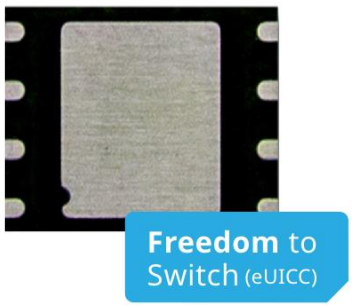
IoT SIM Chip Industrial

Embedded SIM Card Specifications

The traditional plastic-backed SIM originated from the user equipment (UE) usage for telecommunication where customers needed to exchange SIMs easily as the devices were not bound to a particular SIM. Starting from 2016 on, the embedded-SIM (eSIM) or embedded Universal Integrated Circuit Card (eUICC) gained interest for developers due to the smaller footprint and deeper integration possibilities.

Especially in custom embedded Machine-to-Machine (M2M) and IoT hardware application cases, the IoT SIM Chip Industrial offers unique advantages compared to the traditional IoT SIM Card Business. In purpose build IoT devices, there is no need for regular manual SIM Card swaps. Key factors like ruggedness, security and space constrains have high priority. For these special needs, the 1NCE IoT SIMs Chip Industrial provides the ideal solution. This section covers the 1NCE IoT SIM Chip Industrial product with its standardized form factor, technology specifications and outline recommended application cases.



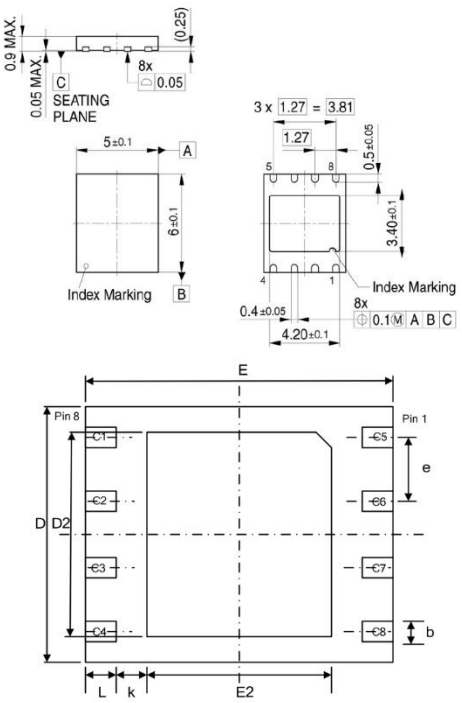
1NCE IoT SIM Chip Industrial MFF2 Integrated Circuit.

IoT SIM Chip Industrial Form Factor

As the IoT SIM Chip Industrial evolved from the traditional IoT SIM Card Business, it shares the same technological functionality but just in a smaller physical packaged form factor. The IoT SIM Chip Industrial format is commonly designated as MFF2. The 1NCE IoT SIM Chip Industrial conforms to this MFF2 footprint in a Quad-Flat No-Leads 8 (QFN8) Integrated Circuit (IC) package. The MFF2 package is specified in ETSI 102 671.

The QFN8 IoT SIM Chip Industrial package is not mounted inside a socketed adapter like the IoT SIM Card Business, it is designed to be directly soldered to the Printed Circuit Board (PCB) of a device. QFN8 is a often used footprint in electronic devices. Thus, it can be easily integrated into automated assembly production lines of IoT enabled devices. The specifications of the form factor are shown in the figure below.

Symbol				
	Min.	Typ.	Max.	Unit
E	5.85	6.00	6.15	mm
D	4.85	5.00	5.15	mm
L	0.45	0.60	0.75	mm
b	0.30	0.40	0.50	mm
E2	3.30			mm
D2	3.90			mm
k	0.20			mm
e		1.27		mm



1NCE MFF2 IoT SIM Chip Industrial Form Factor Dimensions

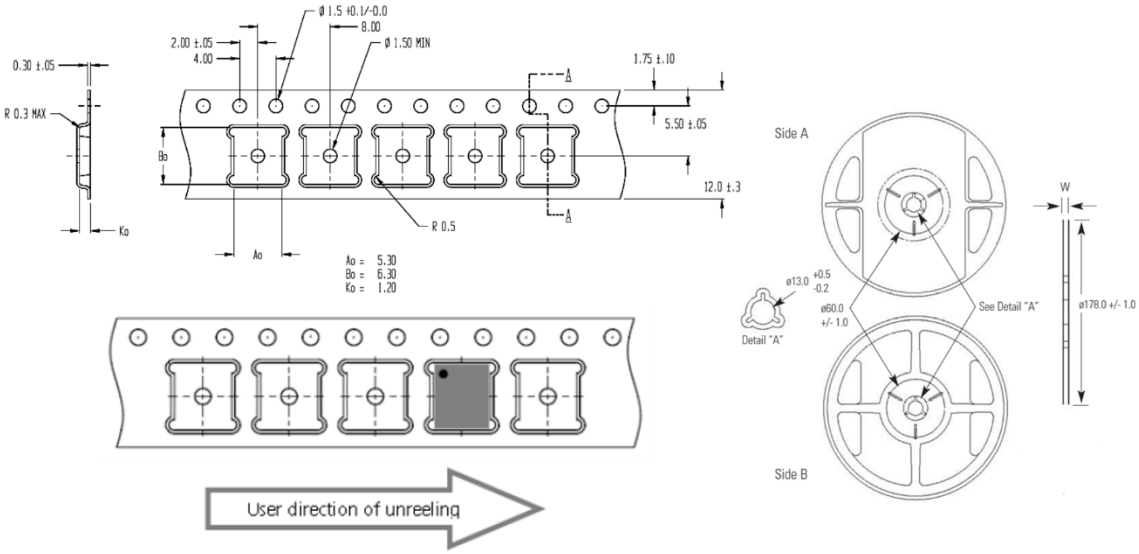
Embedded-SIMs share the same basic pinout as IoT SIMs Card Business but in a different form factor shown in the figure above. The following table references the pin assignments and lists their respective functional pinout.

Contact Pin	**Spec. Description**	**Chip Industrial Pinout**
C1	**VCC** Supply Voltage	VCC
C2	**RST** Reset Pin	RST
C3	**CLK** Clock Signal	CLK
C4 and C8	**Optional** USB interface according to ETSI TS 102 600	N/A
C5	**GND** Ground Connection	GND
C6	**VPP** Programming Voltage	N/A
C7	**I/O** Input Output Data	I/O

Shipping & Assembly Packaging

When ordering 1NCE IoT SIMs Chip Industrial, the QFN8 ICs are packaged in a standardized tape reel of 100, 500 and 3000 IoT SIMs Chip Industrial. These tape reels can be directly used in an automated production assembly line.

1NCE IoT SIMs Chip Industrial are packaged in 12mm wide tape, which is 1.2mm thick and covered with a plastic film to keep the IoT SIM Chip Industrial ICs in place until production. The packing process and materials meet requirements defined in JEDEC J-STD-033 with ESD precautions and proper handling procedures. The tape is provided on 7inch (178mm) and 13inch (330mm) reels. For lots of 100 or 500 IoT SIMs Chip Industrial, 7inch reels are used and for 3000 IoT SIMs Chip Industrial the 13inch reels are used.



Specifications of the IoT SIMs Chip Industrial tape and reels used for packaging.

Each reel is vacuum packaged separately with a humidity indicator card, desiccant and a barcode label in a reel cardboard box. The barcode label shows the first and last IoT SIM Chip Industrial ICCID of the specific reel. IoT SIMs Chip Industrial are produced in sequence in ascending order where smallest ICCID is produced first and is at the end of the tape in middle of the reel. The user direction of unreeling is according to EIA-481 standard.

1NCE IoT SIM Chip Industrial packaging reel and example barcode showing the first an last ICCID of the reel.

IoT SIM Chip Industrial eID Identification

An eID is a 32-digit global unique identifier number, containing information that identifies the SIM supplier for the physical SIM. Using eUICC feature, the eID is the most important number to identify the SIM. The ICCID may change with the change of the active profile, but eID is unique to the IoT SIM, and it is always the same.

The eID can be read by the hardware modem using an AT-Command or manufacturer-specific request. For easier physical identification, each 1NCE IoT SIM Card Industrial has the eID of the particular SIM printed on the 4FF physical chip card.

IoT SIM Chip Industrial Specifications

SIM Cards for mobile network applications follow strict standards for the physical form factor as well as the technology and interfaces. 1NCE IoT SIMs Chip Industrial comply with these technical standard specifications.

Besides the key standard compliances, SIM Chips are validated for specific environmental ranges in which they need to be operated in. The table below shows the most important 1NCE IoT SIM Chip Industrial specifications that are relevant for the deployment of the 1NCE IoT SIM Chip Industrial. Furthermore, references to the key standard compliances for the SIM interfaces are referenced.

Parameter	**1NCE IoT SIM Chip Industrial**
Form Factor (FF)	MFF2, QFN8 (IC Package)
Supported Radio Access Technologies (RAT)	2G, 3G, 4G, CAT-M1, NB-IoT
Environmental Temperature	-40°C to +105°C
Operating Voltages	Class A, B and C (1.62V – 5.5V)
Data Retention Period	min. 10 years
Number of profiles	max. 10
Read/Write Cycles	min. 2.000.000 cycles
Key Standard Compliances	3GPP TR 31.919
	ETSI TS 101 220
	ETSI TS 102 221
	3GPP TS 31.101
	3GPP TS 31.111
	3GPP TR 31.900

Application Cases IoT SIM Chip Industrial

Embedded-SIMs reduce the footprint of the SIM integration and also provide a more rugged and robust connection. In general, the IoT SIM Chip Industrial form factor is more optimized for typical IoT device environments where factors like heavy vibration, higher temperature ranges but also increased security plays a key role. 1NCE recommends the integration of IoT SIMs Chip Industrial in custom developed IoT devices and use cases where extraordinary environmental robustness is needed.
As the IoT SIMs Chip Industrial is surface mounted to the PCB of a device, it provides higher security against end-user tampering as the SIM Card cannot be easily removed. For prototyping and designing custom IoT devices, special QFN8 adapters are available to adapt an IoT SIM Chip Industrial to the IoT SIM Card Industrial footprint.