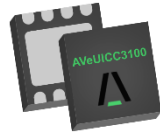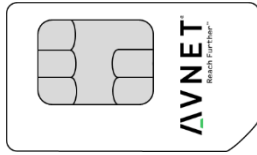# AVeUICC3210BICS

BICS-bootstrapped commercial grade GSMA 3.2-compliant eUICC

Connectivity

- Preloaded BICS profile with 100kB worth of connectivity
- Compliant with 2G / 3G / 4G / 5G / cat-M1 / cat-NB1 networks worldwide
- Access to 2G, 3G, 4G, 5G, cat-M1, cat-NB1 BICS networks worldwide
- Remotely administrable by AVNET's SM-SR platform

Hardware

- Up to 300kB Flash memory space for simultaneous MNO profile hosting (3 to 8 profiles depending on profile size)
- 32-bit ARM® CPU in 90 nm CMOS technology
- 32kB RAM
- CLK frequency 1-10MHz
- Supply voltage range: 1.62 V to 5.50 V
- ESD protection > 4 kV (HBM)
- NVM Endurance
    - up to 500,000 cycles/page
    - max. cycling: 16 million per 256 bytes file @85°C
- Common Criteria EAL5+
- Form Factor: MFF2, 2FF, 3FF, 4FF
- ROHS compliance
- Temperature Range
    - Operating -25°C to +85°C
    - Storage -25°C to +105°C
- Data Retention
    - Up to 10 years at 85°C

Software

- Extended Lifetime Features 2.0
    - 128 kB (16 files per MNO profile) / 16 M cycles HSM
    - High-Stress Embedded Application Control
    - On-card & Remote Counters Monitoring/Audit
    - + Applet Lock Status + NVM Global counter
    - + EF Global counter + RESET Counter
- GSMA SGP.02 v3.2
- GSMA CI
- Global Platform 2.2.1
    - Amendment A: Controlling Authority Scenario 2b
    - Amendment B: OTA management over HTTPS
    - Amendment C: Dynamic Memory Allocation
    - Amendment D: SCP03 support
    - Amendment E/F: Scenario 3
- Java Card™ 3.0.4 Classic Edition
- Local management applet
- SMSR polling applet for low-power device operation

Table of Contents

1 Introduction

This datasheet provides a technical description of the AVeUIVV3210xxx family of eUICC components manufactured by AVNET.

The AVNET eUICC (embedded Universal Integrated Circuit Card) program aims to bring the benefits and services of the eUICC to any business or industry, by allowing SIM cards to be reprogrammed and managed remotely. AVNET has launched a program with affiliated carriers that enables any user to remotely download, enable, disable or swap cellular operator profiles in their cellular-connected IoT devices. The program will continue to expand with the announcement of additional selected carrier partners on a regular basis.

The solution is based on the AVeUIVV3210xxx with an administration platform provided by IDEMIA, leading global provider of SIM cards, eUICC and security solutions. The AVeUIVV3210xxx chip comes with a pre-paid allowance subscribed with an AVNET eUICC Program partner carrier in order to provide an initial connectivity bootstrap which can be used to conduct a product factory test and/or the download of a different profile supplied by a different carrier affiliated to AVNET's eUICC Program.

By offering a complete range of care levels across all the complex processes behind the on-boarding, AVNET is able to save its customers from doing this complicated task. This solution is also a world-first in the way that AVNET takes complete care of the complex processes behind the on-boarding of new cellular carriers instead of its customers doing it.

The AVNET eUICC Program offers customers the most open and future-proof solution on the market and is predicted to unleash the ability to quickly develop cellular connectivity in the IoT.

2 Overview

The AVeUIVV3210xxx is based on IDEMIA's DakOTa M2M v3.2 commercial-grade eUICC Operating System powering an INFINEON SLM97 secure chip, designed to offer capabilities to remotely provision mobile operator credentials onto a SIM to remotely support IoT devices. IDEMIA has actively participated in GSMA driven works on specifying the Remote Provisioning Architecture together with Mobile Network Operators and other SIM solution suppliers, which led to recent release of GSMA SGP.02 version 3.2 in February 2019.

One of the improvements brought by SGP.02v3.2 is a Profile Interoperability achieved by implementation of SIMalliance eUICC Profile Package - Interoperable Format Technical Specification V2.0 (IDEMIA is one of the SIMalliance board members and an active participant).

Keeping in mind that interoperability being a major concern, DakOTa products have been tested with a variety of communication modules and 3rd party Subscription Management Platforms including GSMA SM-SR change PoCs. As a consequence, the AVeUIVV3210xxx supports the revised SM-SR change procedure defined by SGP.02 v3.2.

The AVeUIVV3210xxx benefits from IDEMIA's, INFINEON's and AVNET's extensive experience in IoT and embedded Secure Elements (eSE) markets. OS improvements include, but are not limited to, self-testing capabilities and memory anti-erosion mechanisms. In addition to GSMA specification, AVeUIVV3210xxx offers proprietary functionalities simplifying the implementation of typical IoT scenarios, including local management.

In order to ensure that adequate security measures to protect the interests of mobile network operators (MNO) have been implemented the AVeUIVV3210xxx is personalized in SAS-UP v7 accredited sites and can therefore participate in the GSMA eUICC PKI ecosystem.
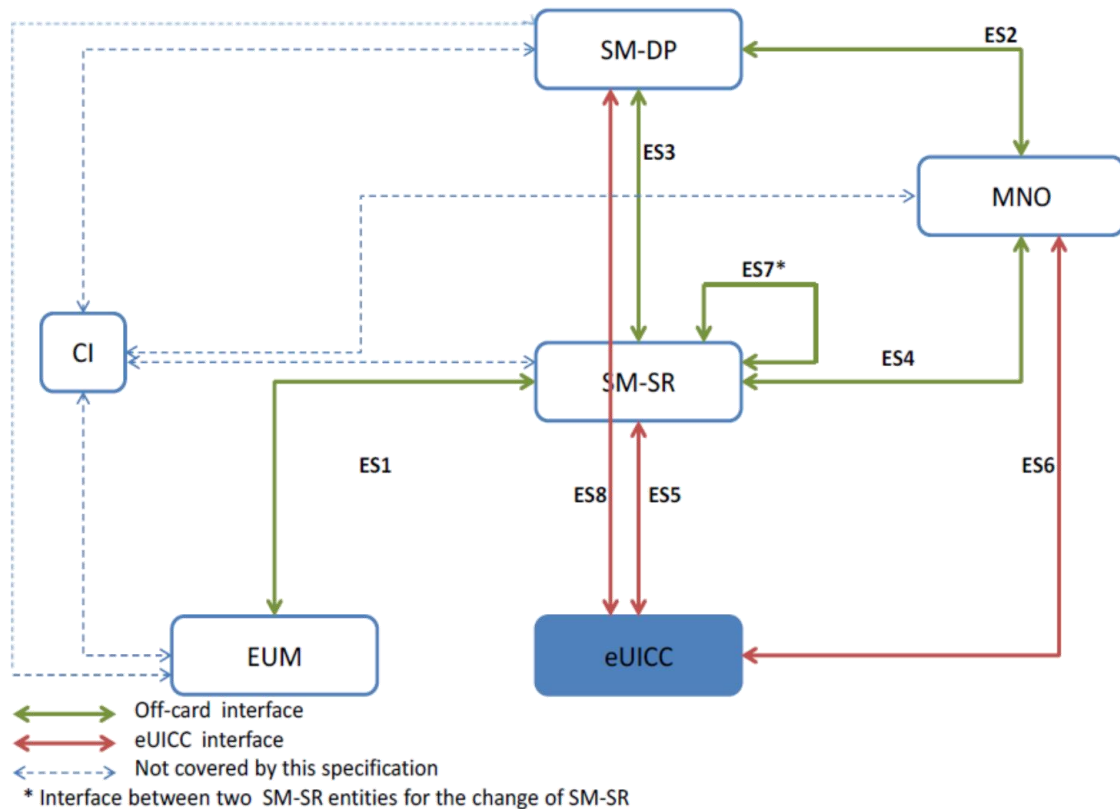
Figure 1: eUICC Remote Provisioning System

3 Compliance

3.1 3GPP specifications

3GPP TS 21.111 (v13.0.1, Rel-13): USIM and IC card requirements

3GPP TS 22.038 (v6.5.0, Rel-6): USIM Application Toolkit (USAT) - Stage 1

3GPP TS 23.040 (v8.6.0, Rel-8): Technical realization of the Short Message Service (SMS)

3GPP TS 23.041 (v7.0.0, Rel-7): Technical realization of Cell Broadcast Service (CBS)

3GPP TS 23.048 (v5.9.0, Rel-5): Security Mechanisms for the (U)SIM application toolkit; Stage 2

3GPP TS 31.048 (v5.1.0, Rel-5): Test of (U)SAT security

3GPP TS 31.101 (v9.1.2, Rel-9): UICC-Terminal interface; Physical and Logical Characteristics

3GPP TS 31.102 (v8.17.0, Rel-8): Characteristics of the USIM Application

3GPP TS 31.103 (v7.7.0, Rel-7): Characteristics of the ISIM Application

3GPP TS 31.111 (v13, Rel-13): USIM Application Toolkit (USAT)

3GPP TS 31.115 (v11.0.1, Rel-11): Secured packet structure for (U)SIM Toolkit applications

3GPP TS 31.116 (v11.0.1, Rel-11): Remote APDU Structure for (U)SIM Toolkit applications

3GPP TS 31.122 (v9.0.0, Rel-9): USIM conformance test (card side)

3GPP TS 31.130 (v13, Rel-13): (U)SIM Application Programming Interface; (U)SIM API for Java™ Card

3GPP TR 31.900 (v13, Rel-13): SIM/USIM Internal and External Inter-working Aspects

3GPP TR 31.919 (v8.0.0, Rel-8): 2G/3G Java Card™ API based applet interworking

3GPP TS 33.102 (v8.6.0, Rel-8): 3G Security; Security architecture

3GPP TS 33.105 (v13.0.0, Rel-13): Cryptographic algorithm requirements

3GPP TS 35.205 (v11.0.0, Rel-11): Specification of the MILENAGE Algorithm Set

3GPP TS 42.017 (v4.0.0, Rel-4): SIM functional characteristics

3GPP TS 42.019 (v5.6.0, Rel-5): SIM API for Java Card™ - Stage 1 -

3GPP TS 43.019 (v5.6.0, Rel-5): Subscriber Identity Module Application Programming Interface; (SIM API) for Java Card™; Stage 2

3GPP TS 51.011 (v4.15.0, Rel-4): Specification of the Subscriber Identity Module - Mobile Equipment (SIM - ME) interface

3GPP TS 51.014 (v4.5.0, Rel-4): Specification of the SIM Application Toolkit for the Subscriber Identity Module - Mobile Equipment (SIM - ME) interface

3GPP TS 51.017 (v4.2.0, Rel-4): Test of SIM-ME interface (card side)

3.2   ETSI specifications

ETSI TS 101 220 (v12.0.0, Rel-12): Application Identifiers for telecommunications

ETSI TS 102 124 (v6.1.0, Rel-6): Transport Protocol for CAT Applications - Stage 1

ETSI TS 102 151 (v6.0.0, Rel-6): Measurement of Electromagnetic Emission of SIM cards

ETSI TS 102 221 (v11.0.0, Rel-11): UICC-Terminal interface; Physical and logical characteristics

ETSI TS 102 222 (v7.1.0, Rel-7): Administrative Commands for telecommunications applications

ETSI TS 102 223 (v12, Rel-12): Card Application Toolkit

ETSI TS 102 224 (v8.0.0, Rel-8): CAT security – Stage 1

ETSI TS 102 225 (v12.1.0, Rel-12): Secured packet structure for UICC applications

ETSI TS 102 226 (v12.0.0, Rel-12): Remote APDU Structure for UICC based Applications

ETSI TS 102 240 (v9.1.0, Rel-9): UICC Java Card™ API - Stage 1

ETSI TS 102 241 (v12, Rel-12): UICC Java Card™ API - Stage 2

3.3 SUN Java Card specifications

Java Card 3.0.4 API Specification

Java Card 3.0.4 Runtime Environment Specification

Java Card 3.0.4 VM Architecture Specification

3.4 Global Platform specifications

Global Platform Card Specification 2.2.1

Global Platform Card UICC Configuration – Version 1.0.1

Global Platform Card - Remote Application Management over HTTP - Card Spec. 2.2 – Amendment B - Version 1.1.3

Global Platform Card Technology - Secure Channel Protocol 03 - Card Spec. 2.2 – Amendment D - Version 1.1.1

Global Platform Card - Security Upgrade for Card Content Management - Card Spec. 2.2 – Amendment E – Version 1.0.1

3.5 GSMA specifications

GSMA SGP.01 - Embedded-SIM-Remote-Provisioning-Architecture-Version-1.1

GSMA SGP.02 - Remote-Provisioning-Architecture-for-Embedded-UICC-Technical-Specification-Version-3.2

GSMA SGP.11 - Remote-Provisioning-Architecture for Embedded UICC Test Specification Version-3.2

4 Pinout & mechanical data

4.1 SimFIT (2FF / 3FF / 4FF) package

SimFIT is laminated card body, ID-1 size, with punched 2FF SIM plug, punched 3FF SIM plug, punched 4FF SIM plug and milled cavity. The module is a 6-contact version as show in the figures below.

Size of ID-1card body: 85.6mm x 54.02mm

Thickness of card body: 0.690 – 0.730 mm

The 4FF SIM plug has a thickness of max. 700μm. The 4FF plug thickness is reduced on top.

2FF: 25+/-0,1mm x 15+/-0.1mm

3FF: 15+/-0,1mm x 12+/-0.1mm

4FF: 12,3+/-0,1mm x 8,8+/-0.1mm

Figure 2: simFIT card body

Figure 3: electrical contacts

4.2 MFF2 package
4.2.1 Mechanical

ETSI TS 102 671 defines the mechanical specifications of the M2M Form Factor #2 (MFF2):
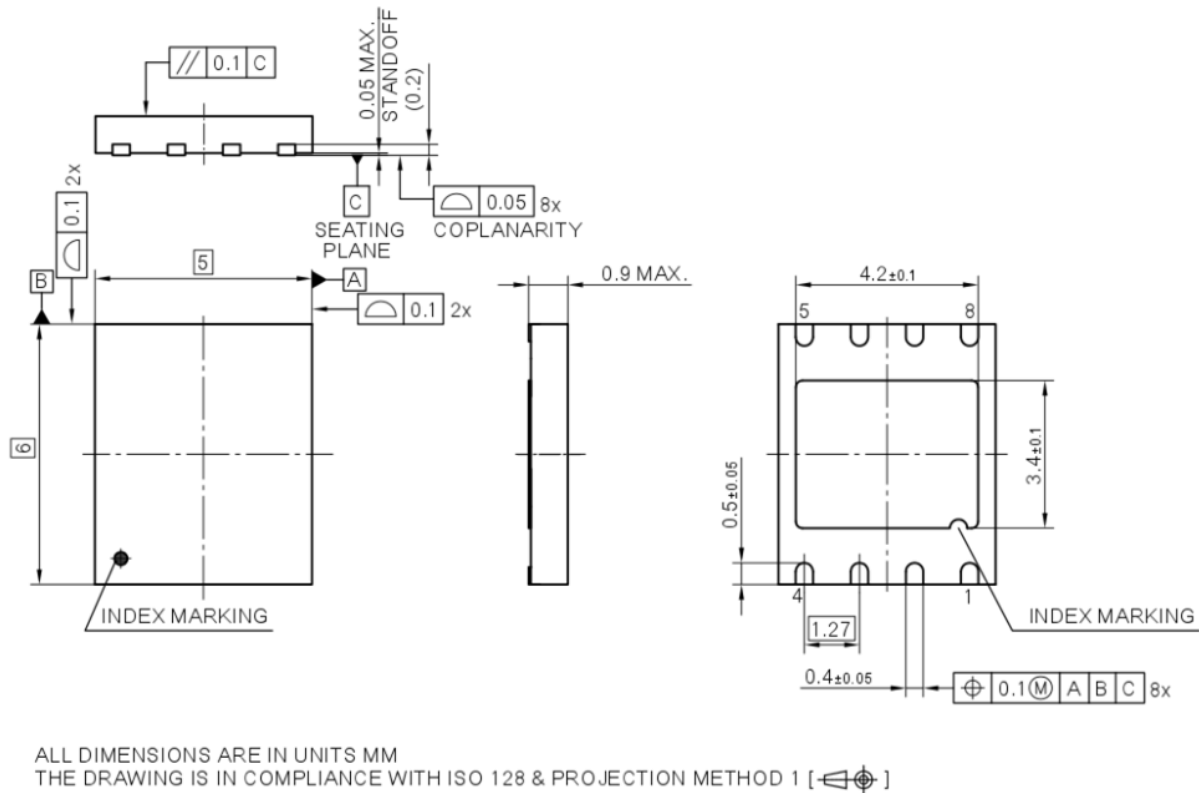
Figure 4: MFF2 package dimensions

Note: the exposed die-pad is not electrically connected to the die and can be used as a mechanical anchor to strengthen the attachment of the MFF2 package to the printed circuit board (PCB).

PIN	ISO	Signal	Description	PIN	ISO	Signal	Description
1	C5	V_{SS}	Ground	5	C4	NC	Reserved
2	C6	NC	Reserved	6	C3	CLK	Clock signal input
3	C7	I/O	Serial data I/O	7	C2	RST	Reset signal input
4	C8	NC	Reserved	8	C1	V_{CC}	Power supply

Pin assignment of contacts C1 to C8 is defined as per ETSI TS 102 221 and TS 102 671.

NC: Do Not Connect

The contacts shall be located on the front of the card. The dimensions are referenced to the left and upper edges of the front surface of the card as defined in ISO/IEC 7810. See ISO/IEC 10373-3 for the test method.

The use of contacts C4 and C8 for the Inter-Chip USB interface is not available. Each numbered contact shall be assigned as specified in ISO/IEC 7816-3 where C4 and C8 are not connected (NC).

The use of contact C6 for the UICC-CLF interface (NFC for instance) is not available. Contact C6 shall not be bonded in the UICC for any function.

Unused contact areas shall be either non-conductive or electrically isolated from any other contact area in order to avoid potential short circuit in interface devices.

Surface profile of contacts

No point of the entire IC contact surface shall be higher than 0.10 mm above or lower than 0.10 mm below the adjacent surface of the card.

Mechanical strength

Each contact surface and contact area (entire galvanic surface) shall not be damaged by a working pressure equivalent to a steel ball of diameter 1 mm applying a force of 1,5 N.

Electrical resistance

When a dc current of any value between 50 µA and 100 mA is applied, the surface resistance between any two points on the same contact pad shall not exceed 0.5 Ω at 1.5 mm between contact points.

4.2.2   Cover tape and trailer

Typically, the carrier tape is constructed from a Antistatic Polyethylene Terephthalate Film. The uniform film thickness is 0.2 mm to 0.4 mm, depending on the size and weight of the component carried by the tape.

- • Cover tape's surface resistance : 10^5 Ohms/sq
- • Carrier tape's surface resistance : 10^5~10^9 Ohms/sq

USER DIRECTION OF FEED
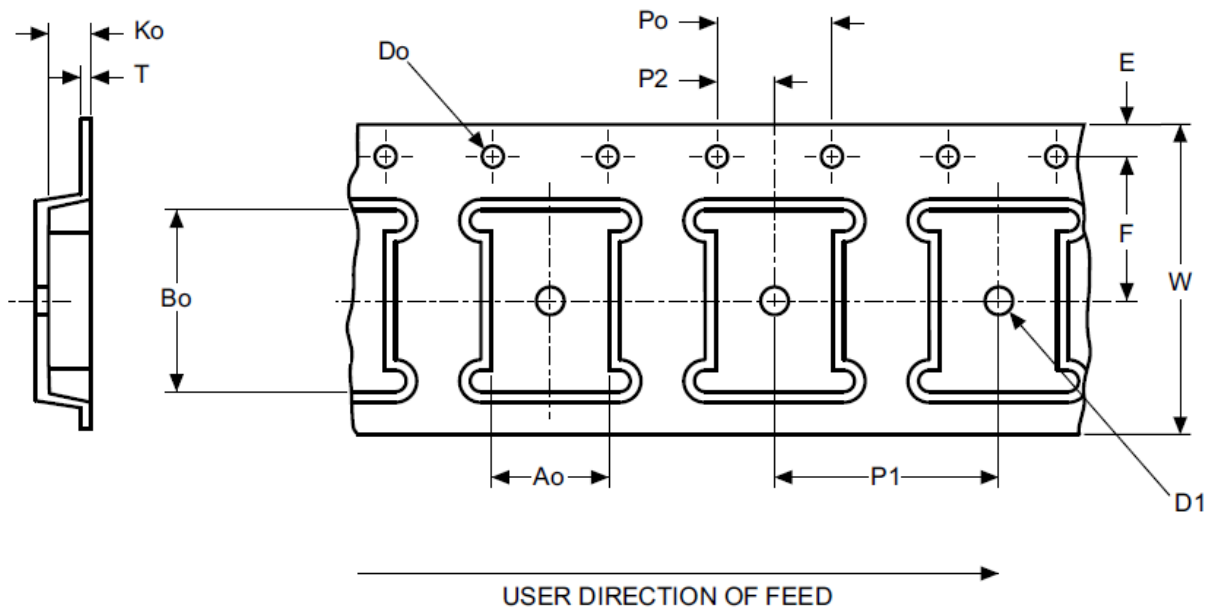
Package	A0	B0	K0	D1 Min.	P1	P2	D0	P0	E	F	W	T Max.	Unit
MFF2	5.3 ±0.1	6.3 ±0.1	1.2 ±0.1	1.5	8 ±0.1	2 ±0.1	1.55 ±0.05	4 ±0.1	1.75 ±0.1	5.5 ±0.1	12 ±0.3	0.3 ±0.05	mm
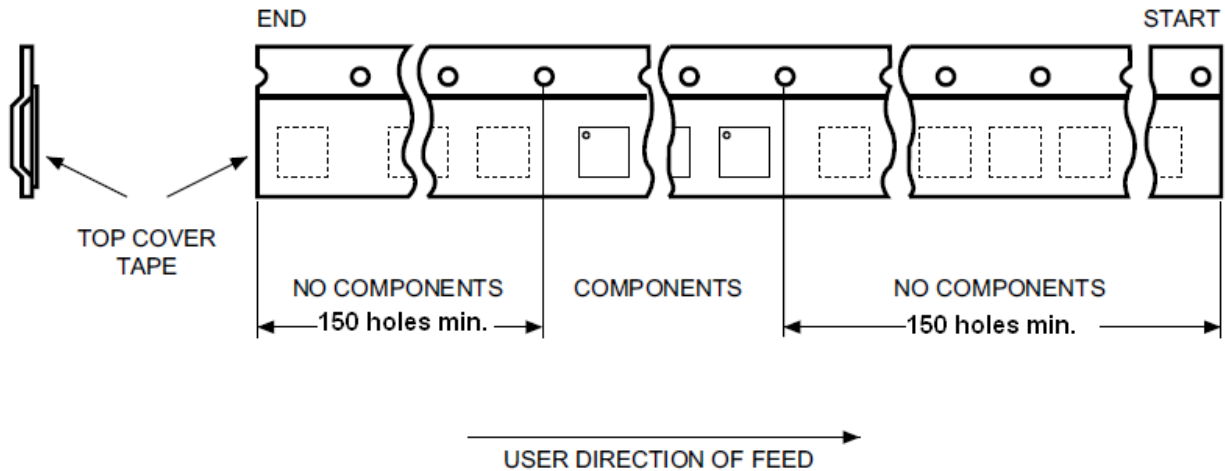
Figure 5: Tape feed

Note: Min. trailer length : 160 mm and min. leader length: 400 mm

5   Typical application diagram

Figure 6: Typical connection to modem

Additional passive components may be required depending on modem brand and model. Please refer to the modem application diagram for a detailed implementation.

6 Product code and ordering

AVeUICC 32 1 0 BICS 0M1 M2 B

Device family ————————

AVeUICC = AVNET eUICC

GSMA SGP.02 version ————————

31 = 3.1

32 = 3.2

Grade ————————

0 = Industrial

1 = Commercial

2 = Automotive

Reserved ————————

Bootstrap carrier ————————

Pre-paid data allowance ————————

0M1 = 100kB

Package ————————

F234 = 2FF/3FF/4FF SimFIT multi-cut plastic format

M2 = MFF2

Packaging options ————————

B = Box of 50

C = Box of 500

D = Tube of 10

R3000 = Reel of 3000
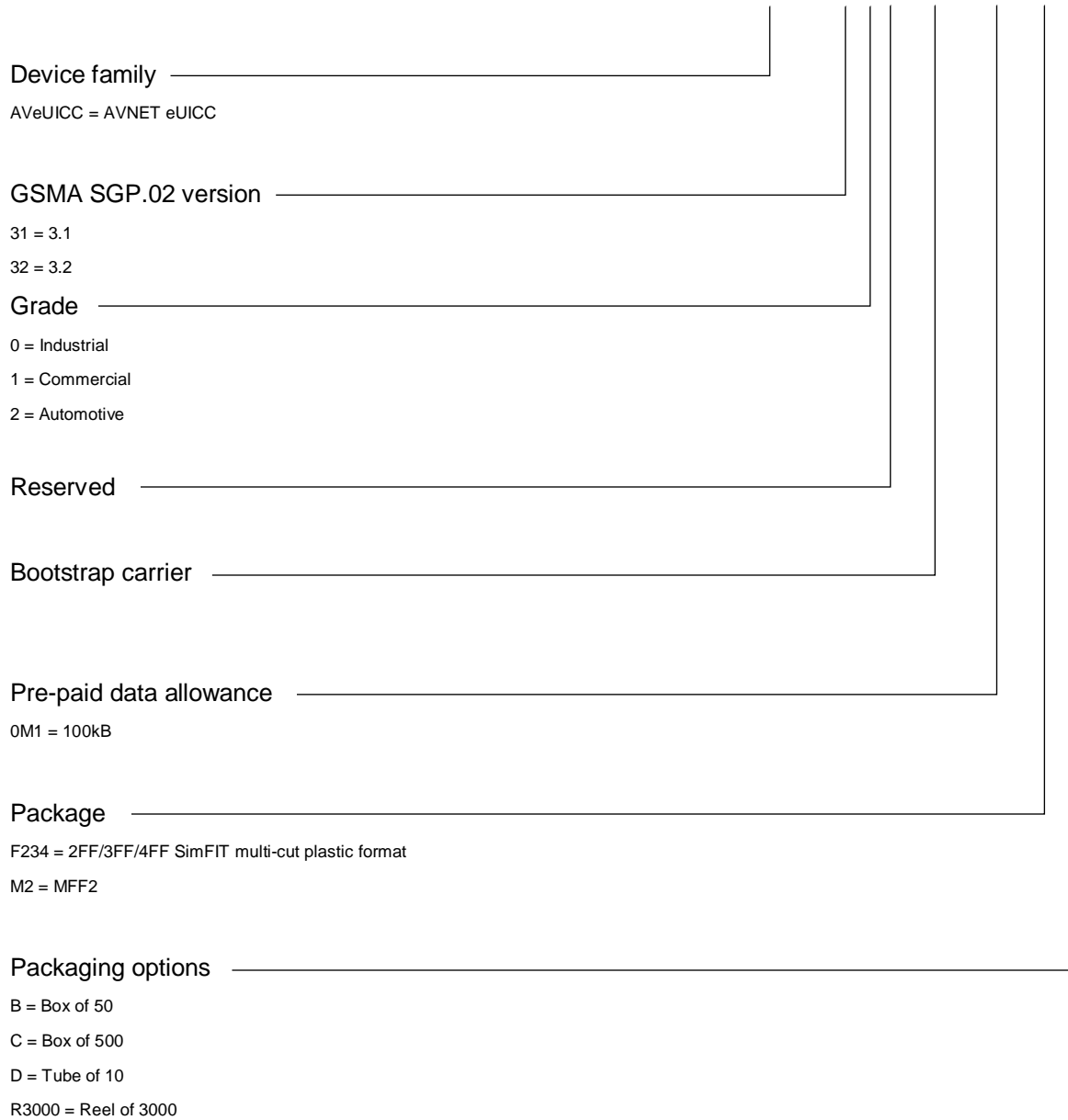
Figure 7: Nomenclature

7 Product characteristics

7.1 Absolute maximum ratings

Parameter	Symbol	Min	Typ	Max	Unit	Comment
Supply Voltage	V_{CC}	-0.3	-	7.0	V	-
Input Voltage	V_{IN}	-0.3	-	$V_{CC} + 0.3$	V	-
Operating Temperature (ambient)	T_A	-40		+105	°C	T_J must be kept
Junction Temperature	T_J	-40		+110	°C	-
Pulse voltage ESD protection of RST, CLK, I/O	V_{ESD}	4000	-	-	V	ISO 7816-1 and JESD22-A114C

Note: Stresses exceeding the values listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or at any other conditions whose values exceed those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability, including EEPROM data retention and write/erase endurance.

7.2 Electrical characteristics

All directions of currents are seen from the terminal's point of view. Positive currents ('+') are sink currents from the terminal to the controller and negative currents ('-') are source currents from the controller to the terminal.
Figure 6 below shows circuitry for the I/O pin (with external pull-up) as a typical example of signs and signals used for representation of the pad characteristics.
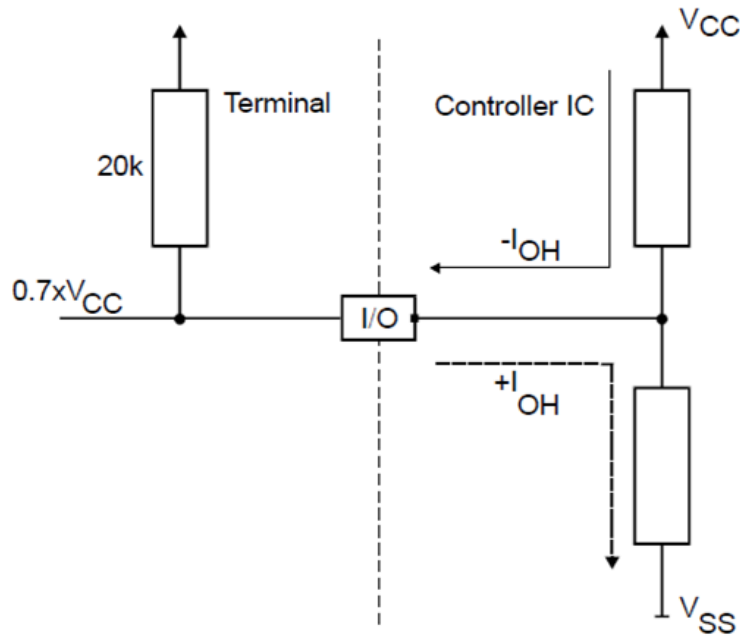
Figure 6: Pad interfacing - signs and symbols

7.2.1 DC characteristics

Current and voltage values assume a terminal that is able to supply the product according to the referenced standards providing a capacitor of 100nF as close as possible to the contacting elements.
T_A = −40 °C to +105 °C (unless otherwise stated).

Parameter	Symbol	Min	Typ	Max	Unit	Comment
Supply Voltage	V_{CC}	4.5	5	5.5	V	Class A
		2.7	3	3.3		Class B
		1.62	1.8	1.98		Class C
Supply Current	I_{CC}			21	mA	T_A = 25°C
Supply Current Spikes	I_{CCD}			100	mA	Class A - Q < 20 nAs
				50		Class B - Q < 10 nAs
				30		Class C - Q < 6 nAs
Supply Current in current limitation mode	I_{MAX}			10	mA	Class A
				6		Class B
				4		Class C

Supply Current in sleep mode	I_{CCS1}			200	uA	TA = 25°C, Clock 1 Mhz
Supply Current in sleep mode	I_{CCS2}			200		Clock OFF Class A
				100	µA	Clock OFF Class B
				100		Clock OFF Class C

Note: Power class is managed by the modem as described in the ISO/IEC 7816-3 standard, chapter 6.2.

7.2.2   AC characteristics

Parameter	Symbol	Min	Typ	Max	Unit	Comment
Supply Voltage ramp-up time	t_{VCCR}	1	-	10^7	µs	0 to 100% of target supply voltage
CLK signal						
Rise/fall time	t_r, t_f			$0.1 * 1/f_{CLK}$	ns	
Frequency	f_{CLK}	1		10	MHz	
Duty Cycle		40		60	%	
Input Voltage	V_{IH}	$0.7 * V_{CC}$		$V_{CC} + 0.3$	V	I_{IH} = -20uA … + 20uA
	V_{IL}	-0.3		$0.2 \times V_{CC}$		I_{IL} = -20uA … + 20uA
RST signal						
Input Voltage	V_{IH}	$0.8 * V_{CC}$		$V_{CC} + 0.3$	V	I_{IH} = -20 uA … + 20uA
	V_{IL}	-0.3		$0.2 \times V_{CC}$		I_{IL} = -50 uA … +20 uA
Rise/fall time	t_r, t_f			1	µs	30 pF external
I/O signal						
Rise/fall time	t_r, t_f			1	µs	30 pF external
Input Voltage	V_{IH}	$0.7 * V_{CC}$		$V_{CC} + 0.3$		I_{IH} = -20uA … + 20uA
	V_{IL}	-0.3		$0.2 \times V_{CC}$		I_{IL} = -1 mA … +20 uA
Output Voltage	V_{OH}	$0.7 * V_{CC}$		$V_{CC} + 0.3$	V	I_{OH} = +/- 20uA
				0.4		I_{OL} = -1 mA Class A

Parameter	Symbol	Min	Typ	Max	Unit	Comment
	V_{OL}			0.4		I_{OL} = -1 mA Class B
				0.3		I_{OL} = -1 mA Class C

Note: Power class is managed by the modem as described in the ISO/IEC 7816-3 standard, chapter 6.2.
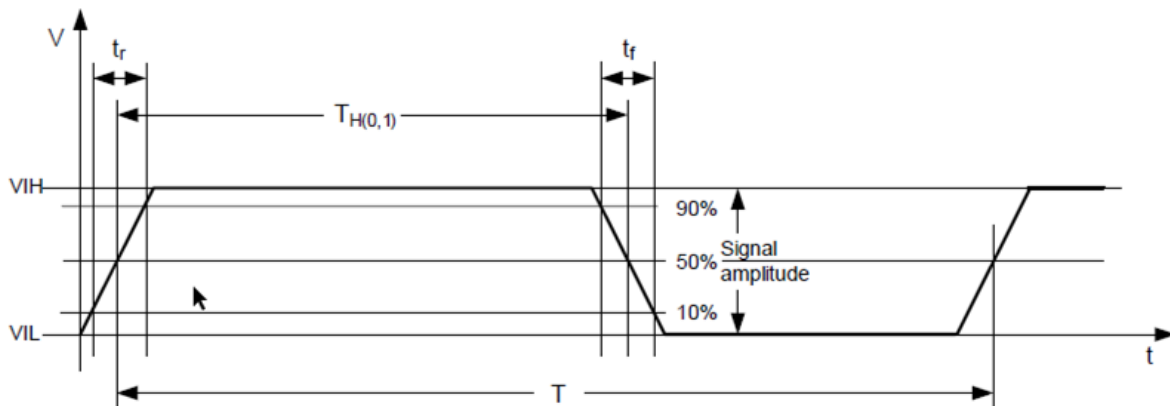

Figure 7: Input voltage signal timing relations

8 Device operation

8.1 Data channels

The AVeUIVV3210xxx drives the modem in order to maintain 2 data channels in parallel:

- 1 data channel via the active MNO profile acting for the user like a SIM card:
  - User APN
  - Access policies
  - User IP address
- 1 admin channel behind the MNO profiles for proper administration by AVNET's SM-SR platform:
  - Specific admin APN (hidden)
  - Secure access (hidden)
  - SM-SR IP address (hidden)

When provisioned with an operator profile activated, the AVeUIVV3210xxx acts like a SIM card to authenticate devices on the active cellular network.

When contacted by or contacting AVNET's SM-SR platform for a life-cycle management task, the AVeUIVV3210xxx may ask the modem to close the user data channel and to open the admin data channel for proper operation.

Network connectivity is required in order to open and maintain both channels, which is the reason why the AVeUIVV3210xxx always needs at least 1 active profile and data subscription in order to be reachable.

Because the admin channel also uses the active data plan, the active MNO needs to open specific ports to allow this admin channel, which is the reason why this can only be done with MNOs/MVNOs partner to AVNET's eUICC program where this technical integration is being managed by AVNET.

8.2   Network types for eUICC compatibility

When provisioned with an operator profile, the AVeUIVV3210xxx acts like a SIM card to authenticate devices on cellular networks. As such, the AVeUIVV3210xxx will support connecting devices to any type of network available with the MNO providing the profile: 2G, 3G, 4G, 5G, Cat-M1(LTE-M), Cat-NB1 (NB-IoT).

When administered by AVNET's SM-SR, the device and the platform will need to exchange SMS and open a secure data IP connection. These services are available on 2G, 3G, 4G, 5G and optional on Cat-M1 (LTE-M) networks but not on Cat-NB1 (NB-IoT) networks as of today due to a lack of standardization.

As a consequence, the AVeUIVV3210xxx can operate on any type of network for data operation, but needs to connect with 2G, 3G, 4G, 5G or Cat-M1 (LTE-M) for life-cycle management services by the SM-SR as of now.

Cat-NB1 (NB-IoT) is expected to support eUICC services in future 3GPP releases although there is no clear timeline publicly available. AVNET, IDEMIA and BICS will experiment the poller applet before deploying.

In summary:

Network type	SM-SR admin	User data connection
2G (GPRS)	*Yes*	*Yes*
2G (EDGE)	*Yes*	*Yes*
3G	*Yes*	*Yes*
4G	*Yes*	*Yes*
5G	*Yes*	*Yes*
Cat-M1 (LTE-M)	*Yes*	*Yes*
Cat-NB1 (NB-IoT)	*In Progress*	*Yes*

8.3   Pre-qualified modems

The AVeUIVV3210xxx is a GSMA-standardized technology (3.2) and should be seamlessly interoperable with various modem vendors provided that their firmware supports Auto-BIP (Bearer-Independent Protocol).

Nevertheless, real-life situations are sometimes more complex than theory and we want to thoroughly pre-qualify the product bundles we are bringing to market, making sure that our SM-SR platform will never lose permanent synchronization with your modems regardless of a radio and/or local power outage happening during an administration campaign.

We have therefore qualified a few modems to support the product launch and will continue qualifying new modems in order to enrich our ecosystem.

Although we strongly recommend to use one of the pre-qualified modems, we are open to qualifying non-listed modems on a case-by-case basis.

Please refer to your Avnet Sales Representative for an up-to-date list of qualified modems, firmware versions and instructions.

9   Setting-up a data link with BICS

The AVeUICC3210BICS with the BICS profile active will seek connectivity on the BICS global network.

**** IT IS RECOMMENDED TO SET THE MODEM IN AUTO MODE AND NOT TO FORCE A ROAMING PARTNER ****

In order to establish a user data channel, the following settings need to be programmed into the modem:

Field	Value
APN name	BICSAPN (*)
Username	N/A
Password	N/A
Authentication	PAP or none

(*) The APN provided with the pre-paid allowance is a shared APN

9.1   IP addressing

- Dynamic IP assigned by BICS

9.2   Supported protocols

- Nothing is blocked
- UDP example with PacketSender™

		Time	From IP	From Port	To IP	To Port	Method	Error	ASCII	
1		14:59:35.608	You (Response)	21456	193.34.100.6	23888	UDP		This is a UDP answer from the server	54 68 69 73 20 69 73 20 61 20 55 4...
2		14:59:35.608	193.34.100.6	23888	You	21456	UDP		This is a UDP query to the server	54 68 69 73 20 69 73 20 61 20 55 4...

Clear Log

- TCP example with PacketSender™

	Time	From IP	From Port	To IP	To Port	Method	Error	ASCII	
1	15:03:11.472	You (Response)	21456	193.34.100.6	16354	TCP		This is a TCP answer from the server	54 68 69 73 20 69 73 20 61 20 54
2	15:03:09.800	193.34.100.6	16354	You	21456	TCP		This is a TCP query to the server	54 68 69 73 20 69 73 20 61 20 54

Clear Log

9.3   Security

- Production security standard by default

9.4   Supported network types

- 2G/3G/4G/5G/Cat-M1/Cat-NB1 global roaming

9.5   Data allowance

The AVeUICC3210BICS includes a data allowance of 100kB valid for a period of 12 months after purchase in more than 100 territories.

9.6   Countries and roaming networks

BICS connectivity included in the AVeUICC3210BICS bundle operates in the following countries (subject to change):

Albania, Argentina, Armenia, Australia, Austria, Bahrain, Belgium, Bolivia, Brazil, Bulgaria, Canada, Chile, China, Colombia, Congo, Costa, Croatia, Cyprus, Czech Republic, Denmark, Dominican Republic, Ecuador, Egypt, El Salvador, Estonia, Faroe Islands, Finland, France, French Polynesia, Germany, Ghana, Greece, Guatemala, Honduras, Hong Kong, Hungary, Iceland, India, Ireland, Isle of Man, Italy, Japan, Jersey, Jordan, Kenya, Kuwait, Latvia, Lesotho, Liechtenstein, Lithuania, Luxembourg, Malaysia, Malta, Mexico, Mozambique, Netherlands, New Zealand, Nicaragua, Niger, Nigeria, Norway, Panama, Paraguay, Peru, Philippines, Poland, Portugal, Puerto Rico, Qatar, Reunion, Romania, Russian Federation, Rwanda, Saudi, Serbia, Slovakia, Slovenia, South Africa, Spain, Sri Lanka, Sweden, Switzerland, Taiwan,, Tanzania, Thailand, Turkey, Uganda, Ukraine, UK, Uruguay, USA, Vietnam, Zambia.

For a detailed and up-to-date list of roaming partners:

https://www.avnet.com/wps/portal/silica/solutions/technologies/wireless-connectivity/e2c-euicc-to-connect/global-coverage/

9.7   Multi-IMSI profile

In order to operate on as many LTE-M and NB-IoT networks as possible, the AVeUICC3210BICS is preloaded with a BICS multi-IMSI (3) profile. This means that when this profile is active and the device is trying to establish or resume a connection, an internal mechanism may rotate the IMSI until a proper network is found.

Whenever the device wakes-up in a new location or country, allow several minutes for the device to find the appropriate network as per your modem settings. IMSI rotation will occur every 4 minute until the proper network is found. Please do NOT power down your device during this time as it would reset the timer.

Fixed assets or assets moving inside the same country should only experience this IMSI calibration at installation and, if the modem is appropriately configured, will resume connection immediately upon wake-up.

Assets moving from country to country should be allowed up to 12 minutes (1 full rotation of the 3 IMSIs) upon wake-up in the new country before giving-up a network search.

BICS may change or update new IMSIs over the air in order to unlock new countries and networks.

10 Administering the eUICC

The eUICC can be administered both locally with AT commands and remotely from the SM-SR platform operated by AVNET:
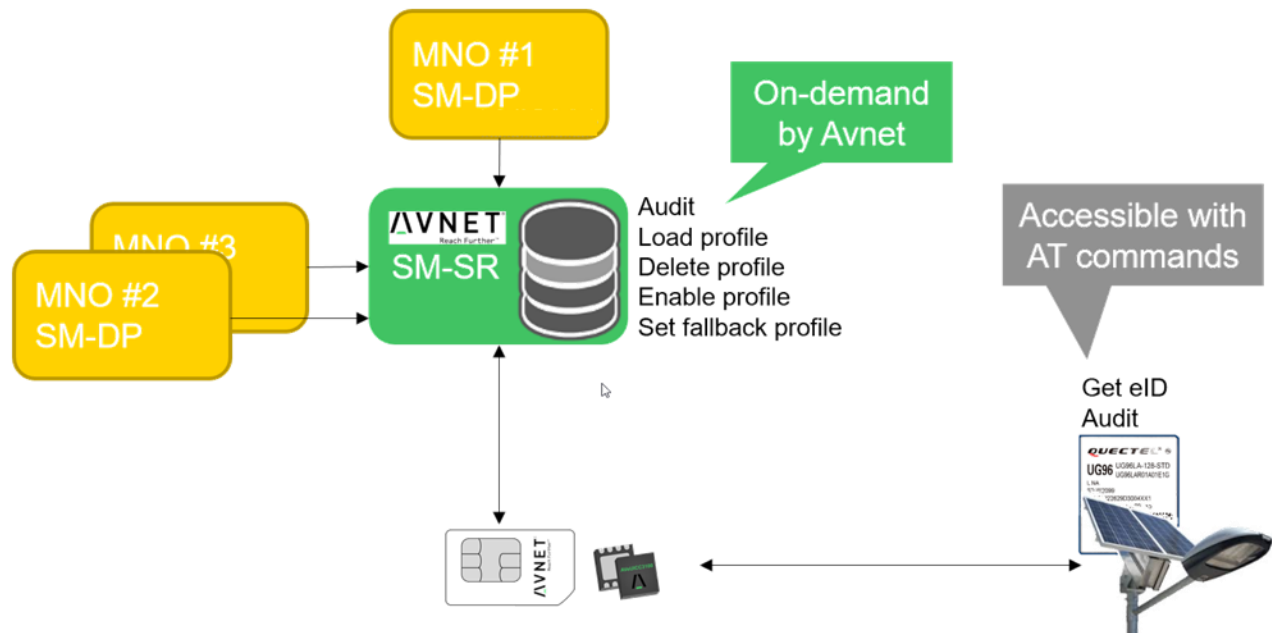

Figure 8: Simplified system overview

Upon request to your AVNET technical support, we will be happy to administer your batches of eUICCs remotely:

- Audit an eUICC to collect its state and re-synchronize to the platform

- Download a new profile provided by an AVNET eUICC Program MNO partner

- Activate a profile

- Delete an inactive profile

In order to optimize operations, please make sure that the eUICC is plugged into a modem and connected to a 2G, 3G, 4G, 5G or Cat-M1 (LTE-M) network as previously explained.

Note: an eUICC connecting to a Cat-NB1 (NB-IoT) network will not be reachable by our SM-SR platform as of today.

10.1 Local management applet

Additionally, you are able to execute locally the following operations on your own with local AT commands to the modem:

- Get the eID of an eUICC: useful at manufacturing in order to build the database of devices

- Audit an eUICC to collect its current state and retrieve a profile ISDP#

- Enable the profile in ISDP#

For this purpose, here is a detailed description of the commands:

10.1.1 GET_eID

- AT+CSIM=10,"0070000001" // open available channel – the eUICC will return a channel # ∈ [1 ; 4]
  - +CSIM: 6,"019000" // channel 1 selected as an example
- AT+CSIM=42,"01A4040010A0000000770307601100FE0000300001" // select LM applet
  - +CSIM: 4,"9000"
- AT+CSIM=10,"8116000012" // get EID
  - +CSIM: 40,"4C1089033024208100491100000000000539 9000"
- AT+CSIM=10,"0070080100" // close channel 1
  - +CSIM: 4,"9000"

10.1.2 AUDIT

Auditing the eUICC allows retrieving the current state of its memory. Profiles are stored in containers called ISDP or ISD-P (Issuer Security Domain Profile).

There are as many ISDP's as profiles loaded into an eUICC and the allocation process is dynamically managed by the eUICC OS whenever a profile is downloaded or deleted.

In the example below, the eUICC has 2 profiles downloaded and answers with descriptions of ISDP #1000 and ISDP #1100 containing respectively an enabled BICS profile set as fallback and a disabled other MNO profile:

- AT+CSIM=10,"0070000001" // open available channel – the eUICC will return a channel # ∈ [1 ; 4]
  - +CSIM: 6,"019000" // channel 1 selected as an example
- AT+CSIM=42,"01A4040010A0000000770307601100FE0000300001" // select LM applet
  - +CSIM: 4,"9000"

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- AT+CSIM=10,"81180000FF" // AUDIT
  - +CSIM: 238,"
    - E3 25 4F 10A0000005591010FFFFFFFF8900001000 // ISDP #1000
    - 9F70 01 3F // Enable
    - 53 01 01 // Fallback attribute set
    - 2C 0A 9823xxxxxxxxxxxxxxxx // ICCID in ISDP #1000
    - E3 25 4F 10A0000005591010FFFFFFFF8900001100 // ISDP #1100
    - 9F70 01 1F // Disable
    - 53 01 00 // Fallback attribute NOT set
    - 2C 0A 9888xxxxxxxxxxxxxxxx // ICCID in ISDP #1100
    - 9000"
- AT+CSIM=10,"0070800100" // close channel 1
  - +CSIM: 4,"9000"

Caution: the ICCID numbers retrieved with this command have their nibbles swapped inside each byte.

Therefore, a BICS profile reading 98230123456789ABCDEF should read 89321032547698BADCFE.

10.1.3　ENABLE

When the eUICC has 2 or more profiles downloaded in its memory, it is possible to switch between them with a simple AT command.

In our previous example, the eUICC has 2 profiles downloaded in ISDP #1000 and ISDP #1100 containing respectively an enabled BICS profile set as fallback and a disabled other MNO profile. The following commands will disable the BICS profile and enable the other profile profile:

- AT+CSIM=10,"0070000001" // open available channel – the eUICC will return a channel # $\in$ [1 ; 4]
  - +CSIM: 6,"019000" // channel 1 selected as an example
- AT+CSIM=42,"01A4040010A0000000770307601100FE0000300001" // select LM applet
  - +CSIM: 4,"9000"
- AT+CSIM=42,"8101000010A0000005591010FFFFFFFF8900001100" // ENABLE ISDP #1100
  - +CSIM: 4,"9000"
- AT+CSIM=10,"0070800100" // close channel 1
  - +CSIM: 4,"9000"
- **Do not forget to set the APN credentials to the new operator**

Caution: Before enabling a profile, a data plan with connectivity must be associated with the profile so that the card can wake-up and communicate on the new network. Otherwise it will fail connecting and the application must implement a detection mechanism for such a situation and manage it, with maybe a fallback scenario.

10.2 Low-power polling applet

The default mechanism to administer an eUICC from the SMSR platform is the following:

1. Power-on the device and make sure it stays registered on the network with SMS MT (Mobile Terminated) and data allowed
2. Send admin command in PUSH mode from the SMSR platform
   a. SMSR sends an SMS to the device prompting the device to connect
   b. Device receives the SMS and forwards to the eUICC
   c. eUICC opens a secure end-to-end https channel with the SMSR platform
   d. Admin commands and data are exchanged
3. Make sure the device is not disconnected from the network until the SMSR receives a notification of acknowledgement for the command

This PUSH mechanism has a poor flexibility since it requires that a device be always connected to the network in order to be reachable by the SMSR platform. It will work for the few cases where power and network coverage are always available to the device, but will mostly fail in use cases where the device disconnects from the network in order to save power or because radio coverage is not guaranteed by the application.

In order to enhance the flexibility of the SMSR administration, the AVeUICC32x0 family comes with an extra mechanism: a low-power Over-the-Air (OTA) polling applet, allowing the device to operate out of synchronization with the SMSR. Here is how it works:

1. Device is in its own state (sleeping, awake, connected to or disconnected from the network)
2. Send admin command in PULL mode from the SMSR platform
   a. The command is queued on the SMSR for 24h
3. At least, once per 24h, device application wakes-up the device, connects to the network and executes the SMSR polling AT command locally
   a. eUICC opens a secure end-to-end https channel with the SMSR platform
   b. Queued commands and data are exchanged between SMSR and eUICC
   c. If no command pending or when queue is empty, the channel is closed
4. Device can go back to sleep

This PULL mechanism is particularly useful for devices making use of Extended Discontinuous Reception (eDRX) and Power Saving Modes (PSM) on cat-M and cat-NB networks, as well as devices running low-power applications with a low wake-up duty-cycle.

The applet is fully card-by-card configurable, and allows to:

1. Enable / disable polling capability
2. Configure polling to happen
   a. At power-on and reset
   b. On regular time intervals
   c. On demand

By default, all AVeUICC32x0 eUICCs are configured with the following default settings:

1. Polling applet enabled
2. If network available, SMSR is contacted 48 seconds after a new profile is injected
3. If network available, SMSR is contacted every 48 seconds

It is possible to change this default configuration with the following commands:

- AT+CSIM=10,"0070000001" // open available channel – the eUICC will return a channel # ∈ [1 ; 4]
  o +CSIM: 6,"019000" // channel 1 selected as an example

- AT+CSIM=42,"01A4040010A00000007701076006000 0FE00000700" /// Select Polling applet
  - +CSIM: 4,"9000"
- Then choose between the following possible configurations (spaces have been added for clarity)
  AT+CSIM=38,"81AA00000E 01 01 0002 03 00 00 000003 FFFFFFFF"

Applet On/Off ───────────────────────────────────┐

    0x00 = Applet off

    0x01 = Applet on

Trigger on Profile download event ──────────────┐

    0x00 = Off

    0x01 = On

Timer on Profile download event in seconds ──────┐

    0x0001 = Min (1 second)

    0xFD20 = Max (18 hours)

    0xFFFF = No change

Number of retries for Profile download event ──────┐

    0x00 = Min (no retry)

    0xFF = No change

Allow applet operation while roaming ────────────┐

    0x00 = Off

    0x01 = On

Trigger on timer event ──────────────────────────┐

    0x00 = Off

    0x01 = On

Timer event delay in seconds ────────────────────┐

    0x000001 = Min (1 second)

    0xED4E00 = Max (180 days)

    0xFFFFFF = No change

  - +CSIM: 4,"9000"
- AT+CSIM=10,"0070800100" // close channel 1
  - +CSIM: 4,"9000"

Important note: timers are stopped and reset whenever power is removed from the eUICC and will therefore not run in power down.

In order to manually trigger a connection to the SMSR and check with any pending action on the SMSR, simply execute:

AT+CSIM=18, "80C20000048802CC00"

11 Glossary

SIM: Subscriber Identifier Module (plastic format)

eSIM: embedded SIM (chip format)

UICC: Universal Integrated Circuit Card = reprogrammable SIM (plastic format)

eUICC: embedded UICC = reprogrammable eSIM (chip format)

eID: eUICC/UICC hardware unique Identifier

ICCID: Integrated Circuit Card Identifier = MNO profile unique ID

IMSI: International Mobile Subscriber Identity

ISDP: Issuer Security Domain Profile

OTA: Over the Air

PULL: an asynchronous mechanism where an SMSR admin task is queued on the SMSR and waits for the eUICC to contact the SMSR to be executed

PUSH: a synchronous mechanism where an SMSR admin task is immediately sent to a device and fails if the device is not connected or does not answer

SM-SR: Subscription Manager Secure Router = AVNET's eUICC life-cycle management platform

SM-DP: Subscription Manager Data Preparation = MNO platform connecting into our SM-SR to securely and remotely deliver profiles into eUICCs in the field

12 RoHS Compliance
12.1 AVNET statement

The Directive 2011/65/EU on the Restriction of the use of certain Hazardous Substances (RoHS II), replacing Directive 2002/95/EC (RoHS I), targets Electrical and Electronic Equipment (EEE) in order to avoid adverse impacts on human health and the environment.

EMEA subsidiaries of the Avnet group ("Avnet") doing business for EBV Elektronik, Avnet Silica, Avnet Abacus, Avnet Integrated Solutions and Avnet United business units, are fully aware of the requirements of

the RoHS Directive 2011/65/EU in the EU. Roles and obligations have been identified by Avnet to the best of its knowledge.

Avnet, as a distributor, does not certify compliance with RoHS on behalf of the original manufacturers, since we e.g. do not control the manufacturing process of the products we supply.

RoHS Directive 2011/65/EU was amended by the Directive 2015/863/EU, which was published in June 2015. Four additional substances (phthalates) were added to Annex II of the original RoHS Directive. The provisions regarding the restriction of the newly added substances in 'Electrical and Electronic Equipment' do not apply before 22.07.2019. For medical devices and for monitoring and control instruments there is an additional two-year grace period.

The table below contains the following list of restricted substances and their tolerated maximum concentration values (MCV) by weight (w/w) in homogeneous materials (specific exemptions may apply or products be out of scope):

Restricted substances	MCV in % (w/w)
Lead (Pb)	0.1
Mercury (Hg)	0.1
Cadmium (Cd)	0.01
Hexavalent chromium (Cr (VI))	0.1
Polybrominated biphenyls (PBB)	0.1
Polybrominated diphenyl ethers (PBDE)	0.1
Bis(2-ethylhexyl) phthalate (DEHP)	0.1 (newly added)
Butyl benzyl phthalate (BBP)	0.1 (newly added)
Dibutyl phthalate (DBP)	0.1 (newly added)
Diisobutyl phthalate (DIBP)	0.1 (newly added)

For any further questions with regard to product RoHS compliance, please get in contact with your local sales representative.

12.2 INFINEON statement

On January 27, 2003 the European Parliament and the council adopted the following directives:

- 2002/95/EC on the Restriction of the use of certain Hazardous Substances in electrical and electronic equipment ("RoHS")

- 2002/96/EC on Waste Electrical and Electrical and Electronic Equipment ("WEEE")

Some of these restricted (lead) or recycling-relevant (brominated flame retardants) substances are currently found in the terminations (e.g. lead finish, bumps, balls) and substrate materials or mold compounds.

The European Union has finalized the Directives. It is the member states' task to convert these Directives into national laws. Most national laws are available, some member states have extended timelines for implementation. The laws arising from these Directives have come into force in 2006 or 2007.

The electro and electronic industry has to eliminate lead and other hazardous materials from their products. In addition, discussions are on-going with regard to the separate recycling of ceratin materials, e.g. plastic containing brominated flame retardants.

Infineon is fully committed to giving its customers maximum support in their efforts to convert to lead-free and halogen-free1) products. For this reason, Infineon's "Green Products" are ROHS-compliant.

Since all hazardous substances have been removed, Infineon calls its lead-free and halogen-free semiconductor packages "green." Details on Infineon's definition and upper limits for the restricted materials can be found here.

The assembly process of our high-technology semiconductor chips is an integral part of our quality strategy.

Accordingly, we will accurately evaluate and test alternative materials in order to replace lead and halogen so that we end up with the same or higher quality standards for our products.

The use of lead-free solders for board assembly results in higher process temperatures and increased requirements for the heat resistivity of semiconductor packages. This issue is addressed by Infineon by a new classification of the Moisture Sensitivity Level (MSL). In a first step the existing products have been classified according to the new requirements.

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Appendix A: List of BICS roaming partners

An up-to-date list of BICS roaming partners and countries can be found here:

https://www.avnet.com/wps/wcm/connect/onesite/a28ccde4-953b-4c13-ac5b-58144685fcba/v5.20210121_BICS+coverage+map_SFT+Premium-avnet.pdf?MOD=AJPERES&attachment=false&id=1611654291674