

MPEG4 Advanced Simple Profile Decoder (v02.01.00) on C64x+

FEATURES

- eXpressDSP Digital Media (XDM 1.0 IVIDDEC2) interface compliant
- Validated on the OMAP3530 EVM
- MPEG4 advanced simple profile, level 0, 1, 2, 3, 4 and 5 supported
- MPEG4 visual simple profile, level 0, 1, 2, 3, and 4A supported
- Supports H.263 profile 3 and level 10, 20, 30, 45, 50, 60, and 70
- Supports H.263 Annex-IJKT
- Post-processing filter, de-blocking, and de-ringing supported
- Spatial and temporal error concealment supported only for I and P progressive frames
- Contains optimized I and P flow to decode frames up to WVGA (854 x 480 and 480 x 854) and D1 (720x576) resolution at 30 fps
- Half-pel and quarter-pel interpolation supported
- Outputs are available in YUV 420 planar and 422 interleaved little endian formats
- Display width feature supported
- Single object supported
- Supports streams that are non-multiple of 16
- Global Motion Compensation (GMC) 0 and 1 warp supported for progressive frame
- Global Motion Compensation (GMC) 2 and 3 warp not supported
- Supports Frame level byte-swap. If it is enabled, algorithm will do byte-swap conversion at frame level dynamically. Also, encoded bytes per frame information need not be provided as input to the application.
- This codec can be used on any of TI's C64x+ based platforms such as DM644x, DM643x, OMAP35xx and their derivatives.

DESCRIPTION

MPEG4 is a popular video algorithm defined by Motion Picture Expert Group (MPEG) for video conferencing applications. This codec has been built and tested on the OMAP3430 EVM with XDS560 JTAG. This version of codec is compiled, assembled, archived, and linked using the code generation tools version 6.0.8 and developed using Code Composer Studio version 3.2.40.8.



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Performance Summary

This section describes the performance of the MPEG4 Advanced Simple Profile Decoder on C64x+.

Table 1. Configuration Table

CONFIGURATION	ID
MPEG4 visual simple profile, levels 0, 1, 2, 3, and 4A H263 profile 3, level 10, 20, 30, 45, 50, 60, and 70 MPEG4 Advanced Simple Profile level 0 to 5	MPEG4_DEC_001

Table 2. Cycles Information for MPEG-4 ASP Streams - Profiled on OMAP3530 EVM with Code Generation Tools Version 6.0.8

CONFIGURATION ID	PERFORMANCE STATISTICS (MEGA CYCLES PER SECOND) ⁽¹⁾		
	TEST DESCRIPTION	AVERAGE ⁽²⁾	PEAK ⁽³⁾
MPEG4_DEC_001	akiyo.cif.890kbps.mta.cmp, YUV420, CIF @ 715 kbps, IQ and Interlace	31	55
	viperkillercuts_p720x576_8000kbps_L5_25fps.m4v, YUV420, D1 @ 9 mbps, IQ and Quarterpel	175	271
	harryPotter_p720x480_8000kbps_L5_30fps.m4v, YUV420, D1 @ 8 mbps, IQ and Quarterpel	178	200
	harryPotter_p720x480_8000kbps_L5_30fps_BFRAME.m4v, YUV420, D1 @ 7 mbps, IQ, Quarterpel and B frames	214	236
	football_800x480_420_5mbps_30fps_BFRAME.m4v, YUV420, WVGA @ 5 mbps, B frames	170	250
	jets_p848x480_420_5mbps_30fps_BFRAME.m4v,, YUV420, WVGA @ 5 mbps, B frames	185	284
	jets_p854x480_420_5mbps_30fps_QUANT1.m4v YUV420, WVGA @ 5 mbps, Quant1	117	164
	jets_p864x480_420_5mbps_30fps_QUANT1.m4v YUV420, WVGA @ 5 mbps, Quant1	124	170
	shild_wp1_wa3_qpel0_IP_8mbps.m4v YUV420, D1 @ 8 mbps,GMC	135	368
	shild_wp1_wa3_qpel0_IPB_8mbps.m4 YUV420, D1 @ 8 mbps,GMC	187	368

(1) Measured with program memory, stack, and I/O buffers in external memory and with cache configuration: 32 K-bytes L1P cache, 16 K-bytes L1D cache, 64 K-bytes L1D RAM, and 64 K-bytes L2 cache.

(2) Average cycles are calculated by taking frame level average for entire sequence and then scaling it to 25/30 fps

(3) Peak cycles are calculated by taking frame level peak over entire sequence and then scaling it to 25/30 fps.

Table 3. Cycles Information for MPEG-4 SP Streams - Profiled on OMAP3530 EVM with Code Generation Tools Version 6.0.8

CONFIGURATION ID	PERFORMANCE STATISTICS (MEGA CYCLES PER SECOND) ⁽¹⁾		
	TEST DESCRIPTION	AVERAGE ⁽²⁾	PEAK ⁽³⁾
MPEG4_DEC_001	akiyo_qcif10_q1.m4v, MPEG4 SP, YUV420, QCIF @ 1 mbps	14	22
	cif_high_256kbps_100f_fixedqp20_nofilter.m4v, MPEG4 SP, YUV420, CIF @ 256 kbps	27	40
	foreman_vga_dp0.m4v, MPEG4 SP, YUV420, VGA @ 3 mbps	78	83
	hp_720x480.m4v, MPEG4 SP, YUV420, D1 @ 10 mbps	150	213
	CIMG0389_480x854.m4v, MPEG4 SP, WVGA @ 6 mbps	131	150
	football_p864x480_420_8mbps_30fps_NoTools.m4v, WVGA 8mbps	150	192
	football_p800x480_420_8mbps_30fps_NoTools.m4v, WVGA 8mbps	143	174
	football_p848x480_420_8mbps_30fps_NoTools.m4v, WVGA 8mbps	149	184
	football_p854x480_420_8mbps_30fps_NoTools.m4v, WVGA 8mbps	150	188

(1) Measured with program memory, stack, and I/O buffers in external memory and with cache configuration: 32 K-bytes L1P cache, 16 K-bytes L1D cache, 64 K-bytes L1D RAM, and 64 K-bytes L2 cache.

(2) Average cycles are calculated by taking frame level average for entire sequence and then scaling it to 25/30 fps.

(3) Peak cycles are calculated by taking frame level peak over entire sequence and then scaling it to 25/30 fps.

Table 4. Cycles Information for H263 Streams - Profiled on OMAP3530 EVM with Code Generation Tools Version 6.0.8

CONFIGURATION ID	PERFORMANCE STATISTICS (MEGA CYCLES PER SECOND) ⁽¹⁾		
	TEST DESCRIPTION	AVERAGE ⁽²⁾	PEAK ⁽³⁾
MPEG4_DEC_001	akiyo.qcif.263, H263, YUV420 , QCIF @ 122 kbps	9	13
	QCIF_64kbps_AnnexIJKT.mpg4, H263, YUV420, QCIF @ 300 kbps, Annex IJKT	16	25
	D1p25_mobcal_420p_8Mbps_Level60.263, YUV420, H263 Level 60, 720x288 @ 8 Mbps	95	101

- (1) Measured with program memory, stack, and I/O buffers in external memory and with cache configuration: 32 K-bytes L1P cache, 16 K-bytes L1D cache, 64 K-bytes L1D RAM, and 64 K-bytes L2 cache.
- (2) Average cycles are calculated by taking frame level average for entire sequence and then scaling it to 25/30 fps
- (3) Peak cycles are calculated by taking frame level peak over entire sequence and then scaling it to 25/30 fps.

Table 5. Cycles Information - Profiled on OMAP3530 EVM with Code Generation Tools Version 6.0.8 for foreman_vga_dp0.m4v, MPEG4 (YUV420, VGA @ 3 mbps)

CONFIGURATION ID	PERFORMANCE STATISTICS (MEGA CYCLES PER SECOND) ⁽¹⁾		
	TEST DESCRIPTION	AVERAGE ⁽²⁾	PEAK ⁽³⁾
MPEG4_DEC_001	With De-blocking enabled	180	187
	With De-ringing enabled	199	204
	With De-blocking and De-ringing enabled	245	252

- (1) Measured with program memory, stack, and I/O buffers in external memory and with cache configuration: 32 K-bytes L1P cache, 16 K-bytes L1D cache, 64 K-bytes L1D RAM, and 64 K-bytes L2 cache.
- (2) Average cycles are calculated by taking frame level average for entire sequence and then scaling it to 25/30 fps.
- (3) Peak cycles are calculated by taking frame level peak over entire sequence and then scaling it to 25/30 fps.

Table 6. Cycles Information - Profiled on OMAP3530 EVM with Code Generation Tools Version 6.0.8 for MPEG4 SP, MPEG4 ASP and H263 streams (YUV422)

CONFIGURATION ID	PERFORMANCE STATISTICS (MEGA CYCLES PER SECOND) ⁽¹⁾		
	TEST DESCRIPTION	AVERAGE ⁽²⁾	PEAK ⁽³⁾
MPEG4_DEC_001	foreman_vga_dp0.m4v, MPEG4 SP, YUV422, VGA @ 3 mbps	84	89
	viperkillercuts_p720x576_8000kbps_L5_25fps.m4v, MPEG4 ASP, YUV422, D1 @ 9 mbps, IQ and Quarterpel	183	280
	hp_720x480.m4v, MPEG4 SP, YUV422, D1 @ 10 mbps	153	218
	D1p25_mobcal_420p_8Mbps_Level60.263, YUV422, H263 Level 60, 720x288 @ 8 Mbps	105	112

- (1) Measured with program memory, stack, and I/O buffers in external memory and with cache configuration: 32 K-bytes L1P cache, 16 K-bytes L1D cache, 64 K-bytes L1D RAM, and 64 K-bytes L2 cache.
- (2) Average cycles are calculated by taking frame level average for entire sequence and then scaling it to 25/30 fps.
- (3) Peak cycles are calculated by taking frame level peak over entire sequence and then scaling it to 25/30 fps.

Note:

- Profiled on OMAP3430 ES1 EVM. Measured with 32 bit DDR at 166 MHz and CPU at 330 MHz
- No hardware accelerators are used.
- Average and peak MCPS measurements can vary by +/-5%.

Table 7. Generated with Code Generation Tools Version 6.0.8

CONFIGURATION ID	MEMORY STATISTICS ⁽¹⁾				TOTAL
	PROGRAM MEMORY	DATA MEMORY			
		INTERNAL ⁽²⁾	EXTERNAL	STACK	
MPEG4_DEC_001 (QCIF)	306	61	661	8	1036
MPEG4_DEC_001 (CIF)	306	61	1610	8	1985
MPEG4_DEC_001 (VGA)	306	61	3990	8	4365
MPEG4_DEC_001 (D1)	306	61	4419	8	4794
MPEG4_DEC_001 (WVGA)	306	61	5191	8	5566

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

(2) Internal memory is placed in L1D RAM.

Table 8. Internal Data Memory Split-Up

CONFIGURATION ID	DATA MEMORY - INTERNAL ⁽¹⁾		
	SHARED		INSTANCE ⁽²⁾
	CONSTANTS	SCRATCH	
MPEG4_DEC_001	0	61	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.

Notes

- I/O buffers:
 - Input buffer size = 405 K-bytes (WVGA, one YUV422 interleaved frame)
 - Output buffer size = 810 K-bytes (for decoding one WVGA frame)
- Memory Configuration
 - L1P : 32 K-bytes program cache (32 bytes cache line width, direct mapped cache)
 - L1D : 64 K-bytes data memory and 16 K-bytes data cache (64 bytes cache line width, 2 way set associative cache)
 - L2 : 64 K-bytes cache (128 bytes cache line width, 4-way set associative cache)
- The algorithm uses 4 QDMA channels each requiring up to a maximum of 6 linked transfers. 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)
- MCPS calculations are done in frame based mode. In case, it is run in buffer mode, MCPS increase can be upto 10% assuming additional buffer size of 10 K-bytes per frame.

References

- MPEG4 Standard (ISO_IEC_14496-2_2001)
- H.263 Standard (ITU-T Series H 02/98)
- MPEG4 Simple Profile Decoder on C64x+ User's Guide(literature number: SPRUGT2)

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
GMC	Global Motion Compensation
NTSC	National Television Standards Committee
QCIF	Quarter Common Intermediate Format
QVGA	Quarter Video Graphics Array
SQCIF	Sub Quarter Common Intermediate Format
VGA	Video Graphics Array
WVGA	Wide Video Graphics Array
XDM	eXpressDSP Multimedia

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