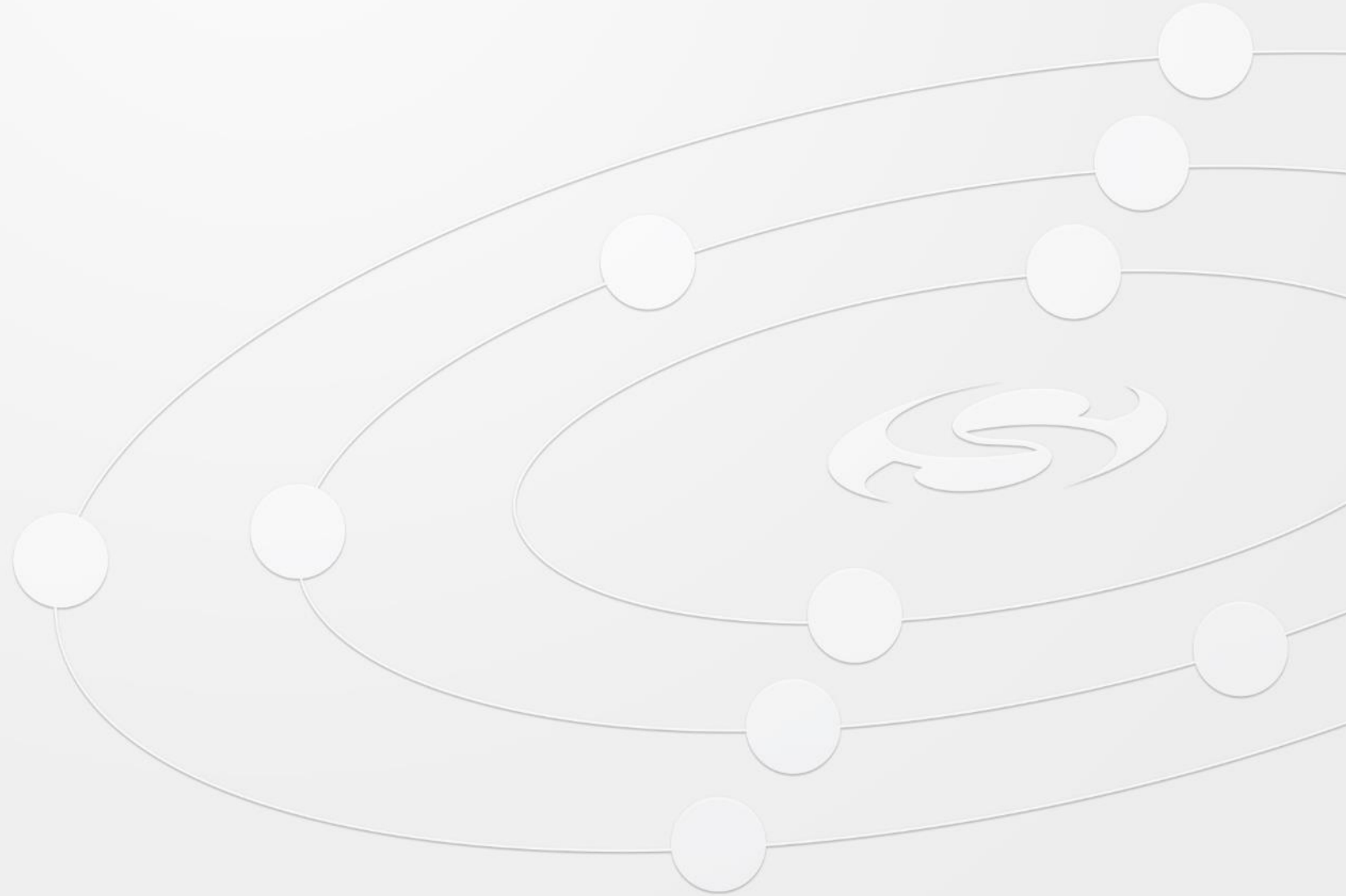




# EFM8 MCU Family

MCUs without compromise



# This is my EFM8

## **Performance**

- 72 MHz
- Low power
- Fast peripherals

## **Value**

- Small packages
- High integration
- More for less

## **Simplicity**

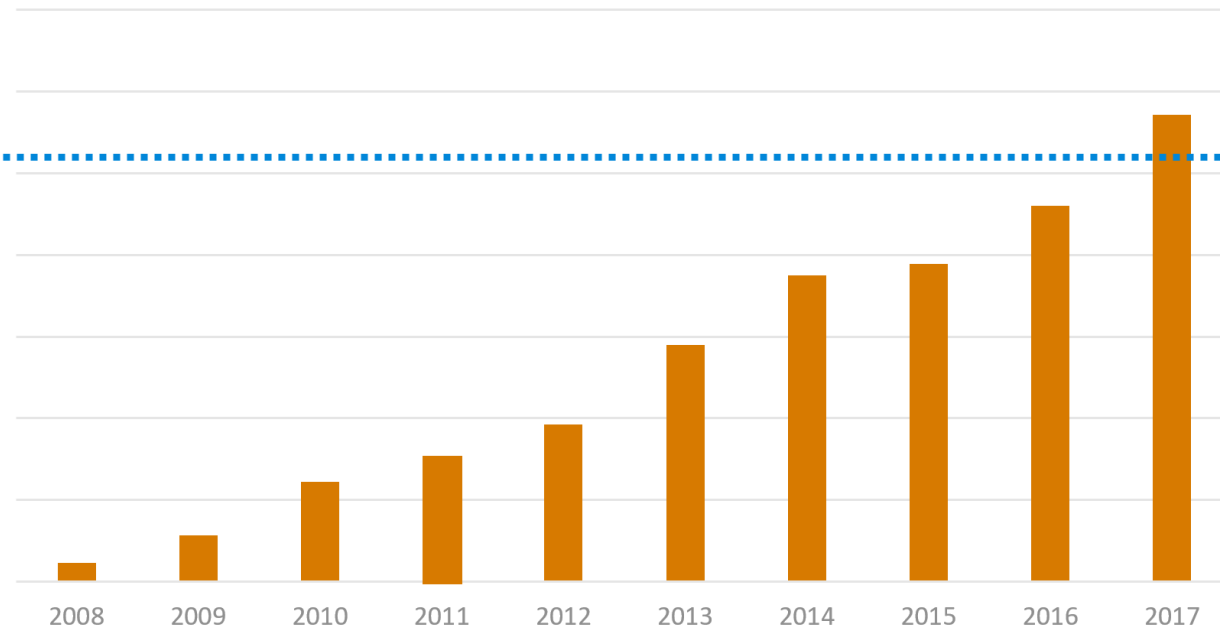
- Easy migration
- Consistent tools
- Common STK

**An MCU without compromise!**

# Commitment and Growth in 8-bit

8-bit Cumulative Shipments

1 Billion Units  
Shipped!



- Continued growth in 8-bit
- Continued investment in 8-bit
  - Universal Bee 3 launched December '17
  - Automotive grade EFM8 release in 2017
- Longevity commitment of at least 10 years
  - <https://www.silabs.com/products/mcu/8-bit/longevity-commitment>



# EFM8 MCU Family

## LASER



### 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 mm<sup>2</sup> package – high integration
- ADC/4xDAC/ 2x comparator – state-of-the-art analog
- $\pm 3$  °C temperature sensor – eliminate calibration
- Config Logic – eliminate external glue logic

## UNIVERSAL



### 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

## SLEEPY



### 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, 300nA sleep w/ RTC
- Active currents – 150  $\mu$ A/MHz
- Fast wake up - < 2  $\mu$ s
- Capacitive sense - <1  $\mu$ A wake on touch

## BUSY



### 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

# Target Markets

Industrial	Consumer	Home and Building	Health and Fitness	Motor Control
 <p>POS equipment</p>	 <p>Data cables</p>	 <p>Fire and Safety</p>	 <p>Medical</p>	 <p>Model vehicles</p>
 <p>Optical modules</p>	 <p>Gaming</p>	 <p>Sensors</p>	<p>Medical</p>	 <p>Small motors</p>
 <p>Power converters</p>	 <p>Inductive charger</p>	 <p>Automation</p>	 <p>Wearables</p>	 <p>Electric tools</p>
<p>Power converters</p>	 <p>LED wristband</p>	 <p>Energy metering</p>	<p>Wearables</p>	 <p>Appliances</p>



8 factors that make the EFM8  
... the world's only no compromise 8-bit MCU

# No Compromise in Performance

## Fast Processor Core

1

Core operates 25 to 72 MHz

Executes 70% of the instructions in 1 or 2 clock cycles

Efficient architecture reduces memory requirements



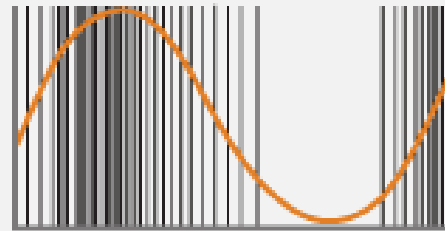
## Efficient Digital Peripherals

2

Autonomous peripherals; Reduced processor overhead

Fast timers and PWMs for higher resolution

Enhanced serial peripherals for higher throughput

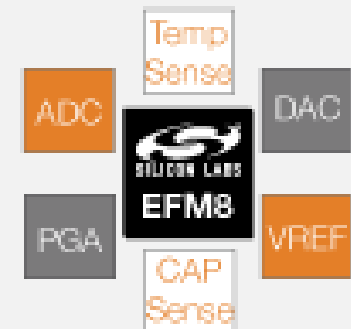


## High-Performance Analog

3

High performance ADCs, temp sensors, comparators and voltage reference in all families

Capsense available in selected families  
DAC available in selected devices



# No Compromise in Design

## Highly Integrated

4

Compact, standard packages as small as 1.66 x 1.78 mm

Resources of a large device in a compact package

Highly Integrated USB: Internal memory, voltage regulator, high precision crystal

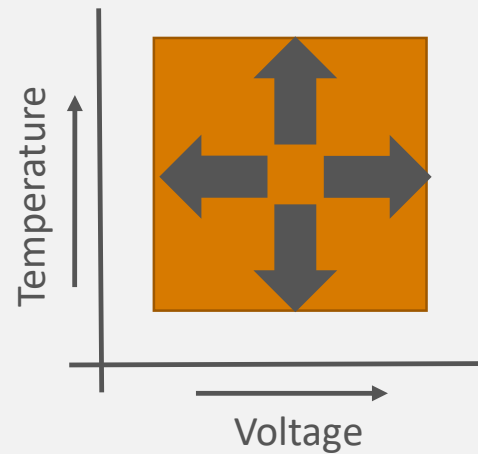


## No Performance compromise

5

Robust design of oscillators, processor, I/O and peripherals

Guaranteed performance over voltage and temperature range (PVT)



## Ultra Low Power

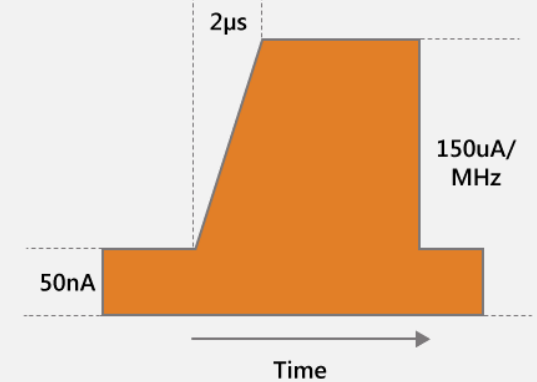
6

Ultra low 50 nA sleep, 2  $\mu$ s wake, 150  $\mu$ A/MHz active

Low Energy USB mode

Easy to Use Energy Modes

Ultra long battery lifetime





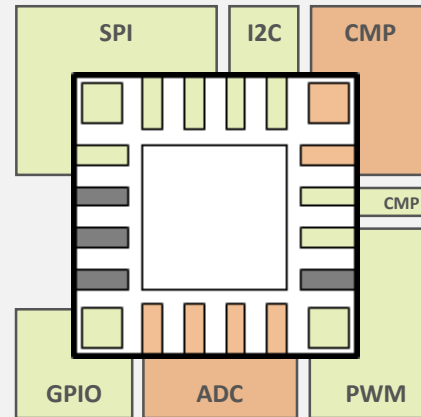
# No Compromise in Layout

## Digital Crossbar and Analog Multiplexer

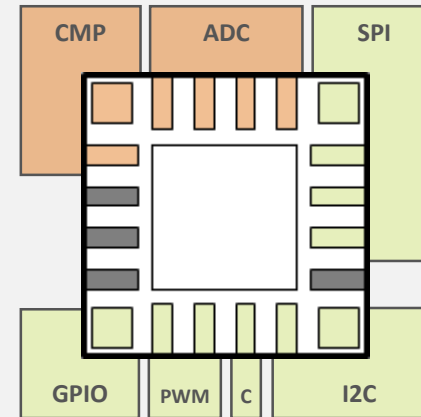
7

- UART
- Comparator 0 Sync
- Comparator 1 Sync
- Comparator 1 Async
- System Clock Out
- PWM 2
- Counter 0 Clock In
- Timer 0
- Timer 1
- Timer 2
- Comparator 0 Neg
- Comparator 0 Pos
- Comparator 1 Neg
- Comparator 1 Pos
- ADC [16:0]
- Voltage REF
- GPIO Port 0
- GPIO Port 1

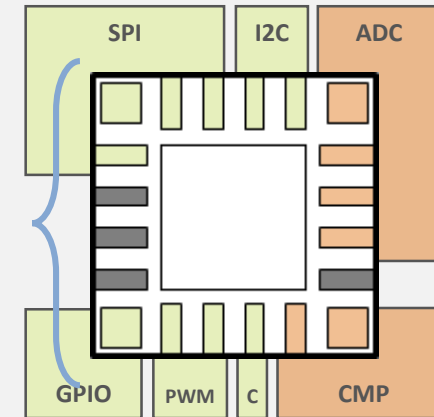
Select any function combination...



...and pin out this way



... or this way



... or this way  
(plus many more)

Solves the unique problem of exposing resources of a large device in a compact package

# No Compromise on Tools

## Simplicity Studio – Consistent tools experience

8

### Eliminate Cost

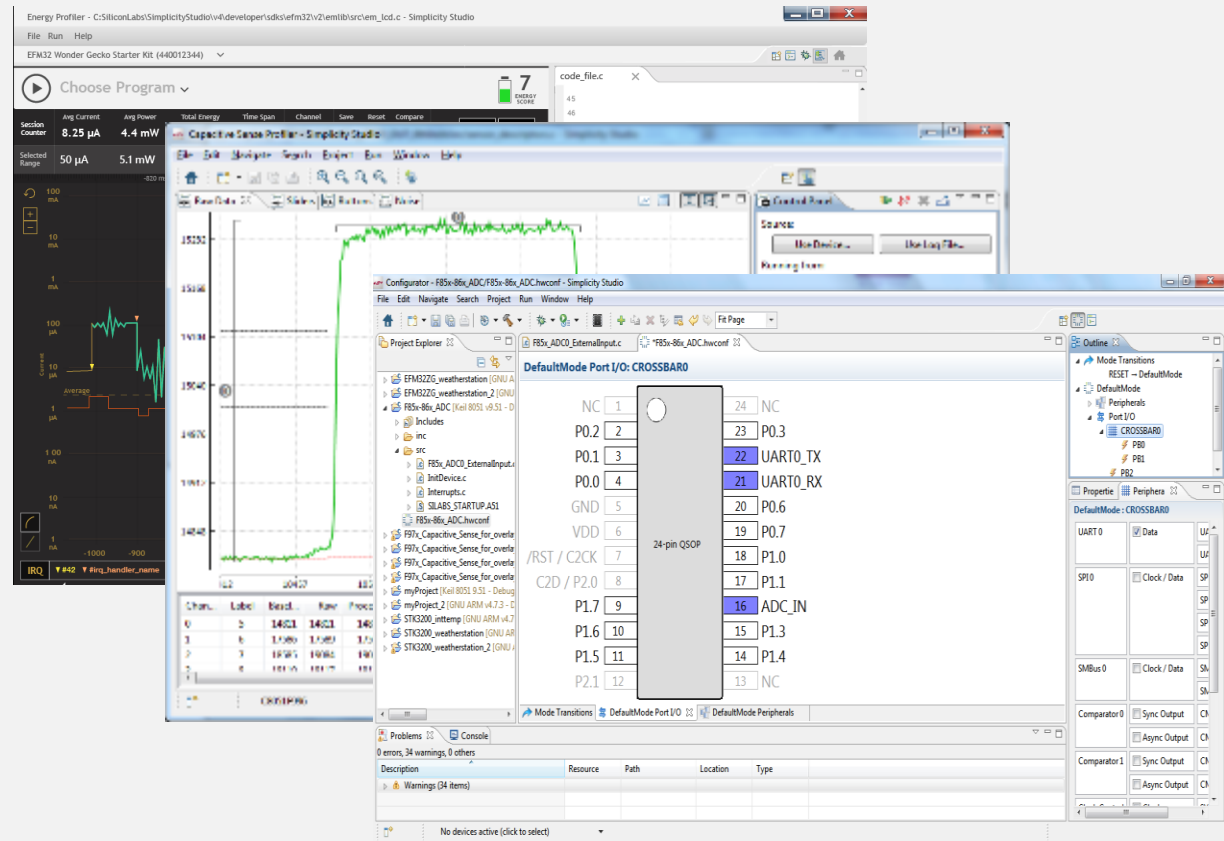
- Free Simplicity Studio w/integrated IDE
- Free Keil compiler and tools with no time or code compromises

### Reduce Risk

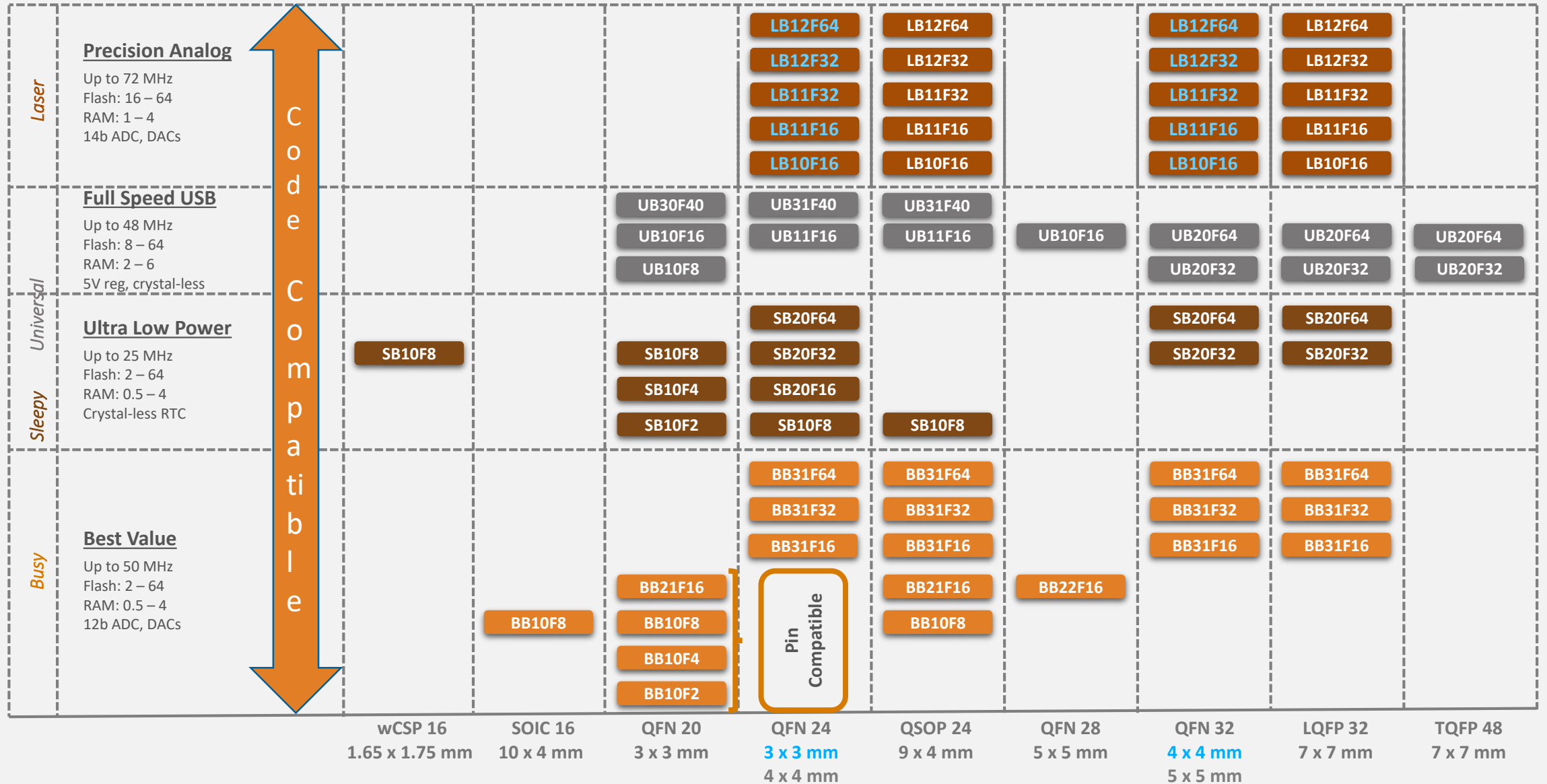
- Demos, libraries, and example code
- One stop solution for all demonstration and development

### Tools

- Simplicity Energy Profiler
- Capsense Profiler
- Configurator



# EFM8 - Portfolio



# Laser Bee



- High performance mixed-signal MCU
  - 72 MHz MCU, 14-bit ADC, 12-bit DAC (4x),  $\pm 3^{\circ}\text{C}$  temp sensor ( $-20^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ )
  - Crossbar and Config logic units (4x) provide system design flexibility
- Comprehensive feature set in a compact package
  - Up to 64 kB flash, 4.25 kB RAM, 29 GPIO with crossbar
  - ADC supported by channel sequencer with direct-to-XRAM output transfer
  - Sizes as small as 3x3 mm in a standard 24-pin QFN package
- Outstanding ease-of-use
  - Comprehensive IDE with Simplicity Studio and Keil compiler
  - Configurator GUI reduces design time and efforts
  - Extensive software libraries, code examples, and demos



Automation

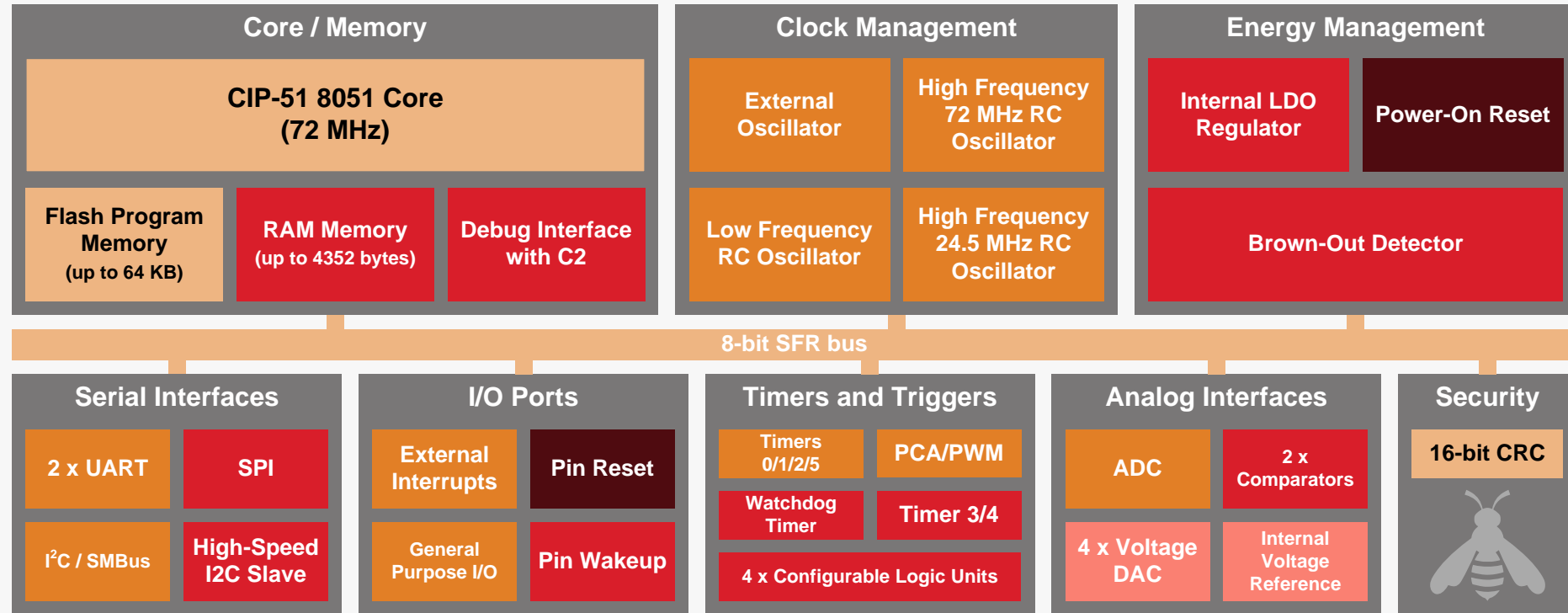


Optical modules



Motor Control

# EFM8LB1 Highlights



## ■ Highlights (LB1)

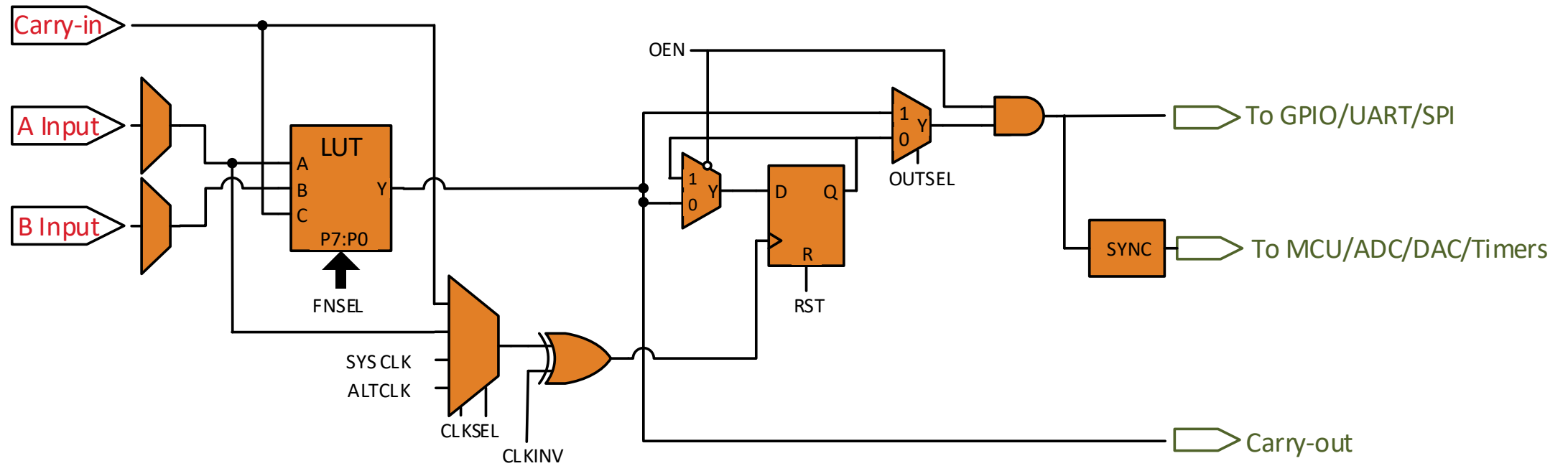
- 72 MHz MCU
- 14-bit 900 ksps; 12-bit 1 msp/s
- $\pm 3$  °C temperature sensor

## ■ Applications

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

# Configurable Logic Units

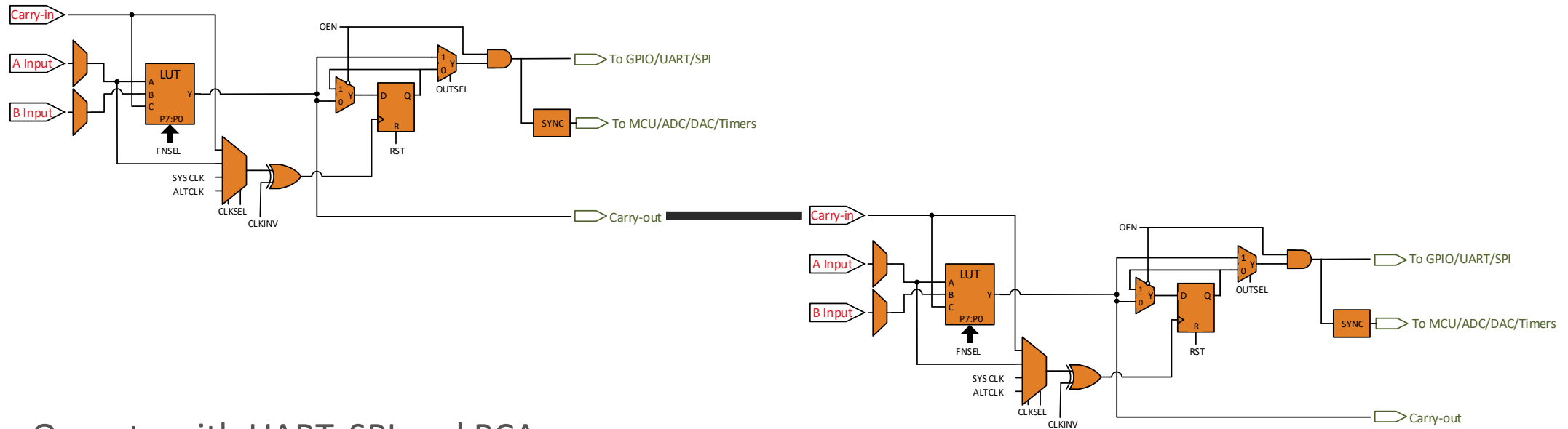
- Four Configurable Logic Units (CLUs)



- Implement any logic function based on 3 inputs and a flip-flop in each CLU
  - Look-up-table (LUT) implements 256 different combinational logic functions
  - Clocked flip-flop for synchronous operations

# Flexibility in Configurable Logic

- Daisy-chain CLUs to implement complicated logic functions



- Operate with UART, SPI and PCA
- Trigger on-chip resources (ADC, DAC, Timers, etc.)
- Wakeup source from low-power modes (asynchronous output)

# Configurable Logic Benefits

- Construct special functions for your specific design
  - No external glue logic needed
  - No MCU overhead
  - No limitation in combining internal and external signals

If you need	Configurable Logic can
External logic/flip-flop	<ul style="list-style-type: none"><li>▪ Match external signal requirements</li><li>▪ Synchronize IO signals with internal/external clock sources</li></ul>
ADC/DAC/Timers special trigger	<ul style="list-style-type: none"><li>▪ Construct trigger event for ADC, DAC, Timers without MCU intervention</li><li>▪ Synchronize and trigger multiple on-chip resources (ADC, DAC, Timers, etc.)</li></ul>
UART, SPI, Timers, PCA flexibility	<ul style="list-style-type: none"><li>▪ Construct Manchester coding with UART and SPI</li><li>▪ Create arbitrary waveform with timers and PCA channels</li></ul>
MCU wake up flexibility	<ul style="list-style-type: none"><li>▪ Customize wake up condition from Suspend and Snooze modes</li></ul>



# Universal Bee

UNIVERSAL

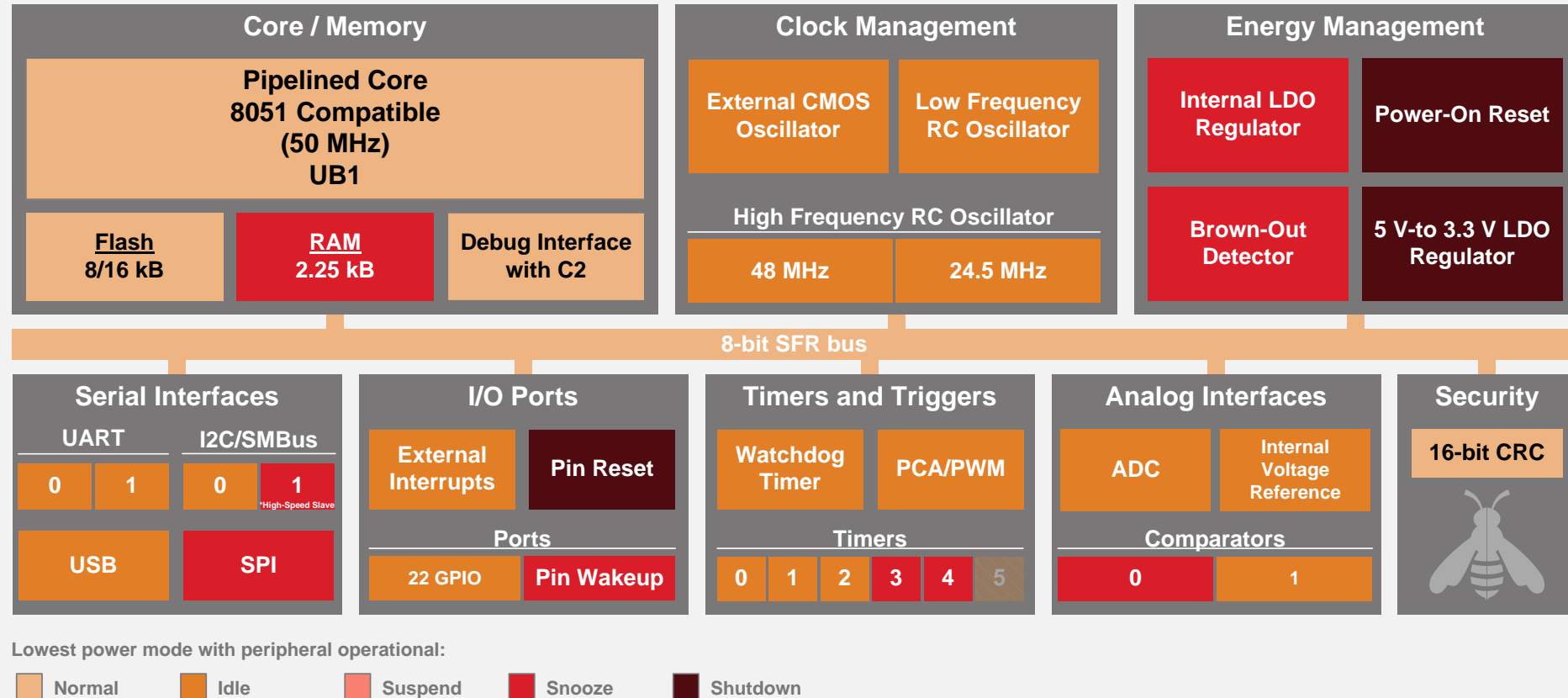


- Smallest, lowest power USB microcontroller
  - Full-speed USB 2.0 compatible with integrated OSC for crystal-less operation
  - Sizes as small as 3x3 mm in a standard 20 pin QFN package
  - Low Energy USB mode reduces USB current by up to 90%
- Features and Innovations
  - Up to 64 kB flash, 40 GPIO with crossbar, 48 MHz core
  - Integrated Charger Detection (USB BCS V1.2)
  - Comprehensive analog including 12-bit, 20 channel ADC
  - USB pins up to 8 kV ESD tolerance
- Enhanced high speed communication interfaces
  - Serial peripherals with integrated FIFOs to improve throughput
  - 3.4 Mbps I2C slave and 12 Mbps SPI in duplex mode
  - 1 Mbps SMBus (master and slave)
  - 2x UART at 3 Mbps throughput with LIN slave “break and sync” auto-detection function





# EFM8 Universal Bee 1 Highlights



## ■ Highlights (UB1)

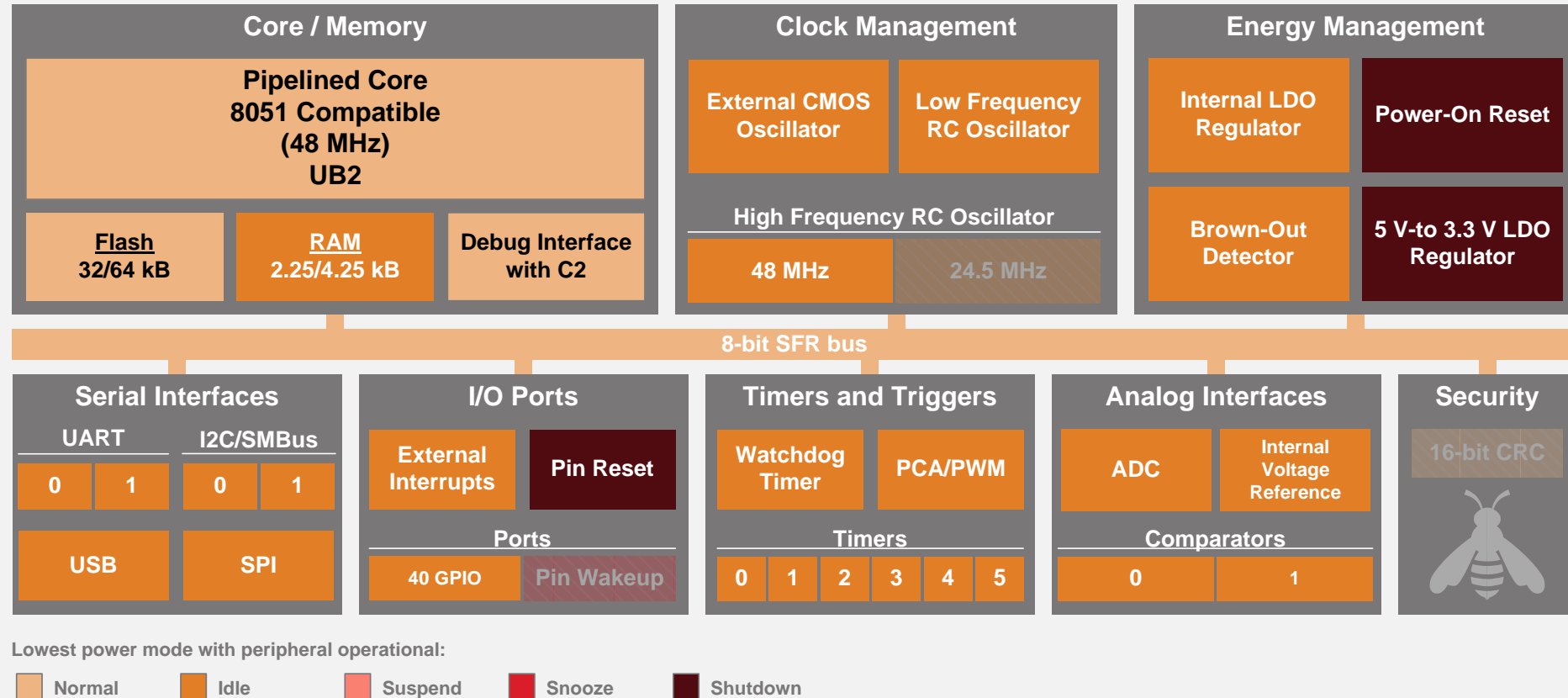
- Low Energy USB w/ High-Speed Serial Peripherals
- 12-bit 200 ksps/10 bit 800 ksps ADC
- BOM Integration - Crystal, Reg and USB

## ■ Applications

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



# EFM8 Universal Bee 2 Highlights



## ■ Highlights (UB2)

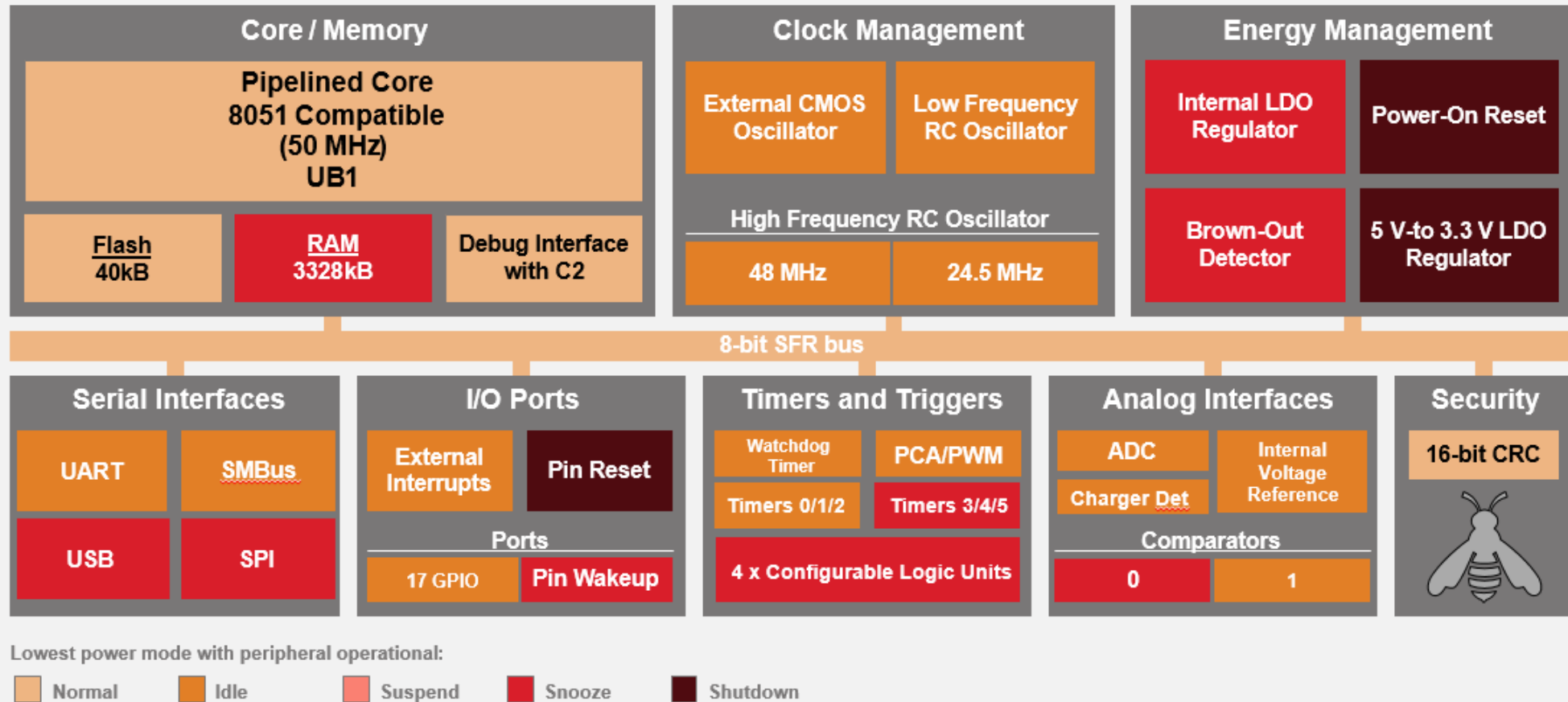
- High IO Count, 10 mA source and 25 mA sink
- Differential 10-bit 500 ksps ADC
- BOM Integration - Crystal, Reg and USB

## ■ Applications

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



# EFM8 Universal Bee 3 Highlights



## ■ Highlights (UB3)

- Low Energy USB w/ High-Speed Serial Peripherals
- 12-bit 200 ksps/10 bit 800 ksps ADC
- Large memory & CLU

## ■ Applications

- Tablet and Smart Phone Peripherals
- Docking stations
- Embedded USB Peripherals
- USB system manager

# Sleepy Bee

SLEEPY



- Lowest power, Capacitive sense MCUs
  - 25 MHz core, up to 64 kB Flash and 4 kB RAM
  - Sizes as small as 1.66x1.78 mm CSP
  - Crossbar exposes many diverse device resources
- Longer battery life solutions
  - 50 nA sleep - full memory retention and Brown out Detect (BoD)
  - 300 nA sleep with internal RTC
  - 150  $\mu$ A/MHz operation
  - < 1  $\mu$ A wake on touch
  - Ultra-fast wake up < 2  $\mu$ s
- Robust, proven capacitive sensing technology
  - For demanding applications requiring noise and interference immunity
  - Replace up to 14 traditional, mechanical buttons or switches



# Sleepy Bee CSP

Small size.  
No compromise.



---

EFM8 Sleepy Bee

1.66 x 1.78<sub>mm</sub>



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Honey Bee

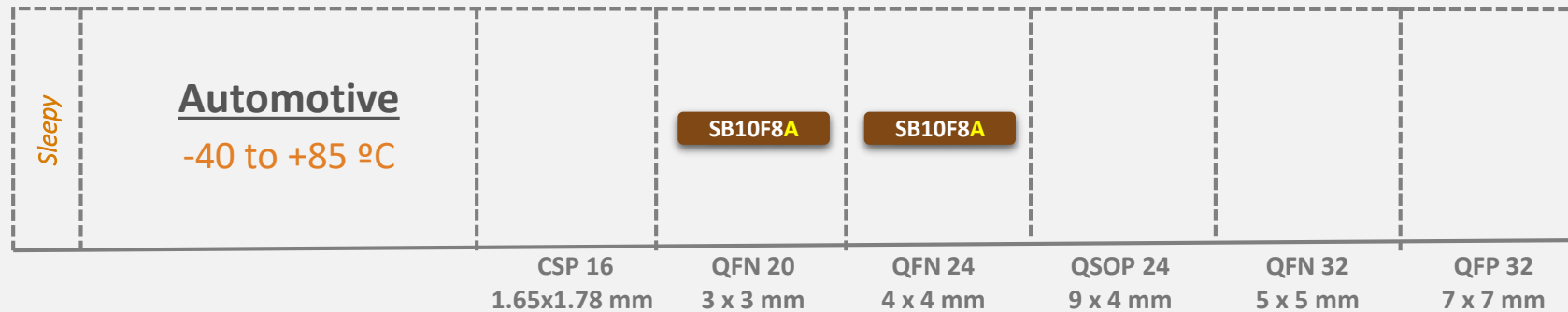
5 x 12<sub>mm</sub>



# EFM8 SB1 A-Grade Portfolio

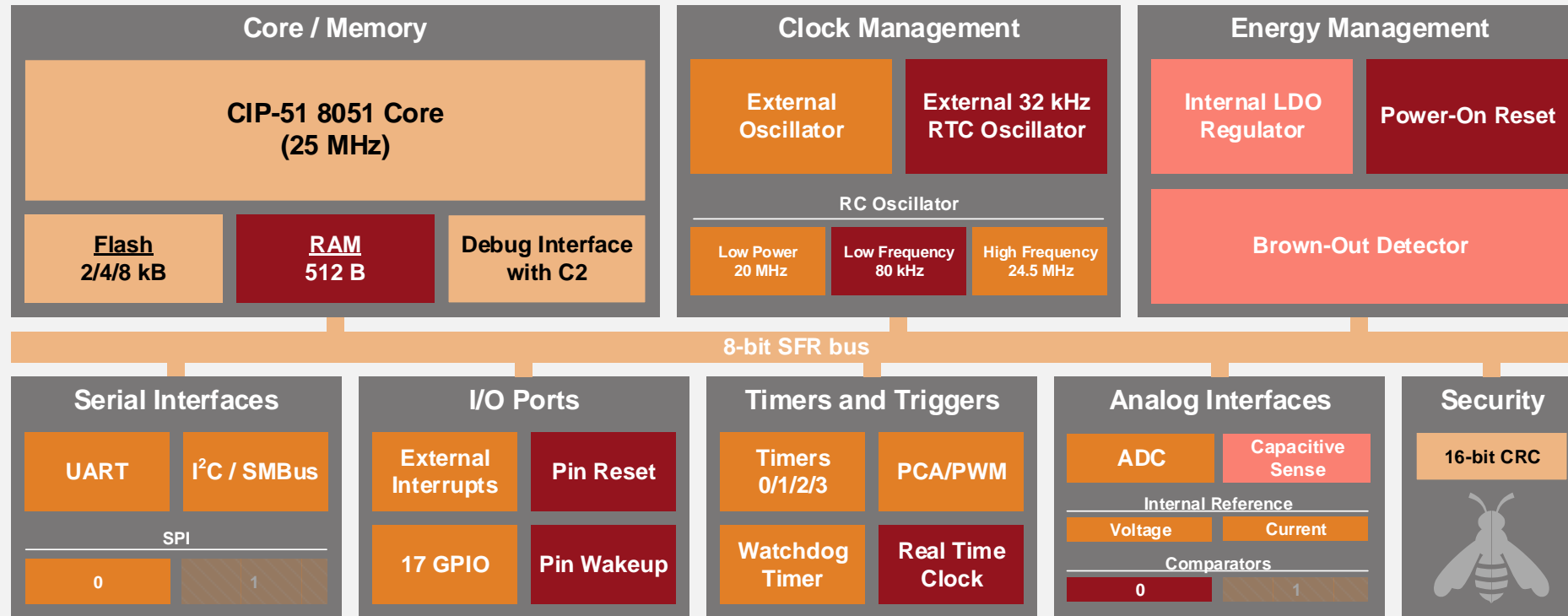
## Automotive Grade Advantages

Fully AEC-Q100 qualified	✓
International Material Data System (IMDS) Registration	✓
Production Part Approval Process (PPAP)	✓
Failure Analysis Priority	✓



# EFM8 Sleepy Bee 1 Highlights

SLEEPY



Lowest power mode with peripheral operational:

Normal Idle Suspend Sleep

## ■ Highlights (SB1)

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

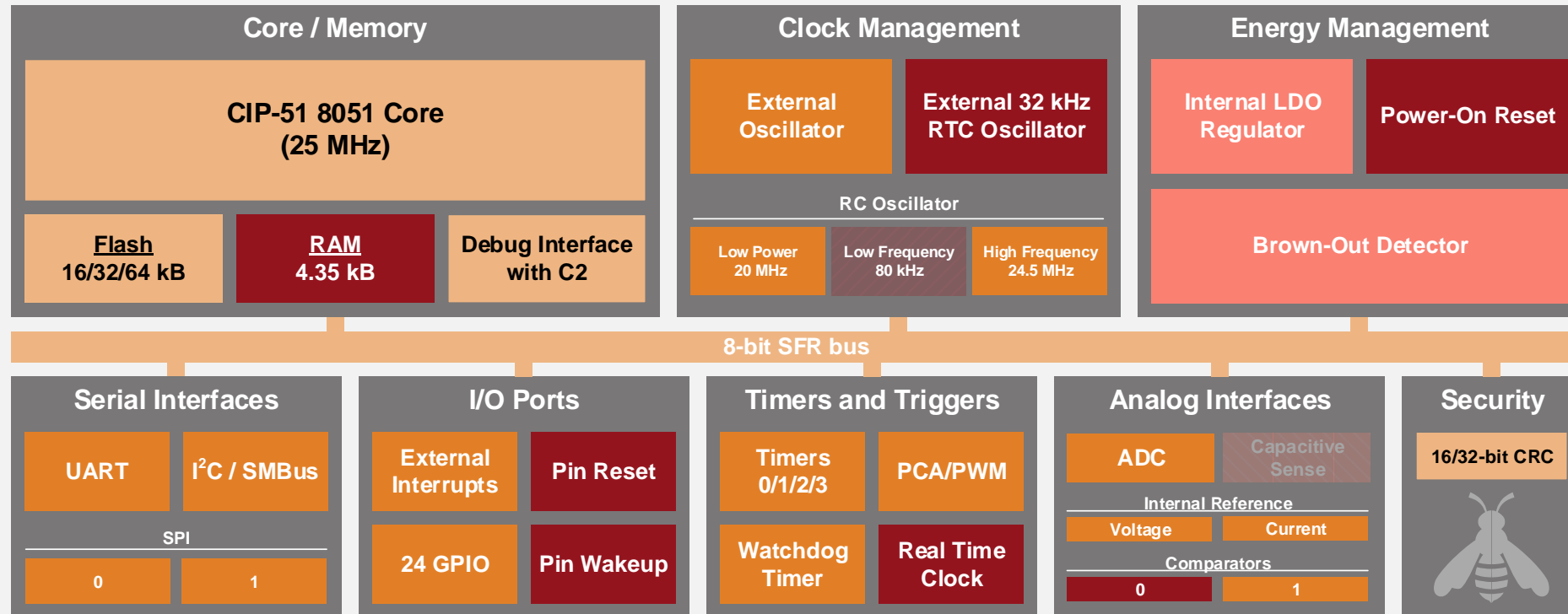
## ■ Applications

- 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

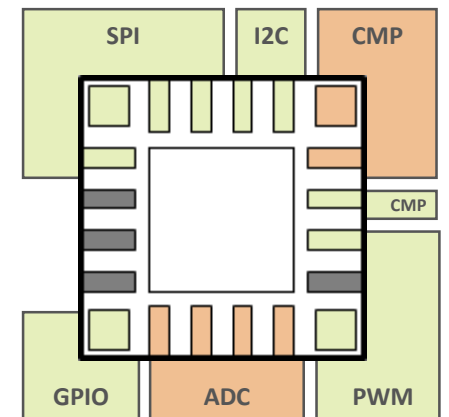
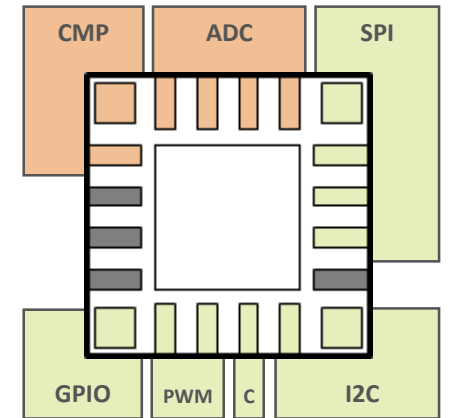
## ■ Applications

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

# Busy Bee



- General Purpose, Highest performance MCU
  - Up to 50 MHz core running 50 MIPS
  - Sizes as small as 3x3 mm in a standard 20 pin QFN package
- Comprehensive feature set
  - Up to 64 kB flash, 4.25 kB RAM, 29 GPIO with crossbar
  - Excellent analog peripherals including 12-bit ADC, 12-bit DAC
  - Integrated PWM and comparator for fail-safe protection
- IO and Peripherals
  - Enhanced high-speed communication interfaces
  - 5 V Tolerant IO



# EFM8 BB G-Grade Portfolio

- Fully AEC-Q100 qualified
- Operating ambient temperature range: -40 to +85 °C



Small motors



Small appliance



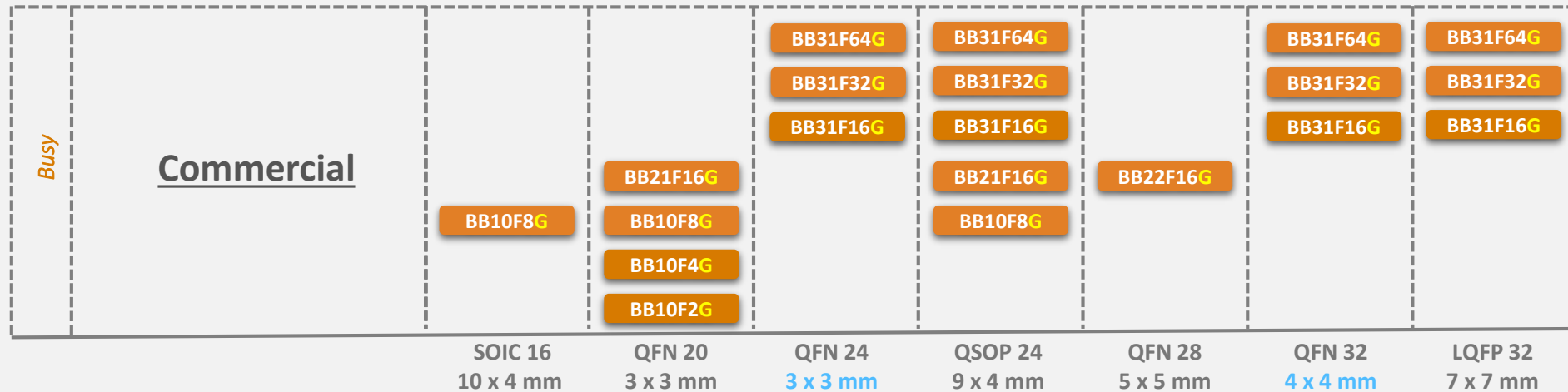
Personal care



Smart lighting



Electric tools



# EFM8 BB I-Grade Portfolio

- Operating ambient temperature range: -40 to +125 °C
- Full family available
- Supports applications operate in high temperature environment



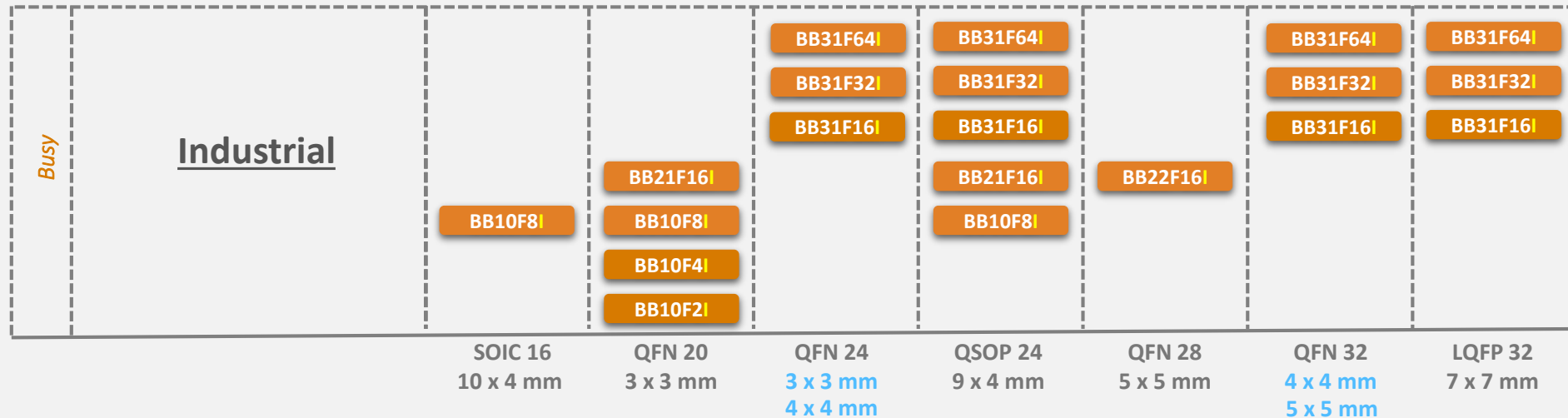
Power converters



Lighting

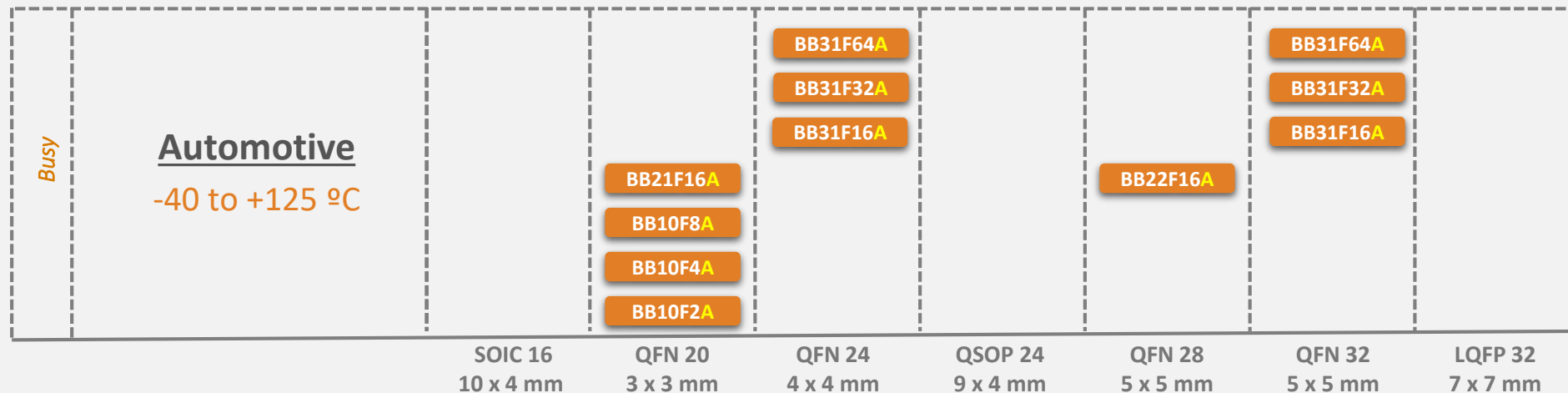


Automation

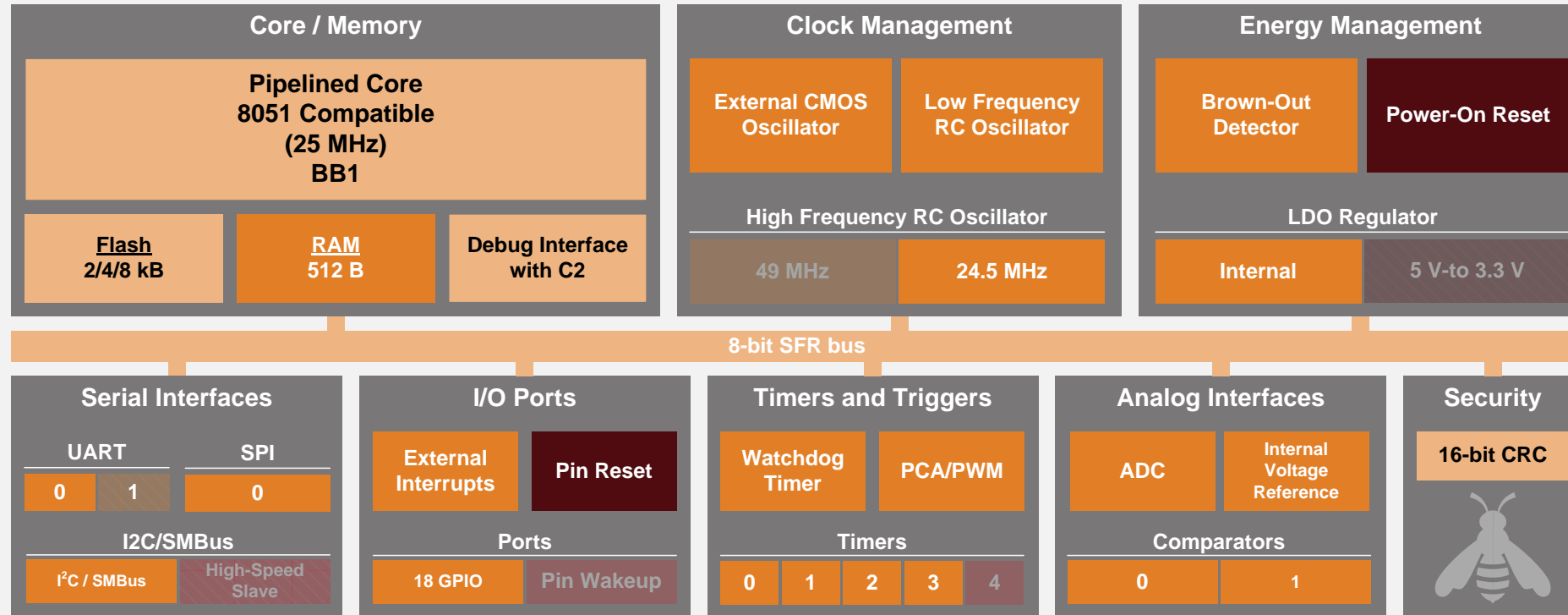


# EFM8 BB A-Grade Portfolio

Automotive Grade Advantages	
Fully AEC-Q100 qualified	✓
International Material Data System (IMDS) Registration	✓
Production Part Approval Process (PPAP)	✓
Failure Analysis Priority	✓



# EFM8 Busy Bee 1 Highlights

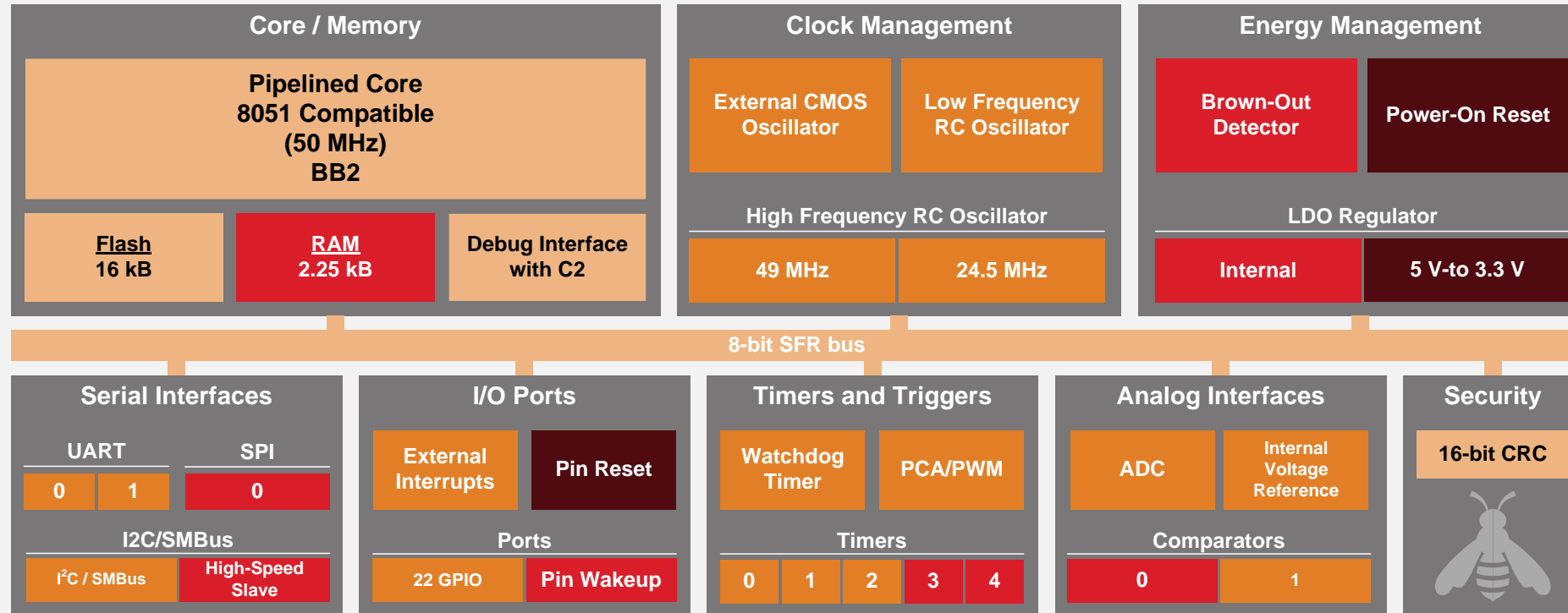


Lowest power mode with peripheral operational:

Normal Idle Suspend Snooze Shutdown

- Highlights (BB1)
  - 25 MHz MCU
  - 12-bit 200 ksps; 10-bit 800 ksps
  - Value oriented w/ high integration
- Applications
  - Motor Control
  - High-speed sensor controller and hub
  - Consumer Electronics

# EFM8 Busy Bee 2 Highlights



Lowest power mode with peripheral operational:



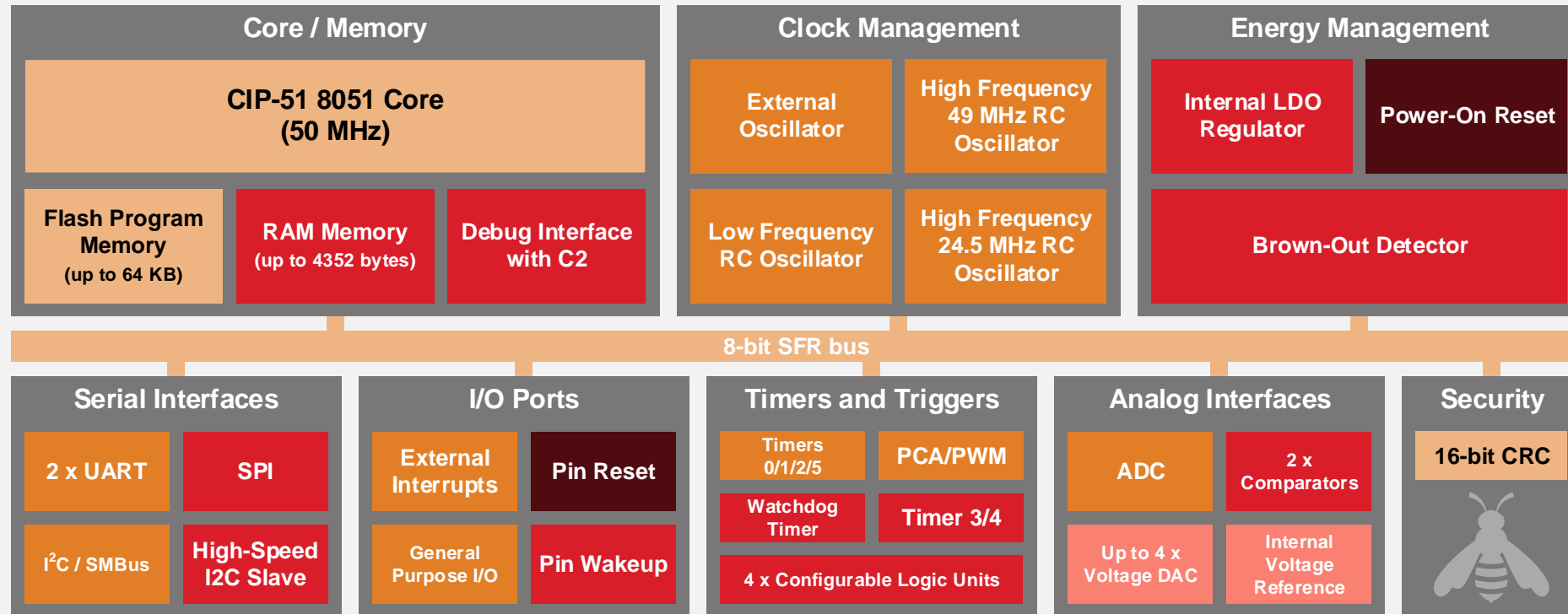
## ■ Highlights (BB2)

- 50 MHz MCU
- 5 V LDO; 5V tolerant IO
- Enhanced digital peripherals

## ■ 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; 5 V tolerant IO

## ■ Applications

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

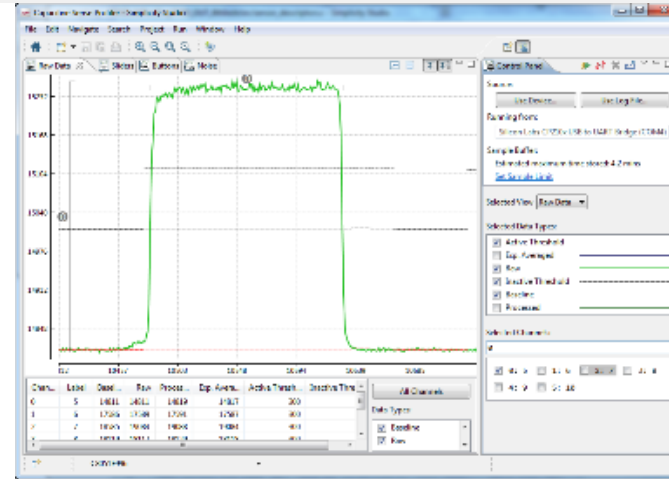




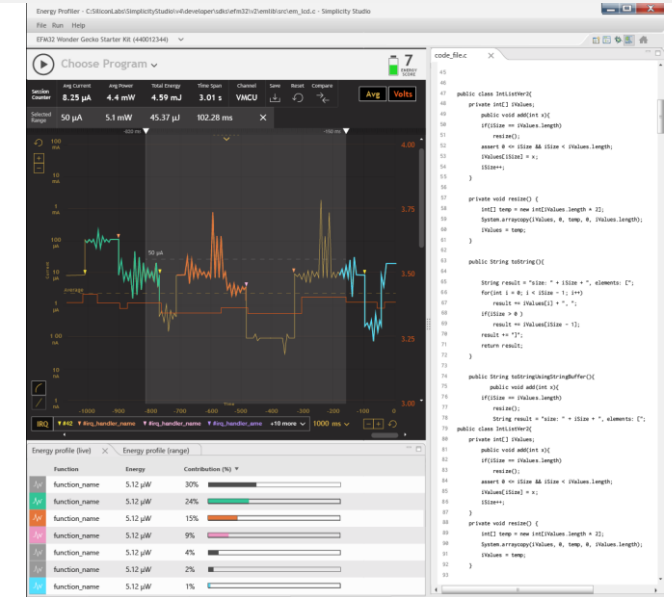
Enablement

# Reduced development risk with Simplicity Studio

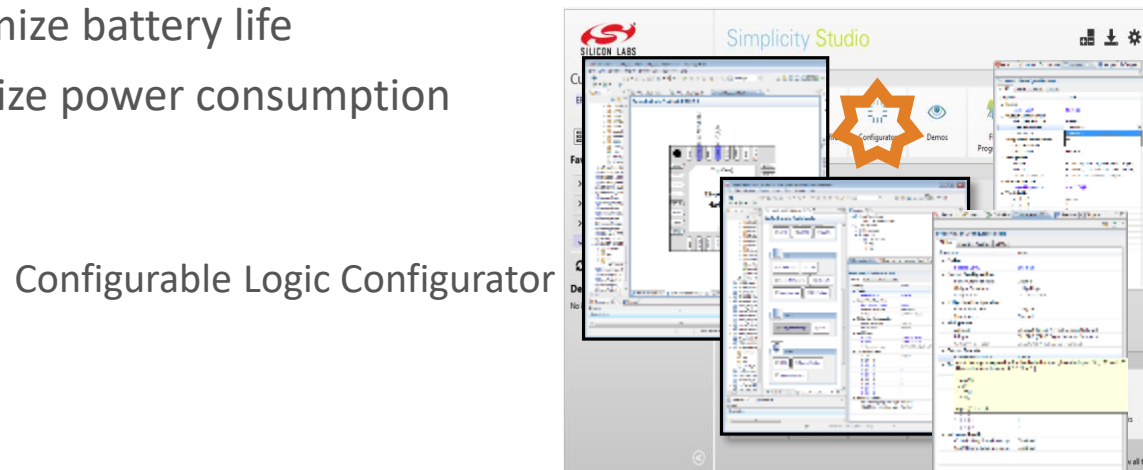
- One Tool..... All MCUs
  - Common development environment
- Reduce Development Time
  - Easy to use APIs
  - Ready to use examples and templates
  - Simple, graphical hardware configurator
  - Well written documentation
- Reduce Energy Consumption
  - Energy profiling tools available to optimize battery life
  - Develop embedded software to minimize power consumption



CapSense Profiler



Energy Profiler

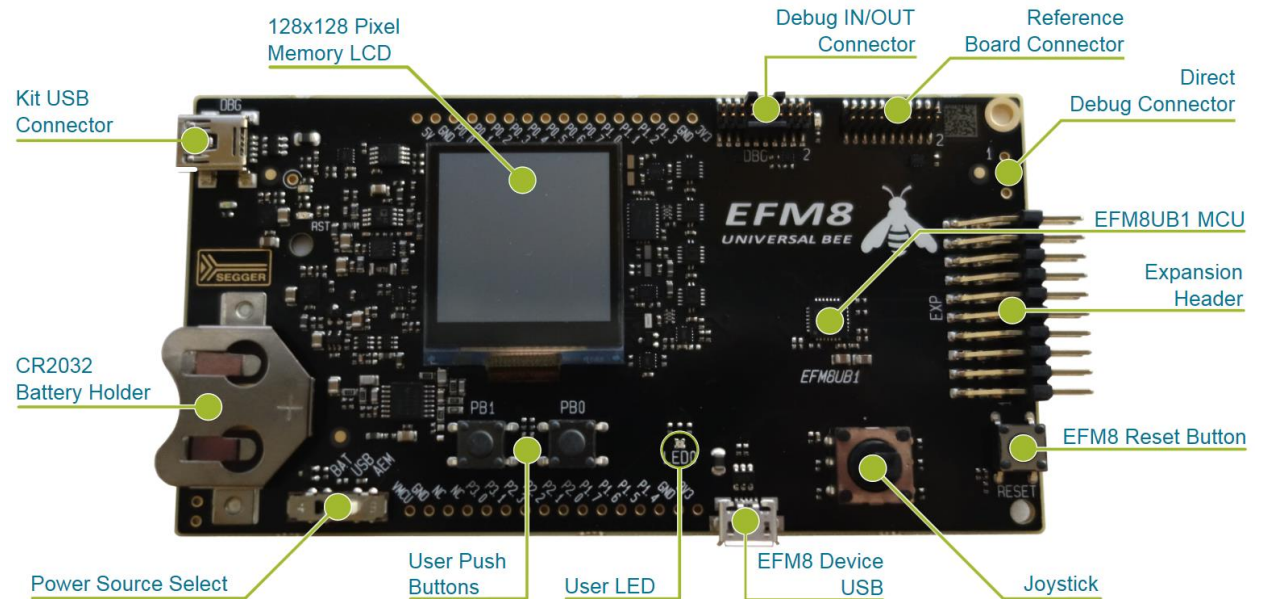


Configurable Logic Configurator

# All-inclusive, cost-effective starter kits

- Comprehensive development
  - 8 starter kits to highlight the features of each of the families
  - Built-in Energy Profiler, flash programmer, and debugger
  - EXP header for expanded functionality

- Integration with Simplicity Studio
  - Plug and play demos
  - Example software projects / templates
  - Easily accessible kit documentation



# Easy to Get Started

- Choose the “Bee” that is right for your application
- Select a starter kit
- Open Simplicity Studio and start development





[www.silabs.com/EFM8](http://www.silabs.com/EFM8)



## Starter Kit Part Numbers

Part #	Description
SLSTK2030A	EFM8LB1 Laser Bee Starter Kit
SLSTK2000A	EFM8UB1 Universal Bee Starter Kit
SLSTK2001A	EFM8UB2 Universal Bee Starter Kit
SLSTK2010A	EFM8SB1 Sleepy Bee Starter Kit
SLSTK2011A	EFM8SB2 Sleepy Bee Starter Kit
SLSTK2020A	EFM8BB1 Busy Bee Starter Kit
SLSTK2021A	EFM8BB2 Busy Bee Starter Kit
SLSTK2022A	EFM8BB3 Busy Bee Starter Kit
SLTB005A	EFM8UB3 Thunder Board Kit