H.264 1080p@30 BP Encoder (v01.10.02) on DM6467

FEATURES

- **eXpressDSP™ Digital Media (XDM 1.0 IVIDENC1) compliant**
- **Validated on DM6467 EVM**
- **YUV420SP interleaved color sub-sampling (Y as a single plane and U and V components interleaved to form the second plane) formats supported**
- **H.264 Baseline Profile for only progressive I and P frames supported**
- **Multiple slices per frame conforming to H.241 requirement of fixed bytes per slice supported**
- **Only one motion vector per macro block supported**
- **Rate control at row and frame level supported**
- **DMA based framework supported**
- **C64x+ and both HDVICP0, HDVICP1 subsystems are used**
- **The 720p quality of this encoder is not at par with the 720p encode only solution from TI, tradeoffs have been made to get performance for 1080p at the cost of quality**

DESCRIPTION

H.264 is the latest video compression standard from the ITU-T Video Coding Experts Group and the ISO/IEC Moving Picture Experts Group. This H.264 Encoder is validated on the DM6467 EVM with Code Composer Studio version 3.3.49 and code generation tools version 6.0.8.

PRODUCT PREVIEW

Performance Summary

This section describes the performance of the H.264 1080p@30 BP Encoder on DM6467 EVM.

Table 1. Configuration Table

CONFIGURATION	ID
H264 Baseline Profile Encoder with single frame as one slice	DM6467_BP_E_001
H264 Baseline Profile Encoder with H.241 support	DM6467_BP_E_002

Table 2. Cycles Information – Profiled on DM6467 EVM with Code Generation Tools Version 6.0.8

CONFIGURATION ID	PERFORMANCE STATISTICS (MEGA CYCLES PER SECOND)(1)				
	TEST DESCRIPTION(2)	NON-BLOCKING DSP CYCLES@675MHZ		BLOCKING DSP CYCLES@675MHZ	
		AVERAGE(3)	PEAK(4)	AVERAGE(3)	PEAK(4)
DM6467_BP_E_001	bluesky_p1920x1088_30fps_420pl.yuv Bitrate : 4Mbps	550	551	587	589
	pedestrian_p1920x1088_24fps_420pl.yuv Bitrate : 4Mbps	554	556	591	593
DM6467_BP_E_002	Input used: bluesky_p1920x1088_30fps_420pl.yuv Bitrate : 4Mbps Packet Size: 1500 bytes	591	593	618	619
	Input used: pedestrian_p1920x1088_24fps_420pl.yuv Bitrate : 4Mbps Packet Size: 1500 bytes	595	598	622	625

(1) Measured with program memory, stack, and I/O buffers in external memory with cache configuration: 32 KB L1P Program Cache, 32 KB L1D Data Cache, 64 KB L2 Cache and 64KB mapped L2 SRAM. There could be a variation of approximately 1- 2% in the values.
(2) The Intra Period for the test vectors is 30 frames. That is, with one I-frame and 29 P-frames.
(3) Based on average number of cycles per frame @ 30fps.That is, with one I-frame and 29 P-frames.
(4) Based on worst case cycles per frame @ 30fps.

Table 3. Memory Statistics

CONFIGURATION ID	MEMORY STATISTICS(1)				
	PROGRAM MEMORY	DATA MEMORY			TOTAL
		INTERNAL(2)	EXTERNAL(3)	STACK	
DM6467_BP_E_001	152	63	8594	12	8821
DM6467_BP_E_002	152	63	8594	12	8821

(1) All memory requirements are expressed in kilobytes (1K-byte = 1024 bytes). There could be a variation of approximately 1-2% in the values.
(2) Internal memory is placed in L2 SRAM.
(3) Includes frame buffers for 1080i/p resolution.

Table 4. Internal Data Memory Split-Up

CONFIGURATION ID	DATA MEMORY - INTERNAL(1)		
	SHARED		INSTANCE
	CONSTANTS	SCRATCH	
DM6467_BP_E_001	0	63	0
DM6467_BP_E_002	0	63	0

(1) All memory requirements are expressed in kilobytes. There could be a variation of approximately 1-2% in the values.

Table 5. External Data Memory Split-Up

CONFIGURATION ID	DATA MEMORY - EXTERNAL(1)		
	SHARED		INSTANCE
	CONSTANTS	SCRATCH	
DM6467_BP_E_001	164	23	8407

(1) All memory requirements are expressed in kilobytes. There could be a variation of approximately 1-2% in the values.

Table 5. External Data Memory Split-Up (continued)

CONFIGURATION ID	DATA MEMORY - EXTERNAL[1]		
	SHARED		INSTANCE
	CONSTANTS	SCRATCH	
DM6467_BP_E_002	164	23	8407

Notes

The performance values in Table 2 is a result of the following configurations:

- HDVICP
  - The entire HDVICP is a video resource and uses 16K ITCM and 8K DTCM.
  - The 1080i encoder uses both the HDVICP resources of DM6467. Hence, simultaneous encode/decode is not possible with this encoder.
- Cache configuration

Table 6. Cache Configuration

	AVAILABLE	USED
L1 p (Program Memory)	32k	32k – cache
L1d (Data Memory)	32k	32k – cache
L2	128k	64k – cache

- Resources used and clock speed

Table 7. Resources Used and Clock Speed

RESOURCES USED	CLOCK SPEED (IN MEGA HERTZ)
C64x+	675
ARM 968	337
HDVICP Co-processors	337
DDR (32-bit, 8 Bank)	310

- DMA configuration

Table 8. DMA Configuration

TC Q's	TC 0	TC 1	TC 2	TC 3	TOTAL USED	TOTAL AVAILABLE
Usage	Writes to HDVICP	Writes to DDR	Writes to L2 SRAM	Writes to HDVICP	-	-
Priority	2	2	2	2	-	-
EDMA Channels	19	7	19	4	49	64
QDMA Channels	0	0	0	0	0	8
Number of PaRAM Sets	-	-	-	-	103	512

- Code Placement
  - All the algorithm code are placed in external memory. The performance values in Table 2 are sensitive to algorithm code placement. See the sample linker file provided in the test application setup for algorithm code placement.

References

- ISO/IEC 14496-10:2005 Information technology -- Coding of audio-visual objects -- Part 10: Advanced Video Coding
- *H.264 1080p@30 BP Encoder User's Guide* (literature number: SPRUGN8E)

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
BP	Baseline Profile
CIF	Common Intermediate Format
DMA	Direct Memory Access
DMAN3	DMA Manager
EVM	Evaluation Module
GOP	Group of Pictures
HDVICP	High Definition Video and Imaging Co-Processor
HP	High Profile
LPF	Loop Filter
MV	Motion Vector
QCIF	Quarter Common Intermediate Format
QDMA	Quick Direct Memory Access
QPI	Quarter Pel Interpolation
QVGA	Quarter Video Graphics Array
SQCIF	Sub Quarter Common Intermediate Format
SEI	Supplemental Enhancement Information
UMV	Unrestricted Motion Vector
VGA	Video Graphics Array
XDM	eXpressDSP Digital Media

Revision History

Revision history highlights the changes made to the SPRS600D codec specific data sheet to make it SPRS600E.

Table 9. Revision History for H.264 1080p@30 BP Encoder on DM6467

Section	Changes
Table 2	• Modified Average and Peak values.

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