

# Zigbee® Selection Guide for SimpleLink MCUs



## Zigbee® Wireless Networking

### About Zigbee

Zigbee is a highly interoperable, standards-based, wireless mesh technology built for integrating monitoring, control and sensor network applications into the Internet of Things. Based on the universal IEEE 802.15.4 standard, Zigbee was created to address the need for a cost-effective, standards-based wireless networking solution that supports low data-rates, low-power consumption, security, and reliability. With its support of self-healing mesh networking, Zigbee is a decentralized network that allows nodes to find new routes throughout the network if one route fails, making it a robust wireless solution.

- A global ecosystem with hundreds of members creating a worldwide wireless standard for home, commercial and industrial applications.
- The only global wireless communications standard enabling the development of green, smart, easily deployable, low-cost, low power monitoring and control products.
- Innovative standards for energy management, home and commercial automation, health care, retail, telecom and consumer electronics, connecting the widest range of devices to work together intelligently.

## Target applications

Zigbee is specifically targeted for wireless sensor networks. While it can be used in any monitoring and control application that requires a wireless link, the primary target markets for Zigbee are:

- Smart Home - building automation, home security
- Smart cities - advanced metering/smart energy
- Commercial building automation, lighting control
- Logistics and asset tracking
- Medical/patient monitoring

## Why Zigbee 3.0?

With the introduction of Zigbee 3.0, this interoperable standard offers a way to address multiple Zigbee application profiles such as home automation, light link etc. into a unified profile via the Zigbee Cluster Library (ZCL). Zigbee 3.0 also features attractive child management updates which help applications save on critical MCU resources, for example by reducing RAM requirements (via child aging policies) and improving network latency (via parent announcements). Solutions deployed on Zigbee 3.0 are fully backwards compatible with legacy systems, end devices can be switched to Zigbee 3.0 in a phased approach with minimal disruption. Zigbee 3.0 also brings with it enhanced security for network formation, joining and operation using Trust Center Link keys and install codes. Green Power source, proxy and sink support have been added to extend wireless mesh networking capability to battery-less or energy harvested applications.

## Zigbee on TI SimpleLink Arm® MCUs

As a 'Promoter' member of the Zigbee alliance for over fifteen years, TI has certified multiple stacks and profile platforms with three generations of wireless MCU families: CC243x, CC253x and now the SimpleLink CC26x2/CC13x2 wireless MCUs. This paper serves as a selection guide for assessing the breadth of TI's portfolio of wireless Zigbee solutions to determine the product that best fits your development needs.

For developers interested in Zigbee 3.0, the SimpleLink CC26x2/CC13x2 family of wireless MCUs allows for easy integration of the Zigbee stack with out-of-the-box examples such door lock, light, switch, temperature sensor and thermostat as well as trainings on [SimpleLink Academy](#) to help get started quickly.

## SimpleLink ecosystem:

The SimpleLink CC26x2/CC13x2 devices, a part of TI's [SimpleLink MCUs](#), sets a new standard for developers with the broadest portfolio of wired and wireless Arm® MCUs (System-on-Chip) in a single software development environment that delivers flexible hardware, software and tool options for IoT applications. A one-time integration of Zigbee SimpleLink MCUs enables modular development with devices within the SimpleLink portfolio, enabled by the foundational SimpleLink Software Development Kit (SDK) with TI-RTOS (real time operating system) and functional TI Drivers providing 100 percent application code reuse across all SimpleLink MCUs. Applications built upon Zigbee SimpleLink MCUs can expand to add other wireless technologies such as Wi-Fi®, *Bluetooth*® low energy, Thread, Zigbee and Sub-1 GHz as well as wired technologies such as Ethernet, SPI, I2C, UART and CAN via the SimpleLink [MSP432 Host MCU family](#).

For more information visit [www.ti.com/simplelink](http://www.ti.com/simplelink)

## SimpleLink CC26x2/CC13x2 MCU family:

The CC26x2/CC13x2 devices are multi-protocol wireless 2.4-GHz / Sub-1 GHz MCUs targeting Zigbee®, Thread, *Bluetooth*® 5, IEEE 802.15.4g, IPv6-enabled smart objects (6LoWPAN), Wi-SUN®, and proprietary systems.

They offer cost-effective, ultra-low power, 2.4-GHz and Sub-1 GHz RF devices featuring very low active RF and microcontroller (MCU) current, in addition to sub-µA sleep current with up to 80KB of RAM retention, providing excellent battery lifetime and allowing for operation on small coin-cell batteries and energy-harvesting applications. This family combines a flexible, very low-power RF transceiver with a powerful 48-MHz Arm® Cortex®-M4F CPU in a platform supporting multiple physical layers and RF standards. A dedicated Radio Controller (Arm® Cortex®-M0) handles low-level RF protocol commands that are stored in ROM or RAM, thus ensuring ultra-low power and great flexibility. The low power consumption of the CC26x2/CC13x2 devices provide best in class RF performance with excellent sensitivity and robustness (selectivity and blocking). In addition, the CC1352P family of devices provide an integrated power amplifier to increase link budget and extend range of Sub-1 GHz and 2.4 GHz applications. The integrated PA increases output power up to +20 dBm allowing for >4x increase in range as

compared to +5 dBm output. This increase in range is achieved while decreasing power consumption by 40% as compared to competitors. The CC1352P offers sub- $\mu$ A sleep current with full RAM retention, 79 mA TX current for 2.4 GHz @ +20 dBm, 5.7 mA active-mode RX current, and active-mode MCU operation at 59  $\mu$ A/MHz. Additionally, the CC1352P makes solution design easier by integrating an application MCU, Sub-1 GHz and 2.4 GHz radio, and a PA into a single chip, turning a three chip solution into a singular design.

The CC26x2/CC13x2 MCUs are a highly integrated, true single-chip solution incorporating a complete RF system with low power sensing. These MCUs also feature a small CPU core – the Sensor Controller that is highly optimized for low power consumption and efficient peripheral operation. The sensor controller operates in 2 MHz and 24 MHz modes and allows the main CPU – the M4F to stay in standby while performing background tasks autonomously. It has the ability to control the analog sub-system comprising of a 12-bit ADC, 2x comparators, a configurable current source and a reference DAC. With the main CPU in standby, sensing data can also be transferred off-chip using the SPI module. Depending on the application, the sensor controller also provides the flexibility to setup a simple logical state machine that can perform decisions based on sensor data and is easily configurable via the GUI-based sensor controller studio.

#### **SimpleLink Zigbee solution:**

The SimpleLink CC26x2/CC13x2 SDK supports the Zigbee 3.0 (Z-stack) solution from TI, which runs on the SimpleLink MCU framework (TI-RTOS, CCS).

The Zigbee stack is Zigbee Pro (2017) compliant, and includes tools, documentation and example applications such as door lock, light, switch, temperature sensor and thermostat.

The Zigbee solution also includes support for Zigbee Network Processor configuration, which can be used in two chip architectures where a host MCU can be used to implement the Zigbee Cluster Library (ZCL) and the Zigbee application.

This release is available royalty-free to select customers using TI's SimpleLink Multi-Standard [CC2652/CC1352/CC1352P](#) wireless MCUs and can be evaluated on TI's LaunchPad development kits.

#### **Key features:**

- A fully compliant ZigBee PRO feature set on the CC26x2/CC13x2 family of wireless SoCs
- Project examples for End device, router and coordinator for applications such as door lock, light, switch control
- Supports over the air firmware upgrades
- Green power source and sink examples for switch and temperature sensor
- [SimpleLink Academy](#) training for designing a custom Zigbee 3.0 certifiable product

#### **Find the TI solution that is right for you**

Already developing with TI Zigbee products or starting a new design? Use our handy solutions guide to help you navigate the resources you need to work with TI Zigbee products.

Selection Parameters/ Device Family	SimpleLink CC2652R	SimpleLink CC1352R, CC1352P	CC2530/CC2531/CC2538	CC2650/CC2630
<b>Getting Started</b>				
Development kit	LaunchPad <a href="#">LAUNCHXL-CC2652R</a>	LaunchPad <a href="#">LAUNCHXL-CC1352R</a>	<a href="#">SmartRF06 evaluation board</a> with daughter cards	LaunchPad <a href="#">LAUNCHXL-CC2650</a>
<b>MCU Architecture</b>				
Flash	352 kB	352 kB	32 to 256 kB	128 kB Zigbee End Device only
RAM	80 kB	80 kB	8 kB	20 kB
MCU, operating frequency	Arm® Cortex®-M4F, 48 MHz	Arm® Cortex®-M4F, 48 MHz	8051 MCU core, 32 MHz	Arm® Cortex®-M3, 48 MHz
Peripheral features	Fully programmable ULP sensor controller with integrated analog, capacitive sensing, UART, SPI, I <sup>2</sup> C and I <sup>2</sup> S	Fully programmable ULP sensor controller with integrated analog, capacitive sensing, UART, SPI, I <sup>2</sup> C and I <sup>2</sup> S	UART, SPI	Fully programmable ULP Sensor controller with integrated analog, capacitive sensing, UART, SPI, I <sup>2</sup> C and I <sup>2</sup> S
Security accelerators	AES 128, 256-bit ECC, RSA public key, SHA2, TRNG	AES 128, 256-bit ECC, RSA public key, SHA2, TRNG	AES 128-bit	AES 128-bit TRNG
Active power Active mode TX Active mode RX	0 dBm, 6.3 mA 5 dBm, 9.3 mA 6.9 mA (Rx)	0 dBm, 6.3 mA 5 dBm, 9.3 mA 20 dBm, 78 mA 6.9 mA (Rx)	+1 dBm, 29 mA 24 mA	+5 dBm, 9.1 mA 5.9 mA
Standby power RTC on, 80KB RAM and CPU retention	0.8 µA	0.8 µA	1 µA	1 µA
Integrated dual-band support	No	Sub-1GHz and 2.4-GHz RF transceiver	No	No
Built-in range extender	No	Available on CC1352P - 10 and 20 dBm modes	No	No
Packages	7 mm x 7 mm RGZ VQFN48 (31GPIO)	7 mm x 7 mm RGZ VQFN48 (28GPIO)	6 mm x 6 mm QFN40 (21 GPIOs)	4 mm x 4 mm VQFN32 (10 GPIOs) 5 mm x 5 mm VQFN32 (15 GPIOs) 7 mm x 7 mm RGZ VQFN48 (31 GPIOs)
<b>Tools &amp; Software</b>				
Zigbee 3.0 compliant	yes	yes	yes* R21/2015	No
Zigbee protocol stack	<a href="#">Z-Stack 3.2.0</a>	<a href="#">Z-Stack 3.2.0</a>	<a href="#">Z-Stack 3.0.2</a>	<a href="#">Z-Stack HA 1.2.2a</a>
TI drivers for advanced peripherals	Supported	Supported	Not supported	Not supported
100% code portable with other products in the SimpleLink ecosystem	Supported POSIX-compliant TI drivers	Supported POSIX-compliant TI drivers	Not supported	Not supported
Tested and maintained on a quarterly cadence	Yes	Yes	Maintenance releases	Deprecated support
Supported IDE	Code Composer Studio V8.1 or later IAR Embedded Workbench ARM 8.20	Code Composer Studio V8.1 or later IAR Embedded Workbench ARM 8.20	IAR Embedded Workbench ARM 8.11 and 8051 10.10	IAR Embedded Workbench ARM 7.40

For more information visit [www.ti.com/zigbee](http://www.ti.com/zigbee).

For new designs requiring ultra-low power standby or low active power TX, we recommend the ZCP 3.0 compliant CC26x2/CC13x2 family of MCUs. Guides for migrating from older devices can be found in the [Z-Stack 3.10 User's Guide](#)

Note that the [Z-stack Home, Lighting and Mesh](#) solutions are currently archived for the CC2650 and CC2630 products. A ZCP3.0 compliant solution is not planned for these products.

## SimpleLink Zigbee MCUs provide end-to-end development resources

By choosing SimpleLink Zigbee wireless MCUs from TI, you get access to the comprehensive SimpleLink ecosystem with scalable hardware, software and tools that enable all aspects of development lifecycles.

- **Evaluation** – The SimpleLink platform provides affordable [LaunchPad evaluation modules](#) for all of the SimpleLink devices, a university-style training environment called [SimpleLink Academy](#) to quickly expose device functionality, and out of box examples that run on the SimpleLink hardware.
- **Development / debug** – The SimpleLink platform provides tools to help developers quickly move from evaluation phase into their application development. The [SimpleLink Academy](#) training modules move past the basics needed for evaluation into advanced labs to jumpstart unique application development. Along with SimpleLink Academy, the [TI Resource Explorer](#) offers many cloud development tools such as the CCS IDE to enable easy development. Additionally there are foundational gateway examples to serve as a reference for developers who require cloud connectivity.
- **Production** – When it's time to finalize the application and make it “production-ready”, the SimpleLink platform offers tools to optimize performance such as [SmartRF Studio](#) for radio tuning and [Sensor Controller Studio](#) [Energy trace](#) for power consumption.

SimpleLink Zigbee MCUs offer a flexible, future-proof solution with the ability to quickly adapt to the changing needs of connected applications in the market.

### TI's Zigbee online forum

Join the Zigbee forum on TI's E2E™ online community and connect with Tlrs and fellow engineers – ask questions, share knowledge, explore ideas, and help solve problems. Visit [e2e.ti.com](http://e2e.ti.com).

For more information on TI's Zigbee networking solutions, please visit [www.ti.com/zigbee](http://www.ti.com/zigbee).

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