NFC TYPE 2 AUTHENTICITY TAG IC

DESCRIPTION

The **em|linq** is targeting authentication application, compliant with NFC Forum Type 2 and ISO 14443-A.

3 Main security elements: UID, One Time Password and Incremental Counter.

Generation of URL for web authentication with message substitution.

The **em|linq** supports NFC Forum Tag 2 Type standard with data rate at 106kbps.

The memory offers R/W user's memory structured by segments and memory pages.

The memory contains the NFC capability container, the NDEF message and other proprietary data.

The NDEF message can be composed of preprogramed URL and IC automatically inserts UID value, state of random step forward value and secure it with HOTP hash generated using a 256-bit key.

The **em|linq** offers two levels of security:

- In high level mode the Secure mode is protected by Authentication with 256-bit key.
- In low level mode the Secure mode is protected by a 4-byte password.

Each **em|linq** chip is delivered with a unique 7-byte ID number programmed at wafer level.

FEATURES

- NFC Forum Type 2 compatible
- Communication baud rates at 106kbps
- 7-byte unique ID number
- Automatic append of UID, token and HMAC code into the NDEF URL.
- New and unique URL HMAC code generated at each tap.

NFC INTERFACE

- NFC Forum Type 2 Tag compliant
- Communication baud rates at 106kbps
- 7-byte unique ID number
- 50pF resonance capacitor

MEMORY

- EEPROM size of 308 Bytes
- Minimum 100k write cycles endurance
- Minimum 10 years data retention
- Anti-tearing features
- RD/WR protection mechanism

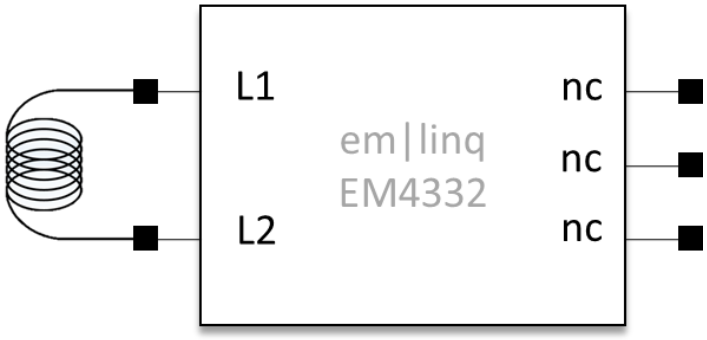
SECURITY

- One Time Password (HOTP)
  - Keyed-hash Message Authentication Code SHA-1
  - Calculated from random forward value and UID
- 256-bit secret key
- Secure mode
  - Protecting defined part of memory against write
  - Login with password 32b
  - Login with HMAC
- Secure product life cycle management.

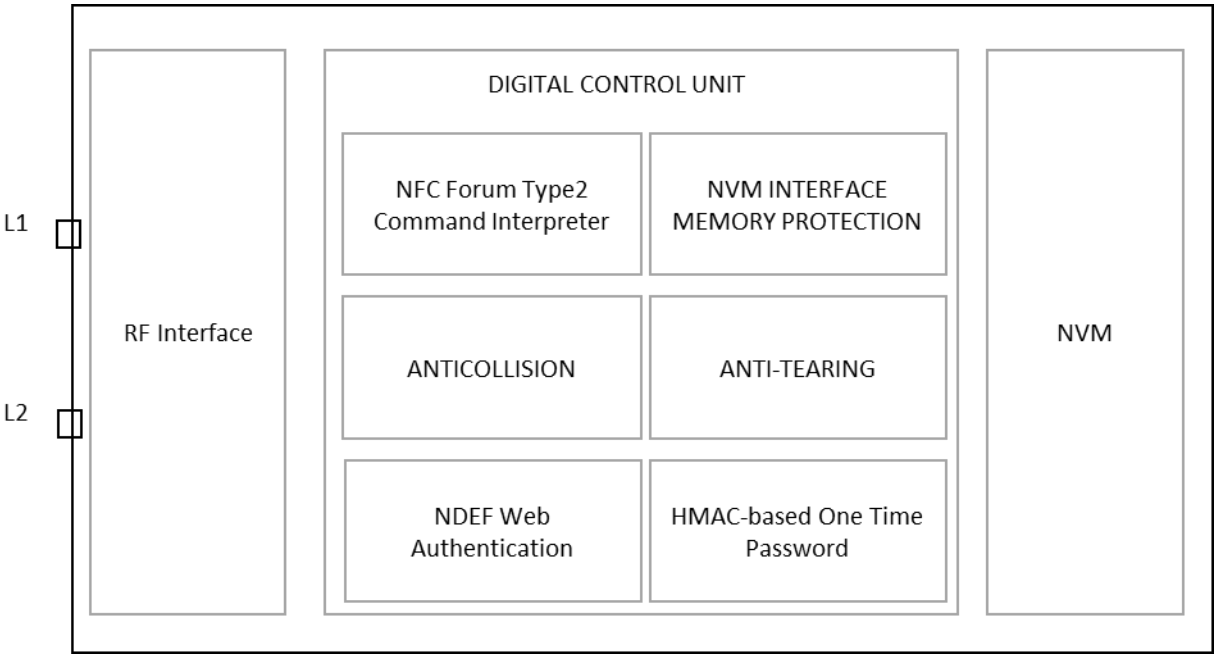
APPLICATIONS

- Product authentication
- Customer engagement, coupon, loyalty programs
- Proof of presence

1. TYPICAL OPERATING CONDITIONS



2. BLOCK DIAGRAM



3. ELECTRICAL SPECIFICATIONS

3.1. ABSOLUTE MAXIMUM RATINGS

Parameters	Symbol	Min	Max	Unit
Storage temperature	T_{STORE}	-50	125	°C
Maximum magnetic field strength with PICC 1 antenna (rms)	$H_{MAX\_MAG\_PICC1}$		12	A/m
Maximum magnetic field strength with PICC 6 antenna (rms)Error! Bookmark not defined.	$H_{MAX\_MAG\_PICC6}$		28.8	A/m
ESD hardness pad HF+ and HF -[1]	V_{ESD}	-2000	2000	V

Stresses above these listed maximum ratings may cause permanent damages to the device. Exposure beyond specified operating conditions may affect device reliability or cause malfunction.

[1] Human Body Model, between HF+, HF- pins and HF+ resp. HF- pins against VSS

3.2. HANDLING PROCEDURES

This device has built-in protection against high static voltages or electric fields; however, anti-static precautions must be taken as for any other CMOS component. Unless otherwise specified, proper operation can only occur when all terminal voltages are kept within the voltage range. Unused inputs must always be tied to a defined logic voltage level.

3.3. OPERATING CONDITIONS

Parameters	Symbol	Min	Max	Unit
Operating Temperature	T_{OP}	-40	+85	°C
Maximum operating field strength with PICC 1 antenna (rms)	H_{MAX_PICC1}		7.5	A/m
Maximum operating field strength with PICC 6 antenna (rms)	H_{MAX_PICC6}		18	A/m

Table 1 Operating Conditions

3.4. ELECTRICAL CHARACTERISTICS

CONDITIONS (UNLESS OTHERWISE SPECIFIED): TOP=25°C

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Resonance Capacitor	C_{RES}	fc = 13.56MHz U = 2Vrms	47.5	50	52.5	pF
Erase / write endurance	T_{CYC}		100k			Cycles
Retention	T_{RET}	T_{OP} = 55ºC	10			Years
Minimum Activation field		ISO10373-6 Class 6 antenna, Fres = 13.7MHz@100mV	0.3			A/m

Table 2 Electrical Specifications

3.5. TIMING CHARACTERISTICS

The time between the end of the last pause transmitted by reader and the first modulation edge within the start bit transmitted by IC is defined as follows for data rate fc/128:

Last reader bit = (1)b

(N x 128 + 84) / fc [ms]

Last reader bit = (0)b

(N x 128 + 20) / fc [ms]

Symbol	Minimum time [N]	Maximum time [N]	Maximum time [ms]
GT_A			5
T_{NACK}	9	9	
T_{READ}	9	≥ 9	4.75
T_{WRITE}	9	≥ 9	9.5
TSECTOR_SELECT	9	9	
$T_{READ\_MULTIPLE\_BLOCKS}$	9	≥ 9	4.75
$T_{READ\_INCREMENTAL}$	9	≥ 9	4.75
T_{LOGIN}	9	≥ 9	4.75
T_{AUTH}	9	≥ 9	4.75

Table 3 Timings

Note: The NFC memory write operation timing can differ depending on the current content and data being written, it means that IC can reply in different timeslots.

4. PRODUCT OVERVIEW

em|linq is used in passive transponder applications and provides support for use as an HF product or as a NFC product.

Main features :

- HMAC-SHA-1 based One-Time Password (HOTP) algorithm
- Incremental counter : Increment counter value with random step. Value is presetable and lockable.
- Security Level (Password or Mutual Authentication)

4.1. OVERVIEW (HF)

em|linq corresponds to ISO 14443 offering innovative and enriched features.

em|linq supports data rates at 106kps.

em|linq offers the maximum of flexibility in terms of security using password protection or mutual authentication based on SHA-1 cryptographic hash function.

Each **em|linq** chip is delivered with a unique 64-bit inalterable UID number programmed at wafer level to ensure full traceability.

4.2. OVERVIEW (NFC)

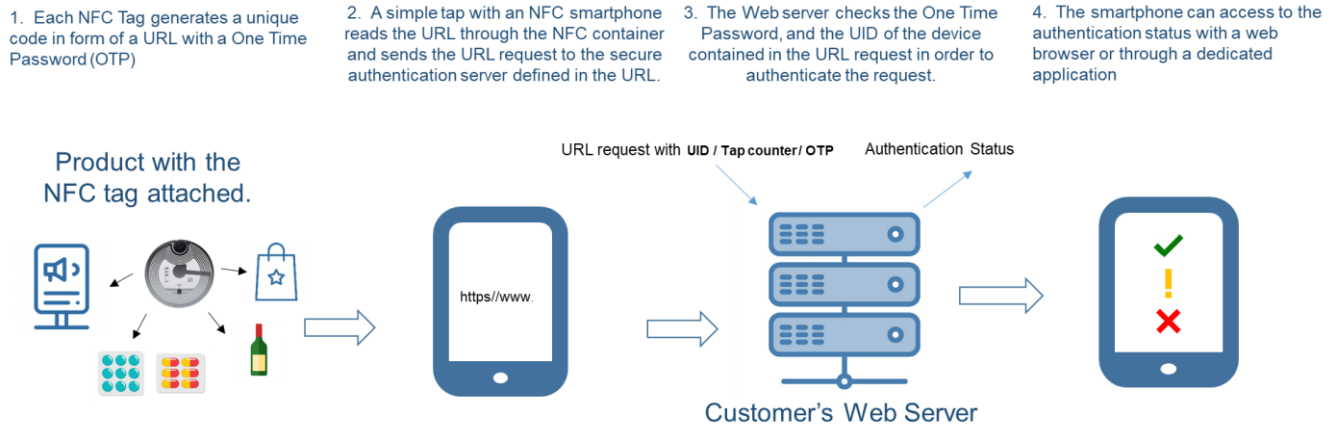
em|linq corresponds to NFC Forum Type 2 devices offering innovative and enriched features.

em|linq supports data rates at 106kps.

em|linq memory contains the NFC Capability Container, the NDEF message, and other proprietary data.

The user has the option to enable the use of the counter and web based OTP crypto authentication.

4.3. TYPICAL APPLICATION CASE



5. PAD LOCATION DIAGRAM

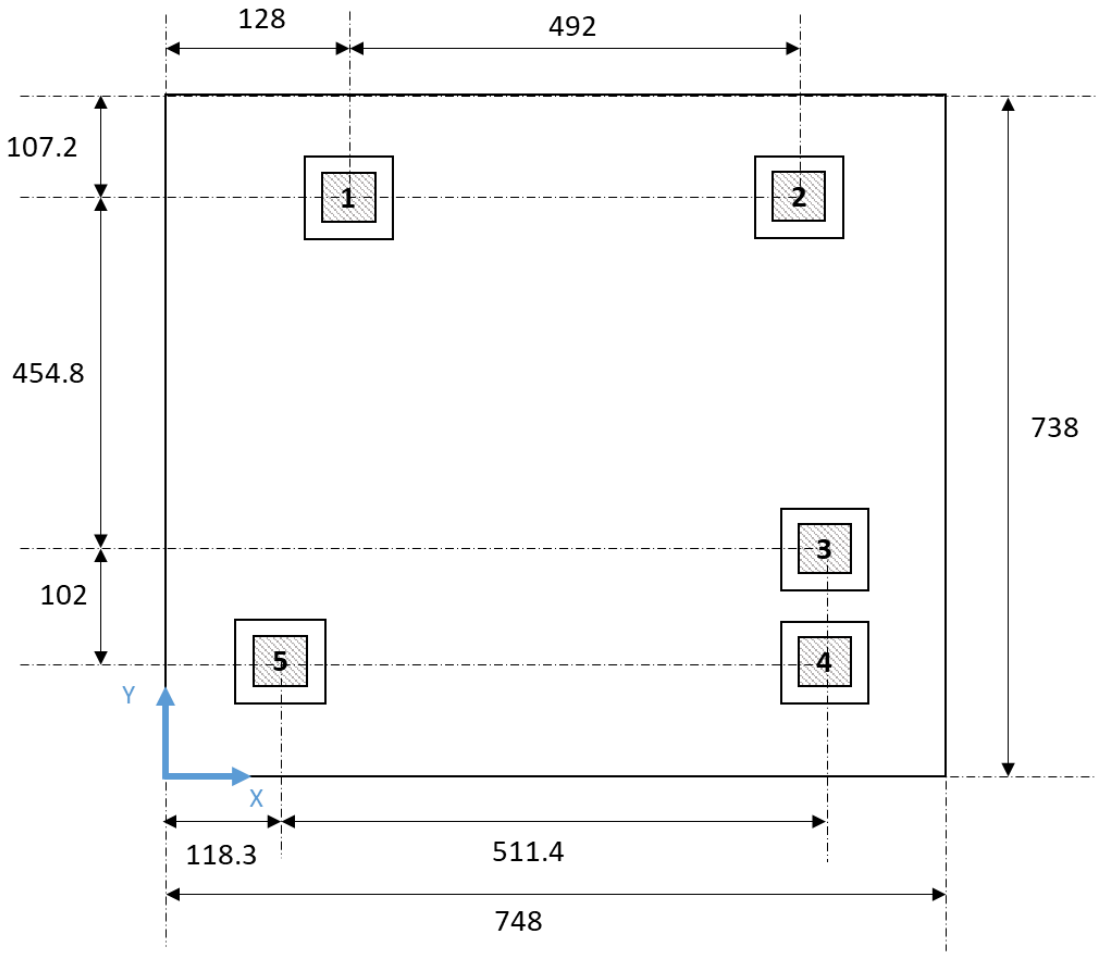
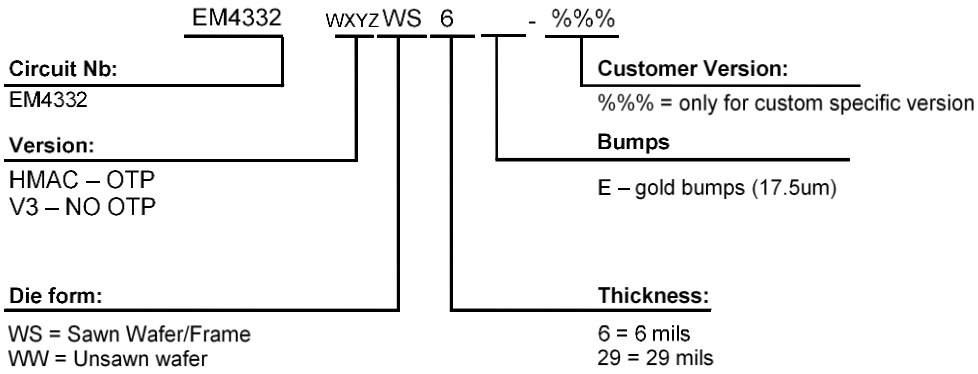


Figure 1 Bump position

Pin number	Pin name	Description
1	L1	Coil antenna input
2	L2	Coil antenna input
3	T1	Test purpose pad – functionally disconnected during sawing. It can be connected to any pad including coils
4	T2	Test purpose pad – functionally disconnected during sawing. It can be connected to any pad including coils
5	T3	Test purpose pad – functionally disconnected during sawing. It can be connected to any pad including coils

Table 4 Bump list

6. ORDERING INFORMATION



Part Nb	Delivery Form
EM4332HMACWS6E	8 inch, 6 mils thickness, sawn wafer with gold bumps HOTP function activated.
EM4332V3WS6E	8 inch, 6 mils thickness, sawn wafer with gold bumps, no HOTP function.

Table 5 Ordering Information

For other delivery formats please contact EM Microelectronics representative.

7. PRODUCT SUPPORT

Check our website at www.emmicroelectronic.com under Products/RF Identification section. Questions can be submitted to rfidsupport@emmicroelectronic.com .