BDE-RF7970N

BDE Multiprotocol Fully Integrated 13.56-MHz RFID and NFC Module

General Description

The BDE-RF7970 module is a multiprotocol integrated 13.56-MHz NFC/RFID module supporting all three NFC operation modes – reader/writer, peer-to-peer, and card emulation according to ISO/IEC 14443 A and B, Sony FeliCa, ISO/IEC 15693, NFCIP-1 (ISO/IEC 18092), and NFCIP-2 (ISO/IEC 21481). Built-in programming options make the device suitable for a wide range of applications for NFC, proximity, and vicinity identification systems.

The BDE-RF7970N is a transceiver module and the BDE-RF7970A-1 is an integration of BDE-RF7970N module, PCB trace antenna and MCU module.

The modules is configured by selecting the desired protocol in the control registers. Direct access to all control registers allows fine tuning of various reader parameters as needed.

The BDE-RF7970N and BDE-RF7970A-1 module supports data rates up to 848 kbps with all framing and synchronization tasks for the ISO protocols onboard. The TRF7970A device also supports reader and writer mode for NFC Forum tag types 1, 2, 3, 4, and 5.

Key Features

- Supports Near Field Communication (NFC) Standards NFCIP-1 (ISO/IEC 18092) and NFCIP-2 (ISO/IEC 21481)
- Completely Integrated Protocol Handling for ISO/IEC 15693, ISO/IEC 18000-3, ISO/IEC 14443 A and B, and FeliCa™
- Integrated Encoders, Decoders, and Data Framing for NFC Initiator, Active and Passive Target Operation for All Three Bit Rates (106 kbps, 212 kbps, 424 kbps), and Card Emulation
- RF Field Detector With Programmable Wake-up Levels for NFC Passive Transponder Emulation Operation
- RF Field Detector for NFC Physical Collision Avoidance
- Integrated State Machine for ISO/IEC 14443 A Anticollision (Broken Bytes) Operation (Transponder Emulation or NFC Passive Target)

- Programmable Output Power: +20 dBm (100 mW), +23 dBm (200 mW)
- Programmable System Clock Frequency Output (RF, RF/2, RF/4) from 13.56-MHz or 27.12-MHz Crystal or Oscillator
- Programmable Modulation Depth
- Dual Receiver Architecture With RSSI for Elimination of "Read Holes" and Adjacent Reader System or Ambient In-Band Noise Detection
- ANT pin out for antenna (BDE-RF7970N)
- Integrated PCB Antenna or U.FL Connector for External Antenna (BDE-RF7970A-1)
- UART Communication for User
- LGA-33 package (BDE-RF7970N) 1.27mm Pitch Milli-Grid Header (BDE-RF7970A-1)
- Dimension: 12.3 mm x 13.8 mm (BDE-RF7970N) Dimension: 42 mm x 79.5 mm (BDE-RF7970A-1)

Applications

- Mobile Devices (Tablets, Handsets)
- Secure Pairing (Bluetooth®, Wi-Fi®, Other Paired Wireless Networks)
- Public Transport or Event Ticketing

- Passport or Payment (POS) Reader System
- Retail Automation and Payment
- Short-Range Wireless Communication Tasks (Firmware Updates)

- ■ Product Identification or Authentication
- ■ Medical Equipment or Consumables
- ■ Access Control, Digital Door Locks
- ■ Sharing of Electronic Business Cards

Table 1. Module Variants

Part Number	Antenna Type	Description	Size (mm)	Operating Temperature
BDE-RF7970N	ANT pin out	A transceiver module with TRF7970A and DCDC on board	12.3 x 13.8 x 2.7	-40℃ to +85℃
BDE-RF7970A-1	PCB Antenna or U.FL connector	An integration of BDE-RF7970N module, PCB trace antenna or U.FL connector, MCU module.	42.0 x 79.5 x 3.5	-40℃ to +85℃

Contents

1. References

1. RF7970A Resources: https://www.ti.com/product/TRF7970A
2. MSPM0 Resources: https://www.ti.com/product/MSPM0L1304

2. Terminal Configuration and Functions

2.1 Pin Diagram
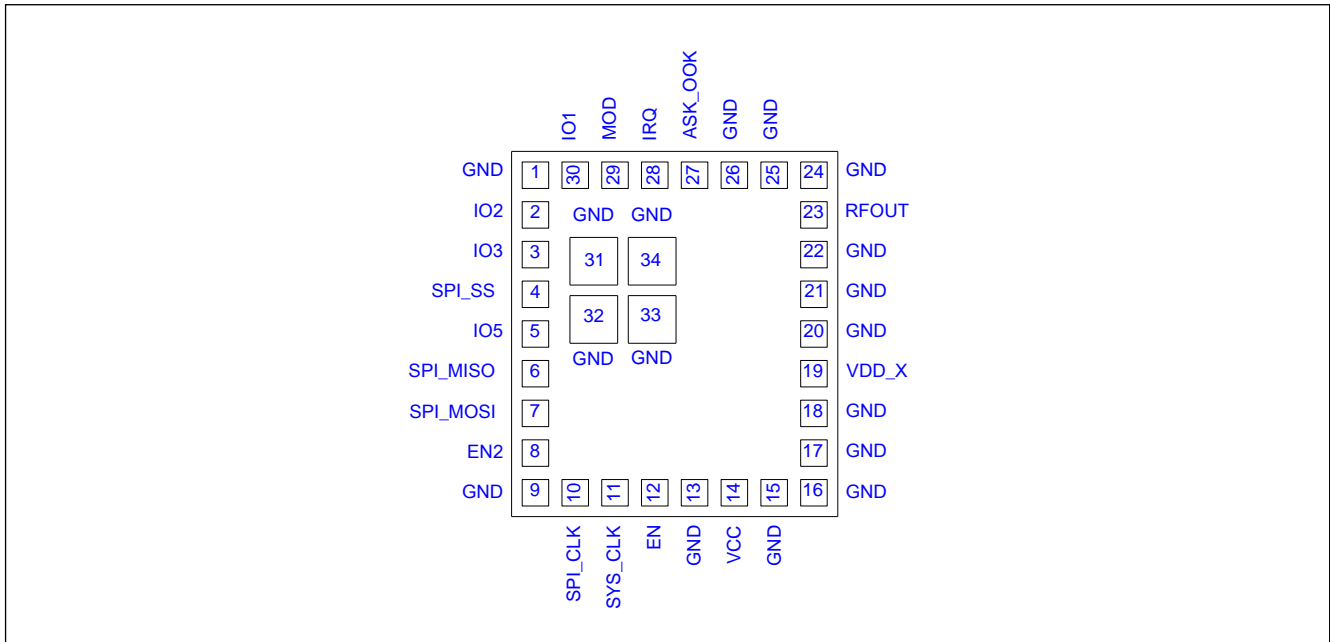
Figure 2-1. Pin Diagram of BDE-RF7970N (Top View)

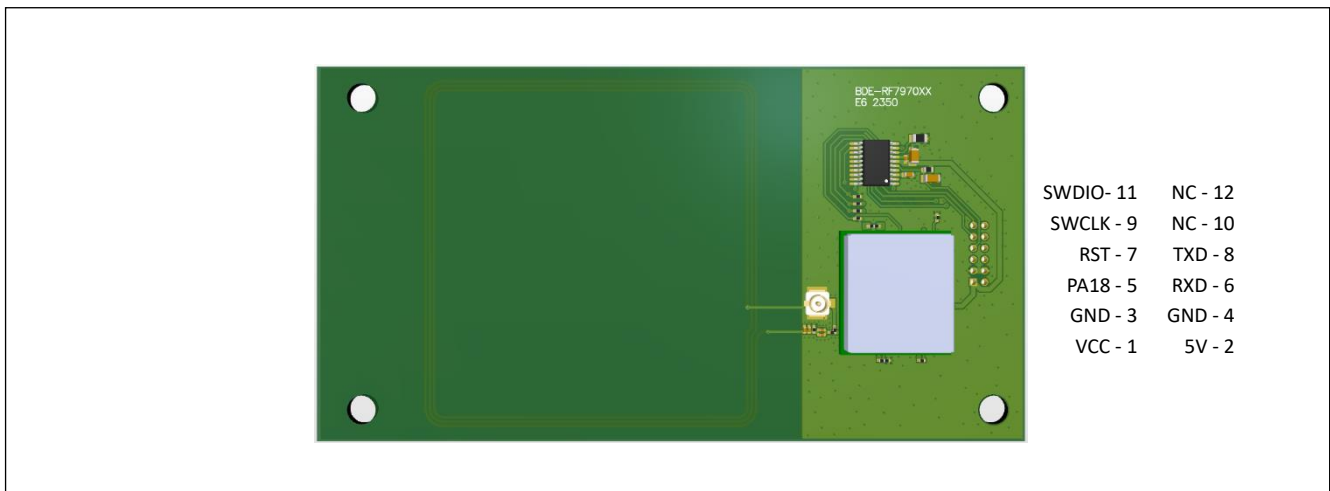|	
SWDIO- 11	NC - 12
SWCLK - 9	NC - 10
RST - 7	TXD - 8
PA18 - 5	RXD - 6
GND - 3	GND - 4
VCC - 1	5V - 2

Figure 2-2. Pin Diagram of BDE-RF7970A-1 (Top View)

2.2 Pin Attributes and Pin Multiplexing

Table 2-1. Pin Description of BDE-RF7970N

Module Pin #	Pin Name	Type	Description
1	GND	Ground	Power ground
2	IO2	I/O	GPIO
3	IO3	I/O	GPIO
4	SPI_SS/IO4	I/O	SPI_CS, GPIO
5	IO5	I/O	GPIO
6	SPI_MISO/IO6	I/O	SPI_MISO, GPIO
7	SPI_MOSI/IO7	I/O	SPI_MOSI, GPIO

Module Pin #	Pin Name	Type	Description
8	EN2	I	Selection of power down mode
9	GND	Ground	Power ground
10	SPI_CLK	I	SPI_CLK, Data clock input for MCU communication
11	SYS_CLK	O	If EN = 1 (EN2 = don't care) the system clock for MCU is configured; If EN = 0 and EN2 = 1, then system clock is set to 60 kHz
12	EN	I	Chip enable input
13	GND	Ground	Power ground
14	VCC	Power	Power supply input pin
15	GND	Ground	Power ground
16	GND	Ground	Power ground
17	GND	Ground	Power ground
18	GND	Ground	Power ground
19	VDD_X	Power	Internally regulated supply (2.7 V to 3.4 V) for digital circuit and external devices
20	GND	Ground	Power ground
21	GND	Ground	Power ground
22	GND	Ground	Power ground
23	RFOUT	O	RF Output
24	GND	Ground	Power ground
25	GND	Ground	Power ground
26	GND	Ground	Power ground
27	ASK_OOK	I/O	Selection between ASK and OOK modulation (0 = ASK, 1 = OOK)
28	IRQ	O	Interrupt request
29	MOD	I/O	External data modulation input for direct mode, Subcarrier digital data output
30	IO1	I/O	GPIO
31	GND	Ground	Power ground
32	GND	Ground	Power ground
33	GND	Ground	Power ground
34	GND	Ground	Power ground

Table 2-2. Pin Description of BDE-RF7970A-1

Module Pin #	Pin Name	Type	Description
1	VCC	Power	Power supply
2	5V	Power	5V power supply, leave NC if not used
3	GND	Ground	Power ground
4	GND	Ground	Power ground
5	PA18	I/O	Reserved I/O, PA18 in MCU, leave NC if not used
6	RXD	I	UART RXD
7	RST	I	Reset pin, active low
8	TXD	O	UART TXD
9	SWCLK	I	SWD input clock
10	NC	-	-
11	SWDIO	I/O	SWD data IO
12	NC	-	-

3. Specifications

3.1 Absolute Maximum Ratings

Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, so functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specification are not implied. Exposure to Absolute Maximum Rating conditions for extended periods may affect device reliability.

PARAMETER	MIN	MAX	UNIT	Notes
V_{DD}	-0.3	4.1	V	
RF pin	TBD	TBD	dBm	
Storage Temperature	-40	85	°C	

3.2 Recommended Operating Conditions

PARAMETER	MIN	MAX	UNIT	Notes
V_{DD}	2.7	3.6	V	
Operating Temperature	-40	85	°C	

3.3 ESD Ratings

		VALUE	UNIT
V (ESD) Electrostatic discharge	Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001[1]	±2000	V
	Charged device model (CDM), per ANSI/ESDA/JEDEC JS-002[2]	±500	

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.

(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

4. Mechanical Specifications

4.1 Mechanical Dimension

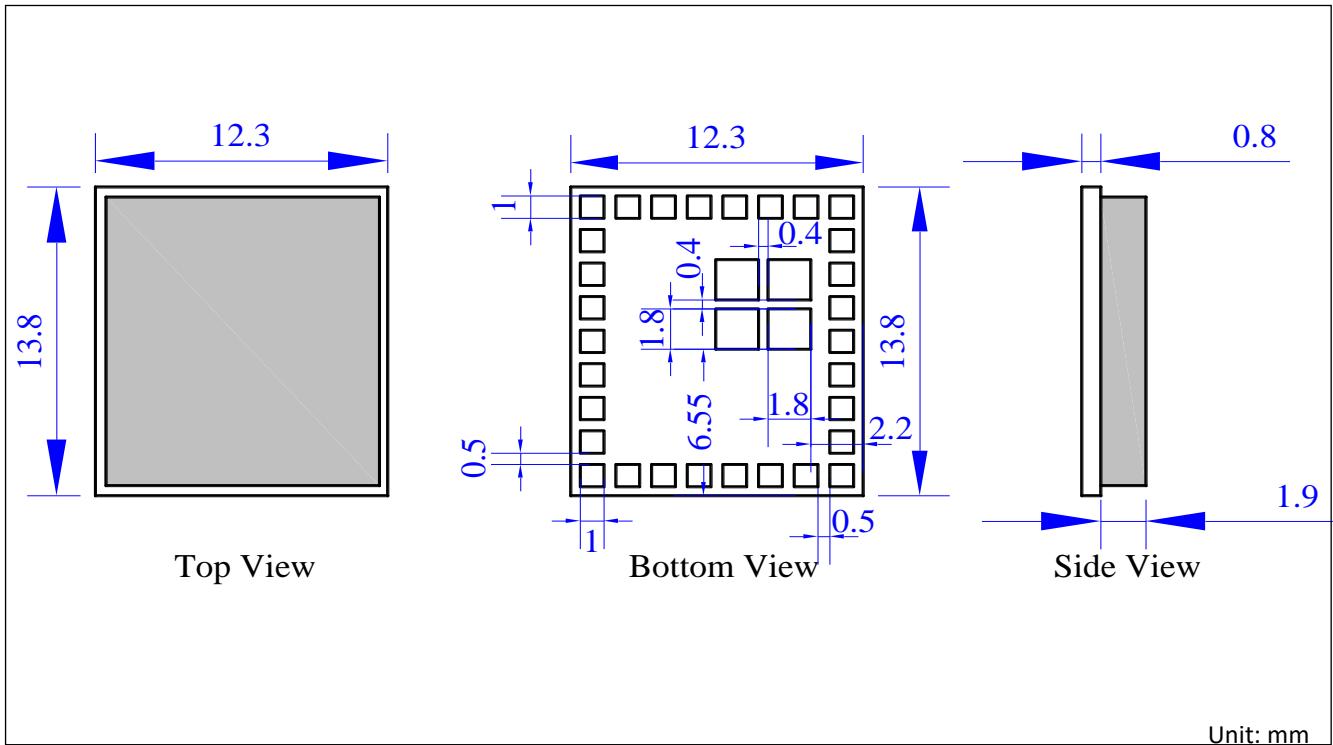Figure 5-1 and 5-2 shows the mechanical dimension of the module.

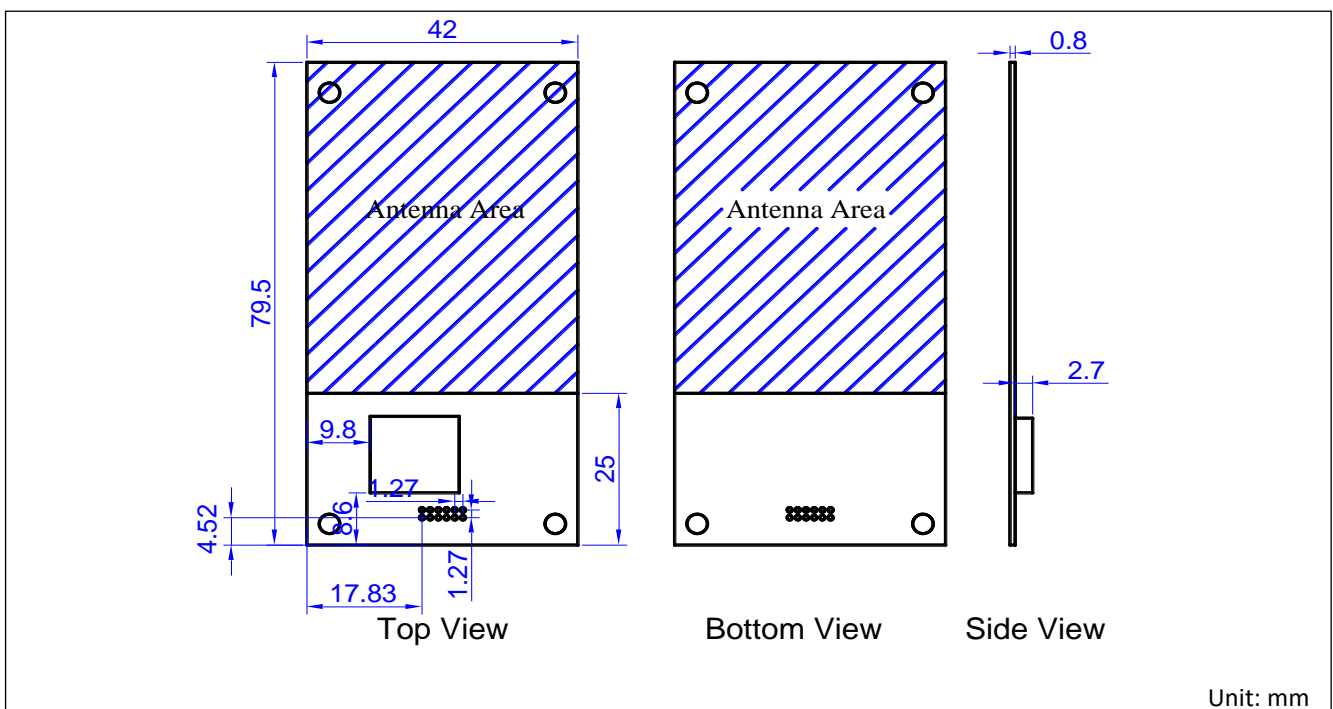**Figure 5-1. Mechanical Dimension of the BDE-RF7970N Module**

Figure 5-2. Mechanical Dimension of the BDE-RF7970A Module

4.2 Recommended Land Pattern

Figure 5-2 shows the recommended land pattern of the BDE-RF7970N module.
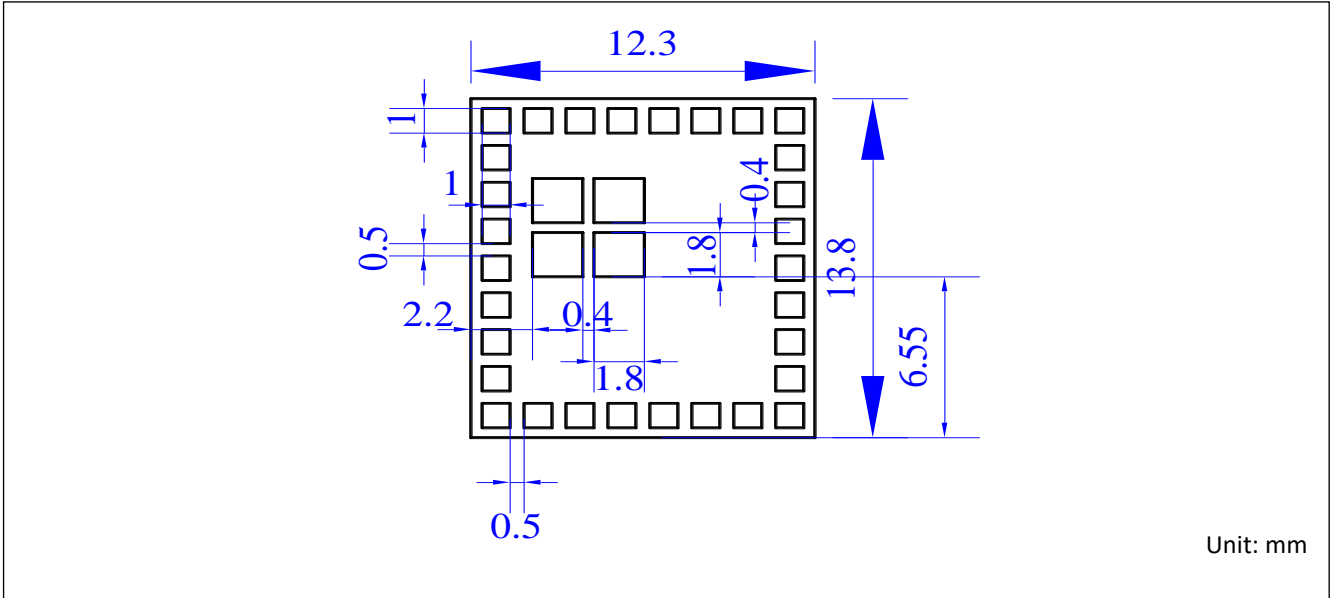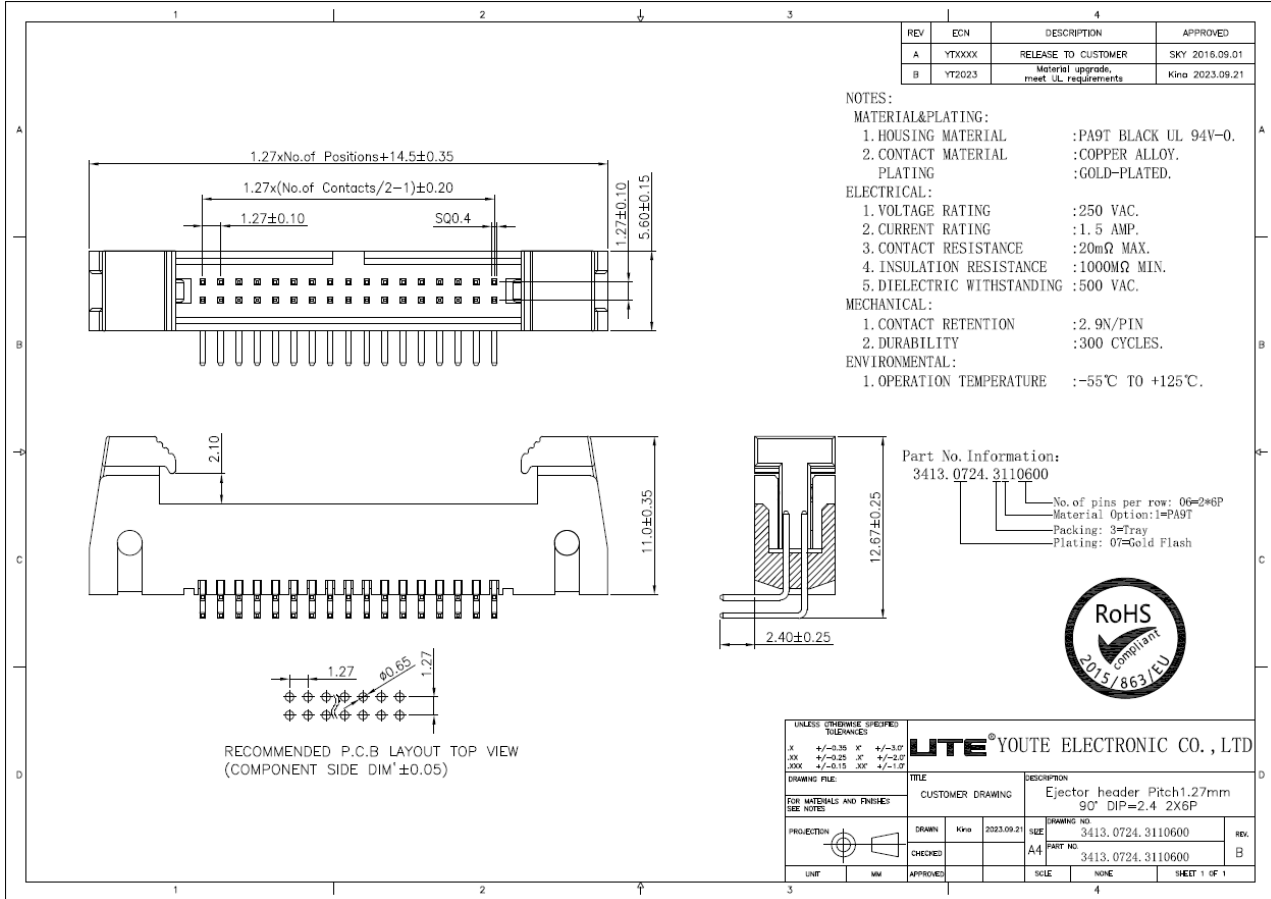

Unit: mm

Figure 5-2. Recommended Land Pattern

4.3 Recommended Ejector Header

Figure 5-3 shows the recommended and default ejector header of the BDE-RF7970A module.

5. Revision History

Revision	Date	Description
V0.1	6-March-2024	Preliminary, draft

FCC Warning

Integration instructions for host product manufacturers according to KDB 996369 D03 OEM Manual v01

2.2 List of applicable FCC rules

FCC Part 15.225

2.3 Specific operational use conditions

This transmitter/module and its antenna(s) must not be co-located or operating in conjunction with any transmitter. This information also extends to the host manufacturer's instruction manual.

2.4 Limited module procedures

Not applicable

2.5 Trace antenna designs

It is "not applicable" as trace antenna which is not used on the module.

2.6 RF exposure considerations

This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. The host product manufacturer would provide the above information to end users in their end-product manuals.

2.7 Antennas

Integrated PCB Antenna; 0dBi; 13.56-13.56MHz

2.8 Label and compliance information

The end product must carry a physical label or shall use e-labeling followed KDB784748D01 and KDB 784748 stating "Contains Transmitter Module FCC ID: 2ABRU-7970".

2.9 Information on test modes and additional testing requirements

For more information on testing, please contact the manufacturer.

2.10 Additional testing, Part 15 Subpart B disclaimer

The modular transmitter is only FCC authorized for the specific rule parts (FCC Part 15.225) listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. The final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed when contains digital circuity.

FCC Statements

(OEM) Integrator has to assure compliance of the entire end-product incl. the integrated RF Module. For 15 B (§15.107 and if applicable §15.109) compliance, the host manufacturer is required to show compliance with 15 while the module is installed and operating.

Furthermore the module should be transmitting and the evaluation should confirm that the module's intentional emissions (15C) are compliant (fundamental / out-of-band). Finally the integrator has to apply the appropriate equipment authorization (e.g. Verification) for the new host device per definition in §15.101.

Integrator is reminded to assure that these installation instructions will not be made available to the end-user of the final host device.

The final host device, into which this RF Module is integrated has to be labeled with an auxiliary label stating the FCC ID of the RF Module, such as "Contains FCC ID: 2ABRU-7970 ".

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.

Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

The Integrator will be responsible to satisfy SAR/ RF Exposure requirements, when the module integrated into the host device.

Module statement

The single-modular transmitter is a self-contained, physically delineated, component for which compliance can be demonstrated independent of the host operating conditions, and which complies with all eight requirements of § 15.212(a)(1) as summarized below.

1) The radio elements have the radio frequency circuitry shielded.
2) The module has buffered modulation/data inputs to ensure that the device will comply with Part 15 requirements with any type of input signal.
3) The module contains power supply regulation on the module.
4) The module contains a permanently attached antenna.
5) The module demonstrates compliance in a stand-alone configuration.
6) The module is labeled with its permanently affixed FCC ID label.
7) The module complies with all specific rules applicable to the transmitter, including all the conditions provided in the integration instructions by the grantee.
8) The module complies with RF exposure requirements.

NOTE: 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 or more 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

IC Statements

The final host device, into which this RF Module is integrated" has to be labeled with an auxiliary label stating the IC of the RF Module, such as" Contains transmitter module IC: 25657-7970".
Le périphérique hôte final, dans lequel ce module RF est intégré, doit être étiqueté avec une étiquette auxiliaire indiquant le CI du module RF, telle que "Contient le module émetteur IC: 25657-7970".

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:
(1) This device may not cause interference.
(2) This device must accept any interference, including interference that may cause undesired operation of the device.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique 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;
(2) L' appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d' en compromettre le fonctionnement.

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