FleX-NFC™ Starter Kit User Guide

Thank you for purchasing this FleX-NFC Starter Kit. The FleX-NFC Starter Kit provides an out-of-the-box demonstration of FHE feasibility and will enable you to experience fully functional ultra-thin FHE systems, examine ultra-thin electronic components and even create your own Flexible Hybrid Electronics (FHE) systems. This Starter Kit and future production of your FHE product ideas are fully supported by the American Semiconductor flexible technology integration team for design and manufacturing.

In this FleX-NFC Starter Kit, includes the following items:

1. Three (3) FleX-NFC Flexible Hybrid Electronics (FHE) Systems
2. Five (5) FleX-NFC Semiconductor-on-Polymer (SoP) Flexible ICs
3. Six (6) FleX-NFC Aluminum Antenna Inlays

CAUTION: Electronic parts are ESD sensitive and must be handled appropriately. Open the protective conductive packaging bags only at an approved anti-static workstation. Use an approved anti-static mat to cover your work surface and a conductive wrist strap attached to earth ground. Also, FHE systems utilize minimal protective layers. Production products may include lamination, labeling, etc. for a more robust final system for conformal and/or flexible applications.

JUMP START

The easiest way to get started is to program one or more of the FleX-NFC Flexible Hybrid Electronics (FHE) Systems. These systems are already assembled and are configured to be ready to accept programming wirelessly using an NFC enabled Android phone.

DOCUMENTATION

Additional documentation, videos, example applications and software tools are available for download at: http://www.americansemi.com/FleX-NFC-Starter-Kit.html.

TECHNICAL SUPPORT

Phone: (208) 336-2773
Email: support@americansemi.com
Hours: Monday-Friday 8 AM – 4 PM Mountain (7 AM – 3PM Pacific, 10 AM – 6PM Eastern)

FleX-NFC is RoHS compliant and is designed, assembled and supported in the USA.
American Semiconductor is a registered trademark of American Semiconductor, Inc.
FleX, Semiconductor-on-Polymer, FleX-IC and FleX-NFC are trademarks of American Semiconductor, Inc.

FleX-NFC™ FHE System Programming

Your new FleX-NFC™ AS_NHS3100P.fhs Flexible Hybrid Electronics Starter System (Figure 1. FleX-NFC AS_NHS3100P.fhs FHE Starter System demonstrates the endless possibilities of FHE systems that incorporate American Semiconductor's FleX™ integrated circuit technology. Each FleX-NFC Starter System includes:

- FleX chip (AS_NHS3100P.fxd FleX-NFC ultra-thin, flexible silicon integrated circuit)
- Multi-layer printed silver antenna on a PET substrate
- Zero Insertion Force (ZIF) programming header for access to all FleX-NFC pins

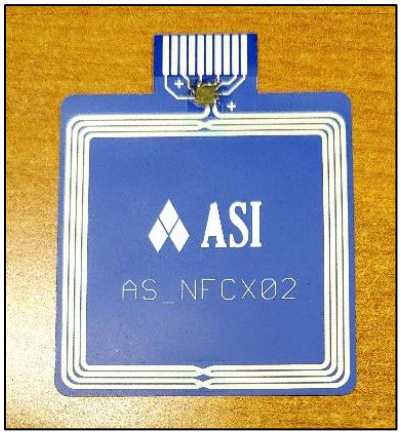

Figure 1. FleX-NFC AS_NHS3100P.fhs FHE Starter System

Your FleX-NFC FHE Starter Systems are provided in the N/P Not Programmed state meaning they are immediately ready for programming. This can be completed easily using the NHS31xx Downloader for Android (Figure 2). The NHS31xx Downloader app can be found on the Google Play store by searching for "nhs31xx". If it is not visible, your phone may not support NFC.

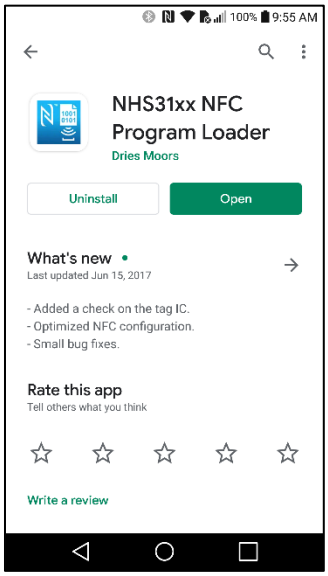

Figure 2. Smart Phone App for Programming a FleX-NFC FHE Starter System

To configure the FleX-NFC FHE Starter System for your desired operation, you must first create a program binary "bin" file using NXP's LPCXpresso program. An example bin file is available for download from the ASI website. Then, open the NHS31xx Downloader app and select the program bin file that you have created (Figure 3 – left).

Next, determine where the NFC antenna on your phone is located. To program, place the NFC antenna on your phone over the FleX-NFC FHE Starter System. Do not move the phone during programming as this could interrupt the transfer of data and prevent successful program. This may take a few tries to find the best location relative to your phone's NFC antenna to get the best signal. Note, receiving an error message after the last packet as seen in Figure 3. Smart Phone Programming of a FleX-NFC FHE Starter System (right) is normal. It is currently unknown why this happens.

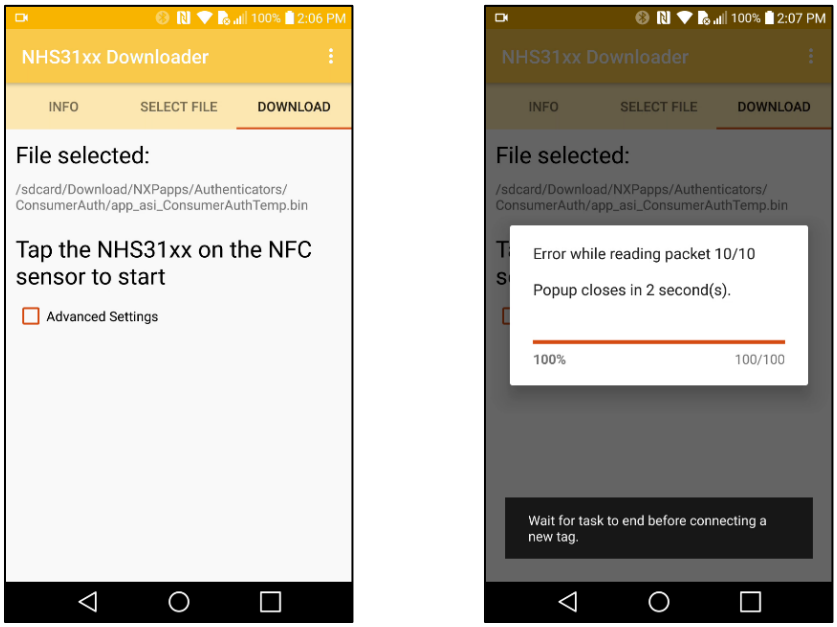

Figure 3. Smart Phone Programming of a FleX-NFC FHE Starter System

Resetting a FleX-NFC FHE Starter System back to the N/P Not Programmed State

The FleX-NFC FHE Starter Systems are programmable one time through wireless NFC communication. If you want to change the program, you will need to first reset the FleX-NFC FHE Starter System back to its original N/P Not Programmed state using the:

- Programing header on the FleX-NFC FHE Starter Systems
- LPC-Link 2 programmer from NXP
- Flash Magic software from NXP

To do this, you will need to connect the ZIF Programming Header on the FHE Starter System to the LPC-Link 2 programmer as illustrated in Figure 4.

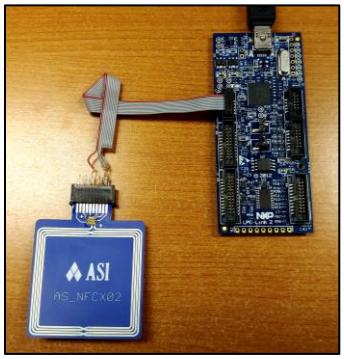

Figure 4. Connecting the LPC-Link2 to the FleX-NFC FHE Starter System

We have used a ribbon cable to connect the the J7 header on the LPC-Link 2 to a ZIF connector that mates to the ZIF programming header on the FleX-NFC FHE Starter System. To create a similar cable, you will need to connect the pins from the FleX-NFC programming header (Table 1) to the J7 header (Table 2) on the LPC-Link 2 using the pin mapping described in Table 3. A magnified view of the ribbon cable wiring to the ZIF connector is shown in Figure 5.

Table 1. FleX-NFC FHE Starter System Header Pin List[1]

Pin	Name
1	PIO0_0
2	N/C
3	PIO0_6
4	N/C
5	VDDBAT
6	N/C
7	VSS
8	N/C
9	SWCLK
10	SWDIO

[1] Pin 1 of the FleX-NFC Programming Header is designated in Figure 5: FleX-NFC Programming Header

Table 2. LPC-Link 2 J7 Connector Pin List[2]

Pin	Name
1	JTAG_VREF
2	JTAG_TMS_SWDIO
3	GND
4	JTAG_TCK_SWCLK

Table 3. FleX-NFC Header to LPC-Link 2 Pin Mapping

FleX-NFC Pin Name	FleX-NFC Pin #		LPC-Link 2 Pin #	LPC-Link 2 Pin Name
VDDBAT	5	↔	1	JTAG_VREF
SWDIO	10	↔	2	JTAG_TMS_SWDIO
VSS	7	↔	3	GND
SWCLK	9	↔	4	JTAG_TCK_SWCLK

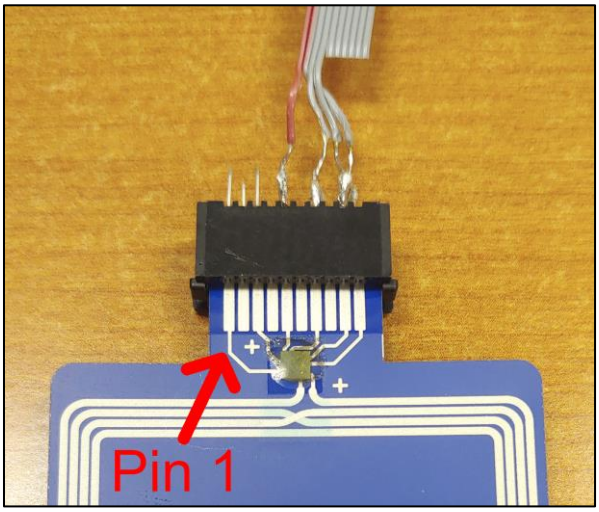

Figure 5: FleX-NFC Programming Header

With the ribbon cable created, do the following to reset the FleX-NFC

1. Plug in LPC-Link 2 to your PC
2. Wait approximately 30 seconds for initialization
3. Open the Flash Magic program
4. Verify Flash Magic settings as shown in Figure 6. The hex file app_closed_nfcprogramloader.hex can be downloaded from the ASI website listed on the first page under Documentation.

[2] Pin 1 of the LPC-Link 2 J7 connector is designated by the white arrow on the LPC-Link 2's PCB

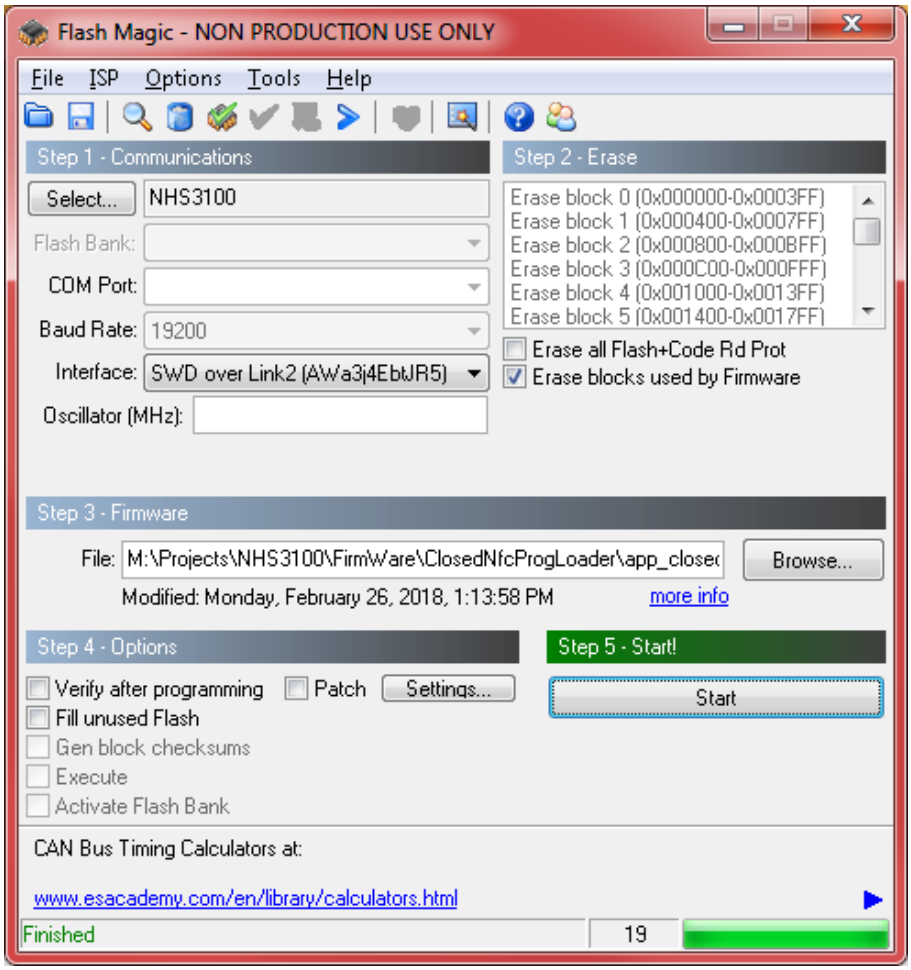

Figure 6. NXP Flash Magic Settings

5. Connect the programming header pins on the LPC-Link 2 to the programming header on the FleX-NFC FHE Starter System as shown previously in Figure 4.
6. Use your Smart Phone to scan FleX-NFC FHE Starter System. Then, quickly after, push the start button on Flash Magic while keeping the LPC-Link 2 connected to the FleX-NFC FHE Starter System.
7. When Flash Magic finishes, remove the LPC-Link 2 from the FleX-NFC FHE Starter System.
8. Verify the tag has been set back to an unprogrammed state using the NXP TagInfo app (Figure 7). We recommend using the full scan option (Figure 8 - left), but the default scan works too. If a popup stating "NFC data set detected" appears as shown in Figure 8 – center, then your FleX-NFC FHE Starter System is working correctly. If you select the NDEF tab (Figure 8 – right), an NDEF record of type "N/P" should appear. The exact payload data should be as seen in Record #1 of Figure 8 – right.

Figure 7. NXP TagInfo App

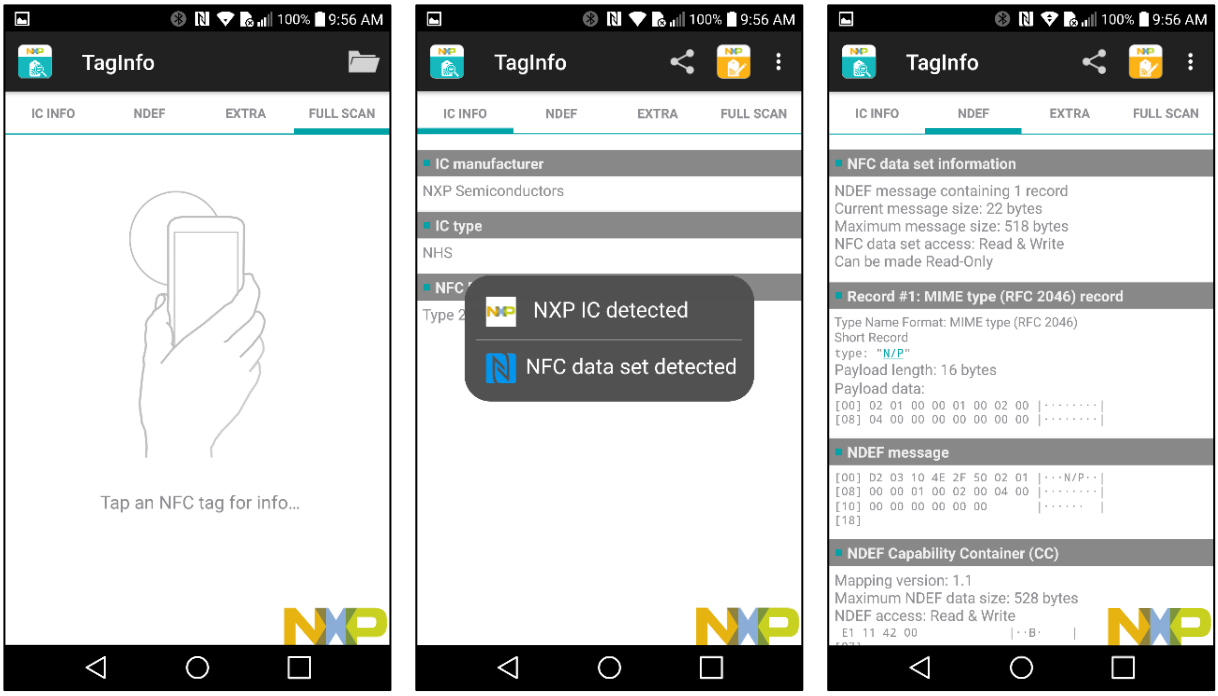

Figure 8. Smart Phone Reading an Unprogrammed FleX-NFC FHE Starter System

FleX-NFC™ Starter Component Use

This kit is designed to support early technology adoptors, thin-product designers and those desiring to implement, adopt or utilize thin-device manufacturing. One of the first questions that is asked about FHE technology using ultra-thin ICs is “what are the chips like”. The FleX-NFC chips in this kit are production devices. They are provided in waffle pack for ease of user access. Production chips can be provided in volume in waffle pack, but are more advantageous for high-volume production when sourced as diced chip-scale packaged (CSP) wafers on tape. The wafer on tape format is available from American Semiconductor. These devices are not bare die. The FleX-NFC

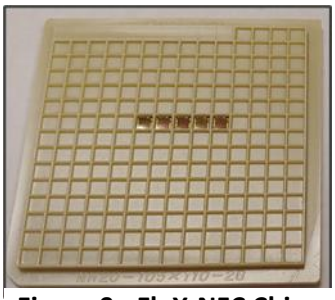

Figure 9 - FleX-NFC Chips in waffle pack

chips in this kit are ultra-thin, CSP ICs. The CSP is composed of an ultra-thin polyimide coating that improves the device resistance to chipping and cracking and creates chips that are physically flexible. All materials used in the chips are high-quality semiconductor industry proven. The chips are generally best assembled in flip-chip orientation using flexible anisotropic conductive adhesives (ACA), pastes (ACP) or films (ACF) or printed interconnects in order to maintain flexibility in the finished FHE systems. Soldering of the chips and wire bonding have been demonstrated, but are not recommended.

The second question about FHE technology using ultra-thin ICs is "how do you make the boards for the chips". FCB (flexible circuit board) design and acquisition is a key consideration for development of ultra-thin electronic systems. American Semiconductor can provide reference designs for layout of all FleX-ICs. In addition to the reference design of the landing pads for the FleX-ICs, FCB assembly should include design rules for keep-out areas around FleX-ICs so that the SMT of any surface mount passive devices and the FleX-ICs are compatible. This includes consideration of the overcoat or other protective layers that the designer is planning for the FHE system. The FHE systems provided in this kit provide an example of a thin overcoat layer appied following ACA flip-chip assembly. A wide variety of FCB materials beyond the aluminum-on-PET samples provided in this kit have been used successfully used for FleX-IC systems. Silver-on-PET is most common and is used in the blue fully assembled FHE systems. Cu-on-Polyimide (also referred to as copper on Kapton or Pyralux®) is frequently selected for more complex FleX-ICs. FCB layout, acquisition and assembly services are available from American Semiconductor.

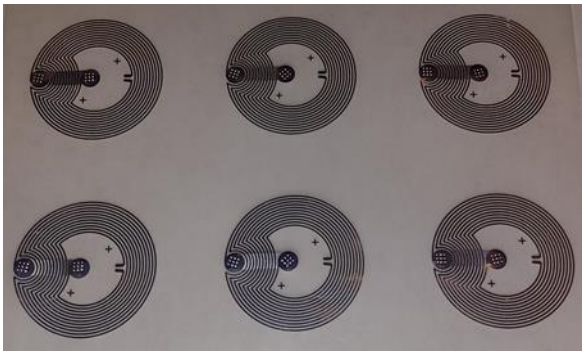

Figure 10 - NFC Antenna Inlays (Aluminum on PET)

The FleX-ICs and Inlays provided in this kit can be assembled into working FHE systems using flip-chip assembly. However, successful assembly is a highly technical endeavor and may be beyond the capability of users that do not already have flip-chip assembly experience. The FleX-ICs and Inlays that are included in this kit are most useful in developing a familiarity with the technology and experiencing first hand what the physical characteristics of FHE materials are.

Contact Info

For more information or to purchase FleX products, please contact us at:

Email: sales@americansemi.com
Phone: 208.336.2773

American Semiconductor Inc., the American Semiconductor logo, FleX, FleX-NFC, and Semiconductor-on-Polymer are trademarks of American Semiconductor, Inc.

NXP is a trademark of NXP Semiconductors.

ARM and Cortex are trademarks of ARM Limited.

NXP SEMICONDUCTOR DOES NOT GIVE ANY WARRANTIES, EXPRESSED OR IMPLIED, ON THE POST NXP CONVERSION PROCESS STEPS AND SHALL HAVE NO LIABILITY FOR THE CONSEQUENCES OF SUCH ACTIVITIES.