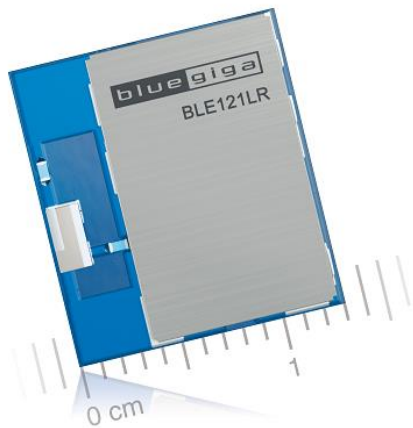




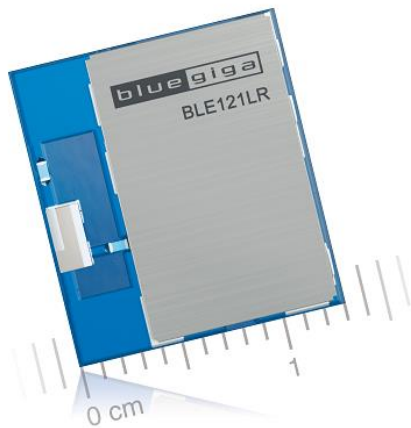
BLE121LR *Bluetooth*® Smart Long Range Module

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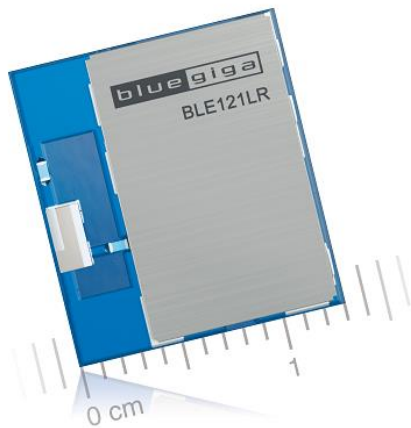


Key Features



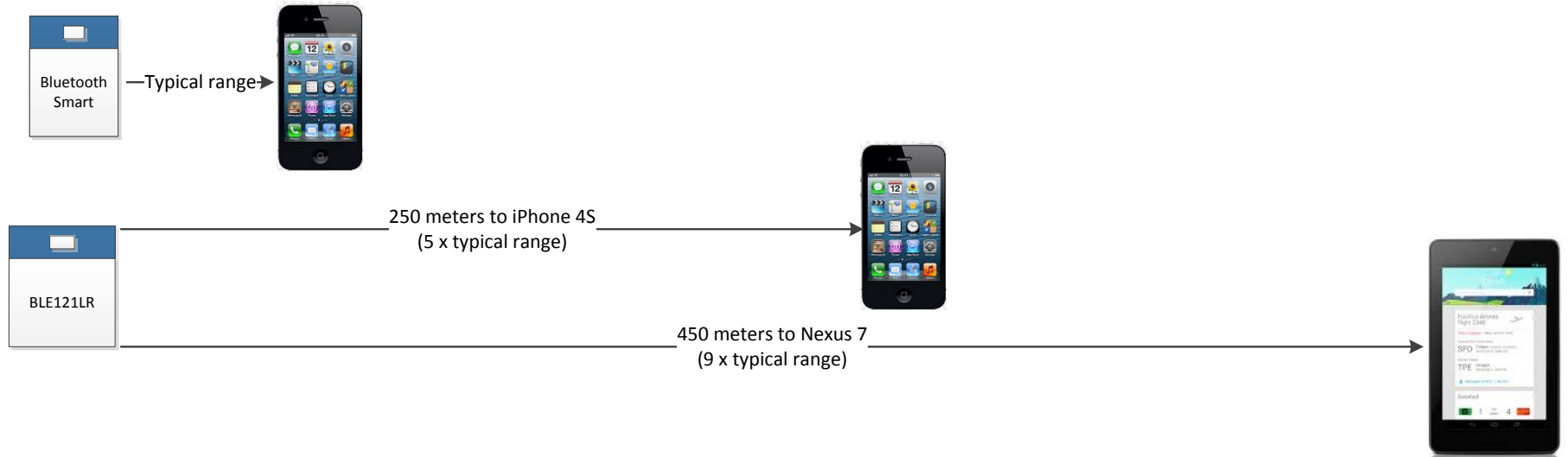
- **Bluetooth v.4.0, single mode compliant**
 - Supports master and slave modes
 - Up to 8 connections
- **Integrated Bluetooth Smart stack**
 - GAP, GATT, L2CAP and SMP
 - Bluetooth Smart profiles
- **Radio Performance**
 - Transmit power : +8 dBm
 - Receiver sensitivity: -98 dBm
- **Low Current Consumption**
 - Transmit: 36 mA
 - Transmit: 25 mA (with DC/DC)
 - Sleep mode 3: 0.5 uA
- **Flexible Peripheral Interfaces**
 - UART, SPI and I2C serial interfaces
 - PWM, GPIO
 - 12-bit ADC
- **Host Interfaces**
 - UART
- **Host Interfaces**
 - 14.7 x 13.0 x 1.8 mm
- **Programmable 8051 processor for stand-alone operation**
- **Bluetooth, CE, FCC, IC, South-Korea and Japan qualified**

Benefits

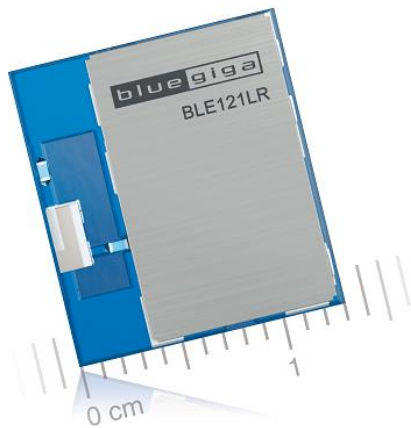


- **World Leading Radio Performance**
 - +8dBm TX power and -98 dBm sensitivity
 - 5-10 x range compared to conventional *Bluetooth* Smart solutions
- **Application Hosting Capability**
 - Application code can be executed on the BLE121LR
 - No need for a separate micro controller
 - Programmable with Bluegiga BGScript™ or C
- **Flash Based**
 - On-the-Field firmware updates over UART or OTA
 - Application data can be stored on the flash
- **Bluetooth, CE, FCC, IC, Japan and Korea Qualifications**
 - Minimal qualification costs
 - Proven interoperability

- **World Leading Radio Performance**
 - 5-10 x range compared to conventional *Bluetooth* Smart solutions

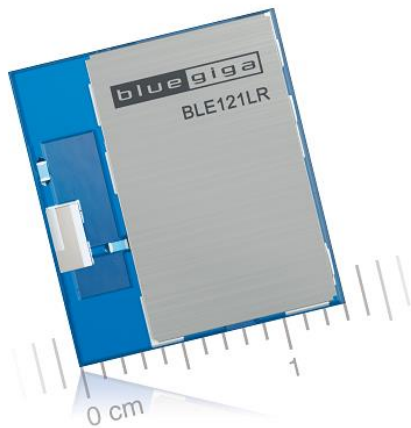


BLE121LR Overview



- **Bluetooth low energy radio**
 - Frequency: 2402 – 2480 MHz
 - TX power: +8 dBm
 - RX sensitivity: -98 dBm
 - Modulation: GFSK
 - Symbol rate: 1 Mbps
- **Antenna**
 - Integrated ceramic chip
- **Measured Line-of-Sight Ranges:**
 - to iPhone 4S 250 meters
 - to Nexus 7 450 meters
 - to BLE121LR 450 meters

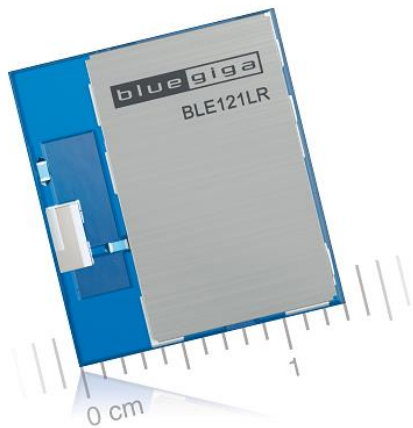
BLE121LR Overview



A total of 16 general purpose I/O pins

- **USART0**
 - SPI master/slave or UART 1Mbps
 - Hardware flow control
- **USART1**
 - SPI master/slave or UART 1Mbps
 - Hardware flow control
- **ADC**
 - 7 x ADC, 7-12-bit resolution
 - Internal temperature sensor
 - Internal battery monitor
- **I2C**
 - Low power, full speed I2C
- **GPIO**
 - Software programmable GPIO
- **PWM**
 - Up to 4 channel PWM

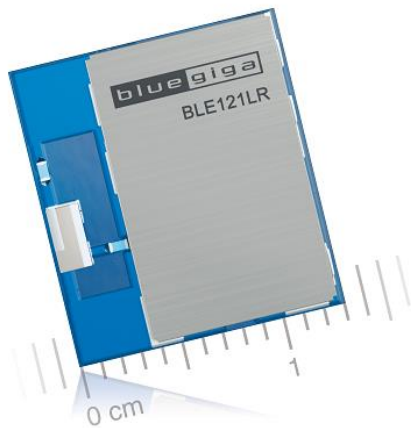
BLE121LR Overview



A programmable 8051 microcontroller

- **Architecture**
 - 8-bit, 8051 architecture
- **SRAM**
 - 8 kB
 - 1.5 to 4kB free for applications
- **Flash**
 - 256kB
 - 158kB free for application and/or OTA firmware updates

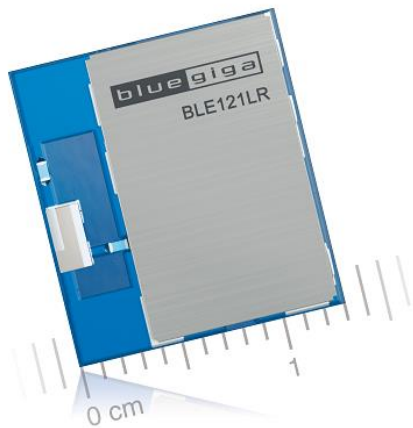
BLE121LR Overview



BLE121LR current consumption

- **TX peak**
 - 36 mA (8 dBm)
 - 25 mA (8 dBm + DC/DC)
- **RX peak**
 - 25 mA
 - 17.5 mA (with DC/DC)
- **MCU**
 - 250uA/Mhz
 - 8 mA peak consumption
- **Sleep modes:**
 - 2.7mA (power mode 1)
 - 1.3 uA (power mode 2)
 - 0.5 uA (power mode 3)

BLE113 vs. BLE121LR



- **TX power**

BLE113 0 dBm

BLE121LR 8 dBm

- **Current consumption**

BLE113 20.7mA (0 dBm)

BLE121LR 36 mA (8 dBm)

- **Physical size**

BLE113 15.75 x 9.15 x 2.1 mm

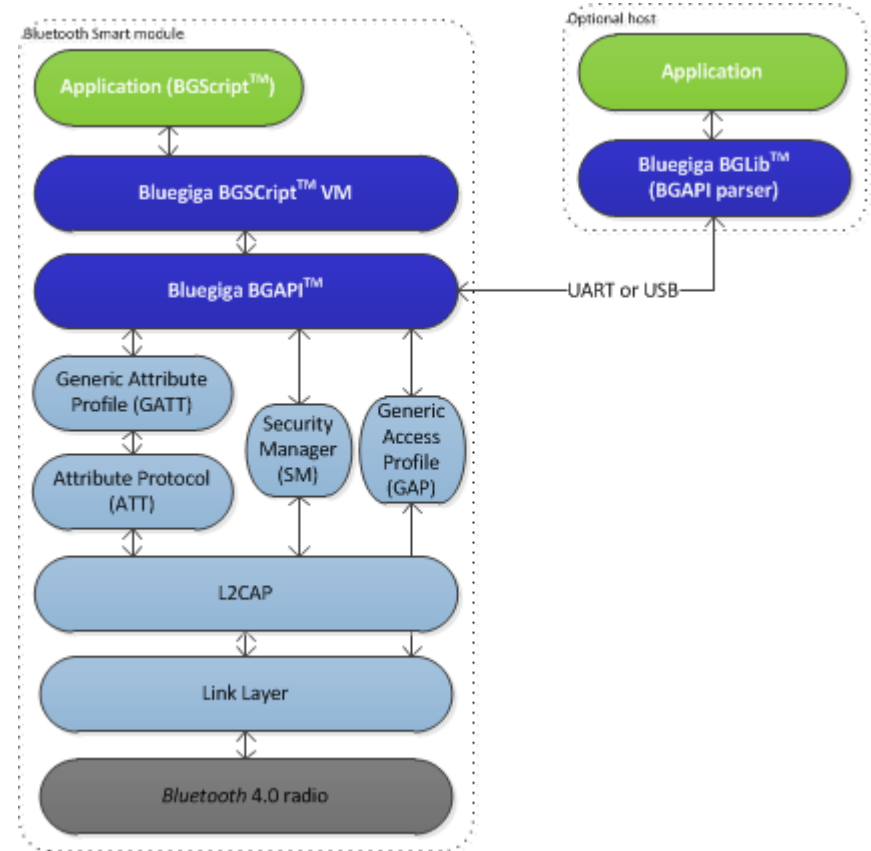
BLE121LR 14.7 x 13.0 x 1.8 mm



Bluetooth® Smart Software

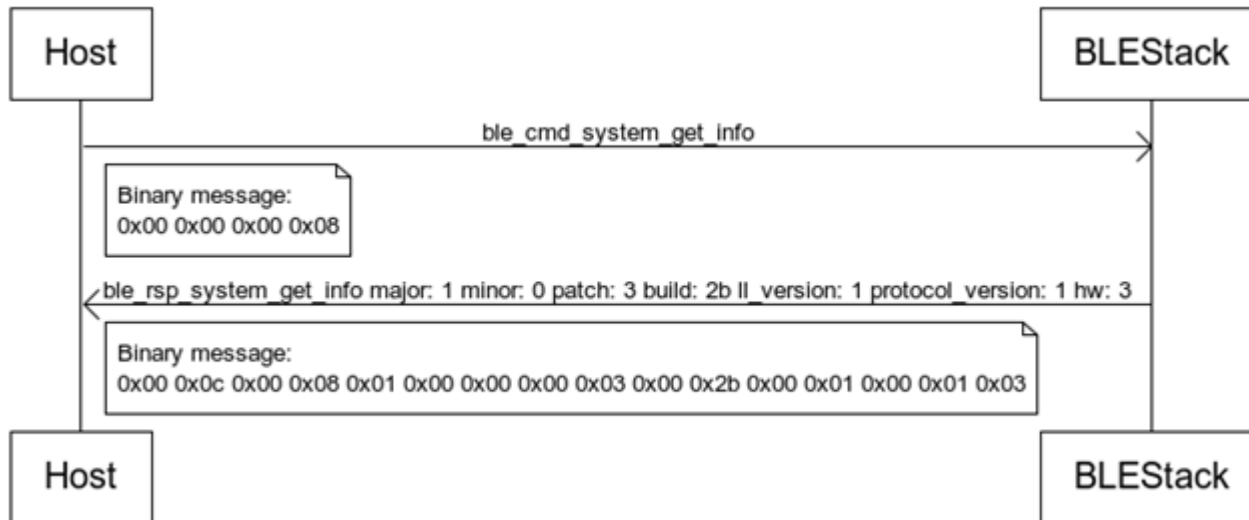
Bluetooth Smart Software

- **Bluetooth v.4.0, Single Mode Compliant**
 - Supports master and slave modes
 - Up to 8 simultaneous connections
- **Implements all Bluetooth Smart Functionality**
 - GAP, L2CAP, ATT, GATT
 - Security manager: bonding, encryption
 - Bluetooth Smart profiles
- **Simple API for External Host Processors**
 - BGAPI™ : A simple protocol over UART or USB interfaces
 - BGLib™ : A C library for host processors implementing BGAPI
- **Supports Integrated Applications**
 - BGScript™ : A simple scripting language for writing applications
 - Native C application development with IAR Embedded Workbench
 - **No separate host needed**
- **DFU and OTA Firmware Upgrade Support**
- **Bluetooth Smart Profile Toolkit™**
 - XML based development tool for Bluetooth Smart profiles
 - Fast and simple profile development
- **Small Memory Requirements**
 - ~4-6 kB RAM
 - ~60-90 kB flash (depending of used features/profiles)
- **Bluetooth Qualified**



**Bluegiga Bluetooth®
Smart Software**

- **BGAPI™ protocol** : A simple binary command, response and event protocol between the host and the stack
 - Used when a separate host (MCU) is used to control BLE121LR over UART
 - Very small memory requirements size requirement and low implementation overhead



- **BGLib™ library** : A portable ANSI C library, which implements the BGAPI protocol
 - Easy to port to various architectures such as : ARM Cortex, PIC16/32 etc.
 - Ported to multiple programming languages : ANSI C, Java, Python and C#
 - Uses fuction–call back architecture

C Functions

```
/* Function */
void ble_cmd_gap_connect_direct(
    bd_addr address ,
    uint8 addr_type ,
    uint16 conn_interval_min ,
    uint16 conn_interval_max ,
    uint16 timeout
);

/* Callback */
void ble_rsp_gap_connect_direct(
    uint16 result ,
    uint8 conn
);
```

- **BGScript™ scripting language** : A very simple BASIC-like application scripting language
 - Used when applications are implemented on the BLE121LR's 8051 controller
 - Enables very fast application development and allows programs to be executed directly on the BLE121LR without the need of an external MCU

```
# System boot event listener : Executed when BLE112 is started
event system_boot(major ,minor ,patch ,build ,ll_version ,protocol_version ,hw )

    # Configure ADV interval to 1000ms and start advertisements an all channels
    call gap_set_adv_parameters(1600, 1600, 7)

    # Start generic advertisement and enable connections
    call gap_set_mode(2,2)

    #Start a continuous software timer, which generates interrupts every 1000ms
    call hardware_set_soft_timer(32768, 1, 0)
end
```

Why to Use BGScript?

- **Very Simple to Use**
 - Fast development of simple *Bluetooth* Smart applications
 - Most applications are 100-200 lines of code
 - Simple iBeacon in 40 lines of code
- **Free Software Development Tools**
 - Bluegiga provides a free BGScript SDK
 - Comes with compiler, example applications and documentation
- **Several Example Scripts Available**
 - Heart Rate transmitter
 - Blood Glucose Sensor
 - Proximity reporter
 - iBeacon
 - Over-the-Air firmware update
 - iOS and Android applications
- **Cuts out the need for external MCU**
 - Reduced eBoM
 - Smaller footprint
 - Faster time-to-market

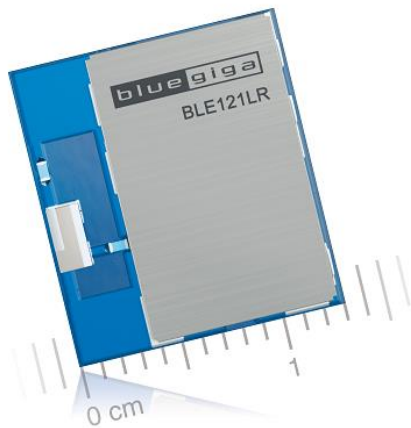
- **Bluetooth Smart Profile Toolkit™**: A tool for creating *Bluetooth* Smart profiles
 - *Bluetooth* Smart profiles are very simple
 - Can be describes with a single file of XML
 - Profile toolkit is a Simple XML description template for *Bluetooth* Smart Profiles
- **Several example profiles and services available**
 - Heart Rate transmitter
 - Proximity reporter
 - Blood glucose sensor
 - iBeacon
 - etc.

```
<service uuid="1800">
  <description>Generic Access Profile</description>

  <characteristic uuid="2a00">
    <properties read="true" const="true" />
    <value>BG Demo</value>
  </characteristic>

  <characteristic uuid="2a01">
    <properties read="true" const="true" />
    <value type="hex">4142</value>
  </characteristic>
</service>
```

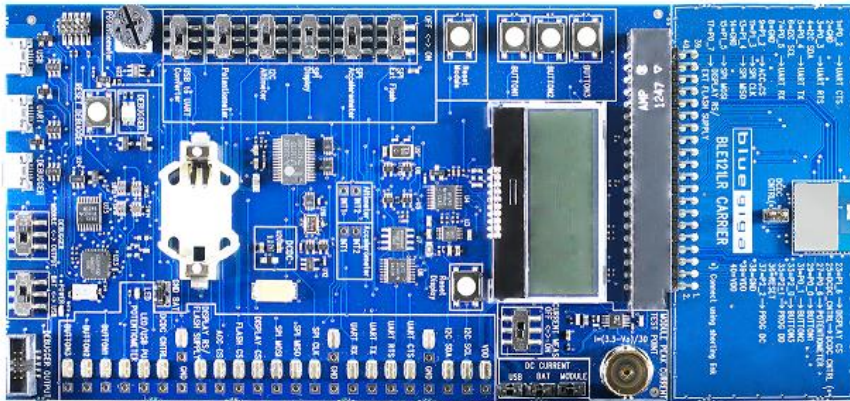
Certifications



- **Bluetooth 4.0**
 - BLE121LR: Controller subsystem
 - Software : Host subsystem
- **CE**
 - EN300328
 - EN301489-1/17
 - EN60950-1
- **FCC**
 - Part 15C modular approval
- **Industry Canada**
 - IC modular certification
- **South Korea**
 - KCC certification
- **Japan**
 - ARIB-STD-66

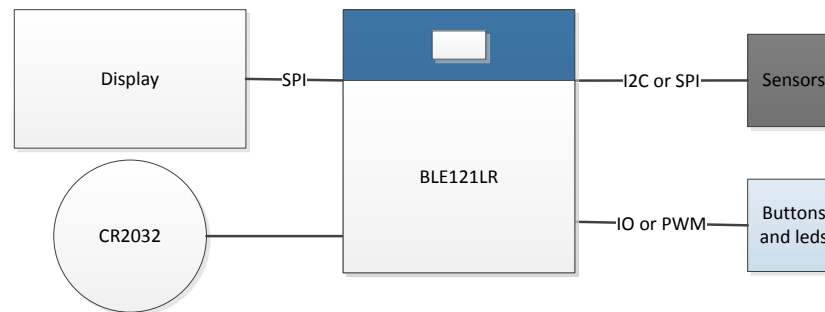


Development Tools

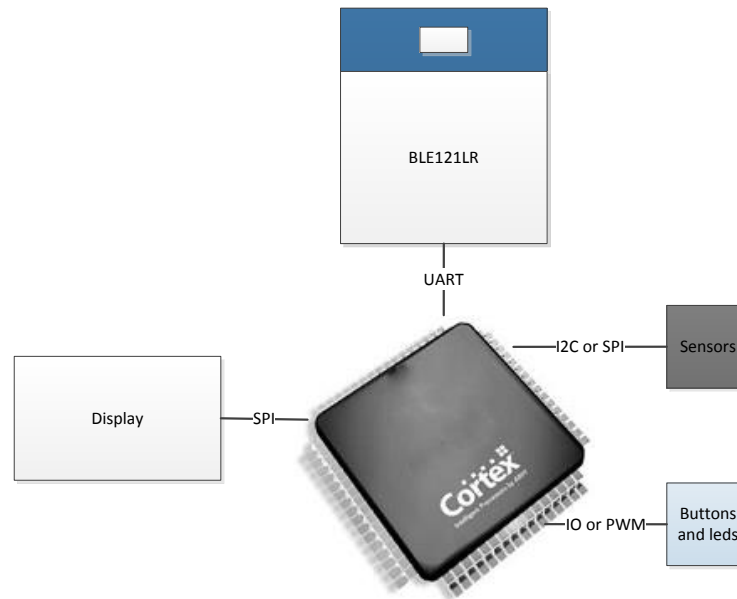


- **DKBLE Development Kit with**
 - Display
 - On-board accelerometer
 - On-board altimeter
 - Potentiometer
 - CR2032 battery holder
 - USB and RS232 interfaces
 - On-board firmware programming
 - Current measurement point
 - External DC/DC converter
 - I/O headers
 - Built-in external SPI flash**+ BLE121LR, BLE112-A, BLE113-A and BLE113-A-M256K carrier boards**
+ BLED112 USB dongle
- **Bluetooth Smart SDK**
 - BGAPI™ documentation
 - BGScript™ development tools
 - BGLib™ source code
 - Profile Toolkit™
 - BGScript and BGLib examples
 - Profile examples
 - Documentation
 - iOS and Android example applications

- **Standalone architecture:** No separate host processor
 - Sensors and peripherals are directly connected to the BLE121LR via the IO interfaces
 - Application executed on the on-board 8051
 - Application developed with BGScript™ or ANSI C and services and profiles with Profile Toolkit™



- **Hosted architecture:** A separate MCU is used
 - Sensors and peripherals are directly connected to the MCU via the IO interfaces
 - BLE121LR connected to the MCU via UART or USB
 - Application developed to the MCU and interfacing to BLE121LR done using BGAPI™ protocol (BGLib™ can be used on the host)
 - Profile developed with Profile Toolkit™





Thank You

