Preliminary Data Sheet – JN5121-xxx-Myy

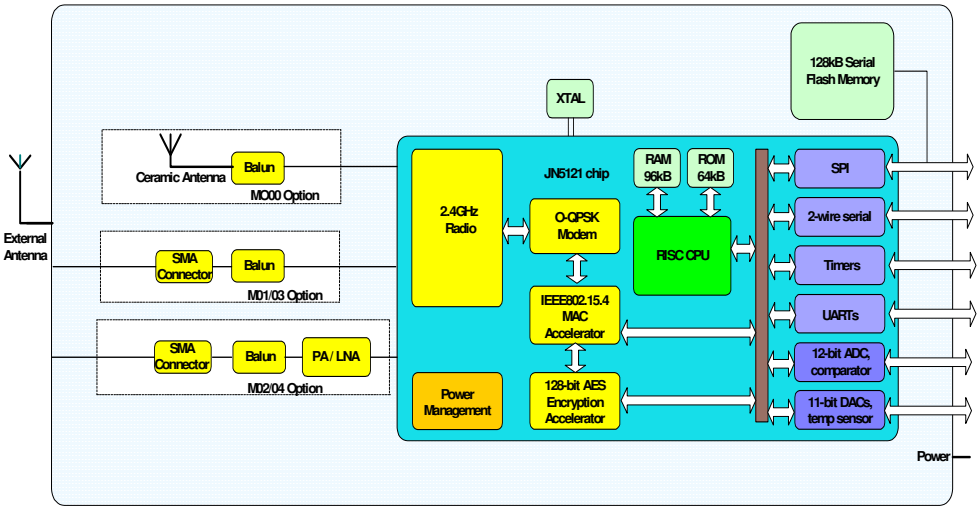
IEEE802.15.4/ZigBee Module Family

Overview

The JN5121-xxx-Myy is a family of surface mounted modules that enable users to implement IEEE802.15.4 or ZigBee compliant systems 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 Jennic's JN5121 wireless microcontroller to provide a comprehensive solution, including all RF components. 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, sensors, considerably simplifying product development.

Three basic hardware module variants are available: JN5121-xxx-M00 with an integrated antenna, JN5121-xxx-M01/M03 with an antenna connector and JN5121-xxx-M02/M04 with a power amplifier and LNA for extended range. Each of these can be provided pre-programmed with a ZigBee network stack (JN5121-Z01-Myy) or with customer-specific software.

Block Diagram



Benefits

- Microminiature module solutions
- Ready to use in products
- Minimises product development time
- No RF test required for systems
- Compliant with FCC part 15 rules, ETSI ETS 300-328 and Japan ARIB STD-T66
- Production volumes supplied pre-programmed with application software

Applications

- Robust and secure low power wireless applications
- Wireless sensor networks, particularly IEEE802.15.4 / ZigBee systems
- Home and commercial building automation
- Home networks
- Toys and gaming peripherals
- Industrial systems
- Telemetry and utilities (e.g. AMR)

Features: Module

- 2.4GHz IEEE802.15.4 compliant
- 2.7-3.6V operation
- Sleep current (with active sleep timer) < 14µA
- **JN5121-xxx-M00/01/03**
  Standard module, 0dBm power
  M00: on board antenna or
  M01: SMA connector,
  M03: RP-SMA connector
  > 400m range
  - Receiver sensitivity -90dBm
  - TX current < 45mA
  - RX current < 50mA
  - 18x30mm
- **JN5121-xxx-M02/04**
  18.5dBm power with LNA and SMA connector, > 4km range
  Receiver sensitivity -93dBm
  - TX current < 120mA
  - RX current < 55mA
  - 18x40mm

Features: Microcontroller

- 16MHz 32-bit RISC CPU
- 96kB RAM, 64kB ROM
- 4-input 12-bit ADC, 2 11-bit DACs, comparator, temperature sensor
- 2 Application timer/counters, 3 system timers
- 2 UARTs (one for in-system debug)
- SPI port with 5 selects
- 2-wire serial interface
- 21 GPIO
- Evaluation kits available with full, unlimited, Software Development Kit

Industrial temperature range (-20°C to +70°C)

Lead-free and RoHS compliant

Contents

1. Introduction

The JN5121-xxx-Myy module family provides designers with a ready made component which allows IEEE802.15.4 [1] wireless applications, including ZigBee, to be quickly and easily included in product designs. The modules integrate all of the RF components, 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 Jennic'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.

Three basic modules are available: JN5121-xxx-M00 (standard module with on board ceramic antenna), JN5121-xxx-M01 (standard module with SMA connector for use with external antennae) and JN5121-xxx-M02 (high RF power, improved sensitivity module for extended range applications). Each of these modules can be supplied with a range of protocol stacks, including a simple IEEE802.15.4 protocol for point to point and star applications and a ZigBee mesh networking stack. The variants available are described below.

1.1. Variants

Variant	Description
JN5121-000-M00	JN5121 Module (IEEE802.15.4 stack, ceramic antenna)
JN5121-Z01-M00	JN5121 Module (ZigBee stack, ceramic antenna)
JN5121-000-M01	JN5121 Module (IEEE802.15.4 stack, SMA connector)
JN5121-Z01-M01	JN5121 Module (ZigBee stack, SMA connector)
JN5121-000-M02	JN5121 Module (High Power (18.5dBm), IEEE802.15.4 stack, SMA connector)
JN5121-Z01-M02	JN5121 Module (High Power (18.5dBm), ZigBee stack, SMA connector)
JN5121-000-M03	JN5121 Module (IEEE802.15.4 stack, RP-SMA connector)
JN5121-Z01-M03	JN5121 Module (ZigBee stack, RP-SMA connector)
JN5121-000-M04	JN5121 Module (High Power (18.5dBm), IEEE802.15.4 stack, RP-SMA connector)
JN5121-Z01-M04	JN5121 Module (High Power (18.5dBm), ZigBee stack, RP-SMA connector)

2. Specifications

Most specification parameters for the modules are specified in JN-DS-JN5121 Datasheet for JN5121 single chip wireless microcontroller, [2]. Where there are differences, the parameters are defined here.

VDD=3.0V @ +25ºC

Typ. DC Characteristics			Notes
	JN5121-xxx-M00/01/03	JN5121-xxx-M02/04	
Deep sleep	<11uA	<11uA	
Sleep	<14uA	<14uA	With active sleep timer
Radio transmit	44mA	115mA	CPU in doze, radio transmitting
Radio receive	49mA	60mA	CPU in doze, radio receiving
Centre frequency accuracy	+/-25ppm	+/-25ppm	Additional +/-15ppm allowance for temperature and aging
Typ. RF Characteristics			**Notes**
Receive sensitivity	-90dBm	-93dBm	Nominal for 1% PER, as per 802.15.4 section 6.5.3.3
Max. Transmit power	0dBm	16dBm	Nominal
Transmit power at 3.6V		18.5dBm	With Vcc=3.6V
Maximum input signal	-10dBm	-15dBm	For 1% PER, measured as sensitivity
RSSI range	-95 to -10 dBm	-115 to -20 dBm	
RF Port impedance - SMA connector	50 ohm	50 ohm	2.4 - 2.5GHz
VSWR (max)	2:1	2:1	2.4 - 2.5GHz
Peripherals			**Notes**
Master SPI port with five select outputs			250kHz - 16MHz
Slave SPI port			250kHz - 16MHz
Two UARTs			16550 compatible
Two-wire serial I/F (compatible with SMbus & I^2C)			Up to 400kHz
Two programmable Timer/Counters with capture/compare facility, Tick timer			16MHz clock
Two programmable Sleep Timers			32kHz clock
Twenty-one digital IO lines (multiplexed with UARTs, timers and SPI selects)			
Four-channel, 12-bit, Analogue-to-Digital converter			Up to 100ks/s
Two 11-bit Digital-to-Analogue converters			Up to 100ks/s
Programmable analogue comparator			Ultra low power mode for sleep
Internal temperature sensor and battery monitor			

3. Product Development

Jennic 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 Jennic's support website: http://www.jennic.com/support/ . A range of evaluation/developer kits is also available, allowing products to be quickly breadboarded. 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 the ZigBee network stack, this package provides everything required to develop application code and to trial it with hardware representative of the final module.

The modules can be programmed by the user, for both development and production, using Jennic supplied software. They can also be supplied ready loaded with customer defined software if required. The JN-UG-3007 Flash Loader User Guide [5], describes how to put the module into programming mode, download software onto the module and to load individual MAC addresses. Access to the on-chip peripherals, MAC and ZigBee stack software is provided through specific APIs. These are described in the JN-RM-2001 Hardware Peripheral Library Reference Manual [3], JN-RM-2002 Stack Software Reference Manual [4] and JN-RM-2014 ZigBee Application Development API Reference Manual [6]. Additional information is available on the Jennic support website.

3.1. JN5121 Single Chip Wireless Microcontroller

The JN5121-xxx-Myy series is constructed around the JN5121 single chip wireless microcontroller, which includes the radio system, a 32-bit RISC CPU, ROM and RAM memory and a range of analogue and digital peripherals.

The chip is described fully in JN-DS-JN5121 Datasheet for JN5121 single chip wireless microcontroller [2].

4. Pin Configurations

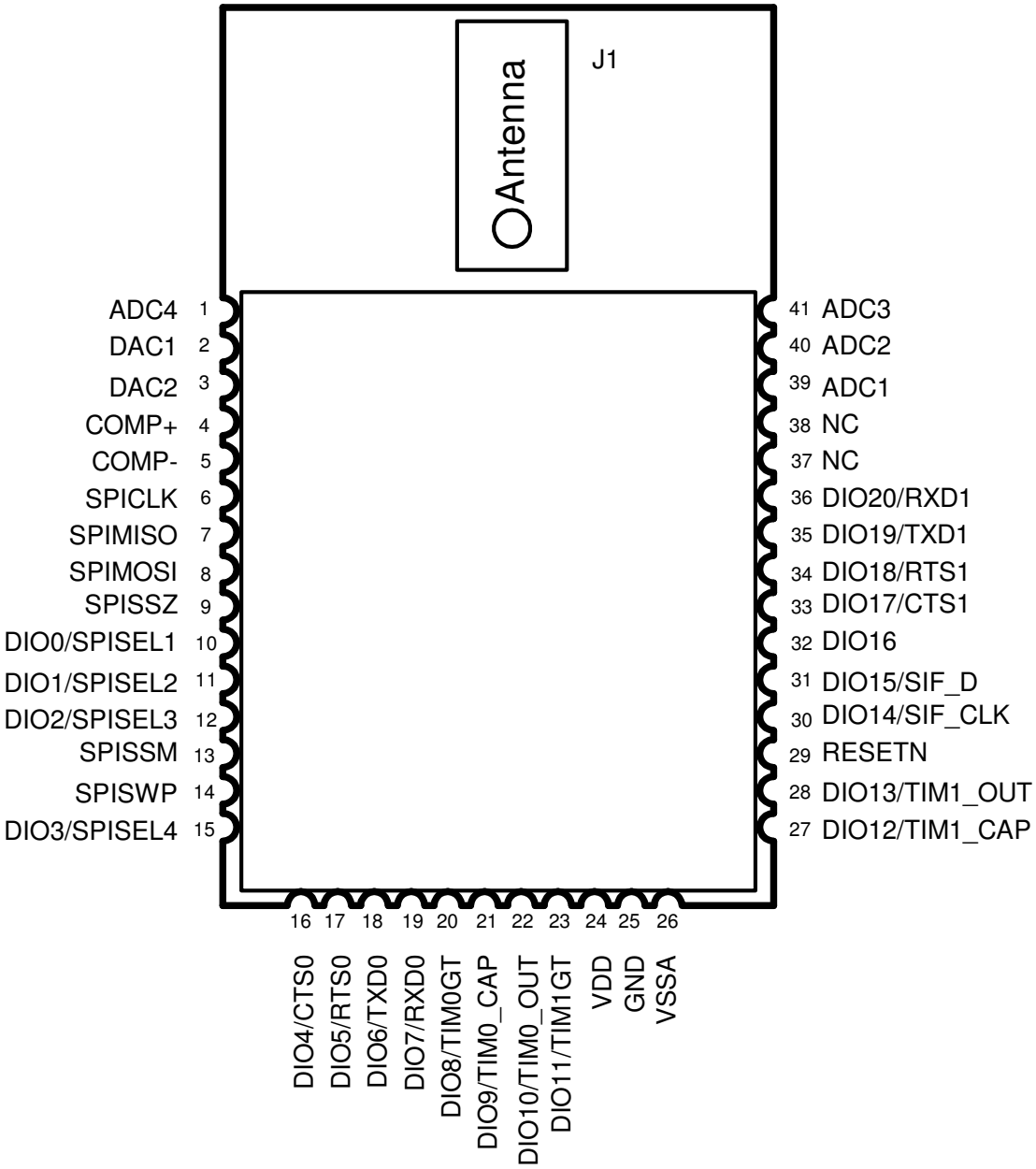


Figure 1: Pin Configuration (top view)

Note that the same basic pin configuration applies for all module designs. However, DIO3/SPISEL4 and DIO2/SPISEL3 are not available with high power modules.

4.1. Pin Assignment

Module Pin	Signal	Function	Alternative Function
1	ADC4	Analogue to Digital input	
2	DAC1	Digital to Analogue output	
3	DAC2	Digital to Analogue output	
4	COMP+	Comparator inputs	
5	COMP-		
6	SPICLK	SPI master clock out/slave clock in	
7	SPIMISO	SPI Master In/Slave Out	
8	SPIMOSI	SPI Master Out/Slave In	
9	SPISSZ	SPI select from module - SS0 (output)	
10	SPISEL1	SPI Slave Select1 (output)	General Purpose Digital I/O DIO0
11	SPISEL2	SPI Slave Select2 (output)	General Purpose Digital I/O DIO1
12	SPISEL3*	SPI Slave Select3 (output)	General Purpose Digital I/O DIO2 *
13	SPISSM	SPI select to FLASH (input)	
14	SPISWP	FLASH write protect (input)	
15	SPISEL4*	SPI Slave Select4 (output)	General Purpose Digital I/O DIO3*
16	CTS0	UART0 Clear To Send (input)	General Purpose Digital I/O DIO4
17	RTS0	UART0 Request To Send (output)	General Purpose Digital I/O DIO5
18	TXD0	UART0 Transmit Data (output)	General Purpose Digital I/O DIO6
19	RXD0	UART0 Receive Data (input)	General Purpose Digital I/O DIO7
20	TIM0GT	Timer0 clock/gate (input)	General Purpose Digital I/O DIO8
21	TIM0_CAP	Timer0 capture (input)	General Purpose Digital I/O DIO9
22	TIM0_OUT	Timer0 PWM (output)	General Purpose Digital I/O DIO10
23	TIM1GT	Timer1 clock/gate (input)	General Purpose Digital I/O DIO11
24	VDD	3V power	
25	GND	Digital ground	
26	VSSA	Analogue ground	
27	TIM1_CAP	Timer1 capture (input)	General Purpose Digital I/O DIO12
28	TIM1_OUT	Timer1 PWM (output)	General Purpose Digital I/O DIO13
29	RESETN	Active low reset	
30	SIF_CLK	Serial Interface clock / Intelligent peripheral clock	General Purpose Digital I/O DIO14

Module Pin	Signal	Function	Alternative Function
31	SIF_D	Serial Interface data / Intelligent peripheral data	General Purpose Digital I/O DIO15
32	DIO 16	Intelligent peripheral device select	General Purpose Digital I/O
33	CTS1	UART1 Clear To Send (input)	General Purpose Digital I/O DIO17
34	RTS1	UART1 Request To Send (output)	General Purpose Digital I/O DIO18
35	TXD1	UART1 Transmit Data (output)	General Purpose Digital I/O DIO19
36	RXD1	UART1 Receive Data (input)	General Purpose Digital I/O DIO20
37	NC	Connect to ground	
38	NC		
39	ADC1	Analogue to Digital input	
40	ADC2	Analogue to Digital input	
41	ADC3	Analogue to Digital input	

*: These two pins are not connected for High power modules

4.2. Pin Descriptions

All pins behave as described in the JN5121 datasheet [2], with the exception of the following:

4.3. Power Supplies

A single power supply pin, VDD is provided. Separate analogue (VSSA) and digital (GND) grounds are provided. These should be connected together at the module pins.

4.4. SPI Memory Connections

SPISWP is a write protect pin for the serial flash memory. This should be held low to inhibit writes to the flash device.

SPISSZ is connected to SPI Slave Select 0 on the JN5121.

SPISSM is connected to the Slave Select pin on the memory.

This configuration allows the flash memory device to be programmed using an external programmer if required. The JN5121 should be held in reset by taking RESETN low. The memory can then be programmed over the UART by using the programming mode described in JN-UG-3007 Flash Loader User Guide [5]. Alternatively, the memory can be programmed by connecting a SPI programmer to SPISSM, SPICLK, and SPIMISO and directly loading the code into the memory.

For normal operation of the module, SPISSZ should be connected to SPISSM.

5. Electrical Characteristics

In most cases, the Electrical Characteristics are the same for both module and chip. They are described in detail in the chip datasheet. Where there are differences, they are detailed below.

5.1. Maximum Ratings

Exceeding these conditions will result in damage to the device.

Parameter	Min	Max
Device supply voltage VDD1, VDD2	-0.3V	3.6V
Voltage on analogue pins ADC1-4, DAC1-2, COMP2M, COMP2P	-0.3V	VDD + 0.3V
Voltage on 5V tolerant digital pins SPICLK, SPIMOSI, SPIMISO, SPISEL0, GPIO0-GPIO20, RESETN	-0.3V	VDD + 2V or 5.5V, whichever is the lesser
Storage temperature	-40ºC	150ºC
Solder reflow temperature (According to IPC/JEDEC J-STD-020C)		260 ℃

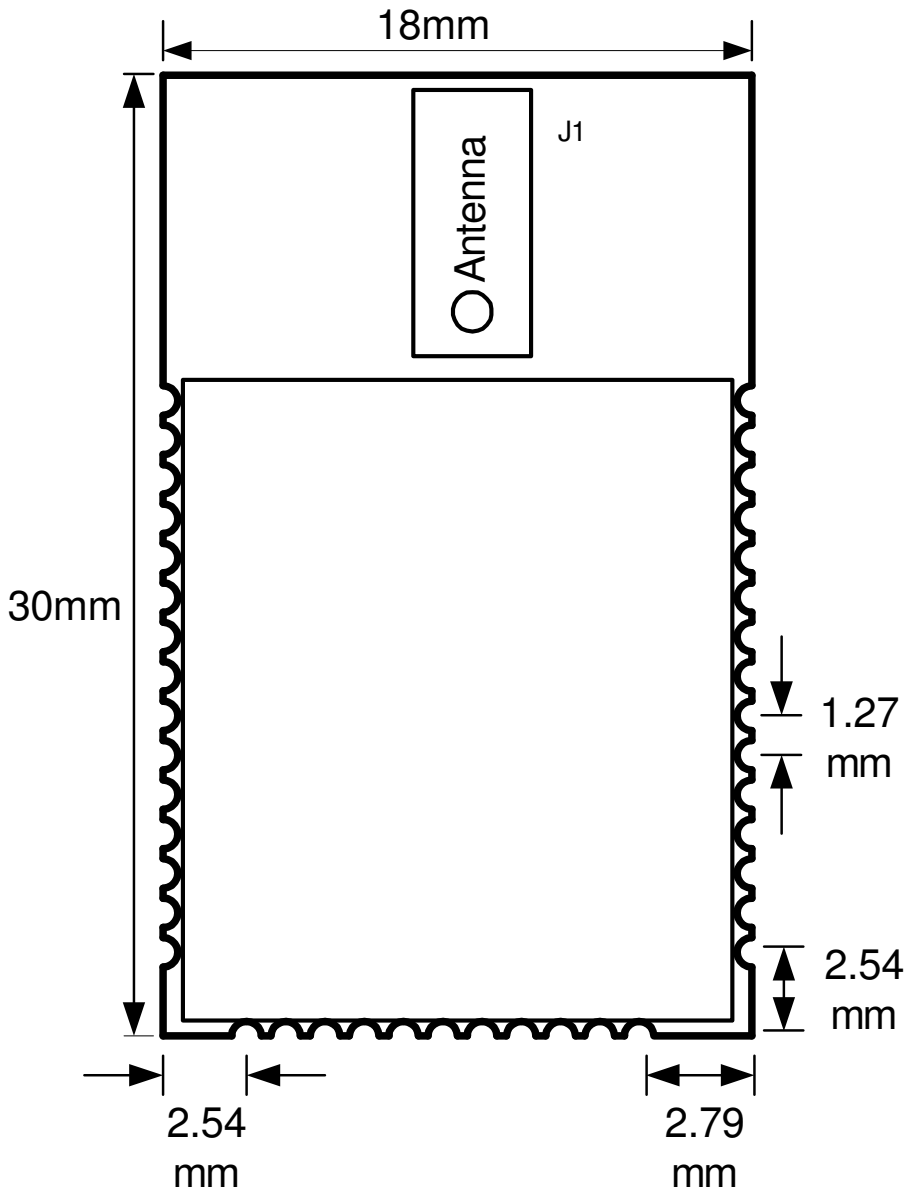
This device is sensitive to ESD and should only be handled using ESD precautions.

5.2. Operating Conditions

Supply	Min	Max
VDD	2.7V	3.6V
Ambient temperature range	-20ºC	70ºC

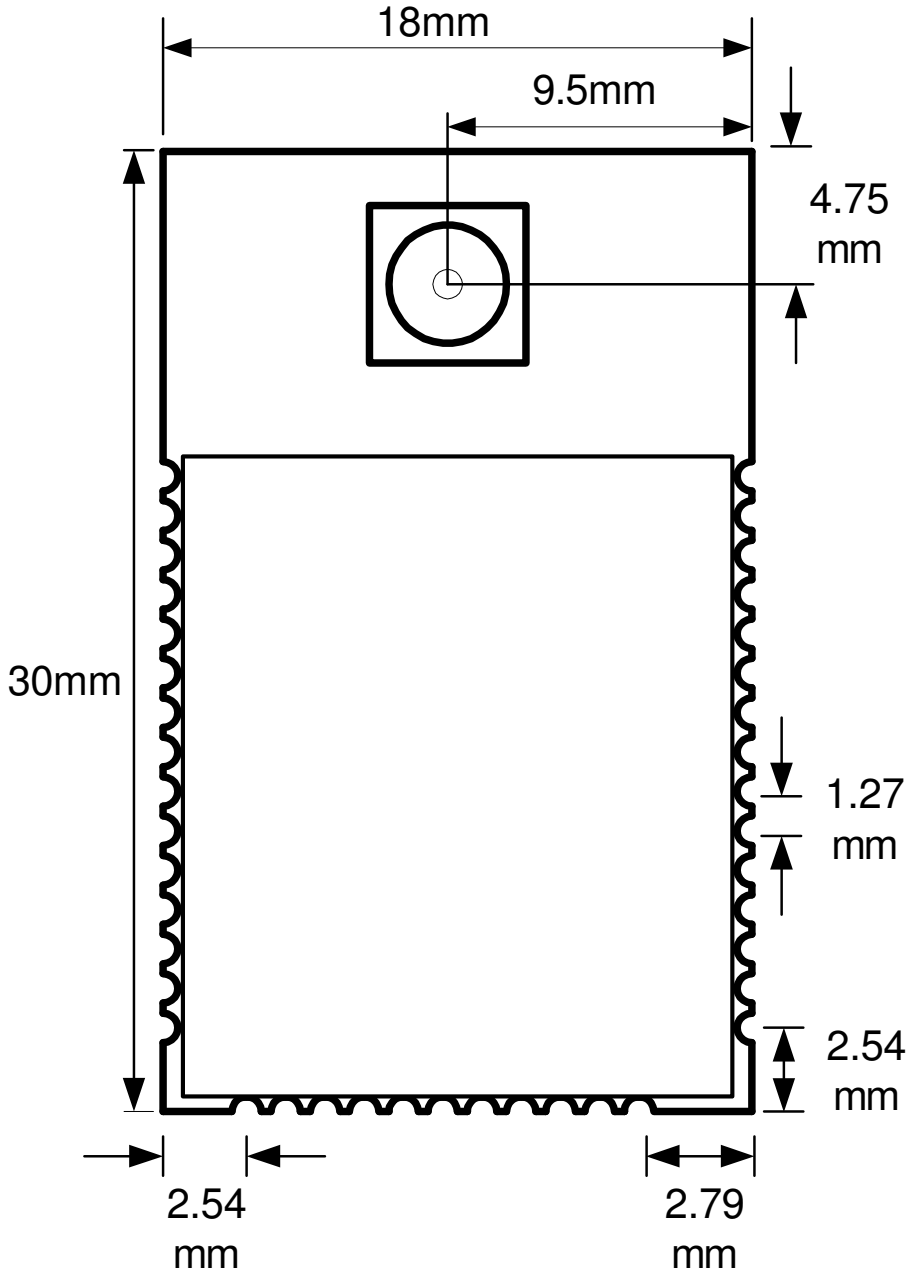
Appendix A Mechanical and Ordering Information

A.1 Outline Drawing



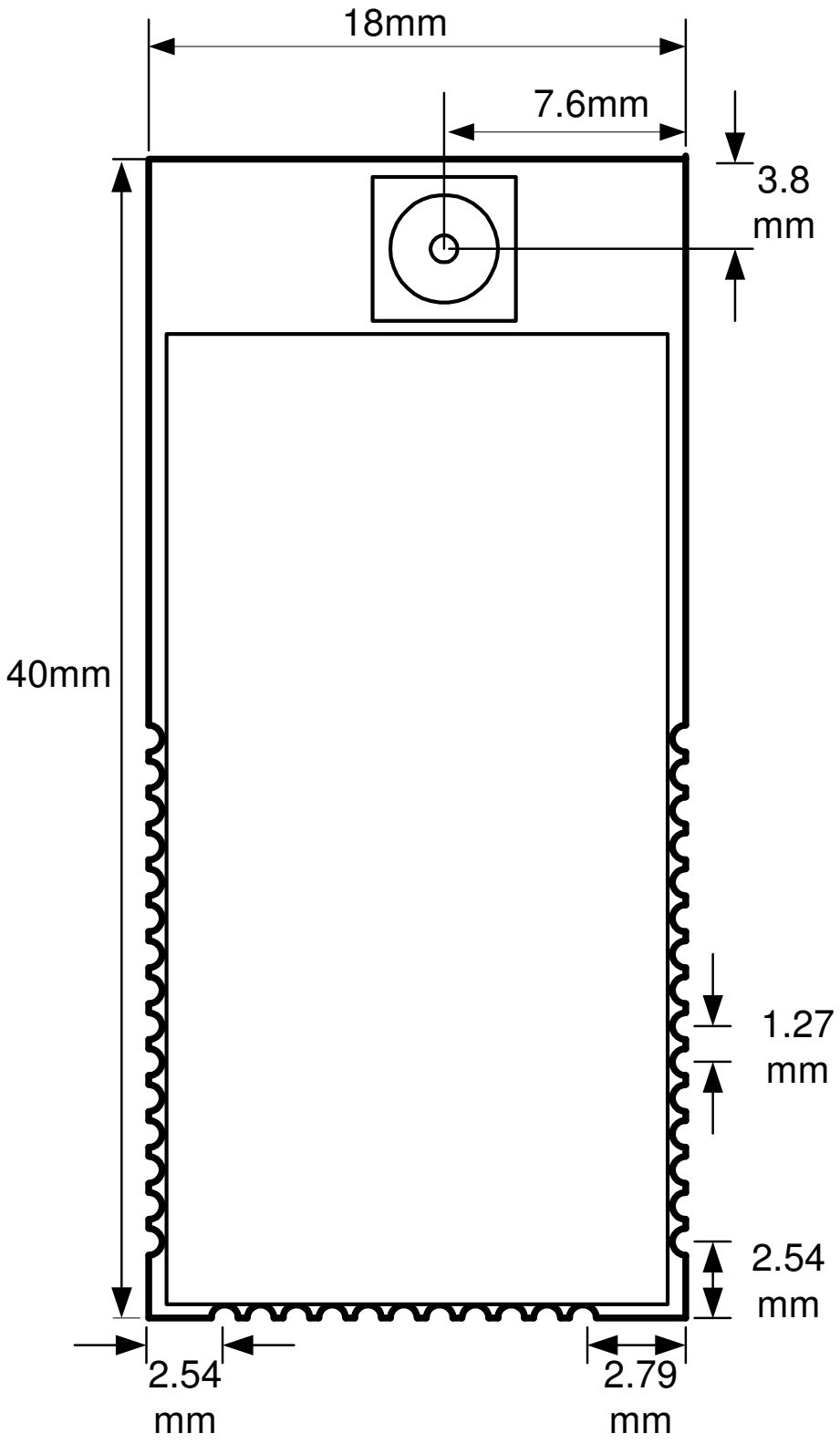
Thickness: 3mm

JN5121-xxx-M00 Outline Drawing



Thickness: 3mm over can, 10.6mm at SMA connector

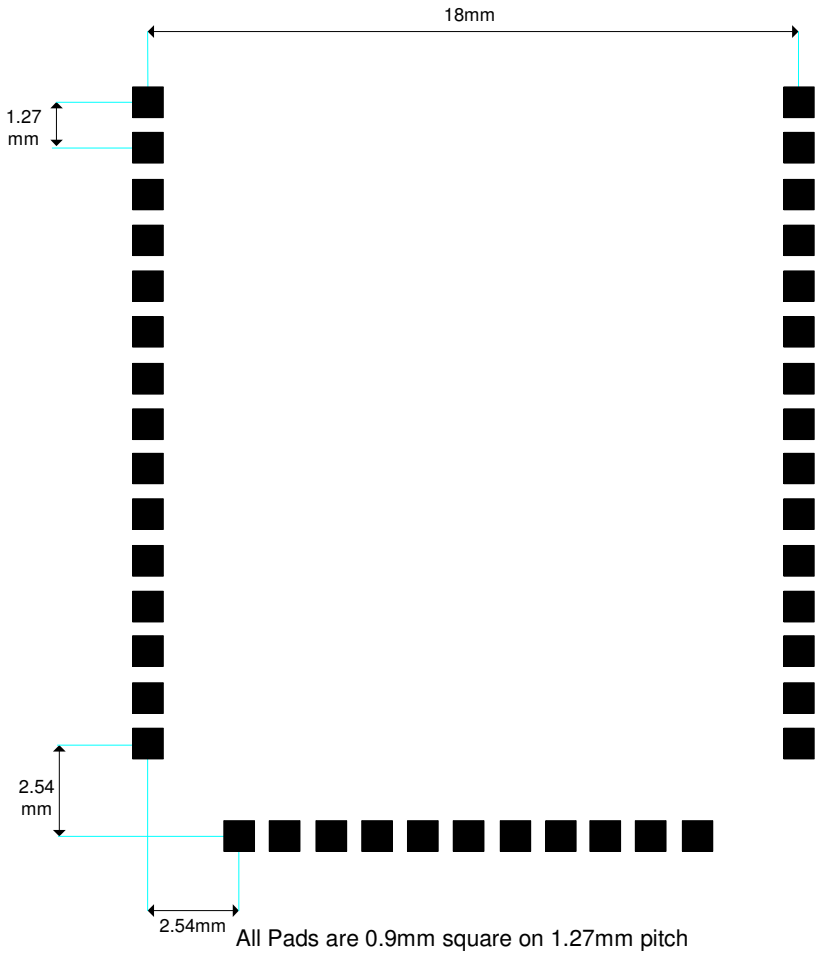
JN5121-xxx-M01/M03 Outline Drawing



Thickness: 3mm, 10.6mm at SMA connector

JN5121-xxx-M02/M04 Outline Drawing

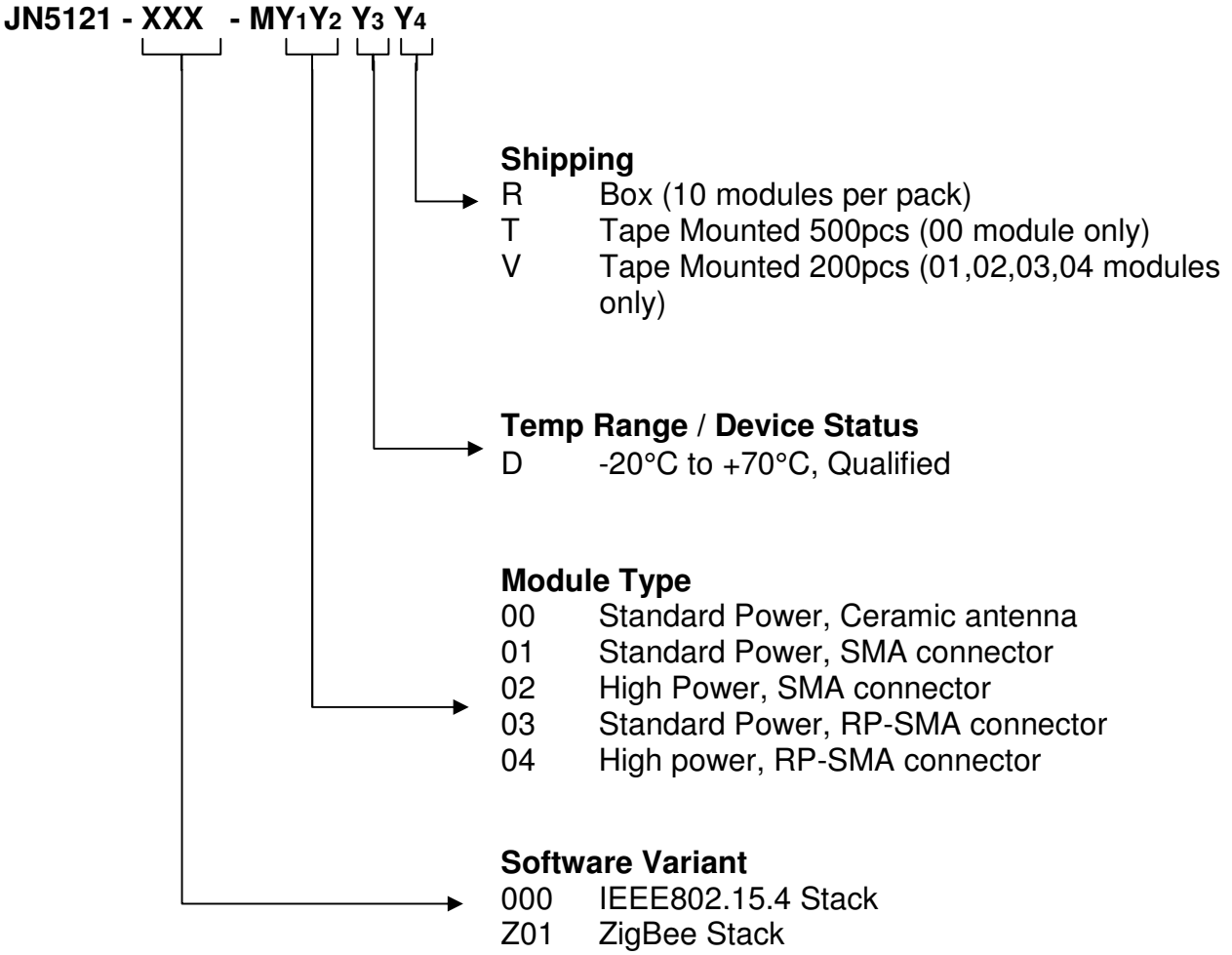
A.2 Module PCB Footprint



Note: All modules have the same footprint.

A.3 Ordering Information

Part Numbering:



A.4 Accessories

Product	Description	Note
JNAC001	JN5 serial level converter dongle	Connects module UART port to PC serial port to allow code development and debug

The JNAC001 RS-232 level converter is used to translate the +/- 7V RS-232 levels to CMOS compatible logic levels. The CMOS levels are made available through a short flying lead with a 6-way IDC socket. This can be connected to the relevant module UART0 pins. The RS-232 Interface is available on a standard nine-way 'D' connector.

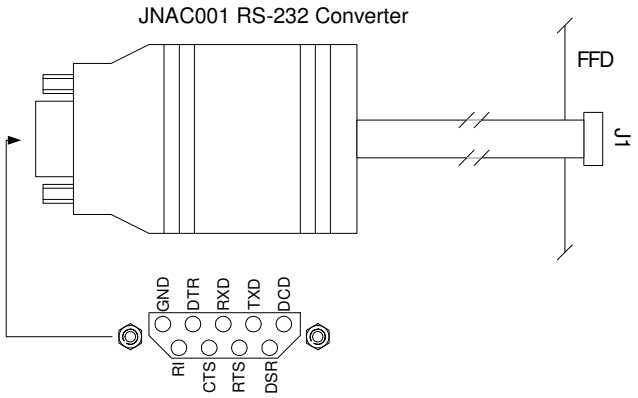
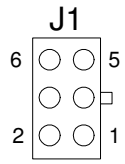


Figure 5-1: JNAC001 RS-232 Converter Connection



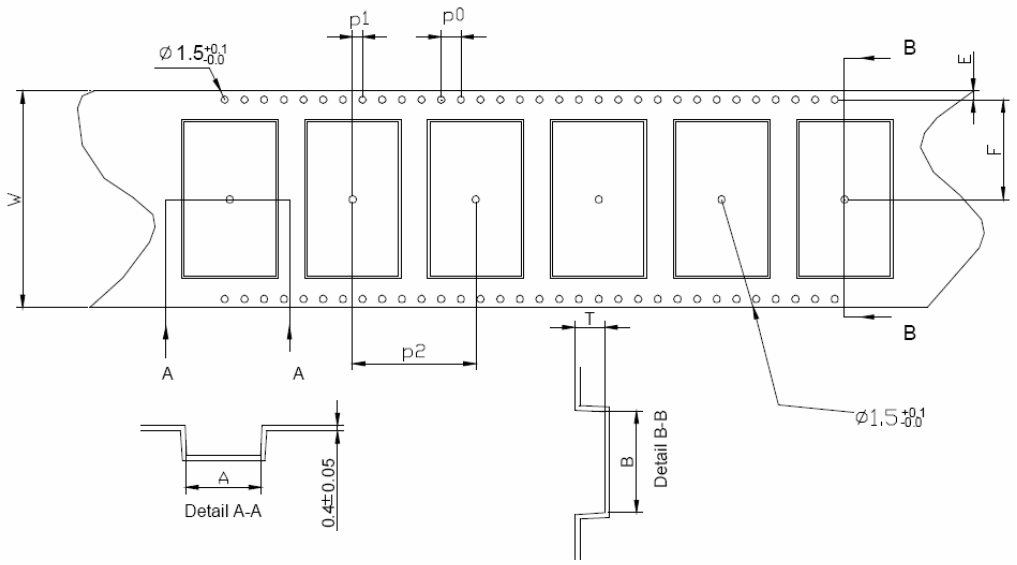
View looking at cable connector

Pin	Function
1	UART 0 TXD
2	UART 0 RXD
3	PROGRAM
4	VCC - IN
5	GND
6	GND

Figure 5-2: RS-232 Connector

A.5 Tape and Reel Information:

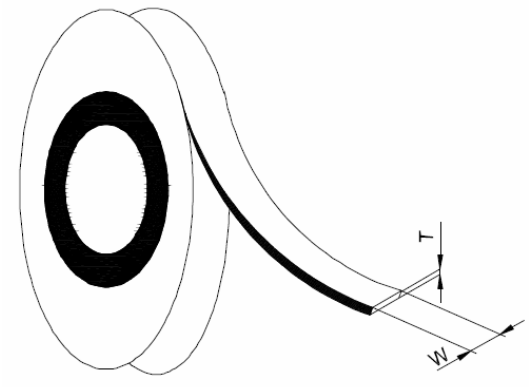
A.5.1 Tape Orientation and dimensions



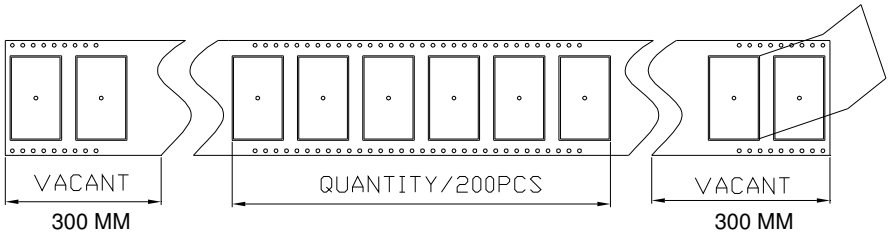
Module type:	A	B	W	F	E	P0	P1	P2	T	Cover Tape width (W)
JN5121-xxx-M00	18.4	30.4	44	20.2	1.75	4.0	2.0	24.0	3.2	37.5
JN5121-xxx-M01/3	18.4	30.4	56	20.2	1.75	4.0	2.0	24.0	11.4	49.5
JN5121-xxx-M02/4	18.4	40.5	56	20.2	1.75	4.0	2.0	24.0	11.4	49.5
Tolerance	±0.1	±0.1	±0.3	±0.1	+0.1	±0.1	±0.1	±0.1	±0.1	

A.5.2 Cover tape details

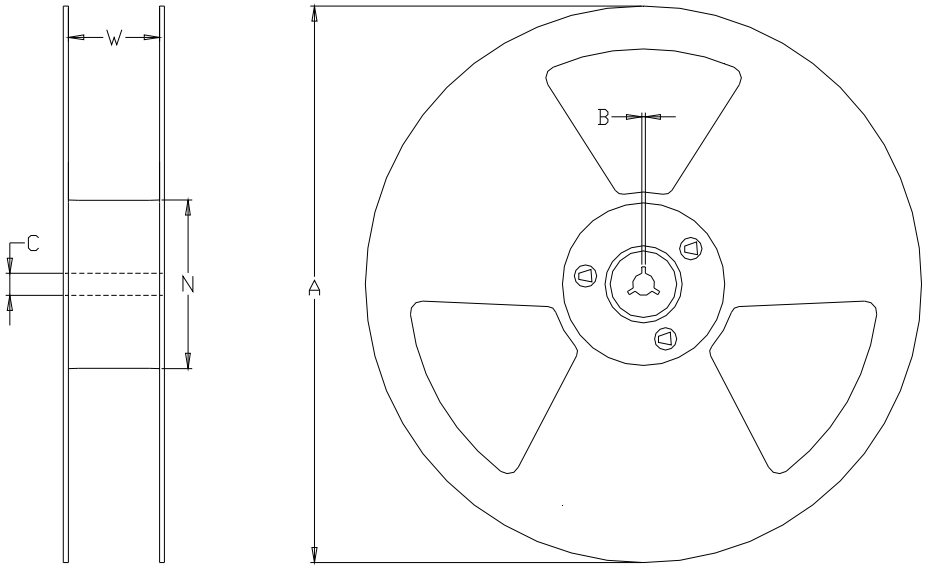
Thickness (T)	0.061mm
Surface resistivity (component side)	10^4 to 10^7 Ohms/sq
Surface resistivity (component side)	Non-conductive
Backing type:	Polyester
Adhesive type:	PSA
Sealing:	Room ambient



A.5.3 Leader and Trailer



A.5.4 Reel Dimensions:



Module type:	A	B	C	N	W (min)
JN5121-xxx-M00	330 ±1.0	2.2±0.5	13 ±0.2	100 +0.1	44.5 ±0.3
JN5121-xxx-M01/02/03/04	330 ±1.0	2.2±0.5	13 ±0.2	100 +0.1	56.5 ±0.3

A.6 Related Documents

[1] 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] JN-DS-JN5121 Datasheet for JN5121 single chip wireless microcontroller

[3] JN-RM-2001 Hardware Peripheral Library Reference Manual

[4] JN-RM-2002 Stack Software Reference Manual

[5] JN-UG-3007 Flash Loader User Guide

[6] JN-RM-2014 ZigBee Application Development API Reference Manual

RoHS Compliance

JN5121-xxx-Myy devices meet the requirements of Directive 2002/95/EC of the European Parliament and of the Council on the Restriction of Hazardous Substance (RoHS).

Status Information

The status of this Data Sheet is **Preliminary**.

Jennic products progress according to the following format:

Advance

The Data Sheet shows the specification of a product in planning or in development.

The functionality and electrical performance specifications are target values and may be used as a guide to the final specification.

Jennic reserves the right to make changes to the product specification at anytime without notice.

Preliminary

The Data Sheet shows the specification of a product that is in production, but is not yet fully qualified.

The functionality of the product is final. The electrical performance specifications are target values and may used as a guide to the final specification. Modules are identified with an R suffix, for example JN5121-Z01-M00R.

Jennic reserves the right to make changes to the product specification at anytime without notice.

Production

This is the final Data Sheet for the product.

All functional and electrical performance specifications, including minimum and maximum values are final.

This Data Sheet supersedes all previous document versions.

Jennic reserves the right to make changes to the product specification at anytime to improve its performance.

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A.8 Version Control

Version	Notes
0.9	1st Issue of Preliminary Datasheet
1.0	Update performance parameters & Ordering / Tape & Reel information

A.9 Contact Details

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