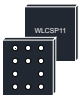
ST4SIM-200M

Data brief

eSIM system-on-chip solution for M2M industrial applications

VFDFPN8
6 × 5 mm, Wettable flanks (MFF2)

D16 micromodule



WLCSP11

Product status link
ST4SIM-200M

Features

- Remote SIM provisioning compliant with GSMA M2M and SIMalliance specifications
- Bootstrap connectivity profile
- Up to 7 profiles (depending on memory size)
- Compliant with 2G / 3G / 4G (LTE) / CDMA / NB-IoT / CAT–M networks
- Network access applications supported: SIM / USIM / ISIM / CSIM
- Secure element access control (ARF / PKCS#15)
- OTA capability over SMS, CAT-TP & HTTPS (including DNS)
- Multi-interfaces able to combine eSIM + eSE

Hardware

- Product available on ST33G1M2M
- ST33 product based on a 32-bit Arm® SecurCore® SC300™ RISC core
- Supply voltage: Class A (5 V), Class B (3 V), Class C (1.8 V)
- Asynchronous serial I/O port ISO/IEC 7816-3 compatible (T=0 protocol)
- Serial Peripheral Interface (SPI), depending on packages
- Industrial qualification (JEDEC JESD47)
- Operating temperature: -40°C to +105°C
- Common Criteria EAL5+

ECOPACK-compliant packages

- D16 micromodule
- DFN8 Wettable Flank (MFF2)
- WLCSP

Security

- Symmetric cryptography DES / 3DES / AES
- Asymmetric cryptography RSA (up to 2048 bits)
- HTTPS remote management TLS v1.0, v1.1 and v1.2
- Elliptic curve cryptography (up to 521 bits) including preloaded curve NIST P-256 and brainpoolP256r1
- Authentication algorithm: MILENAGE, TUAK, CAVE

Software standard compliancy

- GSMA SGP.02 v3.2
- SIMalliance interoperable profile v2.1
- Java Card™ v3.0.4 Classic
- GlobalPlatform® card specification v2.2, including GP amendments A, B, C, D and E
- ETSI, 3GPP and 3GPP2 release 12 (for further information, contact your local STMicroelectronics sales office)
- Power saving features (PSM and eDRX) defined by ETSI release 13

Certification

- GlobalPlatform-certified "Muse eUICC-i2 v1" compliant with GSMA SGP.02 v3.2

Applications

- Cellular Connected Nodes
- LTE: Cat M1 and NBIoT
- Surveillance
- IoT for Smart Home and City such as gas metering
- IoT for Smart Industry such as tracking

1 Description

The ST4SIM-200M is an STMicroelectronics top-class embedded SIM (eSIM or eUICC) product compliant with the GSM Association (GSMA) remote provisioning specification SGP.02 v3.2.

It can remotely manage profiles of different MNOs while ensuring the appropriate security level to all eUICC stakeholders (user, MNO, OEM, hardware integrator, service provider, and so on).

The ST4SIM-200M can include an embedded secure element to store credential and/or independent applications directly managed by the MCU (or by another OEM element).

The ST4SIM-200M provides a secure and interoperable Java Card environment compliant with Java Card v3.0.4 classic. Moreover, the ST4SIM-200M integrates the most advanced UICC features compliant with GlobalPlatform, ETSI, 3GPP, 3GPP2 specifications.

The ST4SIM-200M integrates a dynamic memory management with Java Card garbage collection mechanism optimizing the usage of the memory.

The ST4SIM-200M is a tamper-resistant secure element certified by Common criteria EAL5+, with a powerful 32-bit Arm® SecurCore® SC300™ RISC core.

Note: Arm is a registered trademark of Arm Limited (or its subsidiaries) in the US and/or elsewhere.

Note: Java is a registered trademark of Oracle and/or its affiliates.

2 Supported standards and networks

The ST4SIM-200M solution integrates all advanced NAAs for eSIM solution:

- USIM applications providing access to universal mobile telecommunications system (UMTS) networks,
- IP multimedia services identity module (ISIM) to access IP multimedia subsystem (IMS) networks,
- CDMA subscriber identity module (CSIM) including CAVE algorithm.

To grant mobile network operators (MNO) the best solution for UICC-centric services either owned by the MNO or by third parties, the ST4SIM-200M is compliant with GlobalPlatform Card Specifications v2.2 (depending on UICC configuration) and related amendments.

3 Remote SIM provisioning

The remote SIM provisioning, defined by GSMA in SGP.02 v3.2 specification for M2M, extends the traditional SIM and offers a scalable solution while maintaining the best level of security.

The “traditional SIM card” is usually owned and issued by one network operator. With this solution, the end user must physically change the SIM card to change the operator or subscription. In most embedded solutions, this solution is not satisfactory.

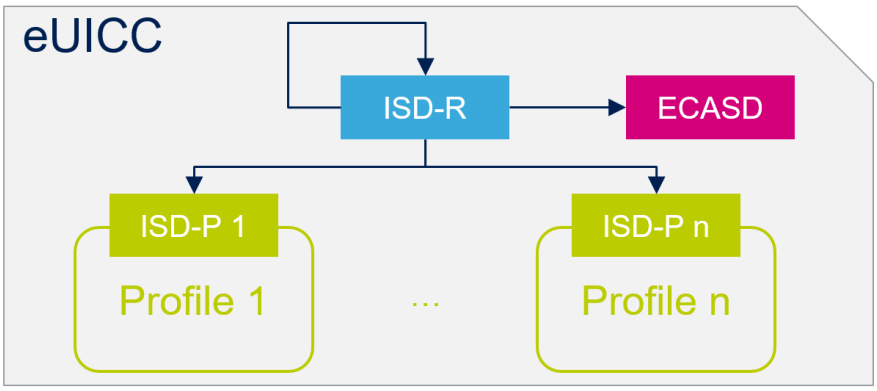
The ST4SIM-200M , using the remote SIM provisioning, provides an embedded SIM solution (called an eSIM or eUICC) which is flexible and independent of operator. It is now possible to change the profile without changing physically the eSIM.

A profile contains the operator network data related to a subscription, including the operator’s credentials (file system, PINs/PUKs, NAA authentication information) and applications. Each profile is independent of the other profiles. In this way, it is possible to have in two profiles an application with the same AID, TAR or global service.

This profile is described by SIMalliance interoperable profile package specification.

The ST4SIM-200M architecture is compliant with GSMA SCP.02 v3.2 specifications and supports all mechanisms performing profile management.

Figure 1. Security domain architecture overview



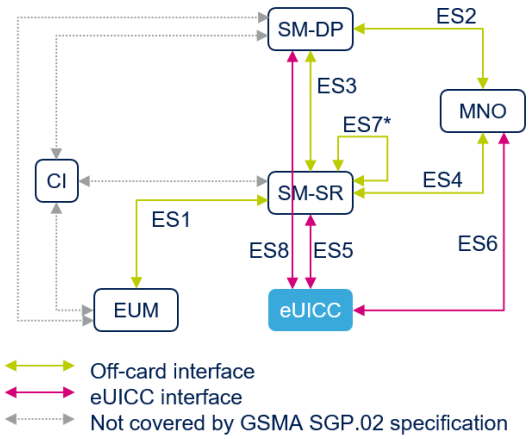
The ST4SIM-200M can host up to 7 profiles. Each profile has the memory size available in the ST4SIM-200M or can have a specific memory size coded using the cumulative granted memory defined by GlobalPlatform amendment C.

The ST4SIM-200M fully supports SIMalliance interoperable profile package v2.1. No proprietary features are introduced and profiles are coded according to ASN.1 / DER coding.

The ST4SIM-200M is an interoperable solution. The ST4SIM-200M already integrates most of main operators (MNO / MVNO) and it is possible to integrate any operator’s profile or personalized profile compliant with the SIMalliance specification. STMicroelectronics also has several trusted partners providing connectivity for bootstrap profile (contact your local STMicroelectronics sales office).

For machine-to-machine, including industrial and automotive markets, this solution is service-oriented; the profile is remotely controlled by the service provider through a platform (push model). In this case, the user interaction is not required.

Figure 2. eUICC Remote provisioning system



* Interface between two SM-SR entities for the change of SM-SR

The ST4SIM-200M supports all interfaces described by GSMA SGP.02:

- ES5 interface (SM-SR/eUICC),
- ES8 interface (SM-DP/eUICC),
- ES6 interface (MNO/ eUICC).

The eSIM protocols provide security and integrity for data transfer: with the ST4SIM-200M , the profile can be downloaded by using SCP03t over HTTPS. Profile download over CAT-TP is not supported.

The ST4SIM-200M is also interoperable with large subscription management platforms already deployed on the field. STMicroelectronics has attended all Test Fest sessions driven by GlobalPlatform and PoC on SM-SR changes initiated by GSMA.

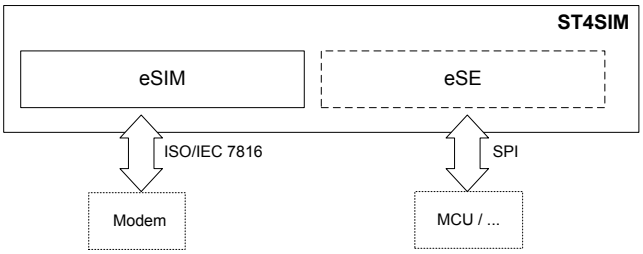
In addition, STMicroelectronics has several trusted partners providing platform services to provision and remotely manage operator profiles (Contact your local STMicroelectronics sales office).

4 Additional embedded secure element (eSE)

The ST4SIM-200M is a solution combining an eSIM with an embedded secure element (eSE) section inside the same chip.

This eSE section can be used to provide secure storage, cryptographic services, etc. via Java card applets.

Figure 3. ST4SIM-200M architecture eSIM & eSE overview



The eSE section is accessible through a dedicated serial peripheral interface (SPI) protocol and the eUICC uses the ISO/IEC 7816 protocol in parallel. Consequently, the eSE is only available on WLCSP packages including ISO and SPI protocols.

The embedded secure element is optional and configurable.

See Package information section in the ST4SIM-200M datasheet for more details on the pin configuration (Contact your local STMicroelectronics sales office).

5 Algorithms and cryptography

The ST4SIM-200M supports the following standard authentication algorithms:

- CAVE
- MILENAGE
- TUAK.

The MILENAGE algorithm enables authorized access to UMTS/LTE networks with an easy and flexible parameter customization, according to specific MNO requirements.

The TUAK authentication algorithm is supported with both 128-bit key length and 256-bit key length.

In addition to these algorithms, the ST4SIM-200M also supports the "3GPP test algorithm" for test profile.

In order to increase security performance, the ST4SIM-200M also incorporates a ratification counter that limits the number of authentication attempts to prevent brute-force attacks from breaking algorithms. In addition, all algorithms support dedicated countermeasures for DPA/SPA attacks.

Besides standard symmetric cryptography and hashing algorithms (DES, Triple DES, AES, MD5, ...), the ST4SIM-200M provides a cryptographic co-processor with asymmetric cryptography capabilities.

For applications demanding the strongest level of cryptography, the ST4SIM-200M supports:

- RSA with a key length of up to 2048 bits
- elliptic curve cryptography (ECC) with a key length of up to 521 bits.

In addition, the ST4SIM-200M fully supports the PKCS#15 standard and offers a rule-based access control mechanism such as digital signature/certificates for data/applications requiring a strong level of cryptography.

The security algorithm implementation respects the chip security guidelines of the ST33G1M2M to guarantee the best security level (for more information, contact your local STMicroelectronics sales office).

6 Over the air (OTA) functionality

The ST4SIM-200M supports over the air protocol for remote application management (RAM) and remote file management (RFM) compliant with ETSI standard (ETSI TS 102 225 and ETSI TS 102 226 specifications Release 12).

The RAM application is also fully supported by Global Platform v2.2 and the related amendment B (allowing the possibility to perform remote applet management and remote file management over HTTP/TLS).

TLS v1.0, 1.1 and 1.2 are available in the ST4SIM-200M . In addition, the ST4SIM-200M integrates a DNS mechanism allowing the card to request the HTTPS server address from a DNS server.

The ST4SIM-200M makes it possible to remotely control over the air the execution of APDU commands to administrate the card contents. It also allows proactive commands to interact with the host device.

The ST4SIM-200M supports the secured packet structure and the remote APDU structure for (U)SIM toolkit applications, conforming 3GPP TS 31.115 and TS 31.116 specifications.

The CAT-TP protocol defined by ETSI release 7 is supported.

As it is compliant with the ETSI, 3GPP and 3GPP2, the ST4SIM-200M can easily be integrated into any OTA platform compliant with relevant standards. STMicroelectronics cards are field-proven to be interoperable with the mainstream OTA platforms commonly chosen by mobile network operators.

7 Memory management

The OTA mechanism is completed by the support of 3G UICC administrative commands as specified by ETSI TS 102 222.

These commands are integrated by a powerful dynamic memory management that allows complete smart memory defragmentation.

Dynamic memory management provides:

- Common space for files/packages/applets/objects
- Memory recovery on deletion operations
- Total free memory available in the Select MF response.

The OTA mechanism is designed to allow a very fast and silent memory recovery, absolutely safe for the end user data.

The ST4SIM-200M is capable of enhancing intrinsic Flash memory cells for files requiring intense update and higher reliability.

Memory quota mechanism based on the GlobalPlatform Amendment C (CGM) is supported. The mechanism can be disabled at card configuration.

Volatile memory management is based on an STMicroelectronics patented mechanism that optimizes the available resources for the enabled profile while guaranteeing resources for the downloading profile and the disabled profiles.

8 Acronyms

Table 1. List of acronyms

Acronym	Description
3GPP	3rd generation partnership project
AES	Advanced encryption standard
AID	Application identifier
APDU	Application protocol data unit
ARF	Access rule file
ASN.1	Abstract syntax notation 1
CAT-M	LTE card application toolkit (CAT) M
CAT-TP	Card application toolkit transport protocol
CAVE	Cellular authentication and voice encryption
CDMA	Code division multiple access
CSIM	CDMA subscriber identity module
DES	Data encryption standard
DFN	Dual flat no-lead package
DNS	Domain name server
EAL	Evaluation assurance level
eDRX	Extended discontinuous reception
eSE	Embedded secure element
eSIM	Embedded SIM
ETSI	European telecommunications standards institute
eUICC	Embedded Universal integrated circuit card
HTTPS	Secured HTTP
IEC	International electrotechnical commission
IMS	IP multimedia subsystem
IoT	Internet of things
ISIM	IP multimedia services identity module
ISO	International organization for standardization
JEDEC	Semiconductor engineering standardization (Joint electron device engineering council)
LTE	Long-term evolution (telecommunication)
MD5	Message-digest algorithm producing a 128-bit hash value
M2M	Machine-to-machine
MNO	Mobile network operator
MNO-SD	Mobile network operator security domain
MVNO	Mobile virtual network operator
NAA	Network access application
NB-IoT	NarrowBand-Internet of Things
NIST	National Institute of Standards and Technology
OEM	Original equipment manufacturer

Acronym	Description
OTA	Over the air
PIN	Personal identification number
PKCS	Public key cryptographic standards
PoC	Proof of concept
PUK	PIN unlock key
RAM	Remote application management
RFM	Remote file management
RISC	Reduced instruction set computer
RSA	Public-key cryptosystem (Ron Rivest, Adi Shamir and Leonard Adleman)
SCP	Secure channel protocol
SIM	Subscriber identity module
SM-DP	Subscription manager - Data preparation
SMS	Short message service
SM-SR	Subscription manager - Secure routing
UICC	Universal integrated circuit card
UMTS	Universal mobile telecommunications system
USIM	Universal subscriber identity module
SE	Secure element
TAR	Toolkit application reference
TLS	Transport layer security
WLCSP	Wafer level chip size package

Revision history

Table 2. **Document revision history**

Date	Version	Changes
25-Nov-2019	1	Initial release.

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