MPEG4 Simple Profile Encoder (v02.02.04) on DM6446

FEATURES

- **eXpressDSP™ Digital Media (XDM 1.0 IVIDENC1) interface compliant**
- **Validated on the DM6446 EVM**
- **MPEG4 simple profile levels 0, 1, 2, 3, 4A, and 5 compliant**
- **H.263 baseline profile levels 10, 20, 30, and 45 supported**
- **Standard TM5 rate control algorithm supported**
- **TI's proprietary rate control algorithms supported**
- **Generates bit streams compliant with the video buffering verifier as per MPEG4 standard**
- **Data Partitioning (DP) and Reversible Variable Length Code (RVLC) supported**
- **AC prediction supported**
- **Adaptive and mandatory intra refresh supported**
- **Image width and height which are non-multiple of 16 supported**
- **Unrestricted Motion Vectors (UMV) for both MPEG4 and H.263 supported**
- **Addition of video sequence end code in the bit stream supported**
- **TI's proprietary content adaptive motion estimation supported**
- **Resolutions up to PAL D1 (720 x 576) supported**
- **Half Pel Interpolation (HPI) for motion estimation supported**
- **Setting of Quantization Parameter (QP) for I-frames and P-frames supported**
- **I-frame insertion and changing size of video packets at run-time supported**
- **422i or 420 input formats for the frames supported**
- **Motion vector access supported**
- **Provides high speed/high quality options using encoding preset**
- **This codec can be used on any of TI's C64x+ based platforms**

DESCRIPTION

MPEG4 is the ISO/IEC recommended standard for video compression. It is validated on the DM6446 EVM with Code Composer Studio version 3.2.39.4 and code generation tools version 6.0.14.

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Performance Summary

This section describes performance of the MPEG4 Simple Profile Encoder on DM6446 EVM.

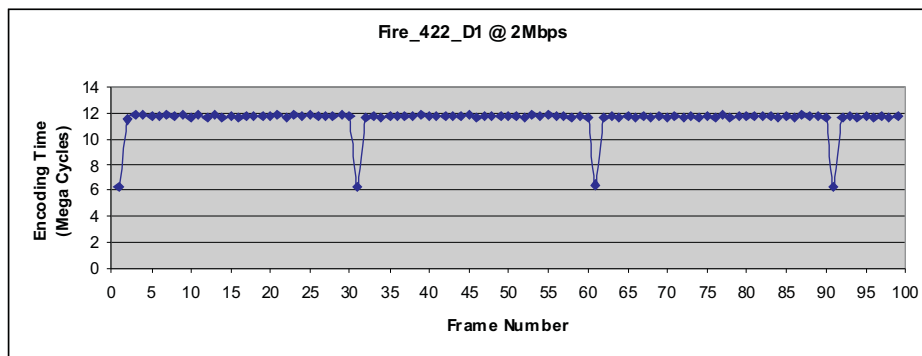**Table 1. Configuration Table**

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 DM6446 EVM with Code Generation Tools Version 6.0.14

CONFIGURATION ID	PERFORMANCE STATISTICS (MEGA CYCLES PER SECOND)[1][2]		
	TEST DESCRIPTION	AVERAGE[3]	PEAK[4]
MPEG4_ENC_001 (HIGH_SPEED preset and PLR4 rate control)	e-traffic.yuv, YUV420/PAL D1 @ 4 Mbps with 1MV, HPI on. UMV on	313	321
	Fire_420.yuv, YUV420/NTSC D1 @ 2 Mbps with 1MV, HPI on. UMV on	315	320
	Fire_422.yuv, YUV422/NTSC D1 @ 2 Mbps with 1MV, HPI on. UMV on	330	339
	Fire_420.yuv, YUV420/NTSC D1 @ 4 Mbps with 1MV, HPI on. UMV on	329	335
	Foreman.yuv, YUV420/VGA @ 4 Mbps with 1MV, HPI on. UMV on	288	301
	Mobile.yuv, YUV420/CIF @ 512 Kbps with 1MV, HPI on. UMV on	93	98
	Foreman.yuv, YUV420/QCIF @ 256 Kbps with 1MV, HPI on. UMV on	27	29
MPEG4_ENC_001 (HIGH_QUALITY preset and PLR4 rate control)	e-traffic.yuv, YUV420/PAL D1 @ 4 Mbps with 1MV, HPI on. UMV on	342	352
	Fire_420.yuv, YUV420/NTSC D1 @ 2 Mbps with 1MV, HPI on. UMV on	343	349
	Fire_422.yuv, YUV422/NTSC D1 @ 2 Mbps with 1MV, HPI on. UMV on	359	367
	Fire_420.yuv, YUV420/NTSC D1 @ 4 Mbps with 1MV, HPI on. UMV on	357	364
	Foreman.yuv, YUV420/VGA @ 4 Mbps with 1MV, HPI on. UMV on	314	325
	Mobile.yuv, YUV420/CIF @ 512 Kbps with 1MV, HPI on. UMV on	102	105
	Foreman.yuv, YUV420/QCIF @ 256 Kbps with 1MV, HPI on. UMV on	30	32

(1) Measured with program memory, stack, and I/O buffers in external memory with cache configuration 32K-bytes L1P program cache, 64K-bytes L1D data memory, 16K-bytes L1D data cache, and 64K-bytes L2 cache.
(2) There could be a variation of approximately ±5% in values.
(3) Based on average number of cycles per frame @ 30 frames per second (fps) except for PAL D1. For PAL D1, the frame rate is 25 fps. The intra frame period used is 1 second for all the sequences.
(4) Based on worst case cycles per frame @ 30 fps. For PAL D1, the frame rate is 25 fps.

Encoding Time for Individual Frames (Fire_422.yuv, YUV422/720x480 @ 2 Mbps @ 30 fps with 1 MV, HPI, UMV, and High Quality Preset)

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Table 3. Memory Statistics - Generated with Code Generation Tools Version 6.0.14

CONFIGURATION ID		PROGRAM MEMORY	MEMORY STATISTICS[1]				
			DATA MEMORY			STACK	TOTAL
			INTERNAL	EXTERNAL			
				PERSISTENT	SCRATCH		
MPEG4_ENC_001	PAL-D1	169	52	1579	1564	8	3372
	NTSC-D1	169	52	1350	1319	8	2898
	VGA	169	52	1217	1180	8	2626
	CIF	169	52	496	431	8	1156
	QCIF	169	52	202	142	8	573

(1) All memory requirements are expressed in kilobytes (1K-byte = 1024 bytes) and there could be a variation of approximately 1-2% in values.

Table 4. Internal Data Memory Split-Up

CONFIGURATION ID	DATA MEMORY - INTERNAL[1]		INSTANCE[2]
	SHARED		
	CONSTANTS	SCRATCH	
MPEG4_ENC_001	0	52	0

(1) Internal memory refers to L1DRAM. All memory requirements are expressed in kilobytes and there could be a variation of approximately 1-2% in values.
(2) I/O buffers not included. Some of the instance memory buffers could be scratch.

Table 5. Co - Processor(s) Memory Statistics

CONFIGURATION ID	SEQ DATA MEMORY [1]	SEQ PROG MEMORY[1]	IMX WORKING MEM[1]	IMX IMG BUF[1]	IMX CMD MEM [1]
MPEG4_ENC_001	0	0	0	0	0

(1) All memory requirements are expressed in kilobytes and all are scratch buffers.

Table 6. PSNR and Bit-Rate

TEST SEQUENCE	BIT RATE RANGE	BIT RATE/AVERAGE LUMA PSNR								
		LOW RATE			MID RATE			HIGH RATE		
		P [1]	FD [2]	BD [3]	P [1]	FD [2]	BD [3]	P [1]	FD [2]	BD [3]
Mobile CIF (352x288), 30 fps, 300 frames		384 kbps			768 kbps			1280 kbps		
	Case 1 [4]	23.27	0	0.65	25.74	0	0.66	27.89	0	0.67
	Case 2 [5]	23.31	0	1.4	25.74	0	0.66	27.89	0	0.67
Tennis D1 (704x480), 30 fps, 150 frames		2000 kbps			3000 kbps			4000 kbps		
	Case 1 [4]	30.91	0	0.67	32.3	0	0.64	33.36	0	1
	Case 2 [5]	30.91	0	0.67	32.3	0	0.64	33.36	0	1

(1) PSNR in decibels. In case of frame drop, PSNR is measured by repeating previous frame.
(2) Number of frame drops
(3) Percentage deviation in bit-rate
(4) Rate control used is IVIDEO_LOW_DELAY, High Quality Preset, intra frame period = 1 second
(5) Rate control used is IVIDEO_STORAGE, High Quality Preset, intra frame period = 1 second

Table 7. PSNR Comparision with Reference Encoder [1]

TEST SEQUENCE	BIT RATE RANGE	BIT RATE/AVERAGE LUMA PSNR		
		LOW RATE	MID RATE	HIGH RATE
Mobile CIF (352x288), 30 fps, 300 frames		PD [2]	PD [2]	PD [2]
		384 kbps	768 kbps	1280 kbps
	Case 1 [3]	0.13	0.19	0.14
	Case 2 [4]	0.09	0.19	0.14
Tennis D1 (704x480), 30 fps, 150 frames		2000 kbps	3000 kbps	4000 kbps
	Case 1 [3]	0.15	0.29	0.43
	Case 2 [4]	0.15	0.29	0.43

(1) Reference encoder is xVID version 1.1.0 configured for single pass, quality level = 2, intra frame period = 1 second
(2) PSNR differences of TI encoder and xVID encoder in decibels
(3) Rate control used is IVIDEO_LOW_DELAY, High Quality Preset
(4) Rate control used is IVIDEO_STORAGE, High Quality Preset

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Notes

- Evaluation version performance may be off by up to 30 MHz
- I/O buffers:
  - Input buffer size = 810K-bytes (PAL D1 (720 x 576), one YUV422 interleaved frame)
  - Output buffer size = 256K-bytes (for encoding one PAL D1 (720 x 576) frame)
- Memory Configuration
  - L1P: 32K-bytes program cache
  - L1D: 64K-bytes data memory and 16K-bytes data cache
  - L2: 64K-bytes 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)
- The algorithm uses 4 QDMA channels. The maximum number of linked transfers is 8. The algorithm uses DMAN3 interface for logical allocation of these channels.

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
- *MPEG4 Simple Profile Encoder on DM6446 User's Guide* (literature number: SPRUEA2F)

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

ACRONYMS	DESCRIPTION
CIF	Common Intermediate Format
EVM	Evaluation Module
HPI	Half Pel Interpolation
MV	Motion Vector
QP	Quantization Parameter
QCIF	Quarter Common Intermediate Format
QVGA	Quarter Video Graphics Array
SQCIF	Sub Quarter Common Intermediate Format
TM5	Test Model 5
TMN5	Test Model Near Term, version 5
UMV	Unrestricted Motion Vectors
VGA	Video Graphics Array
VM4	Verification Model 4
XDM	eXpressDSP Digital Media

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Revision History

This data sheet revision history highlights the changes made to the SPRS316E codec specific data sheet to make it SPRS316F.

Table 8. Revision History of MPEG4 Simple Profile Encoder on DM6446

SECTION	ADDITIONS/MODIFICATIONS/DELETIONS
Global	• Modifed codec version number to 02.02.04 **NOTE:** There are no changes in user guide and data sheet for this release.

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