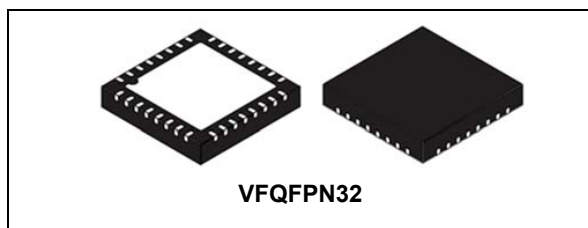


## Digital controller for wireless battery charger transmitters with multistandard Qi, PMA and wearable support

Datasheet - production data



### Features

- Digital controller for wireless battery charger transmitter
- Multiple Qi and PMA standard supported
- Support for up to 5 W applications
  - Mobile
  - Wearable, sports gear, medical
  - Remote controllers
- Native support to half-bridge and full bridge topologies
- 5 V supply voltage
- 2 firmware options
  - Turn-key solution for quick design
  - APIs available for application customization<sup>(a)</sup>
- Peripherals available via APIs<sup>(a)</sup>
  - ADC with 10 bit precision and 1 MW input impedance
  - UART
  - I<sup>2</sup>C master fast/slow speed rate
  - GPIOs
- Memory
  - Flash and E<sup>2</sup>PROM with read-while-write (RWW) and error correction code (ECC)
  - Program memory: 32 KBytes Flash; data retention 15 years at 85 °C after 10 kcycles at 25 °C
  - Data memory: 1 KByte true data E<sup>2</sup>PROM; data retention: 15 years at 85 °C after 100 kcycles at 85 °C
  - RAM: 6 KBytes
- Reference design features
  - 2 layers PCBs
  - Active object detection
  - Graphical user interface for application monitoring
  - Evaluation boards
- Operating temperature: -40 °C up to 105 °C
- Package: VFQFPN32

### Applications

- Qi A11
  - Evaluation board: STEVAL-ISB027V1
  - Power rate: 5W
  - Input: 5V
- Qi A13<sup>(a)</sup>
  - Power rate: 5 W
  - Input: 5 - 16 V, 12 V
- Wearable<sup>(a)</sup>
  - Power rate: 2 W
  - Input: 5 V
- PMA<sup>(a)</sup>
  - power rate: 5 W
  - input: 5 V

a. Contact local sale representative for further details:  
see [www.st.com](http://www.st.com).

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# 1 Description

The STWBC is the STMicroelectronics digital platform designed for wireless battery charger transmitter applications.

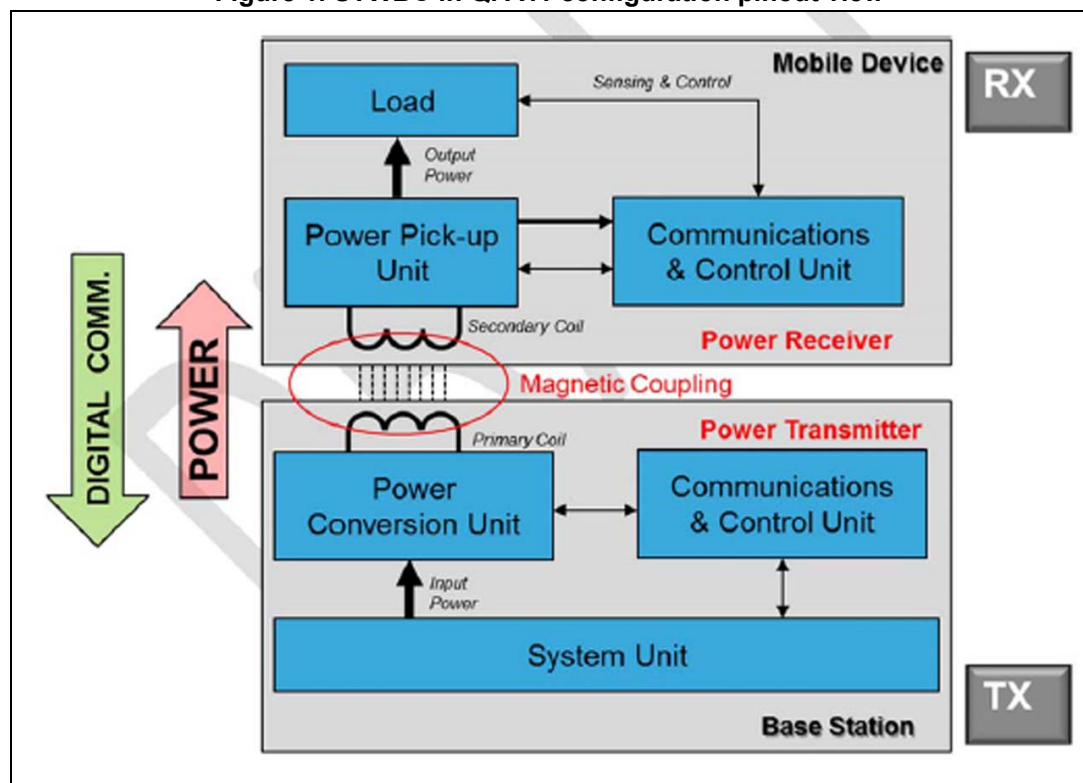
Wireless battery charging systems replace the traditional power supply cable by means of electromagnetic induction between a transmitting pad (TX) and a battery powered unit (RX), such as a mobile phone or a battery pack.

The power transmitter unit is responsible for controlling the transmitting coil and generating the correct amount of power requested by the receiver unit. The receiver unit continuously feeds back to the transmitter the correct power level requested by modulating the transmitter carrier by means of a controlled resistive or capacitive insertion. Generating the correct amount of power guarantees the highest level of end-to-end efficiency due to reduced energy waste. Also, it helps maintaining a lower operational temperature.

The digital feedback is also used to detect foreign objects, i.e.: metal incorrectly exposed to the coils. By stopping the application as soon as a foreign object is detected the risk of damage is reduced.

Digital wireless battery transmitters can adapt the amount of energy transferred by the coil by modulating the frequency, duty cycles or coil input voltage.

**Figure 1. STWBC in Qi A11 configuration pinout view**



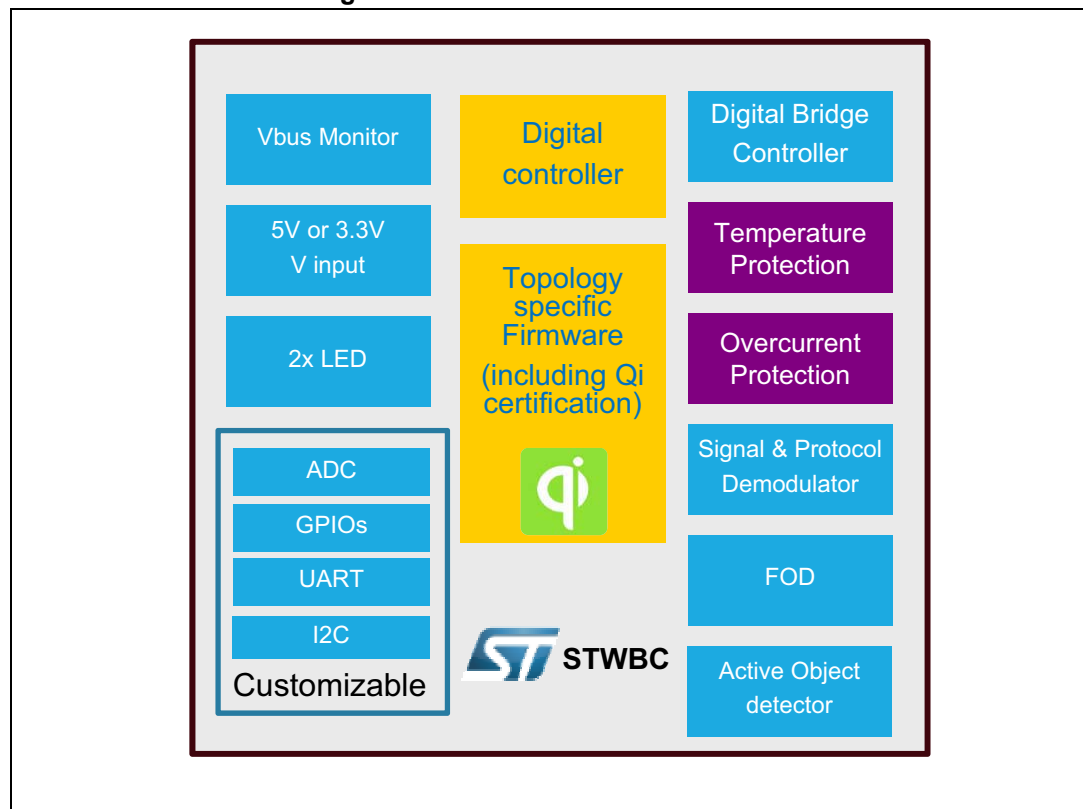
Thanks to the internal STWBC 96 MHz clock, support for half-bridge and full bridge topologies and protocol detection units, the STWBC can drive the power emitted by a transmitting coil. The STWBC firmware sits on the top of the hardware to monitor and control the correct wireless charging operations.

## 2 STWBC system architecture

*Figure 2* illustrates the overall system blocks implemented in the STWBC architecture.

The STWBC is a flexible controller which can be configured to support several types of wireless charging transmitter systems thanks to dedicated firmware options.

**Figure 2. STWBC device architecture**



### Firmware

The STWBC firmware is available in two separate software packages:

- Turn-key: the firmware is distributed as a binary file.
- API customizable: the firmware is designed as a library and external functions as well as peripherals can be added by means of APIs.

The software APIs allow a great freedom of application customization. The STWBC and the API library can be accessed by programming the internal controller via standard programming tools such as the IAR™ Workbench® Studio.

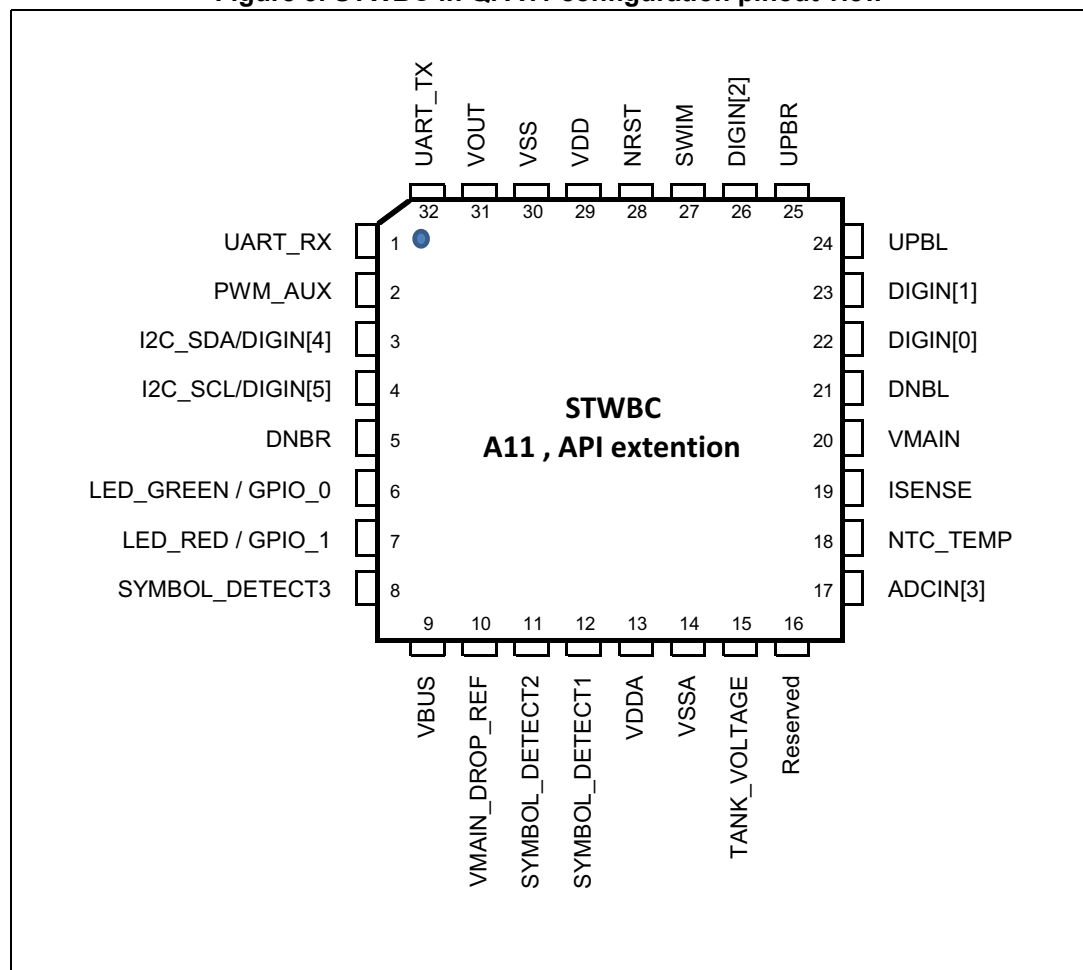
Every STWBC wireless charging architecture is a reference design supported by firmware, evaluation boards, application notes and PCB layouts notes.

### 3 Pinout and pin description

The STWBC is a multifunction device that can support several wireless charging architectures. The pinout is therefore application specific. [Section 3.1](#) shows the pinout used by the STWBC when the Qi A11 configuration is used.

#### 3.1 Pinout for STWBC in Qi A11 configuration

Figure 3. STWBC in Qi A11 configuration pinout view



## 3.2 Pin description

Table 1. Pin description

| Pin number | Pin name                          | Pin type | Description                                                        |
|------------|-----------------------------------|----------|--------------------------------------------------------------------|
| 1          | UART_RX <sup>(1)</sup>            | DI       | UART RX link                                                       |
| 2          | PWM_AUX <sup>(1)</sup>            | DO       | PWM output for general purpose use                                 |
| 3          | I2C_SDA/DIGIN [4] <sup>(1)</sup>  |          | I2C_SDA / digital input 4                                          |
| 4          | I2C_SCL/DIGIN [5] <sup>(1)</sup>  |          | I2C_SCL / digital input 5                                          |
| 5          | DNBR                              | DO       | Output driver for low-side branch right                            |
| 6          | LED_GREEN / GPIO_0 <sup>(1)</sup> | DO       | Digital output for the green light indicator / general purpose I/O |
| 7          | LED_RED / GPIO_1 <sup>(1)</sup>   | DO       | Digital output for the red light indicator / general purpose I/O   |
| 8          | SYMBOL_DETECT3                    | AI       | Symbol detector                                                    |
| 9          | VBUS                              | AI       | Vbus monitor                                                       |
| 10         | VMAIN_DROP_REF                    | AI       | Vmain voltage reference                                            |
| 11         | SYMBOL_DETECT2                    | AI       | Symbol detector                                                    |
| 12         | SYMBOL_DETECT1                    | AI       | Symbol detector                                                    |
| 13         | VDDA                              | PS       | Analog power supply                                                |
| 14         | VSSA                              | PS       | Analog ground                                                      |
| 15         | TANK_VOLTAGE                      | AI       | LC tank voltage probe                                              |
| 16         | Reserved                          |          | Reserved                                                           |
| 17         | ADCIN [3] <sup>(1)</sup>          |          | ADC Input (API only)                                               |
| 18         | NTC_TEMP                          | AI       | NTC temperature measurement.                                       |
| 19         | ISENSE                            | AI       | LC tank current measurement                                        |
| 20         | VMAIN                             | AI       | Vmain monitor                                                      |
| 21         | DNBL                              | DO       | Output driver for low-side branch left                             |
| 22         | DIGIN [0] <sup>(1)</sup>          | DI       | Digital input 0                                                    |
| 23         | DIGIN [1] <sup>(1)</sup>          | DI       | Digital input 1                                                    |
| 24         | UPBL                              | DO       | Output driver for high-side branch left                            |
| 25         | UPBR                              | DO       | Output driver for high-side branch right                           |
| 26         | DIGIN [2] <sup>(1)</sup>          | DI       | Digital input 2                                                    |
| 27         | SWIM                              | DIO      | Debug interface                                                    |
| 28         | NRST                              | DI       | Reset                                                              |
| 29         | VDD                               | PS       | Digital and I/O power supply                                       |
| 30         | VSS                               | PS       | Digital and I/O ground                                             |
| 31         | VOUT                              | Supply   | Internal LDO output                                                |
| 32         | UART_TX <sup>(1)</sup>            | DO       | UART TX link                                                       |

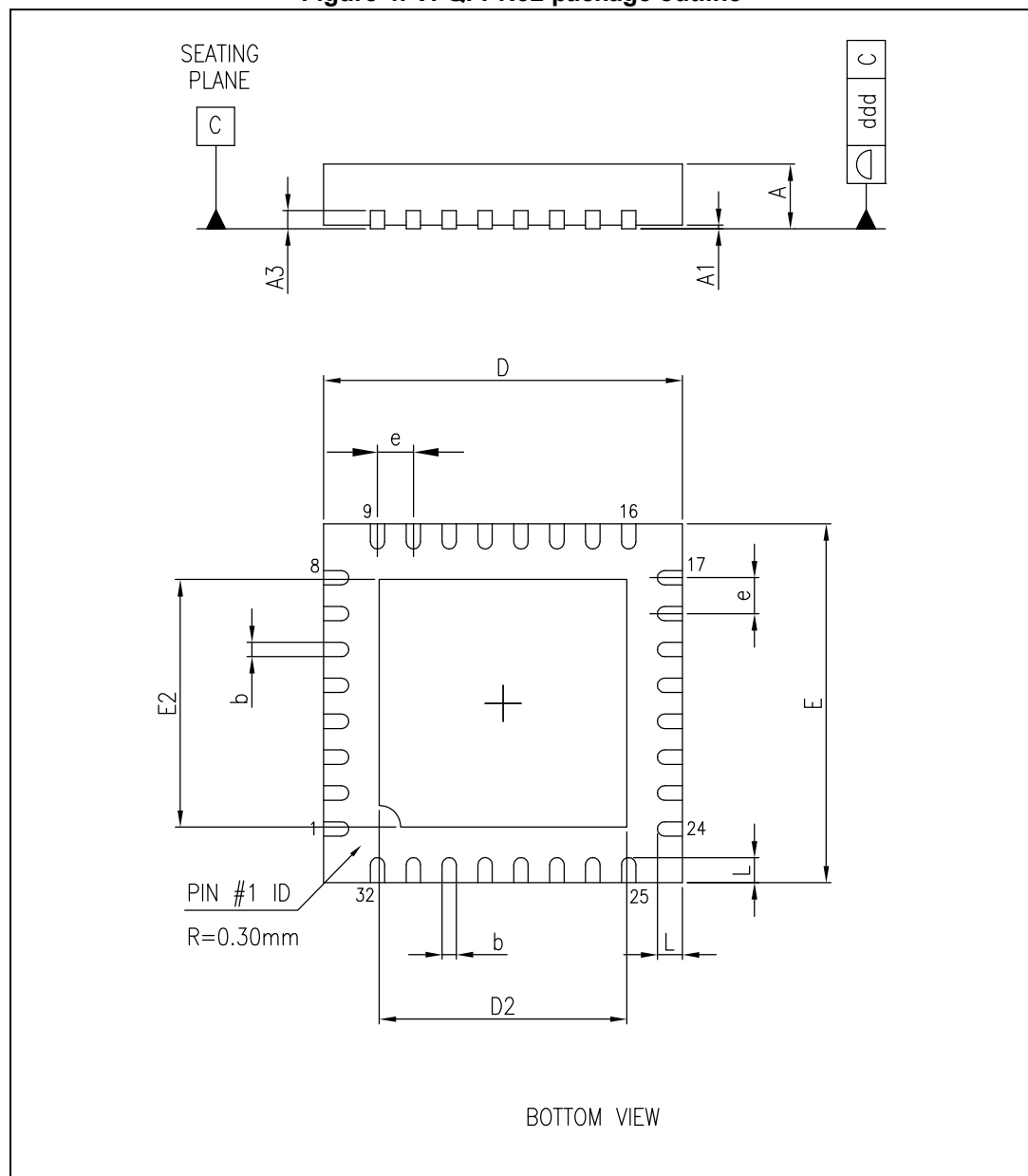
1. API configurable.

## 4 Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK is an ST trademark.

### 4.1 Package design overview

Figure 4. VFQFPN32 package outline



## 4.2 Package mechanical data

Table 2. VFQFPN32 package dimensions

| Symbol | Dimensions (mm) |      |      |
|--------|-----------------|------|------|
|        | Min.            | Typ. | Max. |
| A      | 0.80            | 0.90 | 1.00 |
| A1     | 0               | 0.02 | 0.05 |
| A3     |                 | 0.20 |      |
| b      | 0.18            | 0.25 | 0.30 |
| D      | 4.85            | 5.00 | 5.15 |
| D2     | 3.40            | 3.45 | 3.50 |
| E      | 4.85            | 5.00 | 5.15 |
| E2     | 3.40            | 3.45 | 3.50 |
| e      |                 | 0.50 | 0.55 |
| L      | 0.30            | 0.40 | 0.50 |
| ddd    |                 |      | 0.08 |

Note: 1. VFQFPN stands for "Thermally Enhanced Very thin Fine pitch Quad Flat Package No lead".

2. Very thin profile:  $0.80 < A \leq 1.00$  mm.

3. Details of the terminal 1 are optional but must be located on the top surface of the package by using either a mold or marked features.

4. Package outline exclusive of any mold flashes dimensions and metal burrs.

## 5 Order codes

**Table 3. Silicon product order code**

| Order code | Package  | Packaging     |
|------------|----------|---------------|
| STWBC      | VFQFPN32 | Tube          |
| STWBCTR    |          | Tape and reel |

## 6 Revision history

**Table 4. Document revision history**

| Date        | Revision | Changes          |
|-------------|----------|------------------|
| 18-Dec-2014 | 1        | Initial release. |

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