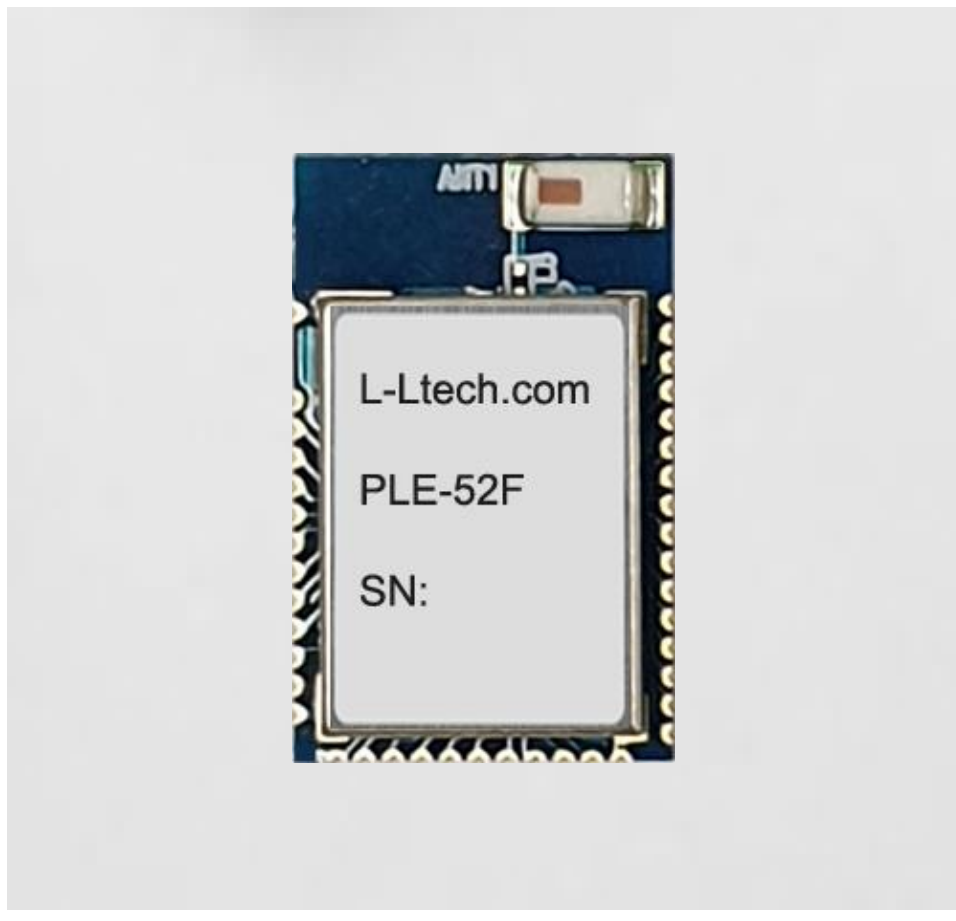
PLE-52F

DATA SHEET v1.6



BLE MODULE

PLE-52F

PLE-52F module is a BLE module based on BT 5.0. It was developed using Nordic's nRF52840 chipset.

L. LTECH

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Revision History

No	Version	Date	Page	Description
1	0.1	2019-05-09	All	First release
2	1.0	2019-05-14	1	Edit introduction
3	1.0	2019-05-14	8-16	Edit module schematic and schematic options
4	1.1	2019-05-21	13-16	Edit circuit configurations
5	1.2	2019-06-27	8	Edit Module Schematic
6	1.3	2019-07-16	5,6p	Edit Module pin numbers (P0.14, P0.15)
7	1.4	2020-01-31	5p	Edit Module pin numbers (P1.08, P1.09, P1.23, P1.01, P1.03, P1.05, P1.07, P1.02, P1.04,P1.06)
8	1.5	2020-04-03	18p	Add certification
9	1.6	2020-04-23	17p	Edit Antenna Performance image

Table of Contents

1. Introduction

PLE-52F

The PLE-52F module was developed using Nordic Semiconductor's nRF52840 QIAA.

The nRF52840 SoC is the most advanced member of the nRF52 Series SoC family. It meets the challenges of sophisticated applications that need protocol concurrency and a rich and varied set of peripherals and features. It offers generous memory availability for both Flash and RAM, which are prerequisites for such demanding applications.

The nRF52840 is built around the 32-bit ARM® Cortex™-M4 CPU with floating point unit running at 64 MHz. It has NFC-A Tag for use in simplified pairing and payment solutions. The ARM TrustZone® CryptoCell cryptographic unit is included on-chip and brings an extensive range of cryptographic options that execute highly efficiently independent of the CPU. It has numerous digital peripherals and interfaces such as high speed SPI and QSPI for interfacing to external flash and displays, PDM and I2S for digital microphones and audio, and a full speed USB device for data transfer and power supply for battery recharging.

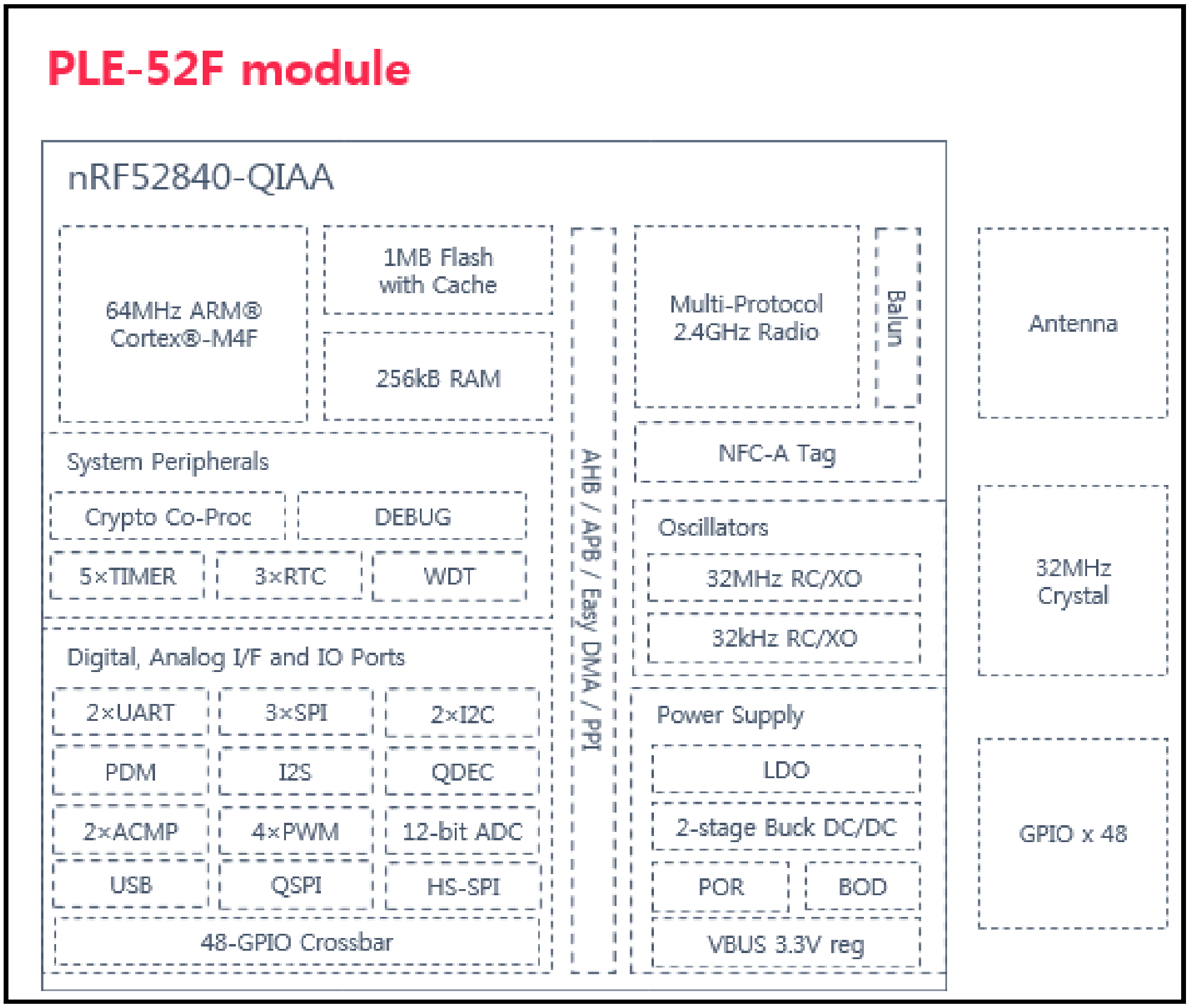
Exceptionally low energy consumption is achieved using a sophisticated on-chip adaptive power management system.

1. 1 Applications

- **IoT**
- Smart Home products
- Industrial mesh networks
- Smart city infrastructure
- **Advanced wearables**
- Connected watches
- Advanced personal fitness devices
- **Wearables with wireless payment**
- Connected Health
- Virtual/Augmented Reality applications
- **Interactive entertainment devices**
- Advanced remote controls
- Gaming controller

2. Specifications

2. 1 Module Block Diagram



PLE-52F MODULE BLOCK DIAGRAM

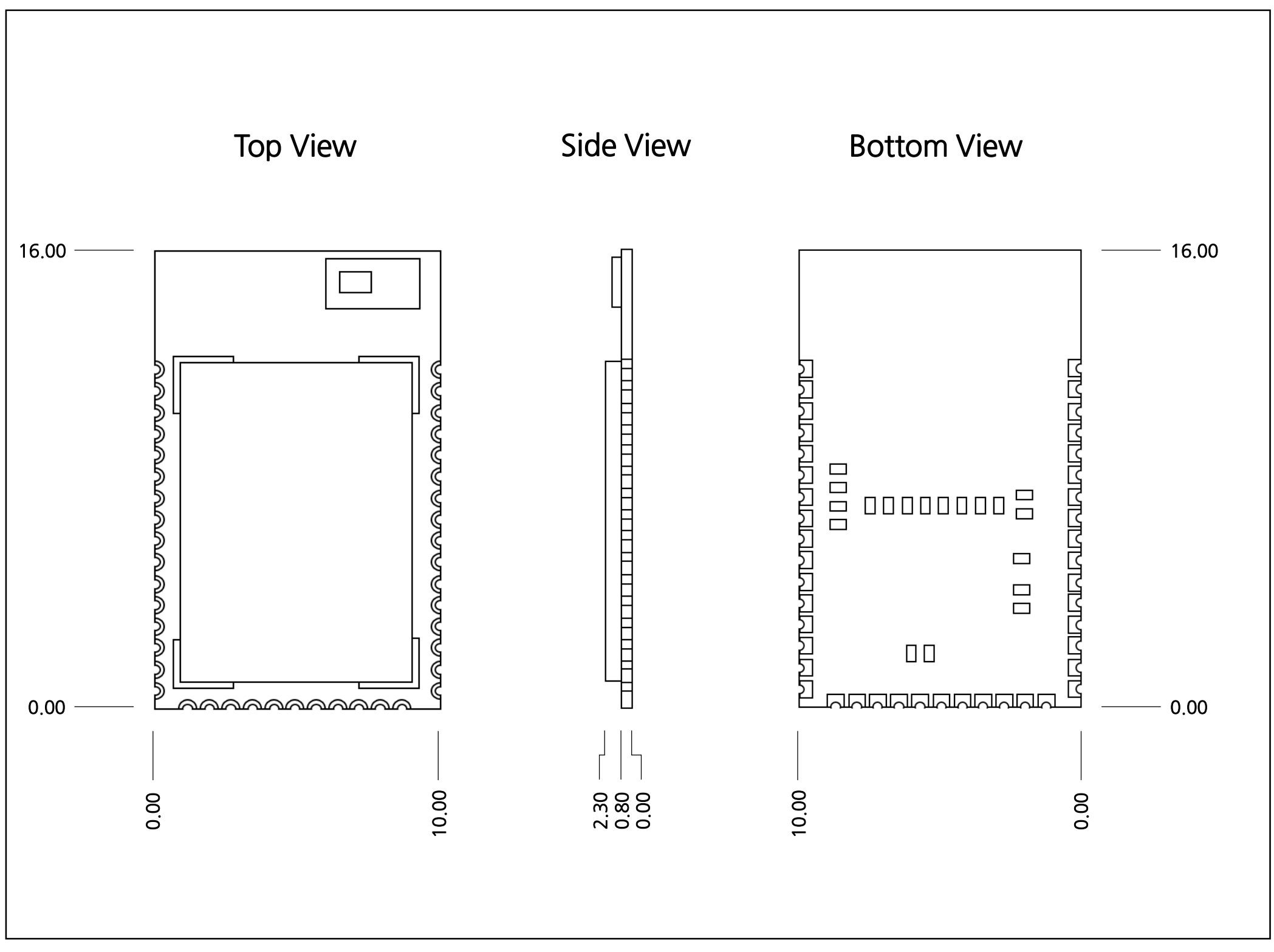
2. 2 Chipset Specifications (nRF52840)

Frequency band	2.4GHz
On-air data rate	2Mbs/1Mbs/500kbs/125kbs - Bluetooth low energy 250kbs — 802.15.4 2Mbs/1Mbs — 2.4GHz proprietary
Output power	Programmable -20dBm to +8dBm
Sensitivity	Bluetooth 5: -103dBm at 125kbs, -99dBm at 500kbs, -96dBm at 1Mbs, -92dBm at 2Mbs 802.15.4: -100dBm at 250kbs ANT: -92.5dBm at 1Mbs 2.4GHz: -92.5dBm at 1Mbs, -89dBm at 2Mbs
Radio current consumption DC-DC at 3v	4.8mA TX at 0dBm, DC/DC at 3V 14.8mA TX at +8dBm, DC/DC at 3V 9.6mA TX at +4dBm, DC/DC at 3V 4.6mA RX at 1Mbps
Microcontroller	ARM Cortex-M4F
Program memory	1MB Flash with cache
RAM	256kB
Oscillators	32MHz crystal oscillator, 64MHz RC oscillator, 32kHz crystal oscillator, 32kHz RC oscillator
System current consumption	0.5µA at 3V System OFF mode, no RAM retention 1.5µA System ON mode, no RAM retention 0.7µA All peripherals in IDLE mode 0.03µA per 4kB RAM retention
Hardware security	128-bit AES ECB/CCM/AAR co-processor
Cryptography	ARM CryptoCell 310
GPIO	48 configurable
Digital I/O	QSPI x 1, SPI master x 3, SPI slave x 3, 2-wire master x 2, 2-wire slave, UARTE x 2, Quadrature decoder, PDM, I^2S
Peripherals	12-bit/200ksps ADC, RNG, LP comparator, WDT, PWM x 4
PPI	20
USB	USB 2.0 (12Mbs)
Power supply	LDO, DC-DC
Timers/counters	32-bit timers x 5, RTC x 3
Package options	AQFN73, 7×7mm
NFC	NFC-A

3. Layout

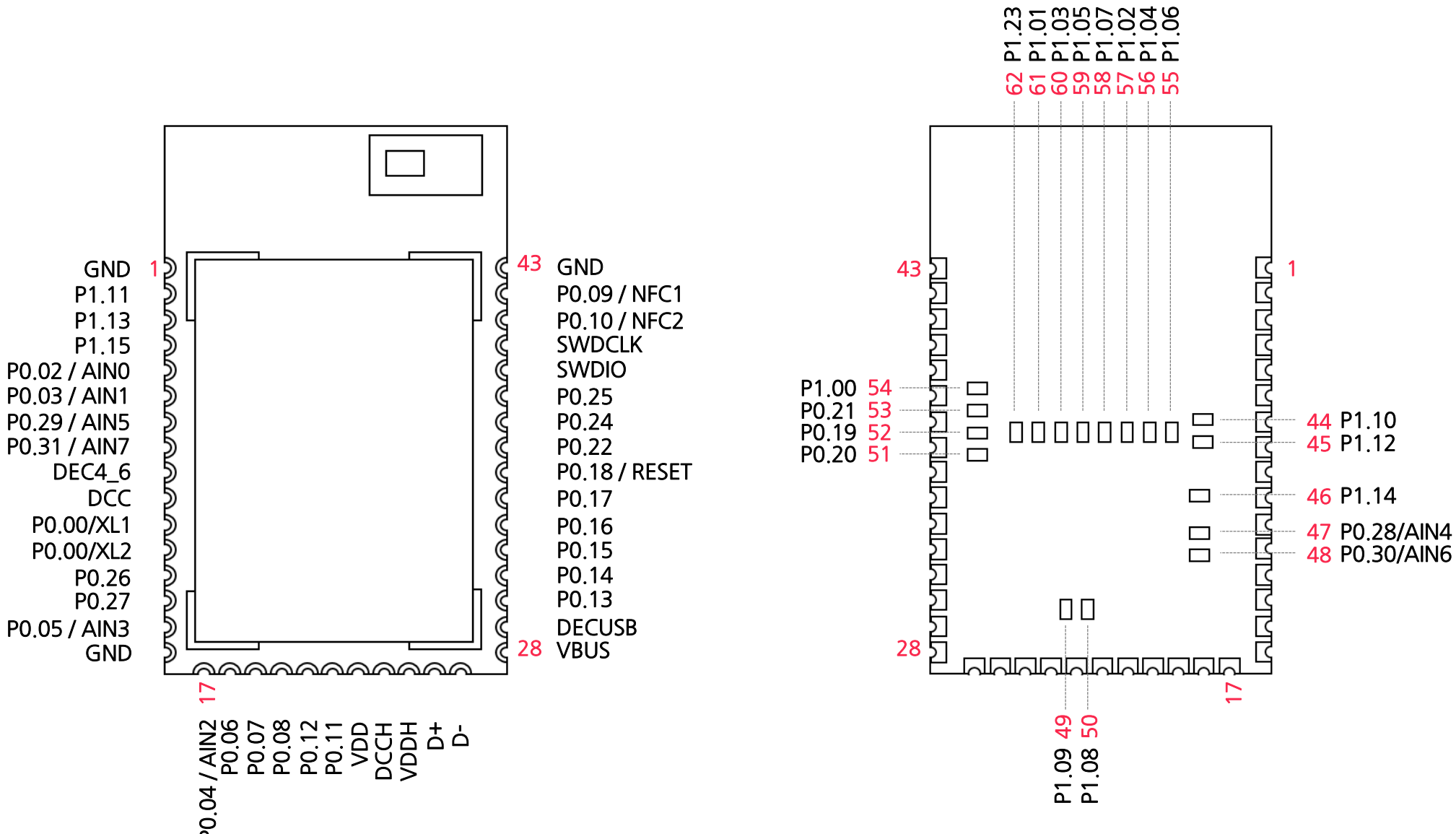
3. 1 Dimensions

[unit : mm]



PLE-52F MODULE DIMENSIONS

3. 1. 1 Pin assignment



(For details, see the nRF52840 datasheet.)

Pin	Name	Description
1	GND	
2	P1.11	
3	P1.13	Standard drive, low frequency I/O only.
4	P1.15	Standard drive, low frequency I/O only.
5	P0.02 / AIN0	Standard drive, low frequency I/O only.
6	P0.03 / AIN1	Standard drive, low frequency I/O only.
7	P0.29 / AIN5	Standard drive, low frequency I/O only.
8	P0.31 / AIN7	Standard drive, low frequency I/O only.
9	DEC4_6	
10	DCC	
11	P0.00 / XL1	
12	P0.01 / XL2	
13	P0.26	
14	P0.27	
15	P0.05 / AIN3	

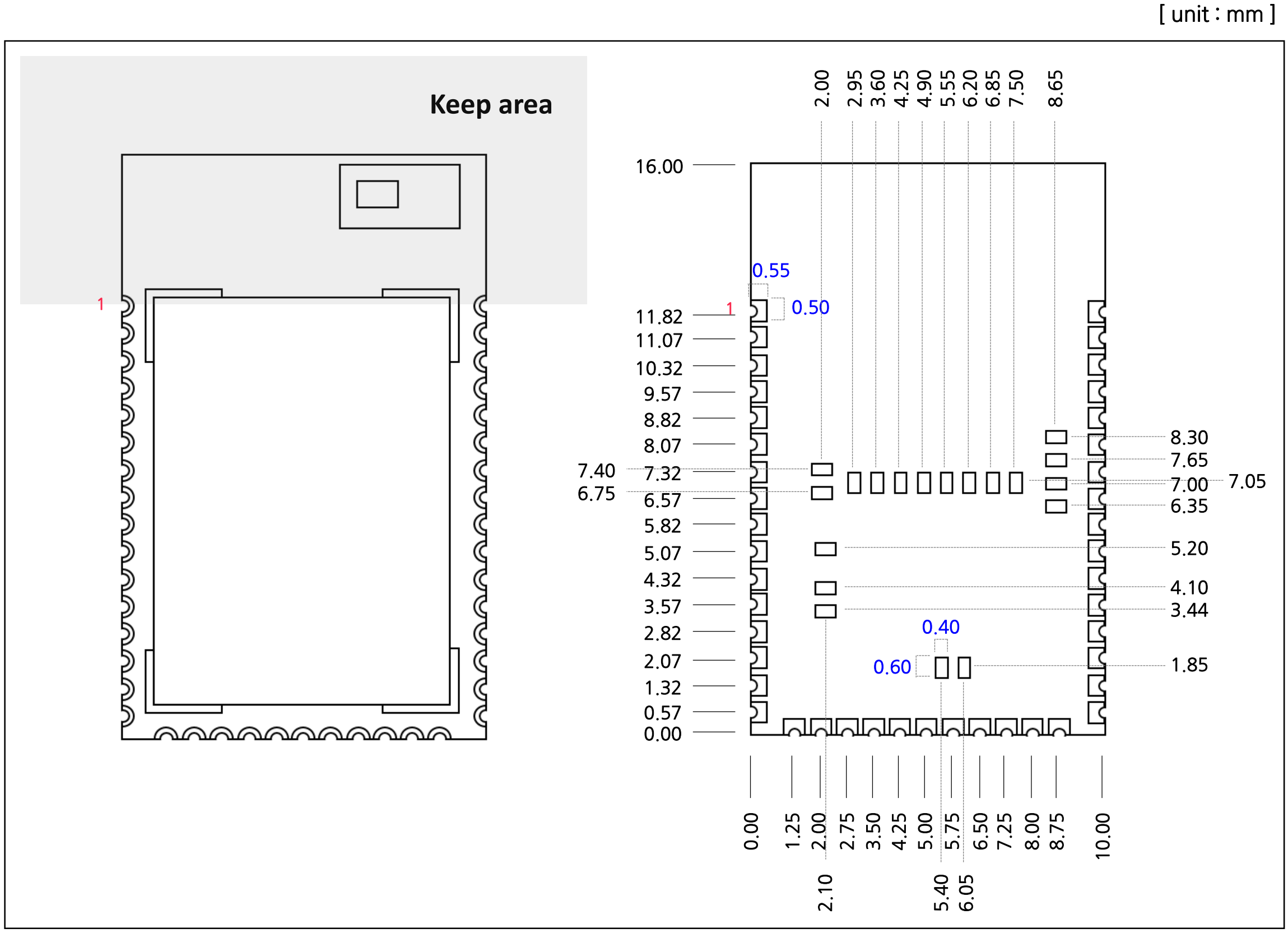
Pin	Name	Description
32	P0.15	
33	P0.16	
34	P0.17	
35	P0.18 / RESET	QSPI / CSN
36	P0.22	QSPI
37	P0.24	
38	P0.25	
39	SWDIO	
40	SWDCLK	
41	P0.10	Standard drive, low frequency I/O only.
42	P0.09	Standard drive, low frequency I/O only.
43	GND	
44	P1.10	
45	P1.12	Standard drive, low frequency I/O only.
46	P1.14	Standard drive, low frequency I/O only.

Pin	Name	Description
16	GND	
17	P0.04 / AIN2	Standard drive, low frequency I/O only.
18	P0.06	
19	P0.07	
20	P0.08	
21	P0.12	
22	P0.11	Standard drive, low frequency I/O only.
23	VDD	
24	DCCH	
25	VDDH	
26	D+	USB
27	D-	USB
28	VBUS	
29	DECUSB	
30	P0.13	
31	P0.14	

Pin	Name	Description
47	P0.28 / AIN4	Standard drive, low frequency I/O only.
48	P0.30 / AIN6	Standard drive, low frequency I/O only.
49	P1.09	
50	P1.08	
51	P0.20	
52	P0.19	QSPI / SCK
53	P0.21	QSPI
54	P1.00	QSPI
55	P1.06	Standard drive, low frequency I/O only.
56	P1.04	Standard drive, low frequency I/O only.
57	P1.02	Standard drive, low frequency I/O only.
58	P1.07	Standard drive, low frequency I/O only.
59	P1.05	Standard drive, low frequency I/O only.
60	P1.03	Standard drive, low frequency I/O only.
61	P1.01	Standard drive, low frequency I/O only.
62	P0.23	QSPI

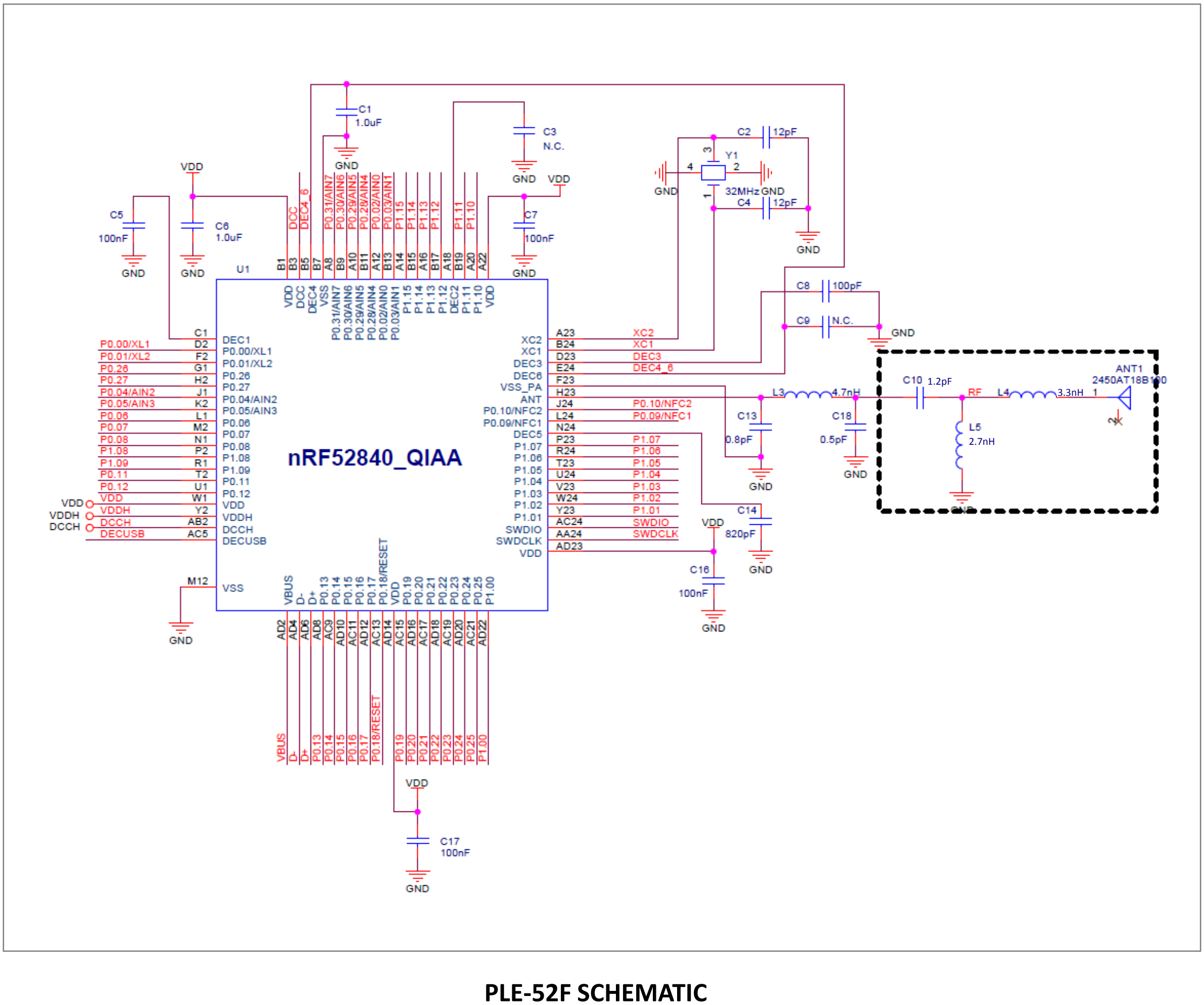
3. 2 Recommended PCB guide

[unit : mm]



PLE-52F PCB FOOTPRINT

3. 3 Module Schematic (PLE-52F)

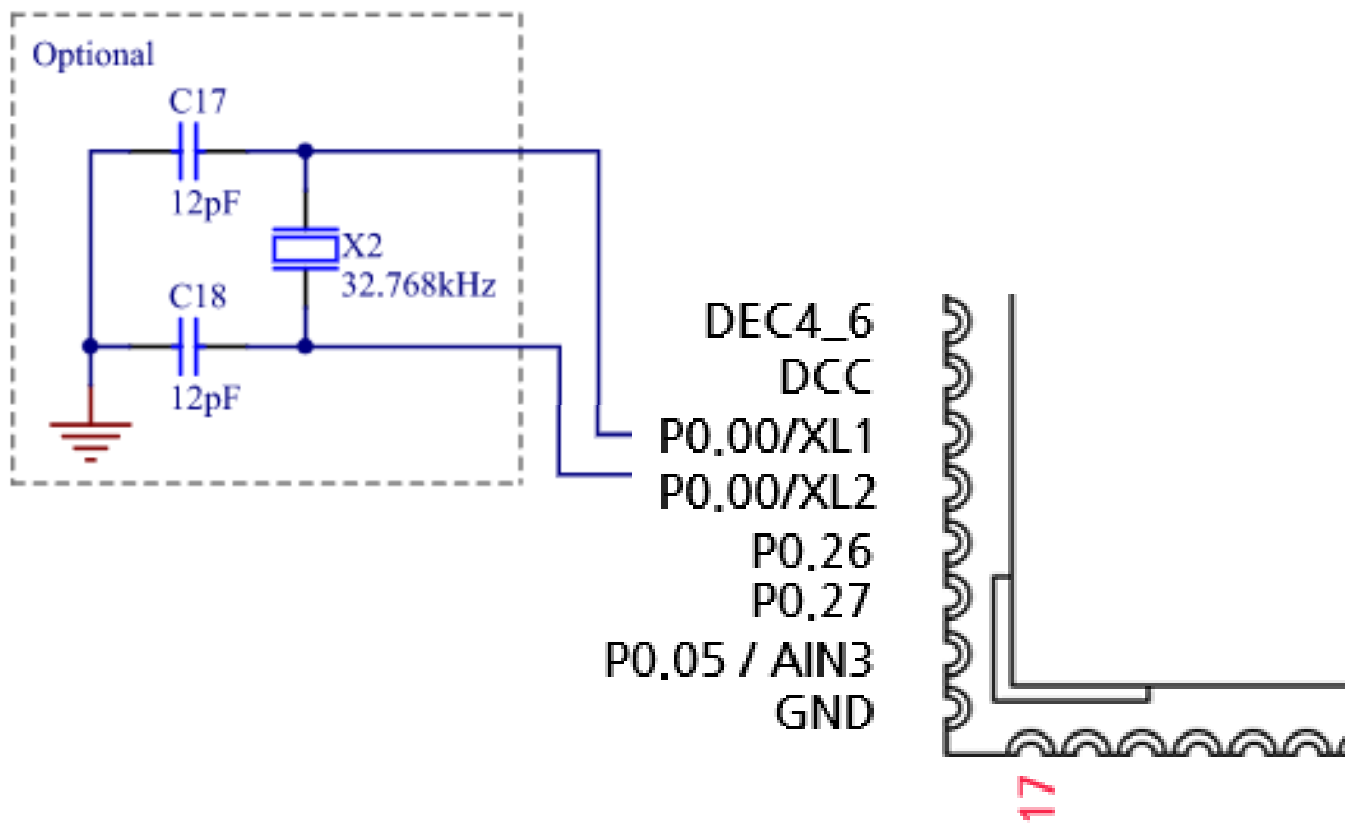


PLE-52F SCHEMATIC

3. 4 Schematic options

3. 4. 1 32.768kHz external crystal (optional)

Internal or external crystal can be set in F / W.
(For details, see the nRF52840 datasheet.)



3. 4. 2 Circuit configurations

Some general guidance is summarized here:
(For details, see the nRF52840 datasheet.)

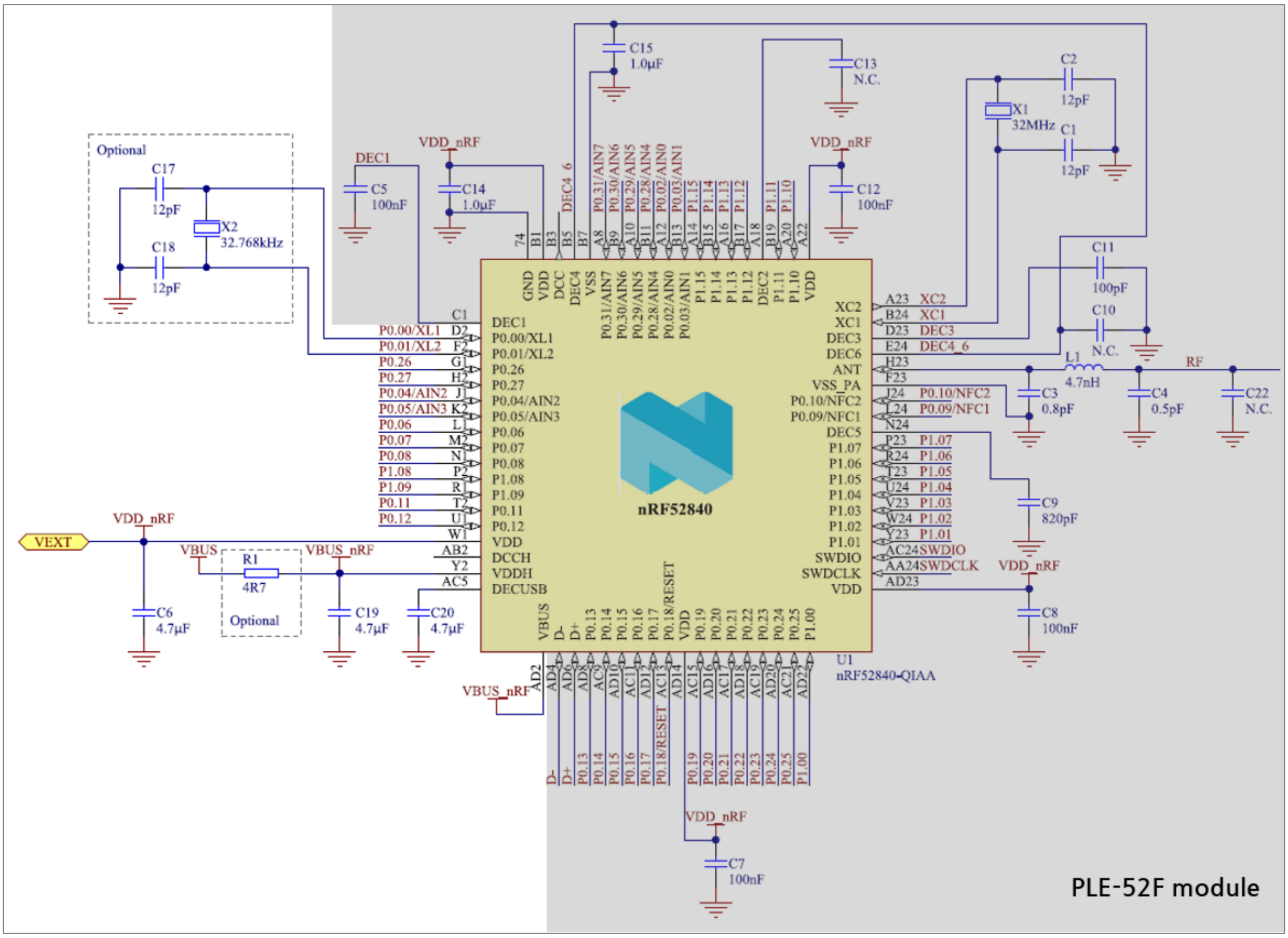
- External supply from VDD is only available when power is supplied to VDDH. External supply is annotated with the VEXT net name.
- When supplying power from a USB source only, VBUS must be connected to VDDH if USB is to be used.
- Components required for DC/DC function are only needed if DC/DC mode is enabled for that regulator.
- NFC can be used in any configuration.
- USB can be used in any configuration as long as VBUS is supplied by the USB host.
- The schematics include an optional series resistor on the USB supply for improved immunity to transient overvoltage during VBUS connection. Using the series resistor is recommended for new designs.
- Two component values for the RF-Match network for the QIAA aQFN™73 package are given and referred to as v1.0 and v1.1 in the following tables. The reference schematics use v1.1 component values, which are recommended for new designs to improve the margin for spurious emissions during regulatory approval tests. However, both v1.0 and v1.1 are valid and can be used. All other RF parameters are unchanged.

Circuit configurations for QIAA aQFN™73

Config no.	Supply configuration		Features that can be enabled for each configuration example				
	VDDH	VDD	EXTSUPPLY	DCDCEN0	DCDCEN1	USB	NFC
Config. 1	USB (VDDH = VBUS)	N/A	Yes	No	No	Yes	No
Config. 2	Battery/Ext. regulator	N/A	Yes	No	No	Yes	No
Config. 3	N/A	Battery/Ext. regulator	No	No	No	Yes	No
Config. 4	Battery/Ext. regulator	N/A	Yes	Yes	Yes	Yes	No
Config. 5	N/A	Battery/Ext. regulator	No	No	Yes	Yes	Yes
Config. 6	N/A	Battery/Ext. regulator	No	No	No	No	No

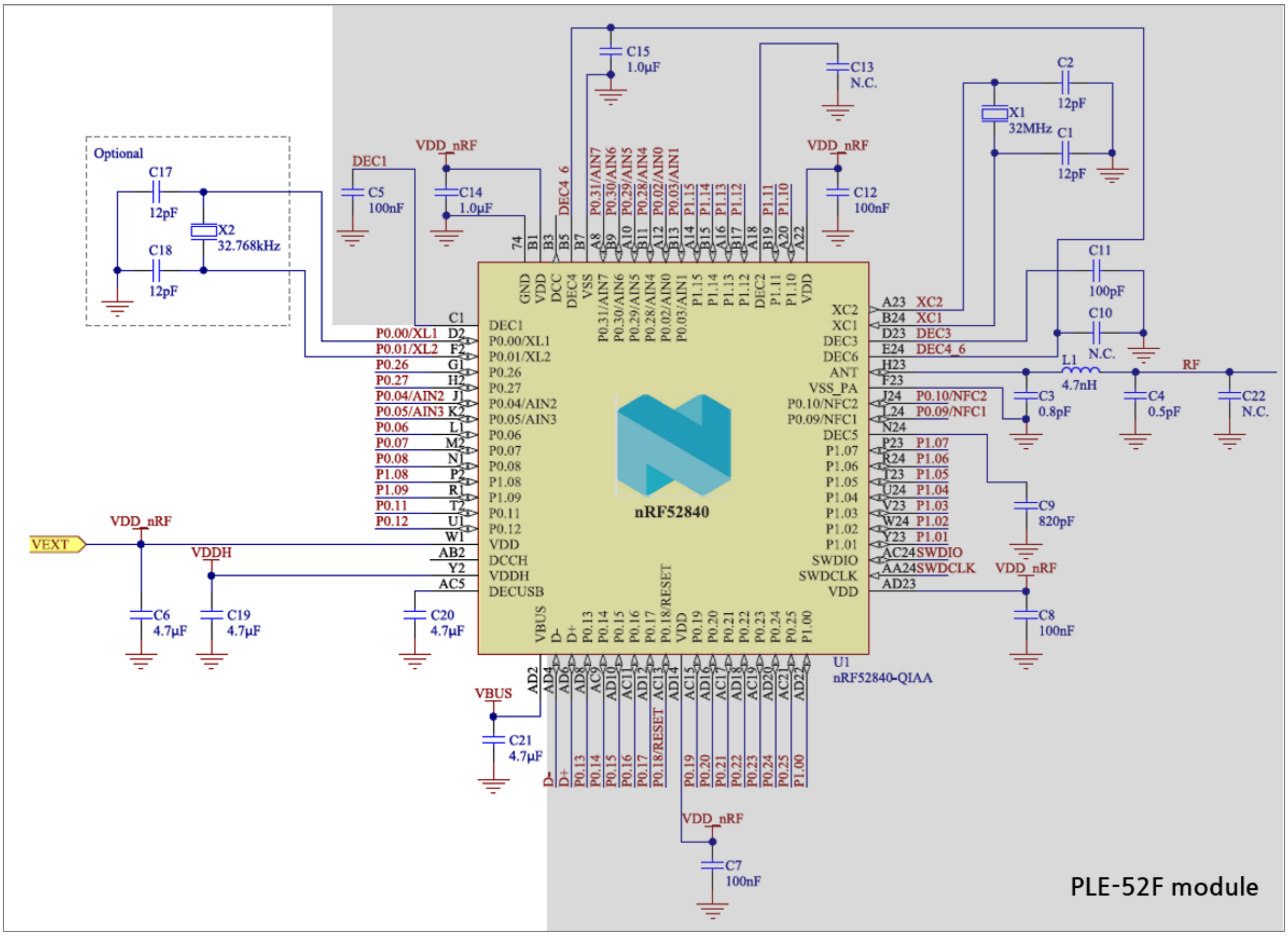
CIRCUIT CONFIGURATIONS

Config no.	Supply configuration		Enabled features				
	VDDH	VDD	EXTSUPPLY	DCDCEN0	DCDCEN1	USB	NFC
Config. 1	USB (VDDH = VBUS)	N/A	Yes	No	No	Yes	No



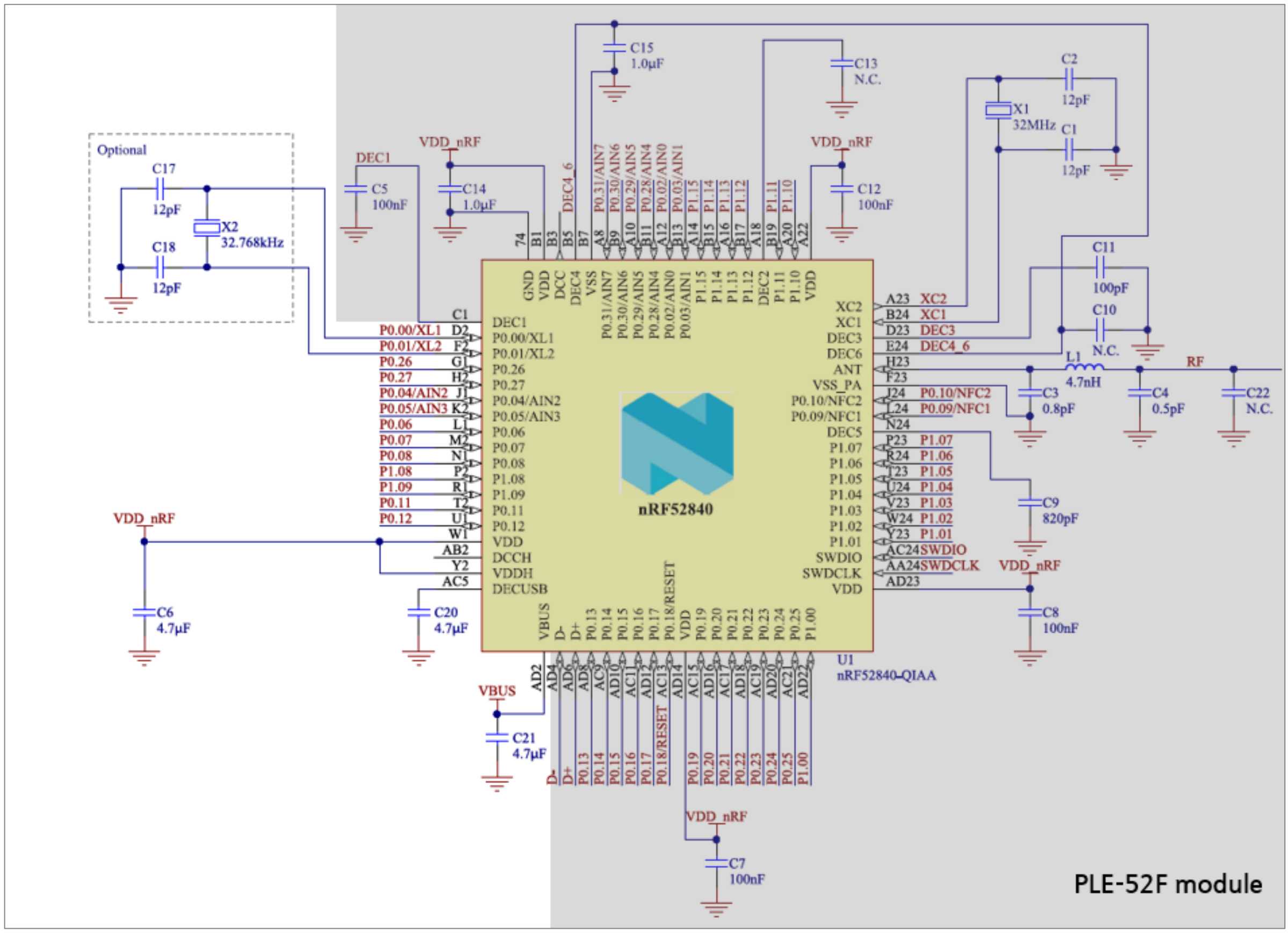
CIRCUIT CONFIGURATION NO. 1

Config no.	Supply configuration		Enabled features				
	VDDH	VDD	EXTSUPPLY	DCDCEN0	DCDCEN1	USB	NFC
Config. 2	Battery/Ext. regulator	N/A	Yes	No	No	Yes	No



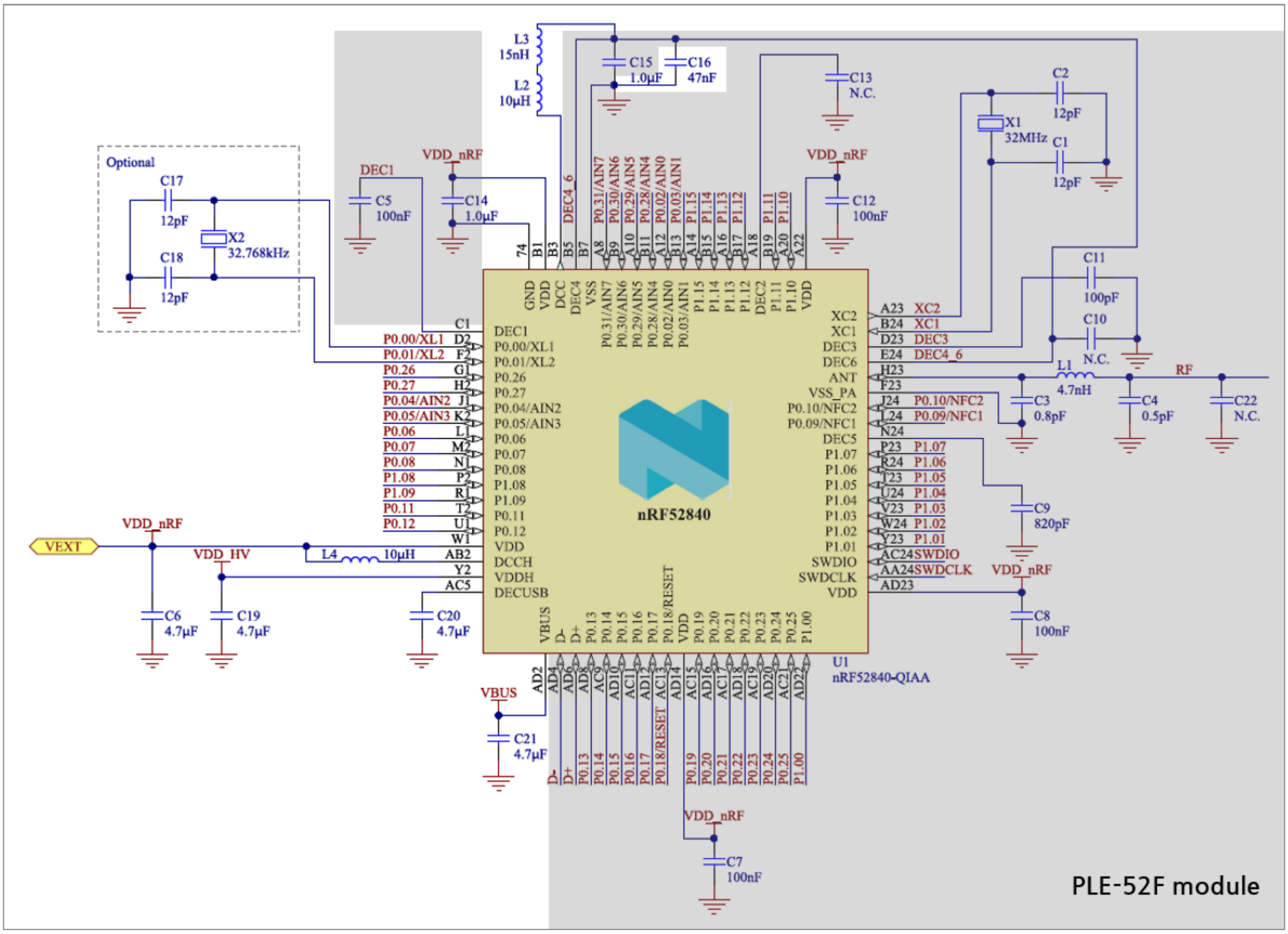
CIRCUIT CONFIGURATION NO. 2

Config no.	Supply configuration		Enabled features				
	VDDH	VDD	EXTSUPPLY	DCDCEN0	DCDCEN1	USB	NFC
Config. 3	N/A	Battery/Ext. regulator	No	No	No	Yes	No



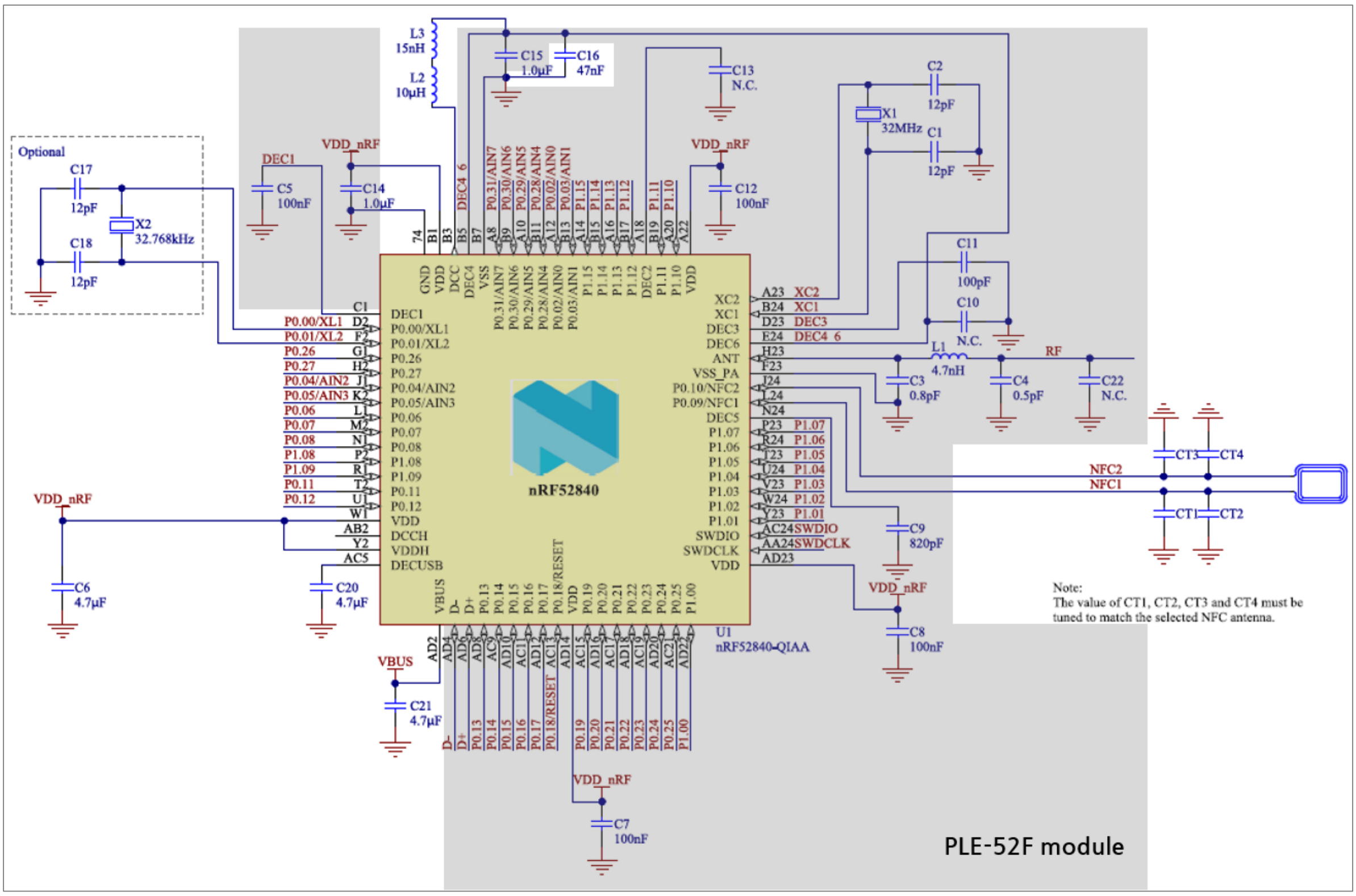
CIRCUIT CONFIGURATION NO. 3

Config no.	Supply configuration		Enabled features				
	VDDH	VDD	EXTSUPPLY	DCDCEN0	DCDCEN1	USB	NFC
Config. 4	Battery/Ext. regulator	N/A	Yes	Yes	Yes	Yes	No



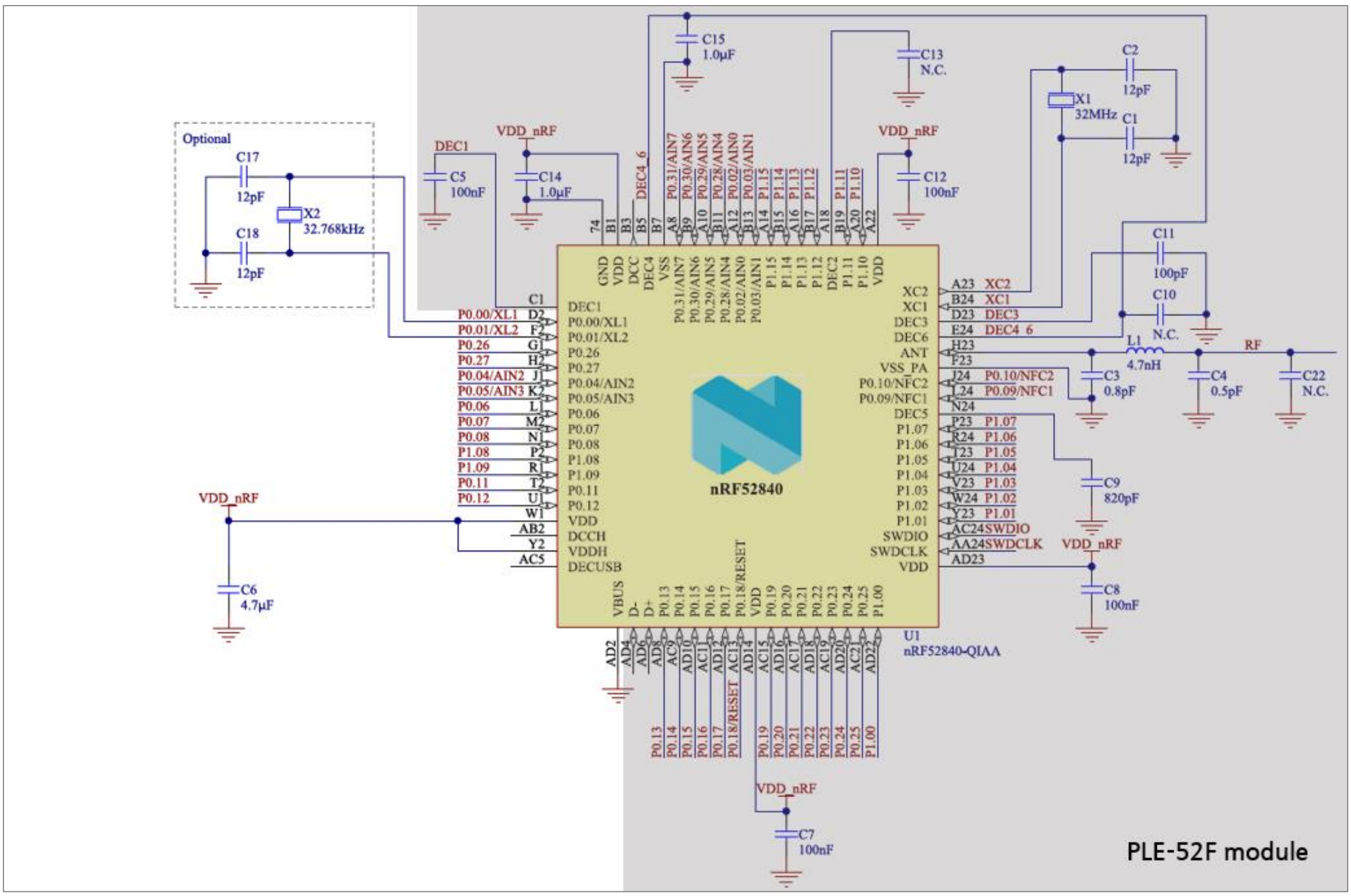
CIRCUIT CONFIGURATION NO. 4

Config no.	Supply configuration		Enabled features				
	VDDH	VDD	EXTSUPPLY	DCDCEN0	DCDCEN1	USB	NFC
Config. 5	N/A	Battery/Ext. regulator	No	No	Yes	Yes	Yes



CIRCUIT CONFIGURATION NO. 5

Config no.	Supply configuration		Enabled features				
	VDDH	VDD	EXTSUPPLY	DCDCEN0	DCDCEN1	USB	NFC
Config. 6	N/A	Battery/Ext. regulator	No	No	No	No	No



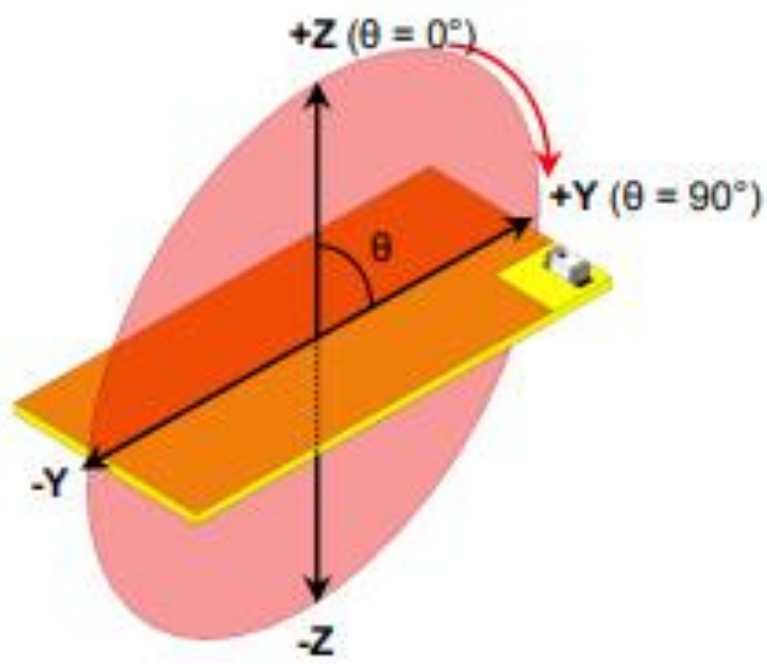
CIRCUIT CONFIGURATION NO. 6

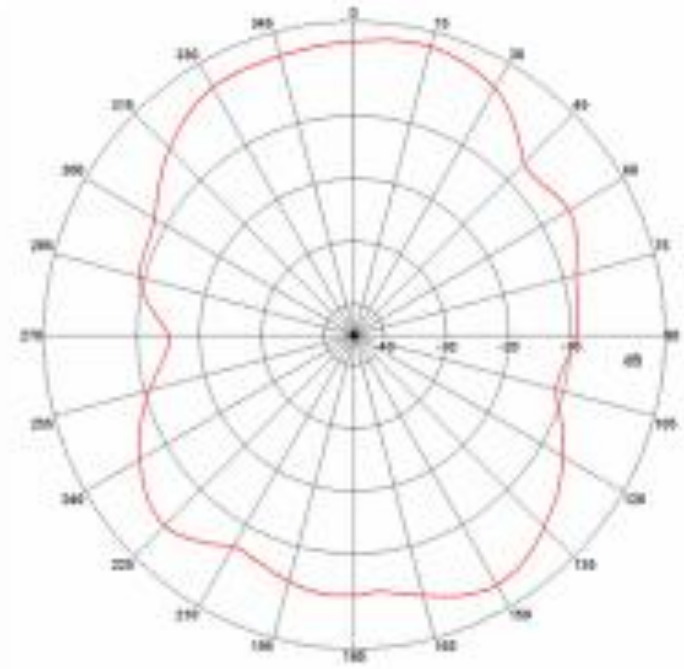
4. Antenna

Mounting Considerations 1: Antenna Performance

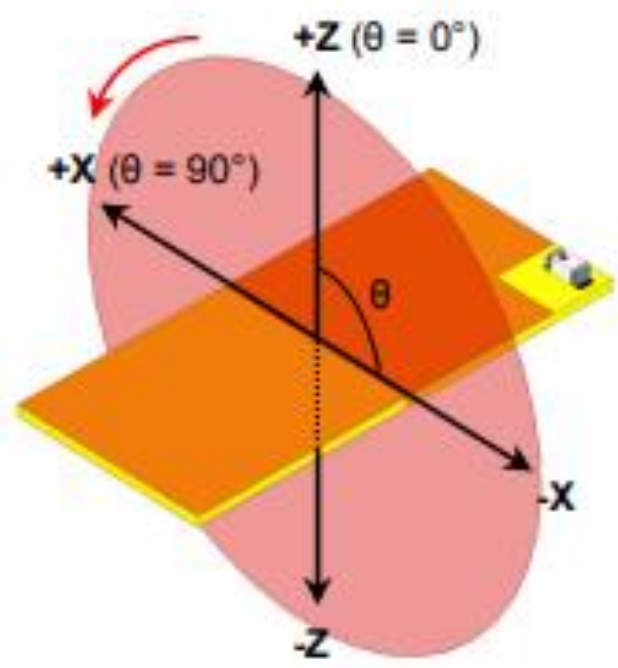
Typical 2D radiation patterns @ 2.44GHz

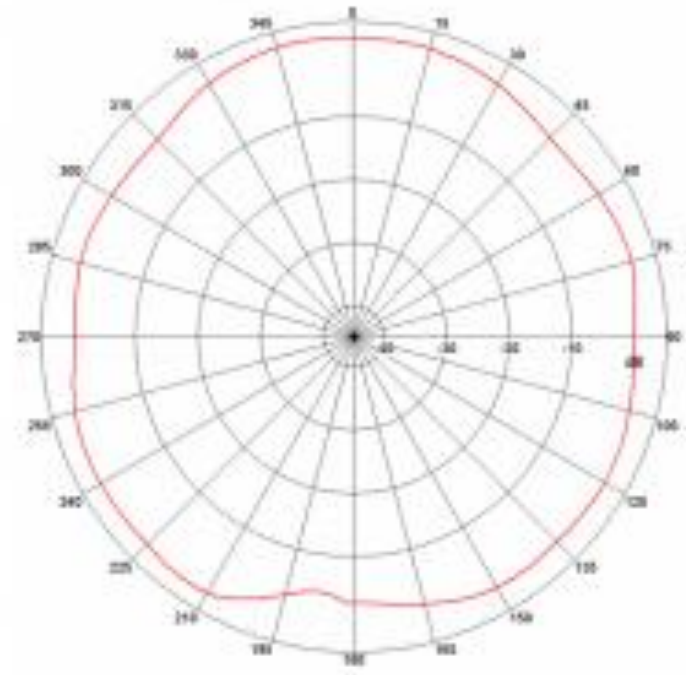
YZ-plane



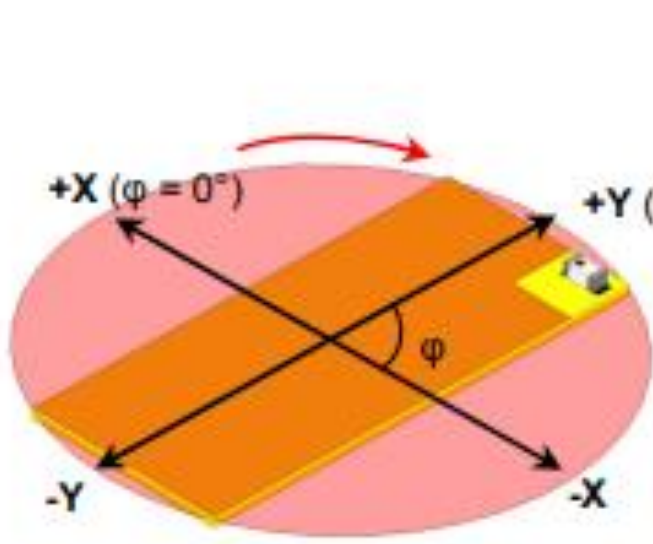


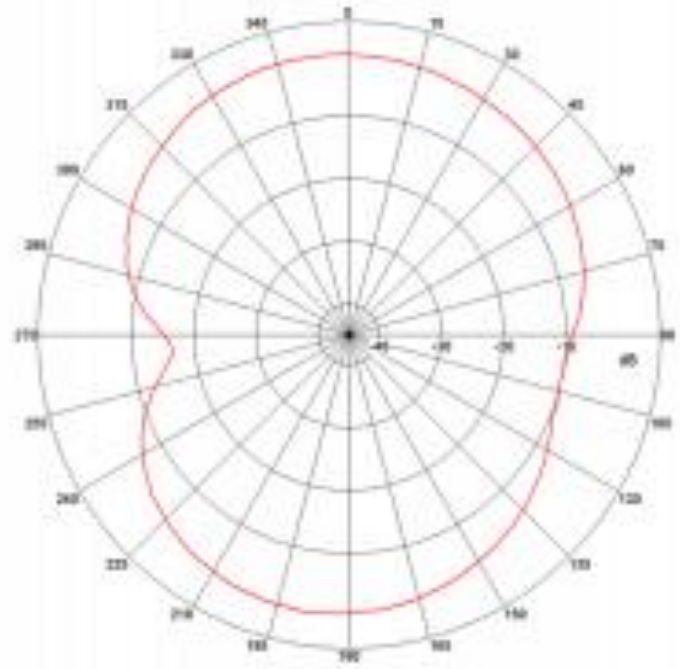
XZ-plane





XY-plane





5. Certification

5. 1 KC

71AF-01F3-B9A4-334B

방송통신기자재등의 적합등록 필증

Registration of Broadcasting and Communication Equipments

상호 또는 성명 *Trade Name or Registrant*	주식회사 엘테크
기자재명칭(제품명칭) *Equipment Name*	특정소출력 무선기기(무선데이터통신시스템용 무선기기)
기본모델명 *Basic Model Number*	PLE-52F
파생모델명 *Series Model Number*	PLE-52FM
등록번호 *Registration No.*	R-R-pro-B02
제조자/제조(조립)국가 *Manufacturer/Country of Origin*	주식회사 엘테크 / 한국
등록연월일 *Date of Registration*	2019-08-29
기타 *Others*	

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It is verified that foregoing equipment has been registered under the Clause 3, Article 58-2 of Radio Waves Act.

2020년(Year) 08월(Month) 13일(Day)

국립전파연구원장 국립전파연구원장인

Director General of National Radio Research Agency

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