



## eXpressDSP Digital Media (XDM 1.0 IVIDDEC2) interface compliant

- Validated on the TMS320C6678 EVM
- MPEG4 advanced simple profile, level 0, 1, 2, 3, 4 and 5 supported
- MPEG4 visual simple profile, level 0, 1, 2, 3, 4A and 5 supported
- H.263 profile 3 and level 10, 20, 30, 45, 50, 60 and 70 supported
- 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) 1, 2 and 3 warp supported for progressive frame
- 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.
- Supports ELF ABI format.
- Supports "ecpy" for EDMA and "IRES" interface.

## 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 TMS320C6678 EVM. This version of codec is compiled, assembled, archived, and linked using the code generation tools version 7.4.0 and developed using Code Composer Studio version 5.2.1.00018.



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## summary of performance

**Table 1. Configuration Table**

CONFIGURATION	ID
MPEG4 visual simple profile, levels 0, 1, 2, 3, 4A and 5 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 TMS320C6678 EVM with Code Generation Tools Version 7.4.0**

CONFIGURATION ID	PERFORMANCE STATISTICS (IN MEGA CYCLES PER SECOND) <sup>1</sup>		
	TEST DESCRIPTION	AVERAGE <sup>2</sup>	PEAK <sup>3</sup>
MPEG4_DEC_001	akiyo.cif.890kbps.mta.cmp, YUV420, CIF @ 715 kbps, IQ and Interlace	35.25	63.48
	viperkillercuts_p720x576_8000kbps_L5_25fps.m4v, YUV420, D1 @ 9 mbps, IQ and Quarterpel	213.95	300.92
	harryPotter_p720x480_8000kbps_L5_30fps.m4v, YUV420, D1 @ 8 mbps, IQ and Quarterpel	173.35	189.04
	harryPotter_p720x480_8000kbps_L5_30fps_BFRAME.m4v, YUV420, D1 @ 7 mbps, IQ, Quarterpel and B frames	214.35	243.71
	football_800x480_420_5mbps_30fps_BFRAME.m4v, YUV420, WVGA @ 5 mbps, B frames	176.31	238.93
	jets_p848x480_420_5mbps_30fps_BFRAME.m4v,, YUV420, WVGA @ 5 mbps, B frames	170.52	236.92
	jets_p854x480_420_5mbps_30fps_QUANT1.m4v YUV420, WVGA @ 5 mbps, Quant1	125.48	170.73
	jets_p864x480_420_5mbps_30fps_QUANT1.m4v YUV420, WVGA @ 5 mbps, Quant1	130.12	175.39
	shild_wp1_wa3_qpel0_IP_8mbps.m4v YUV420, D1 @ 8 mbps,GMC	140.75	361.41
	shild_wp1_wa3_qpel0_IPB_8mbps.m4 YUV420, D1 @ 8 mbps,GMC	181.37	361.42
	akiyo_cif_wp3_wa3_384kbps.cmp, YUV420, CIF @384kbps 3 warp GMC	103.9	116.77

<sup>1</sup> Measured with program memory and I/O buffers in external memory, stack in internal memory and with cache configuration: 32 K-bytes L1P cache, 32 K-bytes L1D cache and 64 K-bytes L2 cache.

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

<sup>3</sup> 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 TMS320C6678 EVM with Code Generation Tools Version 7.4.0**

CONFIGURATION ID	PERFORMANCE STATISTICS (IN MEGA CYCLES PER SECOND) <sup>1</sup>		
	TEST DESCRIPTION	AVERAGE <sup>2</sup>	PEAK <sup>3</sup>
MPEG4_DEC_001	akiyo_qcif10_q1.m4v, MPEG4 SP, YUV420, QCIF @ 1 mbps	12.19	21.68
	cif_high_256kbps_100f_fixedqp20_nofilter.m4v, MPEG4 SP, YUV420, CIF @ 256 kbps	28.69	38.27
	foreman_vga_dp0.m4v, MPEG4 SP, YUV420, VGA @ 3 mbps	103.99	110.98
	hp_720x480.m4v, MPEG4 SP, YUV420, D1 @ 10 mbps	149.51	227
	CIMG0389_480x854.m4v, MPEG4 SP, WVGA @ 6 mbps	141.6	159.73
	football_p864x480_420_8mbps_30fps_NoTools.m4v, WVGA 8mbps	158.29	197.53
	football_p800x480_420_8mbps_30fps_NoTools.m4v, WVGA 8mbps	150.51	179.6
	football_p848x480_420_8mbps_30fps_NoTools.m4v, WVGA 8mbps	158.91	189.81
	football_p854x480_420_8mbps_30fps_NoTools.m4v, WVGA 8mbps	159.62	194.29

<sup>1</sup> Measured with program memory and I/O buffers in external memory, stack in internal memory and with cache configuration: 32 K-bytes L1P cache, 32 K-bytes L1D cache and 64 K-bytes L2 cache.

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

<sup>3</sup> 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 TMS320C6678 EVM with Code Generation Tools Version 7.4.0**

CONFIGURATION ID	PERFORMANCE STATISTICS (IN MEGA CYCLES PER SECOND) <sup>1</sup>		
	TEST DESCRIPTION	AVERAGE <sup>2</sup>	PEAK <sup>3</sup>
MPEG4_DEC_001	akiyo.qcif.263, H263, YUV420 , QCIF @ 122 kbps	8.82	12.37
	QCIF_64kbps_AnnexIJKT.mpg4, H263, YUV420, QCIF @ 300 kbps, Annex IJKT	15.79	25.25
	D1p25_mobcal_420p_8Mbps_Level60.263, YUV420, H263 Level 60, 720x288 @ 8 Mbps	127.63	136.85

<sup>1</sup> Measured with program memory and I/O buffers in external memory, stack in internal memory and with cache configuration: 32 K-bytes L1P cache, 32 K-bytes L1D cache and 64 K-bytes L2 cache.

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

<sup>3</sup> 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 TMS320C6678 EVM with Code Generation Tools Version 7.4.0 for foreman\_vga\_dp0.m4v, MPEG4 (YUV420, VGA @ 3 mbps)**

CONFIGURATION ID	PERFORMANCE STATISTICS (IN MEGA CYCLES PER SECOND) <sup>1</sup>		
	TEST DESCRIPTION	AVERAGE <sup>2</sup>	PEAK <sup>3</sup>
MPEG4_DEC_001	With De-blocking enabled	171.09	178.78
	With De-ringing enabled	191.26	198.21
	With De-blocking and De-ringing enabled	243.26	250.94

<sup>1</sup> Measured with program memory and I/O buffers in external memory, stack in internal memory and with cache configuration: 32 K-bytes L1P cache, 32 K-bytes L1D cache and 64 K-bytes L2 cache.

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

<sup>3</sup> 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 TMS320C6678 EVM with Code Generation Tools Version 7.4.0 for MPEG4 SP, MPEG4 ASP and H263 streams (YUV422)**

CONFIGURATION ID	PERFORMANCE STATISTICS (IN MEGA CYCLES PER SECOND) <sup>1</sup>		
	TEST DESCRIPTION	AVERAGE <sup>2</sup>	PEAK <sup>3</sup>
MPEG4_DEC_001	foreman_vga_dp0.m4v, MPEG4 SP, YUV422, VGA @ 3 mbps	108.62	115.57
MPEG4_DEC_001	viperkillercuts_p720x576_8000kbps_L5_25fps.m4v, MPEG4 ASP, YUV422, D1 @ 9 mbps, IQ and Quarterpel	220.13	306.59
MPEG4_DEC_001	hp_720x480.m4v, MPEG4 SP, YUV422, D1 @ 10 mbps	154.41	232.71
MPEG4_DEC_001	D1p25_mobcal_420p_8Mbps_Level60.263, YUV422, H263 Level 60, 720x288 @ 8 Mbps	126.76	135.64

<sup>1</sup> Measured with program memory and I/O buffers in external memory, stack in internal memory and with cache configuration: 32 K-bytes L1P cache, 32 K-bytes L1D cache and 64 K-bytes L2 cache.

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

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

**Notes:**

- Profiled on TMS320C6678 EVM.
- Average and peak MCPS measurements can vary by +/-5%.

**Table 7. Memory Statistics - Generated with Code Generation Tools Version 7.4.0**

CONFIGURATION ID	MEMORY STATISTICS <sup>1</sup>				
	PROGRAM MEMORY	DATA MEMORY			TOTAL
		INTERNAL <sup>2</sup>	EXTERNAL	STACK	
MPEG4_DEC_001 (QCIF)	395	61	678	12	1146
MPEG4_DEC_001 (CIF)	395	61	1628	12	2096



CONFIGURATION ID	MEMORY STATISTICS <sup>1</sup>				
	PROGRAM MEMORY	DATA MEMORY			TOTAL
		INTERNAL <sup>2</sup>	EXTERNAL	STACK	
MPEG4_DEC_001 (VGA)	395	61	4008	12	4476
MPEG4_DEC_001 (D1)	395	61	5225	12	5693
MPEG4_DEC_001 (WVGA)	395	61	5209	12	5677

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

<sup>2</sup> Internal memory is placed in L1D RAM.

**Table 8. Internal Data Memory Split-up**

CONFIGURATION	DATA MEMORY – INTERNAL <sup>1</sup>		
	SHARED		INSTANCE <sup>2</sup>
	CONSTANTS	SCRATCH	
MPEG4_DEC_001	0	61	0

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

<sup>2</sup> I/O buffers not included. Some of the instance memory buffers could be scratch.

# MPEG4 Advanced Simple Profile Decoder (v02.03.01) on C66x

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## 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
  - 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)
- 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 C66x User's Guide(literature number: SPRUH64A)

## 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



## acronyms

ABI	Application Binary Interface
CIF	Common Intermediate Format
EDMA	Enhanced Direct Memory Access
ELF	Executable and Linkable 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 Digital Media

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