

MPEG2 Main Profile Decoder (v01.00.00) on DM365

FEATURES

- eXpressDSP Digital Media (XDM1.0 IVIDDEC2) interface compliant
- Validated on DM365 EVM with MVL 5.0
- All I, P, and B frame decoding supported
- Both progressive and interlaced supported
- Supports MPEG1 streams
- Resolutions up to 1080P(1920 x 1088) supported
- Frame based decoding with frame size being multiples of 16 supported
- Outputs are available in YUV 420 interleaved formats (Y in one plane and U and V data interleaved to form the other plane)
- Uses configurable frame display delay for out of order display
- Performs slice level Error resilience
- Performs basic error concealment on erroneous frames and reports the type of error occurred
- This version of the decoder does not support

the following features:

- Dynamic change in resolution

DESCRIPTION

MPEG2 (from ISO/IEC) is a popular video coding algorithm enabling high quality multimedia services on a limited bandwidth network. MPEG2 standard defines several profiles and levels, which specify restrictions on the bit stream, and hence limits the capabilities needed to decode the bit-streams. This product is developed using Code Composer studio version 3.3.81.6 and using the code generation tools version 4.1.4.

PRODUCT PREVIEW



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

Performance Summary

This section describes the performance of standalone MPEG2 Main Profile Decoder validated on DM365 EVM resulting in performance equivalent to 30fps.

Table 1. Configuration Table

CONFIGURATION	ID
MPEG2 Main Profile	MPEG2_DEC_01

Performance Measurement Procedure

- Measured with program memory and I/O buffers in external memory, I/D cache enabled, ARM @297 MHz, DDR @ 243 MHz, Monta Vista Linux 5.0
- Linux 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.

Table 2. Cycles Information for Progressive Test Cases Using MPEG2_DEC_01

INPUT NAME	PERFORMANCE STATISTICS (MEGA CYCLES)						
	RESOLUTION	AVERAGE			PEAK		
		ARM926	HDVICP	FPS	ARM926	HDVICP	FPS
foreman_cif_prog_ip	CIF(352x288)	0.384	0.419	367.782	0.435	0.439	352.237
foreman_cif_prog_ipb	CIF(352x288)	0.389	0.452	351.370	0.436	0.507	320.410
mobcal_pal_prog_ip	D1(720x576)	0.384	1.641	146.477	0.434	1.715	140.647
mobcal_pal_prog_ipb	D1(720x576)	0.391	1.776	136.874	0.449	1.997	122.971
pedestrian_area_1080p_prog_ip	1080p(1920x1088)	0.386	7.738	36.536	0.456	8.168	34.691
pedestrian_area_1080p_prog_ipb	1080p(1920x1088)	0.394	8.416	33.692	0.485	9.794	29.088
shields_720p_prog_ip	720p(1280x720)	0.384	3.523	75.930	0.452	3.648	72.939
shields_720p_prog_ipb	720p(1280x720)	0.391	3.843	70.102	0.447	4.330	62.704
colorful_toys_cif_5frms_420p	CIF(352x288)	0.394	0.439	356.125	0.399	0.522	322.477
1080i25_shields_ter_20mbps_INT_ip	1080i(1920x1088)	0.776*	10.058	27.3765	0.884*	10.494	26.349
city_i1280x720_30fps_420pl_600fr_10mbps_INT_ip	720p(1280x720)	0.778*	1.658	121.4475	0.882*	1.794	114.338
mobi_ntsc_2mbps_INT_ip	D1(720x480)	0.768*	4.582	55.2855	0.882*	1.2285	52.1865

Table 3. Cycles Information for Progressive Test cases using MPEG2_DEC_01 in Closed Loop Configuration

INPUT NAME	PERFORMANCE STATISTICS (MEGA CYCLES)						
	RESOLUTION	AVERAGE			PEAK		
		ARM926	HDVICP	FPS	ARM926	HDVICP	FPS
1080p25_pedestrian_area_10mbps_PROG.m2v	1080p(1920x1088)	0.388	8.078	35.052	0.452	8.220	34.247
720p_30fps_420pl_600fr_10mbps_PROG.m2v	720p(1280x720)	0.386	3.478	76.634	0.449	3.673	72.506

Table 3. Cycles Information for Progressive Test cases using MPEG2_DEC_01 in Closed Loop Configuration (continued)

INPUT NAME	PERFORMANCE STATISTICS (MEGA CYCLES)						
	RESOLUTION	AVERAGE			PEAK		
		ARM926	HDVICP	FPS	ARM926	HDVICP	FPS
p720x480_25fps_420pl_252fr_2mbps_PROG.m2v	D1(720x480)	0.386	0.417	366.703	0.443	0.463	340.832
p352x288_30fps_420pl_300fr_1.5mbps_PROG.m2v	CIF(352x288)	0.388	1.374	167.448	0.443	1.437	159.949
1080i25_stockholm_ter_10mbps_INT.m2v	1080i(1920x1088)	0.768*	8.324	32.55	0.956*	8.582	31.334
720i_30fps_420pl_600fr_10mbps_INT.m2v	720i(1280x720)	0.782*	3.78	64.591	0.906*	3.928	62.3055
football_ntsc_8mbps_INT.m2v	D1(720x480)	0.768*	1.43	133.797	0.874*	1.51	125.502

* indicates that the ARM926 numbers are high, as these are interlaced test vectors and the decoded process call is made twice for every frame

Note:

- Decode frame depicts the cumulative load on ARM926 and HDVICP.
- The values in above 4 tables are as measured on the ARM926 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 HDVICP, the active load on ARM926 is the value mentioned in ARM926 column. Decoder frame time has no connection with HDVICP running at 243 MHz.
- All the values are collected (both average and peak) at frame-level processing.
- They are measured with Linux without any system traffic.
- The version of the code used to collect these numbers have the following features included:
 - Interrupt mode of operation – one interrupt signal processing overhead per frame
 - Resetting of HDVICP and loading of code into HDVICP Program Memory – once per stream
- Colorful_toys_cif_5frms_420P is a 5 frame test vector and hence it shows high MCycles and less FPS

Table 4. Memory Statistics (Host ARM926 External Memory)

CONFIGURATION ID	MEMORY STATISTICS in bytes ⁽¹⁾					
	PROGRAM MEMORY (Bytes)	DATA MEMORY				TOTAL
		CONSTANT (Bytes) ⁽²⁾	HEAP (Bytes)		STACK (Bytes)	
			PERSISTENT	SCRATCH		
MPEG2_DEC_01	192036	25984	38528	0	12288	268836

- (1) All these memory requirements are for ARM926 decoder library only. They do not include any memory requirements from test application side and input/output buffers for decoding. Stack, heap and code requirements for test-application are additional.
- (2) Constant memory size requirements include code memory of HDVICP since it forms a constant table on ARM926 before transfer. The constant size is the sum of .cinit, .bss, and .const sections used by MPEG2 decoder library.

Table 5. Internal Data Memory Split-Up

CONFIGURATION ID	DATA MEMORY - HDVICP (IN BYTES)			
	PROGRAM MEMORY (HDVICP)	DATA MEMORY(HDVICP)	HDVICP BUFFERS	VICP(BYTES)
MPEG2_DEC_01	49152	32768	ALL	NONE

Table 6. DM365 MPEG2 Decoder usage of Memory via CMEM

BUFFER	YUV420P
Input Buffer	0x2FD000
Output Buffer	0x2FD000
MEMTAB NUMBER	SIZE IN BYTES
Memtab 0	1536
Memtab 1	1536
Memtab 2	4864
Memtab 3	4864
Memtab 4	4224
Memtab 5	1280
Memtab 6	256
Memtab 7	128
Memtab 8	1536
Memtab 9	128
Memtab 10	256
Memtab 11	128
Memtab 12	17024
Memtab 13	768

The following CMEM allocations are dependent on the maxWidth and maxHeight and it provides the formula for calculating the size based on the input resolution:

- Output Buffer is calculated by making the width as a multiple of 32 and height as a multiple of 16. Therefore ,
Output Buffer = (16 * ceil (height / 16)) * (32 * ceil (width / 32)) * 1.5
- Output Buffer Size mentioned above is for one set of Luma and Chroma output buffer.

Notes

- HDVICP and MJCP
- The entire HDVICP is a video resource and is used by the codec
- The codec uses MJCP memory as scratch buffers and hence poses restriction on the usage of MJCP concurrently.

Table 7. DMA Configuration

TC Q's	TC 0	TC 1	TC 2	TC 3	Total
Usage	Reserved for system	Used by Codec	Used by Codec	Used by Codec	-
Priority	0	1	1	0	-
EDMA channels	NA	11	2	2	15
PaRAM Entries	NA	15	16	16	47
QDMA channels	0	0	0	0	0

- The HDVICP/EDMA resources are acquired using a generic resource manager known as Framework component. Please refer user 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 13818-2:2000(E), Information Technology – Coding Of Audio-Visual Objects – Part 2: Visual
- User Guide for MPEG2 Main Profile Decoder on DM365 (Literature Number: SPRUGS7A)

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
D1	Video Resolution for PAL(720x576) and NTSC(720x480)
DMA	Direct Memory Access
EVM	Evaluation Module
HDVICP	High Definition Video and Imaging Co-processor
NTSC	National Television System Committee
PAL	Phase Alternating Line
PSNR	Peak Signal to Noise Ratio
QCIF	Quarter Common Intermediate Format
QVGA	Quarter Video Graphics Array
SEI	Supplementary Enhancement Information
SQCIF	Sub Quarter Common Intermediate Format
VGA	Video Graphics Array
WVGA	Wide Video Graphics Array (864x480)
XDAIS	eXpressDSP Algorithm Interface Standard

Revision History

There are no changes in the datasheet for this release

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		Applications	
Amplifiers	amplifier.ti.com	Audio	www.ti.com/audio
Data Converters	dataconverter.ti.com	Automotive	www.ti.com/automotive
DLP® Products	www.dlp.com	Communications and Telecom	www.ti.com/communications
DSP	dsp.ti.com	Computers and Peripherals	www.ti.com/computers
Clocks and Timers	www.ti.com/clocks	Consumer Electronics	www.ti.com/consumer-apps
Interface	interface.ti.com	Energy	www.ti.com/energy
Logic	logic.ti.com	Industrial	www.ti.com/industrial
Power Mgmt	power.ti.com	Medical	www.ti.com/medical
Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
RFID	www.ti-rfid.com	Space, Avionics & Defense	www.ti.com/space-avionics-defense
RF/IF and ZigBee® Solutions	www.ti.com/lprf	Video and Imaging	www.ti.com/video
		Wireless	www.ti.com/wireless-apps