IoT – A Perfect Business Enabler for 200mm Fabs

Bill Chuang
Marketing Director
UMC
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Outline

- Market Observation
- Supply Chain Evolution
- Fragmented Market & End-Applications
- Industry Challenge
- Solutions
Computing Paradigm Shift Drives Semi Growth

- **Mainframe**
- **Client Server**
- **Personal**
- **Mobile**
- **Sensing**

Semiconductor (Bn USD)

- 400
- 200
- 50

- 1970
- 1990
- 2015

Innovations
Ubiquitous Connectivity Enables Intelligence

Increase in connected devices from 2000 to 2020 (40% CAGR)

375X

Interactive Home/Office

Analyzed Data

Cloud

Interactive Vehicle

Wearable Connectivity
Application Drivers of Semiconductor

- Smartphone leads post PC era growth
- IoT applications will drive the next wave

YoY Growth Rate in 2015

- Tablet: 9%
- Smartphone: 13%
- LCD TV: (-5%)
- PC: (-8%)
- Feature Phone: (-21%)

Source: BI Intelligence, Gartner, IDC, UMC

Numbers of Devices In Use (in million)
‘Internet Of Things’, Where The Money Goes

Source: Business Intelligence, The Internet of Everything: 2014
Watch/Band Type Devices: ~80% Market (2018)

Source: IEK
Key Drivers of IoT Adoption

- Cost effectiveness and easy-to-use of hardware design and software development

- The level of integration with Big Data/Analytics, from which companies in various sectors can increase revenues and reduce inefficiencies.
Diving Into IoT Requirements On Specialty

- Wearable
  - LP MCU
  - BT/BLE
  - Display
  - Charger PMIC
  - Sensor

- Smart Grid
  - LP MCU
  - HP AP
  - Zigbee
  - Zigbee PLC
  - WiFi
  - BT/BLE
  - Display
  - Sensor

- Smart Home/Building
  - LP MCU
  - HP AP
  - Zigbee
  - Zigbee PLC
  - WiFi
  - BT/BLE
  - Display
  - Charger PMIC
  - Sensor
  - Energy Harvesting

- Remote Healthcare
  - LP MCU
  - HP AP
  - Zigbee
  - Zigbee BT/BLE
  - WiFi
  - BT/BLE
  - Display
  - Charger PMIC
  - Sensor

- Smart Retail/Logistic
  - LP MCU
  - RFID
  - NFC
  - GPS
  - Display
  - Charger PMIC
  - Sensor

- Smart Transport
  - LP MCU
  - RFID
  - NFC
  - GPS
  - Display
  - PMIC
  - Sensor

Additional Components:
- eNVM
- Cutting Edge Logic/MM
- MMRF
- HV
- BCD
- CIS, MEMS
MEMS/Sensors are Critical to IoT applications

IoT

Wearable
Smart Healthcare
Smart Home
City Management
Smart Logistics
Smart Transport
Smart Energy

LP MCU
HP AP
RFID/NFC
GPS
WIFI
PLC
BT/BLE
Zigbee
2G/3G/4G

Display
Charger,
PMIC,
Energy
Harvest

Sensors
Industry Trends Require MEMS Design Automation

- Consumer electronics
  - Lower cost
  - Time to market
- Sensor fusion & integration
  - Cross-coupling effects
  - Increasing complexity
  - Packaging effects
  - System-level optimization
- Fab lite and fab-less model
  - Standardized processes
  - Process Design Kits
  - Reference designs & tool flows
  - Joint process development

Requirements for MEMS Design Automation:

- Capacity for
  - Complex designs
  - Processing effects
  - Cross-coupling effects
  - Packaging effects
- Accuracy to
  - Avoid build & test
  - Avoid component-level testing
- Speed for
  - Design optimization
  - System-level simulation
Battery Life Is the Major Issue – Power Management

- Lower Vcc will extend battery life

Source: http://www.powerstream.com/AA-tests.htm
UMC IoT Solutions with Coverage

- LP core <1.0V
- LP SRAM bit-cell

+RFCMOS platform

Low power eFlash (SONOS)

Low power IP:
- 6/8 track cell lib
- memory complier
- BLE 4.1
Industry Challenges Facing Paradigm Shift

**Challenges**
- Moore’s Law Alive and Well
- More-than-Moore Evolving
- Supply Chain Consolidation
- Skyrocketing R&D and CAPEX

**Partner Requirements**
- Advanced Node Commitment
- Robust Specialty Portfolio
- Open Collaboration for Strong Supply Chain Relations
- Flexibility to Share Risk/Cost
UMC Is Your Enabler for Success

34 Years Experience
20 Years Pure-Play Foundry
16,000 Employees
1,100 R&D Engineers

500,000 wpm Capacity
12” Fab x2
8” Fab x7
6” Fab x1

C/P+ Foundry For China
Best C/P & More

$4B Revenue
24% from <=40nm

28nm Ramp Up 2Q14
14nm Pilot 2014/E

12A
Tainan

8AB
Hsinchu

Fab 12i
Singapore

8C & D
Hsinchu

8E
Hsinchu

8F
Hsinchu

8N
Suzhou

8S
Hsinchu

6A
Hsinchu
Rising Demand Of 200mm Specialty Tech

Source: UMC

UMC's WW Shipment of Specialty Technologies

CAGR~30% (2012-2015)

8" eq. Wafers/year

Source: UMC
UMC: IoT Partner Foundry

Customer-Oriented Foundry DNA

- **Flexibility**
  - Customer Oriented Business Model

- **Portfolio**
  - Comprehensive Technologies

- **Value-Added Services**
  - Total Silicon Realization Solution

- **Cost of Ownership**
  - Optimized Supply Chain Partnership
Flexibility

Customer Oriented Business Model

Customer
- Supply Chain Requirements
- Technology/Manufacturing Needs
- Different Business Models (ASIC, IDM, fabless, etc.)

Time to Market Advantages

UMC
- JDP Engagement
- Process Porting
- Platform Solutions
Depth –
Advanced Logic Technology

Performance

Poly-SiON CoSi2, K=2.9

Poly-SiON NiSi, K=2.9

Poly-SiON NiSi, SiGe K=2.55

HK/MG Gate Last NiSi, SiGe K=2.55, TSV

FinFET SiGe/SiP K=2.55, TSV

Litho: 193nm Scanner
2004

Immersion Scanner
2007

DPT
2009

2014/2016
Width – Specialty Technology Leadership

- **Ultimate 8” Specialties**
  - HV
  - eFlash
  - eE2PROM
  - CIS
  - PMIC
  - MEMS

- **Leadership on 12” Specialties**
  - 55nm HV: industry’s first to production
  - 55nm CIS: technology release for production
  - 55nm eFlash: in developing
  - Ongoing innovations: 40nm/HV, 40nm/eFlash, and more…
UMC Technology Portfolio

Comprehensive Technologies

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Available: O  Developing: O
1. Flexible In-house and Outsourcing Wafer Sort Production
2. Comprehensive Quality Assurance System
3. Short Turn-around Time & Quick Yield Feedback with In-house CP
Total Cost of Ownership

Optimized Supply Chain Partnership

- UMC Foundry Flexibility
- Open Ecosystem Approach
- No Conflict of Interest
- Increased Transparency
- Seamless Business Model
- Long-term Partnerships
Complete 55nm uLP Device Offerings

55nm uLP Technology

Core Devices
- LVt 1.1V → 0.95V
- RVt 1.1V → 0.95V
- HVt 1.1V → 0.95V

I/O Devices
- 2.5V I/O

MS\(^1\) Devices
- Native Vt
- Bipolar
- Diodes
- 5V LDMOS
- NCAP/MOM
- Resistors
- Inductor

55nm uLP SRAM
- 6T SRAM
- 8T SRAM

\(^1\) MS: mixed signal
\(^2\) I/O device offerings: 2.5V, 2.5VD3.3V, 2.5UD1.8V
Customized Solutions For Wearable

- **I\text{active}**: 40% ~ 70%
- **I\text{off}**: 20% ~ 50%
- **SRAM V\text{cc\text{min}}**: 5-15%
- **Flash Mask Adders**: +12, >> 50%

**Legend**:
- Green: General Offerings
- Red: Customized Platform
UMC 55uLP IoT Platform

**Process**
- V1.0 DSM
- FDK

**Fundamental IP**
- Multi-Vol. IO T/O Kit (1.8/2.5/3.3V)
- 6T/8T SC T/O Kit
- SP/1PRF/2PRF/ Via ROM T/O Kit

* Cell library, PMK, ECO kit (Vdd = 0.95V)

** Vcc = 0.95 V
6T bitcell: 0.525um²
8T bitcell: 0.789um²
Leakage: < 5pA/cell

**Foundation IP**
- ADC/DAC/PLL
- eFuse
- OTP

**BT 4.0/4.1**
- BT 4.0/4.1 T/O Kit

**eFlash**
- Bit cell T/O (SONOS)
- Macro T/O (SONOS)
- Qual Finish

Q2’14 | Q3’14 | Q4’14 | Q1’15 | Q2’15 | Q3’15 | Q4’15
---|---|---|---|---|---|---

Right edge of box: Ready Date

UMC © 2014
If You Build It, They Will Come
(Ray Kinsella in “Field of Dreams”, 1989)

Italy, 1352

China, ~1400

~1980

1995

>2013

Future?
Thank You