International Technology Roadmap for Semiconductors (ITRS 2000)

Assembly & Packaging

International Technical Working Group
Leuven Belgium

April 10-11, 2000

Outstanding Issues

-1999 ITRS TWG:
- -expand mixed signal
- -expand MEMS
- -system in package
- -chip size

-1998 NEMI TWG:
- -package substrates not addressed
- -reliability criteria differences between packaged chips and COB

-1999 IRC:
- -add PWB roadmap to AP*
- -add PWB assembly roadmap to AP*

* clarify to mean few chip packages

Key Issues for 2000 Updates

-NEMI emulator completeness of requirements

- -pincount
- -power
- -wireless
- -MEMS

-addition of PWB and PWB assembly roadmaps into AP ITRS (per above)

-KGD

-ITRS cross TWG issues

-Jisso/IPC committee rep

Key Issues for 2000 Updates (cont.)

-die size
-stacked die
-"vision" packaging (cameras)
-optical packaging
-"radar screen" treatment of PCMCIA- ask NEMI to address
-lead/halogen free
-review of market application criteria
-2nd level qual data- lack of standards

AP Cross TWG Activities

- Interconnect
  - Cu/low k integration
    - wire bond
    - flip chip UBM
- ESH
  - Pb free solder
  - halogen/antimony free resins and substrates
- Test
  - pad pitch reduction
  - high frequency
- SOC/Design

Cross TWG Changes

- Test
  - AP TWG should:
    - add system level thermal modeling statement to text to address integrated AP/Test/Design issues
    - discuss how to push industry to deliver thermal models for standard package types
    - add thermal management recommendations
    - review package electrical modeling section for high frequency with Design
  - Test TWG should
    - address pitch reduction issues for contactors
    - address 1+ Ghz issues with Design including package electrical models

Cross TWG Changes

- Factory Integration
  - the FI TWG will add needs and potential solutions for AP and Test to provide
    - unit level traceability
    - mis-processing avoidance
    - cycle time reduction
    - improved equipment utilization

Cross TWG Changes

- Interconnect
  - develop a common section in both TWGs to address materials and integration issues
    - Pete Elenius and Jurgen Wolf for AP
    - Bob Gefken from Interconnect
  - incorporate specific needs and solutions in the respective roadmap sections
    - identify overall issues in 2000
    - determine which issues are specific vs common
    - act on issues/incorporate in 2001

Suggested Changes for 2000- Needs

- Cost/pin
  - All Categories
    - re-examine "yellow" through 2002 (E. Wu)
  - Memory
    - pull 2002 into 2000 and extrapolate out years for low end of range; remove "yellow" through 2002
    - determine how to address memory categories for 2001 update (B. Roemer)
      - deal with increasing complexity
      - change note C

Suggested Changes for 2000- Needs

- Chip Size
  - must get data from IRC ASAP
  - determine how to address small chip issues that are highly cost sensitive (E. Beyne)
- Power- no change
- Core Voltage
  - Harsh- verrify 3.3 has occurred in 2000

Suggested Changes for 2000- Needs

- Pincount
  - Cost Perf- determine why Jisso shows decrease until 2005 with an increase there after
  - Harsh- verify high end of range starting in 2000- check Europe, Japan, U.S. (Delphi-Delco)
  - High Performance- reconcile w/ Jisso
- Package Profile
  - All Categories-shift 2001 into 2000 and review out years
  - determine how to address stacked chips and thin/flexible packaging

Suggested Changes for 2000- Needs

- Performance on chip
  - Cost Performance- change 2000 to 1 Ghz and run algorithm for out years and revisit "yellow" areas
  - Memory- change 2001 to 166 Mhz and review out years
  - review all other categories/ reconcile w/ Jisso
  - review all numbers w/ Design
- Performance chip to board
  - Low End- need a new way to deal with game products (consider making it the high end of Low Cost) and add 400 Mhz for 2000
  - Cost Performance- change 2001 to 166Mhz and review out years
  - High performance- review all numbers

Suggested Changes for 2000- Needs

- Junction Temperature
  - determine how to address need for 150 C junction for in cabin automotive application (add to Harsh or change another category)
  - Hand Held- determine how to reconcile w/ Jisso roadmap which shows 85C for 2000
  - High Performance- change color to white and pull all numbers in one year

Suggested Changes for 2000- Needs

- Operating Temperature
  - High Performance- need to reconcile w/Jisso

Suggested Changes for 2000- Needs

- MEMS
  - determine how to address
  - two volume categories will be sensors and relays

AP ITWG Summary 4-10-11-00

- Several needs have increased more rapidly than anticipated in the 1999 update
  - clock frequency
  - memory product complexity
  - ultra thin package profiles and die
- Market Application Segment revisions are needed
  - complexity is increasing
  - categories are obsolete/new categories are required
  - these are driving new needs in several areas

AP ITWG Summary 4-10-11-00

- Decision reached on PWG addition request
  - AP ITWG will include necessary PWB roadmap items and data
  - no need for separate ITWG
- productive time spent on cross TWG interaction
- need participation from all geographies to make the roadmap the best that it can be

Suggested Changes for 2000- Needs

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2000 ITRS Key Dates

April 10-11 - ITWG meeting sponsored by IMEC, Belgium

May 01 - AP website active

July 10 - ITWG meeting, San Francisco
July 11 - ITRS public presentations, San Francisco

October ?? - AP update complete
December ?? - ITWG meeting in Asia,

2000 AP TWG Combined Key Dates

March 16/17- ITRS DTWG/NEMI kickoff

April 10-11 - ITWG meeting sponsored by IMEC, Belgium

May 01 - AP ITRS website active

May 19 - NEMI mid stream review, Las Vegas

June 14-15 - NEMI workshop, Hendron, VA

July 10 - ITWG meeting, San Francisco

July 11 - ITRS public presentations, San Francisco

August 30 - NEMI TC feedback to TWG chairs, Austin

October ?? - AP ITRS update complete

October 26 - NEMI conflict resolution, Chicago

December ?? - ITWG meeting in Asia,

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1999 Overview

UPDATED

- Market sectors aligned with NEMI
- Expanded discussion on wafer level packaging
- Expanded reliability section
- Thermal management
- High density substrates
- RF and mixed signal packaging
- Multi-chip packaging/modules

ADDED

- System on chip (SOC) & System in a Package (SiP)
- Electro-migration limits of eutectic flip chip bumps

Roadmap Sequencing

ITRS	NEMI/IPC		JISSO
1999	1998	1997	1999 English in progress
2000	2000	1999	1999

U.S. DTWG Outcomes-3/16/00 Mtg

Changes in 1999 AP ITRS

- Separated bump pitch for Hand Held vs. Cost Performance
- depopulation of outer row vs. relaxed substrate line width/space
- cost/pin reduced significantly
- removed pad count
- made package thickness overall profile
- removed bus width
- added 21mm CSP (FBGA)
- added current units for solder bumps
- wafer level packaging

ITWG 4/10-11/00 Actions

- AAO distribute:
  - 12/99 ITWG meeting minutes
  - ITWG membership/contact info
  - 4/10-11/00 ITWG minutes
  - website information