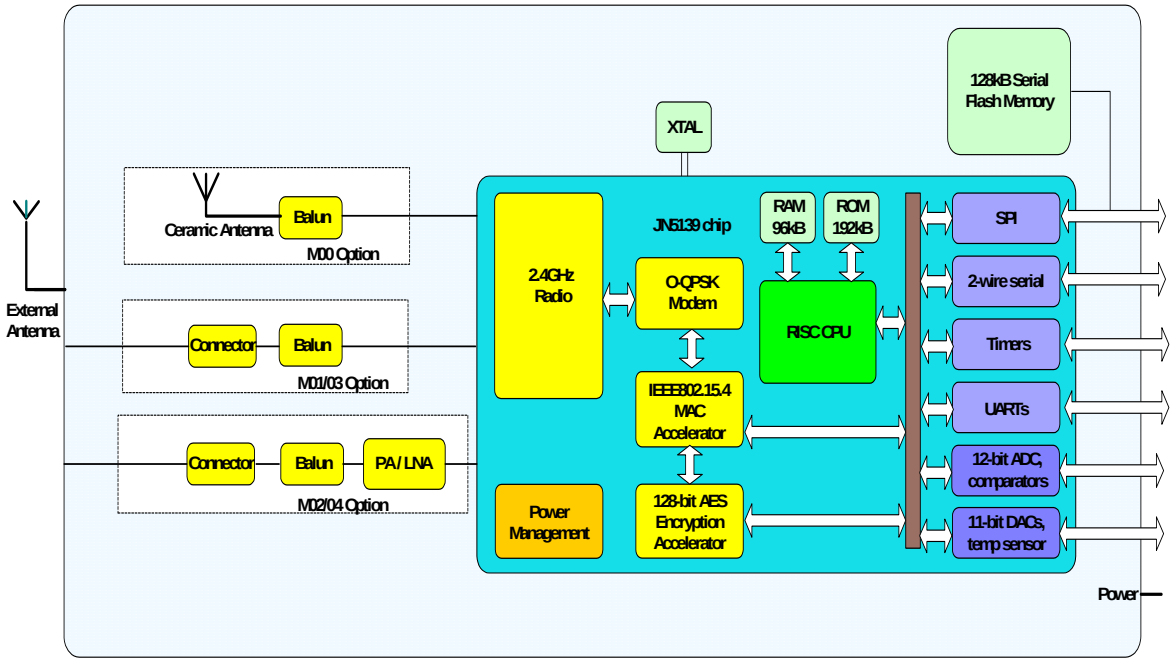
IEEE802.15.4 / ZigBee PIFA Module Family

Overview

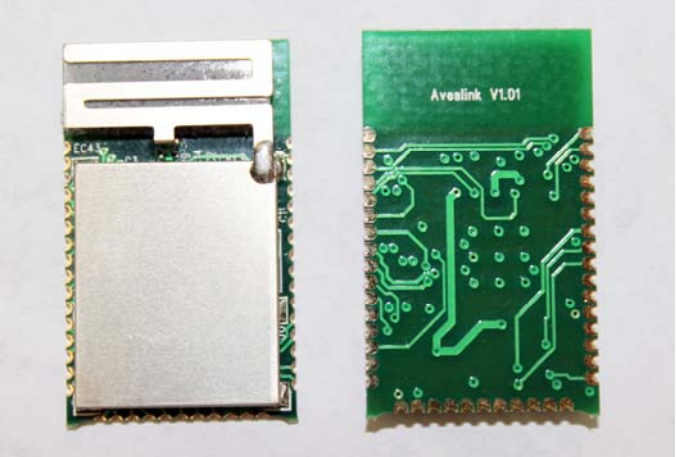
This MD100A ZigBee PIFA Module is a range of surface mount modules that enables users to implement IEEE802.15.4 or ZigBee compliant systems with minimum time to market and at the lowest cost. They remove the need for expensive and lengthy development of custom RF board designs and test suites. The modules provide a comprehensive solution with high 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.

Module Block Diagram



Benefits

- Micro miniature module solutions
- Ready to use in products
- Minimises product development time
- No RF test required for systems
- Compliant with FCC part 15 rules, IC Canada



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 & ZigBee Compatible
- 2.7-3.6V Operation
- Sleep Current (with Active Sleep Timer) 2.6μA
- Receiver Sensitivity -96dBm
- TX Power +1.5dBm (without PIFA Antenna)
- PIFA Antenna Gain +3dBi
- TX Current 37mA
- RX Current 37mA
- Dimension：18*30*3.5mm
- Weight：2.5g

Features: Microcontroller

- 16MHz 32-Bit RISC CPU
- 96KB RAM, 192KB ROM
- 4-input 12-bit ADC, 2 11-Bit DACs, 2 Comparators, 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

Temperature Range

-40°C to +85°C

Humidity

10 to 95% RH

Lead-free and RoHS Compliant

Table of Contents

1. Introduction

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1.1 Key Features

1.1.1 Module

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- 2.7-3.6V Operation
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1.1.2 Microcontroller

- 16MHz 32-Bit RISC CPU
- 96KB RAM, 192KB ROM
- 4-input 12-bit ADC, 2 11-Bit DACs, 2 Comparators, Temperature Sensor
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- 2 UARTs (One for In-System Debug)
- SPI Port with 5 Selects
- 2-Wire Serial Interface
- 21 GPIO

1.2 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)

2. Specifications

VDD=3.0V @ +25°C

Typical DC Characteristics		Notes
Deep Sleep Current	1.6uA	
Sleep Current	2.6uA	With active sleep timer
Radio Transmit Current	37mA	CPU in doze, radio transmitting
Radio Receive Current	37mA	CPU in doze, radio receiving
Centre Frequency Accuracy	±20ppm	Additional ±20ppm allowance for temperature and ageing
Typical RF Characteristics		**Notes**
Receive Sensitivity	-96dBm	Nominal for 1% PER, as per 802.15.4 section 6.5.3.3 (Note 1)
Maximum Transmit Power (without PIFA Antenna)	+1.5dBm	Nominal (Note 1)
Maximum Transmit Power	+4.5dBm	(Note 1)
Transmit Power at 3.6V		With Vdd=3.6V
Maximum Input Signal	0dBm	For 1% PER, measured as sensitivity
RSSI range	-95 to -10dBm	
RF Port Impedance -PIFA Antenna	50 ohm	2.4 - 2.5GHz
VSWR (Max)	2:1	2.4 - 2.5GHz
Peripherals		**Notes**
Master SPI Port	5 selects	250kHz - 16MHz
Slave SPI Port	✓	250kHz - 8MHz
Two UARTs	✓	16550 compatible
Two Wire Serial I/F (Compatible with SM bus & I^2C)	✓	Up to 400kHz
Two Programmable Timer/Counters with Capture/Compare Facility, Tick Timer	✓	16MHz clock
Two Programmable Sleep Timers	✓	32kHz clock
Digital IO Lines (Multiplexed with UARTs, Timers and SPI Selects)	✓	
Four Channel Analogue-to-Digital Converter	✓	12-bit, up to 100ks/s
Two Channel Digital-to-Analogue Converter	✓	11-bit, up to 100ks/s
Two Programmable Analogue Comparators	✓	Ultra low power mode for sleep
Internal Temperature Sensor and Battery Monitor	✓	

Note 1: Sensitivity is defined for conducted measurements on connected modules. Modules with an integrated antenna have approximately 4 dB less e.i.r.p and reciprocal receive sensitivity.

3. Product Development

All development tools and networking stacks needed to enable end product development to occur quickly and efficiently. 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 JenNet networking stack, 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 user programmed for both in development and in production using software supplied by. They can also be supplied ready loaded with customer defined software if required. Access to the on-chip peripherals, MAC and network stack software is provided through specific APIs.

3.1 MD100A Single Chip Wireless Microcontroller

The MD100A series is constructed around the MD100A 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 module also includes a 1Mbit serial flash memory which holds the application code that is loaded into the MD100A during the boot sequence.

4. Pin Configurations

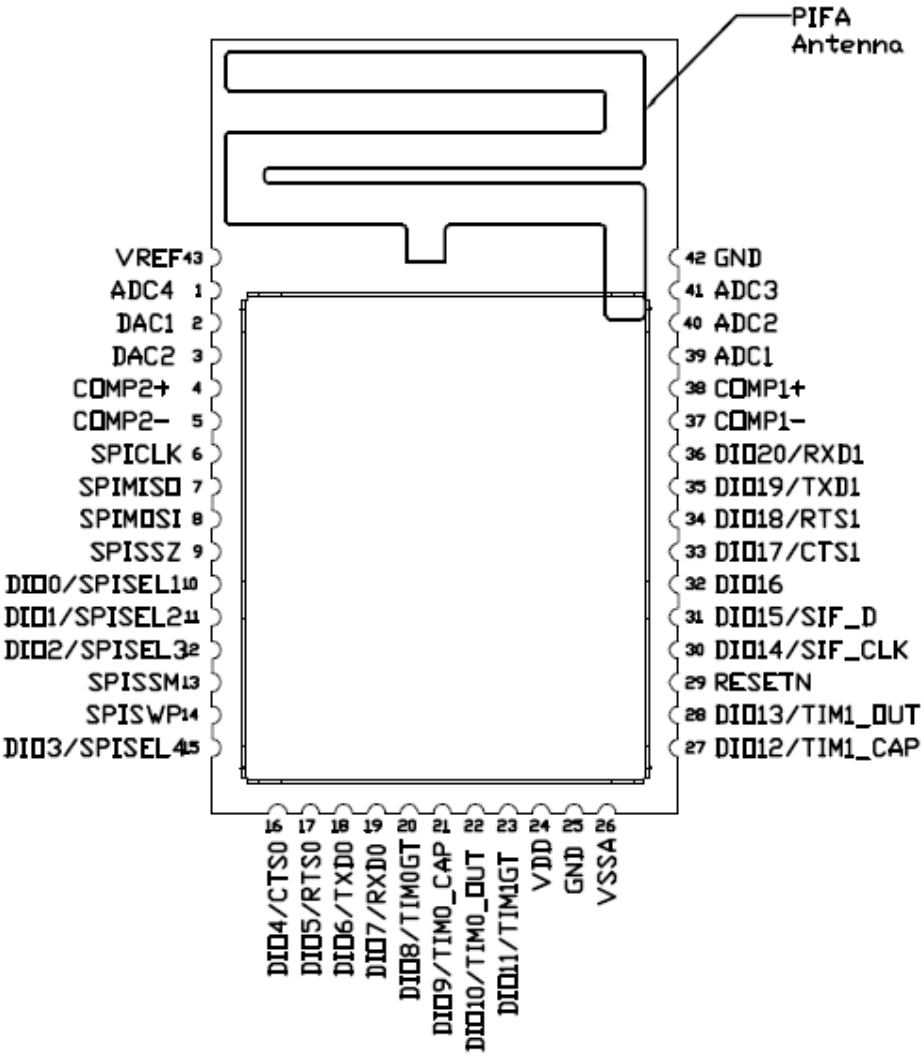


Figure : MD100A Pin Configuration(Top View)

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

4.1 Pin Assignment

Pin	Signal	Function	Alternative Function
1	ADC4	Analogue to Digital input	
2	DAC1	Digital to Analogue output	
3	DAC2	Digital to Analogue output	
4	COMP2+	Comparator 2 inputs	
5	COMP2-		
6	SPICLK	SPI master clock out	
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	General Purpose Digital I/O DIO14

Pin	Signal	Function	Alternative Function
31	SIF_D	Serial Interface data / Intelligent peripheral	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	COMP1-	Comparator 1 inputs	
38	COMP1+		
39	ADC1	Analogue to Digital input	
40	ADC2	Analogue to Digital input	
41	ADC3	Analogue to Digital input	
42	GND	Digital ground	
43	VREF	Analogue peripheral reference voltage	

4.2 Pin Descriptions

4.2.1 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.

4.2.2 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 MD100A.

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

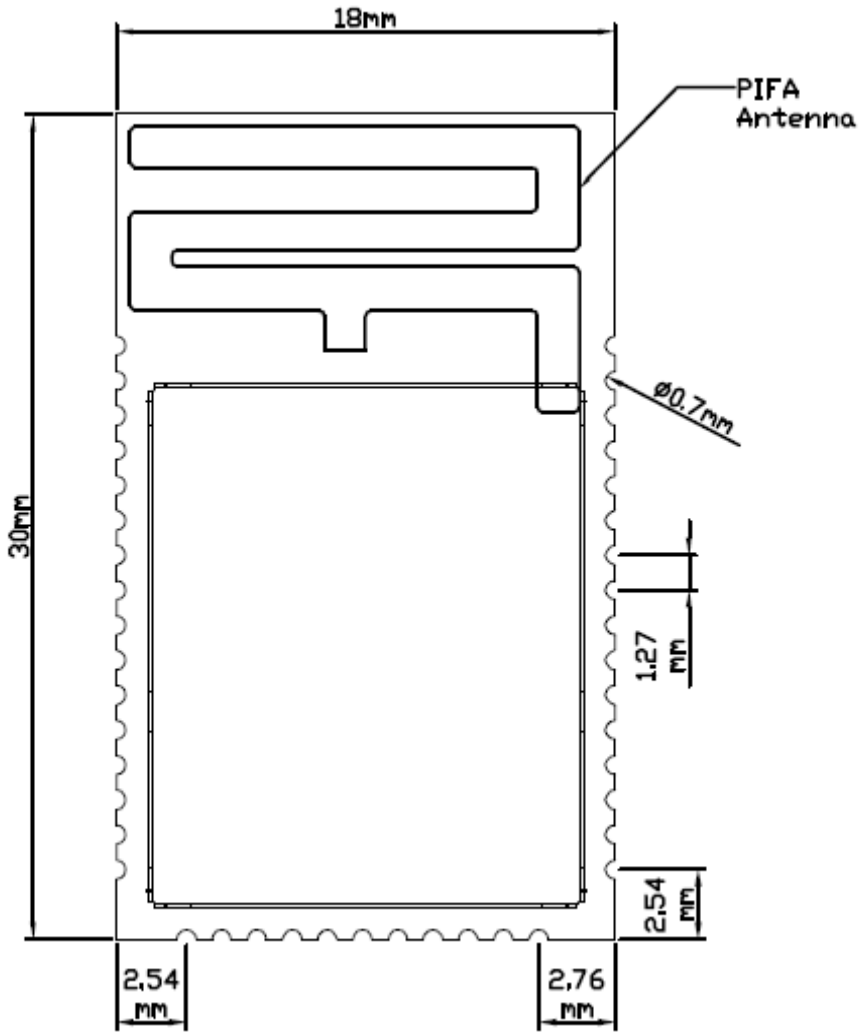
This configuration allows the flash memory device to be programmed using an external SPI programmer if required. For programming in this mode, the MD100A should be held in reset by taking RESETN low.

The memory can also be programmed over the UART by using the flash programmer software. To enter this programming mode, SPIMISO (pin 7) should be held low whilst the chip is reset. Once programming has finished, the chip should be reset, when it will execute the new code downloaded.

For normal operation of the module and programming over the UART, SPISSZ should be connected to SPISSM.

5. Additional Information

5.1 Outline Drawing



Thickness: 3.5mm

Figure: MD100A Outline Drawing

5.2 Module PCB Footprint

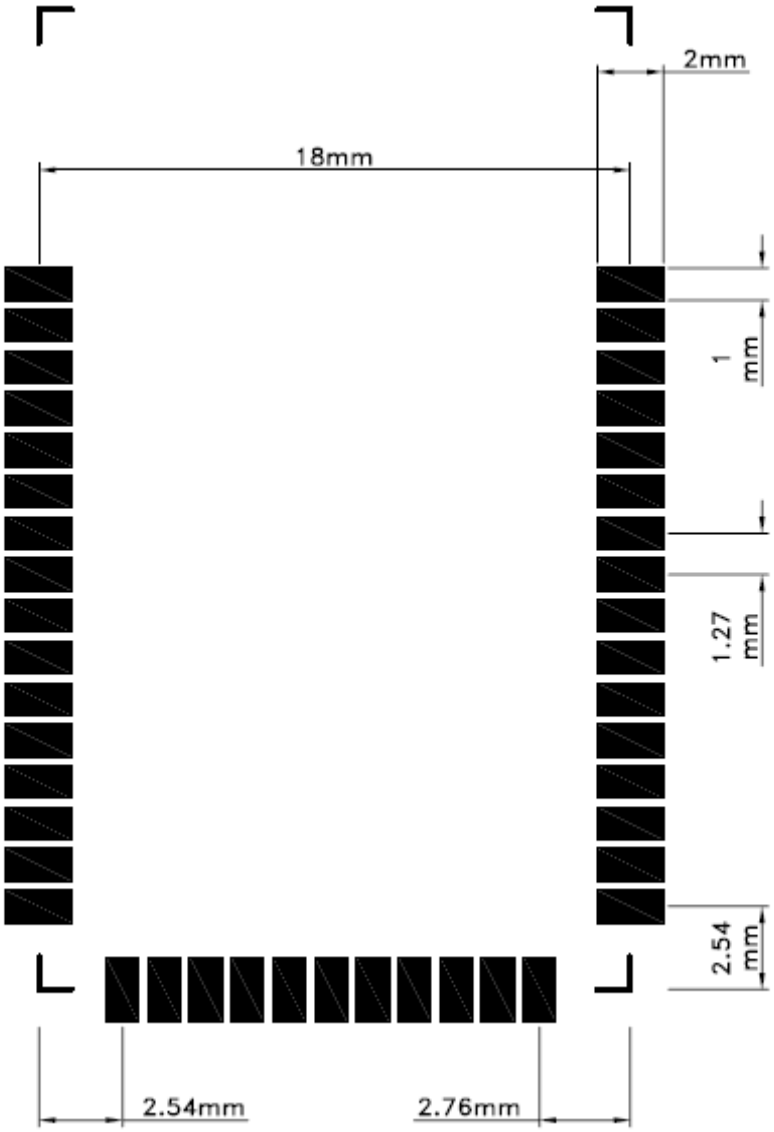
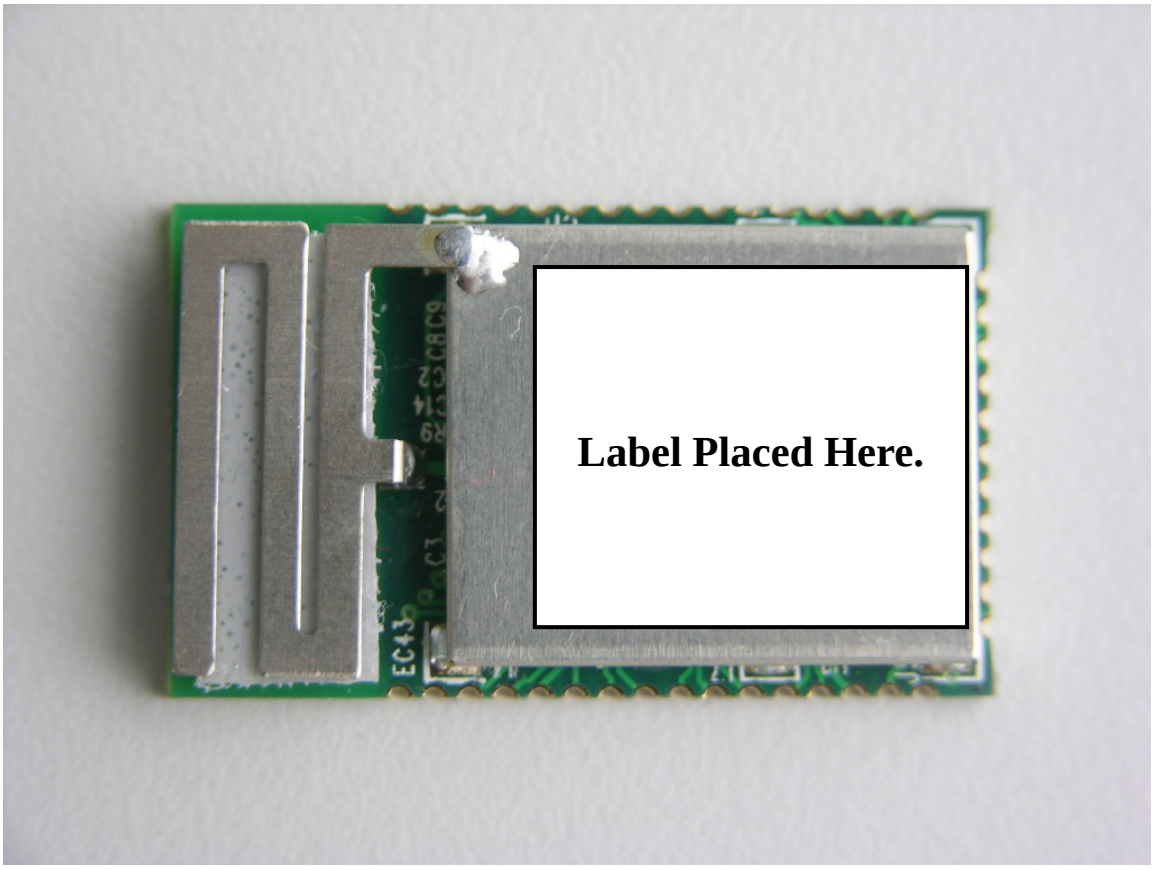


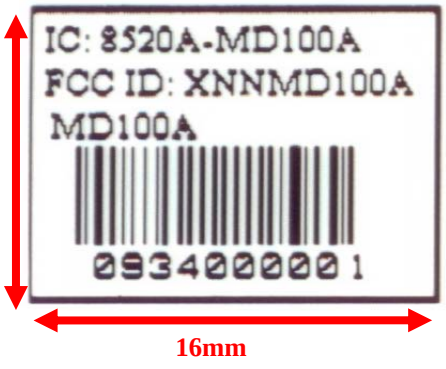
Figure: Module PCB footprint

RF note for MD100A modules with PIFA antenna: No components, ground plane or tracks on any layer of the mother board should be placed within 20mm of the 3 free sides of the antenna. Tracks etc may be placed adjacent to the can, but should not extend past the can towards the antenna end of the module for 20mm from the antenna.

5.3 Ordering / Label Information



Label Line 1：IC ID Number
Label Line 2：FCC ID Number
Label Line 3：Part Name
Label Line 4：Barcode
Label Line 5：Lot Code
YYWWNNNNNN (See Below)



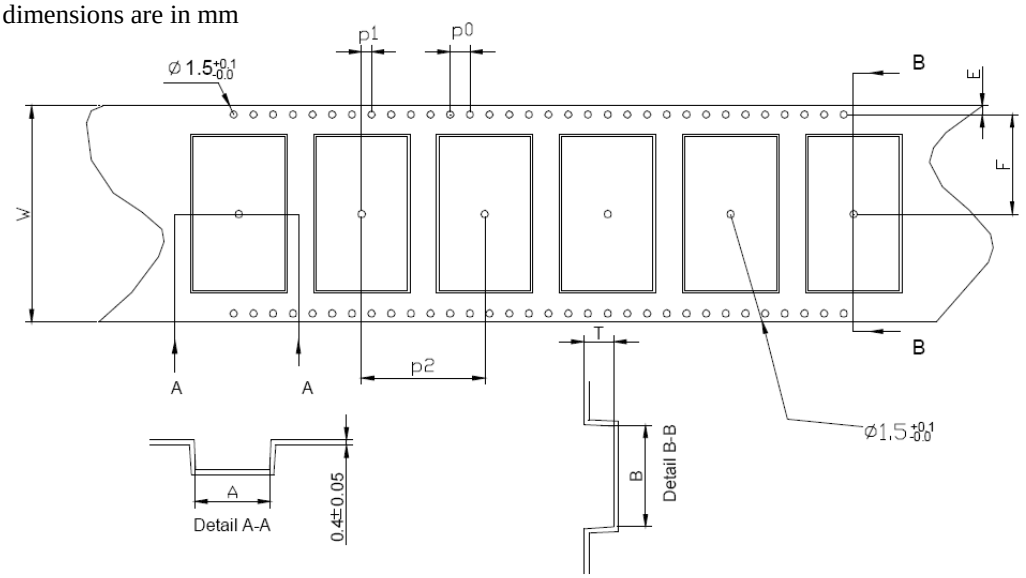
Identifier	Description	Format
YY	Year	09 (Example)
WW	Week	34 (Example)
NNNNNN	Serial Number	000001 (Example)

Figure: Example MD100A Labeling for FCC Approved Modules

5.4 Tape and Reel Information

5.4.1 Tape Orientation and dimensions

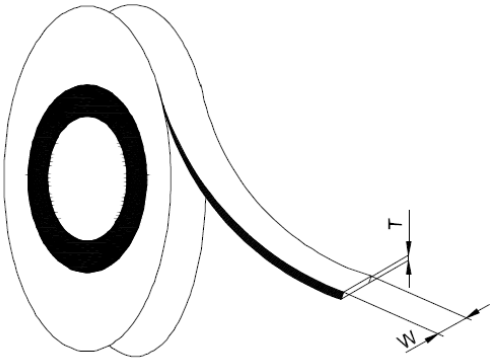
All dimensions are in mm



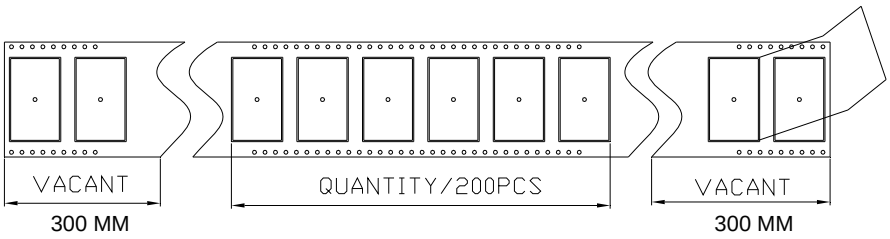
Module type	A	B	W	F	E	P0	P1	P2	T	Cover Tape width (W)
MD100A	18.4	30.4	44	20.2	1.75	4.0	2.0	24.0	4.0	37.5
Tolerance	±0.1	±0.1	±0.3	±0.1	+0.1	±0.1	±0.1	±0.1	±0.1	±0.1

5.4.2 Cover tape details

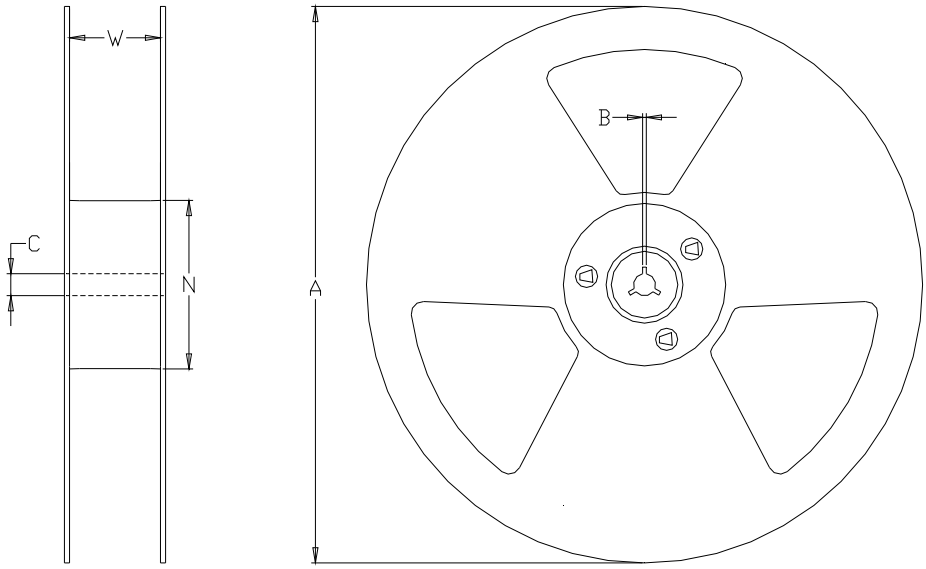
Thickness (T)	0.061mm
Surface resistivity (component side)	10^4 to 10^7 Ohms/sq
Surface resistivity (component side)	Non-conductive
Backing type	Polyester
Adhesive type	PSA
Sealing	Room ambient



5.4.3 Leader and Trailer



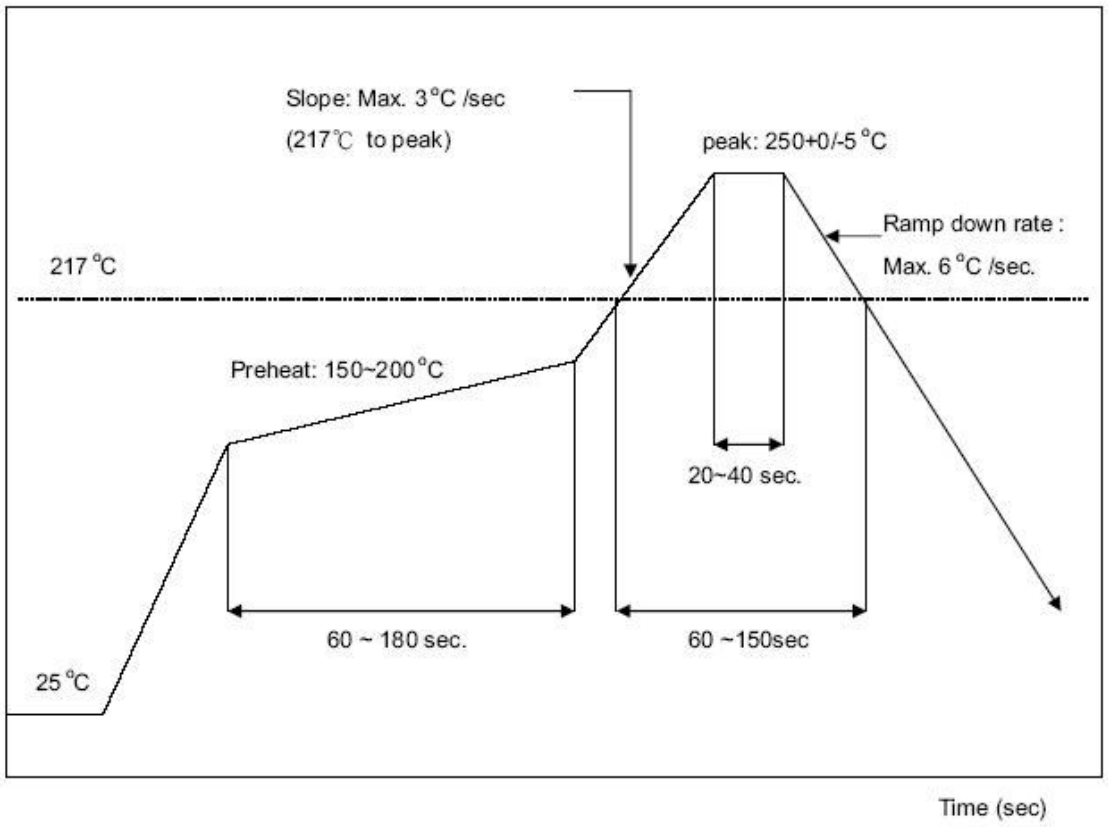
5.4.4 Reel Dimensions



Module type:	A	B	C	N	W (min)
MD100A	330 ±1.0	2.2±0.5	13 ±0.2	100 +0.1	44.5 ±0.3

5.5 SMT IR Profile

Average ramp-up rate (217C to peak): 3 ℃ /sec max.
Preheat：150~200 ℃、60~180 seconds
Temperature maintained above 217 ℃: 60~150 seconds
Time within 5 ℃ of actual peak temperature: 20 ~ 40 sec.
Peak temperature：250+0/-5 ℃
Ramp-down rate: 6 ℃/sec. max.
Time 25 ℃ to peak temperature: 8 minutes max.
Cycle interval：5 minus



5.6 How to Avoid ESD Damage to ICs

* Any person handling the ICs should be grounded either with a wrist strap or ESD-protective footwear used in conjunction with a conductive or static-dissipative floor or floor mat.
* The work surface where devices are placed for handling, processing, testing, etc., must, be made of static-dissipative material and be grounded to ESD ground.
* All insulator materials must either be removed from the work area or must be neutralized with an ionizer. Static-generating clothing must be covered with an ESD-protective smock.
* When ICs are being stored, transferred between operations or workstations, or shipped, they must be kept in a Faraday shield container with inside surfaces (surfaces touching the ICs) that are static-dissipative.

6. Contact Information

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