JPEG IP core（KJN series）

The KJN series of still-image compression/decompression IP cores complies with the JPEG Baseline/Extended process Standard

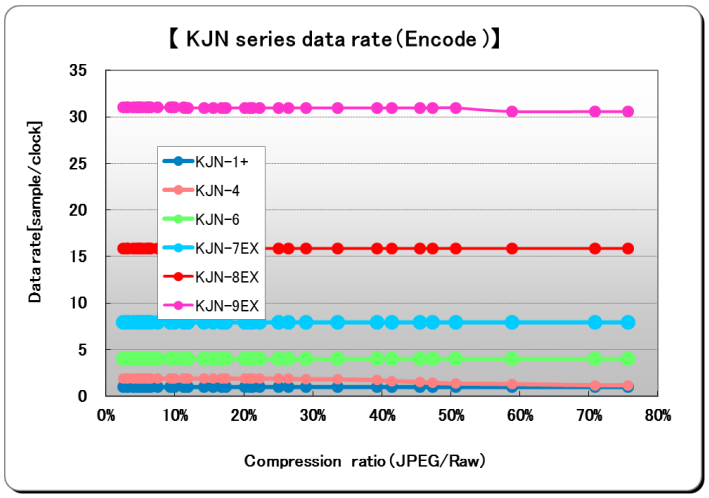
Overview

- Complies with JPEG Baseline / Extended DCT-Based / Lossless (ISO/IEC 10918-1, ITU-T T.81 Annex H)
- Obtains high-speed, small-scale and power-efficient processing by Shikino's original algorithms
- The arithmetic accuracy satisfies the compliance testing requirement of JPEG Part2 (ISO/IEC 10918-2, ITU-T T.83)
- Operation parameters such as processing mode, image size, DRI value etc. are set in internal registers via external CPU
- Markers　Automatically generated on Encode, and automatically analyzed on Decode.
  Supported markers : SOI, SOF_0(Baseline), SOF_1(Extended), SOF_3(Lossless), SOS, DQT, DHT, DRI, RST_m, EOI
- A flexible lineup meeting a wide range of demands on Processing speed (Data rate) and Image bit depth

Performance

◆ The KJN series is up to 32X faster data rate against other common JPEG IP cores

Encode data rate



Decode data rate

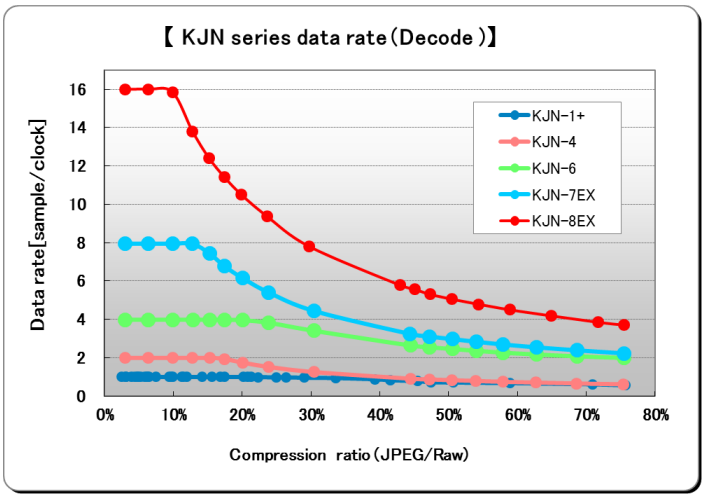
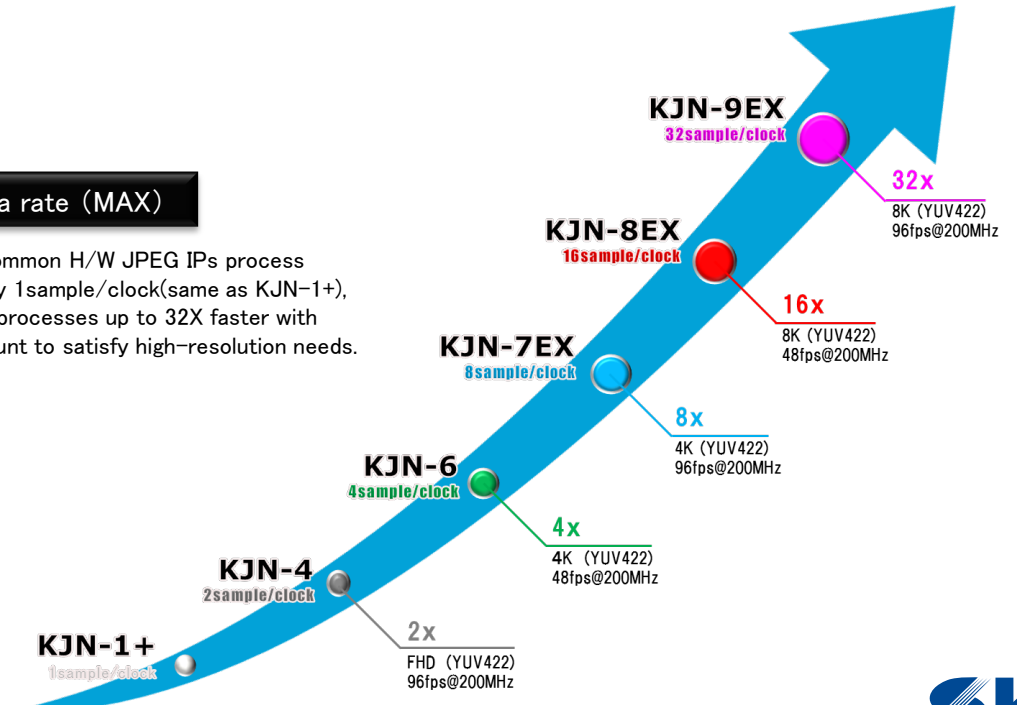


Image data rate（MAX）

＊Although common H/W JPEG IPs process images at only 1sample/clock(same as KJN-1+), our JPEG IP processes up to 32X faster with small gate count to satisfy high-resolution needs.



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Advantage of KJN series

Comparison against common JPEG IP

	Data rate (Samples/clock)	Image Bit Depth	Lossless	Supported Formats	ASIC /FPGA	Frame Rate (fps) (8K:YUV422@200MHz)
Shikino IP (KJN series)	Up to 32	8-16bit	Yes	JPEG (Baseline, Extended, Lossless) JPEG XR	Yes	96
Common JPEG IP	1	8bit	No	JPEG (Baseline)	Yes	3

◆ Overwhelming superiority in Data rate and Gate count

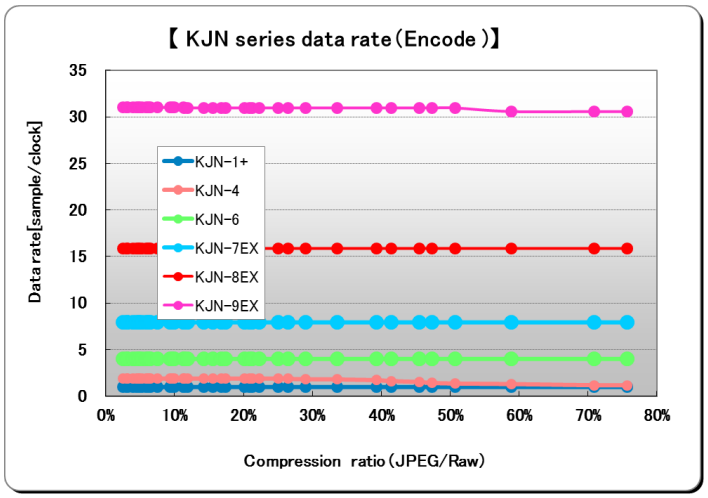
KJN series attains up to 32X higher data rate against other common JPEG IP and only 1/32 frequency is needed to achieve the same target frame rate. On the other hand, it is also possible to meet the target frame rate with a lower gate count.

Encode data rate

Our fastest IP core

32X faster than common JPEG IP

Common JPEG IP (same as KJN-1+)



◆ Support high bit depth/Lossless

The KJN series supports not only standard 8bit JPEG (Baseline), but also 12bit JPEG (Extended) to satisfy high bit depth needs such as HDR(WDR). This function provides the same compression efficiency with JPEG and outstanding images with less image quality deterioration during image compression/decompression of 10-14bit camera sensor data.

Furthermore, this series also provides Lossless formats for applications where any deterioration of image quality is unacceptable. Lossless format : ISO/IEC 10918-1, ITU-T T.81 Annex H and JPEG XR.

Our original high speed algorithm used by the high bit depth/lossless IP cores enables a reduction of the clock frequency and/or gate count.

◆ A thorough support system

We offer customization of the Interface, additional functions and/or the IP core itself, to satisfy specific user demands.

- Processing capacity.
- Fully reversible lossless compression method.
- Code stream format.
- Rate control & image area segmentation functions.
- IP core peripheral circuit design.
- Integration with customer IP core.

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High bit depth/Lossless image IP core

An IP core supporting high bit depth and lossless function to obtain ultra-high definition images against traditional 8bit RGB. We are ready to provide an IP core supporting more than 12 bits depth, Lossless/Lossy image, which minimizes image quality deterioration and enables advanced image correction/edit.

◆ High bit depth

In addition to the existing 8bit depth in JPEG, the high bit depths (10bit/12bit) attains high image quality.
It is even possible to select bit depths for each frame. This product is most suitable for the medical/broadcasting/aerospace/industrial camera fields requiring color reproducibility and exactness..

◆ Lossless/Lossy

Besides the existing lossy JPEG format, the KJN series supports lossless compression for color reproducibility.
This technology is very useful in highly advanced medical equipment, image processing inspection devices and aviation/aerospace equipment that previously have required customers to use uncompressed and large-capacity RAW images to prevent image quality deterioration.

◆ High speed

The Lossy processing function provides users with the 32X, 32Sample/clock processing speed (data rate).
This is optimal for consumer devices requiring high-speed consecutive shooting (e.g. DSC, DSLR, Smartphones, Tablets, 8K4K displays and so forth).

High bit depth/Lossless IP core list

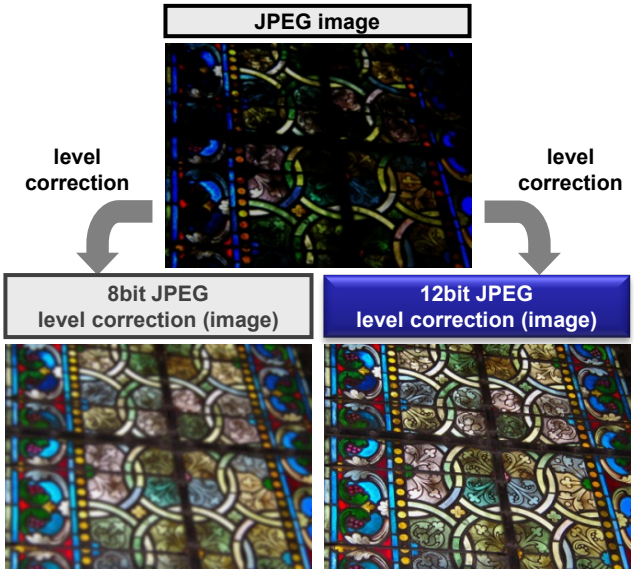
	Image Bit Depth (bits)	Mode	Data Rate (Samples/clock)	Supported Formats
KJN-1LSC	8,12,14,16	Lossless	1	JPEG (Lossless)
KJN-7EX	8,10*1,12	Lossy	8	JPEG (Baseline, Extended)
KJN-7EX_LSC	8,10*1,12	Lossless/Lossy	8 (Lossless Decode:4)	JPEG (Baseline, Extended, Lossless)
KJN-8EX	8,10*1,12	Lossy	16	JPEG (Baseline, Extended)
KJN-9EX_ENC	8,10*1,12	Lossy	32	JPEG (Baseline, Extended)
KJN-X1+	1,5,8,10,12*1,14*1,16	Lossless/Lossy	3	JPEG XR

*1 Our original specification, as an extension to the standard

High bit depth advantage example

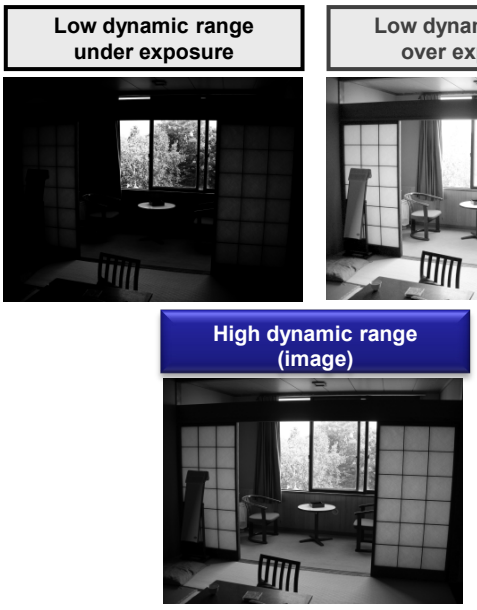
◆ Image data manipulation

Reduce image quality deterioration by high-level image edit.



◆ HDR(WDR)

Obtain high dynamic range.



JPEG IP core specification list

Specification list

KJN series	Data Rate Samples*1/clock	Interface(bit)			Quantization Table	Huffman Table	Profile
		CPU I/F	Image I/F	Code I/F			
KJN-1+ *9	1	8	8	8	4(RAM)	DC2(RAM) AC2(RAM)	Baseline
KJN-1ENC*9	1	8	8	8	2(RAM)	DC2(Fix) AC2(Fix) *2	
KJN-4	2	8	16	16	4(RAM)	DC2(RAM) AC2(RAM)	
KJN-4ENC	2	8	16	16	4(RAM)	DC2(Fix) AC2(Fix) *2	
KJN-6	4	32	32/64	32/64	4(RAM)	DC2(RAM) AC2(RAM)*3	
KJN-6ENC	4	32	32/64	32/64	4(RAM)	DC2(Fix) AC2(Fix) *2	
KJN-7	8	32	64	64	4(RAM)	DC2(RAM) AC2(RAM)*3	
KJN-7ENC	8	32	64	64	4(RAM)	DC2(Fix) AC2(Fix) *2	
KJN-7EX	8	32	96	64/96/128	4(RAM)	DC4(RAM) AC4(RAM)*5	Baseline Extended
KJN-7EX_LSC*8	8	32	96	64/96/128	4(RAM)	DC4(RAM) AC4(RAM)*6	Baseline Extended Lossless
KJN-8EX (8bit)	16	32	128	128	4(RAM)	DC2(RAM) AC2(RAM)*3	Baseline
KJN-8EX (12bit)*7	16	32	192	256	4(RAM)	DC4(RAM) AC4(RAM)*5	Baseline Extended
KJN-8EX_ENC (8bit)	16	32	128	128	4(RAM)	DC2(Fix) AC2(Fix) *2	Baseline
KJN-8EX_ENC (12bit)*7	16	32	192	128/256	4(RAM)	DC2(Fix) AC2(Fix) *5	Baseline Extended
KJN-8EX_DEC (8bit)	16	32	128	128	4(RAM)	DC2(RAM) AC2(RAM)*3	Baseline
KJN-8EX_DEC (12bit)*7	16	32	192	256	4(RAM)	DC4(RAM) AC4(RAM)*5	Baseline Extended
KJN-9EX_ENC (8bit)	32	32	256	256	4(RAM)	DC2(Fix) AC2(Fix) *2	Baseline
KJN-9EX_ENC (12bit)*7	32	32	384	512	4(RAM)	DC2(Fix) AC2Fix) *5	Baseline Extended
KJN-1LSC	1	8	8/12/ 14/16	32	–	DC 4(RAM)	Lossless

*1 1 Component (e.g. :1Sample=8bit at Baseline)
*2 Huffman table is based on recommended standard table.
*3 Huffman table is based on recommended standard table for compression processing, and optional Huffman table can be used for expansion processing.
*5 Fixed table is used on Encode.(DC:2,AC:2)
12bit JPEG: SHIKINO original table
8bit JPEG: Standard table
Download from compressed data on Decode.(DC:4,AC:4)
*6 Use Four DC tables for Lossless. Lossy tables are the same as "*5"
*7 possible to switch the circuit of 8/12bit parameter settings.
*8 KJN-7EX_LSC (Lossy mode), not support 411 colorformat
*9 KJN-1+,KJN-1ENC not support CMYK format

Application

- ■Digital still cameras
- ■Video Phones
- ■Image scanner
- ■Smart phone
- ■Printer
- ■External board for PC
- ■Surveillance system
- ■Tablet device
- ■FAX
- ■Image transfer devices
- ■Medical device
- ■Mobile terminal
- ■and so forth

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JPEG XR IP core

The KJN-X1+ is a still-image compression/decompression IP core, complies with the JPEG XR Standard.

Overview

◆ High Compression Efficiency

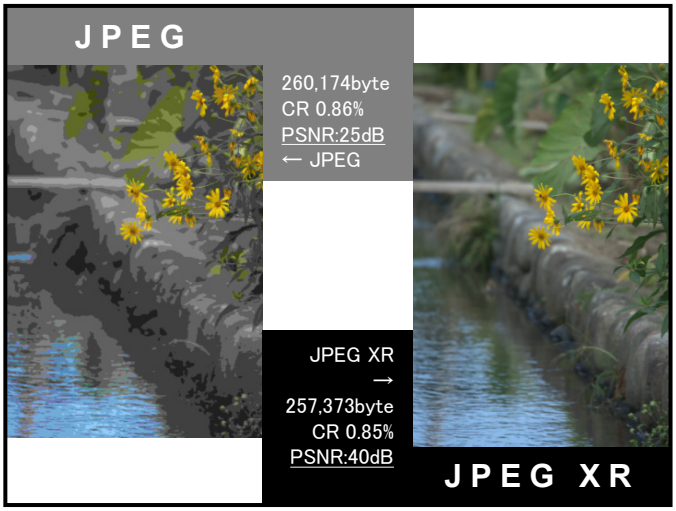
One of the advantages of JPEG XR format is the very high compression efficiency.
The images below show the image quality for JPEG and JPEG XR respectively, when the compression ratio is below 1%.
In spite of the poor quality JPEG image, the JPEG XR image remains useful as a normal photo. PSNR of the JPEG XR image is still around 40dB at this high compression ratio.

◆ High bit depth/Lossless

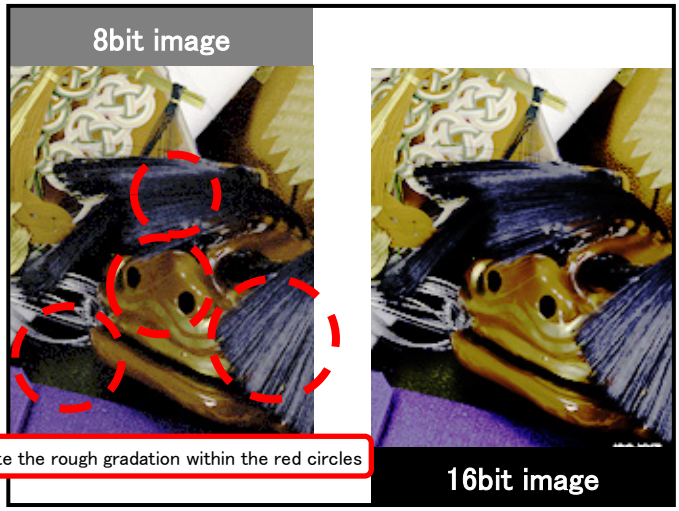
High-end users who modify their photos using photo retouch software prefer raw format for taking DSC pictures. The raw format is the best for storing image base data, when anticipating certain image corrections. This is due to the format being able to record all the data from the image sensor. However, these users also wish to have an alternative format, to reduce the currently gigantic raw file size.

JPEG XR supports Lossless format. This means JPEG XR is able to store the same data as the raw format with much smaller file size. This new format makes is possible to reduce the file size to around 30-40% of the original natural pictures. (Compression Ratio depends on the picture) Our JPEG XR IP core supports up to 16 bits depth in both Lossless and Lossy modes, enabling the use of well compressed, but still unreduced quality image sensor data..

◇ **Compression ratio & PSNR (Original image : 30,357,644byte)**



◇ **Luminance correction with high bit depth image**



Specification list

	Interface			Color Format
	CPU Interface	Image Interface	Code Interface	YONLY/ YUV420 / YUV422 / YUV444 / CMYKDIRECT / RGB / CMYK
KJN-X1+	8/16/32 bit	64bit	64bit	Support *3

*3:Formats YONLY,YUV,YUVK are specified in JPEG XR Part2[3rd edition].
Depending on settings, RGB/CMYK will be internally converted and processed in YUV/YUVK format.

Shikino High-Tech Co.,Ltd.

http://www.shikino.co.jp/eng/index.html

E-mail : ip_sales@shikino.co.jp

■Tokyo Design Center
Shibakoen Denki Bldg 8F, 1-1-12, Shibakoen, Minato-ku,
Tokyo, 105-0011, Japan
Phone :+81-3-5777-3340　FAX :+81-3-5777-3341

■Osaka Design Center
Shin-Osaka Nishiura Bldg 6F, 7-38, Nishimiyahara 2-chome,
Yodogawa-ku, Osaka, 532-0004, Japan
Phone :+81-6-6150-7730　FAX :+81-6-6150-7739