SoC Device Trend & Introduction of ATE Solution

2011/11/16 Advantest Korea Co., Ltd.
Market Trend 1

Home Network (Wire & Wireless)

- DVD or Digital movie camera
- Digital TV or STB
- Digital Still Camera
- Digital Single Lens Reflex Camera
- PC
- Smart phone
- Car navigation & Car TV
- DVD/HDD recorder
- Broadband modem & Router
- Broadband Network (Fiber or Wire or WiFi)
- Car Electronic

The life based on Smart Phones is increasing.
A Smart Phone is a collection of the newest technologies.
A Demand for SoC Devices of Smart Phone

The demands to SoC Devices in a Smart Phone are more high performance and more cost down.
Example of Device Multi Fictionalize

- High Pin Count Test
- Mixed Signal
- RF (RF+BB) Modulation Signal Test
- SoC
  - Add-memory
  - High Speed I/F
  - Combine Multi Function
  - More High Performance and More Cost Down
- SiP
  - Multi Chip on Board
  - More Down Size
- Embedded PCB
  - More Performance
- POP
  - More Down Size
- TSV
- 2008
- 2010
- 2012
- 2014
- Optical
- RF (RF+BB) Modulation Signal Test
- RF-mixed
- BB-mixed
- More High Performance and More Cost Down
- To One Chip (Chip Number Reduce)
- Memory Test
- High Speed I/F Test
- Digital Test
- High Speed Interface Test
- DSP Core
- Processor Core
- Multimedia Processor
- DRAM
- SRAM
- RF
- Video
- Audio
- Flash
**Problem Points in SoC Device Test 1**

**Customer**
- Complicated and various correspondences are required of SoC Device Test.
  - Investment expansion of Tester by impossible to use the conventional Tester.
  - Cost escalation of Engineer education and Tester employment by two or more platform possession.

**Vendor**
- The increase in development cost.
- The timely delivery according to market demand is difficult.
- Complication of support.

*Increase of Test Cost!*
When functions is not enough by evolution of a device, The change with a new system is required. 
(Increase of an investment cost and an engineer resource.)

When functions is not enough by evolution of a device, 
Correspondence is possible at an addition or change of Module. 
(investment cost small and an engineer resource is efficient.)
Common Architecture (H/W & S/W)

**T2000**

- **Mine Frame**
  - Star Pro 2 Main Frame
    - (Max 8 site controller)
  - Light Star Main Frame
    - (1 site controller)

- **Test Head**
  - 52 slots Test Head
  - 26 slots Test Head
  - 13 slots Test Head

- **Test Modules**
  - DM
  - 250M 800M 1G
  - Mixed Etc.,
  - AA/BBWGD RF
  - DPS
  - LC DPS500 DPS90
Provide test solutions with appropriate modules for each area.

T2000 Platform +

SoC Solution
SoC for PC, Game etc.

MCU Solution
MCU for Consumer, Automotive

RF Solution
Wireless communication (RF) IC (W-LAN IC, Cell Phone IC)

Automotive/PMIC Solution
Power IC, PMIC etc.

CIS Solution
CMOS sensor IC

High Speed Solution
High-speed I/F (DDR, HDMI, PCI)

Digital Module
PMU32 Module
RF Module
Power Module
Capture Module
Analog Module
Sync Module
Digital Module
Relay Controller Module
Power Supply Module
Capture Module
6GSPM
The optimal composition which rinks each needs from development to mass production can be chosen freely.

Single Test in development

A large number of Parallelism for Reduce COT in mass-production.

Ex. Modules

800MDM Digital
DPS500mA
Analog/RF

Seamless
Scaleable
T2000 EPP Solution

(6000pin SoC Tester)
New T2000 Series (6000pin SoC Tester)

T2000 Main Frame

LSMF
2800pin Tester

SP2MF (T2000 EPP)
6000pin Tester
An indispensable function (Digital, Power Supply, Analog) is condensed with high density to a general-purpose SoC Device Test.

**Digital Module**
- **800MDM**
  - 800Mbps 128I/O

**Device Power Supply**
- **LCDPS**
  - 4A 8ch (32A total)
- **DPS500mA**
  - 500mA 32ch (16A total)

**Analog Module**
- **PMU32**
  - 16bit/200Ksps 32ch ISVM/VSIM
  - ADC/DAC Linearity test focused
- **BBWGD**
  - 16bit/400Msps 8ch AWG
  - 16bit/128Msps 8ch DGT
  - Not Enough THD for Audio
  - 3G Base Band focused
- **AAWGD**
  - 24bit/190Ksps 8ch AWG
  - 18bit/820Ksps 8ch DGT
  - High precision Audio focused

**1GDM**
- 1.1Gbps 256I/O
- FTA (Functional Test Abstraction)

**DPS90A**
- 2A 32ch + 0.8A 32ch

**GPWGD**
- 16bit/1Msps 16bit/50Mmps
- 18bit/1Msps 16bit/50Mmps
- THD -111dB@1KHz
- 8output Vref (VSIM)
New T2000 Series (6000pin SoC Tester)

<T2000 LSMF RECT 550 PB>

<T2000 SP2MF RECT 680 PB>

Competition's User Area Size

T2000 HiFix simplifies High parallel DUT performance boards at x4 ease of going to at x8, x16 solution
T2000 RF Solution
(Low COT & High Speed Test for LTE)
12GWSGA RF Module Features

- **4VSG /4VSA x 4MUX**: 16 ports Tx and 16 ports Rx/module
- **VSG (Modulation Signal)**: 6GHz (CW;12GHz) , VSA: 12GHz
- **High C/N mode and High speed (300us) settling mode offered**
- **1-100MHz Low Phase Noise REF-SG**
- **Independent resources for 4-DUT testing**
- **Expandable up to 128 ports/system**
- **High speed calculation by built in FFT H/W engine**

**Support of Multi-Band / High Parallelism / Multi-Port with Low Cost**
Advantest can offer
2-resources type RF module also,
For more Low System Price. (Module Price ½).

Competitor’s RF Minimum Configuration
38% resources (TT is Slower than T2000 RF for 4DUT LTE Tx.)

*Note

Advantest 12GWGSGA=1 Module

*Note) The meaning of the figure is actually different in the calculation of theoretical by the test item, the setting parameter, and the Device.
4 Parallel Testing w/o port switching

**AT Example**

- **Sampling time**
- **Calculation in a Module**
- **Data transfer time**

**Used FFT engine**

**Competitor Example**

- **Sampling time**
- **Calculation in a Module**
- **Data transfer time**

**Used**

16 RF ports + 2 RF resources
Example of Full Band-LTE configuration

//X4 DUT is proposal configuration
- 12GWSGAx1, BBWGDx1, 800MDMx2, DPS500mAxA2, RC5V192x1, Analog Syncx1
<table>
<thead>
<tr>
<th></th>
<th>4DUT (Results) / 8DUT (Ramp up inside)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cellular</td>
<td>4DUT (Results) / 8DUT (Ramp up inside)</td>
</tr>
<tr>
<td>LTE</td>
<td>4DUT (Results)</td>
</tr>
<tr>
<td>WLAN</td>
<td>8DUT (Results)</td>
</tr>
<tr>
<td>WiMAX</td>
<td>4DUT (Results for Both EDS &amp; FT)</td>
</tr>
<tr>
<td>DTV Tuner</td>
<td>8DUT (Results)</td>
</tr>
<tr>
<td>GPS</td>
<td>4DUT (Results)</td>
</tr>
<tr>
<td>BlueTooth</td>
<td>4DUT (Results) / 8DUT (Ramp up inside)</td>
</tr>
<tr>
<td>Zigbee</td>
<td>4DUT (Results) / 8DUT (Ramp up inside)</td>
</tr>
</tbody>
</table>
Support TTM by Daughter Board solution

In progressing the kind development of only daughter board
The correlation working man-hour and the cost are reduced.

Daughter Board

For Mass Production Stage

<Easy to PB checking>  <Easy to correlation checking>
T2000 ISS Solution
(Image Sensor Solution)
New T2000 Series (T2000 ISS)

CMOS Image Sensor Solution

[Capture Rate]

IP750EX w/ ICU-D
IP750EX w/ ICU-1GL

T2000 ISS

Cell-Phone
Camcorder
DSC
DSLR

1.4Gbps 1.2Gbps 1.0Gbps 800Mbps 650Mbps 100Mbps

4 8 16 24 32 40 64

[Muti Site]
## Camera Interface Roadmap for Mobile Applications

<table>
<thead>
<tr>
<th>Standard</th>
<th>CCP2</th>
<th>CPI</th>
<th>CSI-2</th>
<th>CSI-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Layer</td>
<td>SMIA</td>
<td>MIPI</td>
<td>MIPI</td>
<td>MIPI</td>
</tr>
<tr>
<td>Sub-LVDS</td>
<td>208Mbps (class0)</td>
<td>Parallel I/F 66MHz</td>
<td>MIPI D-PHY 800Mbps to 1Gbps</td>
<td>MIPI M-PHY A: 1.25, 2.5 &amp; 5 Gbps B: 1.5, 3, 6 Gbps</td>
</tr>
<tr>
<td>Status</td>
<td>In production</td>
<td>In production</td>
<td>2010-2011</td>
<td>Plan in 2012</td>
</tr>
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</table>

### Tester

<table>
<thead>
<tr>
<th>Module</th>
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<th>Module</th>
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<tbody>
<tr>
<td>T2000 ISS</td>
<td>1.2GICAP</td>
<td>1.2GICAP</td>
</tr>
<tr>
<td>IP750EX</td>
<td>ICU-D + Serial Board</td>
<td>ICU-D + Parallel Board</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(ICU-1GL)</td>
</tr>
</tbody>
</table>

**T2000 ISS Advantage**

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CCP2 : Compact Camera Port 2  
CPI : Camera Parallel Interface  
CSI-2 : Camera Serial Interface 2  
CSI-3 : Camera Serial Interface 3  
SMIA : Standard Mobile Imaging Architecture  
MIPI : Mobile Industry Processor Interface Alliance
T2000 ISS Technical Advantage

High Resolution Movies
Seq. Shooting MIPI Interface

1.2Gbps High-speed Capture
- Serial Capture: 1.2Gbps x 4 Lanes x 4ch
- Parallel Capture Enable
- 128M pixel Memory for Movies, Seq. Shooting
  - Enable 800M pix./16 Flames
  - (Legacy product: 800M pix./4 Flames)

64 sites Parallel Test Capability
- 440 φ Probe card
  - 252x208mm, Wide User Area
    - (x2.5 times for Legacy Product)
  - 160mmx150mm for 12” wafer

- High-throughput with New IP Engines
  - Quad Core CPU (Legacy product: Dual Core CPU)

Lower Price

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T2000 IPS Solution

(Integrated Power device test Solution)
New T2000 Series (T2000 IPS)

Integrated Power device test Solution

Power Supply and PMIC

Automotive

General Purpose Inverter

Home Appliance

Hybrid and EV Cars

Industrial Train and Power Plant

T2000 IPS

T2000 IGBT

(A)

(V)
Integrated Power Device Integration Trend

SOIC 8 / CAN Transceiver
Hi Quad 64 / System Base Chip
MQFP 128

CY2009
LQFP 100 / 12 loop Airbag IC

CY2012
Next Gen

Higher Integration
Increasing Pin Count

Big pressure to reduce CoT & Reduce Time-to-Market

CY1998

Big pressure to reduce CoT & Reduce Time-to-Market
Integrated Power DUT

High Voltage Mixed Signal
- MMXH
- PMU
- AWG
- Digital
- DGT
- TMU
- Relay
- Pattern Control
- 32 Analog (85V) & 32 Digital (24V)
- Achieve optimum cost by matching device needs

Low Voltage Mixed Signal
- MMXL
- PMU
- AWG
- Digital
- DGT
- TMU
- Pattern Control
- 64 Analog (18V) | 64 Digital (8V)

General Purpose Generator + Digitizer
- GPWGD
- AWG
- DGT
- TMU
- PMU
- 8 Generators
- 8 Digitizers
- Universal Instrument

Floating Power
- MFHP
- AWG
- DGT
- TMU
- Pattern Control
- 6 Sources 80V/12A
- Stackable & Gangable
- Unique Power Subsystem

Cost optimized power redistribution

Power Matrix

72 power ports

Few multifunctional instruments cover the widest range of needs.
T2000 IPS Doubling Parallelism

- Larger user area of PB than competitor PB.
- Reduced number of relays on PB.
- Simple PB design saves cost for development, manufacturing and maintenance.

**T2000 IPS doubles site count vs. competitor maximum configuration**
PMIC Target Device vs. IPS config.

a) Computing & Consumer

b) Wireless Communication

c) Peripherals & Low-end Consumer
IGBT Target Device vs. IGBT config.

d) Power Train, Safety & Control

e) IGBT Wafer

f) IGBT Chip
Thank you very much.