# Battery-Less Near Field Communication (NFC) Keyboard

**Abstract: To be provided.**

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# 1 Hardware Block Diagram

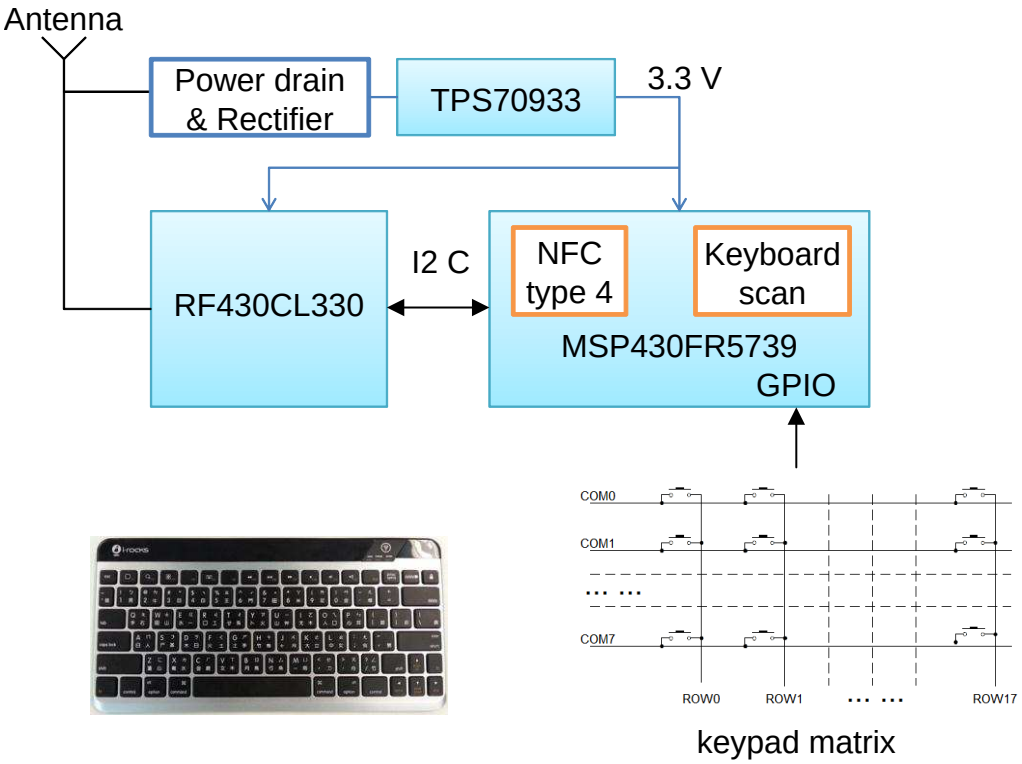



**Figure 1. Hardware Block Diagram**

# 2 How to Mount the PCBA in the Keyboard

1. Open the box.


**Figure 2. New Keyboard—Open Box**

2. Turn the keyboard face down (see Figure 3).

**Figure 3. Turn Over Keyboard**

3. Remove all of the screws (see Figure 4).

**Figure 4. Remove Screws**

4. Turn the keyboard face up (see Figure 5).


**Figure 5. Turn Keyboard Face Up**

5. Release the hidden lock in both sides by using a thin object (see Figure 6).

**Figure 6. Release the Hidden Lock**

6. Open the cover to see the PCBA with battery (see Figure 7)

**Figure 7. Open the Cover**

7. Remove all of the screws and remove the battery from the keyboard (see Figure 8).

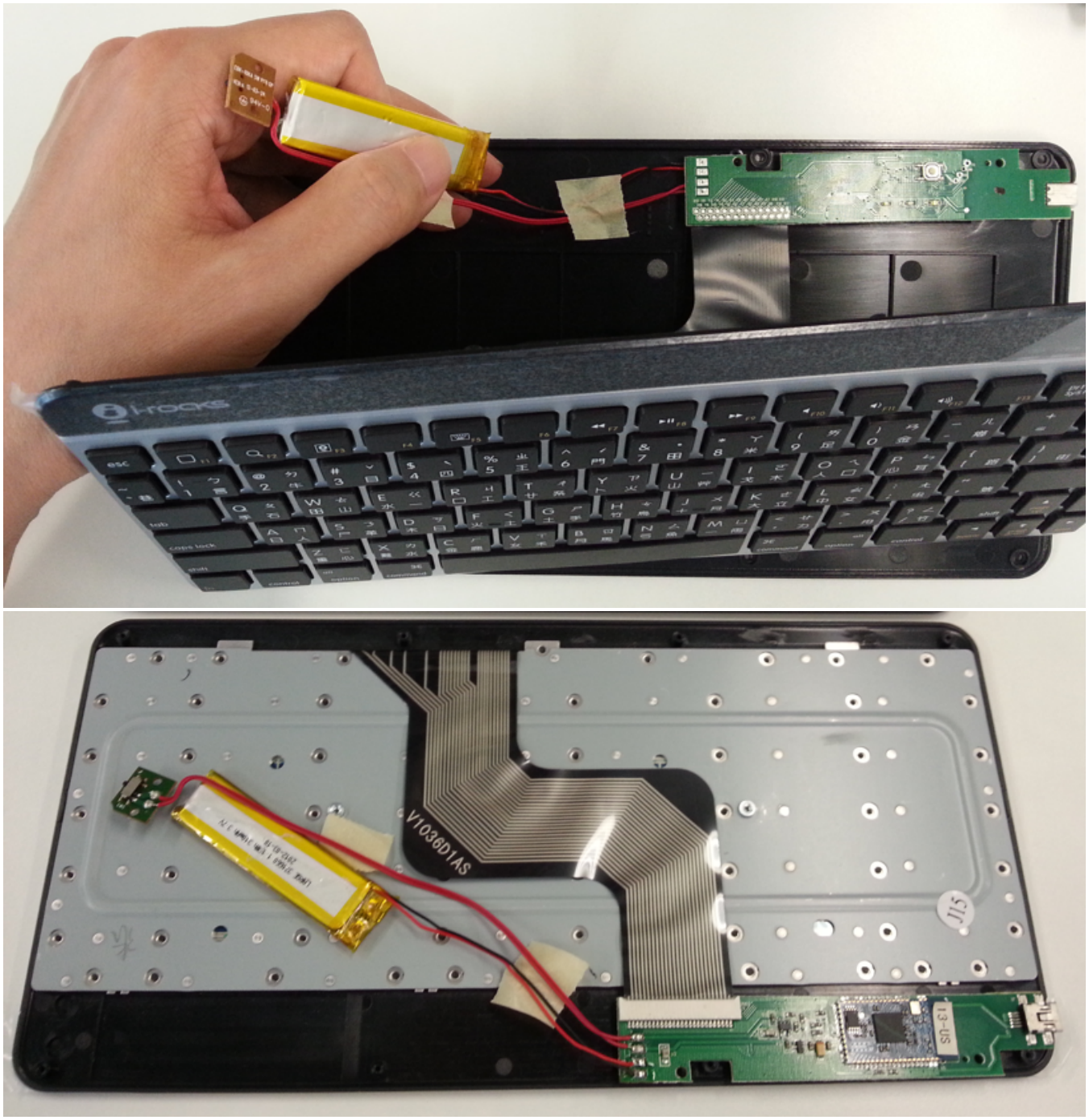



**Figure 8. Remove Battery From the Keyboard**

8. Detach the 26-pin FPC from the PCBA (see Figure 9).

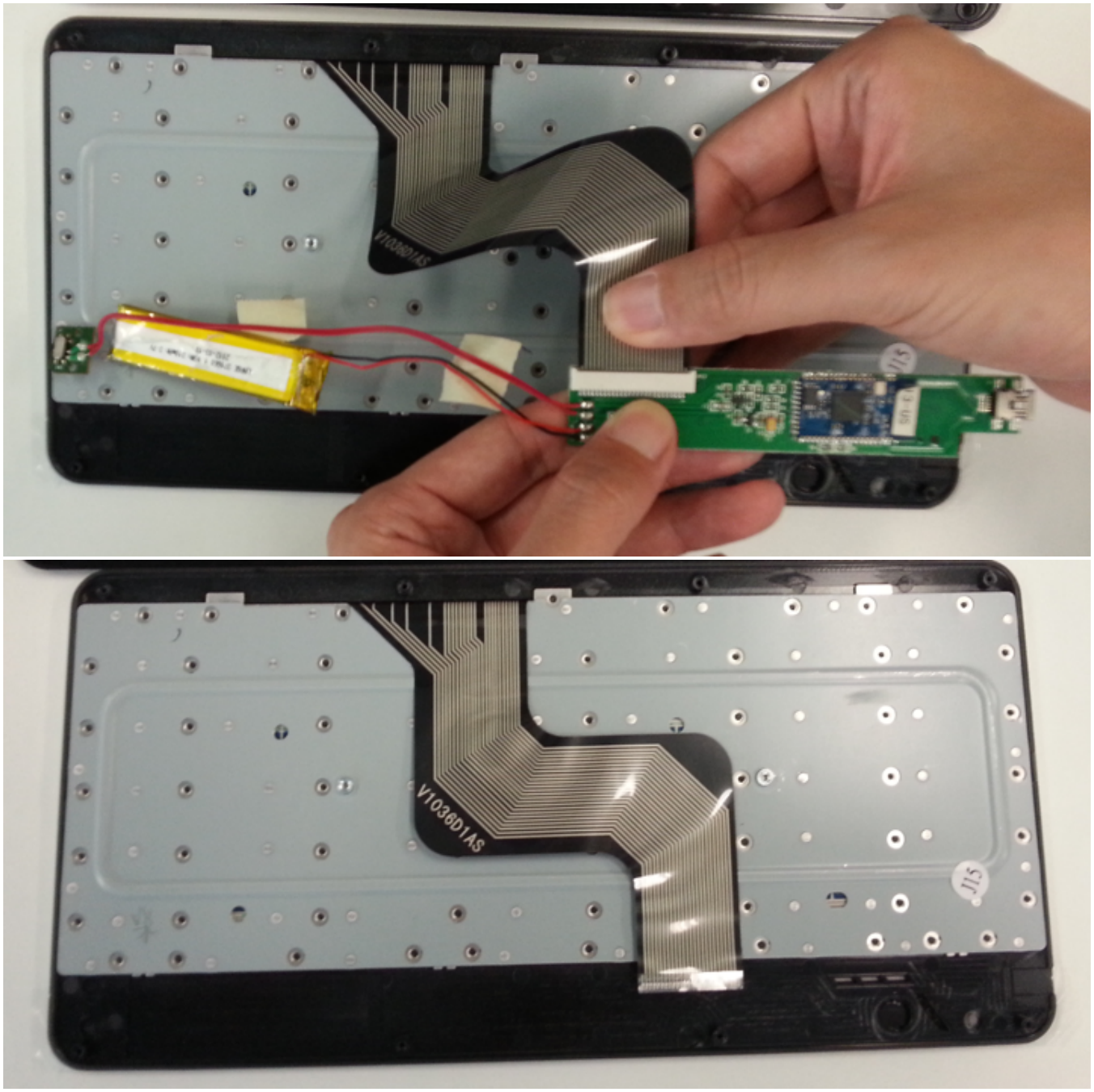



**Figure 9. Detach the 26-Pin FPC**

9. Attach the new NFC keyboard PCBA without the battery (see Figure 10).

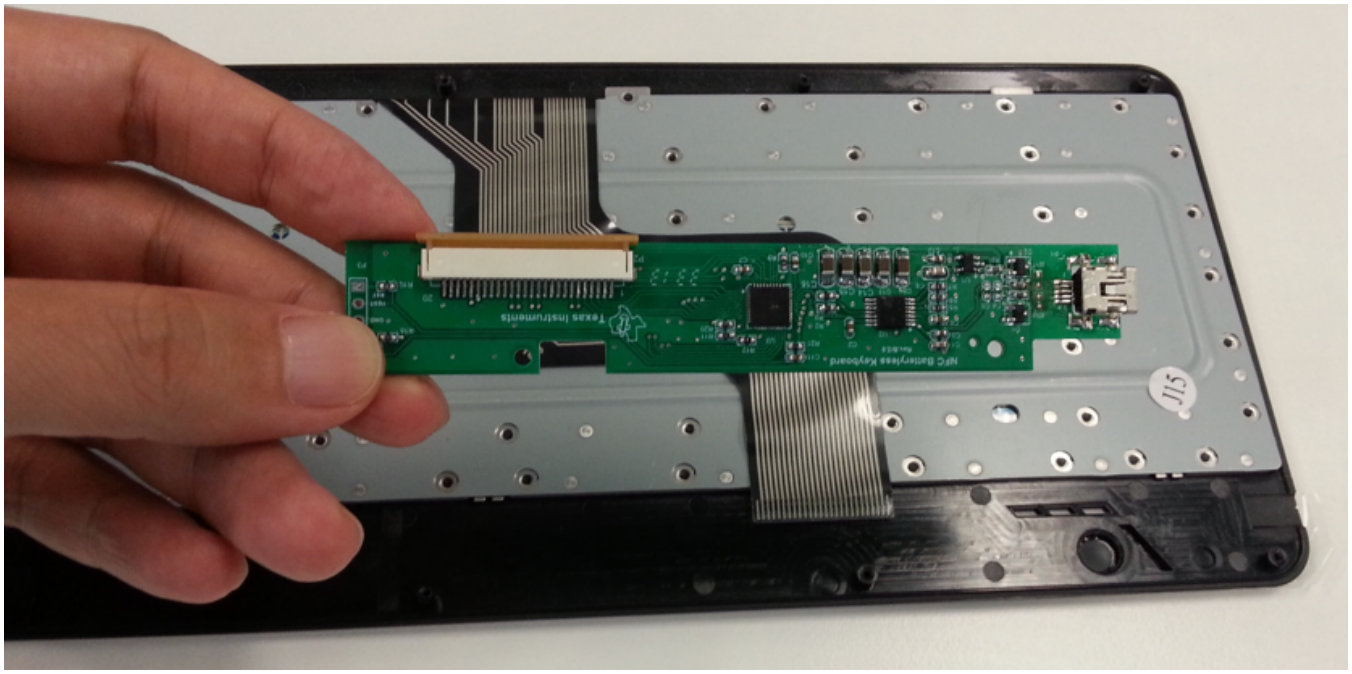


**Figure 10. Attach New NFC Keyboard PCBA**

10. Re-mount all of the screws (see Figure 11).

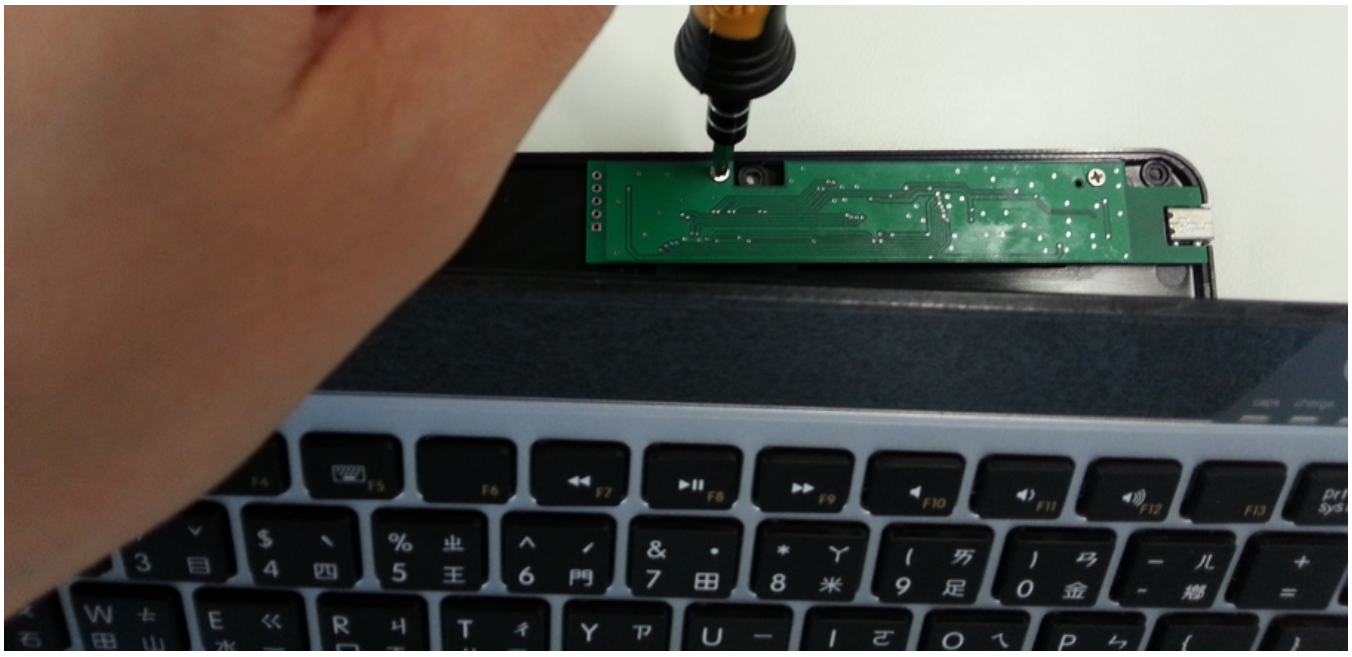


**Figure 11. Re-Mount Screws**

# 3 How to Program the New NFC Keyboard PCBA

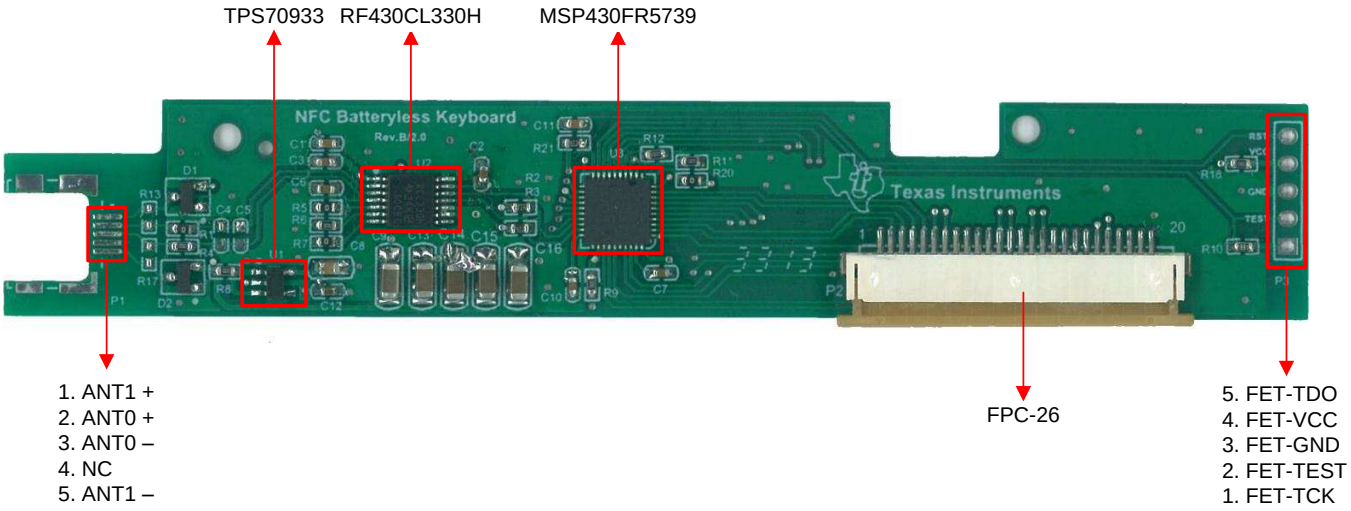



**Figure 12. NFC Keyboard PCBA**

## 3.1 Spy-Bi-Wire Programming Interface

As illustrated in Figure 12, P3 in the PCBA is the 2-wire JTAG communication interface. To debug or program the onboard MSP430RF5739, you need connect all the signals on P3 to a MSP430 USB-FET. A 330-Ω resister is mounted on the PCB between the TCK and TEST pin. Note that FET will power the PCBA during the programming progress.

## 3.2 MSP430 USB-FET JTAG interface

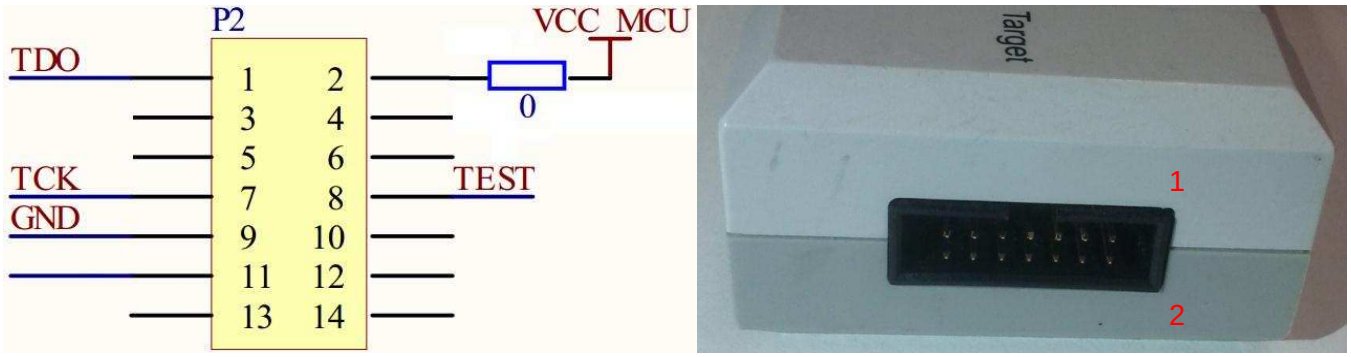



**Figure 13. MSP430 USB-FET JTAG Interface**

# 4 Schematic

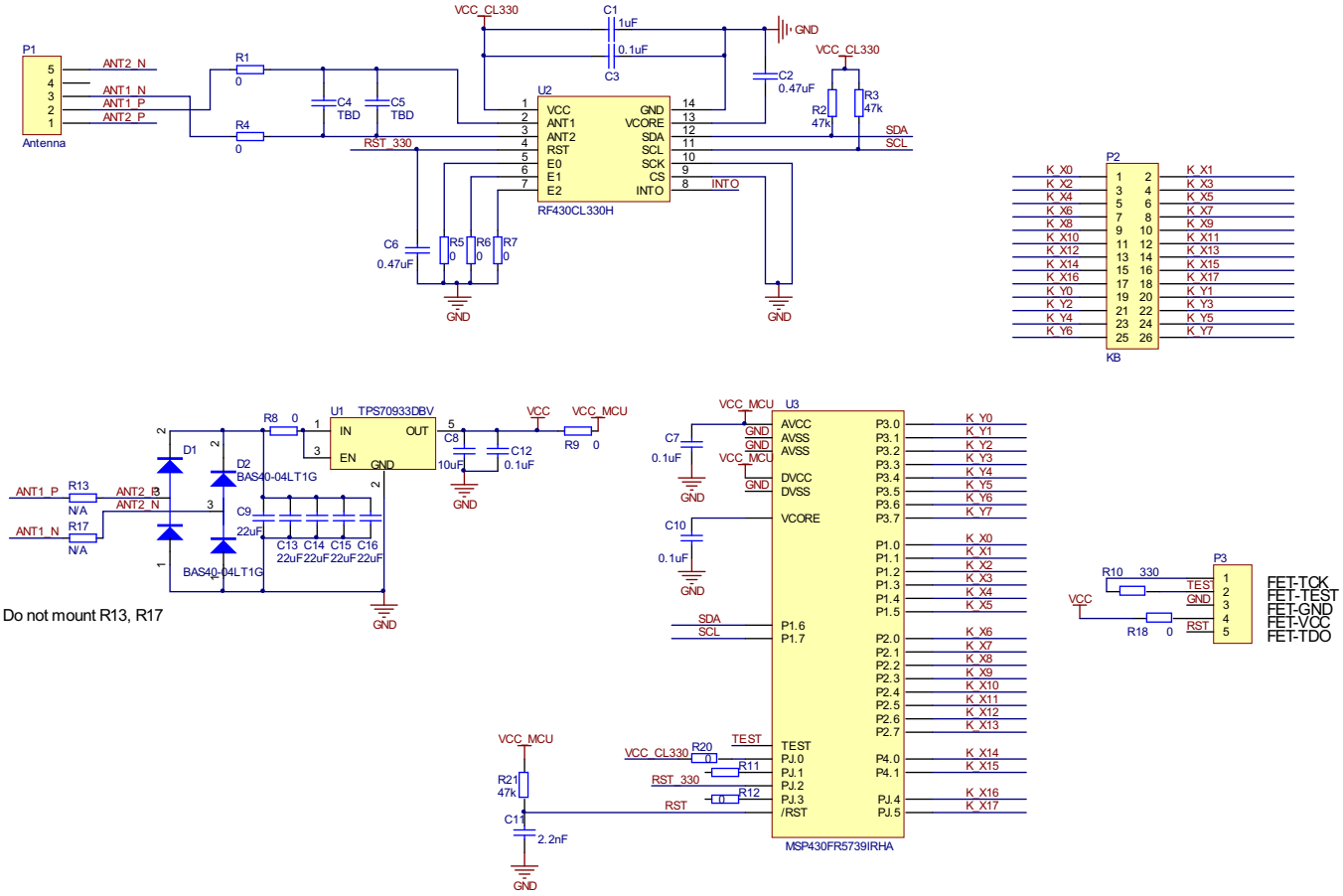
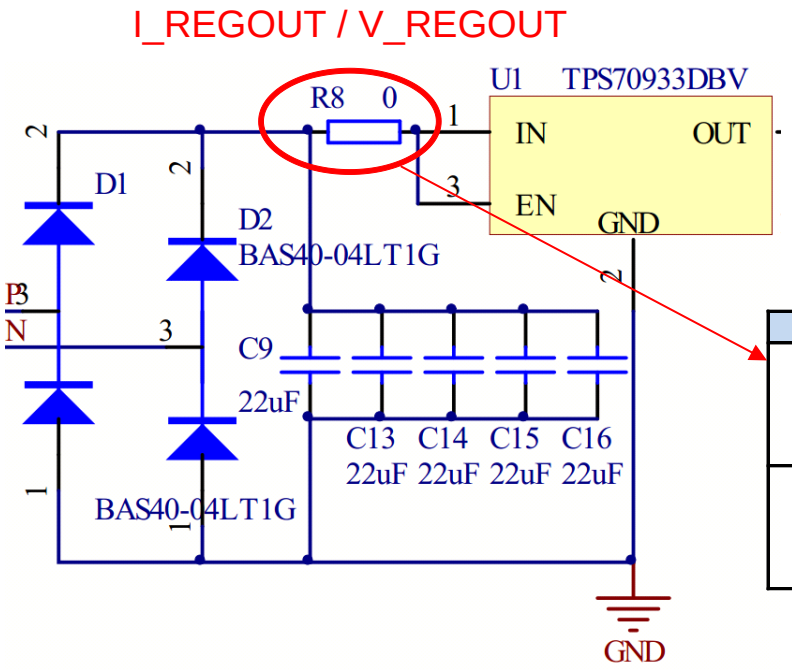



**Figure 14. Schematic**

# 5 Power Consumption Test

- Test based on Schematic 2.0 / PCB Rev B.
- Different mobile placement resulted different I_REGOUT but the same V_REGOUT, which may be clamped by the LDO input circuit.

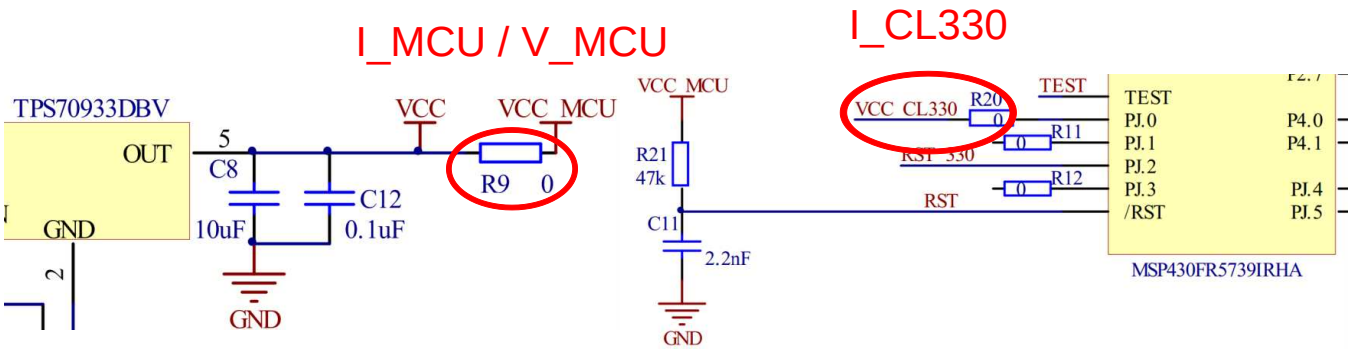
### 5.1 Current Measured on LDO Input




| Mobile | I_REGOUT (mA) | V_REGOUT (v) |
|---|---|---|
| Samsung Note2 | 1.42 | 11.43 |
| | 1.58 | 11.52 |
| | 2.11 | 11.68 |
| | 2.8 | 11.76 |
| Nexus S | 1.75 | 11.59 |
| | 2.4 | 11.72 |
| | 2.92 | 11.76 |
| | 3.32 | 11.78 |

**Figure 15. Power Received from NFC Antenna**

### 5.2 Current Measured on MSP430 and CL330




| | I_MCU (mA) | V_MCU (v) | I_CL330 (uA) |
|---|---|---|---|
| no operation | 0.85 | 3.3 | 66~70 |
| single key stroke | 0.9 | | |
| multiple keys stroke(2 ~ 5 keys) | 1.0~1.4 | | |

**Figure 16. Power Consumed by MCU+CL330 and CL330 Itself**

Note that MSP430RF5739 powers RF430CL330, so the current I_MCU is included in the power that CL330 consumes.

# 6 Android Applications

Figure 17 illustrates the system block diagram. This system has mobile phone and keyboard components. To operate the NFC keyboard, you need an NFC-enabled mobile phone running on Android 2.3 or later version and also the NFC batteryless keyboard. On the mobile phone, two (Android) applications need to be installed. One is NfcServer (an application that collects the key strokes via NFC communication), which is the Android side and defined as an NDEF message. After NfcServer gets the NDEF message, it will parse what is in the message (the message contains the original scan code of the key activity). Then, the scan code is handled and explained, and the character is sent to the other application, NfcKeyboard, which is an input method service in the Android system. NfcKeyboard is a simple service; the program just sends the characters and text or any control information to the other application if it uses the system edit controls.

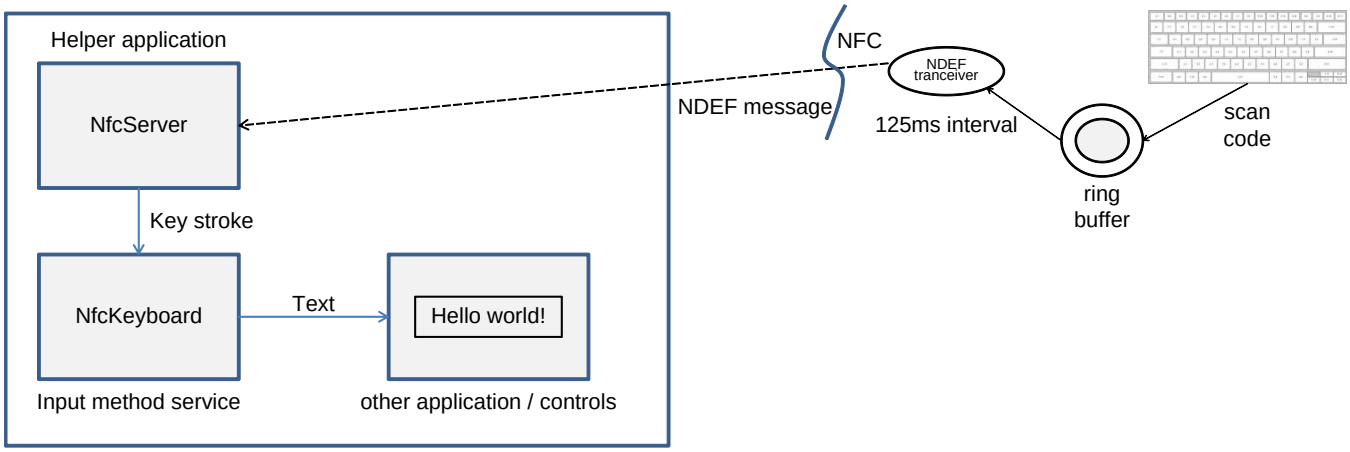



**Figure 17. System Block Diagram**

## 6.1 NfcServer Application

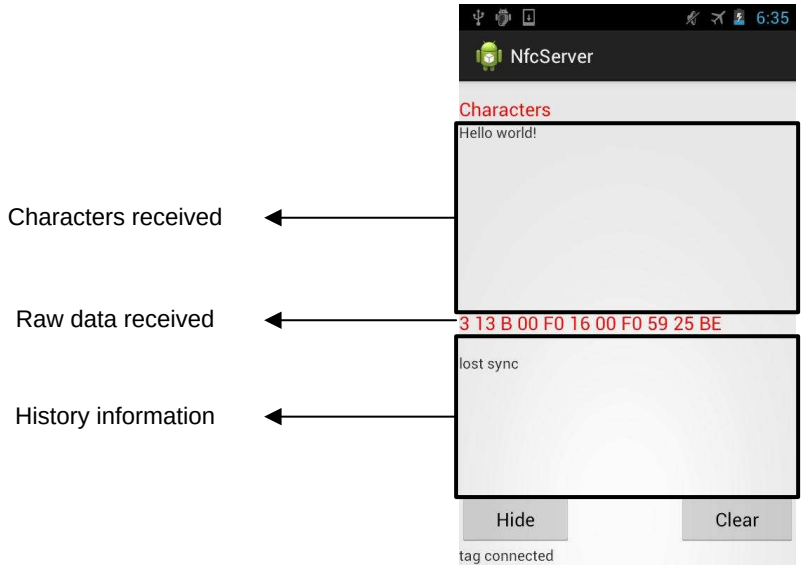



**Figure 18. NfcServer**

This application is designed to be a helper application and can run in the background; you can hide this application by pressing the *Home/Back* button on the mobile phone or the *Hide* button in the graphical user interface (GUI). Even when the program is hidden, it still communicates with the keyboard via the NFC connection.

Limited by the Android NFC mechanism, this application may have to be called each time the NFC reader (mobile phone) and NFC device (keyboard) approaching.

In this GUI, you can see the NDEF message sent by the keyboard. The upper side of the GUI contains the characters decoded by the application, and in the lower side of the GUI, you can see the raw data contained in the NDEF message. It also maintains history information that indicates the communication errors. This function is designed for debug usage and should be eliminate in a real application.

## 6.2 NfcKeyboard Application

The NfcKeyboard application is an input method service application that the Android system uses for user input. You can see many of such applications implementing different language input.

You can only input Latin characters and symbols in this simple application by default. Efforts must be taken for support with other language input.

NfcKeyborad implements an input method named “NFC Keyboard” that you can find on *Language & Input* once you installed the application. In the *Language & Input* menu option, check the NFC Keyboard and also make it the default input method to enable the NfcKeyboard access. Note that when you test the keyboard with the NfcServer application, you do not need to install or change the input method as the NfcServer application handles the message by itself.

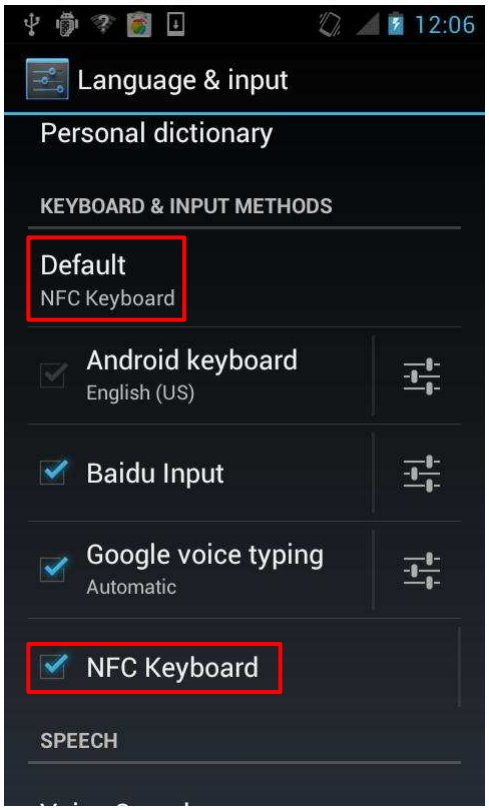



**Figure 19. NfcKeyboard**

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