Semiconductor and Emerging Markets – Industry Trends and Developments

Kai Fai, Ng
President SEMI Southeast Asia
SEMI Connects

SEMI is the global not-for-profit industry association connecting & representing the electronics manufacturing supply chain

For more than 47 years, SEMI has connected its members worldwide to achieve together what each cannot accomplish alone.

250,000+ Global Attendees at SEMICON Shows
500,000+ SEMI Member Individuals
2,500+ SEMI Member Companies Worldwide

900+ SEMI Standards
4,500+ Standards Volunteers
11 Annual Industry Expositions
SEMI Connects to Advance a Global Industry with SEMI 2.0

FlexTech Alliance

MEMs and Sensors Industry Group

Fab Owners Association
SEMI Connects

- Provides the platform for more than 2,500+ member companies to shape standards, policies, issues, initiatives, and actions that advance business growth.

- Creates opportunities that enable active collaborations between suppliers, customers, and business partners regional in SEA and Globally

- Advocates workforce development and gender diversity through SEMI High Tech University Program

- Delivers deep industry knowledge development through SEMI Market Intelligence and SEMI Technology Forums
SEMI Connects: Members & Communities

Achieving together what we cannot do alone
SEMI Membership
the BIG picture

GROWTH
Grow your company through SEMI Regional and Global business events

VISIBLE
Create brand awareness through SEMI Regional and Global activities

LEVERAGE
Up close with industry inflections and development through members ONLY SEMI Market Intelligence

INFLUENCE
Participate in SEMI collaborative communities shaping industry policies that advances mutual business interest

NETWORK
Winning partnership through SEMI Regional and Global networking events
## SEMI SEA 2018 Events

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<tbody>
<tr>
<td>SEMI SEA Members &amp; Partners Appreciation Night January 2018 (Singapore)</td>
<td>SEMI SEA Technical Committee (Formation of Smart Manufacturing Committee)</td>
<td>SEMICON China 2018 14 - 16 March 2018 (Shanghai, China) Singapore Pavilion IMAP Scheme up to 50%!</td>
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<td>SEMICON Southeast Asia 2018 8th - 10th May (Kuala Lumpur, Malaysia) <a href="http://www.semiconsea.org">www.semiconsea.org</a> 100% HRDF supported</td>
<td>SEMI SEA Technical Committee Meeting (Singapore)</td>
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<td>Sept-18</td>
<td>Oct-18</td>
<td>Nov-18</td>
<td>Dec-18</td>
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<tr>
<td>SEMI-SMTA Future EMS Symposium (Thailand)</td>
<td>SEMICON Taiwan 2018 5 - 7 September 2018 (Taipei,Taiwan) Singapore Pavilion IMAP Scheme up to 50%</td>
<td>Micro Tech Asia 2018 (TDC Singapore) 100% HRDF Supported</td>
<td>HIT Workshop &amp; Northern Corridor E&amp;E Members &amp; Partners Networking Night (Penang, Malaysia)</td>
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*Information is correct as of time of published. Schedules may subjected to further changes*
Market Trend Agenda

- 2017 Review
- 2018 Outlook
- Packaging Trends
- Summary
Semiconductor Equipment Cycles -
Revenues to approach $56 billion, a new annual spending record

Previous spending high was in $48B in 2000

Source: SEMI/SEAJ WWSEMS
Wafer Fab Equipment Segments -
Etch Equipment Surges in Era of 3D NAND and sub-20nm Technology

<table>
<thead>
<tr>
<th>Device</th>
<th>Total Etch Steps</th>
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<tr>
<td>Logic 40nm</td>
<td>35</td>
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<tr>
<td>Logic 28nm</td>
<td>50</td>
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<tr>
<td>Logic 10nm</td>
<td>&gt;110</td>
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<tr>
<td>Logic 7nm</td>
<td>&gt;140</td>
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<tr>
<td>2D Flash</td>
<td>35</td>
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<tr>
<td>3D Flash</td>
<td>35</td>
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<tr>
<td>DRAM 19nm</td>
<td>55</td>
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Source: SEMI ISS, G Yin AMEC, January 2017
Silicon Wafer Market - Recovery in Aggregated Average Selling Price

- Peak revenues back in 2007
- Several year period of declining ASPs while shipments increased
- 2017 rebound in ASPs to propel +17% revenue growth

Source: SEMI
2017- A Record Setting Year

- 2017 is a record setting year for the industry
  - Semiconductor sales: \( >$400B \) for the first time
  - Investments
    - All-time high for CAPEX by single company (Samsung)
    - Equipment spending in Korea will smash previous regional spending record
    - Worldwide equipment billings: \( \sim$56B \)
  - Silicon shipments
    - Also, a rebound in wafer pricing
2018 Outlook
Fab Investments-
Records in 2017 and 2018

Record Fab Spending!!

- Construction $ Record of US$13B in 2018
- Equipment $ Record of US$63B in 2018

Source: World Fab Forecast Report, December 2017, SEMI
Key Fab Projects – *Driven by NAND, DRAM and Foundry*

**NAND**
- Samsung Pyeongtaek P1
- SK Hynix M14 3D NAND line
- Micron Building 60 (Lehi) and Fab 10X in Singapore
- Toshiba/Flash Alliance Fab 2, Fab 6 and new R&D Center
- Intel Fab 68 in China

**DRAM**
- Samsung Pyeongtaek P1 and Line 15
- Micron Fab 15 (Hiroshima) and Fab 16
- SK Hynix M14

**Foundry**
- TSMC Fab 12, Fab 14 and Fab 15
- Samsung S2 and S3
- GLOBALFOUNDRIES Fab 1, Fab 8 and Fab 11
- SMIC Beijing B2 and B3, new Shanghai 300mm fab and Shenzhen 300mm fab
- UMC Fab 12A P5 and Xiamen fab

**Fab Equipment Spending**

Source: SEMI, World Fab Forecast, December 2017
Packaging Trends
Packaging Trends and Transitions

- Wire bond is alive!...but industry evolving to increased packaging and assembly at the wafer level
- Memory industry at an inflection point in interconnect technology
  - Leadframe to organic substrate packages
  - Wirebond to Flipchip
- FO-WLP is a disruptive technology
- Traditional model:
  - *Wafer is processed in fab*
  - *Wafer sent to assembly facility for singulation, assembly, and test*
- New model:
  - *Some wafers stay at the foundry for packaging and assembly*
  - *Some OSATs install wafer processing (“like”) equipment to create package on the wafer*
Packaging and Assembly Trends

• SiP remains a hot topic
  – Drivers remain the same…miniaturization #1
  – Heterogeneous integration drives this into high-performance applications

• Silicon interposer finally moved into volume production (but small volumes)
  – FPGA with homogeneous and heterogeneous solution
  – GPU + stacked memory
  – Network systems
  – Artificial intelligence

• Still waiting for the big TSV market, but we have production volume
  – DRAM with TSVs for servers
  – HMC
  – HBM
Summary
Summary

• 2017 was record setting year for the industry
  – Record fab investments; All-time high for total equipment spending
  – Spending in Korea will smash previous regional spending record

• Record fab investments and equipment spending forecasted to continue in 2018

• Significant packaging transitions underway as function of mobility, connectivity, and performance:
  – Smaller, thinner…increasing integration

• China equipment spending to surge in 2018 and could lead the market in 2019 & 2020

• Projections of 8% -11% semiconductor revenue growth 2018 and CAGR of 6.5% 2016-2021
SEMI Market Data Reports and Databases

- **Fab Forecast**
  - Semiconductor, MEMS & Sensors, LED, Power Devices
- **Equipment & Component Market**
- **Material Market**
  - Semiconductor Materials
- **Device Packaging and Testing Market**

- **SEMI China IC Industry Outlook 2017** - a comprehensive report and database containing in-depth analysis of China's wide-ranging IC manufacturing ecosystem within the global semiconductor industry.

- **SEMI FabView**
  - New Update
- **World Fab Forecast**
  - Feb 18
- **World Fab Watch**
  - Feb 18
- Global 200mm Fab Outlook to 2021
- Opto/LED Fab Forecast
- Opto/LED Fab Watch
- Customized Fab Reports

- **Equipment Market Data Subscription**
  - Semiconductor Equipment Market Statistics (WWSEMS)
  - New Equipment Forecast
  - SEMI Secondary Fab Equipment Report Q3, 18
  - Mass Flow Controller Market Statistics

- **Material Market Data Subscription**
  - Photomask Characterization Report
  - Silicon Reclaim Wafer Characterization
  - Mass Flow Controllers Report

- **Worldwide OSAT Manufacturing Sites Database**
  - Global Semiconductor Packaging Materials Outlook Coming soon!

- **China Semiconductor Packaging Market Outlook**
  - Coming soon!
SEMICON SEA 2018 Key Features

01 THEMED PAVILION

02 Global PAVILION

03 CO-LOCATION PARTNER

04 ELECTRONICS MANUFACTURING SUPPLY CHAIN ECOSYSTEM

05 IMMERSIVE NETWORKING

- PMO and Ministerial GoH
- Regional CXO
- After Party Event with Top Musician
SEMICON SEA Show “Think Smart Make Smart”

PRE and ONSITE Publicity – 6 months ahead in 3 channels : media, social and channel partners

DAY 1
OC - PMO
- Keynotes (SUPER THEATER)
SMART Manufacturing
- Technical Forums
- Future Technology showcase
- Immersive networking party

DAY 2
CXO Speaks with Minister, Industry Leaders and Taiwan Ministry
- MATRADE Business Xchange
- Supplier Search Program
- Technical Forums

DAY 3
Public Private Conversation – Minister E, MOHE, IHL and Industry
- MATRADE Business Xchange
- Technical Forums
- Supplier Search Program
- SEMICON U

Daily IoT Gadgetry Display – VR, Autonomous, Smart City, Smart Bike, COBOTS, Drones, NFC Tech

TALENT CARRER FAIR (Daily) + Graduate conversations by Lam Research
SEMICON SEA 2018 Broad Overview

Public Relation Campaign

- SEMICON Promotion in
  - Taiwan
  - Japan
  - Korea
  - China
- SEA regional promotion through direct SEMI outreach
- Pre Press Release
- Feature interviews in regional newspaper
  - Industry Captains within SEA
  - 6 months holistic media campaign in Google, LinkedIn
- Post Press Release
- Features 2018 success via social media/youtube
- Promotion of 2019 SEMICON SEA

Pre-Event

- GOH – PM & Minister of Trade (inviting)
- Smart Manufacturing Keynotes (Day 1)
- CXO Speaks Forum
- SEA Technology Startups
- Technical Forums

Post-Event

- World of IoT show case
- Future EMS Pavilion
- Smart Manufacturing Pavilion
- Business Matching
- VIP networking Event
SEMICON Southeast Asia Theme Pavilion

- AUTOMATION
- PRECISION MANUFACTURING
- BIG DATA
- SOFTWARE PROVIDERS
- 3D PRINTING
- MATERIAL ADVANCEMENT
SEMICON Southeast Asia Theme Pavilion

- HETEROGENEOUS PACKAGING
- ADVANCED SMT
- FLEXIBLE HYBRID ELECTRONICS
- YIELD SOLUTIONS
- CRITICAL INSPECTION & METROLOGY
Technical Forums

- Technology Innovation Forum on Smart Manufacturing
- Market Trends Briefing
- Advanced Packaging
- Product & System Level Testing
- IC Failure Analysis and Defect Characterization
- MEMS & Sensors
- Assembly and Advanced Soldering Technology in PCBA

The content of the programs are guided & governed by SEMI Technical committees. We highly encourage presentations featuring collaborative work between end users and their suppliers. Call for papers begins now until Jan 2018.
SEMICON University Program & Talent Career Fair 2018
SEMICON Southeast Asia Talent Career Fair

“The SEMICON Southeast Asia Career Fair is an extension of a pre-eminent platform of SEMICON Southeast Asia Show targeted to encourage engineering students towards an exciting semiconductor engineering career with reputable global companies”
## SEMICON U Program 2018

<table>
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<tr>
<th>Date</th>
<th>10 May 2018 (Thursday)</th>
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<tbody>
<tr>
<td>Time</td>
<td>1230hr – 1515hr (Tentative)</td>
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<tr>
<td>Targeted number of pax</td>
<td>150-200pax Students and Teachers</td>
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<tr>
<td>Who will join</td>
<td>Engineering/Physics Students from local universities &amp; colleges</td>
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<td>Semiconductor Industry CXO</td>
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# SEMICON U Program 2018 - Overall

**10 May 2018**

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<tr>
<th>Time</th>
<th>Description</th>
<th>Venue</th>
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<tr>
<td>1230pm</td>
<td>Arrival of Students</td>
<td>MITEC</td>
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<tr>
<td>1245pm</td>
<td>Welcome Speech by SEMI</td>
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<tr>
<td>1300-1330pm</td>
<td>Future Talent Readiness in the era of Robotics and AI</td>
<td>Dr. Marcelo (MIT)</td>
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<tr>
<td>1335-1415pm</td>
<td>Experience Future Technology, Today! A tour at World of IoT &amp; Start-ups</td>
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<tr>
<td>1415-1500pm</td>
<td>Dialogue Session: Attracting &amp; Cultivating Engineering Talent for the Future</td>
<td>Minister, MOHE, Industry, IHL</td>
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<tr>
<td>1500-1515pm</td>
<td>Presentation of Certificate of Participation to Students (by Universities/Colleges)</td>
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Thank you for partnering with SEMI Southeast Asia!

For further queries, please do not hesitate to contact SEMI Southeast:

Linda Tan (Ms)
Email: ltan@semi.org
DID: +65 6391.9519
How does the Southeast Asia electronics manufacturing supply chain position themselves to capture business opportunities in the huge growth of the semiconductor industry in foreseeable future? What are the gaps and challenges that the ecosystem face and how do overcome them? What is the impact of recent Taiwan’s Southbound policy meant to the players here? Regional governments and policy makers would need to create a strong foundation to pave the way to capture the growth, however, a proactive approach from the industry will be the way to take the policy forward, and to bring up real competitive advantage. This CXO Speaks provide a perfect platform to hear missing links and opportunities from the policy makers and industry leaders' perspectives. It serves to provide a deep insights into building a resilient and growing electronics industry for Southeast Asia.

**This forum is by Invitation Only**
Market Trends Briefing

In this half a day Market Trend forum, subject matter experts from the chip makers, market research analysts covering equipment and materials, applications domain and advanced packaging space as well as financial analyst will share with you the latest current industry trends and drivers for 2018 and beyond.

Technology Innovation Forum – Keynote Speech on Smart Manufacturing

What does Smart Manufacturing mean for the future of the electronics manufacturing supply chain? The electronics manufacturing supply chain holds many different perspectives, but one thing is clear — the impact of Smart Manufacturing will be huge.

IC Failure Analysis and Defect Characterisation

There are four main driving forces for the semiconductor industry. 1) The race to produce faster and smaller front-end devices; 2) Challenges and innovations in new packaging technology in light of product and system miniaturization, 3) proliferation in the diverse applications relating to IoT devices and their rapid paced evolution 4) increasing complexity of our systems and technologies in a competitive environment.
MEMs and Sensors Technology

The technical presentation delve deep on system level solutions incorporating MEMS and/or sensor device, unique applications and innovative technological or market solutions. Integration challenges and system level architecture decisions are driven by the particular use-case. Speakers will elucidate these challenges and how to manage and overcome them successfully.

Semiconductor Advanced Packaging

The semiconductor industry manufactures a huge variety of IC’s that have different packaging requirements. The package type for a particular semiconductor device depends on different attributes including size, power dissipation, field-operating conditions, and last but not least, cost. Advanced packaging technologies include BGA, Flip-Chip, CSP and their derivatives especially FOWLP, SIP and 3DIC will be discussed.

IC Product and System Level Test

Testing microprocessors is becoming more difficult and more time consuming as these devices are designed to take on more complex tasks, such as accelerating artificial intelligence computing, enabling automated driving, and supporting deep neural networks. This is not just limited to microprocessors, either. Graphics processing units are grabbing market share in supercomputing and other areas. And microcontrollers, often considered the less sophisticated cousins of the mighty MPU, are gaining in complexity as they are pressed into action for the Internet of Things and other new applications. This forum will focus on the technology evolution in product and system level testing.
3 - days Technical Conference @ SEMICON Southeast Asia

The SMTA cordially invites you to participate in SMTA Technical Conference from 9-10 May located in MITEC, Kuala Lumpur. This event, held in conjunction with SEMICON Southeast Asia 2018, will as usual address the industry's most pressing issues in electronics PCBA emerging technologies, and lead-free & reliability.