Application Report

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Using DSS Write-Back Pipeline for RGB-to-YUV Conversion on DRA7xx Devices

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ABSTRACT

This application report provides information on how to use the DSS Write-back pipeline for RGB-to-YUV colorspace conversion on DRA7xx platform running Processor SDK Linux Automotive.

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1 Introduction

DRA7xx System-on-Chip (SoC) contains a video processing engine (VPE) which is a specialized integrated peripheral (IP) for color space conversion of video frames in memory. This IP can be used for color space conversion and scaling of video frames. VPE supports input frames in YUV color spaces and can output frames in both RGB and YUV color spaces. However, VPE does not support RGB frames as input.

The output of most graphics based applications is in RGB color space. Automotive customers interested in car black-box use cases need to encode the output of graphics applications. For achieving this, the output frames from graphics application need to be converted to YUV color space. This can be done by utilizing the write-back pipeline present in the Display Sub-system (DSS) which is exposed to the ProcessorSDK linux automotive users as a V4L2 (video4linux2) interface. The following application note will focus on how to use the V4L2 interface to utilize the DSS write-back pipeline for RGB-to-YUV color space conversation in addition to scaling.

2 Prerequisites

2.1 Software Requirements

This document is based on Processor SDK Linux Automotive 3.02. Please ensure that you:

- Have a working Processor SDK Linux Automotive 3.02 installation
- Are able to clone and build example applications based on Processor SDK Linux Automotive available at:

```
git://git.ti.com/glsdk/example-applications.git
```

- Are able to bring up the EVM with the U-Boot and Kernel images from the installation
- Can see the V4L2 device node corresponding to the DSS write-back pipeline represented as /dev/video10.

The release downloads links and software developers guide can be found at the following link: http://processors.wiki.ti.com/index.php/Category:Processor_SDK_Linux_Automotive.

2.2 Hardware Requirements

The application described here was tested on a:

- Rev H J6 EVM

The application should work on J6 Eco and J6 Entry as well. However they have not been benchmarked on J6 Eco and J6 Entry at this point.

3 DSS Write-Back Pipeline

3.1 DSS Integration

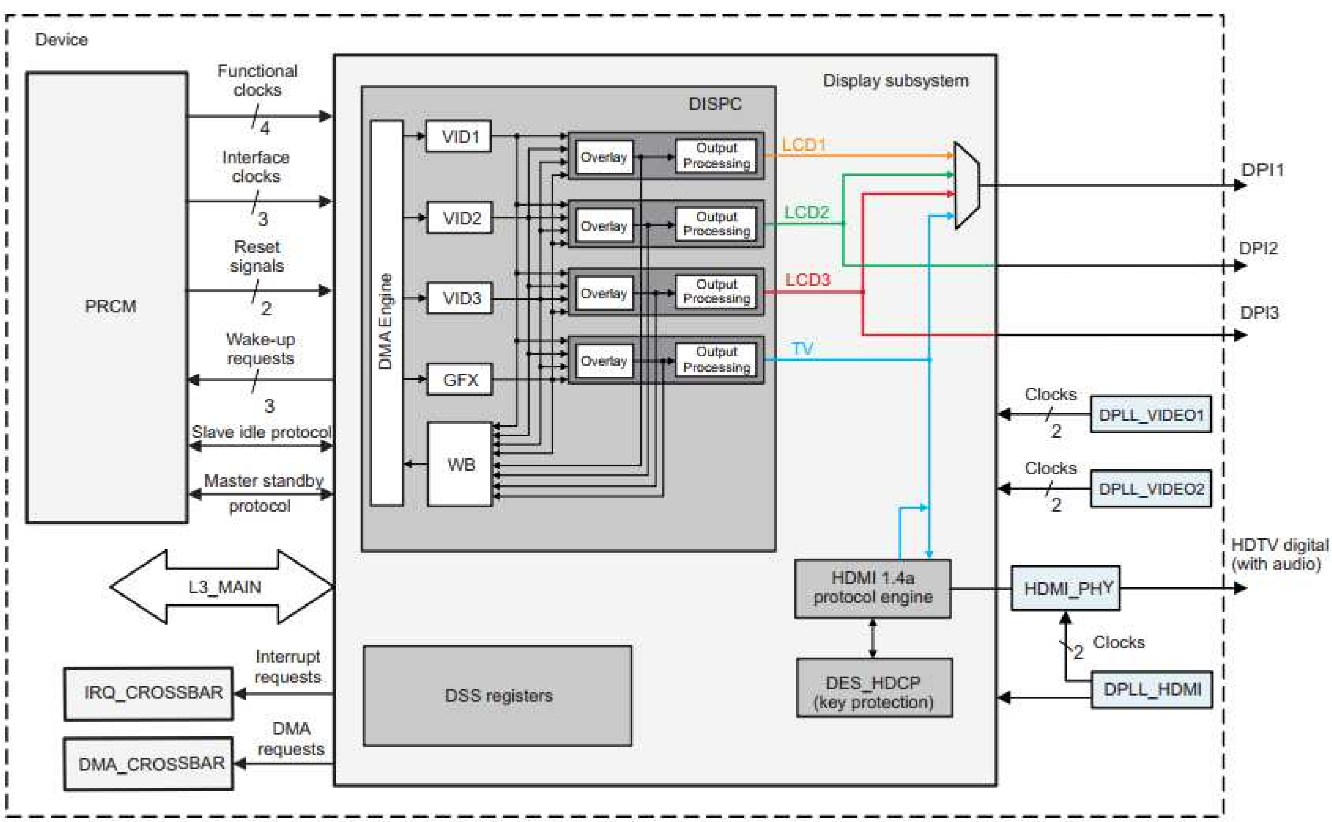

Figure 1. DSS integration in the DRA7xx SoC

Figure 1 is a diagram representing the integration of DSS in the DRA7xx SoC. The write-back pipeline is capable of working in two modes, namely capture mode and mem-to-mem mode. The following section describes the two modes in detail.

3.2 Capture Mode

In capture mode, the output of an overlay-processing unit is input to the write-back pipeline. In this mode, the write-back pipeline records the output that can also drive an external display device. This mode can be used for screen capture capabilities. A V4L2 capture device interface is implemented in the ProcessorSDK Linux Automotive to utilize this feature of the write-back pipeline.

3.3 Mem-to-Mem Mode

In mem-to-mem mode, output of a DSS pipeline is input to the write-back pipeline. In this mode, the write-back pipeline can be used for mem-to-mem color space conversion and scaling of input frames. A V4L2 mem-to-mem device interface is implemented in the Processor SDK Linux Automotive to utilize this feature of the write-back pipeline. The following sections describe how to develop a linux application that leverages this feature.

4 Using DSS Write-Back Pipeline for RGB-to-YUV Conversion

To use DSS write-back pipeline for color space conversion and scaling, you can use the test-v4l2-m2m application, which is part of example-applications delivered as a part of ProcessorSDK Linux Automotive.

To use the `test-v4l2-m2m` application, run the following command on the target. The following usage assumes that you have a file named `srcfile-xbgr32`.raw in your target file system which contains 1920x1080 RGB data.

```
target# test-v4l2-m2m /dev/video10 srcfile-xbgr32.raw 1920 1080 xbgr32 dstfile-
nv12.raw 1280 720 nv12 0 0
```

The application finishes converting all the frames in the file and the 1280x720 NV12 frames are stored in the file named `dstfile-nv12.raw`.

5 Conclusion

In this document, a method to convert RGB frames to YUV format using the DSS write back pipeline is described.

Table 1. Results

	Time (ms)
Input 1920x1080 RGB Output 1920x1080 NV12 (CSC)	11.021
Input 1920x1080 RGB Output 1280x720 NV12 (CSC + Downscale)	11.002
Input 1280x720 RGB Output 1280x720 NV12 (CSC)	4.996
Input 1280x720 RGB Output 1920x1080 NV12 (CSC + Upscale)	12.761

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