JEDEC Strategic Roadmap

Strategic Planning Task Group
JEDEC Board of Directors

Perry Keller, Keysight Technologies – TG Chairman

JEDEC All-Member Update
June 8, 2016
Strategic Roadmap TG

• Formed 2014
• Mission:
  – Identify areas that can benefit from JEDEC’s unique capabilities supporting development of semiconductor and Microelectronics standards. Recommend specific steps the Board can take to help JEDEC members and the industry.
• Members: Keysight, Samsung, Qualcomm, ST Micro, TI, IDT, Oracle, Freescale, NXP, Sanyo, Wintec
• Identified focus areas:
  – Automotive Champion: Samsung, Qualcomm
  – WBG Champion: Keysight, ST Micro
  – Photonics Champion: Oracle
  – Energy Harvesting Champion: Wintec
Development Phases

- **Host Discovery Group***
  - TG review findings & make recommendations to BoD
  - BoD decides next steps
  - Implementation

- **Automotive**
- **Optical Devices & Modules**
- **Wide Bandgap**
- **Energy Harvesting**

*Information gathering session with key industry players and subject matter experts. May include representatives from member and non-member companies, academia, other standards organizations/consortia, etc. May be either F2F or via webconference depending on geographic location and number of participants.
Wide Bandgap Semiconductors
Focus Group Report

Perry Keller
Keysight Technologies
Focus Group Chair

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Semiconductor Device (R)Evolution

1. Fab purity reaches critical threshold - limited commercial production
2. Improved characterization & models improve yield, cost, usability
   1. Industry agreement on parameters, models, test methods is essential
3. Increased demand, new application types, device proliferation and new suppliers create design confusion and supply chain issues, limiting growth
4. Quality, Reliability and Performance metric standardization improves user confidence and ease of use, enabling market expansion
5. Device complexity and capability grows, driving new markets
6. Industry and academia champion the “Next big thing”, leading to

GaN in Stage 2 with SiC near Stage 3
120 years since first SiC diode, WBG is ready for the big time
JEDEC Capabilities and Wide Bandgap Industry Needs

1. JEDEC’s original mission was to get the newborn “solid state” industry thru Phase 2 (parameters, models, test methods)
   1. JC 1X committees still engaged in this effort.
   2. Legacy JC2X committee scopes apply directly to WBG needs
   3. JEDEC has organizational flexibility, IT, process and legal infrastructure to support any WBG needs

2. JEDEC’s was key to Phase 4 standardization of Quality, Reliability and Performance metrics, enabling explosive growth
   1. JEDEC has resources needed to deploy the modern Internet online system when the industry needs it

3. JEDEC kept pace with semiconductor industry globalization
   1. Immediate support for WBG suppliers and users emerging simultaneously in Asia, U.S. and Europe
   2. Longstanding relationships with IEC, ANSI and sister organizations like JEITA are immediately applicable to WBG standardization
Current Direction

1. Plan to support all WBG and power semiconductor technologies and applications
   1. GaN, SiC, latest power Si (IGBT, Mosfets, etc.)
   2. Application classes with unique needs (Automotive, power generation storage and distribution, industrial, equipment power supplies, transportation, etc.)

2. Deploy resources as the industry requires
   1. Committee organization and scope
   2. Website and collaborative development infrastructure
   3. Long lead time industry infrastructure (type registration, etc.)

3. Identify and engage with emerging organizations and longstanding partners
   1. GaN Working Group
   2. SiC developers
   3. Government/Military/Aerospace
   4. IEC, ANSI, JEITA, DLA, ESA, etc.

4. Seek Board of Directors approval in stages from now thru end of year
GaN Power Conversion Device Standards Working Group

Mission: We seek to create standards and guidelines for Test Methods, Qualification Procedures and Datasheet Parametrics for GaN based power conversion devices

1. Steering Group Formed

2. Broad Sponsorship/membership Established:
   1. 11 suppliers and still growing
   2. Standards agencies: JEDEC, PELS Standards Technical Committee

3. 3 focus areas:
   1. Qualification/Reliability Methods
   2. Test Methods
   3. Datasheet Parametrics

4. Focus area teams being formed and launched.
Automotive Initiative
Focus Group Report

Hung Vuong
Qualcomm
Focus Group Co-Chair

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AUTOMOTIVE FORUM PROJECTS

- **H Vuong**: Device products specifications for Automotive Applications
  - Talk about different devices of Interest in the automotive space
  - Standardized template etc.
- **Nick Lycoudes**: Quality and Reliability Requirements for Semiconductor Products
  - Talk about projects in progress in JEP001, NVMs and SiC
QUALITY AND RELIABILITY
Standards for Automotive Applications

PROJECTS ALREADY IN THE WORKS

- **JP001A FOUNDRY PROCESS QUALIFICATION GUIDELINES**
  (Wafer Fabrication Manufacturing Sites)
  - JEDEC JC14.2 owner of the JP001 standard
  - A proposal with additional requirements has been given to JC14.2 By Andreas Aal

- **JESD22-A117C NVMs**
  - JEDEC JC14.1 owner of JESD22-A117C on NVMs
  - Waiting for proposals/inputs from Automotive Forum for Updates
  - AEC uses the JEDEC document as basis for automotive requirements for NVMs

- **JEDEC 14 and AEC cooperate on Standards**
  - At least five documents of JC14 on Q&R are used as basis by AEC.

- **SiC Projects JEDEC JC14.7**
  - SiC Wafer Level Defectivity document has been introduced in IEC TC47
  - JEDEC 14.2 working/cooperating on this document with IEC TC47 wafer level WG5
  - JEDEC JC14.7 Reliability and Quality for Compound Semiconductors.
  - JEDEC JC13.1 Discrete Devices

WAITING FOR ADDITIONAL PROPOSALS FOR STANDARDS
TG Summary of Energy Transfer Interface

June 8, 2016

K.C. Chen / Wintec (TG Chair)
A Wasteful AC World

Energy waste.
e-Waste.
Inconvenience - various adaptors for various devices.
Expensive – extra cost for adaptor.
Three wires (vs. two wires)

It is time to standardize DC energy transfer for the transition to DC world.
DC Power Transmission

Three Gorges Dam (world largest hydropower plant) in China uses High Voltage DC (HVDC) transmission to bring power to people.

Advantages over AC transmission:

- AC reactance loss,
- AC skin effect loss,
- AC capacitance coupling loss to ground.
PV Cells, Wind Turbine and Fuel Cells pave the foundation of future DC microgrid (self-contained grid to feed DC Bus for local buildings).

Wind energy produced at night or solar energy produced during weekend can be used to turn water into hydrogen (best energy storage) for fuel cell use.
Devise a standard interface for self-contained local DC microgrid. The standard addresses three hierarchical segments:

Energy Source bus,
Energy Hub,
Energy Client bus – support clients to communicate with hub.
Updated Energy Transfer Interface Architecture

- **DC Source** (e.g. PV Array)
- **DC Source** (e.g. Wind Turbine)
- **DC Source** (e.g. Fuel Cells)

**Energy Source Bus**

- **Battery**
- **DC-DC Converter**
- **DC-DC Converter**

**Energy Client Bus**

- **DC Device**
- **DC Device**
- **DC Device**
- **DC Device**

**Energy Hub**

- **DC-AC Inverter**

○: intelligent interface port

**AC Grid**

- e.g. USB i/f

**JEDEC**

Global Standards for the Microelectronics Industry
Summary of Energy Transfer Interface

1. DC power transfer interface for DC microgrid in a local energy environment.
2. Delivering DC power upto 3KW per energy client bus, comparable or exceeding a typical 20A AC circuit, without the drawbacks of AC power delivery.
3. Communication with intelligent client devices at the energy transfer interface brings substantial advantages: e.g. simpler IoT implementation, adding control redundancy for mission critical applications.
Thank You

For Helping The Blue Planet.