# AN13013 Get started with EdgeLock SE05x support package Rev. 1.4 – 17 April 2024

**Application note** 

#### **Document information**

Information	Content
Keywords	EdgeLock SE05x, Plug & Trust secure element
Abstract	This document is the entry point for getting familiar with EdgeLock SE05x support package contents and how to get started with them.

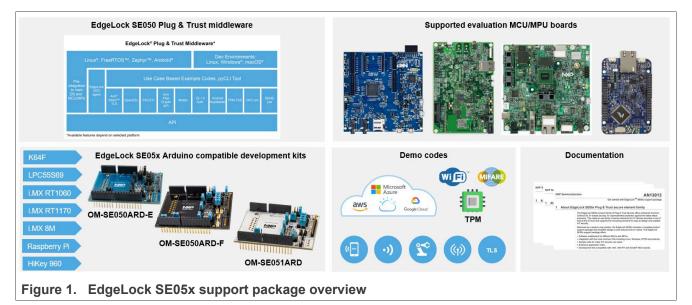


# 1 About the EdgeLock SE05x Plug and Trust secure element family

The EdgeLock SE05x product family of Plug & Trust devices offers enhanced Common Criteria EAL 6+ based security, for unprecedented protection against the latest attack scenarios. This ready-to-use family of secure elements for IoT devices provides a root of trust at the IC level and supports the increasing demand for easy-to-design and scalable IoT security.

Delivered as a ready-to-use solution, the EdgeLock SE05x includes a complete product support package that simplifies design-in and reduces time to market. The EdgeLock SE05x support package offers:

- Software enablement for different MCUs and MPUs.
- Integration with the most common OSs including Linux, Windows, RTOS, and Android.
- Sample code for major IoT security use cases.
- Extensive application notes.
- Development kits are compatible with i.MX, I.MX RT, and Kinetis® MCU boards.



As such, the EdgeLock SE05x support package supplies you with all you must evaluate, prototype, and implement your next secure IoT application. This document lists the existing material within the EdgeLock SE05x support package, organized in the following sections:

- EdgeLock SE05x development kits.
- Supported MCU / MPU boards.
- EdgeLock SE05x Plug & Trust middleware.
- Support documentation.

To implement inclusive language, the terms "master/slave" have been replaced by "controller/target", following the recommendation MIPI.

# 2 EdgeLock SE05x development boards

The EdgeLock SE05x product family is supported with development boards that can be connected with any MCU or MPU board using the compatible Arduino headers or via direct l<sup>2</sup>C connection. The table below summarizes the ordering details of the EdgeLock SE05x development boards:

Part number	12NC	Description	Picture
OM-SE050ARD-E	9354 332 66598	SE050E Arduino <sup>®</sup> compatible development kit	
OM-SE050ARD-F	9354 357 63598	SE050F Arduino <sup>®</sup> compatible development kit	
OM-SE050ARD <sup>[1]</sup>	9353 832 82598	SE050 Arduino <sup>®</sup> compatible development kit	
OM-SE051ARD	9353 991 87598	SE051 Arduino <sup>®</sup> compatible development kit	
<u>OM-SE052ARD</u>	9354 567 55598	SE052F Arduino <sup>®</sup> compatible development kit	

#### Table 1. EdgeLock SE05x development boards

[1] Board is not orderable anymore

You have two options to connect the Raspberry Pi to the OM-SE05xARD board:

- 1. Using the OM-SE05xRPI adapter board. This board does not include any active component.
- 2. Using the OM-SE05xARD connected with wires, as described in AN12570.
- 3. The mini PCB on top of OM-SE052ARD can be plugged directly to a Raspberry Pi-comptible GPIO header.

Part number	12NC	Content	Picture
<u>OM-SE050RPI</u>	935398642598	Raspberry Pi to OM-SE050 ARD adapter	

# Table 2. OM-SE050RPI adapter board details

# 3 Supported MCU/MPU boards

The EdgeLock SE05x security IC is designed to be used as a part of an IoT system. It works as an auxiliary security device attached to a host controller. The host controller communicates with EdgeLock SE05x through an  $I^2C$  interface with the host controller being the  $I^2C$  controller and the EdgeLock SE05x being the  $I^2C$  target.

<u>Table 3</u> summarizes the ordering details of the MCU/MPU boards supported by the EdgeLock SE05x Plug & Trust middleware:

 Table 3. Evaluation MCU/MPU boards details

Part number	12NC	Description	Picture
ERDM-K64E	935326293598	Freedom development platform for Kinetis K64, K63 and K24 MCUs	
MIMXRT1060-EVK	935419011598	MIMXRT1060-EVK low cost evaluation kit for Cortex-M7	
MIMXRT1170-EVK	935378982598	MIMXRT1170-EVK low cost evaluation kit for Cortex-M7	

Part number	12NC	Description	Picture
MCIMX8M-EVK	935378743598	Evaluation Kit for the i.MX 8M Applications Processor	
LPC55S69-EVK	935377412598	LPCXpresso55S69 Development Board	

#### Table 3. Evaluation MCU/MPU boards details...continued

**Note:** Besides the mandatory connection to the host controller, some EdgeLock SE05x product variants can optionally be connected to a sensor node or similar element through a separate I<sup>2</sup>C interface. In this case, the EdgeLock SE05x device is the I<sup>2</sup>C controller and the sensor node is the I<sup>2</sup>C target. Lastly, some EdgeLock SE05x product variants has a connection for a native contactless antenna, providing a wireless interface to an external device like a smartphone.

# 3.1 MIMXRT1070-EVK, MIMXRT1060-EVK, FRDM-K64F, and LPC55S69-EVK MCU board examples

For the <u>MIMXRT1070-EVK</u>, the <u>MIMXRT1060-EVK</u>, the <u>FRDM-K64F</u> and <u>LPC55S69-EVK</u>, a set of project examples can be directly imported from the board SDK package to your MCUXpresso workspace.

These project examples offer a quick way to evaluate EdgeLock SE05x features, and its source code can be reused for your own implementations. The latest SDK packages can be found in EdgeLock SE05x product website, under the *Tools & Software* tab, as shown in Figure 2.

# **NXP Semiconductors**

# AN13013

#### Get started with EdgeLock SE05x support package

NXP (6)	6 software files	Sort by Relevance
O Secure Files ①	BSP, DRIVERS AND MIDDLEWARE Plug&Trust MIMXRT1060 MCUXpresso SDK Package (04.02.00) UPDATED ZIP Rev 04.02.00 Jul 4.2022 188124 KB SDK-EVK-MIMXRT1060-SE05X	DOWNLOAD ~
FILTER BY	Sign in required	
Embedded Software		
BSP, Drivers and Middleware	BSP, DRIVERS AND MIDDLEWARE EdgeLock SE05x Middleware SD card image for i.MX8M (04.00.00) BZ2 Rev 04.00.00 Dec 2, 2021 367371 KB SE-PLUG-TRUST-SD-CARD-IMAGE-IMX8M-NEW Sign in required	DOWNLOAD ~
	BSP, DRIVERS AND MIDDLEWARE Plug&Trust FRDMK64F MCUXpresso SDK Package (04.02.00) UPDATED ZIP Rev 04.02.00 Jul 4, 2022 149223 KB SDK-EVK-FRDMK64F-SE05X Sign in required	DOWNLOAD ~
	BSP, DRIVERS AND MIDDLEWARE Plug&Trust LPC55S69 MCUXpresso SDK Package (04.02.00) UPDATED ZIP Rev 04.02.00 Jul 4, 2022 77410 KB SDK-EVK-LPCXPRESSO55S69-SE05X Sign in required	DOWNLOAD V
	BSP, DRIVERS AND MIDDLEWARE EdgeLock SE05x Plug & Trust Middleware (04.02.00) UPDATED ZIP Rev 04.02.00 Jul 4, 2022 61184 KB SE05x-PLUG-TRUST-MW Sign in required	DOWNLOAD ~
	BSP, DRIVERS AND MIDDLEWARE	DOWNLOAD V
	Plug&Trust MIMXRT1170 MCUXpresso SDK Package (04.02.00) UPDATED ZIP Rev 04.02.00 Jul 4, 2022 114202 KB SDK-EVK-MIMXRT1170-SE05X Sign in required	

**Note:** The MCUXpresso SDK builder for the <u>MIMXRT1070-EVK</u>, the <u>MIMXRT1060-EVK</u>, the <u>FRDM-K64F</u> and <u>LPC55S69-EVK</u> also includes a subset of the Plug & Trust MCUXpresso SKDs. The release cycle of the MCUXpresso SKDs and the Plug&Trust middleware is different. Therefore, the MCUXpresso SDK may include an older or no Plug & Trust middleware version compared to the SDK package provided via the <u>EdgeLock</u> <u>SE05x product website</u>.

**Note:** The default build configuration of the EdgeLock SE05x Plug & Trust middleware  $\geq V04.02.0x$  generates code for the OM-SE050ARD-E development board. You must adapt settings in the feature header file fsl\_sss\_ftr.h in case you are using a different EdgeLock secure element development board or a different secure element product IC. The fsl\_sss\_ftr.h settings are described in the following MCU board application notes:

- AN12396 EdgeLock SE05x Quick start guide with Kinetis K64F
- AN12450 EdgeLock SE05x Quick start guide with i.MX RT1060 and I.MX RT1170
- AN12452 EdgeLock SE05x Quick start guide with LPC55S69

**Note:** In addition, the Full Multiplatform EdgeLock SE05x Plug & Trust middleware is delivered with CMake files, which allows to compile the <u>MIMXRT1070-EVK</u>, the <u>MIMXRT1060-EVK</u>, the <u>FRDM-K64F</u> and <u>LPC55S69-EVK</u> with the help of the CMake-based build system. The CMake-based option is provided for developers familiar with this build system or willing to run the same project example on, PC/Windows/Linux and embedded targets. The MCU board application notes are also describing the CMake-build system.

# 3.2 MCIMX8M-EVK board examples

Similarly, a precompiled Linux image with the EdgeLock SE05x Plug & Trust middleware is available for the <u>MCIMX8M-EVK</u>. This precompiled Linux image can be directly flashed into a micro-SD card, and booted from <u>MCIMX8M-EVK</u> for evaluation of EdgeLock SE05x features. The latest EdgeLock SE05x Plug & Trust middleware software package version to create a bootable SD card image version can be found in <u>EdgeLock SE05x</u> and <u>EdgeLock SE051</u> product website, under the *Tools & Software* tab, as shown in <u>Figure 3</u>.

NXP (6)	6 software files	Sort by Relevance ~
○ Secure Files ①	BSP, DRIVERS AND MIDDLEWARE Plug&Trust MIMXRT1060 MCUXpresso SDK Package (04.02.00) UPDATED ZIP Rev 04.02.00 Jul 4, 2022 188124 KB SDK-EVK-MIMXRT1060-SE05X	DOWNLOAD ~
FILTER BY	Sign in required	
Embedded Software		
BSP, Drivers and Middleware	BSP, DRIVERS AND MIDDLEWARE	DOWNLOAD ~
	EdgeLock SE05x Middleware SD card image for i.MX8M (04.00.00) BZ2 Rev 04.00.00 Dec 2, 2021 367371 KB SE-PLUG-TRUST-SD-CARD-IMAGE-IMX8M-NEW Sign in required	
	BSP, DRIVERS AND MIDDLEWARE	
	Plug&Trust FRDMK64F MCUXpresso SDK Package (04.02.00) UPDATED ZIP Rev 04.02.00 Jul 4, 2022 149223 KB SDK-EVK-FRDMK64F-SE05X Sign in required	DOWNLOAD ~
	BSP, DRIVERS AND MIDDLEWARE Plug&Trust LPC55S69 MCUXpresso SDK Package (04.02.00)	DOWNLOAD Y
	ZIP Rev 04.02.00 Jul 4, 2022 77410 KB SDK-EVK-LPCXPRESSO55S69-SE05X Sign in required	
	BSP, DRIVERS AND MIDDLEWARE	DOWNLOAD ~
	EdgeLock SE05x Plug & Trust Middleware (04.02.00)         UPDATED           ZIP         Rev 04.02.00         Jul 4, 2022         61184 KB         SE05x-PLUG-TRUST-MW	
	Sign in required	
	BSP, DRIVERS AND MIDDLEWARE	DOWNLOAD ~
	Plug&Trust MIMXRT1170 MCUXpresso SDK Package (04.02.00) UPDATED ZIP Rev 04.02.00 Jul 4, 2022 114202 KB SDK-EVK-MIMXRT1170-SE05X Sign in required	
	SHOW LESS	
Figure 3 Bootable SD	Card image for MCIMX8M-EVK	

**Note:** The default build configuration of the EdgeLock SE05x Plug & Trust middleware  $\geq \sqrt{04.02.0x}$  generates code for the OM-SE050ARD-E development board. You must adapt the CMake settings in case you are using a different EdgeLock secure element development board or a different secure element product IC. The settings are described in chapter <u>Section 4.1.2</u> and in the application note <u>AN13027</u> EdgeLock SE05x Quick start guide with i.MX 8M.

# 3.3 Raspberry Pi board examples

As a reference for device running a Linux distribution, the full multi-platform EdgeLock SE05x Plug & Trust middleware includes examples for the Raspberry Pi board.

**Note:** The default build configuration of the EdgeLock SE05x Plug & Trust middleware  $\geq \sqrt{04.02.0x}$  generates code for the OM-SE050ARD-E development board. You must adapt the CMake settings in case you are using a different EdgeLock secure element development board or a different secure element product IC. The settings are described in chapter <u>Section 4.1.2</u> and in the application note <u>AN12570</u> EdgeLock SE05x Quick start guide with Raspberry Pi.

# 4 EdgeLock SE05x Plug & Trust middleware

To support different application requirements, the Plug & Trust Middleware is provided in different packages:

- Full Multiplatform Plug & Trust middleware package
- Plug & Trust Mini Package
- Plug & Trust Nano Package

#### The Full Multiplatform Plug & Trust middleware package is described in Section 4.1.

The **Plug & Trust Mini package** on <u>GitHub</u> is a subset of the Full Multiplatform Plug & Trust middleware package. It contains the minimal content needed for the Linux target platform and is provided under an Apache 2 license. The source files included are identical to the Full Multiplatform Plug & Trust package. The build system is also simplified and builds only the library with one included example (ex\_ecc).

The **Plug & Trust Nano package** on <u>GitHub</u> is an optimized middleware for communicating between a host processor or microcontroller and the EdgeLock SE05x secure elements and the A5000 authenticator. The Plug & Trust Nano Package has been designed for memory-constrained devices and consumes only 1 KB of RAM for SCP03 encrypted communication over I2C. Linux is as well supported, especially for the use case of integration into boot loaders.

**Note:** The examples and libraries contained in the Plug & Trust Nano package have been specifically designed to fit into constrained devices and are not compatible with examples and libraries available in the Full Multiplatform Plug & Trust package.

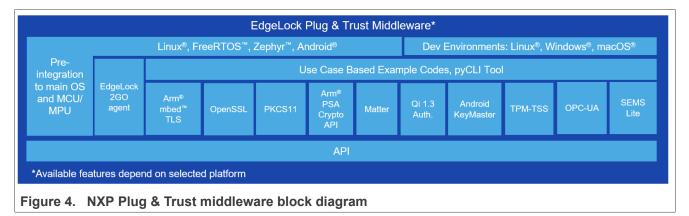
# 4.1 Full multiplatform EdgeLock SE05x Plug & Trust middleware

The EdgeLock SE05x Plug & Trust middleware is a single software stack designed to facilitate the integration of NXP security ICs into your microcontroller or microprocessor software. This middleware has built-in cryptographic and device identity features, abstracts the commands and communication interface exposed by NXP security ICs, and it is directly accessible from stacks like OpenSSL, mbedTLS, or other cryptographic libraries. In addition, it includes code examples for quick integration of features and uses cases such as TLS and cloud service onboarding. It also comes with support for various NXP MCU / MPU platforms and can be ported to multiple host platforms and host operating systems.

The EdgeLock SE05x Plug & Trust middleware exposes an API called *Secure subsystem* (**SSS**), which supports the access to the cryptography and identity features of:

- EdgeLock SE050
- EdgeLock SE051
- EdgeLock SE052
- Auth-EdgeLock A5000

<u>Figure 4</u> is a simplified representation of the layers and components of EdgeLock SE05x Plug & Trust middleware:



# 4.1.1 Download the EdgeLock SE05x Plug & Trust middleware

The latest EdgeLock SE05x Plug & Trust middleware version can be found in <u>EdgeLock SE050</u> and <u>EdgeLock</u> <u>SE051</u> product websites, under the *Tools & Software* tab, as shown in <u>Figure 5</u>

NXP (6)	6 software files	Sort by Relevance V
O Secure Files ①	BSP, DRIVERS AND MIDDLEWARE Plug&Trust MIMXRT1060 MCUXpresso SDK Package (04.02.00) UPDATED ZIP Rev 04.02.00 Jul 4, 2022 188124 KB SDK-EVK-MIMXRT1060-SE05X	DOWNLOAD ~
FILTER BY	Sign in required	
Embedded Software	BSP, DRIVERS AND MIDDLEWARE	DOWNLOAD V
BSP, Drivers and Middlewa		DUWALOAD
	BSP, DRIVERS AND MIDDLEWARE Plug&Trust FRDMK64F MCUXpresso SDK Package (04.02.00) UPDATED ZIP Rev 04.02.00 Jul 4, 2022 149223 KB SDK-EVK-FRDMK64F-SE05X Sign in required	DOWNLOAD v
	BSP, DRIVERS AND MIDDLEWARE Plug&Trust LPC55S69 MCUXpresso SDK Package (04.02.00) UPDATED ZIP Rev 04.02.00 Jul 4, 2022 77410 KB SDK-EVK-LPCXPRESSO55S69-SE05X Sign in required	DOWNLOAD v
	BSP, DRIVERS AND MIDDLEWARE EdgeLock SE05x Plug & Trust Middleware (04.02.00) UPDATED ZIP Rev 04.02.00 Jul 4, 2022 61184 KB SE05x-PLUG-TRUST-MW Sign in required	DOWNLOAD
	BSP, DRIVERS AND MIDDLEWARE Plug&Trust MIMXRT1170 MCUXpresso SDK Package (04.02.00) UPDATED ZIP Rev 04.02.00 Jul 4, 2022 114202 KB SDK-EVK-MIMXRT1170-SE05X Sign in required	DOWNLOAD 🗸
	SHOW LESS	
Figure 5. Download the	e full multiplatform EdgeLock SE05x Plug & Trust mi	ddleware

# 4.1.2 Building and compiling the EdgeLock SE05x Plug & Trust middleware

The EdgeLock SE05x Plug & Trust middleware is delivered with CMake files that include a set of directives and instructions describing the project's source files and targets. The CMake files allow developers to build EdgeLock SE05x middleware in their target platform, enable, or disable features or change setting flags, among others. The CMake-based compilation option is provided as a convenient way for developers to run a project example on different target platforms; for example, Windows and Linux PCs and embedded platforms.

The project settings can be specified dynamically using the CMake GUI. <u>Figure 6</u> shows a CMake GUI screenshot with EdgeLock SE05x project settings.

Where is the source code: C:/se05x_mw/simw-top	Browse Source
Preset: <custom></custom>	$\sim$
Where to build the binaries: C:/se05x_mw/simw-top_build/se_x86	6 Browse Build
Search:	Grouped Advanced 🕂 Add Entry 🕅 Remove Entry Environment
Name	Value
CMAKE_BUILD_TYPE	Debug Debug Belgeren Mis Ster Bell Debuge
CMAKE_CONFIGURATION_TYPES CMAKE_INSTALL_PREFIX	Debug:Release;MinSizeRel;RelWithDebInfo C:/Program Files (x86)/PlugAndTrustMW
NXPInternal	
PTMW A71CH AUTH	None
PTMW_Applet PTMW_FIPS	SE050_E None
PTMW_First	PCWindows
PTMW_HostCrypto	MBEDTLS
PTMW_Log	Default
PTMW_RTOS PTMW_SBL	Default None
PTMW SBL PTMW SCP	None
PTMW_SE05X_Auth	None
PTMW SE05X Ver	07 02
PTMW_SMCOM PTMW mbedTLS ALT	VCOM None
SSSFTR_SE05X_AES	
SSSFTR_SE05X_AuthECKey	
SSSFTR_SE05X_AuthSession	
SSSFTR_SE05X_CREATE_DELETE_CRYPTOOBJ SSSFTR_SE05X_ECC	
SSSFTR_SE05X_KEY_GET	
SSSFTR SE05X KEY SET	
SSSFTR_SE05X_RSA SSSFTR_SW_AES	
SSSFTR_SW_ECC	
SSSFTR_SW_KEY_GET	
SSSFTR_SW_KEY_SET	
SSSFTR_SW_RSA SSSFTR_SW_TESTCOUNTERPART	
WithAccessMgr_UnixSocket	
WithCodeCoverage	
WithExtCustomerTPMCode WithNXPNFCRdLib	
WithOPCUA_open62541	
WithSharedLIB	
Prost Configure to undate and	dianany new values is and, then prove Constrate to constrate selected build files
	display new values in red, then press Generate to generate selected build files.
Configure Generate Open Project Current Generat	tor: Visual Studio 17 2022

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**Note:** The default build configuration of the EdgeLock SE05x Plug & Trust middleware  $\geq \forall 04.02.0x$  generates code for the OM-SE05xARD-E development board. You must adapt the CMake settings in case you are using a different EdgeLock secure element development board or a different secure element product IC. The settings are described in <u>Section 4.1.2.1</u>.

# 4.1.2.1 Product-specific CMake build settings

The EdgeLock Plug & Trust middleware is delivered with CMake files that include a set of directives and instructions describing the project's source files and the build targets. The CMake files are used to select a dedicated EdgeLock product IC and the corresponding IoT applet or Authenticator application.

The SE050 product identification can be obtained as described in <u>AN12436</u> chapter 1 *Product Information*. <u>AN12973</u> describes the same procedure for the SE051 product family.

The following tables show the required PTMW CMake options to build the MCUXpresso SDK for a dedicated product variant. The SSSFTR\_SE05X\_RSA CMake option is used to optimize the memory footprint for product variants that do not support RSA.

Variant	OEF ID	PTMW_ Applet	PTMW_ FIPS	PTMW_ SE05 X_Ver	PTMW_SE05X_Auth		SSSFTR_ SE05X_ RSA
SE050E Dev. Board OM-SE050ARD-E	A921	SE05X_E	None	07_02	any option	None <b>or</b>	disabled
SE050E2	A921					SCP03_ SSS	

#### Table 4. CMake Settings for SE050E product variants

#### Table 5. CMake Settings for SE050F product variants

Variant	OEF ID	PTMW_ Applet	PTMW_ FIPS	PTMW_ SE05 X_Ver	PTMW_SE05X_Auth		SSSFTR_ SE05X_ RSA
SE050F Dev. Board OM-SE050ARD-F	A92A	SE05X_C	SE050	03_XX	PlatfSCP03 or	SCP03_ SSS	enabled
SE050F2	A92A	-			UserID_PlatfSCP03 or AESKey_PlatfSCP03 or ECKey_PlatfSCP03		

 Table 6. CMake Settings for SE050 Previous Generation product variants

Variant	OEF ID	PTMW_ Applet	FIPS	PTMW_ SE05 X_Ver	PTMW_SE05X_Auth	PTMW_ SCP	SSSFTR_ SE05X_ RSA
SE050A1	A204	SE05X_A	None	03_XX	any	None	disabled
SE050A2	A205				option	or SCP03_ SSS	
SE050B1	A202	SE05X_B	None	03_XX	any	None	enabled
SE050B2	A203				option	or SCP03_ SSS	

Variant	OEF ID	PTMW_ Applet	PTMW_ FIPS	PTMW_ SE05 X_Ver	PTMW_SE05X_Auth	PTMW_ SCP	SSSFTR_ SE05X_ RSA
SE050C1	A200	SE05X_C	None	03_XX	any	None	enabled
SE050C2	A201				option	or	
SE050 Dev Board OM-SE050ARD	A1F4					SCP03_ SSS	
SE050F2	A77E	SE05X_C	SE050	03_XX	PlatfSCP03	SCP03_	enabled
	[1]				or	SSS	
					UserID_PlatfSCP03		
					or		
					AESKey_PlatfSCP03		
					or		
					ECKey_PlatfSCP03		

Table 6. CMake Settings for SE050 Previous Generation product variants...continued

[1] All SE050F2 with variant A77E have a date code in the year 2021. All the SE050F2 with a date code in the year 2022 have the variant identifier A92A.

Variant	OEF ID	PTMW_ Applet	PTMW_ FIPS	PTMW_ SE05 X_Ver	PTMW_SE05X_Auth	PTMW_ SCP	SSSFTR_ SE05X_ RSA
SE051A2	A920	SE05X_A	None	07_02	any option	None or SCP03_ SSS	disabled
SE051C2	A8FA	SE05X_C	None	07_02	any option	None or SCP03_ SSS	enabled
SE051W2	A739	SE05X_C	None	07_02	any option	None or SCP03_ SSS or SCP03_ SSS	enabled
SE051A2	A565	SE05X_A	None	06_00	any option	None or SCP03_ SSS	disabled
SE051C2	A564	SE05X_C	None	06_00	any option	None or SCP03_ SSS	enabled

Table 7. CMake Settings for SE051 product variants

### 4.1.3 Example: SE050E CMake build settings

The following images show the configuration for the SE050E development board OM-SE05ARD-E.

- Select SE05X\_E for the CMake option PTWM\_Applet.
- Select None for the CMake option PTWM FIPS.
- Select 07\_02 for the CMake option PTWM\_SE05X\_Ver.
- Disable the CMake option SSSFTR\_SE05X\_RSA.

In this example, we use plain communication. Plain communication for the example execution is enabled by selecting the following options:

- Select None for the CMake option PTMW\_SE05X\_Auth.
- Select None for the CMake option PTMW\_SCP.

How to enable Platform SCP is described in Section 4.2.3.

51 T I O	5x_mw/simw-top_build/se_x86					-		×
<u>File Tools Options</u>								
Where is the source code:	C:/se05x_mw/simw-top						Browse Sou	rce
Preset:	<custom></custom>					$\sim$		
Where to build the binaries:	C:/se05x_mw/simw-top_build/se_x86					~	Browse Bui	ild
S <u>e</u> arch:			Grouped	Advanced	삼 Add Entry	3 Remove Entry	Environm	ent
Name		Value						
CMAKE_BUILD_TYPE CMAKE_CONFIGURATIO	N TYPES	Debug Debug:Re	lease;MinSizeRel;Re	WithDeblo	fo			
CMAKE_INSTALL_PREFIX		C:/Progra	m Files (x86)/PlugA					
NXPInternal PTMW A71CH AUTH		None						
PTMW_Applet PTMW_FIPS		SE050_E None						
PTMW_Host		PCWindo						
PTMW_HostCrypto PTMW_Log		MBEDTLS Default						
PTMW_RTOS		Default						
PTMW_SBL PTMW_SCP		None None						
PTMW_SE05X_Auth		None						
PTMW SE05X Ver PTMW_SMCOM		07 02 VCOM						
PTMW_mbedTLS_ALT SSSFTR_SE05X_AES		None						
SSSFTR_SE05X_AuthECKe								
SSSFTR_SE05X_AuthSessi SSSFTR_SE05X_CREATE_D								
SSSFTR_SE05X_ECC								
SSSFTR_SE05X_KEY_GET SSSFTR_SE05X_KEY_SET								
SSSFTR_SE05X_RSA SSSFTR_SW_AES								
SSSFTR_SW_ECC								
SSSFTR_SW_KEY_GET SSSFTR_SW_KEY_SET								
SSSFTR_SW_RSA	CDDADT							
SSSFTR_SW_TESTCOUNT WithAccessMgr_UnixSoc								
WithCodeCoverage WithExtCustomerTPMCo	ode.							
WithNXPNFCRdLib								
WithOPCUA_open62541 WithSharedLIB		Н						
	Press Configure to update and display new v	alues in red,	then press Generate	to generate	selected build file	is.		
Configure Generat	e Open Project Current Generator: Visual Stu	dio 17 2022		-				
								_

# 4.2 Binding EdgeLock SE05x to a host using Platform SCP

Binding is a process to establish a pairing between the IoT device host MPU/MCU and EdgeLock SE05x, so that only the paired MPU/MCU is able to use the services offered by the corresponding EdgeLock SE05x and vice versa.

A mutually authenticated, encrypted channel will ensure that both parties are indeed communicating with the intended recipients and that local communication is protected against local attacks, including man-in-the-middle attacks aimed at intercepting the communication between the MPU/MCU and the EdgeLock SE05x and physical tampering attacks aimed at replacing the host MPU/MCU or EdgeLock SE05x.

EdgeLock SE05x natively supports Global Platform Secure Channel Protocol 03 (SCP03) for this purpose. PlatformSCP uses SCP03 and can be enabled to be mandatory.

This chapter describes the required steps to enable Platform SCP in the middleware for EdgeLock SE05x.

The following topics are discussed:

- Section 4.2.1 Introduction to the Global Platform Secure Channel Protocol 03 (SCP03)
- <u>Section 4.2.2</u> How to configure the Platform SCP keys
- How to enable Platform SCP How to enable Platform SCP

### 4.2.1 Introduction to the Global Platform Secure Channel Protocol 03 (SCP03)

The Secure Channel Protocol SCP03 authenticates and protects locally the bidirectional communication between host and EdgeLock SE05x against eavesdropping on the physical I2C interface.

EdgeLock SE05x can be bound to the host by injecting in both the host and EdgeLock SE05x the same unique SCP03 AES key-set and by enabling the Platform SCP feature in the EdgeLock SE05x Plug & Trust middleware. The <u>AN12662</u> *Binding a host device to EdgeLock SE05x* describes in detail the concept of secure binding.

SCP03 is defined in Global Platform Secure Channel Protocol '03' - Amendment D v1.2 specification.

SCP03 can provide the following three security goals:

#### Mutual authentication (MA)

 Mutual authentication is achieved through the process of initiating a Secure Channel and provides assurance to both the host and the EdgeLock SE05x entity that they are communicating with an authenticated entity.

#### Message Integrity

- The Command- and Response-MAC are generated by applying the CMAC according NIST SP 800-38B.

#### Confidentiality

 The message data field is encrypted across the entire data field of the command message to be transmitted to the EdgeLock SE05x, and across the response transmitted from the EdgeLock SE05x.

The SCP03 secure channel is set up via the EdgeLock SE05x Java Card OS Manager using the standard ISO7816-4 secure channel APDUs.

The establishment of an SCP03 channel requires three static 128-bit AES keys shared between the two communicating parties: Key-ENC, Key-MAC and Key-DEK. These keys are stored in the Java Card Secondary Security Domain (SSD) and not in the secure authenticator applet.

Key-ENC and Key-MAC keys are used during the SCP03 channel establishment to generate the session keys. Session Keys are generated to ensure that a different set of keys are used for each Secure Channel Session to prevent replay attacks.

Key-ENC is used to derive the session key S-ENC. The S-ENC key is used for encryption/decryption of the exchanged data. The session keys S-MAC and R-MAC are derived from Key-MAC and used to generate/verify the integrity of the exchanged data (C-APDU and R-APDU).

Key-DEK key is used to encrypt new SCP03 keys in case they get updated.

#### Table 8. Static SCP03 keys

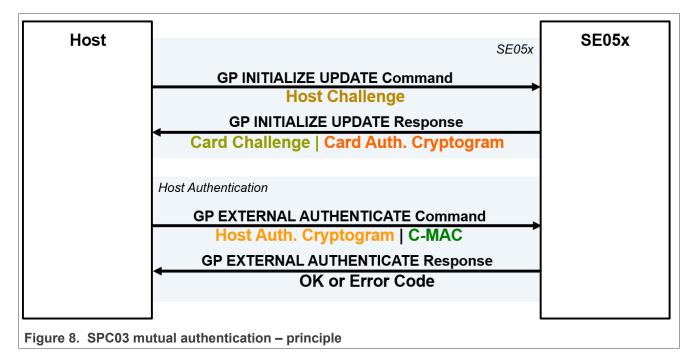
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Key	Description	Usage	Кеу Туре		
Key-ENC	Static Secure Channel Encryption Key	Generate session key for Decryption/Encryption (AES)	AES 128		
Кеу-МАС	Static Secure Channel Message Authentication Code Key	Generate session key for Secure Channel authentication and Secure Channel MAC Verification/Generation (AES)	AES 128		
Key-DEK	Data Encryption Key	Sensitive Data Decryption (AES)	AES 128		

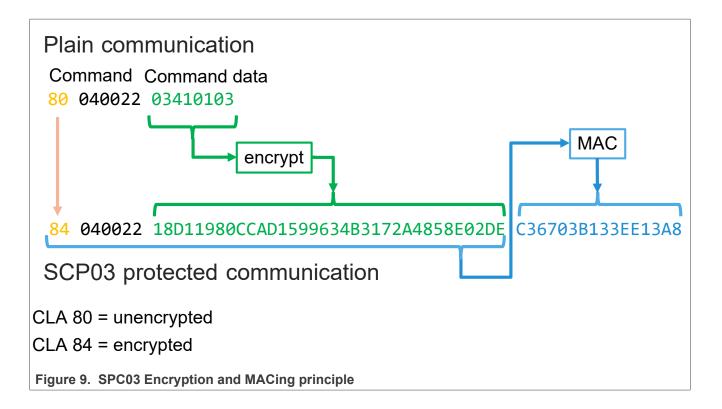
The session key generation is performed by the EdgeLock SE05x Plug & Trust middleware host crypto.

#### Table 9. SCP03 session keys

Кеу	Description	Usage	Кеу Туре
S-ENC	Session Secure Channel Encryption Key	Used for data confidentiality	AES 128
S-MAC	Secure Channel Message Authentication Code Key for Command	Used for data and protocol integrity	AES 128
S-RMAC	Secure Channel Message Authentication Code Key for Response	User for data and protocol integrity	AES 128







#### 4.2.2 How to configure the product-specific default Platform SCP keys

The default Platform SCP key values are described for the EdgeLock SE05x product variants in <u>AN12436</u> and for the EdgeLock SE05x variants in <u>AN12973</u>.

The Platform SCP keys can be defined in the EdgeLock SE05x Plug & Trust middleware source code.

The EdgeLock SE05x Plug & Trust middleware header file  $ex_ss_tp_scp03_keys.h$  contains the default values of all EdgeLock SE05x, EdgeLock SE05x, A5000 and A71CH product variants.

The ex\_sss\_tp\_scp03\_keys.h header file can be found in the following location: C:\se05x\_mw\simw-top \sss\ex\inc

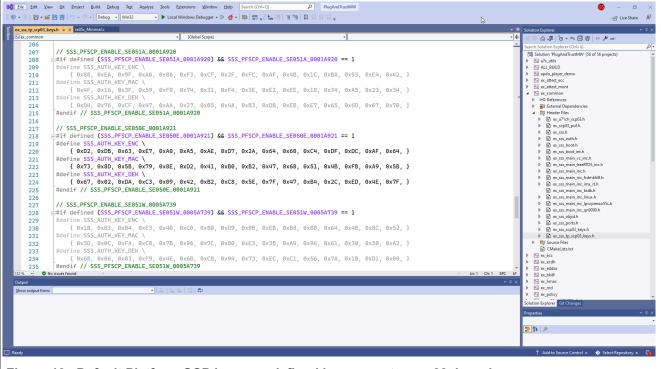


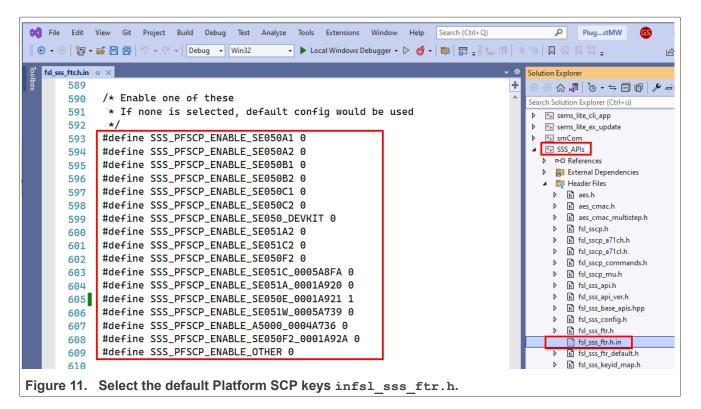
Figure 10. Default Platform SCP keys are defined in ex\_sss\_tp\_scp03\_keys.h

The fsl\_sss\_ftr.h.in file includes options to select one of the predefined default Platform SCP keys. This file is located in: C:\se05x\_mw\simw-top\sss\inc

Select the desired value of the compilation option by setting exclusively the corresponding C-preprocessor define SSS\_PFSCP\_ENABLE\_xx to 1 (enable). All other values for the same option (represented by C-preprocessor defines SSS\_PFSCP\_ENABLE\_xx) must be set to 0.

# AN13013

#### Get started with EdgeLock SE05x support package



The Plug & Trust Middleware uses a feature file to select/detect used/enabled features within the middleware stack. The file fsl\_sss\_ftr.h is automatically generated into the used build directory. CMake is overwriting the fsl\_sss\_ftr.h file every time CMake is invoked. CMake is using the SCP key settings of the fsl\_sss\_ftr.h.in file as input to generate the fsl\_sss\_ftr.h file. You do not have to manually edit the fsl\_sss\_ftr.h feature file. Selections from CMake edit cache would automatically make relevant updates into the generated feature file.

#### Note: The Platform SCP key selection in the fsl sss ftr.h.in CMake input file is persistent.

The location of the generated fsl\_sss\_ftr.h feature header file is: C:\se05x mw\simw-top build\se x86

The following tables contain the Platform SCP key header file define to be set to 1 (enable) for the different secure element and secure authenticator product variants.

Variant	OEF ID	Platform SCP key define to be set to '1'
SE050E Dev. Board OM-SE050ARD-E	A921	SSS_PFSCP_ENABLE_SE050E_0001A921
SE050E2	A921	SSS_PFSCP_ENABLE_SE050E_0001A921

Table 10.	Platform SCP	key define	prefix for	SE050E product variants
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#### Table 11. Platform SCP key define prefix for SE050F product variants

Variant	OEF ID	Platform SCP key is defined to be set to '1'
SE050F Dev.Board OM-SE050ARD-F	A92A	SSS_PFSCP_ENABLE_SE050F2_0001A92A
SE050F2	A92A	SSS_PFSCP_ENABLE_SE050F2_0001A92A

Variant	OEF ID	Platform SCP key define to be set to '1'
SE050A1	A204	SSS_PFSCP_ENABLE_SE050A1
SE050A2	A205	SSS_PFSCP_ENABLE_SE050A2
SE050B1	A202	SSS_PFSCP_ENABLE_SE050B1
SE050B2	A203	SSS_PFSCP_ENABLE_SE050B2
SE050C1	A200	SSS_PFSCP_ENABLE_SE050C1
SE050C2	A201	SSS_PFSCP_ENABLE_SE050C2
SE050 Dev Board OM-SE050ARD	A1F4	SSS_PFSCP_ENABLE_SE050_DEVKIT
SE050F2	A77E <sup>[1]</sup>	SSS_PFSCP_ENABLE_SE050F2

#### Table 12. Platform SCP key define prefix for SE050 Previous Generation product variants

[1] All SE050F2 with variant A77E have a date code in the year 2021. All the SE050F2 with a date code in the year 2022 have the variant identifier A92A.

Table 13.	Platform SCP k	ey define prefix fo	or SE051 product variants	

Variant	OEF ID	Platform SCP key is defined to be set to '1'
SE051A2	A920	SSS_PFSCP_ENABLE_SE051A_0001A920
SE051C2	A8FA	SSS_PFSCP_ENABLE_SE051C_0005A8FA
SE051W2	A739	SSS_PFSCP_ENABLE_SE051W_0005A739
SE051A2	A565	SSS_PFSCP_ENABLE_SE051A2
SE051C2	A564	SSS_PFSCP_ENABLE_SE051C2

#### Table 14. Platform SCP key define prefix for A5000 product variants

Variant	OEF ID	Platform SCP key is defined to be set to '1'
A5000 Dev. Board OM- A5000ARD	A736	SSS_PFSCP_ENABLE_A5000_0004A736
A5000	A736	SSS_PFSCP_ENABLE_A5000_0004A736

#### 4.2.3 How to enable Platform SCP

To enable Platform SCP it is required to rebuild the SDK with the following CMake options:

- Select SCP03 SSS for the CMake option PTMW SCP.
- Select PlatfSCP03 for the CMake option PTMW\_SE05X\_Auth.

The following images show the configuration for the SE050E development board OM-SE05ARD-E.

- 1. Open a command prompt and go to the directory where the EdgeLock SE05x Plug & Trust middleware is built.
  - Send:cd C:\se05x\_mw\simw-top\_build\se\_x86
- 2. Open the cmake configuration interface. Send: cmake-gui.

# **NXP Semiconductors**

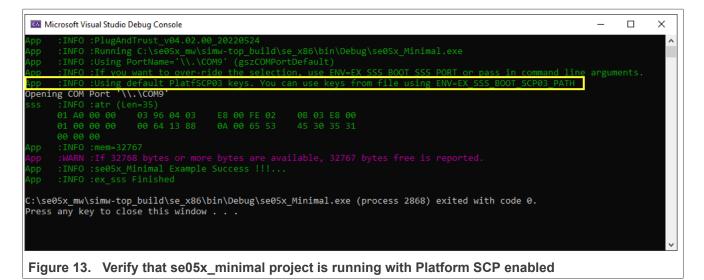
# AN13013

#### Get started with EdgeLock SE05x support package

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#### Figure 12. SE050E CMake Settings - PlatformSCP enabled

If you have edited any of the parameters in the menu, before exiting, press the buttons **Configure** and **Generate** to apply the changes. In the next step we must rebuild the Visual Studio solution. Finally, we can verify if we successfully enabled Platform SCP. For this purpose we run again the se05x\_minimal example as described in <u>AN12398</u>.



The Plug & Trust Middleware provides the following additional examples to rotate the PlatformSCP Keys and to mandate Platform SCP.

- SE05x Rotate PlatformSCP Keys example: Showcases authentication with default Platform SCP03 keys and the rotation (update) of those keys with user-defined keys. The example documentation is available in the EdgeLock SE05x Plug & Trust Middleware documentation (C:\se05x\_mw\simw-top\doc\demos \se05x\se05x\_RotatePlatformSCP03Keys\Readme.html). The example source code is available at C:\se05x mw\simw-top\demos\se05x\se05x RotatePlatformSCP03Keys.
- SE05X Mandate SCP example: Showcases how to make Platform SCP03 authentication mandatory in EdgeLock SE05x. The example documentation is available in the EdgeLock SE05x Plug & Trust Middleware documentation (C:\se05x\_mw\simw-top\doc\demos\se05x\se05x\_MandatePlatformSCP\Readme. html). The example source code is available at C:\se05x\_mw\simw-top\demos\se05x\se05x\_MandatePlatformSCP.
- SE05x AllowWithout PlatformSCP example: This project demonstrates how to configure SE05X to allow without platform SCP. The example documentation is available in the EdgeLock SE05x Plug & Trust Middleware documentation (~/se\_mw/simwtop/doc/demos/se05x/se05x\_AllowWithoutPlatform SCP/Readme.html). The example source code is available at ~/se\_mw/simw-top/demos/se05x/se05x\_AllowWithoutPlatformSCP.

# 4.3 Code documentation

The code documentation provided as part of EdgeLock SE05x Plug & Trust middleware package is supplied in HTML and PDF form. The primary audience of this HTML documentation are programmers, developers, system architects and system designers. It includes:

- Technical API reference guide.
- Instructions to compile and build EdgeLock SE05x Plug & Trust middleware.
- Instructions to run the ssscli tool. See Section 4.4 for more details.
- Developer guides to execute the demo and examples.

To open the HTML documentation:

- 1. Download EdgeLock SE05x Plug & Trust middleware as explained in <u>Section 4</u>.
- 2. Unzip the EdgeLock SE05x Plug & Trust middleware package.
- 3. In the unzipped package, go to simw-top\doc\ folder.
- 4. Double click in the index.html file.
- 5. A browser with the documentation landing page will open as shown in Figure 14:

Plug & Trust MW	<b>1. NXP Plug &amp; Trust Middleware</b> The NXP Plug&Trust Middleware documentation covers following Secure Elements:
<ol> <li>NXP Plug &amp; Trust Middleware         <ol> <li>Organization of Documentation                 <ol> <li>Organization of Documentation                       <li>Second Structure                      <li>Second Structure                       <li>Second Structure                      <li>Second Structure                      <li>Second Structure                      <li>Second Structure                      <li>Second Structure                      <li>Second Structure                      </li> <li>Plug &amp; Trust MW Stack                      </li> <li>Building / Compiling                      <li>Second Structure                      <li>Second Structure                      </li> <li>Second Structure                          </li> <li>Second Structure                      </li> <li>Second Structure                      </li> <li>Second Structure                      </li> <li>Second Structure                     </li> <li>Second Structure                      </li> </li> <li>Second Structure                     </li> <li>Second Structure                      </li> <li>Second Structure                       </li> </li> <li>Second Structure                     </li> <li>Second Structure                     </li> </li> <li>Second Structure                          </li> </li> </li> </li> <li>Second Structure                              </li> </li></li></li></li></ol></li></ol></li></ol>	<ul> <li>EdgeLock<sup>™</sup> SEo50 (Including variants A, B and C)</li> <li>EdgeLock<sup>™</sup> SEo51 (Including variants A and C)</li> <li>A71CH (refer to the A71CH section at the end of this document)</li> </ul> Setting up SEo5x and A71CH development environment for: <ul> <li>iMX6UL, iMX8MQ - Linux</li> <li>Freedom K64F, i.MX RT 1060, LPC55S - FreeRTOS/Without RTOS</li> <li>Hikey 960 - Android</li> <li>Raspberry-Pi 3 - Raspian Linux</li> <li>Windows PC(Visual Studio)</li> </ul> Documentation also covers: <ul> <li>Executing Demos and Examples.</li> <li>Using the CLI Tool to configure the Secure Element for the Demos.</li> <li>Setting up the iMX and Kinetis Freedom boards to be used with the CLI Tool.</li> <li>Setting up and executing Demo Examples.</li> </ul>
9. CLI Tool 10. A71CH 11. Appendix Search:	<ul> <li>Dedicated application notes:</li> <li>To assist end users from different backgrounds, dedicated application notes are prepared and available.</li> <li>Some of the important Application Notes are as shown below:</li> <li>MCU/RTOS: AN12396</li> <li>MPU/Linux: AN12307</li> </ul>
Search:	<ul> <li>MCU/RTOS: AN12396</li> <li>MPU/Linux: AN12397</li> <li>Windows: AN12398</li> <li>More details regarding SE050 and other detailed application notes can be found</li> </ul>

6. From the same browser, you can navigate through the different document sections using the left-hand side menu or the hyper-linked table of contents shown in the center. For instance, to check the EdgeLock SE05x Plug & Trust middleware description, click on Section 3. Plug & Trust MW Stack on the left hand side menu as shown in Figure 15:

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#### Get started with EdgeLock SE05x support package

	3. Plug & Trust MW Stack	
lug & Trust MW	3.1. Features	
	3.2. Plug & Trust MW : Block Diagram	
NXP Plug & Trust Middleware	• 3.3. SSS APIs	
Changes	• 3.3.1. SSS: Introduction	
Plug & Trust MW Stack	• 3.3.2. Session	
3.1. Features	<ul> <li>3.3.2.1. Opening a Session</li> </ul>	
3.2. Plug & Trust MW : Block	<ul> <li>3.3.2.1.1. SE05x Session</li> </ul>	
Diagram	• 3.3.2.2. APIS	
3.3. SSS APIs	<ul> <li>3.3.3. Key Store</li> <li>3.3.3.1. APIs</li> </ul>	
3.4. SSS APIs: SE051 vs SE050	<ul> <li>3.3.3.1. AP15</li> <li>3.3.3.2. Key Format</li> </ul>	
2.5. Parameter Check & Conventions	• 3.3.3.2.1. EC Key pair	
	• 3.3.4. Key Object	
3.6. I2CM / Secure Sensor	<ul> <li>3.3.4.1. Create / Provision</li> </ul>	
3.7. Logging	<ul> <li>3.3.4.2. Change value of previously created Objects</li> </ul>	
3.8. Feature File - fsl_sss_ftr.h	<ul> <li>3.3.4.3. Use previously provisioned/created Keys/Objects</li> </ul>	
3.9. Using Platform SCP Keys from	• 3.3.4.4. APIs	
File System	• 3.3.5. Asymmetric	
3.10. Auth Objects	<ul> <li>3.3.5.1. Sign</li> <li>3.3.5.2. Verify</li> </ul>	
3.11. Auth Objects : UserID	<ul> <li>3.3.5.2. Verify</li> <li>3.3.5.3. Encryption</li> </ul>	
3.12. Auth Objects : AESKey	<ul> <li>3.3.5.4. Decryption</li> </ul>	
3.13. Auth Objects : ECKey	<ul> <li>3.3.5.5. Reference Example</li> </ul>	
3.14. Key Id Range and Purpose	<ul> <li>3.3.5.6. RSA Encryption algorithms supported</li> </ul>	

# 4.4 EdgeLock SE05x ssscli tool

The ssscli is a command-line tool that can be used to send commands to EdgeLock SE05x interactively through the command line. For example, you can use the ssscli to create keys and credentials in the EdgeLock SE05x security IC during evaluation, development and testing phases. The ssscli tool is written in Python and supports complex provisioning scripts that can be run in Windows, Linux, OS X and other embedded devices. It can be used to:

- · Insert keys and certificates
- Read reference-keys and certificates
- Delete (erase) keys and certificates
- Generate keys inside the EdgeLock SE05x
- · Attach policies to objects
- List all secure objects
- Retrieve the EdgeLock SE05x device unique ID
- · Run some basic operations like sign/verify and encrypt/decrypt operations

The EdgeLock SE05x Plug & Trust middleware code documentation provides detailed usage examples of the ssscli tool. To find these usage examples:

- 1. Download EdgeLock SE05x Plug & Trust middleware as explained in Section 4.1.1.
- 2. Unzip the EdgeLock SE05x Plug & Trust middleware package.
- 3. Go to simw-top\doc\ folder.
- 4. Double click in the index.html file.

5. Click on Section 9 CLI tool and then click on the Section 9.6 Usage examples as shown in Figure 16  $\,$ 

N P MW	TOC ▼ Page ▼ «8.7. PKCS#11 9.1. Introduction »
	9. CLI Tool
Plug & Trust MW	• 9.1. Introduction
1. NXP Plug & Trust Middleware	• 9.2. Block Diagram
0	• 9.3. Steps needed before running ssscli tool
2. Changes	<ul> <li>9.3.1. Once per installation</li> </ul>
3. Plug & Trust MW Stack	<ul> <li>9.3.1.1. Windows</li> </ul>
4. Building / Compiling	• 9.3.1.2. IMX
	• 9.3.1.3. Raspberry Pi
5. Demo and Examples	• 9.3.2. On change of interface
6. NXP EdgeLock 2GO Agent	<ul> <li>9.4. Running the ssscli tool - Windows</li> <li>9.5. CLI Provisioning</li> </ul>
7. SEMS Lite Agent	<ul> <li>9.5. CEI FIOVISIONING</li> <li>9.5.1. Generating keys and certificates</li> </ul>
	<ul> <li>9.5.1. Orderating keys and continuess</li> <li>9.5.2. Provisioning for the demo</li> </ul>
8. Plugins / Add-ins	<ul> <li>9.5.3. Steps to provision your device for demo on Windows</li> </ul>
9. CLI Tool	<ul> <li>9.5.3.1. Using precompiled binaries</li> </ul>
9.1. Introduction	<ul> <li>9.5.3.2. Using Python scripts</li> </ul>
9.2. Block Diagram	<ul> <li>9.5.4. Steps to provision your device for demo on iMX or Raspberry Pi</li> </ul>
· · · 2	9.6. Usage Examples
9.3. Steps needed before running	• 9.6.1. SE05X: VCOM Interface
	• 9.6.2. SE05X: PCSC interface
9.4. Running the ssscli tool - Windows	• 9.6.3. seo5x: JRCPV2 interface
9.5. CLI Provisioning	9.6.4. A71CH: VCOM Interface
	<ul> <li>9.6.5. A71CH: SCI2C interface</li> <li>9.6.6. MBEDTLS</li> </ul>
9.6. Usage Examples	• 9.7. List of ssscli commands
9.7. List of ssscli commands	9.7.1. SSSCLI Commands
9.8. CLI Data formats	<ul> <li>9.7.2. Set Commands</li> </ul>
9.9. Object Policies Through SSSCLI	• 9.7.3. Get Commands
9.10. Upload keys and certificates to SE05X using Pycli tool	<ul> <li>9.7.4. Generate Commands</li> <li>9.7.5. Perform Commanda</li> </ul>

6. You will see a new page with examples describing how to use ssscli tool for the most common operations:

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#### Get started with EdgeLock SE05x support package

	9.6. Usage Examples
Plug & Trust MW	
1. NXP Plug & Trust Middleware	9.6.1. SE05X: VCOM Interface
2. Changes	Provisioning ECC Pair and Certificate:
3. Plug & Trust MW Stack	
4. Building / Compiling	ssscli connect se05x vcom COM5 ssscli se05x reset
	ssscli set ecc pair 0x20181001 tstData\tls_client_key.pem
5. Demo and Examples	<pre>ssscli set cert 0x20181002 tstData\tls_client.cer</pre>
5. NXP EdgeLock 2GO Agent	ssscli disconnect
7. SEMS Lite Agent	Generating ecc key and retrive public key:
8. Plugins / Add-ins	
9. CLI Tool	ssscli connect se05x vcom COM5
9.1. Introduction	ssscli se05x reset ssscli generate ecc 0x20181006 NIST P256
9.2. Block Diagram	ssscli get ecc pair 0x20181006 data\tls_key.pem
9.3. Steps needed before running	ssscli disconnect
ssscli tool	
9.4. Running the ssscli tool -	Inject and retrieve certificate:
Windows	ssscli connect se05x vcom COM5
9.5. CLI Provisioning	<pre>ssscli set cert 0x20181004 tstData\tls_client.cer</pre>
9.6. Usage Examples	<pre>ssscli get cert 0x20181004 data\extracted_certificate.cer</pre>
9.6.1. SE05X: VCOM Interface	ssscli disconnect
9.6.2. SE05X: PCSC interface	Europhan Inject and Kan and Cirr contificates
9.6.3. seo5x: JRCPV2 interface	Erase key, Inject ecc Key and Sign certificate:
9.6.4. A71CH: VCOM Interface	ssscli connect se05x vcom COM5
9.6.5. A71CH: SCI2C interface	ssscli erase 0x20181001

## 4.4.1 EdgeLock SE05x ssscli tool example

The EdgeLock SE05x Plug & Trust middleware includes all components required to verify the EdgeLock SE05x under Windows using the ssscli tool without the need to build the middleware. To be able to connect the SE05x-ARD board to a Windows PC, one of the following MCU boards running a VCOM to T1 Over I<sup>2</sup>C firmware is required:

- <u>MIMXRT1170-EVK</u>
- <u>MIMXRT1060-EVK</u>
- FRDM-K64F
- <u>LPC55S69-EVK</u>

The MCU boards are connected via USB to the Windows PC and the MCU board VCOM to T1 Over I<sup>2</sup>C firmware is acting as a bridge between the PC VCOM interface and the EdgeLock SE05x Secure Element.

This setup also allows to run the EdgeLock SE05x middleware Visual Studio project examples on a Windows platform. Further details can be found in <u>AN12398</u> EdgeLock SE05x Quick start guide with Visual Studio project examples explains.

In <u>Table 15</u> you can find the corresponding application note reference which explains the correct OM-SE05xARD and MCU board connecting. The quick start guides for the MCU boards are also including the correct OM-SE05xARD jumper configuration.

The precompiled VCOM binaries for the MIMXRT1170-EVK, the MIMXRT1060-EVK, the FRDM-K64F and the LPC55S69-EVK MCU boards are located in .\simw-top\binaries\MCU\se05x:

- se05x vcom-TloI2C-evkmimxrt1170.bin
- se05x vcom-T1oI2C-evkmimxrt1060.bin
- se05x vcom-TloI2C-frdmk64f.bin
- se05x\_vcom-T1oI2C-lpcxpresso55s69.bin

The pre-compiled Windows ssscli tool is located in .\simw-top\binaries\PCWindows\ssscli.

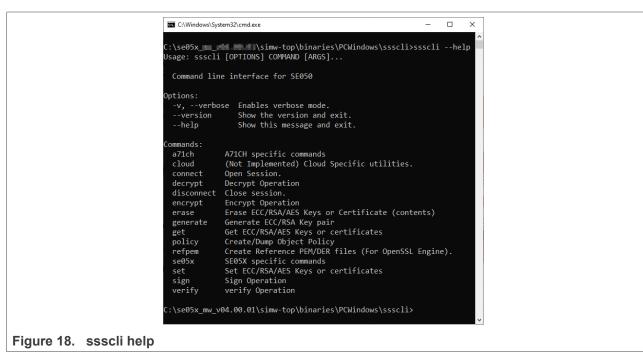
Note: The Windows ssscli tool ssscli.exe (folder .\simw-top\binaries\PCWindows\ssscli) is using a pre-compiled sssapisw.dll. This DLL is compiled for applet version 3.xx to support the previous SE050 product versions. To take advantage of all SE050E features it is recommended to use the pre-compiled sssapisw.dll for applet version 7.02 (folder: .\simw-top\binaries\PCWindows\ssscli\07\_02). You need to rename the sssapisw\_07\_02.dll to sssapisw.dll first. In the next step you need to copy the sssapisw.dll from .\simw-top\binaries\PCWindows\ssscli\07\_02 into .\simw-top\binaries \PCWindows\ssscli.

Alternative you could re-compile the middleware in Windows using the CMake settings as described in <u>AN12398</u> EdgeLock SE05x Quick start guide with Visual Studio project examples. In the final step you need to copy the new generated sssapisw.dll from .\simw-top\tools into .\simw-top\binaries \PCWindows\ssscli.

## 4.4.1.1 List all SE05x secure objects

To list all secure objects from EdgeLock EdgeLock SE05x dynamic file system, follow these steps:

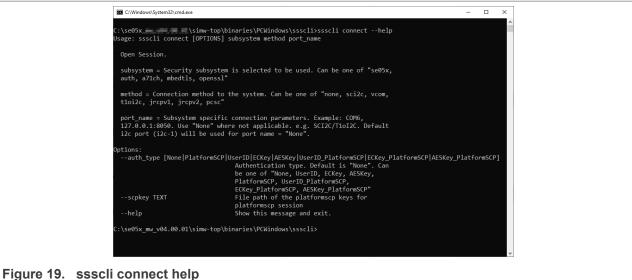
- 1. First, open a command prompt and navigate to .\simw-top\binaries\PCWindows\ssscli.
- 2. You can use the following command to display the ssscli build in help:
  - ssscli --help.



3. To get all option for the connect command use: ssscli connect --help.

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#### Get started with EdgeLock SE05x support package



The EdgeLock EdgeLock SE05x supports same specific commands.

ssscli se05x --help

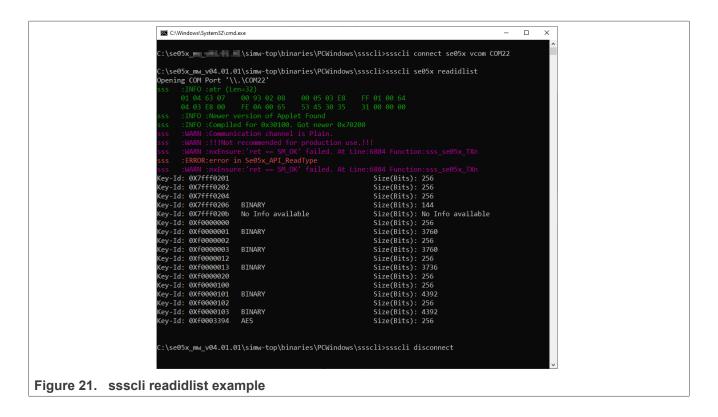
help Show this message and exit.	C:\Windows\System32\cmd.exe	-		×
Options: help Show this message and exit. Commands: certuid Get SE05X Cert Unique ID (10 bytes) readidlist Read contents of SE050 reset Reset SE05X		:li se05x -	-help	
help Show this message and exit. Commands: certuid Get SE05X Cert Unique ID (10 bytes) readidlist Read contents of SE050 reset Reset SE05X	SE05X specific commands			
certuid Get SE05X Cert Unique ID (10 bytes) readidlist Read contents of SE050 reset Reset SE05X				
	certuid Get SE05X Cert Unique ID (10 bytes) readidlist Read contents of SE050 reset Reset SE05X			

Figure 20. ssscli se05x help

- 4. Connect to the EdgeLock SE05x using the executable ssscli.exe. You need to indicate the VCOM port number corresponding to your MCU VCOM port. The subsystem option se05x shall be to define a session with the EdgeLock SE05x. The following commands will connect to the EdgeLock SE05x, list all EdgeLock SE05x secure objects and close the connection.
  - ssscli connect se05x vcom COMxx
  - ssscli se05x readidlist
  - ssscli disconnect

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#### Get started with EdgeLock SE05x support package



## 4.4.1.2 EdgeLock SE05x ssscli Change Supported Applet Version

The binary ssscli uses as well Plug & Trust Middleware to communicate with the Secure element. The Middleware needs to be compiled either vor applet variant 03\_XX or 07\_02. Compiling the Middleware with an older applet version results in displaying a warning like this:

sss :INFO :Newer version of Applet Found sss :INFO :Compiled for 0x30100. Got newer 0x70216

The supported applet variant can be changed as described in Plug & Trust Middleware documentation simw-top/doc/folder-structure.html:

Version 03.XX specific DLL is present in *binaries/PCWindows/ssscli/03\_XX* and version 07.02 specific DLL is present in *binaries/PCWindows/ssscli/07\_02*. Copy the required DLL to *binaries/PCWindows/ssscli* based on the applet version selected.

Using the wrong applet version usually results in failures identifying and using the objects in the secure elements, depending on the exact API used.

#### 4.4.1.3 EdgeLock SE05x ssscli with Secure Channel

The previous ssscli example is unauthenticated and unencrypted, no secure channel is created. A secure channel between host and the secure element is used to generate a binding between them. This secure channel is by default optional and is typically switched to mandated secure channel before the device is sent to the field (see the documents on User Guidelines for the matching product). FIPS certified types like SE050F and SE052F are already delivered with mandated secure channel. They cannot be used with plain communication.

The ssscli tool can as well be configured to use a secure channel for every command. For this first a file with the key needs to be created, here we use the key for SE052F OEF B501. The keys for generic types are documented in the product's configuration sheet and in Plug & Trust Middleware as described in <u>Section 4.2.2</u>

Create a text file with the the three specified keys as content:

ENC 3ae441c747e32ebc16b3bb2d843c6dd8

MAC 6c18f3d08fee1cb96a3c8de5d3538aaa

DEK b0e6a5697dbd929243a482cf9e4d6522

Then this file can be specified when defining the connection to the secure element, here EdgeLock SE052F is used and then the available objects are listed:

- ssscli connect se05x vcom COM37 --auth\_type PlatformSCP --scpkey c:\nxp\SE05X \plain scp SE052F B501.txt
- ssscli se05x readidlist

		k	- a x
Command Prompt		~	
C:\se05x_mw_v04.05.	01\simw-top\bina	ries\PCWindows\ss	scli>ssscli connect se05x vcom COM37auth_type PlatformSCPscpkey c:\nxp\SE05X\plain_scp_SE052F_B501.txt
		ries\PCWindows\ss	scli>ssscli se05x readidlist
Opening COM Port '\ sss :INFO :atr (L			
01 A0 00 00			
01 00 00 00 00 00 00			
	version of Applet		
		Got newer 0x70216	
Key-Id: 0X7fff0201 Key-Id: 0X7fff0202	NIST-P NIST-P	(Key Pair) (Key Pair)	Size(Bits): 256 Size(Bits): 256
Key-Id: 0X7fff0204	NIST-P	(Public Key)	Size(Bits): 256
Key-Id: 0X7fff0206	BINARY		Size(Bits): 144
Key-Id: 0X7fff0207 Key-Id: 0X7fff020c	AES BINARY		Size(Bits): 128 Size(Bits): 128
Key-Id: 0X7fff1000	BINARY		Size(Bis): 936
Key-Id: 0X7fff1001	BINARY		Size(Bits): 704
Key-Id: 0X7fff1002 Key-Id: 0X7fff1003	BINARY BINARY		Size(Bits): 1080 Size(Bits): 584
Key-Id: 0X7fff1004	BINARY		Size(Bits): 816
Key-Id: 0X7fff1005	BINARY		Size(Bits): 448
Key-Id: 0X7fff1006	BINARY		Size(Bits): 1304
Key-Id: 0X7fff1007 Key-Id: 0X7fff1008	BINARY BINARY		Size(Bits): 320 Size(Bits): 504
Key-Id: 0X7fff1009	BINARY		Size(Bits): 536
Key-Id: 0X7fff100a	AES		Size(Bits): 128
Key-Id: 0X7fff100b	HMAC		Size(Bits): 384
Key-Id: 0X7fff100c Key-Id: 0Xf0000000	HMAC NIST-P	(Key Pair)	Size(Bits): 176 Size(Bits): 256
Key-Id: 0Xf0000001	BINARY	(ney run)	Size(Bits): 3760
Key-Id: 0Xf0000002	NIST-P	(Key Pair)	Size(Bits): 256
Key-Id: 0Xf0000003 Key-Id: 0Xf0000010	BINARY RSA_CRT	(Key Pair)	Size(Bits): 3760 Size(Bits): 2048
Key-Id: 0Xf0000011	BINARY	(Rey Pair)	Size(Bits): 6904
Key-Id: 0Xf0000012	NIST-P	(Key Pair)	Size(Bits): 256
Key-Id: 0Xf0000013	BINARY	(Dublid = 11-11)	Size(Bits): 3736
Key-Id: 0Xf0000020 Key-Id: 0Xf0000100	NIST-P NIST-P	(Public Key) (Key Pair)	Size(Bits): 256 Size(Bits): 256
Key-Id: 0Xf0000101	BINARY		Size(Bits): 4392
Key-Id: 0Xf0000102	NIST-P	(Key Pair)	Size(Bits): 256
Key-Id: 0Xf0000103 Key-Id: 0Xf0000110	BINARY RSA_CRT	(Key Pair)	Size(Bits): 4392 Size(Bits): 2048
Key-Id: 0Xf0000111	BINARY	(Rey Fair)	Size(Bis): 9648
Key-Id: 0Xf0000112	RSA_CRT	(Key Pair)	Size(Bits): 2048
Key-Id: 0Xf0000113 Key-Id: 0Xf0000120	BINARY RSA_CRT	(Key Pair)	Size(Bits): 9648
Key-Id: 0X+0000120 Key-Id: 0Xf0000121	BINARY	(Rey Pair)	Size(Bits): 4096 Size(Bits): 11696
Key-Id: 0Xf0000122	RSA_CRT	(Key Pair)	Size(Bits): 4096
Key-Id: 0Xf0000123	BINARY		Size(Bits): 11696
Key-Id: 0Xf0003394	AES		Size(Bits): 256
C:\se05x_mw_v04.05.	01\simw-top\bina	ries\PCWindows\ss	
Figure 22, ss	sscli connec	ct with Platf	orm SCP authentication
		or mun i iun	

# **5** Support documentation

The EdgeLock SE05x support package includes extensive application notes that explain EdgeLock SE05x features, use cases, and how to try out the sample code and demo examples provided in the EdgeLock SE05x Plug & Trust middleware.

<u>Table 15</u> summarizes the EdgeLock SE05x application notes available and indicates for which product family each one is applicable.

**Note:** Click the hyperlink in the app note numbers to download the document, or click the hyperlink in the app note title to navigate through the specific app note section.

App note	Group	Title	Product
AN12396	Quick Start	Quick start guide with Kinetis K64F	SE05x
AN13027		Quick start guide with i.MX 8M	
AN12450		Quick start guide with i.MX RT1060 and i.MX1170	
AN12452		Quick start guide with LPC55S69	
AN12570		Quick start guide with Raspberry Pi	
AN12398		Quick start guide with Visual Studio project examples	
AN12404	Cloud	Secure connection to AWS IoT Core	SE05x
AN12402	Connectivity	Secure connection to Azure IoT Hub	
AN12400		Secure connection to OEM cloud	
AN12449	Use Cases	Sensor data protection	SE05x
AN12399		Device-to-device authentication	
AN12569		Secure access control in Industrial IoT	
AN12661		Wi-Fi credential protection	
AN12664		NFC late-stage configuration	
<u>AN13445</u>		Enable Matter in Smart Home Solutions Using EdgeLock SE05x/A5000	
AN12662	System	Binding a host device to EdgeLock SE05x	SE05x
AN12660	Integration	Ease ISA/IEC 62443 compliance with EdgeLock SE05x	
AN12663		SE05x to implement TPM-like functionality	
AN13014	Porting	Moving from EdgeLock SE050 to EdgeLock SE051	SE051
AN14028		Moving from EdgeLock SE050F to EdgeLock SE052F	SE052
AN12448		SE05x Plug & Trust middleware porting guidelines	SE05x
AN13539	Development Kit	OM-SE05xARD board hardware overview	SE05x
AN14262		OM-SE052ARD board hardware overview	SE052
<u>UM11225</u>	Interface	NXP EdgeLock SE05x T=1 Over I2C specification	SE05x
AN12413	Specification	EdgeLock SE050 APDU specification	SE050A/B/C/F
<u>AN12543</u>		Edgelock Se05x IoT applet APDU specification	SE050E / SE051 / SE052

Table 15. EdgeLock SE05x support documentation

App note	Group	Title	Product
AN12436	Product	EdgeLock SE050 product configurations	SE050
<u>AN12973</u>	Configuration Definition	EdgeLock SE051 product configurations	SE051
<u>AN14277</u>		EdgeLock SE052 product configurations	SE052
AN12907	Update and	Secure update of EdgeLock SE051 IoT applet	SE051
AN13015 - in <u>Secure Files</u>	Reconfiguration	How to use the EdgeLock SE051 personalization applet	
AN12514	User Guidelines	EdgeLock SE050A/B/C/D user guidelines	SE050A/B/C/F
AN13483		EdgeLock SE050E user guidelines	SE50E
AN13482 in <u>Secure Files</u>		EdgeLock SE050F user guidelines	SE50F
<u>AN12730</u>	1	EdgeLock SE051 user guidelines	SE051
AN13904	]	EdgeLock SE052 user guidelines	SE052

Table 15. EdgeLock SE05x support documentation...continued

# 5.1 AN12396 - Quick start guide with Kinetis K64F

The AN12396 explains how to get started with EdgeLock SE05x Plug & Trust middleware using the OM-SE05xARD and FRDM-K64F MCU boards. It provides detailed instructions to run projects imported either from the FRDMK64F SDK or the CMake-based build system included in the EdgeLock SE05x Plug & Trust middleware.

# 5.2 AN13027 - Quick start guide with i.MX 8M

The AN13027 explains how to get started with the OM-SE05xARD board and i.MX 8M board. This guide provides detailed instructions for connecting the boards, installing the software, running the EdgeLock SE05x Plug & Trust middleware test examples and executing the sscli tool.

# 5.3 AN12450 - Quick start guide with i.MX RT1060 and i.MX RT1170

The AN12450 explains how to get started with EdgeLock SE05x Plug & Trust middleware using the OM-SE05xARD and i.MX RT1060/1170 MCU boards. It provides detailed instructions to run projects imported either from the i.MX RT1060 SDK or the CMake-based build system included in the EdgeLock SE05x Plug & Trust middleware.

# 5.4 AN12452 - Quick start guide with LPC55S69

The AN12452 explains how to get started with EdgeLock SE05x Plug & Trust middleware using the OM-SE05xARD and LPC55S69 MCU boards. It provides detailed instructions to run projects imported either from the LPC55S69 SDK or the CMake-based build system included in the EdgeLock SE05x Plug & Trust middleware.

# 5.5 AN12570 - Quick start guide with Raspberry Pi

The AN12570 explains how to get started with the OM-SE050ARD board and the Raspberry Pi board, as a reference for any other device running a Linux distribution. This guide provides detailed instructions for connecting the boards and running the project examples included in EdgeLock SE05x Plug & Trust middleware.

# 5.6 AN12398 - Quick start guide with Visual Studio project examples

The AN12398 explains how to get started with EdgeLock SE05x Plug & Trust middleware using the Visual Studio project examples. It provides detailed instructions to run the Microsoft Visual Studio projects using the CMake-based build system included in the EdgeLock SE05x Plug & Trust middleware.

# 5.7 AN12404 - Secure connection to AWS IoT Core

The EdgeLock SE05x is designed to provide a tamper-resistant platform to safely store credentials needed for device authentication and registration to public or private clouds. EdgeLock SE05x helps to set up a trusted TLS connection to onboard devices to the cloud without writing security code or exposing credentials or keys

The AN12404 describes how to leverage the EdgeLock SE05x for secure cloud onboarding to the AWS IoT Core IoT Hub cloud platform. It provides detailed instructions to run the software example provided as part of the support package using an OM-SE05xARD and an FRDM-K64F board.

## 5.8 AN12402 - Secure connection to Azure IoT Hub

The EdgeLock SE05x is designed to provide a tamper-resistant platform to safely store credentials needed for device authentication and registration to public or private clouds. EdgeLock SE05x helps to set up a trusted TLS connection to onboard devices to the cloud without writing security code or exposing credentials or keys

The AN12402 describes how to leverage the EdgeLock SE05x ease- of-useconfiguration for secure cloud onboarding to the Azure IoT Hub cloud platform. It provides detailed instructions to run the software example provided as part of the support package using an OM-SE05xARD and an iMX6UltraLite or i.MX 8M board with a Linux OS.

## 5.9 AN12400 - Secure connection to OEM cloud

The EdgeLock SE05x is designed to provide a tamper-resistant platform to safely store credentials needed for device authentication and registration to public or private clouds. EdgeLock SE05x helps to set up a trusted TLS connection to onboard devices to the cloud without writing security code or exposing credentials or keys.

The AN12400 describes how to leverage EdgeLock SE050 to establish a secure connection with the private cloud of an Original Equipment Manufacturer.

## 5.10 AN12449 - Sensor data protection

The EdgeLock SE05x is designed to be used as a companion chip to any type of MCU or MPU. Sensors can be directly connected to EdgeLock SE05x using an I<sup>2</sup>C controller interface. EdgeLock SE05x allows you to set up a secure, end-to-end connection from the sensor or actuator to your local IoT gateway or cloud-based service, protecting the interface between the sensor and the security IC. As such, EdgeLock SE05x helps you to provide a higher level of security in your IoT system by:

- **Preventing data manipulation**: The data extracted by the sensor is collected privately and cannot be manipulated.
- Authenticating the sensor: The system authenticates the sensor as a proof of origin.
- **Providing end-to-end security**: The data collected over the private sensor can be encrypted and securely transferred to your gateway or cloud for further treatment and analysis.

The AN12449 note describes how to leverage EdgeLock SE05x for guaranteeing sensor data protection. It gives insights into the integration of EdgeLock SE05x from a hardware and software perspective for this use case. It also provides detailed instructions to run a code example that demonstrates how to leverage EdgeLock SE05x to protect data from a security-sensitive sensor

# 5.11 AN12399 - Device-to-device authentication

The EdgeLock SE05x provides a tamper-resistant hardware that is capable of securely storing keys and credentials needed to verify the authenticity of an IoT device and a server. The AN12399 describes how to implement a strong mutual authentication mechanisms using digital certificates.

# 5.12 AN12569 - Secure access control in Industrial IoT

The EdgeLock SE05x can be used as a Secure Access Module (SAM) to increase the security of your IoTenabled card reader for physical or logical access. In this context, the EdgeLock SE05x can be used by a card reader to setup a secure transaction with MIFARE DESFire EV2 contactless cards. As such, EdgeLock SE05x helps you to provide a higher level of security in your access control system by:

- **Protecting the master keys**: The master keys used for card authentication are protected inside the EdgeLock SE05x and can not be read or manipulated.
- Authenticating the card: EdgeLock SE05x supports the authentication protocol and the session key generation algorithm of MIFARE DESFire EV2 card.
- **Performing securely related commands**: EdgeLock SE05x supports secure key change or key diversification of MIFARE DESFire EV2 cards

The AN12569 describes how EdgeLock SE05x, in combination with a microcontroller, supports secure access control in any industrial operation or environment. It gives insights into the integration of EdgeLock SE05x from a hardware and software perspective for this use case. It also provides detailed instructions to run a set of code examples that demonstrate how to leverage EdgeLock SE05x and LPC55S to support secure operation with a MIFARE DESFire EV2 card. In this case, the LPC55SS is used as an example and the same concept is applicable using another host MCU.

## 5.13 AN12661 - Wi-Fi credential protection

The EdgeLock SE05x allows you to authenticate devices attempting to connect to a Wi-Fi router or wireless LAN network and, in this way, it helps secure access to restricted networks. EdgeLock SE05x supports WPA-PSK and WPA-EAP-TLS security protocols.

In this case, the Wi-Fi module leverages EdgeLock SE05x to safely store the password (in case of WPA-PSK protocol) or the private key and certificate (in case of WPA-EAP-TLS authentication) that are used to establish the secure WiFi connection. During the Wi-Fi connection setup, EdgeLock SE05x is also leveraged to derive the session keys required for data exchange.

The AN12661 describes how to leverage EdgeLock SE05x for Wi-Fi credential protection. It explains how to run a demo setup that showcases the use of EdgeLock SE05x ease-of-use configuration to authenticate devices to a Wi-Fi network based on WPA-EAP-TLS protocol.

## 5.14 AN12664 - NFC late-stage configuration

The EdgeLock SE05x comes with an integrated, fully ISO/IEC14443 A compliant interface that allows you to perform a secure and convenient late stage parameter configuration of industrial IoT devices already deployed in the field using an NFC reader. As such, EdgeLock SE05x acts like a bridge between the IoT device and the contactless reader.

The AN12664 describe how to leverage EdgeLock SE05x to enable a secure and convenient late-stage parameter configuration of IoT devices in the factory, before shipment, or in the field.

AN13013 Application note

# 5.15 AN13445 - Enable Matter in Smart Home Solutions Using EdgeLock SE05x/A5000

The Matter standard provides a secure, reliable, and seamless user experience when integrating IoT devices from different vendors in the smart home ecosystem. This application note describes how EdgeLock SE05x/ A5000, and in particular EdgeLock SE051H, can be leveraged to easily deploy in your smart home IoT solution the security required by the Matter standard.

# 5.16 AN12662 - Binding a host device to EdgeLock SE05x

The EdgeLock SE05x provides manufacturers the option to bind the MCU of the IoT device to the secure element, so that security services offered by EdgeLock SE05x can only be used by that particular MCU.

The AN12662 describes the different stages during the product manufacturing where the binding process can be implemented, depending on the IoT device security requirements and the available MCU

# 5.17 AN12660 - Ease ISA/IEC 62443 compliance with EdgeLock SE05x

The EdgeLock SE05x can support the ISA/IEC 62443, a series of standards which addresses the security of Industrial Automation and Control Systems (IACS) throughout their lifecycle. The AN12660 elaborates on the use of EdgeLock SE05x to reduce the implementation complexity to satisfy the security requirements mandated by the ISA/IEC 62443-4-2 standard.

# 5.18 AN12663 - EdgeLock SE05x to implement TPM-like functionality

Trusted Platform Module (TPM) is an international standard for a secure cryptoprocessor, a dedicated microcontroller designed to secure hardware through integrated cryptographic keys. TPM chips can be used with any major laptop operating system and work best in conjunction with other security technologies such as firewalls, antivirus software, smart cards and biometric verification.

The AN12663 application note describes how to use the EdgeLock SE05x as a Trusted Platform Module (TPM). This document first introduces both the TPM standard and the TPM Software Stack (TSS), how they work and their most important use cases. It then describes in detail how to take advantage of the EdgeLock SE05x Plug & Trust middleware TSS integration to simplify the usage of EdgeLock SE05x as a TPM.

## 5.19 AN13014 - Moving from EdgeLock SE050 to EdgeLock SE051

EdgeLock SE051 is a step up of features compared to SE050. Here the changes to be considered when moving from a SE050 design to SE051 are described.

# 5.20 AN14028 - Moving from EdgeLock SE050F to EdgeLock SE052F

The FIPS-certified EdgeLock SE052F is a step up of features compared to SE050F. Here the changes to be considered when moving from a SE050F design to SE052F are described.

## 5.21 AN12448 - SE05x Plug & Trust Middleware porting guidelines

The EdgeLock SE05x Plug & Trust middleware comes with pre-build support for various NXP MCU / MPU platforms. The AN12448 provides guidelines to port the EdgeLock SE05x Plug & Trust middleware to other platforms. It details the layers and software components that must be adapted to use the EdgeLock SE050 Plug & Trust middleware in your host platform and host operating system.

# 5.22 AN13539 - OM-SE05xARD board hardware overview

The AN13539 describes the OM-SE05xARD development kits and details how to use its jumpers to configure the different communication options with the EdgeLock SE05x security IC.

### 5.23 AN14262 - OM-SE052ARD board hardware overview

The AN14262 describes the OM-SE05xARD development kit used for SE052 and details how to use its jumpers to configure the different communication options with the EdgeLock SE052 security IC.

# 5.24 UM11225 - NXP EdgeLock SE05x T=1 Over I2C specification

The UM11225 is the specification for the data link layer protocol T=1 over I<sup>2</sup>C on the EdgeLock SE05x product family.

# 5.25 AN12413 - EdgeLock SE050 APDU specification

The AN12413 provides the API description for IoT applet version 3.xx. The IoT applet version 3.xx is available for the SE050A/B/C/D/F product variants.

## 5.26 AN12543 - SE05x APDU specification

The AN12543 provides the API description for the IoT applet version 7.xx. The IoT applet version 7.xx is avaiable for the SE050E, SE051 and SE052 product variants.

## 5.27 AN12436 - EdgeLock SE050 product configurations

The AN12436 describe the product differences between the EdgeLock SE050 variants and details the credentials injected in each one as part of the EdgeLock SE050 pre-configuration for ease of use.

## 5.28 AN12973 - EdgeLock SE051 product configurations

The AN12973 describe the product differences between the EdgeLock SE051 variants and details the credentials injected in each one as part of the EdgeLock SE051 pre-configuration for ease of use.

## 5.29 AN14277 - EdgeLock SE052 product configurations

The AN14277 define the EdgeLock SE052 configuration and details the credentials injected in each one as part of the EdgeLock SE052 pre-configuration for ease of use.

## 5.30 AN12907 - Secure update of EdgeLock SE051 IoT applet

The EdgeLock SE051 provides advanced applet management capabilities through NXP's Secure Element Management Service Lite (SEMS Lite) feature. SEMS Lite feature allows customers to update the pre-installed IoT applet with the latest security patches and updates offered by NXP.

The AN12907 describes the SEMS Lite service and explains how it can be leveraged, together with the EdgeLock 2GO platform, to update the preloaded EdgeLock SE051 IoT applet.

# 5.31 AN13015 - How to use EdgeLock SE051 personalization applet

The EdgeLock SE051 is shipped with a pre-installed personalization applet. This personalization applet enables the configuration of EdgeLock SE051 so that OEMs can personalize the configuration of EdgeLock SE051 after the security IC has been manufactured and before it is delivered into the field.

The AN13015 introduces the personalization applet pre-installed in EdgeLock SE051 and describes how it can be used to configure EdgeLock SE051 before the device is delivered into the field and it shows how it can be deleted afterwards with a SEMS Lite script.

# 5.32 AN12514 - SE050A/B/C/D user guidelines

The AN12514 provides the guidelines for the usability of EdgeLock SE050 and the security recommendations for using the security IC.

# 5.33 AN13483 - SE050E - User Guidelines

The AN13483 provides the guidelines for the usability of SE050E and the security recommendations for using the security IC.

# 5.34 AN13482 - SE050F - User Guidelines

The AN13482 provides the guidelines for the usability of SE050F and the security recommendations for using the security IC. This document is available in <u>Secure Files</u>.

## 5.35 AN12730 - EdgeLock SE050 user guidelines

The AN12730 provides the guidelines for the usability of EdgeLock SE051 and the security recommendations for using the security IC.

# 5.36 AN13904 - EdgeLock SE052 user guidelines

The AN13904 provides the guidelines for the usability of EdgeLock SE052 and the security recommendations for using the security IC.

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Revision number	Date	Description
AN13013 v.1.4	17 April 2024	<ul> <li>Add in <u>Section 2</u> SE052F development board</li> <li>Corrected the link to <u>Figure 3</u> in <u>Section 3.2</u></li> <li>Add in <u>Section 4</u> use case of bootloader for Plug &amp; Trust nano library</li> <li>Add SE052F in <u>Section 4.1.2.1</u>, <u>Section 4.1</u>, and <u>Section 4.2.2</u></li> <li>Update in <u>Section 4.1.2</u> SE051 applet 6.0 build settings</li> <li>Add <u>Section 4.4.1.2</u> how to change the supported applet version in the ssscli binary</li> <li>Add <u>Section 4.4.1.3</u> how to use ssscli with a secure channel</li> <li>Update <u>Section 5</u> with new application notes and restructured <u>Table 15</u></li> <li>Added <u>Section 6</u></li> </ul>
AN13013 v.1.3	14 September 2022	Update to EdgeLock SE Plug & Trust Middleware version 04.02.xx. Update Figure 2, Figure 3, Figure 5, Figure 6 Update Section 3 Supported MCU/MPU boards Update Section 4 EdgeLock SE05x Plug & Trust middleware Update Section 4.1.2.1 Product-specific CMake build settings Update Section 4.2 Binding EdgeLock SE05x to a host using Platform SCP Update Section 4.4.1 EdgeLock SE05x ssscli tool

# 7 Revision history

Application note

AN13013

# **NXP Semiconductors**

# Get started with EdgeLock SE05x support package

Revision historycontinued				
Revision number	Date	Description		
AN13013 v.1.2	28 March 2022	Add EdgeLock SE050E product variant		
		Update Figure 1, Table 1, Table 3, Figure 2, Figure 3, Figure 5, Figure 6		
		Add <u>Section 4.1.2.1</u> Product-specific CMake build settings		
		Add <u>Section 4.1.3</u> Example: SE050E CMake build settings		
		Add Section 4.2 Binding EdgeLock SE05x to a host using Platform SCP		
		Update chapter Section 4.4 EdgeLock SE05x ssscli tool		
AN13013 v.1.1	07 December 2020	Updated to latest template and fixed broken links		
AN13013 v.1.0	19 October 2020	First document release		

# Revision history...continued

# AN13013

#### Get started with EdgeLock SE05x support package

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