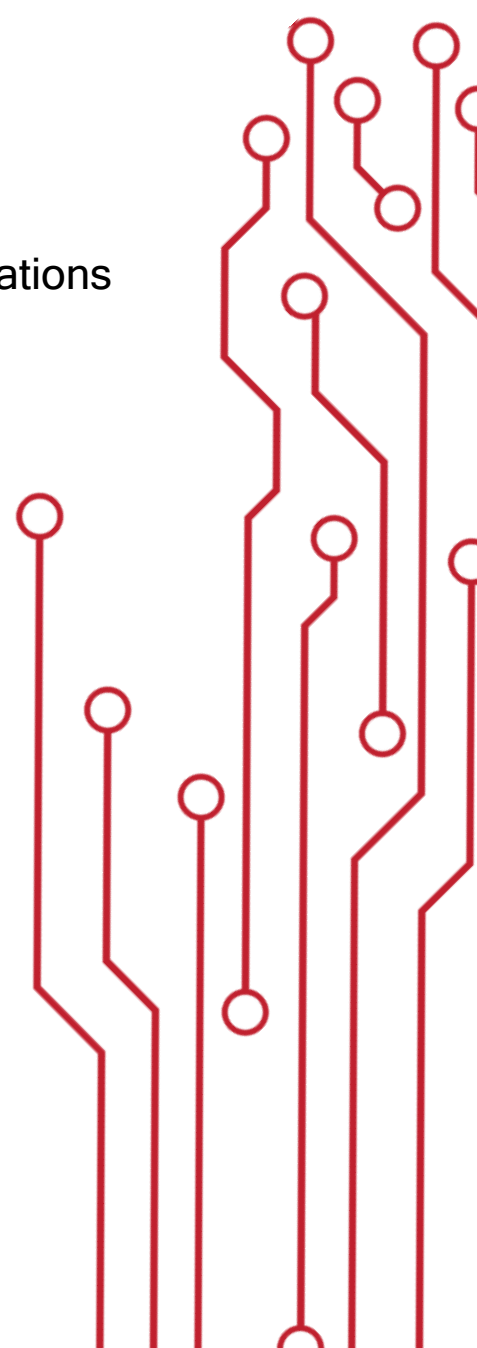




# Datasheet

## CBTMN11

A low-power RF module for AoA/AoD applications



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## 1. General Description

The CBTMN11 is a powerful, highly flexible, ultra-low power RF module using Nordic nRF52811 SoC solution developed by CWD Limited. With an ARM Cortex M4F MCU available 192 kB Flash, 24kB RAM, embedded 2.4GHz multiprotocol transceiver and an integrated PCB trace antenna or x.FL connector for external antenna.

The module incorporates: GPIO, SPI, UART, I2C, I2S, PMD, PWM, ADC interfaces for connecting peripherals and sensors.

## 2. Features

<b>2.4 GHz transceiver</b>	<ul style="list-style-type: none"> <li>• -97 dBm sensitivity in low power RF mode</li> <li>• -104 dBm sensitivity in 125 kbps (long range)</li> <li>• Supported data rates: 1 Mbps, 2 Mbps, 500kbps &amp; 125kbps low power RF mode</li> <li>• -20 to +4 dBm Tx power, configurable in 4 dB steps</li> <li>• On-chip balun (single-ended RF)</li> <li>• 4.6 mA peak current in TX (0 dBm)</li> <li>• 4.6 mA peak current in RX</li> <li>• RSSI (1 dB resolution)</li> </ul>
<b>ARM® Cortex®-M4 32-bit processor, 64 MHz</b>	<ul style="list-style-type: none"> <li>• 144 EEMBC CoreMark® score running from flash memory</li> <li>• 34.4 <math>\mu</math>A/MHz running from flash memory</li> <li>• 32.8 <math>\mu</math>A/MHz running from RAM</li> <li>• Serial wire debug (SWD)</li> </ul>
<b>Flexible power management</b>	<ul style="list-style-type: none"> <li>• 1.7 V-3.6 V supply voltage range</li> </ul>

	<ul style="list-style-type: none"> <li>• Fully automatic LDO and DC/DC regulator system</li> <li>• Fast wake-up using 64 MHz internal oscillator</li> <li>• 0.3 <math>\mu</math>A at 3 V in System OFF mode, no RAM retention</li> <li>• 0.5 <math>\mu</math>A at 3 V in System OFF mode with full 24 kB RAM retention</li> <li>• 1.5 <math>\mu</math>A at 3 V in System ON mode, with full 24 kB RAM retention</li> </ul>
<b>Other features</b>	<ul style="list-style-type: none"> <li>• Microprocessor Control Unit (MCU): nRF52811</li> <li>• Nordic SoftDevice ready</li> <li>• 192 kB flash and 24 kB RAM</li> <li>• Support for concurrent multi-protocol</li> <li>• 12-bit, 200 ksps ADC - 8 configurable channels with programmable gain</li> <li>• 64 level comparator</li> <li>• Temperature sensor</li> <li>• Up to 15 general purpose I/O pins</li> </ul>

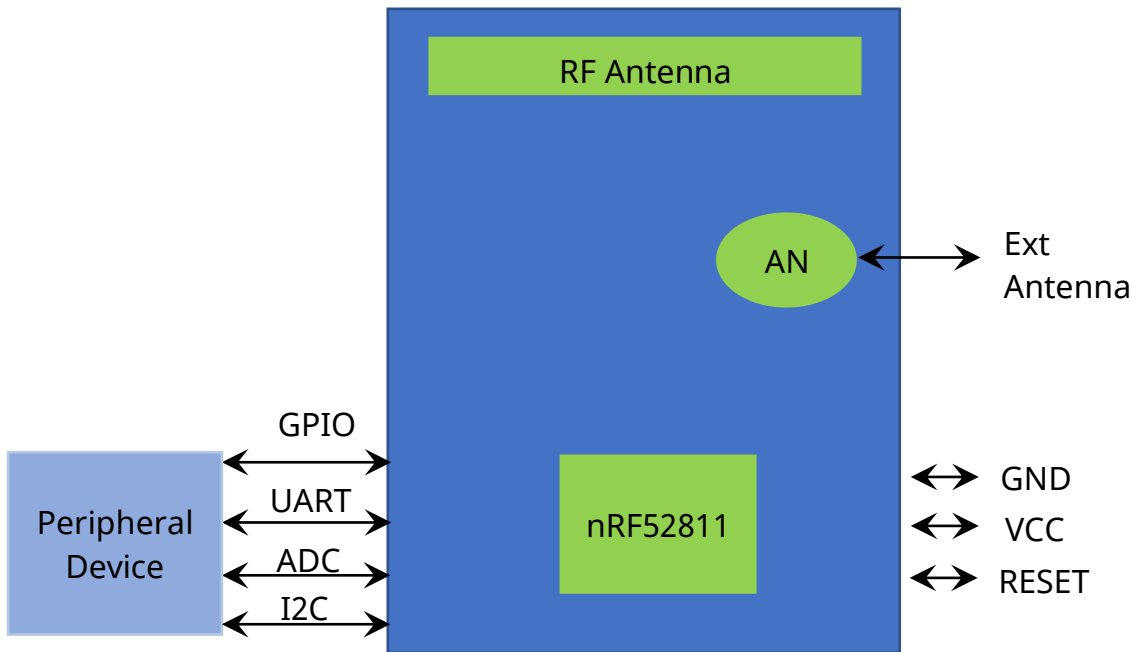
	<ul style="list-style-type: none"><li>• 4-channel pulse width modulator (PWM) unit with EasyDMA</li><li>• Digital microphone interface (PDM)</li><li>• 3x 32-bit timer with counter mode</li><li>• SPI master/slave with EasyDMA</li><li>• I2C compatible 2-wire master/slave</li><li>• UART (CTS/RTS) with EasyDMA</li><li>• Programmable peripheral interconnect (PPI)</li><li>• Quadrature decoder (QDEC)</li><li>• AES HW encryption with EasyDMA</li><li>• 2x real-time counter (RTC)</li></ul>
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### 3. Applications

Due to varied support of protocols and stacks, CBTMN11 can support varied applications. A brief of the applications is as below:

<b>Internet of Things</b>	<ul style="list-style-type: none"> <li>• Smart home products</li> <li>• Industrial mesh networks</li> <li>• Smart city infrastructure</li> </ul>
<b>Advanced wearables</b>	<ul style="list-style-type: none"> <li>• Connected watches</li> <li>• Advanced personal fitness devices</li> <li>• Wearables with wireless payment</li> <li>• Connected health</li> <li>• Virtual/Augmented reality applications</li> </ul>
<b>Interactive entertainment devices</b>	<ul style="list-style-type: none"> <li>• Advanced remote controls</li> <li>• Gaming controller</li> </ul>
<b>Personal area networks</b>	<ul style="list-style-type: none"> <li>• Health/Fitness sensor and monitor device</li> <li>• Medical device</li> </ul>

### 4. Application Block Diagram





## 5. Interfaces

### 5.1. Power Supply

The module requires to have regulated power supply. The input voltage  $V_{cc}$  range should be 1.7V to 3.6V. Suitable decoupling must be provided by external decoupling circuitry (10uF and 0.1uF). It can reduce the noise from power supply and increase power stability.

### 5.2. System Function Interfaces

#### 5.2.1. GPIOs

The general purpose I/O is organized as one port with up to 15 I/Os enabling access and control of up to 15 pins through one port. Each GPIO can be accessed individually with the following user configurable features:

- Input/output direction
- Output drive strength
- Internal pull-up and pull-down resistors
- Wake-up from high- or low-level triggers on all pins
- Trigger interrupt on all pins
- All pins can be used by the PPI task/event system. The maximum number of pins that can be interfaced through the PPI at the same time is limited by the number of GPIOTE channels

- All pins can be individually configured to carry serial interface or quadrature demodulator signals
- All pins can be configured as PWM
- There are 4 ADC input in the 15 I/Os

### 5.2.2. Two-wire Interface (I2C Compatible)

The two-wire interface can communicate with a bi-directional wired-AND bus with two lines (SCL, SDA). The protocol makes it possible to interconnect up to 127 individually addressable devices. The interface is capable of clock stretching, supporting data rates of 100 kbps, 250kbps and 400 kbps.

### 5.2.3. Flash Program I/Os

The module has two programmer pins, respectively SWDCLK pin and SWDIO pin. The two pin Serial Wire Debug (SWD) interface provided as a part of the Debug Access Port (DAP) offers a flexible and powerful mechanism for non-intrusive debugging of program code. Breakpoints and single stepping are part of this support.

### 5.2.4. Serial Peripheral Interface

The SPI interfaces enable full duplex synchronous communication between devices. They support a three-wire (SCK, MISO, MOSI) bi-directional bus with fast data transfers. The SPI Master can communicate with multiple slaves using individual chip select signals for each of the slave devices attached to a bus.

Control of chip select signals is left to the application through use of GPIO signals.

SPI Master has double buffered I/O data. The SPI Slave includes EasyDMA for data transfer directly to and from RAM allowing Slave data transfers to occur while the CPU is IDLE. The GPIOs are used for each SPI interface line and can be chosen from any GPIOs on the device and configured independently. This enables great flexibility in device pinout and efficient use of printed circuit board space and signal routing.

The SPI peripheral support SPI mode 0, 1, 2, and 3. The module has 3 SPI ports, and their properties are as below:

Instance	Master / Slave
SPI0	Master
SPI1	Master
SPIS1	Slave

### 5.2.5. UARTs

The Universal Asynchronous Receiver/Transmitter offers fast, full-duplex, asynchronous serial communication with built-in flow control (CTS, RTS), support in hardware up to 1 Mbps baud. Parity checking is supported. Support the following baud rate in bps unit:

1200/2400/4800/9600/14400/19200/28800/38400/57600/76800/115200.

**Note:** The GPIOs are used for each SPI/TWI/UART interface line and can be chosen from any GPIOs on the device and configured independently.

### 5.2.6. Analogue to Digital Converter (ADC)

The 12-bit incremental Analogue to Digital Converter (ADC) enables sampling of up to 8 external signals through a front-end multiplexer. The ADC has configurable input and reference pre-scaling, and sample resolution (8,10, and 12 bit).

**Note:** The ADC module uses the same analogue inputs as the LPCOMP module. Only one of the modules can be enabled at the same time.

Module PIN Number	nRF52811 PIN Number	Description
15	P0.04/AIN2	General Purpose I/O
14	P0.05/AIN3	General Purpose I/O
29	P0.28/AIN4	General Purpose I/O
27	P0.30/AIN6	General Purpose I/O

### 5.2.7. Reset

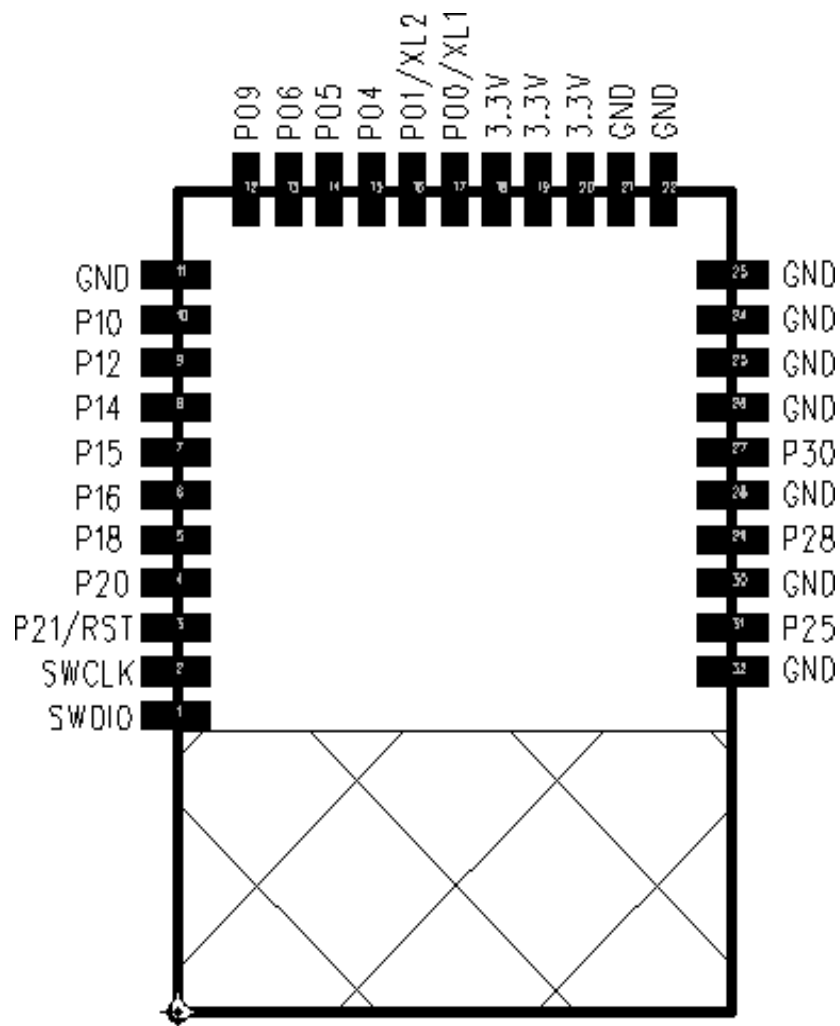
The reset pin of the module is in the internal pull-high state. When the reset pin of the module is input to a low level, the module will be automatically reset. After the reset pin is used, the parameters of the current setting will not be ANT.

## 6. Module Specifications

Hardware Features	
Model	CBTMN11
Antenna Type	PCB Antenna and connector for Patch Antenna
Chipset Solution	nRF52811
Voltage	1.7V ~ 3.6V
Dimensions (L x W x H)	15 x 11 x 2 mm
Wireless Features	
Wireless Standards	2.4GHz ISM, ANT
Frequency Range	2400MHz-2483.5MHz
Data Rates	1-2Mbps
Wireless Security	AES HW Encryption
Transmit Power	Tx Power -20 to +4 dBm in 4dB Steps
Operating Mode	Central / Peripheral in low power RF

## 7. Module Pin-out and Pin Description

### 7.1. Module Pin-out



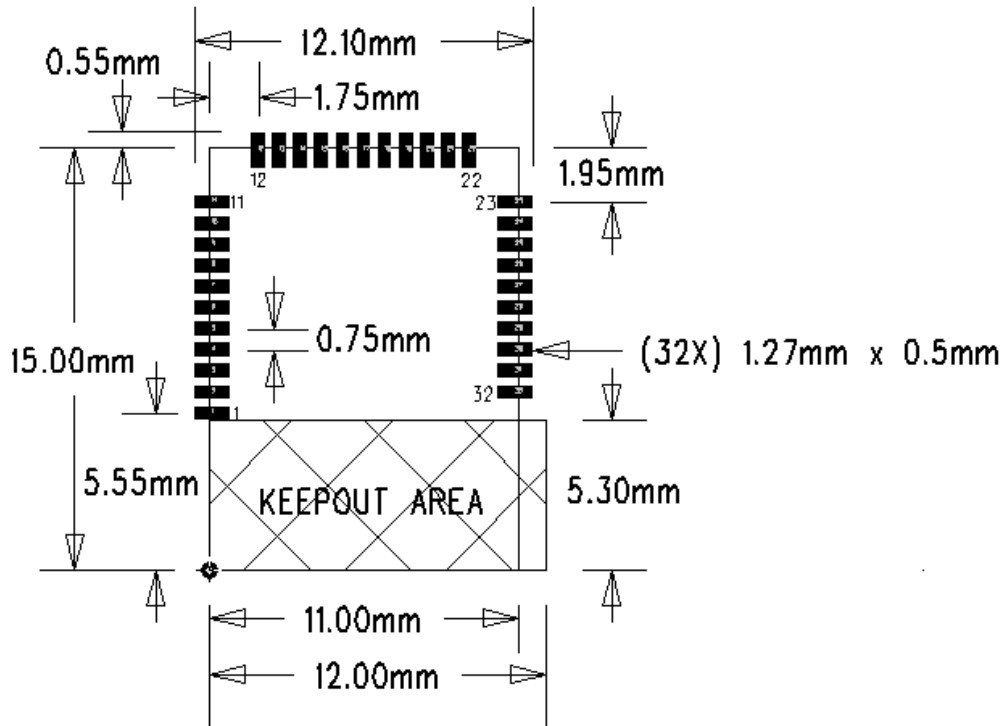
## 7.2. Pin Description

Pin No.	Pin Name	nRF52811 MCU Pin	Pin Description
1	SWDIO	SWDIO	Programming Data
2	SWCLK	SWCLK	Programming clock
3	P21	P21	General purpose I/O pin.
		RESET	Configurable as pin Reset
4	P20	P20	General purpose I/O pin
5	P18	P18	General purpose I/O pin
6	P16	P16	General purpose I/O pin
7	P15	P15	General purpose I/O pin
8	P14	P14	General purpose I/O pin
9	P12	P12	General purpose I/O pin
10	P10	P10	General purpose I/O pin
11	GND	GND	GND
12	P09	P09	General purpose I/O pin
13	P06	P06	General purpose I/O pin
14	P05	P05	General purpose I/O pin
		AIN3	Analogue input
15	P04	P04	General purpose I/O pin
		AIN2	Analogue input
16	XL2	P01	Reserved
		XL2	Reserved
17	XL1	P00	Reserved
		XL1	Reserved

18	3.3V	3.3V	PWR
19	3.3V	3.3V	PWR
20	3.3V	3.3V	PWR
21	GND	GND	GND
22	GND	GND	GND
23	GND	GND	GND
24	GND	GND	GND
25	GND	GND	GND
26	GND	GND	GND
27	P30	P30	General purpose I/O pin
		AIN6	Analogue input
28	GND	GND	GND
29	P28	P28	General purpose I/O pin
		AIN4	Analogue input
30	GND	GND	GND
31	P25	P25	General purpose I/O pin
32	GND	GND	GND



## 8. PCB Footprint and Dimensions



**PCB SIZE: (L) 15mm x (W) 11mm x (H) 2mm**

## 9. Electrical Characteristics

### 9.1. Absolute Maximum Ratings

Parameter	Min.	Max.	Unit
Storage Temp.	-40	125	°C
ESD Protection		2000	V
Supply Voltage	-0.3	3.9	V
Voltage on I/O Pin	-0.3	3.6	V

### 9.2. Recommended Operating Range

Parameter	Symbol	Min.	Typical	Max.	Unit
Operating Temp.	TA	-40		85	°C
Power Supply	VCC	1.7	3.3	3.6	V
Input Low Voltage	VIL	-0.3		0.3*VCC	V
Input High Voltage	VIH	0.7*VCC		VCC	V

### 9.3. Current Ratings

System State	TX Peak @ 4dBm	RX Peak	Sleep Mode (Average)	Idle Mode (Average)
Current (peak) @ 3V	8 mA	10.8 mA	2.5 uA	2.5 uA

## 10. Ordering Information

Module No.	Shielding	Antenna
CBTMN11	No	PCB & Patch Antenna Connector

## 11. Contact Information

### Sales enquiries:

- **India:** [sales@cw din.com](mailto:sales@cw din.com)
- **Americas Region:** [sales.americas@cw din.com](mailto:sales.americas@cw din.com)
- **APAC Region:** [sales.apac@cw din.com](mailto:sales.apac@cw din.com)
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