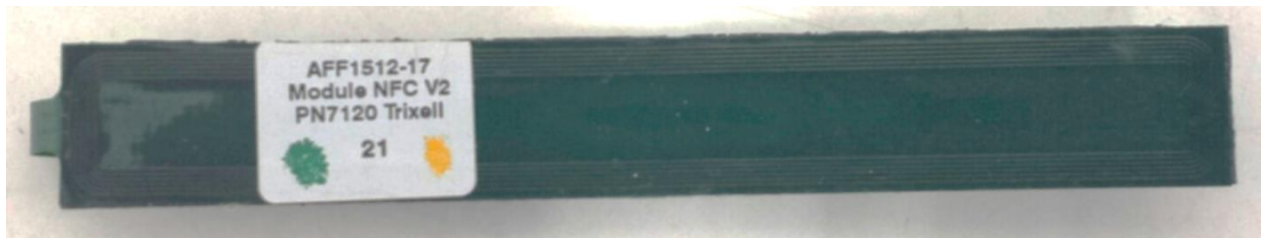
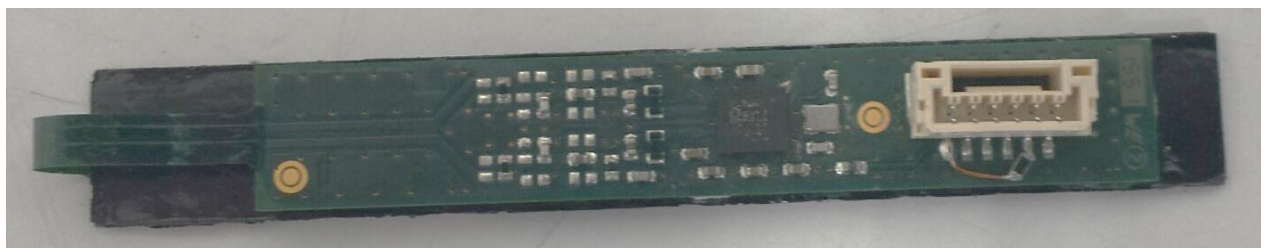


# PN7120 NFC controller

## User Manual



## 1. Introduction

The PN7120 is a full features NFC controller for contactless communication at 13.56 MHz.

## 2. Architecture

The PN7120 is an NFC Controller, which is briefly described in [Fig 1](#):

- The top part describes the Device Host (DH) architecture with Higher Layer Driver (i.e Android stack) hosting the different kind of applications (Reader/Writer, Peer to Peer, Card Emulation in the DH-NFCEE), the NCI driver & the transport layer driver.
- The PN7120 is the NFCC in the [Fig 1](#). It is connected to the DH through a physical interface which is an I<sup>2</sup>C. The PN7120 firmware supports the NCI specification. The firmware also provides support for additional extensions that are not contained in the NCI specification. These additional extensions are specific to the PN7120 chip and are proprietary to NXP.
- The bottom part of the figure contains the RF antenna connected to the PN7120, which can communicate over RF with a Tag (Card) and a Reader/Writer or a Peer device.

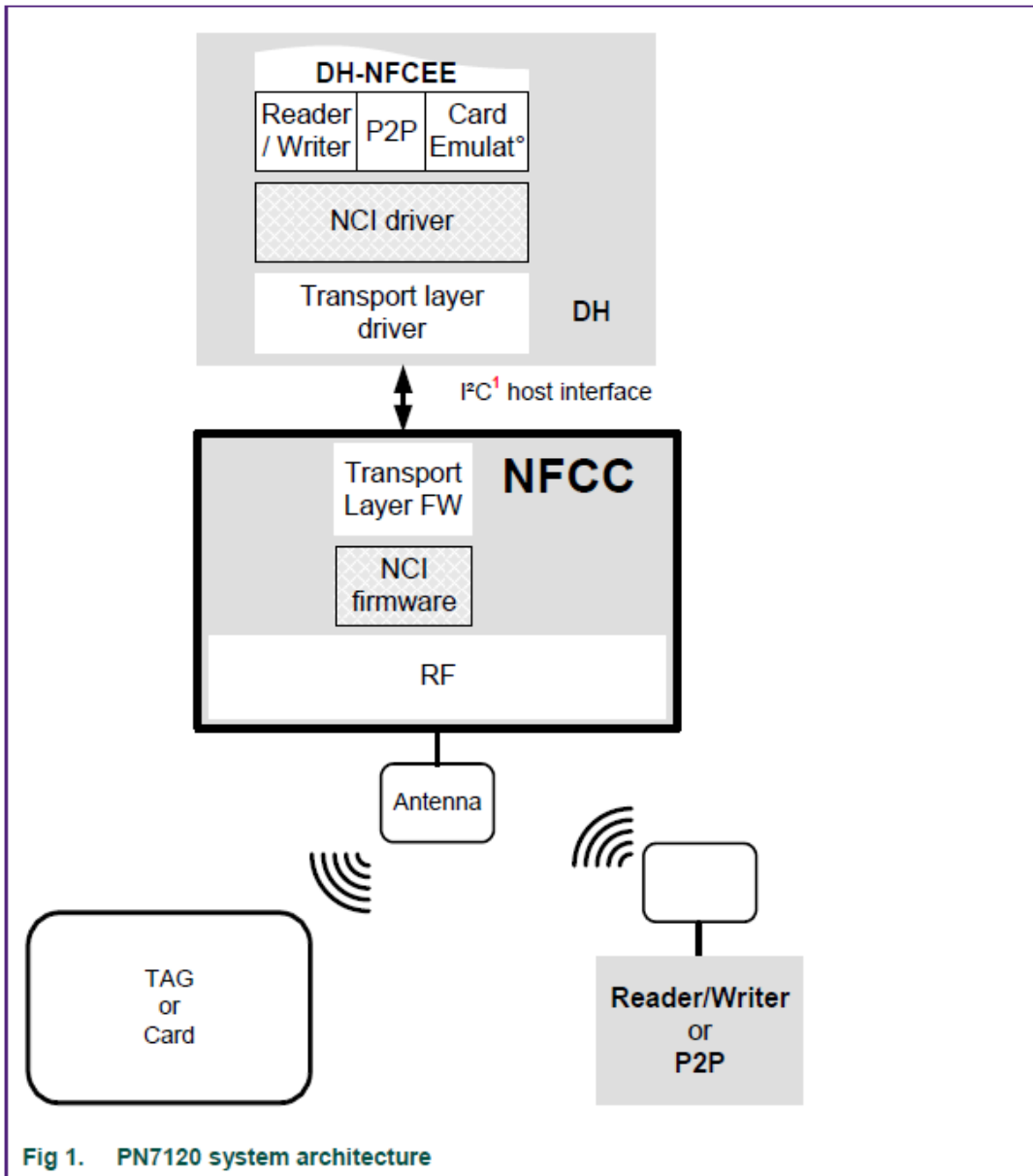


Fig 1. PN7120 system architecture

### 3. Contactless Interface Unit

PN7120 supports various communication modes at different transfer speeds and modulation schemes. The following chapters give more detailed overview of selected communication modes.

**Remark:** all indicated modulation index and modes in this chapter are system parameters. This means that beside the IC settings a suitable antenna tuning is required to achieve the optimum performance.

### 4. Reader/Writer communication modes

Generally 5 Reader/Writer communication modes are supported:

- PCD Reader/Writer for ISO/IEC 14443A/MIFARE
- PCD Reader/Writer for Jewel/Topaz tags
- PCD Reader/Writer for FeliCa cards
- PCD Reader/Writer for ISO/IEC 14443B
- VCD Reader/Writer for ISO/IEC 15693/ICODE

Overview for ISO/IEC 14443A/MIFARE and Jewel/Topaz PCD Reader/Writer communication mode

Communication direction		ISO/IEC 14443A/ MIFARE/ Jewel/ Topaz	ISO/IEC 14443A higher transfer speeds			
	Transfer speed	106 kbit/s	212 kbit/s	424 kbit/s	848 kbit/s	
	Bit length	(128/13.56) $\mu$ s	(64/13.56) $\mu$ s	(32/13.56) $\mu$ s	(16/13.56) $\mu$ s	
<b>PN7120 → PICC</b>						
(data sent by PN7120 to a card)	modulation on PN7120 side	100 % ASK	> 25 % ASK	> 25 % ASK	> 25 % ASK	
	bit coding	Modified Miller	Modified Miller	Modified Miller	Modified Miller	
<b>PICC → PN7120</b>						
(data received by PN7120 from a card)	modulation on PICC side	subcarrier load modulation	subcarrier load modulation	subcarrier load modulation	subcarrier load modulation	
	subcarrier frequency	13.56 MHz/16	13.56 MHz/16	13.56 MHz/16	13.56 MHz/16	
	bit coding	Manchester	BPSK	BPSK	BPSK	

Overview for Felicia Reader/Writer communication mode

Communication direction		FeliCa	FeliCa higher transfer speeds
	Transfer speed	212 kbit/s	424 kbit/s
	Bit length	(64/13.56) $\mu$ s	(32/13.56) $\mu$ s
<b>PN7120 → PICC</b>			
(data sent by PN7120 to a card)	modulation on PN7120 side	8 % – 12 % ASK	8 % – 12 % ASK
	bit coding	Manchester	Manchester
<b>PICC → PN7120</b>			
(data received by PN7120 from a card)	modulation on PICC side	load modulation	load modulation
	subcarrier frequency	no subcarrier	no subcarrier
	bit coding	Manchester	Manchester

## Overview for ISO/IEC 14443B Reader/Writer communication mode

Communication direction		ISO/IEC 14443B	ISO/IEC 14443B higher transfer speeds		
	Transfer speed	106 kbit/s	212 kbit/s	424 kbit/s	848 kbit/s
	Bit length	(128/13.56) $\mu$ s	(64/13.56) $\mu$ s	(32/13.56) $\mu$ s	(16/13.56) $\mu$ s
<b>PN7120 → PICC</b>					
(data sent by PN7120 to a card)	modulation on PN7120 side	8 % – 14 % ASK	8 % – 14 % ASK	8 % – 14 % ASK	8 % – 14 % ASK
	bit coding	NRZ	NRZ	NRZ	NRZ
<b>PICC → PN7120</b>					

## Overview for ISO/IEC 15693 VCD Reader/Writer communication mode

Communication direction			
<b>PN7120 → VICC</b>			
(data sent by PN7120 to a tag)	transfer speed	1.65 kbit/s	26.48 kbit/s
	bit length	(8192/13.56) $\mu$ s	(512/13.56) $\mu$ s
	modulation on PN7120 side	10 % – 30 % or 100 % ASK	10 % – 30 % or 100 % ASK
	bit coding	pulse position modulation 1 out of 256 mode	pulse position modulation 1 out of 4 mode
<b>VICC → PN7120</b>			
(data received by PN7120 from a tag)	transfer speed	26.48 kbit/s	26.69 kbit/s
	bit length	(512/13.56) $\mu$ s	(508/13.56) $\mu$ s
	modulation on VICC side	subcarrier load modulation	subcarrier load modulation
	subcarrier frequency	single subcarrier	dual subcarrier
	bit coding	Manchester	Manchester

## Passive communication mode

Communication direction		ISO/IEC 18092, Ecma 340, NFCIP-1		
	Baud rate	106 kbit/s	212 kbit/s	424 kbit/s
	Bit length	(128/13.56) $\mu$ s	(64/13.56) $\mu$ s	(32/13.56) $\mu$ s
<b>NFC Initiator to NFC Target</b>				
	modulation	100 % ASK	8 % – 30 % ASK <sup>[1]</sup>	8 % – 30 % ASK <sup>[1]</sup>
	bit coding	Modified Miller	Manchester	Manchester
<b>NFC Target to NFC Initiator</b>				
	modulation	subcarrier load modulation	load modulation	load modulation
	subcarrier frequency	13.56 MHz/16	no subcarrier	no subcarrier
	bit coding	Manchester	Manchester	Manchester

## 4. Applications

- All devices requiring NFC functionality especially those running in an Android or Linux environment
- TVs, set-top boxes, Blu-ray decoders, audio devices
- Home automation, gateways, wireless routers
- Home appliances
- Wearables, remote controls, healthcare, fitness
- Printers, IP phones, gaming consoles, accessories

## 5. Quick reference

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{BAT}$	battery supply voltage	Card Emulation and Passive Target; $V_{SS} = 0\text{ V}$ <a href="#">[1]</a> <a href="#">[2]</a>	2.3	-	5.5	V
		Reader, Active Initiator and Active Target; $V_{SS} = 0\text{ V}$ <a href="#">[1]</a> <a href="#">[2]</a>	2.7	-	5.5	V
$V_{DD}$	supply voltage	internal supply voltage	1.65	1.8	1.95	V
$V_{DD(PAD)}$	$V_{DD(PAD)}$ supply voltage	supply voltage for host interface				
		1.8 V host supply; $V_{SS} = 0\text{ V}$ <a href="#">[1]</a>	1.65	1.8	1.95	V
		3.3 V host supply; $V_{SS} = 0\text{ V}$ <a href="#">[1]</a>	3.0	-	3.6	V
$I_{BAT}$	battery supply current	in Hard Power Down state; $V_{BAT} = 3.6\text{ V}$ ; $T = 25\text{ °C}$	-	10	12	$\mu\text{A}$
		in Standby state; $V_{BAT} = 3.6\text{ V}$ ; $T = 25\text{ °C}$	-	-	20	$\mu\text{A}$
		in Monitor state; $V_{BAT} = 2.75\text{ V}$ ; $T = 25\text{ °C}$	-	-	12	$\mu\text{A}$
		in low-power polling loop; $V_{BAT} = 3.6\text{ V}$ ; $T = 25\text{ °C}$ ; loop time = 500 ms	-	150	-	$\mu\text{A}$
		PCD mode at typical 3 V <a href="#">[3]</a>	-	-	170	mA
$I_{O(VDDPAD)}$	output current on pin $V_{DD(PAD)}$	total current which can be pulled on $V_{DD(PAD)}$ referenced outputs	-	-	15	mA

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{th(lim)}$	current limit threshold current	current limiter on $V_{DD(TX)}$ pin; [3] $V_{DD(TX)} = 3.1\text{ V}$ [4]	-	180	-	mA
$P_{tot}$	total power dissipation	Reader; $I_{VDD(TX)} = 100\text{ mA}$ ; $V_{BAT} = 5.5\text{ V}$	-	-	0.5	W
$T_{amb}$	ambient temperature	JEDEC PCB-0.5	-30	+25	+85	°C

**Frequency :** 13.56 MHz

**Host interface:** I<sup>2</sup>C bus

## **6. Information for FCC and IC**

### **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.



**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.
- 2) Module approval valid only when the module is installed in the tested host or compatible series of host which have similar RF exposure characteristic with equal or larger antenna separation distance.

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 can not 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 can not 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: VPQ-PN7120". 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:**

This device complies with ISED's licence-exempt RSSs. 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.

Le présent appareil est conforme aux CNR d'ISED applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) le dispositif ne doit pas produire de brouillage préjudiciable, et (2) ce dispositif doit accepter tout brouillage reçu, y compris un brouillage susceptible de provoquer un fonctionnement indésirable.

**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.
- 2) Module approval valid only when the module is installed in the tested host or compatible series of host which have similar RF exposure characteristic with equal or larger antenna separation distance.

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.

**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 coimplanté avec un autre émetteur ou antenne.
- 2) Approbation du Module valable que lorsque le module est installé dans l'hôte testé ou de la série de l'hôte compatible qui ont même caractéristique de l'exposition aux RF avec la distance égale ou supérieure séparation antenne.

Tant que les 2 conditions ci-dessus sont remplies, des essais supplémentaires sur l'émetteur ne seront pas nécessaires. Toutefois, l'intégrateur OEM est toujours responsable des essais sur son produit final pour toutes exigences de conformité supplémentaires requis pour ce module installé.

### **IMPORTANT NOTE:**

In the event that these conditions can not 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 can not 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 final end product must be labeled in a visible area with the following: "Contains IC: 7392A-PN7120".

**Plaque signalétique du produit final**

Le produit final doit être étiqueté dans un endroit visible avec l'inscription suivante: "Contient des IC: 7392A-PN7120".

**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**

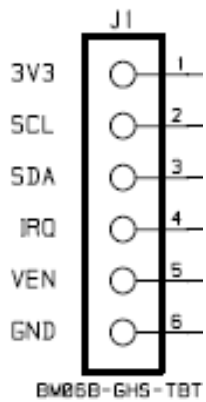
L'intégrateur OEM doit être conscient de ne pas fournir des informations à l'utilisateur final quant à la façon d'installer ou de supprimer ce module RF dans le manuel de l'utilisateur du produit final qui intègre ce module.

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

## 7. Integration instruction

For correct integration into an existing system, please follow the instructions:

1. Be sure to respect the connector pinouts as indicated hereafter:



Pin #	Name	Description
1	3V3	3.3 volts power supply
2	SCL	I <sup>2</sup> C-bus serial clock input
3	SDA	I <sup>2</sup> C-bus serial data
4	IRQ	Interrupt request output
5	VEN	Reset pin. Set the device in Hard Power Down
6	GND	Ground (0V)

Connector reference is BM06B-GHS-TBT. Please use a male connector compatible with this reference.

2. Respect power voltage. Do not apply voltage above 3.6 V
3. Verify that power supply can provide 170 mA.

The PN7120 modules are easily integrated into existing systems via I<sup>2</sup>C serial interfaces. Please contact sales for additional information.