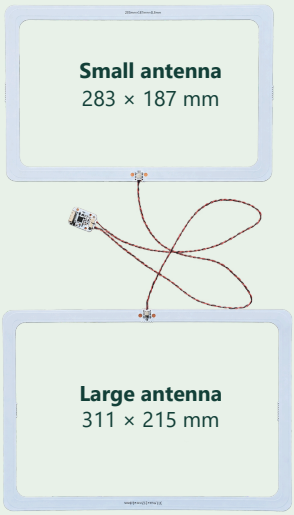
MODULE DATASHEET · HARDWARE V1

ST25R3916B Mini AAT NFC Reader Module with Dual Antennas

A 13.56 MHz NFC reader/writer module with two external antenna paths and Automatic Antenna Tuning (AAT) for each path.



Product kit with both antennas separated and connected. Background removed from the product photo.

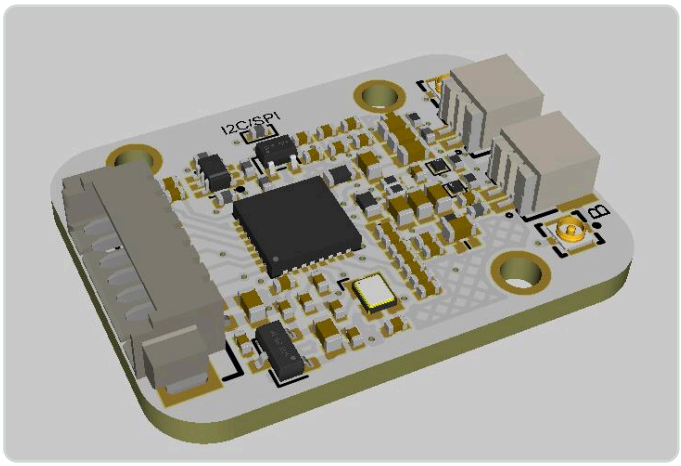
Product overview

An external host selects antenna A or B and controls the reader through I²C or SPI. The reader uses one antenna path at a time.

The antennas share a PCB manufacturing panel before separation. Separate the two frames at their breakaway tabs before installation and connect each frame to the reader with its own 40 cm lead.

Key features

- STMicroelectronics ST25R3916B NFC reader IC.
- Two single-ended antenna paths with independent tuning settings.
- Default I²C interface with IRQ and a selectable SPI interface.
- 3.3–5.0 V DC module supply and a 40 cm lead for each antenna path.
- Verified write and readback at 29 cm with the ICODE SLIX2 sample and the outer antenna in bench testing.



Reader module, 3D rendering.

Typical applications

Dual-position tag detection, workbench fixtures, and NFC integration in equipment with two scan positions.

Automatic tuning for different tags

A small NFC sticker and a full-size card can load the same antenna differently. A fixed matching network uses one preset setting per antenna. With AAT, the host can start a tuning cycle with the target tag in place. The tuning routine measures the antenna response and automatically selects a setting for that load within the available tuning range. The same antenna setup can therefore be tuned for different tags without changing hardware.

TBD marks a specification awaiting confirmation. Values marked nominal describe the current design or reference configuration.

Electrical characteristics

Recommended supply and host interface

Parameter	Condition	Min.	Nom.	Max.	Unit
Module supply input	Host connector power pin	3.3	5.0	5.0	V
Logic rail	Onboard regulator setpoint and I^2C pull-up supply	—	3.0	—	V

Keep the module supply within 3.3–5.0 V, including supply tolerance and transients. Use open-drain I^2C with pull-ups to the module's logic rail.

Digital logic levels at the nominal 3.0 V logic rail

Parameter	Condition	Limit
Input low	I^2C and SPI inputs	0.60 V max.
Input high	I^2C and SPI inputs	2.40 V min.
CMOS output low	With the higher I/O drive setting and 0.5 mA load	0.30 V max.
CMOS output high	With the higher I/O drive setting and 0.5 mA load	2.70 V min.

The logic levels are derived from the reader IC limits at the board's nominal logic-rail voltage. In I^2C mode the pull-up sets the high level. ST25R3916B datasheet, Tables 124 and 133

Absolute maximum ratings at the reader IC

Connection	Condition	Min.	Max.	Unit
Main and RF supply	Both pins connect to module input. Low-voltage supply mode.	−0.3	5.0	V
Main and RF supply	Both pins connect to module input. 5 V supply mode.	−0.3	6.0	V
Digital communication pins	Reader IC pin stress rating	−0.3	6.0	V

Use the recommended supply and host interface levels for the assembled module. Module-level overvoltage and ESD qualification is **TBD**. ST25R3916B datasheet, Table 122

Recommended environmental conditions

Parameter	Condition	Min.	Max.	Unit
Operating temperature	Ambient	0	+60	°C
Storage temperature	Unpowered	−20	+70	°C
Operating humidity	Non-condensing	10	90	% RH

These are preliminary application conditions. Module-level environmental qualification is **TBD**.

Measured power consumption

Typical bench averages at the module input with the reference RF drive, fixed tuning and one MIFARE Classic S50 card per antenna. The host was powered separately. Antennas A and B were driven in turn.

Operating state	3.3 V avg. mA	3.3 V avg. mW	5 V avg. mA	5 V avg. mW
Standby, RF off	6.84	22.57	8.86	44.68
A/B diagnostic polling	41.54	130.72	54.88	269.24
A/B block reads	37.35	117.53	48.53	238.41
One A/B read cycle per second	14.98	47.92	19.45	96.38

Sustained carrier

At nominal 5 V and the highest RF drive setting, the higher of the two sustained-carrier averages was **89.22 mA / 440.57 mW** on antenna A. The reported value represents the stable portion of a 12 s carrier hold.

Supply columns are nominal settings. The report gives actual input voltages, all drive settings, 100 Hz maxima and capture coverage. Complete power test report (PDF)

RF characteristics and protocol support

Characteristic	Module specification
Carrier frequency	13.56 MHz nominal
Antenna operation	Two external paths, selected in turn by the host
Automatic Antenna Tuning	Independent settings for A and B. The tuning routine uses amplitude and phase measurements to select a setting closer to the configured targets.
Tuning sequence	The reference host runs tuning at startup and supports on-demand retuning, including with a tag in place.

Reference host protocol support

RF protocol	Tag families and functions
NFC-A / ISO/IEC 14443 A	Discovery and data access for compatible MIFARE Classic 1K/4K, NFC Forum Type 2 and Type 4A tags. Data access depends on tag permissions and format.
NFC-B / ISO/IEC 14443 B	Discovery and data read/write for compatible Type 4B tags with writable NDEF memory.
NFC-V / ISO/IEC 15693	Tag identification and data block read/write on compatible tags.
NFC-F	Optional discovery in the reference implementation.

Measured read/write range

At each reported distance, the ESP32-S3 test program successfully wrote random data to the tag, read it back and verified an exact match. The bench test used a 40 cm cable for each antenna.

Farthest verified write and readback on each sample · 24 November 2026

Test sample	Sample size and format	Outer antenna 31.1 × 21.5 cm	Inner antenna 28.3 × 18.7 cm
MIFARE Classic S70	85 × 56 mm PVC card	18 cm	15.5 cm
ICODE SLIX2	85 × 56 mm PVC card	29 cm	26 cm
ICODE SLI	85 × 56 mm PVC card	25 cm	24 cm
NTAG215	Ø25 mm round tag	4.7 cm	3 cm[2]
ISO/IEC 14443 B	85 × 56 mm PVC card	4 cm[1]	4.7 cm
ISO/IEC 15693	Ø25 mm round tag	8 cm	8 cm
M1	Ø25 mm round tag	2.7 cm	3 cm[2]

Unmarked results used the AAT settings selected at startup for that run. The superscripts identify settings optimized for the indicated sample and antenna during testing.

1. Drive setting 1, tuning DAC setting 255.
2. Drive setting 7, tuning DAC setting 64.

Results are specific to the tested samples and setup. Tag orientation and test environment are **TBD**. Tag identification-only distance and dual-antenna polling time are **TBD**.

Enclosure materials, antenna spacing and tag position affect the RF field. A tag can be detected through both paths if the reading areas overlap.

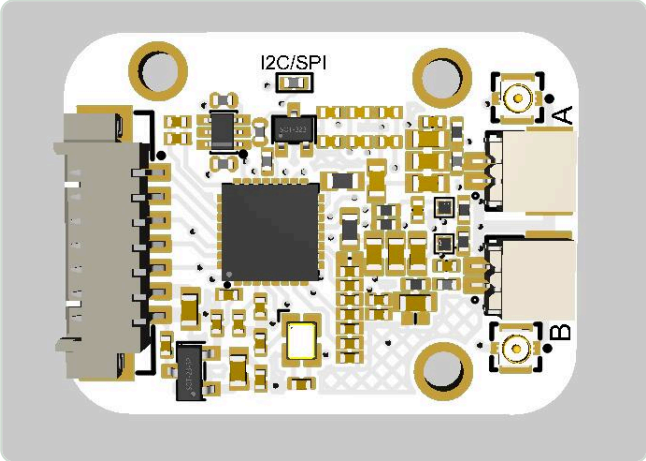
Host and antenna interfaces

Host bus characteristics

Mode	Configuration	Reference clock	Qualified maximum clock
I²C	Default. 7-bit address 0x50.	100 kHz	TBD
SPI	Hardware-selectable. Separate chip-select line.	TBD	TBD

Host connector · 7P, 1.25 mm pitch

Pin	I²C mode	SPI mode
1	IRQ output	IRQ output
2	Open	Chip select input
3	SCL clock input	SCLK clock input
4	Open	MOSI data input
5	SDA bidirectional data	MISO data output
6	3.3–5.0 V DC input	3.3–5.0 V DC input
7	Ground	Ground



Module top view. Pin 1 is at the upper end of the left connector in this view. Paths A and B are on the right.

Mating host cable

The 7-position host header uses a single-row, 1.25 mm-pitch PicoBlade-compatible interface. Choose a matching 7-position receptacle cable. Use 51021-0700 as the mechanical cross-reference for the cable housing, and check pin 1 against the pinout above. ELECHOUSE Connector Selection Guide

Antenna connectors

Path	2-position connector, 1.0 mm pitch	Alternate connection	Reference lead
A	Pin 1 ground · Pin 2 RF	Micro-coax, upper right	40 cm
B	Pin 1 RF · Pin 2 ground	Micro-coax, lower right	40 cm

The two connector options on each path share the RF connection. Use one connection per path. For host setup and mode selection, see the user manual. Wiring instructions

Mechanical and ordering information

Mechanical characteristics

Item	Dimension	Basis
Reader module PCB outline	26.91 × 20.04 mm	CAD reference
Reader assembly height	4.80 mm	CAD, PCB underside to highest part, excluding plugs
Reader PCB thickness	1.20 mm	CAD nominal
Reader mounting	3 holes, approx. Ø2.1 mm	PCB design. Hole locations and tolerances TBD.
Outer antenna frame	311 × 215 mm	Nominal
Inner antenna frame	283 × 187 mm	Nominal
Antenna PCB thickness	0.8 mm	Nominal
Antenna cable length	40 cm each	Reader to antenna
Assembly mass	TBD	Module and antenna assembly

Ordering and compliance

Item	Details
Ordering code / SKU	NFC_ST25R3916B_MINI_AAT_DUAL
Shipping weight	0.5 kg
Package contents and quantities	1 reader module, 1 large PCB antenna, 1 small PCB antenna and 2 × 40 cm antenna leads
Host mating connector	7P PicoBlade-compatible receptacle, 1.25 mm pitch. Housing cross-reference 51021-0700.
Antenna mating connector and accessory part numbers	TBD
Compliance declarations	TBD

Related documents

ELECHOUSE user manual ST25R3916B IC datasheet ST AAT application note

Revision history

Rev. 0.10 · 27 November 2026 · Summarized module power consumption, linked the complete test report and identified the 7P host mating connector.

Rev. 0.9 · 26 November 2026 · Added test sample dimensions and identified the first hardware release as V1.

Rev. 0.8 · 26 November 2026 · Aligned the product name, ordering code and shipping weight with the product listing.

Rev. 0.7 · 26 November 2026 · Added the connected kit photo, package contents and antenna separation requirement.

Rev. 0.6 · 26 November 2026 · Added measured module current and power at nominal 3.3 V and 5 V.

Rev. 0.5 · 25 November 2026 · Specified the supply range, host logic levels, reader IC stress limits and preliminary environmental conditions.

Rev. 0.4 · 25 November 2026 · Added verified write/readback ranges for seven card and tag samples.

Rev. 0.3 · 24 November 2026 · Added AAT benefits and clarified tuning under tag load.

Rev. 0.2 · 24 November 2026 · Preliminary module specifications.