HETEROGENEOUS INTEGRATION ROADMAP

Paul Trio
Senior Manager, Strategic Initiatives
SEMI

Paul Trio is the Senior Manager of Strategic Initiatives at SEMI. He is responsible for collaborative technology platforms, called Technology Communities, organized to identify and address critical industry issues and challenges important to SEMI Members. He currently manages SEMI Technology Communities focused on semiconductor component defects and traceability at advanced process nodes, microelectronics and systems test equipment, secondary equipment and applications, and more recently, advanced packaging.

Prior to his current role, Paul was responsible for SEMI's North America Operations of the SEMI International Standards Program. He joined SEMI in 2002 as a Standards Engineer where he supported technical committees responsible for developing standards for factory automation, microlithography, and automated test equipment.

He was graduated with a BS degree in Electrical Engineering from San Jose State University and holds a Dual Master's Degree in Systems Engineering and Business Management also from San Jose State.

HETEROGENEOUS INTEGRATION ROADMAP

IEEE Heterogeneous Integration Roadmap Symposium
Supply Chain TWG

Chair: Tom Salmon (SEMI)

IEEE | IEEE photonics Society | semi | IEEE Electronics Packaging Society | ASME | Electron Devices Society

Thank You TWG Members

- John Hunt (ASE US)
- Tom Gregorich (Carl Zeiss Semiconductor Manufacturing Technology)
- Rozalia Beica (DowDuPont)
- Siva Sivasankar (Google)
- Krish Dharma (IBM)
- Allan Calamoneri
- Tom Salmon (SEMI), chair

HETEROGENEOUS INTEGRATION ROADMAP

TWG Primer

- Supply chain topic is vast
- Custom implementation
- Reluctance to share IP

IEEE | IEEE photonics Society | semi | IEEE ELECTRONICS PACKAGING SOCIETY | ASME | ELECTRON DEVICES SOCIETY

Heterogenous Integration Roadmap (HIR)
Supply Chain Technical Working Group (TWG)

HIR
HETEROGENEOUS INTEGRATION ROADMAP

DRAFT

- Charter
  - The microelectronics manufacturing is growing increasingly complex and an effective supply chain will be critical in enabling heterogeneous integration.
  - The **HIR Supply Chain TWG** was chartered to **enable heterogeneous integration** by:
    - Identifying critical supply chain challenges
    - Providing guidance, and
    - Recommending solutions

    with sufficient lead time that these challenges do not become roadblocks.

- Scope
  - The HIR Supply Chain TWG will:
    - Define various package architectures to be addressed by the roadmap
    - Develop a roadmap for supply chain requirements with 5-, 10-, and 15-year horizons
    - Identify the difficult challenges that must be overcome to meet these requirements, and where possible,
    - Identify potential solutions and synergies among supply chain stakeholders

IEEE | IEEE photonics Society | semi | IEEE ELECTRONICS PACKAGING SOCIETY | ASME | ELECTRON DEVICES SOCIETY

HETEROGENEOUS INTEGRATION ROADMAP

Areas of Consideration

- Package technology (2D, 3D, panel, …)
- Process flow enabling
- Material sets
- Equipment
- Design Tools
- Testing

Next Steps

HETEROGENEOUS INTEGRATION ROADMAP

- Finalize charter & scope
- Execute, develop position paper
  - Define boundaries, package architectures covered by the roadmap
  - Identify supply chain requirements, gaps, and challenges
  - Identify potential solutions and synergies among supply chain stakeholders
  - Align and collaborate with other HIR TWGs

Back-up

HETEROGENEOUS INTEGRATION ROADMAP

Challenges

- Custom implementation, reluctance to share – IP
- Supply-chain Constraints
  - Natural & Human Resources
  - Geo-political
  - Regulatory & EHS
  - Continuity/Resilience
- Supply-chain Development
  - Equipment Capabilities
  - Materials Design
- Environmental
  - Transactional/Business Models
  - Innovation/talent pipeline

IEEE · IEEE photonics Society · semi · IEEE Electronics Packaging Society · ASME · Electron Devices Society

Technology Landscape Changes

- Shift to system-level scaling and optimization
- Increased technology complexity
  - New Materials/Substrates
  - Thermal Budgets
  - Optical
- New Entrants, Convergence & Learning Curves
  - Co-design & Simulation

HIR HETEROGENEOUS INTEGRATION ROADMAP
IEEE
IEEE photonics Society
semi
IEEE ELECTRONICS PACKAGING SOCIETY
ASME
ELECTRON DEVICES SOCIETY