



SM-MMN17-C01

NFC Controller Module with Antenna

Datasheet Version 1.2

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Revision History

This section describes the changes that were implemented in this document. The changes are listed by revision, starting with the most current publication.

Revision 1.0

Revision 1.0 of this datasheet was published in December 2014. This was the first publication of the document.

Revision 1.1

Updated chapter 2 features, in April 2016.

Revision 1.2

Updated chapter 7 outline, in October 2016.

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1 Introduction

This document consists of descriptions and specifications for both functional and physical aspects of the SM-MMN17-C01 NFC reader / writer module.

In addition to the datasheet, Smart Approach maintains an extensive device-specific library of support and collateral materials that you may find useful in your application. Depending upon the Smart Approach device, this library may include:

- Presentations highlighting the operational features and specifications of the device to assist in developing your own product road map.
- Application notes that provide detailed descriptions of the use of the particular Smart Approach product to solve real-world problems.

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2 Product Overview

SM-MMN17-C01 is full featured NFC controllers designed for integration in portable equipment. It is optimized for low power consumption with fully host controllable power states and for small footprint for portable equipment applications.

The module's compact, flexible design with and exposed pad is optimal for size-sensitive applications, assures robust performance.

The following illustration shows a high-level, generic view of a SM-MMN17-C01 application.

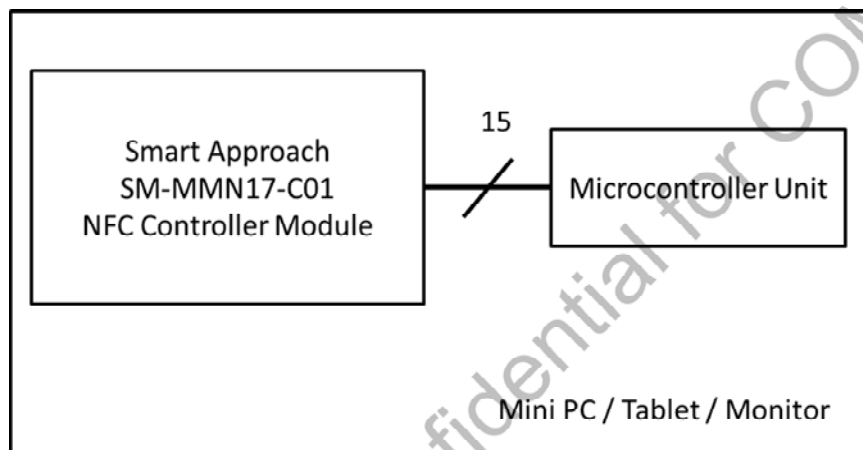


Figure 1 Typical Application

2.1 Features

This section Tables key aspects of the SM-MMN17-C01 module functionality and design that distinguish it from similar products:

- NXP NPC100
- Full featured NFC controller industry's low power consumption.
- Compliant with ISO/IEC 14443 A/B
- Compliant with ISO/IEC 15693/18092
- Compliant with NFCIP-1, NFCIP-2
- Support MIFARE and Felica specifications
- Customized antenna pairing
- I²C interface

2.2 Application

Suggested applications for the SM-MMN17-C01 module include:

- NFC writer/ reader
- NFC peer to peer controller
- NFC identification

3 Functional Descriptions

This section provides detailed information about how SM-MMN17-C01 module works, what configurations and operational features are available.

Loop Antenna is Smart Approach customize solution. Antenna matching is also a customize solution. NFC controller includes NXP NPC100 chipset, and has an I²C control interface through the connector to mother board.

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4 Electrical Specifications

This section provides the DC characteristics, AC characteristics, recommended operating conditions. It includes information on the various timing functions of the module.

4.1 Pin Description

The following Table shows the pin description for SM-MMN17-C01 module.

The connection ground is internally connected and should be connected to GND on the main board as well.

Table 1 Module Pin Description

PIN No.	Name	Description	Power Reference	P/I/O
1	V _{BAT}	+3.3V power supply input	3.3V	P
2	MOD_GND	Module Ground	GND	P
3	SWP	SWP data line to UICC/SIM, Input / Output	PMUV _{CC}	I/O
4	RFU	Unused pin could be floating	-	-
5	IRQ	Interrupt to host, High: Interrupt; Low: Normal	VDD_IO	O
6	PMUV _{CC}	Power supply to UICC/SIM, input, + 1.8V	1.8V	P
7	I ² C_SDA	I ² C Data Line (400Kbps)	VDD_IO	I/O
8	I ² C_SCL	I ² C Clock (400Kbps)	VDD_IO	I
9	MOD_GND	Module Ground	GND	P
10	V _{EN}	Wake up the module from standby mode or reset the module	V _{BAT}	I
11	DWL_REQ	Firmware download control: Active High	VDD_IO	I
12	SIMV _{CC}	The power rail used to power UICC / SIM, output pin	PMUV _{CC}	P(O)
13	V _{BAT}	+3.3V Power Supply	3.3V	P
14	VDD_IO	+1.8V or +3.3V for host IO reference voltage	1.8V/3.3V	P
15	MOD_GND	Module Ground	GND	P

4.2 I²C Address

SM-MMN17-C01 I²C 7bit address is defined to 0x28. To write data, the module is addressed using 0x50, to read data, the module is addressed using 0x51.

Table 2 I²C Address

I2C address (R/W=0, write)	I2C address (R/W=1, read)
0x50	0x51

4.3 Temperature Maximum Ratings

Thermal specifications for this module have been modeled using a two-layer test board.

Table 3 Temperature Maximum Ratings

Symbol	Definition	Value		Units
		Min	Max	
T	Operating Temperature	-20	80	°C
T _s	Storage Temperature	-40	100	°C

4.4 DC Electrical Parameters

DC Electrical specifications for this module have been modeled using a two-layer test board.

Table 4 DC Electrical Specification

Symbol	Definition	Value			Units
		Min	Typ	Max	
V_{BAT}	Power Supply	3.1	3.3	3.5	Volts
I_{VBAT}	DC Current			170	mA

4.5 Antenna Specification

Antenna specifications for this module have been modeled using a two-layer test board.

Table 5 Antenna Specifications

Item	Value			Unit	Note
	Min	Type	Max		
DC Resistance	0.5	1	2	Ω	
AC Impedance		50		Ω	
Frequency	13.06	13.56	14.06	MHz	VSWR <2
Q factor	25	30	35		

4.6 Power Consumption

Table 6 Current Consumption

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{HPD}	Hard power down current	$V_{BAT}=3.6V$, $V_{EN}=0V$	-	10.5	12	μA
I_{STBY}	Standby state current	$V_{BAT}=3.6V$	-	-	20	μA
I_{ACT}	Active state current	$V_{BAT}=3.6V$	-	6	-	mA
I_{TVDD}	Transmitter supply current	$V_{BAT}=3.1V$	-	30	100	mA
I_{PMUVCC}	PMUVCC supply	Class B	-	1.5	3	μA
		Class C	-	1	2	μA

4.7 Thermal Protection

Table 7 Thermal Protection

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$T_{OVERTEMP}$	Temperature protection trigger		120	125	130	$^{\circ}C$

4.8 System power modes

Table 8 System Power Modes Description

Mode	Description
Full power mode	The battery supply (V_{BAT}) as well as the pad supply (VDD_{IO}) is available, all use cases can be executed
Low-power mode	The pad supply (VDD_{IO}) is not available. Only the Card Emulation mode use cases via SWP are allowed
Power Off mode	The system is not supplied from any source or the system is kept Hard Power Down (HPD)

Table 9 Power Mode Configuration

V_{BAT}	VDD_IO	V_{EN}	Power mode
Off	Off	X	Power Off mode
On	X	Off	Power Off mode
On	Off	On	Low Power Mode
On	On	On	Full power mode

Note: X: Don't care

4.9 Reset and download concept

To enter reset there are 2 ways:

- Pulling V_{EN} low (Hard Power Down state)
- If V_{BAT} monitor is enabled: lowering V_{BAT} below the monitor threshold (monitor mode, if V_{EN} is kept above 1.1 V)

To get out of reset, there are 1 ways:

- Pulling V_{EN} high with V_{BAT} above V_{BAT} monitor threshold if enabled

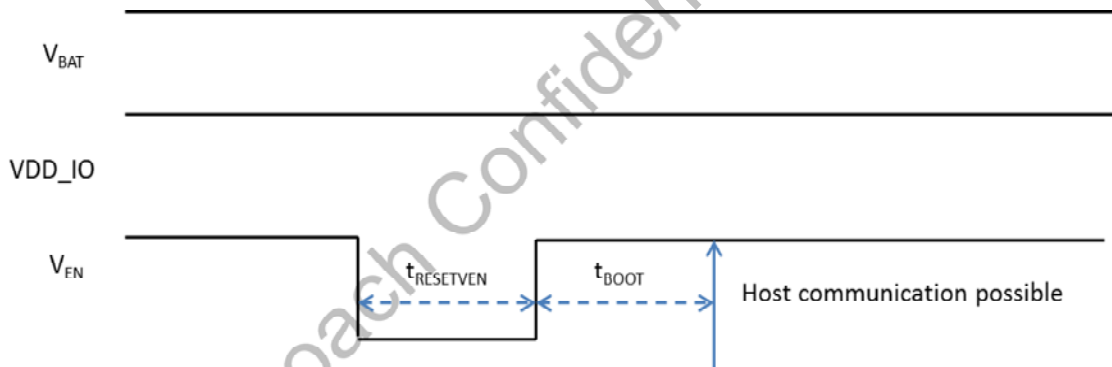

 Figure 3 Reset via V_{EN} pin

Table 10 Reset Timing

Symbol	Parameter	Condition	Min	Typ	Max	Unit
$t_{RESETVEN}$	V_{EN} pulse width to reset		3			μs
t_{BOOT}	Boot time				10	ms

5 Ordering Information

Table 11 Ordering Information Table

Order Number	Descriptions
SM-MMN17-C01	NFC Controller Module (NXP NPC100) with Antenna
Dimension	Module: 26.65x10.00 mm; Antenna Area: 32.00x10.00mm Total Size: 63.65x10.00mm

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6 Reliability Verification

Table 12 Reliability Item Table

No.	Item	Condition	Benchmark	Result	Qty
1	Low Temperature Storage Test	-40°C	IEC60068-2-1	Pass	5
2	High Temperature Storage Test	80°C, Humidity: 95%	IEC60068-2-78	Pass	5
3	Low Temperature Operation Test	-20°C	IEC60068-2-1	Pass	5
4	High Temperature Operation Test	80°C	IEC60068-2-2	Pass	5
5	High Temperature Operation Test	65°C, Humidity: 95%	IEC60068-2-78	Pass	5
6	Salt Test	PH: 3.0 ~ 3.2 50°C, 72 hrs, Density: 5%±1%	ASTM B368	Pass	5
7	RoHS	Normal	Compliance	Pass	5
8	HF	Normal	Compliance	Pass	5

7 NFC Module Outline

The following illustration shows the package drawing for SM-MMN17-C01 module. The drawing contains the detail views, dimensions, tolerances, and notes.

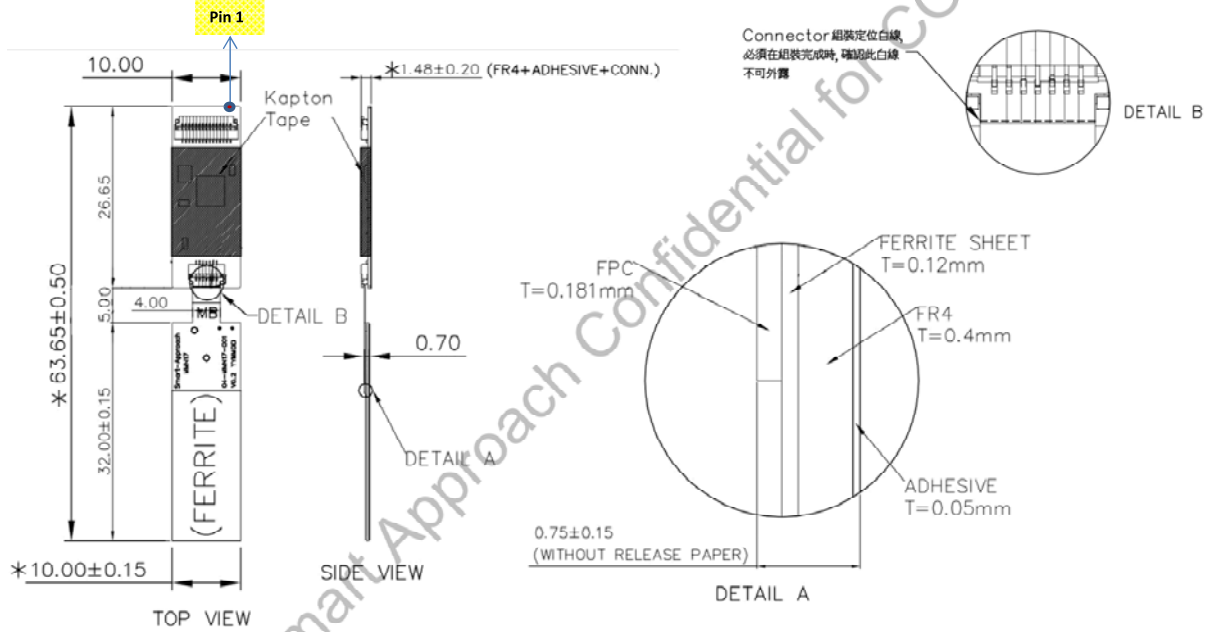


Figure 4 NFC Module Drawing

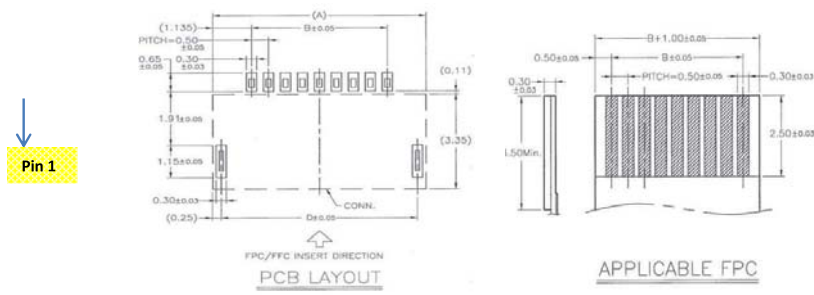


Figure 5 Module FPC Connection Foot Print

NO.OF CONTACTS	PART NUMBER	DIM. A	DIM. B	DIM. D
04	BL115H-04RL-TAxx	3.77	1.5	3.27
05	BL115H-05RL-TAxx	4.27	2.0	3.77
06	BL115H-06RL-TAxx	4.77	2.5	4.27
07	BL115H-07RL-TAxx	5.27	3.0	4.77
08	BL115H-08RL-TAxx	5.77	3.5	5.27
09	BL115H-09RL-TAxx	6.27	4.0	5.77
10	BL115H-10RL-TAxx	6.77	4.5	6.27
11	BL115H-11RL-TAxx	7.27	5.0	6.77
12	BL115H-12RL-TAxx	7.77	5.5	7.27
13	BL115H-13RL-TAxx	8.27	6.0	7.77
14	BL115H-14RL-TAxx	8.77	6.5	8.27
15	BL115H-15RL-TAxx	9.27	7.0	8.77

Figure 6 FPC Wire Dimension

Federal Communication Commission Interference Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Caution:

- Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.
- This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Radiation Exposure Statement:

The product is a low power device and its output power is lower than FCC SAR exemption level. This module can be used with **SM-MMN17-C01**.

This device is intended only for OEM integrators under the following conditions:

- 1) The transmitter module may not be co-located with any other transmitter or antenna. The co-transmitting with other radio will need a separate evaluation.
- 2) Module approval valid only when this module is installed in the tested host “**CAXA0, CXXXXX-CAXA0-XXXXXX-XXXX (X:0~9,A~Z)**”.

As long as 2 conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed

IMPORTANT NOTE: In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

End Product Labeling

The final end product must be labeled in a visible area with the following: “**Contains FCC ID: GKR-CAX00NFC**”. The grantee's FCC ID can be used only when all FCC compliance requirements are met.

Manual Information to the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.

The end user manual shall include all required regulatory information/warning as show in this manual.

Industry Canada statement

- ❶ This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions:
 - 1) this device may not cause interference, and
 - 2) this device must accept any interference, including interference that may

cause undesired operation of the device.

- ❶ Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:
 - 1) l'appareil ne doit pas produire de brouillage, et
 - 2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

- ❷ This Class B digital apparatus complies with Canadian ICES-003.
- ❷ Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

- ❹ This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter, except tested built-in radios.
- ❹ Cet appareil et son antenne ne doivent pas être situés ou fonctionner en conjonction avec une autre antenne ou un autre émetteur, exception faites des radios intégrées qui ont été testées.

**This device is intended only for OEM integrators under the following conditions:
(For module device use)**

- 1) The transmitter module may not be co-located with any other transmitter or antenna.

As long as one condition above is met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

Cet appareil est conçu uniquement pour les intégrateurs OEM dans les conditions suivantes: (Pour utilisation de dispositif module)

- 1) Le module émetteur peut ne pas être coïmplanté avec un autre émetteur ou antenne.

Tant qu'une condition ci-dessus est remplie, un autre test de l'émetteur n'est pas nécessaire. Toutefois, l'intégrateur OEM est toujours responsable de tester leur produit final pour toutes les exigences de conformité supplémentaires requises avec ce module installé.

IMPORTANT NOTE:

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the Canada authorization is no longer considered valid and the IC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate Canada authorization.

NOTE IMPORTANTE:

Dans le cas où ces conditions ne peuvent être satisfaites (par exemple pour certaines configurations d'ordinateur portable ou de certaines co-localisation avec un autre émetteur), l'autorisation du Canada n'est plus considéré comme valide et l'ID IC ne peut pas être utilisé sur le produit final. Dans ces circonstances, l'intégrateur OEM sera chargé de réévaluer le produit final (y compris l'émetteur) et l'obtention d'une autorisation distincte au Canada.

End Product Labeling

The product can be kept as far as possible from the user body or set the device to lower output power if such function is available. The final end product must be labeled in a visible area with the following: "Contains IC: **2533B-CAX00NFC**".

Plaque signalétique du produit final

L'appareil peut être conservé aussi loin que possible du corps de l'utilisateur ou que le dispositif est réglé sur la puissance de sortie la plus faible si une telle fonction est disponible. Le produit final doit être étiqueté dans un endroit visible avec l'inscription suivante: "Contient des IC: **2533B-CAX00NFC**".

Manual Information To the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.

The end user manual shall include all required regulatory information/warning as show in this manual.

Manuel d'information à l'utilisateur final

L'intégrateur OEM doit être conscient de ne pas fournir des informations à

l'utilisateur final quant à la façon d'installer ou de supprimer ce module RF dans le manuel de l'utilisateur du produit final qui intègre ce module.

Le manuel de l'utilisateur final doit inclure toutes les informations réglementaires requises et avertissements comme indiqué dans ce manuel.