MPEG4/H.263 Decoder (v01.00.14) on HDVICP2 and Media Controller Based Platform

FEATURES

- **Supports MPEG4 Simple Profile of level 0,1,2,3,4A,5 and 6**
- **Supports MPEG4 Advanced Simple Profile of level 0,1,2,3,4,5 and 6**
- **Supports H.263 Profile 0 and 3**
- **Supports H.263 annexes I,J,K and T Only**
- **Supports Progressive, interlaced type picture decoding**
- **Supports decoding of picture type as Intra, Inter and bi-predictive**
- **Supports intra-prediction and inter-prediction modes**
- **Supports frame based decoding**
- **Supports picture width and height (resolutions) greater than 64 pixels including all standard resolutions.**
- **Supports picture with width/height non multiple of two resolution**
- **Supports Optional post processing (De-block filtering and Enhanced De-blocking)**
- **Supports graceful exit and error reporting under error conditions**
- **Supports error concealment**
- **Supports parse header functionality**
- **Supports access to provide MB info to application, as part of Meta data information, when Transcode mode is on**
- **Supports configurable display delay for low delay applications**
- **The other explicit features that TI's MPEG4 Decoder supports are**
  - **eXpressDSP Digital Media (XDM IVIDDEC3) interface compliant**
  - **Supports booting of HDVICP2**
  - **Implements different HDVCICP2 Power optimization schemes**
  - **Supports YUV420 semi planar color sub-sampling format**
  - **Independent of any operating system**
  - **Ability to get plugged in any multimedia frameworks (e.g. Codec Engine, OpenMax, GStreamer etc)**
  - **Supports multi-channel functionality**
- **Does not Supports low latency features - sub frame level synchronization for input and output**
- **Does not support Global Motion Compensation (GMC) feature**

DESCRIPTION

MPEG4 is the video compression standard from the ISO/IEC 14496-2:2003 Moving Picture Experts Group. This MPEG4 Decoder is validated on the HDVICP2 and Media Controller Based Platform with Code Composer Studio version 4.2.0.09000 and code generation tools version 4.5.1 for HDVICP2 processor and 5.0.3 for Media Controller Processor.

PRODUCT PREVIEW

Performance and Memory Summary

This section describes the performance and memory usage of the MPEG4 Decoder

Table 1 Configuration Table

CONFIGURATION	ID
MPEG4 Simple Profile decoder	MPEG4_DEC_001
MPEG4 Advanced Simple profile decoder	MPEG4_DEC_002

Table 2 Cycles Information - Profiled on DM816x REV-A2 EVM with Code Generation Tools Version 5.0.3 for Media Controller Processor and 4.5.1 for HDVICP2 processor

CONFIGURATION ID	HDVICP2 PERFORMANCE STATISTICS (MEGA CYCLES PER SECOND) (1)		
	TEST DESCRIPTION(2)	AVERAGE(3)	PEAK(4)
MPEG4_DEC_001	TC_045_football_360x240_420p_150fr.m4v(Progressive I,P)	7.23	8.63
	CrowdRun_p640x360_25fps_420pl_250fr_SP.m4v(Progressive I,P)	16.19	17.3
	BUS_640x480_420p_100fr_SP.m4v(Progressive I,P)	18.97	19.69
	parkrun_p720x480_30fps_420pl_302fr_SP.m4v (Progressive I,P)	21.42	22.22
	container_720x576_420sp_300fr_SP.m4v (Progressive I,P)	25.72	27.6
	parkrun_p1280x720_30fps_420pl_302fr_SP.m4v (Progressive I,P)	52.63	54.23
	vipertrain_p1920x1080_30fps_420pl_100fr_nv12_20MBPS.m4v(Progressive I,P)	116.76	123.95
	TC_045_football_360x240_420p_150fr.m4v(Progressive I,P, with optional filtering enable)	16	18.06
	CrowdRun_p640x360_25fps_420pl_250fr_SP.m4v(Progressive I,P, with optional filtering enable)	27.64	29.88
	BUS_640x480_420p_100fr_SP.m4v(Progressive I,P, with optional filtering enable)	32.83	35.17
	parkrun_p720x480_30fps_420pl_302fr_SP.m4v(Progressive I,P, with optional filtering enable)	35.89	38.13
	container_720x576_420sp_300fr_SP.m4v(Progressive I,P, with optional filtering enable)	41.22	43.75
	parkrun_p1280x720_30fps_420pl_302fr_SP.m4v(Progressive I,P, with optional filtering enable)	78.54	81.47
	vipertrain_p1920x1080_30fps_420pl_100fr_nv12_20MBPS.m4v (Progressive I,P, with optional filtering enable)	163.56	169.43

Table 3 Cycles Information - Profiled on DM816x REV-A2 EVM with Code Generation Tools Version 5.0.3 for Media Controller Processor and 4.5.1 for HDVICP2 processor

CONFIGURATION ID	HDVICP2 PERFORMANCE STATISTICS (MEGA CYCLES PER SECOND) (1)		
	TEST DESCRIPTION(2)	AVERAGE(3)	PEAK(4)
MPEG4_DEC_002	crowdrun_p360x240_30fps_420pl_100fr_ASP.m4v (Progressive I,P)	6.24	8.55
	CrowdRun_p640x360_25fps_420pl_250fr_ASP.m4v (Progressive I,P)	16.18	17.26
	BUS_640x480_420p_100fr.m4v (Progressive I,P)	18.97	19.67
	container_640x480i_30fps_420SP_100fr_Bframes.m4v (Interlace I,P,B)	25.20	32.42
	TC_045_football_720x480_420p_150fr.m4v (Progressive I,P)	20.60	21.88
	crowdrun_720x480i_30fps_420pl_100fr_ASP_Bframes.m4v (Interlace I,P,B)	26.12	33.82
	container_720x576_420sp_300fr_ASP.m4v (Progressive I,P)	25.75	27.62
	V10837_D-Traffic_MP4_ASP_VOP_L5.m4v (interlace I,P,B , resolution 720x576)	32.69	39.18
	parkrun_p1280x720_asp_50B.bits (Progressive I, P, B)	64.4	81.1
	pedestrian_1920x1080_asp_100B.bits (Progressive I, P, B)	135.34	181.94
	CrowdRun_p1920x1080_420sp_100F_ASP.m4v (Progressive I,I,I) (With decode only Intra frames feature)	107.88	110.06
	CrowdRun_p1920x1080_13Mbps_420sp_100F_interlaced.m4v (Interlaced I,I,I,I) (With decode only Intra frames feature)	106.65	108.81
	1080i25_mobcal_ter_1920x1080_10mbps_asp_30fps_bframes_int.m4v (Interlace I,P,B)	152.32	190.79
	crowdrun_p360x240_30fps_420pl_100fr_ASP.m4v (Progressive I,P with optional filtering)	14.88	17.31
	CrowdRun_p640x360_25fps_420pl_250fr_ASP.m4v (Progressive I,P with optional filtering)	27.65	29.81
	BUS_640x480_420p_100fr.m4v (Progressive I, P with optional filtering)	32.84	35.17
	TC_045_football_720x480_420p_150fr.m4v (Progressive I,P, with optional filtering enable)	35.79	38.16
	container_720x576_420sp_300fr_ASP.m4v(Progressive I,P, with optional filtering enable)	41.21	43.74
	parkrun_p1280x720_asp_50B.bits (Progressive I, P, B , with optional filtering enable)	84.75	95.60
	pedestrian_1920x1080_asp_100B.bits (Progressive I, P, B , with optional filtering enable)	179.75	220.51
	CrowdRun_p1920x1080_420sp_100F_ASP.m4v (Progressive I,I,I with optional filtering) (With decode only Intra frames feature)	164.82	168.14

(1) Measured on DM816x REV-A2 EVM having Cortex-A8 @ 1GHz, HDVICP2 @ 533MHZ, Media Controller @ 250 MHZ, L3 interconnect @ 500 MHZ and DDR2 @ 400 MHZ and there could be a variation of around 1-2% in the numbers.
   a) Media Controller code is placed in cacheable memory region in DDR.
   b) No Latency from system at process call and processing unit as frame (no sub-frame level communications) is assumed.
   c) All Luma 2D Video buffers of codec being in TILED_8 Bit Memory and all Chroma 2D Video buffers of codec being in TILED_16 Bit Memory
(2) Test case properties are mentioned along with test case names
(3) Average is computed based on worst case cycles having 2 extra output frame buffers. Average is measured for 30fps.
(4) Peak is computed based on worst case cycles having no extra output frame buffer. It is computed as peak among 30 frames.
(5) No latency from system at process call and processing unit as frame (no sub-frame level communication) is assumed.
(6) Cycles have been measured across process call.

Table 4 Memory Statistics of Media Controller - Generated with Code Generation Tools Version 5.0.3 for Media Controller Processor and 4.5.1 for HDVICP2 processor

CONFIGURATION ID	RESOLUTION	MEMORY STATISTICS[1]							TOTAL
		PROGRAM MEMORY	DATA MEMORY						
			INTERNAL	EXTERNAL[2]				STACK	
				PERSISTENT[3]			CONST		
				TILED8 (numBufs x Width x Height)	TILED16 (numBufs x Width x Height)	TILED PAGE / RAW	RAW		
MPEG4_DEC_001 MPEG4_DEC_002 (Optional filtering off)	360x240	16	0	0	0	155	333	3	507
	640x360	16	0	0	0	406	333	3	758
	640x480	16	0	0	0	529	333	3	881
	720x480	16	0	0	0	594	333	3	946
	720x576	16	0	0	0	712	333	3	1064
	1280x720	16	0	0	0	1580	333	3	1932
	1920x1080	16	0	0	0	3575	333	3	3927
MPEG4_DEC_002 (With decode only Intra frames feature and Optional filtering off)	1920x1080	16	0	0	0	2678	333	3	3030
MPEG4_DEC_001 MPEG4_DEC_002 (Optional filtering on)	360x240	16	0	0	0	767	333	3	1119
	640x360	16	0	0	0	1756	333	3	2108
	640x480	16	0	0	0	2257	333	3	2609
	720x480	16	0	0	0	2322	333	3	2674
	720x576	16	0	0	0	2764	333	3	3116
	1280x720	16	0	0	0	6231	333	3	6583
	1920x1080	16	0	0	0	13653	333	3	14005
MPEG4_DEC_002 (With decode only Intra frames feature and Optional filtering on)	1920x1080	16	0	0	0	6038	333	3	6390

(1) All memory requirements are expressed in kilobytes (1 K-byte = 1024 bytes) and there might be rounding to next integer K-byte. Stack can be kept in internal/external memory, negligible performance impact can be observed in Media Controller cycles if it is placed in external memory

(2) Codec's request of memory container can be over-ridden by application, adhering to the below rules
   a. TILED PAGE can be overridden by RAW
   b. TILED8, TILED16 can be overridden by TILED PAGE, RAW
   c. TILED16 can be overridden by TILED8, RAW, TILED PAGE

   However, in case of overriding of 2B and 2C, there can be some performance impacts

(3) Persistent memory is instance specific and does not include I/O buffers.

Table 5 Split-up of Media Controller Internal Data Memory Statistics

CONFIGURATION ID	DATA MEMORY - INTERNAL[1]		
	SHARED		INSTANCE
	CONSTANTS	SCRATCH	
MPEG4_DEC_001 MPEG4_DEC_002	0	0	0

(1) Internal memory refers to on chip memory. If the system doesn't have enough internal memory, then external memory can also be used. Memory requirements are expressed in kilobytes.

Notes

- I/O buffers:
  - Input buffer size = 1000 K-bytes (average case for 1920x1088 frame)
  - Output buffer size = 3622 K-bytes (1920x1088 frame)
- None of the buffers at input and output level is accessed by Media Controller processor hence the data should be valid in DDR (not in cache).
- Total data memory for N non pre-emptive instances = Constants + Runtime Tables + Scratch + N * (Instance + I/O buffers + Stack)
- Total data memory for N pre-emptive instances = Constants + Runtime Tables + N * (Instance + I/O buffers + Stack + Scratch)
- MAIL BOX FIFO #0 and #1 are used and user numbering for Media Controller as 2 and for HDVICP2 as 3 is assumed
- It is assumed that RTS library from ARM is available in system because few symbols like memcpy, div are used in codec
- All constants and Input Output Buffer to decoder is assumed in vDMA addressable space in DDR

References

- ISO/IEC 14496-2: 2003 – Coding of audio-visual objects – Part2: Visual
- H.264 ITU-T Standard – Video Coding for low bit rate communication
- MPEG4/H.263 Decoder on HDVICP2 and Media Controller Based Platform User's Guide (literature number SPRUGQ8)

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
CIF	Common Intermediate Format
EVM	Evaluation Module
GMC	Global Motion Compensation
GOP	Group of Pictures
GOV	Group of VOP
HDVICP	High Definition Video Coprocessor
IRES	Interface standard to request and receive handles to resources
MV	Motion Vector
QCIF	Quarter Common Intermediate Format
QVGA	Quarter Video Graphics Array
SQCIF	Sub Quarter Common Intermediate Format
UMV	Unrestricted Motion Vectors
VGA	Video Graphics Array
VOP	Video Object Plane
XDM	eXpressDSP Digital Media

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