

MPEG4 Simple Profile Encoder (v2.04) on OMAP3530

FEATURES

- eXpressDSP™ Digital Media (XDM 1.0 IVIDENC1) interface compliant
- Validated on the OMAP3530 EVM
- MPEG4 Simple Profile levels 0, 1, 2, 3, 4A, 5, and 6 compliant
- H.263 Baseline Profile levels 10, 20, 30, 40, 45, 50, 60 and 70 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 WVGA 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
- Four motion vectors supported (4MV)
- Writing of the VBV parameters into the bit-stream supported
- Access to the packet size information for each frame supported
- H.263 Slice Mode supported
- Motion estimation is performed using the iME hardware accelerator provided on the IVA2.2 sub-system

DESCRIPTION

MPEG4 is the ISO/IEC recommended standard for video compression. It is validated on the OMAP3530 EVM with Code Composer Studio version 3.3.38.2 and code generation tools version 6.0.14.

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Performance Summary

This section describes the performance of MPEG4 Simple Profile Encoder in OMAP3530 EVM.

Table 1. Configuration Table

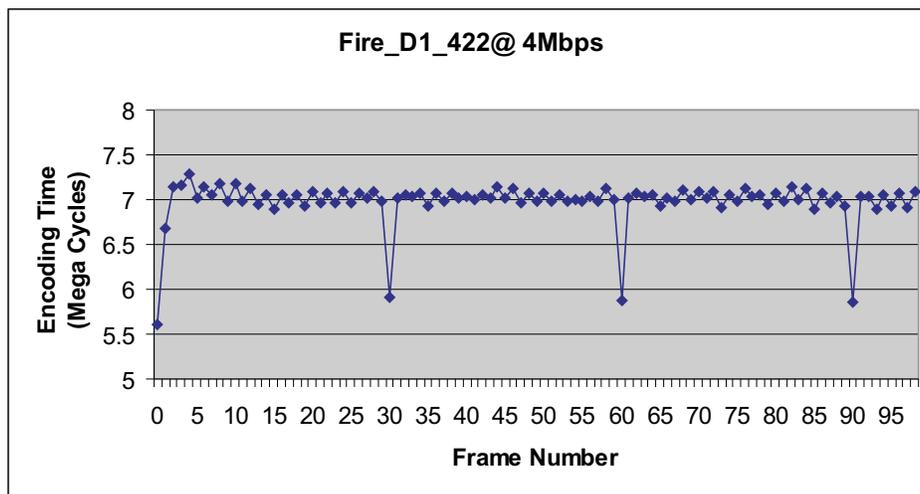
CONFIGURATION	ID
MPEG4 simple profile levels 0, 1, 2, 3, 4A, 5, and 6; H263 baseline profiles 10, 20, 30, 40, 45, 50, 60, and 70	MPEG4_ENC_001

Table 2. Cycles Information– Profiled on OMAP3530 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	Fire_D1_420.yuv, YUV420/NTSC D1 @ 4 Mbps and 30 fps, with 1MV, HPI on, UVM on, DP off, RVLC off, AC prediction off	205	214
	Fire_D1_422.yuv, YUV422/NTSC D1 @ 4 Mbps and 30 fps, with 1MV, HPI on, UVM on, DP off, RVLC off, AC prediction off	209	218
	Foreman_VGA_420.yuv, YUV420/VGA @ 4 Mbps and 30fps with 1MV, HPI on, UVM on, DP off, RVLC off, AC prediction off	178	187
	Mobile_CIF_420.yuv, YUV420/CIF @ 512 Kbps and 30 fps with 1MV, HPI on, UVM on, DP off, RVLC off, AC prediction off	59	62
	Mobile_CIF_422.yuv, YUV422/CIF @ 512 Kbps and 30 fps with 1MV, HPI on, UVM on, DP off, RVLC off, AC prediction off	60	63
	Foreman_QCIF_420.yuv, YUV420/QCIF @ 256 Kbps and 30fps with 1MV, HPI on, UVM on, DP off, RVLC off, AC prediction off	19	19
	Fire_D1_420.yuv, YUV420/NTSC D1 @ 4 Mbps and 30 fps, with 4MV, HPI on, UVM on, DP off, RVLC off, AC prediction off	265	274
	Mobile_CIF_420.yuv, YUV420/CIF @ 512 Kbps and 30 fps with 4MV, HPI on, UVM on, DP off, RVLC off, AC prediction off	93	94
	crew_WVGA_420_60fr.yuv, YUV420/856x480 @ 4Mbps and 30 fps, with 1MV, HPI on, UVM on, DP off, RVLC off, AC prediction off	233	258

- (1) Measured with program memory, stack, and I/O buffers in external memory with cache configuration 32 K-bytes L1P program cache, 64 K-bytes L1D data memory, 16 K-bytes L1D data cache, and 64 K-bytes L2 cache, CPU@350MHz.
- (2) Average and peak MCPS measurements can vary by ±5%
- (3) Based on average number of cycles per frame @ 30 fps, the intra frame period used is one second for all the sequences. The error resiliency tools and AC prediction are switched off for all the sequences.
- (4) Based on worst-case cycles per frame @ 30 fps.

Encoding Time for Individual Frames (Fire_D1_422.yuv, YUV422/720x480 @ 4 Mbps @ 30 fps with 1 MV, HPI, UVM on)



PRODUCT PREVIEW

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

CONFIGURATION ID		MEMORY STATISTICS ⁽¹⁾					TOTAL
		PROGRAM MEMORY	DATA MEMORY				
			INTERNAL	EXTERNAL		STACK	
				PERSISTENT	SCRATCH		
MPEG4_ENC_001	WVGA	172	63.5	1584	1503	8	3330.5
	PAL-D1	172	63.5	1580	1500	8	3323.5
	NTSC-D1	172	63.5	1360	1260	8	2863.5
	VGA	172	63.5	1235	1125	8	2603.5
	CIF	172	63.5	560	399	8	1202.5
	QCIF	172	63.5	297	124	8	664.5

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

Table 4. Internal Data Memory Split-Up

CONFIGURATION ID	DATA MEMORY - INTERNAL ⁽¹⁾		
	SHARED		INSTANCE ⁽²⁾
	CONSTANTS	SCRATCH	
MPEG4_ENC_001	0	63.5	0

(1) Internal memory refers to L1DRAM. All memory requirements are expressed in kilobytes and there could be a variation of around 1-2% in numbers.

(2) I/O buffers not included. Some of the instance memory buffers could be scratch.

Table 5. Co-Processor(s) Memory Statistics [IVA 2.2]

CONFIGURATION ID	SEQ(ARM9) DATA MEMORY ⁽¹⁾	SEQ(ARM9) PROG MEMORY ⁽¹⁾	SHARED L2 (SL2) MEMORY ⁽¹⁾
MPEG4_ENC_001	4	8	32

(1) All memory requirements are expressed in kilobytes and all are scratch buffers for frame level encoding.

Table 6. PSNR and Bit-Rate Details

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⁾
		384 kbps			768 kbps			1280 kbps		
Mobile CIF (352x288), 30 fps, 300 frames	Case1 ⁽⁴⁾	23.29	0	2.11	25.64	0	0.65	27.78	0	0.66
	Case2 ⁽⁵⁾	23.24	0	0.66	25.64	0	0.65	27.78	0	0.66
Tennis D1 (704x480), 30 fps, 150 frames		2000 kbps			3000 kbps			4000 kbps		
	Case1 ⁽⁴⁾	30.88	0	0.65	32.31	0	0.76	33.36	0	1.02
	Case2 ⁽⁵⁾	30.92	0	0.6	32.31	0	0.76	33.36	0	1.02

(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, intra frame period = 1second, number of MV is 1 (1MV)

(5) Rate control used is IVIDEO_STORAGE, intra frame period = 1second, number of MV is 1 (1MV).

Table 7. PSNR Comparison with Reference Encoder⁽¹⁾

TEST SEQUENCE	BIT-RATE RANGE	BIT-RATE / AVERAGE LUMA PSNR		
		LOW RATE	MID RATE	HGH RATE
		PD ⁽²⁾	PD ⁽²⁾	PD ⁽²⁾
		384 kbps	768 kbps	1280 kbps
Mobile CIF (352x288), 30 fps, 300 frames	Case1 ⁽³⁾	0.11	0.29	0.25
	Case2 ⁽⁴⁾	0.16	0.29	0.25
Tennis D1 (704x480), 30 fps, 150 frames		2000 kbps	3000 kbps	4000 kbps
	Case1 ⁽³⁾	0.18	0.28	0.43
	Case2 ⁽⁴⁾	0.14	0.28	0.43

(1) Reference encoder is xVID version 1.1.0 configured for single pass, quality level = 2, intra frame period = 1 second, number of MV is 1 (1MV).

(2) PSNR differences of TI encoder and xVID encoder in decibels.

(3) Rate control used is IVIDEO_LOW_DELAY.

(4) Rate control used is IVIDEO_STORAGE.

Notes

- Evaluation version performance may be off by up to 30 MHz
- I/O buffers:
 - Input buffer size = 810 K-bytes (PAL D1 (720 x 576), one YUV422 interleaved frame)
 - Output buffer size = 256 K-bytes (for encoding one PAL D1 (720 x 576) frame)
- Memory Configuration
 - L1P: 32 K-bytes program cache
 - L1D: 64 K-bytes data memory and 16K-bytes data cache
 - L2: 64 K-bytes cache
- The performance values obtained in Table 2 are sensitive to algorithm code placement. Refer the sample linker file provided in test application setup for algorithm code placement. This is used for profiling in Table
- The algorithm uses 6 QDMA channels and parameter space equal to 39 parameter entries. The algorithm uses DMAN3 interface for logical allocation of these channels
- 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)

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 OMAP3530 User's Guide*(literature number: SPRUFN9A)

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
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
UMV	Unrestricted Motion Vectors
XDM	eXpressDSP Digital Media

Revision History

This revision history highlights the changes made to the SPRS532 codec specific user guide to make it SPRS532A

Table 8. MPEG4 Simple Profile Encoder (v2.04) on OMAP3530

SECTION	CHANGES
Table 2	<ul style="list-style-type: none">• Modified Average and Peak values
Table 3	<ul style="list-style-type: none">• Modified Memory values

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