Apulsetech

α-NANO

UHF RFID Reader Module

Datasheet

Ver. 251218

Copyright

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Revision History

Change	Date	Description
Ver.251218	2025/12/18	Draft

Table of Contents

1. Introduction

α-NANO is a UHF RFID reader module that provides a complete solution for applications using the ISO 18000-6C/EPC Gen2 protocol. It is especially suitable for applications requiring a small size, multi-tag reading capability, and long read range. With a 3dBic reader antenna, it can recognize passive tags at distances over 10 meters, and its maximum tag reading speed exceeds 600+ tags per second (@baudrate: 460.8Kbps).

This document includes specifications for α-NANO's interface, functionality, performance, mechanical design, and reliability test data.

2. Application

- Industrial PDA / Handheld Reader
- RFID Printers / Tag Encoders
- USB Readers
- POS
- Access control / Process control
- Industrial automation

3. System Block Diagram

Figure 3-1 below shows the electrical connection specifications required to control the α-NANO from the HOST for embedded applications.

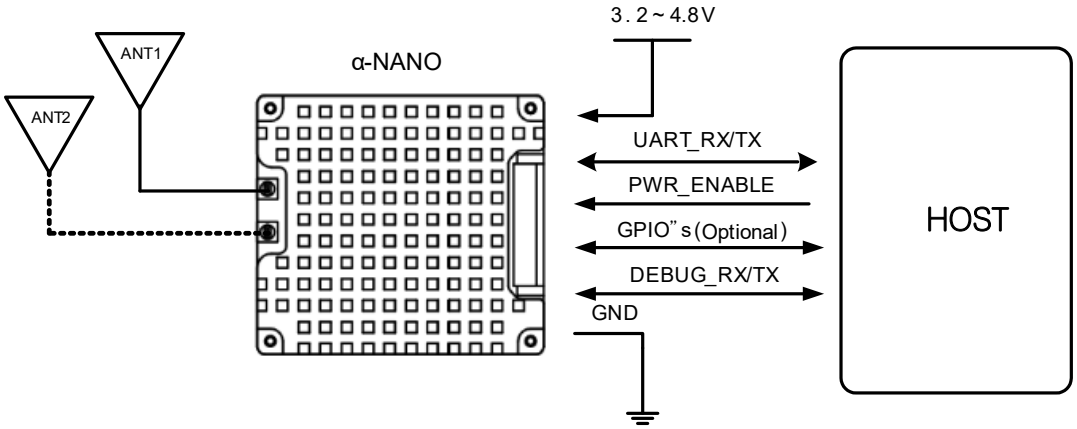


Figure3-1 : SYSTEM Block Diagram

- The α-NANO requires a power supply VDC (typical: 4V) and GND.
- An PWR_ENABLE signal is required to enable or disable the α-NANO power supply. If Enable is Low, the power supply is disabled; if Enable is High, the α-NANO enters standby mode.
- The α-NANO provides two user-controllable GPIOs (digital input/output).

4. α -NANO Series

This guide covers the α-NANO series of RFID readers as follows.

4.1 α -NANO Series

[TABLE 4.1] α-NANO RFID Module

Part Number	Description
α-NANO-G100	Global Reader (KOREA, USA, ETSI Upper band…)
α-NANO-E200	ETSI Reader (Lower band)
α-NANO-J301	JAPAN (1W)
α-NANO-J302	JAPAN (250mW)

4.2 α -NANO Development Kit

[TABLE 4.2] α-NANO Development Kit

Part Number	Description
α-NANO-KIT	α-NANO Module, Antenna, Interface Board, 12V/3A Adaptor, USB Cable

NOTE

If you require the product or Development Kit, please refer to the Part Number and request a purchase from your distributor.

5. Pin Definition

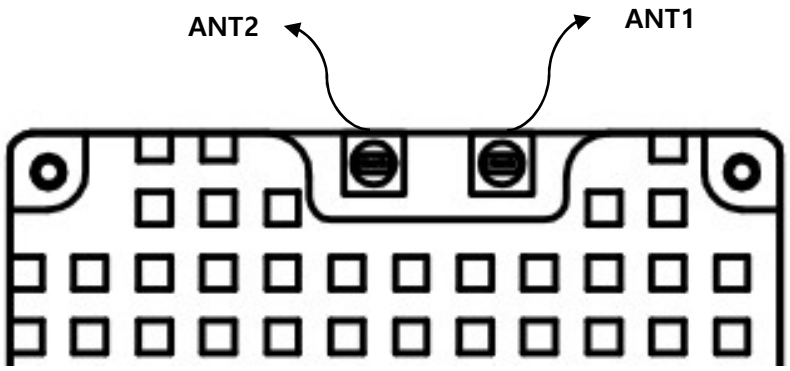


Figure5-1 : ANTENNA Port

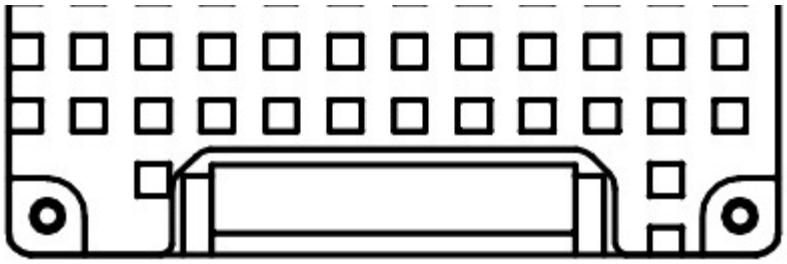


Figure5-2 : Pin Diagram

[TABLE 5.1] Pin Descriptions

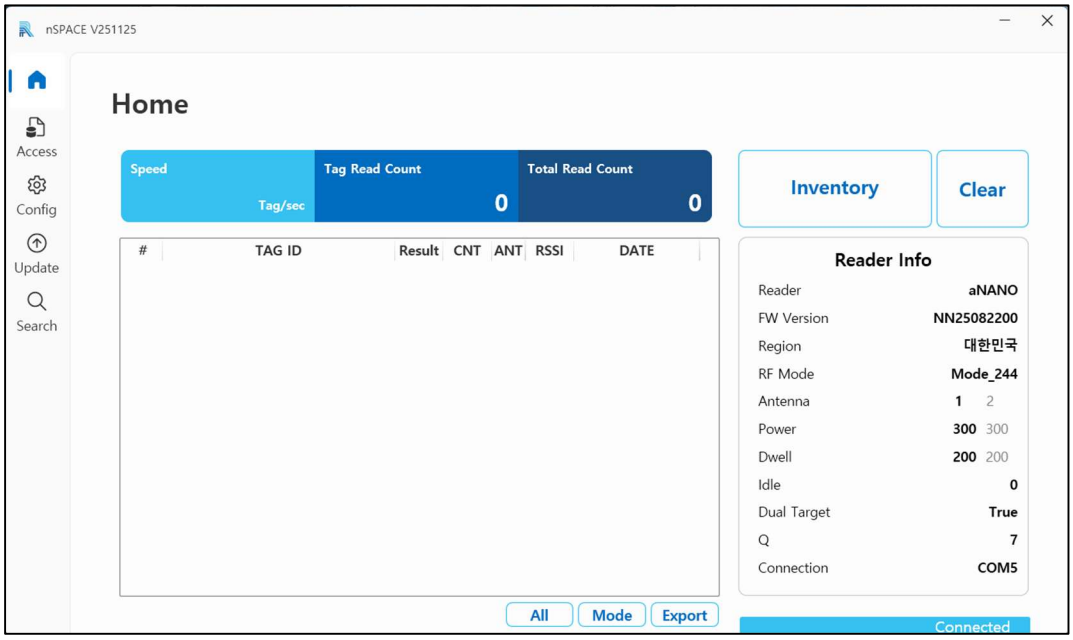
No.	Name	Type	Description
1	VCC	Power	DC voltage supply (3.2 ~ 4.8V)
2	VCC	Power	DC voltage supply (3.2 ~ 4.8V)
3	GND	Power	Ground
4	GND	Power	Ground
5	GND	Power	Ground
6	UART_TX	Digital output	UART TX to host, TTL(3.3V)
7	UART_RX	Digital Input	UART RX from host, TTL(3.3V)
8	PWR_ENABLE	Digital Input	Module Power Enable, Active high
9	DBG_TXD	Digital output	Module Debug output, TTL(3.3V)
10	DBG_RXD	Digital input	Module Debug input, TTL(3.3V)
11	GPIO_1	Digital I/O	General purpose I/O
12	GPIO_2	Digital I/O	General purpose I/O

6. RFID Reader software

The α-NANO is provided together with the 'nSPACE' GUI Application, which allows you to verify its features and performance.

6.1 nSPACE

"nSPACE" is an RFID reader application that provides access to the RFID reader.
Using the α-NANO-KIT, the RFID reader can be modified and controlled through a USB connection with the host PC.
This application offers the ability to configure communication and operational parameters of the RFID reader.
It also provides functions to read tags, review tag data, and perform diagnostics.
The application is intended for verifying the features and performance of the α-NANO prior to product design.
For more details, please refer to the "nSPACE User Guide."



[Figure 6.1] nSPACE GUI

7. Electrical Specifications

7.1 Absolute Maximum Rating

Stresses beyond those listed in Table 7-1 may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Table 7-1 : Absolute Maximum Ratings

Parameter	Min.	Max.	Unit	Comments
Supply voltage	3	5	V	
PWR_ENABLE		6	V	
IO Input voltage	-0.3	5.5	V	
Storage temperature	-30	+100	℃	
Humidity		95	%RH	
ESD immunity (Air discharge) (Contact discharge)		±8 ±4	kV kV	EN6100-4-2

7.2 Operating Conditions

Table 7-2 : Operating Conditions

Parameter	Min.	Max.	Unit	Conditions
Supply voltage (VCC)	3.2	4.8	V	Recommend voltage : 4V
Ambient Temperature	-20	+60	℃	
Inner Board Temperature	-20	+80	℃	**Note :** Prolonged use at high temperatures may cause product performance degradation and deterioration.

7.3 Reader Radio Specifications

VCC=4V, typical values at 25℃, unless otherwise noted.

Table 7-3 : Reader Radio Specifications

Parameter	Min.	Typ.	Max.	Unit	Conditions
Supply Current (Active mode)			1200	mA	Transmit Power : +30dBm
Supply Current (Standby mode)			20 50	mA nA	PWR_ENABLE : High PWR_ENABLE : Low
RX input impedance		50		Ω	
RX sensitivity		-74		dBm	
TX Power	+5		+31.5	dBm	
Frequency	860		930	MHz	See Appendix A
Channel bandwidth			200	kHz	
Channel Dwell time			0.4	Sec.	
Carrier sensing time	5			ms	Case in Japan
Carrier sensing level		-74		dBm	Case in Japan
Transmission time			4	Sec.	Case in Japan

7.4 Reader Digital Interface Specifications

VCC=4V, typical values at 25℃, unless otherwise noted.

Table 7-4 : Reader Digital Interface Specifications

Parameter	Min.	Typ.	Max.	Unit	Conditions
PWR_ENABLE					
VIH	1	3.3	5	V	
VIL	-0.3		0.4	V	
GPIO					
VIH	2.0	3.3	3.6	V	
VIL	-0.3		0.8	V	
UART					
Baud rate	9.6	460.8	921.6	kbaud	
Data bits		8		bit	
Parity		None			
Stop		1		bit	
Flow control		None			

7.5 Reader physical Characteristics

Parameter	Description
Dimensions	36mm(W) × 40mm(L) × 7.9mm(H)
Weight	15.3g
Housing Material	Aluminum

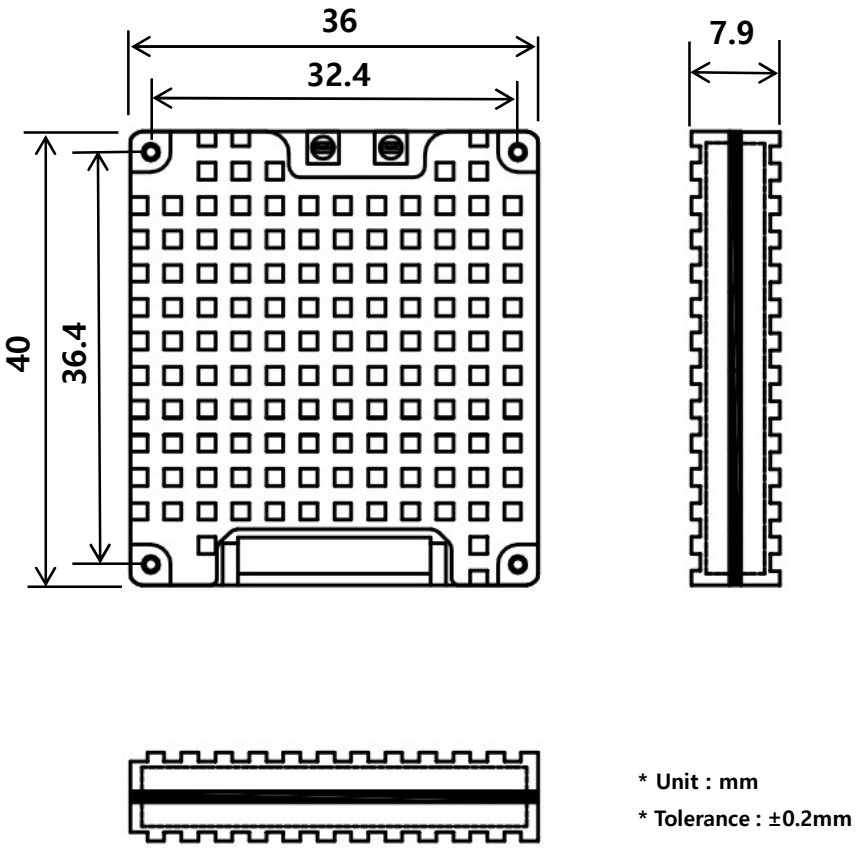
7.6 Reader Interface

Parameter	Description
HOST Connector	Part No. : 12505WR-12 Manufacturer : Yeonho Electronics
Antenna Connector	Part No. : U.FL-R-SMT-1(10) Manufacturer : Hirose

8. Mechanical Characteristics

This section provides mechanical drawings information.

8.1 Dimensions



[Figure 8.1] α-PICO Dimensions (Top, Front, Side View)

* Unit : mm

9. Reliability and Environmental Specification

9. 1 Temperature test

Item	Detail Item	Test Condition	Test results
Storage Temp. test	High temperature	- 3 samples, Power off - Temperature: 100 ±2℃ - Test time : 48 hr - (2~24)hr at room temperature	- Check if it is operating normally - Check the change in tag recognition distance
	Low temperature	- 3 samples, Power off - Temperature: -30 ±2℃ - Test time : 48 hr - (2~24)hr at room temperature	- Check if it is operating normally - Check the change in tag recognition distance
Operating Temp. test	High temperature	- 3 samples, Power on - Temperature: +60 ±2℃ - Test time : 12 hr - Module : Dwell 200ms, Idle 0ms, Max.power(31.5dBm)	- Check if it is operating normally - Check the change in tag recognition distance
	Low temperature	- 3 samples, Power on - Temperature: -20 ±2℃ - Test time : 12 hr - Module : Dwell 200ms, Idle 0ms, Max.power(31.5dBm)	- Check if it is operating normally - Check the change in tag recognition distance
Thermal shock test		- 3 samples, Power off - Temperature : +60℃/30min ⇔ -20℃/30min 1cycle - Test time : 12cycle	- Check if it is operating normally - Check the change in tag recognition distance

9. 2 ESD Test

Item	Test Condition	Test results
ESD TEST	- 1 samples, Power on - Human Body model : standard ±4kV(contact), ±8kV(air) (R1=10 MΩ, R2=1.5 kΩ, C=150pF)	- Check if it is operating normally - Check the change in tag recognition distance

9. 3 Drop test

Free fall the module (condition built in a wrapper which can defend ESD) from 150cm height to cement ground, each side twice, total twelve times. The appearance will not be damaged and all functions OK.

9. 4 Unpackaging information

After unpacking, the module should be stored in environment as follows:

Temperature : 25℃ ± 2℃

Humidity : <60%

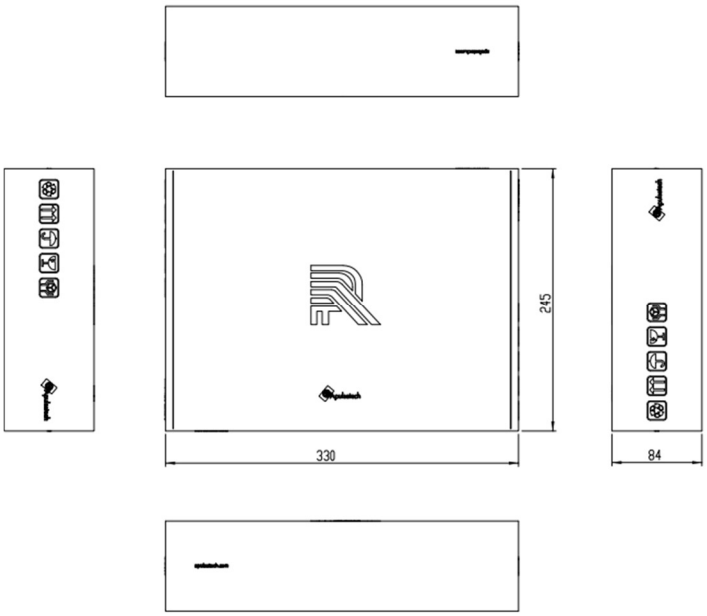
No acidity, sulfur or chlorine environment

10. Packaging Information

The α-NANO shipping package is composed of PE foam that can protect against external impact and an outer carton, with each PE foam accommodating up to 100 modules.

10. 1 Carton box

The carton box, which includes PE foam for protecting the modules against impact, is made of printed cardboard. It protects against dust, moisture, and impact, and facilitates transportation. The dimensions of the outer box are approximately 330 mm in width, 245 mm in length, and 84 mm in height.



Appendix A. Final Test Report

Model : α-NANO	**FW Version :** NN25121800
Customer :	**Region :** KOREA
Test by : JS PARK	**Test Date :** 20251218

S/N	Visual Inspection				Communication Inspection			Performance Test		
	Painting	Bolt	Label	Packing	FW ver.	Region	Setting	Power	Power control	Reading
NK25xxxxxx	O	O	O	O	O	O	O	O	O	O

NOTES :

1. FW ver. : check Firmware version
2. Region : check Region setting
3. Setting : Power, RF Mode, Idle, Dwell....
4. Power : check whether Reader Power is 30±0.5dBm.
5. Power control : Check whether Power control works well from 5dBm to 31.5dBm (by 1dB step).
6. Reading : Check reading recognition rate is above 70%. (Test Condition : 100ea tags, 250cm distance, 260x260 antenna)

Appendix B. RFID Reader Frequency

This chapter provides information on the channels and frequencies of the α-NANO RFID Reader.

[단위 : KHz]

	South Korea (KOR)	FCC	China (CHN)	Hong Kong (HKG)	Singapore (SGP)	Taiwan (TWN)	Vietnam (VNM)	Japan FHSS	ETSI Lower
1	917300	902750	920625	920750	920750	920750	918750	916800	865700
2	917900	903250	920875	921250	921250	921250	919250	918000	866300
3	918500	903750	921125	921750	921750	921750	919750	919200	866900
4	919100	904250	921375	922250	922250		920250	920400	867500
5	919700	904750	921625	922750	922750		920750		
6	920300	905250	921875	923250	923250		921250		
7		905750	922125	923750	923750		921750		
8		906250	922375	924250	924250		922250		
9		906750	922625						
10		907250	922875						
11		907750	923125						
12		908250	923375						
13		908750	923625						
14		909250	923875						
15		909750	924125						
16		910250	924375						
17		910750							
18		911250							
19		911750							
20		912250							
21		912750							
22		913250							
23		913750							
24		914250							
25		914750							
26		915250							
27		915750							
28		916250							
29		916750							
30		917250							
31		917750							
32		918250							
33		918750							
34		919250							
35		919750							
36		920250							
37		920750							
38		921250							
39		921750							
40		922250							
41		922750							
42		923250							
43		923750							
44		924250							
45		924750							
46		925250							
47		925750							
48		926250							
49		926750							
50		927250							

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