

GLSDK Datasheet DRA7xx 6.04.00.02

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Read This First

All performance numbers provided in this document are gathered using DRA7xx Evaluation Module with ARM-15 running at 1500MHz and DDR3 configured at 533MHz unless otherwise specified.

About This Manual

This document provides a feature overview and performance data for each of the device drivers which are part of the **GLSDK 6.04.00.02 Release** package. This document should be used in conjunction with the release notes provided with the GLSDK package for information on specific issues present with drivers included in a particular release.

U-Boot Overview

Boot Modes Supported

Green colored box in the table below means that the particular boot mode is supported on the device in the release.

DRA7xx Supported Boot Modes

Boot Mode	DRA7xx Evaluation Module (EVM)
QSPI Flash	Yes
MMC/SD	Yes
eMMC Boot	Yes
UART Boot	Yes(UART3)
NOR Flash	No
EMAC Boot	No
USB Boot	No

Note: These are supported boot modes in GLSDK software, the actual hardware may support many more boot modes than shown here. Please refer to hardware documentation for list of all supported boot modes.

U-Boot Features Supported

U-Boot is the defacto bootloader for Linux kernel on ARM. The following features of U-Boot are supported in this release.

U-Boot supported feature table

Feature	DRA7xx (Evaluation Module)
UART	Yes
Ethernet Download (TFTP)	Yes
MMC/SD	Yes
QSPI Flash	Yes
Secure Boot (for High-Secure samples)	Yes

Memory Section Details

MMC/SD bootmode 1st Stage Memory Section on DRA7xx

Memory Section	Size(in bytes)
.text	39788
.data	1920
.bss	197828

- MMC/SD bootmode u-boot 1st Stage (MLO) size: 55288 bytes

MMC/SD bootmode 2nd Stage Memory Section on DRA7xx

Memory Section	Size(in bytes)
.text	169020
.data	8252
.bss	212488

- MMC/SD bootmode u-boot 2nd Stage (u-boot.img) size: 252168 bytes

Linux Kernel

Kernel Virtual Memory Layout

The default DRA7xx kernel configuration, uses following Virtual Memory layout:

```
[ 0.000000] Memory: 1519MB = 1519MB total
[ 0.000000] Memory: 1304936k/1304936k available, 251544k reserved, 777216K highmem
[ 0.000000] Virtual kernel memory layout:
[ 0.000000] vector : 0xffff0000 - 0xffff1000   (   4 kB)
[ 0.000000] fixmap : 0xffff0000 - 0xffffe000   ( 896 kB)
[ 0.000000] vmalloc : 0xf0000000 - 0xff000000   (240 MB)
[ 0.000000] lowmem  : 0xc0000000 - 0xef800000   (760 MB)
[ 0.000000] pkmap   : 0xbfe00000 - 0xc0000000   (   2 MB)
[ 0.000000] modules : 0xbfe00000 - 0xbfe00000   (   0 MB)
[ 0.000000] .text   : 0xc0008000 - 0xc08d1ef8   (9000 kB)
[ 0.000000] .init   : 0xc08d2000 - 0xc0930500   ( 378 kB)
[ 0.000000] .data   : 0xc0932000 - 0xc0a03210   ( 837 kB)
[ 0.000000] .bss    : 0xc0a03210 - 0xc0f664b0   (5517 kB)
```

Interrupt Latency Measurement

The following table gives interrupt latency measurements taken across 1001 measurement samples.

Interrupt Latency Measurement		
Interrupt Latency (in micro seconds)	Number of samples (under 0% cpu load) (1001 total samples)	Number of samples (under 100% cpu load using hackbench hackbench -P -1 -1 -g 10) (501 total samples)
TBD	TBD	TBD

Boot-time Measurement

Boot-time measurement was done with kernel built using omap2plus_defconfig. U-Boot environment variable bootargs is set to 'elevator=noop console=tty00,115200n8 root=/dev/mmcblk0p2 rw rootwait earlyprintk fixrtc omapdrm.num_crtc=2 consoleblank=0 cma=64M '. In general kernel boot-up time alone is 17 secs. The following table summarizes the boot-up cycle of different stages in QSPI boot mode.

Note: QSPI EDMA functionality is not part of the GLSDK 6.04 release. It is available as u-boot patch in this [link \(http://processors.wiki.ti.com/index.php/File:Glsdk-uboot-qspi-edma-patch.zip\)](http://processors.wiki.ti.com/index.php/File:Glsdk-uboot-qspi-edma-patch.zip). To enable 'EDMA copy', it is required to apply the patch and rebuild the u-boot images.

QSPI Boot Cycle Measurement			
Boot Mode	Stages	Without EDMA Patch (sec)	With EDMA Patch (sec)
Early Boot	SPL	4.5	0.82
	Kernel Boot-up Time	~17	~17
	Total Timing	22.5	17.82
Two Stage Boot	SPL + u-boot	6	4
	Kernel Boot-up Time	~17	~17
	Total Timing	23	21

Early Video Decode Time measurement:

To enable the early video decode example where the boot loader loads the IPU and starts decoding as soon as possible , refer to the [Early Video Decode example \(http://processors.wiki.ti.com/index.php/DRA7xx_GLSDK_Software_Developers_Guide#Using_the_Early_video_decode_example\)](http://processors.wiki.ti.com/index.php/DRA7xx_GLSDK_Software_Developers_Guide#Using_the_Early_video_decode_example). The time measurements for the decode to start and display on the EVM LCD with the configuration enabled for IPU with the images on SD card is as shown below:

Size of the IPU image = 3738552 bytes (~3.8 Mb)

Early Video decode example Measurement		
Boot Mode	Stages	Time (sec)

SD card Boot	Relative Time taken to Load IPU2 image (size = ~3.8 Mb)	0.73
	Time to display decoded frame on LCD from boot-up	3.09

Linux Kernel Drivers

This section provides brief overview of the device drivers supported in the Linux Kernel of the GLSDK release package.

Device Driver List

The following table list the various device drivers supported and the device they are supported on. On detailed information on specific features or limitations of a particular driver, refer to the chapter catering to that driver in this document.

Peripheral Driver Support			
Peripheral	Description	Linux driver type	DMA usage
Audio (McASP)	Audio Record and Playback	ALSA SoC	SDMA
Ethernet	Ethernet Network driver	Netdev	Internal DMA
USB1 DWC3(DRD)-SS/HS/FS/LS	DWC3 Device & xhci host controller driver	USB HCD/DCD	USB Internal DMA
USB2 DWC3(DRD)-HS/FS/LS	DWC3 Device & xhci host controller driver	USB HCD/DCD	USB Internal DMA
QSPI Flash/Controller Driver	Flash storage system	MTD Block	Not Supported
eMMC/SD/MMC	Interface to MultiMedia Secure Digital cards	Block	SDMA
UART	Serial Communication Interface	Character	Not Supported
I2C	Inter-IC Communication	Character	Not Supported
DSS	Display Subsystem driver	Platform driver	Internal DMA
VIP	Video IP driver	V4L2 Capture	VPDMA
VPE	Video Processing Engine driver	V4L2 Mem to Mem	VPDMA
CPU Freq	Supports multiple SoC operating levels (OPPs)	NA	None

ALSA SoC Audio Driver

This section an overview of the ALSA SoC audio driver features along with the throughput and CPU load numbers.

Introduction

DRA7xx Audio driver complies to the Advanced Linux Sound Architecture (ALSA) System on Chip (SoC) framework (ASoC).

The ASoC framework splits an embedded audio system into three components:

- **Codec driver:** The codec driver is generic and hardware independent code that configures the audio codec to provide audio capture and playback. It should contain no code that is specific to the target platform or machine.
- **Platform driver:** The platform driver can be divided into audio DMA and SoC Digital Audio Interface (DAI) configuration and control. The platform driver only targets the SoC CPU and must have no board specific code.
- **Machine driver:** The ASoC machine (or board) driver is the code that glues together the platform and codec drivers. It can contain codec and platform specific code. It registers the audio subsystem with the kernel as a platform device.

Driver Features

The driver supports the following features:

1. Supports AIC3106 audio codec in ALSA SoC framework.
2. Sample rate support - 44.1 KHz and multiples of 44.1KHz for both capture and playback.
3. Supports audio in stereo mode
4. Supports simultaneous playback and record (full-duplex mode).
5. Supports mixer interface for the audio codec

Features Not Supported

1. OSS based applications, which use ALSA-OSS emulation layer, are not supported.
2. Synthesizer and midi interfaces are not supported.

Constraints

Supported System Calls

Refer ALSA project - the C library reference [1] (<http://www.alsa-project.org/alsa-doc/alsa-lib/>) for API calls.

Performance and Benchmarks

1. Access type - RW_INTERLEAVED
2. Channels - 2
3. Format - S16_LE
4. Period size - 64

Audio Capture

Sampling Rate (in Hz)	Throughput(bits/sec)	CPU Load (in %)
8000	352,581.00	0.17
11025	352,581.00	0.16
16000	352,581.00	0.17
22050	705,163.00	0.32
24000	705,163.00	0.34
32000	705,163.00	0.33
44100	1,410,324.00	0.62

Audio Playback

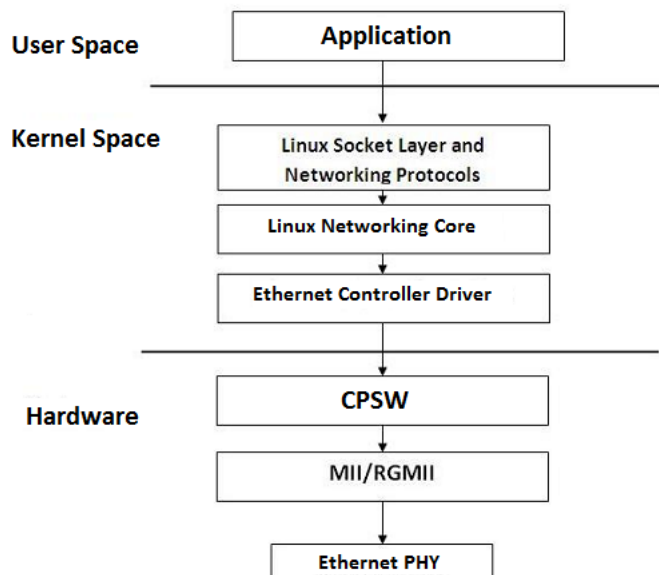
Sampling Rate (in Hz)	Throughput(bits/sec)	CPU Load (in %)
8000	352,599.00	0.16
11025	352,599.00	0.16
16000	352,599.00	0.16
22050	705,197.00	0.32
24000	705,197.00	0.33
32000	705,197.00	0.32
44100	2,643,217.00	0.70
48000	2,643,217.00	1.44
88200	2,820,785.00	1.32
96000	2,820,785.00	1.49

Ethernet Driver

This section provides an overview of the Ethernet driver features along with throughput and CPU load numbers. Ethernet driver follows standard Linux network interface architecture.

Introduction

The Ethernet driver supports the Linux netdev interface.



Driver Features

The driver supports the following features:

1. 10/100/1000 Mbps mode of operation.
2. Auto negotiation.
3. Full duplex and half duplex mode of operation.
4. Linux NAPI support
5. Support for MII and RGMII interfaces to PHY
6. CPSW Interrupt Pacing. This driver uses Timer 5 & 6 for CPSW Interrupt Pacing. Re-using this timer for any other purpose will result in CPSW Interrupt Pacing not working correctly.
7. Operation of both external ports as independent network interfaces
8. VLAN and ALE configuration support
9. Promiscuous mode of operation.
10. IEEE 1588

* Enable CONFIG_ETHERNET through menuconfig (Menu Config->Device Drivers->Network device support & Menu config-> Networking support)

Features Not Supported

N/A

Supported System Calls

Supports the socket() and related system calls in accordance with Linux architecture.

Performance and Benchmarks

TCP Performance

Ethernet Port0 TCP - 1000Mbps Mode Performance

TCP Window Size (in KBytes)	Bandwidth (without interrupt pacing, in Mbits/sec)	CPU Load (without interrupt pacing, in %)	Bandwidth (with interrupt pacing, in Mbits/sec)	CPU Load (with interrupt pacing, in %)
8	326	72	87	10
16	577	91	253	33
32	708	96	697	92
64	725	95	718	90
128	714	91	613	81
256	724	97	636	84

Note: The above data are obtained on DRA7xx EVM running @ 1500MHz.

The performance numbers were captured using the iperf tool. Usage details are mentioned below:

- iperf version 2.0.5
- On PC Host invoke iperf in the server mode.

```
iperf -s
```

- On the DUT iperf is invoked in client mode (bi-directional traffic for 60 seconds).

```
iperf -c <server ip> -w <window size> -m -f M -d -t 60
```

- Interrupt pacing feature enabled with pacing interval set to 250usecs.

```
ethtool -C eth0 rx-usecs 250
```

- DUT is connected to a gigabit network.

UDP Performance

For UDP transmit performance, the iperf server instance is started on the PC and client is started from the DUT. Interrupt pacing for 250usecs interval was enabled

Ethernet Port0 UDP - Transmit Performance (MTU Size packets)			
Bandwidth limit on send(MBits/sec)	Bandwidth measured by server (MBits/sec)	Jitter (milliseconds)	Lost Datagrams (%)
290	290	0.010	0.0015
505	505	0.017	0.0092
627	627	0.018	0.02

For UDP receive performance, the iperf client instance is started on the PC and server is started on the DUT. Interrupt pacing for 250usecs interval was enabled.

Ethernet Port0 UDP - Receive Performance (MTU Size packets)			
Bandwidth limit on send(MBits/sec)	Bandwidth measured by server (MBits/sec)	Jitter (milliseconds)	Lost Datagrams (%)
301	301	0.036	0.14
510	494	0.023	3.1
729	690	0.019	5.4
808	687	0.015	15

- iperf version 2.0.5
- For receive performance, on DUT, invoke iperf in server mode.

```
iperf -s -u
```

- For transmit performance, on DUT, invoke iperf in client mode.

```
iperf -c <server ip> -b <bandwidth limit> -f M -t 60
```

OMAPDRM/OMAPDSS (Display Subsystem Driver)

Introduction

The OMAPDRM internally uses OMAPDSS driver interface for configuration of panel drivers and the encoder interface(DPI/HDMI).

Menuconfig Option

Enable CONFIG_DRM_OMAP through (Menuconfig->Device Drivers->Graphics support)

Enable CONFIG_OMAP2_DSS_DRA7XX_DPI, CONFIG_OMAP5_DSS_HDMI, CONFIG_OMAP5_DSS_HDMI_DDC through (Menuconfig->Device Drivers->Graphics support->OMAP2+ Display Subsystem support)

Enable CONFIG_PANEL_TFCS9700 through (Menuconfig->Device Drivers->Graphics support->OMAP2+ Display Subsystem support->OMAP2/3 Display Device Drivers)

Source Location

drivers/gpu/drm/omapdrm/
drivers/video/omap2/dss/

Driver Features

OMAPDRM Display controller (DISPC)

DRM Plane Features:

- One Graphics (GFX) and Three Video pipelines (VID1, VID2, and VID3)
- Z-order, Alpha blending (Global, pre-multiplied), Scaler and CSC

DRM CRTC Features:

- One TV and three LCD Overlay Managers
- Supports 1080p at 60Hz for all CRTCs

OMAPDRM Interfaces

HDMI Interface

- HDMI protocol engine
- HDMI 1.4 support

RGB Interface

- Supports 24bit LCD Fixed Resolution Panels

Features Not Supported

- Rotation/Tiler 2D
- Default BG color, Transparency and color Keys

Constraints

- Number of CRTCs must be passed either through bootargs or kernel config, which limits number of free DRM planes.

Supported System Calls

All libdrm APIs are supported.

QSPI Driver

Introduction

This chapter describes the QSPI platform driver & flash driver features and performance numbers (throughput and CPU load).

QSPI Platform driver feature

QSPI is a serial driver. Supports 4-Pin single read, 4-Pin single write & 6-Pin quad read. It implements only SPI_CORE mode & no support for memory mapped interface. Clock phase & polarity configured to mode-3 & functional clock programmed at 48MHz. There is no support for DMA data transfer.

The pointer to TI qspi hardware driver is drivers/spi/spi-ti-qspi.c

* Enable CONFIG_SPI_TI_QSPI through menuconfig (Menuconfig->Device Drivers->SPI support->DRA7xxx QSPI controller support)

QSPI Flash driver feature

Spansioin S25FL256S serial flash used on DRA7xx evm. The property of the flash are

- 256 Mbits (32 Mbytes)
- 256 or 512 Byte Page Programming buffer options
- 64KB erase sector size
- Normal, Fast, Dual & Quad

Linux mtd m25p80 used as serial flash device driver for s25FL256S. The driver layer exports API for device info read, sector erase, chip erase, data read & write. It creates the device node for user space access (example, /dev/mtdo)

The pointer to mtd m25p80 flash device driver is drivers/mtd/devices/m25p80.c

* Enable CONFIG_MTD_M25P80 through menuconfig (Menuconfig->Device Drivers->Memory Technology Device(MTD) support ->Self-contained MTD device drivers->Support most SPI Flash chips)

JFFS2 Filesystem Support

QSPI flash driver is mtd based block driver. Support to mount JFFS2 filesystem on /dev/mtdo. Validated to mount JFFS2 filesystem & performed basic file IO operations.

There is an exception on remounting the filesystem. It is known limitation in this release.

Erase the flash to mount JFFS2 filesystem
\$flash_eraseall -j /dev/mtd0

Mount the serial flash
\$mount -t jffs2 /dev/mtdblock01 /mnt/nor

Create a new file
\$echo NewFileCreated > /mnt/nor/testfile.txt

Read the file
\$cat /mnt/nor/testfile.txt

Delete the file
\$rm /mnt/nor/testfile.txt

Performance Benchmark

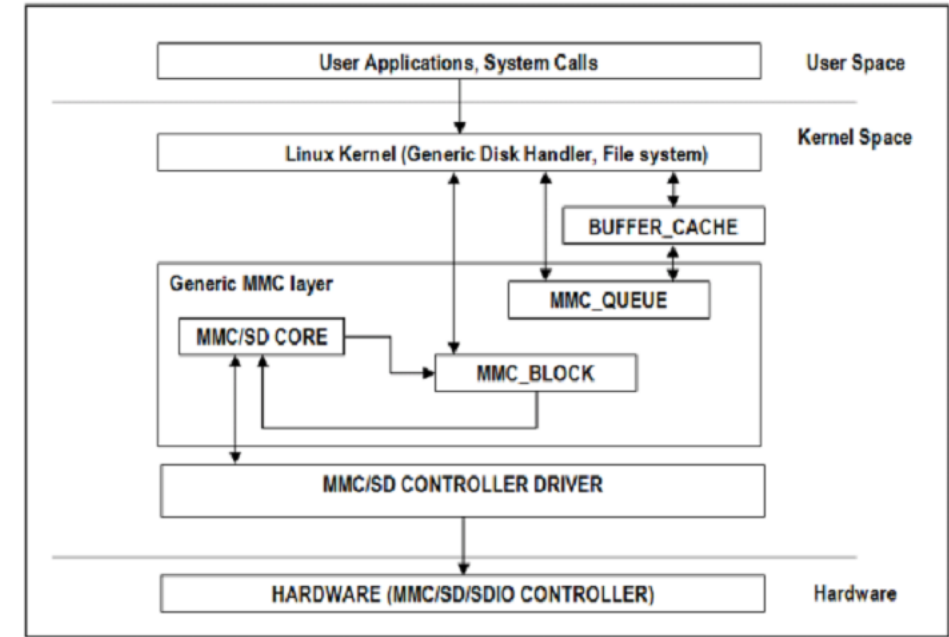
Not available for this release.

MMC/SD Driver

This chapter provides details on MMC/SD driver along with throughput and CPU load numbers.

Introduction

The MMC controller provides an interface to external MMC cards that follow the MMC specification v4.0. The MMC driver is implemented as a block driver. Block device nodes(such as /dev/mmcblkp1, /dev/mmcblkp2) are created for user space access.



Driver Features

The driver supports the following features:

- 1. MMC/SD native protocol command/response set
- 2. Single/multiple block data transfers
- 3. Linux file system and generic MMC layer abstract details of block devices (MMC)
- 4. High-speed (SDv1.1) and High Capacity (SDv2.0) cards
- 5. Support for 4 bit modes
- 6. Support for card detect and Write protect features
- 7. DMA and polled mode for data transfer operations

Features Not Supported

- 1. SPI mode of operation
- 2. PIO mode of operation
- 3. Card detect and Write protection features

Constraints

- 1. MMC/SD cards should not be removed when the mount operation is in progress. If done so, data integrity cannot be guaranteed.

Supported System Calls

```
open(),close(),read(),write()
```

Performance and Benchmarks

IMPORTANT

The performance numbers can be severely affected if the media is mounted in sync mode. Hot plug scripts in the filesystem mount removable media in sync mode to ensure data integrity. For performance sensitive applications, umount the auto-mounted filesystem and re-mount in async mode.

EXT2 file system

SD - Write Performance values

Buffer Size (in Bytes)	Transfer Rate (in MBytes/sec)	CPU Load (in %)
102400	17.88	8.43
262144	17.48	7.70
1048576	16.88	7.44
5242880	18.52	8.47

SD - Read Performance values

Buffer Size (in Bytes)	Transfer Rate (in MBytes/sec)	CPU Load (in %)
102400	20.96	5.45
262144	21.11	5.08
1048576	20.83	2.91
5242880	21.06	3.41

The performance numbers were captured using the following:

- SD Card Sandisk Ultra 8G Class 10 SDHC card
- File System: ext2
- Partition was mounted with async option

VFAT file system

SD - Write Performance values

Buffer Size (in Bytes)	Transfer Rate (in MBytes/sec)	CPU Load (in %)
102400	16.89	11.05
262144	16.48	11.36
1048576	16.46	11.21

5242880	17.23	11.64
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SD - Read Performance values

Buffer Size (in Bytes)	Transfer Rate (in MBytes/sec)	CPU Load (in %)
102400	20.45	4.47
262144	20.47	4.39
1048576	20.39	5.13
5242880	20.41	5.04

EMMC Performance and Benchmarks**IMPORTANT**

The performance numbers can be severely affected if the media is mounted in sync mode. Hot plug scripts in the filesystem mount removable media in sync mode to ensure data integrity. For performance sensitive applications, umount the auto-mounted filesystem and re-mount in async mode.

VFAT file system**EMMC - Write Performance values**

Buffer Size (in Bytes)	Transfer Rate (in MBytes/sec)	CPU Load (in %)
102400	10.26	7.06
262144	10.87	7.04
1048576	10.80	7.04
5242880	10.38	6.68

EMMC - Read Performance values

Buffer Size (in Bytes)	Transfer Rate (in MBytes/sec)	CPU Load (in %)
102400	38.45	8.88
262144	38.49	9.59
1048576	38.45	8.05
5242880	38.49	9.09

The performance numbers were captured using the following:

- File System: ext4
- Partition was mounted with async option

EXT4 file system**EMMC - Write Performance values**

Buffer Size (in Bytes)	Transfer Rate (in MBytes/sec)	CPU Load (in %)
102400	10.82	6.95
262144	11.35	5.95
1048576	10.86	5.79
5242880	11.35	5.99

EMMC - Read Performance values

Buffer Size (in Bytes)	Transfer Rate (in MBytes/sec)	CPU Load (in %)
102400	45.28	8.35
262144	345.28	9.40
1048576	45.57	9.03
5242880	45.28	10.04

The performance numbers were captured using the following:

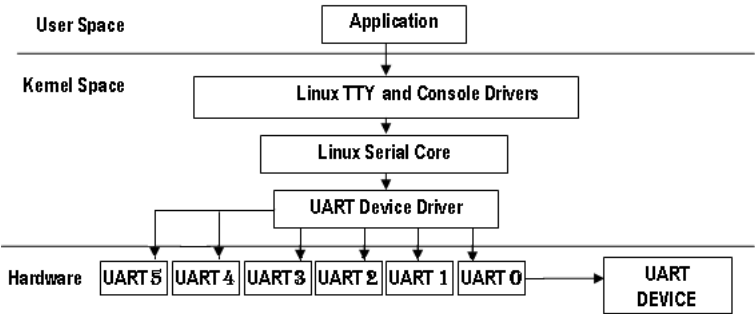
- File System: vfat
- Partition was mounted with async option

UART Driver

This chapter provides details on UART driver.

Introduction

The UART driver is implemented as a serial driver, and can be accessed from user space as /dev/ttyOX(X=0-5)



Features Not Supported

- Hardware Flow Control

Supported System Calls

open(),close(),read(),write(),ioctl()

Supported IOCTLs

Constant	Description
TIOCGSERIAL	Gets device parameters from the UART (example, port type, port num, baud rate, base divisor, and so on.
TIOCSSERIAL	Sets UART device parameters (example, port type, port num, baud rate, base divisor, and so on)

Performance and Benchmarks

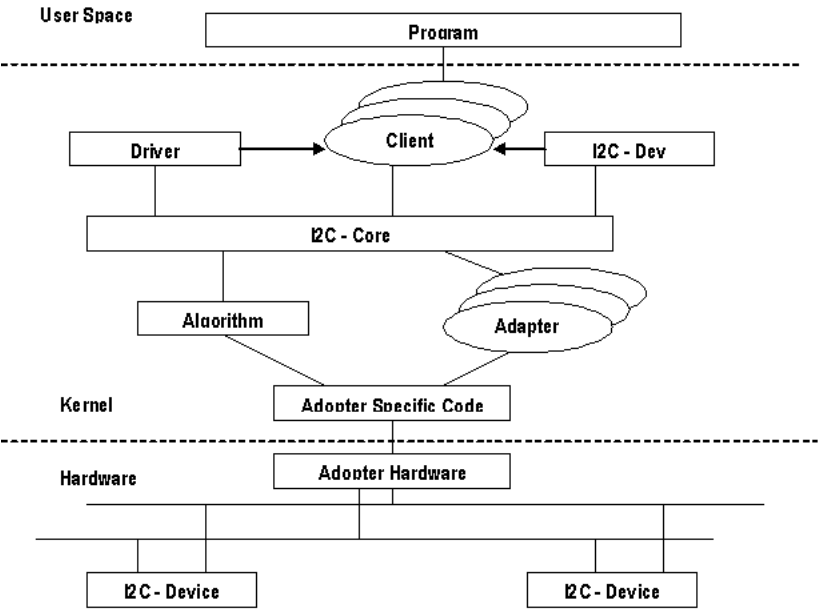
Performance and Benchmarks not available in this release.

I2C Driver

This chapter provides details on I2C driver.

Introduction

The I2C peripheral is compliant with the Philips Semiconductor I2C-bus specification version 2.1. The I2C driver is implemented as a serial driver. The I2C driver can be accessed from the user space as /dev/i2c/0.



Driver Features

The driver supports the following features:

- 1. 7-bit addressing mode
- 2. Fast mode
- 3. Interrupt mode

Features Not Supported

- 1. 7-bit and 10-bit addressing combined format is not supported
- 2. DMA mode is not supported

Supported System Calls

`open(),close(),read(),write(),ioctl()`

Supported IOCTLs

Constant	Description
I2C_SLAVE_FORCE	Changes slave address. Slave address is 7 or 10 bits. This changes the address, even if it is already considered.
I2C_FUNCS	Gets the adapter functionality
I2C_RDWR	Combined R/W transfer (one stop only)

Performance and Benchmarks

Performance and Benchmarks not available in this release.

VIP Driver

Introduction

The Video Input Port (VIP) is a V4L2 based video capture driver.

Driver Features

- Capture via all the Slice0-PortA instances of the VIP1,2 and 3.

- V4L2 Singleplanar ioctl's supported.

Features Not Supported

Following features are not supported at this point of time.

- Color Space Conversion
- Scaling.
- Simultaneous capture via all the VIP ports not supported.
- No other colorspace formats except YUYV are supported.
- Embedded Sync
- Only Slice0 instances of the VIP ports are supported at this point.

Constraints

- Wouldn't work with HDMI driver enabled. Refer release note for more detail.

Supported System Calls

Standard V4L2 Capture ioctl's

VPE Driver

Introduction

Video processing Engine(VPE) is a V4L2 Mem to Mem driver. It supports video operations such as scaling, colour space conversion and deinterlacing.

Menuconfig Option

Enable CONFIG_VIDEO_TI_VPE through (Menuconfig->Device Drivers->Multimedia support->Memory-to-memory multimedia devices)

Source Location

drivers/media/platform/ti-vps/

Driver Features

Video processing Engine(VPE) supports following formats for scaling, csc and deinterlacing:

- Supported Input formats: NV12, YUYV, UYVY
- Supported Output formats: NV12, YUYV, UYVY, RGB24, BGR24, ARGB24, ABGR24
- Scaler supports
- Horizontal up-scaling up to 8x and Downscaling up to 4x using Pre-decimation filter.
- Vertical up-scaling up to 8x and Polyphase down-scaling up to 4x followed by RAV scaling.
- V4L2 Multiplanar ioctl() supported.
- Multiple V4L2 device context supported.

Features Not Supported

- Following formats are not supported : YUV444, YVYU, VYUY, NV16, NV61, NV21, 16bit and Lower RGB formats are not supported.
- Passing of custom scaler and CSC coefficients through user spcace are not supported.
- Only Linear scaling is supported without peaking and trimming.
- Deinterlacer does not support film mode detection.

Constraints

- VPE functional clock is restricted to 152Mhz due to HW constraints.

Supported System Calls

Standard v4l2 ioctl's

SATA Driver

The SATA controller compliance to Serial ATA Standard specification (revision 2.6) and Serial ATA Advanced Host Controller Interface Specification (AHCI) revision 1.1. The AHCI based SATA host controller supports both Gen1/2 speeds, 1.5-Gbps (SATA-1) and 3Gbps (SATA-2)

- Please refer Technical Reference Module for more information.

Registers as a SCSI controller with the Linux SCSI Subsystem. SATA devices get registered as SCSI devices and can be accessed as `"/dev/sd{*}"` devices.

The driver supports the following features:

1. SATA HDD
2. CD/DVD support

* Enable CONFIG_ISO9660_FS through menuconfig (Menuconfig->File Systems->CD-ROM/DVD Filesystem->"ISO 9660 CDROM file system support")
 * Enable CONFIG_BLK_DEV_SR through menuconfig (Menuconfig->Device Drivers->Scsi Device Support->"SCSI CD ROM support")

3. Port Multiplier support

* Enable CONFIG_SATA_PMP through menuconfig (Menuconfig->Device Drivers->Serial ATA and Parallel ATA drivers->SATA Port Multiplier support)

Features Not Supported

- None.

Constraints

Supported System Calls

All Linux ATA/SCSI system calls related to SATA

Supported IOCTLs

Supports IOCTLs available in Linux SCSI and ATA frameworks and which are applicable for SATA. Refer kernel source or documentation for details.

Performance and Benchmarks

- Seagate Barracuda 250GB (3Gbps)SATA HDD is used to measure the performance data

SATA - ext2 File System Performance

SATA Write Performance values

Buffer Size (in KBytes)	Total Bytes Transferred (in MBytes)	DRA7xx	
		MB/sec	cpu load (%)
100	100	85.79	30.67
256	100	88.54	32.22
512	100	88.38	32.01
1024	100	85.71	30.45
5120	100	86.74	30.35

SATA Read Performance values

Buffer Size (in KBytes)	Total Bytes Transferred (in MBytes)	DRA7xx	
		MB/sec	cpu load (%)
100	100	124.69	20.54
256	100	124.83	20.94
512	100	125.46	20.22
1024	100	125.62	19.85
5120	100	125.23	20.85

SATA - VFAT File System Performance

SATA Write Performance values

Buffer Size (in KBytes)	Total Bytes Transferred (in MBytes)	DRA7xx	
		MB/sec	cpu load (%)

100	100	44.47	33.70
256	100	43.90	33.73
512	100	45.34	33.65
1024	100	44.36	33.62
5120	100	44.38	33.95

SATA Read Performance values

Buffer Size (in KBytes)	Total Bytes Transferred (in MBytes)	DRA7xx	
		MB/sec	cpu load (%)
100	100	125.52	23.54
256	100	125.28	23.89
512	100	125.52	24.17
1024	100	125.39	24.44
5120	100	125.35	25.78

USB Driver

This section gives an overview of the USB DWC3(XHCI) controller driver features supported/not supported, constraints and performance numbers.

DWC3(XHCI) USB controller

The DWC3 (XHCI) based controller supports following features

- USB1: SuperSpeed (SS) USB 3.0 Dual-Role-Device (DRD) subsystem with integrated SS (USB3.0) PHY and HS/FS (USB2.0) PHY
- USB2: High-Speed (HS) USB 2.0 Dual-Role-Device (DRD) subsystem with integrated HS/FS PHY

Features Not Supported

- OTG support (HNP/SRP)
- DRD (Dual Role Device) support

USB Configuration

For USB configuration selection please refer to [USB General Guide Linux \(http://processors.wiki.ti.com/index.php/USB_General_Guide_Linux_v3.8#Linux_USB_Stack_Architecture\)](http://processors.wiki.ti.com/index.php/USB_General_Guide_Linux_v3.8#Linux_USB_Stack_Architecture)

Driver Features

The driver supports the following features

Host Mode	
Host Mode Feature	Supported
HUB class support	Yes
Human Interface Class (HID)	Yes
Mass Storage Class (MSC)	Yes
USB Video Class (UVC)	Yes
USB Audio Class (UAC)	Yes

USB Mass Storage Class Host Driver

Constraint

None

Supported System Calls

open(), close(), read(), write(), ioctl()

Supported IOCTLS

None

Performance Benchmarks

Setup : Western Digital HDD (500GB) connected to usb1 or usb2 port.

USB - ext2 File System Performance

USB Host File write (Ext2) Performance values					
Buffer Size (in KBytes)	Total Bytes Transferred (in MBytes)	USB1(HS)		USB2(HS)	
		MB/sec	cpu load (%)	MB/sec	cpu load (%)
100	100	29.56	15.06	29.54	13.48
256	100	30.40	12.69	29.47	13.44
512	100	30.46	14.29	29.38	11.94
1024	100	30.35	14.24	30.53	13.08
5120	100	30.45	13.03	28.97	14.61

USB Host Read (Ext2) Performance values					
Buffer Size (in KBytes)	Total Bytes Transferred (in MBytes)	USB1(HS)		USB2(HS)	
		MB/sec	cpu load (%)	MB/sec	cpu load (%)
100	100	32.81	7.28	32.68	8.46
256	100	32.70	7.73	33.13	6.43
512	100	32.96	8.40	32.83	7.73
1024	100	32.67	6.66	32.98	8.58
5120	100	32.82	7.78	33.14	6.46

Power Management

Introduction

DRA7xx provides a rich set of power management features. The features include Clock control at module level, multiple power and voltage domains etc. It also provides the typical power consumption observed for different scenarios.

cpufreq

CPU is not loaded evenly during execution. This provides an opportunity to save power by adjusting/scaling voltage and frequency based on the current cpu load.

Modules with active clocks	
Name	Instances
ADC_TSC	NA
CPSW	1
ELM	NA
EMIF	1,2
GPIO	1-8
GPMC	1
LCD	1
MCASP	2,3,6&7
MAILBOX	1-16
OCMC	1,2&3
RTC	1

TIMER	1,2,5,6
TPCC	1
TPTC	NA
UART	0-5
USB	1,2,3&4

Lock Frequency of various PLLs

IP	Frequency (MHz)
MPU	As per OPP (1000/1176/1500)
IPU	212.8
DSP	600
IVA	388
SGX	425
L3	266
DDR	532

At each OPP

This section indicates the power measured for all power rails at various OPPs (selected via cpufreq). Measured the power for DRA7xx platform using FTDI adaptor. The power is measured at three different CPU frequencies (OPP_NOM, OPP_OD & OPP_HIGH). Samples are taken at three different scenerios. The measurements were done using EVM revision E1.

1) At kernel Prompt

Active Power Consumption at various OPPs (CPUFreq P states)

Power Rail	OPP_NOM 1000 MHz (milliwatts)	OPP_OD 1176 MHz (milliwatts)	OPP_HIGH 1500 MHz (milliwatts)
Total Power (mW)(Sum of all Rails)	2203	2307	2476

2) Dual AV decode and dual display @ 1080p@30fps, at OPP_NOM with Ondemand governor

Active Power Consumption at various OPPs (CPUFreq P states)

Power Rail	OPP_NOM 1000 MHz (milliwatts)
Total Power (Sum of all Rails)	3471

3) V4L2Capture with loopback display on HDMI 1080p video @60fps, at OPP_NOM with Ondemand governor

Active Power Consumption at various OPPs (CPUFreq P states)

Power Rail	OPP_NOM 1000 MHz (milliwatts)
Total Power (Sum of all Rails)	3088

NOTE: For detailed power measurements split by power rails go through [the attached spreadsheet \(http://processors.wiki.ti.com/index.php/File:Detailed_power_measurements.zip\)](http://processors.wiki.ti.com/index.php/File:Detailed_power_measurements.zip)

Filesystem

The filesystem is built using the Arago Project build system. More information on the project can be found here [2] (http://aragoproject.org/wiki/index.php/Main_Page)

Filesystem information

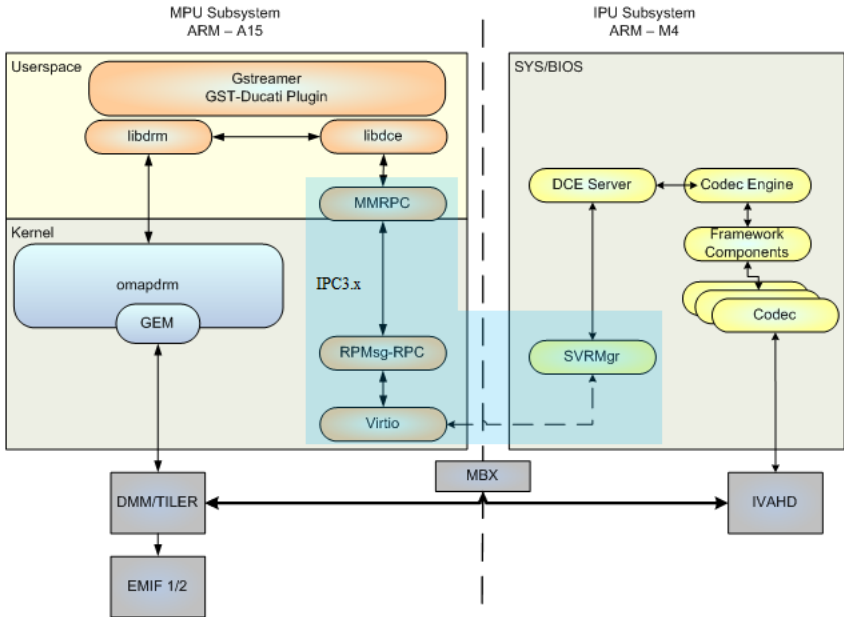
System initialization	System V
------------------------------	-----------------

Compressed filesystem size	63MB
Uncompressed filesystem size	173MB

Multimedia

Introduction

Multimedia consist of hardware accelerated video decoder(IVAHD). IVAHD subsystem is used for video decoding/encoding through libdce interface.



Supported Decoders

- MJPEG decoder - version 01.00.12.01
- H264 decoder - version 02.00.15.01
- MPEG4 decoder - version 01.00.14.01
- VC1 decoder - version 01.00.00.11
- MPEG2 decoder - version 01.00.13.01

Supported Playback Application

GStreamer version 0.10 with following display sinks:

- dri2videosink
- waylandsink
- kmssink

Viddec3test: application that demonstrates viddec3 API usage for video decode and display (using KMS).

Features Not Supported

TBD

Constraints

TBD

Performance Benchmarks

IVAHD performance on DRA7xx

Stream Resolution	IVAHD load	FPS	Opp Frequency
CIF	52%	293	IVAHD at 388MHz MPU at 1500MHz IPU at 212MHz
720p	79%	121	
1080p	86%	58	

- Performance is calculated using the proprietary video decoder application (viddec3test)

Memory Section

- 168MB of memory from 0x95800000 is reserved for slave cores

IPUMM Memory Section on DRA7xx

Memory Section	Size(in bytes)
.text	311534
.data	25698
.bss	326276
.stack	4096

- IPUMM firmware(dra7-ipu2-fw.xem4) size 4013361 bytes

Graphics

SGX544-MP2

Introduction

The SGX544-MP2 is a multicore (dual-core) evolution of the PowerVR® SGX544 GPU from Imagination Technologies. The 3D graphics processing unit (GPU) accelerates 3-dimensional (3D) graphics applications and 2-dimensional (2D) composition operations.

Driver Features

The following specifications are supported on the platform:

- OpenGL ES 1.0
- OpenGL ES 1.1
- OpenGL ES 2.0
- EGL 1.4

Features Not Supported

The following specifications are not supported on the platform:

- OpenVG
- OpenGL ES 3.0

Performance Benchmarks

The following performance benchmarks were measured on DRA7xx with LCD as the only connected display and X11 as the window system.

GLBenchmark 2.5 performance on DRA7xx

Benchmark	Test Number	FPS
GLBenchmark 2.1 Egypt Classic ETC1 - C16Z16	2000000	147
GLBenchmark 2.1 Egypt Classic ETC1 - C16Z16 Offscreen	2000010	85
GLBenchmark 2.5 Egypt HD ETC1 - C24Z24MS4	2500003	34
GLBenchmark 2.5 Egypt HD ETC1 - C24Z16 Fixed timestep	2500005	30
GLBenchmark 2.5 Egypt HD ETC1 - C24Z16 Fixed timestep Offscreen	2500015	20
GLBenchmark 2.5 Egypt HD ETC1 - C24Z16	2501001	37
GLBenchmark 2.5 Egypt HD ETC1 - C24Z16 Offscreen	2501011	24
GLBenchmark 2.5 Egypt HD PVRTC4 - C24Z16	2501101	37
GLBenchmark 2.5 Egypt HD PVRTC4 - C24Z16 Offscreen	2501111	24
GLBenchmark 2.5 Egypt HD ETC1->565 - C24Z16	2501401	37
GLBenchmark 2.5 Egypt HD ETC1->565 - C24Z16 Offscreen	2501411	24

X11

Introduction

X11 is a windowing system for bitmap displays that provides the basic framework for a GUI environment: drawing and moving windows on the display device and interacting with a mouse and keyboard. The X server accepts requests from client applications to create windows, which are (normally rectangular) "virtual screens" that the client program can draw into. The X.org Xserver in GLSDK is based on the 1.11.3 version from freedesktop.

Driver Features

GLSDK includes the xf86-video-omap driver which is the X.org graphics driver for TI OMAP graphics. This driver communicates with the omapdrm kernel driver with GEM (Graphics Execution Management) support for buffer management. Additionally, it includes the PVR EXA driver.

Supported Clients

The supported X applications and commands to run them can be referenced from [DRA7xx_GLSDK_Software_Developers_Guide#X Server](#)

Performance Benchmarks

Performance benchmarks have not been run for this release.

Wayland

Introduction

Wayland is a protocol that specifies the communication between the display server (called Wayland compositor) and its clients. The Wayland protocol is essentially only about input handling and buffer management. The handling of the input hardware relies on evdev in Linux, and similar components in other operating systems. The initial implementation, chiefly libwayland-server, libwayland-client, libwayland-EGL and the reference implementation Weston are published under the MIT License.

It is widely regarded as a replacement for the X Window System.

The GLSDK 6.04.00.02 release supports **Wayland/Weston version 1.3**.

Wayland API documentation

The documentation from the Wayland project can be accessed here [\[\[3\] \(http://wayland.freedesktop.org/docs/html/\)\]](http://wayland.freedesktop.org/docs/html/) X server does not support dual display with LCD and HDMI on DRA7xx.

Default supported clients

The list of clients and instructions on running them can be referenced from [DRA7xx_GLSDK_Software_Developers_Guide#Running_weston_clients](#)

Performance Benchmarks

Performance benchmarks have not been run for this release.

Features Not Supported

- The current version of Wayland does not support Desktop extensions.
- Rendering to more than one display is not possible.

GC320

Introduction

GC320 graphics processing unit (GPU) IP defines a high-performance 2D raster graphics core that accelerates the 2D graphics display on a variety of consumer devices. Addressable screen sizes range from the smallest cell phones to HD 1080p displays. GC320 has two 64 bit AXI bus interfaces to interact to the HOST processor or the MPU. GC320 Hardware is enabled using Native Linux driver. The userspace comprises of bltville interface as defined [here \(http://graphics.github.io/bltville/\)](http://graphics.github.io/bltville/).

Driver Features

- Blit – Composition of multiple sources to a destination image namely, alpha Blend, overlay, overlap, clip
- Filter – High quality scaling (up/down) 3, 5, 7, 9 tap filters
- Multi-image format support and color conversion (YUV and RGB space)
- Multi source blending: Supports up to 8-source blending

Features Not Supported

- 8-bit color index (palette)

Constraints

- Supports only single planar buffer (all the components of the color should be in a single buffer Eg. RGB, YUV)

- Does not support dma_buf yet

Supported Interfaces

- Kernel Driver:
 - open() - Opens the device
 - close() - Closes the device
 - ioctl() - Accepts commands from userspace
- Bitstream Userspace:
 - bv_map() : Supplies a buffer to compositor
 - bv_blt() : Performs the operation
 - bv_unmap() : Relinquishes the buffer
 - bv_cache() : Performs the cache operation if required

Performance Benchmarks

Performance numbers DRA7xx

Test Case	DRA7xx (MPix/s)
RGBA24 to RGBA24	625.62
RGBx24 to RGB16	845.20
RGBx24 to RGB16 with dithering	846.22
RGBA24 to RGBA24 with non-interpolated scale up	171.83
RGBA24 to RGBA24 with non-interpolated 3/4 scale	108.83
RGBA24 to RGBA24 with non-interpolated half scale	93.58
RGBA24 src1over RGBx24 to RGBx24 with global alpha	417.79
RGBA24 src1over RGBx24 to RGBx24 with local alpha	416.15
RGBA24 src1over RGBA24 to RGBA24 with global alpha	415.68
RGBA24 src1over RGBA24 to RGBA24 with local alpha	418.02
RGBA24 src1over RGBA24 to RGBA24 with non-interpolated scaling	173.76
RGBA24 src1over RGB16 to RGB16 with global alpha	642.70
RGBA24 src1over RGB16 to RGB16 with local alpha	639.05
RGBA24 src1over RGB16 to RGB16 with dither with global alpha	640.51
RGBA24 src1over RGB16 to RGB16 with dither with local alpha	638.84
RGBA24 src1over RGB16 to RGB16 with non-interpolated scale up	182.73
RGBA24 src1over RGB16 to RGB16 with non-interpolated scale down half	116.76
RGBA24 src1over RGB16 to RGB16 with non-interpolated scale down third	95.83
RGBA24 src1over RGB16 to RGB16 with non-interpolated scale up and dither	182.58
RGBA24 src1over RGB16 to RGB16 with non-interpolated scale down 3/4 and dither	116.32
RGBA24 src1over RGB16 to RGB16 with non-interpolated scale down half and dither	95.85
RGB16 to RGB124	790.71
NV12 to RGBA24	523.88
YUYV to RGBA24	404
NV12 src1over RGBA24 to RGBA24 with global	71.00

alpha

1. switchcategory:MultiCore=

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