

BN52H-P33

MN52H-P33 evaluation Board

Datasheet Version A

Ordering Code

BN52H-P33 for Box packaging: BN-833A1-01A-PB

BLE Solution: Nordic NRF52833

RF IC	Crystal	PCB antenna
Nordic NRF52833/V1	32MHz/20ppm Embedded	Embedded

Overview and Benefits

Overview

The BN52H-P33 from **Aradconn** is a highly flexible, ultra-low power, embedded with MN52H-C33 Bluetooth Low Energy module based on the nRF52833 SoC from Nordic Semiconductor. With an Arm[®] Cortex[®]-M4 with FPU 32-bit processor, embedded 2.4GHz transceiver, and integrated PCB antenna. Providing full use of the nRF52833's capabilities and peripherals, which include I2C, SPI, UART, I2S, ADC, GPIO, PWM,NFC and USB interfaces.

Benefits

- Bluetooth qualification and Regulatory certification reduce the burden to enter the market.
- Complete RF solution with no additional RF design, allowing faster time to launch a new product, and providing long working distance.

BN52H-P: up to 650 meters in open space. @1 Mbps

- Compact size: (L) 60 x (W) 40mm
- Provides flexibility in the OEM's application development choice with full support for using Nordic SDK and firmware tools.

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1. Packing information

A Type A to Mini USB cable for BN52H-P33 USB interface/power

supplying.

A 2x5 /1.27mm debug cable for BN52H-P33 debugging

A BN52H-P33 board



2. BN52H-P33 evaluation board

2.1 BN52H-P33 component placement

BN52H-P33 is a full-featured evaluation board for MN52H-P33 that supports:

- M1:MN52H-P33 module
- J6: A power and USB interface over mini-USB
- J1: On-board programming and debugging interface
- X1:32.768 kHz crystal
- D1: One user LED
- SW1/SW2/SW3/SW4: Four user buttons
- J3/J4: Complete I/O pinout to headers
- U1:3.3V LDO
- J2 : A jumper (PIN1 and PIN 6 on J2) uses for measure current consumption (must remove R7 first)



2.2 BN52H-P33 schematic



REMARK:

• When using internal 32.768kHz RC oscillator, please remove X1 / C1 / C2 and calibration performed at least every 8 seconds.

2.3 GPIO Recommended usage

Module PIN N0.	NRF52833 GPIO	Recommended usage				
03	P0.10					
04	P0.09					
05	P0.25					
07	P1.05					
08	P0.23	These CDIO and Standard drives				
09	P0.19	These GPIO are Standard drive	roniy			
10	P1.03	Description (Standard driver)	N /1:00	Ture	Max	1 locit
11	P0.02	Description(Standard driver)	iviin.	Typ.	iviax.	
12	P0.03	VDD 21.7, output set low	1	2	4	mA
13	P0.29	VDD≥ 1.7, output set high	1	2	4	mA
14	P0.28		1/0 am			
15	P0.31	A frequency over 10kHz (HABT		y : C 126 T		in a most
16	P0.30	A frequency over 10kHz (UART,	3PI, 12	C,123 F	vvivi) a	ire not
53	P1.02	recommended.				
54	P1.04					
55	P1.06					
58	P1.01					
60	P1.07					

3 Layout design notes 3.1 Recommended RF layout and ground plane

It is recommended to place the module:

- In the center (horizontal) of any mother PCB edge, with GND planes to the left and right
- Keep out Area should be included in the corresponding position of the antenna in each layer.
- Add via hole around GND pads on the mother PCB as many as you can, especially on the four corners and antenna area.





Bottom VIEW

3.2 Not Recommended RF layout and ground plane

TOP VIEW



3.3 Antenna keep out when proximity to Metal

• The minimum safe distance for metals without seriously compromising the antenna tuning is 4cm (bottom, top, left, right).

• Metal close to the antenna (bottom, top, left, right) will degrade RF performance. Any metal closer than 2 cm will significantly degrade RF performance.

4.4 Antenna information

The antenna test report is based on the BN52H-P33 with a ground plane size of 60 mm x 40 mm.

4.4.1 The orientation of Antenna



4.4.2 Antenna Gain and Efficiency

Frequency	Gain(dBi)	Efficiency
2400MHZ	0.08	40
2410MHZ	0.47	41
2420MHZ	0.72	42
2430MHZ	0.80	45
2440MHZ	0.79	46
2450MHZ	0.69	45
2460MHZ	0.54	43
2470MHZ	0.43	42
2480MHZ	0.18	40
2490MHZ	-0.15	36

4.4.3 Antenna Pattern 2D





5. Electrical Specification

5.1 Absolute Maximum Ratings

Maximum ratings are the extreme limits to which the chip can be exposed for a limited amount of time without causing permanent damage. Prolonged exposure to absolute maximum ratings may affect the device's reliability.

Parameter	Min.	Max.	Unit			
Supply voltage						
VDD	-0.3	+3.9	v			
VDDH	-0.3	+5.8				
VBUS	-0.3	+5.8				
VSS		0	v			
I/O pin voltage						
VI/O, VDD ≤3.6 V	-0.3	VDD+0.3	V			
VI/0, VDD >3.6 V	-0.3	3.9	v			
NFC antenna pin currer	NFC antenna pin current					
NFC 1/2		80	mA			
Radio						
RF input level		10	dBm			
Environmental						
Storage temperature	-40	+125	°C			
MSL (moisture sensitivity I	evel)	2				
ESD HBM (human body m	nodel)	2	KV			
ESD CDM (charged device	model)	450	V			
Flash memory						
Endurance		10000	Write/erase cycles			
Retention		10 years at 85°C				

5.2 Operation Conditions

Parameter	Min.	Nom.	Max.	Units
VDD (independent of DCDC)	1.7	3.0	3.6	V
VDDH (independent of DCDC)	2.5	3.7	5.5	v
VBUS (USB supply voltage)	4.35	5.0	5.5	v
VDD rise time (0V to 1.7V)			60	ms
VDDH rise time (0V to 3.7V)			100	ms
Operating temperature	-40	25	85	°C

Important: The on-chip power-on reset circuitry may not function properly if the rise times exceed the specified maximum.

5.3 Radio Specifications

Parameter	Description	Min.	Тур.	Max.	Unit
Operating frequencies	BLE	2402		2480	MHz
Channel spacing	BLE		2		MHz
Frequency deviation	BLE 1Mbps		±250		kHz
	BLE 2Mbps		±500		kHz
On-the-air data rate		125		2000	kHz
	Transmitter				
TX power	Setting at +8dBm		+8		dBm
RF power control range	-20 ~+8dBm, in 4db step	-20		+8	dBm
TX current (TX only)	DCDC@3V/+8 dBm		14.2		mA
	Setting at +8dBm		30.4		mA
Receiver					
Receive Sensitivity	1Msps BLE ideal transmitter		-96		dBm
	Packet <=37bytes BRE=0.1%				
	2Msps BLE ideal transmitter		-92		dBm
	Packet <= 37bytes BRE=0.1%				
	125ksps BLE ideal transmitter Packet <=37bytes BRE=0.1%		-103		dBm
RX current (RX only)	DCDC@3V/1Msps BLE		4.6		mA
	LDO@3V/1Msps BLE		9.6		mA
	DCDC@3V/2Msps BLE		5.2		mA
	LDO@3V/2Msps BLE		10.7		mA
RSSI	RSSI Accuracy Valid range	-90		-20	dBm
	RSSI resolution		1		dB
	Sample period		0.25		us
Antenna gain			1.05		dBi

5.4 System Clock

The MN52H-40 requires two clocks, a high frequency clock and a low frequency clock.

• The high frequency clock (HFCLK)

HFCLK is provided on-module by a high-accuracy 32 MHz/±20 ppm crystal for radio and CPU operation.

•The low frequency clock (LFCLK)

LFCLK can be provided internally by an RC oscillator (±250 ppm) with calibration, or externally by a 32.768 kHz crystal.

Internal 32.768 kHz RC oscillator (LFRC)

Description	Min.	Тур.	Max.	Unit
Nominal frequency		32.768		kHz
Frequency tolerance for LFRC after calibration (calibration performed at least every 8 seconds)			±500	ppm
Run current for 32.768 kHz RC oscillator		0.7		uA
Startup time for 32.768 kHz RC oscillator		1000		us

External 32.768 kHz crystal oscillator (LFXO)

Parameter	Description	Min.	Тур.	Max.	Unit
	Crystal frequency		32.768		kHz
	Frequency tolerance requirement for BLE stack			±500	ppm
	Frequency tolerance requirement for ANT stack			±50	ppm
	Run current for 32.768 kHz crystal oscillator		0.23		uA
CL	Load capacitance			12.5	рF
C0	Shunt capacitance			2	рF
RS	Equivalent series resistance			100	Kohm
PD	Drive level			0.5	uW
Cpin	Input capacitance on XL1 and XL2 pads		4		рF

An external crystal provides the lowest power consumption and greatest accuracy. Using the internal RC oscillator with calibration provides acceptable performance for BLE stack at a reduced cost and slight increase in power consumption.

Important:

- The ANT protocol requires the use of an external crystal for high accuracy.
- Nordic SDK example program P0.00/P0.01 as external LFXO, you need an external crystal to work.
- Nordic SDK example program P0.00/P0.01 as external LFXO, if you would like to reduce material cost, save layout space or requires 2 more GPIO for application. You need program p0.00/p0.01 as internal LFRC.

6.Ordering Code

Model	Ordering code	Photo	
BN52H-P33	BN-833A1-01A-PB		
Ordering	g code: BN-833A1-01A-PB		
BN: Boai 833A1: N	rd/Nordic JRF52833/AOFN/V1		
01A: Arad standard module without customer code			
PB: PCB	antenna/Box packing		

BN52H Series

Model	IC/Version	Antenna	Ordering code	
BN52H-C40	NRF52840/V2	Chip	BN-840A2-01A-CB	
BN52H-C33	NRF52833/V1	- Chip	BN-833A1-01A-CB	
BN52H-P40	NRF52840/V2	DCD	BN-840A2-01A-PB	
BN52H-P33	NRF52833/V1	- РСВ	BN-833A1-01A-PB	
BN52H-U40	NRF52840/V2	U.FL Connector	BN-840A2-01A-UB	

Revision history

Version	Date	Notes	Name
1.0	2024/12/01	Initial Release	