Application Note: AS3953-AN01 – Demoboard Description

AS3953
NFC interface IC (Tag Demokit)
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1. General Overview

This application note describes the AS3953 Tag Demo Kit and its usage. The purpose of the demonstrator is to show all the features and functionalities of the IC. The demo works with a reader (Phone or AS3911 GP demonstrator). The main features are:

- Demonstration of a file transfer with different datarates
- Demonstration of passive EEPROM programming via RF Field which then will be read out later when the board is connected and powered – demonstrating ISO14443A-4 compliance
- File and URL transfer (bidirectional) with an NFC phone – demonstrating framing mode

The Demo Kit allows you to supply all components by the PC USB Port. No external supply or battery is needed. Except the USB cable and the flex cable (included), no wiring is needed. This allows a fast and comfortable Demo of the AS3953.

1.1. Kit Content

The AS3953 Tag Demo Kit includes the following items:

- AS3953 Tags (two tags, 25 x 20 mm & 35 x 25 mm)
- Flex cable
- Controller Board with USB interface
- USB Cable
- USB Data Stick

Figure 1: Package Content
1.2 Compatibility

This demo works with

- AS3953 GP GUI version 3.1.6.0 or higher and FW 3.1.6 or higher
- AS3911 GP GUI version 2.0.18.0 or higher and FW version 2.0.18 or higher
- Google Galaxy Nexus Phone (Android version 4.0 or higher)
2. Hardware Description

2.1. Demo Board Description

The AS3953 demo kit is comprised of 2 boards, the analog tag board and the controller board. The analog tags consist of the AS3953 and an coil antenna. There are the option to mount additional two matching component (one serial and one parallel) on these tags.

Attention: It is necessary to cut the line between the pads of the serial component foot print, if a component should be placed here.

The flex cable connector consists of 8 pins:

P1: VSS/GND
P2: /SS (active low)
P3: SCLK
P4: MOSI
P5: MISO
P6: IRQ
P7: VP_SPI
P8: VP_REG

The controller board mainly consists of the USB connector, PIC27FJ64GB002 and a 8MHz crystal. The board is powered by USB. The above mentioned construct allows:

1. Optional possibility to add another antenna PCB on top
2. a provision to disconnect the on-board micro and connect another micro for the development purpose
3. harvested power measurement with the VP_REG - and GND - pins.
2.1.1. Analog Tag Board Layout (Typical)

The above pictures show the tag with the dimension 25 x 20 mm. Two bigger tags are also available (35 x 25 mm; 45 x 40 mm):
2.1.1.1. Antenna characterization

<table>
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<tr>
<th>Tag form factor [mm]</th>
<th>Resonance freq. @ low power [MHz]</th>
<th>Resonance freq. @ high power [MHz]</th>
<th>Antenna Q – Factor</th>
<th>System Q – Factor</th>
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<td>15</td>
<td>14.2</td>
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<td>14.2</td>
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Typical measurement results:

Antenna Q – Factor of Tag 25 x 20 mm
Controller Board Schematic & Layout

3D View

Top Layer

Bottom Layer
### Bill of Materials

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<tr>
<th>#</th>
<th>Designator</th>
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<th>Component Description</th>
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<td>7M-12.000MAAJ-T</td>
<td>1</td>
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</table>

**Notes**

- Approved: 47
3. Software Description

AS3953 demo kit behaves like a 14443A-4 Tag. It can be used with AS3911 GP board (Reader) or a standard NFC phone. We have defined Google Galaxy Nexus as our reference mobile phone (Android version 4.0 or higher).

The SW can be downloaded from the following destinations:

<table>
<thead>
<tr>
<th>Software</th>
<th>FTP side</th>
<th>User</th>
<th>password</th>
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<td>AS3911GP_GUI Demo</td>
<td><a href="http://www.space4ams.at/user/AS3911GP_GUI/default.php">http://www.space4ams.at/user/AS3911GP_GUI/default.php</a></td>
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<td>as3953_gui</td>
<td>rtvzi3</td>
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3.1. Demonstration with AS3953 & AS3911

- Connect AS3911 GP demo and AS3953 GP demo with the USB to the computer and start the respective GUIs
- AS3911 FW version must be 2.0.18 or higher
- Click on “Demo Board Check”, “Adjust Regulator” and “Calibrate Antenna” to configure the board.
- AS3911 GUI version must be 2.0.18.0 or higher
- AS3953 FW version must be 3.1.6 or higher

- AS3953 GUI version must be 3.1.6.0 or higher
- To transmit from AS3911 (Reader) to AS3953 (NFC):
  On AS3911 GUI select “load image”, select “speed settings” and click on “Write to Card” to execute the file transfer. NOTE: do not forget to keep the AS3953 antenna on AS3911 antenna.

- To transmit from AS3953 (NFC) to AS3911 (Reader):
  On AS3953 GUI select “load Image”. On AS3911 GUI, select “speed settings” and click on “Read from Card” to execute the file transfer.

- EEPROM Read/write (from RF Field):
  This can be done passively. Disconnect the analog tag board from the controller board so that it is not powered. Place it on the top of the AS3911. Use the GUI sub-tab in the AS3911 GUI. Click on “Read EEPROM” and see the config bit changing. The EEPROM can be written by just changing the values here. NOTE: be aware of the effects while writing address 3 and 4.
EEPROM Read/write (from MCU):
Now connect this Analog tab board to the controller board and connect it to the GUI via USB. The EEPROM tab in the AS3953 GUI can be used to read/write out the EEPROM content when the AS3953 is not in the field.
3.2. Demonstration with AS3953 & NFC phone (Android 4.0 onwards)

The NFC FW in the PIC MCU has been written such that it sends and receives the NDEF messages. Hence no special app is required to send a message to a standard NFC phone. Nevertheless, we have developed an app to send info from phone to the AS3953 GP demo.

- Move to Type 4 Tag tab in the AS3953 GUI and install the provided android app on the NFC phone.
- File/URL Transfer from GUI to Phone:
  Select an image or URL which needs to be transferred to phone. Selected option should show up in the right side of the GUI. Now just unlock the phone and place it on the AS3953 GP demo antenna. Note: The filesize is limited to 64Kbit (limited by NDEF message framework)
- File/URL Transfer from GUI to Phone:
  open the amsNFC app and click on “Transfer Image” or “Transfer URL”. Select an image or URL respectively and place the phone on the AS3953 GP demo antenna. The file transfer starts automatically.
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Contact Information

Headquarters

ams AG
Tobelbader Strasse 30
8141 Unterpremstaetten
Austria
T. +43 (0) 3136 500 0
For Sales Offices, Distributors and Representatives, please visit:
http://www.ams.com/contact