

JPEG/M-JPEG for Blackfin Processors

Key Features

Encoder Features

This compression library implements a subset of DCT-based sequential and progressive modes as defined in the JPEG standard.

- Quality of encoder can be controlled by selecting quantization levels or using adaptive quantization
- Supports five different input formats: RGB, YUV 4:4:4, YUV 4:2:2, YUV 4:2:0, or Y only (YUV 4:0:0 or monochrome)
- Quantization tables can be custom defined by the user
- 8 bits/pixel grayscale: 12/16/24 bits/pixel RGB/YUV input format

Decoder Features

This decompression library implements a subset of DCT-based sequential and progressive modes as defined in the JPEG standard.

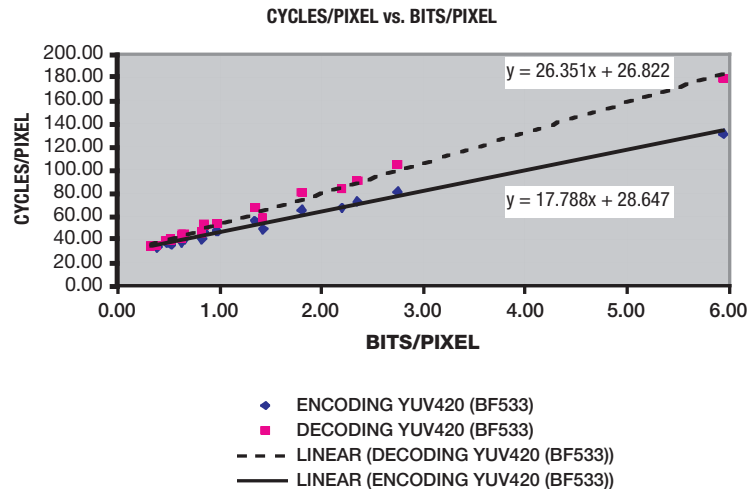
- Supports five different output formats: RGB, YUV 4:4:4, YUV 4:2:2, YUV 4:2:0, or Y only (YUV 4:0:0 or monochrome)

Processors Supported

The library supports the Analog Devices Blackfin® Processor and DSP family.

Applications

- Multimedia and telecommunications products
- Digital still cameras (DSC)
- Security cameras
- Voice/Video over IP
- H.32x (H.320, H.323, etc.)
- Server and client products (gateways, CO equipment, CPE, IADs, SOHO, and more)



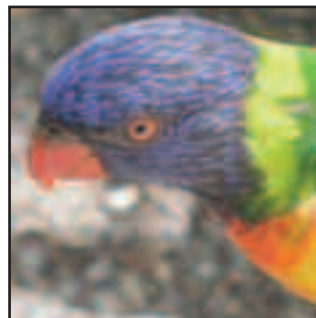
Cycles/pixel vs. compression rate

Algorithm Description

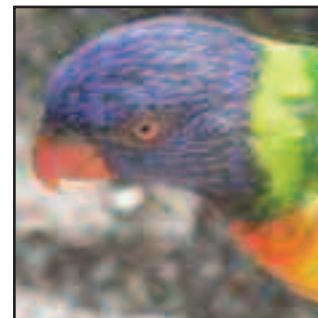
This embedded software module provides JPEG compression of up to 20:1, while still maintaining good picture quality. Based on the discrete cosine transform (DCT), the JPEG algorithm performs both compression and decompression (encode/decode), supports JFIF and Adobe® file formats, and is compliant with ISO/IEC 10918-1:1993 (ITU-T T.81). This software has undergone rigorous interoperability testing across many commercially available platforms and open source viewers/applications. This module is optimized production-ready code that provides a low MIPS, low power version that reduces development time.

M-JPEG is also supported, using the AVI file format.

Encoded image dimensions: Rosella 176 × 144 (QCIF). Image format: YUV 4:2:0



3:1 compression (Q = 95, 97 cycles/pixel)



12:1 compression (Q = 40, 54 cycles/pixel)

Resource Requirements

In sequential mode, the JPEG decoder memory requirements are 10.6 kB of instruction memory and 8.0 kB of data memory; the JPEG encoder requires 9.8 kB of instruction memory and 5.3 kB of data memory. All memory requirements quoted exclude user-defined modules and any standard C library functions. The numbers also exclude any external memory that needs to be allocated to store the actual image data and the JPEG bit stream.

The following table lists resource requirements for images in YUV 4:2:0 format. Benchmarking was done with all code and data placed in L1 memory, instruction and data cache on, and with slow heap placed into SDRAM. The compression ratio is defined as the ratio of raw data file to the compressed JPEG file. The raw data file is encoded to the JPEG file in sequential mode using various quality settings, and then decoded. The M-JPEG figures do not take into account any system level issues (such as PPI), but serve as a good indicator of expected performance. All figures are likely to improve with future code revisions.

JPEG Benchmarking Using Various Test Sequences

	Frame Width	Frame Height	JPEG File Size (Bytes)	Compression Ratio	Quality Factor	Cycles per Pixel		Cycles (MHz)		M-JPEG Cycles 30 fps (MHz)	
						Encoder	Decoder	Encoder	Decoder	Encoder	Decoder
 JPEG Input (YUV420) DVStressTest	720	480	16,632	31.2	20	33.43	34.96	11.56	12.08	347	362
	720	480	22,481	23.1	40	35.72	38.60	12.35	13.34	370	400
	720	480	27,113	19.1	60	37.37	41.10	12.92	14.21	387	426
	720	480	35,732	14.5	80	40.30	45.47	13.93	15.72	418	471
	720	480	61,490	8.4	95	48.82	58.32	16.88	20.16	506	605
 JPEG Input (YUV420) Mandrill	512	512	27,784	14.2	20	46.31	52.42	12.14	13.75	364	412
	512	512	44,082	8.9	40	56.42	67.67	14.79	17.74	444	532
	512	512	59,185	6.6	60	65.12	80.68	17.07	21.15	512	634
	512	512	89,936	4.4	80	81.11	104.89	21.27	27.50	638	825
	512	512	194,674	2.0	95	131.10	179.26	34.37	46.99	1031	1410
 JPEG Input (YUV420) Parrots	768	512	15,882	37.1	20	33.69	33.95	13.25	13.35	397	400
	768	512	23,427	25.2	40	37.46	38.99	14.73	15.33	442	460
	768	512	31,040	19.0	60	41.06	43.88	16.15	17.25	484	518
	768	512	47,496	12.4	80	47.74	53.27	18.78	20.95	563	628
	768	512	115,581	5.1	95	72.63	90.66	28.56	35.65	857	1069
 JPEG Input (YUV420) Sf_720x480	720	480	15,527	33.4	20	33.74	34.97	11.66	12.09	350	363
	720	480	22,171	23.4	40	37.22	39.77	12.86	13.75	386	412
	720	480	28,181	18.4	60	40.21	43.93	13.89	15.19	417	455
	720	480	42,164	12.3	80	46.95	53.30	16.23	18.42	487	553
	720	480	95,085	5.5	95	67.61	83.38	23.37	28.82	701	864

Availability and Licensing

This module supports the Analog Devices, Inc. (ADI) Blackfin Processor family and is a licensed product that is available in object code format. Recipients must sign a license agreement with ADI prior to gaining full access to the JPEG/M-JPEG Software Development Kit (SDK). The SDK supports both the ADSP-BF533 EZ-KIT Lite® and ADSP-BF561 EZ-KIT Lite with appropriate EZ-Extender® (USB-LAN and/or A/V daughter cards). Support for future EZ-KIT Lite products will be considered as they become available.

Support

For additional information and for information concerning available development hardware and software tools, please visit our website at www.analog.com/processors.

For support contact: processor.support@analog.com

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