MPEG4 Restricted Simple Profile Decoder (v01.10.00) on DM365

FEATURES

- eXpressDSP™ Digital Media (XDM 1.0 IVIDENC2) interface and IRES compliant
- Validated on DM365 EVM with Monta Vista® Linux® 5.0
- MPEG4 simple profile levels 0, 1, 2 and 3 are supported with the following limitations:
  - No support for 4 MV
  - No support for MV ranges beyond -32 to 31
  - No support for Data partitioning (DP) and Reversible VLCs (RVLCs)
- Decodes the following formats:
  - VGA (640 x4 80)
  - D1 (720 x 480)
  - 720P (1280 x 720)
  - SXVGA (1280 x 960)
  - 1080p (1920x1080)
- Half Pel Interpolation (HPI) for motion estimation supported
- One motion vector encoding for motion estimation (1MV/MB) with (-32, +31) half pel search range supported
- Streams with DC and AC prediction supported
- Streams with Resync Marker (RM) supported
- Streams with Short Video Header (SVH) supported
- YUV 4:2:2 interleaved data as an output supported
- YUV 4:2:0 semi-planar (NV12 format, that is, Y planar, Cb Cr interleaved) data as an output supported
- Display width can be greater than the image width.
- Supports rotation (90, 180 and 270 degrees) integrated with the Decoder for certain image formats such as QVGA (320x240), VGA (640x480), 720P (1280x720), and SXVGA (1280x960). Also supports rotation of 240x320 (rotated QVGA) and 480x640 (rotated VGA)
- Unrestricted Motion Vectors (UMV) supported
- Decodes all DM365 encoded streams
- Decodes streams of VBR, CBR, and CVBR rate control
- Frame level re-entrancy supported
- Multi-instance of MPEG4 Decoder, and single/multi instance of MPEG4 Decoder with other DM365 codecs supported
- Decodes only those streams encoded with the DM365 MPEG4 Encoder.
- This decoder does not support the following:
  - Video packet resynchronization
  - Header extension code (HEC)
  - AC prediction for varying Qp (rateFix = 0)
  - Arbitrary width and height.
    - Image width as multiple of 16 and height as multiple of 16 supported
    - Image width below 160 and 192 for YUV 422ILE and YUV 420SP format respectively is not supported
  - Decoding of 720x1280 (rotated 720P) and 960x1280 (rotated SXVGA) formats

DESCRIPTION

MPEG4 is the ISO/IEC recommended standard for video compression. This version of the MPEG4 Simple Profile decoder is a restricted decoder. It can only decode streams encoded by DM365 MPEG4 Encoder. It is validated on DM365 EVM with Monta Vista Linux 5.0.

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Performance Summary

This section describes the performance of the MPEG4 Restricted Simple Profile Decoder on DM365 EVM.

Table 1. Configuration Table

CONFIGURATION	ID
MPEG4 simple profile, I/D Cache Enabled Output Format: XDM_YUV_420SP Rotation 0 ME 31 UMV OFF	MPEG4_DEC_01
MPEG4 simple profile, I/D Cache Enabled Output Format: XDM_YUV_422ILE Rotation 0 ME 31 UMV OFF	MPEG4_DEC_02
MPEG4 simple profile (SVH Mode), I/D Cache Enabled Output Format: XDM_YUV_422ILE Rotation 0 ME 31 UMV OFF	MPEG4_DEC_03 (SVH)

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Performance Measurement Procedure

- Measured with program memory and I/O buffers in external memory, I/D cache enabled, ARM @297 MHz, MJCP @243 MHz, DDR @243 MHz, Monta Vista Linux 5.0
- DVTB is used to measure the performance numbers in this Datasheet.
- The process time is measured across algActivate/process/algDeactivate function call using gettimeofday() utility of linux.
- NFS File system is used as an environment in performance measurement.
- To avoid the impact of file I/O operation in performance measurement, file write operation is disabled and checksum calculation is included after fread() function to make sure file read has really completed before process call.
- After rebooting the board, codec binary must be executed at least once before start of performance measurement.

Note: Frame decode load can be divided in ARM load and MJCP load. ARM is idle during MJCP processing, and can be utilized to execute any other program in different thread during this time.

Table 2. Cycles Information for MPEG4_DEC_01

INPUT NAME	RESOLUTION	PERFORMANCE STATISTICS (MEGA CYCLES PER SECOND)(1)					
		AVERAGE			PEAK		
		ARM926 PER FRAME	DECODE PER FRAME	FPS	ARM926 PER FRAME	DECODE PER FRAME	FPS
BUS	CIF (352x288) @512kbps	0.53	1.13	262.81	0.58	1.18	252.53
Coastguard	VGA (640x480) @3mbps	0.53	2.26	131.46	0.61	2.34	127.15
Football	D1 (720x480) @4mbps	0.53	3.01	98.54	0.58	3.07	96.85
Stockholm	720p (1280x720) @8mbps	0.52	5.64	52.70	0.57	5.68	52.25
Pedestrian	SXVGA (1280x960) @10mbps	0.53	7.34	40.47	0.59	7.40	40.16
Ralli	1080p (1920x1080) @16mbps	0.59	14.55	20.41	0.61	14.70	20.20

(1) Average and peak MCPS values may vary by +/-5%.

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Table 3. Cycles Information for MPEG4_DEC_02

INPUT NAME	RESOLUTION	PERFORMANCE STATISTICS (MEGA CYCLES PER SECOND)(1)					
		AVERAGE			PEAK		
		ARM926 PER FRAME	DECODE PER FRAME	FPS	ARM926 PER FRAME	DECODE PER FRAME	FPS
BUS	CIF (352x288) @512kbps	0.53	1.12	265.18	0.58	1.17	252.97
Coastguard	VGA (640x480) @3mbps	0.52	2.23	132.94	0.62	2.33	127.36
Football	D1 (720x480) @4mbps	0.53	3.00	99.15	0.57	3.04	97.72
Stockholm	720p (1280x720) @8mbps	0.52	5.60	53.04	0.56	5.64	52.65
Pedestrian	SXVGA (1280x960) @10mbps	0.53	7.28	40.79	0.60	7.36	40.36
Ralli	1080p (1920x1080) @16mbps	0.59	14.05	21.14	0.61	14.23	20.88

(1) Average and peak MCPS values may vary by +/-5%.

Table 4. Cycles Information for MPEG4_DEC_03

INPUT NAME	RESOLUTION	PERFORMANCE STATISTICS (MEGA CYCLES PER SECOND)(1)					
		AVERAGE			PEAK		
		ARM926 PER FRAME	DECODE PER FRAME	FPS	ARM926 PER FRAME	DECODE PER FRAME	FPS
Foreman	CIF (352x288) @512kbps	0.54	1.14	260.62	0.63	1.22	243.01
ICE	2CIF (704x576) @4mbps	0.55	2.82	105.19	0.60	2.87	103.43

(1) Average and peak MCPS values may vary by +/-5%.

Note:

- The values in Table 2, 3, and 4 are as measured on the ARM 926 side. These are the actual cycles as seen from the host on the DM365 EVM board and will be close to cycles seen on the final system (for average case).
- ARM926 represents mega cycles per frame spend on ARM926.
- Decode frame time is the time seen from ARM926 only. Since most of the processing happens at MJCP, the active load on ARM926 is the value mentioned in ARM926 column. Decode frame time has no connection with MJCP running at 243 MHz.
- All values are collected (both average and peak) at frame-level processing.
- They are measured with Linux without any system traffic.

Table 5. Memory Statistics

RESOLUTION	MEMORY STATISTICS (IN BYTES)					
	PROGRAM MEMORY	DATA MEMORY				TOTAL
		CONSTANT	INTERNAL	EXTERNAL	STACK	
1080p (1920x1080)	101562	4274	0	6882584	8192	6996612
SXVGA (1280x960)	101562	4274	0	4154648	8192	4268676
720P (1280x720)	101562	4274	0	3186968	8192	3300996
D1 (720x480)	101562	4274	0	1305368	8192	1419396
VGA (640x480)	101562	4274	0	1174808	8192	1288836
CIF (352x288)	101562	4274	0	465176	8192	579204

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Table 6. Usage of External Memory through CMEM

BUFFER	SIZE	
Input Buffer(1)	frameSize(2)*2	
Output Buffer	YUV_422_ILE	Buffer1: frameSize*2
	YUV_420_SP	Buffer1: frameSize Buffer2: frameSize/2
External Data Memory	memTab[0]	11928
	memTab[1]	3* frameSize_padded(3)
	memTab[2]	5760 Bytes
	memTab[3]	8192 Bytes

(1) Input buffer size is theoretical size based on 1:1 compression. Actual input size will be lower than this.
(2) frameSize = (Width * Height).
(3) frameSize_padded = ((Width + 64)*(Height+64))

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Notes

- The entire MJCP is a video resource and is used by the codec
- DMA configuration

Table 7. DMA Configuration

TC Q's	TC 0	TC 1	TC 2	TC 3	TOTAL
Usage	Reserved for system	Used by codec	Not used by codec	Not used by codec	-
Priority	0	Not touched by codec (Default – 7)	-	-	-
EDMA Channels	0	31	0	0	31/64
PaRAM Entries	0	47	0	0	47/256
QDMA Channels	0	0	0	0	0/8

- The MJCP/EDMA resources are acquired using a generic resource manager known as Framework component. See *MPEG4 Restricted Simple Profile Decoder on DM365 User's Guide* for details.
- Code placement

  All the algorithm code are placed in external memory. The performance quoted is not sensitive to algorithm code placement.

References

- ISO/IEC 14496-2:2004, Information technology -- Coding of audio-visual objects -- Part 2: Visual (Approved in 2004-05-24)
- *MPEG4 Restricted Simple Profile Decoder on DM365 User's Guide* (literature number: SPRUEV2A)

Glossary

TERM	DESCRIPTION
Constants	Elements that go into .const memory section
Scratch	Memory space that can be reused across different instances of the algorithm
Shared	Sum of Constants and Scratch
Instance	Persistent-memory that contains persistent information - allocated for each instance of the algorithm

Acronyms

ACRONYM	DESCRIPTION
CBR	Constant Bit Rate
CIF	Common Intermediate Format
CVBR	Constrained Variable Bit Rate
DP	Data Partitioning
EVM	Evaluation Module
HPI	Half Pel Interpolation
MJCP	MPEG4-JPEG Co-Processor
MV	Motion Vector
NV12	YUV 420 format with Y plane and CbCr plane
QP	Quantization Parameter
QCIF	Quarter Common Intermediate Format
QVGA	Quarter Video Graphics Array
RVLC	Reversible Variable Length Coding
SQCIF	Sub Quarter Common Intermediate Format
SSE	Sum of Square of Errors
SXVGA	Super eXtended Graphics Array
UMV	Unrestricted Motion Vectors

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ACRONYM	DESCRIPTION
VBR	Variable Bit Rate
VGA	Video Graphics Array
VUI	Video Usability Information
XDM	eXpressDSP Digital Media

Revision History

This revision history highlights the changes made to SPRS546 codec specific data sheet to make it SPRS546A.

Table 8. Revision History for MPEG4 Restricted Simple Profile Decoder (v01.10.00) on DM365

SECTION	ADDITION/DELETION/MODIFICATION
Section 1	FEATURES: • Added Support for 1080p decoding
Table 2	Cycles Information for MPEG4_DEC_01: • Added new test vector Ralli - 1080@p 1(169m2b0pxs1080)
Table 2	Cycles Information for MPEG4_DEC_02: • Added new test vector Ralli - 1080@p 1(169m2b0pxs1080)
Table 5	Memory Statistics: • Added Memory details for 1080p (1920x1080) decoding

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