



GreenBOSS Datasheet

Version 1.3

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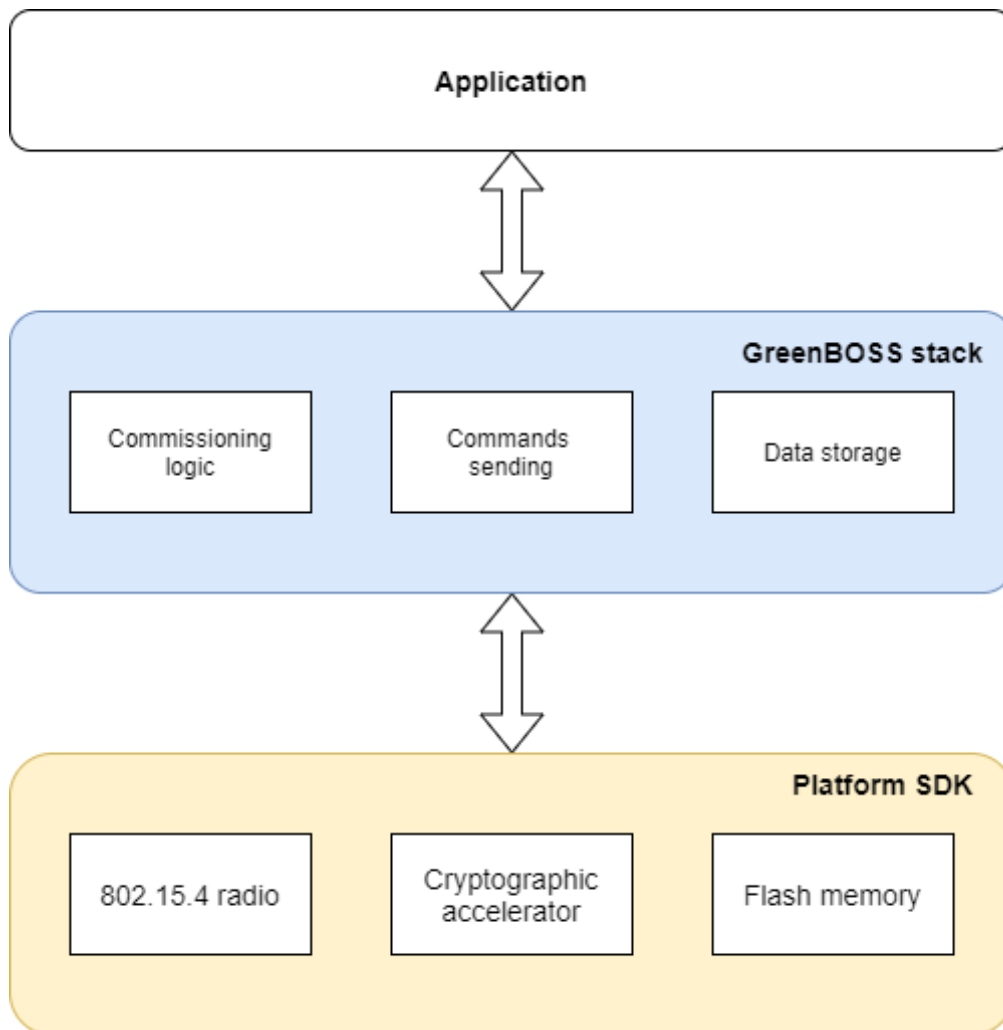
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1 ARCHITECTURE AND FEATURES

1.1 GREENBOSS STACK KEY ARCHITECTURE POINTS

- Optimized power consumption: GreenBOSS can be used to develop battery-less devices
- Low ROM and RAM consumption
- Fixed memory footprint
- Cross-platform: uses hardware-dependent layer for minimal effort porting
- Context data (commissioning data, security counters) management is optimized for battery-less devices
- Can use Hardware Cryptographic Accelerator (see section 1.10 HW Requirements)
- Unidirectional and bidirectional commissioning
- Unidirectional and bidirectional communication



1.2 POWER CONSUMPTION OPTIMIZATION

For battery-less devices, the most power-consuming operations are Tx, Rx, and operations with flash memory. Green power security mandates the use of a security counter, which is updated per transmitted packet. GreenBOSS is designed in a way to optimize operations with counters by saving only a few bits of information each time when the counter is updated. This design allows spending the power budget mainly for Tx operations.

1.3 COMMISSIONING PROCEDURE

GreenBOSS supports unidirectional and bidirectional commissioning. Unidirectional commissioning works well for battery-less devices, while for bidirectional commissioning a battery supply most probably will be required – as this type of commissioning requires a significantly bigger power budget.

GreenBOSS gives control over the commissioning process to an application. The application defines a channel mask and controls channel selection order: channel number may be changed not only monotonically increasing, but also in application-specific order.

1.4 FOOTPRINT

This section provides exemplary footprint calculation for a GPD device, developed using GreenBOSS SDK.

- GPD device: On/Off switch, unidirectional commissioning
- Compiler: TI ARM Clang version v3.2.1.LTS .

Module	ROM (kB)	RAM (kB)
Runtime lib - CC13XX from TI	22.0	3.3
Platform CC13XX for GreenBOSS	1.5	1.7
GreenBOSS lib	9.1	0.4
Application	0.3	0.0
Total	32.9	5.4

Total ROM consumption: 32.9 kB

Total RAM consumption: 5.4 kB

Recommended flash size for context data storage: 48 kB or more

1.5 POWER BUDGET

This section provides power budget measured for a GPD device based on GreenBOSS SDK.

Note: HW platform name cannot be disclosed due to the NDA limitations.

Stage	Time	Current	Energy
SW initialization, read buttons state and NVRAM	2ms	$1.45 + 0.031 \cdot 48 = 2.94$ mA	21.2uJ
Encrypt the packet	0.5ms	2.94 mA	5.3uJ
Radio initialization	1.5ms	5mA	27uJ

TX (2 times)	1.92ms	9.65mA	66.7uJ
Wait between TX	0.64ms	.0.55mA	1.27uJ
Write NVRAM	0.016ms	8.16mA	0.47uJ
Total			122uJ

Energy harvester, used for testing, produced 180uJ of power. This is enough to send 2 GP packets over the air. If CR2032 battery is used, its power capacity would be enough to perform 10 million operations described in the table above.

1.6 COMPLIANCE TO STANDARDS

Green Power Basic specification, v1.1.2 ([14-0563-19 Green-Power-Basic specification v1.1.2.pdf](#))

1.7 SUPPORTED FEATURES

- Security levels 0, 2, and 3 are supported
- Device parameters, configured by application (OOB GPD key, ApplicationID, etc. – for the details see section 1.9 GPD Configuration)
- Unidirectional commissioning
- Bidirectional commissioning
- Efficient counters managing for a GPD security and a MAC layer
- GPD command frames Tx
- GPD commissioning frames Tx, containing a list of supported standard GPD commands
- Bidirectional communication (Read attribute, Write attribute)

1.8 APPLICATION-LEVEL GREENBOSS API

- GPD stack initialization
- Commissioning API
 - Send the commissioning command with given device parameters
- Communication API that allows to construct and transmit the following GPD commands
 - Recall scene
 - Store scene
 - Switch (On/Off/Toggle)
 - Move Up/Down
 - Step Up/Down
 - Hue/Sat/Color commands
 - Lock/Unlock
 - Attribute reporting
 - Request attributes
 - Read attributes response
- API to receive GPD commands

1.9 GPD CONFIGURATION

The following parameters can be configured by application using GreenBOSS SDK:

- DeviceID – Type of the device, according to the Zigbee document 13-0166r01, Master List of Green Power Device Definitions, or 0xFE if it is not a standard GP device
- ApplicationID (can be either 0b000 or 0b010)
- SrcAddr – An IEEE address of the GPD device used for ApplicationID=0b010 mode
- SrcID – a 32-bit GP device identifier used for ApplicationID=0b000 mode
- Commissioning options:
 - Fixed Location flag – If the value of this sub-field is 0b0, then it indicates that the GPD can change its position during its operation on a network
 - PAN ID request – GPD requests to receive PAN ID value from NWK
 - GP Security Key request – GPD requests to receive GP sec. key
 - More parameters can be configured, details can be found on the code documentation – commissioning extended options and commissioning application information
- OOB GPD security key (to use for data encryption)
- ModelID – A 16-bit manufacturer-specific value
- ManufacturerID – A 16-bit Manufacturer ID from the Zigbee Manufacturer Code Database
- Tx channel list – list of channels an application allowed to use to Tx GPD command; the list of channels can be specified during commissioning or defined in some other way specific to the application
- List of supported commands
- List of supported server clusters
- List of supported client clusters

1.10 HW REQUIREMENTS

- Flash memory with RW access for an application; the recommended flash size is 16 KB or more
- A GPD device should have power budget enough to erase at least one flash sector
- A hardware cryptographic accelerator is needed for battery-less GPDs. A battery-powered GPD can use the software implementation version of cryptographic functions (requires a larger power budget).

1.11 SUPPORTED HW PLATFORMS

The list of supported hardware platforms is currently under NDA.