a.daftery@arduino.cc

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42.7mm

40.4mm

Arduino		PN532 Module
GND	<-------------------->	GND
5V	<-------------------->	VCC
SDA	<-------------------->	SDA
SCL	<-------------------->	SCL

Protocols supported :
 - I2C
 - UART (on Leonardo)
 - SPI

PN532 Library :

https://github.com/elechouse/PN532

NDEF Library :

https://github.com/don/NDEF

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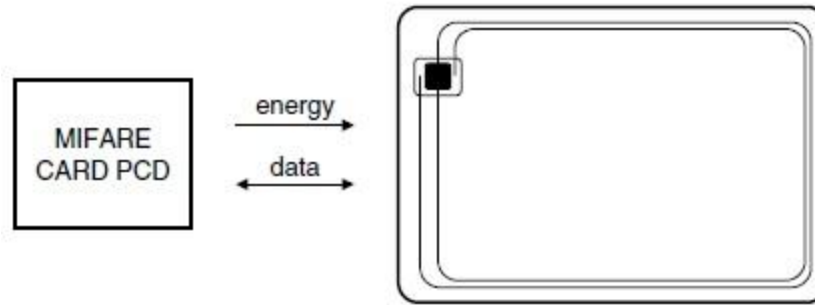
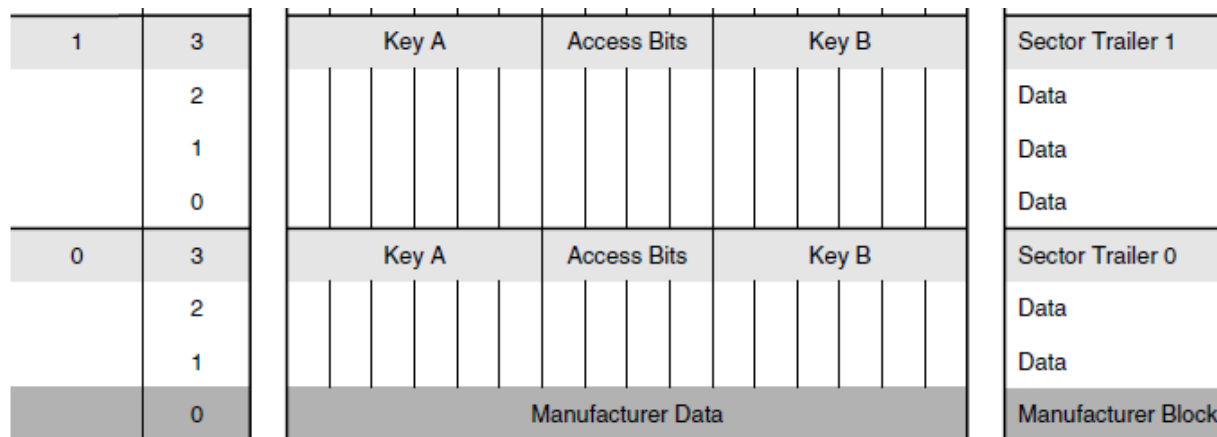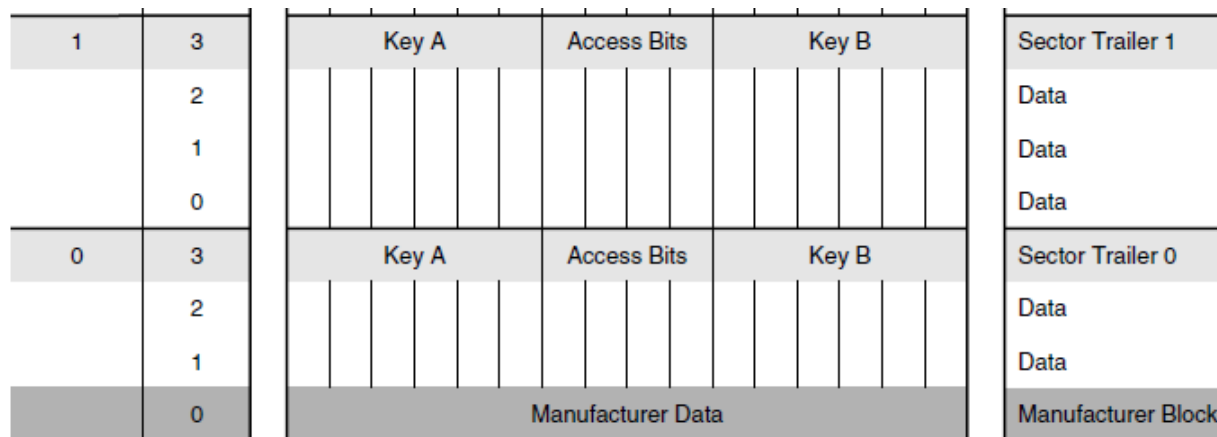

- Short-range wireless communication
- Operating frequency of 13.56 MHz or λ = 22.11m
- Operating distance upto 10cm
- Typical transaction time less than 100ms
- Energy and data are transferred via an antenna consisting of a coil with a small number of turns directly connected to the MF1S503x
-Difficult to eavesdrop
- Transfer rates of 106kbits/s possible

1	3	Key A	Access Bits	Key B	Sector Trailer 1
	2				Data
	1				Data
	0				Data
0	3	Key A	Access Bits	Key B	Sector Trailer 0
	2				Data
	1				Data
	0	Manufacturer Data			Manufacturer Block

- Memory is organised as :
- 16 bytes = 1 block
- 4 blocks = 1 sector
- 16 sectors total
- Each sector has a sector trailer
- The sector trailer controls authentication and permissions

1	3	Key A	Access Bits	Key B	Sector Trailer 1
	2				Data
	1				Data
	0				Data
0	3	Key A	Access Bits	Key B	Sector Trailer 0
	2				Data
	1				Data
	0	Manufacturer Data			Manufacturer Block

- Each block is 16 bytes.
- Sector 0 has 2 data blocks, others have 3
- Used for general data, as long as it can be
  represented as a byte

Value Blocks

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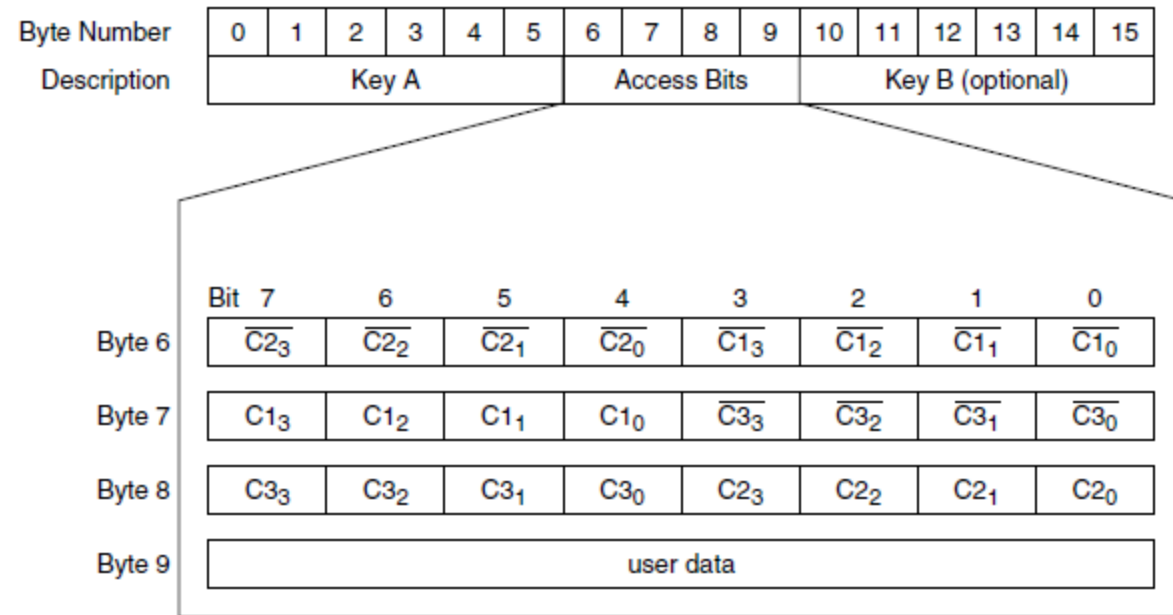| Byte Number	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Description	value				$\overline{value}$				value				adr	$\overline{adr}$	adr	$\overline{adr}$

- Useful for electronic purse applications
- Valid operations :
    - Read
    - Write
    - Increment
    - Decrement
    - Transfer
- Data is written multiple times for integrity
- Address bytes are available for backup systems

Byte Number	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Description	Key A						Access Bits				Key B (optional)					

- Last block in each sector
- Contains authentication keys
- Contains access parameters and data type of the blocks
- Factory defaults are 0xFFFFFFFFFFFF

Byte Number	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Description	Key A						Access Bits				Key B (optional)					

	Bit 7	6	5	4	3	2	1	0
Byte 6	$\overline{C2_3}$	$\overline{C2_2}$	$\overline{C2_1}$	$\overline{C2_0}$	$\overline{C1_3}$	$\overline{C1_2}$	$\overline{C1_1}$	$\overline{C1_0}$
Byte 7	$C1_3$	$C1_2$	$C1_1$	$C1_0$	$\overline{C3_3}$	$\overline{C3_2}$	$\overline{C3_1}$	$\overline{C3_0}$
Byte 8	$C3_3$	$C3_2$	$C3_1$	$C3_0$	$C2_3$	$C2_2$	$C2_1$	$C2_0$
Byte 9	user data							

Access conditions

- Access control available for a whole block
- Byte 9 available for user data
- Bits with Suffix 3 control access to keys / access control
- Careful ! Possible to block yourself out

- Standardised format for exchanging data between NFC devices
- NDEF records store data, NDEF messages transport data
- NDEF defines a mapping model to use the sector and block based memory of MiFare Classic 1K cards as continuous data records

```
Value    Protocol
-----    --------
0x00     No prepending is done ... the entire URI is contained in the URI Field
0x01     http://www.
0x02     https://www.
0x03     http://
0x04     https://
0x05     tel:
0x06     mailto:
0x07     ftp://anonymous:anonymous@
0x08     ftp://ftp.
0x09     ftps://
0x0A     sftp://
0x0B     smb://
0x0C     nfs://
0x0D     ftp://
0x0E     dav://
0x0F     news:
0x10     telnet://
0x11     imap:
0x12     rtsp://
0x13     urn:
0x14     pop:
0x15     sip:
0x16     sips:
0x17     tftp:
0x18     btspp://
0x19     btl2cap://
0x1A     btgoep://
0x1B     tcpobex://
0x1C     irdaobex://
```

- NFC also supports Peer to Peer communication
- Used for exchanging resources quickly in proximity
- Uses NDEF messages as the carrier, and NPP / SNEP as the protocol

a.daftery@arduino.cc

-Ticketing
- E-purse
- Access control
- Process automation
- Data transfer / messaging

Thank You !