



MCU Solutions for IoT

AUGUST 2016





Silicon Labs – at the Center of
Over 100 Million Connected Devices
And Counting...

Smart factories



Smart energy



Smart wearables



Smart homes



Internet of Things (IoT)



Compute

32-bit ARM Cortex-M cores
8-bit 8051 core
Ultra-low energy
High integration & functionality



Sense

Heart rate monitoring (HRM)
IR, ambient and UV light
Proximity & gesture detection
Temperature & humidity



Connect

ZigBee/Thread SoCs and software
Bluetooth and WiFi modules
Blue Gecko solutions
Sub-GHz transceivers and SoCs



Tools

Simplicity Studio
8/32-bit IDE
Starter & development kits
Reference designs

The World's Most Energy-friendly MCUs



EFM32

low energy, autonomous
compatibility

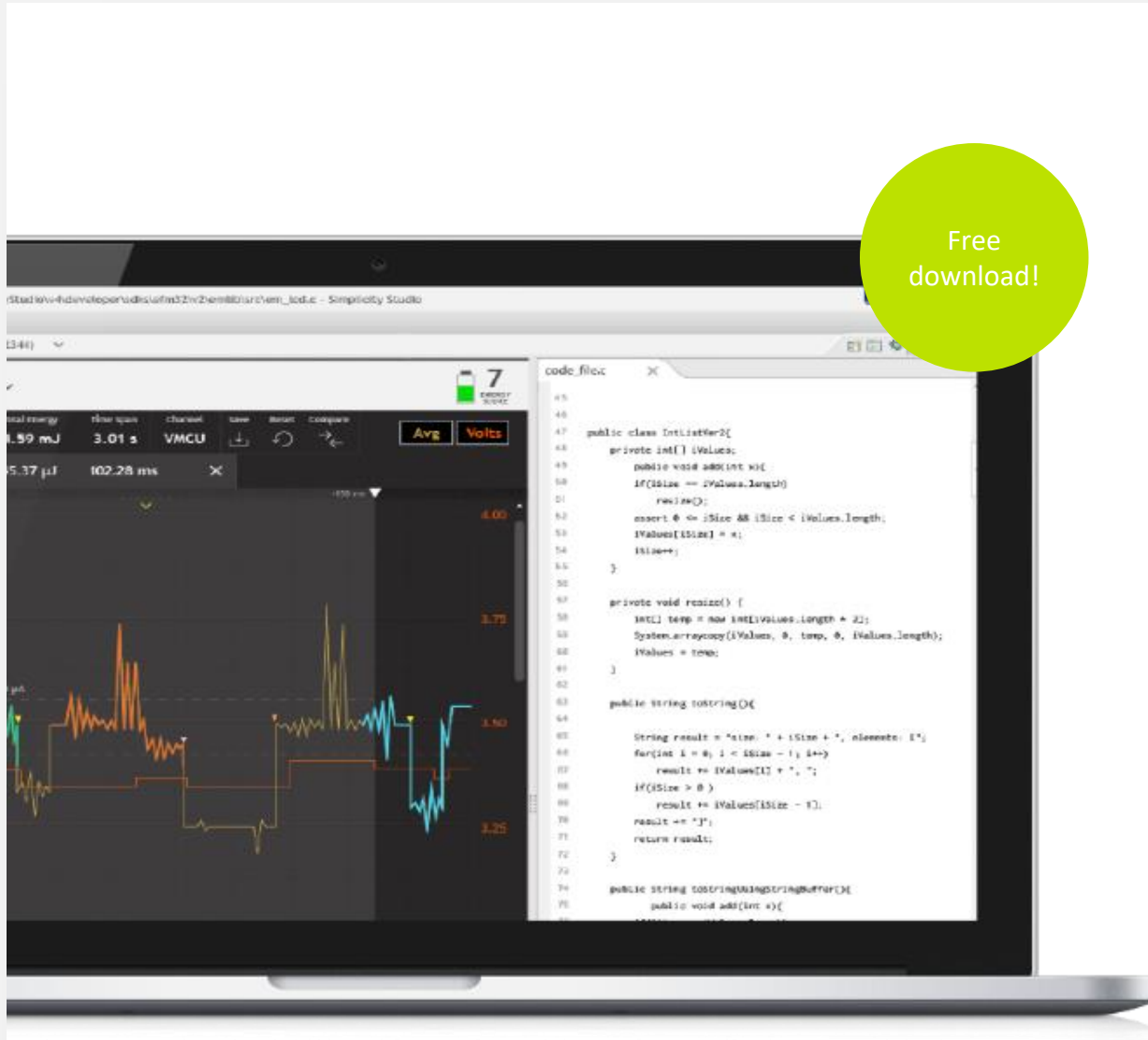


EFM8

high functionality
great value

Lower Cost | Smaller Size | Longest Battery Life

Simplicity Studio™. Helps you develop for the IoT.



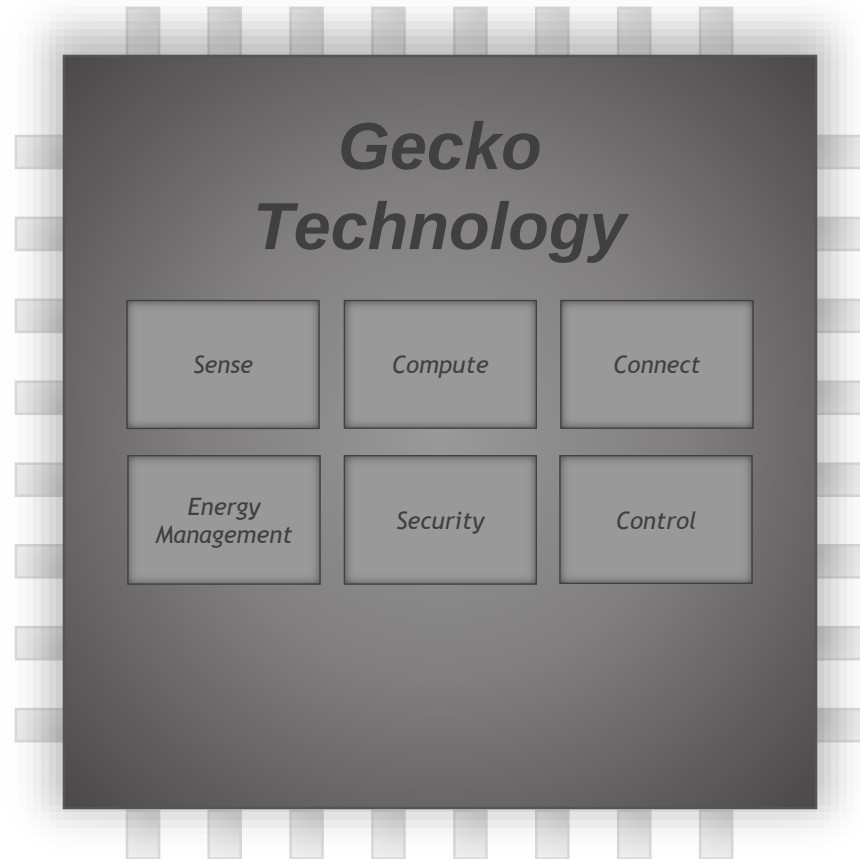
- Unique automatic code creation, debug, and power profile tools
- Software documentation and examples
- Energy profiler provides real time measurements with code correlation
- Wireless development tools to create and analyze networks



EFM32 Gecko MCUs

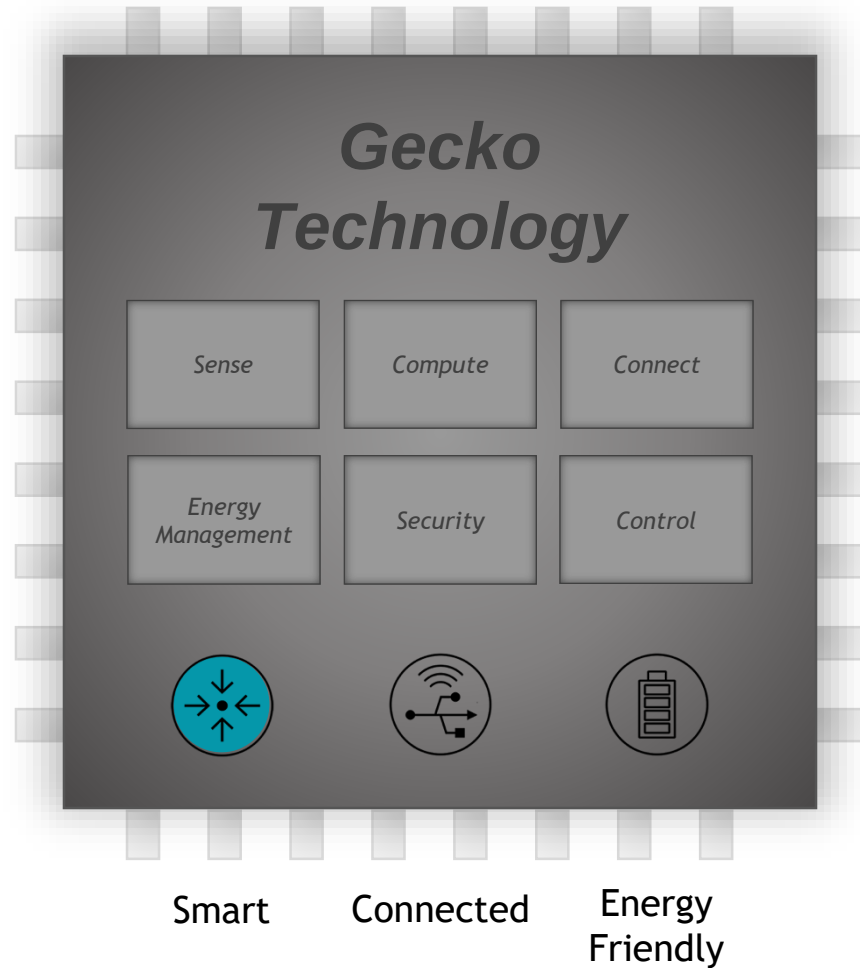


Requirements for Success in the IoT



- Smart
Reduced development time
- Connected
Best integration with the world
- Energy Friendly
Increased battery life

Smart—Reduced Development Time



- Simplicity Studio
 - Energy Profiler
 - Hardware Configurator
 - Extensive Examples and Demos
- Ecosystem
 - Flexible development platforms
 - Free comprehensive drivers and stacks
 - 3rd party RTOS support, including mbed OS
- Compatibility
 - Pin and software compatible
 - Fully featured portfolio (4 kB to 1 MB)
 - MCU and Wireless SoC portfolios

Smart - Simplicity Studio™

- Integrated Tools

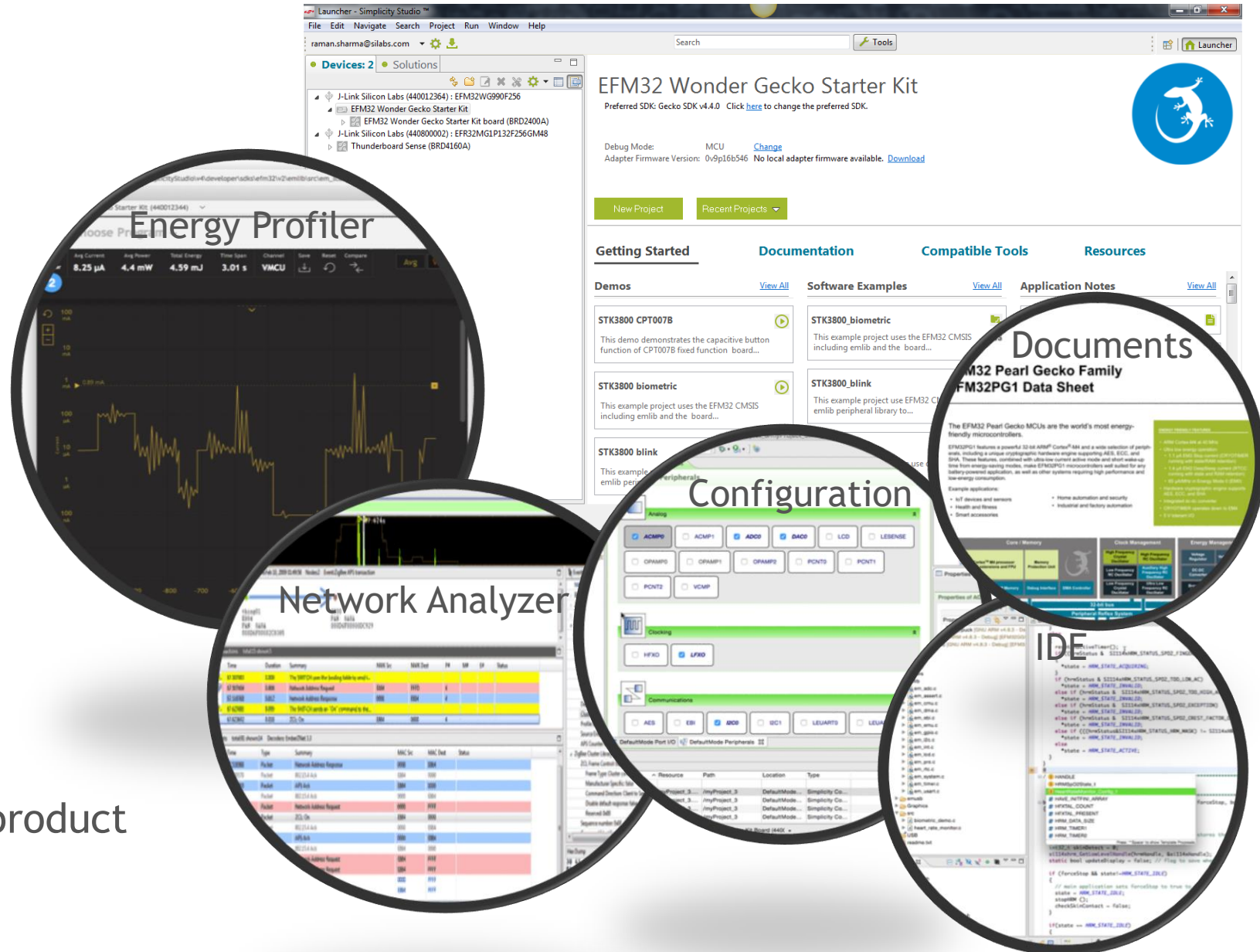
- Energy Profiler
- Capacitive Sense Profiler
- Network Analyser
- Part Configuration

- IDE

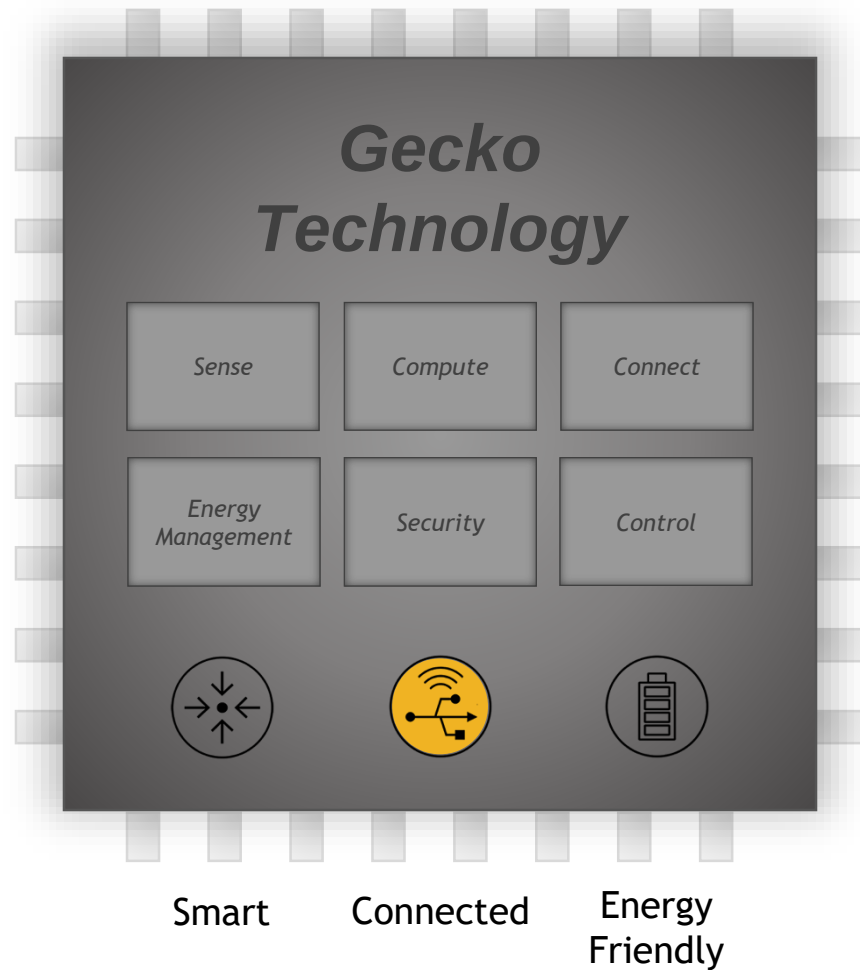
- Eclipse framework
- Build tools: Keil®, IAR®, GCC
- 3rd party IDEs also supported

- Documentation

- One-stop destination for all product documentation

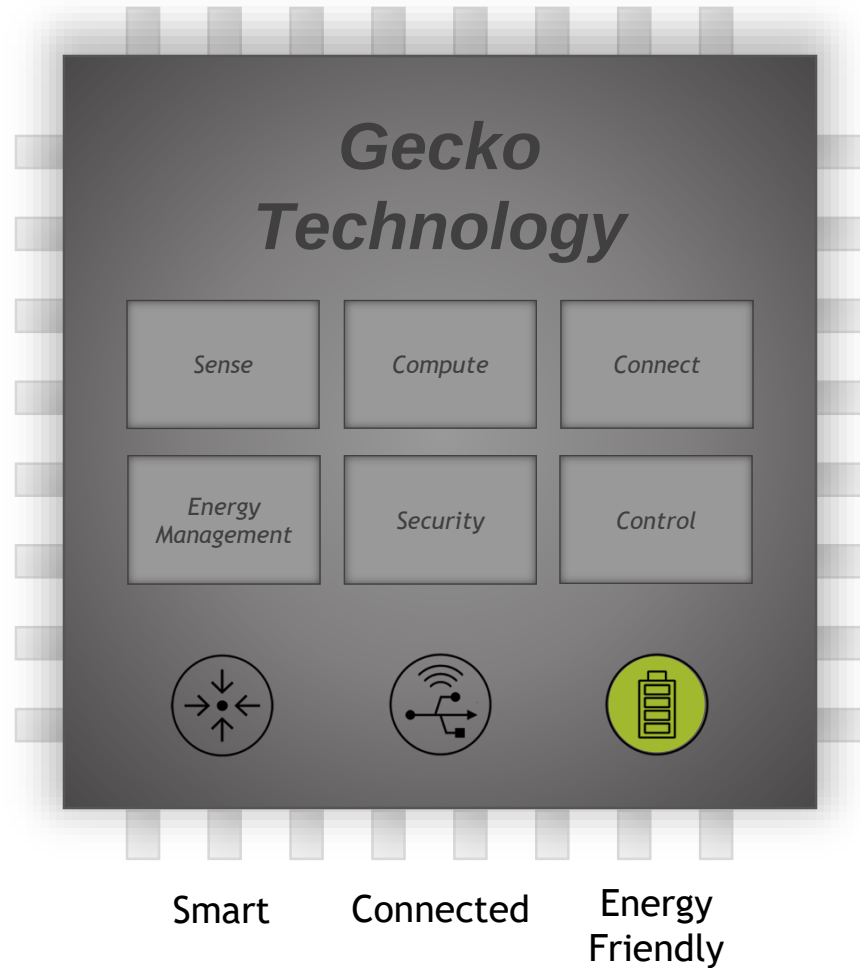


Connected—Best Integration with the World



- Consistent peripheral definition
 - User interface—display and touch
 - Communication—USB, serial and I2S
 - Digital and analog sensor interfaces
- Security
 - HW accelerated crypto libraries
 - Proven security software
 - Security standards and algorithms
 - AES-128/256, SHA-1, SHA-224/256, ECC (Elliptic Curve), CRC
- Wireless options
 - SoCs with robust, multi-protocol radios
 - Sub-GHz, ZigBee, Thread, Bluetooth Smart (BLE)

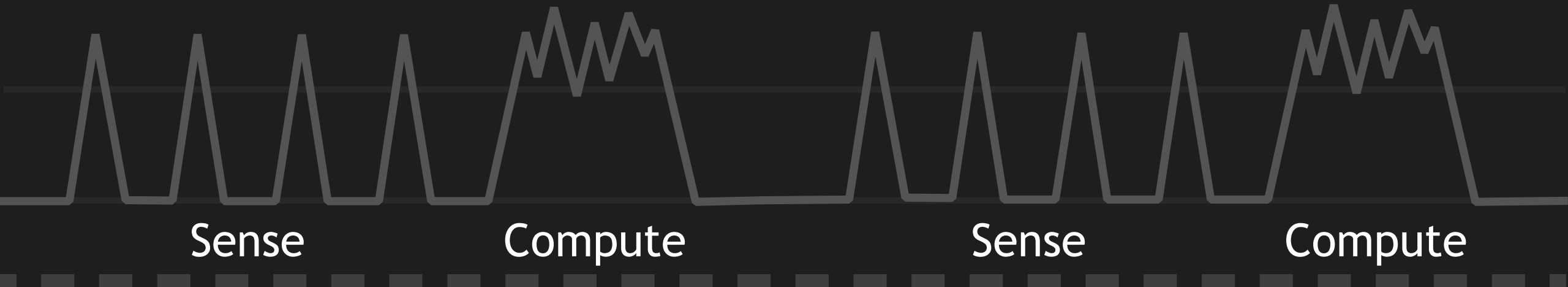
Energy Friendly—Gecko Technology



- Energy efficiency
 - Low active current—63 $\mu\text{A}/\text{MHz}$
 - Sleep current—0.9 μA
 - Fast wake-up—2 μs
- Autonomous operation
 - Peripheral Reflex System (PRS)
 - Low-Energy Sense (LESENSE)
 - Linked DMA (LDMA)
- Low-energy peripherals
 - Low-Energy UART (LEUART)
 - Cryotimer
 - ADC runs in deep sleep modes

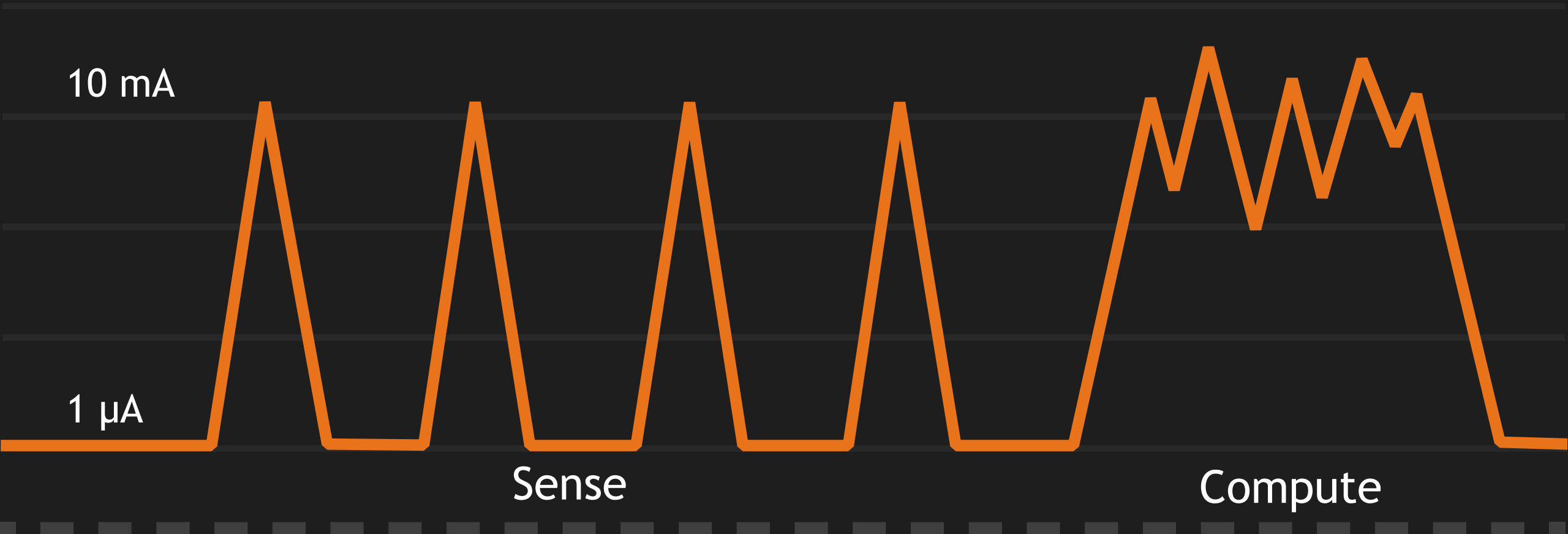
What does Energy Friendly mean?

A typical sense and compute application



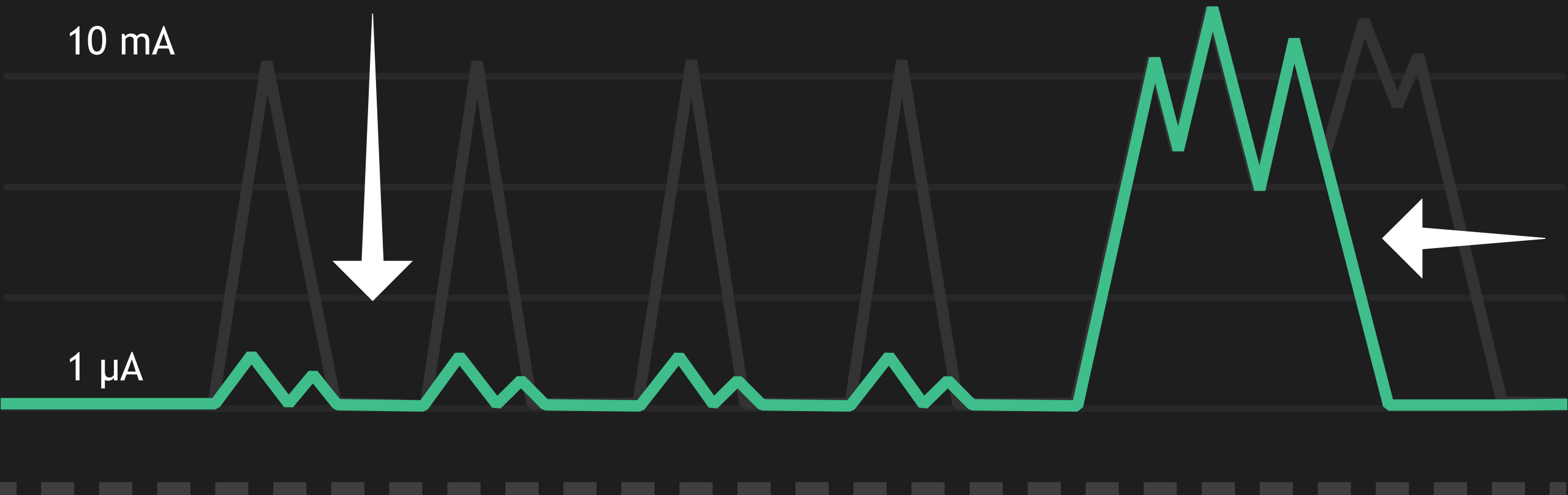
A typical sense and compute application

Generic MCU



A typical sense and compute application

Generic MCU
Gecko Technology

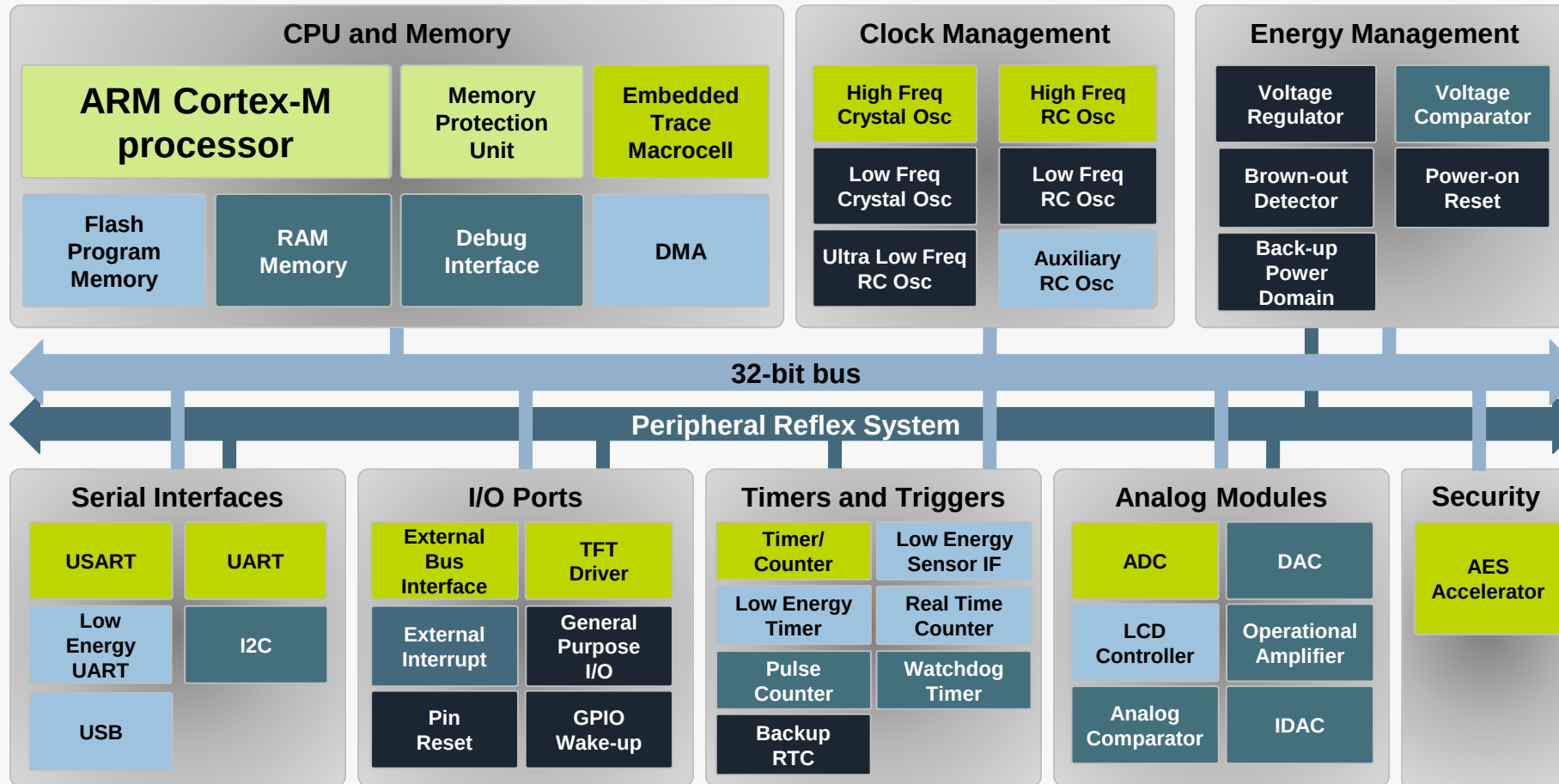


EFM32 Gecko Series 0

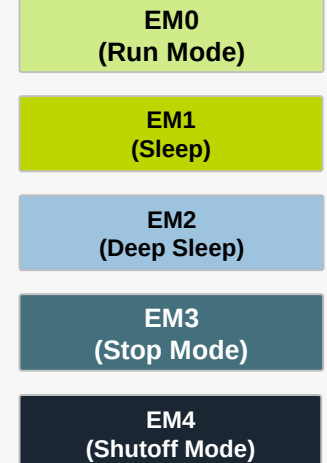


- Processor and memory
 - Cortex-M4+FPU, Cortex M3 or Cortex M0+
 - Up to 48 MHz
 - 4 - 1024 kB Flash, 2 - 32 kB RAM
- Power
 - Down to 114 $\mu\text{A}/\text{MHz}$
 - Down to 0.9 μA with retention/BOD/RTC
- Packages
 - QFN, QFP, BGA, CSP
 - 24 - 120 pins
- Software compatibility
 - EZR32 wireless MCUs

EFM32 Series 0 – Feature Set



Available Down To:

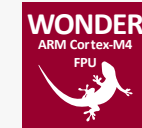


EFM32 Series 0 - Portfolio

Software compatible

Pin compatible within each package

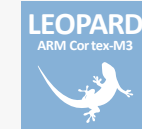
M4	Wonder	Optional Features		EFM32WG940 EFM32WG330 EFM32WG840 EFM32WG230		EFM32WG942 EFM32WG332 EFM32WG842 EFM32WG232		EFM32WG980 EFM32WG380 EFM32WG880 EFM32WG280		EFM32WG990 EFM32WG390 EFM32WG890 EFM32WG290		EFM32WG995 EFM32WG395 EFM32WG895 EFM32WG295								
		USB LCD TFT																		
M3	Giant	USB LCD TFT	EFM32GG940 EFM32GG330 EFM32GG840 EFM32GG230		EFM32GG942 EFM32GG332 EFM32GG842 EFM32GG232		EFM32GG980 EFM32GG380 EFM32GG880 EFM32GG280		EFM32GG990 EFM32GG390 EFM32GG890 EFM32GG290		EFM32GG995 EFM32GG395 EFM32GG895 EFM32GG295									
			EFM32LG940 EFM32LG330 EFM32LG840 EFM32LG230		EFM32LG942 EFM32LG332 EFM32LG842 EFM32LG232		EFM32LG980 EFM32LG380 EFM32LG880 EFM32LG280		EFM32LG990 EFM32LG390 EFM32LG890 EFM32LG290		EFM32LG995 EFM32LG395 EFM32LG895 EFM32LG295									
			Leopard	USB LCD TFT	EFM32G210 EFM32G200		EFM32G840 EFM32G230		EFM32G842 EFM32G232		EFM32G880 EFM32G280		EFM32G890 EFM32G290							
					EFM32TG110 EFM32TG108		EFM32TG840 EFM32TG230		EFM32TG822 EFM32TG222		EFM32TG842 EFM32TG232		EFM32TG825 EFM32TG225							
	Tiny	LCD	EFM32HG309 EFM32HG308 EFM32HG110 EFM32HG108		EFM32HG310 EFM32HG210		EFM32HG322 EFM32HG321 EFM32HG222													
			EFM32ZG110 EFM32ZG108		EFM32ZG210		EFM32ZG222													
	Zero		QFN24		QFN32		QFN64		QFP48		QFP64		QFP100		BGA48		BGA112		BGA120	



Up to 48 MHz
Flash: 64 - 256
RAM: 32



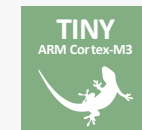
Up to 48 MHz
Flash: 512 - 1024
RAM: 128



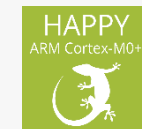
Up to 48 MHz
Flash: 64 - 256
RAM: 32



Up to 32 MHz
Flash: 16 - 128
RAM: 8 - 16



Up to 32 MHz
Flash: 4 - 32
RAM: 2 - 4



Up to 25 MHz
Flash: 32 - 64
RAM: 4 - 8



Up to 24 MHz
Flash: 4 - 32
RAM: 2 - 4

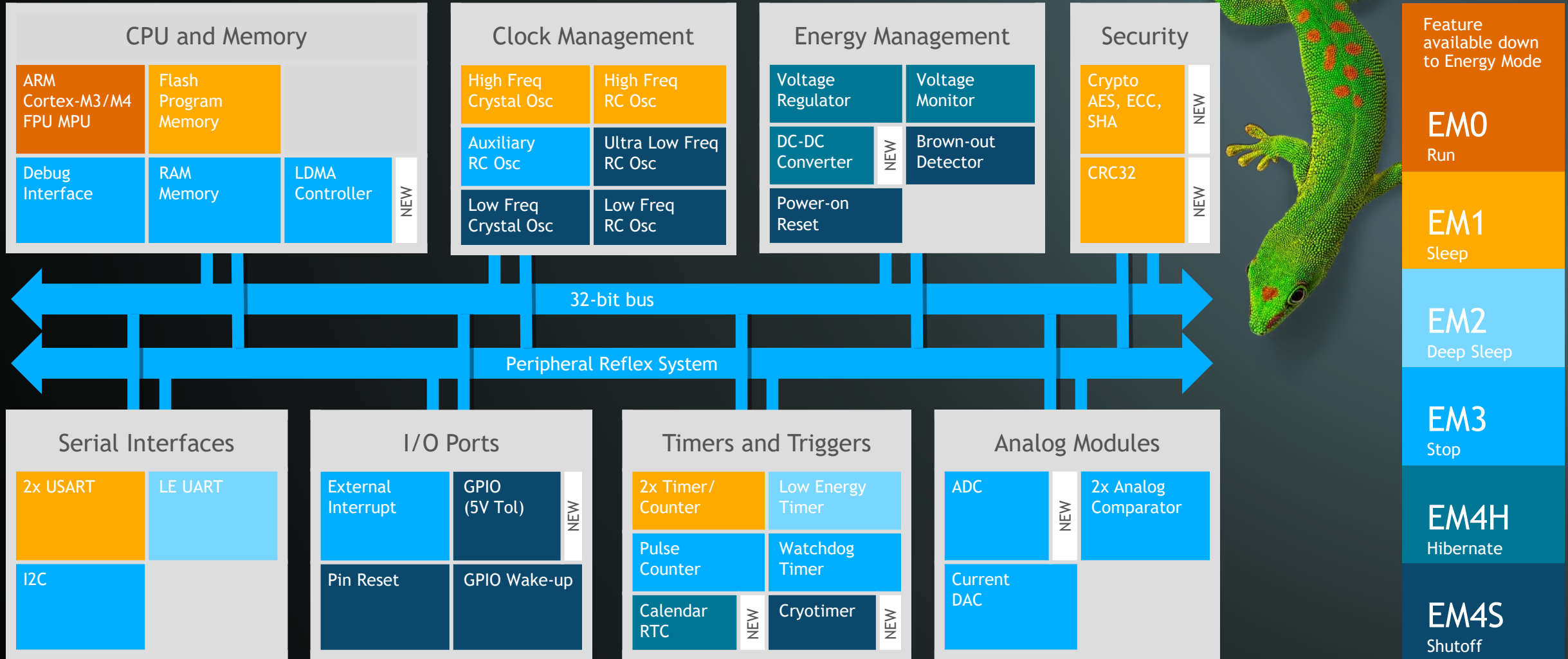
- WLCSP package: Wonder, Leopard and Happy Gecko are available in an ultra-small CSP81/CSP36 package – EFM32WG360, EFM32LG360 and EFM32HG350
- Wafer sales: Giant, Wonder, Leopard, and Gecko are available in wafer form – EFM32GG900, EFM32WG900, EFM32LG900, and EFM32G800.

EFM32 Gecko Series 1

- Processor and memory
 - Cortex-M4 with FPU or Cortex-M3
 - Up to 40 MHz
 - 128-256 kB Flash, 32 kB RAM
 - 512-1024 kB Flash, 256 kB RAM – samples 1Q17
- Power
 - 63 μ A/MHz
 - 2.5 μ A deep sleep with retention/BOD/RTCC
 - 1.85–3.8 V single power supply
- Packages
 - QFN32 (5 mm x 5 mm)
 - QFN48 (7 mm x 7 mm)
- Software compatibility
 - HAL and drivers help transition from Series 0
 - Compatible with EFR32 Wireless Geckos



EFM32 Series 1 - Feature Set



EFM32 Series 1 - Feature Set

CPU and Memory		
ARM Cortex-M3/M4 FPU MPU	Flash Program Memory	
Debug Interface	RAM Memory	LDMA Controller NEW

Clock Management	
High Freq Crystal Osc	High Freq RC Osc
Auxiliary RC Osc	Ultra Low Freq RC Osc
Low Freq Crystal Osc	Low Freq RC Osc

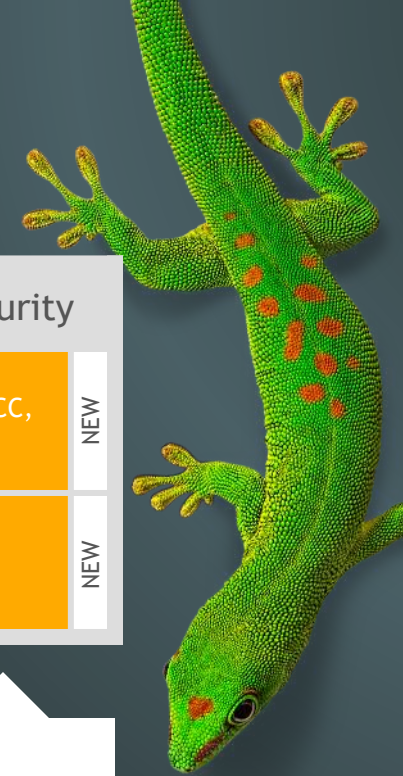
Energy Management	
Voltage Regulator	Voltage Monitor
DC-DC Converter NEW	Brown-out Detector
Power-on Reset	

Security	
Crypto AES, ECC, SHA	NEW
CRC32	NEW

- CPU and Memory
 - Memory Protection Unit
 - Instruction cache
 - Linked DMA engine enables sequenced transactions
 - JTAG programming interface

- Clock Management
 - Flexible on- and off-chip clock source options
- Energy Management
 - High-efficiency dc-dc buck converter supplies both MCU and external system components

- Security
 - Efficient HW offload
 - AES-128/256
 - Elliptic curve
 - SHA-1, SHA-224/256
 - 16/32-bit CRC



Feature available down to Energy Mode	
EM0	Run
EM1	Sleep
EM2	Deep Sleep
EM3	Stop
EM4H	Hibernate
EM4S	Shutoff

EFM32 Series 1 - Feature Set

- Serial interfaces
 - USART supports UART, SPI, I2S, smart cards (IEC 7816), IrDA
 - Low Energy UART
 - 9600 baud at 150 nA using 32 kHz clock
- I/O Ports
 - Up to 32 GPIO
 - 5 V tolerance
 - Supports 1.8 V system components
- Timers and triggers
 - 32-bit RTC with BCD calendar mode
 - Independent windowed watchdog timer
 - Cryotimer operates in all energy modes
- Peripheral Reflex System
 - Inter-peripheral task sequencing
 - Supports logical operations
- Analog
 - Flexible mux provides up to 24 analog pins
 - 12-bit SAR ADC operates down to EM3
 - 190 μ A at 1 Msp
 - Analog comparator with capacitive sense mode

Serial Interfaces

2x USART	LE UART
I2C	

I/O Ports

External Interrupt	GPIO (5V Tol) NEW
Pin Reset	GPIO Wake-up

Timers and Triggers

2x Timer/Counter	Low Energy Timer
Pulse Counter	Watchdog Timer
Calendar RTC NEW	Cryotimer NEW

Analog Modules

ADC NEW	2x Analog Comparator
Current DAC	

Feature available down to Energy Mode

EM0

Run

EM1

Sleep

EM2

Deep Sleep

EM3

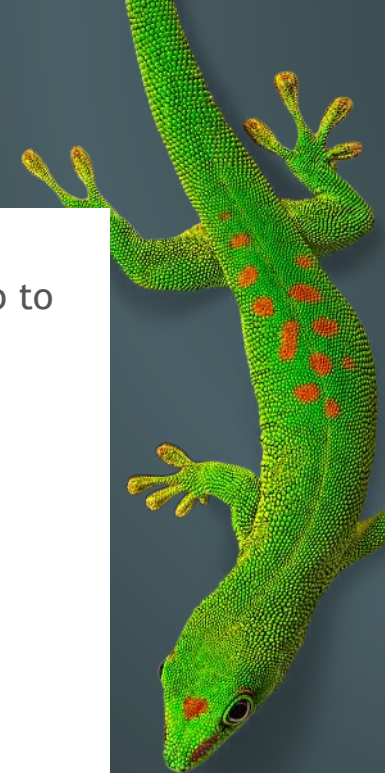
Stop

EM4H

Hibernate

EM4S

Shutoff



EFM32 Series 1 - Portfolio

PEARL  Cortex-M4F	1024 kB*			PG12B500	PG12B500
	512 kB			PG12B500	PG12B500
	256 kB*	PG1B100	PG1B200	PG1B200	
	128 kB	PG1B100	PG1B200	PG1B200	
JADE  Cortex-M3	1024 kB*			JG12B500	JG12B500
	512 kB			JG12B500	JG12B500
	256 kB*	JG1B100	JG1B200	JG1B200	
	128 kB	JG1B100	JG1B200	JG1B200	
		5 x 5 x 0.85 mm QFN32 No DC-DC With DC-DC		7 x 7 x 0.85 mm QFN48 With DC-DC	
				7 x 7 x 1.0 mm BGA125 With DC-DC	

* Offered in both G and I temp grades

Samples 1Q 2017



EFM8 Bee MCUs



This is my EFM8

Performance

- 72 MHz
- Low power
- Fast peripherals

Value

- Small packages
- High integration
- More for less

Simplicity

- Easy migration
- Consistent tools
- Common STK

An MCU without compromise!

EFM8 MCU Family

LASER



UNIVERSAL



SLEEPY



BUSY



Precision Analog line up to 72 MHz

Flash: 16 – 64 KB

RAM: 1 - 4 KB

IO: up to 29

ADC: 14 bit 900 ksps; 12-bit 1 Msps

Benefits

- 72 MHz MCU in 3x3 mm² package – high integration
- ADC/4xDAC/ 2x comparator – state-of-the-art analog
- ± 3 °C temperature sensor – eliminate calibration
- Config Logic – eliminate external glue logic

USB up to 48 MHz

Flash: 8 - 64 KB

RAM: 2 - 4 KB

IO: up to 40

ADC: 12-bit 200 ksps; 10 bit 800 ksps

Benefits

- No external crystal or regulator – save
- Low Energy USB mode – save battery
- Integrated USB Charger Detect (USB - BCS v1.2) – increased functionality for customer

Low Power up to 25 MHz

Flash: 2 - 64 KB

RAM: 0.5 - 4 KB

IO: up to 24

ADC: 12 bit 75 ksps; 10-bit 300 ksps

Benefits

- Energy friendly - 50 nA sleep mode
- Active currents – 150 uA/MHz
- Fast wake up - < 2 us
- Capacitive sense - <1uA wake on touch

Value line up to 50 MHz

Flash: 2 - 64 KB

RAM: 0.5 - 2 KB

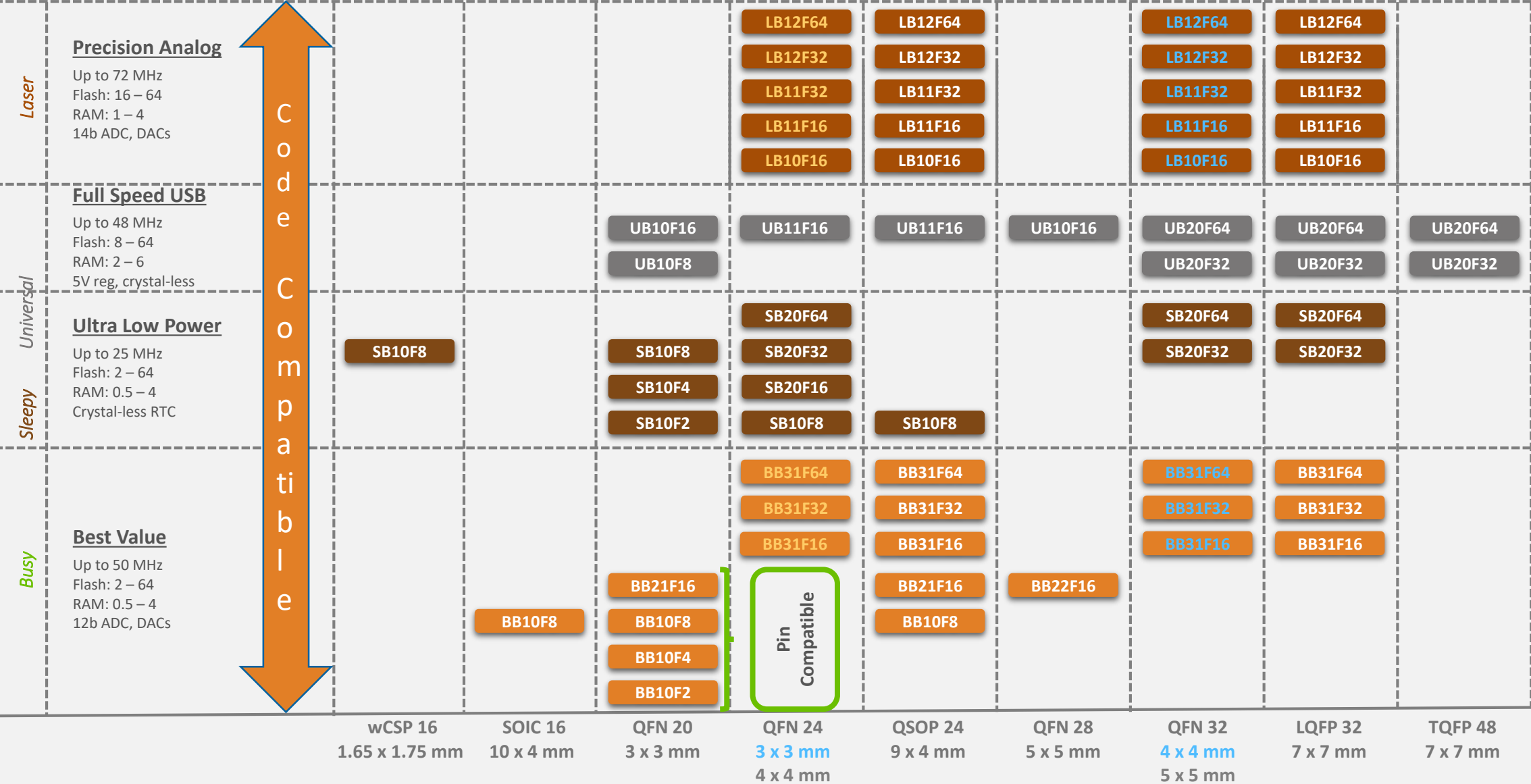
IO: up to 29

ADC: 12 bit 350 ksps; 10-bit 1.125 Msps

Benefits

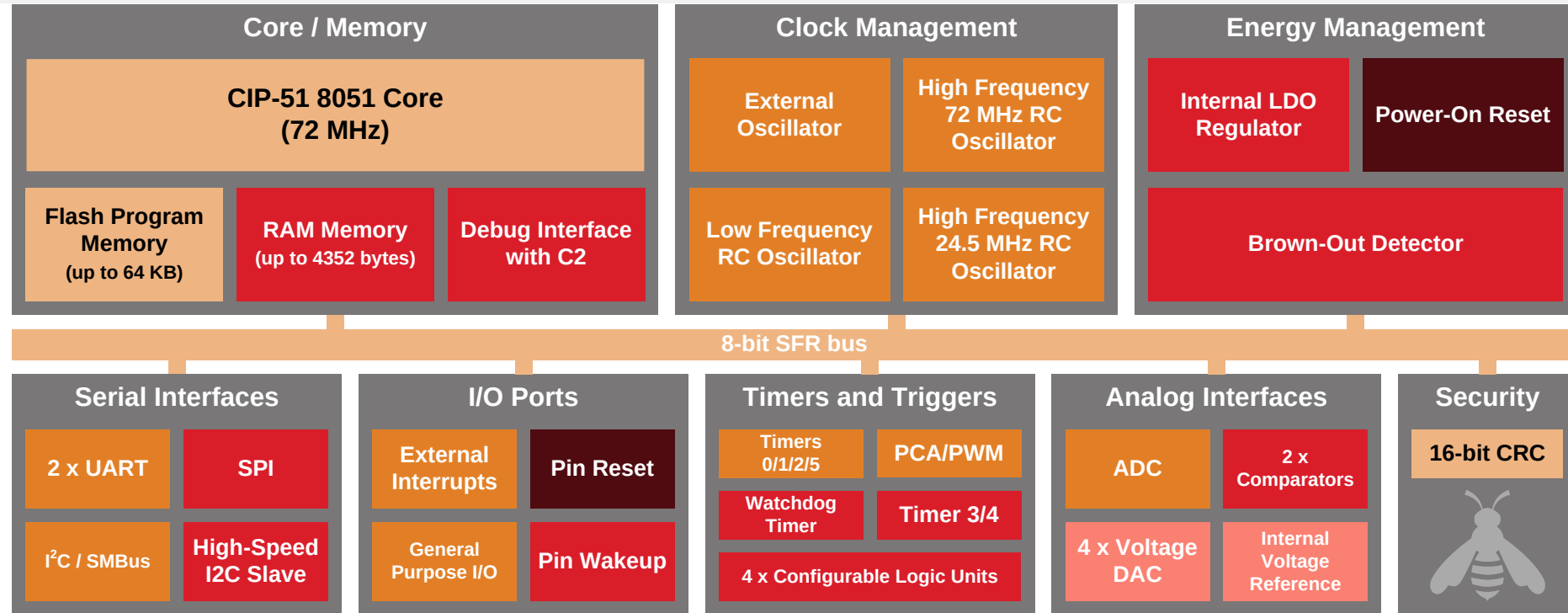
- High-Clock Speeds – Do more with MCU
- High-integration – lower cost for customer
- Priority crossbar – simplify PCB design
- Industrial grade available

EFM8 - Portfolio



EFM8LB1 Highlights

LASER



Lowest power mode with peripheral operational:

Normal Idle Suspend Snooze Shutdown

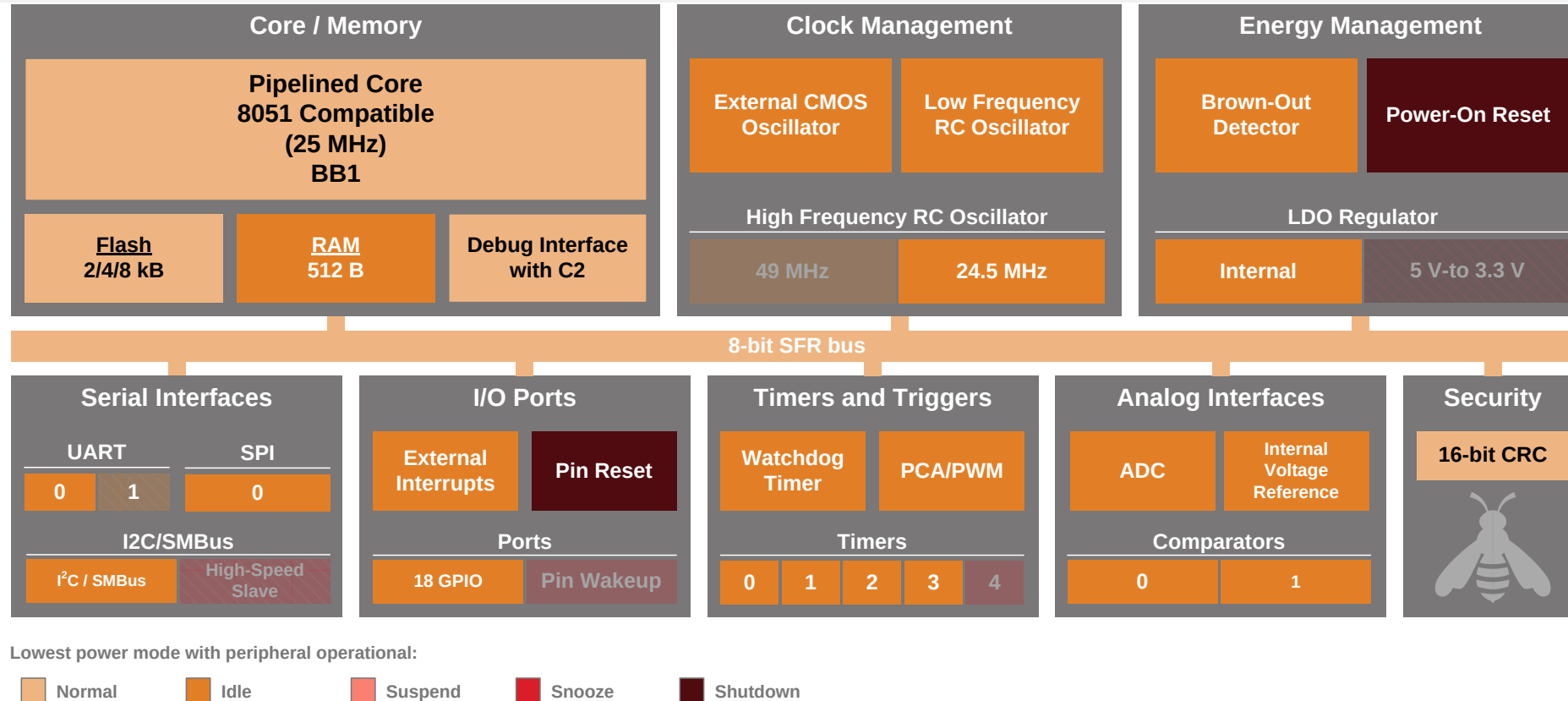
■ Highlights (LB1)

- 72 MHz MCU
- 14-bit 900 kbps; 12-bit 1 msp
- $\pm 3^{\circ}\text{C}$ temperature sensor

■ Applications

- Real-Time Control
- Test and Measurement
- Industrial Electronics

EFM8 Busy Bee 1 Highlights



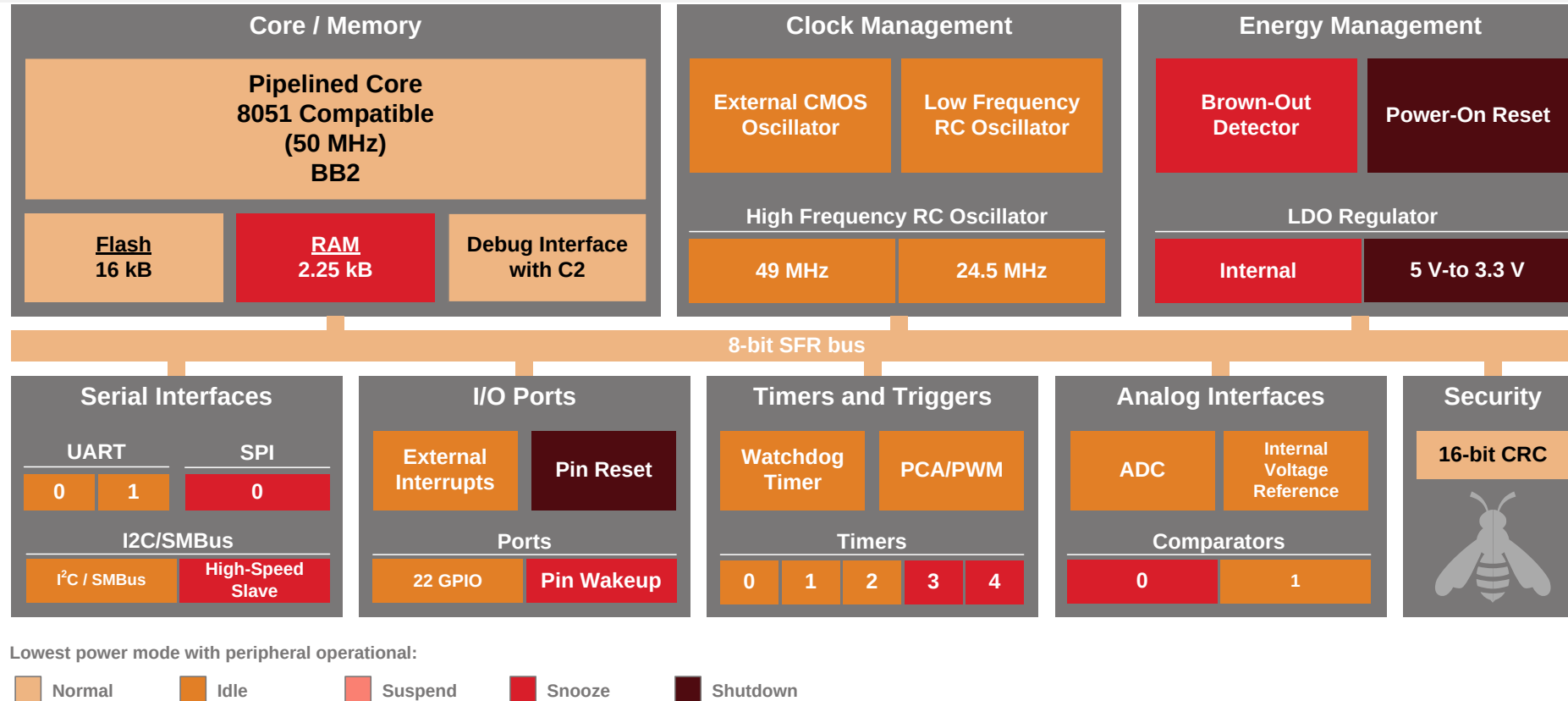
■ Highlights (BB1)

- 25 MHz MCU
- 12-bit 200 ksps; 10-bit 800 ksps
- Programmable Counter Array (PCA)

■ Applications

- Motor Control
- High-speed sensor controller and hub
- Consumer Electronics

EFM8 Busy Bee 2 Highlights



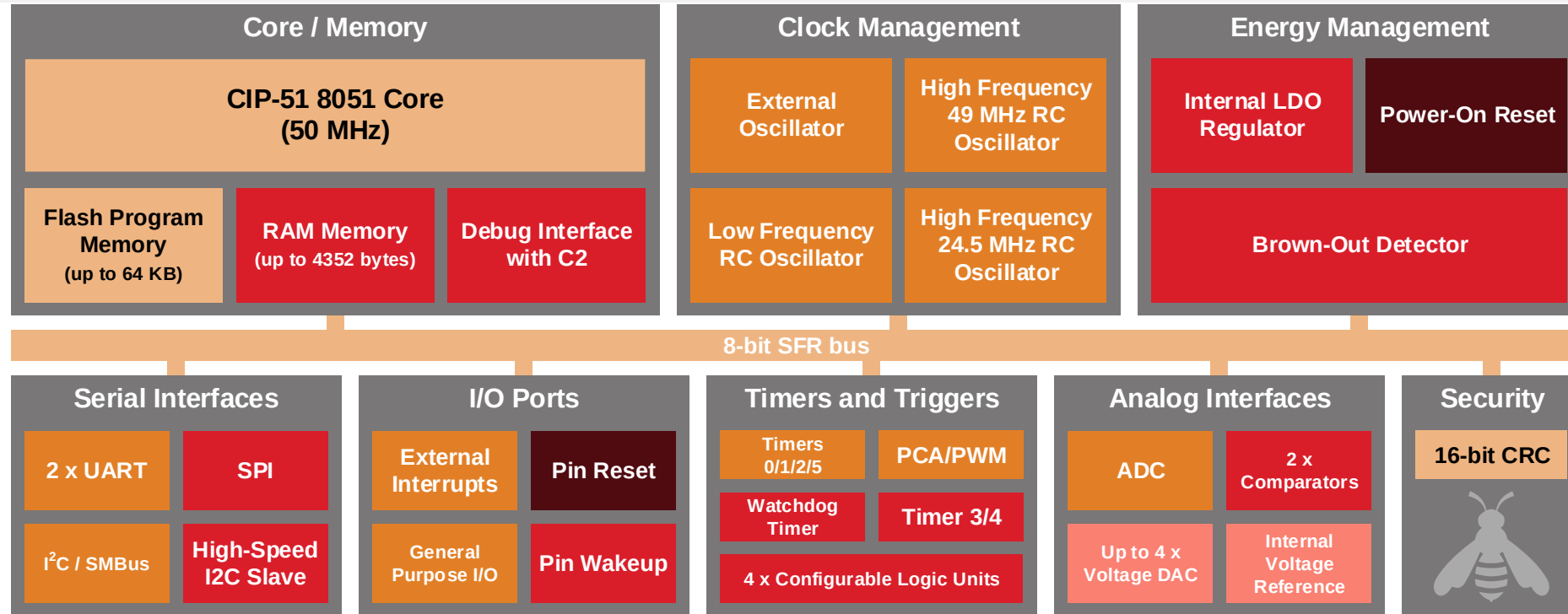
■ Highlights (BB2)

- 50 MHz MCU
- 5V LDO; 5V tolerant IO
- Many useful energy modes

■ Applications

- Motor Control
- High-speed sensor controller and hub
- Consumer Electronics

EFM8 Busy Bee 3 Highlights



Lowest power mode with peripheral operational:

Normal Idle Suspend Snooze Shutdown

■ Highlights (BB3)

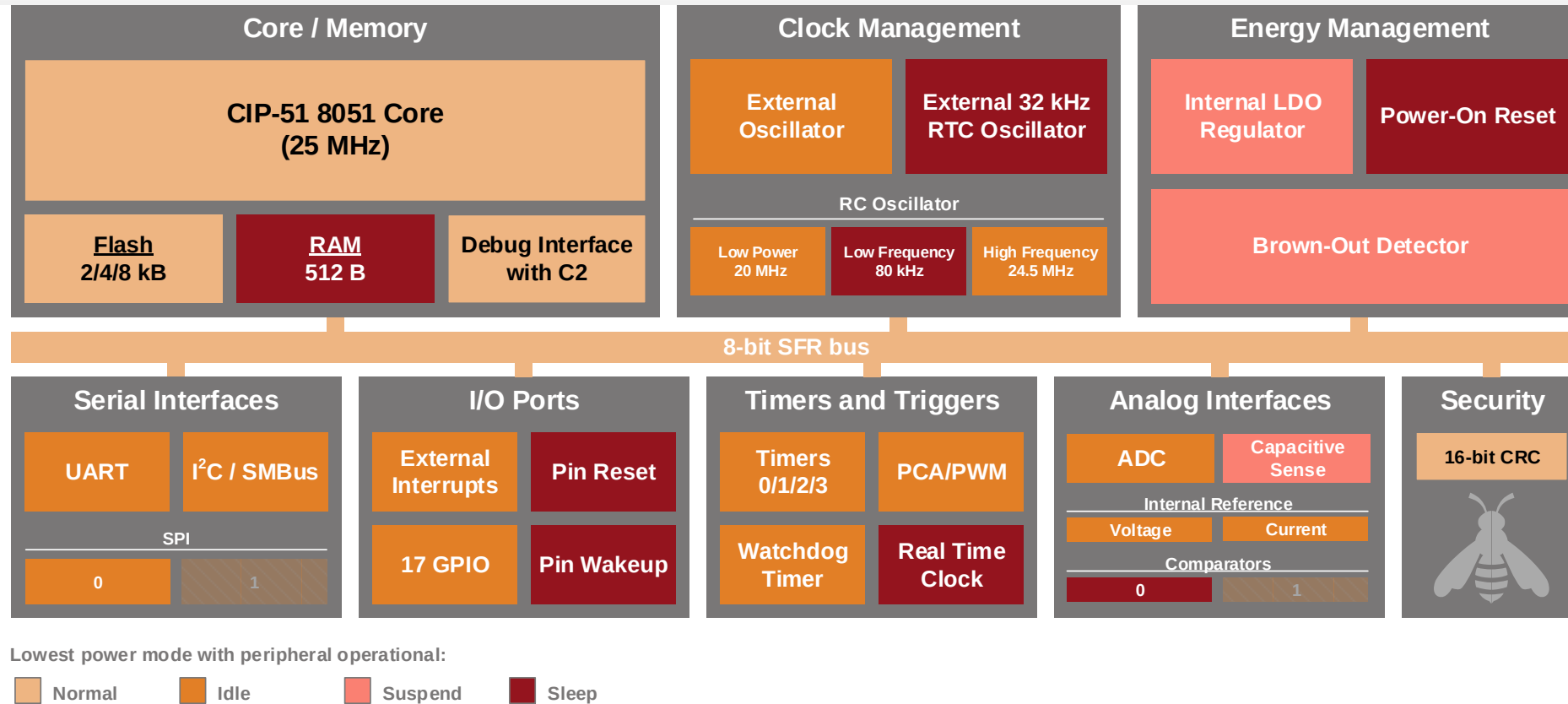
- 50 MHz MCU
- 12-bit ADC; 12-bit DAC
- Config Logic Units; 5V tolerant IO

■ Applications

- Measurement and instrumentation equipment
- Electric tools
- Consumer Electronics

EFM8 Sleepy Bee 1 Highlights

SLEEPY



Highlights (SB1)

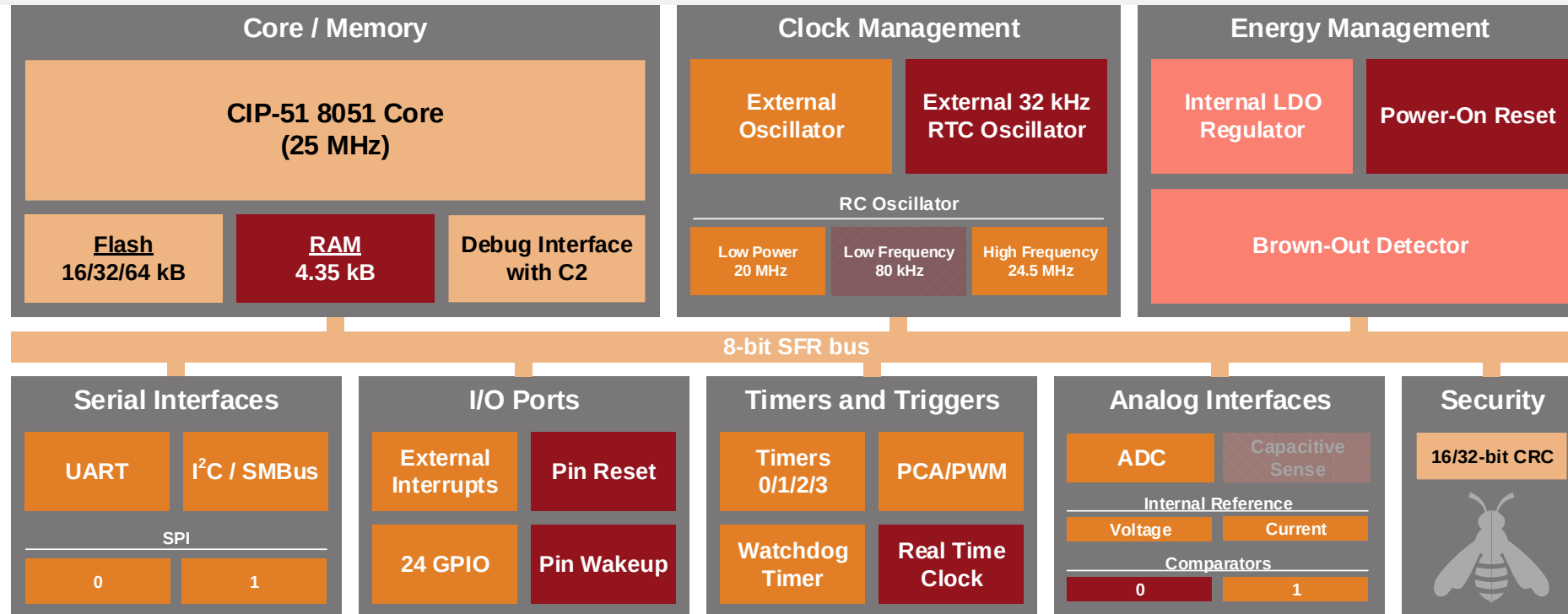
- 12-bit 75 ksps; 10-bit 300 ksps ADC
- Dedicated Cap Sense Block
- Flexible and easy to use Energy Modes

Applications

- IoT – Sense, Control and Communicate
- Wearables – Touch interface
- Consumer Electronics

EFM8 Sleepy Bee 2 Highlights

SLEEPY



Lowest power mode with peripheral operational:

Normal Idle Suspend Sleep

■ Highlights (SB2)

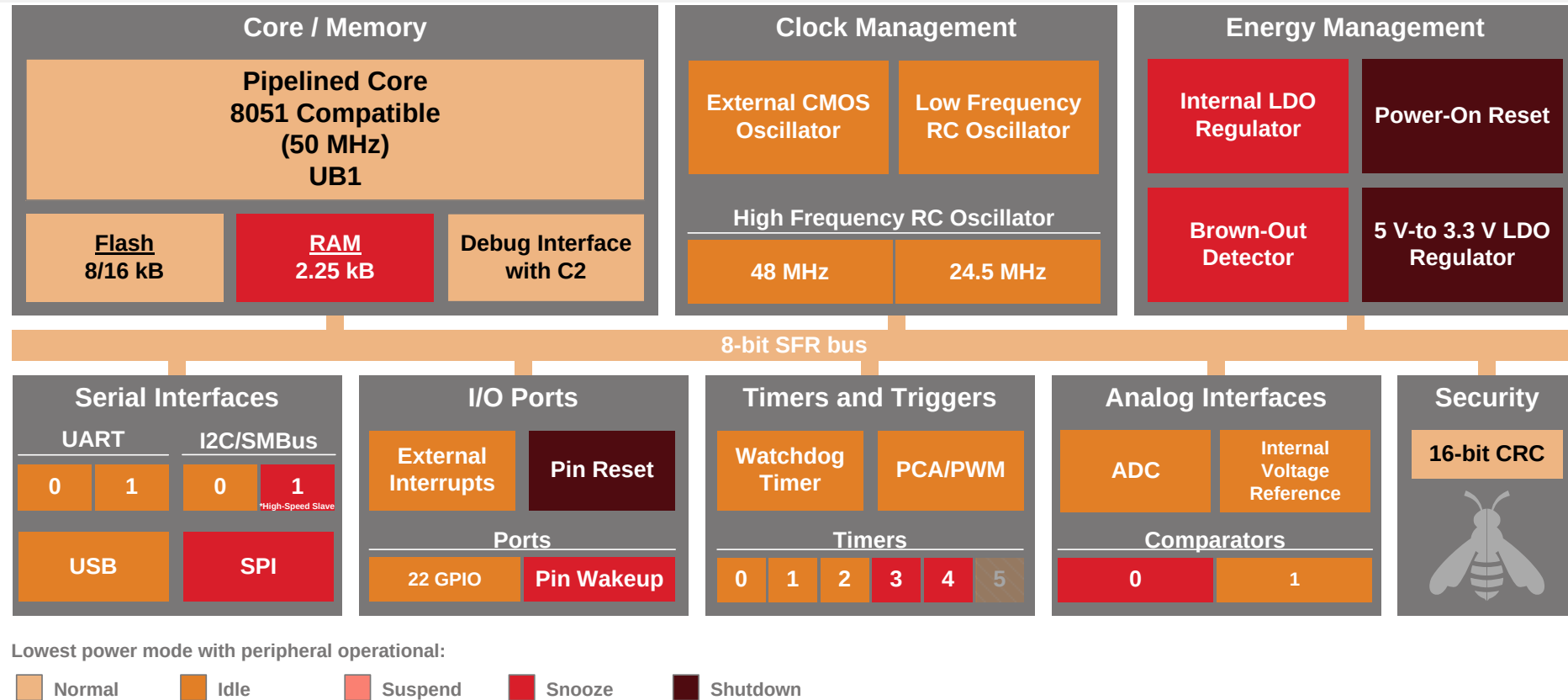
- Larger flash sizes
- 10-bit 300 ksps ADC
- Flexible and easy to use Energy Modes

■ Applications

- IoT – Sense, Control and Communicate
- Wearables – Touch interface
- Consumer Electronics



EFM8 Universal Bee 1 Highlights



Highlights (UB1)

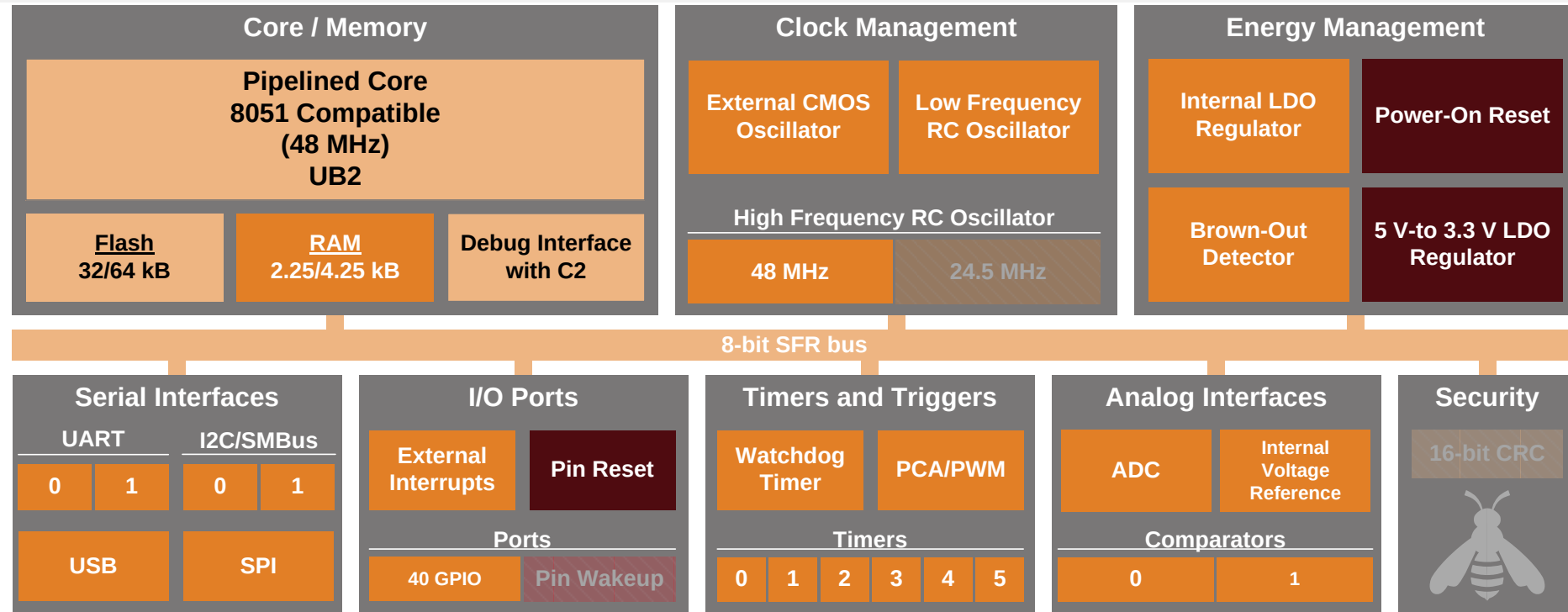
- Low Energy USB w/ High-Speed Serial Peripherals
- 12-bit 200 kbps/10 bit 800 kbps ADC
- BOM Integration – Crystal, Reg and USB

Applications

- Tablet and Smart Phone Peripherals
- Embedded USB Peripherals
- USB IO Controller



EFM8 Universal Bee 2 Highlights



Lowest power mode with peripheral operational:

Normal
 Idle
 Suspend
 Snooze
 Shutdown

■ Highlights (UB2)

- High IO Count, 10 mA source and 25 mA sink
- Differential 10-bit 500 ksps ADC
- BOM Integration – Crystal, Reg and USB

■ Applications

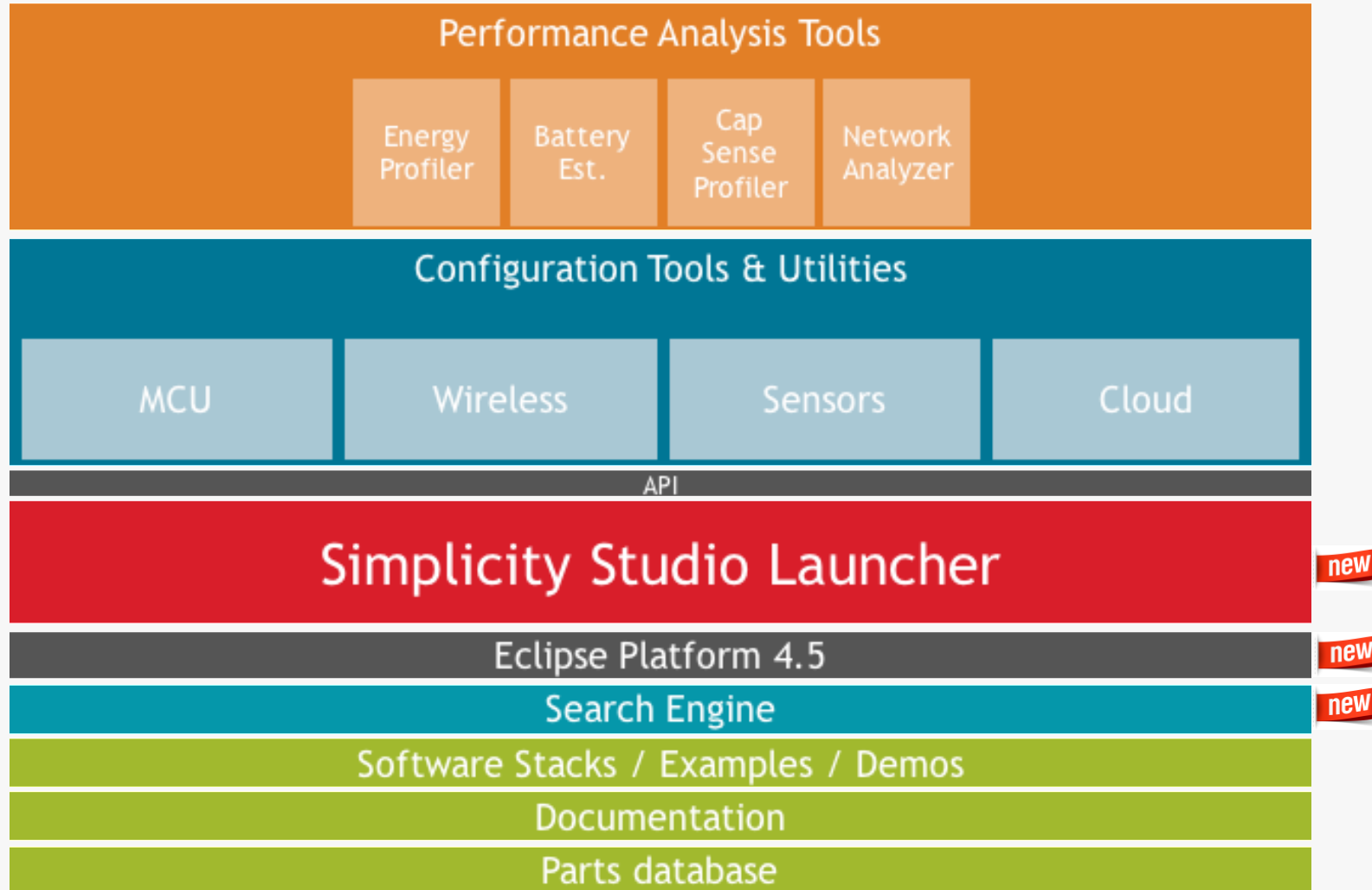
- Tablet and Smart Phone Peripherals
- Embedded USB Peripherals
- USB IO Controller



Simplicity Studio & Development Kits

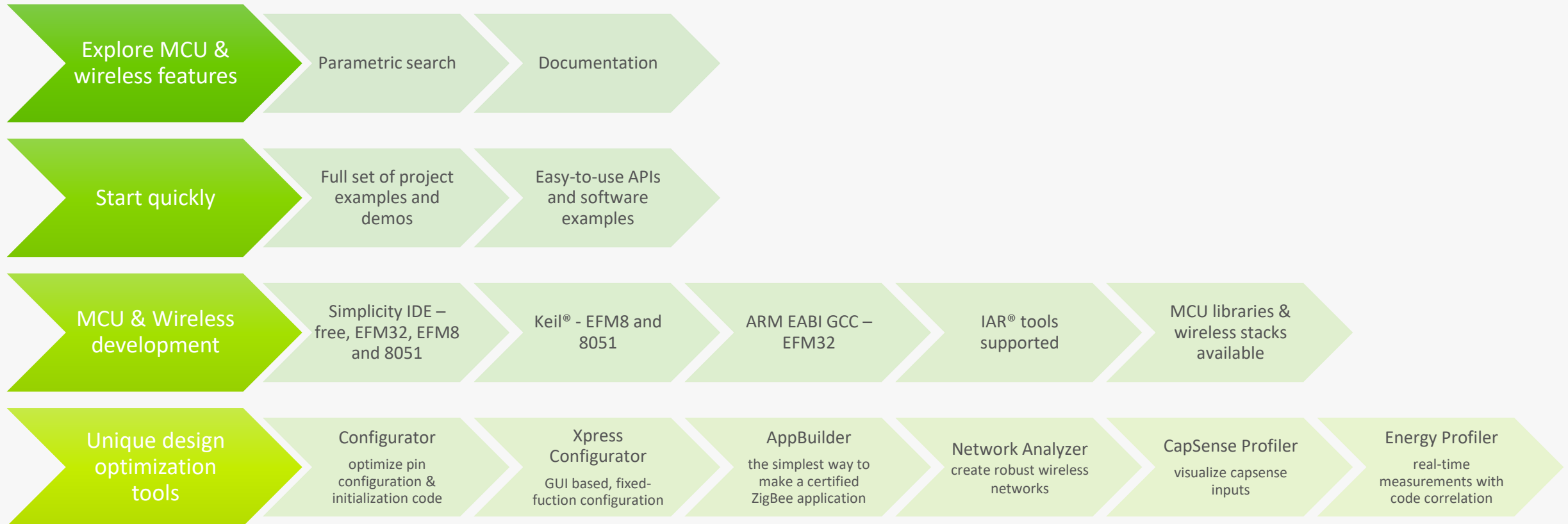


Simplicity Studio | Vision

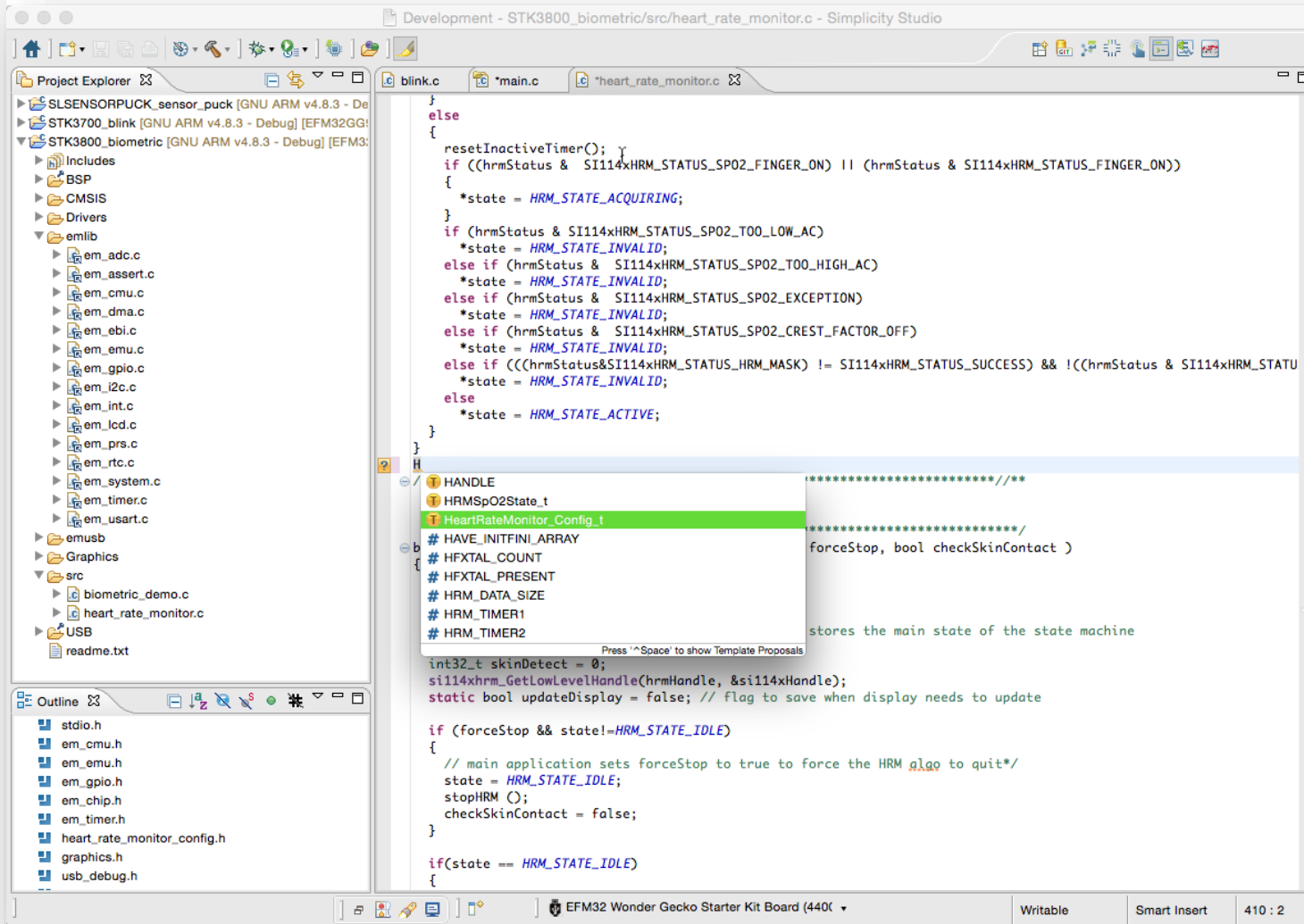


- Simplicity Studio makes it simple to evaluate our solutions and develop with our technology
- An intelligent collection of tools that amplify the value of our technology in a tangible fashion, with an IDE included for convenience

Value Proposition | Idea to Final Product



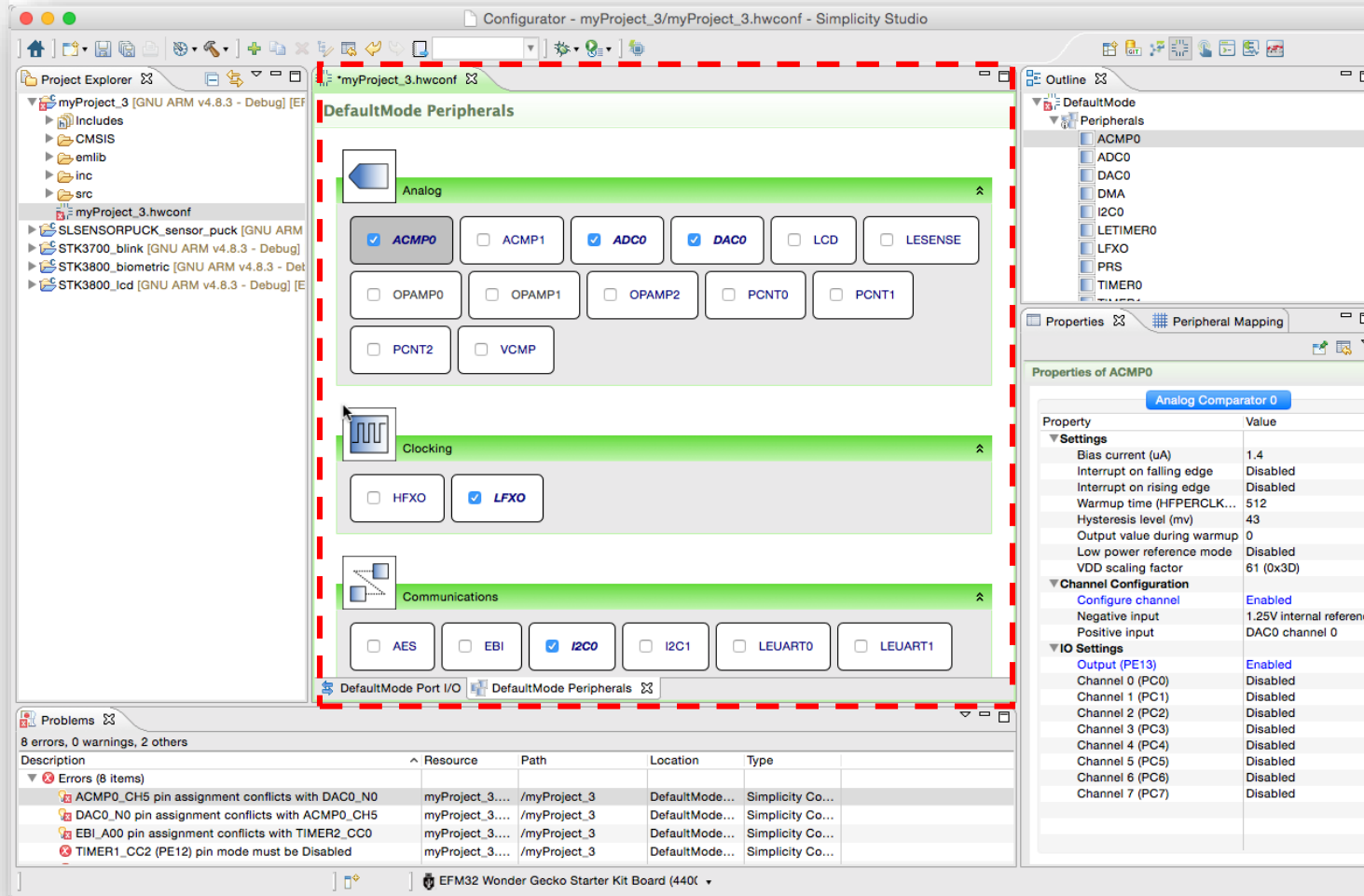
Unique Tools | Simplicity IDE



- Fully featured & free!
- Eclipse framework
- Configurable workspace
- Guidance
- Supported build tools
 - Keil®
 - IAR®
 - GCC
- IDE agnostic
 - 3rd party IDEs also supported



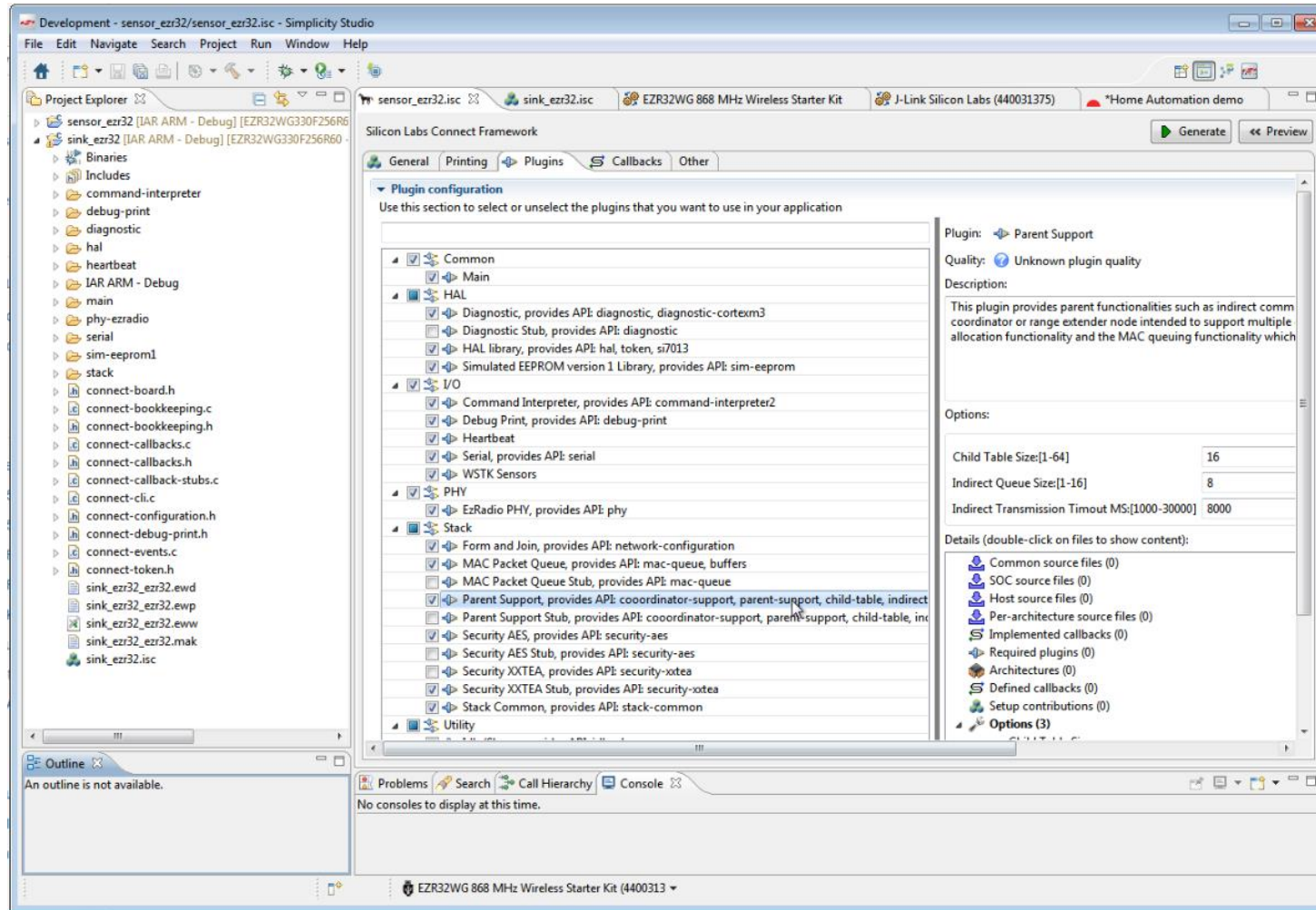
Unique Tools | Simplicity Configurator



- Graphical configuration
- Peripheral view
- I/O view
- No need to set bits
- Initialization & configuration
- Automatic code generation
- Manage pin assignments
- Error checking & calculators
- Resolve pin conflicts



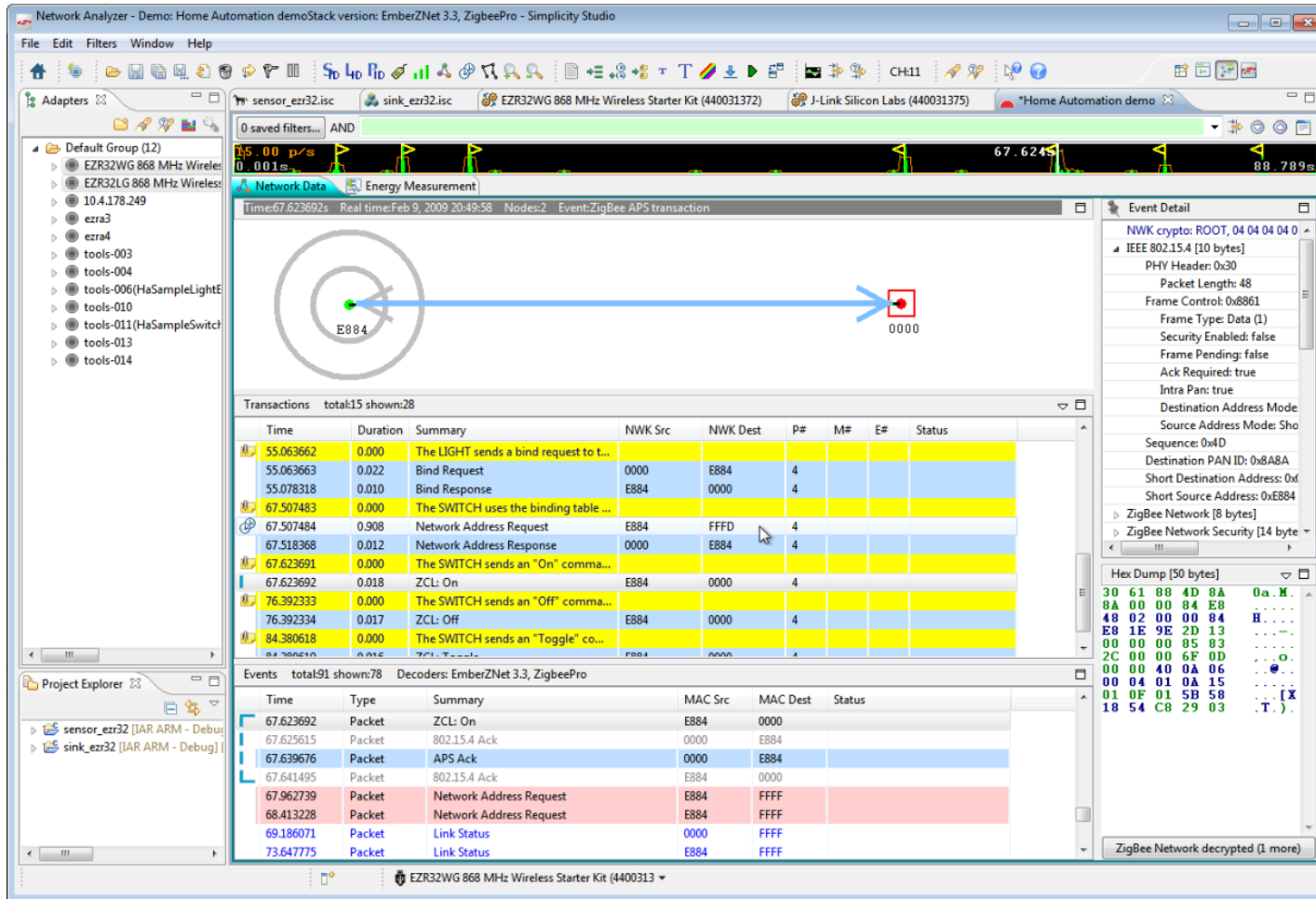
Unique Tools | AppBuilder



- Framework for rapid dev
- Start-up routines
- Find, join, form networks
- High level APIs
- Stack configuration
- Tried & tested templates
- Allows for customer provides libraries
- Fastest way to ZigBee
- Coming soon!



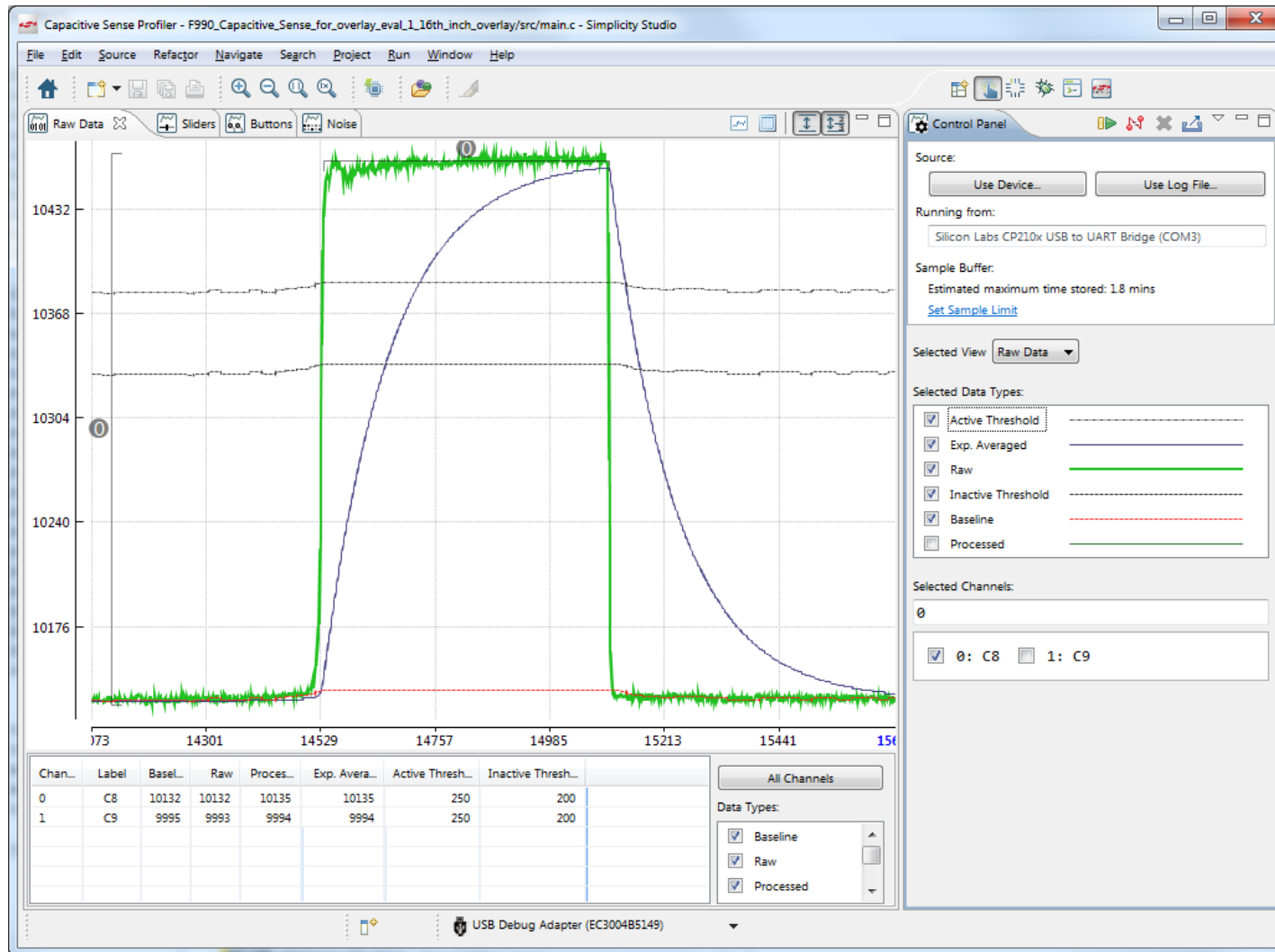
Unique Tools | Network Analyzer



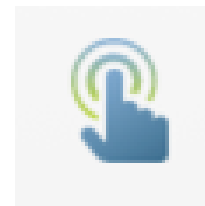
- Packet Trace Interface
- Capture & save data
- Comprehensive data & stats
- API tracing & virtual UART



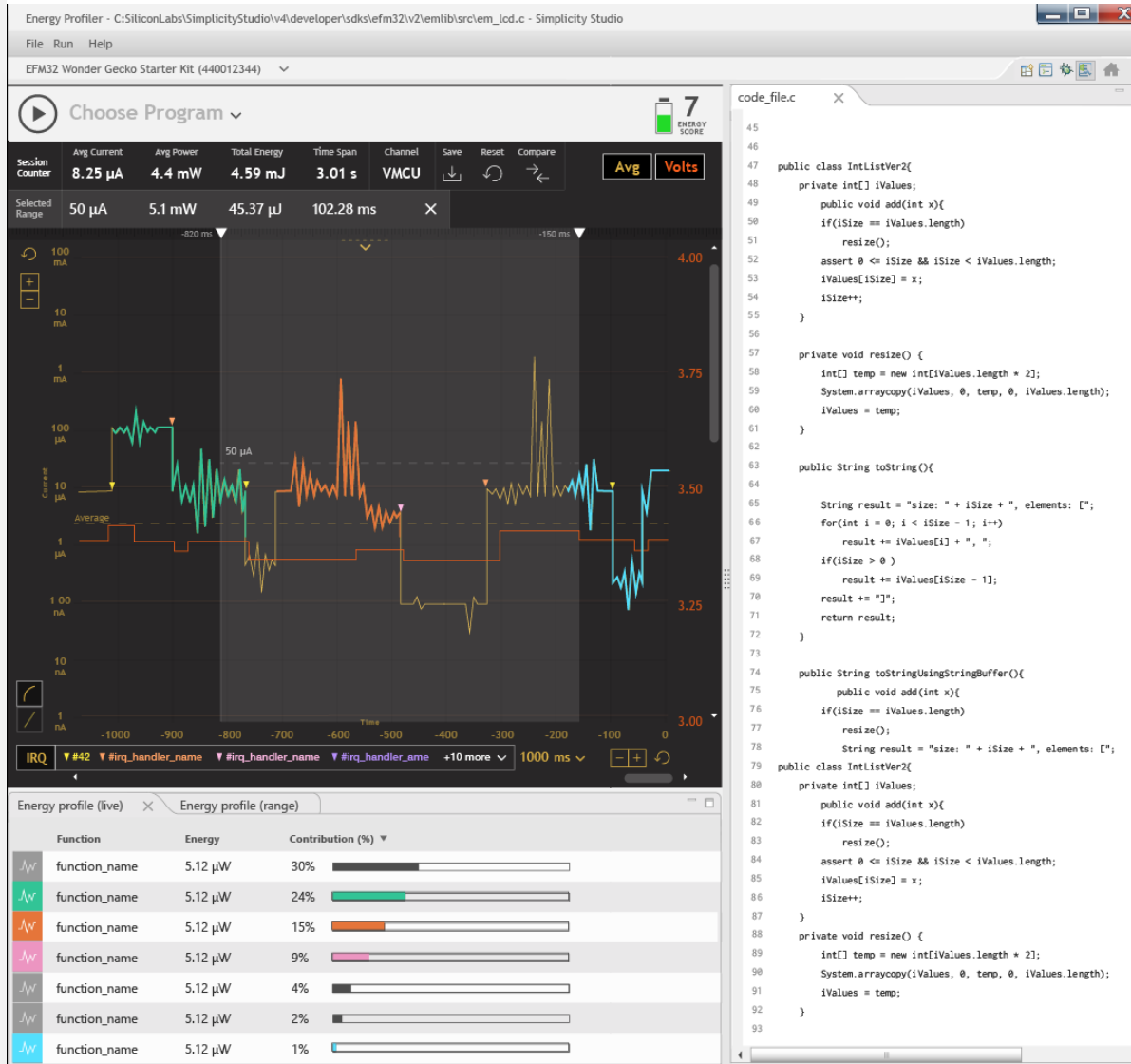
Unique Tools | CapSense Profiler



- Intuitive user interface
- Visualize cap sense inputs
- Data logging
- Signal to noise calculation



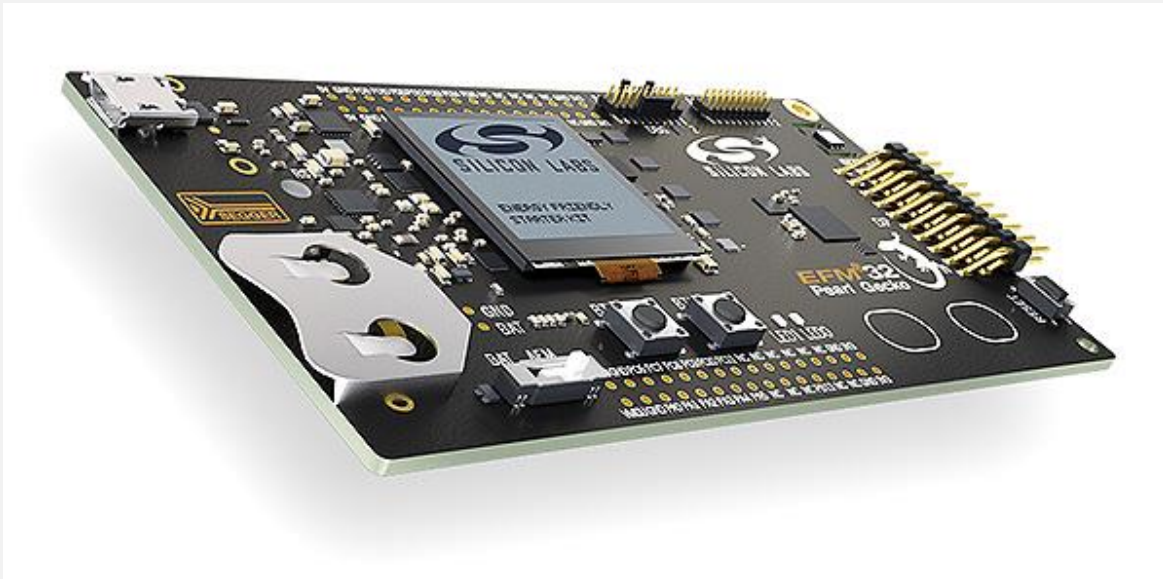
Unique Tools | Energy Profiler (new for v3.1!)



- Improve battery life
- Energy optimization and debugging made simple
- Analyze current consumption in real-time
- Correlate energy consumption to code



EFM8 and EFM32 All-Inclusive, Cost-Effective Starter Kit



*SLSTK3401A starter kit with ARM Cortex-M4
EFM32PG1B200F256GM48 Pearl Gecko MCU*

- Integrated Segger J-Link USB debugger
- Advanced Energy Monitoring system enables real-time energy consumption profiling and code correlation
- Memory LCD, capacitive touch buttons, LEDs, push buttons
- On-chip temp sensor
- Si7021 relative humidity and temp sensor
- Breakout headers for easy MCU pin access
- 20-pin EXP-header for add-on boards
- Integration with Simplicity Studio

Thank You!

www.silabs.com