massive semiconductor industry.

THE DEMONSTRATION

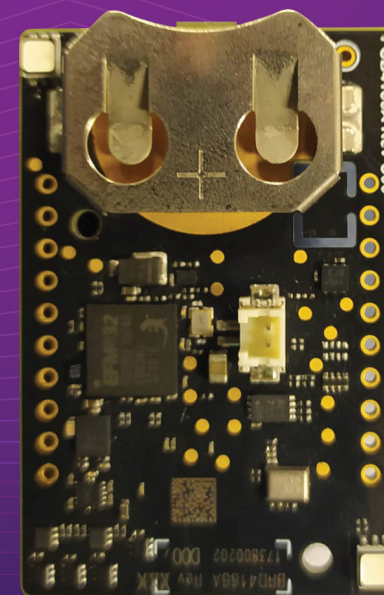
Not even the most successful virtual session can replace the effectiveness of face-to-face interaction. As with the online session, for next phase our engineers came up with novel ways to introduce the very broad semiconductor industry to a group of secondary students through interac-

tive demos using Silicon Labs boards, pop quizzes and even a game of tic-tac toe using Tableau.

What started out as a one-way traffic quickly turned into a vibrant group activity. Students were eager to learn and pick the brains of their mentors on all the different topics. It was inspiring to know that with the right exposure and tools, it is possible to instill a curious mindset towards STEM, with a basis in problem solving and critical thinking. Thus, a session planned for two hours easily went past the scheduled mark.

THE MENTORING

To come full circle on the first phase of interaction with CCKSS, students were encouraged to take up STEM projects. Students would apply their creativity into solving a problem related to one of the sustainability goals defined by the United Nations, either using Silicon Labs boards or any other method



The back of Silabs' Thunderboard Sense 2 which was used for demo. This particular one was left with the school for students or teachers to tinker with.

of their choice. Mentors from Silicon Labs will be guiding them through face-to-face as well as virtual meetups. Projects are expected to be completed before end of 2022, with a small demo to wrap up this phase of the program.

STEM initiative has been a learning opportunity for all of us at Silicon Labs and will continue to be so in coming years. It has given us a chance to interact with the secondary school student/teacher community, understand their thought process and thus give back to the society in best way possible.

We also take heart in the fact that students are willing to take up the challenge to learn and apply new skills like learning and experimenting with Silicon Labs boards, to achieve their goals in the very limited time available.

There's no short or easy answer to what can inspire students towards STEM, but we have learned that through regular interaction between students and industry, by giving them a glimpse into solving real-world problems, we can nurture next generation of engineers and scientists.

Rafe Chan Rui An, a secondary 3 student also echoed about his inspirations in STEM, "During my involvement in the STEM projects, I had the chance to ideate, research, and plan my project, which is also known as the engineering thought processes. Other than that, I also got to use one of Silicon Labs' ThunderBoard. My favourite part about the board is that it has cool sensors and RGB LEDs which can be controlled from their app. Under the guidance of the mentors, I am in the process of constructing a prototype that I hope would make a difference to the world around me based on the topic "Sustainable Development Goals."

SOME BACKGROUND INFO

Silicon Labs team is a group of volunteers plying their trade in diverse branches of the semiconductor industry, bound by the common passion for STEM.

Shantonu Bhadury, Engineering Director at Silicon Labs, observed, "For a thriving engineering ecosystem, it is important to mould the minds of curious students through show and tell, providing real-life experiences and mentoring them through their journey of discovery and aha moments. The work we are doing will bear fruit in a decade, and we are happy to lead this effort of increasing the engineering mindshare among the secondary students."

Miew Cheng Leong, HR Director at Silicon Labs, noted, "I believe the creative minds of our next generation is shaping innovations that will supports sustainability for the future. It is also my learning journey to work with the students and the teachers."

Here's what Gopinath Ravuri, Staff Design Engineer, had to say, "I am really impressed with the education system in which students are enthusiastic to learn more and teachers support for students to organize the event."

CONTRIBUTED BY

HARIKRISHNAN
PRABHA VALSALA
of



The Hitachi Young Leaders Initiative 2022 – Investing in the Next Generation



HYLI students at their Cultural Night from 8 countries

The Hitachi Young Leaders Initiative (HYLI) is Hitachi's way of fulfilling its commitment to society, particularly helping build future generations. This corporate social responsibility program seeks to identify and nurture potential Asian leaders among the best and brightest students in Asia, bringing them together to discuss regional and global issues with influential government officials, prominent business leaders, academics and civil society representatives.

Held in Singapore at the Sands Expo & Convention Centre from 18th to 21st July 2022, 30 students from 7 ASEAN Countries (Indonesia, Malaysia, Myanmar, the Philippines, Singapore, Thailand, Vietnam) and Japan came together in-person and were tasked to develop a solution based on one of the following Sustainable Development Goals (SDGs):

- **SDG 3:** Good Health and Wellbeing
- **SDG 6:** Clean Water and Sanitation
- **SDG 7:** Affordable and Clean Energy
- **SDG 11:** Sustainable Cities and Communities

The main theme for HYLI 2022 is "Social Innovation in the New Normal". In light of the recent COVID-19 pandemic and the political conflicts, countries and people alike have had to adapt to drastic changes, coined as the "new normal". Furthermore, the pause due to COVID-19 exposed the severity of climate change and the urgency that it must be dealt with. HYLI 2022 was Hitachi's way of educating young leaders on this and to challenge them into thinking about how they can make a change.

Graced by Hitachi's Executive Chairman, Mr. Toshiaki Higashihara, Minister Yoshiaki Takahashi, Embassy of Japan in Singapore and Ms. Low Yen Ling, Singapore's Minister of State, Ministry of Trade and Industry & Ministry of Culture, Community and Youth, the event involved plenary sessions, workshops, field visits, student delegate presentations and a cultural evening.

The biennial event included 14 prominent experts to discuss the four SDGs in a series of panel discussions, where the students had the opportunity to ask questions to the leaders of today. On the final day of the event, the students presented their solutions to an advisory panel of experts who scrutinized and questioned the viability of their solutions. The climax for HYLI was the Cultural Night where students put together a performance showcasing cultural aspects from their respective countries.

"We want to say thanks again to the Hitachi Young Leaders Initiative 2022 program for giving us the opportunity to connect with many amazing people. We not only have a chance to connect with the most important persons of the company, but also be friends with many young and talented leaders

around South East Asia. Through all the activities together and especially the culture night, we are now officially a big family. We believe that the program will be the foundation to help us create great social innovations in the future for our country and the region." [Students from Vietnam]

"Beyond grateful to be part of this fantastic and inspiring program, the Hitachi Young Leaders Initiative 2022 in Singapore! Especially after 2 years of online studies, I really value the opportunity for in-person interactions. Meeting passionate youth from 8 different Asian countries and fostering friendship with them is invaluable and [one] of the greatest takeaway I had from this program." [Student from Malaysia]



HYLI students in their SDG workshop

Through this flagship program, Hitachi will continue to contribute towards building a brighter and more promising future for our next generation. The next Hitachi Young Leaders Initiative is currently planned to be held in 2024.

You can also learn more about the event and look for future updates at <https://www.hitachi.com.sg/about/>

Article contributed by Hitachi.

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Themed 'Industry 4.0 for Business Sustainability', the 5th edition of the Industrial Transformation ASIA-PACIFIC - a HANNOVER MESSE event (ITAP) happening on 18-20 October 2022 will deep dive into trends and developments in three key dimensions i.e. Digitalisation, Talent & Workforce Development, and Environmental Sustainability, which influences the magnitude of sustainable business development for advanced manufacturing and its related sectors locally, regionally and globally.



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EXECUTIVE SPOTLIGHT

Say Wee Toh

Head of Human Resources
for the Filter Solutions Group
at Skyworks

In an exclusive interaction with SSIA, Say Wee, Toh, Skyworks Filter Solutions Singapore's newly appointed Head of Human Resources for the filter solutions group at Skyworks' Singapore office, talks about the current challenges faced by the semiconductor industry, and shares how Skyworks builds a sustainable talent pipeline.

Say Wee, Toh is an experienced and passionate HR practitioner who will now lead the HR function at Skyworks' biggest manufacturing plant in Asia that employs 1,200 team members. He started his career in executive search and then joined a US multi-national semiconductor company where he spent close to a decade as a strategic HR business partner.



HOW CAN YOU EMPOWER YOUR ORGANIZATIONS TO WIN THE WAR FOR TALENT?

What are some of the challenges Skyworks face in Singapore?

In Singapore, the manpower crunch in the semiconductor industry is something that the sector has been grappling with for some time.

With the current post-pandemic situation, winning the war for talent has been reignited in today's dynamic and disruptive business landscape. Companies need to reimagine and redesign their recruitment efforts. The talent ecosystem has become increasingly candidate and skill-driven. There is a constant need for HR professionals to reduce the costs of hiring, while leveling up their effectiveness to bridge the current skill gap.

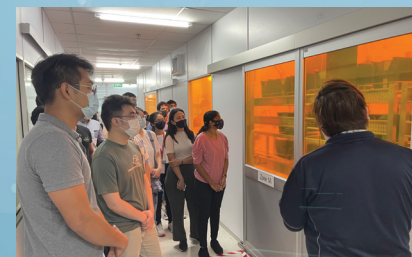
Having spent close to a decade in the semiconductor industry, I've observed that semiconductor companies have struggled to find the talent they need. But, the industry holds opportunities for countless individuals to grow in their professional careers as companies look to grow in data science, artificial intelligence and industry 4.0.

Engaging branding activities could help market to those outside the industry as well as those university graduates by sharing the extraordinary impact semiconductors have on everyday life through 5G, IoT, automotive, industrial or consumer applications.

What are the key initiatives Skyworks is planning to build your future talent pipeline?

We have been working with local universities to cultivate and groom early career talents through initiatives such as internships and supporting research projects. A few universities have reserved our manufacturing site tours to provide students with insights into the clean room environment and the semiconductor industry. This helps to provide a more real hands-on experience, apart from the academic curriculum taught in schools.

In addition to looking outward for new talent during the semiconductor shortage, we are looking inward to strengthen our existing talent pool through continuous upskilling. Upskilling is not only an effective accompaniment to talent acquisition activities, but it also boosts talent retention and further solidifies a career path for employees to progress to next level of growth. This can be done by outlining critical competencies for each role. If mapped adeptly, the career pathing helps employees align their interests to the growing needs of the operations, invest in their upskilling to take on new future roles, and expand their current set of responsibilities.



Importantly, the leadership team needs to have a growth mindset and continue to embrace new strategies and talent solutions to successfully steer the organization through the challenges ahead. It is critical to place greater emphasis on reskilling, in light

of how advanced technologies, such as robotics and factory automation, are driving greater streamlining of processes, that will render many manual jobs of the past obsolete.

In addition, talent attraction goes beyond just an attractive job description. Today's talents desire to join a company that promotes sustainability, environmental and social responsibility. A company that has an established name in corporate social responsibility will cultivate positive employer branding.

Skyworks' Global Connected Community focuses in three areas – STEM (Science, Technology, Engineering & Maths), societal caring and belonging, and Sustainability and Environmental initiatives. With more Gen Z joining the workforce, having corporate social responsibility initiatives is vital to engaging them in the future world of work.

What is the role of HR leaders in empowering your teams to win the war for talent?

Leadership and workforce needs will vary based on the strategic needs of the organization. If you are looking at your current talent pool and can't identify a pool of successors with the potential to lead, you need to revise your hiring practices. You should have



a clear picture of the types of skills and abilities your leaders need at all levels and hire to those expectations.

Always raise the bar and do not compromise on the quality of the talent pipeline. Never settle for mediocre players. Leadership doesn't just happen at the top. It's important to always monitor the midlevel funnel and accelerate each talent's potential. People are not born with the immediate potential to lead. External talent hires should be assessed not just on

current needs, but on future potential. Talent and the organizational needs for talent should be reevaluated regularly, especially for key strategic positions. Your business needs will change as the market evolves as well as the talent pool and growing skillsets and expertise. Hence it is important to stay abreast of the latest semiconductor markets' needs, and proactively address these dynamic changes, and the impact on talent needs.



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SKYWORKS

EXECUTIVE SPOTLIGHT



Mr Johnny Chiou

Head of Electronics, Japan, Southeast Asia and Taiwan, Henkel AEE Business Unit

Johnny Chiou is the Head of Japan, Southeast Asia, and Taiwan for Henkel Adhesive Technologies' Electronics (AEE) business unit. At Henkel AEE, Johnny leads execution of global sales plans, defines, and steers sub-regional resources to ensure customer growth target achievements.

A senior executive with over 20 years of progressive chemical market experience across Asia Pacific and the United States, Johnny led various regional business units at PPG Industries (coatings) and W.R. Grace (specialty chemicals), including the role of Asia Pacific CFO at W.R. Grace, in a highly customer-focused environment.

Johnny holds a Bachelor of Business Administration from The University of Michigan Ross School of Business.

What are the key market segments that you are spearheading in Henkel?

Henkel operates worldwide with leading innovations, brands, and technologies in three business areas: Adhesive Technologies, Beauty Care, and Laundry & Home Care.

Henkel's Adhesive Technology business is subdivided into business steering units, one of which is Adhesive Technologies' Electronics (AEE) and my AEE span of responsibilities in the sub-region geographic cluster is comprised of Japan, Southeast Asia countries, and Taiwan.

In AEE we serve customers in 3 market segments. In **semiconductor packaging**, we improve 5G/communications, automotive/industrial device applications. For **module & components**, we create high impact solutions to improve image sensors, high-frequency antennas, acoustic modules and enhance data and power storage reliability. In the **consumer devices**, our solutions provide our customers with a competitive advantage and offer consumers a unique experience in handheld devices, wearables, and accessories.

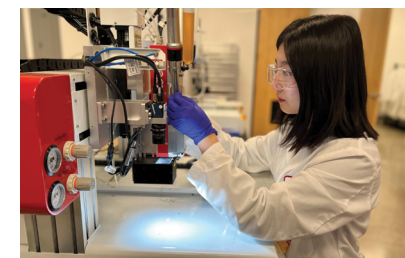
What are the challenges in enabling new materials / advanced packaging for these key market segment (like Automotive EV segment) and how does your team overcome them?

Currently, Henkel is navigating a volatile environment punctuated by geo-political risks, supply chain disruptions and the recalibration of international activities following the end of pandemic.



Concurrently, mounting concerns over semiconductor demand have signalled plans to dial back investment outlays by the world's biggest contract chipmakers.

However, even with the economy softening, many customers are still investing to improve their production technology and developments in accelerating automotive electrification, enterprise data, consumer mobile and 5G proliferation.



Henkel remains mindful of the macro headwinds and take the longer-term view of continuing to invest R&D resources against the progress of our own products, timed with our customer and market data of new product acceptance.

Climate modification is now widely accepted as an urgent need and staying ahead of our environmental threats. Environmental, social, and governance (ESG) considerations is a prime requirement for our solutions and supplier development

efforts across advanced and traditional packages.

How do you personally see sustainability in the semiconductor industry? What are some tangible immediate steps that the industry can take now?

Henkel and our partners continue to embrace sustainability not only for meeting corporate sustainability goals but also for the planet. We acknowledge our role in providing eco-friendly solutions. The good news is that at Henkel, we have been refining our sustainability road map, studying sustainable packaging, capturing green portfolio options with greater functional performance and green credentials. As a global leader in the electronics adhesives market, we invite all suppliers to turbocharge our industry's positive change efforts.

What is your take on the trajectory of the semiconductor industry especially since the United States has just passed the Chips bill recently?

The US Chips Act will bring more uncertainty to the entire industry and locking US and China in a race for chip supremacy. In my opinion, Henkel will continue to lead the semiconductor adhesives and materials market, focused on technological

breakthroughs which are coordinated across East and East West alliances.

Are there any significant plans underway for Henkel that you can share?

Henkel AEE has opened 3 innovation sites in this year, in Santa Clara California, Dongguan (South China) and Songdo (South Korea).

We continue to expand our diagnostic and support laboratory capabilities across Japan, Southeast Asia, and Taiwan to scale with our customers across semiconductor producers to consumer device assemblers.

Specific to Singapore, the semiconductor industry plays a critical role in Singapore's economic transformation. Leveraging our Singapore technical centre, we will continue to build talented teams, expand the use of digital tools and scale agile approaches for rapid deployment of customised solutions to our customers across the sub-region cluster.

Henkel in Singapore was established 39 years ago, our electronics business unit remains committed to Singapore's semiconductor industry.



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Today, all industries are digitizing and decarbonizing.
High-performance, energy-saving semiconductors underpin
this process, and producing them is a key challenge.
With leading edge technology that will reduce environmental
burden, Tokyo Electron aims for a sustainable society.

TEL TOKYO ELECTRON

**Technology
Enabling Life**

Accelerating Sustainability Together

The pandemic has shaped the world differently in many ways and in most part, to change our perception of things around us especially on the environmental, social and people aspects.

Today, in a world with challenges from COVID 19, it has created the condition for ST to accelerate even further different initiatives where they create technology for a sustainable world in a sustainable way. It is not new, and ST has been doing it since their creation in 1987. It has been embedded in their business model and culture for more than 30 years.



For ST, sustainability means three things: **To create technology for a sustainable world**, in a sustainable

ACCELERATING SUSTAINABILITY TOGETHER

LIVING OUR VALUES

PUTTING PEOPLE FIRST

AUGMENTING EVERYBODY'S LIFE

PROTECTING THE ENVIRONMENT

ACTING TOGETHER



way, **To prioritize people and protecting the planet**, and lastly, **To create long-term value for all stakeholders** including employees, customers, investors and partners.

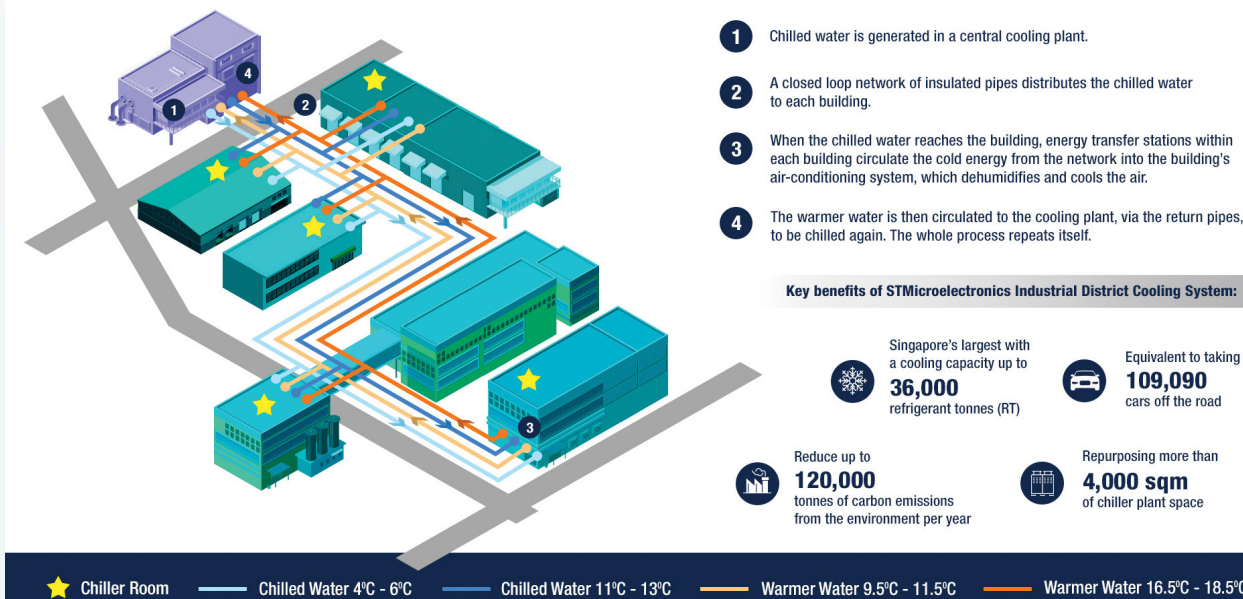
Sustainability is an integral part of ST value proposition. First of all, for their shareholders, the aim is to return value in line with their sustainable, profitable growth objective. For customers, to provide differentiating enablers since the semiconductor is very much driven by society changes.

It means a lot about responsible products and sustainable technologies. And for all stakeholders, ST is extremely committed to sustainability.

ST has a long-standing public commitment to Sustainability and they have been part of the first five companies to join the Electronic Industry Citizenship Coalition, which is now called Responsible Business Alliance.

ST announced in 2020 that they will be carbon neutral by 2027. First of all, they will be compatible with the COP 21 1.5°C most aggressive scenario by 2025. On top of that, they will be one of the semiconductor companies using renewable energy by 2027. For example, they

STMicroelectronics AMK Industrial Park District Cooling System Network



participated in Apple's Clean Energy Program and today, they are already providing Apple with products made with 100% renewable electricity.

ST has a plan on carbon neutrality to significantly reduce energy consumption, which is a strong business model, by reducing their PFCs emission by 78% since 1994, so carbon neutrality is not new for them.

Another great example on PFC reduction is the project they have recently announced in **Singapore** partnering Singapore Power Group to **build a district cooling system for their Ang Mo Kio fab** which will be the **largest industrial DCS project in Singapore**. This is a significant project worth \$370M over 20 years, to provide chilled water as a service for both manufacturing operations and offices. It will be

operational in 2025. **The benefits are clear: 20% savings in cooling-related electricity consumption annually, and a reduction of carbon emissions of up to 120,000 tons per year.**

In terms of water management, ST is a producer of ultrapure water. In reality, they produce 30 billion liter of ultrapure water every year in order to operate and to address the circular economy to aim for zero waste. As for waste management, the target of 93% of recycling before COVID has now been revised to 88%. Their next target is to achieve 95% and eventually zero waste.



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UMC Co-Presidents Jason Wang (left) and S C Chien (right) chair the ESG Steering Committee, which serves as the unit for the highest level of ESG decisionmaking.

The Commitment to Net-Zero



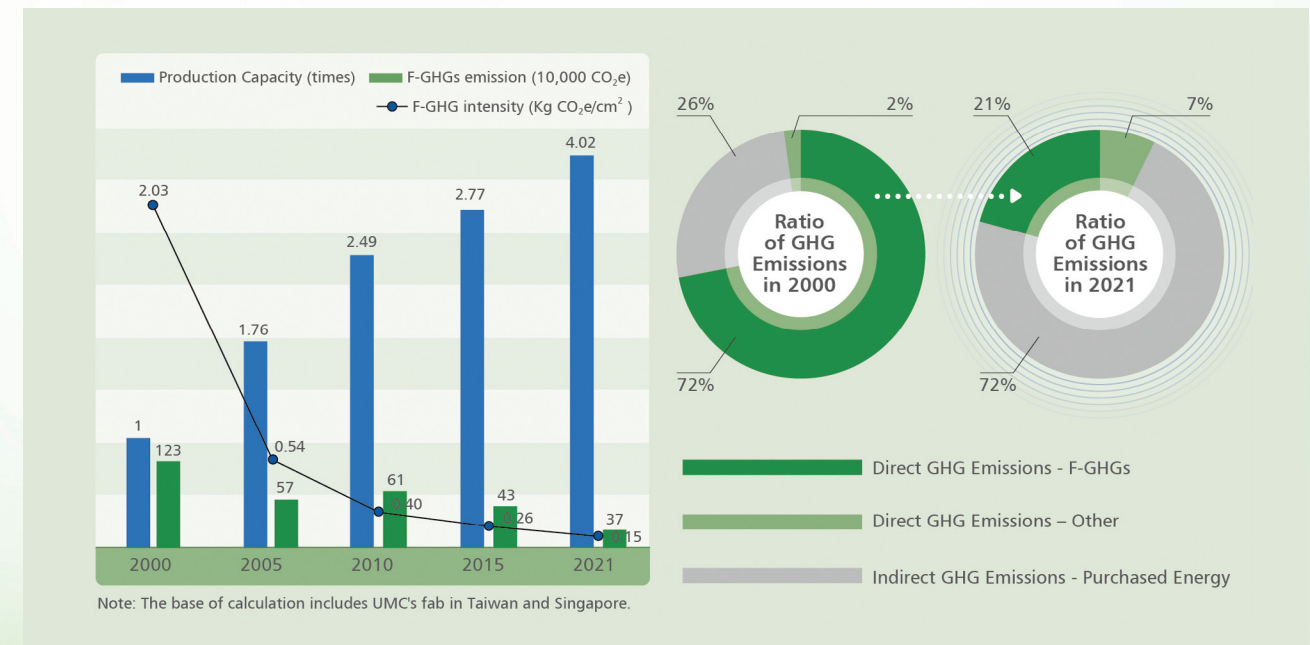
Frequent weather-related disasters such as heat waves, floods, and forest fires have highlighted the intensifying impact of climate change. The World Economic Forum's Global Risks Perception Survey 2022 showed climate action failure, extreme weather events, and biodiversity loss as the top three global risks over the next 10 years, a stark reminder to governments and businesses that climate action is urgent and must be prioritized.

UMC is committed to minimizing our environmental footprint, and has actively taken steps to combat global warming for more than two decades. In 1999, the company established a taskforce to oversee action to reduce fluorinated greenhouse gases (F-GHGs), the largest source of emissions in semiconductor manufacturing. Through measures such as gas replacements, process optimization, and the installation of high-efficiency abatement systems, F-GHG emissions from UMC's operations fell by 69.8% between 2000 and 2021 even as production capacity increased fourfold.

NET-ZERO COMMITMENT

In 2021, UMC led the semiconductor foundry industry globally to make a net-zero commitment. To reach our net zero by 2050 target, the company will continue to focus on reducing emissions associated with both wafer manufacturing and the use of end products, transitioning to 100% renewable energy consumption, and investing in net-zero technologies.

As an important stage of UMC's net-zero journey, we have set interim goals that have been validated by the Science Based Targets initiative (SBTi), ensuring the targets are in line with what the latest climate science says is needed to prevent the worst impacts of climate change. With 2020 as the base year, the company targets 25% reduction in direct GHG emissions (Scope 1) and indirect emissions from



electricity consumption (Scope 2) by 2030, and a 12.3% decrease in emissions from our value chain (Scope 3), which includes emissions from the use of sold products.

GREEN TECHNOLOGY

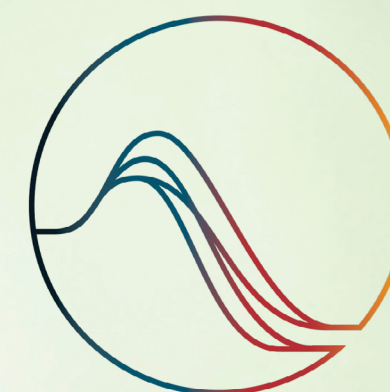
UMC has gradually phased out old processes over the years to focus on the development of greener technologies.

We continue to enhance the energy efficiency of our processes; for example, our 22nm logic technology reduces power consumption by up to 30%, compared with the 28nm process. Our leading specialty technologies such as our power management IC platform are enabling trends driving a more sustainable future, such as the transition to electric cars. In addition, UMC actively invests in the develop-

ment of next-generation semiconductors such as gallium nitride (GaN), which is significantly more energy efficient, contributing to a greener, more sustainable future.



For more on UMC's sustainability actions and progress, please visit our website: https://www.umc.com/en/CSR/sustainability_overview



SCIENCE BASED TARGETS

DRIVING AMBITIOUS CORPORATE CLIMATE ACTION

The SBTi is a partnership between CDP, the United Nations Global Compact, World Resources Institute, and the World Wide Fund for Nature. It defines and promotes best practice in science-based target setting and independently assesses companies' climate targets.

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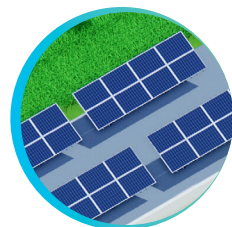
UMC

ACCELERATE YOUR DECARBONIZATION JOURNEY

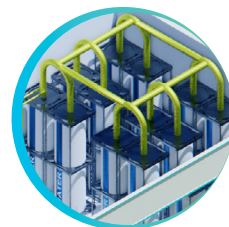
We offer unique end-to-end expertise to support your organization's decarbonization roadmap from design to operations and maintenance of your utility production systems.

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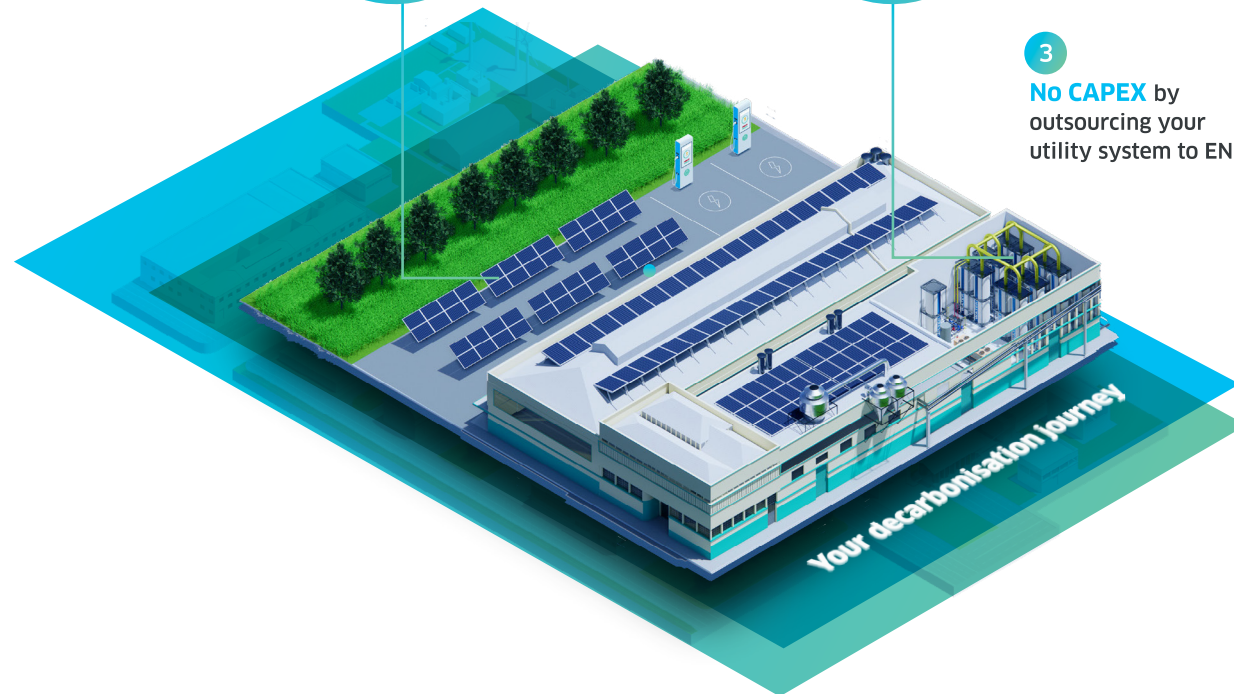


1
Reduced carbon emissions through sustainable energy solutions



2
Improved energy efficiency with the use of latest technologies and best practices

3
No CAPEX by outsourcing your utility system to ENGIE



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The Future of Edge Computing for Semiconductor industry

The easiest way to integrate information technology into machines

Machine-level data analysis in automation systems has always been resource-intensive, scalable only up to a point, and it requires constant outlays for service and maintenance in order to meet the demands of the latest application software and current security mechanisms. That is where Industrial Edge comes in. It simplifies the acquisition and analysis of machine data and supplements automation technology with high-level languages, container technology, and the ability to provide and manage functions flexibly and remotely.

Industrial Edge offers an edge infrastructure that has been proven in practice along with a central management system, an integrated runtime environment, and numerous applications and microservices that make the provision of innovative services much easier.

Cloud and edge computing solutions from Siemens include ready-to-use software solutions for exploiting machine data locally and in real time at the machine or globally across machines via the latest information technology (IT). This allows you to offer your customers innovative services and apps anywhere in the world.

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Achieving leading-edge capabilities with R&D

Our world is built on semiconductors

– you will find thousands of chips in most of the things you use daily, such as cars and computers. Applied Materials is making possible innovations that create smarter, faster and better devices of the future.

Applied is focused on achieving leading-edge capabilities through continued research and development. In Singapore, we have a research collaboration with A*STAR's Institute of Microelectronics (IME) at the Advanced Packaging Development Center (APDC). A combined US\$450 million has been invested over three phases of collaboration to accelerate research in advanced packaging equipment, process and device structures.



Dr. Arvind Sundarajan

Managing Director, Applied Materials' Advanced Packaging Development Center

Dr. Arvind Sundarajan oversees teams in operations, process integration and all product development for Applied Materials' Advanced Packaging Development Center. He also leads the development of partnerships with research institutes across Asia to develop new concepts and drive disruptive innovation at Applied Materials.

Why is constant investment in R&D significant for Applied Materials?

New technology trends like the Internet of Things (IoT), Big Data and artificial intelligence (AI) demand rapid and dramatic improvements in chip power efficiency, performance, area, cost and time to market (PPACt™). This challenge is the force behind the semiconductor industry's new playbook and the reason why we invest in expanding our capabilities in advanced packaging and heterogenous design, which we believe will be critical to meeting the PPACt™ goals of the world's leading semiconductor and systems companies.

Why did Applied Materials set up the APDC in Singapore?

In 2011, Applied Materials was looking to deepen our capabilities in advanced packaging and expanding our R&D footprint outside of the United States for the first time. We chose to expand in Singapore as it ranks highly for ease of doing business, had ideal infrastructure and a robust IP regime, which were essential considerations for market penetration.

Thanks to the strong support from the Singapore government and our partner A*STAR's Institute of Microelectronics, whose expertise in innovative package design and technology platforms allowed us to hit the ground running.

While building up a R&D footprint in a new location from scratch was a challenge initially, the success has proven to be a risk that paid off. Over the past ten years, Applied Materials and A*STAR's IME have collaborated successfully in developing critical capabilities in wafer-level packaging, resulting in several new products and numerous customer engagements. Since 2012, we have generated 160 patents from Singapore!

I am very proud that the APDC is one of the industry's most advanced wafer-level packaging labs. In addition to enabling the foundational building blocks of heterogenous integration, the Center provides a platform to accelerate development of custom hybrid bonding test vehicles including design, modeling/simulation, fabrication and testing.



Mr Gan Kim Yong, Minister for Trade and Industry, touring the Advanced Packaging Development Center on Dec 23, 2021.



Ceremony to kick off expansion of Applied Materials and A*STAR R&D collaboration on Dec 23, 2021.

How has Applied Materials' R&D activities contributed to the local ecosystem?

I'm glad to see that our collaboration with A*STAR's IME has benefited partners in the ecosystem, attracted new industry players, and strengthened Singapore's position as a global leader in the advanced packaging sector.

We have also created new jobs and developed a pool of highly-skilled researchers, scientists and engineers that support the development and implementation of new capabilities in the semiconductor industry. It is our mission to continue nurturing future talent.

Our internship program at APDC has given opportunities to more than 100 interns in the region to kick-start their careers in the fields of semiconductor engineering and R&D, and we have also brought many talents onboard with us, full-time, as we expanded over the years.

The learnings and successes from APDC bolstered our confidence to do more in Singapore. We have launched two new innovation programmes, the Applied Materials-NUS Advanced Materials Corporate Laboratory that focuses on R&D in advanced materials engineering, and Veranome Biosystems, which provides the spatial analysis market with a reliable, easy-to-use, end-to-end multi-omics solution.

What's next for Applied Materials?

Amid the tremendous growth of the semiconductor industry, R&D will be more important than ever to sustain our leading edge in materials engineering. With our new collaboration phase with A*STAR's IME since 2021, we foresee the creation of more jobs for R&D talents as we expand our workforce and deepen our capabilities in advanced packaging.

Singapore is a key strategic region for Applied. We have established strong partnerships with research organizations, academic institutes and the local supply chain. I look forward to more meaningful collaborations that will foster value-creation, develop and nurture talent development and enrich the country's R&D ecosystem.

Your Future Awaits. Join Our Team Today.
Visit us at www.appliedmaterials.com



Micron: Committed to a Sustainable Future for All

FUTURE OF MANUFACTURING

Micron innovations are part of the solution to climate change, from low-power memory and storage to enabling electric vehicles, smart homes and transportation networks. Being an industry leader in innovative memory and storage solutions, Micron keeps sustainability front and center in its design and manufacturing processes.

Micron Singapore is designated as an Advanced 4th Industrial Revolution Lighthouse by the World Economic Forum's Global Lighthouse Network, a testament to its sustainable commitment.

"Micron integrates sustainability into every aspect of its operations, including investments in innovation, new

machine learning and artificial intelligence (AI) technologies that improve manufacturing and production efficiencies," says **Chen Kok Sing, Corporate Vice President and Singapore Country Manager of Micron Technology.**

FLOURISHING WITH OUR COMMUNITIES

Micron is committed to transforming the communities we live in and fostering the culture of environmental sustainability in the company. In 2021, Micron Singapore donated \$1 million toward development of the Water Lily Pond in the upcoming Japanese Garden at Jurong Lake Gardens. The contribution will support the Gardens' sustainability efforts by implementing a smart water-management system.

At the company level, Micron Singapore launches various sustainability initiatives including rainwater harvesting, in-house hydroponics systems to grow and harvest vegetables as well as the first-ever reverse vending machine (RVM) placed in a private company where users can receive rebates from recycling bottles and cans. Team members also raised \$126,000 for the Garden City Fund and

volunteered 570 hours to plant more than 420 trees during January to July 2022 in support of the national OneMillion-Tree movement.

As we navigate future challenges that may emerge from the world's sustainability endeavors, we need to tap into the innovative capability of our people, partners, and industry at large. "Our commitment to sustainable business practices and to our communities will make lasting progress in preserving the planet we live in," says Chen Kok Sing.

Climate change presents one of the world's most significant threats to humans, the environment and the global economy. Corporations have responded by taking initiatives to reduce carbon footprints. In May 2022, Micron announced ambitious commitments to achieve net-zero greenhouse gas (GHG) emissions from its global operations and purchased energy by 2050, coupled with the 2030 goal to reduce GHG emissions by 42% from operations compared to 2020 baseline.

Our Aspirations



Emission:
Net zero
scope 1 and 2
emissions by CY50



Energy:
100%
renewable energy
globally where
available



Water:
75%
water conservation
in CY30



Waste:
95%
reuse, recycling and
recovery, and zero
hazardous waste
to landfill in CY30

Green Footprints



Micron Fab 10's 300mm NAND wafer fabrication facility achieved US GBC LEED certification in 2010 and 2017 (Gold).



Micron Fab 10 expansions were awarded the Green Mark Platinum award in 2016 and 2019.



Expanded on-site renewable energy installations by 2 megawatts at Micron facilities in Singapore in 2021.



Micron Singapore team members volunteer for tree-planting in support of the national "City in Nature" vision through the OneMillionTree movement.



Cheng Yueh Ching, Micron Singapore's Facilities Director and Environmental Sustainability Program Lead, recycles bottles and cans through the reverse vending machine during its launch ceremony.

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Lam's 2021 ESG Report: Acting with Purpose for a Better World

At Lam, we understand that the innovations we create will touch the lives of nearly every person on the planet. As we move the world forward with our technology, we aspire to integrate environmental, social, and governance (ESG) principles into everything we do. From our global operations to our workplace practices, to how we source our materials and design our products, we act with purpose for a better world.

We released our **2021 ESG Report**, offering a comprehensive look at the progress we made last year toward our goals in environmental stewardship, social impact, and business integrity. Below are some highlights:



WORKING TOWARD A NET ZERO FUTURE

Lam took a leadership role on climate action when we announced our most ambitious sustainability goal to date: to achieve net zero emissions by 2050. We know this ambition is bold and must be paired with good governance. To guide our work, we formed a net zero leadership team that is responsible for working with business units to integrate climate considerations into our decision-making processes, driving progress on our net zero strategy, and tracking greenhouse gas (GHG) performance on our climate goals.



BUILDING BETTER COMMUNITIES

Driven by our motivation to contribute to programs that build a better world, the Lam Foundation supported over 1,500 charitable organizations in 2021.

Today, we are proud to announce the launch of our new social impact program, **Powering Breakthroughs Together**, which will empower people to make meaningful change and sustainable progress at scale in three areas: transformative learning, resilient communities, and inclusive societies.



DESIGNING OUR PRODUCTS WITH CLIMATE ACTION IN MIND

For decades, our products and services have driven semiconductor breakthroughs that define the next generation. Now, more than ever before, we feel a heightened responsibility to innovate sustainably as we transition to a net zero economy. In 2021, we introduced new and improved etch products to deliver up to 15% improved generator efficiency on several toolsets for NAND and foundry logic and 30% to 50% improved clean times via chamber modifications.



GOING FURTHER TOGETHER IN SUSTAINABILITY

In 2021, we announced our goal to operate 100% on renewable energy by 2030 and in the past twelve months, we've already made significant progress against this target. We've sourced 54% renewable energy globally, including achieving 100% renewable energy at our Ohio, Malaysia and China sites, joining our manufacturing operations in Austria, which had already met this milestone.

To accelerate the company's progress towards its sustainability goals, we launched Lam's Employee Sustainability Community (LESC) and Green Teams, which drive local sustainability projects and encourage employees to get engaged in environmental opportunities.



PUTTING OUR PEOPLE FIRST

Our employees are at the heart of our success and in the past year our people delivered – all while navigating one of the largest ramps in the company's history amid a global health pandemic. That's why we continue to roll out programs that invest in their wellness and development and foster an inclusive and engaged workforce. In 2021, we enhanced our parental leave program, expanding our paid maternity leave for birth mothers up to six months and providing all parents with up to four months of paid parental leave. We also launched WorkWise, a global initiative to support employee wellness and engagement across our distributed workforce.

Despite our changing work dynamic over the past few years, with a portion of our employees working remotely, we are especially proud that our employee engagement index score of 80 put us in the top 20% of our survey vendor's technology clients for the second year in a row.



ENGAGING OUR PARTNERS

Our supply chain plays a significant role in our scope three emissions. As we endeavor to reach net zero in the coming decades, we recognize that we will need to develop innovative approaches to help our suppliers transform their operations. To facilitate their transition towards greater sustainability, we developed a net zero supplier engagement strategy which will touch our entire supply chain footprint that spans six continents.

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Silicon Connection started out in the year 2000, primarily as a distributor of products and services for semiconductor and other high-tech industries.

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Our tagline "**Turning Challenges Into Solutions**" reflects this devotion of ours to serve.



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ams OSRAM's Oslon Square Batwing Honored with Two Awards at LightFair 2022

ams OSRAM (SIX: AMS), a global leader in optical solutions, announced today it received two awards for its Oslon Square Batwing at this year's LightFair. The celebrated LED, which is used for horticulture lighting, was recognized for its performance, reliability, efficiency, ease of integration / use and innovation with an LEDs Magazine BrightStar Award for Horticultural SSL & Controls Systems. In addition, the product received a LightFair Innovation Award in the LED / OLED, Chips and Modules category.

The optics of the Oslon Square Batwing emit a unique pattern of light that looks like wings, which allows horticulture lighting customers to simplify designs and increase efficiency. The 140° beam angle and rectangular shape of light distribution enables higher uniformity and optimum utilization of space in greenhouses. The wider angle also allows for a larger distance between the luminaires, which can reduce the number of fixtures.

"The Oslon Square Batwing is the world's first batwing optic LED family for horticulture applications," said Janick Ihringer, Vice President and General Manager, Illumination at ams OSRAM. "We are thrilled to receive two awards for this exceptional product and remain committed to leading the horticulture LED market with more innovations in the future."

The BrightStar awards are decided by an experienced panel of judges from the LED and lighting design and manufacturing community.

"On behalf of the LEDs Magazine BrightStar Awards panel, I would like to congratulate ams OSRAM on its high-scoring honoree status," said LEDs Magazine Editorial Director Wanda Lau. "This competitive program allows LEDs Magazine to celebrate and recognize the most innovative products of the past

year that are advancing LED and solid-state lighting technology into various applications."

The prestigious LightFair Innovation Awards honored the industry's top breakthrough products that were introduced between October 2021 and June 2022. Entries are judged by an independent panel of lighting professionals chosen from the IES and IALD. Judging criteria included the product's clarity of purpose, versatility, adaptability, sustainability, ease of use, design efficiency and aspects that enhanced human wellbeing, among others.

For more info about the Oslon Square Batwing, scan the QR code.



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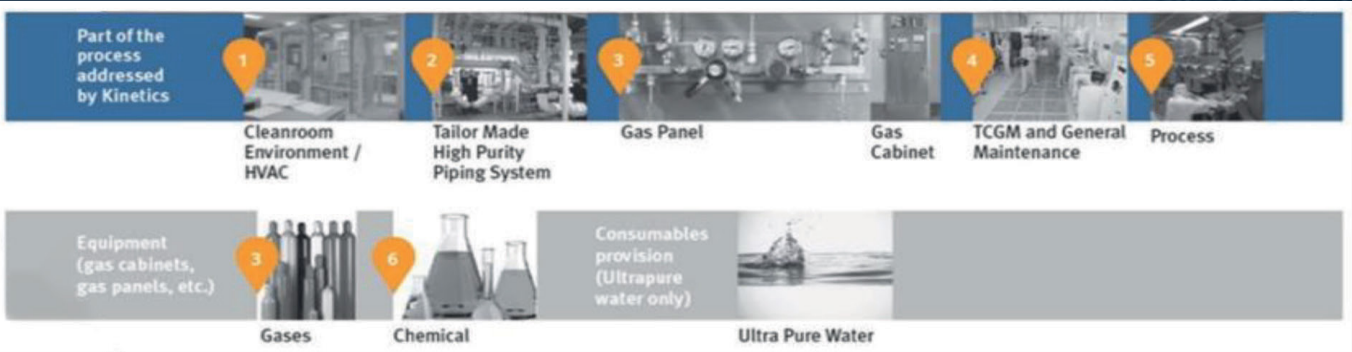
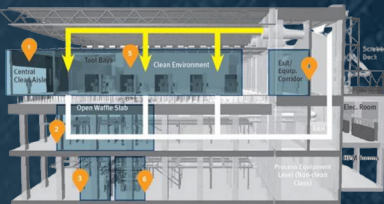
KINETICS AT-A-GLANCE

Founded in 1973, Kinetics is a Full-Service Process and Mechanical Contractor Specializing in the design and installation of process, mechanical, plumbing and HVAC system. We had proven experience supporting global clients in the microelectronics, solar, biopharmaceutical, data center, R&D and other technology-driven market

With approximately 2,000 employees in 24 regional offices in North America, Europe, the Middle-East and Asia, Kinetics can support the challenging requirements of our global clients in all regions of the world. Our engineering project and support teams cover a broad range of technical disciplines and provide competent design services for clients in diverse industries. Our design-build and turnkey solutions enable our clients to focus on strategics issues leaving the important details to the kinetics team.

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 - Specialty analytical and test equipment
 - Life safety systems
 - Design & manufacture equipment for chemical, slurry, process gas and ultrapure water systems
 - Full facilitation of HPM rooms
 - TGCM



Sustainability at ams OSRAM

Our approach to sustainability is the foundation of our license to operate and an enabler for future business. Throughout our value chain we emphasize the careful use of resources, environmental protection, good working conditions, health and safety, compliance with human rights.



Our horticulture LEDs and sensors are used in greenhouses. They help minimize the resources used in growing fruit and vegetables, as well as indirectly reducing CO₂ emissions. If food is produced closer to the location at which it is sold, less CO₂-intensive transportation is required.

SSMC Our Water Sustainability Journey

20 Years With NEWater



SSMC is the first Wafer Fab to use 100% NEWater and also the first to receive the Singapore President Award for Environment in 2015.

SSMC Sustainability Journey

Sustainability is rooted in SSMC's culture. Over the past 2 decades, we have stayed committed to our Eco-Vision, which is to reduce water consumption, energy consumption and carbon footprint. Moving towards a more sustainable future, we are committed to keeping a balance between caring for the environment while running wafer fab operations.

ADOPTED "BEST FROM THE BEST"

SSMC inherited the strength from our Joint Venture parents in sustainability to leverage our global role models of

sustainability from NXP & TSMC where we developed our Eco-Vision sustainability programmes and green manufacturing technologies to broaden our environmental conservation and preservation efforts.



"Sustainability is an integral part of our Business Excellence Journey in SSMC. We are humbled to be recognized as the benchmark with our best practices in our Eco-Vision roadmap for preservation and conservation of our environment. Diversity and Inclusivity are also part of SSMC's culture, where our human-centric environment helps to enable people aspirations for the future. To make a social impact for society, we have been active in our community outreach and CSR initiatives. These actions help pave the way to sustainable profitable growth and to create value for all our stakeholders globally and for our society. We are determined to continue to do more and to accelerate our efforts to be an exemplary corporate citizen." **Mike Young, CEO, SSMC**

and for our society. We are determined to continue to do more and to accelerate our efforts to be an exemplary corporate citizen." **Mike Young, CEO, SSMC**

CULTIVATING SUSTAINABILITY CULTURE IN OUR COMMUNITY

We have cultivated a sustainability culture in SSMC. In 2013, staff from the gardening interest group developed within SSMC premises, an Eco Garden where

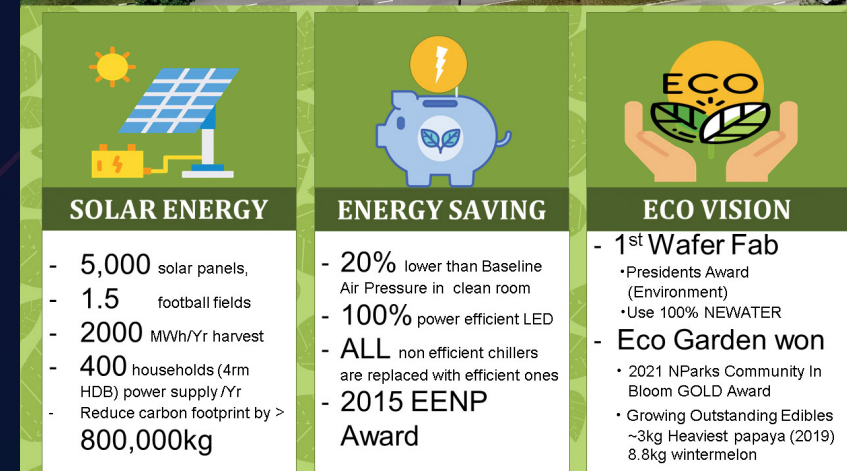
in-house fermented organic waste was used as pesticide and fertiliser to grow plants. Through our Eco Garden, we aim to cultivate Environmental Awareness. Since 2016, our Eco Garden outreach efforts have been recognised by NParks that has honoured SSMC with the 'Community in Bloom' Awards and the 'Outstanding Edibles and Community Garden' Festival Awards.

Together with our employees, customers and suppliers and community partners, we continue to do our part for humanity in our ongoing sustainability journey.



"The numerous awards the Eco Garden has received over the years are the results of the dedication and teamwork among the members of the gardening interest group. We spend time after office hours to care for the plants in the Eco Garden and I am always thrilled when the fruits and vegetables are ready for harvest. It is rewarding to see the transformation of our Eco Garden and how people admire the beauty of it.

I am truly glad to be able to share my knowledge of gardening with colleagues, creating a sense of community", says **Michael Lim (Facilities Engineer), Vice Chairman of Gardening Interest Group.**



Our key pillars in Sustainability

KEY INITIATIVES TO RAISE GREEN STANDARDS

Reducing our Carbon footprint: Since 2006, we have been implementing environmental measures such as the installation of systems to reduce greenhouse gas emissions and opting for non-hazardous alternatives.

EICC Code of Conduct: For ensuring our responsible business practices, we adopted the Electronic Industry Citizenship Coalition (EICC) Code of Conduct since 2011, which established social, environmental and ethical standards in the electronics industry supply chain, and deployed the framework to SSMC's key stakeholders.

ISO 46001 Water Efficiency Management: We are humbled to be the first company in the world to earn ISO 46001 standard for Water efficiency management system. SSMC has been awarded the Water Efficient Building (Gold) since 2013.

Energy Saving Efforts: We are recognized by NEA (Energy Efficiency National Partnership Award 2015 | Best Eco Practice Award 2015 | Most Effort Eco Award 2016 | EcoFriend Award 2017). All light fittings in our premises are replaced with energy efficient ones. Eco-friendly facility systems such as chillers, pumps, heaters, air conditioners and clean room air pressure systems were upgraded and optimized.

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SUSTAINABLE SOLUTIONS FOR THE SEMICONDUCTOR INDUSTRY

The growth of the semiconductor industry has been fuelled by consumer electronics, cloud computing and artificial intelligence. Singapore accounts for 11% of the global semiconductor market, and chip demand is set to grow as the country embarks on its Manufacturing 2030 vision to become a global hub for advanced manufacturing.

Energy costs account for as much as up to 30 percent of a plant's operating expenses¹, while two to five million gallons of ultra-pure water² is consumed per day in silicon wafer manufacturing.

Singapore's national agenda on sustainable development and the recent energy price surges present a huge opportunity for semiconductor companies to develop industry-leading technologies and pursue energy-efficient solutions to minimise environmental impact.

As a leading sustainable solutions provider, Sembcorp Industries is well placed to support the decarbonisation and sustainability goals of resource-intensive industries including the semiconductor sector. Leveraging 7.1GW of renewable energy capacity and 7.7 million m³ per day in water capabilities globally, Sembcorp is one of the largest solar energy and industrial water players in Singapore.

¹ McKinsey on Semiconductors: Bringing energy efficiency to the fab
² Sustainalytics, Waste Not, Want Not - Water use in the semiconductor industry



Sembcorp Tengeh Floating Solar Farm, one of the world's largest inland floating solar PV systems

Driving decarbonisation in Singapore

Sembcorp offers a full suite of solutions including ground-mounted, rooftop and floating solar PV systems. Besides landmark projects like the Sembcorp Tengeh Floating Solar Farm, one of the world's largest inland floating solar photovoltaic (PV) systems, Sembcorp has completed over 110 commercial & industrial projects with rooftop PV systems, helping clients to achieve cost savings and meet their sustainability goals.

Micron is one such client who has started its decarbonisation journey. In addition to the rooftop solar installations across their buildings and plants in Singapore, Sembcorp also developed an innovative carport shelter integrated with a solar PV system within their premises.

With the increase in intermittency due to the nature of renewable energy, battery energy storage systems (BESS) provide stability to power grids. As one of Asia's largest battery operators with a portfolio in Singapore and the UK that stands at 474MW/624MWh, Sembcorp is also able to provide a reliable 24/7 clean energy solution for all segments.

For corporates looking to embark on a journey towards net zero emissions, GoNetZero™ by Sembcorp is the trusted renewable energy and offsets partner offering a one-stop access to renewable energy solutions, including renewable energy certificates and carbon credits. These are underpinned by strong digital capabilities for smart energy asset management and reporting of renewable energy generation and environmental attributes.

"Micron is committed to improving our environmental footprint and enabling these opportunities with our partners. We are glad to collaborate with Sembcorp on our solar panels installation which helps building a more sustainable future."

Ms Cheng Yueh Ching
Director of Facilities,
Micron Singapore



Micron's carport shelter integrated with solar PV system

Industrial water solutions for water sustainability

Besides energy solutions, Sembcorp aims to promote water sustainability by developing solutions that minimise liquid discharge and conserve water resources in water-intensive manufacturing industries. In Singapore, Sembcorp owns and operates highly specialised facilities with a gross industrial water and wastewater treatment capacity of about 4.7 million m³ per day. The distributed model of on-site wastewater treatment and water reclamation is enhanced by Sembcorp's proprietary digital platform Virtual Brain™ Water.

In recent months, an electronic manufacturing client based in Singapore benefited from a Sembcorp-developed water reclamation system aimed at improving water efficiency. This system allows the customer to achieve 67,000m³ per year of water usage savings which translates to a 17% cost reduction.



Changi NEWater Plant with a capacity of 228,000m³ per day

The Virtual Brain™ Water platform also supports the client's automated operations through a 24/7 remote monitoring system, where Sembcorp can provide technical support.

Towards a sustainable, greener future

The adoption of progressive sustainable solutions by the semiconductor industry has the potential to make a positive impact on the environment. Sembcorp's strong sector expertise in renewable energy and total water and wastewater management can help to support businesses in doing so.

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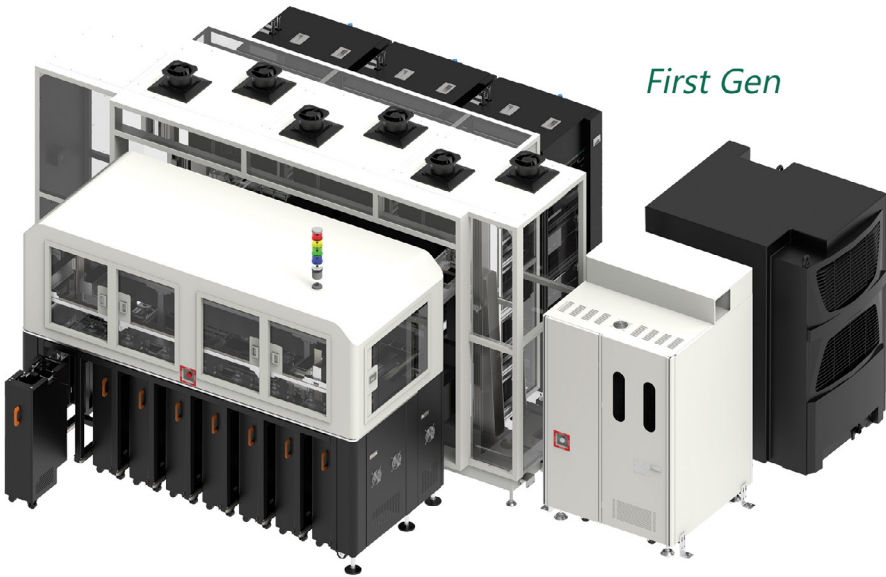
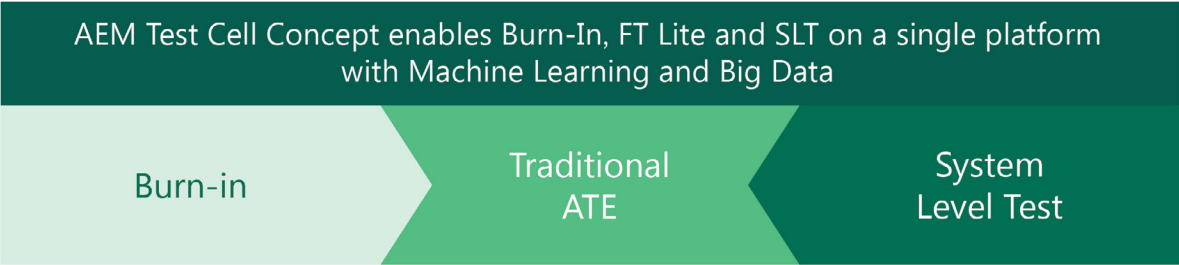
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Convenience living brought by technology should be for all, and this vision keeps driving Realtek to create unique and innovative IC designs that power broad range of high-tech applications, and reachable not only for the few, but for all. Realtek's efforts to provide the ultimate in pioneering IC technology — along with its firm commitment to creating unique and innovative designs for a broad range of high-tech applications. Realtek's solutions allow the general public to enjoy the convenience of life brought by technology, making high tech not unreachable!

ADVANCED SMART HOME - POWERED BY "AMEBA IOT", REALTEK IOT SOLUTIONS

Ameba IoT with Wi-Fi sensing: Simple, Cost Effective, and Secure.

Wi-Fi sensing technology detects human motion and posture and leverages this information to an optimized smart home platform. For example, Wi-Fi sensing can detect when people fall asleep and automatically adjust the air conditioner to sleeping mode. Since Wi-Fi Sensing works beyond line-of-sight, thus it covers greater area with fewer blindspots, and requires less hardware installed. Integrated AI senses Wi-Fi disruptions caused by human motion and uses algorithms to interpret the movement. No motion sensors, wearables, or cameras are needed. Solutions with

Wi-Fi sensing technology are simple, cost-effective, and secure. Ameba IoT with Wi-Fi sensing could be applied to home monitoring, smart home automation, and monitoring activities of daily living. Now, we are a step closer to a real smart home.

Ameba IoT catching Wi-Fi 6 Advantages.

New Ameba IoT dual-band Wi-Fi 6 solutions were launched this year. Upgrading to Wi-Fi 6 achieves 50% more coverage, increases connected devices by four times, provides more meticulous security protection, lower power consumption, and lower latency.



Ameba IoT Solutions are Matter-compatible.

As the new smart home standard, Matter provides interoperability of smart devices from different makers and platforms and cloud services, thus removes the barrier and accelerates the development of smart home. Supporting Matter requires high-stability in both RF signal quality and application software, with ample experience in IC design, Realtek can ensure that its solutions perform seamlessly under this latest communication protocol. Ameba IoT offers large DRAM



version, allowing customers to be more flexible in research and development stage. To provide the best user experience, Realtek has collaborated with major matter promoters and adapted Ameba IoT solutions to these border routers. We believe in the near future, smart home products will be widely spread and easily within consumers' reach, supporting Matter is Realtek's commitment to facilitate more users experiencing the convenience of real IoT.

UPGRADED AUDIO BROADCAST EXPERIENCE BY REALTEK'S BLUETOOTH AUDIO

A new generation of Auracast broadcast audio will enhance how people interact with others and their environment, sharing audio content, removing mute restrictions, and optimiz-

ing listening in public places, bringing listening experience to the next level.

Realtek's Bluetooth solutions can support the Auracast broadcast audio. Realtek has two IC series that support full-featured LE Audio, covering both the transmitter and receiver markets. One is an intelligent AI platform where the power consumption of LE Audio is close to 3mA, and the other is designed for customers who intend to quickly enter the LE Audio market, providing easy-to-use editing tools and SDKs (software development kits) that enable fast development of LE Audio products for speedy market-entry.

Realtek unveiled the demo of True Wireless Stereo (TWS) and speakers that support LE Audio at the product launch in October 2021, and recently launched a complete dongle SDK for LE Audio transmitters, which covers wireless one-to-many and many-to-one microphone solutions, as

well as the TV low-latency application market.

Realtek has improved the latency of end-to-end Classic Bluetooth® audio to a professional gaming headset level, adopted by many gaming manufacturers. The applications based on LE Audio will also regard low latency as an important development direction, eliminating the limitation on audio and video synchronization in the future True Wireless Stereo (TWS) market.

Realtek is currently exploring hearing enhancement. With the lower power consumption and more efficient transmission enabled by LE Audio, Bluetooth® technology is expected to provide much more support for hearing aids to enhance the audio experience for people with hearing loss.

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Making a Difference for People and Planet



In today's world, innovation is more important than ever. Societies are developing answers to the sustainability challenges the planet faces. At the same time, the world is experiencing an ongoing digital revolution. New technologies and solutions are rapidly changing every aspect of how we live, work, play, and communicate.

Tech leader ASM is pioneering innovations that are supercharging the digital revolution while also further strengthening its long commitment to sustainability. ASM is proud that its technology plays a crucial part in developing sectors that are key to achieving enduring sustainable progress, like electric and autonomous vehicles, advanced medical analysis and equipment, and next-generation communication services.

A POSITIVE IMPACT

ASM strives to make a positive impact in the world by delivering sustainable value creation. As an integral part of its long-term business strategy, the

company seeks to actively engage with stakeholders, understand its societal impact and progress and take leading actions. It fosters inclusion and diversity in the fast-growing ASM talent base, and cultivates its network of partners to further stimulate progress.

Over the past decade, ASM has accelerated its focus on ESG priorities (environmental, social, and governance). In 2021, it announced an industry-leading target to achieve Net Zero by 2035 – including Scope 1, 2, and 3 GHG emissions, to the 1.5°C pathway. A key aspect of this target is innovation to further reduce the energy consumption and emissions of ASM's equipment.

RAISING THE BAR FOR ENVIRONMENTAL PERFORMANCE

ASM's overall environmental ambition is to reduce all aspects of its operations' footprint as much as possible and is making great strides:

- The company derives 76% of its electricity from renewable sources, with five key locations already

at 100%, and is on track to achieve 100% use of renewable electricity by 2024

- Overall Scope 1 and 2 emissions have been reduced by 67%
- ASM raised its CDP rating for both Climate Action and Water Security to "B" in 2021, the most improved relative to sector peers
- ASM was selected to the AEX ESG Index as one of the top 25 AEX companies in ESG practices

CONTRIBUTING TO A MORE SUSTAINABLE WORLD

Responsive to key stakeholder priorities and aligned with its long-term strategy, ASM has identified five areas where it will focus its efforts towards long-term sustainable value creation:

- **Innovation** – Innovation is part of ASM's DNA, and the company is using this force to address the challenges and opportunities of sustainability
- **People** – ASM strives to enrich the lives of everyone it engages with and make a positive, enduring impact in its communities, the industry, and society
- **Planet** – ASM is committed to addressing the environmental issues facing our planet by working collaboratively and taking action
- **Responsible Supply Chain** – The company is progressively expand-



ing the sustainability expectations for its suppliers, collaborating with them to accelerate shared impact

- **Governance** – Sustainability is embedded into every aspect of ASM's structure, systems, and connections with stakeholders

BRIGHT IDEAS FOR A BRIGHT FUTURE

As ASM continues to fuel the digital revolution with new innovations for semiconductor products, processes, and new materials, it will also continue to reach out to its partners and stakeholders as it strives to maximize positive impact. The two go hand in hand: what is good for the planet and people is also good for business. After all, it's ASM's products that help empower the talented people whose ideas will guide us towards a brighter future.

Learn more about ASM and how to join its journey at asm.com or [linkedin.com/company/asm](https://www.linkedin.com/company/asm)

SUSTAINABLE BY DESIGN

ASM's Woodlands Height production facility in Singapore was conceived with sustainability in mind. It was designed to meet the specifications of the BCA Green Mark Gold Plus standard and was awarded this certification for energy-efficient and environmentally friendly construction.

The modern, smart building is designed to limit consumption of energy and water, and to minimize waste. The responsive design integrates landscape and waterscape features and includes living walls full of greenery and a spectacular sky garden on the roof. Such features make Woodlands Height a healthier and safer place to work.



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The Megatrends That Shape Manufacturing

We've all been hearing about smart manufacturing for quite some time now. But only with recent developments have manufacturers started to realize the smart factory's full potential and achieve a true digital transformation. This is due to a string of deeply interconnected phenomena, including technologies, trends, and conditions, that are finally coming together. There has been a buzz surrounding smart factories and digital transformation for quite some time. But now is the time that big puzzle pieces finally fall into place.

The combination of 5G networks, cloud services, and cybersecurity are allowing AI and ML to work their magic on the factory floor. This shift is being further accelerated by the growing demand for electric and autonomous vehicles, pressure to operate factories remotely in a post-pandemic reality, and the urgency to meet sustainability goals.

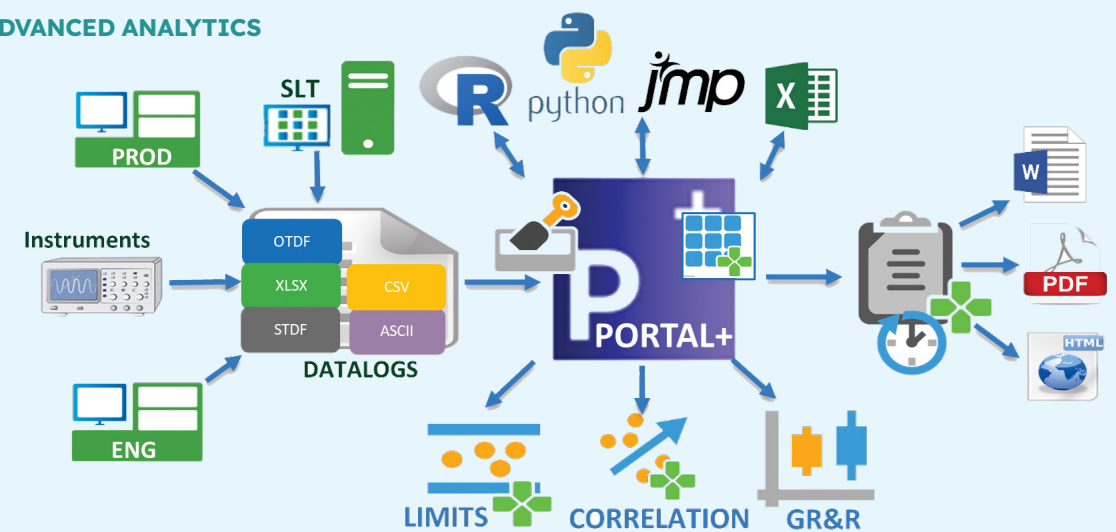
Manufacturers that are quick to recognize these megatrends and prepare for them will stay ahead of the curve. This means moving away from next quarter's tactical objectives and focusing on longer-term strategic projects.

Since all the megatrends mentioned above rely heavily on AI technology, the first step in preparing for 2022 is making sure you can implement AI at scale.

NI together with OptimalPlus provides you with a full-blown, end-to-end platform for AI and Big Data analytics that integrates directly into your systems on the production line and throughout your entire supply chain. The platform enables businesses to deploy machine learning infrastructure at the click of a button and instantly influence decisions that enhance product quality, automate inspection, increase yield, lower scrap rates, accelerate time to market, and more. These benefits naturally lead to leaner manufacturing, creating a positive impact on sustainability.

In addition to providing machine learning infrastructure, our platform enhances the cybersecurity measures around sensitive product data and helps companies move to the

ADVANCED ANALYTICS



cloud and manage their operations remotely. We also have a focused solution for the automotive industry, which helps accelerate innovation in the fields of electrification and autonomous driving. OptimalPlus is now a part of NI, joining its broad spectrum of product lifecycle analytics

solutions to solve the world's most pressing problems.

The full 7 megatrends are compiled in an eBook for your access to usher in a new wave of manufacturing visit <https://tinyurl.com/7-megatrends> or scan the QR code.



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For a Future Worth Living

If there is one thing the present decade has taught us so far – it is that we must invariably keep in mind to never take for granted this home that we call Earth. Ever since the industrial revolutions, we have seen and tolerated geopolitical repercussions over our manic dependence on fossil fuels, that have led to economic upheavals and even wars. But as we have seen from the melting ice caps and scorching heatwaves, we can now no longer ignore the far greater and detrimental impact that carbon dioxide, a by-product of fossil fuel combustion, has on the environment.

Living sustainably is the only way forward. The Singapore Green Plan 2030 calls on citizens to consume less and waste less by switching to green transportation and putting in a more conscious effort to reduce energy wastage. Changing mindsets and behaviours are necessary steps toward securing a liveable Earth for future generations. To achieve a truly sustainable future however, future technologies must also actively contribute to digitalization and decarbonization such that carbon emissions worldwide may be reduced.



Reducing carbon emissions relies upon every decision, every action, big or small, to think sustainably. For example, semiconductor solutions enable longer lasting, more efficient batteries. Smart battery management systems deliver battery status information, enabling optimal use of residual charge present in a battery. Additionally, battery protection features enable batteries to function under stressful conditions such as short circuits and overheating. Sadly, the majority of batteries today are viewed just like any other components of the overall product, usually designed for cost or for performance. As batteries are becoming more widely adopted in electric-powered devices, imagine the savings in resources we could achieve had we begun by designing for efficiency.

On a much larger scale, Singapore is Asia's premier data centre hub. Data centres represent a vital component for the continuity of daily operations, particularly for businesses embarking on digital transformation. Incidentally, Singapore's Smart Nation initiative is driving further digitalization. Other Asian cities are also expected to replicate and innovate smart digital



initiatives in the coming years. With Asia Pacific set to become the world's largest data centre region within the next decade, energy demand in the region is set to rise significantly. We must hence find a sustainable way forward to stimulate the digital economy and meet the corresponding energy demand amidst rising energy costs.

Wide band gap technology-based power semiconductors are the basis for the best-in-class power management solutions for online servers, helping to reduce energy and cooling costs for data centres. They also ensure minimal conversion loss from solar or wind energy to electricity. Solar and wind energy solutions offer immense potential for reversing climate change since greenhouse gases are not part of the generation process.



Over the course of their lifetime, semiconductors which are purposed for decarbonization, power management and the enablement of intelligent systems, will save carbon dioxide far exceeding their production carbon footprint. For Infineon's current portfolio of products, we estimate the savings to be 30 times the carbon dioxide emitted in making these semiconductor chips. As one of the most sustainable semiconductor producers in the market, carbon dioxide avoidance and resource efficiency in production have been a priority at Infineon for years. Infineon is currently ranked amongst the top 10% of the most sustainable companies in the world and is on track to becoming completely carbon-neutral by 2030.

Climate change is a global challenge. Collective effort is needed from all of us – from individuals to organizations, to play our parts toward building a sustainable future. The effects of climate change will not miraculously reverse themselves and our situation will only get worse with each passing day of inaction. The time to act is now in order to secure a future worth living.



CONTRIBUTED BY

CHUA CHEE SEONG

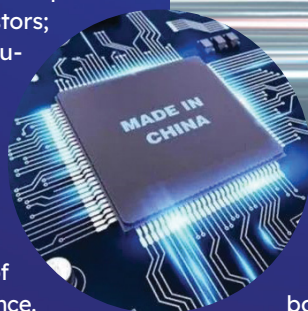
President and Managing Director
Infineon Technologies Asia
Pacific Pte. Ltd.



Build a High-Performance, High-Reliability, and High-Security Semiconductor Storage Foundation

HUAWEI EDA SIMULATION SOLUTION—OCEANSTOR DORADO

Increasing EDA Simulation Jobs and Data Volume Pose Higher Requirements on Storage Performance and Capacity: Moore's Law is still applicable to chip development. A chip can contain billions of transistors; the number of EDA simulation jobs increases by 75% every year. Simulation is becoming more complex; Data volume increases by 50% annually. This requires hundreds of thousands of OPS read/write performance. EDA_FRONTEND processes massive small files. EDA_BACKEND processes both large and small files, posing high requirements on OPS and



bandwidth. Backend services require high bandwidth for sequential reads/writes of large files.

To meet special requirements in EDA simulation scenarios, Huawei Ocean-

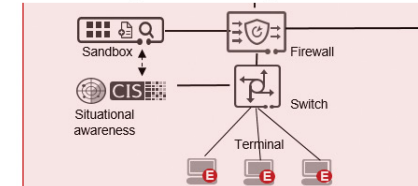
Stor Dorado storage is optimized from eight dimensions, such as metadata management, intelligent CPU partitioning, DToE iNIC, and I/O priority adjustment. In addition, cross-four-layer high reliability, all-scenario data protection, and multi-tenant isolation



Network Interception

Extranet

Network product implementation

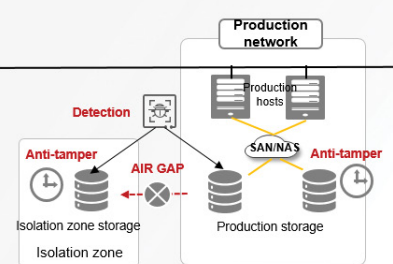


Protection layer 1: network detection

1. Firewall Intrusion detection to filter known ransomware
2. Sandbox for in-depth analysis to identify unknown ransomware
3. Combined with the situational awareness platform to block horizontal ransomware spread

Production Environment

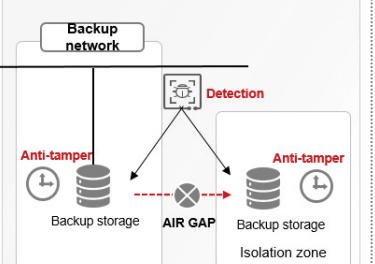
Production network



Protection layer 2: production protection

Backup Environment

Backup network



Protection layer 3: backup protection

are used to ensure the security and reliability of chip design and simulation data. Due to its unique high performance and reliability, more than a dozen customers, such as HiSilicon, have selected Huawei OceanStor Dorado storage to build the EDA simulation platform. For example, in the new platform selection test of a semiconductor IDM customer in Northeast Asia, the EDA solution based on Huawei OceanStor Dorado provided 400% higher end-to-end simulation performance than the solution provided by the vendor on the current environment, far exceeding the customer's expectation.

HUAWEI RANSOMWARE PROTECTION STORAGE SOLUTION



Ransomware has become a major global cyber threat, it is a type of malware that encrypts or steals victim's data and makes computers or specific files unusable or unreadable, and then demands a ransom to recover the computer or decrypt the encrypted file. Ransomware is constantly evolving, and often evades common antivirus software.

Huawei Ransomware Protection Solution provides Comprehensive protection, Accurate detection and Rapid recovery.

It is important to enhance security awareness and management and build a multi-layer defense system for ransomware. Therefore, this requires enhanced security awareness, necessary security systems, and professional storage and backup systems.

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SILTRONIC – A Silicon Wafer Manufacturer in Semiconductor Industry

In Singapore, Siltronic operates one of the world's most advanced production facilities for high quality 200 mm and 300 mm silicon wafers.

Siltronic Singapore Pte Ltd (SSP) was established in 1997 for the manufacturing of 200 mm wafer. This manufacturing facility gave Siltronic an inaugural presence in Asia's growing market by being close to its Asia customers and was a key milestone for the company.

In 2006, a new 300 mm wafer manufacturing facility was established together with the semiconductor joint venture partner - Samsung Electronics Co. Ltd. In 2014, Siltronic increased its shareholdings with the entity re-named as Siltronic Silicon Wafer Pte Ltd (SSW). In 2019, SSW marked another momentous milestone with the official opening of a new CZ crystal pulling hall in Singapore to meet the increasing wafer demand.

In 2021, Siltronic Silicon Wafer Pte Ltd broke ground for its new manufacturing facility at JTC's Tampines Wafer Fab Park in Singapore. In partnership with the Singapore Economic Development Board (EDB), Siltronic's

investment of around EUR 2 billion (equivalent to nearly SGD 3 billion) until the end of 2024 will play an important role in meeting the growing semiconductor demand.

The two legal companies operating under one-system and one-management synergy concept makes Siltronic a strong and robust site in Singapore. Smartphones, laptops, servers, industrial purposes and cars are just a few applications in which Siltronic wafers are used and with which almost everyone comes into contact in daily life. These hyperpure silicon wafers are processed by leading semiconductor manufacturers into semiconductor components.

One critical success factor for Siltronic is the technological competency necessary for its highly complex

manufacturing processes. Stringent requirements at end-user applications continue to drive the needs for the reduction in Design Rules. The ability to continuously develop new Design Rules has made Siltronic one of the technology leaders in this field. Today, Siltronic holds some 1,870 patents and patent applications and is one of the five major manufacturers worldwide offering 300 mm silicon wafers for the semiconductor industry.

Apart from successful technological development, Siltronic focuses on development and growth of its people. Employees are given opportunity to develop their expertise in various disciplines such as engineering, technology, metrology, innovation, business processes, etc. In addition, Siltronic plays active roles in its corporate social responsibility. Since 2011, it

has been providing school bursaries to some financially needy students of primary schools in the neighborhood where Siltronic is located. Siltronic was one of the contributors to the "Grow-a-Reef Garden" initiative in 2018 to enhance marine biodiversity.

www.siltronic.com/en
www.siltronic.com/en/career

LOCAL CONTACT SINGAPORE:

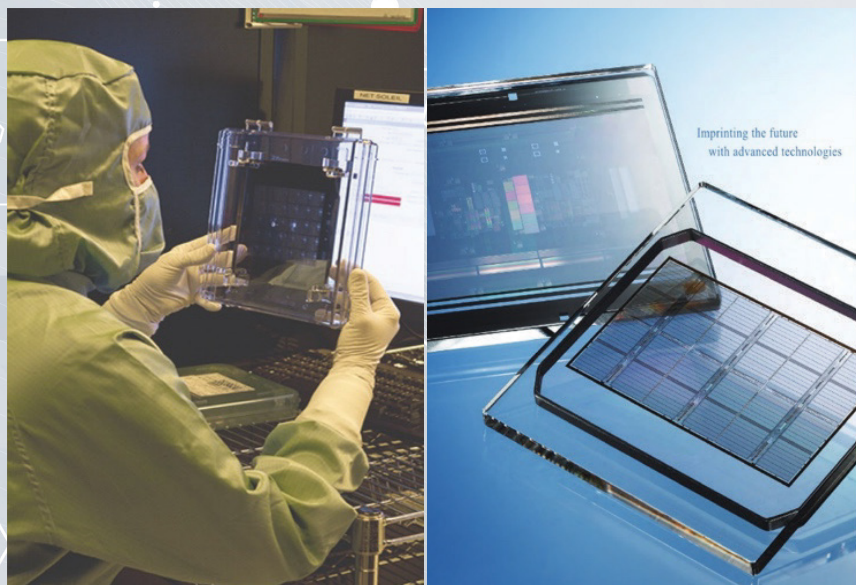
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Toppan Photomask is the world's premier photomask provider. Operating the industry's most advanced and largest network of manufacturing facilities. We offer a comprehensive range of photomask technologies and research and development capabilities to meet the increasingly sophisticated and divergent product and service requirements of the global semiconductor industry. In addition to our Global manufacturing network, Toppan Photomask has a Singapore based customer support team.



This team is headed by Vince Teo, Head of Southeast Asia Sales for Toppan Photomasks. Vince can be reached at desk 65-6826-9645; and vince.teo@photomask.com

Marvell enabling cloud-optimized infrastructure solutions



Data Center

Delivering cloud-optimized silicon for essential data center technologies

5G Network

Advancing 5G for integrated, open and virtualized networks



Automotive

Driving the industry transformation to software defined vehicles

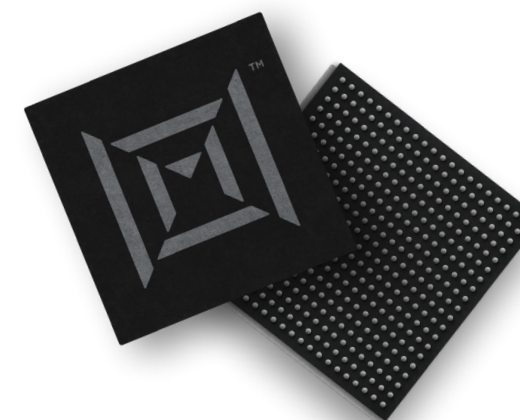
Enterprise

Enabling the borderless enterprise with intelligent networking, storage connectivity and security



- Fabless semiconductor company
- Founded in 1995
- 27 years of innovation
- \$3.0 billion annual revenue in FY21
- 6,700+ employees
- Headquartered in Santa Clara, California
- 10,000+ patents worldwide
- Research and development centers located in USA, Israel, India, Germany, China

To learn more, please visit us at www.marvell.com



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LUMILEDS: Sustainability is Everyone's Responsibility

Here at Lumileds, seeking sustainable solutions helps us push the boundaries of light. We are committed to a culture of engaged employees striving for the highest standards of quality and responsibility in creating products that make life safer, better, and more beautiful.

SUSTAINABILITY APPROACH AT LUMILEDS

Sustainability is everyone's responsibility. In simple terms, it means integrating People, Planet and Profit into

our daily business activities to represent the 3 pillars of Social, Environmental and Economic responsibilities. Lumileds integrates Sustainability into our business process and decision-making for Innovation, Operation and Supplier Management.

SUSTAINABILITY EFFORTS AT LUMILEDS SINGAPORE

In Singapore, Lumileds consistently places sustainability and environmental conservation at the forefront of our management agenda. We have set a 5-year target for energy consumption reduction, aiming to achieve 15% reduction by the year 2025, using 2020 as a baseline. Apart from optimizing facility system settings and driving continuous improvement efforts, we initiate bold and breakthrough projects that provides a leap in results.

LUMILEDS SINGAPORE PARTNERSHIP WITH ENGIE SOUTHEAST ASIA

Lumileds Singapore and ENGIE Southeast Asia signed a 10-years Integrated Design, Build, Own, Operate, Transfer partnership for our Green Chiller and Rooftop Solar project, enhancing Lumileds efforts towards a low-carbon footprint

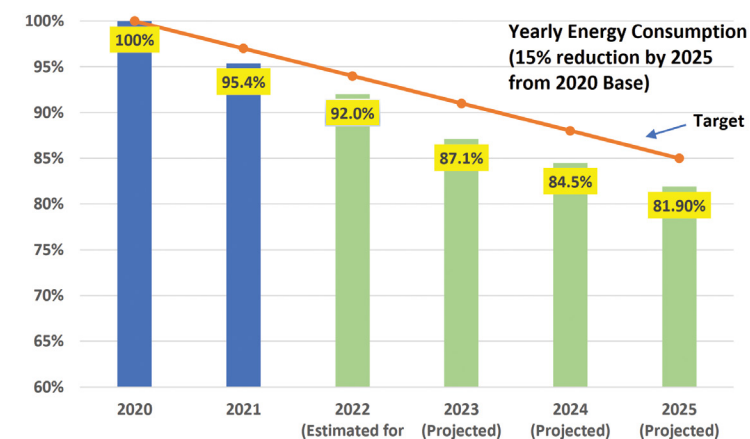


Lumileds Singapore & ENGIE SEA - Contract signing Apr 2022

manufacturing facility. Through this partnership, ENGIE with the focus on affordable, reliable and sustainable energy transition, will re-design Lumileds' existing Chilled Water Plant system and deploy best in class equipment with much greener HFO (Hydro Fluoro Olefins) refrigerant which significantly reduce the GWP (Global Warming Potential) and with improved system efficiency from the current level of 0.63KW/RT to 0.55KW/RT.

When integrated with rooftop solar system with the energy generation

capacity of 1,792MWh/year, this project will provide overall energy saving of >300KW, which also collectively reduce 10,000 tonnes of CO2 emission, during the contracted period, translates to planting 992 tree seedlings grown for 10 years. Expected to be completed in early 2023, the initial project groundworks and preparation for solar panel installation are ongoing. LUMILEDS is committed to provide a safe & healthy workplace through compliance & risk management and evaluation of environmental impact over the life cycle of a product, taking



Lumileds Singapore & ENGIE SEA - MOU signing Oct 2021

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Drive the Transition Towards a Sustainable Economy Through our Innovation and Operations

In a context of global warming, the depletion of natural resources and the loss of biodiversity, our planet is currently facing threats of unprecedented intensity.

At Soitec, we are convinced that businesses have a significant part to play in overcoming these threats. This is what drives us on a daily basis and pushes us to surpass ourselves and innovate in order to better reconcile electronic performance and energy efficiency, and to build a more environmentally friendly future.

We innovate on a daily basis to develop new materials that are increasingly energy efficient. One of these materials, silicon carbide (SiC), has remarkable properties that can considerably reduce the energy consumption of end-use applications in electronic equipment such as smartphones and cars. In recent years, it has emerged as a key material in

electric vehicle and charging infrastructure markets. SiC devices increase travel range per charge by at least 10% and significantly cut battery charging times.



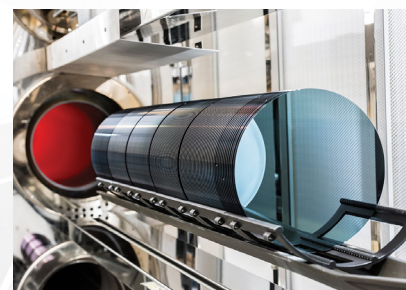
Sustainable innovation also means analysing the entire life cycle of our products in order to identify different levers for reducing our energy consumption and greenhouse gas emissions.

Wherever possible, we also adopt an eco-design approach. For example, this approach has been deployed in the development process for one of our

new products: the SmartSiC™. Based on the early results, we expect this product to reduce the greenhouse gas emissions generated by the production of 100,000 wafers by 4,000 tCO₂eq.



We are committed to playing an active role in building a microelectronics and semiconductor ecosystem. We have established a global network of alliances and cooperation agreements with research laboratories, universities and organisations across the electronic components industry. In addition to CEA-Leti, with which we have had a strong partnership since our foundation, we collaborate with world-class research centres and universities, such as Imec, Fraunhofer Institute, SITRI, CNRT, CEMES, A*STAR - Institute of Microelectronics, as well as Stanford, Berkeley, National University of Singapore, Nanyang Technological University and University College London.



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Synopsys Cloud Any Tool. Any Scale. Any Time.

Synopsys Cloud combines the availability of advanced compute and storage infrastructure with unlimited access to EDA software licenses on-demand so you can focus on what you do best—design chips, faster.

With scalable cloud-native EDA tools, pre-optimized design flows and hardware platforms in a browser-based experience, Synopsys has reimaged the future of chip design on the cloud.

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SEMICONDUCTOR TRADEWINDS – July / August 2022

We are already well into Q3, and so far the semiconductor industry is forging ahead powered by the tailwinds of the global chip shortage. It looks like Q3 maybe the inflection point for the semiconductor chip manufacturing sector with a weaker outlook for Q4 onwards.

SEMICONDUCTOR GROWTHS CONTINUES IN Q2

Most semiconductor companies reported very solid Q2 results as companies still supported full order books in Q2. Amongst the top 10 larg-

est semiconductor companies only Intel was down year on year, most other companies reported between 20-35% year on year growth. However forecasts for the current quarter are not so positive, in general most forecasts were flat sequentially as manufacturers warned of headwinds, whilst memory makers like Micron and SK Hynix are warning of a significant slowdown.

Amongst the foundries and OSAT's, Q2 continued to be a strong quarter with most companies reporting record revenue. TSMC's Q2 revenue grew 37%

to a new record high and the company increased its full year growth target 35%. Most other Taiwanese foundries also reported record Q2 revenue with similar growth. GlobalFoundries reported record Q2 revenue up 23% yoy and are forecasting further growth in Q3. SMIC also reported Q2 revenue growth, up 42% but are forecasting a tougher Q3. In the backend, OSAT's such as ASE reported record quarterly revenue up 15% yoy. Amkor also had a strong quarter but were hampered by the COVID shutdowns in Shanghai, with both ASE and Amkor forecasting a strong Q3. It will probably take at least a quarter for the effect of the slowdown in the end markets to be seen in the foundries.

Equipment companies like Applied Materials and ASML have reported seeing strong demand for their systems but been hampered by supply chain constraints which have limited their revenue in Q2. Looking ahead with the large amount of Fab and OSAT capacity expansions ongoing the demand for new systems should remain strong.

CAPACITY EXPANSIONS CONTINUE

The global chip shortage continues to fuel investment in new wafer Fabs and backend assembly test capacity.

GlobalFoundries and ST Microelectronics announced they will invest US\$5.7billion in a new 300mm Fab in Crolles, France. Whilst Intel is reported to be close to announcing a new US\$5billion advanced semiconductor Assembly Plant in Italy.

In the United States, with the CHIPS and Science Act finally being signed into law promising US\$52billion in subsidies for companies setting up US based semiconductor manufacturing plants, this has kick-started a new

round of activity in the US. Micron announced it will invest US\$40billion through the end of the decade to build in multiple phases advanced memory Fabs in the United States, the first of which is expected to start production in the second half of the decade. GlobalFoundries also will apply for funds to expand both its Malta 300mm Fab and also its Vermont 200mm Fab, with plans to subsequently build a new Fab at its Malta site. Other companies that are expected to benefit from the funding are Intel, Samsung, TSMC, who have already started construction, whilst Skywater and Globalwafers previously announced plans to build new facilities with funding from the US government.

In SE Asia, GlobalFoundries moved in the first piece of equipment into their new Singapore 300mm Fab, whilst nearby in Malaysia, Infineon laid the foundation stone of its 3rd fab module in Kulim. With UMC and Soitec also building new facilities here in Singapore, SE Asia looks well positioned to grow.

The current slowdown in the semiconductor industry, especially in the memory sector however has led SK Hynix to announce it will suspend its planned Fab extension in Cheongui South Korea.

MARKET ANALYSIS

In Q2 the semiconductor market continued to benefit from strong sales. Worldwide sales of semiconductors totaled US\$152.5billion in Q2 2022, an increase of 13.3% compared to Q1 2022, according to the latest data from WSTS, whilst worldwide silicon wafer area shipments also increased in Q2 to a new record high of 3,704 million sq inches according to SEMI. For equipment manufacturers sales of semiconductor manufacturing equipment is expected to increase 14.7% in



2022 to US\$117.5billion according to the latest data from SEMI.

The first half of 2022 has led to record revenue for semiconductor sector but the pace of growth has been slowing for six straight months. There are many warning signs of the slow down coming. Smartphone shipments fell around 9% in Q2 according to data from various analysts, and mobile phone shipments are forecast to decline -7% in 2022 to 1.46billion units, whilst PC and tablet shipments are expected to decline -9% according to Gartner. US manufacturing output dropped for the 2nd straight month in June. Even the automotive market is not exempt with global vehicle sales falling over -10% in the first half of 2022, and several semiconductor companies mentioned that they are seeing the automotive market is slowing in their quarterly reports.

OUTLOOK

Currently the weakness in the smartphone and consumer sectors is being offset by the high-performance computing and automotive sectors, but even here there are initial signs

of weakening. Over the next few quarters there is general consensus that there will be a market correction in the semiconductor sector, which will last into the first half of 2023. How long this correction will last is unclear, but many are saying it will only be a minor downturn. In the longer term the semiconductor market will continue to grow in the coming years as more and more silicon content is added to the devices in our daily lives, the balance between meeting that demand and not creating excess capacity is the perennial dilemma in the industry.



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MARK DYSON

Foundry Account Director
ams OSRAM

ams OSRAM



GF Singapore's new fab expansion nearing completion and ready for production in early 2023.

Artist impression of GF Singapore's new fab expansion

GlobalFoundries Singapore Celebrates First Tool Move-in at its New Fab Expansion

In June 2021, GlobalFoundries (GF) announced that it would invest US\$4B to expand its Singapore site and grow its global manufacturing capacity to meet the rising demand for GF-made semiconductor chips. When completed, this new fab would add 450,000 wafers (300mm) annually, increasing its Singapore site capacity to 1.5 million wafers (300mm) annually.

On 23 June 2022, just a year after the announcement, GF moved in its first tool into the new expansion fab. This mile-

stone is a remarkable achievement as the construction met with many challenges with lockdowns, border closures and supply chain disruptions caused by the pandemic. To celebrate this major milestone, GF held a first tool move-in event at its new expansion fab which was attended by about one hundred and fifty guests, partners and employees.

"Today marks a special moment for GF, as we stand with our Singapore team, our partners, and valued employees to appreciate just how much progress we have made over the past year. From a

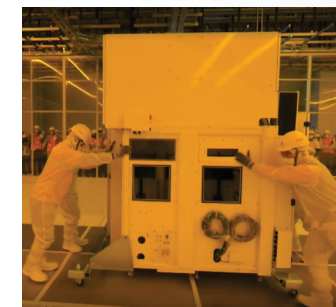
groundbreaking event hosted virtually due to the global pandemic to today's first tool-in, we are delivering on our commitments to expand our global manufacturing footprint to meet the growing need in the marketplace for GF chips," GF CEO Dr. Tom Caulfield said. "This first phase of our Singapore expansion plan is a tremendous example of strong partnerships driving our industry forward. This first tool moved into our facility was incredible to witness and is a harbinger of more great milestones on the horizon for GF."

GF completed majority of the construction of its Singapore expansion, which includes 250,000-square-foot (23,000-square-meters) of cleanroom space and an administrative building. Following the first tool-in ceremony, GF will continue adding new tools to the cleanroom over the coming months, and the fab is expected to start production in early 2023.

The expansion of the Singapore Fab is expected to add about 1,000 new high-value jobs in Singapore, with a strong focus on engineers and technicians. "The semiconductor industry is undergoing a new era of growth and GF Singapore is at the forefront of this, as we continue to execute our expansion plans and build out capacity to meet our customers' long-term needs," said Mr. Tan Yew Kong, SVP and GM, Singapore site, GlobalFoundries. "Given the competitive job environment we are in today, one of our key priorities is to continue our Industry 4.0 journey using technologies such as AI and Machine Learning to improve operational efficiency for advanced manufacturing as well as to attract and develop talents that will become tomorrow's future leaders of the semiconductor industry," he added.



GF CEO Dr. Tom Caulfield giving the opening address at the event attended by guests from the semiconductor community



First tool being moved into the cleanroom

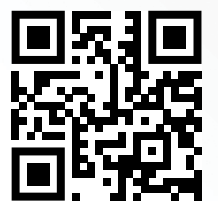


Guests viewing the first tool move-in



Counting down to the first tool move-in (From L-R): Lam Research President and CEO, Tim Archer; GF Vice President of Global Construction, Roberto Avallone; GF CEO, Dr. Thomas Caulfield; Exyte President Asia-Pacific Region, Mark Garvey; GF Chief Manufacturing Officer, KC Ang; Senior Vice President and General Manager of GF Singapore Site, Tan Yew Kong;

Scan the QR code to learn more about opportunities at GlobalFoundries, or visit our website at gf.com to find out more.



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Collaboration for Success - Automotive CMOS Image Sensors Testing Solution

Back in June 2022, UTAC And AEM Announced New CMOS Image Sensor Test System Solution for the automotive and industrial markets.

How does this partnership come about?



UTAC - FATT CHYE: UTAC Singapore offers testing of CMOS Image Sensor (CIS) since 2003. CMOS Image Sensor is used in automotive, medical, security and various commercial applications.

Testing solution is expensive and requires huge capital investment. With the potential growth in the automotive market, UTAC together with AEM establish a joint development of a cost-effective, next generation test system solution for CIS.

What is so unique about this testing solution?



AEM - PASCAL: The rapidly growing demand for advanced image sensors in applications such as security, automotive safety, autonomous vehicles, and industrial application will drive CMOS image sensor products to grow significantly in the future. The collaboration between AEM and UTAC is strongly focused on customers' needs. We offer a solution targeted at CIS devices with unique features added on the Handler and the illuminator provided by AEM.

Can this testing solution be extended beyond current plan usage?

UTAC - FATT CHYE: Yes, we continue to improve and enhance the capabilities of the test system.

What is your experience with this collaboration between UTAC and AEM so far?

UTAC - FATT CHYE: There is strong support from the management of AEM and UTAC. Both teams are very committed, and we overcome many technical challenges. We have good synergy and able to roll out the solution timely.

AEM - PASCAL: We have a strong partnership with UTAC, and the delivery of the CMOS Image Sensor Test Cell Solution is a testimony to both companies' technological capabilities. Customer intimacy is at the core of what we do, and UTAC shares this vision. There is good synergy, and our combined industry knowledge and skills will allow us to deliver industry-leading, highly differentiated, application-specific solutions to the market.

What do you see as merits as well as existing or potential challenges observed and how have the companies overcome it as business partners?

UTAC - FATT CHYE: Bridging the gaps in expertise and knowledge from both companies helps us to overcome technical challenges quickly and achieve results. Though there are differences in technical requirements and specifications, we overcome by brainstorming and think out of the box for alternative solutions.



Despite the covid period, the team managed to accomplish the project within the planned timeline, is indeed a testimony of team's commitment.

AEM - PASCAL: The industry is rapidly changing, and we must stay ahead of the technological curve to meet our customers' demands. We needed to manage our bandwidth. We also needed to navigate challenges as a result of the pandemic. Both companies remained focused, and the strong alignment between the leadership was instrumental in overcoming these challenges

Any key take-away for collaboration for success on this project that you would like to share?

UTAC - FATT CHYE: It is a win-win for both AEM, as an equipment supplier, and UTAC, as an assembly and test service provider. The commitment and drive from both parties, sharing of

expertise, innovative ideas and determination make this project a success.

AEM - PASCAL: The unique Singapore environment is ideal for nurturing these types of partnerships, only second to Silicon Valley.

There is a concentrated pool of experienced professionals and engineering talents combined with strong government support.

The automotive industry is the buzz right now. Do you think this collaboration is headed in that direction due to this trend and any innovative ideas that you envision for this sector?

UTAC - FATT CHYE: Yes, with the evolution of autonomous vehicles in the automotive market, there will be more image sensors in a car. LiDAR can provide a precise evaluation of speed and distance as well as the outlines

of obstacles and moving objects. Time of Flight (ToF) sensors are also gaining market share. The testing solution should have the ability to test higher resolution and frame rate devices for automotive and medical application, hence, the next generation tester needs to be equipped with much higher capture rate capabilities. Besides applying multiple cores high end processors to improve image processing test speed, innovation on image analysis algorithm and the use of host processor in its' architecture controller to allow for true parallel acquisition will be the key advanced test technologies to further improve CPU efficiency.

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There can be up to 1,400 steps involved in manufacturing a semiconductor wafer, taking up to 20 weeks to complete an advanced chip. Semiconductor fabs can use as many as 300 different types of materials throughout fabrication. Quantum computing offers promising new ways to manage so much complexity.

Semiconductor manufacturing is one of the most complex, investment-intensive processes in the world. It is unsurprising that the development of next generation semiconductors is costly and time-consuming, depending on marginal improvements at the atomic scale.

Quantum computers are increasingly being explored as tools to address issues relating to semiconductor manufacturing, such as the development of new materials and complex supply chain management. Inefficiencies in present-day processes lead to profit loss, energy waste, and bottlenecks in other industries that critically depend on semiconductors. Solving these problems is no trivial task and requires creative and novel technological developments such as quantum computing.

What is quantum computing?

Quantum computing is a new computing paradigm based on the fundamental nature of quantum physics. In contrast to classical bits which are binary (0 or 1), quantum bits (qubits) exist in any combination of 0 and 1, a property known as superposition.

Like all subatomic particles, qubits can be entangled which links them collectively as an inseparable system. The power of a quantum computer scales

exponentially with qubit number, which is why it is hoped they may address certain complex problems that are classically intractable. This includes, but is not limited to, accurate simulation of chemical systems, construction of accurate machine learning models, and the solving of massive optimization problems.

How could quantum computing aid the semiconductor industry?

Being quantum systems, it is expected that quantum computers may naturally simulate the complex electron interactions that govern the properties of semiconductor materials. Accurate predictions could help to reduce the number and cost of R&D cycles needed to develop semiconductors that are better performing, more affordable, and environmentally sustainable.

Quantum computers could also help optimize the complicated manufacturing processes and supply chains downstream. Artificial intelligence methods are already employed in semiconductor manufacturing to ensure product quality. Quantum models may be able further to improve the accuracy

of these tools and facilitate implementation of new automated processes. The complexity of semiconductor supply chains may be amenable to efficient simulation using quantum computers. Even marginal improvements to the best classical simulations could have significant

impact on the bottom line along with other benefits, such as lower emissions.

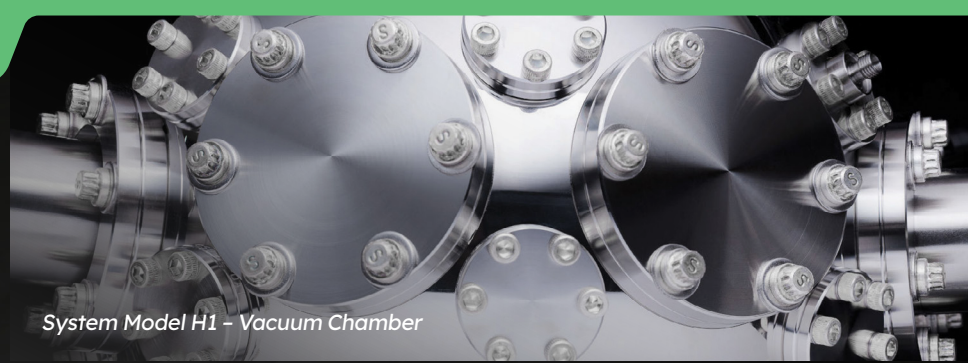
Where to begin?

The promise of quantum advantage cannot be realized yet. There are still barriers to be overcome in hardware and software development. However, levels of investment and research focused on quantum computing have never been greater. It takes time to acquire quantum expertise and understand how it may help a company meet its goals. Across many industries, including semiconductor design and manufacturing, companies have already started to invest in quantum computing, so that they may benefit from the advantages they confer as soon as they mature.

Quantinuum specializes in custom R&D projects across many industries, including semiconductors. Such projects help identify valuable use cases and develop methods, algorithms and strategies to take advantage of fast-paced improvements across hardware and software.

To discuss ways your group or organization could explore the opportunities opening up thanks to quantum computers, please reach out to Quantinuum, and we would be happy to schedule a meeting – email Vincent Anandraj at vincentanandraj@quantinuum.com

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System Model H1 - Vacuum Chamber

A Quantum Leap in Semiconductor Manufacturing

FEA
FUTURE ENERGY ASIA

FAM
FUTURE MOBILITY ASIA

Future Energy Asia 2022 & Future Mobility Asia 2022 successfully converged more than 13,500 participants in the energy and clean mobility sectors to drive a transformative motion in Southeast Asia

Endorsed by the Ministry of Energy of Thailand, and co-hosted by PTT and PTTEP, Future Energy Asia and Future Mobility Asia 2022 presented an integrated exhibition and summit to drive forward Asia's energy transition and clean mobility missions.

Held from 20-22 July 2022 at the Bangkok International Trade & Exhibition Centre (BITEC), the co-located events convened Ministers, policymakers, industry CEOs and international investors from 51 countries, providing an effective platform that will spark strategic and technical discussions and showcase world-leading clean energy and mobility innovations.

Thailand In the Driving Seat of Southeast Asia's Energy Transition and Clean Mobility Missions

"On behalf of the Ministry of Energy Thailand, I am pleased to share our appreciation and support for Future Energy Asia 2022 and Future Mobility Asia 2022. It is apparent that we are now facing many challenges with the enormous shifts underway in the energy sector raised by the energy transition coupled with the pandemic and current global energy crisis. This event comes at a crucial time to provide a comprehensive decarbonization and transformation summit in the region," said Mrs Premrutai Vinaiphat, Deputy Permanent Secretary, Ministry of Energy Thailand.

Future Energy Asia and Future Mobility Asia 2023 will take place from 17-19 May at Queen Sirikit National Convention Centre in Bangkok, Thailand. Enquire about your participation via www.futureenergyasia.com and www.future-mobility.asia

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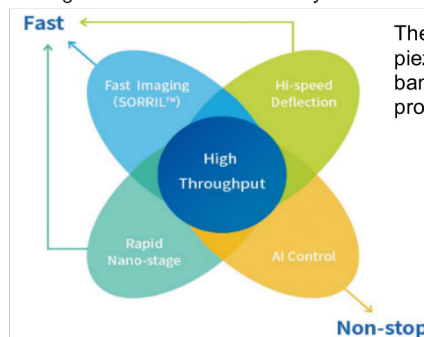
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