Advanced System LSIs for Home 3D Systems

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Agenda

1. Overview of 3D Systems
   - Principles of 3D Imaging
   - Frame Sequential Method

2. Advanced System LSIs for Home 3D
   - Integrated Platform UniPhier
   - System LSIs for 3D TV and Blu-ray 3D

3. Supporting Technologies and Our Efforts
   - Realization of MPEG-4 MVC Decoding
   - Efficiency of System LSIs for Blu-ray Recorders
   - System Emulators

4. Conclusion
Our brains synthesize 3D image from parallax

=> Difference between images on the left and right eyes
## Eyeglasses Approaches for Theater

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Home 3D System Using Frame Sequential Method

Full HD 3D system components:
- Blu-ray 3D device (MPEG-4 MVC-compliant)
- 3D plasma TV (2x speed display)

Blu-ray 3D
2ch x Full-HD Images

MPEG-4 MVC Playback

HDMI (Ver. 1.4)

3D TV
Double Speed (120 frames/s)

MPEG-4 MVC Recording

MPEG-4 MVC

Double Speed Display

Two Full HD Images (Left + Right)

Active Shutter Glasses

1920

1080

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Overview of Home 3D System Using 3D LSIs

3D technologies were implemented into a suite of system LSIs

Blu-ray 3D device
- Main system LSI (UniPhier architecture)
- HDMI Tx LSI (Ver. 1.4)

3D TV
- Main system LSI (UniPhier architecture)
- 3D display LSI

UniPhier system LSI for Blu-ray 3D

- TV recording (MPEG-4 AVCH)
- Processor
- 3D video playback (MPEG-4 MVC)
- HDMI Tx
- Ext. memory

UniPhier system LSI for 3D TV

- Rx 3D TV video processing
- Full HD 3D Display
- Ir Tx
- Processor
- PDP panel
- Ext. memory

HDMI (Ver. 1.4)

Shutter glasses

Sync info
UniPhier is built from a software and a hardware platform
UniPhier system LSIs are based on the same architecture

Structure of UniPhier Platform

UniPhier Processor

CPU
IPP
DPP
Hardware Engine

Hardware Platform (UniPhier System LSI)

Stream I/O
Memory Controller
AV I/O

Application
Middleware
OS
Device Drivers

Microcode

Software Platform
The UniPhier processor is the key module for media processing. The 3D MPEG4-MVC function was achieved by using these mechanisms for parallel processing.
Structure of System LSI for 3D TV

The main LSI is based on the UniPhier architecture.

Feature

- Supports multiple 3D signal formats
  - For broadcasting
  - For storage devices
- 3D graphics / 3D OSD overlay
- 3D high-quality pictures
- High-performance processor @600 MHz
Structure of 3D Blu-ray Recorder/Player

1-chip solution for Blu-ray recorder with 3D support, achieving compact chassis and low power

Blu-ray 3D Recorder

Digital PCB

UniPhier system LSI

Feature

- Double Full HD decoding (MPEG-4 MVC)
- 3D graphics / 3D OSD overlay
- 3D high-quality pictures
- Double H.264 encoding
- SMP CPU @ 500 MHz
Overview of HDMI LSI

HDMI LSI transmits 3D data with copyright protection

UniPhier system LSI for Blu-ray 3D

- Processor
- 3D video playback (MPEG-4 MVC)

3D Structure

Video Data Left/Right

Audio Data

HDMI Transmitter LSI

- MUX
- HDCP Encrypt
- TMDS Driver

Feature

- HDMI 1.4a compliant
  - Support for Blu-ray 3D formats
  - Max transfer rate: 2.25 GHz x 3ch
- Encryption: HDCP Ver1.4
- Multiple 3D formats available
  - Frame sequential, side-by-side, line-by-line, etc.
Overview of MPEG-4 MVC Processing

Expansion of MPEG-4 AVC spec; reduced data size of 3D content. Maintains compatibility with legacy players; 2D playback on left video.

3D Imaging
(Disc production)

3D Encoding
Reduces R data by 50% by referencing L data

Blu-ray 3D disc

3D Decoding
Rebuilds the R image by referencing back and forth between R and L images

3D TV

Playback
Blu-ray 3D Player
Blu-ray 3D disc

Blu-ray Player
Blu-ray 3D Disc

2D Decoding
Plays back only L-side data

2D TV

Full HD 2ch

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MPEG-4 MVC decoding was achieved through a combination of hardware and software processing.

2D Operation Control:
MPEG-4 AVC x 2-ch decode

3D Operation Control:
Correlation of left and right images

1) Decode processing start
2) Control of data input and output

IPP
IPP Core
Accel-erator
Instruction cache & RAM
Data cache & RAM

DPP
Controller
DPP Core
Instruction RAM
Data RAM

Hardware Engine
Controller
Video Decode Engine

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Enhanced UniPhier delivers compact chassis and low power

2006 Year 2D Model
- Modem / Tuner / Digital PCB
- W 430 x D 332 mm
- Power: 56 W
- UniPhier System LSI for MPEG-2
- 4 main LSIs
- 3 PCBs

3D 3D Model
- Digital PCB
- W 430 x D 239 mm
- Power: 33 W
- 1-chip super Integration
- 1 PCB
- 10x long time W recording
- UniPhier System LSI for MPEG-4 MVC
- H 68 mm

Power ▲41% Volume ▲42%
- ▲93 mm
- ▲17 mm
- ▲23 W
System Emulator for Microcode Development

System emulator was used for
1) Microcode development in parallel with the LSI development
2) Verification of system LSI
3) Confirmation of system validity and necessary performance

System emulation before ES by connection to the evaluation board
Conclusion

We continue to evolve the UniPhier for future applications, 4k2k, glasses-less 3D, network and more future 8k4k

Glasses-less 3D Solution

4k2k 3D Solution

8k4k 3D solution

Full-HD 3D Solution

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Thank you for your attention.