- **eXpressDSP™ Algorithm Interface Standard (XDAIS) compliant**
- **eXpressDSP Digital Media (XDM) interface compliant**
- **Validated on the DM6437 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**

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TEXAS INSTRUMENTS

description

MPEG4 is the ISO/IEC recommended standard for video compression. It is validated on the DM6437 EVM with Code Composer Studio version 3.3.26 and code generation tools version 6.0.8.

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 DM6437 EVM with Code Generation Tools Version 6.0.8**

CONFIGURATION ID	PERFORMANCE STATISTICS (IN MEGA CYCLES PER SEC)[1]		
	TEST DESCRIPTION	AVERAGE[2]	PEAK[3]
MPEG4_ENC_001 (HIGH_SPEED preset and PLR4 rate control)	e-traffic.yuv, YUV420/PAL D1 @ 4 mbps with 1MV, HPI on. UMV on.	300	310
	Fire_420.yuv, YUV420/NTSC D1 @ 2 mbps with 1MV, HPI on. UMV on.	303	309
	Fire_422.yuv, YUV422/NTSC D1 @ 2 mbps with 1MV, HPI on. UMV on.	326	332
	Fire_420.yuv, YUV420/NTSC D1 @ 4 mbps with 1MV, HPI on. UMV on.	316	322
	Foreman.yuv, YUV420/VGA @ 4 mbps with 1MV, HPI on. UMV on.	277	288
	Mobile.yuv, YUV420/CIF @ 512 kbps with 1MV, HPI on. UMV on.	90	92
	Foreman.yuv, YUV420/QCIF @ 256 kbps with 1MV, HPI on. UMV on.	27	28
MPEG4_ENC_001 (HIGH_QUALITY preset and PLR4 rate control)	e-traffic.yuv, YUV420/PAL D1 @ 4 mbps with 1MV, HPI on. UMV on.	327	338
	Fire_420.yuv, YUV420/NTSC D1 @ 2 mbps with 1MV, HPI on. UMV on.	331	336
	Fire_422.yuv, YUV422/NTSC D1 @ 2 mbps with 1MV, HPI on. UMV on.	354	359
	Fire_420.yuv, YUV420/NTSC D1 @ 4 mbps with 1MV, HPI on. UMV on.	344	352
	Foreman.yuv, YUV420/VGA @ 4 mbps with 1MV, HPI on. UMV on.	302	313
	Mobile.yuv, YUV420/CIF @ 512 kbps with 1MV, HPI on. UMV on.	98	100
	Foreman.yuv, YUV420/QCIF @ 256 kbps with 1MV, HPI on. UMV on.	29	30

[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 128K-bytes L2 cache.
[2] 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.
[3] 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_422.yuv, YUV422/720x480 @ 2 mbps @ 30 fps with 1 MV, HPI, UMV, and High Quality Preset)
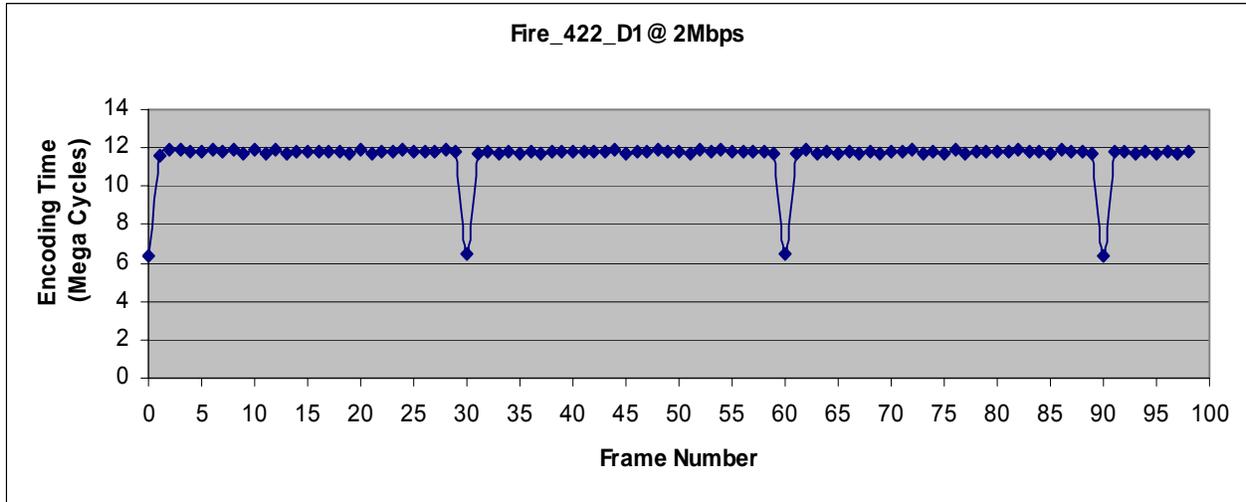

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Table 3.   Memory Statistics - Generated with Code Generation Tools Version 6.0.8

CONFIGURATION ID		PROGRAM MEMORY	MEMORY STATISTICS[4]				
			DATA MEMORY			STACK	TOTAL
			INTERNAL	EXTERNAL			
				PERSISTENT	SCRATCH		
MPEG4_ENC_001	PAL-D1	167	52	1579	1564	8	3370
	NTSC-D1	167	52	1350	1319	8	2896
	VGA	167	52	1217	1180	8	2624
	CIF	167	52	496	431	8	1154
	QCIF	167	52	202	142	8	571

[4] 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[5]		INSTANCE[6]
	SHARED		
	CONSTANTS	SCRATCH	
MPEG4_ENC_001	0	52	0

4

[5] Internal memory refers to L1DRAM. All memory requirements are expressed in kilobytes and there could be a variation of around 1-2% in numbers.
[6] 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[7]	SEQ PROG MEMORY[7]	IMX WORKING MEM[7]	IMX IMG BUF[7]	IMX CMD MEM[7]
MPEG4_ENC_0 01	0	0	0	0	0

[7] 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[8]	FD[9]	BD[10]	P[8]	FD[9]	BD[10]	P[8]	FD[9]	BD[10]
Mobile CIF (352x288), 30 fps, 300 frames		384 kbps			768 kbps			1280 kbps		
	Case1[11]	23.27	0	0.65	25.74	0	0.66	27.89	0	0.67
	Case2[12]	23.31	0	1.4	25.74	0	0.66	27.89	0	0.67
Tennis D1 (704x480), 30 fps, 150 frames		2 mbps			3 mbps			4 mbps		
	Case1[11]	30.91	0	0.67	32.3	0	0.64	33.36	0	1
	Case2[12]	30.91	0	0.67	32.3	0	0.64	33.36	0	1

[8] PSNR in decibels. In case of frame drop, PSNR is measured by repeating previous frame
[9] Number of frame drops
[10] Percentage deviation in bit rate
[11] Rate control used is IVIDEO_LOW_DELAY, High Quality Preset, intra frame period = 1second
[12] Rate control used is IVIDEO_STORAGE, High Quality Preset, intra frame period = 1second

Table 7.   PSNR Comparison with Reference Encoder[13]

Test Sequence	Bit-rate range	BIT-RATE / AVERAGE LUMA PSNR		
		Low rate	Mid rate	High rate
		PD[14]	PD[14]	PD[14]
Mobile CIF (352x288), 30 fps, 300 frames		384 kbps	768 kbps	1280 kbps
	Case1[11]	0.13	0.19	0.14
	Case2[12]	0.09	0.19	0.14
Tennis D1 (704x480), 30 fps, 150 frames		2000 kbps	3000 kbps	4000 kbps
	Case1[11]	0.15	0.29	0.43
	Case2[12]	0.15	0.29	0.43

[11] Rate control used is IVIDEO_LOW_DELAY, High Quality Preset
[12] Rate control used is IVIDEO_STORAGE, High Quality Preset
[13] Reference encoder is xVID version 1.1.0 configured for single pass, quality level = 2, intra frame period = 1 second
[14] PSNR differences of TI encoder and xVID encoder in decibels

PRODUCT PREVIEW

TEXAS INSTRUMENTS

5

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 : 128K -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 SPRUEY9)

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

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
XDAIS	eXpressDSP Algorithm Interface Standard
XDM	eXpressDSP Digital Media

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