Hardware Overview

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1 Overview

This document describes the features of the hardware implemented on PlayStation®Vita. Furthermore, details on the custom SoC, which implements the system core features, are explained by providing a block diagram as well as a specification overview for each feature block. For information on how to access resources from applications and restrictions, refer to the respective Library Overview and other relevant documents.

Organization of This Document

This document is divided into the following parts entitled:

- Development Kit Overview
- Custom SoC
- Development Kit Specific Features
- Testing Kit

Device and Model Types

Hardware for PlayStation®Vita is separated into three device types by use.

- Development Kit
  This device is provided for evaluating application development for PlayStation®Vita and PlayStation®TV. The Development Kit is also referred to as "DevKit" in abbreviation.

- Testing Kit
  Testing Kit is a testing machine for title QA built based on the PlayStation®Vita retail unit. The Testing Kit is also referred to as "TestKit" in abbreviation.

- Retail unit
  The retail unit is a device for end users.

Each device has feature according to the purpose of the device. In addition, performance may differ even if the feature is the same.

In addition, there are multiple models in each device according to the retail release period and applicable region, and feature and performance may vary depending on the model.

Terminology

Term	Meaning
SoC	System on Chip. A "system" composed of CPU, GPU and misc features and so forth is integrated into a single semiconductor "chip".
LPDDR2 DRAM	Low Power Double Data Rate 2 DRAM. A volatile memory enabling low-power, high-speed data transfer.
KiB	Kibibyte. An expression using a binary prefix, equal to 2^{10} bytes.
MiB	Mebibyte. An expression using a binary prefix, equal to 2^{20} bytes.
GiB	Gibibyte. An expression using a binary prefix, equal to 2^{30} bytes.
Binary prefixes	Prefixes such as Ki (kibi), Mi (mebi), and Gi (gibi), used to express power-of-2 numerical values. They were standardized in 1998 by the IEC (International Electrotechnical Commission) to differentiate them from the SI prefixes of the International System of Units (SI), which refer to powers of 10. In relation to computers, binary prefixes are used when expressing the capacity of memory devices with powers of 2 in cases where they are strictly distinguished from powers of 10.

2 Development Kit Overview

SDK Versions and Supported Hardware

The SDK versions and the corresponding supported hardware are indicated below.

SDK1.030 or later

- PDEL-1000 series

> **Note**
>
> If a system update is done using system software version 1.800 or later, restrictions will be introduced following the system update and the DevKit/TestKit will not be updatable to system software version 1.692 or earlier.

Implemented Devices

The main devices implemented on DevKits are indicated below.

Display

A 5-inch organic light emitting diode display is adopted.

The main display resolution is 960 x 544 pixels.

Touch Panels

The capacitive sensing touch panels are implemented at both front and rear of the DevKit.

The maximum number of touch points is 6 for the front touch panel and 4 for the rear touch panel.

Refer to the following document for detailed descriptions of the service which processes the input data from the touch panel:

- Touch Service Overview

To implement touch gestures with the same recognition method and parameters as those used by the system, refer to the following document.

- libsystemgesture Overview

Cameras

The cameras are implemented at both front and rear of the DevKit. Video format (YUV 4:2:2 etc.), resolution and frame rate are set when receiving image data from the cameras.

- Highest Resolution: VGA
- Field Of View: 75°

Refer to the following document for details on the library to input images from cameras:

- libcamera Overview

Controller

The buttons and analog sticks are implemented on DevKit.

> **Note**
> Use the wireless controller when developing an application that supports PlayStation®TV with DevKit. PlayStation®TV supports the SIXAXIS™ wireless controller, DUALSHOCK®3 wireless controller and DUALSHOCK®4 wireless controller.

Refer to the following document for detailed descriptions of the library which processes input data from the controller:

- Controller Service Overview

Motion Sensors

The three-axis accelerometer, the three-axis gyroscope and the magnetometer are implemented on DevKit. Refer to the following document for detailed descriptions about how to process the data you receive from these sensors:

- libmotion Overview

HDMI

The DevKit supports HDMI output mainly in order to aid image previews on a screen as large as possible. Supported features are as follows.

- Video: 480p59.94Hz, 720p59.94Hz
- Audio: Supported
- HDCP: Off

Refer to the following document for details on the HDMI settings:

- Development Kit Neighborhood Settings Guide

Bluetooth®

DevKit supports Bluetooth® feature.

Storage Media

DevKit supports storage media as follows:

PlayStation®Vita Card

DevKits have a PlayStation®Vita card slot.

The capacity of PlayStation®Vita cards is 2 GB or 4 GB.

Memory Card

DevKits have a memory card slot.

A memory card for PlayStation®Vita can be used.

> **Note**
> DevKits are not implemented with a built-in memory card.

For details on how to access storage media from applications, refer to the following document.

- Application Development Process Overview

For details on the access performance of applications to the storage media, refer to the following document.

- Programming Startup Guide

Network

Network features that DevKit supports are explained.

Wired and wireless network connection features operate exclusively. For information on the methods to change the network connection settings, refer to the following document.

- Development Kit Neighborhood Settings Guide

Wired Network Connection

DevKits can perform wired network connection using the USB-Ethernet adapter.

Wireless Network Connection

DevKit can perform wireless network connection.

Activation of DevKit

To use DevKit, activation must be performed. For details, refer to the following document.

- DevKit/TestKit Activation User's Guide

Sound Output Priority

Sound output priority specified for DevKit is as follows. These sound outputs operate exclusively, and the higher listed output has higher priority in the case where a cable is connected to multiple outputs.

- HDMI output
- Bluetooth®
- Headphones
- Main unit speakers

For example, if a cable is connected to both headphones and HDMI, the sound will be output from the HDMI output.

Precautions for Using the DevKit

Keep in mind the following points when using DevKit.

Removal of AC Adapter

Do not remove the AC adapter while the system software or application is starting up. It may cause DevKits to malfunction.

AC adapter can be removed after the standby mode is reached by pressing the power button for two seconds or longer and then selecting **Power Off** from Power Off Confirmation Dialog. When DevKit hangs and accordingly Power Off Confirmation Dialog is not displayed even if the **power** button is pressed, it is possible to forcibly change to the safe mode by pressing the **power** button for 30 seconds or longer.

3 Custom SoC

In PlayStation®Vita, the system core features including CPU, GPU, memory, misc I/O and so forth are implemented on the custom SoC which is specifically designed and developed.

Figure 1   Custom SoC Block Diagram
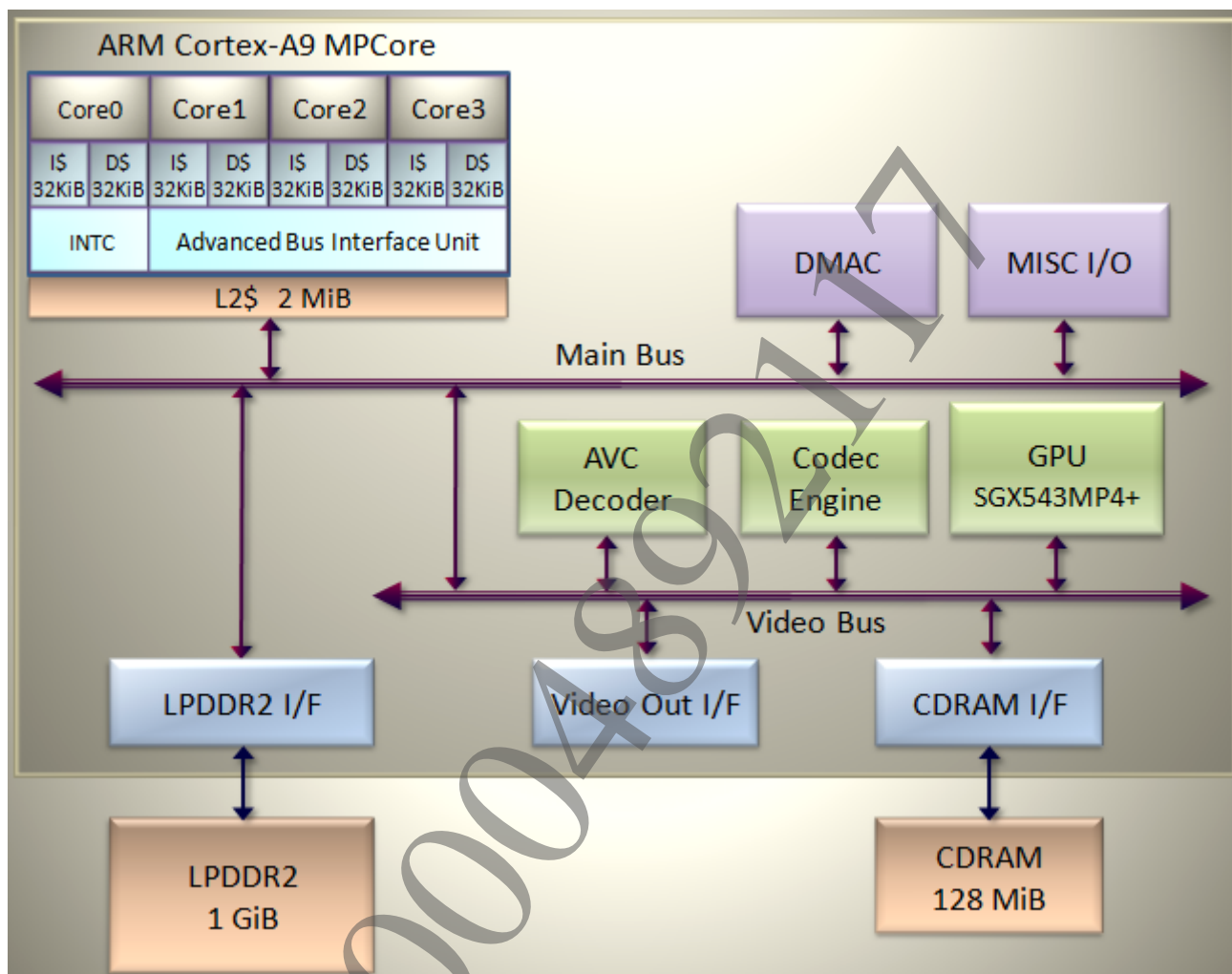
CPU

ARM Cortex-A9 MPCore

The custom SoC includes the ARM Cortex-A9 MPCore as its CPU, mounting four little-endian ARM Cortex-A9 processor cores. Each core includes the following features:

- L1 Instruction Cache of 32 KiB and Data Cache of 32 KiB
- Media Processing Engine (MPE) that can execute Advanced SIMD instructions (NEONv1) and Vector Floating-Point v3 instructions (VFPv3)

In addition, there is a L2 cache of 2 MiB shared by all cores, while precisely speaking, it's external to the ARM processor core.

Refer to the following document for the instruction set, memory model and programmers' model:

- ARM Architecture Reference Manual ARMv7-A and ARMv7-R edition

> **Note**
> Reference: A lot of useful information is available about ARM (Advanced RISC Machines) on the internet including ARM Ltd. official site.

Example:

- Cortex-A9 Technical Reference Manual
  (corresponding to the chip revision supposed to be included in DevKit):
  http://infocenter.arm.com/help/topic/com.arm.doc.ddi0388f/DDI0388F_cortex_a9_r2p2_trm.pdf
- Cortex-A9 NEON Media Processing Engine Technical Reference Manual
  (NEON: Advanced SIMD instructions)
  http://infocenter.arm.com/help/topic/com.arm.doc.ddi0409f/DDI0409F_cortex_a9_neon_mpe_r2p2_trm.pdf
- Cortex-A9 NEON MPE > VFPv3 architecture hardware support
  http://infocenter.arm.com/help/topic/com.arm.doc.ddi0409f/CHDEEJDB.html

(The above reference destination has been confirmed as of June 26, 2014. Note that pages may have been subsequently moved or its contents modified.)

Graphics

SGX543MP4+

The custom SoC is supposed to contain the SGX543MP4+ GPU.

For details on the SGX543MP4+, refer to the following document. This document provides a detailed explanation on basic check points, etc. for the SGX543MP4+ hardware configuration and GPU programming.

- GPU User's Guide

Also, refer to the following documents for more details on graphics in general:

- libgxm Overview
- Display Service Overview
- Shader Compiler User's Guide
- Texture Pipeline User's Guide

Memory

The custom SoC also contains memory interface and integrated DRAM ICs.

> **Note**
> Please note that the physical amount of memory and its configuration of DevKit are significantly different from those of retail unit.

LPDDR2 DRAM

The DevKit carries 1 GiB of LPDDR2 DRAM (usually referred to as the "main memory"). The retail unit and TestKit carry 512 MiB of LPDDR2 DRAM.

For details on the size of main memory that the applications can use, refer to the following document.

- Programming Startup Guide

Trace Memory

The details are described later in Chapter 4 "Development Kit Specific Features".

Custom DRAM

The DevKit carries 128 MiB of custom DRAM (usually referred to as the "video memory"). For details on the size of the video memory that the applications can use, refer to the following document.

- Programming Startup Guide

Codec Engine

Codec Engine is a media processor configured with multiple cores. Only the specific processing of the specific libraries is processed through Codec Engine instead of CPU. For details on the libraries that use Codec Engine as well as on the Codec Engine performance measurement, refer to the following document.

- libcodecengine Overview

Other Key Units and Bus Configuration

As other key units, the custom SoC includes the features below:

- Direct Memory Access Controllers (DMAC)
- AVC Decoder
- A video out interface
- Misc input/outputs interface etc.

4 Development Kit Specific Features

In this chapter, the features unique to DevKit that are not offered on retail units or on TestKits are explained.

CP (Communication Processor)

- This processor handles communications between the development host computer and the DevKit.
- It has its own RAM and flash memory, and runs its dedicated firmware.
- The CP firmware may be updated when the SDK version is updated.
- The CP is only implemented in the DevKit, and will not exist in the retail units.

Performance Monitor Hardware

A dedicated unit performs performance measurement, making it possible to perform performance analysis with minimal impact on applications.

Trace Memory

The DevKit mounts 512 MiB of LPDDR2 DRAM for performance analysis.

This memory is for storing performance measurement data referred by a performance analyzer (Razor for PlayStation®Vita) or runtime libraries.

For more details about performance analysis, refer to the following document:

- libperf Overview
- Razor User's Guide

The DevKit supports GPU performance counter and performance monitor capabilities, enabling detailed high-level GPU performance analysis. Three types of GPU performance analysis (often referred to as the "PA") will be supported:

- Live performance analysis while the game application is running
- Replay performance analysis using GPU capture of Razor for PlayStation®Vita
- highly-detailed performance analysis using high-frequency performance counter capture

Also, the DevKit mounts GPU specific debugging features, allowing advanced shader and frame GPU debugging.

5 Testing Kit

TestKit is a testing machine for title QA built based on the PlayStation®Vita retail unit. In this chapter, the differences between the DevKit and the TestKit are explained.

Differences from DevKit

The main differences between the TestKit and the DevKit are as follows. Other hardware specifications not listed below such as CPU, GPU, and cameras are the same as those of the DevKit.

Use of the AC Adaptor

The AC power code is not required; tests can be performed with just the battery. As with the retail unit, make sure it is charged.

Connection with the Development Host Computer

There is no USB port (Mini-B). Note that the connection, update and some other methods used by the TestKit are different from those used by the DevKit because CP (Communication Processor) does not exist in the TestKit.

Because DECI communication to the development host computer is not possible, Neighborhood for PlayStation®Vita and psp2ctrl cannot be used. In other words, operations that use the above - file serving feature from the development host computer, TTY communication, program boot from the development host computer, APP HOME startup from host0:, and package installing - cannot be carried out.

Connect to the development host computer using the Content Manager Assistant for PlayStation®Vita DevKit (CMA). System software update/activation will be possible via the CMA. The program must use CMA to install the application package file. For details, refer to the "Appendix D: TestKit Setup" chapter of the "DevKit/TestKit Setup Guide" document.

USB Ethernet Adaptor

Wired network communication is possible using the USB-Ethernet adaptor for the TestKit. Wired network communication is exclusive from wireless network communication. The USB-Ethernet adaptor for the TestKit is provided with consideration for enhancing practical use in event venues where Wi-Fi reception may be weak or to preview contents under development. Note that verification in a Wi-Fi environment is required before master submittal.

The following USB Ethernet adaptors are for DevKits only. They cannot be used on TestKits (PTEL-1000 series).

- UETA series

The following USB Ethernet adaptors can be used on both DevKits and TestKits (PTEL-1000 series). Make sure to connect the AC adaptor (PCH-ZAC1) to a USB Ethernet adaptor upon use.

- TEFV-UE0 series
- TEFV-UE1 series

For inquiries regarding the above USB Ethernet adaptors, please contact Sales Support.

TestKits (PTEL-2000 series) are packaged with the following USB Ethernet adaptor.

- TEFV-UE2 series

Display

The TestKit (PTEL-2000 series)/retail unit (PCH-2000 series) is equipped with an LCD display instead of an OLED display.

The types of displays to be equipped on PlayStation®Vita DevKits/TestKits/retail units are as follows.

Device Type	Display
DevKit (PDEL-1000 series) TestKit (PTEL-1000 series) Retail unit (PCH-1000 series)	OLED display
TestKit (PTEL-2000 series) Retail unit (PCH-2000 series)	LCD display

Rear Touch Pad

The size of the rear touch pad differs on TestKit (PTEL-2000 series)/retail unit (PCH-2000 series) compared to DevKit and the TestKit (PTEL-1000 series).

The sizes of the rear touch pad equipped on PlayStation®Vita DevKits/TestKits/retail units are as follows.

Device Type	Size (width x height)
DevKit (PDEL-1000 series) TestKit (PTEL-1000 series) Retail unit (PCH-1000 series)	109.440 x 44.574 mm
TestKit (PTEL-2000 series) Retail unit (PCH-2000 series)	79.243 x 44.574 mm

Memory Size

The size of main memory on a TestKit is 512 MiB. The 512 MiB LPDDR2 DRAM provided on DevKit for analyzing performance is not installed on a TestKit.

Built-in Memory Card

TestKit (PTEL-2000 series)/retail unit (PCH-2000 series)/PlayStation®TV is installed with a built-in memory card of 1 GiB. The existence/lack of the built-in memory card is indicated below per device type.

Device Type	Built-in Memory Card
DevKit (PDEL-1000 series) TestKit (PTEL-1000 series) Retail unit (PCH-1000 series)	Not installed
TestKit (PTEL-2000 series) Retail unit (PCH-2000 series) PlayStation®TV	Installed

Update File

The provided system update file will differ from that of the DevKit. PUP with the model number PTEL-XXXX in the filename can be used.

Release Check Mode

On the TestKit, the only **Release Mode** can be set in **Release Check Mode**. The **Development Mode** is not supported.

Use of Mount Points

Application executed on the TestKit cannot read/write to/from host0: and ux0:.