

- eXpressDSP™ Algorithm Interface Standard (XDAIS) compliant
- eXpressDSP Digital Media (XDM) interface compliant
- Validated on the TMS320C6678 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
- Supports ELF ABI format.
- Supports "ecpy" for EDMA and "IRES" interface.

**description**

MPEG4 is the ISO/IEC recommended standard for video compression. It is validated on the TMS320C6678 EVM with Code Composer Studio version 5.2.1.00018 and code generation tools version 7.4.0.

**summary of performance**

**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 TMS320C6678 EVM with Code Generation Tools Version 7.4.0**

CONFIGURATION ID	PERFORMANCE STATISTICS (IN MEGA CYCLES PER SEC) <sup>1</sup>		
	TEST DESCRIPTION	AVERAGE <sup>2</sup>	PEAK <sup>3</sup>
MPEG4_ENC_001 (HIGH_SPEED preset and PLR4 rate control)	akiyo_standard_720x576_420p_300frames.yuv @ 4 Mbps with 1MV, HPI on. UMV on.	423	452
	coastguard_640x480_420p_300frames.yuv @ 4 Mbps with 1MV, HPI on. UMV on.	360	372
	Mobile_cif.yuv, YUV420/CIF @ 512 Kbps with 1MV, HPI on. UMV on.	116	120
	bus_352x288_420p_150frames.yuv @ 512 Kbps with 1MV, HPI on. UMV on.	109	120
	news_352x288_420p_300frames.yuv @ 512 Kbps with 1MV, HPI on. UMV on.	111	116
	dancer_352x288_420p_250frames.yuv @ 512 Kbps with 1MV, HPI on. UMV on.	115	119
	garden_352x288_420p_374frames.yuv @ 512 Kbps with 1MV, HPI on. UMV on.	112	116
MPEG4_ENC_001 (HIGH_QUALITY preset and PLR4 rate control )	akiyo_standard_720x576_420p_300frames.yuv @ 4 Mbps with 1MV, HPI on. UMV on.	492	531
	coastguard_640x480_420p_300frames.yuv @ 4 Mbps with 1MV, HPI on. UMV on.	414	425
	Mobile_cif.yuv, YUV420/CIF @ 512 Kbps with 1MV, HPI on. UMV on.	132	136
	bus_352x288_420p_150frames.yuv @ 512 Kbps with 1MV, HPI on. UMV on.	128	135
	news_352x288_420p_300frames.yuv @ 512 Kbps with 1MV, HPI on. UMV on.	127	130
	dancer_352x288_420p_250frames.yuv @ 512 Kbps with 1MV, HPI on. UMV on.	131	135
	garden_352x288_420p_374frames.yuv @ 512 Kbps with 1MV, HPI on. UMV on.	129	132

<sup>1</sup> Measured with program memory in MSMCSRAM, stack in internal memory and I/O buffers in external memory with cache configuration 32K-bytes L1P program cache, 32K-bytes L1D data cache, and 128K-bytes L2 cache.

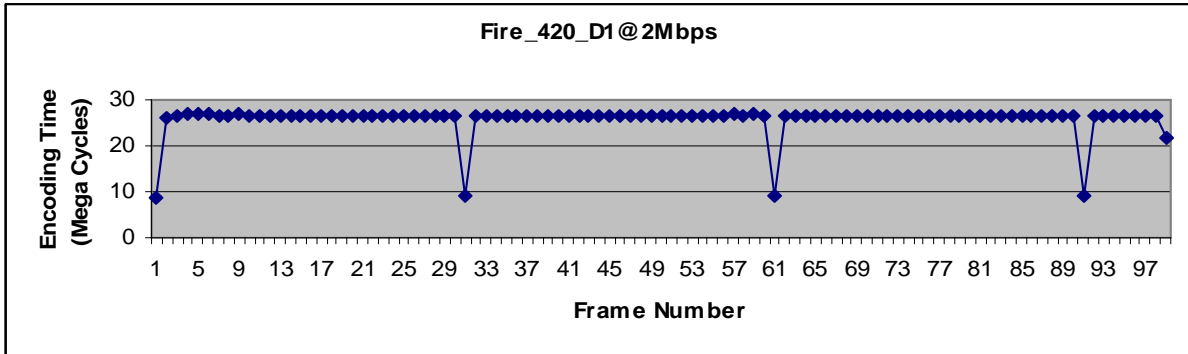
<sup>2</sup> Based on average number of cycles per frame @ 30 fps except for PAL D1. For PAL D1, the frame rate is 25 fps. The intra frame period used is 1second for all the sequences.

<sup>3</sup> Based on worst case cycles per frame @ 30 fps. For PAL D1, the frame rate is 25 fps

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**Figure 1. Encoding Time for Individual Frames (Fire\_420.yuv, YUV420/720x480 @ 2 Mbps @ 30 fps with 1 MV, HPI, UMV, and High Quality Preset)**



**Table 3. Memory Statistics - Generated with Code Generation Tools Version 7.2.2**

CONFIGURATION ID		MEMORY STATISTICS <sup>4</sup>					
		PROGRAM MEMORY	INTERNAL	EXTERNAL		STACK	TOTAL
				PERSISTENT	SCRATCH		
MPEG4_ENC_001	PAL-D1	171	52	1567	1564	12	3366
	NTSC-D1	171	52	1338	1319	12	2892
	VGA	171	52	1205	1180	12	2620
	CIF	171	52	484	432	12	1151
	QCIF	171	52	190	142	12	567

<sup>4</sup> 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 <sup>5</sup>		
	SHARED		INSTANCE <sup>6</sup>
	CONSTANTS	SCRATCH	
MPEG4_ENC_001	0	52	0

<sup>5</sup> Internal memory refers to L1DRAM. All memory requirements are expressed in kilobytes and there could be a variation of around 1-2% in numbers.

<sup>6</sup> I/O buffers not included. Some of the instance memory buffers could be scratch.

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**Table 5. Co Processor(s) Memory Statistics**

CONFIGURATION ID	SEQ DATA MEMORY <sup>7</sup>	SEQ PROG MEMORY <sup>7</sup>	IMX WORKING MEM <sup>7</sup>	IMX IMG BUF <sup>7</sup>	IMX CMD MEM <sup>7</sup>
MPEG4_ENC_001	0	0	0	0	0

<sup>7</sup> All memory requirements are expressed in kilobytes and all are scratch buffers.

**Table 6. PSNR and Bit-Rate details**

Test Sequence	Bit-rate range	BIT-RATE / AVERAGE LUMA PSNR								
		Low rate			Mid rate			High rate		
		P <sup>8</sup>	FD <sup>9</sup>	BD <sup>10</sup>	P <sup>8</sup>	FD <sup>9</sup>	BD <sup>10</sup>	P <sup>8</sup>	FD <sup>9</sup>	BD <sup>10</sup>
<b>Mobile CIF (352x288), 30 fps, 300 frames</b>		<b>384 kbps</b>			<b>768 kbps</b>			<b>1280 kbps</b>		
	Case1 <sup>11</sup>	23.27	0	1.6	25.67	0	0.66	27.81	0	0.67
	Case2 <sup>12</sup>	23.26	0	0.63	25.67	0	0.66	27.81	0	0.67
<b>Tennis D1 (704x480), 30 fps, 150 frames</b>		<b>2000 kbps</b>			<b>3000 kbps</b>			<b>4000 kbps</b>		
	Case1 <sup>11</sup>	30.76	0	0.63	32.14	0	0.75	33.21	0	0.82
	Case2 <sup>12</sup>	30.81	0	0.63	32.14	0	0.75	33.21	0	0.82

<sup>8</sup> PSNR in decibels. In case of frame drop, PSNR is measured by repeating previous frame

<sup>9</sup> Number of frame drops

<sup>10</sup> Percentage deviation in bit-rate

<sup>11</sup> Rate control used is IVIDEO\_LOW\_DELAY, High Quality Preset, intra frame period = 1second

<sup>12</sup> Rate control used is IVIDEO\_STORAGE, High Quality Preset, intra frame period = 1second

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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 : 32 K-bytes program cache
  - L1D : 32 K-bytes data cache
  - L2 : 128 K-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)

#### 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 SPRUH66)

#### glossary

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



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## acronyms

ABI	Application Binary Interface
CIF	Common Intermediate Format
EDMA	Enhanced Direct Memory Access
ELF	Executable and Linkable 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
XDAIS	eXpressDSP Algorithm Interface Standard
XDM	eXpressDSP Digital Media



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