JN5169-001-M0x-2
ZigBee 3.0, ZigBee PRO and IEEE802.15.4 modules
Rev. 3.0 — 19 September 2016   **Product data sheet**

1. General description

The JN5169-001-M0x-2 (with x = 0, 3 or 6) module family provides designers with a ready-made component that provides a fully integrated solution for applications, using the IEEE802.15.4 standard in the 2.4 GHz - 2.5 GHz ISM frequency band, including ZigBee 3.0 and ZigBee PRO stack with Home Automation, Light Link and Smart Energy profiles. The modules integrate all of the RF components required, removing the need to perform expensive RF design and test. Products can be designed by simply connecting sensors and switches to the module IO pins. The modules use NXP's single chip IEEE802.15.4 wireless microcontroller, allowing designers to make use of the extensive chip development support material. Hence, this range of modules allows designers to bring wireless applications to market in the minimum time with significantly reduced development effort and cost.

3 variants are available: JN5169-001-M00-2, JN5169-001-M03-2 and JN5169-001-M06-2. All modules have FCC modular approval. The JN5169-001-M00-2 and JN5169-001-M03-2 are also CE-compliant and subject to a Notified Body Opinion.

The variants available are described in the Table 1.

1.1 Regulatory Approvals

The JN5169-001-M00-2 and JN5169-001-M03-2 have been tested against the requirements of the following European standards.

- Radio EN 300 328 v 1.9.1
- EMC, EN 301 489-17 v 2.2.1, EN 62479 2010, EN 301 489-1 v 1.9.2
- Basic Safety Assessment (BSA) EN 60950-1:2006

A Notified Body statement of opinion for this standard is available on request.

The High-power module with M06 suffix is not approved for use in Europe.

Additionally, both module types have received FCC "Modular Approval", in compliance with CFR 47 FCC part 15 regulations and in accordance to FCC public notice DA00-1407. The modular approvals notice and test reports are available on request.

The JN5169-001-M06-2 module is subject to user proximity restrictions under FCC regulations; more specific information is available in Section 13.1.2.

2. Features and benefits

2.1 Benefits

- Microminiature module solutions
- Ready to use in products
- Minimizes product development time
- No RF test required for systems
- Compliant with:
  - FCC 47CFR Part 15C
  - ETSI EN 300-328 V1.9
  - EN 301-489-17 V2.2.1
  - EN60950-1-2006
  - Temperature range: −40 °C to +85 °C
  - Lead-free and RoHS compliant

2.2 Features: modules

- 2.4 GHz IEEE 802.15.4, ZigBee 3.0 and ZigBee PRO stack with Home Automation, Light Link and Smart Energy compatible
- JN5169-001-M00-2
  - Dimensions: 16 mm × 30 mm
  - Integrated printed antenna
  - TX power 8.5 dBm/10 dBm
  - Receiver sensitivity −96 dBm
  - TX current 27.2 mA at 10 dBm
  - TX current 23.6 mA at 8.5 dBm
  - RX current 17.8 mA at maximum input level 10 dBm
  - RX current 16.2 mA at maximum input level 0 dBm
  - 2.0 V/3.6 V operation
- JN5169-001-M03-2
  - Dimensions: 16 mm × 21 mm
  - µFl connector
  - TX power 8.5 dBm/10 dBm
  - Receiver sensitivity −96 dBm
  - TX current 27.2 mA at 10 dBm
  - TX current 23.6 mA at 8.5 dBm
  - RX current 17.8 mA at maximum input level 10 dBm
  - RX current 16.2 mA at maximum input level 0 dBm
  - 2.0 V/3.6 V operation
- JN5169-001-M06-2
  - Dimensions: 16 mm × 30 mm
  - µFl connector
  - TX power 22 dBm
  - Receiver sensitivity −100 dBm
  - TX current 181 mA at 22 dBm

JN5169M0x

All information provided in this document is subject to legal disclaimers.

© NXP Semiconductors N.V. 2016. All rights reserved.

Product data sheet

Rev. 3.0 — 19 September 2016

2 of 27

◆ RX current 22.8 mA at maximum input level 10 dBm

◆ 2.0 V/3.6 V operation

2.3 Features: microcontroller

- 32-bit RISC CPU; 1 MHz to 32 MHz clock speed
- Variable instruction width for high coding efficiency
- Multi-stage instruction pipeline
- 512 kB Flash
- 32 kB RAM
- 4 kB EEPROM
- Data EEPROM with guaranteed 100 k write operations
- 2-wire I^{2}C-bus compatible serial interface; can operate as either master or slave
- 5 × PWM (4 timers, 1 timer/counter)
- 2 low-power sleep counters
- 2 UARTs
- SPI-bus Master and Slave port, 3 selects
- Supply voltage monitor with 8 programmable thresholds
- 6-input 10-bit ADC, comparator
- Battery and temperature sensors
- Watchdog and Supply Voltage Monitor (SVM)
- Up to 20 Digital IO (DIO) pins

3. Applications

- Robust and secure low-power wireless applications
- ZigBee Smart Energy networks
- ZigBee Home Automation networks
- Toys and gaming peripherals
- Energy harvesting - for example, self-powered light switch

4. Overview

The JN5169-001-M0x-2 family is a range of ultra-low power, high performance surface mount modules targeted at IEEE 802.15.4, ZigBee 3.0 and ZigBee Home Automation, Light Link and Smart Energy networking applications, enabling users to realize products with minimum time to market and at the lowest cost. They remove the need for expensive and lengthy development of custom RF board designs and test suites. The modules use NXP's JN5169 wireless microcontroller to provide a comprehensive solution with large memory, high CPU and radio performance and all RF components included. All that is required to develop and manufacture wireless control or sensing products is to connect a power supply and peripherals such as switches, actuators and sensors, considerably simplifying product development.

3 module variants are available: JN5169-001-M00-2 with an integrated printed antenna, JN5169-001-M03-2 and JN5169-001-M06-2 with a µFL antenna connector. The JN5169-001-M06-2 also has a power amplifier and LNA for extended range.

JN5169M0x

Product data sheet

Rev. 3.0 — 19 September 2016

3 of 27

5. Ordering information

Table 1. Ordering information

Type number	Description	FCCID
JN5169-001-M00-2	Standard power, integrated printed antenna	XXMJN5169M0V2
JN5169-001-M03-2	Standard power, μFL connector	XXMJN5169M3V2
JN5169-001-M06-2	High power, μFL connector	XXMJN5169M6V2

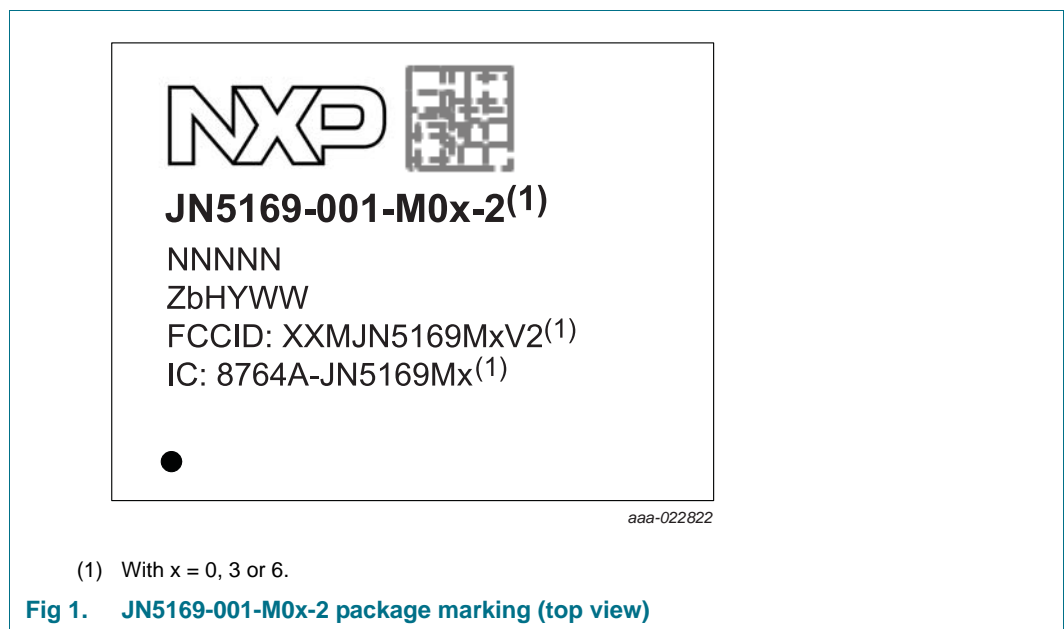For further details, refer to the Wireless Connectivity area of the NXP web site Ref. 3.

6. Marking

(1) With x = 0, 3 or 6.

Fig 1. JN5169-001-M0x-2 package marking (top view)

Table 2. Marking code

Line number	Marking code
Line 1	NXP Logo: B&W outline logo - 2D barcode (internal NXP usage)
Line 2	part ID: JN5169-001-M0x-2, with x the module type, 0, 3 or 6
Line 3	serial number: NNNNN
Line 4	• Z: SSMC • b: SPIL • H: halogen free • Y: year • WW: week code
Line 5	FFC ID = FCCID: XXMJN5169MxV2, with x the module type 0, 3 or 6
Line 6	IC ID = IC: 8764A-JN5169Mx, with x the module type 0, 3 or 6

JN5169-001-M0x-2 modules meet the requirements of Directive 2002/95/EC of the European Parliament and of the Council on the Restriction of Hazardous Substance (RoHS) and of the Chinese RoHS requirements SJ/T11363-2006 which came into force on 1 March 2007.
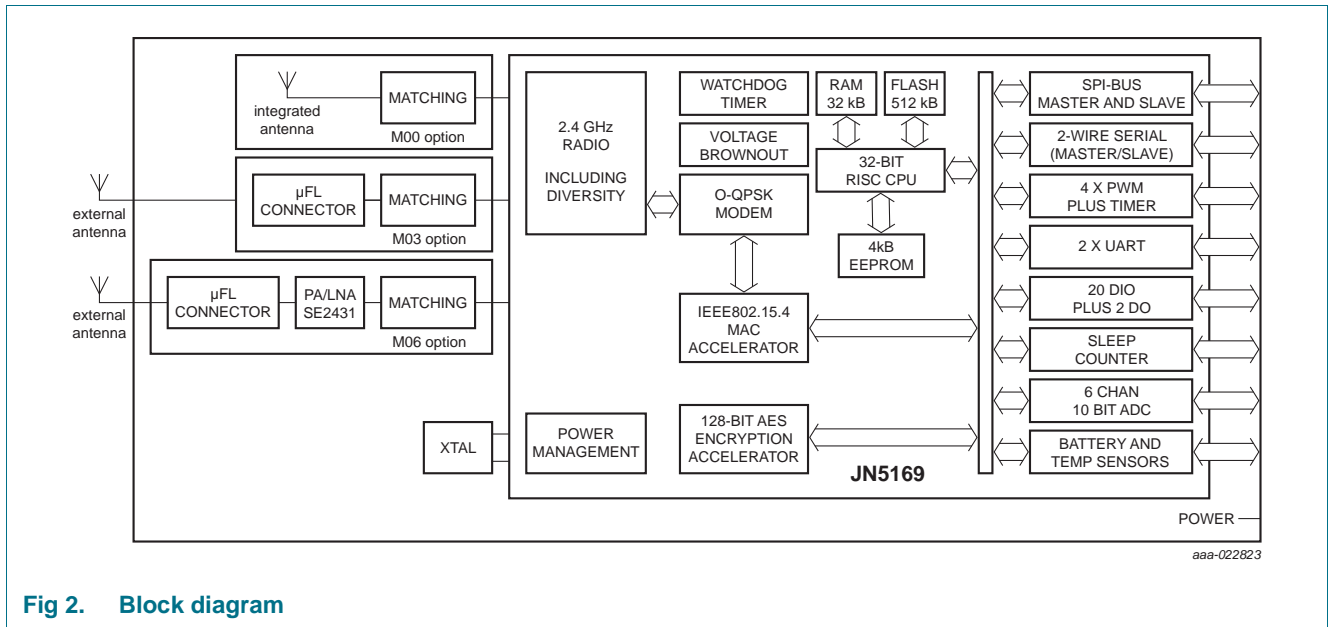
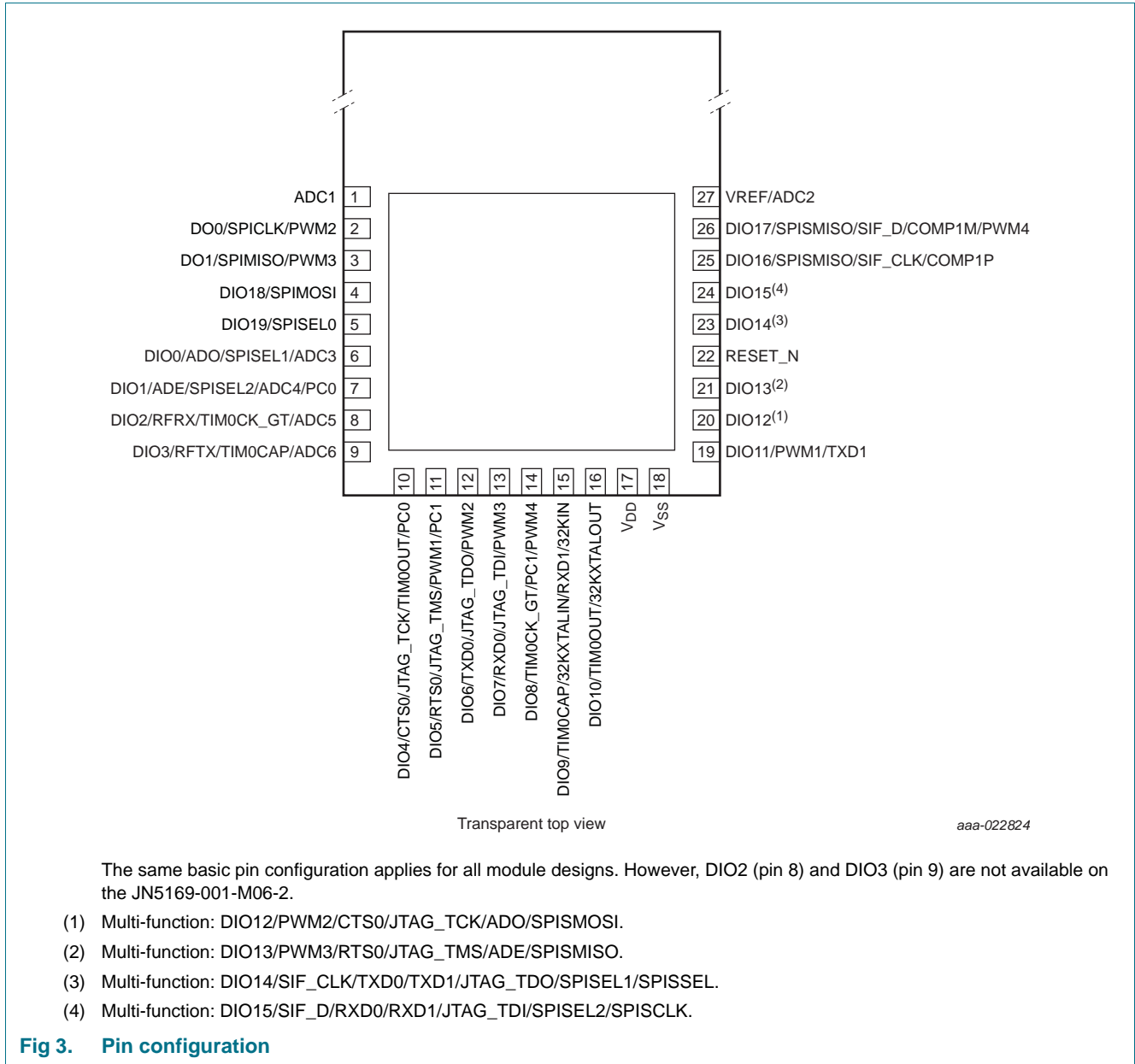## 7. Block diagram

Fig 2.   Block diagram

JN5169M0x

Product data sheet

All information provided in this document is subject to legal disclaimers.

© NXP Semiconductors N.V. 2016. All rights reserved.

Rev. 3.0 — 19 September 2016

5 of 27

8. Pinning information

8.1 Pinning

Transparent top view

aaa-022824

The same basic pin configuration applies for all module designs. However, DIO2 (pin 8) and DIO3 (pin 9) are not available on the JN5169-001-M06-2.

(1) Multi-function: DIO12/PWM2/CTS0/JTAG_TCK/ADO/SPISMOSI.

(2) Multi-function: DIO13/PWM3/RTS0/JTAG_TMS/ADE/SPISMISO.

(3) Multi-function: DIO14/SIF_CLK/TXD0/TXD1/JTAG_TDO/SPISEL1/SPISSEL.

(4) Multi-function: DIO15/SIF_D/RXD0/RXD1/JTAG_TDI/SPISEL2/SPISCLK.

Fig 3.   Pin configuration

8.2 Pin description

Table 3.   Pin description

Symbol	Pin	Type[1]	Description
ADC1	1	I	**ADC1 —** ADC input

Table 3.   **Pin description** *…continued*

Symbol	Pin	Type[1]	Description
DO0/SPICLK/PWM2[2]	2	O	**DO0** — DO0
			SPICLK — SPI-bus master clock output
			PWM2 — PWM2 output
DO1/SPIMISO/PWM3[3]	3	I/O	**DO1** — DO1
			SPIMISO — SPI-bus Master In, Slave Out input
			PWM3 — PWM3 output
DIO18/SPIMOSI	4	I/O	**DIO18** — DIO18
			SPIMOSI — SPI-bus Master Out Slave In output
DIO19/SPISEL0	5	I/O	**DIO19** — DIO19
			SPISEL0 — SPI-bus Master Select Output 0
DIO0/ADO/SPISEL1/ADC3	6	I/O	**DIO0** — DIO0
			ADO — antenna diversity odd output
			SPISEL1 — SPI-bus master select output 1
			ADC3 — ADC input: ADC3
DIO1/ADE/SPISEL2/ADC4/PC0	7	I/O	**DIO1** — DIO1
			ADE — antenna diversity even output
			SPISEL2 — SPI-bus master select output 2
			ADC4 — ADC input: ADC4
			PC0 — pulse counter 0 input
DIO2/RFRX/TIM0CK_GT/ADC5[4]	8	I/O	**DIO2** — DIO2
			RFRX — radio receives control output
			TIM0CK_GT — timer0 clock/gate input
			ADC5 — ADC input: ADC5
DIO3/RFTX/TIM0CAP/ADC6[4]	9	I/O	**DIO3** — DIO3
			RFTX — radio transmit control output
			TIM0CAP — timer0 capture input
			ADC6 — ADC input: ADC6
DIO4/CTS0/JTAG_TCK/TIM0OUT/PC0	10	I/O	**DIO4** — DIO4
			CTS0 — UART 0 clear to send input
			JTAG_TCK — JTAG CLK input
			TIM0OUT — timer0 PWM output
			PC0 — pulse counter 0 input
DIO5/RTS0/JTAG_TMS/PWM1/PC1	11	I/O	**DIO5** — DIO5
			RTS0 — UART 0 request to send output
			JTAG_TMS — JTAG mode select input
			PWM1 — PWM1 output
			PC1 — pulse counter 1 input
DIO6/TXD0/JTAG_TDO/PWM2	12	I/O	**DIO6** — DIO6
			TXD0 — UART 0 transmit data output
			JTAG_TDO — JTAG data output
			PWM2 — PWM2 data output

JN5169M0x

Product data sheet   **Rev. 3.0 — 19 September 2016**   7 of 27

Table 3. **Pin description** *…continued*

Symbol	Pin	Type[1]	Description
DIO7/RXD0/JTAG_TDI/PWM3	13	I/O	**DIO7 —** DIO7
			RXD0 — UART 0 receive data input
			JTAG_TDI — JTAG data input
			PWM3 — PWM 3 data output
DIO8/TIM0CK_GT/PC1/PWM4	14	I/O	**DIO8 —** DIO8
			TIM0CK_GT — timer0 clock/gate input
			PC1 — pulse counter1 input
			PWM4 — PWM 4 output
DIO9/TIM0CAP/32KXTALIN/RXD1/32KIN	15	I/O	**DIO9 —** DIO9
			TIM0CAP — Timer0 Capture input
			32KXTALIN — 32 kHz External Crystal input
			RXD1 — UART1 Receive Data input
			32KIN — 32 kHz External clock input
DIO10/TIM0OUT/32KXTALOUT	16	I/O	**DIO10 —** DIO10
			TIM0OUT — Timer0 PWM Output
			32KXTALOUT — 32 kHz External Crystal output
V_{DD}	17	P	**V_{DD} —** supply voltage
V_{SS}	18	GND	ground
DIO11/PWM1/TXD1	19	I/O	**DIO11 —** DIO11
			PWM1 — PWM1 output
			TXD1 — UART1 Transmit Data output
DIO12[5]	20	I/O	**DIO12 —** DIO12
			PWM2 — PWM2 output
			CTS0 — UART0 clear to send input
			JTAG_TCK — JTAG CLK input
			ADO — antenna diversity odd output
			SPISMOSI — SPI-bus slave Master Out, Slave In input
DIO13[6]	21	I/O	**DIO13 —** DIO13
			PWM3 — PWM3 output
			RTS0 — UART0 request to send output
			JTAG_TMS — JTAG mode select input
			ADE — antenna diversity even output
			SPISMISO — SPI-bus slave master in slave out output
RESET_N	22	I	**RESET_N —** reset input
DIO14[7]	23	I/O	**DIO14 —** DIO14
			SIF_CLK — serial interface clock
			TXD0 — UART 0 transmit data output
			TXD1 — UART 1 transmit data output
			JTAG_TDO — JTAG data output
			SPISEL1 — SPI-bus master select output 1
			SPISSEL — SPI-bus slave select input

Table 3. **Pin description** *…continued*

Symbol	Pin	Type[1]	Description
DIO15[8]	24	I/O	**DIO15 —** DIO15
			SIF_D — serial interface data
			RXD0 — UART 0 receive data input
			RXD1 — UART 1 receive data input
			JTAG_TDI — JTAG data input
			SPISEL2 — SPI-bus master select output 2
			SPISCLK — SPI-bus slave clock input
DIO16/SPISMOSI/SIF_CLK/COMP1P	25	I/O	**DIO16 —** DIO16
			COMP1P — comparator positive input
			SIF_CLK — Serial Interface clock
			SPISMOSI — SPI-bus Slave Master Out Slave In input
DIO17/SPISMISO/SIF_D/COMP1M	26	I/O	**DIO17 —** DIO17
			COMP1M — COMP1M; comparator negative input
			SIF_D — Serial Interface Data
			SPISMISO — SPI-bus Slave Master In Slave Out output
			PWM4 — PWM 4 output
VREF/ADC2	27	P	**VREF —** analog peripheral reference voltage
		I	**ADC2 —** ADC input 2

[1] P = power supply; G = ground; I = input, O = output; I/O = input/output.

[2] JTAG programming mode: must be left floating high during reset to avoid entering JTAG programming mode.

[3] UART programming mode: leave pin floating high during reset to avoid entering UART programming mode or hold it low to program.

[4] Not available on the JN5169-001-M06-2 since they are used to control the front-end module.

[5] Multi-function: DIO12/PWM2/CTS0/JTAG_TCK/ADO/SPISMOSI.

[6] Multi-function: DIO13/PWM3/RTS0/JTAG_TMS/ADE/SPISMISO.

[7] Multi-function: DIO14/SIF_CLK/TXD0/TXD1/JTAG_TDO/SPISEL1/SPISSEL.

[8] Multi-function: DIO15/SIF_D/RXD0/RXD1/JTAG_TDI/SPISEL2/SPISCLK.

9. Functional description

9.1 JN5169 single chip wireless microcontroller

The JN5169-001-M0x-2 series is constructed around the JN5169-001 single chip wireless microcontroller, which includes the radio system, a 32-bit RISC CPU, Flash, RAM and EEPROM memory and a range of analog and digital peripherals.

The chip is described fully in JN5169 Wireless Microcontroller Datasheet (see Ref. 2).

JN5169M0x

Product data sheet **Rev. 3.0 — 19 September 2016** **9 of 27**

9.2 Peripherals

Table 4.   Peripherals description

Peripherals	JN5169-001-M00-2	JN5169-001-M03-2	JN5169-001-M06-2	Notes
Master SPI-bus port	3 selects	3 selects	3 selects	250 kHz - 16 MHz
Slave SPI-bus port	1	1	1	250 kHz - 4 MHz
UART	2	2	2	16550 compatible
Two-wire serial I/F (compatible with SMbus and I^{2}C-bus)	1	1	1	Up to 400 kHz
PWM				16 MHz clock
timer	4	4	4	
timer/counter	1	1	1	
Programmable Sleep Timers	2	2	2	32 kHz clock
Digital IO lines (multiplexed with UARTs, timers and SPI-bus selects)	20	20	18	DIO2 and DIO3 are not available on JN5169-001-M06-2 modules
Analog-to-Digital converter	6	6	6	10-bit, up to 100 ks/s
Programmable analog comparator	1	1	1	ultra low-power mode for sleep
Internal temperature sensor	1	1	1	
Internal battery sensor	1	1	1	

The performance of all peripherals is defined in the JN5169 Wireless Microcontroller Datasheet (see Ref. 2).

NXP supplies all the development tools and networking stacks needed to enable end-product development to occur quickly and efficiently. These are all freely available from the NXP Wireless Connectivity (see Ref. 3). A range of evaluation/developer kits is also available, allowing products to be quickly bread boarded. Efficient development of software applications is enabled by the provision of a complete, unlimited, software developer kit. Together with the available libraries for the IEEE802.15.4 MAC and ZigBee 3.0 and ZigBee PRO network stacks, this package provides everything required to develop application code and to trial it with hardware representative of the final module.

The modules can be user programmed both in development and in production using software supplied by NXP. Access to the on-chip peripherals, MAC and network stack software is provided through specific APIs. This information is available on the NXP support website, together with many example applications, user guides, reference manuals and application notes.

JN5169M0x

Product data sheet **Rev. 3.0 — 19 September 2016** **10 of 27**

10. Limiting values

Table 5. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
V_{DD}	supply voltage		−0.3	+3.6	V
$V_{VREF/ADC2}$	voltage on pin VREF/ADC2		−0.3	V_{DD} + 0.3 V	V
V_{ADC1}	voltage on pin ADC1		−0.3	V_{DD} + 0.3 V	V
$V_{IO(dig)}$	digital input/output voltage		−0.3	V_{DD} + 0.3 V	V
T_{stg}	storage temperature		−40	+150	°C

11. Recommended operating conditions

Table 6. Operating conditions

Symbol	Parameter	Conditions	Min	Max	Unit
V_{DD}	supply voltage	[1]	2	3.6	V
T_{amb}	ambient temperature	standard range	−40	+85	°C

[1] To reach the maximum TX power, 2.8 V is the minimum.

12. Characteristics

12.1 DC current

Table 7. Active processing

V_{DD} = 2 V to 3.6 V; T_{amb} = −40 °C to +85 °C; unless otherwise specified.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
I_{DD}	supply current	M00					
		radio in receive mode; maximum input level at 10 dBm		-	17.8	-	mA
		radio in receive mode; maximum input level at 0 dBm		-	16.1	-	mA
		radio in transmit mode 10 dBm	[1]	-	25	-	mA
		radio in transmit mode 8.5 dBm	[1]	-	22.7	-	mA
		M03					
		radio in receive mode; maximum input level at 10 dBm		-	17.8	-	mA
		radio in receive mode; maximum input level at 0 dBm		-	16.1	-	mA
		radio in transmit mode 10 dBm	[1]	-	25	-	mA
		radio in transmit mode 8.5 dBm	[1]	-	22.7	-	mA
		M06					
		radio in receive mode		-	21.5	-	mA
		radio in transmit mode	[1]	-	153	-	mA

[1] To reach the maximum TX power, V_{DD} = 2.8 V is the minimum.

JN5169M0x

Product data sheet

Rev. 3.0 — 19 September 2016

11 of 27

Table 8.   Sleep mode

V_{DD} = 2 V to 3.6 V; T_{amb} = −40 ℃ to +85 ℃; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{DD(IO)}$	input/output supply current	in sleep mode; with I/O and RC oscillator timer wake-up; T_{amb} = 25 °C	-	0.73	-	µA

Table 9.   Deep sleep mode

V_{DD} = 2 V to 3.6 V; T_{amb} = −40 ℃ to +85 ℃; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{DD}	supply current	deep sleep mode; measured at 25 °C and V_{DD} = 3.3 V [1]	-	70	-	nA

[1]   Waiting on chip RESET or I/O event.

12.2 AC characteristics

12.2.1 Radio transceiver

These modules meet all the requirements of the IEEE802.15.4 standard over 2.0 V to 3.6 V and offers the improved RF characteristics shown in Table 10. All RF characteristics are measured single ended.

Table 10.   RF port characteristics

Single-ended; Impedance = 50 Ω[1]; V_{DD} = 2 V to 3.6 V; T_{amb} = −40 ℃ to +85 ℃; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
f_{range}	frequency range		2.4	-	2.485	GHz

[1]   With external matching inductors and assuming PCB layout.

Table 11.   Radio transceiver characteristics: +25 °C

V_{DD} = 2 V to 3.6 V; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Receiver						
M00						
S_{RX}	receiver sensitivity	nominal for 1 % PER, as per 802.15.4	-	−96	-	dBm
$P_{i(RX)(max)}$	maximum receiver input power	1 % PER, measured as sensitivity; supply current at 17.8 mA	-	10	-	dBm
		1 % PER, measured as sensitivity; supply current at 16.2 mA	-	0	-	dBm
$\Delta\alpha_{RSSI}$	RSSI variation	−95 dBm to −10 dBm; available through JN5169M0x Integrated Peripherals API	−4	-	+4	dB
M03						
S_{RX}	receiver sensitivity	nominal for 1 % PER, as per 802.15.4	-	−96	-	dBm
$P_{i(RX)(max)}$	maximum receiver input power	1 % PER, measured as sensitivity; supply current at 17.8 mA	-	10	-	dBm
		1 % PER, measured as sensitivity; supply current at 16.2 mA	-	0	-	dBm
$\Delta\alpha_{RSSI}$	RSSI variation	−95 dBm to −10 dBm; available through JN5169M0x Integrated Peripherals API	−4	-	+4	dB
M06						

JN5169M0x

All information provided in this document is subject to legal disclaimers.

© NXP Semiconductors N.V. 2016. All rights reserved.

Product data sheet

Rev. 3.0 — 19 September 2016

12 of 27

Table 11.   Radio transceiver characteristics: +25 °C *…continued*

V_{DD} = 2 V to 3.6 V; unless otherwise specified.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
S_{RX}	receiver sensitivity	nominal for 1 % PER, as per 802.15.4		-	−100	-	dBm
$P_{i(RX)(max)}$	maximum receiver input power	1 % PER, measured as sensitivity		-	5	-	dBm
$\Delta\alpha_{RSSI}$	RSSI variation	−100 dBm to −25 dBm; available through JN5169M0x Integrated Peripherals API		−4	-	+4	dB
Transmitter							
M00							
P_o	output power	I_{DD} = 27.2 mA	[1]	-	10	-	dBm
		I_{DD} = 23.6 mA	[1]	-	8.5	-	dBm
$P_{o(cr)}$	control range output power	in 6 major steps and then 4 fine steps	[2]	-	−42	-	dB
M03							
P_o	output power	I_{DD} = 27.2 mA	[1]	-	10	-	dBm
		I_{DD} = 23.6 mA	[1]	-	8.5	-	dBm
$P_{o(cr)}$	control range output power	in 6 major steps and then 4 fine steps	[2]	-	−42	-	dB
M06							
P_o	output power		[1]	-	22	-	dBm

[1]   To reach the maximum TX power, 2.8 V is the minimum on V_{DD}.

[2]   Up to an extra 2.5 dB of attenuation is available if required.

13. Application information

13.1 Federal Communication Commission Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, according to Part 15 of the FCC Rules, see Ref. 4. 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, see Ref. 4. Operation is subject to the following two conditions:

1. This device may not cause harmful interference

JN5169M0x

All information provided in this document is subject to legal disclaimers.

© NXP Semiconductors N.V. 2016. All rights reserved.

Product data sheet

Rev. 3.0 — 19 September 2016

13 of 27

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.

Remark: FCC Radiation Exposure Statement:

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

1. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.
2. Avoid direct contact to the antenna, or keep it to a minimum while using this equipment.

This transmitter module is authorized to be used in other devices only by OEM integrators under the following condition:

The transmitter module must not be co-located with any other antenna or transmitter.

As long as the above condition is met, further transmitter testing will not be required. However, the OEM integrator is still responsible for testing their end product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.).

This applies to the JN5169-001-M00-2 and JN5169-001-M03-2 devices, the JN5169-001-M06-2 is a mobile device (see Section 13.1.2).

13.1.1 Antennas approved by FCC for use with JN5169-001-M0x-2

Table 12. Antennas description (FCC)

	Brand	Model Number	Description	Gain (dBi)	Connector type
1	Aveslink Technology, Inc	E-0005-AC	vertical- flying lead	2	RP-SMA
2	Aveslink Technology, Inc	E-2411-GC	vertical - swivel	2	RP-SMA
3	Aveslink Technology, Inc	E-2410-CA	vertical - bulkhead- flying lead	2	µFL
4	Aveslink Technology, Inc	E-2410-HA	vertical- flying lead	2	µFL
5	Aveslink Technology, Inc	E-2410-GC	vertical - swivel	2	RP-SMA
6	Aveslink Technology, Inc	E-2820-CA	vertical - bulkhead- flying lead	2	µFL
7	Aveslink Technology, Inc	E-2820-GC	vertical - swivel	2	RP-SMA
8	Embedded Antenna Design	FBKR35068-RS-KR	vertical - knuckle antenna	2	RP-SMA
9	Nearson	S131CL-L-PX-2450S	vertical - knuckle-flying lead	2	µFL
10	Laird Technologies	WRR2400-IP04	vertical - knuckle-flying lead	1.5	µFL
11	Laird Technologies	WRR2400-RPSMA	vertical - knuckle-flying lead	1.3	RP-SMA
12	Aveslink Technology, Inc	E-6170-DA	vertical - right angle	1	µFL
13	Laird Technologies	WCR2400-SMRP	vertical - knuckle antenna	1	RP-SMA

JN5169M0x

All information provided in this document is subject to legal disclaimers.

© NXP Semiconductors N.V. 2016. All rights reserved.

Product data sheet

Rev. 3.0 — 19 September 2016

14 of 27

This device has been designed to operate with the antennas listed above, and having a maximum gain of 2 dBi. Alternative vertical antennas may be used provided that the gain does not exceed 2 dBi. Antennas having a gain greater than 2 dBi are strictly prohibited for use with this device.

The required antenna impedance is 50 Ω.

13.1.2 High-power module usage limitation

The high-power module variants are classified as 'mobile' device pursuant with FCC § 2.1091 and must not be used at a distance of < 20 cm (8") from any people. This applies to the JN5169-001-M06-2 module type (XXMJN5169M6V2).

Remark: In the event that these conditions cannot be met (for certain configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user manual of the end product.

The user manual for the end product must include the following information in a prominent location;

"To comply with FCC's RF radiation exposure requirements, the antenna(s) used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter."

13.1.3 FCC end product labeling

The final 'end product' should be labeled in a visible area with the following:

"Contains TX FCC ID: XXMJN5169M0V2, XXMJN5169M3V2 or XXMJN5169M6V2" to reflect the version of the module being used inside the product.

13.2 European R&TTE Directive 1999/5/EC statement

JN5169-001-M00-2 and JN5169-001-M03-2 are compliant with ETSI EN 300 328 V1.9, EMC, EN 301 489-17 v2.1.1 (2009-02) and the Basic Safety Assessment (BSA) EN 60950-1:2006 (2006-06) and are subject to a Notified Body Opinion.

These modules are approved for use with the antennas listed in the following table. The JN5169-001-M06-2 module is not approved for use in Europe.

Alternative vertical antennas may be used provided that the gain does not exceed 2 dBi.

Table 13.   Antennas description (R&TTE)

	Brand	Model Number	Description	Gain (dBi)	Connector type
1	Aveslink Technology, Inc	E-0005-AC	vertical- flying lead	2	RP-SMA
2	Aveslink Technology, Inc	E-2411-GC	vertical - swivel	2	RP-SMA
3	Aveslink Technology, Inc	E-2410-CA	vertical - bulkhead- flying lead	2	µFL
4	Aveslink Technology, Inc	E-2410-HA	vertical- flying lead	2	µFL
5	Aveslink Technology, Inc	E-2410-GC	vertical - swivel	2	RP-SMA

JN5169M0x

Product data sheet

Rev. 3.0 — 19 September 2016

15 of 27

Table 13.   Antennas description (R&TTE) *…continued*

	Brand	Model Number	Description	Gain (dBi)	Connector type
6	Aveslink Technology, Inc	E-2820-CA	vertical - bulkhead- flying lead	2	µFL
7	Aveslink Technology, Inc	E-2820-GC	vertical - swivel	2	RP-SMA
8	Embedded Antenna Design	FBKR35068-RS-KR	vertical - knuckle antenna	2	RP-SMA
9	Nearson	S131CL-L-PX-2450S	vertical - knuckle-flying lead	2	µFL
10	Laird Technologies	WRR2400-IP04	vertical - knuckle-flying lead	1.5	µFL
11	Laird Technologies	WRR2400-RPSMA	vertical - knuckle-flying lead	1.3	RP-SMA
12	Aveslink Technology, Inc	E-6170-DA	Vertical - right angle	1	µFL
13	Laird Technologies	WCR2400-SMRP	Vertical - knuckle antenna	1	RP-SMA

JN5169M0x

Product data sheet

Rev. 3.0 — 19 September 2016

16 of 27

14. Footprint and PCB placement

14.1 Footprint information for reflow soldering

Dimensions in mm

All modules have the same footprint.

Fig 4.   Footprint information for reflow soldering of modules
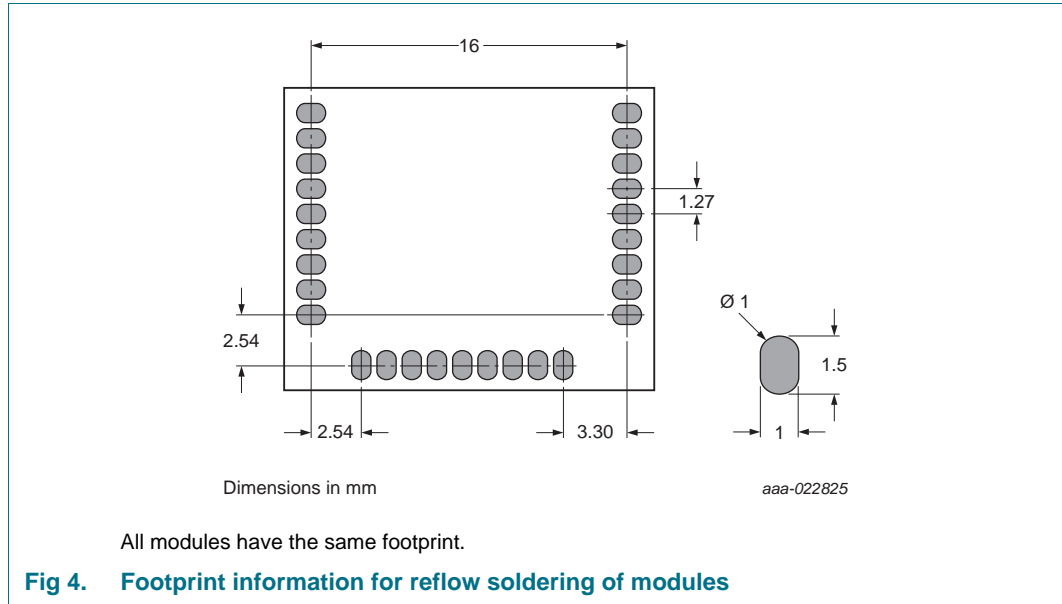
14.2 Optimal PCB placement of the module JN5169-001-M00-2

The JN5169-001-M00-2 module features an optimised, low cost, integrated, inverted F, printed PCB antenna. The antenna has a vertically polarised near omnidirectional radiation pattern and up to 1.6 dBi of peak gain. The PCB design has been elongated in order to increase the ground plane area which increases the antenna efficiency. This allows stand alone operation without any additional ground plane however care must be taken when mounting this module onto another PCB. The area around the antenna must be kept clear of conductors or other metal objects for an absolute minimum of 20 mm. This is true for all layers of the PCB and not just the top layer. Any conductive objects close to the antenna could severely disrupt the antenna pattern resulting in deep nulls and high directivity in some directions.

The Figure 5 shows various possible scenarios. The top 3 scenarios are correct; groundplane may be placed beneath JN5169-001-M00-2 modules as long as it does not protrude beyond the edge of the top layer ground plane on the module PCB.

The bottom 3 scenarios are incorrect; the left-hand side example because there is groundplane underneath the antenna, the middle example because there is insufficient clearance around the antenna (it is best to have no conductors anywhere near the antenna), finally the right-hand example has a battery's metal casing in the recommended keep out area.

JN5169M0x

Product data sheet

Rev. 3.0 — 19 September 2016

17 of 27
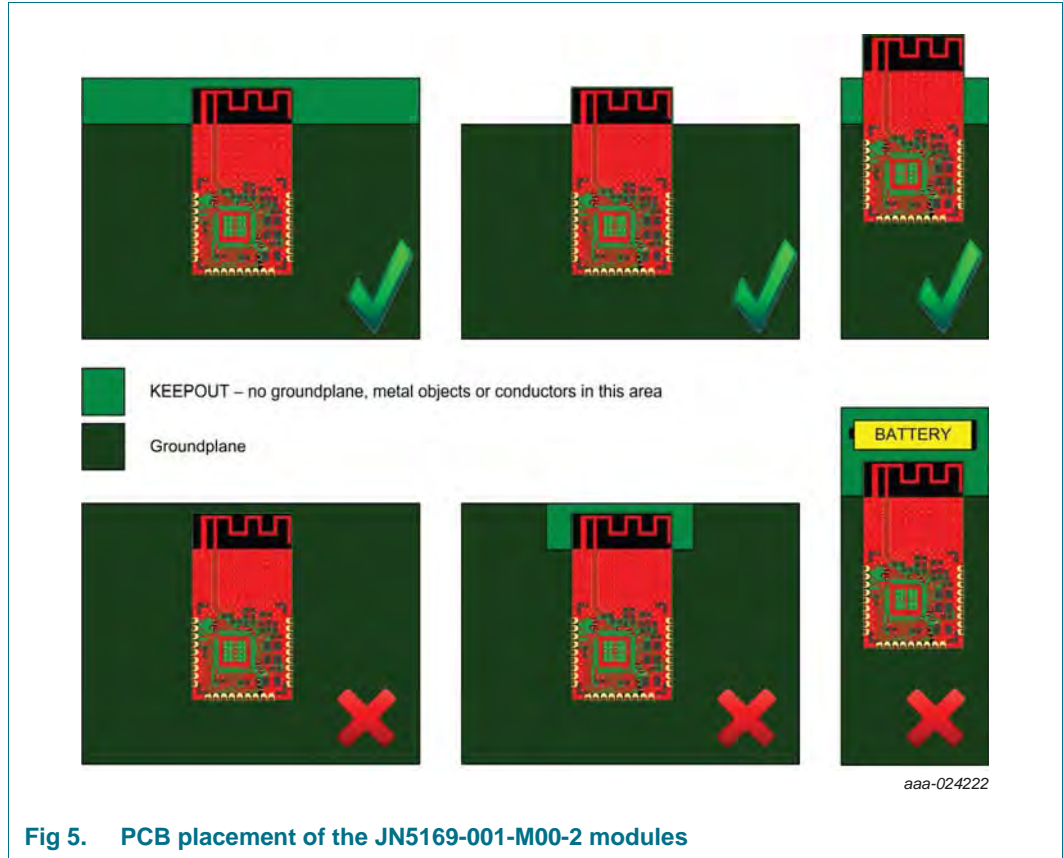
Fig 5.   PCB placement of the JN5169-001-M00-2 modules

14.3 Reflow Profile

For reflow soldering, it is recommended to follow the reflow profile in Figure 6 as a guide, as well as the paste manufacturer's guidelines on peak flow temperature, soak times, time above liquid and ramp rates.
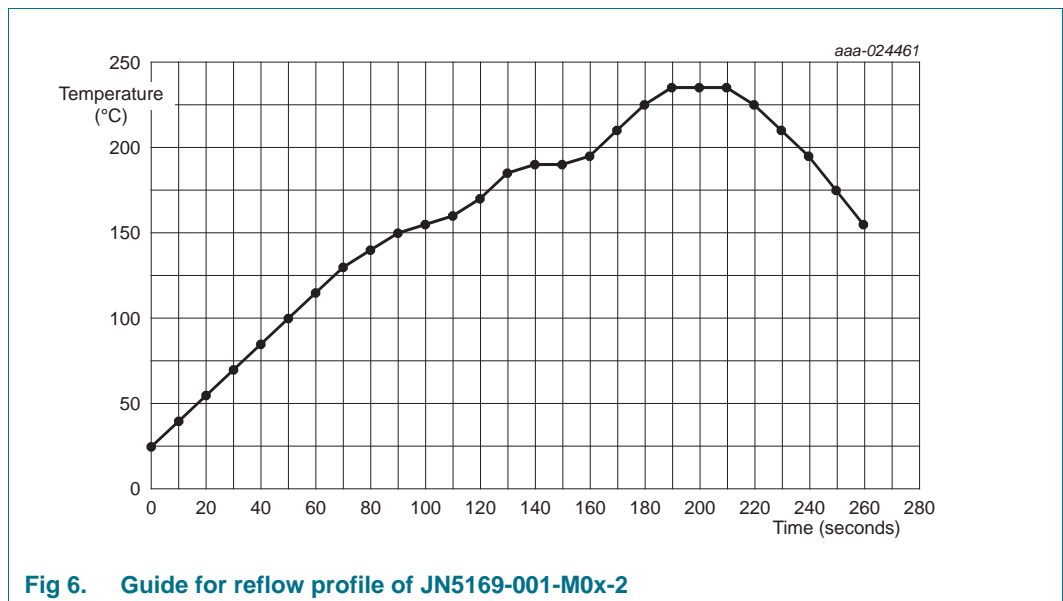
Fig 6.   Guide for reflow profile of JN5169-001-M0x-2

JN5169M0x

Product data sheet   **Rev. 3.0 — 19 September 2016**   **18 of 27**

Table 14.   Recommended solder reflow profile

Temperature range (°C)	Target time range (s)
from 25 to ~160	between 90 and ~130
from 160 to ~220	between 30 and ~60
from 220 to ~230	between 20 and ~50
from 230 to ~peak	between 10 and ~20
from 25 to ~peak	between 150 and ~260

14.4   Soldering paste and cleaning

NXP does not recommend use of a solder paste that requires the module and PCB assembly to be cleaned (rinsed in water) for the following reasons:

- Solder flux residues and water can be trapped by the PCB, can or components and result in short circuits

NXP recommends use of a 'no clean' solder paste for all its module products.

JN5169M0x

Product data sheet

Rev. 3.0 — 19 September 2016

19 of 27
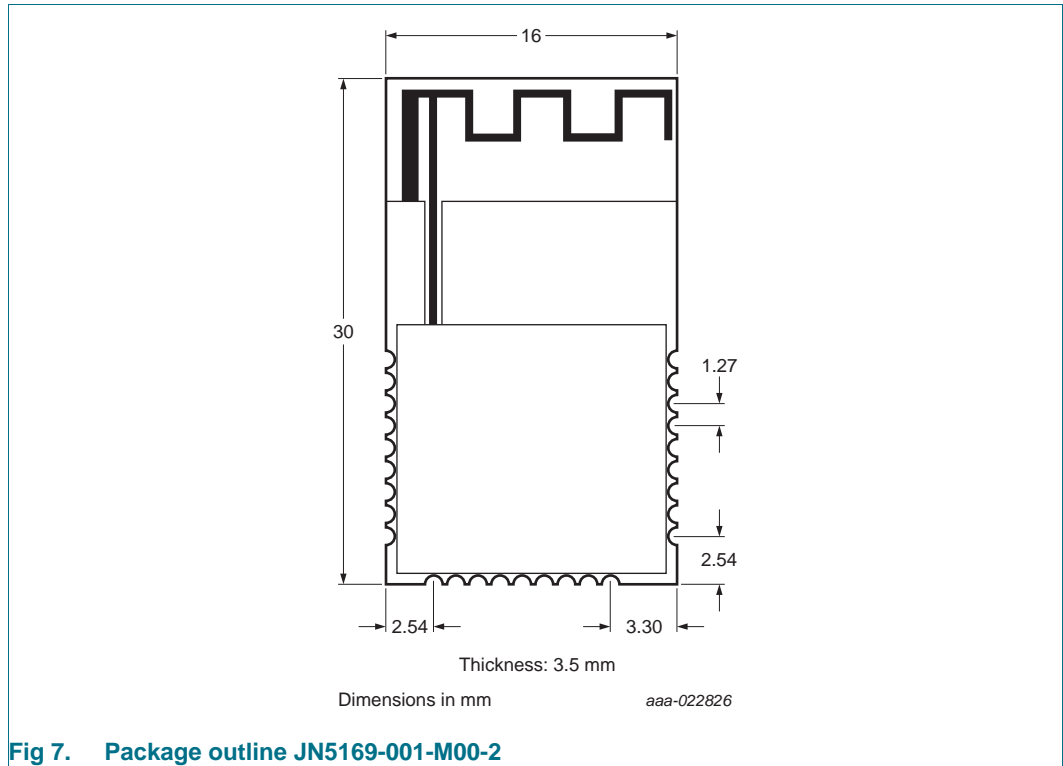
15. Package outline

Fig 7.   Package outline JN5169-001-M00-2
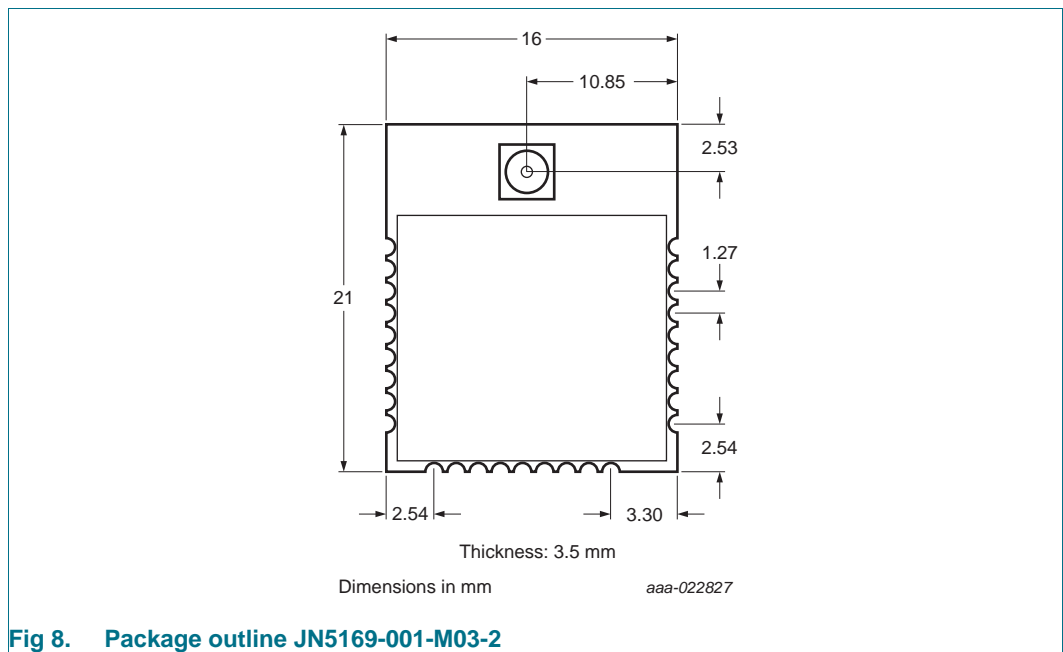
Fig 8.   Package outline JN5169-001-M03-2

JN5169M0x

Product data sheet

Rev. 3.0 — 19 September 2016

20 of 27
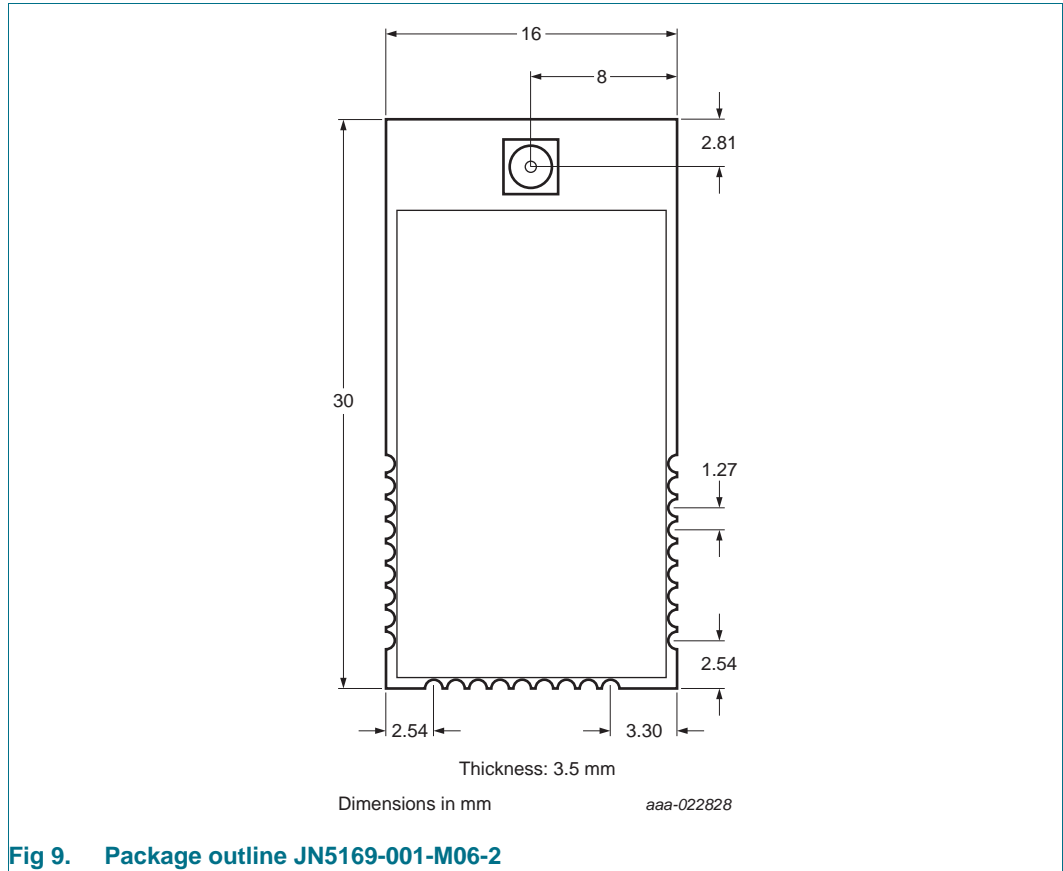
Fig 9.   Package outline JN5169-001-M06-2

16. Abbreviations

Table 15.   Abbreviations

Acronym	Description
AC	Alternating Current
ADC	Analog-to-Digital Converter
API	Application Program Interface
CE	Conformity European
CPU	Central Processing Unit
DC	Direct Current
DIO	Digital Input Output
EEPROM	Electrically Erasable Programmable Read-Only Memory
FCC	Federal Communication Commission
ID	IDentification
IO	Input Output
ISM	Industrial, Scientific and Medical radio bands
JTAG	Joint Test Action Group
LNA	Low Noise Amplifier

Table 15.   Abbreviations *…continued*

Acronym	Description
MAC	Media Access Control
OEM	Original Equipment Manufacturer
PC	Pulse Counter
PCB	Printed-Circuit Board
PER	Packet Error Rate
PRO	PROtocol
PWM	Pulse-Width Modulation
TX	Transmit
R&TTE	Radio And Terminal Telecommunication Equipment
RAM	Random Access Memory
RC	Resistance-Capacitance
RF	Radio Frequency
RISC	Reduced Instruction Set Computing
RoHS	Restriction of Hazardous Substance
RSSI	Received Signal Strength Indicator
RX	Receive
UART	Universal Asynchronous Receiver Transmitter

17. References

[1]   **IEEE Std 802.15.4-2003 —** IEEE Std 802.15.4-2003 IEEE Standard for Information Technology – Part 15.4 Wireless Medium Access Control (MAC) and Physical Layer (PHY) Specifications for Low-Rate Wireless Personal Area Networks (LR-WPANs).

[2]   **JN5169 —** JN5169 wireless microcontroller data sheet.

[3]   **Wireless Connectivity —**
http://www.nxp.com/products/interface-and-connectivity/wireless-connectivity:WIRELESS-CONNECTIVITY

[4]   **Part 15 of the FCC Rules —**
http://www.ecfr.gov/cgi-bin/text-idx?SID=d01e00935bfcb0d53b914e7c8e63f383&node=47:1.0.1.1.16&rgn=div5

18. Revision history

Table 16. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
JN5169-001-M0x-2 v3.0	20160919	Product data sheet	-	JN5169-001-M0x-2 v2.0
Modifications:	- Section 1 updated. - Section 2 updated. - Section 4 updated. - Section 6 updated. - Figure 2 updated. - Figure 3 updated. - Table 7 updated. - Table 9 updated. - Table 11 updated. - Table 12 updated. - Table 13 updated. - Section 14 updated. - Section 14.3 added. - Section 14.4 added. - Section 17 updated.			
JN5169-001-M0x-2 v2.0	20160530	Preliminary data sheet	-	JN5169-001-M0x-2 v1.1
JN5169-001-M0x-2 v1.1	20160524	Objective data sheet	-	JN5169-001-M0x-2 v1.0
JN5169-001-M0x-2 v1.0	20160513	Objective data sheet	-	-
Modifications:	initial version.			

JN5169M0x

Product data sheet **Rev. 3.0 — 19 September 2016** **23 of 27**

19. Legal information

19.1 Data sheet status

Document status[1][2]	Product status[3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL http://www.nxp.com.

19.2 Definitions

Draft — The document is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions. NXP Semiconductors does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

Short data sheet — A short data sheet is an extract from a full data sheet with the same product type number(s) and title. A short data sheet is intended for quick reference only and should not be relied upon to contain detailed and full information. For detailed and full information see the relevant full data sheet, which is available on request via the local NXP Semiconductors sales office. In case of any inconsistency or conflict with the short data sheet, the full data sheet shall prevail.

Product specification — The information and data provided in a Product data sheet shall define the specification of the product as agreed between NXP Semiconductors and its customer, unless NXP Semiconductors and customer have explicitly agreed otherwise in writing. In no event however, shall an agreement be valid in which the NXP Semiconductors product is deemed to offer functions and qualities beyond those described in the Product data sheet.

19.3 Disclaimers

Limited warranty and liability — Information in this document is believed to be accurate and reliable. However, NXP Semiconductors does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information. NXP Semiconductors takes no responsibility for the content in this document if provided by an information source outside of NXP Semiconductors.

In no event shall NXP Semiconductors be liable for any indirect, incidental, punitive, special or consequential damages (including - without limitation - lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory.

Notwithstanding any damages that customer might incur for any reason whatsoever, NXP Semiconductors' aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the *Terms and conditions of commercial sale* of NXP Semiconductors.

Right to make changes — NXP Semiconductors reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

Suitability for use — NXP Semiconductors products are not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical systems or equipment, nor in applications where failure or malfunction of an NXP Semiconductors product can reasonably be expected to result in personal injury, death or severe property or environmental damage. NXP Semiconductors and its suppliers accept no liability for inclusion and/or use of NXP Semiconductors products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

Applications — Applications that are described herein for any of these products are for illustrative purposes only. NXP Semiconductors makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

Customers are responsible for the design and operation of their applications and products using NXP Semiconductors products, and NXP Semiconductors accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the NXP Semiconductors product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products.

NXP Semiconductors does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customer(s). Customer is responsible for doing all necessary testing for the customer's applications and products using NXP Semiconductors products in order to avoid a default of the applications and the products or of the application or use by customer's third party customer(s). NXP does not accept any liability in this respect.

Limiting values — Stress above one or more limiting values (as defined in the Absolute Maximum Ratings System of IEC 60134) will cause permanent damage to the device. Limiting values are stress ratings only and (proper) operation of the device at these or any other conditions above those given in the Recommended operating conditions section (if present) or the Characteristics sections of this document is not warranted. Constant or repeated exposure to limiting values will permanently and irreversibly affect the quality and reliability of the device.

Terms and conditions of commercial sale — NXP Semiconductors products are sold subject to the general terms and conditions of commercial sale, as published at http://www.nxp.com/profile/terms, unless otherwise agreed in a valid written individual agreement. In case an individual agreement is concluded only the terms and conditions of the respective agreement shall apply. NXP Semiconductors hereby expressly objects to applying the customer's general terms and conditions with regard to the purchase of NXP Semiconductors products by customer.

No offer to sell or license — Nothing in this document may be interpreted or construed as an offer to sell products that is open for acceptance or the grant, conveyance or implication of any license under any copyrights, patents or other industrial or intellectual property rights.

JN5169M0x

All information provided in this document is subject to legal disclaimers.

© NXP Semiconductors N.V. 2016. All rights reserved.

Product data sheet

Rev. 3.0 — 19 September 2016

24 of 27

Export control — This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from competent authorities.

Non-automotive qualified products — Unless this data sheet expressly states that this specific NXP Semiconductors product is automotive qualified, the product is not suitable for automotive use. It is neither qualified nor tested in accordance with automotive testing or application requirements. NXP Semiconductors accepts no liability for inclusion and/or use of non-automotive qualified products in automotive equipment or applications.

In the event that customer uses the product for design-in and use in automotive applications to automotive specifications and standards, customer (a) shall use the product without NXP Semiconductors' warranty of the product for such automotive applications, use and specifications, and (b) whenever customer uses the product for automotive applications beyond NXP Semiconductors' specifications such use shall be solely at customer's

own risk, and (c) customer fully indemnifies NXP Semiconductors for any liability, damages or failed product claims resulting from customer design and use of the product for automotive applications beyond NXP Semiconductors' standard warranty and NXP Semiconductors' product specifications.

Translations — A non-English (translated) version of a document is for reference only. The English version shall prevail in case of any discrepancy between the translated and English versions.

19.4 Trademarks

Notice: All referenced brands, product names, service names and trademarks are the property of their respective owners.

I2C-bus — logo is a trademark of NXP B.V.

20. Contact information

For more information, please visit: **http://www.nxp.com**

For sales office addresses, please send an email to: **salesaddresses@nxp.com**

JN5169M0x

All information provided in this document is subject to legal disclaimers.

© NXP Semiconductors N.V. 2016. All rights reserved.

Product data sheet | **Rev. 3.0 — 19 September 2016** | 25 of 27

21. Tables

22. Figures

23. Contents

Please be aware that important notices concerning this document and the product(s) described herein, have been included in section 'Legal information'.