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# M24SR series dynamic NFC tags

MMY division





# Main M24SR market segments

## Smart Things



Consumer, wearable,  
healthcare & wellness

## Smart Home



Home appliance & automation,  
home gateway

## Smart Industry



Networking, lighting



# Key use cases

## Seamless user interface simplicity



- **Device control** with a mobile phone

## Wireless pairing “tap & connect”



- Ease Bluetooth or WiFi by **simple tap**

## Servicing & maintenance



- Download records history
- **Update** parameters even if device is off

## Convenient data logging



- Data **download**
- Data **tracking**



# Typical NFC type 4 range

NFC phones



ISO14443 (106kb/s)

Up to 5 cm / 2in.



M24SR

EEPROM

RFID readers



Up to 10cm / 4in.

ISO14443 (106kb/s)



M24SR

EEPROM

Modulation more simple (ISO 15693), data rate more limited & consume less so better range



# M24SR product

- The M24SR chip belongs to ST25 NFC / RFID Tags & Readers family.
- The M24SR product is Dynamic Tag based on ISO14443 standard with following main features:
  - ISO14443-A NFC Forum Type 4 RF interface
  - I<sup>2</sup>C 1MHz interface – 2.4V to 5.5V
  - Up to 64-kbit EEPROM memory
  - 128-bit password for data protection
  - 200 years data retention & 1Mcycles erase/write
  - Configurable General Purpose Output signal for MCU wake-up
  - RF disable feature

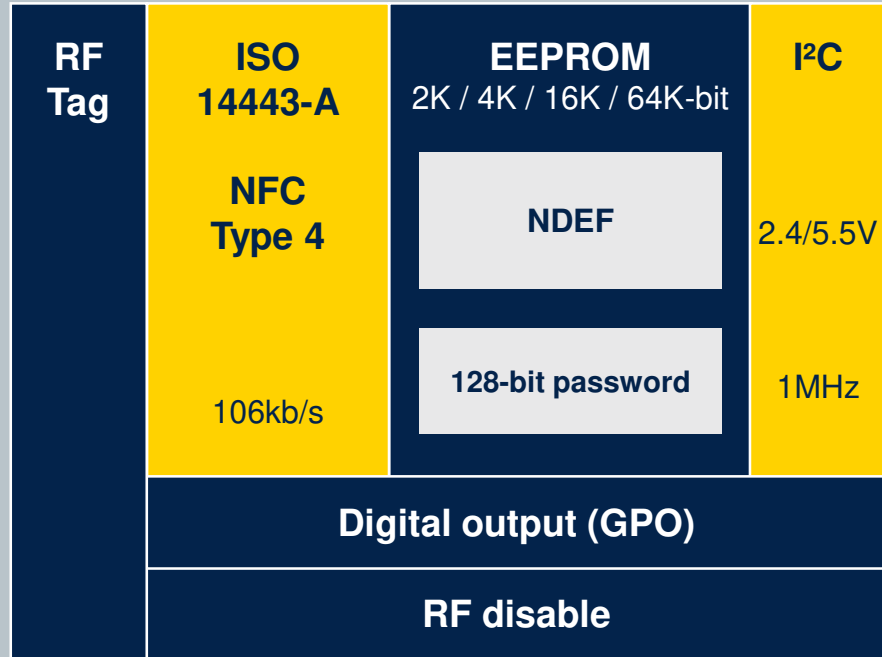


# M24SR

## dynamic NFC tag



M24SR02 / 04 / 16 / 64



SO8



TSSOP8



FPN8



SBN12

Die form, sawn and Bumped inkless 8" wafer, 120µm/ thickness

### Use cases

- Convenient wireless pairing (Bluetooth, Wi-Fi)
- Dynamic data exchange with NFC phone
  - User settings update, information log download,...

### Key Features

- **ISO14443-A** Type A and **NFC Type 4**
- High speed operations (**106kb/s**)
- NDEF memory format
- Data protection thanks to **128-bit password**

### Key Benefits

- Easy of use (limited BOM, 8-pin package)
- Flexible interrupt pin (configurable GPO)
- **200 years** data retention, **1M cycles** erase/write



# Key features

## M24SR series

|                       |                                                                 |
|-----------------------|-----------------------------------------------------------------|
| Contactless Interface | ISO14443-A NFC Type 4                                           |
| RF range              | Short range, up to 10cm                                         |
| RF speed              | 106kbps                                                         |
| Single supply voltage | 2.4V (2.7V) to 5.5V                                             |
| Serial Interface      | I2C @1MHz                                                       |
| Extra features        | MCU wake-up & RF Disable                                        |
| Memory format         | EEPROM<br>preformatted NDEF file                                |
| Memory size           | 2 / 4 / 16 / 64-kbit                                            |
| Data retention        | 200-year at +55°C                                               |
| Erase / Write cycles  | 1M cycles at +25°C                                              |
| Data protection       | Password 128-bit                                                |
| Temperature range     | -40°C to +85°C<br>-40°C to +105°C for I²C operation for M24SR64 |
| Package               | SO8 / TSSOP8 / DFN8 / SBN12 *                                   |

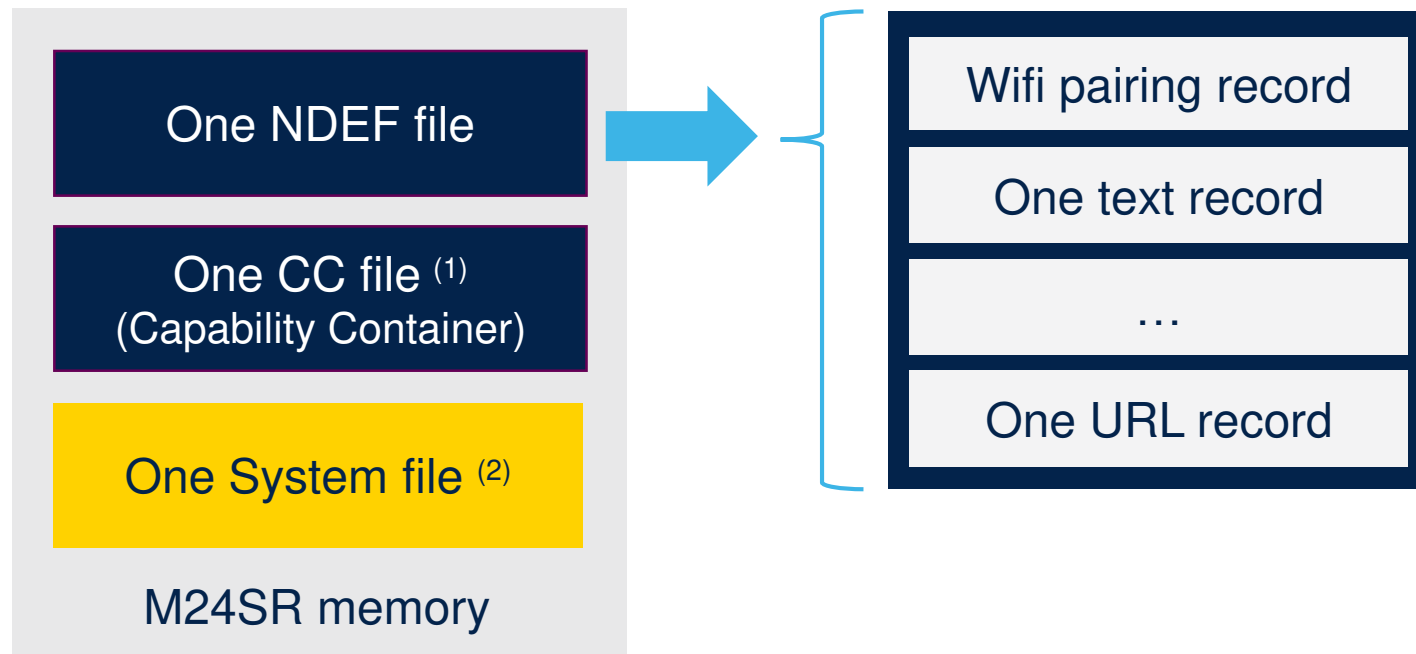


\* SBN12: Die form, sawn and Bumped wafer, 120µm thickness, inkless 8" wafer



# Memory organization

- The memory contains three types of file:
  - NDEF file, CC file and System file



(1) The CC file gives some information about the M24SR and the NDEF file (access conditions etc.). This file is a read-only file for the RF or I<sup>2</sup>C host and cannot be modified by issuing a write command.

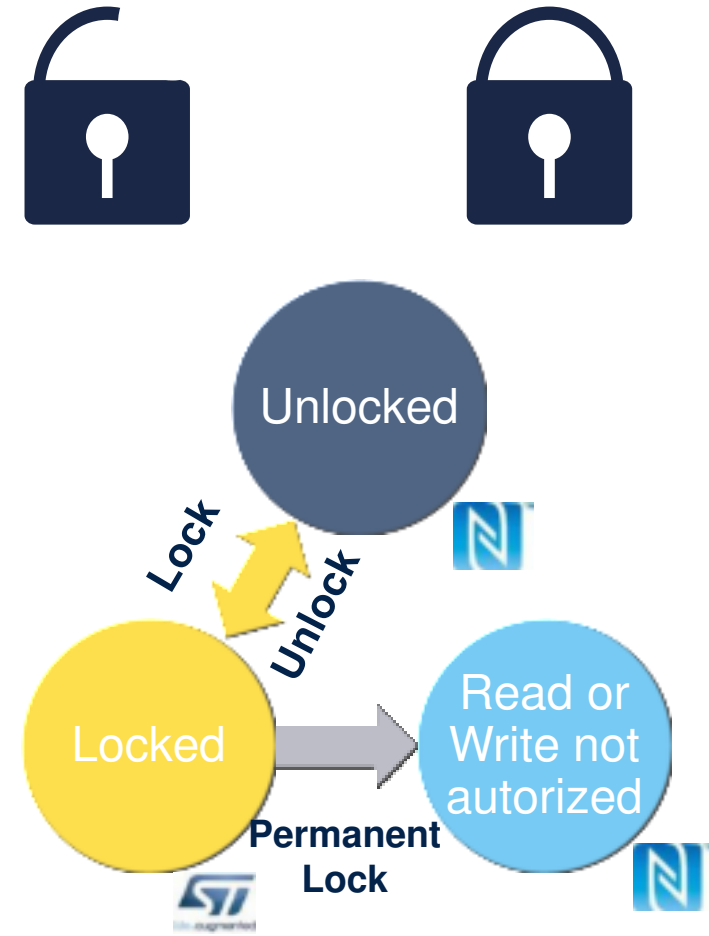
(2) The system file is a ST proprietary file. It can be read by the RF or I<sup>2</sup>C host and written by the I<sup>2</sup>C host.





# Data protection

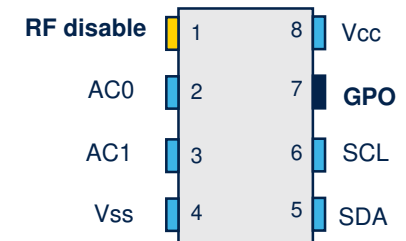
- Data protection thanks to a password. Why ?
  - To lock an NDEF file
- Password size: 128 bits
  - $3.4 \cdot 10^{38}$  possibilities to find the right password
- 2 passwords,
  - One for read access
  - One for write access
- Possible to lock permanently in read or write access
- 2 bytes in the CC file are used to define the Read and Write access rights to the NDEF file.





# GPO feature

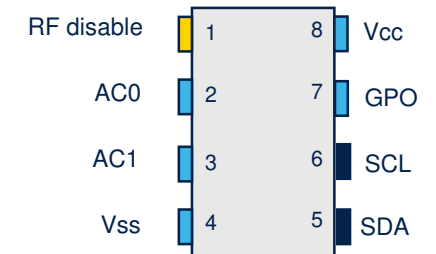
- The configurable output signal (GPO) pad is mainly to wake-up or inform a micro-controller about one event. It's an open drain pad so external pull-up resistor to Vcc is required.
- 7 possible configurations
  - **Session Open**
    - An RF or I<sup>2</sup>C session ongoing
  - **MIP** (NDEF Message updating In Progress)
    - RF host writing an NDEF length different from 0x0000. This mode can be used to detect when the RF host changes the NDEF message as defined by NFC Forum
  - **WIP** (Writing In Progress)
    - M24SR is executing a writing operation
  - **INT** (interrupt)
    - RF or I<sup>2</sup>C host can force M24SR to send a negative pulse on the pin
  - **State mode**
    - RF or I<sup>2</sup>C host can control the state of the GPO pad during the RF session
  - **I<sup>2</sup>C ready response**
    - An I<sup>2</sup>C response is ready to be read by the I<sup>2</sup>C host
  - **RF busy**
    - RF host is communicating with M24SR





# I<sup>2</sup>C interface

- I<sup>2</sup>C interface is typically used for connecting M24SR to a microcontroller. It features:
  - Two-wires I<sup>2</sup>C serial interface supports 1MHz protocol Single supply voltage
    - 2.4V to 5.5V for grade G (M24SR04)
    - 2.7V to 5.5V for grade Y (M24SR02/04/16/64)
- I<sup>2</sup>C uses only two bidirectional open-drain lines
  - Serial Clock (SCL)
    - Input signal used to strobe all data in and out of the device
    - Pull-up resistor must be connected from SCL to Vcc
  - Serial Data (SDA)
    - Bidirectional signal is used to transfer data in or out of the device
    - Pull-up resistor must be connected from SDA to Vcc





# RF tuning capacitance

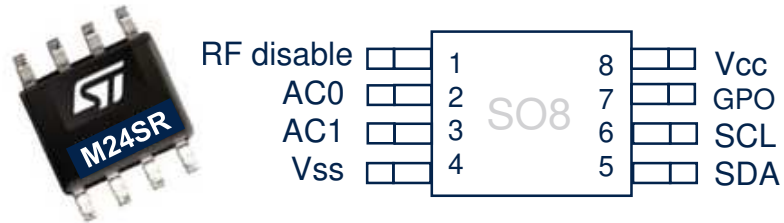
- The internal RF tuning capacitance is 25pF which is allowing antenna design from Class 1 to Class 6 form factor.

| M24SR                                                      |                 |
|------------------------------------------------------------|-----------------|
| Standard                                                   | ISO14443        |
| Main carrier frequency                                     | 13.56MHz        |
| Data sub-carrier frequency                                 | + 848kHz        |
| Optimal frequency tuning                                   | 14MHz – 14.4MHz |
| Internal capacitor (measured at 0.5V)                      | 25pF            |
| Recommended internal capacitor value<br>for antenna design | 27pF            |

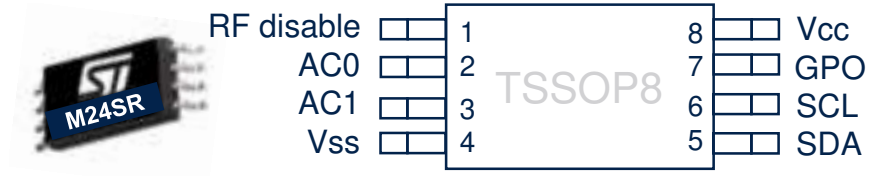


# M24SR packages

- SO8N Package – 4.9 x 3.9 mm



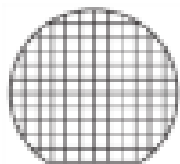
- TSSOP8 Package - 3.0 x 4.4 mm



- UFDFPN8 Package - 2 x 3 mm

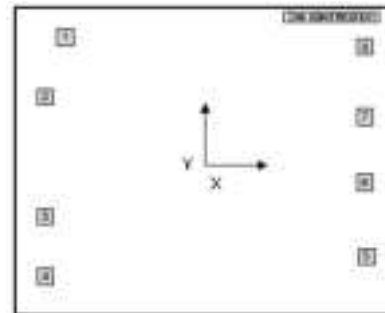


- Sawn & Bumped for wafer



SBN12 \*

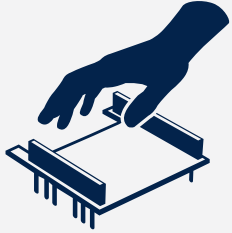
\* : sawn and bumped inkless 8" wafer, 120µm thickness (for M24LR04E and 64E)



| Bump | Signal name |
|------|-------------|
| 1    | RF disable  |
| 2    | AC0         |
| 3    | AC1         |
| 4    | Vss         |
| 5    | SDA         |
| 6    | SCL         |
| 7    | GPO         |
| 8    | Vcc         |



# M24SR rich eco-system



- Discovery kits based on STM32 MCU
- STM32 Nucleo boards ecosystem
- STM32Cube software ecosystem



- Antenna e-design tool
- Schematic and BOM
- Gerber files



- Android ST25 NFC tap app
- PC software tool
- MCU drivers firmware



- Documentation
- e2e community
- Webinar / MOOC
- Training



# M24SR part numbers



| M24SR                                                                                          | Package                                            | 2k-bit                                                                    | 4k-bit                                                                    | 16k-bit                                               | 64k-bit                                                                                                         |
|------------------------------------------------------------------------------------------------|----------------------------------------------------|---------------------------------------------------------------------------|---------------------------------------------------------------------------|-------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|
| Dynamic NFC Type 4 Tag<br>ISO14443-A<br>I2C IF + GPO<br>+ RF disable<br>+ Extended Temperature | SO8<br>TSSOP8<br>UFDFPN8<br>SBN12<br>SO8<br>TSSOP8 | M24SR02-YMN6T/2<br>M24SR02-YDW6T/2<br>M24SR02-YMC6T/2<br>M24SR02-YSG12I/2 | M24SR04-YMN6T/2<br>M24SR04-YDW6T/2<br>M24SR04-YMC6T/2<br>M24SR04-GSG12I/2 | M24SR16-YMN6T/2<br>M24SR16-YDW6T/2<br>M24SR16-YMC6T/2 | M24SR64-YMN6T/2<br>M24SR64-YDW6T/2<br>M24SR64-YMC6T/2<br>M24SR64-YSG12I/2<br>M24SR64-YMN8T/2<br>M24SR64-YDW8T/2 |

# Evaluation boards







# M24SR evaluation boards



M24SR-DISCO-PREM

## M24SR discovery kit

- **M24SR64** Dynamic NFC Tag IC
- 30x30mm 5 turns double layer antenna
- STM32F1 MCU
- LCD Color display + Joystick + LEDs
- USB & JTAG connectors
- BT / Audio module with audio headset



X-NUCLEO-NFC01A1



## M24SR Nucleo Shield

- **M24SR64** Dynamic NFC Tag IC
- 31x30mm 5 turns double layer antenna
- Compatible with STM32 Nucleo boards
- I2C interface to MCU through Arduino™ connector
- Open drain output for MCU wake-up



ANT7-T-M24SR64

## M24SR Tiny antenna

- **M24SR64** Dynamic NFC Tag IC
- 14x14mm dual layer antenna
- I2C test points to connect to MCU
- GPO open drain user configurable output to indicate an ongoing RF operation



# M24SR discovery kit

- M24SR evaluation and demonstration board
  - M24SR64 dynamic NFC tag IC
  - 30x30mm 5 turns double layer antenna
  - STM32F1 micro-controller
  - LCD color display + Joystick + LEDs
  - USB & JTAG connectors
  - BT / audio module with audio headset
- Reference: M24SR-DISCO-PREM





# M24SR Nucleo shield

- M24SR Nucleo board for fast prototyping
  - M24SR64 dynamic NFC tag IC
  - 31x30mm 5 turns double layer antenna
  - Compatible with STM32 Nucleo boards
  - I2C interface to MCU through Arduino connector
  - Open drain output for MCU wake-up
  - Powered through the Arduino UNO R3 connector
  - 3 general purpose color LEDs
- Reference: X-NUCLEO-NFC01A1





# ANT7-T-M24SR antenna board

- ANT7-T-M24SR antenna reference board is a ready-to-use PCB that features a M24SR64-Y dynamic NFC tag.
  - M24SR64-Y dynamic NFC tag
  - 14 mm x 14 mm, 13.56 MHz dual layer etched antenna
  - I2C test points to connect to MCU
  - Open drain user configurable output to indicate an ongoing RF operation (GPO)
  - Digital RF disable input (DIS)
- Reference: ANT7-T-M24SR



[http://www.st.com/content/st\\_com/en/products/evaluation-tools/product-evaluation-tools/st25-nfc-rfid-eval-boards/st25-nfc-rfid-eval-boards/ant7-t-m24sr64.html](http://www.st.com/content/st_com/en/products/evaluation-tools/product-evaluation-tools/st25-nfc-rfid-eval-boards/st25-nfc-rfid-eval-boards/ant7-t-m24sr64.html)  
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## Solutions for NFC / RFID Tags & Readers



**ST25 SIMPLY MORE CONNECTED**



# Thank you

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