

Bringing designers ...

... the world's most energy friendly microcontrollers. By Steve Jones.

The explosion in the use of battery operated electronic products of the last few years has been followed more recently by the need for the battery to last longer for convenience, environmental and cost reasons.

At the same time, applications have become increasingly complex and demand higher performance from the microcontroller, making the challenge of designing systems for low power even more difficult.

Responding to these challenges, Energy Micro has developed the EFM32 family of 32bit ARM Cortex-M3 based microcontrollers. Devices in the family have energy consumptions many times lower than any other 8, 16 or 32 bit microcontroller family currently available.

Low energy consumption, together with high performance, makes the EFM32 family a perfect match for energy sensitive applications such as metering systems, home and building automation, security and medical systems.

Energy friendliness

For battery powered applications, the target is to make the battery last as long as possible. To meet this goal, the device's power consumption has to be as low as possible.

Energy Micro addresses the increasing energy demands of designers by introducing the term 'energy friendly', which means that its focus is on minimising the energy needed to complete the tasks required by the application. Less energy consumed per finished task, combined with ultra low deep sleep current, means the finite amount of energy available in the battery will last significantly longer.

The EFM32 is, by far, the world's most energy friendly and energy efficient microcontroller.

Ten factors make the EFM32 the world's most energy friendly microcontroller:

- Very low active power consumption



The device consumes 180µA/MHz at 3V while running code from flash memory

- High processing performance, reduced processing time

The high performance 32bit ARM Cortex-M3 core reduces the core's active periods

- Very fast wake up time

The ability to wake up in 2µs promotes use of energy modes

- Ultra low standby current

In this mode, ram and cpu retention, power on reset, brown out detection and the real time clock consume just 0.9µA

- Autonomous peripherals

This allows applications to perform advanced tasks without the cpu being active

- Peripheral reflex system

This feature brings predictable and fast signalling between peripherals without cpu intervention

- Well architected energy modes

Five flexible energy modes allow applications to be optimised

- Energy efficient peripherals

Included are: an LCD controller driving 4 x 40

segments and consuming just 550µA; a low energy UART, with full communication using a 32kHz oscillator; a 12bit A/D converter capable of performing 1Msamples/s while consuming 2mA; an analogue comparator drawing as little as 100nA; and a hardware based 128/256bit AES encryption/decryption unit which needs 54 and 75 cycles respectively.

Allows designers to review their prototype's real time current consumption

- energyAware software

Means designers can find, understand and remove energy bugs easily.

Development tools

When developing energy sensitive applications, the designer must make many implementation choices that can impact upon energy consumption. Being able to identify and remove energy drains at an early stage of prototype development can significantly reduce the energy consumption of the end product.

EFM32 microcontrollers are supported by high end and low cost development kits. The

“The Energy Micro solution is a perfect fit for ultra low power applications.”

Stuart Edwards, Technical Manager, Avnet Memec



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The EFM32 microcontroller family has well architected energy modes

| EFM32 @ 3V | EM0 Run Mode | EM1 Sleep Mode | EM2 Deep Sleep Mode | EM3 Stop Mode | EM4 Shut-off Mode |
|------------------------------------|-----------------|-------------------|---------------------------|------------------|-------------------------|
| Current consumption | 180µA/MHz | 45µA/MHz | 0.9µA | 0.6µA | 20nA |
| Wake up time | - | 0 | 2µs | 2µs | 160µs |
| CPU | On | - | - | - | - |
| High frequency peripherals | available | available | - | - | - |
| Low frequency peripherals | available | available | available | - | - |
| Asynchronous peripherals | available | available | available | available | - |
| CPU and RAM retention | on | on | on | on | - |
| Power on reset, brown out detector | on | on | on | on | on |

kits have an integrated J-Link debugger and are supported by all major tool chains. The Advanced Energy Monitor system and the energyAware Profiler software enable graphical visualisation and optimisation of the application's energy consumption and code.

• EFM32 Gecko Development Kit

The kit includes exchangeable MCU and prototyping boards, buttons, serial, audio and analogue interfaces, accelerometer, light sensor, the real-time Advanced Energy Monitor (AEM), J-Link debugger and a 320x240 LCD screen to display the current being consumed by the application or for application use. Two choices are available: the EFM32-G8xx-DK is supplied with a 160 segment display mounted on the CPU board; or the EFM32-G2xx-DK, which comes without LCD support.

• EFM32 Starter Kit

The starter kit is a low cost tool which includes a capacitive touch slider and button, 160 segment LCD, 3V battery operation, I/Os available on pads, J-Link Debugger and the AEM system, which outputs data to the energyAware Profiler.

Conclusion

The EFM32 family has been designed with energy consumption in mind from day one. The result is significantly increased battery lifetime compared to existing solutions without the need to sacrifice performance. Where longer battery lifetime is not needed, the extremely low energy footprint opens up the possibility of using lower cost batteries in applications where higher priced batteries would normally required.

The EFM32 development environment, with the innovative Advanced Energy Monitoring system, enables further energy optimisation of the total application at the prototyping stage.

Energy Micro not only delivers the world's most energy friendly microcontrollers, but also the tools that designers need to extend the battery lifetime in their applications by at least a factor of four.

Author profile:

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What does EFM32 mean for Avnet Memec's customers?



Stuart Edwards, Avnet Memec's technical manager for the UK and Ireland, discusses the benefits of Energy Micro for his customers.

What gap does EFM32 fill in the Avnet Memec portfolio?

Energy Micro provides Avnet Memec with the very latest ARM Cortex M3 technology. In addition, the Energy Micro solution is perfect for ultra low power applications which are not served by any other ARM Cortex M3 solution provider.

What new products might Gecko enable?

Avnet Memec has already identified several fast growing markets where the UK is at the leading edge – these include smart metering, medical and healthcare, home and building automation and fire and security. The Gecko family is a perfect fit into all of these key market spaces where ultra low energy consumption and improved battery utilisation is critical.

What support is available for designers?

A dedicated team of application engineers and business development managers is focused on our key suppliers and target vertical markets. As a team, we provide in depth, hands on technical support and training for the silicon, the software and related development kits. This support ensures our customers can get the most out of the products and get to market quickly with differentiated products.

What is next from Energy Micro?

Energy Micro is already working on additions to its range including a Tiny Gecko family, aimed at cost sensitive applications, and an enhanced Gecko family. There are also roadmaps to launch the world's most energy friendly short range radio devices in 2011.

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