Welcome to this Renesas Interactive course which provides an overview of the Renesas V850 Jx4 Series of 32 bit MCUs. 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 application trends for Low Power devices, focusing on those that are battery powered.

Then we will review the roadmap for our V850 J Series MCUs and finish up by looking at some of the key features of the new V850 Jx4 series and how they provide a direct benefit to a growing number of battery powered applications.

This course should take about 10 minutes to complete, so let's get started.
In the recent years, we've seen an increasing number of portable applications. Examples cover a wide range of applications, including portable medical equipment like glucose meters, blood pressure monitors, as well as smart thermostats that can report the temperature to your mobile phone.

Even though they differ in terms usage and utility, they all have similar technical design requirements.

They need real time monitoring and data acquisition, high levels of computation and memory created by the applications that run on the devices.

Additionally, these devices need to communicate to other devices, typically through wired connections like USB as well as wireless connections like Wi-Fi, and all require the longest possible battery life, which is enabled by incorporating low power devices in their designs.

The key challenge in developing such products is to find devices that offer both higher levels of performance and low battery consumption so they can last as long as possible on a single battery charge.
The V850 supports an extremely wide range of product families, each is categorized in a particular series. The J Series provides a combination of high-performance processing power with low power consumption for battery power applications.

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

Next, we’ll provide an overview of these and other key features of the Jx4 series.
The new V850 Jx4 Series offers several features that are key for high performance, low power designs.

The first is Ultra Low Power:
The V850 Jx4 offers ultra low power operation with 190uA/MHz power consumption at 32 MHz. This places the Jx4 in the best in class for 32 bit MCUs. Other features include a new “snooze” operating mode and an on-chip RTC which only requires 0.6 uA.

Next, High Performance:
The V850 Jx4 supports a category leading 1.9 DMIPS/MHz. Up to 32 MHz operation is supported on the Jx4-L and up to 64 MHz on the Jx4. In addition, the operating voltage range has been extended to a low 1.6V level, targeting longer life for battery based products.

Following that we have Extensive scalability:
The Jx4 gives designers nimble flexibility over multiple pin counts from 40 to 176 pins and memory sizes from 32KB to 2MB Flash.

In terms of System Cost Reduction;
More integration such as data flash, internal oscillator and temperature sensor mean you purchase less external components, resulting in cost savings.
And finally there’s High Quality and Safety;
The flash supports Error Correcting code memory known as ECC. In addition, a number of functions have been added to support IEC 60730, a safety standard commonly required for household and industrial products.

Now that we’ve completed our short overview, let’s look at some details regarding these key features.
One of the key strengths of the V850 Jx4 is its ultra low power operation in most any mode. We were able to reduce the operating current from 30mA to just 6mA at the 32 MHz operating frequency. This makes the V850 Jx4 one of the lowest in power consumption across any 32 bit MCU.

This dramatic decrease in power consumption is a result of a new low power flash process technology as well as a number of power optimization techniques.
In addition to low power operation, the V850 Jx4 supports a new advanced snooze mode. This mode enables the reception of ADC and serial data while the CPU is in STOP mode, the lowest power consumption mode of the chip. Through this feature, the CPU does not have to wake up to receive the first data.
The V850 Jx4 supports very high efficiency with 1.9 DMIPs/MHz performance.
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Whereas typical competitor’s products are rated at only 1.25 DMIPs/MHz, with the V850 Jx4 you can run the clock at a lower frequency, saving even more power while accomplishing the same tasks.

The new V850E2S core can support a maximum frequency of 64MHz, compared to its 50MHz predecessor, providing even higher performance to support your applications.
The Jx4-L now supports a wider operating voltage range all the way down to 1.6V, further expanding the operating life of battery powered applications. The ADC also supports this lower 1.6V.

The previous Jx3-L supports operation down to 2.0V.
The Jx4 series product line up offers one of the broadest offerings of both package sizes and flash memory. Packages start at just 40 pins and can be scaled up to 176 pins. Flash starts at a small 32KB and goes upwards to 2MB. This gives you the most flexibility to standardize on the Jx4 series as a platform for a wide range of products.
In addition to broad scalability, we have added new compact and thin packages so the products can be used in the smallest applications. Thicknesses of the QFN packages are only 0.75mm in some of the more compact smaller pin packages.
A number of new features have been integrated into the Jx4 lineup, including:

- On Chip Oscillator
- Real Time Clock
- Power on Reset and Low Voltage Detection
- Data Flash – No external EEPROM
- Watch Dog Timer
- Internal Voltage Reference
- And an internal Temperature sensor.

By utilizing these internal features and eliminating external components, you can save up to $1.30 in build costs.
As automatic electronic control systems expand into many applications, the requirement for greater reliability and safety is an increasing element in embedded system design. The IEC60730 supports safety standards for household and industrial applications.

The Jx4 has added a number of features to help you quickly comply with the IEC60730 standard shortening your development cycle for such products.

These functions include:

- Flash memory CRC calculation
- RAM parity error check
- Illegal memory access detection
- Special Function Register (SFR) write protection
- Clock Stop/frequency detection
In summary, we discussed the requirements of embedded systems and the need to have longer battery life and at higher levels of performance. Then we reviewed the roadmap of V850 J Series devices showing how new devices would meet these requirements.

Finally, we went into detail on a number of key features supported on the Jx4 Series, including:

- Best in class ultra low power operation with dramatic improvements over the Jx3 series, like 80% reduction in active mode current.
- More connectivity by adding USB function to every device
- A broader range of Flash from 32KB to 2MB, SRAM and Package Sizes from 40 to 176 pins

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 at www.renesas.com.

Thank you for your time and interest.
Thank You