WT02C40C,WT02E40E BLE 5.4,802.15.4,WiFi6 Combo Module

Ver 0.97, Nov. 2024

WT02C40C Series are combo modules of a Nordic WiFi 6 nRF7002 SoC and a Nordic nRF5340 BLE SoC. With a dual core ARM Cortex™ M33 MCU, up to 128MHz, quad radio-protocol transceivers, and various antenna options. They will be certified for BLE, 802.15.4, 2.4 GHz WiFi 6 and 5 GHz WiFi 6. It allows faster time to market with reduced development cost, especially for Matter applications.

No external component needed to minimize host PCB area: 40MHz, 32 MHz and 32.768 KHz, -40°C to +105°C, 20 PPM crystals are integrated. DCDC inductors for VDD and VDDH are integrated. Powering up sequence control circuitry is embedded.

WiFi 6 Specifications

- Nordic nRF7002 SoC.
- Low-power and secure Wi-Fi for the IoT
- Supports IEEE 802.11 a/b/g/n/ac/ax
- Supports Target Wake Time (TWT), Orthogonal Frequency Division Multiple Access (OFDMA, Downlink and Uplink), BSS coloring
- WiFi CERTIFIED 6™, WiFi CERTIFIED™ a/b/g/n/ac, WiFi Enhanced Open™.
- Supports WPA3™, WPA2™, WPA™ - Personal and Enterprise, Protected Management Frames.
- Supports WMM®, WMM-Power Save, WiFi Agile Multiband™, WiFi Direct®.
- 2.4 GHz and 5 GHz dual-band or 2.4 GHz only
- Adjustable TX power from +5 to +19 dBm.
- Wi-Fi 6 Station (STA)
- 1 Spatial Stream (SS)
- 20 MHz channel bandwidth
- 64 QAM (MCS7), 86 Mbps PHY throughput
- Co-existence interfaces
- Carrier frequency: trimmed to +/- 2 ppm in the 5 GHz bands.

BLE/802.15.4 Specifications:

- nRF5340 CLAA, dual core ARM® Cortex M33
- Application Core
  - 128/64 MHz Cortex M33 with FPU and DSP instructions
  - 1MB flash, 512KB RAM
  - 8KB 2-way set associate cache
  - ARM® TrustZone® Cryptocell-312 co-processor
- Network core:
  - 64 MHz Cortex M33 with 2KB instruction cache
  - 256KB flash, 64KB RAM
  - Receiver Sensitivity: -98 dBm at 1Mbps.
  - TX power: programmable +3dBm to -20dBm
  - BLE data rate: 2Mbps, 1Mbps, 500kbps, 125kbps.
  - IEEE 802.15.4 data rate: 250 Kbps
- DCDC inductors for VDD, VDDH on board.
- Serial Wire Debug (SWD)
- Over-the-Air (OTA) firmware update
- 48 General purpose I/O pins
- USB 2.0 full speed (12 Mbps) controller
- QSPI interface
- Type 2 NFC-A tag with wake-on field, Touch-to-pair support
- Programmable peripheral interconnect (PPI)
- 12 bit/200 Kbps ADC, 8 configurable channels.
- Up to 3x pulse width modulator (PWM)
- Audio peripherals: I²S, digital microphone interface (PDM)
- 5 x 32 bit timers with counter mode
- Up to 3x SPI masters/3x SPI slaves
- Up to 2x I²C compatible 2-wire masters/slaves
- 2x UART (CTS/RTS)
- Quadrature Demodulator (QDEC)
- 2x real time counters (RTC)

Miscellaneous

- Hybrid pins: 16 castellated and 45 LGA.
- Modules can be “T” shape
- Operation voltage: 3.3V
- Pending Certifications: (BLE, 802.15.4, 2.4 GHz WiFi, 5GHz WiFi).
- FCC ID:
- ISED ID:
- CE, RCM:
- TELEC ID:
- Taiwan NCC.
- QDID: 119517, 182626
- All modules support **apprtect** features.

Model Summaries

module	WT02E40E	WT02C40C	WT02V40V	WT02E40C	WT02P40P
Size W(antenna)xHxT, mm	14.0(15.5)x23.0x2.0	14.0(25.0)x24.8x2.0	14.0(16.4)x30.5x2.0	14.0(15.5)x24.5x2.0	14(15)x18.5x2.0
SoCs	nRF5340+nRF7002	nRF5340+nRF7002	nRF5340+nRF7002	nRF5340+nRF7002	nRF5340+nRF7002
Embedded crystals	40M+32M+32K	40M+32M+32K	40M+32M+32K	40M+32M+32K	40M+32M+32K
BT/WiFi Antenna	u.FL/u.FL	Chip/Chip	Chip/chip	u.FL/Chip	Pads/pads
2.4GHz WiFi range, iPhone 14					
5GHz WiFI range, iPhone 14					
Operating temp.	-40°C to +85°C	-40°C to +85°C	-40°C to +85°C	-40°C to +85°C	-40°C to +85°C
Evaluation board	EV-WT02E40E	EV-WT02C40C	EV-WT02V40V	EV-WT02E40C	EV-WT02P40P
Availability	Q1, 2025	Q1, 2025	2025	Q1, 2025	Q1, 2025

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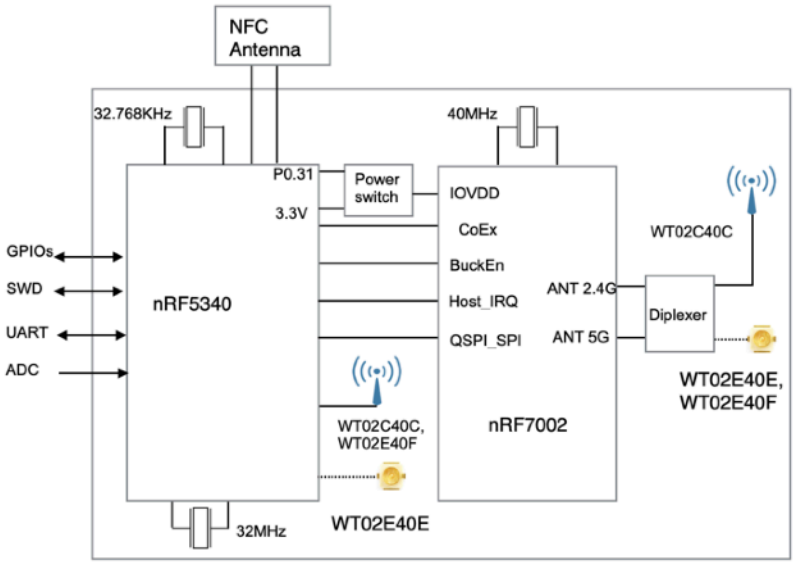
1. Introduction

WT02C40C Series are combo modules of a Nordic WiFi 6 nRF7002 SoC and a Nordic nRF5340 BLE SoC. With a dual core ARM Cortex™ M33 MCU, up to 128MHz, quad radio-protocol transceivers, and various antenna options. They are certified for BLE, 802.15.4, 2.4 GHz WiFi 6 and 5 GHz WiFi 6. It allows faster time to market with reduced development cost, especially for Matter applications.

WT02C40C Block Diagram

The following is a block diagram of WT02C40C. All required crystals are embedded. Connection to an external NFC (Near Field Communication) antenna is provided. Both WiFi 6 and Bluetooth/Thread have 3 antenna options, chip, u.FL or connection pads for an external antenna.



Module Descriptions

WT02C40C

- An nRF5340 SoC with dual core Cortex M33 MCU, up to 128 MHz
- An integrated high performance chip antenna for BLE/802.15.4.
- An nRF7002 WiFi 6 SoC supports IEEE 802.11 a/b/g/n/ac/ax for both 2.4 GHz and 5 GHz bands.
- An integrated high performance chip antenna for WiFi 6.
- Size: 14.0 (25.0 antenna area) x 24.8 x2.0 mm.
- Uses WiFi 6 in the 5GHz bands only for Matter applications.

WT02V40V

- An nRF5340 SoC with dual core Cortex M33 MCU, up to 128 MHz
- An integrated chip antenna for BLE/802.15.4.
- An nRF7002 WiFi 6 SoC supports IEEE 802.11 a/b/g/n/ac/ax for both 2.4 GHz and 5 GHz bands.
- An integrated chip antenna for WiFi 6.
- Size: 14.0 (16.4 antenna area) x 30.5 x 2.0 mm.
- Uses WiFi 6 in the 5GHz bands only for Matter applications.

WT02E40C

- An nRF5340 SoC with dual core Cortex M33 MCU, up to 128 MHz
- An integrated high performance chip trace antenna for BLE /802.15.4.
- An nRF7002 WiFi 6 SoC supports IEEE 802.11 a/b/g/n/ac/ax for both 2.4 GHz and 5 GHz bands.
- An u.FL connector for an external WiFi antenna.
- Size: 14.0 (15.5 antenna area) x 24.5 x 2.0 mm.
- Recommended for Matter applications.

WT02E40E

- An nRF5340 SoC with dual core Cortex M33 MCU, up to 128 MHz
- An integrated chip antenna for BLE/802.15.4.
- An nRF7002 WiFi 6 SoC supports IEEE 802.11 a/b/g/n/ac/ax for both 2.4 GHz and 5 GHz bands.
- An u.FL connector for an external WiFi 6 antenna.
- Size: 14.0 (15.5 antenna area) x 23.0 x 2.0 mm
- Recommended for Matter applications.

WT02P40P

- An nRF5340 SoC with dual core Cortex M33 MCU, up to 128 MHz
- Pads for BLE/802.15.4 antenna connection on the host board.
- An nRF7002 WiFi 6 SoC supports IEEE 802.11 a/b/g/n/ac/ax for both 2.4 GHz and 5 GHz bands.
- Pads for WiFi 6 antenna connection on the host board.
- Size: 14.0 (15.0 antenna area) x 18.5 x 2.0 mm
- Recommended for Matter applications.

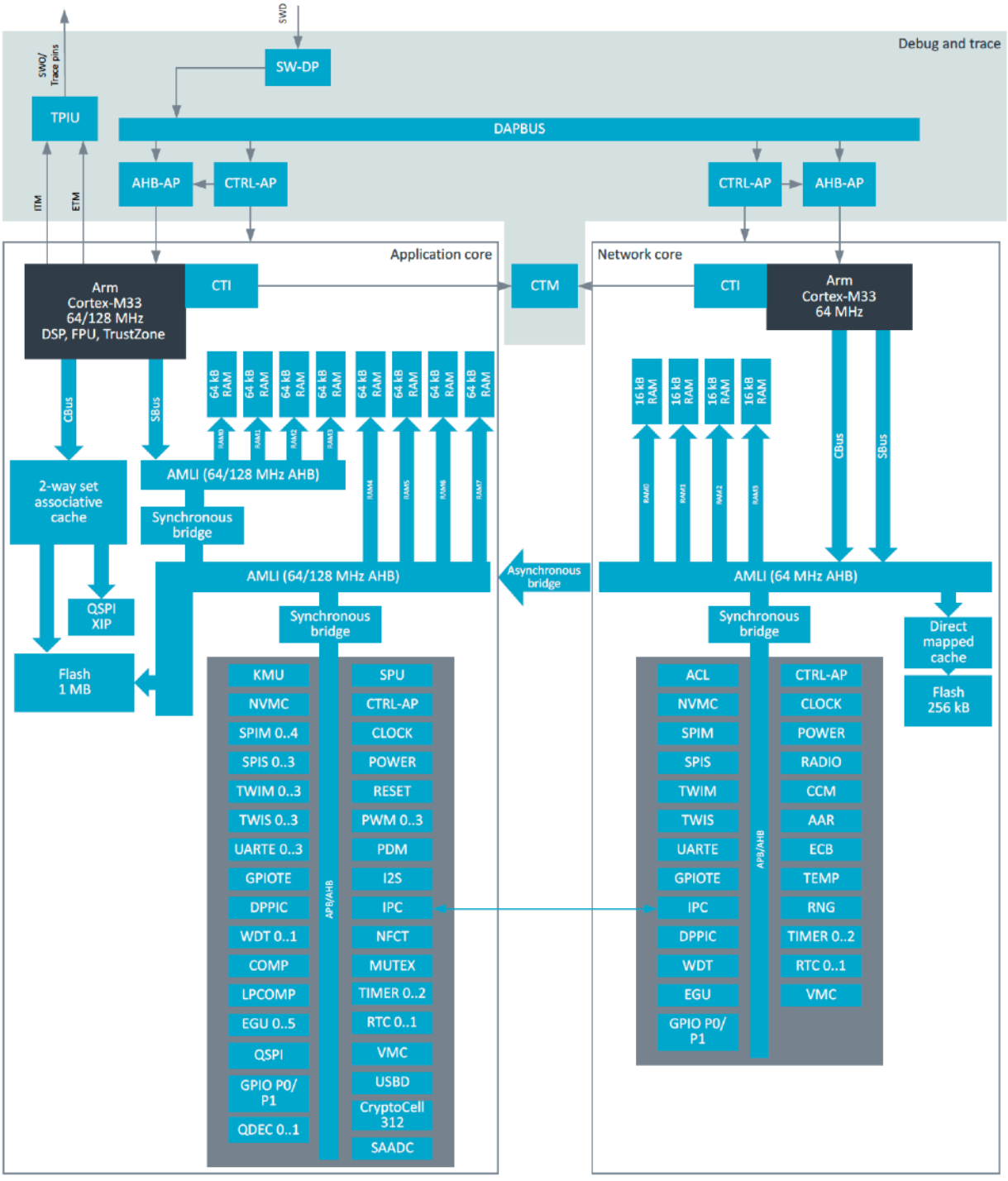
Dual Band Antenna ANT036

- Peak gain in the 2.4 GHz band, 1.52 dBi.
- Peak gain in the 5 GHz band, 3.13 dBi.
- Antenna width x length, 17.7mm x 158.8mm.
- Includes an 100 mm, SMA to u.FL adapter cable. SMA connector with panel mounting hardware.

2. Product Descriptions

Block Diagram of nRF5340

The following is a block diagram of Nordic nRF5340 Bluetooth Low Energy (BLE) SoC. Please visit Nordic website for **full description and product specifications**.



nRF5340 is a wireless ultra-low power multiple core System on Chip (SoC) integrating two fully programmable Arm Cortex M33 processors, advanced security features, a range of peripherals, and a multiprotocol 2.4 GHz

transceiver. The transceiver supports Bluetooth low energy, ANT™, and 802.15.4 and allows the implementation of proprietary 2.4 GHz protocols.

The two Arm Cortex M33 processors share the power, clock, and peripheral architecture with Nordic Semiconductor nRF51, nRF52, and nRF91 Series of PAN/LAN SoCs, ensuring minimal porting efforts. The application core is a full-featured Arm Cortex M33 processor including DSP instructions and FPU and running at up to 128 MHz with 1MB of flash and 512 KB of RAM. The option to run the application processor at 64 MHz allows the CPU to increase energy efficiency. The network core is an Arm Cortex M33 processor with a reduced feature set, designed for ultra-low power operation. It runs at a fixed 64 MHz frequency and contains 256 KB of flash and 64 KB of RAM.

The peripheral set offers a variety of analog and digital functionality enabling single chip implementation of a wide range of applications. Arm trustZone technology, Arm cryptoCell-312, and supporting blocks for ysytem protection and key management are embedded for the advanced security needed for IoT applications.

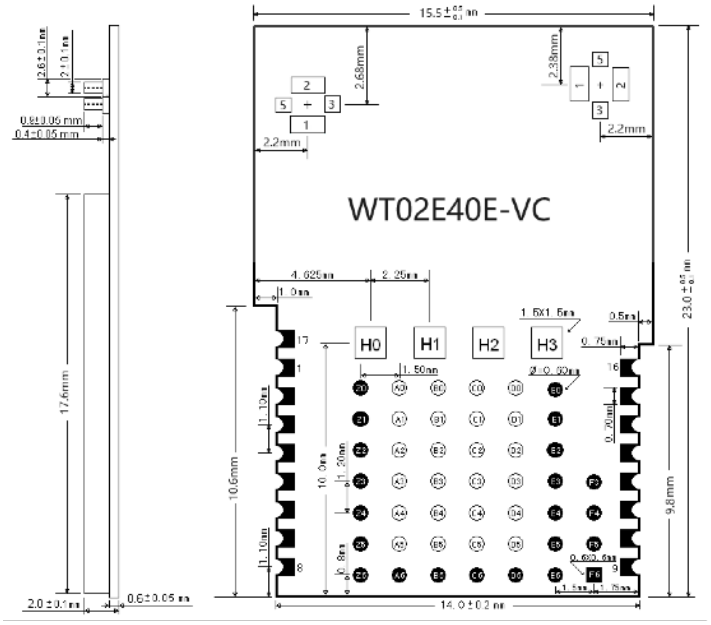
Mechanical Drawings

Soldering pads for WT02C40C is the same as that of the nRF5340 modules, BT40F and BT40N. Due to different antenna designs, the sizes of modules are different.

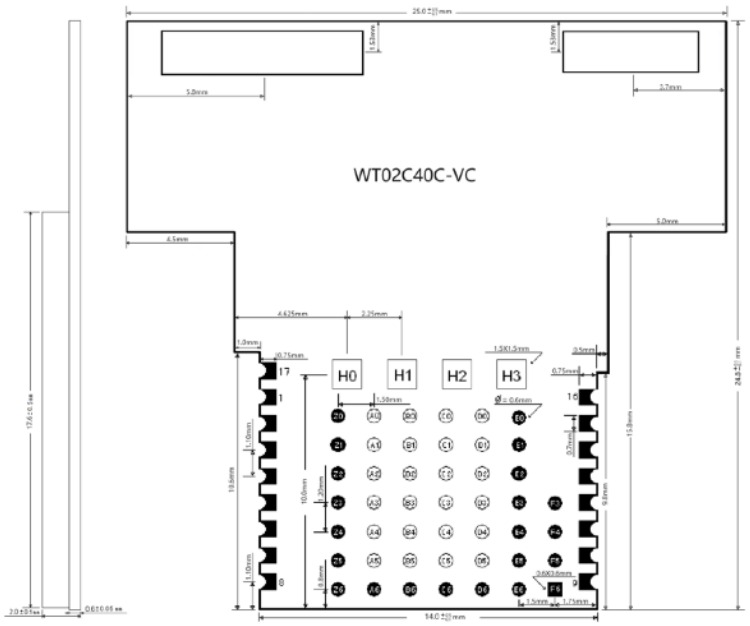
Two types of pins are available to meet different application requirements.

- 16 castellated pins for application needing limited number of IOs. SMT equipment is not required for soldering castellated pins.
- 45 LGA (Land Grid Array) pins to access all 48 GPIOs of nRF5340 when needed.

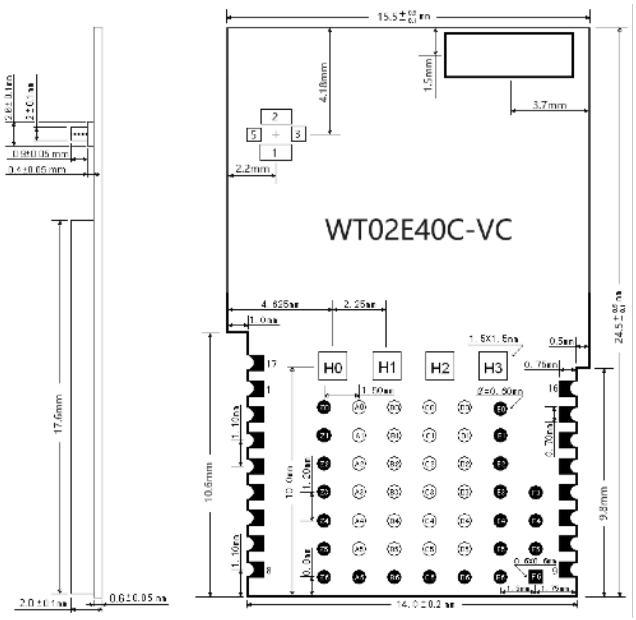
The following is WT02E40E mechanical drawings, top view.



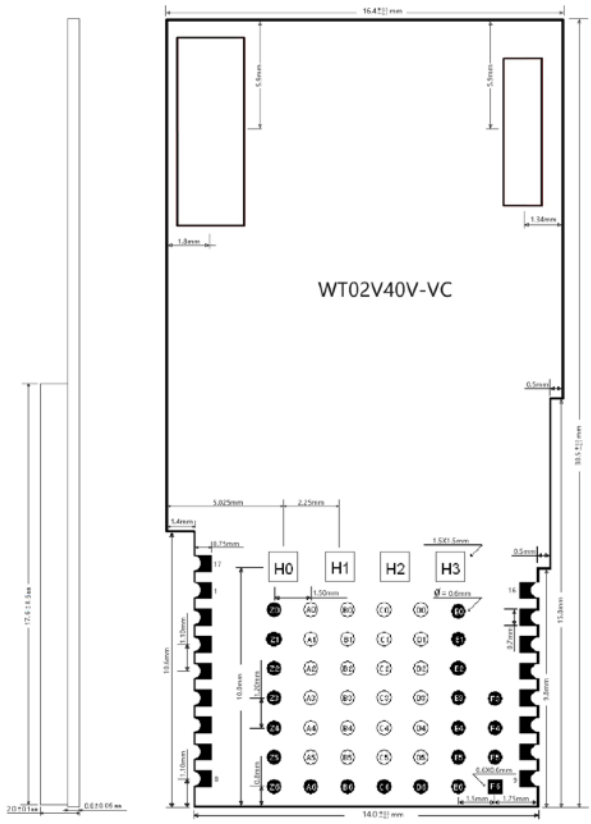
WT02C40C mechanical drawings, top view.



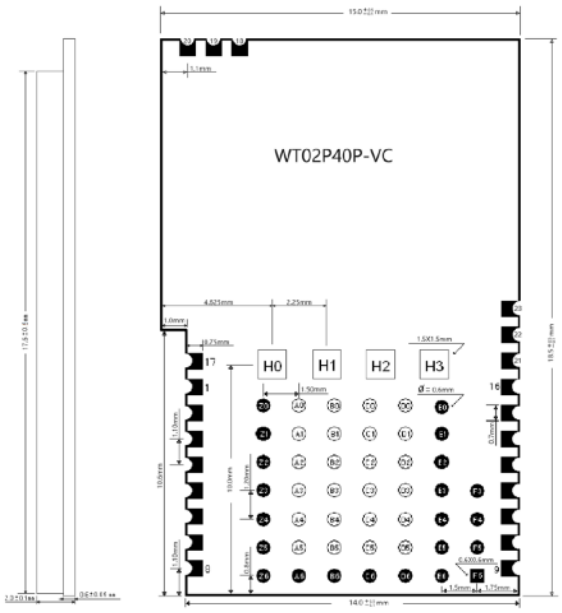
WT02E40C mechanical drawings, top view.



WT02V40V mechanical drawings, top view.



WT02P40P mechanical drawings, top view.

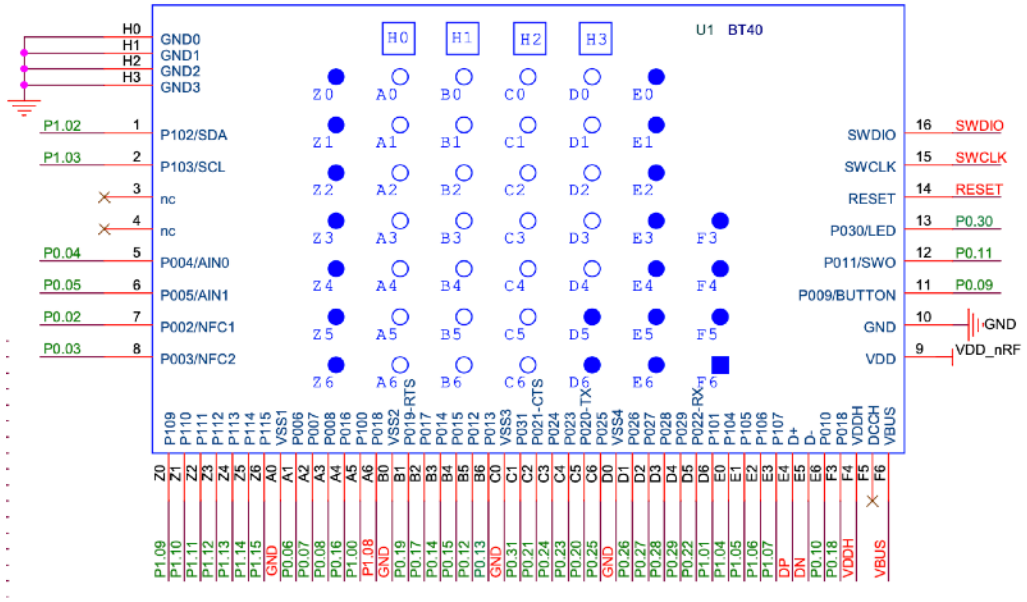


Pin Assignments of WT02C40C

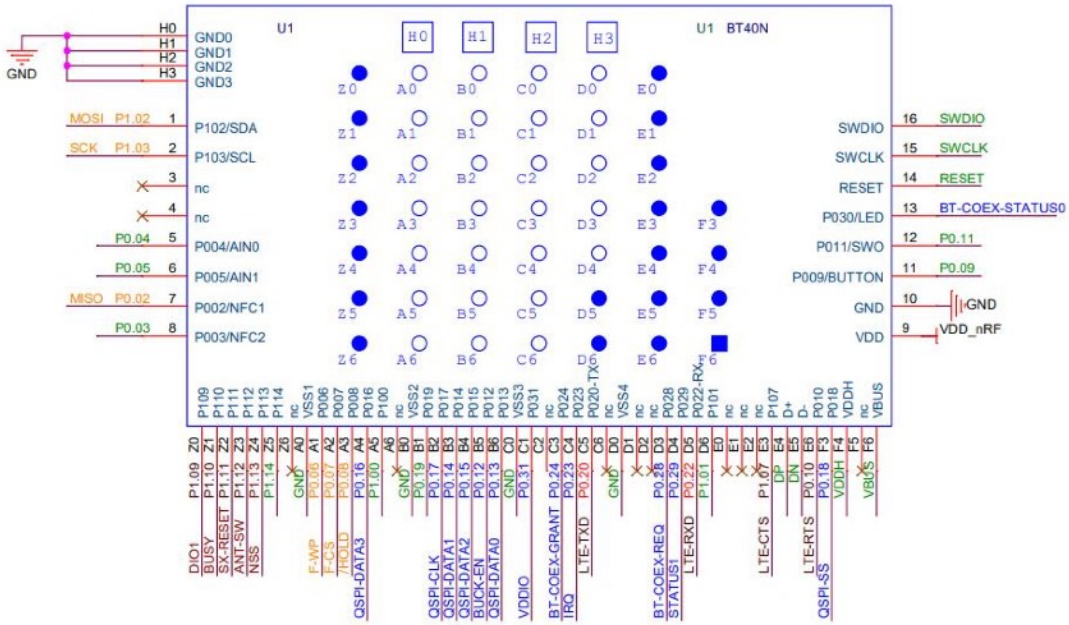
The followings are WT02C40C pin assignment. Pin functions are in a table in next section. Please refer to Nordic **nRF5340 Product Specifications** for detailed descriptions and features supported.

BT40F, BT40N, and WT02C40C have compatible footprints. Pin assignments are below. Firmware configuration is required to upgrade module on the PCB.

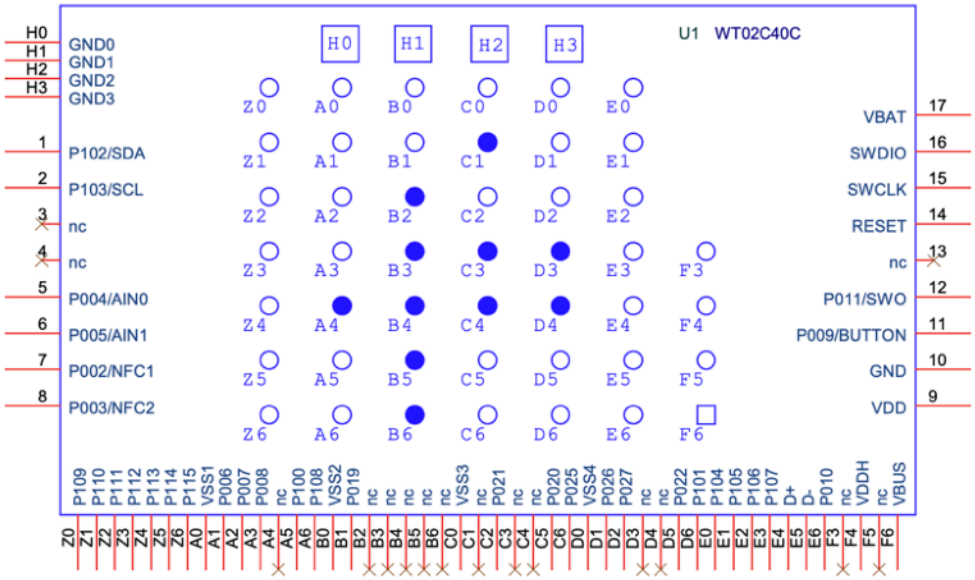
BT40F pin assignments



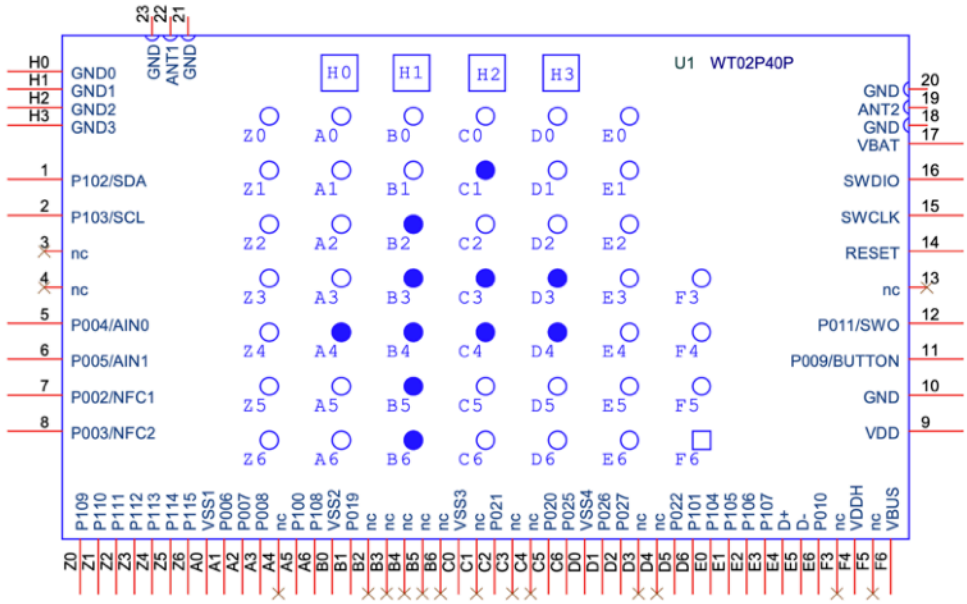
BT40N pin assignments.



WT02C40C pin assignments. Pin 17 is 3.3V DC power input.



WT02P40P pin assignments.



Pin Functions

The nRF5340 GPIO pins used to manage nRF7002 inside WT02C40C are in **blue** color in the **Descriptions** column. These pins are NC (No Connect) on the module.
BT40N/NE has the same soldering pads as BT40F. It uses 9 GPIO pins internally to control the power amplifier, nRF21540. These pins are described in red color in the **Descriptions** column. The SPI pins may be shared with other SPI devices. Avoid using these pins as GPIO pins if you need Bluetooth range upgrade.

- WT02C40C represents WT02C40C, WT02E40C, WT02E40E, WT02P40P, and WT02V40V.
- WT02P40P only pins are marked with WT02P40P.

BT40/BT40N	WT02C40C	nRF5340		
pin#	pin#	pin#	pin name	Descriptions
1	1	AE1	P1.02	GPIO, configured as I2C SDA on EV board
2	2	AF2	P1.03	GPIO, configured as I2C SCL on EV board
3	3	N1	NC	NC, 32.768 KHz crystal embedded.
4	4	R1	NC	NC, 32.768 KHz crystal embedded.
5	5	V2	P0.04/AIN0	GPIO, Analog input
6	6	Y2	P0.05/AIN1	GPIO, Analog input
7	7	W1	P0.02/NFC1	GPIO, NFC antenna connection
8	8	AA1	P0.03/NFC2	GPIO, NFC antenna connection
9	9	A19	VDD	DC supply 1.7V to 3.6V. 3.3V nominal for WT02C40C Series, 2.9V minimum, 3.6V maximum.
10	10	A25	VSS	Ground
11	11	AJ1	P0.09/MOSI	GPIO; BT40F, high speed SPI_MOSI.
12	12	AK4	P0.11	GPIO
13	NC	B24	P0.30	GPIO; NC for WT02C40C, used as COEX_Status 0 internally for nRF7002.
14	14	AC31	/RESET	GPIO, reset with internal pull up, active low.
15	15	W31	SWDCLK	Serial Wire Debug clock input
16	16	AA31	SWDIO	Serial Wire Debug I/O
	17		Vbat-3.3V	To nRF7002 pin 31 BUCKVBATS and pin 25 BUCKVBAT. 3.3V nominal, 3.6V maximum.
	18		GND	WT02P40P only. Ground pad for BLE RF connection.
	19		BLE feed	WT02P40P only. BLE RF connection to a host board antenna.
	20		GND	WT02P40P only. BLE antenna ground.
	21		GND	WT02P40P only. WiFi antenna ground.
	22		WiFi feed	WT02P40P only. WiFi RF connection to a host board antenna.
	23		GND	WT02P40P only. WiFi antenna ground.
Z0	Z0	AK26	P1.09	GPIO
Z1	Z1	R31	P1.10	GPIO
Z2	Z2	B20	P1.11	GPIO;
Z3	Z3	B18	P1.12	GPIO;
Z4	Z4	A17	P1.13	GPIO;
Z5	Z5	B16	P1.14	GPIO
Z6	Z6	B14	P1.15	GPIO, Connected to nRF21540 SCK pin internally for BT40N.
A0	A0	A25	VSS	Ground
A1	A1	AB2	P0.06/AIN2	GPIO, Analog input
A2	A2	AD2	P0.07/AIN3	GPIO, Analog input
A3	A3	AH2	P0.08/SCK	GPIO; BT40F, high speed SPI clock
A4	A4	AL9	P0.16/IO3	GPIO; BT40F, high speed SPI IO3

A5	A5	M2	P1.00	GPIO
A6	A6	AL23	P1.08	GPIO, Connected to nRF21540 MOSI pin internally for BT40N.
B0	B0		VSS	Ground
B1	B1	AL13	P0.19	GPIO
B2	B2	AK12	P0.17/SCK	GPIO; BT40F, QSPI clock.
B3	B3	AK8	P0.14/IO1	GPIO; BT40F, QSPI IO1
B4	B4	AK10	P0.15/IO2	GPIO; BT40F, QSPI IO2
B5	NC	AK6	P0.12/DCX	GPIO; BT40F, high speed SPI DCX; NC for WT02C40C, used internally as BUCKEN for nRF7002.
B6	B6	AL5	P0.13/IO0	GPIO, BT40F, QSPI IO0
C0	C0		VSS	Ground
C1	NC	B22	P0.31	GPIO; NC for WT02C40C, used internally as IOVDD Control for nRF7002.
C2	C2	AL15	P0.21	GPIO; Connected to nRF21540 TX_EN pin internally for BT40N.
C3	NC	AL27	P0.24	GPIO; NC for WT02C40C, used internally as COES_Grant for RF7002.
C4	NC	AK20	P0.23	GPIO; NC for WT02C40C, used internally as Host IRQ for nRF7002.
C5	C5	AK16	P0.20	GPIO
C6	C6	AK28	P0.25/AIN4	GPIO, BT40F, analog input; Connected to nRF21540 MISO pin internally for BT40N.
D0	D0		VSS	Ground
D1	D1	AL29	P0.26/AIN5	GPIO, BT40F, analog input; Connected to nRF21540 PDN pin internally for BT40N.
D2	D2	AK30	P0.27/AIN6	GPIO; BT40F, analog input; Connected to nRF21540 RX_EN pin internally for BT40N.
D3	NC	AE31	P0.28/AIN7	GPIO, BT40F, analog input; NC for WT02C40C, used internally as COEX-REQ for nRF7002.
D4	NC	U31	P0.29	GPIO; NC for WT02C40C, used internally as COEX_Status 1 for nRF7002.
D5	D5	AK18	P0.22	GPIO
D6	D6	P2	P1.01	GPIO
E0	E0	AL19	P1.04	GPIO; Connected to nRF21540 MODE internally for BT40N.
E1	E1	AK22	P1.05	GPIO; Connected to nRF21540 ANT-SEL internally for BT40N.
E2	E2	AL21	P1.06	GPIO; Connected to nRF21540 CSN pin internally for BT40N.
E3	E3	AK24	P1.07	GPIO
E4	E4	B2	D+	USB D+
E5	E5	B4	D-	USB D-
E6	E6	AK2	P0.10/MISO	GPIO, BT40F, high speed SPI MISO
H0	H0			Ground pad
H1	H1			Ground pad
H2	H2			Ground pad
H3	H3			Ground pad
F3	F3	AK14	P0.18/CSN	GPIO, BT40F, QSPI chip select
F4	F4	E1	VDDH	High Voltage Power Supply, 2.5V to 5.5V. 3.3V for WT02C40C, engineering version.
F5	F5	J1	NC	BT40F, No connect, L,C circuit embedded.
F6	F6	A5	VBUS	5V DC power for USB 3.3V regulator

nRF5340 and NRF7002 Internal Connection

The WLCSP version of nRF5340 and the WLCSP version of nRF7002 are used in the WT02C40C Series combo modules. The internal connections are shown below.

WT02C40C Internal connection			
nRF5340 CLAA		nRF7002 CEAA	
Pin	Port name	Pin	Pin name
J6	P0.12	J5	BUCK-EN
K10	P0.13	B2	QSPI-DATA0
K9	P0.14	B4	QSPI-DATA1
L9	P0.15	A3	QSPI-DATA2
K8	P0.16	B6	QSPI-DATA3
L7	P0.17	C1	QSPI-CLK
K7	P0.18	C3	QSPI-SS
H3	P0.23	B10	IRQ
K2	P0.24	A11	BT-COEX-GRANT
E3	P0.28	B8	BT-COEX-REQ
E2	P0.29	A9	SW-CTRL1/STATUS1
C4	P0.30	A5	BT-COEX-STATUS0
C5	P0.31	B12	IOVDD

Using Internal Load Capacitors for the High Frequency Oscillator

The external load capacitors for the 32MHz crystal are not mounted. An Epson or equivalent +/-10 PPM crystal is connected to XC1 and XC2 pins. The Bluetooth signal frequencies are within specifications if the internal load capacitors are not enabled. Use the following procedures to set the internal load capacitors to 11 pF for BT40F, the Bluetooth signal frequency is measured to be within 5 PPM at 25°C. The settings for WT02C40C are to be determined.

The internal load capacitors can be programmed from 7.0 pF to 20 pF in 0.5 pF steps. The addresses and description of registers for programming the value of load capacitors are from the Nordic nRF5340 Product Specifications.

Base address	Domain	Peripheral	Instance	Secure mapping	DMA security	Description	Configuration
0x50004000	APPLICATION	OSCILLATORS	OSCILLATORS : S	US	NA	Oscillator configuration	
0x40004000			OSCILLATORS : NS				

Programmable capacitance of XC1 and XC2

Bit number			31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
ID			B A A A A A
Reset 0x00000000			0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
ID	R/W	Field	Value ID / Value / Description
A	RW	CAPVALUE	Value representing capacitance, calculated using provided equation
B	RW	ENABLE	Enable on-chip capacitors on XC1 and XC2
			Disabled / 0 / Capacitor disabled (use external caps)
			Enabled / 1 / Capacitor enabled

Register	Offset	Security	Description	
XOSC32MCAPS	0x5C4		Programmable capacitance of XC1 and XC2	Retained
XOSC32KI.BYPASS	0x6C0		Enable or disable bypass of LFCLK crystal oscillator with external clock source	Retained
XOSC32KI.INTCAP	0x6D0		Control usage of internal load capacitors	Retained

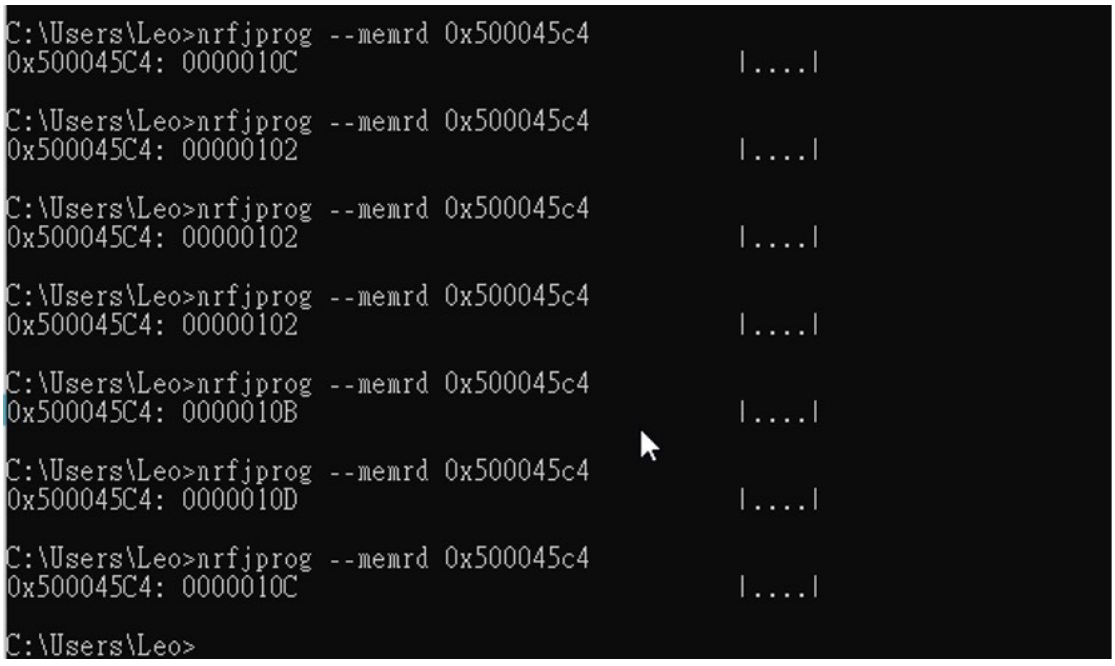
To program the load capacitance, settings in the file cpu_app prj.conf:

CONFIG_SOC_ENABLE_LFXO=y
CONFIG_SOC_LFXO_CAP_INT_7PF=y
CONFIG_SOC_HFXO_CAP_INTERNAL=y
CONFIG_SOC_HFXO_CAP_INT_VALUE_X2=25
CONFIG_BUILD_WITH_TFM=y

X2=14 7pf 0x400045c4=0x102
X2=15 7.5pf 0x400045c4=0x103
X2=16 8pf 0x400045c4=0x104
X2=17 8.5pf 0x400045c4=0x105
X2=18 9pf 0x400045c4=0x106
X2=19 9.5pf 0x400045c4=0x107
X2=20 10pf 0x400045c4=0x107
X2=21 10.5pf 0x400045c4=0x108

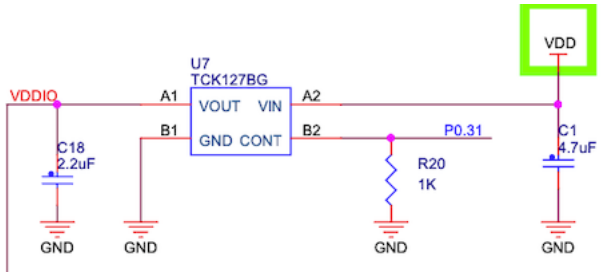
X2=22 11pf 0x400045c4=0x109 //BT40 default
X2=23 11.5pf 0x400045c4=0x10A
X2=24 12pf 0x400045c4=0x10B
X2=25 12.5pf 0x400045c4=0x10C //recover default
X2=26 13pf 0x400045c4=0x10D
X2=27 13.5pf 0x400045c4=0x10E
X2=28 14pf 0x400045c4=0x10F
X2=29 14.5pf 0x400045c4=0x110
X2=30 15pf 0x400045c4=0x111
X2=31 15.5pf 0x400045c4=0x112 //BC40 default
X2=32 16pf 0x400045c4=0x113
……

Alternatively, the load capacitance can be programmed using commands.



Powering Up Sequence

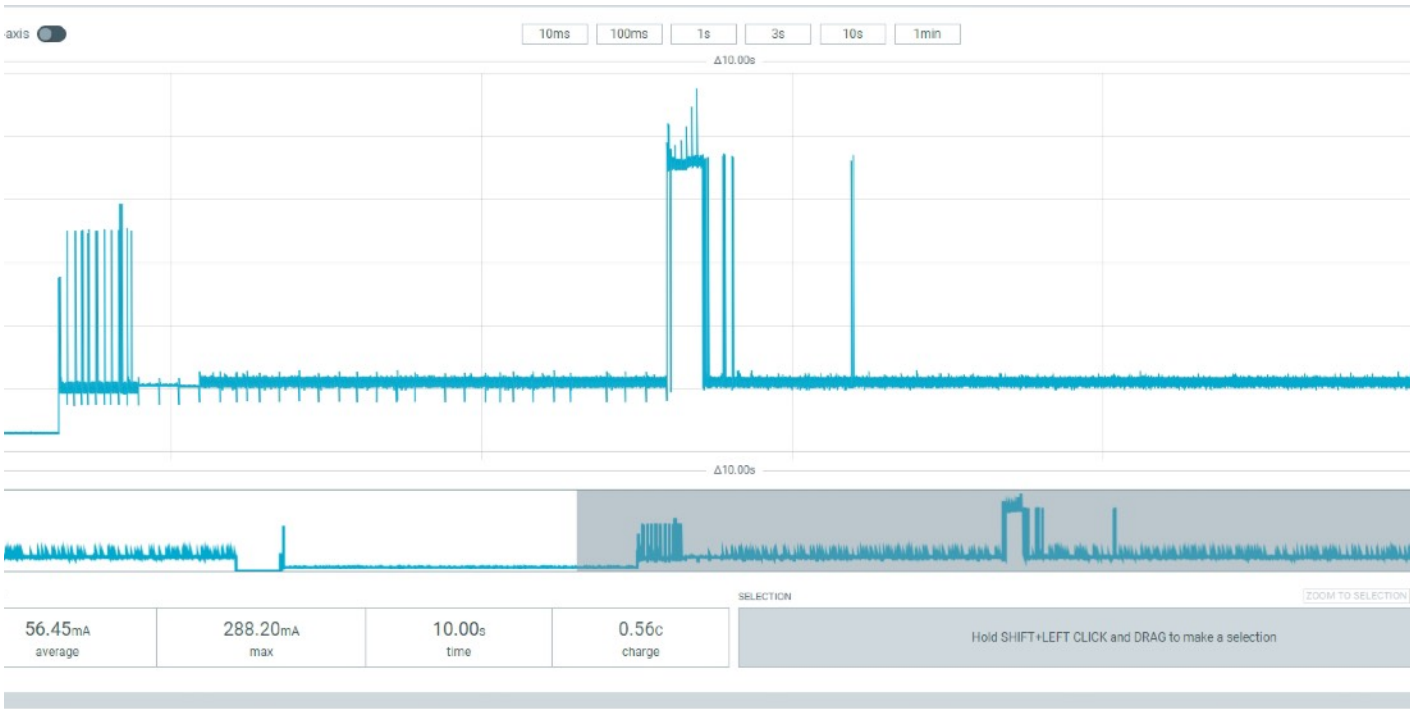
The following circuitry is embedded in WT20C40C series combo modules to control powering up sequence. Please use P0.31 to control 3.3V power supply to nRF7002.



Power Consumption Measurements

The WT02C40C on EV-WT02C40C is set to transmit maximum power to pass FCC certification testing. The peak and the average transmission powers are listed in the **Setting Regional Transmission Parameters** Section.

The worst case power consumption is when WiFi connected with Power Saving OFF. The peak current consumption measurement is below, 270 mA. Fanstel uses a 3.3V, 300 mA voltage regulator in the EV boards.



Carrier Frequency Trimming

The *IEEE 802.11 specification* defines the worst-case frequency offset that can be tolerated, measured in ppm. The limit is ± 20 ppm in the 5 GHz band, and ± 25 ppm in the 2.4 GHz band. This limit ensures that demodulation is successful for all modulation schemes even when both sender and receiver exhibit worst-case and opposite offsets. This limit needs to hold across the full operating temperature range.

The offset is a combination of the selected crystal and the on-chip crystal oscillator circuit. The nRF7002 device includes a programmable capacitor bank that can be configured to correct this frequency offset. The configuration of this capacitor bank needs to be determined using calibrated test equipment, with the resulting parameter (trim value) programmed into the *One Time Programmable (OTP) memory* on the nRF7002 device.

An Epson +/- 20ppm crystal is used in the WT02C40C series modules. The carrier frequency is trimmed to +/- 2 ppm in the 5 GHz band at room temperature. We measure the carrier frequency deviation from -40°C to +85°C, temperature reading from nRF7002, and use Epson's crystal aging simulation. The carrier frequency of WT02C40C Series is within +/-20ppm in the 5GHz bands for 10 years of usage.

Host Board Design

EV board schematics and Gerber files can be used as reference circuit and ground plane designs.

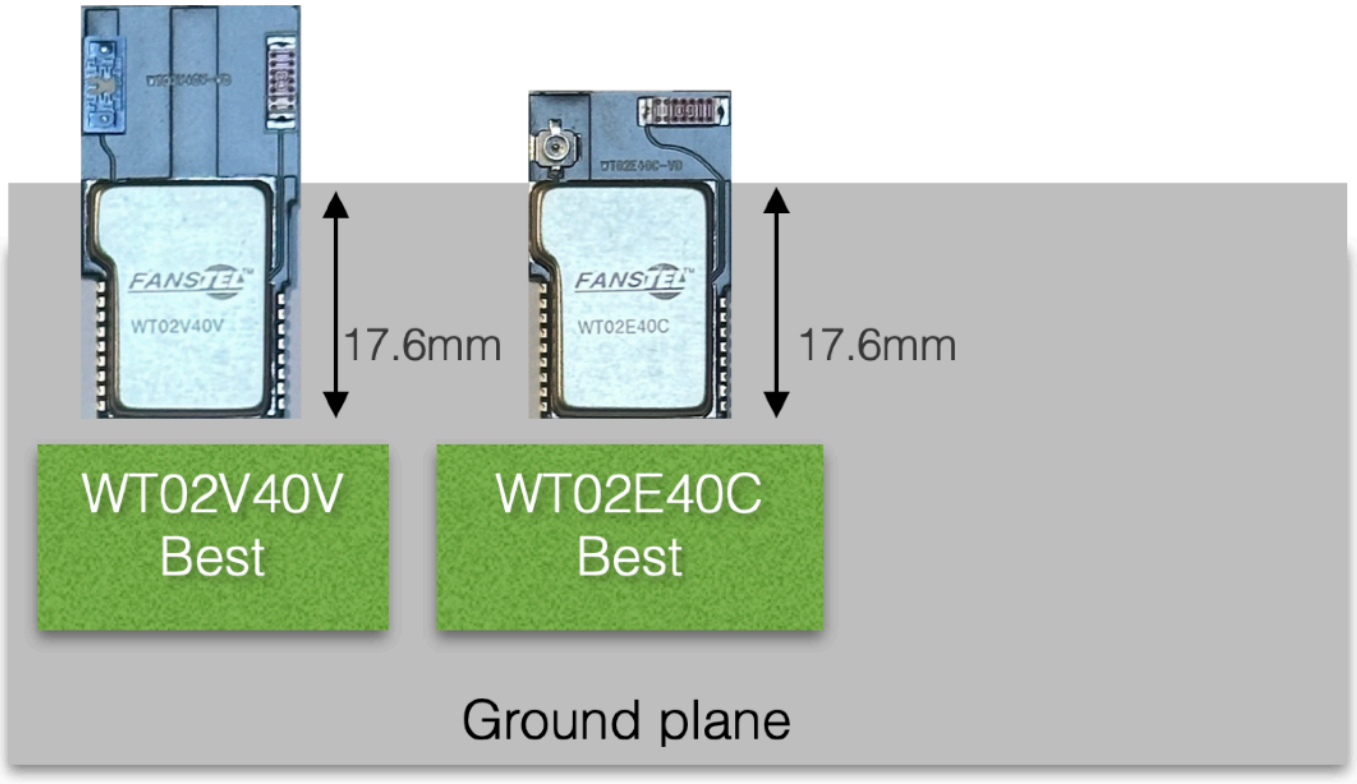
- A 4 or more layers PCB is recommended.
- WT02C40C series soldering pad footprint is compatible with that of BT40F and BT40N (nRF5340+nRF21540). A host PCB design can accommodate an nRF5340 module, with a power amplifier, or supporting WiFi 6. WT02C40C has pin 17, 3.3V DC input to power WiFI 6 SoC, not needed for the BLE modules.

Mounting WT02C40C Module on the Host PCB

The mounting guidelines are applicable to modules with integrated antenna only.

- The size of antenna area varies From a module to another. A ground plane shall cover the castellated pin area of the module or 17.6 mm from the bottom edge.
- EV-WT02C40C Gerber files can be used as a PCB layout example.

For the best Bluetooth and WiFi range performance, keep all external metal at least 30mm from the antenna area.



Evaluation Board Schematics

EV-WM02C schematics, EV-WM02C Gerber, and EV-WT02P40P Schematics and Gerber files can be download. The schematics and Gerber can be as a reference design, ground plane design, and signal routing guides of a host board using WM02C series module. This EV board design can also be used for evaluation of the combo modules, WT02C40C series.

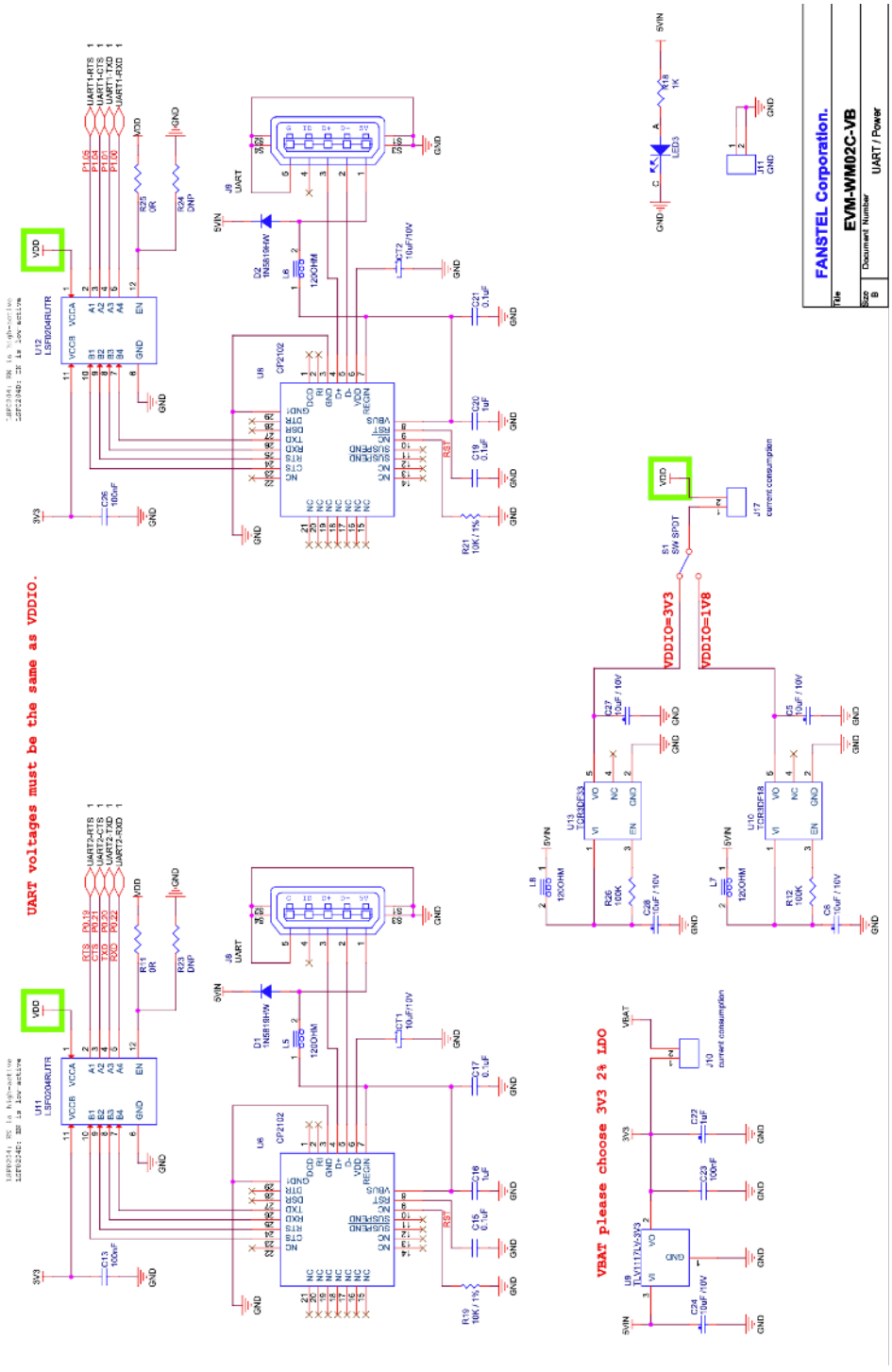
Use for Evaluation of Combo Module WT02C40C

- WT02C40C is mounted at the U1 location. Pin 17 Vbat is for providing 3.3V DC power to nRF7002.
- U2 is not mounted.
- A power switch is embedded in WT02C40C. nRF5340 P0.31 is used to control the power switch to delay application of power to nRF7002 GPIO pins during powering up.
- WT02P40P has 3-pin pads for connection to a BLE antenna on the host board. It also has 3-pin pads for for connection to a WiFi antenna on the host board.

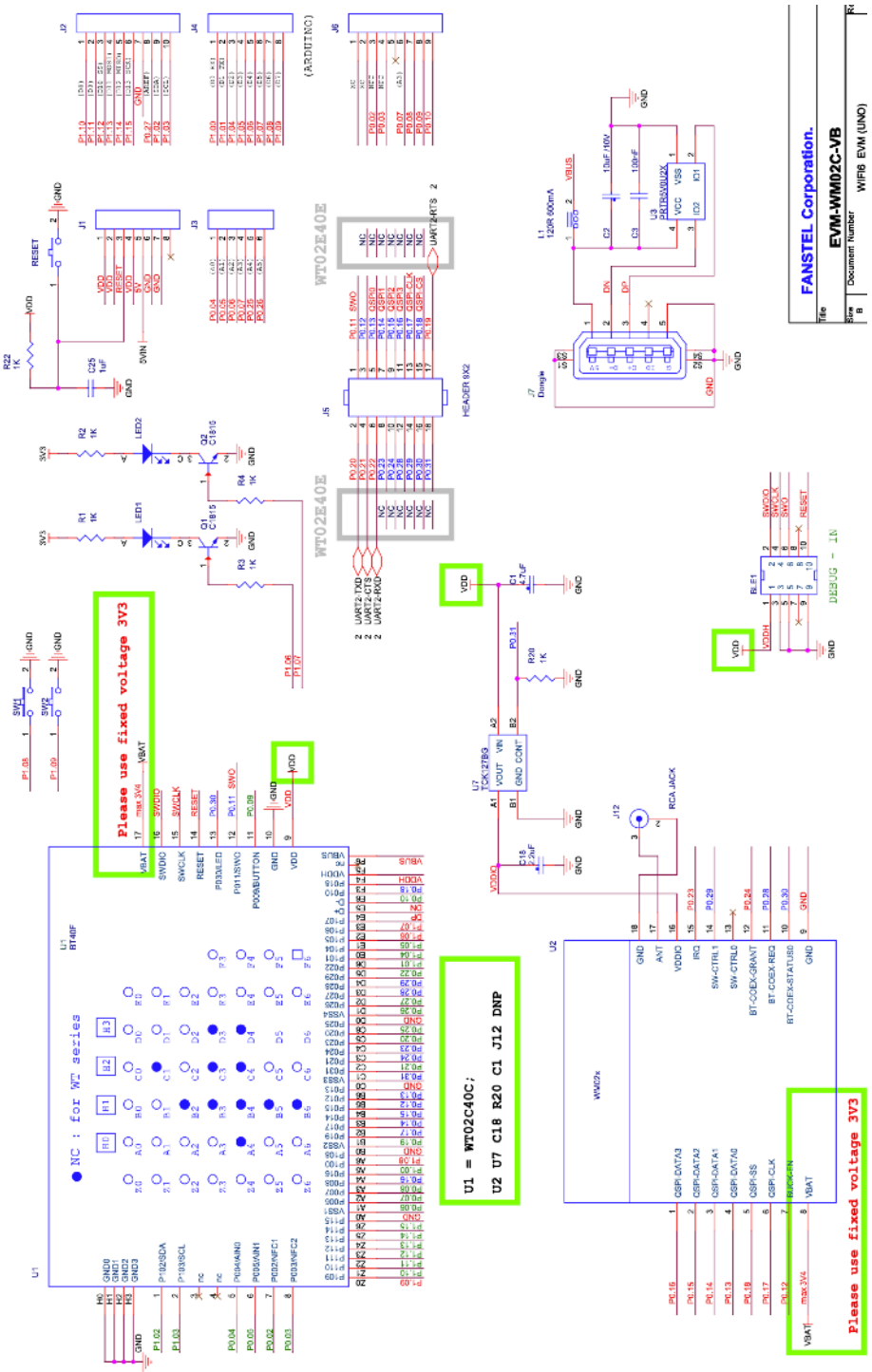
Use for Evaluation of Companion Module WM02C

- BT40F, an nRF5340 module is mounted at the U1 location. You can use S1 switch to select 1.8V or 3.3V DC power to BT40F VDD, pin 9. This VDD also supplies power to WM02C VDDIO, pin 16 through a power switch, U7. BT40F P0.31 is used to control the power switch to delay application of power to WM02C GPIO pins during powering up.
- For long range Bluetooth/Thread applications, a BT40N or BT40NE can be mounted at this U1 location. VDD must be set to 3.3V.
- The WiFi 6 module under evaluation, WM02C, is mounted at the U2 location.
- WM02C pin 8, Vbat power supply voltage is 3.3V nominal, 3.6V maximum.
- CP2102 operates at 3.3V. If you set VDDIO to 1.8V, LSF0204, U11 voltage level translator shall be enabled.

WT02C40C Schematics, page 1



EV-WT02C40C, page 2.



Suggestion for Battery Power Application

Standby current consumption is important for battery-powered product. To reduce host board area, the followings are embedded in modules:

- 32 MHz, 20PPM main crystal. You need to program the value of embedded load capacitance.
- 32.768 KHz, 20PPM sleep crystal and load capacitors.
- 40 MHz crystal for nRF7002.
- Inductors and capacitors required for VDD power supply DC to DC converter.
- Inductors and capacitors required for VDDH power supply DC to DC converter.

No external component is required. DCDC converter shall be enabled to reduce power consumption.

3. Firmware Development

Nordic Development Tools

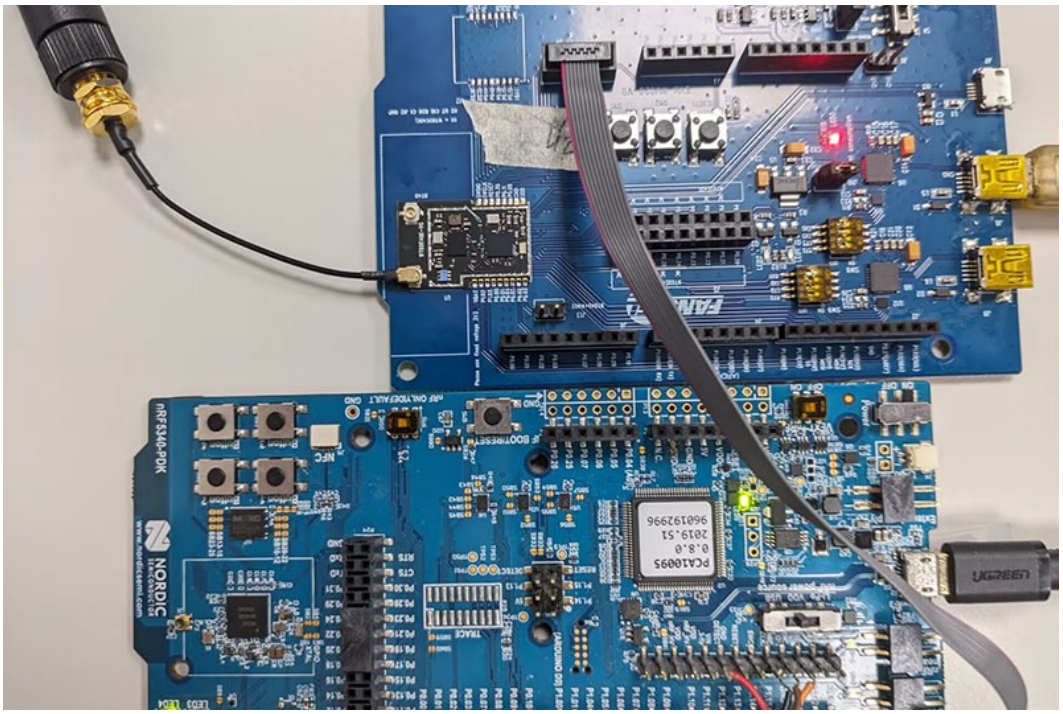
A Nordic nRF5340 DK is recommended for programming this evaluation board. Visit Nordic website for **nRR5340 DK description and product brief**.
Many application examples can be downloaded from Nordic website.
Some firmware, Android OS, and iOS app codes can be downloaded from **Bluetooth 5 Codes section** of this Fanstel webpage.
http://www.fanstel.com/download-document/

BT40 firmware can be used in all nRF5340 modules without power amplifier, e.g., WT02E40C, WT02E40E, WT02C40C, WT02V40V, WT02P40P, BT40F and BT40E. A Nordic nRF5340-DK is recommended for programming this evaluation board. Nordic development tools can be downloaded from Nordic website.

Download and set up on your Windows PC or MAC, nRF command line tool 10.24.2 or newer.
https://www.nordicsemi.com/Products/Development-tools/nRF-Command-Line-Tools/Download

• Download and set up on your Windows PC or MAC, nRF Connect desktop 5.0.0 or newer.
https://www.nordicsemi.com/Products/Development-tools/nRF-Connect-for-Desktop/Download

Use ***nRF Connect*** to program nRF5340 inside WT02C40C module.
• Connect **Debug Out** of the nRF5340DK to **Debug In** of an EV-WT02C40C.
• Connect nRF5340 DK to a PC USB port.
• Connect EV-WT02C40C to am USB power supply.

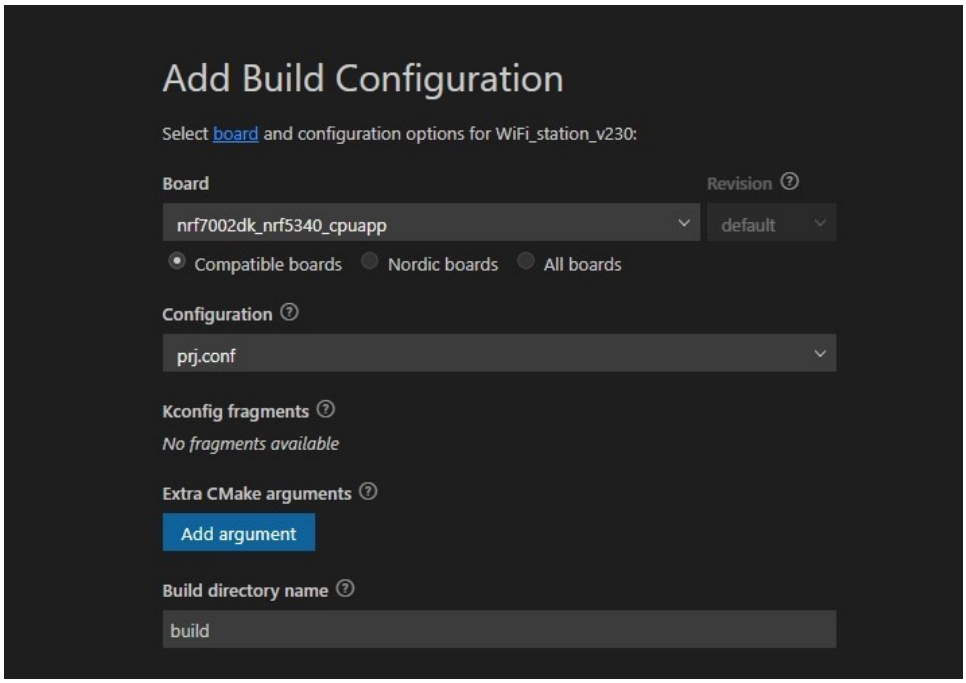


Setting Up Development Environment

Use VS code, nRF Connect for desktop programmer or nrfjprog tool, either one can programming the code.

The connection between the nRF5340 and nRF7002 is the same as the PCA10143 nRF7002 DK. The default connection is as follows:
GPIO 12 7002 Bucken
GPIO 13 qspi io0
GPIO 14 qspi io1
GPIO 15 qspi io2
GPIO 16 qspi io3
GPIO 17 qspi sck
GPIO 18 qspi csn
GPIO 19 uart0 rts
GPIO 20 uart0 tx
GPIO 21 uart0 cts
GPIO 22 uart0 rx
GPIO 23 host ireq
GPIO 24 radio grant
GPIO 28 radio req
GPIO 29 radio swctrl1
GPIO 30 radio status0
GPIO 31 7002 iovdd-ctrl
GPIO 106 led0
GPIO 110 radio btrf-switch
You can create a new project from Nordic's default WiFi example projects, such as WiFi_shell or WiFi_station, to try out the integration. If you need to set up the hardware peripherals, please configure the board using a .overlay file.

UNII-1	5200 MHz	0	0	10.14	19.66

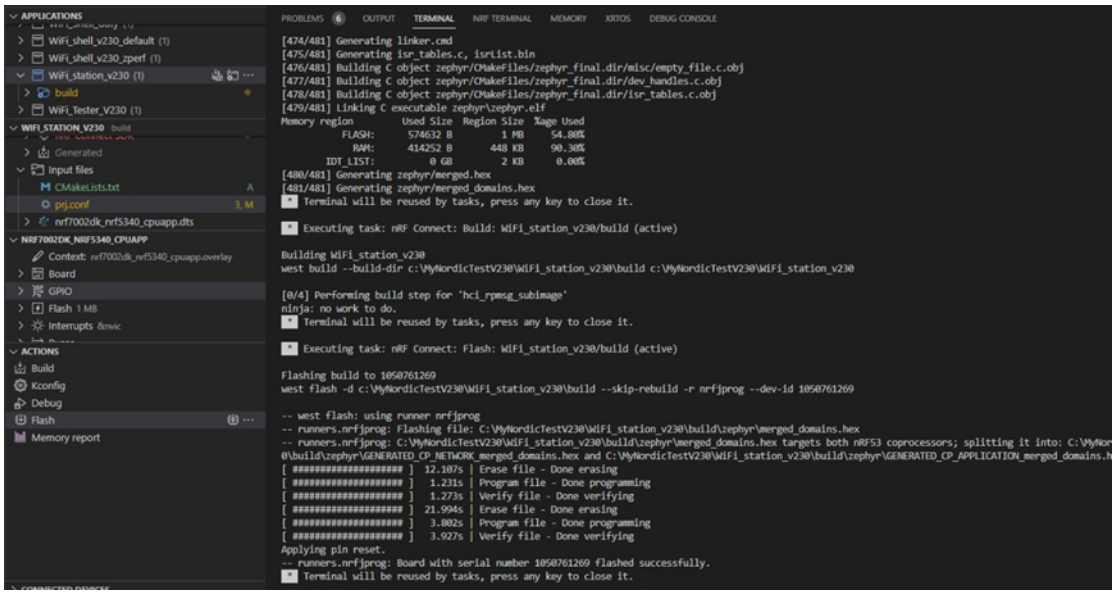


The following is an example for setup the nRF7002_nrf5340_cpuapp.overlay file.

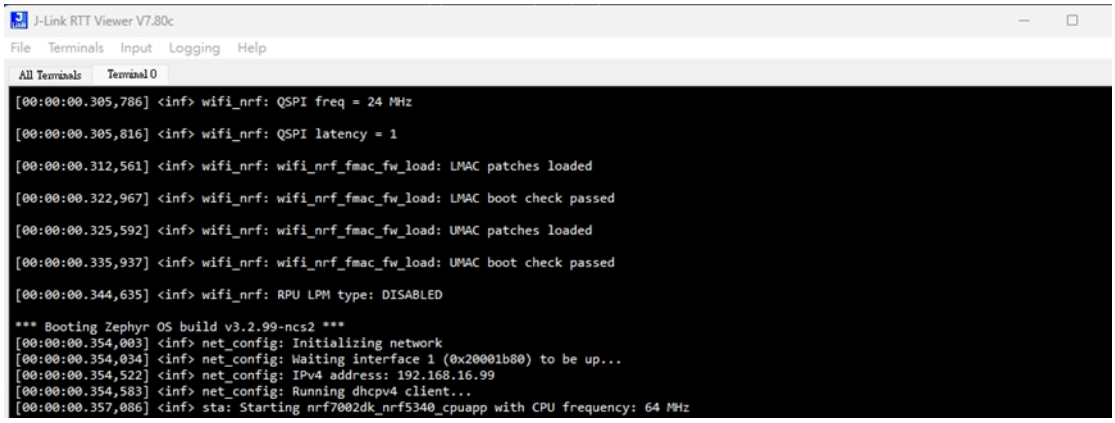
```
&pinctrl {

    myuart0_default: uart0_default {
        group1 {
            psels = <NRF_PSEL(UART_TX, 0, 20)>,
                <NRF_PSEL(UART_RTS, 0, 19)>;
        };
        group2 {
            psels = <NRF_PSEL(UART_RX, 0, 22)>,
                <NRF_PSEL(UART_CTS, 0, 21)>;
            bias-pull-up;
        };
    };

    myuart0_sleep: uart0_sleep {
        group1 {
            psels = <NRF_PSEL(UART_TX, 0, 20)>,
                <NRF_PSEL(UART_RTS, 0,  19)>,
                <NRF_PSEL(UART_RX, 0, 22)>,
                <NRF_PSEL(UART_CTS, 0,  21)>;
            low-power-enable;
        };
    };

};
&uart0 {
```

```
    status = "okay";
    current-speed = <115200>;
    pinctrl-0 = <&myuart0_default>;
    pinctrl-1 = <&myuart0_sleep>;
    pinctrl-names = "default", "sleep";
};
&uart1 {
    status = "disabled";

};
 &spi4 {
    status = "disabled";

};
 &pwm0 {
    status = "disabled";

};
&i2c1{
    status = "disabled";
};

&led1{
    status = "disabled";
};
&button0{
    status = "disabled";
};
&button1{
    status = "disabled";
};
```

After finish setup, build and flash the code.
The code is running.



Use RTT Viewer log or UART to monitor the log to make sure the code is running normally.



Codes for Evaluation Boards.

The codes preloaded into BT40F module to manage WM02C module on the evaluation board can be downloaded.

MAC addresses

Each WT02C40C module is programmed with two MAC addresses. The MAC addresses are pre-programmed into the One Time Programmable(OTP) memory.

The address can be read by Nordic Wi-Fi radio test project command:
“wifi_radio_ficr_prog_read_params”

```
REGION_PROTECT1 = 0x50fa50fa
REGION_PROTECT2 = 0x50fa50fa
REGION_PROTECT3 = 0x50fa50fa

MAC0: Reg0 = 0x00071800
MAC0: Reg1 = 0x00007105
MAC0 Addr  = 00:18:07:00:05:71

MAC1 : Reg0 = 0x00071800
MAC1 : Reg1 = 0x00007106
MAC1 Addr   = 00:18:07:00:06:71

CALIB_XO = 0xff

CALIB_PDADJMCS7 = 0xffffffff

CALIB_PDADJMCS0 = 0xffffffff

CALIB_MAXPOW2G4 = 0xffffffff

CALIB_MAXPOW5G0MCS7 = 0xffffffff

CALIB_MAXPOW5G0MCS0 = 0xffffffff

CALIB_RXGAINOFFSET = 0xffffffff

CALIB_TXPOWBACKOFFT = 0xffffffff
```

Setting Regional Transmission Parameters

Antenna Gain Measurements

Among all antennas certified with the WM02C series modules, the WM02V has the highest peak antenna gains. The gains at various frequency bands are below.

Band	Frequency(MHz)	Antenna chip	WM02C	WM02V	WM02F	ANT036
2.4 GHz	2400 to 2472	2.95 dBi	2.63 dBi	4.28 dBi	1.98 dBi	1.52 dBi
UNII-1	5150 to 5250	5.28 dBi	2.43 dBi	4.64 dBi	-1.08 dBi	3.13 dBi
UNII-2A	5250 to 5350	5.28 dBi	2.43 dBi	4.15 dBi	0.14 dBi	3.01 dBi
UNII-2C	5470 to 5730	5.40 dBi	3.42 dBi	5.22 dBi	-1.30 dBi	2.75 dBi
UNII-3	5730 to 5850	5.34 dBi	3.07 dBi	5.65 dBi	-1.04 dBi	1.93 dBi
UNII-4	5850 to 5895	5.34 dBi	3.58 dBi	5.28 dBi	-1.40 dBi	1.91 dBi

- Antenna chip: Peak antenna gains published by the chip antenna manufacturer.
- WM02C: Measured peak antenna gains of WM02C.
- WM02V: Measured peak antenna gains of WM02V.
- WM02F: Measured peak antenna gains of WM02F.
- ANT036: Gains of the external antenna, certified with WM02E and WM02P.

Spectral Emission Mask and Antenna Gain

Use backoff to reduce the transmit power on the band edge channels to be within regulatory limits.
In general, a device transmits at the maximum possible power for a given data rate. When using this maximum power for band edge channels, the regulatory requirements for *Spectral Emission Mask (SEM)* might be violated. For such cases, the transmit power is reduced by a particular value called backoff to meet SEM requirements. The backoff is applied only for edge channels of a frequency band defined by the regulatory domain.

An example command to back off by 4 at the lower edge.
CONFIG_NRF700X_BAND_2G_LOWER_EDGE_BACKOFF_HT=4

An example command to back off by 5 at the higher edge.
CONFIG_NRF700X_BAND_2G_UPPER_EDGE_BACKOFF_DSSS=5

If a higher gain antenna is used, it can be compensated by reducing gain in firmware. The following command reduce gain by 3 dB in the 2 .4 GHz frequency band.
CONFIG_NRF700X_ANT_GAIN_2G=3

USA FCC, Canada ISED, and Taiwan NCC have band edge specifications. Additional back off is required at the edge channels. The gain is set to zero because no reduction is required.

Europe CE and UK, Australia RCM, and Japan TELEC do not have band edge specifications. Back off setting is zero. However, the maximum transmission power is lower. A non zero setting is required for gain to reduce transmission power.

USA, Canada, and Taiwan

In the 2.4 GHz bands, the Gain and BackOff settings to pass FCC, ISED, and NCC specifications are below.

The conducted transmission powers measured in dBm for average and peak transmission power at room temperature are listed below.

		Settings			
Mode	Freq.	Gain	BackOff	Avg. TX	Peak TX.
802.11b	2437 MHz	0	5	16.09	19.90
802.11g	2437 MHz	0	5	12.26	21.56
802.11n HT20	2437 MHz	0	4	15.46	22.10
802.11ax HE20	2437 MHz	0	6	15.80	21.71

For your products to pass FCC, ISED and NCC specifications in the 2.4 GHz bands, use Nordic SDK 2.6.1 or newer and include the following in your application codes. The peak gain for WM02V antenna is +4.28 dBi in the 2.4 GHz band. No transmission power reduction is required by firmware. A back off parameter must be programmed for each radio protocol.

The following CONFIG statements in .txt format can be downloaded.

```
CONFIG_NRF700X_ANT_GAIN_2G=0
CONFIG_NRF700X_BAND_2G_LOWER_EDGE_BACKOFF_DSSS=5
CONFIG_NRF700X_BAND_2G_LOWER_EDGE_BACKOFF_HT=4
CONFIG_NRF700X_BAND_2G_LOWER_EDGE_BACKOFF_HE=6
CONFIG_NRF700X_BAND_2G_UPPER_EDGE_BACKOFF_DSSS=5
CONFIG_NRF700X_BAND_2G_UPPER_EDGE_BACKOFF_HT=4
CONFIG_NRF700X_BAND_2G_UPPER_EDGE_BACKOFF_HE=6
```

In the 5GHz frequency bands, the Gain and BackOff settings to pass FCC, ISED, and NCC specifications are below.

The conducted transmission powers measured in dBm for average and peak transmission power at room temperature are listed below.

		Settings			
Mode	Freq.	Gain	BackOff	Avg. TX.	Peak TX

UNII-1	5200 MHz	0	0	9.16	19.68
UNII-2A	5200 MHz	0	0	9.68	19.49
UNII-2C	5200 MHz	0	0	10.98	19.59
UNII-3	5200 MHz	0	0	11.18	20.45
Mode	Freq.	Gain	BackOff	Avg. TX.	Peak TX
UNII-1	5300 MHz	0	0	9.10	19.80
UNII-2A	5300 MHz	0	0	9.11	19.53
UNII-2C	5300 MHz	0	0	10.19	19.64
UNII-3	5300 MHz	0	0	9.57	20.06
Mode	Freq.	Gain	BackOff	Avg. TX.	Peak TX
UNII-1	5580 MHz	0	0	9.32	19.85
UNII-2A	5580 MHz	0	0	8.49	19.54
UNII-2C	5580 MHz	0	0	9.83	20.00
UNII-3	5580 MHz	0	0	8.14	20.06
Mode	Freq.	Gain	BackOff	Avg. TX.	Peak TX
UNII-1	5785 MHz	0	0	9.75	20.32
UNII-2A	5785 MHz	0	0	8.21	20.06
UNII-2C	5785 MHz	0	0	8.39	20.17
UNII-3	5785 MHz	0	0	8.60	20.48

For your products to pass FCC, ISED and NCC specifications in the 5 GHz bands, use Nordic SDK 2.6.1 or newer and include the following in your application codes. Gain and back off are set to zero as no round off or attenuation is required by firmware.

The following CONFIG statements in .txt format can be downloaded.

```
CONFIG_NRF700X_ANT_GAIN_5G_BAND1=0
CONFIG_NRF700X_ANT_GAIN_5G_BAND2=0
CONFIG_NRF700X_ANT_GAIN_5G_BAND3=0
CONFIG_NRF700X_BAND_UNII_1_LOWER_EDGE_BACKOFF_HT=0
CONFIG_NRF700X_BAND_UNII_1_LOWER_EDGE_BACKOFF_HE=0
CONFIG_NRF700X_BAND_UNII_1_UPPER_EDGE_BACKOFF_HT=0
```

CONFIG_NRF700X_BAND_UNII_1_UPPER_EDGE_BACKOFF_HE=0
CONFIG_NRF700X_BAND_UNII_2A_LOWER_EDGE_BACKOFF_HT=0
CONFIG_NRF700X_BAND_UNII_2A_LOWER_EDGE_BACKOFF_HE=0
CONFIG_NRF700X_BAND_UNII_2A_UPPER_EDGE_BACKOFF_HT=0
CONFIG_NRF700X_BAND_UNII_2A_UPPER_EDGE_BACKOFF_HE=0
CONFIG_NRF700X_BAND_UNII_2C_LOWER_EDGE_BACKOFF_HT=0
CONFIG_NRF700X_BAND_UNII_2C_LOWER_EDGE_BACKOFF_HE=0
CONFIG_NRF700X_BAND_UNII_2C_UPPER_EDGE_BACKOFF_HT=0
CONFIG_NRF700X_BAND_UNII_2C_UPPER_EDGE_BACKOFF_HE=0
CONFIG_NRF700X_BAND_UNII_3_LOWER_EDGE_BACKOFF_HT=0
CONFIG_NRF700X_BAND_UNII_3_LOWER_EDGE_BACKOFF_HE=0
CONFIG_NRF700X_BAND_UNII_3_UPPER_EDGE_BACKOFF_HT=0
CONFIG_NRF700X_BAND_UNII_3_UPPER_EDGE_BACKOFF_HE=0
CONFIG_NRF700X_BAND_UNII_4_LOWER_EDGE_BACKOFF_HT=0
CONFIG_NRF700X_BAND_UNII_4_LOWER_EDGE_BACKOFF_HE=0
CONFIG_NRF700X_BAND_UNII_4_UPPER_EDGE_BACKOFF_HT=0
CONFIG_NRF700X_BAND_UNII_4_UPPER_EDGE_BACKOFF_HE=0

Europe, UK, and Australia

In the 2.4 GHz bands, the settings to pass CE and RCM specifications are:

Gain=0;
BackOff=0.

The conducted transmission powers measured in dBm at normal or room temperature and extreme or low temperature are listed below.

		Settings		Normal		Extreme	
Mode	Freq.	Gain	BackOff	Conducted	EIRP	Conducted	EIRP
802.11b	2442 MHz	0	0	12.76	16.80	14.26	18.30
802.11g	2442 MHz	0	0	10.92	15.36	12.45	16.89
n20	2442 MHz	0	0	10.78	15.24	12.32	16.78
HE20	2442 MHz	0	0	11.70	16.21	13,22	17.73

For your products to pass CE and RCM specifications in the 2.4 GHz bands, use Nordic SDK 2.6.1 or newer and include the following in your application codes. Gain is set to 3 to reduce TX power by 3 dB in firmware. Back off is set to zero.

The following CONFIG statements in .txt format can be downloaded.

```
CONFIG_NRF700X_ANT_GAIN_2G=0
CONFIG_NRF700X_BAND_2G_LOWER_EDGE_BACKOFF_DSSS=0
CONFIG_NRF700X_BAND_2G_LOWER_EDGE_BACKOFF_HT=0
CONFIG_NRF700X_BAND_2G_LOWER_EDGE_BACKOFF_HE=0
CONFIG_NRF700X_BAND_2G_UPPER_EDGE_BACKOFF_DSSS=0
CONFIG_NRF700X_BAND_2G_UPPER_EDGE_BACKOFF_HT=0
CONFIG_NRF700X_BAND_2G_UPPER_EDGE_BACKOFF_HE=0
```

In the 5GHz bands, the settings to pass CE and RCM specifications are below. The conducted transmission powers measured in dBm at normal or room temperature and extreme or low temperature are listed below.

		Settings		Normal		Extreme	
Mode	Freq.	Gain	BackOff	Conducted	EIRP	Conducted	EIRP
802.11a	5240 MHz	0	0	7.50	8.09	9.00	9.59
HT20	5180 MHz	0	0	6.10	6.70	7.60	8.20
VHT20	5240 MHz	0	0	7.10	7.86	8.60	9.36
HE20	5240 MHz	0	0	7.60	8.40	9.10	9.90
		Settings		Normal		Extreme	
Mode	Freq.	Gain	BackOff	Conducted	EIRP	Conducted	EIRP
802.11a	5320 MHz	0	0	7.20	7.79	8.60	9.20
HT20	5320 MHz	0	0	7.00	7.60	8.50	9.10
VHT20	5320 MHz	0	0	7.00	7.76	8.50	9.26
HE20	5320 MHz	0	0	7.40	8.20	8.90	9.70
		Settings		Normal		Extreme	
Mode	Freq.	Gain	BackOff	Conducted	EIRP	Conducted	EIRP
802.11a	5700 MHz	0	0	12.20	12.20	13.70	14.29
HT20	5700 MHz	0	0	11.90	12.50	13.40	14.00
VHT20	5700 MHz	0	0	12.10	12.86	13.60	14.36
HE20	5700 MHz	0	0	12.50	13.30	14.00	14.80
		Settings		Normal		Extreme	
Mode	Freq.	Gain	BackOff	Conducted	EIRP	Conducted	EIRP
802.11a	5805 MHz	2	0	6.68	12.62	7.61	13.55
HT20	5745 Mhz	2	0	6.46	12.40	7.30	13.24
VHT20	5745 Mhz	2	0	5.92	12.03	7.27	13.38
HE20	5745 Mhz	2	0	6.50	12.65	7.51	13.66

For your products to pass CE and RCM specifications in the 5 GHz bands, use Nordic SDK 2.6.1 or newer and include the following in your application codes. Gain is set to 5 or 6 to reduce TX power by 5 or 6 dB using firmware. Back off is set to zero.

The following CONFIG statements in .txt format can be downloaded.

```
CONFIG_NRF700X_ANT_GAIN_5G_BAND1=0
CONFIG_NRF700X_ANT_GAIN_5G_BAND2=0
```

CONFIG_NRF700X_ANT_GAIN_5G_BAND3=2
CONFIG_NRF700X_BAND_UNII_1_LOWER_EDGE_BACKOFF_HT=0
CONFIG_NRF700X_BAND_UNII_1_LOWER_EDGE_BACKOFF_HE=0
CONFIG_NRF700X_BAND_UNII_1_UPPER_EDGE_BACKOFF_HT=0
CONFIG_NRF700X_BAND_UNII_1_UPPER_EDGE_BACKOFF_HE=0
CONFIG_NRF700X_BAND_UNII_2A_LOWER_EDGE_BACKOFF_HT=0
CONFIG_NRF700X_BAND_UNII_2A_LOWER_EDGE_BACKOFF_HE=0
CONFIG_NRF700X_BAND_UNII_2A_UPPER_EDGE_BACKOFF_HT=0
CONFIG_NRF700X_BAND_UNII_2A_UPPER_EDGE_BACKOFF_HE=0
CONFIG_NRF700X_BAND_UNII_2C_LOWER_EDGE_BACKOFF_HT=0
CONFIG_NRF700X_BAND_UNII_2C_LOWER_EDGE_BACKOFF_HE=0
CONFIG_NRF700X_BAND_UNII_2C_UPPER_EDGE_BACKOFF_HT=0
CONFIG_NRF700X_BAND_UNII_2C_UPPER_EDGE_BACKOFF_HE=0
CONFIG_NRF700X_BAND_UNII_3_LOWER_EDGE_BACKOFF_HT=0
CONFIG_NRF700X_BAND_UNII_3_LOWER_EDGE_BACKOFF_HE=0
CONFIG_NRF700X_BAND_UNII_3_UPPER_EDGE_BACKOFF_HT=0
CONFIG_NRF700X_BAND_UNII_3_UPPER_EDGE_BACKOFF_HE=0
CONFIG_NRF700X_BAND_UNII_4_LOWER_EDGE_BACKOFF_HT=0
CONFIG_NRF700X_BAND_UNII_4_LOWER_EDGE_BACKOFF_HE=0
CONFIG_NRF700X_BAND_UNII_4_UPPER_EDGE_BACKOFF_HT=0
CONFIG_NRF700X_BAND_UNII_4_UPPER_EDGE_BACKOFF_HE=0

Japan TELEC

In the 2.4 GHz bands, the settings to pass TELEC specifications are:

Gain = 0;
BackOff = 0.

For products to meet TELEC specifications, use Nordic SDK 2.6.1 or newer and include the following in your application codes.

The following CONFIG statements in .txt format can be downloaded.

```
CONFIG_NRF700X_ANT_GAIN_2G=0
CONFIG_NRF700X_BAND_2G_LOWER_EDGE_BACKOFF_DSSS=0
CONFIG_NRF700X_BAND_2G_LOWER_EDGE_BACKOFF_HT=0
CONFIG_NRF700X_BAND_2G_LOWER_EDGE_BACKOFF_HE=0
CONFIG_NRF700X_BAND_2G_UPPER_EDGE_BACKOFF_DSSS=0
CONFIG_NRF700X_BAND_2G_UPPER_EDGE_BACKOFF_HT=0
CONFIG_NRF700X_BAND_2G_UPPER_EDGE_BACKOFF_HE=0
```

In the 5 GHz bands, the settings to pass TELEC specifications are:

Gain = 0;
BackOff = 0.

For products to meet TELEC specifications, use Nordic SDK 2.6.1 or newer and include the following in your application codes.

The following CONFIG statements in .txt format can be downloaded.

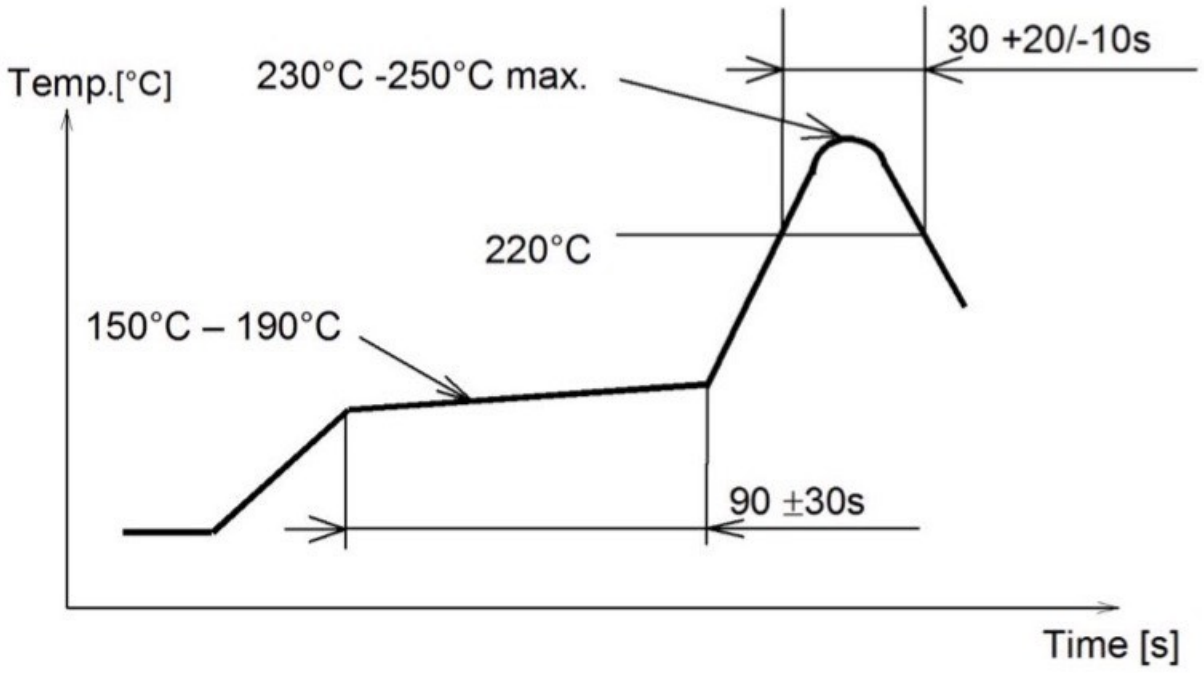
```
CONFIG_NRF700X_ANT_GAIN_5G_BAND1=0
CONFIG_NRF700X_ANT_GAIN_5G_BAND2=0
CONFIG_NRF700X_ANT_GAIN_5G_BAND3=0
CONFIG_NRF700X_BAND_UNII_1_LOWER_EDGE_BACKOFF_HT=0
CONFIG_NRF700X_BAND_UNII_1_LOWER_EDGE_BACKOFF_HE=0
CONFIG_NRF700X_BAND_UNII_1_UPPER_EDGE_BACKOFF_HT=0
CONFIG_NRF700X_BAND_UNII_1_UPPER_EDGE_BACKOFF_HE=0
CONFIG_NRF700X_BAND_UNII_2A_LOWER_EDGE_BACKOFF_HT=0
CONFIG_NRF700X_BAND_UNII_2A_LOWER_EDGE_BACKOFF_HE=0
CONFIG_NRF700X_BAND_UNII_2A_UPPER_EDGE_BACKOFF_HT=0
CONFIG_NRF700X_BAND_UNII_2A_UPPER_EDGE_BACKOFF_HE=0
CONFIG_NRF700X_BAND_UNII_2C_LOWER_EDGE_BACKOFF_HT=0
CONFIG_NRF700X_BAND_UNII_2C_LOWER_EDGE_BACKOFF_HE=0
CONFIG_NRF700X_BAND_UNII_2C_UPPER_EDGE_BACKOFF_HT=0
CONFIG_NRF700X_BAND_UNII_2C_UPPER_EDGE_BACKOFF_HE=0
```

CONFIG_NRF700X_BAND_UNII_3_LOWER_EDGE_BACKOFF_HT=0
CONFIG_NRF700X_BAND_UNII_3_LOWER_EDGE_BACKOFF_HE=0
CONFIG_NRF700X_BAND_UNII_3_UPPER_EDGE_BACKOFF_HT=0
CONFIG_NRF700X_BAND_UNII_3_UPPER_EDGE_BACKOFF_HE=0
CONFIG_NRF700X_BAND_UNII_4_LOWER_EDGE_BACKOFF_HT=0
CONFIG_NRF700X_BAND_UNII_4_LOWER_EDGE_BACKOFF_HE=0
CONFIG_NRF700X_BAND_UNII_4_UPPER_EDGE_BACKOFF_HT=0
CONFIG_NRF700X_BAND_UNII_4_UPPER_EDGE_BACKOFF_HE=0

4. Miscellaneous

Soldering Temperature-Time Profile for Re-Flow Soldering

Maximum number of cycles for re-flow is 2. No opposite side re-flow is allowed due to module weight.



Cautions, Design Notes, and Installation Notes

Failure to follow the guidelines set forth in this document may result in degrading of the product's functions and damage to the product.

Design Notes

(1) Follow the conditions written in this specification, especially the control signals of this module.

(2) The supply voltage has to be free of AC ripple voltage (for example from a battery or a low noise regulator output). For noisy supply voltages, provide a decoupling circuit (for example a ferrite in series connection and a bypass capacitor to ground of at least 47uF directly at the module).

(3) This product should not be mechanically stressed when installed.

(4) Keep this product away from heat. Heat is the major cause of decreasing the life of these products.

(5) Avoid assembly and use of the target equipment in conditions where the products' temperature may exceed the maximum tolerance.

(6) The supply voltage should not be exceedingly high or reversed. It should not carry noise and/or spikes.

(7) this product away from other high frequency circuits.

Notes on Antenna and PCB Layout

(1) Don't use a module with internal antenna inside a metal case.

(2) For PCB layout:

- Avoid running any signal line below module whenever possible,
- No ground plane below antenna,
- If possible, cut-off the portion of main board PCB below antenna.

Installation Notes

(1) Reflow soldering is possible twice based on the time-temperature profile in this data sheets. Set up the temperature at the soldering portion of this product according to this reflow profile.

(2) Carefully position the products so that their heat will not burn into printed circuit boards or affect the other components that are susceptible to heat.

(3) Carefully locate these products so that their temperatures will not increase due to the effects of heat generated by neighboring components.

(4) If a vinyl-covered wire comes into contact with the products, then the cover will melt and generate toxic gas, damaging the insulation. Never allow contact between the cover and these products to occur.

(5) This product should not be mechanically stressed or vibrated when reflowed.

(6) If you want to repair your board by hand soldering, please keep the conditions of this chapter.

(7) Do not wash this product.

(8) Refer to the recommended pattern when designing a board.

(9) Pressing on parts of the metal cover or fastening objects to the metal will cause damage to the unit.

Usage Condition Notes

(1) Take measures to protect the unit against static electricity. If pulses or other transient loads (a large load applied in a short time) are applied to the products, check and evaluate their operation before assembly on the final products.

(2) Do not use dropped products.

(3) Do not touch, damage or soil the pins.

(4) Follow the recommended condition ratings about the power supply applied to this product.

(5) Electrode peeling strength: Do not add pressure of more than 4.9N when soldered on PCB

(6) Pressing on parts of the metal cover or fastening objects to the metal cover will cause damage.

(7) These products are intended for general purpose and standard use in general electronic equipment, such as home appliances, office equipment, information and communication equipment.

Storage Notes

(1)The module should not be stressed mechanically during storage.

(2)Do not store these products in the following conditions or the performance characteristics of the product, such as RF performance will be adversely affected:

- Storage in salty air or in an environment with a high concentration of corrosive gas.
- Storage in direct sunlight
- Storage in an environment where the temperature may be outside the range specified.
- Storage of the products for more than one year after the date of delivery storage period.

(3) Keep this product away from water, poisonous gas and corrosive gas.

(4) This product should not be stressed or shocked when transported.

(5) Follow the specification when stacking packed crates (max. 10).

Safety Conditions

These specifications are intended to preserve the quality assurance of products and individual components. Before use, check and evaluate the operation when mounted on your products. Abide by these specifications, without deviation when using the products. These products may short-circuit. If electrical shocks, smoke, fire, and/or accidents involving human life are anticipated when a short circuit occurs, then provide the following failsafe functions, as a minimum.

(1)Ensure the safety of the whole system by installing a protection circuit and a protection device.

(2)Ensure the safety of the whole system by installing a redundant circuit or another system to prevent a dual fault causing an unsafe status.

Other Cautions

(1)This specification sheet is copyrighted. Reproduction of this data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices.

(2)Do not use the products for other purposes than those listed.

(3)Be sure to provide an appropriate failsafe function on your product to prevent an additional damage that may be caused by the abnormal function or the failure of the product.

(4)This product has been manufactured without any ozone chemical controlled under the Montreal Protocol.

(5)These products are not intended for other uses, other than under the special conditions shown below. Before using these products under such special conditions, check their performance and reliability under the said special conditions carefully to determine whether or not they can be used in such a manner.

- In liquid, such as water, salt water, oil, alkali, or organic solvent, or in places where liquid may splash.

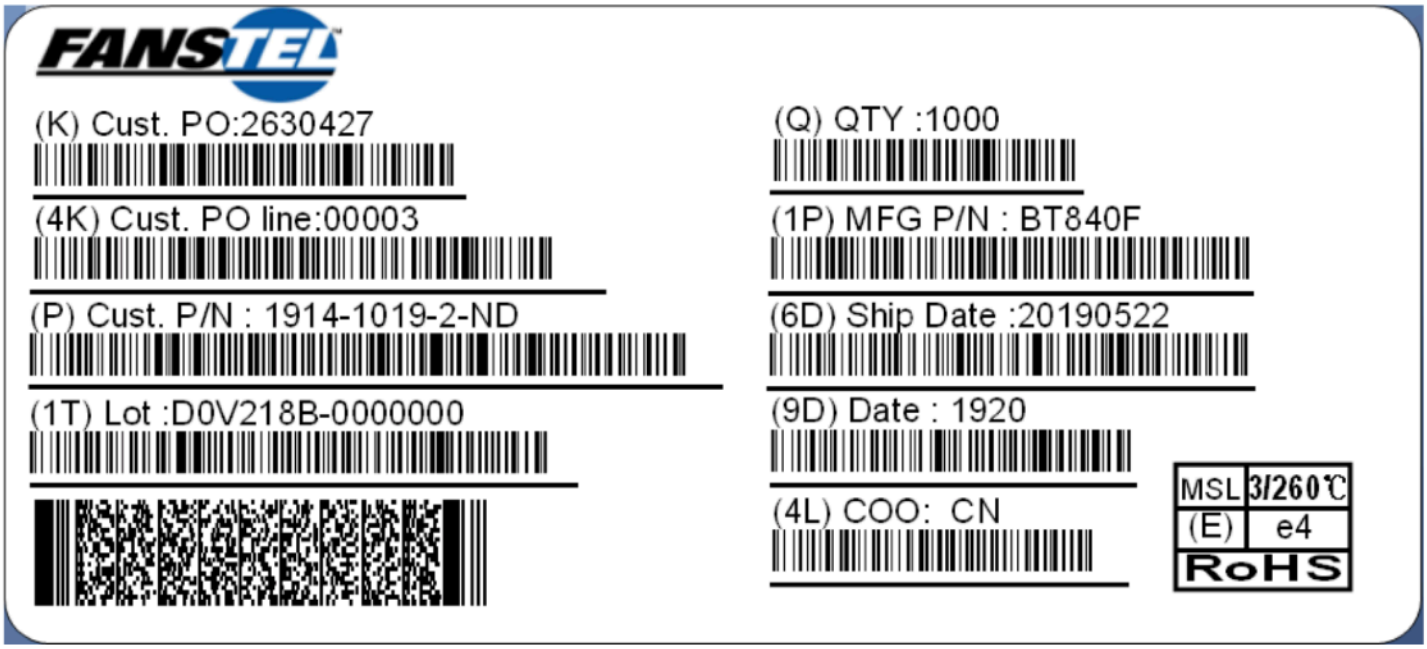
- In direct sunlight, outdoors, or in a dusty environment
- In an environment where condensation occurs.
- In an environment with a high concentration of harmful gas.

(6) If an abnormal voltage is applied due to a problem occurring in other components or circuits, replace these products with new products because they may not be able to provide normal performance even if their electronic characteristics and appearances appear satisfactory.

(7) When you have any question or uncertainty, contact Fanstel.

Packaging and Lot Number

Production modules are delivered in reel, 1000 modules in each reel. Lot number for modules made after May 2019, can be used to track silicon version of SoC, module PCB version, and production test code version.



Lot: **D0 V2 18B - 00 00 000**

D0: 2 digits, version number of SoC.
V2: 2 digits, version number of module PCB.
18B: the first 2 digits for production test codes released year and the last digit for month in hex format. A=October, B=November, C=December. 18B was released in November 2018.
00 00 000, 7 digits, reserved for 2nd SoC for modules with 2 SoCs.

Federal Communications Commission (FCC) Statement

15.21

You are cautioned that changes or modifications not expressly approved by the part responsible for compliance could void the user's authority to operate the equipment.

15.105(b)

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.

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 of the device.

FCC RF Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. End users must follow the specific operating instructions for satisfying RF exposure compliance. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Revision History

- Feb. 2023, Ver. 0.90: Initial draft release
- April 2023, Ver.0.91: Update module photos and mechanical drawings
- April 2023, Ver. 0.92: Update module mechanical drawings.
- July 2023, Ver. 0.93: Update module photos.
- July 2024, Ver. 0.95: Update for production version.
- Oct. 2024, Ver. 0.96: Update drawings.
- Nov. 2024, Ver. 0.97: Update for production release

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