AEC – WORK SHOP SESSION
KNOWN GOOD DIE / MULTI-CHIP MODULE

Banjie Bautista - Integrated Silicon Solution Inc.
Pamela Finer – Pericom Semiconductor
Tim Haifley – Altera
Tom Lawler – Lattice Semiconductor
Nick Lycoudes - Freescale
Steve Sibrel – Harman
Daniel Vanderstraeten – On Semiconductor
Mike Buzinski – Microchip
Gary Fisher – Gentex
Werner Kanert – Infineon
Joe Lucia – John Deere Electronics Solutions
Donna Moreland – TI
Elaine Trotter – Analog Devices

April, 2015

AUTOMOTIVE ELECTRONIC COUNCIL
AEC MCM Discussion Agenda

- MCM Definition
- MCM Decision Flow
- MCM Stress Test Flow
- Tests to be included
- Test under consideration
- Next Steps

Multi-Chip Modules

Multiple die assembled to provide certain performance

Some Examples:

- Logic + sensor
- Logic + memory
- A to D chip + logic
- Active + passive
- Passive + discrete

Definition

Module Definition = a number of electronic components – integrated circuits / passives / discretes - enclosed in a single module (package) that performs an electronic function.

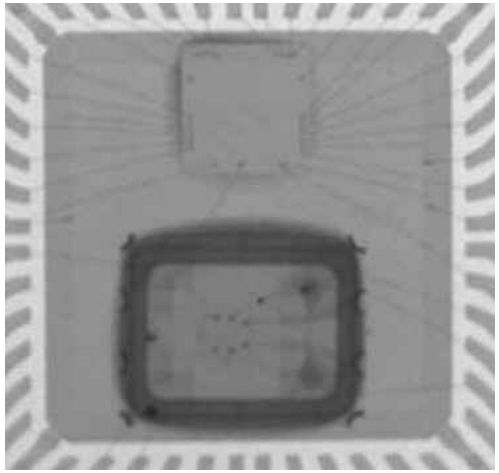
In Scope

Systems in package (SiP)
Package on Package supplied as a component
Modules that are soldered onto a board

Out of Scope

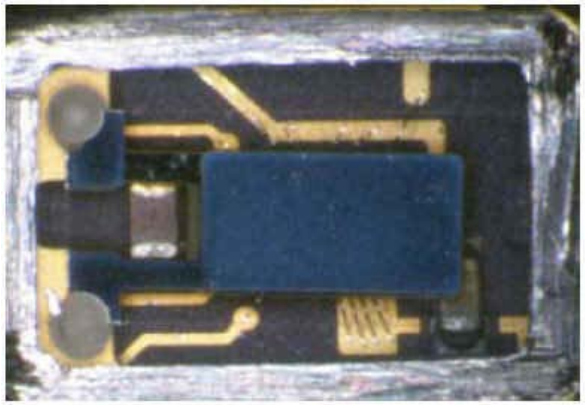
Two components that a T1 /OEM assembles onto a system
LED – presently covered by separate specifications
Power Modules – existing LV324 specifications
Modules that have exterior connectors in this first edition

Die + Oscillator

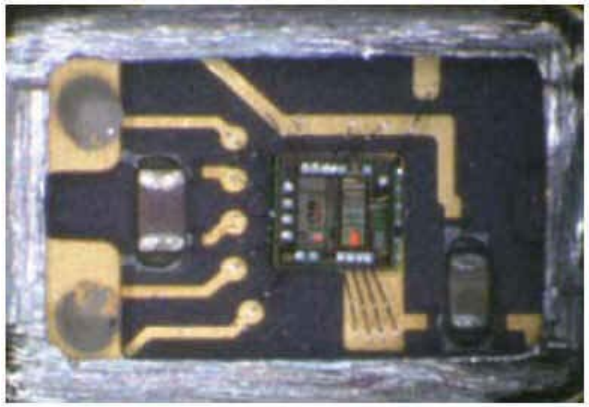


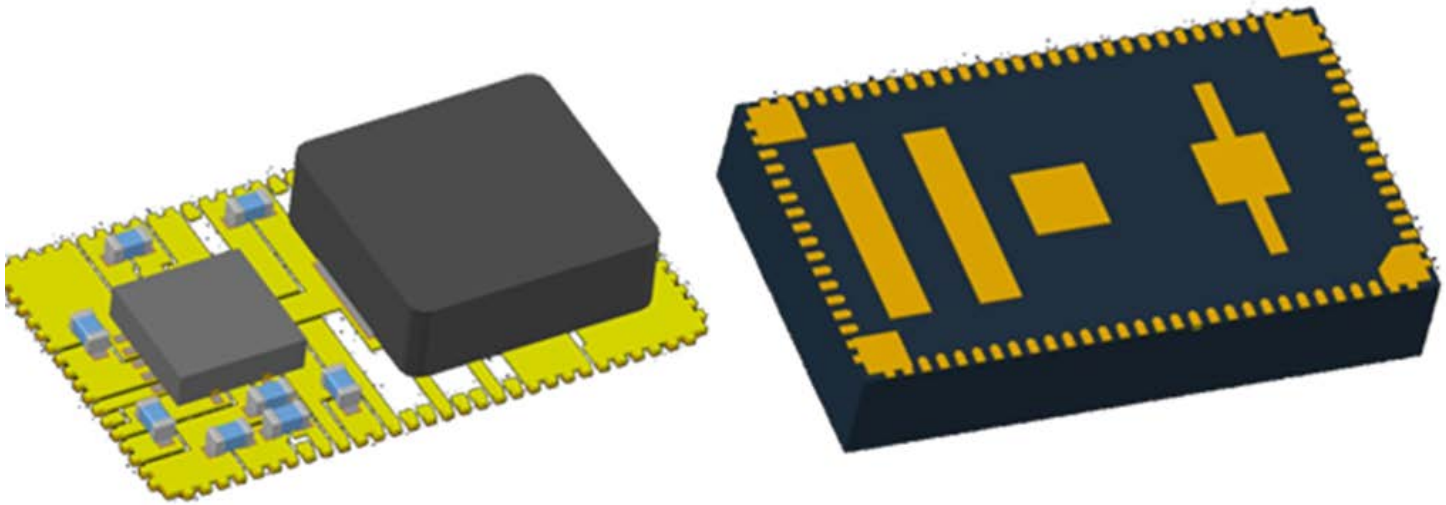
Oscillator = Die + Passives

Ceramic Pkg: Decap with crystal

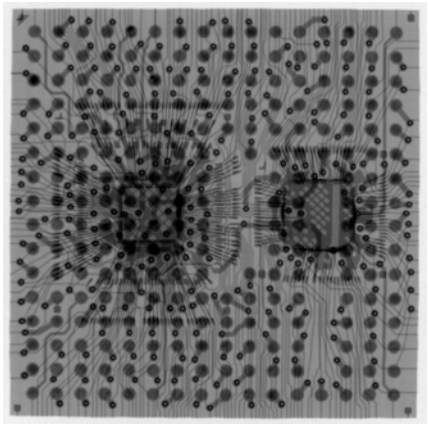


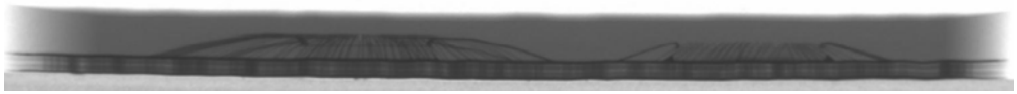
with crystal removed



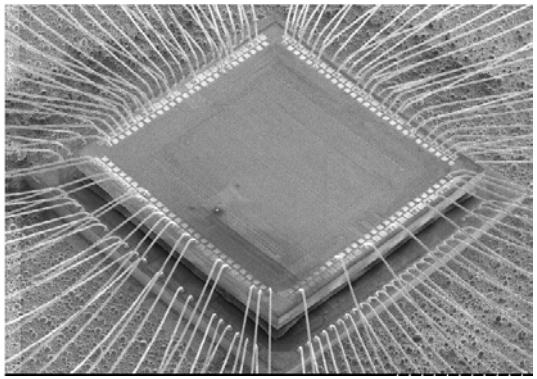


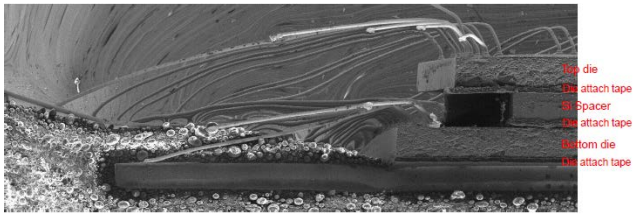
Side by Side Die Packages





Stacked Die Packages





Known Good Die / Multi Chip Modules

- **Build a baseline qualification standard based on reliability concerns -> the details matter**
  - **Some modules are relatively simple and AEC-Q100 may apply as is.**
  - **Complex modules will require a thorough FMEA approach to understand and then quantify the risk**
    - **Multiple materials**
    - **Multiple component sources**
    - **Component types**
    - **Thermal considerations**
- **Characterization concerns**
  - **The module “solution” complicates**
    - **Fault grading understanding**
    - **Performance interactions**

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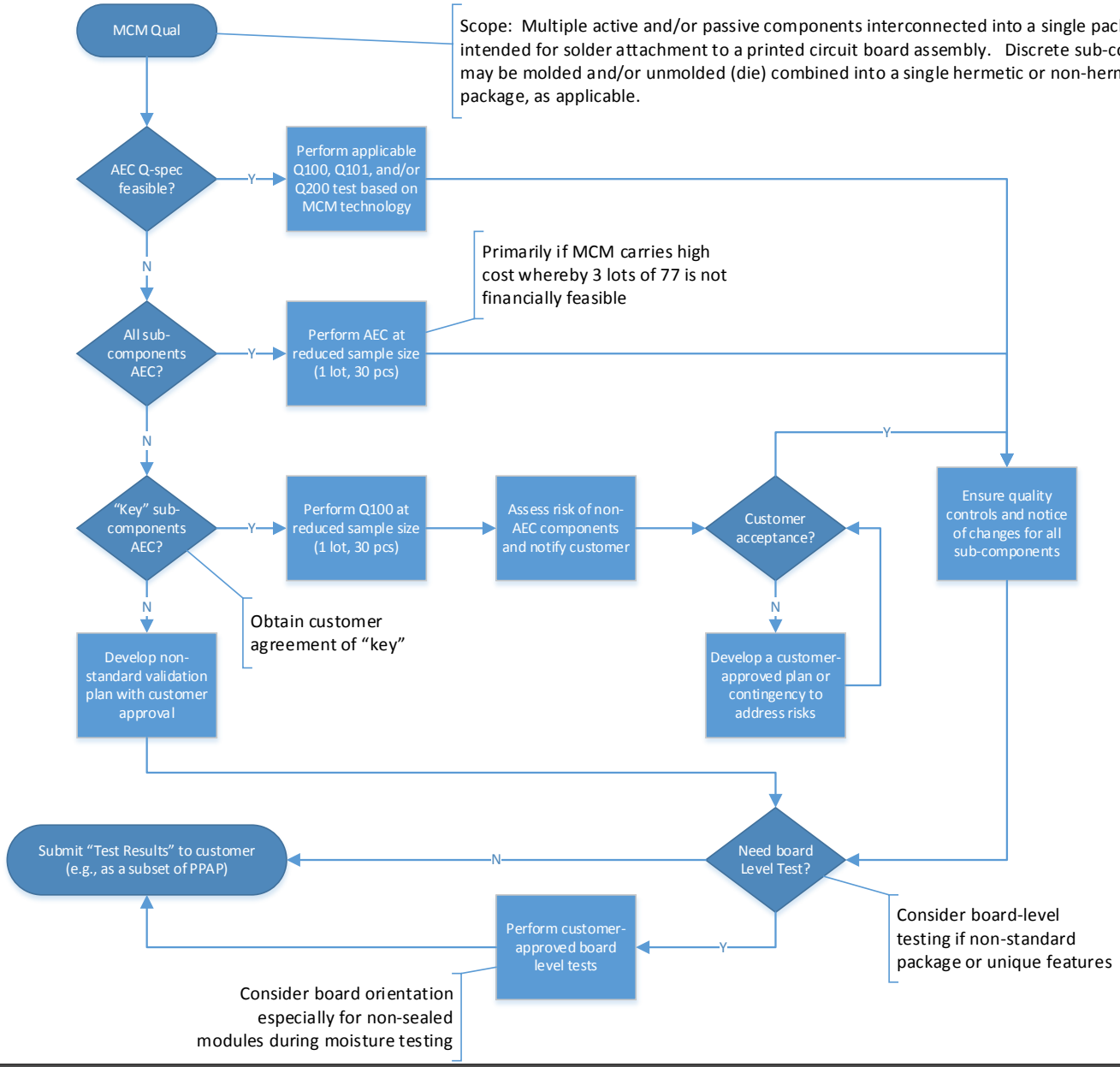
AUTOMOTIVE ELECTRONIC COUNCIL
Work Shop Session – MCM Decision Flow



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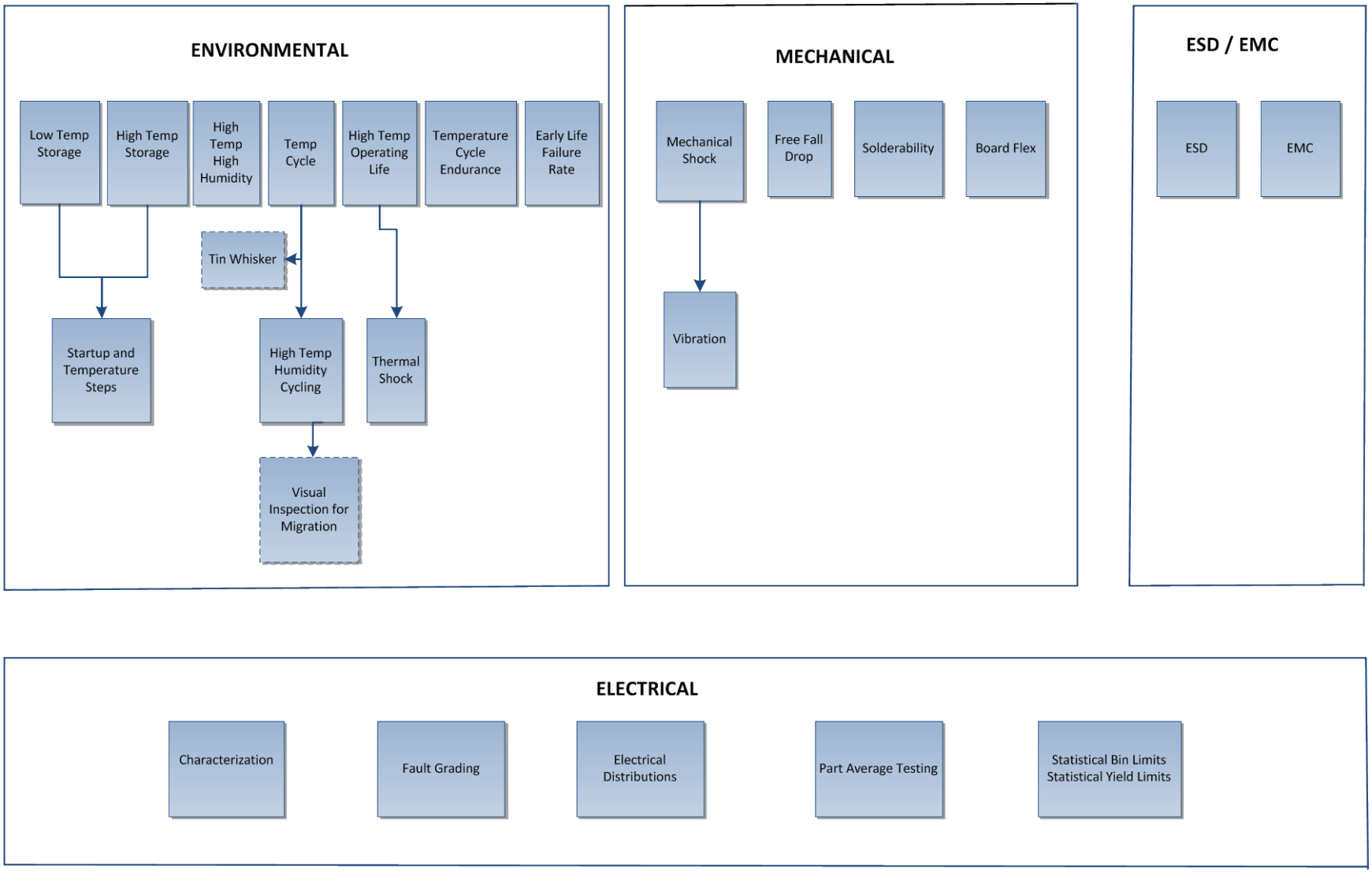
Multi Chip Modules

- **Proposal to use AEC-Q100 as the basis**
  - **Failure Mode Effects Analysis (FMEA) based failure mechanism focus**
  - **Sample size**
    - **per AEC-Q100**
    - **unless module cost is excessive supply-customer to negotiate**
  - **Test sequence flow**
  - **Test to be included**

AUTOMOTIVE ELECTRONIC COUNCIL
Work Shop Session – Test Sequence



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Work Shop Session - Tests to be included

AEC-Q100 Test Sequence	Apply to Module	Apply to Components within the Module	Comments
Accelerated Environment Stress tests THB/BHAST, TC, HSTL, PTC, UHAST/Autoclave (Q100 test Group A)	X		THB – may need to use 85/85 1000 hours in lieu of BHAST to limit stress testing to moisture induced mechanisms
Accelerated Lifetime Simulation tests HTOL, ELFR, EDR (Q100 test Group B)	X		Sample size modifications may be applicable for AEC-Q100 components
Package Assembly Integrity Tests WBS, WBP, SD, PD, SBS,LI (Q100 test Group C)	X		
Die Fabrication Reliability Wafer level testing HCI, NBTI, SM (Q100 test Group D)		X	
Characterization (Q100 test Group E) AEC-Q003	X		Characterization over module data sheet voltage / temperatures for critical performance parameters.

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Work Shop Session – Tests to be included

AEC-Q100 Test Sequence	Apply to Module	Apply to Components within the Module	Comments
Fault Grading AEC Q100-007	X		With MCM devices, it is likely that some signals needed to fully test the individual components will not route to the external module contacts. In these cases, it is necessary to fault grade each separate component used in the MCM and fully test each prior to module assembly.
Electromagnetic Compatibility	X		Team to review the other tests; vCISPR25 ISO 11452-1, 11452-2, 11452-3, 11452-4 and 11452-5 ISO 7637 – 2
Electrical distributions AEC Q100-009 (Q100 test Group E)	X		
ESD HBM & CDM testing (Q100 test Group E) AEC Q002 AEC Q100-011	X		
Latch-Up AEC Q100-004		X	
SER (Q100 test Group E) JESD89		X	
Lead (Pb) Free AEC-Q005	X		
Cavity Package Integrity Test (Q100 test Group G)	X		Applicable for open cavity modules only

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Work Shop Session – Tests to be included

AEC-Q100 Test Sequence	Apply to Module	Apply to Components within the Module	Comments
Cu-wire **AEC Q006**		X	Will include appropriate elements of the released Q006
Process Average Testing **AEC Q001**	X		
Statistical Bin/Yield Analysis **AEC Q002**	X		

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Work Shop Session - Tests to be included

NEW TESTS	Apply to Module	Apply to Components within the Module	Comments
Board Level Reliability	X		In principle we will follow IPC9701. Working on recommendation for a standard board if no lead customer
Other package test e.g. Drop Test	X		Free fall test to be included in mechanical testing section
Start up	X		Electrical test - Assesses ability to start up after low or high temperature storage
Temperature Steps	X		Electrical test - Assesses ability to operate throughout the operating temperature range
Temperature Cycling Endurance	X		Stress conditions in discussion – the test is to insure the module will operator over the automotive use lifetime

AUTOMOTIVE ELECTRONIC COUNCIL
Work Shop Session - Tests under consideration

TESTS – not to be included	Apply to Module	Apply to Components within the Module	Comments
Corrosion			Will not be applicable for Modules Case by case applications
Solar Radiation			Not required since module will not be exposed to sunlight

AEC Multi Chip Modules Next Steps

- Complete stress test definition –> Complete in June 2015
- Draft straw-man proposal within the team –> target September 2015
- Propose draft proposal to AEC Technical Community –> target December 2015
- Ratification and publication –> target March 2016
- Review at 2016 AEC Workshop

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