

NFC Board Antenna

Specification Sheet

FPC Flexible Board Antenna / 13.56MHz

Product Model	NFC-FPC-001
Product Type	On-board FPC Flexible Antenna
Operating Frequency	13.56 MHz
Standards	ISO/IEC 14443A/B, ISO/IEC 15693, NFC Forum
Revision	V1.0
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1. Product Overview

This product is a high-performance NFC (Near Field Communication) on-board FPC flexible antenna, operating at 13.56MHz and compliant with ISO/IEC 14443A/B, ISO/IEC 15693, and NFC Forum standards. The antenna features a flexible FPC substrate design, which is thin, bendable, and easy to integrate, making it suitable for built-in installation in various NFC devices.

The antenna adopts a spiral coil structure with optimized coil turns and line width design, ensuring good impedance matching and high Q value, enabling stable near-field communication performance. The product is equipped with a standard IPEX connector for quick connection to the NFC main control module.

1.1 Product Features

- Operating frequency 13.56MHz, supporting multiple NFC protocols
- Flexible FPC substrate, only 0.2mm thick, bendable and conformable
- Optimized coil design, high Q factor, long communication distance
- Standard IPEX interface, plug-and-play
- Compact size, easy to integrate into various devices
- Wide operating temperature range, suitable for industrial applications
- RoHS compliant

2. Electrical Specifications

Parameter	Symbol	Min.	Typ.	Max.	Unit
Operating Frequency	f_0	13.553	13.560	13.567	MHz
Antenna Inductance	L	-	1.2	-	μH
Antenna Impedance	Z_0	-	50	-	Ω
Quality Factor	Q	20	35	50	-
DC Resistance	R _{dc}	-	1.0	2.0	Ω
VSWR	VSWR	-	1.5	2.0	-
Antenna Gain	Gain	-	1.0	-	dBi
Polarization	-	Vertical	-	-	-
Maximum Power	P _{max}	-	1	-	W
Resonant Capacitance	C	-	110	-	pF

2.1 Frequency Characteristics

The center resonant frequency of the antenna is 13.56MHz, which meets the requirements of NFC Forum standards. The Q value (quality factor) of the antenna is typically 35, ensuring communication distance while maintaining bandwidth characteristics, and supporting multiple NFC data transmission rates.

The antenna input impedance is designed to be 50 Ω , matching the output impedance of standard NFC front-end chips. In practical applications, it is recommended to add a matching network between the antenna and the chip for optimal performance.

3. Mechanical Specifications

Parameter	Value	Unit	Remark
Total Length	50.0	mm	Including tail
Antenna Area Width	30.0	mm	Coil area
Tail Width	8.0	mm	IPEX end
Substrate Thickness	0.2	mm	FPC base material
Total Thickness	0.3	mm	Including coverlay
Coil Turns	5	turns	-
Line Width	0.5	mm	Copper trace width
Line Spacing	0.8	mm	Coil spacing
Copper Thickness	18	μm	Electrodeposited copper
Connector Type	IPEX / U.FL	-	Gen 1
Weight	< 0.5	g	-

3.1 Material Description

The antenna substrate is made of polyimide (PI) flexible FPC material, which has excellent temperature resistance, bending resistance, and dimensional stability. The copper foil is electrodeposited copper with a thickness of 18μm, ensuring good electrical conductivity. The surface is covered with a protective film to enhance the wear resistance and corrosion resistance of the antenna.

4. Performance Parameters

Parameter	Test Condition	Min.	Typ.	Max.	Unit
Read Distance	Standard NFC card	30	50	60	mm
Communication Distance	NFC P2P	20	40	50	mm
Operating Bandwidth	VSWR < 2	-	2	-	MHz
Radiation Efficiency	13.56MHz	-	65	-	%
Insertion Loss	-	-	1.5	2.5	dB
Return Loss	-	10	15	-	dB

4.1 Test Conditions

The above performance parameters are measured under the following standard test conditions: ambient temperature 25°C, relative humidity 50%RH, standard atmospheric pressure, tested with a vector network analyzer 配合 standard NFC test cards. Actual performance in use may vary due to device housing material, internal metal structure, battery, and other factors.

Communication distance is tested using a standard ISO/IEC 14443 Type A card, with the antenna and card aligned in parallel. In practical applications, it is recommended to reserve sufficient antenna clearance area and avoid metal objects close to the antenna for optimal performance.

5. Environmental Specifications

Parameter	Value	Unit	Remark
Operating Temperature	-40 ~ +85	°C	-
Storage Temperature	-40 ~ +105	°C	-
Operating Humidity	5 ~ 95	%RH	Non-condensing
Storage Humidity	5 ~ 95	%RH	Non-condensing
Solder Heat Resistance	260 / 10	°C / s	Reflow soldering
Bending Cycles	> 10000	cycles	R=5mm
ESD Protection	±8	kV	Contact discharge
Salt Spray Test	48	h	5% NaCl

5.1 Reliability Notes

The product has undergone strict reliability testing, including high and low temperature cycling, humid heat aging, salt spray testing, vibration testing, etc., to ensure stable performance in various harsh environments. The FPC substrate has excellent bending resistance and can withstand more than 10,000 bends (bending radius 5mm).

6. Dimensional Drawing

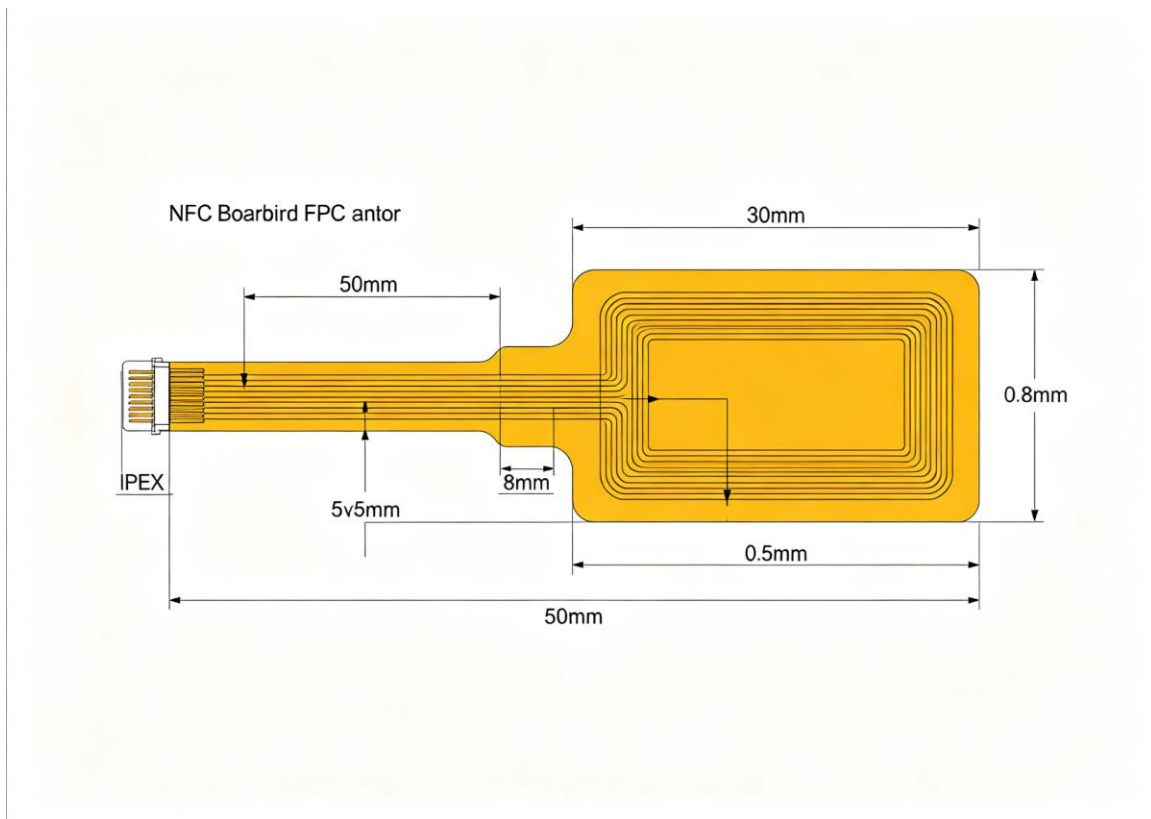


Figure 6-1 NFC Board Antenna Dimensional Drawing (Unit: mm)

6.1 Dimension Notes

The above dimensions are nominal values with a tolerance of $\pm 0.2\text{mm}$. The antenna has a "racket-shaped" structure overall, with the rectangular area on the right being the antenna coil working area, and the narrow long area on the left being the connecting tail, equipped with an IPEX connector at the end.

During installation, it is recommended to reserve at least 2mm of clearance around the antenna coil area to avoid coverage by metal or other conductive materials. The connecting tail can be appropriately bent according to actual installation needs, but the bending radius should not be less than 5mm.

7. Application Areas

This NFC on-board antenna is widely used in various electronic devices requiring near field communication functionality. The main application scenarios include:

- **Mobile Payment Terminals:** POS machines, card readers, mobile payment devices, etc.
- **Smart Door Locks:** NFC access control, smart door locks, elevator control, etc.
- **Consumer Electronics:** Smartphones, tablets, smart watches, Bluetooth earphones, etc.
- **Smart Home:** Smart appliances, smart speakers, routers, etc.
- **IoT Devices:** Sensor nodes, smart tags, asset tracking, etc.
- **Medical Devices:** Portable medical equipment, health monitoring devices, etc.
- **Industrial Control:** Industrial handheld terminals, inspection equipment, identification, etc.
- **Automotive Electronics:** In-vehicle NFC, car keys, in-car payment, etc.

8. Precautions

8.1 Installation Precautions

- The antenna installation position should be away from metal objects, with a recommended distance of at least 10mm;
- Avoid installing the antenna above metal surfaces such as batteries, shields, or PCB copper pours;
- The PCB area below the antenna is recommended to be kept clear, avoiding copper pours and traces;
- When bending the connecting tail, the bending radius should not be less than 5mm, and repeated bending at the same position should be avoided;
- When plugging and unplugging the IPEX connector, apply force vertically to avoid lateral pulling;
- The antenna surface should be kept clean to avoid contamination by oil, dust, etc., which may affect performance.

8.2 Usage Precautions

- Before use, please confirm that the antenna operating frequency matches the NFC chip;
- It is recommended to adjust the matching network parameters according to the actual use environment for optimal performance;
- Do not exceed the maximum power input limit of the antenna;
- Do not use in environments beyond the operating temperature range;
- ESD sensitive device, please pay attention to anti-static protection during operation;
- Store in a dry, dust-free environment.