SD Specifications
Part 1
NFC (Near Field Communication) Interface Simplified Addendum

Version 1.00

July 25, 2018

Addendum to:

SD Specifications
Part 1 Physical Layer Simplified Specification
Version 6.00 July 25, 2018, or later

Technical Committee
SD Card Association

Revision History

Date	Version	Changes compared to previous issue
June 28, 2013	1.00	The first release of NFC Simplified Addendum
November 8, 2013	1.00	Fixed references to Physical Layer Simplified Specification. Fixed references in Appendix A.1
July 25, 2018	1.00	Revised Disclaimers

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Conventions Used in This Document

Naming Conventions

- Some terms are capitalized to distinguish their definition from their common English meaning. Words not capitalized have their common English meaning.

Numbers and Number Bases

- Hexadecimal numbers are written with a lower case "h" suffix, e.g., FFFFh and 80h.
- Binary numbers are written with a lower case "b" suffix (e.g., 10b).
- Binary numbers larger than four digits are written with a space dividing each group of four digits, as in 1000 0101 0010b.
- All other numbers are decimal.

Key Words

- May: Indicates flexibility of choice with no implied recommendation or requirement.
- Shall: Indicates a mandatory requirement. Designers shall implement such mandatory requirements to ensure interchangeability and to claim conformance with the specification.
- Should: Indicates a strong recommendation but not a mandatory requirement. Designers should give strong consideration to such recommendations, but there is still a choice in implementation.

Application Notes

Some sections of this document provide guidance to the host implementers as follows:

Application Note:
This is an example of an application note.

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1. General Description

1.1 Scope

The scope of this Simplified Addendum is to describe the interface between a microSD memory card and a NFC (Near Field Communication) controller. This interface will allow microSD cards to contain contactless applications that will use the capabilities of the NFC controller embedded in the host.

1.2 Primary Reference Document

This addendum refers to any released version of the Part 1 Physical Layer Simplified Specification and related Supplementary Notes. This addendum is not compatible to the RF Antenna connection as describe in the microSD Card Specification addendum.

1.3 Concept

This Addendum Specification defines additional category to the Physical Layer Simplified Specification. The following sections describe additional and modified part of the base specification.

This specification relies on ETSI specifications TS 102 613 (3) and TS 102 622 (4). Cards compliant with this specification shall be compliant with these ETSI standards.
The card shall comply with all the requirements defined for a UICC in the above mentioned specifications unless for specific features specified in the present document.
The host implementing the NFC interface should comply with all the requirements defined for the CLF in the above mentioned specifications unless for specific features specified in the present document.
The implementation of the NFC interface is totally independent of the other interfaces of the card (i.e. SD, UHS-II). Different implementations mixing the different interfaces are possible on the cards and host, for example:

- NFC + SD mode only
- NFC + UHS-II

In this later case, the implementation must take care of the sharing of V_{DD2} power supply signal.

2. Physical Characteristics

2.1 Pin Assignment of microSD Card for NFC Interface

2.1.1 Pin Assignment Compliant to UHS-II microSD Card Connector

The NFC interface requires 3 signals. One signal is dedicated for NFC (SWIO), the others are shared with the other interfaces present on the card (V_{DD2} and Grounds).

Pin#	Name	Type	Description
6	V_{ss}[1]	S	Supply voltage ground
9	V_{DD2}[2]	S	Supply voltage
10	V_{ss}[1]	S	Supply voltage ground
17	SWIO	I	Single Wire Protocol interface

(1) Note 1: This signal is common to all cards' interfaces.
(2) Note 2: This signal is shared with UHS-II Mode interface.

Table 2-1 : microSD NFC Interface Pad Assignment

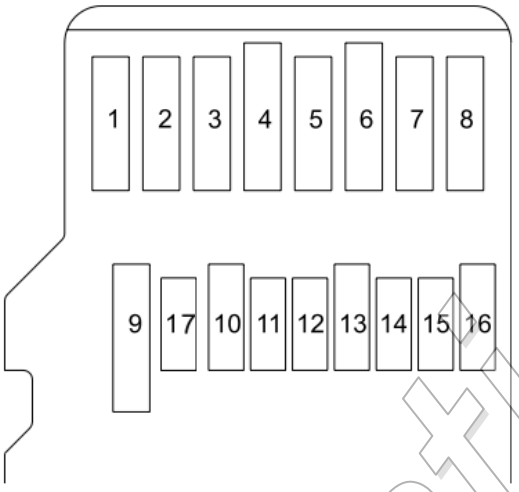

Figure 2-1 : Pin Assignment of UHS-II NFC microSD Card

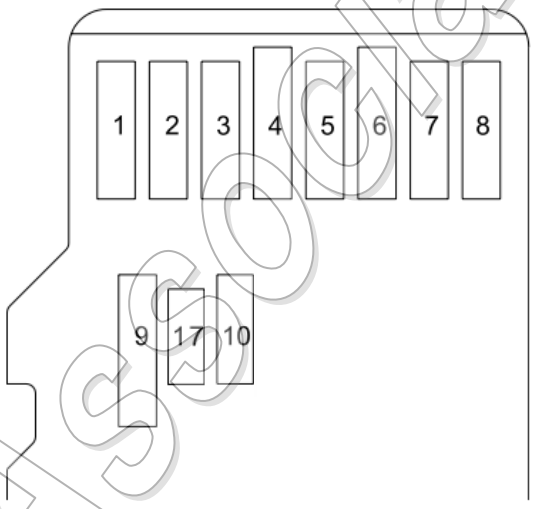

Figure 2-2 : Pin Assignment of SD Mode NFC microSD Card

Application Note:
It should be noted that in some combo connectors, the pin assigned for the SWIO signal could be connected to a power supply (1.7V – 3.6V) while the pin assigned to V_{DD2} signal could be connected to ground. Card manufacturers may have to design proper protection mechanism in order to avoid damaging the card in this circumstance.

2.1.2 Pin Assignment of microSD Card for NFC Interface using ANT1 and ANT2 Pins

In order to be compliant with legacy configurations of card and connectors, the ANT1 and ANT2 pins defined in earlier releases of microSD specifications may be reused in order to support connection to an NFC controller. The electrical and logical specifications for this kind of card are identical to the ones defined at the beginning of the present document.

The NFC interface requires 3 signals. Additional Pins 9 and 10 are used for the SWP protocol. The ground pin is shared with the SD interface on the card.

Pin#	Name	Type	Description
6	V_{ss}[1]	S	Supply voltage ground
9	SWIO	I	Single Wire Protocol interface
10	V_{DD2}	S	Supply voltage

(1) Note 1: This signal is common to all cards' interfaces.

Table 2-2 : Legacy microSD Card NFC Interface over Antenna Pins Pad Assignment

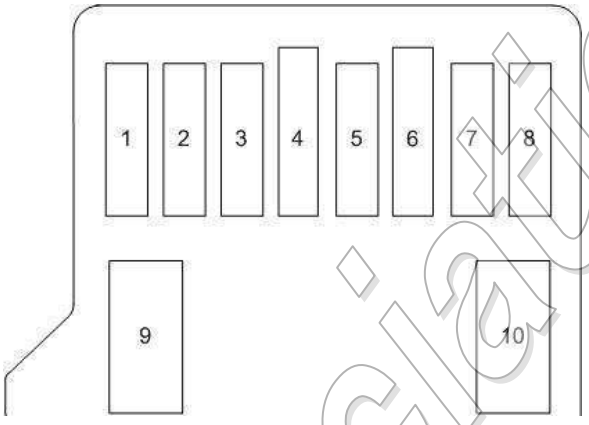

Figure 2-3 : Pin Assignment for Legacy microSD NFC Interface over RF Antenna Pins

It should be noted that this configuration is not compliant with UHS-II cards and hosts and that a host compliant with this configuration may damage a UHS-II card. Thus this configuration shall only be done with some means to protect UHS-II cards

2.2 Electrical Interface Specification

2.2.1 Supply Voltage Class and Operating Current

The NFC interface is powered through the V_{DD2} signal. V_{DD2} signal is shared with the UHS-II Interface if the UHS-II interface is available. The voltage characteristics of V_{DD2} are defined in the UHS-II Addendum (5). 1.2V option for embedded device is not supported for NFC operation.

When neither SD mode nor the UHS-II mode interfaces are activated, the maximum current consumption on V_{DD2} of the card while operating in NFC only mode shall be lower than 5mA during initial interface activation and in low power mode operation. In normal operating condition, the maximum current consumption of the card on V_{DD2} shall be 50mA.

The maximum power consumption of the card shall never exceed the maximum power consumption defined in the Part 1 Physical Layer Simplified Specification.

When neither SD mode nor the UHS-II mode interfaces are activated and if the NFC Interface is not activated, the overall maximum power consumption of the card shall comply with the maximum power consumption allowed before first command as defined in the Physical Layer Specification (1) and the maximum current consumption of the card on V_{DD2} shall be 0.2mA.

2.2.2 S1 and S2 Signals Definition

The electrical characteristics of S1 to be applied for card are defined in table 7.4 of TS 102 613 (3) for normal operating conditions in voltage class C.

The electrical characteristics of S2 are defined in clause 7.1.4 of TS 102 613 (3).

2.3 NFC Interface Activation/Deactivation

2.3.1 NFC Interface Only Mode

When neither the SD mode nor the UHS-II interfaces are activated, the SWIO signal shall be kept deactivated (S1 state L) while V_{DD2} is not activated.

After activation of V_{DD2}, the host may activate the SWIO signal (Transition from state L to state H) in order to indicate to the card the activation of NFC interface.

Following the SWIO signal activation, the procedure described for the UICC in clause 6.2.3 of TS 102 613 (3) shall be used for initial or subsequent NFC interface activation of the card.

In this mode of operation, the card shall not drive any signal belonging to the SD or UHS-II interface.

Application Note:
In this mode of operation, the card may have to operate in low power mode due to the limited power available in the battery of the host or supplied by the NFC electromagnetic field through the NFC controller. This implies that the design should take care of using this limited current supplied to V_{DD2} to operate the NFC and not the UHS-II interface.

2.3.2 NFC Interface Interworking with Others Interfaces

When the SD mode interface only is activated, before activating the NFC interface, the host shall activate the V_{DD2} power supply and then activate the SWIO signal (Transition from state L to state H) in order to indicate to the card the activation of NFC interface..

Following the SWIO signal activation, the procedure described for the UICC in clause 6.2.3 of TS 102 613 (3) shall be used for initial or subsequent NFC interface activation of the card.

When the UHS-II mode interface is activated, the host may activate the NFC interface at any time.

3. SWP Implementation Options

3.1 SWP Interface State Management

The SWP interface state management as described in clause 8.3 of TS 102 613 (3) shall apply with the following exception: For the *RESUME* transition, a card supporting the NFC interface shall indicate the support of extended resume and therefore, the Extended resume by slave time (P6) shall apply.

3.2 Power Mode State/Transition and Power Saving Management

Clause 8.4 of TS 102 613 (3) shall apply with the following exceptions:

- After the initial activation of signal V_{DD2} by the host and when neither SD mode nor the UHS-II interfaces are activated, the power consumption of the card shall not exceed the limit defined in Section 2.2.1 of this specification.
- When neither SD mode nor the UHS-II interfaces are activated, the card shall be in power saving mode as defined in Section 2.2.1 of this specification if one of the following condition is met:
    - The SWP is in DEACTIVATED state for 10ms
    - The last information received on SWP is the SHDLC acknowledgement to the HCI event "EVT_HCI_END_OF_OPERATION" as defined in TS 102 622 (4) and the SWP interface is in SUSPENDED state for 10ms.

4. HCI Implementation Options

4.1 Host Identity Definition

The host ID of a card connected to the NFC controller is dynamically assigned in the range 'C0' to 'FF' (Assigned for proprietary hosts as defined in TS 102 622 (4)) by the host controller upon connection between them.

4.2 Other HCI Options

4.2.1 Identification of Cards

In order to properly identify the type of card, the identity management gate as defined in clause 7.1.3 of TS 102 622 (4) shall contain the "VERSION_HARD" parameter and this parameter shall be in the range '10XXXX' to '1FXXXX' for a microSD card.

Appendix A (Normative): Reference

A.1 Reference

This specification refers the following documents.

(1) SD Specifications Part 1 Physical Layer Simplified Specifications Version 4.10 (January 22, 2013) or later

(2) SD Specifications Part 1 UHS-II Simplified Addendum Version 1.01 (November 8, 2013) or later

(3) ETSI TS 102 613: "Smart Cards; UICC - Contactless Front-end (CLF) Interface; Part 1: Physical and data link layer characteristics" Version 11.0.0

(4) ETSI TS 102 622: "Smart Cards; UICC - Contactless Front-end (CLF) Interface; Host Controller Interface (HCI)" Version 11.1.0

Appendix B (Normative): Special Terms

B.1 Terminology

Interface activation	SWP interface activation is defined in ETSI TS 102 613 (3). SD mode and UHS-II mode interface activation is defined as the reception of the first clock event sent by the host.
NFC only mode	Mode of operation where neither SD mode nor the UHS-II mode interfaces are activated.
SD Mode	Mode of operation including DS (Default Speed), HS (High Speed) and UHS-I modes.

B.2 Abbreviations

NFC	Near Field Communication
SWP	Single Wire Protocol as defined in ETSI TS 102 613 (3)
HCI	Host Controller Interface as defined in ETSI TS 102 622 (4)
UICC	Smart card as defined by ETSI TC SCP
CLF	Contactless Front End as defined in ETSI specifications
SWIO	Single Wire Input/Output
ETSI	European Telecommunications Standards Institute

Appendix C (Informative): Supported Configurations

Card I/F	Host I/F	V_{DD1}	V_{DD2}	SD Activated	UHS-II Activated	NFC Activated	Low Power mode V_{DD2} max current (mA)	Full Power mode V_{DD2} max current (mA)
SD+NFC	SD+NFC	On	Off	Yes	N/A	No	0	0
SD+NFC	SD+NFC	Off	On	No	N/A	Yes	5	50
SD+NFC	SD+NFC	On	On	No	N/A	No	0.2	0.2
SD+NFC	SD+NFC	On	On	Yes	N/A	No	0.2	0.2
SD+NFC	SD+NFC	On	On	No	N/A	Yes	5	50
SD+NFC	SD+NFC	On	On	Yes	N/A	Yes	50	50
UHS-II+NFC	SD+NFC	On	Off	Yes	N/A	No	0	0
UHS-II+NFC	SD+NFC	Off	On	No	N/A	Yes	5	50
UHS-II+NFC	SD+NFC	On	On	No	N/A	No	0.2	0.2
UHS-II+NFC	SD+NFC	On	On	Yes	N/A	No	0.2	0.2
UHS-II+NFC	SD+NFC	On	On	No	N/A	Yes	5	50
UHS-II+NFC	SD+NFC	On	On	Yes	N/A	Yes	50	50
SD+NFC	UHS-II+NFC	On	Off	Yes	N/A	No	0	0
SD+NFC	UHS-II+NFC	Off	On	No	N/A	Yes	5	50
SD+NFC	UHS-II+NFC	On	On	No	N/A	No	0.2	0.2
SD+NFC	UHS-II+NFC	On	On	Yes	N/A	No	0.2	0.2
SD+NFC	UHS-II+NFC	On	On	No	N/A	Yes	5	50
SD+NFC	UHS-II+NFC	On	On	Yes	N/A	Yes	50	50
UHS-II+NFC	UHS-II+NFC	On	On	N/A	No	No	0.2	0.2
UHS-II+NFC	UHS-II+NFC	On	On	N/A	Yes	No	See note 1	See note 1
UHS-II+NFC	UHS-II+NFC	On	On	N/A	No	Yes	5	50
UHS-II+NFC	UHS-II+NFC	On	On	N/A	Yes	Yes	See note 1	See note 1
UHS-II+NFC	UHS-II+NFC	Off	On	N/A	No	No	0.2	0.2
UHS-II+NFC	UHS-II+NFC	Off	On	N/A	No	Yes	5	50

(1) Note 1: Power consumption for V_{DD2} is defined in the Physical Layer Specification (1).

Table C-1 : Supported Configurations