PlayStation®3 Leads Stereoscopic 3D Entertainment World

Sony Computer Entertainment
SVP Technology Platform
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• Every Single PlayStation®3 (PS3®) supports Stereoscopic 3D (S3D)
S3D (Stereoscopic 3D) mechanism

Separate Images for Left & Right Eye, people acknowledge the 3D image
Similar to stereo sound for Left and Right Year
The Ideal Stereoscopic 3D
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MARKET UPDATE

3D TV / PlayStation 3 number
3D TV Rate in Japan

3D function becomes common feature for larger TV

- 37/42 Inch
- 46/47 Inch
- 50 Inch more

※ Sell Through (GfK)
3D TV Install Base Projections in World Wide

*Data Source: Display Search*

3D feature commoditized in HDTV hardware price/spec competition

- **2010**
- **2011**
- **2012**
- **2013**
- **2014**
- **2015**

**330 M**
PS3 Install Base

Over 50M install base as of May 29 2011
Positive Loop Software/Hardware

- Easy Access of S3D encourages S3D contents creation

3D TV

PlayStation 3 As S3D Player

S3D Contents
GAME is the killer content for S3D

S3D AND GAMES
Perfect Mach of Game & S3D

5 Major Characteristics to explain

1. Game Industry struggle for seeking the **new exciting experience**

2. **Reality** is the critical trend of Gaming

3. **Interactive S3D** brings you to next Level

4. Do not mind wearing 3D Glasses
   Game is the Concentration-required Media

5. Relatively Easy to add S3D functionality to 3D Game
Graphics Evolution
3D is the key word of Modern Game

3D Graphics
World’s First Real-time 3D Graphics Game Console

Improve the quality of Real-time 3D Graphics

S3D Graphics
END-to-END 3D Graphics
“Reality” is the key trend of the Home console games

- FPS (First Person Shooter)
- Free World / Sports / Driving
- Games Become Real-World Simulator thanks to the improvement of Quality in Graphics

S3D Adds new dimension of Reality to the Game
S3D Game Titles
Add S3D function to the game
Rendering Performance

- Two times Rendering for Left and Right Images
- The biggest issue for adding S3D is the performance overhead of two times rendering
- Normally needs to tune up the rendering performance

- Relatively easy tuning performance
  - 60Hz Refresh Game
  - Split Screen Multi Player

![Split Screen Multi Player Diagram]
S3D output in HDMI 1.4

- **720P**
  - Create 1280x1470 Image
  - Upper: Left Eye Image
  - Lower: Right Eye Image
  - In the middle of two images, need the same color gap (30 pixel)

- **Refresh Rate of the frame**
  - 60Hz, 30Hz, 20Hz ...

- **Hardware Up-Scaler**
  - 640 x 1470, 960 x 1470
  - 1024 x 1470
  - The final method of performance tuning
Naked-eye Stereoscopic View

Prepare several angle images for wider range of angle viewing
Rendering performance is the key to S3D

**S3D & 3D CHIP**
S3D require render performance

Modeling Data → Rendering → Display Image

2D

Modeling Data → Rendering

S3D with Glass
2x Render Performance

Modeling Data → Rendering

Naked-eye S3D
10x Render Performance
Bandwidth is the key factor for render performance

- GPU & VRAM bandwidth is the key
  - PS2 GPU: embedded DRAM solution
    - Bandwidth High
    - Memory size Small
  - PS3 GPU: off chip VRAM solution
    - Bandwidth Medium
    - Memory size Large
Expectation to 2.5/3D chip

- High Bandwidth & Large size of Memory by 2.5D/3D chip technology
  - Improve Render Performance
    - Pixel Fill Rate Improve by higher bandwidth
  - Improve Render Latency
    - Alpha Blending Performance (ReadModifyWrite)
  - Low Power
- These are very attractive for improving S3D Image quality
- But there are some issues and challenges
Game machine requires high-performance technology but low-cost solution

CHALLENGES OF 2.5D/3D CHIP
Uniqueness of Game Industry

• Buy-all Condition
  – No Binning, Fixed Frequency

• Cost Sensitive
  – To enhance install base, HW should be provided with very low price

• The state of art technology
  – Requires the same performance during a long lifetime; the performance should be stretched at the launch time
Challenges of 2.5D/3D Chip

• We think there are several issues to introduce 2.5D/3D to Game Industry
  – Test
  – Cost
  – Thermal
  – Reliability
  – Multiple Supplier
Cost

• If 2.5D/3D chip stacking is used to enhance the performance of the system,
  – How much premium margin should we pay?
  – This is the critical topic

• The cost of Through-silicon-via (TSV)
Test

• Yield at the final test needs to be very high
  – Each die needs to be tested enough in order to guarantee high yield at the final test.
  – Technologies such as build-in self test, die level probing need to be improved.
Thermal conductivity

• How to escape the heat from lower and middle layer chips
  – High performance chips that are used in a game console generate a lot of heat.
  – In order to reduce the cost of cooling, the thermal conductivity inside the package needs to be very high.
Reliability

• Game machines are required to have relatively longer life than PC
  – Requires manufacturing and testing technology to guarantee the reliability of 3D-IC.

• Clarifying the responsibility
  – It is typically difficult to clarify which die supplier is responsible for the problem.
Multiple supplier

• Devices such as memory should be supplied by multiple vendors in order to obtain a competitive price.

• We need to define a common footprint for the TSV, but each supplier has a different preference. Particularly when the pin count is high, making common footprint introduces additional area and/or metal layers to the die.
3D IC is the promising technology but ..

• Issues are
  – Test, Cost, Heat, Reliability, Multiple-supplier

• We have been using chip stack technology using microbump in the current Playstation2 and PSP for cost reduction purpose.

• There are still some issues to be resolved in order to introduce 3D-IC technology in high performance game consoles such as PS3.
COMING TECHNOLOGY OF S3D AND CONTENTS

Glimpse of future exciting technologies with demonstrations
3D Display for PS3

• Personal 3D Display to enjoy 3D experience with PS3
  – 24 Inch size
  – 4 times frame sequential, high quality 3D image
  – Two different 2D images for each players
  – Stereo 2ch + Sub Woofer, high quality sound
  – Simple & Slim Design
  – Affordable Price
    • 3D Monitor / 3D Glass / 3D Game / HDMI Cable $499 in US

Launch 2011 Fall in World Wide
HMD

- Head Mount Display with 2 OLED panels
  - Ultra High Quality Image
  - No Cross Talk
  - Suitable for focus content like Game
Motion Tracking & S3D

- NIKUDAN

- Motion Controller + S3D Display

- VR Experience
  - Player surrounded by 3D Game World
Interactive 3D Live
Interactive 3D Live

Overlay 3D effect/Video on Real Performer

Audience

3D Projector

3D Video
Head Tracked VR
Table Top 3D
3D Holoscreen
Finally...

• **PlayStation 3** has been evolved to be the native S3D gaming system

• To achieve better S3D experience, render performance is the key factor

• 2.5D/3D chip technology is the promising solution to increase render performance

• **Coming 3D applications** bring the exciting new user experience
THANK YOU