ELECHOUSE PN5321 MINI (Interference-Resistant Antenna)

Product Manual v1.1 — English

> This document describes Product A (PN5321 MINI). Product A and Product B share the same NXP **PN532** chip and features; A differs in the compact board form factor and the **external antenna with pre-applied ferrite**. Dual antenna connectors (MX1.25 / IPEX4) are available.

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1. Overview

The PN5321 MINI is a 13.56 MHz NFC/RFID module supporting **I²C / SPI / HSU (UART)**. The board is only **25 × 16.4 × 4.4 mm**, easy to embed. The external antenna shipped with the module **already includes ferrite backing**, which improves stability and reading distance in metal or noisy environments.

Use cases: consumer devices, wearables, access control, membership/ticket systems, medical handhelds, and short-range data exchange.

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2. Key Features

- **Controller**: NXP PN532 (13.56 MHz)
- **Standards**: ISO/IEC 14443 A/B, ISO 15693, FeliCa (JIS X 6319-4)
- **Interfaces**: I²C, SPI, HSU (UART), selected by solder jumpers (follow the PCB silkscreen)
- **Antenna**: 10×25 mm or 40×50 mm, **pre-applied ferrite**, connectors: MX1.25 & IPEX4
- **Supply**: 2.7–5.5 V; **I/O logic 3.3 V**

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3. Technical Specifications

Item	Spec
Frequency	13.56 MHz
Standards	ISO/IEC 14443 A/B, ISO 15693, FeliCa
Interfaces	I²C / SPI / HSU (UART); selected by solder jumpers
Supply Voltage	2.7–5.5 V (I/O logic 3.3 V)
Board Size	25 × 16.4 × 4.4 mm

Item	Spec
Antenna Size	10×25×0.2 mm or 40×50×0.2 mm (with ferrite)
Antenna Conn.	MX1.25, IPEX4
Operating Temp.	−25 °C to +85 °C

4. Pinout (Silkscreen, multi-function by mode)

Two signal pins are **multiplexed** across I²C / SPI / UART. Wire by the silkscreen.

Silkscreen	I²C Mode	SPI Mode	HSU (UART) Mode	Notes
GND	GND	GND	GND	Ground
5V (or 3V3)	2.7–5.5 V	2.7–5.5 V	2.7–5.5 V	Board power input
RST	RST (active-low)	RST (active-low)	RST (active-low)	Optional
SCK	—	SCK	—	SPI clock
MISO	—	MISO	—	SPI MISO
TX/MOSI/SDA	**SDA**	**MOSI**	**TX**	Multiplexed pin
RX/SS/SCL	**SCL**	**SS**	**RX**	Multiplexed pin

5. ESP32 Wiring (Tables Only)

I/O logic is **3.3 V**. Powering from **3.3 V** is recommended (5 V is supported; logic stays at 3.3 V).

5.1 I²C (ESP32: SDA=GPIO21, SCL=GPIO22)

On-board 3.3 V pull-ups are present on the module; external pull-ups are usually unnecessary. If other devices also add pull-ups, keep the combined equivalent ~2–10 kΩ.

ESP32 Pin	Connect to A (PN5321 MINI)	Note
3V3	**5V/3V3**	Prefer 3.3 V for unified logic
GND	**GND**	Common ground
GPIO4 (any GPIO)	**RST**	Active-low; optional
GPIO21 (SDA)	**TX/MOSI/SDA**	I²C data
GPIO22 (SCL)	**RX/SS/SCL**	I²C clock

5.2 SPI — VSPI (ESP32 default: SCK=18, MISO=19, MOSI=23, SS=5)

ESP32 Pin	Connect to A (PN5321 MINI)	Note
3V3	**5V/3V3**	Logic 3.3 V
GND	**GND**	Common ground
GPIO4	**RST**	Active-low
GPIO18 (SCK)	**SCK**	SPI clock
GPIO19 (MISO)	**MISO**	Host input
GPIO23 (MOSI)	**TX/MOSI/SDA**	Host output
GPIO5 (SS/CS)	**RX/SS/SCL**	Chip select

5.3 HSU / UART2 (ESP32: TX2=GPIO17, RX2=GPIO16)

ESP32 Pin	Connect to A (PN5321 MINI)	Note
3V3	**5V/3V3**	Logic 3.3 V
GND	**GND**	Common ground
GPIO4	**RST**	Active-low
GPIO17 (TX2)	**RX/SS/SCL**	Module RX ← ESP32 TX2
GPIO16 (RX2)	**TX/MOSI/SDA**	Module TX → ESP32 RX2

5.4 SPI — HSPI (ESP32: SCK=14, MISO=12, MOSI=13, SS=15)

ESP32 Pin	Connect to A (PN5321 MINI)	Note
3V3	**5V/3V3**	Logic 3.3 V
GND	**GND**	Common ground
GPIO4	**RST**	Active-low
GPIO14 (SCK)	**SCK**	SPI clock
GPIO12 (MISO)	**MISO**	Host input (**strapping pin**)
GPIO13 (MOSI)	**TX/MOSI/SDA**	Host output
GPIO15 (SS/CS)	**RX/SS/SCL**	Chip select (**strapping pin**)

> **Note on strapping pins**: GPIO12 and GPIO15 affect ESP32 boot mode. Avoid strong external pulls at power-up/reset.

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6. Antenna & Reading Distance (Ferrite-backed)

The included external antenna is **already ferrite-backed**, so no extra ferrite sheet is required for normal installations. Keep the antenna away from large metal areas and high-current/high-frequency traces.

Typical distances (PVC Mifare S50 card, indicative):

Antenna (with ferrite)	S50 Card (85×54 mm)	Coin Tag (Ø25 mm)
40×50 mm	**≈5.8 cm**	**≈3.3 cm**
10×25 mm	**≈3.0 cm**	**≈2.0 cm**

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7. Getting Started

1. **Select the interface** via solder jumpers (I^2C / SPI / HSU). Follow the silkscreen.
2. **Wire and power**: supply 3.3 V (or 5 V); logic level is 3.3 V.
3. **Mount the antenna**: choose 10×25 mm or 40×50 mm (both ferrite-backed).
4. **Run examples** from PN532 Arduino libraries for your chosen interface.

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8. Design Notes

- Keep the antenna trace **short and straight**; avoid loops.
- Keep distance from switching power, motor drivers, and high-speed pairs.
- Add ESD protection if cards/tags are hot-plugged.

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9. Packing List (may vary by order)

- PN5321 MINI mainboard ×1
- External antenna ×1 (10×25 mm or 40×50 mm, **with ferrite**)
- Cable ×1 (~10 cm)

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10. Revision History

- **v1.1 (EN)**: English edition; added ESP32 wiring tables (I^2C/VSPI/UART2/HSPI), clarified **on-board I^2C pull-ups**, and ferrite-backed antenna note.
- **v1.0**: Initial draft.

差异声明 / Difference Statement

- **申请人 / Applicant:** HK ELECHOUSE LIMITED
- **制造商 / Manufacturer:** HK ELECHOUSE LIMITED
- **地址 / Address:** Room A516, 5/F, Yik Lee Industrial Building, 35 Tai Yau Street, San Po Kong, Kowloon, Hong Kong
- **产品名称 / Equipment Name:** 13.56 MHz NFC/RFID 模块 / 13.56 MHz NFC/RFID Module
- **主测型号 / Main model:** PN532 MINI EXT
- **商标 / Trade mark:** ELECHOUSE
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- **一、型号族 / Model Family**
- 以下为同一产品家族的副型号（用于覆盖认证）：/ The following models belong to the same family (covered by this certification):

• 副型号 / Variant	• 差异说明 / Difference Description
• **PN532 MINI EXT-1025**	• 外置天线 10×25 mm，已贴铁氧体 / External antenna 10×25 mm, ferrite-backed
• **PN532 MINI EXT-4050**	• 外置天线 40×50 mm，已贴铁氧体 / External antenna 40×50 mm, ferrite-backed
• **PN532 MINI EXT-MX**	• 天线接口为 MX1.25 / Antenna connector MX1.25
• **PN532 MINI EXT-IPX**	• 天线接口为 IPEX4 / Antenna connector IPEX4

- 备注：上述差异仅涉及外置天线尺寸或连接器形式；主板功能与射频参数保持一致。 / Note: Differences are limited to antenna size or connector; mainboard function and RF parameters remain unchanged.
- **二、等同性声明 / Identity Declaration**
- 所有型号均采用同一主芯片 NXP PN532，工作频率 13.56 MHz； / All models use the same NXP PN532 at 13.56 MHz;
- 射频架构、调制方式、时序与固件功能一致；/ RF architecture, modulation, timing and firmware functions are identical;
- 供电范围 2.7–5.5 V，不同型号的 I/O 逻辑均为 3.3 V； / Supply 2.7–5.5 V; I/O logic is 3.3 V for all variants;

- 主板 PCB、电源与数字电路未做影响 RF/EMC 的更改； / Main PCB, power and digital circuits have no changes affecting RF/EMC;
- 差异仅在外置天线的几何尺寸或连接器形式，不改变中心频率或发射功率目标； / Differences limited to antenna geometry or connector, without changing center frequency or target output power.
- **三、最不利工况与测试覆盖 / Worst-case & Test Coverage**
- 我们确认以 “PN532 MINI EXT（40×50 mm 天线）” 作为最不利工况样机进行测试，其辐射与抗扰度代表本系列最严苛情形；基于等同性，上述副型号共用测试结果与技术文件。 / We confirm that “PN532 MINI EXT with 40×50 mm antenna” is selected as the worst-case sample; its emissions and immunity represent the most stringent condition of the family. By identity, the listed variants share the test results and technical files.
- **四、标识一致性 / Labeling Consistency**
- 所有型号在铭牌上以“PN532 MINI EXT”及相应后缀（如 -1025、-4050 等）标识，商标 ELECHOUSE。说明书、包装与 DoC 中的型号书写与空格/连字符保持一致。 / All models are labeled “PN532 MINI EXT” with suffixes (e.g., -1025, -4050), brand ELECHOUSE. Model strings in manuals, packaging and DoC keep identical spacing/hyphenation.
- **五、声明 / Declaration**
- 本公司承诺上述信息真实、准确，并对因差异说明不实导致的认证风险承担责任。 / We hereby declare that the above information is true and accurate, and we take responsibility for any certification risks arising from inaccurate statements.

公司 / Company	**HK ELECHOUSE LIMITED**
签字 / Authorized Signature	
姓名与职位 / Name & Title	Business Manager
日期 / Date	Aug. 28, 2025