Datasheet

DCU150

Version 1.2

Revision History

Revision	Date	Change Description
1.0	Apr-2021	Preliminary version
1.1	Jul-2023	Updated Module Picture & Ref-design
1.2	Jun-2024	Updated with FCC Certification

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1. Introduction

DCU150 is based on NXP Trimension™ SR150 UWB IC, with 3 Pcb Antennas embedded, power management, clock control, filters and peripheral components. With DCU 150 there is no RF design required.

DCU150 module is a switch-less 2D AoA solution without extra-antenna overhead, no phase/amplitude skew, no SPST insertion loss and low-cost design.

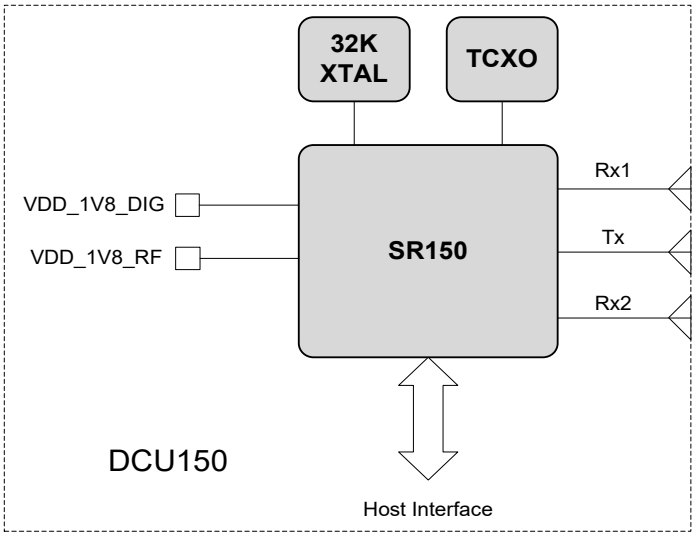
1.1. Key Features

Name	DCU150
Antenna Type	Onboard
Size	27mm * 27.2mm * 1.5mm
Communication Interface	SPI
Main Chip	SR150
Channel	5, 9
Frequency range	6.5GHz,8.00GHz
Supply Voltage	1.71V ~ 1.98V
Max Output Power (EIRP)	14.1dBm @ CH9
Ranging Mode	2D Ranging

1.2. Applications

The perfect ANCHOR for High Precision RTLS (AoA), Industrial, Smart Home & Consumer applications. Smart Home Devices (Point & Trigger), Access Control (Physical and Logical) and Secure payments.

1.3. Block Diagram



2. Electrical characteristics

2.1. Recommended operating conditions

When the input voltage of the module is lower than the rated operating voltage, the operation will be unstable. Input voltage higher than the maximum rating will cause permanent damage to the module. At the same time, working under the maximum rating for a long time also affects the stability of the module.

Parameter	Min	Type	Max	Unit	Conditions/Notes
Operating Temperature	-30		+85	˚C	
Supply Voltage	1.71	1.8	1.98	V	
HIGH level input voltage (V_{IH})	1.26	1.8	2.3	V	
LOW level input voltage (V_{IL})	-0.6	-	0.54	V	
HIGH level output voltage (V_{OH})	1.4	-	1.8	V	
LOW level output voltage (V_{OL})	-	-	0.2	V	

2.2. RF characteristics

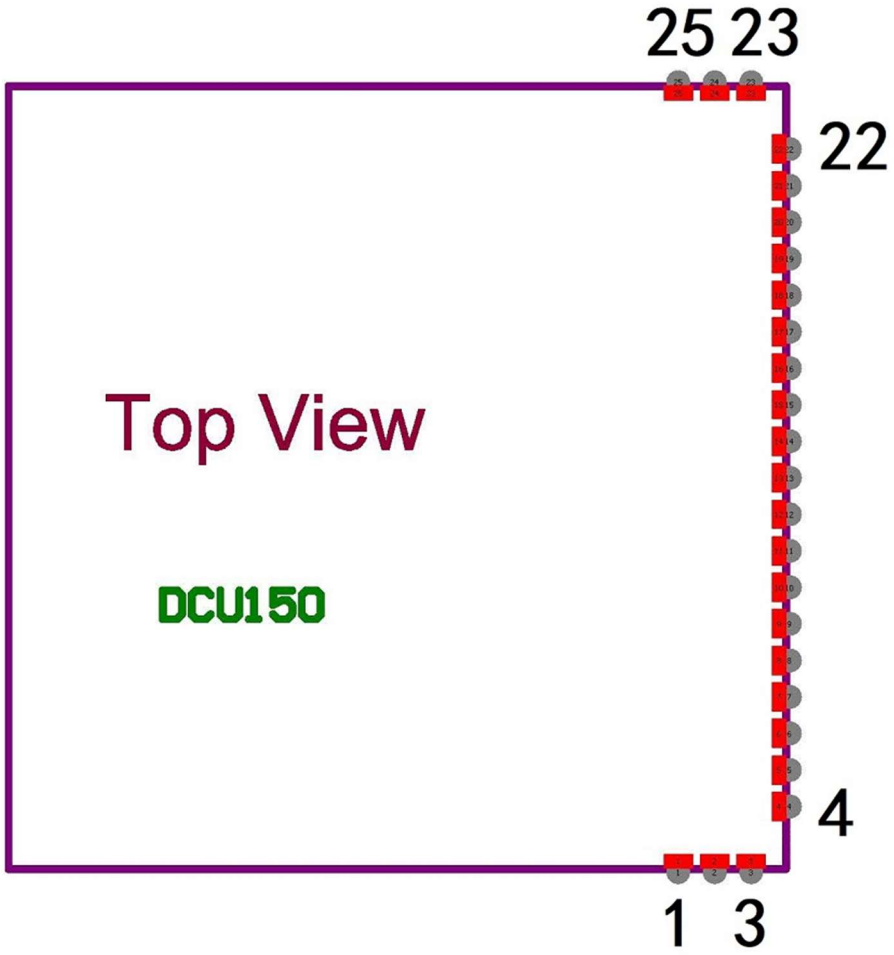
Parameter		Min	Type	Max	Unit	Conditions/Notes
Frequency range		6240		8240	MHz	Channel 5 and 9
Channel bandwidth			500		MHz	
Power level range			32		dB	
Power level step			0.25		dB	
Rx Sensitivity (±10ppm carrier Offset)	Channel 5			-91.9	dBm	64 preamble, 6.8Mbps data rate
	Channel 9			-90	dBm	64 preamble, 6.8Mbps data rate

2.3. Antenna information

Antenna Type	PCB Embedded
Antenna Polarization	Linear
Peak directivity	5.3dBi @CH5 5.8dBi @CH9
Frequency range	6.50 , 8.0GHz

3. Module package

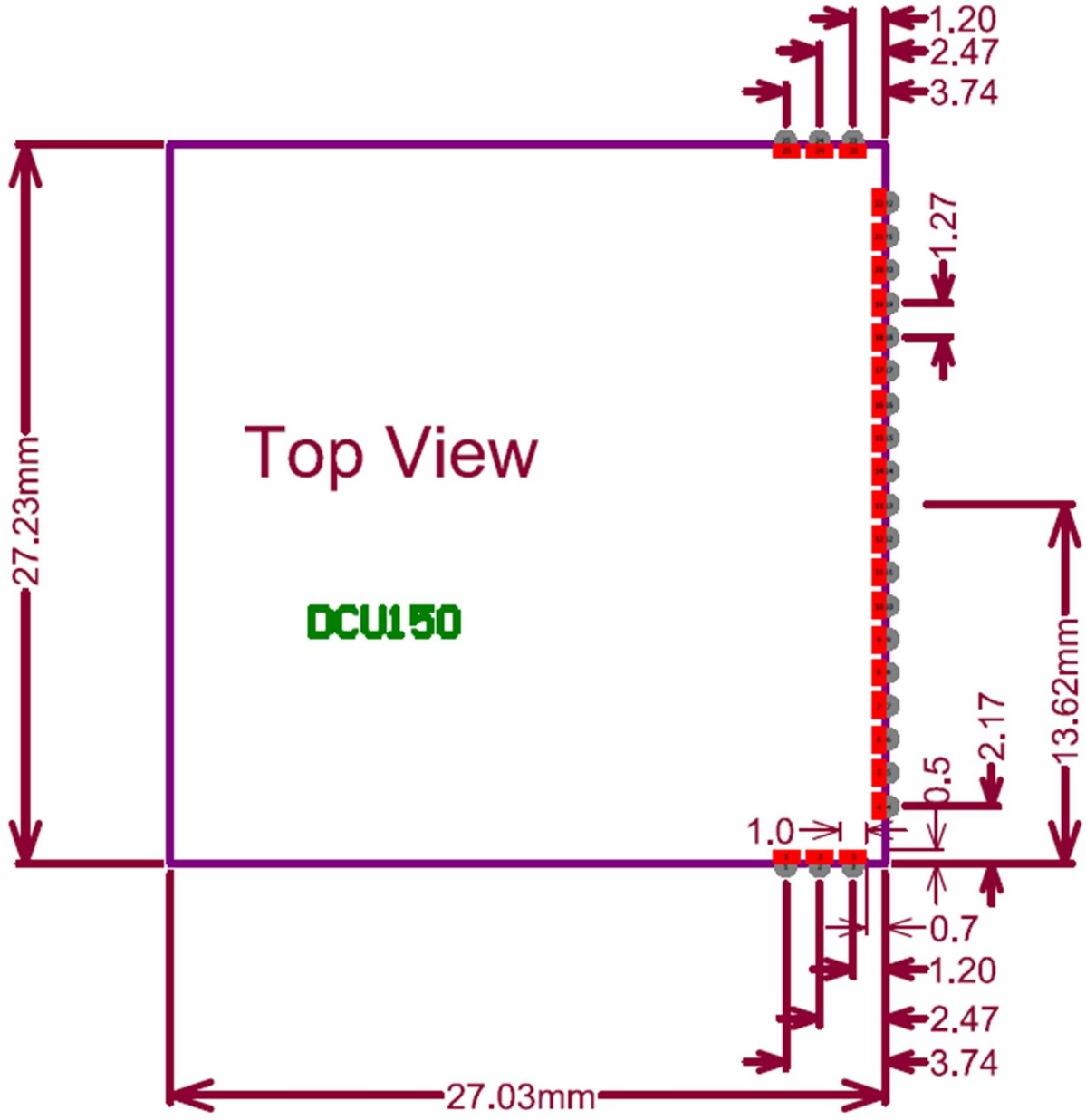
3.1. Pinout Description



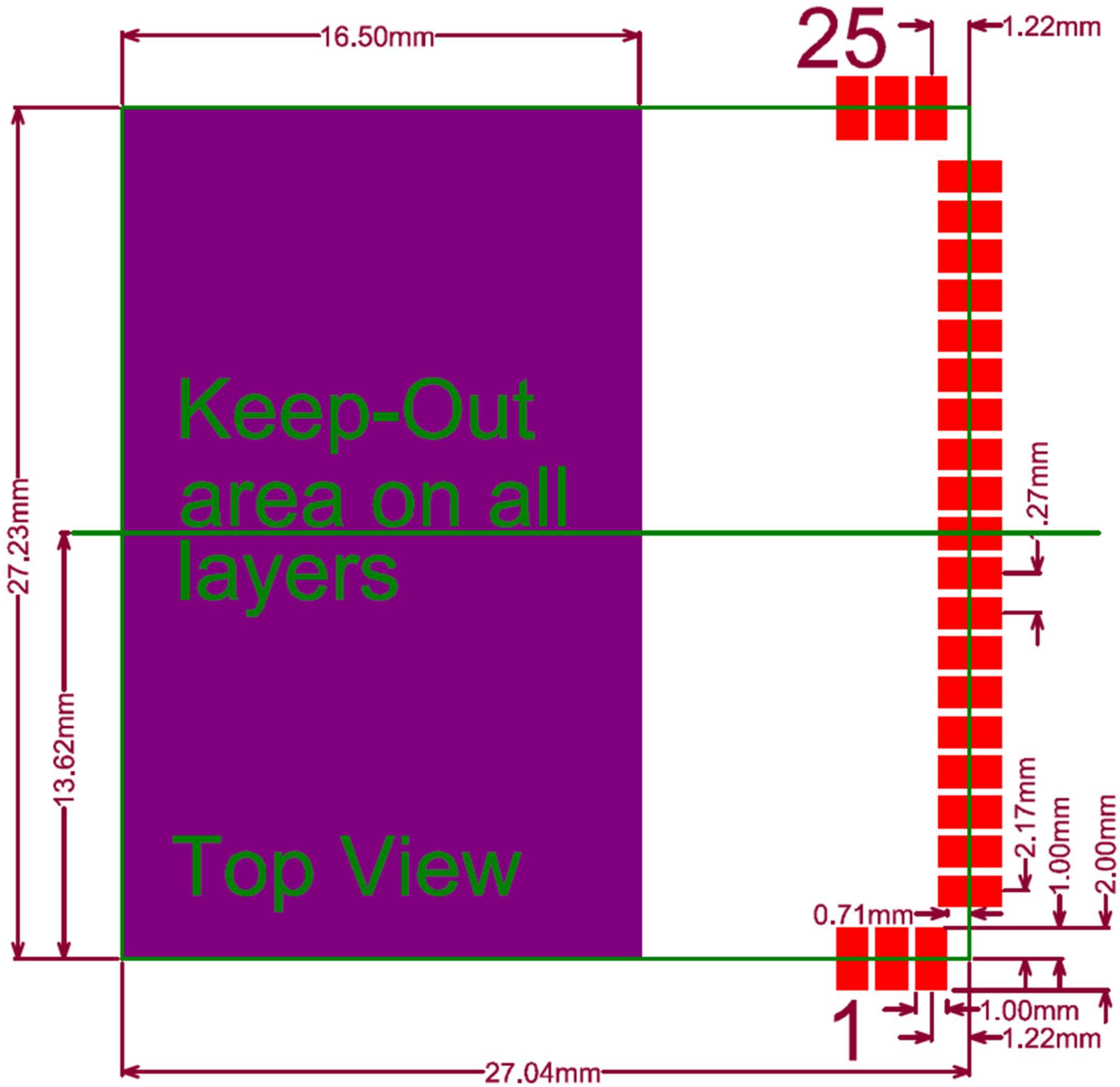
3.2. Pin Description Box

Pin	Pin Name	Pin Type	Description
1	COEX1	I/O	Default customer configuration as secondary I2C-bus clock line I2C_SCL, alternative configuration as secondary UART RX line, switching time is 125ns
2	GND	G	Ground
3	1V8_RF	P	Vin input for 1.8V RF and VDD supply for the Power Amplifier
4	GND	G	Ground
5	1V8_MCU	P	1.8V supply Input and Vin input to all Digital LDOs
6	1V8_DIG	P	Power Supply for the Host Interface and VDD supply for the IO pins
7	OSC_EN	I	Not connected
8	CHIP_EN	I	connection for disabling/enabling the chip
9	HOST_MISO	I/O	Host interface line 4, default configuration is SPI MISO connection alternating configuration I2C address 1, switching time is 125ns.
10	HOST_SCK	I	Host interface line 1, Default configuration is SPI clock line/ alternative configuration is clock for the I3C interface or clock for the I2C host interface, switching time is 125ns.
11	HOST_MOSI	I/O	Host interface line 3. Default configuration is SPI MOSI connection, alternative configuration is I2C address 0 or I3C address & data line "I3C_SDA", switching time is 125ns.
12	HOST_CS	I/O	Host interface line 2. Default configuration is SPI Slave select connection, alternating configuration is I2C SDA connection, switching time is 125ns.
13	GPIO_01	I/O	General Purpose IO, switching time is 125ns
14	GPIO_08	I/O	General Purpose IO, switching time is 125ns.
15	GPIO_02	I/O	General Purpose IO, switching time is 125ns.
16	SWD_IO	I/O	Serial Wire Debug interface input/output Default customer configuration is secondary SPI bus MISO connection, switching time is 125ns.
17	COEX2	I/O	Default customer configuration as secondary I2C-bus address and data line I2C_SDA, alternative configuration as secondary UART TX line, switching time is 125ns.
18	SE_I2C_SDA	I/O	Embedded Secure Element I2C-bus, I2C_SDA connection, switching time is 125ns.
19	SE_I2C_SCL	I/O	Embedded Secure Element I2C Clk interface, I2C_SCL, switching time is 125ns.
20	UART2_RX	I/O	RX connection of the UART interface, switching time is 125ns.
21	GPIO03_IRQ	I	General Purpose Input, switching time is 125ns.
22	GPIO_05_HOST_INT	I/O	General Purpose IO, switching time is 125ns.
23	UART2_TX	I/O	TX connection of the UART interface, switching time is 125ns.
24	SWD_CLK	I/O	Serial Wire Debug interface clock input Default customer configuration as secondary SPI bus clock interface connection SPI_SCK, switching time is 125ns.
25	GND	G	Ground

3.3.Package outline

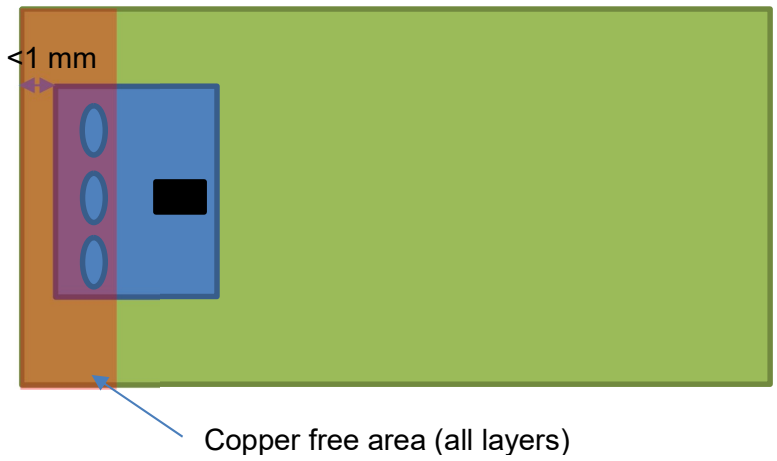


3.4 Recommended PCB Footprint



3.5 Host Board mounting

DCU150 is designed to be mounted onto a host board. Suggested host-board thickness is 0.8mm and it should be greater than 0.5mm. The DCU040 is preferably mounted close to the host board edge, as shown next. Maximum distance to the edge should be up to 1mm.

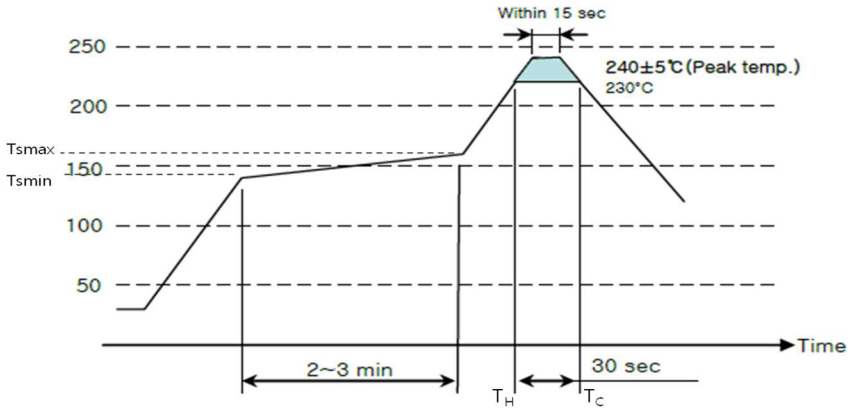


4. Soldering Condition

4.1. Manual Soldering – Pb Free

Soldering Temperature: 360°C ± 5°C, 5sec max.

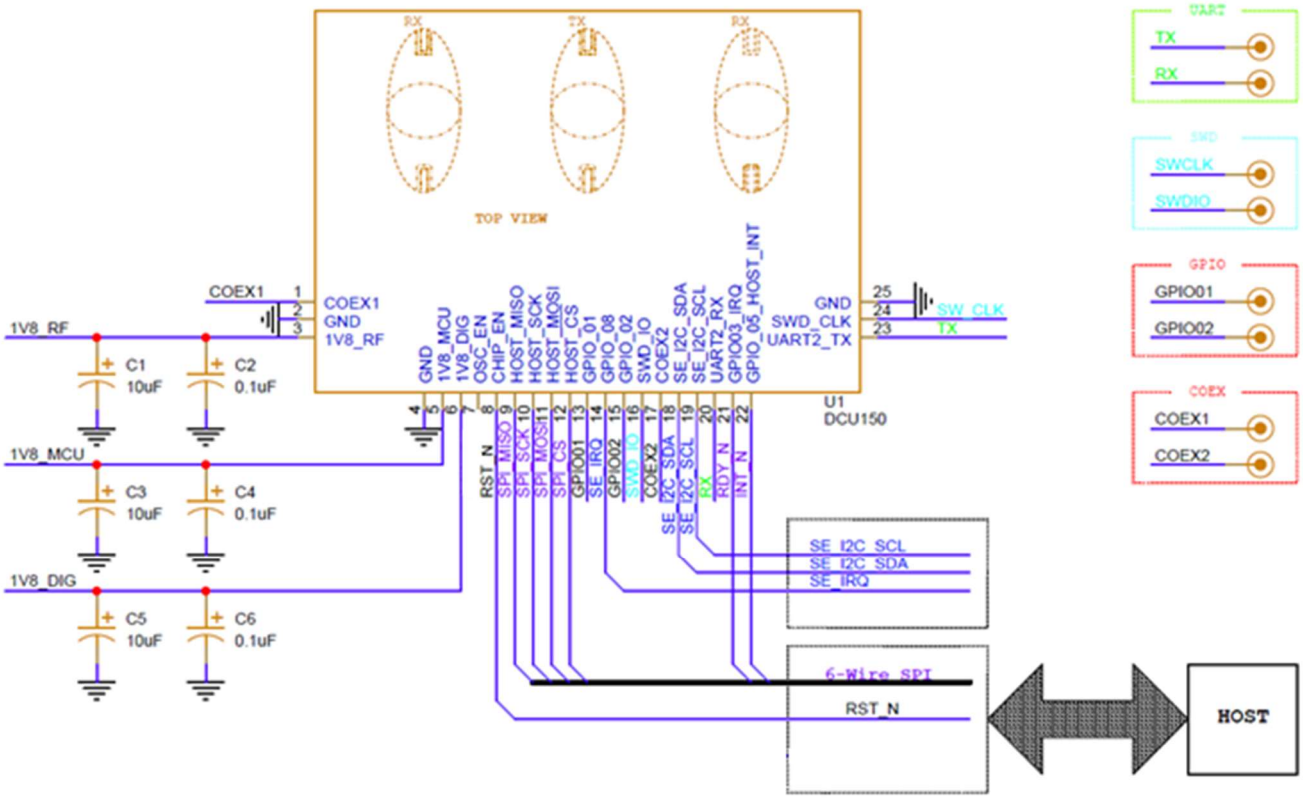
4.2 Recommended Reflow Condition – Pb Free



Profile Feature	Pb-Free Assembly
Preheat	
-Temperature Min (Tsmin)	140˚C
-Temperature Typical (Tstypical)	150˚C
-Temperature Max (Tsmax)	160˚C
-Time Tsmin to Tsmax	2 ~ 3 min
Peak Temperature	240±5˚C
Time of actual peak temperature	Max. 15 seconds
Heating to Cool	
-Temperature Heating (TH)	230˚C
-Temperature Cool (TC)	230˚C
-Time TH to TC	30 seconds

5. Application design-in information

5.1. Reference schematics for DCU150



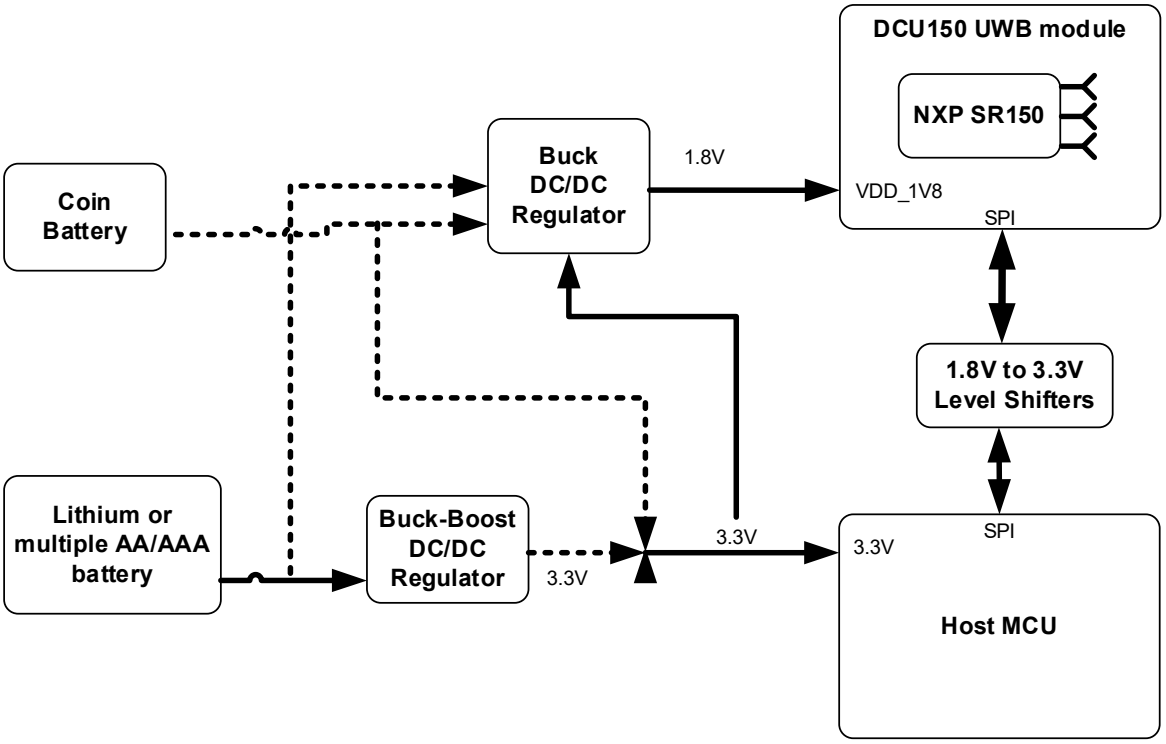
5.2 Power Supply Block Diagram with Host Device

DCU150 module power supply is 1.8V, below diagram includes but is not limited to 4 kinds of power supply mode with Host Device, for reference only.

1, Power Supply with Coin Battery like CR2032, use a Buck DC/DC Regulator to convert battery power to 1.8V.

2, Power Supply with Lithium Battery or multiple AA/AAA type Battery, use a Buck DC/DC Regulator to convert battery power to 1.8V.

3, Buck DC/DC regulator convert board DC 3.3V to 1.8V.



6. Regulatory information

6.1 FCC Certification

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

6.1.1 List of applicable FCC rules

The DCU150 is an UWB Module with BPRF modulation. It operates on the 6.5GHz, 8GH and, therefore, is within U.S. part 15.519,part 15.521,part 15.209 standard

6.1.2 Specific operational use conditions

The EUT is a UWB Module
Operation Frequency: 6.5GHz, 8GHz for UWB;
Modulation Type: BPRF
Number Of Channel: 2 channels
Antenna Designation: On Board PCB Patch Antenna
Antenna Gain: 6.5GHz:5.3dBi, 8GHz:5.8dBi

6.1.3 Limited module procedures

Applicable. The module is a Limited module and complies with the requirement of FCC Part 15.519. According to FCC Part 15 Subpart C Section15.212, The radio elements must have the radio frequency circuitry shielded. However, due to there is no shield and doesn't contain power supply regulation for this Module, this module is granted as a Limited Modular Approval. When this Module is installed into the other host, a Class II Permissive Change or a New FCC ID submission is required to ensure the full compliance of FCC relevant requirements.

6.1.4 Trace antenna designs

Not applicable; The module was designed with the fixed PCB print antenna, any

changes or modifications by the OEM integrator will require additional testing and evaluation.

6.1.5 RF exposure considerations

The device has been evaluated to meet general RF exposure requirement. The device can be used in portable exposure condition without restriction

6.1.6 Antennas

The DCU150 is an UWB Module beams signals and communicates with its antenna, which is On Board PCB Patch Antenna. The On Board PCB Patch Antenna gain is 6.5GHz:5.3dBi, 8GHz:5.8dBi. Antenna could not be in no-load state when module is working. During debugging, it is suggested to add 50 ohms load to the antenna port to avoid damage or performance degradation of the module under long-time no-load condition.

6.1.7 Label and compliance information

The final end product must be label in a visible area with the following
Host must Contains FCC ID:2BFZA-DCU150. If the size of the end product is larger than 24x16mm, then the following FCC part 15.19 statement has to also be available on the label: This device complies with Part 15 of 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.

6.1.8 Information on test modes and additional testing requirements

Data transfer module demo board can control the EUT work in RF test mode at specified test channel.

6.1.9 Additional testing, Part 15 Subpart B disclaimer

The host product manufacturer is responsible for compliance with 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.

6.1.10 When this Module is installed into the Special host, defined in page 19 appendix 1 a Class II Permissive Change Test Plan will act as following:
The specified host Device install this limited modular which has no shield.
The host shall still apply C2PC change:
The host shall not change the module's hardware and software parameters. Modulation modes shall keep consistent with the certified modular.
The host shall still meet the rule section part 15.519,part 15.521,part 15.209 standard .
The host's fundamental maximum output power shall be confirmed under the worst case from module.
Host's AC Conducted emissions and radiated spurious emissions including radiate band edges shall be test to be confirm no parasitic emissions i.e., compliance emissions due to ingress. Band edge compliance test shall also to be verified under the worst case from module. Host cannot change the RF Exposure use conditions. If use conditions is changed, the separate Approval shall be required.

Moudle integrated in other host need new FCC ID application.

6.2 ATTENTION
This device is intended only for OEM integrators under the following conditions: The antenna must be installed and operation without restriction is maintained between the antenna and users, and

1) This device and its antenna(s) must not be co‑located with any other transmitters except in accordance with FCC multi‑transmitter product procedures. Referring to the multi‑transmitter policy, multiple transmitter(s) and module(s) can be operated simultaneously without C2PC.
2) For all products market in US, OEM has to limit the Operating Frequency: 6500-8000MHz by supplied firmware programming tool. OEM shall not supply any tool or info to the end‑user regarding to Regulatory Domain change.

6.3 USERS MANUAL OF THE END PRODUCT:

The device has been evaluated to meet general RF exposure requirement. The devicecan be used in portable exposure condition without restriction.The end user has to be informed that the FCC radio‑frequency exposure guidelines for an uncontrolled environment can be satisfied. The end user has to also be informed that any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment.

If the size of the end product is smaller than 8x10cm, then additional FCC part 15.19 statement is required to be available in the users manual: This device complies with Part 15 of 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.

6.4 FCC WARNING

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.

Any 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 generate, 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.

UWB devices may not be employed for the operation of toys. Operation onboard an aircraft, a ship or a satellite is prohibited.
The use of antennas mounted on outdoor structures, e.g., antennas mounted on the outside of a building or on a telephone pole, or any fixed outdoors infrastructure is prohibited. Antennas may be mounted only on the hand held UWB device.
this module integration is restricted to handheld host products only.

Appendix 1-Installation Guide

Host product name:

ISEO Door TAG with DCU150 UWB module

Host manufacturer:

ISEO&Truesense

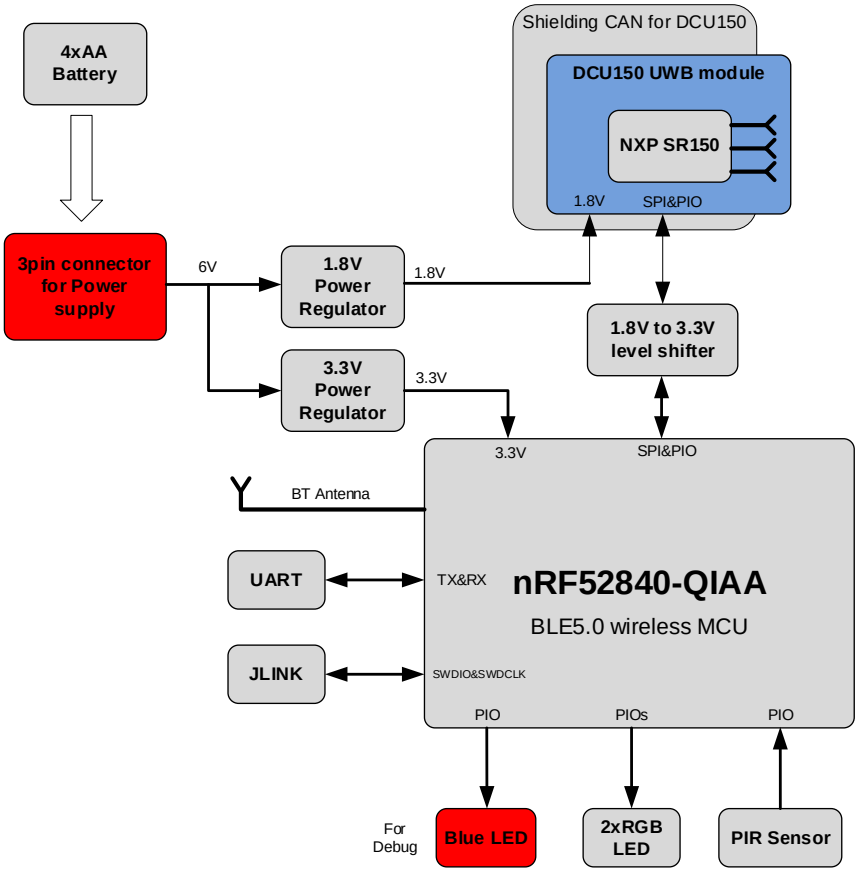
Details on Host product:

ISEO DOOR TAG based on UWB & BLE technology.

The ISEO Door TAG is 4xAA battery powered, and can be placed or sticked to the outside of the door in the entering way. The DCU150UWB module allows an UWB enabled mobile device (smartphone) to measure accurately the distance from the DCU150 UWB module (mooring point) in real time. And ISEO Door TAG provides the automation to the current Mobile Key. Once you enter theunlock zone, the door will be opened automatically.

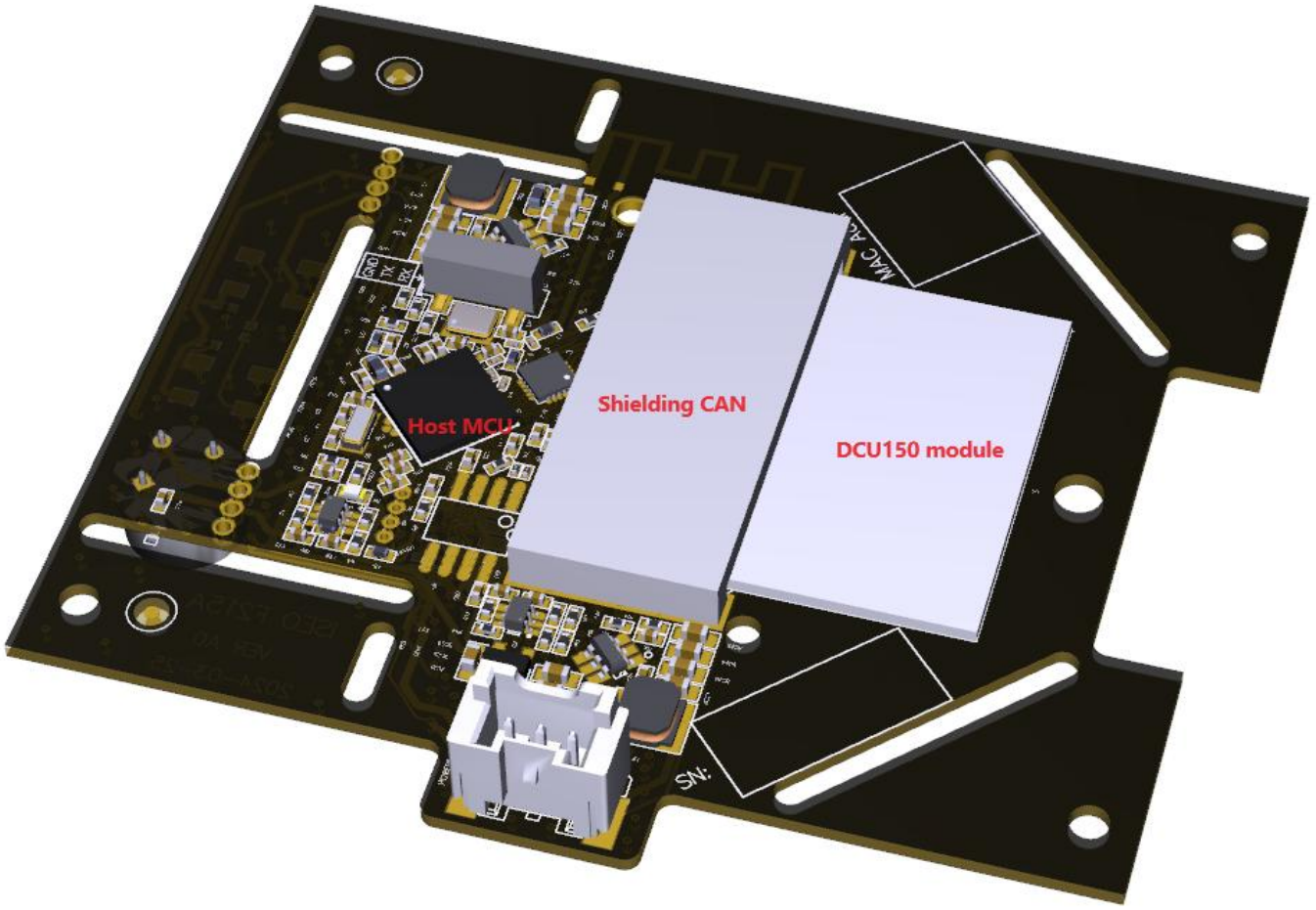
Host MCU: Nordic nRF52840-QIAA as the host MCU which controls DCU150 through 6-wire SPI interface.

Block Diagram:



Host Installation instructions:

1, Solder the DCU150 module to the ISEO Door TAG Board.
please note that DCU150 module is a SMD module, not an easy plug & unplug module. DCU150 module can be manually or reflow soldered in a professional factory. Please refer to DCU150 spec.



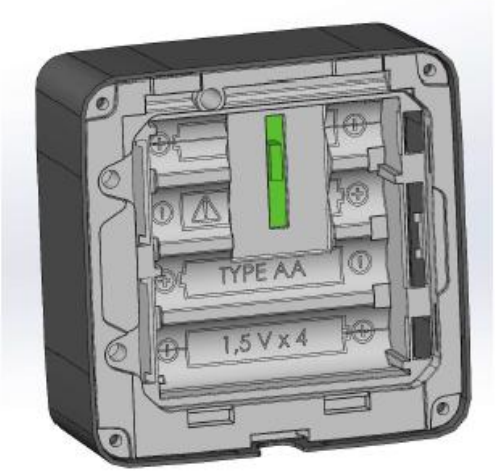
2， Firmware download/Upgrade.

Download firmware through Jlink Connector in ISEO Door TAG board, use the UWB firmware which provided by Truesense.

OTA firmware upgrading through the BLE in future.

3，Fit the board into the casing.

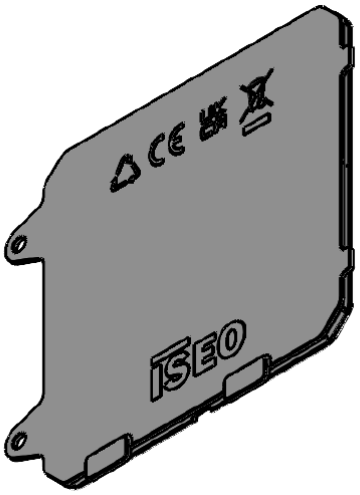
Front view



Back view

4, Power up the ISEO Door TAG with 4xAA battery.

Open the back panel of the casing, and put 4x AA battery into the battery compartment, then the ISEO Door TAG board will boot up.



Appendix 2 -Maintenance instructions

1,During the‘ISEO Door TAG with DCU150 UWB module’ board installation and maintenance, 100% follow Truesense UWB module DCU150 spec, no any change on module HW. And use Truesense firmware, to guarantee the antenna performance is good and also within the limit of FCC.

2, Also this ‘ISEO Door TAG with DCU150 UWB module’ board has a shielding CAN above the DCU150 module, to improve the anti-interference performance.

3, If you encounter any problems during installation and use, or the product is missing/damaged,please contact us at any time.
E-mail: info@truesense.it