Energy-Harvesting Embedded Controller May Eliminate Batteries In IoT Devices

Leveraging Renesas' SOTB process technology, the R7F0E embedded controller achieves extreme reduction in both active and standby current consumption, a combination that was not previously possible to achieve in conventional MCUs, according to the company. This low power consumption, together with an Energy Harvest Controller function, enables the controller to operate directly from ambient energy sources and may eliminate the need for batteries in some applications.

The R7F0E is equipped with an Arm Cortex-M0+-based embedded controller capable of operating up to 64 MHz for rapid local processing of sensor data and execution of complex analysis and control functions. The controller consumes just 20 µA/MHz active current and 150-nA deep standby current, which is said to be approximately one-tenth that of conventional low-power MCUs (Fig. 1). With these extremely low current levels, the R7F0E enables system manufacturers to completely eliminate the need for batteries in some of their products by harvesting ambient energy sources such as light, vibration, and flow.

The R7F0E eliminates many challenges faced by system designers who want to build cost-effective products with efficient energy harvesting capabilities. First, it incorporates a unique and configurable Energy Harvest Controller function that enables direct connection to many different types of ambient energy sources, such as solar, vibration, or piezoelectric, while protecting against harmful inrush current at start-up. This function also manages the charging of external power storage devices such as supercapacitors or optional rechargeable batteries.

Another aspect of the R7F0E supporting energy harvesting is its ability to sense and capture external analog signals at all times with a 14-bit ADC that consumes as little as 3 µA. Similarly, it has the ability to retain up to 256 KB of SRAM data while consuming just 1 nA per kilobyte of SRAM. Finally, the ability to provide graphics data conversion using Memory-In-Pixel LCD technology that consumes virtually no power to retain an image is another power saving feature that makes operation from energy harvesting power sources possible.

"I am very pleased that Renesas achieved this milestone to productize our SOTB technology into a first-of-its-kind solution in the energy harvesting market," said Yoshikazu Yokota, executive vice president and general manager of the Industrial Solution Business Unit of Renesas. "By removing the need for batteries, or the need to replace batteries, new markets will open for us and our customers. Energy harvesting will become a mandatory technology for a smart society and Renesas is poised to lead and expand this technology, and this market. Renesas continues to push forward with e-AI to realize AI at the endpoint, in embedded devices. Looking forward, our SOTB technology will expand our reach into use cases where combining e-AI and energy harvesting will make a very large positive impact to our day-to-day lives."

Samples of the new R7F0E embedded controller are available now for beta customers, and samples are scheduled to be available for general customers from July 2019. Mass production is scheduled to start from October 2019. For more details on Renesas' energy-harvesting controller, see the website.

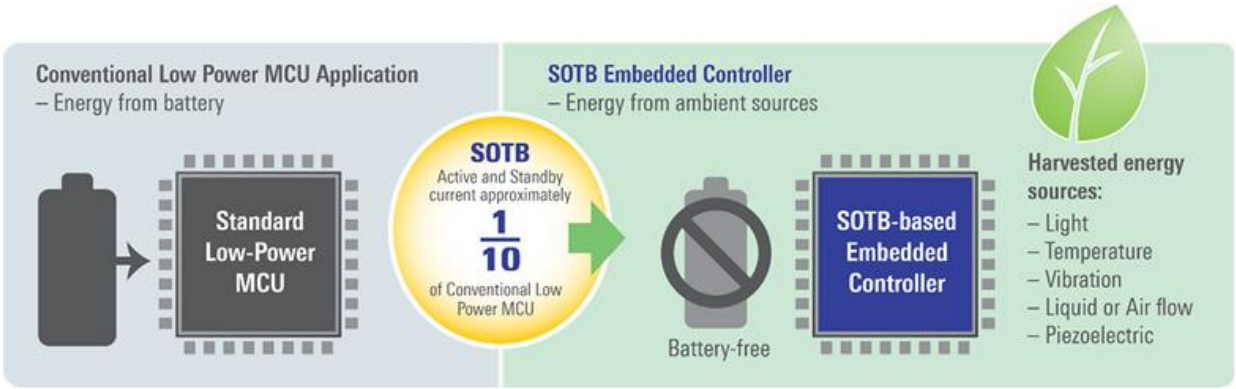

Fig. 1. With its extremely low current levels, the R7F0E enables system manufacturers to completely eliminate the need for batteries in some of their products by harvesting ambient energy sources. An Energy Harvest Controller function enables direct connection to different types of ambient energy sources such as solar, vibration, or piezoelectric.

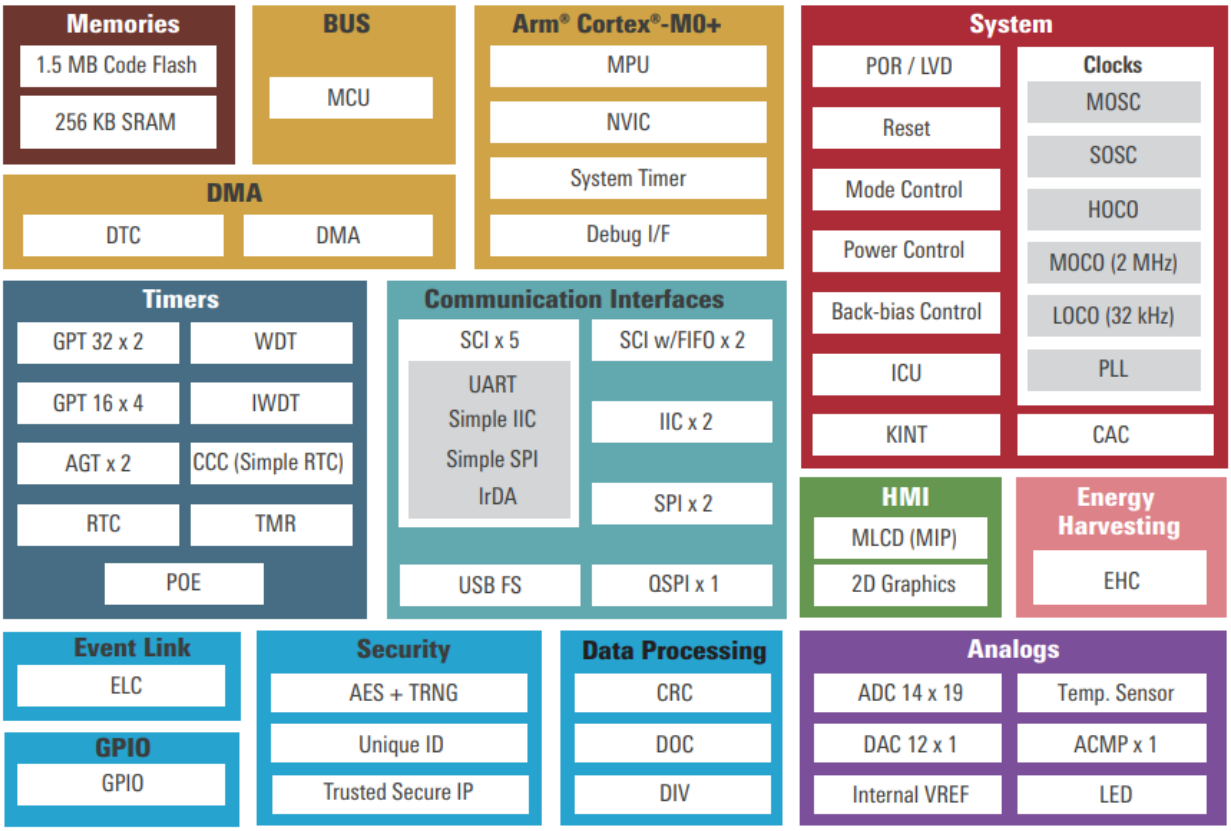

Fig. 2. Block diagram of the R7F0E. This embedded controller is fabricated in SOTB, an advanced low-power process technology that is said to break the usual tradeoff between acheiving either low active current OR low standby current consumption. With SOTB, you get both without compromise, says the vendor. Additionally, SOTB supports high operating frequency for high performance and small silicon node geometry for high-density memory. According to Renesas, this is a recipe for very capable, extreme low-power applications that run from harvested ambient energy.