Use Case Guide

Mar 2012

DM814x 4D1, 8CIF, 16CIF DVR - Use Case Guide

ABSTRACT

This document explains the capabilities and limitations of the below use-cases of DVR-RDK

- 4D1 DVR Use-case
- 8CIF DVR Use-case
- 16CIF DVR Use-case

These use-cases are targeted for DM814x SoC from TI (would be ported to DM8107 in future)

ABSTRACT 1
1 Overview 3
Use-case summary 3
Target Applications 4
Resolutions 4
2 Features 5
System 5
Capture 5
Encode 5
Use-Case switching 6
Decode 6
De-interlacing 6
Encode Parameters 7
OSD 8
Tamper Detect 9
Display 9
Audio 10
Other requirements 11
3 Limitations 12
4 DM8148 4D1 DVR – Additional Details 13
Data Flow 13
Measured Performance 14
Frame-rate 14
CPU Load (Measured) 14
5 DM8148 8CIF DVR – Additional Details 15
Data Flow 15
Notes 15
Performance Measured 16
Frame-rate 16
CPU Load 16
6 DM8148 16CIF DVR – Additional Details 17
Data Flow 1 – 1D1 + 15CIF 17
Notes 18
Performance Measured – 1D1 + 15CIF 18
Frame-rate 18
CPU Load 18

Data Flow 2 – 16D1 non real-time 19
Performance Measured – 16D1 non real-time 19
Frame-rate 19
CPU Load 20

1 Overview

Use-case summary

A summary of the use-cases is given below

Product	Description
4D1 DVR (DM8148)	Enc: 4Ch D1 30fps + 4Ch CIF 30fps + 4CH JPEG 1fps Dec: 4Ch D1 30fps
8CIF DVR (DM8148)	**Use Case 1:** Enc: 2CH D1 30fps + 6Ch CIF 30fps + 8Ch QCIF 30fps + 8CH JPEG 1fps Dec: 2CH D1 30fps + 6Ch CIF 30fps
	Use Case 2: Enc: 8Ch 2CIF 30fps Enc + 8Ch CIF or QCIF 30fps Enc + 8CH JPEG 1fps Dec: 8Ch 2CIF 30fps
	Use Case 3: Enc: 8Ch D1 15fps + 8Ch CIF or QCIF 30fps Enc + 8CH JPEG 1fps Dec: 8Ch D1 15fps
16CIF DVR (DM8148)	**Use Case 1:** Enc: 16Ch CIF 30fps + 16Ch QCIF 8fps (~ 4QCIF 30fps) + 16CH JPEG 1fps Dec: 16Ch CIF 30fps **Use Case 2:** Enc: 1D1 30fps + 15Ch CIF 30fps + 16Ch QCIF 4fps (~ 2QCIF 30fps) + 16CH JPEG 1fps Dec: 16Ch CIF 30fps **Use Case 3:** Enc: 16Ch D1 7fps + 16Ch QCIF 30fps + 16CH JPEG 1fps Dec: 16Ch D1 7fps

* All FPS numbers are mentioned assuming NTSC input, FPS should be scaled accordingly for PAL input.

Target Applications

This use-case is targeted for the below applications

- Multi-channel Digital video recorder (DVR) on DM814x (would be ported to DM8107 in future)

This use-case is NOT targeted for

- Hybrid DVR
- NVR

Resolutions

NTSC / PAL Resolutions	NTSC – 30fps	PAL – 25fps
D1	704x480	704x576
VGA	640x480	640x480
2CIF	704x240	704x288
CIF	352x240	352x288
QVGA	320x240	320x240
QCIF	176x120	176x144

-

HD / VESA Resolutions	
1080p	1920x1080 30/60Hz
720p	1280x720 60Hz
SXGA	1280x1024 60Hz
XGA	1024x768 60Hz

2 Features

		4D1 DVR	8CIF DVR	16CIF DVR
System				
DM8148 Part Number		CE1 (DM8148-Mid) Si Rev 2.1	CE1 (DM8148-Mid) Si Rev 2.1	CE2 (DM8148-High) Si Rev 2.1
System Clocks	ARM	720Mhz	720Mhz	720Mhz
	M3	240Mhz	240Mhz	240Mhz
	DSP	750Mhz	750Mhz	750Mhz
	DDR	440Mhz	480Mhz	533Mhz
	IVA-HD	410Mhz	410Mhz	480Mhz * * NOT FINAL
	HDVPSS	200Mhz	200Mhz	240Mhz * * NOT FINAL
Default U Boot config		NO	YES	NO
DDR		512MB	512MB	512MB
Linux Memory		128MB	128MB	128MB
Capture				
Number of Video decoders		1x TVP5158	2x TVP5158	4x TVP5158
Video decoder Mode		8-bit 4Ch D1 pixel mux mode		
Input resolutions		• Input can be NTSC or PAL • No mixed NTSC/PAL • No dynamic switching between NTSC and PAL		
Other notes		• Capture is in D1 mode since. Input to Live Preview uses D1. • Customer can change from TVP5158 to their own video decoder.		
Encode				
Primary stream (max resolution)		4CH D1 H264 30fps	**Use Case 1:** 2CH D1 H264 30fps 6CH CIF H264 30fps **Use Case 2:** 8CH 2CIF H264 30fps **Use Case 3:** 8CH D1 H264 15fps	**Use Case 1:** 16CH CIF H264 30fps **Use Case 2:** 1CH D1 H264 30fps 15CH CIF H264 30fps **Use Case 3:** 16CH D1 H264 7fps (NTSC)

	4D1 DVR	8CIF DVR	16CIF DVR
D1 channels when mixed with CIF channel for primary stream	NOT APPLICABLE	**Use Case 1:** CH0 and CH4 will be D1, others will be CIF. No dynamic switching between D1 and CIF channels **Use Case 2, 3:** NOT APPLIABLE	**Use Case 1:** NOT APPLICABLE **Use Case 2:** CH0 will be D1, others will be CIF. No dynamic switching between D1 and CIF channels **Use Case 3:** NOT APPLICABLE
Sub-stream (max resolution)	4CH CIF H264 30fps	**Use Case 1:** 8CH QCIF H264 30fps **Use Case 2, 3:** 8CH CIF H264 30fps	**Use Case 1:** 16CH QCIF H264 8 fps **Use Case 2:** 16CH QCIF H264 4 fps **Use Case 3:** 16CH QCIF H264 30 fps
JPEG Sub-stream (max resolution)	4CH D1 JPEG 1fps	**Use Case 1, 2 , 3:** 8CH D1 JPEG 1fps	**Use Case 1, 2, 3:** 16CH D1 JPEG 1fps
Use-Case switching			
Time to switch from CIF/2CIF use-case to non-real time D1	NOT APPLICABLE	Seam-less	4-6secs Video Display will be turned off during this time GRPX Display (GUI) can be ON during this time.
Decode			
Decode	4CH D1 H264 30fps	**Use Case 1:** 2CH D1 H264 30fps 6CH CIF H264 30fps **Use Case 2:** 8CH 2CIF H264 30fps **Use Case 3:** 8CH D1 H264 15fps	**Use Case 1:** 16CH CIF H264 30fps **Use Case 1:** 1CH D1 H264 30fps 15CH CIF H264 30fps **Use Case 1:** 16CH D1 H264 7fps (NTSC)
Trick Play	I-frame based fast-forward, fast-rewind		
De-interlacing			
Primary stream	DEI enabled	**Use Case 1, 2, 3:**	**Use Case 1:**

	4D1 DVR	8CIF DVR	16CIF DVR
		DEI enabled	DEI bypass for CIF channels, even fields are used to scale to CIF resolution **Use Case 1:** DEI enabled for 1CH D1 DEI bypass for CIF channels, even fields are used to scale to CIF resolution **Use Case 3:** DEI enabled in 7fps non-real time mode
Sub-stream	DEI enabled	**Use Case 1, 2, 3:** DEI enabled	**Use Case 1, 2, 3:** DEI bypass, will use even field to scale to sub-stream resolution
JPEG Sub-stream	DEI enabled	**Use Case 1, 2, 3:** DEI enabled	**Use Case 1, 2, 3:** DEI bypass, will use even field to up-scale to JPEG sub-stream resolution

Encode Parameters	
Encoding input type	Progressive
Primary stream codec	H264 HP Profile Level 3.1
Sub-stream codec	H264 HP Profile Level 3.1
JPEG Sub-stream codec	JPEG Baseline
Primary stream resolution (Resolution can be changed dynamically. Downscaling from max resolution ONLY)	D1 – only when max resolution is D1 VGA – only when max resolution is D1 2CIF – only when max resolution is 2CIF or D1 CIF QVGA QCIF
Sub-stream resolution (Resolution can be	CIF – only when max resolution is CIF QVGA – only when max resolution is CIF

	4D1 DVR	8CIF DVR	16CIF DVR
changed dynamically. Downscaling from max resolution ONLY)	QCIF		
JPEG Sub-stream resolution (Resolution can be changed dynamically. Downscaling from max resolution ONLY. JPEG resolution change independent of primary stream)	Fixed to D1 ALWAYS	D1 VGA 2CIF CIF QVGA QCIF	
Frame-rate control	1fps to 30fps in units of 1fps		
Bit-rate control	16Kbps to 6Mbps		
QP control	H264: I-frame QP setting available, P-frame QP setting available JPEG: QP setting available		
RC Algorithm control	CBR VBR		
IP Ratio control	IP Ratio from 1..100		
Force I-frame Control	YES		
Motion Vector Output	YES – can be used for motion detect		
OSD			
Processor / HW used	DSP		
OSD Content	Separate OSD content for primary, sub-stream and MJPEG sub-stream. No OSD for preview stream		
Transparency	YES (Fixed transparency / color Key value of Y = 0x00, C = 0x00)		
Alpha Blending	YES (global alpha, 128 levels, Q7 format)		
Number of windows	10		
Size and position of OSD	Configurable		

	4D1 DVR	8CIF DVR	16CIF DVR
Tamper Detect			
Processor / HW used	DSP		
Input Resolution	CIF or lower (same resolution as sub-stream)		
Frame-rate	5fps (configurable)		
Notification	Notification to A8 on tamper detect		
Display			
Display 0	HD Display 0: On-Chip HDMI max 1080p60		
Display 1	HD Display 1: via DVO2 max 1080p60		
Display 2	SD Display: On-Chip SDDAC		
Tied VENCs	HD Display 0 and HD Display 1 will be "TIED" o They will show same video + GRPX o @ Same frame-rate o @ Same resolution o @ Same timing o i.e Input source to the HD Displays will be the same SD Display can show the same or different content as HD Display BUT at NTSC or PAL timing		
Display Resolutions	**HDMI / VGA Monitor:** 1080p60 – 1920x1080 @ 60Hz 720p60 – 1280x720 @ 60Hz SXGA – 1280x1024 @ 60Hz XGA – 1024x768 @ 60Hz **SD Display:** NTSC – 720x240 @ 60Hz – interlaced PAL – 720x288 @ 50Hz – interlaced Resolution can be changed dynamically.		
Display Layouts	o 1x1 – All CH being showed, deinterlaced at 60fps o 2x2 – All CHs being shown, deinterlaced at 60fps o 3x3 – CH being shown scaled at 30fps by taking ONLY the even fields o 4x4 – CH being shown scaled at 30fps by taking ONLY the even fields (8CIF AND 16CIF ONLY) o 4x5 – CH being shown scaled at 30fps by taking ONLY the even fields (16CIF ONLY) o 1+7 – 1 BIG CH being showed deinterlaced at 60fps. OTHER SMALL CHs scaled at 30fps by taking ONLY the even fields		

	4D1 DVR	8CIF DVR	16CIF DVR
	○ 1+5 – 1 BIG CH being showed deinterlaced at 60fps. OTHER SMALL CHs scaled at 30fps by taking ONLY the even fields		
SD Display	- Input to SDTV MUST to be interlaced 60fps in the following Layouts ○ 1x1 ○ 1+5 ○ 1+7 - In other layouts input to SDTV can be progressive 30fps		
Graphics	- Via FBDev - 16-bit - 720p or SXGA size in DDR – upscaled or downscaled to display resolution - Same GRPX used for SDTV and HDTV - SDTV Graphics downscaled from HDTV GRPX – Mouse Cursor drawn in SW on same GRPX plane.		
Live preview resolution	1x1 Layout: D1 1+7 Layout: 1CH D1, other channels 2CIF 1+5 Layout: 1CH D1, other channels 2CIF 2x2 Layout: D1 Other layouts: 2CIF		
Live preview frame-rate	1x1 Layout: 60fps 1+7 Layout: 1CH 60fps, other channels 30fps 1+5 Layout: 1CH 60fps, other channels 30fps 2x2 Layout: 60fps Other layouts: 30fps		
Decode channels can be mixed with live channels	YES		
Layout Grid lines	Should be done using GRPX plane		
Display OSD	Should be done using GRPX plane		
Audio			
Capture	TVP5158 and McASP, via ALSA library		
Playback	McASP, via ALSA library		
HDMI Audio	Yes, via ALSA library using Sample Rate Converter to generate 32KHz sampling frequency		
Audio encode/decode	To be taken care by customer, sample G711 provided in demo		
Audio Video Sync	To be taken care by customer		

	4D1 DVR	8CIF DVR	16CIF DVR
Other requirements			
Boot logo	Yes, via Uboot 480P60 display of 720x480 resolution bitmap on On-Chip HDMI. **HDMI TV should support 480P60 mode.**		
Boot time	- Power ON to boot logo – 5 secs - Power ON to Display live preview – 30-45 secs		
Networking	Linux drivers provided, application to be taken care by customer		
USB	Linux drivers provided, application to be taken care by customer		
SATA	1x SATA. Port Multiplier can be used. Linux drivers provided, application to be taken care by customer		

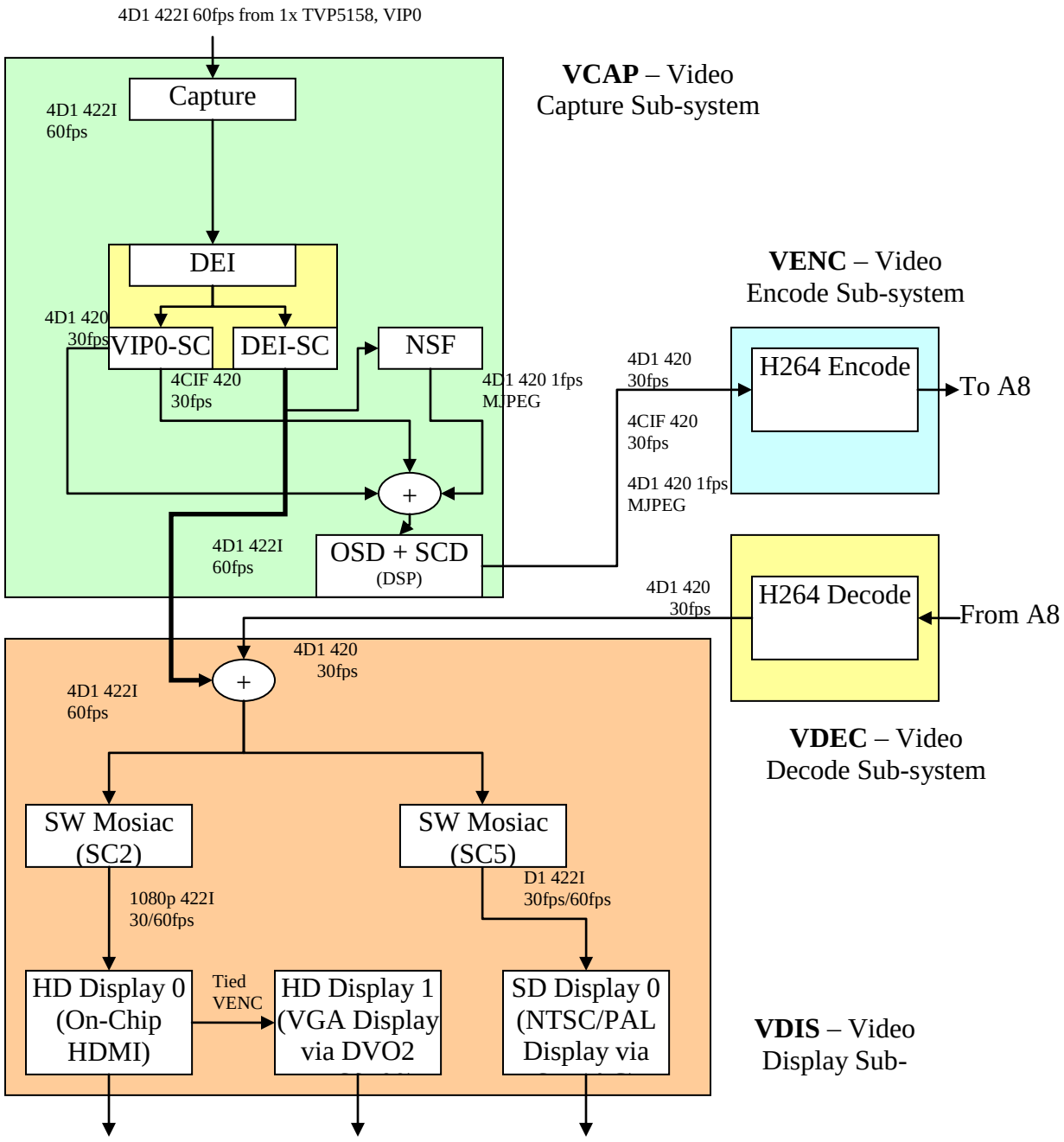
3 Limitations

These data flows have the following limitations / constraints

- These data flows are implemented for DM814x SoC.
  - These will be ported to DM8107 SoC in future.
  - These could be made to work on DM8168 but are NOT ported in current codebase.
- These data flows support dual independant display but one of the display has to be SD resolution.
  - Dual indepedant HD Display or triple indepedant display is not supported.
  - Dual HD Display (along with SD display) can be supported but they MUST be tied, i.e same resolution, same frame-rate, same timing, same content.
- For 16CIF Use-case 1, 2 and non-real time FPS on secondary channels is due IVA-HD Mhz being completely used.

4 DM8148 4D1 DVR – Additional Details

Data Flow



Measured Performance

Frame-rate

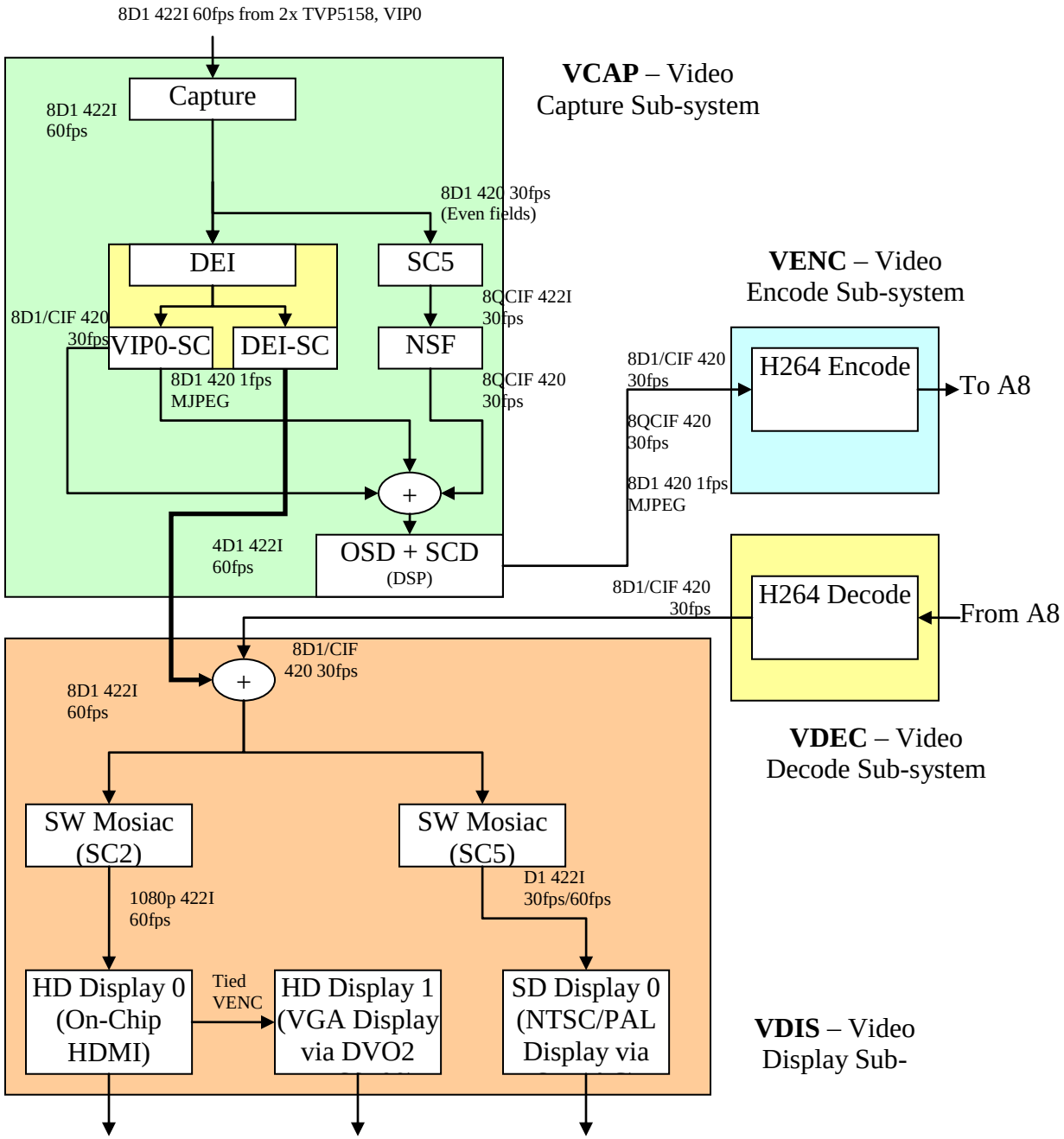
Refer to sub-section Encode, Decode in section 2 Features for details

CPU Load (Measured)

Processor	CPU load in %
M3 VPSS	60 %
M3 Video	36 %
DSP	40 %

5 DM8148 8CIF DVR – Additional Details

Data Flow



Notes

- 8CIF data flow is same as 4D1 except for the below points.
- QCIF secondary stream is generated by taking even fields and scaling them to QCIF using SC5. NSF is used after SC5 to convert 422I to 420 for encode

- VIP0-SC is not switched between primary stream and secondary stream since the CPU overhead to program RT params for every frame is very high and results in DEI not being real time
- 1fps MJPEG is instead generated from VIP0-SC since CPU overhead to change RT params at 1fps is very low
- The VIP0-SC output resolution and FPS can be dynamically changed to support seem-less switch between the different use-cases
    - 2D1 + 6CIF
    - 8CH 2CIF
    - 8CH D1 non-real time

Performance Measured

Frame-rate

Refer to sub-section Encode, Decode in section 2 Features for details

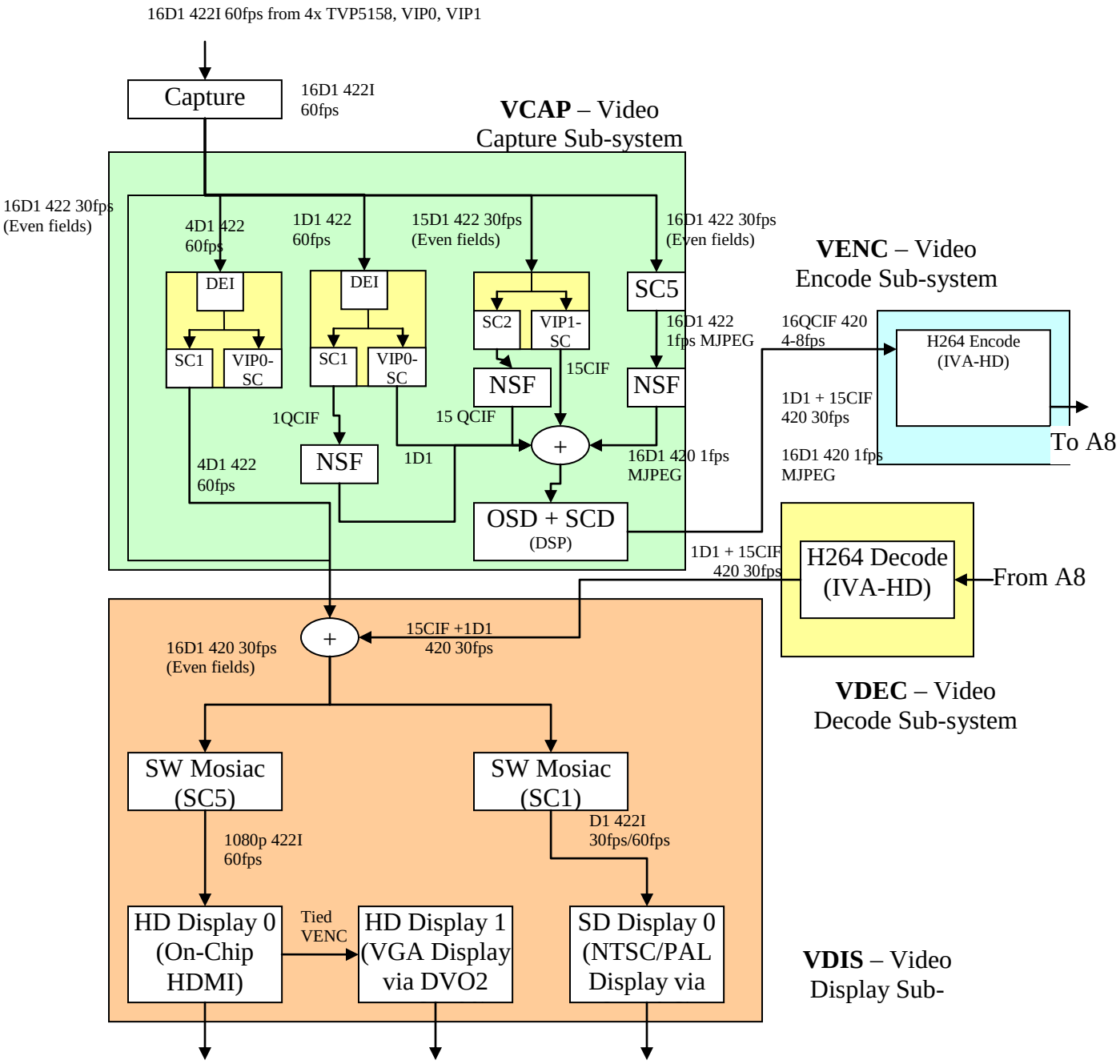
CPU Load

Processor	CPU load in %
M3 VPSS	60%
M3 Video	51%
DSP	20% (SCD OFF)

6 DM8148 16CIF DVR – Additional Details

There are three use-cases and two different data flows for the 16CIF DVR.

Data Flow 1 – 1D1 + 15CIF



Notes

- H264 encode for sub-stream (16QCIF) FPS would be reduced in order to meet primary encode and decode performance
- 16CIF use-case and 1D1+15CIF use-case have the same data flow.
- 16CIF use-case is made from 1D1+15CIF by
  - dynamically changing the CH0 resolution to CIF
  - and dynamically changing the FPS of secondary channels to 8fps

Performance Measured – 1D1 + 15CIF

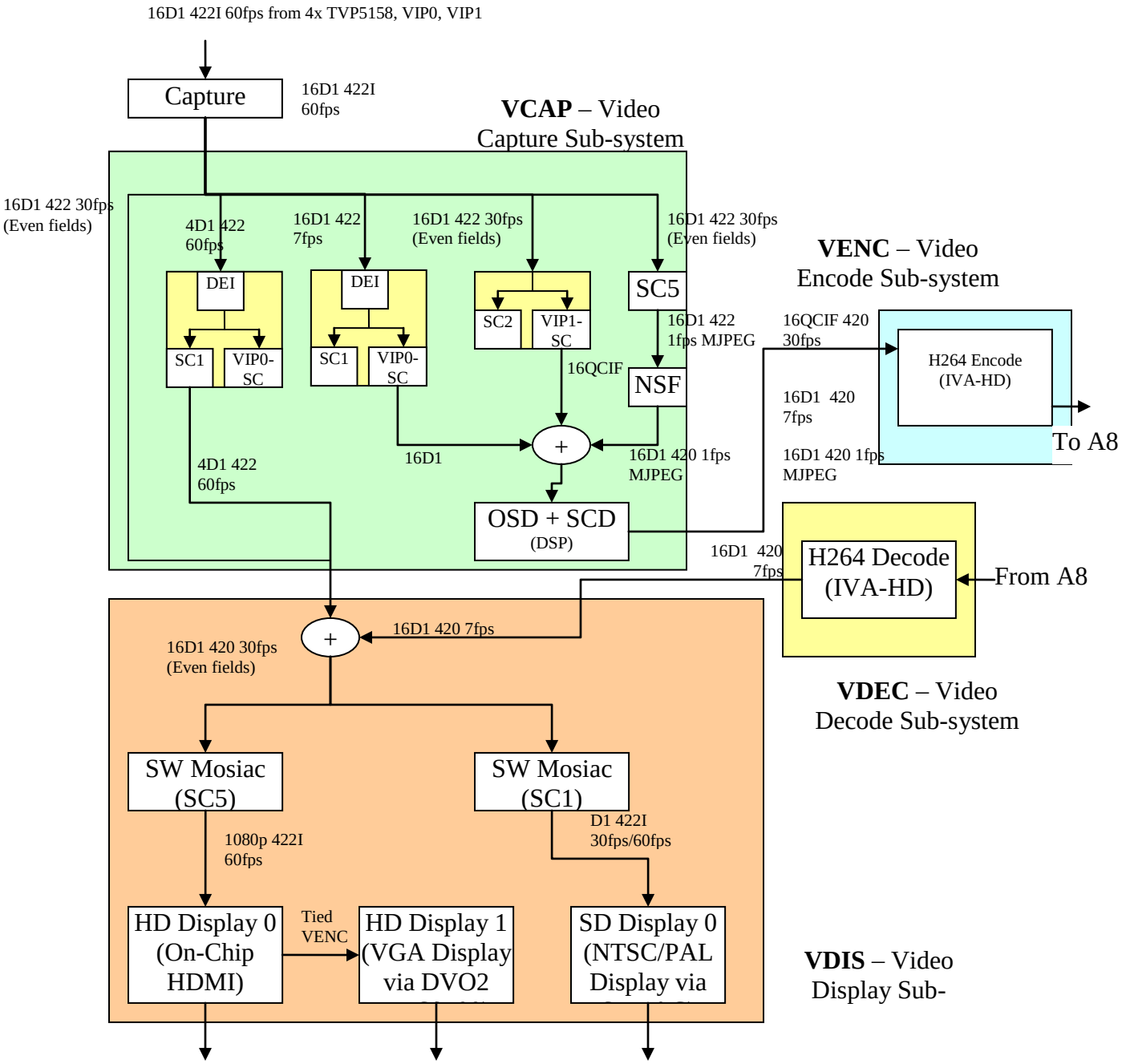
Frame-rate

Refer to sub-section Encode, Decode in section 2 Features for details

CPU Load

Processor	CPU load in %
M3 VPSS	49%
M3 Video	30%
DSP	20% (SCD OFF)

Data Flow 2 – 16D1 non real-time



Performance Measured – 16D1 non real-time

Frame-rate

Refer to sub-section Encode, Decode in section 2 Features for details

CPU Load

Processor	CPU load in %
M3 VPSS	56%
M3 Video	41%
DSP	15% (SCD OFF)