ST4SIM-300M

Data brief

GSMA eSIM for IoT system on chip solution for IoT environment

VFDFPN8

6 x 5 mm, wettable flanks (MFF2)

WLCSP24

Card plugin 2FF, 3FF or 4FF

Product status link
ST4SIM-300M

Features

- Remote *SIM* provisioning compliant with *GSMA eSIM* for *IoT* and *TCA* specifications
- Bootstrap connectivity profile provided by a trusted partner
- Compliant with *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* and *HTTPS* (including *DNS*)
- Multi-Interfaces able to combine *eSIM* + *eSE*

Hardware

- Product available on ST33K1M5M
- ST33 product based on a 32-bit Arm® Cortex®-M35P *CPU* core
- Supply voltage: Supply voltage ranges: 1.8 V, 3 V
- Asynchronous serial *I/O* port ISO/IEC 7816-3 compatible (T=0 protocol)
- Serial peripheral interface (*SPI*) or *I²C*, depending on packages
- Industrial qualification (JEDEC JESD47)
- Operating temperature: -40°C to +105°C
- Common Criteria EAL6+

ECOPACK-compliant packages

- Card plugin 2FF, 3FF, or 4FF
- VFDFPN8 5 × 6 mm, wettable flank (MFF2)
- WLCSP24

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 and XOR

Software standard compliancy

- *GSMA* SGP.32 v1.2
- *TCA* interoperable profile v3.3.1
- Java® Card v3.0.5 Classic
- GlobalPlatform® card specification v2.3, including amendments B, C, D, F, and H
- GlobalPlatform® enhancement with SCP11, *ELF* upgrade
- *OS* update mechanism
- *ETSI*, *3GPP* and *3GPP2* release 17 (*API* Rel16)
- Power saving features (PSM & eDRX) defined by *ETSI* release 17

Applications

- Cellular Connected Nodes
- 5G, LTE, LTE-M and NB-IoT
- Surveillance
- IoT for smart home and city such as gas metering
- IoT for smart industry such as tracking

1 Description

The ST4SIM-300M is an STMicroelectronics top-class GSMA embedded SIM (eSIM or eUICC) product designed for all IoT devices.

It is compliant with the GSM Association (GSMA) specification SGP.32 v1.2.

The ST4SIM-300M 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 device can include an embedded secure element to store credentials and/or independent applications directly managed by the MCU (or by another OEM element).

The device provides a secure and interoperable Java® Card environment compliant with Java® Card v. 3.0.5 Classic. Moreover, the device integrates the most advanced UICC features compliant with GlobalPlatform®, ETSI, 3GPP, 3GPP2 specifications.

The ST4SIM-300M integrates a dynamic memory management with Java® Card garbage collection mechanism optimizing the usage of the memory.

The ST4SIM-300M is based on the ST33K1M5M, an industrial grade hardware solution (JEDEC) supporting severe conditions. This solution is a tamper-resistant secure element certified by Common Criteria EAL6+, with a powerful 32-bit Arm® Cortex®-M35P CPU.

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

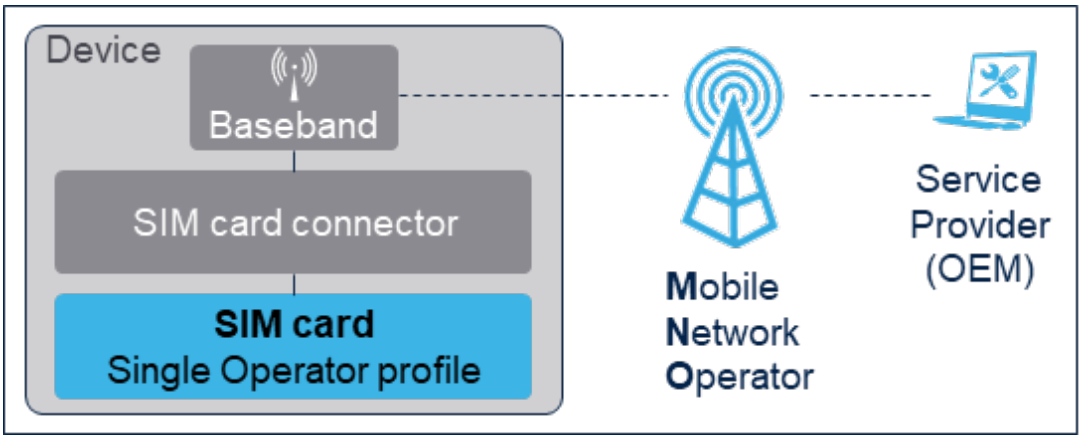
Note: Java is a registered trademark of Oracle and/or its affiliates.

2 Cellular connectivity solutions overview

A cellular connectivity solution enables devices to be used by the edge mobile network operators (also called *MNO*) or mobile virtual network operators (*MVNO*). This solution increases network coverage and it maintains seamless connectivity.

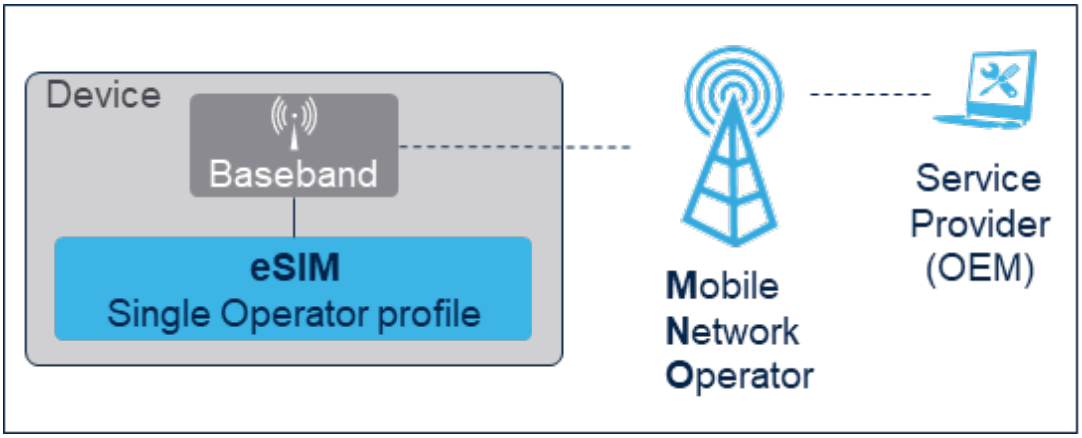
Moreover, a cellular solution is simple to deploy. This solution is mainly composed of the modem (baseband), the *SIM* card connector and the plastic *SIM* card. This is the traditional *SIM* concept inherited from the mobile phone.

Figure 1. SIM solution overview



It is also possible to have an embedded *SIM* (*eSIM*) solution. In this case, the *SIM* is soldered directly into the device. It reduces the board footprint and there is no need for a SIM connector.

Figure 2. eSIM solution overview



These traditional solutions are simple but the *SIM* / *eSIM* only supports one cellular connectivity profile at a time for one network operator. In this case, if the operator needs to be changed, the *SIM* / *eSIM* solution must be changed.

The *eSIM GSMA* solution extends this traditional *SIM* / *eSIM* solution.

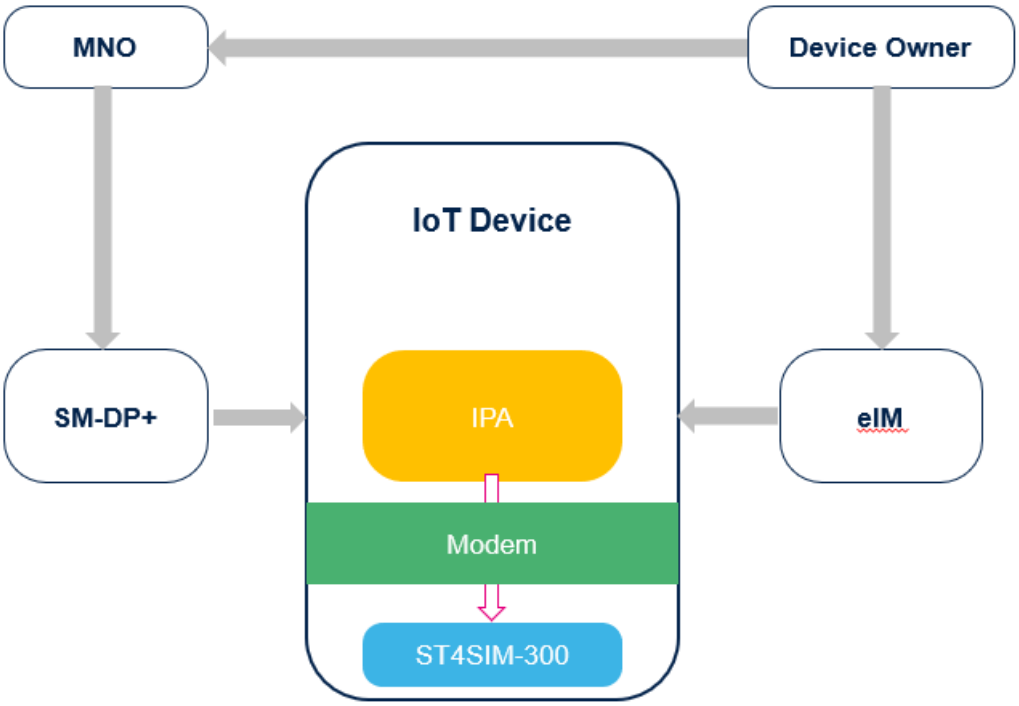
3 eSIM GSMA solution

The ST4SIM-300M is a eSIM GSMA solution: it is an *SIM* / *eSIM* solution compliant to *eSIM* specifications for IoT from GSM Association (GSMA). This solution integrates new secure architectures and complete ecosystem able to manage the cellular network connectivity remotely without impact on eSIM component.

Thanks to this *eSIM* technology, you can now deploy IoT devices on the field with one network connectivity and several times after, you can replace this connectivity by a new one through a platform. So, no need a product recall nor product maintenance.

This solution is flexible and independent of the end-user interaction. For IoT ecosystem, this solution is service-oriented; the profile is remotely controlled by the device owner in charge of the management of the device functionalities, and chooses the operator that is used to provide cellular connectivity.

Figure 3. eSIM for IoT GSMA solution overview



The *eSIM IoT* remote manager provides remote profile state management operations (*PSMO*) on a single *IoT* device or a fleet of *IoT* devices.

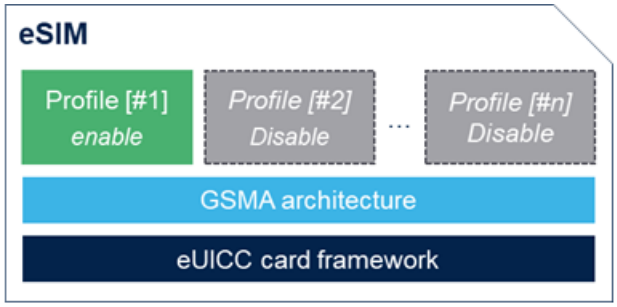
The *eSIM* can either be a stand-alone component or a component of a higher-level functional system (such as a device management platform).

The ST4SIM-300M offers a complete all ecosystem thanks to STMicroelectronics trusted partners. Our partners provide the connectivity profile and the Subscription Management Platform to provision and remotely manage operator profiles. Contact the local STMicroelectronics sales office for more details on the STMicroelectronics trusted partners.

Based on the secure hardware solution, certified Common Criteria EAL6+, the ST4SIM-300M is a solution being *GSMA* certified compliant *GSMA IoT* specification SGP.32 v1.2. It provides this flexible and scalable solution while maintaining the best level of security.

The ST4SIM-300M integrates *GSMA* architecture with the mechanisms performing profile management. A profile contains the operator network data related to a subscription (operator credentials, file system, network authentication, application and so on). Each profile is independent of the other profiles.

Figure 4. **eSIM architecture overview**



The ST4SIM-300M can host up to seven profiles. Each profile has the memory size available in the ST4SIM-300M, or can have a specific memory size coded using the cumulative granted memory defined by GlobalPlatform® amendment C.

This profile is described by *TCA* interoperable profile package specification.

The ST4SIM-300M fully supports *TCA* interoperable profile package v3.3.1. No proprietary features are introduced and profiles are coded according to ASN.1 / DER coding.

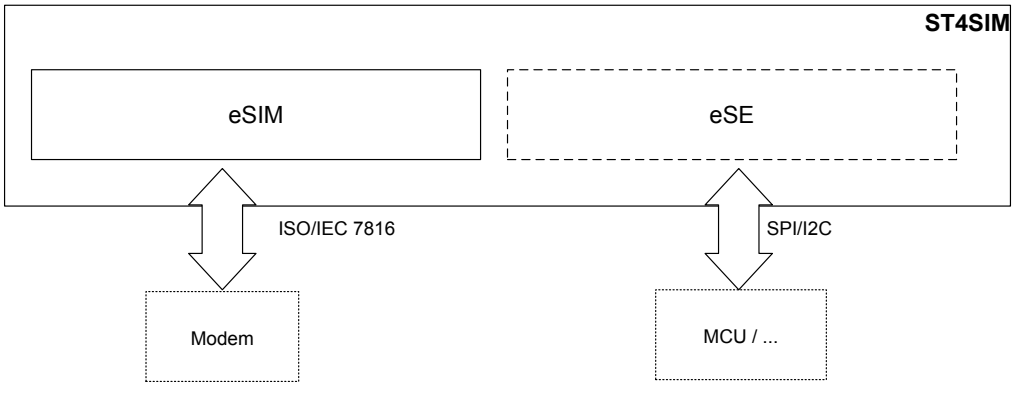
The ST4SIM-300M is an interoperable solution. The ST4SIM-300M already integrates most of main operators (*MNO* / *MVNO*) and it is possible to integrate any operator profile or personalized profile compliant with the *TCA* specification.

4 Additional embedded secure element (eSE)

The ST4SIM-300M 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 5. ST4SIM-300M architecture *eSIM* and *eSE* overview



The *eSE* section is accessible through a dedicated serial peripheral interface (*SPI* or *I²C*) protocol and the eSIM uses the ISO/IEC 7816 protocol in parallel. Consequently, the *eSE* is only available on *WLCSP* packages including ISO and *SPI* or *I²C* protocols.

The embedded secure element is optional and configurable.

Contact the local STMicroelectronics sales office for more details on the pin configuration.

5 Card OS technical features

5.1 Supported standards and networks

The ST4SIM-300M solution complies with the standard networks (*4G LTE*/5G).

From a technical point of view, the ST4SIM-300M solution integrates all advanced *NAA*s for an *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 the *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-300M is compliant with GlobalPlatform® Card Specifications v2.3 (depending on the *UICC* configuration) and related amendments.

5.2 Algorithms and cryptography

The ST4SIM-300M supports the following standard authentication algorithms:

- *CAVE*
- XOR
- *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-300M also supports the "3GPP test algorithm" for test profiles.

Besides standard symmetric cryptography and hashing algorithms (*DES*, Triple DES, *AES*, *MD5*, and so on), the ST4SIM-300M provides a cryptographic co-processor with asymmetric cryptography capabilities.

For applications requiring the strongest level of cryptography, the ST4SIM-300M 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-300M 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 adheres to the chip security guidelines of the ST33K1M5M to guarantee the best security level (for more information, contact the local STMicroelectronics sales office).

5.3 Over the air (*OTA*) functionality

The ST4SIM-300M 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 17, API Release 16.

The *RAM* application is also fully supported by GlobalPlatform® v2.3 and the related amendment B (which enables remote applet management and remote file management over HTTP/*TLS*).

TLS v1.0, 1.1 and 1.2 are available in the ST4SIM-300M. In addition, the ST4SIM-300M integrates a *DNS* mechanism allowing the card to request the *HTTPS* server address from a *DNS* server.

The ST4SIM-300M is able to remotely control the execution of *APDU* commands over the air, to administrate the card content. It also allows proactive commands to interact with the host device.

The ST4SIM-300M supports the secured packet structure and the remote *APDU* structure for (U)*SIM* toolkit applications, conforming to *3GPP* TS 31.115, and TS 31.116 specifications.

The *CAT-TP* protocol defined by *ETSI* release 13 is supported.

As it is compliant with the *ETSI*, *3GPP*, and *3GPP2*, the ST4SIM-300M can easily be integrated into any *OTA* platform compliant with the relevant standards. STMicroelectronics cards are field-proven to be interoperable with the mainstream *OTA* platforms commonly chosen by mobile network operators.

5.4 Memory management

The *OTA* mechanism includes the support of 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, and 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-300M is capable of enhancing intrinsic flash memory cells for files requiring intense update and high reliability.

A 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 allowing resources for the downloading profile and the disabled profiles.

6 Electrical characteristics

This section summarizes the operating and measurement conditions, and the DC and AC characteristics of the device. The parameters in the DC and AC characteristics tables that follow are derived from tests performed under the measurement conditions summarized in the relevant tables.

The users must check that the operating conditions in their circuit match the measurement conditions when relying on the quoted parameters.

6.1 Absolute maximum ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CC}	Supply voltage	1.8 to 3.0	V
V_{IO}	Input or output voltage relative to ground	–0.3 to V_{CC} +0.3	V
T_A	Ambient operating temperature	–40 to +105	°C
T_{STG}	Storage temperature (Please refer to package specification)	–65 to +150	°C
T_{LEAD}	Lead temperature during soldering	See (1)	°C
V_{ESD}	Electrostatic discharge voltage according to JESD22-A114, Human Body Model	4000	V

1. *Compliant with JEDEC standard J-STD-020D (for small-body, Sn-Pb or Pb-free assembly), the ST ECOPACK® 7191395 specification, and the European directive on Restrictions on Hazardous Substances (RoHS directive 2011/65/EU of July 2011).*

Note: Stresses listed above may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of the specification is not implied.

Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

6.2 Recommended power supply filtering

The power supply of the circuit must be filtered using the circuit shown in the following figure.

Figure 6. Recommended filtering capacitors on V_{CC}

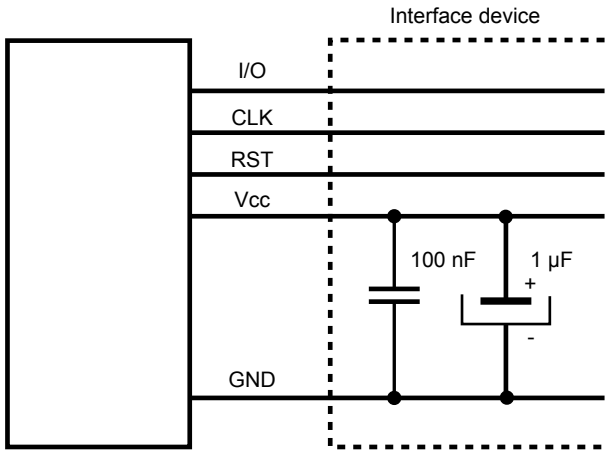


Table 2. **Maximum V_{CC} rising slope**

Symbol	Parameter	Value	Unit
S_{VCC}	Maximum V_{CC} rising slope	5	V / µs

6.3 AC and DC characteristics

These characteristics are compliant with ETSI TS 102 671 release 17.

7 Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK packages, depending on their level of environmental compliance. ECOPACK specifications, grade definitions and product status are available at: www.st.com. ECOPACK is an ST trademark.

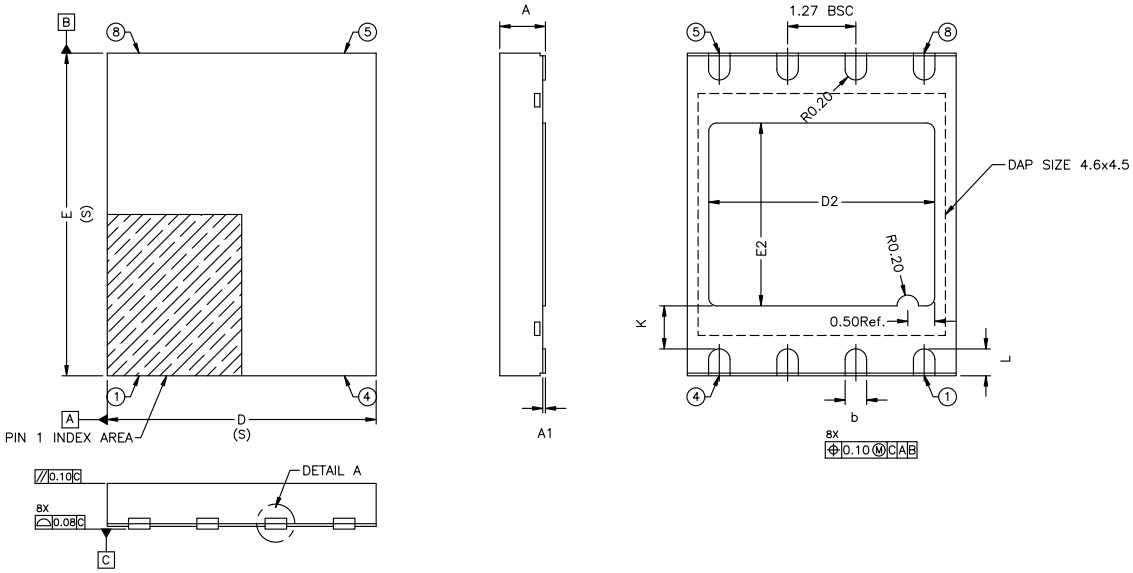
7.1 VFDFPN8 with wettable flanks (MFF2)

This package is qualified in compliance with JEDEC J-STD-020D and MSL 1 specifications.

It is also compliant with MFF2 (Machine-to-machine form factor 2) ETSI specifications (M2M UICC - TS102.671).

VFDFPN8 is a "very thin fine pitch dual flat package no lead" with wettable flanks package with 5 × 6 mm and 1.27 mm pitch.

Figure 7. VFDFPN8 - outline



NOTE :

1. ALL DIMENSION ARE IN mm. ANGLES IN DEGREES.
2. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS. COPLANARITY SHALL NOT EXCEED 0.08 mm.
3. WARPAGE SHALL NOT EXCEED 0.10 mm.
4. PACKAGE LENGTH / PACKAGE WIDTH ARE CONSIDERED AS SPECIAL CHARACTERISTIC.(S)
5. REFER JEDEC MO−229.
6. L/F STOCK# FR6101 (Ag on lead only).

Note: Drawing is not to scale.

Table 3. **VFDFPN8 - mechanical data**

Symbol	Millimetres			Inches[1]		
	Min	Typ	Max	Min	Typ	Max
A[2]	0.80	0.85	1.00	0.031	0.033	0.039
A1	0	0.02	0.15	0	0.001	0.006
b	0.35	0.40	0.45	0.014	0.016	0.018
D	-	5.00	-	-	0.197	-
E	-	6.00	-	-	0.236	-
D2	4.10	4.20	4.30	0.161	0.165	0.169
E2	3.30	3.40	3.50	0.130	0.134	0.138
e	-	1.27	-	-	0.050	-
K	0.60	0.70	0.90	0.024	0.028	0.035
L	0.40	0.50	0.60	0.016	0.020	0.24

1. *Values in inches are converted from mm and rounded to 3 decimal digits.*
2. *The leads size is comprehensive of the thickness of the leads finishing material.*

Note: GENERAL PACKAGE PERFORMANCE

1. *The leads size is comprehensive of the thickness of the leads finishing material.*
2. *Dimensions do not include mold protrusion. not to exceed 0.15 mm*
3. *Package outline exclusive of metal burr dimensions.*
4. *Dimensioning and tolerances conform to ASME Y14.5M-1994.2.*
5. *The location of the terminal #1 identifier and terminal numbering convention conforms to JEDEC publication 95 SPP-002.*

7.1.1 Wettable flank for formation of inspectable solder joint

This package is constructed with wettable flank that guarantees the board level solder joint quality and inspectability.

Figure 8. **Regular VFDFPN8 package without wettable flank**

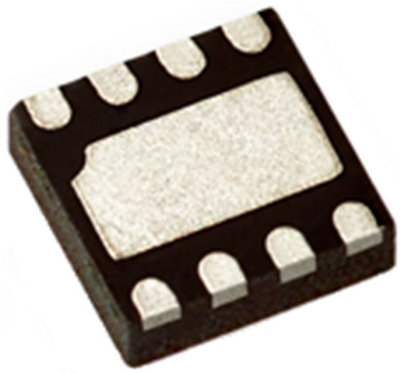
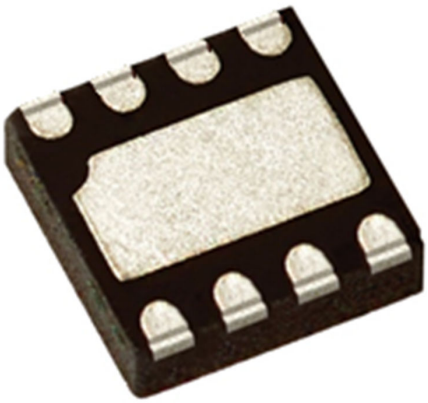


Figure 9. **VFDFPN8 package with wettable flank**



This package is compliant with the Machine to Machine Form Factor defined by ETSI in TS 102 671.

7.2 Pinout information

This package is compatible with the MFF2 package defined by ETSI 102 671 release 17.

Figure 10. **VFDFPN8 pinout (top view)**

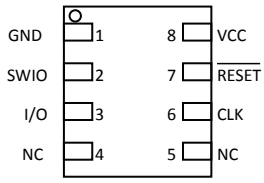
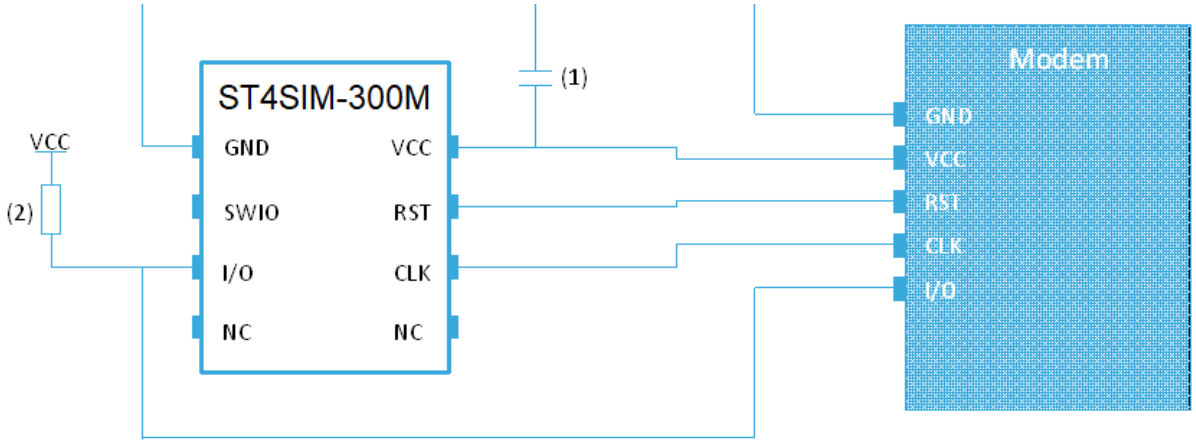


Table 4. **Pin descriptions**

Name	Description	Pin state
GND	Ground supply	-
SWIO	Not used	Input pull-up
$\overline{\text{RESET}}$	External reset	Input pull-down
I/O	Input/output	Pull-down then pull-up after card activation
CLK	External clock	Pull-down
VCC	Power supply	-
NC	Not connected internally	-

Figure 11. **ST4SIM-300M PCB integration recommendations**



Note: 1. *C1 decoupling capacitors as recommended in Figure 6.*
2. *R1: 20 kΩ external pull-up recommended on I/O.*

7.3 VFDFPN8 tape and reel packing

Surface-mount packages are available in tape and reel packing. The reels have a 13" nominal diameter and contain 4000 devices each.

Reels are in, either antistatic or conductive, plastic with a black conductive cavity tape. The cover tape is transparent antistatic or conductive.

The devices are positioned in the cavities with the identifying pin (normally Pin “1”) on the same side as the sprocket holes in the tape.

The STMicroelectronics Tape & Reel specifications are compliant to the EIA 481-A standard specification.

Table 5. **Packing on tape and reel**

Package	Description	Tape width	Tape pitch	Reel diameter	Quantity per reel
DFN8 5 x 6	Flat package, no lead 5 x 6 mm.	12 mm	8 mm	13 in.	4000

Figure 12. **13" reel diagram**

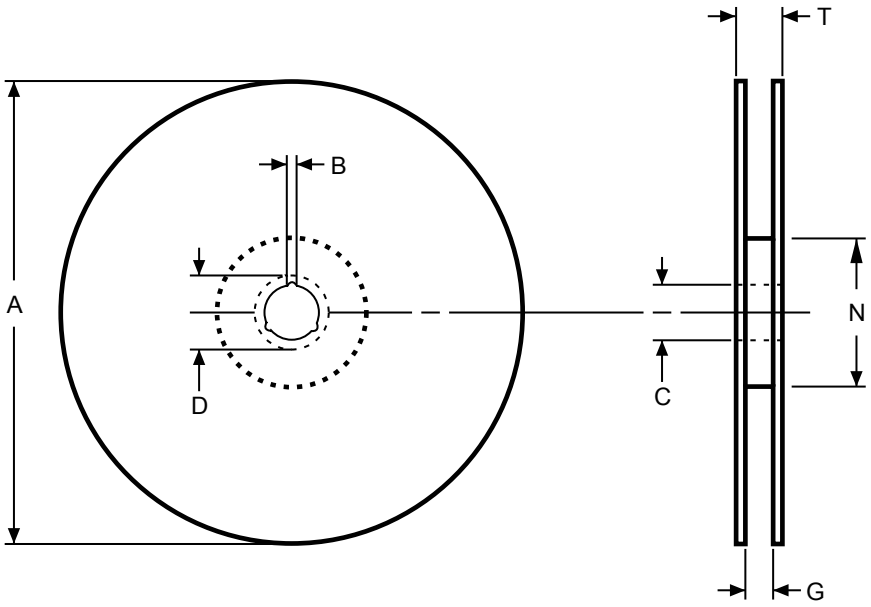


Table 6. **13" reel dimensions**

Reel size	Tape size	A max	B min	C	D min	G max	N min	T max	Unit
13”	12 mm	330	1.5	13 ±0.25	20.2	12.6	100	18.4	mm

Figure 13. **Leader and trailer**

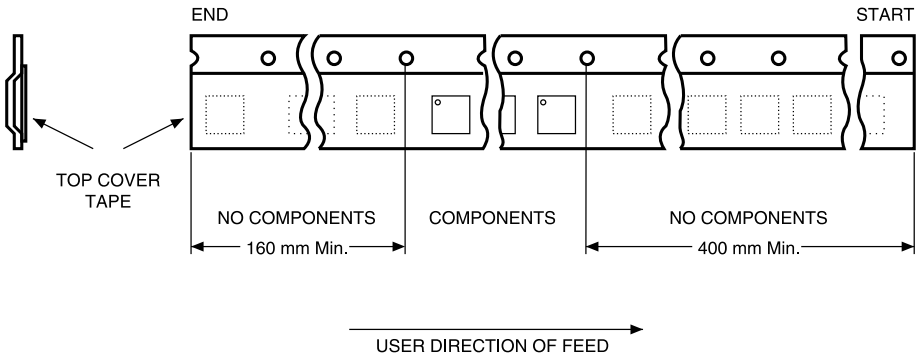
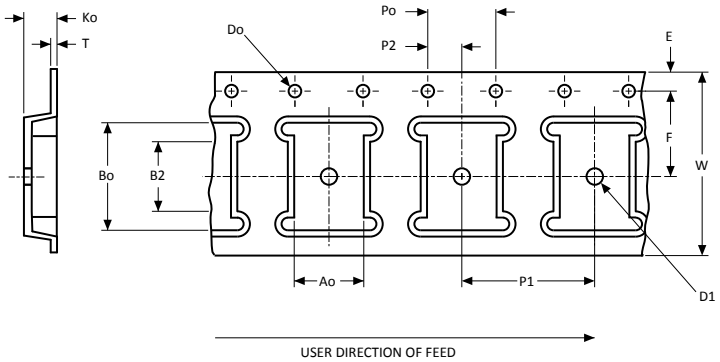


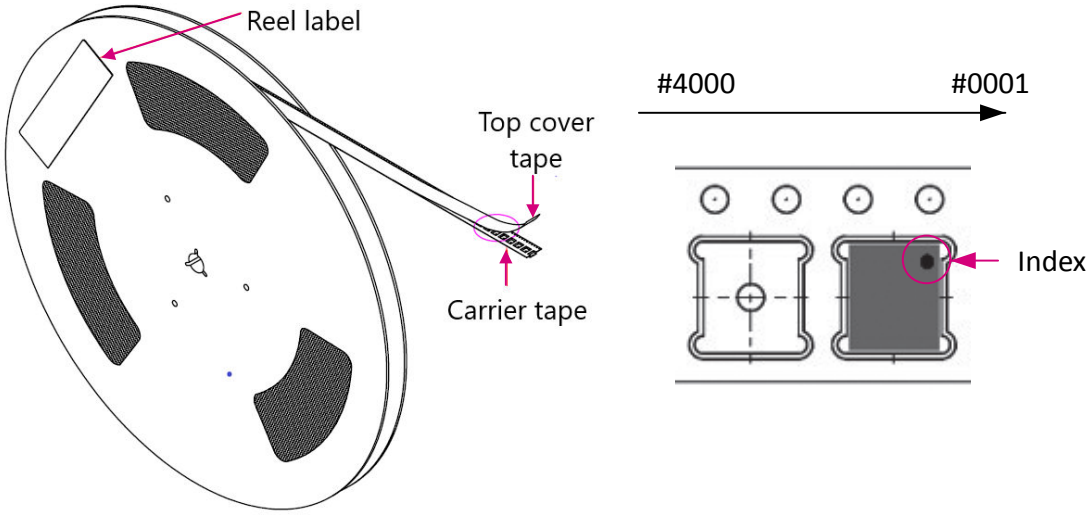
Figure 14. **Embossed carrier tape for DFN8 (5 × 6 mm)**



Note:

1. *Cumulative tolerance of 10 sprocket hole pitch = ±0.20 mm.*
2. *Pocket position relative to sprocket hole is measured as the true position of the pocket, not the pocket hole.*
3. *A0 and B0 are calculated on a plane at a distance “R” above the bottom of the pocket.*
4. *Unless otherwise specified, all dimensions are in millimeters, and decimal values of the form x.x are with ±0.2 tolerance whereas values of the form x.xx are with ±0.10 tolerance.*
5. *Drawing is not to scale*

Figure 15. **Component orientation**



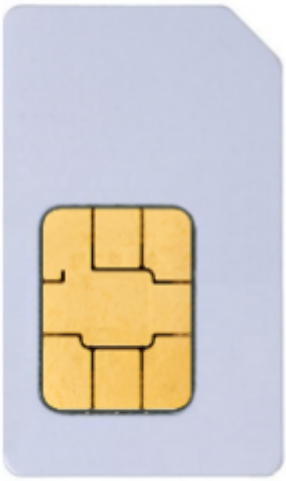
7.4 2FF, 3FF, or 4FF plugin card package information

The ST4SIM-300M card is based on flexible plastic chip cards, composed of ABS and Polycarbonate, improving all-round resistance in an industrial environment. This card contains a STMicroelectronics industrial grade micromodule.

All elements, card and micromodule, are designed to run at a temperature of -40°C to +105°C.

The ST4SIM-300M is available for different card plugin packages as detailed in the table below.

Table 7. SIM plugin package types and dimensions

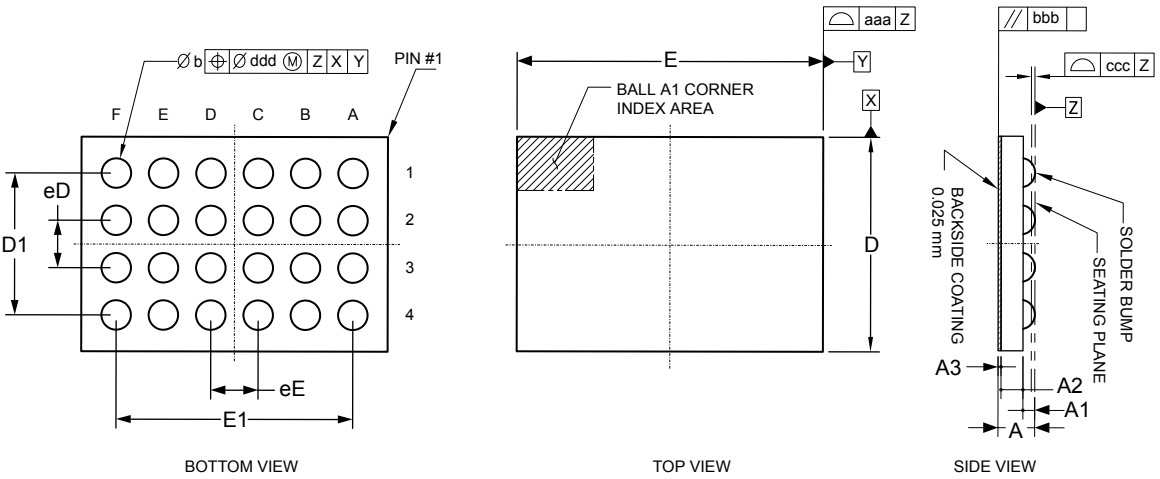
Package	Mini SIM (2FF)	Micro SIM (3FF)	Nano SIM (4FF)
Package format			
Height	25 mm (±0.1 mm)	15 mm (±0.1 mm)	12.3 mm (±0.1 mm)
Width	15 mm (±0.1 mm)	12 mm (±0.1 mm)	8.8 mm (±0.1 mm)
Thickness	0.76 mm (±0.08 mm)	0.76 mm (±0.08 mm)	0.67 mm (+ 0.03 mm / - 0.07 mm)

Note: These formats comply to the ISO/IEC 7810 and ETSI TS 102 221 standards.

7.5 WLCSP24 package information

This WLCSP is a 24-ball, 1.812 × 2.589 mm, 0.40 mm pitch, wafer level chip scale package.

Figure 16. WLCSP24 - Outline



1. *Drawing is not to scale.*
2. *Dimension is measured at the maximum bump diameter parallel to primary datum Z.*
3. *Primary datum Z and seating plane are defined by the spherical crowns of the ball.*
4. *Ball position designation as per JESD 95-1, SPP-010.*

Table 8. **WLCSP24 - Mechanical data**

Symbol	Millimeters			Inches[1]		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	0.290	0.310	0.330	0.0114	0.0122	0.0129
A1	0.090	0.100	0.100	0.0035	0.0039	0.0039
A2	0.173	0.185	0.198	0.0068	0.0072	0.0078
A3[2]	-	0.025	-	-	0.0010	-
b[3]	0.225	0.250	0.275	0.0088	0.0098	0.0108
D	1.787	1.812	1.837	0.0703	0.0713	0.0723
E	2.564	2.589	2.614	0.101	1.0102	0.103
eD	-	0.400	-	-	0.0157	-
eE	-	0.400	-	-	0.0157	-
D1	-	1.200	-	-	0.0472	
E1	-	2.000	-	-	0.0787	-
aaa	-	-	0.030	-	-	0.0012
bbb	-	-	0.060	-	-	0.0023
ccc	-	-	0.050	-	-	0.0020
ddd	-	-	0.015	-	-	0.0006

1. *Values in inches are converted from mm and rounded to 3 decimal digits.*
2. *Back side coating.*
3. *Dimension is measured at the maximum bump diameter parallel to primary datum Z.*

7.5.1 PCB design and reflow recommendations

The recommendations provided in this section apply to the WLCSP package only and must be considered as development guidance for PCB designer. It is linked to ST's package development and qualification procedure; as a result, it must be fine-tuned and adapted according to customer process.

Figure 17. **PCB landing pattern**

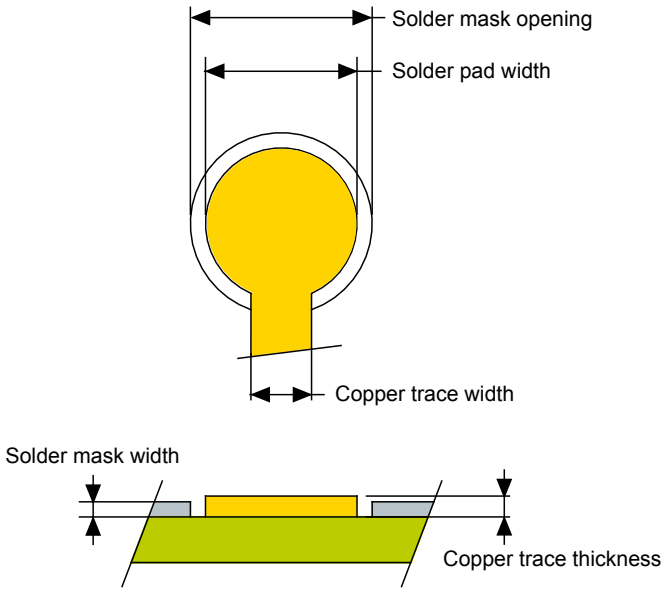


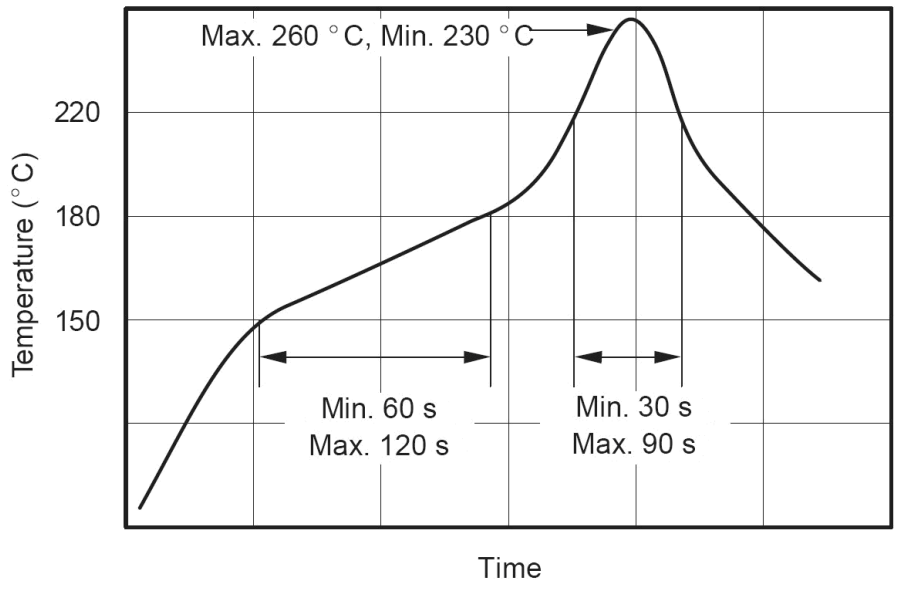
Table 9. WLCSP24 - Recommended PCB design rules

Dimension	Recommended values
Pitch	0.400 mm
Solder pad width	0.225 mm
Solder mask opening	0.275 mm
Solder mask thickness	0.025 mm
Copper trace thickness	0.030 mm
Copper trace width	0.080 mm

This package is compliant with the IPC/JEDEC J-STD-020D specifications.

The ST WLCSP is ECOPACK-compliant: In order to meet environmental requirements, ST offers ECOPACK packages. These packages have a lead-free second-level interconnect. The category of second-level interconnect is marked on the package and on the inner box label, in compliance with JEDEC standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at www.st.com.

Figure 18. Reflow soldering temperature profile



The previous figure shows the Pb-free reflow soldering temperature profile (temperature versus time) and the table below provides the critical reflow parameters (typical values).

Table 10. Critical reflow parameters

Parameter	Value (typical)
Process step lead-free solder: Ramp rate	3°C/s
Preheat	150°C to 180°C, 60 to 180 seconds
Time above liquidus (TAL)	220°C, 30 to 90 seconds
Peak temperature	255°C ±5°C
Time within 5°C of peak temperature	10 to 20 seconds
Ramp-down rate	6°C/s maximum

7.5.2 WLCSP24 tape and reel packing

Surface-mount packages can be supplied with tape and reel packing. The reels have a 13" typical diameter. They contain 5000 devices each.

Reels are in plastic, either antistatic or conductive, with a black conductive cavity tape. The cover tape is transparent antistatic or conductive.

The devices are positioned in the cavities with the identifying pin (normally pin “1”) on the same side as the sprocket holes in the tape.

The STMicroelectronics tape and reel specifications are compliant with the EIA 481-A standard specification.

Table 11. WLCSP24 on tape and reel

Package	Description	Tape width	Tape pitch	Reel diameter	Quantity per reel
WLCSP24	Wafer-length chip scale package	12 mm	8 mm	13"	5000

Figure 19. WLCSP reel diagram

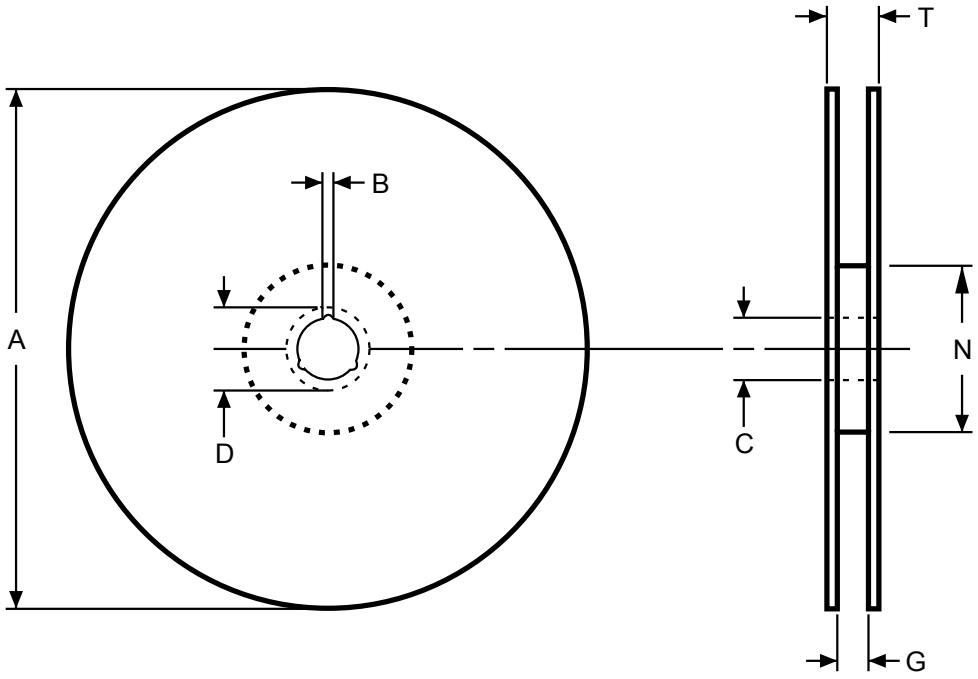
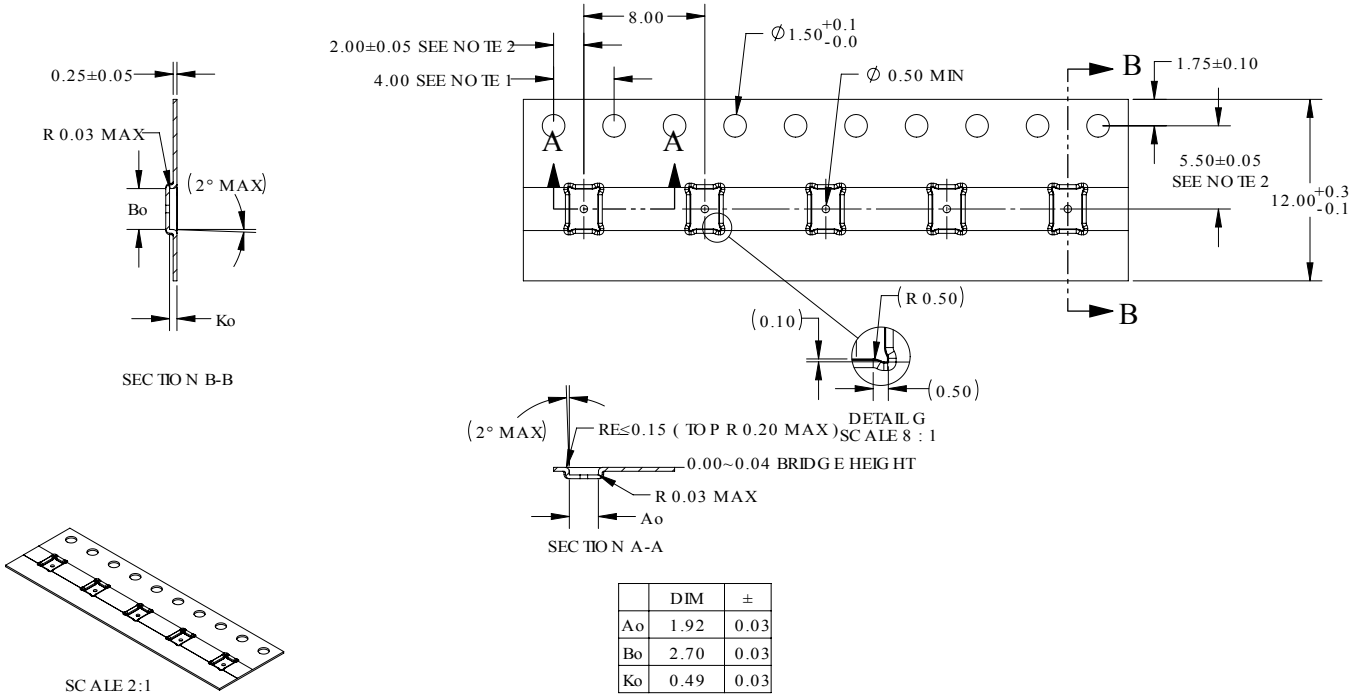


Table 12. WLCSP reel dimensions

Reel size	Tape size	A Max.	B Min.	C	D Min.	G Min.	N Min.	T Max.	Unit
13"	12	330	1.5	13 ±0.25	20.2	12.6	100	18.4	mm

Figure 20. **WLCSP24 carrier tape**



	DIM	±
Ao	1.92	0.03
Bo	2.70	0.03
Ko	0.49	0.03

Note:

1. *10 sproket hole pitch cumulative tolerance ±0.2.*
2. *Pocket position relative to sprocket hole measured as true position of pocket, not pocket hole.*
3. *Ao and Bo are measured on a plane at a distance "R" above the bottom of the pocket.*
4. *Dimensions are in millimeters.*
5. *Tolerances, unless specified: ±0.2 for 1 decimal place; ±0.10 for 2 decimal places.*
6. *Drawing is not to scale.*

7.5.3 Additional communication interface of WLCSP24

When the WLCSP24 package is used, an additional communication interface (I2C or SPI) is available depending on the chip configuration.

The I²C interface supports the Standard mode (up to 100 kbps), the Fast mode (up to400 kbps) and the Fast+ mode (up to 1 Mbps). The ST4SIM-300M system on chip only supports a single shared supply for device and I²C bus.

The SPI interface runs at up to 30 MHz at 1.8 V and at 3 V.

Both interfaces support GlobalPlatform specification "*APDU Transport over SPI/I2C" 1.0*. The table below provides the WLCSP24 package pinout.

Table 13. **WLCSP24 package pinout**

IO PIN	ISO+I2C (default)	ISO+SPI config
IO0	Not used	SPI_MISO
IO1	ISO2_CLK	SPI_CLK
IO2	ISO2_RST	SPI_NSS
IO3	Not used	SPI_MOSI
IO4	Not used	ISO1_RST
IO5	I2C_SCL	ISO1_CLK
IO6	I2C_SDA	ISO1_IO
IO7	Not used	Not used

IO PIN	ISO+I2C (default)	ISO+SPI config
IO8	Not used	Not used
IO9	ISO2_IO	Not used

Revision history

Table 14. **Document revision history**

Date	Revision	Changes
23-Feb-2024	1	Initial release.
16-May-2024	2	Updated the information available in Section 7.5: WLCSP24 package information.
24-Sep-2024	3	Updated: • Figure 7. VFDFPN8 - outline • Table 3. VFDFPN8 - mechanical data
13-Dec-2024	4	Updated: • Section Features • Section 1: Description • Section 3: eSIM GSMA solution • Section 5.1: Supported standards and networks

Glossary

3DES Triple data encryption standard (also known as triple DES or TDES)

3GPP Third Generation Partnership Project

3GPP2 Third Generation Partnership Project 2

4G The fourth generation of broadband cellular network technology.

AES Advanced encryption standard

AID Application dedicated file

APDU Application protocol data unit

API Application programming interface

ARF Access rule file

ASN.1 Abstract syntax notation one. A standard interface description language for defining data structures that can be serialized and deserialized in a cross-platform way. It is broadly used in telecommunications and computer networking, and especially in cryptography

CAT-TP Card application toolkit transport protocol

CAVE Cellular authentication and voice encryption

CDMA Code division multiple access

CGM Cumulative Granted Memory

CPU Central processing unit

CSIM CDMA subscriber identity module

DES Data encryption standard

DFN Dual flat no-lead package

DNS Domain name system

EAL Evaluation assurance level

ECC Elliptic curve cryptography

eDRX Extended discontinuous reception

ELF Executable load file

eSE Embedded secure element

eSIM Embedded subscriber identity module

eSIM Embedded subscriber identity module

ETSI European Telecommunications Standards Institute

eUICC Embedded universal integrated circuit card

GSMA The Global System for Mobile Communications (GSM) Association

HTTPS Hypertext transfer protocol secure

I/O Input/output

IEC International Electrotechnical Commission

IMS IP multiple subsystem

IoT Internet of things

IPA IoT Profile Assistant

ISIM IP multimedia services identity module

ISO Relative to the ISO/IEC 7816 asynchronous receiver transmitter.

I²C Inter-integrated circuit

JEDEC Joint Electron Device Engineering Council

LTE Long-term evolution

M2M Machine to machine

MD5 Message digest 5

MILENAGE Algorithm set of 3GPP™ authentication and key generation functions

MNO Mobile network operator

MNO-SD Mobile network operator security domain

MVNO Mobile virtual network operator

NAA Network access application

NB-IOT Narrow band *IoT*

NIST National Institute of Standards and Technology

OEM Original equipment manufacturer

OS Operating system

OTA Over the air

PIN Personal identification number

PKCS Public key cryptographic standards

PoC Proof of concept

PSMO Profile state management operations

PUK PIN unlock key

RAM Remote applet management

RFM Remote file manager

RISC Reduced instruction set computing (CPU design strategy)

RSA Public-key cryptosystem (created by Ron Rivest, Adi Shamir and Leonard Adleman)

SCP Secure channel protocol

SE Secure element

SIM Subscriber identity module

SM-DP+ Subscription manager - Data protection +

SMS Short message service

SPI Serial peripheral interface

TAR Toolkit application reference

TCA Trusted Connectivity Alliance

TLS Transport layer security

TUAK Algorithm set of 3GPP™ authentication and key generation functions

UICC Universal integrated circuit card

UMTS Universal mobile telephone system

USIM Universal subscriber identity module

WLCSP Wafer-level chip-scale package

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