



- eXpressDSP Digital Media (XDM1.0 IVIDENC1) compliant
- Generates bit-streams compliant with the MPEG4 standard
- Progressive frame type picture encoding supported
- MPEG4 Simple Profile levels 0, 0b, 1, 2, 3, 4A, and 5 supported
- H.263 baseline profile levels 10, 20, 30, and 45 supported
- AC prediction supported up to CIF resolution
- Resync marker (packet mode) is supported.
- TI's proprietary motion estimation supported
- Half Pixel Interpolation (HPI) for motion estimation supported
- 4MV (four motion vectors) mode is supported
- Unrestricted Motion Vectors (UMV) supported
- Addition of video sequence end code in the bit stream supported
- Resolutions up to PAL D1 (720 x 576) and WVGA (864 x 480) are supported
- Setting of Quantization Parameter (QP) for I-frames and P-frames supported
- Rate Control (CBR and VBR) supported
- YUV420 semi-planar format for input frames is supported

## description

MPEG4(from ISO/IEC) is a popular video coding algorithm enabling high quality multimedia services on a limited bandwidth network. MPEG4 standard defines several profiles and levels, which specify restrictions on the bit stream, and hence limits the capabilities needed to encode/decode the bit-streams. This project is developed using Code Composer Studio version 3.3.49 and using the code generation tools version 6.0.8



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**Summary of Performance**

This section describes performance of Standalone MPEG4 Encoder tested on DM6467 EVM.

**Table 1. Configuration Table**

CONFIGURATION	ID
MPEG4 simple profile levels 0, 1, 2, 3, 4A, and 5; H263 baseline profiles 10, 20, 30, and 45	MPEG4_ENC_001

**Table 2. Cycles Information – Profiled on DM6467 EVM with Code Generation Tools Version 6.0.8**

CONFIGURATION ID	TEST DESCRIPTION	PERFORMANCE STATISTICS					
		AVERAGE			PEAK		
		DSP (C64X+) NON-BLOCKING CYCLES	DSP BLOCKING CYCLES	FPS (DSP @ 600 MHZ )	DSP (C64X+) NON-BLOCKING CYCLES	DSP BLOCKING CYCLES	FPS (DSP @ 600 MHZ )
MPEG4_ENC_001	foreman_176x144_399frames_420p.yuv (QCIF@30fps, 128 kbps, 150 frames )	11.54	13.78	841	11.70	14.09	831
	Mobile_352x288_300frames_420p.yuv (CIF@30fps, 512 kbps, 150 frames)	37.9	45.06	321	38.3	45.60	318
	foreman_352x288_300frames_420p.yuv (CIF@30fps, 384 kbps, 150 frames)	37.8	44.9	321	38.2	45.82	317
	hall_p640x480_300frames_420p.yuv (VGA@30fps 3Mbps, 100 frames)	111.3	132.2.4	132	113.1	134.0	130
	foreman_p640x480_30fps_420p_300fr.yuv (VGA@30fps 2Mbps, 100 frames)	110.6	132.0	132	112.0	133.9	131
	crowdrun_p720x480_30fps_420p_250fr.yuv (NTSC-D1 @30fps 2Mbps 100 frames)	125.6	149.4	117	127.2	153.0	115
	parkrun_p720x480_25fps_420p_252fr.yuv (NTSC D1 @30fps 4Mbps, 100 frames)	125.9	150.6	116	127.5	152.5	115

**Note:**

1. These figures depict the load on DSP and HDVICP separately. For calculating FPS, frame level overhead (on DSP) is added to maximum of DSP and HDVICP loads. These are actual cycles as seen from host on DM6467 EVM and will be close to cycles seen on the final system (for average case).
2. These figures are with Cache enabled on C64x+ side.
3. They are measured in standalone mode without actual framework.
4. All numbers are based on numbers collected [both average and peak] at frame level processing @ 30fps.
5. The version of the code used to collect these numbers have the following features included:

- i. Interrupt mode of operation – one interrupt signal processing overhead perMB pair.
  - ii. Resetting of vIMCOP and loading of code into ARM968 DTCM – once per frame.
6. Measured with program memory, stack, and I/O buffers in external memory with cache configuration : 32 KB L1P Program Cache, 32 KB L1D Data Cache and 64 KB L2 Cache. There could be a variation of approximately 1-2% in the values.

**Table 3. External memory Statistics (Host DSP)**

CONFIGURATION ID		MEMORY STATISTICS <sup>1,2</sup>						
		PROGRAM MEMORY	DATA MEMORY				STACK	TOTAL
			CONSTANT	HEAP				
				PERSISTENT	SCRATCH			
MPEG4_ENC_001	PAL-D1 (720x576)	140	16	1460	0	32	1648	
	NTSC-D1 (720x480)	140	16	1242	0	32	1430	
	VGA (640x480)	140	16	1118	0	32	1306	
	CIF (352x288)	140	16	437	0	32	625	
	QCIF (176x144)	140	16	163	0	32	351	

<sup>1</sup> All these memory requirements are for DSP encoder library only. Program memory size includes DMA library also. They do not include any memory requirements from test application side. Stack, heap and code requirements for test-application are extra. Constant memory size includes code size of ARM968 since it forms constant table on DSP to enable code transfer from DSP to ARM968. All memory requirements are expressed in terms of kilobytes. There could be a variation of approximately 1-2% in the values. <sup>2</sup>The constant size is the sum of .cinit, .bss, and .const sections used by MPEG4 encoder library. It includes the frame buffers.

<sup>2</sup> All memory requirements are expressed in terms of kilobytes..

**Table 4. Internal Data Memory Split-up**

CONFIGURATION ID	DATA MEMORY – INTERNAL		
	SHARED		PERSISTENT
	CONSTANTS	SCRATCH	
MPEG4_ENC_001	NA	32	NA

All memory requirements are expressed in terms of kilobytes.

**Resource requirement:**

- The entire HDVICP-0 is a video resource and uses 16K ITCM and 8K DTCM.
- 28 EDMA channels and 66 param entries are required.

**References**

- ISO/IEC 14496-2:2004, Information technology - Coding of audio-visual objects -- Part 2: Visual (Approved in 2004-05-24)
- H.263 ITU-T Standard - Video Coding for low bit rate communication



- User Guide for MPEG4 Encoder (literature number: SPRUFC0A)

## Glossary

Constants Elements that go into const memory section

## Acronyms

AC	Alternate Current
AIR	Adaptive Intra Refresh
CIF	Common Intermediate Format (352x288 resolution)
CBR	Constant Bit Rate control
DMA	Direct Memory Access
DP	Data Partitioning
D1	720x576 resolution for PAL and 720x480 resolution for NTSC
DSP	Digital Signal Processor
EVM	Evaluation Module
FPS	Frames Per Second
H263	ITU-T video compression standard
HPI	Half Pixel Interpolation
ITU	International Telecommunication Union
MPEG	Motion Picture Expert Group
MV	Motion Vector
NTSC	National Television Standards Committee (Television standard)
PAL	Phase Alteration by Line (Television standard)
PSNR	Peak Signal to Noise Ratio
QP	Quantization Parameter
QCIF	Quarter Common Intermediate Format (176x144 resolution)
QVGA	Quarter Video Graphics Array (320x240 resolution)
RVLC	Reversible Variable Length Coding
SQCIF	Sub Quarter Common Intermediate Format
TCM	Tightly Coupled Memory
UMV	Unrestricted Motion Vectors
VBR	Variable Bit Rate control
VGA	Video Graphics Array (640x480 resolution)



vIMCOP	Video and Imaging co-processor
WVGA	Wide VGA resolution (864x480)
XDAIS	eXpressDSP Algorithm Interface Standard
XDM	eXpressDSP Digital Media
YUV	Raw video format Y(luminance) UV (Chrominance)

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