

JN-RM-2065

JN516x-USB-Dongle Reference Manual

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Reference Manual

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Contact information

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1. Introduction

This manual provides a detailed reference for NXP's JN516x USB dongle (DR1198) and forms part of the *JN516x USB Dongle Reference Design (JN-RD-6039)*. This USB dongle features a JN516x wireless microcontroller and allows communication with this JN516x device from a USB connection. With suitable embedded software running on the JN516x device, the dongle can then communicate with an IEEE 802.15.4, ZigBee 3.0, ZigBee PRO (LL, SE, HA) and ZigBee-RF4CE wireless network.

OM15020 is the official reference for any order of the JN5169 USB dongle.

This chapter introduces the NXP JN516x USB dongle (DR1198), which provides a hardware development platform for wireless microcontroller applications with a USB interface.

1.1 Overview

The JN516x USB Dongle features a JN516x wireless microcontroller and allows communication with this JN516x device from a USB connection. The JN516x device can act as a node of a wireless network. Thus, the dongle provides an easy way of interfacing a host machine (such as a PC) to a wireless network based on the IEEE802.15.4, ZigBee Smart Energy or ZigBee-Home Automation networking protocol. An FTDI device provides the USB connection between the host machine and the JN516x device, which in turn provides the radio interface to the wireless network.

Note: The JN516x device used in this USB dongle design can be an NXP JN5169, JN5168, JN5164 or JN5161 wireless microcontroller. Full details of the JN516x range of devices can be found in the *JN516x data sheets on the Wireless Connectivity area of the NXP website*.

Typical uses of the dongle include:

- A complete and stable hardware environment for the development of IEEE802.15.4, ZigBee 3.0, ZigBee Smart Energy and ZigBee-Home Automation networking applications, facilitating an accelerated time-to-market for wireless network products
- The basis of a packet sniffer for IEEE 802.15.4-based wireless communications
- A means of integrating the host machine into a wireless network, typically as the network coordinator

The small-footprint PCB of the dongle provides all the necessary components for a wireless microcontroller with access to a USB connection. All RF layout and decoupling issues are handled by the design of this dongle. Therefore, this design is ready for application development without the necessity of hardware development.

The JN516x USB dongle, shown [Fig 1](#), is supplied in the JN516x- Evaluation Kit.



Fig 1. JN516X USB dongle (OM15020)

1.2 Features

The dongle has the following features:

- USB 2.0 Full-Speed Compatible Interface
- IEEE 802.15.4-based wireless microcontroller (JN516x) with the following radio characteristics:

JN5169:

- Transmit power: 8.5 dBm (typ.), can be increased to 10 dBm (typ.)
- Transmit current: 19.6 mA (typ.) at 8.5 dBm/23.3 mA (typ.) at 10 dBm
- Receive sensitivity: -96dBm (typ.)
- Receive current: 13 mA (typ.)

JN5161/JN5164/JN5168:

- Transmit power: 2.5dBm (typ.)
 - Transmit current: 15 mA (typ.)
 - Receive sensitivity: -95dBm (typ.)
 - Receive current: 17.5 mA (typ.)
- Integrated printed RF antenna
 - General-purpose LEDs (one green, one orange)
 - Serial Flash memory device (4 Mbits)
 - 32-kHz crystal oscillator

1.3 Reference design

The reference design JN-RD-6039 for the JN516x USB dongle is available from the connectivity area of the website.

This reference design comprises a ZIP file containing the following files:

- This reference manual
- Two HW packages; one for JN5169 and one for JN5161/JN5164/JN5168:
 - The schematic diagram for the board
 - The BOM (Bill Of Materials) for the board
 - Gerbers for the board

Note: The PADS source file in the Reference Design does not include the PCB antenna. This must be obtained from the Gerber files.

2. Hardware overview

This chapter provides an overview of the hardware design and the main hardware components of the JN516x USB dongle.

2.1 Dongle layout

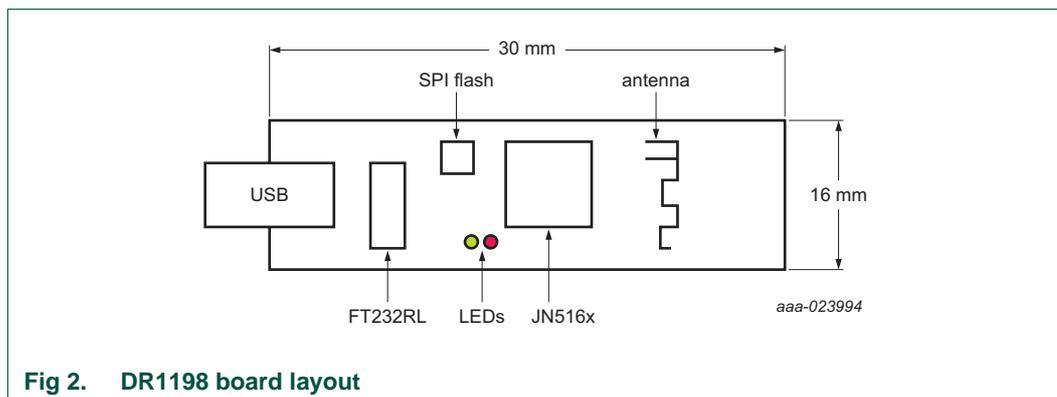


Fig 2. DR1198 board layout

2.2 Dongle block diagram

The Fig 3 illustrates the main hardware blocks of the dongle in the case when a JN5169 device is fitted to the board.

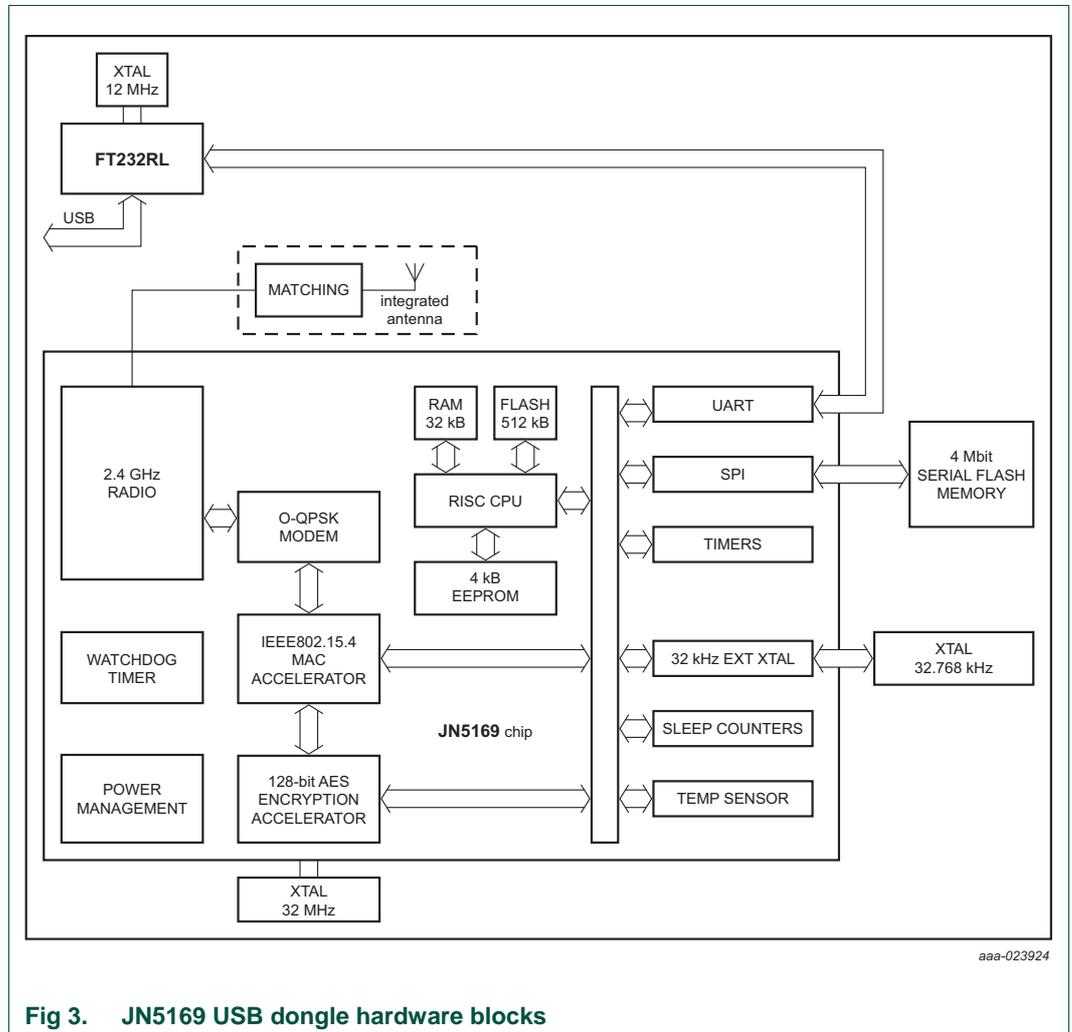


Fig 3. JN5169 USB dongle hardware blocks

2.3 Hardware components

The hardware components on the board are described in the following sub-sections.

- JN516x wireless microcontroller – see [section 2.3.1](#)
- FTDI FT232RL driver device – see [section 2.3.2](#)
- LEDs – see [section 2.3.3](#)
- 32-kHz crystal oscillator – see [section 2.3.4](#)

2.3.1 JN516x device

The JN516x wireless microcontroller used in the dongle design can be an NXP JN5169, JN5168, JN5164 or JN5161 device. The JN516x range of wireless microcontrollers is detailed in the *JN516x data sheet*.

The JN516x circuit on the board is based around the standard *JN516x Module Reference Design (JN-RD-6038)*. However, it is built on a 2-layer board, as the DIOs do not need to be externally available.

The main implementation differences between JN5161/JN5164/JN5168 and JN5169 are also depicted in the JN-RD-6038. It consists mainly in a different matching network.

Note1: The JN516x device uses an integrated antenna on the PCB of the dongle. Note that in the reference design JN-RD-6039, the PADS source file does not include the PCB antenna - it must be obtained from the Gerber files.

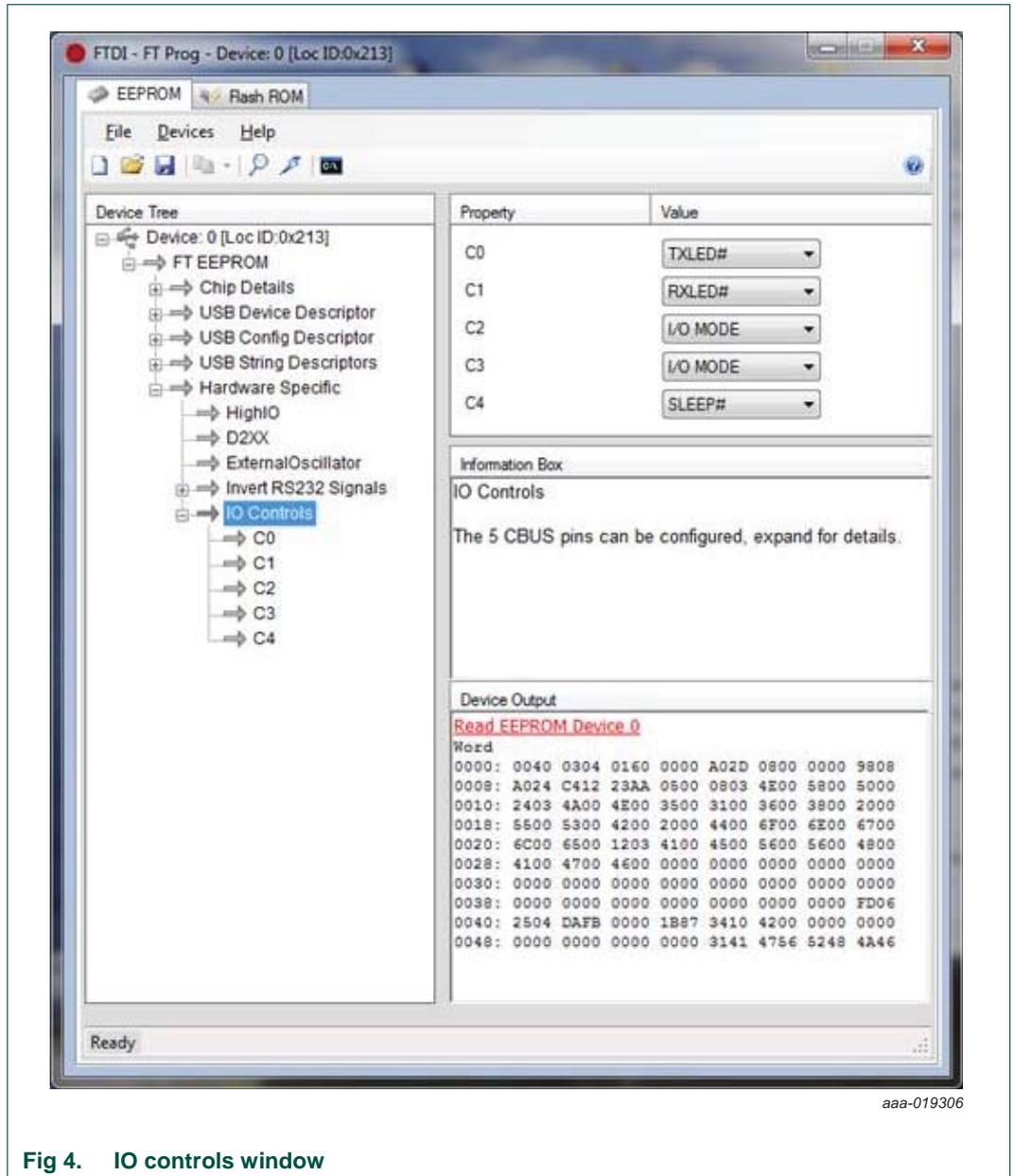
Note 2: Bill Of Material is depicted in the RD6039 package but it has to be noted some OM15020 USB dongles have been released with 15 pF capacitor on 32 MHz quartz instead of the recommended 12 pF for JN5169.

2.3.2 FT232RL device

The FT232RL device is connected to the USB connector and acts as an interface between the PC and the JN516x device. The FT232RL will enumerate on the PC as a virtual COM port connected directly to UART0 on the JN516x device.

The IO controls C2 and C3 in the FT232RL device need to be set to 'I/O Mode' to allow the RESET and PGM signals to operate correctly. To do this, execute the following instructions.

1. Download the application FT_Prog from the FTDI website www.ftdichip.com
2. Insert the JN516x USB dongle into a USB port of your computer and wait for the device to enumerate
3. Start FT_Prog and click Scan and Parse (the magnifying glass button)
4. Update the IO controls C2 and C3 to I/O MODE – see [Fig 4](#)



aaa-019306

Fig 4. IO controls window

5. Click Program Devices (the lightning button)
6. On the resulting screen, click Program – see [Fig 5](#)

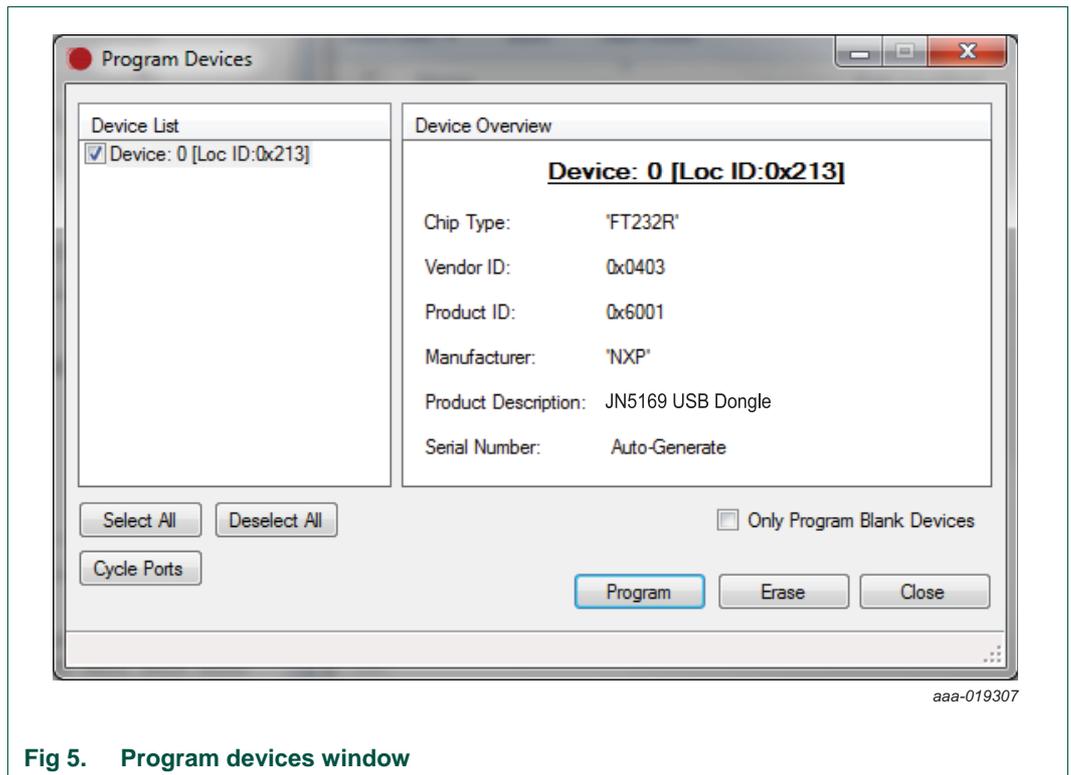


Fig 5. Program devices window

2.3.3 LEDs

There are two surface-mounted LEDs that can be controlled by the JN516x wireless microcontroller (see [Fig 2](#) for locations):

- LED D1 (green)
- LED D2 (orange)

Both LEDs are connected to DIO16 and DIO17. These DIOs can be used to control the LEDs as indicated in the [Table 1](#).

Table 1. DIO control of LEDs

		DIO17	
		Low	High
DIO16	Low	D1: Off D2: Off	D1: Off D2: On
	High	D1: On D2: Off	D1: Off D2: Off

2.3.4 32-kHz crystal oscillator

The JN516x device has an internal 32-kHz RC oscillator. In order to provide more accurate system timings, an external 32-kHz crystal can be used with the device. This is provided on the JN516x USB dongle and can be enabled from the JN516x application using the

JN516x Integrated Peripherals API - refer to the JN516X Integrated Peripherals API User Guide (JN-UG-3087).

3. Flash programming

When the JN516x USB dongle is powered up, it attempts to run an application from the internal Flash memory of the JN516x device. This may be a self-contained application that sends and receives wireless data, and which does not need to communicate with the host. Alternatively, it may communicate via the USB with an application running on the host, such as a Windows program, and also communicate with a wireless device or network.

In order to program an application binary into Flash memory, the JN51xx Production Flash Programmer can be used, which is described in the JN51xx Production Flash Programmer User Guide (JN-UG-3099). This programming utility will place the JN516x into its programming mode. It will then download the program to the Flash memory and reset the JN516x device, causing the application to be executed.

4. Compliance statements and documentation

The compliance statements and documentation in this chapter apply only to a JN516x USB Dongle fitted with the JN5168 or JN5169 device.

The FCC ID number of the JN5169 USB dongle is XXMJN5169U0

The IC ID number of the JN5169 USB dongle is 8764A-JN5169U0

The FCC ID number of the JN5168 USB dongle is TYOJN5168U0

The IC ID number of the JN5168 USB dongle is 7438A-CYO5168U0

4.1 FCC statements and documentation

This section contains the Federal Communication Commission (FCC) statements and documents.

4.1.1 FCC interference statement

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 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.

FCC caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

WARNING!

FCC radiation exposure statement:

This portable equipment with its integrated antenna complies with FCC's RF radiation exposure limits set forth for an uncontrolled environment. To maintain compliance follow the instructions below;

Avoid direct contact to the antenna, or keep it to a minimum while using this equipment.

4.1.2 FCC Declaration of Conformity

4.2 Industry Canada statement

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables

aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

4.3 European R & TTE Directive 1999/5/EC Statement

The JN5168-001-U00 and JN5169-001-U0 are compliant with the following standards:

- Radio - ETSI EN 300 328 V1.7.1 (2006-10),
- EMC - EN 301 489-17 v2.1.1 (2009-02)
- Basic Safety Assessment (BSA) EN 60950-1:2006 (2006-06)

The JN5168-001-U00 and JN5169-001-U0 are subject to a Notified Body Opinion.

5. Abbreviations

Table 2. Abbreviations

Acronym	Description
BOM	Bill Of Materials
DIO	Digital Input/Output
FCC	Federal Communication Commission
IC	Industry Canada
PCB	Printed Circuit Board
UART	Universal Asynchronous Receiver/Transmitter
USB	Universal Serial Bus

6. References

- [1] **JN516x** – JN5161/JN5164/JN5168 data sheet
- [2] **JN5169** – JN5169 data sheet
- [3] **JN-UG-3087** – JN516x Integrated Peripherals API User Guide
- [4] **DR1198_JN5168_USB_Dongle_1V0** – DR1198 USB dongle PCB files for JN5161/JN5164/JN5168
- [5] OM15020 -**JN5169_USB_Dongle_1V0b** – DR1198 USB dongle PCB files for JN5169

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