MPEG2 Decoder (v01.00.16.01) on HDVICP2 and Media Controller Based Platform

FEATURES

- **Supports up to High level of Main Profile (MP)**
- **Supports decoding of MPEG1 constrained video streams**
- **Supports progressive and interlaced type picture decoding**
- **Supports P and B frames**
- **Supports optional out-of-loop deblocking**
- **Supports error concealment while decoding erroneous streams**
- **Supports picture width and height (resolutions) greater than 64 pixels including all standard resolutions up to 2048x2048**
- **Graceful exit under error conditions is supported**
- **Has logic and checks to help application to support trick mode playback**
- **Return of macroblock properties is supported in transcode mode**
- **Does not support sub frame level data synchronization**
- **The other explicit features that TI's MPEG2 Decoder supports are**
  - **eXpressDSP Digital Media (XDM IVIDDEC3) interface compliant**
  - **Supports multi-channel functionality**
  - **Supports booting of HDVICP2**
  - **Implements different Power optimization schemes**
  - **Supports YUV420 semi planar color sub-sampling formats**
  - **Independent of any operating system**
  - **Ability to get plugged in any multimedia frameworks (eg. Codec Engine, OpenMax, GStreamer etc)**

DESCRIPTION

MPEG-2 is an international standard for video compression. This standard is defined in the ISO/IEC-13838-2 document. This MPEG2 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 and code generation tools version 5.0.3 for Media Controller.

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Performance and Memory Summary

This section describes the performance and memory usage of the MPEG2 Decoder

Table 1 Configuration Table

CONFIGURATION	ID
MPEG-2 Main Profile Decoder (supports up to High level)	MPEG2_DEC_001
MPEG-2 Main Profile Decoder (supports up to High level) with optional out-of-loop deblocking ON (`outloopDeBlocking` field in IMPEG2VDEC_Params is set to 3)	MPEG2_DEC_002

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

CONFIGURATION ID	HDVICP2 PERFORMANCE STATISTICS (MEGA CYCLES PER SECOND) [1]		
	TEST DESCRIPTION	AVERAGE[2]	PEAK[3]
MPEG2_DEC__001	Motion1_640x360_P_1385kbps_420P_IPP.mpv	14.65	14.84
	LAMBORGHINI_640x480_P_2Mbps_420P_IPB_MPEG1.mpv	18.19	20.00
	office_720x480_P_2Mbps_420P_IPB.mpv	20.00	21.57
	ParkJoy_1280x720_P_5.3mbps_420P_IPB.mpv	48.93	52.10
	5D2_PORTRAIT_1920x1080_P_10Mbps_420P_IPB.mpv	109.00	112.77
	stockholm_720x480_I_2Mbps_420P_IPB.mpv	23.90	26.76
	RALLI_1920x1080_I_28mbps_420P_IPB.mpv	123.83	136.36
MPEG2_DEC__002	Motion1_640x360_P_1385kbps_420P_IPP.mpv	20.28	20.73
	LAMBORGHINI_640x480_P_2Mbps_420P_IPB_MPEG1.mpv	26.35	26.47
	office_720x480_P_2Mbps_420P_IPB.mpv	28.24	28.66
	ParkJoy_1280x720_P_5.3mbps_420P_IPB.mpv	69.78	70.16
	5D2_PORTRAIT_1920x1080_P_10Mbps_420P_IPB.mpv	154.75	154.83
	stockholm_720x480_I_2Mbps_420P_IPB.mpv	28.80	29.80
	RALLI_1920x1080_I_28mbps_420P_IPB.mpv	155.89	158.72

(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) It is computed based on worst case cycles having 2 extra output frame buffer. Average is calculated @ 30fps
(3) It is based on worst case cycles having no extra output frame buffer. It is computed based on peak among 30 frames @ 30fps.

Table 3 Memory Statistics of Media Controller - Generated with Code Generation Tools Version 5.0.3

CONFIGURATION ID	RESOLUTION	PROGRAM MEMORY	MEMORY STATISTICS[1]						
			DATA MEMORY						TOTAL
			INTERNAL	EXTERNAL[2]				STACK	
				PERSISTENT[3]			CONST		
				TILED8 (numBufs x Width x Height)	TILED16 (numBufs x Width x Height)	TILED PAGE / RAW	RAW		
MPEG2_DEC_001	All	21	0	0	0	1.5	412	2	436.5
MPEG2_DEC_002	352x288	21	0	3x354x290	3x354x146	1.5	412	2	888.7
	720x480	21	0	3x722x482	3x722x242	1.5	412	2	1967.9
	1920x1088	21	0	3x1922x1090	3x1922x546	1.5	412	2	9648.6

(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 4 Split-up of Media Controller Internal Data Memory Statistics

CONFIGURATION ID	DATA MEMORY - INTERNAL[1]		
	SHARED		INSTANCE
	CONSTANTS	SCRATCH	
MPEG2_DEC_001/ MPEG2_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 = 2040 K-bytes (for 1920x1088 resolution, YUV420)
    - Output buffer size = 3070.7 K-bytes (for decoding 1920x1088 resolution)
- 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). This is not valid incase of decoding erroneous frames with outloopDeblocking enabled, where the output buffer is accessed by Media Controller processor and the valid data might be in cache not in DDR.
- 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

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References

- ISO/IEC-13838-2: MPEG-2 Standard Specification
- eXpressDSP Algorithm Interoperability Standard (TMS320 Algorithm Interface Standard)
- MPEG-2 Decoder on HDVICP2 and Media Controller Based Platform User's Guide

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
CCITT	Committee Consultative International Telephone and Telegraph
DCT	Discrete Cosine Transform
DSP	Digital Signal Processing
HDTV	High Definition Television
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
ITU	International Telecommunication Union
MPEG	Motion Picture Experts Group
XDM	eXpressDSP Digital Media

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