# M519 Datasheet

## NFC/RFID HF and smart cards OEM USB+Serial module

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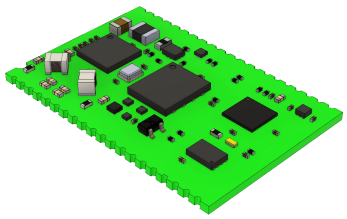
# 1. Introduction

**This document describes the functionality and electrical specification of the SpringCard M519 OEM NFC/RFID HF module, using firmware version 1.30 or higher.**

## 1.1. General description



SpringCard M519 is a versatile OEM NFC/RFID HF module. It is designed into industrial equipments or consumer devices, and has to be connected to an external antenna through a “mother” PCB.

The M519 is able to communicate with virtually any contactless smart card, RFID label, NFC tag or NFC smartphone compliant with one of the standard technologies in the 13.56MHz range.

The M519 features a contact smart card interface, that is able to drive either one SAM card (ID-000) either directly or through a NXP TDA8035 IC, or to drive up to 5 ID-1 and ID-000 slots through a NXP TDA8026 IC.

The M519 also features a protected storage for secret and private cryptographic keys, and is able to run secure transactions protected by AES or ECC schemes with contactless cards and NFC smartphones.

The M519 is either a serial device or a USB device; it operates either in coupler mode (reader/writer, APDU level) or in smart reader mode, freeing the host from all technical aspects of the transaction with the cards.

The M519 may either be surface-mounted on its “mother” PCD using the edge-plated pads, or be soldered on 0.50" (1.27mm) headers using Ø0.6 half-holes on the outline.

## 1.2. Features and benefits

### 1.2.1. Easy integration into your hardware and energy budget

- Smallest design on the market (26.67 x 17.78 x 2.6 mm or 1.05 x 0.7 x 0x10 "),
- Components mounted on the top side only, bottom and edges ready for either SMD or THT mounting,
- NXP PN5190 NFC/RFID HF frontend allowing best in-class performance/power ratio,
- Self-antenna tuning capability,
- Single-source power supply, power saving modes, low power card detection features on less than 5µA,
- ISO 7816 interface supporting up to 4 external SIM/SAM (ID-000) slots and 1 ID-1 smart card slot.

### 1.2.2. Easy integration into your application and use case

- Serial interface supporting a various choice of protocols, making it easy to operate the module even from low-end MCUs,
- USB interface supported by Linux (even low-end embedded SOCs), Windows and macOS
- In-the-field configuration and firmware upgrade (flash) without interruption,
- Comprehensing starter kit and a wide range of sample available for free on GitHub,
- Compliant with earlier SpringCard SDKs and software libraries (PC/SC, SpringProx, etc).

### 1.2.3. Open and interoperable

- Standard-compliant USB CCID (PC/SC) and USB HID keyboard wedge (RFID Scanner) profiles,
- Contactless stack validated against EMV CL L1 Digital, NFC Forum CR12 and CEN/TS 16794 (RCTIF) test suites,
- Contact stack validated against EMV CT L1 Digital test suite,
- Support of Apple Pay ECP1 and ECP2 for Passkit / Apple VAS applications, support of Google Smart Tap,
- Support of NXP Mifare and NTAG families, the largest portfolio of contactless cards.

### 1.2.4. Typical applications

- Public transport, public bike systems, car sharing,
- Car-park gates or cashiers,
- Kiosk, vending machines,
- Mobile or afixed terminals for loyalty, events, gaming...
- Access control, secure identification,
- and more.

## 1.3. Related documents

M519 belongs to the SpringCore family. The reference book for developers and software integrators is available online at https://docs.springcard.com/books/SpringCore/

+++ JCH fichier empreinte pour OrCAD ou autre ???

+++ JCH fichier 3D ???

# 2. Technical data

## 2.1. General

| | |
|---|---|
| Dimensions | 26.67 x 17.78 x 2.6mm |
| Weight | Approx. 7g |
| Power supply | 3.3V nomimal for serial operation, 5V (powered by the bus) for USB operation |
| Power requirement | |
| Temperature | |
| Environment | |

## 2.2. NFC/RFID HF interface

### 2.2.1. Coupler and smart reader operation

| | |
|---|---|
| NFC/RFID HF frequency | 13.56MHz |
| Antenna requirement | External antenna, 20Ω-matched, balanced |
| Operating distance | Up to 100mm depending on antenna, card and environment |
| Power | Max 2W (Imax = 250mA) |
| Standards | ISO/IEC 14443 A & B (PCD) / NFC-A et NFC-B<br>ISO/IEC 15693 (VCD) et ISO/IEC 18000-3M1 / NFC-V<br>ISO/IEC 18000-3M3 (RFID HF) / EPC HF<br>JIS X 6319-4 / NFC-F<br>ISO/IEC 21481 (NFCIP-2) |
| Bitrates | 26, 53, 106, 212, 424, 848 kbit/s selon le protocole |
| Supported card technologies | Innovatron (cartes Calypso)<br>NFC Forum types 1, 2, 3, 4 et 5<br>Mifare Classic avec CRYPTO1, toute la gamme NXP Mifare, Mifare Plus, Desfire, NTAG, ICODE...<br>STMicroElectronics SR & LR...<br>Infineon SLE44, SLE66, SRF55...<br>Texas Instrument Tag-it<br>Sony FeliCa Lite<br>Apple ECP, Apple VAS Google Smart Tap et autres applications NFC<br>Inside Secure PicoPass / HID iClass (ID seulement) |
| Advanced features | LPCD, AWC, ... |

### 2.2.2. Card emulation and peer-to-peer operation

| | |
|---|---|
| Standards | ISO/IEC 14443 A (PICC) / emulation of NFC Forum Type 4A Tag<br>ISO/IEC 18092 (NFCIP-1) active and passive, iniator and target |
| Bitrates | 106 kbit/s (PICC)<br>106, 212 ou 424 kbit/s (P2P) |

## 2.3. Smart card interface

| | |
|---|---|
| Standards | ISO/IEC 7816-2, -3 and -4, protoles T=0 and T=1<br>HSP (SAM Calypso) |
| Card clock frequency | 4MHz |
| Bitrates | TA1=11 to TA1=97 (500kbps @ 4MHz) |

## 2.4. Host interfaces

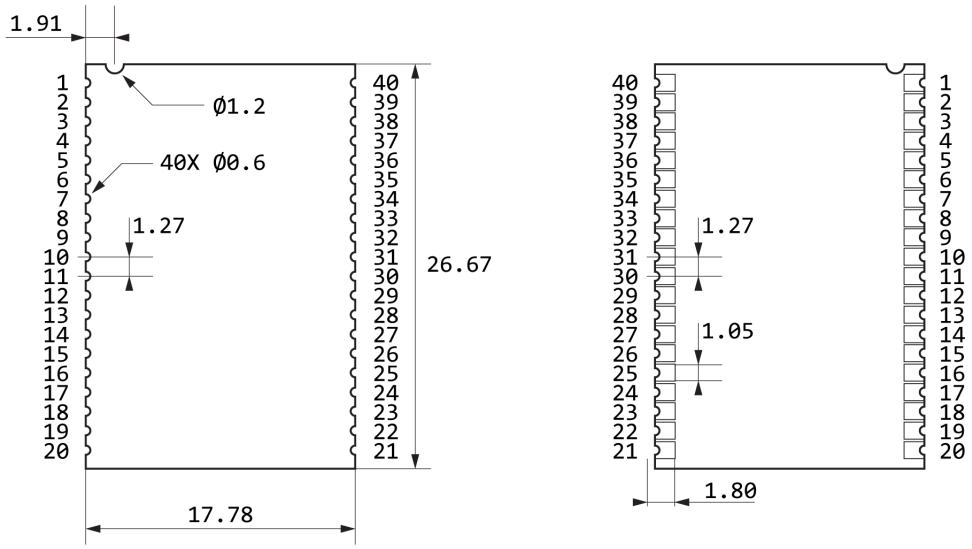
### 2.4.1. Serial

| | |
|---|---|
| Communication scheme | RS @ 3.3V, 8 data bits, 1 stop bit, no parity, no flow control |
| Bitrates | 38400bps (default), 115200bps, 500kbps |
| Protocols | CCID over serial, SpringProx legacy, SpringCore Direct, RDR MK1, $SCRDR... |

### 2.4.2. USB

| | |
|---|---|
| Standard | USB 2.0 full-speed device (compatible with USB 3.x) |
| Bitrate | 12Mbit/s |
| Profiles | CCID (PC/SC), HID keyboard, CDC-ACM, SpringCore Direct |

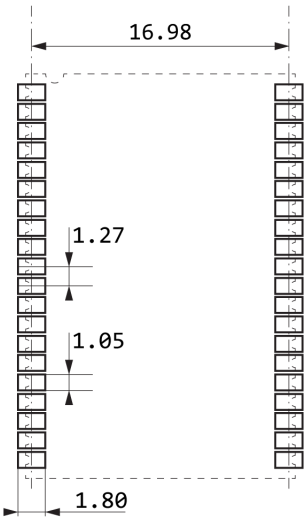
# 3. Mechanical characteristics




TOP VIEW

BOTTOM VIEW

ALL DIMENSIONS IN MILLIMETERS
PRINT VERSION NOT TO SCALE
(APPROX 2:1)
OUTLINE TOLERANCE ±0.25MM - TOLERANCE ON DRILLING Ø ±0.05MM
LOCATION OF PADS ACCORDING TO IPC-A-600 CLASS 2




RECOMMENDED PCB LAYOUT

# 4. Pinout

## 4.1. West-bound header

| Pin | Symbol | Type | Description |
|---|---|---|---|
| 1 | HF_TUNE1 | Analog | Antenna self-tuning probe |
| 2 | HF_RXP | Analog | Antenna receiver |
| 3 | HF_TX1 | Analog | Antenna driver |
| 4 | HF_GND | Analog | Antenna ground |
| 5 | HF_TX2 | Analog | Antenna driver |
| 6 | HF_RXN | Analog | Antenna receiver |
| 7 | HF_TUNE2 | Analog | Antenna self-tuning probe |
| 8 | GPIO4 | In/Out | |
| 9 | GPIO5 | In/Out | |
| 10 | SC_VCC | Out | ISO 7816, card VCC supply |
| 11 | /SC_IRQ | In | ISO 7816, card status / TDA8026 interruption |
| 12 | SC_IO | In/Out | ISO 7816, card IO signal |
| 13 | SC_RST | Out | ISO 7816, card RST signal |
| 14 | SC_CLK | Out | ISO 7816, card CLK signal / TDA8026 or TDA3035 master clock |
| 15 | GPIO1 | In/Out | |
| 16 | /WAKEUP | Out | Tell the host that the module is active |
| 17 | /SUSPEND | In | Tell the module to enter standby mode |
| 18 | /FLASH | In | Force DFU (bootloader) mode upon reset |
| 19 | /RESET | In | Reset by the host |
| 20 | GND | Gnd | Ground |

## 4.2. East-bound header

| Pin | Symbol | Type | Description |
|---|---|---|---|
| 21 | RX | In | Main UART, host to module |
| 22 | TX | Out | Main UART, module to host |
| 23 | /PER_EN | Out | Allow the peripherals of the module to start |
| 24 | GPIO2 | | |
| 25 | I2C_SCL | Out | I2C SCL (master) |
| 26 | I2C_SLA | In/Out | I2C SDA (master) |
| 27 | /PER_CS | In/Out | SPI chip select output in master mode / SPI chip select input in slave mode |
| 28 | PER_CLK | In/Out | SPI clock output in master mode / SPI clock input in slave mode |
| 29 | PER_TX | Out | UART TX to peripherals / SPI MOSI in master mode / SPI MISO in slave mode |
| 30 | PER_RX | In | UART RX from peripherals / SPI MISO in master mode / SPI MOSI in slave mode |
| 31 | MODE0 | In | Configure operating mode |
| 32 | MODE1 | In | Configure operating mode |
| 33 | GPIO3 | | |
| 34 | VOUT | Out | 3.3V output, max 100mA, to power the peripherals |
| 35 | USB_DM | USB | USB D- line |
| 36 | USB_DP | USB | USB D+ line |
| 37 | GND | Gnd | Ground |
| 38 | VBUS | USB | Power supply via USB (5V) |
| 39 | VIN_RF | Pwr | Power supply for RF, either 3.3V or 5V |
| 40 | VIN_3V3 | Pwr | Digital power supply 3.3V |

# 5. Limiting values

Stresses beyond those listed under 'Limiting values' may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these conditions is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

| Symbol | Parameter | Conditions | Min | Max | Unit |
|---|---|---|---|---|---|
| $VIN\_3V3_{ABS}$ | Supply voltage on pin VIN_3V3 | | ??? | ??? | V |
| $VBUS_{ABS}$ | Supply voltage on pin VBUS | | ??? | ??? | V |
| $VIN\_RF_{ABS}$ | Supply voltage on pin VIN_RF | | ??? | ??? | V |
| $V_{ANA}$ | Supply voltage on any analog pin | | ??? | ??? | V |
| $V_{ESD}$ | Electrostatic discharge voltage | | -500 | 500 | V |
| $T_{JUNCTION}$ | Junction temperature | | — | +120 | °C |
| $T_{STORAGE}$ | Storage temperature | No supply voltage applied | -20 | +70 | °C |

# 6. Characteristics

## 6.1. Thermal characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $T_{OPERATION}$ | Operating temperature | In still air, soldered on a PCB | -20 | +25 | +70 | °C |

## 6.2. Electrical characteristics

T=25°C, VIN_3V3=3.3V (exclusive) or VBUS=5V unless otherwise specified.

### 6.2.1. Power supply

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| VIN_3V3 | Main supply voltage | Operation on serial line | 3.0 | 3.3 | 3.6 | V |
| VBUS | Main supply voltage | Operation on USB | 4.5 | 5.0 | 5.5 | V |
| $VIN\_RF_{VIN\_3V3}$ | RF supply voltage | Operation on serial line | 3.0 | 3.3 | 4.5 | V |
| $VIN\_RF_{VBUS}$ | RF supply voltage | Operation on USB | 3.0 | 5.0 | 5.5 | V |

### 6.2.2. Current consumption

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $I_{VIN\_3V3,IOUT=0}$ | System supply | Operation on serial line, no power drain on VOUT | ??? | ??? | ??? | mA |
| $I_{VIN\_3V3,IOUT=100}$ | System supply | Operation on serial line, 100mA drained on VOUT | ??? | ??? | ??? | mA |
| $I_{VBUS,VOUT=0}$ | System supply | Operation on USB, no power drain on VOUT | ??? | ??? | ??? | mA |
| $I_{VBUS,IOUT=100}$ | System supply | Operation on serial line, 100mA drained on VOUT | ??? | ??? | ??? | mA |
| $I_{VIN\_RF=3.3}$ | RF supply | VIN_RF=3.3V | ??? | ??? | ??? | mA |
| $I_{VIN\_RF=5}$ | RF supply | VIN_RF=5V | ??? | ??? | ??? | mA |

### 6.2.3. VOUT pin

| Symbol | Parameter | Conditions | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| VOUT | Peripheral(s) power supply voltage | — | ??? | 3.3 | ??? | V |
| $I_{VOUT}$ | Peripheral(s) power supply current | — | — | — | 100 | mA |

## 6.2.4. SC_VCC pin

| Symbol | Parameter | Conditions | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| SC_VCC | Smart card power supply voltage | — | ??? | 3.3 | ??? | V |
| $I_{SC\_VCC}$ | Smart card power supply current | — | — | — | *???* | mA |
| TR | Up or down transition time, maximum capacitance 300nF | — | — | — | ??? | µs |

## 6.2.5. /RESET, /SUSPEND, /SC_IRQ pins

These input pins have permanent internal pull-up resistors.

| Symbol | Parameter | Conditions | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{IL}$ | Low level input voltage | — | — | — | 1.0 | V |
| $V_{IH}$ | High level input voltage | — | 2.4 | — | — | V |
| $I_{IL}$ | Low level input leakage current | — | 55 | 80 | 165 | µA |
| $I_{IH}$ | High level input leakage current | — | -1 | ±0.01 | 1 | µA |

## 6.2.6. /FLASH, MODE0, MODE1 pins

These input pins have internal pull-up resistors that are enabled at boot time only, and disabled once the firmware is running.

| Symbol | Parameter | Conditions | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{IL}$ | Low level input voltage | — | — | — | 1.0 | V |
| $V_{IH}$ | High level input voltage | — | 2.4 | — | — | V |
| $I_{IL}$ | Low level input leakage current | — | -1 | 0.1 | 165 | µA |
| $I_{IH}$ | High level input leakage current | — | -1 | ±0.01 | 1 | µA |

## 6.2.7. RX, PER_RX

These are input-only pins, with no internal pull-up resistors.

| Symbol | Parameter | Conditions | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{IL}$ | Low level input voltage | — | — | — | 1.0 | V |
| $V_{IH}$ | High level input voltage | — | 2.4 | — | — | V |
| $I_{IL}$ | Low level input leakage current | — | -1 | ±0.01 | 1 | µA |
| $I_{IH}$ | High level input leakage current | — | -1 | ±0.01 | 1 | µA |

## 6.2.8. TX, PER_TX, /PER_EN, /WAKEUP, SC_RST, SC_CLK, I2C_SCL

These are output-only pins.

| Symbol | Parameter | Conditions | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{OL}$ | Low level ouput voltage | $I_{OL}$=1mA | 0 | 0.3 | 0.6 | V |
| $V_{OH}$ | High level ouput voltage | $I_{OH}$=1mA | 2.7 | 3 | 3.3 | V |
| $I_{OL}$ | Low level output current | — | — | — | 2 | mA |
| $I_{OH}$ | High level output current | — | — | — | 2 | mA |
| TR | Up or down transition time, maximum capacitance 30pF | — | — | — | 0.04 | µs |

## 6.2.9. SC_IO, /PER_CS, PER_CLK, I2C_SDA pins

These pins are either input or output pins; when operating as input, they have no internal pull-up resistors.

## 6.2.10. As input

| Symbol | Parameter | Conditions | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{IL}$ | Low level input voltage | — | — | — | 1.0 | V |
| $V_{IH}$ | High level input voltage | — | 2.4 | — | — | V |
| $I_{IL}$ | Low level input leakage current | — | -1 | ±0.01 | 1 | µA |
| $I_{IH}$ | High level input leakage current | — | -1 | ±0.01 | 1 | µA |

## 6.2.11. As output

| Symbol | Parameter | Conditions | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{OL}$ | Low level ouput voltage | $I_{OL}$=1mA | 0 | 0.3 | 0.6 | V |
| $V_{OH}$ | High level ouput voltage | $I_{OH}$=1mA | 2.7 | 3 | 3.3 | V |
| $I_{OL}$ | Low level output current | — | — | — | 2 | mA |
| $I_{OH}$ | High level output current | — | — | — | 2 | mA |
| TR | Up or down transition time, maximum capacitance 30pF | — | — | — | 0.04 | µs |

## 6.2.12. GPIO1, GPIO2, GPIO3, GPIO4, GPIO5 pins

These are either input or output pins; when operating as input, they do have internal pull-up resistors.

## 6.2.13. As input

| Symbol | Parameter | Conditions | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{IL}$ | Low level input voltage | — | — | — | 1.0 | V |
| $V_{IH}$ | High level input voltage | — | 2.4 | — | — | V |
| $I_{IL}$ | Low level input leakage current | — | 55 | 80 | 165 | µA |
| $I_{IH}$ | High level input leakage current | — | -1 | ±0.01 | 1 | µA |

## 6.2.14. As output

| Symbol | Parameter | Conditions | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{OL}$ | Low level ouput voltage | $I_{OL}$=1mA | 0 | 0.3 | 0.6 | V |
| $V_{OH}$ | High level ouput voltage | $I_{OH}$=1mA | 2.7 | 3 | 3.3 | V |
| $I_{OL}$ | Low level output current | — | — | — | 2 | mA |
| $I_{OH}$ | High level output current | — | — | — | 2 | mA |
| TR | Up or down transition time, maximum capacitance 30pF | — | — | — | 0.04 | µs |

# 7. Operating modes

## 7.1. Reset configurations

When the device is powered-up or the /RESET pin is risen (Low to High transition), the M519 boots up and probes VIN3_V3, VBUS, /FLASH, MODE0 and MODE1.

This reset configuration defines

1. whether the M519 activates its main firmware, stays in bootloader mode, or runs the restore factory defaults routine,
2. whether the host interface is the serial line or the USB bus,
3. when the main firmware is activated, which operating mode shall be selected.

The table below lists all the supported reset configurations:

| VIN_3V3 | VBUS | /FLASH | MODE0 | MODE1 | Host interface | Operating mode |
|---|---|---|---|---|---|---|
| — | — | Low | Low | Low | — | Restore factory defaults |
| High | Low | Low | — | — | Serial | Bootloader |
| Low | High | Low | — | — | USB | Bootloader |
| High | Low | High | High | High | Serial | According to configuration set in register `02C0` |
| High | Low | High | High | Low | Serial | CCID (PC/SC) + Direct |
| High | Low | High | Low | High | Serial | Smart Reader, $SCRDR protocol + Direct |
| Low | High | High | High | High | USB | According to configuration set in register `02C0` |
| Low | High | High | High | Low | USB | CCID (PC/SC) + Direct |
| Low | High | High | Low | High | USB | HID keyboard (RFID Scanner) + Direct |

Reset configurations that are not listed in the table above are RFU and shall not be used.

## 7.2. Detail of the operating modes

### 7.2.1. Restore factory defaults

Maintain this state during at least 10s before applying another reset configuration and resetting the M519 again.

### 7.2.2. Serial bootloader

The M519 waits for Direct-protocol messages on its serial interface.

Only the SpringCore DFU class is available.

### 7.2.3. USB bootloader

The M519 enumerates on USB with the Direct profile only. VendorId is `1C34`, ProductId is `6217` and ProductName is `M519 DFU`.

Only the SpringCore DFU class is available.

### 7.2.4. CCID (PC/SC) + Direct

Same as writing value `02` in register `02C0`.

This mode is available both on USB and serial interfaces.

When USB interface is selected, the M519 enumerates as a compound device with both the CCID and Direct profiles present. VendorId is `1C34`, ProductId is `6212` and ProductName is `M519 PC/SC`.

### 7.2.5. SmartReader, $SCRDR protocol + Direct

Same as writing value `04` in register `02C0` and `01` in byte 1 of register `02A0`.

This mode is available only when host interface is serial.

### 7.2.6. HID keyboard (RFID Scanner) + Direct

Same as writing value `03` in register `02C0`.

This mode is available only when host interface is USB.

The M519 enumerates as a compound device with both the HID keyboard and Direct profiles present. VendorId is `1C34`, ProductId is `6213` and ProductName is `M519 RFID Scanner`.

# 8. Integration guide

## 8.1. General

### 8.1.1. USB operation

+++ JCH schéma du module avec alimentation par USB

### 8.1.2. Serial operation

+++ JCH schéma du module avec alimentation 3.3V + communication serie

## 8.2. Reset

The M519 has its own reset supervisor. The /RESET pin shall be used only if a manual reset is needed. Otherwise, cycling the power is enough to ensure a correct reset of the module.

If your application does not need to be able to reset the module externally, you may leave the /RESET pin unconnected.

When /RESET is set to LOW, the module's CPU stops. When /RESET is set to HIGH again, firmware execution restarts. Depending on the firmware release, the settings on MODE0 and MODE1, and the settings in the persistent configuration, the module needs 20 to 200ms to be ready after a reset.

The module is ready to receive commands on its serial line when it sets the /WAKEUP low.

## 8.3. Flash

The /FLASH pin is intended to force the M519 in booloader mode. Set /FLASH to LOW and reset the module (or cycle power) to enter this mode. Firmware upgrade takes place through the main host interface (either serial or USB) depending on how the module is powered (VCC_3V3 –> serial, VBUS –> USB).

Note that the M519 also supports "live" firmware upgrades, using the Direct protocol on top of the main host interface without disabling the main operation mode (see chapter *In-the-field firmware upgrade* for details). Unless the host MCU or CPU is unable to drive the firmware upgrade by itself, you may leave the /FLASH pin unconnected.

## 8.4. Suspend

The /SUSPEND pin is intended to put the M519 in idle, low-power mode.

If your application does not need to be able to set the module in low-power mode, you may leave the /SUSPEND pin unconnected.

### 8.4.1. Entering suspend mode

When /SUSPEND is set to LOW,

1. the RF field is shut down and the RF front-end is powered down,
2. the ISO 7816 interface is shut down,
3. /PER_EN is set HIGH and VOUT is switched OFF,
4. if the M519 is running in CCID (PC/SC) mode, “card removed” notifications are sent to the host for any contactless or contact card that was present, then the “suspend” notification is sent to the host,
5. the M519 sets its /WAKEUP pin HIGH
6. if connected on USB, the M519 disconnects from the bus,
7. the M519 enters low-power mode.

This sequence namely takes 100 to 400ms.

### 8.4.2. Exiting suspend mode

When /SUSPEND is set to HIGH,

1. the M519 exits low-power mode,
2. VOUT is switched ON and /PER_EN is set HIGH,
3. if connected on USB, the M519 connects to the bus again and waits for enumeration,
4. the M519 sets its /WAKEUP pin LOW,
5. operation is resumed on the ISO 7816 interface,
6. operation is resumed on the RF interface.

This sequence namely takes 200 to 600ms.

## 8.5. Using the GPIOs as output

## 8.6. Using the GPIOs as input

# 9. NFC/RFID HF interface

## 9.1. Important - Read me first

The M519 OEM module requires an external antenna to work as a contactless (NFC/RFID HF) coupler or smart reader. The antenna has to be carefully designed given the characteristics of the module and your own specifications and constraints (size, expected operating distance). Flexibility is limited to some extent due to the requirements of the ISO standards and the EMC regulations (CE, FCC...). It's the integrator's responsibility to validate compliance with regulations over the final product.

SpringCard engineers have a strong experience in NFC/RFID antenna design. Do not hesitate to consult us any time you need a custom design.

We also offer ready-to-use contactless couplers, featuring the M519 module mounted on an antenna, with or without a shell.

Please visit www.springcard.com for an up-to-date list.

# 10. Smartcard interface

## 10.1. Important - Read me first

The M519 OEM module requires a few external components to drive a ID-1 smartcard slot and up to 4 SAM slots. Special care must be taken when designing the layout and PCB so that clock and I/O lines allow fast communication while complying with EMC regulations (CE, FCC...). It's the integrator's responsibility to validate compliance with regulations over the final product.

SpringCard engineers have a strong experience in PCB design. Do not hesitate to consult us any time you need a custom design.

We also offer ready-to-use smartcard couplers, featuring the M519 together with smartcard slots, with or without a shell.

Please visit www.springcard.com for an up-to-date list.

# 11. In-the-field firmware upgrade

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