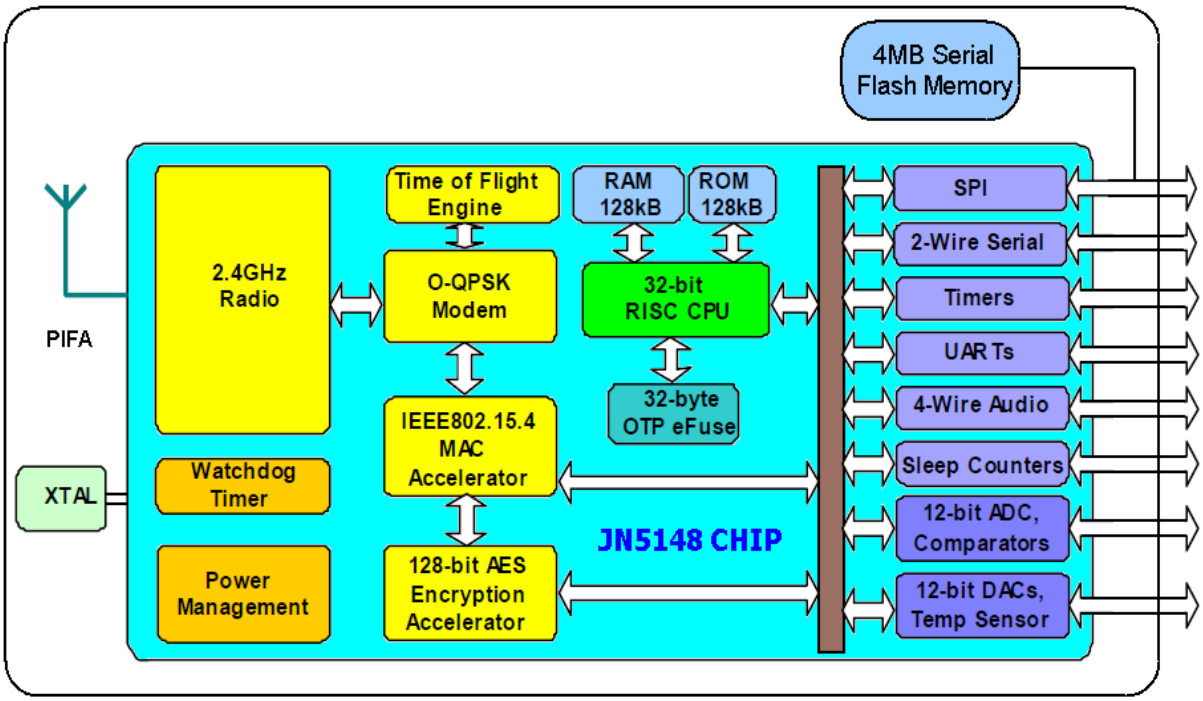
IEEE802.15.4 / ZigBee PIFA Module Family

Overview

This MD-102AC ZigBee PIFA Module is a surface mount module with 1mW output power that enables users to implement IEEE802.15.4 or ZigBee PRO networking applications 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

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

Features: Module

- 2.4GHz IEEE802.15.4 & ZigBee PRO Compatible
- 2.3-3.6V for SOC
- Sleep Current (with Active Sleep Timer) 2.6μA
- Receiver Sensitivity -95dBm
- PIFA Antenna Gain +3dBi
- TX Power +2dBm (without PIFA Antenna)
- TX Current 15mA
- RX Current 17.5mA
- Dimension：32.2*18*3.5mm
- Weight：3.0g

Features: Microcontroller

- 32-Bit RISC CPU,up to 32MIPs with low power
- 128KB RAM, 128KB ROM
- 4Mbit serial flash for program code and data
- On chip OTP efuse
- JTAG debug interface
- 4-input 12-bit ADC, 2 12-Bit DACs, 2 Comparators
- 3 Application Timer / Counters, 3 System Timers
- 2 UARTs (One for In-System Debug)
- SPI Port with 5 Selects
- 2-Wire Serial Interface
- 4-wire digtal audio interface
- Watchdog timer
- 21 GPIO

Temperature Range:-40°C to +85°C

Humidity: 10 to 95% RH

Lead-Free and RoHS Compliant

Applications

- Robust and secure low power wireless applications
- ZigBee PRO networks
- Home and commercial building automation
- Home networks
- Toys and gaming peripherals
- Industrial systems
- Telemetry and utilities (e.g. AMR)

Revised History		
Date	Revision	Description
2011/01/03	1.0	1st Released

Table of Contents

1. Introduction

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1.1 Key Features

1.1.1 Module

- 2.4GHz IEEE802.15.4 & ZigBee PRO Compatible
- 2.3 -3.6V for SOC
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- 2-Wire Serial Interface
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1.2 Applications

- Robust and secure low power wireless applications
- ZigBee PRO networks
- 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	1.3uA	
Sleep Current	2.6uA	With active sleep timer
Radio Transmit Current	15mA	CPU in doze, radio transmitting
Radio Receive Current	17.5mA	CPU in doze, radio receiving
Centre Frequency Accuracy	±20ppm	Additional ±20ppm allowance for temperature and ageing
Typical RF Characteristics		**Notes**
Receive Sensitivity	-95dBm	Nominal for 1% PER, as per 802.15.4 section 6.5.3.3 (Note 1)
Maximum Transmit Power (without PIFA Antenna)	+2dBm	Nominal (Note 1)
Maximum Transmit Power	+5dBm	(Note 1)
Total Transmit Current	15mA	
Total Receive Current	17.5mA	
Maximum Input Signal	+5dBm	For 1% PER, measured as sensitivity
RSSI Range	-95 to -10 dBm	
RF Port Impedance - uFL Connector	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
TwoWire 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
Digital IO Lines (Multiplexed with UARTs, Timers and SPI Selects)	21	
Four Channel Analogue-to-Digital Converter	✓	12-bit, up to 100ks/s
Two Channel Digital-to-Analogue Converter	✓	12-bit, up to 100ks/s
Two PProgrammable Analogue Comparators	✓	Ultra low power mode for sleep
Internal Temperature Sensor and Battery Monitor	✓	

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

3. Pin Configurations

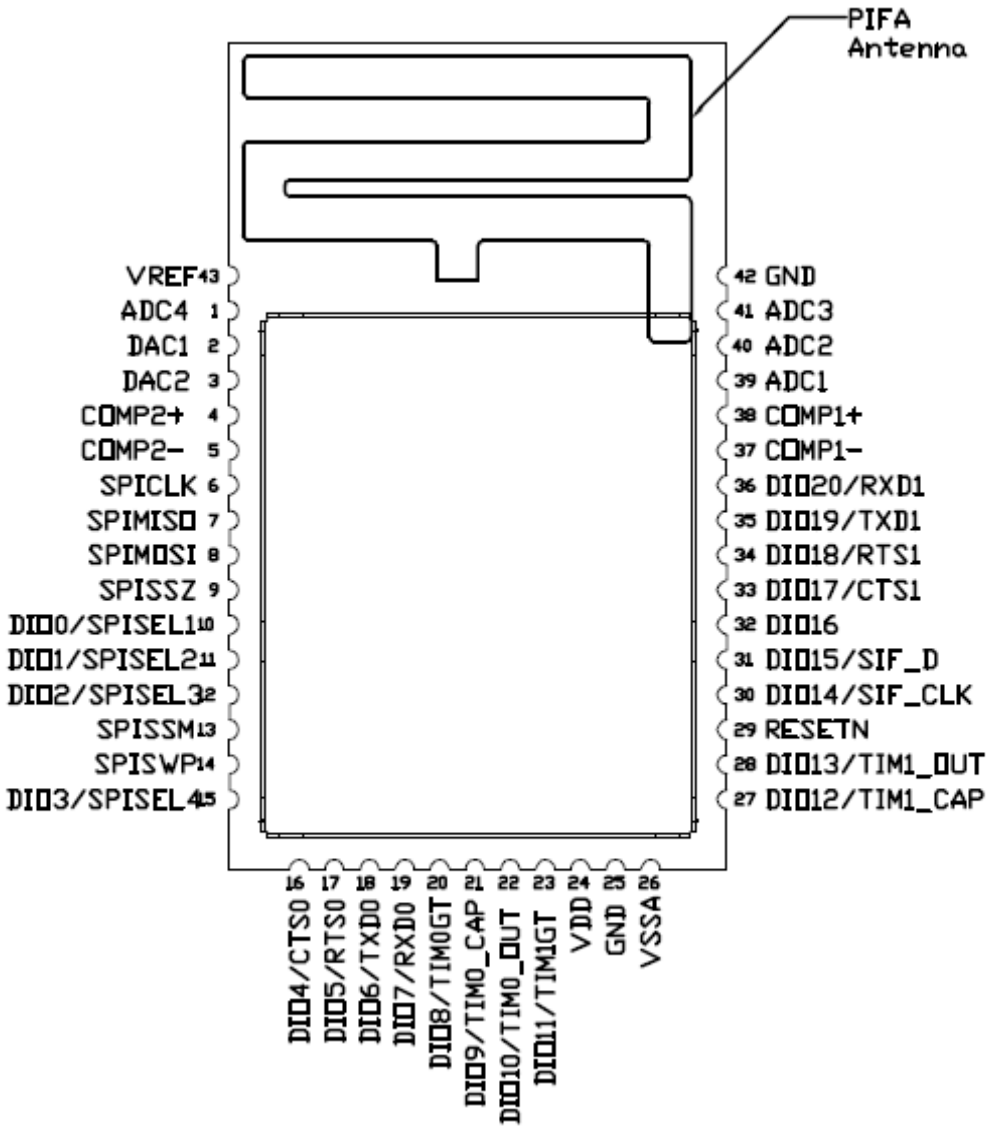


Figure: MD-102AC Pin Configuration (Top View)

3.1 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	DIO0	DIO0 or SPI Slave Select1 (output)	SPISEL1		
11	DIO1	DIO1, SPI Slave Select2 (output) or Pulse Counter0 Input	SPISEL2	PC0	
12	DIO2	DIO2, SPI Slave Select3 (output) or Radio Receive Control Output	SPISEL3	RFRX	
13	SPISSM	SPI select to FLASH (input)			
14	SPISWP	FLASH write protect (input)			
15	DIO3	DIO3, SPI Slave Select4 (output) or Radio Transmit Control Output	SPISEL4	RFTX	
16	DIO4	DIO4, UART0 Clear To Send (input) or JTAG	CTS0	JTAG_TCK	
17	DIO5	DIO5, UART0 Request To Send (output) or JTAG Mode Select	RTS0	JTAG_TMS	
18	DIO6	DIO6, UART0 Transmit Data (output) or JTAG Data Output	TXD0	JTAG_TDO	
19	DIO7	DIO7, UART0 Receive Data (input) or JTAG Data Input	RXD0	JTAG_TDI	
20	DIO8	DIO8, Timer0 clock/gate (input) or Pulse Counter1 Input	TIM0GT	PC1	
21	DIO9	DIO9, Timer0 capture (input), 32K External Crystal Input or 32K Clock Input	TIM0_CAP	32KXTALIN	32KIN
22	DIO10	DIO10, Timer0 PWM (output), 32K External Crystal Output	TIM0_OUT	32KXTALOUT	

Pin	Signal	Function	Alternative Function			
23	DIO11	DIO11, Timer1 clock/gate (input) or Timer2 PWN Output	TIM1GT	TIM2OUT		
24	VDD	Supply Voltage				
25	GND	Digital ground				
26	VSSA	Analogue ground				
27	DIO12	DIO12, Timer1 capture (input), Antenna Diversity or Digital Audio Word Select	TIM1_CAP	ADO	DAI_WS	
28	DIO13	DIO13, Timer1 PWM (output), Antenna Diversity or Digital Audio Data Input	TIM1_OUT	ADE	DAI_SDIN	
29	RESETN	Reset input				
30	DIO14	DIO14, Serial Interface clock or Intelligent peripheral clock Input	SIF_CLK	IP_CLK		
31	DIO15	DIO15, Serial Interface data or Intelligent peripheral data out	SIF_D	IP_DO		
32	DIO16	DIO16, Intelligent peripheral Data In	IP_DI			
33	DIO17	DIO17, UART1 Clear To Send (input), Intelligent Peripheral Device Select Input or Digital Audio Clock or JTAG CLK	CTS1	IP_SEL	DAI_SCK	JTAG_TCK
34	DIO18	DIO18, UART1 Request To Send (output), Intelligent Peripheral Interrupt Output or Digital Audio Data Output or JTAG Mode Select	RTS1	IP_INT	DAI_SDOUT	JTAG_TMS
35	DIO19	DIO19, UART1 Transmit Data (output) or JTAG Data Out	TXD1	JTAG_TDO		
36	DIO20	DIO20, UART1 Receive Data (input) or JTAG Data In	RXD1	JTAG_TDI		
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	VSSA	Analogue ground				
43	VREF	Analogue peripheral reference voltage				

4. Additional Information

4.1 Outline Drawing

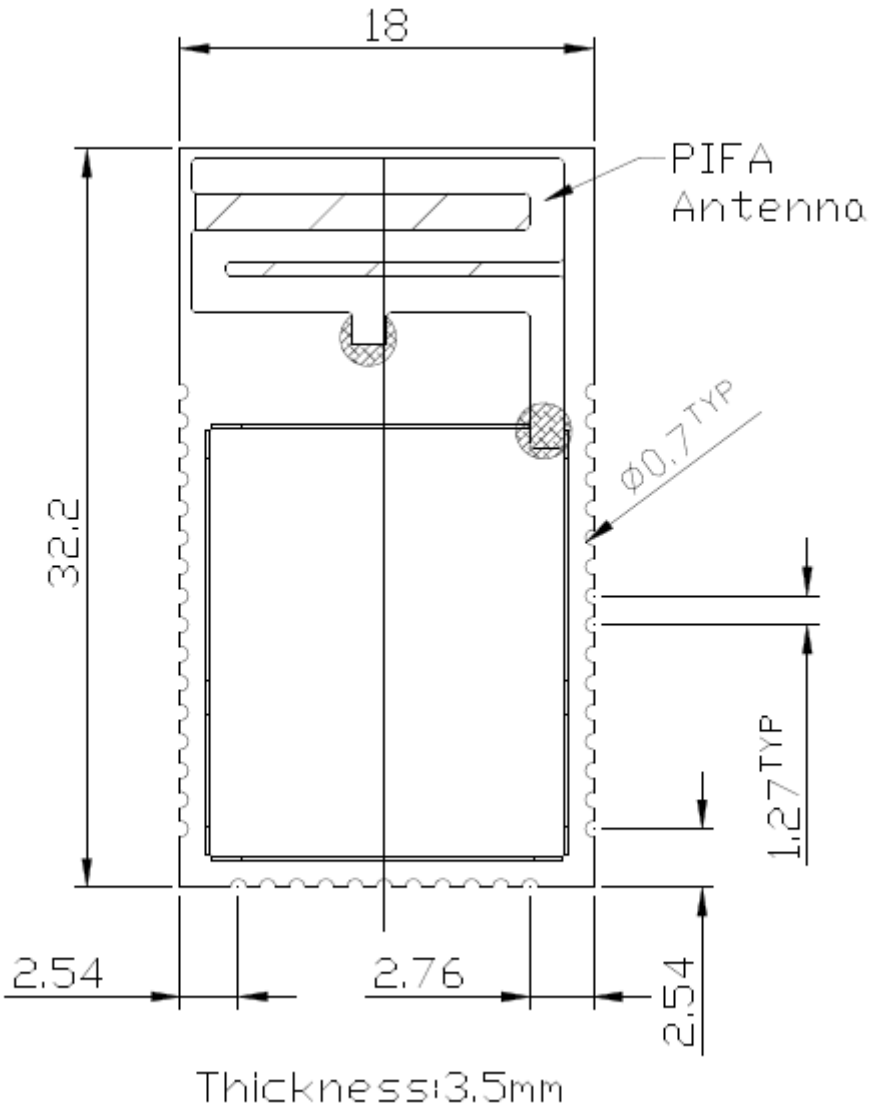


Figure: MD-102AC Outline Drawing

4.2 Module PCB Footprint

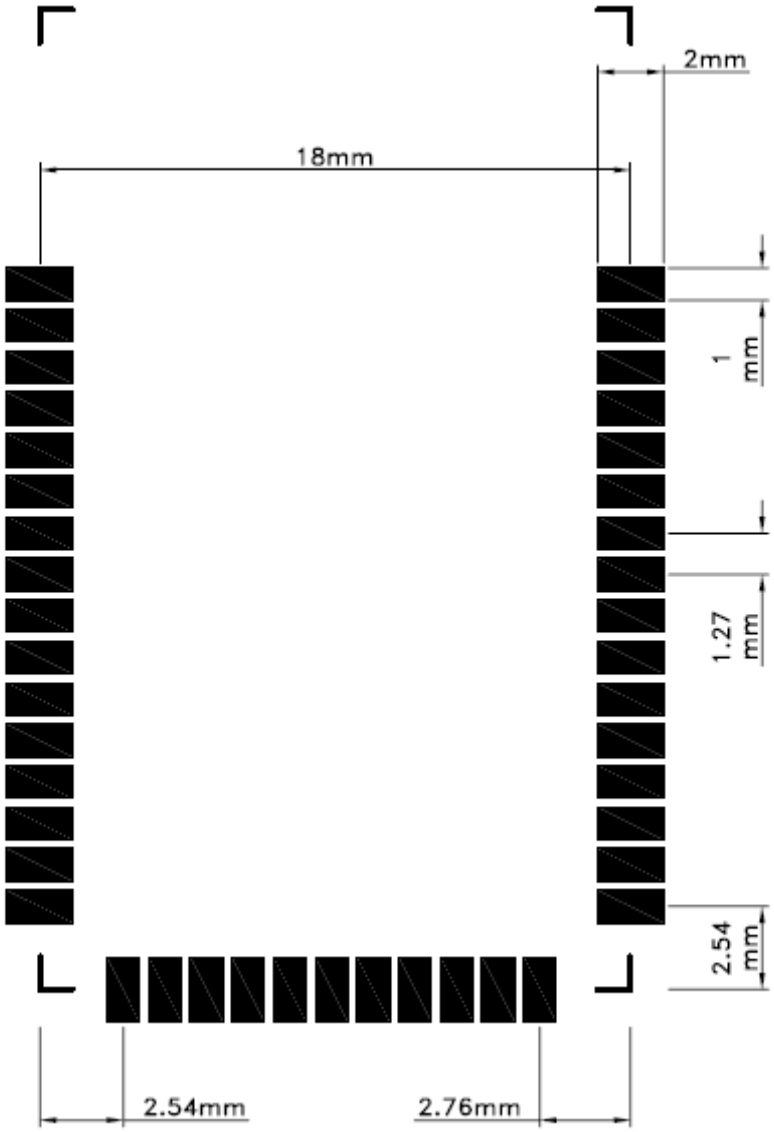
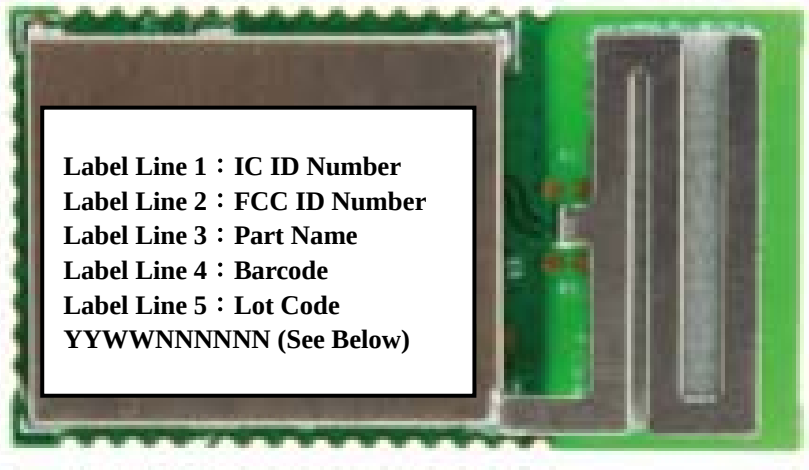


Figure: Module PCB footprint

RF note for MD-102AC 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.

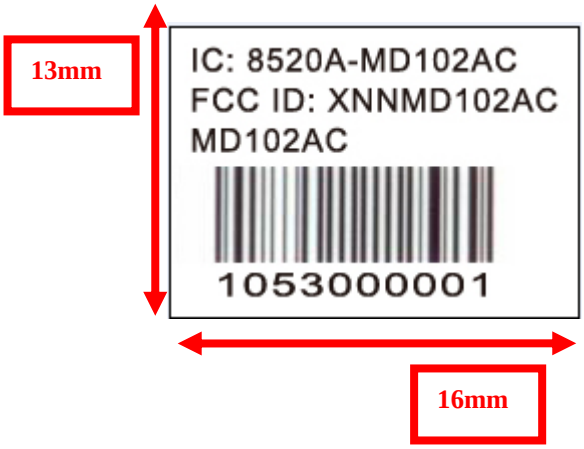
4.3 Ordering / Lable Information



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)

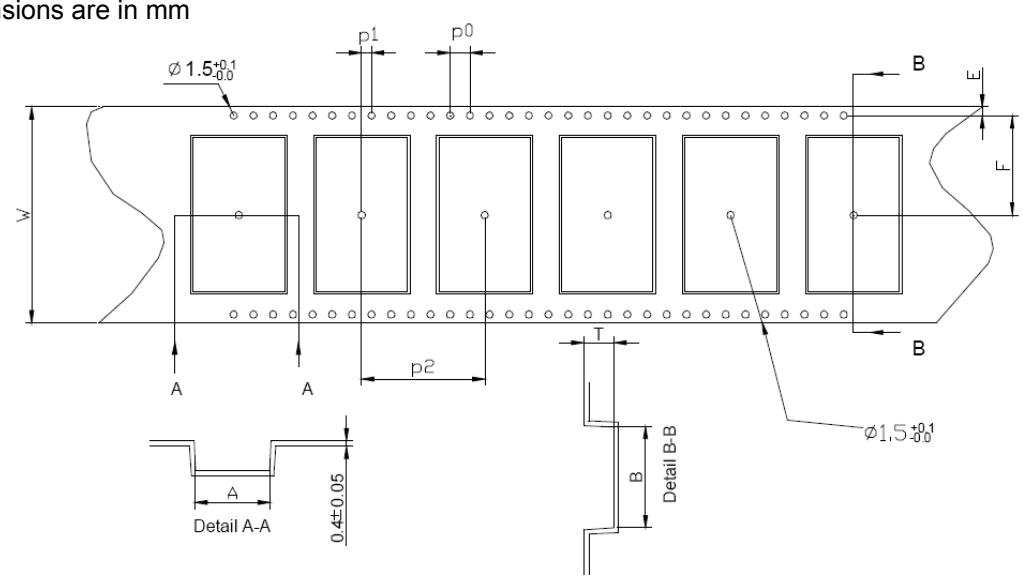
Figure: Example MD-102AC Labeling for FCC Approved Modules



4.4 Tape and Reel Information

4.4.1 Tape Orientation and dimensions

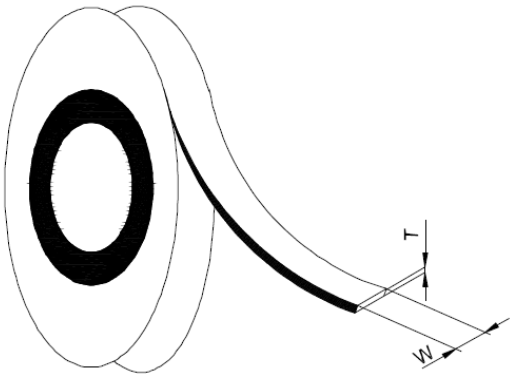
All dimensions are in mm



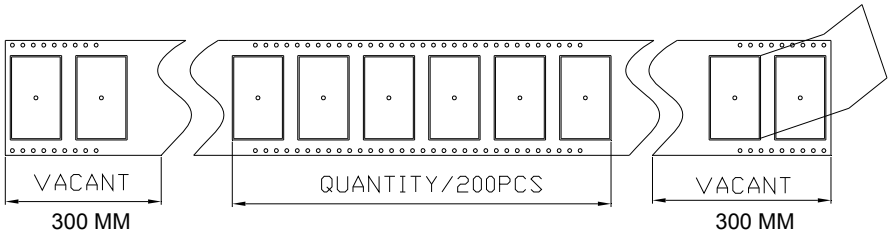
Module type	A	B	W	F	E	P0	P1	P2	T	Cover Tape width (W)
MD-102AC	18.5	32.7	44	20.2	1.75	4.0	2.0	24.0	3.4	37.5
Tolerance	±0.1	±0.1	±0.3	±0.1	+0.1	±0.1	±0.1	±0.1	±0.1	±0.1

4.4.2 Cover tape details

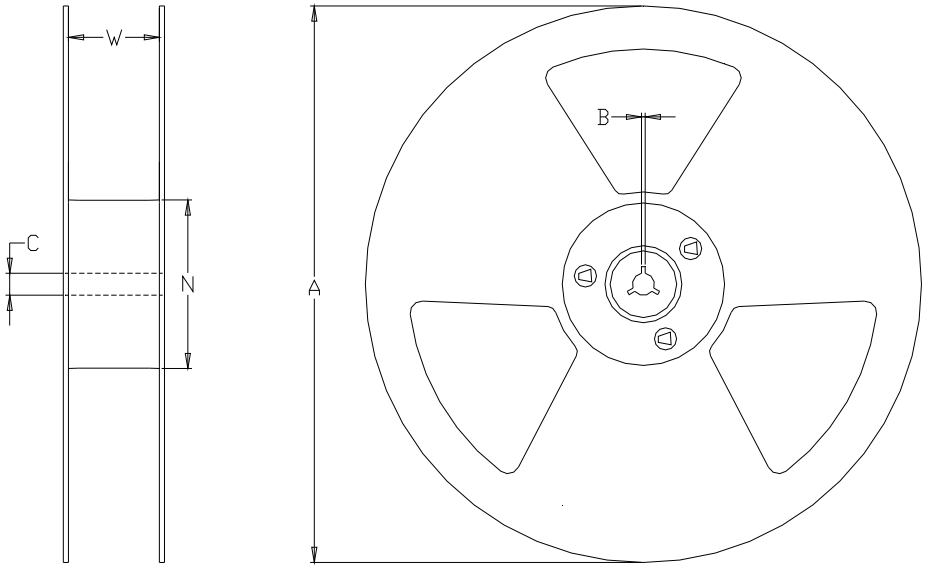
Thickness (T)	0.061mm
Surface resistivity (component side)	10^4 to 10^7 Ohms/sq
Surface resistivity (component side)	Non-conductive
Backing type	Polyester
Adhesive type	PSA
Sealing	Room ambient



4.4.3 Leader and Trailer



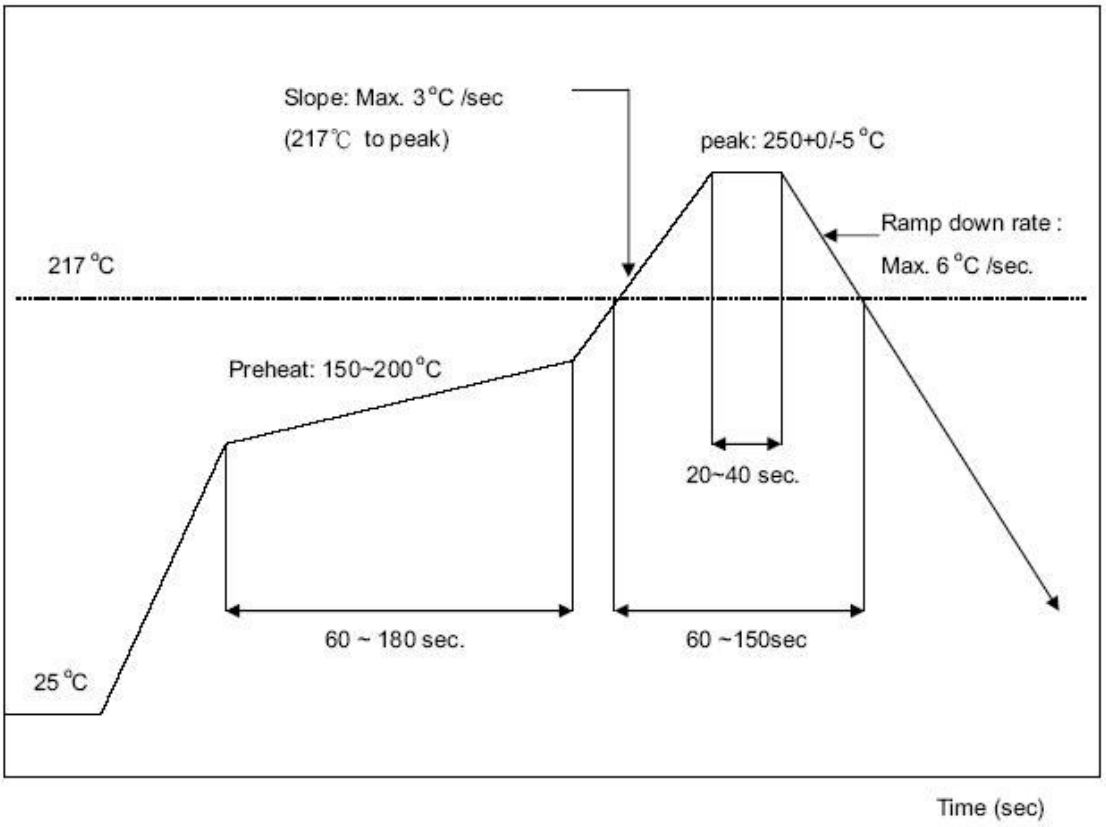
4.4.4 Reel Dimensions



Module type	A	B	C	N	W (min)
MD-102AC	330 ±1.0	2.2±0.5	13 ±0.2	100 +0.1	45.5±0.3

4.5 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



4.6 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.

5. FCC Statement

Federal Communication Commission 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.

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.

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.

This device and its antenna(s) must not be co-located or operation in conjunction with any other antenna or transmitter.

IMPORTANT NOTE:

FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

IMPORTANT NOTE:

This module is intended for OEM integrator. The OEM integrator is still responsible for the FCC compliance requirement of the end product, which integrates this module.

20cm minimum distance has to be able to be maintained between the antenna and the users for the host this module is integrated into. Under such configuration, the FCC radiation exposure limits set forth for an population/uncontrolled environment can be satisfied.

Any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment.

USERS MANUAL OF THE END PRODUCT:

In the users manual of the end product, the end user has to be informed to keep at least 20cm separation with the antenna while this end product is installed and operated. The end user has to be informed that the FCC radio-frequency exposure guidelines for an uncontrolled environment can be satisfied. The end user has to also be informed that any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment. If the size of the end product is smaller than 8x10cm, then additional FCC part 15.19 statement is required to be available in the users manual: This device complies with Part 15 of 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.

LABEL OF THE END PRODUCT:

The final end product must be labeled in a visible area with the following " Contains TX FCC ID: XNNMD102AC ". If the size of the end product is larger than 8x10cm, then the following FCC part 15.19 statement has to also be available on the label: This device complies with Part 15 of 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.

6. IC Statement

This Class B digital apparatus complies with Canadian ICES-003.

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.

Cet appareil numérique de la classe B est conforme á la norme NMB-003 du Canada.

This device and its antenna(s) must not be co-located or operation in conjunction with any other antenna or transmitter.

The device could automatically discontinue transmission in case of absence of information to transmit, or operational failure. Note that this is not intended to prohibit transmission of control or signaling information or the use of repetitive codes where required by the technology.

IMPORTANT NOTE:

IC Radiation Exposure Statement:

This equipment complies with IC RSS-102 radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

This module is intended for OEM integrator. The OEM integrator is still responsible for the IC compliance requirement of the end product, which integrates this module.

20cm minimum distance has to be able to be maintained between the antenna and the users for the host this module is integrated into. Under such configuration, the IC RSS-102 radiation exposure limits set forth for an population/uncontrolled environment can be satisfied.

Any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment.

USERS MANUAL OF THE END PRODUCT:

In the users manual of the end product, the end user has to be informed to keep at least 20cm separation with the antenna while this end product is installed and operated. The end user has to be informed that the IC radio-frequency exposure guidelines for an uncontrolled environment can be satisfied. The end user has to also be informed that any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment. IC statement is required to be available in the users manual: This Class B digital apparatus complies with Canadian ICES-003. 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.

LABEL OF THE END PRODUCT:

The final end product must be labeled in a visible area with the following " Contains TX IC: 8520A-MD102AC ".

7. Contact Information

Aveslink Technology, Inc.
2375 Zanker Rd. #240
San Jose, CA 95131
Tel: 408 383-0688
Fax: 408 383-0388
http://www.aveslink.com
Email: info@aveslink.com