

How to port the NFC Reader Library to K64F

Jordi Jofre (Speaker) Angela Gemio (Host)

Webinar instructions

Audio settings:

- You are in "listen only" mode due to possible background noise
- Set mic & speakers option (headset + external mic advised)

For questions:

- Write them in section "Questions" of your GoToWebinar panel
- The host will receive and compile them for the Q&A time

Materials will be made available to you The session will be recorded for on-demand viewing Please answer the evaluation questions after session.

> Scheduled sessions for 11/10/2017 10:00 am - 10:30 am CET 05:00 pm - 05:30 pm CET



HOW TO PORT THE NFC READER LIBRARY TO K64F

WEBINAR SERIES: NFC SOFTWARE INTEGRATION

JORDI JOFRE NFC READERS NFC EVERYWHERE 11/10/2017





SECURE CONNECTIONS FOR A SMARTER WORLD

PUBLIC



Agenda

NFC software integration webinar series

Session I, 14th September How to integrate NFC frontends in Linux.

Session II, 28th September How to integrate NFC controllers in Linux.

Session III, 11th October How to port the NFC Reader Library to K64F.





Agenda

NFC software integration webinar series

Session III, 11th October How to port the NFC Reader Library to K64F

- NFC Reader Library positioning and architecture
- ► Hands-on: NFC Reader Library porting to K64F.
- General considerations to port NFC Reader Library to your target MCU.
- ► Q&A



NXP software support for NFC integration in any platform



NFC Reader Library integration for RTOS and non-RTOS systems



NFC Reader Library contents and architecture



NFC Reader Library release contents



NFC Reader Library API:

- Freely downloadable.
- Full implementation of all NFC protocols
- NDA version with full support for MIFARE® DESFire® and MIFARE Plus®
- SW package for MCUXpresso



Software examples:

- BasicDiscoveryLoop
- AdvancedDiscoveryLoop
- NFCForum
- MIFARE Classic
- ISO15693

. . . .

EMVCo Loopback



Documentation:

- API documentation
- Generated from source file annotations
- Provided as HTML document





Info and more information: www.nxp.com/pages/:NFC-READER-LIBRARY

7

NFC Reader Library support for multiple products and platforms



Info and more information: www.nxp.com/pages/:NFC-READER-LIBRARY

* NFC Reader Library v5.02.00



Today, we port NFC Reader Library to FRMD-K64F board !

Supported products:*

- CLRC663 plus
- PN5180
- PN7462AU

Supported dev boards:*

- CLEV6630B
- PNEV5180B
- PNEV7462B

Supported platforms:*

- LPC1769, LPC11U68
- FRDM-K82F
- Raspberry Pi Model 3
- *... and portable to other MCUs and platforms.*





OSAL which abstracts the OS simplifying development in multiple SW platforms

NFC Reader Library architecture (II)



The software examples can be imported and run the supported platforms without any adaptation.

Support for other platforms requires adaptations in OSAL and DAL.

NP

NFC Reader Library structure

🏠 Project Explorer 🔀 🚼 Peripherals+ 🕮 Regi



API documentation Driver abstraction layer FreeRTOS support

Platform support

NFC Reader Library examples

NFC Reader Library source code OS abstraction layer





11

NFC Reader Library porting to K64F Main steps



🞽 10- NFC Reader Lib - Develop - NfcrdlibEx1_BasicDiscoveryLoop/NfcrdlibEx1_BasicDiscoveryLoop.c - MCUXpresso IDE

File Edit Source Refactor Navigate Search Project Run FreeRTOS Window Help



NFC Reader Library porting to K64F

Setup

14

Training

Knowledge

HW design: SW development: We select CLRC663 plus and Kinetis K64F ICs NFC Reader Library supports CLRC663 plus but for designing an NFC reader no driver is available for K64F ed NFC Forum MIFARC Classic ISORED 15500 EM/Co poling Host Card NTAG BD demo application application policities of the p Host interface **RF** interface Matching **CLRC663 Kinetis K64F** plus Prototype with NXP Port NFC Reader Library to reference dev boards K64F host MCU NXP CLEV6630B FRDM-K64F NFC Reader Library SW stack can be easily adapted to support your target MCU! Key message:



NFC Reader Library porting to K64F Setting up the hardware



CLEV6630B board wiring with FRDM-K64F board

Pin function	FRDM-K64F	CLEV6630B
MOSI	J2-8	MOSI
MISO	J2-10	MISO
SCK	J2-12	SCK
SSEL	J2-6	SSEL
RESET	J1-3	CLRC_NRST
IRQ	J1-11	IRQ
IFSEL0	J1-2	IF0
IFSEL1	J1-4	IF1
GND	J2-14	GND

Resistors that need to be removed to decouple the LPC1769 MCU from CLEV6630 and connect K64F MCU. Described in <u>AN11908</u> doc.





16

Key message: CLEV6630B boards enables easy connection to your target MCU!



NFC Reader Library porting to K64F Setting up the dev. environment



Get latest NFC Reader Library release



Generate a downloadable SDK package for FRDM-K64F board

MCUXpresso overview tools - MAN	AGE •	● English • 上 nxp65964 • 🖡
MCUXpre with a Kin developm	UXpresso Config Tools sso Config Tools provides a set of system configuration tools that help users etis or LPC-based MCU solution. Let it be your guide from first evaluation to p ent.	of all levels roduction
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Current Configuration	Select a Device, Board, or Kit	FROM-K64F MK64F12 Contex MAC / 120Mate
Review SDK Details Items listed on the side panel will be included in you These selections can be edited using the Tools -> C	FRDM-K28F FRDM-K86F FRDM-K86F FRDM-K86F	1024 KB Plash 206 KB RAM
Click the link below to request this specific MOUX; In general, SDK builds should compate within a few You will be notified via email and notifications in the Parties Name	FRDM-KE15Z FRDM-KL02Z Name your configuration	Non 2 2 0 Windows MCUXpresso IDE CMSIS DSP Library, FatFS, hviP
Request Build SDK_2.2_FRDM-K64F	FRDM-K64F Cancel Save changes	MCUXpresso SOK API Reference Manual
Feedback		
Privacy Policy Terms of Use Contact		© 2017 NXP Semiconductors. All rights reserved.

Step 1: Go to MCUXpresso Config tools.

- Browse to https://mcuxpresso.nxp.com
- Select SDK Builder

Step 2: Customize SDK package for your MCU.

- Select **FRDM-K64F** in the **Current Configuration** drop • down menu.
- Select *Request Build*.
- Download your custom SDK package.



MCUXpresso Config Tools <kinetis.expert@nxp.com> MCUXpresso Config Tools - Build Notification

To Jordi Mk

NXP MCUXpresso Config Tools User,

Your recent build request (SDK_2.2_FRDM-K64F) has completed and is now available for download from within your MCUXpresso Config Tools SDK Build Archive (http://mcuxpresso.nxp.com).



Download the package from the following link: https://mcuxpresso.nxp.com/en/license? hash=3967a155a1806482798aa3590af4f481&uvid=55853

Import NFC Reader Library into MCUXpresso workspace

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		U <u>SDK 2.2 FRDM-K64F</u>	

Import NFC Reader Library package into MCUXpresso IDE





Install and link FRDM-K64F SDK into MCUXpresso workspace



Drag and drop the FRDM-K64F SDK into Installed SDKs tab of MCUXpresso IDE



Import FRDM-K64F SDK into workspace and link it with the software examples.





NFC Reader Library porting to K64F Configuration changes



Select FRDM-K64F SDK in the project MCU settings

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NFC Reader Library NfcrdlibEx1 for FRDM-K82F

In Project properties \rightarrow MCU settings:

NFC Reader Library NfcrdlibEx1 ported to <u>FRDM-K64F</u>

Change SDK MCU to FRDM-K64F SDK





Define FRDM-K64F SDK preprocessor symbols in the project



NFC Reader Library NfcrdlibEx1 for FRDM-K82F

In Project properties \rightarrow Settings \rightarrow Preprocessor:

NFC Reader Library NfcrdlibEx1 ported to <u>FRDM-K64F</u>

Change preprocessor defined symbols





Add include paths for FRDM-K64F SDK files

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NFC Reader Library NfcrdlibEx1 for FRDM-K82F

In Project properties \rightarrow Settings \rightarrow Includes:



NFC Reader Library NfcrdlibEx1 ported to FRDM-K64F

Add include paths for FRDM-K64F SDK files



25 Training

Mobile

Knowledge

Add include path for FRDM-K64F MCU assembler

dev_test_start - Develop - NfcrdlibEx1_B	asicDiscoveryLoop/NfcrdlibEx1_	BasicDiscoveryLoop.c - MCUXpres	iso IDE	
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NFC Reader Library NfcrdlibEx1 for FRDM-K82F

In Project properties \rightarrow Settings \rightarrow MCU assembler:



NFC Reader Library NfcrdlibEx1 ported to FRDM-K64F

Add include path for MCU assembler



NFC Reader Library porting to K64F Code changes





DAL driver adaptation for FRDM-K64F

Board Pin/Gpio configurations

#define PHDRIVER_PIN_RESET ((GPIO_PORT_B << 8) | 19) /**< Reset pin, Pin13, GPIOA, PORTA */
#define PHDRIVER_PIN_IRQ ((GPIO_PORT_C << 8) | 0) /**< IRQ pin, Pin7, GPIOC, PORTC */</pre>

SPI configuration

<pre>#define ENABLE_PORT_SSP_1 #define PORT_SSP_1 #define FIRST_PINNUM_SSP</pre>	kCLOCK_PortD//SCK PORTD 1
<pre>#define ENABLE_PORT_SSP_2 #define PORT_SSP_2 #define SECOND_PINNUM_SSP</pre>	kCLOCK_PortD//MOSI PORTD 3
<pre>#define ENABLE_PORT_SSP_3 #define PORT_SSP_3 #define THIRD_PINNUM_SSP</pre>	kCLOCK_PortD//MISO PORTD 2
<pre>#define PHDRIVER_PIN_SSEL</pre>	((GPIO_PORT_D << 8) 0) /**< SSEL pin, Pin14, GPIOA, PORTA */

Timer configuration

#define PH_DRIVER_KSDK_PIT_TIMER
#define PH_DRIVER_KSDK_PIT_CLK
#define PH_DRIVER_KSDK_TIMER_CHANNEL
#define PH_DRIVER_KSDK_TIMER_NVIC

PIT
kCLOCK_BusClk
kPIT_Chnl_0 /**< PIT channel number 0 */
PIT0 IRQn</pre>



Import project(s) from file system...

- K Build 'NfcrdlibEx1_BasicDiscoveryLoop' [DebugFRDMK64F]
- Clean 'NfcrdlibEx1_BasicDiscoveryLoop' [DebugFRDMK64F]
- Debug 'NfcrdlibEx1_BasicDiscoveryLoop' [DebugFRDMK64F]
- h /NfcrdlibEx1_BasicDiscoveryLoop/DAL/boards/Board_FRDM_K64FRc663.h

Use SDK examples to get K64F board specific configuration



2. Select HelloWorld example

3. Use board folder source code as reference

1. Import K64F SDK examples





MCUXpresso IDE (Free Edition)

- Start here
- X New project...
- Import SDK example(s)...
- Import project(s) from file system...
- Suild 'NfcrdlibEx1_BasicDiscoveryLoop' [DebugFRDMK64F]
- Clean 'NfcrdlibEx1_BasicDiscoveryLoop' [DebugFRDMK64F]
- Debug 'NfcrdlibEx1_BasicDiscoveryLoop' [DebugFRDMK64F]
- Terminate, Ruild and Debug 'NfordlihEv1, RasicDiscoveryLoon' (DebugERDMK64E)

MfcrdlibEx1_BasicDiscoveryLoop

Added FRDM_K64F macro definitions

BoardSelection.h

#ifdef PHDRIVER_FRDM_K64FRC663_BOARD
 #include <Board_FRDM_K64FRc663.h>
#endif

phNxpBuild_App.h

- #if defined(PHDRIVER_LPC1769RC663_BOARD) \
 - || defined(PHDRIVER_FRDM_K82FRC663_BOARD) \
 - defined(PHDRIVER_FRDM_K64FRC663_BOARD)
- # define NXPBUILD__PHHAL_HW_RC663

phApp_Init.h

#if defined(PHDRIVER_FRDM_K64FRC663_BOARD)
#define PHDRIVER_KINETIS_K64

phApp_Init.c

#ifdef PHDRIVER_KINETIS_K64
static void phApp_K64_Init(void);
#endif /* PHDRIVER_KINETIS */







Add FRDM-K64F CPU initialization code

phApp_Init.c

void phApp_CPU_Init(void){
#if defined PHDRIVER_KINETIS
 phApp_K64_Init();



phApp_K64_Init() function

BOARD_BootClockRUN(); /* Code for BOARDClock Run configuration*/

SystemCoreClockUpdate();

PIT_GetDefaultConfig(&pitConfig);

PIT_Init(PIT, &pitConfig); /* Init pit module */

BOARD_InitPins(); /* Initialize UART pins below used to Print */

phApp_Init.c includes code specific to HW used (FRDM-K64F) Clock and pin_mux config files were taken from FRDM-K64F SDK example



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Wrap up & Q&A



General considerations to port NFC Reader Library to your target MCU

- Adapt the MCU drivers \rightarrow DAL Layer
 - Timers

34

- Interrupts
- GPIOs pin configuration
- Host interface configuration
- Adapt the OS \rightarrow OSAL layer
 - Porting the FreeRTOS
 - Porting to a different OS
- Adapt the sample projects
 - Project configuration settings, includes & macros
 - Main application HW init code (e.g. Clocks)

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Reference links & info

- NFC Reader Library <u>www.nxp.com/pages/:NFC-READER-LIBRARY</u>
- CLRC663 plus www.nxp.com/products/:CLRC66303HN
- CLRC663 *plus* development kit <u>www.nxp.com/demoboard/OM26630</u>
- FRDM-K64F board www.nxp.com/demoboard/FRDM-K64F





Software development in Android and iOS Embedded software for MCUs JCOP, Java Card operating Systems Hardware design and development Digital, analog, sensor acquisition, power management Wireless communications WiFi, ZigBee, Bluetooth, BLE Contactless antenna RF design, evaluation and testing

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How to port the NFC Reader Library to K64F

Jordi Jofre (Speaker) Angela Gemio (Host)

Thank you for your kind attention!

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