

DM8168 16 Channel D1 DVR - Use Case Guide

ABSTRACT

This document explains the capabilities and limitations of the primary DVR use-cases of DM8168 DVR-RDK

- 16 D1 DVR Use-case

These use-cases are targeted for DM8168 SoC from TI

ABSTRACT.....	1
1 Overview.....	2
Use-case summary	2
Target Applications.....	2
Resolutions.....	2
2 Features	3
System.....	3
Capture.....	3
Encode.....	3
Decode	3
De-interlacing	4
Encode Parameters.....	4
OSD.....	5
Tamper Detect.....	5
Live Motion Detect	6
Display	6
Audio.....	8
Other Features	8
3 Limitations	9
4 DM8168 4D1 DVR – Additional Details	10
Data Flow	10
Measured Performance	11
Frame-rate	11
CPU Load (Measured)	11

Copyright © Texas Instruments Incorporated. All rights reserved.

Information in this document is subject to change without notice. Texas Instruments may have pending patent applications, trademarks, copyrights, or other intellectual property rights covering matter in this document. The furnishing of this documents is given for usage with Texas Instruments products only and does not give you any license to the intellectual property that might be contained within this document. Texas Instruments makes no implied or expressed warranties in this document and is not responsible for the products based from this document.

1 Overview

Use-case summary

A summary of the use-cases is given below

Product	Description
16D1 DVR (DM8168)	Enc: 16Ch D1 30fps + 16Ch CIF 30fps + 16CH JPEG 1fps Dec: 16Ch D1 30fps

Target Applications

This use-case is targeted for the below applications

- Multi-channel Digital video recorder (DVR) on DM8168
- Hybrid DVR

This use-case is NOT targeted for

- NVR
- HD-DVR

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

		16 D1 DVR	
System			
DM8168 Part Number		Silicon Rev 2.0 (Also available on Silicon Rev 1.1 for backward compatibility)	
System Clocks	ARM	1000 MHz	
	M3	280 MHz * Needs DM8168 parts supporting 280MHz for M3	
	DSP	1000 MHz	
	DDR	800 MHz	
	IVA-HD	600 MHz	
	HDVPSS	280 MHz * Same as M3 clock frequency	
DDR		1 GB	2 GB
Linux Memory		242 MB	468 MB
Capture			
Number of Video decoders		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		• Customer can change from TVP5158 to their own video decoder.	
Encode			
Primary stream (max resolution)		16CH D1 H264 30fps	
Sub-stream (max resolution)		16CH CIF H264 30fps	
JPEG Sub-stream (max resolution)		16CH D1 JPEG 1fps	
Decode			
Decode		16CH D1 H264 30fps	
Trick Play		I-frame based fast-forward, fast-rewind	

	16 D1 DVR
	All frame decode and fast-forward playback. Constrained by the maximum performance of decode channels.
De-interlacing	
Primary stream	DEI enabled
Sub-stream	DEI enabled
JPEG Sub-stream	DEI enabled
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 VGA 2CIF CIF QVGA QCIF
Sub-stream resolution (Not recommended to be changed as this is used in live preview. Resolution can be changed dynamically. Downscaling from max resolution ONLY)	CIF QVGA QCIF
JPEG Sub-stream	Same resolution as Primary stream resolution

16 D1 DVR	
resolution (Resolution can be changed dynamically. Downscaling from max resolution ONLY.)	
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 IDR-frame Control	YES
Motion Vector Output	YES – can be used for motion detect
OSD	
Processor / HW used	DSP
OSD Content	OSD content on live preview, primary stream and secondary stream. Same OSD content on all streams OSD overlay content used in YUV422ILE format
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
Privacy Mask	Not Implemented – Can be done using OSD overlay by filling the OSD content with some specific color
Tamper Detect	
Processor / HW used	DSP
Input Resolution	CIF or lower (same resolution as sub-stream)
Frame-rate	2fps (configurable)

	16 D1 DVR
Notification	Notification to A8 on tamper detect
Live Motion Detect	
Processor / HW used	DSP
Input Resolution	CIF or lower (same resolution as sub-stream)
Frame-rate	2fps (configurable)
Notification	Motion Detection Statistics available on A8. Algorithm on A8 to use this information and generate triggers of motion detection.
Sensitivity	0..6
Minimum Block Size	32x10 for NTSC Input 32x12 for PAL Input
Display	
Display 0	HD Display 0: On-Chip HDMI max 1080p60. Default – 1080p60
Display 1	HD Display 1: via DVO2 and external HDMI transmitter max 1080p60. Default – 1080p60
Display 2	HDDAC/VGA max 1080p60. Default – 1080p60
Display 3	SD Display: On-Chip SDDAC
Tied VENCs	<p>Configurable.</p> <p><u>Default:</u></p> <p>HD Display 0 is independent</p> <p>HD Display 1 and HDDAC/VGA Display is “TIED”</p> <ul style="list-style-type: none"> o They will show same video + GRPX o @ Same frame-rate o @ Same resolution o @ Same timing o i.e Input source to these displays will be the same <p>HD Display0 and HD Display1/HDDAC can show same or different content BUT at different timing.</p> <p>SD Display shows single channel at NTSC/PAL timings</p> <p><u>Other Supported Configuration:</u></p> <p>HD Display0 and HDDAC/VGA Display is “TIED”</p> <p>HD Display1 is independent</p> <p>SD Display shows single channel at NTSC/PAL timings</p>
Display	HDMI / VGA Monitor:

	16 D1 DVR
Resolutions	<p>1080p60 – 1920x1080 @ 60Hz 720p60 – 1280x720 @ 60Hz SXGA – 1280x1024 @ 60Hz XGA – 1024x768 @ 60Hz</p> <p>SD Display: NTSC – 720x240 @ 60Hz – interlaced PAL – 720x288 @ 50Hz – interlaced Resolution can be changed dynamically.</p>
Display Layouts	<p>All the layouts and fps listed below are with worst case of both HDMI displays@1080P60 and SD display @ NTSC/PAL</p> <ul style="list-style-type: none"> ○ 1x1 – All CH being showed, deinterlaced at 30fps ○ 2x2 – All CHs being shown, deinterlaced at 30fps ○ 3x3 – All CHs being shown are deinterlaced and using the secondary encode stream resolution to generate mosaic layout. ○ 4x4 – All CHs being shown are deinterlaced and using the secondary encode stream resolution to generate mosaic layout. ○ 1+7 – 1 BIG CH being shown is deinterlaced at 30fps. OTHER SMALL CHs shown are deinterlaced and same as secondary encode stream resolution. ○ 1+5 – 1 BIG CH being shown is deinterlaced at 30fps. OTHER SMALL CHs shown are deinterlaced and same as secondary encode stream resolution.
SD Display	<ul style="list-style-type: none"> - Input to SDTV is interlaced (60 fields per sec) and directly bypassed after capture. - No mosaic display supported on SDTV
Graphics	<ul style="list-style-type: none"> - Via FBDev - 16-bit - 720p size in DDR – upscaled or downscaled to display resolution - Graphics available for HDMI Display 0 and HDMI Display 1 in the application - SDTV Graphics can be enabled using /dev/fb2 <p>For more details on graphics usage, refer to the DM8168 DVRRDK GUI Guide</p>
Live preview resolution	<p>1x1 Layout: D1 1+7 Layout: 1CH D1, other channels CIF (secondary stream resolution) 1+5 Layout: 1CH D1, other channels CIF (secondary stream resolution) 2x2 Layout: D1 Other layouts: CIF (secondary stream resolution)</p>
Live preview frame-rate	All Layouts: All channels at 30fps
Decode channels can be mixed with live channels	YES
Layout Grid lines	Should be done using GRPX plane
OSD overlay on	Done using SWOSD solution on DSP

	16 D1 DVR
Live Preview	The same OSD content is overlaid on all encode streams
Audio	
Capture	<p>TVP5158 and McASP, via ALSA library</p> <ul style="list-style-type: none"> - TVP5158 configuration done through a user space driver on A8 - 4xTVP5158 are connected in cascaded mode to support all 16 channel audio capture through single McASP interface - Dynamic configuration of sampling rate and volume control supported for TVP5158 using A8 userspace driver (not using ALSA) - Mono audio capture per channel - 8KHz and 16KHz sampling rate support - ALSA layer used for interfacing to McASP driver and configuring the McASP for TVP5158 audio codec. Volume control, sampling rate change of the audio codec not integrated with ALSA.
Playback	<p>AIC3x and McASP, via ALSA library</p> <ul style="list-style-type: none"> - Playback audio samples captured from input channels - Supports mono or stereo playback, although the captured audio samples are only mono - All controls for AIC3x are through ALSA layer (including amixer) <p>More details available at http://processors.wiki.ti.com/index.php/DM81xx_AM38xx_Audio_Driver_User_Guide </p>
HDMI Audio	<p>Yes, via ALSA library using Sample Rate Converter plug-in to generate 32KHz sampling frequency</p> <p>More details available at http://processors.wiki.ti.com/index.php/DM81xx_AM38xx_Audio_Driver_User_Guide and http://processors.wiki.ti.com/index.php/DM81xx_AM38xx_HDMI_User_Guide </p>
Audio encode/decode	To be taken care by customer, sample G711 provided in demo
Audio Video Sync	Preliminary AVSync supported. To be taken care in the application while feeding audio and video data.
Other Features	
Boot logo	<p>Yes, via Uboot</p> <p>720P60 display of 1280x720 resolution bitmap on On-Chip HDMI. HDMI TV should support 720P60 mode.</p>
Boot time	<ul style="list-style-type: none"> - Power ON to boot logo – 7 secs - Power ON to Display live preview – 30-45 secs
Networking	<p>Linux drivers provided, application to be taken care by customer</p> <p>Refer to http://processors.wiki.ti.com/index.php/DM816x_AM389x_PSP_User_Guide</p>
USB	<p>Linux drivers provided, application to be taken care by customer</p> <p>http://processors.wiki.ti.com/index.php/DM816x_AM389x_PSP_User_Guide</p>

	16 D1 DVR
SATA	2x SATA Linux drivers provided, application to be taken care by customer http://processors.wiki.ti.com/index.php/DM816x_AM389x_PSP_User_Guide

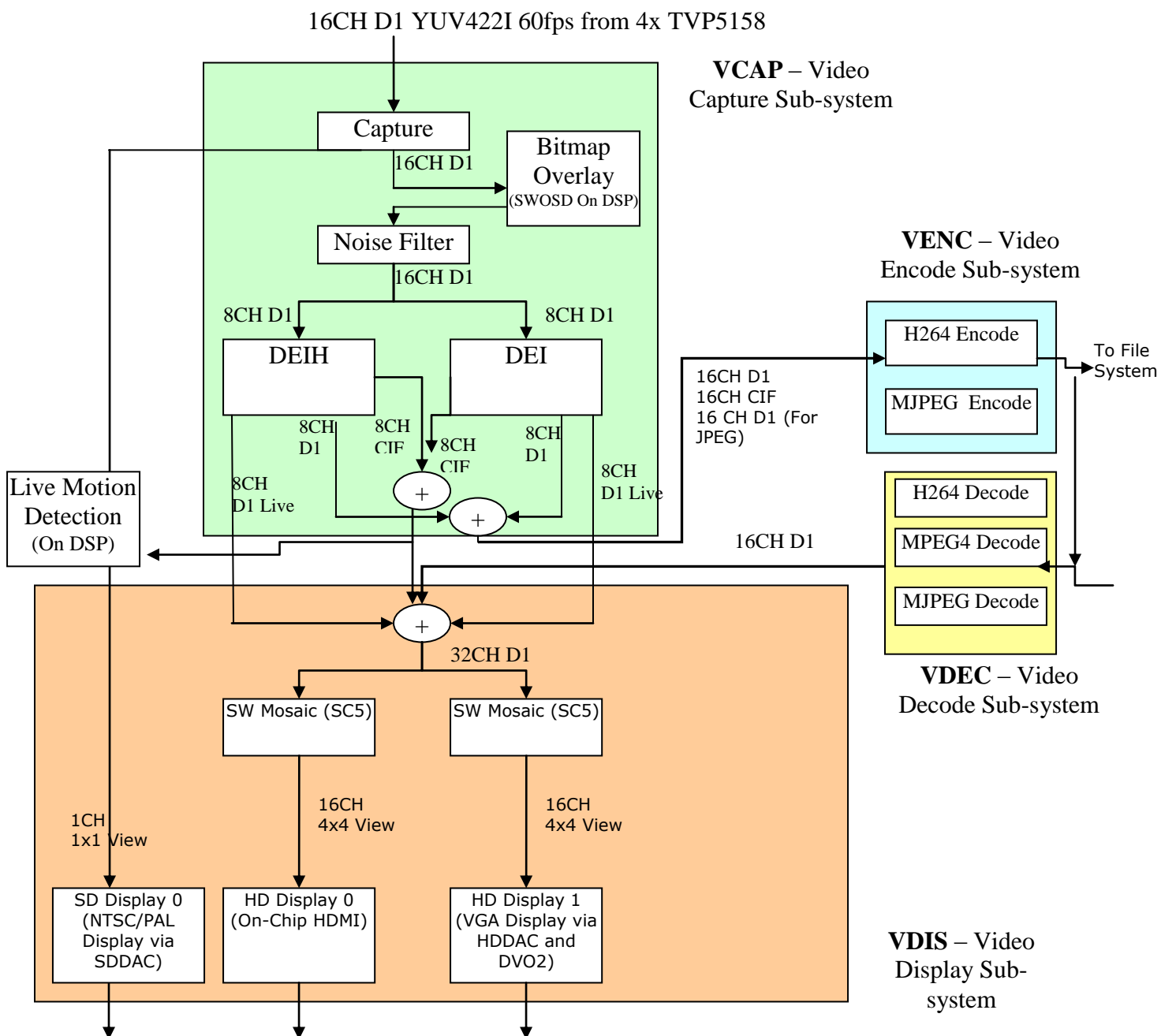
3 Limitations

The system has the following limitations / constraints

- 16 channel audio capture using TVP5158 is supported on hardware platforms which have cascaded mode of audio connections. Refer to DM8168 DVRRDK Schematics for details and also refer to TVP5158 datasheet <http://www.ti.com/lit/gpn/tvp5158>
- Secondary encode stream resolution is used in live preview also. Hence it is not recommended to change the secondary stream resolution. If it is downscaled from CIF, the preview quality starts degrading for live preview in 3x3, 4x4 and other similar mosaic layouts.
- SDTV cannot have mosaic grid layout. For grid layout on SDTV, one of the HD displays has to be switched off.
- 60fps deinterlaced content cannot be shown on live display. For such usecase, one of the HD displays has to be switched off.

4 DM8168 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	80 %
M3 Video	68 %
DSP	62 %

For more details on the processor load, refer to DM8168 DVRRDK Datasheet.