PN512 NFC Reader based on Arduino

v1.1

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About

The PN512 NFC Reader is based on the Arduino Nano and shares the same pinouts and capabilities, but it can also read cards and tags with the help of the PN512 chip. It is designed to replace the RFID-RC522 module, so all the functionality of the RFID-MFRC522 and PN512 are the same.

Library

To use the device you will need a RFID library. We have modified an, already known, library for the MFRC-522 RFID Reader to work with the PN512 chip. The library that we used was miguelbalboa's rfid, https://github.com/miguelbalboa/rfid. You can find the PN512 library in the official Arduino Library Manager in the Arduino IDE application, or you can find it on github, https://github.com/nfc-rfid-reader-sdk/MFRC522_PN512/.
If you want to do your own changes in the document below are the steps that you need to initialize the PN512's registers to work with the MFRC522 library.

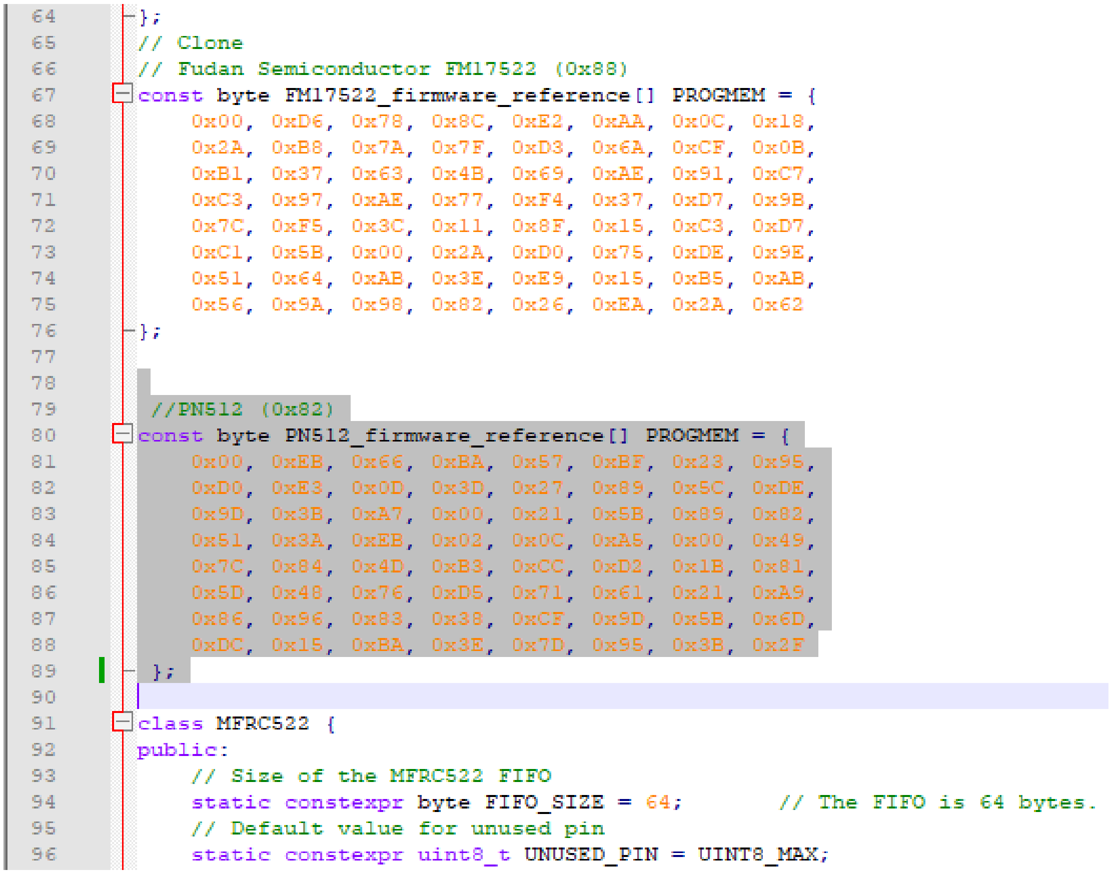
First, in the "*mfrc522.h*" file, add the PN512 self-test firmware reference:

```
 //PN512 (0x82)
const byte PN512_firmware_reference[] PROGMEM = {
     0x00, 0xEB, 0x66, 0xBA, 0x57, 0xBF, 0x23, 0x95,
     0xD0, 0xE3, 0x0D, 0x3D, 0x27, 0x89, 0x5C, 0xDE,
     0x9D, 0x3B, 0xA7, 0x00, 0x21, 0x5B, 0x89, 0x82,
     0x51, 0x3A, 0xEB, 0x02, 0x0C, 0xA5, 0x00, 0x49,
     0x7C, 0x84, 0x4D, 0xB3, 0xCC, 0xD2, 0x1B, 0x81,
     0x5D, 0x48, 0x76, 0xD5, 0x71, 0x61, 0x21, 0xA9,
     0x86, 0x96, 0x83, 0x38, 0xCF, 0x9D, 0x5B, 0x6D,
     0xDC, 0x15, 0xBA, 0x3E, 0x7D, 0x95, 0x3B, 0x2F
 };
```

In the "*mfrc522.cpp*" file on line 326(at the end of the *switch-case* function) , expand the function "*PCD_PerformSelfTest()*" with the following case:

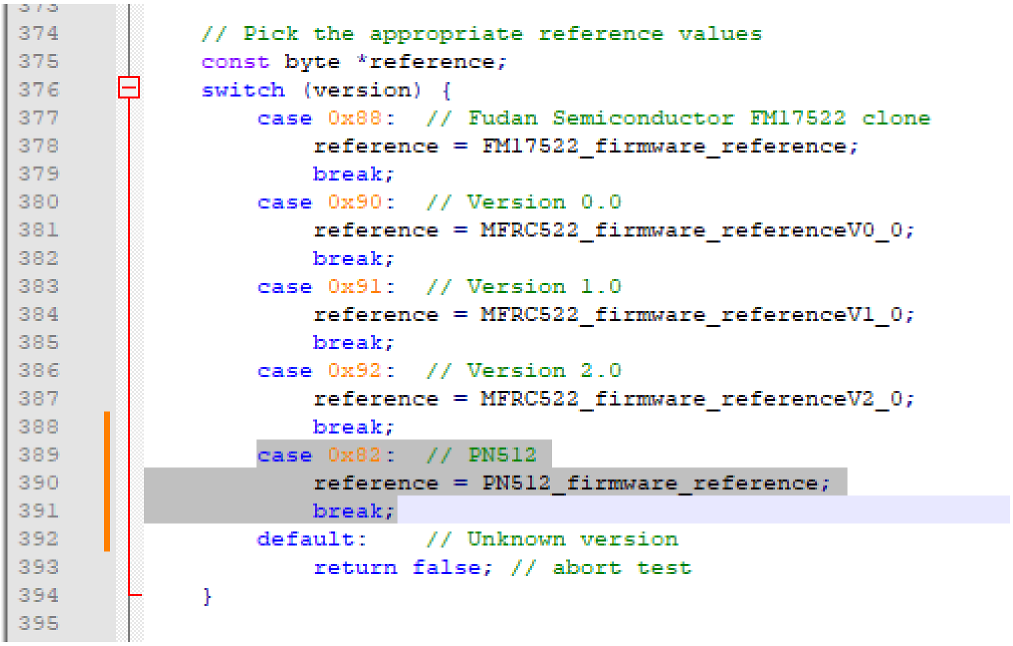
```
     case 0x82:// PN512
     reference = PN512_firmware_reference;
     break;
```

These code changes should look like the following:



```
};
// Clone
// Fudan Semiconductor FM17522 (0x88)
const byte FM17522_firmware_reference[] PROGMEM = {
    0x00, 0xD6, 0x78, 0x8C, 0xE2, 0xAA, 0x0C, 0x18,
    0x2A, 0xB8, 0x7A, 0x7F, 0xD3, 0x6A, 0xCF, 0x0B,
    0xB1, 0x37, 0x63, 0x4B, 0x69, 0xAE, 0x91, 0xC7,
    0xC3, 0x97, 0xAE, 0x77, 0xF4, 0x37, 0xD7, 0x9B,
    0x7C, 0xF5, 0x3C, 0x11, 0x8F, 0x15, 0xC3, 0xD7,
    0xC1, 0x5B, 0x00, 0x2A, 0xD0, 0x75, 0xDE, 0x9E,
    0x51, 0x64, 0xAB, 0x3E, 0xE9, 0x15, 0xB5, 0xAB,
    0x56, 0x9A, 0x98, 0x82, 0x26, 0xEA, 0x2A, 0x62
};


 //PN512 (0x82)
const byte PN512_firmware_reference[] PROGMEM = {
    0x00, 0xEB, 0x66, 0xBA, 0x57, 0xBF, 0x23, 0x95,
    0xD0, 0xE3, 0x0D, 0x3D, 0x27, 0x89, 0x5C, 0xDE,
    0x9D, 0x3B, 0xA7, 0x00, 0x21, 0x5B, 0x89, 0x82,
    0x51, 0x3A, 0xEB, 0x02, 0x0C, 0xA5, 0x00, 0x49,
    0x7C, 0x84, 0x4D, 0xB3, 0xCC, 0xD2, 0x1B, 0x81,
    0x5D, 0x48, 0x76, 0xD5, 0x71, 0x61, 0x21, 0xA9,
    0x86, 0x96, 0x83, 0x38, 0xCF, 0x9D, 0x5B, 0x6D,
    0xDC, 0x15, 0xBA, 0x3E, 0x7D, 0x95, 0x3B, 0x2F
 };

class MFRC522 {
public:
    // Size of the MFRC522 FIFO
    static constexpr byte FIFO_SIZE = 64;       // The FIFO is 64 bytes.
    // Default value for unused pin
    static constexpr uint8_t UNUSED_PIN = UINT8_MAX;
```

1. added the self-test reference, preview

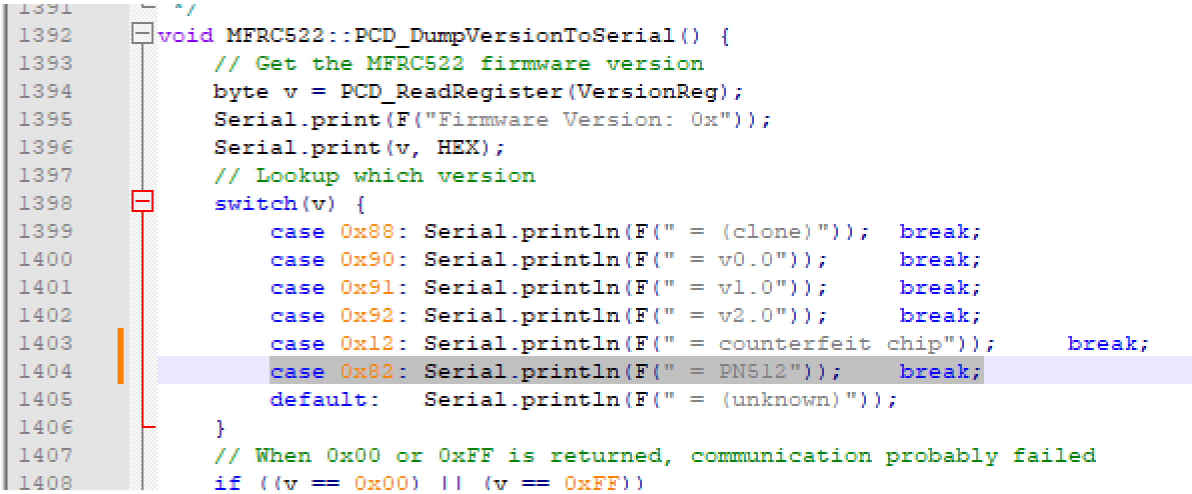


```
    // Pick the appropriate reference values
    const byte *reference;
    switch (version) {
        case 0x88:  // Fudan Semiconductor FM17522 clone
            reference = FM17522_firmware_reference;
            break;
        case 0x90:  // Version 0.0
            reference = MFRC522_firmware_referenceV0_0;
            break;
        case 0x91:  // Version 1.0
            reference = MFRC522_firmware_referenceV1_0;
            break;
        case 0x92:  // Version 2.0
            reference = MFRC522_firmware_referenceV2_0;
            break;
        case 0x82:  // PN512
            reference = PN512_firmware_reference;
            break;
        default:    // Unknown version
            return false; // abort test
    }
```

2. added case at the end of the *switch-case*

And in the *PCD_DumpVersionToSerial()* in the "*mfrc522.h*" file, add the following *switch-case* line.

```
case 0x82: Serial.println(F(" = PN512"));    break;
```



```
 */
void MFRC522::PCD_DumpVersionToSerial() {
    // Get the MFRC522 firmware version
    byte v = PCD_ReadRegister(VersionReg);
    Serial.print(F("Firmware Version: 0x"));
    Serial.print(v, HEX);
    // Lookup which version
    switch(v) {
        case 0x88: Serial.println(F(" = (clone)"));  break;
        case 0x90: Serial.println(F(" = v0.0"));     break;
        case 0x91: Serial.println(F(" = v1.0"));     break;
        case 0x92: Serial.println(F(" = v2.0"));     break;
        case 0x12: Serial.println(F(" = counterfeit chip"));     break;
        case 0x82: Serial.println(F(" = PN512"));    break;
        default:   Serial.println(F(" = (unknown)"));
    }
    // When 0x00 or 0xFF is returned, communication probably failed
    if ((v == 0x00) || (v == 0xFF))
```

3. added version in the *switch-case* function

Next,it would be necessary to add the following 3 registers in the *PCD_Register* list:

```
TypeBReg        = 0x1E << 1,    // Configure the ISO/IEC 14443 type B

GsNOffReg       = 0x23 << 1,    // Selects the conductance of the antenna
driver pin TX1 and TX2 for modulation, when the driver is switched off

TxBitPhaseReg   = 0x25 << 1,    // Adjust the TX bit phase at 106 kbit
```

These registers are “Reserved for future use” in the MFRC522 chip, but are used in PN512 chips.

The final step is to initialize the new registers and more in the PCD_Init() function in the MFRC522.cpp file. Initializing these registers enables the chip to work properly

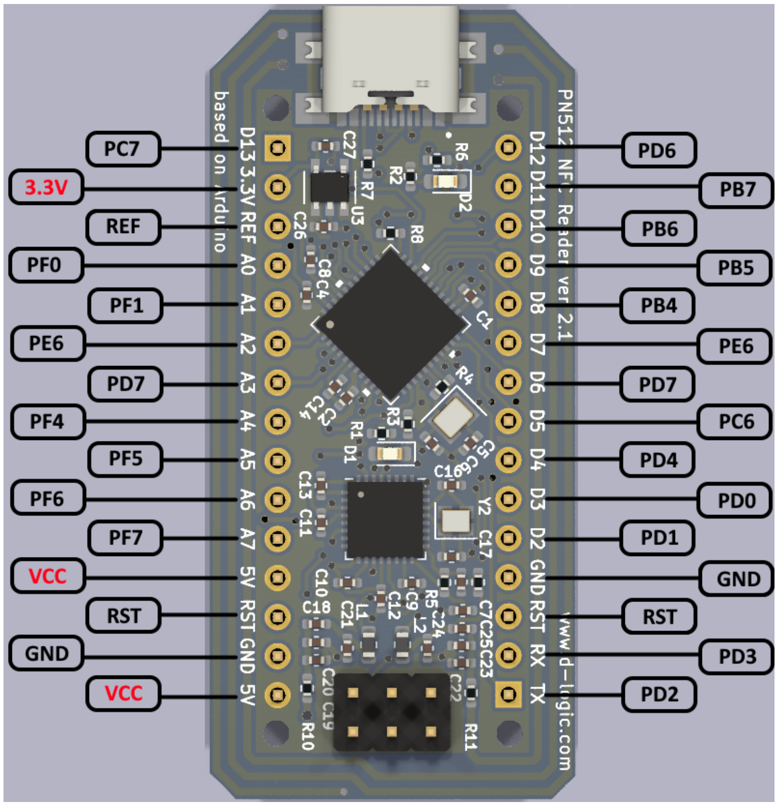
```
{
    PCD_WriteRegister(TxModeReg, 0x00);
    PCD_WriteRegister(RxModeReg, 0x00);
    PCD_WriteRegister(ModWidthReg, 0x26);

    PCD_WriteRegister(TxASKReg, 0x40);
    PCD_WriteRegister(RxThresholdReg, 0xFF);
    PCD_WriteRegister(ControlReg, 0x10);
    PCD_WriteRegister(DemodReg, 0x4D);
    PCD_WriteRegister(MfTxReg, 0x62);
    PCD_WriteRegister(TxBitPhaseReg, 0x87);
    PCD_WriteRegister(RxSelReg, 0x84);
    PCD_WriteRegister(RFCfgReg, 0x48);
    PCD_WriteRegister(GsNReg, 0x88);
    PCD_WriteRegister(CWGsPReg, 0x20);
    PCD_WriteRegister(GsNOffReg,0x88);
    PCD_WriteRegister(ModGsPReg,0x20);

    PCD_WriteRegister(ModeReg, 0x3D);
    PCD_WriteRegister(BitFramingReg, 0x00);
    PCD_WriteRegister(WaterLevelReg, 64);
    PCD_WriteRegister(TypeBReg, 0);
    PCD_WriteRegister(MfTxReg, 0x8A);
    PCD_AntennaOn();
} // End PCD_Init()
```

After this the device will work properly. For further assistance, we made some examples for how you would use the device on our github https://github.com/nfc-rfid-reader-sdk/MFRC522_PN512

Hardware

Pinout

Pin Number	Pin Name	Mapped Pin Name	Pin Number	Pin Name	Mapped Pin Name
1	PC7	Digital pin 13	16	PD6	Digital pin 12
2	3.3V	3.3V	17	PB7	Digital pin 11
3	AREF	REF	18	PB6	Digital pin 10
4	PF0	Analog pin 0	19	PB5	Digital pin 9
5	PF1	Analog pin 1	20	PB4	Digital pin 8
6	PE6	Analog pin 2	21	PE6	Digital pin 7
7	PD7	Analog pin 3	22	PD7	Digital pin 6
8	PF4	Analog pin 4	23	PC6	Digital pin 5
9	PF5	Analog pin 5	24	PD4	Digital pin 4
10	PF6	Analog pin 6	25	PD0	Digital pin 3
11	PF7	Analog pin 7	26	PD1	Digital pin 2
12	VCC	5V	27	GND	GND
13	Reset	RST	28	Reset	RST
14	GND	GND	29	PD3	RX
15	VCC	5V	30	PD2	TX


PC7
3.3V
REF
PF0
PF1
PE6
PD7
PF4
PF5
PF6
PF7
VCC
RST
GND
VCC
D13
3.3V
REF
A0
A1
A2
A3
A4
A5
A6
A7
5V
RST
GND
5V
based on Arduino
PN512 NFC Reader ver 2.1
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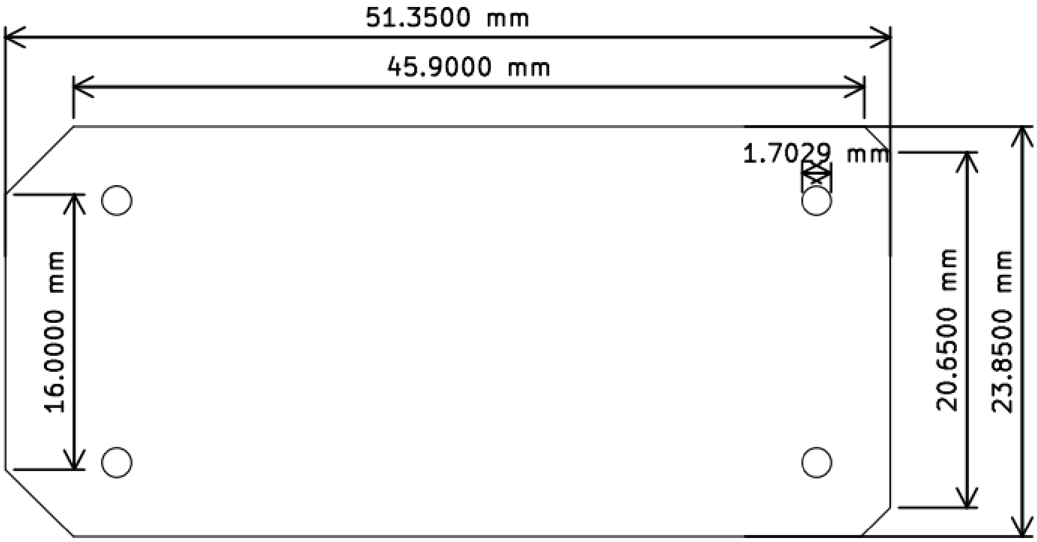
D12
D11
D10
D9
D8
D7
D6
D5
D4
D3
D2
GND
RST
RX
TX
PD6
PB7
PB6
PB5
PB4
PE6
PD7
PC6
PD4
PD0
PD1
GND
RST
PD3
PD2


51.3500 mm
45.9000 mm
1.7029 mm
16.0000 mm
20.6500 mm
23.8500 mm

Revision history

Date	Version	Comment
2023-08-03	1.1	Document format updated
2023-08-01	1.0	Base document