

BoT-cDA110

DATASHEET

V 0.1.0

■ History

버전	배포일자	내역	작성자
0.0.1	2022. 01. 11	- First release	Enoch
0.1.0	2022. 02. 11	- minimum operating voltage change - RF Characteristic LE update	Enoch

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1. General

1.1. Overview

This specification covers Bluetooth module which complies with Bluetooth specification version 5.1 and integrates RF & Baseband controller in small package. This Module has deployed MCU with Bluetooth function included chipset.

All detailed specification including pin outs and electrical specification may be changed without notice.

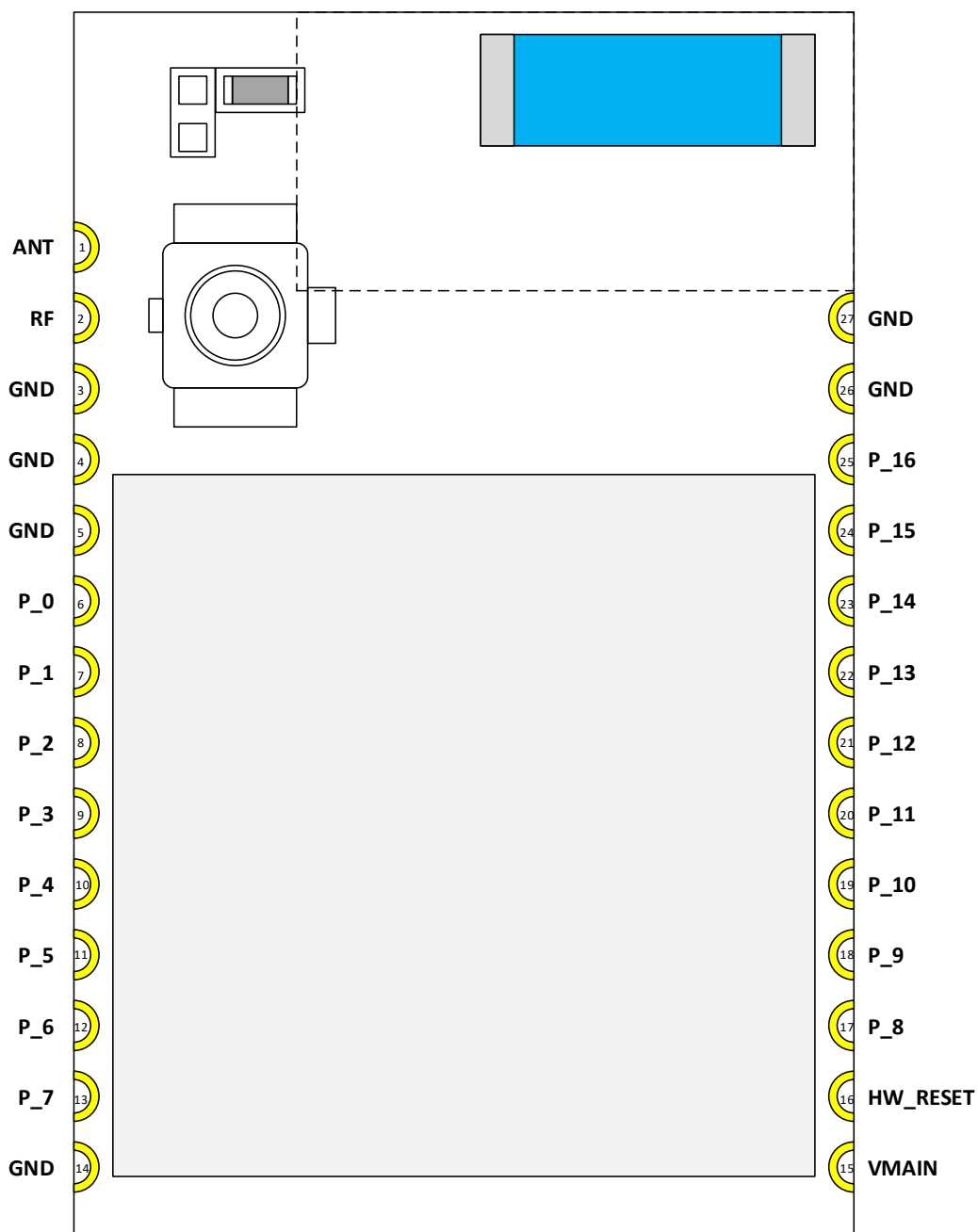
1.3. Feature

- Complies with Bluetooth Core Specification v5.1
- Supports Basic Rate (BR), Enhanced Data Rate (EDR) 2&3 Mbps, Bluetooth Low Energy
- TX RF Power 4dBm
- RX sensitivity -87dBm
- 96-MHz Arm Cortex-M4 microcontroller unit MCU
- 1MB Flash, 512KB RAM
- 1x peripheral UART
- Hardware security engine
- 16 GPIOs
- Wide operating voltage range: 3.0V to 3.6V
- Operating temperature range (MAX -30°C ~ 85°C)
- Competitive Size: 14mm x 22mm x 2.3mm: 27Pin

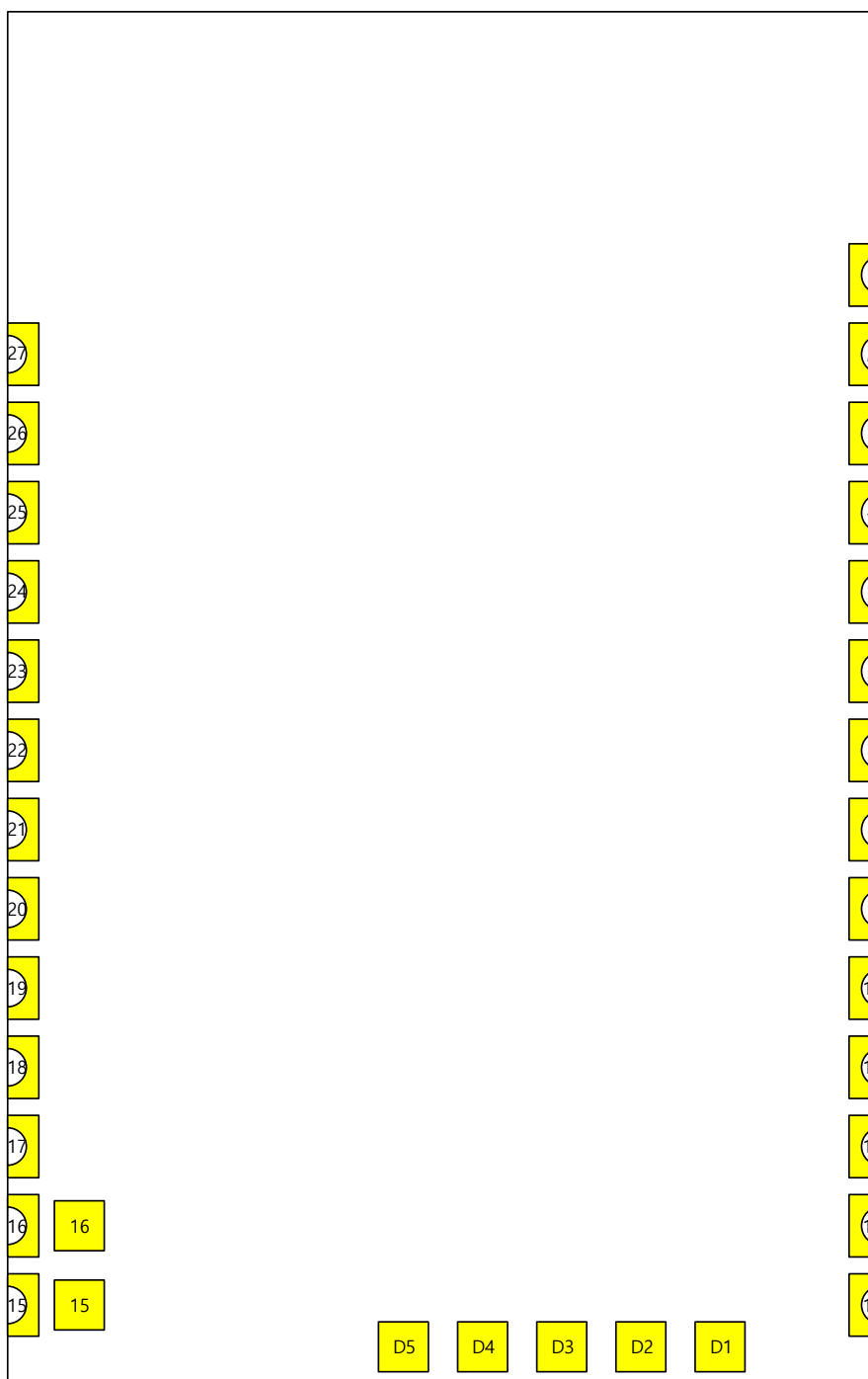
1.4. Applications

- Bluetooth data communication
- Laptop / Handheld Device
- Bluetooth access point
- Industrial automation
- Remote meter reading system
- POS / Mobile printer

1.5. Pin Configuration



< Pin configuration (Top view) >



< Bottom View >

1.6. Device Terminal Function

Pin No.	Pin Name	Pin Function	Description
1	ANT	Internal Antenna IN/OUT	Internal antenna. It should be connected to 2 Pin RF for using internal antenna.
2	RF	Radio In/out PORT	Bluetooth 50Ω Tx/Rx Port
6	P_0	Digital I/O	General purpose I/O pin.
7	P_1	Digital I/O	General purpose I/O pin.
8	P_2	Digital I/O	General purpose I/O pin.
9	P_3	Digital I/O	General purpose I/O pin.
	BT_MODE(T.B.D)	Digital Input	Bluetooth SPP Role select. ¹⁾
10	P_4	Digital I/O	General purpose I/O pin.
	AUTO CONNECTION	Digital Input	Auto connect to latest device. ¹⁾ Active High
11	P_5	Digital I/O	General purpose I/O pin.
	ADC_0	ADC Input	10bit DC voltage measurement. ¹⁾
12	P_6	Digital I/O	General purpose I/O pin.
	ADC_1	ADC Input	10bit DC voltage measurement. ¹⁾
13	P_7	Digital I/O	General purpose I/O pin.
	FACTORY RESET	Digital Input	DISCONNECT & FACTORY_RESET ¹⁾ Active High
17	P_8	Digital I/O	General purpose I/O pin.
	UART_RXD	Digital Input	UART Receive ¹⁾
18	P_9	Digital I/O	General purpose I/O pin.
	UART_TXD	Digital output	UART Transmit ¹⁾
19	P_10	Digital I/O	General purpose I/O pin.
	UART_RTS	Digital output	UART Request to Send ¹⁾
20	P_11	Digital I/O	General purpose I/O pin.
	UART_CTS	Digital Input	UART Clear to Send ¹⁾
21	P_12	Digital I/O	General purpose I/O pin.
	UART_DTR(T.B.D)	Digital output	UART Data Terminal Ready ¹⁾
22	P_13	Digital I/O	General purpose I/O pin.
	UART_DSR(T.B.D)	Digital Input	UART Data Set Ready ¹⁾
23	P_14	Digital I/O	General purpose I/O pin.
	BT STATUS	Digital output	BT Status indicator ^{1),2)}
24	P_15	Digital I/O	General purpose I/O pin.
25	P_16	Digital I/O	General purpose I/O pin.
15	VMAIN	Power	Power supply pin
16	HW_RESET	Hardware reset	Internal 470K ohm pull up resistor RC delay for power-on reset. Active low. ³⁾
D1-D5	Reserved	Only manufacture use	Not Connect. Do not tied ground, power, any I/O.
3,4,5,14,26,27	GND	Ground	Ground Pin.

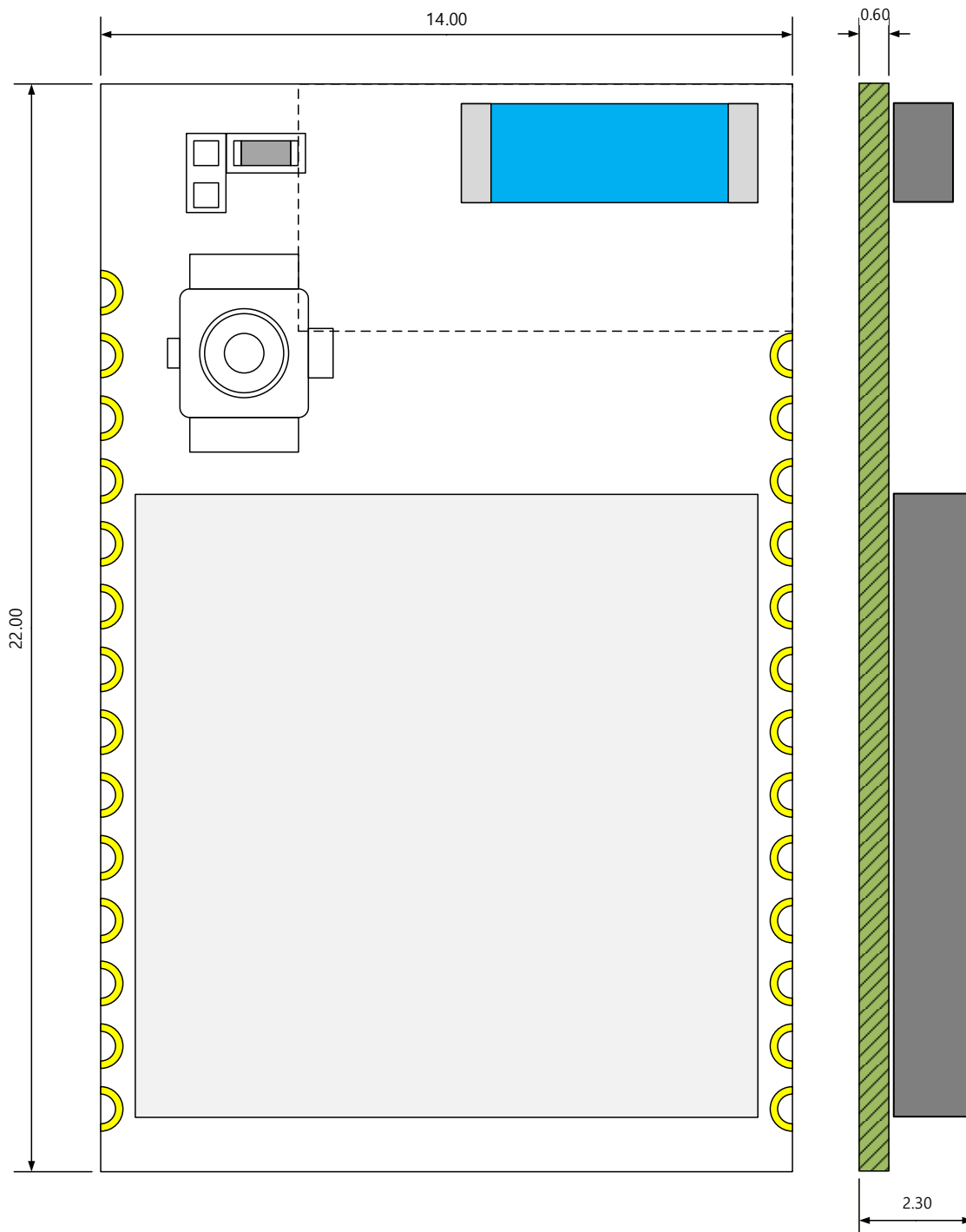
1) This I/O function operate on CHIPSEN commercial firmware.

2) For more information refer to CHIPSEN commercial firmware document.

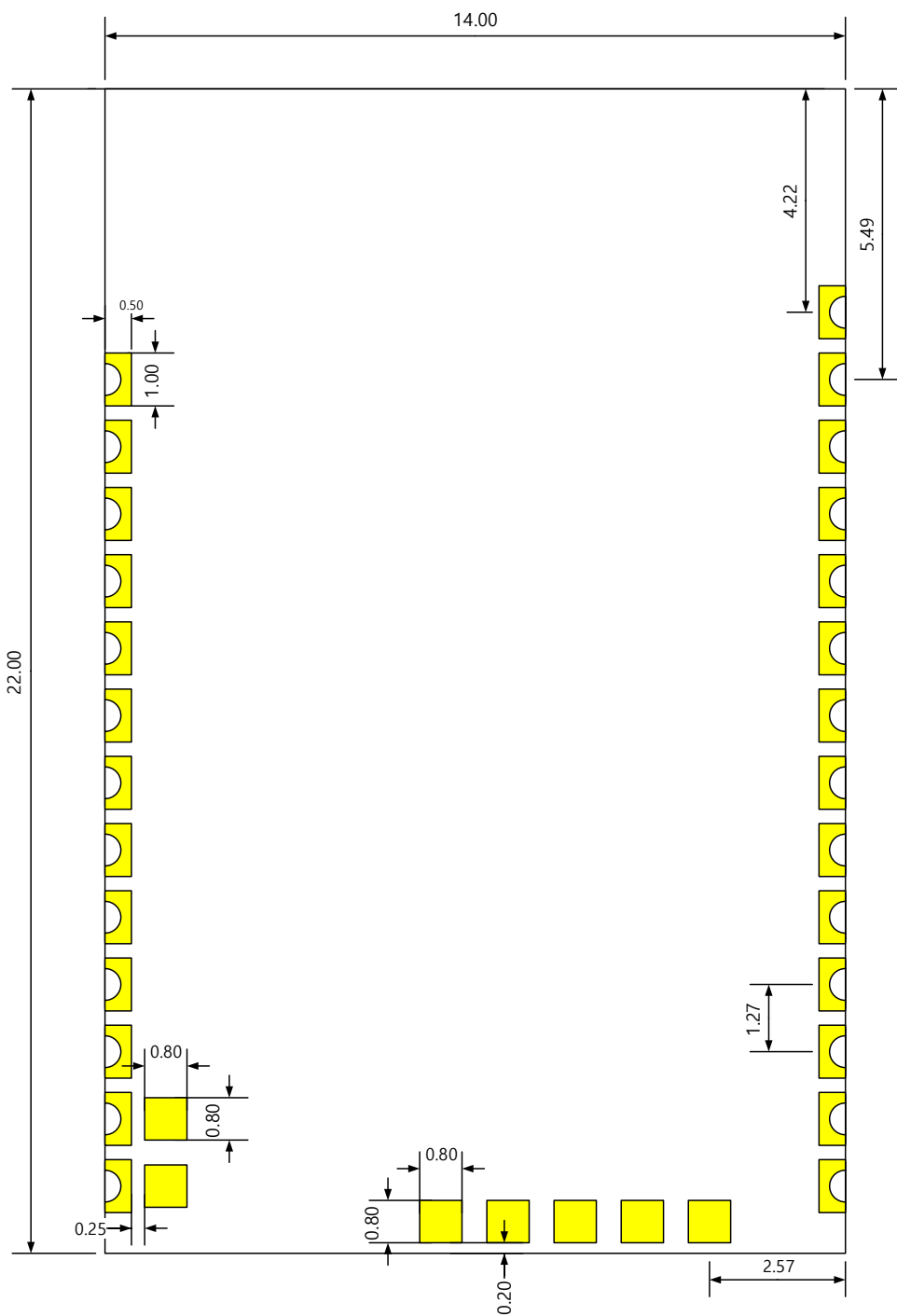
3) For more information refer to [3.2 EXTERNAL RESET](#) Content

1.7. Dimensions

- Unit: mm
- General Tolerances = $\pm 0.2\text{mm}$



<TOP View>

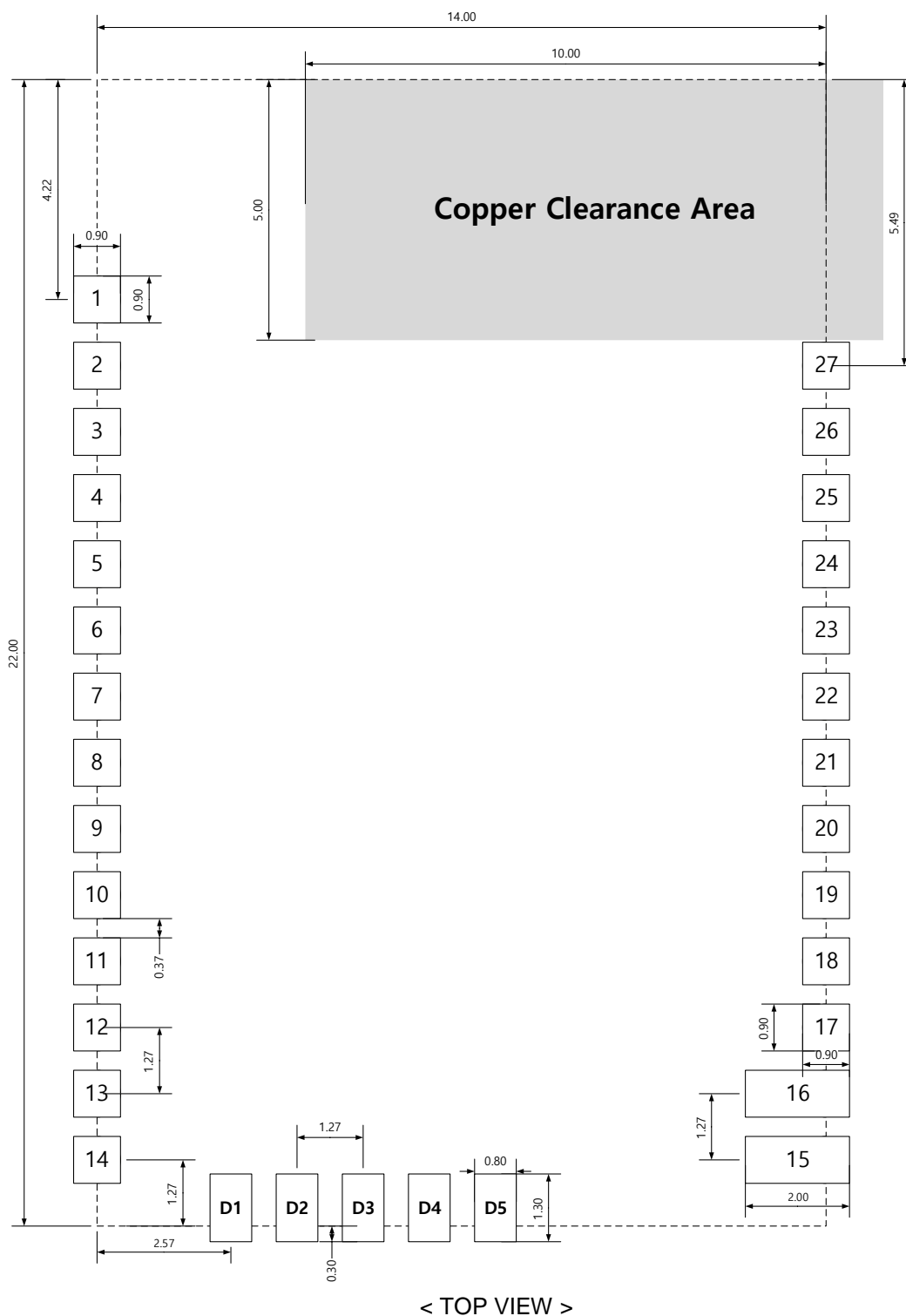


<Bottom View>

1.8. Land Pattern

■ Unit: mm

■ General Tolerances = ± 0.2 mm



2. Characteristics

2.1. Electrical Characteristics

■ Absolute Maximum Ratings

ITEM	Min	Typ	Max	Unit
Storage Temperature range	-40	-	150	°C
VMAIN	-	-	3.79	V

■ Recommended Operating Conditions

ITEM	Min	Typ	Max	Unit
Operating Temperature range	-30	20	85	°C
VMAIN	3.0	3.3	3.6	V

■ Digital I/O Characteristics

ITEM	Min	Typ	Max	Unit
Input low voltage (VMAIN = 3 V)	-	-	0.8	V
Input high voltage (VMAIN = 3 V)	2.4	-	-	V
Output low voltage	-	-	0.45	V
Output high voltage	VMAIN -0.45V	-	-	V

2.2. RF Characteristics (BR/EDR)

RF	Specification	Min	Typ	Max	Unit	
Transmit	Frequency range	2402	-	2480	MHz	
	Power (@ GFSK)	-	4	-	dBm	
	Adjacent Channel Power					
	$ M - N = 2$	-	-	-20	dBm	
	$ M - N \geq 3$	-	-	-40	dBm	
	Out-of-Band Spurious Emission					
	30 MHz to 1 GHz	-	-	-36	dBm	
	1.8 GHz to 1.9 GHz	-	-	-47	dBm	
	5.15 GHz to 5.3 GHz	-	-	-47	dBm	
	Frequency Drift					
	DH1	-25	-	25	KHz	
	DH3, DH5	-40	-	40	KHz	
	Drift Rate	-20	-	20	KHz/50us	
	Modulation Accuracy					
	p/4-DQPSK frequency stability	-10	-	10	KHz	
	p/4-DQPSK RMS DEVM	-	-	20	%	
	p/4-QPSK Peak DEVM	-	-	35	%	
	p/4-DQPSK 99% DEVM	-	-	30	%	
	8-DPSK frequency stability	-10	-	10	KHz	
	8-DPSK RMS DEVM	-	-	13	%	
	8-DPSK Peak DEVM	-	-	25	%	
	8-DPSK 99% DEVM	-	-	20	%	
	In-Band Spurious Emissions					
	$1.0 \text{ MHz} < M - N < 1.5 \text{ MHz}$	-	-	-26	dBm	
	$1.5 \text{ MHz} < M - N < 2.5 \text{ MHz}$	-	-	-20	dBm	
	$ M - N > 2.5 \text{ MHz}$	-	-	-40	dBm	
	Receiver	RX sensitivity, Dirty Tx is OFF				
GFSK, 0.1% BER, 1 Mbps		-	-	-88	dBm	
$\pi/4$ -DQPSK, 0.01% BER, 2 Mbps		-	-	-90	dBm	
8-DPSK, 0.01% BER, 3 Mbps		-	-	-84	dBm	

2.3. RF Characteristics (LE)

RF	Specification	Min	Typ	Max	Unit
Transmit	Frequency range	2402	-	2480	MHz
	Power (@ GFSK)	-	4	-	dBm
	Modulation Characteristics				
	Delta F1 average	225	255	275	KHz
	Delta F2 max	99.9			%
	Ratio	0.8	0.95		%
Receiver	RX sensitivity, Dirty Tx is OFF				
	LE GFSK, 0.1% BER, 1 Mbps	-	-	-92	dBm

3. Terminal Description

3.1. Power Connection (VMAIN)

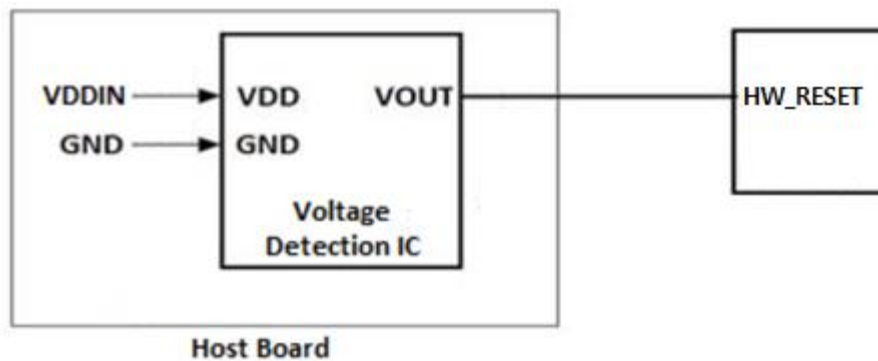
The BoT-cDA110 contains one power supply connection, VDD. VDD accepts a supply input of 2.7 V to 3.6 V. The maximum power supply ripple for this power connection is 100 mV.

Considerations and Optional Components for Brownout (BO) Conditions

Power supply design must be completed to ensure that the BoT-cDA110 module does not encounter a Brownout condition, which can lead to unexpected functionality, or module lock up. A Brownout condition may be met if power supply provided to the module during power up or reset is in the range shown below: $V_{IL} \leq VDD \leq V_{IH}$. Refer to "2.1 Digital IO Characteristics"

System design should ensure that the condition above is not encountered when power is removed from the system. In the event that this cannot be guaranteed (i.e. battery installation, high value power capacitors with slow discharge), it is recommended that an external voltage detection device be used to prevent the Brownout voltage range from occurring during power removal.

Refer to the recommended circuit design when using an external voltage detection IC.



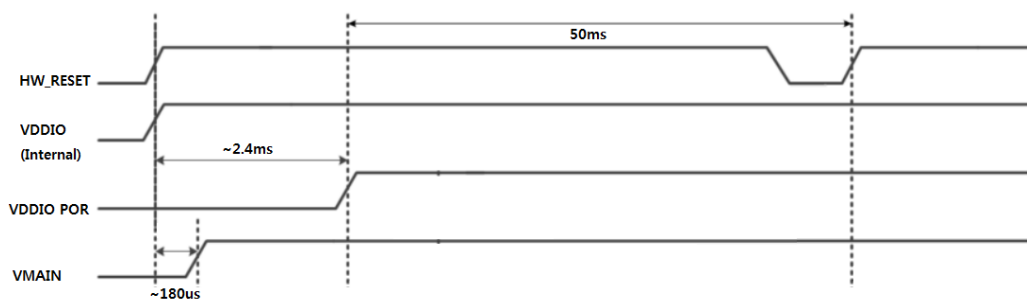
< Reference Circuit Block Diagram for External Voltage Detection IC >

In the event that the module does encounter a Brownout condition, and is operating erratically or not responsive, power cycling the module will correct this issue and once reset, the module should operate correctly. Brownout conditions can potentially cause issues that cannot be corrected, but in general, a power-on-reset operation will correct a Brownout condition.

3.2. External Reset (HW_RESET)

The BoT-cDA110 has an integrated power-on reset circuit which completely resets all circuits to a known power-on state. This action can also be invoked by an external reset signal, forcing it into a power-on reset state. HW_RESET is an active-low input signal on the BoT-cDA110 module (solder pad 16). The BoT-cDA110 does not require external pull-up resistors on the HW_RESET input. Refer to Figure "Reset Timing" for HW_RESET operating and timing requirements during power on events. During power on operation, the HW_RESET connection to the BoT-cDA110 is required to be held low 50ms after the VDD power supply input to the module is stable. This can be accomplished in the following ways:

- The host device can connect a GPIO to the HW_RESET of BoT-cDA110 module and pull HW_RESET low until VDD is stable. HW_RESET is recommended to be released 50 ms after VDD is stable.
- If the HW_RESET connection of the BoT-cDA110 module is not used in the application, should be not connected to the HW_RESET solder pad of the BoT-cDA110 in order to delay the HW_RESET release by internal RC delay circuit. Internal RC delay time may differ depending on the VDD power supply ramp time of the system. The RC delay time should result in an HW_RESET release timing of at least 50 ms after VDD stability.
- The HW_RESET release timing may be controlled by a external voltage detection IC. HW_RESET should be released 50 ms after VDD is stable



<RESET Timing>

3.3. UART Interface

This is a standard UART interface for communicating with other serial devices.

BoT-cDA110 UART interface provides a simple mechanism for communicating with other serial devices using the RS-232 protocol.

When BoT-cDA110 is connected to another digital device, UART_RX and UART_TX transfer data between the 2 devices. The remaining 2 signals, UART_CTS and UART_RTS, implement optional RS232 hardware flow control where both are active low indicators.

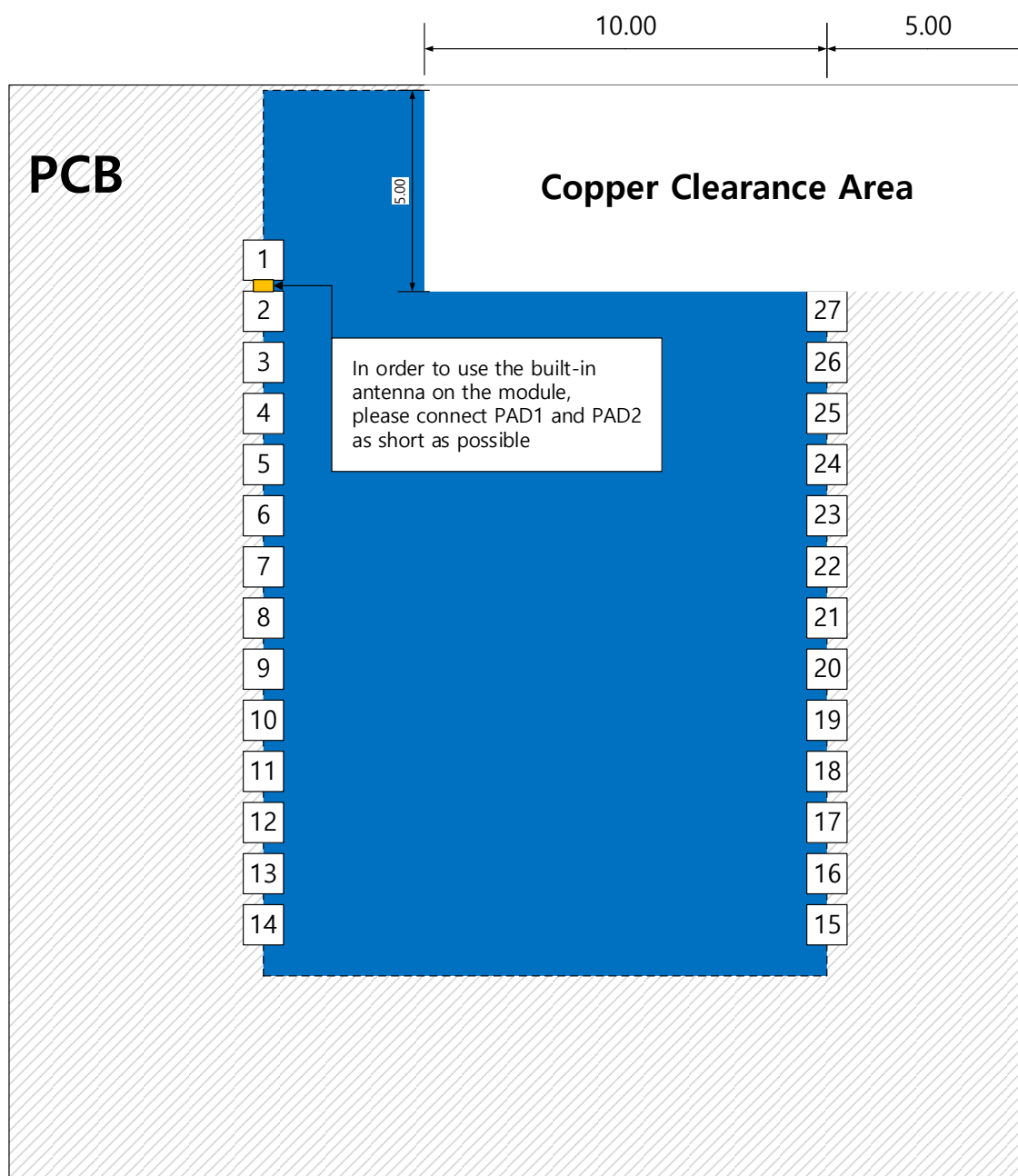
UART configuration parameters, such as baud rate and packet format, are set using BoT-cDA110 firmware.

Configuration Parameters	Supported Value
Data Length	8 bit
Flow Control	Hardware RTS/CTS None
Parity	Even Odd None
Number of stop bit	1 or 2
Baud rate	1200 2400 4800 9600 19200 38400 57600 76800 115200 230400 460800

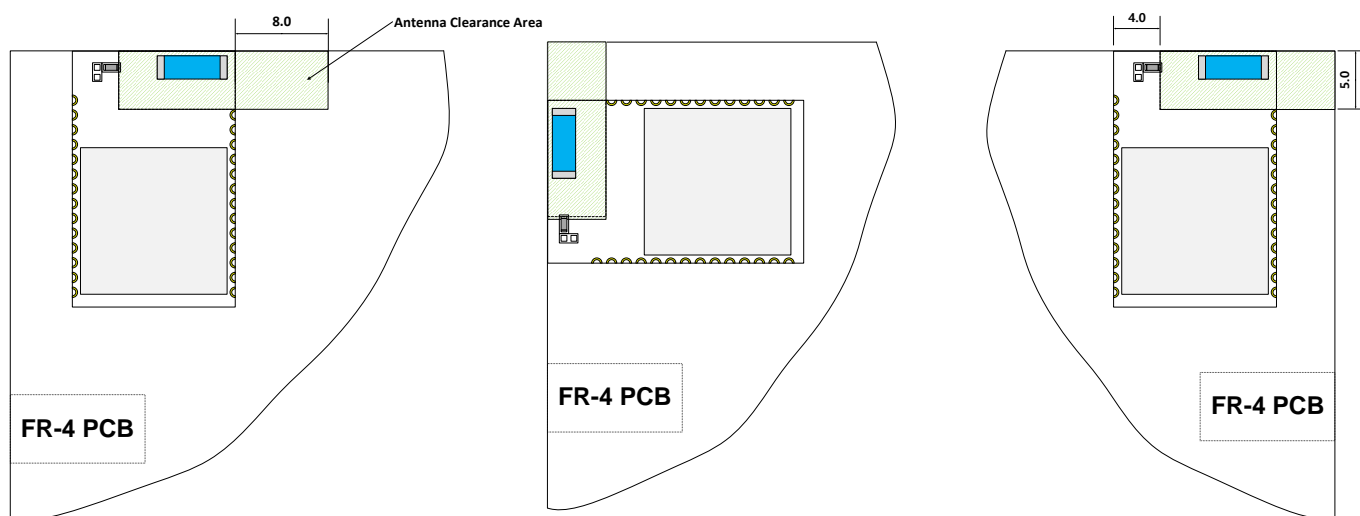
<UART Configuration List>

4. Internal Antenna

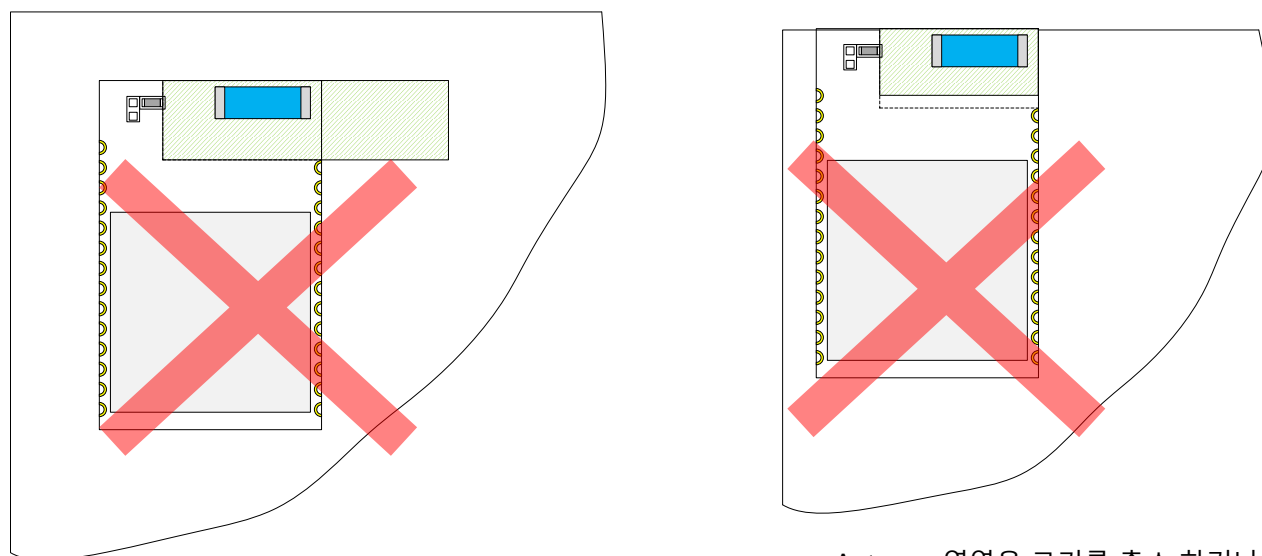
4.1. Antenna Layout Guide



4.2. Recommended Module Mounting



Recommended Module Mounting Example



Antenna 영역을 GND가 둘러싸고 있는 형태

Antenna 영역을 크기를 축소 하거나
Antenna 영역에 GND가 겹치는 형태

Wrong Module mounting Example

5. Reflow Temperature profile

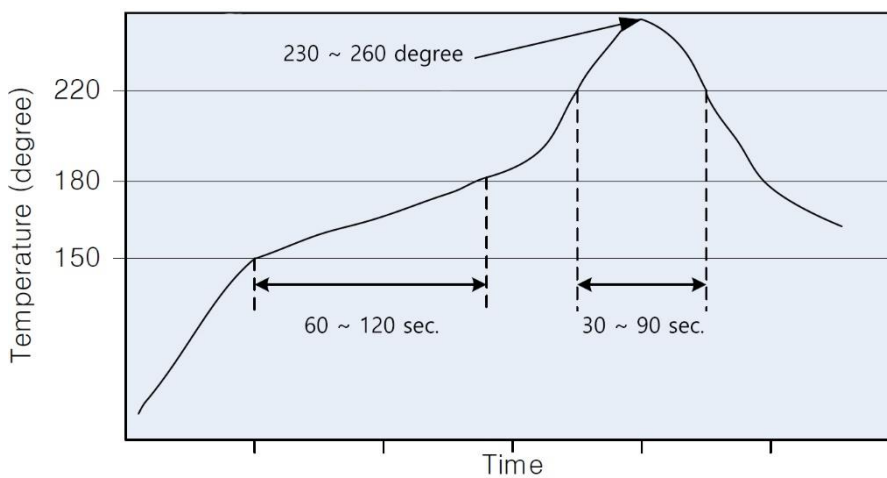
Recommended solder reflow profile are shown in below and follow the lead-free profile I accordance with JEDEC Std. 20C.

Table lists the critical reflow temperatures.

Flux residue remaining from board assembly can contribute to electrochemical migration over time.

This depends on number of factors, including flux type, amount of flux residue remaining after reflow, and stress conditions during product use, such as temperature, humidity, and potential difference between pins.

Care should be taken in selecting production board/module assembly processes and materials, taking into account these factors.



Process Step	Lead-Free Solder
Ramp rate	3°C/sec
Preheat	Max. 150°C to 180°C, 60 to 180 sec
Time above liquidus	+220°C 30 to 90 sec
Peak temperature	+255°C ±5°C
Time within 5°C of peak temperature	10 to 20 sec
Ramp-down rate	6°C/sec max

WARNING: For BoT-cDA110.

If you have reflow process multiple times in your product, you must be proceed this module in the final reflow process. If not the Shield can will drop out if shield-can adopted.

FCC MODULAR APPROVAL INFORMATION EXAMPLES for Manual

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.
- (2) This device must accept any interference received, including interference that may cause undesired operation.

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

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.

FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

OEM INTEGRATION INSTRUCTIONS:

This device is intended only for OEM integrators under the following conditions:

The module must be installed in the host equipment such that 20 cm is maintained between the antenna and users, and the transmitter module may not be co-located with any other transmitter or antenna. The module shall be only used with the internal on-board antenna that has been originally tested and certified with this module. External antennas are not supported. As long as these 3 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 (for example, digital device emissions, PC peripheral requirements, etc.). The end-product may need Verification testing, Declaration of Conformity testing, a Permissive Class II Change or new Certification. Please involve a FCC certification specialist in order to determine what will be exactly applicable for the end-product.

Validity of using the module certification:

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization for this module in combination with the host equipment is no longer considered valid and the FCC ID of the module cannot 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. In such cases, please involve a FCC certification specialist in order to determine if a Permissive Class II Change or new Certification is required.

Upgrade Firmware:

The software provided for firmware upgrade will not be capable to affect any RF parameters as certified for the FCC for this module, in order to prevent compliance issues.

End product labeling:

This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following: "Contains FCC ID:2APB6-BOT-CDA110" .

Information that must be placed in the end user manual:

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.

WARNING

Changes or modifications not expressly approved by the manufacturer could void the user' s authority to operate the equipment.

“CAUTION : Exposure to Radio Frequency Radiation.

Antenna shall be mounted in such a manner to minimize the potential for human contact during normal operation. The antenna should not be contacted during operation to avoid the possibility of exceeding the FCC radio frequency exposure limit.

Requirement per KDB996369 D03

2.2 List of applicable FCC rules

List the FCC rules that are applicable to the modular transmitter. These are the rules that specifically establish the bands of operation, the power, spurious emissions, and operating fundamental frequencies. DO NOT list compliance to unintentional–radiator rules (Part 15 Subpart B) since that is not a condition of a module grant that is extended to a host manufacturer. See also Section 2.10 below concerning the need to notify host manufacturers that further testing is required.³

Explanation: This module meets the requirements of FCC part 15C(15.247).

2.3 Summarize the specific operational use conditions

Describe use conditions that are applicable to the modular transmitter, including for example any limits on antennas, etc. For example, if point–to–point antennas are used that require reduction in power or compensation for cable loss, then this information must be in the instructions. If the use condition limitations extend to professional users, then instructions must state that this information also extends to the host manufacturer’ s instruction manual. In addition, certain information may also be needed, such as peak gain per frequency band and minimum gain, specifically for master devices in 5 GHz DFS bands.

Explanation: The EUT has a Chip Antenna , and the antenna use a permanently attached antenna which is not replaceable.

2.4 Limited module procedures

If a modular transmitter is approved as a “limited module,” then the module manufacturer is responsible for approving the host environment that the limited module is used with. The manufacturer of a limited module must describe, both in the filing and in the installation instructions, the alternative means that the limited module manufacturer uses to verify that the host meets the necessary requirements to satisfy the module limiting conditions.

A limited module manufacturer has the flexibility to define its alternative method to address the conditions that limit the initial approval, such as: shielding, minimum signaling amplitude, buffered modulation/data inputs, or power supply regulation. The alternative method could include that the limited module manufacturer reviews detailed test data or host designs prior to giving the host manufacturer approval.

This limited module procedure is also applicable for RF exposure evaluation when it is necessary to

demonstrate compliance in a specific host. The module manufacturer must state how control of the product into which the modular transmitter will be installed will be maintained such that full compliance of the product is always ensured. For additional hosts other than the specific host originally granted with a limited module, a Class II permissive change is required on the module grant to register the additional host as a specific host also approved with the module.

Explanation: The Module is not a limited module.

2.5 Trace antenna designs

For a modular transmitter with trace antenna designs, see the guidance in Question 11 of KDB Publication 996369 D02 FAQ - Modules for Micro-Strip Antennas and traces. The integration information shall include for the TCB review the integration instructions for the following aspects:

layout of trace design, parts list (BOM), antenna, connectors, and isolation requirements.

a) Information that includes permitted variances (e.g., trace boundary limits, thickness, length, width, shape(s),

dielectric constant, and impedance as applicable for each type of antenna);

b) Each design shall be considered a different type (e.g., antenna length in multiple(s) of frequency,

the wavelength, and antenna shape (traces in phase) can affect antenna gain and must be considered);

c) The parameters shall be provided in a manner permitting host manufacturers to design the printed circuit (PC) board layout;

d) Appropriate parts by manufacturer and specifications;

e) Test procedures for design verification; and

f) Production test procedures for ensuring compliance.

The module grantee shall provide a notice that any deviation(s) from the defined parameters of the antenna trace, as described by the instructions, require that the host product manufacturer must notify the module grantee that they wish to change the antenna trace design. In this case, a Class II permissive change application is required to be filed by the grantee, or the host manufacturer can take responsibility through the change in FCC ID (new application) procedure followed by a Class II permissive change application.

Explanation: Yes, The module with trace antenna designs, and This manual has been shown the layout

of trace design, antenna, connectors, and isolation requirements.

2.6 RF exposure considerations

It is essential for module grantees to clearly and explicitly state the RF exposure conditions that permit a host product manufacturer to use the module. Two types of instructions are required for RF exposure information: (1) to the host product manufacturer, to define the application conditions (mobile, portable - xx cm from a person's body); and (2) additional text needed for the host product manufacturer to provide to end users in their end-product manuals. If RF exposure statements and use conditions are not provided, then the host product manufacturer is required to take responsibility of the module through a change in FCC ID (new application).

Explanation: This module complies with FCC RF radiation exposure limits set forth for an uncontrolled

environment, This equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body." This module is designed to comply with the FCC statement, FCC ID:2APB6-BOT-CDA110

2.7 Antennas

A list of antennas included in the application for certification must be provided in the instructions. For modular transmitters approved as limited modules, all applicable professional installer instructions must be included as part of the information to the host product manufacturer. The antenna list shall also identify the antenna types (monopole, PIFA, dipole, etc. (note that for example an “omni-directional antenna” is not considered to be a specific “antenna type”)).

For situations where the host product manufacturer is responsible for an external connector, for example with an RF pin and antenna trace design, the integration instructions shall inform the installer that unique antenna connector must be used on the Part 15 authorized transmitters used in the host product. The module manufacturers shall provide a list of acceptable unique connectors.

Explanation: The EUT has a Chip Antenna, and the antenna use a permanently attached antenna

which is unique.

2.8 Label and compliance information

Grantees are responsible for the continued compliance of their modules to the FCC rules. This includes advising host product manufacturers that they need to provide a physical or e-label stating “Contains FCC ID” with their finished product. See Guidelines for Labeling and User Information for RF Devices - KDB Publication 784748.

Explanation: The host system using this module, should have label in a visible area indicated the

following texts: "Contains FCC ID:2APB6-BOT-CDA110.

2.9 Information on test modes and additional testing requirements⁵

Additional guidance for testing host products is given in KDB Publication 996369 D04 Module Integration Guide. Test modes should take into consideration different operational conditions for a stand-alone modular transmitter in a host, as well as for multiple simultaneously transmitting modules or other transmitters in a host product.

The grantee should provide information on how to configure test modes for host product evaluation for different operational conditions for a stand-alone modular transmitter in a host, versus with multiple, simultaneously transmitting modules or other transmitters in a host.

Grantees can increase the utility of their modular transmitters by providing special means, modes, or

instructions that simulates or characterizes a connection by enabling a transmitter. This can greatly simplify a host manufacturer’s determination that a module as installed in a host complies with FCC requirements.

Explanation: Top band can increase the utility of our modular transmitters by providing instructions that simulates or characterizes a connection by enabling a transmitter.

2.10 Additional testing, Part 15 Subpart B disclaimer

The grantee should include a statement that the modular transmitter is only FCC authorized for the specific rule parts (i.e., FCC transmitter rules) 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. If the grantee markets their product as being Part 15 Subpart B compliant (when it also contains unintentional-radiator digital circuitry), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

Explanation: The module without unintentional-radiator digital circuitry, so the module does not

require an evaluation by FCC Part 15 Subpart B. The host should be evaluated by the FCC Subpart B.

6. Application Schematic

- All Reference application schematic art attached next page.