Quick Presentation:
Cypress PSoC and PRoC BLE Solutions

PSoC = Programmable System-on-Chip
PRoC = Programmable Radio-on-Chip
BLE = Bluetooth Low Energy

Easily Design Low-Power, Wireless Systems With the Industry’s Most Integrated BLE Solutions
BLE Is The Choice for Short-Range, Low-Power Wireless Connectivity

Bluetooth Low Energy (BLE) is a standards-based technology
BLE is managed by the Bluetooth Special Interest Group (SIG)
BLE eliminates the need for a USB dongle\(^1\) and provides multi-vendor interoperability

BLE is being deployed widely
BLE is now natively supported in the iOS, OS X, Android and Windows operating systems
1.2B\(^2\) Bluetooth Smart Ready\(^3\) devices (see below) were sold in 2013, including iPhone, MacBook, Galaxy, Nexus and Thinkpad
165M\(^4\) Bluetooth Smart\(^5\) devices (see below) were sold in 2014 with projections to grow to 1.3B units by 2018

BLE is optimized for coin-cell battery operation
BLE is designed to communicate state or control information, not to transfer data continuously
BLE connections are quick and transient, enabling connection, data transmission and graceful disconnection in less than 3 ms

With a standard, ecosystem and very low power, BLE is the choice for short-range wireless connectivity

1. External hardware that provides USB-based wireless connectivity for PCs and tablets
2. Source: ABI Research
3. A brand for Bluetooth 4.0/4.1 products that support both Bluetooth Classic and BLE
4. Source: IHS Wireless
5. A brand for Bluetooth 4.0/4.1 products that support only BLE
Cypress BLE Silicon & Module Portfolio

### Programmable Radio-on-Chip (PRoC™)

<table>
<thead>
<tr>
<th>MCU</th>
<th>CapSense®</th>
<th>TrueTouch®&lt;sup&gt;1&lt;/sup&gt;</th>
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<tbody>
<tr>
<td>CYBL1016x PRoC BLE</td>
<td>CM0&lt;sup&gt;3&lt;/sup&gt;, 2 SCBs&lt;sup&gt;4&lt;/sup&gt; 36 GPIOs, 128KB Flash</td>
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<tr>
<td>CYBL1046x PRoC BLE</td>
<td>CM0&lt;sup&gt;3&lt;/sup&gt;, 2 SCBs&lt;sup&gt;4&lt;/sup&gt;, CapSense 36 GPIOs, 128KB Flash</td>
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<tr>
<td>CYBL1056x PRoC BLE</td>
<td>CM0&lt;sup&gt;3&lt;/sup&gt;, 2 SCBs&lt;sup&gt;4&lt;/sup&gt;, 2-Finger&lt;sup&gt;1&lt;/sup&gt; 36 GPIOs, 128KB Flash</td>
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<tr>
<td>CYBL1017x PRoC BLE</td>
<td>CM0&lt;sup&gt;3&lt;/sup&gt;, 2 SCBs&lt;sup&gt;4&lt;/sup&gt; 36 GPIOs, 256KB Flash</td>
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<tr>
<td>CYBL1047x PRoC BLE</td>
<td>CM0&lt;sup&gt;3&lt;/sup&gt;, 2 SCBs&lt;sup&gt;4&lt;/sup&gt;, CapSense 36 GPIOs, 256KB Flash</td>
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<tr>
<td>CYBL1057x PRoC BLE</td>
<td>CM0&lt;sup&gt;3&lt;/sup&gt;, 2 SCBs&lt;sup&gt;4&lt;/sup&gt;, 2-Finger&lt;sup&gt;1&lt;/sup&gt; 36 GPIOs, 256KB Flash</td>
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### Programmable System-on-Chip (PSoC®)

<table>
<thead>
<tr>
<th>PSoC 4 BLE</th>
<th>Intelligent Analog</th>
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<tbody>
<tr>
<td>CY8C41x7-BL PSoC 4 BLE</td>
<td>CM0&lt;sup&gt;3&lt;/sup&gt;, 2 SCBs&lt;sup&gt;4&lt;/sup&gt;, 2-Finger&lt;sup&gt;1&lt;/sup&gt; 2 CMP&lt;sup&gt;5&lt;/sup&gt;, 4 Opamps 36 GPIOs, 128KB Flash</td>
</tr>
<tr>
<td>CY8C42x7-BL PSoC 4 BLE</td>
<td>CM0&lt;sup&gt;3&lt;/sup&gt;, 2 SCBs&lt;sup&gt;4&lt;/sup&gt;, 2-Finger&lt;sup&gt;1&lt;/sup&gt; 2 CMP&lt;sup&gt;5&lt;/sup&gt;, 4 Opamps, 4 UDBs&lt;sup&gt;6&lt;/sup&gt; 36 GPIOs, 256KB Flash</td>
</tr>
<tr>
<td>CY8C41x8-BL PSoC 4 BLE</td>
<td>CM0&lt;sup&gt;3&lt;/sup&gt;, 2 SCBs&lt;sup&gt;4&lt;/sup&gt;, 2-Finger&lt;sup&gt;1&lt;/sup&gt; 2 CMP&lt;sup&gt;5&lt;/sup&gt;, 4 Opamps 36 GPIOs, 256KB Flash</td>
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<td>CY8C42x8-BL PSoC 4 BLE</td>
<td>CM0&lt;sup&gt;3&lt;/sup&gt;, 2 SCBs&lt;sup&gt;4&lt;/sup&gt;, 2-Finger&lt;sup&gt;1&lt;/sup&gt; 2 CMP&lt;sup&gt;5&lt;/sup&gt;, 4 Opamps, 4 UDBs&lt;sup&gt;6&lt;/sup&gt; 36 GPIOs, 256KB Flash</td>
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### BLE<sup>2</sup> Modules

<table>
<thead>
<tr>
<th>Module Name</th>
<th>Description</th>
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<tbody>
<tr>
<td>CYBLE-020002-00 EZ-BLE Serial Module</td>
<td>UART to BLE 10 x 10 x 1.80-mm SMT&lt;sup&gt;7&lt;/sup&gt;</td>
</tr>
<tr>
<td>CYBLE-022001-00 EZ-BLE PRoC Module</td>
<td>CM0&lt;sup&gt;3&lt;/sup&gt;, 2 SCBs&lt;sup&gt;4&lt;/sup&gt; 16 GPIOs, 128KB Flash 10 x 10 x 1.80-mm SMT&lt;sup&gt;7&lt;/sup&gt;</td>
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<tr>
<td>CYBLE-222005-00 EZ-BLE PRoC Module</td>
<td>CM0&lt;sup&gt;3&lt;/sup&gt;, 2 SCBs&lt;sup&gt;4&lt;/sup&gt; 16 GPIOs, 256KB Flash 10 x 10 x 1.80-mm SMT&lt;sup&gt;7&lt;/sup&gt;</td>
</tr>
<tr>
<td>CYBLE-224008-00 EZ-BLE PSoC Module</td>
<td>CM0&lt;sup&gt;3&lt;/sup&gt;, 2 SCBs&lt;sup&gt;4&lt;/sup&gt;, 4 Opamps, 1 CMP&lt;sup&gt;5&lt;/sup&gt;, 4 UDBs&lt;sup&gt;6&lt;/sup&gt; 26 GPIOs, 128KB Flash 12 x 12 x 1.80 mm SMT&lt;sup&gt;7&lt;/sup&gt;</td>
</tr>
<tr>
<td>CYBLE-224009-00 EZ-BLE PSoC Module</td>
<td>CM0&lt;sup&gt;3&lt;/sup&gt;, 2 SCBs&lt;sup&gt;4&lt;/sup&gt;, 4 Opamps, 1 CMP&lt;sup&gt;5&lt;/sup&gt;, 4 UDBs&lt;sup&gt;6&lt;/sup&gt; 26 GPIOs, 256KB Flash 12 x 12 x 1.80 mm SMT&lt;sup&gt;7&lt;/sup&gt;</td>
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### Integration

**Status**
- **Production**
- **Sampling**
- **Development**
- **Concept**

**Availability**
- **QQYY**

**Notes:**
- <sup>1</sup> Touch-sensing technology with 2-finger gestures referred to as 2-Finger
- <sup>2</sup> Bluetooth Low Energy, also known as Bluetooth Smart
- <sup>3</sup> ARM® Cortex®-M0
- <sup>4</sup> Serial communication block
- <sup>5</sup> Comparator
- <sup>6</sup> Universal digital block
- <sup>7</sup> Surface mount technology
Cypress Provides a Complete BLE Solution

Cypress is the only BLE solution provider with expertise in silicon, stack, module hardware and software.

<table>
<thead>
<tr>
<th>Solution Discipline</th>
<th>Cypress</th>
<th>BLE Module Suppliers</th>
<th>BLE Silicon Suppliers¹</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Microchip</td>
<td>Panasonic</td>
</tr>
<tr>
<td>BLE Silicon Design</td>
<td>✓</td>
<td></td>
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<tr>
<td>BLE Wafer Fabrication</td>
<td>✓</td>
<td></td>
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<tr>
<td>BLE Silicon Package Assembly/Test</td>
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<tr>
<td>BLE Stack Development</td>
<td>✓</td>
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<tr>
<td>Software (IDE)</td>
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<tr>
<td>BLE Module Hardware Design</td>
<td>✓ ✓ ✓ ✓ ✓</td>
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<tr>
<td>BLE Module Manufacturing</td>
<td>✓ ✓ ✓ ✓ ✓</td>
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</tbody>
</table>

1 Nordic, TI, CSR, Dialog
2 Chip-scale package (CSP) manufactured by Cypress subsidiary Deca Technologies Inc.

Cypress is the end-to-end expert for all of your BLE needs.
**PSoc® 4 BLE (CY8C4xxx-BL)**

**Programmable System-on-Chip with Bluetooth Low Energy**

### Applications
Sports and fitness monitors, wearable electronics, medical devices, home automation solutions, game controllers, sensor-based low-power systems for IoT

### Features

**32-bit MCU subsystem**
48-MHz ARM® Cortex®-M0 CPU
Up to 256KB flash and 32KB SRAM

**Programmable AFE**
Four opamps, configurable as PGAs, comparators, filters, etc.
One 12-bit, 1-MspS SAR ADC

**CapSense® with SmartSense™ Auto-tuning**
One Cypress Capacitive Sigma-Delta (CSD) controller with touchpad capability

**Programmable digital logic**
Four universal digital blocks (UDBs): custom digital peripherals
Four configurable TCPWM blocks: 16-bit timer, counter or PWM
Two configurable serial communication blocks (SCBs): I²C master or slave, SPI master or slave, or UART

**Packages**
56-pin QFN, 68/76-ball CSP

**Bluetooth Smart connectivity with Bluetooth 4.1**
2.4-GHz BLE radio with integrated Balun

### Collateral
- Datasheet
- Application Notes

### Availability
Sampling: 128KB: Now, 256KB: Q215
Production: 128KB: Now, 256KB: Q315

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1 Analog front end(s)
2 Successive approximation register
3 Timer, counter, pulse-width modulator
4 Universal digital block
5 Serial communication block configurable as I²C/SPI/UART
6 Serial wire debug communication protocol
**PRoC™ BLE (CYBL101x/4x/5xx)**
Programmable Radio-on-Chip with Bluetooth Low Energy

### Applications
- Wireless touch mice
- Wireless keyboards with trackpads
- Wireless trackpads
- Wireless remote control with trackpads
- BLE connectivity
- Wireless toys

### Features
- 48-MHz ARM® Cortex®-M0 MCU
- Up to 256KB Flash, 32KB SRAM, 36 programmable GPIOs
- Bluetooth Smart connectivity with Bluetooth 4.1:
  - 2.4-GHz BLE radio and baseband with integrated Balun
  - -91-dBm Rx sensitivity, +3-dBm Tx output power
- Modes: 1.3-µA Deep-Sleep, 150-nA Hibernate, 60-nA Stop
- Analog and digital peripherals:
  - One 12-bit, 1-Msps SAR ADC
  - Four 16-bit TCPWM blocks
  - Two SCBs, configurable as I2C, SPI or UART
  - I²S for audio input
  - Flexible mapping onto GPIOs
- Integrated library support for one- and two-finger gestures
- 56-QFN, 68/76-ball CSP packages

### Collateral
- Datasheet
- Application Notes

### Availability
- Sampling: 128KB: Now, 256KB: Q215
- Production: 128KB: Now, 256KB: Q315

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1. General-purpose input/output (configurable)
2. Bluetooth Low Energy, also known as Bluetooth Smart
3. Successive approximation register
4. Timer, counter, pulse-width modulator
5. Serial communication blocks
6. Capacitive Sigma-Delta controller
7. Serial wire debug communication protocol
EZ-BLE PRoC™ Module
Bluetooth Low Energy Module using PRoC BLE

Applications
BLE¹ connectivity
Medical
Industrial
PC accessories
Toys
Smartphone accessories

Features
Qualification and certification:
Bluetooth SIG QDID²
FCC³, CE⁴, KC⁵, MIC⁶ and IC⁷
Small footprint:
10 mm x 10 mm x 1.8 mm, 21-pad SMT with 16 GPIO
Bluetooth Smart connectivity with Bluetooth 4.1:
2.4-GHz BLE radio and baseband
-91-dBm Rx sensitivity, +3-dBm Tx output power
Power modes:
1.3-μA Deep-Sleep, 150-nA Hibernate, 60-nA Stop
Highly integrated solution:
Two crystals, chip antenna, passives, shield
CYBLE-022001-EVAL adapter board interface:
Easy interface to CY8CKIT-042-BLE Pioneer Kit
Enables testing of CapSense, buttons, GPIOs, OTA⁸

Availability
Sampling: Now
Production: Q215

Block Diagram

Collateral
EZ-BLE PRoC Module Datasheet
PRoC BLE Datasheet
Getting Started Application Note
PSoC Creator
PSoC Programmer
CySmart¹⁰ Windows Host Emulation Tool
CySmart iOS and Android Apps

² Bluetooth Special Interest Group Qualification Design ID
³ Federal Communications Commission
⁴ Conformité Européenne (Europe)
⁵ Korea Certification
⁶ Ministry of Internal Affairs and Communications (Japan)
⁷ Industry Canada
⁸ Over-the-Air
⁹ Serial wire debug communication protocol
¹⁰ A GUI-based software tool that installs on your PC to test and debug BLE functionality; also available in iOS and Android mobile applications
PRoC™ BLE Solution Example: Remote Control

Cypress Solution Value

Design Challenges
- Advanced features: trackpad, voice, motion sensing
- Very low cost
- Seamless Touch Sensing\(^1\) and RF

PRoC BLE Solution
- Provides support for advanced features:
  - Trackpad with two-finger gestures
  - Voice commands over BLE
  - Six-axis motion sensing
- Integrates BLE radio, microcontroller and touch sensing\(^1\)
- Integrates balun to reduce external RF components
- Allows two-layer PCB design
- Delivers high signal-to-noise ratio with SmartSense™ Auto-tuning\(^2\)

Collateral

Kit Website: PRoC BLE Remote Control
Datasheet: PRoC BLE Datasheet
App Note: Getting Started with PRoC BLE

How To Get Started

Buy a Remote Control RDK (CY5672)
Download PSoC Creator
Download the Kit installer file

1 A technology based on capacitive coupling that recognizes human touch as an input protocol
2 An algorithm that enables CapSense buttons to continuously compensate for system, manufacturing and environmental changes
3 Serial wire debug communication protocol

PRoC BLE Remote Control RDK
Supports BLE HID Profile, two-finger gestures, voice command, six-axis motion sensing, Infrared LED and 10 buttons
**Cypress Solution Value**

**Design Challenges**
- Low cost
- Seamless touch sensing\(^1\) and RF
- One-year battery life

**PRoC BLE Solution**
- Integrates BLE radio, microcontroller and touch sensing\(^1\)
- Integrates balun to reduce external RF components
- Provides two-layer PCB design
- Delivers SmartSense™ Auto-tuning\(^2\) with high signal-to-noise ratio
- Provides flexible power modes for one-year battery life

**Collateral**

- **Kit Website:** [PRoC BLE Touch Mouse](#)
- **Kit User Guide:** [CY5682 User Guide](#)
- **Datasheet:** [PRoC BLE Datasheet](#)
- **App Note:** [Getting Started with PRoC BLE](#)

**How To Get Started**

- Buy a [Touch Mouse RDK](#) (CY5682)
- Download [PSoC Creator](#)
- Download the [Kit installer file](#)

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\(^1\) A technology based on capacitive coupling that recognizes human touch as an input protocol

\(^2\) An algorithm that enables CapSense buttons to continuously compensate for system, manufacturing and environmental changes

\(^3\) Serial wire debug communication protocol
Getting Started With BLE

1. Download the PSoC Creator IDE:
   www.cypress.com/Creator

2. Buy the $49 BLE Pioneer Kit and the $15 plug-in module(s)¹
   www.cypress.com/CY8CKIT-042-BLE

3. Download the Getting Started App Note
   PSoC 4 BLE  www.cypress.com/go/AN91267
   PRoC BLE   www.cypress.com/go/AN94020
   EZ-BLE PRoC www.cypress.com/go/AN96841

BLE Pioneer Kit provides simple, rapid development
Compatible form factor with Arduino® shields and Digilent® Pmod™ daughter cards
Includes two FCC-certified² BLE modules
PSoC 4 BLE module (also sold separately as CY8CKIT-141)
PRoC BLE module (also sold separately as CY5671)
Features onboard CapSense slider, RGB LED and push buttons
Provides direct access to all device GPIOs
Selectable voltage setting of 1.9 V, 3.3 V or 5 V

BLE Pioneer Kit provides an advanced debug interface
Includes an on-board PSoC 5LP, factory-programmed as a programmer and debugger
  Serial wire debug interface over USB
  USB-to-serial interface

¹ The BLE Pioneer Kit includes PSoC 4 BLE and PRoC BLE 128KB Flash Modules. The PSoC 4 BLE or PRoC BLE 256KB Flash modules can be purchased separately for $15 each
² A mark on electronic products manufactured or sold in the U.S. certifying that its electromagnetic interference is under limits defined by the Federal Communications Commission