Collaborative Alliance for Semiconductor Test (CAST)
Technology Community

Overview | March 2020

SEMI speeds the time-to-better business results for its members across the global electronics design and manufacturing supply chain.
SEMI OVERVIEW
PLATFORMS TO CONNECT YOU TO THE GLOBAL ELECTRONICS SUPPLY CHAIN

- Holistic Workforce Development
- Global Advocacy
- 7 Offices Worldwide
- 170+ Technology Programs
- Thought Leadership
- 20+ Tech Communities
- Expositions/Conferences
- 1.3M People Engaged
- 2,300+ Members Worldwide
- 2,300+ Program Hours
- EHS
- Market Intelligence Reports
- 1,000+ Standards
CONVERGENCE AND NEW DISRUPTIONS ARE ENABLING TRANSFORMATION OF MANY NEW COMPANIES TO DIGITAL ERA

SEMI CONNECTS THE GLOBAL ELECTRONICS DESIGN & MANUFACTURING SUPPLY CHAIN
WHAT SEMI DOES FOR ITS MEMBERS

Focused, Forward-Looking Collaboration
- Smart Mobility
- Smart Medtech
- Smart Data / AI
- Smart Manufacturing / Industry 4.0

International Standards
- Synchronize and safeguard industry
- 5,000 global volunteers
- >1,000 Standards
- >25 SEMI Standards referenced on each PO
- Interoperability, safety, EH&S, specs, tests

Comprehensive WFD Programs
- High Tech U – 237 programs, >130K students
- University connections
- Mentoring, Diversity & Inclusion, Women in Tech

Member-Driven Global Advocacy
- Amplify collective voice of the industry
- Met with 220 policymakers worldwide since US-China trade conflict began
- Promote 10 Global Trade Principles

SEMI Technology Communities
- Member companies can engage with customers and suppliers and form new business relationships
- Enables collaboration and connection between companies and colleagues
- 450+ participating companies
- 20+ technical communities
SEMI TECHNOLOGY COMMUNITIES
Activity Flow

Discuss
Unearth Collect Promote Present

Develop
Identify Scope/Recruit Develop Framework Pre-Draft

Standardize
Initialize Draft Ballot Publish
COLLABORATIVE ALLIANCE FOR SEMICONDUCTOR TEST (CAST)

CAST develops, coordinates, and directs all SEMI services for the semiconductor test community.

Organizational Structure

- Steering Committee
- Rich Interactive Test Database (RITdb)
- Tester Event Messaging for Semiconductors (TEMS)
- Chip ID & Traceability

Participating Companies
CAST Activities

• Rich Interactive Database (RITdb)
  • **Focus:** Develop the next-generation format following STDF to allow more flexibility in data types and support for adaptive test.
    • RITdb enables a real-time streaming model that provides the ability to collect and monitor data/systems from sand to landfill
  • **Rationale:** While Standard Test Data Format (STDF) is widely used in the semiconductor industry, there is a need for more efficient and flexible format to manage “big test data.”

• Tester Event Messaging for Semiconductors (TEMS)
  • **Focus:** Establish a vendor-neutral way to collect test cell data by standardizing ATE data messaging system based on industry-standard internet communication protocols between a test cell host and a server.
  • **Rationale:** Address surging demand for real-time data analysis, real-time ATE input and control of the test flow to improve test yield, throughput, efficiency, and product quality.

• Chip ID & Traceability
  • **Focus:** Develop a standardized approach for enabling traceable die-level identification (ID) throughout the IC manufacturing, test, and assembly processes to the point of use in the final system.
  • **Rationale:** Many product types representing significant volumes that do not provide ID traceability. Without component-level traceability, it is extremely difficult to analyze failures and drive corrective action
Activity Process Flow [1/3]

SEMI CAST

Identify Scope/Recruit Develop Framework ► Pre-Draft

SEMI Standards

Initialize Draft Ballot Publish
Activity Process Flow [2/3]

SEMI CAST

Identify | Scope/Recruit | Develop | Framework ► Pre-Draft

SEMI Standards

Initialize | Draft | Ballot | Publish

CAST:
- RITdb WG
- TEMS WG
- Chip ID & Trace WG

ATE Standards Committee:
- RITdb TF
- TEMS TF

Traceability Standards Committee:
- Single Device Traceability TF

Status:
Standards Balloting

• Letter Ballots
  • The first step in the approval process required for publication of a new or revised standard
  • Electronic system, hosted on the SEMI website
  • Multiple voting cycles / year
  • 30-day voting period
STREAMING DATA & RITDB

WHAT ARE THE UNIQUE APPLICATIONS THAT DRIVES STREAMING DATA?

STACY AJOURI, SMTS

3/19/2020
PROPOSED STANDARD – SPECIFICATION FOR RICH INTERACTIVE TEST DATABASE (RITDB)

Standardized approach for data sharing and consumption of data throughout the IC manufacturing processes from fab to final user and back across the whole ecosystem – Applies to all data collected in the production, assembly, and testing of semiconductors

Supports SMART adaptive test with ability to feed back/forward – Deploy ML algorithms to enhance yield

Addresses challenges of data sharing between internal and external facilities and stakeholders

- Security and provenance of the RITdb data - critical to enable integrity of data pipeline
RITdb Features

- RITdb Containers and/or streams of data
- Capable of integrating batch data with individual streams

RITdb bi-directional messaging

- Exchange information between Test cell and anything else connected to RITdb (data or control)
- Enables operational control and data analytics

Build upon IoT architecture using MQTT messaging protocol

- Modern open source message based communication enables plug and play tools and applications
- Adds layer of security with private/public key sharing rules
- Easily integrates into Big Data infrastructure
BENEFITS AND INDUSTRY ADOPTION OF RITDB SOLUTION

RITdb enables a **data driven environment** for Semiconductor Manufacturing

- Simple standards-based data capture, transport and relationship model
- Supports multiple data use cases (datalog, cell events, equipment logs, diagnostics, IoT sensors, MES events)

Streaming RITdb is based on open source SW and enables **easy exchange of information** between systems

- Aligned with HIR Adaptive Test Model
- Enables IoT integration into SMART Facility
- Model supports real-time control based on events

Industry **deployment** of RITdb standard proposal

- COHU implemented RITdb datalogs on Roadmap testers in 2019
- Roos Instruments and TI implemented case studies and prototype of RITdb system
- Advantest - in development targeting 2020
INDUSTRIAL INTERNET OF THINGS ENABLES ADAPTIVE TEST

Events come from many sources:
ATE, OEE, Handler/Prober, Test Cell Control
MES, Automation Systems, .....
STREAMING RITDB SUPPORTS THE INTEGRATION OF IIOT SMART TEST STRATEGIES TO SOLVE QUALITY AND COST PROBLEMS
APPLICATIONS USING SYSTEM BASED ON RITDB:
ADAPTIVE TEST AND EDGE COMPUTING

Adaptive Test: Historical & Immediate Data

Edge Computing: Decentralized Solutions
RULE MANAGER - CAN COMBINE REAL-TIME DATA/EVENTS, WINDOWED DATA, & HISTORICAL DATA

- Variable automated process rules
- Monitoring Rules
- Product engineering support

*Rules Engine can run on or off tester*
A system to incorporate historical data/stream with current event is necessary
RESOURCE TRACKING IMPROVES QUALITY, LOWERS COST

- Preventative diagnostics
- Reduce mean time between failures
- Improve planning efficiency
- Correlates problem to resource

Real Time Tracking System (RTLS):
Improve identity, align streams from different sources, support automation
DATA PLAYBACK LOWERS COST OF DEVELOPMENT

RITdb Data Lakes

Data Playback

Application

Robust software updates
Rule change impact assessment
Low impact app development

**RITdb Data Lake**
System needs to be integrated to capture, manage, and store RITdb containers/streams.
CHALLENGES USING INTERNET OF THINGS IN TEST FLOOR

- Central data access speed
- Different data types
- Test cells
- Databases

- Streaming data
- Node identity
- Network overhead
- Node deployment operational cost
TEMS Update
This activity aims to establish a specification for ATE data messaging system based on standard internet communication protocols between a Test Cell host and a server.

The activity will map the services and data of the specification to HTTP/JSON streams, URLs, and data payload definitions.

The specification is designed to co-exist with current implementations of the different communication methods and allow for easy implementation of client-server-based functionality services for ATE operations.
Tester Event Messaging for Semiconductors (TEMS)
Standards Task Force

• Established under the North America Chapter of the Automated Test Equipment Technical Committee

• Charter:
  • To develop a standardized ATE data messaging system based on standard internet communication protocols between a Test Cell host and a server.

• Activity
  • New Specification for the Automated Test Equipment Tester Event Messaging for Semiconductors (TEMS) [Document #6580]
    • Semiconductor test operations involving ATE today are experiencing increasing use of data for real-time data analysis and real-time ATE input and control to improve test yield, throughput, efficiency, and product quality. At the same time, test equipment and test operations around the world utilize a diverse range of data formats, specifications, and interface requirements that create significant customer service and application engineering costs for ATE vendors, OSAT companies, IDM test operations, software providers, and handler equipment. The goal of this specification is to create a vendor neutral way to collect test cell data.
    • This document:
      • Describes the data communication between the Test Cell and an external server.
      • Covers Test Cell data and operating condition collection.
      • Describes the minimum interface requirements along with methods for adding custom

• Status: Issued for Letter Ballot October 2019
  • Ballot proposal to be adjudicated in January 2020
Chip ID & Traceability Update
Chip ID & Traceability

CAST Chip ID & Traceability Framework Development Completed

SEMI Standards Activity Established:
- Single Device Traceability (SDT) Task Force

CAST Development Completed (Jun 2018)
Standards TF Formation (Jul 2018)
Standards Activity Start (Aug 2018)
Letter Ballot Issued (Sep 2018)
Technical Committee Adjudication (Nov 2018)
Procedural Review (Dec 2018)
Standard Published (Jan 2019)
Single Device Traceability (SDT) Task Force

• **New Standard Proposal – Specification for Counterfeit Prevention for the Electronics Manufacturing Supply Chain**
  - Immutable and secure recording and authentication of parts as they flow between members of an electronics manufacturing supply chain
  - Based on Hyperledger Fabric and Blockchain technology for recording the chain of custody of parts as they transition through the supply chain;
  - The BOM will be recorded in SEMI E142 format
  - **Root of Trust** may be embedded in silicon on the die (Examples of RoT: the PUF and SHIELD Dielet)
  - Purpose is detection, not prevention of counterfeit and security risks

*Image source: PDF Solutions*
Single Device Traceability (SDT)
Task Force

• Liaison with other standards activities
  • Institute for Interconnecting and Packaging Electronic Circuits (IPC)
  • HDPUG traceability work
  • Explore interaction between ISO TC 292 W4 and SEMI Traceability Committee
  • International Roadmap for Devices and Systems (IRDS) Factory Integration
  • Advanced Backend Factory Integration (ABFI) TF
  • DARPA - Liaison with AISS project

• Call to Action
  • SDT TF is looking for industry stakeholders to become founding members of a consortium that will host the proposed blockchain solution
Future CAST Activities
Future CAST Focus Areas

• Topics to explore further for future CAST efforts
  • SEMI Smart Manufacturing Activities
  • Leveraging HIR Roadmap
  • Chiplets – Collaborating with ODSA on Test Challenges
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