

RM00284

EdgeLock Enclave Hardware Security Module API

Rev. 2.0 — 29 March 2024

Reference manual

Document information

Information	Content
Keywords	i.MX, Linux, LF6.6.3_1.0.0, EdgeLock Enclave, Hardware Security Module, API
Abstract	This document is a software reference description of the API provided by the i.MX 8ULP, i.MX 93, and i.MX 95 Hardware Security Module (HSM) solutions for the EdgeLock Enclave (ELE) Platform.

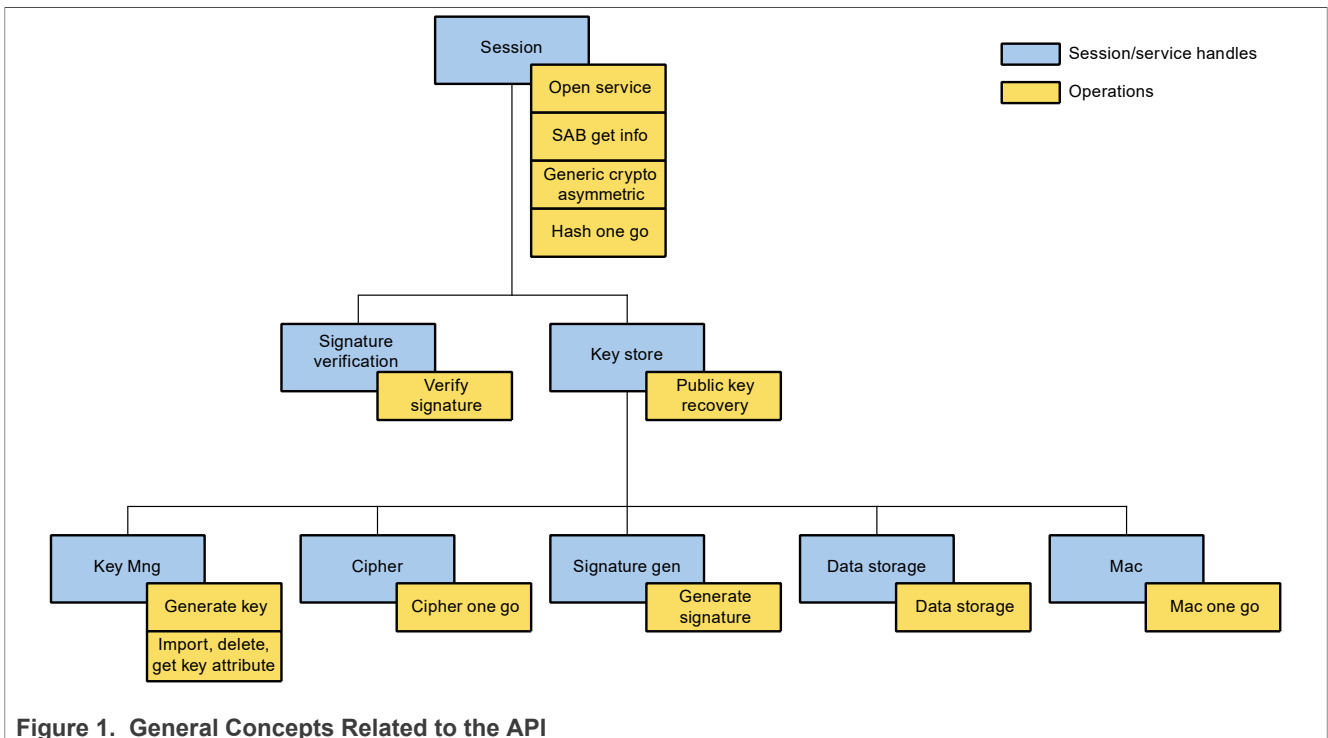


1 Overview

This document is a software reference description of the API provided by the i.MX 8ULP, i.MX 93, and i.MX 95 Hardware Security Module (HSM) solutions for the EdgeLock Enclave (ELE) Platform.

Note: A reference implementation of this API is available at <https://github.com/nxp-imx/imx-secure-enclave>. All code examples in this document use this implementation.

2 General Concepts Related to the API



2.1 Session

The API must be initialized by a potential requestor by opening a session.

The session establishes a route (MU, DomainID...) between the requestor and the HSM. When a session is opened, the HSM returns a handle identifying the session to the requestor.

2.2 Service flow

For a given category of services that require service handle, the requestor is expected to open a service flow by invoking the appropriate HSM API.

The session handle, as well as the control data needed for the service flow, are provided as parameters of the call.

Upon reception of the open request, the HSM allocates a context in which the session handle, as well as the provided control parameters are stored and return a handle identifying the service flow.

The context is preserved until the service flow, or the session, are closed by the user and it is used by the HSM to proceed with the sub-sequent operations requested by the user on the service flow.

2.3 Example

```
/* Open a session: create a route between the user and the HSM */
hsm_open_session(&open_session_args, &session_hdl);

/* Open a key store user is authenticated */
hsm_open_key_store_service(session_hdl, open_svc_key_store_args,
    &key_store_hdl);

/* Open cipher service it grants access to ciphering operations */
hsm_open_cipher_service(key_store_hdl, &open_svc_cipher_args, &cipher_hdl);

/* Perform ECB, CCB ... */
hsm_cipher_one_go (cipher_hdl, &op_cipher_one_go_args);
/* Perform authenticate and encryption algos: e.g GCM */
hsm_auth_enc(cipher_hdl, &op_auth_enc_args);

/* Perform hashing operations: e.g SHA */
hsm_hash_one_go(hash_hdl, &op_hash_one_go_args);

/* Close the session and all the related services */
hsm_close_session(session_hdl);
```

2.4 Key store

A key store can be created by specifying the CREATE flag in the `hsm_open_key_store_service` API. The created key store is not stored in the NVM until a key is generated or imported specifying the "STRICT OPERATION" flag.

Only symmetric and private keys are stored into the key store. Public keys can be exported during the key pair generation operation or recalculated through the `hsm_pub_key_recovery` API.

Secret keys cannot be exported under any circumstances, while they can be imported in encrypted form.

2.4.1 Key management

Keys are divided in groups. Keys belonging to the same group are written/read from the NVM as a monolithic block.

Up to 2 key groups can be handled in the HSM local memory (those immediately available to perform crypto operations), while up to 100 key groups can be handled in the external NVM and imported in the local memory as needed.

If the local memory is full (2 key groups already reside in the HSM local memory) and a new key group is needed by an incoming user request, the HSM swaps one of the local key group with the one needed by the user request.

The user can control which key group to be kept in the local memory (cached) through the `manage_key_group` API lock/unlock mechanism.

As general concept, frequently used keys should be kept, when possible, in the same key group and locked in the local memory for performance optimization.

2.4.2 NVM writing

All the APIs creating a key store (open key store API) or modifying its content (key generation, key management, key derivation functions) provide a "STRICT OPERATION" flag. If the flag is set, the HSM exports

the relevant key store blocks into the external NVM. In case of key generation/derivation/update, the "STRICT OPERATION" has effect only on the target key group.

Any update to the key store must be considered as effective only after an operation specifying flag "STRICT OPERATION" is acknowledged by the HSM. All the operations not specifying the "STRICT OPERATION" flags impact the HSM local memory only and will be lost in case of system reset.

Due to the limited monotonic counter size, the user should, when possible, perform multiple update before setting the "STRICT OPERATION" flag (i.e., keys to be updated should be kept in the same key group).

When the monotonic counter is completely blown, a warning is returned on each key store export to the NVM to inform the user that the new updates are not roll-back protected.

2.5 Implementation specificities

HSM API with common features are supported on i.MX 8ULP, i.MX 93, and i.MX 95. The details of the supported features per chip are listed in the platform specificities.

3 Module Documentation

3.1 Session

The API must be initialized by a potential requestor by opening a session.

Once a session is closed, all the associated service flows are closed by the HSM.

Data structures

- struct [hsm_session_hdl_s](#)
- struct [hsm_service_hdl_s](#)
- struct [open_session_args_t](#)

Macros

- #define HSM_MAX_SESSIONS (8u)
Maximum sessions supported.
- #define HSM_MAX_SERVICES (32u)
Maximum services supported.
- #define HSM_OPEN_SESSION_PRIORITY_LOW (0x00U)
Low priority. Default setting on platforms that does not support session priorities.
- #define HSM_OPEN_SESSION_PRIORITY_HIGH (0x01U)
High Priority session.
- #define HSM_OPEN_SESSION_FIPS_MODE_MASK (1u << 0)
Only FIPS certified operations authorized in this session.
- #define HSM_OPEN_SESSION_EXCLUSIVE_MASK (1u << 1)
No other HSM sessions are authorized on the same security enclave.
- #define HSM_OPEN_SESSION_LOW_LATENCY_MASK (1u << 3)
Use a low latency HSM implementation.
- #define HSM_OPEN_SESSION_NO_KEY_STORE_MASK (1u << 4)
No key store is attached to this session. May provide better performances on some operations depending on the implementation. Usage of the session is restricted to the operations that do not involve secret keys (e.g., hash, signature verification, and random generation).
- #define HSM_OPEN_SESSION_RESERVED_MASK ((1u << 2) | (1u << 5) | (1u << 6) | (1u << 7))
Bits reserved for future use. Should be set to **0**.

Typedefs

- typedef uint32_t [hsm_hdl_t](#)

Functions

- [hsm_err_t hsm_open_session](#) ([open_session_args_t](#) *args, [hsm_hdl_t](#) *session_hdl)
- [hsm_err_t hsm_close_session](#) ([hsm_hdl_t](#) session_hdl)
- struct [hsm_session_hdl_s](#) * [session_hdl_to_ptr](#) (uint32_t hdl)
- struct [hsm_service_hdl_s](#) * [service_hdl_to_ptr](#) (uint32_t hdl)
- void [delete_session](#) (struct [hsm_session_hdl_s](#) *s_ptr)
- void [delete_service](#) (struct [hsm_service_hdl_s](#) *s_ptr)
- struct [hsm_session_hdl_s](#) * [add_session](#) (void)
- struct [hsm_service_hdl_s](#) * [add_service](#) (struct [hsm_session_hdl_s](#) *session)

3.1.1 Detailed description

The API must be initialized by a potential requestor by opening a session.

When a session is closed, all the associated service flows are closed by the HSM.

3.1.2 Data structure documentation

3.1.2.1 struct hsm_session_hdl_s

Structure describing the session handle members.

Data Fields

struct plat_os_abs_hdl *	phdl	Pointer to the OS device node.
uint32_t	session_hdl	Session handle.
uint32_t	mu_type	Session MU type.

3.1.2.2 struct hsm_service_hdl_s

Structure describing the service handle members.

Data Fields

struct hsm_session_hdl_s *	session	Pointer to session handle.
uint32_t	service_hdl	Service handle.

3.1.2.3 struct open_session_args_t

Structure detailing the open session operation member arguments.

Data Fields

uint32_t	session_hdl	Session handle.
uint8_t	session_priority	Priority of the operations performed in this session.
uint8_t	operating_mode	Options for the session to be opened (bitfield).
uint8_t	interrupt_idx	Interrupt number of the MU used to indicate data availability.

3.1.3 Typedef documentation

3.1.3.1 hsm_hdl_t

```
typedef uint32_t hsm\_hdl\_t
```

Define the HSM handle type.

3.1.4 Function documentation

3.1.4.1 hsm_open_session()

```
hsm\_err\_t hsm_open_session (
open\_session\_args\_t * args,
hsm\_hdl\_t * session_hdl)
```

Parameters

<i>args</i>	Pointer to the structure containing the function arguments.
<i>session_hdl</i>	Pointer to where the session handle must be written.

Returns

Error code.

3.1.4.2 hsm_close_session()

```
hsm\_err\_t hsm_close_session (hsm\_hdl\_t session_hdl)
```

Terminate a previously opened session. All the services opened under this session are closed as well.

Parameters

<i>session_hdl</i>	Pointer to the handle identifying the session to be closed.
--------------------	---

Returns

Error code.

3.1.4.3 session_hdl_to_ptr()

```
struct hsm\_session\_hdl\_s* session_hdl_to_ptr (uint32_t hdl)
```

Return pointer to the session handle.

Parameters

<i>hdl</i>	Identifying the session handle.
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Returns

Pointer to the session handle.

3.1.4.4 service_hdl_to_ptr()

```
struct hsm\_service\_hdl\_s* service_hdl_to_ptr (uint32_t hdl)
```

Return pointer to the service handle.

Parameters

<i>hdl</i>	Identifying the session handle.
------------	---------------------------------

Returns

Pointer to the service handle.

3.1.4.5 delete_session()

```
void delete_session (struct hsm\_session\_hdl\_s * s_ptr)
```

Delete the session.

Parameters

<i>s_ptr</i>	Pointer identifying the session.
--------------	----------------------------------

3.1.4.6 delete_service()

```
void delete_service (struct hsm\_service\_hdl\_s * s_ptr)
```

Delete the service.

Parameters

<i>s_ptr</i>	Pointer identifying the service.
--------------	----------------------------------

3.1.4.7 add_session()

```
struct hsm\_session\_hdl\_s* add_session (void )
```

Add the session.

Returns

Pointer to the session.

3.1.4.8 add_service()

```
struct hsm\_service\_hdl\_s* add_service (  
struct hsm\_session\_hdl\_s * session)
```

Add the service.

Returns

Pointer to the service.

3.2 Key management

Data Structures

- struct [op_delete_key_args_t](#)
- struct [op_get_key_attr_args_t](#)
- struct [op_import_key_args_t](#)
- struct [kek_enc_key_hdr_t](#)
- struct [op_generate_key_args_t](#)
- struct [open_svc_key_management_args_t](#)
- struct [op_manage_key_group_args_t](#)

Macros

- #define [HSM_OP_DEL_KEY_FLAGS_STRICT_OPERATION](#) ((hsm_op_delete_key_flags_t)(1u << 7))
- #define [HSM_OP_IMPORT_KEY_INPUT_E2GO_TLV](#) ((hsm_op_import_key_flags_t)(1u << 0))
Bit 0: set 1 means input is E2GO_TLV.
- #define [HSM_OP_IMPORT_KEY_INPUT_SIGNED_MSG](#) ((hsm_op_import_key_flags_t)(0u << 0))
Bit 0: set 0 means input is signed message.
- #define [HSM_OP_IMPORT_KEY_FLAGS_AUTOMATIC_GROUP](#) ((hsm_op_import_key_flags_t)(0u << 2))
Bit 2: set 0 means ELE automatically chooses key group.
- #define [HSM_OP_IMPORT_KEY_FLAGS_GROUP_FIELD](#) ((hsm_op_import_key_flags_t)(1u << 2))
Bit 2: set 1 means ELE stores key in the key group set by the key group field.
- #define [HSM_OP_IMPORT_KEY_FLAGS_STRICT_OPERATION](#) ((hsm_op_import_key_flags_t) (1u << 7))
Bit 7: Strict: Request completed - New key written to NVM with updated MC.
- #define [HSM_KEY_USAGE_ENCRYPT](#) ((hsm_key_usage_t) (1u << 8))
- #define [HSM_KEY_USAGE_DECRYPT](#) ((hsm_key_usage_t) (1u << 9))
- #define [HSM_KEY_USAGE_SIGN_MSG](#) ((hsm_key_usage_t) (1u << 10))
- #define [HSM_KEY_USAGE_VERIFY_MSG](#) ((hsm_key_usage_t) (1u << 11))
- #define [HSM_KEY_USAGE_SIGN_HASH](#) ((hsm_key_usage_t) (1u << 12))
- #define [HSM_KEY_USAGE_VERIFY_HASH](#) ((hsm_key_usage_t) (1u << 13))
- #define [HSM_KEY_USAGE_DERIVE](#) ((hsm_key_usage_t) (1u << 14))
- #define [HSM_OP_KEY_GENERATION_FLAGS_STRICT_OPERATION](#) ((hsm_op_key_gen_flags_t)(1u << 7))
- #define [HSM_OP_MANAGE_KEY_GROUP_FLAGS_CACHE_LOCKDOWN](#) ((hsm_op_manage_key_group_flags_t) (1u << 0))
- #define [HSM_OP_MANAGE_KEY_GROUP_FLAGS_CACHE_UNLOCK](#) ((hsm_op_manage_key_group_flags_t) (1u << 1))
Import the key group.
- #define [HSM_OP_MANAGE_KEY_GROUP_FLAGS_IMPORT](#) ((hsm_op_manage_key_group_flags_t) (1u << 2))
Export the key group.
- #define [HSM_OP_MANAGE_KEY_GROUP_FLAGS_EXPORT](#) ((hsm_op_manage_key_group_flags_t) (1u << 3))
- #define [HSM_OP_MANAGE_KEY_GROUP_FLAGS_MONOTONIC](#) ((hsm_op_manage_key_group_flags_t) (1u << 5))
- #define [HSM_OP_MANAGE_KEY_GROUP_FLAGS_SYNC_KEYSTORE](#) ((hsm_op_manage_key_group_flags_t) (1u << 6))
- #define [HSM_OP_MANAGE_KEY_GROUP_FLAGS_STRICT_OPERATION](#) ((hsm_op_manage_key_group_flags_t) (1u << 7))

Typedefs

- typedef uint8_t [hsm_op_delete_key_flags_t](#)
- typedef uint8_t [hsm_op_import_key_flags_t](#)
- typedef uint32_t [hsm_key_usage_t](#)
- typedef uint16_t [hsm_key_group_t](#)
- typedef uint16_t [hsm_key_info_t](#)
- typedef uint8_t [hsm_op_key_gen_flags_t](#)
Reserved Bits 0 - 6.
- typedef uint8_t [hsm_svc_key_management_flags_t](#)
- typedef uint8_t [hsm_op_manage_key_group_flags_t](#)

Enumerations

- enum [hsm_storage_loc_t](#) {
HSM_SE_KEY_STORAGE = 0x00000000 }
- enum [hsm_storage_persist_lvl_t](#) {
HSM_VOLATILE_STORAGE = 0x0,
HSM_PERSISTENT_STORAGE = 0x1,
HSM_PERMANENT_STORAGE = 0xFF }
- enum [hsm_key_lifetime_t](#) {
HSM_SE_KEY_STORAGE_VOLATILE = HSM_SE_KEY_STORAGE | HSM_VOLATILE_STORAGE,
HSM_SE_KEY_STORAGE_PERSISTENT = HSM_SE_KEY_STORAGE | HSM_PERSISTENT_STORAGE,
HSM_SE_KEY_STORAGE_PERS_PERM = HSM_SE_KEY_STORAGE | HSM_PERMANENT_STORAGE }
- enum [hsm_pubkey_type_t](#) {
HSM_PUBKEY_TYPE_RSA = 0x4001,
HSM_PUBKEY_TYPE_ECC_BP_R1 = 0x4130,
HSM_PUBKEY_TYPE_ECC_NIST = 0x4112,
HSM_PUBKEY_TYPE_ECC_BP_T1 = 0xC180 }
- enum [hsm_key_type_t](#) {
HSM_KEY_TYPE_HMAC = 0x1100,
HSM_KEY_TYPE_AES = 0x2400,
HSM_KEY_TYPE_SM4 = 0x2405,
HSM_KEY_TYPE_RSA = 0x7001,
HSM_KEY_TYPE_ECC_BP_R1 = 0x7130,
HSM_KEY_TYPE_ECC_NIST = 0x7112 },
HSM_KEY_TYPE_OEM_IMPORT_MK_SK = 0x9200 }
- enum [hsm_bit_key_sz_t](#) {
HSM_KEY_SIZE_HMAC_224 = 224,
HSM_KEY_SIZE_HMAC_256 = 256,
HSM_KEY_SIZE_HMAC_384 = 384,
HSM_KEY_SIZE_HMAC_512 = 512,
HSM_KEY_SIZE_AES_128 = 128,
HSM_KEY_SIZE_AES_192 = 192,
HSM_KEY_SIZE_AES_256 = 256,
HSM_KEY_SIZE_SM4_128 = 128,
HSM_KEY_SIZE_RSA_2048 = 2048,
HSM_KEY_SIZE_RSA_3072 = 3072,
HSM_KEY_SIZE_RSA_4096 = 4096,
HSM_KEY_SIZE_ECC_BP_R1_224 = 224,
HSM_KEY_SIZE_ECC_BP_R1_256 = 256,
HSM_KEY_SIZE_ECC_BP_R1_320 = 320,
HSM_KEY_SIZE_ECC_BP_R1_384 = 384,

```

HSM_KEY_SIZE_ECC_BP_R1_512 = 512,
HSM_KEY_SIZE_ECC_NIST_224 = 224,
HSM_KEY_SIZE_ECC_NIST_256 = 256,
HSM_KEY_SIZE_ECC_NIST_384 = 384,
HSM_KEY_SIZE_ECC_NIST_521 = 521,
HSM_KEY_SIZE_ECC_BP_T1_224 = 224,
HSM_KEY_SIZE_ECC_BP_T1_256 = 256,
HSM_KEY_SIZE_ECC_BP_T1_320 = 320,
HSM_KEY_SIZE_ECC_BP_T1_384 = 384 },
HSM_KEY_SIZE_OEM_IMPORT_MK_SK_128 = 128,
HSM_KEY_SIZE_OEM_IMPORT_MK_SK_192 = 192,
HSM_KEY_SIZE_OEM_IMPORT_MK_SK_256 = 256
• enum hsm\_permitted\_algo\_t {
PERMITTED_ALGO_SHA224 = ALGO_HASH_SHA224,
PERMITTED_ALGO_SHA256 = ALGO_HASH_SHA256,
PERMITTED_ALGO_SHA384 = ALGO_HASH_SHA384,
PERMITTED_ALGO_SHA512 = ALGO_HASH_SHA512,
PERMITTED_ALGO_SM3 = ALGO_HASH_SM3,
PERMITTED_ALGO_HMAC_SHA256 = ALGO_HMAC_SHA256,
PERMITTED_ALGO_HMAC_SHA384 = ALGO_HMAC_SHA384,
PERMITTED_ALGO_CMAC = ALGO_CMAC,
PERMITTED_ALGO_CTR = ALGO_CIPHER_CTR,
PERMITTED_ALGO_CFB = ALGO_CIPHER_CFB,
PERMITTED_ALGO_OFB = ALGO_CIPHER_OFB,
PERMITTED_ALGO_ECB_NO_PADDING = ALGO_CIPHER_ECB_NO_PAD,
PERMITTED_ALGO_CBC_NO_PADDING = ALGO_CIPHER_CBC_NO_PAD,
PERMITTED_ALGO_CCM = ALGO_CCM,
PERMITTED_ALGO_GCM = ALGO_GCM,
PERMITTED_ALGO_RSA_PKCS1_V15_SHA224 = ALGO_RSA_PKCS1_V15_SHA224,
PERMITTED_ALGO_RSA_PKCS1_V15_SHA256 = ALGO_RSA_PKCS1_V15_SHA256,
PERMITTED_ALGO_RSA_PKCS1_V15_SHA384 = ALGO_RSA_PKCS1_V15_SHA384,
PERMITTED_ALGO_RSA_PKCS1_V15_SHA512 = ALGO_RSA_PKCS1_V15_SHA512,
PERMITTED_ALGO_RSA_PKCS1_PSS_MGF1_SHA224 = ALGO_RSA_PKCS1_PSS_MGF1_SHA224,
PERMITTED_ALGO_RSA_PKCS1_PSS_MGF1_SHA256 = ALGO_RSA_PKCS1_PSS_MGF1_SHA256,
PERMITTED_ALGO_RSA_PKCS1_PSS_MGF1_SHA384 = ALGO_RSA_PKCS1_PSS_MGF1_SHA384,
PERMITTED_ALGO_RSA_PKCS1_PSS_MGF1_SHA512 = ALGO_RSA_PKCS1_PSS_MGF1_SHA512,
PERMITTED_ALGO_ECDSA_SHA224 = ALGO_ECDSA_SHA224,
PERMITTED_ALGO_ECDSA_SHA256 = ALGO_ECDSA_SHA256,
PERMITTED_ALGO_ECDSA_SHA384 = ALGO_ECDSA_SHA384,
PERMITTED_ALGO_ECDSA_SHA512 = ALGO_ECDSA_SHA512,
PERMITTED_ALGO_HMAC_KDF_SHA256 = ALGO_HMAC_KDF_SHA256,
PERMITTED_ALGO_ALL_CIPHER = ALGO_CIPHER_ALL,
PERMITTED_ALGO_ALL_AEAD = ALGO_ALL_AEAD,
PERMITTED_ALGO_OTH_KEK_CBC = ALGO_CIPHER_KEK_CBC }
• enum hsm\_key\_lifecycle\_t {
HSM_KEY_LIFECYCLE_OPEN = 0x1,
HSM_KEY_LIFECYCLE_CLOSED = 0x2,
HSM_KEY_LIFECYCLE_CLOSED_LOCKED = 0x4 },
HSM_KEY_LIFECYCLE_INVALID = 0xFF }

```

Functions

- [hsm_err_t hsm_delete_key](#) ([hsm_hdl_t](#) key_management_hdl, [op_delete_key_args_t](#) *args)

- [hsm_err_t hsm_get_key_attr](#) ([hsm_hdl_t](#) key_management_hdl, [op_get_key_attr_args_t](#) *args)
- [hsm_err_t hsm_import_key](#) ([hsm_hdl_t](#) key_management_hdl, [op_import_key_args_t](#) *args)
- [hsm_err_t hsm_generate_key](#) ([hsm_hdl_t](#) key_management_hdl, [op_generate_key_args_t](#) *args)
- [hsm_err_t hsm_open_key_management_service](#) ([hsm_hdl_t](#) key_store_hdl, [open_svc_key_management_args_t](#) *args, [hsm_hdl_t](#) *key_management_hdl)
- [hsm_err_t hsm_close_key_management_service](#) ([hsm_hdl_t](#) key_management_hdl)
- [hsm_err_t hsm_manage_key_group](#) ([hsm_hdl_t](#) key_management_hdl, [op_manage_key_group_args_t](#) *args)

The entire key group is cached in the HSM local memory.

3.2.1 Detailed description

3.2.2 Data structure documentation

3.2.2.1 struct op_delete_key_args_t

Structure detailing the delete key operation member arguments.

Data Fields

uint32_t	key_identifier	Identifier of the key to be used for the operation.
hsm_op_delete_key_flags_t	flags	Bitmap specifying the operation properties.

3.2.2.2 struct op_get_key_attr_args_t

Structure describing the get key attribute operation arguments.

Data Fields

uint32_t	key_identifier	Identifier of the key to be used for the operation.
hsm_key_type_t	key_type	Indicates which type of key must be generated.
hsm_bit_key_sz_t	bit_key_sz	Indicates key security size in bits.
hsm_key_lifetime_t	key_lifetime	This attribute comprises of two indicators-key persistence level and location where the key is stored.
hsm_key_usage_t	key_usage	Indicates the cryptographic operations that key can execute.
hsm_permitted_algo_t	permitted_algo	Indicates the key permitted algorithm.
hsm_key_lifecycle_t	lifecycle	Indicates the device lifecycle in which key is usable.

3.2.2.3 struct op_import_key_args_t

Structure detailing the import key operation member arguments.

Data Fields

uint32_t	key_identifier	Identifier of the KEK used to encrypt the key to be imported (Ignored if KEK is not used as set as part of the "flags" field).
uint8_t *	input_lsb_addr	Address in the requester space where: <ul style="list-style-type: none"> • EdgeLock 2GO TLV can be found. • Ignore this field if not <code>E2GO_TLV</code>.
uint32_t	input_size	Size in bytes of: <ul style="list-style-type: none"> • EdgeLock 2GO TLV can be found.

Data Fields...continued

		<ul style="list-style-type: none"> Ignore this field if not E2GO_TLV.
hsm_op_import_key_flags_t	flags	Bitmap specifying the operation properties.
uint16_t	key_group	In case of import key ELE option: <ul style="list-style-type: none"> The imported key group. Ignore this field if it is not the ELE option.

3.2.2.4 struct kek_enc_key_hdr_t

Structure describing the encryption key header.

Data Fields

uint8_t	iv[IV_LENGTH]	-
uint8_t *	key	-
uint32_t	tag	-

3.2.2.5 struct op_generate_key_args_t

Structure describing the generate key operation member arguments.

Data Fields

uint32_t *	key_identifier	Pointer to the identifier of the key to be used for the operation. In case of create operation, the new key identifier is stored in this location.
uint16_t	out_size	Length in bytes of the generated key. It must be 0 in case of symmetric keys.
hsm_op_key_gen_flags_t	flags	Bitmap specifying the operation properties.
hsm_key_type_t	key_type	Indicates which type of key must be generated.
hsm_key_group_t	key_group	Key group of the generated key. It must be a value in the range of 0-99. Keys belonging to the same group can be cached in the HSM local memory through the <code>hsm_manage_key_group</code> API.
uint8_t *	out_key	Pointer to the output area where the generated public key must be written.
uint16_t	exp_out_size	Expected output key buffer size, valid in case of HSM_OUT_TOO_SMALL (0x1D) error code.
hsm_bit_key_sz_t	bit_key_sz	Indicates key security size in bits.
hsm_key_lifecycle_t	key_lifecycle	Defines the key lifecycle in which the key is usable. If it is set to 0, the current key lifecycle is used.
hsm_key_lifetime_t	key_lifetime	This attribute comprises of two indicators-key persistence level and location where the key is stored.
hsm_key_usage_t	key_usage	Indicates the cryptographic operations that the key can execute.
hsm_permitted_algo_t	permitted_algo	Indicates the key permitted algorithm.

3.2.2.6 struct open_svc_key_management_args_t

Structure detailing the key management open service member arguments.

Data Fields

hsm_hdl_t	key_management_hdl	Handle identifying the key management service flow.
hsm_svc_key_management_flags_t	flags	Bitmap specifying the services properties.

3.2.2.7 struct op_manage_key_group_args_t

Data Fields

hsm_key_group_t	key_group	It must be a value in the range of 0-99. Keys belonging to the same group can be cached in the HSM local memory through the <code>hsm_manage_key_group</code> API.
<code>hsm_op_manage_key_group_flags_t</code>	flags	Bitmap specifying the operation properties.
<code>uint8_t</code>	reserved	-

3.2.3 Macro definition documentation

3.2.3.1 HSM_OP_DEL_KEY_FLAGS_STRICT_OPERATION

```
#define HSM_OP_DEL_KEY_FLAGS_STRICT_OPERATION ((hsm_op_delete_key_flags_t) (1u << 7))
```

Bitmap detailing the delete key operation properties.

- Bits 0-4: Reserved.
- Bit 5: Monotonic counter increment.
- Bit 6: Reserved.
- Bit 7: Strict: Request completed - New key written to NVM with updated MC.

3.2.3.2 HSM_KEY_USAGE_ENCRYPT

```
#define HSM_KEY_USAGE_ENCRYPT ((hsm_key_usage_t) (1u << 8))
```

Bit indicating the permission to encrypt a message with the key.

3.2.3.3 HSM_KEY_USAGE_DECRYPT

```
#define HSM_KEY_USAGE_DECRYPT ((hsm_key_usage_t) (1u << 9))
```

Bit indicating the permission to decrypt a message with the key.

3.2.3.4 HSM_KEY_USAGE_SIGN_MSG

```
#define HSM_KEY_USAGE_SIGN_MSG ((hsm_key_usage_t) (1u << 10))
```

Bit indicating the permission to sign a message with the key.

3.2.3.5 HSM_KEY_USAGE_VERIFY_MSG

```
#define HSM_KEY_USAGE_VERIFY_MSG ((hsm_key_usage_t) (1u << 11))
```

Bit indicating the permission to verify a message signature with the key.

3.2.3.6 HSM_KEY_USAGE_SIGN_HASH

```
#define HSM_KEY_USAGE_SIGN_HASH ((hsm_key_usage_t) (1u << 12))
```

Bit indicating the permission to sign a hashed message with the key.

3.2.3.7 HSM_KEY_USAGE_VERIFY_HASH

```
#define HSM_KEY_USAGE_VERIFY_HASH ((hsm_key_usage_t) (1u << 13))
```

Bit indicating the permission to verify a hashed message signature with the key.

3.2.3.8 HSM_KEY_USAGE_DERIVE

```
#define HSM_KEY_USAGE_DERIVE ((hsm_key_usage_t) (1u << 14))
```

Bit indicating the permission to derive other keys from this key.

3.2.3.9 HSM_OP_KEY_GENERATION_FLAGS_STRICT_OPERATION

```
#define HSM_OP_KEY_GENERATION_FLAGS_STRICT_OPERATION ((hsm_op_key_gen_flags_t) (1u << 7))
```

The request is completed only when the new key is written in the NVM. This is applicable for the persistent and permanent keys.

3.2.3.10 HSM_OP_MANAGE_KEY_GROUP_FLAGS_CACHE_LOCKDOWN

```
#define HSM_OP_MANAGE_KEY_GROUP_FLAGS_CACHE_LOCKDOWN ((hsm_op_manage_key_group_flags_t) (1u << 0))
```

The entire key group is cached in the HSM local memory.

3.2.3.11 HSM_OP_MANAGE_KEY_GROUP_FLAGS_EXPORT

```
#define HSM_OP_MANAGE_KEY_GROUP_FLAGS_EXPORT ((hsm_op_manage_key_group_flags_t) (1u << 3))
```

Export the key group.

3.2.3.12 HSM_OP_MANAGE_KEY_GROUP_FLAGS_MONOTONIC

```
#define HSM_OP_MANAGE_KEY_GROUP_FLAGS_MONOTONIC ((hsm_op_manage_key_group_flags_t) (1u << 5))
```

When used in conjunction with the SYNC key group or SYNC key store and storage only, the request is completed only when the monotonic counter is updated.

3.2.3.13 HSM_OP_MANAGE_KEY_GROUP_FLAGS_SYNC_KEYSTORE

```
#define
HSM_OP_MANAGE_KEY_GROUP_FLAGS_SYNC_KEYSTORE ((hsm_op_manage_key_group_flags_t)
(1u << 6))
```

The request is completed only when the update is written in the NVM. Not applicable for cache lockdown/unlock.

3.2.4 Typedef documentation

3.2.4.1 hsm_op_delete_key_flags_t

```
typedef uint8_t hsm\_op\_delete\_key\_flags\_t
```

Bitmap describing the delete key operation properties.

3.2.4.2 hsm_op_import_key_flags_t

```
typedef uint8_t hsm\_op\_import\_key\_flags\_t
```

Bitmap specifying the import key operation supported properties.

- Bit 0: Defines input configuration.
- Bits 1-4: Reserved.
- Bit 5: Monotonic counter increment.
- Bit 6: Reserved.
- Bit 7: Strict.

3.2.4.3 hsm_key_usage_t

```
typedef uint32_t hsm\_key\_usage\_t
```

Bitmap indicating the cryptographic operations that the key can execute.

3.2.4.4 hsm_key_group_t

```
typedef uint16_t hsm\_key\_group\_t
```

Bit field indicating the key group.

3.2.4.5 hsm_key_info_t

```
typedef uint16_t hsm\_key\_info\_t
```

Bit field indicating the key information.

3.2.4.6 hsm_op_key_gen_flags_t

```
typedef uint8_t hsm\_op\_key\_gen\_flags\_t
```

Reserved Bits 0 - 6.

Bitmap specifying the key generate operation supported properties.

3.2.4.7 hsm_svc_key_management_flags_t

```
typedef uint8_t hsm\_svc\_key\_management\_flags\_t
```

Bitmap specifying the key management service supported properties.

3.2.5 Enumeration type documentation

3.2.5.1 hsm_storage_loc_t

```
enum hsm\_storage\_loc\_t
```

Enum indicating the key location indicator.

3.2.5.2 hsm_storage_persist_lvl_t

```
enum hsm\_storage\_persist\_lvl\_t
```

Enum indicating the key persistent level indicator.

3.2.5.3 hsm_key_lifetime_t

```
enum hsm\_key\_lifetime\_t
```

Enum indicating the key lifetime.

3.2.5.4 hsm_pubkey_type_t

```
enum hsm\_pubkey\_type\_t
```

Enum indicating the public key type.

3.2.5.5 hsm_key_type_t

```
enum hsm\_key\_type\_t
```

Enum indicating the key type.

3.2.5.6 hsm_bit_key_sz_t

```
enum hsm\_bit\_key\_sz\_t
```

Enum indicating the key security size in bits.

3.2.5.7 hsm_permitted_algo_t

```
enum hsm\_permitted\_algo\_t
```

Enum describing the permitted algorithm.

Permitted algorithm attribute.

- MAC default algorithms supported
- HMAC truncated permitted algorithm encoding, CMAC truncated permitted algorithm encoding, and Cipher algorithms supported
- AEAD algorithms supported
- Signature algorithms supported

Note: Only one of the previous algorithms could be set.

3.2.5.8 hsm_key_lifecycle_t

```
enum hsm\_key\_lifecycle\_t
```

Enum detailing the permitted key lifecycle.

3.2.6 Function documentation

3.2.6.1 hsm_delete_key()

```
hsm\_err\_t hsm_delete_key (
hsm\_hdl\_t key_management_hdl,
op\_delete\_key\_args\_t * args)
```

This command is designed to perform the following operation:

- Delete an existing key.

Parameters

key_management_hdl	Handle identifying the key management service flow.
args	Pointer to the structure containing the function arguments.

Returns

Error code

3.2.6.2 hsm_get_key_attr()

```
hsm\_err\_t hsm_get_key_attr(
hsm\_hdl\_t key_management_hdl,
op\_get\_key\_attr\_args\_t * args)
```

This command is designed to perform the following operation:

- Get attributes of an existing key.

Parameters

key_management_hdl	Handle identifying the key management service flow.
------------------------------------	---

Parameters...continued

<code>args</code>	Pointer to the structure containing the function arguments.
-------------------	---

Returns

Error code

3.2.6.3 `hsm_import_key()`

```
hsm\_err\_t hsm_import_key (
hsm\_hdl\_t key_management_hdl,
op\_import\_key\_args\_t * args)
```

This API is used to import the key.

Parameters

<code>key_management_hdl</code>	Handle identifying the key management service flow.
<code>args</code>	Pointer to the structure containing the function arguments.

Returns

Error code

3.2.6.4 `hsm_generate_key()`

```
hsm\_err\_t hsm_generate_key (
hsm\_hdl\_t key_management_hdl,
op\_generate\_key\_args\_t * args)
```

Generate a key or a key pair. Only the confidential keys (symmetric and private keys) are stored in the internal key store, while the non-confidential keys (public key) are exported.

The generated key can be stored using a new or existing key identifier with the restriction that an existing key can be replaced only by a key of the same type.

Parameters

<code>key_management_hdl</code>	Handle identifying the key management service flow.
<code>args</code>	Pointer to the structure containing the function arguments.

Returns

Error code

3.2.6.5 `hsm_open_key_management_service()`

```
hsm\_err\_t hsm_open_key_management_service (
hsm\_hdl\_t key_store_hdl,
open\_svc\_key\_management\_args\_t * args,
hsm\_hdl\_t * key_management_hdl )
```

Open a key management service flow.

Users must open this service flow to perform operation on the key store keys (generate, update, delete).

Parameters

<i>key_store_hdl</i>	Handle identifying the key store service flow.
<i>args</i>	Pointer to the structure containing the function arguments.
<i>key_management_hdl</i>	Pointer to where the key management service flow handle must be written.

Returns

Error code.

3.2.6.6 hsm_close_key_management_service()

```
hsm_err_t hsm_close_key_management_service (hsm_hdl_t key_management_hdl)
```

Terminate a previously opened key management service flow.

Parameters

<i>key_management_hdl</i>	Handle identifying the key management service flow.
---------------------------	---

Returns

Error code

3.2.6.7 hsm_manage_key_group()

```
hsm_err_t hsm_manage_key_group (
hsm_hdl_t key_management_hdl,
op_manage_key_group_args_t * args)
```

The entire key group is cached in the HSM local memory.

This command is designed to perform the following operations:

- Lock/Unlock down a key group in the HSM local memory so that the keys are available to the HSM without additional latency.
- Un-lock a key group. HSM may export the key group into the external NVM to free up the local memory as needed.
- Delete an existing key group.

Users can call this function only after having opened a key management service flow.

Parameters

<i>key_management_hdl</i>	Handle identifying the key management service flow.
<i>args</i>	Pointer to the structure containing the function arguments.

Returns

Error code

3.3 Ciphering

Modules

- [i.MX 8ULP](#)

Data Structures

- struct [op_auth_enc_args_t](#)
- struct [open_svc_cipher_args_t](#)
- struct [op_cipher_one_go_args_t](#)

Macros

- #define [HSM_AUTH_ENC_FLAGS_DECRYPT](#) (([hsm_op_auth_enc_flags_t](#))(0u << 0))
- #define [HSM_AUTH_ENC_FLAGS_ENCRYPT](#) (([hsm_op_auth_enc_flags_t](#))(1u << 0))
- #define [HSM_AUTH_ENC_FLAGS_GENERATE_FULL_IV](#) (([hsm_op_auth_enc_flags_t](#))(1u << 1))
- #define [HSM_AUTH_ENC_FLAGS_GENERATE_COUNTER_IV](#) (([hsm_op_auth_enc_flags_t](#))(1u << 2))
- #define [HSM_CIPHER_ONE_GO_FLAGS_DECRYPT](#) (([hsm_op_cipher_one_go_flags_t](#))(0u << 0))
- #define [HSM_CIPHER_ONE_GO_FLAGS_ENCRYPT](#) (([hsm_op_cipher_one_go_flags_t](#))(1u << 0))

Typedefs

- typedef uint8_t [hsm_op_auth_enc_flags_t](#)
- typedef uint8_t [hsm_svc_cipher_flags_t](#)
- typedef uint8_t [hsm_op_cipher_one_go_flags_t](#)

Enumerations

- enum [hsm_op_auth_enc_algo_t](#) {
 HSM_AEAD_ALGO_CCM = ALGO_CCM,
 HSM_AEAD_ALGO_GCM = ALGO_GCM,
 HSM_AEAD_ALGO_ALL_AEAD = ALGO_ALL_AEAD }
- enum [hsm_op_cipher_one_go_algo_t](#) {
 HSM_CIPHER_ONE_GO_ALGO_CTR = ALGO_CIPHER_CTR,
 HSM_CIPHER_ONE_GO_ALGO_CFB = ALGO_CIPHER_CFB,
 HSM_CIPHER_ONE_GO_ALGO_OFB = ALGO_CIPHER_OFB,
 HSM_CIPHER_ONE_GO_ALGO_ECB = ALGO_CIPHER_ECB_NO_PAD,
 HSM_CIPHER_ONE_GO_ALGO_CBC = ALGO_CIPHER_CBC_NO_PAD }

Functions

- [hsm_err_t hsm_do_cipher](#) ([hsm_hdl_t](#) cipher_hdl, [op_cipher_one_go_args_t](#) *cipher_one_go)
- [hsm_err_t hsm_auth_enc](#) ([hsm_hdl_t](#) cipher_hdl, [op_auth_enc_args_t](#) *args)
- [hsm_err_t hsm_open_cipher_service](#) ([hsm_hdl_t](#) key_store_hdl, [open_svc_cipher_args_t](#) *args, [hsm_hdl_t](#) *cipher_hdl)
- [hsm_err_t hsm_cipher_one_go](#) ([hsm_hdl_t](#) cipher_hdl, [op_cipher_one_go_args_t](#) *args)
- [hsm_err_t hsm_close_cipher_service](#) ([hsm_hdl_t](#) cipher_hdl)

3.3.1 Detailed description

3.3.2 Data structure documentation

3.3.2.1 struct op_auth_enc_args_t

Structure describing the authenticated encryption operation arguments.

Data Fields

uint32_t	key_identifier	Identifier of the key to be used for the operation.
uint8_t *	iv	Pointer to the user supplied part of initialization vector or nonce, when applicable, otherwise 0 .
uint16_t	iv_size	Size of the fixed part of the initialization vector.

Data Fields...continued

		<p>For GCM algorithm, it can be:</p> <ul style="list-style-type: none"> • 0 when the full IV is internally generated (RBG-based construction, Bit 1 of “Flags” field). • 4 when the counter IV generation option is used (deterministic construction, Bit 2 of “Flags” field). • 12 when the IV is entirely generated by the user (Bit 1 and Bit 2 of “Flags” field must be set to 0). <p>For CCM algorithm IV size, it must be 12 bytes.</p>
uint8_t *	aad	Pointer to the additional authentication data.
uint16_t	aad_size	Length in bytes of the additional authentication data.
hsm_op_auth_enc_algo_t	ae_algo	Algorithm to be used for the operation.
hsm_op_auth_enc_flags_t	flags	Bitmap specifying the operation attributes.
uint8_t *	input	<p>Pointer to the input area.</p> <ul style="list-style-type: none"> • Plaintext for encryption • Ciphertext + Tag (16 bytes) for decryption
uint8_t *	output	<p>Pointer to the output area.</p> <p>Ciphertext + Tag (16 bytes)</p> <ul style="list-style-type: none"> • IV for encryption • Plaintext for decryption if the Tag is verified
uint32_t	input_size	Length in bytes of the input.
uint32_t	output_size	Length in bytes of the output.
uint32_t	exp_output_size	Expected output buffer size in bytes, valid in case of HSM_OUT_TOO_SMALL (0x1D) error code.

3.3.2.2 struct open_svc_cipher_args_t

Structure describing the open cipher service members.

Data Fields

uint32_t	cipher_hdl	Handle identifying the cipher service flow.
uint8_t	flags	Bitmap specifying the services properties.
uint8_t	reserved[3]	Reserved bits.

3.3.2.3 struct op_cipher_one_go_args_t

Structure describing the cipher one go operation arguments.

Data Fields

uint32_t	key_identifier	Identifier of the key to be used for the operation.
uint8_t *	iv	Pointer to the initialization vector.
uint16_t	iv_size	Length in bytes of the initialization vector. It must be 0 for algorithms not using the initialization vector.
uint8_t	svc_flags	Bitmap specifying the services properties.
uint8_t	flags	Bitmap specifying the operation attributes.
uint32_t	cipher_algo	Algorithm to be used for the operation.

Data Fields...continued

uint8_t *	input	Pointer to the input area: <ul style="list-style-type: none"> Plaintext for encryption Ciphertext for decryption
uint8_t *	output	Pointer to the output area: <ul style="list-style-type: none"> Ciphertext for encryption Plaintext for decryption
uint32_t	input_size	Length in bytes of the input. <ul style="list-style-type: none"> In case of CBC and ECB, the input size should be multiple of a block cipher size (16 bytes).
uint32_t	output_size	Length in bytes of the output.
uint32_t	exp_output_size	Expected output buffer size in bytes, valid in case of (0x1D) error code.

3.3.3 Macro definition documentation

3.3.3.1 HSM_AUTH_ENC_FLAGS_DECRYPT

```
#define HSM_AUTH_ENC_FLAGS_DECRYPT ((hsm_op_auth_enc_flags_t) (0u << 0))
```

Bit indicating the decryption operation.

3.3.3.2 HSM_AUTH_ENC_FLAGS_ENCRYPT

```
#define HSM_AUTH_ENC_FLAGS_ENCRYPT ((hsm_op_auth_enc_flags_t) (1u << 0))
```

Bit indicating the encryption operation.

3.3.3.3 HSM_AUTH_ENC_FLAGS_GENERATE_FULL_IV

```
#define HSM_AUTH_ENC_FLAGS_GENERATE_FULL_IV ((hsm_op_auth_enc_flags_t) (1u << 1))
```

Bit indicating the Full IV is internally generated (only relevant for encryption).

3.3.3.4 HSM_AUTH_ENC_FLAGS_GENERATE_COUNTER_IV

```
#define HSM_AUTH_ENC_FLAGS_GENERATE_COUNTER_IV ((hsm_op_auth_enc_flags_t) (1u << 2))
```

Bit indicating 4 bytes supplied other bytes internally generated (only relevant for encryption).

3.3.3.5 HSM_CIPHER_ONE_GO_FLAGS_DECRYPT

```
#define HSM_CIPHER_ONE_GO_FLAGS_DECRYPT ((hsm_op_cipher_one_go_flags_t) (0u << 0))
```

Bit indicating the decrypt operation.

3.3.3.6 HSM_CIPHER_ONE_GO_FLAGS_ENCRYPT

```
#define HSM_CIPHER_ONE_GO_FLAGS_ENCRYPT ((hsm_op_cipher_one_go_flags_t) (1u << 0))
```

Bit indicating the encrypt operation.

3.3.4 Typedef documentation

3.3.4.1 hsm_op_auth_enc_flags_t

```
typedef uint8_t hsm_op_auth_enc_flags_t
```

Bit field indicating the authenticated encryption operations.

3.3.4.2 hsm_svc_cipher_flags_t

```
typedef uint8_t hsm_svc_cipher_flags_t
```

Bit field describing the open cipher service requested operation.

3.3.4.3 hsm_op_cipher_one_go_flags_t

```
typedef uint8_t hsm_op_cipher_one_go_flags_t
```

Bit field indicating the requested operations.

3.3.5 Enumeration type documentation

3.3.5.1 hsm_op_auth_enc_algo_t

```
enum hsm_op_auth_enc_algo_t
```

Bit field indicating the supported algorithm.

Enumerator

HSM_AEAD_ALGO_CCM	CCM (AES CCM)
HSM_AEAD_ALGO_GCM	GCM (AES GCM)
HSM_AEAD_ALGO_ALL_AEAD	ALL AEAD (ALL AEAD)

3.3.5.2 hsm_op_cipher_one_go_algo_t

```
enum hsm_op_cipher_one_go_algo_t
```

Enum describing the cipher one go operation algorithm.

Enumerator

HSM_CIPHER_ONE_GO_ALGO_CTR	CTR (AES supported).
HSM_CIPHER_ONE_GO_ALGO_CFB	CFB (AES supported).

Enumerator...continued

HSM_CIPHER_ONE_GO_ALGO_OFB	OFB (AES supported).
HSM_CIPHER_ONE_GO_ALGO_ECB	ECB no padding (AES supported).
HSM_CIPHER_ONE_GO_ALGO_CBC	CBC no padding (AES supported).

3.3.6 Function documentation

3.3.6.1 hsm_do_cipher()

```
hsm_err_t hsm_do_cipher (
hsm_hdl_t cipher_hdl,
op_cipher_one_go_args_t * cipher_one_go)
```

Secondary API to perform ciphering operation.

This API does the following operations:

- Opens an Cipher service flow.
- Performs the Ciphering operation.
- Terminates a previously opened Cipher service flow.

Users can call this function only after having opened a cipher service flow.

Parameters

cipher_hdl	Handle identifying the cipher service flow.
cipher_one_go	Pointer to the structure containing the function arguments.

Returns

Error code

3.3.6.2 hsm_auth_enc()

```
hsm_err_t hsm_auth_enc (
hsm_hdl_t cipher_hdl,
op_auth_enc_args_t * args)
```

Perform authenticated encryption operation.

Users can call this function only after having opened a Cipher service flow.

For decryption operations, the full IV is supplied by the caller through the iv and iv_size parameters.

HSM_AUTH_ENC_FLAGS_GENERATE_FULL_IV and HSM_AUTH_ENC_FLAGS_GENERATE_COUNTER_IV flags are ignored.

For encryption operations, either HSM_AUTH_ENC_FLAGS_GENERATE_FULL_IV or HSM_AUTH_ENC_FLAGS_GENERATE_COUNTER_IV must be set when calling this function:

- When HSM_AUTH_ENC_FLAGS_GENERATE_FULL_IV is set, the full IV is internally generated, iv and iv_size must be set to 0.
- When HSM_AUTH_ENC_FLAGS_GENERATE_COUNTER_IV is set, the user supplies a 4 byte fixed part of the IV. The other IV bytes are internally generated.

Parameters

<i>cipher_hdl</i>	Handle identifying the cipher service flow.
<i>args</i>	Pointer to the structure containing the function arguments.

Returns

Error code

3.3.6.3 hsm_open_cipher_service()

```
hsm_err_t hsm_open_cipher_service (
hsm_hdl_t key_store_hdl,
open_svc_cipher_args_t * args,
hsm_hdl_t * cipher_hdl)
```

- Open a Cipher service flow.
- Users can call this function only after having opened a key-store service flow.
- Users must open this service to perform Ciphering operation.

Parameters

<i>key_store_hdl</i>	Handle identifying the key store service flow.
<i>args</i>	Pointer to the structure containing the function arguments.
<i>cipher_hdl</i>	Pointer to where the cipher service flow handle must be written.

Returns

Error code

3.3.6.4 hsm_cipher_one_go()

```
hsm_err_t hsm_cipher_one_go (
hsm_hdl_t cipher_hdl,
op_cipher_one_go_args_t * args)
```

Perform Ciphering operation.

Users can call this function only after having opened a cipher service flow.

Parameters

<i>cipher_hdl</i>	Handle identifying the cipher service flow.
<i>args</i>	Pointer to the structure containing the function arguments.

Returns

Error code

3.3.6.5 hsm_close_cipher_service()

```
hsm_err_t hsm_close_cipher_service (hsm_hdl_t cipher_hdl)
```

Terminate a previously opened Cipher service flow.

Parameters

<code>cipher_hdl</code>	Pointer to handle identifying the Cipher service flow to be closed.
-------------------------	---

Returns

Error code

3.4 Signature generation

Data Structures

- struct `op_pub_key_attest_args_t`
- struct `open_svc_sign_gen_args_t`
- struct [op_generate_sign_args_t](#)
- struct [op_prepare_sign_args_t](#)

Macros

- #define [HSM_OP_GENERATE_SIGN_FLAGS_INPUT_DIGEST](#) (([hsm_op_generate_sign_flags_t](#)) (0u << 0))
- #define [HSM_OP_GENERATE_SIGN_FLAGS_INPUT_MESSAGE](#) (([hsm_op_generate_sign_flags_t](#)) (1u << 0))
- #define [HSM_OP_PREPARE_SIGN_INPUT_DIGEST](#) (([hsm_op_prepare_signature_flags_t](#)) (0u << 0))
Bit indicating input digest.
- #define [HSM_OP_PREPARE_SIGN_INPUT_MESSAGE](#) (([hsm_op_prepare_signature_flags_t](#)) (1u << 0))
Bit indicating input message.
- #define [HSM_OP_PREPARE_SIGN_COMPRESSED_POINT](#) (([hsm_op_prepare_signature_flags_t](#)) (1u << 1))
Bit indicating compressed point.

Typedefs

- typedef uint8_t [hsm_op_generate_sign_flags_t](#)
- typedef uint8_t [hsm_op_prepare_signature_flags_t](#)

Enumerations

- enum [hsm_pub_key_attest_sign_algo_t](#) {
HSM_PKEY_ATTEST_ALGO_CMAC = ALGO_CMAC,
HSM_PKEY_ATTEST_ALGO_ECDSA_SHA224 = ALGO_ECDSA_SHA224,
HSM_PKEY_ATTEST_ALGO_ECDSA_SHA256 = ALGO_ECDSA_SHA256,
HSM_PKEY_ATTEST_ALGO_ECDSA_SHA384 = ALGO_ECDSA_SHA384,
HSM_PKEY_ATTEST_ALGO_ECDSA_SHA512 = ALGO_ECDSA_SHA512 }
- enum [hsm_signature_scheme_id_t](#) {
HSM_SIGNATURE_SCHEME_RSA_PKCS1_V15_SHA224 = 0x06000208,
HSM_SIGNATURE_SCHEME_RSA_PKCS1_V15_SHA256 = 0x06000209,
HSM_SIGNATURE_SCHEME_RSA_PKCS1_V15_SHA384 = 0x0600020A,
HSM_SIGNATURE_SCHEME_RSA_PKCS1_V15_SHA512 = 0x0600020B,
HSM_SIGNATURE_SCHEME_RSA_PKCS1_V15_ANY_HASH = 0x060002FF,
HSM_SIGNATURE_SCHEME_RSA_PKCS1_PSS_MGF1_SHA224 = 0x06000308,
HSM_SIGNATURE_SCHEME_RSA_PKCS1_PSS_MGF1_SHA256 = 0x06000309,
HSM_SIGNATURE_SCHEME_RSA_PKCS1_PSS_MGF1_SHA384 = 0x0600030A,
HSM_SIGNATURE_SCHEME_RSA_PKCS1_PSS_MGF1_SHA512 = 0x0600030B,
HSM_SIGNATURE_SCHEME_RSA_PKCS1_PSS_MGF1_ANY_HASH = 0x060003FF,
HSM_SIGNATURE_SCHEME_ECDSA_ANY = 0x06000600,
HSM_SIGNATURE_SCHEME_ECDSA_SHA224 = 0x06000608,

```
HSM_SIGNATURE_SCHEME_ECDSA_SHA256 = 0x06000609,
HSM_SIGNATURE_SCHEME_ECDSA_SHA384 = 0x0600060A,
HSM_SIGNATURE_SCHEME_ECDSA_SHA512 = 0x0600060B }
```

Functions

- [hsm_err_t hsm_do_sign](#) ([hsm_hdl_t](#) key_store_hdl, [op_generate_sign_args_t](#) *args)
- [hsm_err_t hsm_open_signature_generation_service](#) ([hsm_hdl_t](#) key_store_hdl, [open_svc_sign_gen_args_t](#) *args, [hsm_hdl_t](#) *signature_gen_hdl)
- [hsm_err_t hsm_pub_key_attest](#) ([hsm_hdl_t](#) signature_gen_hdl, [op_pub_key_attest_args_t](#) args)
- [hsm_err_t hsm_close_signature_generation_service](#) ([hsm_hdl_t](#) signature_gen_hdl)
- [hsm_err_t hsm_generate_signature](#) ([hsm_hdl_t](#) signature_gen_hdl, [op_generate_sign_args_t](#) *args)
- [hsm_err_t hsm_prepare_signature](#) ([hsm_hdl_t](#) signature_gen_hdl, [op_prepare_sign_args_t](#) *args)

3.4.1 Detailed description

3.4.2 Data structure documentation

3.4.2.1 struct op_pub_key_attest_args_t

Structure to represent the generate sign operation arguments.

Table 1. Data Fields

uint32_t	key_identifier	Identifier of the key to be attested.
uint32_t	key_attestation_id	Identifier of the key to be used for the attestation.
hsm_pub_key_attest_sign_algo_t	sign_algo	Signature algorithm to be used for the attestation.
uint8_t *	auth_challenge	Pointer to the authentication challenge.
uint32_t	auth_challenge_size	Authentication challenge size in bytes.
uint8_t *	certificate	Pointer to the output certificate encoded as signed TLV buffer.
uint32_t	certificate_size	Certificate size in bytes.
uint32_t	exp_certificate_size	Expected certificate size for output, returned by FW in case of HSM_OUT_TOO_SMALL (0x1D) error.

3.4.2.2 struct open_svc_sign_gen_args_t

Structure to represent the generate sign open service arguments.

Data Fields

hsm_hdl_t	signature_gen_hdl	-
---------------------------	-------------------	---

3.4.2.3 struct op_generate_sign_args_t

Structure to represent the generate sign operation arguments.

Data Fields

uint32_t	key_identifier	Identifier of the key to be used for the operation.
uint8_t *	message	Pointer to the input (message or message digest) to be signed.

Data Fields...continued

uint8_t *	signature	Pointer to the output area where the signature must be stored. The signature S=(r,s) is stored in the format r s Ry where: <ul style="list-style-type: none"> Ry is an additional byte containing the lsb of y. Ry is considered valid only if the HSM_OP_GENERATE_SIGN_FLAGS_COMPRESSED_POINT is set.
uint16_t	signature_size	Length in bytes of the output. After the signature generation operation, this field contains the expected signature buffer size, if the operation fails due to the provided output buffer size being too short.
uint32_t	message_size	Length in bytes of the input.
hsm_signature_scheme_id_t	scheme_id	Identifier of the digital signature scheme to be used for the operation.
uint16_t	salt_len	Salt length in bytes.
uint16_t	exp_signature_size	Expected signature buffer size for output, returned by FW in case the input signature size provided is less than the required size.
hsm_op_generate_sign_flags_t	flags	Bitmap specifying the operation attributes.

3.4.2.4 struct op_prepare_sign_args_t

Structure detailing the prepare signature operation member arguments.

Data Fields

hsm_signature_scheme_id_t	scheme_id	Identifier of the digital signature scheme to be used for the operation.
hsm_op_prepare_signature_flags_t	flags	Bitmap specifying the operation attributes.

3.4.3 Macro definition documentation

3.4.3.1 HSM_OP_GENERATE_SIGN_FLAGS_INPUT_DIGEST

```
#define HSM_OP_GENERATE_SIGN_FLAGS_INPUT_DIGEST ((hsm\_op\_generate\_sign\_flags\_t)
(0u << 0))
```

Bit field indicating the input is the message digest.

3.4.3.2 HSM_OP_GENERATE_SIGN_FLAGS_INPUT_MESSAGE

```
#define HSM_OP_GENERATE_SIGN_FLAGS_INPUT_MESSAGE ((hsm\_op\_generate\_sign\_flags\_t)
(1u << 0))
```

Bit field indicating the input is the actual message.

3.4.4 Typedef documentation

3.4.4.1 hsm_op_generate_sign_flags_t

```
typedef uint8_t hsm\_op\_generate\_sign\_flags\_t
```

Bit field indicating the requested operation.

3.4.4.2 hsm_op_prepare_signature_flags_t

```
typedef uint8_t hsm_op_prepare_signature_flags_t
```

Bitmap specifying the prepare signature operation supported attributes.

3.4.5 Enumeration type documentation

3.4.5.1 hsm_pub_key_attest_sign_algo_t

Enum containing the Signature Algorithms for Public Key Attestation.

Table 2. Enumerator

HSM_PKEY_ATTEST_ALGO_CMAC	CMAC.
HSM_PKEY_ATTEST_ALGO_ECDSA_SHA224	ECDSA SHA224.
HSM_PKEY_ATTEST_ALGO_ECDSA_SHA256	ECDSA SHA256.
HSM_PKEY_ATTEST_ALGO_ECDSA_SHA384	ECDSA SHA384.
HSM_PKEY_ATTEST_ALGO_ECDSA_SHA512	ECDSA SHA512.

3.4.5.2 hsm_signature_scheme_id_t

```
enum hsm_signature_scheme_id_t
```

Bit field indicating the PSA compliant requested operations:

Bits 2-7: Reserved.

3.4.6 Function documentation

3.4.6.1 hsm_do_sign()

```
hsm_err_t hsm_do_sign (
hsm_hdl_t key_store_hdl,
op_generate_sign_args_t * args)
```

Secondary API to generate the signature on the given message.

This API does the following:

- Open a service flow for signature generation.
- Based on the flag to identify the type of message: Digest or actual message, generate the signature using the key corresponding to the key ID.
- Post performing the operation, terminate the previously opened signature-generation service flow.

Users can call this function only after having opened a key-store.

Parameters

key_store_hdl	Handle identifying the current key-store.
args	Pointer to the structure containing the function arguments.

Returns

Error code

3.4.6.2 hsm_do_pub_key_attest()

```
hsm_err_t hsm_do_pub_key_attest (
hsm_hdl_t key_store_hdl,
op_pub_key_attest_args_t * args)
```

Secondary API to attest the public key of an asymmetric key present in the ELE FW key storage (generated or imported).

This API does the following:

- Open a service flow for signature generation.
- Perform the operation to attest the public key of required asymmetric key present in the ELE FW key storage.
- Post performing the operation, and terminate the previously opened signature-generation service flow.

Users can call this function only after opening a key store service flow.

Parameters

<i>key_store_hdl</i>	Handle identifying the key store service flow.
<i>args</i>	Pointer to the structure containing the function arguments.

Returns

Error code

3.4.6.3 hsm_pub_key_attest()

```
hsm_err_t hsm_pub_key_attest (
hsm_hdl_t signature_gen_hdl,
op_pub_key_attest_args_t * args)
```

Attest the public key of an asymmetric key present in the ELE FW key storage. Users can call this function only after having opened a signature generation service flow.

Parameters

<i>signature_gen_hdl</i>	Handle identifying the signature generation service flow.
<i>args</i>	Pointer to the structure containing the function arguments.

Returns

Error code

3.4.6.4 hsm_open_signature_generation_service()

```
hsm_err_t hsm_open_signature_generation_service (
hsm_hdl_t key_store_hdl,
open_svc_sign_gen_args_t * args,
hsm_hdl_t * signature_gen_hdl)
```

- Open a signature generation service flow.
- Users can call this function only after having opened a key store service flow.

- Users must open this service to perform signature generation operations.

Parameters

<code>key_store_hdl</code>	Handle identifying the key store service flow.
<code>args</code>	Pointer to the structure containing the function arguments.
<code>signature_gen_hdl</code>	Pointer to where the signature generation service flow handle must be written.

Returns

Error code

3.4.6.5 hsm_close_signature_generation_service()

```
hsm_err_t hsm_close_signature_generation_service (hsm_hdl_t signature_gen_hdl)
```

Terminate a previously opened signature generation service flow.

Parameters

<code>signature_gen_hdl</code>	Handle identifying the signature generation service flow to be closed.
--------------------------------	--

Returns

Error code

3.4.6.6 hsm_generate_signature()

```
hsm_err_t hsm_generate_signature (
hsm_hdl_t signature_gen_hdl,
op_generate_sign_args_t * args)
```

Generate a digital signature according to the signature scheme.

Users can call this function only after having opened a signature generation service flow.

The signature $S=(r,s)$ is stored in the format `r || s || Ry` where:

- `Ry` is an additional byte containing the lsb of `y`. `Ry` has to be considered valid only if the `HSM_OP_GENERATE_SIGN_FLAGS_COMPRESSED_POINT` is set.

Parameters

<code>signature_gen_hdl</code>	Handle identifying the signature generation service flow.
<code>args</code>	Pointer to the structure containing the function arguments.

Returns

Error code

3.4.6.7 hsm_prepare_signature()

```
hsm_err_t hsm_prepare_signature (
hsm_hdl_t signature_gen_hdl,
op_prepare_sign_args_t * args)
```

Prepare the creation of a signature by pre-calculating the operations having no dependencies on the input message.

The pre-calculated value is stored internally and used once `hsm_generate_signature` is called. Up to 20 pre-calculated values can be stored, and additional preparation operations have no effects.

Users can call this function only after having opened a signature generation service flow.

The signature $S=(r,s)$ is stored in the format `r||s||Ry` where:

- `Ry` is an additional byte containing the lsb of `y`. `Ry` has to be considered valid only if the `HSM_OP_PREPARE_SIGN_COMPRESSED_POINT` is set.

Parameters

<code>signature_gen_hdl</code>	Handle identifying the signature generation service flow.
<code>args</code>	Pointer to the structure containing the function arguments.

Returns

Error code

3.5 Signature verification

Data Structures

- struct [open_svc_sign_ver_args_t](#)
- struct [op_verify_sign_args_t](#)

Macros

- #define [HSM_OP_VERIFY_SIGN_FLAGS_INPUT_DIGEST](#) (([hsm_op_verify_sign_flags_t](#))(0u << 0))
- #define [HSM_OP_VERIFY_SIGN_FLAGS_INPUT_MESSAGE](#) (([hsm_op_verify_sign_flags_t](#))(1u << 0))
- #define [HSM_OP_VERIFY_SIGN_FLAGS_COMPRESSED_POINT](#) (([hsm_op_verify_sign_flags_t](#))(1u << 1))
- #define [HSM_OP_VERIFY_SIGN_FLAGS_KEY_INTERNAL](#) (([hsm_op_verify_sign_flags_t](#))(1u << 2))
- #define [HSM_VERIFICATION_STATUS_SUCCESS](#) (([hsm_verification_status_t](#))(0x5A3CC3A5u))
- #define [HSM_VERIFICATION_STATUS_FAILURE](#) (([hsm_verification_status_t](#))(0x2B4DD4B2u))

Typedefs

- typedef uint32_t [hsm_verification_status_t](#)
- typedef uint8_t [hsm_op_verify_sign_flags_t](#)

Functions

- [hsm_err_t hsm_verify_sign](#) ([hsm_hdl_t](#) session_hdl, [op_verify_sign_args_t](#) *args, [hsm_verification_status_t](#) *verification_status)
- [hsm_err_t hsm_open_signature_verification_service](#) ([hsm_hdl_t](#) session_hdl, [open_svc_sign_ver_args_t](#) *args, [hsm_hdl_t](#) *signature_ver_hdl)
- [hsm_err_t hsm_close_signature_verification_service](#) ([hsm_hdl_t](#) signature_ver_hdl)
- [hsm_err_t hsm_verify_signature](#) ([hsm_hdl_t](#) signature_ver_hdl, [op_verify_sign_args_t](#) *args, [hsm_verification_status_t](#) *status)

3.5.1 Detailed description

3.5.2 Data structure documentation

3.5.2.1 struct open_svc_sign_ver_args_t

Structure to represent verify sign open service arguments.

Data Fields

hsm_hdl_t	sig_ver_hdl	-
---------------------------	-------------	---

3.5.2.2 struct op_verify_sign_args_t

Structure to represent verify signature operation arguments.

Data Fields

uint8_t *	key	Pointer to the public key to be used for the verification. If the <code>HSM_OP_VERIFY_SIGN_FLAGS_KEY_INTERNAL</code> is set, it must point to the key reference returned by the <code>hsm_import_public_key</code> API.
uint8_t *	message	Pointer to the input (message or message digest).
uint8_t *	signature	Pointer to the input signature. The signature $S=(r,s)$ is expected to be in the format <code>r s Ry</code> , where <code>Ry</code> is an additional byte containing the lsb of <code>y</code> . <code>Ry</code> is considered as valid only if the <code>HSM_OP_VERIFY_SIGN_FLAGS_COMPRESSED_POINT</code> is set.
uint16_t	key_size	Length in bytes of the input key.
uint16_t	signature_size	Length in bytes of the output. It must contain one additional byte where to store the <code>Ry</code> .
uint32_t	message_size	Length in bytes of the input message.
hsm_verification_status_t	verification_status	Verification status.
hsm_signature_scheme_id_t	scheme_id	Identifier of the digital signature scheme to be used for the operation.
uint16_t	salt_len	Salt length in bytes.
hsm_bit_key_sz_t	key_sz	Indicates key security size in bits.
hsm_pubkey_type_t	pkey_type	Indicates the public key type.
hsm_op_verify_sign_flags_t	flags	Bitmap specifying the operation attributes.

3.5.3 Macro Definition Documentation

3.5.3.1 HSM_OP_VERIFY_SIGN_FLAGS_INPUT_DIGEST

```
#define HSM_OP_VERIFY_SIGN_FLAGS_INPUT_DIGEST ((hsm\_op\_verify\_sign\_flags\_t) (0u << 0))
```

Verify signature bit indicating input is message digest.

3.5.3.2 HSM_OP_VERIFY_SIGN_FLAGS_INPUT_MESSAGE

```
#define HSM_OP_VERIFY_SIGN_FLAGS_INPUT_MESSAGE ((hsm_op_verify_sign_flags_t) (1u << 0))
```

Verify signature bit indicating input is actual message.

3.5.3.3 HSM_OP_VERIFY_SIGN_FLAGS_COMPRESSED_POINT

```
#define HSM_OP_VERIFY_SIGN_FLAGS_COMPRESSED_POINT ((hsm_op_verify_sign_flags_t) (1u << 1))
```

Verify signature bit indicating input based on signature format.

3.5.3.4 HSM_OP_VERIFY_SIGN_FLAGS_KEY_INTERNAL

```
#define HSM_OP_VERIFY_SIGN_FLAGS_KEY_INTERNAL ((hsm_op_verify_sign_flags_t) (1u << 2))
```

Verify signature bit indicating input is key argument.

3.5.3.5 HSM_VERIFICATION_STATUS_SUCCESS

```
#define HSM_VERIFICATION_STATUS_SUCCESS ((hsm_verification_status_t) (0x5A3CC3A5u))
```

Verify signature response success status.

3.5.3.6 HSM_VERIFICATION_STATUS_FAILURE

```
#define HSM_VERIFICATION_STATUS_FAILURE ((hsm_verification_status_t) (0x2B4DD4B2u))
```

Verify signature response failure status.

3.5.4 Typedef documentation

3.5.4.1 hsm_verification_status_t

```
typedef uint32_t hsm_verification_status_t
```

Bit indicating the response verification status.

3.5.4.2 hsm_op_verify_sign_flags_t

```
typedef uint8_t hsm_op_verify_sign_flags_t
```

Bit indicating the requested operations.

3.5.5 Function documentation

3.5.5.1 hsm_verify_sign()

```
hsm_err_t hsm_verify_sign (
hsm_hdl_t session_hdl,
op_verify_sign_args_t * args,
hsm_verification_status_t * verification_status)
```

Secondary API to verify a message signature.

This API does the following:

- Open a flow for verification of the signature.
- Based on the flag to identify the type of message: Digest or actual message, verification of the signature is done using the public key.
- Post performing the operation, terminate the previously opened signature-verification service flow.

Users can call this function only after having opened a session.

Parameters

<i>session_hdl</i>	Handle identifying the current key-store.
<i>args</i>	Pointer to the structure containing the function arguments.
<i>verification_status</i>	Pointer for storing the verification status.

Returns

Error code

3.5.5.2 hsm_open_signature_verification_service()

```
hsm_err_t hsm_open_signature_verification_service(
hsm_hdl_t session_hdl,
open_svc_sign_ver_args_t * args,
hsm_hdl_t * signature_ver_hdl)
```

Users must open this service to perform signature verification operations. Users can call this function only after opening a session.

Parameters

<i>session_hdl</i>	Handle identifying the current session.
<i>args</i>	Pointer to the structure containing the function arguments.
<i>signature_ver_hdl</i>	Pointer to where the signature verification service flow handle must be written.

Returns

Error code

3.5.5.3 hsm_close_signature_verification_service()

```
hsm_err_t hsm_close_signature_verification_service (hsm_hdl_t signature_ver_hdl)
```

Terminate a previously opened signature verification service flow.

Parameters

<code>signature_ver_hdl</code>	Handle identifying the signature verification service flow to be closed.
--------------------------------	--

Returns

Error code

3.5.5.4 hsm_verify_signature()

```
hsm_err_t hsm_verify_signature (
hsm_hdl_t signature_ver_hdl,
op_verify_sign_args_t * args,
hsm_verification_status_t * status)
```

Verify a digital signature according to the signature scheme. Users can call this function only after opening a signature verification service flow.

The signature S=(r,s) is expected to be in format `r || s || Ry`, where:

- Ry is an additional byte containing the lsb of y. Ry is considered as valid only if the `HSM_OP_VERIFY_SIGN_FLAGS_COMPRESSED_POINT` is set.

Only not-compressed keys (x,y) can be used by this command. Compressed keys can be decompressed by using the dedicated API.

Parameters

<code>signature_ver_hdl</code>	Handle identifying the signature verification service flow.
<code>args</code>	Pointer to the structure containing the function arguments.
<code>status</code>	Pointer to where the verification status must be stored. If the verification succeed, the value <code>HSM_VERIFICATION_STATUS_SUCCESS</code> is returned.

Returns

Error code

3.6 Random number generation

Data Structures

- struct [op_get_random_args_t](#)

Functions

- [hsm_err_t hsm_do_rng](#) ([hsm_hdl_t](#) session_hdl, [op_get_random_args_t](#) *args)
- [hsm_err_t hsm_get_random](#) ([hsm_hdl_t](#) rng_hdl, [op_get_random_args_t](#) *args)

3.6.1 Detailed description

3.6.2 Data structure documentation

3.6.2.1 struct op_get_random_args_t

Structure detailing the get random number operation member arguments.

Data Fields

uint8_t *	output	Pointer to the output area where the random number must be written.
uint32_t	random_size	Length in bytes of the random number to be provided.

3.6.3 Function documentation

3.6.3.1 hsm_do_rng()

```
hsm_err_t hsm_do_rng (
hsm_hdl_t session_hdl,
op_get_random_args_t * args)
```

Secondary API to fetch the Random Number.

This API does the following:

Get a freshly generated random number.

Parameters

session_hdl	Handle identifying the current session.
args	Pointer to the structure containing the function arguments.

Returns

Error code

3.6.3.2 hsm_get_random()

```
hsm_err_t hsm_get_random (
hsm_hdl_t rng_hdl,
op_get_random_args_t * args)
```

Get a freshly generated random number.

Users can call this function only after opening an RNG service flow.

Parameters

rng_hdl	Handle identifying the rng service flow.
args	Pointer to the structure containing the function arguments.

Returns

Error code

3.7 Hashing

Data Structures

- struct [op_hash_one_go_args_t](#)

Macros

- #define HSM_HASH_FLAG_ALLOWED

Enumerations

- enum [hsm_hash_algo_t](#) {
 HSM_HASH_ALGO_SHA_224 = 0x02000008,
 HSM_HASH_ALGO_SHA_256 = 0x02000009,
 HSM_HASH_ALGO_SHA_384 = 0x0200000A,
 HSM_HASH_ALGO_SHA_512 = 0x0200000B }
- enum [hsm_hash_svc_flags_t](#) {
 HSM_HASH_FLAG_ONE_SHOT = 0x1,
 HSM_HASH_FLAG_INIT = 0x2,
 HSM_HASH_FLAG_UPDATE = 0x4,
 HSM_HASH_FLAG_FINAL = 0x8,
 HSM_HASH_FLAG_GET_CONTEXT = 0x80 }

Functions

- [hsm_err_t hsm_do_hash](#) ([hsm_hdl_t](#) session_hdl, [op_hash_one_go_args_t](#) *args)
- [hsm_err_t hsm_hash_one_go](#) ([hsm_hdl_t](#) hash_hdl, [op_hash_one_go_args_t](#) *args)

3.7.1 Detailed description

3.7.2 Data structure documentation

3.7.2.1 struct [op_hash_one_go_args_t](#)

Structure describing the hash one go operation arguments.

Data Fields

uint8_t *	msb	Pointer to the MSB of address in the requester space where buffers can be found, must be 0 until supported.
uint8_t *	ctx	Pointer to the context.
uint8_t *	input	Pointer to the input data to be hashed.
uint8_t *	output	Pointer to the output area where the resulting digest must be written.
uint32_t	input_size	Length in bytes of the input.
uint32_t	output_size	Length in bytes of the output.
hsm_hash_algo_t	algo	Hash algorithm to be used for the operation.
hsm_hash_svc_flags_t	svc_flags	Flags identifying the operation <code>init()</code> <code>update()</code> , <code>final()</code> , or one shot operation.
uint16_t	ctx_size	Size of context buffer in bytes, ignored in case of one shot operation.
uint32_t	exp_output_size	Expected output digest buffer size, returned by FW in case the provided output size is incorrect.
uint16_t	context_size	Expected context size to allocate in bytes, if flag Get context size is set or provided context size is incorrect.

3.7.3 Macro definition documentation

3.7.3.1 HSM_HASH_FLAG_ALLOWED

```
#define HSM_HASH_FLAG_ALLOWED
```

```
Value: (HSM_HASH_FLAG_ONE_SHOT | HSM_HASH_FLAG_INIT \
        | HSM_HASH_FLAG_UPDATE | HSM_HASH_FLAG_FINAL \
        | HSM_HASH_FLAG_GET_CONTEXT)
```

Bitmap indicating the allowed hash service operations.

3.7.4 Enumeration type documentation

3.7.4.1 hsm_hash_algo_t

```
enum hsm_hash_algo_t
```

Bitmap indicating the supported hash algorithm.

3.7.4.2 hsm_hash_svc_flags_t

```
enum hsm_hash_svc_flags_t
```

Bit field indicating the hash service operations.

3.7.5 Function documentation

3.7.5.1 hsm_do_hash()

```
hsm_err_t hsm_do_hash (
    hsm_hdl_t session_hdl,
    op_hash_one_go_args_t * args)
```

Secondary API to digest a message.

This API performs hash.

Parameters

<i>session_hdl</i>	Handle identifying the current session.
<i>args</i>	Pointer to the structure containing the function arguments.

Returns

Error code

3.7.5.2 hsm_hash_one_go()

```
hsm_err_t hsm_hash_one_go (
    hsm_hdl_t hash_hdl,
    op_hash_one_go_args_t * args)
```

Perform the hash operation on a given input.

Users can call this function only after opening a hash service flow.

Parameters

<i>hash_hdl</i>	Handle identifying the hash service flow.
<i>args</i>	Pointer to the structure containing the function arguments.

Returns

Error code

3.8 Data storage

Data Structures

- struct [open_svc_data_storage_args_t](#)
- struct [op_data_storage_args_t](#)
- struct [op_enc_data_storage_args_t](#)

Macros

- #define HSM_OP_DATA_STORAGE_FLAGS_EL2GO (([hsm_op_data_storage_flags_t](#)) (1u << 0))
- #define HSM_OP_DATA_STORAGE_FLAGS_DEFAULT (([hsm_op_data_storage_flags_t](#)) (0u << 0))

Store data.

- #define HSM_OP_DATA_STORAGE_FLAGS_STORE (([hsm_op_data_storage_flags_t](#)) (1u << 1))

Retrieve data.

- #define HSM_OP_DATA_STORAGE_FLAGS_RETRIEVE (([hsm_op_data_storage_flags_t](#)) (0u << 1))
- #define [ENC_DATA_TLV_DEV_UUID_TAG](#) 0x41u
- #define [ENC_DATA_TLV_IV_TAG](#) 0x45u
- #define [ENC_DATA_TLV_ENC_DATA_TAG](#) 0x46u
- #define [ENC_DATA_TLV_SIGN_TAG](#) 0x5Eu
- #define [ENC_DATA_TLV_DEV_UUID_TAG_LEN](#) 0x01u
- #define [ENC_DATA_TLV_IV_TAG_LEN](#) 0x01u
- #define [ENC_DATA_TLV_ENC_DATA_TAG_LEN](#) 0x01u
- #define [ENC_DATA_TLV_SIGN_TAG_LEN](#) 0x01u
- #define HSM_OP_ENC_DATA_STORAGE_FLAGS_RANDOM_IV (([hsm_op_enc_data_storage_flags_t](#)) (1u << 0))

Internally generate random IV, if needed for operation.

- #define HSM_OP_ENC_DATA_STORAGE_FLAGS_READ_ONCE (([hsm_op_enc_data_storage_flags_t](#)) (1u << 1))

Read once, and delete data from NVM after retrieve.

Typedefs

- typedef uint8_t [hsm_svc_data_storage_flags_t](#)
- typedef uint8_t [hsm_op_data_storage_flags_t](#)
- typedef uint16_t [hsm_op_enc_data_storage_flags_t](#)

Functions

- [hsm_err_t hsm_data_ops](#) ([hsm_hdl_t](#) key_store_hdl, [op_data_storage_args_t](#) *args)
- [hsm_err_t hsm_enc_data_ops](#) ([hsm_hdl_t](#) key_store_hdl, [op_enc_data_storage_args_t](#) *args)

- [hsm_err_t hsm_open_data_storage_service](#) ([hsm_hdl_t](#) key_store_hdl, [open_svc_data_storage_args_t](#) *args, [hsm_hdl_t](#) *data_storage_hdl)
- [hsm_err_t hsm_data_storage](#) ([hsm_hdl_t](#) data_storage_hdl, [op_data_storage_args_t](#) *args)
- [hsm_err_t hsm_enc_data_storage](#) ([hsm_hdl_t](#) data_storage_hdl, [op_enc_data_storage_args_t](#) *args)
- [uint8_t decode_enc_data_tlv](#) ([op_data_storage_args_t](#) *args)
- [hsm_err_t hsm_close_data_storage_service](#) ([hsm_hdl_t](#) data_storage_hdl)

3.8.1 Detailed description

3.8.2 Data structure documentation

3.8.2.1 struct open_svc_data_storage_args_t

Structure specifying the data storage open service member arguments.

Data Fields

hsm_hdl_t	data_storage_handle	Data storage handle.
hsm_svc_data_storage_flags_t	flags	Bitmap specifying the services properties.
uint8_t	reserved[3]	-

3.8.2.2 struct op_data_storage_args_t

Structure detailing the data storage operation member arguments.

Data Fields

uint8_t *	data	Pointer to the data. In case of store request, it is the input data to store. In case of retrieve, it is the pointer where to load data.
uint32_t	data_size	Length in bytes of the data.
uint32_t	data_id	ID of the data.
hsm_op_data_storage_flags_t	flags	Flags bitmap specifying the operation attributes.
hsm_svc_data_storage_flags_t	svc_flags	Bitmap specifying the services properties.
uint16_t	uuid_len	Device UUID length in bytes. In case of retrieve, if the data retrieved is in the TLV format, which was stored by Encrypted Data Storage API, the TLV format data is decoded to fill the following fields. Memory for storing uuid/iv/ciphertext/payload/signature is allocated by the HSM library. Caller of the function decode_enc_data_tlv() , needs to ensure freeing up memory.
uint8_t *	uuid	Device UUID.
uint16_t	iv_len	IV length in bytes if needed, otherwise 0 .
uint8_t *	iv	IV buffer, if needed.
uint32_t	ciphertext_len	Encrypted text length in bytes.
uint8_t *	ciphertext	Encrypted text buffer.
uint32_t	payload_len	Payload length in bytes.
uint8_t *	payload	Payload data buffer to verify signature.
uint16_t	signature_len	Signature length in bytes.

Data Fields...continued

uint8_t *	signature	Signature buffer.
uint32_t	exp_output_size	Expected output buffer size in bytes, valid in case of HSM_OUT_TOO_SMALL (0x1D) error code.

3.8.2.3 struct op_enc_data_storage_args_t

Data Fields

uint32_t	data_id	ID of the data.
uint8_t *	data	Pointer to the data, to be encrypted and signed.
uint32_t	data_size	Length in bytes of the data.
uint32_t	enc_algo	Cipher algorithm to be used for encryption of data.
uint32_t	enc_key_id	Identifier of the key to be used for encryption.
uint32_t	sign_algo	Signature algorithm to be used for signing the data.
uint32_t	sign_key_id	Identifier of the key to be used for signing.
uint8_t *	iv	Pointer to the IV buffer.
uint16_t	iv_size	IV size in bytes.
hsm_op_enc_data_storage_flags_t	flags	Bitmap specifying the operation attributes.
hsm_svc_data_storage_flags_t	svc_flags	Bitmap specifying the service attributes.
uint16_t	lifecycle	Bitmask of device lifecycle, in which the data can be retrieved.
uint32_t	out_data_size	Size (bytes) of the signed TLV stored, received with API resp.

3.8.3 Macro definition documentation

3.8.3.1 ENC_DATA_TLV_DEV_UUID_TAG

```
#define ENC_DATA_TLV_DEV_UUID_TAG 0x41u
```

Encrypted Data TLV Tags.

3.8.3.2 ENC_DATA_TLV_DEV_UUID_TAG_LEN

```
#define ENC_DATA_TLV_DEV_UUID_TAG_LEN 0x01u
```

Encrypted Data TLV Tags lengths.

3.8.4 Typedef documentation

3.8.4.1 hsm_svc_data_storage_flags_t

```
typedef uint8_t hsm\_svc\_data\_storage\_flags\_t
```

Bitmap specifying the data storage open service supported properties.

3.8.4.2 hsm_op_data_storage_flags_t

```
typedef uint8_t hsm_op_data_storage_flags_t
```

Bitmap specifying the data storage operation supported attributes.

3.8.4.3 hsm_op_enc_data_storage_flags_t

```
typedef uint16_t hsm_op_enc_data_storage_flags_t
```

Bitmap specifying the encrypted data storage operation supported attributes.

3.8.5 Function Documentation

3.8.5.1 hsm_data_ops()

```
hsm_err_t hsm_data_ops (
hsm_hdl_t key_store_hdl,
op_data_storage_args_t * args)
```

Secondary API to store and retrieve data from the Linux filesystem managed by EdgeLock Enclave Firmware.

This API does the following:

- Open a data storage service Flow.
- Based on the flag for operation attribute: Store or Retrieve
 - Store the data.
 - Retrieve the data, from the non-volatile storage.
- Post performing the operation, terminate the previously opened data-storage service flow.

Users can call this function only after opening a key-store.

Parameters

<i>key_store_hdl</i>	Handle identifying the current key-store.
<i>args</i>	Pointer to the structure containing the function arguments.

Returns

Error code

3.8.5.2 hsm_enc_data_ops()

```
hsm_err_t hsm_enc_data_ops (
hsm_hdl_t key_store_hdl,
op_enc_data_storage_args_t * args)
```

Secondary API to store the encrypted and signed data in NVM.

This API does the following:

- Open a data storage service Flow.
- Store the encrypted and signed data in NVM. The stored data can be retrieved through Data Storage API.
- Post performing the operation, terminate the previously opened data-storage service flow.

Users can call this function only after having opened a key-store.

Parameters

<code>key_store_hdl</code>	Handle identifying the current key-store.
<code>args</code>	Pointer to the structure containing the function arguments.

Returns

Error code

3.8.5.3 hsm_open_data_storage_service()

```
hsm_err_t hsm_open_data_storage_service (
hsm_hdl_t key_store_hdl,
open_svc_data_storage_args_t * args,
hsm_hdl_t * data_storage_hdl)
```

Open a data storage service flow.

Users must open this service flow to store/retrieve generic data in/from the HSM.

Parameters

<code>key_store_hdl</code>	Handle identifying the key store service flow.
<code>args</code>	Pointer to the structure containing the function arguments.
<code>data_storage_hdl</code>	Pointer to where the data storage service flow handle must be written.

Returns

Error code.

3.8.5.4 hsm_data_storage()

```
hsm_err_t hsm_data_storage (
hsm_hdl_t data_storage_hdl,
op_data_storage_args_t * args)
```

Store or retrieve generic data identified by a `data_id`.

Parameters

<code>data_storage_hdl</code>	Handle identifying the data storage service flow.
<code>args</code>	Pointer to the structure containing the function arguments.

Returns

Error code

3.8.5.5 hsm_enc_data_storage()

```
hsm_err_t hsm_enc_data_storage (
hsm_hdl_t data_storage_hdl,
op_enc_data_storage_args_t * args)
```

Store encrypted and signed data in the NVM.

Parameters

<i>data_storage_hdl</i>	Handle identifying the data storage service flow.
<i>args</i>	Pointer to the structure containing the function arguments.

Returns

Error code

3.8.5.6 decode_enc_data_tlv()

```
uint8_t decode_enc_data_tlv (op_data_storage_args_t * args)
```

Decode and populate the data storage op args for Encrypted Data TLV fields.

Parameters

<i>args</i>	Pointer to the structure containing Retrieved Encrypted Data TLV buffer and to be populated with decoded data from TLV.
-------------	---

ReturnsError code **0** for success**3.8.5.7 hsm_close_data_storage_service()**

```
hsm_err_t hsm_close_data_storage_service (
hsm_hdl_t data_storage_hdl)
```

Terminate a previously opened data storage service flow

Parameters

<i>data_storage_hdl</i>	Handle identifying the data storage service flow.
-------------------------	---

Returns

Error code

3.9 Authenticated encryption**Functions**

- [hsm_err_t hsm_do_auth_enc \(hsm_hdl_t key_store_hdl, op_auth_enc_args_t *auth_enc_args\)](#)

3.9.1 Detailed description**3.9.2 Function documentation****3.9.2.1 hsm_do_auth_enc()**

```
hsm_err_t hsm_do_auth_enc (
hsm_hdl_t key_store_hdl,
op_auth_enc_args_t * auth_enc_args)
```

Secondary API to perform Authenticated Encryption.

This API does the following:

- Opens Cipher service flow.
- Perform authenticated encryption operation.
- Terminates the previously opened Cipher service flow.

Users can call this function only after opening a key store service flow.

Parameters

<code>key_store_hdl</code>	Handle identifying the key store service flow.
<code>auth_enc_args</code>	Pointer to the structure containing the function arguments.

Returns

Error code

3.10 MAC

Data Structures

- struct [open_svc_mac_args_t](#)
- struct [op_mac_one_go_args_t](#)

Macros

- #define [HSM_OP_MAC_ONE_GO_FLAGS_MAC_VERIFICATION](#) (([hsm_op_mac_one_go_flags_t](#)) (0u << 0))
- #define [HSM_OP_MAC_ONE_GO_FLAGS_MAC_GENERATION](#) (([hsm_op_mac_one_go_flags_t](#))(1u << 0))
- #define [HSM_MAC_VERIFICATION_STATUS_SUCCESS](#) (([hsm_mac_verification_status_t](#)) (0x6C1AA1C6u))

Typedefs

- typedef uint8_t [hsm_op_mac_one_go_flags_t](#)
- typedef uint32_t [hsm_mac_verification_status_t](#)
- typedef [hsm_permitted_algo_thsm_op_mac_one_go_algo_t](#)

Functions

- [hsm_err_t hsm_do_mac](#) ([hsm_hdl_t](#) key_store_hdl, [op_mac_one_go_args_t](#) *mac_one_go)
- [hsm_err_t hsm_open_mac_service](#) ([hsm_hdl_t](#) key_store_hdl, [open_svc_mac_args_t](#) *args, [hsm_hdl_t](#) *mac_hdl)
- [hsm_err_t hsm_mac_one_go](#) ([hsm_hdl_t](#) mac_hdl, [op_mac_one_go_args_t](#) *args, [hsm_mac_verification_status_t](#) *status)
- [hsm_err_t hsm_close_mac_service](#) ([hsm_hdl_t](#) mac_hdl)

3.10.1 Detailed description

3.10.2 Data structure documentation

3.10.2.1 struct open_svc_mac_args_t

Structure describing the MAC open service member arguments.

Data Fields

hsm_hdl_t	mac_serv_hdl	Indicates the MAC handle.
---------------------------	--------------	---------------------------

3.10.2.2 struct op_mac_one_go_args_t

Structure describing the MAC one go operation member arguments.

Data Fields

uint32_t	key_identifier	Identifier of the key to be used for the operation.
hsm_op_mac_one_go_algo_t	algorithm	Algorithm to be used for the operation.
hsm_op_mac_one_go_flags_t	flags	Bitmap specifying the operation attributes.
uint8_t *	payload	Pointer to the payload area.
uint8_t *	mac	Pointer to the tag area.
uint32_t	payload_size	Length in bytes of the payload.
uint16_t	mac_size	Length of the tag. <ul style="list-style-type: none"> • Specified in bytes if HSM_OP_MAC_ONE_GO_FLAGS_MAC_LENGTH_IN_BITS is clear. • Specified in bits when HSM_OP_MAC_ONE_GO_FLAGS_MAC_LENGTH_IN_BITS is set. <ul style="list-style-type: none"> – When specified in bytes, the MAC size cannot be less than 4 bytes. – When specified in bits, the MAC size cannot be less than: <ul style="list-style-type: none"> – The key specific min_mac_len setting if specified for this key when generated/injected. – The min_mac_length value if specified at the key store provisioning. (If a key specific setting is not specified at key generation/injection). – The default value (32 bit) if a minimum value is not specified using one of the 2 methods above.
hsm_mac_verification_status_t	verification_status	MAC verification status.
uint16_t	exp_mac_size	Expected MAC size for output, returned by FW in case the MAC size provided is less than the expected MAC size calculated from MAC algorithm.

3.10.3 Macro definition documentation

3.10.3.1 HSM_OP_MAC_ONE_GO_FLAGS_MAC_VERIFICATION

```
#define HSM_OP_MAC_ONE_GO_FLAGS_MAC_VERIFICATION ((hsm\_op\_mac\_one\_go\_flags\_t) (0u << 0))
```

Bit indicating MAC one go verification operation.

3.10.3.2 HSM_OP_MAC_ONE_GO_FLAGS_MAC_GENERATION

```
#define HSM_OP_MAC_ONE_GO_FLAGS_MAC_GENERATION ((hsm\_op\_mac\_one\_go\_flags\_t) (1u << 0))
```

Bit indicating MAC one go generate operation.

3.10.3.3 HSM_MAC_VERIFICATION_STATUS_SUCCESS

```
#define HSM_MAC_VERIFICATION_STATUS_SUCCESS ((hsm_mac_verification_status_t)
(0x6C1AA1C6u))
```

Bit indicating MAC verification success status.

3.10.4 Typedef documentation

3.10.4.1 hsm_op_mac_one_go_flags_t

```
typedef uint8_t hsm_op_mac_one_go_flags_t
```

Bitmap describing the MAC one go operation.

3.10.4.2 hsm_mac_verification_status_t

```
typedef uint32_t hsm_mac_verification_status_t
```

Bitmap describing the MAC verification status.

3.10.4.3 hsm_op_mac_one_go_algo_t

```
typedef hsm_permitted_algo_t hsm_op_mac_one_go_algo_t
```

Bitmap describing the MAC one go operation permitted algorithm.

The following three permitted algos are allowed:

- PERMITTED_ALGO_HMAC_SHA256 = 0x03800009
- PERMITTED_ALGO_HMAC_SHA384 = 0x0380000A
- PERMITTED_ALGO_CMAC = 0x03C00200

3.10.5 Function documentation

3.10.5.1 hsm_do_mac()

```
hsm_err_t hsm_do_mac (
hsm_hdl_t key_store_hdl,
op_mac_one_go_args_t * mac_one_go)
```

Secondary API to perform MAC operation.

This API does the following:

- Open an MAC Service Flow.
- Perform MAC operation.
- Terminate a previously opened MAC service flow.

Users can call this function only after opening a key store service flow.

Parameters

<i>key_store_hdl</i>	Handle identifying the key store service flow.
----------------------	--

Parameters...continued

<code>mac_one_go</code>	Pointer to the structure containing the function arguments.
-------------------------	---

Returns

Error code

3.10.5.2 hsm_open_mac_service()

```
hsm_err_t hsm_open_mac_service (
hsm_hdl_t key_store_hdl,
open_svc_mac_args_t * args,
hsm_hdl_t * mac_hdl)
```

Open a MAC service flow.

Users can call this function only after opening a key store service flow.

Users must open this service to perform MAC operation.

Parameters

<code>key_store_hdl</code>	Handle identifying the key store service flow.
<code>args</code>	Pointer to the structure containing the function arguments.
<code>mac_hdl</code>	Pointer to where the MAC service flow handle must be written.

Returns

Error code

3.10.5.3 hsm_mac_one_go()

```
hsm_err_t hsm_mac_one_go (
hsm_hdl_t mac_hdl,
op_mac_one_go_args_t * args,
hsm_mac_verification_status_t * status)
```

Perform MAC operation.

Users can call this function only after opening a MAC service flow.

For CMAC algorithm, a key of type `HSM_KEY_TYPE_AES_XXX` must be used.

For HMAC algorithm, a key of type `HSM_KEY_TYPE_HMAC_XXX` must be used.

For MAC verification operations, the verified MAC length can be specified in:

- Bits by setting the `HSM_OP_MAC_ONE_GO_FLAGS_MAC_LENGTH_IN_BITS` flag.
- If this flag is clear, the `mac_length` is specified in bytes.

For MAC generation operations:

- MAC length must be set in bytes.
- `HSM_OP_MAC_ONE_GO_FLAGS_MAC_LENGTH_IN_BITS` flag must be **0**.

Parameters

<code>mac_hdl</code>	Handle identifying the MAC service flow.
<code>args</code>	Pointer to the structure containing the function arguments.

Parameters...continued

<code>status</code>	Pointer for storing the verification status.
---------------------	--

Returns

Error code

3.10.5.4 `hsm_close_mac_service()`

```
hsm_err_t hsm_close_mac_service (hsm_hdl_t mac_hdl)
```

Terminate a previously opened MAC service flow.

Parameters

<code>mac_hdl</code>	Pointer to handle identifying the MAC service flow to be closed.
----------------------	--

Returns

Error code

3.11 Dump firmware log

Data Structures

- struct [op_debug_dump_args_t](#)

Functions

- [hsm_err_t dump_firmware_log \(hsm_hdl_t session_hdl\)](#)

3.11.1 Detailed description

3.11.2 Data structure documentation

3.11.2.1 struct `op_debug_dump_args_t`

Structure detailing the debug dump operation member arguments.

Data Fields

<code>bool</code>	<code>is_dump_pending</code>	-
<code>uint32_t</code>	<code>dump_buf_len</code>	-
<code>uint32_t</code>	<code>dump_buf[MAC_BUFF_LEN]</code>	-

3.11.3 Function documentation

3.11.3.1 `dump_firmware_log()`

```
hsm_err_t dump_firmware_log (hsm_hdl_t session_hdl)
```

This command is designed to dump the firmware logs.

Parameters

<code>session_hdl</code>	Handle identifying the session handle.
--------------------------	--

Returns

Error code

3.12 Dev attest

Data Structures

- struct [op_dev_attest_args_t](#)

Macros

- #define [DEV_ATTEST_NOUNCE_SIZE_V1](#) (4)
- #define [DEV_ATTEST_NOUNCE_SIZE_V2](#) (16)

Functions

- [hsm_err_t hsm_dev_attest](#) ([hsm_hdl_t](#) sess_hdl, [op_dev_attest_args_t](#) *args)

3.12.1 Detailed description

3.12.2 Data structure documentation

3.12.2.1 struct op_dev_attest_args_t

Structure describing the device attestation operation member arguments. Memory for storing uid/sha_rom_patch/sha_fw/signature is allocated by the HSM library. Caller of the function [hsm_dev_attest\(\)](#) needs to ensure freeing up memory.

Data Fields

<code>uint16_t</code>	<code>soc_id</code>	SoC ID.
<code>uint16_t</code>	<code>soc_rev</code>	SoC Revision.
<code>uint16_t</code>	<code>lmda_val</code>	Lmda Lifecycle value.
<code>uint8_t</code>	<code>ssm_state</code>	Security Subsystem State Machine state.
<code>uint8_t</code>	<code>uid_sz</code>	Buffer size in bytes for Chip Unique Identifier.
<code>uint8_t *</code>	<code>uid</code>	Pointer to the Chip Unique Identifier buffer.
<code>uint16_t</code>	<code>rom_patch_sha_sz</code>	Buffer size in bytes for SHA256 of Sentinel ROM patch fuses.
<code>uint16_t</code>	<code>sha_fw_sz</code>	Buffer size in bytes for the first 256 bits of installed FW SHA.
<code>uint8_t *</code>	<code>sha_rom_patch</code>	Pointer to the buffer containing SHA256 of Sentinel ROM patch fuses.
<code>uint8_t *</code>	<code>sha_fw</code>	Pointer to the buffer containing first 256 bits of installed FW SHA.
<code>uint16_t</code>	<code>nounce_sz</code>	Buffer size in bytes for request nounce value.
<code>uint8_t *</code>	<code>nounce</code>	Pointer to the input/request nounce value buffer.
<code>uint16_t</code>	<code>rsp_nounce_sz</code>	Size in bytes for FW nounce buffer, returned with FW resp.
<code>uint8_t *</code>	<code>rsp_nounce</code>	Pointer to the FW nounce buffer, returned with FW resp.
<code>uint16_t</code>	<code>oem_srkh_sz</code>	Buffer size in bytes for OEM SRKH (version 2).
<code>uint8_t *</code>	<code>oem_srkh</code>	Pointer to the buffer of OEM SRKH (version 2).
<code>uint8_t</code>	<code>imem_state</code>	IMEM state (version 2).

Data Fields...continued

uint8_t	csal_state	CSAL state (version 2).
uint8_t	trng_state	TRNG state (version 2).
uint16_t	info_buf_sz	Size in bytes for info buffer.
uint8_t *	info_buf	Pointer to the info buffer, for verification of the signature.
uint8_t	attest_result	Attest Result. 0 means pass. 1 means fail.
uint16_t	sign_sz	Buffer size in bytes for signature.
uint8_t *	signature	Pointer to the signature buffer.

3.12.3 Macro definition documentation

3.12.3.1 DEV_ATTEST_NOUNCE_SIZE_V1

```
#define DEV_ATTEST_NOUNCE_SIZE_V1 (4)
```

Device Attestation Nounce sizes.

3.12.4 Function documentation

3.12.4.1 hsm_dev_attest()

```
hsm_err_t hsm_dev_attest (
hsm_hdl_t sess_hdl,
op_dev_attest_args_t * args)
```

Perform device attestation operation.

Users can call this function only after opening the session.

Parameters

sess_hdl	Handle identifying the active session.
args	Pointer to the structure containing the function arguments.

Returns

Error code

3.13 Dev Info

Data Structures

- struct [op_dev_getinfo_args_t](#)

Enumerations

- enum [hsm_lmda_val_t](#) {
 - HSM_LMDA_OEM_OPEN = 0x10,
 - HSM_LMDA_OEM_CLOSED = 0x40,
 - HSM_LMDA_OEM_LOCKED = 0x200 }

Functions

- [hsm_err_t hsm_dev_getinfo](#) ([hsm_hdl_t](#) sess_hdl, [op_dev_getinfo_args_t](#) *args)
- [hsm_key_lifecycle_t hsm_get_lc_from_lmda](#) ([hsm_lmda_val_t](#) lmda_val)

3.13.1 Detailed description

3.13.2 Data structure documentation

3.13.2.1 struct op_dev_getinfo_args_t

Structure detailing the device getinfo operation member arguments. Memory for storing uid/sha_rom_patch/sha_fw/signature is allocated by the HSM library. Caller of the function [hsm_dev_getinfo\(\)](#) needs to ensure freeing up memory.

Data Fields

uint16_t	soc_id	SoC ID.
uint16_t	soc_rev	SoC revision number.
uint16_t	lmda_val	Indicates the lmda lifecycle value.
uint8_t	ssm_state	Security subsystem state machine.
uint8_t	uid_sz	Chip unique identifier size.
uint8_t *	uid	Pointer to the chip unique identifier.
uint16_t	rom_patch_sha_sz	Indicates the size of SHA256 of sentinel ROM patch fuses.
uint16_t	sha_fw_sz	Indicates the size of first 256 bits of installed FW SHA.
uint8_t *	sha_rom_patch	Pointer to the SHA256 of sentinel ROM patch fuses digest.
uint8_t *	sha_fw	Pointer to the first 256 bits of installed FW SHA digest.
uint16_t	oem_srkh_sz	Indicates the size of FW OEM SRKH.
uint8_t *	oem_srkh	Pointer to the FW OEM SRKH.
uint8_t	imem_state	Indicates the IMEM state.
uint8_t	csal_state	Crypto Lib random context initialization state.
uint8_t	trng_state	Indicates TRNG state.

3.13.2.2 hsm_lmda_val_t

```
hsm_lmda_val_t enum hsm_lmda_val_t
```

LMDA values.

Enumerator

HSM_LMDA_OEM_OPEN	LMDA value for OEM Open state LMDA value for OEM Closed state.
HSM_LMDA_OEM_CLOSED	LMDA value for OEM Locked state.

3.13.3 Function documentation

3.13.3.1 hsm_dev_getinfo()

```
hsm_err_t hsm_dev_getinfo (
```

```
hsm_hdl_t sess_hdl,
op_dev_getinfo_args_t * args)
```

Perform the device attestation operation.

Users can call this function only after opening the session.

Parameters

<i>sess_hdl</i>	Handle identifying the active session.
<i>args</i>	Pointer to the structure containing the function arguments.

Returns

Error code

3.13.3.2 hsm_get_lc_from_lmda()

```
hsm_key_lifecycle_t hsm_get_lc_from_lmda (hsm_lmda_val_t lmda_val)
```

Returns the lifecycle value corresponding to the given LMDA value.

Parameters

<i>lmda_val</i>	LMDA value.
-----------------	-------------

Returns

LC Lifecycle value

3.14 Generic Crypto: Asymmetric Crypto

Data Structures

- struct [op_gc_acrypto_args_t](#)

Macros

- #define [HSM_OP_GC_ACRYPTO_FLAGS_INPUT_MESSAGE](#) (([hsm_op_gc_acrypto_flags_t](#)) (1u << 0))
- #define [HSM_GC_ACRYPTO_VERIFICATION_SUCCESS](#) (([hsm_gc_acrypto_verification_status_t](#)) (0x5A3CC3A5u))
- #define [HSM_GC_ACRYPTO_VERIFICATION_FAILURE](#) (([hsm_gc_acrypto_verification_status_t](#)) (0x2B4DD4B2u))

Typedefs

- typedef uint8_t [hsm_op_gc_acrypto_flags_t](#)
- typedef uint32_t [hsm_gc_acrypto_verification_status_t](#)

Enumerations

- enum [hsm_op_gc_acrypto_algo_t](#) {
 - HSM_GC_ACRYPTO_ALGO_ECDSA_SHA224 = ALGO_ECDSA_SHA224,
 - HSM_GC_ACRYPTO_ALGO_ECDSA_SHA256 = ALGO_ECDSA_SHA256,
 - HSM_GC_ACRYPTO_ALGO_ECDSA_SHA384 = ALGO_ECDSA_SHA384,
 - HSM_GC_ACRYPTO_ALGO_ECDSA_SHA512 = ALGO_ECDSA_SHA512,
 - HSM_GC_ACRYPTO_ALGO_RSA_PKCS1_V15_SHA224 = ALGO_RSA_PKCS1_V15_SHA224,
 - HSM_GC_ACRYPTO_ALGO_RSA_PKCS1_V15_SHA256 = ALGO_RSA_PKCS1_V15_SHA256,
 - HSM_GC_ACRYPTO_ALGO_RSA_PKCS1_V15_SHA384 = ALGO_RSA_PKCS1_V15_SHA384,

```
HSM_GC_ACRYPTO_ALGO_RSA_PKCS1_V15_SHA512 = ALGO_RSA_PKCS1_V15_SHA512,
HSM_GC_ACRYPTO_ALGO_RSA_PKCS1_PSS_MGF1_SHA224 =
ALGO_RSA_PKCS1_PSS_MGF1_SHA224,
HSM_GC_ACRYPTO_ALGO_RSA_PKCS1_PSS_MGF1_SHA256 =
ALGO_RSA_PKCS1_PSS_MGF1_SHA256,
HSM_GC_ACRYPTO_ALGO_RSA_PKCS1_PSS_MGF1_SHA384 =
ALGO_RSA_PKCS1_PSS_MGF1_SHA384,
HSM_GC_ACRYPTO_ALGO_RSA_PKCS1_PSS_MGF1_SHA512 =
ALGO_RSA_PKCS1_PSS_MGF1_SHA512,
HSM_GC_ACRYPTO_ALGO_RSA_PKCS1_V15_CRYPT = ALGO_RSA_PKCS1_V15_CRYPT,
HSM_GC_ACRYPTO_ALGO_RSA_PKCS1_OAEP_SHA1 = ALGO_RSA_PKCS1_OAEP_SHA1,
HSM_GC_ACRYPTO_ALGO_RSA_PKCS1_OAEP_SHA224 = ALGO_RSA_PKCS1_OAEP_SHA224,
HSM_GC_ACRYPTO_ALGO_RSA_PKCS1_OAEP_SHA256 = ALGO_RSA_PKCS1_OAEP_SHA256,
HSM_GC_ACRYPTO_ALGO_RSA_PKCS1_OAEP_SHA384 = ALGO_RSA_PKCS1_OAEP_SHA384,
HSM_GC_ACRYPTO_ALGO_RSA_PKCS1_OAEP_SHA512 = ALGO_RSA_PKCS1_OAEP_SHA512 }
```

- enum [hsm_gc_acrypto_op_mode_t](#) {
 - HSM_GC_ACRYPTO_OP_MODE_ENCRYPT = 0x01,
 - HSM_GC_ACRYPTO_OP_MODE_DECRYPT = 0x02,
 - HSM_GC_ACRYPTO_OP_MODE_SIGN_GEN = 0x03,
 - HSM_GC_ACRYPTO_OP_MODE_SIGN_VER = 0x04 }

Functions

- [hsm_err_t hsm_gc_acrypto](#) ([hsm_hdl_t](#) session_hdl, [op_gc_acrypto_args_t](#) *args)

3.14.1 Detailed description

3.14.2 Data structure documentation

3.14.2.1 struct op_gc_acrypto_args_t

Structure describing the generic asymmetric crypto member arguments.

Data Fields

hsm_op_gc_acrypto_algo_t	algorithm	Algorithm to use for the operation.
hsm_gc_acrypto_op_mode_t	op_mode	Indicates the operation mode.
hsm_op_gc_acrypto_flags_t	flags	Indicates operation flags.
hsm_bit_key_sz_t	bit_key_sz	Key size in bits.
uint8_t *	data_buff1	Pointer to the data buffer 1: <ul style="list-style-type: none"> Plaintext in case of encryption/decryption operation. Digest or message in case of signature generation/verification operation.
uint8_t *	data_buff2	Pointer to the data buffer 2: <ul style="list-style-type: none"> Ciphertext in case of encryption/decryption operation. Signature in case of signature generation/verification operation.
uint32_t	data_buff1_size	Size in bytes of data buffer 1.
uint32_t	data_buff2_size	Size in bytes of data buffer 2.
uint8_t *	key_buff1	Pointer to the key modulus buffer.

Data Fields...continued

uint8_t *	key_buff2	Pointer the key exponent, either private or public. <ul style="list-style-type: none"> • Encryption mode, public exponent • Decryption mode, private exponent • Signature Generation mode, private exponent • Signature Verification mode, public exponent
uint16_t	key_buff1_size	Size in bytes of the key buffer 1.
uint16_t	key_buff2_size	Size in bytes of the key buffer 2.
uint8_t *	rsa_label	RSA label address. Only used for OAEP encryption/decryption operation mode and optional.
uint16_t	rsa_label_size	RSA label size in bytes. Only used for OAEP encryption/decryption operation mode.
uint16_t	rsa_salt_len	RSA salt length in bytes. Only used for PSS signature algorithm scheme.
uint32_t	exp_plaintext_len	Expected plaintext length in bytes, returned by FW in case of DECRYPT operation mode.
hsm_gc_acrypto_verification_status_t	verification_status	Signature verification status.

3.14.3 Macro definition documentation

3.14.3.1 HSM_OP_GC_ACRYPTO_FLAGS_INPUT_MESSAGE

```
#define HSM_OP_GC_ACRYPTO_FLAGS_INPUT_MESSAGE ((hsm\_op\_gc\_acrypto\_flags\_t) (1u << 0))
```

Bit indicating the generic asymmetric crypto input message operation.

3.14.3.2 HSM_GC_ACRYPTO_VERIFICATION_SUCCESS

```
#define HSM_GC_ACRYPTO_VERIFICATION_SUCCESS ((hsm\_gc\_acrypto\_verification\_status\_t) (0x5A3CC3A5u))
```

Bit indicating the generic asymmetric crypto success verification status.

3.14.3.3 HSM_GC_ACRYPTO_VERIFICATION_FAILURE

```
#define HSM_GC_ACRYPTO_VERIFICATION_FAILURE ((hsm\_gc\_acrypto\_verification\_status\_t) (0x2B4DD4B2u))
```

Bit indicating the generic asymmetric crypto failure verification status.

3.14.4 Typedef documentation

3.14.4.1 hsm_op_gc_acrypto_flags_t

```
typedef uint8_t hsm\_op\_gc\_acrypto\_flags\_t
```

Bitmap describing the generic asymmetric crypto supported operation.

3.14.4.2 hsm_gc_acrypto_verification_status_t

```
typedef uint32_t hsm\_gc\_acrypto\_verification\_status\_t
```

Bitmap describing the generic asymmetric crypto verification status.

3.14.5 Enumeration type documentation

3.14.5.1 hsm_op_gc_acrypto_algo_t

```
enum hsm\_op\_gc\_acrypto\_algo\_t
```

Enum detailing the generic asymmetric crypto supported algorithms.

3.14.5.2 hsm_gc_acrypto_op_mode_t

```
enum hsm\_gc\_acrypto\_op\_mode\_t
```

Enum describing the generic asymmetric crypto supported operating modes.

3.14.6 Function documentation

3.14.6.1 hsm_gc_acrypto()

```
hsm\_err\_t hsm_gc_acrypto (
hsm\_hdl\_t session_hdl,
op\_gc\_acrypto\_args\_t * args)
```

This command is designed to perform the following operations:

- Asymmetric crypto
- Encryption/decryption
- Signature generation/verification

Parameters

<i>session_hdl</i>	Handle identifying the current session.
<i>args</i>	Pointer to the structure containing the function arguments.

Returns

Error code

3.15 Generic Crypto Asymmetric Key Generate

Data Structures

- struct [op_gc_akey_gen_args_t](#)

Functions

- [hsm_err_t hsm_gc_akey_gen](#) ([hsm_hdl_t](#) session_hdl, [op_gc_akey_gen_args_t](#) *args)

3.15.1 Detailed description

3.15.2 Data structure documentation

3.15.2.1 struct op_gc_akey_gen_args_t

Structure detailing the generic crypto asymmetric key generate operation members.

Table 3. Data Fields

uint8_t *	modulus	Pointer to the output buffer of key modulus.
uint8_t *	priv_buff	Pointer to the output buffer of key private exponent.
uint8_t *	pub_buff	Pointer to the input buffer containing key public exponent.
uint16_t	modulus_size	Size in bytes of the modulus buffer.
uint16_t	priv_buff_size	Size in bytes of the private exponent buffer.
uint16_t	pub_buff_size	Size in bytes of the public exponent buffer.
hsm_key_type_t	key_type	Indicates which type of keypair must be generated.
hsm_bit_key_sz_t	bit_key_sz	Size in bits of the keypair to be generated.

3.15.3 Function documentation

3.15.3.1 hsm_gc_akey_gen()

```
hsm\_err\_t hsm_gc_akey_gen (
hsm\_hdl\_t session_hdl,
op\_gc\_akey\_gen\_args\_t * args)
```

This command is designed to perform the following operation:

Generate asymmetric keys, without using FW keystore.

Parameters

<i>session_hdl</i>	Handle identifying the current session.
<i>args</i>	Pointer to the structure containing the function arguments.

Returns

Error code

3.16 Get Info

Data Structures

- struct [op_get_info_args_t](#)

Functions

- [hsm_err_t hsm_get_info](#) ([hsm_hdl_t](#) sess_hdl, [op_get_info_args_t](#) *args)

3.16.1 Detailed description

3.16.2 Data structure documentation

3.16.2.1 struct op_get_info_args_t

Structure describing the get info operation member arguments.

Data Fields

uint32_t	user_sab_id	Stores User identifier (32 bits).
uint8_t *	chip_unique_id	Stores the chip unique identifier.
uint16_t	chip_unq_id_sz	Size of the chip unique identifier in bytes.
uint16_t	chip_monotonic_counter	Stores the chip monotonic counter value (16 bits).
uint16_t	chip_life_cycle	Stores the chip current life cycle bitfield (16 bits).
uint32_t	version	Stores the module version (32 bits).
uint32_t	version_ext	Stores the module extended version (32 bits).
uint8_t	fips_mode	Stores the FIPS mode bitfield (8 bits). Bitmask definition: bit0: FIPS mode of operation: <ul style="list-style-type: none"> Value 0: part is running in FIPS non-approved mode. Value 1: part is running in FIPS approved mode. Bit 1: FIPS certified part: <ul style="list-style-type: none"> Value 0: part is not FIPS certified. Value 1: part is FIPS certified. Bit 2-7: reserved <ul style="list-style-type: none"> Value 0.

3.16.3 Function documentation

3.16.3.1 hsm_get_info()

```
hsm_err_t hsm_get_info (
hsm_hdl_t sess_hdl,
op_get_info_args_t * args)
```

Perform device attestation operation.

Users can call this function only after opening the session.

Parameters

sess_hdl	Handle identifying the active session.
args	Pointer to the structure containing the function arguments.

Returns

Error code

3.17 Key exchange

Data Structures

- struct [op_key_exchange_args_t](#)

Macros

- #define [HSM_OP_KEY_EXCHANGE_FLAGS_SALT_ZERO](#) ((hsm_op_key_exchange_flags_t)(0u << 0))
- #define [HSM_OP_KEY_EXCHANGE_FLAGS_SALT_PEER_PUBKEY_HASH](#) ((hsm_op_key_exchange_flags_t)(1u << 0))
- #define [HSM_OP_KEY_EXCHANGE_FLAGS_MONOTONIC](#) ((hsm_op_key_exchange_flags_t)(1u << 5))
- #define [HSM_OP_KEY_EXCHANGE_FLAGS_STRICT_OPERATION](#) ((hsm_op_key_exchange_flags_t)(1u << 7))

Typedefs

typedef uint16_t [hsm_op_key_exchange_flags_t](#)

Enumerations

- enum [hsm_op_key_exchange_algo_t](#) {
 HSM_KEY_EXCHANGE_ECDH_HKDF_SHA256 = 0x09020109,
 HSM_KEY_EXCHANGE_ECDH_HKDF_SHA384 = 0x0902010A }
- enum [hsm_op_key_derivation_algo_t](#) {
 HSM_KEY_DERIVATION_HKDF_SHA256 = 0x08000109,
 HSM_KEY_DERIVATION_HKDF_SHA384 = 0x0800010A }

Functions

[hsm_err_t hsm_key_exchange](#) (hsm_hdl_t key_management_hdl, op_key_exchange_args_t *args)

3.17.1 Detailed description

3.17.2 Data structure documentation

3.17.2.1 struct op_key_exchange_args_t

Structure describing the key exchange operation member arguments.

Table 4. Data Fields

uint32_t	signed_content_sz	Input signed content payload size in bytes.
uint8_t *	signed_content	Input signed content payload buffer.
uint32_t	peer_pubkey_sz	Input peer public key size in bytes.
uint8_t *	peer_pubkey	Input peer public key buffer.
uint32_t	user_fixed_info_sz	Input user fixed information size in bytes.
uint8_t *	user_fixed_info	Input user fixed information buffer (optional i.e., can be NULL)
uint32_t	out_derived_key_id	Identifier of the derived key, with FW Resp.
uint32_t	out_salt_sz	Salt size in bytes, from FW Resp. It is equal to the hash (in bytes) of hash algorithm used in the key exchange algorithm.
hsm_op_key_exchange_flags_t	flags	Bitmap specifying the operation properties.

3.17.3 Macro definition documentation

3.17.3.1 HSM_OP_KEY_EXCHANGE_FLAGS_SALT_ZERO

```
#define HSM_OP_KEY_EXCHANGE_FLAGS_SALT_ZERO ((hsm_op_key_exchange_flags_t) (0u << 0))
```

Use zeros salt.

3.17.3.2 HSM_OP_KEY_EXCHANGE_FLAGS_SALT_PEER_PUBKEY_HASH

```
#define HSM_OP_KEY_EXCHANGE_FLAGS_SALT_PEER_PUBKEY_HASH ((hsm_op_key_exchange_flags_t) (1u << 0))
```

Use peer public key hash salt.

3.17.3.3 HSM_OP_KEY_EXCHANGE_FLAGS_MONOTONIC

```
#define HSM_OP_KEY_EXCHANGE_FLAGS_MONOTONIC ((hsm_op_key_exchange_flags_t) (1u << 5))
```

When used in conjunction with the STRICT flag, the request is completed only when the monotonic counter has been updated.

3.17.3.4 HSM_OP_KEY_EXCHANGE_FLAGS_STRICT_OPERATION

```
#define HSM_OP_KEY_EXCHANGE_FLAGS_STRICT_OPERATION ((hsm_op_key_exchange_flags_t) (1u << 7))
```

The request is completed only when the new key has been written in the NVM. This is applicable for the persistent key only.

Note: In the latest ELE FW API guide, "STRICT" has been replaced with "SYNC".

3.17.4 Typedef documentation

3.17.4.1 hsm_op_key_exchange_flags_t

```
typedef uint16_t hsm_op_key_exchange_flags_t
```

Bitmap specifying the key exchange operation properties.

3.17.5 Enumeration type documentation

3.17.5.1 hsm_op_key_exchange_algo_t

```
enum hsm_op_key_exchange_algo_t
```

Enum describing Key Exchange algorithms supported.

Table 5. Enumerators

HSM_KEY_EXCHANGE_ECDH_HKDF_SHA256	ECDH HKDF SHA256
HSM_KEY_EXCHANGE_ECDH_HKDF_SHA384	ECDH HKDF SHA384

3.17.5.2 hsm_op_key_derivation_algo_t

```
enum hsm_op_key_derivation_algo_t
```

Enum describing the Key Derivation algorithms supported.

Table 6. Enumerators

HSM_KEY_DERIVATION_HKDF_SHA256	HKDF SHA256 (HMAC two-step)
HSM_KEY_DERIVATION_HKDF_SHA384	HKDF SHA384 (HMAC two-step)

3.17.6 Function documentation

3.17.6.1 hsm_key_exchange

```
hsm_err_t hsm_key_exchange (
hsm_hdl_t key_management_hdl,
op_key_exchange_args_t * args)
```

This command is designed to compute secret keys through a key exchange protocol and the use of a key derivation function. The resulting secret keys are stored into the key store as new keys or as an update of the existing keys.

A freshly generated key or an existing key can be used as input of the shared secret calculation.

Users can call this function only after having opened a key management service flow.

Table 7. Parameters

<i>key_management_hdl</i>	Handle identifying the key store management service flow.
<i>args</i>	Pointer to the structure containing the function arguments.

Returns

Error code

3.18 Public key recovery

Public Key Recovery is also known as Public Key Exportation, in PSA compliant APIs. The naming here has been kept unchanged, for backward compatibility and Non-PSA compliant APIs.

Data Structures

- struct [op_pub_key_recovery_args_t](#)

Functions

- [hsm_err_t hsm_pub_key_recovery](#) ([hsm_hdl_t](#) key_store_hdl, [op_pub_key_recovery_args_t](#) *args)

3.18.1 Detailed description

Public Key Recovery is now known as Public Key Exportation, in PSA compliant APIs. The naming here has been kept unchanged, for backward compatibility and Non-PSA compliant APIs.

3.18.2 Data structure documentation

3.18.2.1 struct op_pub_key_recovery_args_t

Structure detailing the public key recovery operation member arguments.

Data Fields

uint32_t	key_identifier	Pointer to the identifier of the key to be used for the operation.
uint8_t *	out_key	Pointer to the output area where the generated public key must be written.
uint16_t	out_key_size	Length in bytes of the output key.
uint16_t	exp_out_key_size	Expected output key buffer size, valid in case of HSM_OUT_TOO_SMALL (0x1D) resp code.

3.18.3 Function documentation

3.18.3.1 hsm_pub_key_recovery()

```
hsm_err_t hsm_pub_key_recovery (
    hsm_hdl_t key_store_hdl,
    op_pub_key_recovery_args_t * args)
```

Recover Public key from private key present in key store.

Users can call this function only after opening a key store.

Parameters

key_store_hdl	Handle identifying the current key store.
args	Pointer to the structure containing the function arguments.

Returns

Error code

3.19 Key store

User must open a key store service flow to perform the following operations.

Data Structures

- struct [open_svc_key_store_args_t](#)
- struct [op_key_store_reprov_en_args_t](#)

Macros

- #define HSM_SVC_KEY_STORE_FLAGS_LOAD ((hsm_svc_key_store_flags_t)(0u << 0))
It must be specified to load a previously created key store.
- #define HSM_SVC_KEY_STORE_FLAGS_CREATE ((hsm_svc_key_store_flags_t)(1u << 0))
- #define HSM_SVC_KEY_STORE_FLAGS_SET_MAC_LEN ((hsm_svc_key_store_flags_t)(1u << 3))

- #define [HSM_SVC_KEY_STORE_FLAGS_MONOTONIC](#) (([hsm_svc_key_store_flags_t](#))(1u << 5))
- #define [HSM_SVC_KEY_STORE_FLAGS_STRICT_OPERATION](#) (([hsm_svc_key_store_flags_t](#))(1u << 7))

Typedefs

- typedef uint8_t [hsm_svc_key_store_flags_t](#)

Functions

- [hsm_err_t hsm_open_key_store_service](#) ([hsm_hdl_t](#) session_hdl, [open_svc_key_store_args_t](#) *args, [hsm_hdl_t](#) *key_store_hdl)
- [hsm_err_t hsm_close_key_store_service](#) ([hsm_hdl_t](#) key_store_hdl)
- [hsm_err_t hsm_key_store_reprov_en](#) ([hsm_hdl_t](#) session_hdl, [op_key_store_reprov_en_args_t](#) *args)

3.19.1 Detailed description

Users must open a key store service flow to perform the following operations:

- Create a new key store.
- Perform operations involving keys stored in the key store (ciphering, signature generation...)
- Perform a key store reprovisioning using a signed message. A key store re-provisioning results in erasing all the key stores handled by the HSM.

Grant access to the key store. The caller is authenticated against the domain ID (DID) and Messaging Unit used at the keystore creation. In addition, an authentication nonce can be provided.

3.19.2 Data structure documentation

3.19.2.1 struct open_svc_key_store_args_t

Structure specifying the open key store service member arguments.

Data Fields

uint32_t	key_store_hdl	Handle identifying the key store service flow.
uint32_t	key_store_identifier	User defined ID identifying the key store. Only one key store service can be opened on a given <code>key_store_identifier</code> .
uint32_t	authentication_nonce	User defined nonce used as authentication proof for accessing the key store.
uint8_t	flags	Bitmap specifying the services properties.

3.19.2.2 struct op_key_store_reprov_en_args_t

Structure describing the key store reprovisioning enable operation arguments.

Data Fields

uint8_t *	signed_message	Signed content payload.
uint32_t	signed_msg_size	Signed content payload size in bytes.

3.19.3 Macro definition documentation

3.19.3.1 HSM_SVC_KEY_STORE_FLAGS_CREATE

```
#define HSM_SVC_KEY_STORE_FLAGS_CREATE ((hsm_svc_key_store_flags_t) (1u << 0))
```

It must be specified to create a new key store. The key store is stored in the NVM only if the STRICT OPERATION flag is set.

3.19.3.2 HSM_SVC_KEY_STORE_FLAGS_SET_MAC_LEN

```
#define HSM_SVC_KEY_STORE_FLAGS_SET_MAC_LEN ((hsm_svc_key_store_flags_t) (1u << 3))
```

If set, the minimum MAC length specified in the `min_mac_length` field is stored in the key store when creating the key store. It must only be set at key store creation.

3.19.3.3 HSM_SVC_KEY_STORE_FLAGS_MONOTONIC

```
#define HSM_SVC_KEY_STORE_FLAGS_MONOTONIC ((hsm_svc_key_store_flags_t) (1u << 5))
```

When used in conjunction with the STRICT flag, the request is completed only when the monotonic counter has been updated.

3.19.3.4 HSM_SVC_KEY_STORE_FLAGS_STRICT_OPERATION

```
#define HSM_SVC_KEY_STORE_FLAGS_STRICT_OPERATION ((hsm_svc_key_store_flags_t) (1u << 7))
```

The request is completed only when the new key store is written in the NVM. This is applicable for CREATE operations only.

3.19.4 Typedef documentation

3.19.4.1 hsm_svc_key_store_flags_t

```
typedef uint8_t hsm_svc_key_store_flags_t
```

Bitmap specifying the open key store service supported attributes.

3.19.5 Function documentation

3.19.5.1 hsm_open_key_store_service()

```
hsm_err_t hsm_open_key_store_service (
hsm_hdl_t session_hdl,
open_svc_key_store_args_t * args,
hsm_hdl_t * key_store_hdl)
```

Open a service flow on the specified key store. Only one key store service can be opened on a given key store.

Parameters

<i>session_hdl</i>	Pointer to the handle identifying the current session.
<i>args</i>	Pointer to the structure containing the function arguments.
<i>key_store_hdl</i>	Pointer to where the key store service flow handle must be written.

Returns

Error code.

3.19.5.2 hsm_close_key_store_service()

```
hsm_err_t hsm_close_key_store_service (hsm_hdl_t key_store_hdl)
```

Close a previously opened key store service flow. The key store is deleted from the HSM local memory. Any update not written in the NVM is lost.

Parameters

<i>key_store_hdl</i>	Handle identifying the key store service flow to be closed.
----------------------	---

Returns

Error code.

3.19.5.3 hsm_key_store_reprov_en()

```
hsm_err_t hsm_key_store_reprov_en (
hsm_hdl_t session_hdl,
op_key_store_reprov_en_args_t * args)
```

Table 8. Parameters

<i>session_hdl</i>	Pointer to the handle identifying the current session.
<i>args</i>	Pointer to the structure containing the function arguments.

Returns

Error code.

3.20 Life cycle update

Data Structures

- struct [op_lc_update_msg_args_t](#)

Enumerations

- enum [hsm_lc_new_state_t](#) {
 - HSM_NXP_PROVISIONED_STATE = (1u << 0),
 - HSM_OEM_OPEN_STATE = (1u << 1),
 - HSM_OEM_CLOSE_STATE = (1u << 3),
 - HSM_OEM_FIELD_RET_STATE = (1u << 4),
 - HSM_NXP_FIELD_RET_STATE = (1u << 5),
 - HSM_OEM_LOCKED_STATE = (1u << 7) }

Functions

- [hsm_err_t hsm_lc_update](#) ([hsm_hdl_t](#) session_hdl, [op_lc_update_msg_args_t](#) *args)

3.20.1 Detailed description

3.20.2 Data structure documentation

3.20.2.1 struct op_lc_update_msg_args_t

Structure specifying the life cycle update message arguments.

Data Fields

hsm_lc_new_state_t	new_lc_state	-
------------------------------------	--------------	---

3.20.3 Enumeration type documentation

3.20.3.1 hsm_lc_new_state_t

```
enum hsm\_lc\_new\_state\_t
```

Enum specifying the Life Cycle state.

3.20.4 Function documentation

3.20.4.1 hsm_lc_update()

```
hsm\_err\_t hsm_lc_update (
hsm\_hdl\_t session_hdl,
op\_lc\_update\_msg\_args\_t * args)
```

This API performs the Life Cycle update.

Parameters

<i>session_hdl</i>	Handle identifying the session handle.
<i>args</i>	Pointer to the structure containing the function arguments.

Returns

Error code

3.21 Global information

Data Structures

- struct [global_info_s](#)

Functions

- void [populate_global_info](#) ([hsm_hdl_t](#) hsm_session_hdl)
- void [show_global_info](#) (void)
- bool [is_global_info_populated](#) (void)
- [uint8_t](#) [hsm_get_dev_attest_api_ver](#) (void)
- [uint16_t](#) [se_get_soc_id](#) (void)

- uint16_t se_get_soc_rev (void)
- uint16_t se_get_chip_lifecycle (void)
- uint8_t se_get_fips_mode (void)
- uint8_t se_get_lib_newness_ver (void)
- uint8_t se_get_lib_major_ver (void)
- uint8_t se_get_lib_minor_ver (void)
- uint8_t se_get_nvm_newness_ver (void)
- uint8_t se_get_nvm_major_ver (void)
- uint8_t se_get_nvm_minor_ver (void)
- const char * se_get_commit_id (void)
- const char * se_get_lib_version (void)
- const char * se_get_nvm_version (void)
- const char * [get_soc_id_str](#) (uint16_t soc_id)
- const char * [get_soc_rev_str](#) (uint16_t soc_rev)
- const char * [get_soc_lf_str](#) (uint16_t lifecycle)
- void se_get_info (uint32_t session_hdl, op_get_info_args_t *args)
- void se_get_soc_info (uint32_t session_hdl, uint16_t *soc_id, uint16_t *soc_rev)

Variables

- struct [global_info_s global_info](#)

3.21.1 Detailed description

3.21.2 Data structure documentation

3.21.2.1 struct global_info_s

Global Information structure contains the information about SoC and the Library. It is used globally to take platform specific decisions.

Data Fields

bool	is_populated	To ensure global information is populated once.
uint8_t	ver	Supported version of HSM APIs.
uint8_t	fips_mode	Fips mode.
uint16_t	soc_id	SoC ID.
uint16_t	soc_rev	SoC revision.
uint16_t	lifecycle	Device lifecycle.
uint32_t	lib_newness_ver	Secure Enclave Library Newness version.
uint32_t	lib_major_ver	Secure Enclave Library major version.
uint32_t	lib_minor_ver	Secure Enclave Library minor version.
uint32_t	nvm_newness_ver	NVM Library Newness version.
uint32_t	nvm_major_ver	NVM Library major version.
uint32_t	nvm_minor_ver	NVM Library minor version.
char	se_commit_id[GINFO_COMMIT_ID_SZ]	Secure Enclave Build Commit ID.
char	lib_version[GINFO_LIB_VERSION_LEN]	Secure Enclave Library version string.

Data Fields...continued

char	nvm_version[GINFO_NVM_VERSION_LEN]	NVM version string.
------	------------------------------------	---------------------

3.21.3 Function documentation**3.21.3.1 populate_global_info()**

```
void populate_global_info (hsm_hdl_t hsm_session_hdl)
```

This function is called to populate the Global Information structure.

Parameters

<i>hsm_session_hdl</i>	Identifying the active session.
------------------------	---------------------------------

3.21.3.2 show_global_info()

```
void show_global_info (void )
```

This function prints the Global Information of the library.

3.21.3.3 is_global_info_populated()

```
bool is_global_info_populated (void )
```

This function gets the status of Global Info, if populated or not.

3.21.3.4 hsm_get_dev_attest_api_ver()

```
uint8_t hsm_get_dev_attest_api_ver (void )
```

This function returns the version supported for Device Attestation.

3.21.3.5 se_get_soc_id()

```
uint16_t se_get_soc_id (void )
```

Get the SoC ID.

3.21.3.6 se_get_soc_rev()

```
uint16_t se_get_soc_rev (void )
```

Get the SoC revision.

3.21.3.7 se_get_chip_lifecycle()

```
uint16_t se_get_chip_lifecycle (void )
```

Get the chip lifecycle.

3.21.3.8 se_get_fips_mode()

```
uint8_t se_get_fips_mode (void )
```

Get the Fips mode.

3.21.3.9 se_get_lib_newness_ver()

```
uint8_t se_get_lib_newness_ver (void )
```

Get the library newness version.

3.21.3.10 se_get_lib_major_ver()

```
uint8_t se_get_lib_major_ver (void )
```

Get the library major version.

3.21.3.11 se_get_lib_minor_ver()

```
uint8_t se_get_lib_minor_ver (void )
```

Get the library minor version.

3.21.3.12 se_get_nvm_newness_ver()

```
uint8_t se_get_nvm_newness_ver (void )
```

Get the NVM newness version.

3.21.3.13 se_get_nvm_major_ver()

```
uint8_t se_get_nvm_major_ver (void )
```

Get the NVM major version.

3.21.3.14 se_get_nvm_minor_ver()

```
uint8_t se_get_nvm_minor_ver (void )
```

Get the NVM minor version.

3.21.3.15 se_get_commit_id()

```
const char* se_get_commit_id (void )
```

Get the build commit ID.

3.21.3.16 se_get_lib_version()

```
const char* se_get_lib_version (void )
```

Get the library version string.

3.21.3.17 se_get_nvm_version()

```
const char* se_get_nvm_version (void )
```

Get the NVM version string.

3.21.3.18 get_soc_id_str()

```
const char* get_soc_id_str (uint16_t soc_id)
```

This function returns a string representating SoC ID.

Parameters

<i>soc_id</i>	SoC ID fetched from Global Information.
---------------	---

Returns

String representation of the SoC ID.

3.21.3.19 get_soc_rev_str()

```
const char* get_soc_rev_str (uint16_t soc_rev)
```

This function returns a string representating SoC Revision.

Table 9. Parameters

<i>soc_rev</i>	SoC Revision fetched from Global Information.
----------------	---

Returns

String representation of the SoC revision.

3.21.3.20 get_soc_lf_str()

```
const char* get_soc_lf_str (uint16_t lifecycle)
```

This function returns a string representating Lifecycle.

Table 10. Parameters

<i>lifecycle</i>	Value fetched from Global Information.
------------------	--

Returns

A string representation of Lifecycle

3.21.3.21 se_get_info()

```
void se_get_info (
    uint32_t session_hdl,
    op_get_info_args_t * args )
```

Get the information for Global Info setup.

3.21.3.22 se_get_soc_info()

```
void se_get_soc_info (
    uint32_t session_hdl,
    uint16_t * soc_id,
    uint16_t * soc_rev )
```

Get the SoC information for Global Info setup generated.

3.21.4 Variable documentation

3.21.4.1 global_info

```
struct global\_info\_s global_info
```

Global Information structure instance, which is populated and then is used for getting the required platform or library details.

3.22 Error codes

Enumerations

- enum [hsm_err_t](#){
 - HSM_NO_ERROR = 0x0,
 - HSM_INVALID_MESSAGE = 0x1,
 - HSM_INVALID_ADDRESS = 0x2,
 - HSM_UNKNOWN_ID = 0x3,
 - HSM_INVALID_PARAM = 0x4,
 - HSM_NVM_ERROR = 0x5,
 - HSM_OUT_OF_MEMORY = 0x6,
 - HSM_UNKNOWN_HANDLE = 0x7,
 - HSM_UNKNOWN_KEY_STORE = 0x8,
 - HSM_KEY_STORE_AUTH = 0x9,
 - HSM_KEY_STORE_ERROR = 0xA,
 - HSM_ID_CONFLICT = 0xB,
 - HSM_RNG_NOT_STARTED = 0xC,
 - HSM_CMD_NOT_SUPPORTED = 0xD,
 - HSM_INVALID_LIFECYCLE = 0xE,
 - HSM_KEY_STORE_CONFLICT = 0xF,
 - HSM_KEY_STORE_COUNTER = 0x10,
 - HSM_FEATURE_NOT_SUPPORTED = 0x11,
 - HSM_SELF_TEST_FAILURE = 0x12,
 - HSM_NOT_READY_RATING = 0x13,
 - HSM_FEATURE_DISABLED = 0x14,


```
HSM_KEY_GROUP_FULL = 0x19,
HSM_CANNOT_RETRIEVE_KEY_GROUP = 0x1A,
HSM_KEY_NOT_SUPPORTED = 0x1B,
HSM_CANNOT_DELETE_PERMANENT_KEY = 0x1C,
HSM_OUT_TOO_SMALL = 0x1D,
HSM_DATA_ALREADY_RETRIEVED = 0x1F,
HSM_CRC_CHECK_ERR = 0xB9,
HSM_OEM_CLOSED_LC_SIGNED_MSG_VERIFICATION_FAIL = 0xF0,
HSM_OEM_OPEN_LC_SIGNED_MSG_VERIFICATION_FAIL = 0xF0,
HSM_FATAL_FAILURE = 0x29,
HSM_LIB_ERROR = 0xEF,
HSM_INVALID_LIFECYCLE_OP = 0xF2,
HSM_SERVICES_DISABLED = 0xF4,
HSM_UNKNOWN_WARNING = 0xFC,
HSM_SIGNATURE_INVALID = 0xFD,
HSM_UNKNOWN_ERROR = 0xFE,
HSM_GENERAL_ERROR = 0xFF }
```

3.22.1 Detailed description

3.22.2 Enumeration type documentation

3.22.2.1 hsm_err_t enum hsm_err_t

Error codes returned by HSM functions.

Enumerator

HSM_NO_ERROR	Success.
HSM_INVALID_MESSAGE	The received message is invalid or unknown.
HSM_INVALID_ADDRESS	The provided address is invalid or does not respect the API requirements.
HSM_UNKNOWN_ID	The provided identifier is not known.
HSM_INVALID_PARAM	One of the parameters provided in the command is invalid.
HSM_NVM_ERROR	NVM generic issue.
HSM_OUT_OF_MEMORY	There is not enough memory to handle the requested operation.
HSM_UNKNOWN_HANDLE	Unknown session/service handle.
HSM_UNKNOWN_KEY_STORE	The key store identified by the provided “key store Id” does not exist and the “create” flag is not set.
HSM_KEY_STORE_AUTH	Key store authentication fails.
HSM_KEY_STORE_ERROR	An error occurred in the key store internal processing.
HSM_ID_CONFLICT	An element (key store, key...) with the provided ID already exists.
HSM_RNG_NOT_STARTED	The internal RNG is not started.
HSM_CMD_NOT_SUPPORTED	The functionality is not supported for the current session/service/key store configuration.
HSM_INVALID_LIFECYCLE	Invalid lifecycle for requested operation.

Enumerator...continued

HSM_KEY_STORE_CONFLICT	A key store with the same attributes already exists.
HSM_KEY_STORE_COUNTER	The current key store reaches the maximum number of monotonic counter updates. Updates are still allowed but monotonic counter will not be blown.
HSM_FEATURE_NOT_SUPPORTED	The requested feature is not supported by the firmware.
HSM_SELF_TEST_FAILURE	Self-tests report an issue.
HSM_NOT_READY_RATING	The HSM is not ready to handle the current request.
HSM_FEATURE_DISABLED	The required service/operation is disabled.
HSM_KEY_GROUP_FULL	Not enough space to store the key in the key group.
HSM_CANNOT_RETRIEVE_KEY_GROUP	Impossible to retrieve key group.
HSM_KEY_NOT_SUPPORTED	Key not supported.
HSM_CANNOT_DELETE_PERMANENT_KEY	Trying to delete a permanent key.
HSM_OUT_TOO_SMALL	Output buffer size is too small.
HSM_DATA_ALREADY_RETRIEVED	Data is Read Once, and has already been retrieved.
HSM_CRC_CHECK_ERR	Command CRC check error.
HSM_OEM_CLOSED_LC_SIGNED_MSG_VERIFICATION_FAIL	In OEM closed lifecycle, Signed message signature verification failure.
HSM_OEM_OPEN_LC_SIGNED_MSG_VERIFICATION_FAIL	In OEM open lifecycles, Signed message signature verification failure.
HSM_FATAL_FAILURE	A fatal failure occurs. The HSM goes in unrecoverable error state not replying to further requests.
HSM_SERVICES_DISABLED	Message neither handled by ROM nor FW.
HSM_LIB_ERROR	HSM library failure.
HSM_INVALID_LIFECYCLE_OP	Invalid Lifecycle operation (ROM).
HSM_UNKNOWN_WARNING	Unknown warnings.
HSM_SIGNATURE_INVALID	Failure in verification status of operations such as MAC verification, Signature verification.
HSM_UNKNOWN_ERROR	Unknown errors.
HSM_GENERAL_ERROR	Error in case General Error is received.

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[Ciphering](#)

- HSM_CIPHER_ONE_GO_ALGO_OFB is not supported.
- HSM_AEAD_ALGO_GCM is not supported.
- HSM_AEAD_ALGO_ALL_AEAD is not supported.
- ALGO_RSA_PKCS1_V15_SHA224 is not supported.
- ALGO_RSA_PKCS1_V15_SHA256 is not supported.
- ALGO_RSA_PKCS1_V15_SHA384 is not supported.
- ALGO_RSA_PKCS1_V15_SHA512 is not supported.
- ALGO_RSA_PKCS1_PSS_MGF1_SHA224 is not supported.
- ALGO_RSA_PKCS1_PSS_MGF1_SHA256 is not supported.

- ALGO_RSA_PKCS1_PSS_MGF1_SHA384 is not supported.
- ALGO_RSA_PKCS1_PSS_MGF1_SHA512 is not supported.

Key exchange: No key exchange.

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MAC: No HMAC.

Key exchange: No key exchange.

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5 Revision History

This table provides the revision history.

Revision history

Document ID	Release date	Description
RM00284 v2.0	29 March 2024	Upgraded for the Linux LF6.6.3_1.0.0 release.
RM00284 v1.0	15 December 2023	Initial release.

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