Welcome to this Renesas Interactive course which covers migration from the V850 Jx3 series of 32bit MCUs to the Jx4 Series.

The J Series provides a combination of high-performance processing power with low power consumption for battery powered applications.
In this course, we'll start by discussing the key development goals for the V850 Jx4 Series of Products and then review the roadmap for our V850 J Series MCUs.

Following that, we'll examine the Jx4’s Enhancements over the Jx3 and review compatibility between the two series, including a pinout comparison.

And to wrap up, we'll take a closer look at a few peripheral comparisons.

Total learning time for this course is about 10 minutes, so let’s get started.
When developing the V850 Jx4 line of MCUs, Renesas had several goals in mind that offer noticeable improvements over the previous series.

First, a significant power reduction from Jx3 products both in normal operation as well as in various power down modes.

Second, software scalability amongst V850 products, with a wide range of cores from 32MHz all the way to 200 MHz dual core versions.

Third, standard packages that are compact; not only in terms of length and width, but also thickness, making them an excellent choice for small battery power devices.

Finally, this series provides a tremendous range of Flash Memory sizes from 32KB to 2MB as well as pin counts from 40 to 176 pins, which allows designers to standardize on the Jx4 as a capable platform for many different solutions.
The V850 supports an extremely wide range of product families, categorized by series. The J Series provides a combination of high-performance processing power with low power consumption for battery powered applications.

The existing Jx3 series of products includes support for two broad categories of solutions, namely connectivity and low power. Much of the recent success of the Jx3 has been in battery power applications using the low power series of products.

Enter the next generation, Jx4 series. There will be two different families of Jx4 products, the Jx4 basic and Jx4-L low power lines.

Some key enhancements include higher performance. For the lower power lineup, the Jx-4-L delivers up to 61 DMIPS vs. 43 DMIPs found in the Jx3-L. Furthermore, the Jx4 Basic series offers 116 DMIPs vs 98 DMIPs found in it’s Jx3 counterpart.

Power consumption has been reduced in virtually any operating mode.
USB function is now standard in every Jx4 series device with USB Host functions supported in select Jx4 Basic devices

And finally, more functionality has been incorporated into each product resulting in an overall expansion of the Jx3 product line
Now we would like to provide a summary of the major enhancements of the Jx4-L over the Jx3-L.

At the heart of the new Jx4 series is an equally new CPU core, the V850E2S which offers improvements over the previous V850ES core. One important feature of this new core is its upward compatibility.

More performance has been realized by increasing the operating frequency from 20MHz to 32MHz with the same efficiency.

Several new memory options are available including Flash options up to 2MB and RAM has been expanded up to 128KB for increased flexibility.

Additionally, Data Flash has been added to eliminate the need for and external EEPROM.

Low voltage operation has been extended to 1.6V minimum.

A RTC has also been included in the Jx4-L.

USB 2.0 Full Speed is available on all Jx4-L devices.

Power on Reset added, in addition to an enhanced LVD function.

The A/D converter has been upgraded from 10 to 12 bits and also supports lower 1.6V operation.
Power consumption has been further improved in every operating mode, re-confirming the V850s place as a true Ultra-low power MCU.
And to top off this list of improvements is the addition of some larger packages sizes.
As previously stated, the V850 Jx4 uses the latest V850E2S core which is completely upward compatible with the V850ES core used in the Jx3. This is also true of the newly developed V850E2M core. So, any software that you have developed for the Jx3 will work on the Jx4.

Both cores are highly efficient, producing a high 1.9DMIPS/MHz performance. The new V850E2S core can support a higher 64MHz maximum frequency, improved over the 50MHz found in the V850ES.

A few instructions have been added to the core including two 64 bit Multiply Accumulate or MAC instructions as well as a two bit search instruction, a sum-of-product instruction and a number of 32bit relative branch instructions.
Although pin compatibility is always a desired feature, there is unfortunately no pinout compatibility between the Jx3-L and Jx4-L series due to the number of new features and functionality built into the Jx4-L. In terms of topology, there were changes made to the internal power supply routing, enhancements made to the peripheral set as well as changes to the analog functions.
This page shows a quick comparison of similar products from the Jx3-L and 4-L series, namely the JG3-L and JG4-L. Although it is a bit difficult to see all of the pins in this diagram, you can see by the various colored sections that functional blocks have been moved to allow for the new features supported by the Jx4-L.
This table provides a brief compatibility comparison between features and functions found on the Jx4-L and Jx3-L.

Of the features and functions listed, those with a green dot are fully compatible (same intellectual property); those with orange triangles denote functional compatibility in combination with additional functions, and features which are not compatible are indicated by a red X. As you can see, most of the functions in  are either the same IP or functionally compatible.
The DMA Controller is compatible with just a few changes

The number of channels has increased from 4 to 8 and support has been added for 32 bit transfers.

The maximum transfer count has been lowered and some new transfer targets have been added.
The External bus interface is functionally compatible, however some changes were made.

Namely, there is One less address bit (23 rather than 24)
And the BUS Clock can now be divided by 2, 4 or 8

Little/Big endian is now supported and selectable every CS

An additional wait state has been added and the bus hold function was eliminated.
The Timers have changed in that a Timer Array Unit (TAU) has been added. This new array provides a wide range of timers useful over a wide range of applications.
The Watch Dog Timer has been enhanced to provide a selectable window size. Other than this enhancement, this is fully compatible with the WDT on the Jx3 series.
For the Serial Ports, we have added support for a Serial Array Unit (SAU) which provides similar functionality as before but in an array.

Much of the enhancements include support for higher speeds.
For example, the CSI now supports up to 16Mbps
The UART supports up to 5.3Mbps for Jx4-L and (click) 8Mbps for Jx4
I2C now supports up to 1Mbps

<table>
<thead>
<tr>
<th>Function</th>
<th>Jx3-L</th>
<th>Jx3-H</th>
<th>Jx3-E</th>
<th>Jx4-L</th>
<th>Jx4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSI</td>
<td>Func.</td>
<td>CSIB</td>
<td>CSIF</td>
<td>CSIF</td>
<td>CSIE(w/FIFO)</td>
</tr>
<tr>
<td>Speed</td>
<td>8Mbps</td>
<td>8/12Mbps</td>
<td>5/8Mbps</td>
<td>8/16Mbps</td>
<td></td>
</tr>
<tr>
<td>UART</td>
<td>Func.</td>
<td>UARTA</td>
<td>UARTC (9bit)</td>
<td>UARTC (9bit)</td>
<td>UARTC(w/FIFO)</td>
</tr>
<tr>
<td>Speed</td>
<td>625Kbps</td>
<td>3Mbps</td>
<td>3.125Mbps</td>
<td>5.3Mbps</td>
<td>8Mbps</td>
</tr>
<tr>
<td>I2C</td>
<td>Func.</td>
<td>I2C</td>
<td>I2C</td>
<td>I2C</td>
<td>I2C</td>
</tr>
<tr>
<td>Speed</td>
<td>100/400Kbps</td>
<td>&lt;=---</td>
<td>&lt;=---</td>
<td>100K/400K/1Mbps</td>
<td></td>
</tr>
</tbody>
</table>
In summary, in course, we reviewed the key development goals for the V850 Jx4 including ultra low power, software compatibility with many V850 devices, compact and small packages as well as broad scalability of Flash from 32KB to 2MB and a wide range of package types.

Then we reviewed the large number of enhancements over the previous Jx3 series.

Finally, we tried to demonstrate that it’s a relatively simple and straightforward process to migrate from a Jx3 solution to Jx4. In fact, all of your Jx3 software is upward compatible and much of the IP is the same or a superset of existing functionality.

For more information on the Renesas V850 lineup and features, please view the other V850 courses here on Renesas Interactive or visit the Renesas website @ www.renesas.com

Thank you for your time an interest.
Thank You