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**

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

### Comparison against common JPEG IP

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

◆ **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.

◆ **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.

---

[Image of data rate comparison graph]

Our fastest IP core
32X faster than common JPEG IP

Common JPEG IP (same as KJN-1+)

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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

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

*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.

---

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# Specification list

<table>
<thead>
<tr>
<th>KJN series</th>
<th>Data Rate</th>
<th>Interface(bit)</th>
<th>Quantization Table</th>
<th>Huffman Table</th>
<th>Profile</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Samples¹/clock</td>
<td>CPU</td>
<td>Image</td>
<td>Code</td>
<td>4(RAM)</td>
</tr>
<tr>
<td>KJN-1+</td>
<td>1</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>4(RAM)</td>
</tr>
<tr>
<td>KJN-1ENC</td>
<td>1</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>2(RAM)</td>
</tr>
<tr>
<td>KJN-4</td>
<td>2</td>
<td>8</td>
<td>16</td>
<td>16</td>
<td>4(RAM)</td>
</tr>
<tr>
<td>KJN-4ENC</td>
<td>2</td>
<td>8</td>
<td>16</td>
<td>16</td>
<td>4(RAM)</td>
</tr>
<tr>
<td>KJN-6</td>
<td>4</td>
<td>32</td>
<td>32/64</td>
<td>32/64</td>
<td>4(RAM)</td>
</tr>
<tr>
<td>KJN-6ENC</td>
<td>4</td>
<td>32</td>
<td>32/64</td>
<td>32/64</td>
<td>4(RAM)</td>
</tr>
<tr>
<td>KJN-7</td>
<td>8</td>
<td>32</td>
<td>64</td>
<td>64</td>
<td>4(RAM)</td>
</tr>
<tr>
<td>KJN-7ENC</td>
<td>8</td>
<td>32</td>
<td>64</td>
<td>64</td>
<td>4(RAM)</td>
</tr>
<tr>
<td>KJN-7EX</td>
<td>8</td>
<td>32</td>
<td>96</td>
<td>64/96/128</td>
<td>4(RAM)</td>
</tr>
<tr>
<td>KJN-7EX_LSC</td>
<td>8</td>
<td>32</td>
<td>96</td>
<td>64/96/128</td>
<td>4(RAM)</td>
</tr>
<tr>
<td>KJN-8EX</td>
<td>16</td>
<td>32</td>
<td>128</td>
<td>128</td>
<td>4(RAM)</td>
</tr>
<tr>
<td>KJN-8EX_ENC</td>
<td>16</td>
<td>32</td>
<td>128</td>
<td>128</td>
<td>4(RAM)</td>
</tr>
<tr>
<td>KJN-8EX_DEC</td>
<td>16</td>
<td>32</td>
<td>128</td>
<td>128</td>
<td>4(RAM)</td>
</tr>
<tr>
<td>KJN-8EX_ENC(8bit)</td>
<td>16</td>
<td>32</td>
<td>128</td>
<td>128</td>
<td>4(RAM)</td>
</tr>
<tr>
<td>KJN-8EX_DEC(12bit)</td>
<td>16</td>
<td>32</td>
<td>128</td>
<td>128</td>
<td>4(RAM)</td>
</tr>
<tr>
<td>KJN-9EX_ENC</td>
<td>32</td>
<td>32</td>
<td>256</td>
<td>256</td>
<td>4(RAM)</td>
</tr>
<tr>
<td>KJN-9EX_ENC(12bit)</td>
<td>32</td>
<td>32</td>
<td>256</td>
<td>256</td>
<td>4(RAM)</td>
</tr>
<tr>
<td>KJN-1LSC</td>
<td>1</td>
<td>8</td>
<td>8/12/14/16</td>
<td>32</td>
<td>–</td>
</tr>
</tbody>
</table>

*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
Fixed Huffman table is used on Encode (DC:2, AC:2)
If 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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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 it 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)**

JPEG XR IP core

![JPEG Comparison](image1.png)

Note the rough gradation within the red circles

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

![Luminance Correction](image2.png)

**Specification list**

<table>
<thead>
<tr>
<th></th>
<th>Interface</th>
<th>Color Format</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CPU Interface</strong></td>
<td>8/16/32 bit</td>
<td>YONLY/YUV420/YUV422/YUV444/CMYK/DIRECT/RGB/CMYK</td>
</tr>
<tr>
<td><strong>Image Interface</strong></td>
<td>64bit</td>
<td></td>
</tr>
<tr>
<td><strong>Code Interface</strong></td>
<td>64bit</td>
<td></td>
</tr>
<tr>
<td><strong>KJN-X1+</strong></td>
<td>Support #3</td>
<td></td>
</tr>
</tbody>
</table>

*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.
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